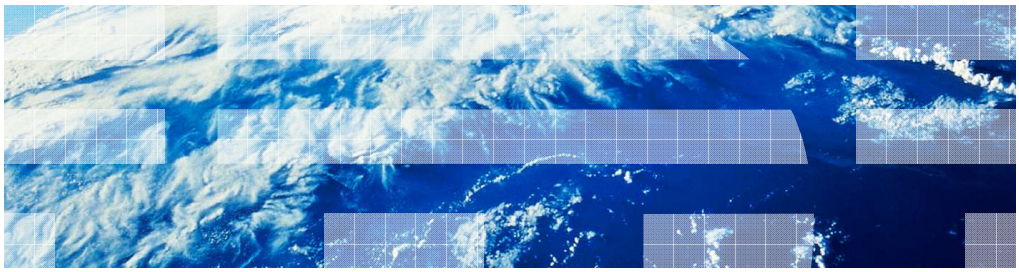
# Business Process Management
## IBM Business Process Manager V7.5

## BPM Advanced capabilities



WebSphere. software



IBM Business Process Manager is a comprehensive and consumable business process management platform that provides visibility and management of your business processes. It includes tools and run time for process design, execution, monitoring, and optimization. It is also designed to help process owners and business users to engage directly in the improvement of their business processes.

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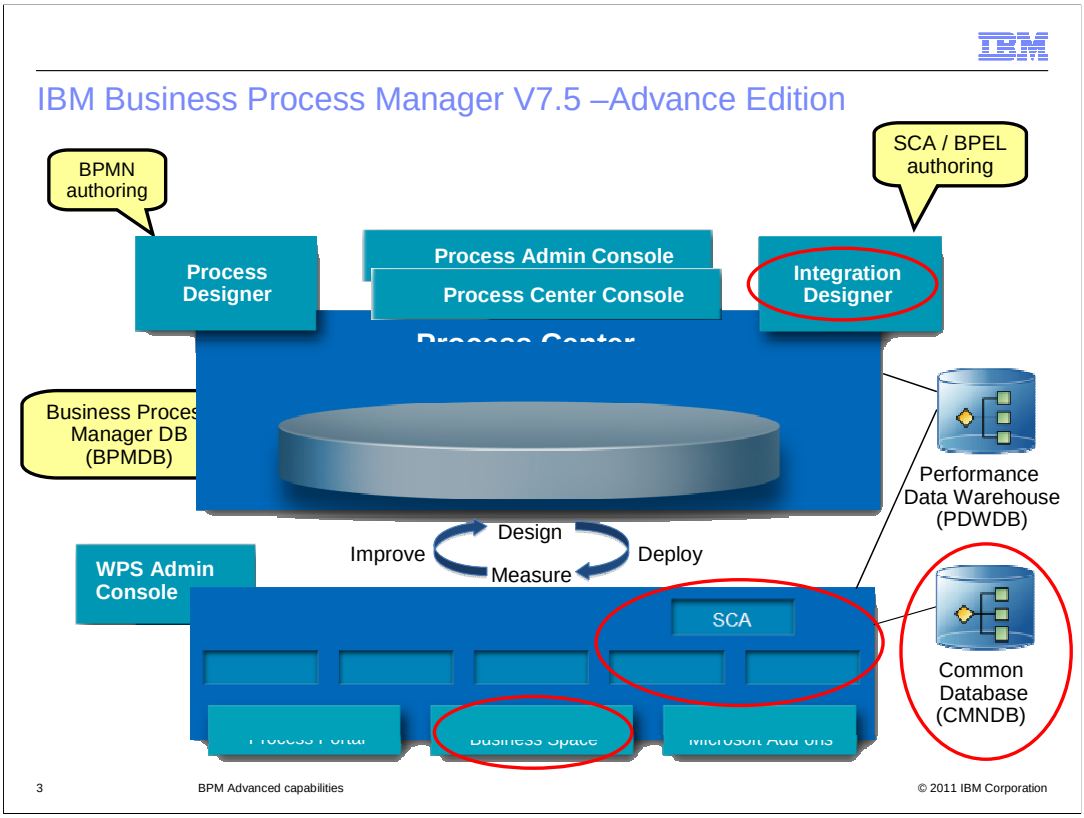
Business Process Manager Advanced is an extension of BPM Standard. Therefore all of the capabilities that are available with BPM Standard are also available with BPM Advanced. This presentation will only discuss those capabilities that introduced with BPM Advanced.

Listed here are the key capabilities that are introduced with the BPM Advanced.

Each of the capabilities listed here is discussed at a level that will provide insight as to what they do and how they fit into the overall architecture.



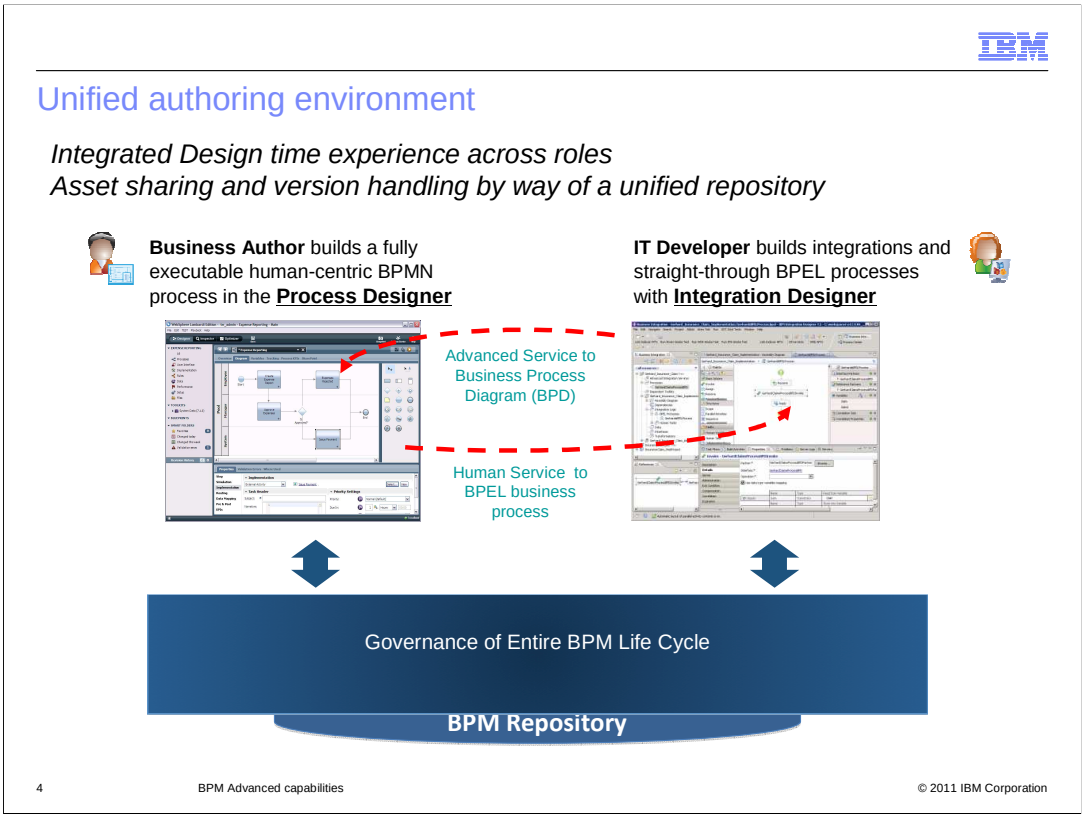

Before diving into the capabilities, lets take a moment to review the BPM Advanced architecture.

The items highlighted with the red circles are the parts introduced with the advanced configuration.

This picture shows both the development and the runtime aspects of the system. The BPMN authoring is done using the Process Designer and the SCA/BPEL authoring is done using the Integration Designer. They share artifacts using the common BPM repository. Both authoring environments can contribute to the business process application which is managed and versioned by the Process Center.

The runtime component is the Process Server. The process applications are deployed using the Process Center or scripts for off-line servers. At runtime, the BPMN components use the BPM repository and the SCA/BPEL components use the Common database. They both run in the same JVM.

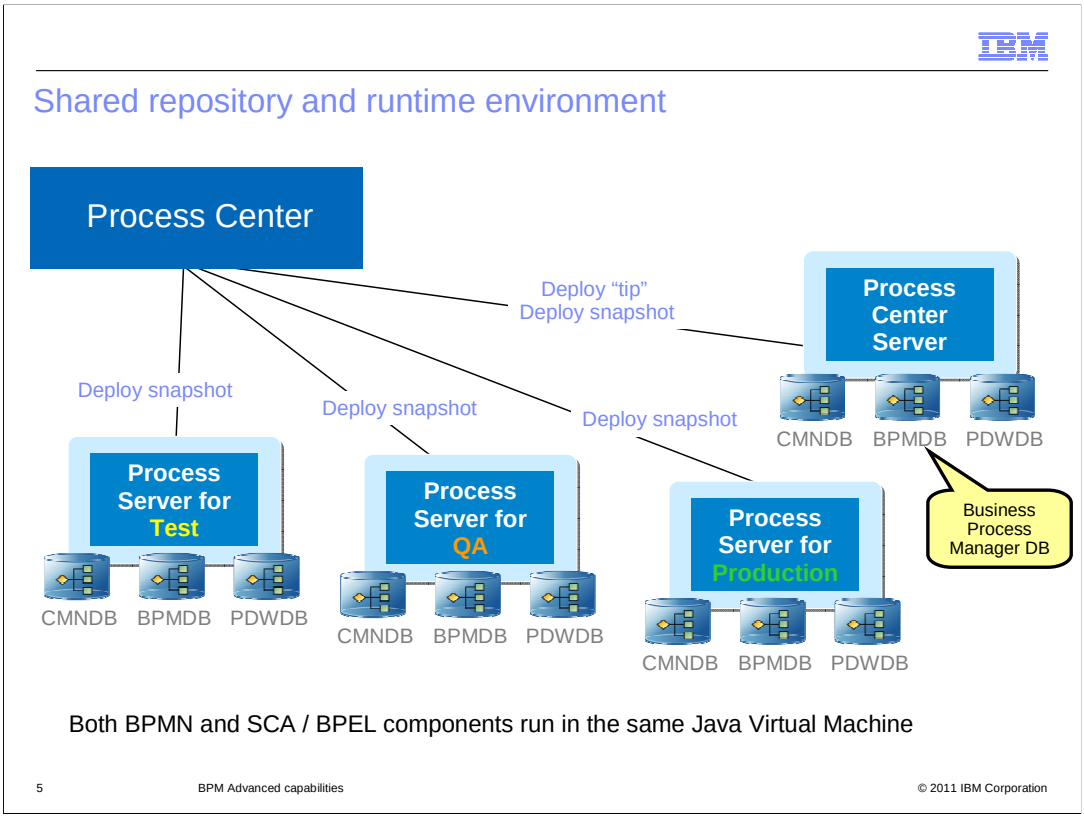
The net result is a unified authoring and runtime environment for both BPMN and SCA/BPEL.




There are two authoring tools, the Process Designer and the Integration Designer. Each tool supports different development roles. The Process Designer is for the business process developer creating BPMN processes. The Integration Designer is for the IT developer who creates the implementations for the advanced services used to integrate disparate systems. You will learn more about advanced integration services when the WebSphere Process Server capabilities are presented.

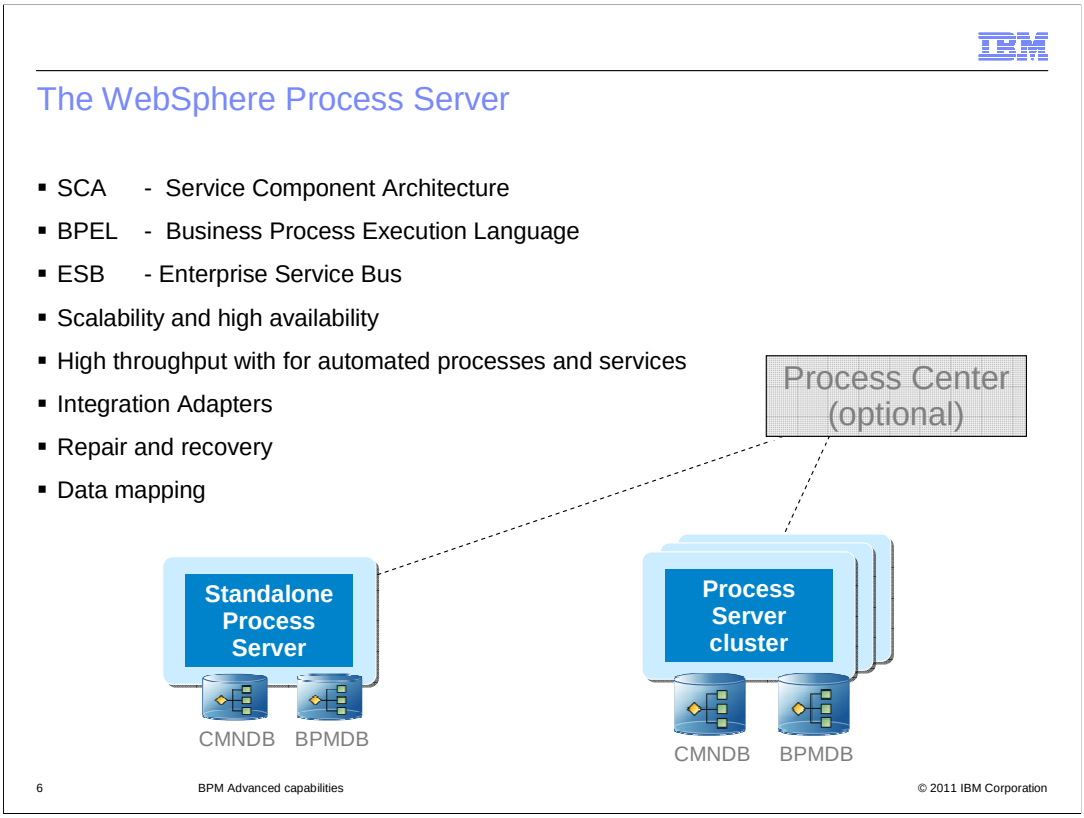
The Integration Designer has features to create process applications and toolkits and bring them into an Integration Designer workspace. Once the process application or toolkit is in the workspace, service implementations, interfaces and business object can be added to it.

It is also possible to take a Human Centric business process that was developed in the Process Designer and include it in a BPEL component.




During development the business process manager database for the Process Server Center contains all the versions of the process applications. This includes the SCA / BPEL components that have been added to a process applications or toolkits. The business process manager database is shared between both the Process Designer and the Integration Designer.

When the BPMN and SCA / BPEL components are running in a server, they are running in the same Java Virtual Machine. This might seem trivial, but keep in mind that both of these runtime process models come from different products that have converged. An alternative way to integrate them would have been to use separate JVMs and use inter-process communication mechanisms for sharing data and invoking activities between the two. By using a single JVM the communication is more direct and efficient, and the overall overhead of managing the JVMs is reduced.




At the core of the BPM Advanced configuration is the WebSphere Process Server. The WebSphere Process Server provides many features which are essential for integrating disparate systems within an enterprise. The capabilities listed here are all available to the process developer using the Process Designer,

as Advanced Integration Services.

To use them with the Process Designer,

make a connection to the Process Center,

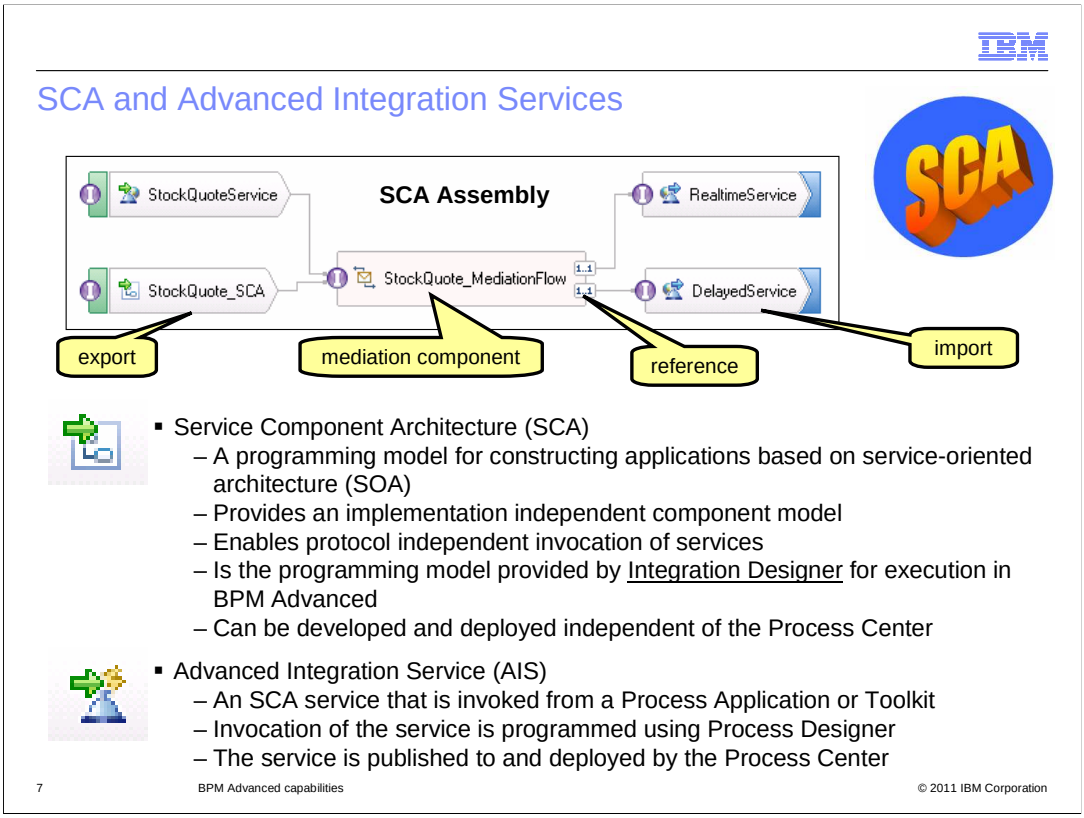
bring the process application or toolkit into the Integration Designer workspace.

add the Advanced Integration Service to the process application or toolkit and publish to the Process Center.

At the heart of the ability to provide the Advanced Integration Services to the Process Designer is the Service Component Architecture. This along with the other capabilities are presented in subsequent slides.

**Note** that the Process Center is not required in order to take advantage of these capabilities if you are not creating BPMN process applications.

This is in line with the WebSphere Process Server heritage and provides 100% compatibility with the previous release of WebSphere Process Server.




The Service Component Architecture (SCA) is a set of specifications which describe a model for building applications and systems using a Service-Oriented Architecture. SCA extends and complements prior approaches to implementing services, and SCA builds on open standards such as web services.

SCA encourages a service oriented architecture organization of business application code based on components that implement business logic. Each component provides their capabilities through service-oriented interfaces, which consume functions offered by other components through service-oriented interfaces, called service references.

SCA divides up the steps in building a service-oriented application into two major parts;

The **implementation** of service components which provide services and consume other services.

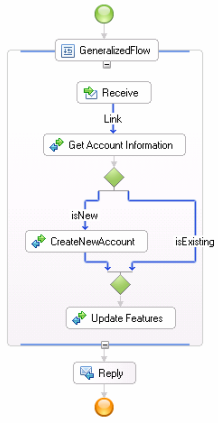
The **assembly** of components to build business applications, through the **wiring** of service references to services.

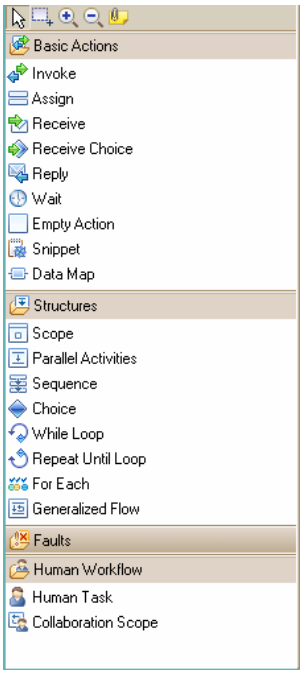
SCA emphasizes the decoupling of service implementation and of service assembly from the details of infrastructure capabilities and from the details of the access methods used to invoke services. SCA components operate at a business level and use a minimum of middleware APIs.

The Advanced Integration Service is a new export type introduced with BPM Advanced for integrating with the Process Center and Process Designer. The icon for the Advanced Integration Service is the service bell with a lightning bolt.

## BPEL

- Business Process Execution Language
  - Standard
  - XML based business process modeling language
  - Describes the execution semantics for business processes
  - Short and long running transactions
  - Events
  - Data mapping
  - Fault handling
  - Typical control structures
- Integration Designer
  - Graphical editor
  - Test environment







The business process execution language is a standard XML based, modeling language for describing the execution semantics of a business process.

The Integration Designer provides a graphical editor for creating your BPEL business processes. The palette of available elements is displayed on the right. You can see that there are elements for receiving and waiting for incoming events, and invoking other SCA services and Java Snippets. There is also a range of control and scoping structures, as well as fault handling and human interactions.

You can create short or long running business processes that are fully transactional and you can create parallel or sequential flows.

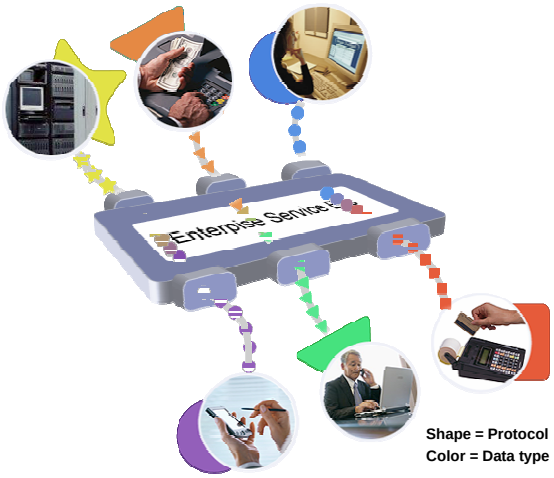
The Integration Designer also provides a full function test and debug environment for verifying the behavior of the your BPEL business processes.

ESB

***An enterprise service bus (ESB) is a flexible connectivity infrastructure for integrating applications and services***

***An ESB performs the following between requestor and service***

- **ROUTING messages between services**
- **CONVERTING transport protocols between requestor and service**
- **TRANSFORMING message formats between requestor and service**
- **HANDLING business events from disparate sources**

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An enterprise service bus provides a flexible connectivity infrastructure for integrating applications and services, enabling composite applications to be built as a loose coupling of independent services. It is at the heart of your service oriented architecture, reducing the number, size, and complexity of interfaces and connections that must be defined and maintained.

There are four primary functions provided by an enterprise service bus:

Its first responsibility is the routing of messages. Rather than the service requestor calling directly to the service provider, the requestor sends the request to the ESB, and the ESB then is responsible for making the call on the service provider.

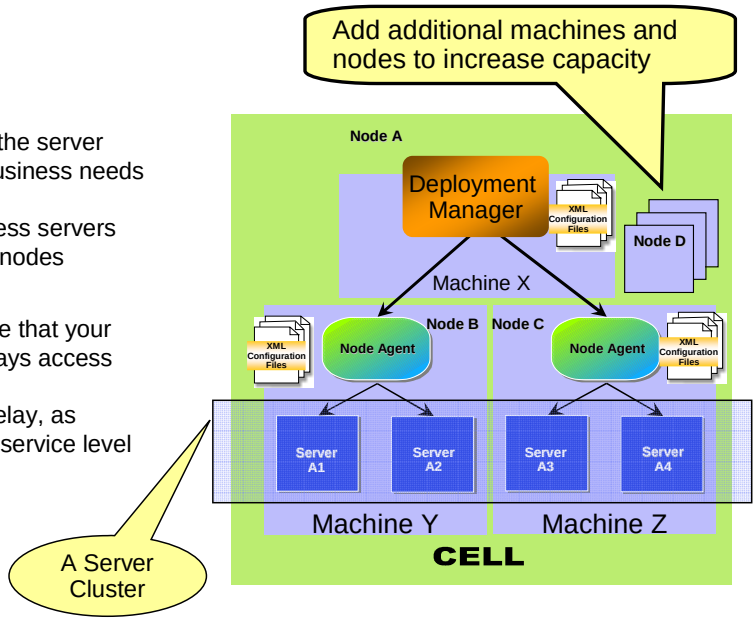
Secondly, it is responsible for converting transport protocols. When a service requestor calls directly to the service provider, they need to use the same transport protocol. The ESB enables the service requestor to use one transport protocol while the service provider uses another.

Thirdly, it is responsible for transforming message formats. By eliminating the direct call from the service requestor to the service provider, the ESB is capable of modifying the message so that the interfaces used by the requestor and provider do not have to be identical. In these cases of message transformation, the interfaces are semantically the same yet syntactically different.

Finally, the ESB is capable of handling business events from disparate sources. Therefore, the same service provider that is responsible for performing some particular business function can be indirectly invoked from a variety of application contexts.

## Scalability and high availability

- Scalability
  - The ability to grow the server topology as your business needs grow
    - Add more process servers
    - Add more host nodes
- High availability
  - The ability to ensure that your customers can always access the applications
    - With minimal delay, as defined in your service level agreements







As an architect or system administrator using WebSphere Process Server to implement your business processes, you expect to have a system that will tolerate failure and allow for maintenance without the loss of data or loss of service.

You also need to be able to add processing capacity, to grow your systems to meet increased user demand.

WebSphere Network Deployment, which is the foundation for WebSphere Process Server, provides the ability to create logical groups of servers, with the servers being distributed across one or more machines.

This capability provides a mechanism that tolerates failover, and allows you to apply maintenance to some servers while other remain running. You can grow or shrink capacity by adding and removing servers from the group, all with a single point of administration.

The nodes can be on separate boxes or they can be on the same box. They are shown here on separate boxes and the deployment manager is on a separate machine as well. To host more than one node, the host machine must have ample memory, disk space, and processor capacity.

All four servers in the **server cluster** are identical.

> If Machine Z needs to be taken off-line for maintenance then Machine Y will still have two servers available to service requests.
>
> If any one of the servers experiences a problem and depending on how the system is configured, it is possible for one of the remaining three to recover the work in progress. This is accomplished by failing over to one of the remaining servers in the server cluster.
>
> Adding additional application servers to a server cluster on the same machine is called ***vertical*** scaling.
>
> Adding additional application servers to the server cluster on a different machine is called ***horizontal*** scaling.
>
> To **scale up** the capacity, one or more machines can be brought online and the new nodes can be federated into the Cell and more servers can be added to the cluster.

## Integration adapters


- Adapters provide
  - Enterprise information system (EIS) integration
  - Service oriented approach
  - Encapsulation of functions and events as Business Objects.
  - A consistent framework for access to back-end systems
  - Consistent configuration, deployment, and administration
- Adapters can be categorized as:
  - Application
  - Technology
- Two major types
  - WebSphere Business Integration Adapters - adapters used with WebSphere brokers
  - WebSphere Adapters - adapters based on Java™ 2 Enterprise Edition (J2EE) Connector Architecture (JCA), version 1.5 specification




Adapters provide a service-oriented approach to integrating enterprise information systems.

In general, EIS applications are fairly sophisticated, have been in place for a long time, and have a fairly high degree of complexity. Each system generally has a set of application programming interfaces (API) that expose the business activities or business events, allowing you to interact with these activities using fine-grained, low-level programming constructs.

Adapters abstract and expose the EIS business functions and events in the form of business objects. Instead of dealing with the low-level API of the application, you interact through the adapter and business object which encapsulate the functions and events.

**For example**, an adapter can be passed a business object of type purchase order with the function of create.

Another key benefit of adapters is that they allow you to build and compose process integration applications based on several EIS services in a quick and efficient manner. They save time and money that would be spent building and maintaining custom modules just for interacting with the enterprise information system.

In addition, adapters provide a consistent framework for accessing back-end systems, and a consistent means of configuration, deployment, and administration.

There are two broad categories of adapters, application adapters and technology adapters.

Application adapters are designed to interface with a specific application programming interface for a specific version of an enterprise information system.

Technology adapters are designed to support a standard technology interface to any enterprise information system that supports the same interface.

There are two major types of adapters, the WebSphere Business Integration Adapters which can be used to integrate EIS applications with several different IBM® WebSphere brokers, (in this case, the WebSphere Process Server would be the broker); and the WebSphere Adapters, which are adapters based on the J2EE Connector Architecture (JCA) version 1.5 specification.

## Repair and recovery

- Automatic retries
  - Built-in default is three
- Manual repair
- Compensation
  - for long running BPEL processes
- Store and forward
  - Explicitly configured
  - Qualifier on the interface of the component or non-SCA exports
  - Holds messages until the service is available again




With WebSphere Process Server there is a complete infrastructure for managing business exceptions and runtime faults.

It begins with the automatic retries.

A long-running BPEL process spans multiple transactions. If a transaction fails because of an infrastructure failure, the Business Flow Manager provides a facility for automatically recovering from these failures. When a message fails, it is automatically retried up to the retry limit. When the retry limit is reached, it is held so that it can be manually repaired.

With the use of the enterprise service bus there is another level of retry and recovery. There are mediation flow primitives that let you catch the fault and programmatically mediate their resolution using retries, redirection and if necessary passing it on to the runtime infrastructure.

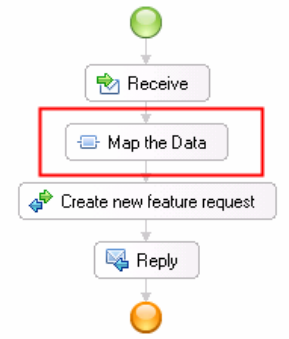
The manual recovery consists of working with failed messages that have been held, and resubmitting them once the failure has been addressed.

Compensation is a mechanism that is available for BPEL processes. It addresses the problem of recovering from a long running business process, where previous activities have already been committed. With compensation, the operations to un-do the committed work are specified in a ‘compensation scope’ which is triggered by a the fault handing mechanism.

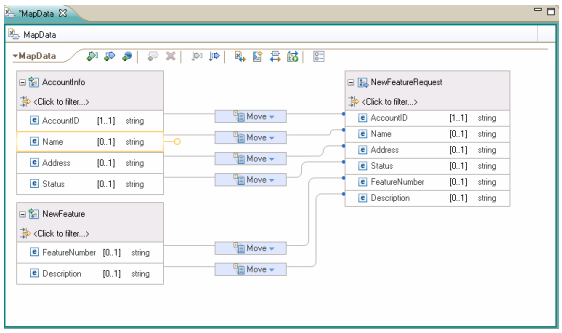
When a service becomes unavailable, the first failed event (and possibly more) are sent to the failed event manager. However, subsequent events are stored if the system encounters a service unavailable exception that matches the one set in the store-and-forward qualifier. The most common application of the store-and-forward qualifier is to detect when a service is unavailable. By defining different runtime exceptions for the qualifier it can also be used to detect other problems such as “not authorized” exceptions.

## Data mapping

- XML map
  - Generates XSL style sheet
  - Transformation done at runtime
- Editor
- Transforms
  - Move, merge, concatenate, …
- Functions
  - XSLT and XPath




XML map editor

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When integrating services, you almost always need to transform the data into a format that the receiving service can process.

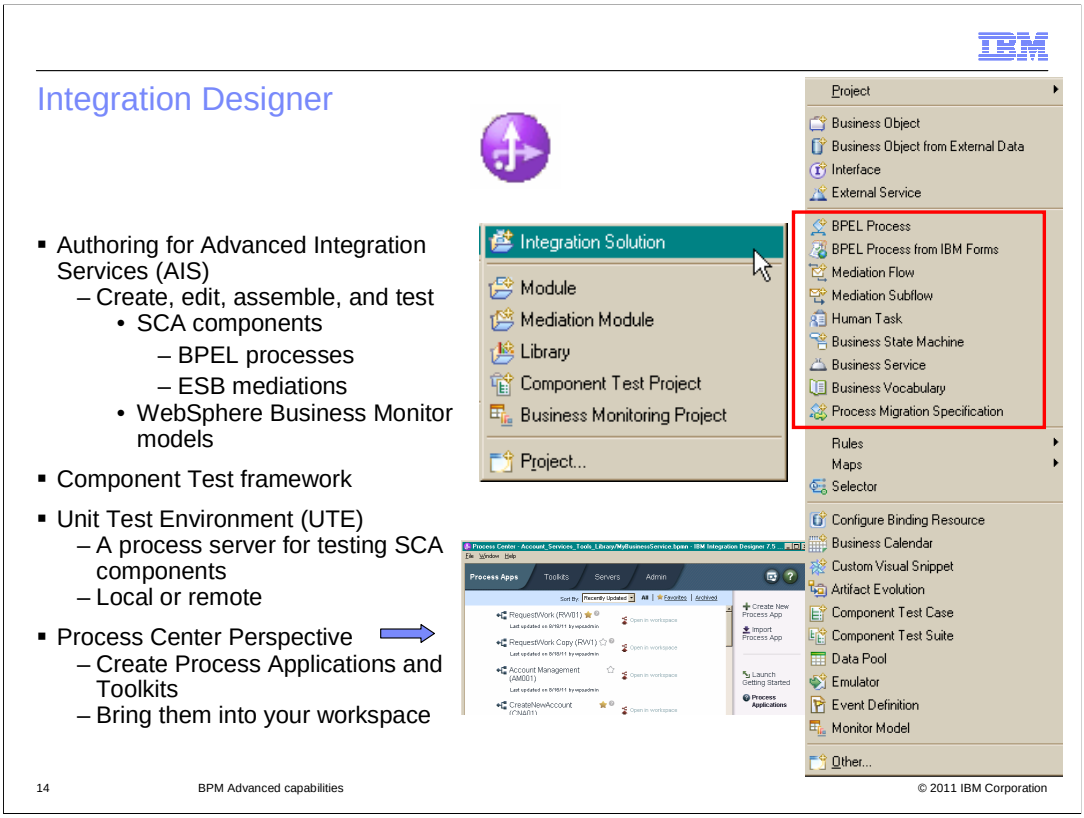
You can use the XML map editor to create an XML map between input and output data. An XSL style sheet is generated from the XML map and performs the transformation at runtime.

To use the data mapping feature, you place a map element before the service you want to invoke. In the XML map editor, you then wire the elements that you want to map and or transform, to the output variable.

The XML map editor provides a complete range of ready-made transforms, each of which performs some action on the input data. You can move the data element to the output or you can apply transformations such as concatenate, substring, merge, remove whitespace, and much more.

The XML map editor also provides XSLT and XPath functions as primary transformations.

XSLT 1.0 and XSLT 2.0, XPath 1.0 and XPath 2.0 functions are provided.




The Integration Designer is the Eclipse based, software development tool used to create, edit, and test all of the features that are introduced with the Advanced Process Server.

Here you can see that you can create modules, mediation modules, libraries, component test projects, and business monitoring projects.

The part of the second menu that is highlighted in red, shows that you can create BPEL processes, mediation flows, human tasks, and state machines. These are all SCA components that can be used by other SCA components. They are linked together using the SCA assembly diagram.

Once the services and their components have been created they can be tested using the component test framework which uses the Unit Test Environment.

The Unit Test Environment can be on your local development system or can be on a remote server somewhere else in your network.

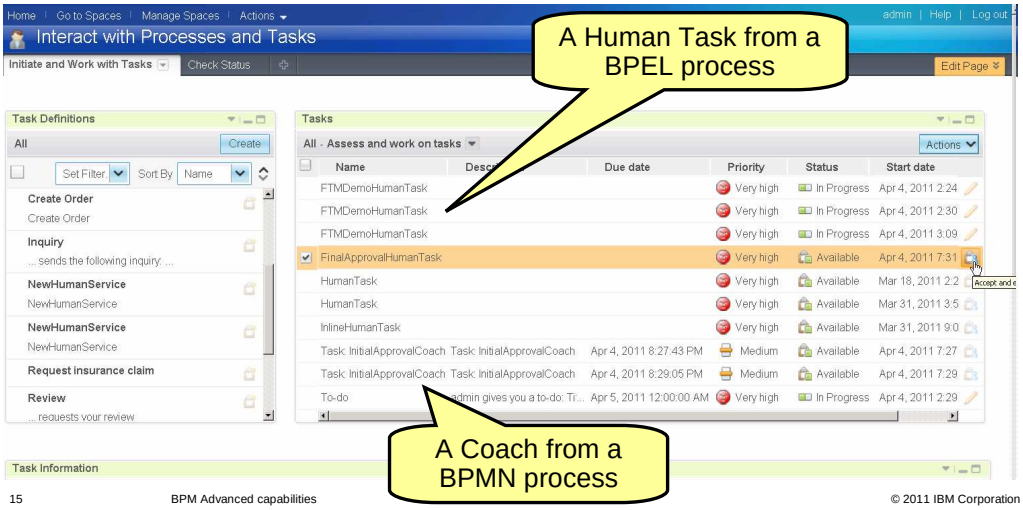
After the services are thoroughly tested they can be deployed to a Process Server and run as they are;

or they can be associated with a process application or toolkit and run as part of a BPMN business process application.

The Integration Designer provides a way to retrieve process applications and toolkits from the Process Center by way of the Process Center perspective.

## Federated task management

- Business Space widget to manage both
  - BPMN processes (from Process Designer)
  - BPEL processes (from Integration Designer)

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There are two different kinds of business processes that you can create and work with when using Business Process Manager Advanced.

There are the BPMN business processes that are created in the Process Designer and the BPEL business processes that are created in the Integration Designer.

The BPMN business processes can be exercised using the Process Portal and the BPEL business processes can be exercised using the Business Process Choreographer Explorer.

The real value of Business Process Manager Advanced is the ability to bring these two different programming models together into a single integrated business process flow.

The Business Space is used to create a common end-user experience by introducing the federated tasklist.

When shown in the federated tasklist, the origin is not displayed. Here the task names indicate the origin for demonstration purposes.

## Summary

- Unified authoring environment for
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  - BPEL
- Shared repository and common runtime environment
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- The WebSphere Process Server
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- Integration Designer
  - Authoring for SCA and Advanced Integration Services
- Federated task management




Business Process Manager Advanced adds the capability of using advanced integration services to BPMN business processes. They are brought together through the shared BPM repository and a unified runtime.

There are two separate development tools, based on the development role. The Process Designer for creating, editing and testing BPMN business processes and the Integration Designer for creating, editing and testing the advanced integration services.

An advanced integration service can be any SCA component that has an SCA export.

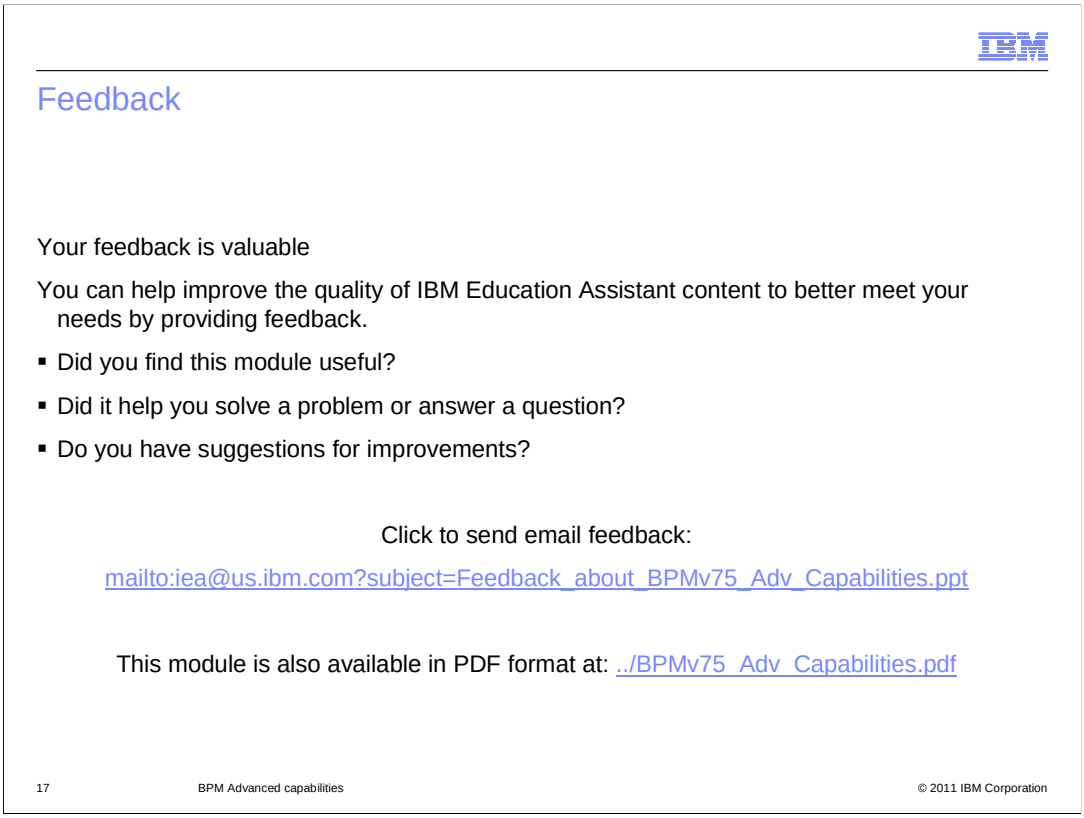
The SCA components bring a wide range of integration capability to the Business Process Manager Advanced;

adapters for integrating with other enterprise information systems, data mapping, and mediations using the enterprise service bus.

The advanced integration services also provide high throughput and scalability for automated processes that do not require human interactions.

There is 100% compatibility with previous versions of WebSphere Process Server, which means that

the SCA components can also be run directly in a Process Server without the use of the Process Center.

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