

Interstage: Fujitsu's Application Platform Suite

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Flexibility, transparency, and continuity are important features for current enterprise IT systems. Interstage, Fujitsu's application platform suite, provides these features by supporting Service Oriented Architecture (SOA) and ensuring high operability with open standards and high compatibility between its different versions. In this paper, we discuss the roles and benefits of Interstage in these aspects using case examples.

1. Introduction

Corporations are facing business changes such as new competitive environments due to globalization, new legislation for increasing corporate responsibility, and diversified and rapidly changing customer tastes. Enterprise IT systems are expected to be flexible enough to address these environment changes as well as to be transparent so users can understand what is happening within and around a corporation.

On the other hand, continuity is a key requirement for enterprise IT systems. The components of IT infrastructures such as operating systems and hardware have been updated to pursue the latest technologies, and business applications have needed to be tested, modified, and sometimes replaced every time an IT infrastructure is updated — which is generally a costly and time-consuming process. To reduce the operational costs of their IT systems, corporations must be able to use their business applications on different IT infrastructures without modification and thereby achieve continuity.

Interstage, Fujitsu's application platform suite, provides 1) advanced support for Service Oriented Architecture (SOA) so enterprise IT

systems can be made flexible and transparent and 2) high operability with open sources and high compatibility between its different versions to ensure continuity of enterprise IT systems.

In this paper, we discuss the concept of Fujitsu's Interstage application platform suite and then discuss how Interstage gives flexibility, transparency, and continuity to enterprise IT systems. Lastly, we list the Interstage products that provide capabilities to support these features.

2. Interstage concept

This section describes the role of Interstage using the simplified IT system architecture shown in **Figure 1**.

The basic idea here is that Fujitsu's Interstage application platform suite separates IT systems into an IT infrastructure layer and an IT business application layer to enable the following:

- 1) Application of SOA to the IT business application layer to make IT systems flexible and transparent. Interstage enables IT systems to be built by combining components (services) with an open interface and

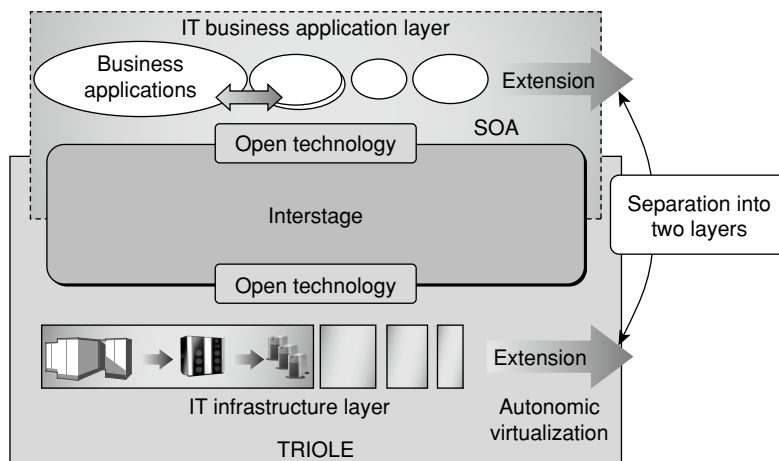


Figure 1
Fujitsu's model for IT system architecture.

monitors transactional data transferred between components.

- 2) Continuous use of business applications by absorbing the impacts of changes in the IT infrastructure layer. Interstage provides an invariant open interface to business applications and keeps the business application layer invariant when changes are made to the IT infrastructure layer.

In the following sections, we focus on how Interstage supports SOA and how it absorbs changes in the IT infrastructure layer.

3. Interstage's approach for SOA

SOA is “a client/server software design approach in which an application consists of software services and software service consumers,” and “its primary intentions are business-level software modularity and rapid, non-intrusive reuse of business software in new runtime contexts.”¹⁾ For the last few years, many corporations have adopted SOA for their IT systems and obtained experience and know-how about what services need to be created and reused. Now that there is a variety of middleware that promotes the reuse of services, corporations can realize SOA and benefit from it easier than before.

Figure 2 shows a model that Fujitsu suggests for applying SOA to enterprise IT systems by using Interstage. In this model, the business process is defined by the workflow, and each operation of a business process calls the required business services. Then, the business services are mapped, executed, and automatically logged through an Enterprise Service Bus. The service monitoring visualizes the real-time business environment by analyzing the business processes. All these services are managed and governed by a registry and repository to give enterprise-wide control of services. The Interstage products are listed and summarized in Section 5, “Interstage Suite.”

With this model, corporations can easily create and reuse the necessary services and quickly change business processes by encapsulating the impact of the changes. Business processes are monitored, and any irregular activities will be reported to trigger the appropriate recovery process. Services across IT systems are governed, and corporate policies can be applied to all the services. IT systems based on this model have a high flexibility and transparency.

The key features of this model are 1) flexible use of services, 2) creation of services and preparation for reuse, 3) visualization of business

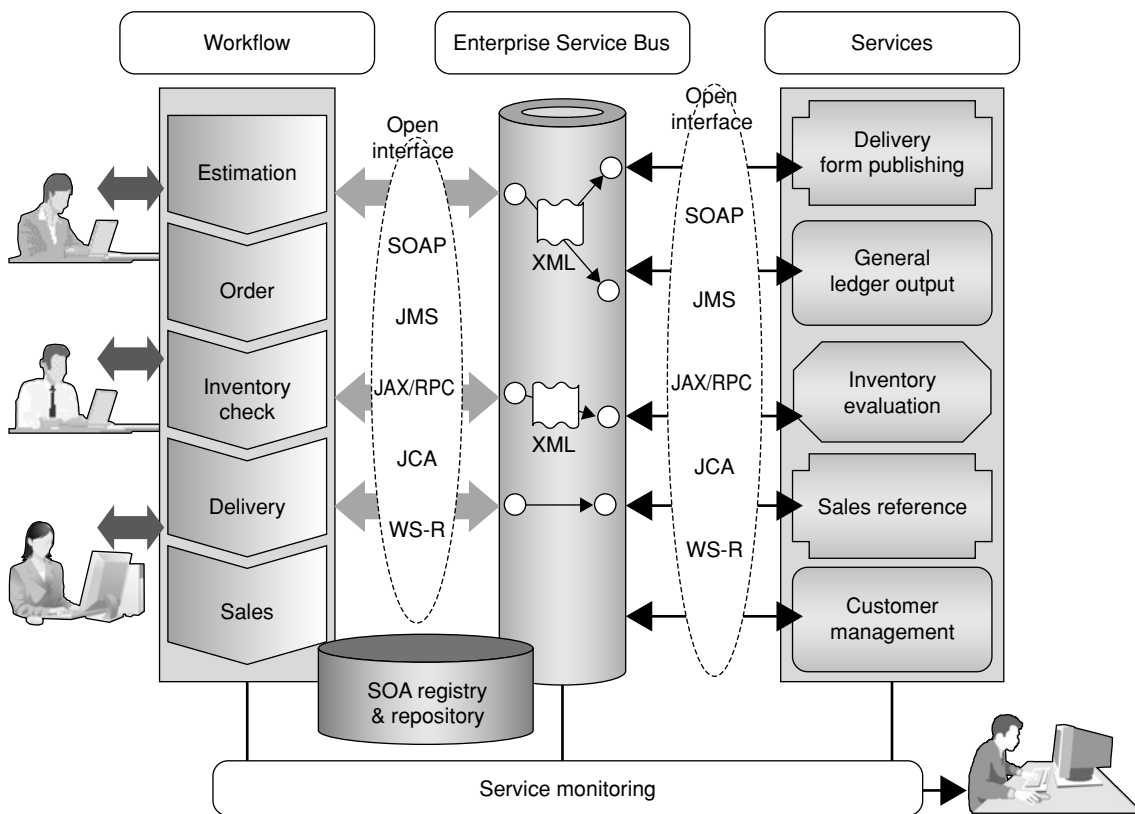


Figure 2
IT system model with SOA.

operations, and 4) management and governance of services. We discuss how Interstage realizes these features in IT systems in more detail below.

3.1 Flexible use of services

To make an IT system highly flexible so it can respond to changes, it is important to combine multiple services during system development. There are several methods for combining services, and here we discuss two major methods: combining services based on business processes and combining services based on the user's viewpoint.

1) Combining services based on business processes

Interstage allows new business processes to be designed by combining services using workflow technology. Building an IT system based on the workflow means not only being able to easily design optimum business processes but

also to prepare for future changes made to them. A system based on the workflow is highly flexible when the business processes need changing in the future because new services can be called simply by changing the workflow without modifying the applications.

Figure 3 shows an example of a large-scale product design system based on the workflow. This system handles more than 50 000 product parts, and there are different request regarding design, quality, and delivery materials, making it difficult to make systems that support the design process. However, the new workflow-based system increased the speed and quality of the design under diversified requests, creating and combining services for each operation based on the workflow.

2) Combining services based on the user's viewpoint

In addition to combining services in terms

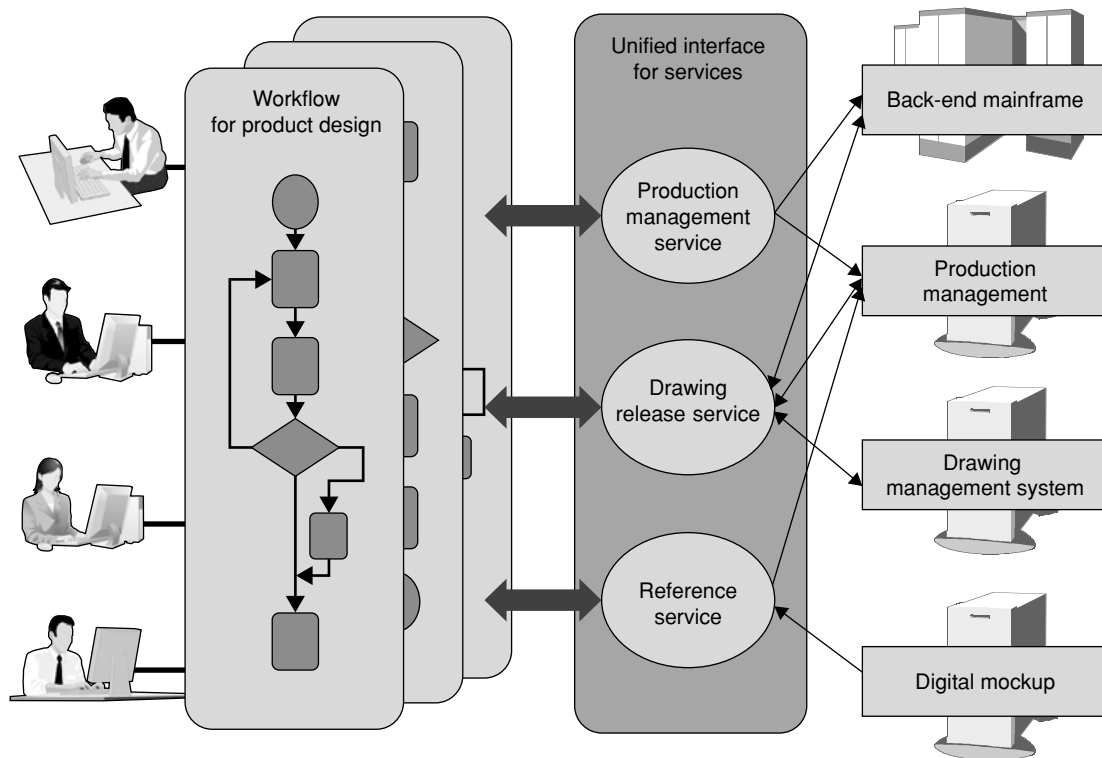


Figure 3
Service combination using workflow.

of the business processes, it is also important to combine services from the user's viewpoint. Interstage helps to combine services based on the user's viewpoint and experiences with its portal server. To benefit from services in a variety of contexts, the use of services should not be limited to the workflow. It is more straightforward to combine services for user viewpoints so users can obtain all the relevant information at a glance.

3.2 Creating services and preparing for reuse

There are two important issues when creating a service: how to make use of existing IT systems to reduce the time and cost of system development and how to prepare for future changes in the reliability and performance requirements.

- 1) Reliability and scalability expected for services

The starting point for building an IT system is apparently to meet the current requirements — neither over-specifying nor under-specifying them. The same is true for creating services. Services should be designed and developed for the current requirements, although they might be reused in the future by other systems. What is important here is that these services should be built on a platform that provides scalability and extensionality. Also, it should be possible to enhance the reliability in the future if necessary.

Interstage Application Server makes business applications highly reliable by providing functions such as hot standby, load balancing, automatic system resource tuning, and automatic system recovery. For example, Interstage monitors and senses the periods when an IT system is likely to consume all the available resources. Treating multiple business applications as a work unit, Interstage identifies and

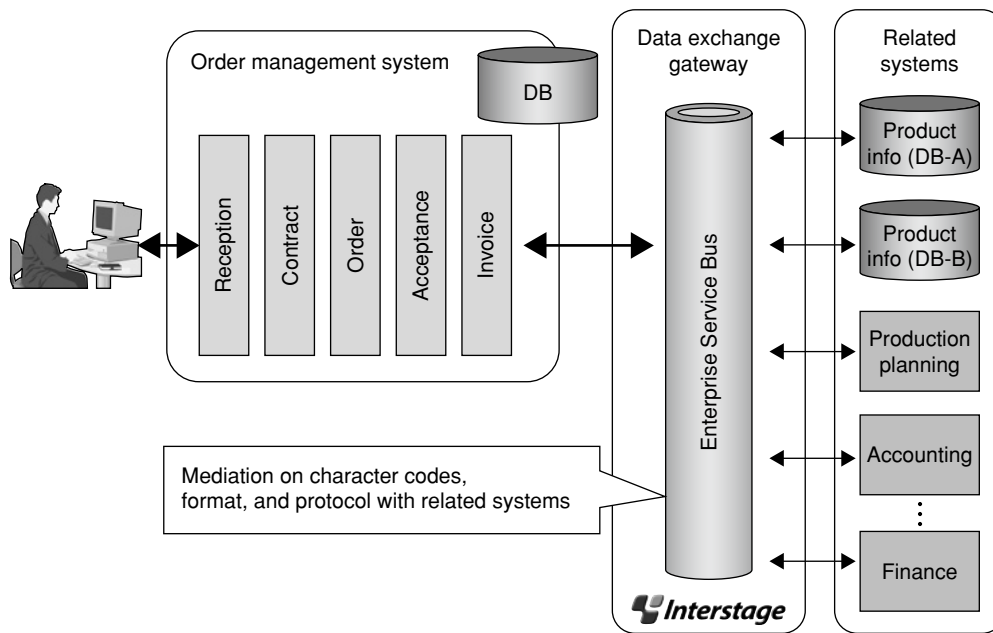


Figure 4
Standardized interface using Enterprise Service Bus.

automatically solves problems such as exceptions, program loops, deadlocks, and insufficient heap sizes for Java VM. The paper, “Problem Detection and Automatic Recovery of Business Applications,” elsewhere in this special issue discusses auto recovery by Interstage in detail.²⁾

2) Creating a service with existing systems

When creating a service, it is general to use as many existing systems as possible to reduce the time and cost of system development. However, in some cases the design of a service or interface cannot be freely decided due to the current system implementation, which correlates with other IT systems in a complex manner.

Interstage offers Enterprise Service Bus functionality to create an open-standard, XML-based, real-time interface from existing IT systems even in these cases. **Figure 4** shows that Interstage handles different data formats from a variety of services and opens the interface in a standard format to business applications. With Interstage, it is also possible to give a service a new Web service interface without changing the current interfaces (e.g., file exchange interface).

Kosuge and Morino described a variety of methods and classifications for making services using existing systems.³⁾

3) Another view on services

So far, we have focused on services as business operations. There are also services that are characterized by middleware functions but still can be considered as general services.

For example, there is a middleware service for the management of forms. Corporations have recently been required to control their forms more strictly because of legislation changes. For example, forms must now be in Portable Document Format (PDF) format and printable only by authorized persons. Because it is inefficient and insufficient to provide this kind of control at each application, there is a need for a common form service that can be used by every IT system.

Interstage List Works and Interstage List Creator offer a complete set of products for form management. By using Interstage’s form functionality as a service, it becomes possible, for example, to create a PDF file with monthly sales data aggregated from different IT systems and

control who can print managerial data.

Another example for middleware functions would be a batch service for monthly or daily processing or any process that is executed after a certain number of requests. Such batch processing is vital for enterprise IT systems, even in the context of SOA, and has to be executed. For example, business processes such as deliveries and purchase orders are executed in the most efficient delivery and purchase units rather than individually as the need arises (Figure 5). Interstage Job Workload Server provides an application platform for batch job application in an open environment.

3.3 Visualizing business operations

IT systems with SOA provide corporations

with the following advantage when visualizing business operations. They can take a step-by-step approach to visualizing the entire business environment — monitoring each business operation first and then connecting these operations when they are ready. Interstage's service monitoring collects relevant information so a corporation can understand its business environment. Interstage monitors 1) the business processes' designed workflow, 2) services connected to an Enterprise Service Bus, and 3) business information stored in databases.

Figure 6 shows an IT system of a manufacturing company with different business processes, including sales, production, trade-in, and delivery flows.

Interstage extracts business information

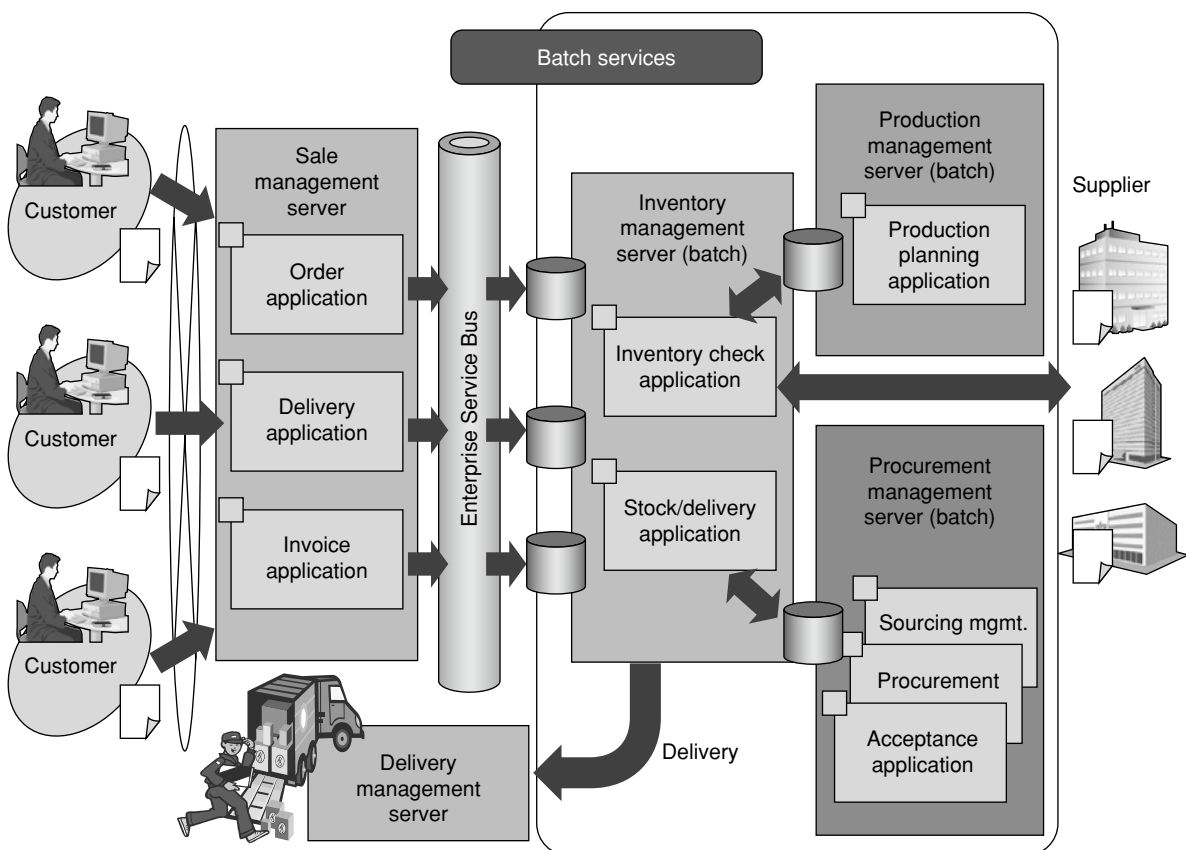


Figure 5
Batch service in open environment.

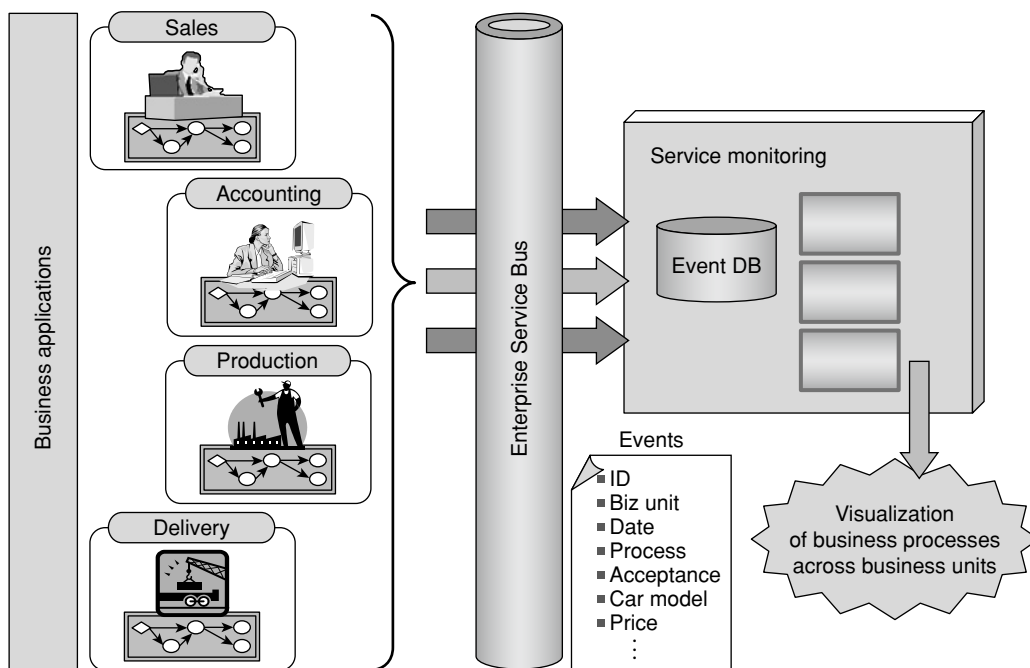


Figure 6
Visualization of business operations.

from these workflows and makes it possible to grasp the business status across different business units.

A logic to sense problems was also implemented in this system. For example, Interstage interprets a combination of the business status across the business operations and issues an alert if production does not start within three days after an order has been received and settled. Interstage also implements the idea of Event Driven Architecture,⁴⁾ in which the system status is treated and collected as an event and IT systems are optimized by driving a new process according to a business rule for total optimization.

3.4 Management and governance of services

As we have discussed so far, corporations can obtain many benefits by adopting SOA. At the same time as applying SOA to IT systems, corporations should think about how they manage these services. Without control,

nobody will know which services exist within a company, the reuse of services will be limited, and duplicated development of services will not be reduced.⁵⁾ Moreover, corporate policies regarding services will not be enforced in such an environment. Fujitsu thinks that governance of services is important for maximizing the benefits of SOA and services should be controlled at the corporate level, rather than controlled by each unit.

Interstage provides an SOA registry and repository for managing all the information about services, promoting reuse of services, reducing the redundancy of services, and applying corporate policies to each service. The SOA registry and repository can handle diversified information about the use of services, for example, interface information, administrative information, and development resources. They also store the relationships between services and support the impact analysis of service changes.

Figure 7 shows a case in which all the service information that has been created by

different middleware is stored in the SOA registry and repository. The registry and repository detect any changes in the services and prompt the appropriate business process to make sure the service change is under control and follows corporate policies. Such processes include, for example, approval/rejection processes for verifying security and implementing technologies.

4. Interstage's approach for changes in IT infrastructure layer

Enterprise IT systems should have not only flexibility and transparency, but as described earlier, they also need continuity so they can be maintained in response to changes in the IT infrastructure layer. In order to provide the same services over the long term, corporations need to continue using the same business applications, even when operating systems and hardware are

replaced.

- 1) Continued use of assets after version changes

When the operating system or hardware of an IT system is replaced, the middleware on which business applications are generally built will also be replaced. In such cases, corporations would have to carry out an intensive test and then make the necessary changes to their business applications, which usually is not an easy process. However, Interstage makes this work unnecessary because it is designed and implemented so that users can smoothly migrate to the new environment as effortlessly as possible without reviewing or recoding their business applications.

For example, there is an incompatibility between Java Development Kit (JDK) 1.3 and JDK 1.4. In general, when an application server is upgraded, JDK also needs to be upgraded,

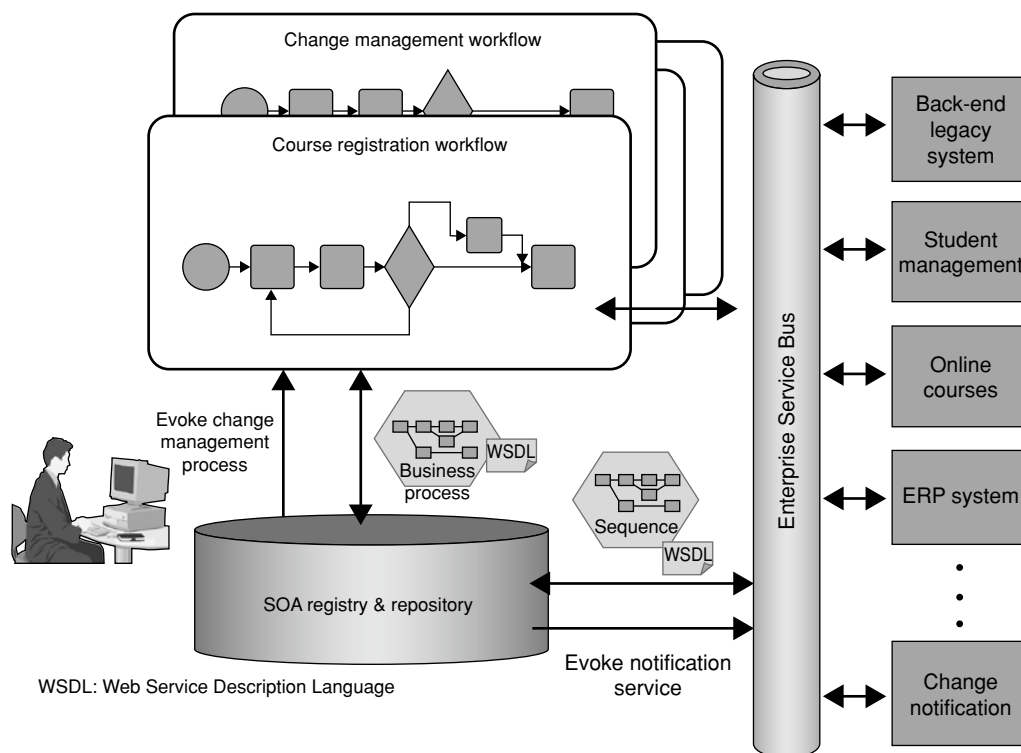


Figure 7 Service information collected and managed at single location.

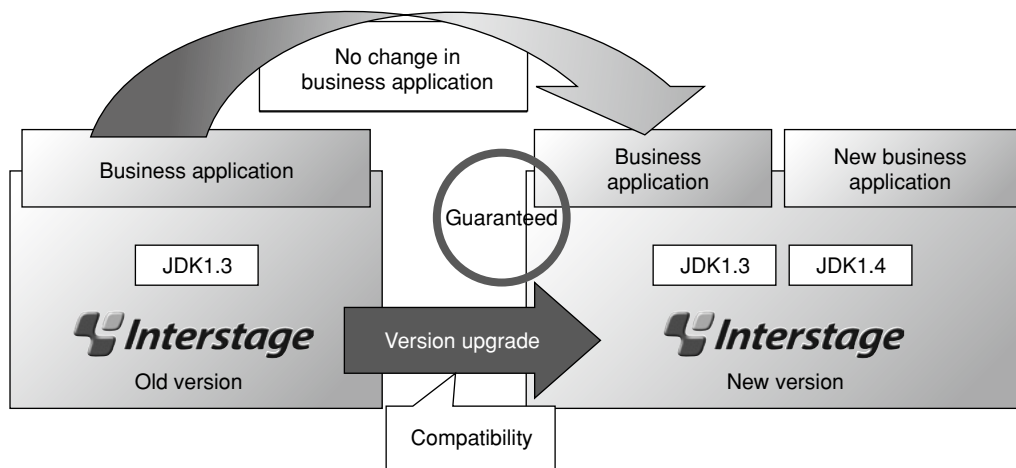


Figure 8
Minimizing costs of system changes.

Table 1
Support scope over generations.

Type	Support scope
Application interface	Interstage guarantees upward compatibility of application interface so that applications running on an old environment can be easily deployed to a new environment. In addition to compatibility at the source-code level, Interstage supports binary compatibility for certain cases (e.g., COBOL when operation system is the same and COBOL is upward compatible). For Java Development Kit (JDK) and Java Runtime Environment (JRE), Interstage guarantees the old version by providing two generations of JDK/JRE.
Commands, operational APIs	Not only applications on Interstage but also batch applications using Interstage are supported across different versions. Interstage reserves the same interface for commands and operational APIs — adding new options if new features are introduced in a newer version of Interstage.
Configuration	Configuration information is also taken to the newer version of Interstage without change. If a new configuration item is defined in a newer version, Interstage reads the option not defined in the old version as the default value.
Messages	Output messages from Interstage are also kept the same over different versions. This is so that system management software can work in the same way without modification, even after Interstage is upgraded. Compatibility of messages cannot be ignored when considering the impact on the entire IT systems of corporations.
Connectivity	Interstage supports connections among different versions of Interstage up to three generations. For example, users can keep a client as is while updating the server. This allows users to save time and cost by minimizing changes to be made.
User information	Interstage allows users to restore user assets to a newer version of Interstage. The assets include not only information created by users but backup information saved during the production phase.

and if the JDK upgrade is from version 1.3 to version 1.4, all the business applications on the application server will be influenced by the incompatibility. In this case, the engineers would have to check whether the problem applies to their business applications, and if so they would have to fix it and retest the applications. However, as shown in **Figure 8**, Interstage

provides both these versions of JDK, so business applications can be kept as is to minimize the operational costs.

Table 1 shows the type and scope of support provided by Interstage Application Server for minimizing the time and cost of version upgrades.

- 2) High interoperability with open source software

Table 2
Interstage products (selected).

Category	Functionality	Product
Flexible use of services	Business process management	Interstage Business Process Manager
	Portal server	Interstage Portalworks
Creating services and preparing for reuse	Application server	Interstage Application Server
	Mission-critical foundation	Interstage Business Application Server
	Enterprise service bus	Interstage Service Integrator
	Middleware service (forms)	Interstage List Works, Interstage List Creator
	Batch processing	Interstage Job Workload Server
	Enterprise Application Integration (EAI)/Electronic Data Interchange (EDI)	Interstage CollaborationRing
	Mainframe support	Interstage for GS
Visualizing business operations	Monitoring tool	Interstage BPM Monitoring
	Search engine	Interstage Shunsaku Data Manager
	Business intelligence	Interstage Navigator
Management and governance of services	SOA registry & repository	CentraSite
Continuous services	Application server	Interstage Application Server
	Mission-critical foundation	Interstage Business Application Server

EAI: Enterprise Application Integration
EDI: Electronic Data Interchange

Interstage also offers simple migration of business applications built on open source application servers. With the highly open and standard features of Interstage, Interstage Application Server allows straight porting of business applications and takes over existing Java source code written on an open source application server. Comprehensive manuals on porting are provided, and a sales package with 220 Enterprise JavaBeans (EJB) components, for example, has been ported to Interstage within a single day.

5. Interstage Suite

Interstage incorporates all the experience and know-how that Fujitsu has obtained by working on a wide range of IT system integrations around the world. Interstage has been providing high reliability to IT systems, focusing on mission-critical use of enterprise IT systems and based on technologies we have built through long-term development and support of back-end IT systems. At the same time, because

of its openness, Interstage provides state-of-the-art technologies, especially for human-centric business process management and service governance in the SOA context.

Table 2 shows a selected product list of Interstage Suite.

6. Conclusion

In this paper, we discussed how Interstage provides flexibility for meeting future business changes, transparency for understanding the business environment, and continuity to enable long-term use of business applications with minimum cost. By doing so, Interstage offers intensive support for SOA to create, compose, monitor, and govern services and at the same time represents Fujitsu's commitment to support applications over generations. Fujitsu believes that these and other features of Interstage enable it to play a significant role within enterprise IT systems and are keys for corporations seeking further success and growth.

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Mr. Ishikawa received the B.A. degree in Linguistics from Tohoku University, the B.Sc. degree in Speech and Natural Language Processing from the University of Edinburgh, and the MBA from the University of Oxford. He has a seven-year experience in software design and development. His expertise lies in integration software, business intel-

ligence, and information retrieval. Since 2006, he has been engaged in the development of the CentraSite SOA registry and repository.