Session C24

iSeries: Windows 2000-NT Server Integration with IXA/IXS

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IBM @server iSeries Technical Conference

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iSeries Consolidated Server Strategy

iSeries applications from core business to e-business

IBM @server iSeries

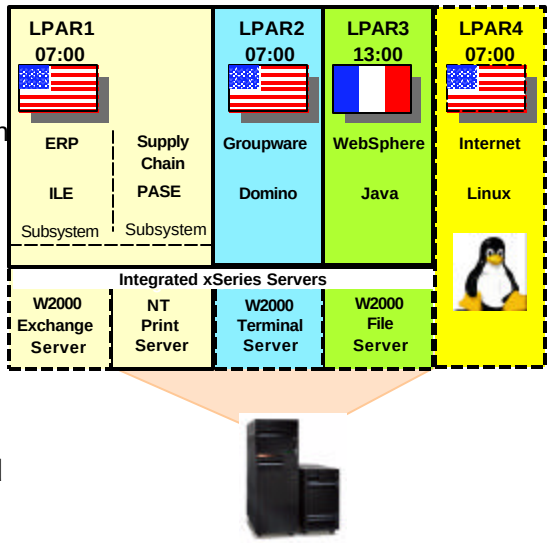
Single server, multiple applications

- Microsoft® Windows® 2000 Server
- Domino
- OS/400 Portable Applications Solution Environment (OS/400 PASE)
- Integrated File System (IFS)
- WebSphere and Java™
- Linux

Workload management

- Subsystems
- Logical Partitioning

Incorporates pSeries, zSeries, and xSeries technology



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iSeries and Windows Servers

IBM eserver iSeries

60% of iSeries and AS/400 customers have NT Installed*

ISVs and IBM are delivering complementary applications with Windows® Servers

Customers want to consolidate servers

* IBM Server Group Market Intelligence 2Q 00

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Notes: iSeries and Windows Servers

IBM eserver iSeries

If we look at iSeries and AS/400 customers as well as industry trends we see the following factors:

Per IBM market survey data as of 2nd quarter 2000, 60% of iSeries and AS/400 customers have NT Installed. iSeries customers have Windows products installed on clients as well as servers. Our customers have Windows products installed more than any other operating environment.

ISVs and IBM are delivering complementary applications with Windows Servers. With complementary applications part of the application is on OS/400 and part of the application is on Windows. It takes a heterogeneous server environment to deliver these applications with iSeries. Windows is a popular choice for the application portion of the application working with an OS/400 backend application.

Customers want to consolidate servers. Mainframe, Unix, Windows, and iSeries customers are looking to consolidate servers to take advantage of the cost savings that can be received. Pulling together iSeries and Windows servers is one way to consolidate servers.

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Offerings

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Strategy:

- Flexible offerings supporting heterogeneous (OS/400 and Windows) applications, distributed servers with central management, and server consolidation

Integrated xSeries Server

- An Intel server running Windows 2000 Server or NT Server inside the iSeries
- 20% of new iSeries have an Integrated xSeries Server

Integrated xSeries Adapter

- Enables high speed attachment of xSeries server running Windows 2000 Server to iSeries

IBM eserver ---Integration of iSeries and xSeries

Notes: Offerings

IBM eserver iSeries

To address the demand for iSeries and Windows server integration and consolidation, our strategy is to offer iSeries based solutions that provide for the management of Windows servers. These solutions are targeted for the branch office environment, where OS/400 and Windows applications are served from one system, while management can be accomplished in a central location. In addition, the solutions target server consolidation environments, where iSeries can provide management for a number of Windows servers.

The first offering is the Integrated xSeries Server. This product has been in the marketplace for a number of years. The IXS is a Windows server on a card that is installed inside the iSeries server. The IXS supports NT Server or Windows 2000 Server. Approximately 20% of iSeries shipments include an Integrated xSeries Server.

The second offering is the Integrated xSeries Adapter. This is a new product for 2001 and is part of the V5R1 announcement. The IXA provides for the high speed direct attachment of selected xSeries servers to iSeries. The IXA is a card that is installed in the xSeries server that enables a direct connection to iSeries. The IXA supports Windows 2000 Server and Windows 2000 Advanced Server running on the xSeries server.

Both of these offerings demonstrate the advantage of IBM eserver. The best of iSeries and xSeries servers are brought together via the IXS and IXA offerings.

iSeries Windows Server Integration Benefits

IBM @server iSeries

Manage multiple applications and services in a single server

- Run both OS/400 business applications and Windows complementary applications

Lower the cost of user administration

- Create users once, synchronize user profiles and passwords

Provide flexible Storage Area Network management for Windows Servers

- OS/400 storage management, disk reliability with RAID 5 & mirroring

Reduce operations and skills costs

- OS/400 operator can manage Windows server operations and backup

Improve Windows server uptime and stability

- Update xSeries device drivers automatically from iSeries

Reduce total cost of ownership

- iSeries warranty and maintenance cover Integrated xSeries Servers

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Notes: Integration Benefits

IBM @server iSeries

Multiple servers: The IXS and IXA for iSeries are designed for local consolidation of PC servers and storage, plus remote management of PC servers in distributed offices. They improve central control and remote operations by providing a consolidated server for OS/400 applications and Windows 2000 and NT services. And they lets you consolidate multiple servers. Up to three IXSs are supported in a single iSeries Model 270, and up to 32 Windows servers in an iSeries Model 840. Up to 2 direct attach xSeries servers are supported on a 270, up to 16 on an 840. This allows you to keep your Intel-based servers separate, but manage them in a single system with consolidated storage of up to 2 Terabyte of disk per Windows server.

User Administration: Cut LAN administration and PC Server operations costs: By synchronizing user profiles and passwords between OS/400 and Windows 2000 and NT, you can cut the high cost of client administration.

Storage Management: Manage iSeries **storage area network** for multiple Windows servers, Allocate 1 MB - 64 GB per Windows drive, 32 drives per server, Create Windows disks in OS/400 system or user auxiliary storage pools, Protect Windows disks with iSeries RAID-5 or mirroring, distribute Windows disk images to remote servers. Full OS/400 system backup provides disaster recovery for Windows, OS/400 managed backup saves daily incremental Windows file changes, and Windows backup saves daily Windows files changes direct to iSeries tape

Server Management: OS/400 operators in a central location can view Windows 2000 and NT messages, restart and add disk to remote Windows servers. Management Central operator can: Remotely monitor, reboot and add or distribute disk to Windows server , Distribute packages and commands to groups of Windows servers, and Submit Windows commands from OS/400. With Message Logging O/400 operator can monitor Windows operations and filter and send Windows messages to OS/400 operator: System, security and application messages

Flexible server replacement: If your server fails, quickly switch to a hot spare server without reinstalling Windows 2000 or NT, or use hot-plug to replace a failed server without restarting the iSeries.

Enhances reliability: iSeries disk drives with RAID-5 and mirroring options can improve uptime and consolidate storage. Increase business recovery protection with backup of the combined OS/400 and Windows Servers.

Improve Windows server uptime and stability: Update device drivers automatically from OS/400. Windows device drivers are from a single supplier, single configuration, integrated testing/support. Fixes to device drivers deployed via OS/400 PTFs Simple to manage distribution across entire network

Reduce total cost of ownership: iSeries warranty and maintenance cover Integrated xSeries Servers

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Opportunities

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Branch Office

- Central management of distributed iSeries server supporting OS/400 and Windows applications

Large Consolidation

- iSeries is the Storage Area Network for Windows servers

Windows Server

- File/Print, Exchange, SQL Server ....

Citrix Metaframe

- Run heavy Windows client application on server, send user interface to client

Complementary Application Support

- Application requires OS/400 and Windows servers

Notes: Opportunities

IBM @server iSeries

The Opportunities to sell the Integrated xSeries Server and Integrated xSeries Adapter include:

- Branch Office: The IXS is a great solution for a branch office environment where a small number of users need access to OS/400 and Windows applications. One iSeries server (e.g., 270) with an IXS can support these users. This environment can be managed centrally with tools like Operations Navigator, Management Central, and Windows 2000 Server Terminal Services.
- Large Consolidation: Consolidate multiple Windows servers with the IXS and IXA. iSeries provides storage area network services, server management, and user management for the attached Windows servers.
- Windows Server: The IXS is a Microsoft logo'd Windows NT and 2000 server. The xSeries servers that support the IXA are Microsoft logo'd for Windows 2000 Server. As a result both of these offering support the various Windows server applications including File/Print, IIS, Exchange, and SQL Server.
- Citrix Metaframe: This Citrix product supports running the heavy Windows client application on server (IXS or direct attach with IXA) and sending the user interface to client. In this environment a new Windows application can be used by older, smaller, and even non-Windows clients.
- Complementary Application Support: Application requires OS/400 and Windows servers. The next chart has examples.

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Complementary Applications

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ISVs are leveraging the multiple servers to deliver solutions

- Siebel - database on OS/400, eBusiness applications on Windows
- Baan - BaanERP applications and data on OS/400, BaanSCS (Supply Chain Series) on Windows
- Logility - core applications and data on OS/400, complementary applications (e.g., Voyager) on Windows
- JD Edwards - One World and World applications and data on OS/400, Deployment Server and Advanced Planning Solution on Windows
- .... more to come

ISVs are partnering with other solution providers to deliver integrated offerings

- Yojna and Fiserv / GG Pulley
- Citrix Metaframe
- Checkpoint Firewall

IBM is using Windows NT/2000 to deliver complementary applications

- Domino: Learning Space
- B2B: MQ Series Integrator

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Notes: Complementary Applications

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ISVs are currently leveraging the multiple servers to deliver solutions. These applications are called complementary application. For example:

- Siebel - database on OS/400, eBusiness applications on Windows
- Baan - BaanERP applications and data on OS/400, BaanSCS (Supply Chain Series) on Windows
- Logility - core applications and data on OS/400, complementary applications (e.g., Voyager) on Windows
- JD Edwards - One World and World applications and data on OS/400, Deployment Server and Advanced Planning Solution on Windows
- Additional solutions are planned for 2001.

In addition some ISVs are partnering with other solution providers to deliver integrated offerings. For example:

- Yojna is an Windows Internet banking application that works with OS/400 backend banking applications from Fiserv and GG Pulley.
- Citrix Metaframe works with numerous ISVs to run the Windows client portion of the application on a Windows server
- Checkpoint Firewall is a popular product used to provide secure Internet connections.

IBM is also using Windows NT/2000 to deliver complementary applications. For example,

- The next release of Domino Learning Space will be a Windows application
- The next release of MQ Series Integrator will be a Windows application

We are using the xSeries ServerProven program to highlight these complementary applications. The ServerProven program tests and validates solutions, middleware and hardware on specific server configurations

ServerProven platforms include: Integrated xSeries Server, 7100 and 7600 Netfinity servers, and 250 and 350 xSeries servers. For more information see http://www.pc.ibm.com/ww/eserver/xseries/serverproven/index.html

ServerProven Adapters include: Integrated xSeries Adapter. For more information see http://www.pc.ibm.com/us/compat/index.html

ServerProven Solutions -for a current list see http://www8.software.ibm.com/solutions/isv/igssg.nsf/SearchGUI2?OpenForm

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Success Stories

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Les Schwab Tire Centers - US

- 1 Integrated Netfinity Server in each of 315 store
- OS/400 Business application with Network Stations
- Application: Citrix Metaframe

Infiniti Division of Nissan - US

- 2 Integrated Netfinity Servers in each of 150 dealerships
- Allows headquarters to re-image remote PCs which become damaged
- Application: LAN Client Control Manager

Swiss Reinsurance - Australia

- 5 Integrated Netfinity Servers installed on a 720
- Purchased AS/400 purely as a Windows NT server consolidation platform
- Application: Terminal Server/MetaFrame

Chase Manhattan Bank - Spain

- 5 Integrated Netfinity Servers installed on a 720
- Replaced 10 Compaq with native Domino and INS
- AS/400 is the storage consolidation solution
- Application: SQL Server applications

Integrated xSeries Adapter: Sea Island Company

IBM @server iSeries

- World-class resort destination
- iSeries Model 830 with 2 LPAR partitions
- Business Issues:
  - Costs to install, upgrade, etc. software on "fat client" PCs
  - Costs to support multiple PC servers
- Business Results:
  - Installed Citrix MetaFrame XP (tm) on IXA-attached external xSeries Server
  - Reduced PC support costs
  - Higher availability of PC applications

"IBM has made deploying Windows 2000 servers a better experience than one could ever obtain by using Microsoft technologies alone. We couldn't be happier."

What is New in 2001

IBM @server iSeries

February 2001

- 850 MHz Integrated xSeries Server

April 2001

- Integrated xSeries Adapter to attach xSeries servers
- Storage Area Network Enhancements
  - Hot Addition of Disk
  - Increase disk capacity from 1TB to 2TB
  - Independent Auxiliary Storage Pools
  - DVD ROM Support
- Operations Navigator Enhancements
  - Management Central Pervasive Support
- 1 Gb Ethernet LAN
- New 5078 and 0578 Expansion Towers
- Doubled to 32 the number of Integrated xSeries Servers

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Notes: What is New in 2001

IBM @server iSeries

February 2001

- On February 13, 2001 a new 850 MHz Integrated xSeries Server was announced. It is generally available on February 23, 2001.

April 2001 with V5R1

- Integrated xSeries Adapter to attach xSeries servers
- Storage Area Network Enhancements
  - Hot Addition of Disk - add disk to Windows 2000 Server while Windows 2000 Server continues to run
  - Increase disk capacity from 1TB to 2TB per IXS or IXA attached server
  - Independent Auxiliary Storage Pools - Windows server storage spaces can be located in IASPs and switched between iSeries servers
  - DVD ROM Support - Windows 2000 Server can read the new iSeries DVD device
- Operations Navigator Enhancements - significant enhancements to Operations Navigator include functions for the IXS/IXA. Specifically, support is now provided for the storage space and user management. Management Central Pervasive support has also been added.
- 1 Gb Ethernet LAN is now an option for the Integrated xSeries Server.
- New 0578 and 5078 Expansion Towers support two Integrated xSeries Servers. These towers, since they contain no room for disk drives, are a less expensive option for adding Integrated xSeries Servers.
- Doubled to 32 the number of Integrated xSeries Servers supported on the iSeries Model 840.

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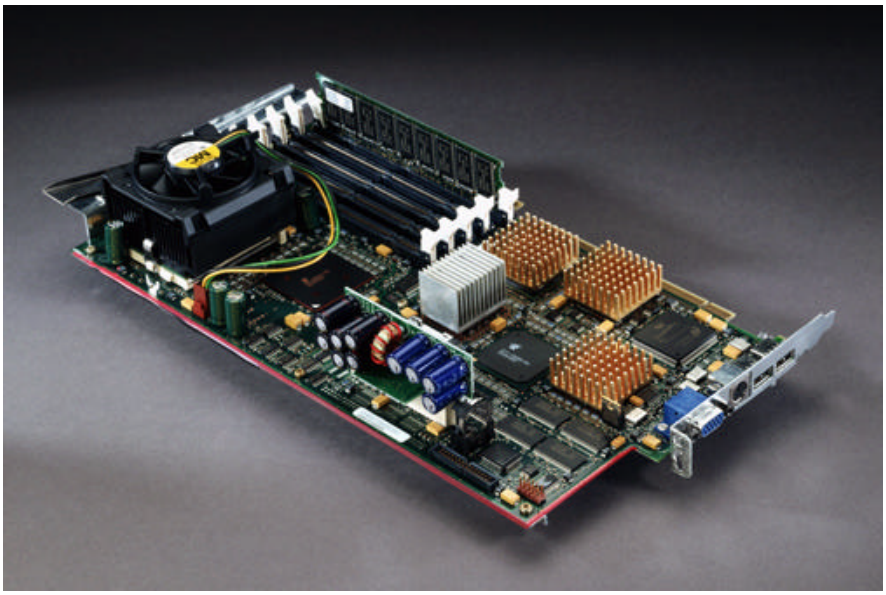
Integrated xSeries Server for iSeries



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Notes: IXS

This section provides more details on the Integrated xSeries Server.

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Compaq ProLiant 8000 Server

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- **11 Boxes**
  - Rack
  - Side Panels
  - System Unit (2 more boxes inside)
  - Rack Stabilizing Feet
  - Disk Drive
  - Disk Drive
  - Memory (Box was smashed)
  - Tape
  - RAID Controller
  - Blank Panels
  - Storage Enclosure
- **6 Deliveries**
- **4 Shipping Companies**
- **2 Components are Missing**
  - Keyboard
  - Mouse

Source: IBM experience with purchase of a Compaq Server in 12/99.

- **"Some assembly required"**
- **Has never been turned on**
- **Has never been tested together**
- **Software is not installed**

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iSeries Server

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iSeries comes out of the box looking like this ...

- **Processors**
- **Memory**
- **Disk**
- **LAN Adapters**
- **Tape**
- **Software**

iSeries is ....

Assembled, Powered On, Tested for Hours, and Preloaded at the IBM Plant

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Integrated xSeries Server for iSeries

Announce and GA in February 2001

IBM @server iSeries

Integrated xSeries Server Intel 850 MHz Pentium III

- Hot plug PCI on selected iSeries servers
- Up to 4 GB memory
- Up to 2 TB of disk storage*
- Up to 32 per iSeries*
- Up to 3 LAN adapters (all hot plug PCI)
- 2 Universal Serial Bus (USB) ports
- Device drivers to share iSeries disk, tape, DVD*, and CD-ROM
- Supported on iSeries models 270, 820, 830, 840
- Supported with OS/400 V4R5 and V5R1

xSeries ServerProven platform

Microsoft Windows NT Server 4.0

- Logo'd by Microsoft

Microsoft Windows 2000 Server

- Logo'd by Microsoft

Designed for Microsoft Windows 2000 Server

* V5R1 Enhancement

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Notes: Integrated xSeries Server for iSeries

IBM @server iSeries

A PC-based server has an Intel processor and PC memory on a motherboard, combined with a LAN adapter, disk and CD-ROM drives. The Integrated xSeries Server for iSeries has an Intel processor and PC memory, but these are packaged on a motherboard to fit inside the iSeries. Once inside the iSeries, devices drivers are provided to share the iSeries disks, CD-ROM, DVD, and tape drives. LAN adapters cannot be shared between iSeries and Windows: a separate LAN adapter and TCP/IP address are required for each system.

The Integrated xSeries Server is designed to run Windows 2000 Server and Windows NT Server 4.0. The Integrated xSeries Server can also run Citrix MetaFrame which is used with Windows NT or 2000 to connect IBM Network Stations. The IXS requires a monitor, keyboard and mouse to be attached as a Windows console.

The Integrated xSeries Server has an Intel Pentium III 850 MHz processor with 256K of L2 cache, a 100 MHz front side bus (FSB) and S3 Savage4 video adapter with 32 MB of video RAM. Up to 3 hot plug LAN adapters are supported with options for 4/16/100 Mbps token-ring, 10/100 Mbps Ethernet, and 1 Gb Ethernet. Two Universal Serial Bus (USB) ports are available for connection of various devices, including printers. The Integrated xSeries Server has four memory slots supporting 128 MB, 256 MB and 1 GB ECC SDRAM memory for up to 4 GB total memory.

The 850 MHz Integrated xSeries Server requires OS/400 V4R5 or V5R1 and is supported in iSeries Models 270, 820, 830 and 840. Up to 32 Integrated xSeries Servers can be installed in an 840.

Hot plug PCI provides concurrent maintenance for LAN adapters on all iSeries servers and for the Integrated xSeries Server board on selected iSeries servers as shown in the table below. An Integrated xSeries Server must be varied off to perform concurrent maintenance on either the server board or the LAN adapter.

The IXS is an IBM ServerProven platform. The ServerProven program highlights applications that have been validated to run on IBM xSeries servers including the Integrated xSeries Server for iSeries. Customers know they can purchase ServerProven applications with confidence.

The IXS has been logo's by Microsoft to support NT Server 4.0 and Windows 2000 Server.

iSeries Model	Server Hot Plug in System Unit	Server Hot Plug in # 5075 I/O Tower	Server Hot Plug in # 5074 I/O Tower	LAN Adapter Hot Plug
270	Y	Y	N/A	Y
820	Y	Y	N	Y
830	N	N/A	N	Y
840	N	N/A	N	Y

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Additional V5R1 Enhancements

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Operations Navigator for Windows Integration

- User Enrollment
- Storage Management
- Management Central Pervasive
- Supports internal and direct attach offerings

1 Gb Ethernet Adapter for IXS

- Same adapter as iSeries
- Feature #s
  - #2743 (optical)
  - #2760 (copper)
  - Specify code #0225 to indicate that the adapter is associated with an IXS

Increased support for Integrated xSeries Servers

- Up to 32 on 840
- Up to 28 on 830

iSeries Model	# of IXS
270	3
820	12
830	28
840	32

New 5078 and 0578 Expansion Towers

- Support 2 Integrated xSeries Servers
- Same # of slots as 5074, no disk drives
- Tophat for 5074
- Included in HSL tower count

Notes: Additional V5R1 Enhancements

IBM @server iSeries

There are several enhancements in the V5R1 announcement for the Integrated xSeries Server.

Operations Navigator provides a graphical administration environment for iSeries. Operations Navigator provides enhanced support for the iSeries Windows server integration offerings. In addition to the server management functions (e.g., start and stop Windows servers) that was introduced in V4R5, V5R1 includes support for user enrollment (enrolling an OS/400 user to a Windows server) and storage management (e.g., define a storage space for a Windows server). The Operations Navigator functions support the IXS and IXA direct attach offerings.

The iSeries 1 Gb Ethernet Adapter is now supported by the Integrated xSeries Server (700 and 850 MHz servers). It is the same adapter as iSeries. The feature numbers are #2743 (optical) and #2760 (copper). As with the other adapters there is a specify code (#0225) to indicate that the adapter is associated with an IXS

iSeries now supports more Integrated xSeries Servers. The maximum for the 840 is raised from 16 to 32. The maximum for the 830 is raised from 16 to 28. The maximums for the 270 and 820 were not changed.

A new 5078 (with covers for a tower installation) and 0578 (without covers for a rack installation) Expansion Towers provide additional options for Integrated xSeries Server deployments. They support 2 Integrated xSeries Servers. The 5078 and 0578 have the same # of slots as 5074, but no disk drives. They are installed on top of the 5074 disk tower. They are included in the HSL tower count. They offer a less expensive option to consolidate Windows servers with the IXS.

Operations Navigator

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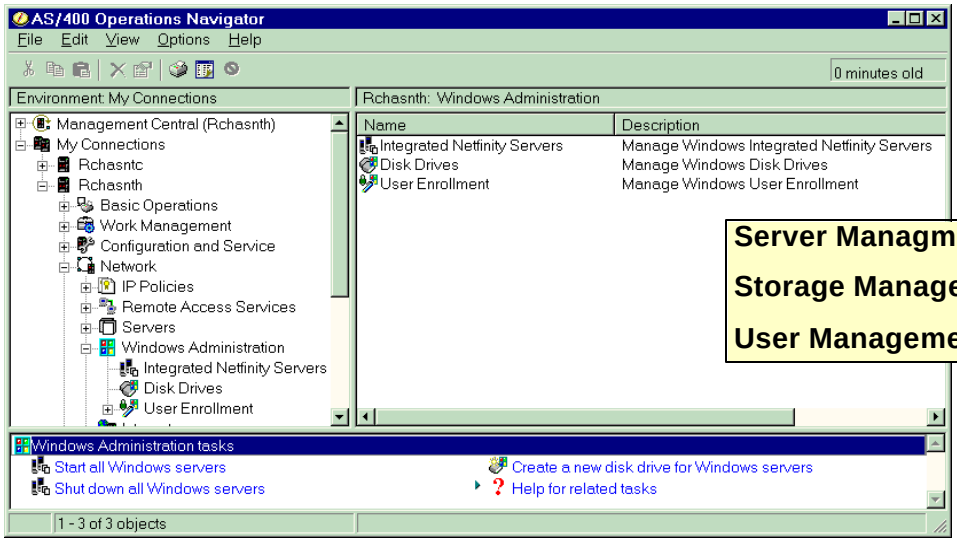

Server Managment

Storage Management

User Management

Notes: Operations Navigator

IBM @server iSeries

This screen shot shows the Operations Navigator tree opened to the Windows Administration area. On the right panel the major functions are listed: Integrated Netfinity Servers (plans are in place to update this name in the next release), Disk Drives, and User Enrollment. In addition, the task pad at the bottom of the page shows common tasks that can be done directly.

Additional screen shots included in this presentation provide more details of the functions available through Operations Navigator. In general everything can be done for the IXS/IXA offerings through Operations Navigator except for the installation of the Windows NT or 2000. The installation is done via a 5250 interface.

User Enrollment

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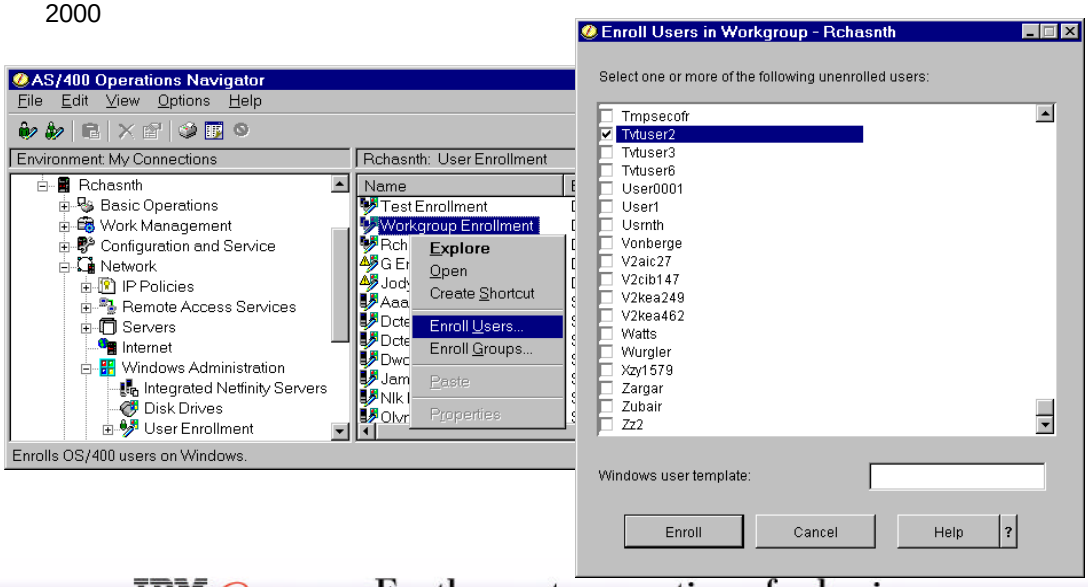
Combined user administration

- OS/400 users or groups propagated to, then passwords synchronized on Windows 2000



Notes: User Enrollment

IBM @server iSeries

User administration integration enables OS/400 users and groups to be enrolled on an Windows server or a domain and for user passwords to be synchronized. This feature significantly reduces the overhead of maintaining two separate administration systems for OS/400 and Windows.

When you create an OS/400 user, you can add the user to a group that is predefined to propagate users to the Windows server. The user is then created on the Windows server using a predefined template, to allocate the correct security rights and user preferences. If the user leaves the company, deleting the OS/400 profile will also delete the Windows server profile.

Once OS/400 users are enrolled, their password changes are passed automatically from to the Windows server. If a password is changed through the Windows server interface, however, the change is not synchronized back to the OS/400 side.

With V5R1. Operations Navigator has been enhanced to support user enrollment. In this Operations Navigator screen shot, the iSeries administrator is selecting which OS/400 users they want to be added to a specific Windows server.

Managing Remote Servers

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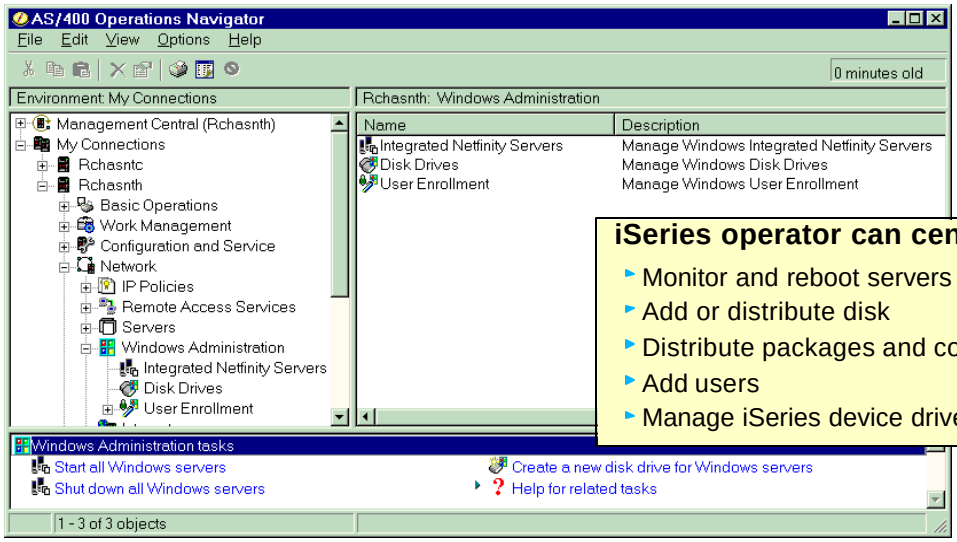

iSeries operator can centrally:

- Monitor and reboot servers
- Add or distribute disk
- Distribute packages and commands
- Add users
- Manage iSeries device drivers

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Notes: Managing Remote Servers

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Windows server operations are simplified when using the Integrated xSeries Server and Integrated xSeries Adapter, with a central OS/400 operator being able to perform key operations remotely through OS/400 Operations Navigator. With Operations Navigator, Windows servers can be started, stopped, or restarted. Windows users can also be added.

Installation and disk allocation is performed through OS/400. The OS/400 message queue is also used to collect hardware error messages from the Integrated xSeries Server.

Windows server system, security and application messages can be filtered and sent from the Windows event log up to a message queue or job log on OS/400. This allows the central OS/400 operator to monitor messages from distributed servers in the network. The OS/400 operator can use the submit network server command to send an Windows command from OS/400. This can be used to start an Windows application or service.

For companies with iSeries in a branch office network, new disks can be assigned to a remote Windows server remotely, using Operations Navigator. The Windows 2000 Server does not need to be shutdown during the operation, when a storage space is created on the iSeries and then linked to the Windows server. This is particularly useful when providing operations support for remote installations, where adding hard disk to a server often requires significant downtime.

Disk images can also be saved on the central iSeries and then transmitted as a save file, or sent on a tape to a remote site. This allows a complete disk image to be replaced with new information without a hardware change on the server. This might be used where a company wants to periodically update a catalogue of parts or sales information to its branches.

Many operations are performed directly on the Windows server console that is attached to the Integrated xSeries Server. This preserves the Windows operations interface for most Windows operations, including installing Windows applications.

Windows 2000 Server with Terminal Server support provides additional flexibility in managing local or remote operations of the Windows 2000 Server such as the ability to take active or passive control over the Windows 2000 Server's console screen, keyboard and mouse. This gives the operator the ability, for example, to install a Windows 2000 service pack on the branch office server.

Microsoft Windows NT Server 4.0 and Windows 2000 Server are not modified to run on the IXS or with the IXA. IBM has designed new device drivers, running below Windows, to attach to the iSeries disk, tape DVD, and CD-ROM drives. The device drivers can be updated through OS/400 PTFs and downloaded to the Windows server via a level check routine that runs each time the server is started. Thus all servers on your iSeries are kept at a consistent driver level, and at the level that has been tested by IBM with each new Windows service pack.

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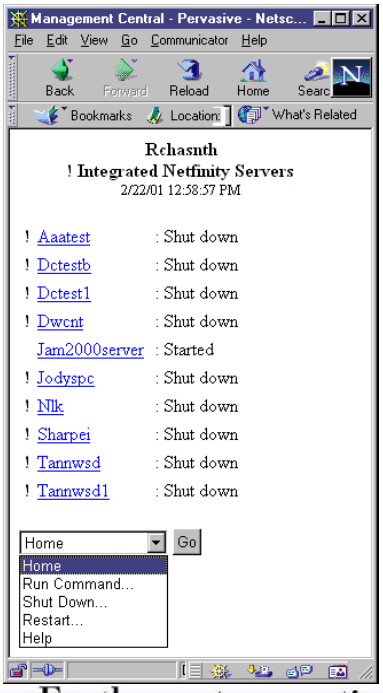
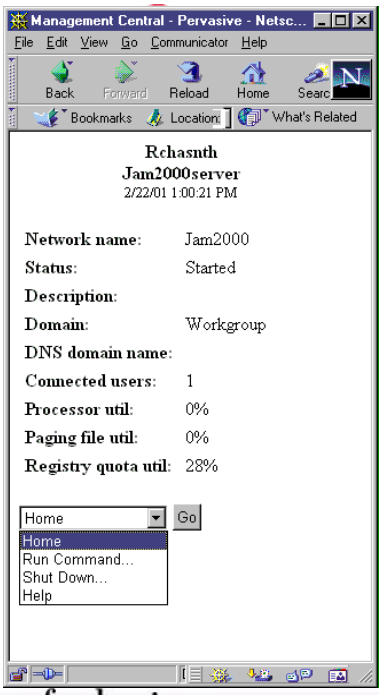
Management Central Pervasive

Manage Windows Servers from a Cell Phone or Personal Digital Assistant.

- View status of servers
- Startup/Shutdown servers
- Run Windows commands
- Monitor events





Notes: Management Central Pervasive

IBM @server iSeries

Administrators now have more flexibility to access Management Central information and monitor the iSeries systems they support. Management Central - Pervasive lets you remotely monitor system performance and status using an Internet phone, a PDA with a wireless modem, or a traditional web browser on a workstation.

After you set up a web server on your central system, you simply enter the URL into your Internet phone, PDA, or browser to check the availability of your systems and any active Management Central monitors. For example, you can check to find out if one of your systems finished restarting, or you can check an active monitor to see if any thresholds for CPU, disk utilization, or other metrics were exceeded.

Functions added in V5R1 include management for the Integrated xSeries Server and the direct attach xSeries server. Functions supported include:

- View status of servers
- Startup/Shutdown servers
- Run NT commands
- Monitor events (routed to an iSeries message queue)

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700 MHz Integrated xSeries Server

IBM @server iSeries

Supported with V4R5 and V5R1

Logo'd by Microsoft for NT Server and Windows 2000 Server

xSeries ServerProven Platform

Being Withdrawn from Marketing

- Processor is no longer available from Intel
- Announcement: 2/27/01
- Effective: 5/31/01

Notes: 700 MHz IXS

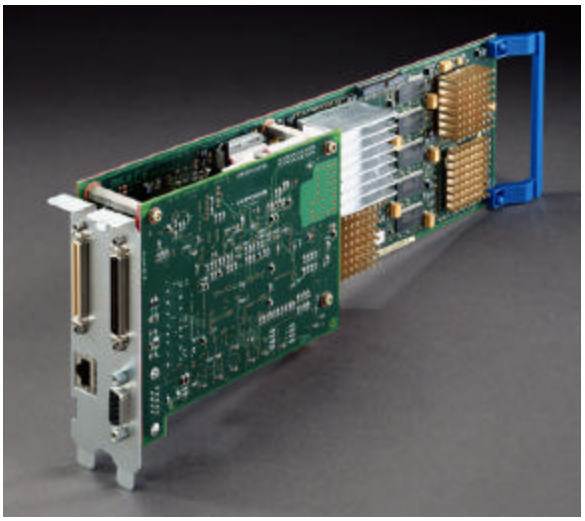
IBM @server iSeries

The 850 MHz Integrated xSeries Server replaces the 700 MHz IXS offering.

For customers that have purchased the 700 MHz product, it remains
- Supported with V4R5 and V5R1.
- Logo'd by Microsoft for NT Server and Windows 2000 Server
- xSeries ServerProven Platform

The 700 MHz Integrated xSeries Server was withdrawn from Marketing on February 27, 2001, effective May 31, 2001.
The 700 MHz processor used in the IXS is no longer available from Intel.

Integrated xSeries Adapter for iSeries



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Notes: IXA

IBM @server iSeries

This section presents the new Integrated xSeries Adapter.

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Why a Direct Attach Offering

IBM @server iSeries

Scalability
- Support larger workloads and more users

Availability of PCI Slots
- Flexibility to attach devices (e.g., modems, CD towers)

Performance Currency
- Offer latest xSeries server technology

Leverage xSeries Marketing, Channels, and Development

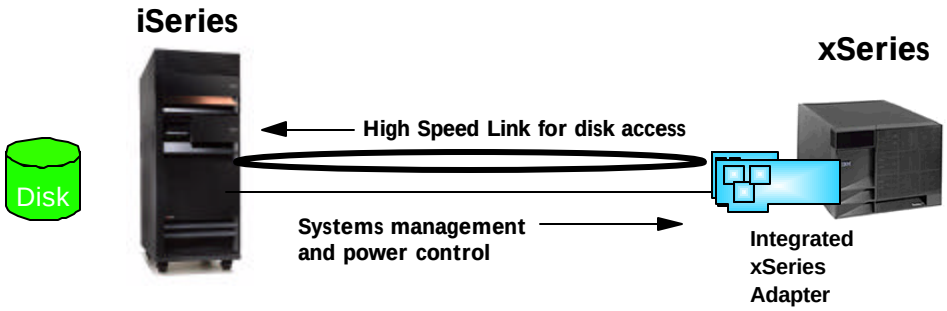
Notes: Why a Direct Attach Offering

IBM @server iSeries

We are offering the Integrated xSeries Adapter that supports the direct attachment of selected xSeries servers to offer enhanced:
- Scalability - the IXA will support xSeries servers with up to 4 processors. These servers are able to support larger workloads and more users than the 1 processor Integrated xSeries Server.
- Availability of PCI Slots - since the direct attach xSeries server is a standard xSeries server is has PCI slots available for the customer to use. Some customers use these slots to attach devices like CD-ROM towers and modem towers. The Integrated xSeries Server does not have PCI slots.
- Performance Currency - the IXA is installed in standard xSeries servers. As these servers offer faster processors (e.g., 550, to 700, to 900 MHz) the we will be able to connect these servers to iSeries with little to no development work. As IBM introduces new xSeries servers, Rochester will test them with the IXA and announce which models are supported. The iSeries web site at www.iSeries.ibm.com/windowsintegration will include a list of the xSeries servers we have tested and support. The Integrated xSeries Server is a product that is specifically designed by Rochester to fit inside the iSeries server. It takes time and resources to develop a faster version of the IXS.
- Leverage xSeries Marketing, Channels, and Development - the xSeries servers are offered by the standard xSeries channels at normal prices. As a result the IXA offering leverages xSeries marketing, channels and development.

Integrated xSeries Adapter

IBM @server iSeries



IXA attaches n-way IBM xSeries servers to iSeries 8xx and 270

- Supports 4-way servers - xSeries 350 and 250 - - 7100 and 7600

Retains features and value of Integrated xSeries Server

- Uses OS/400 storage consolidation and systems management
- xSeries Server has processors, memory, ServerProven adapters but no disks

Complementary Application Support

Server Consolidation

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Notes: Integrated xSeries Adapter

IBM @server iSeries

The Integrated xSeries Server extends iSeries integration with Windows 2000 Server to IBM xSeries high performance Intel servers for companies with core applications running on the iSeries and complementary applications running on Windows 2000 Server and for companies looking to consolidate their Windows servers.

A PCI-based Integrated xSeries Adapter is placed in the xSeries server to connect to the iSeries via the High-Speed Link. The IXA provides the power control for the server and also links the xSeries server to disks in the iSeries.

The servers that will attach to the iSeries include the new xSeries 350 and 250 4-way servers as well as Netfinity 7100 and 7600 4-way servers.

- x350: 700 and 900 MHz Models 86824RY, 86825RY, 86826RY
- x250: 700 and 900 MHz Models
- 7100: Current models: 86661RY, 866611Y, 86662RY, 866621Y, 86663RY, 866631Y 86664RY, 866641Y,
- 7600: Current models: 86651RY, 86652RY, 86653RY, 86654RY, 86655RY

The xSeries server will be a standard model, containing processors, memory, and ServerProven adapters but no disks. All the disks for the xSeries server will be housed in the iSeries and managed in the same way as for the current Integrated xSeries Server models. All the current storage management and other integration features of the current Integrated xSeries Server will be maintained.

The Integrated xSeries Adapter connection interfaces directly with xSeries's service processor. The integration provided between iSeries and direct attach xSeries servers is an IBM technology initiative and is not designed to support OEM Intel servers.

Key opportunities for the IXA include:

- Complementary Application Support: Application requires OS/400 and Windows servers.
- Server Consolidation: consolidating multiple Windows 2000 Servers with iSeries storage, server, and user management.

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xSeries Product Line

IBM @server iSeries

xSeries 220

xSeries 230

xSeries 340

xSeries 330

xSeries 240

xSeries 350

xSeries 250

xSeries 200

xSeries 370

1 Processor

1 - 2 Processors

1 - 4 Processors

1 - 8 Processors

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Notes: xSeries Product Line

IBM @server iSeries

This chart shows the current xSeries product line, from the one way servers to the 8-way server. The Integrated xSeries Adapter works with the 1-4 way xSeries servers Model 350 and 250. Specific modifications have been made to these servers to support the IXA. In addition, the IXA interfaces with the service processors on the 350 and 250 for power management. Specific hardware connections and software have been developed with the IXA to interface with this service processor. With this support the iSeries can start and stop the xSeries server. Other xSeries servers have different service processors.

The IXA is supported with 1, 2, 3 or 4 processors in the server.

The IXA is not supported with other xSeries servers.

The IXA is supported with specific Netfinity models 7100 and 7600. The 7100 and 7600 were replaced by the xSeries 250.

The IXA is not supported with the 6000R. The 6000R was replaced by the xSeries 350.

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xSeries 4-way Servers

IBM @server iSeries

New servers announced in March 2001

Replacement products for 6000R, 7100, and 7600

xSeries 350

- 1/2/3/4 Way Server
- 700 and 900 MHz Pentium III Xeon Processors
- 1 or 2 MB Cache
- 4 U Rack
- 16 GB Memory
- SCSI Controller
- 10/100 Ethernet
- 6 PCI Slots
- Hot Plug PCI
- No Disk Drives

Popular Choice for iSeries Connection

xSeries 250

- 1/2/3/4 Way Server
- 700 and 900 MHz Pentium III Xeon Processors
- 1 or 2 MB Cache
- Tower or 8 U Rack
- 16 GB Memory
- SCSI Controller
- 10/100 Ethernet
- 6 PCI Slots
- Hot Plug PCI
- No Disk Drives

Notes: xSeries 4-way Servers

IBM @server iSeries

The xSeries 350 and 250 where announced in March of 2001 to replace the 6000R, 7100, and 7600. The 350 and 250 offer faster processors (700 and 900 MHz) than the models they replaced (550 and 700 MHz).

The specifications for the servers are listed on the chart. The servers offer similar features. The 350 offers fewer disk bays and is smaller at 4U. The 250 offers more disk bays at 8U. Since disk is not supported in the xSeries servers that are directly attached to iSeries, these additional bays provided with the 250 will not be used. The 350 will be the popular choice for the iSeries connection.

xSeries 4-way Servers - Previous Models

IBM eserver iSeries

4-way Netfinity servers are also supported

7100

- 1/2/4 Way Server
- 550 and 700 MHz Pentium III Xeon Processors
- 1 or 2 MB Cache
- Tower or 8 U Rack
- 16 GB Memory
- SCSI Controller
- 10/100 Ethernet
- 6 PCI Slots
- No Disk Drives

http://www.pc.ibm.com/ us/netfinity/7100.html

7600

- 1/2/4 Way Server
- 550 and 700 MHz Pentium III Xeon Processors
- 1 or 2 MB Cache
- Tower or 8 U Rack
- 16 GB Memory
- RAID Adapter
- SCSI Controller
- 10/100 Ethernet
- 6 PCI Slots
- Hot Plug PCI
- No Disk Drives

http://www.pc.ibm.com/ us/netfinity/7600.html

Notes: xSeries 4-way Servers - Previous Models

IBM eserver iSeries

In addition to the current xSeries 350 and 250 Models, the IXA is also supported with the Netfinity 7100 and 7600. These servers offer 550 and 700 MHz processors.

The 7100 and 7600 provide similar features. The 7600 offers hot plug PCI adapters. In addition, the 7600 includes a RAID adapter. This RAID adapter is not used with the IXA offering.

Integrated xSeries Adapter

IBM @server iSeries

PCI Card

- xSeries Server Proven Adapter
- 2 Slots
- 1 64 bit 66 MHz connection
- Slot location depends on model

Two HSL Connectors

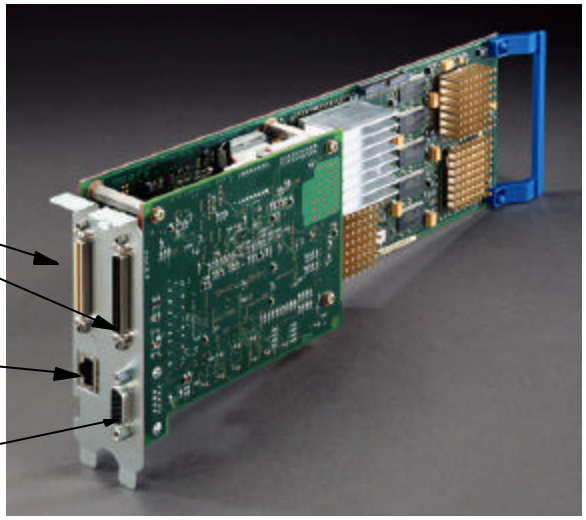
- Uses same data interface as iSeries I/O tower

RS485 Connector

- Interface to xSeries Service Processor

SPCN Connector

- Uses same system power and control interface as iSeries I/O tower



Notes: IXA Card

IBM @server iSeries

This is a picture of the Integrated xSeries Adapter.

The IXA is a PCI card. It requires 2 slots in the xSeries server. The IXA has one connection. This connection is plugged into a 64 bit 66 MHz slot. The specific slot location depends on the xSeries model. The location is specified in the installation documentation that is included with the IXA.

The IXA is an xSeries Server Proven Adapter. It has been tested in the xSeries 350 and 250 as well as the Netfinity 7100 and 7600. Like other xSeries ServerProven adapters, customers can purchase the IXA with the confidence that is has been tested in the supported configuration. IBM recommends that customers purchase xSeries ServerProven adapters for their xSeries servers.

The IXA has two HSL connectors. HSL is the same data interface used with iSeries I/O towers. The two HSL connectors are used to from a loop. One HSL cable comes into the xSeries server, while the second connects to the next component on the HSL loop.

There is an RS485 Connector on the IXA as well. This connector is used to interface to xSeries Service Processor . A cable is provided that connects the IXA to the xSeries service processor.

The IXA also includes an SPCN (System Power Control Network) Connector. This connection is the system power and control interface. A SPCN cable is used to connect the xSeries to the iSeries. SPCN connections are also used to control the power of iSeries I/O towers.

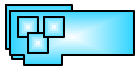
What to Buy From Whom

IBM @server iSeries

iSeries Channel

- iSeries 8xx or 270
- iSeries Disk Drives for Windows storage
  - Up to 2 TB
- Integrated xSeries Adapter for iSeries
- HSL and SPCN cables
- OS/400 V5R1
- iSeries Integration for Windows Server
  - No Charge LPP, Preloaded - (5722-WSV)

Integrated xSeries Adapter



xSeries Channel

- xSeries Server Model 7100, 7600, x250, or x350
  - 1/2/3/4 Processors and Memory
  - Ethernet LAN (on system board)
- Keyboard/Mouse
- Display
- ServerProven Adapters (optional)

Microsoft Channel

- Windows 2000 Server - 4 processors, 4 GB Memory
- Windows 2000 Advanced Server - 8 GB Memory

Microsoft Windows 2000

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Notes: What to Buy From Whom

IBM @server iSeries

Components of the direct attach xSeries solution are purchased from different channels. Most iSeries channels also sell xSeries servers. This solution will often times be integrated in the channel.

iSeries Channel

- iSeries 8xx or 270
- iSeries Disk Drives for Windows storage ... Up to 2 TB per server
- Integrated xSeries Adapter for iSeries
- HSL and SPCN cables
- OS/400 V5R1
- iSeries Integration for Windows Server ... No Charge LPP, Preloaded - (5722-WSV)
  - IBM provides a set of integration programs for Windows as a no-charge licensed program 5722-WSV. This software includes the hardware devices drivers, as well as the software integration facilities.

xSeries Channel

- xSeries Server Model 7100, 7600, x250, or x350
  - 1/2/3/4 Processors and Memory
  - Ethernet LAN (on system board)
- Keyboard/Mouse
- Display
- ServerProven Adapters (optional)

Microsoft Channel

- Windows 2000 Server - supports up to 4 processors and 4 GB Memory
- Windows 2000 Advanced Server - supports up to 8 GB Memory
- NT Server 4.0 is not supported

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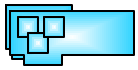
Ordering, Warranty, and Service

Integrated xSeries Adapter

IBM @server iSeries

Ordering

- Machine type: 1519 Model 100,
- iSeries Configurator:
  1. **Specify code 0092 on iSeries**
  2. **Feature codes for HSL cables**
  3. **Feature codes for SPCN cable**
- Shipped with iSeries order or MES



Installation

- Customer Installable Feature
- Not a hot plug adapter in xSeries

Warranty

- 3 years (consistent with xSeries adapters)
- 24 x 7 on site service

Service and Supportline

- iSeries for IXA, Windows Integration software
- Warm transfer to xSeries for other questions

Notes: IXA Ordering

IBM @server iSeries

Ordering
- Machine type: 1519 Model 100,
- iSeries Configurator:
  - Specify code 0092 on iSeries
    - IXA 1519 Model 100
    - RS485 Cable for connection between IXA and xSeries service processor
    - SPCN Doubler Cable - provides 2 SPCN connections. Used when multiple components are on one loop
    - Installation Instructions
    - xSeries ordering information
  - Feature codes for HSL cables (1 or 2) -3, 6, or 15 meters
  - Feature codes for SPCN cable - 2, 6, 15, or 30 meters
- Shipped with iSeries order or MES

Installation
- Customer Installable Feature
- Not a hot plug adapter in xSeries

Warranty - best of both worlds
- 3 years (consistent with xSeries adapters)
- 24 x 7 on site service (consistent with iSeries)

Service and Supportline
- iSeries for IXA, Windows Integration software
- Warm transfer to xSeries for other questions

Ordering, Warranty, and Service

IBM @server iSeries

xSeries

Ordering

- xSeries Server, processors, memory, LAN
- Standard xSeries channels and pricing
- Recommend ServerProven adapters
- No Disk Drives

Warranty

- 3 year warranty, 5 x 8 hardware service
- Recommend purchase of 7 x 24 service for consistency with iSeries

Service and Supportline

- xSeries

Sample Configurations

x350
2 700 MHz Processors
2 GB Memory
Monitor, Keyboard
3 YR 7x24 Warranty

$14,933

x350
4 700 MHz Processors
4 GB Memory
Monitor, Keyboard
3 YR 7x24 Warranty

$27,291

* xSeries prices from www.pc.ibm.com/us/eserver/xseries/ on 3/23/01

Notes: xSeries Ordering

IBM @server iSeries

Ordering
- xSeries Server
  - specify 1, 2, 3, or 4 processors, and memory
  - 10/100 Ethernet LAN adapter is included
  - Includes IBM Director for server management
  - Includes Server Guide for operating system installation - support with IXA adapter not currently available
  - Standard xSeries channels and pricing
- Recommend ServerProven adapters if additional I/O is needed
- No Disk Drives are supported in the xSeries server, the disk is in the iSeries
- Base Model Features and Specifications
  - xSeries 350 , Form factor Rack
  - Processor type Pentium III Xeon, Processor speed 700 MHz
  - Processor cache 2048 KB
  - Maximum storage 218 GB
  - Hot swap HDD Yes
  - Base Memory 512 MB , Maximum memory 16GB (WIndows 2000 Advanced Server only support 8 GB)
  - Optical drive 48X-20X CD-ROM

Warranty
- 3 year warranty, 5 x 8 hardware service is standard
- Recommend purchase of 7 x 24 service for consistency with iSeries

Service and Supportline
- standard xSeries support

Two sample xSeries server configuration prices are also included, one with two processors, another with 4 processors.

Planning Considerations

IBM @server iSeries

Maximum Number Supported

iSeries Model	# of Direct Attach xSeries Servers
270	2
820	4
830	8
840	16

Actual Number Depends on

- Load on iSeries server
- Number of components on an HSL loop
- Number and speed of the xSeries processors
- I/O rate to iSeries disk subsystem

Planning considerations will be made available on www.iseries.ibm.com/windowsintegration

HSL Connection

- xSeries servers do not impact the number of I/O towers supported on an HSL loop
- Recommend installing xSeries server on separate HSL loop

Notes: Planning Considerations

IBM @server iSeries

The maximum number of xSeries servers that can be directly attached to iSeries depends on the Model of the iSeries server. On the 270, up to 2 servers can be attached, on the 820 up to 4, on the 830 up to 8 and on the 840 up to 16 xSeries servers can be attached.

The actual number of xSeries servers that can be attached to iSeries and offer a good performing environment depends on many factors, including

- How busy the iSeries server is
- The speed and quantity of the xSeries servers
- What type of applications will run on the xSeries server
- How many I/Os per second will the xSeries server drive into the iSeries disk subsystem
- How many other components are on the HSL loop and the workload they are driving on the loop

Planning considerations for the amount of CPW used by a directly attached xSeries server, the impact to the disk subsystem, and the impact to the HSL loop will be published on the iSeries Windows integration web site: www.iseries.ibm.com/windowsintegration

HSL Connection

- xSeries servers do not impact the number of I/O towers supported on an HSL loop
- Recommend installing xSeries server on separate HSL loop if one is available. If not, install xSeries server in the middle (behind I/O towers) if possible on HSL loops
- With HSL Opticonnect and Independent ASPs, the switchable tower must be adjacent to a tower owned by the alternate CEC

IXA Price Comparison

IBM @server iSeries

Integrated xSeries Adapter

- $2800 US List Price

RAID Adapters

- xSeries*
  - $1,435 for 2 Channel 64 MB Cache
  - $2,439 for 4 Channel 128 MB Cache
- Compaq**
  - $1,799 for 2 Channel 64 MB Cache
    attaches 28 drives x 18 GB drives = 500 GB
  - $2,499 for 4 Channel 128 MB Cache
    attaches 56 drives x 18 GB drives = 1 TB

Fibre Channel Solutions

- xSeries*
  - $9,999 for FAStT200 Storage Server (no disk drives)
  - $1,485 for FAStT Host Adapter
- Compaq**
  - $6,852 4100 RAID Array (no disk drives)
  - $1,590 Fibre Channel Host Adapter

Notes:
* xSeries prices from www.pc.ibm.com/us/eserver/xseries/ on 12/4/00
** Compaq prices from www.directplus.compaq.com on 12/13/00
Does not include prices for cabling or disk drives

Notes: IXA Price Comparison

IBM @server iSeries

The price of an Integrated xSeries Adapter is similar to the price of other high function PCI adapters used in PC Servers.

For example the price of RAID Adapters from xSeries and Compaq are

- xSeries*
  - $1,435 for 2 Channel 64 MB Cache
  - $2,439 for 4 Channel 128 MB Cache
- Compaq**
  - $1,799 for 2 Channel 64 MB Cache
    attaches 28 drives x 18 GB drives = 500 GB of storage
  - $2,499 for 4 Channel 128 MB Cache
    attaches 56 drives x 18 GB drives = 1 TB of storage

The IXA supports up to 2 TBs of storage for the direct attach xSeries server.

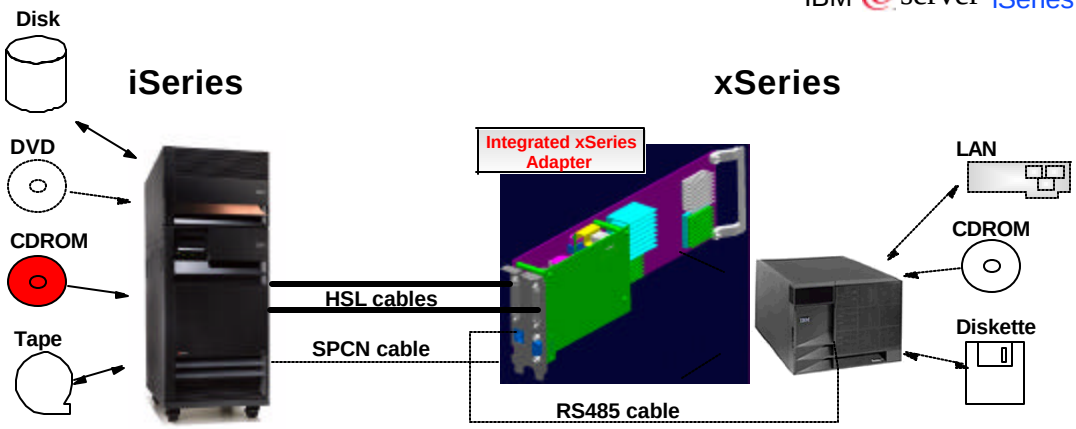
Another price comparison is to look at what Fibre Channel Storage solutions cost. Fibre channel connects disk to servers at a rated speed of 100 MBs per second

- xSeries*
  - $9,999 for FAStT200 Storage Server (a storage tower with a RAID adapter, no disk drives)
  - $1,485 for FAStT Host Adapter (adapter goes in xSeries server)
- Compaq**
- $6,852 4100 RAID Array (a storage tower with a RAID adapter, no disk drives)
- $1,590 Fibre Channel Host Adapter (adapter goes in Compaq server)

The IXA uses HSL for connections between the disk drives and the xSeries server. HSL has a rated speed of 1GB per second, 10 times faster than Fibre.

Installation

IBM @server iSeries



Software

- Windows 2000 Server CD in iSeries
- Run INSWNTSVR Command to start installation

Hardware

- Assemble xSeries server
- Install Integrated xSeries Adapter (CIF)
- Connect HSL, SPCN, RS485 cables

Notes: Installation

IBM @server iSeries

The steps to install a direct attach xSeries server with an Integrated xSeries Adapter include:

Hardware

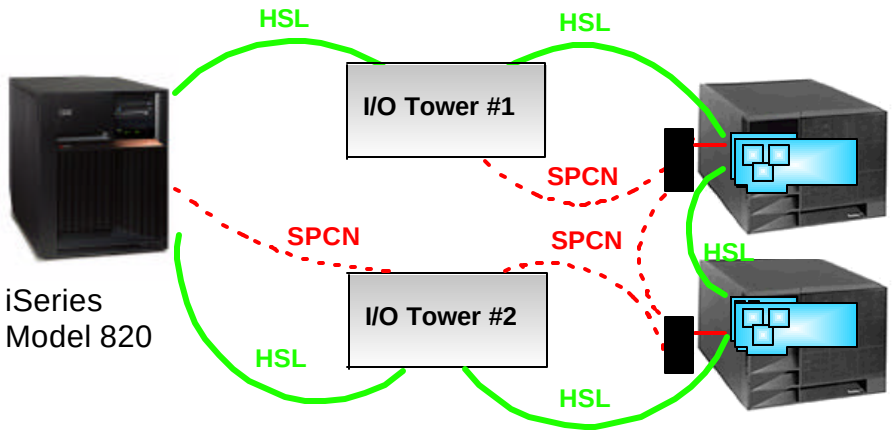
- Assemble the xSeries server with its processors, memory, and adapters
- Install the Integrated xSeries Adapter in the xSeries server. The IXA is a customer installable feature. It is not a hot plug adapter. The xSeries power cord needs to be removed from the power outlet before the IXA is inserted in the server.
- Connect the 2 HSL cables - one from the iSeries to the IXA, and one from the IXA to the iSeries. This creates an HSL loop. If one the cables fails, the other path can be used by both servers.
- Connect the SPCN cable - one from iSeries to the IXA
- Connect the RS485 cable - one from the IXA to the xSeries service processor

Software

- Insert the Windows 2000 Server CD in iSeries CD-ROM drive
- Run INSWNTSVR Command to start installation
- Follow the prompts on the screen to enter company name, server name, license information, etc.

Configuration Example

IBM @server iSeries



HSL Loop

- iSeries can access all devices going out either connection
- Provide redundancy and performance improvements

Notes: Configuration Example

IBM @server iSeries

This is an example of how Integrated xSeries Adapters can be used to directly attach xSeries servers to iSeries.

The iSeries is a Model 820. The 820 has one HSL loop, so any disk towers and xSeries servers in the configuration will be installed on the same loop. The recommendation is to install the xSeries servers behind the disk towers, giving the disk towers higher priority on the loop.

From the 820, an HSL cable is used to connect I/O tower number 1, from the I/O tower another HSL cable is used to connect to an IXA in an xSeries server, from this server another HSL cable is used to connect another IXA in an xSeries server, from this server another HSL cable is used to connect to a second I/O tower, and from the I/O tower another HSL cable is used to connect to iSeries.

iSeries can access any component going out either HSL connection. The HSL loop provides for redundancy. If any of the HSL cables fail, the iSeries can still access all of the components. Multiple requests can be processed over the HSL loop at a given time.

The SPCN (System Power Control Network) cables are also connected to every component. SPCN is not a loop. The IXA only has one SPCN connector. To support a SPCN connection into and out of an IXA in an xSeries server, an SPCN doubler cable is provided with every IXA. This box on the end of the cable provides two SPCN connections (in and out). The other end of this doubler cable is plugged into the IXA. SPCN providers for the power control and management of the components on the HSL loop.

Storage Area Network

Notes: Storage Area Network

This section provides information on the storage area network facilities provided to Windows servers. New enhancements in V5R1 are highlighted.

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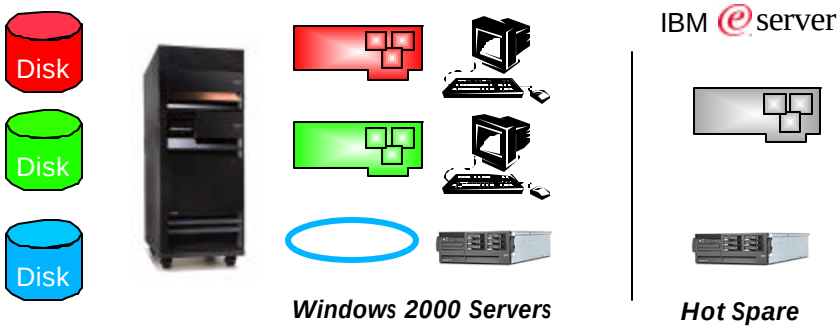
iSeries SAN for Windows Servers

IBM @server iSeries



iSeries storage area network for multiple Windows 2000 servers

- SAN: Storage, Fabric, and Management

Consolidation provides simplified management

Consistent hardware and device drivers can improve Windows stability

Unique hot spare facility provides simple, efficient high availability

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Notes: iSeries SAN for Windows Servers

IBM @server iSeries

The iSeries is the only system in the world that has an automated storage management system. The iSeries customer does not employ storage specialists. Optimized arm utilization, caching, paging, data placement & RAS, are an implicit part of OS/400. Single Level store means that mainstore and disk are a logical continuum. Mainstore is literally the cache for the disk, and therefore from the beginning it has been the business of the storage management system to manage the retrieval and location of data between mainstore and disk in a manner that continual optimizes system performance on the fly.

Today, SAN vendors are selling such function as disk stripping for better arm utilization. This has always been an inherent part of the iSeries SM architecture. There is the expert cache which monitors logical to physical I/O and takes advantage of the ubiquitous logical address space activity in concert with the physical data access activity to dynamically optimize the retrieval and retention of data from disk an in mainstore based on current and future temporal and spatial data and address locality. Bottom line, the iSeries invented the automatic transmission of storage and has been optimizing it for over a decade.

The iSeries can be used to provide a flexible storage area network (SAN) to consolidate the disk requirements of multiple Windows NT and 2000 servers. While full Windows storage capability is maintained, the iSeries provides the value of its advanced storage management facilities and reliability.

iSeries disk storage is allocated to Windows by creating a storage space object or virtual disk space from the iSeries pool of disk resources. Up to 32 storage spaces can be created and linked to each Integrated xSeries Server or direct attached server via the IXA. Each storage space can be between 1 MB and 64 GB in size, for a maximum of up to 2 TB per server. Multiple storage spaces can be linked together using in a volume set using the Windows disk administrator utility. By using iSeries disks, Windows server files are protected by the iSeries RAID-5 and mirroring. Windows storage spaces can either be located in the iSeries system disk pool, or separated from iSeries applications and data on specific drives in a user auxiliary storage pool.

The iSeries disk provide the storage, the HSL and bus connections provide the fabric, and OS/400 provides the management for the iSeries storage are network. Operations Navigator provides one management environment to backup and restore OS/400 and Windows objects.

Consistent hardware device drivers for iSeries disk, tape, and LAN adapters can improve the stability of Windows servers. Stability is enhanced since IBM tests the combinations of these device drivers working with Windows and OS/400. With standard PC servers and the 100s of possible devices, it is impossible to test all the various combinations that a customer might implement.

Hot Spare can offer protection from planned and unplanned outages of the directly attached xSeries servers or the Integrated xSeries Servers.

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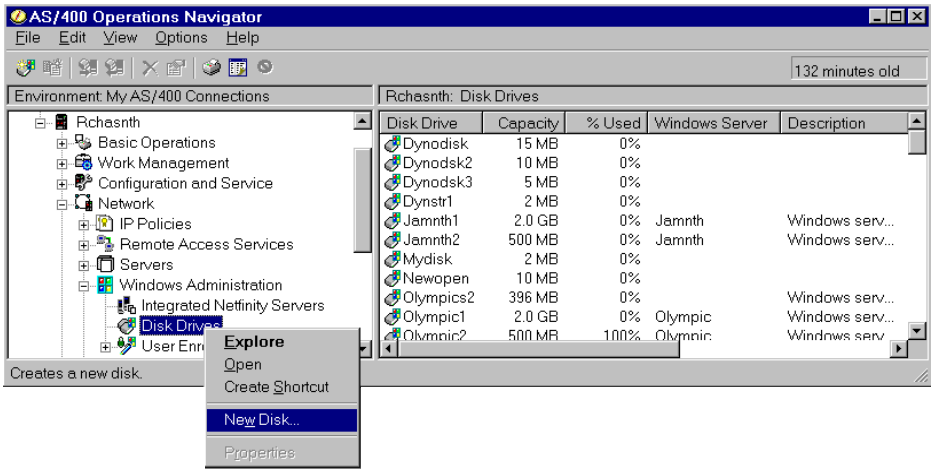
Windows Server Disks

IBM @server iSeries

Windows Disks are managed from OS/400
Disks are linked to Windows Server



Notes: Windows Server Disks

IBM @server iSeries

In V5R1, Operations Navigator has been enhanced to offer disk management facilities for the Integrated xSeries Servers and the directly attached xSeries servers.

In the screen shot when Disk Drives is selected in the left tree, the disk drives (or storage spaces) defined for Windows servers are listed in the right pane. The name of the drive, its capacity, percent used, and the Windows server (NWSD) it is connected to are listed for each drive.

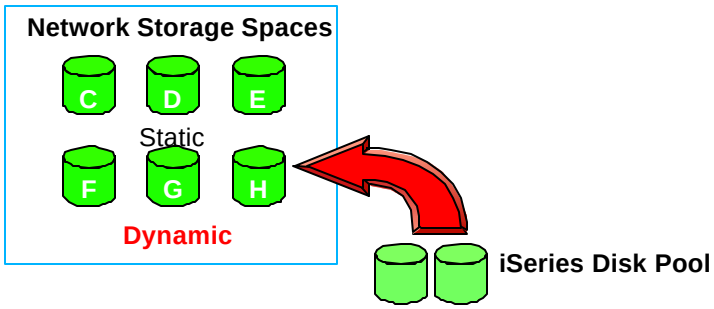
A right mouse click on Disk Drives brings up the context menu where a new drive can be created.

Hot Addition of Disk

IBM @server iSeries

Add Disk Storage to Windows 2000 Server dynamically

- New Dynamic Network Storage Space
- Does not require Windows 2000 Server to be shut down



Attach up to 2 TBs of disk to each server

- 32 storage spaces, each from 1 MB to 64 GB
  - 16 Static and 16 Dynamic

Works with Integrated or direct attach xSeries Servers and Windows 2000 Server

Notes: Hot Addition of Disk

IBM @server iSeries

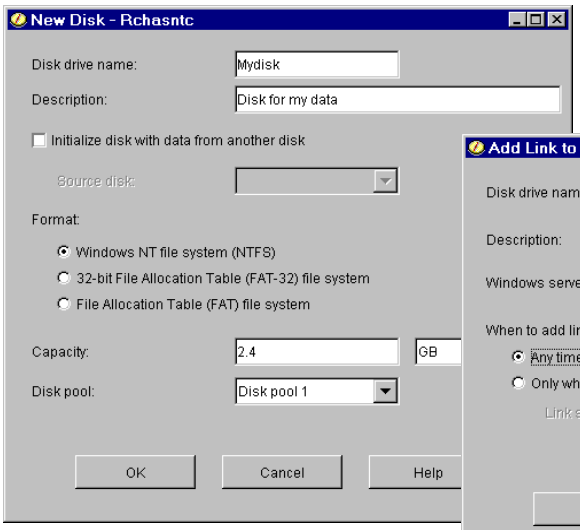
iSeries storage area network support for Windows servers has also been enhanced. For Windows 2000 Servers, the number of storage spaces that can be defined has increased from a maximum of 16 to 32. With a storage space supporting up to 64 GB of disk, each Windows server can now access approximately 2 Terabytes of disk space. Up to 16 of these storage spaces can be added without requiring a shut down of Windows 2000 Server.

The number, size, and support for dynamically adding disk to Windows 2000 Server works with Integrated or direct attached xSeries Servers.

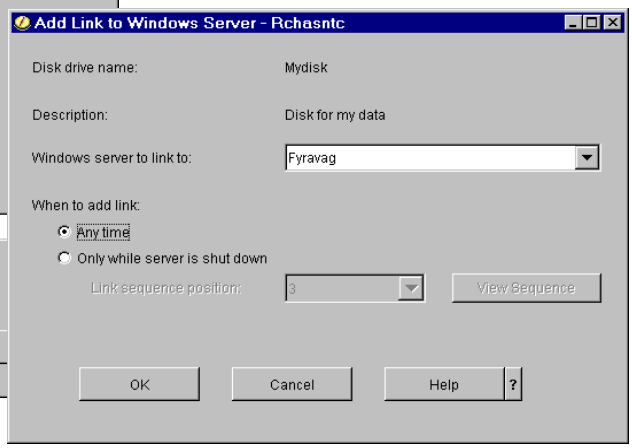
Hot Addition of Disk

IBM @server iSeries

Disks are defined...



... and then linked to Windows servers



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Notes: Hot Add Disk - Operations Navigator

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Additional facilities have been added to Operations Navigator for managing Integrated xSeries Servers and xSeries servers that are directly attached to iSeries via the Integrated xSeries Adapter. In addition to server management, Operations Navigator now supports disk and user management for these Windows servers. Enhancements include the capability to create, delete, copy, link, unlink, and show status for Windows server disks.

The first screen shot shows the panel for creating a new disk drive for a Windows server . In this example a 2.4 GB drive is being added. The administrator selects which Disk Pool the space will be taken from.

The second screen shot shows the panel for linking the new disk drive to a specific Windows server. The administrator selects which Windows server will get the additional disk capacity. These servers can be Integrated or direct attached xSeries servers. The administrator also selects when the disk should be linked ---- Anytime (dynamic) or when the server is shut down (static).

When the disk drive is linked to a Windows server, the Windows administrator uses Windows tools to format the drive and add it to the Windows storage environment.

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Extreme Flexibility

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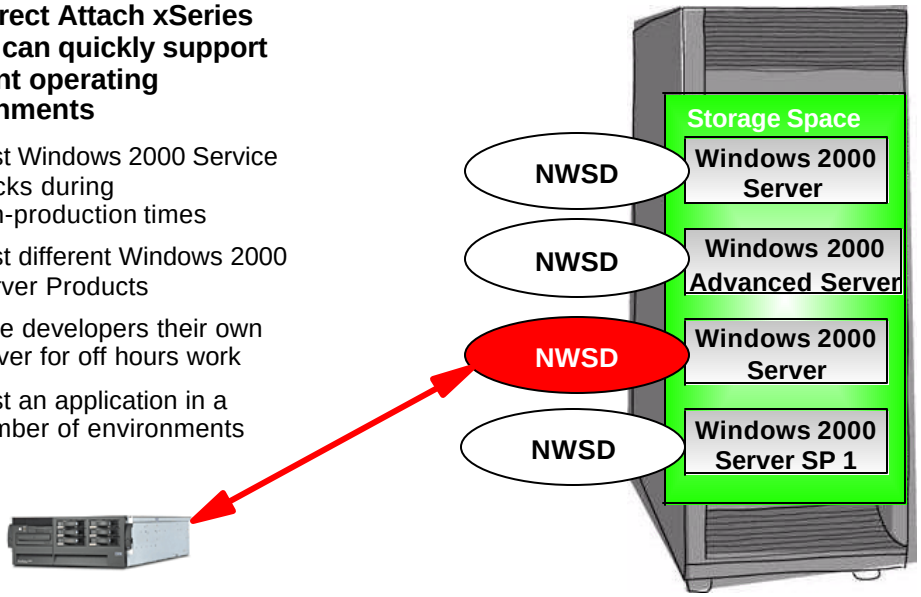
One Direct Attach xSeries Server can quickly support different operating environments

- Test Windows 2000 Service Packs during non-production times
- Test different Windows 2000 Server Products
- Give developers their own server for off hours work
- Test an application in a number of environments



NWSD = Network Server Description

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Notes: Extreme Flexibility

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The Windows 2000 Server objects and disks stored on the iSeries are linked at vary on (boot) time to the Integrated xSeries Server or direct attached xSeries server hardware. When the Windows 2000 Server is down, that Integrated xSeries Server and direct attached xSeries server are available to be booted with another configuration of Windows 2000 Server. This flexible hardware linking allows the use of multiple Windows 2000 Server configurations on the same Integrated xSeries Server or direct attached server, although only one can be active at a time.

This option allows companies to test a new service pack, upgrade Windows 2000 Server on the same hardware, or run Windows 2000 Advanced Server, without losing the original production server. It is simple to switch back to the original production server. Therefore this provides the option to test over a weekend and return to the production server during the week. Or to maintain the original production server as a backup during the implementation of the new release.

The OS/400 object the describes a specific Windows server environment is called an NWSD (Network Server Description). By varying off one NWSD and varying on another with its associated Windows server environment, the IXS or direct attached servers can simply brought up in a different environment.

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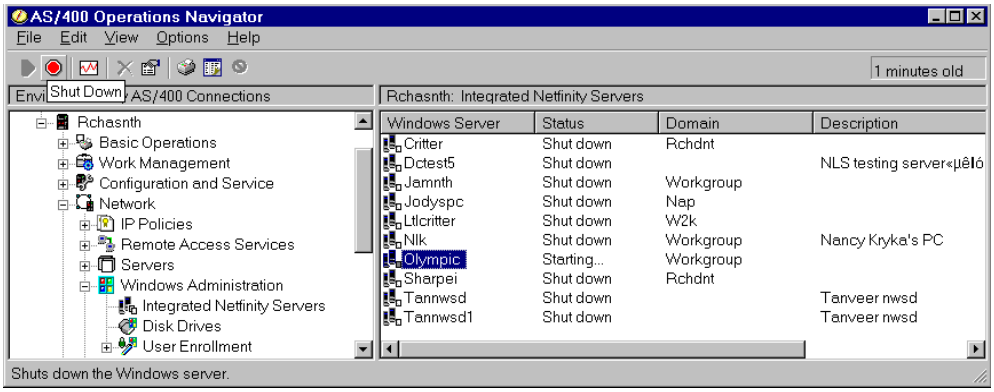
Windows Servers

IBM @server iSeries



Multiple Windows Server environments installed
Start / Stop the desired environment

Notes: Windows Servers

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This Operations Navigator screen shot shows server management. By clicking on Integrated Netfinity Servers in the left panel, the right panel lists the Windows servers that are installed. This list of Windows servers is the list of NWSDs. In this example, there are 10 Windows server installations. There can be any number of Integrated xSeries Servers or directly attached xSeries servers physically installed. The screen shot shows one xSeries server named Olympic being started, while the other 9 are stopped.

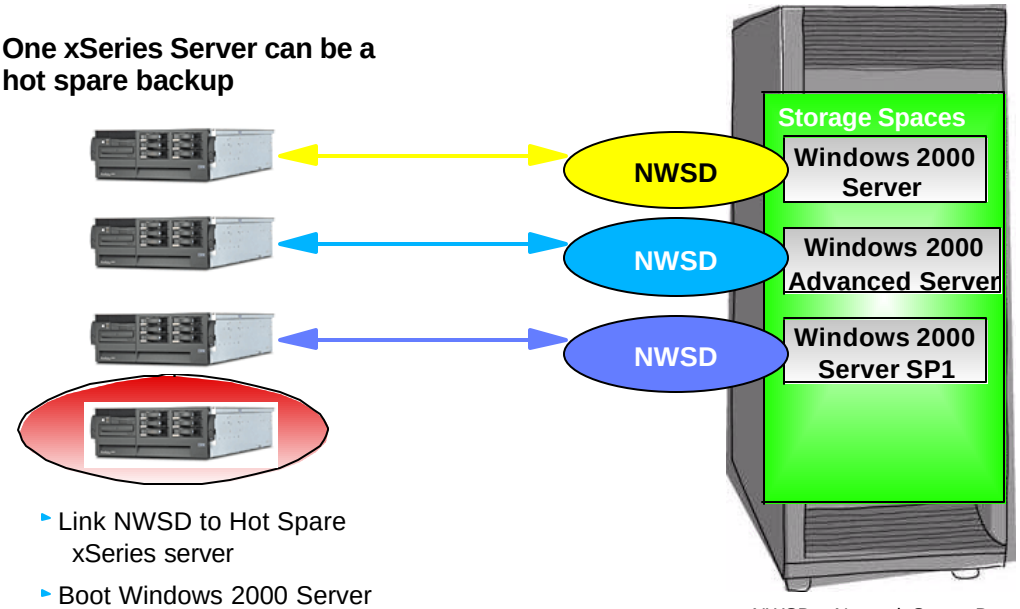
A simple right click on a specific Windows server in the right pane brings up the context menu to start, stop, or restart the Windows server.

Hot Spare

Solution for planned and unplanned xSeries server outages

IBM @server iSeries

One xSeries Server can be a hot spare backup



- Link NWSD to Hot Spare xSeries server
- Boot Windows 2000 Server
- xSeries servers need to have the same configuration

NWSD = Network Server Description

Notes: Hot Spare

IBM @server iSeries

Hot Spare can offer protection from planned and unplanned outages of the directly attached xSeries servers or the Integrated xSeries Servers.

The Windows server objects and disks stored on the iSeries are linked at vary on (boot) time to the Integrated xSeries Server or the Integrated xSeries Adapter connected hardware. This flexible hardware linking is the base for the **hot spare** capability of the iSeries Windows server integration offerings. If the IXS or the directly attached xSeries Server hardware fails, then it is simple to switch the Windows server description to boot on another IXS or xSeries Server connected to the same iSeries. No reconfiguration of Windows objects is required.

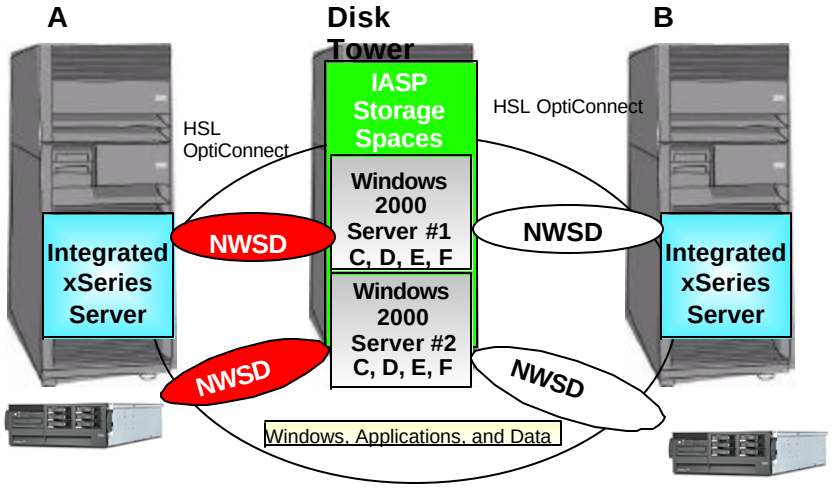
With iSeries Windows server integration offerings, one server can provide hot spare backup to a number of servers (e.g., 3 as shown in the chart). The hot spare server can be a standby server or can be running a workload that is non-critical. In this environment, if a production server failed, the non-critical work on the hot spare server would be stopped, and the hot spare server would be linked to the storage spaces of the production server and rebooted.

The Integrated xSeries Servers need to have the same configuration and directly attached xSeries servers need to have the same configuration (e.g., same LAN Adapters) .

Independent Auxiliary Storage Pool

Solution for planned and unplanned iSeries server outages

IBM @server iSeries



Support for Windows disks in Independent ASP

- **xSeries servers need to have the same configuration**

NWSD = Network Server Description

Notes: IASP

IBM @server iSeries

Independent Auxiliary Storage Pools can offer protection for planned and unplanned iSeries outages. The Windows server environment (Windows itself, applications, and data) can be stored in a IASP and switched to another iSeries server.

In this example, iSeries A has one Integrated xSeries Server and one directly attached xSeries server. The IASP storage spaces for these Windows environments are stored in an I/O tower. iSeries A is connected to iSeries B and the I/O tower via HSL OptiConnect.

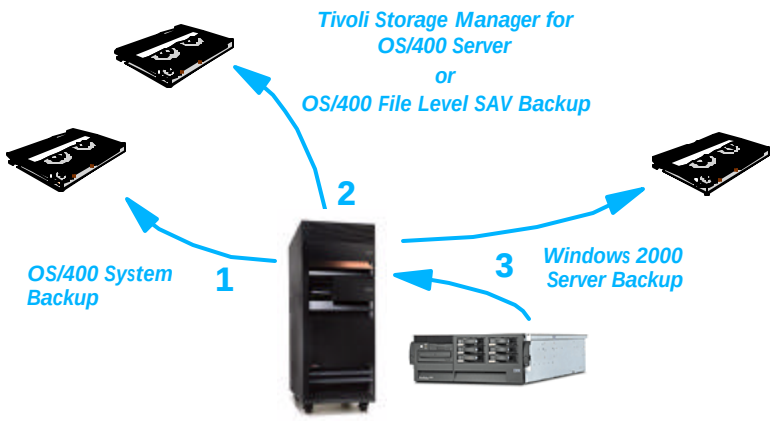
Server A is running with IXS A and Windows 2000 Server storage space #1 and direct attached xSeries server A with Windows 2000 Server storage space #2. The red circles indicate the NWSDs that are started.

At some point there is a planned or unplanned outage on iSeries server A. The iSeries HSL OptiConnect facilities detect the outage and the I/O Tower is switched to iSeries B. At that time, an administrator can manually link NWSDs to B resource names and reboot the Windows servers. Windows servers are back online on iSeries B.

Currently an Integrated xSeries Server and a directly attached xSeries server are required for each iSeries server. These resources can not be switched via the OptiConnect facilities. The Integrated xSeries Servers need to have the same configuration and directly attached xSeries servers need to have the same configuration (e.g., same LAN Adapters) .

Business Recovery Protection

IBM @server iSeries



1. Full system backup provides disaster recovery for Windows 2000 Server
2. OS/400 managed backup saves daily incremental Windows file changes
3. Windows 2000 Server backup saves daily files changes direct to iSeries tape

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Notes: Business Recovery Protection

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There are three approaches to backup of the xSeries Server:

1. **Full server backup for disaster recovery.**
   Backup of the complete Windows disks or storage spaces is excellent for weekly or monthly backups as part of a complete system save; it is also the fastest, but least flexible method of backup. Using this method does not allow you to restore a single file from the storage space. To backup the complete disk images (or storage spaces) of an Integrated xSeries Server to iSeries tape, you first need to vary off the Windows server. The performance of this backup depends on your iSeries model and tape drive speed, but is similar to the performance of any other OS/400 object backup on the system.
2. **Daily file level backup via O**S/400 tools.
   With OS/400 V4R5 Integrated File System backup SAV command can be used for incremental backup of individual files and directories from Windows server running on the Integrated xSeries Server.
   IBM Tivoli Storage Manager (previously ADSM) is an enterprise-wide solution integrating unattended network backup and archive with storage management and powerful disaster recovery planning functions. Tivoli Storage Manager, OS/400 server provides backup and archive services to multiple client platforms including Windows NT and 2000 Server on the Integrated xSeries Server as well as a variety of leading database and groupware products. This broad range of support makes Tivoli Storage Manager a comprehensive storage management solution for heterogeneous networks.
3. **Daily file level backup via Windows server tools.**
   You can use the same Windows backup utilities as you use today on PC-based servers, but target an iSeries tape drive. This OS/400 tape support provides good performance that varies depending on system and tape drive models. The supported backup tools include Windows server's integrated backup applet and also Seagate's Backup Exec and Computer Associates (Cheyenne) ARCserve for Windows NT. While using the Windows tape support, the iSeries tape drive must be varied off, and thus is not available for other tape operations from OS/400 commands. Once varied off, the tape is locked from the Windows Server before using the Windows backup utility. Backups from OS/400 save operations cannot be mixed on tapes that contain backups from Windows utilities. All the common tape drives sold today on the iSeries RISC models including 3570 can be used with these backup tools. The 3480, 3490, 3490e and reel-to-reel drives, however, are not supported.

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Storage Area Network

IBM @server iSeries

SAN Features	Integrated xSeries Servers
✓ Storage for multiple servers	Yes
✓ Storage up to 2 TB per server	Yes
✓ Protection via RAID	Yes
✓ File level backup / restore	Yes
✓ Disaster level backup / restore	Yes
✓ Add storage space dynamically	Yes
✓ Move storage space between servers	Yes
✓ Switch storage space to another server	Yes
✓ Heterogeneous server support	Yes
✓ Share Tape, CD-ROM and DVD Resources	Yes

Notes: Storage Area Network

IBM @server iSeries

Storage Area Networks provide facilities to manage disk space for servers. iSeries provides similar storage management facilities for OS/400 and integrated or directly attached Windows servers.

Storage Area Network features include:

- Storage for multiple servers
- Storage (e.g., up to 2 TB per server)
- Protection via RAID
- File level backup / restore
- Disaster level backup / restore
- Add storage space dynamically
- Move storage space between servers
- Switch storage space to another server
- Heterogeneous server support
- Share Tape, CD-ROM and DVD Resources

iSeries storage management facilities provide these functions

Disk Price Comparison

iSeries

- 5074 I/O Tower
- Storage for OS/400, Windows, and Linux
- Disk is Protected via RAID-5

105 Useable GB Configuration

	Quantity	List Price
5074	1	$17,900
RAID Controller	1	6,000
17.5 GB 10K Disk	7	17,640
Total		$41,540

682 Useable GB Configuration

	Quantity	List Price
5074	1	$17,900
30 Exp. Pack	1	9,000
RAID Controller	3	18,000
17.5 GB 10K Disk	45	113,400
Total		$158,300

EMC

- Symmetrix 8430
- Storage for Mainframe, UNIX, Windows, OS/400
- Disk is Protected via Mirroring (No RAID-5)
- Software, services, support are extra

108 Useable GB Configuration

	Quantity	List Price
Base + 36 GB	1	$154,700
2048 MB Cache	1	51,000
Fibre Channel	1	26,700
Pairs of 18 GB Disk	5	33,500
Total		$265,900

EMC is 6X More

666 Useable GB Configuration

	Quantity	List Price
Base + 36 GB	1	$154,700
4096 MB Cache	1	75,200
Fibre Channel	2	53,400
Pairs of 36GB Disk	18	219,600
Total		$502,900

EMC is 3X More

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Source: iSeries prices from IBM e-config on 1/16/01. Sample EMC configuration. EMC prices from Ideas International on 1/18/01, EMC product information from www.emc.com on 1/18/01

EMC proposals usually include hardware, software, and services and price discounts

Notes: Disk Price Comparison

IBM @server iSeries

iSeries has similar functions to a Storage Area Network. What about the price comparison?

The chart shows the price for disk on iSeries vs a popular SAN solution from EMC. Two comparisons are made, one at 100 GB of useable space and one at 670 GB of useable space. Useable space is the space available to the servers that is protected via RAID 5 or mirroring.

For iSeries, the 5074 disk tower is priced. This disk tower can hold up to 45 disk drives. OS/400, Windows, and Linux objects can be stored on these drives. The configurations include RAID 5 protection.

For EMC, the new Symmetrix 8430 is priced. Symmetrix disk drives can provide storage for Mainframe, UNIX, Windows, and OS/400 servers. The configurations use mirroring for disk protection. RAID 5 is not support on Symmetrix. Mirroring is a common protection scheme for EMC. Only the hardware is priced in the EMC configuration. Additional charges for software, services, support may be required.

At the 100 GB useable comparison the EMC price is six times more than the iSeries price.

At the 670 GB comparison the EMC price three times more.

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Summary

Integration Benefit Comparison

IBM @server iSeries

	IXS	Direct Attach with IXA
Support multiple operating systems	Yes	Yes
Storage Area Network	Yes	Yes
User / Password Propagation	Yes	Yes
Windows Messages Sent to OS/400	Yes	Yes
Share Tape, CD-ROM, DVD	Yes	Yes
Manage Remote Servers	Yes	Yes
Hot spare	Yes	Yes
IASP Support	Yes	Yes
Auto update iSeries device drivers	Yes	Yes
Consistent PC Server Configuration	Yes	Yes for IXA
iSeries Warranty / Maintenance	Yes	Yes for IXA
Single footprint	Yes	No

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Windows Server Integration Summary

IBM @server iSeries

iSeries offerings for Windows server integration extended to n-way xSeries server

iSeries integration offers Storage Area Network, Server Management, and User Management for Windows servers

Integration opportunities include Branch Offices, Server Consolidation, and Complementary applications

www.iseries.ibm.com/windowsintegration

For More Information

IBM @server iSeries

iSeries Windows Integration Web Site:

- www.iseries.ibm.com/windowsintegration
- Product information
- Service information (PTF's)
- Library

iSeries InfoCenter:

- http://publib.boulder.ibm.com/html/as400/v4r5/ic2924/info/index.htm
- Articles on Windows NT and Windows 2000 on the IXS
  - Select: Network Operating Systems..... Windows server on AS/400

Redbooks:

- www.redbooks.ibm.com
- AS/400 - Implementing Windows NT on the Integrated Netfinity Server SG24-2164
- Consolidating Windows 2000 Servers in iSeries SG24-6056
- Planned in 2001: Integrated xSeries Adapter

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Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput or performance improvements equivalent to the ratios stated here.

Photographs shown are of engineering prototypes. Changes may be incorporated in production models.

Integrated xSeries Server vs PC Server - Pricing

IBM @server iSeries

iSeries

Integrated xSeries Server	Price
850 MHz Pentium III	$2,800
256 KB L2 Cache	included
512 MB Memory	1,610
8 GB 10K Disk (on iSeries)	1,400
LAN Card	840
CD ROM (Uses iSeries)	0
Tape (Uses iSeries)	0
Cables, Keyboard, Mouse	200
Hardware Maintenance (7X24, on-site, same day)	0
Integration Software	0
Total	$6,850

Other costs
- Monitor
- Windows Server software

Compaq

ProLiant ML 370	Price
933 MHz Pentium III 128 MB memory and 9 GB Disk	$2,897
256 KB L2 Cache	included
512 MB Memory (upgrade from 128 MB)	941
9 GB 10K Disk (upgrade from standard 7200 RPM)	137
LAN Card	included
CD ROM	included
Tape - DAT	852
Cables, Keyboard, Mouse	included
Hardware Maintenance (Upgrade to 7X24, on-site, same day service for three years)	1,450
Hardware Installation	350
Total	$6,627

Other costs
- Monitor
- Windows Server software
- Hardware Maintenance Year 4,5...

Source: IBM US List Prices 2/01, http://www.directplus.compaq.com/ on 1/22/01

IXA Performance Considerations

IBM eserver iSeries

Impact of xSeries on iSeries depends on the number of disk operations

Disk Ops/sec (1)	400	800	1,600	3,200
HSL (MB/sec)	3	6	13	26
CPW	41	81	152	300
Disk Arms (2)	7	10	18	40

1 Disk ops/sec assume 8K byte block transfers, 67% read, 33% write.
2 Disk arms at 40% utilization (unprotected)
Performance results measured on a xSeries 4-way 700 MHz server connected to iSeries via an IXA

Putting these numbers in perspective:

- File serving: A Netbench 6.0 Enterprise load resulted in approximately 1000 write ops per second maximum before the Xeon CPUs become the bottleneck.
- Mail Serving: An Exchange 5.5 Loadsim test exercising 9000 medium exchange user's produced approximately 400 disk ops per second - 50/50 reads to writes.
- The IXS and IXA has a similar maximum capacity as a high end xSeries RAID controller.

Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput or performance improvements equivalent to the ratios stated here.

Notes: Performance Considerations

IBM eserver iSeries

The Integrated xSeries Server and Integrated xSeries Adapter use iSeries DASD for its hard drives. This is accomplished by special Windows DASD device drivers written for the Integrated xSeries Server. The Windows DASD device drivers cooperate with the iSeries to perform the DASD operations, so iSeries CPU resource is used as well. Thus, IXS and IXA operation primarily effects the DASD subsystem an the iSeries CPU, and is primarily a function of the disk I/O rate.

The following chart shows the measured resource usage of one IXS performing 8k random disk operations to a 4 Gigabyte storage space. The operations are mixed at 67% reads, 33% writes.

The resource guidelines will be the same whatever model of installed IXS or IXA. But, of course, the actual load (in disk ops/sec) will be different for each model and depend heavily on the server application. Also, the number of disk arms required to achieve the same performance levels will change depending on the protection method, such as parity or mirroring, and the size of the storage area being accessed.

To put these numbers in perspective, consider that typical application loads are smaller than the 3,200 disk ops shown in the above table. For example, in lab tests:

A Netbench 6.0 Enterprise load, running on a 700 MHz 4 way Xeon SMP attached via the IXA resulted in approximately 1000 write ops per second maximum before the Xeon CPUs become the bottleneck. Thus, for a heavy file serving load, the maximum load produced is about 1k ops/sec.

An Exchange 5.5 Loadsim test exercising 9000 medium exchange user's produced approximately 400 disk ops per second - 50/50 reads to writes.

The IXS and IXA has a similar maximum capacity as a high end raid controller. However, the IXS and IXA capacity is independent of the disk protection. The maximum capacity is similar to that produced by the Netfinity ServeRAID-3H controller, which has a maximum Raid 0 throughput of about 3400 Ops/Sec (Random 8K Byte, 67% read, 33% write operations; according to the Red Book: "Tuning Netfinity Servers for Performance" SG24-5287-01).