



LINQ:
The Professional's Network

PERQ Systems Corporation



The LINQ™ Team

Team work.

It's a fact of life in today's business world: professionals work on projects as part of a team. In such an environment the vital factor is effective communication: communicating ideas, work-in-progress, and final presentations both within the organization and outside it.

Effective communication, then, directly results in the enhanced productivity of these team efforts. And the extent to which information is communicated easily, quickly and efficiently is fundamental to the performance of the group and of the organization as a whole.

LINQ, PERQ Systems' advanced, distributed computing network, brings workstations, servers, mainframes, gateways and much more into a cohesive team. Today's professionals demand communications solutions that are easily accessible and adaptable, yet cost effective. LINQ responds to this need by providing these and other benefits while still delivering to users uncompromised individual performance at their own workstations.

Left: Large projects, such as the design and construction of a tall building or the reconstruction of entire city blocks, can be efficiently handled with a LINQ network. Opposite and cover: Ethernet and other cables. LINQ extends proven Ethernet technology with a unique operating system: Accent.

"Today's professionals demand communications solutions that are easily accessible and adaptable, yet cost effective."

LINQ Power: Easy to Access, Simple to Use

Team professionals expect extensive computer power and visualization for optimum productivity. They want one machine at their desk that can provide sophisticated graphics and perform complex design computations. But they also need access to a variety of additional resources—mainframes for very large databases and intensive computation, specialized devices for printing, scanning, and additional storage capacity, as well as links to other networks. Furthermore, they require these flexible resources to be available instantly.

LINQ answers the needs of professionals by providing all this distributed computing power, quickly and in a way that is simple to use.

One of the most important characteristics of LINQ is that it incorporates a message-based operating system, Accent, that is fundamentally designed to enhance network services. With Accent, processes that are remote communicate with each other, by the use of messages, in the same way as processes on a local machine. This results in a simpler user interface—both at the programming level and for the user himself, who doesn't need to waste time locating, creating and monitoring activities at other network nodes.

In other words, LINQ enables PERQ™ workstations, peripherals, communications links and a wide range of computer systems from a variety of manufacturers to be connected together into a fully integrated, distributed network that is transparent to the user. This means that a user can obtain data or access resources that are available somewhere else on the network, or even on a different network—either locally or remotely—without the



need to know the location of that data or resource, or even understand how it is accessed.

The physical LINQ connection is based on the leading standard in networking technology—Ethernet™. This standard has been adopted by over forty major US and international manufacturers, and ensures an ever-widening range of computer systems and peripherals which can be interconnected to communicate within a LINQ environment. It offers inexpensive, standardized components and is extremely reliable and easy to use.

LINQ also provides a sophisticated network-wide software development environment that enables program developers to create and support applications packages of all types. In fact, LINQ features multiple, co-equal environments for optimal software development and operational flexibility. These environments include the native Accent

environment, an advanced UNIX™ environment licensed from AT&T, and a Lisp environment for Artificial Intelligence applications.

The four major elements of the LINQ network, then, are:

- The Network Operating System
- Network Hardware
- Software Development Environment
- Applications Software Systems

Accent: An Advanced Network Operating System

The Accent operating system has been designed to specifically exploit the full potential of LINQ, with particular emphasis on ensuring ease of access between workstations and other resources. It is the product of over five years of research dedicated to achieving a very attractive alternative to time shared computing systems. As such, Accent provides a truly distributed, transparent operating environment for the LINQ user.

Accent efficiently manages LINQ resources—including graphics, computation and data—by providing interprocess communication, transparent access to network resources, multiple language support, demand paging, and advanced virtual memory management.

At its most fundamental level, Accent is a multi-process, message-based operating system providing a 32 bit paged virtual address space for each user process. This space provides ample room for large programs and helps to ensure the integrity of the operating system across the network.

Accent also offers capabilities that efficiently manage user workspace, both in terms of the individual workstation and the network as a whole. Workstation memory and disk space are managed by a demand paging feature which offers a 512 byte page size. Another facet of Accent substantially reduces network traffic by permitting users to access remote files, without the need to transfer all the information to their own disk. Only those file pages that are actually needed are moved.

"Accent provides a truly distributed, transparent operating environment for the LINQ user."

Accent features, in addition, priority scheduling with preemption and aging. Those processes that have a higher priority on the workstation will gain faster access to machine resources. Compute-bound processes (those that don't require user interaction) are automatically lowered in priority, giving faster response to current user commands.

One of the most important features of any computer system, especially when put in the hands of non-technical professionals, is the user interface. The Accent user interface includes a multiple window display controlled by the Accent Window Manager. Users can simultaneously access as many as 64 different windows on the screen, each of which can contain a process, a file, data, programs, system information, etc. These windows can be overlapped and manipulated on the screen as if they were papers on a desk, to allow the flexibility of working on a variety of tasks at the same time. A series of icons displays the status of each active process, showing exactly what is occurring—e.g. compilation, file access, data storage, program edit—and to provide information or prompts to the user.

LINQ Hardware

In most networks, the needs of the many outweigh the needs of the one.

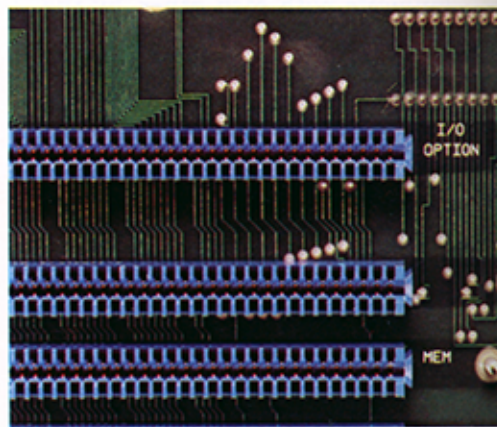
A single user can get lost in network protocols, spend precious time waiting for computer response, be locked into input methods that are foreign or inefficient, be locked away from a particular output device that is needed on an infrequent basis.

But not with LINQ.

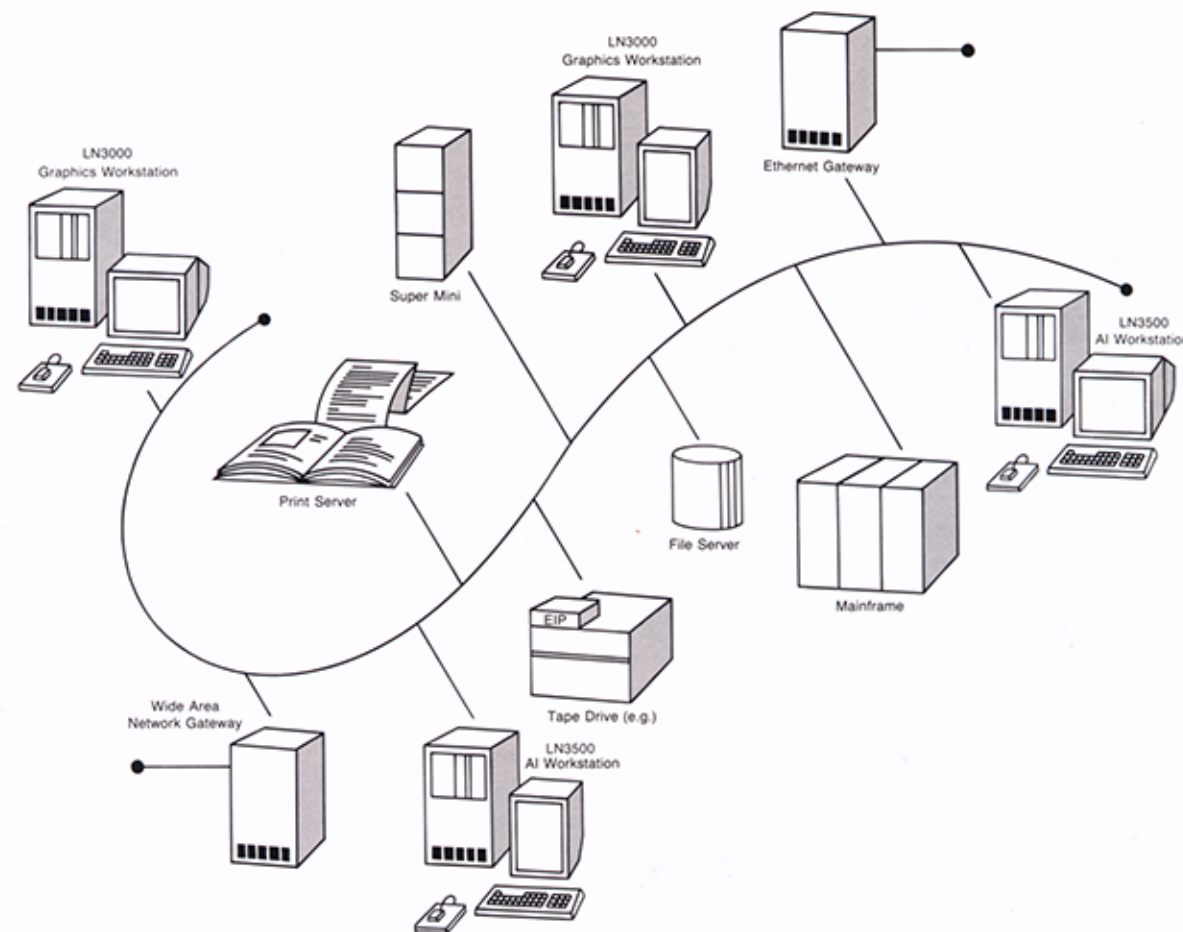
LINQ provides hardware that is geared to the individual needs of groups of single-users—power, graphics, input/output facilities, and easy accessibility. This hardware includes families of:

- Workstations
- Servers and Peripherals
- Gateways
- Other Ethernet-compatible systems and devices

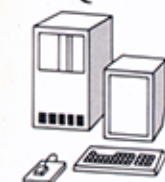
that are constantly growing—a growth which ensures that the needs of all LINQ users are satisfied no matter what their application requirements.



Above: A board ready for assembly work. PERQ's unique system architecture permits a customer to alter the PERQ microcode. Right: A schematic representation of a LINQ network consisting of workstations, servers, gateways and other devices directly connected to LINQ.



PERQ Workstations



The PERQ family of high performance graphics workstations is a major component of the LINQ network.

PERQ workstations offer unprecedented power and flexibility to professionals who are involved in areas that deal with information visually—areas like electronic publishing, artificial intelligence, computer-aided design, and software development. PERQ combines the work capacity and processing speed of an expensive minicomputer with the price of a traditional microcomputer and adds a graphics capability that is far superior to both.

A basic PERQ configuration includes: a floor-mounted cabinet which houses the bit-slice, proprietary processor, the main memory and disk storage facilities; a high resolution, bit-mapped raster display; an alphanumeric keyboard;

and a graphics tablet with pointing device for a natural, efficient user interface.

The foundations of PERQ's high performance are its large memory capacity and processing power, giving it exceptionally large computation ability and speed of operation, and enabling the flicker-free image on the display to be manipulated in the most complex ways, with such speed that even realistic animation is possible. PERQ's unrivalled graphics capability has put the system in a league of its own.

In addition, PERQ is microcodable. This means that the whole system architecture can be changed for efficient performance of particular operating systems or languages—to become for example a C engine, Pascal engine or Lisp engine. Individual time-critical routines in software packages can also be microprogrammed to improve speed of execution.

Yet with all this power and flexibility, PERQ is extremely easy to use, having been designed for people who are experts in their fields but who are not necessarily computer specialists.

The growing family of PERQ graphics workstations includes the high-performance LN3000 series; LN3500 (PERQ AI) which implements a version of Common Lisp that is specially suited to the needs of the Artificial Intelligence community; PERQ Color Workstation, a system that illuminates layouts or designs in up to 256 colors from a palette of over 16.7 million; and PERQ Audre which offers advanced optical digitizing capabilities across the network. As the PERQ line of workstations continues to expand, the LINQ network also expands in its ability to adapt to the specific needs of an individual, project team or indeed whole organizations.

Network Servers



Sharing resources is essential to the efficiency and effectiveness of joint projects. The ability for a variety of pro-

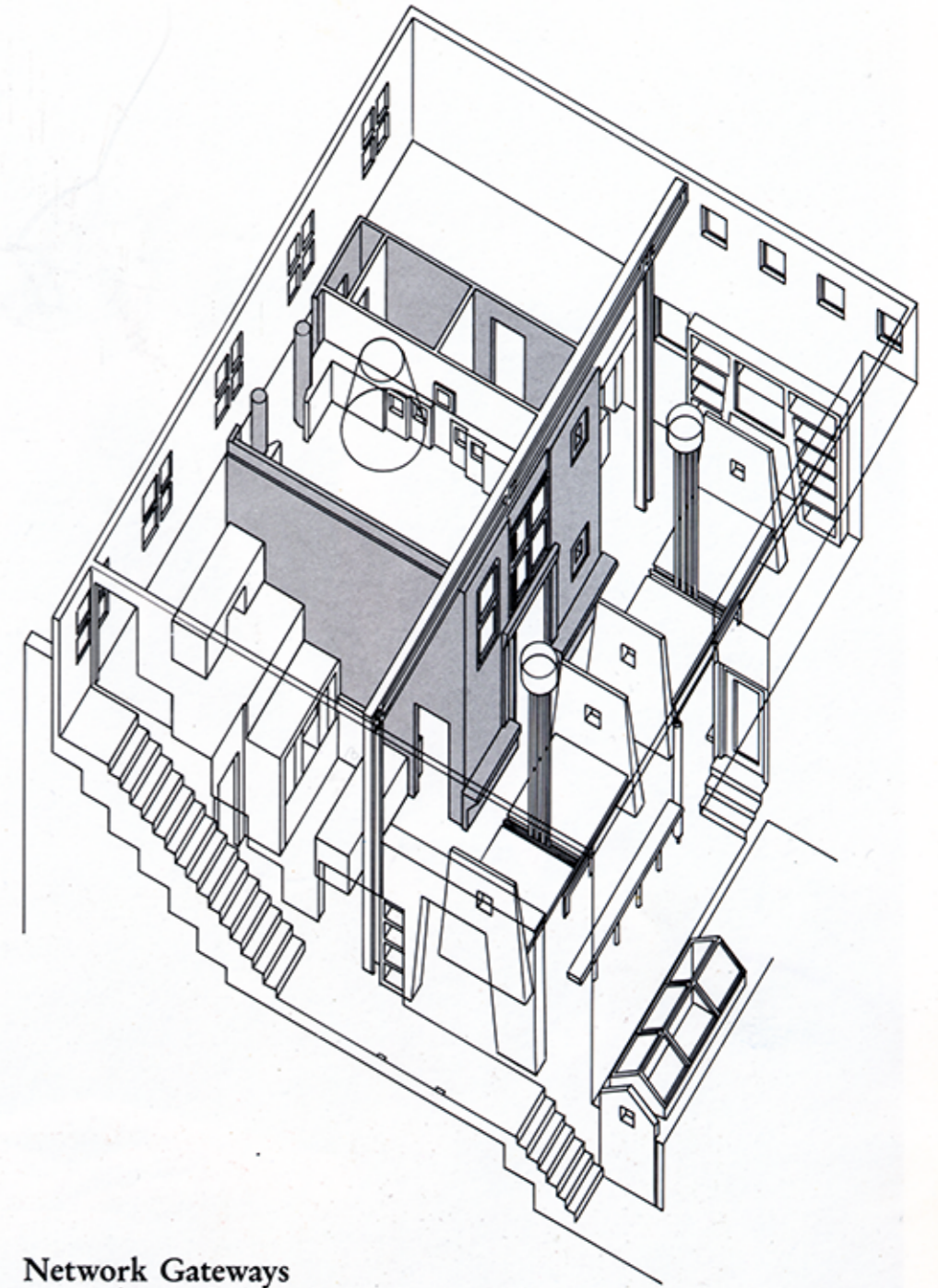
fessionals to access resources such as central databases, costly peripherals, or to perform time-expensive computations without heavy operational delays is critical in maximizing an organization's productivity. And sharing such facilities from workstation to workstation, from department to department, and from building to building will reduce costs significantly.

The LINQ Network provides an expanding variety of servers that allow users to share any number of resources across the network. File servers, print servers, peripheral servers, computational servers—all add to the resources available to each user.

A basic server is a process dedicated to performing a specific task with special network software and appropriate peripherals and/or services. A file server, for example, provides the network with mass storage for shared files and is beneficial to a group of people working on a common set of drawings or designs. A print server is a dedicated processor attached to the network which can drive laser printers, letter-quality printers, electrostatic printers, and plotters. LINQ print servers free users from tedious printing delays by providing a spooling function which allows the originating workstation to continue with other work while the document is printed. Large magnetic or optical disks, digitizers, floppy disks, and streaming cartridge tape drives are just some of the other peripherals that are made available by LINQ peripheral

servers. These servers turn expensive, often idle devices into cost-effective, productive resources. Computational servers too extend LINQ's productivity potential by allowing programs, services and data to be quickly and efficiently off-loaded from local workstations.

The functionality of network servers then, whether they be used to share file storage, access printers and peripheral devices or distribute heavy computation, extends the capabilities of the LINQ network as a whole, and enables it to address the needs of the organization more completely.



Right: An axonometric drawing of an architectural project. PERQ workstations can easily modify and manipulate drawings digitized with an Audre camera system. (Courtesy of Arthur Lubetz and Associates, Architects) Left: PERQs lined up at night for final factory testing before shipment. Recent expansions in the Quality Assurance and Customer Service groups represent a continued commitment to customer satisfaction.



Network Gateways



Communication is not only a function that is performed between individuals. Often groups or divisions within an

organization must intercommunicate both locally and across large distances. LINQ Gateways open the door for such communications.

Gateways enable LINQ networks to share data, files, and expensive peripherals with either other LINQ networks, or with foreign networks. LINQ can even be incorporated into

other Ethernet compatible networks. Gateways ensure that LINQ is truly an OPEN network.

The usefulness of LINQ gateways is not limited by physical distance. An organization might have computer facilities in a variety of separate locations, with mainframes, for instance, connected by X-25 protocols in what is referred to as a Wide Area Network. Using LINQ Gateways, it is possible for users on an individual Local Area Network to access data resident on that Wide Area Network.



“An enormous potential remains to be explored in the development of packages that tailor LINQ for specialized areas.”

One of the most important features of any computer system, especially when put in the hands of non-technical professionals, is the user interface. The Accent user interface is unparalleled for system applications designed for professionals in specific disciplines.

Make Our System Your System

LINQ offers many intrinsic benefits which greatly aid in the creation of customized software. Ease of access and transportability across the LINQ network facilitates the development of applications packages that fully utilize the individual characteristics of both the LINQ network operating system and LINQ hardware.

Accent's multiple, co-equal environments directly support optimal software development and unprecedented operational flexibility. These environments include the native Accent environment, Qnix™—a UNIX implementation, and a Lisp environment for Artificial Intelligence applications. A single workstation can simultaneously run applications in these environments. This is especially significant for software developers who can now work in the specific environment best suited for each individual application and then tie together these applications as a single LINQ package. Traditionally, software developers have been limited to the single environment in which they created their applications.

The Accent Software Development Environment offers a broad range of resources to assist the custom software designer, including utilities, tools, languages, and facilities for enhancing the software interface. Languages supported by Accent include Pascal, FORTRAN 77, Lisp, ADA, Modula-2 and C. A wide range of software debugging tools and a sophisticated multi-file, point-

and-act screen editor are also provided. Special graphics facilities ensure that the superb visual qualities of the PERQ workstation can be fully integrated into applications software packages that demand exceptional display capability.

For those who want to develop software in the UNIX operating system, Qnix can be integrated into LINQ. Qnix provides a UNIX System V user interface and access to System V system calls and utilities. Qnix also permits other application software developed for UNIX System V to be easily ported to LINQ. Because Qnix is built upon Accent's virtual memory management, file system and IPC facilities, Qnix users enjoy all the benefits of full demand paging, a transparent distributed file system, and access to network resources.

Put LINQ On Your Team

LINQ represents one of the most powerful tools available to technical professionals. As such, LINQ has the potential to multiply the productivity of users whose application needs have heretofore not been adequately addressed.

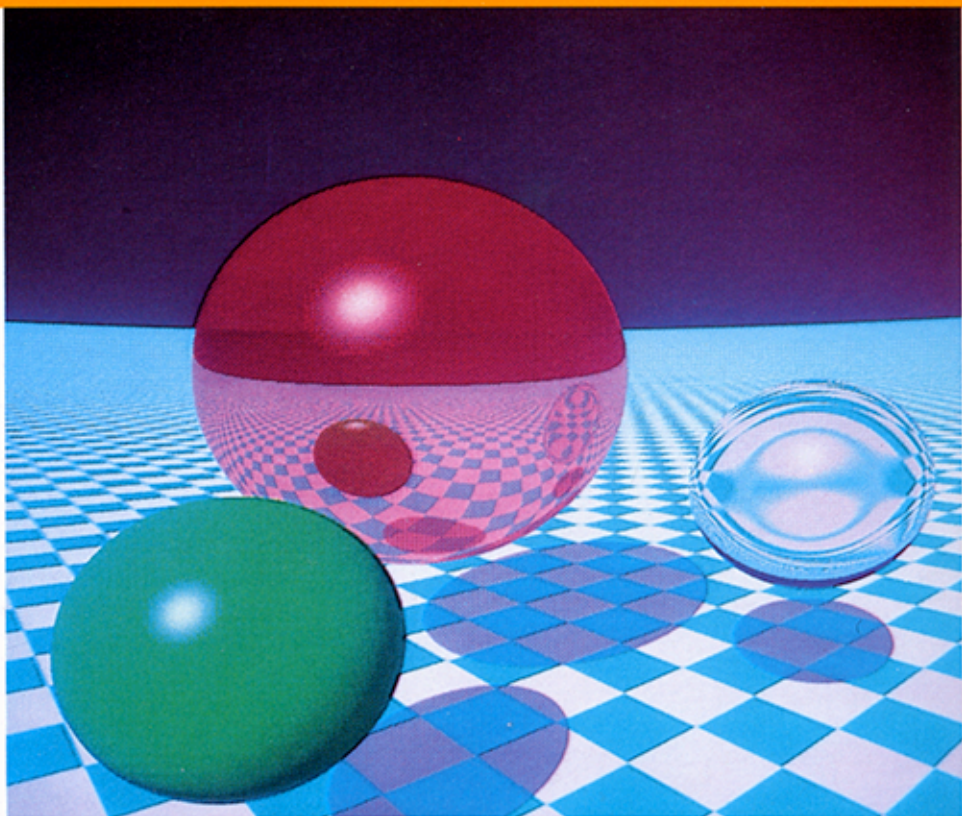
Application software designed for specific users can optimize an impressive range of LINQ features which make it possible to:

- display, process and analyze data in real time
- manipulate any combination of text and graphics
- simulate scientific and engineering models with ease
- readily compose page layouts for business and technical reports, magazines and books
- generate typefaces of any design by building up characters pixel-by-pixel

Sophisticated packages already have been developed by PERQ OEMs for electronic publishing, computer-aided design, and knowledge-based systems. PERQ encourages custom systems development of the sort that has already produced a new generation of applications packages.

An enormous potential remains to be explored in the development of other packages that tailor LINQ for specialized areas in electronic publishing, CAD/CAM, architecture, artificial intelligence, econometrics—the list goes on and on.

With LINQ as the source, the possibilities are endless.



Spheres generated on a PERQ at the University of Toronto. The spheres illustrate the quality of PERQ graphics capabilities: the spheres are translucent—both sides can be seen and seen through; a single point source of light is reflected at precise angles; the shadowing is correct; and the spheres accurately reflect each other. (Courtesy of John Amanatides and Dr. A. Fournier, Computer Systems Research Group)



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