

SAP Partner Connectivity Kit 7.1



SAP Partner Connectivity Kit - Simple Use Cases

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1 Preface

Constraints

The texts, references, and graphics contained in this manual have been compiled with utmost care; nevertheless, it is impossible to guarantee that they are fully without error. SAP cannot assume any responsibility for the correctness or completeness of the following documentation; the user alone is responsible for verifying the information contained therein.

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Definition

This manual describes simple application cases for SAP Partner Connectivity Kit (PCK) and all the configuration steps that are necessary to execute the application cases on the basis of SAP Partner Connectivity Kit 7.1.

This document is updated on a regular basis in SAP Developer Network (SDN) at <https://www.sdn.sap.com/irj/sdn/nw-soa> → *Service Bus-Based Integration* → *Getting Started*.

Intended Audience

This manual is intended to be used by both technology and application consultants.

Structure

The structure of this document follows the sequence of steps required to configure and run the use cases.

2 Introduction and Prerequisites

2.1 Introduction

Use cases are based on simple examples that enable you to learn the main features of SAP Partner Connectivity Kit. These instructions will enable you to understand, configure, and execute simple scenarios (that are based on fundamental communication patterns), as well as check that the scenarios are executed correctly. The prerequisite for this document is that you have a general understanding of SAP Partner Connectivity Kit and SAP NetWeaver Process Integration (for variant 2).

The following use case variants are available at present:

Variant	Description
Variant 1: One sender PCK and one receiver PCK – with mapping (see Section 3)	Represents the message exchange between a sender PCK and a receiver PCK that saves the message using the file receiver adapter. A mapping is executed when the message is sent to the second PCK system.
Variant 2 One sender PCK with another (or the same) PCK as receiver using SAP NetWeaver PI (see Section 4)	Represents message exchange between one sender PCK and one receiver PCK. The Integration Server of SAP NetWeaver Process Integration (SAP NetWeaver PI) is used to send the message to the second PCK where the message is saved using the receiver file adapter.

The PCK is usually always used to communicate with an Integration Server. Nevertheless, SAP provides one simple use cases without the Integration Server so that customers without an SAP NetWeaver PI installation in their landscape can also configure a first simple scenario to see just how the PCK works. In variant 1, two PCKs are used to exchange messages, the first PCK sends the message to the second PCK instead of an Integration Server. You can even use the same PCK as sender and receiver.



Be aware that this is not the intended behavior for productive usage where the PCK system always sends the message to an Integration Server.

You will learn about the following for use cases:

- Working with the PCK Configuration user interface: Configuring simple scenarios and understanding created configuration objects
- Working with the Integration Directory user interface: Configuring simple scenarios and understanding configuration objects created
- Working with runtime: Executing use cases and checking results using monitoring

SAP provides the required files for these learning targets. This document contains a complete set of instructions to enable you to configure and execute the use cases without any additional special prerequisites.



SAP Partner Connectivity Kit must be installed and configured and be error-free. In this respect, note the information under 2.2.1.

For variant 2 SAP NetWeaver PI must also be installed and configured.

File directories on the host of the SAP system on which the PCK is installed serve as the senders and receivers of messages. These use cases rely on file directories (and therefore the file/FTP adapter) to keep the technical prerequisites as simple as possible.

2.2 Prerequisites

2.2.1 General Prerequisites

To configure and execute the use cases, SAP Partner Connectivity Kit (sufficient for variant 1) and SAP NetWeaver PI (for variant 2) must be correctly installed and configured. The following table lists the prerequisites and the relevant guides:

List of required steps for variant 1

Step	Documentation
1. You have installed (one) or two SAP Partner Connectivity Kit 7.1. systems	<i>Master Guide – SAP NetWeaver</i> <i>Installation Guide – SAP Web AS Java</i>

List of additional steps required for variant 2

1. You have installed SAP NetWeaver PI 7.1.	<i>Master Guide – SAP NetWeaver</i> <i>Installation Guide – SAP Web AS ABAP and Java</i>
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<p>2. You have imported the content for the Enterprise Services Repository for the latest support package/patch.</p>	<p>Importing ESR Content</p>  <p>The demo examples are located in the Enterprise Services Repository in the software component <i>SAP BASIS</i>, software component version <i>SAP BASIS 7.10</i>, in the namespaces http://sap.com/xi/XI/Demo/Agency and http://sap.com/xi/XI/Demo/Airline.</p>
<p>3. You have configured SAP NetWeaver Process Integration 7.1.</p>	<p>Configuration of SAP NetWeaver Process Integration</p>
<p>4. You have configured the System Landscape Directory (SLD).</p>	<p>Configuring, Working with and Administering System Landscape Directory</p>



Ensure that you set up the use cases in your development or test system, but **not** in your productive system.

2.2.2 Providing the Necessary User

Users in the PCK System

To log on to the PCK system to configure the simple use cases, use the user PCKUSER created during installation. For monitoring, use the PCKMONITOR. For message exchange you have to use the user PCKRECEIVER.

The following PCK users are created during installation:

- **PCKUSER** (PCK Configuration User): Used for PCK configuration.
- **PCKRECEIVER** (PCK Communication User): Used for inbound http communication.
- **PCKMONITOR** (PCK Monitoring User): Used for message and adapter monitoring.
- **PCKADMIN** (PCK Administration User): Administrator user; has all permissions regarding PCK activity

Users in the System of Integration Server (Required for Variant 2)

To log on to the system of the Integration Server to configure the simple use cases, you first have to create a user *XIDEMO* with the following roles in the integration server client 001:

- **SAP_XI_ADMINISTRATOR**
- **SAP_XI_CONFIGURATOR**
- **SAP_XI_MONITOR**
- **SAP_XI_DEMOAPP**

2.2.3 Special Prerequisites for Configuring the Variants

The variants are based on a very simple system landscape that comprises various different file systems (on the host of the SAP system on which the PCKs are installed). When the use cases are executed, files are moved between file directories. Therefore, to be able to configure the use cases, the file directories must have been created. Only then can you

access the directories during configuration. To set up and describe the system landscape you must carry out the following steps.

Setting Up the File Directories on the First PCK (Sender)

Perform the steps below to create the required directories on the host of the SAP system on which the first PCK (sender) is installed.

1. Using Windows Explorer, open the file directory of the SAP system on which the first PCK (sender) is installed.
2. Create a directory in which you can save files temporarily and create a sub directory in it. Give the sub directory an appropriate name.



A work directory already exists on many computers that can be used for this purpose and under which you can create the required directories.

3. Create two further sub directories in the first sub directory. Suggested names `XiPattern1`, `XiPattern3`.



You must have authorization to access this directory to be able to test the PCK scenario. Bear this in mind when you define the directory, and contact your system administrator if necessary.

4. Copy the following file to directories `XiPattern1` and `XiPattern3`.
 - `ZXiPatternSenderFile1.xml`



This file is provided by SAP in a ZIP file. The ZIP file is located in SAP Developer Network (SDN) at <https://www.sdn.sap.com/irj/sdn/nw-soa> → **Service Bus**. On the page *Service Bus-Based Integration*, select *Getting Started*. On the page *Getting Started With Service Bus-Based Integration* select the hyperlink *SAP NetWeaver Process Integration – Test Files for Simple Use Cases*.

Setting Up the File Directories on the Second PCK (Receiver)

Perform the steps below to create the required directories on the host of the SAP system on which the second PCK (receiver) is installed. If necessary you can also use the sender PCK as receiver PCK, in this case create the directories on the host the sender and receiver PCK is installed.

1. Using Windows Explorer, open the file directory of the SAP system on which the second PCK (receiver) is installed.
2. Create a directory in which you can save files temporarily and create a sub directory in it. Give the sub directory an appropriate name.



A work directory already exists on many computers that can be used for this purpose and under which you can create the required directories.

3. Create two further sub directories in the first sub directory. Suggested names: `XiPattern2`, `XiPattern4`.



You must have authorization to access this directory to test the PCK scenario. Bear this in mind when you define the directory, and, if applicable, contact your system administrator.

Defining Business System Components in the PCK Configuration Tool

In the following steps you define communication components for the scenarios.

To prepare the configuration of the PCK scenarios, you must define the sender and receiver business systems involved as communication components (business system components) in the PCK Configuration Tool of both PCKs, the one sending the message and the one receiving the message. In case you use only one PCK as sender and receiver you have to create the communication components only once.

Only then can you address the business systems as senders or receivers of messages.

You define communication components in the PCK Configuration Tool in both PCKs.

Therefore, to execute the activities described below, call the PCK Configuration Tool on both PCKs one after the other.

1. To call the PCK Configuration Tool, call the PCK start page:

`http://pck-host:pck-port/pck/start`

2. On the initial screen, choose the hyperlink PCK (under *Configuration*).
3. Log on using the PCKUSER.

The system opens the configuration interface of the SAP Partner Connectivity Kit.

You use the steps below to define a communication component (business system component) in the PCK Configuration Tool for each business system.

1. In the PCK Configuration navigation area, on the *Objects* tab page, position the cursor on the *Communication Components Without Party* node.
2. In the menu choose *Object* → *New*.
3. Select *Business Component*.
4. As *Communication Component* set `PCK_<Sender_SID>_FileSystem_XiPattern1` and press *Create*.

<Sender_SID> is to be replaced with the SID of the sending PCK system.

The business system components are not assigned to a party.

5. Save the business component.
6. Create the following business components using the same procedure:

- `PCK_<Receiver_SID>_FileSystem_XiPattern2`
- `PCK_<Sender_SID>_FileSystem_XiPattern3`
- `PCK_<Receiver_SID>_FileSystem_XiPattern4`

<Sender_SID> is to be replaced with the SID of the sending PCK system.

<Receiver_SID> is to be replaced with the SID of the PCK system receiving the messages.

The system displays the communication components in the navigation area, on the *Objects* tab page, under *Communication Components Without Party*.

Defining the Message Mapping and Importing the Mapping Archive

The variant 1 uses a message mapping to map the source to the target structure in the PCK system. To create the mapping, execute the following steps.

This mapping is provided as an archive in SDN.



This file is provided by SAP in a ZIP file. The ZIP file is located in SAP Developer Network (SDN) at <https://www.sdn.sap.com/irj/sdn/nw-soa> → **Service Bus**. On the page *Service Bus-Based Integration* select *Getting Started*. On the page *Getting Started With Service Bus-Based Integration* select the hyperlink *SAP NetWeaver Process Integration – Mapping Archive for PCK Simple Use Cases*.

You use the steps below to define the mapping and import the archive into the PCK Configuration Tool of the first PCK (sender).

1. Download the archive from the location described above and save it to your local PC from where you start the Configuration Tool. Unpack the .xim archive.
2. Call the PCK Configuration Tool for the sender PCK as described above.
3. In the PCK Configuration navigation area, on the *Objects* tab page, position the cursor on the *Mapping Objects* node.
4. In the menu choose *Object* → *New*.
5. Select *Message Mapping*.
6. As *Message Mapping Name* set *XiPatternMessage1ToMessage2* and press *Create*.
7. In the menu choose *Message Mapping* → *Import*.
8. Select the unpacked .xim archive (*XiPatternMessage1ToMessage2.xim*) and click *Open*.
9. Save the message mapping.

3 Variant 1: One Sender and One Receiver PCK – with Mapping

This variant enables you to configure and execute the simplest kind of message exchange: one sender PCK (file directory *XiPattern1*) sends a message to one receiver PCK (file directory *XiPattern2*). A mapping is executed between the outbound and inbound interface in this variant.



Be aware that this is not the intended behavior for productive usage, here the PCK system always sends the message to an Integration Server.

3.1 Design Objects Used

Mapping Objects

A mapping between the sender and receiver data structures must therefore be executed for the message to be processed.

In the PCK configuration tool of the sender PCK, navigate to the mapping object created in chapter 2.2.3.

Double-click on the name of the message mapping (`XiPatternMessage1ToMessage2`) to open it. The names of the source and target structure are displayed.



You have the option to display which elements of the source and target structure mappings are to be executed. To do so, choose *Dependencies* → *Display All* ().

3.2 Configuring the PCK Scenario

You perform the following configuration steps in the PCK Configuration.



Note the prerequisite steps described in section 2.2.

3.2.1 Configuring the Objects in the First PCK (Sender)

Calling the PCK Configuration

First, call the PCK Configuration Tool as described in chapter 2.2.

Creating Communication Channel File Sender

1. In the PCK Configuration navigation area, on the *Objects* tab page, open the business component *PCK_<Sender_SID>_FileSystem_XiPattern1*, position the cursor on communication channel and choose *New* in the context menu.
2. As *Communication Channel Name* set `XiPatternChannel_FileSender` and press *Create*.
3. Select the Adapter Type *File*.
4. Choose *Sender* as direction.
5. Under *File Access Parameter* in the *Source Directory* field, enter the path in the file directory that you defined previously (see [2.2.3](#)). In the case of the sender communication channel, enter the whole path for the file directory *XiPattern1*.
Example: `C:/<selected path>/XiPattern1`
6. As *File Name* set `XiPatternSenderFile*.xml`
7. In tab *Processing* set the *Processing Mode* to *Delete*.
8. Save the communication channel.

Creating Communication Channel XI Receiver

1. In the PCK Configuration navigation area, on the *Objects* tab page, open the business component *PCK_<Receiver_SID>_FileSystem_XiPattern2*, position the cursor on communication Channel and choose *New* in the context menu.
2. Set `XiPatternChannel_XIReceiver` as *Communication Channel Name* and press *Create*.
3. Select the Adapter Type *XI*.
4. Choose *Receiver* as direction.
5. As *URL* enter the URL to the second PCK.
`http://host:port/MessagingSystem/receive/AFW/XI`

6. As *User Name* and *Password* enter the User with its password used for message exchange: PCKRECEIVER.
7. As *Language* enter EN,
8. As *Client* set 000. Here normally the client of the sap system of the Integration Server has to set, but as in this variant the message is sent to another PCK any value can be set.
9. Save the communication channel.

Creating Sender Agreement

1. In the PCK Configuration in the menu choose *Object* → *New*.
2. Select *Sender Agreement*
3. As *Communication Component* select PCK_<Sender_SID>_FileSystem_XiPattern1 , as interface set XiPatternInterface1, as namespace set <http://sap.com/xi/XI/System/Patterns>.
4. Select *Sender uses Virtual Receiver*
5. As *Receiver Communication Component* select PCK_<Receiver_SID>_FileSystem_XiPattern2. Press *Create*.
6. Select the communication channel XiPatternChannel_FileSender.
7. Save the sender agreement.

Creating Receiver Agreement

1. In the PCK Configuration, choose *Object* → *New* from the menu.
2. Select *Receiver Agreement*
3. Under *Sender Communication Component* select PCK_<Sender_SID>_FileSystem_XiPattern1 , as *Receiver Communication Component* select PCK_<Receiver_SID>_FileSystem_XiPattern2, set XiPatternInterface1 as interface, set <http://sap.com/xi/XI/System/Patterns> as namespace. Choose *Create*.
4. Select the Receiver communication channel XiPatternChannel_XIReceiver.
5. Set the flag to activate the *Mapping*.
6. Select the mapping XiPatternMessage1ToMessage2 using the F4 Help.
7. As Receiver Interface set [XiPatternInterface2](http://sap.com/xi/XI/System/Patterns), as namespace set <http://sap.com/xi/XI/System/Patterns>.
8. Save the receiver agreement.

Summary of the Configuration Objects Used in the Sender PCK

The configuration objects used are summarized in the following table.

Configuration Objects Used

Object Type (Name)	Description
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<p>Communication Component (<i>PCK_<Sender_SID>_FileSystem_XiPattern1</i> for sender and <i>PCK_<Receiver_SID>_FileSystem_XiPattern2</i> for receiver)</p>	<p>Identifies a communication component in the PCK configuration tool that is to be addressed as the sender or receiver of messages.</p>
<p>Sender Communication Channel (<i>XiPatternChannel_FileSender</i>)</p>	<p>Contains the details for configuring a sender adapter that is used to process the message on the inbound side.</p> <p>In a real installation, the sender file/FTP adapter is used to write a file from a source directory to the pipeline.</p>
<p>Receiver Communication Channel (<i>XiPatternChannel_XIReceiver</i>)</p>	<p>Contains the details for configuring a receiver adapter that is used to process the message on the outbound side.</p> <p>The receiver XI adapter sends the file to another PCK or to the system of the Integration Server.</p>
<p>Sender Agreement (<i>PCK_<Sender_SID>_FileSystem_XiPattern1</i> <i>XiPatternInterface1</i>)</p>	<p>Specifies the sender communication channel <i>XiPatternChannel_FileSender</i> to be used for the sender and the outbound interface.</p>
<p>Receiver Agreement (<i>PCK_<Sender_SID>_FileSystem_XiPattern1</i> <i>PCK_<Receiver_SID>_FileSystem_XiPattern2</i> <i>XiPatternInterface1</i>)</p>	<p>Specifies the receiver communication channel <i>XiPatternChannel_XIReceiver</i> to be used for the sender, the receiver, and the inbound interface. The mapping <i>XiPatternMessage1ToMessage2</i> is added here.</p>

3.2.2 Configuring the Objects in the Second PCK (Receiver)

Call the PCK Configuration Tool as described in chapter 2.2 on the PCK that is used as the receiver of the message. If you use only one PCK as sender and receiver then you have to create these objects in the one PCK used as sender and receiver.

Calling the PCK Configuration

First, call the PCK Configuration Tool on the second PCK as described in chapter 2.2.

Creating Communication Channel XI Sender

1. In the PCK Configuration navigation area, on the *Objects* tab page, open the business component *PCK_<Sender_SID>_FileSystem_XiPattern1*, position the cursor on communication channel and choose *New* in the context menu.
2. Set *XiPatternChannel_XISender* as *Communication Channel Name* and press *Create*.
3. Select the Adapter Type *XI*.
4. Choose *Sender* as direction.
5. Save the communication channel.

Creating Communication Channel File Receiver

1. In the PCK Configuration navigation area, on the *Objects* tab page, open the business component *PCK_<Receiver_SID>_FileSystem_XiPattern2*, position the cursor on communication channel and choose *New* in the context menu.
2. As *Communication Channel Name* set *XiPatternChannel_FileReceiver* and press *Create*.
3. Select the Adapter Type *File*.
4. Choose *Receiver* as direction.
5. Under *File Access Parameter* in the *Target Directory* field, enter the path in the file directory that you defined previously (see [2.2.3](#)). In the case of the receiver communication channel, enter the whole path for the file directory *XiPattern2*.
Example: *C:/<selected path>/XiPattern2*
6. As File Name set *XiPatternReceiverFile.xml*
7. Save the communication channel.

Creating Sender Agreement

1. In the PCK Configuration choose *Object* → *New* in the menu.
2. Select *Sender Agreement*
3. As *Sender Communication Component* select *PCK_<Sender_SID>_FileSystem_XiPattern1*, as interface set *XiPatternInterface2*, as namespace set *http://sap.com/xi/XI/System/Patterns*.
4. Select *Sender uses Virtual Receiver*
5. As *Receiver Communication Component* select *PCK_<Receiver_SID>_FileSystem_XiPattern2*. Press *Create*.
6. Select the Sender communication channel *XiPatternChannel_XISender*.
7. Save the sender agreement.

Creating Receiver Agreement

1. In the PCK Configuration in the menu choose *Object* → *New*.
2. Select *Receiver Agreement*
3. As *Sender Communication Component* select *PCK_<Sender_SID>_FileSystem_XiPattern1*, as *Receiver Communication Component* select *PCK_<Receiver_SID>_FileSystem_XiPattern2*, as interface set *XiPatternInterface2*, as namespace set *http://sap.com/xi/XI/System/Patterns*. Choose *Create*.
4. Select the receiver communication Channel *XiPatternChannel_FileReceiver*.
5. Save the receiver agreement.

Summary of the Configuration Objects Used in the Receiver PCK

The configuration objects used are summarized in the following table. If only one PCK is used, all objects for the sender and the receiver are available in this PCK.

Configuration Objects Used

Object Type (Name)	Description
--------------------	-------------

Communication Component (<i>PCK_<Sender_SID>_FileSystem_XiPattern1</i> for sender and <i>PCK_<Receiver_SID>_FileSystem_XiPattern2</i> for receiver)	Identifies a communication component in the PCK configuration tool that is to be addressed as the sender or receiver of messages.
Sender Communication Channel (<i>XiPatternChannel_XISender</i>)	Contains the details for configuring the sender adapter that is used to process the message on the inbound side. The XI adapter gets the message from the sending PCK and puts it into the PCK pipeline for processing.
Receiver Communication Channel (<i>XiPatternChannel_FileReceiver</i>)	Contains the details for configuring a receiver adapter that is used to process the message on the outbound side. The receiver File adapter saves the file to the file system.
Sender Agreement (<i>! PCK_<Sender_SID>_FileSystem_XiPattern1 XiPatternInterface2</i>)	Specifies the sender communication channel <i>XiPatternChannel_XISender</i> to be used for the sender and the outbound interface.
Receiver Agreement (<i>! PCK_<Sender_SID>_FileSystem_XiPattern1 PCK_<Receiver_SID>_FileSystem_XiPattern2 XiPatternInterface2</i>)	Specifies the receiver communication channel <i>XiPatternChannel_FileReceiver</i> to be used for the sender, the receiver, and the inbound interface.

3.3 Execution

You perform the following steps to check that the PCK scenario is executed without errors:

1. On the host of the sender PCK, open the file directory *XiPattern1*.
2. Rename the file **ZXiPatternSenderFile1.xml** as follows: *XiPatternSenderFile1.xml*.

The file/FTP adapter is designed so that a file with exactly this name is recognized and moved from the source directory *XiPattern1* to the target directory *XiPattern2* every 60 seconds. If the configuration was executed without errors, the file will be moved from the source directory 60 seconds after it is renamed.
3. On the host of the receiver PCK (or on the host of the one PCK used as sender and receiver) open the directory *XiPattern2* and check that the file has arrived.

Open the file and check whether the content has changed (compare with the original file *ZXiPatternSenderFile1.xml*). The structure will have changed: the first and second names of the person have been concatenated; the field for the telephone number has a new name.

Furthermore, you can check the processing of the message in monitoring in both PCKs. To do this, proceed as follows:

1. Start the PCK start page (<http://pck-host:pck-port/pck/start>).
2. On the initial screen, choose the hyperlink *Message Monitor* (under Monitoring).
3. Log on using the user PCKMONITOR.
4. Use appropriate filter criteria to restrict the number of XML messages displayed (for example, the processing period).

5. Choose *Start*.

The system displays the selected messages in a table. You want to locate the messages that were sent during execution.

6. Select the message to be displayed by selecting the appropriate radio button and then choose *Details*.

The tab page *Message Contents* displays the message contents including all message versions for the various phases of message processing.

4 Variant 2: One Sender and One Receiver Roundtrip using SAP NetWeaver PI

This variant enables you to configure and execute a message exchange from the PCK using the file/FTP adapter as sender to another PCK via the Integration Server using SAP NetWeaver PI. The Integration Server is used to send the message to the second PCK: one sender (file directory *XiPattern3*) sends a message to the Integration Server, which routes the message to another PCK where the message is saved using the file/FTP receiver adapter (file directory *XiPattern4*).

4.1 Configuring the PCK Scenario

You perform the following configuration steps in the PCK Configuration.



Note the prerequisite steps described in section 2.2.

4.2 Configuring Objects in the First PCK (Sender)

This section contains the description of all configuration steps that have to be performed in the first PCK. That means, in a real-live scenario this would correspond to the activities that are done by an integration expert on the side of the business partner who has installed the first PCK.

Call the PCK Configuration Tool as described in chapter 2.2 on the PCK used as the sender of the message.

Creating Communication Channel File Sender

1. In the PCK Configuration navigation area, on the *Objects* tab page, open the Business Component *PCK_<Sender_SID>_FileSystem_XiPattern3*, position the cursor on communication channel and choose *New* in the context menu.
2. Set *XiPatternChannel_FileSenderRoundtrip* as *Communication Channel Name* and click *Create*.
3. Select the Adapter Type *File*.
4. Choose *Sender* as direction.
5. Under *File Access Parameter* in the *Source Directory* field, enter the path in the file directory that you defined previously (see [2.2.3](#)). In the case of the sender communication channel, enter the whole path for the file directory *XiPattern3*.
Example: `C:/<selected path>/XiPattern3`
6. As File Name set `XiPatternSenderFile*.xml`
7. In tab *Processing* set the *Processing Mode* to `Delete`.
8. Save the communication channel.

Creating Communication Channel XI Receiver

1. In the PCK Configuration navigation area, on the *Objects* tab page, open the business component *PCK_<Receiver_SID>_FileSystem_XiPattern4*, position the cursor on communication channel and choose *New* in the context menu.
2. As *Communication Channel Name* set *XiPatternChannel_XIReceiverRoundtrip* and press *Create*.
3. Select the Adapter Type *XI*.
4. Choose *Receiver* as direction.
5. As *URL* enter the URL to the system of the Integration Server.
<http://host:port/sap/xi/engine?type=entry>
6. As *User Name* and *Password* enter the User with its password used for message exchange: *PIAPPLUSER*.
7. As *Language* enter *EN*.
8. As *client* set the client of the system of the Integration Server.
9. Save the communication channel.

Creating Sender Agreement

1. In the PCK Configuration in the menu choose *Object* → *New*.
2. Select *Sender Agreement*
3. As *Communication Component* select *PCK_<Sender_SID>_FileSystem_XiPattern3*, set *XiPatternInterface1* as interface, set <http://sap.com/xi/XI/System/Patterns> as namespace.
4. Select *Sender Uses Virtual Receiver*
5. As *Receiver Communication Component* select *PCK_<Receiver_SID>_FileSystem_XiPattern4*
6. Press *Create*.
7. Select the communication channel *XiPatternChannel_FileSenderRoundtrip*.
8. Save the sender agreement.

Creating Receiver Agreement

1. In the PCK Configuration in the menu choose *Object* → *New*.
2. Select *Receiver Agreement*
3. As *Sender Communication Component* select *PCK_<Sender_SID>_FileSystem_XiPattern3*, as *Receiver Communication Component* select *PCK_<Receiver_SID>_FileSystem_XiPattern4*, as interface set *XiPatternInterface1*, as namespace set <http://sap.com/xi/XI/System/Patterns>. Press *Create*.
4. Select the receiver communication channel *XiPatternChannel_XIReceiverRoundtrip*.
5. Save the receiver agreement.

Summary of the Configuration Objects Used in the Sender PCK

The configuration objects used are summarized in the following table.

Configuration Objects Used

Object Type (Name)	Description
Communication Component (<i>PCK_<Sender_SID>_FileSystem_XiPattern3</i> for sender and <i>PCK_<Receiver_SID>_FileSystem_XiPattern4</i> for receiver)	Identifies a communication component in the PCK configuration tool that is to be addressed as the sender or receiver of messages.
Sender Communication Channel (<i>XiPatternChannel_FileSenderRoundtrip</i>)	Contains the details for configuring a sender adapter that is used to process the message on the inbound side. In a real installation, the sender file/FTP adapter is used to write a file from a source directory to the pipeline.
Receiver Communication Channel (<i>XiPatternChannel_XIReceiverRoundtrip</i>)	Contains the details for configuring a receiver adapter that is used to process the message on the outbound side. The receiver XI adapter sends the file to the system of the Integration Server.
Sender Agreement (<i>PCK_<Sender_SID>_FileSystem_XiPattern3</i> <i>XiPatternInterface1</i>)	Specifies the sender communication channel <i>XiPatternChannel_FileSenderRoundtrip</i> to be used for the sender and the outbound interface.
Receiver Agreement (<i>PCK_<Sender_SID>_FileSystem_XiPattern3</i> <i>PCK_<Receiver_SID>_FileSystem_XiPattern4</i> <i>XiPatternInterface1</i>)	Specifies the receiver communication channel <i>XiPatternChannel_XIReceiverRoundtrip</i> to be used for the sender, the receiver, and the inbound interface.

4.3 Configuring Objects in the System of the Integration Server

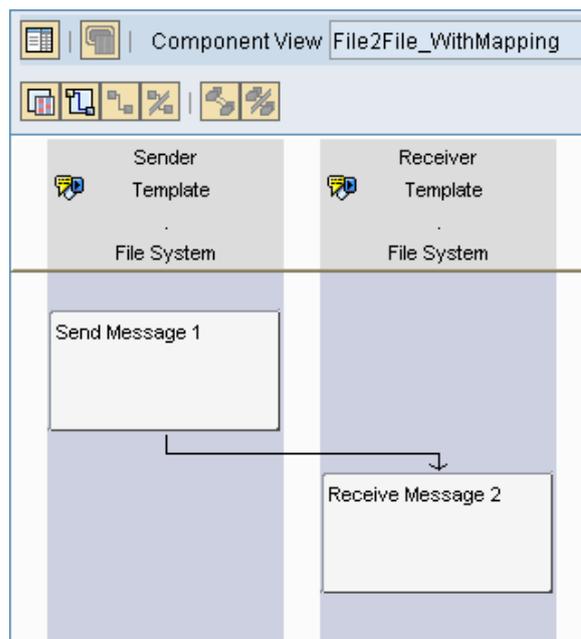
In the system of the Integration Server, the technical and business systems have to be created and the configuration objects in the Integration Directory have to be generated or created.

4.3.1 Design Objects Used



This section explains all the design objects that are used for describing this variant in that part of the system landscape where SAP NetWeaver PI is installed. There is a step-by-step description of how to access each object. SAP recommends that you follow these steps directly in the system.

Use the component view *File2File_WithMapping* in process integration scenario *XiPatternOneStepScenario* to configure this variant. The following graphic shows the component view:



The following sets out in turn all the objects that describe the message exchange in this variant. Starting with the process integration scenario (component view), you can open all the objects that the component view uses.

1. To call the Enterprise Services Builder (user interface of the Enterprise Services Repository), choose *Process Integration* → *Start Integration Builder* in the user menu.
2. On the *Process Integration* initial screen, choose *Enterprise Services Builder* under (*Enterprise Services Repository*).
3. In the navigation area, open the software component *SAP BASIS*, software component version *SAP BASIS 7.10*, and namespace *http://sap.com/xi/XI/System/Patterns*.
4. Open the node *Process Integration Scenarios*.
5. Open process integration scenario *XiPatternOneStepScenario* with a double-click.

The process integration scenario editor is opened.

Process Integration Scenario/Component View

A process integration scenario describes the process flow and represents the points in the process flow at which messages are exchanged between application components (in this case, the application components *Sender* and *Receiver*).

Ensure that component view *File2File_WithMapping* is displayed in the graphical editor. If it is not displayed, choose the component view in the preview area on the left by double-clicking. The component view comprises two actions *Send Message 1* and *Receive Message 2*, which are linked by an asynchronous communication step (angled arrow).

Interface Objects

Interface objects describe the communication mode and data structure for exchanging messages. Interface objects comprise service interfaces, message types, and data types, which you can open by means of forward navigation, starting in the component view.

1. To open the interface objects used, double-click the connecting arrow in the component view.

The connection editor is displayed.

The service interfaces for the sender and receiver are displayed on the *Assign Interfaces* tab page: in the case of the sender, it is the outbound interface *XiPatternInterface1* and in

the case of the receiver, it is the inbound interface *XiPatternInterface2*. Since the interface is different for the sender and receiver, the mapping *XiPatternInterface1ToInterface2* is used to map the interfaces.

2. To open the service interface *XiPatternInterface1*, double-click the interface name.
3. In the *Service Interface* editor you can see that it is an abstract interface.

The interface is *abstract* because the interface description is not implemented in the relevant software component.

4. To open the message type, double-click the name of the message type *XiPatternMessage1* (in the service interface editor under *Messages*).

In the *Message Type* editor, you can display the data structure of the message. The data structure is defined by the data type *XiPatternDataType1*.

Information about a person is structured by different elements in the data structure of the exchanged message. Details such as the maximum character length are displayed in the *Details* column.

5. Close all objects and the process integration scenario.

Summary of Design Objects Used

The design objects used are summarized once more in the following table.



For a general description of the various object types, see [Enterprise Services Repository](#).

Design Objects Used

Object Type (Name)	Description
Process Integration Scenario (<i>XiPatternOneStepScenario</i>)	Describes the process flow and indicates the points at which messages are exchanged between the different components. The component view <i>File2File_NoMapping</i> in particular describes all variants in which no mapping is executed (interfaces at the sender and receiver are identical).
Service Interfaces (<i>XiPatternInterface1</i> and <i>XiPatternInterface2</i>)	Specifies the communication mode (asynchronous) and references the message type used.
Message Types (<i>XiPatternMessage1</i> and <i>XiPatternMessage2</i>)	Describes the message sent at runtime and references the data type used.
Data Types (<i>XiPatternDataType1</i> and <i>XiPatternDataType2</i>)	Describes the data structure of the message
Operation mapping (<i>XiPatternInterface1ToInterface2</i>)	Describes the mapping between the source and target interface
Message Mapping (<i>XiPatternMessage1ToMessage2</i>)	Describes the mapping between the source and target structure in detail

4.3.2 Configuring the Process Integration Scenario

Creating Technical and Business Systems in the System Landscape Directory

Perform the following steps to create the technical and business systems required in the System Landscape Directory (SLD):

1. To call the System Landscape Directory, choose *Process Integration* → *Start Integration Builder* in the user menu.
2. Start the SLD. To do so, choose *System Landscape Directory* on the Process Integration start page.
3. Log on using the XIDEMO user you created in 2.2.2.
4. On the initial screen of the SLD, choose *Technical Systems*.
5. Create a new technical system. To do so, choose *New Technical System*.
6. Select the type *Standalone* by choosing the appropriate radio button.
7. Choose *Next*.
8. On the *Technical System Wizard - System Details* screen, enter the following information about the technical system:
 - *Technical System Identification*: Enter a name according to the following naming convention: PCK_<Sender_SID>_FileSystem. In this case, <Sender_SID> is the system ID of the PCK system that sends the message.
 - *System Host Name*: Enter the host name of the sending PCK system, for example pdf2638.
9. Choose *Finish*.
10. Create another technical system for the receiver. To do so, choose *New Technical System*.



In case you use only one PCK as sender and receiver you can skip the step creating the second technical system as the technical system is the same for the sending and the receiving PCK.

11. Select the type *Standalone* by choosing the appropriate radio button.
12. Choose *Next*.
13. On the *Technical System Wizard - System Details* screen, enter the following information about the technical system:
 - *Technical System Identification*: Enter a name according to the following naming convention: PCK_<Receiver_SID>_FileSystem. In this case, <Receiver_SID> is the system ID of the receiving PCK system.
 - *System Host Name*: Enter the host name of the Receiving PCK system, for example pdf2638.

14. Choose *Finish*.

Now create two business systems.

1. To create the first business system, on the SLD start page, choose *Business Systems*.
2. Choose *New Business System*.
3. Select the type *Standalone*.
4. Choose *Next*.

5. Select the technical system of the sending PCK that you defined previously (dropdown list box in field *System*).
6. Choose *Next*.
7. Enter the name PCK_<Sender_SID>_FileSystem_XiPattern3.
8. Choose *Next*.
9. Specify the assigned Integration Server to be used for process integration (field *Related Integration Server*).
10. Choose *Finish*.
11. Following the same procedure, create another business system for the receiving PCK with the following name:

PCK_<Receiver_SID>_FileSystem_XiPattern4



In case you use only one PCK as sender and receiver you have to create this business system for the technical system of the single PCK.

Defining Business System Components in the Integration Directory

By performing the following steps you define communication components for the business systems you just created. You need to create communication components to be able to address the business systems as senders/receivers of messages when you configure the process integration scenario in the Integration Directory.

To prepare the configuration of the process integration scenario, you must do the following:

- Define the involved business systems as communication components (business system components) in the Integration Directory
Only then can you address the business systems as senders or receivers of messages.
- Define a communication channel for outbound message processing.

You define communication components in the Integration Directory.

Therefore, to execute the activities described below, call the Integration Builder (user interface of Integration Directory).

1. To call the Integration Builder, choose *Process Integration* → *Start Integration Builder* in the user menu.
2. On the initial screen, choose the hyperlink *Integration Builder* (under *Integration Directory*).
3. Log on using the XIDEMO user you created in 2.2.2.

The system opens the Integration Builder.

You use the steps below to define a communication component (business system component) in the Integration Directory for each business system.

1. Clear the SLD cache. To do this, select *Environment* → *Clear SLD Data Cache* in the menu of the Integration Builder.
2. In the Integration Builder navigation area, on the *Objects* tab page, position the cursor on the *Communication Components Without Party* node.
3. To call the wizard for assigning business systems, choose *Assign Business System* in the context menu.
4. Choose *Continue*.

5. On the next screen, choose *Continue*.

The business system components are not assigned to a party.

6. On the next screen, select the following business systems by using the corresponding checkboxes:

- PCK_<Sender_SID>_FileSystem_XiPattern3
- PCK_<Receiver_SID>_FileSystem_XiPattern4

7. Make sure that the *Create Communication Channels Automatically* checkbox is **deselected**.

8. Choose *Finish*.

The system displays the communication components in the Integration Builder navigation area, on the *Objects* tab page, under *Communication Components Without Party*.

To create the communication channel to send the message to the second PCK execute the following steps.

1. In the Integration Builder navigation area, on the *Objects* tab page, position the cursor on the *Communication Channel* node.
2. In the context menu choose *New*.
3. As Communication Component select PCK_<Receiver_SID>_FileSystem_XiPattern4.
4. As communication channel set *XiPatternChannel_PCKReceiver*.
5. As description set *Channel to Receiver PCK*.
6. Choose *Create*.
7. Select the Adapter Type *XI*.
8. Choose *Receiver* as direction.
9. Enter the *host name* of the receiver PCK as *Target Host* and *Service Number*.
10. Enter the path */MessagingSystem/receive/AFW/XI* as *Path Prefix*
11. As *Authentication Type* use *Logon Data to Non-SAP System*. As *User Name* and *Password* enter the User with its password in the receiver PCK used for message exchange: PCKRECEIVER.
12. As *Language* enter *EN*,
13. Save the communication channel.

Perform the following steps to activate the communication components and the channel.

1. In the navigation area, choose the *Change Lists* tab page.
2. Choose *Open* → *Standard Change List*.
3. Check that the two communication components you just created are contained in the change list.
4. Position the cursor on the *Standard Change List* node and choose *Activate* () in the context menu.

Defining Configuration Objects in Integration Directory

You use the model configurator for the whole configuration procedure. This tool enables you to use a process integration scenario from the Enterprise Services Repository as a

configuration template and to add further information (which is not known until configuration time).

Call the Integration Directory as described above.

Selecting the Process Integration Scenario

Perform the following steps to select the process integration scenario that you want to configure from the Enterprise Services Repository. Also, enter the name of the *configuration scenario* (in the Integration Directory) in which you want to group the configuration objects.

1. To call the model configurator, choose *Tools* → *Transfer Model from Enterprise Services Repository* in the Integration Builder menu bar.

This calls a wizard that you then use to select a model (in this case, a process integration scenario) and create a configuration scenario in the Integration Directory.

2. Make sure that the model type *Process Integration Scenario* is selected (checkbox under *Type of ES Repository Model*).

3. Choose the input help (for the *Name* field) () and select *Process Integration Scenario* in the dropdown list box.

This calls an input help, which displays all process integration scenarios from the Enterprise Services Repository in a list.

4. Select the process integration scenario *XiPatternOneStepScenario* (software component version *SAP BASIS 7.10*, namespace <http://sap.com/xi/XI/System/Patterns>) from the Enterprise Services Repository and choose *Apply*.

5. Choose *Continue*.

6. Enter the name of the configuration scenario as: `XiPatternOneStepScenarioPCK`.

7. Choose *Finish* and then *Close*.

The system calls the model configurator.

Selecting the Component View

Check whether the component view *File2File_WithMapping* is displayed. If not, choose the menu option *Select Component View* () . On the subsequent screen, select the component view (in the preview area) with a double-click.

Assigning Communication Components

You perform the following steps to assign communication components to the application components of the process integration scenario. You use the business system components that you created before (see 2.2.2).

1. In the graphical editor, click on the *Sender* application component.

This calls the *Assign Business System Component* dialog box for the *Sender* application component (below the graphical representation of the process integration scenario).

2. To assign a communication component, on the *Business System Components for A2A* tab page, click in the input field in the *Communication Component* column and call the input help () .

3. In the subsequent screen, select the communication component *PCK_<Sender_SID>_FileSystem_XiPattern3* and then choose *Apply*.

4. Choose *Next Role* () to navigate to the configuration dialog for the application component *Receiver*.

5. Assign the communication component *PCK_<Receiver_SID>_FileSystem_XiPattern4* to the application component *Receiver*. Follow the same procedure as when assigning the communication component to the application component *Sender*.
6. Choose *Assign*.

Configuring the Connection

You perform the following steps to configure the connection of the process integration scenario. You activate the relevant sender-receiver relation (between the sender and receiver component) and assign a (sender or receiver) communication channel to both the sender and receiver. You create the communication channel on the basis of the communication channel templates that the process integration scenario already contains.

1. In the graphical editor, click on the connection between the lanes representing the two application components.
2. This calls the *Configure Connection* dialog box for the connection between the actions (below the graphical representation of the process integration scenario).
3. On the *Configure Connections* screen, choose the tab page *Connections from Component Assignment*. The communication components that you assigned in the previous configuration step are displayed.



The remaining tab pages contain further information about the process integration scenario, for example, the communication channel templates that are defined for the process integration scenario in the Enterprise Services Repository.

4. Assign the receiver a communication channel. To do so, select the channel *XiPatternChannel_PCKReceiver* in the input help.

Generating Configuration Objects

With the following steps, you generate the relevant configuration objects based on the settings made in previous steps.

1. Choose the push button *Create Configuration Objects* (.
2. Under *General*, select the radio button *Generation*.
3. Choose *Start*.
The configuration objects are generated based on the settings you made. Once generation is complete, the generation log is opened. The generation log displays the results of generation. The generation log enables you to analyze any errors that occurred during generation.
4. Close the generation log.
5. Close the model configurator. Choose *Apply*.
6. Save the configuration scenario.

Activating the Change List

1. To do this, select the *Change Lists* tab page in the Integration Directory navigation area.
2. Choose *Open* → *Standard Change List*.
3. Position the cursor on the *Standard Change List* node and choose *Activate* () in the context menu.

Summary of the Configuration Objects Used

The generated configuration objects used are summarized once more in the following table.



SAP recommends that you look at the configuration objects directly in the system and that you understand the configuration settings resulting from these objects.

Configuration Objects Used

Object Type (Name)	Description
Configuration Scenario (<i>XiPatternOneStepScenarioPCK</i>)	Groups all configuration objects that are relevant for the execution of the process integration scenario.  This documentation recommends that you group the configuration objects for all variants of the process integration scenario in the same configuration scenario.
Business System Component (<i>PCK_<Sender_SID>_FileSystem_XiPattern3</i> for sender and <i>PCK_<Receiver_SID>_FileSystem_XiPattern4</i> for receiver)	Identifies a business system in the Integration Directory that is to be addressed as the sender or receiver of messages.
Receiver Communication Channel (<i>XiPatternChannel_PCKReceiver</i>)	Contains the details for configuring a receiver adapter that is used to process the message on the outbound side. The receiver XI adapter sends the message to the receiver PCK.
Receiver Determination (<i>! PCK_<Sender_SID>_FileSystem_XiPattern3 XiPatternInterface1</i>)	Specifies the receiver of the message for the sender and the outbound interface <i>XiPatternInterface1</i> . The receiver <i>PCK_<Receiver_SID>_FileSystem_XiPattern4</i> must be entered in the receiver determination as a configured receiver.
Interface Determination (<i>! PCK_<Sender_SID>_FileSystem_XiPattern3 XiPatternInterface1 PCK_<Receiver_SID>_FileSystem_XiPattern4</i>)	Specifies the receiver interface <i>XiPatternInterface2</i> for the sender, sender interface, and the receiver. The mapping <i>XiPatternInterface1ToInterface2</i> is specified.
Receiver Agreement (<i>! PCK_<Sender_SID>_FileSystem_XiPattern3 PCK_<Receiver_SID>_FileSystem_XiPattern4 XiPatternInterface2</i>)	Specifies the receiver communication channel <i>XiPatternChannel_PCKReceiver</i> to be used for the sender, the receiver, and the inbound interface.

4.4 Configuring Objects in the Second PCK (Receiver)

Call the PCK Configuration Tool as described in chapter 2.2 on the PCK that is used as the receiver of the message. In case you use only one PCK as sender and receiver you have to create the objects in the one PCK used as sender and receiver.

Creating Communication Channel XI Sender

1. In the PCK Configuration navigation area, on the *Objects* tab page, open the Business Component *PCK_<Sender_SID>_FileSystem_XiPattern3*, position the cursor on Communication Channel and choose *New* in the context menu.
2. As *Communication Channel Name* set *XiPatternChannel_XISenderRoundtrip* and press *Create*.
3. Select the Adapter Type *XI*.
4. Choose *Sender* as direction.
5. Save the communication channel.

Creating Communication Channel File Receiver

1. In the PCK Configuration navigation area, on the *Objects* tab page, open the business component *PCK_<Receiver_SID>_FileSystem_XiPattern4*, position the cursor on communication channel and choose *New* in the context menu.
2. As *Communication Channel Name* set *XiPatternChannel_FileReceiverRoundtrip* and press *Create*.
3. Select Adapter Type *File*.
4. Choose *Receiver* as direction.
5. Under *File Access Parameter* in the *Target Directory* field, enter the path in the file directory that you defined previously (see [2.2.3](#)). In the case of the receiver communication channel, enter the whole path for the file directory *XiPattern4*.
Example: `C:/<selected path>/XiPattern4`
6. As File Name set `XiPatternReceiverFile.xml`
7. Save the communication channel.

Creating Sender Agreement

1. In the PCK Configuration in the menu choose *Object* → *New*.
2. Select *Sender Agreement*
3. As *Communication Component* select *PCK_<Sender_SID>_FileSystem_XiPattern3*, as interface set *XiPatternInterface2*, as namespace set `http://sap.com/xi/XI/System/Patterns`.
8. Select *Sender uses Virtual Receiver*
4. As *Receiver Communication Component* select *PCK_<Receiver_SID>_FileSystem_XiPattern4*. Press *Create*.
5. Select the communication channel *XiPatternChannel_XISenderRoundtrip*.
6. Save the sender agreement.

Creating Receiver Agreement

1. In the PCK Configuration in the menu choose *Object* → *New*.

2. Select *Receiver Agreement*
3. As *Sender Communication Component* select
PCK_<Sender_SID>_FileSystem_XiPattern3, as *Receiver Communication Component* select *PCK_<Receiver_SID>_FileSystem_XiPattern4*, as interface set *XiPatternInterface2*, as namespace set <http://sap.com/xi/XI/System/Patterns>. Press *Create*.
4. Select the receiver communication channel
XiPatternChannel_FileReceiverRoundtrip.
5. Save the receiver agreement.

Summary of the Configuration Objects Used in the Receiver PCK

The configuration objects used are summarized in the following table. In case only one PCK is used all objects for the sender and the receiver are available in this PCK.

Configuration Objects Used

Object Type (Name)	Description
Communication Component (<i>PCK_<Sender_SID>_FileSystem_XiPattern3</i> for sender and <i>PCK_<Receiver_SID>_FileSystem_XiPattern4</i> for receiver)	Identifies a communication component in the PCK configuration tool that is to be addressed as the sender or receiver of messages.
Sender Communication Channel (<i>XiPatternChannel_XISenderRoundtrip</i>)	Contains the details for configuring a sender adapter that is used to process the message on the inbound side. The XI adapter processes the message coming from the Integration Server.
Receiver Communication Channel (<i>XiPatternChannel_FileReceiverRoundtrip</i>)	Contains the details for configuring a receiver adapter that is used to process the message on the outbound side. The receiver file/FTP adapter saves the message to the file system of the receiving PCK.
Sender Agreement (<i>PCK_<Sender_SID>_FileSystem_XiPattern3</i> <i>XiPatternInterface2</i>)	Specifies the sender communication channel <i>XiPatternChannel_XISenderRoundtrip</i> to be used for the sender and the outbound interface.
Receiver Agreement (<i>PCK_<Sender_SID>_FileSystem_XiPattern3</i> <i>PCK_<Receiver_SID>_FileSystem_XiPattern4</i> <i>XiPatternInterface2</i>)	Specifies the receiver communication channel <i>XiPatternChannel_FileReceiverRoundtrip</i> to be used for the sender, the receiver, and the inbound interface.

4.5 Execution

You perform the following steps to check that the PCK scenario is executed without errors.

1. On the host of the sender PCK, open the file directory *XiPattern3*.

2. Rename the file *ZXiPatternSenderFile1.xml* as follows: *XiPatternSenderFile1.xml*.
The file/FTP adapter is designed so that a file with exactly this name is recognized and moved from the source directory *XiPattern3* to the target directory *XiPattern4* on the receiver PCK every 60 seconds. If the configuration was executed without errors, the file will be moved from the source directory 60 seconds after it is renamed.
3. Open the directory *XiPattern4* on the receiver PCK (or the PCK used as sender and receiver) and check that the file has arrived.
4. Open the file and check whether the content has changed (compare with the original file *ZXiPatternSenderFile1.xml*).



The file must be altered when this variant is executed because a mapping is executed in the system of the Integration Server.

Furthermore, you can check the processing of the message in monitoring. To do this, proceed as follows:

1. Start the PCK Start page on both PCKs (<http://pck-host:pck-port/pck/start>).
2. On the initial screen, choose the hyperlink *Message Monitor* (under Monitoring).
3. Log on with the user PCKMONITOR.
4. Use appropriate filter criteria to restrict the number of XML messages displayed (for example, the processing period).
5. Choose *Start*.

The system displays the selected messages in a table. You want to locate the messages that were sent during execution.

6. Select the message to be displayed by selecting the appropriate radio button and then choose *Details*.

The tab page *Message Contents* displays the message contents including all message versions for the various phases of message processing.

You can also check the monitoring in the system of the Integration Server. To do this, proceed as follows:

1. Start the Runtime Workbench in the system of the Integration Server by choosing *Runtime Workbench* on the Process Integration start page.
2. Choose *Message Monitoring*.
3. Select *Integration Engine <SID>* as the component and then choose *Display*.
4. Use appropriate filter criteria to restrict the number of XML messages displayed (for example, the processing period).
5. Choose *Start*.

The system displays the selected messages in a table. You want to locate the messages that were sent during execution.

6. Select the message to be displayed by selecting the appropriate radio button and then choose *Details*.

The tab page *Message Contents* displays the message contents including all message versions for the various phases of message processing.