
SAP ERP Integration Overview with Other Systems

So far in the first three chapters of this book we have studied an overview of SAP business suite applications and the NetWeaver Application Server ABAP and Java technology foundation that it runs on. In this chapter we will study the central role the SAP ERP system has in an organization and its network integration into the organization's enterprise infrastructure, as well as to the external systems outside the organization and the SAP support infrastructure. This chapter covers various communication and integration technologies that "bind" different SAP ABAP and Java-based applications, along with the third-party enterprise solutions, external vendors, and SAP support organization into an enterprise-wide SAP solution adding value and driving the business needs of an organization. This chapter is also intended to give an overview to enterprise architects as to how a SAP solution would fit into an enterprise-wide architecture.

Figure 4-1 illustrates the integration scenarios that could come into play with the implementation and operations of a SAP ERP system for a hypothetical SAP customer. The remaining sections of this chapter will use this hypothetical scenario to explain the common integration scenario groupings and the underlying communication protocol and standards used by SAP.

Basic Communication in SAP Business Solutions

SAP business applications use the following protocols and standards for communication and data transfer between different systems. One of the following basic network and communication standards is at the heart of the different integration scenarios with the SAP ERP system. Let us look into the details of each of the following protocols and standards.

TCP/IP

In SAP business applications, network communication is with the Transmission Control Protocol/Internet Protocol (TCP/IP) standards. During the system build phase, the required IP address is assigned to the host and necessary configuration is performed where a particular SAP business solution is planned to be installed.

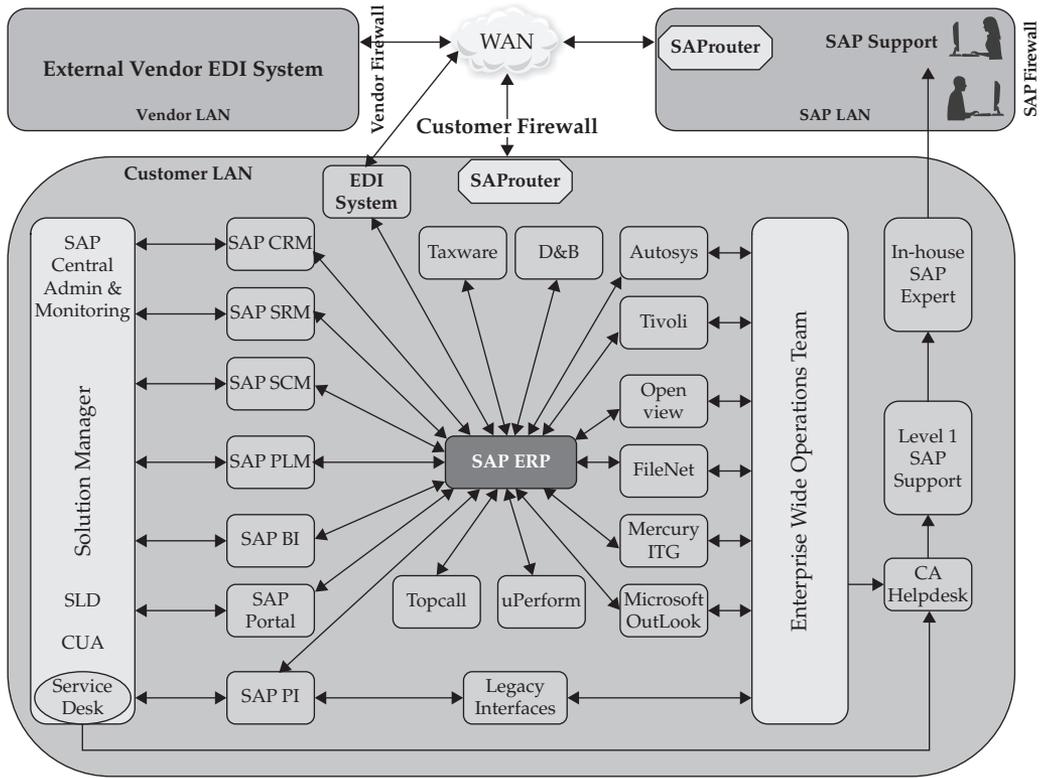


FIGURE 4-1 ERP integration scenarios

Network Ports

SAP business applications listen at clearly defined port numbers for incoming network connections. Table 4-1 lists the most important port numbers and the naming conventions and rules used for defining them for ABAP-based SAP applications.

Service	Default TCP Service Name	Default Port #	Range
Dispatcher	sapdp## where ## is the system number of the instance	3200	3200–3299
Message Server	sapms<SID> where SID = System Identifier	3600	Free
Gateway	sapgw## where ## is the system number of the instance	3300	3300–3399
ICM HTTP	80## where ## = system number of the instance	8000	Free
ICM HTTPS	443## where ## = system number of the instance	Not Active	Free
ICM SMTP	25	Not Active	25

TABLE 4-1 Network Ports in SAP ABAP Applications

Service	Default TCP Service Name	Default Port #	Range
HTTP	5##00 where ## is the system number of the instance	50000	50000–59900
HTTP over SSL	5##01 where ## is the system number of the instance	50001	50001–59901
Telnet	5##08 where ## is the system number of the instance	50008	50008–59908

TABLE 4-2 Network Ports in SAP Java Applications

SAP Java–based applications use a different set of network ports. Table 4-2 lists the most important ports and rules for using the SAP Java–based applications.

In UNIX operating systems, the services file maps port numbers to the named services.

This entry gets there during the time of the SAP installation of a given business solution. The services file location in a UNIX operating system is /etc/services. If, for any reason, the service file entry is missing, then the communication between the SAP applications will be lost and can be restored by adding an entry manually. Usually it requires a root user permission to make any changes to the etc/services file.

RFC

Remote Function Call (RFC) is SAP’s communication interface. RFC communication between SAP business solutions involves an RFC client and an RFC server. The RFC server provides function modules. RFC clients call one of the function modules, pass on the data, and get a reply (value) back from the RFC server.

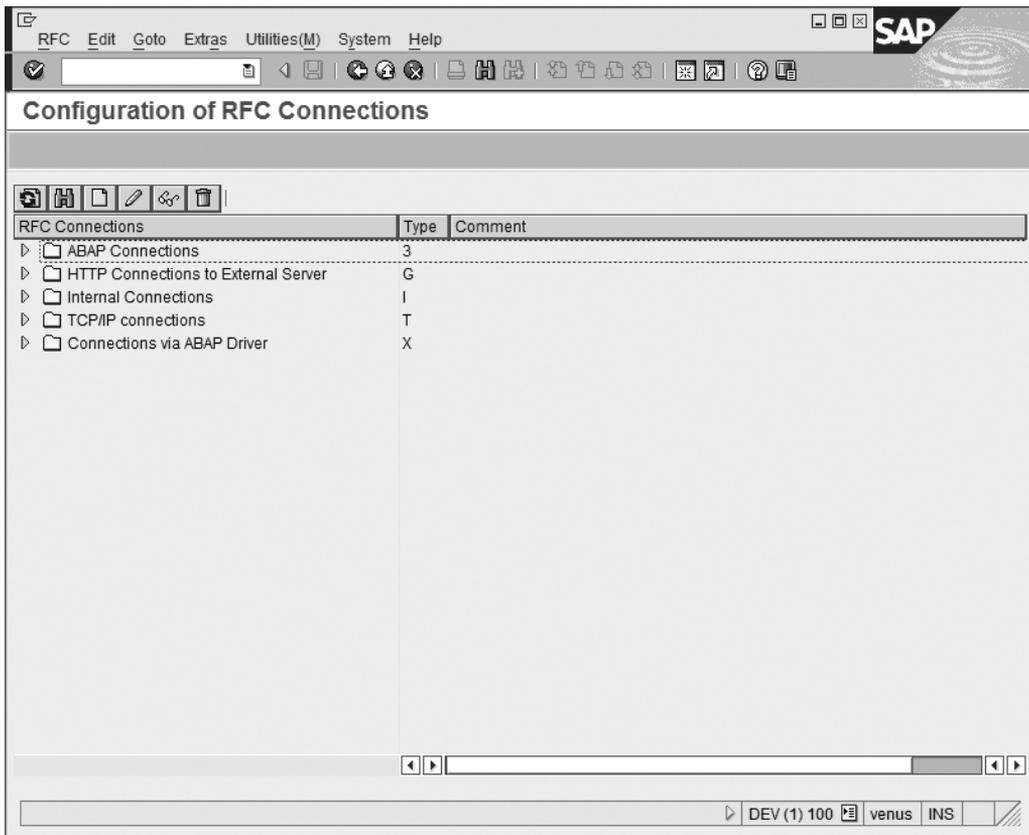
Setting Up an RFC Connection

Transaction code SM59 is used to create new RFC connections or to alter an existing connection. Several types of RFC connections can be set up in SAP systems using SM59 transaction code. RFC connection types “3” (connects to another ABAP system) and “T” (TCP/IP Connection) are most often used.

The following procedure is used to set up an RFC connection type “3” in SAP systems. Use transaction code SM59 in the SAPGUI command line (see Figure 4-2).

Select the connection type ABAP Connections, and click the Create icon. This will open the screen shown in Figure 4-3. Enter the following fields to complete the RFC destination configuration:

- **RFC Destination** Name of the RFC destination of the target ABAP system.
- **Description** Enter a text description.
- **Target Host** Enter the hostname or the IP address of the target ABAP system.
- **System Number** Enter the target ABAP system number.



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FIGURE 4-2 Initial RFC creation screen

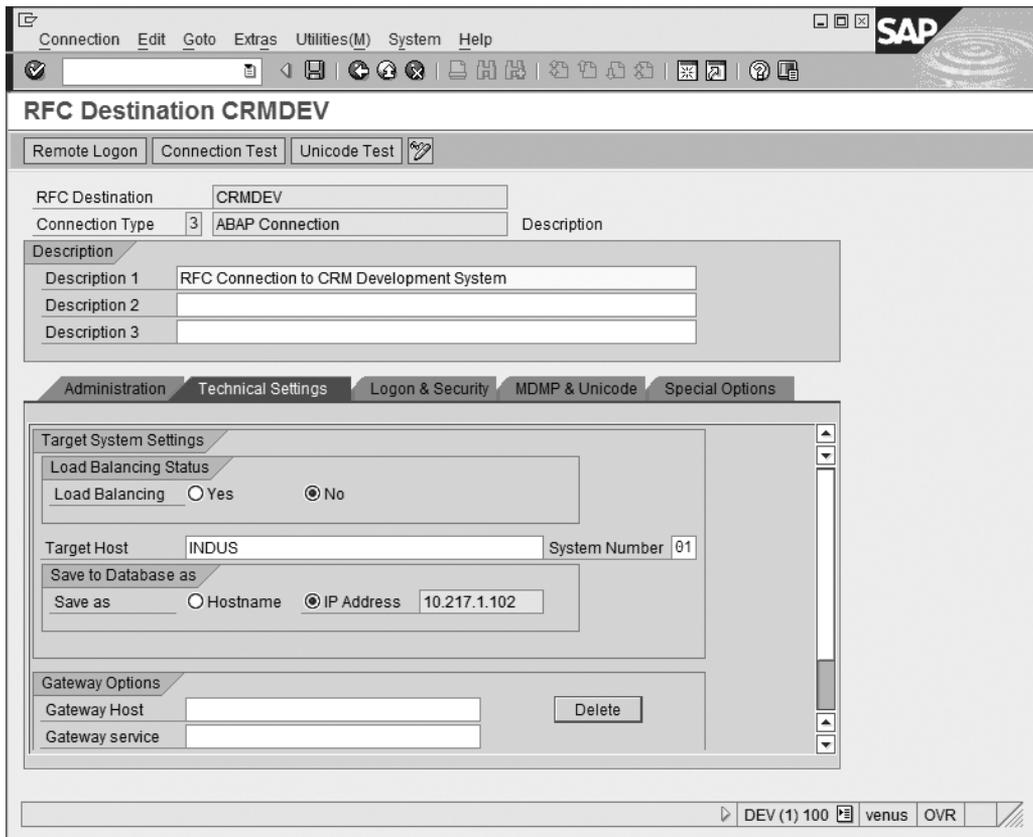
Click the Logon & Security tab, and enter the logon information (Client, User, and Password).

After this, save your connection entries by clicking the Save button, as in Figure 4-4.

If you receive any message window saying the user can log in to the remote system, just click OK and continue. Your connection entries will be saved. The next step is to test if our RFC connection is working properly. Click the Connection Test button at the top of the screen. You will see the screen shown in Figure 4-5 if all of your connection entries are correct.

This is a basic connection test. This does not test the authorizations of the user who initiated the connection. In order to test if this user has the authorizations to initiate an RFC connection and successfully log in to the target system, go back to your RFC connection parameters screen and use the menu option Utilities | Test | Authorization Test.

This test should be successful as well before you can proceed with your work in the target ABAP system or use this connection for noninteractive login by application. You can use the similar procedure to create RFC connections to different ABAP systems in your SAP



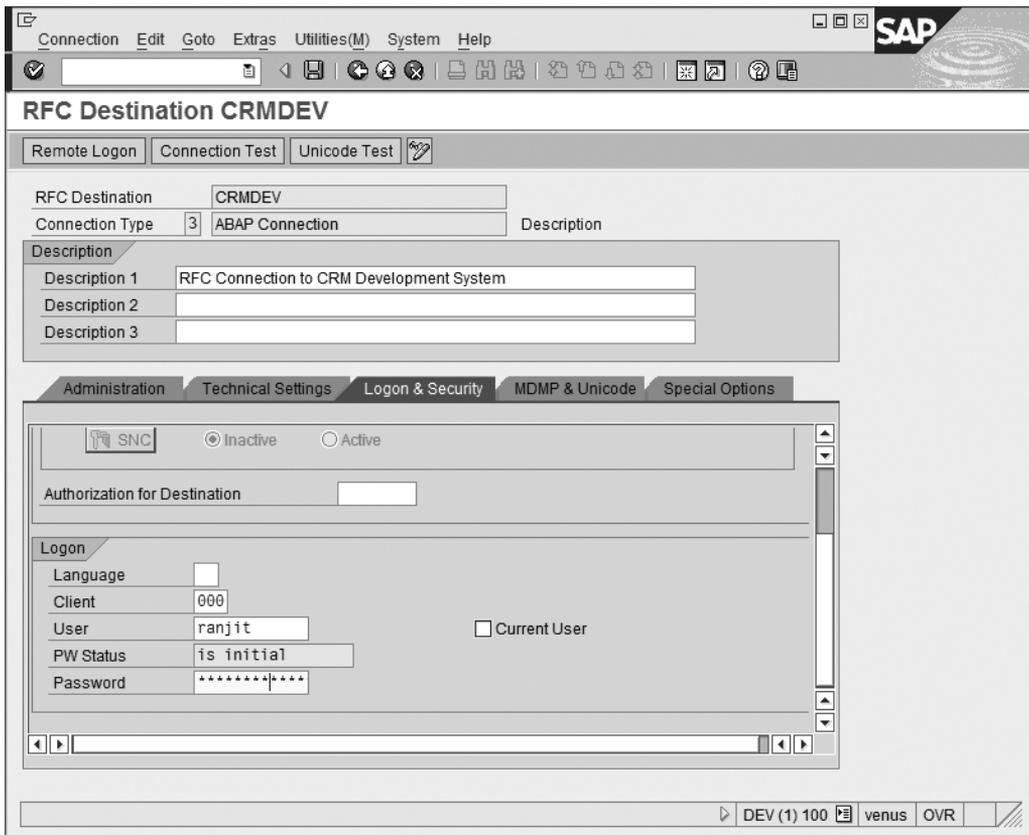
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FIGURE 4-3 RFC connection entries

system landscape. Please note that a successful authorization test is mandatory, as this test executes a user login along with password verification and authorization test in the target RFC-connected system. A successful authorization test ensures that the RFC connection is completely ready for use in an application.

Several other RFC connection types are used to integrate the SAP system landscape. The RFC connection type “T” refers to starting an external program using TCP/IP. One example of such need in a SAP system landscape integration scenario is within the SAP Process Integration application. In this scenario the Process Integration (PI) ABAP components integrate with the SAP PI Java component using this connection type.

The SAP PI ABAP system integrates with the SAP Java-based PI component referred to as the System Landscape Directory (SLD) using an RFC connection called SAPSLDAPI. Figure 4-6 shows the details that have to be entered in setting up a TCP/IP RFC connection type. In this type of connection, a registered server program ID is entered in the RFC connection on the ABAP side, and the exact same entry is made in the JCO RFC provider service on the Java side. Once the settings are complete, the connection test can be executed.



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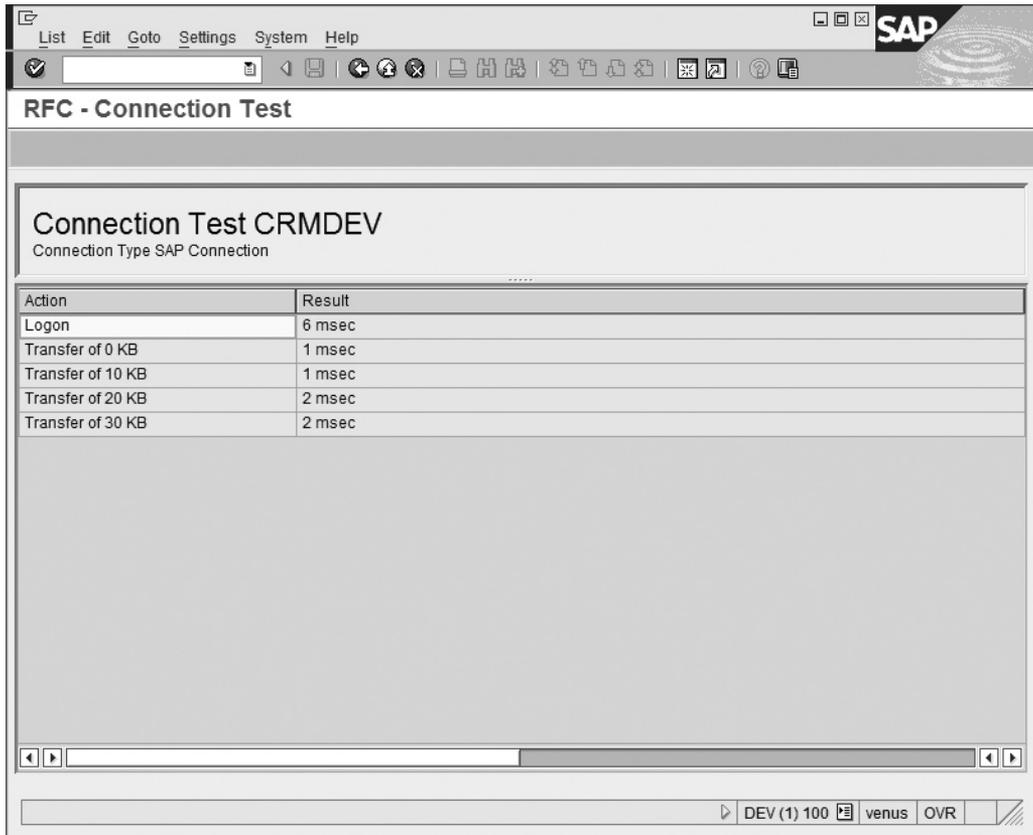
FIGURE 4-4 Login fields in maintaining an RFC connection

Table 4-3 lists all available RFC connection types that are used in the integration of SAP and different applications in an organization.

One of the common problems encountered while integrating older SAP releases with SAP releases starting with NW 7.0 is the changes to the password rules. Starting with NW 7.0, SAP supports a password length up to 40 characters and differentiates between uppercase and lowercase passwords. Earlier SAP releases supported a password length of eight characters and any lowercase passwords were automatically converted to uppercase. In order to resolve this issue easily, it is recommended to use an uppercase password of up to eight characters in length where you are integrating a newer SAP release into older SAP releases in a system landscape. OSS Notes 1023437 and 862989 provide additional details and recommendations for passwords that will help with integrating older SAP releases into the newer release landscape.

SAPconnect

SAPconnect allows a SAP ABAP system to send external communication to systems such as a SAP-certified fax, page, and e-mail solutions. SAPconnect can be set up using transaction code SCOT. The following procedure is used to set up a Simple Mail Transport Protocol

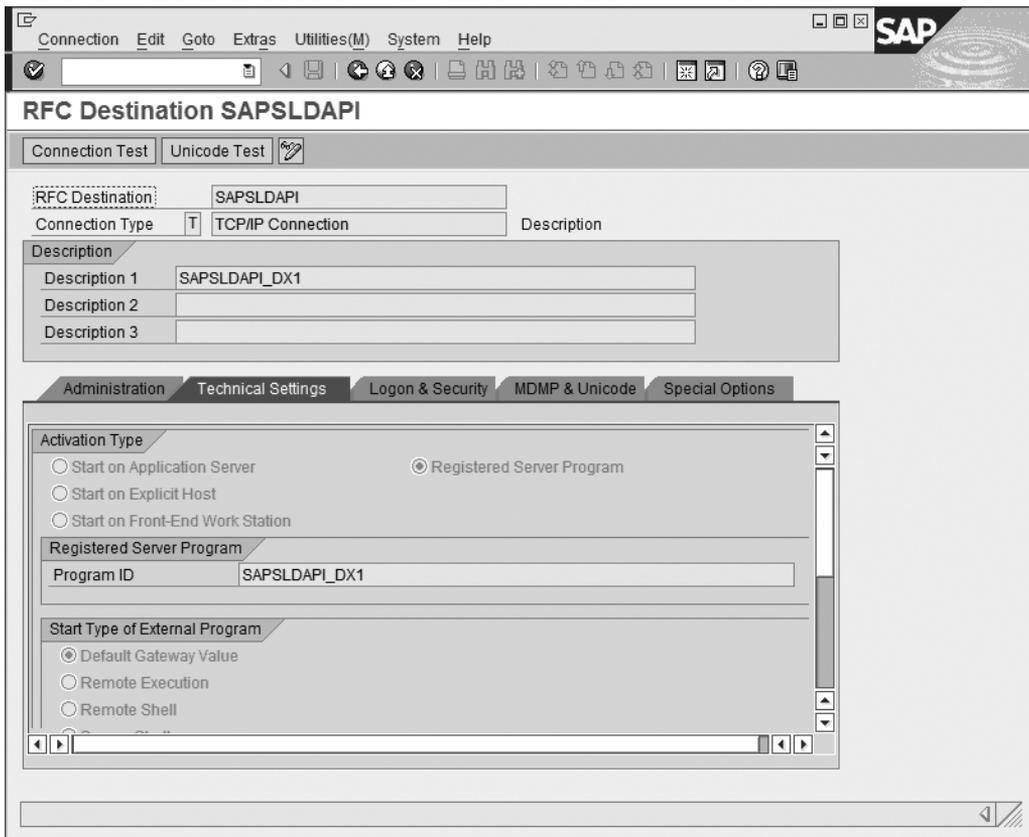


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FIGURE 4-5 Successful connection test

RFC Connection Type	Description
1	ABAP systems connected to the same database
3	Connection to other R/3-based ABAP system
2	Connection to other R/2-based ABAP system
L	Logical connection referring to other physical RFC connection
S	Start external program using IBM SNA (System Network Architecture)
X	Connection via ABAP driver routines or ABAP device drivers
M	Asynchronous RFC connections to ABAP systems using CMC (X.400 protocol)
H	HTTP connection to an ABAP system
G	HTTP connection to an external server

TABLE 4-3 SAP RFC Connection Types



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FIGURE 4-6 SAP RFC connection type T

(SMTP) connection so that e-mails can be sent from SAP applications to external e-mail systems. The integration settings are performed in transaction code SCOT. Enter transaction code SCOT, double-click the SMTP node, and enter the configuration as per Figure 4-7.

Change the mail host for your environment. Click the Set button beside the Internet address type, type an asterisk (*) in the address area, and click either the check mark icon or Enter. After this step click Continue. Next, schedule a send job by clicking the Job icon on the top or pressing `SHIFT-F7` and clicking and choosing the schedule job for all address types. Choose Schedule Immediately, leave the other defaults, and continue. This will schedule the send job. Next, make sure you maintain the e-mail address of the users in SU01 transaction. You can monitor the sent jobs by using the SOST transaction code.

Application Link Enabling/Electronic Data Interchange (ALE/EDI)

The basis of this ALE (SAP-to-SAP business data exchange) and EDI (SAP-to-EDI system business data exchange) communication mechanism is the Intermediate Documents (IDOC). An IDOC acts as a data container facilitating the exchange of business information between

General information	
Node	SMTP
Description	Mail Server
Maximum waiting time for repeat send attempt procedure:	
Hours/minutes	/ 30
<input checked="" type="checkbox"/> Node in use	

SMTP Connection	
Mail Host	mail.indus.com
Mail Port	25
Code Page	0 No Conversion into Other Character Set

Supported address types	
<input type="checkbox"/> Fax	Set
<input checked="" type="checkbox"/> Internet	Set
<input type="checkbox"/> Pager (SMS)	Set

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FIGURE 4-7 SCOT configuration

SAP systems and non-SAP systems. The basis of IDOC generation is the message types. Message types identify the usage of specific business data. One example of a SAP standard message type is "CREMAS." CREMAS is the vendor master data distribution message type. Transaction code WE81 shows all the message types that have been delivered along with the SAP standard install and customer-created ones as well.

SAProuter

SAProuter is an SAP program that is used to securely connect to the SAP support. There is a SAProuter program running on both the customer site and the SAP support organization site. The SAProuter program is installed inside the firewall and acts as an "application level gateway." This adds another layer of network security for both the SAP customer and SAP. More specific details will be discussed in Chapter 20.

SAP EPR Integration with Other Business Suite Applications

This group of SAP business applications includes SAP Business Suite 7 (SAP ERP 6 with EhP4, SAP SRM 7.0, SAP CRM 7.0, SAP SCM 7.0, and SAP PLM 7.0). SAP ERP 6 integrates with the other SAP Business Suite applications, primarily with the RFC connections. Each of the Business Suite applications in this group has special interfaces, but the underlying communication mechanism is via RFC connection over TCP/IP protocol.

SAP ERP Integration with Other NetWeaver Applications

SAP ERP 6 integration with other NetWeaver applications, such as SAP BW 7.0, SAP NetWeaver Portal 7.0, and SAP PI 7.1, is based on RFC connections as well.

SAP ERP Integration with Other Third-Party Enterprise Applications

SAP ERP 6 integrates with a number of third-party solutions, each performing an enterprise-wide service. RFC connections are used to integrate these tools with SAP ERP 6 systems, and SAP usually provides the interfaces to these third-party tools. Third-party vendors also work closely with SAP, who provides certification of their products. Some of the SAP-certified third-party products include

- **Tivoli** This is an IBM product certified with SAP for performing activities such as backup and monitoring capabilities.
- **Autosys** This provides enterprise-wide job scheduling functions.
- **FileNet** This provides archiving capabilities.
- **Open View** This provides enterprise-wide monitoring and reporting capabilities.
- **Mercury ITG** This provides change management capabilities.
- **uPerform** This provides training solutions for SAP end users.
- **Topcall** This provides faxing capabilities.
- **Taxware** This provides sales and use tax calculation for SAP systems.
- **D&B** This provides the business credit check capabilities for SAP systems.

This list is not comprehensive. Several hundreds of third-party enterprise-wide solutions are certified by SAP and can be integrated using one of the communication protocols discussed in this chapter. Table 4-4 provides the SAP certified partner directory link. This link will help SAP customers search for all SAP-certified third-party products. Some of the third-party tools require some additional configuration at setup before they can be used. Each of the third-party vendors publishes an install and configuration guide providing details of the third-party connector tool and the communication setup that is required before using the tool with the SAP solutions.

SAP URL	Description
www.sap.com/ecosystem/customers/directories/searchpartner.epx	SAP-certified third-party products
www.sdn.sap.com/irj/sdn/interface-certifications	SAP-certifiable integration scenarios

TABLE 4-4 Links to SAP-Certified Third-Party Products

SAP Business Suite Integration with Solution Manager

With the growing number and complexity of SAP business applications, it is becoming difficult to administer and operate the solution in an effective manner. SAP Solution Manager is recommended as a central system for all administration and monitoring activities of the SAP system landscape of an organization. SAP has delivered a number of capabilities in the SAP Solution Manager such as change and transport management, service desk functionality, monitoring and reporting capabilities, Central User Administration (CUA), hosting central System Landscape Directory (SLD), enterprise-wide NetWeaver administration, and end-to-end root cause analysis with tools such as Solution Manager Diagnostics (SMD) and Wily Introscope to help manage the entire landscape. More specific details will be discussed in Chapter 20.

SAP Solution Integration with Enterprise-Wide Operations

One of the key points from an operational perspective when integrating a complex system such as SAP is to integrate it effectively with existing enterprise solutions of a given organization so that the operations of the solution will be effectively managed by the enterprise-wide operations team. Different enterprise-wide third-party tools are integrated with the new SAP system, and the escalation procedures are documented and widely distributed so that the operations team can provide the agreed service level agreements (SLA) to the business side of the organization. Usually, the operations team is trained in the new SAP product's basic operations, such as taking backups, resetting user passwords, scheduling jobs, and addressing printing issues. The operations team will escalate the issue to an in-house expert to resolve a reported SAP issue.

SAP Solution Integration with SAP Support

SAP is a complex business solution and needs support from SAP resources from time to time. SAP Solution Manager is integrated into the SAP support organization via a SAProuter connection. SAP support resources can be granted access to the customer's SAP systems by the customer's system administrators using this SAProuter connection. Usually, the support process starts with an internal help desk ticket logged by an end user reporting an SAP issue. Solution Manager service desk functionality or a third-party enterprise-wide help desk solution such as Unicenter is used for logging the help desk tickets. Internal SAP experts at the organization will first try and resolve the reported problem. If this is not possible, an SAP message is logged by the customer at the SAP portal (<http://service.sap.com/message>). SAP resources log into client systems if required to resolve the reported issue.

SAP Solution Integration with EDI and Other External Vendors

SAP Solution Manager integrates and exchanges data with external vendors' EDI systems using integration products such as Gentran. Gentran is one of the leading EDI and data translation solutions.

SAP PI as an Enterprise Integration Hub

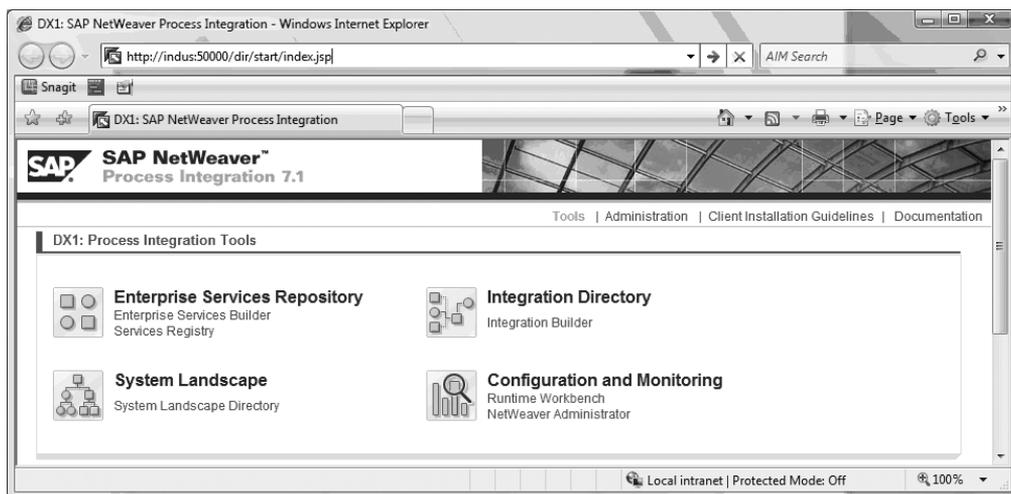
SAP Process Integration is intended as an integration hub for all of the organization's interfaces. PI 7.1 is the most current release and includes a number of performance improvements, with service-oriented architecture capabilities, and is well positioned to standardize and optimize all of the enterprise interface requirements. It avoids point-to-point interface connections and uses native integration capabilities between different SAP solutions, which helps reduce integration costs in a client's landscape.

Service-oriented architecture (SOA) is emerging as a standard for developing interfaces in an organization. In SOA, interfaces are developed as enterprise services so that they can be consumed by a number of other applications across the enterprise. SOA is an architectural standard that requires the functionality of the interfaces be published as a service in a platform-independent fashion.

SAP provides a methodology referred to as Enterprise SOA to implement SOA projects that includes additional capabilities that help clients build business solutions that have a lot of reuse capabilities within an enterprise. Enterprise SOA includes the following stages in a service interface development lifecycle:

- Business requirements gathering
- Service modeling
- Service definition
- Service implementation
- Service publishing
- Service consumption

SAP PI provides SOA tools for facilitating organizations to build and consume enterprise services. Different components of the SAP PI 7.1 systems are shown in Figure 4-8.



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FIGURE 4-8 SAP PI 7.1 system and integration components

Enterprise Service Repository

Enterprise Service Repository (ESR) is a repository for the enterprise service inventory of assets built by an organization over time. This includes tools such as Enterprise Services Builder and Services Registry. Enterprise Services Builder helps to build enterprise services based on enterprise SOA standards. The services are then published in the Services Registry for enterprise-wide consumption.

System Landscape Directory (SLD)

System Landscape Directory (SLD) is a central provider of all software product and component definitions to the ESR. New software product and component definitions are created in SLD and are exported to the ESR to begin the development of the service interfaces.

Integration Directory

Integration Directory is the central configuration tool that helps in configuring message processing, communication and security, and routing rules for message flow.

Configuring and Monitoring

Runtime Workbench and NetWeaver Administrator (NWA) are two tools provided by SAP for monitoring and administering the PI solution. SAP is moving more monitoring and administration capabilities to the NWA tool, consistent with centralizing these activities across the entire SAP solution in a client landscape.

Integration Server

Integration Server is the runtime environment for the service interfaces and is installed as an ABAP component. Other PI components, such as ESR, SLD, and ID, are installed as Java applications.

Advanced Adapter Engine

This component consists of a number of adapters, such as the file adapter, IDOC adapter and JMS adapter. These adapters provide built-in mediation, mapping, queuing, and other capabilities between provider and consumer business applications. Advanced Adapter Engine can be installed as a central adapter engine along with Integration Server, or as a separate installation.

Enterprise Service Bus

Enterprise Service Bus (ESB) is an enterprise SOA environment combining the different service providers and consumers on a single communication infrastructure that provides functions such as runtime services, thereby enabling service-based communication.

The SAP PI solution with all the aforementioned capabilities is thus emerging as a central service interface hub for organizations.

Summary

- SAP ERP plays a central role in an organization's enterprise, integrating with several other SAP and non-SAP systems.
- Industry-standard TCP/IP and RFC communication is the basis of most of the SAP applications' network communication and integration.
- SM59 transaction is used to set up an RFC connection in SAP systems.
- The SAPconnect interface and SCOT transaction is used to set up communication services such as e-mail integration, faxing, and paging integration in SAP.
- ALE (Application Link Enabling) provides the basis for loosely coupling SAP business applications to exchange business data in different integration scenarios.
- EDI (Electronic Data Interchange) standards form one of the basis for exchanging data between SAP and outside vendors.
- The SAProuter program helps to establish a connection between customers' SAP systems and the SAP support organization using secure methods of network integration.
- The SAP PI system is emerging as an organization-wide integration hub in customer sites that have SAP as their main ERP system.
- The SAP PI system provides tools to develop enterprise services that enable SOA.

Additional Resources

- **SAP Process Integration** www.sdn.sap.com/irj/sdn/nw-pi71
- **SAP Solution Manager eLearning Catalog**
www.sdn.sap.com/irj/scn/solutionmanager-elearning