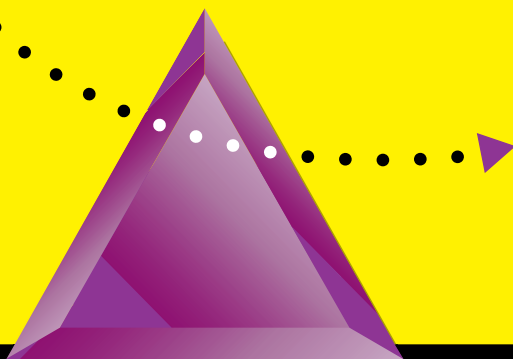


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# Workflow for Web-Based Customer Service



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# Introduction

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There has been a dramatic change in the landscape of business over the past 10 years. Organizations have moved from a structured hierarchical model in which the output and productivity of the individual was the primary concern, to a more flattened structure in which teams are emphasized along with cooperation and collaboration. The mainframe-centralized approach to computing gave way to the network-centric, distributed computing model. Business processes have become streamlined with the introduction of technologies such as workflow and document management. Companies expanded globally, not only in their operations, but also in search of new customers. In addition to this global expansion, competition was expanding as well. Companies could no longer assume the only threat to their well being was in their own backyard. In addition, with employee downsizing, company loyalty fell as well.

There were many drivers leading to this changing business landscape, but the driver which had the most dramatic impact wasn't technology, it was the customer. During the 1990s, customers became more demanding. Customers now expect everything faster, cheaper, and better. Product substitution is the norm. The Internet and the World Wide Web gave the ever more knowledgeable customer just the tools he or she needed to become effective. Information is available everywhere, right or wrong. In a nutshell, all the rules changed.

As the end of the century approaches, service will become the one area a company can use to set itself apart from the competition, and the Web is going to be its primary enabler. Customer-centric organizations are going to use the Web to link themselves with their suppliers and their customers. As bandwidth limitations disappear, companies who invest in the correct Web-

based products will be poised to gain significant competitive advantages, in the customer service arena. The competitive power of customer service when unleashed will be remarkable.

## The Move to a Customer-Centric Business Approach

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What is the key differentiating factor between you and your competition? Is it the quality of the products and services you produce? Is it the price you charge your customers for these products and services? Is it knowledge only you have regarding your processes that are used to create your products and services? Perhaps. More than likely, it is the relationships you have built over the years with your customers. The business approaches in the past have focused on quality improvements, cost-cutting improvements, and process improvements directly related to the products and services a company offered. Quality, cost, and process advantages are no longer the key differentiators between you and your competition. In an age when information is literally available at the click of a button, and the barriers of entry into a particular marketplace are being torn down overnight, you cannot afford to lose existing customers to competition. The future of your organization rests in the ability of your company to provide service levels that exceed what your customers expect. The new model of business for companies has moved from product/service-centric to being customer-centric. We are no longer satisfied in meeting customer expectations; we are expected to exceed them.

# The Value of a Customer

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What does it cost to retain an existing customer? Better yet, what does it cost to attract a new customer? Studies have determined that it is 16 times more costly to attract new customers than it is to retain existing customers. Once you have a relationship with a customer, you can enhance revenues by cross-selling and up-selling within that account. New opportunities can be found in existing clients far easier than can be found in trying to sell to new clients. The 80/20 rule explicitly states that 80 percent of your business income comes from 20 percent of your customers. If this old adage is true, it is imperative that you keep the critical 20 percent of your existing customers happy. And, as organizations move to a customer-centric business approach, any company willing to invest, develop, and understand the necessary tools required to unleash the power of customer service will gain a new source of competitive advantage for the next millennium. The value proposition for the future is in the customer service deliverables of the customer-centric business.

## Customer Service Defined

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What exactly then is customer service and why is it so hard to define? Ask someone to define customer service and then take a moment to notice the puzzled look on his or her face. Some might try to define customer service, but many will tell you that you can't define it. Whatever it is, most people will say they know it when they come in contact with it. It could be as simple as a smile from a sales person in a department store, or a more formal gesture such as a thank you letter from a company that values your continued business.

More often than not, customer service involves fast, accurate, and complete responses to any inquiry a customer might have. "One and Done" interaction is a fundamental component of the new paradigm of customer service. No one wants to wait, and no one will wait, because today there's no reason to do so. If you can't satisfy the customer, your competitor will. One-call resolutions are expected and will not be unique. Customer service using the Web will transcend both distance and time. Customers will expect service when they want it, not when you offer it.

Customer service is not unique to any particular industry. Rather, it is a fundamental aspect of all industries. For example, consider a customer enrollment process for a mortgage. Traditionally, where does the process start? In most cases the process starts off in the office of the bank or lending institution. However, the customer might also initiate the process with a phone call requesting information. At some point, it is only a matter of time before the customer has to show up at the client's location. Checks, letters, forms, and other documents need to be created, gathered, signed, and routed (usually manually) to the appropriate individuals for continued processing. Finally, at some point, the process is completed and the documents are archived for later reference. How many steps are involved in the process? How many individuals interacted in the process including both the customer and employees? How many different business applications and functions were used? How many times did the customer call and ask as to the progress of the enrollment only to be told someone would have to return the call? The answer is probably anywhere from once to many times. This situation is not unique to mortgages. Technical support in manufacturing operations, insurance claims and policy service, call center operations, catalog sales, and accounts payable/receivable processes all involve various aspects of customer service.

# Enabling Technologies for Customer Service

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One technology in particular has had a growing effect on the value that customer service can offer a company, and that technology is workflow. More than just the technology itself, the true value is in applying workflow to facilitate the automation of customer-centric business processes. What exactly is workflow? According to the Workflow Management Coalition (“WfMC”), workflow is concerned with the automation of procedures where documents, information, or tasks are passed among participants according to a defined set of rules, to achieve, or contribute to, an overall business goal. While workflow may be manually organized, in practice, most workflow is normally organized within the context of an IT system to provide computerized support for procedural automation. The true value of workflow extends beyond the organization to the derived benefits to the customer.

Workflow can also be used in concert with business process reengineering (BPR) to enhance the improvements gained by using workflow technologies. Before introducing workflow technology into an existing process, one first needs to evaluate the process itself. Ask yourself two questions: (1) Is there an easier way to do this? (2) Why do we do it this way? Introducing a technology such as workflow on top of an existing process without optimizing the process to exploit the capabilities of the technology can lead to “mechanizing” the process. In such a case, we are simply deploying technology without gaining any real business value. There is a great difference between mechanizing and automation. If deployed properly, workflow will lead to process automation. Some of the areas in which workflow has made a dramatic impact on process improvement and increased levels of customer service include:

- Routing customer communications to the appropriate customer service point.
- Creating “virtual folders” about customers by combining information from multiple databases as well as image documents, thereby giving a customer representative all the information they need to achieve the “one and done” call goal.
- Applying the same business rules to complex processes consistently.
- Tracking deadlines and commitments.
- Enhancing productivity through the automation of manual tasks.
- Providing management reporting and detail relating to a particular workflow process.
- Deploying customer service personnel flexibly and optimally.

Workflow is not the only enabling technology to be used to automate customer-centric business processes. Imaging tools are also key in automating and creating customer service applications. Imaging allows for the capture of traditional paper documents often referred to as “source documents.” Scanners are used to capture paper documents and create electronic digital representations of the original document. These digital documents can then be incorporated into a workflow process and routed electronically, as opposed to being moved manually through a process using the more traditional “sneaker-net” method. It is important to note that although often mentioned together, imaging and workflow are separate technologies entirely. Images are a form of content, which is input into a workflow process using scanners or fax machines. Imaging is important in workflow discussions because imaging often times will be an integral part of the automation process. As much as we have bandied about the “paperless office”

concept, paper remains a principal medium for inbound customer communication in customer service applications.

Although paper is a principal medium for customer communication, it is by no means the only one. Images represent only a portion of the input that can be incorporated in customer service workflow applications, particularly as the Web encroaches further and deeper into customer homes around the world. This evolution is evident in the fact that the concept of a source document is beginning to change. Indeed, the notion has changed so far that Xerox scientists have come up with a new definition for the document: information structured for human consumption. A document once meant a piece of paper that was tangible, but today's digital document may include voice messages, e-mails, video, and Web pages; in short, anything which conveys information from one human to another. Customer service requires the management of traditional documents as well as the management of these new non-traditional digital forms of information, all of which can be types of input into a workflow process.

As much as technologies such as workflow and imaging have had an impact on customer service, it is the Internet, and in particular the World Wide Web, which will have the greatest impact on how customer service is delivered from the organization in the future.

## Extended Communities and Customer Service

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Customer self-service is becoming a growing trend among many businesses. The benefit of the self-servicing trend is twofold with respect to cost savings. First, self-service represents a way for organizations to reduce their costs by having the customer provide many of the

services that, in the past, were performed by an employee of the company. Second, self-service is a way for the customer to expedite many aspects of the process and reduce the process time, which in turn reduces the customer's cost. Automatic Teller Machines (ATMs) are a good example of the trend towards customer self-service. In the past, it was accepted that if you wanted to withdraw or deposit money from a bank account you had to see a bank teller. As bank customers, we were used to that part of the process and accepted its drawbacks; the bank was only open certain hours in a day and many times you had to wait in long lines. Not only did the ATM change the process, it also changed the customer's view of customer service. The ATM gave the customer faster and easier access to their money, and instant feedback with respect to information such as account balances. Essentially, the customer determined the availability of the process, not the bank. For many who use ATMs, the option of the teller is no longer a viable solution. The end result was that the value of the customer service provided by the organization changed in the eyes of the customer. The customer wanted more ATMs with more functionality.

Workflow on the Web is going to continue the trend of self-service initiatives within organizations. When integrated into customer service applications, workflow on the Web will provide the customer with a faster and easier alternative to traditional forms of communication and interaction such as postal mail and the telephone. The Web, like the ATM, can provide immediate feedback on any number of items of interest such as account balances, account history, and new product information. The Web will also be tied into marketing activities and provide a means for cross-selling. And, like the ATM, the Web will eliminate the intermediaries that are part of many existing customer service processes. Why do I need the teller to give me my money when I can get it myself? To revisit the earlier

mortgage example, what is different today is that the mortgage applicant can visit a Web page provided by the bank which contains all of the various mortgage products, closing costs, points, and the latest percentages for fixed and variable rate mortgages. Further, the Web page can offer some spreadsheet-like “applets” which allow the potential customer to do some preliminary analysis of which mortgage products make the most sense for their particular situation, and submit an initial request over the Web. The Web has become the Great Disintermediator, allowing users to initiate self-service and to interact more proactively and intelligently in business processes.

In order for Web-based applications to take off as a customer service-enabling technology there has to be public access to the Web. Not only does there need to be access to the Web, but organizations will need to deploy Web-based applications to generate the interest in extending the enterprise beyond its traditional boundaries. According to IDC, it is estimated that by the year 2000, over 4.7 million applications are going to be deployed using the Internet. We will continue to see an increase in the numbers of both users of the Web and Web applications to the point that the Web becomes a universal service for everyone in the same way that the telephone is today.

## Extranets Integrate the Supply/ Distribution Chain

If you are going to develop a customer-centric business approach, it probably is a good idea to spend some time thinking about who your customers really are. In some companies, the customers are internal to the organization. In other companies, the consumer is the customer and for others, the customer is a business entity. For those who have as their customer other business establishments, workflow on the Web has many

advantages. Extranets, which consist of networks among trading partners using the Internet as the network infrastructure, are going to pave the way for extended Web-based workflow applications between organizations with dissimilar computing system environments. Using the Internet’s infrastructure, the extranet will connect the business processes of both the customer and the supplier.

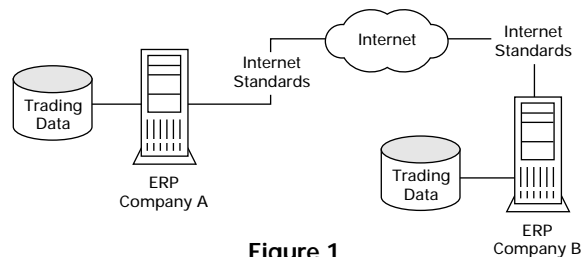


Figure 1

One of the first implementations of network-based workflow between trading partners was Electronic Document Interchange or EDI. EDI is a technology that allows trading partners to send data from one computer system to another. This concept has proven beneficial to many companies. Orders can be sent directly from a customer’s purchase order system to the completely different order entry system of the vendor with no human intervention (see Figure 1). This form of business communication is also a form of workflow. As much as there are upsides to traditional EDI solutions, there are also downsides. Traditional EDI implementations are costly. The Internet-enabled supply chain between business partners is expected to change this. Extranet solutions using workflow on the Web will be simpler than EDI in many ways. Using the Web, business partners will be able to share not only data among dissimilar systems but will be able to share documents, too.

## Intranets Allow Cost-effective Enterprise Deployment of Business Applications

In most organizations, customer service is not limited to back office functions between customers on the “outside” and the organization on the “inside.” Communication between internal departments also requires customer service. These departments may not be in a single location. They might be geographically dispersed throughout the city, state, country, or even the world. Companies made up of distributed branch offices and field offices require contact with one another. Internal networks based on Internet technologies, called intranets, will be the foundation on which Web-based workflow applications will be built. The intranet is a tool that will be used by everyone in the organization.

Companies traditionally deploy applications internally and then extend the functionality externally, which is one reason why intranets are receiving so much attention. Enterprise applications need to first succeed internally. Internal customer service applications such as Human Resources will give the employee the opportunity to use the self-service features of a Web-enabled workflow application to begin a workflow process within the organization. For example, suppose company XYZ has implemented an intranet that lets employees control certain aspects of their 401K plans. Using the intranet application, employees can determine which mutual funds they would like to use to create their retirement portfolio. The flow of these processes moves across departments and access is controlled by firewalls that keep employees out of sensitive areas such as accounts receivables, accounts payables, and cash management. Ultimately, as the applications evolve and customers and other external organizations become part of the extended workflow process, it is imperative that all users have the same view of the process. Using Web-based technology both internally and externally allows companies to do just that.

## Why the Web?

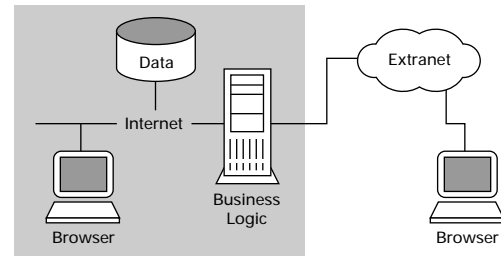


Figure 2

There are many reasons why workflow for customer service applications will use the Web as the underlying infrastructure for the process. For one thing, the Web offers universal access. Access to the Internet is essentially limitless, from next door to Chicago to Sri Lanka. As long as someone has access to a telephone line, they can — with some caveats — have access to the Internet. The software required to view information on the Internet, the browser, is essentially free. Because the Internet is based on international standards, everyone with a browser should be able to view the Internet in exactly the same way. And finally, the cost of ownership in using Web-based applications is low because the only software required on the client is the Web browser.

Multiple-tier architectures using the Internet allow for the business logic to reside on a Web workflow server and the data to reside on a database server (see Figure 2). In this environment, the Web client is the first tier. It is responsible for the display of workflow items to the user. The second tier is the Internet application server. This server is where the connections between the client and Internet server are made. This middle tier server houses the Java code and the JDBC connections (Java DataBase Connectivity — a mechanism for allowing Java code to interface to a broad spectrum of databases). The third tier is where both the

workflow server and the database server reside. In this environment, the workflow logic and data remain separate from the client and delivery services. This multi-tier approach adds several key advantages. First of all, companies can control the deployment of functionality better because most of the business logic and database functions reside at the server end, rather than the client end. Second, configuration control becomes a trivial issue because all of the upgrade issues are handled at the server end, and any browser upgrades can be effected via simple broadcast downloads. Finally, using an intranet/extranet philosophy allows companies to test any changes thoroughly inside the organization and have the confidence that the rollout to the extranet will be effective because all are using the same tools.

## The Challenge of Internet-Enabled Workflow

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Over the past few years, as the Web began to skyrocket, workflow vendors looked to redesign their workflow products to take advantage of the Web and its inherent features. The first-generations of Web-based workflow products are viewed as positive efforts, but they fell short in their ability to take full advantage of the Internet and its capabilities. These early attempts focused on low-volume, non-mission-critical administrative applications. Simple “forms-based” Web workflow worked well on a limited scale, but the required ability to scale to a much larger, more mission-critical application was not possible. The early Web-based workflow products were able to create work items via the Web, but when it came to actually managing the work items or performing the required administrative functions of the product, the functionality was absent. Forms-oriented Web-based workflow—for the most

part—also lacked the ability to manage and display images, which often played a critical part of workflow processes.

These early applications leveraged HTML-based forms and because of this approach, they were inherently limited to what they could do using the user interface of the browser and the limitations of an Internet standard whose primary purpose was displaying electronic documents. These early applications also required long development lifecycles to bring the product up to an operational level. The pre-installed “plug-ins” required by many of the early Web-based products restricted the usability of the product and were actually a step back from the conceptual theory surrounding the Web and its need to not have an application loaded and running on your local PC.

## Meeting the Challenge with Java Technology

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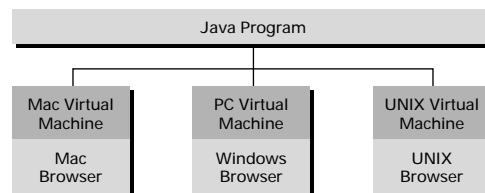


Figure 3

The next generation of Web-based workflow products will be based on a programming language called Java which was specifically designed for the Web. These Java applications will be scalable to thousands of users and tens of thousands of workflow transactions per day. A fundamental reason that Java will be the development tool of choice for Web-based workflow

applications is the “write once, run anywhere” capabilities of Java. This capability promises to let the Java application code execute in any browser or hardware platform with a Java Virtual Machine, whether it is a PC, a Mac, a Unix box, a server, or a mainframe (see Figure 3). Using Java, the document display and management limitations of early Web workflow products are also eliminated. Java allows the workflow users the ability to not only get their work via the Web, but also and more importantly, perform work based on a work item via the Web.

Java technology has been described by some industry experts as a revolution in computing. The focus of this revolution has been the shift from a desktop-centric computing model to a “network-centric” model. The focus of the network-centric model has been to move complexity off the desktop and onto the network and servers, where it can be centrally and professionally managed. The fuel for the development of a computing language such as Java comes from much of the discontent in today’s enterprise-computing environment. Commonly discussed shortcomings include:

- It is too complex.
- The constant administration and upgrading of desktops is too expensive.
- It is not secure.
- It is not reliable.
- Incompatible desktops prevent universal access to applications.
- Applications take too long to develop and deploy.

Java Computing addresses most of these problems. Just as important, its platform independence makes Java a paradigm that can be adopted incrementally, without obsoleting existing investments in hardware

and software. The user of the Java-based workflow application needs only a machine with a Java-compliant browser to work with the application and nothing else.

According to Sun Microsystems (the company which developed Java), there has been tremendous enthusiasm and acceptance from the market about this new computing paradigm. Sun states that:

- In the first 800 days of existence, installed “seats” of Java-based applications have gone from 0 to 70 million.
- There are now over 400,000 Java developers.
- 1 million copies of Java Developer Kit (JDK) Version 1.1 have been downloaded.
- Over 200 universities are offering courses in Java.
- Over 800 books are now in print about Java.

The essence of Java Computing is a client/server model in which Java application code is dynamically downloaded from server to client “on-demand”. In some cases, the applications are stored on a hard disk at the client location and in others, they are stored only in memory. Since applications normally reside on the server and are delivered only as needed, all administration activities can be focused centrally on the server, and users are assured of access to the latest application release level. Standard Java applications can run anywhere the Java Virtual Machine software is installed. The Java Virtual Machine is nothing more than an interpreter that deciphers Java code downloaded from a Web server. The Java Virtual Machine isolates the Java program in a restricted part of memory. The Java program is not allowed to access local Hard drives and System resources. Since the program resides in memory and is not tied to the operation system of the computer, the same Java program can run on any platform. Thus, they can run in any Java-enabled browser

(e.g., Netscape Navigator or Internet Explorer).

Applications such as Java-based workflow, running on the client, communicate with servers via standard network protocols such as TCP/IP. A Java client may open a TCP/IP socket connection with an application server. Alternatively, more sophisticated client-server protocols can be employed. The JDBC (Java Database Connectivity) protocol provides SQL-oriented connectivity to databases. Three-tiered or multi-tiered application models are the keys to leveraging existing back-end systems used in workflow applications. Since Java is truly platform independent, Java computing spans much more than traditional desktop environments. Java clients could include “smart” telephones with built-in displays, PDA-like devices, set-top boxes, kiosks, point-of-sale devices, and even home video game machines, to name a few. Java computing gives companies an architecture that leverages their enterprise computing investment across all of these emerging channels.

## Characteristics of Next Generation Java-Enabled Workflow—What to Look For

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The next generation of Java-enabled workflow will feature a set of common capabilities found in many of today’s traditional client/server applications. The difference in the next generation of products is that these capabilities will include the ability for workflow participants to retrieve work items from a standard Web browser. The user will access their workflow tasks from browsers. At this point, the user will perform their required work using whatever application is necessary. These applications may or may not be Web applica-

tions. The workflow administrator will also be able to manage and track the progress of a workflow from a browser, while the workflow process will be presented to the user via a common browser interface.

The advantage of using Java-enabled workflow extends beyond the browser interface. This new paradigm offers a production-based, scalable architecture that was not possible before. The question of who needs to be involved in the workflow has been eliminated. Because of the Internet’s universal capabilities, participants in workflow processes can reside anywhere.

The demand for access to information residing in the workflow framework has expanded beyond the production line. Management, casual in-house users, and users external to the organization including suppliers and customers are among the key constituencies that can derive benefits from inclusion in the workflow process. The upshot of this user base extension is this: we can no longer guarantee or mandate that each and every individual user of the system operate from a required platform or load proprietary software to run the workflow application. This is the true advantage of Java. Java also brings with it a unique richness to the desktop. Using Java, developers can create desktops with user-sortable views of work, customizable action buttons, and intelligent forms with local validation.

The servers required to operate the Java-based workflow processes will need to be scalable. If processes are going to incorporate tens of thousands of transactions per day and thousands of users, production Web services will be required. Workflow services will also be required to scale across multiple servers and make use of Java’s multithreading capabilities.

# Autonomous Workflow

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The traditional workflow “positioning” has been to segment workflow into three sub-categories: (1) production workflow, whose needs focus on providing high volume workflow management with the associated process indicators, allocation and scheduling requirements. (2) Ad-hoc workflow, that focuses on the knowledge worker and the ad-hoc nature of a large number of tasks, and finally (3) the collaborative workflow model that focuses on the discussion orientation of tasks associated with teams.

This segmentation no longer proves useful as we move towards the network-centric model. Here the economics of silicon are replaced by the economics of connectivity. In referring to Metcalf’s Law, George Gilder states that you can “connect any number, ‘n,’ of machines—whether computers, phones or even cars—and you get ‘n’ squared potential value. Think of phones without networks or cars without roads. Conversely, imagine the benefits of linking up tens of millions of computers and sense the exponential power of the telecosm.” Thus, as networks expand to become the catalyst for productivity, they become dramatically more valuable to the organization. This is the true value of the network.

We have extended our traditional production workflow architecture to address the technical and business constraints of connecting all potential users that exist on the globe. Autonomous workflow capability allows companies to extend their organizational boundaries to seamlessly include their customers and suppliers. Autonomous workflow is defined as “goal-directed workflow with a specific outcome that requires no human supervision for completion or specific client application requirements.” Consequently a work item can move through multiple organizations linked over the Internet to achieve the required goal. In addition,

authorized users can track workflow activity through the various heterogeneous organizations from their desktop.

Participants in workflow—whether they are internal or external to the organization—will not always be connected to the workflow process itself. Participants will often be disconnected from the process for any number of reasons. Because of this, access to a universal front-end that can be accessed from a browser becomes an important element in the deployment of the workflow, but not the only element. In a disconnected synchronous workflow environment, if a participant is not connected to the workflow process, the Java-based application will be able to provide e-mail notifications with embedded URLs as to the location of the work item. From the browser or e-mail client, the participant will be able to both retrieve and perform the required work.

The distributed nature of the Internet prevents a large segment of the user-base from cost-effectively connecting to the central repository for data access. However, for a user to be able to complete the given tasks effectively, he or she requires access not only to the data but also the methods required to process the data. In this scenario, an intelligent software agent or “courier agent” will maintain and manage the pointers to all required data and methods, and in addition will also maintain the pointers to the history log and routing rules of the target work item. Therefore, the target user is presented literally with a work-folder that contains all information required to process the work item. In addition, it is possible to pre-fetch the contents of the work folder directly to the desktop, for the user to execute the required work in an asynchronous off-line mode.

Mobile computing has an important performance advantage over traditional synchronous network computing. A laptop computer is an example of a user

who is connected to a network occasionally rather than permanently. Mobile computing allows the user to delegate to an agent with a defined set of tasks. The laptop is then connected to the network long enough to transmit the agent or alternatively to receive agents. The laptop need not be connected to the network while the agent carries out its assignment. This allows users to develop applications that previously would have been impractical from the more traditional synchronous connection requirement.

## Rapid Application Development

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The functionality required to build, run, and maintain the intelligent agents and components required for autonomous workflow will be made using pre-built Java components called JavaBeans that access the required workflow and object management services. Some companies today are offering a JavaBeans-based component library that Java developers can use for quick modeling and development of Internet capable inter-company workflow and imaging applications. The component-based distributed object libraries provide high-level business functions that can account for up to over 90% of the total functionality of a typical Internet-based workflow enabled system. Through these “readyware” object-oriented components, developers will be able to rapidly model and deploy network-aware WAN business applications, therefore reducing the cost and time for the development and deployment of these types of workflow systems.

These new products will enable users to build workflow systems that extend their business processes to include the business processes of their customers and suppliers. They will allow organizations to shift the focus on the current supply chain model to the next-

generation value chain paradigm based on the demand chain, in which their customers and suppliers become active participants in the workflow and co-produce the required outcomes over the Internet. This demand chain extension allows suppliers and customers to integrate their value chains in a single process that integrates their systems, resources, expertise and processes to allow return maximization.

The benefits of rapid application deployment using pre-built Java user interface components are that they require less custom development. They are faster and cheaper to deploy and unlike ActiveX controls, they offer cross-platform support. These component-based architectures allow you to customize the look and feel of the workflow application without much of the traditional required programming. To truly extend the workflow application capabilities, both high-level and low-level functionality needs to exist in the components to offer the most economical and beneficial workflow application.

- Low-level Java interfaces to workflow and imaging packages provide functionality to directly access detailed API functionality from the development environment as a platform independent true Java Class Library.
- The high-level functional component provides application level functionality for rapid application development and deployment.

## Proven in Production Workflow Applications

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The technology is available today to create applications consisting of both the traditional workflow application, with functionality extensions to support

extranet and intranet models, and radically new workflow applications that specifically target the self-fulfillment paradigm shift created by the Internet. One company that has taken this approach to heart is Plexus. Plexus offers Java Business Objects (JBO) which is a JavaBeans component library that Java Developers can use to quickly create Internet-capable workflow and imaging applications.

Some major applications developed or being developed are listed below.

- **Customer CARE**—Developed for a large telecommunications company, this application consists of the traditional case management functionality, inquiry processing, issues management, and applications processing. Important extensions to the basic customer care application model, include direct customer access and Web page integration. Customers would be able to query and review account status, raise requests, and participate in user group discussions on selected issues. Application is distributed over a wide area private network with over five hundred concurrent users.
- **Application Authorization**—Large mid-western investment firm for managing authorization approval cycles for investment decisions. Solution works over a low-bandwidth wide area satellite network. Application uses Tuxedo for transaction management and LDAP for directory services.
- **Individual Retirement Accounts Management**—Provides document and workflow management of IRA accounts opened at a community bank on the East Coast. Departmental users can store IRA files for retrieval or process IRA applications or changes in IRA status. Accessibility to the imaged documents is anywhere in the corporate intranet.

- **Order Processing and Data Entry Over the Internet**—A subscription fulfillment organization is using the custom developed solution to scan over 100,000 order forms a day, process these orders with data entry over a wide area intranet, with a sophisticated batch balancing process to manage remittances.
- **Customer Enrollment and Account Initiation**—Large electronic brokerage firm uses JBO to process customer enrollment forms and initiate new accounts. Both paper and on-line applications are processed for creation of brokerage accounts. Solution supports transaction integrity using Tuxedo and load balancing using Kivasoft.
- **Semiconductor Component Change Request**—Large electronics firm manages component change request process through both the marketing and business units. Field service engineers can track change requests through the various departments located throughout the world.

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## Benefits of a Java-Based Web-enabled Workflow

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The new Web-based production workflow applications will offer solutions for highly scalable, high-volume, and document intensive processes. The Web not only will be the vehicle for work access, but more importantly, the Web will be the method for true work accomplishment. The benefits for developing new customer service workflow applications using Java development techniques are listed.

## Rapid Application Deployment and Risk Mitigation

Developing applications using Java provides component level functionality for high-level business functions, which can account for 60-90% of the total functionality of any typical system. This leads to substantially quicker application development with projected savings of between 60-70% of development time.

## Customizable Readyware Through Component-Based Development

Customizing applications using Readyware through component-based development as opposed to the development kit approach that takes far more time to design and develop. Modifications can be made to the application component library to meet end-user requirements using customizable Readyware components.

## Reduced Cost of Ownership

Java development features a “server-centric” approach that provides software on demand through automatic software distribution. This approach provides organizations with a much lower cost of maintenance and administration, while ensuring universal access to the workflow environment. An open, standards-based approach will help avoid the substantial investment required to install and manage the client workstations as well as reduce the dependency of continual hardware upgrades now required to complete the deployment of applications. This strategy can help companies greatly reduce the total cost of initial deployment and ongoing ownership.

## Scalability as a System Feature

The interoperability of the Internet plus the extension of the viable user base has created a need for systems that are capable of handling millions of users. The new Web-based applications offer a distributed

workflow system, that is both network and transaction load-aware, and that can scale to meet significantly larger magnitudes of demand and connectivity.

## Executable Content and Multi-Threaded Clients

The nature of a workflow query is very interactive, as opposed to the static pages that HTML offers. Java supports interactive applications that can execute on a client machine. Additionally, Java supports extended data types (i.e. TIFF image data, etc.) without the need for plug-ins. A single Java program can have many processes executing independently and continuously. This makes the workflow application incredibly responsive to user input and interaction.

## Platform Independence

The new Web-based workflow applications are designed to run on any platform that supports the Java Virtual Machine. This platform independence allows customers the opportunity to develop on a single platform and deploy on multiple platforms. In addition, the power of the network is giving rise to a whole new range of client systems. Joining traditional PCs will be network computers, PDAs, set-top boxes, kiosks, and a host of task-specific systems—with browser supported end user interfaces providing new levels of ease of use. Users can take advantage of the particular strengths of each client platform, while being able to tap into the power, applications and management capabilities available on the network servers.

## Mobile Computing

Java supports mobile computing where applications can be developed that work both asynchronously or synchronously. This allows users to check out work and work on them offline. In addition, a messaging architecture supports low bandwidth environments by allowing the queuing of requests over the network.

## Conclusion

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The new paradigm for competitive advantage in the future will be customer service. The key to unlocking its potential is in how quickly companies will be responsive in both changing and adapting their ways to take advantage of value proposition that customer service offers. Customer service applications built upon the Web offer companies the opportunity to move in the direction of unlocking the limitless capabilities of the customer service advantage. Direct interaction over the Web is where the future of customer service will take place. The self-service Web-based applications integrated into a global framework for workflow is going to be the catalyst to create the more responsive organization.

Participants in the new customer service Web workflow will not be defined by the process itself. The participants will define the process and these new workflow participants will be connected to the process directly or they might be connected indirectly using both asynchronous and synchronous methods. In terms of the success of the workflow, it will not matter as long as the correct Plexus tools are used.

## Case Study 1: GTE

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Based in Irving, Texas, GTE's Dallas location handles local line service and long distance provisioning as well as all aspects of customer service. GTE needed to provide all GTE customer care representatives an integrated, centralized access point for all customer requests regarding all aspects of local and long distance services regardless of source (i.e., fax, white mail, e-mail, phone, etc.). The objectives at GTE were to design, develop, and implement a workflow management system in a Web-based environment. In addition to being able to receive scanned-in paper documents, the system must also have the flexibility of receiving faxed requests via a fax server or e-mail via an e-mail server.

### Scope and Complexity of the Project

Developed in-house at GTE, the Workflow Manager software has over 500 users and takes input (requests and letters of authorization) from customers interested in communications services. The input can be in the form of faxes, e-mails, or paper based requests. Once these documents are added into the workflow system, they are automatically routed to Action Coordinators. The Action Coordinators review the document for completeness, input data to the order entry and billing system, request additional information from current service providers, and forward the document to co-workers and/or supervisors for review. As additional documents related to this order are received, they are "indexed", filed in the customer folder, and associated with the current work item associated with the order. Once the documents are associated with the work item, the work item is automatically routed to the proper activity based on the type of document received and associated routing rules.

## Benefits

The use of this workflow management system provides several benefits:

- Service related documentation (Letter of Authorization, Customer Service Request, Local Service Request, etc.) can be electronically routed among users.
- The status of an order can be determined at any time.
- Supervisors can monitor the workload of their staff to relieve bottlenecks and redistribute work.
- Work items can be suspended while waiting for additional authorizations/information. The suspended items can be automatically routed when new information is received.
- Track the ordering and activation of communications services.
- Provide document cataloging
- Indexing of tracking
- Archiving of faxed-in documents related to customers and suppliers.
- Provide TIFF image viewing capability.
- Track and archive documents related to the provisioning of long distance, cellular, paging, Internet, and voice mail service.
- Activation of service for all requested classes at the same time or individually.
- Routing and tracking of activation processes according to class-of-service unique characteristics.
- Ability for users to view status and access work for any or all class-of-service orders/activations associated with the same general order.

## Internet

This Workflow Manager software uses the Plexus FloWare™ and Java Business Objects to provide a Web-based application. Since the client application is written using Java, the application can run on any machine which runs Java VM. The TIFF viewer component needs support for ActiveX from the browser.

The workflow server is running on an HP-UX 10.20 system. The users access the server through the Internet browser and run the application. The Java application provides the following functionality:

- Indexing of documents—both fax and e-mail transmissions. Ability to attach a single page to multiple documents.
- TIFF Image Viewing using the Wang Viewer ActiveX, which comes with Windows 95.
- Find and route the work based on the indexed document.
- View the In-Box and select a work.
- Ability to select work based on priority of the work.
- Ability to select any piece of work irrespective of its priority.
- Search for documents and work based on document attributes in current and history database.
- Administration capability for organizing users, teams and their permissions to workflow maps, activities and documents.
- Ability to add new document types at run-time.
- Vacation handling.
- Reassigning work from one user to another.

This software includes both server and client side components with the client being a thin Java client that can run on any Java enabled browser, while the server can run on platforms where FloWare is available. Since the client is written in Java and the application class files are downloaded at runtime, there is no installation involved for the client. As the browsers have intelligent caching capability, the Java class files are not downloaded every time; instead they are kept in the browser's cache.

The various components in this Workflow Manager software include the following:

Component Type	Vendor—Platform Running FloWare 4.0
Workflow Engine	BancTec HP-UX 10.20; Java Business Objects 1.0
Middleware Server	BancTec HP-UX 10.20/Java Virtual Machine; Java Business Objects 1.0
GUI/Client	BancTec Windows 95/NT/Internet Explorer; Plexus Java Primitives
Middleware Server/Client <i>(In this Project, it is used as a Middleware server)</i>	BancTec HP-UX 10.20/Java Virtual Machine
ActiveX Component <i>(For downloading TIFF images) Client</i>	BancTec Windows 95/NT/Internet Explorer

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## Case Study 2: A Model for Moving to the Web

(Written by Bruce Silver and reprinted from *IW Magazine*)

Recently I suggested that a major reason why users are delaying document systems projects is that the leading vendors have not acknowledged the full impact of Internet computing, nor have they offered their customers a roadmap to the Web-enabled future that protects their investment in today's technology. That is particularly true in the production—or mission-critical—application segment, where integrating centralized high-volume, back-office processing with distributed front-office, supply chain and customer care solutions is still typically viewed as “the systems integrator's job.” While most wring their hands and strategize, at least one production software vendor is embracing the Web with a new generation of software tools that leverage its existing high-volume imaging and workflow services and extend them to the new network computing model.

Plexus, an imaging and workflow pioneer, still ranks among the worldwide production market leaders—its more than 25 installations with 500 concurrent seats each is probably unmatched—but admittedly lost much of its market visibility in recent years under Recognition International, which was acquired last year by BancTec. Contrary to the expectations of many, BancTec has invested heavily in building the Plexus operation, continuing the focus on high-volume, mission-critical applications. Among the fruits of that investment is Plexus Java Business Objects++, a package of reusable class libraries that allow rapid development of production-scale imaging and workflow applications on the Web.

Plexus' strategy for Java Business Objects hits the nail on the head for users today:

- Extend the proven secure, high-volume transaction management architecture to a widely distributed environment using the Web and accommodate the load of tens of thousands of users.
- Extend information access and workflow participation from dedicated heads-down users to occasional users across the enterprise and to suppliers and customers as well. At the same time, bring messaging and server-connected users into a single integrated workflow environment.
- Reduce the administrative cost of ownership by dynamically distributing software as needed from Web servers, including document viewers and business application “clients.”
- Reduce the cost of building interactive Web applications with reusable component object libraries, supporting both DCOM and CORBA, and providing access to the same back-end imaging and workflow servers used in existing client-server implementations.

Few vendors would quibble with the strategy, but redirecting their large R&D organizations, hell-bent on advancing rich 32-bit, fat-client architectures for the past two years, has proven beyond the powers of most of them so far. The way Plexus accomplished that trick is interesting in its own right, and could suggest an improved model for the industry. The Java Business Objects were originated by the home office-based Professional Service Group as components of specific customer solutions. While the initial functionality was customer-driven, the software architecture and design specs were reviewed and revised by Software Engineering to ensure the resulting software could be developed. Most companies don't closely integrate the

work of their professional services groups with software R&D. The advantage of integrating them is focused, funded development by dedicated resources, with real-world customer input and field testing—and hopefully referenceable customers—before announcing the new software as a fully supported product. In the hyper-accelerated world of Internet tools and standards, that increasingly looks like the way to go.

Java Business Objects++ will be available in three forms. Java Primitives provide low-level, C-like access to the Plexus imaging (XDP ObjectServer) and workflow (FloWare) services. At a higher level, Java Business Objects provide component-level interfaces for rapid application through IIOP. Finally, Plexus will offer full-solution clients, like Customer Service, as integrated Java applications. Functions available through Java Business Objects++ include batch and interactive scanning, document assembly and indexing, document search and retrieval, workflow inbox and customizable work item views, work routing, management reporting and more. Essentially they provide full cross-platform (“100% pure Java”) access to Plexus production workflow and imaging services from a Web browser, E-mail inbox or other Java-compatible client.

Already Plexus, through Professional Services and integrator partners, is Web-enabling a number of production applications for customers, and much of that work will ultimately be offered in the form of new Java Business Objects. Those include:

- Customer care (for a large telecom company): case management and resolution, extended to direct customer access and Web page integration. Customers can query and review account and case status.
- IRA management (for a community bank): document management and workflow for IRA applications and customer service, with enterprise-wide image access over an intranet.

- Order processing (for a subscription fulfillment house): scanning more than 100,000 forms per day, with distributed data entry using wide area intranet.
- Universal workflow (for a large government agency): use Microsoft Exchange as client for FloWare, providing integrated production/collaborative/ad hoc enterprise workflow environment.

The Plexus case illustrates how a company with a proven strong server offering — and without the need to protect a big investment in OCX and other fat-client components — can leverage the Web revolution to leapfrog better-known software providers. In addition, Plexus' strategy and roadmap provide the kind of clear path from today's solution technology to a Web-centric future that reassures the buyer and protects near-term investment.

Other imaging and workflow vendors would do well to follow suit. Even though most users today are not yet deploying production document solutions on the Web, they know they will be in a year or two. Vendors in our industry thus face a simple choice: Either show users how today's investment gets them to that endpoint quickly and safely, or expect more buying decision delays and defections.

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## Glossary

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**100% Java**—A Sun Microsystems initiative to guide developers in writing, certifying, and marketing of applications.

**Abstract Window Toolkit (AWT)**—A collection of graphical user interface (GUI) components that were implemented using native-platform versions of the components. These components provide that subset of functionality which is common to all native platforms. Largely supplanted by the Swing component set. See also Swing Set.

**Ad hoc workflow**—Low-value processes generally connected to routine office work such as FYI routing, review, and approval.

**Applet**—A program written in Java to run within a Java-compatible web browser, such as HotJava or Netscape Navigator.

**Appliances**—Networked devices such as printers, Java terminals, and clients, that are managed using applications built using JMAPI.

**Application Program Interface (API)**—Generic term for any language and format used by one program to help it communicate with another program. Specifically, an imaging vendor can provide an API that enables programmers to repackage or recombine parts of the vendor's imaging system, or integrate the imaging systems with other applications, or to customize the user interface to the imaging system.

**Bandwidth**—(1) Number of hertz expressing the difference between the lower and upper limiting frequencies of a frequency band. (2) Width of a band of frequencies. (3) Maximum number of information units (bits, characters) capable of traversing a path per second.

**Bean**—A reusable software component. Beans can be combined to create an application.

**Binary Large Objects (BLOB)**—The ability to embed large binary objects (images) as part of a character database record.

**Business Process Automation**—The use of computer-based information technology (specifically workflow technology) to automate the steps in a business process, coordinate the assignment and distribution of work items and information among individuals, and manage the completion of tasks, activities and ultimately business processes.

**Business Process Reengineering (BPR)**—The radical restructuring of the business processes, organizational boundaries, and management systems of an organization. Business process redesign and business process automation are components of BPR.

**Bytecode**—Machine-independent code generated by the Java compiler and executed by the Java interpreter.

**Class**—In Java, a type that defines the implementation of a particular kind of object. A class definition defines instance and class variables and methods, as well as specifying the interfaces the class implements and the immediate superclass of the class. If the superclass is not explicitly specified, the superclass will implicitly be object.

**Client/Server**—The relationship between machines in a communications network. The client is the requesting machine, the server the supplying machine. Also used to describe the information management relationship between software components in a processing system.

**Common Object Model**—The Common Object Model is the functional equivalent of the Component Object Model for UNIX-based platforms that today

include SunOS, OBM, AIX, HP-UX, ULTRIX, OSF/1 and OpenVMS. The Common Object Model defines a common DCE RPC-based protocol and a subset of core OLE functions that Digital and other interested companies plan to support within their products.

**CORBA**—Common Object Request Broker Architecture. A standard which defines the manner in which software “objects” created in one program can be used in another.

**Core Class**—A public class (or interface) that is a standard member of the Java Platform. The intent is that the Java core classes, at minimum, are available on all operating systems where the Java Platform runs. A 100% pure Java program relies only on core classes, meaning it can run anywhere. All core classes reside in the Java\* package.

**Database Management System (DBMS)**—Set of programs designed to organize, store and retrieve machine-readable information from a computer-maintained database or data bank. Database management programs form the foundation for most document storage indexing systems.

**Encapsulation**—The localization of knowledge within a module. Because objects encapsulate data and implementation, the user of an object can view the object as a black box that provides services. Instance variables and methods can be added, deleted, or changed, but as long as the services provided by the object remain the same, code that uses the object can continue to use it without being rewritten. See also Instance Variable, Instance Method.

**HTML (Hyper Text Markup Language)**—This is a file format, based on SGML, for hypertext documents on the Internet. It is very simple and allows for the embedding of images, sounds, video streams, form fields and simple text formatting. References to other objects are embedded using URLs.

**HTTP (Hyper Text Transfer Protocol)**—The Internet protocol, based on TCP/IP, used to fetch hypertext objects from remote hosts. See also TCP/IP.

**Inheritance**—The concept of classes automatically containing the variables and methods defined in their supertypes.

**JAR Files (.jar)**—Java ARchive. A file format used for aggregating many files into one.

**Java**—An object-oriented programming language developed by Sun Microsystems. A “write once, run anywhere” programming language.

**Java Application Environment**—The source code release of the Java Development Kit.

**Java Database Connectivity (JDBC)**—An industry standard for database-independent connectivity between Java and a wide range of databases. The JDBC provides a call-level API for SQL-based database access.

**Java Development Kit (JDK)**—A software development environment for writing applets and application in Java.

**Java Interface Definition Language (IDL)**—Java APIs that provide standards-based interoperability and connectivity with CORBA (Common Object Request Broker Architecture).

**Java Platform**—The Java Virtual Machine and the Java core classes make up the Java Platform. The Java Platform provides a uniform programming interface to a 100% Pure Java program regardless of the underlying operating system.

**Java Remote Method Invocation (RMI)**—A distributed object model for Java-to-Java applications, in which the methods of remote Java objects can be invoked from other Java virtual machines, possibly on different hosts.

**Java Virtual Machine**—The part of the Java Runtime Environment responsible for interpreting Java bytecodes.

**JavaBeans**—A portable, platform-independent reusable component model.

**JavaScript**—An open, cross-platform object language developed by Netscape for creating and customizing applications. Commonly confused with Java.

**JavaSoft**—A business unit of Sun Microsystems, Inc.

**Object technology**—Object technology is a broad term that refers to the use of “objects” to (1) analyze; (2) model or design; and/or (3) implement some aspect of a computer system.

**Object-Oriented Design**—A software design method that models the characteristics of abstract or real objects using classes and objects.

**Process**—A virtual address space containing one or more threads.

**RMI (Java Remote Method Invocation)**—A distributed object model for Java-to-Java applications, in which the methods of remote Java objects can be invoked from other Java virtual machines, possibly on different hosts.

**RPC (Remote Procedure Call)**—Executing what looks like a normal procedure call (or method invocation) by sending network packets to some remote host.

**Runtime System**—The software environment in which programs compiled for the Java Virtual Machine can run. The runtime system includes all the code necessary to load Java programs, dynamically link native methods, manage memory, handle exceptions, and an implementation of the Java virtual machine, which may be a Java interpreter.

**TCP/IP (Transmission Control Protocol/Internet Protocol)**—Transmission Control Protocol based on IP. This is an Internet protocol that provides for the reliable delivery of streams of data from one host to another. See also IP.

**Thread**—The basic unit of program execution. A process can have several threads running concurrently, each performing a different job, such as waiting for events or performing a time-consuming job that the program doesn't need to complete before going on. When a thread has finished its job, the thread is suspended or destroyed. See also Process.

**Transmission Control Protocol/Internet Protocol (TCP/IP)**—(1) The common name for the suite of protocols developed by the U.S. Department of Defense in the 1970s to support the construction of world-wide internetworks. TCP and IP are the two best-known protocols in the suite. TCP corresponds to Layer 4 (the transport layer) of the OSI reference model. It provides reliable transmission of data. IP corresponds to Layer 3 (the network layer) of the OSI reference model and provides connectionless datagram service. (2) The collection of transport and application protocols used to communicate on the Internet and other networks.

**URL (Uniform Resource Locator)**—A standard for writing a text reference to an arbitrary piece of data in the WWW. A URL looks like “protocol://host/local-info” where protocol specifies a protocol to use to fetch the object (like HTTP or FTP), host specifies the Internet name of the host on which to find it, and localinfo is a string (often a file name) passed to the protocol handler on the remote host.

**Virtual Machine**—An abstract specification for a computing device that can be implemented in different ways, in software or hardware. You compile to the instruction set of a virtual machine much like you

would compile to the instruction set of a microprocessor. The Java Virtual Machine consists of a bytecode instruction set, a set of registers, a stack, a garbage-collected heap, and an area for storing methods.

**Work item**—Representation of work to be processed in the context of a workflow process activity in a workflow process instance.

**Work Process**—Any process that involves cooperative work; that is, processes involving multiple persons working to accomplish a specific goal.

**Workflow**—In imaging software, a program that queues, tracks and otherwise manages documents and collections of documents as they progress from entry into the system, through the various departments in the organization, to their final destination.

**Workflow Application**—A software program(s) that either completely or partially supports the processing of work item(s) in order to accomplish the objective of a workflow process activity instance or instances.

**Workflow Interoperability**—The ability for two or more workflow engines to communicate and interoperate in order to coordinate and execute workflow process instances across those engines.

**Workflow Management System**—(1) An electronic system that includes workflow capabilities to route, schedule and control business processes often triggered by the movement of documents within an organization. (2) A system that completely defines, manages and executes workflow processes through the execution of software whose order of execution is driven by a computer representation of the workflow process logic.

**Workflow Participant**—A resource which performs in partial or in full the work represented by a workflow process activity instance.

**Workflow Process**—The computerized facilitation or automated component of a process.

**Workflow Process Activity**—The complete automation of a logical step that contributes toward the completion of a workflow process.

**Workflow Process Activity Instance**—An instance of a workflow process activity that is defined as part of a workflow process instance.

**Workflow Process Control Data**—Data that is managed by the workflow management system and/or a workflow engine.

**Workflow Process Definition**—The component of a process definition that can be automated using a workflow management system.

**Workflow Process Engine**—A software service or “engine” that provides part or all of the run-time execution environment for a workflow process instance.

**Workflow Process Execution**—The duration in time when a workflow process instance is created and managed by a Workflow Management System based on a workflow process definition.

**Workflow Process Instance**—Represents an instance of a workflow process definition which includes the automated aspects of a process instance.

**Workflow Process Monitoring**—The ability to track workflow process events during workflow process execution.

**Workflow Process Relevant Data**—Data that is used by a workflow management system to determine the state transition of a workflow process instance.

**Workflow System**—A system that automates the processing, scheduling, routing, and tracking of documents automatically among individuals and departments.

**Workflow Templates**—Workflow templates are pre-programmed route-enabled messages that are used to create new instances of routing messages.

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"The significant problems we face cannot be solved  
by the same level of thinking that created them."

Albert Einstein

Plexus' Java Business Objects (JBO) is recognized as the industry-leading Internet-based workflow and imaging solution. JBO provides users the capability to rapidly build complete Internet-, intranet-, and extranet-based production applications to support the entire business enterprise.

JBO is particularly suited to the development of Customer Service solutions where control and automation of the business process, based around workflow technology, provides key operational advantages to the user. Such features include routing to the appropriate user, task automation, tracking deadlines, and management reporting, all of which ultimately increase productivity of the entire organization and decrease mean time to payback on technology investments.



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