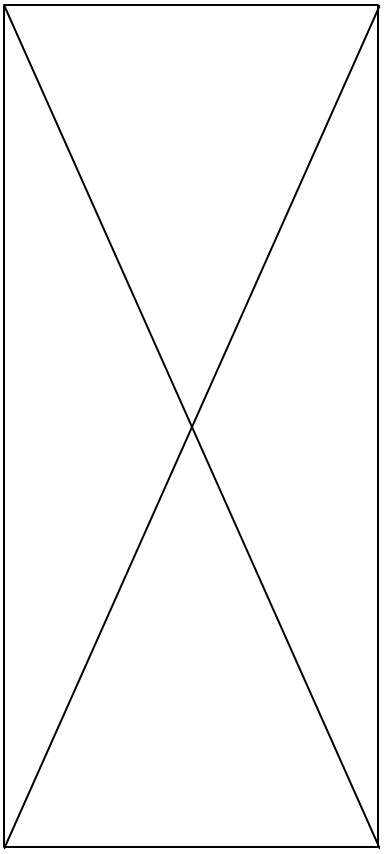
AppleTalk Communications



Background

When introduced in 1984, the Macintosh personal computer represented a radically different vision of personal computing: tools for individuals. The engineers who developed the Macintosh began with a vision of a computer that would be accessible, engaging, and exciting to use--a computer that would insulate users from the technical complexities traditionally associated with computing.

To accomplish this, two elements were added to the hardware and operating system that make up the Macintosh computer architecture:

- An environment, based on the metaphor of the desktop, that uses real-world graphic images and a see-and-point user interface.
- A toolbox of common routines, functions, and features from which all software applications can draw.

These elements created a foundation for applications that all work in the same way, sharing graphics and other information through the simple "cut-and-paste" metaphor. This has enabled the development of powerful, easy-to-learn software with a consistent look and feel, and has helped Apple establish a style of computing that has since become the industry standard. In fact, Apple is the only company to implement a consistent user interface successfully.

More than 3,000 applications have been created for the Macintosh computer, including programs from most of the world's major software publishers. These include the basics such as spreadsheets, word processors, and database managers, but they also include such innovative software as Aldus PageMaker, which helped the Macintosh computer go beyond the basics to create entirely new application categories.

Macintosh computer desktop publishing and presentation applications, for example, have revolutionized printed materials. Presentation-quality graphics are now the norm, not only in creative and graphic arts departments but also throughout corporations.

In 1987, Apple introduced the Macintosh II computer which offered color and increased power over early Macintosh computers. The Macintosh II family of computers has since expanded to form the modular line. With this Motorola 68000 family of 32-bit computers, the Macintosh computer has become an ideal platform for applications in the design, visualization, and modeling categories. Applications

The Environment

previously available only on costly engineering workstations, such as two- and three-dimensional design and drafting applications, are now available on the Macintosh computer.

The consistent environment of the Macintosh computer allows these applications to be fully integrated and therefore exchange text and graphics with productivity, publishing, and presentation applications. As Macintosh computer graphics become even more powerful, new design applications using techniques such as solid modeling, parametric design, photo-realistic rendering, and animation will become commonplace on the Macintosh computer.

The Macintosh computer also has sophisticated sound capabilities incorporated into every system. This ability to play high quality sound permits the Macintosh computer to perform as a multimedia presentation system as well as a composition environment for advanced music applications.

The AppleTalk network system allows for a variety of network services including:

- *Sharing of files via file servers, which give multiple users simultaneous access to files and applications*
- *Sharing of high-quality printers and other network resources (modems, fax, etc.)*
- *Communication between users via electronic mail, electronic conferencing, or screen sharing*
- *Access to remote databases and applications*

The AppleTalk Network System

Apple's local area network system, AppleTalk, was the first significant step giving the Macintosh computer user the ability to reach beyond the desktop. The AppleTalk network system extends the user's experience across a network, providing access to electronic mail applications, print and file servers, and other network services in the same manner that Macintosh users access desk accessories, hard disks, or other Macintosh computer features. The user sees familiar aspects of the desktop interface, yet the software modules that control those services are hidden or transparent to the user.

The LocalTalk® network connection is built into every Macintosh providing access to AppleTalk network system services. Access to other network types, such as Ethernet or token ring, is available through additional interface cards.

The AppleTalk network system's design makes it simple to install by merely connecting the appropriate cable system into the computer network. Devices on an AppleTalk system, including printers and file servers, participate with all the other devices, without having to go through a host-provided service. This means that users never have to sacrifice the power and individuality of their own desktop in order to communicate with any other computer, even the most powerful mainframe.

The AppleTalk network system has an open, layered protocol system, on which a wide range of network services is built. It is consistent with the Open Systems Interconnection (OSI) reference model as defined by the International Standards Organization (ISO).

OSI Model	Functionality	AppleTalk Examples
Application Layer	Network-based applications and utilities	AppleShare print server AppleShare PC
Presentation Layer	File service; conversion of file formats; control of representation of information	AFP (Filing Protocol) PAP (Printer Protocol)
Session Layer	Delivery of sequenced packets of streams of characters; coordination of activity across network zones	ASP (Session Protocol) ADSP (Data Stream Protocol) ZIP (Zone Protocol)
Transport Layer	Reliable transportation; name-to-address mapping	ATP (Transport Protocol) Echo, NBP, ZIP
Network Layer	"Best effort" packet delivery between network entities	DDP (Datagram Delivery Protocol)
Data Link Layer	Access to physical transmission medium; speed of transmission; send/receive functions	ALAP (Link Access Protocol), Ethernet
Physical Layer	Transmission medium (cabling); electrical interface	Twisted-pair, coaxial, fiber-optic

The OSI reference model organizes hierarchically the types of services that must be provided in a communications network environment, defining seven categories, or layers, of network services. It starts at the lowest layer with a characterization of the physical media that carry the communications signals, and moves up to the highest layer where services specific to end-user applications are provided. By using this model, AppleTalk offers a flexible and open environment.

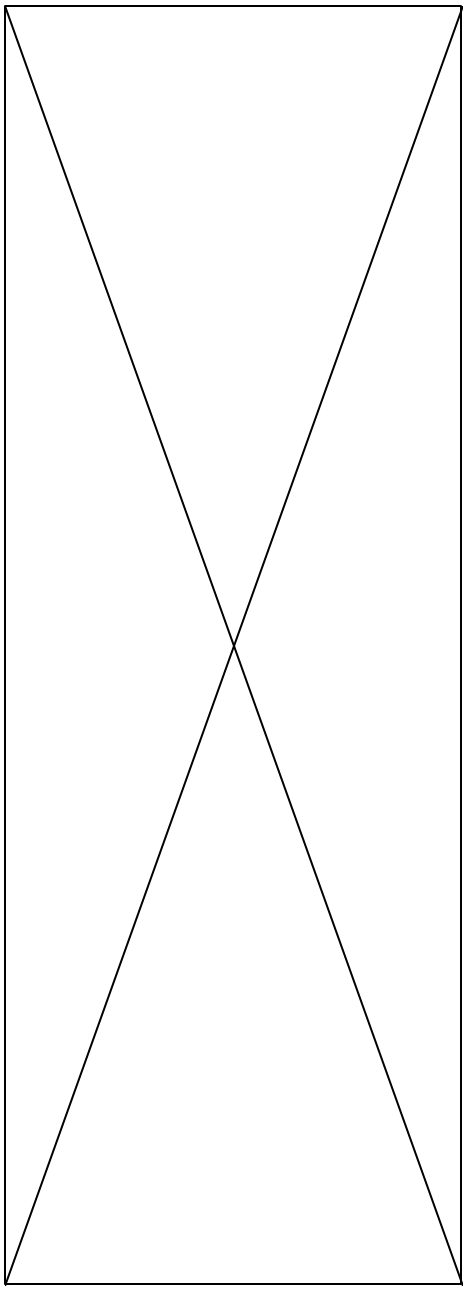
AppleTalk is supported on a variety of computing platforms:

- *VMS*
- *UNIX*
- *MSDOS*
- *NetWare*
- *And Others*

AppleTalk protocols are open to other vendors through a licensing program allowing networking companies to obtain AppleTalk software directly from Apple, instead of writing it from scratch. This program will extend the availability of AppleTalk network services on other computer platforms.

The AppleTalk network system offers a wide variety of choices in cabling and network data links including Apple's LocalTalk, which is built into every Macintosh, and industry-standard Ethernet (802.3) and token ring (802.5) networks. AppleTalk works with most major cable technologies--unshielded twisted-pair cable (phone wires), low-cost shielded twisted-pair wire, coaxial cable, infrared, and fiber-optics. And since AppleTalk is designed to be media-independent at the lowest levels of the OSI model, new cable technologies can be adopted as they evolve.

The Environment



AppleTalk Phase 2

AppleTalk Phase 2, introduced in June 1989, provides compatible extensions to the AppleTalk network system that enable it to function effectively in large network environments. AppleTalk Phase 2 extends AppleTalk to large enterprise networking systems over many cabling schemes and with many different network topologies and performance characteristics. Such environments often include thousands of concurrently active devices and multiple concurrent network protocols and data links. AppleTalk Phase 2 removed the restriction of a maximum of 254 concurrently active AppleTalk devices on one network. In addition, AppleTalk Phase 2 was designed to integrate the AppleTalk protocols with other non-AppleTalk devices in the same environment.

Extended addressing allows more nodes to be addressed on a single network. Previously, AppleTalk networks were limited to 254 nodes; with AppleTalk Phase 2, an AppleTalk network may now have up to 16 million nodes.

The improved routing capabilities optimize the performance of an AppleTalk internet by transmitting information across the most efficient route.

Dynamic zone naming allows flexibility in the design of an internet so that, when machines or people move from place to place, the network administrator can easily track them without having to actually change the physical configuration of the network.

A key component of AppleTalk Phase 2 is the AppleTalk Internet Router product. In addition to serving as the first router to implement the Phase 2 protocols, the AppleTalk Internet Router allows up to eight AppleTalk networks (of any data-link type) to be interconnected. The router software runs on a Macintosh and thus provides the familiar Macintosh user interface for router setup and for monitoring of the internet. The router supports LocalTalk, EtherTalk®, and TokenTalk® network systems and can be extended to support other data links as they are added to the AppleTalk network system.

Information Sharing with AppleShare

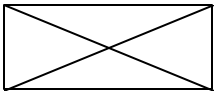
Through the AppleTalk network system and the AppleShare File Server, Apple also offers transparent, intuitive information sharing for work groups.

AppleShare File Server software converts any Macintosh computer into a high-performance file server. And since the AppleShare File Server was designed together with the Macintosh Finder™ and system software, the interface between user and server is seamless and transparent.

The user works with information on the server as if it were stored on his or her own hard disk. Individuals have the ability to control who has access to documents they create and store on the server. In addition, single-user and multi-user applications can be run directly from the server.

Network services such as print spooling and electronic mail can run concurrently with AppleShare. And AppleShare provides a predictable growth path. Users can enhance the overall performance of their servers by upgrading to a Macintosh II computer and a higher-performance protocol. Or users can upgrade to an AppleShare-compatible server running on a Digital VAX® minicomputer. Refer to the *Digital Equipment Corporation* chapter in this Guide for more detailed information.

AppleShare protocols have been adopted by major systems vendors such as Digital, 3Com, and Novell. Thus when users work with any AppleShare-compatible server, the user interface remains the same.

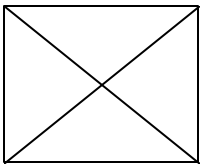


Printing

Historically, professional-looking printed output required extremely expensive peripherals. Networks, however, allow users to share those peripherals, making quality printing cost-effective.

Apple's LaserWriter® printer initiated a new era in printed office output, because it made high-quality printing available to work groups. The revolution in desktop publishing springs from the following enabling printing technologies:

- Adobe's PostScript® page-description language can describe and produce everything from simple fonts to complex graphic objects, all in many sizes and forms.
- The Printer Access Protocol (PAP) allows devices on a network to find and share different printers. It supports not only the LaserWriter family of printers, which are most commonly used as shared hardware devices, but also the less frequently shared ImageWriter II and ImageWriter LQ printers.



Network Administration

The larger a network grows, the more difficult it becomes to manage. Diagnostic and management tools are necessary to fine-tune network functioning to provide maximum efficiency and reliability. Apple's Inter·Poll® Network Administrator's Utility can identify network devices and system software versions from a single network station, allowing a network administrator to diagnose and correct problems quickly.

The AppleTalk network system offers transparent internetworking capabilities for organizations and work groups that need to connect more devices than a standard

The Environment

AppleTalk Phase 2 enhancement improves and extends AppleTalk network administration in three areas:

- *Extended addressing*
- *Improved routing capabilities*
- *Dynamic naming services across the internet*

AppleTalk network can handle. Apple's AppleTalk Internet Router dramatically increases the size and flexibility of an AppleTalk network system. It allows systems such as LocalTalk, EtherTalk, and TokenTalk to be interconnected to form an internet. Internets of up to 1024 networks and 16 million nodes can be created with AppleTalk Internet Routers.

Also, because Apple designed bridging capabilities into the AppleTalk network architecture, third-party vendors can create additional internetworking solutions. For example, a number of AppleTalk networks can be linked via the Hayes InterBridge, and products such as FastPath, from Shiva, allow communications between LocalTalk TalkandEthernet networks supporting AppleTalk, DECnet, or TCP/IP protocols.