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GM's KAMINSKI SAYS FACTORY NEED FOR MICROS EQUALS OFFICE NEED

General Motors ranks highest on the list of automakers currently looking at various ways to utilize local area networks (LANs). Its Manufacturing Automated Protocol (MAP) program promises to be one of the first widespread uses of a LAN to connect corporate mainframes with personal computers, milling equipment, and all the machines used during automobile production.

The head of GM's MAP program, which involves 17 different vendors, is Mike Kaminski, a 16-year veteran of the auto business whose background includes production engineering, information systems management, and data communications. Kaminski's dream of a single network linking an entire auto factory started in the 1970s. Today, it's nearly a reality.

Kaminski is based at the GM Technical Center near Detroit. He talked with senior editor Jim Forbes about MAP and the role of personal computers on factory floors.

RICHARD ROGGE

Mike Kaminski, head of General Motors' MAP program, thinks 2,000 to 3,000 micros will eventually be connected on the MAP network.

How did the idea for MAP originate?

In the 1970s, we formed a broadband user group within General Motors. The group was made up of people who had experience in connecting manufacturing — process control — equipment. The group's purpose was to share solutions to problems encountered in getting manufacturing machines to talk to each other and to computers. We all had the problems you would think were common to a group of people who had no real experience in data communications and networks.

Four or five people later got together and formed the MAP task force within GM. In 1982, we began to pursue a system that would conform to the International Standards Organization's seven-layer model.

How many pieces of equipment will be attached to a GM MAP network?

It probably won't be uncommon to find some networks in our manufacturing plants with 2,000 to 3,000 programmable controllers attached [personal computers and machines with microprocessors]. In many cases, there will actually be parallel networks, that is, baseband systems attached to broadband, backbone networks.

We need the protection of parallel networks. That way, if a baseband link goes down because of overdemand, the whole factory won't be crippled.

Can MAP help reduce the cost of local area networking at GM?

Yes. We expect to implement silicon [semiconductor] versions of hardware boxes that currently cost $1,500 for baseband and broadband LANs. This should reduce the connection costs to about $750 for broadband and about $350 for baseband LANs. We also believe the cost of installing systems and communications software will drop by about a third at GM after we get our systems up and running.

Ethernet networks cost less than MAP networks, but our system is more suited for the factory floor than Ethernet. We've had to make sure our cables are protected against ambient electrical signals and can withstand a rugged factory environment. In our view, Ethernet is more suited for offices than for factories.

Why did GM ask 17 vendors for help?

First of all, no one vendor can meet all of GM's needs. Second, it stands us in good stead not to be tied to a single vendor, and there are no economic incentives to do this. We would like to see price and technological innovation among our vendors.

This gives us the ability to pick suppliers that meet our needs in the most cost-effective manner possible.

Do you see more personal computers being used in factory floor applications?

Personal computers on our factory floors have to be hardened, and they have to be serviced very quickly. In addition, machines on the floor have to have an interface language that is easily understood by the people who use the machines, not the computer jocks and wizards found in offices.

When micros first came out, I looked at them as office devices. Today, micros can be hardened against the dangers of the factory, and we've learned that they are as easily used on the factory floor as in the office.

What other innovations in personal computers on the factory floor will be common in the coming years?

There will be more micros linked to mainframes and people accessing corporate databases right from their positions on the factory floor. There are people out there in factories who need to communicate with mainframes in offices. Factory floor users have the same requirement for information as do office workers.

production and inventory requirements.

"Now that the personal computer is an accepted device, people are more willing to apply it in an area where 10 minutes of downtime can mean hundreds of thousands of dollars." says Steve Malyszko, manager of computer products and systems at French Gerleman Electric, a St. Louis distributor of industrial controls.

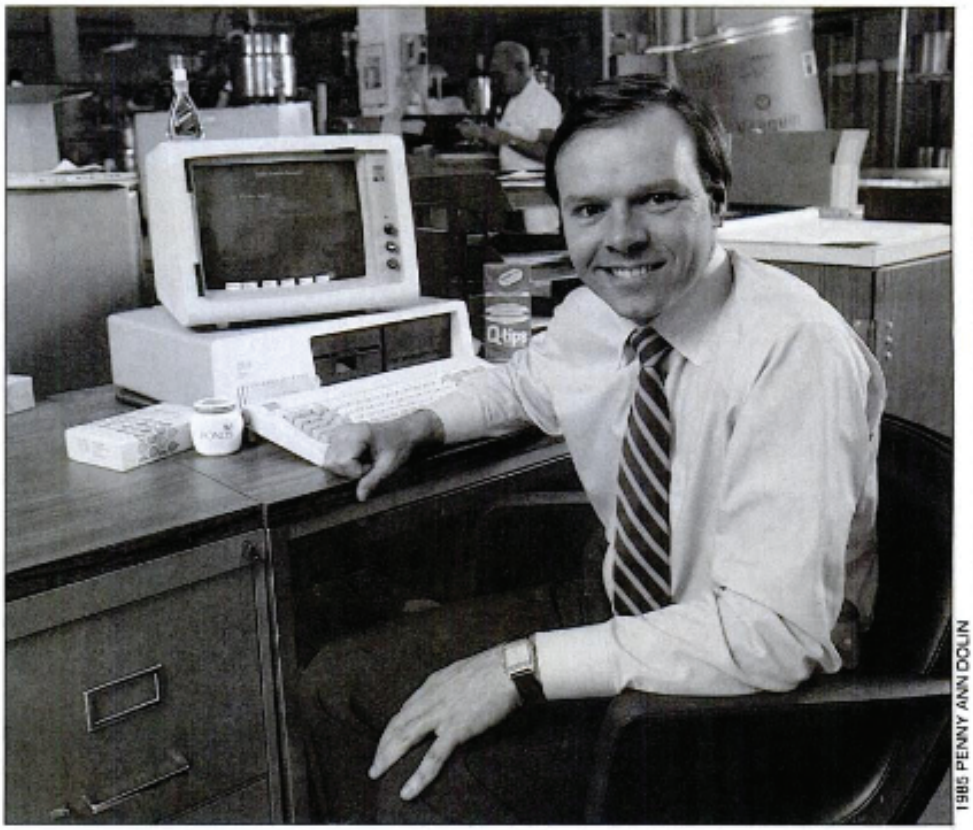
Malyszko sees personal computers as just the next step in the evolution of factory automation. In the past three years, he's installed personal computers in nearly 40 companies, ranging in size from small mom-and-pop operations to Fortune 50 corporations.

In many cases, microcomputers are being used in places where minicomputers prove too expensive or fail to provide the right solution. At Northwest Pipeline, Phillips spent eight months trying to get a minicomputer to control eight separate integrators, devices that read charts produced by gas meters on the company's main gas lines. The mini proved to be too slow, and data collected from the integrators had to be manually re-entered from the minicomputer into Northwest's mainframe.

It took Phillips only one month to get eight IBM 3270 Personal Computers up and running. Now each integrator is connected to a personal computer that programs it, reads data from it, and dumps data directly to the mainframe. Phillips says, "It's still cheaper than one minicomputer."

Networks are also coming into greater use on the factory floor. Norton's Walker is installing a 3Com network in the company's Worcester plant to connect the IBM PCs spread throughout the company's production planning, milling, quality assurance, and inventory areas. Walker would like to see an integrated network throughout the plant. He's watching the development of GM's Manufacturing Automation Protocol and sees it as a long-term networking solution. (See related story page 39.)

The automation efforts at Norton are



1985 PENNY ANN DOLIN

William Goebel of Chesebrough Ponds says that MRP software for micros has become so sophisticated that it rivals mainframe software except for speed, storage, and multiusers.

MRP AND MRP II OFFER SMALL FIRMS A COMPETITIVE EDGE

More and more personal computers are being used for material requirements planning (MRP) and manufacturing resource planning (MRP II) because of increases in personal computer memory, speed, and mass storage.

MRP blossomed in the late 1960s as a method for ordering and scheduling materials. MRP's main function is to ensure that inventory levels are adequately maintained; it also entails the tracking of bills for materials and calculating of parts requirements based upon a given production schedule. Because of the number of items tracked and the need to reschedule materials on order as production demands fluctuate, the computer is a natural tool to perform these functions.

MRP evolved gradually into a larger manufacturing resource planning tool as these basic scheduling techniques were applied to such areas as capacity planning and shop floor control. MRP II addresses a basic need among manufacturing companies: to make the right things at the right time. As it emerged in the early 1970s, MRP II became a system for managing the major tasks of a manufacturing company, including production scheduling, cash flow, labor, capacity planning, inventory, and distribution.

MRP and MRP II systems were first implemented on mainframe and minicomputers; although packages for personal computers have been available since the mid-1970s, only in the past 12 to 18 months has personal computer hardware been powerful enough to support the software needed to make MRP and MRP II viable on microcomputers. Nearly 50 MRP packages are currently available, offering the same manufacturing techniques used by larger corporations with mainframes and terminals to the smaller companies and the divisions of larger companies that use microcomputers.

With fewer financial resources to buffer them and less clout with vendors, smaller companies have a greater need for MRP II software than larger corporations. The former are in a "much more fragile, more competitive situation," says Lew Silverstein, marketing director at Helmsman Systems Inc. of San Jose, California. He describes a typical customer for Helmsman's MRP products as a company that does discontinuous assembly (basically making products to order) rather than continuous fabrication.

Such a company's problems are "cash flow, material availability, and priority scheduling to meet delivery," Silverstein says.

"MRP is a tool, not a panacea," because it doesn't teach companies how to run their business, he says.

designed to replace a cumbersome manual method for tracking production. Under the old system, customer order information from the company's mainframe was downloaded to the production planning area, which produced multiple-part, handwritten tickets. At each stage of production, operators removed one part of the ticket and added information for the containers' next stop. Eventually, the tickets were routed to data entry clerks who entered the data into the mainframe computer.

Using personal computers on the mill's floor has all but eliminated the need for manual data entry. Now production planners print bar code labels that the mill operators use to mark the containers. The bar codes give the operators access to a database in which all order information is stored. Based on this data, the mill operators produce lots of a particular abrasive. As the containers pass on to the quality assurance area, bar code readers on personal computers are used to pull up the database to add quality information. Finally, the containers reach inventory, where information is again logged into the system.

The personal computer's appeal in the factory is the same as in the office: It's a low-cost, versatile tool. And it's easily had. "You can order them out of stock," says Michael Galane, marketing manager of HP's Manufacturing Systems Group. In addition, it liberates the manufacturing group from the control of the data processing department. As Walker points out, "We can service the personal computers ourselves and don't have to wait in a data processing queue."

HP's Galane is amazed at how quickly personal computers have spread across the factory floor. "We knew it was going to happen, but it's out of control," he says. One area where Galane has seen personal computers used extensively is in the direct control of equipment.

Throughout the factory, personal computers are performing data collection and monitoring functions in conjunction with the control devices. The operator interface is emerging as another important use of micros. William Seipp, marketing manager for Allen-Bradley's Industrial Computer and Communications Division, thinks that high-resolution graphics monitors will play an important role on the factory floor.

He cites an example of an operator's following the production process as it is depicted graphically on the monitor. If, for instance, one area along the production line was highlighted in red — indicating a problem — the operator could enter commands into the computer and watch the results.

With HP's PC Instruments, a personal computer-controlled test and measurement system, instrument panels are replicated on the personal computer screen and the instruments are operated directly from the computer.

Like Galane, Seipp expects the number of personal computers used in industrial applications to grow rapidly. "We think the proportion of personal computerlike products used in industrial environments is increasing more rapidly now than use of personal computers in the office, and we see that trend continuing for the next two to three years," he says. Other manufacturing managers think it won't be long before nearly all control devices are sold with a personal computer.

The companies involved in industrial automation are excited by the market's potential. Allen-Bradley's bullish outlook is backed by its recently introduced product

GM SETS THE STANDARD ON THE FACTORY FLOOR

For years, the captains of industry — companies such as General Motors, Ford, Boeing, and Du Pont — have been automating parts of their manufacturing facilities. The key word here is *parts*. Although the automation of specific manufacturing processes has brought cost savings and greater quality control to individual areas, it has resulted in manufacturing islands.

These islands cause problems of communications, forcing human operators to manually reinput the data. The alternative is for the manufacturer to develop customized hardware and software to connect the different islands.

Nearly five years ago, GM decided to tackle the problem of linking devices and manufacturing cells on the factory floor. It formed a task force to come up with a standard protocol for an industrial local area network (LAN). GM has a compelling reason to address the issue: Of the more than 40,000 intelligent devices from a dozen vendors currently installed in its facilities, fewer than 15 percent can communicate with each other. Because GM sees automation as a primary means of competing with the Japanese, the company plans to increase the number of its automation devices by 400 percent to 500 percent over the next five years.

Although GM has already defined parts of its Manufacturing Automation Protocol (MAP), a communications standard for building networks, it will probably be another two years before the protocol is fully specified. Because many programmable devices such as milling machines require responses that are measured in milliseconds, GM chose a LAN architecture that would deliver a signal in a predictable amount of time. It steered away from Ethernet-type LANs, popular in business offices, because it is difficult to be certain about the timing of signals on such networks.

Instead, the MAP committee settled on a token-passing network on which data is transmitted from one station to another in a predictable route to its destination. The committee also opted for a broadband bus network. Broadband, a cable television technology, allows data as well as video signals to travel along the cable and can even accommodate more than one network on the cable. A bus configuration means that the cable can be run in a straight line with devices being connected to the broadband cable at almost any point.

To promote acceptance of MAP as an international standard, GM has adopted Open System Interconnection, a seven-layer LAN model developed by the International Standards Organization. For the bottom four layers, GM is following recommendations made by the IEEE standards committee.

This means that if MAP is accepted as a standard, all programmable devices, robots, and computers will be able to communicate via the same network. This capability to interchange information among manufacturing cells will give manufacturers greater control in areas such as work flow, scheduling, machine availability, inventory, and quality control. In addition, MAP could save manufacturers money, considering that more than 50 percent of the cost of new automation comes from developing interdevice communications, including customized software.

According to *Gateway: The MAP Reporter*, GM has already received commitments of support for MAP from nearly 20 companies, including Allen-Bradley, AT&T, Concord Data Systems, Gould, Hewlett-Packard, Honeywell, Motorola, Intel, and Siemens. This past April, Allen-Bradley, an industrial automation company, introduced a family of MAP-compatible networking products, including Vistanet. This industrial broadband network was designed to interconnect factory floor controllers, peripheral devices, and computers. Concord Data Systems also has MAP-compatible networking products available.

line: an industrial desktop computer, portable computer, and printer all supplied by IBM's Manufacturing Systems Products group. The three products are ruggedized to withstand fluctuations in temperature, humidity, vibration, and power.

Allen-Bradley sees the primary application for the portable, due out in June, as online diagnostics of the company's Vistanet networking products. Vistanet is one of the first factory networking products to comply with GM's MAP, a network designed to allow equipment from multiple vendors to communicate easily in the factory. The portable can also be used for monitoring and device programming, as well as for a portable operator interface.

Although Allen-Bradley's management obviously thinks IBM is on the right track by offering a line of ruggedized personal computer equipment, not all personal computer manufacturers are convinced that users need hardened equipment. The main reason for having a hardened computer, according to Galane, is that you don't want the computer to break. Even if it does break, "personal computers are so cheap that people will consider replacing them," he maintains.

In fact, HP's Trescott recounts a story of a company that used Commodore 64s, which were "so cheap, the company bought twice as many as it needed because if one broke down, people could just go to the closet and pull out another one."

HP currently offers ruggedized terminals, and Galane concedes the company is watching the market closely to see how strong the demand is for ruggedized personal computers.

Norton's Walker maintains that the mill where he is putting personal computers is so rough that even ruggedized equipment "wouldn't last two months." In making abrasives, dust and grit are released into the air as 2-inch lumps of aluminum oxide and silicon carbide are reduced to particles for its sandpaper. Walker's solution is to put commercial IBM Personal Computers in a specially sealed and pressurized enclosure, leaving a ruggedized keyboard and the bar code reader outside.

Whether computers are ruggedized or not, on the factory floor or in the manufacturing manager's office, expect to find many more personal computers in the manufacturing plant. As this trend grows, the push toward integrating computer systems throughout an organization will increase. As Malyszko of French Gerleman Electric observes, "The advent of personal computers in the manufacturing environment is the first tangible step toward getting the manufacturing and engineering people closer to the data processing people, which I think is a positive." □