

1.1 INTRODUCTION

E-business is a revolution driven by technology. The established enterprises have been turned upside-down by the Internet and its associated technologies. Internet created new businesses that would have never been thought of just a few years ago. Any company that wants to survive in today's hypercompetitive e-business landscape needs to investigate the implications of these new technologies for their business environment. Managers need to assess for themselves the impact of these new technologies for their own business.

Since processes incorporated by e-business include all sorts of IT systems and applications, it is well worth looking at the general architecture of current client/server systems, separately of whether these systems include package-ware such as SAP, Siebel, or Ariba, or whether they have been custom-built to solve a specific business problem. A modern IT system usually is built based on the three-tier architecture.

1.2 THREE-TIER ARCHITECTURE

Three-tier architecture

In the past decade IT systems have moved from monolithic mainframe-based systems to client/server systems, where the graphical user interface (GUI) is located in the client, while the business logic and main data storage is located in the server. For up to date Internet-enabled applications, a three-tier client/server architecture is normally used (Figure 1.1).

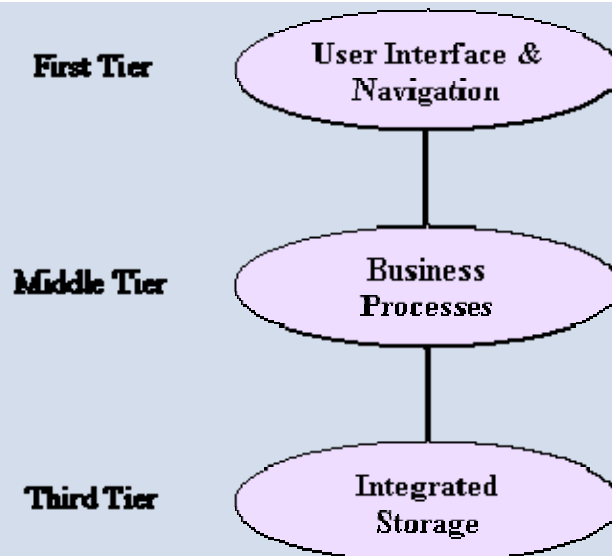


Figure 1.1 Three-tier client/server architecture

- **First Tier:** The GUI is implemented in this tier, either on a thin or a fat client . A "*thin*" *client* , such as a network computer, displays the application front end in a Web Browser, or in an application specific GUI. A "*fat*" *client* , normally a PC, offers local data processing capabilities, besides providing the same functionality as a thin client.
- **Middle Tier:** The process logic of the business processes is running on the middle tier on the local server . From time to time, middle-tier business logic is integrated on fat clients. This is where, for example, routing of messages happens, where transaction processing is running, or where scanned-in data is processed. Web application servers, a new brand of Web-enabled local servers that allow for high-volume, time-critical, business-critical applications on the Web, also conceptually exist in the middle tier.
- **Third Tier:** The third tier provides the back end . This is where the corporate data warehouse, the company-wide databases, and the file system storage reside.

1.3 CORE E-BUSINESS TECHNOLOGIES

To effectively implement e-business solutions needs to put together a puzzle of different IT-technologies. All of these technologies existed well before the arrival of the Internet. For e-business applications, they only provide their full potential in the Internet context, offering company-wide and inter-company

portability and connectivity using standard Internet protocols and tools such as TCP/IP, HTTP, HTML/ XML, Java, etc.

Information retrieval

Information retrieval tools offer Boolean search capabilities in structured and unstructured text collections. Web search engines such as Google, Yahoo, AltaVista, InfoSeek, or Lycos, are information retrieval tools. Vendors that existed well before the Internet such as Fulcrum or OpenText offer local or company-wide solutions as well. Document management systems (see below) generally include an information retrieval component to search the contents in their document collections.

Document management

Document management systems provide the environment for authoring, storage, and retrieval of documents. These can be simple, text-based documents, but increasingly, document management systems are also capable of handling multimedia documents containing images, audio, or video. Document management systems need to be able to distinguish between multiple versions of a document that might be accessed by different authors simultaneously. More powerful systems also handle the problem of different data formats. Document management systems range in complexity from general-purpose tools with integrated document management capabilities such as Lotus Notes, to simple dedicated document management systems like PCDOCS, to powerful systems capable of handling hundreds of thousands of documents such as FileNet, Eastman, or Documentum. Document management systems are frequently combined with workflow management systems.

Workflow management

Workflow management systems support the dynamic definition, execution, monitoring, and modification of business processes. All sorts of processes like opening a bank account, managing a supply chain, or hiring a new employee can be automated. Process control (who is doing what at what time) is separated from core business logic (such as a financial portfolio investment strategy, or accounting rules) and from data. This permits flexible adaptation of rapidly changing business processes without having to touch the other elements of the IT system. Workflow management systems are well suited to integrate existing legacy applications into new business processes. Leading workflow management systems are, for instance, Staffware, IBM's FlowMark, FileNet, and extensions of groupware system such as Lotus Notes Prozess Ware. Although the concept offers striking advantages, pure workflow management

solutions have had only limited success in specialized application areas. More frequently, package vendors such as SAP, PeopleSoft, Oracle, Siebel, or Ariba have integrated workflow concepts and engines into their prepackaged offerings, using the workflow component to permit custom-specific tailoring of their packages. Boolean searching uses AND, OR and NOT operators

Workflow management systems are typically used to send documents managed by a document management system through the organization. They are particularly well suited to support highly structured business processes. If the workflow is of an *ad hoc* nature, groupware and messaging systems are used.

Groupware/messaging

e-Mail has been one of the Internet killer applications right from its humble beginnings in the 1970s, permitting asynchronous message exchange between the academics working at the Arpanet, the predecessor of the Internet. Today's messaging products such as Microsoft Exchange and Lotus Notes offer comfortable and user friendly world-wide connectivity over the Internet. They include document management capabilities such as versioning, seamless integration of office applications like word processors and spreadsheets, multimedia integration of voice, image, and video messages, as well as workflow routing capabilities. Just recently, dedicated fully Web-based systems for team collaboration such as eRooms, Visto, Webex, or Lotus Teamrooms have been appearing.

Data warehousing

One of the dominant features of selling goods over the Internet is mass customization. This means that customers get an automatically customized offering, based on their personal profile and preferences. Data warehousing is the enabling technology for automatic mass marketing, mining gigabytes of sales data to figure out patterns of buying behaviors. This permits vendors to come up with a personalized offering for each customer. Integrated data warehousing tools are offered by database vendors such as Oracle, dedicated high-end tools, for example from Cognos or SAS, perform complicated statistical analysis.

Web application server

Web application servers are used to link a back-end system, for instance a data warehouse, or a sales and order tracking system, with a Web front-end. Major vendors like IBM and Oracle offer their own products. There are now also at least half a dozen dedicated vendors like BlueStone, Allaire with ColdFusion,

Microstate with Hamilton, and Silverstream. Web application servers work around the stateless nature of the Web. HTTP requests are stateless, which means that a Web HTTP server does not store any information about previous requests to keep a virtual connection open. Web application servers make sure that resources, including documents, user objects, and database connections persist across multiple requests to the server, Persistent database connections inherent to the Web application server engine permit applications to skip the expensive operation of connecting to a database every time a user requests a document. Web application servers connect to multiple data sources including relational databases, CICS, MQ Series, SAP, PeopleSoft, Lotus Notes, document management systems, etc. They also make Web applications suitable for enterprise deployment for tens of thousands of users, they make applications scalable by providing load-balancing features, and they improve application reliability, security and manageability. Usually, they also include utilities to create Web front-ends using both HTML and Java.

The followings describes how a Web application server works using ColdFusion:

- A Web browser requests a dynamically generated page.
- The Web HTTP server notifies the ColdFusion Web Application server.
- ColdFusion processes the dynamic page based on specific tags. If necessary, ColdFusion contacts the database, file, e-mail, or distributed object server to process the request.
- ColdFusion then dynamically generates the HTML page.
- The Web HTTP server sends the HTML page back to the browser.

Very importantly, Web application servers include object and transaction services. Thus business logic can be encapsulated in distributed middle-tier objects using standards like Microsoft COM (Component Object Model), EJB (Enterprise Java Beans) and CORBA (Common Object Request Broker Architecture). Transaction services for objects and databases can also be implemented using Web application servers.

Object-oriented middleware

Web application servers are one special type of object-oriented middleware. Depending on the needs of the applications to be integrated, other types of middleware can be used: ORBs (Object Request Brokers) such as Iona's Orbix, Microsoft's COM, or IBM's DSOM permit the integration of applications based on the OMG (Object Management Group) CORBA (Common Object Request

Broker Architecture) standard. If the object request brokers communicate over the Web, a protocol called IIOP (Internet Inter-ORB Protocol) is commonly used. If reliability requirements are high, a transaction monitor guarantees failsafe properties: A sequence of actions (the transaction) is placed between transaction brackets, assuring that the whole sequence of actions is either successfully completed, or the transaction will be reset to the original starting point in case of failure. Object request brokers and transaction monitors are currently converging: Beas ' transaction monitor Tuxedo has been extended to include the CORBA object request broker protocol, while Iona 's Orbix now also incorporates transaction properties.

Process-oriented package-ware

Although business process automation with workflow management systems has not been a broad success so far, workflow management concepts have been integrated into leading standard software packages. These standard software packages (package-ware) are moving from proprietary formats towards Internet user interfaces, standards and protocols. For example, most packages can now be accessed by Web browsers. Most business processes can be automated by package-ware:

- Buying and selling: Vendors like Siebel or Vantive claim market leadership in areas such as sales force automation, call centre automation, electronic customer care, or customer relationship management.
- Design and production: ERP vendors such as SAP, PeopleSoft, or Oracle automate transaction processing in areas ranging from manufacturing to insurance. Supply chain planning and optimization is supported by tools from vendors like 12 technologies.
 - Management and decision making: Controlling tools, MIS (management information systems) and data warehouses back these processes.
- Learning and change: In this area there are few pre-built packages. Learning and change processes are supported by groupware systems for collaboration such as Lotus Notes, by company-wide Intranets, and other custom-built knowledge management tools.

Java

The Java programming language has been introduced by Sun as a platform- independent Web software development environment. It has been adopted as the preferred language for developing complex Internet applications. Java applets run within the Web browser, extending its functionality by adding, for example,

advanced security or animation capabilities. In the meantime, Java has grown to also become a mainstream programming language competing with languages such as C++ or Visual Basic. It is increasingly used for enterprise-wide large-scale programming projects.

Jini

While middleware is used to tie together applications, Sun's Jini is intended to tie together computer appliances such as printers, scanners, and PCs, but also intelligent refrigerators, and coffee machines. Jini connection technology makes computers and devices able to quickly form spontaneously connected systems, so-called federations. Within a federation, devices are instantly on — no one needs to install them. The network is resilient — devices are simply disconnected when they are not needed. Jini technology provides simple mechanisms that enable devices to plug together to form an ad hoc community — a community put together without any planning, installation, or human intervention. Each device provides services that other devices in the community may use. Devices include their own interfaces, which ensures reliability and compatibility. Jini is fully implemented in Java. Devices in a network employing Jini technology are tied together using Java Remote Method Invocation (RMI). Security is implemented by the built-in Java programming language security features.

Knowledge navigation and visualization

There are no ready-to-buy pre-built solutions for knowledge management and access. Instead, companies set up firm-wide Intranets and document management systems for storing knowledge. Employees are then encouraged to accumulate their explicit knowledge in structured databases, in groupware systems like Lotus Notes, or as Web documents. To access the information, customized knowledge navigation systems like InXight's Hyperbolic trees and information retrieval systems are utilized.

Business logic applications can be grouped into knowledge management technologies such as groupware, document management, and data warehousing supporting mostly unstructured team processes. Workflow, custom-build Web applications and standard packages integrate structured business processes, normally extending over multiple teams in different parts of the company. The user interface in the first tier visualizes processes and knowledge. It should permit easy navigation between multiple applications and different

knowledge bases.

The original definition language of the Web was HTML, the Hypertext Markup Language. Although it has undergone many revisions and extensions, HTML quickly reached its limit. XML, its much more powerful successor, has been designed to address all the shortcomings of HTML.

1.4 VIRTUAL COLLABORATION

In the Internet era relationships have become much closer, for example changing “customer—vendor” relationships into true partnerships. The Internet provides the perfect communication mechanism to support virtual teams spanning the globe. Although there are situations where there is no replacement for face-to-face communication, Web-based communication technologies make it much easier for physically separated teams to work together, dramatically reducing the need for face to face meetings.

Lotus Notes has defined the domain of groupware systems for collaboration. Notes/Domino, now under IBM's ownership, is still one of the leading products in this area, although Microsoft with its Exchange/Outlook product is close on its heels. Both Notes/Domino and Exchange/Outlook are extended e-mail systems, which are in their current versions almost seamlessly integrated into the Web. Because of their upbringing, they still do have some fundamental differences. The Notes package excels in the replication of unstructured or semi-structured databases. It also contains an integrated programming environment supporting three different programming languages: a macro language, a scripting language called LotusScript, and Java.

Microsoft Exchange grew out of Microsoft Mail and still is message based. Replication functionality is by now also included, this is particularly useful for mobile users and workgroups that can replicate and share mailboxes and other files. Contrary to Notes, programming capabilities are not built into Exchange, but extended customizing needs to be done using other Microsoft development tools such as Access, Excel, Visual Basic, Visual C++, or Visual Java.

Virtual Workgroups

Virtual workgroups can be supported by setting up a work environment in

Notes or Exchange, possibly connected by the Internet.

Nevertheless, implementing a workgroup system in Notes or

Exchange still involves a substantial amount of customization and even application development. There are now at least a dozen vendors that have recognized this need and are offering out-of-the-box software for virtual workgroups, based on the Internet. The following listing of vendors is by no means final:

- eRoom (www.eroom.com)
- Webex (www.webex.com)
- Visto (www.visto.com)
- Instant!Teamroom
(www.lotus.com/home.nsf/tabs/teamroom)
- Sametime (www.lotus.com/home.nsftabs/sametime)
- Teamspace (www.involv.com)
- Groupsystems (www.ventana.com)
- www.teamsoft.com
- www.projectplace.com
- www.ancxa.com

eRoom

eRoom is one of the leaders in this field. It provides an on-line virtual out-of-the-box project office. Web pages are either hosted on eRoom's servers; alternatively, the software can be run on the firm-internal Intranet of the client company.

eRoom's desktop displays a shared project space, where team members can communicate in real-time, but also share all sorts of thoughts and documents. eRoom offers drag-and-drop folders, where a file can be grabbed from the Windows desktop and made accessible to the team member by dragging it with the mouse into a shared folder. There is a sophisticated mechanism to define different levels of membership. Group tasks can be managed by creating structured "to do lists". eRoom supports taking polls, to resolve open group issues. Web links can be shared in special "link" documents. There are also useful document management features, such as tracking multiple versions of a document, or controlling access to documents. To support navigation in shared project spaces, maps of projects can be created.

The left window in illustrates real-time communication between team members in an intercom chat window. To find information in complex project spaces, search functions to search all documents in the global project space are provided.

Webex (<http://www.webex.com>)

The Webex system is very similar to eRooms. It allows for virtual meetings, offices, and project suites that are shared over the

Web. A group of users can establish group identity. Members of the group can create multiple offices with a consistent look. They can invite private guest attendees, share a group calendar, participate in discussion forums, and also send inter-group messages. Webex facilitates application sharing.

Visto (<http://www.visto.com>)

The Visto product consists of three parts: My Visto, My Groups, and My Events. My Visto contains a calendar, e-mail, address book and file storage service. My Groups lets the user create multiple interactive groups, where family, friends, and colleagues can interact, share photos and files and plan events. My Events gives the user easy access to event Listings in different categories. Events can be selected and tracked on the calendar.

Instant!Teamroom and Sametime

Lotus offers two Notes-based systems for team collaboration. Instant!Teamroom (www.lotus.com/home.nsf/tabs/teamroom) allows users to set up a private workspace on the Web. It uses a Notes Domino server to implement this functionality.

Sametime (<http://www.lotus.com/home.nsf/tabs/sametime>) helps business users to communicate with colleagues, partners and customers. It provides chat, audioconferencing, shared whiteboards and shared applications. Users can find co-workers on-line, chat with them instantaneously, and share documents to simultaneously work on them.

Teamspace (<http://www.involv.com>)

Teamspace is yet another system for project collaboration. It includes document management capabilities, group discussion support, a shared group calendar, chat and paging functions, issue management, a bulletin board, and an event and meeting planner. A distinctive feature of Teamspace is its virtual classroom for group training.

GroupSystems (<http://www.ventana.com>)

Contrary to the other systems described in this section, GroupSystems not only embodies a Web-based system for virtual cooperation, but also includes a methodology. The methodology consists of four steps:

1. Set a clear agenda.
2. Let everyone speak at once.
3. Analyze and explore the issues.

4. Develop consensus and buy-in.

The common characteristic of the above listed software systems for virtual workgroups is that all the functions needed to support group activities are already built-in. In contrast, when solely using Lotus Notes or Microsoft Exchange, these functions must be implemented first. This makes Notes and Exchange potentially more powerful, but also much harder to install. More specifically, to set up a Notes- or Exchange-based collaboration system, good systems management and programming skills are mandatory.

If different authors want to edit the same document simultaneously over the Web, they need applications that support contemporary authoring. The WebDAV standard makes sure that different applications from different vendors support this functionality.

Appendix I

DoubleClick - *Marketing with Personal Information* [1]

While privacy advocate groups argue that the Web will not survive without some login of regulation advertising organizations disagree. DoubleClick, an Internet advertising firm suggests that advertising must be effective to minimize Internet-related costs. Regulation of the Internet could limit a company's efforts to buy and sell advertising. As with television and radio advertising, the money generated by Internet advertising can allow people of all economic means to use the medium.

Web sites use a variety of tracking methods to record where visitors come from, where they go and what catches their interest along the way. This information is tied to your computer's IP address (i.e., the numerical address of your computer on the Internet), Web browser and operating system; it is used by marketers to target relevant advertisements at specific computers. DoubleClick has an advertising network of more than 1,500 sites where banner advertisements for 11,000 of its clients appear. This network enables DoubleClick to combine data from many sites to target advertisements for particular computers.

However, targeting a specific IP address, browser and operating system is less effective than targeting a specific consumer. In 1999, DoubleClick acquired Abacus Direct Corporation, a direct-marketing organization. Abacus stores names, addresses, telephone numbers, age, gender, income levels and a history of purchases at retail, catalog and online stores. This acquisition enabled DoubleClick to attach personal information to the activities of what were once "nameless" personal computers.

One concern with this method of collecting and using data is termed *digital redlining*. Digital redlining suggests that a company could skew an individual's knowledge of available products by basing the advertisements the user sees on past behavior. This practice could allow

advertisers to influence consumers' habits by limiting the information they see to what the advertisers determine the consumers want to see.

Direct marketing in the traditional sense affords a certain time lapse between an individual's purchases, the processing of that information and the use of that information to target the particular customer. However, users can be targeted instantly as they browse the Internet.

Perhaps of greater concern is the recording of personal activities. The Internet is appreciated as a medium in which users can search for information and express opinions anonymously. Privacy advocates are concerned that such data could be used against individuals attempting to obtain housing, get a loan, and apply for insurance coverage. For example, a user visiting a Web site to learn more about an illness might not want that information to be made available to insurance companies. DoubleClick promises to uphold its privacy policy, which assures users that the company will not collect financial, sexually oriented or medical information. In response to concerns about privacy, DoubleClick has joined the Network Advertising Initiative.