IBM Communications Server for S/390
Enterprise-class Networking

Script for "Communications Server for S/390" Freelance presentation

Title page

Many companies today are struggling with the need to expand their networking capabilities to meet new requirements. They may need seamless access to information from business partners to give them a competitive advantage. Or perhaps individual teams need better ways to provide collaborative computing. And growing numbers of mobile workers need full secure access to all resources on the network to really be effective. Along with these new needs, business networks must continue to provide predictability, capacity, performance and manageability for their current applications.

The IBM Communications Servers for S/390 provide Enterprise-class networking to meet current and expanding network requirements. This presentation will help you understand how the IBM Communications Servers help you meet these requirements.

Presenter notes: The key messages for Communications Servers for S/390 that you should get across in this presentation are:

Enterprise-Class networking - predictability, scalability, reliability, availability, performance

"Plug and go" anywhere with secure remote access

IBM provides the key networking technologies for Internet/intranet solutions today - and tomorrow

We will be emphasizing these messages in presentations, press releases, etc. throughout the year.

Agenda

With this presentation you will learn what the Communications Servers for System 390 are and the features and benefits they provide. A brief description of OS/390 features and functions is included to help you understand how the Communication Servers fit into the overall OS/390 server. At the end of the presentation I'll briefly discuss future directions for the Communications Servers and try to answer any questions you have.

Presenter notes: The end of this presentation contains additional information about OS/390 for you to use at your discretion if you think the customer is not familiar with OS/390. The script also contains OS/390-related information which can be skipped if you don't include the OS/390 section. All the OS/390 information and script came from the OSPG package on MKTTOOLS, so if you need more information on OS/390 you can refer to that more comprehensive package.

Communications Servers for S/390

Communications Servers for System/390 provide powerful networking facilities for cost-effectively connecting diverse application and network environments for the enterprise.

Communications Server runs on two System 390 operating systems, OS/390 and MVS/ESA. The Communications Server for MVS/ESA is a separately orderable product that combines TCP/IP 3.2, VTAM 4.4, and an Integrated AnyNet Feature. On OS/390, Communication Server for OS/390 also provides VTAM, TCP/IP and AnyNet (the same functionality provided in Communications Server for MVS), but it is an integrated part of OS/390. Later in the presentation I'll cover in more detail how Communications Server for OS/390 fits into the overall OS/390 picture and some of the other features you get as part of OS/390.

Both Communications Servers give you the high availability, capacity, performance and predictability that are needed for enterprise-class networking. Because of the multi-protocol capabilities built in to the Communications Server, you also have universal "any to any" access to provide enterprise-class networking for your business. As I mentioned before, most businesses must support both their core business applications and emerging electronic business applications -- and do so in many environments - across Local Area Networks (LANs), Wide Area networks, intranets within the business or across the Internet.

Networking for S/390

I've mentioned the Enterprise-class dependability of the Communications Servers. I'm going to define Enterprise-class qualities more specifically, and then I'll give some specific examples of how Communications Server provide you these qualities.

Communications Server give you high availability to keep your network up and running whenever you need to get to network resources. Many of IBM's customers must have 24 X 7 availability to run their business, and IBM understands how to make networking products for that environment.

With Communication Server you also get high capacity performance so that you can handle the volume of users needed from your network with the performance standards you've grown to expect from IBM networking. For example, with TCP/IP, you can have more that 20,000 active telnet sessions, (which from our experience is more than two times the capacity of our nearest competitor). With SNA, you can also have tens of thousands of sessions.

Controlled access security allows you to secure your business applications and information while still providing complete network access to your host server.

In addition to performance, with Communications Server and the System 390 you can have a wide range of network connections, from a few to tens of thousands, depending on your requirements.

Predictable response times and reliability are a key part of the IBM Communications Servers. With IBM's experience in providing networking to business customers for over 25 years, you can be confident that IBM knows how to provide Enterprise Class Dependability.

High Availability

S/390 is unequaled in the marketplace as the platform providing the highest network availability. During 1996 this availability was enhanced with Virtual IP addressing (VIPA) which, in conjunction with Route D, provides automatic and transparent recovery from controller interface and network failures in TCP/IP environments. High Performance Routing (HPR) is available for APPN environments and allows failed network nodes and paths to be routed around without disruption to the end-user session. S/390 availability, which is best in the industry, is now even better with such new Communications Server capabilities as Multinode Persistent Sessions (MNPS), Routing Internet Protocol Version 2 (RIP V2), HPR support of broader configurations and TSO/E Generic Resource capabilities.

Previously SNA sessions could be preserved across application outages with a function known as persistent LU-LU sessions. With MNPS these sessions are now preserved in configurations where hosts are connected through the S/390 Coupling Facility. Since session information is preserved, the workload and extra network traffic to re-establish potentially thousands of connections is avoided. As you might imagine, cost savings can be quite significant. The restart of failed applications can be dynamically executed with the Automatic Restart Manager function of MVS/ESA, further minimizing any potential impacts to the end-user. The actual level of recovery capability that can be achieved is dependent on the application.

Coupled with HPR, MNPS allows you to build networks and applications that are fault-tolerant, with the potential to maintain S/390 connectivity through planned or unplanned outages.

RIP V2 is now supported by Communications Servers for S/390. RIP V2 is a TCP/IP function that enables routers to discover network route failures sooner such that routing around these failures may occur more quickly. This allows alternative routes to be initiated faster to minimize the impacts of network failures to your end-users.

As some of you may recall, HPR provides such networking benefits as improved performance, non-disruptive recovery from network failures, sophisticated congestion control, maximum throughput and the highly efficient utilization of network bandwidth. Communication Servers

for S/390 now provide these benefits to support configurations where HPR sessions extend across multiple networks, extending HPR value to a substantially larger user population. Supporting a broader range of network configurations, migration to HPR is simplified from environments using APPN over subarea connections (VRTGs). For example, applications can reside on a S/390 with an attached 374X/NCP so users will have the benefits of HPR when applications are on a composite network node (CNN) or migration data host (MDH).

For OS/390 user environments, Communications Server for OS/390 provides VTAM Generic Resource capabilities to TSO/E users of parallel sysplex. We will discuss this function in greater detail later in the presentation.

High Capacity Performance

S/390 has a strong heritage and reputation for performance that is robust enough to address some of the largest network requirements. With customers building TCP/IP networks exceeding 20,000 sessions and VTAM networks exceeding 100,000 sessions, Communications Servers for S/390 proven capacity and "fits all sizes" scalability positions it as the premier solution supporting your networking needs today and as your business expand to exploit the Internet for business advantage.

Fall of 1996 brought the introduction of High Performance Native Sockets (HPNS) for TCP/IP users. HPNS provides an improved transport layer which significantly enhances TCP/IP performance by reducing path length and CPU times. Customers may take advantage of this and other HPNS benefits such as improved cross memory communications while not requiring changes to their existing applications. Also during 1996 IBM introduced Virtual IP Addressing (VIPA), which in addition to enabling fault-tolerant TCP/IP networks, provides the capability to split work loads across multiple controllers for improved performance. These TCP/IP enhancements strengthens an already high performance set of S/390 Communications Server offerings currently anchored by technologies such as HPR which provides superior congestion control and highly efficient utilization of network bandwidth.

To better capitalize on high-speed networking, Communications Servers for S/390 introduces High Performance Data Transfer (HPDT) services and new programming interface to optimize performance for APPC applications, particular those transferring large data objects. HPDT services are available to applications written to the APPCCMD interface whose sessions connect two intrahost applications or transverse one of the following high-bandwidth network attachments.

  { S/390 Open Systems Adapter-2 connected to a native ATM network
  { APPN (R) node-to-node channel connections
  { Cross System Coupling Facility (XCF) links between Sysplex processors
  { IBM NWays 2216 Multi-access Connector Model 400 with ESCON attachment or IBM
      3746 NWays Multi-protocol Controller models 900 and 950 with the Multiaccess
      Enclosure and ESCON channel

HPDT services improves performance by reducing the movement of data within the S/390. A new buffer management scheme requires shorter path lengths for buffer handling of large data objects. Data packing and improved channel programs scheduling increases data transfer rates and reduces S/390 CPU overhead related to I/O, all adding to improved performance. Though application changes are not required to receive these benefits, performance improvements may be more substantial when applications include some customer modifications. In general, performance benefits will be greater as message size increases.

The HPDT programming interface allows system authorized applications requiring bulk data transfer to gain additional performance improvements by eliminating entirely the data copy as data is transferred between the APPCCMD application and VTAM. The data copy is no longer necessary due to a new communications storage manager component of the APPCCMD interface that allows VTAM and applications to exchange ownership of single piece of commonly addressable storage so there is no need to copy data at the APPCCMD API. In order to exploit the additional performance improvements enabled by the new HPDT interface, applications must be modified to use the new communication storage manager and new extensions provided for the APPCCMD macroinstruction.

VTAM multipath channel (MPC) is being enhanced to include HPDT MPC also known as MPC+) connections. HPDT MPC connections provide more efficient transfers of data than previous MPC connections because they utilize the higher performing HPDT services described above. HPDT MPC can reduce CPU cycles used for communications by as much as two-thirds depending on the system configurations and size and type of data objects transferred.
The Communication Servers, in conjunction with the S/390 (R) Open Systems Adapter-2 (OSA-2) provides an ATM Forum User-to-Network Interface (UNI) compliant, native ATM communication capability to better support high-speed and high-capacity data requirements on the S/390 server. This native ATM capability provides VTAM users with support for best-effort virtual circuits and reserved-bandwidth virtual circuits.

Best-effort virtual circuits combines the capabilities of the OSA-2 ATM adapter and VTAM to provide the ability to optimize link capacity. Link capacity is optimized by allowing best-effort circuits to use the native ATM network when reserved-bandwidth connections are idle. Reserved-bandwidth virtual circuits gives you the ability to provide your network users with the most up-to-date support characteristics such as....

- { Bandwidth reservation specified and allocated based on application needs
- { Prioritization of interactive traffic over batch traffic
- { Prioritization and segregation of batch traffic associated with disaster recovery backup of mission-critical data within a predefined window of time
- { Prioritization and segregation of classes of users allowing the establishment of mandatory response time targets. In this manner engineering, medical, or emergency response traffic is prioritized over business-as-usual administration traffic.

Native ATM support, coupled with High Performance Data Transfer and APPN/HPR, provides access to the most advanced networking and system functions available on your S/390 servers.

APPN and HPR class of service is mapped to ATM virtual channel connection characteristics. This allows existing applications to exploit the full capabilities of the ATM network without requiring changes.

Controlled Access Security

IBM continues to enhance customer capabilities to protect their information assets by providing the following Communications Servers for S/390 security enhancements...

RIP V2 messages can be authenticated for security purposes thus allowing users to discard messages which do not past authentication testing.

VTAM Cryptographic support is enhanced with Message authentication code (MAC), which improves network security by ensuring data was not tampered with between sender and receiver, and Transaction Security System (TSS) which provides support for a broader range of Common Cryptographic Architecture (CCA) products and services.

TCP/IP support of the IMS Open Transaction Manager Access facility (OTMA) allows IMS/OTMA security enhancements to be exploited more easily by IMS applications over TCP/IP networks.

Universal Any to Any Access

VTAM, AnyNet, and TCP/IP are well known IBM products and I won't spend time on an exhaustive review of their functions here. However, I would like to highlight that TCP/IP now supports IMS/OTMA which allows TCP/IP clients to access OTMA applications without requiring changes. Also, the AnyNet/MVS feature is now an integrated component of VTAM at no increase in price. This enhances the value of VTAM and alleviates the need to separately install a new product when adding multi-protocol application support.

I want to take a few minutes to highlight some of the particularly important functions of the Communications Servers and their value-add to the Client/Server arena.

As noted earlier, network integration was most often mentioned as a top priority in a recent survey of System/390 networking users.

The Communications Servers allow you to seamlessly integrate applications, data and users across APPN and SNA subarea networks. VTAM APPN's Interchange Node (ICN) and Virtual Route Transmission Groups (VRTGs) allow subarea and APPN (with or without HPR) sessions traffic to traverse each other seamlessly allowing users in either network to fully access applications, users or other resources regardless of which network type they are in.

You can also integrate TCP/IP and SNA networks by using the Sockets over SNA access node and the SNA over IP gateway capability. For example, UNIX applications on MVS/OpenEdition are accessible simultaneously by users in SNA and TCP/IP networks.

A broad array of application support and programming interfaces is provided in CS/MVS and CS for OS/390. While supporting the traditional IBM subsystems and applications infrastructure such as CICS, TSO and 3270, it also offers a full set of open client server interfaces such as APPC, CPI-C, and Sockets including Berkeley (BSD), CICS and IMS sockets, and MVS/Open Edition. A key benefit of the IBM sockets interface is that, along with the traditional "C" language sockets interface, you get additional language support for sockets programming with COBOL, PL/I, assembler, and many other languages. A full complement of popular applications such as file transfer (FTP for TCP/IP, AFTP for APPC), telnet, and e-mail are also included.

Advanced client/server services are also offered with Communications Server. Both APPN and TCP/IP are peer-to-peer networking types freeing the network owner from the coordinated system definitions typical of more hierarchical approaches. The Dependent LU Server (DLUS) allows 3270 APPN devices using Dependent LU Requester function to take full advantage of the dynamics of APPN networking. This allows the 3270 APPN device to be in the best location for the user rather than location being dictated by the location of the mainframe or controllers. Furthermore, on the System 390 you can get the APPN Central Directory Server (CDS). With CDS, all APPN nodes in the network can register their resources in this central repository. When a resource, such as an order entry application, needs to be located, the CDS is searched first and broadcast searches are reduced to only those instances where the resource has yet to be registered or is perhaps in another connected network. This powerful feature can significantly reduce network overhead.

Finally, High Performance Routing, as discussed earlier in this presentation, offers high speed, high availability, high throughput and optimal network utilization contributing substantially to improved customer productivity and Client/Server networking cost effectiveness.

Intranet/Internet Access From Anywhere

Doing business on the Internet is an increasingly hot topic for many businesses trying to gain a competitive advantage. However, interest in exploiting Internet/Web technologies for an enterprise "intranet" for easy access to enterprise document and services by enterprise personnel is growing at an even faster pace.

Communications Server provides networking infrastructure to support Internet/intranet access with little or no impact to existing networks.

Let's illustrate these advantages by a closer look at the diagram which shows several scenarios.

First, consider the enterprise with S/390, intelligent workstation clients and perhaps servers connected via an existing SNA network. We assume that it well meets the enterprise needs for network performance, reliability, and availability and so changing to or adding a parallel TCP/IP network just to support Internet use is not cost-effective.

Using the Communications Server multi-protocol function, you can run browsers (which are sockets applications) on your clients over the SNA network to a multi-protocol gateway and then out to your Internet service provider to access the Internet. The multi-protocol gateway can be any of the Communications Server family, including CS on OS/2, AIX, and S/390 or the 2217 concentrator, and allows users to run sockets applications over an SNA network. This provides a cost-effective solution for accessing the Internet, since it eliminates the need for a complete change of the network or for an additional TCP/IP network backbone.

If you want to provide an enterprise-wide web server, you can use the "super server" capability of your S/390 to provide access to applications and services.

The other scenario could be that your company has core business applications designed to run over SNA, but your network is changing to TCP/IP. The same multi-protocol function of Communication Server can be used to provide this function. IBM is committed to providing you the application access you need for the network you choose, with flexible any-to-any access for end users.

Unique Benefits of OS/390
For OS/390 user environments, Communications Server for OS/390 provides VTAM Generic Resource capabilities to TSO/E users of Parallel Sysplex. This function increases TSO/E resource availability because all TSO systems in a Parallel Sysplex may be accessed using a generic name. Should a particular TSO system fail, an alternative TSO system may be selected as the session partner using the same generic name. In addition to Generic Resource, the capability to balance sessions distributed across TSO systems in the sysplex is also provided. This greatly enhances productivity for users of S/390 parallel sysplex servers with coupling facilities.

Considering Platform Alternatives?
If you are considering a change from your current platform, Communications Server capabilities as an integrated component of OS/390 is a powerful combination. Communications Server for OS/390 is the leading-edge multi-protocol networking component of OS/390, IBM's strategic MVS/ESA operating platform. As an OS/390 integrated component, Communications Server for OS/390 is integration tested, shipped, installed and maintained concurrently with a list of other key applications and secure network computing functions. This integration improves the total cost of computing by reducing and greatly simplifying planning, installation and maintenance of your MVS/ESA operating system. OS/390 is the platform for future MVS /ESA software and Parallel Sysplex enhancements and extentions.

Transforming S/390 Software

OS/390 transforms S/390 Software by integrating all the necessary piece parts to enable a completely new, open, integrated, application enabled, secure network computing server operating system.

All over the world, the most sophisticated and competitive business environments run under one large-scale system environment: the MVS operating system from IBM.

The MVS system is known for its classic strengths such as rock-solid reliability, continuous availability, multi-level security, enterprise-wide systems management and the capability to support massive transaction volumes and large number of users while maintaining high performance.

Over time more and more functions were available for the MVS platform, delivered in a piece parts fashion such as: parallel processing via the Parallel Sysplex; state of the art networking; client/server; and object-oriented technologies.

To further expand the S/390 application portfolio, a UNIX development and execution environment became available on the S/390 platform, including all of the primary functions to support XPG4 Base Profile Branding and Open Distributed Computing (DCE, DFS, DFSMS/MVS NFS). In addition Network Computing functions became available and dependent upon the UNIX functions of the operating system.

OS/390 has transformed the S/390 software environment by integrating all of those functions in one completely new, open, integrated, application enabled, secure network computing server operating system.

We have transformed S/390 software environment with OS/390. Let's discuss what OS/390 is now.

What is OS/390?

OS/ 390 is leading Edge Open, Secure Network Computing Server Operating System

OS/390 Release 3 not only retains, but enhances significantly the classic strengths of MVS/ESA that have been the backbone of so many organization's computing capabilities for years. It has been updated to make it even easier to enable, deploy and distribute enterprise applications, thus improving time to market for business solutions.

Some of the biggest requirements we hear from our customers is to enable applications and provide secure network computing while reducing IT complexity, and enabling improvements in their productivity. This comes to us from many sources: our customer software satisfaction surveys, open discussions in user group meetings such as Guide and Share, etc. As a result of this strong customer input, we focused on delivering an open secure platform that supports the hot applications and secure network computing as well as continuing to deliver enhancements to reduce and greatly simplifying planning, installation, testing and maintenance.

OS/390 improves total cost of computing by improving people productivity, reducing complexity, improving enterprise costs and providing value based application and secure network computing solutions that are competitive priced to alternative solutions.

Besides that, OS/390 provides the platform for Parallel Sysplex terms and conditions. Customers may select OS/390 as the single qualifying software product for Parallel Sysplex License Charge (PSLC) pricing in both the single and coupled system environments. In the coupled system environments OS/390 replaces MVS V5, DFSMS, VTAM Version 4 and the requirement of a Parallel Data Base Manager and a Parallel Transaction Manager. OS/390 is the platform for the Parallel Sysplex that enables transaction processing, batch processing, data sharing, secure network computing and systems management and is the base for future Parallel Sysplex enhancements and extensions.

OS/390 Release 3 open server operating system is a complete secure Network-ready integrated operational environment. The base operating system functions of key products in the MVS environment are now integrated and have been installed and systems integration tested as one system prior to customer delivery. Installation of OS/390 makes available the base operating system, a leading-edge open Communications Server, and distributed data and file services. Other functions integrated represent the latest technological enhancements of the existing systems, including Enhanced Parallel Sysplex Support, Object-Oriented technology programming, OSF Distributed Computing Environment (DCE) and UNIX 95 Open Application Interfaces branded by X/Open. OS/390 also provides secure network computing which is delivered via the Internet Connection Secure Server for OS/390 as part of each order. Additional features are designated as optional. They are installed at the same time as OS/390, and have been integrated and tested. Everything you need for the most available, high performance, scaleable and secure server platform has been developed, tested and delivered as one system. All future enhancements of selected integrated base elements and optional features will be delivered only via OS/390.

In addition to integrated product function we integrated product information as Softcopy facilities on OS/390. Using the integrated functions in OS/390 customers will be able to easily locate information, view and high quality print it online.

OS/390 created a major change in the way S/390 delivers systems software. For our MVS customers, the transformation has and will continue to be staged to support customer plans for migration from current product releases to OS/390. Current application and middleware investments will be protected, because this integration will not require programming changes. All these things will make it easier to implement, use, and demonstrate the value of the System/390 for today's Client/Server and UNIX applications, as well as for the Network Computing model.

OS/390 is not a package. It is an integrated solution. It integrates software, information (publications) and testing. We are working hard to exploit that integration.

OS/390 R3 Base Elements Enhanced

OS/390 continues the integration of additional MVS products and features in Release 3. The following are new base elements added in Release 3:

OS/390 Application Enabling Technology
TCP/IP 3.2 CICS Sockets (formerly was an integrated priced optional OS/390 feature)
TCP/IP 3.2 IMS Sockets (formerly was an integrated priced optional OS/390 feature)
Internet Connection Secure Server for OS/390 V2R1

Although not an integrated base element, exclusive functions have been added to OS/390 R3 to provide SAP R/3 and Lotus Domino enablement. All base elements and integrated optional features are extensively tested and delivered as a single network-ready operational environment. The integration eliminates separate orders, eliminates separate pre-requisite or co-requisite checks, eliminates separate installations and customer testing after each step.

OS/390 consists of base elements that deliver essential operating system functions. When you order OS/390 Release 3, you receive all base elements, if you so choose a copy of the latest level of the IBM Internet Connection Secure Server for OS/390 V2R2 (next higher release level of ICSS that's already integrated in the OS/390 base) and an updated OS/390 Internet BonusPak II that supports both ICSS V2R1 and ICSS V2R2. (Note: When ordering ICSS, NA Security or Export Security must be specified for inclusion with OS/390.)

More elements of OS/390 Release 3 are exclusive and deliver new and enhanced functions available only in OS/390. Customers will have the ability to replace OS/390 base functions with a commercially available product which provides similar functions. Please contact an IBM representative for qualification and pricing information. All OS/390 integration testing results and performance claims will be voided with such replacement.

In addition to the base, OS/390 Release 3 has optional integrated features that have an affinity to the base.

OS/390 R3 Optional Priced Features Enhanced

All OS/390 Release 3 optional priced features are integrated and shipped with the OS/390 product whether or not you order them. These features support dynamic enablement, which allows you to dynamically enable and disable them. If you order them, they are shipped enabled for use. If you do not order the feature, they are shipped disabled for use. If, later on, you choose to run them, you first let IBM know of your intentions and then enable them dynamically through PARMLIB. These enabled functions now become subject to the payment terms of the customer's OS/390 license.

The OS/390 Product Registration and Enablement capability are used by all integrated optional priced features delivered in OS/390 Release 3. This function does dynamic enablement in OS/390. Each host based optional feature shipped can be individually enabled; for example, JES3 or BDT File to File, etc. All optional features are integrated and shipped with the base product, support dynamic enablement, and are available for customers in OS/390 R3. The exception is VisualLift ADE which cannot use dynamic enablement because it is shipped on diskette and is not host based. All optional features are tested and service synchronized as part of the entire system integration test so their impact on customer testing and production cycles can be limited when they are implemented.

OS/390 Release 3 also delivers optional no charge features that have been enhanced. Let's review them now.

R3 Optional No Charge Feature Enhancements

This foil depicts the OS/390 R3 optional no charge features that have been added or updated in OS/390 R3. The primary reason for not integrating these optional features into the OS/390 base is because of export restrictions on data encryption software. These optional features are all tested and service is synchronized as part of the OS/390 systems integration test so their impact on customer testing and production cycles can be limited if they are implemented.

To receive these features they must always be ordered as an OS/390 optional feature. If you order the feature, you can use it once you install OS/390; there is no dynamic enablement for it. Checking will be done at order time to insure export restriction are not violated.

For those customers licensed for OS/390 and using a PC Server System/390 or an RS/6000 S/390 Server-on-Board they can order a preconfigured OS/390 Release 3 CD base image that provides a "load and go" system. It is available as an optional distribution feature of OS/390 Release 3 for no additional charge to licenses of the OS/390 base.

PC Server S/390 and RS/6000 S/390 Server-on-Board
As part of the OS/390 software order, a PC Server S/390 and/or RS/6000 S/390 Server-on-Board customer can request a CD with a pre-configured OS/390 Release 3 base image that provides a "load and go" system. These CD's will be available May 1997. This CD takes advantage of the unique dual operating system environment of the PC Server S/390 and RS/6000 S/390 Server-on-Board. It is available for no additional charge to Entry Support Licenses (ESL) of the base.

Note to presenter: If you don't choose to present the OS/390 portion of the presentation, make sure you cover the last foil on Directions.

Directions

IBM will continue to invest in networking technologies which enhance System/390 as the premier Internet/intranet server today and as you evolve toward a network computing environment. IBM will be there with the leadership networking technologies you need.

Trademarks