IBM Hosts

Background

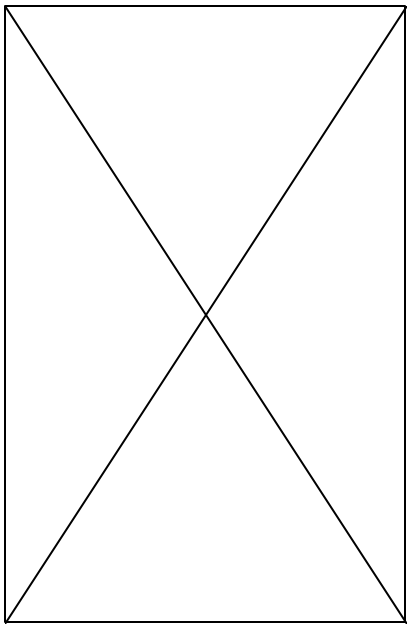
IBM was one of the pioneers of the information-processing industry, and so its computers are installed in most large management information system/data processing (MIS/DP) locations today. IBM cemented its leadership position during the 1960s with the introduction of the 360 Series. For the first time, users were offered a family of products that ran a variety of commercial and scientific applications on a single extensive architecture. During the early 1970s the 360 evolved into the 370 architecture in use today. With over 20 years of investments in these systems and in related application software and training, the commitment to IBM architecture is strong even in many sites that don't have a single IBM mainframe. Even though the mainframes may not be from IBM, the architecture usually is built around the IBM environment.

The traditional mainframe environment can be envisioned as a centralized core of computing power accessed by a large number of non-programmable terminals (NPT). These terminals are typically "dumb" devices or personal computers emulating dumb devices. The design of traditional Systems Network Architecture (SNA) protocols, pacing and routing algorithms has been based on a system in which dumb devices are in continuous connection with a central host.

As a class of workstations, these 327X devices are slowly being replaced by PC-based intelligent workstations capable of 3270 emulation. The inclusion of 3270 emulation in the extended version of OS/2 for the IBM PS/2 Series presages the eventual replacement of the 327X family by intelligent devices. Many industry experts believe, however, that this phasing out will occur over an extended period of time.

In a mainframe environment, access to host services is typically handled through a cluster controller that allows the 327X displays and printers attached to it to share a communications line or 370 channel, thereby reducing communications costs. In traditional 370-based products, the cluster controller is a separate product such as the 3274 or 3174. In newer processor lines, such as the 9370, the cluster-controller function is handled by a built-in board-level adapter. In either case, communications from the 327X device to the controller/adapter are transmitted via coaxial cable or token ring, and those from the cluster controller via channel connections, dial-up-telephone, token ring, leased telephone lines, or X.25 packet-switched networks.

The Environment



Establishing Communications Standards

Since IBM has defined and established the communications standards associated with IBM products, most computer companies have created protocol support and communications software that allow their products to appear to the network and its components as IBM 327X devices.

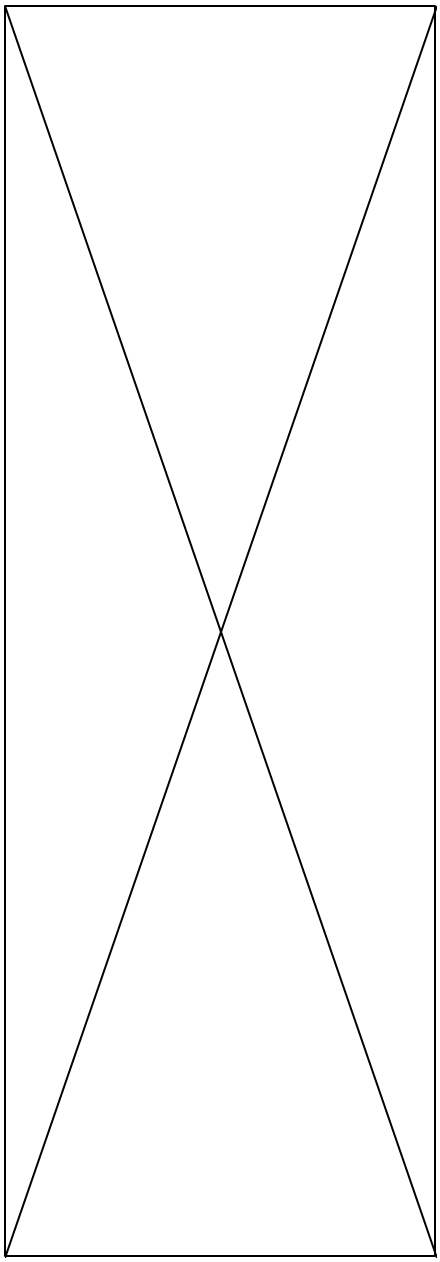
The problems associated with IBM's traditional network architecture are based on the state of computing at the time of its initial development. During the early 1970s, computing power was very expensive. Minicomputers were just emerging, and personal computers were not yet conceived. As a result, the hierarchical communications architecture developed by IBM in this environment reflected the need for large numbers of dumb devices to access and share the costly central computing resource.

Communications architectures developed in the late 1970s (such as TCP/IP) reflected the economics of computing at that time: The cost of computing had gone down sufficiently to allow distribution of intelligence at the node level throughout a network. Now, with the proliferation of personal computers, the ability to distribute computing power to every individual is a fact of life. The challenge today is to connect these intelligent end points in a fashion that optimizes and balances the benefits of distributed processing power for individuals, departments, divisions, and corporations.

IBM's SNA is a very robust networking architecture. It has been able to accommodate advances in computer technology over the 16 years of its life, but maintaining compatibility with previous software has made progress much slower than most users would like. IBM has had to accommodate new technologies to meet the demands of users in a constantly changing market.

To date, most PC-to-host interaction within the IBM environment has been limited to 3270 terminal emulation. While this technology allows the personal-computer user to access host resources, it essentially eliminates the main strengths of the personal computer.

As the personal computer steadily replaces the 327X device as the universal workstation, the communications procedures and protocols between the micro and mainframe must be streamlined to allow more transparent interaction for cooperative processing. Host-based services and enhanced access to these services, via improved device-interconnection capabilities, will continue to evolve. File servers, database servers, virtual disk emulation, distribution services, library services, and transformations are some of the functions that will receive increased attention from IBM and other vendors.



Product Groups

The term "micro-mainframe links" has degenerated over the last few years, through inappropriate usage, to the point that the meaning any one individual might attach to it is very likely to be misinterpreted by any other person hearing the phrase. It is, therefore, preferable to describe the basic types of interactions possible between personal computers and mainframes, illustrated by representative products.

Terminal Emulation

Terminal emulation is a form of link that presents the personal computer to the network as a dumb terminal supported within SNA. Terminal emulation typically is provided by a board and accompanying software.

Virtual Disks

These products, which allow the personal computer user to treat the massive storage capacity of the mainframe as a local disk, usually involve coordinated software at both the host and PC nodes. The user can store data on the host in PC format for sharing with other users who have access authority, and take advantage of the backup and archiving capabilities in place within the MIS/DP world. Tempus Link from Micro Tempus, and PC-Organizer from IBM, are examples of virtual disks.

User Interface for Host-Based Applications

These products extend the advantages of easy-to-use PC interfaces to host-resident applications software. There are two main product types, differing in whether or not changes are required in the host software.

User interface products that do not require alterations to host applications are essentially operating in terminal-emulation mode and present the user with a graphics, icon-based application interface. Products of this type include Masquerade for Macintosh computers and Easel for IBM PCs and compatibles.

The second type of product involves either adding new software or altering existing software on the host, as well as adding software at the PC. Apple's Mac-WorkStation, Simware's terminal emulator for the Macintosh computer, and SIMPC for the IBM PC are examples of products that allow data processing managers to customize a user interface to facilitate working with screens.

The essence of both approaches is to enhance end-user interaction with mainframe software by introducing an easy-to-use icon-based interface.

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Extraction Tools

These products are typically based on the ANSI Structured Query Language (SQL) developed initially by IBM and now used by virtually all host-based database vendors. They can extract data to the field or record level for use within PC applications.

Vendor-specific extraction tools, such as FOCUS/PCFOCUS, interact with and extract data from a single database for use within a particular PC application. The interaction is made much more transparent to the end user with this method, but flexibility is lost.

Cross-vendor extraction tools allow interaction with and data extraction from a variety of host database-management systems. Thus, applications are provided with more flexibility, although the transparency of interaction may be lost to the extent that less knowledgeable end users are excluded from using these tools.

Apple's Data Access Language (DAL) is a standard connectivity language that links personal computer applications to host data and provides a transparent extraction tool. Based on the client/server architecture, Data Access Language includes software components that run on both personal computer and host computer platforms, providing support for a wide range of operating systems, host database-management systems, and network connections.

Major Host Environments

It is important to understand that much of the complexity associated with IBM host-based environments is largely a function of the many different operating-system environments used within a single product line. The following is a quick overview of those environments deemed strategic enough by IBM to be included in its Systems Application Architecture (SAA).

Operating Systems Within the 370 Environment

Multiple Virtual Storage/Enterprise System Architecture (MVS/ESA) is the flagship operating system for large mainframes (308X, 309X). It is a multi-user, multitasking operating system used as the production system for most large mainframe sites. Its main strengths are in the batch and transaction-processing environments. It is the only operating system presently being shipped that supports the four- and six-processor models of the 3090 line. Interactive processing is accommodated via the Time Sharing Option/Extended (TSO/E) product. The Customer Information Control System (CICS) is the teleprocessing monitor within the MVS world. It provides a common interface between the communications facilities of the network and applications that employ its utilities.

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Virtual Machine/Extended Architecture (VM/XA) is the primary operating environment for PROFS office automation systems of the newly announced 9370 Series. Jointly developed by IBM and MIT, VM/XA divides the processor into several virtual machines, each under the control of a separate guest operating system. Originally developed as a migration tool, it has now become the only mainframe operating system supported over the entire product range from the 3090 down to the VM/PC. The Conversational Monitoring System (CMS) component of VM handles interactive processing. Limitations within the VM environment preclude it from driving the larger models of the 3090 mainframe line. It also cannot run CICS-based applications in a production environment (code and test only).

Disk Operating System/Virtual Storage Extended (DOS/VSE) is not deemed a strategic operating system by IBM. It remains popular, however, due to its relatively low cost compared to MVS, its large installed base within the 4300 line of 370 processors, and its ability to run CICS applications. DOS/VSE is not an SAA system.

Existing within the System 370 environment, but likely to be encountered far less frequently, are UNIX, in the guise of VM/IX, and TPF 2 (Transaction Processing Facility-2), which exists at only 250 sites in the airline and financial-services sectors. Neither system is included in IBM's SAA, though TPF 2 is IBM's strategic mainframe-based high volume transaction processing system.

Operating Systems Within the System 3X Environment

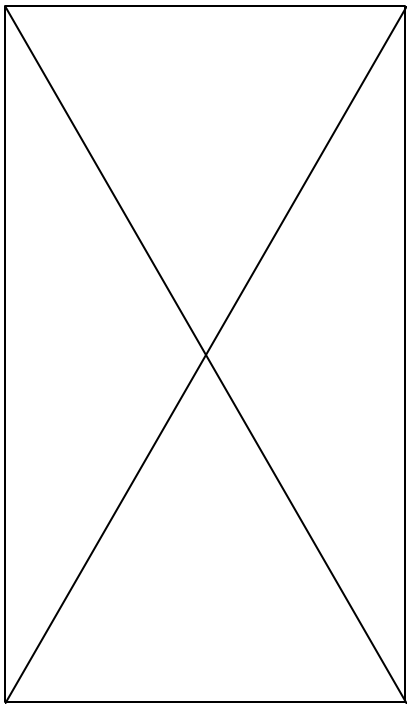
SSP is the operating system of the small-business-oriented processors of the System/34 and its successor, the System/36. There are well over 150,000 System/34/36 installations throughout the world. This environment stresses ease of use and does not focus on System/370 affinity. There is an extensive base of small- and medium-sized business software available for the S/3X.

CPF is the operating system of the System/38. Strengths associated with the System/38 center on its integral database-management system and the fact that it extends programmer productivity in a less support-intensive environment than that of the host.

Operating Systems Within the AS/400 Environment

The AS/400 replaces the S/34, S/36, and S/38 models. OS/400 is the operating system of the AS/400 system and will run applications from these systems. The OS/400 operating is a preloaded, integrated operating system for all AS/400 models. Most system functions are menu driven, with a fast path capability for the more experienced user. Graphics and image support is built into the OS/400 operating system, but not yet fully implemented by applications.

The Environment



Network Architecture--The Future

IBM is steadily moving SNA away from a rigidly hierarchical network toward a more peer-oriented method of interconnection. This migration has been underway for several years and will continue. Enhanced interconnectivity within SNA is possible through Advanced Program-to-Program Communications (APPC), a combination of Logical and Physical Unit Types--LU 6.2 and PU Type 2.1--within SNA. Applications designed in accordance with APPC rules and procedures can meaningfully communicate with other APPC applications located elsewhere on the network. Physical Unit Type 2.1 defines the necessary physical characteristics that allow a device to interconnect directly with other Type 2.1 nodes rather than having to pass through the host (as was the case with traditional SNA). Support of LU 6.2 without concurrent support of PU Type 2.1 allows for peer-to-peer communications, but doesn't allow a direct connection with the desired destination.

Eventually, end users running applications supported under SAA will be able to make requests for information without having to be aware of the location of the information or the underlying architecture of the device at that location. Today, that capability is available only within the System/3X environment, via the Advanced Peer-to-Peer Networking (APPN) feature.

In the long run, any device that contains the necessary communications capabilities (LU 6.2/PU 2.1) will be able to interconnect in an ever-increasing variety of connectivity modes, including:

- Packet-switched networks
- Computerized Branch Exchanges (CBXs)
- Low-Entry Network Nodes, which are special types of PU Type 2.1 nodes defined for APPN

Macintosh in the IBM Environment

Apple's 3270 API, a high-level application programming interface, and MacDFT^{s}, which is end-user software, provide a variety of new functions. These include a platform for developing 3270 applications that emulate IBM display terminals yet use the Macintosh computer graphic user interface, the ability to transfer entire documents between Macintosh computers and IBM hosts, and the ability to copy text from an IBM host word-processor program and paste it into a MacWrite II document. MacDFT software also provides capabilities for copying data between host and Macintosh-based spreadsheets.

The Macintosh computer, with its graphics and intuitive interface, is an effective workstation with outstanding communications capabilities. As the Macintosh

computer has become an open-architecture machine, and one for which impressive communications tools have been developed, it has become increasingly effective in the IBM environment. While communications products today allow the Macintosh computer to emulate an IBM 3278 terminal and transfer files, newer products from Apple such as MacAPPC software are offering exciting possibilities for the Macintosh computer as a participant in IBM's still evolving SNA strategy for peer-to-peer communications. MacAPPC makes it possible to develop commercial applications on the Macintosh computer that can dynamically exchange information with IBM host-based applications. These applications will use the full capabilities of the Macintosh as a powerful computer with its own intelligence, not simply as a dumb terminal.

Apple and SAA

A key element of Apple's networking strategy has been Macintosh integration with IBM systems. The goal is to provide developers and customers with an Apple-standard set of protocols, interfaces, and tools that enable the development of consistent, integrated Macintosh applications for the IBM environments.

The Apple approach is to implement the IBM Systems Application Architecture technologies that complement the Macintosh, thereby enabling user-transparent access to IBM data and services. Apple's product development will continue to focus on the core networking protocols, interfaces, and services enabling commercial developers and customers to create applications for end users. This helps developers to produce fully functional software in the shortest possible time by allowing them to concentrate on the application and user interface rather than networking. Both the customer and developer benefit from interoperability among applications based on consistent, integrated networking functions in the Macintosh.

Apple will continue to enhance the IBM-connectivity product line through improvements in functionality, performance, and usability. The commitment is to provide customers with a common Macintosh view of IBM data, services, and applications through support of key SAA technologies. With the key connection and communication standards available, SAA application services such as SNA/DS and DIA are planned as well as enhancements to the existing products. Apple will also investigate implementations of SNA/MS, DDM, and SNA/FS as those technologies and IBM implementations evolve. As the customer requirement for LU6.2 products expands, CPI-C (the SAA interface to LU6.2) will be implemented as an enhancement to existing Apple APPC products.

The Common User Access (CUA) element of SAA covers a wide range of guidelines, technologies, and products aimed at improving user interface consistency

The Environment

across IBM platforms. Apple does not plan to support the diverse elements of CUA since the Macintosh provides the most consistent and mature user interface across IBM systems as well as in multivendor environments. The fundamental goal of Common Applications (CA) is to enable applications that span the several IBM platforms with a base level of user interface, functionality, and portability.

In addition to the advantages in a multivendor environment discussed above, Macintosh participates in SAA environments through support of key IBM SAA communications protocols and programming interfaces. Combined with the rich and diverse networking and toolbox facilities in the Macintosh environment, these SAA functions provide Macintosh users with a "common view" of the IBM host environments.