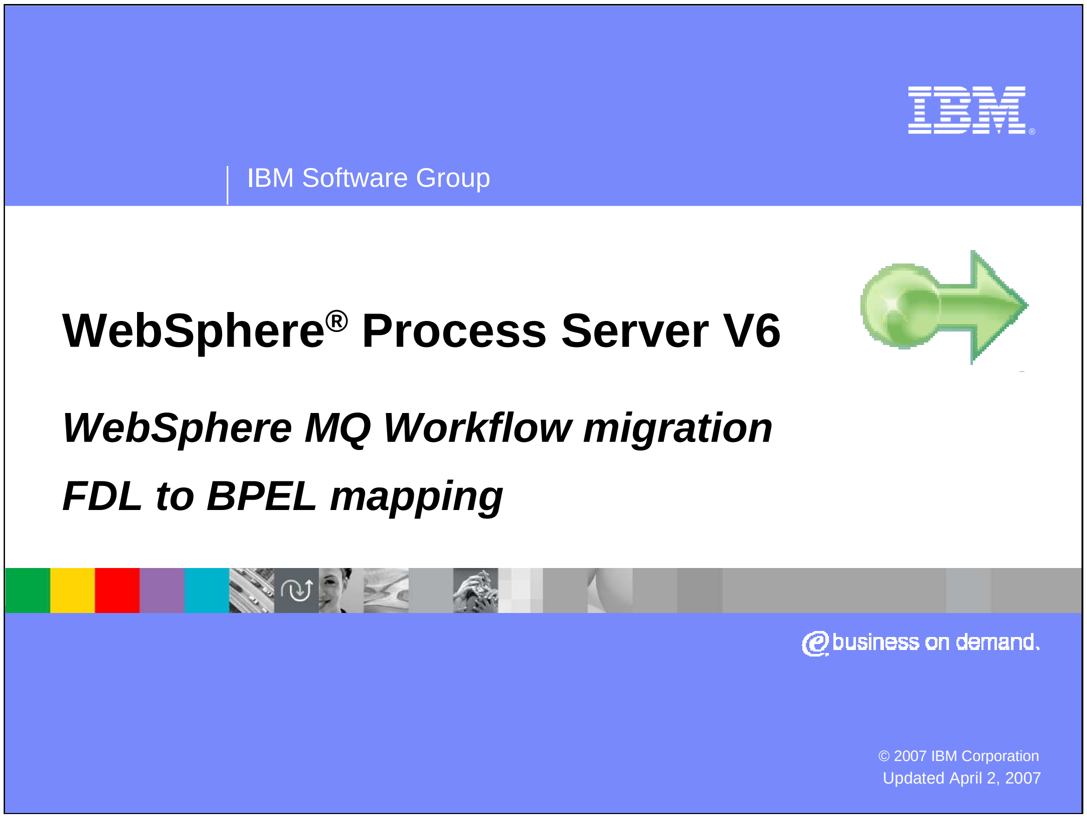

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WebSphere® Process Server V6

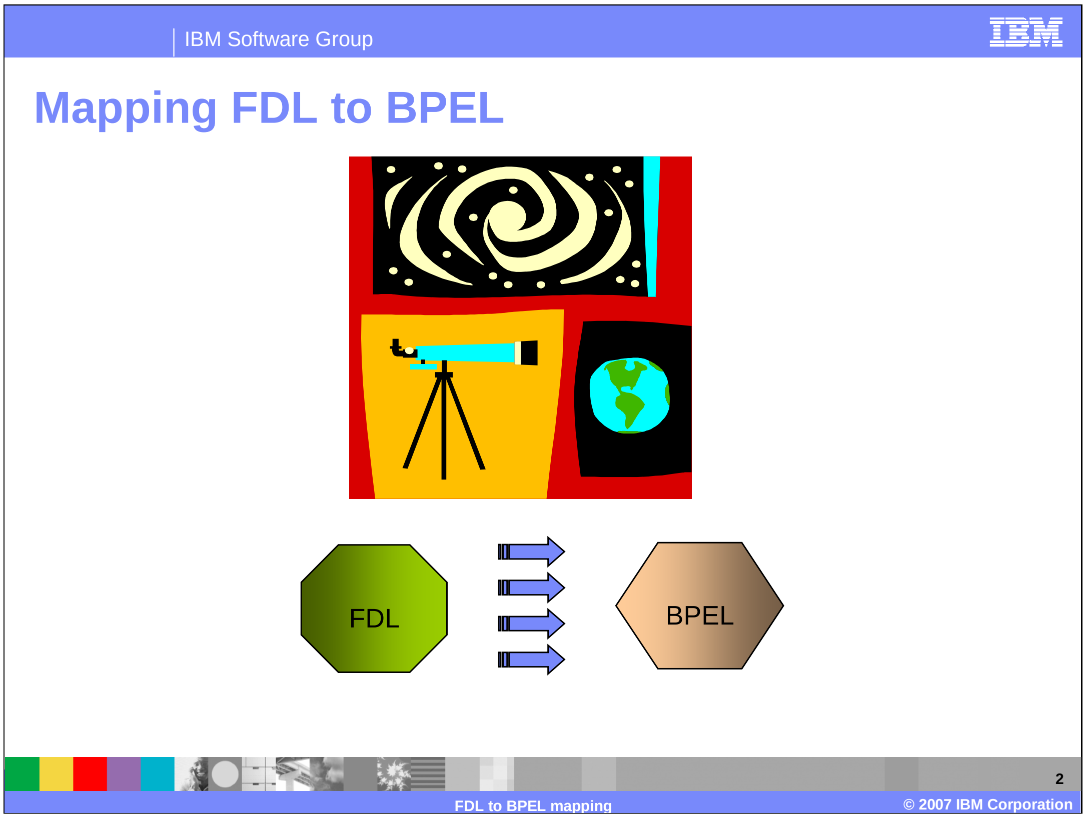
WebSphere MQ Workflow migration

FDL to BPEL mapping

business on demand.

Updated April 2, 2007

This presentation will cover the mapping of the Flow Definition Language, or FDL, to Business Process Execution Language or BPEL. This process is part of migrating to WebSphere Process Server V6.0 from WebSphere MQ Workflow.



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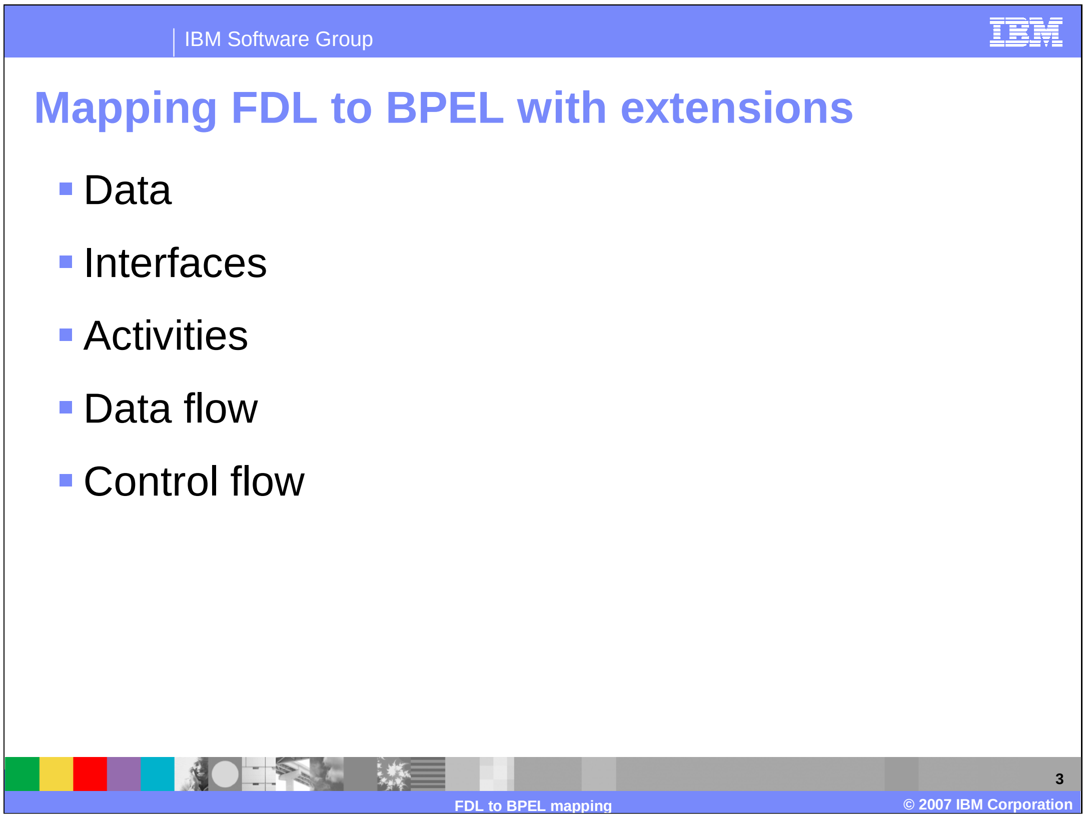
Mapping FDL to BPEL

2

FDL to BPEL mapping

This presentation will describe the mapping of FDL to BPEL for each of the FDL artifacts. It will also show the mapping between the WebSphere MQ Workflow and the business process choreographer graphical interfaces. .



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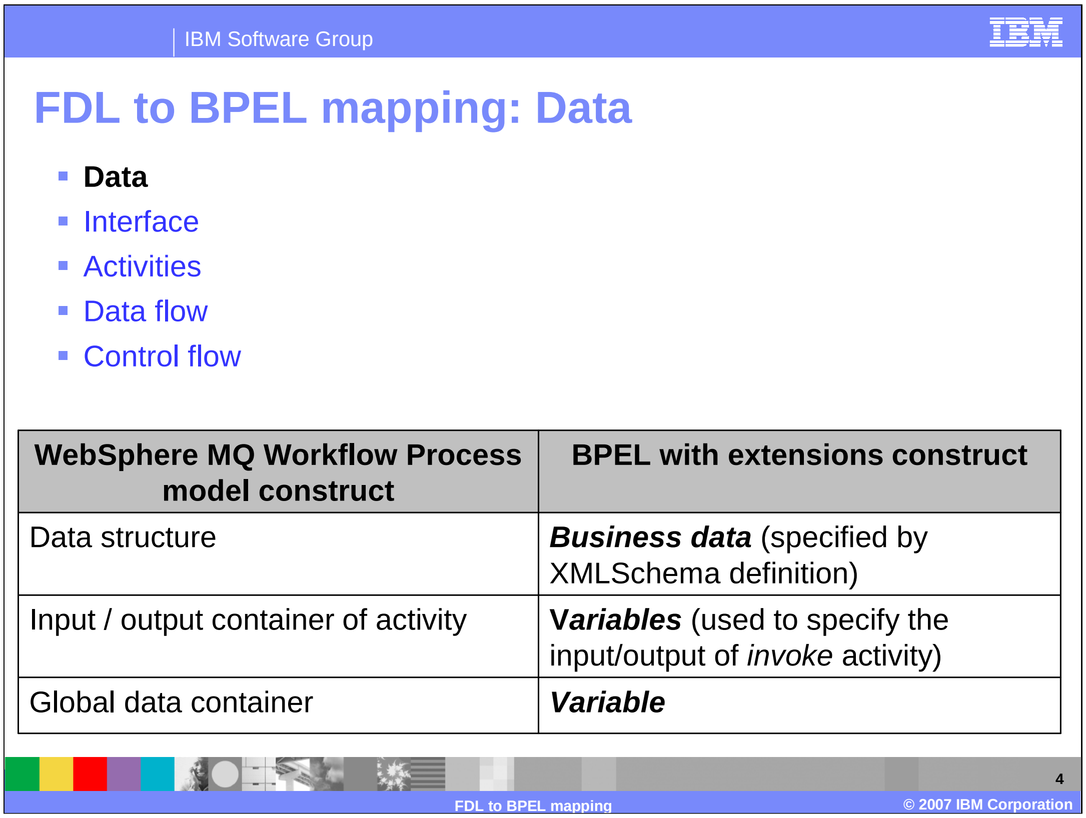
Mapping FDL to BPEL with extensions

- Data
- Interfaces
- Activities
- Data flow
- Control flow

3

FDL to BPEL mapping

Each category listed here represents a kind of FDL artifact that must be considered when migrating from FDL to BPEL.



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FDL to BPEL mapping: Data

- **Data**
- Interface
- Activities
- Data flow
- Control flow

WebSphere MQ Workflow Process model construct	BPEL with extensions construct
Data structure	***Business data*** (specified by XMLSchema definition)
Input / output container of activity	***Variables*** (used to specify the input/output of *invoke* activity)
Global data container	***Variable***

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FDL to BPEL mapping

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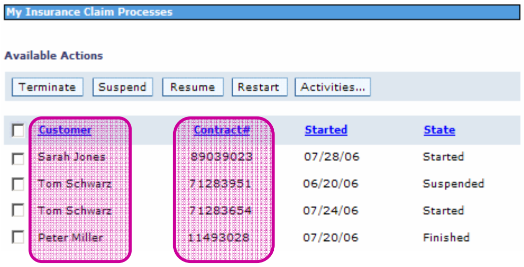
In BPEL and SCA, data is represent by XML Schema and XSDs and variables are used to hold the data values and facilitate the movement of data from one activity to another. The WebSphere MQ Workflow data container can be mapped directly to the BPEL variables.

User defined queries

New V602

- User defined queries can be based on business data associated with a business process.
  - For example, include business data like *Customer* or *Contract#*.



My Insurance Claim Processes

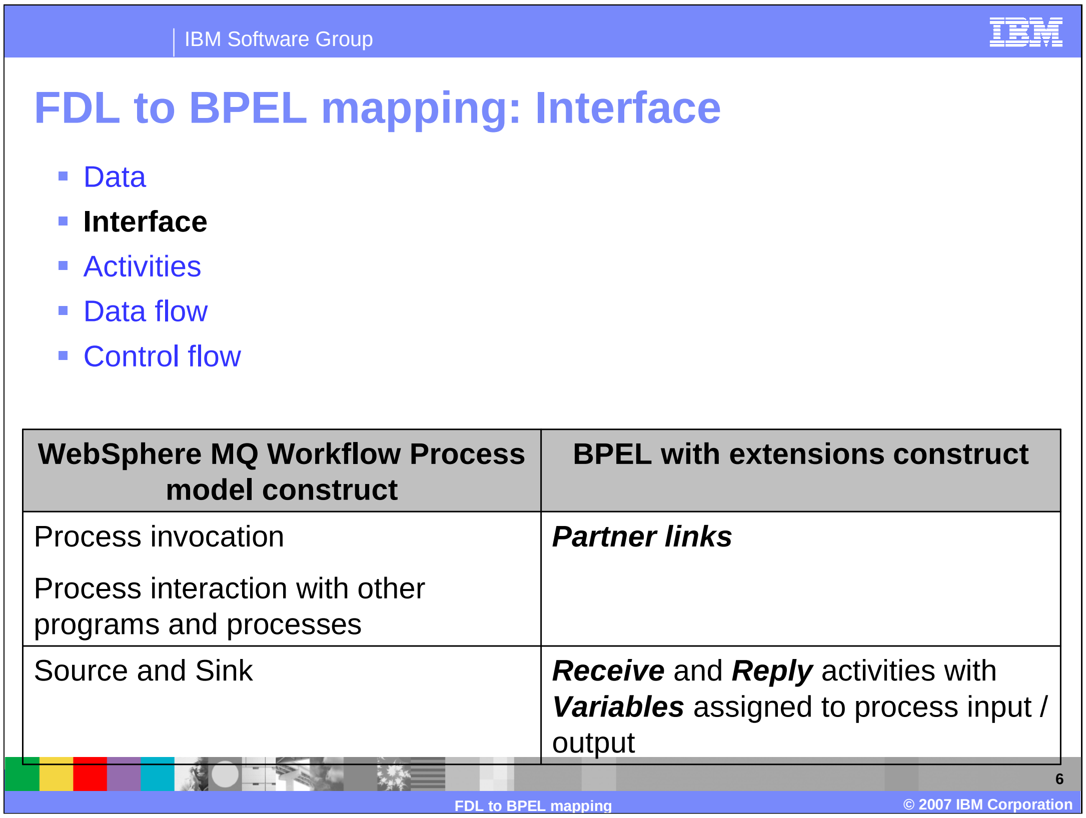
Available Actions

□	Customer	Contract#	Started	State
□	Sarah Jones	89039023	07/28/06	Started
□	Tom Schwarz	71283951	06/20/06	Suspended
□	Tom Schwarz	71283654	07/24/06	Started
□	Peter Miller	11493028	07/20/06	Finished

  - Or, retrieve process instances for customer *Sarah Jones* only.
- In WebSphere MQ Workflow, this feature is known as *Global Key Data Container*.

The query properties feature enables user defined queries to be based on **business data** associated with a business process. This is not limited to the properties assigned and maintained by the business process engine (such as date started, current state and so on). The picture in the example shows a user defined query of insurance claim processes. Notice that the data being displayed includes business data like *Customer* and *Contract#*, in addition to the date the process was started, and the current state of the process. Another example might be to retrieve all process instances for customer *Sarah Jones*.

The query properties feature brings WebSphere Process Server 6.0.2 into functional equivalence with WebSphere MQ Workflow, where this feature is known as *Global Key Data Container*.



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FDL to BPEL mapping: Interface

- Data
- **Interface**
- Activities
- Data flow
- Control flow

WebSphere MQ Workflow Process model construct	BPEL with extensions construct
Process invocation Process interaction with other programs and processes	***Partner links***
Source and Sink	***Receive*** and ***Reply*** activities with ***Variables*** assigned to process input / output

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FDL to BPEL mapping

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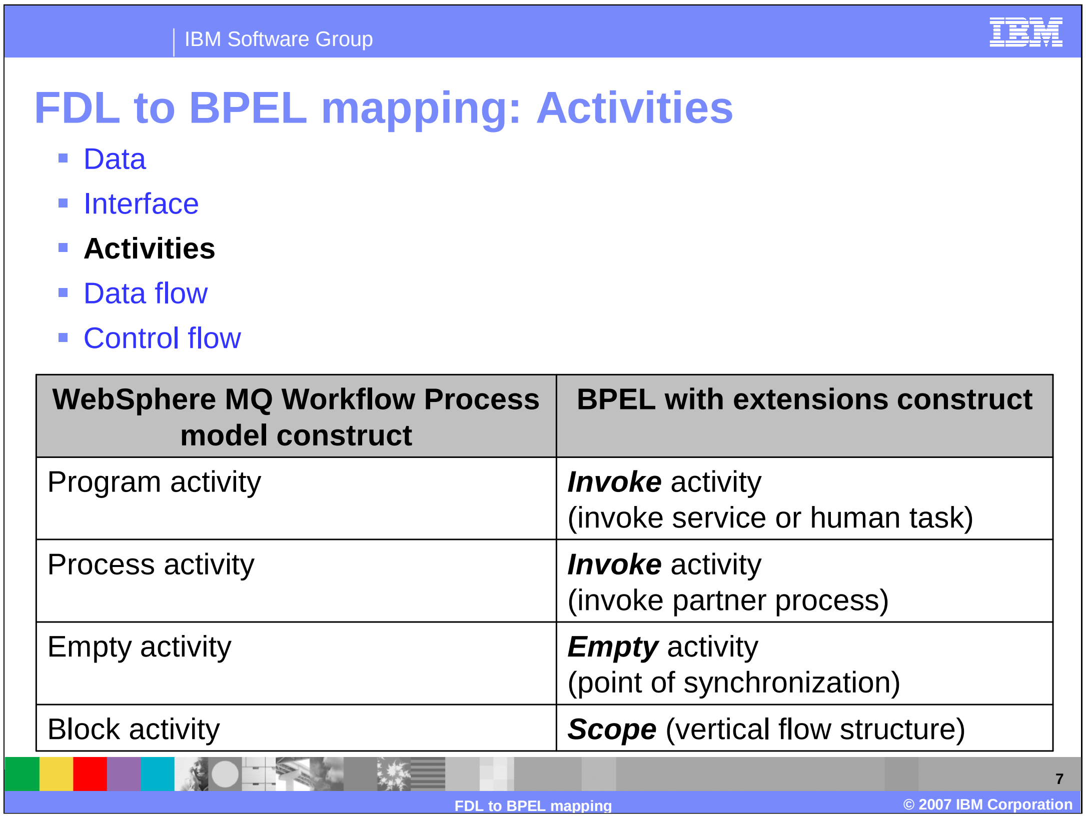
With BPEL, the interfaces are defined using WSDL, which in turn defines interactions with other services in terms of Partner Links.

With WebSphere MQ Workflow, the external interface to the business process is called a **Source** and the external interface for the output is called the **Sink**. BPEL provides analogous constructs called **Receive** for input and **Reply** for output. It is very natural to map the Source to the Receive and the Sink to the Reply.

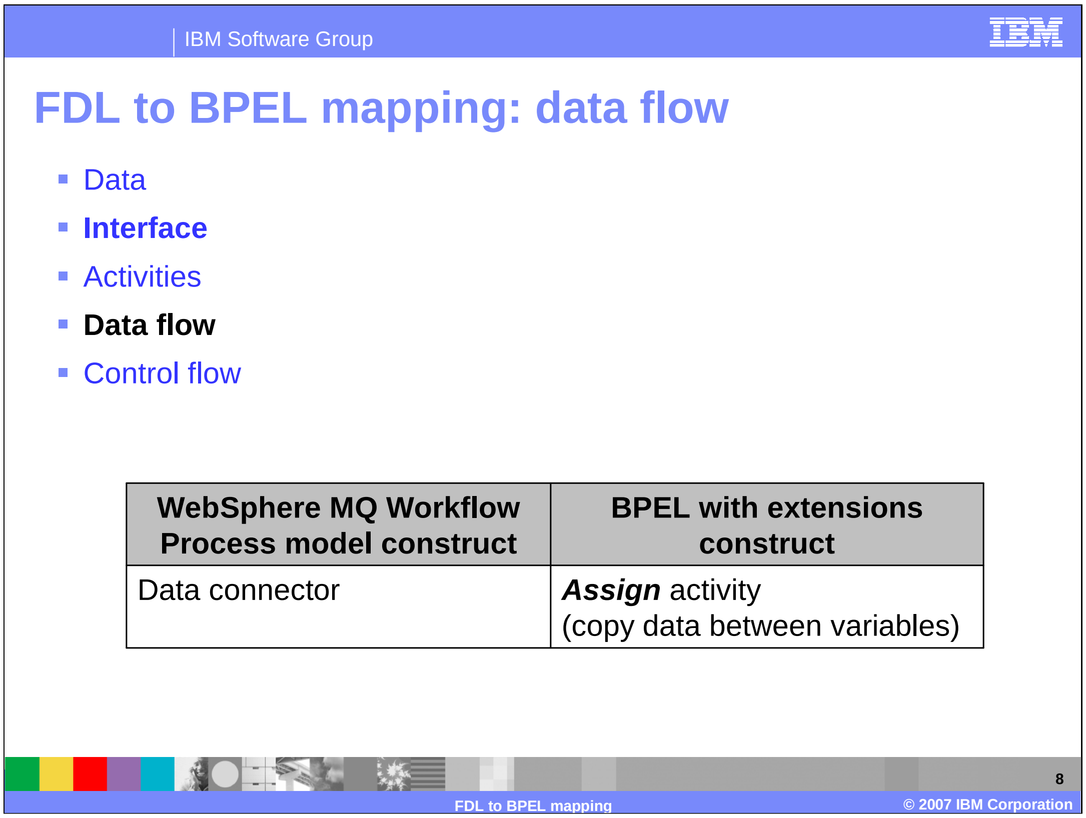


FDL to BPEL mapping: Activities

- Data
- Interface
- **Activities**
- Data flow
- Control flow

WebSphere MQ Workflow Process model construct	BPEL with extensions construct
Program activity	***Invoke*** activity (invoke service or human task)
Process activity	***Invoke*** activity (invoke partner process)
Empty activity	***Empty*** activity (point of synchronization)
Block activity	***Scope*** (vertical flow structure)

For each of the four basic activities in WebSphere MQ Workflow there are corresponding constructs in BPEL. The mapping is relatively straightforward based on classification rules, which will be discussed in subsequent slides.



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FDL to BPEL mapping: data flow

- Data
- **Interface**
- Activities
- **Data flow**
- Control flow

WebSphere MQ Workflow Process model construct	BPEL with extensions construct
Data connector	***Assign*** activity (copy data between variables)

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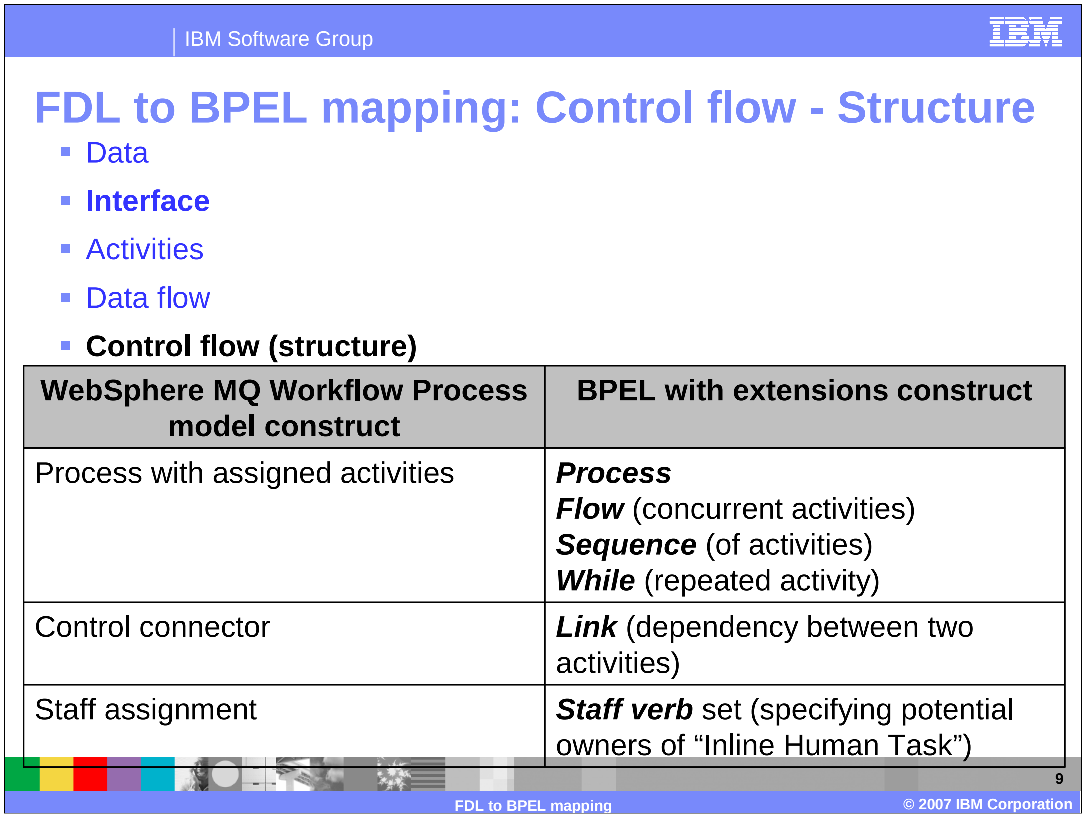
FDL to BPEL mapping

Data flow is one of those constructs in WebSphere MQ Workflow for which there is no analog in BPEL. The movement of data in BPEL is managed by assigning data to variables, which are then used by the activities. When a data connector is encountered in the WebSphere MQ Workflow model, Assign activities are created and inserted into the BPEL model at the appropriate places. An example is provided later in this presentation.



FDL to BPEL mapping: Control flow - Structure

- Data
- **Interface**
- Activities
- Data flow
- **Control flow (structure)**

WebSphere MQ Workflow Process model construct	BPEL with extensions construct
Process with assigned activities	***Process*** ***Flow*** (concurrent activities) ***Sequence*** (of activities) ***While*** (repeated activity)
Control connector	***Link*** (dependency between two activities)
Staff assignment	***Staff verb*** set (specifying potential owners of "Inline Human Task")

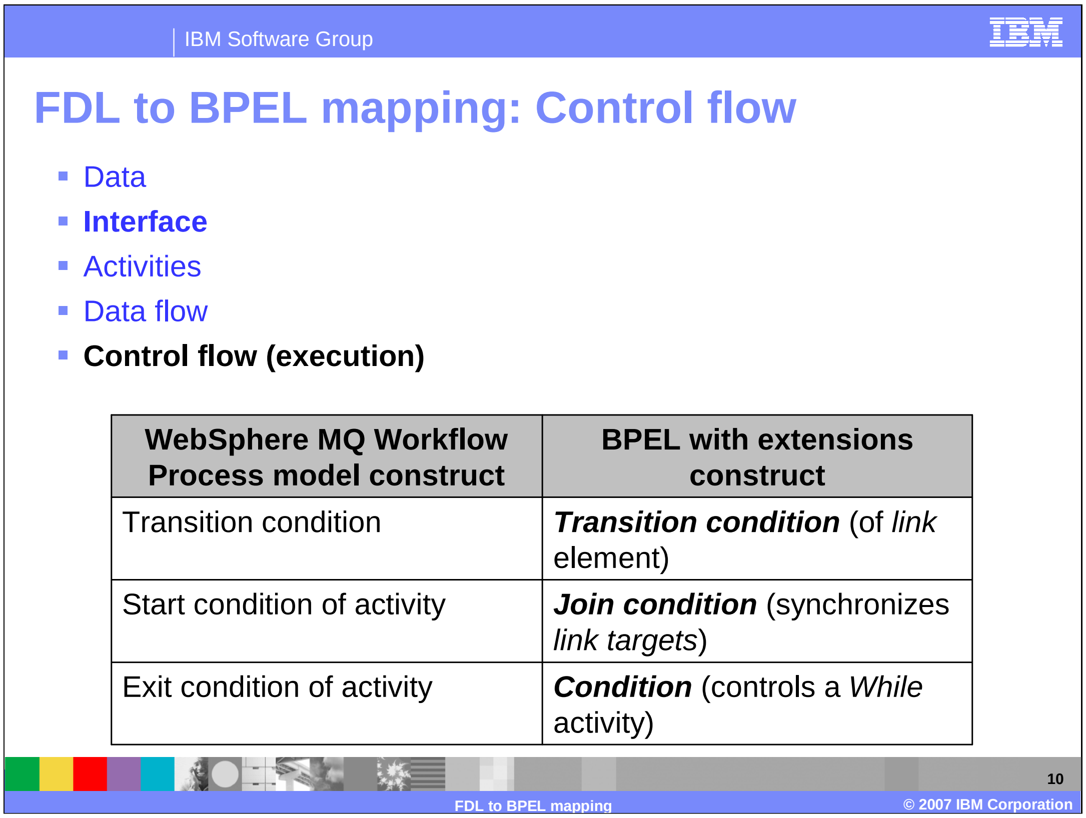
There are two aspects to control flow, one is structure and the other is execution. When considering the **structural** aspect of control flow in a WebSphere MQ Workflow business process, there are elements such as assigned activities, connectors and staff assignments.

WebSphere MQ Workflow provides only one basic kind of process and there are no 'structuring' elements like the ones available in BPEL. With BPEL, there is the "Flow", which allows for grouping activities that will be run concurrently in a collapsible container with a distinct scope. There is also the "Sequence", which provides a collapsible container for activities that will run sequentially.

The "while" construct is another feature that BPEL handles differently than WebSphere MQ Workflow. The "while" construct provides a way of grouping activities that will be run repeatedly while waiting for some condition to be met. WebSphere MQ Workflow has a more generic approach, using a condition on the activity.

Therefore, based on the properties of the WebSphere MQ Workflow activity, a BPEL Flow, Sequence or While will be created.

The Link is the BPEL way of connecting two or more activities and the management of the Staff assignment is done in the Verb of the Human Task activity.



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FDL to BPEL mapping: Control flow

- Data
- **Interface**
- Activities
- Data flow
- **Control flow (execution)**

WebSphere MQ Workflow Process model construct	BPEL with extensions construct
Transition condition	***Transition condition*** (of *link* element)
Start condition of activity	***Join condition*** (synchronizes *link targets*)
Exit condition of activity	***Condition*** (controls a *While* activity)

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FDL to BPEL mapping

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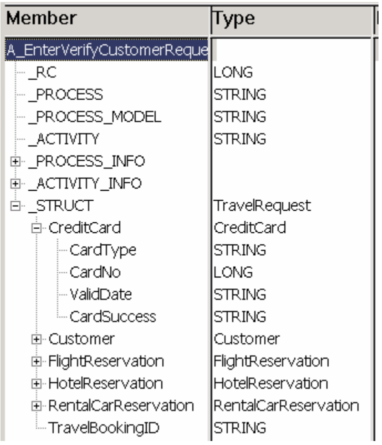
WebSphere MQ Workflow uses conditions, which are checked to determine when to start, exit or transition from an activity for controlling the flow of the business process. There is a corresponding condition or construct for each of these in the BPEL model.

Mapping FDL Data Containers to XMLSchema

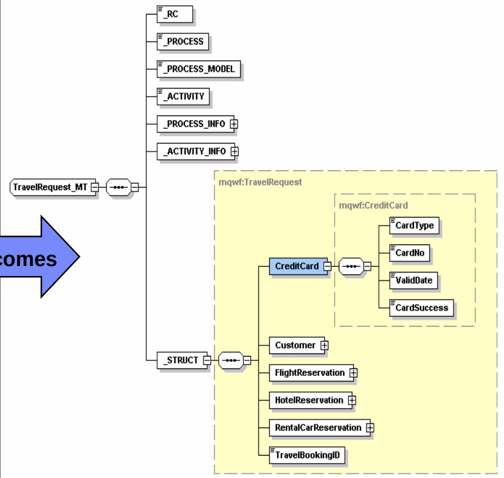
WebSphere MQ Workflow



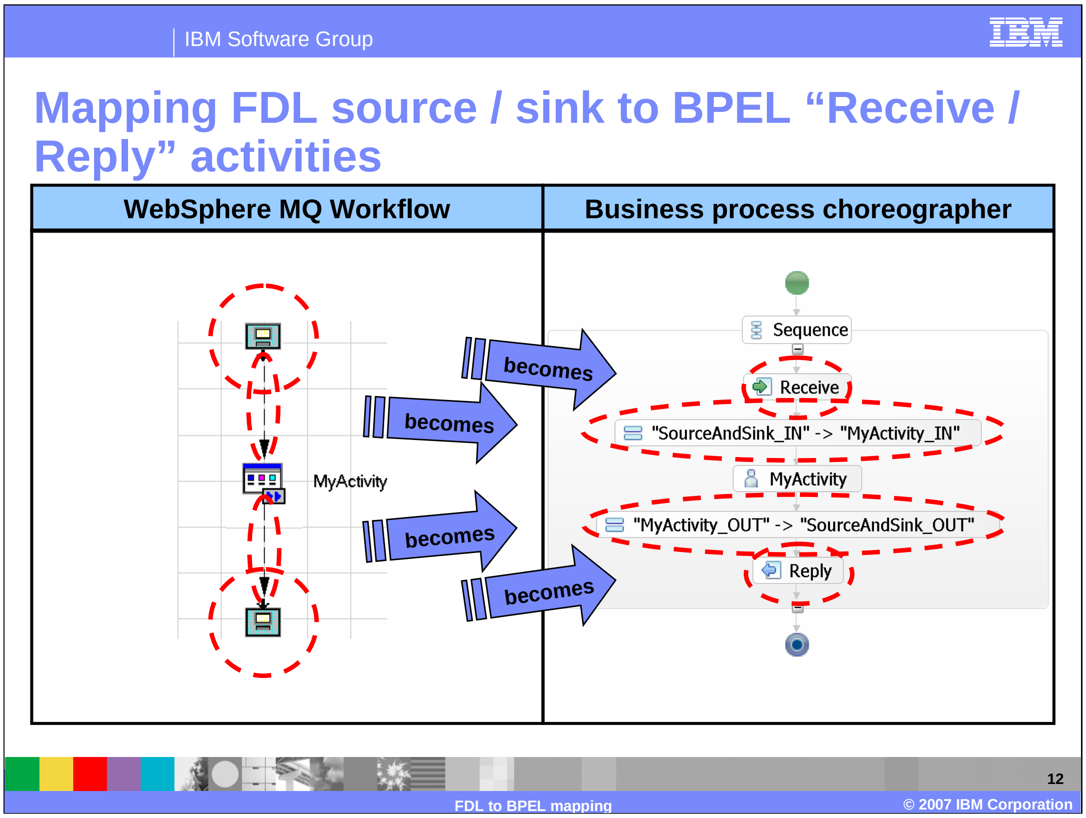
Member	Type
A_EnterVerifyCustomerReque	
_RC	LONG
_PROCESS	STRING
_PROCESS_MODEL	STRING
_ACTIVITY	STRING
_PROCESS_INFO	
_ACTIVITY_INFO	
_STRUCT	TravelRequest
CreditCard	CreditCard
CardType	STRING
CardNo	LONG
ValidDate	STRING
CardSuccess	STRING
Customer	Customer
FlightReservation	FlightReservation
HotelReservation	HotelReservation
RentalCarReservation	RentalCarReservation
TravelBookingID	STRING

becomes

Business process choreographer



Mapping of the data structures from WebSphere MQ Workflow to WebSphere Process Server/BPEL is very straightforward. In WebSphere MQ Workflow the data is defined as structures and in WebSphere Process Server and BPEL data is defined using XML Schema and XSD. Both systems provide for complex nested structures, which makes the mapping intuitive.



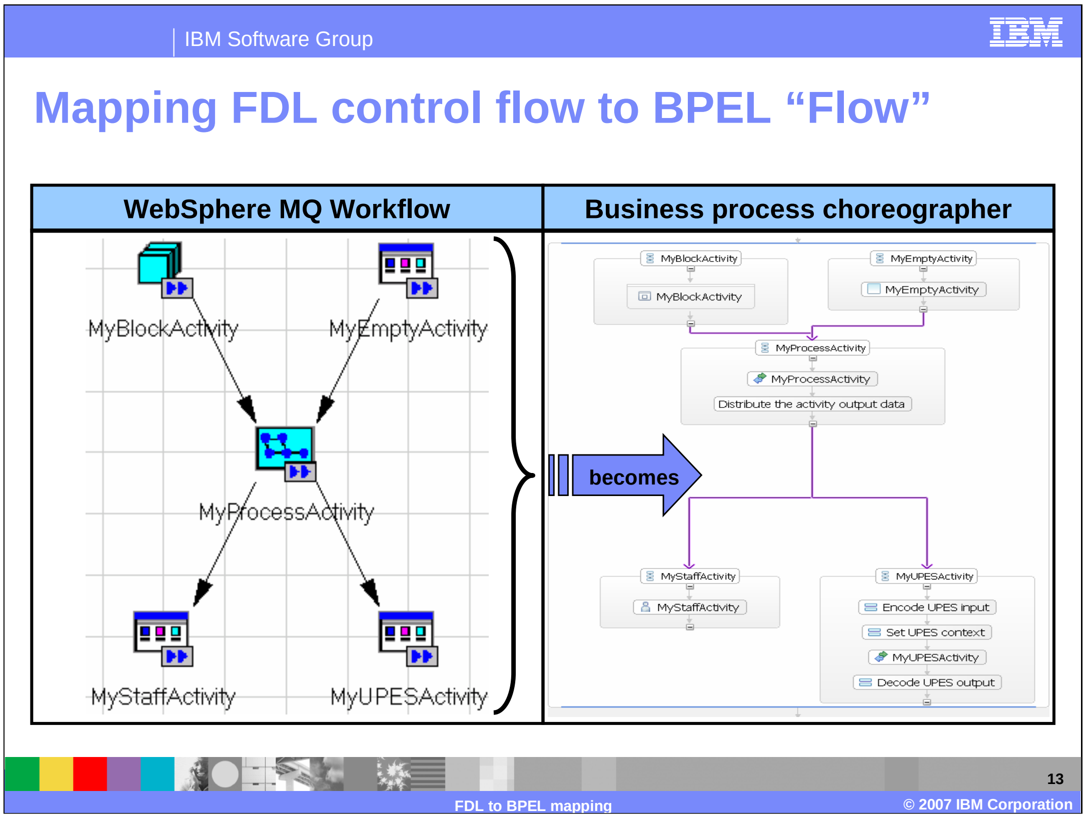
Mapping FDL source / sink to BPEL “Receive / Reply” activities

WebSphere MQ Workflow	Business process choreographer

MyActivity
becomes
becomes
becomes
becomes
Sequence
Receive
"SourceAndSink_IN" -> "MyActivity_IN"
MyActivity
"MyActivity_OUT" -> "SourceAndSink_OUT"
Reply

The WebSphere MQ Workflow concept of source and sink map nicely to the BPEL receive/reply activities. Because there is no explicit data flow in the BPEL model, the Assign activities are inserted in the BPEL model to facilitate the movement of data into and out of the activity.

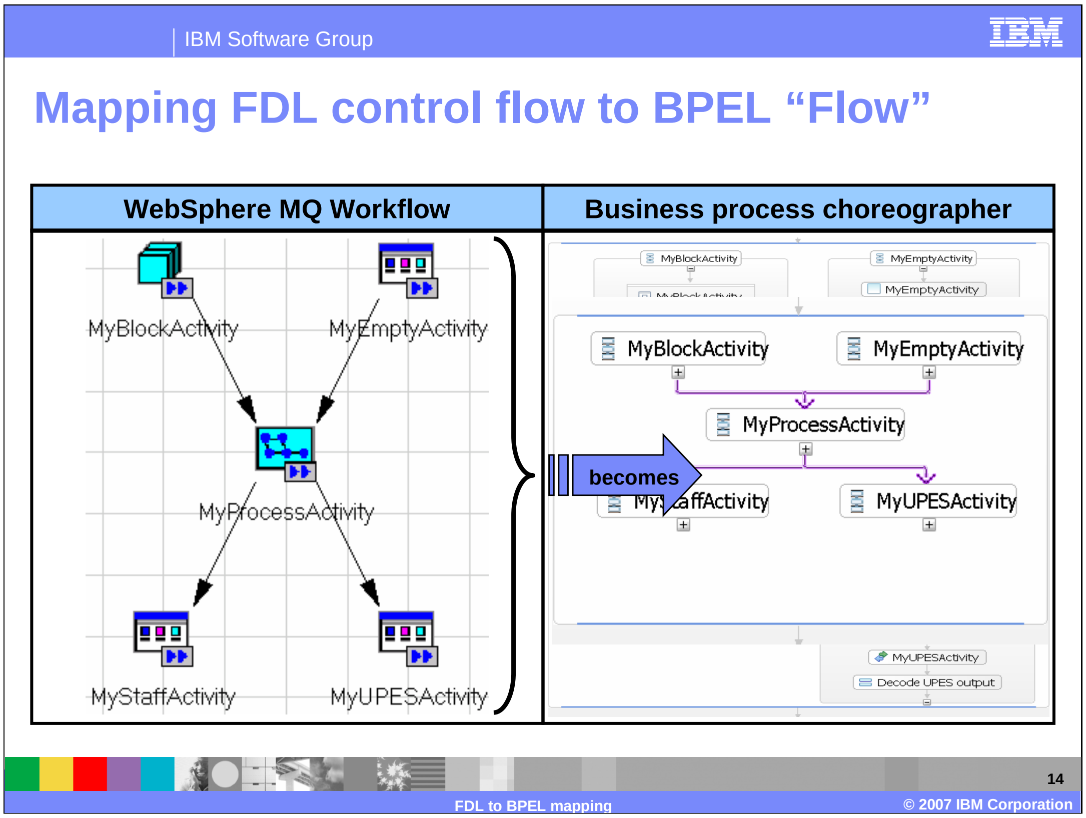
The graphic here illustrates how the WebSphere MQ Workflow Source and Sink activities map to the BPEL Receive and Reply activities. It also shows how the WebSphere MQ Workflow data flow is mapped to the BPEL Assign activity.



Mapping FDL control flow to BPEL “Flow”

The generalized WebSphere MQ Workflow on the left will be used to illustrate the WebSphere MQ Workflow to BPEL mappings. With WebSphere MQ Workflow, the concept of multiple concurrent threads is inherent in the model. The multiple paths converge on an activity, which is responsible for synchronizing and distributing the data. There is no special kind of activity.

In BPEL, concurrent execution is modeled with a Flow activity, which is a special kind of activity designed to manage and organize the concurrent paths. The contents of the flow can be hidden by collapsing the icon (-) and viewed by expanding it again (+).



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Mapping FDL control flow to BPEL “Flow”

WebSphere MQ Workflow	Business process choreographer

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FDL to BPEL mapping

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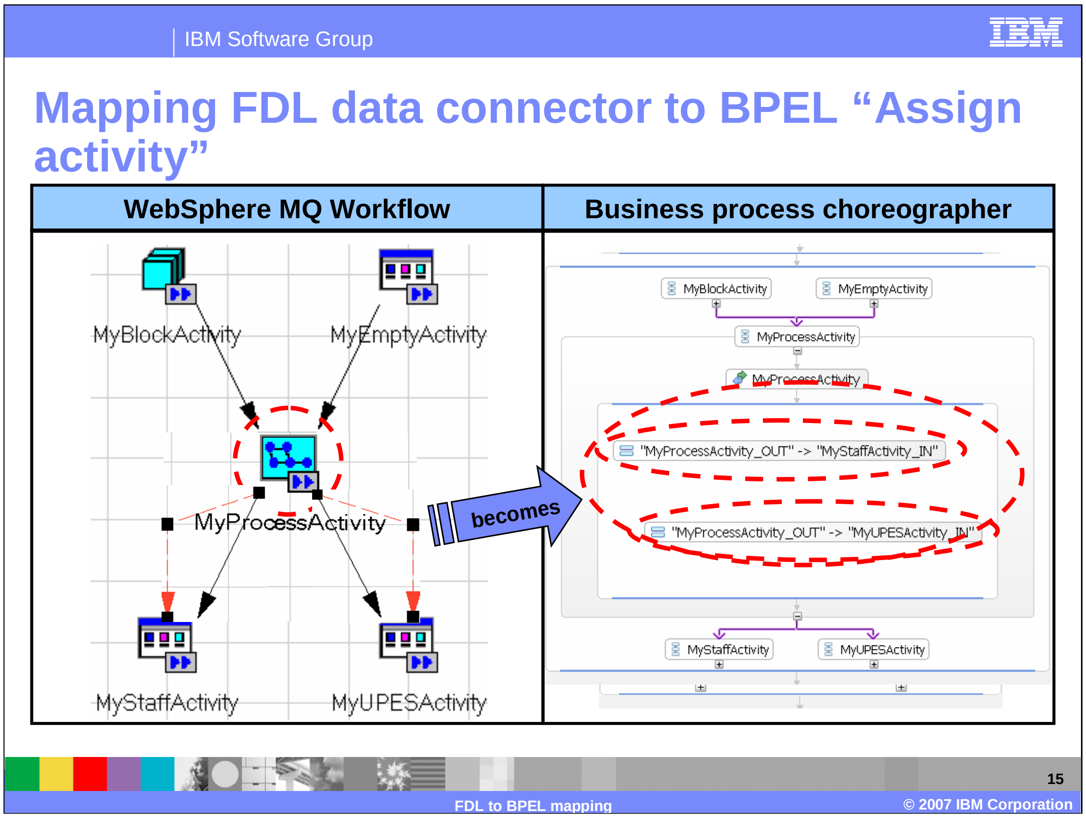
This graphic illustrates the mapping of the entire WebSphere MQ Workflow model to a BPEL Flow. Expanding the BPEL Flow activity you can see the boundary of the flow is defined by the horizontal blue bars at the top and the bottom. The purple lines represent the links from one activity to the next, the concurrent paths of execution. Notice too, that each activity is also encapsulated by the BPEL Sequence activity, which is another organizing structure. The expansion of the Sequence activities reveals the details of the activities.

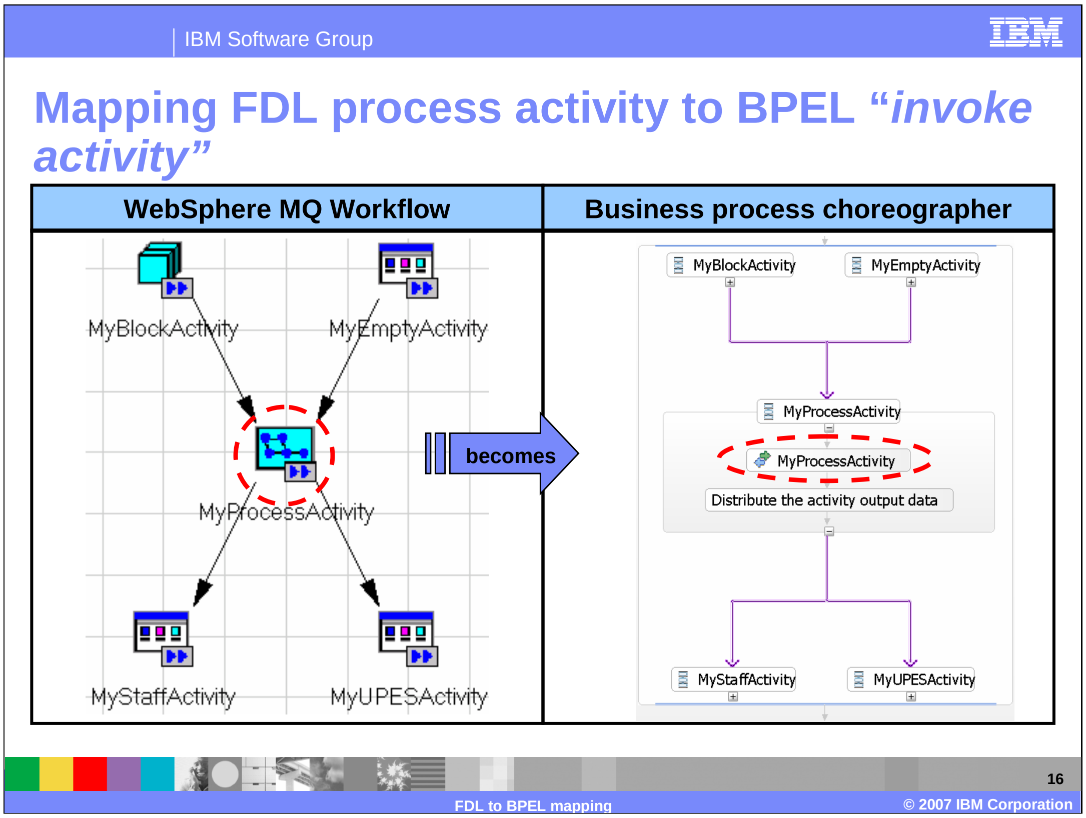


Mapping FDL data connector to BPEL “Assign activity”

WebSphere MQ Workflow	Business process choreographer

In this example, the “MyProcessActivity” has data that must be distributed to two different outputs. In WebSphere MQ Workflow the data connectors provide the mechanism for achieving this. In BPEL there are no data connectors, so the solution is to insert a BPEL Flow in the BPEL Sequence called “MyProcessActivity” directly after the Invoke activity. The data assignments are then made in the context of the Flow, one for each possible output (data connector).

The red circles highlight the area of interest in the graphic shown here, which illustrates the data connectors on the WebSphere MQ Workflow side and the insertion of the sequence on the BPEL side. It also shows the mapping of the data connectors to the Assign activities in the BPEL Sequence.

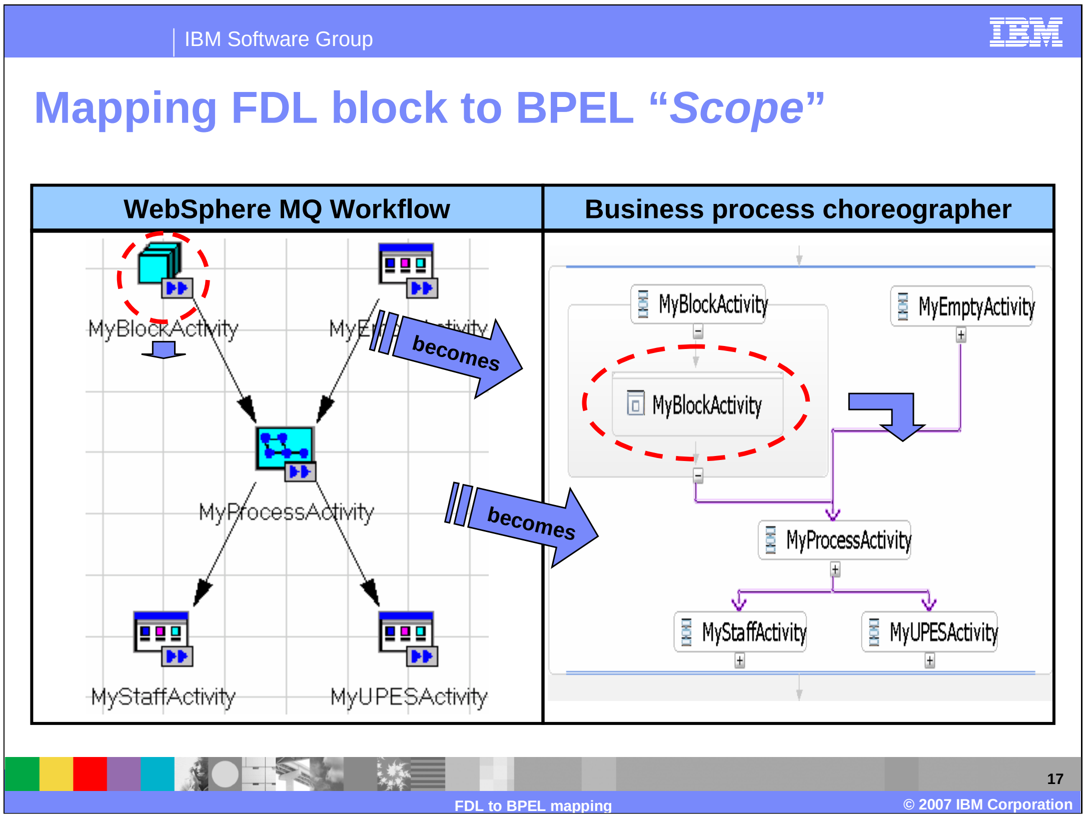


Mapping FDL process activity to BPEL “*invoke activity*”

WebSphere MQ Workflow | **Business process choreographer**

Mapping the WebSphere MQ Workflow activity to the BPEL Invoke activity is straightforward.

Remember that with WebSphere MQ Workflow, the kind, or behavior of an activity is defined by the properties. The property panels for both the WebSphere MQ Workflow and the BPEL are shown to illustrate how the details are mapped from one to the other. Notice that the name of the WebSphere MQ Workflow activity, which is a process, is mapped to an operation on a Web Service in the BPEL implementation.



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Mapping FDL block to BPEL "*Scope*"

WebSphere MQ Workflow	Business process choreographer

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FDL to BPEL mapping

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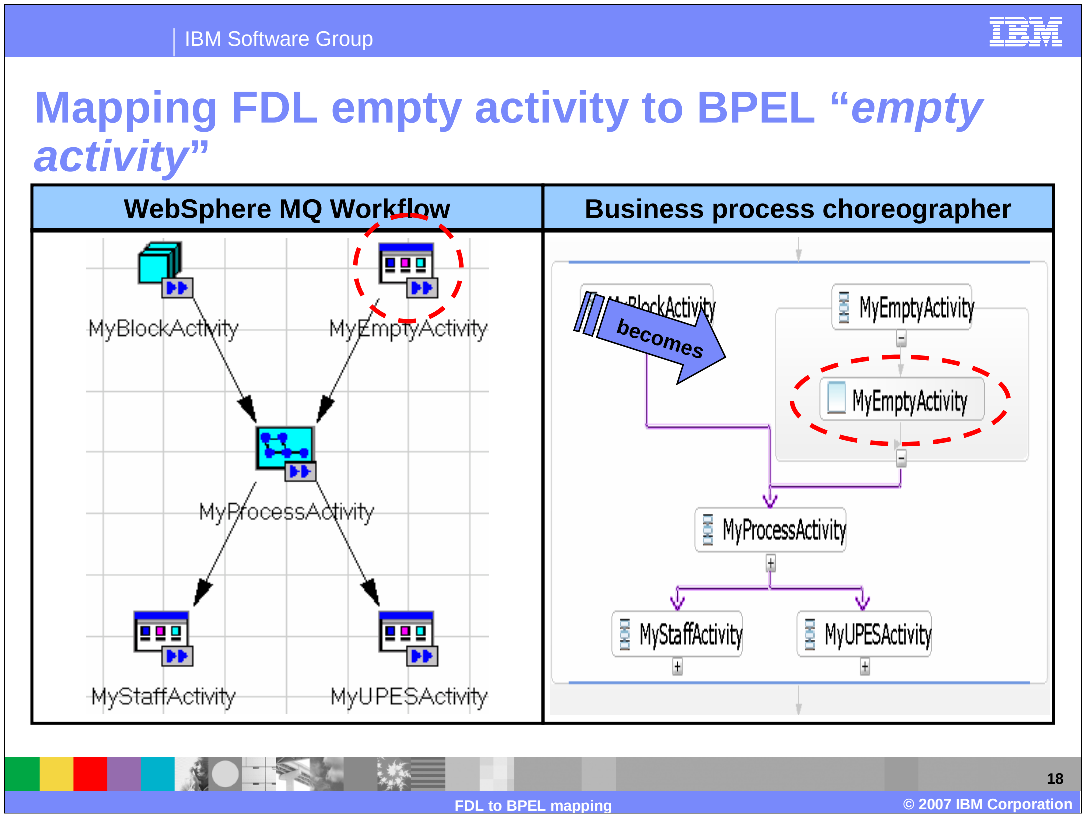
The concepts of Block and Scope are identical. They both provide a mechanism to create a local boundary, which is used to create a local context for isolating local variables and associating units of work and error handling constructs. They are also used to organize and hide the complexity.

In the graphic shown, the red circles highlight the area of interest. The WebSphere MQ Workflow Block and BPEL scope can be expanded to reveal the details.



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Mapping FDL empty activity to BPEL “*empty activity*”

WebSphere MQ Workflow | Business process choreographer

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FDL to BPEL mapping

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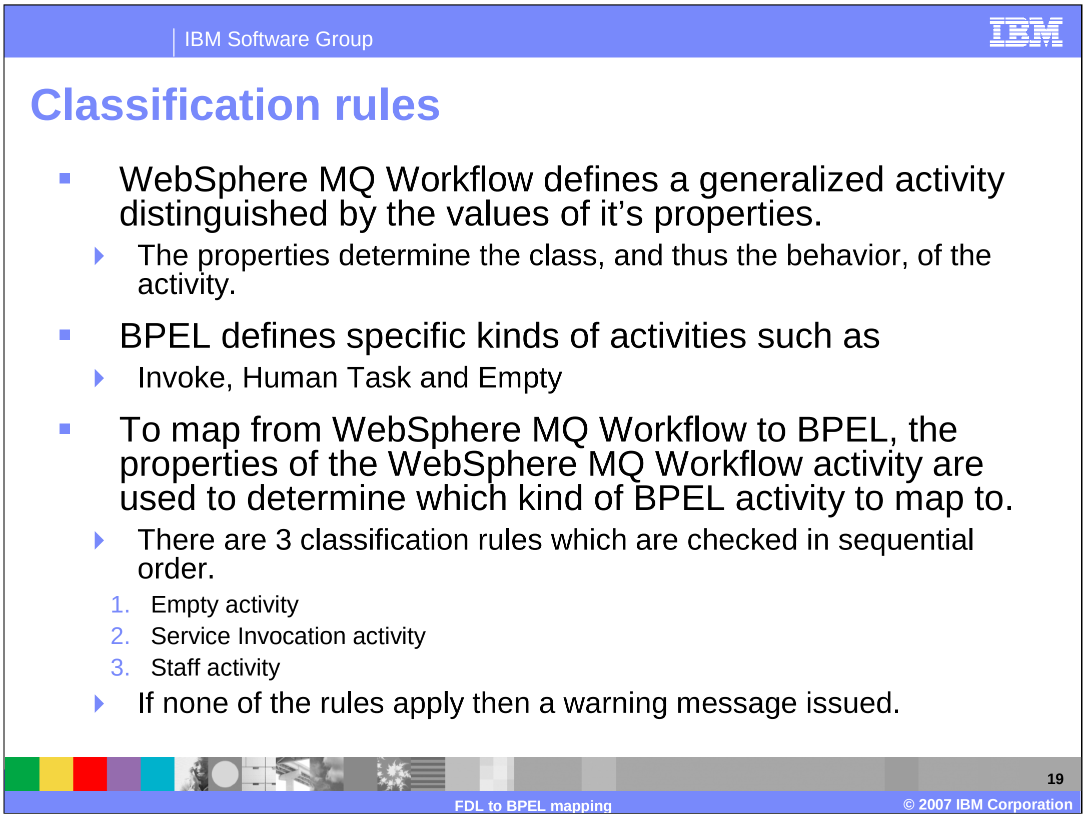
There is a direct mapping of the Empty Activity from WebSphere MQ Workflow to BPEL. To determine if the WebSphere MQ Workflow Activity is truly an Empty activity there are properties that must be interrogated first. The application of the classification rules will be discussed in the next few slides.

In the graphic shown, the red circles highlight the areas of interest.



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Classification rules

- WebSphere MQ Workflow defines a generalized activity distinguished by the values of it's properties.
  - The properties determine the class, and thus the behavior, of the activity.
- BPEL defines specific kinds of activities such as
  - Invoke, Human Task and Empty
- To map from WebSphere MQ Workflow to BPEL, the properties of the WebSphere MQ Workflow activity are used to determine which kind of BPEL activity to map to.
  - There are 3 classification rules which are checked in sequential order.
    1. Empty activity
    2. Service Invocation activity
    3. Staff activity
  - If none of the rules apply then a warning message issued.

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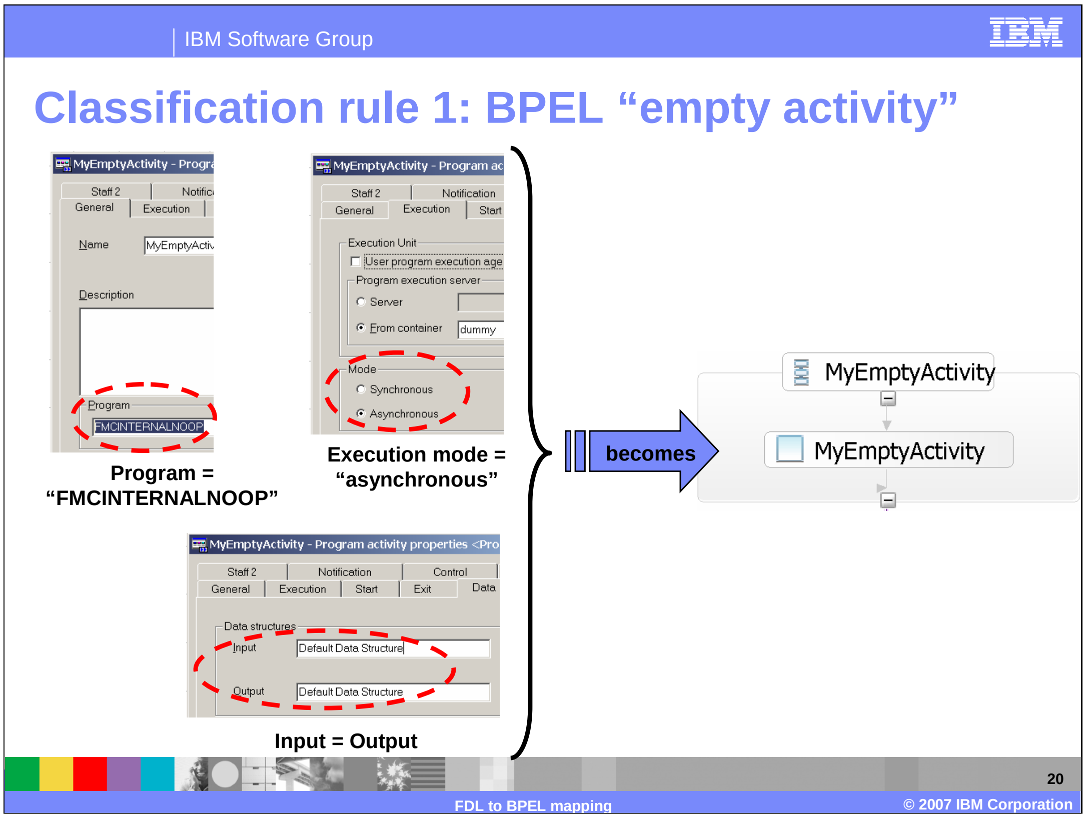
FDL to BPEL mapping

The WebSphere MQ Workflow activities are defined using properties whereas with BPEL there are distinct kinds of activities, such as Human Task (Staff), Empty or Service Invocation. To determine which kind of BPEL activity to map the WebSphere MQ Workflow activity to, the properties must be inspected and the classification rules applied.



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Classification rule 1: BPEL “empty activity”

MyEmptyActivity - Progra

Name: MyEmptyActiv

Description:

Program: FMCINTERNALNOOP

Program = “FMCINTERNALNOOP”

MyEmptyActivity - Program ac

Execution Unit

☐ User program execution age

Program execution server

○ Server

● From container: dummy

Mode

○ Synchronous

● Asynchronous

Execution mode = “asynchronous”

MyEmptyActivity - Program activity properties <Pro

Data structures

Input: Default Data Structure

Output: Default Data Structure

Input = Output

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FDL to BPEL mapping

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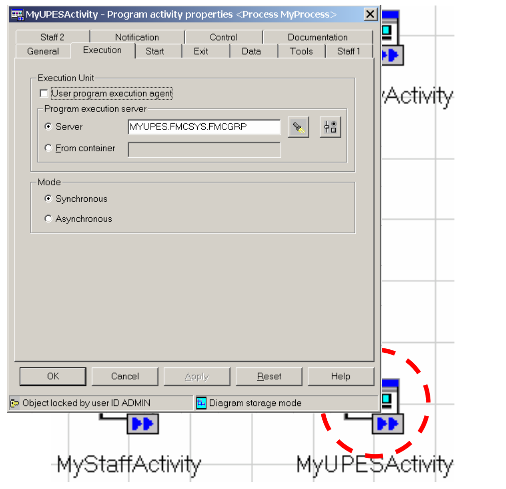
The migration utility will inspect the properties associated with the “Program Activity”. If it is defined to be a no-operation (NOOP) type of activity, which is asynchronous, and there is no change in the data, the activity is mapped to the Empty BPEL activity.

All three conditions must be met.

In other words, If “FMINTERNALNOOP” and “asynchronous” and “Input=Output” then Activity is of type “Empty” must be met.

Mapping FDL UPES activity to BPEL "*service invocation activity*"

WebSphere MQ Workflow



MyUPESActivity - Program activity properties <Process MyProcess>

Staff 2, Notification, Control, Documentation, General, Execution, Start, Exit, Data, Tools, Staff 1

Execution Unit

□ User program execution agent

Program execution server

● Server: MYUPES.FMCSYS.FMCGRP

○ From container

Mode

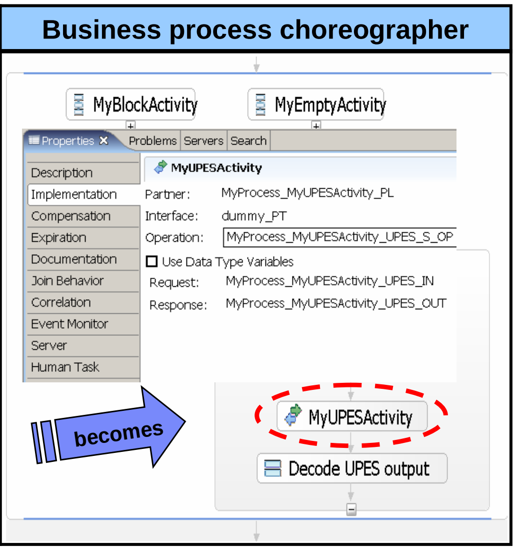
● Synchronous

○ Asynchronous

OK | Cancel | Apply | Reset | Help

Object locked by user ID ADMIN | Diagram storage mode

Business process choreographer



MyUPESActivity

Partner: MyProcess_MyUPESActivity_PL

Interface: dummy_PT

Operation: MyProcess_MyUPESActivity_UPES_S_OP

□ Use Data Type Variables

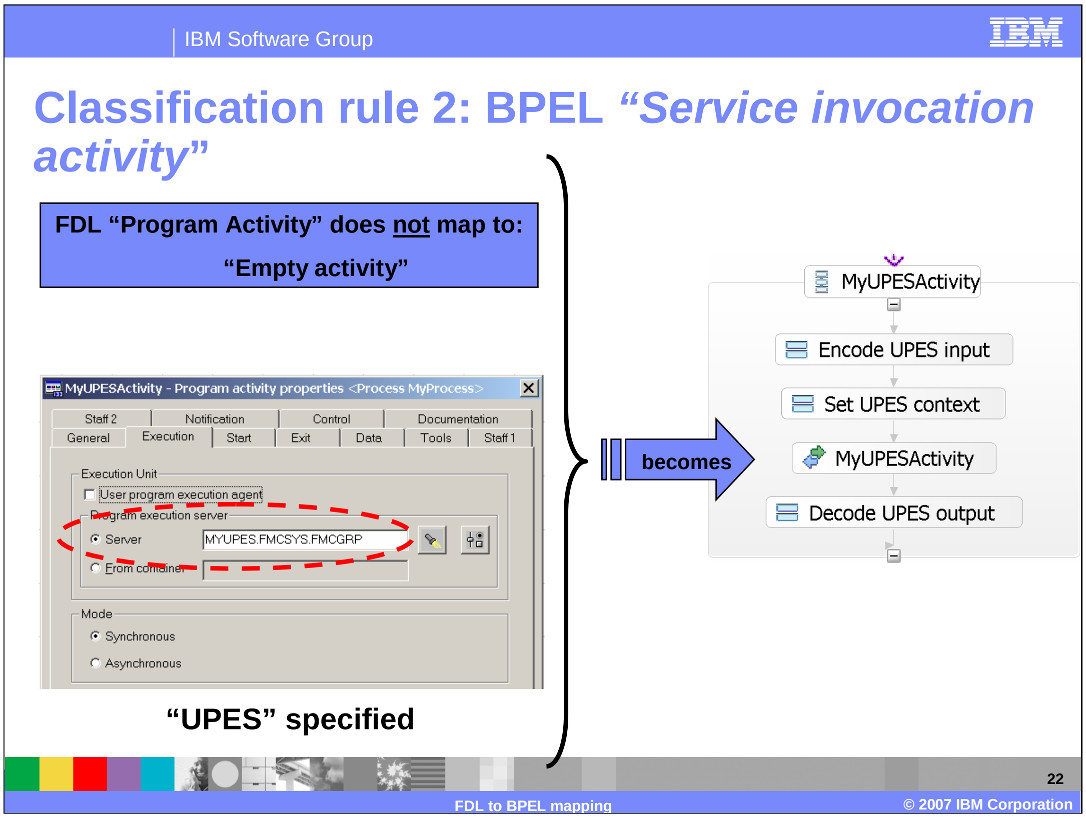
Request: MyProcess_MyUPESActivity_UPES_IN

Response: MyProcess_MyUPESActivity_UPES_OUT

The WebSphere MQ Workflow UPES activity is mapped to BPEL Invoke activity. The program started by the UPES becomes the implementation for a Web Service invocation from BPEL.

The Migration Wizard will create the corresponding Invoke activity for the UPES but there is no support for creating the Web Service implementation. There is no UPES compatibility layer provided at this time.

In the graphic shown, the red circles highlight the areas of interest. The details of the activity definitions are displayed for comparison.



Classification rule 2: BPEL *“Service invocation activity”*

FDL “Program Activity” does <u>not</u> map to: “Empty activity”

MyUPESActivity - Program activity properties <Process MyProcess>

Execution Unit

☐ User program execution agent

Program execution server

● Server MYUPES.FMCSYS.FMCGRP

○ From container

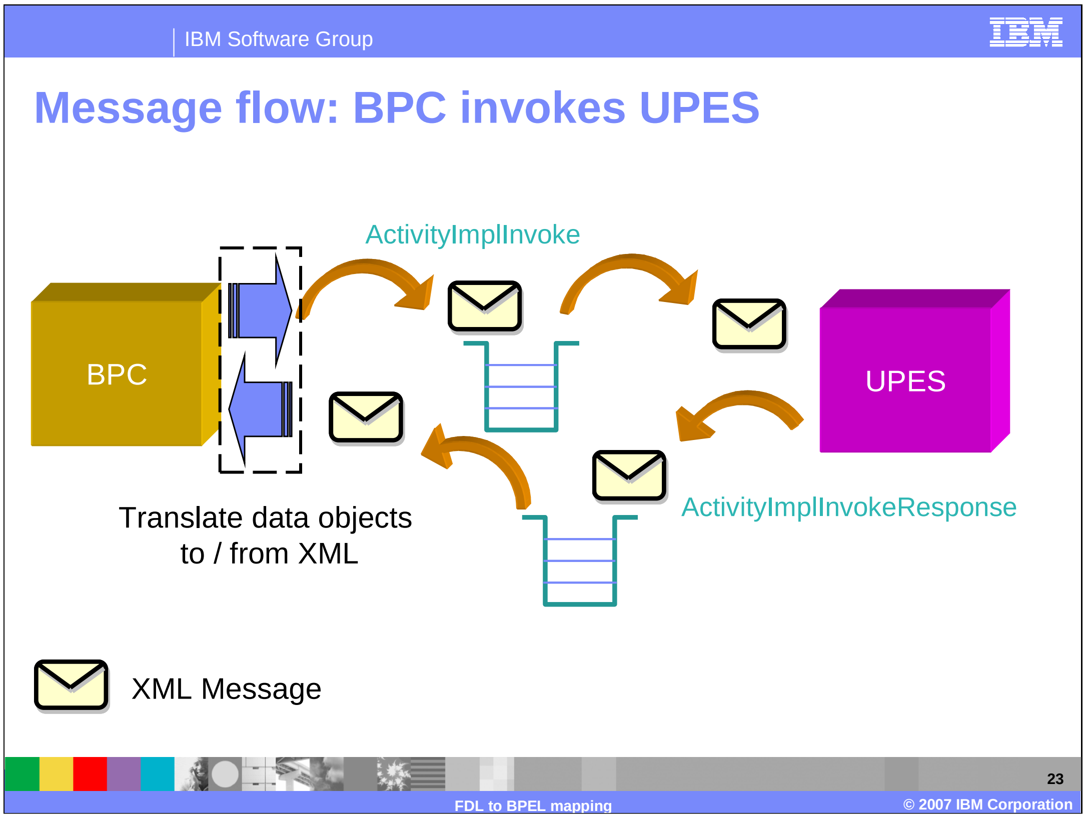
Mode

● Synchronous

○ Asynchronous

“UPES” specified

If the execution mode of the WebSphere MQ Workflow “Program Activity” is configured to be a server, then the activity is mapped to a BPEL Invoke Activity.



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Message flow: BPC invokes UPES

ActivityImplInvoke

BPC

UPES

Translate data objects
to / from XML

ActivityImplInvokeResponse

✉ XML Message

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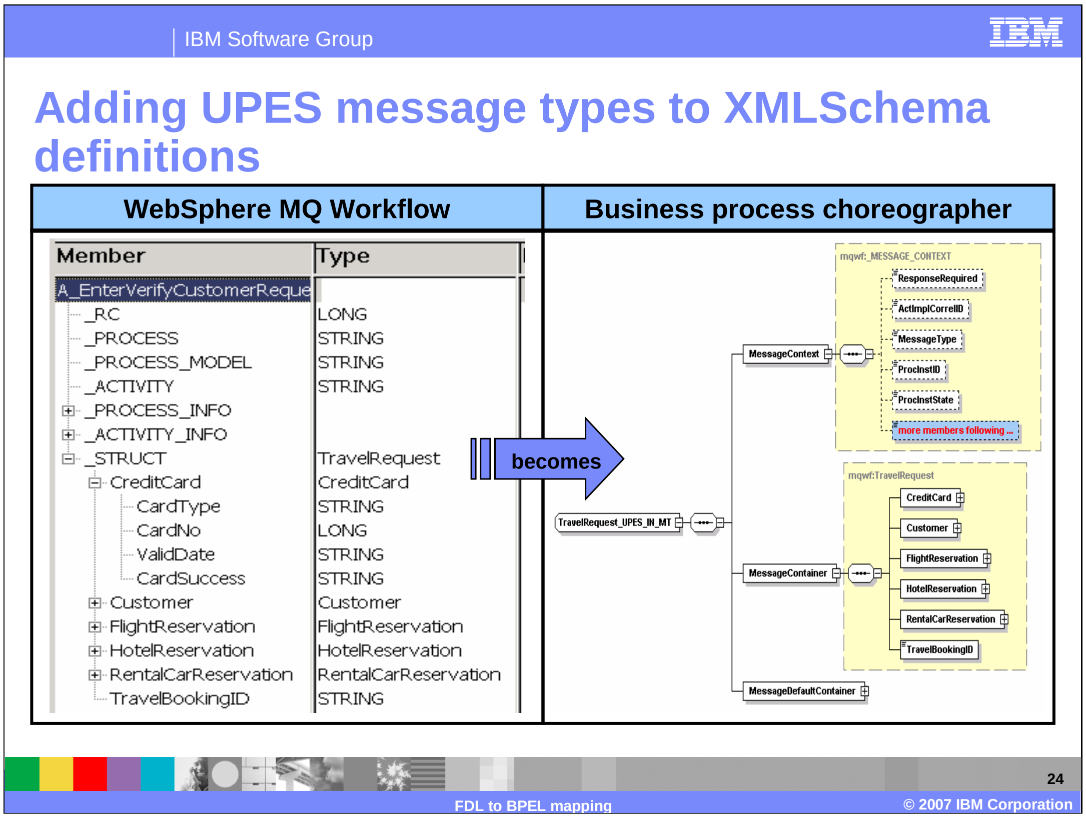
FDL to BPEL mapping

This illustrates the message flow involved with invoking a UPES from business process choreographer.

The implementation of MyUPESActivity as BPEL is responsible for marshalling the message and calling the UPES.

In the WebSphere Process Server V6.0.1 Information Center, this is referred to as the UPES compatibility layer. The UPES compatibility layer is not provided with WebSphere MQ Workflow and must be developed by integration developers.



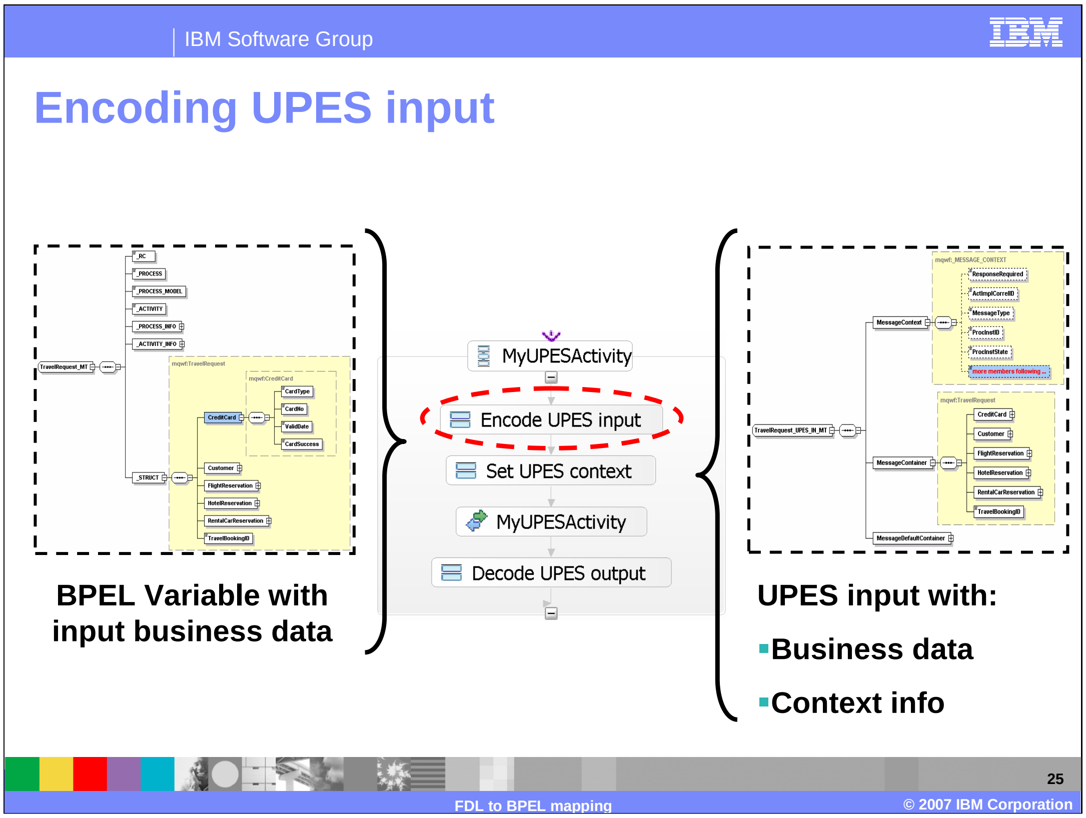
Adding UPES message types to XMLSchema definitions

WebSphere MQ Workflow	Business process choreographer

Member	Type
A_EnterVerifyCustomerReque	
_RC	LONG
_PROCESS	STRING
_PROCESS_MODEL	STRING
_ACTIVITY	STRING
⊞ _PROCESS_INFO	
⊞ _ACTIVITY_INFO	
⊟ _STRUCT	TravelRequest
⊟ CreditCard	CreditCard
CardType	STRING
CardNo	LONG
ValidDate	STRING
CardSuccess	STRING
⊞ Customer	Customer
⊞ FlightReservation	FlightReservation
⊞ HotelReservation	HotelReservation
⊞ RentalCarReservation	RentalCarReservation
TravelBookingID	STRING

becomes

The UPES message types will be converted to XML Schema.



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Encoding UPES input

BPEL Variable with input business data

UPES input with:

- **Business data**
- **Context info**

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FDL to BPEL mapping

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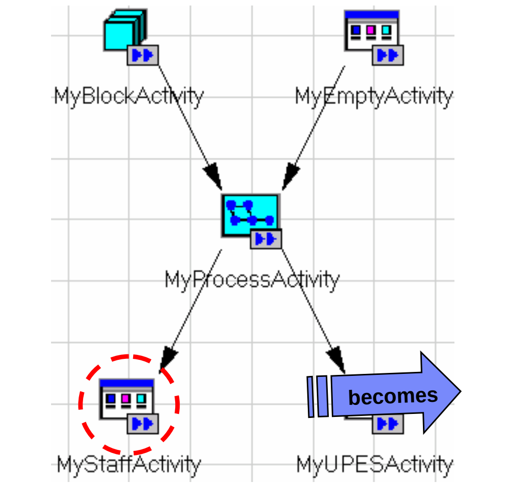
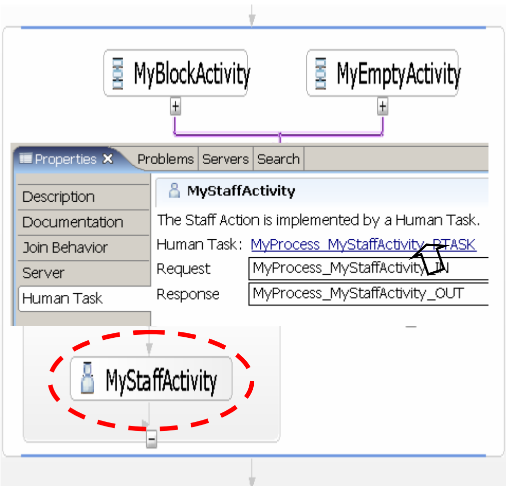
BPEL Assignment activities will be inserted to copy the data to/from the BPEL variables and the UPES Business data and context.

Mapping FDL staff assignment to "inline human task"

WebSphere MQ Workflow	Business process choreographer
	

MyStaffActivity

The Staff Action is implemented by a Human Task.

Human Task: MyProcess_MyStaffActivity_PTASK

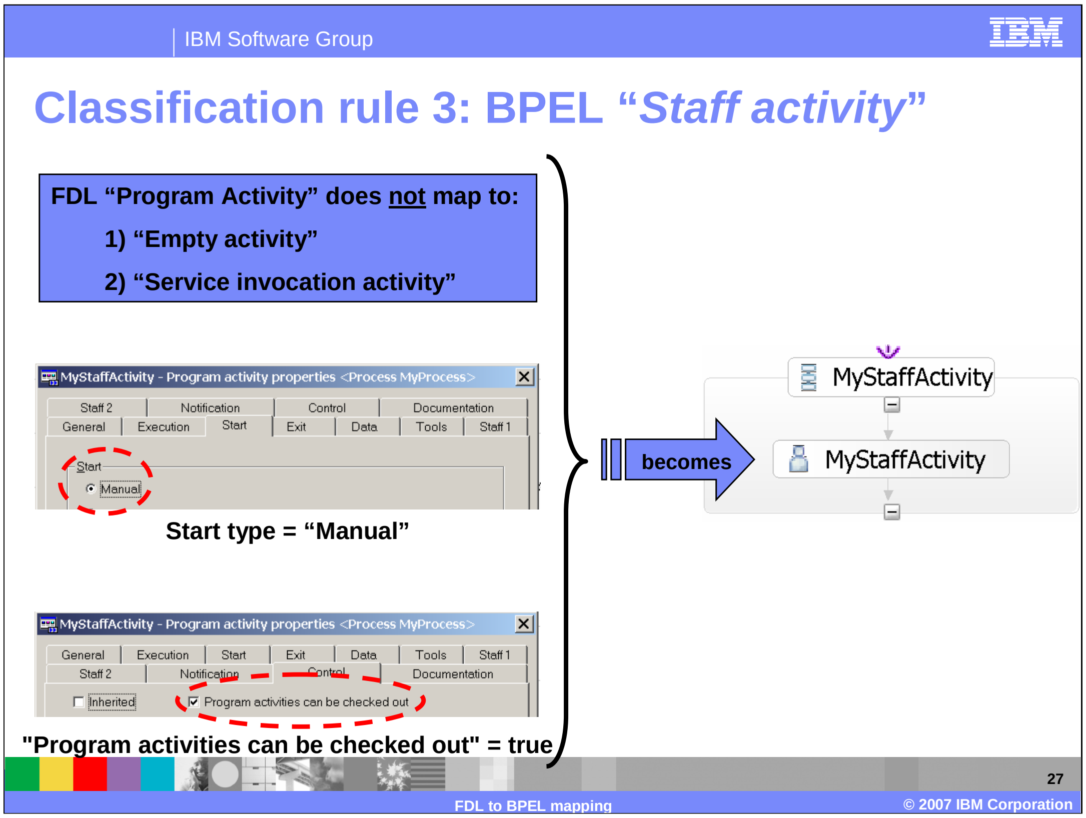
Request: MyProcess_MyStaffActivity_IN

Response: MyProcess_MyStaffActivity_OUT

The WebSphere Process Server BPEL extension for the Human Task is a direct analog for the WebSphere MQ Workflow Staff activity.

The inline Human Task activity provides strong integration capabilities between the business process and the human task but is not BPEL 2.0 compliant.

In the graphic shown, the red circles highlight the areas of interest. The WebSphere MQ Workflow Staff becomes an inline Human Task. The Human Task is further expanded to show the association of the groups and people permitted to interact with the task.



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Classification rule 3: BPEL “*Staff activity*”

FDL “Program Activity” does not map to:

1) “Empty activity”

2) “Service invocation activity”

MyStaffActivity - Program activity properties <Process MyProcess>

Start

● Manual

Start type = “Manual”

MyStaffActivity - Program activity properties <Process MyProcess>

□ Inherited ☑ Program activities can be checked out

"Program activities can be checked out" = true

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FDL to BPEL mapping

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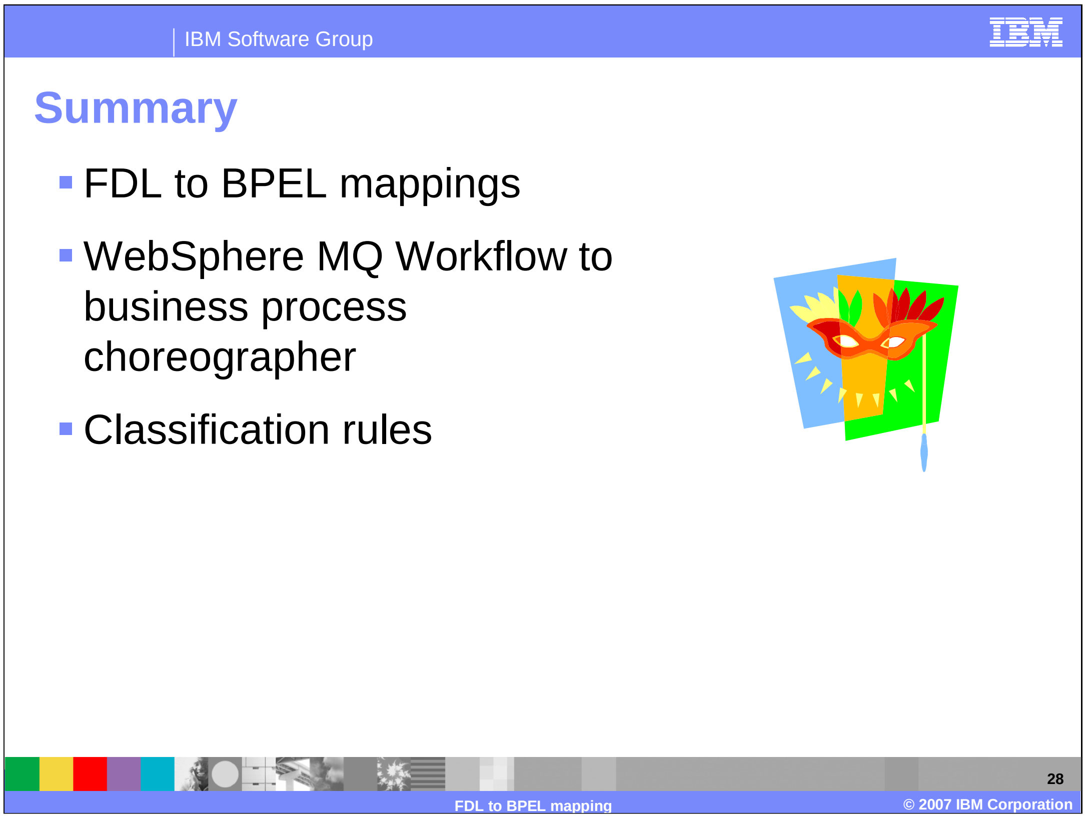
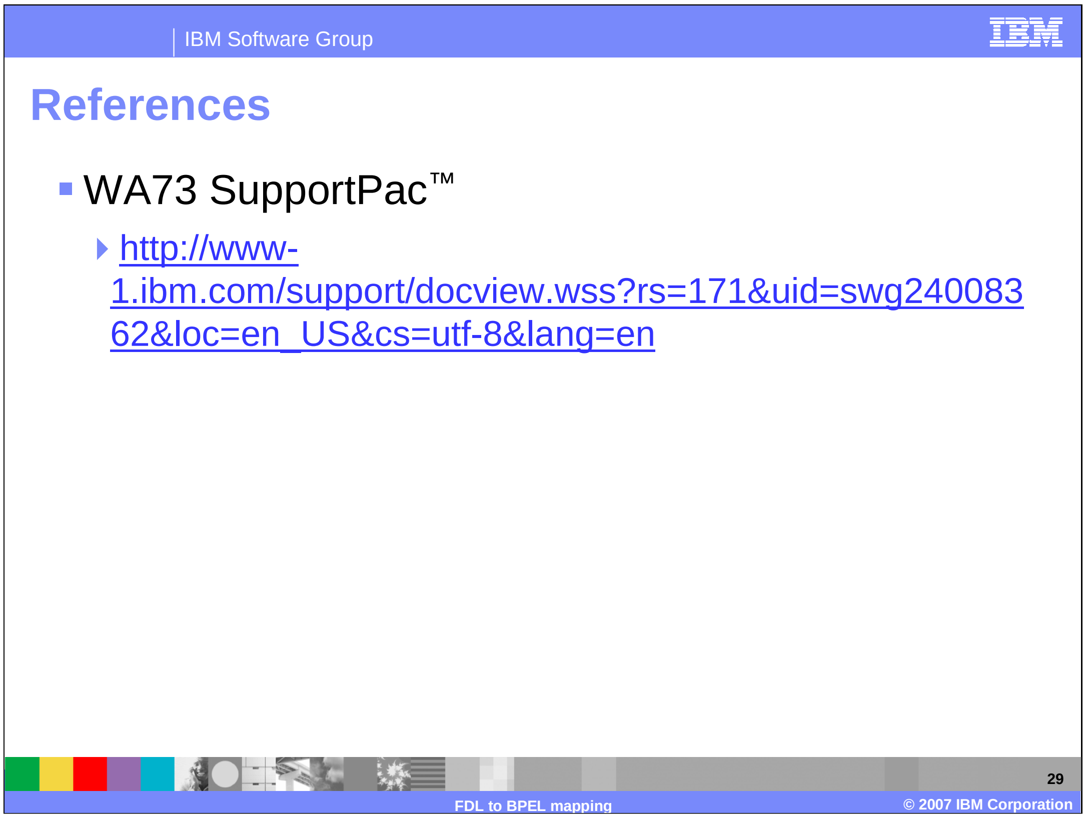
The third classification rule checks the properties of the WebSphere MQ Workflow “Program Activity” to determine if it has been configured to be checked out and requires manual intervention. If this is the case, then the appropriate corresponding BPEL activity will be an inline Human Task activity.



Summary

- FDL to BPEL mappings
- WebSphere MQ Workflow to business process choreographer
- Classification rules

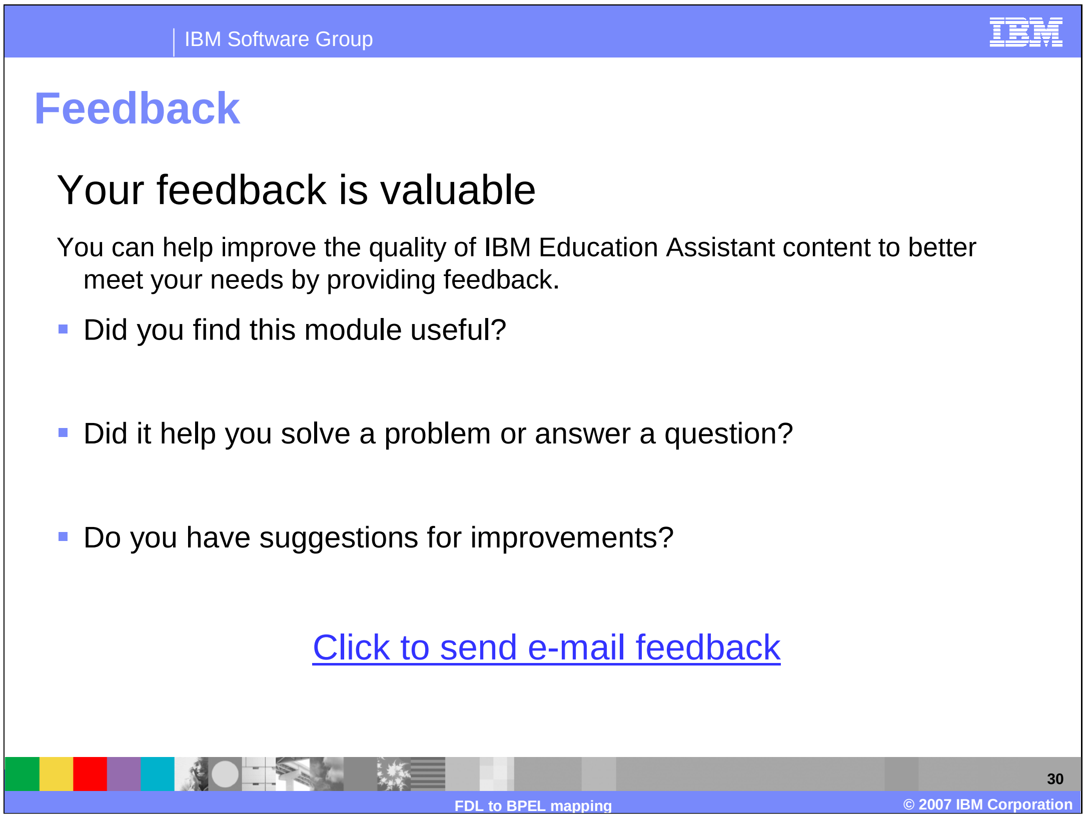
This presentation provided information on the mappings from the flow definition language to BPEL, describing each of the different types. It reviewed the mapping from the WebSphere MQ Workflow to the business process choreographer as graphical representations of business objects. It also reviewed a set of classification rules that define how to map activities to the business process choreographer.



References

- WA73 SupportPac™
  - http://www-1.ibm.com/support/docview.wss?rs=171&uid=swg24008362&loc=en_US&cs=utf-8&lang=en

The WA73 SupportPac contains the FDL2BPEL utility and documentation.



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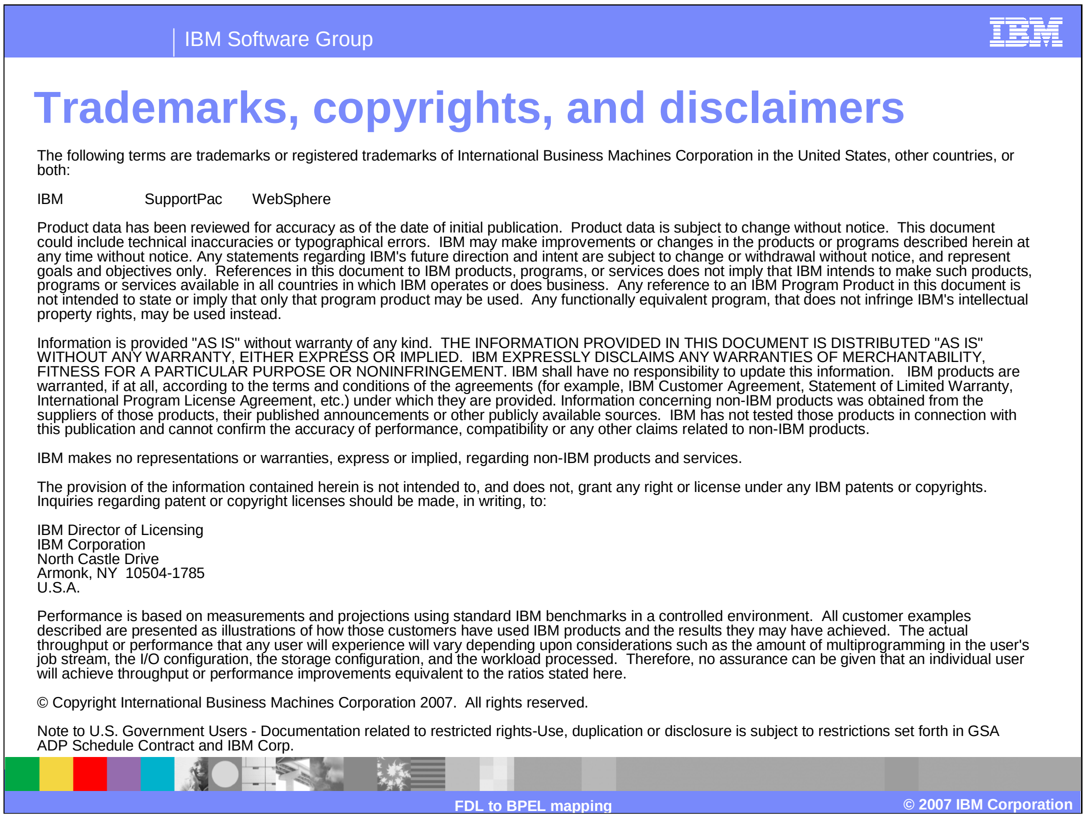

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