

CHAPTER

1

Introduction

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About This Book

This book describes the SAS 9.1.3 Open Metadata Interface and contains all of the information you need to write a SAS Open Metadata Interface client that creates and manages metadata in SAS Metadata Repositories. This book describes

- the SAS Metadata Model
- namespaces
- metadata-related, security-related, and server-control methods
- call interfaces
- open client requirements.

Hierarchy and association diagrams are provided to help you to understand the relationships between application-related metadata types in the SAS Metadata Model. You need to understand these relationships before you can issue SAS Open Metadata Interface method calls that read and write metadata. In addition, program-specific examples are provided that show how to issue SAS Open Metadata Interface method calls in Java, Visual Basic, and C++ clients.

The SAS Open Metadata Architecture is a client-server architecture that uses XML as its transport language. If you are unfamiliar with XML, see the W3C XML Specifications at

www.w3.org/TR/1998/REC-xml-19980210

This book also contains reference information about SAS language interfaces for metadata. The SAS language interfaces for metadata are SAS Open Metadata Interface clients that enable you to read and write metadata in SAS Metadata Repositories from base SAS.

Note: Due to production issues, reference information about the SAS namespace metadata types is provided only in online versions of this book. When you come upon a reference to the “Alphabetical Listing of SAS Namespace Metadata Types,” look for this listing in *SAS Help and Documentation* or in *SAS OnlineDoc*. \triangle

Prerequisites

To get the most out of this document, you should be familiar with the following:

- a client-application programming language, such as Visual Basic, C++, or Java
- a software development environment, such as Microsoft’s Visual Studio or SAS AppDev Studio
- Extensible Markup Language (XML) 1.0.

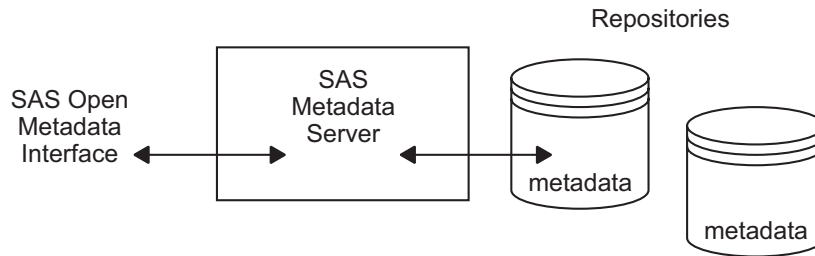
See “Setting Up a Client Development Environment” in the *SAS Metadata Server: Setup and Administration Guide* for details about the software that must be installed to support the SAS Open Metadata Interface.

What Is the SAS Open Metadata Architecture?

The SAS Open Metadata Architecture is a general-purpose metadata management facility that provides common metadata services to SAS applications. Using the metadata architecture, separate SAS applications can exchange metadata, which makes it easier for these applications to work together. The metadata architecture also saves development effort because applications no longer have to maintain their own metadata facilities.

The metadata architecture includes an application metadata model, a repository metadata model, an application programming interface, and a metadata server.

- The application metadata model, called the SAS Metadata Model, provides classes and objects that define different types of application metadata. It models associations between individual metadata objects, it uses inheritance of attributes and methods to effect common behaviors, and it uses subclassing to extend behaviors.
- The repository metadata model is a special-purpose model that defines metadata types for repositories and repository managers. Like the SAS Metadata Model, it uses classes, objects, inheritance, and subclassing. However, its purpose is to support repository queries and impose controls on the objects contained in the repositories which the repository objects describe.
- The SAS Open Metadata Interface provides methods for reading and writing metadata objects that are stored in repositories. These same methods can be used to maintain the repositories, although this is a secondary task. Another set of methods is provided for administering repositories and the server.
- The SAS Metadata Server is a multiuser server that surfaces metadata from one or more repositories via the SAS Open Metadata Interface. The SAS Metadata Server uses the Integrated Object Model (IOM) from SAS Integration Technologies. IOM provides distributed object interfaces to Base SAS software features and enables you to use industry-standard languages, programming tools, and communication protocols to develop client programs that access base features on IOM servers. Its purpose is to provide a central, shared location for accessing metadata.

Display 1.1 SAS Open Metadata Architecture

What Can I Do with the SAS Open Metadata Interface?

The SAS Open Metadata Interface enables you to read and write the metadata of applications that comply with the metadata architecture. It also enables you to maintain repositories and to control the SAS Metadata Server, but these tasks are secondary. For the most part, you will use the SAS Open Metadata Interface to read or write the metadata of applications. For example, you can write clients that perform the following tasks:

- return a list of data stores that contain a metadata item that you specify, such as a column name of Salary
- export the metadata from one application to another application, so that the metadata can be analyzed
- export the metadata for a data store so that the data store can be accessed by more than one application.

How Does the SAS Open Metadata Architecture Work?

To use the metadata architecture, you write SAS Open Metadata Interface client applications in Java, Visual Basic, C++, or you use SAS Open Metadata Interface clients provided by SAS.

Java, Visual Basic, and C++ clients include the appropriate object libraries and method calls that are required to connect to the metadata server and to

- access the metadata within a repository
- access the metadata that defines a repository
- control the SAS Metadata Server.

SAS Open Metadata Interface clients like SAS ETL Studio, SAS Management Console, PROC METADATA, PROC METAOPERATE, SAS Metadata DATA step functions, the SAS Java Metadata Interface, and the SAS Foundation Services Information Service Interface enable you to create and access metadata within a SAS Metadata Repository without having to know the details of the SAS Open Metadata Interface.

SAS ETL Studio

is a thin-client application that enables you to create and manage ETL process flows – sequences of steps for the extraction, transformation, and loading of data. Using SAS ETL Studio, you create metadata objects that define sources, targets,

and the transformations that connect them. The software then uses this metadata to generate or retrieve code that reads sources and creates targets in a file system. For more information, see the *SAS ETL Studio: User's Guide*.

SAS Management Console

provides a graphical user interface for registering repositories; creating global metadata, including metadata access controls; and controlling the metadata server.

PROC METADATA

enables you to issue XML-formatted method calls to create, update, and query metadata from within a SAS program.

PROC METAOPERATE

enables you to pause and resume repositories and refresh, stop, and get the status of the metadata server from a SAS program. See “Maintaining the SAS Metadata Server” in the *SAS Metadata Server: Setup and Administration Guide* for tasks that you might want to perform with PROC METAOPERATE.

SAS Language Metadata DATA Step Functions

provides a family of metadata DATA step functions to get attributes, associations, and properties from metadata objects. These functions also enable you to set and update attributes, associations, and properties for metadata objects.

SAS Java Metadata Interface

provides a Java programming interface to the SAS Metadata Server. The interface provides a way to access SAS metadata repositories through the use of client Java objects that represent server metadata.

Foundation Services Information Service Interface

provides a generic programming interface for interacting with heterogeneous repositories, including SAS Metadata Repositories, Lightweight Directory Access Protocol (LDAP) repositories, and WebDAV repositories, from an application. Using Information Service methods, a client can submit a single query that searches all available repository sources and returns the results in a "smart object" that provides a uniform interface to common data elements such as the object's name, description, and type. The smart objects hide repository and model details. The interface then uses the SAS Java Metadata Interface to launch further queries.

This book describes the SAS Open Metadata Interface and how to write clients that use this interface directly. It also provides reference information about the “METADATA Procedure” on page 254, the “METAOPERATE Procedure” on page 275, and the “SAS Metadata DATA Step Functions” on page 285. For information about the other SAS Open Metadata Interface clients, see their respective documentation.

Important Concepts

metadata type	specifies a template that models the metadata for a particular kind of object. For example, the metadata type Column models the metadata for a SAS table column, and the metadata type RepositoryBase models the metadata for a repository.
namespace	specifies a group of related metadata types and their properties. Names are used to partition metadata into different contexts. The SAS Open Metadata Interface defines two namespaces: SAS and REPOS. The SAS namespace contains metadata types that describe

application elements such as tables and columns. The REPOS namespace contains metadata types that describe repositories.

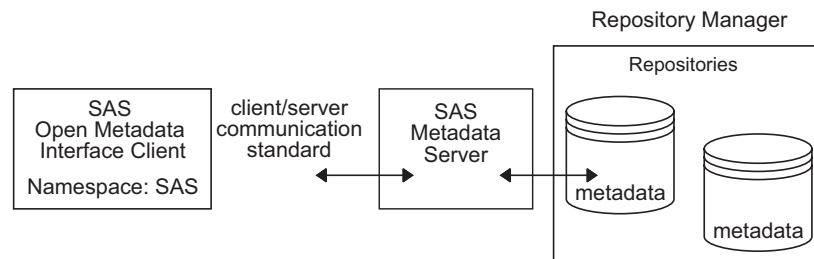
metadata object specifies an instance of a metadata type, such as the metadata for a particular data store or the metadata for a particular metadata repository. All SAS Open Metadata Interface clients use the same methods to read or write a metadata object, whether the object defines an application element or a metadata repository.

Accessing Application Metadata

As shown in the next figure, a SAS Open Metadata Interface client that accesses application metadata has the following characteristics:

- specifies the SAS namespace in order to access the metadata types for application elements such as tables and columns
- connects to the SAS Metadata Server via a communication standard that is appropriate for the client and the IOM-based server, such as COM/DCOM or CORBA
- uses SAS Open Metadata Interface method calls to access instances of the metadata types that are stored in SAS metadata repositories.

Display 1.2 Accessing Metadata Defined in the SAS Namespace



For general information about writing SAS Open Metadata Interface clients, see Chapter 2, “Open Client Requirements,” on page 11. For an overview of the metadata types in the SAS namespace, see Chapter 4, “SAS Namespace Submodels,” on page 47. Reference information about each metadata type is provided in the “Alphabetical Listing of SAS Namespace Metadata Types,” which is provided only in online versions of this book. Details about the methods that are used to read or write metadata objects are provided in Chapter 7, “Methods for Reading and Writing Metadata (IOMI Class),” on page 125.

Creating Repositories

Before you can read and write metadata objects, at least one repository must be registered in the server’s repository manager. The information stored in the repository manager tells the server how to access the repository. You can register repositories by writing a SAS Open Metadata Interface client. However, the preferred method for

registering repositories is to use SAS Management Console. SAS Management Console creates default authorization metadata and templates in each repository.

For information about registering repositories using SAS Management Console, see the Help for the product. For information about the metadata types used to represent repositories, see Chapter 6, “REPOS Namespace Metadata Types,” on page 117.

Controlling the SAS Metadata Server

A metadata server must be running before any client can access metadata repositories. At many sites, a server administrator starts the SAS Metadata Server and SAS Open Metadata Interface clients simply connect to that server. However, there are times when the administrator might want to refresh the server to change certain configuration or invocation options, or to pause and resume repositories and the repository manager to temporarily change their state, for example, in preparation for a backup. He might also want to stop the metadata server. For more information about tasks that might require an administrator to control the metadata server, see “Maintaining a SAS Metadata Server” in the *SAS Metadata Server: Setup and Administration Guide*. This guide is available at support.sas.com/rnd/eai/openmeta.

The SAS Open Metadata Interface provides IServer class methods for controlling the metadata server. You can write a Java, Visual Basic, or C++ client that issues IServer class methods to control the metadata server. Or you can use a SAS Open Metadata Interface clients such as SAS Management Console or PROC METAOPERATE, which automate the IServer methods, to perform server control tasks.

A user must have *administrative user* status on the metadata server in order to issue IServer class methods, except Status. For more information, see “Establishing Server Administrative Privileges” in the *SAS Metadata Server: Setup and Administration Guide*.

For information about writing a SAS Open Metadata Interface client that controls the metadata server, see Chapter 2, “Open Client Requirements,” on page 11 and Chapter 9, “Repository and Server Control Methods (IServer Class),” on page 193. For information about controlling the metadata server using SAS Management Console, see the SAS Management Console documentation. For information about PROC METAOPERATE, see “METAOPERATE Procedure” on page 275.

Security

The SAS Metadata Server supports a variety of authentication providers to determine who can access the metadata server and uses an authorization facility to control user access to metadata on the server. Only users who have been granted *unrestricted user* status on the metadata server have unrestricted access to metadata on the server. A user must be either an *unrestricted user* or an *administrative user* on the metadata server in order to be able to create and delete repositories, modify a repository’s registrations, change the state of a repository, and to register users. For more information, see “Establishing Server Administrative Privileges” and “Controlling User Access to Metadata” in the *SAS Metadata Server: Setup and Administration Guide*.

Authorization Facility

Authorization processes are insulated from metadata-related processes in the SAS Metadata Server. Authorization decisions are made by an authorization facility.

The authorization facility provides an interface for querying authorization metadata that is on the metadata server and returns authorization decisions based on rules that are stored in the metadata. The SAS Metadata Server consumes this interface to make queries regarding read and write access to metadata and enforces the decisions that are returned by the authorization facility. It is not necessary for SAS Open Metadata Interface clients to write queries or to enforce authorization decisions regarding read and write access to metadata.

SAS Open Metadata Interface clients can use the interface to request authorization decisions on other types of metadata access, for example, to return decisions regarding administrative access or to request authorization decisions on the data represented by the SAS metadata. Applications that use the authorization facility to return authorization decisions on user-defined actions must provide their own authorization enforcement.

The query interface consists of a set of methods that are available in the SAS Open Metadata Interface `ISecurity` class. For more information, see Chapter 8, “Security Methods (ISecurity Class),” on page 183.

For information about how the authorization facility makes authorization decisions, see "Using the Authorization Facility" in the *SAS Metadata Server: Setup and Administration Guide*.

