Interconnect Technology as a Management Challenge

Introduction

The interplay of technology and management is recursive and multidimensional. From one view technology facilitates management and may improve the processes that must be managed. From another view the technology itself leads to a set of management problems associated with its own introduction to an organization, and its proliferation throughout the organization, and its operation within the subcultures of an enterprise structure. Technology both solves and presents *management* problems. Management both solves and creates *technology* problems.

Critical Aspects

How a particular technology is managed is largely determined by critical aspects of the technology, such as:

1. Cost of the technology
2. Management familiarity with the technology
3. Relation between the availability and demand for technology access
4. Degree to which technology provides a complete solution
5. Change rate of technology itself

These factors, referred to as risk elements by some [3], will determine what must be managed, what may be managed, and what does not need to be managed.

Common problems of information systems being obsolete before implementation or not implemented within the planned time frame often result from mistimed technology acquisition or misjudgements about the technology's rate of change. Consequently, accurate and timely technology prediction is essential when the technology is changing rapidly and constraints to its use are being removed. Changes may occur either in degree or in kind of technology.

Changes in degree of technology. Through continued improvement in price and capability for resources which are already used and understood, changes in degree of technology affect the management process cumulatively over time. An example is the regular doubling of direct access storage device (DASD) density. Managing those changes requires only limited adaptation of existing management practices.

Changes in kind of technology. These changes are dramatic, disruptive, and very difficult to predict. An example was the introduction of online disk storage to a magnetic tape, batch world. When a change in kind of technology occurs, the professional community surrounding the technology changes. Changes are seen in the information systems design process, the operational patterns, the nature of the skills required, and the type of people needed.

The Critical Technology Issue: Interconnect Capability

A dramatic change in kind of technology within the next half decade will remove interconnect as a constraint in systems and will require revision of all current assumptions as to what computer resources constrain use and what resources facilitate use. The technological underpinning for interconnect is the availability of fiber optics for interconnect paths that will operate a multi-gigabyte transfer rate, have greater reliability characteristics, and will reverse a major cost trade-off in that it will cost less to move a byte from one system to another than to store and move a byte from a processing unit to a DASD device. Until the technology is extended to general read/write storage devices and processors (in a time frame of perhaps ten years), computers will replace communications as the expensive interconnect bottleneck.

This reversal of technological bottlenecks requires that the management of application development, information control and data

design, network management and design, information systems and end-user relationships, and strategic planning be critically reviewed. Management problems associated with this change are presented in this essay.

Application development

Easy connectability will provide for a proliferation of project and application level networks, many of them under direct user control. This distribution will take the form of separating data and processes across a number of nodes. Distributed application development will become the fundamental approach that requires management support. The design of applications by the user requires methodologies that are neither complete nor widely understood.

Information control and data design

A number of data and information flow analysis techniques are being recommended by vendors and consultants. As abstract ideas, the methods are sound, but they suffer from the problem affecting information science methods—the method is simple, but the effort required to collect the information in order to use the method is overwhelming and essentially limits the use of the method.

A great risk is that management will commit to undertakings that are just not feasible with current data analysis methodologies. It is not feasible to do a corporate-wide data flow analysis with sufficient detail to guide an information systems design. It is probably not feasible to do such an analysis at a divisional level or plant-wide level either. Attempts to do such an analysis are commendable but doomed to fail.

Network management and design

Local area networks have been clumsy to install, limited in application, and disappointing in performance. Wide area networks do not have the reliability of computer electronics; they are orders of magnitude slower than computer electronics and are expensive.

The networks made possible by the new interconnect technology will be reliable, faster than most computers, and, for up to twenty kilometers or so, inexpensive. They will be largely manageable by end-user organizations using the same level of professional talent that has been used in the past to manage the telephone system.

Current computer-oriented solutions for network optimization will be counterproductive. The process for fault determination will be largely unnecessary, and the entire issue of network management, as practiced today, will be quaintly antique. New algorithms will be required to manage tomorrow's networks. Unhappily, many organizations will spend large sums managing the networks of 1995 as if they were the networks of 1985. As so often happens, we gain insight and build solutions to problems that are about to disappear. Much management attention must be given to networking because there will be such dramatic changes in the future. We must assess the problems that will emerge once the problems we discover have been solved.

Information systems and end-user relationships

The interconnect breakthrough requires that we understand the circumstances, risks and benefits along various lines of centralization and decentralization. The risk to the vitality of the enterprise from overconstraining an aggressive, end-user entrepreneurial function may be much greater than any suboptimal use of the computer resource. The risk of forcing technology on an end-user organization that does not wish to use the technology can be equally high.

A process of negotiating function and responsibility is required that will lead to a documented statement of who does what based upon factors agreed to by concerned parties [1,2]. There must be plans put in place now because the skills inventory and enterprise organizational structure may change radically as more computing autonomy evolves. Without this plan, information systems will come to be viewed as a discourager and not as a facilitator in an era where denied benefits are a major risk.

Strategic planning

Disasters in information processing often oc-

cur either because we are thinking too small or too big. The risk of thinking too small is an inability to link information processing solutions to strategic needs of the business. The risk of thinking too big is that we undertake vast conceptual systems which are too complex to realize, never adequately specified, never really perform as anticipated, are years late, and become obsolete quickly.

Interconnect technology will make it possible for us to overcome the risks of thinking too small more easily than the risks of thinking big. We can therefore avoid projects that are massive top-down efforts, and can build large systems out of already existing systems. The critical executive decision in the planning area is to determine what to plan and how much planning must be done [1].

Conclusions

Our view of what must be planned and strategized, what must be controlled, and the degree of freedom available has changed in important ways. In this essay we propose that a change in kind of technology will occur that will have a major impact on the management of information systems. While we do not suggest management solutions, we do offer a view of a new set of management concerns.

One important fact about accommodating increasing rates of technology change is the recognition that organizational structures are truly ephemeral. The laws of physics do not identify a natural organization for management of information processing, and neither, properly conceived, do the laws of management. But deciding to reorganize to face critical problems is not good enough unless critical problems can be quickly and correctly recognized.

Harold Lorin
IBM Systems Research Institute

Leslie D. Ball
Babson College

Gilbert Eloy
IBM Belgium

References

[1] Lorin, H. *Aspects of Distributed Computing Systems*, John Wiley & Sons, New York, New York, 1981.

[2] Lorin, H. "Management Approaches to New Information Environments," *Data Processing*, Butterworth Scientific Journals, May 1983, Volume 125, Number 4, pp. 137–144.

[3] McFarlan, F.W. "Portfolio Approach to Information Systems," *Harvard Business Review*, Volume 59, Number 5, September-October 1981, pp. 142–150.