IBM® SecureWay® Policy Director

IBM

Programming Guide and Reference

Version 3 Release 0

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Note

Before using this information and the product it supports, read the general information under "Appendix. Notices" on page 93.

First Edition (October 1999)

This edition applies to Version 3, release 0, modification 0 of IBM SecureWay Policy Director product and to all subsequent releases and modifications until otherwise indicated in new editions.

Contents

About this book

This book contains programming guide and reference information about IBM® SecureWay® Policy Director. This book documents these Policy Director functions:

- Authorization application programming interface (API)
- External authorization service
- Credentials acquisition service

Who should read this book

Developers who are designing and developing applications for IBM SecureWay Policy Director should read this book.

Developers should have some knowledge of IBM Distributed Computing Environment (DCE) and the IBM SecureWay Directory's lightweight directory access protocol (LDAP). DCE and LDAP are co-requisite products of Policy Director. Developers should have basic working knowledge about writing and configuring DCE and LDAP servers.

This *Policy Director Programming Guide and Reference* book assumes basic working knowledge about writing and configuring DCE servers.

How this book is organized

This book contains the following chapters:

- "Chapter 1. IBM SecureWay" on page 1 introduces you to the IBM SecureWay FirstSecure and IBM SecureWay Policy Director products.
- "Chapter 2. Authorization API" on page 3 guides the application designer or developer on the use of the Policy Director Authorization API.
- "Chapter 3. External authorization service" on page 33 describes the remote procedure call (RPC) interface as well as the interface details. This chapter discusses how to implement and customize a custom external authorization service. External authorization service-related API reference information is also provided.
- "Chapter 4. Credentials Acquisition Service" on page 41 describes the Policy Director Credentials Acquisition Service (Policy Director CAS) remote procedure call interface and the interface details. This chapter discusses how to implement and deploy a custom credentials acquisition service. CAS-related API reference information is also provided.
- "Chapter 5. Authorization API manual pages" on page 51 provides reference information about the Policy Director Authorization API. The manual pages for these API are documented in this section.

What is new in this release

The Policy Director Version 3.0 Authorization API is binary compatible, at the Authorization server remote procedure call (RPC) interface, with applications that are built with the Policy Director Version 2.1 Authorization API. Applications developed with the Policy Director Version 2.1 Authorization API library must be ported before they can be compiled against the Policy Director authorization ADK.

The Policy Director Authorization Service fully supports applications that are built using the Policy Director Version 2.1 Authorization API.

Note that the Policy Director authorization API now requires authentication with the Authorization server (ivacld) before API functions are called.

Policy Director Version 2.1 API applications are required to be members of the remote-acl-servers group before they are permitted to query the Policy Director Authorization Service. Add the application principal to this group to effect this change. You must log the principal out and log in again to create a security context with the new group membership.

Other changes since Policy Director Version 2.1 include:
- Addition of local cache mode
- Revision of the Authorization API to reflect the standardized Authorization API submission made to The Open Group.
- Addition of initialize and shutdown functions to allow optional reconfiguration of the API.

The following table lists functions and data types that have been deactivated for Policy Director. It lists the new functions and data types that have replaced them.

Version 2.0 Functions and Data Types	**Version 3.0 Functions and Data Types**
ivAuthznInit()	azn_initialize()

ivBuildLocalPrincipal()
ivBuildPrincipalByName()
ivBuildPrincipalFromPAC()
ivBuildUnauthPrincipal()
	azn_id_get_creds()
	azn_pac_get_creds()

ivCheckAuthorization()	azn_decision_access_allowed()
	azn_decision_access_allowed_ext()

ivFreePrincipal()	azn_creds_delete()
ivServerLogin()	azn_util_server_authenticate()
ivauthzn_init_params_t	attribute lists
ivauthzn_service_mode_t	attribute lists

In addition, the *Policy Director Up and Running* book provides information about what is new for IBM SecureWay Policy Director Version 3.0.

Year 2000 readiness

This product is Year 2000 ready. When used in accordance with its associated documentation, it is capable of correctly processing, providing, and/or receiving date data within and between the twentieth and twenty-first centuries, provided that all products (for example, hardware, software, and firmware) used with the products properly exchange accurate date data with it.

Service and support

Contact IBM for service and support for all the products included in the IBM SecureWay FirstSecure offering. Some of these products might refer to non-IBM support. If you obtain these products as part of the FirstSecure offering, contact IBM for service and support.

Conventions

This book uses the following typographical conventions:

Convention	Meaning
bold	User interface elements such as check boxes, buttons, and items inside list boxes.
`monospace`	Syntax, sample code, and any text that the user must type.
Italic	Emphasis and first use of special terms that are relevant to Policy Director.
→	Shows a series of selections from a menu. For example, click **File → Run** means click **File**, and then click **Run**.

Web information

Information about last-minute updates to Policy Director is available at the following Web address:

`http://www.ibm.com/software/security/policy/library`

Information about updates to other IBM SecureWay FirstSecure products is available by starting at the following Web address:

`http://www.ibm.com/software/security/firstsecure/library`

Chapter 1. IBM SecureWay

IBM SecureWay Policy Director (Policy Director) is available either as a component of IBM SecureWay FirstSecure or as a standalone product.

What is IBM SecureWay FirstSecure?

IBM SecureWay FirstSecure (FirstSecure) is part of the IBM integrated security solution. FirstSecure is a comprehensive set of integrated products that help your company:

- Establish a secure e-business environment.
- Reduce the total cost of security ownership by simplifying security planning.
- Implement security policy.
- Create an effective e-business environment.

The IBM SecureWay products include:

Policy Director
IBM SecureWay Policy Director (Policy Director) provides authentication, authorization, data security, and Web resource management.

Boundary Server
IBM SecureWay Boundary Server (Boundary Server) provides:

- The critical firewall functions of filtering, proxy, and circuit level gateway
- A virtual private network (VPN) connection to the IBM Firewall
- The components for Internet security
- A mobile code security solution

A configuration graphical user interface (GUI) ties together the Policy Director's proxy user function with the Boundary Server's Firewall product.

Intrusion Immunity
Intrusion Immunity provides intrusion detection and antivirus protection.

Trust Authority
IBM SecureWay Trust Authority (Trust Authority) supports public key infrastructure (PKI) standards for cryptography and interoperability. Trust Authority provides support for issuance, renewal, and revocation of digital certificates. These certificates provide a means to authenticate users and to ensure trusted communications.

Toolbox
The IBM SecureWay Toolbox (Toolbox) is a set of application programming interfaces (API) with which application programmers can incorporate security into their software. You can obtain the Toolbox as part of FirstSecure. Both Policy Director and the Toolbox include the Policy Director API library and documentation. The Toolbox README file contains installation instructions for the Policy Director ADK.

Because each IBM SecureWay FirstSecure product can be installed independently, you can plan a controlled move toward a secure environment. This capability reduces the complexity and cost of securing your environment and speeds deployment of Web applications and resources.

See the FirstSecure *Planning and Integration* documentation for more information about the FirstSecure components and for a list of all the IBM SecureWay products' documentation.

What is IBM SecureWay Policy Director?

Policy Director is a standalone authorization and security management solution. Policy Director provides end-to-end security of resources over geographically dispersed intranets and *extranets*. An *extranet* is a virtual private network (VPN) that uses access control and security features to restrict the use of one or more intranets attached to the Internet to selected subscribers.

Policy Director provides authentication, authorization, data security, and resource-management services. You can use Policy Director in conjunction with standard Internet-based applications to build secure and well-managed intranets and extranets.

Policy Director runs on the Windows NT, AIX, and Solaris operating systems.

Chapter 2. Authorization API

This chapter includes:

Introducing the Authorization API

Using the Policy Director Authorization Application Programming Interface (API), you can code Policy Director applications and third-party applications to query the Policy Director Authorization Service for authorization decisions.

The Policy Director Authorization API is the interface between the server-based resource manager and the authorization service and provides a standard model for coding authorization requests and decisions. The Authorization API let you make standardized calls to the centrally managed authorization service from any legacy or newly developed application.

The Authorization API supports two implementation modes:

- **Remote cache mode**

  In remote cache mode, you use the Authorization API to call the Policy Director 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 Authorization API to download a local replica of the authorization policy database. In this mode, the application can perform all authorization decisions locally.

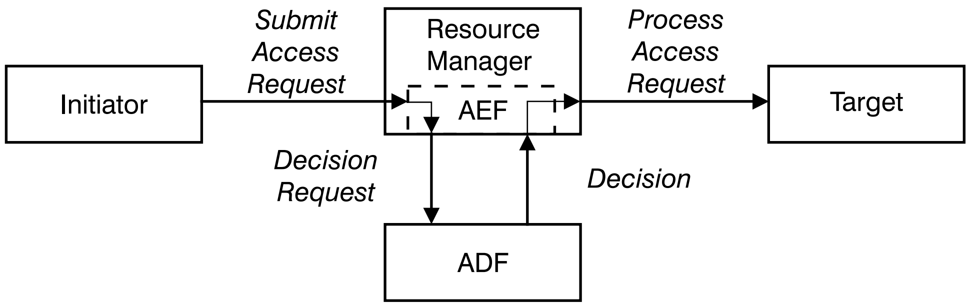
  The Authorization API shields you from the complexities of the authorization service mechanism. Issues of management, storage, caching, replication, credentials format, and authentication methods are all hidden behind the Authorization API.

The Authorization API works independently from the underlying security infrastructure, the credential format, and the evaluating mechanism. The Authorization API makes it possible to request an authorization check and get a simple ″yes″ or ″no″ recommendation in return.

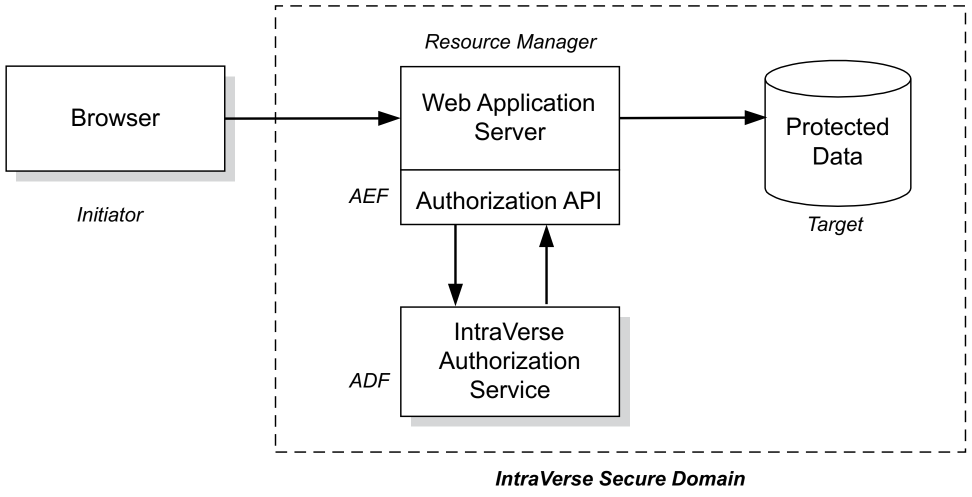
The Authorization API is a component of the Policy Director Application Development Kit (ADK).

The Open Group Authorization API standard

The Policy Director Authorization API implements The Open Group Authorization API (Generic Application Interface for Authorization Frameworks) standard. This interface is based on the International Organization for Standardization (ISO) 10181-3 model for authorization. In this model, an initiator requests access to a target resource. The initiator submits the request to a resource manager, which incorporates an access enforcement function (AEF). The AEF submits the request, along with information about the initiator, to an access decision function (ADF). The ADF returns a decision to the AEF, and the AEF enforces the decision.



Policy Director implements the ADF component of this model and provides the Authorization API as an interface to this function:



In the figure above, a browser (initiator) requests access to a file or other resource on a protected system (target). The browser submits the request to a Web application server (the resource manager incorporating the access enforcement function). The Web application server uses the Authorization API to submit the request to the Policy Director Authorization Service (the access decision function).

The Policy Director Authorization Service returns an access decision, through the Authorization API, to the Web application server. The Web application server processes the request as appropriate.

To implement this model, developers of AEF applications add Authorization API function calls to their application code.

Note: Developers should refer to The Open Group Authorization API document for additional information on the standard authorization model.

Background and references for using Policy Director authorization

The first step in adding authorization to an application is to define the security policy requirements for your application. Defining a security policy means that you must determine the business requirements that apply to the application's users, operations, and data. These requirements include:

- Objects to be secured
- Operations to be permitted on each object
- Users that are permitted to perform the operations

After your security requirements have been defined, you can use the Authorization API to integrate your security policy with the Policy Director security model.

Complete the following steps in order to deploy an application into a Policy Director secure domain:

1. Configure the Policy Director secure domain to recognize and support the objects, actions, and users that are relevant to your application.
   - For an introduction to the Policy Director authorization model, see "Chapter 3. Understanding authorization" in the *Policy Director Administration Guide*.
   - For complete information on access control, see Chapter 7. "Understanding access control" in the *Policy Director Administration Guide*.
2. Use the Authorization API within your application to obtain the needed authorization decisions.
   - For an introduction to the Authorization API, including information on remote cache mode and local cache mode see "Chapter 3. Understanding authorization" in the *Policy Director Administration Guide*.
3. Develop your application logic to enforce the security policy.

Installing the Authorization API components

The Authorization API is included as an optional installation package in the Policy Director distribution. The Authorization API files are installed in the authzn_adk directory, directly under the Policy Director installation directory.

If you are installing the Authorization API portion of the Policy Director ADK from the Policy Director CD, the ADK is installed in the subdirectories in the following table. If you are installing the Authorization API port of the ADK from the IBM SecureWay Toolbox, refer to the Toolbox README file for installation instructions.

Directory	**Contents**
include	C header files
lib	A library that implements the API functions. • On Solaris® systems, the library is libivauthzn.so • On AIX® systems, the library is libivauthzn.a • On Microsoft® Windows® systems, the library to include at run time is ivauthzn.dll • On Windows, the library to link to is ivauthzn.lib
example	An example program that demonstrates usage of the Authorization API. Source files and a MAKEFILE are provided.

For Policy Director installation instructions, including the Policy Director ADK, refer to the *Policy Director Up and Running*book for your particular platform.

Header files

The header files are found in the include directory, located directly under the Policy Director Authorization ADK package installation directory.

File	**Contents**
ogauthzn.h	The Authorization API standard functions
aznutils.h	Utility functions (extensions to The Authorization API)

Error codes

The Authorization API error codes are defined in the following files, located in the include directory:

File	**Contents**
ogauthzn.h	Major error codes for the standard Authorization API functions.
aznutils.h	Major error codes to the Authorization API utility functions.
dceaclmsg.h	Minor error codes for utility functions and the Policy Director Authorization Service.

Building applications with the Authorization API

The following sections provide information on building an application with the Authorization API:

- "Software requirements"
- "Library links"

Software requirements

To develop applications by using the Policy Director Authorization API, you must install and configure a Policy Director secure domain.

If you do not have a Policy Director secure domain installed, install one before beginning application development. The minimum installation consists of a single system with the following Policy Director components installed:

- Policy Director Base (IVBase)
- Policy Director Management server (IVMgr)
- Policy Director Authorization server (IVAcld)
- Policy Director Application Development Kit (IVAuthADK)
- Policy Director Management Console (IVConsole)

When the Policy Director secure domain uses an LDAP user registry, the application development system must have an LDAP client installed.

For Policy Director installation instructions refer to the *Policy Director Up and Running* book for your particular platform.

If you already have a Policy Director secure domain installed and you want to add a development system to the domain, the minimum Policy Director installation will consist of the following components:

- Policy Director Base (IVBase)
- Policy Director Authorization server (IVAcld)
- Policy Director Application Development Kit (IVAuthADK)

Note: The development environment must include a DCE runtime. The DCE runtime is installed as a prerequisite to the Policy Director installations described above.

Library links

In order to compile applications that use the Authorization API, you must install the Policy Director ADK on the build machine.

When compiling your application, make sure you add the include directory for the Policy Director ADK to the compiler command line. When linking your application, specify the directory containing the authorization shared library if it is not in the default location.

On Solaris systems, you also need to link to the following libraries:

Platform	DCE	Libraries
Solaris	Transarc 2.0	libdce.so, libgssdce.so, libC.so

On AIX and Windows NT systems, you do not need to link to the DCE libraries.

On all platforms, the DCE libraries are needed at application runtime. See "Deploying applications with the Authorization API" on page 32.

Understanding the Authorization API functions and data types

The Authorization API provides a set of functions and data types. This section lists the name of each Authorization API construct and the task it accomplishes.

The following structured data types and constants are defined as part of the Authorization API:

- "API functions"
- "Character strings" on page 10
- "Buffers" on page 10
- "Attribute lists" on page 11
- "Credential handles" on page 12
- "Status codes and error handling" on page 12

API functions

The following tables list the Authorization API functions and provide a reference to the section in this document that describes each function's task.

Attribute lists

Function	Task
"azn_attrlist_add_entry()" on page 52 "azn_attrlist_add_entry_buffer()" on page 53 "azn_attrlist_create()" on page 54 "azn_attrlist_delete()" on page 55 "azn_attrlist_entry_get_num()" on page 56 "azn_attrlist_get_entry_buffer_value()" on page 57 "azn_attrlist_get_entry_string_value()" on page 58 "azn_attrlist_get_names()" on page 59	"Attribute lists" on page 11

Credentials

Function	Task
"azn_creds_combine()" on page 62	"Creating a chain of credentials" on page 30
"azn_creds_create()" on page 63	"Obtaining user authorization credentials" on page 22
"azn_creds_delete()" on page 64	"Releasing allocated memory" on page 28
"azn_creds_for_subject()" on page 65	"Obtaining a credential from a chain of credentials" on page 30
"azn_creds_get_attrlist_for_subject()" on page 67	"Obtaining an attribute list from a credential" on page 31
"azn_creds_get_pac()" on page 69	"Converting credentials to a transportable format" on page 29
"azn_creds_modify()" on page 71	"Modifying the contents of a credential" on page 31
"azn_creds_num_of_subjects()" on page 73	"Determining the number of credentials in a credentials chain" on page 30
"azn_id_get_creds()" on page 80	"Obtaining user authorization credentials" on page 22
"azn_pac_get_creds()" on page 83	"Converting credentials to the native format" on page 29

Authorization decisions

Function	Task
"azn_decision_access_allowed()" on page 74	"Obtaining an authorization decision" on page 26
"azn_decision_access_allowed_ext()" on page 76	

Initialization, shutdown, and error handling

Function	Task
"azn_error_major()" on page 78	"Status codes and error handling" on page 12
"azn_error_minor()" on page 79	
"azn_initialize()" on page 82	"Initializing the authorization service" on page 15
"azn_release_buffer()" on page 84	"Releasing allocated memory" on page 28
"azn_release_string()" on page 85	
"azn_release_strings()" on page 86	
"azn_shutdown()" on page 87	"Shutting down the Authorization API" on page 29

API extensions

The following functions are extensions to the Authorization API standard:

Function or Data Type	Task
"azn_util_client_authenticate()" on page 89	"Logging in using a password" on page 14
"azn_util_password_authenticate()" on page 90	"Obtaining an identity for a user" on page 21
"azn_util_server_authenticate()" on page 91	"Logging in using a DCE keytab file" on page 14
"azn_authdce_t" on page 60	"Specifying the user authentication identity" on page 23
"azn_authldap_t" on page 61	
"azn_unauth_t" on page 88	

Character strings

Many Authorization API functions take character strings as arguments or return character strings as values. Use the azn_string_t data type to pass character string data between your application and the Authorization API:

```
typedef char *azn_string_t;
```

Use azn_release_string() and azn_release_strings() to release memory that has been allocated to strings of type azn_string_t.

Buffers

Some Authorization API functions take byte string arguments and return byte strings as values. Use the data type azn_buffer_t to pass byte string data between your application and the Authorization API.

The azn_buffer_t data type is a pointer to a buffer descriptor consisting of a **length** field and a **value** field. The **length** field contains the total number of bytes in the data. The **value** field contains a pointer to the data.

```
typedef struct azn_buffer_desc_struct {
    size_t    length;
    void      *value;
} azn_buffer_desc,  *azn_buffer_t;
```

The application must allocate and release the storage necessary for all azn_buffer_desc objects. The Authorization API allocates the storage needed for the buffer array referenced by the *value member of the azn_buffer_desc.

Use "azn_release_buffer()" on page 84 to release storage that is allocated for use by azn_buffer_desc objects.

Parameters of type azn_buffer_t can be assigned and can be compared with the following constant values:

Name	Value	Definition
AZN_C_EMPTY_BUFFER	NULL	Empty data value-buffer.
AZN_C_NO_BUFFER	NULL	No value-buffer is supplied or returned.

Attribute lists

Several Authorization API functions take attribute list handles as input parameters or return attribute list handles as output parameters. Use the azn_attrlist_h_t data type to pass attribute list handles between the Authorization API and the calling application.

Variables of type azn_attrlist_h_t are opaque handles to lists of name and value pairs. Use Authorization API functions to add or retrieve name-value pairs from attribute lists.

Many Authorization API functions use attribute lists to store and retrieve values. Attribute lists are lists of name-value pairs. The values can be stored as either strings or buffers. A name can have more than one value.

Some names are defined by the Authorization API. You also can define any additional names needed by your application.

The Authorization API provides functions to create attribute lists, set or get list entries, and delete attribute lists. The following table summarizes the functions that operate on attribute lists:

Task	Description
Create an attribute list.	Use "azn_attrlist_create()" on page 54 to complete the following tasks: • Allocate a new, empty attribute list • Associate a handle with the attribute list • Return the handle
Set an entry in an attribute list.	Use "azn_attrlist_add_entry()" on page 52 to add a string name-value pair of type azn_string_t. Use "azn_attrlist_add_entry_buffer()" on page 53 to add a buffer name-value pair of type azn_buffer_t.
Get attribute names from an attribute list.	Use "azn_attrlist_get_names()" on page 59 to get all the names in an attribute list, contained in an array of strings of type azn_string_t.
Get the number of values for a specified attribute name.	Use "azn_attrlist_entry_get_num()" on page 56 to get the number, as an integer, of the value attributes for a specified name in the attribute list.
Get a value.	Use "azn_attrlist_get_entry_string_value()" on page 58 to get the value attribute of a string (azn_string_t) for a specified name in an attribute list. Use "azn_attrlist_get_entry_buffer_value()" on page 57 to get the value attribute of a buffer (azn_buffer_t) for a specified name in an attribute list. The specified name can have multiple values. You specify the needed value by supplying an index (integer) into the list of values.
Delete an attribute list.	Use "azn_attrlist_delete()" on page 55 to delete the attribute list associated with a specified attribute list handle.

Credential handles

Several Authorization API functions take credentials handles as input parameters or return credential handles as output parameters. Use the azn_creds_h_t data type to pass credential handles between the Authorization API and the calling application.

Variables of type azn_creds_h_t are opaque handles to credential structures that are internal to the Policy Director security framework.

Use the function "azn_creds_create()" on page 63 to complete the following tasks:

- Allocate a new, empty credential structure.
- Associate a handle with the credential structure.
- Return the handle.

Call the function "azn_creds_delete()" on page 64 on the handle to release the memory allocated for the credential structure.

Status codes and error handling

Authorization API functions return a status code of type azn_status_t. The values in azn_status_t are integers. The return value for successful completion of the function is AZN_S_COMPLETE, which is defined as zero (0).

The returned status code includes both major and minor error codes. A major error code of AZN_S_FAILURE indicates that a minor error code contains the error status.

Use "azn_error_major()" on page 78 to extract major error codes from the returned status. Major error codes are defined according to The Open Group Authorization API standard.

Use "azn_error_minor()" on page 79 to extract minor error codes from the returned status. The minor codes contain error messages from the utility function extensions to the API as well as from the Policy Director Authorization server.

See the following files for a complete list of error codes:

File	Contents
ogauthzn.h	Major error codes for the standard Authorization API functions.
aznutils.h	Major error codes for the Authorization API utility functions.
dceaclmsg.h	Minor error codes for utility functions and the Policy Director Authorization Service.

Summarizing Authorization API tasks

The primary task of the Authorization API is to obtain an authorization decision from the Policy Director Authorization Service.

Use the Authorization API to present information about the user, operation, and requested resource to the Policy Director Authorization Service. Then use the Authorization API to receive the authorization decision. Your application is responsible for enforcing the decision, as appropriate.

Required tasks

To obtain an authorization decision, you must accomplish certain tasks. The following sections in this document provide a step-by-step guide to completing each of these required tasks:

- "Authenticating an API application"
- "Initializing the authorization service" on page 15
- "Obtaining an identity for a user" on page 21
- "Obtaining user authorization credentials" on page 22
- "Obtaining an authorization decision" on page 26
- "Cleaning up and shutting down" on page 28

Optional tasks

The Authorization API also provides functions for performing optional tasks on users credentials. The following section describes the supported optional tasks:

- "Handling credentials (optional tasks)" on page 29

Runtime environment

To determine whether your network environment is configured correctly to support your application, review the following section:

- "Deploying applications with the Authorization API" on page 32

Authenticating an API application

The API application must establish its own authenticated identity within the Policy Director secure domain in order to request authorization decisions from the Policy Director Authorization Service. This authenticated identity is normally separate from the identity of the user submitting the request for service from the application.

Before you run the Authorization API application for the first time, you must create a unique identity for the application in the Policy Director 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 that use local cache mode.
- **remote-acl-users**

  This group membership is needed for applications that use remote cache mode.

When the application wants to contact one of the secure domain services while it is running, it must first log in to the secure domain.

The Policy Director Authorization API provides two utility functions the application can use to log in and obtain an authenticated identity. One function performs a login by using username and password information. The other function performs a DCE login by using a keytab file.

Use the appropriate API login functions, as described in the following sections:

- "Logging in using a DCE keytab file" on page 14
- "Logging in using a password" on page 14

Logging in using a DCE keytab file

Some application servers are executed non-interactively, such as in response to an access request from an application client. The application servers must establish an authenticated identity without manual intervention by an administrator.

To avoid the need for manual intervention, the application developer can create and store a password in a keytab file.

The Authorization API utility function azn_util_server_authenticate() submits the user name and the name of the keytab file to the Policy Director authentication service. The Policy Director authentication service can use the DCE keytab file to establish an authenticated identity.

For example, the following code logs in a server svrPrin by using a keytab file, svrKeytab:

```
status = azn_util_server_authenticate(svrPrin, svrKeytab);
if ( status != AZN_S_COMPLETE ) {
    fprintf(stderr, "Could not perform keytab login\n");
    exit(1);
}
```

Note: You can use azn_util_server_authenticate() in a Policy Director secure domain that uses an LDAP user registry. However, it can only be used for DCE principals (as registered in a DCE user registry).

For more information, see "azn_util_server_authenticate()" on page 91 in the Authorization API manual pages.

Logging in using a password

Some applications might be used by more than one identity in the Policy Director secure domain. These applications can choose their login identity based on application requirements. For example, the application can prompt the user, examine user information contained in an HTTP header, or simply supply a username and password that denotes a category of user.

The Authorization API provide the utility function azn_util_client_authenticate() to enable the application to log in as a specific identity with a username and password.

For example, the following code logs in the application as "testuser":

```
/* Login and start context refresh thread */
status = azn_util_client_authenticate(testuser, testuserpwd);
if ( status != AZN_S_COMPLETE ) {
    fprintf(stderr, "Could not perform client login\n");
    exit(1);
}
```

You can use azn_util_client_authenticate() in an Policy Director secure domain with a DCE user registry.

For more information, see "azn_util_client_authenticate()" on page 89 in the Authorization API manual pages.

Initializing the authorization service

To use the Policy Director Authorization API, an application must initialize the API. Initialization consists of specifying initialization data and calling an initialization function.

The Authorization API initialization function ("azn_initialize()" on page 82) takes as an input parameter an attribute list named init_data. To specify initialization data, you must add the necessary attributes to init_data.

Complete the instructions in the following sections:
- "Specifying the type of cache mode"
- "Adding attributes for remote cache mode" on page 16
- "Adding attributes for local cache mode" on page 16
- "Adding attributes for LDAP access" on page 19
- "Starting the authorization service" on page 20

Specifying the type of cache mode

The cache mode determines whether the Authorization API talks to a Policy Director Authorization server running in the same process space (local cache mode) or in a different process space (remote cache mode) in the secure domain.

Local cache mode can increase application performance because authorization checks can be performed on the same system as the application. Local cache mode, however, requires additional configuration and maintenance of a replicated authorization database.
- For more information on remote cache mode, see "Remote cache mode" in Chapter 3 of the *Policy Director Administration Guide*.
- For more information on local cache mode, see "Local cache mode" in Chapter 3 of the *Policy Director Administration Guide*.

To specify the type of cache mode, complete the following steps:
1. Call "azn_attrlist_create()" on page 54 to create a new attribute list called init_data. This function returns an attribute list handle.
2. Use "azn_attrlist_add_entry()" on page 52 to add the attribute azn_init_mode and assign it a value:

Attribute	Value	Description
azn_init_mode	local	The Policy Director Authorization Service runs in the same server process as the application using the Authorization API.
	remote	The Policy Director Authorization Service runs as a different server process from the application using the Authorization API.

Continue to the appropriate section:
- "Adding attributes for remote cache mode" on page 16
- "Adding attributes for local cache mode" on page 16

Adding attributes for remote cache mode

If you specified remote cache mode, use “azn_attrlist_add_entry()” on page 52 to add the attribute azn_init_qop and assign it a value:

Attribute	Value	Description
azn_init_qop	none	No protection.
	integrity	Data stream integrity. The data can be seen but not modified or replayed by a third party.
	privacy	Data stream privacy. The data cannot be seen, modified, or replayed by a third party.

For example, the following code shows the creation of a new attribute list. It also shows the assigning of name-value pairs for cache mode (azn_init_mode) and quality of protection (azn_init_qop):

```
azn_attrlist_create(&init_data);

/*** Don't use a local replica, use the authorization server ***/
status = azn_attrlist_add_entry(init_data,
                                azn_init_mode,
                                "remote");
if (status != AZN_S_COMPLETE)
return (status);

/* Set quality of protection for communications with ivacld to be privacy. */

status = azn_attrlist_add_entry(init_data,
                               azn_init_qop,
                                "privacy");
if (status != AZN_S_COMPLETE)
return (status);
```

Initialization of remote cache mode is now complete.

- If your secure domain uses an LDAP user registry, refer to “Adding attributes for LDAP access” on page 19.
- If your secure domain uses a DCE user registry, refer to “Starting the authorization service” on page 20.

Adding attributes for local cache mode

When you specify local cache mode, you must decide how the local copy of the authorization database is updated.

Choose one of the following methods to implement updating:

- Set the Authorization API to poll the master authorization service database.
- Register the local (replicated) database with the master database, and enable a listener process on the local database’s system. This process listens for update notifications.
- Configure the Authorization API to both poll and listen.
- Configure the Authorization API to neither poll nor listen. This could be useful, for example, when the local system is not connected to a network.

The above methods are configured by adding attributes to the init_data attribute list.

Complete all the steps in this section in order to implement your chosen method:

1. Use azn_attrlist_add_entry() to specify pathnames for files used by the authorization service:

Attribute	Value	Description
azn_init_db_file	*filename*	Path name to the persistent authorization policy database replica.
azn_init_audit_file	*filename*	Path and file name for the file that collects Authorization API audit events.

2. Use azn_attrlist_add_entry() to configure the Authorization API to poll the master authorization database:

Attribute	Value	Description
azn_init_cache_refresh_interval		
	disable	Refreshing of the local authorization policy database disabled.
	default	600 seconds
	number of seconds	Number of seconds between refreshes of the local authorization policy database. Set appropriate values to ensure that the replicated database is updated in a timely manner to reflect changes made to the master database.

3. Use azn_attrlist_add_entry() to configure the notification listener:

Attribute	Value	Description
azn_init_listen_flags	disable	Disable the notification listener.
	enable	Enable the notification listener.
	When you select **enable**, you can also specify any combination of the following values. The values are logically OR'd together.	
	use_tcp_port	Enable the listener to use Transmission Control Protocol (TCP).
	use_udp_port	Enable the listener to use the User Datagram Protocol (UDP).
	dynamic_port_selection	Instruct the listener to use randomly assigned ports.

4. If you enable the notification listener, use the **ivadmin** command to inform the Policy Director Management server (ivmgrd) of your location in order to receive notification of updates. Use the **ivadmin server register dbreplica** command to inform the Policy Director Authorization Service (specifically, the Management server) of the existence and location of applications using the Authorization API in local cache mode.

The following syntax applies:

```
ivadmin> server register dbreplica server-name ns-location server-host
```

Where:

server-name	A name (or label) for this application. This is the name that appears in the display of the object space on the Management Console and in the ivadmin server list command.
ns-location	The RPC entry in the CDS namespace where the application exports its RPC bindings.
server-principal	The name of the DCE principal representing this application process.
server-host	The Domain Name System (DNS) name or IP address of the machine where this application process resides.

5. If you enabled the notification listener, use azn_attrlist_add_entry() to add the following attributes.

   Note: If you disabled the notification listener, skip this step.

Attribute	**Value**	**Description**
azn_init_tcp_port	*port number*	If you specified use_tcp_port and did not specify dynamic_port_selection for the attribute azn_init_listen_flags, use this value to specify a TCP port.
azn_init_udp_port	*port number*	If you specified use_udp_port and did not specify dynamic_port_selection for the attribute azn_init_listen_flags, use this value to specify an UDP port.
azn_init_namespace_location	*CDS location*	Specify the CDS namespace location for exporting the RPC endpoints for local policy cache updates.

For example, the following code shows the creation of a new attribute list init_data. It also shows the addition of entries to specify configuration settings for local cache mode:

```
azn_attrlist_create(&init_data);
status = azn_attrlist_add_entry(initdata,
                                azn_init_mode,
                                "local");
if (status != AZN_S_COMPLETE)
return (status);

/*** The file name of the replica policy database ***/

status = azn_attrlist_add_entry(initdata,
                                azn_init_db_file,
                                "./auth_demo.db");
if (status != AZN_S_COMPLETE)
return (status);
```

```
/*** The file name of the audit file ***/

status = azn_attrlist_add_entry(initdata,
                               azn_init_audit_file,
                               "./auth_demo.audit");
if (status != AZN_S_COMPLETE)
return (status);

/*** Enable polled updates at the default interval ***/

status = azn_attrlist_add_entry(initdata,
                               azn_init_cache_refresh_interval,
                               "default");
if (status != AZN_S_COMPLETE)
return (status);

/*** Enable the update notification listener ***/

status = azn_attrlist_add_entry(initdata,
                                azn_init_listen_flags,
                                "enable");
if (status != AZN_S_COMPLETE)
return (status);

status = azn_attrlist_add_entry(initdata,
                                azn_init_listen_flags,
                                "use_tcp_port");
if (status != AZN_S_COMPLETE)
return (status);

status = azn_attrlist_add_entry(initdata,
                                azn_init_tcp_port,
                                "6056");
if (status != AZN_S_COMPLETE)
return (status);

status = azn_attrlist_add_entry(initdata,
                                azn_init_namespace_location,
                                CDSloc);
if (status != AZN_S_COMPLETE)
return (status);
```

Adding attributes for LDAP access

When your application runs in a Policy Director secure domain that uses an LDAP user registry, you must provide the LDAP configuration settings to the Authorization API. The required LDAP configuration settings match the settings that were entered when Policy Director was installed on the local system.

Note: When your application runs in a Policy Director secure domain that uses a DCE user registry, skip this step and go to “Starting the authorization service” on page 20.

To add attributes for LDAP access:

1. Use azn_attrlist_add_entry() to add the following attributes to the init_data attribute list:

Attribute	Value	Description
azn_init_ldap_host	*hostname*	Host name of LDAP server.
azn_init_ldap_port	*port number*	Port number for communicating with the LDAP server.
azn_init_ldap_admin_dn	*LDAP DN*	Distinguished name of the LDAP administrator.
azn_init_ldap_admin_pwd	*password*	Password for the LDAP administrator.

2. If the communication between the Policy Director Authorization server and the LDAP server is over Secure Sockets Layer (SSL), use azn_attrlist_add_entry() to add the following attributes to the init_data attribute list:

Attribute	Value	Description
azn_init_ldap_ssl_keyfile	*filename*	Name of the SSL key file.
azn_init_ldap_ssl_keyfile_dn	*KeyLabel*	Key label to identify the client certificate that is presented to the LDAP server.
azn_init_ldap_ssl_keyfile_pwd	*password*	Password to access the SSL key file.

Starting the authorization service

Complete the following steps:

1. Ensure that the attribute list *init_data* has been created and filled in, as described in the preceding sections.
2. Create a new attribute list, *init_info*, to receive returned information.

   For example:

   ```
   azn_attrlist_create(&init_info);
   ```
3. Call azn_initialize() to bind to and initialize the authorization service.

   For example:

   ```
   /* Start the service */
   status = azn_initialize(init_data, init_info);
   if (status != AZN_S_COMPLETE)
       return(status);
   ```

In the example code above, azn_initialize() returns the attribute list *init_info*. This attribute list is appended with any initialization information attributes that apply. This includes the AZN_C_VERSION attribute, which contains the version number of the API implementation.

Note: To re-initialize the API, use azn_shutdown() and then call azn_initialize().

For more information, see “azn_initialize()” on page 82 in the Authorization API manual pages.

Obtaining an identity for a user

The application must determine the identity of the user who has submitted a request. The identity can be expressed as one of the following user types:

- **Authenticated**

  In this case, the user's identity in the secure domain is registered in either an LDAP or DCE user registry. The user is authenticated, and information about the user can be obtained. This information includes, for example, the Distinguished Name (LDAP) or principal (DCE).
- **Unauthenticated**

  In this case, the user's identity in the secure domain is not specifically registered in either an LDAP or DCE user registry. The user is defined to be unauthenticated, and further information about the user's identity is irrelevant to the authorization process.

Applications can obtain user identities through a variety of methods. These can include the use of a Credentials Acquisition Server, or a call to an application-specific method for querying user registries and establishing a security (login) context.

Optionally, applications can use the Policy Director Authorization API utility function azn_util_password_authenticate() to obtain user identity information from the secure domain.

The function azn_util_password_authenticate() requires the user name and password as input parameters. Typically, an application receives a user name and password from the user who initiated the access request.

The function performs a login by using the supplied user name and password. If the login is successful, the function will return the following information:

- The string *mechanism_id* that specifies the authentication mechanism (DCE or LDAP) that was used.
- The buffer *authinfo* that contains user identity information.

Note: The function azn_util_password_authenticate() does not obtain a security (login) context for the user.

For more information, see "azn_util_password_authenticate()" on page 90 in the Authorization API manual pages.

After the application has obtained identity information for the user, you can use the Authorization API to obtain authorization credentials for the user.

Obtaining user authorization credentials

In order to submit an authorization request to the Policy Director Authorization Service, an application must obtain authorization credentials for the user making the request. The authorization credentials contain user identity information that is needed to make authorization decisions, such as group memberships and a list of actions or rights that the user can exercise.

To obtain credentials for a user who has submitted an access request, an application must obtain user identity information from the user registry (DCE or LDAP) that is used by the Policy Director secure domain.

The Authorization API function "azn_id_get_creds()" on page 80 takes user identity information as input parameters and returns user authorization credentials.

The credentials can then be submitted to the authorization service for an authorization decision.

Note: Identity information can also be obtained from a privilege attribute certificate (PAC). See "Converting credentials to the native format" on page 29.

To obtain a credential, complete the instructions in the following sections:

- "Specifying the authorization authority"
- "Specifying the authentication user registry type"
- "Specifying the user authentication identity" on page 23
- "Specifying additional user information" on page 23
- "Placing user information into an API buffer" on page 24
- "Obtaining authorization credentials for the user" on page 25

Specifying the authorization authority

Assign the appropriate value for the authorization authority to a string of type azn_string_t. This string is passed as the parameter authority to azn_id_get_creds(). Set authority to NULL to specify Policy Director authorization.

Specifying the authentication user registry type

Applications must know the type of user registry that is used in the Policy Director secure domain in order to obtain an authenticated identity for the user. The type of registry used was determined in "Obtaining an identity for a user" on page 21.

If the user was not authenticated in a user registry, then the user registry type will be unauthenticated.

Assign a value for the type of user authentication identity to a string of type azn_string_t. This string is passed as the parameter *mechanism_id* to azn_id_get_creds().

Set *mechanism_id* to one of the following values:

User Registry	**Value**
DCE User Registry	IV_DCE
LDAP User Registry	IV_LDAP
Unauthenticated	IV_UNAUTH

Specifying the user authentication identity

For each user to be authenticated, information is loaded into a data structure, which corresponds to the type of user registry used in the secure domain, or corresponds to a user category of *unauthenticated*.

If the user is authenticated, load the user's identity into the appropriate string in the data structure that corresponds to the user registry type.

User Identity Type	**Data Structure**	**String**	**Example**
DCE User Registry	"azn_authdce_t" on page 60	principal	cell_admin
LDAP User Registry	"azn_authldap_t" on page 61	ldap_dn	cn=root
Unauthenticated User	"azn_unauth_t" on page 88	*none*	*none*

When the user is unauthenticated, you do not have to load an identity into azn_unauth_t.

Specifying additional user information

When the application authenticates the user, the application can optionally obtain additional information about the user. This additional information is for use by the application as needed. The Policy Director Authorization Service does not use this information.

The application can store the additional user information in the data structures that the Authorization API provides for each type of authenticated identity. The data structures are: azn_authdce_t, azn_authldap_t, and azn_unauth_t.

The elements in each data structure are character strings, with the exception of *ipaddr*, which is an integer.

Element	**Description**
auth_method	Indicates that the user was authenticated through either the DCE user registry or the LDAP user registry. This value can be any string that is useful to the application. Not available in azn_unauth_t.
authnmech_info	Additional authentication information. This value can be any string that is useful to the application. For example, when the DCE authentication was accomplished using SSL certificates, the certificate's Distinguished Name can be stored here. Not available in azn_unauth_t.
qop	Quality of protection level for requests made by this user. This level is set by the application and is specified as an arbitrary character string.
user_info	Additional user information for auditing purposes. This string can contain any information that is useful to the application.
browser_info	Information about the type of browser through which the user has submitted the request, if applicable. This string can contain any information that is useful to the application.
ipaddr	The IP address of the user. This is optional information for use by the application.

Placing user information into an API buffer

Place the data structure you filled out in "Specifying the user authentication identity" on page 23 and "Specifying additional user information" on page 23 into an Authorization API buffer.

Complete the following steps:

1. Declare a buffer of type azn_buffer_t:
   ```
   typedef struct azn_buffer_desc_struct {
   size_t    length;
   void      *value;
   } azn_buffer_desc,  *azn_buffer_t;
   ```
2. Determine the length of your data structure and assign that value to length.
3. Set the pointer value to point to the address of your data structure.

This buffer is passed as the parameter *mechanism_info* to azn_id_get_creds().

Obtaining authorization credentials for the user

To obtain authorization credentials, complete the following steps:

1. Call the Authorization API function "azn_creds_create()" on page 63 to create a new, empty credentials structure.
2. Call "azn_id_get_creds()" on page 80 with the following input parameters:

Parameter	**Description**
authority	The authorization authority, as described in "Specifying the authorization authority" on page 22.
mechanism_id	The authentication mechanism, as described in "Specifying the authentication user registry type" on page 22.
mechanism_info	User information, as described in the following sections: • "Specifying the user authentication identity" on page 23 • "Specifying additional user information" on page 23 • "Placing user information into an API buffer" on page 24

The azn_id_get_creds() function returns a handle to the authorization credentials for the user. The authorization credentials are contained in an azn_creds_h_t structure.

For example, the following sample code demonstrates the assigning of identity information for a user authenticated in an LDAP user registry, and calls azn_id_get_creds() to obtain authorization credentials:

```
azn_authldap_t ldap_minfo;
azn_string_t mech = NULL;
azn_buffer_desc buf = { 0, 0 };
azn_creds_h_t creds;

azn_creds_create(&creds);

/* Specify authentication registry type */
mech = IV_LDAP;

/* Specify LDAP user name */
ldap_minfo.ldap_dn = "cn=testuser";

/* Set LDAP user information. Note: these values are just placeholders */
ldap_minfo.auth_method = "ldap_auth_method";
ldap_minfo.authnmech_info = "ldap_authnmech_info";
ldap_minfo.qop = "ldap_qop";
ldap_minfo.user_info = "ldap_user_info";
ldap_minfo.browser_info = "ldap_browser_info";
ldap_minfo.ipaddr = 0x0a000002;

/* Set a buffer to point to the LDAP user information */
buf.length = sizeof(ldap_minfo);
buf.value = (unsigned char *)&ldap_minfo;

/* Obtain an authorization credential. Specify the authority as NULL */

status = azn_id_get_creds(NULL, mech, &buf, &creds);
if (status != AZN_S_COMPLETE) {
  fprintf(stderr, "Could not get creds.\n");
  continue;
}
```

For more information, see "azn_id_get_creds()" on page 80 in the Authorization API manual pages. Refer also to the Authorization API demonstration program (see "Example program authzn_demo" on page 32).

The application is now ready to submit the authorization request (see"Obtaining an authorization decision").

Obtaining an authorization decision

After the application has obtained authorization credentials for the user, the application passes the requested operation and the requested resource to the Authorization API function "azn_decision_access_allowed()" on page 74. This function returns the authorization decision.

To obtain an authorization decision, complete the instructions in each of the following sections:

- "Mapping the user operation to a Policy Director permission"
- "Mapping the requested resource to a protected object"
- "Assigning the user credentials to a credentials handle" on page 27
- "Building an attribute list for additional application information" on page 27
- "Obtaining an authorization decision" on page 27

Mapping the user operation to a Policy Director permission

The operation requested by the user must correspond to one of the operations for which a Policy Director permission has been defined. The operation is a standard action supported in all Policy Director secure domains. Examples operations are azn_operation_read and azn_operation_traverse.

Note: For a complete list of supported operations, see the aznutils.h file.

Alternatively, the operation can be a custom operation defined by an external authorization service.

- Assign the operation to the string operation. Pass this string as an input parameter to azn_decision_access_allowed().

Mapping the requested resource to a protected object

The requested resource to query for must correspond to a resource that has been defined as a protected object. The protected object must be within the Policy Director secure domain's protected object namespace.

The resource can be a standard WebSEAL protected resource, such as a file in the Web space. Alternatively, the resource can be a custom-protected object.

- Assign the protected object to the string protected_resource. Pass this string as an input parameter to azn_decision_access_allowed().

Assigning the user credentials to a credentials handle

The authorization credentials for a user obtained in "Obtaining user authorization credentials" on page 22can be accessed through the handle returned by azn_id_get_creds().

These credentials contain the user's identity information and include information, such as the user's group membership and permitted operations.

- Pass the handle returned by azn_id_get_creds() as an input parameter to azn_decision_access_allowed().

Note: Authorization credentials can also be obtained from "azn_pac_get_creds()" on page 83. See "Converting credentials to the native format" on page 29.

Building an attribute list for additional application information

The Policy Director Authorization API provides the extended function azn_decision_access_allowed_ext() for obtaining an access decision. This function extends azn_decision_access_allowed() by providing an additional input parameter and an additional output parameter.

These parameters can be used to supply additional information as needed by the application. The Policy Director Authorization Service does not use these parameters when making the access control decision. However, you can write external authorization servers to use this information.

The parameters consist of an attribute list. You can build an attribute list of any length to hold information specific to the application.

To add additional application-specific context, complete the following steps:

1. Use azn_attrlist_create() to create a new, empty attribute list.
2. Use azn_attrlist_add_entry() or azn_attrlist_add_entry_buffer() to add attributes.
3. After all attributes have been added, assign the input parameter app_context to point to the attribute list.

For more information, see "azn_decision_access_allowed_ext()" on page 76 in the Authorization API manual pages.

Obtaining an authorization decision

To obtain an authorization decision, call one of the following functions:

- azn_decision_access_allowed()
- azn_decision_access_allowed_ext()

If the API is operating in remote cache mode, the authorization request will be forwarded to the Policy Director Authorization server (ivacld). The Authorization server makes the decision and returns the result.

If the API is operating in local cache mode, the API will use the local authorization policy database replica to make the authorization decision.

The result of the access request is returned in the following output parameter:

Type	Parameter	Description
int	permission	The result of the access request. Consists of one of the following constants: AZN_C_PERMITTED AZN_C_NOT_PERMITTED

The extended function azn_decision_access_allowed_ext() also returns the following information:

Type	Parameter	Description
azn_attrlist_h_t	*permission_info*	Application-specific context information contained in attribute list.

For more information on the above functions, see these Authorization API manual pages:

- "azn_decision_access_allowed()" on page 74
- "azn_decision_access_allowed_ext()" on page 76

Cleaning up and shutting down

The Authorization API provides functions to perform these cleanup and shutdown functions:

- "Releasing allocated memory"
- "Shutting down the Authorization API" on page 29

Releasing allocated memory

The Authorization API provides functions to perform these releasing of memory functions:

- "azn_attrlist_delete()" on page 55

  Use this function to release memory that is allocated for attribute lists.
- "azn_creds_delete()" on page 64

  Use this function to release memory that is allocated for the azn_creds_h_t structure that is returned by a call to azn_creds_create().
- "azn_release_buffer()" on page 84

  Use this function to release memory that is allocated for buffers. Buffers of this type are used by some attribute list functions, and also by some of the credentials handling functions.
- "azn_release_string()" on page 85

  Use this function to release memory that is allocated for any strings. Many Authorization API functions use this data type to store values in strings.
- "azn_release_strings()" on page 86

  Use this function to release memory that is allocated for an array of strings.

Shutting down the Authorization API

See "azn_shutdown()" on page 87.

When an application has obtained an authorization decision and when it does not need further authorization decisions, use this function to disconnect from and shut down the Authorization API.

Handling credentials (optional tasks)

The Authorization API provides functions to accomplish the following optional tasks:

- "Converting credentials to a transportable format"
- "Converting credentials to the native format"
- "Creating a chain of credentials" on page 30
- "Determining the number of credentials in a credentials chain" on page 30
- "Obtaining a credential from a chain of credentials" on page 30
- "Modifying the contents of a credential" on page 31
- "Obtaining an attribute list from a credential" on page 31

Converting credentials to a transportable format

See "azn_creds_get_pac()" on page 69.

Use this function to place user credentials into a format that can be transported across a network to another application. Use this function when you need to delegate the authorization decision to an application on another system.

Complete the following steps:

1. Set the input string *pac_svc_id* to NULL.
2. Set the input credentials handle *creds* to the credentials handle returned by a previous call to azn_id_get_creds() or azn_pac_get_creds().
3. Call azn_creds_get_pac().

The privilege attribute certificate (PAC) is returned in an output buffer named pac. This buffer can be transported to another system, where the function azn_pac_get_creds() can be used to return the credentials to a native format.

Converting credentials to the native format

See "azn_pac_get_creds()" on page 83.

Use this function when an application receives credentials in a transportable format from another system on the network. Typically, these credentials are placed into a buffer by azn_creds_get_pac().

Complete the following steps:

1. Set the input string *pac_svc_id* to NULL.
2. Set the input buffer pac to the buffer returned by a previous call to azn_creds_get_pac().
3. Call azn_pac_get_creds().

This function returns a handle to a credentials structure (azn_creds_h_t), for access by other Authorization API functions.

Creating a chain of credentials

See "azn_creds_combine()" on page 62.

Use this function to combine, or chain, two credentials together. Use this, for example, when the credentials for a server application must be combined with user credentials in order to delegate the authorization decision to another application.

Complete the following steps:

1. Assign the credentials handle *creds_to_prepend* to point to the credentials of the request's initiator.
2. Assign the credentials handle *creds_to_add* to point to the credentials to be added.
3. Call azn_creds_create() to create a new, empty credentials structure.
4. Call azn_creds_combine().

The combined credentials are placed in a credentials structure that can be referenced by the credentials handle combined_creds.

Determining the number of credentials in a credentials chain

See "azn_creds_num_of_subjects()" on page 73.

Use this function to determine the number of credentials that are contained in a credentials chain. Credentials chains are created by the azn_creds_combine() function.

This functions takes as an input parameter the credentials handle of the credentials chain, and returns an integer containing the number of credentials.

Obtaining a credential from a chain of credentials

See "azn_creds_for_subject()" on page 65.

Use this function to extract individual credentials from a credentials chain. Credentials chains are created by the azn_creds_combine() function.

Complete the following steps:

1. Assign the credentials handle *creds* to point to the credentials chain.
2. Assign the integer *subject_index* the index of the needed credential within the credentials chain.

   The credentials of the user who made the request are always stored at index 0. To retrieve the credentials for the initiator (user), you can pass the constant AZN_C_INITIATOR_INDEX as the value for subject_index.

   Use azn_creds_num_of_subjects(), if necessary, to determine the number of credentials in the chain.
3. Call azn_creds_for_subject().

This function returns the requested credentials in the credentials structure *new_creds*.

Modifying the contents of a credential

See “azn_creds_modify()” on page 71.

Use this function to modify a credential by placing additional information, contained in an attribute list, into the credentials structure. Use this function when you need to add application-specific information to a user’s credentials.

Complete the following steps:

1. Use the attribute list functions to create an attribute list containing the information to be added. Assign the attribute list handle *mod_info* to the new attribute list.

   For more information on attribute lists, see “Attribute lists” on page 11.
2. Set the credential modification service *mod_svc_id* to NULL.
3. Assign the credentials handle *creds* to point to the credentials to be modified.
4. Call azn_creds_create() to create a new, empty credentials structure.
5. Call azn_creds_modify().

The modified credentials are placed in the credentials structure *new_creds*.

Obtaining an attribute list from a credential

See “azn_creds_get_attrlist_for_subject()” on page 67.

Use this function to obtain information, in the form of an attribute list, from a credential. Attribute lists are added to credentials structures by calls to azn_creds_modify().

You can use this function to obtain the attribute list for a credential that is part of a credentials chain.

Complete the following steps:

1. Assign the credentials handle *creds* to point to the credentials chain.
2. Assign the integer *subject_index* to the index of the credential within the credentials chain.

   If the credential is not part of a chain, set *subject_index* to zero (0).

   The credentials of the user who made the request are always stored at index 0. To retrieve the credentials for the initiator (user), you can pass the constant AZN_C_INITIATOR_INDEX as the value for subject_index.

   Use azn_creds_num_of_subjects(), if necessary, to determine the number of credentials in the chain.
3. Call azn_attrlist_create() to create a new, empty attribute list.
4. Call azn_creds_get_attrlist_for_subject().

The function returns a handle to the attribute list containing the credential’s attribute information. The handle is named *creds_attrlist*.

Deploying applications with the Authorization API

To deploy an application with the Authorization API, verify that your environment contains the necessary supporting software. You can test your environment by building and running the example program that is provided with the Authorization API.

See the following sections:
- "Software requirements"
- "Example program authzn_demo"

Software requirements

Applications that have been developed with the Policy Director Authorization API must be run on systems that are configured into a Policy Director secure domain. When the Policy Director secure domain uses an LDAP user registry, the application deployment system must have an LDAP client installed.

The minimum Policy Director installation on a system that runs an application is:
- Policy Director Base (IVBase)
- Policy Director Authorization server (IVAcld)
- Policy Director Application Development Kit (IVAuthADK)

DCE client runtime requirements

The application runtime environment must include a DCE client runtime. The DCE runtime is installed as a prerequisite to the Policy Director installations described above.

Note: On Windows NT®, the Policy Director NetSEAT client provides the DCE client runtime environment.

Example program authzn_demo

The Policy Director Authorization API is provided with an example program called **authzn_demo** that demonstrates use of the Authorization API. The example directory contains source files and a MAKEFILE. Refer to the README file, located in the same directory, for information regarding the use of this example program.

Chapter 3. External authorization service

This chapter contains:

- "Introducing the external authorization service" on this page.
- "Using the remote procedure call interface" on page 34.
- "Implementing a custom external authorization server" on page 36.
- "Configuring a custom external authorization service" on page 37.
- "Reference: interface implementation" on page 38.

Introducing the external authorization service

Note: This *Policy Director Programming Guide and Reference* book assumes basic working knowledge about writing and configuring DCE servers.

An *external authorization service* is an optional extension of the Policy Director Authorization Service that allows you to impose additional authorization controls and conditions. These additional controls and conditions are dictated by a separate (external) authorization server program.

External authorization capability is automatically built into the Policy Director Authorization Service. If you configure an external authorization service, the Policy Director Authorization Service will simply incorporate the new controls and conditions into its evaluation process.

Applications that use the Policy Director Authorization Service (such as WebSEAL, NetSEAL, and any application using the Policy Director Authorization API) benefit from the additional, but seamless, contribution of a configured external authorization service. Any addition to the security policy through the use of an external authorization service is transparent to these applications and requires no change to the applications.

The external authorization service architecture allows the full integration of an organization's existing security service. An external authorization service preserves a company's initial investment in security mechanisms by allowing legacy servers to be incorporated into the Policy Director authorization decision-making process.

Three general steps are required to set up an external authorization service:

1. Write a server program that can be referenced during an authorization decision.
2. Configure the server into a DCE environment.
3. Register the external authorization service with Policy Director.

After the service is registered, a new permission that represents this service appears in the Policy Director Management Console. You can now use this permission in any access control list (ACL) entry to force the authorization mechanism to include the external authorization server in the decision-making process.

When the permission is encountered during an authorization check, the external authorization service is referenced for additional authorization decisions.

Additional references:

- ″External authorization capability″ in Chapter 3 of the *Policy Director Administration Guide*
- ″Chapter 11. Managing the authorization service″ in the *Policy Director Administration Guide*

  This section includes information on how to register an external authorization server with Policy Director.

Using the remote procedure call interface

The Policy Director Authorization Service uses the extern_auth IDL interface to request an authorization decision from an external authorization server.

The extern_auth interface specifies a single remote procedure call (RPC):

- check_authorization

This RPC is called by the Policy Director Authorization Service whenever an occurrence of the external authorization permission is encountered during an ACL check.

See the following sections for interface details.

Interface Definition Language (IDL): extern_auth.idl

This IDL specifies a single RPC exported by all external authorization servers.

```
[
  uuid(4df55494-e9b8-11d0-bb97-00c078500253),
  pointer_default(ptr),
  version(2.0)
]
interface extern_auth {
    import "auth_base.idl";
    /*
     * FUNCTION NAME
     *    check_authorization
     *
     * DESCRIPTION
     *    This function is called by Policy Director as part of the authorization
     *    check, if required by the appropriate ACL.
     *
     * ARGUMENTS
     *    handle        Server binding handle.
     *    principals    Authenticated delegation chain.
     *    obj_name      Protected object name.
     *    req_perm      Requested capabilities.
     *    acl_perm      Capabilities granted by the ACL on the protected
     *                  object.
     *    req_state     Opaque protected-object specific state information.
     *    qop           Returns minimum acceptable quality of protection.
     *    status        Returns status.  Returns error_status_ok if request is
     *                  authorized.
     *
     */
    void check_authorization(
       [in]          handle_t               handle,
       [in]          ivprincipal_chain_t    *principals,
       [in, string]  char                   *obj_name,
       [in]          unsigned32             req_perm,
       [in]          unsigned32             acl_perm,
       [in]          ivauthzn_state_t       *req_state,
       [out]         ivqop_t                *qop,
       [out]         error_status_t         *status
     );
 }
```

Attribute configuration file

```
interface extern_auth {
    check_authorization([comm_status,fault_status] status);
}
```

Implementing a custom external authorization server

The Policy Director product includes the external authorization service interface and demonstration server source as part of the IVAuthADK installation package. The demonstration server is designed to be used as a starting point for implementing your own customized external authorization server.

Source files

The demonstration server source is included as an example and starting point for building customized external authorization servers. All of the external authorization service source files are located in the following directory:

UNIX®: `/opt/intraverse/eas_adk/`

Windows: *`install-path`*`\eas_adk\`

Supported platforms

The external authorization service source files can be compiled on any platform. The custom built executable must reside on a machine within WebSEAL's secure domain.

Pre-requirements

The external authorization service prerequisites include:

- DCE application development tools must be installed on the build machine

  These tools are normally included as part of an installation package. Specifically, you must install DCE header files and the IDL compiler.
- A platform-specific C compiler and development environment

Build process

The external authorization service source directory contains a MAKEFILE that builds interface files and demonstration files. In most cases, after you install the required packages on the build machine, you can compile the server files with only minor modification to the MAKEFILE.

When building a custom external authorization server, you should not modify any of the interface files, such as the IDL and attribute configuration file (ACF). These files are used to communicate with the Policy Director Security Manager. Any changes to the interface files can potentially disrupt the communication process between the Policy Director Security Manager and the external authorization server and possibly produce undesired results.

Configuring a custom external authorization service

Perform the following sequence of tasks to configure Policy Director to use an external authorization service:

1. Write the server program.

   This program must be a DCE server that exports the extern_auth IDL interface (see "Using the remote procedure call interface" on page 34). Additionally, the server must maintain a DCE login context and be able to accept authenticated RPCs.

   Note: Refer to the *DCE Application Development Guide* for details about writing a DCE server.

   Refer to "Implementing a custom external authorization server" on page 36.
2. Use the DCE program command **dcecp** to create a DCE account for the external authorization server. In general, creating a DCE account requires the following steps:
   a. Create a new principal representing the external authorization server. For example:
      ```
      dcecp> principal create eas_server
      ```
   b. Add the principal to a group. For example:
      ```
      dcecp> group add none -member eas_server
      ```
   c. Add the principal to an organization. For example:
      ```
      dcecp> organization add none -member eas_server
      ```
   d. Create an account that reflects the above information plus a password. For example (entered as one line):
      ```
      dcecp> account create eas_server -group none -organization none -password ibmpw
      ```

   Note: Refer to the appropriate DCE documentation for detailed information.
3. Create the RPC entry in the CDS namespace where the external authorization server exports its RPC bindings. For example:
   ```
   dcecp> rpcentry create /.:/subsys/intraverse/eas_server
   ```

   This entry is used by the Policy Director Authorization Service to locate the server.
   - The external authorization server must ensure that its bindings are exported to this CDS entry.
   - When the server is replicated, each replica must also export its bindings to the same CDS location.

     Note: Refer to the appropriate DCE documentation for detailed information.

4. Set the correct permissions on the RPC entry so that the server principal has read (r) and write (w) capabilities. For example (entered as one line):

   ```
   dcecp> acl modify /.:/subsys/intraverse/eas_server -entry -add {user eas_server rw}
   ```

   Note: Refer to the appropriate DCE documentation for detailed information.
5. Create a DCE key table (keytab) that the server principal can access when it logs in. For example (entered as one line):

   ```
   dcecp> keytab create eas_server -storage /opt/intraverse/eas_adk/eas_server.key
          -data {eas_server plain 1 ibm}
   ```

   Note: Refer to the appropriate DCE documentation for detailed information.
6. Register the service with Policy Director by using the **ivadmin server register** command. Use the information created in steps 2 on page 37 and 3 on page 37 as arguments to this command. For example (entered as one line):

   ```
   ivadmin> server register externauth eas_server /.:/subsys/intraverse/eas_server
            none k External_Authorization
   ```

   Refer to "Registering an external authorization service" in Chapter 11 of the *Policy Director Administration Guide* for details on registering an external authorization service.

Reference: interface implementation

"check_authorization" on page 39.

check_authorization

Policy Director calls this function as part of an authorization check, if required by an external authorization ACL.

Syntax

```
void check_authorization(
  [in]          handle_t             handle,
  [in]          ivprincipal_chain_t  *principals,
  [in, string]  char                 *obj_name,
  [in]          unsigned32            req_perm,
  [in]          unsigned32            acl_perm,
  [in]          ivauthzn_state_t     *req_state,
  [out]         ivqop_t              *qop,
  [out]         error_status_t       *status
);
```

Parameters

handle – **input**
Server binding handle.

principals – **input**
Authenticated delegation chain. This data structure might be directly cast into an azn_creds_h_t for use with the Authorization API.

obj_name – **input**
Protected object name.

req_perm – **input**
Requested capabilities.

acl_perm – **input**
Capabilities that are granted by the ACL on the protected object.

req_state – **input**
Opaque protected object-specific state information.

qop – **output**
Minimum acceptable quality of protection.

status – **output**
Return status. Returns **error_status_ok**, if the request is authorized.

Remarks

Performs an extended authorization check from an external authorization server. This call is made only when it is required by the specific ACL that controls access to an external authorization server.

Return Values

None.
Success or failure status is returned in the *status* output parameter.Normal, successful completion.

Chapter 4. Credentials Acquisition Service

This chapter contains:

Introducing the Credentials Acquisition Service

Note: This *Policy Director Programming Guide and Reference* book assumes basic working knowledge about writing and configuring DCE servers.

The Policy Director Credentials Acquisition Service (Policy Director CAS) extends the authentication capabilities of Policy Director. A CAS allows authentication and mapping of non-Policy Director user identity information (such as a non-Policy Director username and password, or X.509 client-side certificate) to a Policy Director user (principal). The Policy Director Security Manager (using its default registry) can then return credentials for this principal. A CAS also provides password management services.

The specifics of this authentication and mapping service are determined entirely by the CAS developer or designer. Mapping rules are stored in a database external to Policy Director.

To allow setup of a CAS, Policy Director provides:

- The IDL interface between WebSEAL and the CAS.
- The general server framework that handles CAS server functions, such as: startup, server registration, and signal handling.

It is the CAS developer’s responsibility to extend the CAS framework to implement the identity mapping functions required by the particular application.

Additional references:

- ″Credentials acquisition″ in Chapter 2 of the *Policy Director Administration Guide*
- ″Credentials acquisition service overview″ in Chapter 2 of the *Policy Director Administration Guide*
- ″X.509 certificate mapping mode″ in Chapter 2 of the *Policy Director Administration Guide*
- ″Username mapping mode″ in Chapter 2 of the *Policy Director Administration Guide*
- ″Policy Director Credentials Acquisition Service″ in Chapter 13 of the *Policy Director Administration Guide*

Using the remote procedure call interface

WebSEAL uses the cdas IDL interface to request identity mapping or password management services from a credentials acquisition server.

The cdas interface specifies two remote procedure calls (RPC):

- cdas_get_identity
- cdas_change_password

These RPCs are called by the Policy Director Authorization Service whenever the CAS is called to perform authentication.

See the following sections for interface details.

IDL: cas_auth.idl

This IDL specifies two RPCs and four data structures that are exported by all external credentials acquisition servers. The following authentication styles are currently supported by this interface:

- No Authentication
- Username, Password, or Passticket
- Public Key Certificates

```
[
   uuid(04f8642a-0fae-11d3-b3df-0a0000c6aa77),
   pointer_default(ptr),
   version(1.0)
]
interface cdas {
   /*
    *  Authentication style constants
    */
   const unsigned32 IVAUTHN_STYLE_NONE = (0); /* No authn information */
   const unsigned32 IVAUTHN_STYLE_PASSWORD   = (1); /* Secret key authn */
   const unsigned32 IVAUTHN_STYLE_CERT       = (2); /* Public key authn */
   const unsigned32 IVAUTHN_STYLE_TOKEN_CARD = (3); /* SecurID-style authn */
   const unsigned32 IVAUTHN_STYLE_ANONYMOUS  = (4); /* Username only authn */

   /*
    *  cdas_authn_info_t
    *
    *  This data structure conveys all client authentication information
    *  required by a CDAS.
    */
   typedef struct {
      union switch (unsigned32 authn_style) data {
         case IVAUTHN_STYLE_NONE:
         ;                                   /* No data */
         case IVAUTHN_STYLE_PASSWORD:
             struct {
                [string] char *username;         /* Client username */
                [string] char *password;         /* Client password */
            }  password_data;
         case IVAUTHN_STYLE_CERT:
             struct {
                unsigned32      cert_chain_len;  /* Length of cert chain */
                     [size_is(cert_chain_len)]
                byte       *cert_chain;          /* Certificate chain */
            }  cert_data;
      case IVAUTHN_STYLE_TOKEN_CARD:
          struct {
             [string] char *username;         /* Client username */
             [string] char *pin;              /* Client \PIN number */
             [string] char *token;            /* Current valid token */
          }  token_card_data;
      case IVAUTHN_STYLE_ANONYMOUS:
          struct {
             [string] char *username;         /* Client username */
          }  anonymous_data;
   }  authn_data;
   unsigned32         ipaddr;                 /* Client IP address */
   [string] char    *qop;                     /* Client quality of protection */
   [string] char    *browser_info;    /* Client browser type (if present) */
} cdas_authn_info_t;

/*
 *  Constants that represent how a resulting client identity is conveyed
 *  by the CDAS.
 */
const  unsigned32  IVAUTHN_PRIN_TYPE_NAME  =  (0);    /* Principal name */
const  unsigned32  IVAUTHN_PRIN_TYPE_DN    =  (1);    /* Distinguished name */

/*
 *  cdas_xattr_t
 *
 *  An extended attribute for use in an attribute list.
 *
 *  Fields:
 *
 *  name       string name for the attribute.
 *  value      string value for the attribute.
 *
 */
 typedef struct {
    [string] char        *name;
    [string] char        *value;
 } cdas_xattr_t;
 /*
  *  cdas_xattr_list_t;
  *
  *  A list of extended attributes
  *
  *  Fields:
  *
  *  count          number of attribute structs in list.
  *  list           a list of attribute structs.
  *
  */
  typedef struct {
     unsigned32                    count;
        [size_is(count)]
     cdas_xattr_t                *list;
  } cdas_xattr_list_t;

  /*
   *  cdas_identity_t
   *
   *  This data structure conveys the resulting client identity
   *  information returned from a CDAS upon successful authentication.
   */
 typedef struct {
    union switch (unsigned32 prin_type) data {
        case IVAUTHN_PRIN_TYPE_NAME:
            [string] char       *name;     /* Resulting principal name */
        case IVAUTHN_PRIN_TYPE_DN:
            [string] char      *dn;         /*  Resulting principal DN */
    } prin;
    [string] char      *user_info;          /* Audit information */
    [string] char      *authnmech_info;     /* Authn mechanism  information */
    cdas_xattr_list_t xattrs;               /* Extended attributes */
} cdas_identity_t;

/*
 * cdas_get_identity()
 *
 *  This function performs client authentication on behalf of WebSEAL
 *  and returns the resulting client identity upon success.  If the
 *  client has presented a certificate to Policy Director, it is the role of
 *  the CDAS to perform the relevant client identity mapping.
 *
 *  [in] h:
 *    RPC binding handle.
 *
 *  [in] authn_info:
 *    Client authentication information.  This will be one of:
 *        1) username/password pair
 *        2) an ASN1 encoded chain of certificates.
 *        3) A tokencard username/pin/token
 *            NOTE: This is not supported in the current version of WebSEAL.
 *
 *        4) Anonymous (username only)
 *            NOTE: This is not supported in the current version of WebSEAL.
 *
 *            Other useful client-related information is also included.
 *            Please see cas_auth.idl for more details about the
 *            cdas_authn_info_t structure
 *
 *  [out] client_id:
 *    The resulting client identity (upon successful authentication).
 *    Set to point to NULL on failure
 *
 *  [out] st:
 *    Used for reporting both RPC communication errors and server errors
 *    processing the request.  For now it is assumed that error_status_ok
 *    will be returned, otherwise another binding/server interface will
 *    be tried for the same request until one works or none are left.
 */
void cdas_get_identity(
   [in]     handle_t            h,
   [in]     cdas_authn_info_t    *authn_info,
   [out]    cdas_identity_t      **client_id,
   [out]    error_status_t       *st
);
```

```
    /*
     *  cdas_change_password()
     *
     *  This function enables the caller to manage a given client's password
     *  information.
     *
     *  [in] h:
     *   RPC binding handle.
     *
     *  [in] username:
     *   Username associated with the client account upon which the password
     *   modification should be made.
     *
     *  [in] old_password:
     *    Password associated with the client account that should be changed.
     *
     *  [in] new_password:
     *    New password to associate with the client account.
     *
     *  [out] st:
     *    Used for reporting both RPC communication errors and server errors
     *    processing the request.  For now it is assumed that error_status_ok
     *    will be returned, otherwise another binding/server interface will
     *    be tried for the same request until one works or none are left.
     */
    void cdas_change_password(
       [in]              handle_t               h,
       [in, string]      char                  *username,
       [in, string]      char                  *old_password,
       [in, string]      char                  *new_password,
       [out]             error_status_t        *st
    );
}
```

Attribute configuration file

```
interface cdas
{
    cdas_get_identity(
        [comm_status,fault_status] st
    );
    cdas_change_password(
        [comm_status,fault_status] st
    );
}
```

Implementing a custom Credentials Acquisition Service

Policy Director WebSEAL includes the Policy Director CAS interface and the Policy Director CAS server files. The source files provided with the ADK are a starting point for implementing your own customized CAS server.

Source files

The CAS server's source files are located in the following directory:

UNIX: `/opt/intraverse/cdas_adk`

Windows: *install-path*`\cdas_adk`

If you install the Policy Director IVNet package, the Policy Director CAS will be automatically installed. See the Policy Director README file available on the Web for information on how to configure it for use.

In addition, source files are included with Policy Director as an example and starting point for building customized CAS servers.

If you create a customized CAS server from the CAS source files, replace the Policy Director CAS server binary with your own custom server binary at:

UNIX: `/opt/intraverse/cdas_server/bin/cdas_server`

Windows: *install-path*`\cdas_server\bin\cdas_server`

Supported platforms

The CAS source files can be compiled on any platform. The custom built executable must reside on a machine within WebSEAL's secure domain.

Pre-requirements

The Credentials Acquisition Service prerequisites include:

- DCE application development tools must be installed on the build machine

  These tools are normally included as part of an installation package. Specifically, you must install DCE header files and the IDL compiler.
- A platform-specific C compiler and development environment

Build process

The CAS source directory contains a MAKEFILE that builds interface files and demonstration files. In most cases, after you install the required packages on the build machine, you can compile the CAS server files with only minor modification to the MAKEFILE.

When building a custom CAS server, you should not modify any of the interface files (IDL and ACF). These files are used to communicate with the Policy Director Security Manager. Any changes to the interface files can potentially disrupt the communication process between the Policy Director Security Manager and the CAS server and possibly produce undesired results.

Deploying a custom Credentials Acquisition Service

Perform the following sequence of tasks to deploy a credentials acquisition server in a Policy Director environment.

1. Install the IVAuthADK package to obtain the CAS source files (located in the cdas_adk directory).
2. Modify the CAS server source files as needed.
3. Build a new binary server file.

   See “Build process” on page 46.
4. Copy this new server file to the cdas_server/bin directory.
5. Configure WebSEAL to point to the appropriate CAS CDS location.

   See ″Policy Director Credentials Acquisition Service″ in Chapter 13 of the *Policy Director Administration Guide*.

Note: Note that the level of accountability in a many-to-one mapping is not fine-grained. The auditing services can track only the Policy Director user (principal), not the individual users mapped to this principal.

Reference: interface implementation

- “cdas_get_identity” on page 48.
- “cdas_change_password” on page 49.

cdas_get_identity

Performs client authentication on behalf of Policy Director and returns the resulting client identity upon success.

Syntax

```
void cdas_get_identity(
   [in]   handle_t           h,
   [in]   cdas_authn_info_t  *authn_info,
   [out]  cdas_identity_t    **client_id,
   [out]  error_status_t     *st
);
```

Parameters

h – **input**
RPC-binding handle.

authn_info – **input**
Client authentication information, which can be one of the following:

- Username and password pair
- An ASN1 encoded chain of certificates

client_id – **output**
The resulting client identity (upon successful authentication).

st – **output**
Used for reporting both RPC communication errors and server errors when processing the request. Returns error_status_ok upon success.

Remarks

This remote procedure call performs client authentication on behalf of Policy Director and returns the resulting client identity upon success. When the client presents a certificate to Policy Director, it is the role of the CAS to perform the relevant client identity mapping.

Return Values

None.
Success or failure status is returned in the ″st″ output parameter.

cdas_change_password

Enables the caller to manage a given client's password information.

Syntax

```
void cdas_change_password(
   [in]          handle_t       h,
   [in, string]  char           *username,
   [in, string]  char           *old_password,
   [in, string]  char           *new_password,
   [out]         error_status_t *st
);
```

Parameters

h – **input**
: RPC binding handle.

username – **input**
: User name associated with the client account upon which the password modification should be made.

old_password – **input**
: Password associated with the client account that should be changed.

new_password – **input**
: New password to associate with the client account.

st – **output**
: Used for reporting both RPC communication errors and server errors when processing the request. Returns **error_status_ok** upon success.

Remarks

This remote procedure call enables the caller to change a given client's password information.

Return Values

None.
: Success or failure status is returned in the *st* output parameter.

Chapter 5. Authorization API manual pages

This section discusses the following Authorization API:

- azn_attrlist_add_entry()
- azn_attrlist_add_entry_buffer()
- azn_attrlist_create()
- azn_attrlist_delete()
- azn_attrlist_entry_get_num()
- azn_attrlist_get_entry_buffer_value()
- azn_attrlist_get_entry_string_value()
- azn_attrlist_get_names()
- azn_authdce_t
- azn_authldap_t
- azn_creds_combine()
- azn_creds_create()
- azn_creds_delete()
- azn_creds_for_subject()
- azn_creds_get_attrlist_for_subject()
- azn_creds_get_pac()
- azn_creds_modify()
- azn_creds_num_of_subjects()
- azn_decision_access_allowed()
- azn_decision_access_allowed_ext()
- azn_error_major()
- azn_error_minor()
- azn_id_get_creds()
- azn_initialize()
- azn_pac_get_creds()
- azn_release_buffer()
- azn_release_string()
- azn_release_strings()
- azn_shutdown()
- azn_unauth_t
- azn_util_client_authenticate()
- azn_util_password_authenticate()
- azn_util_server_authenticate()

azn_attrlist_add_entry()

Adds a name or string-value entry to an attribute list.

Syntax

```
azn_status_t
azn_attrlist_add_entry(
     azn_attrlist_h_t attr_list,
     azn_string_t attr_name,
     azn_string_t string_value
);
```

Parameters

attr_list **– input**
Handle to an attribute list.

attr_name **– input**
Name attribute of the entry to be added.

string_value **– input**
Value (string) attribute of the entry to be added.

Remarks

This call adds an entry to the attribute list *attr_list*. The added entry has a name *attr_name* and value *string_value*.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_ATTRLIST_HANDLE
Attribute list handle is invalid.

AZN_S_INVALID_ATTR_NAME
Attribute name is invalid.

AZN_S_INVALID_ATTR_VALUE
Attribute value is invalid.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_attrlist_add_entry_buffer()

Adds a name or buffer-value entry to an attribute list.

Syntax

```
azn_status_t
azn_attrlist_add_entry(
     azn_attrlist_h_t attr_list,
     azn_string_t attr_name,
     azn_buffer_t buffer_value
);
```

Parameters

attr_list **– input**
Handle to an attribute list.

attr_name **– input**
Name attribute of the entry to be added.

buffer_value **– input**
Value (buffer) attribute of the entry to be added.

Remarks

This call adds an entry to the attribute list, *attr_list*. The added entry has a name *attr_name* and a value *buffer_value*.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_ATTRLIST_HANDLE
Attribute list handle is invalid.

AZN_S_INVALID_ATTR_NAME
Attribute name is invalid.

AZN_S_INVALID_ATTR_BUFFER
Attribute buffer is invalid.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_attrlist_create()

Creates a valid and empty attribute list, assigns it a handle, and returns the handle.

Syntax

```
azn_status_t
azn_attrlist_create(
     azn_attrlist_h_t *new_attr_list
);
```

Parameters

new_attr_list– **output**
A reference to the new attribute list handle that is returned.

Remarks

This call creates a new and empty attribute list, assigns it a handle *new_attr_list*, and returns the handle.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_ATTRLIST_HANDLE
Attribute list handle is invalid.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_attrlist_delete()

Deletes the attribute list associated with the attribute list handle.

Syntax

```
azn_status_t
azn_attrlist_delete(
    azn_attrlist_h_t *attr_list
);
```

Parameters

attr_list **– input**
: On input, an existing attribute list handle.

old_attr_list **– output**
: On output, an existing attribute list handle.

Remarks

This call deletes the attribute list associated with the handle *old_attr_list*. The call can set the input attribute list handle to an invalid value to ensure that it cannot be used in future calls.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
: Successful completion.

AZN_S_INVALID_ATTRLIST_HANDLE
: Attribute list handle is invalid.

AZN_S_FAILURE
: An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_attrlist_entry_get_num()

Returns the number of value attributes in the entry for a specified name attribute in a specified attribute list.

Syntax

```
azn_status_t
azn_attrlist_entry_get_num(
     azn_attrlist_h_t attr_list,
     azn_string_t attr_name,
     unsigned int *num_values
);
```

Parameters

attr_list **– input**
Handle to an existing attribute list.

attr_name **– input**
Name attribute for the entry whose number of value attributes is to be returned.

num_values **– output**
Reference to an integer through which the number of value attributes (in the entry whose name attribute is specified by *attr_name*) is returned.

Remarks

This call returns the number of value attributes in the entry for a specified attribute in a specified attribute list.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_ATTRLIST_HANDLE
Attribute list handle is invalid.

AZN_S_INVALID_ATTR_NAME
Attribute name is invalid.

AZN_S_INVALID_ATTR_INTEGER_REF
The integer reference is not valid.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_attrlist_get_entry_buffer_value()

Returns one value attribute from an entry in an attribute list whose entries' value attributes are buffers.

Syntax

```
azn_status_t
azn_attrlist_get_entry_buffer_value(
     azn_attrlist_h_t attr_list,
     azn_string_t attr_name,
     unsigned int value_index,
     azn_buffer_t buffer_value
);
```

Parameters

attr_list **– input**
Handle to an attribute list.

attr_name **– input**
Name attribute of the entry from which the value attribute is to be returned.

value_index **– input**
Index within the entry of the value attribute to be returned.

buffer_value **– output**
Buffer that holds the returned value attribute.

Remarks

This call returns one buffer-type value attribute in *buffer_value*. The returned value attribute is the one at position *value_index* within the entry whose name attribute is specified by *attr_name*.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_ATTRLIST_HANDLE
Attribute list handle is invalid.

AZN_S_INVALID_ATTR_NAME
Attribute name is invalid.

AZN_S_ATTR_INVALID_BUFFER_REF
The buffer reference is not valid.

AZN_S_ATTR_INVALID_INDEX
The index is not valid (no value exists for this index).

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_attrlist_get_entry_string_value()

Returns one value attribute from an entry in an attribute list whose entries' value attributes are strings.

Syntax

```
azn_status_t
azn_attrlist_get_entry_string_value(
     azn_attrlist_h_t attr_list ,
     azn_string_t attr_name,
     unsigned int value_index,
     azn_string_t *string_value
);
```

Parameters

attr_list **– input**
Handle to an existing attribute list.

attr_name **– input**
Name attribute of the entry from which the value attribute is to be returned.

value_index **– input**
Index within the entry of the value attribute to be returned.

string_value **– output**
String that holds the returned value attribute

Remarks

This call returns one string-type value attribute in *string_value*. The returned value attribute is the one at position *value_index* within the entry whose name attribute is specified by *attr_name*.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_ATTRLIST_HANDLE
Attribute list handle is invalid.

AZN_S_INVALID_ATTR_NAME
Attribute name is invalid.

AZN_S_ATTR_INVALID_STRING_REF
The string reference is not valid.

AZN_S_ATTR_VALUE_NOT_STRING_TYPE
The value attributes of this entry are not of type string.

AZN_S_ATTR_INVALID_INDEX
The index is not valid (no value exists for this index).

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_attrlist_get_names()

Returns the list of all name attributes appearing in entries of the attribute list.

Syntax

```
azn_status_t
azn_attrlist_get_names(
     azn_attrlist_h_t attr_list,
     azn_string_t *attr_names[]
);
```

Parameters

attr_list **– input**
Handle to an existing attribute list.

attr_names **– output**
Array of NULL-terminated strings to hold the returned list of name attributes. The last entry in the array is denoted by a NULL *azn_string_t*.

Remarks

This call returns a list of names attributes as an array of NULL terminated strings.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_ATTRLIST_HANDLE
Attribute list handle is invalid.

AZN_S_INVALID_STRING_REF
The string reference is not valid.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_authdce_t

Provides authentication information about a user for use by the Authorization API.

Syntax

```
typedef struct {
    char *principal;
    char *auth_method;
    OM_uint32 ipaddr;
    char *qop;
    char *user_info;
    char *browser_info;
    char *authnmech_info;
} azn_authdce_t;
```

Values

principal
Name of the DCE user (principal).

auth_method
String that indicates use of the DCE authentication method. The content of the string is defined by the application.

ipaddr
IP address of requesting user.

qop
Quality of protection that is required for requests that are made by this user.

user_info
Additional user information that might be required for auditing.

browser_info
Browser (if any) that is employed by the user.

authnmech_info
Additional authentication mechanism information. Supplied and used as needed by the application.

Remarks

This base DCE information structure is passed into the azn_id_get_creds() interface. Values in all fields, except for *principal*, are specified by the application for use as needed by the application.

azn_authldap_t

Is used by the Authorization API as an input of credential and other information for use within the Policy Director secure domain.

Syntax

```
typedef struct {
    char *ldap_dn;
    char *auth_method;
    OM_uint32 ipaddr;
    char *qop;
    char *user_info;
    char *browser_info;
    char *authnmech_info;
} azn_authldap_t;
```

Values

ldap_dn
LDAP distinguished name.

auth_method
String that indicates use of the LDAP authentication method. The content of the string is defined by the application.

ipaddr
IP address of requesting user.

qop
Quality of protection that is required for requests that are made by this user.

user_info
Additional user information that might be required for auditing.

browser_info
Browser (if any) that is employed by the user.

authnmech_info
Additional authentication mechanism information. Supplied and used as needed by the application.

Remarks

This base LDAP information structure is passed into the azn_id_get_creds() interface. Values in all fields, except for *ldap_dn*, are specified by the application for use, as needed, by the application.

azn_creds_combine()

Combines two credentials and a handle to the resulting combined credential.

Syntax

```
azn_status_t
azn_creds_combine(
     azn_creds_h_t creds_to_add,
     azn_creds_h_t creds_to_prepend,
     azn_creds_h_t *combined_creds
);
```

Parameters

creds_to_add **– input**
Handle to credentials to be added to the existing credentials chain.

creds_to_prepend **– input**
Handle to the credentials chain where the first indexed entry is the credential of the request initiator.

combined_creds **– output**
Handle to the returned new credentials, which includes all the credential chain referenced by *creds_to_prepend*, and is followed by the credentials referenced by *creds_to_add*.

Remarks

This call takes a credential handle *creds_to_add* and adds it to the end of a chain of one or more credentials, which are referenced by another credential handle *creds_to_prepend*. The credentials chain referenced by *creds_to_prepend* must contain as its first indexed credential the credentials of the initiator. It might contain the (previously combined) credentials of one or more of the initiator's proxies. A handle to the combined credentials is returned through *combined_creds*.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_CREDS_HDL
The handle passed as *creds_to_prepend* is invalid.

AZN_S_INVALID_ADDED_CREDS_HDL
The credentials handle passed as *creds_to_add* is invalid.

AZN_S_INVALID_NEW_CREDS_HDL
The credentials handle passed as *combined_creds* is invalid.

AZN_S_UNIMPLEMENTED_FUNCTION
This function is not supported by the implementation.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_creds_create()

Creates a new, empty credentials structure, assigns it a handle, and returns the handle.

Syntax

```
azn_status_t
azn_creds_create(
    azn_creds_h_t *creds
);
```

Parameters

creds **– input**
: Reference to the new credentials handle that is returned.

Remarks

This call creates a new, empty credentials structure, assigns it a handle, and returns the handle.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with “azn_error_major()” on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_CREDS_HDL
The credentials handle supplied is invalid.

AZN_S_FAILURE
An error or failure has occurred. Use “azn_error_minor()” on page 79 to derive specific minor error codes from the returned status code.

azn_creds_delete()

Deletes the credentials associated with the credential handle.

Syntax

```
azn_status_t
azn_creds_delete(
     azn_creds_h_t *creds
);
```

Parameters

creds – **input**
: Reference to the handle of the credentials to be deleted.

creds – **output**
: Reference to the handle of the credentials to be deleted.

Remarks

This call deletes the credentials associated with the handle *creds*. The call sets the input credentials handle to an invalid value to ensure that it cannot be used in future calls.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with “azn_error_major()” on page 78.

AZN_S_COMPLETE
: Successful completion.

AZN_S_INVALID_CREDS_HDL
: The credentials handle supplied is invalid.

AZN_S_FAILURE
: An error or failure has occurred. Use “azn_error_minor()” on page 79 to derive specific minor error codes from the returned status code.

azn_creds_for_subject()

Returns a handle to a credentials structure. The handle is used to extract individual credentials from combined credentials.

Syntax

```
azn_status_t
azn_creds_for_subject(
    azn_creds_h_t creds,
    unsigned int subject_index,
    azn_creds_h_t *new_creds
);
```

Parameters

creds **– input**
: Handle to a credentials structure representing a credentials chain, which contains a list of 1 or more individual credentials structures.

subject_index **– input**
: Index of the requested individual credential within the credentials chain. The index of the first credential in the chain, which should be that of the initiator, is zero (0).

new_creds **– output**
: Handle to the new credentials structure that is returned.

Remarks

This call returns a handle, *new_creds*, to a credentials structure for the individual credential at index *subject_index* within a credentials structure *creds* which represents a credentials chain. Credentials chains are created by the azn_creds_combine() function. The first credential in a credentials chain is that of the initiator, and its index is zero (0). Callers can retrieve the credentials of the initiator by passing the constant AZN_C_INITIATOR_INDEX as the value of *subject_index*.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
: Successful completion.

AZN_S_INVALID_CREDS_HANDLE
: The credentials handle supplied as *creds* is invalid.

AZN_S_AUTHORIZATION_FAILURE
: The caller does not possess the authority required to invoke this function.

AZN_S_INVALID_SUBJECT_INDEX
: The supplied index is not valid.

AZN_S_UNIMPLEMENTED_FUNCTION
: This function is not supported by the implementation.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_creds_get_attrlist_for_subject()

Returns information from a specified credentials structure.

Syntax

```
azn_status_t
azn_creds_get_attrlist_for_subject (
    azn_creds_h_t creds,
    unsigned int subject_index,
    azn_attrlist_h_t *creds_attrlist
);
```

Parameters

creds **– input**
Handle to a credentials structure representing a credentials chain.

subject_index **– input**
Index of the requested individual credential within the credentials chain. The index of the first credential in the chain, which should be that of the initiator, is zero (0). If *creds* is an individual credential rather than a credentials chain, the index zero (0) will specify the entire credentials structure.

creds_attrlist **– output**
Reference to the handle of an attribute list that holds the specified credential's attribute information on return.

Remarks

This call returns an attribute list containing information from the credentials structure for the individual credential at index *subject_index* within a credentials structure *cred*s. The structure *creds* can be a single credential or a credentials chain; credentials chains are created by the azn_creds_combine() function. The first credential in a credentials chain is that of the initiator, and its index is zero (0). Callers can retrieve the credentials of the initiator by passing the constant AZN_C_INITIATOR_INDEX as the value of *subject_index*.

The audit identifier associated with the specified credentials structure is present in the returned attribute list. It is the value attribute of an entry whose name attribute is AZN_C_AUDIT_ID.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_CREDS_HDL
The credentials handle supplied is invalid.

AZN_S_INVALID_SUBJECT_INDEX
The supplied index is not valid.

AZN_S_INVALID_ATTRLIST_HDL
The attribute list handle supplied is invalid.

AZN_S_AUTHORIZATION_FAILURE
The caller does not possess the authority required to invoke this function.

AZN_S_UNIMPLEMENTED_FUNCTION
This function is not supported by the implementation.

AZN_S_FAILURE
An error or failure has occurred. Use “azn_error_minor()” on page 79 to derive specific minor error codes from the returned status code.

azn_creds_get_pac()

Creates and returns a privilege attribute certificate (PAC) by invoking a specified PAC service on the supplied credentials.

Syntax

```
azn_status_t
azn_creds_get_pac(
    azn_creds_h_t creds,
    azn_string_t pac_svc_id,
    azn_buffer_t pac
);
```

Parameters

creds **– input**
Handle to the credentials whose information is used to build the Privilege Attribute Certificate (PAC).

pac_svc_id **– input**
Identification (id) of the PAC service that produces the PAC.

pac **– output**
The buffer structure that holds the returned PAC.

Remarks

This call uses the PAC service whose identification is supplied as *pac_svc_id* to build a new PAC. The PAC service uses the information in the supplied credentials to build the PAC. Different PAC services might produce PACs with different formats. Some PAC services can cryptographically protect or sign the PACs they produce.

This call takes as an input parameter a handle to an existing credentials structure, and returns the output PAC in an Authorization API buffer.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_CREDS_HDL
The credentials handle supplied is invalid.

AZN_S_INVALID_PAC_SVC
The privilege attribute certificate service identifier is invalid.

AZN_S_AUTHORIZATION_FAILURE
The caller does not possess the authority required to invoke this function.

AZN_S_UNIMPLEMENTED_FUNCTION
This function is not supported by the implementation.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_creds_modify()

Modifies an existing credential and returns a handle to a new credential that contains the modifications.

Syntax

```
azn_status_t
azn_creds_modify(
    azn_creds_h_t creds,
    azn_string_t mod_svc_id,
    azn_attrlist_h_t mod_info,
    azn_creds_h_t new_creds
);
```

Parameters

creds **– input**
: Handle to the authorization credentials to be modified.

mod_svc_id **– input**
: Identification (id) of the credential modification service.

mod_info **– input**
: Attribute list that contains modification service-specific or application-specific data that describes the desired credential modifications.

new_creds **– output**
: Handle to a credentials structure that contains the modified credentials upon return.

Remarks

This call modifies an existing credential by adding the attribute list *mod_info* to the credentials structure, and assigning the modified credential to a new credentials structure *new_creds*.

Before calling this function, you must call azn_creds_create() to create a new and empty credentials structure *new_creds*.

This function uses the specified modification service *mod_svc_id* and (optionally) an attribute list *mod_info*, which contains modification information provided by the caller to modify a copy of the supplied credential. The function returns a handle to a new credentials structure containing the modified credential. The supplied credential *creds* is unchanged.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
: Successful completion.

AZN_S_INVALID_CREDS_HDL
: The credentials handle supplied is invalid.

AZN_S_INVALID_MOD_FUNCTION
: The supplied modification service identifier is not valid.

AZN_S_INVALID_ATTRLIST_HDL
The attribute list handle supplied is invalid.

AZN_S_INVALID_NEW_CREDS_HDL
The new credentials handle is invalid.

AZN_S_AUTHORIZATION_FAILURE
The caller does not possess the authority required to invoke this function.

AZN_S_UNIMPLEMENTED_FUNCTION
This function is not supported by the implementation.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_creds_num_of_subjects()

Returns the number of individual credentials in a credentials chain.

Syntax

```
azn_status_t
azn_creds_num_of_subjects(
    azn_creds_h_t creds,
    unsigned int *num_of_subjects
);
```

Parameters

creds **– input**
Handle to a credentials structure

num_of_subjects **– output**
Number of credentials in the credentials structure upon return.

Remarks

This call returns the number of individual credentials, *num_of_subjects*, in a credentials chain *creds*. Credentials chains are created by the azn_creds_combine() function.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_CREDS_HDL
The credentials handle supplied is invalid.

AZN_S_ATTR_INVALID_INTEGER_REF
The integer reference is invalid.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_decision_access_allowed()

Makes an access control decision.

Syntax

```
azn_status_t
azn_decision_access_allowed(
    azn_creds_h_t creds,
    azn_string_t protected_resource,
    azn_string_t operation,
    int *permission
);
```

Parameters

creds **– input**
Handle to the initiator's credentials.

protected_resource **– input**
Name of the request's target.

operation **– input**
Name of the requested operation.

permission **– output**
Value of the returned permission. Will be either AZN_C_PERMITTED or AZN_C_NOT_PERMITTED if the returned status value is AZN_S_COMPLETE.

Calling applications are bound by the decision returned using the permission argument only when the returned status code is AZN_S_COMPLETE.

When the returned status code is not AZN_S_COMPLETE, the returned permission might be set to any value.

Remarks

This call decides whether the initiator with credentials *creds* is authorized to perform the operation *operation* on the target *protected_resource*. The decision is returned through *permission*.

azn_decision_access_allowed() is a convenience function for azn_decision_access_allowed_ext() with app_context=NULL and permission_info=NULL.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_CREDS_HDL
The credentials handle supplied is invalid.

AZN_S_INVALID_RESOURCE
The target name is invalid.

AZN_S_INVALID_OPERATION
The operation has no meaning for the specified target.

AZN_S_INVALID_PERMISSION_REF
The integer reference to return the permission is invalid.

AZN_S_AUTHORIZATION_FAILURE
The caller does not possess the authority required to invoke this function.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_decision_access_allowed_ext()

Makes an access control decision by using application-specific context information; returns information about why the decision was made.

Syntax

```
azn_status_t
azn_decision_access_allowed_ext(
    azn_creds_h_t creds,
    azn_string_t protected_resource,
    azn_string_t operation,
    azn_attrlist_h_t app_context,
    int *permission,
    azn_attrlist_h_t *permission_info
);
```

Parameters

creds **– input**
Handle to the initiator's credentials

protected_resource **– input**
Name of the request's target.

operation **– input**
Name of the requested operation

app_context **– input**
Attribute list that contains application-specific context access control information (ACI). A NULL value indicates that there is no context ACI.

permission_info **– input**
Pointer to an attribute list through which the implementation might return implementation-specific information about the decision. If a NULL value is passed as input, then no information will be returned.

permission **– output**
Value of the returned permission. Will be either AZN_C_PERMITTED or AZN_C_NOT_PERMITTED if the returned status value is AZN_S_COMPLETE.

Calling applications are bound by the decision returned using the permission argument only when the returned status code is AZN_S_COMPLETE.

When the returned status code is not AZN_S_COMPLETE, the returned permission can be set to any value.

permission_info **– output**
Pointer to an attribute list through which the implementation can return implementation-specific information about the decision. If a NULL value is passed as input, then no information will be returned.

Remarks

This call decides whether the initiator with credentials *creds* is authorized to perform the operation *operation* on the target *protected_resource*. Optionally, callers can supply application-specific context access control information (ACI) by using the *app_context* argument. The decision is returned through *permission*.

Optionally, the implementation can return implementation-specific information about the decision through *permission_info*.

The constants AZN_C_REQUEST_TIME, AZN_C_AUTHN_QUALITY, AZN_C_REQUESTER_LOC, and AZN_C_REQUEST_ROUTE_QOP can be used as the name attributes of entries in the *app_context* attribute list to communicate common types of context.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_CREDS_HDL
The credentials handle supplied is invalid.

AZN_S_INVALID_RESOURCE
The target name is invalid.

AZN_S_INVALID_OPERATION
The operation has no meaning for the specified target.

AZN_S_INVALID_PERMISSION_REF
The integer reference to return the permission is invalid.

AZN_S_INVALID_APP_CONTEXT_HDL
The attribute list handle for the context ACI is invalid.

AZN_S_INVALID_ATTRLIST_HDL
The attribute list handle for the returned *permission_info* is invalid.

AZN_S_AUTHORIZATION_FAILURE
The caller does not possess the authority required to invoke this function.

AZN_S_UNIMPLEMENTED_FUNCTION
This function is not supported by the implementation.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_error_major()

Returns the major error code that is associated with a returned status code.

Syntax

```
unsigned int
azn_error_major(
    azn_status_t status_code
);
```

Parameters

status_code **– input**
    Previously returned status code by any of the azn_* routines.

Remarks

This call returns the major error code associated with a previously returned status code.

Return Values

Any of the defined major error codes, AZN_S_*, is returned.

azn_error_minor()

Returns the implementation-specific minor error code that is associated with a returned status code.

Syntax

```
unsigned int
azn_error_minor(
    azn_status_t status_code
);
```

Parameters

status_code **– input**
Previously returned status code by any of the azn_* routines.

Remarks

This call returns the minor error code associated with a previously returned status code.

Return Values

An implementation-specific minor error code is returned. For a complete list of minor error codes, see the dceaclmsg.h file.

azn_id_get_creds()

Returns a handle to the credentials associated by a specified authorization authority with a specified identity.

Syntax

```
azn_status_t
azn_id_get_creds(
    azn_string_t authority,
    azn_string_t mechanism_id,
    azn_buffer_t mechanism_info,
    azn_creds_h_t new_creds
);
```

Parameters

authority – **input**
: Identification (id) of the authorization authority to be used to build the credential. A NULL input value selects a default.

mechanism_id – **input**
: Authentication mechanism that is used to generate the identity passed through *mechanism_info*. A NULL input value selects a default authentication mechanism.

mechanism_info – **input**
: Buffer containing initiator access control information (ACI), which consists of identity information obtained from an authentication service. The authentication service used to produce this information should be identified using the *mechanism_id* argument. A NULL input value denotes the default identity for the selected authentication mechanism from the environment.

new_creds – **output**
: Handle to the credentials structure that holds the returned *creds*.

Remarks

This call builds an authorization credentials structure, referenced by the returned handle *new_creds*, for the identity corresponding to the initiator Access Control Information *mechanism_info* produced by an authentication mechanism *mechanism_id*.

Specifying a NULL value for *authority* causes the default authority to be used. The default authority is Policy Director, which is the only authority supported by this release of the Policy Director Authorization API.

Specifying NULL values for *mechanism_id* and for *mechanism_info* causes the default authentication mechanism and the default identity to be the authentication mechanism used in the Policy Director secure domain.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
: Successful completion.

AZN_S_INVALID_AUTHORITY
The authorization authority identification (id) is invalid.

AZN_S_INVALID_MECHANISM
The security mechanism identification (id) is not supported by the selected authorization authority.

AZN_S_INVALID_MECHANISM_INFO
The security mechanism information is not valid.

AZN_S_INVALID_NEW_CREDS_HDL
The credentials handle supplied for the new credentials is invalid.

AZN_S_AUTHORIZATION_FAILURE
The caller does not possess the authority required to invoke this function.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_initialize()

Initializes the authorization service.

Syntax

```
azn_status_t
azn_initialize(
    azn_attrlist_h_t init_data,
    azn_attrlist_h_t init_info
);
```

Parameters

init_data **– input**
: Handle to an attribute list containing implementation-specific initialization data.

init_info **– output**
: Handle to an attribute list through which implementation-specific information is returned from initialization.

Remarks

This function must be called before you call any other standard Authorization API function.

Before calling this function, an API application must establish a security context in the Policy Director secure domain. Use either azn_util_server_authenticate() or azn_util_client_authenticate() to establish this context.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
: Successful completion.

AZN_S_INVALID_INIT_DATA_HDL
: The attribute list handle for the initialization information is invalid.

AZN_S_INVALID_ATTRLIST_HDL
: The attribute list handle for the initialization information is invalid.

AZN_S_FAILURE
: An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_pac_get_creds()

Returns a handle to new credentials that are derived from a privilege attribute certificate (PAC) by a specified PAC service.

Syntax

```
azn_status_t
azn_pac_get_creds(
    azn_buffer_t pac,
    azn_string_t pac_svc_id,
    azn_creds_h_t *new_creds
);
```

Parameters

pac **– input**
Buffer structure that holds the supplied PAC.

pac_svc_id **– input**
Identification (id) of the PAC service that produces the *creds*.

new_creds **– output**
Handle to the credentials structure that holds the returned *creds*.

Remarks

This call uses the PAC service whose identification (id) is supplied to build a new credentials structure that uses the information in the supplied PAC. Some PAC services will cryptographically verify the protection or signature on the received PAC and will return an error if the PAC cannot be verified.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with "azn_error_major()" on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_PAC
The PAC is invalid or cannot be verified by the PAC service.

AZN_S_INVALID_PAC_SVC
The id of the PAC service is invalid.

AZN_S_INVALID_NEW_CREDS_HDL
The credentials handle supplied is invalid.

AZN_S_AUTHORIZATION_FAILURE
The caller does not possess the authority required to invoke this function.

AZN_S_UNIMPLEMENTED_FUNCTION
This function is not supported by the implementation.

AZN_S_FAILURE
An error or failure has occurred. Use "azn_error_minor()" on page 79 to derive specific minor error codes from the returned status code.

azn_release_buffer()

Frees storage that is associated with a buffer

Syntax

```
azn_status_t
azn_release_buffer(
    azn_buffer_t buffer
);
```

Parameters

buffer **– input**
Buffer whose memory is to be released.

Remarks

This call releases azn_buffer_t structures.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with “azn_error_major()” on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_BUFFER_REF
The buffer reference is invalid.

AZN_S_FAILURE
An error or failure has occurred. Use “azn_error_minor()” on page 79 to derive specific minor error codes from the returned status code.

azn_release_string()

Frees storage that is associated with a string.

Syntax

```
azn_status_t
azn_release_string(
    azn_string_t string
);
```

Parameters

string **– input**
Pointer to the string to be released.

Remarks

This call releases azn_string_t structures.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with “azn_error_major()” on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_INVALID_STRING_REF
The string reference is invalid.

AZN_S_FAILURE
An error or failure has occurred. Use “azn_error_minor()” on page 79 to derive specific minor error codes from the returned status code.

azn_release_strings()

Frees storage that is associated with an array of strings.

Syntax

```
azn_status_t
azn_release_strings(
    azn_string_t strings[ ]
);
```

Parameters

strings **– input**
: Pointer to the array of azn_string_t structures to be released.

Remarks

This call releases a NULL-terminated array of azn_string_t structures.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with “azn_error_major()” on page 78.

AZN_S_COMPLETE
: Successful completion.

AZN_S_INVALID_STRING_REF
: The reference to the array of strings is invalid.

AZN_S_FAILURE
: An error or failure has occurred. Use “azn_error_minor()” on page 79 to derive specific minor error codes from the returned status code.

azn_shutdown()

Cleans up internal authorization service state in preparation for shutdown.

Syntax

```
azn_status_t
azn_shutdown(
);
```

Remarks

This call is used by an application that has initialized the Authorization API using the azn_initialize() function. Calls azn_shutdown() to clean up the Authorization APIÆs memory and other internal implementation state before the application exits.

Return Values

If successful, the function will return AZN_S_COMPLETE.

If the returned status code is not equal to AZN_S_COMPLETE, the major error codes will be derived from the returned status code with “azn_error_major()” on page 78.

AZN_S_COMPLETE
Successful completion.

AZN_S_FAILURE
An error or failure has occurred. Use “azn_error_minor()” on page 79 to derive specific minor error codes from the returned status code.

azn_unauth_t

Is used by the Authorization API as an input of credential and other information for unauthenticated users in the Policy Director secure domain.

Syntax

```
typedef struct {
    OM_uint32 ipaddr;
    char *qop;
    char *user_info;
    char *browser_info;
} azn_unauth_t;
```

Values

ipaddr
: IP address of requesting user.

qop
: Quality of protection that is required for requests that are made by this user.

user_info
: Additional user information that might be required for auditing.

browser_info
: Browser (if any) that is employed by the user.

Remarks

This data structure is used to pass information about an unauthenticated user into the azn_id_get_creds() interface. The content of each element of this structure is determined by the application, based on application requirements.

azn_util_client_authenticate()

Performs a login from a username and password.

Syntax

```
OM_uint32 azn_util_client_authenticate(
    const azn_string_t principal_name,
    const azn_string_t password
);
```

Parameters

principal_name **– input**
Name of the principal (user) to be logged in.

password **– input**
Text password for the user.

Remarks

This call performs a login from a username and password pair. Starts a background thread to refresh the login context as necessary.

Return Values

Returns AZN_S_COMPLETE on success, error code on failure.

azn_util_password_authenticate()

Performs a login for a username and password pair, and returns authentication information when the login is successful.

Syntax

```
OM_uint32 azn_util_password_authenticate(
    const azn_string_t principal_name,
    const azn_string_t password,
    azn_string_t mechanism_id,
    azn_buffer_t authinfo
);
```

Parameters

principal_name **– input**
Name of the user (principal) used to log in.

password **– input**
Password for the user.

mechanism_id **– output**
Pointer to a buffer that is loaded with the results of the login when the login attempt is successful.

authinfo **– output**
String-identifying authentication mechanism with which the user is authenticated.

Remarks

This call performs a login for a username and password pair, and returns authentication information when the login is successful. Does not establish a security context for the application. The *mechanism_id* and *authinfo* returned can then be appended with data specific to the principal and passed into the azn_id_get_creds() call.

The authentication mechanism used depends upon the underlying authentication mechanism that was configured when the Authorization API was installed.

The *mechanism_id* string is allocated by the utility function and must be freed using azn_release_string() when no longer needed.

Return Values

Returns AZN_S_COMPLETE on success, error code on failure.

azn_util_server_authenticate()

Performs a login from a keytab file, and starts a background thread to refresh the login context as necessary.

Syntax

```
OM_uint32 azn_util_server_authenticate(
    const azn_string_t principal_name,
    const azn_string_t keytab_path
);
```

Parameters

principal_name – **input**
: Path to the keytab file containing the principal's key.

keytab_path – **input**
: Name of the user (principal) to log in.

Remarks

Performs a login from a keytab file, and starts a background thread to refresh the login context as necessary.

In order to use this utility function, applications that operate in a Policy Director secure domain that uses an LDAP user registry must use the DCE commands to create a keytab file.

Return Values

Returns AZN_S_COMPLETE on success, error code on failure.

Appendix. Notices

Trademarks

AuthAPI	DASCOM, Inc.
DASCOM	DASCOM, Inc.
IntraVerse	DASCOM, Inc.
NetSEAL	DASCOM, Inc.
NetSEAT	DASCOM, Inc.
Solaris	Sun Microsystems, Inc
WebSEAL	DASCOM, Inc.

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