Business data processing has evolved over the last 50 years. The first influential electronic computer, the Eniac, was designed to do numeric calculations. But the ink was barely dry on their patent applications when project leaders J. Presper Eckert and John W. Mauchly began designing the Uni-vac, which was designed to process both numeric business data and alphanumeric business data. Forty-six Uni-vac computers were delivered between 1951 and 1958, and IBM produced their business-oriented 305 RAMAC in the late 1950s, but business data processing took off with the widespread conversion of batch punch-card applications from accounting machines to the IBM 1401, beginning in 1959. From there we moved to online systems with terminals (and later, PCs emulating terminals) connected to time-sharing systems and to client-server applications.

If we count batch processing, time-sharing systems, and client-server applications as the first three business data processing generations, we now approach the fourth generation: Web information systems (see [2]). WISs are the rapidly growing number of business intranets, Web-presence sites, consumer-oriented electronic commerce sites, and extranets supporting business-to-business communication and commerce built with a three-tier architecture. The rapid growth of the Internet and TCP/IP-based intranets is raising our ambitions. Can we use them to integrate applications within an organization and between organizations? Can we do so in a way that utilizes existing application programs, hardware (PCs connected to LANs and mainframes), and standards (like EDI)?

IBM dominated the first two generations. In spite of Microsoft’s success in compilers and operating systems, there have been many players in the third. Who will lead us into the next generation? Microsoft would like to do just that, and it has many WIS development servers and tools, a proprietary component-object model (COM) and dynamic HTML, an object model allowing client-side scripting with its Explorer Web client. Perhaps more important, Microsoft has taken a page out of IBM’s book and is building a marketing and support organization along with the tools. Microsoft’s tools and support were described at last year’s Business Applications Conference.

A Fourth-Generation Conference

Microsoft defined a hypothetical business situation and then implemented 10 sample applications. The applications ran on Windows, Unix and IBM mainframe platforms and used software from Microsoft, Baan, SAP, and others. The invented business situation involved two fictitious companies, Fabrikam and Contoso. Fabrikam is an industrial equipment manufacturer marketing through direct and catalog channels; Contoso is a high-volume customer.
Ironically, as Microsoft emulates IBM’s early emphasis on support and proprietary features, IBM is among the leaders of companies advocating technical excellence and open standards.

The two organizations are very close. Contoso sends Fabrikam 10-day purchase forecasts to facilitate its just-in-time manufacturing, and Fabrikam has the right to invoice orders based on forecast figures. The order and forecast streams flow over the Internet. The Internet is also used for order status change, invoicing, and shipment notices. Requests for bids on custom-engineered equipment are faxed to Fabrikam, and processed on an intranet used by clerical, engineering, and management staff. Orders of in-stock items are received and tracked over the Internet, and warehouse employees receive picking and shipping information using wireless Windows CE computers. In a situation like this, the boundary between organizations is blurred.

The conference presented 10 applications shared by these two companies. They ran live on mainframes, LANs, and the Internet. They were three-tier applications, with clients running Microsoft Explorer and Outlook on Windows 98 or CE, a middle tier with Microsoft Web server, Message Queue Server, Transaction Server, and Exchange running on Windows NT. The third tier consisted of SQL databases and legacy SAP, Baan, and MVS systems.

The heart of the conference was code walkthroughs. Microsoft tools were the focus, and applications were integrated using Visual Basic to tie COM components together. Say Fabrikam wanted to develop an application that sent an email to Contoso confirming receipt of a request for a bid. It would not be necessary to program email capability into the bid-entry system because Outlook has built-in email capability. The bid-entry program could update Fabrikam’s records and use Outlook for the email.

In addition to code walkthroughs, there were talks by Microsoft executives, including one by Microsoft President Steve Ballmer, in which he outlined Microsoft’s commitment to business applications and the extent of its support. Microsoft plans to spend $3 billion in R&D this year, $2.4 billion of that allocated for Windows, Office, and Back Office, the software used in developing business applications. Ballmer stated that interoperability was a priority with a commitment to building servers for Unix, supporting COM and Internet Explorer on Unix, and creating a COM-Corba bridge. Application interoperability initiatives include Active Store, which promotes a set of conventions and protocols to get applications to work together in the retail industry, and the Value Chain Initiative, which promotes a set of standards so manufacturing, distribution, and retail organizations can exchange information across the Internet. Microsoft is also supporting XML, licensing Visual Basic for Applications, and working with companies like Baan and SAP.

Ballmer understands that Windows NT servers, which frequently crash and require rebooting after changes, are not as reliable as Unix servers. He admitted that NT Version 4 was buggy when it shipped, and was less reliable than Version 3.51. He contended that subsequent upgrades had remedied the situation and promised that the next version, NT 2000, would be better. NT 2000 will not be a radical departure, but will offer overall improvement in reliability, management, scalability, and efficiency. If Microsoft delivers on Ballmer’s promises, Windows NT will be a more mature operating system, closing some gaps with Unix. If not, Linux and other Unix solutions may reverse NT’s growing sales lead.

Ballmer also stressed that customer acceptance hinges on having a popular platform. Internet Explorer owns 53% of the browser market; Microsoft shipped 33 million units of Office, 4 million SQL servers, and 11.8 million Exchange Servers during the last 12 months, and Windows NT servers are now outselling Net-ware and Unix servers combined. Popularity with developers is
even more important. Microsoft has many internal resources—2,000 people in product R&D, 1,000 in telephone support of developers, and so forth, but as big as Microsoft is, the developer community is much larger:

- Solution provider partners: 900
- Independent software vendors: 4,000
- Software resellers: 50,000
- Consulting and service firms: 100,000
- Windows developers: 4.3 million

Microsoft believes its tools can be used to build modern, distributed, multi-organization business applications. Microsoft's installed base is dominant, so it is a safe bet its product line will continue to exist and evolve—your systems will not become orphans. It also employs people who understand its technology and your industry, has extensive training facilities and options, and can help you with consultants. Even if its offerings are not the cheapest and most efficient, you can count on their being satisfactory for now and eventually catching up by copying features, improving products, and interoperating. Microsoft will offer pervasive and safe solutions. This sounds like IBM during generations one and two of business data processing, and I do not mean that to be pejorative.

A Development Project
I visited with one of Microsoft's customers, Toyota. Toyota cars are well known, but the company is also a forklift manufacturer with 179 dealers in the U.S. Until recently, all electronic communication between the dealers and Toyota was with PCs using synchronous modems emulating terminals connected to an IBM mainframe. Dealers used a FoxPro program on a DOS PC to enter financial information, warranty processing information and orders for forklifts and parts. These were uploaded to the mainframe in batches, and reports generated overnight for downloading. This system sufficed at first, but became a bottleneck as transaction volume increased over time. Everyone in a dealership shared one PC and dealers were unhappy with the cost of their proprietary IBM hardware.

The dealers wanted quick change, but Y2K problems had frozen mainframe development at Toyota, so it decided to move to a three-tier solution leaving the mainframe applications untouched. Users would access Toyota's Web server and mainframe from PCs on dealer LANs connected to a Web server connected to the mainframe. This enabled users to use both their existing mainframe applications and the PC LANs in the dealerships. Client machines only needed to run Microsoft Internet Explorer with Dynamic HTML.

The development was done by a team of five people—Toyota IT staff members, outside contractors, and a consultant from Microsoft. The project began in November 1997, and in April 1998, parts ordering, order tracking, and email were switched to the new system.

Historically, Toyota was always an IBM shop. What led to adoption of a Microsoft solution? The same applications could have been built using Java applets and server-side programs, but Toyota mentioned nontechnical factors. Its staff was made up of Cobol programmers with little experience in either Java or Microsoft development, so it was attracted by Microsoft Consulting Services. A Microsoft consultant has worked full time on this project. His role was to help with the system design and implementation while training Toyota staff on Microsoft development tools, languages, and project management techniques. Microsoft is not looking for a profit on this service; it is happy to see customers learning and using its products. This is reminiscent of IBM's use of system engineers, whose services were free to customers until the government forced them to be unbundled.

Toyota also wanted to learn Microsoft's Solution Framework [3], a development methodology and project management discipline used internally. The Solution Framework specifies a project team organization and development process.

A team is organized into groups responsible for six functions:

- Product management: understanding the application vision and business case, and ensuring that the functional specification responds to business requirements.
- Program management: system analysis and definition of the
architecture and functional specification.

- **Development**: participation in defining the functional specification and delivering a system that complies with it.
- **Test and quality assurance**: verifying that the system complies with the functional specification, working in parallel with development, and striving for zero-defect code as opposed to debugging after the fact.
- **User education**: the user advocates, designing, developing, and publishing printed and online documentation and instructional material.
- **Logistics planning**: managing a smooth transition from development to operation, ensuring a smooth rollout, deployment, and transfer to the operations and support group.

The development process is milestone-based with a significant degree of task overlap and iterative development. The major milestones are vision/scope acceptance, functional specification approval, code completion, and release. These are not freeze points, but baseline points (say after the component is 80% defined) at which time interim deliverables are placed under change control. These are beta releases and multiple iterations (versions) are expected. The operation is like a spiral rather than the traditional “waterfall” process in which a project proceeds in sequential steps from definition to production. Responsibility for milestones is owned by team groups.

Learning this methodology was important to Toyota. Microsoft was distinguished by a combination of its tools, support staff, and understanding of Toyota’s applications, not by technical specifications, speed, or cost. In the 1960s, IBM sales people did not talk about CPU speed and system cost, they talked about the “rest of the iceberg.” Microsoft is pursuing a similar strategy.

Ironically, as Microsoft emulates IBM’s early emphasis on support and proprietary features, IBM is among the leaders of companies advocating technical excellence and open standards for business data processing. It builds WIS using Java, and hopes to leverage the rapid progress made possible by many companies working on open standards. While waiting to see how Microsoft does at debugging Windows NT, IBM and many others are supporting Linux, thereby gaining access to a community of thousands of support people and debuggers.³

It will be interesting to see how this works out. Will Microsoft dominate WIS development? Will the Java coalition? Will Windows NT close the reliability, scalability, and manageability gaps with Unix? Might Microsoft one day support Linux servers? Forrester Research, a prominent IT research company, predicts that by 2002, Microsoft will have 79% of the unit sales in the WIS server market, but only 39% of the revenue, with IBM, Oracle, Netscape, and Sun dividing the rest of the market [1].

If this forecast is valid, Microsoft will dominate the low-end market, and the others will compete for big-ticket sales. Forrester also predicts prices will drop over time. Looking further to the future, what will we see in the fifth business data processing generation? Will all traffic on private networks move to the public Internet? What will be the impact on business data processing of Teledesic’s satellite-based Internet backbone when it opens for business in 2003? As bandwidth increases, will we begin thinking of our intranets and even extranets more as backplanes than input/output devices? If so, will developers and users need to know of “tiers” or which computers are executing their programs and storing their data?

“Business data processing” sounds mundane. (The venerable Data Processing Management Association even changed its name to the Association of Information Technology Professionals.) Cobol programmers have had low status, and computer scientists have been known to make snide remarks about the language and people who use it. The real challenges were in systems and scientific programming. Well, that may have been true at one time, but today’s ambitious communication-oriented, cross-organization WIS applications are surely complex and challenging. Maybe DPMA changed its name too soon.

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³Of course IBM is not monolithic. A few IBM employees may be nursing scars resulting from work with Microsoft on OS/2, and others are selling Java solutions, but IBM is happy to sell workstations and servers that run Microsoft software.

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**References**


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