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Abstract

The local area network (LAN) interconnecting computer systems and soft- ware can make a significant contribution to the hospitality industry. The author discusses the advantages and disadvantages of such systems.

Automating Hospitality Information: Network Technology and Systems Management

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The local area network (LAN) interconnecting computer systems and software can make a significant contribution to the hospiality industry. The author discusses the advantages and disadvantages of such systems.

"Sometimes the magic works. Sometimes it doesn't."

This is the prophetic message from the mighty Medicine Man in the Thomas Berger classic, *Little Big Man,* which may have a ring of familiarity to anyone involved in automating one or more functions within a hotel, restaurant, or other hospitality operation. With the interest and hyperactivity in placing computers and related equipment throughout the business, staying abreast of information automation alternatives is increasingly vital as a possible potion to make the "magic" work, and work more effectively and efficiently.

Computers are entering the business at an astonishing rate; they are the newest appliances, administrative aides, and even business partners, in some instances. During this era of evolution in hospitality information automation, it is wise to have implementation check-ups on an ongoing basis. Are we seeking solutions to the right problems? Are we buying the right equipment? Are we effectively utilizing the equipment we have? What are the alternatives for in-house information/communications technologies, and what glimpses do we have of future directions?

After examining these questions, one relatively young group of technologies, "the local area network." (LAN), emerges as a strong candidate to play an exciting role in the handling and coordination of hospitality information and communications.

LAN Is New Giant

The hospitality industry will be seeing and hearing volumes about the "local area network" as vendors and media recognize this giant in its infancy; the current "consensus" description of what a LAN is and is not may serve to clear any smokescreens or inconsistencies.

The primary objectives of the LAN are to allow each user with the appropriate security to have access to network resources and to coor-

dinate signal pathways for a cost effective and operationally efficient data and communication management system.

An LAN is defined as a system for the interconnection of two or more communicating devices. It consists of two or more computers of any size, a connection medium (e.g., cable), and specialized software both to manage signal pathways and to allow otherwise incompatible hardware and software to work together. Attached to these may be nodes or devices such as hard disks, printers, modems, sensors, actuators, office automation equipment, and, in specific configurations, telephone (audio) and video operations.

The local area network may then become a node or sending and receiving point on a larger network, e.g., the long-haul telephone network, through the use of a gateway (a special computer responsible for translating signals coded for one network to the code of another network, e.g., protocol conversion).

The term network is used with such frequency in promoting computers and applications that the unwary may not know what the products are; it is a little like ordering coffee with cream, or was it half and half, or non-dairy whitener? In order to differentiate local area network technology from the many other "networks," Datapro Research offers these six characteristics of the LAN.[1]

• **Intra-company:** Privately-owned, user-administered, and free from FCC regulations, this excludes common carriers such as phone companies, public local networks, and local cable T.V. networks.

• **Limited in geographical scope:** With devices physically separated and probably able to be relocated, but not mobile, the current maximum distance, depending on the LAN technology used, is about 3 to 50 miles. For example, devices may be interconnected on multiple floors of a hotel, or among the campus service and supply areas of a university.

• **Structured:** Integrated into a discreet physical unit, with devices linked together by one continuous medium (cables, wires, fiber optics).

• **Full connectivity potential:** If desired, any user device on the network is able to communicate with any other user device, not merely main processors. This qualifier differentiates a LAN from the usual local link which supports only hardwired point-to-point connections between a host computer and its attached devices, and from many so-called personal computer nets.

• **High speed:** The LAN technology usually supports signal distribution operations in a much higher range of bits-per-second than other networks, depending upon the type of medium used.

• **Available in the marketplace:** More than 350 LAN products are on the market today, including more than 45 complete systems.[2] However, only the simplest true LANs are turnkey products today.

With the local area network description now honed to a more recognizable tool, the next step is to explore in more detail the makeup of the LANs which separate the vendor products and which make them both powerful and controversial.

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LANs Become Specialized

As giant firms are recognizing the opportunities in the local area network technology, each is beginning to specialize in particular types of LANs, based on the capabilities and costs of the LAN components they have or plan to design into their respective LAN product(s). The primary differences among the current major LAN products are in the choice of transmission medium, topology, and access methods. Vendors have mixed and matched these components.

• **Transmission medium:** Choices include twisted pair (phone wires), coaxial cable (such as cable T.V. firms use) and fiber optics. Twisted pair are inexpensive, but not yet capable of high speed or video transmission. Advocates of coax cable praise the opportunity to combine video with audio and digital data, (baseband cable) and to split the medium into multiple channels (broadband cable) for simultaneous, separate transmission on a single cable. Fiber optics promise tremendous speed, but thus far the problems in system relocation and maintenance of the intricate glass threads has slowed their use in an environment as dynamic as hotel information systems.

• **Topology:** As in geography, topology here refers to the description of a system showing the specific relations of component parts as to shape, size, position, etc. In other words, what would a map of the cable and attached devices look like? Each topology has differing characteristics in such areas as information delay, reliability, speed, distance, costs, and in the ability to function or recover after a component network device fails.

The three most prominent network topologies are the linear bus or tree, the ring, and the star. In a bus, the nodes or devices are arranged along a single length of medium which can be added to on at least one end (linear), or may branch at either end (tree). A signal has only one path between any two devices. In a star network (e.g., a PBX), all devices are connected directly to a central node, with any signal destined to travel via this "traffic cop" center. Simple to picture, in the ring topology the medium forms a closed circle, with devices arranged around the circle on a pathway such that a signal passes sequentially through each node to its destination, then returns full circle to its originating device.

• **Access method:** A network's access method refers to the way in which signals traveling along the path are directed in order to avoid collisions with competing signals. This component of the LAN technology may well be the most important factor in determining its performance. The way an access method functions is largely dependent upon the kind, frequency, and volume of data, and on the network's physical dimensions, topology, and configuration. Will signals be sporadic? Will many devices vie for the same resource(s) simultaneously? (A file? A printer?) The two prominent methods are CSMA/CD and Token Passing.

Carrier Sense Multiple Access/Collision Detection (CSMA/CD) is the most common random access method today (Ethernet, Wangnet, Local-

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net), and would handle most hospitality needs having even a tiny error tolerance. A station needing to transmit will first "listen" (sense the carrier) on the circuit to detect any traffic. If the circuit is busy, intermittent listening resumes. When the line seems available, the signal is sent. To reduce error problems from transmission collisions, most CSMA networks have added "collision detection." Using CD, the device also listens after its signal transmission. If a collision is detected, the signal is re-sent following a random delay.

The Token Passing access method, while not yet as popular, enjoys growing strength in manufacturing operations, due to its predictable response time. It may be visualized as a peppy staff meeting in which the floor belongs to you as long as you have the microphone. When you are finished, or if you had nothing to say this round, you pass the mike to the next staffer and the floor belongs to him or her. In this way, the mike (or token) passes its way very deliberately around the ring or along the bus, from station to station.

Communications Are Now a Patchwork

Today we are approaching the automation of our data, voice, and video needs in an uncoordinated and overlapping fashion. In transmitting information electronically, we have developed separate physical "highways" within our businesses for each of the three forms of information we now transmit: digital, audio, and video signals. Many hospitality organizations require all three forms. Traditionally this has called for multiple pairs of wires laced throughout our buildings, one set for our digital data signals (electronic data processing, word processing) with its many subsystems; a second set dedicated only to audio (voice, telephones); and a third set, a cable for video transmission (television). Using conventional wiring, tying these diverse highways together is not yet possible.

Much like the parable of the three blind men, each trying to describe an elephant by the part he could touch, no one seems to have a grasp of the enormity and potential of the "big picture." One blind man, feeling the beast's brawny leg, exclaimed, "This must be a tree!" With hands over his head, flat against the elephant's broadside, the second patted, pushed, and finally decided that "this surely is a wall." The third blind man anxiously fidgeted with the tail of the pachyderm and soon called out, "No, no! You are mistaken! We have here a snake, a short, quick snake."

We can be smug and omnipotent in chuckling at these "silly conclusions" because we know a little something about elephants. Yet this example illustrates the limited perspective and comprehension by many good people in our industry, not of an elephant, but of types and channels of data and communications required within hospitality organizations. When information/communication needs are knowledgeably studied from a facility-wide and a company-wide viewpoint, similar "silly conclusions" may be avoided and more appropriate solutions can be investigated.

Consider these communication opportunities. Rather than using separate overlapping systems side by side, why not a front office com-

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puter program in combination with the PBX? It should include a two-way housekeeping link, with a direct link from all point-of-sale (POS) devices (food service, gift shop, pool bar) to guest accounting, and to back office and credit checking. Further efficiency could be achieved by having a word processor communicate directly with dictation equipment, telephone call messaging, and electronic banking and mail, with a video travel service and with photocopiers.

Other communication systems being automated in increasing numbers of hospitality facilities include inventory control, food and beverage, security-alarm and video monitoring systems, energy management, machine operations monitoring and control (such as laundry and climate-conditioning equipment), guest entertainment and business services equipment, beverage control systems, employee time accounting, isolated robotics installations, and, of course, the fastest-growing computer application, call accounting. Currently many of these applications are added as non-interacting systems, each separate from the other.

LAN Offers Opportunities

The technology of the local area network offers the capability of pulling the pieces of existing in-house systems into one or more coordinated, efficient networks. Once we have the vision to see the "big picture" of our information/communication needs, we then are in a position to explore the potential of local area network and related, convergent technologies.

A local area network can support most applications now served by manual methods, by separate automated systems, or by conventional point-to-point communications. If the current methods seem satisfactory, the incentive and justification to begin utilizing such technology as the LAN must be strong. Simply stated, to justify such an expensive step, the benefits should either allow the operation to save money, or to make money faster. What are the abilities and benefits of this technology?

• **Developing a company-wide, long-term plan:** Datamation surveyed 52 MIS managers to identify their nominees for the most troublesome areas of concern in information management. The two top-rated concerns surrounded "lack of a company plan" and a "company-wide, long-term perspective about personal computing."[3] These concerns are equally relevant for separate systems computing, e.g., a front office system, a housekeeping system, an F&B POS system, each separate, with no initial communications plan to forge together even the overlapping areas.

The planning required in the LAN feasibility survey addresses these very problems. The broad perspective and the focus on all functions, users, routes, and types of information which a LAN feasibility study requires are the first steps toward the vision, policies, and procedures capable of combatting these widespread and powerful problems.

• **Saving dollars and confusion:** The second level of ill content from the Datamation survey involved the examples of unnecessary high costs

to the company due to such widespread problems as "users reinventing the wheel in systems development,"[4] e.g., an inventory program for beverage control and a separate system and program for beverage purchasing down the hall. A related dilemma erupts when users, in a random department by department way, purchase desk top computers and software, learning by trial and error about the lack of compatibility of both with other mainframe(s), minis, micros, or existing peripherals in the building and the organization. Both the purchaser and the organization next must deal with the frustration and expense of maintaining these user-developed systems and programs.

The LAN solution here is to link information users within and between the natural "clusters" in which they work with one another, using resources shared by anyone with a device and clearance. By interfacing hardware and software, this waste of corporate funds is eliminated. Users have access to or specifications for resources which already work together, so they neither need to re-invent the wheel, support separate systems, or encounter incompatibility snags.

• **Sharing of data and programs:** The number one reason firms are beginning to investigate and invest in the LAN is to gain the ability to share data and software packages. Sharing files should enhance accuracy and reliability since all attached users begin with the same master data or version and use the same programs, with modifications being available to all users instantaneously upon access. For these same reasons, file storage costs are reduced because duplicate or similar files are no longer required for separate systems, e.g., one vendor list for purchasing is also used for accounts payable. Each user with the appropriate clearance now may have access to files and data bases (groups of related files, e.g., vendor information, guest history) from any terminal on the network.

Software programs and protocols are becoming available which will allow previously incompatible programs to be shared by other LAN computers and nodes without the extra cost of licensing, installation, and maintenance for separate systems. For example, if a labor scheduling or spreadsheet analysis program were installed on one LAN computer, other computers (desk tops as well) could participate in using these programs.

• **Sharing of hardware resources:** Next to file sharing, the most enticing benefit of the LAN is the sharing of resources (although money saved may well be spent elsewhere on the LAN, so be advised to look at performance benefits). As many organizations may have or soon have printers here, disk drives there, all dedicated to specific terminals or tasks, the benefit to be found with a LAN is that this hardware becomes available to share. Any LAN terminal may now access a host or member computer and, for example, send work to a lone, expensive laser printer, or to a disk or another floor. In this way, workloads can be more equitably distributed and expensive equipment need not be duplicated, but may well be utilized as a shared resource.

In networks which include mainframes, use timesharing, or have an overburdened mini, expensive and oversubscribed processing time may

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be reduced through a LAN. With the local area network, attached micros and smart terminals can contribute to the workload by doing some or even all processing locally, requiring only storage and distribution demands of a central computer.

• **Taking advantage of enhanced integration technologies:** Most LAN designs offer sophisticated capabilities which are pragmatic and timely for our hospitality needs. A LAN offers the opportunity to receive and send high speed graphics. Electronic mail and electronic filing within the facility are naturals for a LAN, with devices suddenly compatible and capable of such communications. Digital, video, and audio signals may be managed on a single network, with upgrades at any level available to all.

LAN Has Some Restrictions

Nearly every major advantage accommodated by a LAN is offset by at least one significant disadvantage. Research is expected to break many of these barriers and industry standardization will, if it can be synchronized, aid tremendously with others. The hospitality industry can contribute to this evolution by determining what it is we need in local communications from a broad viewpoint, and by expressing these needs to suppliers, who may, in turn, work through such problems.

• **Prices:** LANs are costly. Prices are beginning to fall, and savings can be had through effective resource sharing. Still, when DATAPRO researched the "average price per work station connection" of commercial vendors, quoted prices ranged from $250 to over $40,000. This breathtaking range highlights the caution that the same system be specified and bid in the same way by each vendor. The above LAN price of $250, for example, may have been the LAN portion of the cost of merely "tapping" an additional user station into an existing LAN. The "over $40,000" quote may represent a total cost, spread over a given number of devices. These costs would consists of the entire network system, possibly including systems analysis, cables and their installation, connection hardware, transmission components (laser?), network management hardware and software, technical support, and operator training.[5]

• **Immaturity:** In an echoing of the complaints surrounding any immature but irresistible technology, the LAN has yet to live up to all of its many promises. Lew Glendenning, director of information systems research with a firm in San Jose, California, has some stern words about his $160,000 network, although he believes that the system has paid for itself in under the two years projected. He explains, "Commercially available networks in general suffer . . . low performance, poor upgradeability, inadequately integrated application environments, miserable documentation, inability to realistically connect incompatible microcomputers, and very little application software equivalent to single-user software." Working through these problems, however, the president, Michael Killen, claims that the productivity of the firm's researchers increased at least 25 percent, and that the firm has doubled in size and scope without a significant support staff increase.[6]

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It seems to be true that the marketing claims and even the test installations boast of capabilities which are one to two years ahead of those commercially available.

- **Confusion:** LAN advertisements speak of "band widths," "migration paths," and "megahertz" as casually as if these words and concepts were in everyone's working vocabulary. Especially in such a very young and promising technology, it takes a knowledgeable consumer to sort through the LAN land of plenty-of-promises to the land of pragmatic practice.

International Data Corporation (IDC) reports that even though there were about 16,000 LANs installed as of mid-1984, "many users are confused, frightened and suspicious of the technology's slow acceptance in the market."[7]

- **Incompatibility:** Can any devices which will accept the LAN cable really communicate? Not always. According to Robert Metcalfe, chairman of 3Com Corporation, an example of incompatibility is an IBM PC with a Xerox laser printer on 3Com Corporation Ethernet; yet each will accept the cable.[8] In other words, you might phone Taipei, but if there is no common language or interpreter, communication still does not "happen."

Incompatibility between peripherals and between systems is a complicated foe. As of today, each unit of hardware and software must individually be investigated for use on a given LAN.

- **Security:** Most local area networks are designed to be easily tapped (linked into) for reconfiguration or for adding devices. It is precisely this design that makes them easy prey for tampering or data interception. Some firms offer optional data encryption, but although received data is then scrambled, even a novice can still destroy data or shut down the system. To a firm with sensitive data to place on the LAN, security may be considered the number one disadvantage.

Toward data security in terms of data integrity, what happens when an inventory or a spreadsheet file is accessed simultaneously by separate operators? One operator subtracts five cans of chili sauce; the other is entering purchases, including 24 cans of chili sauce. Effective systems now have file-locking software to restrict such simultaneous writing to files and the confusion and conflict which result.

- **Software shortage:** Dr. Jerry FitzGerald, internationally-regarded data communications consultant and author, sees the major limiting factor in network availability, compatibility, and security at this time to be software. There is a shortage of the software which provides not only the applications, but also the conversion from protocol to protocol or equipment to equipment. Most existing software requires adaptation for use in a multi-user LAN environment. Even software for which the claim is made "works in network systems without modification" may merely mean that the program will work as long as no more than one device accesses the program at the same time.[9]

Just as they have flourished to sustain and propel the computer market, FitzGerald foresees the emergence of small software houses

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specializing in protocol conversion and operating systems to deliver on the promise of a truly integrated LAN.

• **Standards:** Lack of standards is attributed by many to have led to this "no man's LAN" of device and software incompatibility. The available LANs now have mixed and matched such components as cable type, topology, access method, and operating system, many with little regard to compatibility with the equipment or LANs of other vendors. Just as in the case with computers, no one wants to invest in a version of the technology which lacks flexibility or market longevity. Because the ability to link the devices of various companies can be a major purpose of a LAN, many buyers resist buying a network designed to link a single vendor's end-user equipment to avoid being locked into what may become proprietary standards and a non-competitive buying situation.

In an impressive effort to overcome this market reluctance, both industry organizations and, separately, vendors and vendor groups are cooperating to establish standards. The most active commercial group in this effort has been the Ethernet vendors (Xerox, Intel, and DEC), who have been publishing their interface specifications to encourage others to make them available. This effort has helped make Ethernet nearly a standard by default. Most recent vendors are complying with these specifications, even while awaiting products from the two super-firms who are on the verge of a LAN market presence and who could topple the effect of these delicate decisions and alliances: AT&T and IBM.

Alternatives to LAN Exist

Certainly alternatives to the local area network abound. Computers have been tuned into one another for years, through direct wiring or via modems and telephone lines. Also, for example, hard copies could be delivered locally without a LAN via mail, facsimile, or even by carrier pigeon; voice signals may be transferred via phone or cassette, and video via closed circuit T.V. or VCR.

In many applications, a LAN may prove cost beneficial and may reduce duplication and allow provision of better services; yet in other applications, a LAN may be unjustifiably costly and complex, or may be inappropriate technologically. For these latter cases, alternative solutions may serve as well or better than a LAN and may utilize more mature, "comfortable" technology. These alternatives exist in a hierarchy of sophistication levels, according to the requirements, environments, and resources at hand.

"Lower tech" solutions include the use of a familiar "intercomputer link," such as a direct cable between computer communications ports, or a telecommunications link using modems (signal converters) and transmitting data via the telephone lines. Even these "lower tech" answers require satisfying a long list of compatibility criteria such as baud rate, data transfer speed, and transmission, conversion, and signal formats. Commonly these connections are used in such applications as point of sale, housekeeping departments, or travel agencies, to input data and to view data base responses to inquiries.

An intermediate solution, and the most commercially evident development toward coordinating our isolated, multiple computer systems, is the availability of increasingly integrated software. A front office package may once have handled rooms management and guest accounting only. Today's package may offer interfaces (a common line) with other systems such as call accounting and point-of-sale registers, and may provide F&B, payroll, and general ledger modules. Some include capabilities for word processing, management reporting, and financial analysis, including data base management and spreadsheet features.

At the more complex end of this spectrum of alternatives for local communications is the emerging PBX/CBX technology, the private branch exchange, which today is often known as the computer branch exchange. A new generation of CBX's are now capable of converting the analog signals of the voice into digital form for transmission as binary bits. With this development, digital switching enables the user to integrate voice and data transmission over the same network in a manner not yet perfected in LANs.

So who will win this technology race? From the sidelines, it is safe to say that we, as potential users, are or should be guiding this development through our requests to vendors, and that we may not be forced to choose sides at all. We will be the winners. The LAN/CBX technologies are seen to be borrowing more and more from the technologies of one another to meet our requests. Hybrids are emerging and available for the best of both.

One such merged version teams traditional telephone circuit switches handling local communications within their particular domains, while participating in a network of other such switches; the network being based on a LAN technology such as the token passing ring. InteCom, for example, has available a PBX which can communicate directly with one or more Ethernet (LAN) segments. Ztel Corporation, among others, is now marketing a full integration of the PBX/LAN technologies, a LAN configured with voice/data PBX's as nodes (or devices). In fact, the insiders predict that it will be at this very communications interface focus within our properties and headquarters that the "showdown" will come between Goliaths AT&T and IBM, fighting alongside other enterprising geniuses, such as 3M Corporation, Corvus, DEC, and Wang Laboratories.

Chase Manhattan Bank's administrators have tied together four buildings in lower Manhattan with WANGNET, the broadband network (multi-channel coax) of Wang Laboratories, Inc. Chase Vice President Harvey Hershkowitz seems to affirm the optimistic claims and rosy growth predictions for LANs, even after working through the traumas of so new and so large an installation. "We have no regret," he assures. "People want one terminal on their desk that can access everything."[10]

LAN Sales Will Soar

The future of LANs is the fulfillment of this very desire, a desire which extends not only from the manager at his desk, but also to the

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guest in his hotel room and to each of us in our homes and automobiles. Access, connectivity, and prompt service are expected in our data communications. To this purpose, International Data Corporation, an industry researcher, projects LAN sales of over $1 billion by 1988.[11] Architecture Technology Corp. consultants predict LAN installations will grow to well over 100,000 within four years, up from 16,000 today.[12] This generation likes access, connectivity, and speed, whether snatching a burger in a fast food drive-thru or in pumping information through the organization.

How will these voice/data/video local area networks put us in touch with everything? The LAN itself will serve as a local node on growing "outside" networks, both public and private. For example, using a gateway (links networks), a LAN today might link into a WATS line. By adaptation of today's LANs, and by design in tomorrow's, gateways and bridges (links signal types) to other networks should include the use of microwave circuits and high speed satellite paths. The LAN may link with and use other information/entertainment networks, such as other LAN and computer systems, employee home computers, cellular mobile radio systems, videotex (e.g., teleshopping by catalog on T.V.), satellite T.V. and movie channels, domestic and international teleconferencing, as well as services such as electronic mail, messaging, and banking, plus voice store and forwarding services.

"Sometimes the magic works. Sometimes it doesn't."

In the hospitality setting, voice data and image signals now travel over separate networks. Their coordination within existing buildings is already underway, but on a patch-by-patch basis.

The pitfall of the three blind men and the elephant is obvious. Without seeing the big picture, it is nearly impossible to draw accurate conclusions for an isolated part. This very pitfall is a natural outcome of our departmentalized businesses; well-meaning but isolated department managers are pressured for performance and so obtain individual computer solutions according to a tunnel vision perspective.

Some vendors are guilty of tunnel vision as well. Rather than listening to and studying our overall needs and offering modern solutions, these firms have an old product, a partial or inefficient solution, which they must cleverly repackage and convince us is in our best interest.

As users, we are faced with a large and confusing array of technologies and products for LANs and for alternatives. To adopt any, we must study, think, and shop; and we are expected to justify the change, the investment and the "trouble" in terms of better service, accuracy, efficiency, or other measures which eventually should swell revenues. Those users who adopt just any LAN before determining its purpose, appropriateness, alternatives, or design may soon be dissatisfied customers. However, those users who decide on a LAN or LAN hybrid after a thorough and objective property study and market search will gain a powerful tool for the integration of automated functions throughout the organization. This LAN can be a versatile tool, able to evolve and to accommodate the needs and ideas upcoming in the dynamic hospitality environment.

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