

SAS[®] 9.4 Integration Technologies: Overview

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SAS® 9.4 Integration Technologies: Overview

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Contents

<i>What's New in SAS 9.4 Integration Technologies</i>	<i>v</i>
Chapter 1 / Overview of SAS Integration Technologies	1
What Is SAS Integration Technologies?	1
Accessibility Features of SAS Integration Technologies	2
What SAS Integration Technologies Includes	2
Support for SAS Open Metadata Architecture	3
Support for Industry Standards	4
Chapter 2 / Components of SAS Integration Technologies	7
IOM Servers	8
Using IOM to Develop Applications	13
Foundation Services	17
Publishing Framework	18
Application Messaging	21
Stored Processes	22
SAS BI Web Services	23
Directory Services	24
SAS Web Infrastructure Platform	25

What's New in SAS 9.4 Integration Technologies

Overview

New features for SAS Integration Technologies in SAS 9.4 include a number of general enhancements for the following products:

- SAS Stored Processes
- SAS BI Web Services
- SAS Publishing Framework
- Directory Services
- Application Messaging
- SAS Foundation Services

General Enhancements

SAS Integration Technologies includes the following enhancements:

- SAS Stored Processes introduces new features for the STP procedure and the SAS Stored Process Web Application, as well as general enhancements.
- SAS BI Web Services includes an update for RESTful web services.
- SAS Publishing Framework has added support for circular integrity constraints and extended attributes. If you are publishing to SharePoint or WebDAV, SSL setup can be done using TKESSL. In addition, event publishing is obsolete, and the event publishing documentation has been removed.
- Directory Services includes new TLS_MODE_ON and TLS_MODE_OFF options for the LDAPS_OPEN CALL routine.

In SAS 9.4M1, the PagedResults argument is new for the LDAPS_SEARCH CALL routine. The PagedResults argument can be used to specify the number of results on a page of output.

In **SAS 9.4M5**, the LDAPS_SEARCH_PAGE CALL routine is new. The LDAPS_SEARCH_PAGE CALL routine enables you to search and retrieve paged information from the specified LDAP directory.

- Application messaging provides a new ACTIVEMQ file access method.
- In SAS Foundation Services, the Event Broker Service is no longer available.

Overview of SAS Integration Technologies

<i>What Is SAS Integration Technologies?</i>	1
<i>Accessibility Features of SAS Integration Technologies</i>	2
<i>What SAS Integration Technologies Includes</i>	2
<i>Support for SAS Open Metadata Architecture</i>	3
<i>Support for Industry Standards</i>	4

What Is SAS Integration Technologies?

SAS Integration Technologies, in combination with other SAS software and solutions, enables you to make information delivery and decision support a part of the information technology architecture for your enterprise.

SAS Integration Technologies provides you with software that enables you to build a secure client/server infrastructure on which to implement SAS distributed processing solutions. With SAS Integration Technologies, you can integrate SAS with other applications in your enterprise; provide proactive delivery of information from SAS throughout the enterprise; extend the capabilities of SAS to meet your organization's specific needs; and develop your own distributed applications that leverage the analytic and reporting powers of SAS.

SAS Integration Technologies is part of the SAS Intelligence Platform. For an overview of the SAS Intelligence Platform and the products that it contains, see the *SAS Intelligence Platform: Overview*.

Accessibility Features of SAS Integration Technologies

This product has not been tested for compliance with U.S. Section 508 standards. If you have specific questions about the accessibility of SAS products, send them to accessibility@sas.com or call SAS Technical Support.

What SAS Integration Technologies Includes

SAS Integration Technologies includes the following integration and system development tools, which are based on a combination of industry-standard technologies and technology developed by SAS:

- the Integrated Object Model (IOM), which provides distributed object interfaces to SAS software features. IOM enables you to use industry-standard languages, programming tools, and communication protocols to develop client programs that access these services on IOM servers. The IOM Bridge communications protocol enables diverse clients to connect transparently to IOM servers on multiple platforms.
- two types of IOM servers: the SAS Workspace Server, which surfaces the SAS programming environment to calling clients through an application programming interface (API); and the SAS Stored Process Server, which enables clients to execute parameterized SAS programs without having to know the SAS language.

Note: Other types of IOM servers include the SAS Metadata Server, which is provided with Foundation SAS, and the SAS OLAP Server, which is provided with SAS Intelligent Storage products.

- SAS Foundation Services, which is a set of core infrastructure services that Java programmers can use to write distributed applications that are integrated with the SAS platform. The services provide client connections to IOM servers, dynamic service discovery, user authentication, profile management, session context management, metadata and content repository access, activity logging, information publishing, and stored process execution.
- SAS Publishing Framework, which consists of SAS CALL routines and graphical user interfaces that enable you to publish information proactively by using a subscription channel model.
- the Application Messaging interface, which provides three sets of CALL routines that enable you to incorporate messaging services into your SAS programs.

- SAS Stored Processes, which enable client applications to execute SAS programs that are stored centrally on a server.
- SAS BI Web Services, which expose SAS Stored Processes for execution by using web service protocols. Remote clients are then able to specify input parameters, drive execution of SAS code, and obtain results from that execution.
- the SAS Web Infrastructure Platform, which enables you to develop web applications and components using portal technology.

Note: Starting with [SAS 9.4M8](#), SAS Information Delivery Portal and SAS BI Portlets are not available from SAS. If you have an existing installation of SAS Information Delivery Portal and SAS BI Portlets in your environment and plan to upgrade or migrate to SAS 9.4M8 or later, SAS recommends that you first unconfigure and uninstall SAS Information Delivery Portal and SAS BI Portlets. A best practice is to unconfigure retired SAS products before you upgrade and to uninstall them after you upgrade. For more information, see [Unconfiguring and Uninstalling Retired Products](#) in *SAS Guide to Software Updates and Product Changes*.

- the Directory Services interface, which enables you to incorporate LDAP directory services functions into your SAS programs.

Support for SAS Open Metadata Architecture

SAS Integration Technologies supports the SAS Open Metadata Architecture, which is a metadata management facility that provides common metadata services to SAS applications. This architecture is required in order to do the following tasks:

- use the SAS Metadata Server to store configuration information for SAS Integration Technologies and other SAS products
- use SAS Management Console as a central interface to administer configuration and security information for SAS Integration Technologies and other SAS products
- use new security features for user registration, authentication, and authorization (access control)
- configure new types of IOM servers (SAS Metadata Servers, SAS Stored Process Servers, and SAS OLAP Servers) in addition to SAS Workspace Servers
- use load balancing for workspace servers and spawners, as well as stored process servers and spawners
- operate stored processes on a stored process server to produce streaming output for use in web applications
- use the SAS Web Infrastructure Platform to create web applications that use portal technology

Note: Starting with SAS 9.4M8, SAS Information Delivery Portal and SAS BI Portlets are not available from SAS. If you have an existing installation of SAS Information Delivery Portal and SAS BI Portlets in your environment and plan to upgrade or migrate to SAS 9.4M8 or later, SAS recommends that you first unconfigure and uninstall SAS Information Delivery Portal and SAS BI Portlets. A best practice is to unconfigure retired SAS products before you upgrade and to uninstall them after you upgrade. For more information, see [Unconfiguring and Uninstalling Retired Products](#) in *SAS Guide to Software Updates and Product Changes*.

- use SAS Foundation Services to implement Java applications that are integrated with the SAS Intelligence Platform
- install and operate other SAS products that depend on the SAS Intelligence Platform

For more information about the SAS Open Metadata Architecture, see the *SAS Intelligence Platform: System Administration Guide*.

Support for Industry Standards

SAS Integration Technologies supports the following industry standard technologies, allowing you to leverage your existing infrastructure investments and skill sets to provide application interoperability:

- client development by using any programming environment that supports bindings to the COM and DCOM or Java object model. The programming environments that are supported include the following:
 - Microsoft Visual Basic for Applications, VBScript, Visual C++ .NET, Visual Basic .NET, and Visual C# .NET
 - any Java integrated development environment (IDE), including Eclipse, Sun ONE Studio, IBM VisualAge, and Borland JBuilder
 - proprietary Windows programming environments such as Borland Delphi, Sybase PowerBuilder, and others
- asynchronous message queuing through the use of IBM WebSphere MQ (formerly called MQSeries), Microsoft MSMQ, and TIBCO Rendezvous.
- file management that uses web-based Distributed Authoring and Versioning (WebDAV). The publish and subscribe features of SAS Integration Technologies can access any WebDAV server. Two specific types of WebDAV servers are supported for use by SAS business intelligence web applications:
 - Xythos Software's WebFile Server (WFS) can be used to store content for the SAS Web Infrastructure Kit and the SAS Information Delivery Portal. It can also be used to store reports that have been created with SAS Web Report Studio. The SAS User Management Customization enables a Xythos WebFile Server to interact with the SAS Metadata Server for authorization and authentication.

Note: Starting with SAS 9.4M8, SAS Information Delivery Portal and SAS BI Portlets are not available from SAS. For more information, see [Unconfiguring](#)

[and Uninstalling Retired Products](#) in *SAS Guide to Software Updates and Product Changes*.

- Apache HTTP Server (with its WebDAV module enabled) can also be used to store reports that have been created with SAS Web Report Studio.
- web services development based on the XML for Analysis interface, SOAP, XML, JSON, and RESTful technologies.
- web application development on web servers that are compatible with the Java 2 platform.

Components of SAS Integration Technologies

<i>IOM Servers</i>	8
Overview of IOM Servers	8
Configuring and Using IOM Servers	9
Connecting Clients to IOM Servers	11
<i>Using IOM to Develop Applications</i>	13
IOM Scenario	13
Workspace Object Hierarchy	14
<i>Foundation Services</i>	17
<i>Publishing Framework</i>	18
Overview of SAS Publishing Framework	18
Channel Definition	19
Subscription Management	19
Package Publishing	20
Package Retrieval and Viewing	20
<i>Application Messaging</i>	21
Overview of Application Messaging	21
WebSphere MQ Functional Interface	21
MSMQ Functional Interface	22
Common Messaging Interface	22
<i>Stored Processes</i>	22
<i>SAS BI Web Services</i>	23
<i>Directory Services</i>	24
<i>SAS Web Infrastructure Platform</i>	25

IOM Servers

Overview of IOM Servers

The Integrated Object Model (IOM) in SAS Integration Technologies provides distributed object interfaces to SAS software features. To call these interfaces, clients can use industry-standard languages, programming tools, and communication protocols. The interfaces are built into SAS and are available to clients whenever SAS is executed as an object server.

An IOM server is an object server that is launched in order to fulfill client requests for IOM services. There are four types of IOM servers:

SAS Workspace Server

is provided with SAS Integration Technologies and is accessed through the IOM workspace interface. This interface provides access to Foundation SAS software features such as the SAS language, SAS libraries, the server file system, results content, and formatting services. A SAS workspace represents a session with the SAS System, and it is functionally equivalent to a SAS Display Manager session or the execution of the SAS System as a batch job.

SAS Stored Process Server

is a multi-user server that is provided with SAS Integration Technologies and is used to execute SAS Stored Processes and deliver the results. A SAS Stored Process is a SAS program that is stored on a server and can be called by client applications. SAS Stored Processes enable clients to execute parameterized SAS programs without having to know the SAS language.

SAS OLAP Server

delivers pre-summarized cubes of data to OLAP clients like SAS Enterprise Guide using OLE DB for OLAP. *Cubes* are logical sets of data that are organized and structured in a hierarchical, multidimensional arrangement. You can query cubes by using the multidimensional expression (MDX) language. The SAS OLAP Server, which is provided with SAS Intelligent Storage products, is designed to reduce the load on traditional back-end storage systems by delivering summarized views of data to business intelligence applications, irrespective of the amount of data underlying these summaries.

SAS Metadata Server

is a multi-user server, provided with SAS Foundation, that enables users to read metadata from or write metadata to one or more SAS Metadata Repositories. SAS Metadata Repositories contain metadata that represents items such as SAS application servers (including SAS Workspace Servers, SAS OLAP Servers, and SAS Stored Process Servers), users in the metadata environment, libraries, tables, stored processes, and cubes.

Configuring and Using IOM Servers

You can use the SAS Deployment Wizard to plan, install, and define the configurations for your IOM servers. Detailed documentation is provided to help you perform these tasks either with or without the wizard. Documentation is also provided to help you manage and administer your server configurations after installation, and to assist you in developing application programs that use the IOM servers.

The following table provides information about the documentation that is available for IOM servers:

Table 2.1 Documentation for IOM Servers

Server Type	Type of Information	Documentation
all IOM server types	using SAS Deployment Wizard to plan and configure	<i>SAS Intelligence Platform: Installation and Configuration Guide</i>
	securing	<i>SAS Intelligence Platform: Security Administration Guide</i>
	starting	<i>SAS Intelligence Platform: System Administration Guide</i>
	developing applications	“IOM Scenario” on page 13 in this overview
	connecting a client application	“Connecting Clients to IOM Servers” on page 11 in this overview “Using the Java Connection Factory” in SAS Integration Technologies: Java Client Developer’s Guide “Using the SAS Object Manager” in SAS Integration Technologies: Windows Client Developer’s Guide
	implementing distributed security for clients	“Java Client Security” in SAS Integration Technologies: Java Client Developer’s Guide

Server Type	Type of Information	Documentation
		“Windows Client Security” in SAS Integration Technologies: Windows Client Developer’s Guide
SAS Workspace Server	modifying and administering the configuration after installation	SAS Intelligence Platform: System Administration Guide SAS Intelligence Platform: Application Server Administration Guide
	developing clients	“Workspace Object Hierarchy” on page 14 in this overview “Developing Java Clients” in SAS Integration Technologies: Java Client Developer’s Guide “Developing Windows Clients” in SAS Integration Technologies: Windows Client Developer’s Guide
SAS Stored Process Server	modifying and administering the configuration after installation	SAS Intelligence Platform: System Administration Guide SAS Intelligence Platform: Application Server Administration Guide
	developing clients	SAS Stored Processes: Developer’s Guide “Developing Java Clients” in SAS Integration Technologies: Java Client Developer’s Guide
SAS OLAP Server	modifying and administering the configuration after installation	SAS Intelligence Platform: Application Server Administration Guide
SAS Metadata Server	modifying and administering the configuration after installation	SAS Intelligence Platform: System Administration Guide

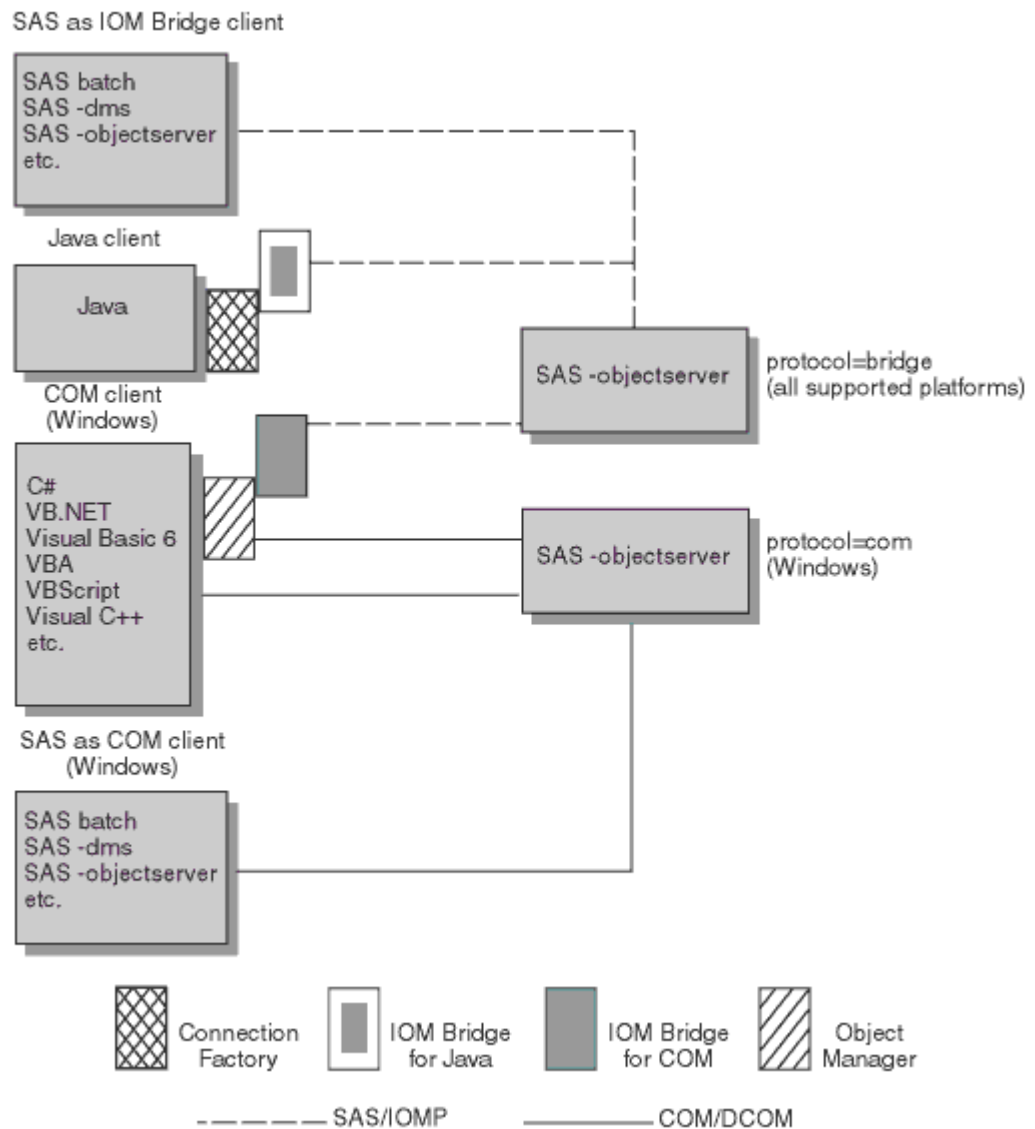
Server Type	Type of Information	Documentation
	developing clients	<i>SAS Open Metadata Interface: Reference and Usage</i>

Connecting Clients to IOM Servers

Overview of Communication between Clients and IOM Servers

The information that is needed to connect to an IOM server is obtained from the SAS Metadata Server. SAS Integration Technologies supports additional SAS software features by enabling Java and Windows clients to connect to and request objects from various types of IOM servers including other SAS Metadata Servers, SAS OLAP Servers, SAS Stored Process Servers, and SAS Workspace Servers.

SAS Integration Technologies facilitates client/server communication across multiple vendor architectures by supporting multiple client/server interoperability standards. The following figure shows the different ways that clients and IOM servers can communicate.

Figure 2.1 Communication between Clients and IOM Servers

Windows Clients

As shown in the figure, Windows clients that are written in languages such as Visual Basic or Visual C++ access IOM servers that are running in the Windows operating environment by using the Microsoft Component Object Model (COM). Windows client interfaces provided in SAS Integration Technologies support two leading industry standards: ActiveX Data Objects (ADO) and Object Linked Embedding for Databases (OLE DB).

Windows clients accessing IOM servers on other server platforms use the IOM Bridge for COM. This bridge enables you to develop native COM and DCOM applications that access server data, for example, on UNIX and mainframe platforms. This transparency is a key feature of SAS Integration Technologies. It enables application developers to have full access to the architectural elements that are available in the Windows environment, even when their clients communicate

with servers in other operating environments. The bridge makes other operating environments appear to be extensions of the client's native operating environment.

With SAS Integration Technologies, Windows clients can use the Windows Object Manager to connect to IOM servers.

Note: In SAS®9, SAS Integration Technologies still supports the SAS 8 interface for using the Windows Workspace Manager. However, it is recommended that you use the Windows Object Manager interface in order to take advantage of the new features.

Java Clients

Java clients that access IOM servers use the Common Object Request Broker Architecture (CORBA). CORBA is an architecture for an open software bus on which objects can interoperate across networks and operating systems.

The Object Request Broker (ORB) is the key element of CORBA. It provides the infrastructure for distributed object computing by enabling software components (objects) on one machine to locate and communicate with components on other machines. This infrastructure enables you, as an application developer, to focus on implementing your business logic instead of worrying about all the underlying technology.

SAS Integration Technologies provides an ORB called the IOM bridge for Java. This ORB implements the standard CORBA ORB interface defined by the Object Management Group (OMG). It uses a proprietary inter-orb protocol (called the IOM Bridge protocol) to communicate with the IOM server.

With SAS Integration Technologies, Java clients can use the Java Connection Factory to connect to IOM servers.

Note: In SAS®9, SAS Integration Technologies still supports the SAS 8 interface for using the Java Workspace Factory. However, it is recommended that you use the Connection Factory interface in order to take advantage of the new features.

Using IOM to Develop Applications

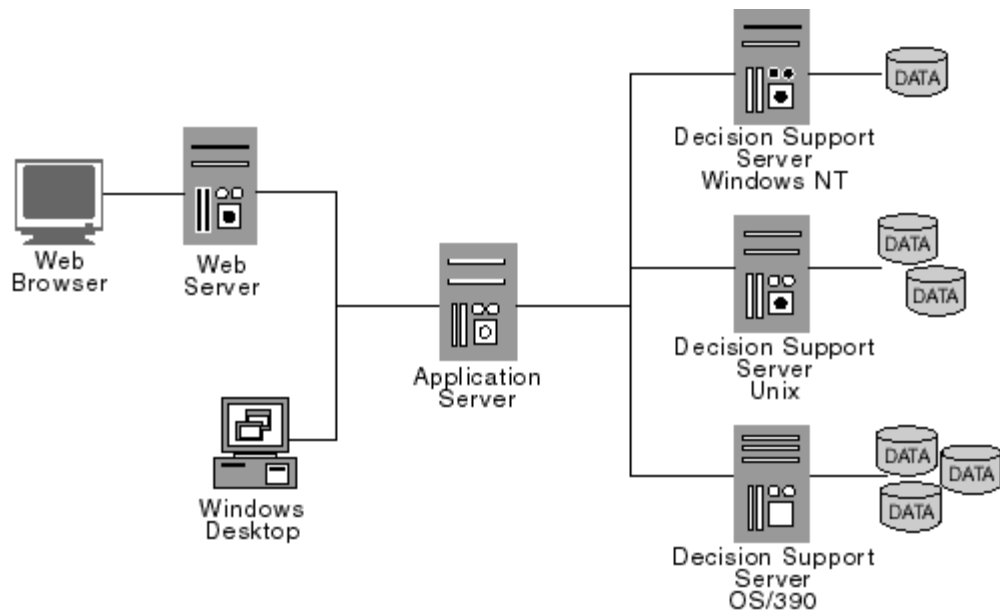
IOM Scenario

One of the chief benefits of building component-based applications by using the Integrated Object Model (IOM) is that it enables you to de-couple your business application logic from your presentation methods. This enables you to reuse core

application functionality in multiple presentation personalities and, as a result, it extends your application's deployment options.

For example, consider the following figure. Using SAS Integration Technologies software, you can develop applications in which web browsers, desktop GUIs, and middle-tier web and application server presentation platforms can all become clients of SAS software server components.

Figure 2.2 Clients of SAS Software Server Components



Within the web browser context, you can use client-side scripting such as VBScript, local components such as ActiveX controls, and Java applets to implement access to server components.

Similarly, you can assess server components from desktop application environments including custom applications that are written in Visual Basic, Java, C++, Delphi, and PowerBuilder. Further, any desktop application container that supports Visual Basic for Applications (VBA), including those in the Microsoft Office suite and many third-party offerings, can also participate.

Finally, you can deploy middle-tier web and application servers, such as the Microsoft Internet Information Server (IIS), Microsoft Transaction Server (MTS), and various .NET servers to host logic that accesses SAS software server components.

This level of deployment flexibility enables you to distribute your logic components across the enterprise in order to realize the performance advantages that are associated with data source co-location. This component distribution can be accomplished in a manner that is transparent to the client.

Workspace Object Hierarchy

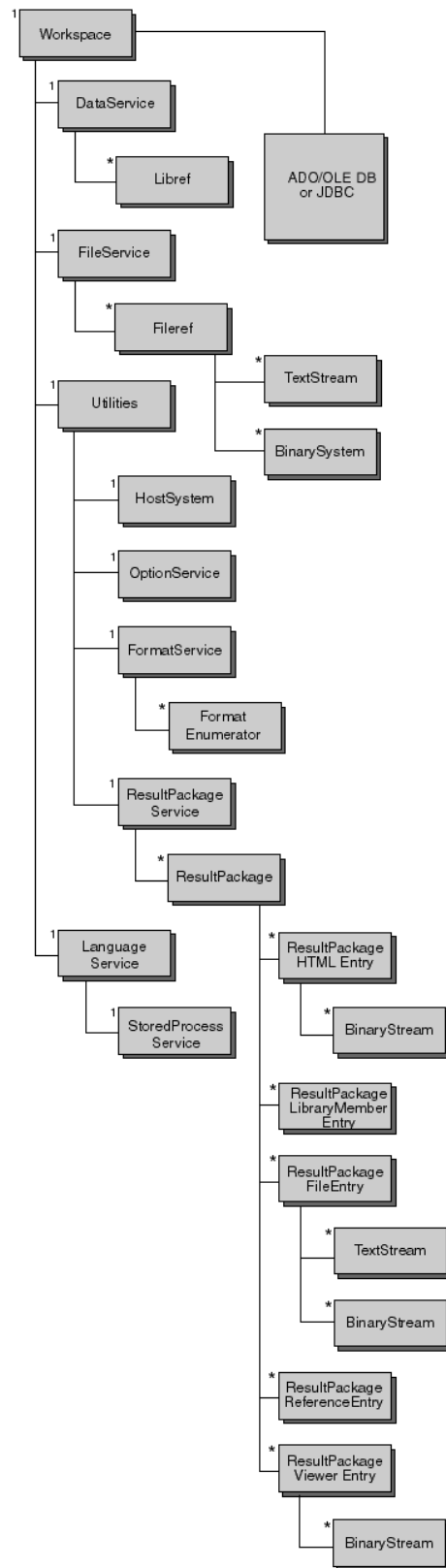
The principal IOM interfaces of the SAS Workspace Server include the following:

- Workspace (a SAS session)
- LanguageService (submit, list/log, stored processes)

- DataService (librefs, plus access through ADO, OLE-DB or JDBC)
- FileService (filerefs and directories)
- Utilities (result packages, formats, host info)

The following figure depicts the object hierarchy for these interfaces.

Figure 2.3 Workspace Object Hierarchy



In the figure, the number 1 indicates that that part of the hierarchy has exactly one child per parent. An asterisk (*) indicates that that part of the hierarchy has zero or greater children per parent.

The LanguageService defines methods for submitting SAS procedural scripting language statements (to execute SAS DATA and procedure steps) and for retrieving the associated LOG and LIST outputs.

Applications that produce sophisticated results such as HTML and graphs generated by using the SAS Output Delivery System can use the ResultPackageService to retrieve collected elements. Program execution progress events such as step begin, step end, and error conditions can also be monitored with a LanguageService event interface.

The FileService defines methods for managing SAS file references (FILEREFS) and reading or writing files on the server's host file system. A client can exploit SAS external file access methods and host-specific fileref assignment options to access the wide variety of specialized features in SAS external file I/O on the various server host platforms. The DataService surfaces similar control over SAS library references (librefs).

IOM uses standard interface mechanisms within the Microsoft COM and Java application environments to expose the object hierarchy. This enables you to use the ActiveX Data Objects (ADO) and OLE DB access protocols in the Windows COM environment. In Java environments, the JDBC 2.0 access protocol is supported. These standard mechanisms provide semantic richness, including read, write, update, and query services. All components that support the same standards can easily interoperate.

Application hierarchies are also available through specialized SAS product offerings and custom applications developed with the SAS/AF software.

SAS Integration Technologies provides the middleware necessary to connect clients and servers across multiple vendor architectures, as described in ["Connecting Clients to IOM Servers"](#) on page 11.

Foundation Services

The SAS Foundation Services are a set of infrastructure and extension services that support the development of integrated, scalable, and secure Java applications. The SAS Foundation Services are based on the following design principles:

- implementation modularity
- location transparency
- robust and adaptive resource management
- run-time monitoring
- consistent deployment methodology
- client neutrality

The design model of the SAS Foundation Services supports both local and remote resource deployment and promotes resource sharing among applications. Sharing can occur for a specific session, for a specific user, or globally, as appropriate. At

the same time, the model controls access to protected resources based on privileged-user status and group membership.

The SAS Foundation Services are as follows:

- Connection Service
- Discovery Service
- Information Service
- Publish Service
- Security Service
- Session Service
- Stored Process Service
- User Service

The Connection, Publish, and Stored Process services are extensions of similar services that are part of the Integrated Object Model (IOM) Services published with SAS Integration Technologies 8.2. The IOM Services continue to be supported. However, the SAS Foundation Services provide enhanced features, including support for the use of a SAS Metadata Server for storing configuration information, and support for the use of shared remote service deployments.

For information about configuring and administering SAS Foundation Services, see the *SAS Foundation Services: Administrator's Guide*. For information about using SAS Foundation Services to develop applications, see the *SAS Integration Technologies: Java Client Developer's Guide*.

Publishing Framework

Overview of SAS Publishing Framework

The SAS Publishing Framework feature of SAS Integration Technologies provides a complete and robust publishing environment for enterprise-wide information delivery. The Publishing Framework consists of SAS CALL routines, application programming interfaces (APIs), and graphical user interfaces that enable both users and applications to publish SAS files (including data sets, catalogs, and database views) and other digital content to a variety of destinations:

- e-mail addresses
- message queues
- publication channels and subscribers
- WebDAV-compliant servers
- archive locations
- Microsoft SharePoint servers

SAS Publishing Framework also provides tools that enable both users and applications to receive and process published information. For example, users can

receive packages with content, such as charts and graphs, that is ready for viewing. In addition, SAS programs can receive packages with SAS data sets that might in turn trigger additional analyses on that data.

The functions of the Publishing Framework include channel definition, subscription management, package publishing, package retrieval, and package viewing.

For information about how to perform publishing tasks, or how to incorporate publishing tasks into your SAS programs or applications, see the *SAS Publishing Framework: Developer's Guide*. For information about how to administer publication channels and subscriber information, see the product Help for the Publishing Framework plug-in in SAS Management Console.

Channel Definition

SAS Publishing Framework enables you to define SAS publication channels, which are conduits for publishing particular categories of information. You can set up a channel for a particular topic, organizational group, user audience, or any other category.

To define a channel, use SAS Management Console to define a name for the channel, a description, a subject, the path in which the channel's archived packages are to be stored, and one or more key words. The channel definition, or metadata, is stored on the SAS Metadata Server. SAS Management Console can also be used to specify which groups of users are authorized to subscribe to the channel.

Subscription Management

Once publication channels have been defined, authorized users can subscribe to them and automatically receive information whenever it is published to those channels.

First, you must define the users who are eligible subscribers. To do so, use SAS Management Console to enter user authentication information.

If your organization has installed the SAS Information Delivery Portal, users can manage their subscriptions from within the portal. The portal enables users to select channels to subscribe to channels, specify the desired delivery transport (such as an e-mail address or message queue), and specify filters that indicate which information is to be included or excluded.

Note: Starting with SAS 9.4M8, SAS Information Delivery Portal and SAS BI Portlets are not available from SAS. If you have an existing installation of SAS Information Delivery Portal and SAS BI Portlets in your environment and plan to upgrade or migrate to SAS 9.4M8 or later, SAS recommends that you first unconfigure and uninstall SAS Information Delivery Portal and SAS BI Portlets. A best practice is to unconfigure retired SAS products before you upgrade and to uninstall them after you upgrade. For more information, see [Unconfiguring and Uninstalling Retired Products](#) in *SAS Guide to Software Updates and Product Changes*.

Administrators can also use the Publishing Framework plug-in for SAS Management Console to manage subscriptions. Using this application, administrators can create groups of subscribers, subscribe individual users or groups to a channel, and specify delivery transport and filtering options.

Package Publishing

SAS Publishing Framework enables you to create packages that contain one or more information entities, including SAS data sets, SAS catalogs, SAS databases, and almost any other type of digital content. You can also define viewers that make the information entities easier to display.

After creating a package, you can publish the package and its associated viewers to one or more channels. Publishing the package causes the information to be delivered to each user who has subscribed to those channels if the package and its contents meet the subscriber's filtering criteria. In addition to channels, you can publish packages directly to one or more e-mail addresses, message queues, WebDAV-compliant servers, SharePoint servers, and archive locations.

To create and publish packages, you can use any of the following methods:

- use the publish CALL routines to create packages and publish them from within a SAS program
- use the APIs that are provided with SAS Integration Technologies to create packages and publish them from within a third-party application

You can also use SAS Enterprise Guide or the SAS Information Delivery Portal to create and publish packages via SAS Publishing Framework.

Note: Starting with SAS 9.4M8, SAS Information Delivery Portal and SAS BI Portlets are not available from SAS. For more information, see [Unconfiguring and Uninstalling Retired Products](#) in *SAS Guide to Software Updates and Product Changes*.

Package Retrieval and Viewing

SAS Publishing Framework provides SAS Package Retriever, which is a graphical user interface that enables users to extract and save information from packages that have been published through the Publishing Framework. The SAS Package Reader user interface enables users to display the contents of packages. If the SAS Information Delivery Portal has been installed, users can view published information from the portal.

Note: Starting with SAS 9.4M8, SAS Information Delivery Portal and SAS BI Portlets are not available from SAS. If you have an existing installation of SAS Information Delivery Portal and SAS BI Portlets in your environment and plan to upgrade or migrate to SAS 9.4M8 or later, SAS recommends that you first unconfigure and uninstall SAS Information Delivery Portal and SAS BI Portlets. A best practice is to unconfigure retired SAS products before you upgrade and to

uninstall them after you upgrade. For more information, see [Unconfiguring and Uninstalling Retired Products](#) in *SAS Guide to Software Updates and Product Changes*.

In addition, you can use CALL routines to extract and process published information from within SAS programs. APIs are provided to enable third-party programs to extract and process published information.

Application Messaging

Overview of Application Messaging

The Application Messaging Interface includes three sets of CALL routines that enable you to incorporate messaging services into your SAS programs. The interfaces support asynchronous message queuing through the use of the following messaging software: IBM WebSphere MQ (formerly called MQSeries); Microsoft Message Queuing Services (MSMQ), which are part of the Windows NT® Server product; and TIBCO TIB/Rendezvous.

Application messaging enables two or more applications to communicate with one another indirectly and asynchronously using message queues. The applications do not have to be running at the same time or even in the same operating environment. An application can communicate with another application by sending a message to a queue. The receiving application retrieves the message when it is ready.

SAS Integration Technologies provides three messaging interfaces: the WebSphere MQ Functional Interface, the MSMQ Functional Interface, and the Common Messaging Interface.

In addition to the messaging interfaces, SAS Integration Technologies provides the JMS file access method. The SAS JMS file access method allows SAS programs to read and write records to and from any message-oriented middleware that supports a JMS provider.

For complete documentation of the SAS application messaging interfaces and the JMS file access method, see *Application Messaging with SAS*.

WebSphere MQ Functional Interface

With the SAS interface to IBM WebSphere MQ (formerly called MQSeries), SAS programs can create new WebSphere MQ message queues or take advantage of existing ones that are available throughout the enterprise. This interface was designed to be as similar as possible to the WebSphere message queuing interface (MQI).

MSMQ Functional Interface

With the SAS interface to Microsoft MSMQ, SAS programs can create new MSMQ message queues or take advantage of existing ones that are available throughout the enterprise. The CALL routines in this interface interact directly with the MSMQ application programming interface (API).

Common Messaging Interface

The SAS Common Messaging Interface provides a seamless environment for writing SAS programs that access message queues of the IBM WebSphere MQ, Microsoft MSMQ, and TIBCO TIB/Rendezvous transports. The CALL routines in this interface enable programs to interact in a consistent manner that is independent of the application messaging transport being used.

The Common Messaging Interface also includes CALL routines that enable your SAS program to use the local SAS registry or a distributed LDAP repository to store and retrieve messaging information.

Stored Processes

A stored process is a SAS program that is stored centrally on a server. A client application can then execute the program and receive and process the results. Stored processes enable you to centrally maintain and manage code, give you better control over changes, enhance security and application integrity, and ensure that every client executes the latest version of code that is available.

Stored processes are like other SAS programs except they have an additional feature that enables customization of the program's execution. This feature enables the invoking application to supply parameters at the time that the stored process is invoked. For example, if you have a stored process that analyzes monthly sales data, you could create a MONTH variable in the stored process. At execution time, the user could supply the parameter MONTH=MAY to analyze May sales data.

You can use stored processes for web reporting, analytics, building web applications, delivering packages to clients or the middle tier, and publishing results to channels or repositories. Stored processes can access any SAS data source or external file and can create new data sets, files, or other data targets supported by the SAS System.

You can use the following clients to invoke stored processes:

- JMP
- SAS Add-In for Microsoft Office
- SAS BI Dashboard

- SAS BI Web Services
- SAS Data Integration Studio
- SAS Enterprise Guide
- SAS Information Delivery Portal
- SAS Information Map Studio
- SAS Stored Process Web Application
- SAS Web Report Studio
- Stored Process Java API
- Stored Process Windows API

Note: Starting with SAS 9.4M8, SAS Information Delivery Portal and SAS BI Portlets are not available from SAS. For more information, see [Unconfiguring and Uninstalling Retired Products](#) in *SAS Guide to Software Updates and Product Changes*.

Stored processes can generate output files in a variety of formats. They can also produce streaming output for web applications, as well as package output for publishing. Stored processes can operate either on a SAS Workspace (IOM) Server or a SAS Stored Process Server.

For information about how to create a stored process and invoke it in a client application, see the *SAS Stored Processes: Developer's Guide*. For information about how to create the metadata to define a stored process, see the product Help for the New Stored Process wizard or the Stored Process Properties dialog box in SAS Management Console.

SAS BI Web Services

A web service is an interface that enables communication between distributed applications. Web services provide cross-platform integration by enabling applications written in various programming languages to communicate by using a standard web-based protocol. This functionality makes it possible for businesses to bridge the gaps between different applications and systems.

In general, SAS BI Web Services expose SAS Stored Processes for execution by using web service protocols. Remote clients are then able to specify input parameters, drive execution of SAS code, and obtain results from that execution. Also, web services make it possible to write clients that perform this act in a myriad of languages and on a variety of operating systems by using HTTP to exchange messages. Web services can enable a service-oriented, enterprise application approach, or they can support the development of mobile or web clients, all of which leverage reusable SAS Stored Processes.

There are two core types of SAS BI Web Services: XMLA and structured web services. Structured web services can further be divided based on how you access the services and the format of the messages that you send and receive.

With XMLA web services, two methods, Discover() and Execute(), are provided. The Discover method calls the SAS Metadata Server to obtain the requested metadata, and the Execute method calls the application server to invoke a stored process.

Starting with SAS 9.3, all stored processes are available individually for execution using web services without any action required from the user. SAS BI Web Services automatically exposes a WSDL file for each and every stored process that is available in the system. These WSDL files use XML to include detailed information about the inputs and outputs of each stored process using XML schema descriptions. Also, the WSDL file includes the URLs of endpoints to use to invoke these stored processes by using SOAP over HTTP.

You can also group multiple stored processes together in a single, named web service using the Deploy As Web Service wizard in SAS Management Console. In SAS 9.2, these were called generated web services because the wizard generated a grouping (and because server artifacts were actually generated as well).

All structured web services can be invoked by using SOAP over HTTP. SOAP strictly defines message structure, including the envelope containing headers and body. SAS BI Web Services define the content (and namespace) of the payload within the body. In addition, starting with SAS 9.3, web services support Javascript Simple Object Notation (JSON) and plain XML as message formats for all structured web services. The format of input XML messages for a structured web service can be deduced from its WSDL file. The addition of new output resource URL suffixes in conjunction with the new SAS folder path mapping means that SAS BI Web Services now support Representational State (REST) style web service invocation.

For detailed information about using SAS BI Web Services, including instructions for creating stored processes that web services can access, see the *SAS BI Web Services: Developer's Guide*.

Directory Services

If your organization uses an enterprise directory that conforms to the Lightweight Directory Access Protocol (LDAP), you can use the directory services interfaces of SAS Integration Technologies to incorporate enterprise directory services into your SAS applications. Through these interfaces, distributed SAS applications can share a common enterprise directory with components that might be executing in other run-time environments across the enterprise.

SAS Integration Technologies provides two interfaces that you can use to interact with an LDAP server from a SAS program:

- The LDAP CALL Routine Interface, which is set of CALL routines that you can use to add, delete, modify, and search entries in the LDAP server.
- The LDAPSERVICES class for the SAS Component Language (SCL). This class provides methods that add, delete, modify, and search entries in the LDAP server.

For documentation about the syntax and use of these interfaces, refer to the *SAS Integration Technologies: Directory Services Reference*.

SAS Web Infrastructure Platform

The SAS Web Infrastructure Platform is a collection of services and applications that provide common infrastructure and integration features to be used by SAS web applications. These services and applications provide the following benefits:

- consistency in installation, configuration, and administration tasks for web applications
- greater consistency in users' interactions with web applications
- integration among web applications as a result of the ability to share common resources

The following services and applications are included in the SAS Web Infrastructure Platform:

SAS BI Web Services for Java

can be used to enable your custom applications to invoke and obtain metadata about SAS Stored Processes. Web services enable distributed applications that are written in different programming languages and that run on different operating systems to communicate using standard web-based protocols. The most common protocol is the Simple Object Access Protocol (SOAP).

The SAS BI Web Services for Java interface is based on the XML for Analysis (XMLE) Version 1.1 specification.

SAS Shared Web Assets

contains graph applet JAR files that are shared across SAS web applications. They display graphs in stored processes and in the SAS Stored Process Web Application.

SAS Web Infrastructure Platform Services

provide a common infrastructure for SAS web applications. The infrastructure supports activities such as auditing, authentication, configuration, status and monitoring, e-mail, theme management, and data sharing across SAS web applications.

SAS Logon Manager

provides a common user authentication mechanism for SAS web applications. It displays a dialog box for user ID and password entry, authenticates the user, and launches the requested application. SAS Logon Manager supports a single sign-on authentication model. When this model is enabled, it provides access to a variety of computing resources (including servers and web pages) during the application session without repeatedly prompting the user for credentials.

You can configure SAS Logon Manager to display custom messages and to specify whether a logon dialog box is displayed when users log off.

In addition, you can use third-party products in conjunction with SAS Logon Manager to enable users to access multiple web applications within the same browser session.

SAS Preferences Manager

provides a common mechanism for managing preferences for SAS web applications. The feature enables administrators to set default preferences for locale, theme, alert notification, and time, date, and currency display. Within

each web application, users can view the default settings and update their individual preferences.

SAS Stored Process Web Application

executes stored processes on behalf of a web client and return results to a web browser. The SAS Stored Process web application is similar to the SAS/IntrNet Application Broker, and has the same general syntax and debug options.

SAS Web Administration Console

provides features for monitoring and administering middle-tier components. This browser-based interface enables administrators to do the following:

- view a list of users who are logged on to SAS web applications, and send e-mail to active users
- create, delete, and manage permissions for folders on the SAS Content Server
- view configuration information for each middle-tier component

SAS Content Server

stores digital content (such as documents, reports, and images) that is created and used by SAS web applications. For more information, see "SAS Content Server" in *SAS Intelligence Platform: Overview*.

The following documentation is provided for the SAS Web Infrastructure Platform:

- the *SAS Information Delivery Portal: Introduction*, which provides a high-level description of the features of the SAS Information Delivery Portal
- the *SAS Intelligence Platform: Web Application Administration Guide*, which describes the configuration and administration tasks that are necessary to implement web applications (including the SAS Information Delivery Portal) that were developed using the SAS Web Infrastructure Platform
- *Developing Portlets for the SAS Information Delivery Portal*, which describes how to use the platform to develop a portal-like web application or to customize or extend the functionality of the SAS Information Delivery Portal
- help files, accessible through the SAS Web Infrastructure Platform and SAS Information Delivery Portal's user interface, which provide instructions for page navigation, logging on and logging off, metadata searching, bookmarking, personalization, and content administration

Note: Starting with SAS 9.4M8, SAS Information Delivery Portal and SAS BI Portlets are not available from SAS. If you have an existing installation of SAS Information Delivery Portal and SAS BI Portlets in your environment and plan to upgrade or migrate to SAS 9.4M8 or later, SAS recommends that you first unconfigure and uninstall SAS Information Delivery Portal and SAS BI Portlets. A best practice is to unconfigure retired SAS products before you upgrade and to uninstall them after you upgrade. For more information, see [Unconfiguring and Uninstalling Retired Products](#) in *SAS Guide to Software Updates and Product Changes*.
