

IBM GLOBAL SERVICES



Session G13, Nov. 2, 2004

# OSA-Express2

## Bringing you the latest in networking

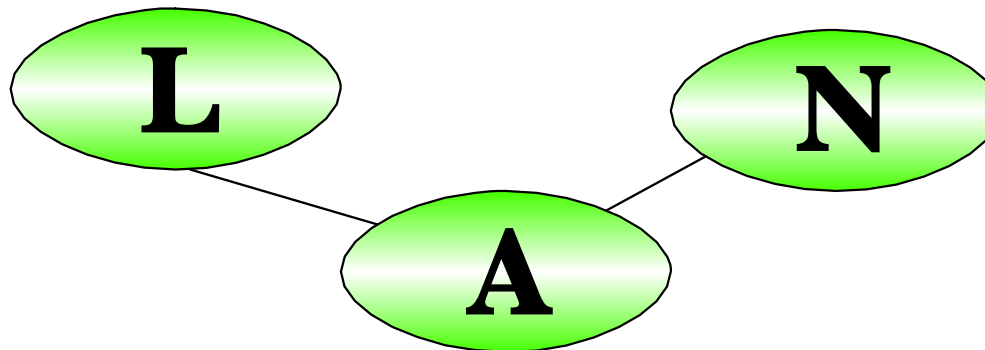
Connie K. Beuselinck, IBM Corporation

Poughkeepsie, NY [conniek@us.ibm.com](mailto:conniek@us.ibm.com)

**zSeries Expo**

Nov. 1 - 5, 2004

Miami, FL



# Trademarks

The following are trademarks of the International Business Machines Corporation in the United States and/or other countries.

390	FICON	OS/2 *	Virtual Image Facility *
ACF/VTAM*	HiperSockets	OS/390 *	VM/ESA *
AIX*	HPR	Parallel Sysplex *	VSE/ESA
APPN*	IBM *	pSeries	VTAM *
CICS*	IBM logo *	RACF *	WebSphere *
DB2*	IMS	RMF	xSeries
e-business logo*	Magstar *	RS/6000 *	z/OS
ESCON*	MVS/ESA	S/390 *	zSeries
GDPS*	Net.Data*	S/390 Parallel Enterprise Server	z/VM
Geographically Dispersed Parallel Sysplex*	Netfinity	Sysplex Timer *	

\* Registered trademarks of IBM Corporation

The following are trademarks or registered trademarks of other companies.

Linux is a registered trademark of Linus Torvalds

Penguin (Tux) compliments of Larry Ewing

Java and all Java-related trademarks and logos are trademarks of Sun Microsystems, Inc., in the United States and other countries

UNIX is a registered trademark of The Open Group in the United States and other countries.

Microsoft, Windows and Windows NT are registered trademarks of Microsoft Corporation.

SET and Secure Electronic Transaction are trademarks owned by SET Secure Electronic Transaction LLC.

\* All other products may be trademarks or registered trademarks of their respective companies.

## Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput 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 improvements equivalent to the performance ratios stated here.

IBM hardware products are manufactured from new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

All customer examples cited or described in this presentation are presented as illustrations of the manner in which some customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics will vary depending on individual customer configurations and conditions.

This publication was produced in the United States. IBM may not offer the products, services or features discussed in this document in other countries, and the information may be subject to change without notice. Consult your local IBM business contact for information on the product or services available in your area.

All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

Information about non-IBM products is obtained from the manufacturers of those products or their published announcements. IBM has not tested those products and cannot confirm the performance, compatibility, or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Prices subject to change without notice. Contact your IBM representative or Business Partner for the most current pricing in your geography.


# Glossary

Acronym	Full name	Use
1000BASE-T	Standard term for Ethernet when	capable of operating at 10/100/1000 Mbps
CHPID	Channel Path Identifier	
CRH	Channel Request Handler	Internal host bus for I/O communication
dB	decibel	Metric used to measure signal strength in fiber
GB	GigaByte	
GbE	Gigabit Ethernet	LAN protocol
km	kilometer	
LAN	Local Area Network	
LCS	LAN Channel Station	
LCSS	Logical Channel Subsystem	Architecture that allows more than one physical channel subsystem
LIC	Licensed Internal Code	
LPAR	Logical Partition	
LR	Long Reach	Transceiver used with single mode fiber optic cabling
LX	Long wavelength	Transceiver used with single mode fiber optic cabling
MCP	Mode Conditioning Patch	Cable used with sm fiber to accommodate reuse of mm
MBA	Memory Bus Adapter	Part of Central Electronic Complex
MBps	Megabits per second	
MCM	Multichip Module	Part of Central Electronic Complex
MM	Multimode	50 or 62.5 micron fiber optic cabling
MTU	Maximum Transmission Unit	Largest physical packet size in bytes that a network can transmit
OSA	Open Systems Adapter	zSeries family name for LAN adapters
PCI	Peripheral Component Interconnect	Local bus standard
PCI-X	Peripheral Component Interconnect Extended	Enhanced PCI bus - for increased performance over PCI
SM	Single mode	9 micron fiber optic cabling
SNMP	Simple Network Management Protocol	TCP/IP application layer protocol to manage network devices
STI	Self-Timed Interconnect	Internal host bus for I/O communication
SX	Short wavelength	Transceiver used with multimode fiber optic cabling

IBM GLOBAL SERVICES

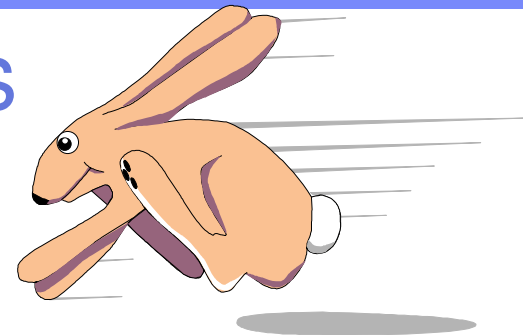


## --- AGENDA ---

- ✓ **Speeds - performance**
- ✓ **History of OSA - delivered over time**
- ✓ **Personalities of OSA - CHPIDs**
- ✓ **Features - the hardware - What's new?**
- ✓ **New functions** 
- ✓ **Cabling, connectors**
- ✓ **Distance, Link loss budgets**
- ✓ **10 Gigabit Ethernet architecture**

# OSA - family of LAN adapters

*Open, Industry-standard  
Local Area Network Interfaces*



## Gigabit Ethernet

(June 1999)

## Fast Ethernet

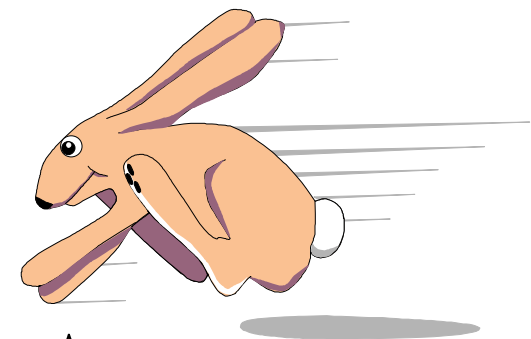
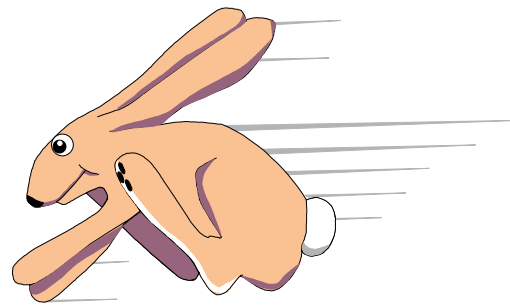
(January 2000)

## Token Ring

(October 2001)

## 1000BASE-T Ethernet

(June, 2003)



## OSA-Express2

## Gigabit Ethernet

(October 2004)



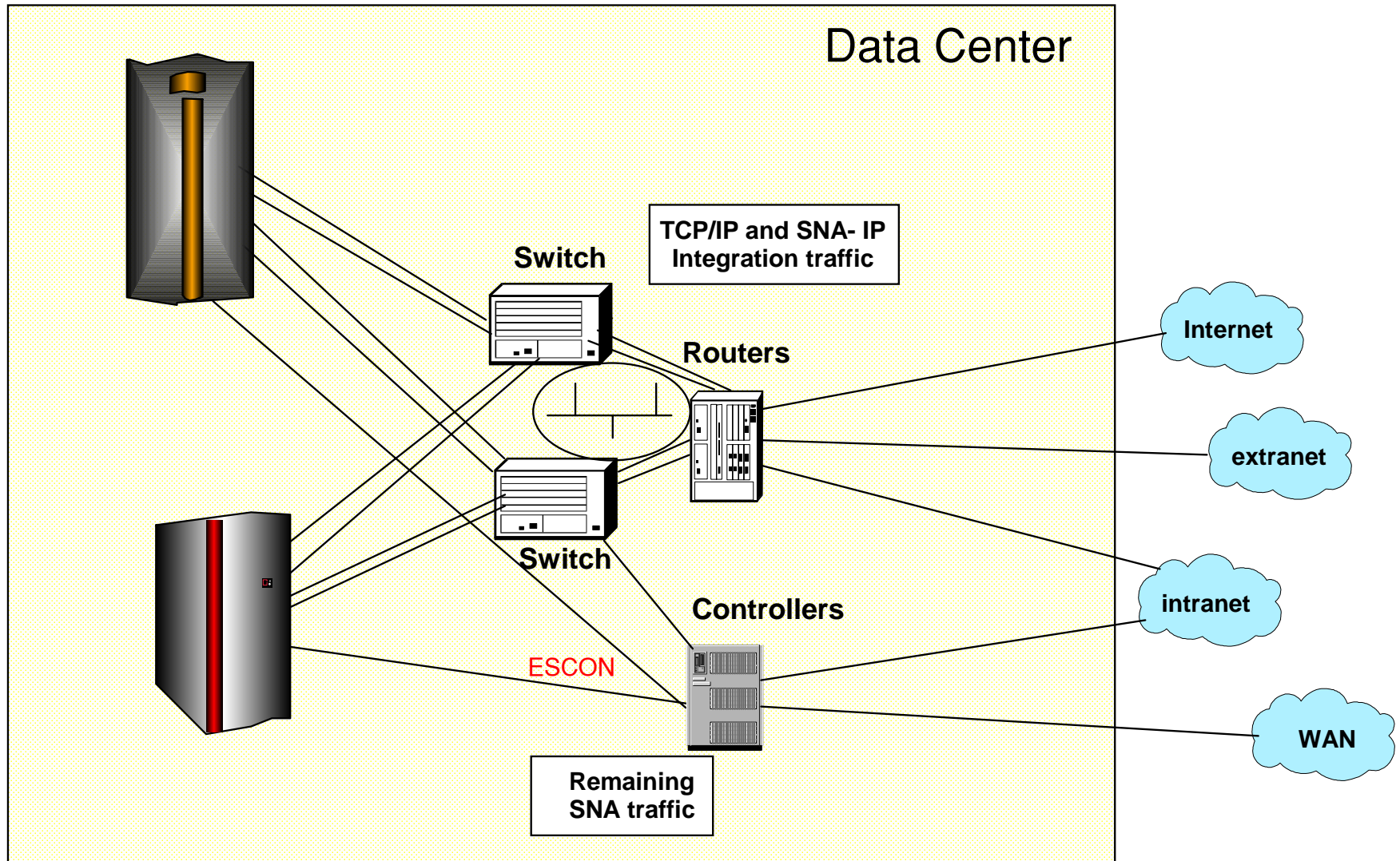
## OSA-Express2

## 10 Gigabit Ethernet

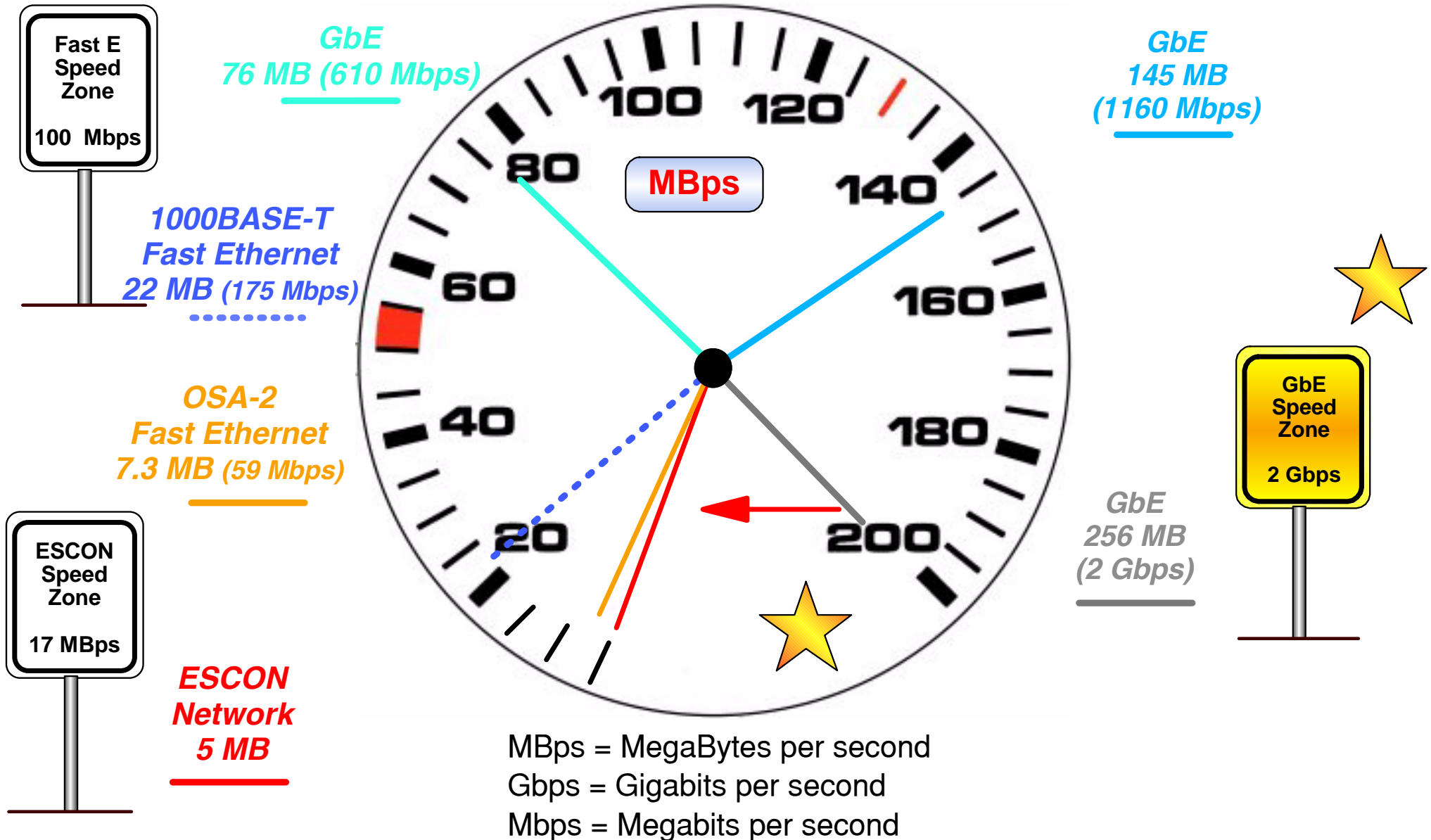
(October 2004)



# Any-to-Any Connectivity

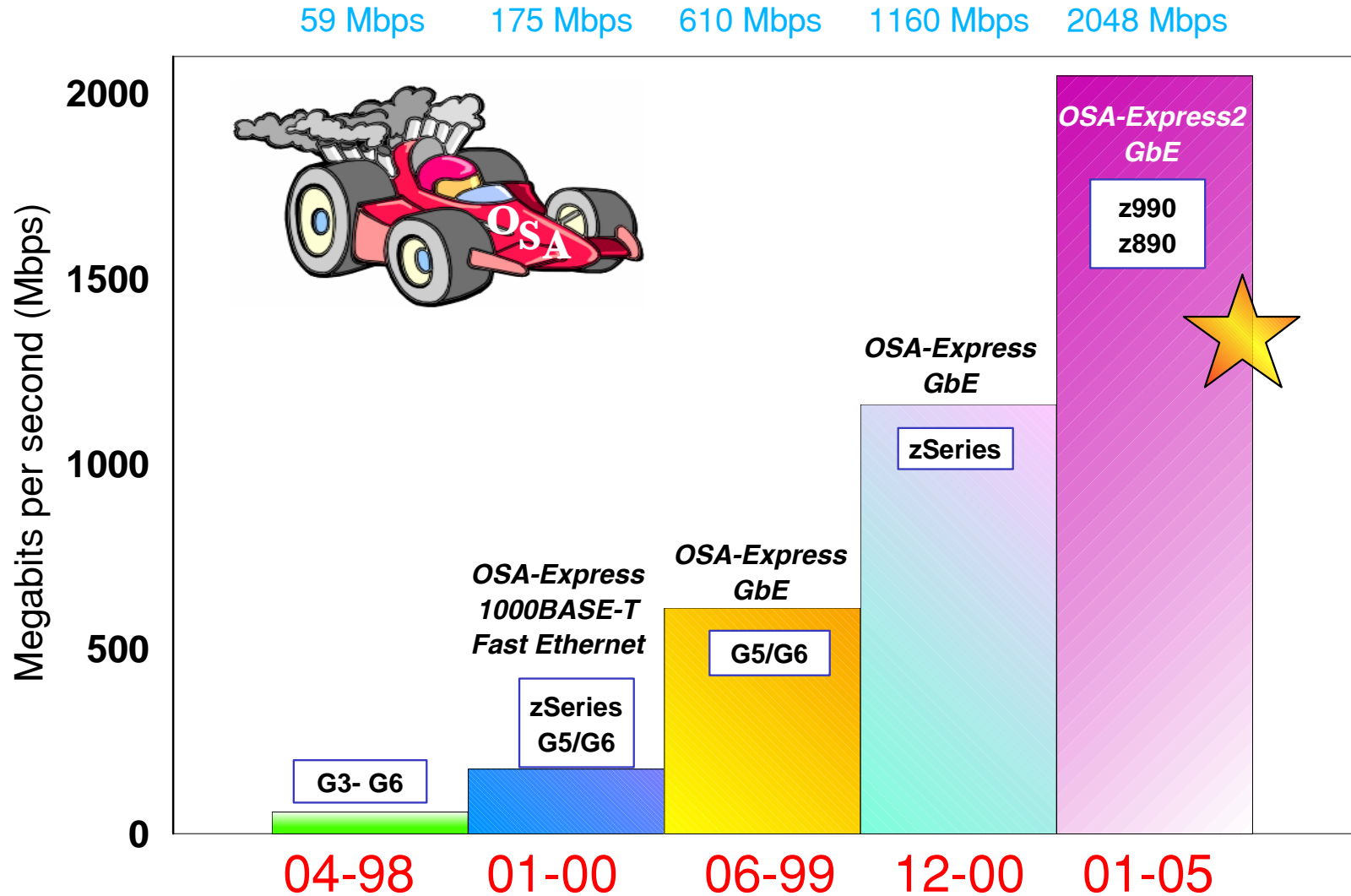


# Speed zones on the information highway



# Breaking the Barrier

- ✓ OSA-Express2 GbE is designed to achieve line speed - 1 Gbps in each direction
- ✓ Greatest throughput achieved with jumbo frames



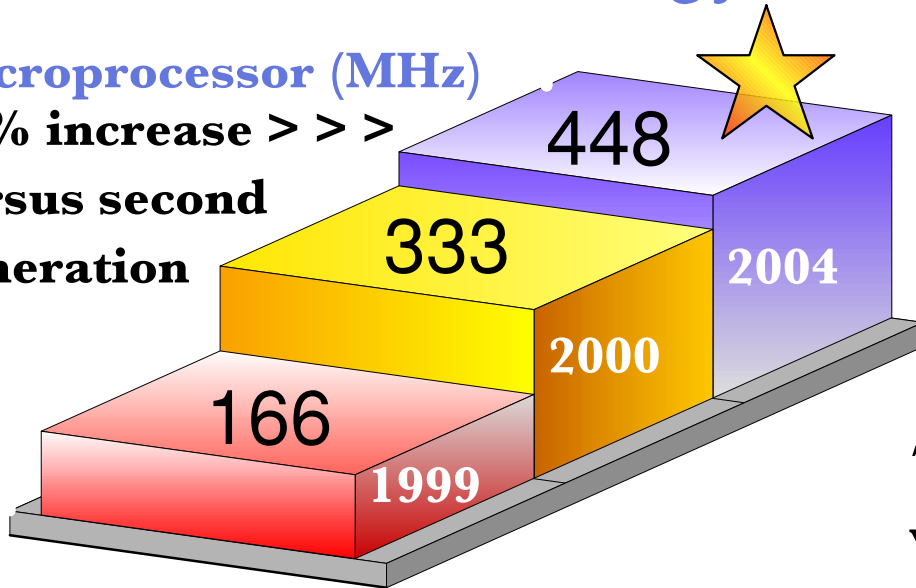


# OSA-Express2 Gigabit Ethernet A refresh of technology

## Microprocessor (MHz)

35% increase >>>

versus second generation



Microprocessor

- OSA-Express2 is the 3rd generation of Ethernet technology to deliver the throughput needed to satisfy bandwidth-hungry applications

- OSA-Express2 GbE is designed to achieve line speed - 1 Gbps in each direction

## Generation

Third . . . . .

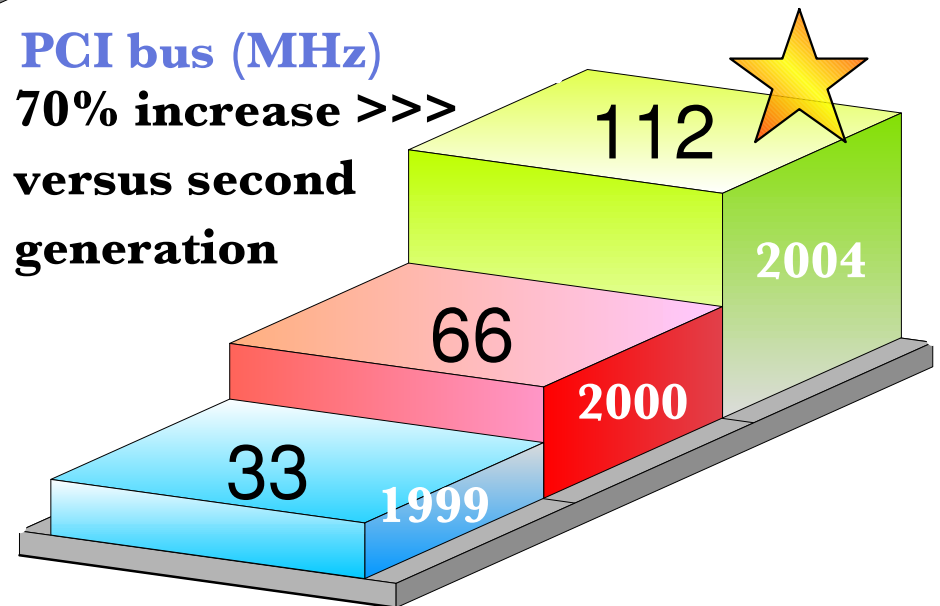
Second . . . . .

First . . . . .

## PCI bus (MHz)

70% increase >>>

versus second generation



PCI bus

# OSA-Express performance

- ★ **OSA processor becomes more efficient as throughput increases**
- ★ **Window size**
  - TCP window determines amount of data that the sender can transmit to receiver without needing an acknowledgment from the receiver
  - Faster and longer networks require larger windows to keep data flowing smoothly
- ★ **Blocking**
  - Performance is affected by the amount of data blocked together for transfer between OSA and TCP.
- ★ **Frame size**
  - Larger frames perform better
  - Larger frames reduce host and OSA processing costs
  - Size of frame depends on LAN type, MTU setting, size of data sent
- ★ **Measure: throughput, transaction response time, server utilization**
  - Bulk data transfer and interactive transactions
- ★ **QDIO and jumbo frames (8992 byte MTUs) yield the highest streams**

# OSA solutions - how do they measure up?

- **Want to compare?**
- **Use AWM (Application Workload Modeler).**
  - ▶ Replaces Netmarks, and is now externally available.
- **Can model your current network configuration in your environment**
- **Rerun the same workload against a proposed alternative (e.g. OSA gigabit).**
- **Access information at**
  - ▶ <http://www-3.ibm.com/software/network/awm/>

IBM GLOBAL SERVICES



**zSeries Expo**

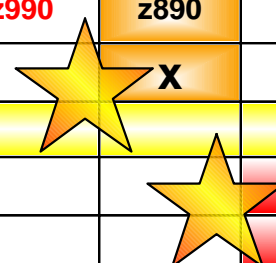
Nov. 1 - 5, 2004

**Miami, FL**

# The history of OSA + what's new

# OSA-Express2 / OSA-Express . . . Building for tomorrow

Functions	G5/G6 June 99	G5/G6 Jan 00	z900 Mar 01	z900 Oct 01	zSeries May 02	z990 June 03	z890 z990 May 04	z890 z990 Jan 05
<b>OSA-Express features</b>								
Gigabit Ethernet LX and SX	X	>	>	>	>	>	>	>
Fast Ethernet (10/100 Mbps)		X	>	>	>	>	>	>
Token Ring (4/16/100 Mbps)				X	>	>	>	>
1000BASE-T Ethernet (10/100/1000 Mbps)						X	>	>
<b>Functions</b>								
OSA/SF Java GUI						X	>	>
48 network connections z990, 40 on z890						z990	z890	>
Spanned channels							X	>
<b>OSA-Express2 features</b>								
10 Gigabit Ethernet LR								X
Gigabit Ethernet LX and SX								X



The dates are general availability dates.

## OSA-Express2 / OSA-Express . . . Building for tomorrow

Functions	G5/G6 Jan 2000	z900 March 2001	z900 October 2001	zSeries May 2002	z990 June 2003	z890 z990 May 04
<b>OSE (non-QDIO, SNA and / or TCP/IP)</b>						
IPv4, Broadcast, Multicast, VIPA (manual)	X	>	>	>	>	>
SNMP (via OSA/SF), SNA (LSA), TCP/IP (LCS)	X	>	>	>	>	>
SNA at 1 Gbps over copper (1000BASE-T Ethernet)					X	>
Direct SNMP for LCS (z/OS V1.6)						X
<b>OSD (QDIO, TCP/IP Only)</b>						
IPv4, Multicast, VIPA (Dynamic)	X	>	>	>	>	>
SNMP (via OSA/SF) QDIO and non-QDIO	X	>	>	>	>	>
Primary/Secondary Routers	X	>	>	>	>	>
VLAN (Priority Tagging); 10/100/1000 Ethernet		X	>	>	>	>
ARP Query		X	>	>	>	>
IPv6 for 10/100/1000 Ethernet				X	>	>
VLAN for 10/100/1000 Ethernet (IEEE 802.1q)				Linux	>	>
ARP Query and ARP Purge entire cache for IPv4				X	>	>
Broadcast support for RIP V1, Direct SNMP subagent				X	>	>
Direct SNMP subagent + Get,GetNext, z/OS				z/OS V1.4	>	>
Multiple Secondary Routers for 10/100/1000 Ethernet				Aug 02	>	>
Adapter interruptions, zVM and Linux					X	>
Performance assist for V=V guests, z/VM					X	>
Checksum offload for IPv4 packets					X	>

# OSA-Express2 / OSA-Express . . . Building for tomorrow

Functions	z900 October 2001	zSeries May 2002	z990 June 2003	Oct. 2003	z890 z990 May 04	z890 z990 Oct 04	z890 z990 Jan 05
<b>OSD (QDIO, TCP/IP Only)</b>							
160 TCP/IP stacks per port			X	>	>	>	>
VLAN support (IEEE 802.1q), z890 z990			z/OS V1.5 z/VM V4.4	>	Linux	>	>
Intrusion Detection Services enhancements			z/OS V1.5	>	>	>	>
SNMP dot3StatsTable, 10/100/1000 Ethernet			X	>	>	>	>
Port name relief, zSeries				X	>	>	>
Full VLAN (IEEE 802.1q) for z/OS on z800, z900				X	>	>	>
SNMP, performance data. 10/100/1000 Ethernet			z990	z800 z900	>	>	>
Direct SNMP subagent support for Traps, Set					X	>	>
Stack utilization improvement (OSA-E)						X	>
Layer 2 (OSA-E, OSA-E2)						OSA-E	OSA-E2
640 TCP/IP stacks (OSA-E2)							X
Large send (OSA-E2)							X
Concurrent LIC update (OSA-E2)							X
<b>OSC (Integrated Console Controller, OSA-ICC)</b>							
TN3270E, Non-SNA DFT 3270 emulation 1000BASE-T Ethernet feature only					X	>	>
120 console sessions per port					X	>	>

The dates are general availability dates.

OSA-E is OSA-Express, OSA-E2 is OSA-Express2

# OSA-Express2, OSA-Express limits

Limits	S/390 G5/G6	z900 Dec 00	z900 Oct 01	zSeries May 02	z990 June 03	z990,z890 Oct 04 OSA-E	z990,z890 Jan 05 OSA-E2
Ports per feature (on G5/G6 #5201 had 2 ports)	1	2	2	2	2	2	GbE = 2 10 GbE = 1
Features per system	12	12	12	12	24	24	24
CHPIDs port	1	1	1	1	1	1	1
<b>IP</b>							
Home IP Addresses (IPv4+IPv6+DVIPA) per port	512	512	2048	2048	2048	2048	4096
Max Multicast addresses (IPv4+ IPv6)	64	64	64	1024	1024	1024	2048
ARP table Size *	512	2048	8192	8192	8192	8192	16384
<b>SNA</b>							
PUs per port	2,048	4096	4096	4096	4096	4096	4096
<b>OSE</b>							
Subchannels per stack	2	2	2	2	2	2	2
Devices	240	240	240	240	240	240	240
IP Stacks per port/CHPID on system	120	120	120	120	120	120	120
<b>OSD</b>							
Subchannels per stack	3	3	3	3	3	3	3
IP Stacks per port/CHPID on server	15	80	80	80	160	160	640 \$
Subchannels per port	240	240	240	240	480	480	1920 \$
IP stacks per LPAR	15	80	80	80	84	160	640 \$
Devices per LPAR	240	240	240	240	254	480	1920 \$
Maximum Control Units Supported	1	1	1	1	1	16	16

OSA-E is OSA-Express, OSA-E2 is OSA-Express2

\* Note: The ARP table's capacity limit equals the sum of the IPv4 Home Addresses, plus the IPv6 Home Addresses, plus the IPv4 Multicast Addresses, plus the IPv6 Multicast Addresses, plus the IPv4 Remote Addresses stored in the table.

\$ If multiple priorities for queues is enabled (one to four QDIO priorities) the maximum remains at 160 stacks/480 devices





# Limits for VLANs

Limits	z900 GA2 Oct 01	z900 GA3 May 02	z990 June 03	z990, z890 May 04
<b>VLANs per stack</b>				
Linux		4,096	4,096 IPv4 + IPv6	
z/OS	Null tagging	Null tagging	1 per IPv4, 1 per IPv6 stack on z/OS V1.5	
z/VM			1 per IPv4 stack, z/VM V4.4	
z/VM				1 per IPV6 stack, z/VM V5.1

IBM GLOBAL SERVICES



**zSeries Expo**

Nov. 1 - 5, 2004

**Miami, FL**

# The "personalities" of OSA

# CHPID type controls operation

## Mutually exclusive

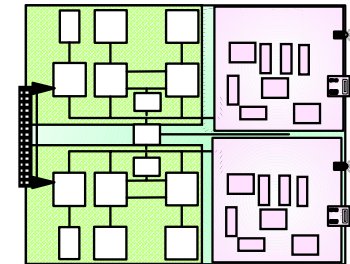
- CHPID type of OSE: native SNA/APPN/HPR and TCP/IP traffic can flow
- CHPID type of OSD: TCP/IP traffic can flow
  - Use Enterprise Extender (EE) or TN3270 for SNA applications
- CHPID type of OSC: 3270 data streams can flow

CHPID Type	MEDIA	SNA/APPN/HPR	TCP/IP	3270	OSA/SF Required
OSC	1000BASE-T Ethernet	NO	NO	YES	NO
OSE (non-QDIO)	1000BASE-T Ethernet Fast Ethernet	YES	YES	NO	YES
OSE (non-QDIO)	Token Ring	YES	YES	NO	YES
OSD (QDIO)	Gigabit Ethernet	NO (Use EE or TN3270)	YES	NO	NO
OSD (QDIO)	1000BASE-T Ethernet Fast Ethernet	NO (Use EE or TN3270)	YES	NO	NO
OSD (QDIO)	Token Ring	NO (Use EE or TN3270)	YES	NO	NO

## CHPID type OSC

# OSA-Express Integrated Console Controller (OSA-ICC)

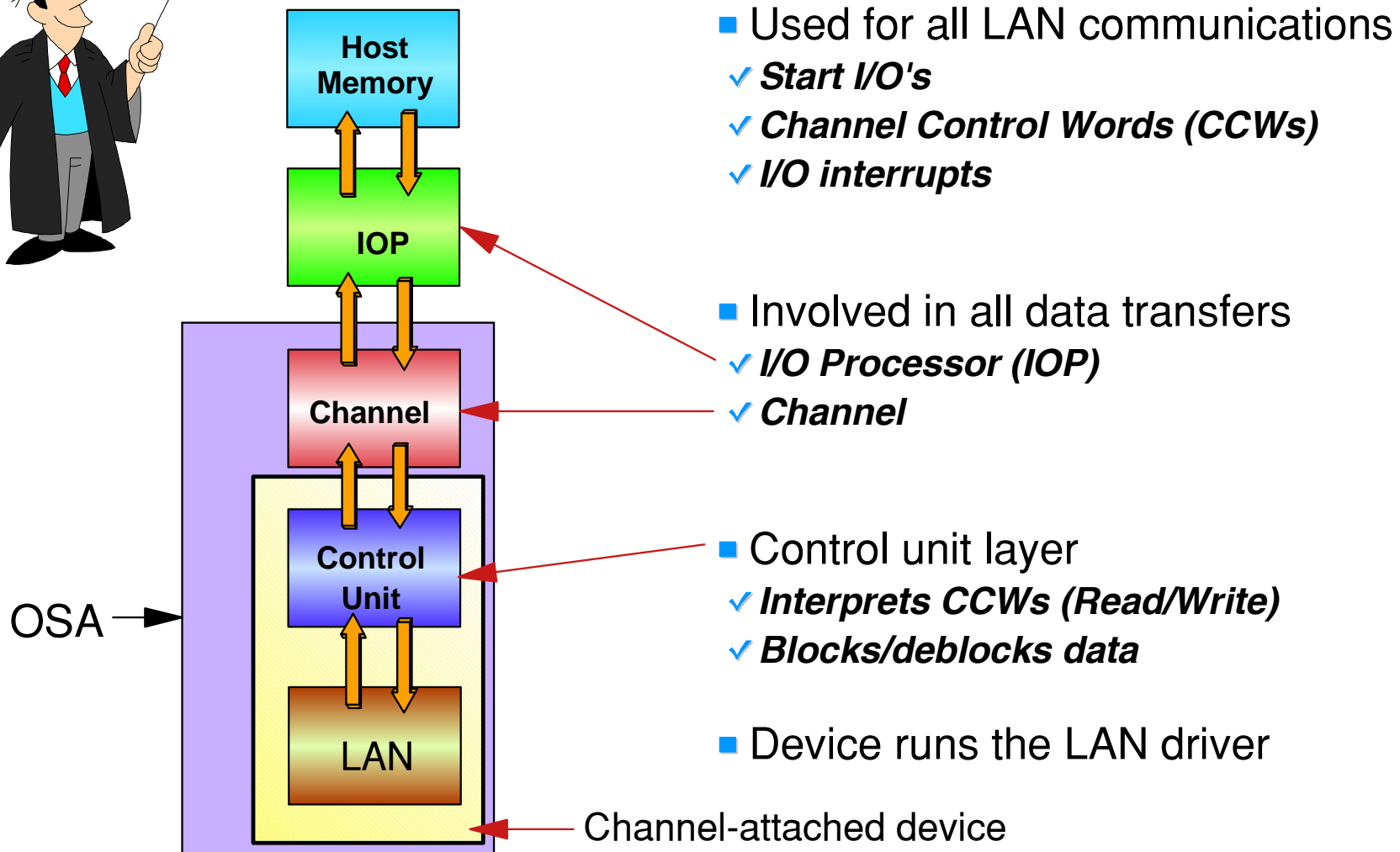
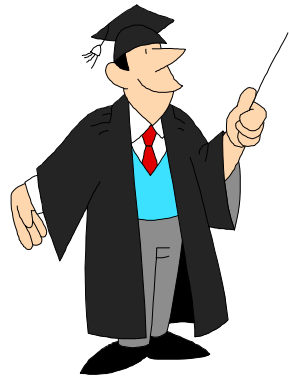
- Exclusive to OSA-Express 1000BASE-T Ethernet
  - ▶ New CHPID type **OSC**
  - ▶ OSA-ICC configured on a port-by-port basis
    - Port can be CHPID type OSC, OSD, or OSE
- LAN Connectivity
  - ▶ LAN-attached consoles running TN3270E clients
    - Non-SNA DFT data streams to TN3270E
    - Capable of operating at 10, 100, or 1000 Mbps (1 Gbps)
  - ▶ Uses RJ-45 connection to category 5 Unshielded Twisted Pair (UTP) copper cabling
- Configuration support via Support Element (SE) and Hardware Management Console (HMC)
- Operating systems - z/OS, z/VM, VSE/ESA, TPF
- Can coexist in configurations using prior IBM 2074 models and older 3174 controllers
- No coaxial cable support or Token Ring support



**1000BASE-T  
Ethernet  
Feature 1366**

**May 2004**

# CHPID type OSE for SNA and/or TCP/IP



- Used for all LAN communications
  - ✓ *Start I/O's*
  - ✓ *Channel Control Words (CCWs)*
  - ✓ *I/O interrupts*

- Involved in all data transfers
  - ✓ *I/O Processor (IOP)*
  - ✓ *Channel*

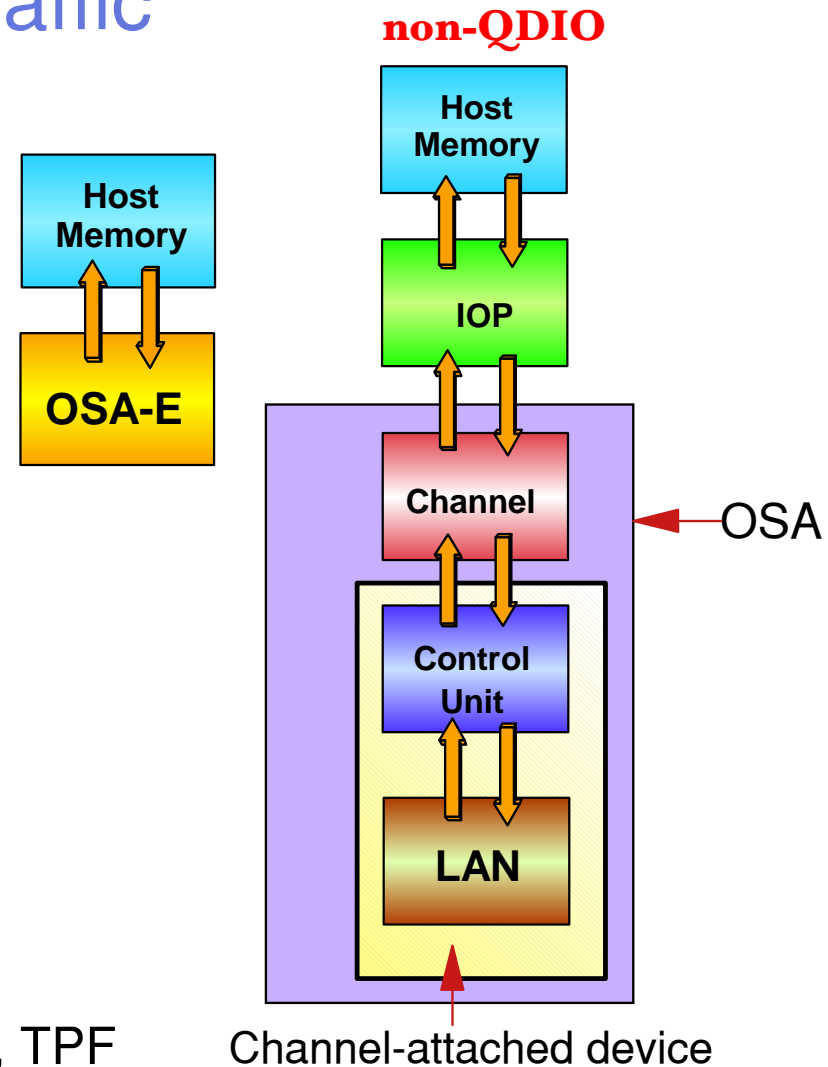
- Control unit layer
  - ✓ *Interprets CCWs (Read/Write)*
  - ✓ *Blocks/deblocks data*

- Device runs the LAN driver

Controller, Router, OSA-2, OSA-Express Non-QDIO

# CHPID type OSD for TCP/IP traffic

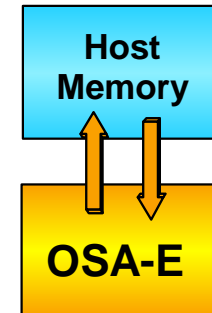
- Queued Direct Input/Out (QDIO)
    - For SNA/APPN/HPR traffic with QDIO use TN3270, Enterprise Extender
  - Design for high speed communication
    - ▶ **Reduced TCP/IP path length**
      - ▶ Internal testing reflects host utilization drop of 15% for FTP with 1500 byte datagrams
  - 1. **QDIO IP Processing Assist (see next slide)**
  - 2. **LPAR-to-LPAR Communication with port sharing**
  - 3. **Direct Memory Access (DMA) Protocol**
    - Memory-to-memory communication
      - I/O interrupts minimized
      - Continuous direct data exchanges
  - 4. **Dynamic customization**
- z/OS, OS/390, z/VM, VM/ESA, VSE/ESA, LINUX, TPF
  - Gigabit Ethernet, 1000BASE-T Ethernet, Fast Ethernet, Token Ring



## z990, z890 OSA-Express New Functions - QDIO only

### ■ QDIO IP Processing Assists

- ▶ Performs all ARP processing
- ▶ Provides Multicast support
- ▶ Builds MAC and LLC headers
- ▶ Performs filtering - TCP/IP stack sees only IP datagrams



### ■ Checksum offload for IPv4 packets (June 2003)

- ▶ Calculates the TCP/UDP and IP header checksums
- ▶ Verifies the correctness of files
- ▶ Reduces host CPU cycles
- ▶ Checksum offload support is offered for z/OS V1.5, Linux on zSeries on:
  - GbE features (new features 1364, 1365)
  - 1000BASE-T Ethernet (new feature 1366)

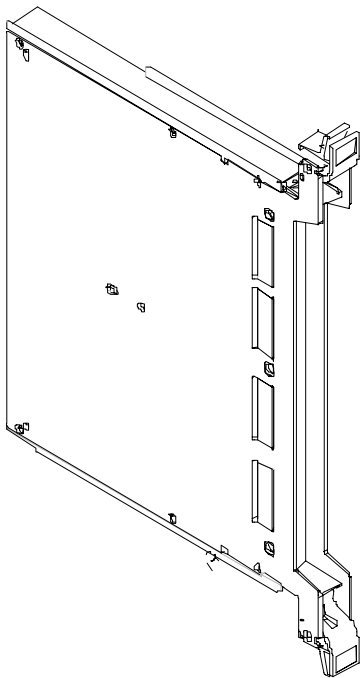
IBM GLOBAL SERVICES



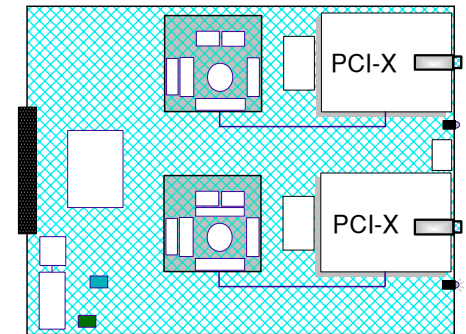
# zSeries Expo

Nov. 1 - 5, 2004

Miami, FL



# The "features"

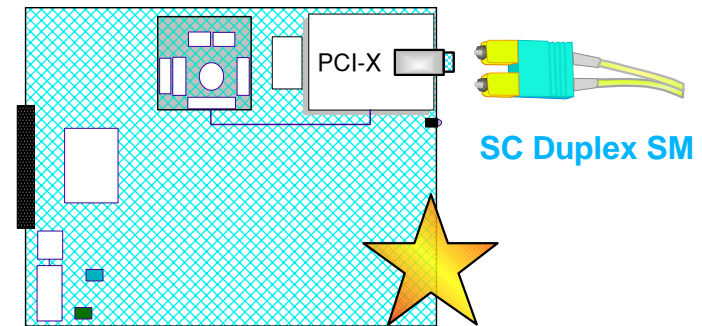




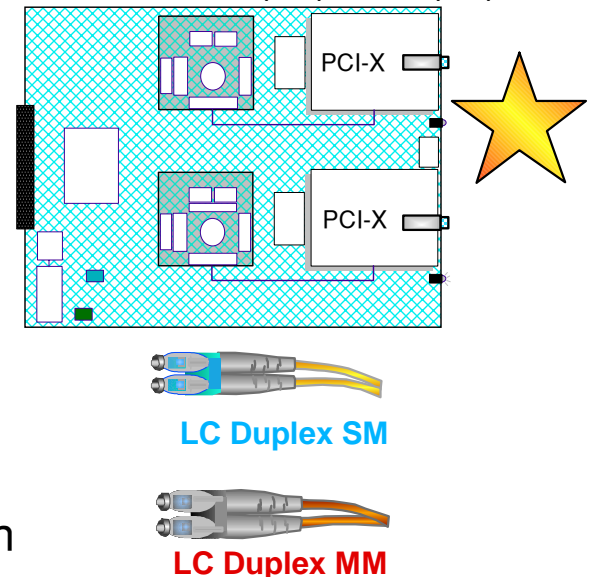
# z990, z890 OSA-Express2

- **Newest member** - 10 Gigabit Ethernet LR (long reach)
  - ▶ One port per feature
  - ▶ 9 micron single mode fiber, **SC Duplex connector**
- **New** - Gigabit Ethernet features
  - ▶ Gigabit Ethernet LX (Long wavelength)
    - 9 micron single mode fiber, LC Duplex connector
  - ▶ Gigabit Ethernet SX (Short wavelength)
    - 50 or 62.5 micron multimode fiber, LC Duplex connector
  - ▶ Designed to achieve line speed - 1 Gbps in each direction
- Support offered by both 10 GbE and GbE:
  - ▶ Queued Direct Input/Output (QDIO) for TCP/IP traffic only
    - Use TN3270 or Enterprise Extender for SNA traffic
  - ▶ **Layer 2 support** for flexible and efficient data transfer
  - ▶ **640 TCP/IP stacks** for improved virtualization
  - ▶ **Large send** for CPU efficiency
  - ▶ **Concurrent LIC update** to minimize network traffic disruption
- Mode of operation for all - QDIO only - CHPID type OSD

## 10 Gigabit Ethernet Feature 3368



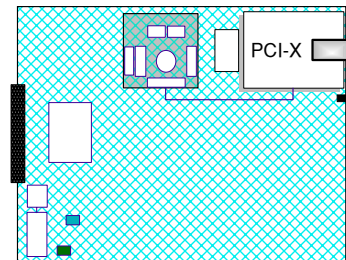
## Gigabit Ethernet Features 3364 (LX), 3365 (SX)



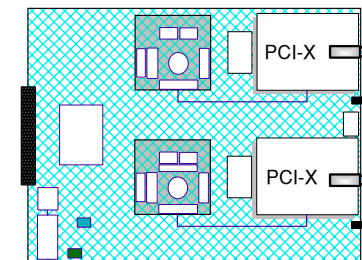
# z990, z890 - 5 features to choose from

- **Up to 48 network connections - z990**
- **Up to 40 network connections - z890**
  - ▶ 24 on z890 capacity setting 110
- **OSA-Express2 GbE LX and SX, 10 GbE**
- **OSA-Express**
  - ▶ 1000BASE-T Ethernet (10/100/1000 Mbps)
    - Same Category 5 **copper** as Fast Ethernet
  - ▶ Token Ring (4/16/100 Mbps)
    - Category 5 **copper**
- Modes of Operation for Token Ring
  - ▶ QDIO = TCP/IP traffic only
    - TN3270 or Enterprise Extender for SNA traffic
  - ▶ Non-QDIO = TCP/IP and/or SNA/APPN/HPR
- See next slide for Ethernet "modes of operation"
- **SOD - z990/z890 are the last zSeries servers to support Token Ring - new build, upgrade, MES, or carry forward**

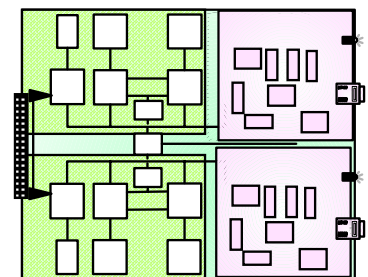
**10 Gigabit Ethernet  
Feature 3368**



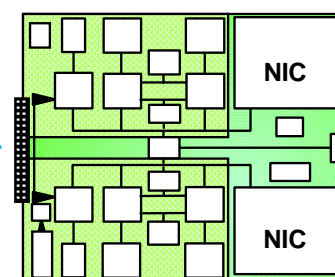
**Gigabit Ethernet  
Features 3364 (LX), 3365 (SX)**



**1000BASE-T Ethernet  
Feature 1366**



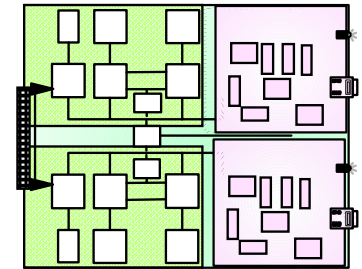
**Token Ring  
Feature 2367**



# z990, z890 OSA-Express 1000BASE-T Ethernet

- **Supports auto-negotiation: 10, 100, 1000 Mbps**
- **Capable of achieving line speed \***
- **New = OSA-ICC**
  - ▶ **OSA-Express Integrated Console Controller**
    - Supports TN3270E (RFC 2355) and non-SNA DFT 3270 emulation
    - 120 console sessions per port

**1000BASE-T Ethernet  
Feature 1366**



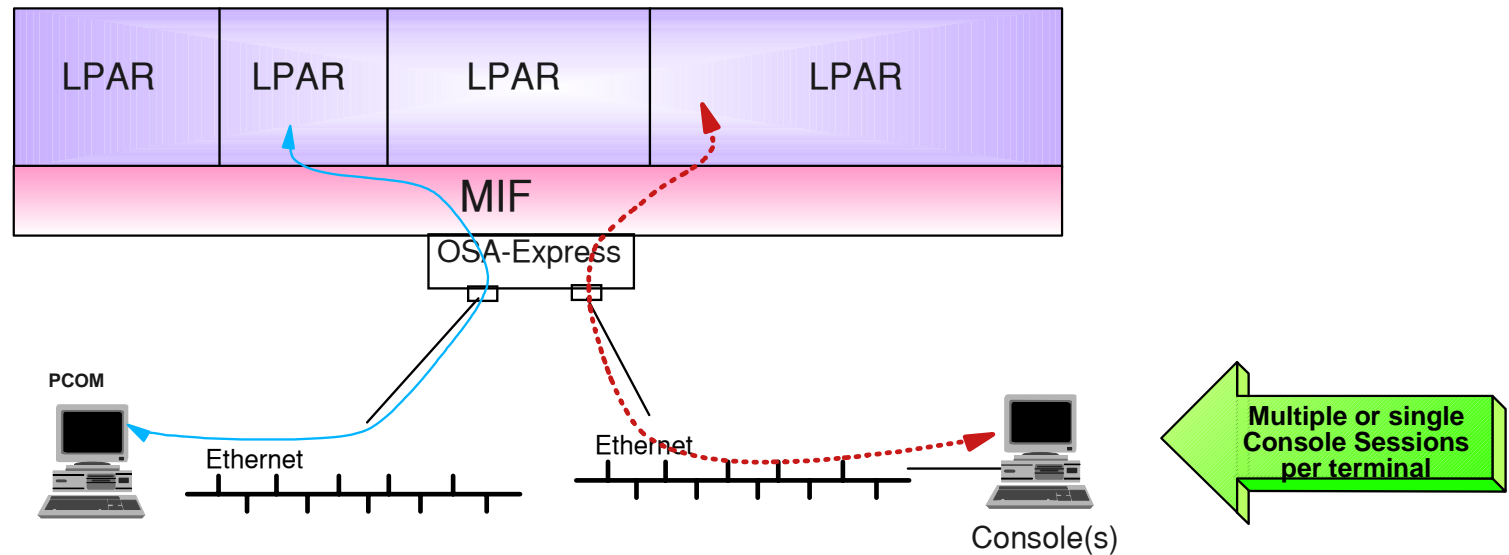
## ■ Modes of operation for 1000BASE-T Ethernet

<b>Mode</b>	<b>CHPID</b>	<b>Description</b>
QDIO	OSD	TCP/IP traffic
Non-QDIO	OSE	TCP/IP and/or SNA/APPN/HPR traffic
OSA-ICC	OSC	3270 data streams

- **When configured at 1 Gbps**
  - ▶ Operates in full duplex mode only
  - ▶ Operates in QDIO mode or non-QDIO mode
  - ▶ Can carry SNA/APPN/HPR traffic (non-QDIO mode)
  - ▶ Can carry TCP/IP packets (QDIO or non-QDIO mode)
  - ▶ Supports jumbo frames in QDIO mode (8992 byte frame size)

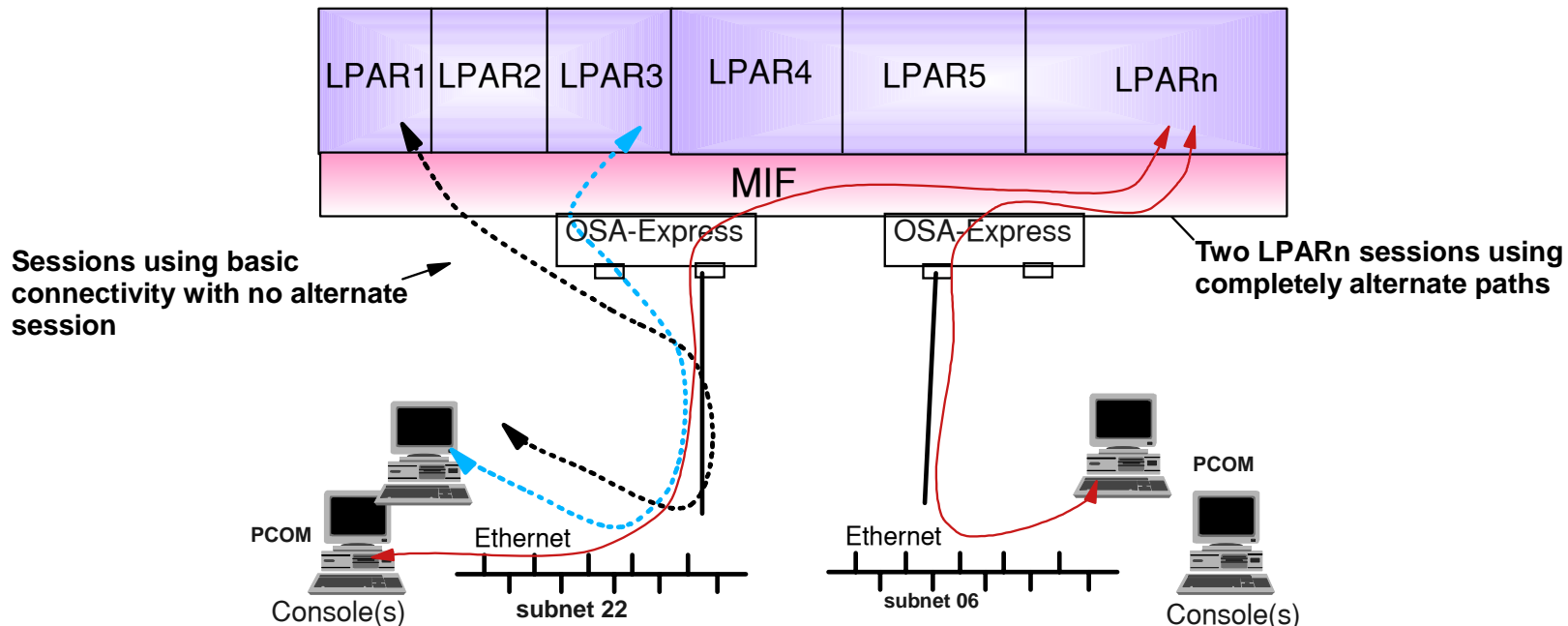
\* Actual throughput is dependent upon customer environment

# OSA-ICC Single System with Alternate Sessions



- To IPL CEC and LPARs, and operating system console operations
- Up to 120 sessions per port across multiple LPARs .. MIF capable
  - ▶ Can run multiple sessions on a single workstation
- For increased console session availability, plan for separate consoles, on separate LANs, on separate ports, on separate OSA-Express features
  - ▶ Manual, disruptive console session switch possible

# OSA-ICC Single System with Redundancy Configuration



- Up to 240 sessions to multiple LPARs on the CEC
- Session-level redundancy using different paths on ports, LANs, and consoles
  - ▶ Different console sessions from different LAN to same LPAR for dual connectivity
  - ▶ Manual, disruptive console session switch possible for failed session
  - ▶ Individual session cannot be shared between LPARs
  - ▶ LAN ports must attach to different subnets
- Loss of one port does not nondisruptively switch sessions to second port on same or different OSA-Express

# Comparison: OSA-ICC versus IBM 2074 Console Support Controller

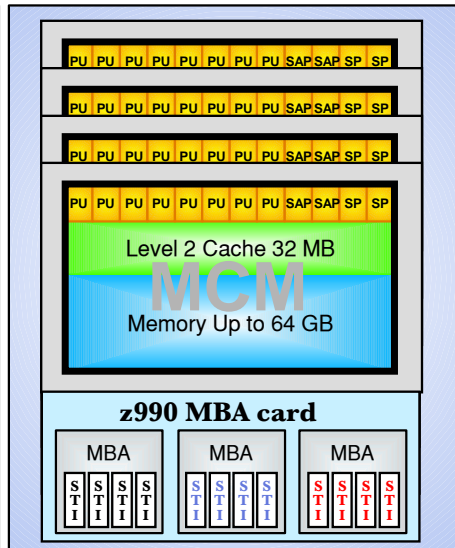
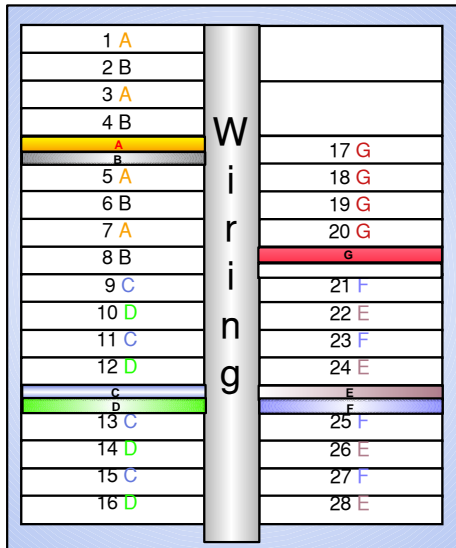
	<b>OSA-ICC</b>	<b>IBM 2074 Console Support Controller</b>
<b>Packaging</b>		
Separate feature or product	1 or 2 ports can be configured on OSA-Express 1000BASE-T Ethernet feature	Standalone box..rack mounted, or floor standing depending on model
\$\$\$\$\$\$\$	OSA-Express 1000BASE-T Ethernet Support included as part of server LIC	IBM 2074, with optional priced second ESCON
<b>Management</b>		
Ping to session	Yes via SE and HMC panel	No
Trace route	Yes via SE and HMC panel	Yes, different trace type
SNMP support	No	No
<b>Configuration</b>		
User interface	SE (for initial configuration), SE or HMC panels and/or ASCII file thereafter	Utility GUI, no batch file
Backup configurations	Can be imported/exported to floppy disk. Limited to size of disk	Yes up to 4 active, Backed up to floppy disk
Reconfiguration	Yes if OSA-Express predefined, disruptive to session(s)	Yes, disruptive
Remote configuration support	SE (for initial configuration), SE or HMC panels for remote support thereafter	No



# Plugging Rules for FICON Express, PCICA, PCIXCC, OSA-Express Total cannot exceed 20 features per I/O cage

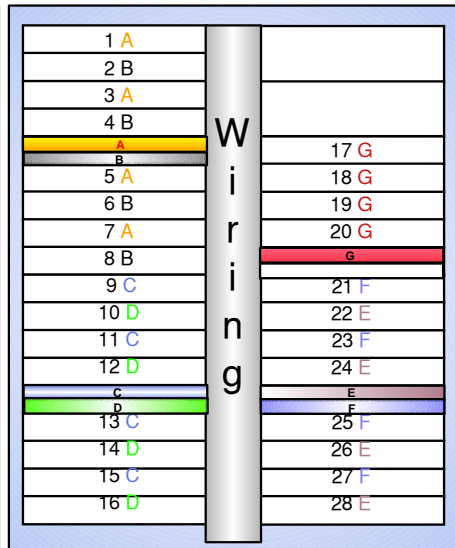
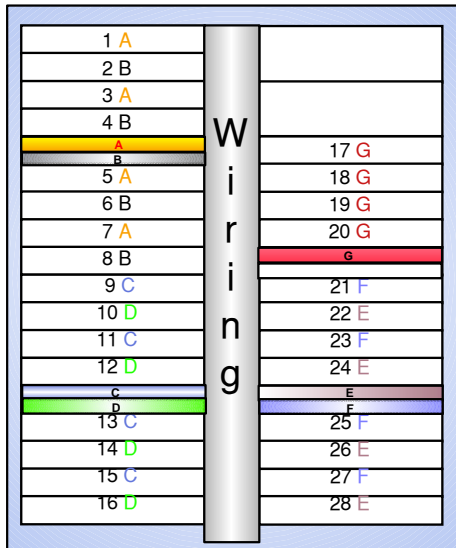
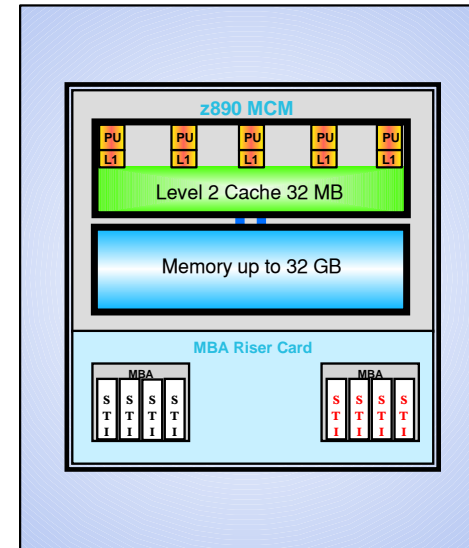
## z990 - 2 Frames

## z890 - 1 Frame



Each I/O cage has  
7 STIs  
7 I/O domains  
28 I/O slots

Maximum OSAs



24 per z990

and

20 per z890

Front = 16

Back = 12

# Spanned channels

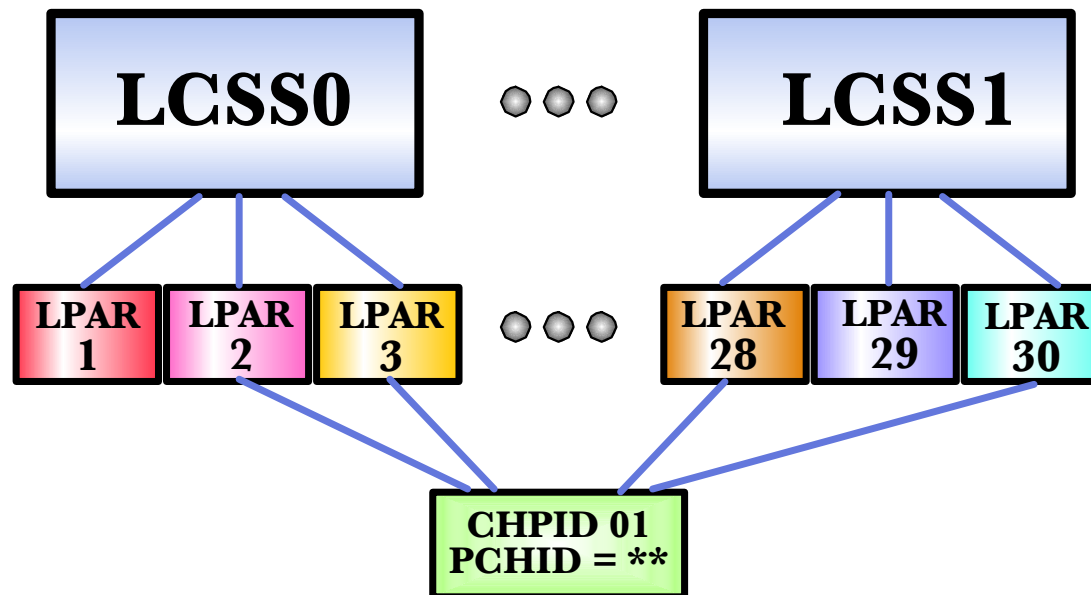
## Share channels among LPARs across LCSSs

### ★ Internal spanned channels

- HiperSockets and Internal Coupling links

### ★ External spanned channels

- FICON Express
- ICBs, ISC-3
- OSA-Express



\*\* No PCHID for HiperSockets and Internal Coupling links. PCHID required for FICON, ICs, ICBs, ISC-3, OSA  
 Spanning reduces the number of channels that can be defined for all LCSSs on server  
 Worst case - 256 if all channels are spanned between all LCSSs



IBM GLOBAL SERVICES



**zSeries Expo**

Nov. 1 - 5, 2004

**Miami, FL**

# The latest functions

## Layer 2 switching and transport on zSeries

### Flexible and efficient data transfer of IP and non-IP traffic



- **OSA-Express2, OSA-Express**

+

- **z/VM virtual switch**

- **Can support IP and non-IP based protocols**

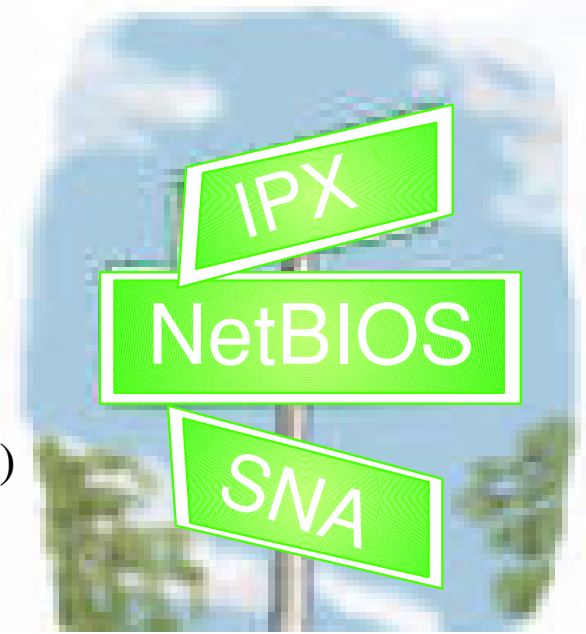
- IP (IPv4 or IPv6)
- Non-IP (such as AppleTalk, DECnet, IPX, NetBIOS, SNA)

- **z/VM virtual switch**

- ▶ Performs protocol-independent Ethernet switching
- ▶ Authorizes and manages guest connections and IEEE 802.1q VLAN assignments
- ▶ Provides flexible and automatic MAC address generation and assignment ensuring uniqueness within and across z/VM images, LPARs, server

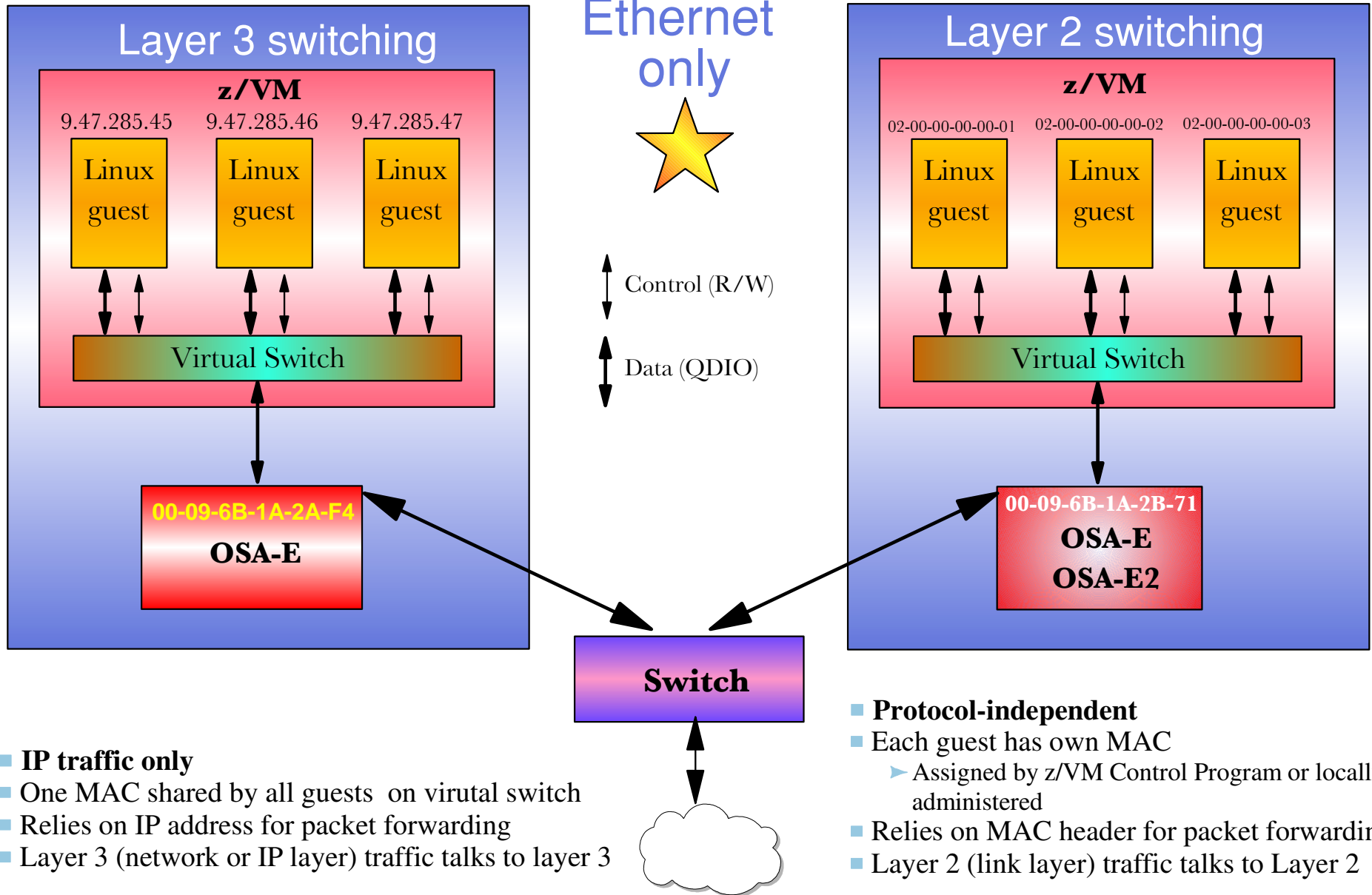
- **QDIO mode only (CHPID type OSD)**

- **Gigabit Ethernet, 10 Gigabit Ethernet**



# Link layer transport for protocol-independent data transfer

Ethernet  
only

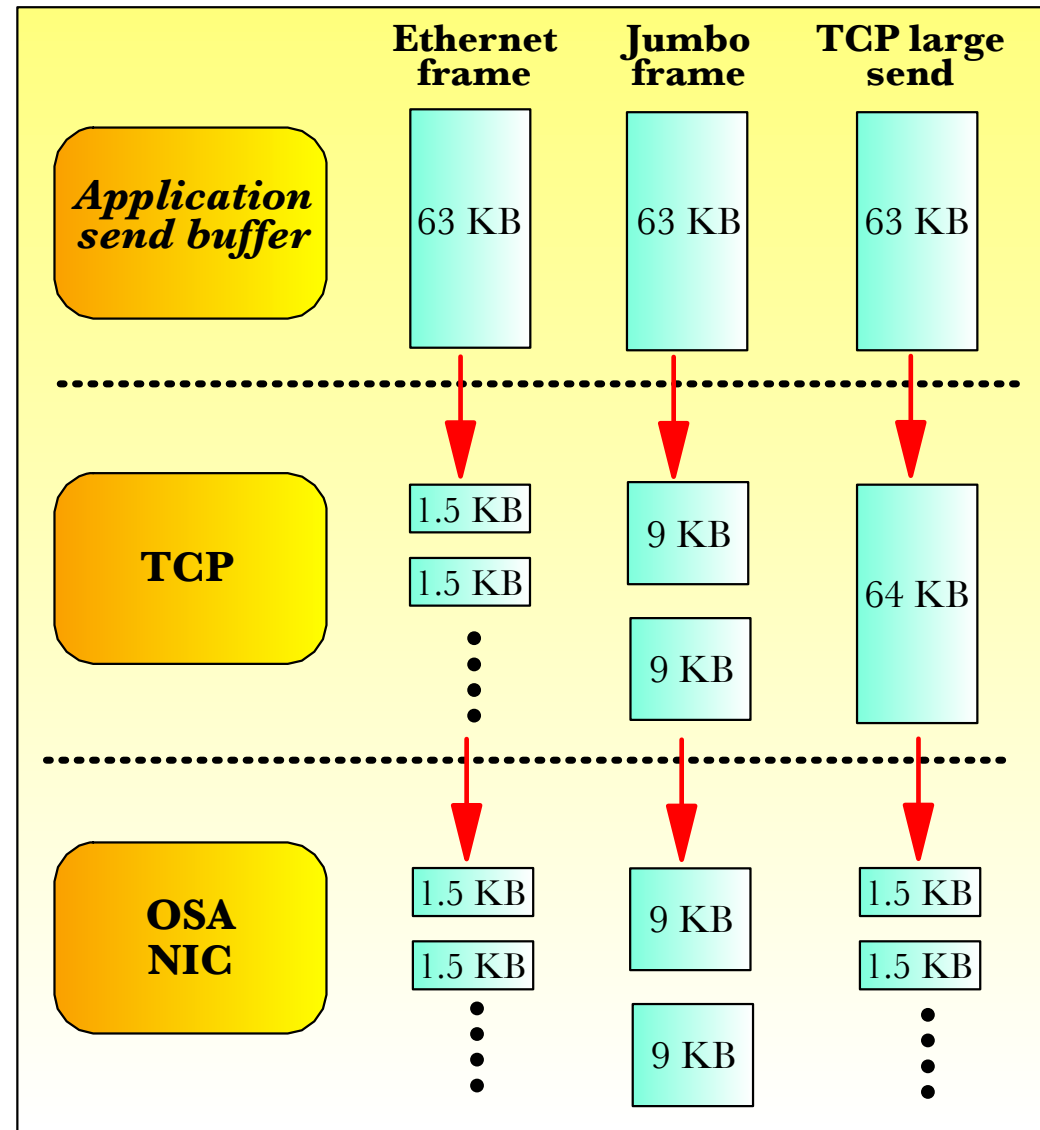


- IP traffic only
- One MAC shared by all guests on virtual switch
- Relies on IP address for packet forwarding
- Layer 3 (network or IP layer) traffic talks to layer 3

- Protocol-independent
- Each guest has own MAC
  - ▶ Assigned by z/VM Control Program or locally administered
- Relies on MAC header for packet forwarding
- Layer 2 (link layer) traffic talks to Layer 2

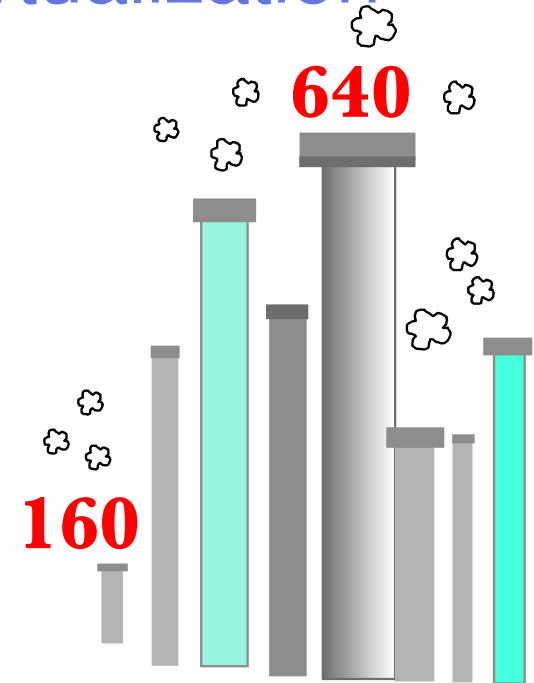
## ★ Large Send for TCP/IP traffic (TCP segmentation offload) for CPU efficiency

- OSA-Express2 (GbE and 10 GbE)
- Segmentation of IP packets done by OSA NIC, not IP stack
- Offloads the TCP segmentation processing from host TCP/IP stack
- Host code path length reduced
- **Sends 64 kilobyte (KB) blocks to OSA**
- Processing performed by OSA NIC
  - IP/TCP checksum processing
  - TCP packet processing
  - Sends out 1.5 KB packets (1492 byte)
- For outbound traffic only
- For IPv4, IPv6
- For unicast datagrams
- QDIO mode only (CHPID type OSD)
- Supported by Linux on zSeries



# ★ 640 TCP/IP stacks for improved virtualization

- **Exclusive to OSA-Express2**
  - ▶ 640 TCP/IP stacks per OSA-Express2 port/CHPID
- **For hosting more images on zSeries**
- **Reduces the number of OSA features required to host multiple images**
- **Exclusive to OSA-Express2 (GbE, 10 GbE)**
  - ▶ QDIO mode only (CHPID type OSD)
- **Supported by**
  - ▶ z/OS and z/OS.e V1.6 with PTF
  - ▶ z/VM V5.1
  - ▶ Linux on zSeries




Limits	S/390 G5/G6	z900 Dec 00	z900 Oct 01	zSeries May 02	z990 June 03	z990, z890 Oct 04 OSA-E	z990, z890 Jan 05 OSA-E2
<b>OSD</b>							
Subchannels per stack	3	3	3	3	3	3	3
IP Stacks per port/CHPID on server	15	80	80	80	160	160	640 \$
Subchannels per port	240	240	240	240	480	480	1920 \$
IP stacks per LPAR	15	80	80	80	84	160	640 \$
Devices per LPAR	240	240	240	240	254	480	1920 \$
Maximum Control Units Supported	1	1	1	1	1	16	16

OSA-E = OSA-Express, OSA-E2 is OSA-Express2

\$ If multiple priorities for queues is enabled (one to four QDDIO priorities) the maximum remains at 160 stacks/480 devices

# Availability - OSA offerings

<b>Announced October 7, 2004</b>	<b>CHPID type</b>	<b>Available 2004 OSA-Express Ethernet *</b>	<b>Available 2005 OSA-Express2 Ethernet</b>	<b>Description</b>
<b>OSA-Express2 GbE</b>	OSD	---	January 28	New generation of GbE
<b>OSA-Express2 10 GbE LR</b>	OSD	---	January 28	New member of OSA family
<b>Layer 2 support</b>	OSD	October 29	January 28	IP and non-IP workloads. Simplifies network configuration
<b>640 TCP/IP stacks</b>	OSD	---	January 28	More TCP/IP stacks Hosting more Linux images
<b>Large send</b>	OSD	---	January 28	Sends 640 Kilobyte blocks to OSA. Saves CPU cycles
<b>Concurrent LIC update</b>	OSD	---	January 28	LIC updates without configuration off/on
<b>Stack improvement</b>	OSD	October 29	 ---	Now 160 stacks per LPAR instead of 84 per LPAR

\* Not supported on OSA-Express Fast Ethernet #2366

# Software requirements (minimum)

Feature/Function	z/OS	z/VM	VSE/ESA	TPF	Linux on zSeries
OSA-Express2 GbE	V1.2	V3.1, 4.3	V2.6	4.1	Current distributions
OSA-Express2 10 GbE LR	V1.2	V3.1, 4.3	V2.6	4.1	Early 05 drop
Stack utilization improvement (OSA-E)	V1.6 *	V3.1, 4.3 *	--	--	--
Checksum offload for IPv4 (OSA-E, OSA-E2)	V1.5	--	--	--	SLES8&9, TLES8, CLEE
Layer 2 (OSA-E, OSA-E2)	--	V5.1	--	--	Oct 04 drop (2.4) Early 05 drop (2.6)
640 TCP/IP stacks (OSA-E2)	V1.6 *	V5.1 *			Early 05 drop
Large send (OSA-E2)	--	--	--	--	Early 05 drop

OSA-E = OSA-Express, OSA-E2 = OSA-Express2

Always check PSP buckets. PTFs may be required. Refer to announcement letters for applicable APARs.

Refer to the online sales manual for a complete list of software prerequisites at

<http://www-3.ibm.com/common/ssi/OIX.wss>

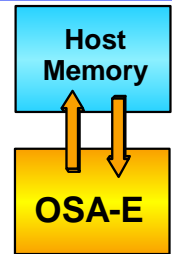
z/OS implies z/OS.e (offered on z800, z890 only). z/OS.e began with V1.3

Linux on zSeries current distributions = SUSE SLES 8, Red Hat RHEL 3, Turbolinux TLES 8, and Conectiva CLEE

\* PTFs are required.

# SNMP update - QDIO only

- **SNMP - Monitor network devices/functions, identify problems**
- **Direct SNMP subagent MIB for all of the OSA-Express features when configured in QDIO mode (CHPID type OSD)**
- **Do not require OSA/SF to obtain data**
  
- **Get and GetNext requests - zSeries**
- **dot3StatsTable - zSeries**
- **Performance data - zSeries**
- **Traps and Set - z890 and z990**
  - ▶ Trap - Asynchronously receive an alert
  - ▶ Set - Change value (currently limited to set traps on/off)
  
- **Direct SNMP support for LCS - z890 and z990**
  - ▶ Same support as listed above
  - ▶ Non-QDIO CHPID type OSE
  - ▶ z/OS V1.6



**May 2004**



IBM GLOBAL SERVICES



**zSeries Expo**

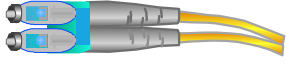
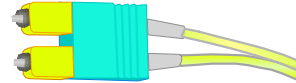
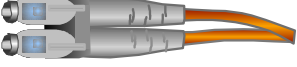

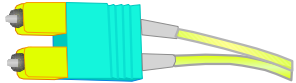

Nov. 1 - 5, 2004

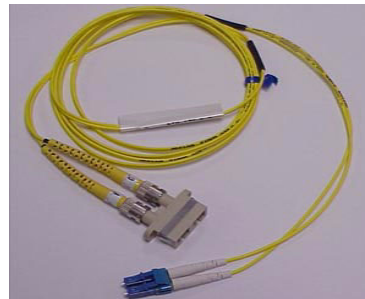
**Miami, FL**

# Cabling and connectors

# z990, z890 GbE Features - Connector Change

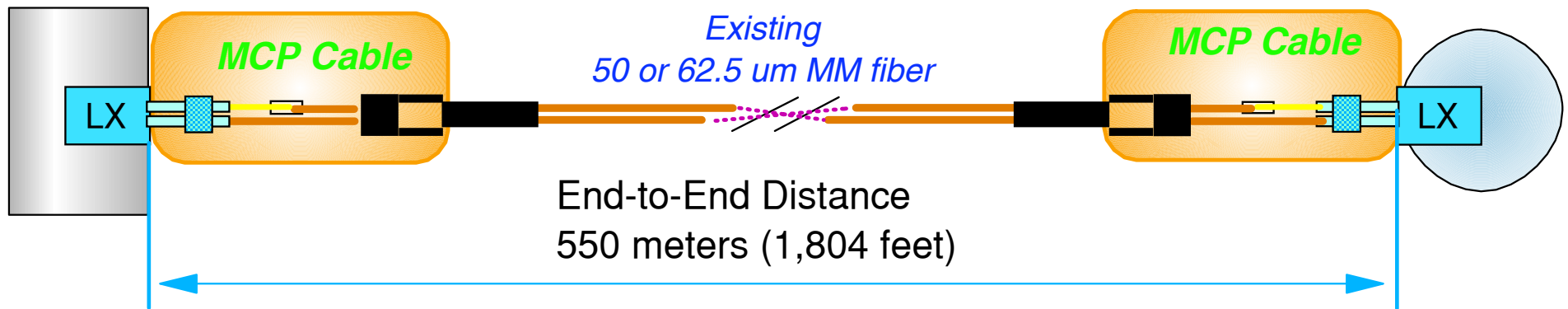
May require a Conversion Kit to attach to switches

Feature	Connector	Connector
Gigabit Ethernet LX Single mode (SM) fiber	 LC Duplex SM #1364, #3364	 SC Duplex SM #2364
Gigabit Ethernet SX Multimode (MM) fiber	 LC Duplex MM #1365, #3365	 SC Duplex MM #2365
10 Gigabit Ethernet LR Single mode (SM) fiber	 SC Duplex SM #3368	



Conversion Kit example  
2 meters (6.5 feet)

# Mode Conditioning Patch Cables

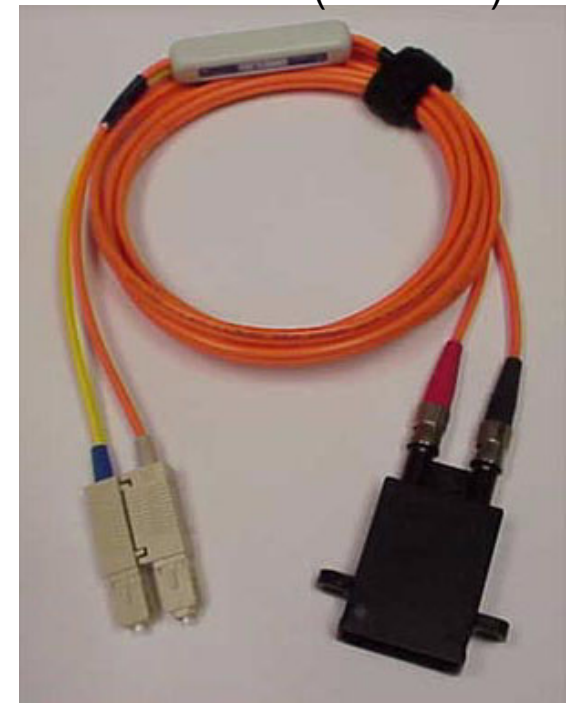


MCP Cable example  
2 meters (6.5 feet)

I have a multimode fiber infrastructure.  
Now what?

**MCP Cables can be used**  
(for 1 Gigabit links only)

*A pair is required for each link*  
*Offered as features on z900 only*



# Gigabit Ethernet Cabling Options

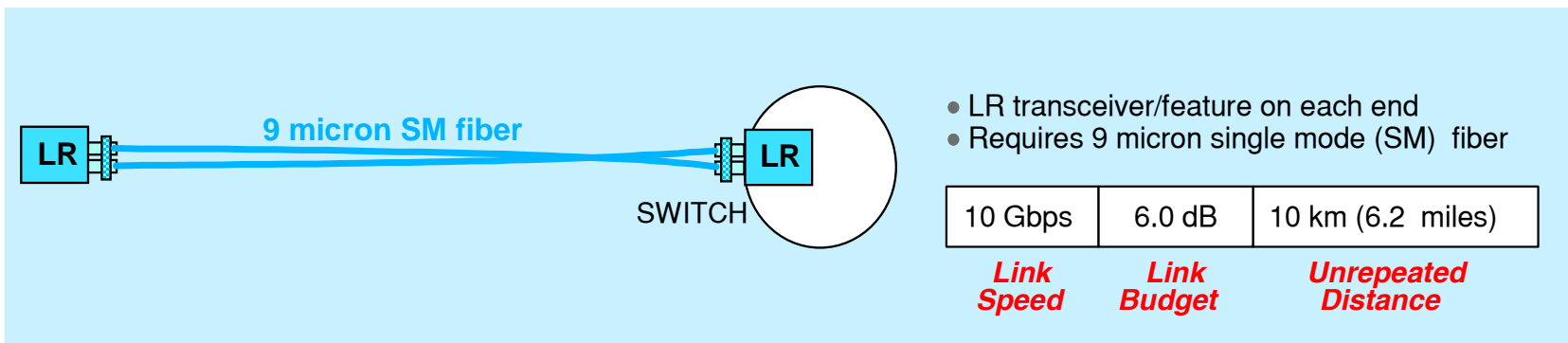
LX = Long wavelength 1300 nm transceiver

SX - Short wavelength 850 nm transceiver

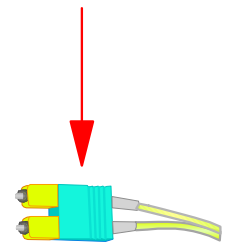
<p>9 micron SM fiber</p>	<ul style="list-style-type: none"> <li>LX transceiver/feature on each end</li> <li>Requires 9 micron single mode (SM) fiber</li> </ul> <table border="1"> <tr> <td>1 Gbps</td> <td>4.6 dB</td> <td>5 km (3.1 miles)</td> </tr> </table>	1 Gbps	4.6 dB	5 km (3.1 miles)
1 Gbps	4.6 dB	5 km (3.1 miles)		
<p>50 or 62.5 micron MM fiber</p>	<ul style="list-style-type: none"> <li>LX transceiver/feature on each end combined with a pair of MCP cables</li> <li>Uses current 50 or 62.5 multimode (MM) fiber infrastructure</li> <li><b>Reduced distance</b> and link budget</li> </ul> <table border="1"> <tr> <td>1 Gbps</td> <td>2.4 dB</td> <td>550 meters (1804 feet)</td> </tr> </table>	1 Gbps	2.4 dB	550 meters (1804 feet)
1 Gbps	2.4 dB	550 meters (1804 feet)		
<p>50 micron MM fiber</p>	<ul style="list-style-type: none"> <li>SX transceiver/feature on each end</li> <li>Requires 50 micron multimode fiber</li> <li><b>Reduced distance</b> and link budget</li> </ul> <table border="1"> <tr> <td>1 Gbps</td> <td>3.6 dB</td> <td>550 meters (1804 feet)</td> </tr> </table>	1 Gbps	3.6 dB	550 meters (1804 feet)
1 Gbps	3.6 dB	550 meters (1804 feet)		
<p>62.5 micron MM fiber</p>	<ul style="list-style-type: none"> <li>SX transceiver/feature on each end</li> <li>Requires 62.5 micron multimode fiber</li> <li><b>Reduced distance</b> and link budget</li> </ul> <table border="1"> <tr> <td>1 Gbps</td> <td>2.6 dB</td> <td>220 meters (722 feet)</td> </tr> </table> <p><i>Link Rate</i>      <i>Link Budget</i>      <i>Unrepeated Distance</i></p>	1 Gbps	2.6 dB	220 meters (722 feet)
1 Gbps	2.6 dB	220 meters (722 feet)		

# 10 Gigabit Ethernet LR cabling

LR= Long reach 1310 nm transceiver



Connector



SC Duplex SM

- **Exclusive to z990 and z890**
- **Refer to session G27 for details on link budgets.  
Date: Nov. 3, Time: 2:50 P.M., Location: Same**

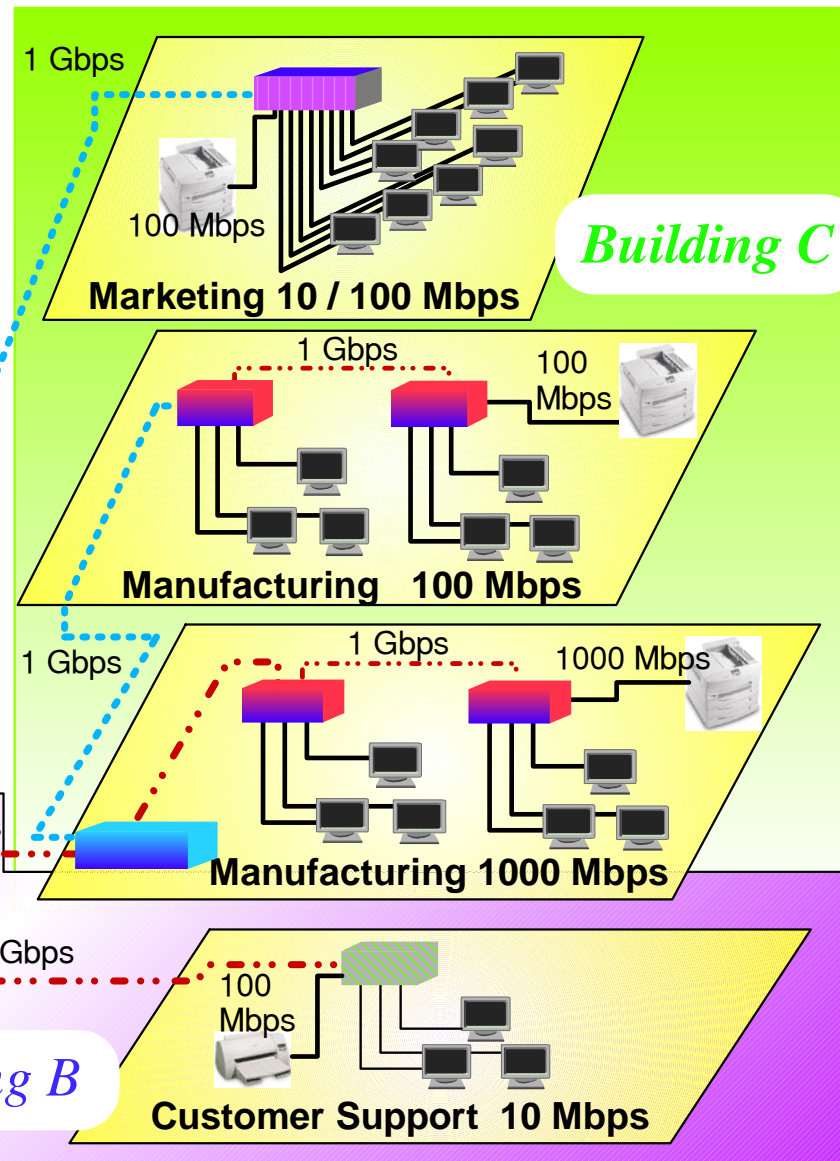
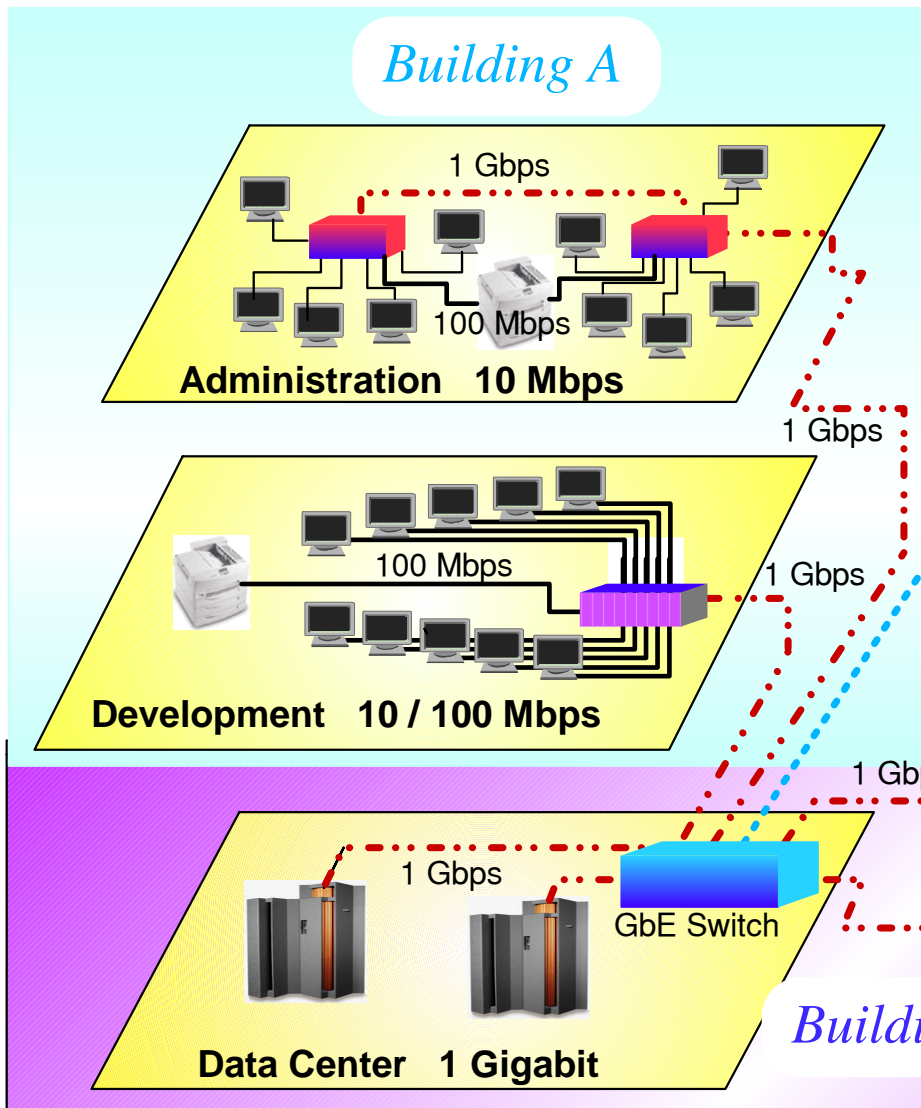
## z990, z890 connectors and fiber optic cabling

Feature Code	Feature Name	Connector Type	Cable Type
2364	OSA-Express GbE LX	SC Duplex	9 micron SM
2365	OSA-Express GbE SX	SC Duplex	50, 62.5 micron MM
2366	OSA-Express Fast Ethernet	RJ-45	Category 5 UTP
2367	OSA-Express Token Ring	RJ-45	STP or UTP
<hr/>			
1364	OSA-Express GbE LX	LC Duplex	9 micron SM
1365	OSA-Express GbE SX	LC Duplex	50, 62.5 micron MM
1366	OSA-Express 1000BASE-T Ethernet	RJ-45	Category 5 UTP
<hr/>			
3364	OSA-Express2 GbE LX	LC Duplex	9 micron SM
3365	OSA-Express2 GbE SX	LC Duplex	50, 62.5 micron MM
3368	OSA-Express2 10 GbE LR	SC Duplex	9 micron SM

SM = Single mode fiber, MM = Multimode fiber  
 LX = Long wavelength transceiver, LR = Long Reach transceiver  
 SX = Short wavelength transceiver  
 UTP = Unshielded Twisted Pair, STP - Shielded Twisted Pair

# Ethernet Coexistence

- ⋯⋯⋯ = SM fiber
- ⋯⋯⋯ = MM fiber
- = 1000 or 100 Mbps, Category 5 copper
- = 10 Mbps, Category 3 copper



# IEEE 802.3ae Ethernet specification

- The following chart summarizes the unrepeated distances and link loss budgets supported by the standards. The link loss budget is the channel insertion loss plus the unallocated link margin as identified by the standard.
  - ▶ Ethernet physical layer specification (IEEE 802.3)
  
- As a light signal traverses a fiber optic cable, the light signal loses strength
  - ▶ dB (decibel) is the metric used to measure the signal strength (loss or gain)
  - ▶ The Link loss budget identified in the following slides is represented in dBs.
  
- Factors that contribute to the loss of signal strength
  - ▶ Number of connections (conversion kits, MCP cables, jumpers, trunks, patch panels)
  - ▶ Length of the fiber optic cable
  
- **All industry standard links (FICON, FCP, Ethernet) follow published standards.**



# Ethernet physical layer specification (IEEE 802.3ae)

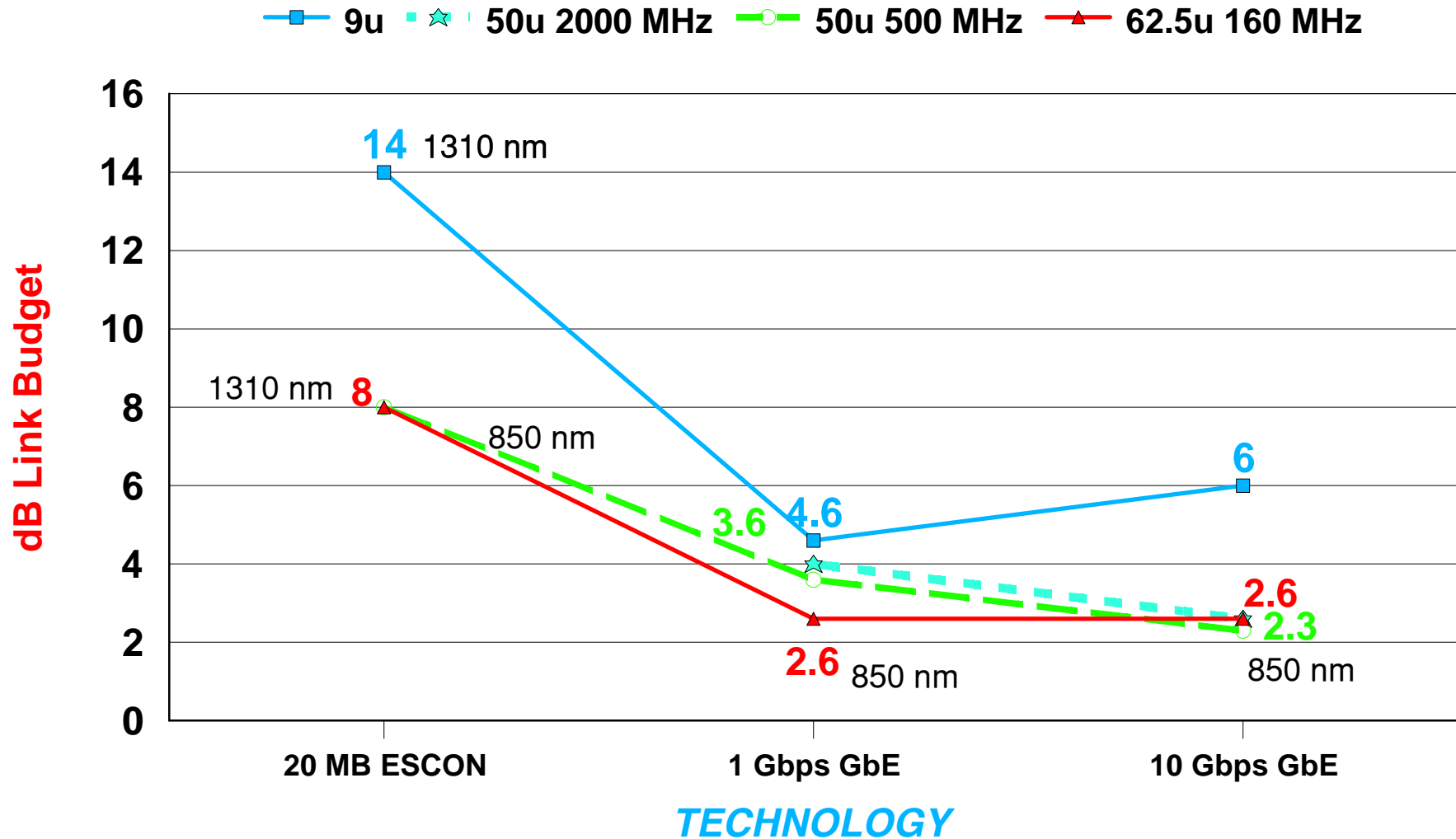
	Nanometer (nm)	1 Gigabit Ethernet /sec	10 Gigabit Ethernet /sec
Fiber Core Microns Light Source	Fiber Bandwidth @wavelength	Unrepeated distance	* Link loss budget
9 micron SM LX laser	@ 1310 nm	5 km 3.1 miles	4.6 dB
9 micron SM LX laser with MCP cable 50 or 62.5 micron	500 MHz km	550 meters 1804 feet	2.4 dB
<b>NEW</b> 50 micron MM SX laser	2000 MHz km @850 nm	Manufacturers guarantee to be equal or better than standard 50 um fiber (not yet qualified by IBM)	300 meters 984 feet
50 micron MM SX laser	500 MHz km @850 nm	550 meters 1804 feet	3.6 dB
62.5 micron MM SX laser	200 MHz km @ 850 nm	275 meters 902 feet	2.6 dB
62.5 micron MM SX laser	160 MHz * km @850nm	220 meters 722 feet	2.6 dB

\* The **link loss budget** is the channel insertion loss + unallocated link margin as defined by the standard.

\*\* The new aqua 2000 MHz km multimode fiber became available September, 2003.

\*\*\* Most often applicable to currently installed ESCON environments

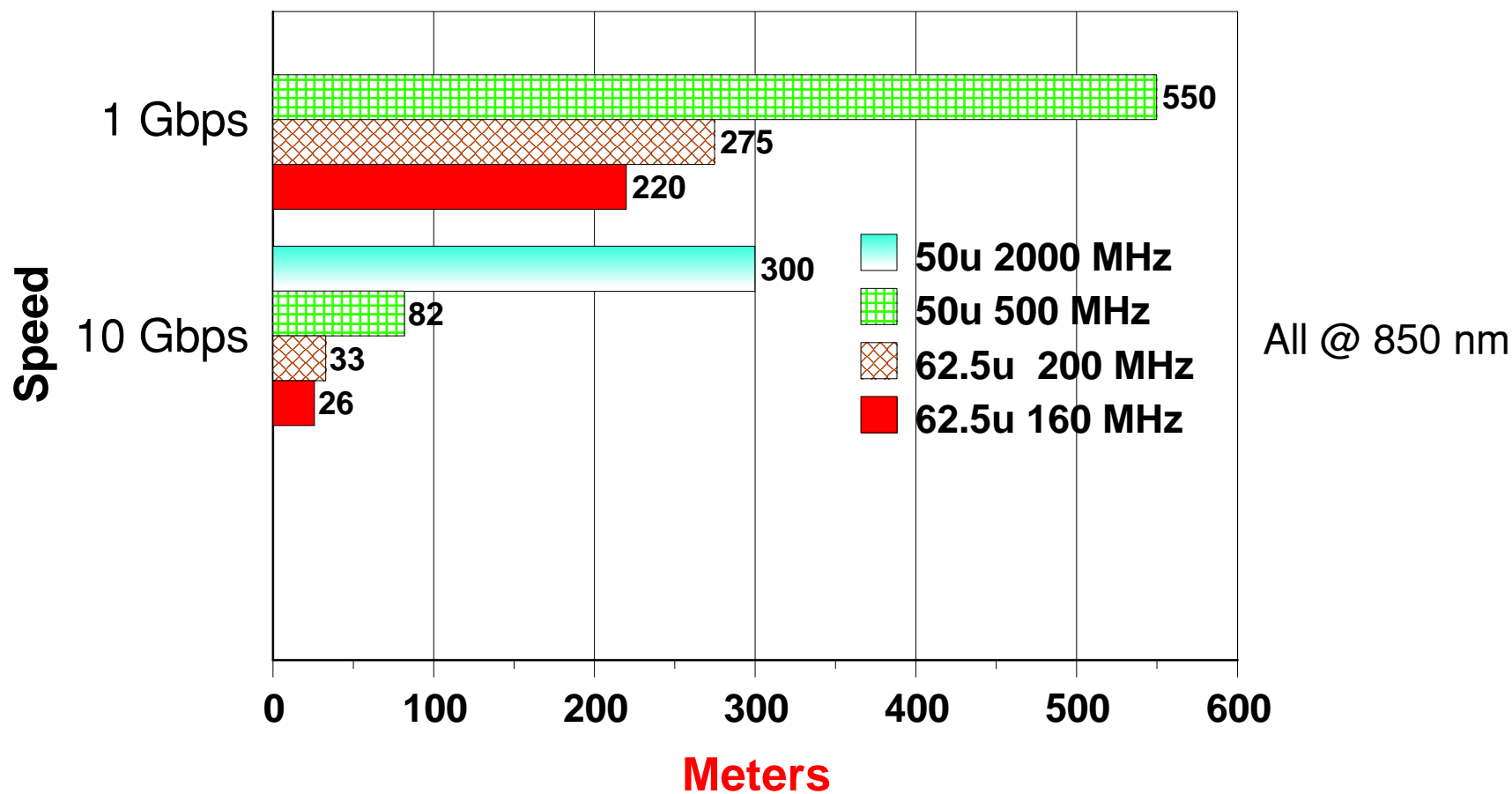
# Gigabit Ethernet link loss budget at high data rates



# Gigabit Ethernet distances when using multimode fiber optic cabling

1 and 10 Gbps = 9u @1310nm - - - 10,000 meters (10 km)

**Compare using 9u single mode fiber = 10,000 meters** →



## More information on the www

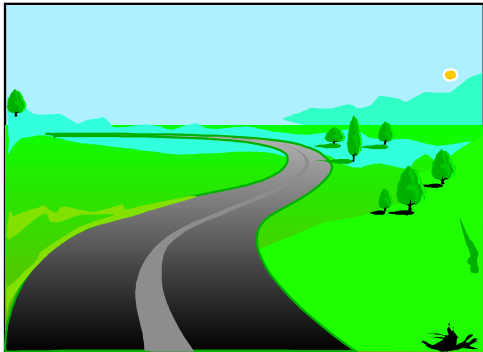
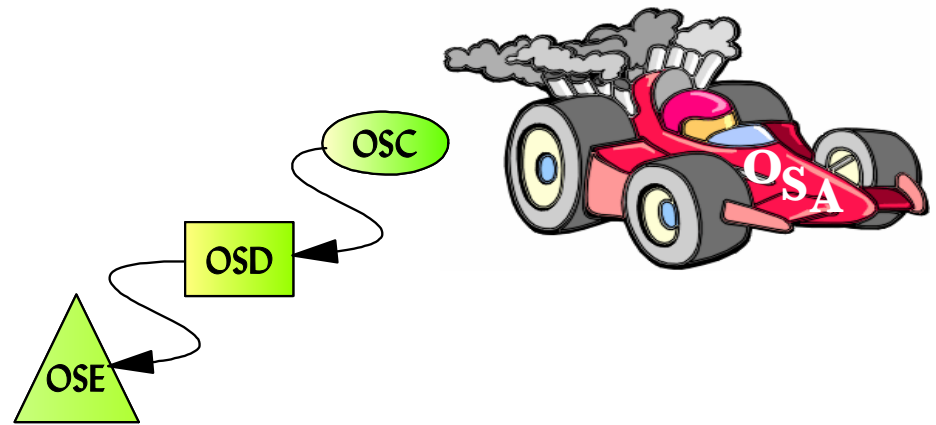
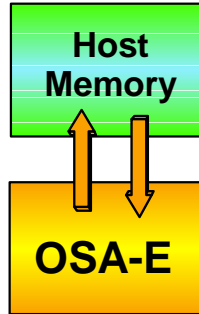
- Visit <http://www.ibm.com/wwoi> where you can find
  - ▶ Announcement letters for z990, z890
  - ▶ Sales manuals for z990, z890
- Refer to the October 7, 2004 announcement letter for more details about OSA-Express2 and the newly announced functions.
- The *sales manual* includes:
  - ▶ All of the software requirements
    - For OSA-Express2 and OSA-Express and all of the functions that have been introduced on z990 and z890 over time
    - Feature descriptions including minimums, maximums, limitations, etc.



# zSeries Expo

Nov. 1 - 5, 2004

Miami, FL



# Thank you!

## This is Session # G13

# Direct SNMP Support - Updated module

## ■ Updated Direct SNMP MIB module for z800, z900, z890, z990

- ▶ Gigabit Ethernet features, 1000BASE-T Ethernet feature
- ▶ Logical Channel Subsystems (LCSSs)
- ▶ Updated performance table with more detailed information
- ▶ Get, GetNext, Traps, Set

## ■ OSA-Express Direct SNMP MIB module is available via Resource Link

- ▶ Resource Link is set up to house multiple copies of the MIB in anticipation of version or release changes/updates.

## ■ To retrieve the MIB follow these steps:

- ▶ Locate Resource Link at: [www.ibm.com/servers/resourcelink](http://www.ibm.com/servers/resourcelink)
- ▶ Log in
- ▶ Click on Library (on the bottom of the page or the left in the navigation bar)
- ▶ Under "Library shortcuts" on the right side of the screen, click on "Open System Adapter (OSA) Library"
- ▶ Choose "OSA-Express SNMP Direct MIB Module" for a description, or click on "TXT" for the module itself

## ■ Another technique:

- ▶ Once logged on, select "site search" from the navigation bar on the left of the screen
- ▶ Type in "MIB" as the search argument, and hit submit at the bottom of the page

# OSA New Builds and Upgrades

Features on z900 (12/00) and z800 (03/02)	z890 , z990 Upgrade	z890, z990 New Build
<b>OSA-Express</b>	<b>OSA-Express</b>	<b>OSA-Express</b>
<i>All carried forward from z900 - - - &gt;</i>		
<b>2367</b> Token Ring	<b>2367</b> Token Ring	<b>2367</b> Token Ring
<b>2366</b> Fast Ethernet	- - > Carried forward - - - >	<b>1366</b> 1000BASE-T Ethernet
<b>2365</b> Gigabit Ethernet SX	- - > Carried forward - - - >	<b>1365</b> Gigabit Ethernet SX
<b>2364</b> Gigabit Ethernet LX	- - > Carried forward - - - >	<b>1364</b> Gigabit Ethernet LX
<b>2363</b> 155 ATM MM	Offered as RPQ 8P2258 (z990)	Not offered
<b>2362</b> 155 ATM SM	Offered as RPQ 8P2258 (z990)	Not offered
<b>OSA-2</b>	<b>OSA-2</b>	<b>OSA-2</b>
<b>5201</b> Converted to either <b>2366</b> or <b>2367</b>	<b>5201</b> Converted to either <b>2367</b> or <b>1366</b>	<b>5201</b> Converted to either <b>2367</b> or <b>1366</b>
<b>5202</b> FDDI (not offered on z800)	Not offered	Not offered

# On the Internet

- IBM Resource Link, Web-based tool
  - ▶ [www.ibm.com/servers/resourcelink/](http://www.ibm.com/servers/resourcelink/)
    - Services section: zSeries Fiber Cabling Service
    - Planning section/Physical Planning
      - Physical Planning manuals, GIM
    - Education section: zSeries courses (z800, z900)
      - General Information for Planning a Physical Site (GIM)
- <http://www.ibm.com/services/networking/>
  - ▶ Product and Enterprise cabling offerings
- <http://www.redbooks.ibm.com>
  - ▶ IBM Redbooks
- <http://www.ibm.com/servers/eserver/zseries/networking>
  - ▶ The network connectivity home page
- <http://www.ibm.com/servers/eserver/zseries/connectivity>
  - ▶ The I/O connectivity home page
  - ▶ Go to this location for a list of FICON/FCP supported devices
- <http://www.ibm.com/wwoi>
  - ▶ Announcement Letters, sales manual





# On the Internet

- IBM Resource Link
  - ▶ [www.ibm.com/servers/resourcelink/](http://www.ibm.com/servers/resourcelink/)
  - ▶ A fiber optic cabling presentation with narrative is available
  - ▶ Covers ISCs, ETR, ESCON, FICON/FCP, OSA
  - ▶ Overview of each feature with fiber optic cabling requirements
  - ▶ FQC, Conversion kits, MCP cables
  - ▶ Extended distance implications
  - ▶ IBM Networking Services
    - zSeries fiber cabling services
    - Enterprise fiber cabling services
  - ▶ You can locate the Fiber Optic Cabling presentation on Resource Link and subscribe to receive updates.
    - After logging in click on Education in the blue on the left.
    - Under zSeries Courses click on z990.
    - Click on Fiber Optic Cabling.

# On the Internet

URL	Content
<a href="http://www.ibm.com/eserver/zseries/networking">http://www.ibm.com/eserver/zseries/networking</a>	zSeries Networking
<a href="http://www.ibm.com/eserver/zseries/networking/technology.html">http://www.ibm.com/eserver/zseries/networking/technology.html</a>	Networking white papers and information
<a href="http://www.ibm.com/software/network">http://www.ibm.com/software/network</a>	Networking & communications software
<a href="http://www.ibm.com/software/network/commserver">http://www.ibm.com/software/network/commserver</a>	Communications Server
<a href="http://www.ibm.com/software/network/commserver/library">http://www.ibm.com/software/network/commserver/library</a>	CS white papers, product documentations
<a href="http://www.ibm.com/support/techdocs/">http://www.ibm.com/support/techdocs/</a>	Advanced technical support (flashes, presentations, white papers)
<a href="http://www.rfc-editor.org/rfcsearch.html">http://www.rfc-editor.org/rfcsearch.html</a>	Request For Comments (RFC)
<a href="http://www.ibm.com/servers/eserver/zseries/networking/dsnmp.html">http://www.ibm.com/servers/eserver/zseries/networking/dsnmp.html</a>	Direct SNMP Subagent MIB

# OSA-Express LAN Transmission Matrix

OSA-Express Feature	Auto-sense	Auto-negotiate	Operating Mode	Frame Size
Gigabit Ethernet	YES	YES	Full Duplex	802.3: 1492 bytes DIX: 1492 bytes Jumbo: 8992 bytes
1000BASE-T Ethernet Fast Ethernet	NO	YES	Full Duplex Half Duplex	802.3: 1492 bytes DIX: 1492 bytes
Token Ring	YES	N / A	4 Mbps: Half/full duplex 16 Mbps: Half/full duplex 100 Mbps: Full duplex	4 Mbps: 4550 bytes 16/100 Mbps: 18200

# OSA reference materials

SA22-7935	z890 and z990 Open Systems Adapter-Express Customer's Guide and Reference
SA22-7990	OSA-Express Integrated Console Controller User's Guide
SA22-7476	z800, z900 Open Systems Adapter-Express Customer's Guide and Reference
SA22-7403	S/390 OSA-Express Customer's Guide and Reference (G5/G6)
GA22-7477	Planning for the Open Systems Adapter-2 for zSeries
SG24-5948	S/390 OSA-Express Implementation Guide (Redbook)
SG24-5444	IBM eServer zSeries Connectivity Handbook (Redbook)
SG24-5443	S/390 OSA-Express Gigabit Ethernet Implementation Guide (Redbook)
GX28-8002-10	Network and e-business Products Reference booklet (Redbook)
SG24-4770	Open Systems Adapter 2 Implementation Guide (Redbook)
SC28-1950-04	OS/390 Resource Measurement Facility Report Analysis
G221-0110	OSA-Express for IBM eServer zSeries 900 and S/390 Specification Sheet
GA23-0367-07b	Planning for Fiber Optic Links (ESCON, FICON, Coupling Links, and Open Systems Adapters)
Look in CS library	For a complete description of the SNMP management data supported by OSA-Express features: z/OS Communications Server: IP Configuration Guide and the SNMP chapter of IP System Administrator's Commands

# OSA-Express VLANs

VLAN support	Linux on zSeries	z/OS	z/VM
OSA-Express	Yes, IPv4, IPv6	Yes, V1.5 IPv4, IPv6	yes, V4.4 - - IPv4 yes, V5.1 - - IPv6
z/VM guest LAN	Yes, IPv4	Yes, IPv4	yes, IPv4
<b>IPv6 support</b>			
OSA-Express	Yes	Yes , V1.4	No
z/VM guest LAN	Yes, z/VM V4.4	Yes, z/VM V4.4	Yes, V4.4
<b>Broadcast support</b>			
OSA-Express	Yes, IPv4	Yes, IPv4	Yes, IPv4
z/VM guest LAN	Yes, IPv4	Yes, IPv4	Yes, IPv4