

1 Introducing AppDev Studio

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Welcome to AppDev Studio

Welcome to AppDev Studio, the first thin-client applications development solution that focuses specifically on information delivery. In today's competitive marketplace, organizations face the challenge of delivering information in a form that supports successful decision-making. Web-enabled applications can increase users' access to strategic data and can provide other benefits such as a lower cost-per-user, reduced maintenance costs, and increased use of resources. But even with these benefits, organizations still have to convert large amounts of raw data into meaningful information before it can be useful to users. Data is just data, and today's knowledge workers demand more.

That's where AppDev Studio fits in. AppDev Studio is a complete, stand-alone development environment from SAS Institute, the industry leader in information delivery. This integrated suite of development tools provides the power you need for building Web-based applications that use CGI and HTML, Java servlets and JavaServer Pages technology, or sophisticated Java applications and applets to access the information-delivery capabilities of SAS software. And that access enables you to take advantage of the SAS System for decision support, data visualization, data mining, statistical analysis, and reporting – all of which make it easier to turn those stores of data into knowledge for your organization.

About This Book

Just as AppDev Studio and SAS software combine to support successful decision making, the goal of this book is to help you make effective decisions about the most appropriate technology to use in your organization's environment. The book is designed to get you started with selecting a technological approach to information delivery and to help you understand the benefits and implications of that particular technology.

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The remaining sections in this introductory chapter describe the front-end, communication, and back-end components that are part of AppDev Studio. This chapter also includes hardware and software requirements, an overview of the terminology that you will most likely encounter when designing Web-based applications, and a list of additional resources to help you learn more about what you can do with AppDev Studio.

Chapter 2 provides an overview of each technology that you can use to take advantage of SAS software in a thin-client or Web-enabled environment. Each section also includes a description of the development skills that are required for using the technology, scenarios where it makes the most sense to use the technology, and one or more short examples.

Chapter 3 describes the basic deployment issues that surround each technology. This chapter will answer many of your questions about implementing a particular technology, and it explains how that implementation may involve SAS software on a server.

Appendix A covers essential troubleshooting for installation problems and remote-access problems.

Appendix B provides a detailed guide to the AppDev Studio Middleware Server, a component that helps scale applications for enterprise-wide access to SAS servers.

Overview of AppDev Studio

AppDev Studio bundles all of the software products that you need for developing client/server and *n*-tiered Web applications on your Windows PC. Each of these products can be categorized into one of three groups, depending on its purpose.

Category	Products	Purpose
Front-end Components	webAF, webEIS	Used to create Java based thin-client applications that take advantage of the power of the SAS server on the back end.
Communication Components	SAS/IntrNet (including Application Dispatcher and htmSQL), SAS/CONNECT, SAS/SHARE, Middleware Server	Used to establish and/or manage communication and data sharing between clients (such as a browser or a webAF or webEIS application) and servers.
Back-end Components	Base SAS, SAS/AF, SAS/EIS, SAS/FSP, SAS/SHARE, SAS/GRAPH	Used to provide specific functionality in your client/server applications. Base SAS software and SAS/IntrNet software are required on the server, and the other products are dependent on the requirements of your application.

With AppDev Studio, your applications can take advantage of the following Web-enabled technologies:

- Common Gateway Interface (CGI) Support.** The CGI support included with AppDev Studio enables your Web server to communicate with a SAS application or data server without requiring any base-level CGI programming. Your thin-client applications can use the Application Dispatcher to access SAS programs on the server and can send the results back to a Web browser. You can also use htmSQL to implement dynamic SQL queries for formatting data and displaying results in a browser.
- Java Development.** With easy-to-use wizards and drag-and-drop interfaces, webAF provides a complete Java development environment in which you can build Java applets and applications that can instantly connect to a SAS server. You can add access to SAS/AF components, SAS tables, and OLAP engines, using a library of over 100 ready-to-use InformationBeans (JavaBeans that use the data access, computational, and analytical features

of SAS software). Other webAF features help you distribute and deploy Java applets and applications across your organization or help you implement Java servlets on your Web server.

- **OLAP Reporting.** You can deliver robust applications for online analytical processing (OLAP) reporting without writing a single line of code. Using the drag-and-drop environment of webEIS, business analysts can build their own Web-based Java reports quickly and easily. They can access data, drill down on areas of interest, and employ a variety of reporting styles. Users can also take advantage of two pre-built applications for viewing data, including the MetaSpace Explorer for navigating through a SAS data warehouse and the MDDB Report Viewer for HTML-based views of multidimensional databases (MDDBs).

The advantages that AppDev Studio provides go beyond Web-enabled applications development. You can build applications quickly and easily without connecting to remote servers, tying up production resources, or moving files back and forth across your network. You can take advantage of code-free reporting and pre-built applications. Or you can develop sophisticated applications that use object-oriented development techniques on both the client and the server. Most importantly, you can develop what your users need to get the most out of SAS software.

Front-end Components

webAF Software

webAF software is an integrated visual programming environment that enables you to rapidly build Java applications, applets, servlets, and classes using a drag-and-drop object-oriented interface that helps reduce the amount of programming needed.

webAF software helps you build applications that are easy to manage, and which instantly connect to SAS software. Support for the creation and debugging of servlets and JavaServer Pages is also provided. webAF software's component-based visual development environment provides easy access to SAS software from Java classes, transparent access to SAS/AF objects, access to tables and MDDBs, and access to SAS computing power through procedure submissions. With webAF software, you have

- **easy access to enterprise-wide information over the Web.** Use webAF software to create user-friendly, Java-based applications that have simple access to the full capabilities of SAS software – from data warehousing to decision support. webAF also facilitates seamless access to a wide range of data sources, including major database management systems (Oracle, SYBASE, Informix, DB2) on all major operating systems, including HP-UX, Solaris, AIX/6000, COMPAQ Tru64 UNIX, Windows 95/98/NT, and (with Version 8 of the SAS System) OS/390.
- **rapid application development and instant SAS connections.** With webAF, you can avoid rewriting code for various platforms. Instead, you can drag the pre-

packaged SAS components that are provided by webAF to your application to connect to the full capabilities of SAS software. You can also reuse existing code to create custom objects. Best of all, the objects that you create with webAF are functionally identical on any platform.

- **centralized application management.** webAF software's unique *n*-tiered environment sends requests to the most appropriate SAS server, eliminating unnecessary server sessions and the time-consuming tasks of managing applications across multiple platforms and networks. Java applets and applications that are built with webAF software are easily distributed, updated, and managed across the Web from one central location.
- **the ability to build JavaBeans-compliant proxies to connect to remote SAS/AF objects running on a SAS server.** The same ability enables you to build connections to remote objects through CORBA and Remote Method Invocation (RMI). You can use the Data Wizard to build access to remote data tables.
- **integrated visual development with 100% Java, and complete JDBC and JavaBean support.**
- **industry-standard GUIs, which reduce training costs and add consistency to your organization's information access.**

webAF software creates 100% Java applets and applications – without hidden tags or macros – so it's easy to integrate code from other application development tools. webAF software also integrates Java-based applications that are not associated with SAS, all within a simple point-and-click visual development environment.

webAF features include

- a visual drag-and-drop application builder
- 100% Pure Java source-code generation
- comprehensive support for JavaBeans
- a rich set of JavaBeans-compliant components
- a GUI-based class editor
- a source code editor and debugger
- project, event, and data wizards to simplify the development process

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- full support for standard Java layout managers
- intelligent, user-customizable packaging support that writes to JAR and CAB files
- access to remote SAS servers.

webEIS Software

webEIS software is an Online Analytical Processing (OLAP) application for the Web. It enables users to create interactive documents quickly and easily and then to publish those documents on the Web as Java applets. With webEIS, powerful decision-support capabilities are combined with a friendly, easy-to-use environment.

OLAP documents are produced through an interface that provides a high level of user interaction. An easy-to-use, drag-and-drop environment enables business analysts to build their own Web-based documents for sharing and viewing information. They can access data, drill down on areas of interest, and enjoy a variety of reporting styles. Data that is stored in multidimensional data structures is viewed and navigated with a familiar browser interface such as Microsoft Internet Explorer or Netscape.

Developers can use webEIS to create customized OLAP viewer InformationBeans, which are JavaBeans that take advantage of the advanced data access and decision-support functionality of SAS software. In addition, developers can reuse InformationBeans that are created by webEIS in future Java applets or applications. This results in shorter development cycles and more time spent on strategic projects.

In short, webEIS provides

- rapid, code-free creation of Java OLAP documents
- easy access to enterprise-wide information over the Web
- a fully customizable document design
- an industry-standard GUI
- bookmarking to enable collaboration
- support for e-mail and printing from Java-based documents
- centralized data management and distributed data access.

Communication Components

SAS/IntrNet Software

SAS/IntrNet software is a powerful set of CGI and Java tools that enable you to analyze and report on data, using the proven functionality of SAS software. SAS/IntrNet software helps organizations

- share information with anyone who has a Web browser
- build and distribute applications via the Internet
- deploy sophisticated applications across the Web.

You might need to use different pieces of SAS/IntrNet software depending on the AppDev Studio technology that you use. For example, if you create CGI applications, you might need to use the Application Dispatcher and to place the Application Dispatcher Broker on your Web server. You can also install htmSQL on your Web server to perform SQL queries using a CGI tool. If you create Java applications, you might need to use the SAS/SHARE driver for JDBC or the SAS/CONNECT driver for Java. You might also deploy one of the working applications that are shipped with SAS/IntrNet, such as the HTML/CGI-based MDDB Report Viewer.

SAS/CONNECT Software

SAS/CONNECT software is a SAS client/server tool set. SAS/CONNECT gives users and applications developers the ability to manage, access, and process data in a distributed client/server environment.

If you create SAS/IntrNet applications that provide remote access to the computing power of the SAS System, SAS/IntrNet software sometimes uses a SAS/CONNECT server to provide these services. A SAS/CONNECT server is a process that provides single-user access to a SAS session for the purpose of accessing, updating, and analyzing data through SQL statements and SAS procedures.

Java applets and servlets use the SAS/CONNECT driver for Java classes to start a SAS/CONNECT session on the server machine and to establish a connection to that session. The applet or servlet can then submit SAS statements and retrieve the log lines and output that are generated by those statements.

AppDev Studio Middleware Server

The AppDev Studio Middleware Server (MWS) is a server-side Java application that enhances the functionality of applets and applications that are developed with webAF. MWS functionality is sometimes referred to as *funneling* because it enables multiple clients to share the same SAS session. MWS is also completely configurable, which enables you to balance server loads, to use connection caching, and to daisy-chain multiple middleware servers.

For more information about the AppDev Studio Middleware Server, see Appendix B.

Back-end Components

Base SAS Software

Base SAS software provides the common functionality that is required by all other SAS software products. You can use existing DATA step programs or SAS macro programs as part of your client/server or Web-enabled application. You can also create new DATA step programs that use HTML formatting macros to speed the delivery of SAS output to other front-end components. Additionally, base SAS software provides access to the Output Delivery System (ODS), which is an easy way to produce SAS output in HTML format.

Base SAS software is also required if the server needs to execute SAS Component Language (SCL) elements.

SAS/AF Software

SAS/AF software provides the back-end strength that enables you to implement object-oriented server components. Using SAS Component Language (SCL) to take advantage of the full features of SAS software, you can build models that execute on the server.

You can then use these SAS/AF models in AppDev Studio by associating them with appropriate InformationBeans, or you can use them in conjunction with an application that sends its output through the Application Dispatcher.

You can also use SAS/AF software to develop stand-alone, full-client applications that are portable across many host platforms.

SAS/EIS Software

SAS/EIS software is a code-free, object-oriented application development facility that is used to create custom, interactive, extendable, full-client graphical user interfaces. It provides a wide variety of business reporting, data access, management, and analysis objects. EIS and OLAP applications that are developed with SAS/EIS software can be customized to individual user's needs.

If you are using AppDev Studio in conjunction with Version 6 of the SAS System, and if you want your AppDev Studio clients to use EIS objects or to read multidimensional databases (MDDBs), then SAS/EIS software is required. For example, webEIS applications commonly read MDDBs and therefore require SAS/EIS software.

With Version 8 of the SAS System, AppDev Studio applications can read MDDBs without having to license SAS/EIS software. You must have SAS/EIS software licensed on the server to read EIS objects.

SAS/FSP Software

SAS/FSP software provides server-side interactive facilities for editing and browsing SAS tables.

If you are using Version 6 of the SAS System, some of the applications that you can build with AppDev Studio may require SAS/FSP for editing or modifying SAS tables.

SAS/GRAPH Software

SAS/GRAPH software, the information and presentation graphics component of the SAS System, provides graphics capabilities to produce a wide variety of business and scientific charts, plots, and maps in many colors and patterns.

The licensing of SAS/GRAPH software is optional. You might want to license SAS/GRAPH if your applications have specific graphic needs. For example, you can use SAS/GRAPH to increase the functionality that you can provide with the Application Dispatcher.

Licensing SAS/GRAPH software is also desirable if you need to perform graphical processing on the server when you build thin-client applications. For example, you can use one of the many graphical procedures to generate a .GIF file that can be deployed via a Web browser, or you can stream the graphics output directly back to the Web client.

SAS/SHARE Software

SAS/SHARE software was created for multi-user environments such as sales management or purchasing, in which users need to update information concurrently. With SAS/SHARE, two or more users can gain concurrent access to a SAS data library, to data sets in the library, or to observations in the data set. The SAS server, a control program, coordinates all requests to ensure maximum concurrency and security.

SAS/SHARE software might be required depending on what type of thin-client applications you create with AppDev Studio. For example, SAS/SHARE software is required anytime a Java class from the SAS/SHARE driver for JDBC is used.

SAS/IntrNet software might also use a SAS/SHARE server to provide remote data services for your thin clients. A SAS/SHARE server is a process that provides multi-user access to a single SAS session for the purpose of accessing and updating data through SQL statements.

Hardware/Software Requirements and Recommendations

AppDev Studio has the following system requirements:

- Windows NT, Windows 98, or Windows 95
- a Web server on the installation machine is recommended (for example, Microsoft Internet Information Server (IIS), Microsoft Peer Web Services, Microsoft FrontPage Web Server, Netscape Enterprise Server, etc.)
- Java Plug-in (available from Sun Microsystems)
- Pentium II processor, 200MHz or faster
- VGA monitor (SVGA recommended)
- CD-ROM drive
- 64 MB RAM (128 MB recommended)
- 350 MB hard disk space

In order to deploy and run applications that you create with AppDev Studio, you need to apply SAS software server-side updates. The necessary SAS Release 6.12 and SAS Version 8 server-side updates are included with AppDev Studio for the following platforms:

- Windows NT, Windows 98, and Windows 95
- Solaris
- HP-UX
- COMPAQ Tru64 UNIX
- AIX
- OS/2

AppDev Studio also includes SAS Version 8 server-side updates for OS/390.

Glossary

AppDev Studio incorporates many technologies that encompass a wide range of information-delivery concepts. To help you decide which technology is appropriate for your needs, this section provides a brief description of some of the terminology that you may encounter.

applets

Java-based applications that run in a Web browser. You can run applets by embedding them in an HTML page and then opening the HTML page in the browser, or by using the *appletviewer* tool, which is provided in the Sun Microsystems Java Development Kit (JDK). Specific HTML tags enable you to embed Java applets in an HTML page. When the Web page that contains an applet is loaded, the applet is downloaded from a Web server and executes.

application servers

servers that are used to store applications. Users access and use these server applications instead of having to load the application on their client machines.

CGI-based technology

CGI, or Common Gateway Interface, is a standard that enables external applications to communicate with information servers such as Web servers. CGI programs are executed in real time, sending or retrieving information when interacting with servers.

full clients

traditional applications that must be loaded on each machine in order for that machine to be able to access and use the application. See also thin clients.

HTML formatting tools

tools that enable you to generate SAS output in HTML format without knowing how to code HTML. These tools are available in Release 6.12 and Version 8 of the SAS System. They are provided as a standard part of base SAS software.

The Output Delivery System (ODS) may be preferable to using HTML formatting tools to generate HTML output. ODS is available in Version 8 of the SAS System. For more information, see *The Output Delivery System* in Chapter 2.

InformationBeans

JavaBeans that encapsulate advanced data, decision-support, and communication functionality from the SAS System. InformationBeans provide full access to any data that the SAS System can access (such as Oracle, DB2, SAS, SQL Server), including multidimensional databases (MDDBs). They also perform computational services such as statistical analysis, reporting, summarization, quality control, and more.

AppDev Studio supplies several InformationBeans. You can also create your own InformationBeans with AppDev Studio. See also JavaBeans, TransformationBeans.

Java-based technology

a technology that enables you to create programs that can be run on any platform. Additionally, these programs can be loaded onto clients or servers, depending on your needs. Java-based technology typically includes Java applets, applications, and servlets. See also applets, servlets.

JavaBeans

reusable components that can work on any platform that is supported by Java technology. Developers can write their own JavaBeans, or they can use existing JavaBeans in Java applets or applications. See also InformationBeans.

JavaServer Pages Technology

a type of servlet that enables you to create Java classes through HTML. See also servlets.

MDDB Report Viewer

an CGI-based viewer that enables users to generate and view data (in report or graph format) that is stored in a multidimensional database without running a SAS session. The MDDB Report Viewer is shipped with SAS/IntrNet software.

Through the MDDB Report Viewer, users can quickly view large amounts of data as a value at any cross-section of business dimensions. Access to the MDDB reports and graphs is provided in a Web environment. A SAS session is not required.

Remote Object Class Factory (ROCF)

an application that provides the ability to automatically encapsulate SAS/AF software models in Java so that a client application can use them in an open solution without having to write any specialized code.

servlets

programs written in Java that run on a Web server. Servlets can be considered a complement technology of applets, which run on Web browsers. Servlets are preferred to applets in some situations because servlet code (unlike applet code) does not have to be downloaded to a Web browser. Instead, servlets send only HTML output to a browser.

thin clients

applications that are deployed across a network, thereby reducing the need for disk space on client machines. Thin-client development tools reduce the cost of deploying and maintaining applications. Cost reductions occur since thin client applications need to be updated only once on the server as opposed to on multiple user machines running multiple operating systems. See also full clients.

TransformationBeans

Java Beans that consume data from an existing webAF model and transform it into the HTML, DHTML, and/or JavaScript necessary for delivery in a JavaServer Page. See also JavaServer Page.

Web servers

server machines and software that are used to help organizations share information through intranets and the Internet. Web server software is now available for almost all platforms, making them both open and platform-independent.

Web servers typically have security features that enable organizations to share information with appropriate people. For example, an organization might load a Java application on a Web server, and then enable users to access that application through the Web server.

Information Resources

This section describes several resources that you can use to access more information about AppDev Studio, as well as about other SAS products that are either included in the AppDev Studio suite or required by your application for server-side processing.

Online Help

You can refer to the online Help for additional information about each of the main components of AppDev Studio. webAF and webEIS include detailed, task-oriented online Help. To access the online Help, open the appropriate product, and then select the **Help** menu. The Help menu includes a list of commands that enable you to use online Help.

The Web tools that are included with SAS/IntrNet are also accompanied by complete online documentation. See the Web site that is installed with AppDev Studio for complete information.

The SAS System also provides comprehensive online Help that includes a syntax reference for base SAS procedures, functions, and statements, as well as SAS/AF class documentation and SCL syntax. To access this Help from within SAS software, select **SAS System Help** from the **Help** menu.

AppDev Studio Developer Web Site

The AppDev Studio Developer Web Site is designed to help you develop and implement enterprise applications that use the power of SAS software to support information delivery and decision making. It is frequently updated with new information, including comprehensive tutorials, how-to topics, and technical papers. You can access the most current version of this site at www.sas.com/rnd/appdev/.

A snapshot of the AppDev Studio Developer Web Site is installed on your local Web server when you install AppDev Studio.

Publications

Many books that provide detailed reference information about SAS software are available through SAS Institute, including

- *SAS Component Language: Reference*
- *SAS/EIS Software: Reference*
- *SAS Guide to Applications Development*
- *SAS Language Reference: Dictionary*
- *SAS Macro Language: Reference*

Reference documentation for Version 8 of SAS software is also provided on a CD-ROM. The *SAS OnlineDoc* CD-ROM enables you to locate information quickly through its online table of contents, index, and full-text search facility.

See the SAS Publications Catalog for a complete listing of available documentation. This catalog is also available online at the SAS Publications Web site (www.sas.com/pubs).

Training

SAS Institute offers a broad curriculum of instructor-based courses to help you use AppDev Studio and SAS software to meet your development goals. Instructor-based training allows you the flexibility of attending courses in training facilities across the United States and in other countries. Check with your local SAS office for availability. Courses cover a wide range of Web applications development, including

- *SAS Web Tools: Overview of SAS Web Technology*
- *SAS Web Tools: Running SAS Applications on the Web*
- *SAS Web Tools: Static and Dynamic Solutions Using SAS/IntrNet Software*
- *SAS Web Tools: Developing Java Based Applications*
- *SAS Web Tools: Understanding Java in webAF Applications*
- *SAS Web Tools: Accessing MDDB Data Using webEIS Software*

In addition, Institute staff can conduct on-site training. For more information about these and other courses, visit the SAS Training site at www.sas.com/training.

Consulting

SAS Institute provides consulting services that enable your organization to get the most out of its investment in its information technology. Services include expertise in software, industry, and functional areas that are related to your immediate and future needs. Contact your local SAS office for details on the SAS consulting services that are available in your area, or visit the SAS Consulting site at www.sas.com/consulting.

Technical Support

SAS Institute Technical Support provides a wide variety of services and resources to help you answer questions about AppDev Studio and SAS software. For detailed information, see www.sas.com/ts.

For phone support in North America, call 919-677-8008 between 9:00a.m. and 6:00p.m. Eastern Standard Time Monday through Friday. For e-mail support in North America, send e-mail to SAS Technical Support at support@sas.com.

For support outside of North America, contact your local sales office.

