Tivoli software

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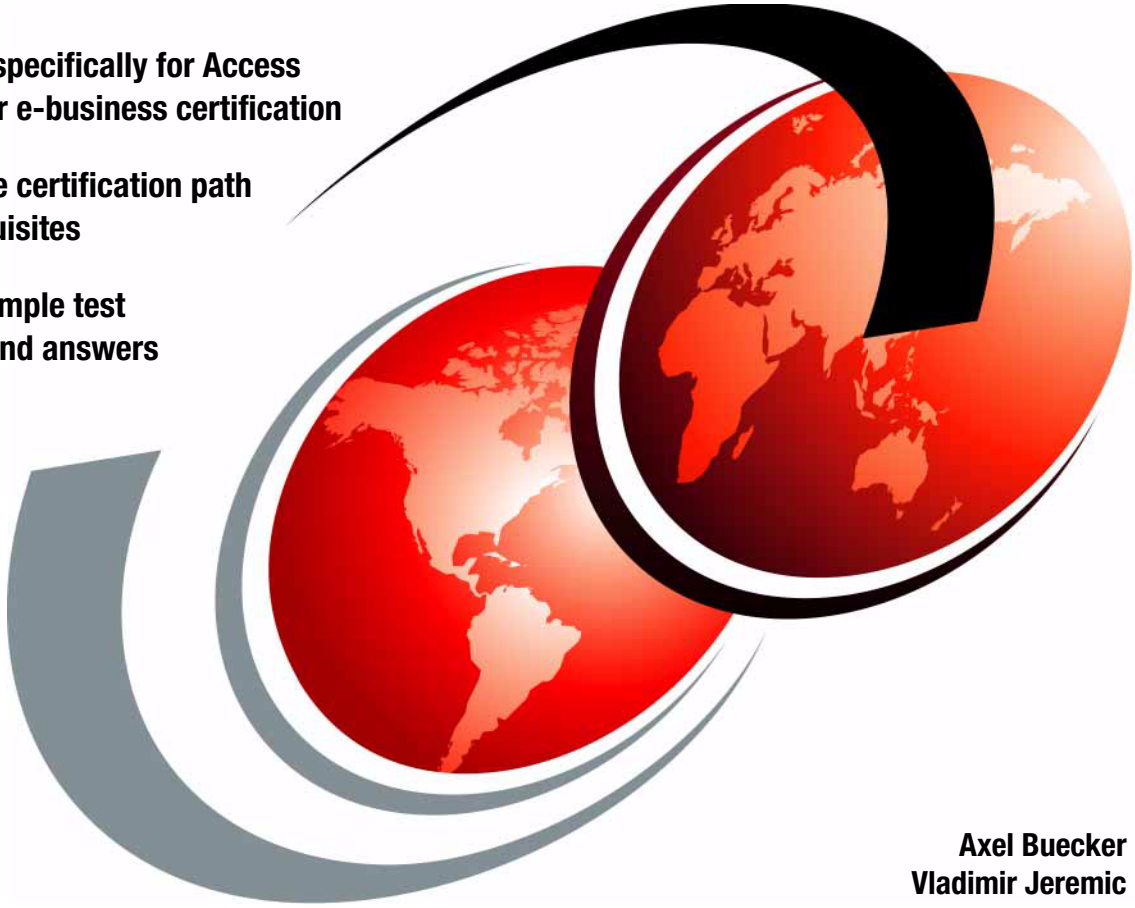
Certification Study Guide: IBM Tivoli Access Manager for e-business 6.0

- Developed specifically for Access Manager for e-business certification
- Explains the certification path and prerequisites
- Includes sample test questions and answers



Axel Buecker
Vladimir Jeremic

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International Technical Support Organization

Certification Study Guide: IBM Tivoli Access Manager for e-business 6.0

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Note: Before using this information and the product it supports, read the information in “Notices” on page vii.

First Edition (February 2006)

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Contents

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Preface

This IBM® Redbook is a study guide for the “IBM Certified Deployment Professional - IBM Tivoli® Access Manager V6.0” certification test, test number 876, and is meant for those who want to achieve IBM Certifications for this specific product.

The IBM Certified Deployment Professional - IBM Tivoli Access Manager V6.0 certification, offered through the Professional Certification Program from IBM, is designed to validate the skills required of technical professionals who work in the implementation of the IBM Tivoli Access Manager Version 6.0 product.

This book provides a combination of theory and practical experience needed for a general understanding of the subject matter by discussing the planning, installation, configuration and customization, programming, auditing, and troubleshooting of Access Manager for e-business solutions. It also provides sample questions that will help in the evaluation of personal progress and provide familiarity with the types of questions that will be encountered in the exam.

This publication does not replace practical experience, nor is it designed to be a stand-alone guide for any subject. Instead, it is an effective tool that, when combined with education activities and experience, can be a very useful preparation guide for the exam.

The team that wrote this redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization, Austin Center.

Axel Buecker is a Certified Consulting Software IT Specialist at the International Technical Support Organization (ITSO), Austin Center. He writes extensively and teaches IBM classes worldwide on areas of software security architecture and network computing technologies. He holds a degree in Computer Science from the University of Bremen, Germany. He has 19 years of experience in a variety of areas related to workstation and systems management, network computing, and e-business solutions. Before joining the ITSO in March 2000, Axel worked for IBM in Germany as a Senior IT Specialist in Software Security Architecture.

Vladimir Jeremic is a Security Consultant with the IBM Global Services Security and Privacy Group. He has eight years of experience in the IT field related to

security, networking, and programming. He is a Tivoli Certified Professional and holds a BS E.E. degree from the University of Novi Sad, in Serbia and Montenegro. He has experience in designing and writing learning materials. Vladimir has participated in several other ITSO projects, including working with Axel on the Certification Study Guide for IBM Tivoli Identity Manager V4.6.

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Certification overview

This chapter provides an overview of the skill requirements needed to obtain an IBM Advanced Technical Expert certification. The following sections are designed to provide a comprehensive review of specific topics that are essential for obtaining the certification:

- IBM Professional Certification Program
- IBM Tivoli Access Manager for e-business Version 6.0 certification
- Recommended study resources

1.1 IBM Professional Certification Program

Having the right skills for the job is critical in the growing global marketplace. IBM Professional Certification, designed to validate skill and proficiency in the latest IBM solution and product technology, can help provide that competitive edge. The Professional Certification Program from IBM offers a business solution for skilled technical professionals seeking to demonstrate their expertise to the world.

The program is designed to validate your skills and demonstrate your proficiency in the latest IBM technology and solutions. In addition, professional certification can help you excel at your job by giving you and your employer confidence that your skills have been tested. You may be able to deliver higher levels of service and technical expertise than non-certified employees and move on a faster career track. Professional certification puts your career in your control.

The certification requirements are tough, but not impossible. Certification is a rigorous process that differentiates you from everyone else. The mission of IBM Professional Certification is to:

- Provide a reliable, valid, and fair method of assessing skills and knowledge
- Provide IBM with a method of building and validating the skills of individuals and organizations
- Develop a loyal community of highly skilled certified professionals who recommend, sell, service, support, and use IBM products and solutions

The Professional Certification Program from IBM has developed certification role names to guide you in your professional development. The certification role names include IBM Certified Specialist, IBM Certified Solutions/Systems Expert, and IBM Certified Advanced Technical Expert for technical professionals who sell, service, and support IBM solutions.

For technical professionals in application development, the certification roles include IBM Certified Developer Associate and IBM Certified Developer. IBM Certified Instructor certifies the professional instructor.

The Professional Certification Program from IBM provides you with a structured program leading to an internationally recognized qualification. The program is designed for flexibility by enabling you to select your role, prepare for and take tests at your own pace, and, in some cases, select from a choice of elective tests best suited to your abilities and needs. Some roles also offer a shortcut by giving credit for a certification obtained in other industry certification programs.

You might be a network administrator, systems integrator, network integrator, solution architect, solution developer, value-added reseller, technical coordinator,

sales representative, or educational trainer. Regardless of your role, you can start charting your course through the Professional Certification Program from IBM today.

The IBM Professional Certification Program Web site is:

http://www.ibm.com/certify/index.shtml

1.1.1 Benefits of certification

Certification is a tool to help objectively measure the performance of a professional on a given job at a defined skill level. Therefore, it is beneficial for individuals who want to validate their own skills and performance levels, those of their employees, or both. For optimum benefit, the certification tests must reflect the critical tasks required for a job, the skill levels of each task, and the frequency at which a task needs to be performed. IBM prides itself in designing comprehensive, documented processes that ensure that IBM certification tests remain relevant to the work environment of potential certification candidates.

In addition to assessing job skills and performance levels, professional certification may also provide such benefits as:

- For employees:
  - Promote recognition as an IBM Certified Professional
  - Help to create advantages in interviews
  - Assist in salary increases, corporate advancement, or both
  - Increase self-esteem
  - Provide continuing professional benefits
- For employers:
  - Measure the effectiveness of training
  - Reduce course redundancy and unnecessary expenses
  - Provide objective benchmarks for validating skills
  - Make long-range planning easier
  - Help to manage professional development
  - Aid as a hiring tool
  - Contribute to competitive advantage
  - Increase productivity, morale, and loyalty
- For Business Partners and consultants:
  - Provide independent validation of technical skills
  - Create competitive advantage and business opportunities
  - Enhance prestige of the team
  - Contribute to IBM requirements for various IBM Business Partner programs

Specific benefits might vary by country (region) and role. In general, after you become certified, you should receive the following benefits:

- Industry recognition

  Certification may accelerate your career potential by validating your professional competency and increasing your ability to provide solid, capable technical support.

- Program credentials

  As a certified professional, you receive an e-mail with your certificate of completion and the certification mark associated with your role for use in advertisements and business literature. You can also request a hardcopy certificate, which includes a wallet-size certificate.

  The Professional Certification Program from IBM acknowledges the individual as a technical professional. The certification mark is for the exclusive use of the certified individual.

- Ongoing technical vitality

  IBM Certified Professionals are included in mailings from the Professional Certification Program from IBM.

1.1.2 Tivoli Software Professional Certification

The IBM Tivoli Professional Certification Program offers certification testing that sets the standard for qualified product consultants, administrators, architects, and partners.

The program also offers an internationally recognized qualification for technical professionals who are seeking to apply their expertise in today's complex business environment. The program is designed for those who implement, buy, sell, service, and support Tivoli solutions and who want to deliver higher levels of service and technical expertise.

Whether you are a Tivoli customer, partner, or technical professional wanting to put your career on the fast track, you can start your journey to becoming a Tivoli Certified Professional today.

Benefits of being Tivoli certified

Tivoli certification has the following benefits:

- For the individual:
  - IBM Certified certificate and use of logos on business cards

Note: Certificates are sent by e-mail; however, a paper copy of the certificate and a laminated wallet card can also be requested by sending an e-mail to mailto:certify@us.ibm.com.

  - Recognition of your technical skills by your peers and management
  - Enhanced career opportunities
  - Focus for your professional development

- For the Business Partner:
  - Confidence in the skills of your employees
  - Enhanced partnership benefits from the Business Partner program
  - Higher rates for billing out your employees
  - Stronger customer proposals
  - Demonstration of the depth of technical skills available to prospective customers

- For the customer:
  - Confidence in the services professionals handling your implementation
  - Ease of hiring competent employees to manage your Tivoli environment
  - Enhanced return on investment (ROI) through more thorough integration with Tivoli and third-party products
  - Ease of selecting a Tivoli Business Partner that meets your specific needs

Certification checklist

The steps to certification are as follows:

1. Select the certification you would like to pursue.
2. Determine which tests are required by reading the certification role description.
3. Prepare for the test, using the following resources:
   - Test objectives
   - Recommended educational resources
   - Sample/Assessment test
   - Other reference materials
   - Opportunities for experience

   Note: These resources are available from each certification description page and from the Test information page.

4. Register to take a test by contacting one of our worldwide testing vendors:
   - Thomson Prometric
   - Pearson Virtual University Enterprises (VUE)

Note: When providing your name and address to the testing vendor, be sure to specify your name exactly as you would like it to appear on your certificate.

5. Take the test. Be sure to keep the Examination Score Report provided upon test completion as your record of taking the test.

   Note: After you take the test, the results and demographic data (such as name, address, e-mail, and phone number) are sent from the testing vendor to IBM for processing (allow two to three days for transmittal and processing). After all the tests required for a certification are passed and received by IBM, your certificate will be issued.

6. Repeat steps three through five until all required tests are successfully completed for the certification. If there are additional requirements (such as another vendor certification or exam), follow the instructions on the certification description page to submit these requirements to IBM.
7. After you meet the requirements, you will be sent an e-mail asking you to accept the terms of the IBM Certification Agreement.
8. Upon your acceptance, you receive an e-mail with the following deliverables:
   - A Certification certificate in PDF format, which can be printed in either color or black and white
   - A set of graphic files containing the IBM Professional Certification mark associated with the certification achieved
   - Guidelines for the use of the IBM Professional Certification mark
9. To avoid an unnecessary delay in receiving your certificate, ensure that your current e-mail is on file by keeping your profile up to date. If you do not have an e-mail address on file, your certificate will be sent by postal mail.

After you receive a certificate by e-mail, you can also contact IBM at mailto:certify@us.ibm.com to request that a hardcopy certificate be sent by postal mail.

Note: IBM reserves the right to change or delete any portion of the program, including the terms and conditions of the IBM Certification Agreement, at any time without notice. Some certification roles offered through the IBM Professional Certification Program require recertification.

1.2 Access Manager for e-business V6.0 certification

In this section, we categorize the certification process for IBM Tivoli Access Manager for e-business (Access Manager for e-business for short).

Important: IBM offers the following promotion code, which is good for a 15% discount on the indicated Tivoli certification exams if taken at any Thomson Prometric testing center:

- Code: 15T876
- Percentage off: 15%
- Valid for exams: 000-876
- Code is valid as long as the exam is available.

1.2.1 Job description and target audience

An IBM Certified Deployment Professional is a technical professional responsible for planning, installation, configuration, data management, troubleshooting, rollout to production, maintenance, and upgrade of an IBM Tivoli Access Manager for e-business V6.0 solution. This person is expected to perform these tasks without assistance, or with only limited assistance from peers, product documentation, and support resources.

1.2.2 Prerequisites

Prerequisites needed to pass Certification Test 876 include knowledge of:

- Basic operating system administrative skills for AIX®, Solaris™, Windows®, HP-UX, and/or Linux®
- Web server fundamentals
- Web application server fundamentals
- User registry installation
- PKI fundamentals
- Security policy management concepts
- TCP/IP fundamentals
- Security communication protocols
- Networking concepts
- Firewall concepts
- Programming fundamentals
- Directory services fundamentals
- Basic Web page development fundamentals (including security issues)
- Familiarity with industry standard reporting tools
- C, Java™, XML and application server (for example, WebSphere Application Server) skills

1.2.3 Test 876 objectives

Let us take a closer look at the five objective areas for this test:

- Planning
- Installation
- Configuration and customization
- Programming
- Maintenance and troubleshooting

Section 1: Planning

This section provides further information about the planning area of the test:

- Given a Security Analysis Document, produce product deployment recommendations that meet security requirements as verified via review cycles.

  With emphasis on performing the following steps:

  - Interview administrators, users, and security team.
  - Determine the type of user registry used for the secure domain.
  - Determine authentication mechanisms—user IDs/passwords (basic or forms-based), certificates, SecurID tokens, or custom authentication mechanisms.
  - Identify customization requirements such as External Authorization Services, External Authentication C API, Policies, and so on).
  - Identify auditing and logging requirements.
  - Determine account and password management rules.

- Given Access Manager for e-business deployment recommendations and the customer's current network configuration, define an Access Manager for e-business system layout and produce a deployment document containing a network topology diagram with placement of Access Manager for e-business user registry and servers.

  With emphasis on performing the following steps:

  - Identify capacity requirements (number of users, concurrent users, junctioned Web servers, ACLs required).
  - Identify Reliability and Serviceability (RAS) requirements (24 hours x 7 days; throughput and recovery capability).
  - Identify current network and security aspects (geography of LANs, firewalls, Internet, intranet, DMZ, and so on).

- Create logical configuration (number and type of Access Manager for e-business servers, number of load balancers, replicated Web servers, secure domains) and integrate with other applications.
- Create physical configuration (location of Access Manager for e-business servers, location of load balancers, and relationship to firewalls).
- Determine number and location of user registries.

- Given an existing Access Manager for e-business environment, define a migration strategy to maintain user data as well as security policy data.

  With emphasis on performing the following steps:

  - Create a roadmap defining the migration strategy.
  - Identify required user registry migration or upgrade procedures.
  - Identify migration and backup utilities required to perform migration.
  - Identify Access Manager for e-business security policy data to be migrated and determine procedures to perform.

Section 2: Installation

This section provides further information about the installation area of the test:

- Given a PKI product, configure a valid client-side certificate so that a user can successfully authenticate to Access Manager for e-business.

  With emphasis on performing the following steps:

  - Load Certificate Authority (CA) root certificate(s) into WebSEAL (CA root comes from PKI product).
  - Enable client-side certificate authentication.
  - Configure client-side certificates.

- Given the Access Manager for e-business packages and necessary hardware, perform the Access Manager for e-business installation to produce a working Access Manager for e-business system.

  With emphasis on performing the following steps:

  - Install Access Manager for e-business user registry if not installed.
  - Complete Access Manager for e-business user registry customization.
  - Install LDAP clients on the computers to be used for Access Manager for e-business servers.
  - Install the Access Manager for e-business server components.
  - Complete advanced Access Manager for e-business customization.

- Given user account information, create a registry usable by Access Manager for e-business.

With emphasis on performing the following steps:

- Identify existing user registries.
- Determine integration options and benefits/pitfalls.
- Determine migration options and benefits/pitfalls.
- Decide user registry approach.
- If integration: Design and code External Authentication C API or EAI (& SYNC process), decide 1-1 or n-1, and validate results.
- If migration: Identify sources of information, build and run the migration tool, and validate results.

- Given an existing Access Manager for e-business environment, perform basic system tests to validate the environment is functioning correctly.

  With emphasis on performing the following steps:

  - Check that all processes are running.
  - Perform logon and user/group ACL template creation administrative tasks.
  - Verify WebSEAL or Web server Plug-in works by attaching an ACL template to an HTML file and validate using a browser.

Section 3: Configuration and customization

This section provides further information about the configuration and customization area of the test:

- Given a firewall environment, create the proper rule setup so that a user can access Access Manager for e-business through the firewall.

  With emphasis on performing the following steps:

  - Identify where to install/configure Access Manager for e-business in a firewall environment.
  - Identify firewall changes for user registry and HTTP/HTTPS, and SSL Access Manager for e-business traffic.
  - Install/configure Access Manager for e-business in a firewall environment.

- Given security requirements, define a security namespace that includes all objects to be protected.

  With emphasis on performing the following steps:

  - Identify resources to be protected and identify explicit and default ACLs.
  - Identify replication semantics.
  - Identify non-static Web resources (JAVA, servlets, ActiveX®).
  - Identify how to apply protected object policies (POPs).

- Identify how to apply authorization rules.

- Given an organization's security policy, complete each task so that the policy database is configured successfully.

  With emphasis on performing the following steps:

  - Create extended ACL permissions and action groups.
  - Create protected object policies (POPs).
  - Identify how to apply POPs.
  - Create authorization rules.
  - Create secure domains.
  - Create policy templates.
  - Attach policy template to protected resource.
  - Implement Delegated User Administration requirements.

- Given a completed Access Manager for e-business deployment document containing password rules, set up all Access Manager for e-business administrators and users and configure the password rules for each.

  With emphasis on performing the following steps:

  - Define password policy options, including delegation of password reset.
  - Configure the Access Manager for e-business password policies.

- Given a Security Analysis Document and a Web application, configure Access Manager for e-business to achieve a secure, working solution.

  With emphasis on performing the following steps:

  - Analyze application characteristics, plug-ins, applets, user registry, ACLs, JavaScript™, absolute URLs, roles in use.
  - Identify and analyze application security requirements.
  - Design junctions (TCP, replication, encrypted, proxy, mutually authenticated, tag value, portal, transparent, virtual host) and required options.
  - Design SSO (FSSO, GSO, LTPA, EAI, TAI).
  - Describe junction mapping table usage.
  - Populate namespace (query contents, DYNURLs, application objects).
  - Design and create application security policy (EAS, ACLs, delegation, authorization rules).

- Given a business requirement to supplement the standard authorization process, implement external authorization services (EAS) to impose additional authorization controls and conditions.

With emphasis on performing the following steps:

- Register the EAS server with the Access Manager for e-business authorization service.
- Configure the attribute retrieval service plug-ins for connection to external sources.

- Given a deployment plan and details document, implement Web single sign-on such that cross domain and single domain requirements are met.

  With emphasis on performing the following steps:

  - Ensure that e-community, cross domain and/or Web single sign-on has been configured in Access Manager for e-business.
  - Create appropriate junctions to the candidate Web servers.
  - Add GSO resources and/or GSO resource groups.
  - Implement LTPA SSO for WebSphere and Domino® targets.
  - Implement TAI SSO for WebSphere.
  - Implement FSSO and EAI.
  - Implement Windows SPNEGO SSO for IIS or WebSEAL.
  - Populate each user's resource credential information.
  - Test Web SSO function (browser-to-Access Manager for e-business-to-Web server).
  - Test resource credential and change password via admin console and via end user.

- Given a requirement for dynamic URLs, configure dynamic URL control to protect Web content.

  With emphasis on performing the following steps:

  - Create a single static protected object file for dynamic URLs.
  - Map ACL namespace objects to dynamic URLs.
  - Update WebSEAL or plug-ins for dynamic URLs.

- Given a requirement for container-level integration, configure IBM Access Manager for WebSphere Application Server (AMWAS) to manage J2EE™ role-based security.

  With emphasis on performing the following steps:

  - Migrate EAR files from WebSphere Application Server to Access Manager for e-business environment.
  - Install and configure AMWAS under WebSphere Application Server.
  - Administer J2EE roles using AMWAS.

- Given an existing Tivoli Access Manager for e-business environment with WebSphere Application Server, perform steps to validate that Common Audit and Reporting Service server and client are functioning correctly.

  With emphasis on performing the following steps:

  - Examine directories for cached files.
  - Check that required processes are running.
  - Check that appropriate applications are running in the WebSphere Application Server.
  - Test connection from DB2® client to DB2 server.
  - Establish connection with DB2 and query for event records.
  - Perform administrative tasks in pdadmin to enable auditing.
  - Create events that will be reported by the Common Audit and Reporting Service.
  - Stage reports into tables.
  - Create a report using any reporting utility that is able to query DB2.
  - Verify configuration logs.
- Given an existing Tivoli Access Manager for e-business environment with Session Management Server installed, gather requirements necessary for the configuration of a Session Management Server environment.

  With emphasis on performing the following steps:

  - Gather system information necessary for configuration of participating servers.
  - Define configuration strategy (number and type of WebSEAL servers, number of load balancers, replicated Web servers, network information, physical and logical location of servers).
  - Design replica sets and session realms.
  - Define configuration parameters.
  - Determine what roles will be delegated to specific users.
  - Configure and test the configuration.

Section 4: Programming

This section provides further information about the programming area of the test:

- Given an existing Access Manager for e-business environment with WebSEAL, configure the external authentication C API to meet customer requirements.

With emphasis on performing the following steps:

- Configure WebSEAL to use external authentication C API.

- Given a custom application that requires specific authorization checking, evaluate and explain the authorization programming options via the Access Manager for e-business authorization APIs available to the development team, so they can design their application security architecture.

  With emphasis on performing the following steps:

  - Identify the application level resources needing protection.
  - Define and use the application namespace.
  - Identify available programming tools (such as Java2/JAAS and aznAPI).
  - Describe entitlement services.
  - Decide how to obtain optimum performance.
  - Decide how the credential inside the application will be obtained.

- Given requirements to programmatically manipulate the Access Manager user and policy repositories, design, code, and deploy an application using the administration API so that business requirements are met.

  With emphasis on performing the following steps:

  - Identify APIs by function.
  - Identify types of Access Manager for e-business objects which can be maintained using the administration APIs.
  - Identify the components of the administration API.

- Given custom password requirements that exceed built-in functionality, design, code, and deploy a password strength module so that the custom password requirements are met.

  With emphasis on performing the following steps:

  - Identify the APIs by function.
  - Configure the password strength module to be used during authentication.

- Given a deployment plan and details document, implement a secure external authentication interface (EAI) to WebSEAL such that additional authorization controls and conditions are met.

  With emphasis on performing the following steps:

  - Enable and configuring the EAI authentication mechanism in WebSEAL.
  - Initiate the authentication process.
  - Error handling.
  - Write the EAI authentication module.

Section 5: Maintenance and Troubleshooting

This section provides further information about the maintenance and troubleshooting area of the test:

- Given user and organization audit requirements, set up and configure auditing so that log files are produced for events and authorizations.

  With emphasis on performing the following steps:

  - Structure and enable the Access Manager for e-business audit processes.
  - Manage the size of audit files.
  - Capture audit and statistical data with information gathering tool.
  - Analyze and interpret log and audit reports.

- Given user and organization logging requirements, set up and configure logging so that log file entries are produced for events and authorizations.

  With emphasis on performing the following steps:

  - Structure and enable Access Manager for e-business logging functions; tailor events logged.
  - Manage the size of Access Manager for e-business log files.
  - Capture log data with information gathering tool.
  - Analyze log reports.
  - Enable remote logging function.

- Given a valid Access Manager for e-business problem, perform troubleshooting tasks so that a successful problem resolution or workaround is found.

  With emphasis on performing the following steps:

  - Qualify the problem.
  - Collect debug information using Access Manager for e-business trace facilities.
  - Isolate the problem.
  - Consult knowledge base.
  - Solve the problem (if possible).

- Given an existing Access Manager for e-business environment, use command-line utilities to perform backup and recovery tasks.

  With emphasis on performing the following steps:

  - Commands and options for restoring data from an archive.
  - Commands and options for backing up data to an archive.

– Information and files collected by the default backup configurations.

1.3 Recommended educational resources

Courses and publications are offered to help you prepare for the certification tests. The courses are recommended, but not required, before taking a certification test. If you want to purchase Web-based training courses or are unable to locate a Web-based course or classroom course at the time and location you desire, contact one of our delivery management teams at:

- Americas:

  mailto:tivamedu@us.ibm.com

- EMEA:

  mailto:tived@uk.ibm.com

- Asia-Pacific:

  mailto:tivtrainingap@au1.ibm.com

Note: Course offerings are continuously being added and updated. If you do not see courses listed in your geographical location, contact the delivery management team.

1.3.1 Courses

This section provides information about the currently available or planned Tivoli Access Manager for e-business (ITAMeb) 6.0 courses. At the time of this writing some of the courses are not yet being offered. Refer to the Tivoli software education Web site to learn more about course availability and to find the appropriate courses and education delivery vendor for each geography. The Web site is:

http://www.ibm.com/software/tivoli/education

General training information is available at the following Web site:

http://ibm.com/training

You can also refer to the existing *Education Roadmap for IBM Tivoli Access Manager for e-business 5.1* at the following Web site:

ftp://ftp.software.ibm.com/software/tivoli/education/Roadmaps/TAM_51.pdf

(Although this document still refers to Access Manager for e-business V5.1, you will find many helpful education guidelines.)

ITAMeb 6.0 Overview

This course functions as a general overview and outline of the benefits and functions of IBM Tivoli Access Manager for e-business.

Course duration

This is a two-hour, self-paced course.

Objectives

After taking this course, you will be able to:

- Describe the IBM Tivoli Access Manager product family.
- Describe the high-level architecture of IBM Tivoli Access Manager for e-business.
- Describe how IBM Tivoli Access Manager for e-business secures access to business applications and resources.

Outline

The course follows this outline:

1. Introduction to IBM Tivoli Access Manager for e-business
2. Managing IBM Tivoli Access Manager for e-business
3. Securing access with IBM Tivoli Access Manager for e-business

ITAMeb 6.0 Installation

This Web-based course focuses on IBM Tivoli Access Manager for e-business installation. An overview of the IBM Tivoli Access Manager for e-business architecture will also be covered in this course.

Course duration

This is a four-hour, self-paced course.

Objectives

After taking this course, you will be able to:

- Explain the architecture of IBM Tivoli Access Manager for e-business.
- Describe how to install and configure IBM Tivoli Access Manager for e-business and its prerequisites for a particular case study.
- Describe how to install and configure Web Portal Manager to manage the Access Manager environment.
- Describe how to install and configure the IBM Tivoli Directory Server Web Application Tool in order to simplify management of the IBM Tivoli Directory Server user registry.

- Describe how to tailor a security environment with IBM Tivoli Access Manager for e-business Web server plug-ins.
- Troubleshoot Access Manager for e-business installations.

ITAMeb 6.0 Managing Users and Access Control

This Web-based course focuses on managing users, groups, and access control.

Course duration

This is a four-hour, self-paced course.

Objectives

After taking this course, you will be able to:

- Describe the role of the user registry in IBM Tivoli Access Manager for e-business implementation.
- Create users, groups, access control lists, and protected object policies to manage the authentication and authorization of users.
- Use pdadmin commands and Web Portal Manager to manage users, groups, and access control.
- Describe authorization rules to customize access control.
- Create Access Manager domains to unify the authentication and authorization of users.
- Create Access Manager delegated administrators to delegate domain management responsibilities to lower-level administrators.
- Use auditing to track users' and administrators' activities.
- Implement the Access Manager common auditing and reporting systems (CARS) for historical and operational reporting.

ITAMeb 6.0 WebSEAL

This Web-based course focuses on the Access Manager for e-business WebSEAL.

Course duration

This is a four-hour, self-paced course.

Objectives

After taking this course, you will be able to:

- Describe how WebSEAL secures Web-based resources.
- Install and configure WebSEAL.

- Use pdadmin commands and Web Portal Manager to manage the WebSEAL environment.
- Describe and implement a variety of authentication methods including forms-based single sign-on, cross domain single sign-on, Windows desktop single sign-on (SPNEGO), and client-side certificates.
- Install and configure Session Management Server (SMS), and use WebSEAL shared session management to limit concurrent sessions and terminate or inspect active sessions.
- Create and manage WebSEAL junctions to unify the Web space of the back-end servers with the Web space of the WebSEAL server.
- Enable auditing to track user activities.
- Enable logging to troubleshoot the WebSEAL environment.

ITAMeb 6.0 Deployment and Administration

This is a classroom course with hands-on labs for the IBM Tivoli Access Manager for e-business 6.0 product. IBM Tivoli Access Manager is an authentication and authorization solution for corporate Web, client/server, and existing applications.

This product allows customers to control user access to protected information and resources by providing a centralized, flexible, and scalable access control solution. This course is targeted for System Administrators, Security Architects, Application Programmers, and Identity Developers who are responsible for maintaining large numbers of users, groups, and access to specific information resources.

Course duration

This is a four-day, classroom course.

Objectives

After taking this course, you will be able to:

- Describe how IBM Tivoli Access Manager for e-business secures access to business applications and resources.
- Explain the architecture of IBM Tivoli Access Manager for e-business.
- Describe how IBM Tivoli Access Manager for e-business can integrate with new or existing products to secure business applications and resources.
- Describe how to install and configure IBM Tivoli Access Manager for e-business and its prerequisites for a particular case study.
- Describe how to install and configure Web Portal Manager to manage the Access Manager environment.

- Describe how to install and configure IBM Tivoli Directory Server Web Application Tool in order to ease management of the IBM Tivoli Directory Server user registry.
- Troubleshoot Access Manager for e-business installations.
- Describe the role of the user registry in IBM Tivoli Access Manager for e-business implementation.
- Create users, groups, access control lists, and protected object policies to manage the authentication and authorization of users.
- Use pdadmin commands and Web Portal Manager to manage users, groups, access control, and WebSEAL environment.
- Describe authorization rules to customize access control.
- Create Access Manager domains to unify the authentication and authorization of users.
- Create Access Manager delegated administrators to delegate domain management responsibilities to lower-level administrators.
- Use auditing to track users' and administrators' activities.
- Implement the Access Manager common auditing and reporting systems (CARS) for historical and operational reporting.
- Describe how WebSEAL secures Web-based resources.
- Install and configure WebSEAL.
- Describe a variety of authentication methods including basic authentication, forms authentication, client-side certificate authentication, and external authentication interface.
- Describe Session Management Server (SMS) and WebSEAL shared session management to limit concurrent sessions and terminate or inspect active sessions.
- Create and manage WebSEAL junctions to unify the Web space of the back-end servers with the Web space of the WebSEAL server.
- Enable auditing to track user activities.
- Enable logging to troubleshoot the WebSEAL environment.
- Describe how to tailor a security environment with IBM Tivoli Access Manager for e-business Web server plug-ins.

Outline

The course follows this outline:

1. IBM Tivoli Access Manager for e-business 6.0 Introduction and Overview
   - Lesson 1: IBM Tivoli Access Manager for e-business

- Lesson 2: Tivoli Access Manager for e-business Architecture
- Lesson 3: Authentication and Authorization

2. IBM Tivoli Access Manger for e-business Installation and Configuration
   - Lesson 1: Planning a New Tivoli Access Manager Deployment
   - Lesson 2: Installing Tivoli Access Manager
   - Lesson 3: Tivioli Access Manager Prerequisites
   - Lesson 4: Installation Methods
3. Tivoli Access Manager and the User Registry
   - Lesson 1: Lightweight Directory Access Protocol
   - Lesson 2: Setting up LDAP
   - Lesson 3: Processing LDAP Requests
4. Managing Users and Groups
   - Lesson 1: Tivoli Access Manager Administration
   - Lesson 2: Tivoli Access Manager Users and Groups
5. Managing Access Control
   - Lesson 1: Protected Object Space
   - Lesson 2: Access Control Lists (ACLs)
   - Lesson 3: Protected Object Policies (POPs)
   - Lesson 4: IP Authentication
   - Lesson 5: New to Tivoli Access Manager for e-business
6. Introduction to WebSEAL
   - Lesson 1: WebSEAL
   - Lesson 2: WebSEAL Features
   - Lesson 3: WebSEAL Authentication Mechanisms
   - Lesson 4: WebSEAL Junctions
   - Lesson 5: Web Space Scalability
   - Lesson 6: Single Sign-on
7. WebSEAL Installation and Configuration
   - Lesson 1: WebSEAL Installation
   - Lesson 2: WebSEAL Configuration
   - Lesson 3: WebSEAL Instance Management

8. WebSEAL Authentication
   - Lesson 1: Authentication Overview
   - Lesson 2: Authentication Methods
   - Lesson 3: Basic Authentication
   - Lesson 4: Forms Authentication
   - Lesson 5: Client-side Certificate Authentication
   - Lesson 6: Token Authentication
   - Lesson 7: Reauthentication
   - Lesson 8: External Authentication Interface
9. Standard WebSEAL Junctions
   - Lesson 1: WebSEAL Junctions
   - Lesson 2: URL Filtering
   - Lesson 3: Junction Mapping Table
   - Lesson 4: Transparent Path Junctions
   - Lesson 5: Worker Thread Limits
10. Virtual Host Junctions
   - Lesson 1: Virtual Host Junction Concepts
   - Lesson 2: Managing Virtual Host Junctions
   - Lesson 3: Multiple Listening Addresses and Ports
   - Lesson 4: Junction Throttling
11. Single Sign-on
   - Lesson 1: Single Sign-on Concepts
   - Lesson 2: Basic Authentication Single Sign-on
   - Lesson 3: Global Sign-on (GSO)
   - Lesson 4: Forms Single Sign-on Authorization
12. Session Management Server
   - Lesson 1: Session State Concepts
   - Lesson 2: Session Management Server
   - Lesson 3: SMS Administration
   - Lesson 4: Installation
   - Lesson 5: Configuration

13. Domain and Policy Proxy Server
    - Lesson 1: Domains
    - Lesson 2: Policy Proxy Server
14. Delegated Administration
    - Lesson 1: Delegated Administration
    - Lesson 2: ACLs for User and Group
15. Logging and Auditing
    - Lesson 1: Overview of Event Types and Logging Support
16. Common Auditing and Reporting Services (CARS)
    - Lesson 1: Common Auditing and Reporting Services Overview
    - Lesson 2: Installation and Configuration
    - Lesson 3: CARS Reporting

Required skills

The following list contains the prerequisite general knowledge and Tivoli product knowledge an attendee must have prior to attending the course:

- Basic operating-system administrative skills for Linux
- Basic knowledge of Lightweight Directory Access Protocol (LDAP)
- TCP/IP fundamentals
- Firewall concepts
- Working knowledge of Web protocols (HTTP, XML)
- Basic knowledge of IBM WebSphere Application Server

ITAMeb 6.0 Customization

This instructor-led course focuses on Access Manager for e-business customization topics.

Course duration

This is a four-day, classroom course.

Objectives

After taking this course, you will be able to:

- Create and manage authorization rules to customize access control.
- Implement step-up authentication to control the method used to access a protected resource.

- Describe performance tuning for Access Manager.
- Describe how to develop a redundant Access Manager environment to reduce down time.
- Customize External Authentication Interface (EAI) to supply custom authenticated identity information to WebSEAL.
- Develop custom login pages for each junction to tailor the user experience.
- Use the Java Authentication and Authorization Service (JAAS), and the aznAPI to integrate Access Manager in custom applications.
- Describe J2EE Application and Security
- Configure Access Manager for a Java application framework.
- Integrate Access Manager into a J2EE application framework such as WebSphere.
- Externalize roles from WebSphere to Access Manager.
- Import users and groups from WebSphere to Access Manager.

1.3.2 Publications

IBM Tivoli Access Manager guides and Redbooks are useful tools for preparing to take Test 876.

IBM Tivoli Access Manager product documentation

You might want to refer to the following guides:

- Release notes
  - *IBM Tivoli Access Manager for e-business Version 6.0 Release Notes,* SC32-1702
- Installation guides
  - *Tivoli Access Manager for e-business Version 6.0 Installation Guide,* SC32-1361
- User and administration guide
  - *IBM Tivoli Access Manager Version 6.0 Administration Guide,* SC32-1686
  - *IBM Tivoli Access Manager for e-business Version 6.0 WebSEAL Administration Guide,* SC32-1687
  - *IBM Tivoli Access Manager for e-business Version 6.0 Plug-in for Web Servers Administration Guide*, SC32-1690-01Other publications
  - *IBM Tivoli Access Manager for e-business Version 6.0 BEA WebLogic Server Administration Guide*, SC32-1688

- Developers guides
  - *IBM Tivoli Access Manager for e-business Version 6.0 Administration C API Developer Reference*, SC32-1692
  - *IBM Tivoli Access Manager Version 6.0 Administration Java Classes Developer Reference*, SC32-1692
- Technical supplement
  - *IBM Tivoli Access Manager for e-business Version 6.0 Problem Determination Guide*, SC32-1701

To obtain the online publications for IBM Tivoli Access Manager for e-business, visit the following Web site.

http://publib.boulder.ibm.com/tividd/td/IBMAccessManagerfore-business6.0.html

IBM Redbooks

Refer to the following IBM Tivoli Identity Manager-related Redbooks:

- *Enterprise Security Architecture Using IBM Tivoli Security Solutions*, SG24-6014

  This redbook looks at Tivoli's overall Enterprise Security Architecture, focusing on the integration of audit and compliance, access control, identity management, and federation throughout extensive e-business enterprise implementations. The available security product diversity in the marketplace challenges everybody in charge of designing single secure solutions or an overall enterprise security architecture. With Access Manager, Identity Manager, Privacy Manager, Risk Manager, Federated Identity Manager, Security Compliance Manager, Directory Server, and Directory Integrator, Tivoli offers a complete set of products designed to address these challenges.

  This redbook describes the major logical and physical components of each of the Tivoli products and it depicts several e-business scenarios with different security challenges and requirements. By matching the desired Tivoli security product criteria, it describes appropriate security implementations that meet the targeted requirements.

- *Integrated Identity Management using IBM Tivoli Security Solutions*, SG24-6054

  This redbook provides a solution-oriented overview of using Tivoli security products to provide an implementation for integrated identity management based on real-life customer experience.

  When defining functional requirements for e-business-related projects, you have to take into consideration a serious amount of security-related tasks and disciplines. These disciplines are authentication and credential acquisition,

use of directory infrastructures, session management, multiple tiers of single sign-on, authorization, administration, users and policy, accountability, and availability. Together they stand for the integrated identity management approach, an approach that should be regarded as a holistic way of tying security requirements into your projects.

- *Identity and Access Management Solutions Using WebSphere Portal V5.1, Tivoli Identity Manager V4.5.1, and Tivoli Access Manager V5.1*, SG24-6692

  The identity and access management solutions described is this redbook feature user provisioning, authentication, and authorization.

  Part 1 of the redbook describes the key concepts, benefits, and architecture of an identity and access management solution.

  Part 2 contains an end-to-end working example scenario for an identity and access management system. The example includes business requirements, architecture, details for implementing the runtime and development environments, creation of the Tivoli Identity Manager policies and workflow, provisioning portlet development, deployment, and administration.

  Part 3 provides procedures to deploy and run the human resources and document management applications used in the working example.

  The working example includes solutions for the following key areas:

  – User provisioning: Develop a portlet interface for self-care (user and account management), and approval of user provisioning requests by using the Tivoli Identity Manager APIs, policies, and workflow. Tivoli Directory Integrator assembly lines and connectors are used to provision users to LDAP, DB2 Content Manager, and the HR application database. In addition, Tivoli Identity Manager-provided security audit trail reports are used.

  – Authentication: Provide a user an integrated single sign-on (SSO) solution using Tivoli Access Manager to authenticate once and access resources or applications within the enterprise.

  – Authorization: Manage user access control through Tivoli Identity Manager provisioning policies and role mapping with products that have access models such as Tivoli Access Manager, WebSphere® Portal, and DB2 Content Manager.

2

Planning

This chapter gives an overview of IBM Tivoli Access Manager for e-business (ITAMeb). It describes the major components and their position in a real network environment. This description provides an overview of things important to planning and architecting the design of an Access Manager system. It also covers migration planning, tools, and issues.

2.1 Access management overview

Access control management plays a very significant role in any security architecture and implementation. The purpose of access control in an overall IT security architecture is to enforce security policies by gating access to, and execution of, processes and services within a computing solution via identification, authentication, and authorization processes, along with security mechanisms that use credentials and attributes. In security systems, authentication is distinct from authorization. *Authentication* is the process of identifying an individual who is attempting to log in to a secure domain. It gives the answer on the question: “Who are you?”. *Authorization* is the act of determining what resources an authenticated user can access. To put it simply, authorization provides you with a yes or no answer to the question: “Are you authorized (do you have permission) to access/manipulate the requested object?”. Part of the authentication process involves the creation of a credential that describes the identity of the user. Authorization decisions made by an authorization service are based on user credentials.

Access control information, which generally evolves around authentication and authorization mechanisms, is handled by IBM Tivoli Access Manager.

The following products make up the IBM Tivoli Access Manager family:

- IBM Tivoli Access Manager for e-business (ITAMeb)
- IBM Tivoli Access Manager for Business Integration (ITAMBI)
- IBM Tivoli Access Manager for Operating Systems (ITAMOS)

This book focuses on IBM Tivoli Access Manager for e-business, which provides robust, policy-based security to a corporate Web environment. Authentication of users, control of access privileges, auditing, single sign-on, high availability, and logging are all essential elements of any security management solution and are provided by Access Manager for e-business.

2.2 Core components

Access Manager for e-business, like the whole Access Manager product family, is based on two core components:

- A user registry.
- An *authorization service* consisting of an *authorization database* and an *authorization engine* that performs the decision-making action on the request.

A user registry and an authorization service are the fundamental building blocks upon which Access Manager provides its security service capabilities. All other Access Manager services and components are built upon this base foundation.

Figure 2-1 shows the general authorization model.

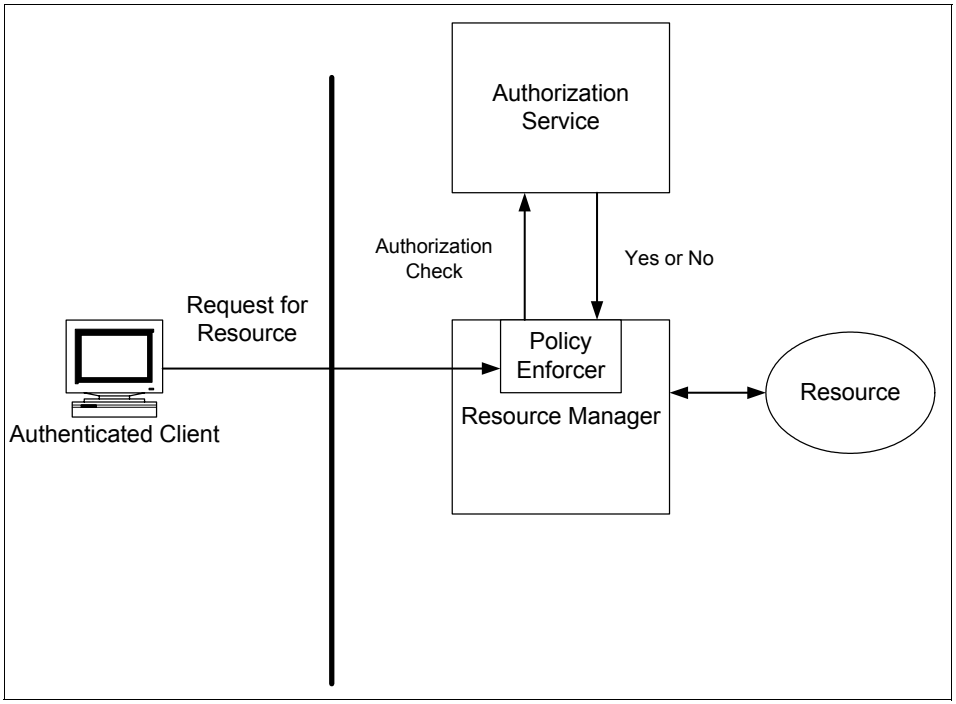


Figure 2-1 General authorization model

Another component that is very close to the base components is called a *resource manager*. It is responsible for applying security policy to resources. The policy enforcer component directs the request to the authorization service for evaluation. Based on the authorization service result (approval or denial) the resource manager allows or denies access to the protected resources.

Access Manager authorization decisions are based upon the *Privilege Attribute Certificate* (PAC), which is created for each user authenticated in an Access Manager environment, regardless of the authentication mechanism used.

Figure 2-2 on page 30 shows the implementation of the general authorization model for an Access Manager for e-business security solution. The major components are:

- User registry
- Policy Server
- WebSEAL, as a major resource manager

Those components are described in the following sections.

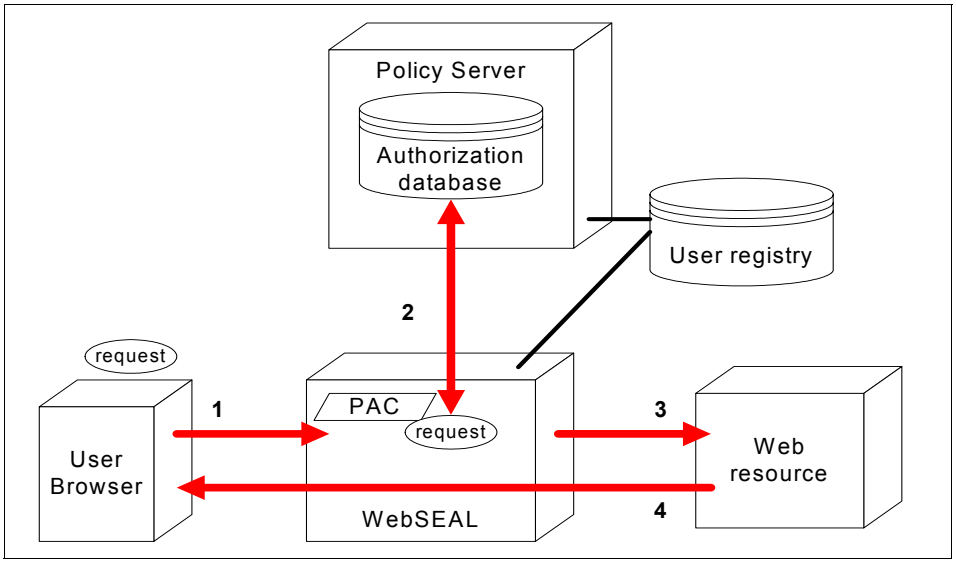


Figure 2-2 Access Manager for e-business basic components

Let us take a look at the basic logical flow for an authorization decisions:

1. After a user has authenticated, WebSEAL requests a Privilege Attribute Certificate (PAC) to be created from the information in the user registry. This certificate is bound to the specific user session and it is used as the basis for querying the policy database during subsequent authorization decisions. This certificate is important because authorization decisions are context-dependent. That means, a user might be granted access to back-end information for one type of transaction, but be rejected when attempting a similar transaction from another application.
2. Whenever a user requests access to a back-end resource (application, data, and so on), WebSEAL uses the PAC to query the authorization database, which contains the protected object space maintained by the Access Manager Policy Server, for any existing access control list (ACL), protected object policy (POP), or authorization rule, in order to determine a *yes/no* answer whether the request can be granted or has to be denied. (Access control lists, protected object policy, and authorization rules are discussed in 2.2.2, “Policy Server” on page 32.)
3. If the answer is *yes*, the request is allowed to the Web resource.
4. The Web resource answers the request and the results are returned to the user.

Note that in a real situation this authorization process can be more complex. One of the major differences is that WebSEAL caches an authorization database replica locally and does not query the Policy Server for every user request.

2.2.1 User registry

Access Manager requires a user registry to support the operation of its authorization functions. Specifically, it provides:

- A database of the user identities that are known to Access Manager.
- A representation of groups in Access Manager that users have membership with.
- A data store of metadata required to support additional functions.

Identity mapping

While it can be used to authenticate users, this is not the primary purpose of the user registry. Access Manager can authenticate a user via a variety of methods (ID/password, certificate, and so on), and then map the authenticated identity to one defined in the user registry. For example, consider a user John who authenticates himself to Access Manager using a certificate as dn=john123. Access Manager can be configured to programatically map the distinguished name (DN) in the certificate to a pre-defined value for many to one (n:1) mappings, or an algorithm can be applied to manipulate the username based on external attributes or data. When making subsequent authorization decisions, the internal Access Manager user identity is passed between the application and other components using various mechanisms, including a special credential known as a Privilege Attribute Certificate (PAC).

User registry structure

The default user registry is LDAP-based, and Access Manager consolidates its registry support around a number of LDAP directory products. Access Manager can use the following directory products for its user registry:

- IBM Tivoli Directory Server
- Novell eDirectory
- Sun™ Java™ System Directory Server
- Microsoft® Active Directory
- IBM Lotus® Domino Server
- IBM z/OS® LDAP Server

The IBM Tivoli Directory Server is included with Access Manager and is the default LDAP directory for implementing the user registry. For the latest list of supported user registries refer to the *IBM Tivoli Access Manager for e-business Version 6.0 Release Notes,* SC32-1702.

An LDAP-based user registry stores its data as objects and organizes it hierarchically in a tree structure called the *Directory Information Tree* (DIT). An LDAP-based user registry can have multiple DITs. The root of every tree starts with a *suffix*. Objects are described with various attributes. The user registry for Access Manager contains three types of objects:

- User objects, which contain basic user attributes.
- Group objects, which represent roles that user objects may be associated with.
- Access Manager metadata objects, which contain special Access Manager attributes that are associated with user and group objects. The metadata includes information that helps linking an Access Manager user ID to its corresponding registry user object.

Tivoli Access Manager v6 has altered the way it stores a user's metadata objects in the directory. It has migrated to a minimal data model that minimizes the disruption to an existing DIT structure. All data for Tivoli Access Manager can now be stored under a separate *secAuthority=Default* suffix, leaving user and group objects that are part of the existing suffix to co-exist in the directory untouched.

Access Manager components support the use of directory replicas, peer-to-peer (multi-master) replication, and directory partitioning. It is recommended that a directory architecture be completed to ensure the directory environment will perform as expected with Tivoli Access Manager and any other applications that may wish to participate in directory services. Minimal functional and security recommendations for the directory architecture in regard to a Tivoli Access Manager deployment are a master-replica topology where Access Manager resource managers (WebSEAL, Plug-in for Web servers) are configured to use directory replicas and the Access Manager Policy Server is configured to use the directory master(s).

2.2.2 Policy Server

The Access Manager Policy Server maintains the master authorization database for the *secure domain*. This server is primarily used for two types of administrative activities:

- Modifying the registry to define which objects participate in the secure domain.
- Updating the authorization database with policy definitions.

The Policy Server manages the master authorization database, which, in addition to resource policies, contains location information about other Access Manager servers in the secure domain. Local replicas of the master authorization database are available for resource managers via a push/pull method initiated

through the Access Manager runtime service. Each secure domain can only have one Policy Server.

Authorization database

Separate from the user registry, Access Manager uses for its authorization functions a special database containing a virtual representation of resources it protects. Called the Tivoli Access Manager policy database, it uses a proprietary format and contains object definitions for the *protected object space* that may represent logical or actual physical resources. Objects for different application types may be contained in different parts of the object space, and the object space may be extended to support new application types as required. The policy database stores the following elements:

- Protected objects in a hierarchical tree structure (these are abstract representations of the real objects which Access Manager intends to protect)
- Policies in 3 different forms: ACLs, POPs, and authorization rules
- Actions and action groups
- Relationships (attachments) between policies and objects

Management of the policy database is achieved with one of the following three administration methods or a combination thereof:

- pdadmin CLI
- Web GUI Web Portal Manager (WPM)
- Administration API (C or Java)

The security policy for these resources is implemented by applying appropriate security mechanisms to the objects requiring protection. Security mechanisms are also defined in the authorization database, and include:

- Access control list (ACL) policy templates
- Protected object policy (POP) templates
- Authorization rules (Rules)

A security policy can be explicitly applied or inherited. The Tivoli Access Manager protected object space supports inheritance of ACLs, POPs, and authorization rules. This is an important consideration for the security administrator who manages the object space. The administrator needs to apply explicit policies only at points in the hierarchy where the rules must change, but must be mindful that unless otherwise defined, child objects at points below will inherit those policies.

Access control list (ACL) policy

ACLs are special Access Manager objects that define policies identifying user types that can be considered for access, and specify permitted operations. In the Access Manager model, ACLs are defined separately from and then attached to

one or more protected objects, so an ACL has no effect on authorization until it becomes associated with a protected object. The best practice, as with any type of access control list, is to place users into groups and then assign specific permissions to those groups.

Access Manager uses an inheritance model in which an ACL attached to a protected object applies to all other objects below it in the tree until another ACL is encountered.

Protected object policy (POP)

ACL policies provide the authorization service with information that results in a yes or no answer on a request to access a protected object and perform some operation on that object.

A POP specifies additional conditions governing the access to the protected object, such as privacy, integrity, auditing, and time-of-day access.

POPs are attached to protected objects in the same manner as ACLs. Unlike ACLs, which are dependent on what user or group is attempting the action, POPs affect all users and groups.

Note: In addition to ACL and POP, extended attributes are additional values placed on an object that can be read and interpreted by third-party applications (such as an external authorization service).

Authorization rules (Rules)

Authorization rules are defined in XSL (eXtensible Stylesheet Language) to specify further conditions that must be met before access to a resource is permitted. Rules enable you to make authorization decisions based on the context and the request environment, as well as who is attempting the access and what type of action is being attempted. These conditions are evaluated as a Boolean expression to determine whether the request should be allowed or denied.

Multi-domain Policy Server

There can only be a single Policy Server in an Access Manager secure domain. There can, however, be multiple secure domains contained within a single Policy Server. Each domain has its own authorization database, resource managers, administrative users and groups, and Global Sign-On (GSO) information. In addition, domains can either share users and groups or each have their own set of users and groups. Management tools may also be shared between domains or allocated on a per-domain basis. Figure 2-3 illustrates the relationship between Access Manager components in a multi-domain environment.

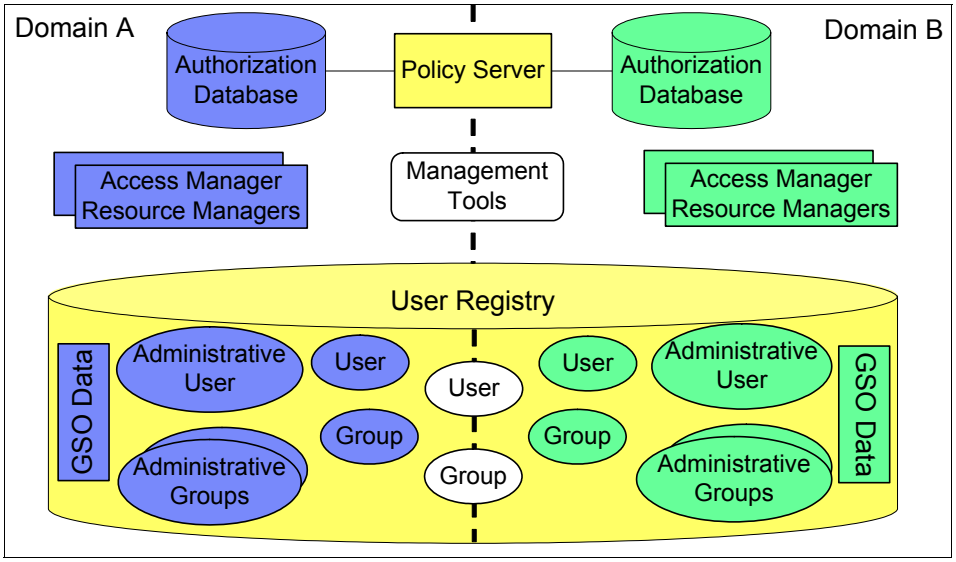


Figure 2-3 Access Manager components in a multi-domain environment

In a single domain environment, the default domain is the only domain used. In a multi-domain environment, the default domain becomes the management domain. The Policy Server will always belong to this domain. All domains are created and deleted from the management domain.

Figure 2-4 on page 36 illustrates the relationship between the Policy Server, multiple domains, and their corresponding authorization databases.

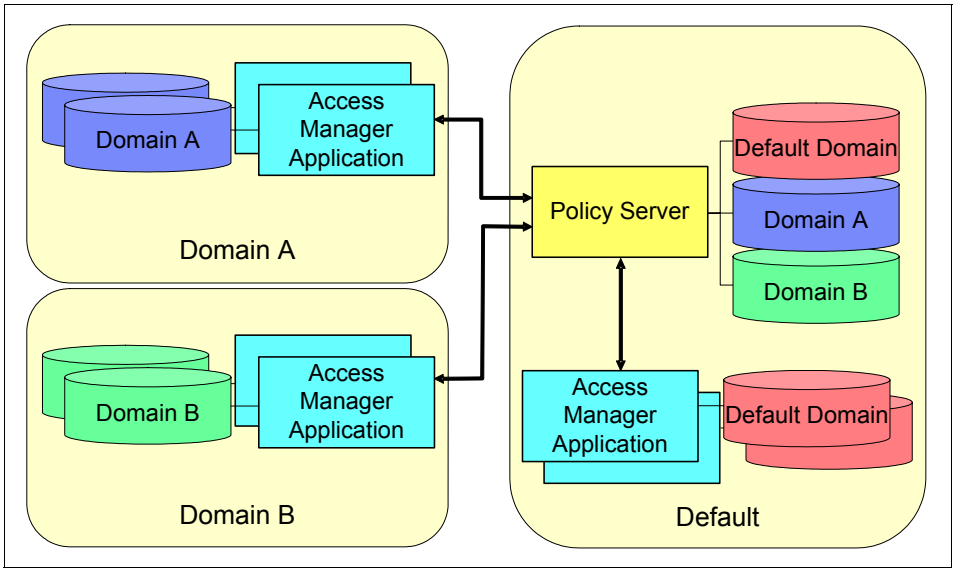


Figure 2-4 Multiple domains with multiple authorization databases

There are many valid reasons why an enterprise might consider the multiple domain model when developing their security architecture. One of the main reasons is the need to segment security completely while still sharing the same user base. When using multiple domains, completely separate policies can be set up for each domain. There is no possibility that a security policy from one domain can conflict with a security policy of another. Also, since the administrative functionality is completely separated, an administrator from one domain does not necessarily have rights in another domain. A real world example of this would be a partnership of companies that wish to use Access Manager and have different policies (and perhaps even laws that regulate them), which prevent them from using the same security model. Another would be a development environment in which each development organization is given their own domain to prevent conflicts during the development cycle.

Standby Policy Server

To provide the redundancy for the shared data and for the functions that are provided by the Tivoli Access Manager Policy Server, you can install and configure a primary Policy Server and a standby Policy Server. The standby server takes over Policy Server functions in the event of a system or primary Policy Server failure. The standby Policy Server acts as the primary Policy Server until the original primary Policy Server is up and running again, at which time the standby server goes back to serving as the failover server.

Note: Configuring a standby Policy Server requires the use of additional software such as HACMP™ on AIX.

2.2.3 WebSEAL

Access Manager for e-business has several resource managers that build upon the core infrastructure to provide access control to Web-based applications.

WebSEAL is a high-performance, multi-threaded *reverse proxy* that sits in front of back-end Web applications. It applies a security policy to a protected object space. WebSEAL can provide single sign-on solutions and incorporate back-end Web application server resources into its security policy. Because it is implemented on an HTTP server foundation, it is limited to enforcing policy for applications communicating with HTTP and HTTPS protocols.

Junctions

The back-end services to which WebSEAL can proxy are defined via *junctions*, which define a set of one or more back-end Web servers that are associated with a particular URL. Access Manager for e-business 6.0 provides three types of junctions, which are described in more detail in the following sections. The three types are:

- Standard junction
- Virtual host junction
- Transparent path junction

Replicated WebSEALs

It is possible to replicate WebSEAL servers for availability and scalability purposes. There are specific configuration requirements for creating WebSEAL replicas, and a front-end load balancing service must be used to distribute incoming requests among the replicas. Also, since each WebSEAL replica, by default, maintains active session states for its own authenticated users, when front-end load balancing options for affinity are limited or not available, it is recommended that the Access Manager Session Management Server (SMS) be used to maintain state and avoid limitations for policy enforcement, management, security, and the end user experience.

Note: Front-end load balancing metrics should be configured to keep users *sticky* to individual instances of WebSEAL. Only when used with the Session Management Server should metrics such as *round-robin* be used.

Single sign-on (SSO)

The concept of single sign-on (SSO) is fairly straightforward: When a user accesses a Web application, the user is challenged for a password only once, and from that point forward in the user experience with all Web content, no additional passwords are requested. Tivoli Access Manager provides SSO capabilities through WebSEAL with a software library that authenticates the user-provided name and password against information stored within a user registry. Access Manager for e-business SSO can be provided through several authentication methods: Basic Authentication (BA), as provided via an HTML standard authentication mechanism, X.509 certificates, biometrics, and so on. Once authenticated via WebSEAL, there are techniques to configure the Access Manager framework to pass certificate information to back-end Web resources transparently to the user.

Virtual hosting

Multiple instances of WebSEAL can be created on a single machine using the WebSEAL configuration utility. Also, a single WebSEAL instance can listen to multiple interfaces and multiple ports. Different IP and SSL configuration information can be associated with each interface.

2.2.4 Plug-In for Web servers

The *Plug-In for Web servers* architecture provides a solution where the customer has decided to deploy a Web plug-in architecture rather than taking a reverse proxy approach.

Figure 2-5 shows an architectural overview of the Plug-In for Web servers implementation.

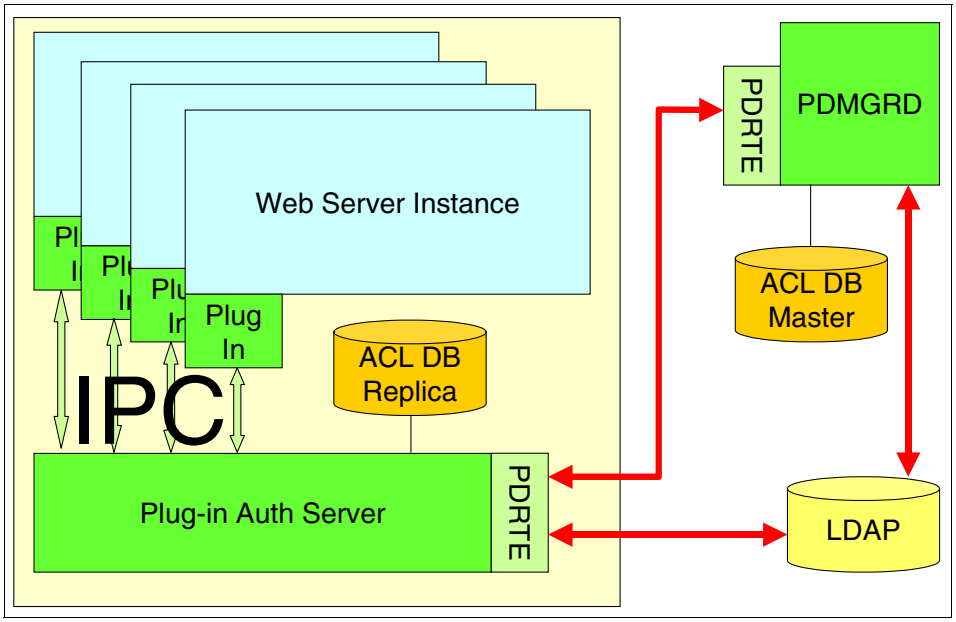


Figure 2-5 Access Manager Plug-In for Web servers architecture

In most Web server environments, there are multiple server threads in operation on the machine. These might be different threads of the same Web server instance or threads of different Web server instances. Having a distinct authorization engine for each thread would be inefficient, but would also mean that session information would have to be shared between them somehow.

The architecture used contains two parts:

- Interceptor

  This is the real *plug-in* part of the solution. Each Web server thread has a plug-in running in it that gets to see and handle each request/response that the thread deals with. The interceptor does not authorize the decisions itself; it sends details of each request (via an inter-process communication interface—IPC) to the Plug-In Authorization Server.

- Plug-In Authorization Server

  This is where authorization decisions are made and the action to be taken is decided. There is a single Plug-In Authorization Server on each machine and it can handle requests from all plug-in types. The Plug-In Authorization Server is a local cache mode aznAPI application that handles authentication and authorization for the plug-ins. The Authorization Server receives intercepted requests from the plug-ins and responds with a set of commands that tell the plug-in how to handle the request.

2.2.5 Plug-In for Edge Server

The Access Manager *Plug-In for Edge Server* is a plug-in for the Edge Server Caching Proxy component of the IBM WebSphere Edge Server. It adds Access Manager authentication and authorization capabilities to the proxy, and in certain scenarios it provides an alternative to WebSEAL for managing access to Web content and applications.

While the Plug-In for Edge Server shares many of the same capabilities as WebSEAL, its configuration is different. However, architecturally, it fits into most Access Manager scenarios in the same manner as WebSEAL.

Among other differences is one key differentiator between the plug-in and WebSEAL: the plug-in can be used in both forward and reverse proxy configurations, while WebSEAL only supports a reverse proxy.

The plug-in also integrates with the IBM WebSphere Everyplace® Suite and supports forms-based login and Access Manager WebSEAL fail-over cookies. Figure 2-6 provides a simplified view of the Plug-In for Edge Server architecture used as a reverse proxy (a forward proxy scenario is virtually identical, except that the proxy operations are to the outside rather than back-end servers).

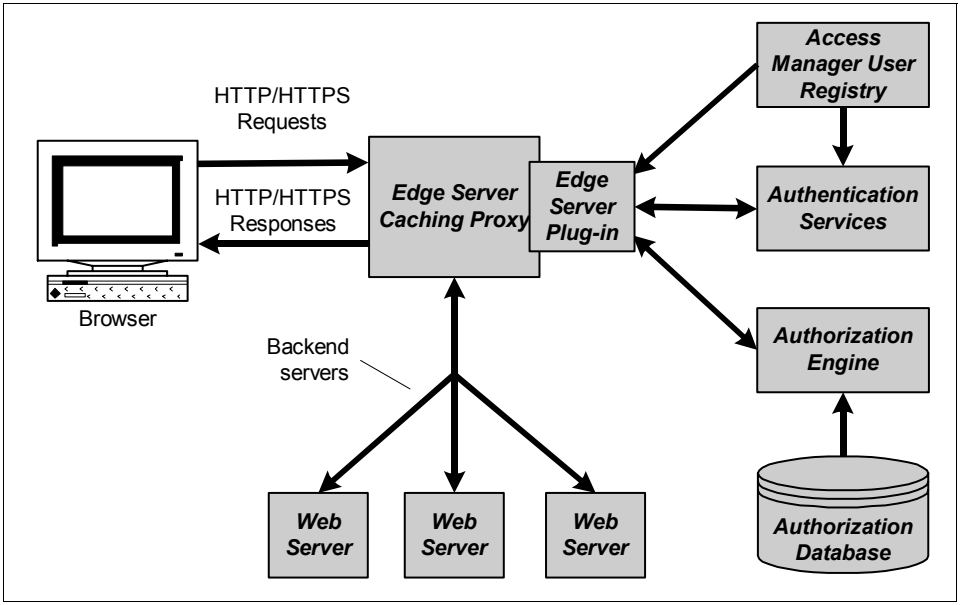


Figure 2-6 Plug-in for Edge Server architecture

2.3 Management components

Access Manager for e-business provides three management tools that can be used for the administration of your Access Manager system. Those tools are:

- The *pdadmin* utility, which provides a command line interface (CLI) for performing administrative functions such as adding users or groups. It is a C-based application that is installed as part of the Access Manager run time environment (PDRTE) client component.
- The *Web Portal Manager* (WPM), which provides a browser-based capability for performing most of the same functions provided by the pdadmin utility.
- The previous two utilities are built using the Tivoli Access Manager *administration API*, which enables the CLI and WPM interfaces for program-initiated administrative functions and queries. The administration API may also be used by custom applications to perform various Access Manager administrative functions.

2.3.1 Web Portal Manager

The Access Manager Web Portal Manager provides a browser-based graphical user interface (GUI) for Access Manager administration.

A key advantage of the Web Portal Manager over the pdadmin command line utility is the fact that it is a browser-based application that can be accessed without installing any Access Manager-specific client components on the administrator's local machine or requiring special network configuration to permit remote administrator access. In fact, the authorization capabilities of WebSEAL can be used to control access to the Web Portal Manager. This means greater flexibility for administrators' locations with respect to the physical systems they are managing.

Administrative functionality

The Web Portal Manager was designed to be an alternative to the pdadmin command line interface (CLI) for many administrative functions. However, not all pdadmin functions are supported (such as the retrieval of server statistics) and the command line interface will still be required in certain cases. In other cases, such as exporting Access Manager authorization data, Web Portal Manager is required. Web Portal Manager also offers some key functional benefits over pdadmin, such as cloning and cut/paste functionality.

Migration of data using WPM

Web Portal Manager allows for the migration of data from one Access Manager environment to another. Data is exported from the master authorization database

and placed into an XML file with optional encryption. It can then be transported to a new Access Manager environment and imported.

This functionality allows for the export of one or more of the following items:

- Access Control Lists (ACLs)
- Protected Object Policies (POPs)
- Authorization Rules (Rules)
- Objects and object spaces including attached ACLs, POPs, and Rules

The export of data ensures a smooth transition from one Access Manager environment to another, such as migrating from a test or staging environment to production.

Delegated administration

The Web Portal Manager also provides a delegated user administration capability. This enables an Access Manager administrator to create delegated user groups and assign delegate administrators to these groups.

The initial aim of the Web Portal Manager delegate function is to enable multiple independent enterprises to manage their own user population in a single Access Manager secure domain. This functionality could be used when a service provider that uses Access Manager to provide access control to Web resources wants to allow its customers to define and manage their own user population.

Depending on their assigned roles, the delegated administrators can perform a subset of the administration functions. There are four different levels of administration in Access Manager, with the basic fields of action shown in Table 2-1.

Table 2-1 Delegated administration roles in Access Manager

Action/role	Domain admin	Senior admin	Admin	Support	Any other
View user	X	X	X	X	X
Reset password	X	X	X	X	
Add existing Access Manager user as an administrator	X	X	X		
Create domain user	X	X			
Remove user	X	X			
Domain control	X				

Note: Domains referenced in this table *do not* correspond to Access Manager secure domains. Domains in the delegate function of Web Portal Manager are simply groups of users and functionality and have nothing to do with the separation of security policy between groups of Access Manager servers.

Some design considerations

Other design considerations that should be kept in mind when deploying Web Portal Manager:

- Multiple instances of WPM can be deployed for remote administrators, and so on.
- It is possible to provide access to the Web Portal Manager via a WebSEAL junction or the Access Manager Plug-in for Web servers component, and implement SSO (single sign-on) to the WPM.

2.4 Additional components

Along with core and management components, Access Manager for e-business has additional components that are not mandatory for implementation, but in many real-life implementations they carry important roles. In this section we provide a high-level description of those components.

2.4.1 Policy Proxy Server

The *Policy Proxy Server* enables Access Manager applications and authorization servers to connect to a Policy Proxy Server rather than the Policy Server. The addition of a separate physical machine running Policy Proxy Server enables an architecture to be created where the only incoming SSL sessions to the Policy Server come from the Policy Proxy Server. This facilitates increased security because a firewall protecting the Policy Server only has to allow inbound connections from the Policy Proxy Server(s) rather than from all Tivoli Access Manager applications or authorization servers. The SSL session from Access Manager applications to the Policy Proxy Server(s) is independent of the SSL session from the Policy Proxy Server to the Policy Server.

The only exception to this rule is if you are using an application that requires use of the administration API. Because administration API applications typically perform functions requiring write access to both the policy database and the master Access Manager LDAP, these applications should be configured for direct communication with the Access Manager Policy Server.

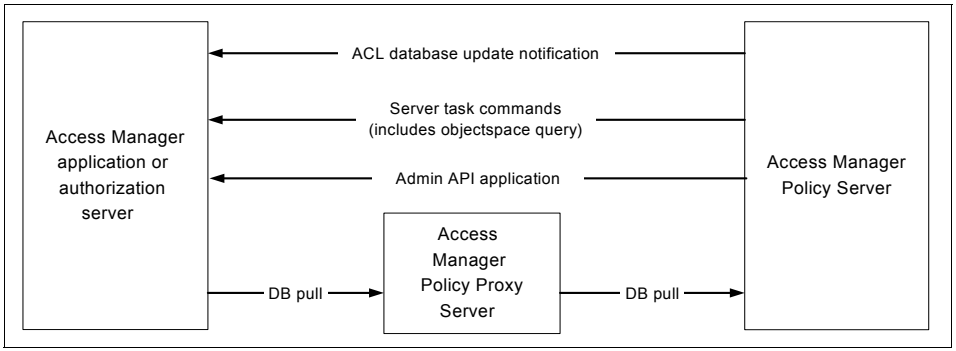


Figure 2-7 Communication flows using the Policy Proxy Server

Figure 2-7 shows the connections (and the direction of flow) between the Policy Server, a Policy Proxy Server and an Access Manager application or authorization server.

All requests inbound destined for the Policy Server go via the Policy Proxy Server, except for applications using the administration API. All requests outbound from the real Policy Server go directly to the Access Manager application.

Policy Server database caching

In addition to providing a simple proxy service, the Tivoli Access Manager Policy Proxy Server can also offload database replication tasks from the Policy Server by caching the Policy Server databases that it serves to Access Manager applications. If several Access Manager applications make requests for the same database, then the database is only transferred from the Policy Server to the Policy Proxy Server one time.

The ACL database is cached in memory for security. There is no authorization database stored on the disk of the Policy Proxy Server that could be read (or modified) if the Policy Proxy Server were compromised.

The currency of the ACL database in the Policy Proxy Server cache is checked every time a replication request is made so that there is no chance of an Access Manager application receiving an out-of-date cached version of the Policy Server database.

Note: The Policy Proxy Server does not perform any Policy Server functions; it simply forwards requests to the Policy Server. This means that the Policy Server is still the authoritative source for Policy Server database and user repository updates.

2.4.2 Authorization service

The foundation of Access Manager is its authorization service, which permits or denies access to protected objects (resources) based on the user's credentials and the access controls placed on the objects.

The Policy Server provides an authorization service that may be leveraged by applications and other Access Manager components that use the IBM Tivoli Access Manager Authorization Application Programming Interface (aznAPI). Optionally, additional Authorization Servers may be installed to offload these authorization decisions from the Policy Server and provide for higher availability of authorization functions. The Policy Server provides updates for authorization database replicas maintained on each Authorization Server.

The Access Manager authorization service can also be embedded directly within an application. In this case, the functions of an Authorization Server are contained in the application itself.

2.4.3 Access Manager Session Management Server

Access Manager *Session Management Server* (SMS) is an optional Tivoli Access Manager component that runs as an IBM WebSphere Application Server service. It manages user sessions across complex clusters of Tivoli Access Manager security servers, ensuring that session policy remains consistent across the participating servers. Using the Session Management Server allows Access Manager WebSEAL and Access Manager Plug-in for Web Servers to share a unified view of all current sessions and permits an authorized user to monitor and administer user sessions. The Session Management Server permits the sharing of session information, makes session statistics available, and provides secure and high-performance failover and single sign-on capabilities for clustered environments.

The Session Management Server provides a user interface from which authorized persons can administer and monitor user sessions. Administration of the Session Management Server is performed using either the pdadmin command line utility, or the Session Management Server Web-based graphical user interface that is run from within the Web Portal Manager.

Figure 2-8 on page 46 shows how multiple security servers can achieve a single session by using a common Session Management Server that provides a unified backing store for session data. Each Web security server maintains a local copy of the session data in its own session cache for performance reasons. A backup or master copy is also maintained on the Session Management Server and this data can be accessed by other Web security servers when necessary. The Web security servers work with the Session Management Server to create, retrieve,

and update the shared session data. The Session Management Server provides updates to Web servers that are participating in a given user session, alerting them to urgent changes in the session data such as a user logging out.

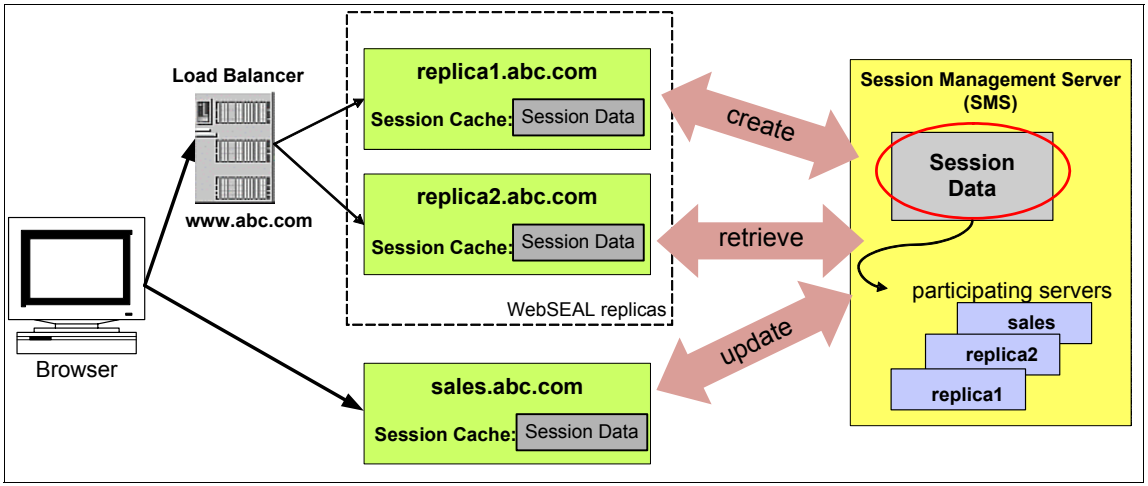


Figure 2-8 Access Manager Session Management Server

Through the use of the Session Management Server, it is now possible to present a consistent user experience across all Web security servers, as well as providing the ability to strictly enforce security policy such as maximum number of sessions.

The benefits of shared session management include that it:

- Provides a distributed session cache to manage sessions across clustered Web security servers
- Provides a central point for maintaining login history information
- Resolves session inactivity and session lifetime time out consistency issues in a replicated Web security server environment
- Provides secure failover and single sign-on among replicated Web security servers
- Provides controls over the maximum number of allowed concurrent sessions per user
- Provides single sign-on capabilities among other Web sites in the same DNS domain
- Provides performance and high availability protection to the server environment in the event of hardware or software failure
- Allows administrators to view and modify sessions on the WebSEAL server

2.4.4 Access Manager for Microsoft .NET Applications

Tivoli Access Manager exposes the aznAPIs at the .NET Common Language Runtime (CLR) level. This allows Access Manager functionality to be available to all .NET languages such as Managed C++, C#, and Visual Basic® .NET.

Access Manager for Microsoft .NET provides single sign-on from Tivoli Access Manager Web security servers (WebSEAL and Plug-In for Web servers) to ASP .NET applications. Put simply, the .NET application can accept an Access Manager user ID or credential and authenticate traffic origin.

Figure 2-9 illustrates how Access Manager provides single sign-on in a Microsoft .NET environment.

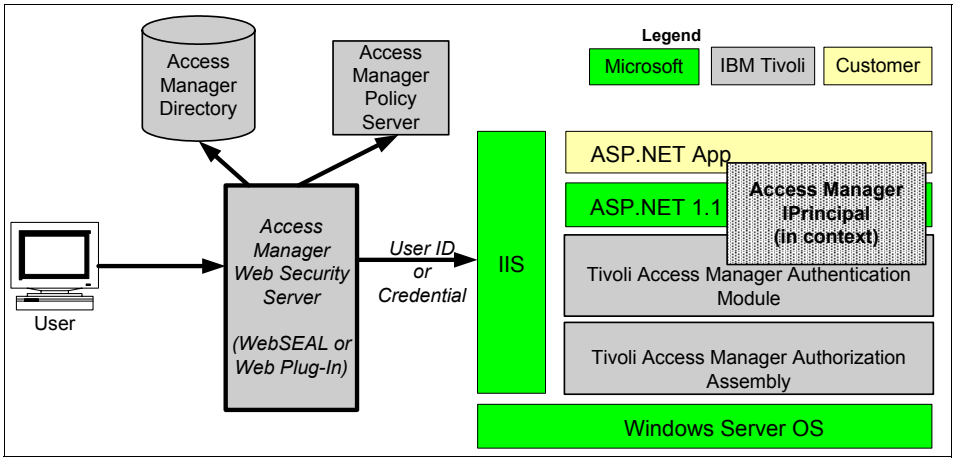


Figure 2-9 Access Manager for .NET single sign-on

In addition, role membership is evaluated using Tivoli Access Manager policy in one of two ways:

- Declarative role security, where the ASP .NET container enforces roles declared by the application
- Programmatic role security, where the application makes an API call to determine whether a user possesses a particular role

No code changes are required to use Access Manager authorization provided that the application is using either the declarative security model or the programmatic security model. Access Manager uses one of two approaches to determine if the user possesses a given role:

- User-to-role mapping via the user's group membership

- User-to-role mapping via an Access Manager authorization check of an object in the Access Manager protected object space that represents the role

Note: While the user-to-role mapping via group membership is the simpler of the two models, it does have some limitations. Advanced authorization policies, such as Protected Object Policies (POPs) and Authorization Rules (Rules) cannot be used. Also, any change to a policy will not be effective until the next time the user logs in. If a more advanced and dynamic security policy is required, the user-to-role mapping via an Access Manager authorization check should be used.

Access Manager for Microsoft .NET also provides for Web services security in one of two ways:

- Client-side authorization and identity propagation via HTTP headers
- Server-side authentication and authorization via HTTP header or SOAP WS-Security header (Username Token)

There are two APIs that are exposed to .NET applications:

- .NET Assembly for Tivoli Access Manager Administration Services
- .NET Assembly for Tivoli Access Manager Authorization Services

Access Manager for Microsoft .NET allows for a user to change their role dynamically without restarting the user's session or the application. In addition, Access Manager can use any directory for the security information that is supported by the core components.

2.4.5 WebSphere Application Server integration

Starting with WebSphere Application Server 5.1.1 and above, WebSphere Application Server ships with all the Access Manager Java Runtime Environment and .jar files required for integration into a secure domain. This is not a separate product, but an integration point between Access Manager and WebSphere that can be used to centralize security for J2EE applications in one location, Access Manager. In addition, a J2EE-to-Access Manager user/role migration utility is provided to assist customers in populating the Access Manager policy database with users and roles.

This enables enterprises to use a common security model across WebSphere and non-WebSphere resources, leveraging common user identity and profiles, Access Manager-based authorization, and using Access Manager's Web Portal Manager to leverage a single point of security management across J2EE and non-J2EE resources.

The integration is transparent to the J2EE applications because no coding or deployment changes are needed at the application level.

2.4.6 Access Manager for BEA WebLogic Server

Tivoli Access Manager for WebLogic Version 6.0 provides a full security framework for BEA WebLogic Server using the Security Service Provider Interface (SSPI).

BEA WebLogic Server provides SSPI for third-party security providers, such as Tivoli Access Manager for WebLogic, to seamlessly integrate their security functions into the BEA WebLogic Server architecture.

Access Manager Security Service Provider Interface components

Tivoli Access Manager for WebLogic replaces the default security realm created with each BEA WebLogic Server secure domain and provides the following BEA WebLogic Server Security Providers:

- Authentication Provider
- Authorization Provider
- Role Mapping Provider

Tivoli Access Manager for WebLogic uses the default BEA WebLogic Server Credential Mapping security provider and the default keystore.

Each of the providers listed also contains a Management Bean (MBean) that enables configuration editing through the WebLogic console. The following sections detail the functionality supplied by each of these providers and MBeans.

Tivoli Access Manager provides the following integration points with BEA WebLogic Server:

- Authentication Provider

  The Tivoli Access Manager for WebLogic Authentication Provider implements BEA WebLogic Server simple authentication. In simple authentication, a user attempts to authenticate to a BEA WebLogic Server with a user name and password combination. This user name and password are checked by Tivoli Access Manager using the Tivoli Access Manager Java runtime component.

  Tivoli Access Manager for WebLogic also provides its own Login Module that is used to provide WebSEAL or Tivoli Access Manager Plug-in for Web Servers single sign-on functionality.

- Authorization Provider

  Authorization Providers supply an interface between BEA WebLogic Server and the external authorization service. The Authorization Provider determines

whether access should be granted or denied to BEA WebLogic Server resources. The access decision is made using the PDPermission classes that are distributed with the Tivoli Access Manager Java runtime component.

- Role Mapping Provider

  Role Mapping Providers are used to supply an interface between BEA WebLogic Server and the external authorization service that is being used to manage roles. The Role Mapping Provider focuses on roles rather than on policy, which is the responsibility of the Authorization Provider.

Policy and role deployment

Policy and roles can be defined in deployment descriptors or created through the WebLogic console. Upon deployment of J2EE applications, roles and policy defined within the application deployment descriptors are exported to the Tivoli Access Manager protected object space.

Although possible, it is not expected that policy creation will be performed using the Tivoli Access Manager administrative utility, pdadmin, or the Tivoli Access Manager Web Portal Manager. Before starting a BEA WebLogic Server that is using Tivoli Access Manager for WebLogic, some default policy must be created in Tivoli Access Manager. This is performed during configuration of Tivoli Access Manager for WebLogic.

Resources and roles

BEA WebLogic Server defines a number of different resource types, all of which are supported by Tivoli Access Manager for WebLogic. All resource types are considered the same within Tivoli Access Manager for WebLogic, so new resource types, created for future releases of BEA WebLogic Server, will be supported automatically.

The policies and roles defined for all resource types are stored in the Tivoli Access Manager protected object space in a uniform way.

2.5 Interfaces

Access Manager supports a number of application programming interfaces that permit direct application interaction with its components. While these interfaces support a rich set of functionality and are useful in many situations, it is important to point out that there is substantial product function that does not require their use. Initially, many organizations do not need to utilize these interfaces, allowing rapid deployment of security components such as WebSEAL. However, as the needs of the organization evolve, these interfaces allow for a high level of

security integration and customization. Tivoli Access Manager interfaces can be divided into three large groups:

- Tivoli Access Manager Authorization API (aznAPI)
- Tivoli Access Manager Authentication API (External Authentication Interface)
- Tivoli Access Manager Administration API

2.5.1 Tivoli Access Manager Authorization API (aznAPI)

The Access Manager aznAPI provides a standard programming and management model for integrating authorization requests and decisions with applications. Use of the aznAPI enables applications to utilize fine-grained access control for application-controlled resources.

Application-specific resources may be individually defined and added to the protected object space, and maintained in the authorization database in the same manner that WebSEAL and other standard Access Manager blades define their respective resources. ACLs, POPs, and authorization rules can be attached to these application objects, and aznAPI calls can then be used to access the Access Manager Authorization Service to obtain authorization decisions.

The authorization API provides common initialization and shutdown interface calls for use by the service plug-ins. The authorization API also provides additional interfaces that are specific to each of the service plug-ins.

Authorization service plug-ins

The Tivoli Access Manager authorization API supports a service plug-in model. This model enables developers to write plug-in modules that extend the capabilities of the Tivoli Access Manager authorization service. Developers of third party applications can use authorization API functions that access the service plug-in interface to perform authorization operations that are specific to the Tivoli Access Manager secure domain.

Authorization service plug-ins are shared libraries written by application developers. Developers create these libraries to implement a domain-specific task for the domain-specific application. The types of data passed between the service plug-in and the application are also domain-specific. This means that the only restrictions on the data types are the parameter definitions in the authorization API service functions. The data can be in a format that is unknown to the Tivoli Access Manager authorization server. The data is passed unchanged through the authorization service dispatcher to the authorization service plug-ins.

Authorization service plug-ins are identified by a unique identification number (ID). The service dispatcher uses the unique ID number to load the service plug-in. The service dispatcher can optionally pass initialization parameters to the service plug-in. The service plug-in can optionally return service information, such as the plug-in version number, to the service dispatcher.

This modular plug-in authorization service architecture is shown on Figure 2-10 on page 53. The authorization service plug-in architecture features the following major objects:

- Authorization service plug-in dispatcher
- Service plug-in modules
- Calling applications

When an external application needs authorization information, it sends a request to the service dispatcher. The service dispatcher vectors the request to the appropriate service plug-in.

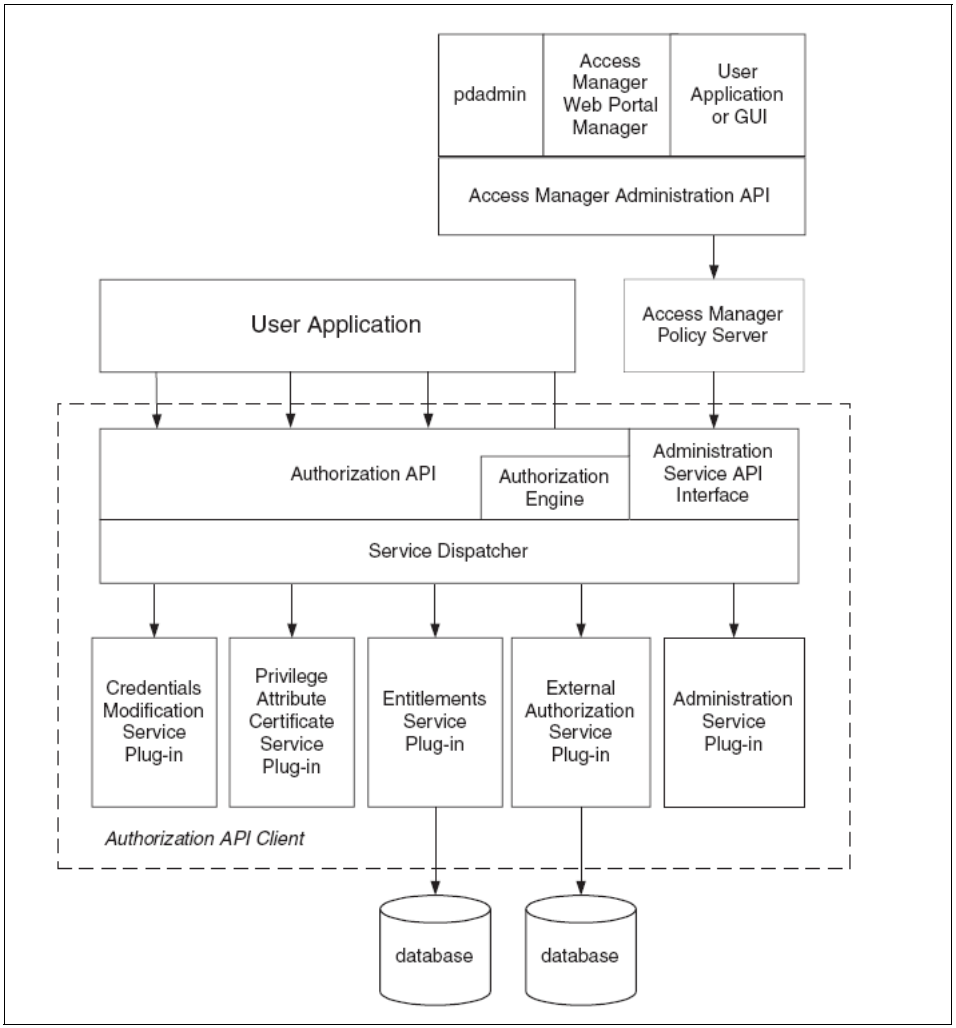


Figure 2-10 Authorization service plug-in architecture

Figure 2-10 shows that the authorization service supports these types of service plug-ins:

- Entitlement service
- Credentials modification service
- Privilege attribute certificate (PAC) service
- Administration service
- External authorization service

Entitlement services

An *entitlement service plug-in* enables domain-specific authorization API applications to retrieve the entitlements for a user from a domain-specific policy repository. The application can use this entitlements information as needed. For example:

- An application can allow or deny a user request for access to a protected action or protected resource, based on the user's entitlements.
- A graphical user interface application can use entitlements information to construct a graphical view of the Tivoli Access Manager secure domain that contains only those protected objects that the user is authorized to view.

Tivoli Access Manager also supports two sub-classes of entitlement service known as:

- The dynamic ADI retrieval service
- The credential attribute service

Credentials modification service

A *credentials modification service plug-in* enables domain-specific authorization API applications to perform modifications on a Tivoli Access Manager credential. Then, the credentials modification service can return this modified credential for use by the calling application. Applications can use this service to add additional information to a user's credential. For example, this additional information could include the user's credit card number and the user's credit limit.

Privilege attribute certificate service

A *privilege attribute certificate (PAC) service plug-in* gives domain-specific authorization API applications the ability to move Tivoli Access Manager credentials back and forth between the native Tivoli Access Manager credentials format and an alternate format called privilege attribute certificates (PAC). Applications can convert user credentials to PACs for use within other authorization domains. Applications can then pass the PACs to a server in another authorization domain and perform an operation. For example, customers can write a PAC service implementation to transform the attributes in Tivoli Access Manager credentials into a SAML assertion, an attribute certificate, or some other standardized PAC format used by other elements of the business model.

Administration service

An *administration service plug-in* enables applications to perform application-specific administration tasks on protected object resources that are secured in the Tivoli Access Manager secure domain. The administration service provides functions that enable a plug-in to obtain the contents of a defined portion of the protected object hierarchy. Additional functions enable a plug-in to

define application-specific administration tasks, and to return commands that perform those tasks.

The administration service plug-in is accessed by a calling application that sends Tivoli Access Manager administration API calls. The calling application can be either an administrative utility such as the Tivoli Access Manager pdadmin command or the Tivoli Access Manager Web Portal Manager, or it can be a custom-built application. The administration service maps the administration API calls to the corresponding administration service API calls, and carries out the requested action.

External authorization service

An *external authorization service plug-in* is an optional extension of the Tivoli Access Manager authorization service that allows you to impose additional authorization controls and conditions. You can use an external authorization service plug-in to force authorization decisions to be made based on application-specific criteria that are not known to the Tivoli Access Manager authorization service.

2.5.2 Administration API

Also known as the *administration API*, the Management API provides C language bindings and Java admin classes to the same functions supported by the pdadmin command line utility. It can be used by custom applications to perform various Access Manager administrative functions.

Do not confuse the Tivoli Access Manager administration API with the Tivoli Access Manager authorization administration service described in “Administration service” on page 54.

The administration API provides a series of programmatic interfaces that a calling application can use to send requests to the Tivoli Access Manager policy server. In most cases, applications can use the administration API independent of any use of the authorization administration service. However, application developers can use the authorization administration service plug-in to provide “back-end” authorization functions that can leverage administration API functions to execute application-specific administrative commands.

Most of the Tivoli Access Manager administration C API functions provide programmatic equivalents to each of the pdadmin command line interfaces. The names of the administration API functions begin with the **`ivadmin_`** prefix.

Since Java is an object-oriented programming language, each Tivoli Access Manager administration object that can be manipulated directly from a Java application is represented by a corresponding Java class. The objects supported

in this version of Tivoli Access Manager all have names that begin with a **PD** prefix, for example:

PDUser class Represents a user in the Tivoli Access Manager Policy Server.

PDGroup class Represents a group in the Tivoli Access Manager Policy Server.

2.5.3 External authentication interface (EAI)

Tivoli Access Manager uses a flexible framework that allows the functions that handle authentication operations to be easily modified or replaced.

In the previous versions of Access Manager, WebSEAL and the WebPI used the CDAS infrastructure for all user authentication. The appropriate information was gathered by the server (userid/password, userid/token, or client certificate information) and then this was passed to the CDAS. The CDAS would then verify the information and return a user identity.

The CDAS infrastructure is still available in Access Manager 6.0 and is still the only way to perform authentication for non-HTTP authentication (for example, client certificate authentication). Only the CDAS name has become obsolete and is now called *external authentication C API*. It is also still used for inter-component authentication. All existing CDAS interfaces are also still supported.

Access Manager for e-business 6.0 introduces a new *external authentication HTTP interface* known as EAI. This interface enables you to extend the functionality of the built-in authentication process to allow a remote service to handle the authentication process. The identity information in the HTTP response headers is used to generate user credentials. The EAI interface is an alternative way to customize authentication when the authentication information is passed in HTTP messages. It allows a back-end application server to perform the authentication of the user (with the HTTP messages passing through WebSEAL) and then, upon successful authentication, return an identity to WebSEAL/WebPI using some pre-defined HTTP headers.

Allowing an application server to perform authentication provides a very flexible solution. Almost any desired authentication strategy can be implemented using this technique. Another potentially big advantage of using an external authentication HTTP interface to perform authentication is that you are not restricted to using C as the programming language.

Another benefit from implementing an external authorization interface is, the restrictions on user registries for authentication are no longer applicable. In

theory you could authenticate against any user registry you wish (directory, database, and so on) provided that the interface you are writing supports it. In addition, you could also authenticate against multiple user registries. Regardless of where the external authentication interface authenticates a user or how it authenticates them, the EAI must return a valid Access Manager user. This means that user and groups must exist in the Access Manager user registry that can represent users and groups in the foreign registry. There are three ways to approach this problem:

- Synchronize user registries

  In this case, users in a foreign user registry are one-to-one mapped to users in the Access Manager user registry. User and group objects could be synchronized from the foreign user registry into the Access Manager user registry. This allows for user-level authorization to still be performed within WebSEAL. When the user ID is passed from the EAI to WebSEAL, group information is pulled into the credential from the Access Manager user registry, not the foreign user registry. Since authentication is not being performed against the Access Manager user registry, there is no need to synchronize user passwords or password policy information. Since the synchronization would need to be constant because users and group could be modified on both the Access Manager user registry and the foreign user registry, IBM Tivoli Directory Integrator would be a good solution for user registry synchronization in this situation.

- Fixed user ID returned

  User and group information is not synchronized between the Access Manager user registry and the foreign user registry. The EAI returns a fixed user ID to WebSEAL. That means that we have many-to-one mapping between the foreign user registry and Access Manager user registry, since many users in the foreign user registry are mapped to one Access Manager user. While easier to implement, this solution has serious drawbacks in terms of enforcing security policy. Since all users being authenticated by the EAI are returning the same user ID to WebSEAL, there is no way to use ACLs for security. This model simply allows for authenticated or unauthenticated access to resources. Authorization Rules could be used to enforce policy, however, if the EAI included the actual user ID in an extended attribute in the credential. Using only authorization rules for security results in higher administrative overhead due to the effort need to define the Rules. It also results in lower system performance as evaluating Rules is more expensive than evaluating ACLs.

- Dynamic group assignment

  This option only works if the EAI passes back a credential to WebSEAL (this is also known as a Privilege Attribute Certificate or PAC). The EAI would insert group membership information from the foreign user registry into the

user's credential. The groups could then be synchronized from the foreign user registry into the Access Manager user registry. Another way to perform this type of mapping is to have the EAI map the users into a specified set of static groups in the Access Manager user registry. Using this technique, authentication is performed against a foreign user registry and the group memberships in the foreign user registry can be reflected in the Access Manager credential. ACL authorization can now be performed at the group level. It is important to be aware that user level authorization is still not possible since the EAI is still returning a fixed user ID to WebSEAL.

2.5.4 Java API for Access Manager

The IBM Tivoli Access Manager Runtime for Java component includes the Java language version of a subset of the Tivoli Access Manager API. The authorization API consists of a set of classes that provide Java applications with the ability to interact with Tivoli Access Manager to make authentication and authorization decisions.

Java security

The Tivoli Access Manager authorization Java classes provide an implementation of Java security code that is fully compliant with the Java 2 security model and the Java Authentication and Authorization Service (JAAS).

The Tivoli Access Manager authorization Java classes are built around JAAS and the Java 2 security model. The Tivoli Access Manager API closely follows the Java 2 permission model. The Tivoli Access Manager authorization API Java classes also support a completely Java-compliant usage of the Tivoli Access Manager authorization check that is outside of the Java 2 and JAAS framework.

2.5.5 Access Manager-based authorization for Microsoft .NET

IBM Tivoli Access Manager provides integration and support for implementing Access Manager-based authorization for Microsoft .NET applications. Access Manager APIs are exposed at the .NET Common Language Runtime level. This exposes the functionality to all .NET languages such as Managed C++, C#, and Visual Basic .NET.

2.6 Placing components in a network

There is no unique configuration of Access Manager components in a network. No solution uses the same number of Access Manager components and some of the components are not mandatory. The placement of Access Manager components represents a set of choices, but in this book we show some general

security guidelines. Keep in mind that you cannot simply separate network configuration issues from Access Manager. While Access Manager components perform their duties extremely well, good sense dictates that they must operate in an environment that prevents them from being bypassed and protects them from undue exposure to other forms of attack.

Today networks are divided into several zones. Network boundaries are used to isolate networking zones with differing security policies. These boundaries are created to implement restrictions on the type of traffic that is allowed in a zone. In its simplest case, a firewall creates boundaries between two or more networks and stands as a shield against unwanted penetrations into your environment.

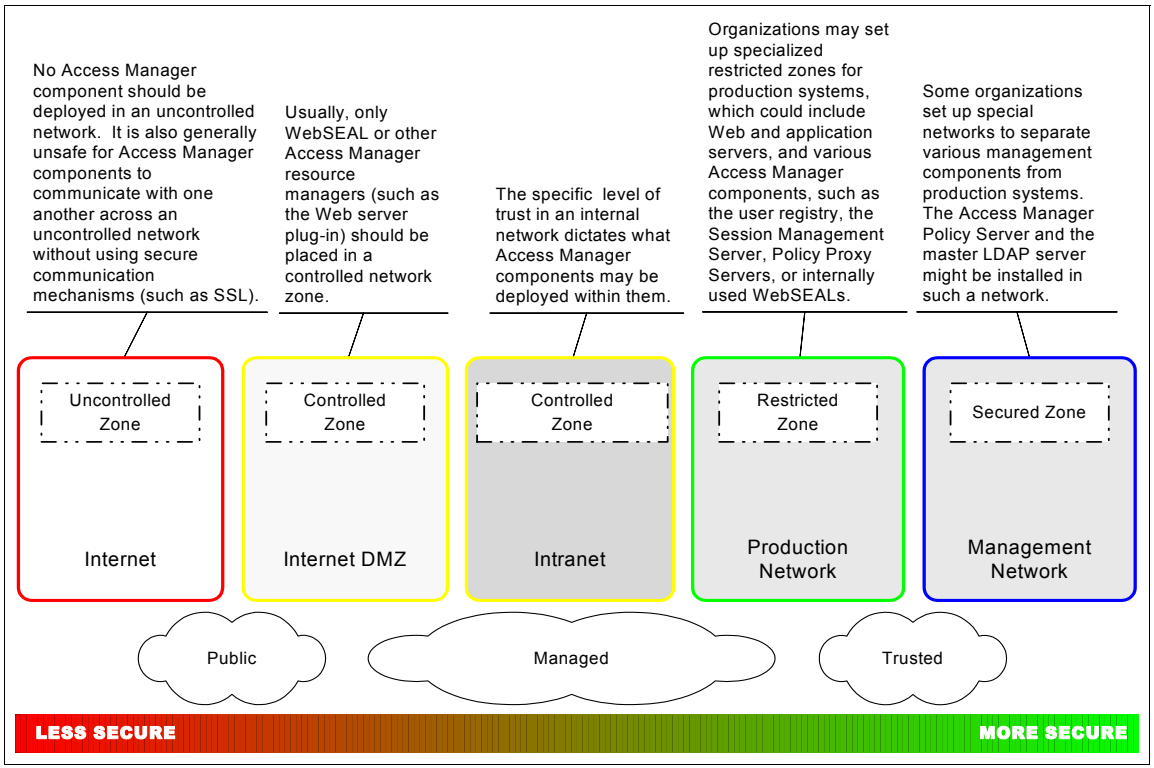


Figure 2-11 Network zones and Access Manager components

The number of zones depends on the existing security policies and the level of security that needs to be implemented. Typical network configurations consist of three to five zones:

- Internet, outside network (uncontrolled zone)
- Internet DMZ (controlled zone)
- Intranet (controlled zone)

- Production (restricted zone)
- Management (secured zone)

The position of Access Manager components depends on the number of zones. Figure 2-11 summarizes the general Access Manager component type relationships to the network zones.

Since firewalls are usually deployed between zones to filter network traffic on different ports, a thorough understanding of the communication ports used for all Access Manager components is essential. The default listening ports for Access Manager components (which can be changed in real implementations) are as follows:

- Policy Server port: 7135
- Authorization Server port:
  - Authorization request port 7136
  - Administration request port: 7137.
- Policy Proxy Server:
  - Policy request port: 7138.
  - Authorization request port: 7139.
- WebSEAL listening 7234

Along with those listening ports, Access Manager also communicates with additional ports like 389 for LDAP non-SSL communication, and 636 for LDAP SSL communication. Also, all ports for HTTP and HTTPS transport should be specified. Default ports are 80 for non-SSL and 443 for SSL. Note that HTTP(S) traffic is not only used between WebSEAL and the client, but also between WebSEAL and back-end servers (using junction), between WebSEAL and the Session Management Server, and others.

2.6.1 IBM Global Security Kit (GSKit)

Tivoli Access Manager components communicate in a secure way over the network. Tivoli Access Manager provides data encryption through the use of the IBM Global Security Kit (GSKit) version 7.0.

The GSKit package also installs the iKeyman key management utility (gsk7ikm), which enables you to create key databases, public-private key pairs, and certificate requests. In other words, GSKit can be used to build a (somewhat trivial) PKI infrastructure. You must install GSKit before installing most other Tivoli Access Manager components. GSKit is a prerequisite to the Access Manager Runtime component, which is required on all Tivoli Access Manager systems with the exception of the Access Manager Attribute Retrieval Service, Access Manager for WebLogic Server, Access Manager Runtime for Java, or Access Manager Web Portal Manager.

The GSKit tool is often used to manage certificates that are used for WebSEAL's HTTPS communication. For performance improvement, WebSEAL supports SSL hardware acceleration. Utilizing the functionality of GSKit7, hardware acceleration can minimize the CPU impact of SSL communications, improving the overall performance of the system.

FIPS enablement

In Tivoli Access Manager 6.0, Federal Information Processing Standard 140-2 (FIPS 140-2) enablement is introduced. FIPS enablement means Tivoli Access Manager uses only government-approved cryptography wherever cryptography is required. Tivoli Access Manager uses cryptography in the following areas:

- Creation and replacement of internal, self-signed certificates. These certificates are used by Access Manager Runtime and Tivoli Access Manager security servers to authenticate with each other.
- Runtime and servers utilize a secure communication protocol to communicate between each other.

Federal Information Processing Standard 140-2 (FIPS 140-2) is a standard that describes U.S. Federal Government requirements that IT products should meet for Sensitive but Unclassified (SBU) use. The standard defines the security requirements that must be satisfied by a cryptographic module used in a security system protecting unclassified information within IT systems. There are four levels of security, from Level 1 (lowest) to Level 4 (highest). These levels are intended to cover the wide range of potential applications and environments in which cryptographic modules can be deployed. The security requirements cover areas related to the secure design and implementation of a cryptographic module. These areas include basic design and documentation, module interfaces, authorized roles and services, physical security, software security, operating system security, key management, cryptographic algorithms, electromagnetic interference/electromagnetic compatibility (EMI/EMC), and self-testing. For more information on FIPS 140-2, see:

`http://csrc.nist.gov/cryptval/140-2.htm`

Enablement of FIPS for Tivoli Access Manager is only meant to satisfy the requirement of the Tivoli Access Manager's cryptographic operations from an application aspect. Tivoli Access Manager is not responsible for other products or prerequisite products enablement of FIPS. If in FIPS mode, Transport Layer Security version 1 (TLS v1) will be used as the secure communication protocol instead of SSL v3. To communicate with the Tivoli Access Manager Policy Server using a secure communication protocol, TLS is the required protocol. An attempt to communicate using SSL v3 (non-FIPS mode) when the Policy Server is configured in FIPS mode will result in a socket-closed exception.

2.6.2 Sizing and availability

Availability is the major concern that a failing part of the infrastructure will cause the overall solution to languish. This eventually leads to unsatisfied customers and decreasing business success. Adding replicas of crucial servers increases your site's availability by avoiding single point of failure. All Access Manager components can be replicated with the exception of the Policy Server, since there can be only one Policy Server per secure domain. However, there can be a second Policy Server in standby to provide manual fail-over capabilities as a first aid response. If you want to assure 24x7 availability of your Access Manager Policy Server you could implement a high-availability cluster solution such as HACMP for AIX.

Before configuring a standby Policy Server, the files that it needs to operate must be made available. To avoid synchronization problems, it is best to locate these files on a shared file system.

In general, the most effective way to have a redundant Policy Server is to configure an *original* and *standby* Policy Server in an HACMP (or similar) environment. This handles routing IP traffic to the active instance and can handle (via scripting) the starting and stopping of the Policy Servers so that only one is active at any time. IBM supports automatic failover only on the AIX platform.

Figure 2-12 shows a possible configuration that uses a network load-balancer to direct SSL traffic to the active Policy Server. If it is not possible for the load balancer to monitor the Policy Servers, then manual intervention (or custom scripting) will have to be used to monitor the Policy Servers and switch to the backup on failure.

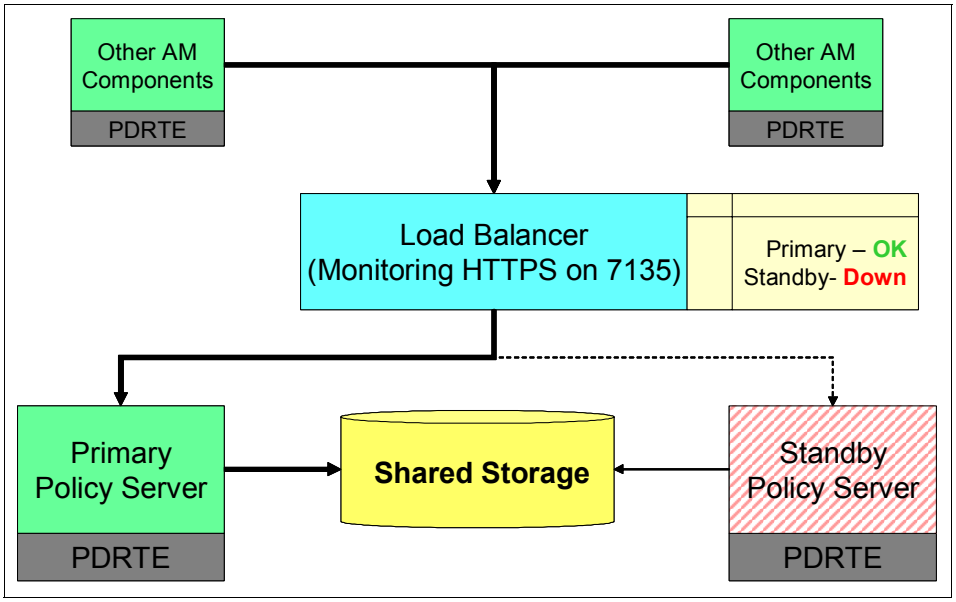


Figure 2-12 Standby Policy Server configuration using a load balancer

Access Manager is designed for scalability as well as availability. Scalability of Access Manager enables good growth in size of future capacities by allowing you to add additional components of the same sort and providing smart load balancing mechanisms to perfectly utilize these new components.

2.7 Upgrade considerations

Access Manager is a complex solution that uses many components and relies on many dependencies. The process of upgrading IBM Tivoli Access Manager to Version 6.0 requires you to consider the interdependencies among the various Tivoli Access Manager components and other software components on which the system depends. There are many different ways to deploy Tivoli Access Manager components. *IBM Tivoli Access Manager for e-business Upgrade Guide Version 6.0*, SC32-1703 presents specific scenarios that cover a large portion of Tivoli Access Manager deployments.

The following steps describe, at a high-level, the activities for upgrading an Access Manager for e-business environment:

1. The first step in any upgrade or migration process is to back up all components of the current system. A backup should be done for every server that contains any Access Manager components using the standard Access

Manager tool for backup and restore operations **pdbackup**. Along with this step, it is very important to back up the user registry using appropriate backup tools that come with the product. If you encounter a problem when migrating to Tivoli Access Manager 6.0, you might need to restore the system to its prior level.

2. Upgrade the user registry to the level that is supported by Access Manager V6.0. IBM Tivoli Directory Server 6.0 is the only supported registry that does not require additional configuration after upgrading. For all other supported registries (including previous version of IBM Tivoli Directory Server), the LDAP schema needs to be manually updated to support Access Manager 6.0. Use the **ivrgy_tool** to update the schema. If your user registry is Microsoft Active Directory, the upgrade needs to be performed in two steps:

   a. Update the data model using the **adreg_migrate** utility. This tool adds and modifies Microsoft Active Directory ACL/ACE for Tivoli Access Manager users and groups.

   b. Update the schema from the previous release to Tivoli Access Manager 6.0 using **adschema_update**.

   Note: If you did not perform the installation using the IBM Tivoli Directory Server installation wizard, you need to manually perform a Directory Server migration from the previous release. This can be done using the *Instance Administration Tool* (started with the command **idsxinst**), or using the **idsimigr** utility for command-line migration.

3. Back up your Policy Server. Tivoli Access Manager supports an upgrade of the Policy Server to version 6.0 either on the same system, or using two separate systems — your current Policy Server system and a second, clean system for the new 6.0 Policy Server. The two-system approach is not supported if you are using Microsoft Active Directory or Lotus Notes® Server as your user registry. The two-system approach provides the ability to keep your current Policy Server functioning as you set up and test a new 6.0 Policy Server system. This approach provides a shorter system downtime, but it is more expensive since it requires additional hardware. If you encounter a problem when upgrading using two systems, take the Access Manager 6.0 Policy Server offline.

4. The upgrade of Access Manager core components is now finished. We can approach the upgrade of the remaining systems:
   – WebSEAL
   – Authorization Servers
   – Policy Proxy Servers and so on

If you want your aznAPI application to have minimum downtime, you must install a second Authorization Server to ensure that your aznAPI application can continue to make authorization decisions during the upgrade process. To install the second Authorization Server, follow these steps:

a. Install another instance of the Authorization Server on your application host. It should be the same software version as the Authorization Server that is running on your current Authorization Server, just running on a different machine.

b. Edit your aznAPI application configuration file on the application host, comment out the replica entry for the original Authorization Server, and add a new replica line for the new Authorization Server.

c. Restart the aznAPI application on the application host and verify that it functions properly.

Proceed with the normal upgrade of the aznAPI application that also requires unconfiguration steps.

If you have a load balancer in front of the WebSEALs and you plan to upgrade your WebSEAL on a server while users are trying to access the system, you must isolate each WebSEAL server before you upgrade it. To do this, change the port on which the WebSEAL server listens or configure your load balancer so that it does not route traffic to the WebSEAL server.

5. After you have updated all your Tivoli Access Manager systems, if you upgraded the Policy Server using the two system approach, retire the original Policy Server after its data and the Tivoli Directory Server client and server are successfully migrated to the 6.0 Policy Server system.

   Use the **pdmgr_ucf** command to retire the original Policy Server.

Important: Do not unconfigure the original Policy Server or the new Policy Server at any time during the upgrade process. Unconfiguration of the original Policy Server or the new Policy Server will destroy critical data needed by the Policy Server.

2.7.1 Additional upgrade considerations

Any server that has Access Manager components installed requires the following two software components:

- GSkit
- IBM Tivoli Directory Server 6.0 client

This is necessary even if your upgrade strategy keeps a previously supported version of the IBM Tivoli Directory Server (for example 5.2) in production. You

have to deploy the IBM Tivoli Directory Server client 6.0 on any machine that has an Access Manager 6.0 component installed.

The IBM Tivoli Directory Server 6.0 client can coexist with previous client versions but there can only be one server version at the same time on a machine. For example, if you keep Tivoli Directory Server client and server 5.2, you can upgrade to Tivoli Directory Server client 6.0 without any problems.

All communication between Access Manager components over the network is encrypted using SSL/TLS. The GSKit tool provides SSL services between Access Manager components. Every version of Access Manager requires a certain level of GSKit as a prerequisite. If you do not watch out for these the installation/upgrade may fail.

2.7.2 Useful commands for the upgrade process

We have previously mentioned several commands that we used for the upgrade process, like:

- `pdbackup`
- `ivrgy_tool`
- `adreg_migrate`
- `adschema_update`
- `idsimigr`

Besides these already mentioned commands, there are some other useful commands that we can use during the upgrade process, and for everyday administration.

For manipulating (checking the status, stopping and starting) of Access Manager services installed on the server use:

```
pd_start {status | stop | start}
```

Verification of Access Manager environment

A useful tool for the verification of installed or upgraded Access Manager software on any machine that has the Access Manager runtime component deployed is:

```
pdversion
```

More basic verification of your Tivoli Access Manager environment can be performed with the following utilities:

1. Verify whether the user registry is up and running.

   You have to use different tools depending on what type of user registry is installed. For example, if you are using an LDAP-based user registry like IBM

Tivoli Directory Server, then you can use the **ldapsearch** command to verify whether the server is responsive.

2. Verifying the Policy Server

   The **pdadmin** command can be used to verify the proper operation of the Policy Server. Use the pdadmin command to log in as a Tivoli Access Manager administrator:

   ```
   pdadmin –a sec_master –p password
   ```

   This is the first step of your validation. After that you can execute a few commands to validate your environment. For example, you could list users with the user list command.

   ```
   pdadmin> user list * 100
   ```

3. Verifying the runtime environment

   Every machine with the Access Manager runtime installed can be tested with the pdadmin tool just as the Policy Server is. The pdadmin utility is installed along with the Access Manager runtime.

4. Verifying WebSEAL

   You can use a browser to verify that WebSEAL is operating properly. To verify, enter the following URL into your browser:

   ```
   https://webseal-machinename
   ```

   Because a port number is not specified, it is assumed that WebSEAL is listening on port 443 (HTTPS). Your browser might give you the following warnings:

   a. The certificate received from this Web server was issued by a company that you have not yet chosen to trust

   b. The name within the certificate received from WebSEAL does not match the name of the system from which it was received

   If these warnings occur, they simply indicate that you have not yet purchased your own server certificate for your WebSEAL server. Your browser is complaining that it has received a default server certificate from WebSEAL that contains default names for the issuing certificate authority and the name of the Web server. Next, the browser prompts you to specify a Tivoli Access Manager user name and password. Enter sec_master for the user name and the password that you configured for sec_master during installation. If authentication is successful, an image labeled Tivoli Access Manager for WebSEAL appears.

   If you are using Tivoli Access Manager Web Server plug-in the verification process is the same, but as a result screen the default Web server page appears.

3

Installation

An Access Manager system may contain many components and require careful planning, as we discussed in the previous chapter. In this chapter we identify the component dependencies and provide an overview of configuration tools and the required PKI infrastructure.

3.1 Installation overview

The environment based on IBM Tivoli Access Manager is called a *secure domain,* and it consists of many components. These components have specific software dependencies and require prerequisites with respect to hardware and operating system platforms that are supported. For hardware requirements like disk size, memory, and so on, refer to the *IBM Tivoli Access Manager for e-business Version 6.0 Release Notes,* SC32-1702. Access Manager is supported on the following operating systems:

- AIX 5.1
- SLES 8
- RHEL 3.0
- Solaris 8
- HP-UX 11i
- Windows 2003

For details about minimum operating system fix pack levels review the Release Notes document.

Access Manager 6.0 also supports the IPv6 protocol on those operating systems.

3.1.1 User registry

The first core component of the Access Manager system is the user registry. The installation of a user registry is product specific. Access Manager supports all major user registries:

- LDAP-based user registry
  - IBM Tivoli Directory Server version 5.1, 5.2, and 6.0
  - IBM z/OS LDAP Server 1.4, 1.5, and 1.6
  - Novell eDirectory 8.6.x and 8.7.x
  - Sun ONE™ Directory Server 5.1, 5.2, and 6.0
  - Sun Java System Directory Server 6.1
- Lotus Domino Enterprise Server 5.0.10, 6.0.2, and 6.5

  With the following restriction: Tivoli Access Manager supports the use of IBM Lotus Domino as a user registry only on the Windows platform.
- Microsoft Active Directory 2003

  With the following restriction: Tivoli Access Manager Policy Server needs to be deployed on the Windows platform.

IBM Tivoli Directory Server 6.0 overview

Although Access Manager supports a number of different user registries, IBM Tivoli Directory Server is supplied with Access Manager, and the Directory Server LDAP client is used by the Access Manager aznAPI implementation to provide LDAP client services. IBM Tivoli Directory Server 6.0 is supplied with IBM Tivoli Access Manager 6.0 and it is envisaged that this will be the Directory Server version used with any new deployments of Access Manager 6.0. As we mentioned in 2.7.1, “Additional upgrade considerations” on page 65, it is possible to use older versions of the Directory Server with Access Manager 6.0 (for migration purposes) but the Directory Server 6.0 client must always be used whenever an LDAP client is required.

The user registry contains user information, additional Access Manager information, and mappings between Access Manager users and users in the registry. Access Manager information is stored under the suffix *secAuthority=default*, which needs to be manually created in LDAP before you can begin to configure the Policy Server. The only exception is the automatic installer for IBM Tivoli Directory Server v6.0 shipped with the Access Manager install set. This installer automatically creates the secAuthority=default suffix. The installer also creates a suffix for user data (users are stored under a separate DIT from the Access Manager configuration).

Also, when using this particular installer, the Directory Server instance created is configured for SSL communication (using the LDAPS port 636 by default). In order for this to happen, a private key and public certificate pair must be available. In Tivoli Access Manager v5.1, the Access Manager Directory Server installer supplied a static “test” certificate/key for the Directory Server to use SSL. This was not useful for production because it was the same certificate for every installation. In addition, the KDB file that contained this test certificate used a fixed password (which was *key4ssl*). For Tivoli Access Manager v6.0, the Access Manager Directory Server installer generates a new self-signed certificate/key pair every time. It prompts the user to specify a password and this password is used to secure a new certificate database (KDB) file.

Directory Server 6.0 includes an optional proxy component. This component is not part of the freely available Directory Server 6.0 distribution and is not part of the bundle that is shipped with Access Manager 6.0. In order to make use of this feature it must be independently licensed. The Directory Server Proxy can be used for two purposes:

- Provide a proxy component so that Directory Servers can be accessed from the Internet but the Directory Servers (and their associated databases) are not located in the DMZ.
- Provide an entry point to a distributed directory that allows very large registries to be set up. All client requests are routed to load-balanced proxies

and they forward the request on to the backend cluster that holds the information.

Configuration improvements for the user registry

When using previous versions of Access Manager with Directory Server, the configuration of the Access Manager Policy Server overwrote all ACL entries configured on existing suffixes. This means that if Access Manager was configured into an existing LDAP server where other applications were already configured, it could prevent them from functioning until the ACL entries were manually reinstated. This behavior has been changed for Access Manager v6.0. When configuring the Access Manager 6.0 Policy Server, new ACL entries are added to existing suffixes (to allow the Access Manager services to read and write data) but the existing entries are not modified. Those Access Manager-specific ACL entries for any LDAP are:

- cn=SecurityGroup,secAuthority=Default
- cn=ivacld-servers,cn=SecurityGroup,secAuthority=Default
- cn=remote-acl-users,cn=SecurityGroup,secAuthority=Default

The new data model (called the *minimal* model) reduces the number of LDAP objects created per user (from a minimum of three to a minimum of two) and also removes all Access Manager-specific data from the *public* part of the LDAP directory (where the shared user and group objects are stored). The previous data model (called the *standard* model) is still supported and available and would usually be used if migrating to Access Manager 6.0 from a previous version of Access Manager (especially if the migration must be done with zero downtime). The new minimal data model does not provide any significant performance improvement over the standard data model used in Access Manager 5.1. All of the reductions in number of queries that are possible with the minimal model are also possible using the standard model.

3.1.2 Installation methods

The installation of the Access Manager security environment can be grouped into three categories:

- Tivoli Access Manager base systems
- Tivoli Access Manager Web security systems
- Tivoli Access Manager distributed sessions management systems

The following sections provide an installation overview of all Access Manager components grouped by those categories. First, we describe the installation methods.

All Access Manager components can be installed in the following ways:

- Installation wizards

- Native installation utilities
- Software Distribution installation method

Installation wizards

You can run a single program to set up one of a variety of Tivoli Access Manager systems. Software prerequisites and product patches are automatically installed in the appropriate order. Operating system patches are not installed automatically. Use installation wizards to simplify installation and configuration of Tivoli Access Manager systems. The Tivoli Access Manager components support installation wizards running in:

- Graphical mode
- Text-based console mode
- Response file (silent) mode

This flexibility of installation methods allows you to create multiple solutions for deploying your software.

All installation wizards have the same prefix *install_* followed by component name. For the list of all components wizards, refer to *IBM Tivoli Access Manager Version 6.0 Administration Guide,* SC32-1686. If using an installation wizard to install and configure a Tivoli Access Manager system, IBM Java Runtime 1.4.2 SR2 provided with Tivoli Access Manager is required.

Occasionally, there are times when there is no graphical display device available or you want to run the installer without the graphical user interface when installing the Tivoli Access Manager packages. Console mode is an interactive installation without the use of a graphical user interface. To launch the installation wizard in console mode, enter:

```
install_component_name - console
```

The installation wizard can also be used for the silent type of installation. All answers to questions during the installation process of any component are placed in a response file. The installation process reads the information from the response file instead of prompting you to fill in the blanks. Each Tivoli Access Manager component can be installed by using a response file. The installation wizards use a template file, provided by Tivoli Access Manager, to create a file known as an options file, which contains all possible responses. Response files, created using these template files, are then used to perform the silent mode installations. A response file streamlines installation and configuration of Tivoli Access Manager components.

Native installation utilities

You can use platform-specific utilities to install Tivoli Access Manager components. Unlike automated installation wizards, you must manually install

each component and its prerequisite software in the appropriate order. The platform-specific utilities used are:

- **`installp`** for AIX
- **`swinstall`** for HP-UX
- **`rpm`** Linux
- **`pkgadd`** for Solaris
- **`setup.exe`** for Windows

After installing, the appropriate configuration commands have to be used. All configuration commands are described later in this chapter.

Software Distribution installation method

IBM Tivoli Configuration Manager is required for this type of installation. IBM Tivoli Configuration Manager controls software distribution and asset management inventory in a multi-platform environment. It is designed for configuration, distribution, change, version, and asset management in a distributed computing environment. If you choose this installation method, you should be familiar with using the Software Distribution installation method of IBM Tivoli Configuration Manager. For more detail about this method refer to the *Tivoli Access Manager for e-business Version 6.0 Installation Guide,* SC32-1361.

3.2 Base components

Almost all servers that are part of an Access Manager installation contain sets of software that are common to any Access Manager component. This software is like a framework that provides communication between Access Manager services that run on top of it. Figure 3-1 on page 75 shows this framework that comes as a part of the Access Manager base system installation CD set.

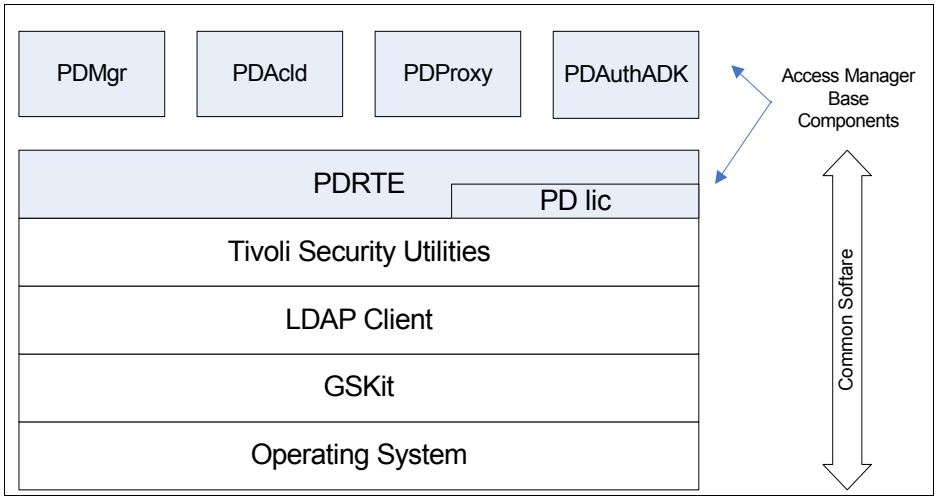


Figure 3-1 Access Manager basic system and common software

The figure also shows all Access Manager components that are part of the base system. The rest of this section provides an installation overview of those components.

3.2.1 GSKit

The bottom layer of any Access Manager installation is GSKit, which provides a set of tools for SSL communication between Access Manager components. GSKit provides a C API command line tool **`gsk7ikm`** (and a Java API equivalent **`ikeyman`**) that helps you set up and maintain a basic PKI environment. This tool can create a new certificate database (it supports all types of standard certificate databases), open an existing certificate database, create self-signed certificates, submit certificate requests to another CA, revoke a certificate, and create a *certificate revocation list* (CRL) list.

In addition to providing SSL communication between Access Manager components, very often GSKit is utilized in the WebSEAL configuration for setting up HTTPS communication between WebSEAL and clients, for example, between WebSEAL and back-end servers (this communication is realized through an SSL-junction). More details are presented in Chapter 4, “Configuration and customization” on page 91.

Once installation of the GSKit package is complete, no configuration of the GSKit is necessary.

3.2.2 LDAP client

Any Access Manager component that requires communication with an LDAP server needs the LDAP client. The client provides a set of tools and an API used for communication with the LDAP server. The following components do not need the LDAP client:

- Access Manager Runtime for Java
- Web Portal Manager
- Access Manager Attribute Retrieval Service
- Session Management Server
- Session Management Web Interface System

Basically, all Java-based Access Manager components do not require an LDAP client.

Most of the time the required LDAP client is the IBM Tivoli Directory Server client version 6.0. The exceptions are:

- If your Tivoli Access Manager system uses the Windows Active Directory (AD) domain environment as the user registry, the required LDAP client is the built-in Windows LDAP client required for AD.
- If Lotus Domino is used as your user registry server, the Access Manager-supported client is the Lotus Notes client.

After the installation of the LDAP client package no configuration is necessary.

3.2.3 Tivoli Security Utilities

The IBM Tivoli Security Utilities provides common utilities that are required by Access Manager Runtime. Tivoli Security Utilities package must be installed before you can install the Access Manager Runtime package. After the installation of the Tivoli Security Utilities package no configuration is necessary.

3.2.4 Access Manager License (PDlic)

This component contains license information for Tivoli Access Manager. The Access Manager License component is installed automatically when an installation wizard is used to install either the Access Manager Runtime, Access Manager Session Management Server, or the Access Manager Runtime for Java component.

3.2.5 Access Manager Runtime (PDRTE)

The Access Manager Runtime contains runtime libraries and supporting files that applications can use to access Tivoli Access Manager servers. You must install and configure the Access Manager Runtime component on each system that runs Tivoli Access Manager, with the exception of Java-based Access Manager components that require Access Manager Runtime for Java (PDJRTE).

In other words, components that do not require PDRTE are:

- Access Manager Runtime for Java systems
- Web Portal Manager
- Access Manager Attribute Retrieval Service
- Access Manager for WebLogic Server
- Sessions Management Systems

One of the tools that is installed with the PDRTE environment is **`pdconfig`**. This tool provides screens for the configuration of various Access Manager components like the PDRTE itself.

Note: You *must not* configure the Access Manager Runtime on the same server that runs the Policy Server component until *after* the Policy Server is installed.

The tool can also be used to unconfigure Access Manager components. This tool utilizes the **`bassslcfg`** command in the background, which configures or modifies the configuration information of the Tivoli Access Manager runtime.

3.2.6 Access Manager Policy Server (PDMgr)

There can only be one Policy Server for each secure management domain. Optionally on AIX systems, IBM supports a secondary standby Policy Server. This particular configuration requires additional software and hardware, including High Availability Cluster Multiprocessing (HACMP) software.

Policy Server is part of the base system configuration; it gets installed on top of the PDRTE as shown in Figure 3-1 on page 75.

During the installation of the Policy Server component, you are given the opportunity to select what LDAP data format is to be used for user and group tracking information. The two LDAP data formats available for user and group information are:

- Minimal LDAP data formats (default)
- Standard LDAP data formats

The *minimal LDAP data format* is valid only for IBM Tivoli Access Manager version 6.0 or later. Use of this format reduces the size of your user registry information by storing minimal user and group tracking information. However, previous versions of Tivoli Access Manager and Tivoli Access Manager products do not support this format and cannot access the user and group tracking information.

The *standard LDAP data format*, which is the same format used in previous versions of Tivoli Access Manager, permits any version of Tivoli Access Manager to use the user and group information in the LDAP registry.

If there is no previous user registry information, as is the case with a new installation, and minimal format is selected, fewer LDAP objects are used to maintain the user and group tracking information. However, previous versions of Tivoli Access Manager do not support this format and cannot access the user and group information.

If upgrading all Tivoli Access Manager products to version 6.0, the existing user registry information can be converted to use the minimal format for user and group tracking information, if desired. Use the Tivoli Access Manager **amldif2V6** tool for this LDAP data conversion. You can find technical support for the **amldif2V6** tool at the IBM Tivoli Access Manager for e-business Web site.

Initial configuration

After installation, you can use the **pdconfig** tool to configure the Access Manager Runtime and Policy Server components. This tool prompts for answers to certain questions and then configures the Access Manager components. The PDRTE component is always configured before Policy Server (PDMGR), but not before PDMGR is installed.

Initial configuration creates new key and stash files and generates new CA certificates for the Policy Server called PDCA certificate. This certificate is stored in the ivmgr.kdb certificate database. This certificate also is stored in the file pdcacert.b64 on the Policy Server as a base-64 DER-encoded version of the PDCA certificate. This file must be distributed to each machine in your secure domain that utilizes SSL communication with the Tivoli Access Manager Policy Server. If this certificate is for any reason compromised, it must be regenerated. If this happens, each key file and each certificate in the domain needs to be regenerated. Use **mgrsslcfg** to create or modify the SSL certificates of the Policy Server. This tool is called in the background when you use the **pdconfig** tool.

3.2.7 Access Manager Authorization Server (PDAcld)

Access Manager Authorization Server is an optional component in the Access Manager secure domain. The Access Manager Authorization Server provides

access to the authorization service for third-party applications that use the Tivoli Access Manager authorization API in remote cache mode. The Authorization Server also acts as a logging and auditing collection server to store records of server activity.

The Authorization Server is also part of the base install set and requires the Access Manager Runtime as depicted in Figure 3-1 on page 75. Configuration of PDAcld can be done using the **pdconfig** utility or using the **svrsslcfg** command. This command configures, unconfigures, or modifies the configuration information of a resource manager to use an SSL connection for communicating with the Policy Server.

The **svrsslcfg** command is used to configure C-based application servers only. For Java-based application servers, use the equivalent *com.tivoli.pd.jcfg.SvrSslCfg* Java class.

3.2.8 Access Manager Policy Proxy Server (PDProxy)

The Access Manager Policy Proxy Server is used to set up a proxy server, which acts as an intermediary between a less trusted network and a more trusted network. This server ensures security and provides administrative control and caching services. It is associated with, or part of, a gateway server that separates the enterprise network from the outside network, and a firewall server that protects the enterprise network from outside intrusion. In a Tivoli Access Manager environment, the proxy server runs on behalf of the Policy Server for a given number of authorization applications and administrative functions, such as **pdadmin** commands.

The Tivoli Access Manager Policy Proxy Server is another base component that can be configured using the **pdconfig** tool, which calls the **pdproxycfg** command in the background. This command configures or unconfigures a Policy Proxy Server.

3.2.9 Tivoli Access Manager development (PDAuthADK) system

The Access Manager Application Development Kit provides a development environment that enables you to code third-party applications to query the authorization server for authorization decisions. This kit contains support for using both C APIs and Java classes for authorization and administration functions. To run the Java program or to compile and run your own Java programs, you must install and configure a Java runtime environment system.

3.2.10 Access Manager Runtime for Java (PDJRTE)

The Access Manager Runtime for Java offers a reliable environment for developing and deploying Java applications in a Tivoli Access Manager secure domain. Use it to add Tivoli Access Manager authorization and security services to new or existing Java applications. This Run Time environment is common for all Java-based application. You can use the **pdjrtecfg** command to configure a Java Runtime Environment (JRE) to use Tivoli Access Manager Java security.

Access Manager Runtime for Java requires that Java already is installed. Ensure that either IBM Java Runtime 1.4.2 SR2 provided with Tivoli Access Manager or the JRE provided with WebSphere Application Server 6.0.2 is installed before running the installation program. Access Manager Runtime for Java configures additional security features into the specified JRE and only these two JREs are supported.

Note that this component does not require GSKit, the LDAP client or Tivoli Security Utilities as a prerequisite.

If you plan to install the Web Portal Manager interface, this component is required. It is also required with the Access Manager Application Development Kit component if you are a developer using Access Manager Runtime for Java classes.

3.2.11 Access Manager Web Portal Manager (PDWPM)

The Access Manager Web Portal Manager is a Web-based graphical user interface (GUI) used for Tivoli Access Manager administration. The GUI counterpart to the **pdadmin** command line interface, Web Portal Manager provides management of users, groups, roles, permissions, policies, and other Tivoli Access Manager tasks. A key advantage of using Web Portal Manager is that you can perform these tasks remotely, without requiring any special network configuration.

The Web Portal Manager interface also includes additional components that we mentioned in “Delegated administration” on page 42. Both applications, the standard **pdadmin** utility and the delegate application, come in single WAR packages that are installed into the IBM WebSphere Application Server, but they use different deployment descriptors.

To access the GUI version of the **pdadmin** command use the following URL:

```
http://<host name>/pdadmin
```

To access the application for delegated administration that is integrated into WPM use the following URL:

```
http://<host name>/delegate
```

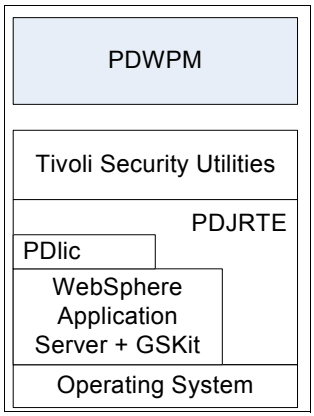


Figure 3-2 Web Portal Manager components

Web Portal Manager is a Java-based application that is deployed in IBM WebSphere Application Server. With the WebSphere Application Server installation also comes the GSKit tool, but it is not a necessary part for PDWPM. Since WPM is a Java-based application it requires PDJRTE components, as shown in Figure 3-2.

3.3 Web security components

Tivoli Access Manager Web security components are a set of Access Manager components that use different kinds of resource managers to protect Web resources. These components are on the IBM Tivoli Access Manager Web Security CD for the supported platforms. The components are:

- Access Manager Attribute Retrieval Service
- Access Manager for WebLogic Server
- Access Manager Plug-in for Edge Server
- Access Manager Plug-in for Web Servers
- Access Manager Web Security Runtime
- Access Manager WebSEAL Application Development Kit
- Access Manager WebSEAL

These components use the same common set of software depicted in Figure 3-1 on page 75, with some additional components that we describe in the following sections.

3.3.1 Web Security Runtime (PDWebRTE)

The Access Manager Web Security Runtime contains shared authentication library files used for Web Security systems. As a prerequisite, PDWebRTE requires Access Manager RTE installed (and all other dependent software).

All other Web Security components run on top of PDWebRTE, as shown in Figure 3-3.

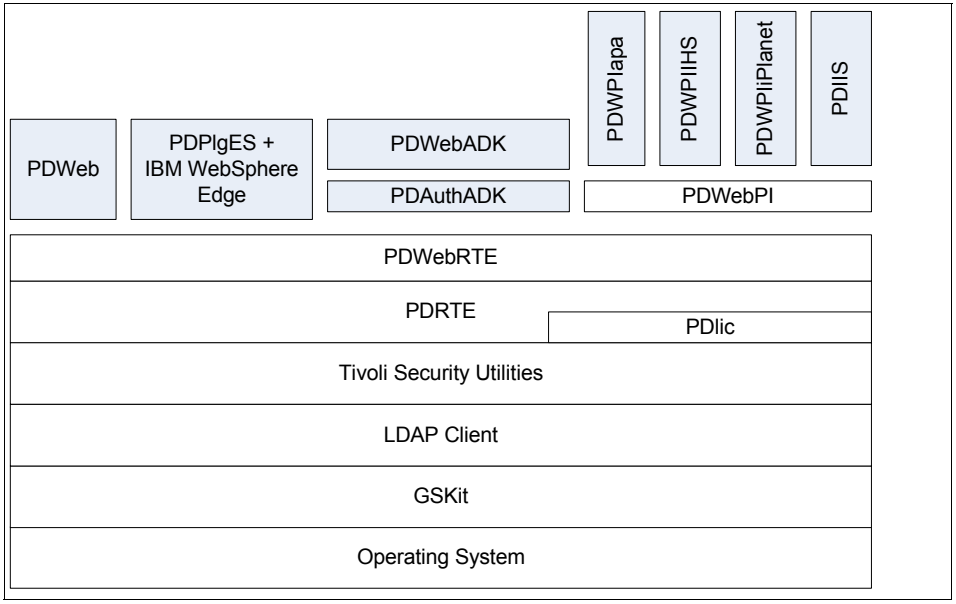


Figure 3-3 Tivoli Access Manager Web Security components

3.3.2 WebSEAL (PDWeb)

Access Manager WebSEAL is a security manager for Web-based resources. WebSEAL is a high-performance, multi-threaded Web server that applies fine-grained security policy to the protected Web object space. WebSEAL can provide single sign-on solutions and incorporate back-end Web application server resources into its security policy.

As shown in Figure 3-3, WebSEAL runs on top of the Web Security Runtime component. Like the other components, WebSEAL can be configured using the **`pdconfig`** utility. In addition the configuration tool **`amwebcfg`** can be used for configuration or unconfiguration of a WebSEAL server.

3.3.3 The Plug-in for Edge Server (PDPlgES)

The Access Manager Plug-in for Edge Server (PDPlgES) also runs on top of PDWebRTE. The Access Manager Plug-in for Edge Server adds authentication and authorization functionality to the IBM WebSphere Edge Server product. That means IBM WebSphere Edge Server is an additional prerequisite for the PDPlgES installation. We used **pdconfig** to configure PDPlgES. The configuration utility performs the following tasks:

1. Creates registry objects for the server.
2. Adds the server to the security groups, ivacld-servers and SecurityGroup.
3. Creates an SSL certificate.
4. Obtains an SSL-signed certificate from the Tivoli Access Manager Policy Server.
5. Configures the Edge Server caching proxy to use the Plug-in for Edge Server by setting directives in the Edge Server caching proxy configuration file.
6. Restarts the Edge Server caching proxy process, ibmproxy.
7. Starts the Plug-in for Edge Server object space manager utility by using the **wesosm** utility. This utility updates the Tivoli Access Manager object space to create a new object space container for the Plug-in for Edge Server.

3.3.4 WebSEAL ADK (PDWebADK)

The Access Manager WebSEAL ADK contains development APIs for the Tivoli Access Manager cross-domain authentication service (CDAS), the Tivoli Access Manager cross-domain mapping framework (CDMF), and the Tivoli Access Manager Password Strength Module. This ADK requires PDWebRTE as well as the Access Manager ADK as an additional prerequisite component. This component also requires configuration by running the **pdconfig** tool.

3.3.5 Plug-in for Web Servers (PDWebPI)

Access Manager Plug-in for Web Servers manages the security of your Web-based resources by acting as the gateway between your clients and secure Web space. The plug-in implements the security policies that protect your Web object space. The plug-in can provide single sign-on solutions, support Web servers running as virtual hosts, and incorporate Web application server resources into its security policy.

Access Manager Plug-in for Web Servers depends on the operating system and Web server in use. All Access Manager Plug-ins for Web Servers have common components and additional Web-server-specific components, as illustrated in Figure 3-3. The Web-server-specific components depend on the type of

supported Web server and the supported operating system. The following combination of Web servers and operating systems are supported:

- Apache 1.3.27
  - Solaris 8 and 9
  - Linux Red Hat 3 and 4, SLES 8 and 9
- Apache 2.0.48
  - AIX 5.2
  - Solaris 10
  - Linux Red Hat 3 and 4, SLES-9
- IBM HTTP Server 1.3.26
  - AIX 5.1 and 5.2
  - Solaris 8 and 9
  - Linux Red Hat 3 and 4, SLES-8
- IBM HTTP Server 2.0.47 and 6.0
  - AIX 5.1, 5.2
  - Solaris 10
  - Linux Red Hat 3 and 4, SLES-9
- Sun ONE Web Server 6.0
  - AIX 5.1, 5.2
  - Solaris 8 and 9
- Sun Java System Web Server 6.1
  - AIX 5.1 and 5.2
  - Solaris 8 and 9
- IIS 6.0
  - Windows 2003 Server

3.3.6 Attribute Retrieval Service (PDWebARS)

The Access Manager Attribute Retrieval Service is used in conjunction with the WebSEAL authorization decision information (ADI) feature. This service provides communication and format translation services between the WebSEAL entitlement service library and an external provider of authorization decision information. Since this component is a Java application that runs as an IBM WebSphere Application, the only prerequisite software component is the PDJRTE and an installed WebSphere Application Server configured with the Access Manager Runtime for Java. This is shown in Figure 3-4.

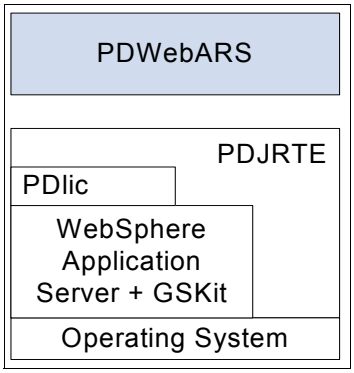


Figure 3-4 Tivoli Access Manager Attribute Retrieval Service

After the installation of the product, we did not use the **pdconfig** tool, we just deployed the application using the WebSphere Application Server Admin console.

3.3.7 Access Manager for WebLogic Server (PDWLS)

Access Manager for WebLogic Server extends Tivoli Access Manager to support applications written for BEA WebLogic Server. Using the BEA WebLogic Server Security Service Provider Interface, Access Manager for WebLogic Server authenticates users via a user registry administered by Tivoli Access Manager. Group membership in the user registry can be used to affect authorization decisions made by WebLogic Server. The only prerequisite software for the installation is PDJRTE. This is shown in Figure 3-5.

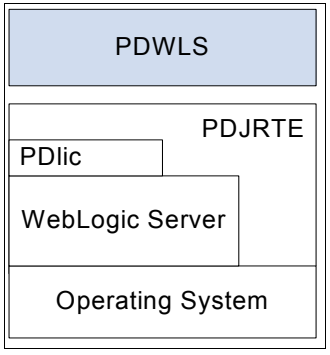


Figure 3-5 Tivoli Access Manager for WebLogic Server

You can also install WebSEAL or the Access Manager Plug-in for Web Servers to extend the security features of Access Manager for WebLogic Server to provide support for an end-user single sign-on experience. This component

enables WebLogic Server applications to use Tivoli Access Manager security without requiring any coding or deployment changes.

3.4 Setting up a Session Management Server (PDSMS)

This section provides information about installing and configuring a Tivoli Access Manager Session Management Server (SMS) system. The major role of the Session Management Server is to manage and monitor sessions across dispersed, clustered Web servers. The Session Management Server is an optional component of Tivoli Access Manager. It runs as a service of the IBM WebSphere Application Server, as show in Figure 3-6.

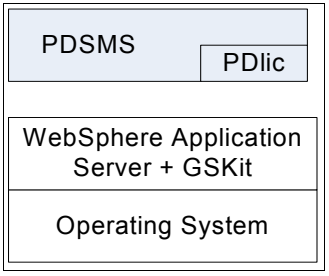


Figure 3-6 Tivoli Access Manager Session Management Server

The only prerequisite for the PDSMS installation is an installed and configured WebSphere Application Server server. A Tivoli Access Manager environment must exist before installing the Session Management Server. Access Manager WebSEAL or Access Manager Plug-in for Web Servers must be installed, configured, and running.

In addition, if you decide to enable WebSphere global security (to ensure that administration actions are secured), you need to create three groups in WebSphere Application Server that can be used to manage the Session Management Server environment:

- A group for administrators, for example: sms-administrators
- A group for delegators, for example: sms-delegators
- A group for clients, for example: sms-clients

The names of the groups must follow the naming conventions of the user registry used by WebSphere Application Server. You can use existing groups for this purpose, if desired.

As an installation option you can enable SSL for the communication between the Access Manager servers in the replica set and the IBM WebSphere Application Server where the Session Management Server is installed.

If you plan to use Access Manager certificates to authenticate with PDSMS, or if you want to use the Access Manager sec_master user (or other users and groups defined in the secAuthority=Default suffix) to administer PDSMS using either the session management command line or Web interface, then you must unconfigure the base DN in the LDAP user registry used by WebSphere Application Server.

An optional prerequisite component is a DB2 database. DB2 is required only if you are intending to use a DB2 database to store login history information. Also, an IBM DB2 JDBC™ driver must be available to the WebSphere Application Server.

Setting up a Session Management Server system is a three-step process that consists of installation, deployment to the application server or cluster, and configuration. After installing the Session Management Server using native installation utilities, the DSess.ear file must be deployed as a WebSphere Application Server application.

Note: After deployment, *do not* start the DSess.ear application until the Session Management Server has been configured using the **smscfg** command.

After installing the Session Management Server you can configure the server using the following command:

```
smscfg -action config
```

After installing the Session Management Server, you must reconfigure WebSEAL or the Plug-in for Web Servers (or both) to use the Session Management Server for managing sessions.

Along with the PDSMS installation, the structure of your session realms and associated replica set must be planned and mapped. Determine whether you want to have replicated Session Management Server instances that provide failover capability and improved performance.

3.4.1 Session Management Server administrative interfaces

The Session Management Server offers two kinds of administration interfaces:

- The session management Web interface (PDSMSWP)
- The session management command line interfaces (PDSMSCLI)

Both interfaces and dependent software are shown in Figure 3-7 on page 88.

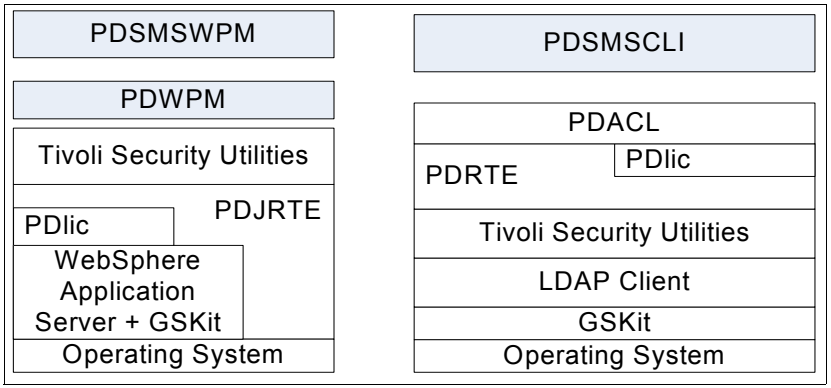


Figure 3-7 Session Management Server administrative interfaces

You can administer the Session Management Server either by using the Tivoli Access Manager **pdadmin** command line utility located on the participating Tivoli Access Manager Authorization Server or by using a Web interface, which is part of the Tivoli Access Manager Web Portal Manager.

Session Management Server command line interface

Before you install and configure the session management command line interface, the following steps are required:

- As you can see from the Figure 3-7, to administer the Session Management Server from the command line, the Access Manager Command Line package (PDSMSCLI) must be installed on the Authorization Server.
- WebSEAL or the Plug-in for Web Servers component must be installed, configured, and running before the Session Management Server can operate.
- The Session Management Server and the Authorization Server components must be installed and configured before configuring the Access Manager session management command line component.
- The configuration requires the name of the server that hosts the Session Management Server and the port number to be used for communication between the server where the Session Management Server is hosted and the Authorization Server that is hosting the command line extension utility.
- If more than one Session Management Server is installed for failover and performance reasons, the host names and communication port numbers for each Session Management Server must be configured.
- Determine whether you want to enable SSL for session management command line interface communications. You can enable SSL between the Session Management Server and the Authorization Server so that all **pdadmin** command communications are secure.

- If you plan to use the Tivoli Access Manager sec_master user (or other users and groups defined in the secAuthority=Default suffix) to administer PDSMS using either the session management command line or Web interface, then you must unconfigure the base DN in the LDAP user registry used by WebSphere Application Server.

To configure (or unconfigure) the Session Management Server command line interface, use the **pdsmsclicfg** utility. This utility can be run either interactively, where the user is prompted to provide configuration information, or silently, where the utility accepts input from a response file. During configuration, the program prompts the user to specify the path to the configuration file for an already configured aznAPI application. If the Authorization Server (PDAcld) is installed and configured on the hosting system, the prompts default to the ivacld.conf configuration file.

Run the command from the system hosting the Session Management Server. The **pdsmsclicfg** utility writes to the host Authorization Server configuration file, ivacld.conf.

The program prompts the user to specify the location of the Web service. The location of the Web service is defined by a host name and port that are separated by a semicolon. The user can specify multiple locations, when each location is separated by a comma. If this Web service uses a secure connection, the program prompts the user for the SSL options. The name of the configuration file for the authorization application and SSL files are saved during configuration to the *pdsmsclicfg.conf* configuration file. This configuration information will be used during unconfiguration to determine the location of the pdsmsclicfg.conf configuration file. The SSL configuration information is used as input into the backup utility. The presence of this configuration file is also used to determine the configuration status of the plug-in.

Optionally this command can be executed in the background if you choose the **pdconfig** utility for performing configuration task.

Session Management Server Web interface (PDSMSWPM)

Before you install and configure the session management Web interface system, you must perform the following pre-installation tasks:

- Figure 3-7 on page 88 shows that PDSMSWPM must be installed on the system that hosts the Web Portal Manager (PDWPM). So, as a prerequisite WPM (and all software that WPM requires) needs to be installed, and up and running. The session management Web interface can run as a service in WebSphere Application Server and it can be accessed through the WPM Web interface.

- WebSEAL or the Plug-in for Web Servers component must be installed, configured, and running before the Session Management Server can operate.
- The Session Management Server component must be installed and configured before configuring the session management Web Interface component.
- The configuration requires the name of the server that hosts the Session Management Server and the port number to be used for communication between the server where the Session Management Server is hosted and the Authorization Server that is hosting the command line extension utility.
- If more than one Session Management Server is installed for failover and performance reasons, the host names and communication port numbers for each Session Management Server must be configured.
- Determine whether you want to enable SSL for session management Web interface communications. You can enable SSL between the Web Portal Manager and the IBM WebSphere Application Server hosting the Session Management Server so that all communications between the Web interface and the Session Management Server are secure.
- Decide whether to use existing Web Portal Manager certificates for the SSL communication between the Web Portal Manager and the server hosting the Session Management Server, or to use the IBM WebSphere Application Server trust store certificates.
- If you plan to use the Tivoli Access Manager sec_master user (or other users and groups defined in the secAuthority=Default suffix) to administer the Session Management Server using either the session management command line or Web interface, then you must unconfigure the base DN in the LDAP user registry used by WebSphere Application Server.

The **pdsmswpmcfg** utility configures or unconfigures the Session Management Server Web Portal Manager extensions. When configured, the Session Management Server can be administered using Web Portal Manager.

4

Configuration and customization

This chapter discusses various configuration and customization tasks that are optional or mandatory after the installation and initial configuration of the Access Manager environment. Depending on your particular implementation, various configuration steps can be performed, including enabling single sign-on (SSO) with forms-based SSO (FSSO), LTPA, or TAI configuration, then e-community SSO, and so on. Depending on your environment, various ACLs, POPs, and authorization rules can be implemented. Besides the traditional junction, Access Manager WebSEAL version 6.0 now supports two new types of junctions, the transparent and virtual host junctions, and a set of new accompanying junction options. These configuration tasks are discussed in this chapter, along with a new Access Manager component: the Session Management Server.

4.1 Basic customization tasks

After the installation and initial configuration of the Access Manager security environment there are numerous additional configuration and customization tasks that need to be performed on Access Manager components. What tasks you need to perform will depend on how you have planned and architected your Access Manager deployment. Since the Access Manager environment may include additional non-mandatory components, their configuration will have to be performed as well.

Two configuration tasks are related to major services that the Access Manager system performs: authorization and authentication. Some of the basic configuration tasks related to the authorization service are:

- Configuration of additional secure domains.
  Every new secure domain has its own policy database.
- Customization of the policy database that includes:
  - Configuration of the protected object space.
  - Definitions of security policies through use of ACLs, POPs, and authorization rules.
  - Assigning users and groups to ACL, POPs, and authorization rules.

The customization of the authentication service depends on the type and number of resource managers that are in use for the particular Access Manager secure domain. Access Manager comes with some “out of the box” resource managers that are introduced in Chapter 2, “Planning” on page 27. In this chapter, we concentrate on the WebSEAL customization since this is the resource manager offering the most customization options.

Some of the resource managers’ customization tasks (like, for example, creating a WebSEAL junction) are again connected with the customization of the policy database. Also in the policy database you can set up global user policies like minimum password length, time of day access, and so on.

4.1.1 Secure domain

A *secure domain* consists of all the resources that require protection along with the associated security policy used to protect those resources. The resources that you can protect depend on the resource managers that are installed. The concept of more than one secure domain is shown in Figure 2-4 on page 36. Any security policy that is implemented in a domain affects only the objects in that domain. Users with authority to perform tasks in one domain do not necessarily have the authority to perform those tasks in other domains. For small and moderately sized enterprises, one domain is usually sufficient. If only one

domain is needed, no explicit action needs to be taken. Tivoli Access Manager automatically creates a domain called *Default*, referred to as the management domain, as part of its initial configuration. This domain is used by Tivoli Access Manager to manage the security policy of all domains and is available for managing other protected resources as well. In large enterprises, however, you might want to define two or more domains. Each domain is given a name and is established with a unique set of physical and logical resources.

A domain can be created using the pdadmin CLI or WPM. An example of a command that creates the *RedBooks* domain with domain administrator ID *book_master* and password *passw0rd* is shown here:

```
pdadmin sec_master> domain create RedBooks book_master passw0rd -desc
"Test Domain"
```

All other domain-related functionality (listing, modifying, and deleting domains) is supported in both administration interfaces. An administrator in the management domain can create additional secure domains. A secure domain is given a unique name, and a domain administrator must be specified when the domain is created.

The security administrator can define the resources in a domain based on geography, business unit, or major organizational division within the enterprise. The security policy defined in the domain affects only the resources in that domain, which allows data to be partitioned and managed completely independently. A multiple domain environment can be invaluable when there is a business need to keep a physical separation between different sets of data.

An administrator assigned to a specific domain has authority only within that domain. Within a domain, an administrator can create users, groups, and other objects. Users and groups are specific to their domain and are not allowed to access resources that are contained in other domains. However, by default, an administrator can view users and groups defined in the user registry that are not necessarily Tivoli Access Manager users or groups. This is beneficial if, for example, an administrator wants to import a user or group from a different domain. Conversely, if you are the administrator of the management domain and want to limit the registry data that a domain administrator can access, you can add the *allowed-registry-substrings* stanza entry to the [domains] stanza in the ivmgrd.conf configuration file for the Policy Server. Resources that are defined and access controls for resources that are protected by Tivoli Access Manager are maintained on a per domain basis. Resources and access controls for resources cannot be shared among domains.

Additional Tivoli Access Manager components can be made a member of a specific domain during their initial runtime component configuration since there is an option to define a domain name for the PDRTE. Java applications, on the

other hand, are configured into an Access Manager domain by specifying the domain name during the configuration of the Java application.

4.1.2 Protected object space

Tivoli Access Manager represents resources within a domain using a virtual representation called the *protected object space*. The protected object space is the logical and hierarchical portrayal of resources belonging to a domain.

The protected object space consists of two types of objects:

Resource objects Resource objects are the logical representation of actual physical resources, such as files, services, Web resources, message queues, and so on, in a domain.

Container objects Container objects are structural components that enable you to group resource objects hierarchically into distinct functional regions.

Security policy can be applied to both types of objects. Figure 4-1 shows a logical representation of a protected object space with multiple container and resource objects.

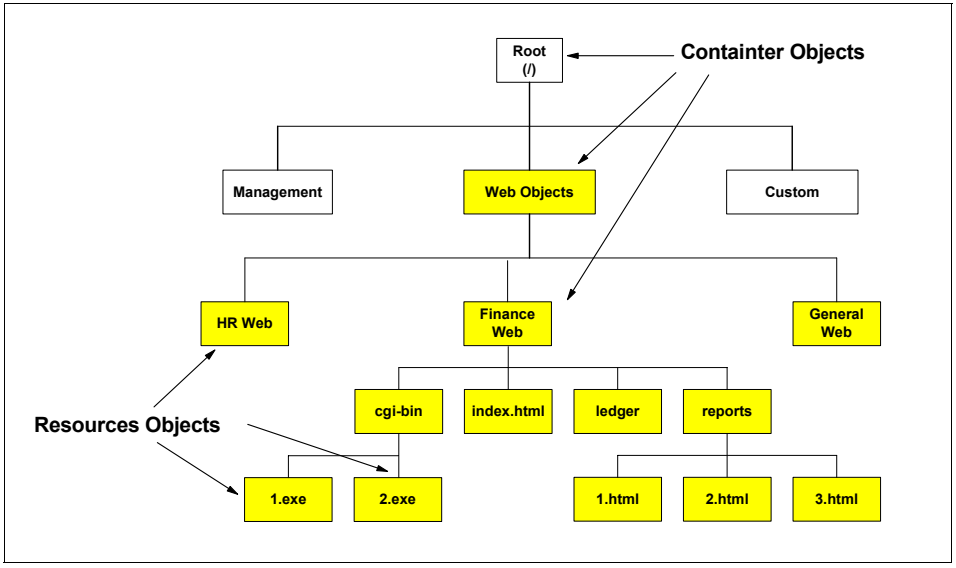


Figure 4-1 Access Manager protected object space

The structural top, or start, of the protected object space is the root container object, which is represented by a forward slash (/) character. Below the root container object are one or more container objects. Each container object

represents an object space consisting of a related set of resources. These resources can be resource objects or other container objects.

Tivoli Access Manager creates an object space called /Management that consists of the objects used to manage Tivoli Access Manager itself. Figure 4-2 shows the complete /Management object space that is created during the installation of Tivoli Access Manager.

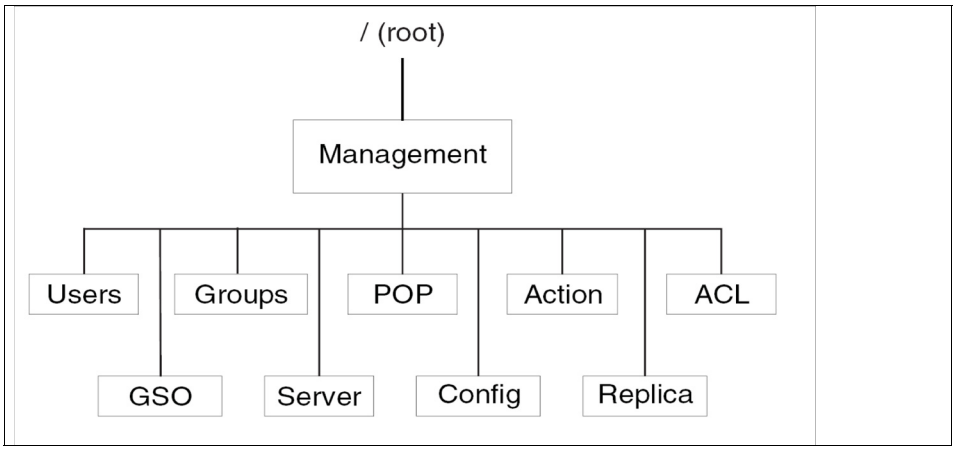


Figure 4-2 Access Manager default object space

Each resource manager that protects a related set of resources creates its own object space. For instance, the WebSEAL resource manager, which protects Web-based information and resources, creates an object space called /WebSEAL.

Using both administrative tools, you can perform the following actions on the object space:

- Create object space
- List object space
- Delete object space

Web Portal Manager can be used to perform some additional actions:

- Copying object space
- Importing object spaces
- Exporting object spaces

In addition to object space actions, similar actions can be performed on the objects:

- Create object
- List object

- Delete object
- Import object
- Export object

Again, only WPM can be used to import and export objects from the object space.

4.1.3 Users and groups

Tivoli Access Manager maintains information about Tivoli Access Manager users and groups in the user registry. Users and groups that already exist in the user registry can be imported into Tivoli Access Manager. If a user or group does not already exist in the user registry, it can be created directly within Tivoli Access Manager.

When a user is authenticated to Tivoli Access Manager, a user credential is returned. This credential is used by other Tivoli Access Manager functions to uniquely identify the user making the request.

Tivoli Access Manager supports different types of users. When a domain is created, a special user known as the *domain administrator* is created. For the management domain, the domain administrator is *sec_master*. The sec_master user and associated password are created during the configuration of the Tivoli Access Manager Policy Server. For other domains, the user ID and password of the domain administrator are established when the domain is created. The domain administrator has nearly complete control of the domain. The domain administrator is added as a member of the Tivoli Access Manager *iv-admin* group within the domain. The iv-admin group represents those users with domain administration privileges. When adding users to the iv-admin group, ensure that you do not compromise the security of your domain. Another predefined group, *ivmgrd-servers* contains the Policy Servers and the Policy Proxy Servers. By default, members of this group are authorized to delegate requests to other Tivoli Access Manager servers on behalf of the requestor.

There are two more predefined (built-in) Access Manager groups:

any-other	Represents all authenticated users.
unauthenticated	Represents all users who have not been authenticated by Access Manager.

Those two groups have a very important role in defining and applying ACLs, as described in “Evaluating an ACL” on page 103.

Managing users and groups

Users and groups in Access Manager can be managed using the WPM or the pdadmin CLI. All standard actions on the groups and users can be performed, including:

- Create a user or group
- Import users or groups
- Modify existing users or groups
- Delete users or groups
- List users or groups
- Show existing user properties

These actions on users begin with **user** followed by the type of action with appropriate options in **pdadmin**.

```
pdadmin > user [create | import | list | modify | show | delete] options
```

The commands performed on groups begin with **group**:

```
pdadmin > group [create | import | list | modify | show | delete] options
```

Changing a password

There is no explicit command for managing user passwords. Since the user password is actually one of the user attributes, the **user modify** command is used to change (or set up) a user password.

```
pdadmin > user modify user_name password password
```

Every time you create a new user you need to set the password.

When setting or changing a password, the password must comply with the following policies:

- The defined Tivoli Access Manager password policy
- The password policy for the underlying operating system
- The password policy for the underlying user registry

When creating a new user you also need to enable the user in the Access Manager domain:

```
pdadmin> user modify user_name account-valid yes
```

If the account is disabled (not explicitly enabled) a user cannot log in.

The other necessary step in setting up new users in Access Manager is to make the password valid. This step is not necessary if the user does not need to supply a password during authentication (for example, the user logs into the system with a certificate).

```
pdadmin> user modify user_name password-valid yes
```

If the value is *no*, the password will appear to be expired and the user will be unable to log in using the password until an administrator sets the valid state to *yes*.

Setting user policy

Besides the security policy that we describe later in 4.1.4, “Security policy” on page 99, every user has to abide by user policies, such as password policies, login-failure policies, access policies, and account expiration policies. Those policies can be defined globally for all users in the Access Manager domain or they can be specified for a single user. The format of the command is:

```
pdadmin > policy set options [-user user_name]
```

The options are the following:

- `account-expiry-date {unlimited|absolute_time|unset}`
  Sets the account expiration date. The default value is unset.
- `disable-time-interval {number|unset|disable}`
  Sets the time, in seconds, to disable each user account when the maximum number of login failures is exceeded. The default value is 180 seconds.
- `max-login-failures {number|unset}`
  Sets the maximum number of login failures allowed. Tivoli Access Manager does not impose an upper limit for the maximum number allowed. Instead, use a range from zero to a number that represents the value that is most logical for the parameter you are trying to set. If the number is too large, it might render the login policy ineffective. The default value is 10.
- `max-password-age {unset|relative_time}`
  Sets the maximum time, in days, that a password will be valid. The relative_time option is relative to the number of days since the last password change occurred.
- `max-password-repeated-chars {number|unset}`
  Sets the maximum number of repeated characters allowed in a password. The default value is 2.
- `min-password-alphas {unset|number}`
  Sets the minimum number of alphabetic characters required in a password. The default value is 4.
- `min-password-length {unset|number}`
  Sets the minimum password length. Tivoli Access Manager does not impose an upper limit for the minimum number allowed. The default value is 8.
- `min-password-non-alphas {unset|number}`
  Sets the minimum number of non-alphabetic characters required in a password. The default value is 1.

- `password-spaces {yes|no|unset}`
  Sets the policy of whether spaces are allowed in passwords. The default value is unset.
- `tod-access {{anyday|weekday|day_list}:{anytime|time_spec-time_spec}[:{utc|local}]|unset}}`
  Sets the time of day access policy.
- `user user_name`
  Specifies the user whose policy information is to be set. If this option is not specified, the general policy is set.

For any given policy, if a user has a specific policy applied, this specific policy takes precedence over any general policy that might also be defined. The precedence applies regardless of whether the specific policy is more or less restrictive than the general policy set.

Password strength default values

Table 4-1 lists the password strength policies and the default values.

Table 4-1 Default values for password strength policy

Policy	Default Value
min-password-length	8
min-password-alphas	4
min-password-non-alphas	1
max-password-repeated-chars	2
password-spaces	not set

To display some of the user policy settings use the following command:

`pdadmin > policy get options [–user user_name]`

If the user name is omitted, the returned value gives the settings for all users at a global level. The options are the same as in the policy set command.

4.1.4 Security policy

The goal of any security policy is to adequately protect business assets and resources with a minimal amount of administrative effort. First, you must define what resources should be protected. These could be any types of data objects such as files, directories, network servers, messages, databases, or Web resources. Then, you must decide what users and groups of users should have access to these protected resources. You also need to decide what type of

access should be permitted to these resources. Finally, you must apply the proper security policy on these resources to ensure that only the right users can access them (we already explained that resources are represented as objects in the Policy Server object space).

Access to objects within a domain is controlled by applying a security policy to the container and resource objects in the protected object space. To secure network resources in a protected object space, each object must be protected by a security policy. A security policy can be explicitly applied to an object or inherited from objects above it in the hierarchy. You need to apply an explicit security policy in the protected object space only at those points in the hierarchy where the rules must change.

Adopting an inherited security scheme can greatly reduce the administration tasks for a domain. The power of security policy inheritance is based on the following principle:

> *Any object without an explicitly attached security policy inherits the policy of its nearest container object with an explicitly set security policy. The inheritance chain is broken when an object has an explicitly attached security policy.*

Security policy inheritance simplifies the task of setting and maintaining access controls on a large protected object space. In a typical object space, you need to attach only a few security policies at key locations to secure the entire object space. Therefore, it is called a *sparse security policy model*.

Security policy is defined using a combination of:

- Access control lists (ACLs)

  An access control list specifies the predefined actions that a set of users and groups can perform on an object. For example, a specific set of groups or users can be granted *read* access to the object.

- Protected object policies (POPs)

  A protected object policy specifies access conditions associated with an object that affect all users and groups. For example, a *time-of-day* restriction can be placed on the object that excludes all users and groups from accessing the object during the specified time.

- Authorization rules

  An authorization rule specifies a complex condition that is evaluated to determine whether access will be permitted. The data used to make this decision can be based on the context of the request, the current environment, or other external factors. For example, a request to modify an object *more than five times in an 8-hour period* could be denied.

A security policy is implemented by strategically applying ACLs, POPs, and authorization rules to those resources requiring protection. The Tivoli Access Manager authorization service makes decisions to permit or deny access to resources based on the credentials of the user making the request and the specific permissions and conditions set in the ACLs, POPs, and authorization rules.

ACL policy

The policy that defines who has access to an object, and what operations can be performed on the object, is known as the *ACL policy*. Each ACL policy has a unique name and can be applied to multiple objects within a domain. An ACL policy consists of one or more entries describing:

- The names of users and groups whose access to the object is explicitly controlled
- The specific operations permitted to each user, group, or role
- The specific operations permitted to the special any-other and unauthenticated user categories

Using ACL policies with the authorization service

Tivoli Access Manager relies on ACL policies to specify the conditions necessary for a particular user to perform an operation on a protected object. An ACL policy consists of one or more ACL entries. An *ACL entry* defines a user or group and permissions that user or group has on a protected object. A domain administrator can manage ACL entries before or after the ACL policy is attached to domain resources.

A *permission* is an action that is defined by an action bit in an action group. An action group is a set of permissions. A domain administrator can add to or remove from an ACL entry. When Tivoli Access Manager is installed, the primary action group is created and contains 18 permissions. These permissions are defined using action bits. Actions, or permissions, are represented by single alphabetic ASCII characters (a-z, A-Z). The values are defined in Table 4-2 on page 102.

Table 4-2 Action bits and WPM category of the default primary action group

Action bit	Description of permission	Category
a	Attach	Base
A	Add	Base
b	Browse	Base
B	Bypass protected object policy (POP)	Base
c	Control	Base
d	Delete	Generic
g	Delegation	Base
l	List directory	Application
m	Modify	Generic
N	Create	Base
R	Bypass rule	Base
r	Read	Application
s	Server administration	Generic
t	Trace	Base
T	Traverse	Base
v	View	Generic
W	Password	Base
x	Execute	Application

You can perform the following ACL policy tasks:

- Create an ACL policy
- Modify the description of an ACL policy
- List ACL policies
- View an ACL policy
- Clone an ACL policy
- Import ACL policies
- Export all ACL policies
- Export a single ACL policy
- Export multiple ACL policies
- Attach an ACL policy to an object
- Locate where an ACL policy is attached

- Detach an ACL policy from an object
- Delete an ACL policy

These actions can be performed using either the pdadmin CLI or the WPM GUI. Importing, exporting, or cloning ACL policies can only be performed with WPM. For a detailed syntax of ACL commands refer to the *IBM Tivoli Access Manager Version 6.0 Administration Guide,* SC32-1686.

Evaluating an ACL

Tivoli Access Manager follows a specific evaluation process to determine the permissions granted to a particular user by an ACL. When you understand this process, you can determine how best to keep unwanted users from gaining access to resources. Access Manager distinguishes between authenticated and unauthenticated requests.

- Evaluating authenticated requests

  Tivoli Access Manager evaluates an authenticated user request in the following order:

  a. Match the user ID with the ACL's user entries. The permissions granted are those in the matching entry.

     Successful match: Evaluation stops here.
     Unsuccessful match: Continue to the next step.

  b. Determine the groups to which the user belongs and match with the ACLs group entries: If more than one group entry is matched, the resulting permissions are a logical *or* (most permissive) of the permissions granted by each matching entry.

     Successful match: Evaluation stops here.
     Unsuccessful match: Continue to the next step.

  c. Grant the permissions of the *any-other* entry (if it exists).

     Successful match: Evaluation stops here.
     Unsuccessful match: Continue to the next step.

  d. An implicit any-other entity exists when there is no any-other ACL entry. This implicit entry grants no permissions.

     Successful match: No permissions granted. End of evaluation process.

- Evaluating unauthenticated requests

  Tivoli Access Manager evaluates an unauthenticated user by granting the permissions from the ACLs unauthenticated entry.

  The unauthenticated entry is a mask (a bitwise "and" operation) against the any-other entry when permissions are determined. A permission for

unauthenticated is granted only if the permission also appears in the any-other entry.

Because unauthenticated depends on any-other, it makes little sense for an ACL to contain unauthenticated without any-other. If an ACL does contain unauthenticated without any-other, the default response is to grant no permissions to unauthenticated.

Protected object policies

A protected object policy (POP) specifies security policy that applies to an object regardless of what user or what operation is being performed. Each POP has a unique name and can be applied to multiple objects within a domain.

The purpose of a POP is to impose access conditions on an object based on the time of the access and to indicate whether the access request should be audited. Specifically, the conditions you can apply are:

- POP attributes, such as warning mode, audit level, and time-of-day.
- The authentication-strength POP allows for the configuration of step-up authentication to enforce stronger security for certain parts of the object space.
- The quality-of-protection POP implements privacy and integrity mechanisms such as encryption (SSL) and hash algorithms.
- The network-based authentication POP makes it possible to control access to objects based on the IP address of the client.

Tivoli Access Manager enforces the following POP attributes:

Name Specifies the name of the policy. This attribute relates to the *pop-name* variable in the pop command documentation.

Description Specifies the descriptive text for the policy. This attribute appears in the **pop show** command.

Warning mode Provides to administrators a means to test ACLs, POPs, and authorization rules. Warning mode provides a way to test the security policy before it is made active. The attribute has value *yes* or *no*.

Audit level Specifies the type of auditing: all, none, successful access, denied access, or errors. Audit level informs the authorizations service that extra services are required when permitting access to the object.

Time-of-day access Day and time restrictions for successful access to the protected object. Time-of-day places restrictions on access to the object.

Each resource manager or plug-in can optionally enforce one or more of the following attributes:

IP endpoint authorization method policy Specifies authorization requirements for access from members of external networks. The IP endpoint authentication method policy places restrictions on the access to the object.

EAS trigger attributes Specifies an External Authorization Service (EAS) plug-in that is invoked to make an authorization decision using the externalized policy logic of the customer.

Quality of Protection Specifies the degree of data protection: none, integrity, or privacy. Quality of Protection informs the authorizations service that extra services are required when permitting access to the object. Note, when the quality of protection level is set to either integrity or privacy, WebSEAL requires data encryption through the use of Secure Socket Layer (SSL).

Similar to ACL management, the following tasks can be performed on a POP policy:

- Create a POP policy
- Modify the description of a POP policy
- List POP policies
- View a POP policy
- Clone a POP policy
- Import POP policies
- Export all POP policies
- Export a single POP policy
- Export multiple POP policies
- Attach a POP policy to an object
- Locate where a POP policy is attached
- Detach a POP policy from an object
- Delete a POP policy

All these actions can be performed using either the pdadmin CLI, or the WPM GUI. Importing, exporting, or cloning POP policies can only be performed with WPM. For a detailed syntax of POP commands refer to the *IBM Tivoli Access Manager Version 6.0 Administration Guide,* SC32-1686.

Authorization rules

Authorization rules are defined to specify conditions that must be met before access to a protected object is permitted. A rule is created using a number of boolean conditions that are based on data supplied to the authorization engine within the user credential, from the resource manager application, or from the encompassing business environment. The language of an authorization rule allows customers to work with complex, structured data by examining the values in that data and making informed access decisions. This information can be defined statically within the system or during the course of a business process. Rules can also be used to implement extensible, attribute-based authorization policy by using attributes within the business environment or attributes from trusted external sources.

A Tivoli Access Manager authorization rule is a policy type similar to an access control list or a protected object policy. The rule is stored as a text rule within a rule policy object and is attached to a protected object in the same way and with similar constraints as ACLs and POPs.

How authorization rules differ from ACLs and POPs

ACLs take a given predefined set of operations and control which users and groups have permission to perform those operations on a protected object. For example, a user's ability to read data associated with an object is either granted or denied by an ACL policy. POPs apply to all users and groups and control conditions that are specific to a particular protected object. For example, time-of-day access excludes all users and groups from accessing an object outside of the times set in the time-of-day policy.

Rules enable you to make decisions based on the attributes of a person or object and the context and environment surrounding the access decision. For example, you can use a rule to implement a time-of-day policy that depends on the user or group. You also can use a rule to extend the access control capabilities that ACLs provide by implementing a more advanced policy, such as one based on quotas. While an ACL can grant a group permission to write to a resource, a rule can go a step further by enabling you to determine whether a group has exceeded a specific quota for a given week before permitting that group to write to a resource.

When to use authorization rules

In the Tivoli Access Manager authorization process, all three policy objects—the ACL, the POP, and the authorization rule—must permit access to a protected object before access to the object is granted. Authorization rules provide the flexibility needed to extend an ACL or POP by tailoring the security policy to your needs.

Although authorization rules can be used to extend the policy implemented by other Tivoli Access Manager policy types, they are not simply extensions of the existing policy types. An authorization rule is a policy type that is rich enough in functionality to replace the ACL and POP. However, using ACLs and POPs generally provides better performance. Therefore, use a rule to complement these policies instead of replacing them.

Authorization rules detail

The Access Manager authorization rules engine is implemented using an XSL parser. This defines how the inputs to the rules engine must be specified.

The two inputs to an XSL parser are:

Document An XML document. In the case of the Access Manager authorization rules engine, this is a document, built internally, that contains all of the required access decision information (ADI).

Stylesheet An XSL document. In the case of the Access Manager authorization rules engine, this is a document built from the configured rule for the object being accessed.

The output from an XSL parser is a new version of the document formatted using the stylesheet. In the case of the Access Manager authorization rules engine, the rules must be written in such a way that this *formatting* causes the output to be the access decision.

Figure 4-3 shows how the logical components of the rules engine are implemented using XML and XSL technology.

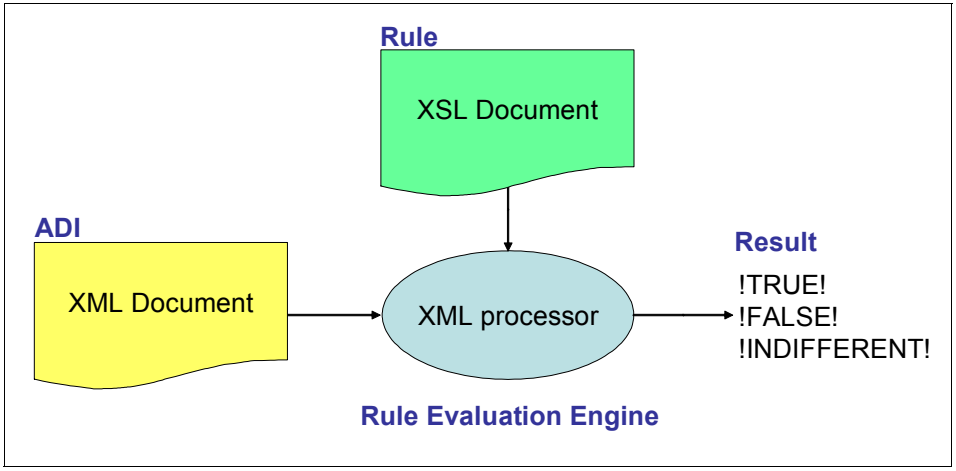


Figure 4-3 Authorization rules engine

The XSL parser *formats* the XML document containing the authorization decision information using an XSL formatted rule. The input XML document for the transformation contains a definition for how the authorization engine can retrieve one of the following sources for the ADI:

- User credential entitlement that is requesting the authorization
- Application context information that is passed in by the access decision call (passed in by the resource manager)
- Tivoli Access Manager authorization engine context
- Dynamic ADI retrieval entitlement services

The rule must be written in such a way that the output is one of the following string identifiers:

!TRUE!	(permit access)
!FALSE!	(deny access)
!INDIFFERENT!	(no opinion)

These identifiers ensure uniqueness in the event that an XSL rule is written incorrectly and the evaluation returns incorrect information. Delimiting the identifiers with an exclamation point (!) enables the evaluator to identify errant cases. The identifiers should be the only text in the output document; although they can be surrounded by white space. If a value other than the defined valid values or an empty document is returned, the access decision fails and an error code is returned to the resource manager to indicate that the rule is not compliant.

Similar to ACL and POP management, the following tasks can be performed on an authorization rule policy:

- Create an authorization rule policy
- Modify the description of an authorization rule policy
- List authorization rule policies
- Clone an authorization rule policy
- Import authorization rule policies
- Export all authorization rule policies
- Export a single authorization rule policy
- Export multiple authorization rule policies
- Attach an authorization rule policy to an object
- Locate where an authorization rule policy is attached
- Detach an authorization rule policy from an object
- Delete an authorization rule policy

For the detailed syntax of authorization rule commands refer to the *IBM Tivoli Access Manager Version 6.0 Administration Guide,* SC32-1686.

Note:

1. There are no equivalent pdadmin commands for importing, exporting, or cloning authorization rules.
2. When providing rule text with the pdadmin utility, enclose the rule text in double quotation marks ("). Double quotation marks embedded within the rule text must be escaped with a backslash so that they are ignored by the pdadmin utility. The XSL processor treats single and double quotation marks equally for the purpose of defining text strings so they can be used interchangeably, but they must always be paired appropriately.

   For example:

```
pdadmin sec_master> authzrule create testrule1 "<xsl:if
test='some_piece_of_ADI =\"any string\"'>!TRUE!</xsl:if>"
```

Authorization flow

Figure 4-4 shows where ACLs, POPs, and authorization rules fall in the authorization process.

When an authorization decision request is received, the access control list for the object is checked first. If this does not allow access to the object then the request is denied. No further processing is required and no rule is evaluated.

If the ACL is satisfied, then the POP is checked. If the POP returns a *deny* decision (for example, if the time-of-day check fails), then the overall access is denied. No further processing is required and no rule is evaluated.

If both the ACL and POP allow access, then the rules engine is called, and the engine's output ultimately determines whether access is permitted or denied.

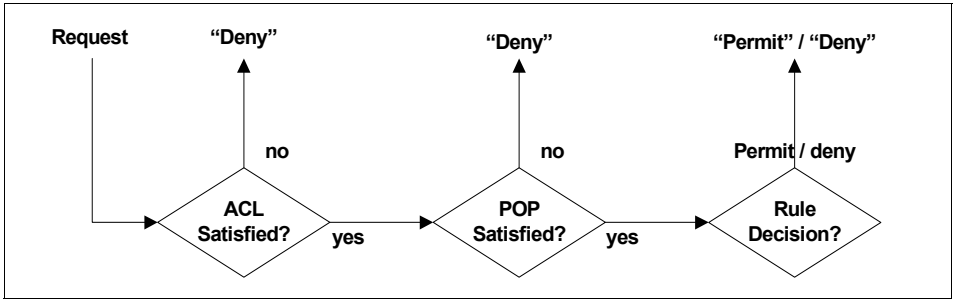


Figure 4-4 Authorization decision flow

The authorization engine uses the following algorithm to process the policy attached to a protected object:

1. Check ACL permissions. Details of this process are described in “Evaluating an ACL” on page 103.

   The ACL is also checked to determine whether the user (for whom the authorization check is being made) has the additional privilege of being unaffected by POP or authorization rule policy. This privilege is bestowed when the user’s effective ACL for access to the object contains the B permission to denote that POP policy is ignored, or the R permission to denote that authorization rule policy is ignored.
2. When an authorization rule is attached to the object and the user does not have the privilege of being unaffected by authorization rules, verify that all of the ADI[1] is present for the coming rule evaluation. If it is not, then find it by querying one of the available sources.
3. When there is a POP attached, check the Internet Protocol (IP) endpoint authentication method policy.
4. When there is a POP attached, check the time-of-day policy on the POP.
5. When there is a POP attached, check the audit-level policy on the POP, and audit the access decision as directed.
6. When an authorization rule is attached to the object and the user does not have the privilege of being unaffected by authorization rules, check the authorization rule policy.
7. When an external authorization service (EAS) operation or POP trigger applies to this access decision, invoke the external authorization services that apply.

If any of the ACL, POP, or authorization rule evaluations fail, then the access request is denied. The external authorization service can override this decision on its own, if it has been designed to do so, or it might choose not to participate in the authorization decision at all.

Every ACL, POP, or authorization rule can be thought of as a policy. Fill in the policy, specifying the appropriate access conditions. After the policy is complete, apply it to any number of resources within the domain. Subsequent changes to the policy are automatically reflected across the domain.

[1] The data and attributes that are used by the authorization engine to evaluate a rule. Authorization API attributes are name-value pairs that form the basis of all ADI that can be referenced in a rule or presented to the authorization engine.

Action groups

Tivoli Access Manager provides 18 predefined permissions for immediate use. These permissions are stored in the predefined action group named *primary*. Each permission is associated with an action bit. These predefined permissions are described in “Using ACL policies with the authorization service” on page 101

As additional resource managers are installed, additional action groups might be created. A domain administrator can create additional action groups and add new actions to previously created action groups as needed.

Resource manager software typically contains one or more operations that are performed on protected resources. Tivoli Access Manager requires these applications to make calls into the authorization service before the requested operation is allowed to progress. This call is made through the authorization application programming interface (authorization API) for both Tivoli Access Manager services and other applications.

The authorization service uses the information contained in the ACL to provide a simple *yes* or *no* response to the question: Does this *user* (group) have the *r* permission (for example) to *view* the requested *resource*?

The authorization service has no knowledge about the operation requiring the r permission. It is merely noting the presence, or not, of the r permission in the ACL entry of the requesting user or group. The authorization service is completely independent of the operations being requested. This is why it is easy to extend the benefits of the authorization service to other applications.

4.1.5 Default security policy

When initially installed, Tivoli Access Manager establishes a predefined default set of ACL policies to protect all objects in a domain. Those policies are placed on different parts of the default protected object space tree shown in Figure 4-2 on page 95. A typical object space begins with a single explicit security policy attached to the root container object. The root ACL must always exist and can never be removed. Normally, this is an ACL with very little restriction. All objects located in the object space inherit this ACL. Table 4-3 shows default ACL policies and their positions in the object space.

Table 4-3 Default ACLs

ACL policy	Permissions	Position in object space
default-root	group iv-admin TcmdbvaBR any-other T unauthenticated T	/ (root)

ACL policy	Permissions	Position in object space
default-management	group iv-admin TcmdbsvaBtNWAR group ivmgrd-servers Ts any-other Tv	/Management
default-replica	group iv-admin TcbvaBR group ivmgrd-servers m group secmgrd-servers mdv group ivacld-servers md	/Management/Replica
default-config	Group iv-admin TcmdbsvaBR Any-other Tv Unauthenticated Tv	/Management/Config
default-gso	group iv-admin TcmdbvaBNR any-other Tv unauthenticated Tv	/Management/GSO
default-policy	group iv-admin TcmdbvaBNR any-other Tv unauthenticated Tv	/Management/Policy
default-domain	group iv-admin TcmdbvaBNR group ivmgrd-servers v	/Management/Domain
default-management-proxy	group iv-admin Tcbv group ivmgrd-servers Tg	/Management/Proxy

This table shows that the /Management region of the protected object space contains multiple container objects that each require a specific set of permissions. If you want to modify default permissions you need to be aware of the impact of ACL options on the /Management region in the object space. For example, if you want users who are members of the PolicyAudit group to have permission to find where the ACL “salary” is placed in the object tree, they need permission to execute the following command:

```
pdadmin > acl find salary
```

This command can only be executed if the PolicyAudit group has the **v** permission on the /Management/ACL object space. If this group needs to be allowed to create and modify ACLs, then the additional permission **m** needs to be assigned to this group.

Table 4-3 shows that there is no default ACL policy, but the inherited default-management policy describes that, by default, members of the iv-admin group have permission to manipulate ACLs.

4.2 WebSEAL customization

Different approaches are needed to provide different types of user access (for example, unrestricted access or restricted access with passwords, SecurID tokens, or PKI certificates) to a variety of back-end applications. This flexibility should be provided within one security solution, and the management of this security solution must support both centralized and distributed security administration groups, while maintenance of the Web applications can be done by other individual groups.

WebSEAL can enforce a high degree of security in a secure domain by requiring users to provide proof of their identity. The following conditions apply to the WebSEAL authentication process:

- WebSEAL supports several authentication methods by default, and can be customized to use other methods.
- When both server and client require authentication, the exchange is known as *mutual authentication*.
- The WebSEAL server process is independent of the authentication method.
- The result of successful authentication to WebSEAL is a Tivoli Access Manager user identity.
- WebSEAL uses this identity to build a credential for that user.
- The authorization service uses this credential to permit or deny access to protected objects after evaluating the ACL permissions, POP conditions, and authorization rules governing the policy for each requested resource.

This flexible approach to authentication allows the security policy to be based on business requirements and not physical network topology.

Here are some of the technical requirements for authentication that WebSEAL has to address:

- Authentication

  Enforce authentication of users, where the type of authentication depends on the resources they want to access. Sometimes all users need to be authenticated, sometimes only users that want to access some protected URLs or applications need to identity themselves.

- User-based authorization

  Perform an initial user-based authorization check (such as, decide whether a user should be allowed to initially contact any of the Web applications). This step prevents certain users from accessing the system at all.

- Target-based authorization

  Perform a resource-based authorization by deciding whether a user should be allowed to contact a certain Web application.

- Single sign-on

  If user authentication and authorization was successful, forward the user's request and user's credentials to a certain Web application server for further processing.

- Use of a separate component for authentication

  It might be necessary to allow a separate and already existing authentication application and repository to perform the initial user authentication. These additional authentication methods should be usable without having to rewrite any of the applications.

4.2.1 Authentication and single sign-on mechanisms

Authentication describes the process of exchanging credentials to identify the communication partners. Authentication can be directional or mutual. *Single sign-on* is the process of forwarding information about a user's identity in a secure way to another system. WebSEAL can enforce certain types of user authentication and can use several single sign-on mechanisms to forward user requests together with user information to a Web application server.

WebSEAL provides enough flexibility to support multiple authentication and single sign-on mechanisms to act as a reverse Web proxy between different user groups and different types of Web application servers in a secure way.

4.3 Supported WebSEAL authentication mechanisms

This section describes the authentication mechanisms that are supported by WebSEAL to protect access to a Web environment. Some mechanisms in this section can be combined with some of the single sign-on mechanisms in 4.9, "WebSEAL single sign-on mechanisms" on page 154 to make the connection between a user and a Web application. When WebSEAL examines a client request, it searches for authentication data using some of the available authentication methods in the following order:

1. Failover cookie
2. CDSSO ID token
3. Client-side certificate
4. Token passcode
5. Forms-based authentication (username and password)
6. SPNEGO (Kerberos)

7. Basic authentication (username and password)
8. HTTP headers
9. IP address
10. External Authentication Interface (EAI)

HTTP and HTTPS authentication methods can be independently enabled and disabled for both HTTP and HTTPS transports. The only exception is the client-side certificate that requires an HTTPS type of connection (transport). If no authentication methods are enabled for a particular transport, the authentication process is inactive for clients using that transport.

WebSEAL uses the concept of authentication modules to use different authentication methods. An authentication mechanism describes how an authentication method is enabled and specifically refers to the configuration stanza entry (such as passwd-ldap) used in the WebSEAL configuration file.

WebSEAL supports three types of authentication modules:

- Built-in modules that ship with WebSEAL and that are fully supported
- Support for custom external authentication solutions using the external authentication interface (EAI)
- Support for custom modules written using the external authentication C API (know as CDAS in the previous release)

The following built-in modules exist in Access Manager:

passwd-ldap	Password authentication via LDAP (Forms/BasicAuth)
passwd-uraf	Password authentication using the Tivoli Access Manager User Registry Adapter Framework (URAF) for Active Directory or Domino (Forms/Basic Auth)
token-cdas	Token authentication (SecureID)
cert-ldap	SSL client certificate authentication
http-request	HTTP header or IP address authentication
kerberosv5	Simple and Protected Negotiation (SPNEGO) authentication with WebSEAL (Windows Desktop Single Sign-On)

4.3.1 Basic authentication with user ID and password

Basic authentication (BA) is part of the HTTP standard and defines a standardized way in which user ID and password information is passed to a Web server. When WebSEAL sends a BA challenge to the browser, the browser pops up a dialog panel requesting user name and password from the user. When this information is entered, the browser sends its original request again, but this time

with the user name and password included in the BA header of the HTTP request. WebSEAL extracts this information from the header and uses it to verify the user's identity. In this case, a specific library shipped with Access Manager implements a built-in authentication service and performs a check against the Access Manager user registry. If successful, a credential is created and cached.

After a user has authenticated an ID and password through the browser, the browser caches this information in memory and sends it with each subsequent request to the same server. Even by configuring a session log-out parameter, which is possible for HTTPS sessions, the user will automatically log on to WebSEAL with each new request the user sends. The only way to clear this cache (and log the current user out) is to close all browser panels.

4.3.2 Forms-based login with user ID and password

The alternative to using basic authentication is to use forms-based login. Rather than send a basic authentication challenge in response to a client request, WebSEAL responds with a sign-in form in HTML format. The client browser displays this and the user fills in a user ID and password. When the user clicks the send or logon button, the form is returned to WebSEAL using an HTTP POST request. WebSEAL extracts the information and uses it to verify the user's identity through the Access Manager authentication service, where it performs a check against the Access Manager user registry.

Since the user ID and password information is not cached on the browser, it becomes possible to perform a programmatic logout for the user. On a client request, WebSEAL presents a customized logout form to a user. After the user confirms the logout, the session is considered closed and the credential is deleted from the WebSEAL cache.

Another benefit of using the forms-based login process is that you can enforce a time-based logout for authenticated sessions. The time values can be customized in the WebSEAL configuration files.

4.3.3 Authentication with X.509 client certificates

In response to a certificate request from WebSEAL, as part of the SSL Version 3 tunnel negotiation, the browser prompts the user to select a certificate from the local certificate store or smartcard. The user is asked for a password to access the private key. When the user has selected a certificate, it is passed to WebSEAL, which uses the certificate authentication library to check the signature of the client certificate. It also checks the validity period to ensure that the certificate has not expired. Assuming that the certificate is valid, the identity in the certificate is mapped (one-to-one) to an Access Manager identity. After the

Access Manager identity is passed back to WebSEAL, WebSEAL pulls the user information from the Access Manager user registry and builds the credential.

If you configure Access Manager to use X.509 client certificates for authentication, but the user does not have a certificate available, WebSEAL can fall back to basic authentication, if required.

4.3.4 Failover authentication

WebSEAL provides an authentication method that preserves an authenticated session between a client and WebSEAL when the WebSEAL server becomes unavailable in a replicated server (fault-tolerant) environment. The method is called failover authentication.

The purpose of failover authentication is to prevent a forced login when the WebSEAL server that has established the original session with the client suddenly becomes unavailable. Failover authentication enables the client to connect to another WebSEAL server, and creates an authentication session containing the same user session data and user credentials. This is supported through a failover cookie.

Failover cookie

The failover cookie is a mechanism for transparently re-authenticating the user, and is not actually a mechanism for maintaining sessions. Failover cookies contain encrypted user authentication data that a WebSEAL server can use to validate a user's identity. The cdsso_key_gen utility is used to generate a key pair that can secure the cookie data.

A failover cookie maintains the following information:

- User credential information
- Session inactivity timeout value
- Session lifetime timeout value

All other session state data, however, is not captured or maintained by failover cookies. Failover cookie configuration requires the distribution of a shared secret key to all of the WebSEAL servers in the cluster.

Failover cookies pose a greater security risk than normal session cookies. If an attacker hijacks a session cookie, the session cookie is only valid until the WebSEAL server deletes the associated session. Failover cookies are valid until the lifetime or inactivity timeout in the failover cookie is reached. Failover cookies do allow the enforcement of session lifetime timeouts, inactivity timeouts, and pkmslogout. Failover cookies can also provide single sign-on across multiple WebSEAL clusters in the same DNS domain.

Failover cookies do not have to be implemented in an environment with a Session Management Server since the failover cookie takes responsibility for maintaining a user session.

4.3.5 Authentication with RSA SecurID token

Access Manager supports authentication of clients using user name and token pass code information from an RSA SecurID token authenticator (TAR), a physical device that stores and dynamically generates a piece of authentication data (a token).

The TAR is used in tandem with an authentication server (the RSA ACE/Server), which actually performs the authentication. During authentication to WebSEAL, the client enters a user name and pass code. The pass code consists of:

- The unique PIN number associated with the client's SecurID TAR
- The current number sequence generated by the SecurID TAR

The Ace/Server uses its own registry database to determine the PIN that the user should be using, checks it, and strips it off of the pass code. It then checks the remaining number sequence against its own internally generated number sequence. A matching number sequence completes the authentication.

At this point, the role of the token passcode authentication is complete. The token passcode authentication does not perform identity mapping, but simply returns to WebSEAL an Access Manager identity containing the user name of the client. This user name must match a user ID stored in the Access Manager user registry.

4.3.6 Windows desktop single sign-on (SPNEGO)

Before describing Windows desktop single sign-on, there are some important security considerations to point out:

- In order for Microsoft Internet Explorer (IE) to be able to use the integrated Windows authentication, it must recognize the Access Manager server as an Intranet or Trusted site. The Internet Explorer client must be configured to use the SPNEGO protocol and Kerberos authentication when contacting WebSEAL or the Web Server Plug-in.
- WebSEAL or the Web Server Plug-in must be able to access Active Directory as its Kerberos Key Distribution Center (KDC). This may expose Active Directory to new networks.

Therefore, it is important to only use SPNEGO authentication over a secure network or over a secure transport. WebSEAL and the Web Server Plug-in support the SPNEGO (Simple and Protected GSS-API Negotiation) protocol and

Kerberos authentication for use with Windows clients to achieve Windows desktop single sign-on. The SPNEGO protocol allows for a negotiation between the client (browser) and the server regarding the authentication mechanism to use. The client identity presented by the browser can be verified by WebSEAL or the Web Server Plug-in using Kerberos authentication mechanisms.

Important: The use of SPNEGO requires that a time synchronization service be deployed across the Active Directory server, the WebSEAL server or the Web Server Plug-in, and any clients that will authenticate using SPNEGO.

WebSEAL SPNEGO support provides single sign-on from Internet Explorer running on Windows client workstations configured into an Active Directory domain.

Note: SPNEGO single sign-on support is also available on other platforms, including:

- IBM AIX
- Windows
- Solaris
- Linux x86
- Linux for S/390®

More technical information on how to integrate Linux desktop single sign-on and the Mozilla Firefox browser can be found in the IBM Redbook *Federated Identity Management and Web Services Security with IBM Tivoli Security Solutions*, SG24-6394.

For the WebSEAL SPNEGO configuration it is not necessary for Access Manager to use Microsoft Active Directory as the user registry. When Active Directory is *not* the Tivoli Access Manager user registry, users must be replicated between the client Active Directory registry and the Tivoli Access Manager user registry.

Mapping an ID from Active Directory to Access Manager is an important part of SPNEGO. Normally, WebSEAL will truncate the domain name portion of an Active Directory ID in order to get the user ID. This can cause conflicts, however, if two different users have the same ID in different Active Directory domains. In this case, WebSEAL would need to be configured to keep the domain section of the user ID attached in order to be able to resolve the conflict.

Multiple Active Directory domain support

Active Directory uses *domains* and *forests* to represent the logical structure of the directory hierarchy. Domains are used to manage the various populations of

users, computers, and network resources in your enterprise. The forest represents the security boundary for Active Directory. SPNEGO authentication for users from multiple Active Directory domains is supported by Tivoli Access Manager only if an appropriate trust relationship between the domains is established. This trust exists automatically for domains that are part of the same Active Directory forest. For SPNEGO authentication to work across multiple forests, a forest trust relationship must be established.

4.3.7 Authentication using customized HTTP headers

Access Manager supports authentication via customized HTTP header information supplied by the client or a proxy agent.

This mechanism requires a mapping function (a shared library) that maps the trusted (pre-authenticated) header data to an Access Manager identity. WebSEAL can take this identity and create a credential for the user.

WebSEAL assumes that custom HTTP header data has been authenticated previously. For this reason, you should implement this method exclusively, with no other authentication methods enabled. It is possible to impersonate custom HTTP header data.

By default, this shared library is built to map data from trusted proxy headers.

4.3.8 Authentication based on IP address

Access Manager supports authentication via an IP address supplied by the client. This mechanism is used best in combination with other mechanisms. For example, you can use IP network addresses to identify a certain group of users, give them access to a certain application, then use additional authentication mechanisms to give access to more protected applications. Such a configuration can be used to implement a two-factor authentication as well. It may be more secure than plain password authentication.

4.4 Advanced WebSEAL authentication methods

In addition to the authentication methods described in the previous section, WebSEAL provides advanced authentication functionality, which is described in this section. Advanced authentication methods include:

- Multiplexing proxy agents
- Switch user authentication
- Re-authentication
- Authentication strength policy (step-up)

- External authentication interface (EAI)

4.4.1 MPA authentication

Access Manager provides an authentication mechanism for clients using a multiplexing proxy agent (MPA). This is a special variation of the authentication with customized HTTP headers that is often used for mobile phones and PDAs, but is not limited to these devices.

Multiplexing proxy agents are gateways that accommodate multiple client access. The IBM Everyplace Wireless Gateway (EWG) is an integrated part of the IBM WebSphere Everyplace Suite that provides security-rich wired and wireless connectivity between the IT network and the communications network; for example:

- Cellular networks, including GSM, CDMA, TDMA, PDC, PHS, iDEN, and AMPS
- Packet radio networks, including GPRS, CDPD, DatatTAC, and Mobitex
- Satellite and wire environments, including DSL, cable modems, Internet service providers, ISDN, dial, and LAN

In addition, the Everyplace Wireless Gateway provides protocol translation as a Wireless Application Protocol (WAP) gateway, information push as a WAP push proxy gateway, and support for short messaging services (SMS). EWG establishes a single SSL channel to the origin server and “tunnels” all client requests and responses through this channel.

To WebSEAL, the information across this channel initially appears as multiple requests from one client. WebSEAL must distinguish between the authentication of the MPA server over SSL and the additional authentication requests for each individual client.

Because WebSEAL maintains an SSL session state for the MPA, it cannot use SSL session IDs for each client simultaneously. WebSEAL instead authenticates clients using HTTP authentication techniques over SSL.

If the user is authenticated at the EWG, for example, to a RADIUS Server, then WebSEAL can be configured to receive an “authenticated ID” from the gateway and not re-authenticate the user.

WebSEAL has support for the Entrust Proxy and the Nokia WAP gateway.

4.4.2 Switch user authentication

The WebSEAL *switch user* function allows administrators to assume the identity of a user who is a member of a Tivoli Access Manager secure domain. The ability to assume a user's identity can help an administrator in a Help Desk environment to troubleshoot and diagnose problems. Switch user can also be used to test a user's access to resources and to perform application integration testing.

The switch user implementation is similar to the **su** command in UNIX® environments. In the WebSEAL environment, the administrator acquires the user's credentials and interacts with resources and back-end applications with exactly the same abilities as the actual user. The administrator uses a special HTML form to supply switch user information. WebSEAL processes the form and calls a special authentication mechanism that returns the specified user's credential without the requirement of knowing the user's password. WebSEAL determines whether to allow the switch user request by performing the following checks:

1. WebSEAL examines the membership of the Tivoli Access Manager *su-admins* group to determine if the administrator has permission to invoke the switch user function. Administrators requesting use of switch user authentication must be members of the su-admins group. Membership in this group must be configured before switch user can be used.
2. WebSEAL examines the membership of the Tivoli Access Manager *su-admins*, *securitygroup*, and *su-excluded* groups to ensure that the user identity supplied in the switch user form is not a member of one of these groups. User identities that belong to any of these groups cannot be accessed by the switch user function. The WebSEAL administrator must configure memberships in these groups before administrators use the switch user function.

For configuration instructions and more information on these groups refer to the *IBM Tivoli Access Manager for e-business Version 6.0 WebSEAL Administration Guide,* SC32-1687.

When WebSEAL decides to allow the switch user request, WebSEAL calls the appropriate switch user module to perform the special switch user authentication. WebSEAL supports a variety of authentication mechanisms. Each authentication mechanism has a corresponding switch user authentication mechanism. WebSEAL provides built-in modules that contain the special switch user function. Before switch user authentication can be used, the WebSEAL administrator must configure WebSEAL to use the appropriate modules.

When authentication of the designated user succeeds, the switch user module returns a valid credential for the user—without requiring the user password for

input. WebSEAL manipulates the contents of the appropriate entry in the WebSEAL session cache by:

1. Removing the administrator's WebSEAL session cache data and storing it in a separate location
2. Inserting the switched-to user's cache data, including the user's credential, in place of the administrator's cache data

WebSEAL sends a *redirect* to the browser for the destination URL supplied in the switch user form. The request is processed normally, using the user's credential. The administrator can continue to make other requests. All authorization decisions for these requests are based on the credential of the user. The administrator ends the switch user session using the standard Tivoli Access Manager *pkmslogout* utility.

Upon successful logout:

1. The user's cache data is deleted.
2. The administrator's original cache data (and credential) is restored.
3. The administrator is returned to the original page from which the switch user form was requested.

4.4.3 Re-authentication

Tivoli Access Manager WebSEAL can force a user to perform an additional login (re-authentication) to ensure that a user accessing a protected resource is the same person who initially authenticated at the start of the session. Forced re-authentication provides additional protection for sensitive resources in the secure domain. Re-authentication can be activated by:

- A protected object policy (POP) on the protected object.
- Expiration of the inactivity timeout value of a WebSEAL session cache entry.

Re-authentication is supported by the following WebSEAL authentication methods:

- Forms-based (user name and password) authentication
- Token authentication
- External authentication interface

In addition, a custom user name and password module can be written to support re-authentication. Re-authentication assumes that the user has initially logged in to the secure domain and that a valid session (credential) exists for the user. During re-authentication, the user must log in using the same identity, authentication method, and authentication level that generated the existing credential. WebSEAL preserves the user's original session information, including

the credential, during re-authentication. The credential is not replaced during re-authentication. During re-authentication, WebSEAL also caches the request that prompted the re-authentication. Upon successful re-authentication, the cached data is used to rebuild the request.

Creating and applying the re-authentication POP

Forced re-authentication based on security policy is configured by creating a protected object policy (POP) with a special extended attribute named *reauth*. You can attach this POP to any object that requires the extra protection provided by forced re-authentication. Remember that all children of the object with the POP also inherit the POP conditions. Each requested child object requires a separate re-authentication.

The following example illustrates creating a POP called *restricted* with the reauth extended attribute and attaching it to an object (salary.html):

```
pdadmin> pop create restricted
pdadmin> pop modify restricted set attribute reauth true
pdadmin> pop attach /WebSEAL/hostA/junction/salary.html secure
```

Anyone attempting to access salary.html is forced to re-authenticate using the same identity and authentication method that generated the existing credential. If the user requesting the resource is unauthenticated, the POP forces the user to authenticate. No re-authentication is necessary for this resource after successful initial login.

Re-authentication based on session inactivity

Re-authentication based on session inactivity is enabled by a configuration stanza entry and is activated by the expiration of the inactivity timeout value of a session cache entry. A user's session is normally regulated by a *session inactivity* value and a *session lifetime* value. When WebSEAL is configured for re-authentication based on session inactivity, the user's session cache entry is *flagged* whenever the session inactivity timeout value expires. The session cache entry (containing the user credential) is not removed. The user can proceed to access unprotected resources. However, if the user requests a protected resource, WebSEAL sends a login prompt. After successful re-authentication, the inactive session *flag* is removed and the inactivity timer is reset.

If re-authentication fails, WebSEAL returns the login prompt again. The session cache entry remains *flagged* and the user can proceed to request unprotected resources until the session cache entry lifetime value expires. Two other conditions can end a user session:

1. The user can explicitly log out.
2. An administrator can terminate a user session.

4.4.4 Authentication strength policy (step-up)

WebSEAL supports many authentication methods that are described in 4.3, “Supported WebSEAL authentication mechanisms” on page 114. WebSEAL provides a feature that enables administrators to assign a ranking or level to some of the supported authentication methods. Administrators can define an ordered list that ranks each authentication method from lowest to highest. This hierarchical ranking can be arbitrarily tailored to each individual WebSEAL deployment.

This set of authentication levels can be used to implement an authentication strength policy. Authentication strength is sometimes referred to as *step-up authentication*. Step-up authentication is not a unique authentication method like forms-based or certificate-based authentication. Instead, it is a defined process for requiring users to change their current authentication method to another authentication method.

There is no absolute ranking between the authentication methods. No one authentication method is inherently better or stronger than another method. The ranking is simply a method for an administrator to define a relative level for each authentication method for use with a specific Tivoli Access Manager WebSEAL protected object namespace. The only rule governing the assignment of levels is that the unauthenticated level is always lower than all other authenticated levels.

The following authentication methods can be assigned an authentication level:

- Unauthenticated
- Password authentication

  Password authentication is limited to forms-based authentication. Basic authentication is not supported as a step-up authentication level.
- Token authentication
- Certificate authentication
- External authentication interface

Authentication strength is supported over both HTTP and HTTPS, with the exception of certificate-based authentication. Because certificates are valid only over an SSL connection, it is not possible to step up to certificates over HTTP.

Note: When a user activates authentication strength by attempting to access a protected object, the user does not have to log out first. Instead, the user is presented with a login prompt, and simply logs in again to the higher level.

Administrators apply an authentication level to a protected resource by declaring and attaching a standard Tivoli Access Manager protected object policy (POP) to the resource object. Authentication strength policy is set and stored in a POP attribute called an *IP Endpoint Authentication Method*. WebSEAL always checks for this attribute before it performs the standard algorithm of ACL checking followed by POP and authorization rule checking.

Configuration of step-up policy

To establish an authentication strength policy, the administrator does the following:

1. Specify authentication levels.
2. Specify the authentication strength login form.
3. Create a protected object policy.
4. Specify network-based access restrictions.
5. Attach a protected object policy to a protected resource.
6. Enforce user identity match across authentication levels.
7. Control the login response for unauthenticated users.

Specifying authentication levels

To specify authentication levels you need to edit the `[authentication-levels]` stanza in the WebSEAL configuration file. For each authentication method to be used for authentication level step-up, add an entry to the stanza.

The supported authentication methods are described in Table 4-4.

Table 4-4 Authentication methods supported for authentication strength

Authentication Method	Configuration File Entry
None	level = unauthenticated
Forms authentication	level = password
Token authentication	level = token-card
Certificate authentication	level = ssl
External authentication interface	level = ext-auth-interface

The default entries are:

```
[authentication-levels]
level = unauthenticated
level = password
```

The following entry must always be the first in the list:

```
level = unauthenticated
```

Additional entries can be placed in any order.

For example, to enable authentication strength levels for certificate authentication at the highest level, the completed stanza entry would be:

```
[authentication-levels]
level = unauthenticated
level = password
level = ssl
```

In this example, SSL authentication needs to be configured in *delayed certificate authentication mode* since the user is not required to authenticate with a certificate at session start-up. The user can later initiate certificate authentication. Delayed certificate authentication mode is enabled in WebSEAL by configuring the following stanza:

```
[certificate]
accept-client-certs = prompt_as_needed
```

Important: To successfully perform step-up authentication you need to disable the use of SSL session IDs to track session state. Verify the default *no* value for the `ssl-id-sessions` for the `[sessions]` stanza entry in the WebSEAL configuration file. In this case, SSL IDs cannot be used to maintain user sessions because when the user is prompted for a certificate, the user's SSL ID will change.

4.4.5 External authentication interface (EAI)

Tivoli Access Manager provides an external authentication interface that enables you to extend the functionality of the WebSEAL authentication process. The external authentication interface allows third-party systems to supply an authenticated identity to WebSEAL and Web-server Plug-ins. The identity information is then used to generate a credential. This extended authentication functionality is similar to the existing custom authentication module capability provided by the Web security external authentication C API (formerly known as CDAS). However, the external authentication interface allows the user identity to be supplied in HTTP response headers rather than through the authentication module API interface.

EAI is described in more detail in Chapter 5, "Programming" on page 181.

4.4.6 No authentication

Any user who can reach WebSEAL belongs to the group of unauthenticated users. This group can also get certain permissions.

This group of unauthenticated users generally is used to define public Web access. WebSEAL can force unauthenticated users to use another authentication method when selecting certain protected URLs.

All users who can reach WebSEAL might already have enough permissions to contact certain junctioned Web servers. For example, if WebSEAL is connected to a VPN gateway, only authorized VPN users will be able to reach that server, and additional authentication might not be needed. In this situation, you can probably treat unauthenticated users as you would a group of password-authenticated Internet users.

4.5 Standard junctions

A WebSEAL *junction* is an HTTP or HTTPS connection between a front-end WebSEAL server and a back-end Web application server. Junctions logically combine the Web space of one or more back-end servers with the Web space of the WebSEAL server, resulting in a unified view of the entire Web object space.

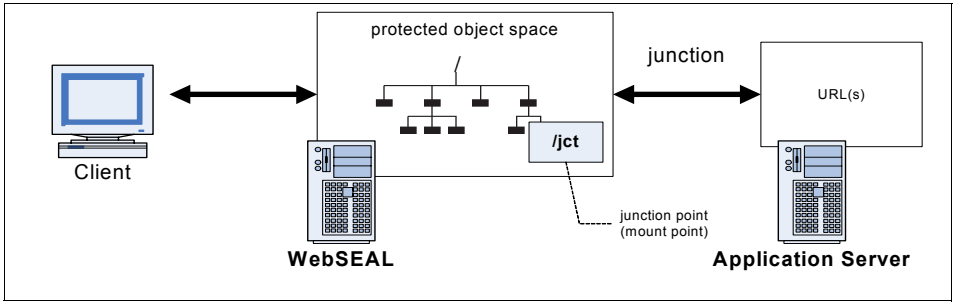


Figure 4-5 WebSEAL junction

A junction allows WebSEAL to provide protective services on behalf of the back-end server. WebSEAL performs authentication and authorization checks on all requests for resources before passing those requests across a junction to the back-end server. Junctions also allow a variety of single sign-on solutions between a client and the junctioned back-end applications.

In addition, the junctions provide a scalable, secure environment that allows load balancing, high availability, and centralized, state management capabilities—all performed transparently to clients.

You can create WebSEAL junctions with the pdadmin command-line utility or with the Web Portal Manager. To create WebSEAL junctions, use the **pdadmin server task create** command:

```
pdadmin> server task instance_name-webseald-host_name create options
/junction_name
```

You must address the following two concerns when creating any junction:

- Decide where to junction (mount) the Web application server in the WebSEAL object space.
- Choose the type of junction.

You can create the following Standard WebSEAL junction types:

- WebSEAL to back-end server over TCP connection
- WebSEAL to back-end server over SSL connection
- WebSEAL to back-end server over TCP connection using HTTP proxy server
- WebSEAL to back-end server over SSL connection using HTTPS proxy server
- WebSEAL to WebSEAL over SSL connection

WebSEAL junction information is stored in XML-formatted database files. The location of the junction database directory is defined in the `[junction]` stanza of the WebSEAL configuration file.

The directory is relative to the WebSEAL server root (server-root stanza entry in the `[server]` stanza):

```
[junction]
junction-db = jct
```

Each junction is defined in a separate file with an .xml extension. The XML format allows you to manually create, edit, duplicate, and back up junction files, but the best approach is to manage junctions with WPM or the pdadmin tool.

4.5.1 WebSEAL object space and authorization configuration

Every installation and initial configuration of WebSEAL creates a new object container in the Policy Server object space. /WebSEAL/host-instance_name represents the beginning of the Web space for a particular WebSEAL instance. Along with the object space, default ACLs are created. The ACLs are attached to the /WebSEAL container and named *`default-webseal`*. Default ACL entries for this ACL are:

```
Group iv-admin Tcmdbsvarxl
Group webseal-servers Tgmdbsrxl
User sec_master Tcmdbsvarxl
```

```
Any-other Trx
Unauthenticated T
```

The group `webseal-servers` contains an entry for each WebSEAL server in the secure domain. The default permissions allow the servers to respond to browser requests.

The creation of a junction causes the creation of a new junction object in the Access Manager object space under the /WebSEAL/host-instance_name branch. The name of the object is the same as the junction point name specified in the junction creation command.

After creating a new junction it is always recommended to place an ACL on the junction object that provides coarse-grained control over the back-end resources. That ACL provides a general overall (coarse-grained) set of permissions for every individual resource accessed through the junction.

After that you can provide additional fine-grained protection to the resources accessed through the junction by explicitly placing ACLs on individual resource objects or groups of objects. WebSEAL cannot automatically *see* and understand a back-end file system. The object space that WebSEAL protects needs to be either manually defined, or the *query_contents* program should be used.

WebSEAL ACL permissions

Table 4-5 describes the ACL permissions applicable for the WebSEAL region of the object space.

Table 4-5 WebSEAL ACL permissions

ACL permission	Operation	Description
r	read	View the Web object.
x	execute	Run the CGI program.
d	delete	Remove the Web object from the Web space.
m	modify	PUT an HTTP object. (Place - publish - an HTTP object in the WebSEAL object space.)
l	list	Required by policy server to generate an automated directory listing of the Web space. This permission also governs whether a client can see the directory contents listing when the default .index.html. page is not present.
g	delegation	Assigns trust to a WebSEAL server to act on behalf of a client and pass requests to a junctioned WebSEAL server.

Generating a back-end server Web space (query_contents)

A CGI program called *query_contents* scans the back-end Web space and reports the structure and contents to WebSEAL. The query_contents program searches the back-end Web space contents and provides this inventory information to the Web Portal Manager on WebSEAL.

The program comes with the WebSEAL installation, but must be manually installed on the back-end Web server. There are different program file types available, depending on whether the back-end server is running UNIX or Windows.

The Object Space manager of the Web Portal Manager automatically runs query_contents any time the portion of the protected object space belonging to the junction is expanded in the Object Space management panel. When the Web Portal Manager knows about the contents of the back-end Web space, you can display this information and apply policy templates to appropriate objects.

Securing the query_contents program

It is very important to secure this file to prevent unauthorized users from running it. You must set a security policy that allows only the Policy Server (PDMgr) identity to have access to the query_contents program.

The following example ACL (query_contents_acl) meets this criteria:

```
group ivmgrd-servers Tr
user sec_master dbxTrlcam
```

Use the pdadmin utility to attach this ACL to the query_contents.sh (UNIX) or query_contents.exe (Windows) object on the junctioned servers. For example (UNIX):

```
pdadmin> acl attach
/WebSEAL/host/junction-name/cgi-bin/query_contents.sh
query_contents_acl
```

Note: Certain Tivoli Access Manager permissions are not enforceable across a junction. You cannot control, for example, the execution of a CGI script with the **x** permission, or a directory listing with the **l** permission. WebSEAL has no means of accurately determining whether or not a requested object on a back-end server is, for example, a CGI program file, a dynamic directory listing, or a regular HTTP object. Access to objects across junctions, including CGI programs and directory listings, is controlled only through the **r** permission.

Object space and access control to dynamic URLs

Many Web applications dynamically generate Uniform Resource Locators (URLs) in response to each user request. These dynamic URLs usually exist only for a short time. Despite their temporary nature, dynamic URLs still need strong protection from unwanted use or access.

Because dynamic URLs exist only temporarily, it is not possible to have entries for them in a pre-configured authorization policy database. Tivoli Access Manager solves this problem by providing a mechanism where many dynamic URLs can be mapped to a single static protected object. Mappings from objects to patterns are kept in a plain text configuration file called *dynurl.conf*.

The default location of this file (relative to the server-root value) is defined by the `dynurl-map` stanza entry in the `[server]` stanza of the WebSEAL configuration.

```
configuration file: [server]
dynurl-map = lib/dynurl.conf
```

This file does not exist by default. The existence of this file (with entries) during WebSEAL startup enables the dynamic URL capability.

To specify access control of dynamic URLs, create the dynurl.conf configuration file and edit the file to map resource objects to patterns. Entries in the file are of the format:

```
object template
```

You can use the Tivoli Access Manager Web Portal Manager to edit this file remotely. In Web Portal Manager, select the **Dynamic URL Files** link from the WebSEAL menu. The Dynamic URL page allows you to select a WebSEAL server and then view, edit, and save the dynurl.conf configuration file located on that server. After making your changes, use the dynurl update command to update the server:

```
pdadmin> server task instance_name-webseald-host_name dynurl update
```

After the file has been processed, the object name appears as a child resource in the WebSEAL object space.

Tivoli Access Manager uses a subset of UNIX shell pattern matching (including wildcard) to define the set of parameters that constitute one object in the object space. Any dynamic URL that matches those parameters is mapped to that object. The template can contain a subset of the standard pattern matching characters. The template can also be an exact string with no pattern matching characters.

4.5.2 Creating a local type standard junction

One specific type of junction is a local type junction (-t local). It is a mount point for specific content located locally on the WebSEAL server. Like the content from junctioned remote servers, local junction content is incorporated into WebSEAL's unified protected object space view.

The following junction options are appropriate for local type junctions:

–t type	Type of junction (local).
–d dir	Local directory to junction. Required if the junction type is local.
–f	Force the replacement of an existing junction.
–l percent-value	Defines the soft limit for consumption of worker threads.
–L percent-value	Defines the hard limit for consumption of worker threads.

4.5.3 URL filtering

The challenges of URL filtering are specific to standard WebSEAL junctions. For successful communication across standard junctions, WebSEAL must filter absolute and server-relative URLs in HTML response documents returned from the protected Web servers so that the URLs are correct when viewed as a part of WebSEAL's single host document space. The term *filtering* is used to indicate WebSEAL's process of scanning Web documents (for absolute and server-relative links) and modifying the links to include junction information. The junction feature of WebSEAL changes the server and path information that must be used to access resources on junctioned back-end systems. A link to a resource on a back-end junctioned server can only succeed if the URL contains the identity of the junction.

To support the standard junction feature and maintain the integrity of URLs, WebSEAL must, where possible:

1. Modify the URLs (links) found in responses sent to clients
2. Modify requests for resources resulting from URLs (links) that WebSEAL could not change

Figure 4-6 on page 134 summarizes the solutions available to WebSEAL for modifying URLs to junctioned back-end resources.

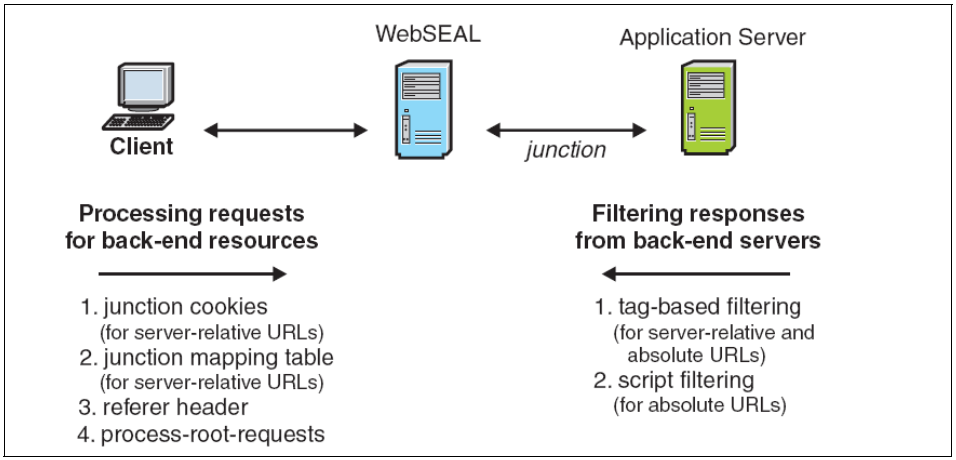


Figure 4-6 URL filtering solutions

Path types used in URLs

Any HTML page is likely to contain URLs (links) to other resources on that back-end server or elsewhere. URL expressions can appear in the following formats:

- Relative
- Server-relative
- Absolute

Links containing URLs expressed in relative format never require any modification by WebSEAL. By default, the browser handles relative URLs in links by pre-appending the correct scheme (protocol), server name, and directory information (including the junction) to the relative URL. The browser derives the pre-appended information from the location information of the page on which the link is located.

Links to back-end resources expressed in absolute or server-relative formats succeed only if WebSEAL is able to modify the URL path expression to include junction information. WebSEAL URL modification techniques apply to absolute and server-relative URLs.

Options for modifying URLs in responses from junctioned back-end application servers are the following:

- Filtering tag-based static URLs
- Script filtering for modifying absolute URLs
- Filtering with configuring the rewrite-absolute-with-absolute option

Filtering tag-based static URLs

WebSEAL uses a set of default rules to scan for (or filter) tag-based static URLs contained in pages that are responses to client requests. This default filtering mechanism examines static URLs located within tag-based content (such as HTML or XML). An important requirement for this mechanism is that the URLs must be visible to WebSEAL. For example, tag-based content filtering cannot handle URLs that are dynamically generated on the client side.

Filter rules for server-relative URLs

WebSEAL must add the junction name to the path of server-relative URLs that refer to resources located on junctioned servers. Server-relative URLs indicate a URL position in relation to the document root of the junctioned server, for example:

```
/dir/file.html
```

Server-relative URLs are modified by adding the junction point of the junctioned server to the path name, for example:

```
/jct/dir/file.html
```

Filter rules for absolute URLs

WebSEAL must add the junction name to the path of absolute URLs that refer to resources located on junctioned servers. Absolute URLs are modified according to the following set of rules:

- If the URL is HTTP and the host/port matches a TCP junctioned server, the URL is modified to be server-relative to WebSEAL and reflect the junction point. For example:

  ```
  http://host-name[:port]/file.html
  ```

  becomes:

  ```
  /tcpjct/file.html
  ```

- If the URL is HTTPS and the host/port matches an SSL junctioned server, the URL is modified to be server-relative to WebSEAL and reflect the junction point. For example:

  ```
  https://host-name[:port]/file.html
  ```

  becomes:

  ```
  /ssljct/file.html
  ```

Modifying absolute URLs with script filtering

WebSEAL requires additional configuration to handle the processing of absolute URLs embedded in scripts. Web scripting languages include JavaScript, VBScript, ASP, JSP™, ActiveX, and others.

The `script-filter` stanza entry in the `[script-filtering]` stanza of the WebSEAL configuration file enables or disables filtering of embedded absolute URLs. Script filtering is disabled by default:

```
[script-filtering]
script-filter = no
```

To enable script filtering, set the value of this stanza entry to *yes*.

The script filtering mechanism examines the entire contents of a response and is not restricted to, for example, tag-based content. The script-filter mechanism expects absolute URLs with a standard scheme, server, resource format:
`http://server/resource`

The script filter mechanism replaces the scheme and server portions of the link with the correct junction information (as a relative pathname):
`/junction-name/resource`

This filtering solution parses a script embedded in HTML code and therefore requires additional processing overhead that can negatively impact performance. The setting applies to all junctions. Only enable the script-filter stanza entry when your WebSEAL environment requires filtering of embedded absolute URLs.

Configuring the rewrite-absolute-with-absolute option

WebSEAL normally filters absolute URLs by adding the junction point and changing the format to a server-relative expression. This rule for filtering absolute URLs applies to tag-based filtering and script filtering.

You can optionally configure WebSEAL to rewrite the original absolute URL as an absolute URL, instead of a relative URL. To enable this type of filtering, set the value of the `rewrite-absolute-with-absolute` stanza entry in the `[script-filtering]` stanza of the WebSEAL configuration file to equal *yes*:

```
[script-filtering]
rewrite-absolute-with-absolute = yes
```

When rewrite-absolute-with-absolute is enabled, the following example URL in a response from a back-end server (connected to WebSEAL through jctA):

```
http://server/abc.html
```

is modified as follows:

```
http://webseal-hostname/jctA/abc.html
```

Modifying URLs in requests

Difficulties arise when URLs are dynamically generated by client-side applications (such as applets) or embedded in scripts in the HTML code. Web scripting languages include JavaScript, VBScript, ASP, JSP, ActiveX, and others.

These applets and scripts execute when the page arrives at the client browser. WebSEAL never has an opportunity to apply its standard filtering rules to these URLs that are dynamically generated on the client side. Three options for modifying URLs in requests are available to WebSEAL and are applied in the following order of precedence:

1. Junction mapping table
2. Junction cookies
3. HTTP Referer header

This section describes the options for processing server-relative links (used to make requests for resources located on junctioned back-end application servers) that are dynamically generated on the client side. There are no solutions available for handling absolute URLs generated on the client side.

Modifying server-relative URLs with junction mapping

Server-relative URLs generated on the client side by applets and scripts initially lack knowledge of the junction point. WebSEAL cannot filter the URL because it is generated on the client side. During a client request for a resource using this URL, WebSEAL can attempt to reprocess the server-relative URL using a junction mapping table.

A *junction mapping table* maps specific target resources to junction names. Junction mapping is an alternative to the cookie-based solution for filtering dynamically generated server-relative URLs.

WebSEAL checks the location information in the server-relative URL with the data contained in the junction mapping table. WebSEAL begins searching from the top of the table and continues downward through the table. If the path information in the URL matches any entry in the table during the top-down search, WebSEAL directs the request to the junction associated with that location. The table is an ASCII text file called *jmt.conf*.

The location of this file is specified in the `[junction]` stanza of the WebSEAL configuration file:

```
[junction]
jmt-map = lib/jmt.conf
```

The format for data entry in the table consists of the junction name, a space, and the resource location pattern. You can also use wildcard characters to express the resource location pattern.

It is not necessary to restart the WebSEAL process, after you create the jmt.conf file and add or change data in it. Use the **jmt load** command to load the data so that WebSEAL has knowledge of the new information.

```
pdadmin> server task server-name jmt load
JMT table successfully loaded.
```

Any errors that occur while loading the mapping table result in serviceability entries in the WebSEAL server log file (webseald.log). However, WebSEAL continues to run.

This solution does not require the junction cookie described in the next section.

Modifying server-relative URLs with junction cookies

This section describes a cookie-based solution to modifying server-relative URLs dynamically generated on the client side. When a client receives a page from a junctioned server, and requests a resource using a dynamically generated server-relative URL on this page, WebSEAL can attempt to reprocess the URL using a special cookie. The cookie contains the appropriate junction information.

This solution requires that you initially create the junction to the back-end application server using the -j junction option.

The following sequence of steps explains the process flow:

1. Client makes a request for an HTML page on a back-end junctioned application server. In addition to other content, the page contains an embedded applet that generates a server-relative URL once the page is loaded on the client's browser.
2. The page is returned to the client across the junction that was created with the -j option. The -j option causes WebSEAL to append a JavaScript block at the beginning of the HTML page. The purpose of the JavaScript is to set a junction-identifying cookie on the browser.
3. When the page is loaded on the client's browser, the JavaScript runs and sets the junction-identifying cookie in the browser's cookie cache. The cookie is a session cookie containing the name of the junction.
4. The embedded applet on the page dynamically runs and generates the server-relative URL.
5. The client makes a request for a resource using this server-relative URL. The junction cookie information is sent as an HTTP header in this request:
   `IV_JCT = /junction-name`

6. Because the server-relative URL in the client request has not been filtered, it appears to WebSEAL as a request for a local resource.
7. When it fails to locate the resource locally, WebSEAL immediately retries the request using the junction information supplied by the cookie.
8. With the correct junction information in the URL expression, the resource is successfully located on the back-end application server.

Figure 4-7 illustrates the junction cookie solution for filtering server-relative URLs.

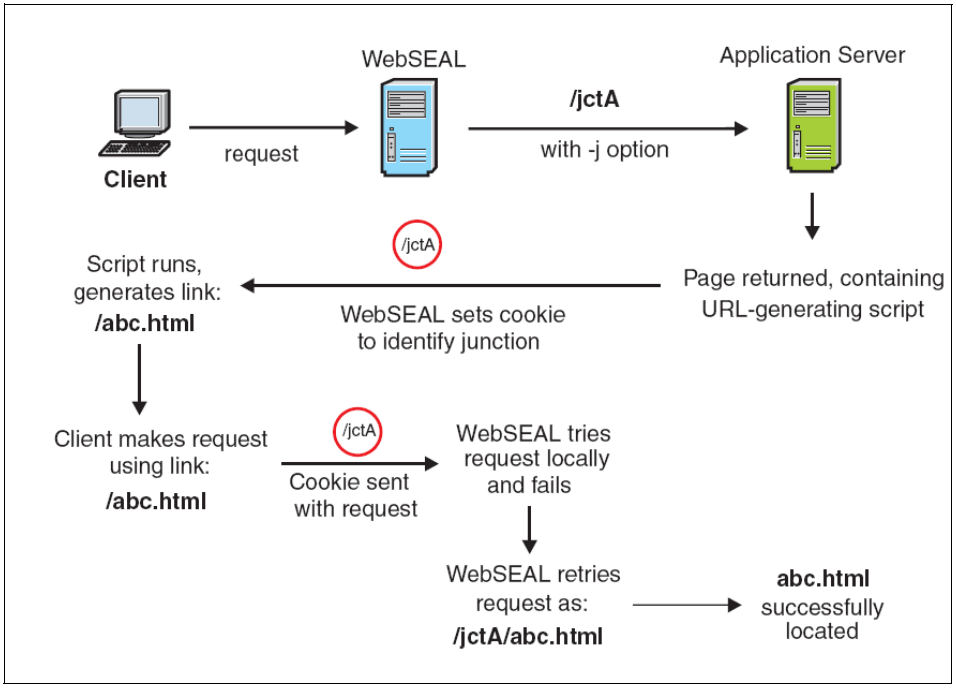


Figure 4-7 Processing server-relative URLs with junction cookies

Appending the junction cookie JavaScript block (trailer)

The -j junction option modifies HTML documents returned from junctioned servers by inserting a JavaScript block that sets a junction identification cookie on the browser interpreting the document.

By default, the JavaScript block is inserted at the beginning of the page, before the <html> tag. This prepended location of the JavaScript on the page can cause HTML rendering problems in some environments. If this type of problem is encountered, you can configure WebSEAL to append the JavaScript block to the end of the document instead. To configure WebSEAL to append the junction

cookie JavaScript block to the end of pages returned by the back-end server, add the -J option with the trailer argument when creating the -j junction. For example:

```
pdadmin> server task instance-webseald-host create ... -j -J trailer
...
```

The trailer argument can be used when compliance with HTML 4.01 specifications is not required.

Inserting the JavaScript block for HTML 4.01 compliance (inhead)

The HTML 4.01 specification requires <script> tags to be located within the <head> </head> tags. To configure WebSEAL to insert the junction cookie JavaScript block between <head> </head> tags (HTML 4.01 compliant), add the -J option with the inhead argument when creating the -j junction. For example:

```
pdadmin> server task instance-webseald-host create ... -j -J inhead ...
```

The xhtml10 argument also addresses compliance with other HTML 4.01 and XHTML 1.0 specifications.

Inserting an XHTML 1.0 compliant JavaScript block (xhtml10)

To configure WebSEAL to insert a junction cookie JavaScript block that is compliant with XHTML 1.0 specifications (and HTML 4.01 specifications), add the -J option with the xhtml10 argument when creating the -j junction. If you create a junction using the xhtml10 argument, it is best practice to use the inhead argument as well. For example:

```
pdadmin> server task instance-webseald-host create ... -j -J
xhtml10,inhead ...
```

Resetting the junction cookie for multiple -j junctions (onfocus)

In environments where multiple instances of a single client access multiple -j junctions simultaneously, the most recent IV_JCT cookie created by the JavaScript may erroneously refer to a different junction than the one being currently accessed. In such a situation, WebSEAL receives the wrong junction information and fails to correctly resolve links.

For example, consider a scenario where a user has two browser windows open, each pointing to one of two junctions, jctA and jctB. Both junctions were created with the -j junction option.

1. In the first browser window, the user requests a page from an application server located on jctA. The IV_JCT cookie for jctA is set in the browser.
2. The user then leaves the first browser window open, switches to the other browser window, and requests a page from an application server located on jctB. The IV_JCT cookie for jctB is set in the browser (replacing jctA).

3. If the user then returns to the first browser window and clicks a link to a resource located on jctA, the wrong IV_JCT cookie is sent to WebSEAL.

To eliminate this problem, you can configure WebSEAL to use the onfocus event handler in the JavaScript. The onfocus handler resets the IV_JCT cookie whenever users switch the browser focus from one window to another. To use the JavaScript onfocus event handler, add the -J option with the `onfocus` argument when creating the -j junction. If you create a junction using the onfocus argument, it is best practise to use the trailer argument as well.

For example:

```
pdadmin> server task instance-webseald-host create ...-j -J
trailer,onfocus ...
```

Modifying server-relative URLs using an HTTP Referer header

This section describes a solution for modifying server-relative URLs dynamically generated on the client side. This solution involves use of the standard Referer header in an HTTP request. WebSEAL uses this solution only if a junction cookie cannot be found in a request or a junction mapping table entry does not match the request. The information in the Referer header of an HTTP request can be used to identify the junction point of the application server responsible for the embedded applet or script. This solution assumes that the dynamically generated links point to resources located on the same application server (and therefore would require the same junction used by that application server).

A page returned from the back-end application server (and containing the links generated by the embedded applet or script) would provide knowledge of the junction name. The junction name will appear in the URL value of the Referer header of a request that results when the user clicks on one of the client-side-generated links located on this page. For example:

```
GET /back_end_app/images/logo.jpg
Referer: http://webseal/jctA/back_end_app ...
```

WebSEAL would not be able to find the resource using the request URL (/back_end_app/images/logo.jpg). By using the information in the Referer header of that request, WebSEAL can modify the request URL to additionally include the junction name jctA. For example:

```
GET /jctA/back_end_app/images/logo.jpg
```

Using the modified URL, WebSEAL can successfully locate the resource. This of course assumes the resource (logo.jpg) is located on the same server.

If the environment results in client-side-generated links that point to resources across multiple junctions, the Referer header method for modifying URLs will not be reliable.

4.5.4 The challenges of URL filtering

WebSEAL acts as a single host Web server. To allow WebSEAL to protect many back-end Web servers, and still act as a single host server, WebSEAL merges all of the back-end server document spaces into a single document space. For successful communication across junctions, WebSEAL must filter absolute and server-relative URLs in HTML response documents returned from the protected Web servers so that the URLs are correct when viewed as a part of WebSEAL's single host document space. The junction feature of WebSEAL changes the server and path information that must be used to access resources on junctioned back-end systems. A link to a resource on a back-end junctioned server can only succeed if the URL contains the identity of the junction.

WebSEAL supports a number of solutions for filtering and processing URLs returned in responses from back-end junctioned application servers. In all cases, these solutions require WebSEAL to parse the HTML content in search of the URLs. Because HTML is an evolving and complex specification, parsing HTML is equally complex.

To overcome those and some other problems, Access Manager 6.0 introduced two new type of junctions:

- Virtual host junction
- Transparent path junction

4.6 Virtual host junction

WebSEAL supports virtual hosting and, through virtual host junctions, can eliminate the limitations of URL filtering. The term *virtual hosting* refers to the practice of maintaining more than one server on one machine, as differentiated by their apparent hostnames. Virtual hosting allows you to run multiple Web services, each with a different host name and URL, that appear to be completely separate sites.

Virtual host junctions allow WebSEAL to communicate with local or remote virtual hosts. WebSEAL uses the HTTP Host header in client requests to direct those requests to the appropriate document spaces located on junctioned servers or on the local machine. Access to resources using virtual hosting is possible because the HTTP 1.1 specification requires client browsers to include, in any request, the HTTP Host header. The Host header contains the host name

of the server where the requested resource is located. WebSEAL uses the value of the HTTP Host header, rather than the URL of the request, to select the appropriate virtual host junction for dispatching the request. If the HTTP Host header is present in the request and its value matches the host name of a configured virtual host junction, then the virtual host junction is used. Otherwise, a standard WebSEAL junction is used, based on the URL of the request.

In a case where there is no Host header in the HTTP request (such as in an HTTP 1.0 request), WebSEAL again uses a standard junction.

Using virtual host junctions, a user can access resources directly using the host name of the junctioned server (http://protected-server/resource), rather than indirectly using the host name of the WebSEAL server with a potentially modified resource path (http://webseal/junction/resource). Direct access to the resource using the host name of the junctioned server does not require URL filtering. Virtual host junctions preserve the content of response pages in the same form as originally found on the junctioned Web servers. Clients can use the unmodified absolute and server-relative URL links on these response pages to successfully locate the resources. Configuration for virtual host junctions requires that the external DNS maps all virtual host names to the IP address (or addresses) of the WebSEAL server. When the user makes a request to the host name of the junctioned server, the request is actually routed to WebSEAL.

This also has great value in the larger organizations that already have traditional Web address space. By using virtual host junctions you can preserver this Web address space from the user standpoint, just changing DNS mappings to point to WebSEAL instead of real Web Servers. For example, a company may have www.myhr.com for their HR system and www.mypayroll.com for their payroll system. Since these applications already exist and their Web addresses are known throughout the user community, application of the traditional WebSEAL junction method would not benefit the corporation. Instead, resolving www.myhr.com and www.mypayroll.com to WebSEAL's IP address and allowing it to decipher which server to direct traffic to would be the most beneficial.

4.6.1 Creating a remote type virtual host junction

Creating a virtual host junction is similar to creating a standard junction. A virtual host junction can be created using either WPM or the standard **server task** command in the pdadmin CLI. The following example specifies the syntax for the pdadmin command for creation of a virtual host junction (entered as one line):

```
pdadmin> server task instance_name-webseald-host_name virtualhost
create options vhost-label
```

The virtual host label (*vhost-label*) is simply a name for the virtual host junction. The junction label is used to indicate the junction in the display of the protected

object space (Web Portal Manager). Here is some highlights regarding virtual hosts labels:

- Virtual host junctions are by default always mounted at the root of the WebSEAL object space and are easily identified because they start with the @ character followed by the host label defined during junction creation.
- You can refer to a junction in the pdadmin utility using this label.
- The virtual host junction label must be unique within each instance of WebSEAL.
- Because the label is used to represent virtual host junctions in the protected object space, the label name must not contain the forward slash character (/).

Common and required options specified for creation of virtual hosts are:

–t type Type of junction. It can be one of: tcp, ssl, tcpproxy, sslproxy.

–h host-name The DNS host name or IP address of the target back-end server. The same host name can be used for a TCP junction and an SSL junction. The port of each virtual host differentiates one from the other so that they are each considered unique.

–v vhost-name[:port] WebSEAL selects a virtual host junction to process a request if the request's HTTP Host header matches the virtual host name and port number specified by the -v option. The -v option is also used to specify the value of the host header of the request sent to the back-end server.

–g vhost-label If both HTTP and HTTPS protocols need to be supported between the client and WebSEAL, then two junctions to the same virtual host (-h) are required, one for each protocol (-t). By default, each junction recognizes its own unique protected object space, even though the junctions (which are differentiated by protocol only) point to a single object space. The -g option causes a second additional junction to share the same protected object space as the initial junction. This single object space reference allows you to maintain a single access control list (ACL) on each protected object. This option is appropriate for junction pairs only (two junctions using complementary protocols). The option does not support the association of more than two junctions. Use of this parameter is optional.

Additional junction options

Almost all junction functionality (SSO options, and so on) that is available for traditional junctions is also available for virtual host junctions. The only exceptions to this are the junction cookie options (-j , -J) and the cookie/path modification options (-l, -n). They are not available for virtual host junctions because they are not required. The problems that these options were introduced to solve are no longer an issue when using virtual host junctions.

4.6.2 Defining interfaces for virtual host junctions

The multiple interface capability is important when setting up certificate support (SSL) for multiple virtual host junctions. A digital certificate contains the name of the host being accessed. Therefore, it is necessary to have a unique certificate exchange for each virtual host configured for SSL. Browsers produce a warning message when there is a name mismatch between certificate and host.

A default network interface is defined as the combined set of values for a specific group of settings that include HTTP or HTTPS port setting, IP address, worker threads setting, and certificate handling setting. The single default interface for a WebSEAL instance is defined by the values for the following stanza entries in the WebSEAL configuration file:

```
[server]
http
http-port
https
https-port
worker-threads
network-interface
[ssl]
webseal-cert-keyfile-label
[certificate]
accept-client-certs
```

WebSEAL can be configured to listen on multiple interfaces. To configure additional interfaces, you define each custom-named interface within the `[interfaces]` stanza of the WebSEAL configuration file. A custom interface specification uses the following format:

```
[interfaces]
interface-name = property=value[;property=value[;...]]
```

Example interface definition:

```
[interfaces]
support = https-port=444;certificate-label=WS6;
worker-threads=16;network-interface=9.0.0.8
```

This example (entered as one line) creates an interface named *support* with the following properties:

- Allows WebSEAL to listen for requests at IP address 9.0.0.8.
- Listens on HTTPS port 444.
- The HTTP port defaults to *disabled*.
- WebSEAL authenticates to SSL clients using a server-side certificate named *WS6* stored in the WebSEAL key database file.
- The interface uses its own pool of 16 worker threads to service requests.
- The interface defaults to never requiring (prompting for) client-side certificates during authentication.

4.7 Transparent path junctions

In order to combine the benefits of both a single URL space for session management (which uses fewer certificates) and single sign-on, without the problems of path filtering, Access Manager for e-business uses the concept of a *transparent path junction*.

Transparent path junctions are really the same as standard junctions except that the junction name, instead of being an addition to the URL path, is based on the path already present on the back-end application. The junction creation command is the same as for a standard junction and just includes one additional option, -x.

Transparent path junctions allow WebSEAL to route requests to a junction based on the URL path of the back-end server resources rather than based on a junction name added to the path.

For example, if the configured junction name is /docs, all resources controlled by this junction must be located on the back-end server under a subdirectory called /docs.

The transparent path junction mechanism prevents WebSEAL from filtering the path portion of links to the resources protected by this junction. The junction name has now become part of the actual path expression describing the location of a resource and no longer requires filtering. The junction name is not added to

or removed from the path portion of URLs, as it is in junctions created without the transparent path option.

WebSEAL must be configured with one transparent path junction for each unique path that is held on each back-end server. This may mean that there are multiple transparent path junctions to the same back-end server. When configuring traditional junctions it is not recommended to have multiple junctions to the same back-end server, but this restriction is lifted for transparent path junctions. The restriction can be lifted because in the case of transparent path junctions, the junction name is tightly linked to the resource path, so any absolute URL being filtered can be matched uniquely to a transparent path junction.

In a case that we have two applications in the back-end server that do share a common path we have two configuration options for the transparent path junction:

1. Extend the transparent path junction name so it can be unique. A transparent path junction name can contain more than one directory.

   This technique is not going to work if you need to protect two instances of the *same* application that are used for two different purposes. They will have the exact same URLs in all cases, so there is no uniqueness in the paths at all to distinguish them.

2. Use separate WebSEAL instances if you want to use transparent path junctions for two applications that have the same URL paths.

   In this case you are back to the issue of single sign-on, so perhaps virtual host junctions would be more suitable for this application.

It is possible to use virtual host junctions, transparent path junctions, and traditional path junctions all within the same WebSEAL instance.

1. WebSEAL will first check the Host header of requests to pick up the virtual host junctions.
2. If the request doesn't match a virtual host junction, it will then perform path matching to discover if this is a transparent path or a traditional junction.
3. If none of the paths match any configured junctions, WebSEAL will assume this is a traditional junction and will start looking for JMT matches or junction cookies to identify the correct back-end server.

4.8 Advanced junction configuration

In this section we discuss some advanced junction configuration tasks, including:

- Mutually authenticated SSL junctions
- WebSEAL-to-WebSEAL junctions over SSL

- Stateful junctions
- Junction throttling
- Supporting not case-sensitive URLs
- Junctioning to the Windows file systems

4.8.1 Mutually authenticated SSL junctions

If necessary, WebSEAL can authenticate itself to a junctioned server using either server certificates or BA authentication. When using an SSL communication channel for this junction (–t ssl or –t sslproxy), WebSEAL and the junctioned server can also mutually authenticate each other. This is very important in order to establish the trust relationships between WebSEAL and back-end Web application servers.

The following outline summarizes the supported functionality for mutual authentication over SSL:

1. WebSEAL authenticates the back-end server (normal SSL process).
   a. WebSEAL validates the server certificate from the back-end server.

      In order to do this, WebSEAL needs to have information about the certificate from the back-end server. WebSEAL stores all certificates into the pdsvr.kdb database. GSKit tool can be used to manage those certificates. Use this tool to import the Certificate Authority (CA) certificates that form the trust chain for the application server certificate.

   b. WebSEAL verifies the distinguished name (DN) contained in the certificate. (This step is optional.)

      You can enhance server-side certificate verification through distinguished name (DN) matching. To enable server DN matching, you must specify the back-end server DN when you create the SSL junction to that server. Although DN matching is an optional configuration, it provides a higher degree of security with mutual authentication over SSL junctions.

      During server-side certificate verification, the DN contained in the certificate is compared with the DN defined by the junction. The connection to the back-end server fails if the two DNs do not match.

      To enable the server DN matching, specify the back-end server DN when you create the SSL junction using the –D option.

2. Back-end server authenticates WebSEAL (two methods).
   a. Back-end server validates client certificate from WebSEAL (–K).

      Use the –K option to enable WebSEAL to authenticate to the junctioned back-end server using its client certificate. The –K option uses an

argument that specifies the key-label of the required certificate as stored in the WebSEAL key database.

b. Back-end server validates WebSEAL identity information in a Basic Authentication (BA) header (–B, –U, –W).

   Use the –B –U *username* –W *password* option to enable WebSEAL authentication using basic authentication. In this type of configuration the –b option does not work, as internally the –B option uses –b filter.

4.8.2 WebSEAL-to-WebSEAL junctions over SSL

Tivoli Access Manager supports SSL junctions between a front-end WebSEAL server and a back-end WebSEAL server. Use the –C option with the create command to junction the two WebSEAL servers over SSL and provide mutual authentication. Additionally, the –C option enables single sign-on functionality provided by the –c option.

The –c option allows you to place Tivoli Access Manager-specific client identity and group membership information into the HTTP header of the request destined for the back-end WebSEAL server.

Both WebSEAL servers must share a common user registry. This configuration allows the back-end WebSEAL server to authenticate the front-end WebSEAL server identity information.

If the WebSEAL-to-WebSEAL junction and the back-end application server junction both use the –j junction option (for junction cookies), a naming conflict can occur between the two junction cookies created by each of the two WebSEAL servers. In this case, an intermediary WebSEAL server changes the following parameter to *yes* in the WebSEAL configuration file:

```
[script-filtering]
hostname-junction-cookie = yes
```

4.8.3 Stateful junction

Back-end servers that run Web-enabled applications can be replicated in order to improve performance through load sharing. By default, Tivoli Access Manager balances back-end server load by distributing requests across all available replicated servers. Tivoli Access Manager uses a *least-busy* algorithm. This algorithm directs each new request to the server with the fewest connections already in progress.

However, when WebSEAL processes a request over a stateful junction, WebSEAL must ensure that all subsequent requests from that client during that

session are forwarded to the same server, and not distributed among the other replicated back-end servers according to the load balancing rules.

Configuring stateful junction

To configure a stateful junction you need to use –s junction options. The –s option is appropriate for a single front-end WebSEAL server with multiple back-end servers junctioned at the same junction point. When a new junction is created to a back-end Web application server, WebSEAL normally generates a Unique Universal Identifier (UUID) to identify that back-end server. This UUID is used internally and also to maintain stateful junctions. If the scenario involves multiple front-end WebSEAL servers, all junctioned to the same back-end servers, you must use the –u option to correctly specify each back-end server UUID to each front-end WebSEAL server.

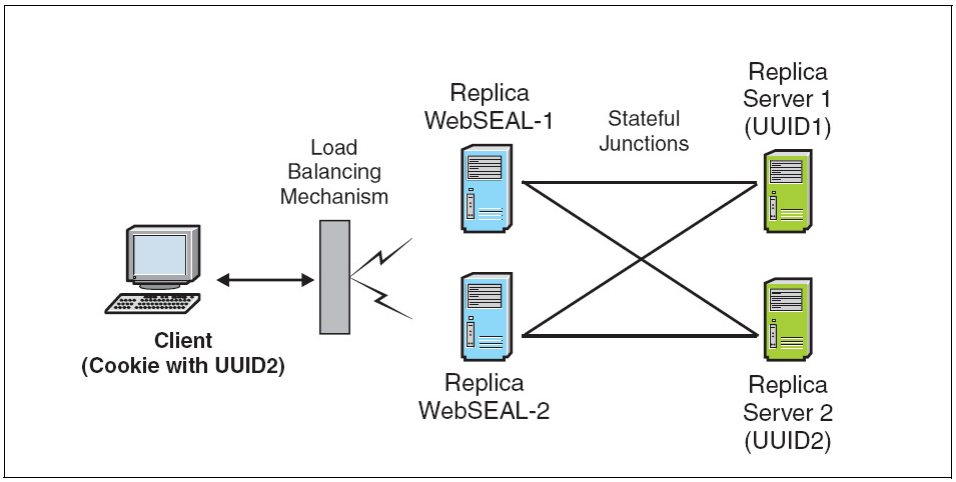


Figure 4-8 Stateful junction and load balancing mechanism

Multiple front-end servers require a load balancing mechanism to distribute the load between the two servers. For example, an initial state could be established to a back-end server through WebSEAL server 1 using a specific UUID. However, if a future request from the same client is routed through WebSEAL server 2 by the load balancing mechanism, the state will no longer exist, unless WebSEAL server 2 uses the same UUID to identify the same back-end server.

Apply the following process for specifying a UUID during the creation of a junction:

1. Create a junction from WebSEAL server 1 to each back-end server. Use **`create –s`** and **`add`**.
2. List the UUID generated for each back-end server during step 1.

3. Create a junction from WebSEAL server 2 to each back-end server and specify the UUIDs identified in Step 2. Use **`create -s -u`** and **`add -u`**.

Handling an unavailable stateful server

You can use the *`use-new-stateful-on-error`* stanza entry in the `[junction]` stanza of the WebSEAL configuration file to control how WebSEAL responds to a stateful server that becomes unavailable.

- When use-new-stateful-on-error is set to *`yes`* and the original server becomes unavailable during a session, WebSEAL directs the user's next request to a new replica server on the same stateful junction. If a new replica server is found on that stateful junction, and is responsive to the request, WebSEAL sets a new stateful cookie on the user's browser. Subsequent requests during this same session are directed to this same new server.
- When use-new-stateful-on-error is set to *`no`* (the default, to keep compatibility with previous versions) and the original server becomes unavailable during a session, WebSEAL does not direct the user's subsequent requests to a new replica server on the same stateful junction. Instead, WebSEAL returns an error and attempts to access the same server for subsequent requests by the user during this session.

4.8.4 Junction throttling

High demand WebSEAL environments usually rely on server clusters made up of multiple machines hosting replicated content and applications. A replica server environment allows you to take individual servers offline to perform regular maintenance. The network load is redistributed across the remaining replicas, allowing the user experience to proceed without disruption.

Junction throttling allows you to gradually take a junctioned back-end Web server offline without interrupting the transactions of users with existing sessions. The throttling action on a junction is particularly useful for allowing stateful sessions, such as shopping cart transactions, to continue until completed.

Junction throttling accomplishes the following actions:

- The throttled server continues to process current and subsequent requests from users with sessions created before the throttle action was taken.
- The throttled server blocks all requests from unauthenticated users and new authenticated users and directs these requests to other available replica servers on the same junction.
- As the current users finish their sessions, the throttled server eventually becomes idle and can be taken offline.

- Junction throttling does not require you to stop WebSEAL and does not interrupt user access to other junctioned Web servers.

The Access Manager provides commands to place junctioned servers in one of three operational states:

Throttle	Server can only be used by users that logged in before throttle. It shows as *throttle* and will show a *throttled at* timestamp. Only users that have sessions that started before the throttle timestamp can access the server.
Offline	Server cannot be used at this time even if available. It shows as *offline.*
Online	Server can be used, and shows as *running* if it is available.

Use of junction throttling with existing WebSEAL features

Junction throttling has an impact on the following WebSEAL functions:

- Failover authentication

  Failover authentication transparently supports failed over sessions that continue to use a throttled junction if the original session was created before the junction was throttled. The session creation time is added as an attribute to the failover cookie so it can be restored when a failover cookie is used to authenticate. When the failover cookie is used for authentication, the session creation time from the cookie is set for the newly created failover session.

- Session Management Server

  Session Management Server makes the session creation time available to all processes that are sharing the session. The session creation time is important because only sessions created before a junction server is throttled are allowed continued access to the throttled junction server.

- Re-authentication

  Re-authenticated sessions are allowed continued access to a throttled junction server if the sessions are initially created before the junction was throttled. The additional effect of session lifetime extensions or resets can make it difficult for you to determine when the throttled junction is truly idle.

- Switch user

  When a switch user event occurs, a new session creation time is generated. This new creation time is used to determine accessibility to a throttled junction server. When the switch user logs out and returns to the original identity, the original session creation time becomes effective again and is used to determine accessibility to a throttled junction server.

- Stateful junctions

  Stateful junctions allow requests from a specific session to always be sent to the same server on a junction. If the junctioned server being used is throttled, the stateful session is allowed to continue accessing that server. However, new stateful sessions are blocked from using that server. If a junctioned server is taken offline, then stateful sessions are no longer allowed to access the server. These sessions must choose a new junctioned server and possibly loose the original state information.

- Step-up authentication

  Step-up authentication does not create a new session. The session creation time is therefore not affected, and the ability of the session to access a throttled junction does not change.

- Junction modification with Web Portal Manager (WPM)

  When you modify a throttled junction using Web Portal Manager, you always lose the *Throttled at* time. A throttled junction modified by WPM is returned to an online state. Because WPM has no ability to perform junction throttle operations, you must use the pdadmin utility to return the junction to a throttled state again.

4.8.5 Supporting not case-sensitive URLs

By default, Tivoli Access Manager treats URLs as case-sensitive when performing checks on access controls. The –i junction option is used to specify that WebSEAL treat URLs as not case-sensitive when performing authorization checks on a request to a junctioned back-end server.

To correctly authorize requests for junctions that are not case sensitive, WebSEAL does the authorization check on a lowercase version of the URL. That means, object names must be lower case in order for WebSEAL to be able to find any ACLs or POPs attached to those objects.

The –i option is also supported on virtual host junctions.

The –i option is automatically invoked if you select the –w option.

4.8.6 Junctioning to Windows file systems

When you create junctions in a Windows environments, it is important to restrict access control to one object representation only and not allow the possibility of “back doors” that bypass the security mechanism.

The –w option on a junction provides the following measures of protection:

- Prevents the use of the 8.3 file name format. When the junction is configured with the –w option, a user cannot avoid an explicit ACL on a long file name by using the short (8.3) form of the file name. The server returns a `403 Forbidden` error on any short form file name entered.
- Disallows trailing dots in directory and file names. If a file or directory contains trailing dots, a `403 Forbidden` error is returned.
- The –w option automatically invokes the –i option (meaning it enforces case-insensitivity).

4.9 WebSEAL single sign-on mechanisms

After a user has been authenticated by WebSEAL and an authorization decision has been made, WebSEAL has to forward the user's request to a back-end Web application server. If needed, WebSEAL can include information about the user, such as X.509 distinguished name, group memberships, or any other value.

The mechanisms to forward that information can vary. You can use standard protocols such as the HTTP basic authentication header, or proprietary mechanisms, when talking to specific server products. WebSEAL supports several mechanisms for forwarding requests to Web application servers.

This section presents alternatives on how to pass information about the user and the user's request to the back-end application.

When a protected resource is located on a junctioned Web application server, a client requesting that resource can be required to perform multiple logins: one for the WebSEAL server and one for the back-end server. Each login may require a different login identity. Often, the problem of administering and maintaining multiple login identities can be solved with a single sign-on mechanism.

The Open Group defines single sign-on as a mechanism whereby a single action of user authentication and authorization can permit a user to access all computers and systems where that user has access permission, without the need to enter multiple passwords[2]. WebSEAL's realm is to provide this single sign-on functionality for Web infrastructures. Acting as a Web reverse proxy to the company's Web environment, WebSEAL communicates with the junctioned servers on behalf of the users. It enables the user to access a resource, regardless of the resource's location, using only one initial login. Any more login requirements from back-end application servers are handled so that they are transparent to the user.

[2] From the security section of the Open Group Web site (`http://www.opengroup.org/security/sso/`).

Depending on integration requirements, different data should be sent to the WebSEAL-secured Web application using different formats. However, most of the Web applications support standard HTTP-based mechanisms for the user identification, which are exploited by WebSEAL.

4.9.1 Tivoli Global Sign-On (GSO) lockbox

Most Web applications support basic authentication or forms-based login for checking authenticity and obtaining a user's identity information. When using this support, an application or the server the application is running on maintains a database with user IDs and passwords (in the most simple case). After challenging a user and obtaining a user ID and password, an application looks up the matching entry and, if one is found, the user is considered authenticated and his or her identity is associated with the provided user ID. In more sophisticated environments' relational databases, legacy applications or LDAP-based repositories are targeting that scope.

Access Manager supports a flexible single sign-on solution that features the ability to provide alternative user IDs and passwords to the Web application servers in two ways:

- By supplying user ID and password information via basic authentication headers
- By performing forms-based single sign-on

The integration is achieved by creating SSO-aware junctions between WebSEAL and Web servers hosting the applications. GSO resources and GSO resource groups must first be created in Access Manager for every application that requires a different logon. When WebSEAL receives a request for a resource located on the SSO-junctioned server, WebSEAL queries the Access Manager user registry for the appropriate authentication information. The user registry contains mappings for each user registered for using that application, which provides alternative user IDs and passwords for specific resources. Evidently, that information has to be in the repository prior to initial use. The values (user IDs and passwords) should match those stored in the application home registry.

Note: Although junctions are set up on a Web server basis, it is possible to provide different SSO data to different applications hosted on the same server. In order to achieve this, multiple GSO junctions to the same Web server are created. However, using access control lists, the access to the resources is defined that way, so that only appropriate URLs can be requested through a specified junction.

The visible advantage of the solution is that no changes are supposed to be made on the application side. However, synchronization of the user IDs and passwords in the application's home user registry and Access Manager user registry is required. (Registry synchronization can be accomplished with IBM Tivoli Directory Integrator.)

A special situation emerges if Access Manager and the secured application share the same repository for storing user data, as shown in Figure 4-9 on page 157. An LDAP directory is the most suitable platform for maintaining application-specific information about users and groups. Given compatible LDAP schemes, many applications may share the same LDAP directory. LDAP provides a standardized way of authenticating users based on user ID and password stored as user attributes. However, it provides no flexibility in defining object classes to be used for authenticating a user rather than performing a call based on primary identification attributes of a user (user ID and password).

While using an Access Manager GSO junction, Access Manager uses specific LDAP attributes for storing GSO information for every GSO user. As a result, the GSO user ID and password provided for a specific junction are not necessarily the same as the primary ones. However, a junctioned application sharing the same LDAP repository would then try to authenticate a user using these values against primary ones (by doing LDAP bind or compare). The need arises to keep the values of primary user IDs and passwords the same as GSO IDs and passwords.

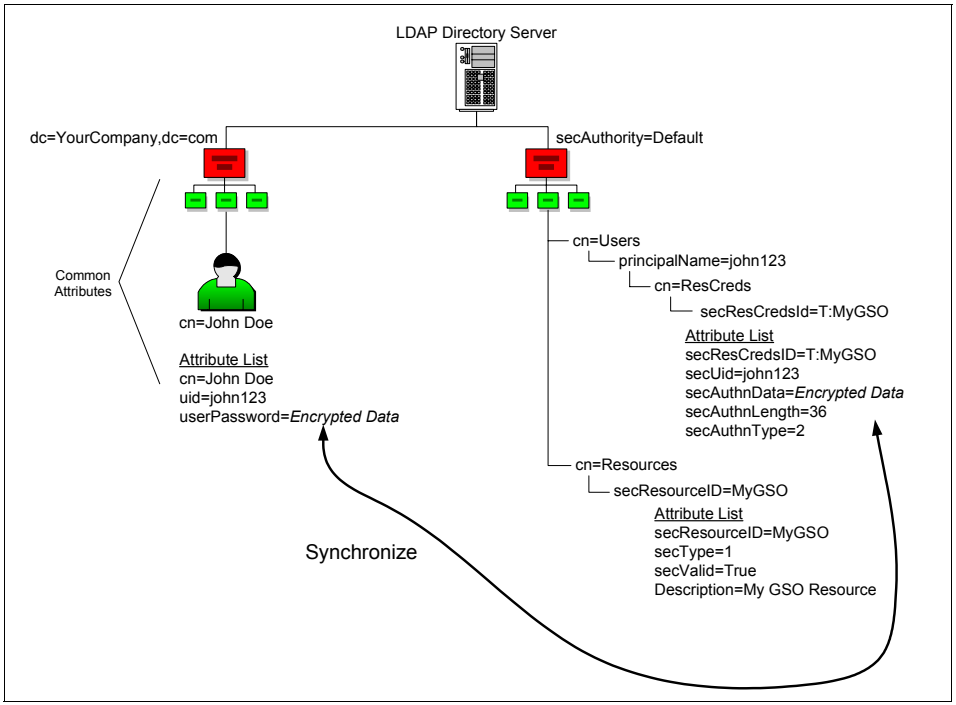


Figure 4-9 LDAP shared by Access Manager and other applications

The following issues should be considered while looking for solutions for integrating Access Manager and Web applications using the same LDAP repository or even different user repositories:

- Using a directory synchronization product such as IBM Tivoli Directory Integrator to synchronize both the corporate tree and the Access Manager tree within the same directory. IBM Tivoli Directory Integrator also allows for the synchronization of a user's password.
- Since GSO passwords are encrypted, they can only be read by the Access Manager GSO APIs.

GSO configuration

Support for GSO is configured at the junction between WebSEAL and a back-end server. To create a junction that enables GSO, use the **create** command with the **–b gso** option. The following example illustrates the syntax for the **create** command (entered as one line):

```
pdadmin> server task instance_name-webseald-host_name create -t ssl -h
host-name -b gso -T resource jct-point
```

The important options for setting up GSO junctions are:

–b gso Specifies that GSO should provide authentication information for all requests crossing this junction.

–T resource Specifies the GSO resource or resource group. The resource name used as the argument to this option must exactly match the resource name as listed in the GSO database. Required for gso junctions.

To create a resource you can use WPM or pdadmin CLI:

```
pdadmin> rsrc create resource_name [–desc description]
```

At the end, you need to have mappings of resources to specific authentication information. The authentication information is a user name and password combination known as a resource credential. A resource credential is a credential that is used to identify a user's authentication information. A user's authentication information is used by WebSEAL when accessing a back-end Web resource or resource group through a GSO-enabled junction on behalf of that user.

For example, to create the Web resource credential named engwebs01 for the resource user ID 4807ws01 and password pwd4lucas given to Access Manager user dlucas, execute following command:

```
pdadmin sec_master> rsrccred create engwebs01 rsrcuser 4807ws01 rsrcpwd
pwd4lucas rsrctype web user dlucas
```

4.9.2 Forms-based single sign-on

Forms-based single sign-on authentication supports existing applications that use HTML forms for authentication that cannot be modified to directly trust the authentication performed by WebSEAL. Forms-based single sign-on is built on the following process:

1. WebSEAL interrupts the authentication process initiated by the back-end application.
2. WebSEAL supplies the data required by the login form and submits the login on behalf of the user.
3. WebSEAL saves and restores all cookies and headers.
4. The user is unaware of the second login taking place between WebSEAL and the back-end application.
5. The back-end application is unaware that the login form is not coming directly from the user.

The login form from the back-end application can be filled in with a variety of information from WebSEAL, such as:

- Static text
- GSO user name and password (see 4.9.1, “Tivoli Global Sign-On (GSO) lockbox” on page 155 for more information)
- Values contained within a user’s credential

In order to use forms-based single sign-on, the back-end application’s login page must be uniquely identifiable. Also, client-side scripting can be used to validate input data, but it must not modify the input data. The junction where the authentication request is directed must be the same junction where the login page is returned.

Forms single sign-on (FSSO) configuration

Configuration of forms single sign-on (FSSO) is done in two steps:

1. Create a configuration file to specify how the login form is to be recognized, completed, and processed.

   The forms single sign-on configuration file is custom-created by the administrator and can be saved in any location. The configuration file must begin with the [forms-sso-login-pages] stanza and has the following format:

   ```
   [forms-sso-login-pages]
   login-page-stanza = xxxxx
   #login-page-stanza = aaaaa
   #login-page-stanza = bbbbb

   [xxxxx]
   login-page = regular-expression-page-match
   login-form-action = regular-expression-form-match
   gso-resource = gso-target argument-stanza = yyyyy

   [yyyyy]
   name = method:value
   ```

2. Enable forms single sign-on by configuring the appropriate junction with the –S option (which specifies the location of the configuration file).

4.9.3 Single sign-on using HTTP BA headers

A junction can be set up to specify client identity information in BA headers. This section discusses the possible solutions for creating single sign-on configurations across WebSEAL junctions using the –b options. The –b option allows four possible arguments: filter, supply, ignore, gso.

Passing an unchanged basic authentication header

WebSEAL can be configured to pass the received basic authentication data unchanged to the junctioned application. If Access Manager and the application share the same LDAP registry, Access Manager authenticates a user against the same LDAP attributes as an application performing a regular LDAP bind (that is, using a main user ID and password). In this case, there is no need to maintain the GSO attributes of a user, and the main password may be encrypted. However, basic authentication is the only available authentication method used by WebSEAL because WebSEAL has to obtain the BA header values in order to pass them through.

The `–b ignore` option instructs WebSEAL to pass the original client basic authentication (BA) header straight to the back-end server without interference. Because sensitive authentication information (user name and password) is passed across the junction, the security of the junction is important. An SSL junction is most appropriate.

Junction without BA authentication information

This may be useful if WebSEAL does all of the authentication and authorization and there is no need to forward any information to the back-end servers.

This scenario seems applicable either for servers without any reliable security functions or where there is no need for extra back-end authentication and authorization (for example, providing only static Web pages). Nevertheless, this approach requires full trust toward WebSEAL, and the back-end servers should be configured to accept only incoming requests from WebSEAL.

Junction needs to be configured with the `-b filter` option to remove all basic authentication header information from any client requests before forwarding the requests to the back-end server. In this scenario, WebSEAL becomes the single security provider.

If the back-end server needs to have some client information, this option can be combined with the `–c` option to insert Tivoli Access Manager client identity information into HTTP header fields. This option is described in 4.9.4, “Supplying identity information in HTTP headers” on page 161.

Providing client identity with a generic password

This scenario assumes that the back-end server requires authentication from a Tivoli Access Manager identity. By mapping a client user to a known Tivoli Access Manager user, WebSEAL manages authentication for the back-end server and provides a simple domain-wide single sign-on solution.

The –b supply option instructs WebSEAL to supply the authenticated Tivoli Access Manager user name (client's original identity) with a static, generic ("dummy") password. The original client password is not used in this scenario.

The dummy password is specified in the [junction] stanza under basicauth-dummy-passwd and by default it is set to dummy.

In this solution the same Tivoli Access Manager dummy password is used for all requests, which means that all users have the same password in the back-end server registry.

The use of the common dummy password offers no basis for the application server to prove the legitimacy of the client logging in with that user name. If clients always go through WebSEAL to access the back-end server, this solution does not present any security problems. However, it is important to physically secure the back-end server from other possible means of access.

Because sensitive authentication information (user name and password) is passed across the junction, the security of the junction is important. Therefore, an SSL junction is appropriate.

Supplying user names and passwords from GSO

This mechanism requires -b gso junction option and it is described in 4.9.1, "Tivoli Global Sign-On (GSO) lockbox" on page 155

The following conditions exist for this solution:

- The back-end server applications require different user names and passwords that are not contained in the WebSEAL registry.
- Security is important for both WebSEAL and the back-end server.

4.9.4 Supplying identity information in HTTP headers

WebSEAL can be configured to provide information to a junctioned application about user ID, groups, and resources the user has access to. That is accomplished by supplying the values of defined HTTP variables:

iv-user	For user ID
iv-user-l	For user's LDAP distinguished name (DN) of the client
iv-groups	For groups a particular user belongs to
iv-creds	For the user's credentials in base64-encoded Privilege Attribute Certificate (PAC) format

To send those variables in HTTP headers, junction needs to be specified with the `-c` option, followed with one or more arguments:

- iv_user
- iv_user_l
- iv_groups
- iv_creds

To pass all HTTP variables except iv_user_l use option `all`. For example:

```
-c all
```

You cannot use option `all` in a case that you need to send both headers iv_user and iv_user_l. You must individually specify all four header options to pass all four header types across the junction:

```
-c iv_user,iv_user_l,iv_groups,iv_creds
```

The variables supplied in the HTTP stream can be mapped easily to the CGI environment variables that can be interpreted by a Web application. To support CGI programming, header information is transformed into a CGI environment variable format by replacing all dashes (-) with underscores (_) and adding "HTTP" to the beginning of the header string. The Tivoli Access Manager-specific HTTP header entries are available to CGI programs as the following environment variables

- HTTP_IV_USER
- HTTP_IV_USER_L
- HTTP_IV_GROUPS
- HTTP_IV_CREDS

Supplying client IP addresses in HTTP headers (–r)

The `–r` junction option allows you to insert client IP address information into the HTTP headers of requests destined for junctioned application servers. The HTTP header information enables applications on junctioned third-party servers to perform actions based on this IP address information. The option does not require any arguments, and based on the type of IP protocol (version 4 or 6), one of the following information is set up in HTTP headers:

1. *iv-remote-address*, and CGI equivalent `HTTP_IV_REMOTE_ADDRESS`
2. *iv-remote-address-ipv6*, and CGI equivalent `HTTP_IV_REMOTE_ADDRESS_IPV6`

Supplying server name into junction header

A header with the URI-encoded authorization API administration server name is passed to all junction servers. When no header name is specified, the header will not be sent to the junction.

The value is set in the default WebSEAL configuration file:

```
[header-names]
server-name = iv_server_name
```

This setting controls the name of the header used to pass the name of the server to junctioned applications.

For example, when `server-name = iv_server_name`, and the WebSEAL instance is `default-webseald-seal1.itso.ibm.com`, WebSEAL passes the following header to the junction:

```
iv-server-name:default-webseald-seal1.itso.ibm.com
```

4.9.5 Using LTPA authentication with WebSEAL

WebSEAL can provide authentication and authorization services and protection to an IBM WebSphere or Lotus Domino environment. When WebSEAL is positioned as a protective front end to WebSphere or Lotus Domino, accessing clients are faced with two potential login points. Therefore, WebSEAL supports a single sign-on solution to one or more IBM WebSphere or Lotus Domino servers across WebSEAL junctions.

WebSphere provides the cookie-based lightweight third-party authentication (LTPA) mechanism. You can configure WebSEAL junctions to support LTPA and provide a single sign-on solution for clients.

When a user makes a request for a WebSphere or Lotus Domino resource, the user must first authenticate to WebSEAL. Upon successful authentication, WebSEAL generates an LTPA cookie on behalf of the user. The LTPA cookie, which serves as an authentication token for WebSphere or Lotus Domino, contains user identity and password information. This information is encrypted using a password-protected secret key shared between WebSEAL and the WebSphere or Lotus Domino server.

WebSEAL inserts the cookie into the HTTP header of the request that is sent across the junction to WebSphere or Lotus Domino. The back-end WebSphere or Lotus Domino server receives the request, decrypts the cookie, and authenticates the user based on the identity information supplied in the cookie.

To improve performance, WebSEAL can store the LTPA cookie in a cache and use the cached LTPA cookie for subsequent requests during the same user session. You can configure lifetime timeout and idle (inactivity) timeout values for the cached cookie using parameters in the WebSEAL configuration file.

The creation, encryption, and decryption of LTPA cookies basically introduces processing overhead. The LTPA cache functionality enables you to improve the

performance of LTPA junctions in a high load environment. By default, the LTPA cache is enabled. Without the enhancement of the cache, a new LTPA cookie is created and encrypted for each subsequent user request.

Having the LTPA cookie enabled is independent of the basic authentication header. This means that with the LTPA cookie inserted into the request header, it is still possible to have the BA header to carry any authentication information to the back-end server, depending on the –b option specified during the junction creation. The usage of the BA header depends on the configuration of the back-end WebSphere or Lotus Domino server.

Configuring an LTPA junction

Enabling single sign-on to WebSphere using an LTPA cookie requires the following configuration tasks:

1. Enable the LTPA mechanism in the WebSphere Administrative console.
2. Generate the LTPA key file used for encryption of the identity information.
3. Create an LTPA-aware junction with location of the LTPA key file and the password to this key file.

The following options are necessary to the standard junction and virtual host junction create commands:

-A Enables LTPA cookies. LTPA version 1 cookies (LtpaToken) and LTPA version 2 cookies (LtpaToken2) are both supported. LTPA version 1 cookies are specified by default. LTPA version 2 cookies must be specified with the additional -2 option.

-2 Specifies that LTPA version 2 cookies (LtpaToken2) are used.

-F The “keyfile” option and argument specifies the full path name location (on the WebSEAL server) of the key file used to encrypt the identity information contained in the cookie. The shared key is originally created on the WebSphere server and copied securely to the WebSEAL server.

-Z The “keyfile-password” option specifies the password required to open the key file. The password appears as encrypted text in the junction XML file.

Use these options in addition to other required junction options when you create the junction between WebSEAL and the back-end WebSphere server. For example (entered as one line):

```
pdadmin> server task default-webseald-webseal.ibm.com create ... -A -F
"/abc/xyz/key.file" -Z "abcdefg" ...
```

Trust Association Interceptor Plus (TAI++)

Along with LTPA mechanism, WebSphere provides an additional SSO mechanism called *Trust Association Interceptor* (TAI). Since WebSphere 5.1.1. this interceptor has been named TAI++. TAI++ implies that the WebSphere security application recognizes and processes HTTP requests received from WebSEAL. WebSphere and WebSEAL engage in a contract in which the former gives its full trust to the latter, which means that WebSEAL applies its authentication policies on every Web request that is dispatched to WebSphere.

When using Trust Association Interceptor Plus, WebSEAL authenticates the user, acquires credentials for the user from the user registry, and possibly authorizes the request at the URL level. With a successful authorization, WebSEAL augments the request with an additional HTTP header (iv-creds) that contains the user's credentials. It also changes the password contained in the Basic Authentication header so it matches a configured SSO user.

This request is sent to WebSphere Application Server, which calls a TAI method to determine whether the request is from a perimeter authentication service that has already authenticated the user, to establish trust with the perimeter authentication server and retrieve the credentials. This method establishes trust with WebSEAL by checking whether the Basic Authentication header contains the correct password for the configured SSO user. This is done by calling Access Manager Authorization Server to make this decision.

The *iv-creds* header is then extracted from the request and used to construct a PDPrincipal object. A credential object containing user and group information is constructed from information contained in the PDPrincipal. The Principal and the Credential objects are inserted into a JAAS Subject, which is returned from the call. At this point WebSphere Application Server has valid credentials that it can use for making authorization decisions in the usual J2EE manner. In addition, the Subject now contains the PDPrincipal object, which application code can access if needed.

Important points to note are:

- WebSEAL needs to insert the iv-creds header into the request, not the iv-user header.
- TAI++ does not directly contact LDAP, unlike the previous TAI version. It instead contacts the Access Manager Authorization Server, which validates the SSO password to establish trust with WebSEAL. This means that additional configuration is required on the WebSphere Application Server side to ensure that the TAI can reach the Access Manager Authorization Server.
- The Credential object inserted into the Subject by the TAI means WebSphere Application Server does not have to perform any additional user registry searches as part of the authentication process.

- The use of TAI++ needs to be configured/enabled in WebSphere. The easiest way to perform this is by using the WebSphere Administrative console and selecting **Global Security** → **LTPA** → **Trust Association** → **Interceptors**.

For additional information on how to configure TAI++, see:

`http://www.ibm.com/developerworks/websphere/techjournal/0406_botzum/0406_botzum.html`

4.10 SSO across Access Manager domains

In a large environment, or in a segmented organization, it may be desirable to have multiple Access Manager domains with separate user registries and authorization databases. In this type of environment, it may be a requirement that users can move between these domains without having to re-authenticate each time they enter a different domain. This kind of domain crossing depends on trust between the domains because one domain needs to accept the authenticated entities being passed from another.

The ability for a user to access resources in a secure domain depends on the user acquiring a credential in that domain. Normally a credential is built after the user authenticates. In the cross-domain environment, some other way has to be found for WebSEAL to build a credential for the user. WebSEAL supports two types of cross-domain authentication to address such scenarios:

- Cross-domain single sign-on (CDSSO)
- e-community single sign-on (ECSSO)

For both of these types of single sign-on mechanisms to work, it is necessary that the users participating in the single sign-on exist in the user registries of both security domains.

4.10.1 Cross-domain mapping framework

The cross-domain mapping framework (CDMF) is a programming interface that can be used in conjunction with WebSEAL e-community single sign-on and cross-domain single sign-on. It enables a developer to customize the mapping of user identities and the handling of user attributes when single sign-on functions are used. You can use the cross-domain mapping framework C API to customize the handling of user attributes and the mapping of user identities from different secure domains.

4.10.2 Cross-domain single sign-on

WebSEAL supports the ability to forward an authenticated identity from a user in one secure domain to a WebSEAL server in another secure domain. The *receiving* WebSEAL then maps the identity provided by the *sending* WebSEAL to an identity that is valid in its secure domain. This functionality can also be viewed as a *push* model with respect to authentication.

This functionality is known as cross-domain single sign-sn (CDSSO). In CDSSO, the user makes a request to a special link on a WebSEAL server, which then initiates the process to forward the request, along with credential information, to a WebSEAL server in a different Access Manager domain. If the user were to instead directly access the link in the target domain, he would have to authenticate to that domain.

Note: Cross-domain single sign-on requires that the back-end application is aware of this functionality existing. It is required to generate the appropriate URL when forwarding the request to another domain. If back end changes to an application are not permitted or desired, or if application awareness of WebSEAL's single sign-on functionality is not possible, then e-community single sign on should be used. See 4.10.3, "e-community single sign-on" on page 169 for more information.

The CDSSO process includes the following steps:

1. A user initially logs on to a WebSEAL server in one secure domain.
2. At some point the user accesses a link controlled by the user's WebSEAL, which contains a special directive (pkmscdsso). This directive results in redirecting the user to a URL controlled by a WebSEAL server in another secure domain and passing encrypted credential information to the new WebSEAL.
3. The user is redirected to the other WebSEAL and this server decrypts the credential information passed to it, maps the identity to one defined in its own user registry, and then creates a secure session with the browser.
4. At this point the user has established secure sessions with two WebSEAL servers in different domains, but has only had to log in once.

The tokens are encrypted using triple-DES. The symmetric key is generated by the cdsso_key_gen utility and exchanged between all WebSEALS that participate in CDSSO.

Another way of looking at CDSSO is that it provides a mechanism by which a WebSEAL server in one secure domain can send something analogous to a *letter of introduction* to a WebSEAL server in another secure domain.

Figure 4-10 summarizes a typical CDSSO flow.

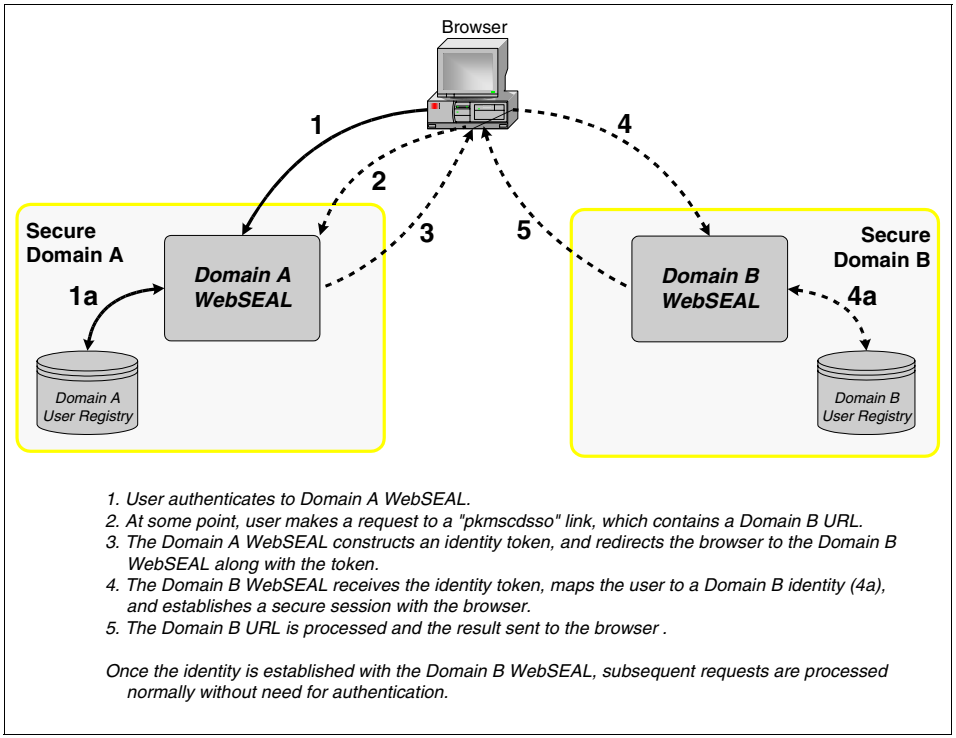


Figure 4-10 CDSSO identity determination process

Another significant CDSSO implication for a given secure domain, in addition to the need to potentially modify back-end applications, involves the mapping of user identities. How this mapping is done is not really an architectural issue; it is more a detailed design and implementation concern. The important thing to remember is that the mapping must make sense for the specific situation.

It is possible (using the CDMF interfaces discussed in 4.10.1, “Cross-domain mapping framework” on page 166) to map from an ID in one domain to a different ID in another. However, if the IDs in both domains are the same, a direct mapping may be done. This is the default and does not require the use of any special programming interfaces.

User synchronization and CDSSO

The default mapping for CDSSO is to map a user from one domain exactly as it appears into another domain. For example, if a user authenticates as user123 from *domain A* and is forwarded to *domain B*, the user must also exist as user123 in domain B even though they were never prompted to authenticate in

domain B. This presents the challenge of synchronizing the user accounts that need to participate in single sign-on between domains

If a custom written cross-domain mapping framework is used, then it is possible to map a user from one domain to a different user in another domain. However, if a one-to-one mapping is used, the problem of synchronizing users still would exist regardless of whether or not the IDs matched from one domain to another.

Virtual hosts and CDSSO

Cross-domain single sign-on is not supported with virtual hosts and virtual host junctions. If single sign-on is needed between separate DNS domains and/or Access Manager domains, and either virtual hosts or virtual host junctions are used, e-community single sign-on is the only technology supported for this type of functionality.

4.10.3 e-community single sign-on

e-community single sign-on supports a cross-domain authentication capability. However, it differs from CDSSO in a few key respects. Recall that in CDSSO, authenticated identities are *forwarded*. In an e-community scenario, identities are instead retrieved—it is a *pull* model. The use of e-communities has certain advantages over CDSSO, yet it also has architectural impacts that are not encountered in a CDSSO environment.

Instead of having to use special URLs to indicate the use of single sign-on as in the CDSSO model, e-community allows for direct access to secured links. This has a benefit over CDSSO in that users can bookmark links to resources but will still be allowed to participate in e-community.

In this model, multiple Access Manager domains are defined to be part of a single e-community. While each participating domain has its own user registry, one of the domains is designated to be the *home domain*. Users requesting protected resources in any of the participating domains initially authenticate to a *Master Authentication Server* (MAS) in the home domain. After the initial authentication has taken place, the user has an e-community identity based on the home domain's user registry. A user's e-community identity subsequently can be mapped, as required, to local identities by WebSEAL servers in other domains within the e-community.

Note: Users who do not exist in the MAS home domain can still authenticate to their own domain and access protected resources. This allows a company to restrict who can essentially single sign-on to resources. Only users defined to both the MAS domain and the domain where the protected resource is defined can participate in e-community single sign-on.

The e-community model is shown in Figure 4-11 on page 171. Some key points to be aware of in the e-community model are:

- The model supports access using direct URLs (bookmarks) to resources. This feature contrasts with the CDSSO model that relies on a specially configured pkmscdsso link.
- All users who are participating in the e-community authenticate against a single master authentication server (MAS) located in the home domain.
- The e-community implementation allows for “local” authentication in remote domains if the user does not have a valid account with the MAS (for example, users who belong to domain B but do not participate in the domain A-domain B e-community).
- A user who fails authentication with the MAS when requesting a resource in a non-MAS (but participating) domain is given the option to authenticate to the local server where the request is being made.
- The MAS (and eventually other selected servers in the remote domains) “vouches for” the user’s authenticated identity.
- Domain-specific cookies are used to identify the server that can provide “vouch for” services. Domain cookies allow servers in a remote domain to request “vouch for” information locally. The encrypted contents of e-community cookies do not contain user identity or security information.
- Special tokens are used to pass encrypted “vouched for” user identity. The “vouch for” token does not contain actual user authentication information. Integrity is provided by a shared secret key (triple-DES) generated by the cdsso_key_gen utility. The token contains a timeout (lifetime) value to limit the duration of the token validity.

Single sign-on with e-community can be used if there are two completely separate Access Manager security environments (two different Policy Servers and user registries) or in an Access Manager multi-domain environment where there is one Policy Server and one user registry shared between domains (this does not imply that the users and groups are shared between domains, though).

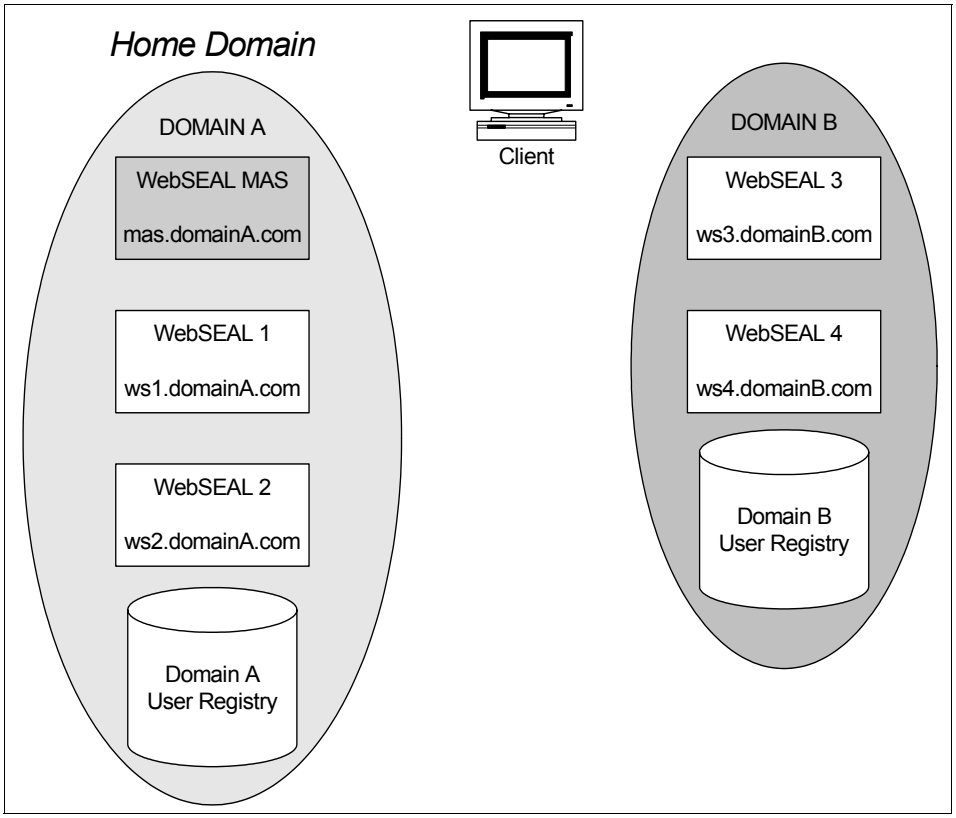


Figure 4-11 e-community single sign-on model

The e-community mechanism involves the following steps:

1. A user makes a request for a protected resource controlled by a WebSEAL server in one of the e-community domains. This WebSEAL does not yet have an established secure session with this user.
2. The WebSEAL server redirects the user to the MAS and sends with the request a special directive (pkmsvouchfor), which requests that the MAS provide identity information for the user.
3. The MAS checks to see whether the user has already been authenticated to the e-community, and if not, the MAS authenticates the user.
4. The MAS sends a token back to the original WebSEAL server that contains credential information that vouches for the user's identity.
5. The WebSEAL server maps the identity provided to it by the MAS to an appropriate Access Manager within its local domain and establishes a secure session with the browser.

Figure 4-12 summarizes the flow of an initial e-community user authentication.

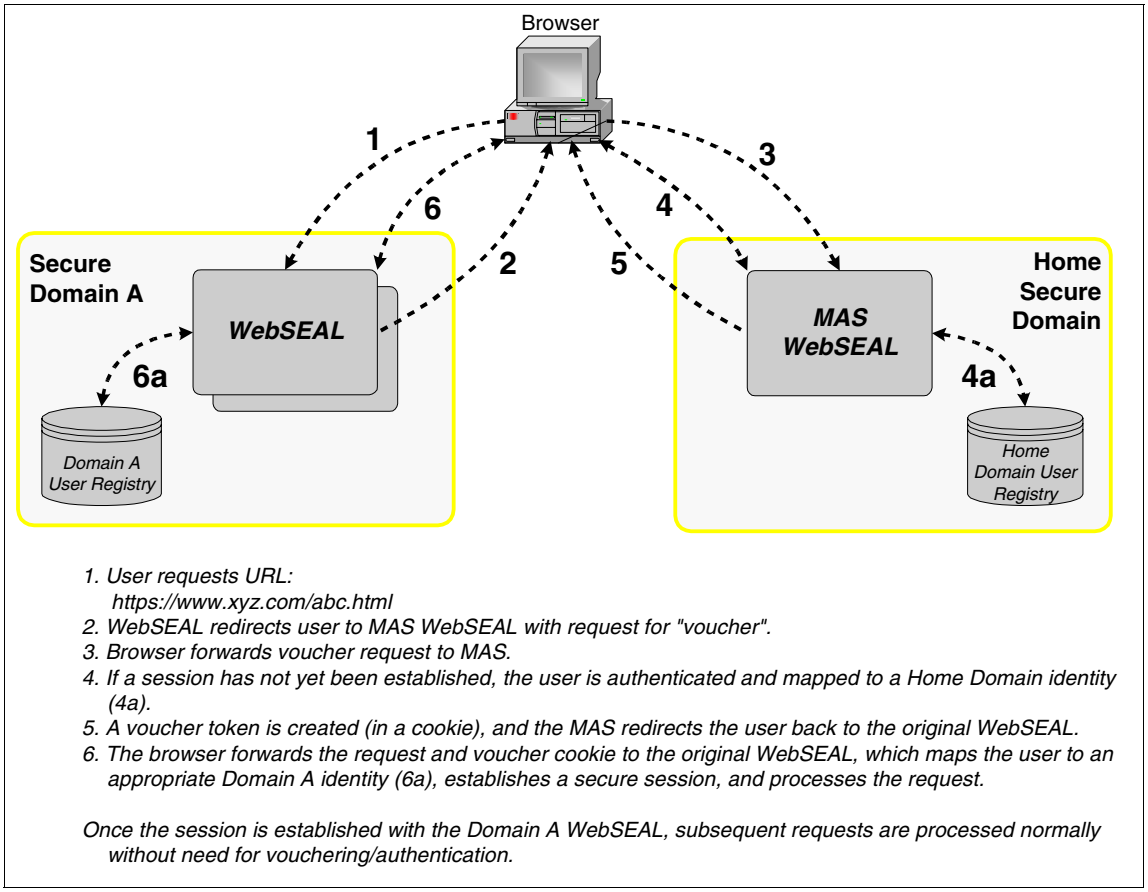
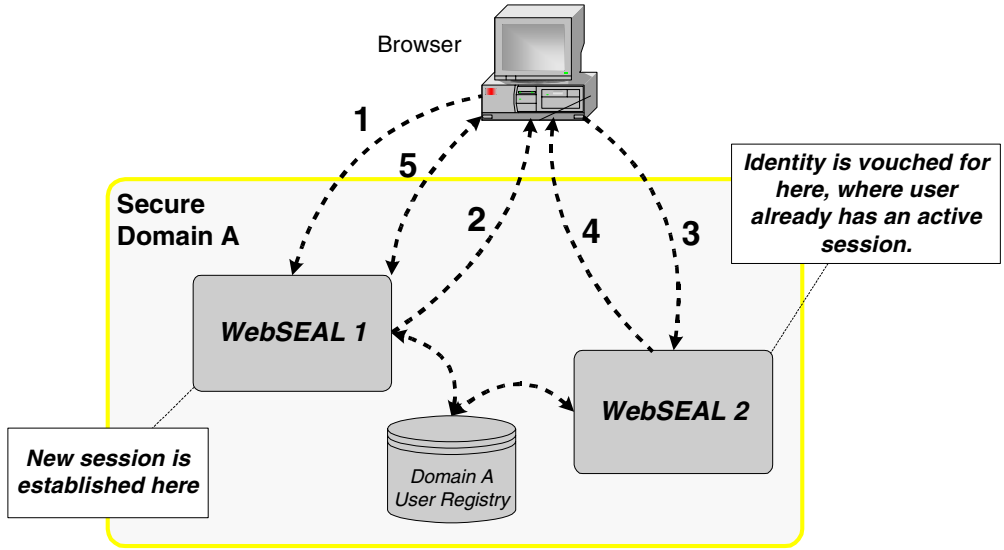


Figure 4-12 e-community initial identity determination process

Within the home domain, unauthenticated requests are always vouched for via the MAS. In other participating domains, after the user initially logs in to the MAS, subsequent authentication activities to other WebSEAL servers in those domains are handled locally. The first WebSEAL in the domain that validates the user's identity against the MAS then vouches for that user's identity within the local domain. This is depicted in Figure 4-13 on page 173.



(User has authenticated to an e-community MAS in a previous request to WebSEAL 2. WebSEAL 2 now will vouch for subsequent identity "voucher" requests by other WebSEALs for this user in this domain.)

1. User requests URL from WebSEAL 1:
https://www.xyz.com/abc.html
2. WebSEAL 1 redirects user to WebSEAL 2 with request for "voucher".
3. Browser forwards voucher request to WebSEAL 2.
4. WebSEAL 2 provides a voucher cookie token, and redirects the user back to WebSEAL 1.
5. The browser forwards the request and voucher cookie to WebSEAL 1, which maps the user to the correct Domain A identity, establishes a secure session, and processes the request.

Once the session is established with the WebSEAL 1, subsequent requests are processed normally without need for vouchering/authentication.

Figure 4-13 e-community subsequent identity determination process

The key advantage of e-community single sign-on over CDSSO is that the initial URL request can be made directly to the target WebSEAL server. Recall that with CDSSO, the URL request must go through the WebSEAL to which the user is currently authenticated. In an e-community configuration, the target WebSEAL is specifically configured to *retrieve* credential information through the vouching mechanism, and the URL request itself need not be accompanied by special processing or contain special characteristics, as in the CDSSO case.

User synchronization and e-community single sign-on

The default mapping for e-community single sign-on is to map a user from the home domain exactly as it appears into another domain. For example, if a user

authenticates as user123 to the home domain and is returned to domain B, the user must also exist as user123 in domain B even though they were never prompted to authenticate in domain B. This presents the challenge of synchronizing the user accounts that need to participate in single sign-on between domains.

If a custom written cross-domain mapping framework (CDMF) is used, then it is possible to map a user from one domain to a different user in another domain. However, if a one-to-one mapping is used, the problem of synchronizing users still would exist regardless of whether or not the IDs matched from one domain to another.

Virtual hosts and e-community single sign-on

Virtual hosts are also allowed to participate in an e-community single sign-on environment. The same concepts apply to a virtual host WebSEAL environment that apply to physical WebSEALs themselves.

For example, let's take the following virtual host junctions:

- www.abc.com:80
- www.abc.com:443
- www.xyz.com:80
- www.123.com:80

Note: www.abc.com:80 and www.abc.com:443 are a virtual host junction protocol pair. They correspond to the same server and same objectspace in Access Manager.

There are three domains that would be participating in e-community single sign-on in this environment:

- abc.com
- xyz.com
- 123.com

We could make the www.abc.com server the MAS server. That means whenever authentication would need to occur for www.xyz.com, www.abc.com, or www.123.com, all requests would first be forwarded to www.abc.com for authentication and e-community token creation.

4.11 Session Management Server

The Session Management Server solution is most commonly used in a scenario where client requests are directed by a load balancing mechanism to two or more replicated WebSEAL servers. The replicated servers are identical. They contain replica copies of the WebSEAL protected object space, junction database, and (optionally) dynurl database. The client is not aware of the replicated front-end server configuration. The load balancing mechanism is the single point of contact for the requested resource.

The Session Management Server is an independent service that acts as a centralized session repository for a clustered WebSEAL server environment. The major function of the Session Management Server is to act as a distributed session cache.

There are two variations of server clusters:

- Multiple servers that present the exact same content (Web site) to users.

  The main users of the Session Management Server are replicated Web security servers organized into groups called replica sets. A *replica set* consists of servers with identical configurations and protected Web spaces, such that a client session created by one member of a replica set could be used unmodified by another. Replica sets can provide performance benefits such as load balancing and high availability.

- Multiple servers that present differing, but related, content to users.

  These Web sites do not present the same content but typically have single sign-on requirements between each other and share the Tivoli Access Manager user registry and Policy Server. A group of replica sets is called a *session realm*. Certain policies, including maximum concurrent session policy and policies affecting credential change, can apply consistently across a session realm. From the user and administrator points of view, sessions exist as a single entity across a session realm. All replica sets in a session realm must use the same DNS domain.

In a case that the Session Management Server is configured to handle session information for WebSEAL, it is obvious that WebSEAL needs to maintain a stable connection with the Session Management Server. (WebSEAL returns HTTP error 503 “Service unavailable” to the client when it does not have an active connection to a Session Management Server.) In architecting a Session Management Server solution, we need to consider a WebSphere cluster environment to avoid a single point of failure for the Session Management Server configuration.

4.11.1 WebSEAL Session Management Server configuration

After the installation and initial configuration (using **`smscfg -action config`**), you need to configure WebSEAL servers to work with the Session Management Server.

WebSEAL configuration steps are the following:

1. Enabling and disabling the Session Management Server for WebSEAL

   Use the `dsess-enabled` stanza entry in the `[session]` stanza of the WebSEAL configuration file to enable and disable use of the Session Management Server. To enable WebSEAL to use the Session Management Server to maintain user sessions, enter a value of *`yes`*. For example:

   ```
   [session]
   dsess-enabled = yes
   ```

2. Specifying the Session Management Server location

   Use the `dsess-url` stanza entry in the `[dsess]` stanza of the WebSEAL configuration file to provide WebSEAL with the location (URL) of the session management server. For example:

   ```
   [dsess]
   dsess-url = http://abc.example.com/DSess/services/DSess
   ```

   If the dsess-url stanza entry specifies the HTTPS protocol in the URL, you must configure WebSEAL for SSL communication with the Session Management Server.

3. Retrieving the maximum concurrent sessions policy value

   – You can use the maximum concurrent sessions policy to control the number of sessions each user can have at one time within a distributed session environment managed by the Session Management Server. By default, this policy is enabled:

     ```
     [session]
     enforce-max-sessions-policy = yes
     ```

     Setting the `max-concurrent-web-sessions` user attribute does not, by itself, trigger policy enforcement.

   – When this policy is enabled you have to use WPM or the pdadmin command to set appropriate maximum value on global or user level. For example, to allow every user to establish only one session with WebSEAL, use the following command:

     ```
     pdadmin> policy set max-concurrent-web-sessions 1
     ```

   – The policy is stored in the Tivoli Access Manager user registry. To be enforced by the authentication process in a Session Management Server

environment, the policy must be retrieved from the registry and stored as an extended attribute in each user's credential. To store a policy value as an extended attribute in a user credential, you must enable the built-in credential policy entitlements service for Tivoli Access Manager using `cred-attribute-entitlement-services`. The name of credential policy attribute is: `tagvalue_max_concurrent_web_sessions`.

Managing session realms and replica sets

An authorized user can use WPM or the pdadmin CLI to display session realms, list the participating replica sets, list current sessions, and search for specific sessions.

After the initial configuration, you can add session realms and add replica sets to a specific session realm. The following UNIX command is the minimal requirement for this type of session management server configuration:

```
/opt/pdsms/bin/smscfg.sh -action config -was_host host_name -was_port
port \ -session_realm_add realm=set_name[,...][;realm=set_name[,...]...
```

Do not combine the –session_realm_add configuration parameters with any of the following parameters:

- –session_realm_remove
- –replica_sets_add
- –replica_sets_remove

After the initial configuration, you can add replica sets that are not assigned to a specific session realm. The following UNIX command is the minimal requirement for this type of session management server configuration:

```
/opt/pdsms/bin/smscfg.sh -action config -was_host host_name -was_port
port \ -replica_sets_add set_name[,...]
```

Do not combine the –replica_sets_add configuration parameters with any of the following parameters:

- –session_realm_add
- –session_realm_remove
- –replica_sets_remove

Replica set configuration

A replica set consists of servers with identical configurations and protected Web spaces. A client session created by one member of a replica set can be used unmodified by another.

Each replica set name must be initially defined during the configuration of the session management server.

You must specify each replica set name in the configuration file of each WebSEAL instance that participates in those replica sets. Additionally, you must assign each junctioned or virtual host to the appropriate replica set. There are different procedures for assigning standard junctions and virtual hosts to a replica set.

Each replica set that WebSEAL participates in must be listed in the `[replica-sets]` stanza of the WebSEAL configuration file.

Assigning standard junctions to a replica set

By design, all standard junctions for a WebSEAL instance are assigned to one replica set, as specified by the `standard-junction-replica-set` stanza entry in the `[session]` stanza for the WebSEAL configuration file.

To use the Session Management Server, the standard-junction-replica-set stanza entry value must also be listed in the `[replica-sets]` stanza. If the standard-junction-replica-set value is not present in the `[replica-sets]` stanza, WebSEAL will not start.

For example:

```
[session]
standard-junction-replica-set = www.example.com
[replica-sets]
replica-set = www.example.com
```

Assigning virtual hosts to a replica set

In contrast to standard junctions, virtual hosts can be individually assigned to different replica sets by using the `-z` junction option during creation of virtual host junction. The -z option specifies the replica set that sessions on the virtual host junction are managed under.

Additionally, the name of the replica set used by this virtual host must be defined by the `replica-set` stanza entry in the `[replica-sets]` stanza of the configuration file for the WebSEAL instance:

```
[replica-sets]
replica-set = replica_set_name
```

Interactive displacement

If the maximum concurrent sessions policy is enabled, the `prompt-for-displacement` stanza entry in the `[session]` stanza of the WebSEAL configuration file determines whether or not a user is prompted for appropriate

action when the max-concurrent-web-sessions displace policy has been exceeded.

If prompt-for-displacement is set to *yes* and maximum concurrent sessions policy is set to *displace*, when a second login is attempted, the user receives the `too_many_sessions.html` response page.

You can customize the contents of this page. The default message on this page states:

```
You are already logged in from another client. Do you want to
terminate your existing login or cancel this new login request?
Terminate existing login
Cancel this new login
```

Action descriptions:

- Terminate existing login

  The terminate action calls the WebSEAL */pkmsdisplace* function. This function terminates the existing (original) login, creates a new session for the user, logs the user in transparently, and redirects the user to the requested URL.

- Cancel this new login

  The cancel action calls the WebSEAL */pkmslogout* function. This function closes the current login attempt and returns the standard WebSEAL logout page to the user. The original (older) login session can continue accessing resources.

Non-interactive displacement

If prompt-for-displacement is set to *no* and maximum concurrent sessions policy is set to *displace*, when a second login is attempted, the original (older) login session is automatically terminated with no prompt. A new session is created for the user and the user is logged in to this new session transparently. The original (older) session is no longer valid.

This concludes the configuration and customization discussion for Access Manager for e-business.

5

Programming

This section describes the application programming interfaces that were introduced in Chapter 2, “Planning” on page 27. The major interfaces covered in this chapter are:

- External Authentication Interface (EAI)
- External authentication C API
- Entitlement service interface
- External Authorization Service (EAS)

5.1 External authentication interface

Tivoli Access Manager WebSEAL and Web Server Plug-in both support the externalization of authentication through an HTTP interface. This technology is known as the *external authentication interface* (EAI). The EAI is an alternative way to customize authentication when the authentication information is passed in HTTP messages. It allows a back-end application server to perform the authentication of a user (with the HTTP messages passing through WebSEAL/Web Plug-in) and then, upon successful authentication, return an identity to WebSEAL/Web Plug-In using some pre-defined HTTP headers. A generic flow is depicted in Figure 5-1.

By allowing an application server to perform an authentication, virtually any desired authentication strategy can be implemented. Since the interface is HTTP, the back-end application can be written in any language that supports communication via the HTTP protocol. This is an advantage over the external authentication C API (previously known as CDAS) that must be written exclusively in C. The external authentication C API interface is still, however, the only method for performing non-HTTP authentication such as client certificate authentication.

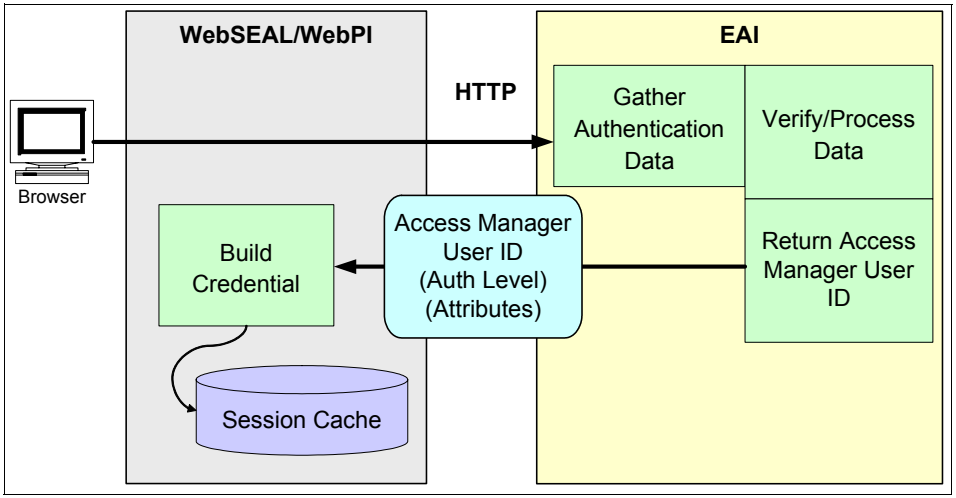


Figure 5-1 External authentication interface

The external authentication interface could return a Privilege Attribute Certificate (PAC) which could then be used to build the credential.

There are some implications to externalizing authentication outside of the standard WebSEAL/Web Plug-in password module. The password module in WebSEAL/Web Plug-In provides for maximum failed login attempts, password

lifetime checks, and a password change function. All of these functions will need to be duplicated if using an external authorization interface.

External authentication interface process flow

Figure 5-2 depicts the process flow for an EAI authentication.

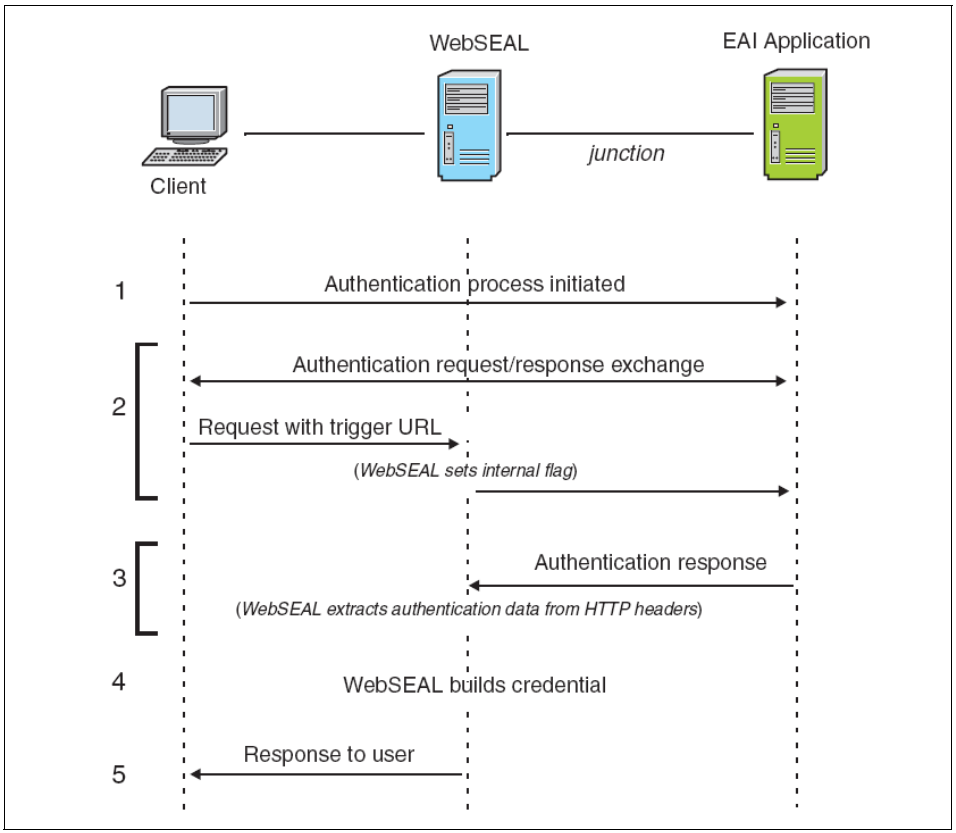


Figure 5-2 External Authentication Interface process flow

As we already mentioned, this new interface allows authentication to be performed by a back-end application being accessed over a junction using HTTP(S), then the authenticated identity is sent to WebSEAL or WebPI server in the header of an HTTP response. In detail, the process follows these steps:

1. The authentication process is initiated.

   There are many possibilities for initiating the authentication process. A few typical examples are:

   a. An unauthenticated user requests a protected resource.

b. WebSEAL intercepts the request and returns a redirect to a customized login.html response page. The login.html page is customized to contain a submit link to the external authentication application. Alternatively, WebSEAL can be configured to redirect all requests for pages (including the login page) directly to a page generator which is part of the EAI application.

   Note that the EAI application is assessed over a junction and must be available to unauthenticated users. An appropriate Access Manager security policy (for example, an ACL) needs to be configured to allow unauthenticated users to access this page.

c. The user provides login information (user name and password) on the form and clicks the submit link to send the data to the external authentication application.

2. Authentication request.

   The process of authentication might require a number of exchanges between the external authentication application and the client. Exchanges are streamed through (not intercepted) by WebSEAL.

   The final authenticating request to the external authentication application must be directed to a distinct URL. This POST URL is configured in WebSEAL as an EAI *trigger URL* because the EAI might return an authenticated identity in response to this POST.

   In this case, the EAI application does not return an EAI message. Instead it has decided that this user must also provide some secondary authentication, so it returns another form to the client. WebSEAL sees that this is not an EAI message so it is forwarded to the client.

3. Authentication response.

   The client completes the additional challenge and again POSTs it to the EAI application (via WebSEAL). WebSEAL again matches a *trigger URL*. This time authentication is complete and so the EAI application responds with an EAI message that contains the authenticated identity.

4. WebSEAL uses the authentication data to build a credential for the user. WebSEAL spots the EAI message and processes the identity information it contains to build an authenticated session. The user is now authenticated and can be directed to the resource they originally requested.

5. WebSEAL sends a response to the user following the algorithm illustrated in Figure 5-3.

   a. If automatic redirection is enabled, the user is redirected to the location specified in the WebSEAL configuration file.

   b. If the initial request was cached, the request is reprocessed for the user.

c. If the response from the external authentication application contains a redirection URL header, the user is redirected to the location specified by that URL.

d. Otherwise, WebSEAL responds with the standard login_success.html page.

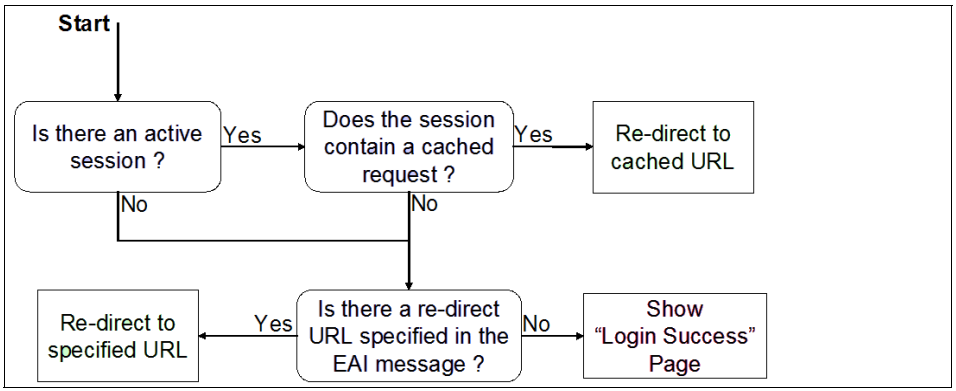


Figure 5-3 WebSEAL response to user after authentication with EAI

External authentication interface configuration

This section describes how to configure WebSEAL to use the external authentication interface. At a high level, the steps are as follows:

1. Enable the external authentication interface.

   In the `[eai]` stanza of the WebSEAL configuration file, specify the protocols to support in your network environment.

   ```
   [eai]
   eai-auth = {http | https | both | none}
   ```

2. Initiate the authentication process.

   In an EAI scenario, WebSEAL does not provide any built-in methods for initiating the authentication process. WebSEAL does not provide any special prompts or login pages. You can, however, modify WebSEAL's existing *login.html* form to include a custom link to the EAI application.

   Modification of the login.html form is necessary to support re-authentication and authentication strength (step-up).

3. Configure the external authentication interface trigger URL.

   A trigger URL is a server-relative or absolute URL string configured in the WebSEAL configuration file. The trigger URL usually requests authentication from the external authentication application. For example, the trigger URL

could be the URL to the external authentication application located in a special link on a customized login page.

Use the `trigger` stanza entry, located in the `[eai-trigger-urls]` stanza of the WebSEAL configuration file, to specify one or more trigger URL strings.

4. Specify HTTP header names for authentication data.

   You must specify the names of the HTTP headers that contain the authentication data returned from the external authentication application. Use the `[eai]` stanza of the WebSEAL configuration file to specify the names of the HTTP headers that contain the authentication data returned from the external authentication interface server.

   There are three categories of HTTP headers used to hold authentication data:

   – Privilege Attribute Certificate (PAC) format
     The PAC is an ASN.1 data structure used to express identity information. Authentication data returned to WebSEAL in PAC format can be directly converted to a credential.

   – WebSEAL user identity structure
     The WebSEAL user identity structure is the same structure generated by WebSEAL's default built-in authentication modules. When the user identity format type is used, the information is processed by the eaiauthn authentication module and a credential is built by the Tivoli Access Manager authorization API.

   – Common
     The common header category holds additional information and can be used with either the PAC or user identity formats.

5. Configuring the EAI mechanism

   The built-in module is used to process the authentication data found in the special HTTP headers. After WebSEAL extracts the authentication data from the headers in the response, the data is passed to the eaiauthn module.

   The eaiauthn module is not used to process PAC header data. The PAC format allows WebSEAL to convert the authentication data directly to a credential.

   You can configure the EAI authentication mechanism by entering the `ext-auth-interface` stanza entry with the platform-specific name of the shared library file in the `[authentication-mechanism]` stanza of the WebSEAL configuration file.

   – On UNIX, the module that processes user identity type header information is a shared library called *libeaiauthn*.

   – On Windows, the module that processes user identity type header information is a DLL called *eaiauthn*.

Note: EAI is configured for the Plug-in for Web Servers in the `[ext-auth-int]` stanza. This stanza can be qualified by virtual host if necessary.

The configuration options are similar to those used for WebSEAL. However, there are some differences:

- *auth-url* is the "start" page of the EAI application. When the EAI authentication module is selected for authentication it will return this page to the client to start EAI authentication.
- When the *trigger-url* is matched by the EAI authentication post-authn module it will request access to the response from this page. Multiple trigger URLs can be specified.
- When the EAI Authentication response module is called it will look for the configured headers. If appropriate headers are found, it will trigger the building of a credential and an authentication event. If the headers are not found, the response will be sent back to the client. The EAI headers are configured in the same way as for WebSEAL.

5.1.1 External authentication C API

In previous releases, custom authentication modules were built using the Tivoli Access Manager *cross-domain authentication services* or *CDAS*. This term is no longer used because its scope is not wide enough to cover all the functions performed by Web security resource manager authentication modules. The replacement term is *external authentication C API*. The new term reflects only a change in terminology.

The external authentication C API performs the following tasks:

- Receives authentication data from the runtime.
- Organizes the data into a standard format.
- Passes the data to the authentication modules.
- Receives statuses, identity structures, or both back from the authentication modules.
- Passes the statuses, identity structures, or both back to the runtime.

As shown in Figure 5-4 on page 188, the external authentication C API enables you to substitute the default built-in WebSEAL authentication mechanism with a highly flexible shared library mechanism that allows custom handling and processing of client authentication information.

Every authentication module implements one or more of four functions defined by the external authentication module interface. This is true for the built-in authentication modules as well as for custom modules that you can develop

using the external authentication C API. The complete programming reference for the external authentication C API is described in detail in developers manuals.

In summary, the four functions of the external authentication C API are:

xauthn_initialize()	Initializes a specified authentication module shared library.
xauthn_authenticate()	Performs the authentication module authentication tasks.
xauthn_change_password()	Performs a password change.
xauthn_shutdown()	Shuts down a specified authentication module shared library.

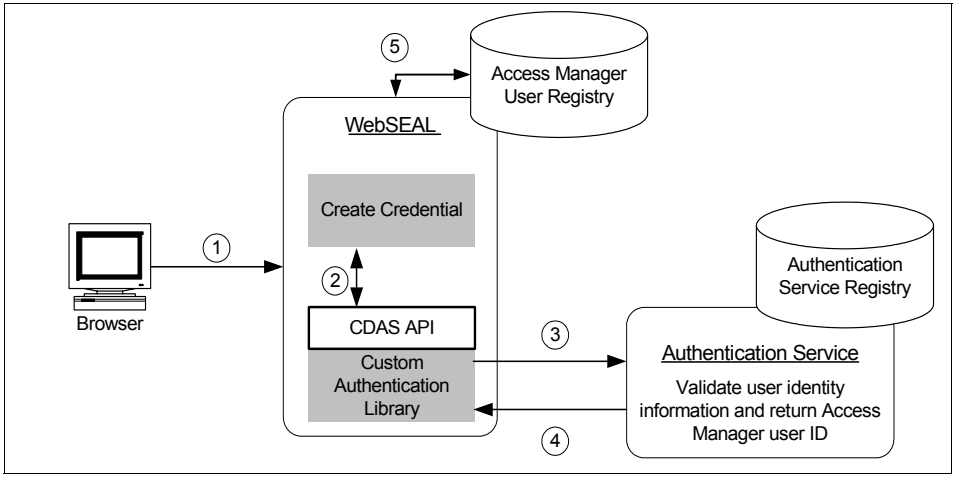


Figure 5-4 WebSEAL authentication model with CDAS

Extending the built-in capabilities of authentication mechanisms provided by Access Manager is another reason to build a custom EAI. This method enables you to authenticate clients who are not direct members of the Access Manager secure domain. In that case, the custom EAI can direct authentication data to be processed by an external authentication mechanism and third-party registry (for example, RACF®, One-Time Password Server, or authentication via personal question). Ultimately, the EAI returns an Access Manager identity to WebSEAL for querying the Access Manager user registry and creating a credential.

5.2 Authorization API overview

Using the Tivoli Access Manager authorization application programming interface (aznAPI), you can program Tivoli Access Manager applications and third-party applications to query the Tivoli Access Manager authorization service for authorization decisions. The Tivoli Access Manager authorization API is the interface between the server-based resource manager and the authorization service; it provides a standard model for coding authorization requests and decisions. The aznAPI lets you make standardized calls to the centrally managed authorization service from any developed application. The aznAPI supports two implementation modes:

- Remote cache mode

  In remote cache mode, you use the aznAPI to call the Tivoli Access Manager authorization server, which performs authorization decisions on behalf of the application. The authorization server maintains its own cache of the replica authorization policy database.

- Local cache mode

  In local cache mode, you use the aznAPI to download a local replica of the authorization policy database. In this mode, the application can perform all authorization decisions locally.

The aznAPI shields you from the complexities of the authorization service mechanism. Issues of management, storage, caching, replication, credentials format, and authentication methods are all hidden behind the aznAPI. The aznAPI works independently from the underlying security infrastructure, the credential format, and the evaluating mechanism. The aznAPI makes it possible to request an authorization check and get a simple yes or no recommendation in return.

5.2.1 Configuration of an aznAPI application

The aznAPI application must establish its own authenticated identity within the IBM Tivoli Access Manager (Tivoli Access Manager) secure domain in order to request authorization decisions from the Tivoli Access Manager authorization service. Before you run the aznAPI application for the first time, you must create a unique identity for the application in the Tivoli Access Manager secure domain. In order for the authenticated identity to perform API checks, the application must be a member of at least one of the following groups:

ivacld-servers This group membership is needed for applications using local cache mode.

remote-acl-users This group membership is needed for applications using remote cache mode.

When the application wants to contact one of the secure domain services, it must first log in to the secure domain.

Use the *svrsslcfg* utility to accomplish this task. Run this utility before initializing the aznAPI. The svrsslcfg utility performs the following tasks:

- It creates a user identity for the application by combining the server name with the local TCP/IP host name.
- It creates an SSL key file for that user.
- It adds the user to the ivacld-servers group for a server type of local, or to the remote-acl-users group for a server type of remote.

Configuring a Java application into the secure domain

Java applications that use Tivoli Access Manager security must be configured into a Tivoli Access Manager secure domain. Tivoli Access Manager provides a utility class called com.tivoli.pd.jcfg.SvrSslCfg that can be used to accomplish the necessary configuration and unconfiguration tasks.

The SvrSslCfg class is used to create a Tivoli Access Manager user account for an application server and to store the server's configuration and certificate information in local configuration and keystore files. After obtaining the necessary information, use the SvrSslCfg option -action config to create the Tivoli Access Manager application name, the configuration file, and the keystore file. Configuring an application server creates user and server information in the user registry, and creates local configuration and keystore files.

Again, Tivoli Access Manager supports Java application servers in either remote mode or local mode.

Note: The svrsslcfg command line interface and the SvrSslCfg Java utility are not interchangeable. Do not use the svrsslcfg command line interface to create configuration files that are to be used with Java applications. Do not use the SvrSslCfg Java class to create configuration files for use by C applications.

As we have already shown in Figure 2-10 on page 53, the Tivoli Access Manager aznAPI supports a service plug-in model. The Tivoli Access Manager authorization service recognizes and registers service plug-ins by reading entries in the aznAPI client configuration file. When the application initializes the aznAPI, the authorization server parses the configuration file. The dispatcher resolves the location of each service plug-in, and loads each service plug-in. The azn_svc_initialize() function returns an error if a service plug-in is not configured correctly or if the service plug-in module cannot be located.

Each type of service has a separate section within the configuration file. The default configuration files for every plug-in are shown in Table 5-1.

Table 5-1 Stanza entries for authorization plug-ins

Entry	Service type
[aznapi-entitlement-services]	Entitlement service plug-ins
[aznapi-pac-services]	Privilege attribute certificate service plug-ins
[aznapi-cred-modification-services]	Credentials modification service plug-ins
[aznapi-admin-services]	Administration service plug-ins
[aznapi-extern-authzn-services]	External Authorization Service plug-ins

In the following sections we describe some of those interfaces in more detail.

5.2.2 Entitlement service interface

An entitlement service interface is a part of the aznAPI that is called during the building of a credential. This entitlement service receives the basic user credential being created and is able to specify a list of additional custom attributes to be added to the credential before it is returned to the application.

The entitlement service interface is called from within the aznAPI, so the function is available to all Access Manager applications regardless of the registry and regardless of the authentication method used. Each entitlement service plug-in is a standalone module that is dynamically loaded into the authorization service. The Tivoli Access Manager authorization service recognizes and registers entitlement service plug-ins with the service dispatcher by reading entries in the aznapi.conf configuration file. Entitlement service plug-ins are declared in the configuration file under the stanza entry called [`aznapi-entitlement-services`]. In this stanza, every entitlement service gets a unique ID. The value assigned to this ID can be either the service, or an entirely different one written by an authorization API application developer. (The Tivoli Access Manager authorization service also recognizes and registers entitlement service plug-ins through arguments passed to the init_data parameter of the azn_initialize() function.)

Figure 5-5 on page 192 shows the architecture for adding attributes to a new user credential. The main aspect is that the Resource Manager can be any Access Manager aznAPI application — it is no longer limited to just WebSEAL and the Web Server Plug-in.

Initially the application calls the aznAPI to request a credential. The aznAPI builds a basic Access Manager credential for the user (1) and then calls the

configured *credential attribute* entitlement services. These gather additional attributes for the user (from the registry in this example) and return them to the aznAPI (2). The aznAPI then adds these attributes to the basic Access Manager credential before returning it to the calling application.

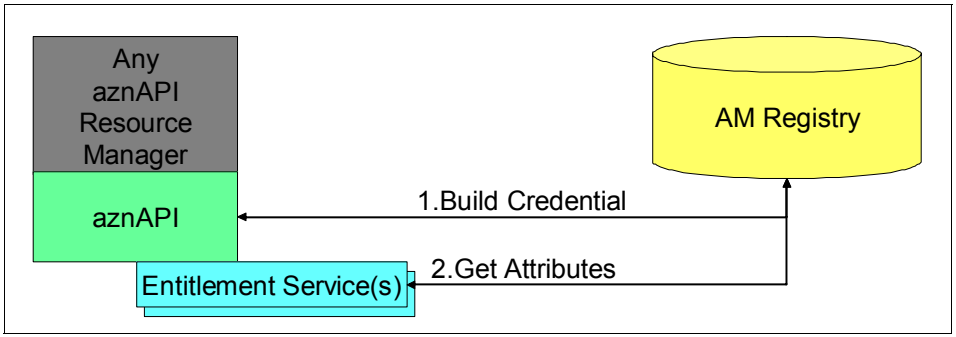


Figure 5-5 Entitlement service

An entitlement service is a very generic plug-in that can be called by the Access Manager authorization service. It is possible to register multiple credential attribute entitlement services with the aznAPI. These will all be called, and all of the attributes are added to the user's credential.

The input to an entitlement service is a user credential and an application context. The output of an entitlement service is an attribute list. This is how the entitlement service passes back its results.

Credential attribute entitlement service

The credential attribute service can obtain the custom credentials from any source; they don't have to come from the user registry. Custom entitlement services can be written to obtain attributes from any desired source.

The credential attribute entitlement service extracts information from a user's LDAP entry and adds it to their credential. For example, a back-end application requires a user's department number in addition to their user ID in order to build the application interface appropriately. By using the credential attribute entitlement service, WebSEAL can pull the user's department out of their entry in LDAP, place it in the user's credential, then use the information from the credential to place the department value in an HTTP header.

Registry attribute entitlement service

The registry attribute entitlement service is a credential attribute entitlement service that is supplied with the Tivoli Access Manager authorization runtime package and that can be used to retrieve attributes from the Tivoli Access Manager user registry.

The attributes retrieved by the credential attributes entitlement service do not necessarily have to be placed directly into a user credential. These name/value pairs from the user registry are placed into an attribute list, which can then be used for purposes other than adding information to a user credential.

This built-in registry attribute entitlement service is a generic entitlement service that can be used by many resource managers.

High-level configuration steps are the following:

1. As with any entitlement service plug-in, credential attribute entitlement services are declared in the configuration file (for example webseald.conf) under the stanza entry `[aznapi-entitlement-services]`. The value for the registry attribute retrieval service that is part of the Tivoli Access Manager runtime environment is *azn_ent_cred_attrs*.
2. Along with the ID definition of an entitlement service we need to define automatic loading of the service. Services to be automatically called by azn_id_get_creds2() must also be listed in the `[aznapi-configuration]` stanza. Services listed under this stanza are enabled and called automatically. To specify that the service ID refers to a credential attributes entitlement service, use the keyword *cred-attribute-entitlement-services*.
3. At the end, we need to provide several stanzas that specify the attributes to be added to the credential.

Dynamic ADI retrieval services

This class of entitlement service is designed to fulfill requests for access decision information (ADI) that is needed for the Tivoli Access Manager authorization engine to perform an authorization rule evaluation. To meet the classification of attribute retrieval service the entitlement service needs to take a specific set of inputs and return to the caller a specific set of outputs in XML format. Dynamic ADI retrieval services are configured in the same way as other entitlement services. To have the authorization rules evaluator call a dynamic ADI retrieval service when ADI is required to complete a rule evaluation, you must specify the service ID of the entitlement service as a value for the configuration file entry dynamic-adi-entitlement-services or specified to the azn_initialize() application interface using the initialization attribute *azn_init_dynamic_adi_entitlement_services*. Multiple service IDs can be specified in this way. They are called in the order in which they are specified in the configuration setting or initialization parameter.

5.2.3 External Authorization Service (EAS)

The External Authorization Service (EAS) interface provides support for application-specific extensions to the authorization engine. You can use an

external authorization service plug-in to force authorization decisions to be made based on application-specific criteria that are not known to the Tivoli Access Manager authorization service. Each external authorization service plug-in is a standalone module that is dynamically loaded into the authorization service. This enables system designers to supplement Access Manager authorization with their own authorization models. The external authorization service allows you to impose additional authorization controls and conditions that are dictated by a separate, external, authorization service module.

An EAS is accessed via an authorization *callout*, which is triggered by the presence of a particular bit in the ACL that is attached to a protected object. The callout is made directly by the Authorization Service.

In the current release of Access Manager, the EAS interface is supported via a simple Authorization Service plug-in capability. This allows an EAS to be constructed as a loadable shared library. The EAS architecture is summarized in Figure 5-6.

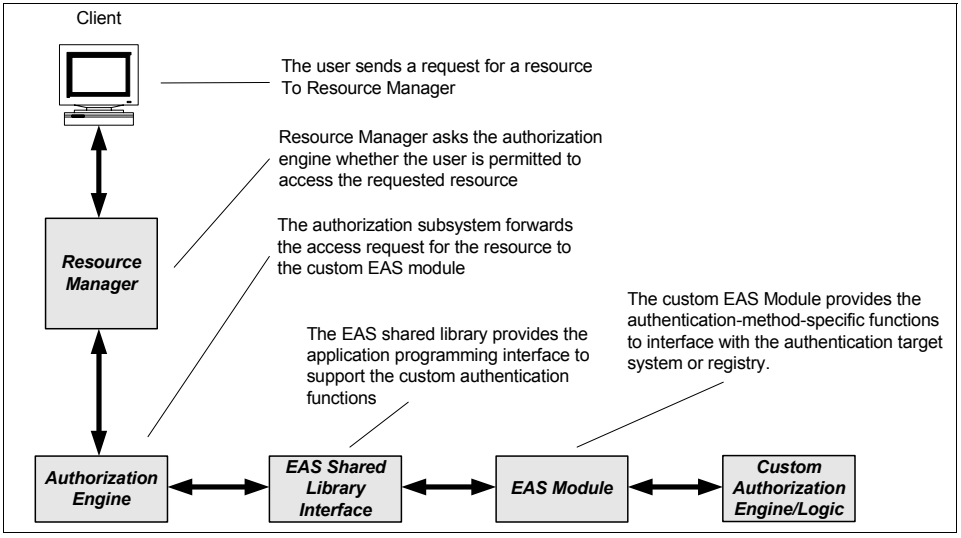


Figure 5-6 EAS architecture

Implementing an EAS

Two general steps are required to set up an External Authorization Service:

1. Write an external resource manager service plug-in module with an authorization interface that can be referenced during authorization decisions.
2. Register the external authorization service with the resource manager so that the resource manager can load the plug-in service at initialization time.

Registering the service sets a trigger condition for the invocation of the external authorization service. When the trigger condition is encountered during an authorization check, the external authorization service interface is invoked to make an additional authorization decision.

Configuration of external authorization service plug-ins is performed in the same way as other authorization service plug-ins. Initialization settings are specified either through a configuration file or programmatically through the initialization attribute list of the azn_initialize() function.

Initialization settings consist of a service definition that specifies a policy trigger for which the external authorization service is invoked, a weighting that is assigned in the access decision process to the particular external authorization service, and the location of the dynamically-loadable library module that performs the authorization work specific to the external authorization service. The concepts of policy triggers and weightings are described later in this section. Each external authorization service plug-in must expose three interfaces to the authorization service:

- azn_svc_intialize()
- azn_svc_shutdown()
- azn_svc_decision_access_allowed_ext()

Deployment strategies

Tivoli Access Manager allows you to implement an EAS in several ways:

- Any number of external authorization services can be registered with resource manager applications. Applications that can load external authorization services include the authorization server, other Tivoli Access Manager resource managers, and any other resource manager applications that you create.
- Remote-mode authorization API clients, which make requests to the authorization server for authorization decisions, automatically make use of any external authorization service that is loaded by the authorization server.
- More than one external authorization service can be called for any single trigger condition. In this case, the result of each external authorization service is weighted accordingly, and then the results are combined with the result of the Tivoli Access Manager authorization service.
- Trigger conditions can be placed on objects, using a POP trigger, such that any request to an object, regardless of the operation that is being requested, triggers a call to the external authorization services that are configured for the trigger.
- Trigger conditions can also be placed on the operations requested by a user. For example, an external authorization service can be triggered specifically

when a user requests a Write operation to a protected resource, but not for any other operation. It is then possible to develop sets of operations for which one or more external authorization services in combination are triggered according to the set of operations requested.

- The external authorization services are implemented as dynamically loadable library (dynamic link library (DLL)) modules. This greatly simplifies the task of external authorization service development. There is no requirement to make remote requests to the external authorization service and the overhead of making the call is equivalent to the overhead of a function call.

The combination of the aznAPI and an EAS provides a highly extensible and flexible solution for implementing a complex security policy.

This concludes the discussion on the programming interfaces for Access Manager for e-business.

6

Auditing and troubleshooting

This chapter describes the auditing features and troubleshooting tools in Tivoli Access Manager 6.0.

Tivoli Access Manager supports two types of auditing. Native auditing has been used in previous versions of Access Manager and is still supported in Access Manager 6.0. The auditing capability in Access Manager 6.0 has been enhanced to send audit data to a new subsystem, the Common Auditing and Reporting Service (CARS).

6.1 Native auditing

Auditing is defined as the logging of audit records. It includes the collection of data about system activities that affect the secure operation of the Tivoli Access Manager server processes. Each Tivoli Access Manager server can capture audit events whenever any security-related auditable activity occurs.

Auditing uses the concepts of a record, an audit event, and an audit trail. Each audited activity is referred to as an audit event. The output of a specific server event is called a *record*.

An *audit trail* is a collection of multiple records that document the server activity. Audit trail files can capture authorization, authentication, and management events that are generated by the Tivoli Access Manager servers. There are multiple sources for auditing events that you want to gather. You can collect either a combination or all of the different types of auditing events at the same time. Some of the event types that can be used for native auditing are:

audit.authz	Authorization events for WebSEAL servers
audit.azn	Authorization events for base servers
audit.authn	Authentication, credential acquisition authentication, password change, and logout events
audit.authn.successful	Successful authentication credential acquisition authentication, password change, and logout events
audit.authn.unsuccessful	Failed authentication credential acquisition authentication, password change, and logout events
audit.http	HTTP access events
audit.http.successful	Successful HTTP access events
audit.http.unsuccessful	Failed HTTP access events
audit.mgmt	Management events
http	HTTP logging information
http.clf	HTTP request information in common log format (clf)
http.ref	HTTP Referer header information
http.agent	HTTP User Agent head information
http.cof	HTTP information in NCSA combined output format (cof) with timestamp and appends the quoted referer and agent strings to the common log format

6.1.1 Native auditing configuration

To enable logging, define the *logcfg* entry in any or all of the following locations:

- The [ivmgrd] stanza of the Policy Server ivmgrd.conf configuration file.
- The [ivacld] stanza of the authorization server ivacld.conf configuration file.
- The [aznapi-configuration] stanza of a WebSEAL server webseald.instance.conf configuration file.
- The [aznapi-configuration] stanza of the Plug-in for Web Servers pdwebpi.conf configuration file.
- The [aznapi-configuration] stanza of the resource manager aznAPI.conf configuration file.

For each entry, specify the following:

- Type of audit event
- Location of the audit log
- Maximum file size
- File flush interval

When defining the logcfg entry in a configuration file, use the following general format (on a single line) to specify audit event logging:

```
logcfg = category:{stdout|stderr|file|pipe|remote}
[[parameter[=value]], [parameter[=value]]], ..., [parameter[=value]]]
```

To enable the recording of audit events, associate an event category with a log agent (file, pipe, or remote) or associate an event category with a console destination (stdout or stderr).

With event logging, the concept of a *log agent* includes capturing events that are redirected to destinations other than the local file system. Event logging uses the following types of log agents, each agent representing an audit trail:

- Sending events to the console.
- Configuring file log agents.
- Configuring pipe log agents.
- Configuring remote log agents.

The available parameters for the logcfg stanza entry differ by log agent. The console log agent does not support parameters.

Configuring the event pool category

Events are passed to subscribed log agents asynchronously from the application-level requests that construct the events. All events enter the common *propagation queue* before being forwarded to the subscribed log agents. The propagation queue is configurable. To configure the propagation queue, define the logcfg stanza entry using *EventPool* as the category name and specify the configuration parameters without specifying a log agent. You should manage the propagation queue to support the configuration of log agents. For example, to limit the amount of memory used to queue events for a remote log agent, you should constrain the propagation queue with the queue_size parameter:

```
[aznapi-configuration]
logcfg = EventPool queue_size=number,hi_water=number,
flush_interval=number_seconds
logcfg = category:remote buffer_size=number,path=pathname,
server=hostname,queue_size=number
```

Parameters for EventPool audit category

The following parameters can be defined for pipe log agents:

flush_interval Configure the flush_interval parameter to limit the amount of time in seconds that events can remain in the propagation queue. If the size of the queue does not reach the high water mark within the specified interval, events in the queue are forwarded to the log agents. The default value is 10 seconds. Specifying a value of 0 is equivalent to setting the value to 600 seconds.

hi_water Configure the hi_water parameter to indicate the threshold where events in the propagation queue are forwarded to the log agents. If the size of the queue does not reach this high water mark within the defined flush interval, events in the queue are forwarded to the log agents. The default value is calculated as two-thirds of the configured queue size. If the queue size is 0 (unlimited), the high water mark is set to 100 events. If the high water mark is 1 event, each event in the queue is forwarded immediately to the log agents. Setting a low value for the high water mark can have an adverse effect on performance.

queue_size Because each event in the propagation queue consumes memory, configure the queue_size parameter to define the maximum number of events that the propagation queue can hold. If the maximum size is reached, the event-producing thread is blocked until space is available

in the queue. Blocking has the effect of throttling back the performance of the event-producing thread to a rate that can be consumed by the logging threads. The default value is 0. Specifying a value of 0 indicates that no size limit is enforced on the propagation queue. When using the default value and when the logging threads cannot process events as they enter the propagation queue, the propagation queue can grow to an unmanageable size.

Parameters for file log agents

The following parameters can be defined for file log agents:

buffer_size To reduce memory fragmentation and improve the performance of writing to a file, rather than queuing many small events individually to the file log agent, events can be buffered into blocks of a nominated size before queuing for writing. The buffer_size parameter specifies the maximum size message that the program attempts to construct by combining smaller events into a large buffer. Buffers consist of only an integral number of events; events are not split across buffers. If any individual event exceeds that maximum configured size, the large event is recorded in a buffer of its own, exceeding the configured value. The default buffer size for logging to a file is 0 bytes. This value prevents buffering and each event is handled individually. If a value is specified for the buffer_size parameter, events are packed into buffers of that size before queuing to the file log agent.

flush_interval The flush_interval parameter is a multiuse parameter. To ensure that stream buffers are flushed to disk regularly, the frequency with which the server asynchronously forces a flush of the file stream to disk is configurable using the flush_interval parameter. The value defined for this parameter is 0, less than 0, or the flush interval in seconds.

- Specifying a value of 0 results in the buffer being flushed every 600 seconds.
- Specifying a value of less then 0 results in the absolute value being used as the asynchronous flush frequency, but a stream flush is also forced synchronously after each record is written.
- If events are being consolidated into large buffers by specifying a value for the buffer_size parameter, the flush_interval parameter also might affect the size of

buffer written. If there is a partially filled buffer in memory when a flush is scheduled, that buffer is also queued for writing before it completes the buffer fill. The event queue is triggered for processing at the flush interval rate. This process prevents events waiting to be processed for longer than the scheduled flush time when the queue high water mark is not reached between scheduled flushes.

hi_water In addition to the description of this parameter in the previous section, the following comment also applies: If the event queue high water mark is set to 1, every event queued is relayed to the log agent as soon as possible. This setting is not optimal, although you might want to use it if you want to ensure events get to disk as fast as possible, at the expense of overall performance.

log_id An open log file is associated with a short name identifier to facilitate the recording of events from different categories to the same file. Use the log_id parameter to set the log file identifier (ID) explicitly; otherwise, it is given a default value. If the path parameter is specified, the default value is the configured path name. If the path parameter is not specified, the log ID defaults to the domain component of the event category being captured. For example: logcfg = audit.azn:file implies log_id=audit

mode Configure the mode parameter to open a file in either text or binary mode. Text mode is deprecated on Linux and UNIX operating systems and has no effect. On Microsoft Windows 32-bit platforms, opening a file in text mode enables end-of-line character translations in the log file. Binary mode on a Windows operating system writes the log file in a UNIX-compatible format.

path The path specifies the name and location of a log file. There is no default value, because the value of the log_id parameter takes precedence. The directory portion of this path must exist. The log file is created if it does not already exist.

queue_size There is a delay between events being placed on the queue and the file log agent removing them. The queue_size parameter specifies the maximum size to which the queue is allowed to grow. If the maximum size is reached when a new event is ready to be placed on the queue, the requesting thread is blocked until space is available in the queue. This process has the effect of

throttling back performance of the event propagation thread to the speed of the file logging thread if it cannot keep up. Limiting the queue size for the log agent should be configured in conjunction with setting the queue size for the central event propagation queue. Unless the event propagation defined by the queue_size parameter is constrained appropriately, memory usage can still grow without bounds. The default value is 0. Specifying a value of 0 indicates that no limit is enforced on the growth of the unprocessed event queue. Correspondingly, the event propagation thread is not constrained by the speed of the logging thread. Using the default can result in the unrecorded event queue growing to an unmanageable size, if events are being generated faster than they can be recorded to file.

rollover_size Configure the rollover_size parameter to specify the maximum size to which a log file can grow. The default value is 2000000 bytes. When the size of a log file reaches the specified value, known as its r*ollover threshold*, the existing file is backed up to a file of the same name with the current date and time stamp appended. A new log file is then started. The various possible rollover size values are interpreted as follows:

- If the rollover_size value is less than zero, a new log file is created with each invocation of the process and every 24 hours from that instance.
- If the rollover_size value is equal to zero, the log file grows until it reaches 2 GB and then rolls over. If a log file already exists at startup, new data is appended to it.
- If the rollover_size value is greater than zero, the log file grows until it reaches the lesser of the specified value or 2 GB and then rolls over. If a log file already exists at startup, new data is appended to it.

Parameters for pipe log agents

The parameters flush_interval, hi_water, and queue_size can be defined for pipe log agents and are similar to those specified for file log agents. An additional parameter can be configured for pipe log agents:

path Configure the path parameter to specify the location of the program to receive the log output as standard input. There is no default value.

Parameters for remote log agents

Configure the remote log agent to send events to a remote authorization server for recording. The following parameters can be defined for remote log agents:

buffer_size To reduce network traffic, events are buffered into blocks of the nominated size before relaying to the remote server. The buffer_size parameter specifies the maximum size message that the local program attempts to construct by combining smaller events into a large buffer. Buffers consist only of an integral number of events; events are not split across buffers. If any individual event exceeds that maximum configured size, the large event is sent in a buffer of its own, exceeding the configured value. The default value is 1024 bytes.

compress Tivoli Access Manager events are principally text messages. To reduce network traffic, use the compress parameter to compress buffers prior to transmission and expand on reception. The default value is no.

dn To establish mutual authentication of the remote server, a distinguished name (DN) must be configured that can be checked against the name returned in the remote servers certificate. The default value is a null string. Explicitly specifying an empty string or using the default value enables the logging client to request a remote server connection with any server that is listening. Specifying a value for the dn parameter limits successful connection to a specific server, such as: `dn="cn=ivacld/timelord.testnet.tivoli.com,o=policy director,c=us"` A distinguished name must be specified as a string that is enclosed by double quotation marks.

error If a send to a remote service fails, it is retried after waiting for the error retry time out in seconds. If the retry also fails, the link is recorded and this event and future events are saved in the local event cache file until the remote service is rebound. The default value is 2 seconds.

flush_interval If events are being consolidated into very large buffers and there is not much logging activity, events can sit in memory for a long time before being forwarded to the remote server or being written to the cache file. The flush_interval parameter limits the time a process waits to fill a consolidation buffer. The default value is 20 seconds. A flush interval of 0 is not allowed. Specifying a value of 0 results in the buffer being flushed every 600 seconds.

hi_water The hi_water parameter for a remote logging connection is similar to that specified for logging to a file.

path Configure the path parameter to specify the location of a cache file on the local host. The cache file name defaults to `./server.cache`, where *server* is the name of the remote server being logged to. If the running process cannot establish communication with the remote server, or the link fails during operation, event recording switches to storing events in the specified file until the server again becomes available. When the server is available, events are drained from the disk cache and relayed to the remote server.

port Configure the port parameter to specify the port that the remote authorization server listens on for remote logging requests. The default value is port 7136.

queue_size The queue_size parameter for a remote logging connection is similar to that specified for logging to a file.

rebind_retry If the remote authorization server is unavailable, the log agent attempts to rebind to this server at this frequency in number of seconds. The default rebind retry time out value is 300 seconds.

server The remote logging services are offered by the authorization service. The server parameter nominates the hosts to which the authorization server process is bound for event recording.

6.1.2 Auditing using logaudit

WebSEAL and Plug-in for Web Servers continue to support audit logging using the logaudit entries and related entries in the `[aznapi-configuration]` stanza.

This approach uses the following stanza entries under `[aznapi-configuration]`:

logaudit Has value *yes* or *no*. Yes enables auditing for the server.

auditlog Specifies the location of the audit trail file.

auditcfg Defines what event categories are captured in the logs.

logsize The value for the logsize stanza entry specifies the maximum size to which each of the audit trail files can grow and is initially configured with the value 2000000 (in bytes). Depends on the value; behavior is similar to rollover_size parameter in the log file agent.

logflush Defines frequency with which the server forces a flush of the audit trail file buffers. Depends of the value; behavior is similar to flush_interval parameter in the log file agent.

This approach is comparable to the logcfg entry with a file agent. For example, to capture authentication events, the configuration file entries could be set as follows:

```
[aznapi-configuration]
logaudit = yes
auditcfg = authn
auditlog = /var/pdweb/log/audit.log
logsize = 2000000
logflush = 20
```

If you are still using the logaudit approach, consider using either the logcfg approach or the Common Auditing Service. The logcfg approach provides additional configuration options, such as buffer size and event queues, and the ability to use the console, pipe, and remote log agents.

6.1.3 WebSEAL HTTP logging

WebSEAL maintains the following HTTP log files that record HTTP activity:

request.log The request.log records HTTP request information, such as the URL that was requested and client data (for example, IP address).

agent.log The agent.log file records the contents of the User_Agent: header in the HTTP request. This log reveals information about the client browser, such as architecture or version number, for each request.

referer.log The referer.log records the Referer: header of the HTTP request. For each request, the log records the document that contained the link to the requested document. The log uses the following format:
referer $\rightarrow$ *object*
This information is useful for tracking external links to documents in your Web space. The log reveals that the source indicated by referer contains a link to a page (object). This log allows you to track stale links and to find out who is creating links to your documents.

By default, these log files are located in the following directory:

- Linux and UNIX operating systems /var/pdweb/www-default/log
- Windows operating systems C:\Program Files\Tivoli\PDWeb\www-default\log

Note: When you configure WebSEAL (or any other Access Manager component) you are being asked if you want to use *Tivoli common logging*. If you decide to opt for this common logging feature your WebSEAL log files will be located at C:\Program Files\IBM\tivoli\common\DPW\logs\www-default\log.

Stanza entries for configuring traditional HTTP logging are located in the `[logging]` stanza of the WebSEAL configuration file. By default, HTTP logging is enabled in the WebSEAL configuration file and configuration looks like:

```
[logging]
requests = yes
referers = yes
agents = yes
```

Along with these options, there are a couple more that can be defined in the `[logging]` stanza:

gmt-time — The value can be *yes* or *no*. *Yes* specifies that timestamps in each HTTP log file be recorded in Greenwich Mean Time (GMT) instead of the local time zone. By default, the local time zone is used (value is set to *no*).

max-size — Specifies the maximum size to which each of the HTTP log files can grow. Default value in bytes is 2000000. Depends on the value; behavior is similar to the rollover_size parameter in the log file agent.

flush-time — Specifies the frequency with which the server forces a flush of the log file buffers. Depends on the value; behavior is similar to the flush_interval parameter in the log file agent.

When using virtual hosts, you can use the following configuration parameters in the `[logging]` stanza to distinguish between requests that are to different virtual hosts:

```
[logging]
host-header-in-request-log = {yes | no}
absolute-uri-in-request-log = {yes | no}
```

When you enable the host-header-in-request-log entry in the configuration file, the log contains the header at the front of each line in the request log and in the combined log.

When you enable the absolute-uri-in-request-log entry in the configuration file, the log contains the absolute URI. This information is included in the request log, the combined log, and HTTP audit records.

6.1.4 XML output of native audit events

When using native Tivoli Access Manager auditing, audit events are captured in the audit trail in a standard format using the Extensible Markup Language (XML) elements. XML is only an intermediary step to delivering a presentation view of the data. The XML file is in ASCII format and can be read directly or passed to other external parsing engines for further analysis.

An entire audit trail does not represent a single XML document. Each audit event within the file is written as an isolated XML data block. Each data block conforms to the rules of standard XML syntax.

6.2 Common Auditing and Reporting Service

Access Manager can be configured to send audit data to existing file-based audit subsystem, the Common Auditing and Reporting Service (CARS), or both. The Common Auditing and Reporting Service subsystem transports and stores audit events to a common audit database that can be used to support operational reports from Crystal Enterprise or any other reporting tool. Common Auditing and Reporting Service also provides the capability to stage audit data to customizable report tables.

6.2.1 Audit infrastructure

An audit infrastructure provides the mechanisms to submit, centrally collect, and persistently store and report on audit data, and it satisfies the previously mentioned requirements to manage audit data. The IBM Tivoli Common Auditing and Reporting Service component leverages the *Common Base Event* and the technologies to provide an audit infrastructure.

The Common Base Event is a common format for events proposed by IBM and submitted to the Organization for the Advancement of Structured Information Standards (OASIS) for standardization. (For more information on OASIS, see `http://www.oasis-open.org`.)

The purpose of the Common Base Event is to facilitate effective intercommunication among disparate components within an enterprise. In order to effectively process audit data, it needs to be in a standard format, and the Common Auditing and Reporting Service component requires the audit data to be in the Common Base Event format.

The Common Event Infrastructure (CEI) is an IBM strategic event infrastructure for submission, persistent storage, query, and subscription of Common Base Events. The Common Auditing and Reporting Service component uses the CEI

interfaces for submission of events. Such events can be denoted as auditable using configuration options at the CEI server, in which case CEI stores them in a CEI XML event store that meets the auditing requirements described previously.

The Common Auditing and Reporting Service component allows staging of data from the CEI XML event store into report tables. IBM products and customers can provide audit reports based on auditable events staged into such report tables. The Common Auditing and Reporting Service component also supports the lifecycle of auditable events, including archive, restore, and audit reports on restored archives. It enables common reporting against auditable events from different products and sources.

The first release of the Audit Infrastructure delivered by the IBM Tivoli Common Auditing and Reporting Service is used by the Access Manager for e-business product for submitting, storing, and reporting auditable security events.

Archiving and restoring audit data

The relational database schema of the CEI XML event store is externalized so the audit data stored in it can be archived by customers using third-party archival tools of their choice. The Common Auditing and Reporting Service provides an XML store utility that aids customers in archiving and restoring audit data. Also, the Common Auditing and Reporting Service supports staging of restored audit data into report tables so that audit reports can be run against restored audit data.

Securing audit data

CEI emitter event interfaces are protected using J2EE declarative security to ensure that only authenticated and authorized entities are allowed to use them. Transmission of the Common Base security events to the CEI server can be secured using SSL. Customers can protect access to the audit reports by using the access control mechanism supported by the reporting tools. Customers also need to protect the Common Auditing and Reporting Service XML event store and the report tables using the access mechanisms provided by the database.

6.2.2 Reporting

The operational reports feature of the Common Auditing and Reporting Service provides a number of compiled reports that provide information about security-related activities that occur on your system.

The compiled Crystal Reports provided with Common Auditing and Reporting Service include audit event history, password change activity, authentication event history, authorization event history, event details, resource access, and

server availability reports. The compiled reports format allows you to run reports without having the Crystal Reports Designer installed on the system.

The following out-of-the-box reports are available:

- General Audit Event Details Report

  Displays all information about a single auditable event denoted by the event reference ID parameter. Typically a user will run this report after running other reports and deciding an event drill down is desired.

- General Audit Event History

  Displays the total number of auditable events for each event type during a specified time period. It also shows all events of the specified event type and product name sorted by specified sort criterion and time stamp. This report can be used for incident investigation and assuring compliance.

- Audit Event History by User

  Displays total number of events for a specified user during a specified time period. It also presents a list of all events of the specified event type and product name sorted by time stamp and grouped by session ID during the time period. The purpose of this report is to investigate activity of a particular user during a specified time period.

- Failed Authentication History

  Presents a list of all failed authentication events over the time period sorted by specified sort criteria such as timestamp. This report can be used by an administrator to investigate security incidents.

- Failed Authorization History

  Lists all of the failed authorizations events during a specified time frame.

- Locked Account History

  Displays all of the accounts that have been locked during a specified time period.

- User Password Change History

  Displays events related to password changes done by the users themselves during a specified time period.

- Administrator and Self-Care Password Change History

  Displays events related to password changes done by the user and the administrator during a specified time period.

- Server Availability Report

  Shows the availability status of Security servers on a specific machine. The user can display all protected machines in the report or limit the report by entering a single hostname as the subject of the report.

- Certificate Expiration Report

  Allows detection of soon-to-expire certificates and highlights the need to replace the certificate to insure 24/7 operability. It shows the number of clients that have server/SSL certificates that expire in ‘x’ days. It will also show a table of client hostnames, the days until their certificates expire, and the server they are configured to.

- Most Active Accessors Report

  Shows a list of users who are the most active in the system, and can lead the administrators to investigate improper use of their resources.

- General Authorization Event History

  Displays the total number of authorization events, failed authorization events, successful authorization events and unauthenticated events during the specified time period. Additionally it shows list of all authorization events sorted by specified sort criteria (timestamp, resource, or user name) during the time period. The purpose of this report is to analyze authorization event history for incident investigation and assuring compliance.

- Authorization Event History by Action

  Displays a list of all authorization events that contain the specified action sorted by resource and then time stamp during the time period specified.

- General Administration Event History

  Shows the history of general management actions done over a specified time interval. The administrator can use the report to track the actions of a user for administrative events.

- User Administration Event History

  Can be used to investigate security incidents, and to track changes to users by administrators.

- Group Administration Event History

  Can be used to investigate security incidents and to track changes to groups by administrators.

- Security Server Audit Event History

  Presents a list of auditable events related to security servers that occurred during the specified time period.

- Resource Access By Accessor Report

  Shows the top resources in terms of access/authorization events during a time period for each machine name identified. The report identifies who is repeatedly accessing resources and what resource is being accessed.

- Resource Access By Resource Report

  Shows the top accessors in terms of access/authorization events during a time period for each machine name identified. The report identifies which resources are most heavily accessed and which user is accessing the resource.

6.2.3 Common Auditing and Reporting Service configuration

Figure 6-1 on page 213 shows the major components of the Common Auditing and Reporting Service model:

- Common Event Infrastructure (CEI)
- Clients
- Operational reports

The Common Auditing and Reporting Service event infrastructure runs on top of IBM WebSphere Application Server and contains three separate applications:

- Common Audit Service
- EventServer
- EventServerMdb

When using the Common Auditing Service, you need to configure the server-specific Common Auditing Service client to record specific audit events. Depending on the type of Access Manager services, there are two auditing clients, namely the Java client and C (or native) client. The Java client and C client are referred to as the Java API and C API, respectively.

As part of the server installation you can install the operational reports. The operational reports provide information that you can use to analyze security events that might have occurred.

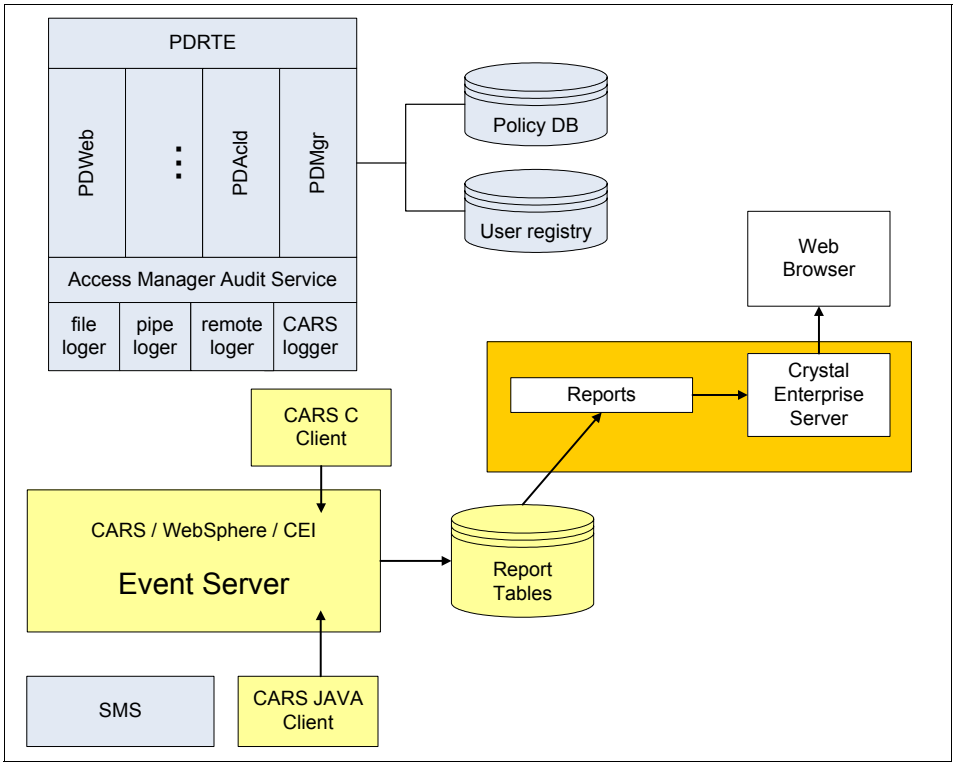


Figure 6-1 Common Auditing and Reporting Service architecture

Installing the event server

At a high level, the steps to install the event server are the following:

1. Install the prerequisite products
   - IBM DB2 Server
   - WebSphere Application Server
2. Review the preinstallation checklist for UNIX, Linux, or Windows operating system that includes verification of valid user and group permissions, and validate the DB2 and WebSphere Application Server environment.
3. Determine the installation options.
4. Install the event server using either the interactive or silent installation.

After successful installation, the Common Auditing and Reporting Service event server offers two utilities that can be executed:

- The staging utility
- The XML store utilities

These utilities can be executed with a different set of options placed in the *ibmcars.properties* configuration file. The ibmcars.properties file is located in CARS_HOME\server\etc

As a prerequisite for these commands, the CLASSPATH environment variable for the staging and event store utilities must be set.

Staging utility command

The *staging utility* provides staging of the data from the XML event store to the staging tables. You can stage data in the following modes:

- Incremental
- Historical
- Prune

Use the following command syntax for the staging utility:

```
java com.ibm.cars.staging.Staging -mode historical -starttime value
-endtime value
java com.ibm.cars.staging.Staging -mode incremental
java com.ibm.cars.staging.Staging -mode prune -prunetime value
```

These commands may contain additional optional parameters. For the parameters that are not specified on the staging utility command line, their values will be used according to what is set in the ibmcars.properties file. The parameters that you set on the command line will override any value you have set in the ibmcars.properties file.

XML data store utilities

The *XML event store utilities* provide tools to help you manage the XML event store in preparation for archiving, and to clean up restored data that is no longer needed. There are three types of operations that the XML utilities can perform:

- Pre-archive
- Post-archive
- Clean restore table set

Use the following command syntax for each of the XML event store utilities:

```
java com.ibm.cars.xmlstoreutils.XmlStoreUtils -operation prearchive
java com.ibm.cars.xmlstoreutils.XmlStoreUtils -operation postarchive
[-mode force] [-copydir value]
java com.ibm.cars.xmlstoreutils.XmlStoreUtils -operation cleanrestore
[-mode force]
```

Again, for the optional parameters that are not specified on the XML event store utility command line, their values will be used according to what is set in the

ibmcars.properties file. The parameters you set on the command line will override any value you have set in the ibmcars.properties file.

Pre-archive operation

Use the pre-archive operation prior to archiving data from the XML event store tables. The pre-archive operation prints out the data needed for archiving, such as:

- The names of the XML event store tables to archive.
- The first date contained in the table set to be archived. For example: Jan 1, 2005 5:30:00 AM.
- The last date contained in the table set to be archived. For example: Jan 2, 2005 3:42:03 PM.

Post-archive operation

Use the post-archive operation after archiving from the XML event store tables is completed. This operation removes the data from the inactive XML event store tables. The post-archive operation prompts for confirmation that the data may get purged from the XML event store table set. For silent mode operation, specify *–mode force*, which will force the post-archive operation without a confirmation prompt.

Post-archive performs the following actions:

- Purges the data from the target XML event store table set.
- Updates the cei_t_properties table with the current active bucket number, wherein the value is swapped from 0 to 1 and vice versa.

The events that are purged from the XML event store table set are not available for drill-down reporting. Prior to running the post-archive operation, the staging utility prune operation should be used to remove the operational report table data for events ranging within the begin date and the end date as provided by the pre-archive operation.

Clean restore table set operation

Use the clean restore table set operation when the events in the restore table set are no longer required. The clean restore table set operation prompts for confirmation that the data in the restore table set will be cleaned and no longer available.

For silent mode operation, specify `–mode force`, which will force the cleaning of the restore table set without a confirmation prompt. If you need archived XML event store events for reporting purposes, then restore the events into a restore table set (cei_t_xmlre and cei_t_xmlxre). The restore table set is recognized by the staging utility as a source for generating operational report tables.

Note: Make a note of the first and last time stamp because you will need this information when you want to *prune* the report tables. When you run the XMLStoreUtils program for the first time, you will get an exception since there is no data to archive.

The settings for the XML event store utility parameters are determined as follows:

1. The XML event store utility settings specified on the command line.
2. The settings in the ibmcars.properties file.
3. The default settings in the code.

Common Auditing and Reporting Service client

When using the Common Auditing Service, you need to configure the server-specific Common Auditing and Reporting Service client to record specific audit events. The installation of the client involves the following steps:

1. Install the prerequisite products.
   IBM Java Version 1.4.2 is required before installing the client.

   The following software is required for the C client:

   – Global Security Kit (GSKit)
   – Tivoli Security Utilities

   The WebSphere Application Server software is required for the Java client.
2. Review the pre-installation checklist.
3. Determine the installation options.
4. Install the client using either the interactive or silent installation.

Configuring the C client

To send events to the Common Auditing Service event server, the Common Auditing Service client needs to be configured on the Tivoli Access Manager server. To configure the Common Auditing Service client, use the *amauditcfg* utility. The amauditcfg utility generates the Access Manager server-specific auditing configuration files. After these files are generated, you can use the **pdadmin config modify** command to modify configuration settings. The following invocation is the simplest way of using the amauditcfg utility to configure a Tivoli Access Manager server:

```
amauditcfg -action config -srv_cfg_file configuration_file
-audit_srv_url url
```

Running the amauditcfg utilities generates the following configuration files to control the configuration of the Common Auditing Service C clients:

pdaudit.pdmgr.conf Used to configure the Common Auditing Service for the Tivoli Access Manager Policy Server

pdaudit.pdproxymgr.conf Used to configure the Common Auditing Service for a Tivoli Access Manager Policy Proxy Server

pdaudit.pdacld.conf Used to configure the Common Auditing Service for the Tivoli Access Manager authorization server

pdaudit.instance-webseald-host.conf Used to configure the Common Auditing Service for a specific instance of a Tivoli Access Manager WebSEAL server

pdaudit.webpi.conf Used to configure the Common Auditing Service for a Tivoli Access Manager Plug-in for Web Servers

pdaudit.appsvr.conf Template configuration file used to configure the Common Auditing Service for any Tivoli Access Manager resource managers

All those configuration files have a [cars-client] stanza with an appropriate set of attributes. To change a setting in a configuration file, use the **pdadmin config modify** command. Do not change the contents of any configuration file in an ASCII editor.

To start Common Auditing Service auditing, set the *doAudit* entry to *yes* in the [cars-client] stanza of the server-specific configuration file:

```
pdadmin> config modify keyvalue set config_file cars-client doAudit yes
```

For example to enable Common Auditing Service auditing for an AIX-based Policy Server, enter the following command:

```
pdadmin> config modify keyvalue set \
/opt/PolicyDirector/etc/audit/pdaudit.pdmgr.conf cars-client doAudit
yes
```

After enabling event auditing, you can add events to be forwarded to the Common Auditing Service server. To add an event, append an auditevent entry with the new event type to the [cars-filter] stanza of the server-specific configuration file. Modification should be made using pdadmin CLI command:

```
pdadmin> config modify keyvalue append config_file cars-filter
auditevent type
```

For example, to add runtime event auditing for an AIX-based Policy Server, enter the following command:

```
pdadmin> config modify keyvalue append \
/opt/PolicyDirector/etc/audit/pdaudit.pdmgr.conf cars-filter auditevent
runtime
```

To remove an event, remove the auditevent entry for that event type from the [cars-filter] stanza of the server-specific configuration file. To make the modification use the pdadmin CLI command:

```
pdadmin> config modify keyvalue remove config_file cars-filter
auditevent type
```

For example, to remove the authorization event auditing from an AIX WebSEAL server, enter the following command:

```
config modify keyvalue \ remove
/opt/PolicyDirector/etc/audit/pdaudit.default-webseald-aix.ibm.com.conf
\ cars-filter auditevent authz
```

Configuring the Java Client

For Tivoli Access Manager, the only Java-based server is the Session Management Server. To record audit events for the Session Management Server, you send the events to the event server of the Common Auditing Service. You cannot use native Tivoli Access Manager auditing with the Session Management Server.

To use Common Auditing Service with the Session Management Server, you need to perform the following tasks:

- Modify the SMSAuditClient.properties file so that the Java client of the Common Auditing Service can talk with the event server and know which event to record.
- When using Java 2 security, modify the WebSphere library.policy file.
- Enable the DSess Session Management Server application on the WebSphere node to use the shared libraries of the Common Auditing Service using either the smscars utility or the WebSphere administrative console.

Running the smscars utility creates the SMSAuditClient.properties properties file. The properties file is stored in one of the following operating system specific locations as SMSAuditClient.properties.template:

- Linux and UNIX operating systems
  /opt/pdsms/etc
- Windows
  C:\Program Files\Tivoli\PDSMS\etc

The Common Auditing Service library requires a number of permissions. The Session Management Server cannot grant permissions to the Common Auditing Service library through the was.policy file that is provided by the Session Management Server. Because the Session Management Server accesses the Common Auditing Service library as a shared library, the Session Management Server needs to grant permission using the WebSphere library.policy file on each cluster member. Because it is difficult to configure a Java 2 security file, use the *policytool* utility that is provided by the Java Runtime Environment.

After installing the Common Auditing Service and the Session Management Server, you can enable the Session Management Server to send auditing events to the Common Auditing Service. You can enable the Session Management Server to send events to the Common Auditing Service event server from either the command line or with the WebSphere administrative console. For a WebSphere single server deployment, use the command line smscars utility. For a WebSphere cluster deployment, use the WebSphere administrative console.

Operational reports

Before you run the reports, you must have the operational reports feature of the server installed and configured on the system that the reports will run on.

Before installing the operational reports, you need to install other software products. The following software is required for the operational reports:

- DB2 client
- Crystal Enterprise Server
- HTTP Server

Install the operational reports only on a machine that has Crystal Enterprise Server installed. Also, verify that the Crystal Enterprise Server is running before installing the operational reports. An IBM Java Version 1.4.2 is required to run the Common Auditing and Reporting Service server installer.

The Common Auditing Service contains compiled reports created using the Compiled Reports feature of the Crystal Reports Designer program. The Compiled Reports format allows you to run reports without having the Crystal Reports Designer installed on the system. Note that you must purchase and install the Crystal Reports Designer if you want to create or edit Crystal Reports. The compiled Crystal Reports provided with Common Auditing Service include data related to:

- Audit events
- Authorization events
- Certificate expiration
- Administration events
- Server availability

- Password changes
- Resource access
- Trust service and security token service

Running operational reports

After installing the operational reports, you can either run the reports on demand or schedule one or more reports to run on a routine basis using the Crystal Enterprise Launchpad. Before running any of the operational reports, verify that you configured ODBC and the DB2 client.

Before running the General Audit Event Details Report, verify that you have installed the Java stored procedure on the DB2 server.

Creating custom reports

The Common Auditing and Reporting Service provides a set of operational reports created with Crystal Enterprise to analyze audit data in the XML data store. The operational reports draw upon a specific subset of the audit data which is staged into a set of reporting tables. These predefined reports may not meet all user reporting requirements, so Common Auditing and Reporting Service provides a procedure for defining the subset of data that is staged into the reporting tables. Custom reports can then be created to analyze the custom subset of data staged into the reporting tables.

Any reporting tool that queries data from a DB2 database is supported. As custom reports are developed, the event types and specific elements of each event type that are of interest need to be identified. This subset of the audit data will be staged into the report tables by the Common Auditing and Reporting Service staging utility, which relies on a configuration file, *CARSShredder.conf*, to determine exactly what data to stage. This configuration file must be replaced and the CARSShredder.conf.custom.template updated to reflect the subset of data needed for the custom reports. The event-specific report tables created during Common Auditing and Reporting Service event server installation are meant to support only the predefined operational reports. Additional report tables may need to be created to hold data for custom reports. The staging utility can stage custom data into these newly defined table.

6.3 Troubleshooting techniques

Problem determination, or troubleshooting, is a process of determining why a product is not functioning in the expected manner. Tivoli Access Manager provides ways to collect events that you can use for diagnostic and auditing purposes of the servers. Events for diagnostics and auditing pertain to the operations of the Tivoli Access Manager servers. These events do not pertain to

the installation of these servers. During the installation of the Tivoli Access Manager servers, the installation logs capture all messages for that specific installation. When using the installation wizard, each server has its own log file. When using a native installation, the installation uses its operating-system-specific logs.

For diagnostics, you define which message events and which trace events to capture. These events can help you troubleshoot problems. To configure diagnostic events, you define statements in the server-specific routing files. Each server has an associated routing file. The statements in these routing files are for both message events and trace events. You define the statements for message events by severity level. You define the statements for trace events by trace level and optionally by component. This guide contains information about the message and trace events.

6.3.1 Routing files

Routing files are ASCII files that you can use to customize the logging of message and trace events for C-language-based servers, daemons, and other C language programs and applications. The contents of routing files allow you to control the following aspects of event logging:

- Whether to enable logging for specific event classes
- Where to direct the output for each event class
- How many log files to use for each event class
- How large each log file can be for each event class

Every Access Manager component has its own name for the routing file, and all routing files are placed by default under:

```
<TAM_install_root>/etc/routing
```

Format of routing files

Each routing file contains entries that control the logging of message events and trace events. However, the format of these entries differs by event type.

- Message events

```
severity:destination:location [[;destination:location]...]
[;GOESTO:{other_severity | other_component}]
```

- Trace events

```
component:subcomponent.level[[,subcomponent.level]...]
:destination:location [[;destination:location]...] [;GOESTO:{other_severity
| other_component}]
```

The parameters in these entries have the following meanings:

component:subcomponent.level[[,subcomponent.level]...]

Specifies the component, subcomponents, and reporting levels of trace events to log. For trace events only.

- For the component portion, you can specify an asterisk (*) to log trace data for all components.
- For the subcomponent portion, you can specify an asterisk (*) to log trace data for all subcomponents of the specified component.
- For the level portion, specify the reporting level to log. This value is a number between 1 and 9. A level of 1 indicates the least amount of details, and a level of 9 indicates the greatest amount of details.

destination

Specifies where to log the events. For each destination, you need to specify a location. When specifying multiple destination-location pairs, separate each pair with a semicolon (;). The following destinations are valid:

DISCARD Discards the events.

FILE Writes the events as ASCII text in the current code page and locale to the specified location. When using this destination, you must specify a location for the file. Optionally, you can follow the FILE destination by a period and two numbers that are separated by a period (for example, FILE.10.100). The first value indicates the number of files to use. The second value indicates the number of events each file can contain. If you do not specify these values, there is only one log file that grows without limit. The average size of an ASCII event is 200 bytes. Because the maximum size of a log file is 2 GB, the maximum number of events should be limited to approximately 10,000,000 events.

STDERR Writes the events as ASCII text in the current code page and locale to the standard error device.

STDOUT Writes the events as ASCII text in the current code page and locale to the standard output device.

TEXTFILE Same a FILE.

UTF8FILE It has similar behavior to FILE, but it writes the events as UTF-8 text to the specified location. The average size of a UTF-8 event is also 200 bytes. When the operating system does not use a UTF-8 code page, the conversion to UTF-8 can result in data loss. When data loss occurs,

the log file contains a series of question mark (?) characters at the location where the data conversion was problematic.

XMLFILE Writes events to the specified location in the Tivoli XML log format. When using this destination, you must specify a location for the file. Optionally, you can follow the XMLFILE destination by a period and two numbers that are separated by a period (for example, XMLFILE.10.100). The first value indicates the number of files to use. The second value indicates the number of events each file can contain. If you do not specify these values, there is only one log file that grows without limit. The average size of an XML message event is 650 bytes, and the average size of an XML trace event is 500 bytes. Because the maximum size of a log file is 2 GB, the maximum number of events should be limited to approximately 3,000,000 message events or 4,000,000 trace events.

XMLSTDERR Writes events to the standard error device in the Tivoli XML log format.

XMLSTDOUT Writes events to the standard output device in the Tivoli XML log format.

GOESTO:{other_severity | other_component}]

Specifies that events should additionally be routed to the same destination and location as either message events of the specified severity or trace events of the specified component.

location

Specifies the name and location of the log file.

When the destination is TEXT, TEXTFILE, UTF8FILE, or XMLFILE, you must specify a location.

When the destination is DISCARD, STDERR, STDOUT, XMLSTDERR, or XMLSTDOUT, you must specify a hyphen (-).

severity

Specifies the severity of the message events to log. For message events only. The following message severities are valid:

- FATAL
- ERROR
- WARNING

- NOTICE
- NOTICE_VERBOSE

You can specify an asterisk (*) to log messages regardless of severity.

6.3.2 Java properties files

Java properties files are ASCII files that are used to customize event logging for Java-based Tivoli Access Manager servers, daemons, and other Java-language programs and applications.

Beyond customizing logging, these properties files are used to configure other aspects of the application. The content of the properties file enables the user to control the following aspects of message logging:

- Whether event logging is enabled
- Where the output should be directed
- If the output is to a file, the number of files to use and the size of each file

The default locations for the Java properties files for Tivoli Access Manager components are shown in Table 6-1.

Table 6-1 Location of Java properties files

Component	Default file name
Java application configured using the com.tivoli.pd.jcfg.SvrSslCfg class.	The output application configuration file as specified in the com.tivoli.pd.jcfg.SvrSslCfg class.
Java-based Tivoli Access Manager commands, such as the pdjrtecfg command and com.tivoli.pd.jcfg.SvrSslCfg or applications not explicitly configured.	$JAVA_HOME/PolicyDirector/ PDJLog.properties[a]
Web Portal Manager	<TAM install root>\java\export\ pdwpm\pdwpm.properties
Tivoli Access Manager for WebLogic Server	$JAVA_HOME/amwls/wls_domain_name/ wls_realm_name/amwlsjlog.properties

a. pdjrtecfg command creates PD.properties file that stores the result of a successful configuration. PDJlog.properties file is used just for logging purposes.

To summarize, PDJLog.properties is used to define message and trace logging properties in the following cases:

- For non application-related Java commands, such as pdjrtecfg and com.tivoli.pd.jcfg.SvrSslCfg.

- If a Java application was not explicitly configured with the com.tivoli.pd.jcfg.SvrSslCfg command.
- If the application-specific properties file is inaccessible or does not exist.
- If a required property in the application-specific properties file is not found.

Format of trace events with the Java properties file

To capture trace events for Java applications, you need to configure the Java properties file defining trace loggers and file handlers.

Trace loggers

Each properties file contains properties for one or more trace loggers. The isLogging property specifies whether trace logging is enabled.

To turn tracing on for a specific trace logger, use:

```
baseGroup.trace_logger_name.isLogging=true
```

To disable logging for a specific trace logger, use:

```
baseGroup.PDJapp_nameTraceLogger.isLogging=false
```

File handlers

Associated with each trace logger is at least one file handler. A file handler specifies the destination for a specific class, or severity, of messages. After trace logging is enabled by the trace logger, the file handler properties are examined to determine if traces should be logged and, if so, how and where.

The properties for a file handler are:

```
baseGroup.PDJapp_nameTraceFileHandler.fileName=
baseGroup.PDJapp_nameTraceFileHandler.maxFileSize=
baseGroup.PDJapp_nameTraceFileHandler.maxFiles=
```

The meanings of the handlers are the following:

fileName	Specifies the fully qualified file name to be used as the base name for trace log files. The file can be in any location accessible by the Java application.
maxFileSize	Specifies the maximum size, in KB, of each trace log file. Default is 512.
maxFiles	Specifies the maximum number of files to be used for trace logging. Default is 3.

6.3.3 Message event logging

The contents of log files can be useful sources of information when monitoring or troubleshooting Tivoli Access Manager servers. You can use log files to capture any Tivoli Access Manager message. Message logging for the C language portions of Tivoli Access Manager is controlled through routing files. Similarly, message logging for the Java language portions is controlled through Java properties files.

Use the statements within routing files to control which messages to log, the location of the log files, and format of the messages. This chapter describes the configuration syntax used in the routing files and defines the default file name and location of the message log files. The directory location for message log files can be different, depending on whether Tivoli Common Directory is configured.

Tivoli Common Directory

To provide a consistent mechanism for locating serviceability information, Tivoli Access Manager provides the ability to use Tivoli Common Directory logging. Tivoli Access Manager needs to be enabled during the installation of the product.

By default, serviceability information is stored in the /log subdirectory of the product installation directory. If Tivoli Common Directory support is requested, the installation wizard uses the existing Tivoli Common Directory as the default location for serviceability information.

If no existing Tivoli Common Directory is in use, the directory specified during the installation is identified as the Tivoli Common Directory and serviceability information for Tivoli Access Manager and other Tivoli products is stored there.

When Tivoli Common Directory is enabled, all message log files are in this central location. Other types of application log files continue to be located in their installation directories. After enabling Tivoli Common Directory, Tivoli Access Manager uses the /logs subdirectory to store message and trace logs. The logs files can be found at the following default location:

```
common_directory/yyy/logs/
```

The syntax rules are as follows:

- **common_directory**

  Represents the parent directory for serviceability data. This directory is usually defined by the first Tivoli product that uses Tivoli Common Directory. The default values, if Tivoli Access Manager is the first Tivoli product, is one of the following platform-specific directories:

  – Linux and UNIX operating systems
    `/var/ibm/tivoli/common`

– Windows operating systems
`c:\program files\ibm\tivoli\common\`

- **yyy**

  Represents the 3-letter identifier to use for the product-specific message log files. Tivoli Access Manager uses the identifiers described in Table 6-2.

Table 6-2 Tivoli Access Manager identifiers

HPD	The identifier for Tivoli Access Manager
DPW	The identifier for Tivoli Access Manager WebSEAL
AMZ	The identifier for Tivoli Access Manager Plug-in for Web Servers
AWL	The identifier for Tivoli Access Manager for WebLogic Server
AWD	The identifier for Tivoli Access Manager Plug-in for Edge Server
CTG	Tivoli Access Manager Shared Session Management

- **logs**

  The subdirectory that is used for Tivoli Access Manager message and trace log files. Only one subdirectory, /logs, is defined for these log files.

Note: After defining the Tivoli Common Directory location, you cannot change it. If Tivoli Access Manager is the first Tivoli product on this system to use Tivoli Common Directory, you can change this location. However, if another product already defined the location, this location is displayed and you cannot change it.

Severity of message events

In the message log file, each message event has an associated severity level. The following message severities are valid:

FATAL The identifier for these messages uses the error (E) message severity.

ERROR The identifier for these messages uses the error (E) message severity.

WARNING The identifier for these messages uses the warning (W) message severity.

NOTICE The identifier for these messages uses the information (I) message severity.

NOTICE_VERBOSE The identifier for these messages uses the information (I) message severity.

If Tivoli Common Directory is not used, the message logs are located in the directories specified in Table 6-3 on page 228.

Table 6-3 Location of message log files without Tivoli Common Directory

Component	Default log location

Runtime environment Policy server Authorization server Policy proxy server	Windows
	`base_install_dir\log`
	Linux and UNIX
	`/var/PolicyDirector/log`

WebSEAL server	`$PD_WEB/log`
Plug-in for Web Servers	`$PD_WEBPI/log`
Attribute retrieval service	`$WAS_HOME`

Plug-in for Edge Server	Windows
	`edgepi_install_dir\cp\logs`
	Linux and UNIX
	`/var/ibm/edge/cp/server_root/logs`

WebLogic Server	`$BEA_HOME/user_projects/server_name`

Message types

Tivoli Access Manager is written in both the C and Java programming languages. Applications that use the Tivoli Access Manager APIs are also written in these programming languages.

Tivoli Access Manager produces the following types of messages:

- Runtime messages
  Messages that are generated by applications, commands, and utilities that use the Tivoli Access Manager Runtime component, as well as messages that are generated from the C language-based Tivoli Access Manager components, such as WebSEAL. These messages are written to the runtime message logs based on their severity levels.
- Tivoli Access Manager Runtime for Java messages
  Messages that are generated by applications, commands, and utilities that use the Tivoli Access Manager Runtime for Java component, as well as messages that are generated from the Java language-based Tivoli Access Manager components. These messages are written to the Tivoli Access Manager Runtime for Java message logs. These messages tend to provide exception and stack trace information from the JRE.
- Server messages
  Messages that are generated by the Tivoli Access Manager daemons and servers. Messages from the policy server, authorization server, WebSEAL servers, and policy proxy server are written to the server message logs.

- Installation and configuration messages
  Messages that are generated by the InstallShield MultiPlatform installation wizards as well as by the configuration utilities. Some of these messages follow the message standard and have an associated ID.
- WebSEAL HTTP messages
  WebSEAL provides the capability of logging HTTP messages.

Message format

A message consists of:

- A message identifier (ID)
- A message text
- An error code

The error code is a unique 32-bit value. The error code is either a decimal or hexadecimal number and indicates that an operation was not successful.

A message ID consists of 10 alphanumeric characters that uniquely identify the message. The message ID consists of the following parts:

- A 3-character product identifier described in Table 6-2 on page 227
- A 2-character component or subsystem identifier
- A 4-digit serial or message number
- A 1-character (W, E or I) type code indicating one of the message severities described in “Severity of message events” on page 227.

6.3.4 Trace event logging

Tivoli Access Manager provides configurable tracing capabilities that can aid in problem determination. Unlike message logging, trace logging (or tracing) is not enabled by default. Messages from tracing are sometimes cryptic, are not translated, and can severely degrade system performance.

Tracing can be activated when servers, daemons, and applications start by using routing files and Java properties files.

In some cases, tracing can be activated dynamically using the pdadmin utility **`server task trace`** command with the set option.

You can use the trace command to perform the following operations:

trace list	List all available trace components.
trace set	Enable the trace level and trace message destination for a component and its subordinates.

trace show Show the name and level for all enabled trace components or for the specified component.

Enabling trace

The server task trace set command enables the gathering of trace information for the specified component and level. The command has the following syntax:

```
pdadmin > server task server_name–host_name trace set component level \
[file path=file | log_agent]
```

component The trace component name. This required argument indicates the component to be enabled. WebSEAL components are prefixed with pdweb.

level Reporting level. This required argument must be in the range of 1 to 9. The level argument specifies the amount of details that are gathered by the trace command. Level 1 indicates the least detailed output, and level 9 indicates the most detailed output.

file path The fully qualified name of the file to which trace data will be written.

log_agent Optionally specifies a destination for the trace information gathered for the specified component.

6.3.5 Troubleshooting WebSEAL servers

This section details how to enable the capture of events when using Tivoli Access Manager WebSEAL. WebSEAL provides the following components to trace HTTP requests:

- pdweb.debug
- pdweb.snoop

pdweb.debug component

The pdweb.debug component traces the HTTP headers for requests and responses. The pdweb.debug component only operates at level 2. If you want to enable logging of the message body, the pdweb.snoop component needs to be enabled.

The following command invokes the trace utility for the pdweb.debug component at level 2 and directs the output to a file:

```
pdadmin> server task webseald-instance trace set pdweb.debug 2 \
file path=/opt/pdweb/log/debug.log
```

pdweb.snoop component

The pdweb.snoop component traces HTTP traffic. This component logs the HTTP headers and the message body for requests and responses. The pdweb.snoop component has the following subcomponents:

pdweb.snoop.client The trace subcomponent to trace data that is sent between WebSEAL and clients.

pdweb.snoop.jct The trace subcomponent to trace data that is sent between WebSEAL and junctions.

If you want to trace only the message headers, use the pdweb.debug component.

The following command invokes the trace utility for the pdweb.snoop component at level 9 and directs the output to a file:

```
pdadmin> server task webseald-instance trace set pdweb.snoop 9 \
file path=/tmp/snoop.out
```

6.3.6 Diagnostic utilities

Many of the commands, tools, scripts, and daemons associated with Tivoli Access Manager are installed under the installation directory in the /bin and /sbin subdirectories. The one exception is the Tivoli XML Log Viewer. This viewer is installed separately and, by default, resides in its own directory.

Tivoli XML Log Viewer

The C-based components of Tivoli Access Manager support the generation of message and trace information in a common XML format. This format is known as the Tivoli XML log format and is used by a number of Tivoli applications.

Note: Java-language-based Tivoli Access Manager components and applications cannot produce messages or traces in the Tivoli XML log format.

A Java-based log viewer application is provided that allows these messages and traces to be filtered in a number of ways, including by time window, severity, thread ID, and component. Information that is produced by different products can be analyzed and converted into ASCII or HTML that use the Tivoli XML Log Viewer.

This log viewer is not installed as part of any Tivoli Access Manager installation. You must explicitly install the Tivoli XML Log Viewer. Because the InstallShield MultiPlatform installation program and the Tivoli XML Log Viewer are both Java applications, a JRE must be installed prior to installing and using the viewer. The

same JRE that is used by Tivoli Access Manager can be used for the Tivoli XML Log Viewer. If a different JRE is used, that JRE must be at version 1.2.2 or later.

The XMLFILE, XMLSTDERR, and XMLSTDOUT formats in the routing file are used to produce XML message logs and XML trace logs.

Using Tivoli XML Log Viewer

To run the Tivoli XML Log Viewer, use the **viewer** script and specify the name of one or more XML files. Output is directed to STDOUT in either HTML or text format. The output can be redirected to a file for viewing with a Web browser or text editor.

For example, to create an HTML file containing all of the messages from the policy and authorization servers sorted into chronological sequence, enter the following command:

```
viewer msg__pdmgrd.xml msg__pdacld.xml > msg_19Oct2003_report.html
```

To display the messages from the Policy Server in text format, do the following:

```
viewer -s text msg__pdmgrd.xm
```

Gathering version information

This section describes tools used to determine the version of the various components and products that can be installed in a Tivoli Access Manager environment.

Tivoli Access Manager

The **pdversion** command displays a list of Tivoli Access Manager components and indicates the version number for any component that is installed on the system.

IBM Global Security Kit

Secure Sockets Layer (SSL) communication in Tivoli Access Manager is provided by the Global Security Kit (GSKit). Each version of Tivoli Access Manager potentially provides a different level of GSKit. In addition, updates to GSKit might be applied as a result of applying fix packs or other service. To determine the version of GSKit that is installed, use the **gsk7ver** command.

User registries

The Tivoli Directory Server client is used by Tivoli Access Manager to communicate with any LDAP user registry, not just with Tivoli Directory Server. The client is not needed if Microsoft Active Directory or Lotus Domino server is being used as the Tivoli Access Manager user registry. The Tivoli Directory

Server client is installed on any system that communicates with an LDAP user registry.

To determine the version of the Tivoli Directory Server client that is installed, use the **ldapsearch** command:

```
ldapsearch –e
```

This command also reveals the version of the LDAP server software. The following sample command is appropriate when the LDAP server is configured for non-SSL communication:

```
ldapsearch -h ldapserver-hostname -p 389 -D "ldapadminDN" \ -w
ldapadmin-password -b "" -s base objectclass=*
```

The pdadmin utility

The pdadmin utility can be used for collecting information about the system. The following commands can be helpful:

server list Lists all registered Tivoli Access Manager servers.

server task trace Enables the gathering of trace information for components of installed Tivoli Access Manager servers or server instances that support debug event tracing.

errtext Displays the error message of a given error number. This command does not require a login or authentication to use.

pdjservicelevel

Returns the service level of installed Tivoli Access Manager files that use the Tivoli Access Manager Runtime for Java package.

pdservicelevel

Returns the service level of installed Tivoli Access Manager files that use the Tivoli Access Manager Runtime package.

pdwebpi

Returns the current version of Tivoli Access Manager Plug-in for Web Servers. Also, specifies whether to run Plug-in for Web Servers as a daemon or run it in the foreground.

pdwpi-version

Lists the version and copyright information for the Tivoli Access Manager Plug-in for Web Servers installation.

pdbackup

Backs up, restores, and extracts Tivoli Access Manager data. The syntax is as follows:

```
pdbackup –action backup –list list_file [–path path] [–file filename]
pdbackup –action restore –file filename [–path path]
pdbackup –action extract –file filename –path path
pdbackup –usage
pdbackup –?
```

pdacld_dump

The pdacld_dump command is a serviceability utility that can be used to validate and maintain the Tivoli Access Manager policy database and database replicas. This command is located under the installation directory in the /sbin subdirectory and is installed as part of the policy server.

The pdacld_dump command provides the following functions:

- Transform the binary content of the specified database file into readable text. By default, the output is directed to standard output, but it can be redirected to a file.
- Create a summary report that describes the conditions of the specified database.
- Examine the specified database for any corrupted content, defragment the structure of the database, and produce a valid, updated version of the database.
- Provide two levels of validation checking.

This concludes the auditing and troubleshooting discussion for Tivoli Access Manager for e-business.

A

WebSEAL junction options

This appendix gives a list of all available options for your junction configuration. Table A-1 defines the options you can utilize when setting up WebSEAL junctions using either the pdadmin command line pdadmin> server task <webseal> create ..... /junction (for example, pdadmin> server task web1-webseald-cruz create -t tcp -h doc.ibm.com /pubs) or the Web Portal Manager GUI.

Table A-1 Junction options

Junction types	
–t type	Type of junction. One of: - tcp - ssl - tcpproxy - sslproxy - local. .
Host name	
-h host-name	The DNS host name or IP address of the target back-end server.

General options	
TCP and SSL junction types	
–f	Forces the replacement of an existing junction.
–i	WebSEAL server treats URLs as case insensitive.
–p port	TCP port of the back-end third-party server. Default is 80 for TCP junctions; 443 for SSL junctions.
–q location	Provides WebSEAL with the correct name of the query_contents program file and where to find the file. By default, the Windows file is called query_contents.exe and the UNIX file is called query_contents.sh. By default, WebSEAL looks for the file in the cgi_bin directory of the back-end Web server.
–R	Allows denied requests and failure reason information from authorization rules to be sent in the Boolean Rule header (AM_AZN_FAILURE) across the junction.
–T resource/resource-group	Name of GSO resource or resource group. Required for and used only with –b gso option.
–w	Windows 32-bit (Win32®) file system support.
Stateful junctions	
–s	Specifies that the junction should support stateful applications. By default, junctions are not stateful.
–u UUID	Specifies the UUID of a back-end server connected to WebSEAL using a stateful junction (–s).
Mutual authentication over Basic Authentication and SSL certificates	
–B	WebSEAL uses BA header information to authenticate to back-end server. Requires –U, and –W options.
–D “DN”	Specifies the distinguished name of back-end server certificate. This value, matched with actual certificate DN enhances authentication.
–K “key-label”	Key label of WebSEAL’s client-side certificate, used to authenticate to back-end server.
–U “username”	WebSEAL user name. Use with –B to send BA header information to back-end server.
–W “password”	WebSEAL password. Use with –B to send BA header information to back-end server.

Proxy junction (requires –t tcpproxy or –t sslproxy).	
–H host-name	The DNS host name or IP address of the proxy server.
–P port	The TCP port of the proxy server.
Supply identity information in HTTP headers	
–b BA-value	Defines how the WebSEAL server passes client identity information in HTTP basic authentication (BA) headers to the back-end server. One of: - filter (default), - ignore, - supply, - gso
–c header-types	Inserts Tivoli Access Manager-specific client identity information in HTTP headers across the junction. The header-types argument can include any combination of the following Access Manager HTTP header types: iv-user iv-user-l iv-groups iv-creds all
–e encoding-type	Specifies the encoding to use when generating HTTP headers for junctions. This encoding applies to headers that are generated with both the –c junction option and tag-value. Possible values for encoding are: v utf8_bin v utf8_uri v lcp_bin v lcp_uri
–l	Cookie handling: -l ensures unique Set-Cookie header name attribute.
–j	Supplies junction identification in a cookie to handle script generated server-relative URLs.

–J {trailer, inhead, onfocus, xhtml10}	Controls the junction cookie JavaScript block. Use –J trailer to append (rather than prepend) the junction cookie JavaScript to HTML page returned from back-end server. Use –J inhead to insert the JavaScript block between <head> </head> tags for HTML 4.01 compliance. Use –J onfocus to use the onfocus event handler in the JavaScript to ensure the correct junction cookie is used in a multiple-junction/multiple-browser-window scenario. Use –J xhtml10 to insert a JavaScript block that is HTML 4.01 and XHTML 1.0 compliant.
–k	Sends session cookie to back-end portal server.
–n	Specifies that no modification of the names of non-domain cookies are to be made. Use when client-side scripts depend on the names of cookies. By default, if a junction is listed in the JMT or if the -j junction option is used, WebSEAL prepends the names of non-domain cookies that are returned from the junction to with: AMWEBJCT_junction_point_
–r	Inserts incoming IP address in HTTP header across the junction.
Junction fairness	
–l percent-value	Defines the soft limit for consumption of worker threads.
–L percent-value	Defines the hard limit for consumption of worker threads.
WebSphere single sign-on (LTPA) junctions	
–A	Enables junctions to support LTPA cookies (tokens). LTPA version 1 cookies (LtpaToken) and LTPA version 2 cookies (LtpaToken2) are both supported. LTPA version 1 cookies are specified by default. LTPA version 2 cookies must be specified with the additional -2 option. Also requires –F, and –Z options.
–2	Used with the -A option, this option specifies that LTPA version 2 cookies (LtpaToken2) are used. The -A option without the -2 option specifies that LTPA version 1 cookies (LtpaToken) are used.
–F “keyfile”	Location of key file used to encrypt LTPA cookie data. Only valid with -A option.

–Z “keyfile-password”	Password for the key file used to encrypt LTPA cookie data. Only valid with -A option.
WebSEAL-to-WebSEAL SSL junctions	
–C	Mutual authentication between a front-end WebSEAL server and a back-end WebSEAL server over SSL. Requires –t ssl or –t sslproxy type.
Forms based single sign-on	
–S path	Location of forms single signon configuration file.
Virtual hosts	
–v virtual-host-name[:port]	Virtual host name represented on the back-end server. This option supports a virtual host setup on the back-end server. You use –v when the back-end junction server expects a Host header because you are junctioning to one virtual instance of that server. The default HTTP header request from the browser does not know that the back-end server has multiple names and multiple virtual servers. You must configure WebSEAL to supply that extra header information in requests destined for a back-end server set up as a virtual host.
Transparent junctions	
–x	Creates a transparent path junction.
Local junction (use with –t local)	
–d dir	Local directory to junction. Required if the junction type is local.
Junction Point	
Name of the location in the WebSEAL namespace where the root of the back-end application server namespace is mounted.	

B

Sample questions

This sample test is designed to give the candidate an idea of the content and format of the questions that will be on the certification exam. Performance on the sample test is *not* an indicator of performance on the certification exam and this should not be considered an assessment tool.

Questions

1. Which registry server suffix is required by IBM Tivoli Access Manager for e-business?
   a. cn=root
   b. o=tivoli,c=us
   c. secAuthority=Default
   d. cn=secAuthority,o=tivoli
2. Which two are prerequisites for installing the WebSEAL ADK? (Choose two).
   a. GSKit
   b. WebSphere fix pack 2
   c. IBM Tivoli Access Manager for e-business ADK
   d. Access Manager for e-business authorization server
   e. IBM Tivoli Directory Server SDK
3. Which command is used to list the status of the IBM Tivoli Access Manager for e-business processes on UNIX machines?
   a. iv_status
   b. am_status
   c. pd_status
   d. pd_start status
4. Which three entries are defined by default in the ACL of the IBM Tivoli Directory Server suffix in order to manage users and groups from IBM Tivoli Access Manager for e-business? (Choose three.)
   a. default-webseal
   b. cn=SecurityGroup,secAuthority=Default
   c. cn=management,cn=SecurityGroup,secAuthority=Default
   d. cn=users/groups,cn=SecurityGroup,secAuthority=Default
   e. cn=ivacld-servers,cn=SecurityGroup,secAuthority=Default
   f. cn=remote-acl-users,cn=SecurityGroup,secAuthority=Default
5. What is the default listening port for the authorization server?
   a. 7135
   b. 7136
   c. 7234

d. 7235

6. Which syntax would prevent a user from logging in to pdadmin from outside of the company network?
   a. acl modify testacl set any-other Tr
   b. acl modify testacl set any-other unauthenticated
   c. pop modify testpop set ipauth add 9.0.0.0 255.0.0.0 0
   d. pop modify testpop set ipauth anyothernw deny 9.0.0.0 255.0.0.0 0
7. Which two end-user authentication methods are supported by WebSEAL to its junctioned Web servers for web SSO? (Choose two.)
   a. basic authentication
   b. kerberos authentication
   c. SPNEGO authentication
   d. forms-based authentication
   e. SecurID token-based authentication
8. Which HTTP header value is passed by default to a back-end web server?
   a. iv-user
   b. iv-creds
   c. iv-groups
   d. iv-server-name
9. What occurs if the aznapi-configuration stanza of the IBM Tivoli Access Manager for e-business WebSEAL configuration file contains the following entry: logsize=-1?
   a. No records are logged.
   b. A configuration error message is displayed.
   c. No rollovers are performed and the log grows indefinitely.
   d. A new file is created each time the logging process starts and every 24 hours thereafter.
10. Given an IBM Tivoli Access Manager for e-business error message number, which command returns the associated message text?
    a. pdadmin errnum
    b. pdadmin errtext
    c. pdadmin server errnum
    d. pdadmin server errtext

Answer Key

1. C
2. AC
3. D
4. BEF
5. B
6. C
7. AD
8. D
9. D
10. B

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

IBM Redbooks

For information on ordering these publications, see “How to get IBM Redbooks” on page 246. Note that some of the documents referenced here may be available in softcopy only.

- *Enterprise Security Architecture Using IBM Tivoli Security Solutions*, SG24-6014
- *Integrated Identity Management using IBM Tivoli Security Solutions*, SG24-6054
- *Identity and Access Management Solutions Using WebSphere Portal V5.1, Tivoli Identity Manager V4.5.1, and Tivoli Access Manager V5.1*, SG24-6692
- *Federated Identity Management and Web Services Security with IBM Tivoli Security Solutions*, SG24-6394

Other publications

These publications are also relevant as further information sources:

- *IBM Tivoli Access Manager for e-business Version 6.0 Release Notes,* SC32-1702
- *Tivoli Access Manager for e-business Version 6.0 Installation Guide,* SC32-1361
- *IBM Tivoli Access Manager Version 6.0 Administration Guide,* SC32-1686
- *IBM Tivoli Access Manager for e-business Version 6.0 WebSEAL Administration Guide,* SC32-1687
- *IBM Tivoli Access Manager for e-business Version 6.0 Plug-in for Web Servers Administration Guide*, SC32-1690
- *IBM Tivoli Access Manager for e-business Plug-in for Edge Server Administration Guide Version 6.0*, SC32-1689

- *IBM Tivoli Access Manager for e-business Version 6.0 Administration C API Developer Reference,* SC32-1692
- *IBM Tivoli Access Manager Version 6.0 Administration Java Classes Developer Reference*, SC32-1692
- *IBM Tivoli Access Manager for e-business Version 6.0 BEA WebLogic Server Administration Guide*, SC32-1688
- *IBM Tivoli Access Manager for e-business Version 6.0 Problem Determination Guide*, SC32-1701
- *IBM Tivoli Access Manager for e-business Upgrade Guide Version 6.0*, SC32-1703-00

Online resources

These Web sites and URLs are also relevant as further information sources.

- To obtain the online publications for IBM Tivoli Access Manager for e-business, visit the following Web site.

`http://publib.boulder.ibm.com/tividd/td/IBMAccessManagerfore-business6.0.html`

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Certification Study Guide: IBM Tivoli Access Manager for e-business 6.0

(0.5” spine)
0.475”<->0.875”
250 <-> 459 pages

Certification Study Guide: IBM Tivoli Access Manager for e-business 6.0

Developed specifically for Access Manager for e-business certification

Explains the certification path and prerequisites

Includes sample test questions and answers

This IBM Redbook is a study guide for IBM Tivoli Access Manager for e-business Version 6 and is meant for those who want to achieve IBM Certifications for this specific product.

The IBM Tivoli Access Manager for e-business Certification, offered through the Professional Certification Program from IBM, is designed to validate the skills required of technical professionals who work in the implementation of the IBM Tivoli Access Manager for e-business Version 6 product.

This book provides a combination of theory and practical experience needed for a general understanding of the subject matter. It also provides sample questions that will help in the evaluation of personal progress and provide familiarity with the types of questions that will be encountered in the exam.

This publication does not replace practical experience, nor is it designed to be a stand-alone guide for any subject. Instead, it is an effective tool which, when combined with education activities and experience, can be a very useful preparation guide for the exam.

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