Beyond Executive Information Systems

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Introduction

Changes in business are being forged by two primary factors -- globalization and technology. Corporations must be able to digest and use mountains of data and make decisions quickly in the international marketplace. Mature information systems are needed to make information out of an onslaught of data. And organizations must transform to capitalize on the competitive advantage these breakthroughs will bring.

The data processing industry is ripe for the coinage of a new phrase describing the information systems of the nineties that encompass information technology, executive information systems and decision support systems critical to achieving organizational transformation. This paper discusses the evolution of information systems, the characteristics of the emerging form of enterprise-wide distributed computing environments, the solution developing at MCI, and the relationship of MCI's model to SAS software.

Globalization as a Factor of Change

With the dramatic political and economic changes that are taking place in Europe and the rest of the world, globalization has become a reality which must be faced in the nineties. The European Common Market is changing the way business is conducted and new market places are emerging rapidly. The return on Hong Kong in 1997 to the People's Republic of China will necessitate significant adjustments.

With a world-wide market, customer expectations and measures of excellence take on new dimensions. Language and cultural differences will yield unique new products. Corporations adapting to globalization will develop parallel internal challenges in communication, team building, and project management across time zones, cultural norms and work ethics, and political and religious calendars. Cultural change will be imperative.

Technology as a Factor of Change

Information system technology has reached a level of maturity that will support the thrust toward globalization and the trend toward service, quality and impressive cycle time. The technology that will allow countries, companies and individuals to compete and be empowered is the technology that leverages the power of information as a strategic resource, integrates information centers into virtual computing environments, and reengineers business processes.

Historical Perspective

The evolution of information systems can be loosely divided into four eras: (1) approximately 1950 through the mid sixties, (2) mid sixties through the seventies, (3) the eighties, and (4) the nineties. These eras can best be described in terms of focus, culture, data, and technology.

During the first era, we were introduced to EDP (electronic data processing) and TP (transaction processing) as businesses developed data processing departments to computerize their paperwork processes. The early automation of accounting functions was based in a mainframe environment controlled by DP-developed applications. Vast amounts of data were "jailed", with only about 1% ever escaping the hardwired application.

The second era saw the emergence of the MIS (management information system). Process automation continued providing on-line and control systems to the first-line operational personnel. Information bases were developed, and the early stages of decision support systems tapped the data more effectively.

By the third era, IS (information systems) and IT (information technology) departments took a more proactive role, delivering power and flexibility to the desktop with the PC. With extensive training, users experienced independence in creating their own processing. More information was provided to middle and top management, and data analysis and communication of the analysis results were facilitated. But data became redundant, being moved, copied, extracted and reformatted for porting between environments.
**The Here and Now**

The fourth era is witnessing the advent of "information services" that capitalize on knowledge and information sharing as exploitable assets. Keywords are universal access, accessibility, integration, information databases and information data modeling. Business solutions are being re-engineered to reduce cycle time for decision making. Companies are recognizing the hodge-podge of hardware they accumulated in previous eras, and are harnessing that computing power by implementing network strategies to link data sources and people. Distributed computing in a multi-vendor architecture reaches the desktop via interpersonal computer with user-friendly interfaces. Fourth generation languages and expert systems facilitate data analysis and presentation. Groupware extends communication possibilities. External data banks such as Dunn and Bradstreet, Dow, and Nielsen have become as important as internal databases.

**What Hasn't Worked**

Previous attempts to bring automation to the senior management have failed because these executives are lacking in computer skills, don't have time for training, and generally aren't convinced they need a computer. The technology has not been intuitive and user-friendly, and the EIS didn't deliver the information they wanted. There were insufficient feeder systems and business-savvy developers to bring operationally and technically acceptable, as well as appropriately focused, systems to the desktop. The return on investment has been slow to show, particularly if only financial measures are used.

**What IS Making It Work**

Computer literacy at all levels is increasing, and hardware and software costs are decreasing. Transformed organizational structures support the information-empowered employees. But the most obvious factor enabling the enterprise-wide model is technology.

The concept of enterprise-management represents a single, integrated end-to-end view for managing information systems and networking resources. IBM is addressing the enterprise-wide need with SystemView. ITs dimensions define protocols, standards, and interfaces for systems management applications under SAA (Systems Applications Architecture) and CUA (Common User Interface) using and SQL (Standard Query Language) interface. AIX (Advanced Interactive Executive) provides interoperability. The Information Warehouse concept allows for access and management of all data sources.

DEC (Digital Equipment Corporation) is entering the market with EMA (Enterprise Management Architecture) to handle the multi-vendor systems, applications, and databases. AT&T is competing with UNMA (Unified Network Management Architecture).

It is clear that the trend is toward enterprise-wide solutions. The vendor directions support it, and customers are demanding it. MCI has been a recognized leader in implementing information system delivery technology, and was developing an enterprise information delivery system when most others were still investigating strictly face-value executive information systems.

**Operations Enterprise Model**

Era four technology will not take root and endure unless companies simultaneously effect internal empowerment and establish a supporting organizational architecture. MCI's information delivery system is its Operations Enterprise Model (OEM), and enterprise-wide information and decision support system currently under development. The thrust of the OEM is to improve productivity through technology, culture change, and organizational architecture. See Figure 1.

**Figure 1**

MCI is using a simple business re-engineering paradigm which can best be described as: ELIMINATE, INNOVATE, AUTOMATE, INTEGRATE, and PROLIFERATE.

Elimination refers to the removal of excess and redundant process steps. Innovation means the creation of new processes and approaches using workflow technology, business engineering formats, operations research and optimization techniques like Organization Architecture, Program Valuation and Prioritization, and Technology Modeling.
Automation is being accomplished using information technology (LANs, groupware, client-server MIPs) to enable the new processes, not just mechanize old procedures. Integration establishes horizontal linkages between platforms, applications and processes, focused on information sharing and instantaneous availability. Proliferation happens through implementation in a single environment, demonstration of excellence, then extension to other communities of users or organizations.

**Organizational Empowerment**

MCI is striving for behavior change through positive attitude. Individual attitudes are contagious, and a positive attitude can energize an entire organization. The results are immediately evident in the unbelievable commitment and job satisfaction experienced by MCI employees. "We are not a bunch of maniacs all doing our own thing. But we are passionate about our own ideas, we never say die, we're fierce team players and tremendously inventive" (Kevin Sharer in MCI management meeting, 1991).

The hierarchical nature of modern businesses has evolved apart from the influences of technology. Information sharing, communication, and decision making capabilities should be pushing business towards more responsive, flat organizations where individuals are empowered to decide what needs to be done and what teams need to be formed to do it.

A successful organizational architecture provides clear cut roles and responsibilities, promotes ownership, and fosters teamwork in an atmosphere of trust and positive attitude. See Figure 2. The resulting empowered organization eliminates unnecessary bureaucracy.

These fundamentals are the foundation of world class quality. See Figure 4. People are the most important resource in a company and through technology people can more easily assume ownership and establish effective work groups in a positive work environment. When business processes become highly definable, predictable and repeatable, cycle time reduction and a zero defect environment can be a reality.

**OEM Fundamentals**

The tools of the OEM provide productivity support in four primary areas: people, business, technology and desktop. See Figure 5.

**People**

People affected by the OEM are presented with three primary tools: Organizational Models, the "Everyone's Information System", and a Customer Information System.

People are the most important resource within a company. The OEM provides organizational modeling tools such as a "living" Organization Chart, an Organizational Capacity Model, a skills inventory, quarterly assignment inventory, and a quarterly achievement database. These tools provide MCI with an organizational architecture which define clear roles and responsibilities; core competencies and skills required to perform an assigned role; tools which match existing skills to prioritized projects; and systematic feedback of individual and team performance.

The OEM transforms the concept of the Executive Information System into "Everyone's Information System", providing an information system that allows appropriate access enterprise-wide. This approach avoids the
documented pitfalls of most EIS systems: providing only one level of management with automated tools to run the business. Applications target personal profiled real-time news feeds, traffic trends and projections, economic and business analysis tools, organizational status reports available in various views, group and personal calendaring, CD ROM access to technical information, and key business indicators.

As a provider of telecommunications services throughout the world, MCI can leverage its knowledge database of customers, customers requirements, and account details is its most empowering feature. Transformation in this area means responsiveness and quality customer service. The OEM will meet customer concerns with a database of complete customer profiles as well as quality control measurements that track the customer perspective. All the elements of world class customer service will be accounted for: instant access to critical data, ensured timely, appropriate responsiveness, and proactive customer support. See Figure 5.

**Business**

The business area of the OEM includes: Planning Information, Program Management Information, and Budget Information.

The OEM promotes a continuous planning environment that goes beyond strategic and tactical planning to include end-to-end planning (rolling four years and four quarters). The associated tools provide precise desktop support for defining the business strategies and for goal-based product and infrastructure prioritization. The applications cover automated development plans, marketing and product forecasting tools, competitive market analysis tools, revenue and expenditure analysis tools, program prioritization tools and direct linkages to the program management and budget information systems within the OEM.

MCI’s state-of-the-art Program Management Facility allows tracking of not only program schedules and resource allocations but also work, cost, and organizational breakdown structures on each program. Issues tracking and resolution are features of this tool. The OEM is providing this program management facility, executive reporting of key program deliverables and milestones, manpower utilization and task ownership, impact assessments, and a direct linkage to both the automated planning and the budget information systems.

The OEM will deliver an automated capital and budget allocation and tracking system which are directly linked into the planning and program management information systems. See Figure 5.

**Technology**

The technology components of the OEM are: Technology Platforms, Operations Information, and Quality.

The Technology Platform system provides a set of models for examining new technologies and their potential impacts on the MCI network. This tool set offers the desirable architectures and technologies for selection, and optimizes their deployment and implementation. The telecommunication service sector has transformed itself from an analog to a digital environment. New technologies need to be carefully examined to determine their proper deployment within the infrastructure. Specific applications include architectural validation, analysis tools for technology selection, and performance analysis tools.

An Operations Information System has also been developed to track the billions of bits of operational data it has on the performance of its network (switching, transmission, etc.). These tools will
provide trending and analysis capabilities which will allow MCI to proactively predict traffic anomalies, potential network degradations, and proper restoration and planning aids for network outages. They also measure, analyze, and optimize the performance of MCI networking facilities thus enabling premier customer service. Applications to be developed include: operational characteristic tools, performance management tools, and trending and analysis of operations information.

The Quality Information System is a set of tools to trend and analyze network availability, queuing/delays, call setup times, bit error rates, and other measures associated with "world class" telecommunications service delivery. See Figure 5.

Desktop
Under development is an improved desktop to promote the use of OEM tools to users across MCI's LANs and WANs. Users will get improved communication tools, desktop access to MCI's Information Resource Center, and seamless access to the various available operating systems for the more sophisticated users of the OEM. The goal is to provide a universal desktop that looks and feels the same under DOS, OS2, VMS, MVS and System 7.

MCI fully utilizes its own products for internal and external communication including voice and data and MCI's own E-Mail system, MCI_MAIL. E-mail systems are excellent mediums for 1-to-1 and 1-to-many communications. "Groupware" products enhance the existing mediums to provide many-to-one and many-to-many communications. Applications provide access to an on-line phone directory, easy to use launches to E-mail from any place within the OEM, automated pointers to groupware which promote new communication techniques, automatic phone log, personal phone directories, desktop audio and video conferencing, improved access to the various word processors and graphic packages that are available to OEM users via its LAN/WAN, and a library of the various media presentations.

OEM users also have access to MCI's Information Resource Center, a state-of-the-art technical research and library facility in Richardson, Texas.

Tools used with the OEM
The approach taken by MCI to develop the OEM includes four distinct elements: network, services, workstations, and applications.

Network
The transport portion of the OEM utilizes what MCI calls its "Enterprise Network": a single, heterogeneous computer environment encompassing all computers, services, resources, elements and networks at MCI. The intent of such a network is a transparent front end for the user, encompassing file, print, communication and applications services. Various types of workstations can be in service and the interface is transparent. The "Enterprise Network" has or will provide access to multiple client/server platforms (DOS, OS2, MAC, UNIX, VMS, MVS), WAN integration, interoperability, distributed processing, and a single-point concept of network administration.

Services
OEM users have basic network services which are available seven days a week, twenty-four hours a day and encompass basic file, disk, print, communication, and application services. File disk service provides users with storage on one or all servers. Printer service connects all users to all printers on the network. Communication service puts OEM users in touch with all applications residing on the Network. The applications service provides access to a wide variety of distributed-application engines.

Workstation
MCI is committed to providing a seamless presentation layer. The OEM "screen" driver appears identically on each user and serves as their menu-driven front-end. Although the predominant client is an INTEL-based 80286/386/486 PC, efforts are under way to include MAC, UNIX, and RISC clients.

Applications
OEM applications development is based on a rapid prototyping model which automate business processes and facilitate discussion, tracking, problem solving, issue resolution, and presentation of critical data. The applications are developed using the most appropriate software for the situation. Embedded in the applications are advanced data management capabilities which provide "what if" scenarios to decision makers.

Software interoperability requires applications to interface with one another using such processes as DDE (dynamic data exchange) and OLE (object linkage exchange). Wherever possible, linkages are made to data in its original location to avoid duplication of data.
The current trend toward multi-vendor architecture permits development on economical and available platforms. It also supports the ultimate goal of scalability, once a prototype has been tested and approved for full-scale development.

The OEM and SAS Software

One of MCI’s strategic vendors is SAS Institute Inc. in Cary, NC, chosen because of their leadership role in the decision support community and their commitment to the fundamentals critical to the OEM: multi-vendor architecture and empowerment through enterprise-wide information integration.

The nature of SAS Software as a programmer efficient language lends itself to the rapid prototyping model embraced by the OEM. Key applications have been developed using SAS on the mainframes under OS/MVS, on PCs under OS/2 and DOS, on a Banyan LAN, and on a VAX 6540 under VMS.

Data collected on skill levels, training requests, and assignment preferences for a sample population within MCI have been analyzed to isolate training needs, facilitate project staffing, and develop group profiles. This skills inventory feeds the Organizational Capacity Model (OCM) which ranks projects, and allows managers to query skills, schedules and priorities to optimal resource utilization.

SAS is also used to collapse critical business statistics into meaningful graphical presentations for trending and forecasting. The travel and expense report auditing system written in AF and SCL runs interactively on the mainframe. A budget reporting system runs on the LAN and feeds groupware databases, and will ultimately be merged with project management and development plan data.

SAS provides one of the key development environments on all OEM platforms, and permits access to all data sources. The horizontal linkage provided is fundamental to an IDS -- one data source and a common data dictionary.

The OEM and SAS/EIS

The EIS component of the OEM has been conceptualized based on SAS/EIS (release pending) which will provide an object-oriented development facility and a toolkit for building interface and maintenance tools. The product has the following capabilities: hot-spotting, drill-down, what-if analysis, links to host E-mail systems, graphical reporting, exception reporting and critical success factors.

Conclusions

The OEM embodies all the characteristics of the era four technology system, termed an Information Delivery System (IDS) by SAS Institute president Jim Goodnight. "A successful IDS can overcome the diversity of data sources, incompatible applications, broad-ranging user requirements, and diverse computing environments."

When fully implemented, the OEM will be a revolutionary enterprise-wide information delivery system servicing all levels of the company and enhancing decision making at all levels. This is the kind of strategy that will have the greatest impact on organizational goals and will provide MCI the strategic and competitive advantage for the future.

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