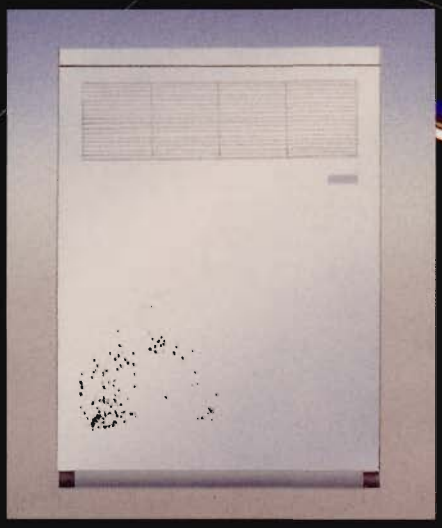
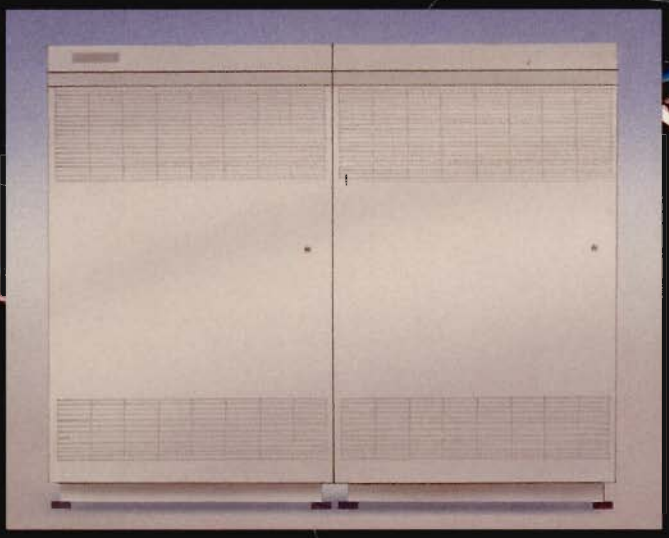
HEWLETT-PACKARD

OSI: The HP AdvanceNet Foundation





Why OSI?

Rapid growth in the use of computers in the business office, engineering and manufacturing environments has produced a wide choice of software solutions and hardware options from many different vendors.

This variety appears to allow users to select the best solutions for their business problems. But if the offerings of different vendors can't be linked in productive networks, integrated business solutions will be difficult to achieve.

In the past, customers have had to decide: they either bought application software that would permit coexistence with their established networks, or they chose their best solutions and tolerated any hardware incompatibility problems. And hardware incompatibilities often meant that data exchange was impossible without expensive protocol conversion.

What customers need is transparent networking that will allow them to select the best solutions for their businesses. This requires uniform standards—implemented by all vendors—that will make multivendor networking a reality. And that is what OSI is in the process of providing: transparent, multivendor networking that sets decision makers free to concentrate on solving their business problems.

OSI (Open Systems Interconnection) is the name for the family of standards that is being established by the International Organization for Standardization (ISO), with major contributions from IEEE (Institute of Electrical and Electronics Engineers), CCITT (International Telegraph and Telephone Consultative Committee), and other groups, to enable transparent multivendor communication.

Hewlett-Packard has been a computer networking leader since the early Seventies and a major contributor to the worldwide effort to develop and implement OSI standards.

These standards are central to HP AdvanceNet, Hewlett-Packard's networking strategy. The HP AdvanceNet strategy is to replace all proprietary networking protocols and services with their OSI equivalents. This replacement began in the early Eighties, and all major networks now installed are based on international standards.

HP AdvanceNet also emphasizes quality network support. Such support is a prime consideration for companies whose networks are vital to their success. Hewlett-Packard has been consistently ranked as the industry leader in customer support in the annual Datapro survey.

Companies today use a wide variety of computers to solve their business problems. Before OSI, connecting these computers was complex; OSI has simplified this.

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OSI: The Standard for Multivendor Networking

The OSI Reference Model is a blueprint for multivendor networking. It is a structured model divided into seven layers to facilitate protocol development. Protocols for each layer perform a specific task, and protocols for all seven layers together enable data transfer across a multivendor network.

Most of the standard protocols for each layer have been defined and published by ISO; major vendors are now implementing the available standards.

Why are vendors like Hewlett-Packard committing to OSI? Unlike protocols for proprietary networks such as SNA or DECNet, OSI protocols are being defined in an open, global forum. All vendors are able to participate in the development of these networking standards, and results are in the public domain.

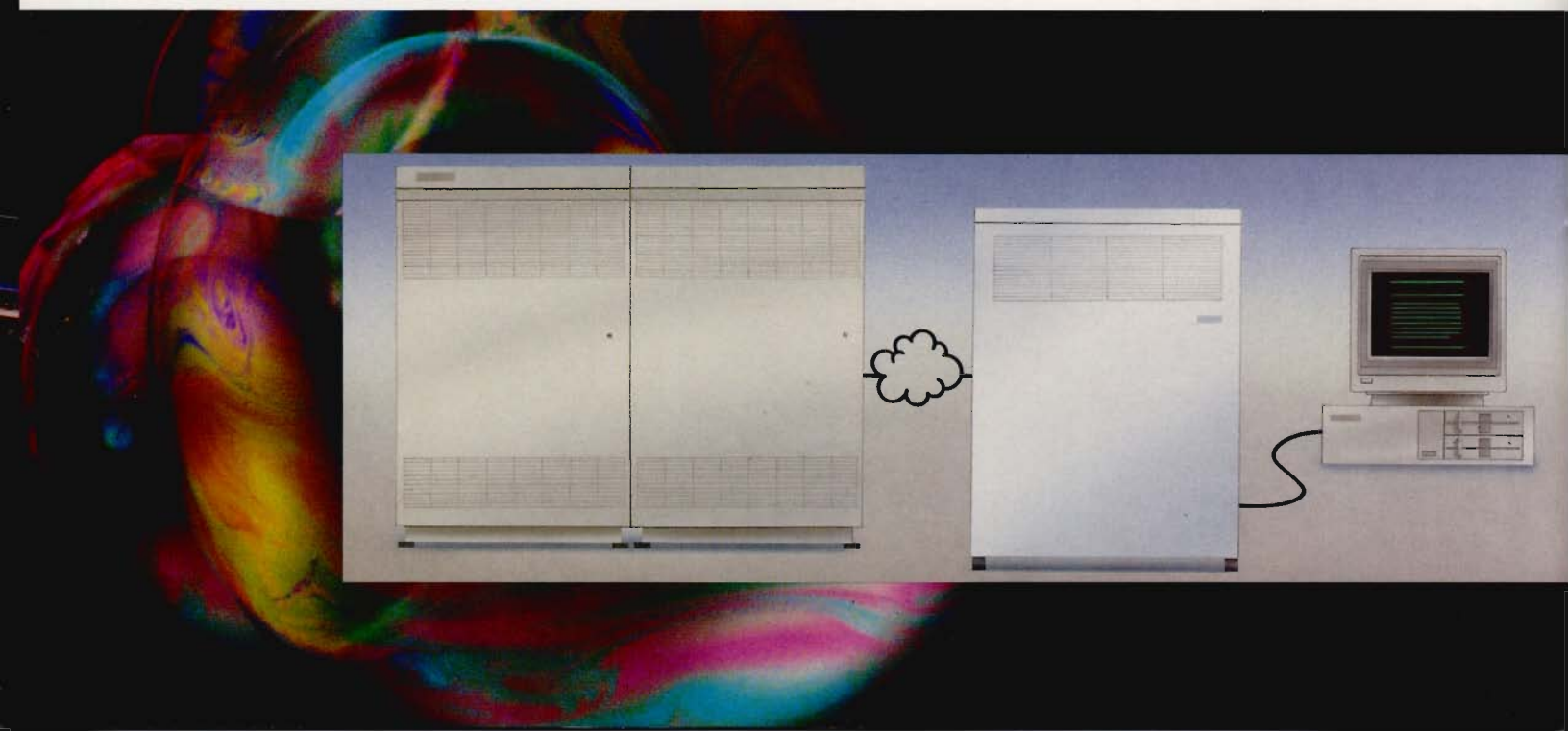
The Emergence of Standards

The movement toward standardization in networking began in several areas in the early Seventies. This movement was unified when ISO took up the effort in 1977.

The involvement of ISO meant that an international approach to standardized networking could become a reality. ISO published the basic OSI Reference Model in 1983, and since then, work to finalize and publish protocols for each layer has been ongoing.

Major computer users also recognized the importance of multivendor networking, and established users' groups to define networking needs within various markets. Among the best-known are MAP (Manufacturing Automation Protocol), TOP (Technical Office Protocol) and GOSIP (Government OSI Profile).

These initiatives respectively address the multivendor needs of the computer integrated manufacturing (CIM), engineering and business office, and government environments.



Journey of an International Letter

The capabilities defined in the OSI Reference Model can be illustrated by a real-life analogy. So let's look at a simple business practice – sending a memo from San Francisco, California to Beijing, China.

We see what happens at each layer of the model as the letter makes its way from the U.S. to Beijing.

Departure:

Layer 7

Marketing Director Joe Johnson prepares a handwritten memo to be sent to Sam Huang, Marketing Manager in Beijing.

Layer 6

Johnson's memo is typed and put in final letter format.

Layer 5

The memo is put into an envelope, addressed and mailed.

Layer 4

Johnson's local post office receives the envelope and sends it along to a regional post office.

Layer 3

The regional post office receives the letter and puts it into a mailbag to be routed to Beijing.

Layer 2

The mailbag headed for Beijing arrives at the airport receiving area to be put on the right airplane.

Layer 1

The airplane carries the letter to Beijing.

The OSI Layers

The **Application Layer** provides the "interface" between user programs and the network.

The **Presentation Layer** provides a common format and language of messages.

The **Session Layer** manages and synchronizes conversations between two application processes.

The **Transport Layer** provides reliable, transparent data flow between end users.

The **Network Layer** routes the communications.

The **Data Link Layer** provides error control, synchronization.

The **Physical Layer** activates, maintains and deactivates the physical connection.

Arrival:

Layer 7

Huang reads the memo from Johnson.

Layer 6

Huang's secretary opens the letter and translates the memo into Chinese.

Layer 5

The letter is delivered to Huang's office by the postman.

Layer 4

The letter arrives at the local post office for delivery to addressee.

Layer 3

The mailbag arrives at a regional post office. Here the letters are sorted to see if the letter to Huang goes to a local or another regional post office.

Layer 2

The airport receiving area checks to see if mailbag has arrived.

Layer 1

The airplane arrives in Beijing.

OSI: From Concept to Product

The OSI Reference Model is a structured approach to the transmission of data; while protocols at each layer have their own specific tasks to perform, all must work together to provide transparent networking. The bottom four layers are concerned with the transmission of data; the top three layers serve the users of data.

From a business perspective, the most important layer is Layer 7, the Application Layer. This is where file transfer, message handling, transparent terminal access and other Application Layer standards are placed. Like the Application Layer, the other layers are multipurpose; Hewlett-Packard's OSI products incorporate the necessary capabilities for each of the seven layers.

Ensuring that a vendor's OSI product conforms to international standards is of prime importance to users. This issue is being addressed by the development of conformance tests. These tests will certify that OSI products meet ISO standards.

Even with comprehensive conformance testing, there may still be differences between vendors' products; this necessitates final testing to ensure multivendor interoperability. Interoperability tests check that the offerings of different vendors will, in fact, work together. Products whose ability to interoperate has not been certified are not true multivendor OSI products.

OSI has facilitated the networking of computers from different vendors.

Standards Today

By 1986, services and protocols for layers 1–5 of the OSI Reference Model were international standards. Today, at layers 6 and 7, specific services such as X.400 (electronic messaging and mail) and FTAM (File Transfer, Access and Management) are defined. Work to expand the functionality of protocols for layers 6 and 7 is ongoing. Soon, the standard capabilities available at Layer 7 will encompass a complete range of networking services.

In addition to these networking services, OSI has defined both specific layer management protocols and standards for Network Management (NM). Network Management is critical to the effective operation of an OSI network. Successful Network Management provides reliable services, data integrity, efficiency and flexibility for users.

The definition and development of conformance tests closely parallel the development of standards; those for X.400 and FTAM, for example, are finalized.

Hewlett-Packard: The Leader in Networking Standards

Hewlett-Packard's commitment to multivendor connectivity is the driving force behind its commitment to industry and de facto networking standards.

Hewlett-Packard installed its first networking products in 1972, and from the beginning we have been committed to implementing standards wherever possible—from our first implementation of IEEE 488, for computer-to-peripheral networking, to today's commitment to OSI as the foundation of true multivendor networking.

Hewlett-Packard has been an active leader in the effort to develop international multivendor standards. HP employees serve as vice-chair of ISO's X3 committee on Computers and Information Processing, and chair the committee on IEEE 802.3 Local Area Networks and the IEEE 802.1 Network Management Task Group. HP also contributes to the development of many other standards, including those for Logical Link Control, Directory Services and other application layer protocols.

In the early Eighties we rewrote our proprietary networking software to align with the structure of the OSI Reference Model, and implemented our first international standard products, based on ISO 8802/3 and CCITT X.25. Subsequent products have included layer 4 and 5 protocol implementations: full MAP stacks and X.400. And our family of OpenView network management products is built in conformance to the OSI Management Framework. As further OSI standards emerge, Hewlett-Packard will include them in its offerings.

In recognition of the importance of conformance testing, Hewlett-Packard was a founding member of the Corporation for Open Systems (COS), a primarily North American consortium of vendors and users whose mission is to promote conformance to OSI standards.

To facilitate multivendor testing, Hewlett-Packard was also a founding member of OSINET and EurOSInet, North American and European multivendor test and demonstration networks.

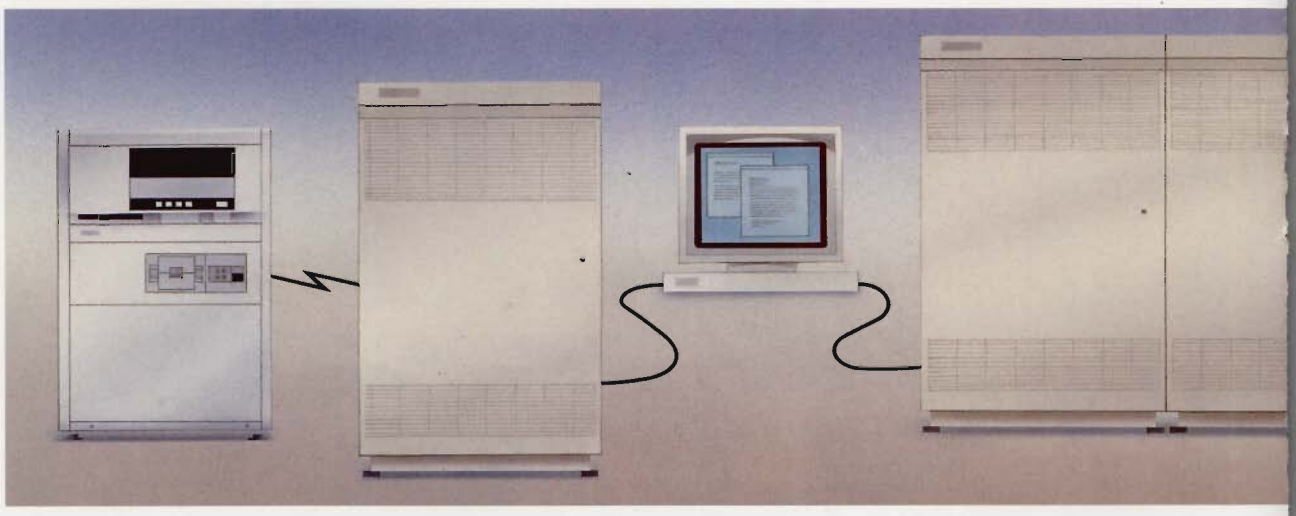
Interoperability: The Key to Success

Within HP AdvanceNet, OSI standards are already the foundation for both HP-to-HP and multivendor communications.

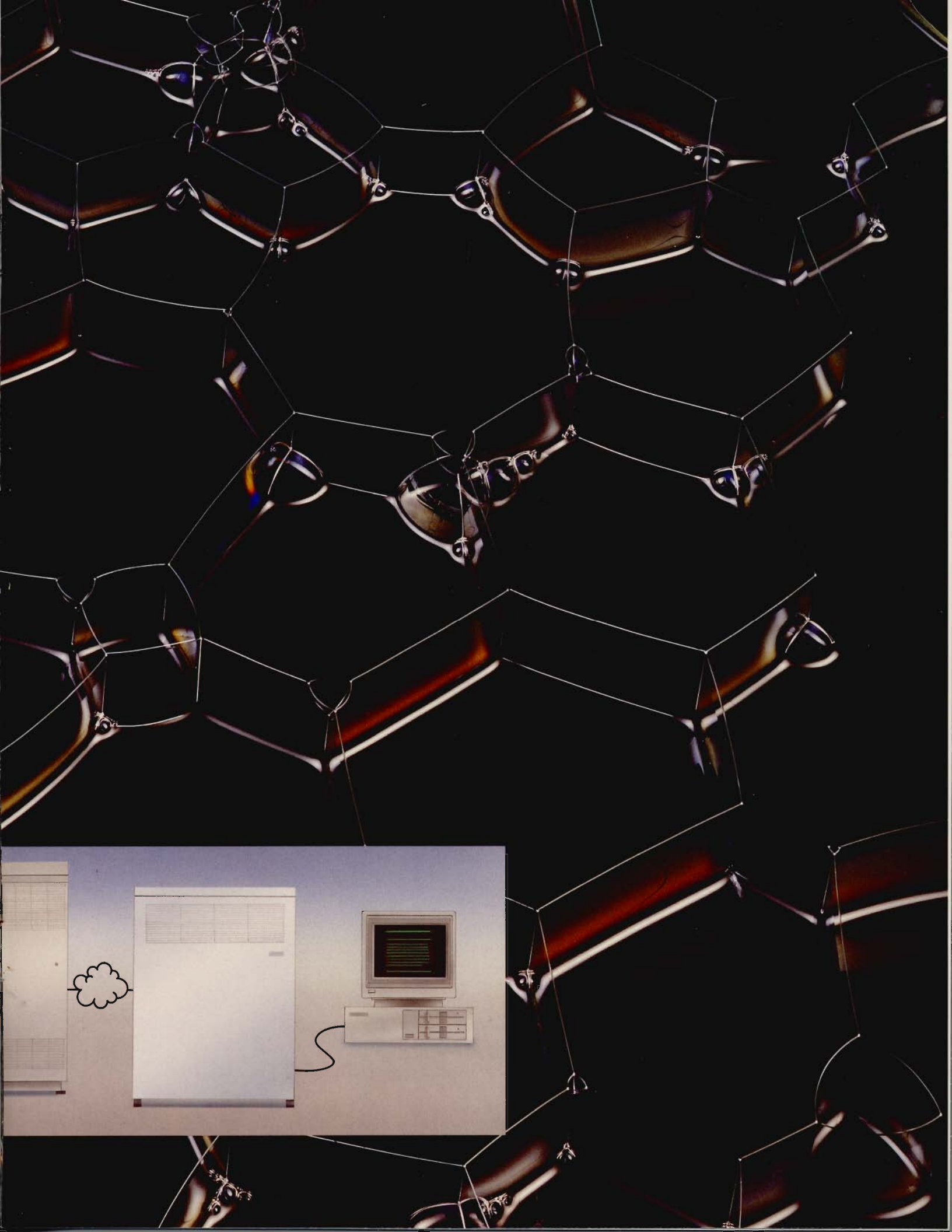
While OSI products are the basis for multivendor networks, the key to successful multivendor networking is to ensure that OSI products from different vendors actually work together, or interoperate.

With leading MAP and X.400 products, Hewlett-Packard has extensive experience in making OSI products interoperate in a live environment.

This experience, combined with our trained Network Consultants worldwide and our reputation for high-quality products and customer support, has established Hewlett-Packard's leadership in multivendor networking.



With the establishment of OSI-based multivendor networks, users will be free to concentrate on solving business, not technical, problems.



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