Recent Trends and Challenges in Enterprise Application Integration

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ABSTRACT

Enterprise application integration (EAI) is the use of technologies and services across an enterprise to enable the integration of software applications and hardware systems. Many proprietary and open projects provide EAI solution support. EAI is related to middleware technologies. Other developing EAI technologies involve Web service integration, service-oriented architecture, content integration and business processes. Intercommunication between enterprise applications (EA), such as customer relations management (CRM), supply chain management (SCM) and business intelligence is not automated. Thus, EAs do not share common data or business rules. EAI links EA applications to simplify and automate business processes without applying excessive application or data structure changes. However, EAI is challenged by different operating systems, database architectures and/or computer languages, as well as other situations where legacy systems are no longer supported by the original manufacturers.

Keywords: Web services and business integration

1. INTRODUCTION

The term EAI is an application coupling mechanism, to integrate individual applications into enterprise. EAI provides a unified interface to legacy systems. Enterprise Application Integration (EAI) is defined as the uses of software and computer systems architectural principles to integrate a set of enterprise computer applications. The real beauty of Enterprise Application Integration is making various separate applications work together to produce a unified set of functionality. At the same time, new technology can be added to take the enterprise to the next level.

Any successful EAI implementation should follow these 7 steps:
(a) Understanding the enterprise problem domain
(b) Understanding the data
(c) Identifying business events
(d) Identifying application interfaces
(e) Identifying the data transformation
Scenarios and defining business rules
Mapping information movement

2. UNDERLYING PRINCIPLE FOR EAI

In today’s competitive and dynamic business environment, applications such as Supply Chain Management, Customer Relationship Management, Business Intelligence and Integrated Collaboration environments have become imperative for organizations that need to maintain their competitive advantage. Enterprise Application Integration (EAI) is the process of linking these applications and others in order to realize financial and operational competitive advantages.

When different systems can’t share their data effectively, they create information bottlenecks that require human intervention in the form of decision making or data entry. With a properly deployed EAI architecture, organizations are able to focus most of their efforts on their value-creating core competencies instead of focusing on workflow management.

For generations, systems have been built that have served a single purpose for a single set of users without sufficient thought to integrating these systems into larger systems and multiple applications. EAI is the solution to the unanticipated outcome of generations of development undertaken without a central vision or strategy. The demand of the enterprise is to share data and processes without having to make sweeping changes to the applications or data structures. Only by creating a method of accomplishing this integration can EAI be both functional and cost-effective.

One of the challenges facing modern organizations is giving all their workers complete, transparent and real-time access to information. Many of the legacy applications still in use today were developed using arcane and proprietary technologies, thus creating information silos across departmental lines within organizations. These systems hampered seamless movement of information from one application to the other.
EAI, as a discipline, aims to alleviate many of these problems, as well as create new paradigms for truly lean proactive organizations. EAI intends to transcend the simple goal of linking applications, and attempts to enable new and innovative ways of leveraging organizational knowledge to create further competitive advantages for the enterprise. EAI is a response to decades of creating distributed monolithic, single purpose applications leveraging a hodgepodge of platforms and development approaches. EAI represents the solution to a problem that has existed since applications first moved from central processors. Put briefly, EAI is the “unrestricted sharing of data and business processes among any connected application or data sources in the enterprise”

Undoubtedly, there are a number of instances of stovepipe systems in an enterprise, such as inventory control systems, sales automation systems, general ledger systems, and human resource systems. These systems typically were custom-built with specific needs in mind, utilizing the technology-of-the-day. Many used non-standard data storage and application development technology.

3. IMPROVING CONNECTIVITY

Enterprise Application Integration has increased in importance because enterprise computing often takes the form of islands of automation. This occurs when the value of individual systems are not maximized due to partial or full isolation. If integration is applied without following a structured EAI approach, point-to-point connections grow across an organization. Dependencies are added on an impromptu basis, resulting in a tangled mess that is difficult to maintain. This is commonly referred to as spaghetti, an allusion to the programming equivalent of spaghetti code. For example:

The number of \( n \) connections needed to have a fully meshed point-to-point connections is given by \( \frac{n(n - 1)}{2} \). Thus, for 10 applications to be fully integrated point-to-point, \( \frac{(10)(10)}{2} \), or 45 point-to-point connections are needed. However, EAI is not just about sharing data between applications; it focuses on sharing both business data and business process. Attending to EAI involves looking at the system of systems, which involves large scale inter-disciplinary problems with multiple, heterogeneous, distributed systems that are embedded in networks at multiple levels.

4. PURPOSES OF EAI

EAI can be used for different purposes:

**Data (information) integration:** Ensuring that information in multiple systems is kept consistent. This is also known as EII (Enterprise Information Integration).

**Process integration:** Linking business processes across applications.

**Vendor independence:** Extracting business policies or rules from applications and implementing them in the EAI system, so that even if one of the business applications is replaced with a different vendor’s application, the business rules do not have to be re-implemented.

**Common facade:** An EAI system could front-end a cluster of applications, providing a single consistent access interface to these applications and shielding users from having to learn to interact with different applications.

5. EAI PATTERNS

5.1 Integration Patterns

There are two patterns that EAI systems implement:

5.1.1 Mediation: Here, the EAI system acts as the go-between or broker between multiple applications. Whenever an interesting event occurs in an application (e.g., new information created, new transaction completed, etc.) an integration module in the EAI system is notified. The module then propagates the changes to other relevant applications.

5.1.2 Federation: In this case, the EAI system acts as the overarching facade across multiple applications. All accesses from the ‘outside world’ to any of the applications are front-ended by the EAI system. The EAI system is configured to expose only the relevant information and interfaces of the underlying applications to the outside world, and performs all interactions with the underlying applications on behalf of the requester.

Both patterns are often used concurrently. The same EAI system could be keeping multiple applications in sync (mediation), while servicing requests from external users against these applications (federation).

5.2 Access Patterns

EAI supports both asynchronous and synchronous access patterns, the former being typical in the mediation case and the latter in the federation case.

5.3 Lifetime Patterns

An integration operation could be short-lived (e.g., keeping data in sync across two applications could be completed within a second) or long-lived (e.g., one of the steps could involve the EAI system interacting with a human workflow application for approval of a loan that takes hours or days to complete).
6. EAI TOPOLOGIES

There are two major topologies: hub-and-spoke, bus. Each has its own advantages and disadvantages. In the hub-and-spoke model, the EAI system is at the center (the hub), and interacts with the applications via the spokes. In the bus model, the EAI system is the bus (or is implemented as a resident module in an already existing message bus or message-oriented middleware).

Technologies

Multiple technologies are used in implementing each of the components of the EAI system:

- **Bus/hub:** This is usually implemented by enhancing standard middleware products (application server, message bus) or implemented as a stand-alone program (i.e., does not use any middleware), acting as its own middleware.

- **Application connectivity:** The bus/hub connects to applications through a set of adapters (also referred to as connectors). These are programs that know how to interact with an underlying business application. The adapter performs two-way communication, performing requests from the hub against the application, and notifying the hub when an event of interest occurs in the application (a new record inserted, a transaction completed, etc.). Adapters can be specific to an application (e.g., built against the application vendor's client libraries) or specific to a class of applications (e.g., can interact with any application through a standard communication protocol, such as SOAP or SMTP). The adapter could reside in the same process space as the bus/hub or execute in a remote location and interact with the hub/bus through industry standard protocols such as message queues, web services, or even use a proprietary protocol. In the Java world, standards such as JCA allow adapters to be created in a vendor-neutral manner.

- **Data format and transformation:** To avoid every adapter having to convert data to/from every other applications' formats, EAI systems usually stipulate an application-independent (or common) data format. The EAI system usually provides a data transformation service as well to help convert between application-specific and common formats. This is done in two steps: the adapter converts information from the application's format to the bus's common format. Then, semantic transformations are applied on this (converting zip codes to city names, splitting/merging objects from one application into objects in the other applications, and so on).

- **Integration modules:** An EAI system could be participating in multiple concurrent integration operations at any given time, each type of integration being processed by a different integration module. Integration modules subscribe to events of specific types and process notifications that they receive when these events occur. These modules could be implemented in different ways: on Java-based EAI systems, these could be web applications or EJBs or even POJOs that conform to the EAI system's specifications.

- **Support for transactions:** When used for process integration, the EAI system also provides transactional consistency across applications by executing all integration operations across all applications in a single overarching distributed transaction (using two-phase commit protocols or compensating transactions).

Communication architectures

Currently, there is a lot of variation of thought on what constitutes the best infrastructure, component model, and standards structure for Enterprise application integration. There seems to be consensus that four things are essential for modern enterprise application architecture:

1. There needs to be a centralized broker that handles security, access, and communication. This can be accomplished through integration servers (like the School Interoperability Framework (SIF) Zone Integration Servers) or through similar software like the Enterprise service bus (ESB) model which acts as a SOAP-oriented services manager.

2. The use of an independent data model based on a standard data structure. It appears that XML and the use of XML style sheets has become the de facto and in some cases de jure standard.

3. A connector, or agent, model where each vendor, application, or interface can build a single component that can speak natively to that application and communicate with the centralized broker.

4. A system model that defines the APIs, data flow and rules of engagement to the system such that components can be built to interface with it in a standardized way.

Although other approaches like connecting at the database or user-interface level have been explored, they have not been found to scale or be able to adjust. Individual applications can publish messages to the centralized broker and subscribe to receive certain messages from that broker. Each application only requires one connection to the broker. This central control approach can be extremely scalable and highly evolvable.

Enterprise Application Integration is related to middleware technologies such as message-oriented middleware (MOM), and data representation technologies such as XML. Other EAI technologies involve using web services as part of
service-oriented architecture as a means of integration. Enterprise Application Integration tends to be data centric. In the near future, it will come to include content integration and business processes.

**Middleware**

Middleware is computer software that connects software components or applications. It is used most often to support complex, distributed applications. It includes web servers, application servers, content management systems, and similar tools that support application development and delivery. Middleware is especially integral to modern information technology based on XML, SOAP, Web services, and service-oriented architecture.

**Middleware in Simulation Technology.** In Simulation, "middleware" is a term generally used in the context of the High Level Architecture (HLA) that applies to many distributed simulations. It is a layer of software that lies between the application code and the Run-Time Infrastructure (RTI), hence `middle` in its title. Middleware generally consists of a library of functions, and enables a number of applications (simulations, or Federates in HLA terminology) to page these functions from the common library rather than re-create them for each application.

**Definition**

Middleware is the enabling technology of Enterprise application integration. It describes a piece of software that connects two or more software applications so that they can exchange data.

**Origins**

Middleware is a relatively new addition to the computing landscape. It gained popularity in the 1980s as a solution to the problem of how to link new applications to older legacy systems, although the term had been in use since 1968. It also facilitated distributed processing – the connection of multiple applications to create a larger application, usually over a network.

**Organizations**

In addition to the existing vendors updating their wares to address the newly expanded vision, vendors such as TIBCO, Mercator, Crossflo, Vitria, XIB, AMTrix and web Methods were specifically founded to provide Web-oriented middleware tools. Groups such as the Apache Software Foundation and the Object Web Consortium encourage the development of open source middleware.

**Types of middleware**

The following are the classifications, which are based on scalability and recoverability:

**Remote Procedure Call (RPCs)** — Client makes calls to procedures running on remote systems. Can be asynchronous or synchronous. RPCs enable the logic of application to be distributed across the network. Program logic on remote systems can be executed by simply calling a routine. For example network printer or shared folder can be located across the network as locally attached resource.

**Message Oriented Middleware (MOM)** — Messages sent to the client are collected and stored until they are acted upon, while the client continues with other processing. This implementation, also known as Message-oriented middleware (MOM), provides program-to-program data exchange with intelligent messages sent asynchronously. It is similar to email exchanged between the programs. It requires recipient programs to interpret these messages and take appropriate action. MOM increases flexibility of architecture by enabling applications to exchange messages with each other without need to bother about the underlying operating system or the processors. MOM is most appropriate for event-driven applications. For an airline, for example, passenger ticket reservation and cargo bookings events are source for load factor, flight arrival and departure events through ground operations, is source for aircraft movement. All this information moves using MOM. The executive staff can know the effective aircraft utilization.

**Object Request Broker (ORB)** — This type of middleware makes it possible for applications to send objects and request services in an object-oriented system.

**SQL-oriented Data Access** — middleware between applications and database servers.

Other sources include these additional classifications:

**Transaction processing (TP) monitors** — Provides tools and an environment for developing and deploying distributed applications.

**Enterprise Service Bus** — An abstraction layer on top of an Enterprise Messaging System.

**Application servers** — software installed on a computer to facilitate the serving (running) of other applications. There is a shared host on which business logic, computation and data retrieval engine resides. The GUI component resides on the front-end client making this architecture highly scalable, secure and lends itself to changes easily. For example in banking scenario in which interest rates change frequently. This would entail changing a parameter only on shared host without change at teller end or at database end.

The figure below shows clients accessing the web server which optimized to serve web pages while application server based on the inputs from clients and business decision logic residing on it, queries the database. The results are pushed on the web server for serving to end user browser.
Expansion of EAI Technology

These days, companies need information systems that can quickly adapt to the constantly changing business environment. One of the technologies for meeting this need is Enterprise Application Integration (EAI). EAI can provide an infrastructure for promptly establishing a link between business applications according to a business process. However, to quickly respond to changes, it is first necessary to detect those changes by analyzing and evaluating business activities. Therefore, to realize an information system that can respond to changes more quickly, a new technology called Business Process Management (BPM) has been added to EAI so it can also be used to analyze and evaluate business activities. BPM is now the principal technology of EAI, and it is already being used in enterprise front-ends, which are heavily dependent on human workflows.

The advent of open systems such as UNIX and the PC facilitated the use of IT and contributed enormously to the advancement of informatization in the business world. As a result, many companies have installed information systems in each of their divisions. Because these are standalone information systems that were introduced to achieve local solutions, it is important to integrate them organically and use them to optimize the activities of an entire company. Packaged business software such as Enterprise Resource Planning (ERP) is an effective option for system integration. In some companies however, there are a lot of systems that cannot be integrated using such packaged business software.

Enterprise Application Integration (EAI) technology is a system integration solution that quickly and seamlessly integrates the business applications in a system. However, companies are experiencing amazing changes in the business environment. For example, the lifecycle of products is getting shorter day by day. To keep up with this change, it is not enough to just link business applications together. Instead, it is also necessary to reform the workflow (business processes) by using a set of business applications that, for example, eliminate bottlenecks and simplify business by sharing processes between divisions.

The technology targeted for this business process reform is Business Process Management (BPM). BPM is an approach to using IT united with the concept of the PDCA (Plan, Do, Check, Action) cycle, which consists of planning, implementation, quantitative evaluation, and feedback of results for optimizing company activities. We have realized EAI/BPM using Fujitsu’s Interstage integration middleware. This paper outlines EAI and BPM and describes the relation between EAI and BPM from the functional point of view. Next, it describes the EAI/BPM solution offered by Interstage and the Interstage CollaborationRing, which is the core product of Interstage. Finally, it shows how BPM technology is being used in an actual application.

Advent of EAI and its main technologies

EAI is a technology for realizing data sharing without restriction between business applications and databases in a network. The word “Integration” in “Enterprise Application Integration” means seamless interlinkage between applications using data. EAI can be regarded as a response to the progress in distributed computing and open information systems. In the era of mainframe central computing, services were carried out by many business applications mutually cooperating in a single general-purpose computer called a Mainframe. Then, the client-server type system appeared and various server systems were constructed around a mainframe so they could use its data. This brought the need for stronger linkages between servers and between servers and mainframes (e.g., improvement in data freshness).

There are three main considerations when strengthening these linkages:
1) Generally, there is more than one target system.
2) Because the target systems are already in use, they should be connected with as few reconfigurations as possible.
3) The linkage should be performed in real time to speed up business activities.
To meet these requirements, a new integration system called the hub-and-spoke was introduced. In this system, data flow is controlled in a unified way by part of the hub and differences in the data formats of information systems are absorbed by conversion. This allows quick linkage between different information systems with minimum reconfiguration and is the system used to achieve EAI.

**EAI provides three key features (Figure 1):**

Hubs (also called brokers), adapters, and process automation. The hubs form the infrastructure for highly adaptable information systems. The adapters enable speedy data sharing by using the existing system as is. Lastly, EAI’s process automation links business applications according to a business process and automates execution of a series of business applications.

The following is a more detailed description of EAI’s effects.

1) Realization of a highly adaptable infrastructure In a conventional integration system, which directly links information systems, each system must be changed simultaneously, because a change in one system inevitably influences the others. On the other hand, in EAI, which remotely links information systems via a hub, only the links with the hub need to be considered, because all the interface operations with the other systems are performed by the hub. For example, when updating an entire information system, related systems can be changed step-by-step instead of simultaneously and the work needed to make the changes can be reduced (the hub can absorb the temporary interface differences caused by the changes). Thus, the system can respond flexibly to various changes in company activity, for example, additions and changes to business applications and the acquisition of new customers.

2) Speedy data sharing using existing systems Adapters connect an existing information system with a hub using a linkage method that the system already uses, for example, file transfer or message transmission. It also provides a service for communication processing with a partner information system and a data conversion service for passing communication through an adapter. Furthermore, it provides an administrative service that, for example, resends data when communication with a partner information system fails.

The data conversion service changes the data format so a partner information system can read the data to be transmitted.

The functions provided by the data conversion service include the following:

- Conversion between standard formats such as CII, EDIFACT, and RosettaNet and also between Extensible Markup Language (XML), Comma Separated Value (CSV), and company-original formats
- Sorting, partitioning, and combining of data items; changing of data item lengths; and other data item manipulations
- Conversion between data item values of different data item types (e.g., conversion from product codes to product names) these adapter functions make it easy to link between information systems and integrate a new information system with an existing one. They therefore make it easy to start business with a new customer and can add value to information systems.

3) Work automation according to a business process The process automation function provided by EAI connects business applications according to a business process in a company and automates their execution. It can also
respond to the need to integrate human processes such as reviews and approvals, which up to now have been coordinated by humans. Moreover, it enables a business process to be defined as a workflow, an application flow, or a combination of both, which makes it possible to change a business process by changing its flow definition.

7. FROM EAI TO BPM

As mentioned above, EAI offers a new infrastructure that simplifies and promotes the integration of all the activities and information of a company. By concentrating all the integration tasks in a single hub, the so-called “spaghetti state” can be eliminated. Also, by minimizing the development work required for this integration, it can be achieved earlier and the associated cost can be reduced. Furthermore, because all the data flows into a hub, it can easily be collected and used for company activities. The integration infrastructure provided by EAI, therefore, can be used as an infrastructure for management.

Based on this idea, BPM can be used to raise the analysis and evaluation capabilities of businesses. For example, BPM provides an index for business process reforms and facilitates evaluation of their results. BPM’s main functions are to 1) gather and monitor information and 2) analyze and evaluate the information required to speed up the PDCA cycle for process innovation. By using EAI, independent information systems and business applications can be interconnected and then the data required for analysis can be collected and analyzed (Figure 2).

We now give a more detailed consideration of the influence of BPM on company activities.

1) Realization of service (process) oriented system configuration

In a conventional application development, the first task is to describe the business process and then determine the execution sequences for the applications. Therefore, when a business process changes, the applications must be changed as well. On the other hand, BPM can provide a single service by means of a business process that combines internal and external business applications. For future business constructions, much anticipation has arisen for a method that can freely combine and use individual operating processes by wrapping and publishing them using Web services. BPM technology can be used to realize such a method by acting like an adhesive that connects systems to Web services.

2) Improvement in satisfaction level of employees and customers

By monitoring daily company activities, BPM provides decision-makers at the work front (e.g., managers and customer service clerks) with a window on business processes. Therefore, it helps them to distribute work, reply to customer complaints, and take other actions, which improves the satisfaction level of employees and customers.

3) Contribution to optimization of all company activities

Daily accumulation of the business results produced at the work front can speed up the PDCA cycle for optimizing an entire company. More accurate evaluations can be made by analyzing the activity records recorded in real time in combination with the results of conventional quantitative analysis using a data warehouse (DWH).

Interstage

Interstage is a Fujitsu software platform that supports company informatization based on the international and industry open standard technologies of the Web, for example, Java, CORBA, and XML. It integrates various information systems and realizes a real-time business environment. Fujitsu built the EAI/BPM solution using Interstage (Figure 3).

Interstage is a suite of middleware products. The main products are as follows.
1) Interstage CollaborationRing This is a core product of the EAI/BPM environment realized by Interstage. It provides the characteristic features of EAI such as an adapter, hub, and process automation as shown in Figure 1. It also monitors and displays the status of business processes.

2) Interstage Navigator This product has an OLAP (Online Analytical Processing) function that is used, for example, to analyze and report business activities. Daily results can be managed based on the information collected by Interstage CollaborationRing. It also makes it possible to change a business process based on this information.

3) Interstage Shunsaku Data Manager This is an XML type database engine that accumulates data in the form of XML documents so it can be easily searched. It features fixed-speed searching, regardless of the number of criteria and users, which means that data at any location in a company can be used at the work front in real time.

4) Interstage Contentbiz This product provides a repository function by which company information and its relationships with other information can be managed. By using these relationships as knowledge, a wide range of information distributed throughout a network can be used to analyze company activities.

Next, we introduce the features of Interstage Collaboration Ring, which is the core of an EAI/BPM solution.

1) Widely applicable integration ability
Companies use various operating applications and packages and also deal with each other in different ways. These diversified integration approaches are indispensable for future business process innovation.
Interstage Collaboration Ring offers various integration methods, for example:
• A variety of communication protocols such as Web, Simple Mail Transfer Protocol (SMTP), and File Transfer Protocol (FTP)
• Middleware to link between systems, for example, Common Object Request Broker Architecture (CORBA) and Message Oriented Middleware (MOM)
• Business package products such as ERP and Customer Relationship Management (CRM)
• Various trading protocols currently in use, for example, Electronic Data Interchange (EDI) and Business to Business (B2B) protocols such as Rossettanet and Electronic Business XML (ebXML)
• Web services, for example, Simple Object Access Protocol (SOAP), Web Services Description Language (WSDL), and Universal Description, Discovery and Integration (UDDI) Interstage CollaborationRing, therefore, can respond to the broad requirements of integration.

2) Response to diversified business processes
Interstage CollaborationRing can integrate various processes, for example, an application flow, a human workflow, or a public process between companies. Especially, regarding human workflows, a sensitive response function is prepared to meet the functional requirements peculiar to human systems, for example, performance by a substitute authority and issue review.
Furthermore, EAI makes it easy to realize a seamless interlinkage between a human workflow and external systems. Consequently, even if a company’s operations are heavily dependent on processing by humans, it becomes possible to unify them into a single business process and then automate it.
For the definition of business processes, not only a GUI but also XML and Universal Modeling Language (UML) are provided. Therefore, Interstage CollaborationRing can easily cooperate with various business process definition tools that use XML or UML.

3) Outstanding ability to analyze processes
To dynamically recombine business processes in response to changes in the external environment, a company must be able to rigorously analyze data in real time. Because Interstage CollaborationRing makes the operation status of
business processes available by using analysis and reference tools such as Interstage Navigator and Interstage Shunsaku Data Manager, information can be shared and used not only within a specific staff division but also throughout an entire company and centered on the work front.

4) High performance and high reliability

By providing a robust Online Transaction Processing (OLTP) function, Interstage CollaborationRing has realized high performance and high reliability. Stable performance can be guaranteed, even when there is a temporarily heavy load or when a large-scale system is being operated.

5) Example application

At present, the favored approach in BPM is to reform front-end work, which consists mainly of human activities. The reasons for this are that it is comparatively easy to do and sometimes the cost effects are quickly realized. Among others, the main goals of this reform are to reduce the workload of the person in charge by automating operations, detect bottlenecks (caused, e.g., by work backlogs) at an early stage, share information between processes, and optimize personnel assignments. Figure 4 shows an example in which Interstage CollaborationRing and Interstage Navigator are used to optimize the staff of a company. Using Interstage CollaborationRing, activities at the work front can be defined as a business process and the relationship between a task and the person in charge can be determined from the process execution status. Then, based on this information, the required action can be taken without placing an excessive workload on specific individuals. Also, Interstage CollaborationRing clearly indicates the process status in other groups, so requests for temporary loans of additional personnel from other groups can be handled smoothly. Furthermore, Interstage Navigator can be used to accumulate the records of an operating process during a specified period and make an overall analysis of them so an effective long-term staff assignment plan can be drawn up.

8. CONCLUSION

BPM technology improves and enhances a company’s ability to analyze and evaluate its company activities. It makes visible many of the invisible areas of company activity and enables quick detection of changes in the business environment.

By enabling an operating process to be reorganized at the opportune moment, BPM technology can improve a company’s flexibility and Integrate individual operations into a single business process and optimize the work distribution to the personnel based on the process status response speed, which will become critical factors in the near future.

BPM is being introduced in the front-ends of companies, where its effects can easily be seen, and it is expected to eventually spread to all business processes, including back-end systems.

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