Enterprise Storage Server
Native FICON Technical Overview

IBM
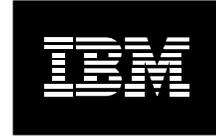
Steve West ATS - Storage Systems **Harv Emery** ATS - Enterprise Systems	**08/15/01**

LX Laser

Core
9 micron diameter

Cladding
125 micron diameter

Outer coating
250 micron diameter

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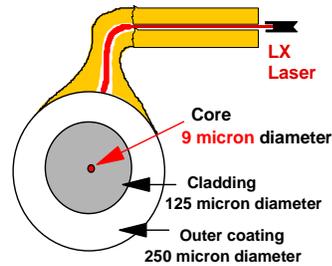
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IBM®	**Enterprise Storage Server**
zSeries	**iSeries**
zSeries 900	**pSeries**
z/OS	**AS/400®**
z/Architecture	**RS/6000®**
OS/390®	**RMF**
S/390®	**FICON**
PR/SM	**ESCON®**
MVS/ESA	**FlashCopy**
DFSMS/MVS®	**XRC**
VM/ESA	**PPRC**
z/VM	**PAV**
VSE/ESA®	**TotalStorage**

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ESS Native FICON and iSeries Enhancements Technical/Sales Education Teleconference Series

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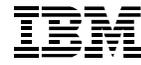
- Five 1.5 Hour Training Modules with Q & A

- Target Audience
  - Storage/zSeries/iSeries
  - FTSS, Techline, Supportline, ATS, System Assurance Coordinators, Business Partners, and Sales Specialists

- Sessions
  - Aug 15   ESS Native FICON Technical Overview
  - Aug 22   ESS Native FICON Configuration & Planning
  - Aug 29   ESS Native FICON Performance & FICON Sizing Estimation
  - Sept 5   ESS with iSeries: Planning and Implementation
  - Sept 12   Native FICON Directors: Planning and Implementation

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Topics

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ESS 2105 Native FICON

HIGHLIGHTS

- Preview Announcement 10/03/00

- Up to 16 **FICON** Ports per ESS

- SCSI / **ESCON** / FCP / **FICON** Intermix

- Supported on Models F10, F20

- Available on new ESSs or as a Field Upgrade
  - **Field Upgrade: non-disruptive ucode load**

- Long Distance Attachment
  - **Up to 10 km direct attach (20 km w/RPQ)**
  - **Up to 100 km with repeaters (no data rate droop)**

- Channel Consolidation reduces cabling infrastructure
  - **Up to 8:1 ESCON-to-FICON (4:1 typical)**

- CCW Pipelining & frame Multiplexing

Performance Highlights

- Data Transfer Rate
  - **FICON: 100MB/s full duplex**
  - **ESCON: 18MB/s half duplex**
- Effective Throughput
  - **60-65 MB/s vs 10-13 MB/s**
- 2.5X Single Stream Sequential Throughput Improvement

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ESS Enhancements

- **Native FICON Attachment**
  - **FC 9909 (administrative only)**
  - **zSeries 900 & 9672 G5/G6**
  - **Direct or Switched**

- **3 New ESS Host Adapters**
  - **Fibre Channel / FICON (long wave)**
    - **FC 3021**
    - **Commonly used for FICON**
    - **1 Port per Card**
  - **Fibre Channel / FICON (short wave}**
    - **FC 3023**
    - **Commonly used for FCP (Open)**
    - **Enhanced Performance**
    - **1 Port per Card**
  - **Enhanced ESCON**
    - **FC 3012**
    - **2 Ports per Card**

- **Field MES to Add New Host Adapters**
  - **F10 / F20 Models Only**

- **ESS Specialist Configuration**
  - **3 New Panels for FICON**

- **24 GB Cache**
  - **FC 4005**

- **Machine Reported Product Data**
  - **Storage Capacity Upgrade on Demand**
  - **ESS Configuration Information**

- **Additional Server Support**
  - **FlashCopy and PPRC for iSeries**

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Features: ESS Enhanced with Native **FICON** Support

Feature	Description
3012	Enhanced ESCON Host Adapter (successor to 3011)
3021	Fibre Channel / FICON (Long Wave) Host Adapter (used with 9 micron cables with single mode SC duplex connectors)
3023	Fibre Channel / FICON (Short Wave) Host Adapter (used with existing ESCON cables with mulitmode SC duplex connectors, successor to 3022)
4005	24 GB Cache (more granularity - 8, 16, **24**, 32 GB)
9909	Native FICON Attachment (necessary - administrative purposes only)

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FICON - What Is It?

- New Interface for zSeries & S/390 Attachment

- Fiber Optic Technology

- Based on Industry Standard Fibre Channel Architecture
  - FICON is a new FC-4 on Top of Standard FC-0, 1, and 2
  - Architecturely assigned the Fibre Channel name of 'FC-SB-2'

- Fully Compatible with Existing zSeries & S/390 Software
  - Software Changes (APARs/PTFs) Required to Exploit New Features

- **ESCON** Successor
  - Relieves **ESCON** Architectural Limitations
  - Will Supplement (Not Replace) **ESCON**
  - **FICON** & **ESCON** Can Coexist

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Fiber Optic Technology

For comparison purposes this is the relative size of a human hair (**@ 70 microns**)

IBM

FOSA
OSA

Multimode fiber
" Multiple paths" for the light to travel

LED
or
Light Emitting Diode

SX Laser

Core
50 or 62.5 micron diameter

Cladding
125 micron diameter

Outer coating
250 micron diameter

SC Duplex multimode

ESCON Duplex Connector

ESCON MTRJ

Single mode fiber
"Single path" for the light to travel

LX Laser

Core
9 micron diameter

Cladding
125 micron diameter

Outer coating
250 micron diameter

SC Duplex single mode

LC Duplex single mode
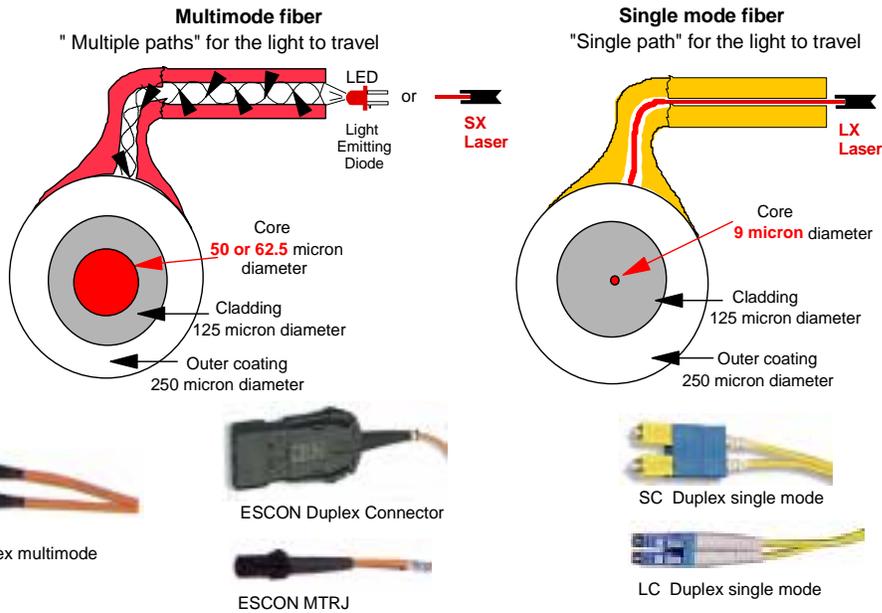
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FICON builds on Fibre Channel Standard

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FC-SB-2
FICON

	Audio / Video	IPI / **SCSI** / HIPPI / SB /	P / 802.2
FC-4 Mapping	Multimedia	IP	Channels	Networks

Upper Level Protocol (ULP)

FC-3
Common Services

FC-2 Signaling Protocol
Framing Protocol / Flow Control

FC-1 Transmission Protocol
Encode / Decode

FC-FS
FC-PI

FC-0 Interface / Media
Physical Characteristics
Single Mode Fibre / Multimode Fibre / Copper

- **FICON** (FC-SB-2) is an additional upper layer (FC-4) protocol

- **FICON** (FC-SB-2) is compatible with existing lower layers

- **FICON** (FC-SB-2) is currently in the NCITS (ANSI) standardization process
  - **http://www.t11.org**

- In "Approval Status" awaiting adoption

- Bridge protocol differs from FICON protocol

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Fibre Channel Terminology

IBM

ANSI	American National Standards Institute
FC	Fibre Channel Standard approved in 1994 (work started in 1989)
FC-0	defines physical link including cables, connectors, & optical/electrical parameters for each supported signalling rate
FC-1	transmission protocol including serial encoding and decoding rules, special characters, timing recovery, and error control
FC-2	performs the basic signaling and framing functions and defines the transport mechanism for data transfer between upper & lower layers ("ship and pray" service class)
FC-3	defines special service features including striping (multiple paths), hunt groups (multiple ports can respond), multicast (1 source, many targets)
FC-4	maps other networking protocols to lower layers, i.e., personalization for FICON-SB-2
FC-FS	Fibre Channel Framing & Signaling Interface - Fibre Channel layers 0-2
FC-PI	Fibre Channel - Physical Interface - Fibre Channel layers 0-2
FC-SB-2	Fibre Channel Single Byte (command set) version 2
NCITS	National Committee for Information Technology Standards
T11	Technical Committee T11

FICON Architectural Characteristics

IBM

- **Topology: Point-to-Point or Switched Point-to-Point**
  - Single FICON Director

  xxx Channel to channel or channel to control unit

- **Class of Service: Primarily FC Class 3**

- **CCW Pipelining and Frame Multiplexing**
  - Asynchronous command execution
  - Concurrent IOs

- **Distance: 100 KM Capability Without Data Rate Droop**
  - Point-to-Point Capability of 10 KM (RPQ for up to 20KM)

- **Data Transfer Rate: 100 MB/s full duplex**
  - Initial Implementation Approximately 60-65 MB/s (for 2:1 Read/Write Ratio)

- **Expanded Addressability**
  - CU images / CU
  - Unit addresses / channel
  - Unit addresses / CU
  - CU logical paths / CU port

Why **FICON**? (distance, throughput)

IBM

- ■ Increased distance (non-repeating distance)
  - ● **ESCON** up to 3km - **FICON** up to 10km (20km with RPQ)

- ■ Increased distance (before data rate droop)
  - ● **ESCON** up to 9km - **FICON** up to 100km

- ■ Increased architected bandwidth
  - ● **ESCON** 18MB/s (half duplex) - **FICON** 100MB/s (full duplex)

- ■ Increased effective bandwidth (sequential)
  - ● **ESCON** 10-13MB/s - **FICON** 60-65MB/s

- ■ Increased operations/second/channel (4KB/IO)
  - ● **max : ESCON** 1100 - **FICON** 4400
  - ● **for resonable Response Time : ESCON** 250-500 - **FICON** 2000-3000

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Why **FICON**? (i/os, images, unit addresses, paths)

IBM

- ■ Increased number of concurrent I/O operations
  - ● **ESCON** supports 1 - **FICON** supports mulitple

- ■ Increased number (architected) CU images / CU
  - ● **ESCON** supports 16 - **FICON** supports 256

- ■ Increased number unit addresses / channel
  - ● **ESCON** supports 1024 - **FICON** supports 16384
  - ● ESCON can only support 1k of the ESS 4k devices
  - ● FICON can support 4 maximum configured ESSs

- ■ Increased number (architected) unit addresses / CU
  - ● **ESCON** supports 4K - **FICON** supports 64K

- ■ Increased number logical paths / CU port
  - ● **ESCON** supports 64 - **FICON** supports 256   error statement

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Why **FICON**? (fewer chpids)

IBM

- ■ Fewer host CHPIDs, i.e., **ESCON** to **FICON** aggregation
    - − replace 8 **ESCON** with 1 **FICON** if low (<25% avg) **ESCON** utilization
    - − replace 4 **ESCON** with 1 **FICON** if medium (about 50% avg) **ESCON** utlization
    - − replace 2-3 **ESCON** with 1 **FICON** if high (>75% avg) **ESCON** utlization

    NOTE: The above guidelines are for 9276 G5/G6 channels and result from the "rule of thumb" that a single FICON channel can accomodate ESCON channels that sum up to 200% average channel utilization. If a z900, then the single FICON channel can accomodate ESCON channels that sum up to 300% average channel utilization.

FICON vs. **ESCON**

IBM

	FICON	ESCON
Link Rate	1.0625 Gbits/s	200 Mbits/s

Effective Data Rate
   Architected
   Implemented
	
	100 MB/s Full Duplex
	60-65 MB/s
		
		18 MB/s Half Duplex
		10-13 MB/s

Max Distance w/o Repeat	10 KM (20 KM w/RPQ)	3 KM
Max Distance w/o Droop	100 KM	9 KM
Frame Transfer Buffer	128 KB	2 KB

CU Images / CU
   Architected
   Implemented
	
	256
	16
		
		16
		16

UAs / Channel
   Architected
   Implemented
	
	16M
	16K
		
		1M
		1K

UAs / Control Unit
   Architected
   Implemented
	
	64K
	4K
		
		4K
		4K

Logical Paths / CU Port	256	64
Command Execution	Nonsynchronous	Synchronous

ESCON Channel Program Processing

ESCON Command and Data Transfer

Channel	Control Unit	Device
CCW1	CCW1 → CCW1	CCW1
	CE/DE ←	End
CCW2	CCW2 → CCW2	CCW2
	CE/DE ←	End
CCW3	CCW3 → CCW3	CCW3
	CE/DE ←	End
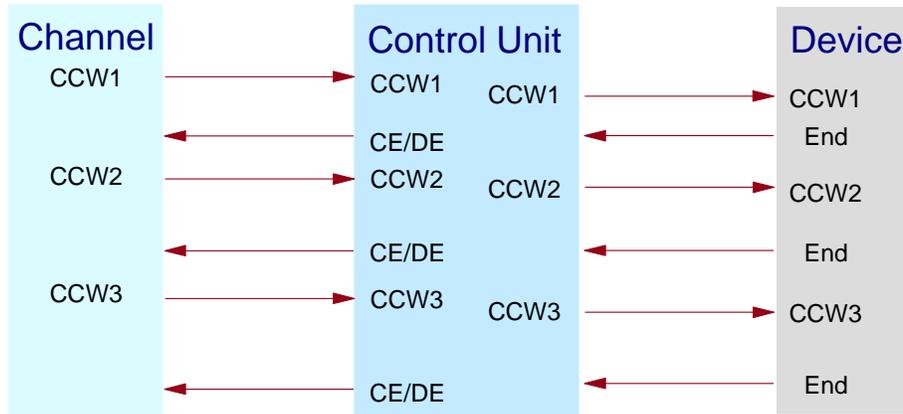
*** error - from the channel, not to the channel

ESCON Frames

Server

ESCON Channel

Half duplex

ESCON Director

ESCON Frame

B

- CU-A
- CU-B
- CU-C
- CU-D

ESCON Control Units
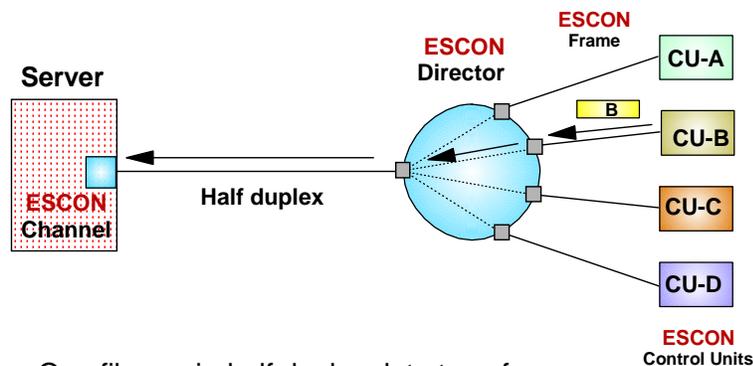
- One fiber pair; half duplex data transfer
- 18 MB/sec maximum data transfer
- Only **one** concurrent I/O operation at a time per **ESCON** channel
- Do not intermix small and large block data transfers
- Logically daisy-chained control units to a single channel take turns

FICON Channel Program Processing

FICON Command and Data Transfer

FC Channel	Control Unit	Device
CCW1	CCW1	CCW1
CCW2	CCW2	End
CCW3	CCW3	CCW2
CCW4	CCW4	End
CCW5	CCW5	
CCW6	CCW6	CCWn
- - - -	- - - -	End

CCW1
CCW2
CCWn

CMR (I/O operation started at CU)

Ending status (I/O operation ended at CU)

CE/DE

good text

FICON Frames

G5/G6, z900

FICON/FC Director

FICON Frames

FICON Control Units

FICON Channel

FICON Frames

Full Duplex

CU-A

CU-B
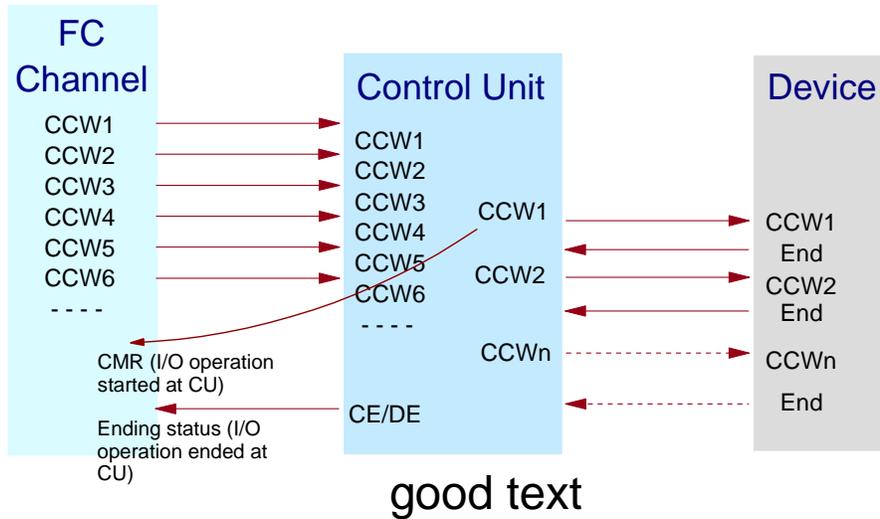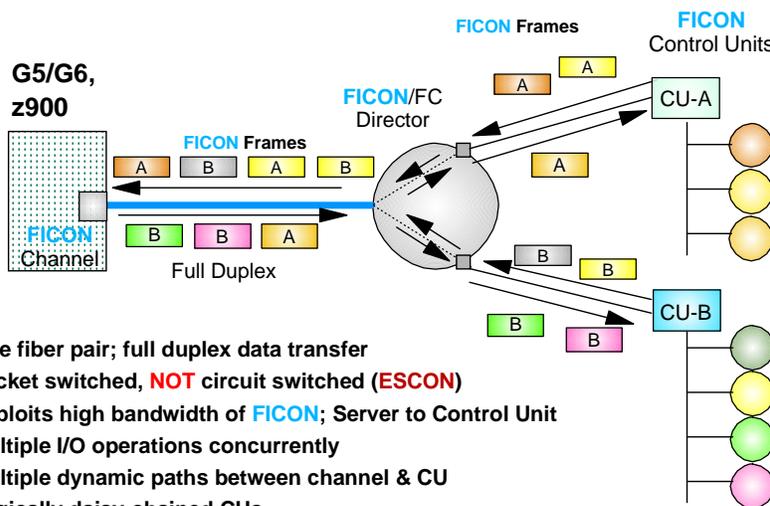
- One fiber pair; full duplex data transfer
- Packet switched, **NOT** circuit switched (**ESCON**)
- Exploits high bandwidth of **FICON**; Server to Control Unit
- Multiple I/O operations concurrently
- Multiple dynamic paths between channel & CU
- Logically daisy-chained CUs
  - ► Multiple operations at a time from / to each CU

*** error - an I/O operation must complete before circuit switchs

FICON Performance Highlights

- Performance goals achieved or exceeded (team continuing to tune)
- Maximum IOs/sec per host channel for **z900:**
  - 4400 IOs/sec (single CU host adapter)
  - 5700 IOs/sec (two logical daisy-chained host ESS adapters)
- Up to 74 MB/sec read sequential bandwidth per host channel
  - two logically daisy-chained ESS CUs
- Single stream sequential 2.5 X improvement
  - 38 MB/sec!! Depends on RAID-5 . . .
- Response time improvements for large block data
- Director port busy eliminated, reducing pend time
- Single **FICON** channel can tap RAID rank bandwidth
- Synergy with I/O priority queuing in the host adapter
- Data rate droop eliminated up to 100 km

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ESS / FICON Performance Advantage

- **FICON** Allows Multiple Concurrent Data & Command Transfers
- PAVs Allow Multiple Concurrent I/Os, Same Volume, Same Time, Same Host
- PAVs & **FICON** Multiple Data Transfers - Same Volume, Same Time, Same Host, Same Channel
- **FICON**, RAID-5, Serial Disk, Priority I/O Queuing and PAVs Combine in ESS for High-Speed Multiplexed Operations
- ESS Provides Greater Parallelism and Bandwidth than Other Technologies

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3590 A60 FICON: Product Description

- Up to two **FICON** Long Wave or Short Wave ports per A60
  - Attaches to **FICON** channels on 9672 G5/G6, or zSeries servers or to **FICON** Directors
  - Works with SCSI or Fibre Channel attached 3590 drives

- Error stated FICON attached

- **ESCON**/**FICON** intermix
  - One **FICON** and 2, 4, or 6 **ESCON** ports
  - Two **FICON** and 2 or 4 **ESCON** ports

- Higher performance
  - Up to 60 MB/sec total throughput for four 3590 E drives attached to an A60 with one **FICON** port for blocksizes greater than 32KB

- Attachment distance
  - **FICON** Long Wave: Up to 10 km direct attach (20 km w/RPQ) or up to 100 km attach with **FICON**/FC director and appropriate repeaters
  - **FICON** Short Wave: Up to 500 meters direct attach
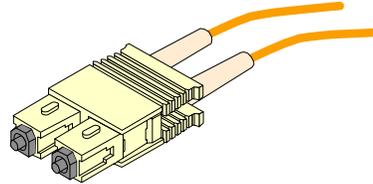
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A60 Native FICON: Feature Codes

- **FICON**: Long Wave - 3432
  - **FICON** adapter card with SC duplex connector
  - Includes 31 meter, SM, 9 micron cable with SC duplex connectors (not shipped when 0103/0106 is ordered)

- MCP Cable Feature
  - 0103 (50 micron) & 0106 (62.5 micron)
  - Allows customer to use current **ESCON** infrastructure (total cable length < 550 meters)

- Feature Conversion from 3412 to 3432
  - Allows customer to replace **ESCON** adapter with **FICON** adapter at a reduced price

- **FICON**: Short Wave - 3433
  - **FICON** adapter card with SC duplex connector
  - Includes 31 meter, MM, 50 micron cable with SC duplex connectors (not shipped when 0109 is ordered)

- ESCON/62.5 micron Multimode SC duplex jumper: 0109
  - Allows customer to use current **ESCON** infrastructure (total cable length < 250 meters)

- Feature Conversion from 3412 to 3433
  - Allows customer to replace **ESCON** adapter with **FICON** adapter at a reduced price

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9672 G6 System Structure

ETR

STI   Processor Set   STI

MBA 0

| PU0 | PU1 | PU2 | PU3 | PU4 | PU5 | PU6 |
| L1 | L1 | L1 | L1 | L1 | L1 | L1 |

MBA 1

Clock

8 MB L2 Shared Cache

Crypto 0   **Crypto 1**

Memory card 0   **Memory card 2**

8 MB L2 Shared Cache

| PU7 | PU8 | PU9 | PUA | PUB | PUC | PUD |
| L1 | L1 | L1 | L1 | L1 | L1 | L1 |

MBA 3

MBA 2

(CP0)   **(CP1)**

Processor Set   333Mbs   STI

STI

ESCON
Parallel
OSA
ISC
FICON

Parallel
ESCON   ISC
OSA   FICON

I/O Cage (x 3)

CUs, Switches, Networks, CFs

FICON Channel   **FICON Fiber**   **Gb Ethernet Channel**   **Ethernet Fiber**

IC Channel

ICB Channel
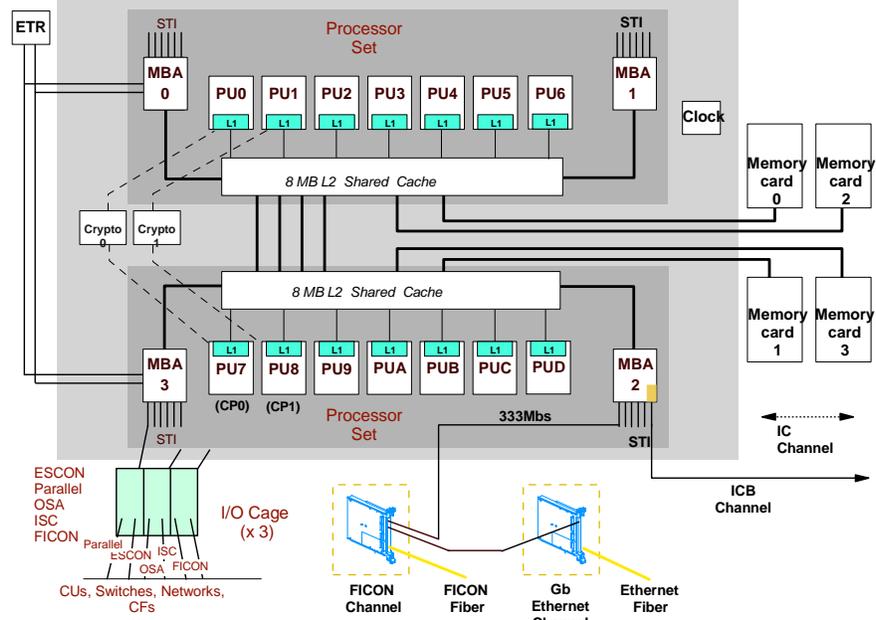
9672 FICON Feature

- **Two feature types (LX/SX)**
- **One port (CHPID) per feature**
- **Rigid plugging rules exist**
- **Minimum of _zero_ features**
- **Maximum of 24 for G5 or 36 for G6**
- **Two different code loads**
  - **FICON** Bridge - FCV (LX only!)
  - Native **FICON** - FC (LX/SX)
- **Partitions can share FICON channel (EMIF)**

- **FICON LX (long wavelength) - 2314**
  - 9 micron, SM fiber at long distance
  - 50, 62.5 multimode fiber at reduced distances requires MCP cables

- **FICON SX (short wavelength) - 2316**
  - ➤ Supports 50, 62.5 micron, MM fiber
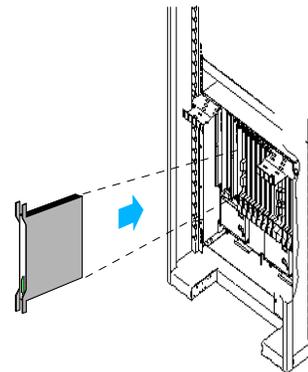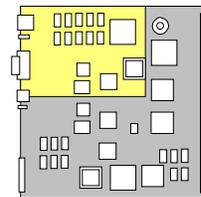
G6 FICON Channel Locations

Rear View


9672 CPC Cage

MCM

STI 10 STI 9 STI 15 STI 16

2 4 6 20   1 3 5 19   26 28 30   25 27 29

Install Seq Number

6+2
#6 Moved

06 07 08 25   31 32 33 34   11 10 29   26 27 28
F8 F9 FA FB   FC FD FE FF   E0 E1 E2   E4 E5 E6

I/O Slot Number
CHPID Number

STI 12   STI 11   STI 17   STI 18

8 10 12 22   7 9 11 21   32 34 36   31 33 35

Install Seq Number

6+2
12 Moved

06 07 08 25   31 32 33 34   11 10 29   26 27 28
F0 F1 F2 F3   F4 F5 F6 F7   D8 D9 DA   DC DD DE

STI 14   STI 13

14 16 18 24   13 15 17 23

6+2
#18 Moved

06 07 08 25   31 32 33 34
E8 E9 EA EB   EC ED EE EF

I/O Slot Number
CHPID Number

---

z900 Logical Structure

35 logic chips in total on a 20 PU MCM

ETR ETR

STI

Cluster 0

MBA 1

PU00 PU01 PU02 PU03 PU04 PU05 PU06 PU07 PU08 PU09

MBA 0

L1 L1 L1 L1 L1 L1 L1 L1 L1 L1

Cache control Chip and cache data Chips
16 MB L2 Shared Cache

Crypto 0
Crypto 1

Clock

Memory card 0   Memory card 2

Cache control Chip and cache data Chips
16 MB L2 Shared Cache

Memory card 1   Memory card 3

L1 L1 L1 L1 L1 L1 L1 L1 L1 L1

MBA 2

PU0A PU0B PU0C PU0D PU0E PU0F PU10 PU11 PU12 PU13

MBA 3

ICB 333 Mbyte/s

STI

Cluster 1

STI

ICB-3 1 Gbyte/s

Parallel 3/4 Port
OSA-2 TR 2 port
OSA-2 FDDI 1 port
ESCON 4 Port

333 Mbyte STIs

Compatibility cI/O Cage (Optional)

ESCON 16 Port
FICON 2 Port
OSA-E GbE 2 port
OSA-E FEN 2 port
OSA-E ATM 2 port
ISC-3 1-4 Port
PCICC 2 Processors

1 Gbyte STIs

nI/O Cage

I/O Domains - - - >   1 2 3   1 2 3 4 5 6 7

z900 **FICON** Feature (GA1)

IBM

- ■ **Two feature types (LX/SX)**
- ■ **Two ports (CHPIDs) per feature**
- ■ **Minimum of** _zero_ **features**
- ■ **Maximum of 48 features/**_96 ports_
  - ─ Max 16 features per new I/O cage
- ■ **Two different code loads**
  - ─ **FICON** Bridge - FCV (LX only!)
  - ─ Native **FICON** - FC
- ■ **Partitions can share (EMIF)**

- ■ **FICON LX (long wavelength) - 2315**
  - ─ 9 micron, SM fiber at long distance
  - ─ 50, 62.5 multimode fiber at reduced distances with MCP cable

- ■ **FICON SX (short wavelength) - 2318**
 - ➤ Supports 50, 62.5 micron, MM fiber

PCI Adapter

PCI Adapter

SC Duplex SM

SC Duplex MM

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z900 **FICON** Feature (GA2)

IBM

- ■ **Two feature types (LX/SX)**
- ■ **Two ports (CHPIDs) per feature**
- ■ **Minimum of** _zero_ **features**
- ■ **Maximum of 48 features/**_96 ports_
  - ─ Max 16 features per new I/O cage
- ■ **Two different code loads**
  - ─ **FICON** Bridge - FCV (LX only!)
  - ─ Native **FICON** - FC
- ■ **Partitions can share (EMIF)**

- ■ **FICON LX (long wavelength) - 2315**
  - ─ 9 micron, SM fiber at long distance
  - ─ 50, 62.5 multimode fiber at reduced distances with MCP cable

- ■ **FICON SX (short wavelength) - 2318**
  - ➤ Supports 50, 62.5 micron, MM fiber

PCI Adapter

PCI Adapter

SC Duplex SM

SC Duplex MM

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z900 FICON Configuration
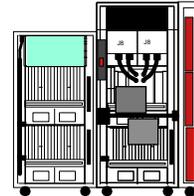

A   **Z   A**   **Z   A**

- **At least 1 New I/O cage per system (A frame, bottom)**
  - **Option of 2 additional cages in second frame (Z frame)**
    - **New I/O cage**
             or
    - **Compatibility I/O cage**
- **Maximum of 16 FICON features (cards) per New I/O cage**
  - **Two FICON channels per feature**
  - **Maximum of 48 FICON features (96 channels) per system**
- **256 maximum channel limit**

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z900 CHPID Mapping Tools

- Where: IBM Resource Link
  - www.ibm.com/servers/resourcelink/
    - Resource Link provides help in planning, installation, and maintainance of zSeries & S/390 servers and associated software

- What: **Two OPTIONAL Tools:** Availability Tool, Manual Tool
  - Assign CHPIDs independent of type or physical location
  - Remap default CHPID assignments prior to installation
  - After order is configured, received by manufacturing and manufacturing data is loaded
  - Not intended for MES channel adds after z900 install

- Output: Diskette for service to use at installation time

- Alternative: Use default CHPID assignments

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ESS **FICON** Software Positioning
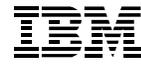
- **Releases that support ESS Native FICON**
  - **z/OS V1R1**
  - **OS/390 V2R8**
    - **Note: 3590 A60 Native FICON is supported at OS/390 V2R6**
  - **z/VM V3R1**
  - **VM/ESA V2R3**
  - **TPF V4R1**

- **Monitor PSP for required PTFs (expect updates!)**
  - **OS PSP buckets - OS390R8, ZOSV1R1, etc.**
  - **Hardware PSP buckets - 2064DEVICE, 2105DEVICE, etc.**

- **z/OS and OS/390 will require an IPL**

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ESS **FICON** CEC Positioning

- **zSeries 900**
  - **FICON Channel Features (LX-2315, SX-2318)**
  - **Driver 38 LIC with MCL005 on EC H25495**
    - ➤ **Upgrade to Driver 38 from 36 requires POR**
    - ➤ **MCL005 on EC H25495 apply requires a POR**

- **S/390 Parallel Enterprise Server G5/G6**
  - **FICON Channel Features (LX-2314, SX-2316)**
  - **Driver 26 LIC with MCL016 on EC F99907**
    - ➤ **All G5/6 should be at Driver 26 today**
    - ➤ **MCL016 on EC F99907 apply requires a POR**

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Some Valid FICON Configurations

IBM

Processor(s): G5, G6, & z900

FC   FC   FC   FC   FC   FC   FC

← FICON Cables

...

2029   2029

2029   2029

FICON Director

FICON Director

2029

FICON Director

2029

FC   FC   FC   FC   FC   FC   FC

CU   CU   ...   CU   CU   CU   CU   CU

...
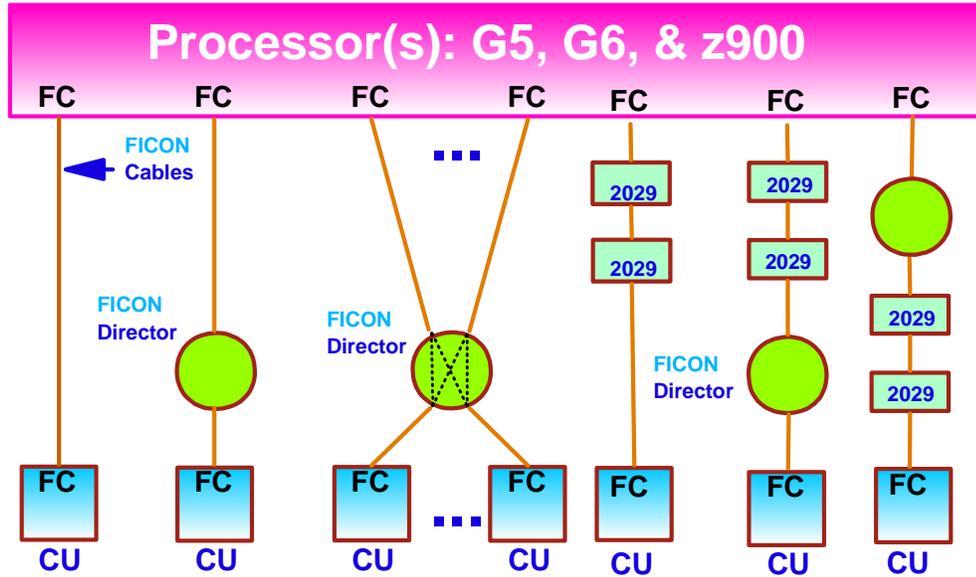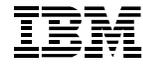
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Typical FICON Configuration

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A
S/390 G5/6

B
z900

01
FICON Director

FICON Director
02

1
ESS 2105

ESS 2105
2
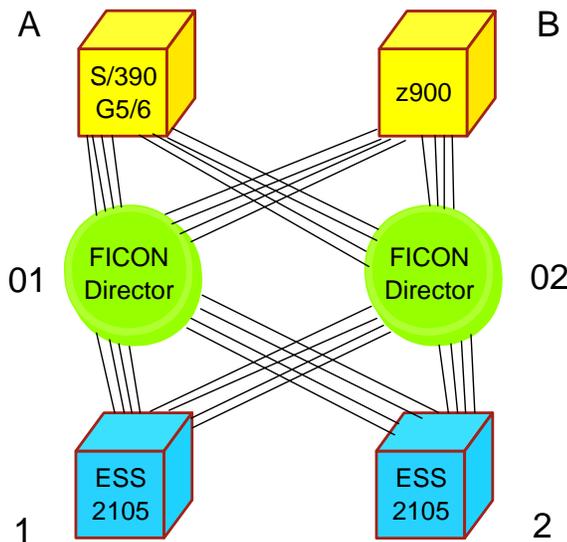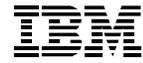
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How Many ESCONs per FICON Link?

IBM

z900

z900

8 **ESCON** Channels

2 **FICON** Channels

ESCON
Director

FICON
Director

8 Paths

2 Paths

ESCON Utilization	Mapping
Low	8 - 1
Average	4 - 1
High	2 - 1

ESS
2105

ESS
2105
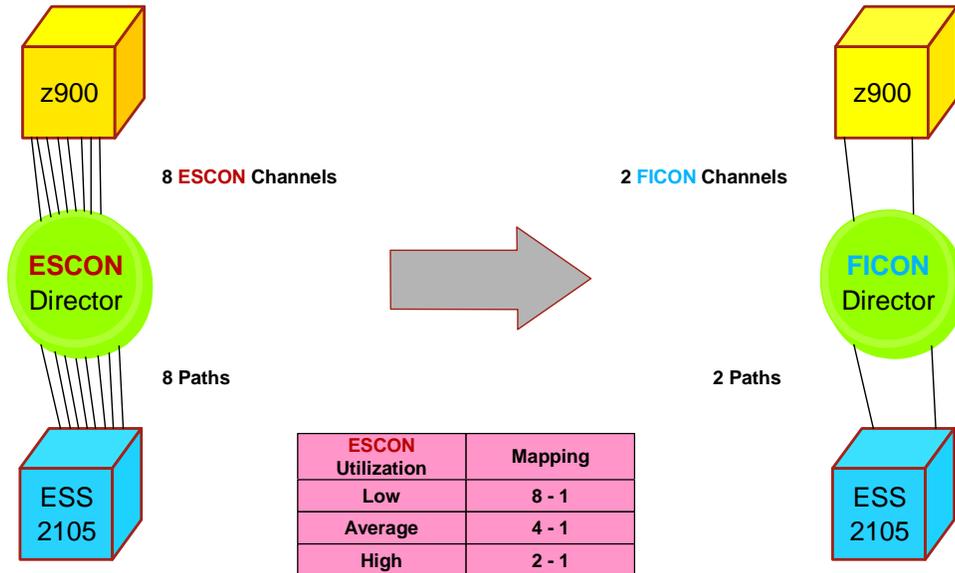
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How Many Paths in a Path Group?

IBM

z900

z900

8 **ESCON** Channels

2 **FICON** Channels

ESCON
Director

FICON
Director

8 Paths / PG

2 Paths / PG

For FICON:
- 2-8 Paths/PG
- Dependent Upon Throughput Reqmt

ESS
2105

ESS
2105
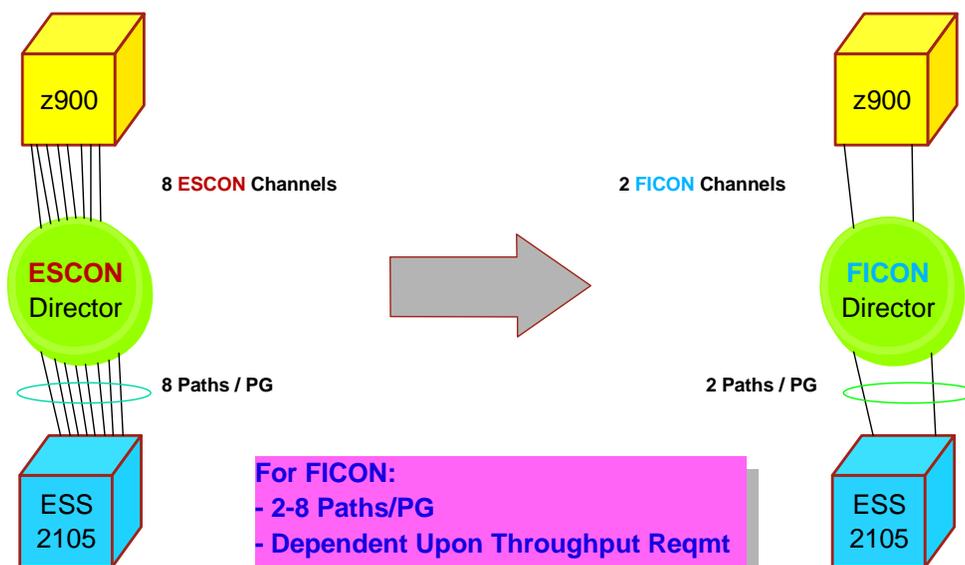
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What About Daisy-Chaining?

IBM

z900

8 - 16 **ESCON**

ESCON Director

8 - 16 **ESCON**

ESS 2105

- **Logical "daisy-chain"**
- **FICON is Superior**

ESS 2105

8 **FICON**

8 **FICON**

FICON Director

z900

8 **FICON**

8 **FICON**

8 **FICON**

ESS 2105

ESS 2105

ESS 2105
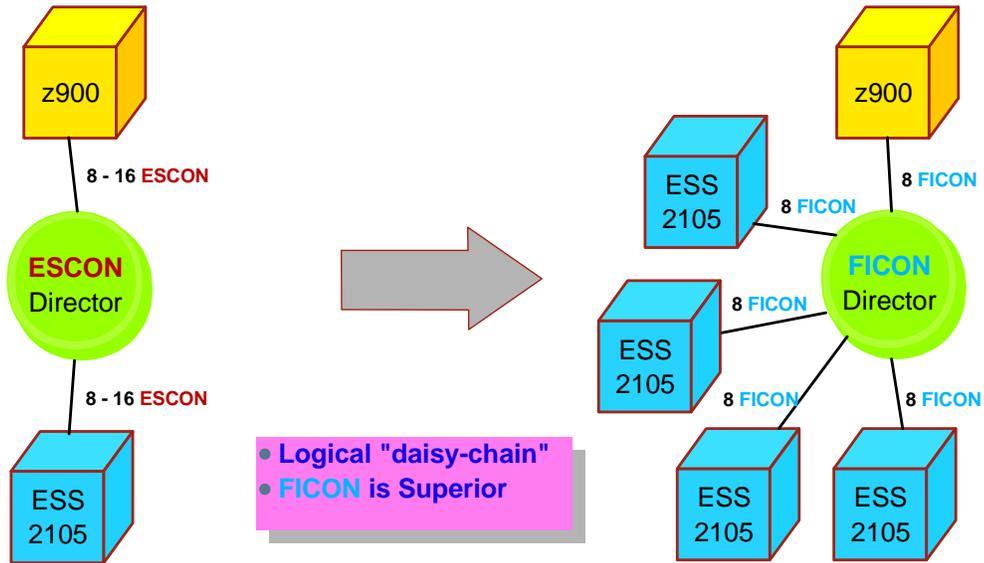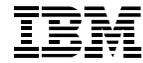
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ESCON to FICON Migration

IBM

z900 Host

ESCON Channels

Channel Path Group

ESCON Director

ESCON Director

ESCON Ports

E E E E

ESS

z900 Host

E E E E F F

ESCON Director

ESCON Director

FICON Director

FICON Director

E E E E F F

ESS

z900 Host

F F

FICON Channels

FICON Director

FICON Director

FICON Ports

F F

ESS

Before

During

After
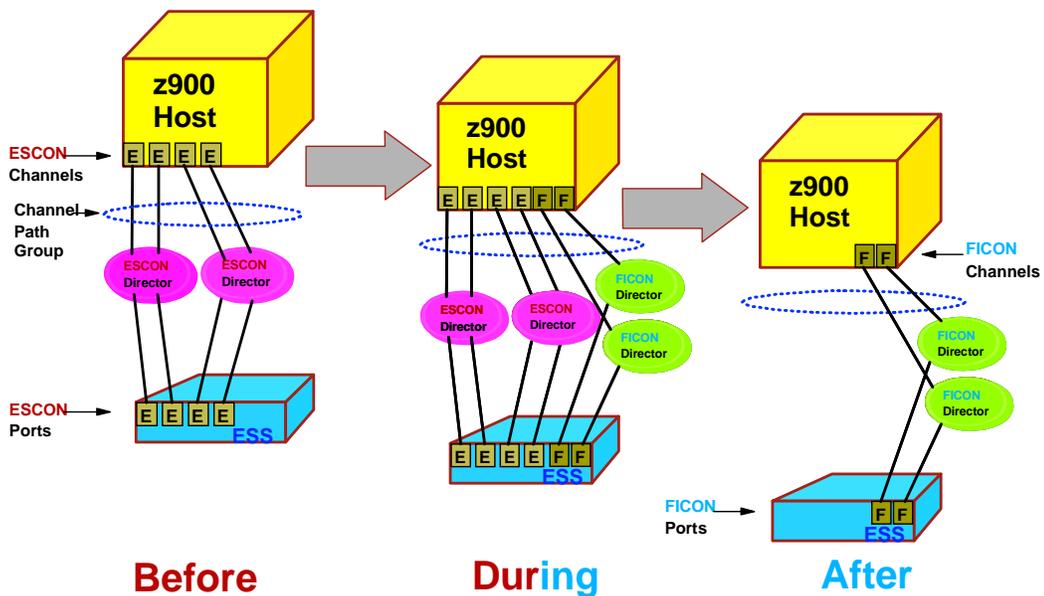
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"Intermix Mode"

- Objective
  - Provide migration path to ease transition

- Minimize Transition Time in "Intermix Mode" (**FICON** with **ESCON** in the same host attach path group)
  - Dynamic reconnect can be on different technologies
  - RMF reports will be inaccurate
  - Channel allocation algorithms are different
    - **ESCON** - round robin
    - **FICON** - current, real-time utilization estimate
  - Will not realize full performance advantages of **FICON**

- Acceptable "Intermixing Configurations"
  - All **FICON** path group(s) with all **ESCON** path group(s)
  - **FICON** for host attach and **ESCON** for PPRC links

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FICON Distance

IBM

ESS Feature Code	Fiber Type	Unrepeated FICON Distance	Host Feature Code
3023 (SX - short wave)	50 micron (MM - multimode)	500 meters (1,640 feet)	2316/2318 (SX - short wave)
3023 (SX - short wave)	62.5 micron (MM - multimode)	250 meters (820 feet)	2316/2318 (SX - short wave)
3021 (LX - long wave)	50 micron (MM - multimode) with a pair of MCP cables	550 meters (1,804 feet)	2314/2315 (LX - long wave)
3021 (LX - long wave)	62.5 micron (MM - multimode) with a pair of MCP cables	550 meters (1,804 feet)	2314/2315 (LX - long wave)
3021 (LX - long wave)	9 micron (SM - single mode) unrepeated	10 kilometers (6.2 miles)	2314/2315 (LX - long wave)
3021 (LX - long wave)	9 micron (SM - single mode) unrepeated	20 kilometers with RPQ (12.4 miles)	2314/2315 (LX - long wave)

NOTE: 100 km with repeaters (62 miles)

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ESS FICON Benefits

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- Industry Standard Architecture

  FC-SB-2:
  Builds on Fibre Channel Standards

- Reduction of Channels
  - **Reduced Cable Infrastructure**
  - **Reduces Cost**

  8:1 - ESCON < 25% Ch Util
  4:1 - ESCON about 50% Ch Util
  2:1 - ESCON > 75% Ch Util

- Greater Addressing

  Max. addressable devices per channel: 16K vs. 1K

- Longer Distances

  10 km vs. 3 km (w/o repeater)
  20 km with RPQ
  No Droop: 100 km vs. 9 km

- Greater Effective Throughput
  - **For capacity planning**

  60-65 MB/s vs. 10-13 MB/s

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  - SG24-5465   The IBM Enterprise Storage Server
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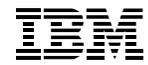
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  - 2064-IMPP   z900 Physical Planning (on ResourceLink)
  - GA22-7106   G5/6 Physical Planning
  - GA22-7234   IBM Fiber Transport Services - Planning
  - GA23-0367   Fiber Optic Link Planning (all types)
  - SA23-0394   ESCON I/O Interface Physical Layer
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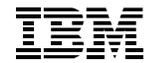
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  - SA22-1027   IBM z900 Overview
  - SB10-7029   IOCP IYPIOCP User's Guide
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  - SC28-6809   HMC Operations Guide (Driver 38, 03/2001)
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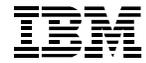
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  - GA22-7236   PR/SM Planning Guide
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- ■ Promotional Material
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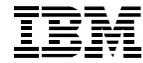
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- partners.boulder.ibm.com

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Glossary #1

ANSI	American National Standards Institute
CF	Coupling Facility
cladding	surrounds core - refracts/bends light to keep in core
core	cable center - medium for light transmission
CPC	Central Processor Complex
DWDM	Dense Wavelength Division Multiplexer
EMIF	ESCON Multiple Image Facility (LPARs share CHPID)
ETR	External Time Reference (Sysplex Timer)
FC	a "native" FICON attach that does not get converted

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Glossary #2

FCP	Fibre Channel Protocol
FCS	Fibre Channel Standard
FCV	a FICON attach that is converted to ESCON
FC-FS	Fibre Channel Framing & Signaling Interface
FC-PI	Fibre Channel - Physical Interface
FC-SB-2	Fibre Channel - Single Byte (cmd code set) - Ver 2
FDDI	Fiber Distributed Data Interface
FOSA	Fiber Optic Subassemby
GDPS	Geographically Dispersed Parallel Sysplex

Glossary #3

LED	Light Emitting Diode
LX	Long wavelength (1300nm)
MCM	Multiple Chip Module
MCP	Mode Conditioning Patch cable
mm	multimode
multimode	multiple frequencies of transmission
OSA-2	S/390 Open Systems Adapter 2
OSA-E	Open Systems Adapter - Express
PCI	Peripheral Component Interconnect

Glossary #4

IBM

SCSI	Small Computer System Interface
single mode	single frequency/wavelength of transmission
SM	single mode
SOD	Statement Of Direction
STI	Self Timed Interconnect bus
SX	Short Wavelength (850nm)
XDF	eXtended Distance Feature

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