WebSphere® Process Server V6
WebSphere Integration Developer V6

WS-BPEL support overview

This presentation will provide an overview of the WS-BPEL specification and support provided for it in WebSphere Process Server V6 and WebSphere Integration Developer V6.

Goals

- Introduce Web service Business Process Execution Language (WS-BPEL)

- Identify the enhancements to the support of the WS-BPEL specification

The two primary goals for this presentation are to introduce the Web service Business Process Execution Language specification also known as WS-BPEL or BPEL and to identify the enhancements to the specification that are supported by IBM®.

Agenda

- Overview of WS-BPEL support
- Summary

WS BPEL support overview

This section will provide an overview of the support for the WS-BPEL specification.

WS-BPEL overview

- WS-BPEL is a standard way of defining a business process model
  - ▶ Maintains separation between definition and implementation

- Based on WSDL and other XML standards
  - ▶ The interface to a Web service is described by WSDL
  - ▶ Data context handling and business rules are defined by XML Schema and XPath expressions

| WS-BPEL (Web services Business Process Execution Language) |
| --- |
| WSDL (Web services Description Language) |
| XPath (XML Path Language) |
| XSD (XML Schema) |
| XML |

The WS-BPEL standard is developed by OASIS and is currently at version 2.0. The standard allows business process models to be defined independent of the implementation, keeping the processes separate from the underlying infrastructure or technology. This fits nicely with the concept of a service oriented architecture (SOA) where interfaces are kept separate from implementations. WS-BPEL uses services and service interfaces as a means of defining the connections between the different steps. For example, in a business process with five steps, interfaces on the steps indicate the type of data that is passed and potentially received and the type of operation to be performed. The WS-BPEL standard uses other industry standards such as Web services Description Language (WSDL) to define steps and interfaces and XML Schema Definition (XSD) to define data structures. A BPEL process is actually an XML file that is interpreted at runtime to indicate the sequence of steps that make up a business process. XPATH support is also provided as a primary means of working with data objects passed between steps.

Main elements of a BPEL process
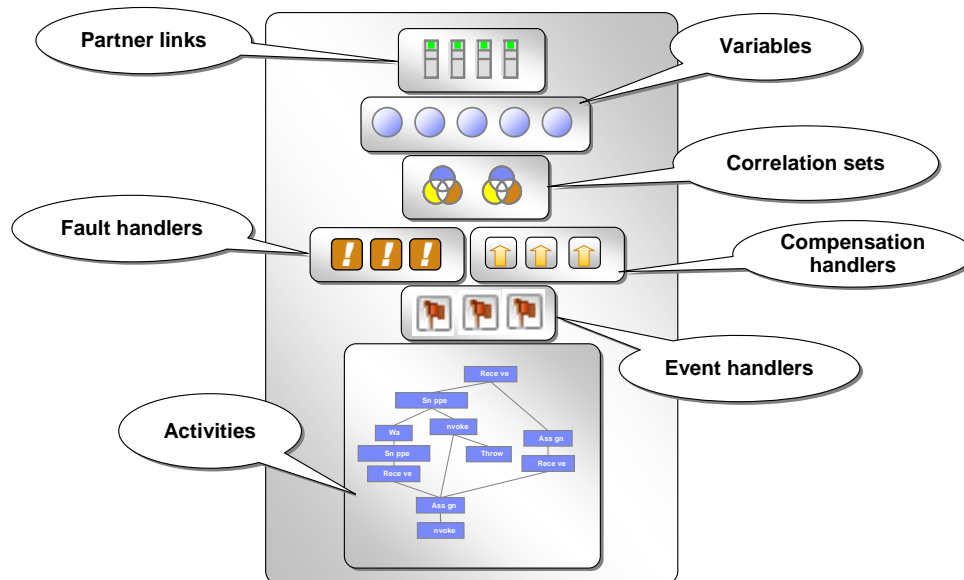
The BPEL specification describes several areas for defining business processes. The primary elements or concepts are partner links, variables, correlation sets, fault handlers, compensation handlers, event handlers, and activities. These areas detail how a business process is organized and how it might be run.

Run-time support for WS-BPEL

- Support for running WS-BPEL is provided by business process choreographer
  - Business flow manager in WebSphere Process Server V6
  - Business process editor in WebSphere Integration Developer V6
  - Built on top of BPEL support introduced in WebSphere Business Integration Server Foundation V5.1 and WebSphere Studio Application Developer Integration Edition V5.1

- Extensions to WS-BPEL
  - People extensions to allow for human interaction specifications and authorization specification (for example, process administrators)
  - Java extensions for expressing parts of your process logic in Java
  - Quality of service extensions for implementing and deploying a business process within an enterprise environment (for instance, microflows and long-running processes)
  - Enabled only through WebSphere Integration Developer and supported only by WebSphere Process Server

Business processes defined in BPEL require robust runtimes that interpret the business process and run the appropriate steps, considering things like integration with transactional environments and long running processes that span hours, days, or even longer. WebSphere Process Server V6 includes the Business Flow Manager which is responsible for all aspects of BPEL business process execution. Support for designing BPEL business processes is provided with the Business Process Editor in WebSphere Integration Developer. Both WebSphere Process Server V6 and WebSphere Integration Developer V6 build on the support provided by WebSphere Business Integration Server Foundation V5.1.1 and WebSphere Studio Application Developer Integration Edition V5.1 for BPEL business processes. WebSphere Process Server and WebSphere Integration Developer provide additional enhancements and extensions to the WS-BPEL specification. People extensions allow you to specify human interactions. Java extensions allow for tighter integration with the underlying Java implementation. Quality of service extensions support executing long-running business processes in an enterprise environment where transaction capabilities are an important consideration.

Run-time aspects of WS-BPEL

- WS-BPEL is only concerned with the execution semantics of the business logic
  - ▶ It makes no assumptions about run-time infrastructure aspects, such as transaction boundaries, data representations, locating service endpoints, choosing service bindings, or enforcing quality of service
- IBM defines specific attributes for running business processes within the business process choreographer of WebSphere Process Server

Process Type	Microflow	Long-running
Transactions	One transaction for the entire process	Transaction boundaries can be set between each activity
Persistence	None	Processes can be quiesced to a database and restarted
Crash Recovery	None, execution is completely transient. f the server stops, process state is lost.	Process can resume from the last checkpoint
Parallelism	None, strictly single-threaded	Flow activities can run in parallel
Interruptible	NO	YES
Asynchronous	NO	YES
C l ti	NO	YES

It is important to understand some of the runtime specific areas of support and BPEL extensions before going any further. Even though the goal of BPEL is to separate business logic from the underlying implementation, there are some implementation details that you need to be aware of in order to construct a business process. Certain extensions will restrict the capabilities and BPEL constructs available during design time. Many of these details are related to the IBM implementation of BPEL and are not outlined in the BPEL specification.

These runtime specific details are divided into the two primary areas of Uninterruptible, short-running business processes and Interruptible, long-running business processes.

The Business Process Choreographer runtime supports executing business processes in different ways and provides different capabilities depending on the type of process. For example, a transaction is considered one uninterruptible process that is used to run the entire business process. If the transaction consists of five steps, they will all run under a single Java EE transaction. A transaction can be either a new transaction initiated on the server or it can be a transaction passed in by a client. If it is passed in by a client, it is the responsibility of the client to commit the transaction when the business process is returned. If the business process engine starts a new transaction, the transaction is committed when the business process completes.

With an uninterruptible, short-running business process, a failed transaction will result in all the completed activities of the process being rolled back to the beginning of the process or back to the client that passed the transaction. Because all information is stored in memory, there is no persistence and all information is lost in the event of a failure. Because all processing is done on a single thread, there is no capability for parallelism. Even if the process was modeled in a parallel manner, the business process engine will alternate between the different paths, simulating parallelism. However, this is not a true multi-threaded parallel type of runtime. All processing is synchronous and no correlation is provided.
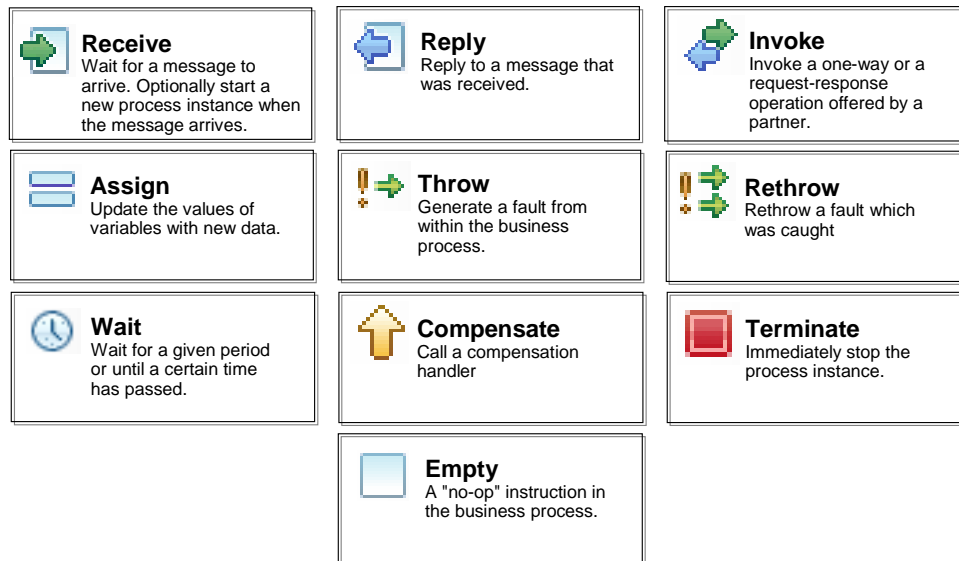
Run-time aspects of WS-BPEL (continued)

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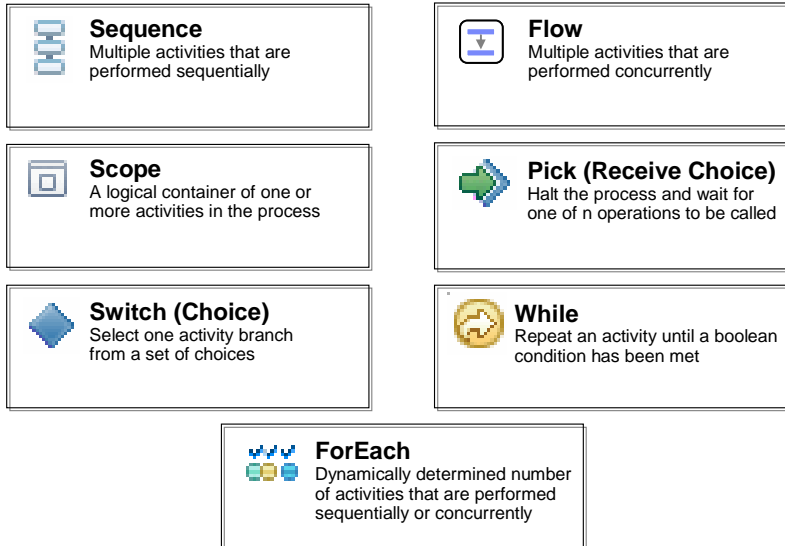| Process Type	Microflow	Long-running
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C l ti	NO	YES

With an interruptible, long-running business process, business process execution consists of multiple transactions. For example, a loan approval process can potentially take a week or longer to complete and the standard server transaction cannot be held open that long. For this reason, there are multiple transactions at each step of the business process. For instance, one step of the loan approval process might be obtaining the credit rating for the applicant, which would be one separate transaction. There would be another transaction for the approval step. This separation of process steps provides fault tolerance because if a specific part of the process fails, it does not cause the entire process to fail. The process can be resumed and completed at a later time. Additional processing can also be done to recover from the failure. Another feature of an interruptible process is persistent state. This allows for resumption of a process in the event of failure or for exits to break out of the process for a task requiring human intervention such as a loan approval by a loan officer. Once the approval is given, the process can resume at the next step in the process. Multiple threads can be created, allowing flow activities to run in parallel. Asynchronous processing provides better stability, fault tolerance and persistence. A variety of messaging queues are used internally to distribute workload and establish transaction boundaries to indicate units of work. Correlation is provided, ensuring outside requests coming in to a business process are routed to the correct instance.

Overview of WS-BPEL basic activities

Receive
Wait for a message to arrive. Optionally start a new process instance when the message arrives.

Reply
Reply to a message that was received.

Invoke
Invoke a one-way or a request-response operation offered by a partner.

Assign
Update the values of variables with new data.

Throw
Generate a fault from within the business process.

Rethrow
Rethrow a fault which was caught

Wait
Wait for a given period or until a certain time has passed.

Compensate
Call a compensation handler

Terminate
Immediately stop the process instance.

Empty
A "no-op" instruction in the business process.

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Here is an overview of the basic BPEL activities which are used primarily to carry out the different steps in the business process. The Receive activity is an asynchronous activity which can be added to a business process. When a Receive activity is reached, the business process will halt and wait for a specific operation to be called from an outside location, in theory, synchronizing the business process with an outside action. When the operation is called, the business process will continue. The Receive activity is a blocking wait. The Reply activity is used in conjunction with a Receive activity when a request/response is used by an outside action to communicate with the business process. Invoke activities are the main activities which interact with outside entities and service providers. Each Invoke activity will specify a specific Partner Link and operation on that partner. Depending on the type of interface of the partner, the Invoke activity will specify variables for the request and response message. Assign activities are the primary way that data is transformed and moved from one variable to another. Business processes can fail at a business process level, which is something that is acceptable and can be part of the business process model. When a Fault occurs in a business process, the Fault Handler is invoked and the fault can be managed at the current scope or thrown to higher level scopes, signaling that the business process has failed. Throw activities are for indicating some type of failure has occurred within the business process and it needs to be handled either in the business process or passed back to the client because no further processing can occur. If a failure is caught, a Rethrow activity can be used to throw the same failure without needing to use an Assign activity to move the failure contents from one failure to another. The Wait activity allows for a business process to stop and wait for a specific amount of time. During this time, navigation will not occur on the path of the Wait activity but can continue on other parallel paths. The Compensate activity is used to call a Compensation Handler which contains business processing to undo or reverse processing for completed steps in a business process. The Terminate activity can be used in a business process where all processing should end with no way of compensating or performing reverse processing on the instance. The Empty activity acts as a placeholder in a business process for a subsequent activity that might be implemented. When the Empty activity is reached, the business process continues without stopping, treating the activity as a no op. The Empty activity can be changed later to any of the other activity types. The Rethrow and Compensate activities were newly supported in WebSphere Process Server V6.

Overview of WS-BPEL structured activities

Sequence
Multiple activities that are performed sequentially

Flow
Multiple activities that are performed concurrently

Scope
A logical container of one or more activities in the process

Pick (Receive Choice)
Halt the process and wait for one of n operations to be called

Switch (Choice)
Select one activity branch from a set of choices

While
Repeat an activity until a boolean condition has been met

ForEach
Dynamically determined number of activities that are performed sequentially or concurrently

Here is an overview of structured activities, which are used to perform structured programming within a business process. Activities can be run one after another using the Sequence activity, or they can be run in parallel with the Flow activity. A Scope activity defines a collection of activities with their own set of variables, fault handlers, a compensation handler, and event handlers. The Pick activity, also known as Receive Choice, is similar to a Receive activity in that the business process will stop and wait at the activity until a message arrives. In this case, there are several potential operations, and when a matching request arrives, that branch of the Pick is executed. The Switch activity, also known as Choice, provides a way to perform conditional logic in a business process. The While activity is a way to repeat a group of activities based on a boolean condition which is evaluated before running each iteration. Finally, the ForEach activity provides a way to perform a dynamically determined number of activities either sequentially or concurrently.

Section

Summary

WS BPEL support overview

This section will summarize the presentation.

Summary

- WS-BPEL provides a standard-based language for defining the business process model independent of the implementation

- BPC provides the runtime to support WS-BPEL and additional extensions provided by IBM for running processes in an enterprise environment on WebSphere Process Server

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In summary, WS-BPEL provides a description language for defining business processes independent of the implementation. WebSphere Process Server and WebSphere Integration Developer V6 provide support for almost all of the WS-BPEL 2.0 specification and address several issues that have been raised with it. There are also several enhancements, like event and compensation handlers, compensate activity, and rethrow, all built upon the core support originally provided in WebSphere Business Integration Server Foundation V5.1.

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