

 **software** AG

LEGACY INTEGRATOR FOR SAP NETWEAVER®
INTEGRATION OF SAP NETWEAVER® WITH BACK-OFFICE APPLICATIONS

POWERED BY
SAP NetWeaver®



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EXECUTIVE SUMMARY

The SAP® Exchange Infrastructure (SAP XI) is an essential component of the SAP NetWeaver® platform for integrating the processes of an SAP-driven business. Software AG's Legacy Integrator for SAP NetWeaver® links back-office applications with SAP NetWeaver® and SAP® Exchange Infrastructure in an elegant, robust and efficient manner.

If any of the following issues sound familiar, Software AG's Legacy Integrator for SAP NetWeaver® is a very worthwhile consideration:

- Time-consuming ordering processes based on unsafe file transfers with back-office applications
- Isolation of mainframe applications – running vital parts of your enterprise – from SAP-driven business processes
- Unsatisfactory migration projects resulting in lack of functionality and lost time and money

The Legacy Integrator for SAP NetWeaver® is essential for organizations who

- run vital parts of their business on mainframe
- would like to protect their investments in mainframe
- want to see their enterprise-wide business processes cover all systems, not just the SAP world
- need real-time integration of mainframe and/or Unix applications with SAP NetWeaver® and SAP® Exchange Infrastructure
- are planning to use SAP® Exchange Infrastructure as their central XML communication hub
- trust and rely on SAP-certified solutions

This solution is designed to unlock a wide range of legacy applications, at either the terminal session layer or at the program logic for an SAP-driven business. Software AG's Legacy Integrator for SAP NetWeaver® is a 100% SAP NetWeaver®-compliant and SAP-certified solution to solve these challenges. Legacy Integrator for SAP NetWeaver® is based on XI adapters that plug into the SAP XI 3.0 adapter framework. For mainframe and Unix environments, Natural, COBOL, PL/1, RPG, C and Assembler alike, Legacy Integrator for SAP NetWeaver® enables reliable, bidirectional and real-time integration of your processes.

OVERVIEW: ARCHITECTURE OF LEGACY INTEGRATOR FOR SAP NETWEAVER®

Software AG's Legacy Integrator for SAP NetWeaver® solution integrates legacy applications on mainframe and Unix systems with the SAP side of a business. It is based on XI adapters that are deployed in the SAP® Exchange Infrastructure (SAP XI 3.0) runtime environment.

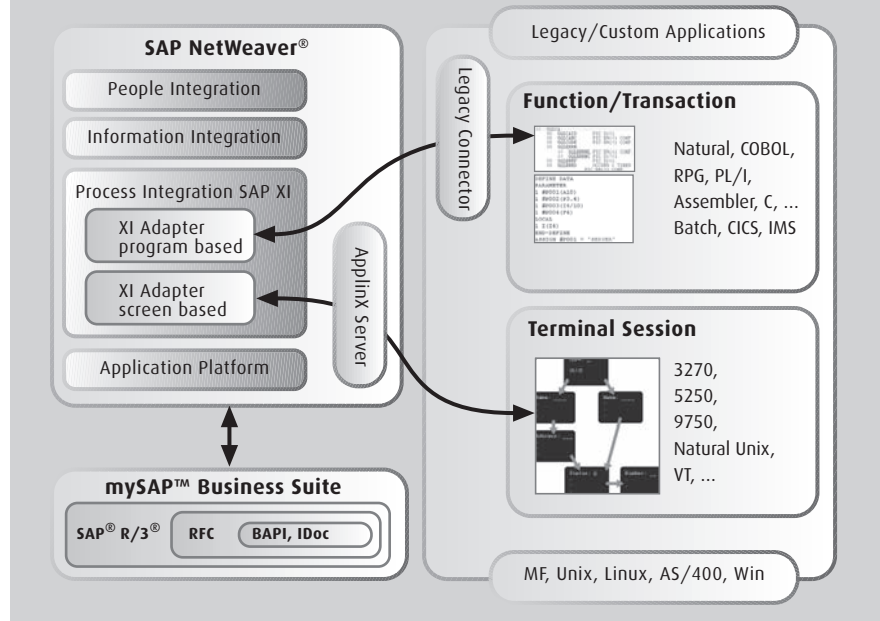
It comprises certified XI adapters running on an SAP® Exchange Infrastructure adapter engine, the Legacy Connector for program-based integration and the ApplinX Server for session-based integration. While the XI adapters ensure connectivity to SAP XI 3.0, the Legacy Connector or ApplinX Server makes the connection to your mainframe applications.

In a typical deployment, the Legacy Connector resides on the legacy application platform and the ApplinX Server resides on the web or application server – the SAP J2EE Web Application Server (WAS), for example. Mainframe applications can now exchange messages via a TCP/IP-based RPC protocol or Telnet with Software AG XI adapters. The XI adapters automatically transform messages from host format to SAP XI format and vice versa.

When an SAP XI message is received by an XI adapter, the message's payload is transformed from XML into the specific format of the respective legacy mainframe application and the message is processed. The legacy application's result will be sent back to the XI adapter. The response message is then transformed back to SAP XI message format.

With program-based integration it is also possible to initiate communication on the side of the legacy application, i.e. send

Overview of Legacy Integrator for SAP NetWeaver® architecture

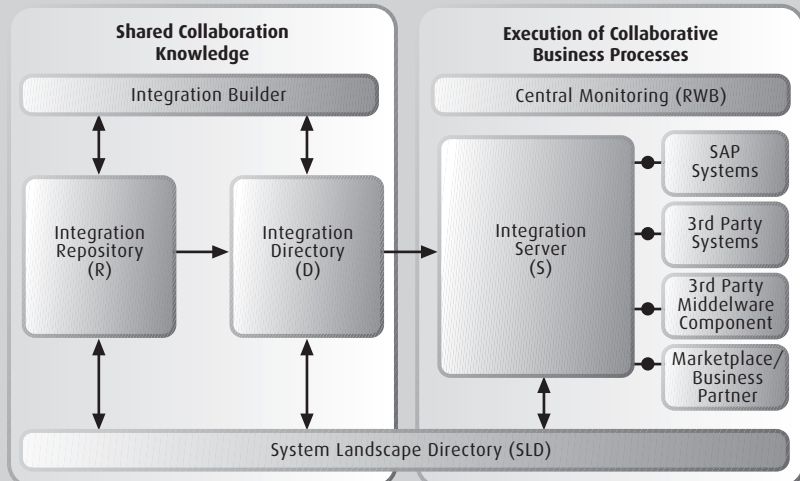


a message from the legacy application to SAP XI and receive a response. In this case, the adapter acts as a sender adapter and the sequence of steps takes place in the reverse order.

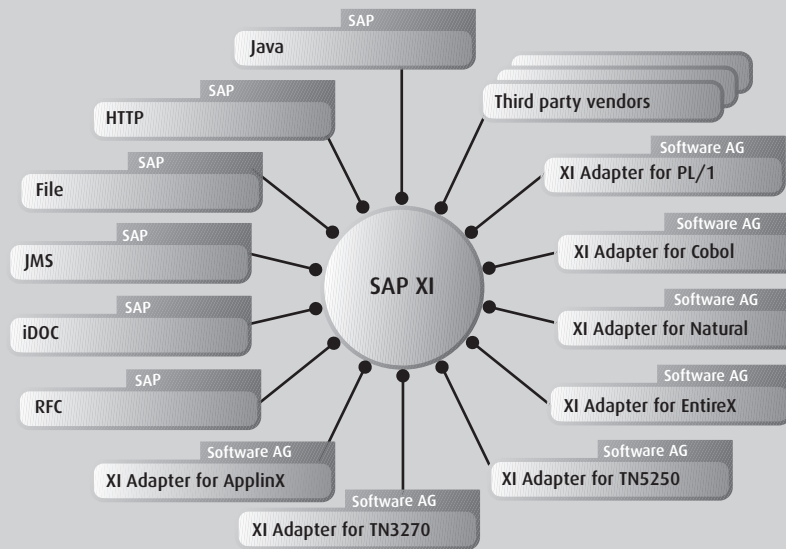
As a built-in component of the SAP® Exchange Infrastructure, Legacy Integrator for SAP NetWeaver® leverages the following tools and concepts within the Infrastructure:

- System Landscape Directory (SLD) – to define software component versions
- Adapter Framework/Adapter Engines – to install and run XI adapters
- Integration Repository (IR) – to define message types
- Integration Directory (ID) – to configure communication channels
- Runtime Workbench (RWB) – for monitoring purposes

SAP XI Component Overview



Connectivity of SAP® Exchange Infrastructure



FEATURES

Software AG's Legacy Integrator for SAP NetWeaver® provides a comprehensive range of features which are the results of Software AG's long-standing expertise in:

- Mainframe application and system programming,
- XML and legacy integration and
- SAP integration.

Multiple platform support

The XI adapters are supported on a variety of Windows and Unix platforms and are deployed on the respective SAP Web AS.

The solution also supports a number of mainframe, Unix and Windows systems for legacy applications. Batch, CICS, IMS and the operating systems BS2000, VSE, z/OS as well as OS/400 are examples of supported mainframe environments.

Support for a wide range of programming languages

The Legacy Integrator for SAP NetWeaver® is compatible with an array of legacy application programming languages, e.g. COBOL, PL/1, RPG, C, as well as .NET and Java.

For most programming languages, the message format description of the RPC-based protocol can be generated automatically. This format is described using the Interface Definition Language (IDL).

Support for a wide range of screen protocols

For terminal-session based integration the Legacy Integrator for SAP NetWeaver® supports a wide variety of terminal and screen

protocols, such as IBM 3270, AS/400 (5250), Siemens OSD/BS2000 (9750), VT (VT100, VT220, ANSI, DG), Unisys (T27), Fujitsu (6680) and Hitachi (5601).

Bi-directional communication

With program-based integration the XI adapters by Software AG can be employed for sending as well as receiving. This means that with Legacy Integrator for SAP NetWeaver® you can invoke your communication from any XI client to the mainframe. If desired, your mainframe application can also initiate XI communication as an XI client.

Unlike other offerings, this affords users great flexibility in how they design their legacy integration scenarios. In contrast to legacy exploitation or even migration, mainframe applications can become equal communication partners in integration scenarios.

Real-time integration

Integration with Legacy Integrator for SAP NetWeaver® is in real time. Whenever communication via an XI adapter or Legacy

Connector is initiated, messages are sent immediately.

Regardless of which side of the environment initiates communication, messages are delivered promptly, enabling synchronous and asynchronous communication.

Full security support and data encryption

User authentication, authorization and data encryption are supported. Different levels of data compression and encryption can be selected.

The platform of the Legacy Connector determines which security repositories are queried. For example, under z/OS, SAF-based security (RACF, ACF2, Top Secret) can be exploited, while the local system-level security is used for authentication under Unix.

High scalability

Integration solutions with Legacy Integrator for SAP NetWeaver® are high performing and highly scalable. This has already been proven in numerous industrial-strength integration projects using Software AG's legacy integrator technology.

The technology transparently supports multiple servers to handle client requests. Moreover, most of the available RPC servers support automatic load balancing. This allows fine tuning of server threads based on a min-max approach.

Automatic character code conversion

Code conversion between mainframe character sets (e.g. EBCDIC) and XML is done completely automatically and transparently. This conversion is handled in both communication directions. No programming is

involved on either client or server side to achieve this automatic data conversion.

Full mainframe data type support

All typical mainframe data types, such as packed and unpacked decimals, that occur in your legacy applications are supported by Legacy Integrator for SAP NetWeaver®. They are automatically translated to XML data while the messages flow back and forth – again no additional programming necessary.

SAP-certified solution

Legacy Integrator for SAP NetWeaver® has been developed in close cooperation with SAP engineers and SAP XI technology consultants. Thus, Legacy Integrator for SAP NetWeaver® is a SAP-certified solution, which has been tested in SAP's certification labs.

Furthermore, Software AG employs technical consultants that specialize in legacy integration with SAP. They are highly trained and SAP-certified with a particular focus on SAP Web AS/SAP XI.

100 % SAP XI integration

As an XI adapter-based approach, all of the XI adapters are fully integrated into the SAP® Exchange Infrastructure (SAP XI 3.0) via the XI Adapter Framework. Only the Legacy Connector needs to be deployed on the legacy platform so as to ensure efficient communication with mainframe applications.

Easy and lean software deployment

The XI adapters are installed with SAP NetWeaver®'s Software Deployment Manager (SDM). SDM is the standard tool for deploying SAP NetWeaver® components. In the case of the XI adapters, SDM reduces the amount of work to just a few clicks of the mouse.

The Metadata Extraction tools are installed with standard Eclipse behavior.

Quality of Service (QoS)

Legacy Integrator for SAP NetWeaver® supports all qualities of service defined by SAP® Exchange Infrastructure: Best Effort (BE), Exactly Once (EO) as well as Exactly Once In Order (EOIO). Thereby the communication is handled directly by the XI adapters via an RPC-based protocol.

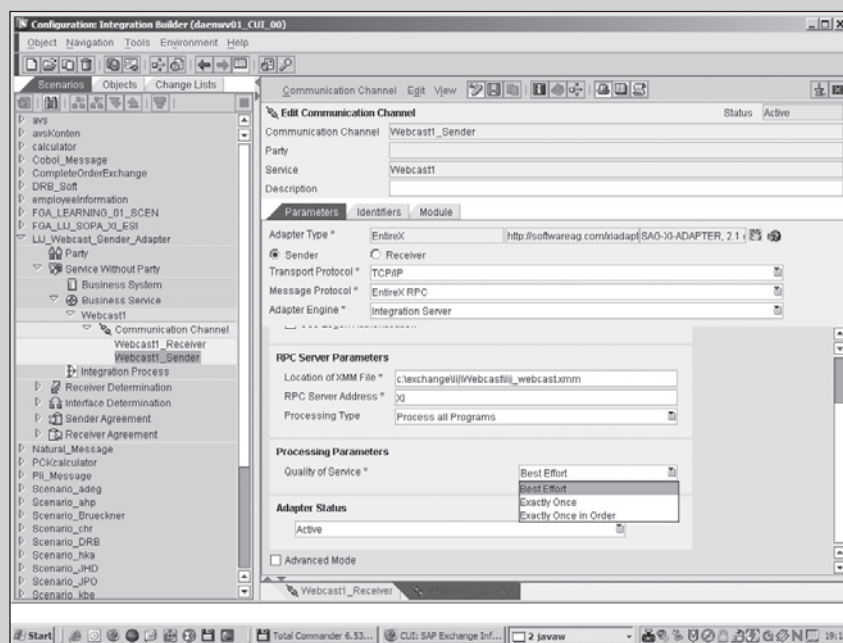
Due to the synchronous nature of session-based integration, this type of integration supports quality of service (QoS) Best Effort (BE) only.

Central configuration

All XI adapter configurations are done in SAP XI's communication channel editor. This editor includes adapter-specific settings and provides a common look and feel for all configuration tasks associated with the XI adapters.

Central monitoring

Thanks to tight integration of the XI adapters into SAP XI, monitoring of the adapter, adapter status and dependent communication channels is 100 % XI. Therefore, all common monitoring tasks, such as adapter monitoring, message monitoring, error analysis, etc., can be managed with SAP XI's Runtime Workbench.



LEGACY INTEGRATOR @ WORK – PROGRAM-BASED

Installation

Software AG's XI adapters are installed on an SAP XI adapter engine. Installation is fully supported by standard SAP NetWeaver® tools and is carried out with the SAP® Software Deployment Manager (SDM).

For each XI adapter, the adapter meta data must also be provided to SAP XI. This is done by declaring the adapter product and component in the System Landscape Directory (SLD). Subsequently, adapter meta data can be imported from its XML definition file within the Integration Builder (Design).

In Natural, COBOL and PL/1 environments, it is advisable to deploy the Meta-data Extractor for the respective environment as well. They are provided as Eclipse-features and can easily be installed via standard Eclipse behavior.

Ideally, the Legacy Connector is installed on the legacy system server, using the easy-to-follow step-by-step installation instructions.

Sample JCL is provided for mainframe to guarantee simple installation.

Configuration

There are a few things that need to be configured. Before running a scenario, the respective Communication Channel needs to be set up with some parameters. As indicated by the screenshot below these include:

- Sender/Receiver
- Transport and Message Protocols
- Connection Parameters
- RPC Parameters
- QoS Parameters

In addition, security settings for authentication and authorization can also be selected. Security settings will also be defined in the Legacy Connector's attribute file.

Besides these legacy-side security settings, everything else is completely SAP XI.

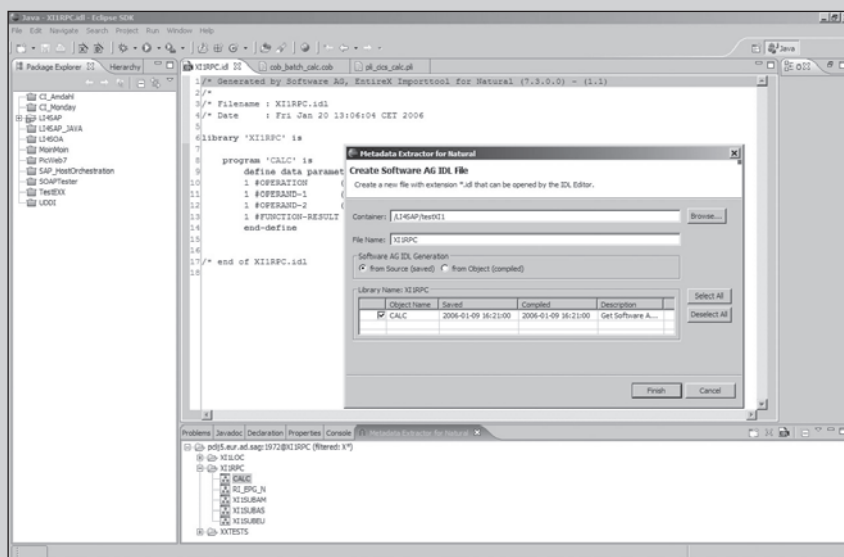
Although the settings are different for each kind of XI adapter, the SAP XI GUI provides the same look and feel for all, ensuring fast and user-friendly configuration.

XMM files which can be fully generated are used to define the mapping between the XML message format and the RPC-based data format. These are specific to the message type. The XMM file location also has to be specified in the Communication Channel.

Creating mainframe integration scenarios

In the following section, we will examine two typical integration scenarios. The first scenario illustrates a receiver XI adapter with a receiving mainframe application.

The second scenario shows the opposite scenario with respect to the direction of communication: A message is invoked by a mainframe application using a sender XI adapter.



Scenario I: mainframe as the receiver

After having installed the Legacy Integrator components, you can begin creating Legacy Integration scenarios. The following list of steps will guide you to your enterprise-class integration with SAP XI systems:

1. Generate definition files
2. Wrap schema definition with SAP XI External Definition
3. Create a Communication Channel using configuration definition
4. Incorporate both objects into your SAP XI integration scenario
5. Start Legacy Connector
6. Start and test your legacy integration scenario

The most important steps will be described in greater detail in the following sections of this white paper.

As mentioned, RPC messages are defined with an Interface Description Language (IDL). You can automatically generate the IDL files used for your integration scenarios for a variety of programming lan-

guages from the application's source or object.

The IDL can be reused for editing and regeneration if desired.

Every SAP XI Message needs a message type definition. Likewise, to be able to effectively talk to the Legacy Connector, the XI adapters need to be configured with message type information. Both types of definitions can be generated from the legacy application's interface definitions (IDL).

For the XI, the message is described with an XML Schema Definition (XSD). This XSD has to be wrapped by an SAP XI External Definition object. Once wrapped in an External Definition, the message type is known to SAP XI.

As previously stated, the XI adapters also need message type information. To be able to effectively map the XML message payload to the RPC-based format, XMM files are used. These XMM files are referred to in the Communication Channels.

How will you be able to generate the necessary files? Software AG's XI Adapters come with Metadata Extractor tools that

automatically generate the files needed from COBOL, PL/1 or Natural source code. After some basic settings and selection of the desired sources or objects, three types of files are generated:

1. IDL – for the RPC message definition
2. XMM – an XML mapping file needed for the adapter
3. XSD – XML Schema Definition of the message type

When the server part is implemented in other programming languages, like Assembler, RPG, or C, the generation of XSD and XMM files is supported with similar tools.

The External Definition will subsequently be used by the Message Interface objects of your integration scenario. The configured Communication Channel and the External Definition allow to thoroughly define your scenario.

Prior to running your scenario, the server side needs to be started up. With Natural, a Natural RPC server forwards incoming requests to the respective Natural

CICS Integration Scenario

subprograms. In this manner, every Natural subprogram can be offered as a service.

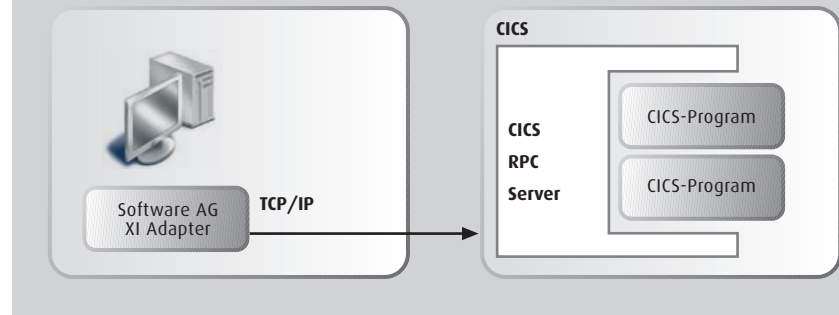
In CICS, for example, any subprogram that is callable via the DHFCOMMAREA can be connected with the help of the CICS RPC server. The CICS RPC Server can be started via CICS program or automatically during CICS initialization.

The CICS RPC Server communicates with legacy programs via the CICS COMMAREA.

With COBOL applications, for example, the interface to be used with the CICS COMMAREA is defined in the Linkage Section of the COBOL program. The CICS RPC Server calls the legacy COBOL or PL/1 programs and communicates with them via COMMAREA, which is part of the linkage section.

Scenario II: mainframe as the sender

For the mainframe-as-sender scenario, imagine you want to connect a COBOL client running under CICS to your SAP XI. The following steps will guide you to your COBOL client program that integrates with SAP XI:



1. Generate message type definition files
2. Create a Communication Channel using configuration definition
3. Incorporate both objects into your SAP XI integration scenario
4. Generate and install the COBOL client
5. Start Legacy Connector
6. Start and test your legacy integration scenario

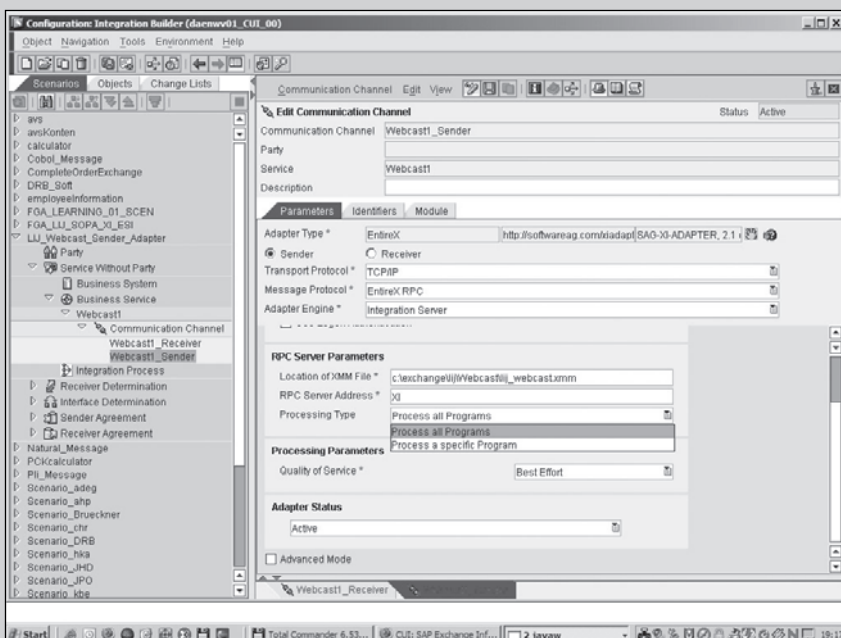
Most of the steps needed are identical to those in the first scenario. Therefore, only the differences will be covered in detail in the following sections.

As in the first scenario, RPC messages are defined with an Interface Description Language (IDL). Here, the message type will be taken from XI message type descriptions. This means that you will use a different source to generate your IDL. Depending on your needs, you can generate IDL from a variety of sources such as DTDs, XML Schema Definitions (XSD), Web Service Descriptions (WSDL) or a sample XML document.

It is common when working with XI to describe Best Effort XI message interfaces with two XSD files: One for the message and a second one for the message response. Subsequently, the best way to generate IDL is by using these two XML schema definitions as input.

Just as in the last scenario, users generate IDL and the XMM file. The XML mapping file will again be used in the Communication Channel settings. Since XI already knows the message interface through the XSD files, your SAP XI integration scenario can be fully described.

For a COBOL client interface, you now have to generate a COBOL client adapter



Sender Adapter Communication Channel Editor

```

DAEFT50 - Entire Connection Terminal
-----
File Edit Edit_Settings Menu Utilities Compilers Test Help
-----
EDIT      ETS.COB.DFHRSRCE($JCL#COB) - 01.09          columns 00001 00072
Command ==> _____ scroll ==> CSR
000011 // *
000012 // * CLIENT SOURCES *
000013 // *
000014 // STUB EXEC $DFHCOB,DYN=,SLIB=&S,LLIB=&L,SMEM=XICLNT2
000015 // DRIVER EXEC $DFHCOB,DYN=,SLIB=&S,LLIB=&L,SMEM=XICLNT1
000016 // *
000017 // * CLIENT SERVICES *
000018 // *
000019 // RUNTIME EXEC DFHYITVL,
000020 // PARM. TRN='COBOL2,SOURCE',
000021 // PARM. COB='DYNAM,NODBCS,NS(DBCS),LIB,OBJ,RENT,APOST,NOMAP,NOXREF',
000022 // OUTC=*,AD370HLQ=IGY,LE370HLQ=CEE,
000023 // DSCTLIB=&S,
000024 // PROGLIB=&L
000025 // TRN.SYSIN DD DISP=SHR,DSN=&S(RPCSRVI)
000026 // LKED.EXALIB DD DISP=SHR,DSN=INS.EXX721.MVSL001
000027 // LKED.ADALIB DD DISP=SHR,DSN=INS.WAL743.MVSL001
000028 // LKED.SYSLMOD DD DISP=SHR,DSN=&L
000029 // LKED.SYSIN DD *
000030 MODE AMODE(31) RMODE(ANY)
4A0
05,002
Ready

```

together with the COBOL services. Both can be generated from IDL, and both are available in a CICS, IMS, as well as batch version. The COBOL CICS version should be employed for this scenario.

The generated files are transferred to the mainframe using ftp, for instance. The new members should now be compiled and linked for usage under CICS. The resulting modules need to then be defined in a

CICS group. The option exists to add the CICS group to the CICS AUTOINSTALL list.

Now the Legacy Connector has to be started and the desired RPC service should be added to the Legacy Connector's attribute file.

Users can write their own client program or adapt an existing one. To call the generated client adapter, they just use EXEC CICS LINK with the parameters from

the linkage section of the generated client adapter. In this manner, client programs written in mainframe languages such as COBOL, PL/1 or Assembler can actually be docked.

Once the client program has been written and compiled, it is ready to run, and the new integration scenario can be tested.

LEGACY INTEGRATOR @ WORK - SESSION-BASED

Installation

Software AG's XI adapters are installed on an SAP XI adapter engine. Installation is fully supported by standard SAP NetWeaver® tools and is carried out with the SAP® Software Deployment Manager (SDM).

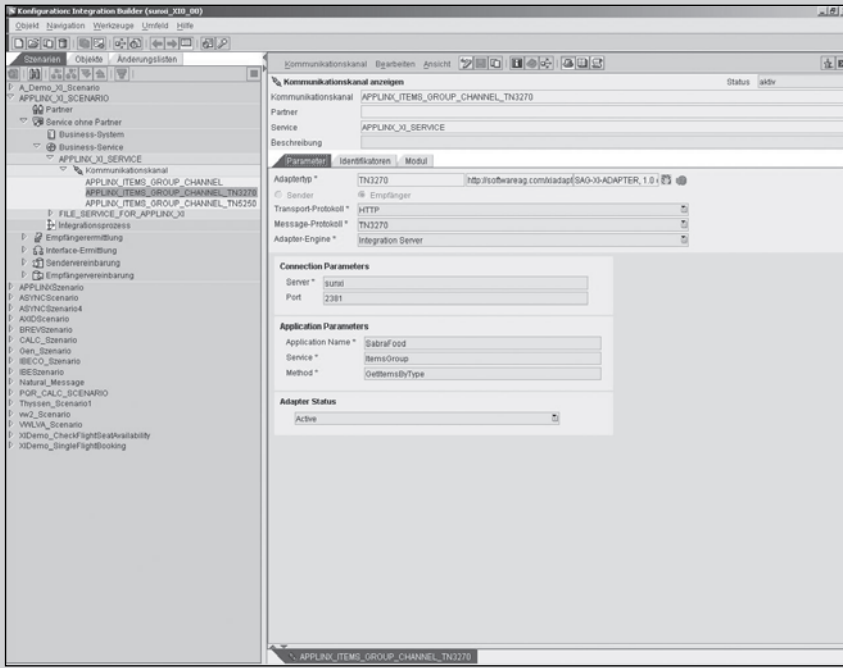
For each XI adapter, the adapter meta data must also be provided to SAP XI. This is done by declaring the adapter product and component in the System Landscape Directory (SLD). Subsequently, adapter meta data can be imported from its XML definition file within the Integration Builder (Design).

The ApplinX Server and ApplinX Administrator may be installed on the SAP XI Server or on any other server. More details are available in the ApplinX installation documentation and the ApplinX Getting Started Guide.

```

DAEFC1 - Entire Connection Terminal
-----
17:14:48      -----< DorderNA RPC-Client >-----      28-06-2005
-----
ETB515-RPC/XI/CALLNAT
-----
CMD  TYP  FUNCTION
-----
1  RPC  Send: AAAAA, BBBB, 1111
2  RPC  Send: LLLLL, MMMM, 5555
3  RPC  Send: YYYYY, ZZZZ, 9999
-----
.  Exit
-----
Please select: _
-----
Out: DORDER 1: AAAAA, BBBB, 1111
Got: ChriswResto
Err: 0000-0000
-----
F1      F2      F3 Exit  F4      F5      F6
F7      F8      F9 Cmd 1  F10 Cmd 2  F11 Cmd 3  F12
4A0
15,036
Ready

```



Adapter Configuration for session based XI Adapter using Communication Channel Editor

4. Incorporate both objects into your SAP XI integration scenario
5. Start and test your legacy integration scenario

The ApplinX XI Adapters use ApplinX Procedure Groups definitions, available as WSDL, as the message type definition. These WSDL definitions can be retrieved in two ways: from the ApplinX Plug-In for Eclipse or from the ApplinX 2380 HTTP Interface. Both methods are fully documented in the ApplinX SAP XI Documentation and in the ApplinX User Guide.

Configuration

There are a few things that need to be configured. Before running a scenario, the respective Communication Channel needs to be set up with some parameters. As indicated by the screenshot below these include:

- Application Parameters
- Connection Parameters

1. Retrieve the WSDL of an ApplinX Procedure Group
2. Import the WSDL file into SAP XI as an External Definition
3. Create a Communication Channel using configuration definition

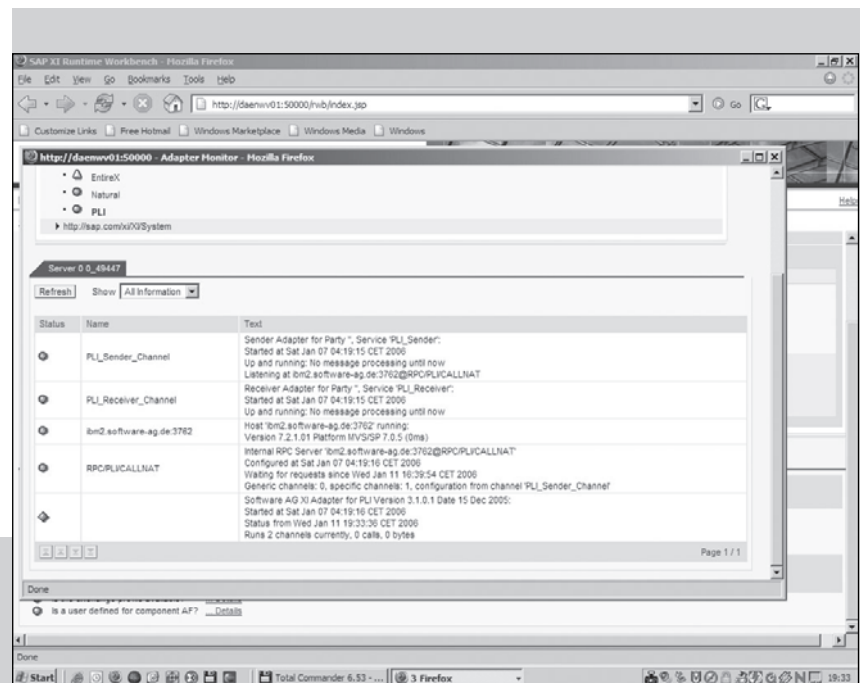
MONITORING

As Legacy Integrator for SAP NetWeaver® is a pure SAP XI solution, all monitoring activities, such as

Creating session integration scenarios

When doing session-based integration you will configure a receiver XI adapter with a receiving ApplinX enabled legacy application.

After having installed the Legacy Integrator components, you can begin creating Legacy Integration scenarios. The following are the steps needed to integrate your ApplinX enabled legacy systems with SAP XI:



Monitoring Software AG XI adapters within the Runtime Workbench

- Adapter Monitoring
- Message Monitoring
- Detailed Message Analysis via TA SXMB_MONI

are incorporated into the standard SAP XI monitoring tools such as Runtime Workbench.

These tools are all familiar to SAP XI specialists and allow a focused analysis of integration scenario anomalies. This and the proven stability of Software AG's legacy integration technology enable integration of the most mission-critical legacy applications.

CONCLUSION

SAP-Certified integration

Legacy Integrator for SAP NetWeaver® is based on SAP-certified XI adapters. This guarantees a powerful integration solution for back-end systems.

100% SAP XI integration

Unlike other offerings, Software AG's XI adapters are completely integrated into SAP XI. This provides a single point of control for design, configuration and monitoring.

Sophisticated wrapping technology

Legacy Integrator for SAP NetWeaver® makes use of a proven wrapping technology. This provides full integration both on the XI side of an IT environment and on the legacy side as well. The communication process handles all the complex marshaling and character conversion internally.

High performance

Legacy Integrator for SAP NetWeaver® has been designed for mainframe and Unix environments. It offers users an extremely high-performance and highly scalable solution that meets the highest of integration demands in today's heterogeneous IT environments.

Ease of use

Software AG's wrapping technology is straightforward and thus very easy to use. In addition to being completely SAP-integrated, it minimizes completion time of integration projects, thereby ensuring low maintenance and technical support costs.

Hidden mainframe complexity

The trials and tribulations of integration and migration will soon belong to the past with the Legacy Integrator for SAP NetWeaver®. Back-end applications will become part of SAP-centric business processes in a transparent and efficient manner.

Return on assets

Integrating mainframe applications in this user-friendly manner protects investments made in transaction-driven, high-performance enterprise environments.

Long-standing integration and mainframe expertise

With more than 35 years of mainframe know-how and over 10 years of experience in state-of-the-art XML technologies, Software AG is the no-nonsense partner for mainframe and SAP integration. When organizations choose Software AG's Legacy Integrator for SAP NetWeaver®, they are selecting a one-of-a-kind solution that guarantees successful mainframe integration.

GLOSSARY OF ABBREVIATIONS

There are a number of abbreviations used when discussing the topic of SAP integration that belong to either SAP, Software AG or industry integration jargon. In case these terms are unfamiliar, please use this glossary for a better understanding and an easy startup:

- **CICS** – Customer Information Control System, IBM®
- **IB** – Integration Builder, SAP NetWeaver®
- **IB (Configuration)** – Integration Builder (Configuration), same as Integration Directory (ID)
- **IB (Design)** – Integration Builder (Design), same as Integration Repository (IR)
- **IR** – Integration Repository, SAP NetWeaver®
- **ID** – Integration Directory, SAP NetWeaver®
- **IDL** – Interface Definition Language, Software AG
- **JCL** – Job Control Language
- **LE370** – Language Environment 370, IBM®
- **RPC** – Remote Procedure Call, Software AG
- **RWB** – Runtime Workbench, SAP NetWeaver®
- **SAP XI** – SAP® Exchange Infrastructure
- **SDM** – Software Deployment Manager, SAP NetWeaver®
- **SLD** – System Landscape Directory, SAP NetWeaver®
- **TA** – Transaction, usually an SAP® R/3® transaction
- **Web AS** – SAP® Web Application Server
- **XI** – SAP® Exchange Infrastructure
- **XMM** – XML Mapping File, Software AG
- **XSD** – XML Schema Definition

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