S/390 Enterprise Server Hardware Update

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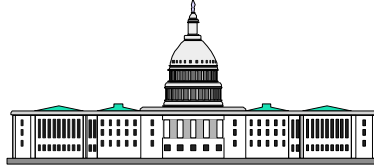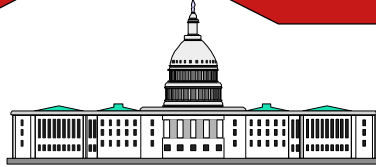
WAVV 2000
October 6-10, 2000

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eserver zSeries 900 Processor

Expanding addressing from 2 Gigabytes to 16 Exabytes

zSeries 900 Processor

★ **New level of performance**
- G6 CP + 25%
- G6 ZZ7 + 50%
- Balanced Structure

★ **New 64-bit Architecture**
- 64-bit Addressing (Real and Virtual)
- 64-bit Arithmetic/Logical
- 64-bit I/O architecture
- 64-bit SIE architecture
- 64-bit Cryptography
- 64-bit QDIO

★ **Integrated Availability**
- Transparent CP, SAP, ICF, IFL Sparing
- Memory sparing
- ESCON sparing
- New I/O - hot plug, hot swap
- Dual Power Service and Control Net
- SE Auto-switch

★ **Non Disruptive Growth**
- 26 Servers and a CF Model
- CUoD and CBU
- SOD: Memory Upgrade

★ **IRD (Intelligent Resource Director)**
- Dynamically balance system resources
- Integration of
  - PR/SM - CPU Management, I/O Priority
  - CSS - I/O Priority Queueing, DCM
  - Parallel Sysplex
  - Workload Manager

★ **Workload Pricing**

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Highlights

★ **Introducing new I/O Subsystem**
- 3X I/O Bandwidth
- New I/O Cage - 28 slots
- CHPID Mapping
- 16 port ESCON card, sparing
- 2 port FICON card, 96 FICON channels
- 2 port Gigabit Ethernet cards
- 2 port Fast Ethernet cards
- 2 port ATM 155 cards
- 4 port ISC-3 card
- Dynamic Channel Path Management (DCM)
- 1 GB STI

★ **Sysplex Enhancements**
- Model 100 CF
- ISC-3 (Internal System Channel) at 2 Gbits/s
- ICB-3 (Integrated Cluster Bus) at 1 GByte/s
- IC-3 (Internal Coupling Channel)
- Peer Coupling Link Mode
- 2 standard Sysplex Timer Cards

★ **Enhanced Security Leadership**
- Cryptographic Coprocessors
- Up to 16 PCICC processors
- ~2,000 SSL transactions/second
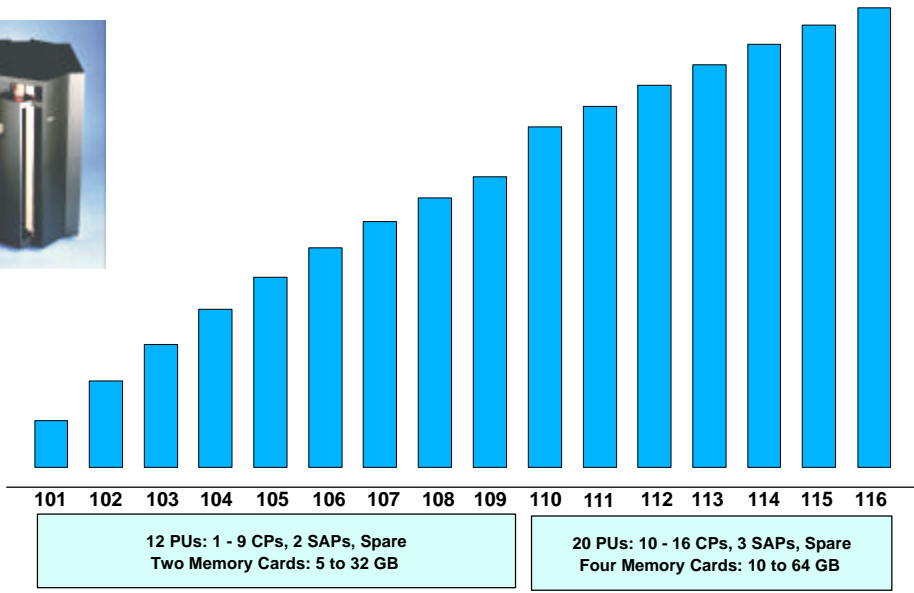
★ **Investment Protection**
- G5/6 MES Upgrades
- Infrastructure reuse

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Models 101 - 116

| 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |

12 PUs: 1 - 9 CPs, 2 SAPs, Spare
Two Memory Cards: 5 to 32 GB

20 PUs: 10 - 16 CPs, 3 SAPs, Spare
Four Memory Cards: 10 to 64 GB

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Capacity Models 1C1 - 1C9
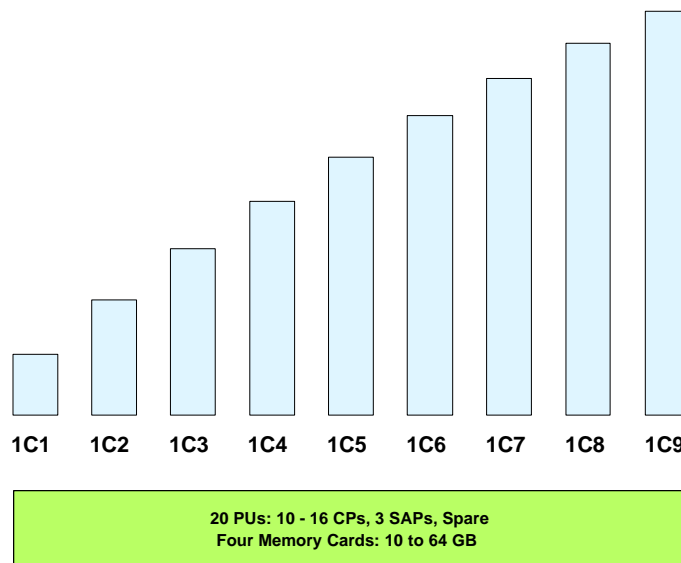
| 1C1 | 1C2 | 1C3 | 1C4 | 1C5 | 1C6 | 1C7 | 1C8 | 1C9 |

20 PUs: 10 - 16 CPs, 3 SAPs, Spare
Four Memory Cards: 10 to 64 GB
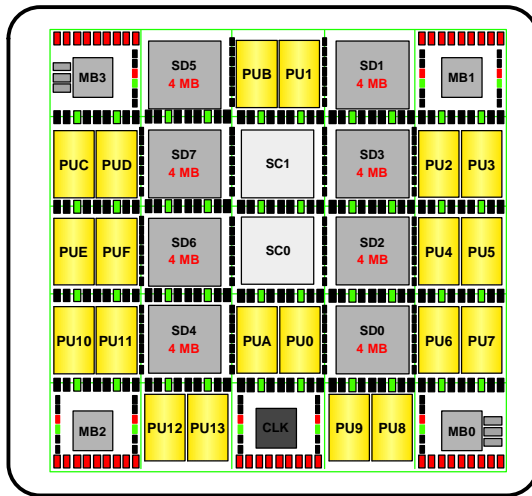
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Multichip Module (MCM)

Models 110 - 116 and 1C1 - 1C9

| MB3 | SD5 4 MB | PUB | PU1 | SD1 4 MB | | MB1 |

20 PU MCM

Technology Excellence

★ **CMOS8S Technology**
- Copper interconnections

★ **35 Chips**
- 30 chips CMOS8S

★ **MCM Packaging**
- 127.5 mm x 127.5 mm
- Over 2.5 billion transistors
- 20 Processor Units (PUs)
  - 17.9 mm x 9.9 mm
  - 47 million transistors
  - L1 cache/CP
    - 256 KB I-cache
    - 256 KB D-cache
  - 1.3 ns Cycle Time
- 8 System Data (SD) cache chips
  - L2 cache
    - 234 million transistors
    - 4 MB/chip
    - 2 x16 MB/cluster per MCM
- 2 Storage Control (SC) chips
- 4 Memory Bus Adapter (MBA) chips
- 1 Clock (CLK) chip
- 101 Glass ceramic and 6 Thin Film layers
  - 1 km of wire

Multichip Module (MCM)

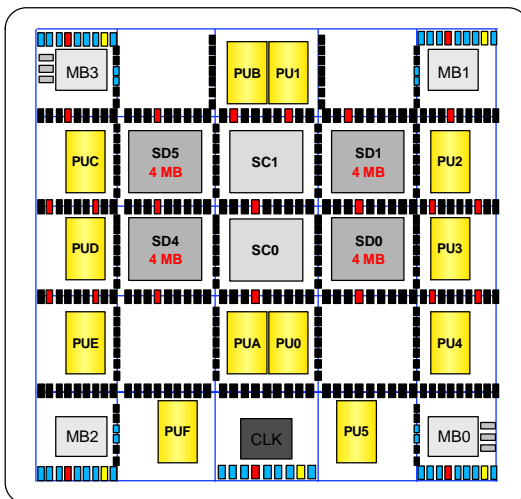### Models 100, 101 - 109

12 PU MCM

Technology Excellence

★ **CMOS8S Technology**
- Copper interconnections

★ **23 Chips**
- 18 chips CMOS8S

★ **MCM Packaging**
- 127.5 mm x 127.5 mm
- Over 1.5 billion transistors
- 12 Processor Units (PUs)
  - 17.9 mm x 9.9 mm
  - 47 million transistors
  - L1 cache/CP
    - 256 KB I-cache
    - 256 KB D-cache
  - 1.3 ns Cycle Time
- 4 System Data (SD) cache chips
  - L2 cache
    - 234 million transistors
    - 4 MB/chip
    - 2 x8 MB/cluster per MCM
- 2 Storage Control (SC) chips
- 4 Memory Bus Adapter (MBA) chips
- 1 Clock (CLK) chip
- 45 Alumina ceramic and 6 Thin Film layers
  - 0.4 km of wire

Processor Features

- One spare is required

- CF LP: ICFs and/or CPs, dedicated and/or shared, CFCC only

- Linux LP: IFLs only, dedicated or shared, Linux or VIF only

- OS LP: CPs only, dedicated or shared

- Optional SAPs are almost never needed

	PUs	CPs	SAPs Standard	SAPs Opt. (up to)	IFLs/ICFs (up to)
101	12	1	2	3	8
102	12	2	2	3	7
103	12	3	2	3	6
104	12	4	2	3	5
105	12	5	2	3	4
106	12	6	2	3	3
107	12	7	2	2	2
108	12	8	2	1	1
109	12	9	2	0	0
1C1	20	1	3	5	15
1C2	20	2	3	5	14
1C3	20	3	3	5	13
1C4	20	4	3	5	12
1C5	20	5	3	5	11
1C6	20	6	3	5	10
1C7	20	7	3	5	9
1C8	20	8	3	5	8
1C9	20	9	3	5	7
110	20	10	3	5	6
111	20	11	3	5	5
112	20	12	3	4	4
113	20	13	3	3	3
114	20	14	3	2	2
115	20	15	3	1	1
116	20	16	3	0	0
100	12	0	2	0	9

IFL=Integrated Facility for Linux

Memory Cards, Storage Sizes

- Memory Cards: 4, 8, or 16 GB

- LIC CC storage control: "Dial-a-Gig"

- Cards Used:
  - ► 2 - Model 100 CF
  - ► 2 - Models 101 - 109
  - ► 4 - Models 110 - 116
  - ► 4 - Models 1C1 - 1C9

- SOD: Concurrent upgrade within card capacity

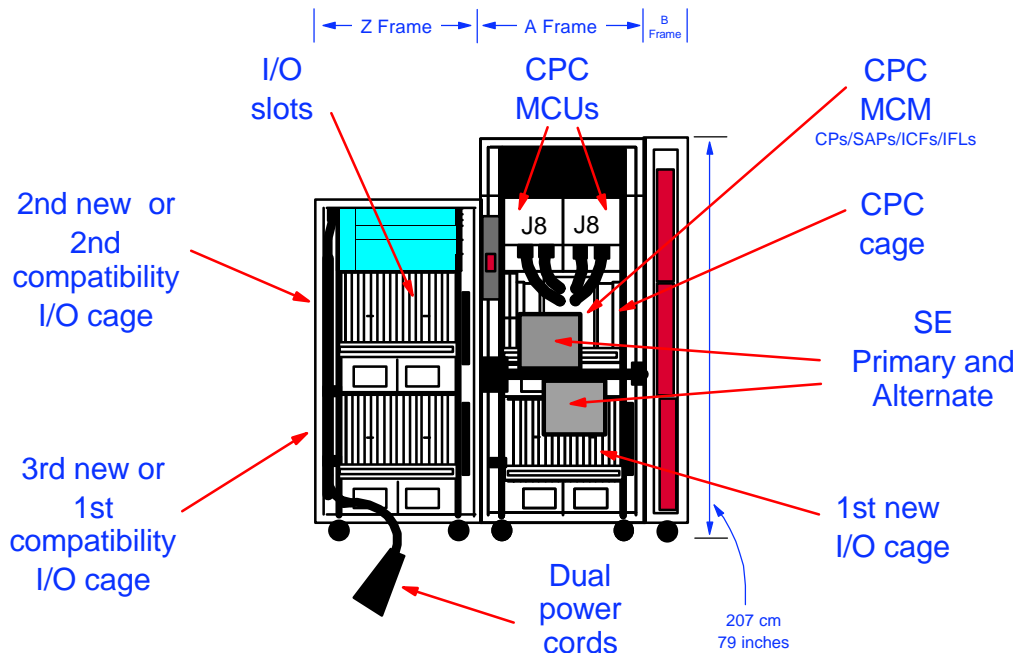| Storage	Models 100 - 109	Models 110 - 116	Models 1C1 - 1C9
5 GB	2 x 4 GB		
6 GB	2 x 4 GB		
7 GB	2 x 4 GB		
8 GB	2 x 4 GB		
10 GB	2 x 8 GB	4 x 4 GB	4 x 4 GB
12 GB	2 x 8 GB	4 x 4 GB	4 x 4 GB
14 GB	2 x 8 GB	4 x 4 GB	4 x 4 GB
16 GB	2 x 8 GB	4 x 4 GB	4 x 4 GB
18 GB	2 x 16 GB	4 x 8 GB	4 x 8 GB
20 GB	2 x 16 GB	4 x 8 GB	4 x 8 GB
24GB	2 x 16 GB	4 x 8 GB	4 x 8 GB
28 GB	2 x 16 GB	4 x 8 GB	4 x 8 GB
32 GB	2 x 16 GB	4 x 8 GB	4 x 8 GB
40 GB		4 x 16 GB	4 x 16 GB
48 GB		4 x 16 GB	4 x 16 GB
56 GB		4 x 16 GB	4 x 16 GB
64 GB		4 x 16 GB	4 x 16 GB

Software Requirements

- z/OS
- OS/390 Version 2 Release 6
- VM
  - ▸ z/VM
  - ▸ VM/ESA Version 2 Release 4
  - ▸ VM/ESA Version 2 Release 3
  - ▸ VM/ESA Version 2 Release 2
- VSE
  - ▸ VSE/ESA Version 2 Release 3 and higher
- Transaction Processing Facility (TPF)
  - ▸ TPF Version 4 Release 1

Notes:
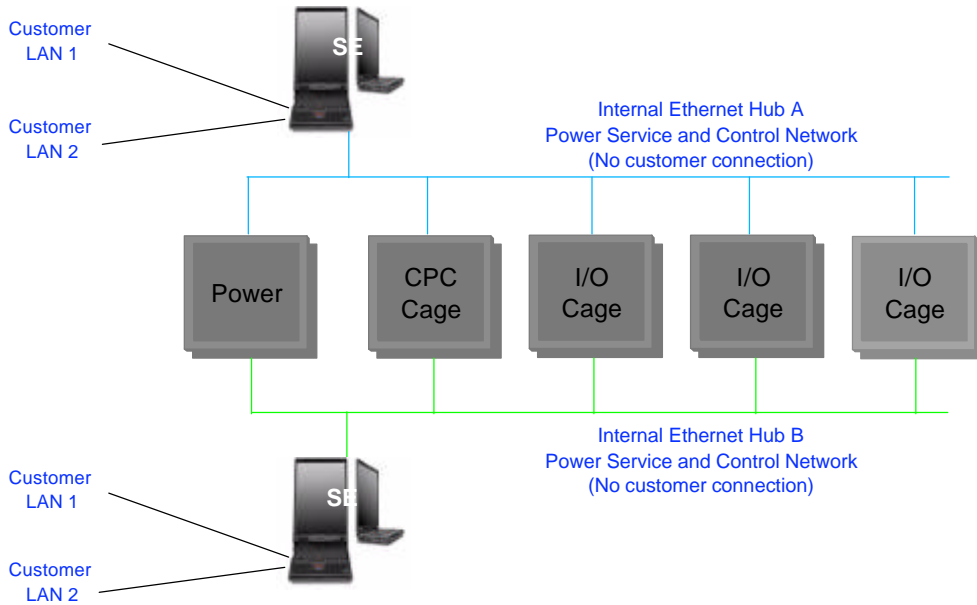- The zSeries 900 do not support S/370 mode operations
- The zSeries 900 do not support Version Codes

System Layout (CPC and I/O cages)

- Z Frame — A Frame — B Frame
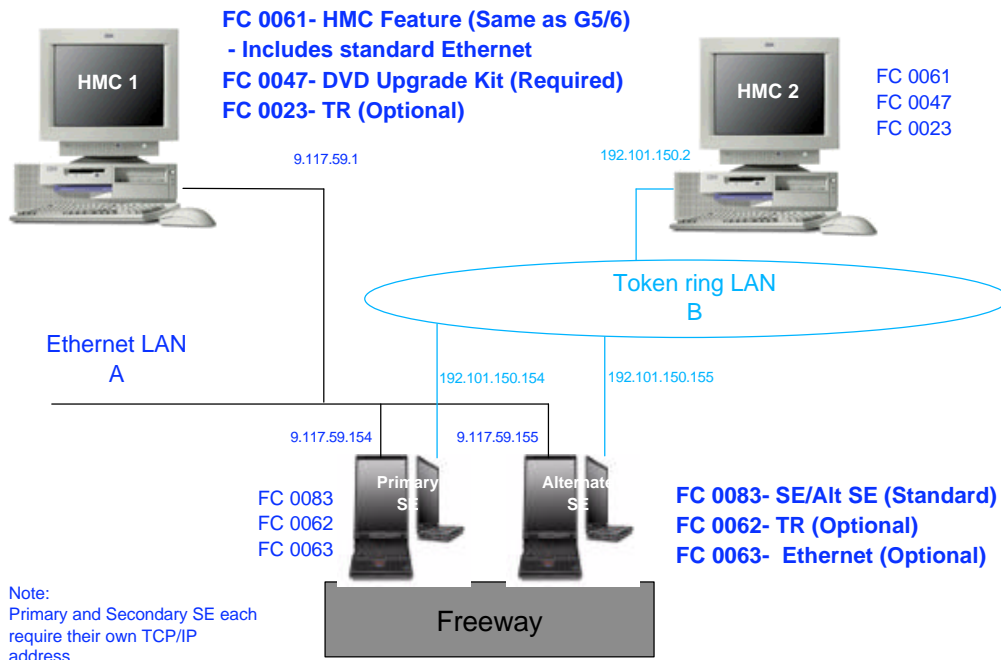- I/O slots
- CPC MCUs
- CPC MCM — CPs/SAPs/ICFs/IFLs
- 2nd new or 2nd compatibility I/O cage
- CPC cage
- J8   J8
- SE Primary and Alternate
- 3rd new or 1st compatibility I/O cage
- 1st new I/O cage
- Dual power cords
- 207 cm 79 inches

Power Service and Control Network

Customer
LAN 1

Customer
LAN 2

SE

Internal Ethernet Hub A
Power Service and Control Network
(No customer connection)

| Power | CPC Cage | I/O Cage | I/O Cage | I/O Cage |

Internal Ethernet Hub B
Power Service and Control Network
(No customer connection)

Customer
LAN 1

SE

Customer
LAN 2

HMC to SE TR and Ethernet

HMC 1

FC 0061- HMC Feature (Same as G5/6)
 - Includes standard Ethernet
FC 0047- DVD Upgrade Kit (Required)
FC 0023- TR (Optional)

HMC 2

FC 0061
FC 0047
FC 0023

9.117.59.1

192.101.150.2

Token ring LAN
B

Ethernet LAN
A

192.101.150.154

192.101.150.155

9.117.59.154

9.117.59.155

FC 0083
FC 0062
FC 0063

Primary SE

Alternate SE

FC 0083- SE/Alt SE (Standard)
FC 0062- TR (Optional)
FC 0063- Ethernet (Optional)

Note:
Primary and Secondary SE each
require their own TCP/IP
address

Freeway

System Structure (CP and I/O)
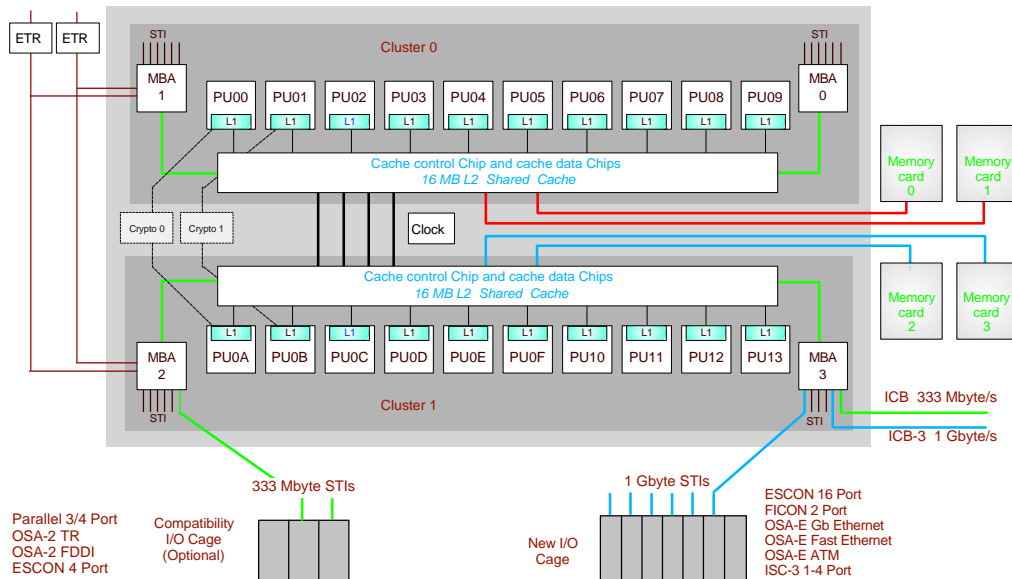
STIs

- The STI cables provide the connectivity for both internal CPC to channel I/O domains, as well as for external ICB links
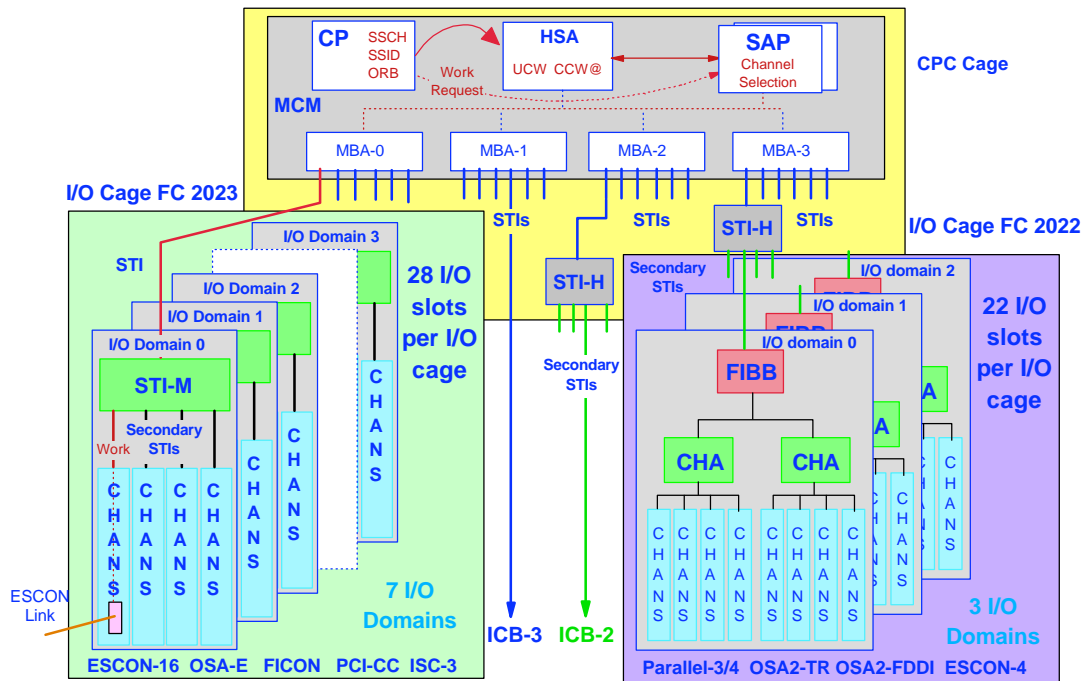
- There are up to 24* 1 Gigabyte/second STI links

- One 1 Gigabyte STI link is required for each installed I/O domain in a new I/O cage (FC #2023), up to 7 per cage

- Up to 16 of the 24 1 Gigabyte STIs can be used for ICB-3 connections (uses the STIs directly from the rear of the MCM board)

- Some of the 1 Gigabyte STIs can be multiplexed down to 333MB STI connections to support:
  - The legacy I/O cages (FC #2022) if installed
  - ICB connections to G5/G6 processors

Channel Subsystem I/O Operation

CP SSCH SSID ORB

HSA UCW CCW@

SAP Channel Selection

CPC Cage

Work Request

MCM

MBA-0   MBA-1   MBA-2   MBA-3

I/O Cage FC 2023

STIs   STIs   STI-H   STIs

STI-H

I/O Cage FC 2022

I/O Domain 3
I/O Domain 2
I/O Domain 1
I/O Domain 0

STI

STI-M

28 I/O slots per I/O cage

Secondary STIs

Work

Secondary STIs

Secondary STIs

I/O domain 2
I/O domain 1
I/O domain 0

FIBB

FIBB

CHA   CHA

CHA

CHA

22 I/O slots per I/O cage

CHANS

ESCON Link

CHANS   CHANS   CHANS   CHANS   CHANS   CHANS

7 I/O Domains

ICB-3   ICB-2

3 I/O Domains

ESCON-16 OSA-E FICON PCI-CC ISC-3
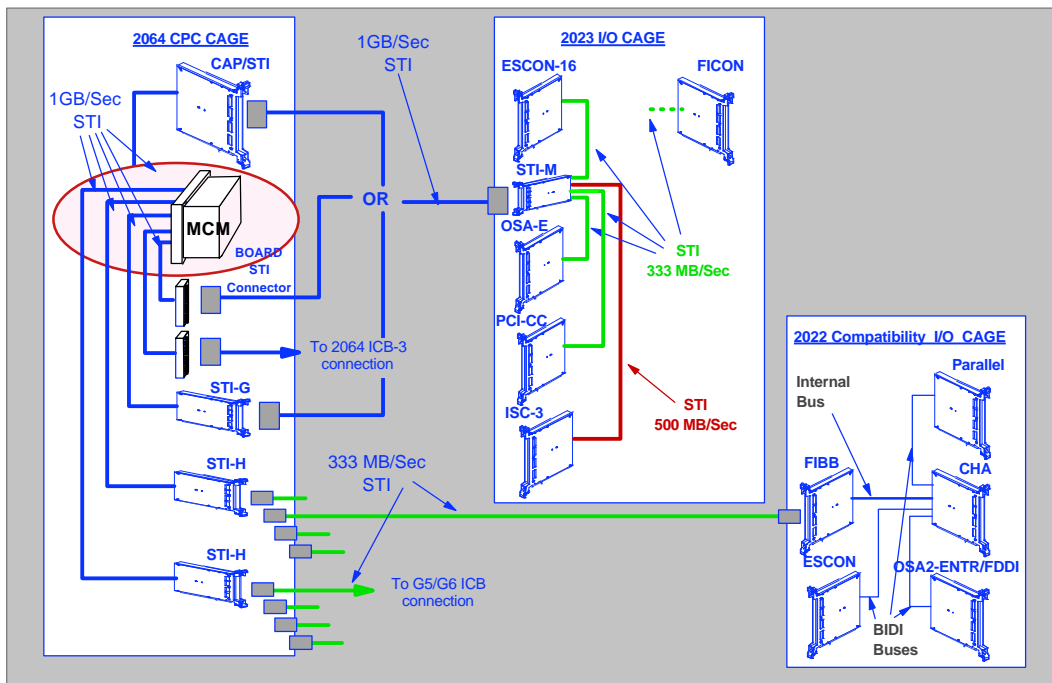
Parallel-3/4 OSA2-TR OSA2-FDDI ESCON-4

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Channel Connections - STIs

2064 CPC CAGE

CAP/STI

1GB/Sec STI

2023 I/O CAGE

ESCON-16   FICON

1GB/Sec STI

MCM

STI-M

OSA-E

OR

BOARD STI Connector

To 2064 ICB-3 connection

STI-G

PCI-CC

STI 333 MB/Sec

STI-H

ISC-3

STI 500 MB/Sec

STI-H

333 MB/Sec STI

To G5/G6 ICB connection

2022 Compatibility I/O CAGE

Internal Bus

Parallel

FIBB   CHA

ESCON   OSA2-ENTR/FDDI

BIDI Buses

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Channel card plugging

- Channel cards in a new style I/O cage (FC 2023) are spread as evenly as possible across I/O domains in the I/O cage

- As the number domains increases to the maximum in a new style I/O cage, and more channels are required to be installed, another new style I/O cage is added to the configuration and the required channel cards are spread in domains in both I/O cages (new machine build process only)

- Domains (STI's) do NOT have affinity to an SAP. Channel cards are assigned SAP affinity at POR or "hot plug" activation. Assign paths to CUs to achieve maximum availability. SAP affinity should not be considered.

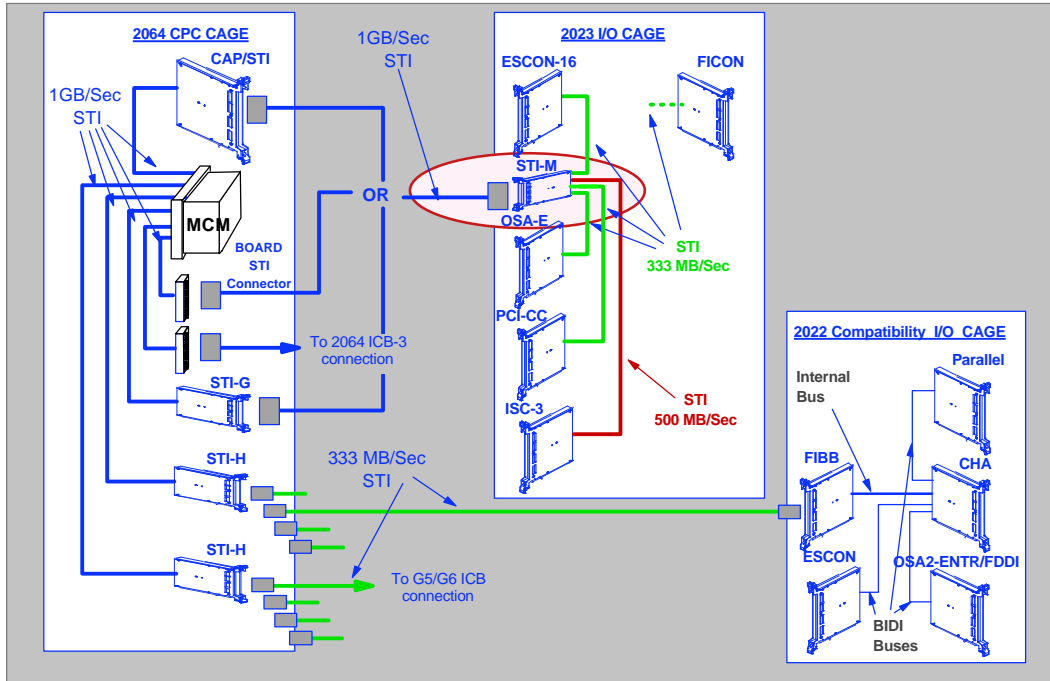# New I/O Cage(FC2023) Domain Plugging

Number of Cards	Total Domains Plugged	2023 cage # 1 (bottom of A frame)	2023 cage # 2 (top of Z frame)	2023 cage # 3 (bottom of Z frame)
1 or 2 or 3	1 or 2 or 3	0 - 1 - 2		
4 - 16	4	0,1,2,3		
17 - 24	6	0,1,2,3,4,5		
25 - 28	7	0,1,2,3,4,5,6		
29 -32	8	0,1,2,3	0,1,2,3	
33 - 40	10	0,1,2,3,4	0,1,2,3,4	
41- 48	12	0,1,2,3,4,5	0,1,2,3,4,5	
49 - 56	14	0,1,2,3,4,5,6 (All)	0,1,2,3,4,5,6 (All)	
57 - 72	18	0,1,2,3,4,5	0,1,2,3,4,5	0,1,2,3,4,5
73 - 80	20	0,1,2,3,4,5,6 (All)	0,1,2,3,4,5,6 (All)	0,1,2,3,4,5
81 - 84	21	0,1,2,3,4,5,6 (All)	0,1,2,3,4,5,6 (All)	0,1,2,3,4,5,6 (All)

This chart shows the new I/O cage (FC 2023) I/O domain plugging sequence for a new 2064.

The above information is a guide and can change. It is always recommended to review the econfig output for details of the actual channel card placement.

Channel Connections - I/O Cage

2064 CPC CAGE

CAP/STI

1GB/Sec STI

1GB/Sec STI

MCM

OR

BOARD STI Connector

To 2064 ICB-3 connection

STI-G

STI-H

333 MB/Sec STI

STI-H

To G5/G6 ICB connection

2023 I/O CAGE

ESCON-16

FICON

STI-M

OSA-E

STI 333 MB/Sec

PCI-CC

ISC-3

STI 500 MB/Sec

2022 Compatibility I/O CAGE

Internal Bus

Parallel

FIBB

CHA

ESCON
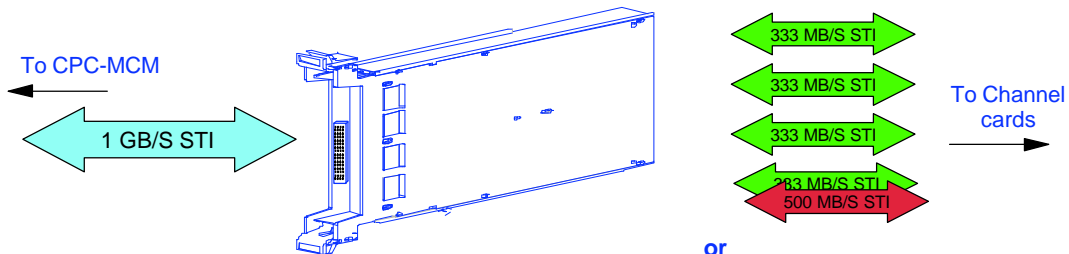
OSA2-ENTR/FDDI

BIDI Buses

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STI-M Card

Four 333 MB/Sec STI internal board connections to ESCON-16, FICON, OSA-E or PCI-CC

To CPC-MCM

1 GB/S STI

333 MB/S STI

333 MB/S STI

333 MB/S STI

333 MB/S STI

500 MB/S STI

To Channel cards

or
Three (or two) 333 MB/Sec STI FC 2023 Internal Board connections to ESCON-16, FICON, OSA-E or PCI
and
One (or two) 500 MB/Sec STI FC 2023 Internal Board connection to ISC-3

- Installed in the new I/O cage in dedicated I/O slots (up to 7 in new I/O cage)
- Supports one I/O domain
- Half high card assembly
- Two cards per slot, one in the upper half and one in the lower half of the I/O slot
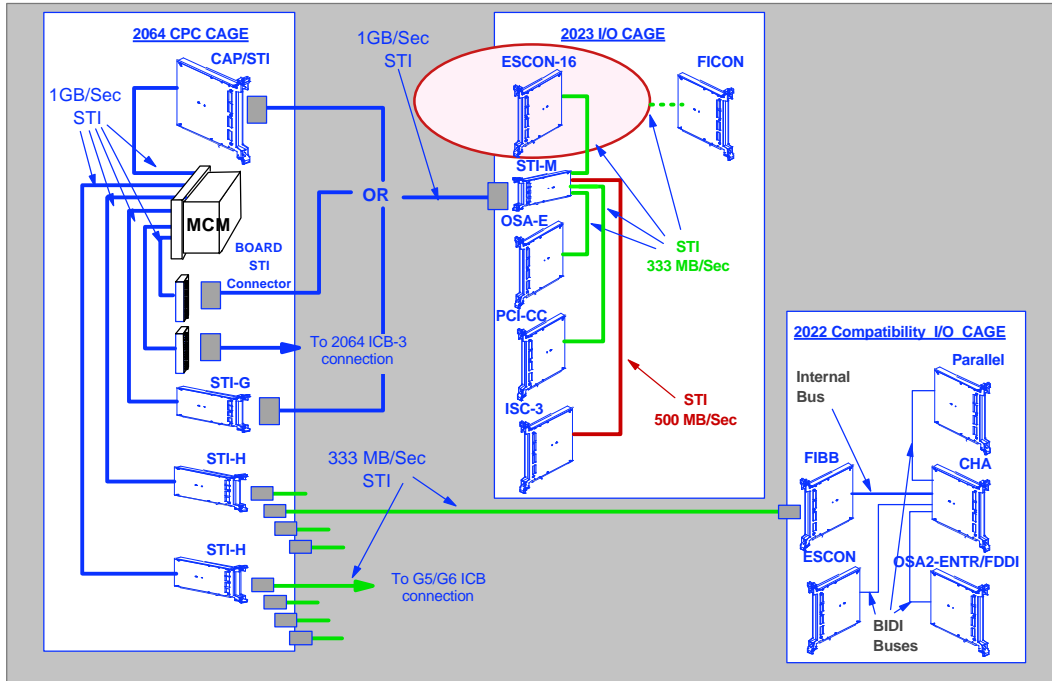- Hotplug support

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Channel Connections - ESCON

2064 CPC CAGE

CAP/STI

1GB/Sec STI

1GB/Sec STI

MCM

BOARD STI Connector

To 2064 ICB-3 connection

OR

STI-G

STI-H

333 MB/Sec STI

STI-H

To G5/G6 ICB connection

2023 I/O CAGE

ESCON-16

FICON

STI-M

OSA-E

STI 333 MB/Sec

PCI-CC

ISC-3

STI 500 MB/Sec

2022 Compatibility I/O CAGE

Internal Bus

Parallel

FIBB

CHA

ESCON

OSA2-ENTR/FDDI

BIDI Buses

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16 Port ESCON Card - FC #2323
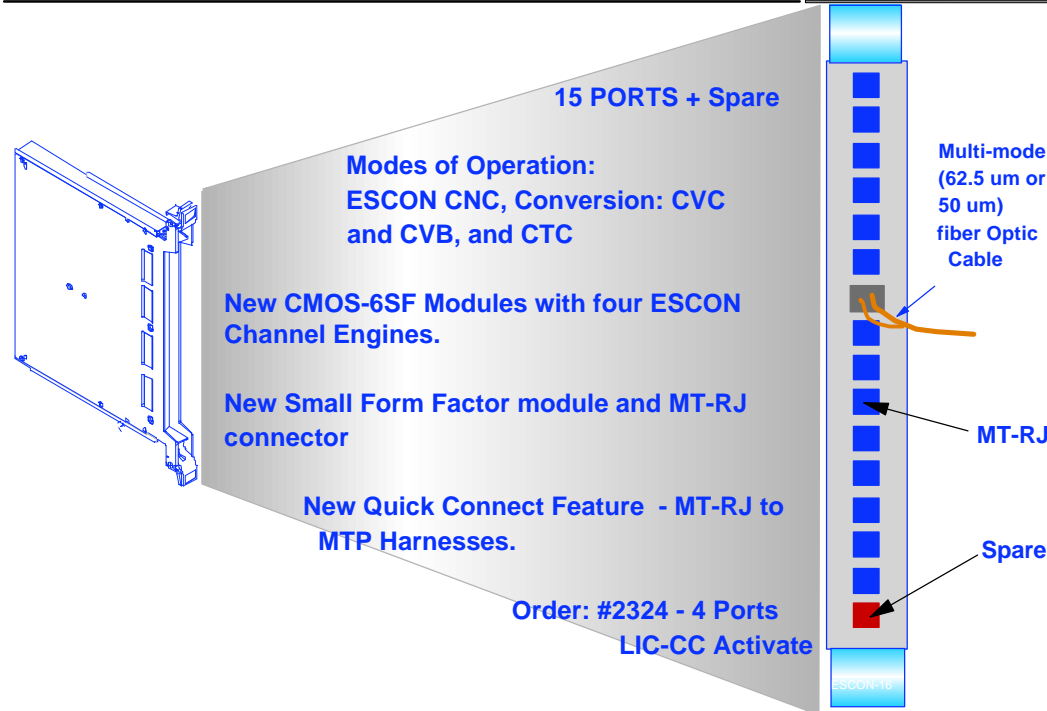
15 PORTS + Spare

Modes of Operation: ESCON CNC, Conversion: CVC and CVB, and CTC

New CMOS-6SF Modules with four ESCON Channel Engines.

New Small Form Factor module and MT-RJ connector

New Quick Connect Feature - MT-RJ to MTP Harnesses.

Order: #2324 - 4 Ports LIC-CC Activate

Multi-mode (62.5 um or 50 um) fiber Optic Cable
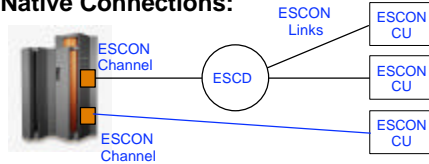
MT-RJ

Spare

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ESCON Operating Modes

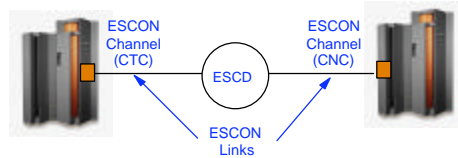**ESCON Native Connections:**

ESCON Channel — ESCD — ESCON Links — ESCON CU, ESCON CU, ESCON CU

ESCON Channel

★ *Native ESCON Control Units*
★ *Switched Point-to-point topology*
★ *Point-to-point topology*

Type=CNC

Channel-To-Channel Connections:
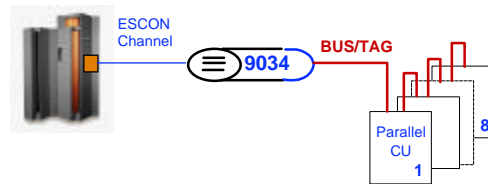
ESCON Channel (CTC) — ESCD — ESCON Channel (CNC)

ESCON Links

★ *Channel-to-Channel Adapter*

Type=CTC one end
Type=CNC other end

ESCON Conversion Connections:

ESCON Channel — 9034 — BUS/TAG — Parallel CU 1 ... 8

★ *Exploit ESCON Channel with legacy Parallel Block Multiplex and Byte Multiplex control units*

Type=CVC
Type=CBY

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ESCON Support

- On a new build, the required ESCON channel cards are spread across as many different STIs as possible for customer availability reasons
- 256 ESCON channels requires 18 ESCON channel cards (16 port channel cards) and all of these channel cards could be installed in one new style I/O cage
  - ► Each ESCON 16 port channel card has at least one spare channel. Except for the last spare channel all other ESCON channel ports are eligible for being LIC-CC enabled
  - ► The spare channel can be used in the case of an assigned channel that fails. The 2064 repair approach will request that a channel sparing action be invoked.
  - ► If a channel card fails after a previous sparing action and there are no spares left, the rule is disconnect all the fiber cables from the failing channel card, and after the card has been replaced return the cables to the same location that they were on the failing card
  - ► An MES action may require that an ESCON that has had multiple channel failures be replaced by the MES (no more LICC-CC channels on failed ESCON channel card)
  - ► Be aware that for 28 or less ESCON channels only 2 ESCON channel cards are installed.

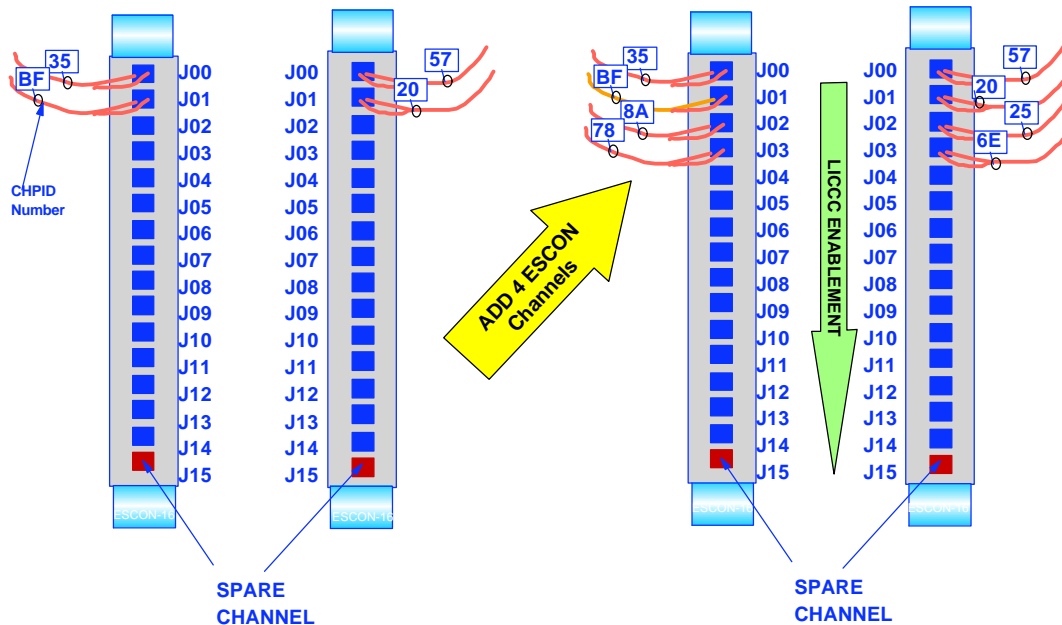S/390 Enterprise Server Hardware Update

ESCON Support

# ESCON Channels	# ESCON Cards	# Used ports per card	# Unused ports per card	# Reserved spare ports per card and total
4	2	2	13	1 / 2
8	2	4	11	1 / 2
16	2	8	7	1 / 2
28	2	14	1	1 / 2
32	4	8	7	1 / 4
60	4	15	0	1 / 4
64	6	11/11/11/11/10/10	4/4/4/4/5/5	1 / 6
68	6	12/12/11/11/11/11	3/3/4/4/4/4	1 / 6
76	6	13/13/13/13/12/12	2/2/2/2/3/3	1 / 6
88	6	15/15/15/15/14/14	0/0/0/0/1/1	1 / 6
92	8	12/12/12/12 11/11/11/11	3/3/3/3 4/4/4/4	1 / 8
120	8	15	0	1 / 8
124	10	13*4/12*6	2*4/3*6	1 / 10
148	10	15*8/14*2	0*8/1*2	1 / 10
152	12	13*8/12*4	2*8/3*4	1 / 12
180	12	15	0	1 / 12
184	14	14*2/13*12	1*2/2*12	1 / 14
208	14	15*12/14*2	0*12/1*2	1 / 14
212	16	14*4/13*12	1*4/2*12	1 / 16
240	16	15	0	1 / 16
244	18	14*10/13*8	1*10/2*8	1 / 18
256	18	15*4/14*14	0*4/1*14	1 / 18

S/390 Enterprise Server Hardware Update

ESCON-16 LIC-CC Enabled

S/390 Enterprise Server Hardware Update

ESCON-16 Channel Sparing
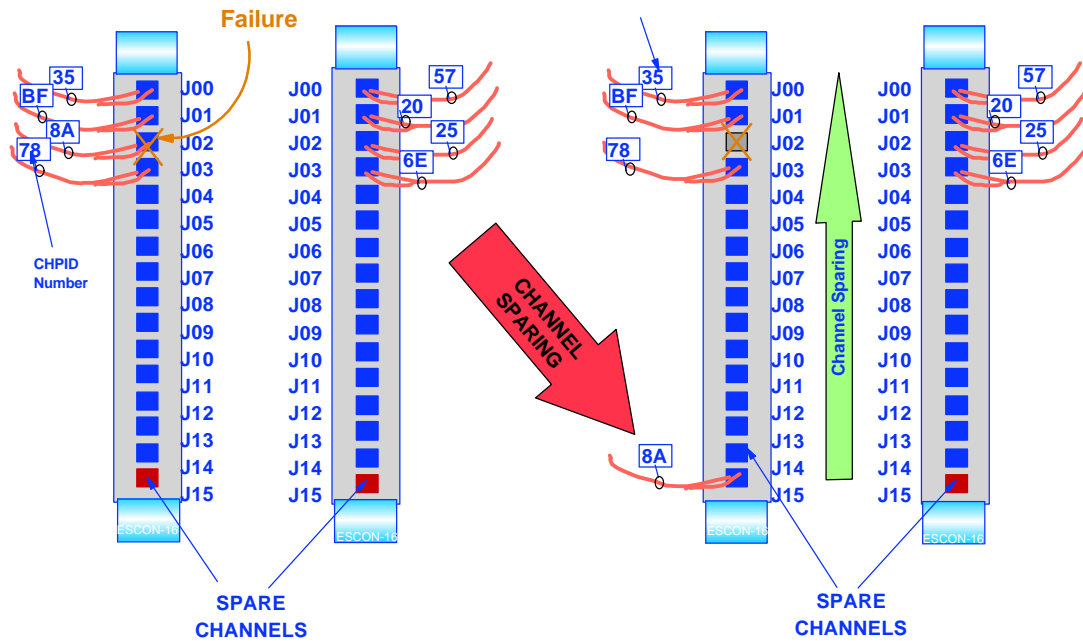
Failure

CHPID Number

SPARE CHANNELS

CHANNEL SPARING

Channel Sparing

SPARE CHANNELS

ESCON-16 Card Failure
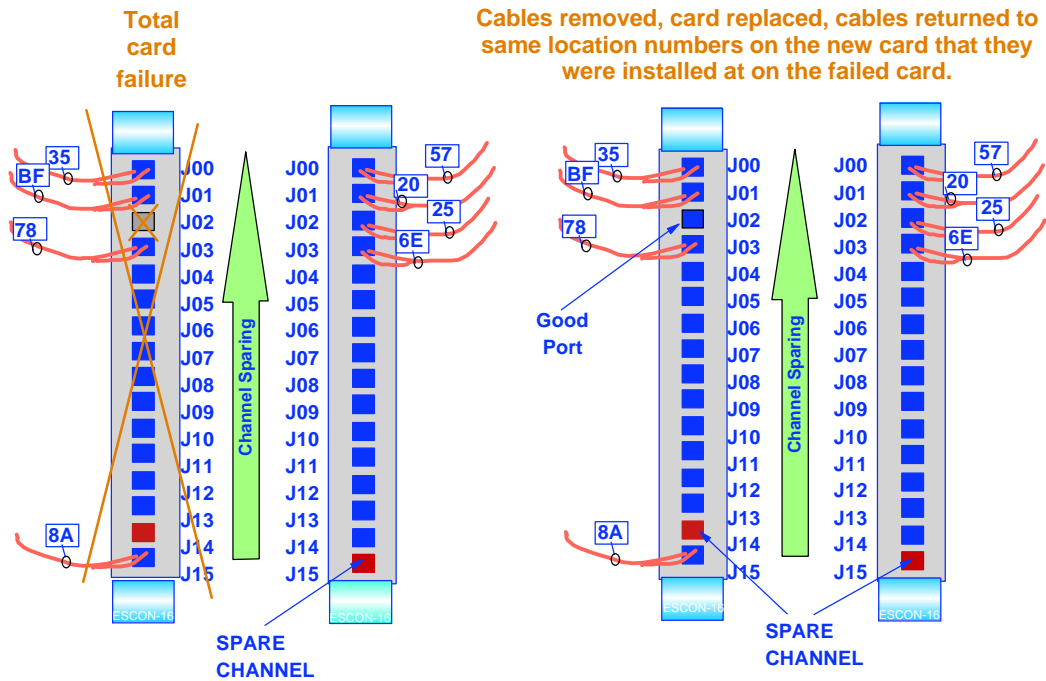
Total card failure

Cables removed, card replaced, cables returned to same location numbers on the new card that they were installed at on the failed card.

Channel Sparing

SPARE CHANNEL

Good Port

Channel Sparing

SPARE CHANNEL

Channel Connections - FICON
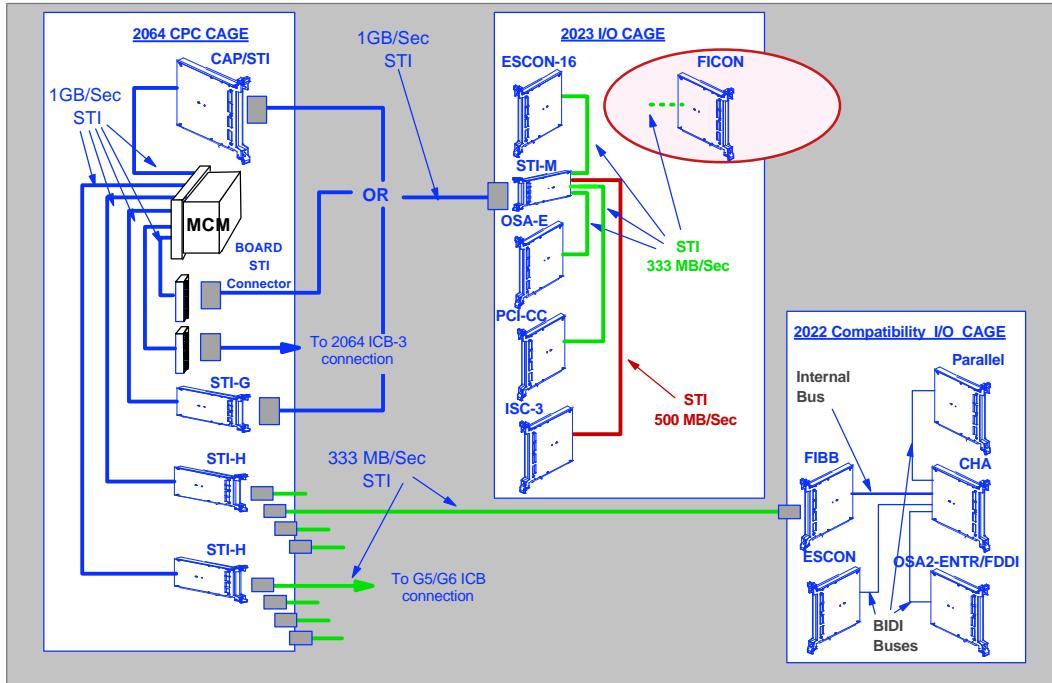
2064 CPC CAGE

CAP/STI

1GB/Sec STI

1GB/Sec STI

MCM

BOARD STI Connector

OR

To 2064 ICB-3 connection

STI-G

STI-H

333 MB/Sec STI

STI-H

To G5/G6 ICB connection

2023 I/O CAGE

ESCON-16

FICON

STI-M

OSA-E

STI 333 MB/Sec

PCI-CC

ISC-3

STI 500 MB/Sec

2022 Compatibility I/O CAGE

Internal Bus

Parallel

FIBB

CHA

ESCON

OSA2-ENTR/FDDI

BIDI Buses

S/390 Enterprise Server Hardware Update

FICON Channel Cards

SC-Duplex

Two Channels per Card

Two Channel Card types:
- **LONG WAVE (LX) - #2315**
- **SHORT WAVE (SX) - #2318**

Two Modes of Operation:
- **FICON Bridge (FCV) - LX Only!**
- **Native Mode (FC)**

Link Speed: One Gbit/Sec
Distance - LX:10 Km, 20 Km with RPQ; SX: ??? m

Up to 96 FICON channels
(32 maximum per new I/O cage)

E0
D0

Single mode (9 um) or

A0 B0

C0

Multimode (62.5 um or 50 um) This also requires a MCP (mode conditioner patch cable)

A1 B1

C1

D1
E1

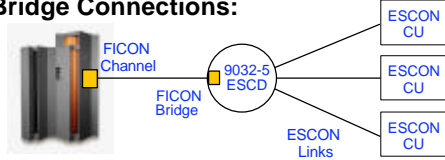S/390 Enterprise Server Hardware Update
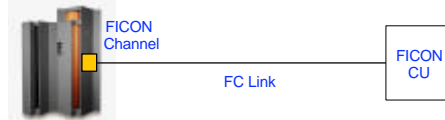
FICON Operating modes

FICON Bridge Connections:

★ *Exploit FICON Channel with Existing ESCON Control Units*
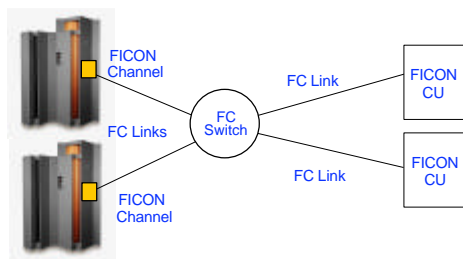
**Type=FCV
(FICON LX Only!)**

Native FICON Direct Attachment:

★ *Native FICON Control Units*

Type=FC

Native FICON Switched Connectivity:

★ *Full Dynamic Switching of FICON Control Units*
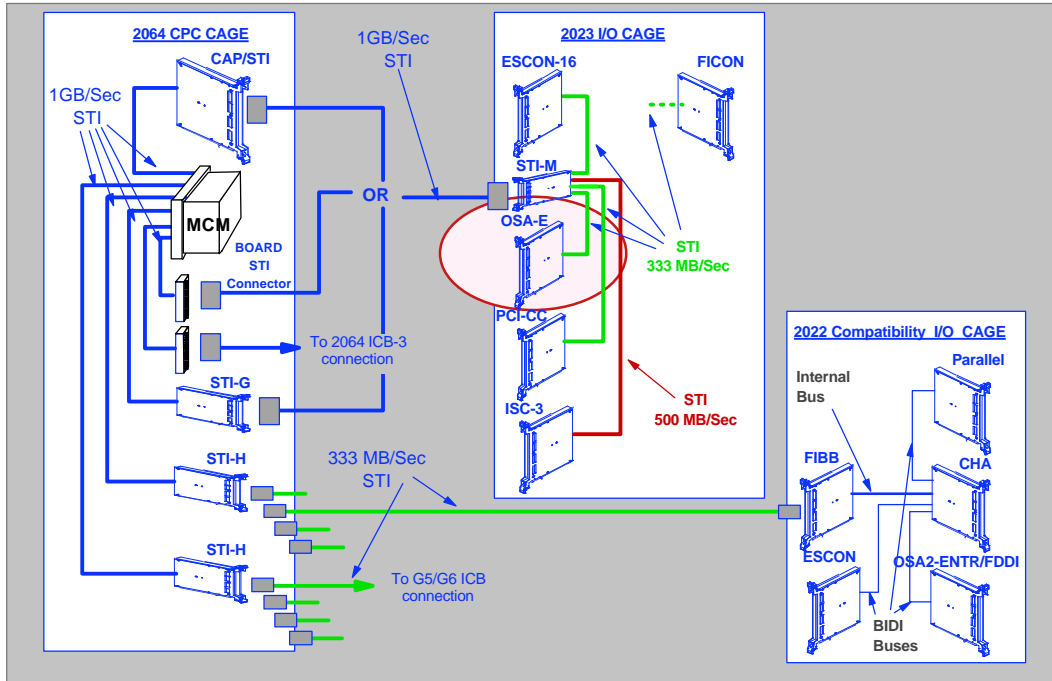
Type=FC

---

z900 FICON Installation

- Up to 16 FICON cards can be installed per new I/O cage (#2023) (FICON channels cannot be installed in the compatibility I/O cage (#2022)

- G5/6 MES to z900 - Existing FICON exchanged for like type (LX, SX)

- 2 FICON channel ports per card, order increment is 2

- New build or z900 MES add of FICON
  - ▶ Cards are balanced among new I/O cages on a new build
  - ▶ FICON increment 34/35 (17th card) drives a second #2023
  - ▶ FICON increment 66/67 (33rd card) drives a third #2023

- If a compatibility I/O (#2022) cage is driven out
  - ▶ Parallel, OSA-2 - Moved to remaining #2022 or removed
  - ▶ ESCON - Moved to remaining #2022 or exchanged

Channel Connections - OSA-E

2064 CPC CAGE

CAP/STI

1GB/Sec STI

1GB/Sec STI

MCM

BOARD STI Connector

OR

1GB/Sec STI

To 2064 ICB-3 connection

STI-G

STI-H

STI-H

333 MB/Sec STI

To G5/G6 ICB connection

2023 I/O CAGE

ESCON-16

FICON

STI-M

OSA-E

PCI-CC

ISC-3

STI 333 MB/Sec

STI 500 MB/Sec

2022 Compatibility I/O CAGE

Internal Bus

Parallel

FIBB

CHA

ESCON

OSA2-ENTR/FDDI

BIDI Buses

OSA-E Channel Cards

GbE　　**ATM**　　**FENET**

Gigabit Ethernet:
Two card types:
   - Short Wavelength (SX) -
   - Long Wavelegngth (LX)

Asynchronous Tranfer Mode:
Two card types:
   - Multi-mode (MM)
   - Single mode (SM)

Fast Ethernet:
One card type -

Two ports (channels) per card

Order increment - Two channels

QDIO support on all adapters

Up to 24 OSA-E channels, 12 cards

E0 D0

G0 F0
E0 D0

RJ-45 connector

J00

E0 D0

J00

J00

SC-Duplex connectors

A0 B0
C0
A1 B1
C1

A0 B0
C0
A1 B1
C1

A0 B0
C0
A1 B1
C1

Single mode (9 um) or Mult-imode (62.5 um or 50 um)

10BASE-T cable or 100BASE-T cable

J01

J01

D1 E1 F1

J01

D1 E1

D1 E1
F1 G1

Page 37-38

Channel Connections - PCI-CC

2064 CPC CAGE

CAP/STI

1GB/Sec STI

1GB/Sec STI

MCM

BOARD STI Connector

OR

To 2064 ICB-3 connection

STI-G

STI-H

STI-H

333 MB/Sec STI

To G5/G6 ICB connection

2023 I/O CAGE

ESCON-16

FICON

STI-M

OSA-E

STI 333 MB/Sec

PCI-CC

ISC-3

STI 500 MB/Sec

2022 Compatibility I/O CAGE

Parallel

Internal Bus

FIBB

CHA

ESCON

OSA2-ENTR/FDDI

BIDI Buses
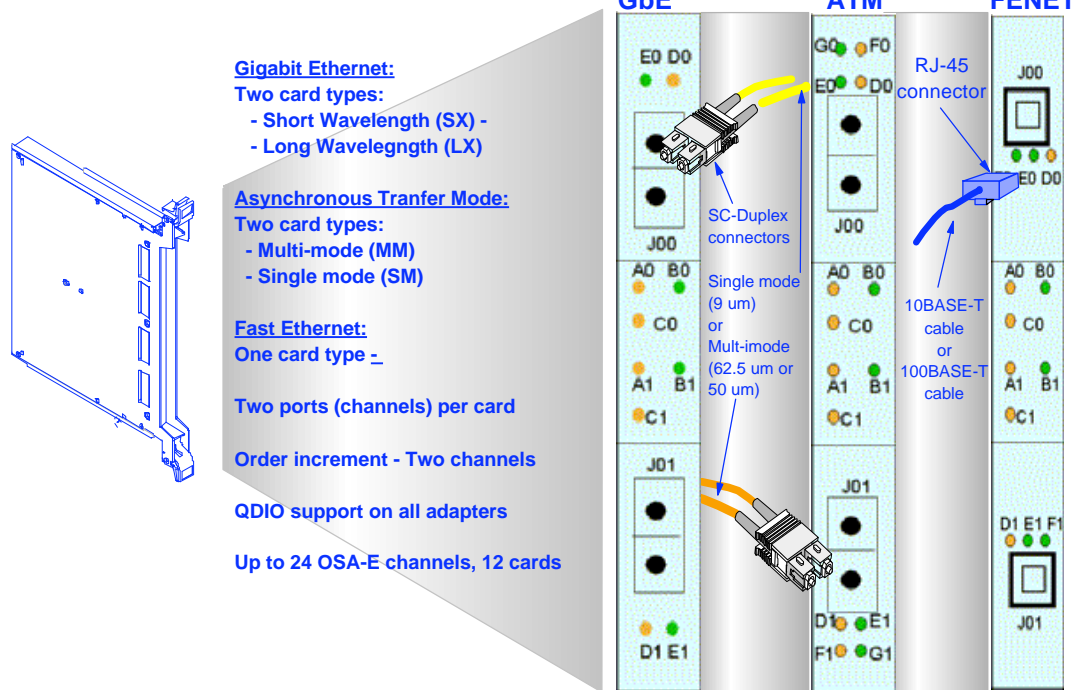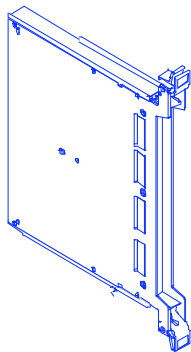
PCI-CC Card

PCI Cryptographic Coprocessor:
- SSL
- Triple DES
- User Defined Extensions (UDX)

Up to eight PCI-CC cards
(All except Model 100 CF)

Two PCI-CC APs per card, up to 16 total

Each PCI-CC AP takes a CHPID number
(No HCD or IOCP definition)

There are no customer external
connections from the PCI-CC card

K00

J0

A0   B0

C0

A1   B1

C1

K01

FICON, OSA-E and PCI-CC

- Rules
  - Up to 96 FICON channels (48 cards) can be installed
  - Up to 24 OSA-Express channels (12 cards) can be installed
  - Up to 16 PCI-CC engines (8 cards) can be installed
  - All cards in FC #2023 cages, none in FC #2022
  - Maximum 16 cards per FC #2023 cage
  - 17th and 33rd cards force 2nd and 3rd FC #2023 cages

- Force out of a FC #2022 cage
  - Parallel, OSA-2: Move to remaining FC #2022 or remove
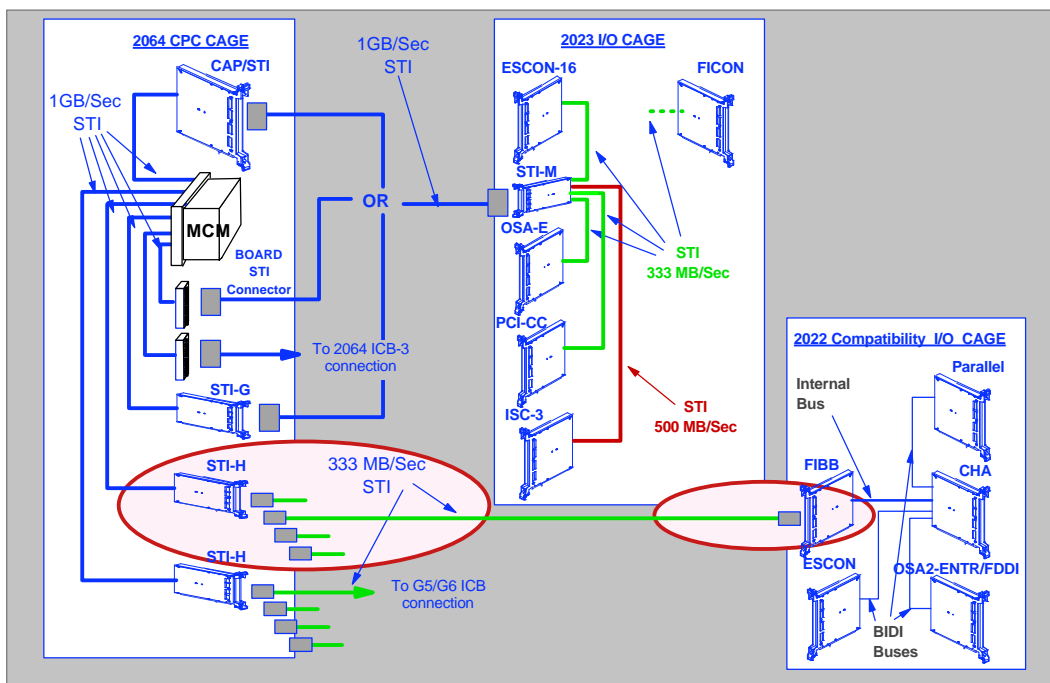 - ESCON 4-port: Exchange to new ESCON card(s)

- Upgrade from G5/6
  - Feature exchange for like type and like optical transceiver
  - Odd number: Charge for the additional one (G5/6 MES cost?)

Channel Connections - #2022 Cage
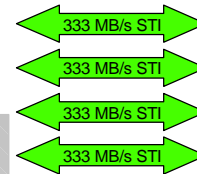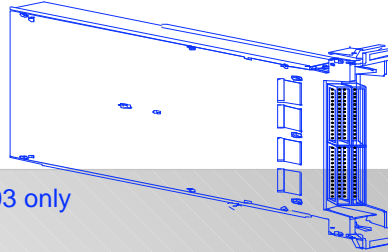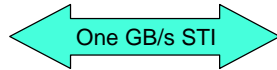
STI-H Card

One GB/Sec STI From CPC Board

Four 333 MB/Sec STI connections to legacy Passat cages or 9672 G5/G6 models (ICB-2)

One GB/s STI

333 MB/s STI

333 MB/s STI

333 MB/s STI

333 MB/s STI

CPC cage slot locations 01 and 03 only

Half high card assembly.

Up to two cards per slot

Multiplexes one 1 Gigabyte STI into four 333Mbyte STI links

The output connections from this card are all used by the legacy style I/O cage (FC 2022), or they are all used to support ICBs, no intermixing is allowed.

Compatibility I/O Cage FC #2022

- Cards Supported
  - Parallel channel cards with 3 or 4 ports
    - **Parallel 3 port cards only on G5/G6 MES upgrade**
    - **Parallel 4 port cards, G5/G6 upgrades or new builds**
  - OSA-2 Token Ring
  - OSA-2 FDDI
  - ESCON 4 port channel cards
    - **G5/G6 MES upgrade only**

- Maximum Configurations - 22 cards per cage, one or two cages
  - Parallel: 88 channels on new build
    96 channels on new build by RPQ or on G5/6 upgrade with two cages
  - OSA-2: 12 cards (channels) maximum on new build or G5/6 upgrade
  - ESCON: 44 cards (176 channels) on G5/6 upgrade with two cages

- CHPID Mapping - Fully Supported

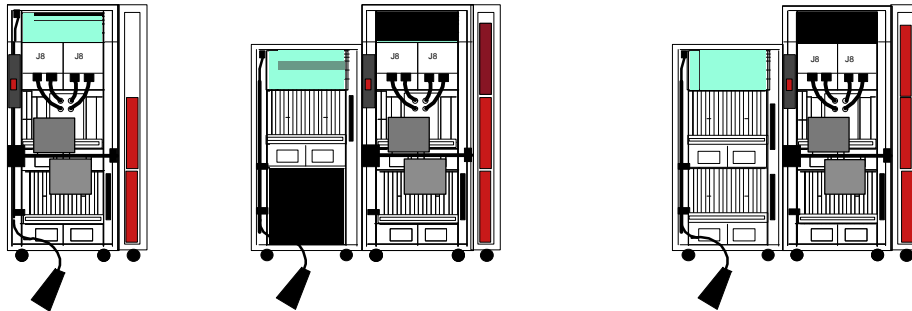- Hot Plug: Same as G5/6 (All EXCEPT FIBB and CHA)

Channel type support

I/O channel/engine type ports or STIs per feature (maximum 256 CHPIDs)	Feature Codes	Total Quantity of Channels Supported and I/O Slots required	Channel Increments for Ordering	Comments Total I/O cages min 1 - max 3 (Cargo plus Passat)
ESCON - 4 ports	2313	176 / 44	4	G5/G6 upgrades only
ESCON - 15/16 ports	2323 (2324)	256 / 18	4 (LIC-CC)	1 spare port per card
Parallel - 4 ports	2304	88 / 22	4	96 via RPQ or G5/G6 u/g
Parallel - 3 ports	2303	96 / 32	3	G5/G6 MES upgrade only
FICON (SX & LX) - 2 ports	2318/2315	96 / 48	2	different features - SC conn
PCI-CC (Crypto) - 2 engines	0861	16 / 8	2	Not defined in IOCP
Fast Ethernet - 2 ports	2366	24 / 12	2	
Gbit Ethernet (SX & LX) - 2 ports	2365/2364	24 / 12	2	different features
ATM (155) (SM &MM) - 2 ports	2362/2363	24 / 12	2	different features
FE, Gbit and ATM	--	---	---	24 chan (12 card) maximum
FICON, PCI-CC, FE, Gbit, ATM	--	---	---	48 cards maximum per system 16 cards maximum per I/O cage
OSA-2 - FDDI - 1 port	5202	12 / 12	1	FDDI + TR = 12 cards max
OSA-2 - TR - 2 ports (1 chan)	5201	12 / 12	1	FDDI + TR = 12 cards max
ISC-3 (1 & 2 Gbit) - 2 + 2 ports	0217/0218/(0219)	32 / 8	1 (LIC-CC)	
ISC-3 (1 Gbit) - 2 + 2 ports	RPQ 8P2197	32/8	2	20 km Extended distance RPQ
ICB-3 - 1 STI connection	0993	16 / 0	1	1 GByte STI connection
ICB-2 - 1 STI connection	0992	8 / 0	1	333 MByte STI connection RPQ to 12 and to 16 max 16 on standalone CFs
ISC-3, ICB-3, ICB-2	--	---	---	32 channel maximum
IC Channel - 2 defined channels	--	32 / 0	2	microcode support
ISC-3, ICB-3, ICB-2, IC Channels	--	---	---	64 channel maximum

I/O Concurrency

Channel Type	1 x FC2023
ESCON (max) FICON Parallel	256 0 0
FICON (Max) ESCON Parallel	32 180 0
Maximum total I/O concurrency	436

Channel Type	2 x FC2023	1 x FC2022 1 x FC2023
ESCON(max) FICON Parallel	220 36 0	88 + 168 0 0
FICON (Max) ESCON Parallel	64 192 0	32 88 + 136 0
Maximum total I/O concurrency	704	480

Channel Type	3 x FC2023	1 x FC2022 2 x FC2023	2 x FC2022 1 x FC2023
ESCON (max) FICON Parallel	188 68 0	88 + 132 36 0	160 0 96
FICON (max) ESCON Parallel	96 160 0	64 88 + 104 0	32 128 96
Maximum total I/O concurrency	928	704	480

1st FC2023 cage supports
1 to 16 FICON cards
2 channel ports per FICON card

17th FICON card drives a 2nd FC2023 cage
4 port ESCON cards in the FC2022 cage

33rd FICON card drives a 3rd FC2023 cage
88 (4 port) ESCON drives the 1stFC2022 cage
96+ (4 port) Parallel (upgrade) drives a 2nd FC2022 cage

CHPID Mapping Function

- Ability to change the default CHPID Assignments
  - ➡ Better match environment
- Tool accessible by customers via Resource Link
  - ➡ Available when order sent to manufacturing database
- Protects current definitions
  - ➡ Ability to input IOCP source deck
- Two approaches (Resource Link)
  - ➡ Manual mapping
  - ➡ Availability mapping
    - ★ IOCP and Control Unit Priorities
- Output stored on diskette for input to SE
  - ➡ Extended outage time for manual input
- Customer maintains CHPID documentation

Availability Mapping

Looking for problems......

IOCP Control Unit - CHPID Assignment and Availability

CHPID Home | IOCP Load | Availability | Remapping | Reports | Diskette Download

Channel CHPID Assignment Task

CHPID Assignment Function

Options   View   Help

CHPID Assignment Function.

Enter the Proposed CHPID assignments and press apply.

Channel Cage	Location Card Slot	Jack	Bus/Link	Assigned CHPID	Proposed CHPID	Card
A01B	LG01	J.07	00-11.00	19		ESCON 16 CH
A01B	LG01	J.08	00-11.00	1A		ESCON 16 CH
A01B	LG01	J.09	00-11.00	1B		ESCON 16 CH
A01B	LG01	J.10	00-11.00	1C		ESCON 16 CH
A01B	LG01	J.11	00-11.00	1D		ESCON 16 CH
A01B	LG01	J.12	00-11.00	1E		ESCON 16 CH
A01B	LG01	J.13	00-11.00	1F		ESCON 16 CH
A01B	LG01	J.14	00-11.00	20	C0	ESCON 16 CH
A01B	LG02	J.00	01-10.00	21	C1	ESCON 16 CH
A01B	LG02	J.01	01-10.00	22	C2	ESCON 16 CH
A01B	LG02	J.02	01-10.00	23	C3	ESCON 16 CH
A01B	LG02	J.03	01-10.00	24		ESCON 16 CH
A01B	LG02	J.04	01-10.00	25		ESCON 16 CH
A01B	LG02	J.05	01-10.00	26		ESCON 16 CH
A01B	LG02	J.06	01-10.00	27		ESCON 16 CH
A01B	LG02	J.07	01-10.00	28		ESCON 16 CH
A01B	LG02	J.08	01-10.00	29		ESCON 16 CH
A01B	LG02	J.09	01-10.00	2A		ESCON 16 CH

[Proposed CHPID Change...]   or Double Click selected line for Proposed CHPID change

[Apply]   [Verify]   [Clear]   [Exit]   [Help]

CPC Configuration

Channel CHPID Assignment

Channel CHPID Assignment Notes

- Any channel or PCI-CC engine (AP) may have any CHPID number assigned
  - Assignment is performed either by manually entering the CHPID re-map information from the HMC/SE, or by importing a re-map diskette also from the HMC/SE
    - This is a CE-mode only function
- IC Channels are recommended to be assigned CHPID numbers from x'FF' downwards

---

I/O Definition Support (IOCP)

- IOCP program support for the Freeway is IYPIOCP (new IOCP program)
- There are minimal external changes to IOCP to support the 2064
- The IOCP statement changes for the 2064 are as follows:
- ID statement
  - SYSTEM=(2064,1) for general purpose models (101 to 116 and 1C1 to 1C9)
  - SYSTEM=(2064,2) for CF only model (100)

- RESOURCE statement
  - No change

- CHPID statement support for DCM managed CHPIDs
  - OS=01 - Identifies CNC, FC or FCV channel as managed and shared
  - Required: IOCLUSTER=xxxxxxxx - I/O cluster (sysplex) name of owning sysplex
  - Required: SWITCH - director identification
  - Not Allowed: PART, PARTITION, NOTPART - can't restrict candidate LP list

I/O Definition Support (IOCP)

- CHPID macro-instruction statements unchanged (except for DCM)
  - FICON channels
    - FICON Bridge - FCV
    - FICON native - FC (Point-to-Point or Switched Point-to-Point)
  - ESCON
    - Connection - CNC (Point-to-Point or Switched Point-to-Point)
    - Channel-to-channel - CTC
    - Conversion byte - CBY
    - Conversion block - CVC
  - Parallel
    - Block - BL
    - Byte - BY
  - OSA-2
    - Open Systems Adapter - OSA
  - OSA-E
    - Open Systems Adapter - Express - OSD
    - Open Systems Adapter - Express - OSE
- PCI-CC engines
  - No support required - not defined by IOCP

Questions?
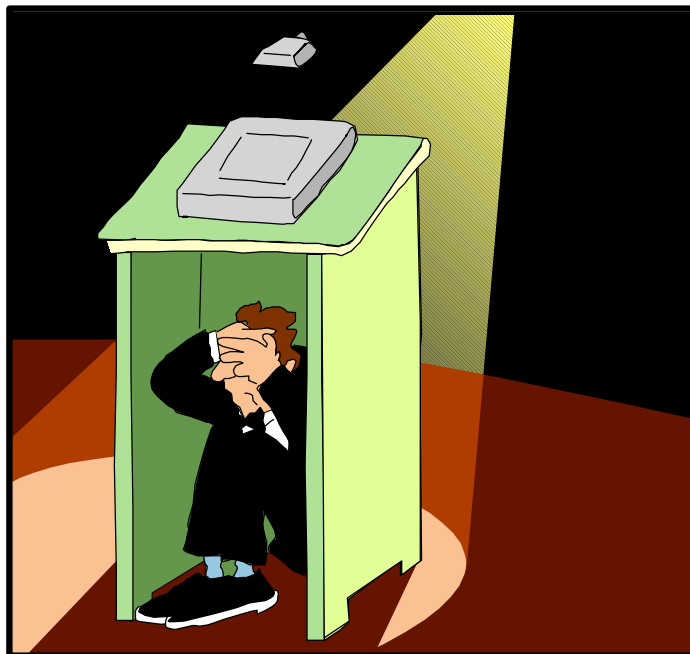
Backup Charts.....

Self Timed Interfaces (STIs)

CPC Cage - Rear View

1 GByte STIs - ICB-3 or #2023 cage I/O domain

Top

ETR/OSC Cards to sysplex timer

New Connector: MT RJ

| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 |

MEMORY

08 | 09   10 | 11

CE0 CE1

12 | 13   14 | 15

MEMORY

DCA DCA DCA

Bottom

Crypto

Self Timed Interfaces (STIs)

CPC Cage - Front View

1 GByte CAP/STIs - #2023 I/O domains only

STI-H

4 busses
333 MBytes/Sec
#2022 I/O domains
or ICB to G5/6
No mix same card!

STI-G
1 GByte/sec
#2023 I/O domains only

```
top

22  20   1            M              M        1
         8            E              E        6
                      M   Processor  M
              MEMORY  O      MCM     O   MEMORY
 2   2   1            R              R        1
 3   1   9            Y              Y        7

01 03  04          bottom                    18
```

Slots 01 and 03: STI-H and/or STI-G mix determined by the configuration.

STI Connections

Internal
1 Gbyte STI
cables 4 meters

MBAs

2064 GP models

CAP/STI | STI-G | STI-H | STI-H | STI-H

1 Gbyte ICB-3
7 (10) meters

2023
I/O CAGE
(Example)

ESCON | OSA-E | STIM | ESCON | OSA-E | ISC-3 | ESCON | STIM | ESCON | ESCON | STIM | ESCON

PARALLEL | PARALLEL | FIB | OSA-2 | FIB | ESCON | ESCON

333 Mbyte ICB-2
7 (10) meters

2022
I/O CAGE
(Example)

1 Gbyte ICB-3
7 (10) meters

Secondary
STIs

333 Mbyte ICB-2
7 (10) meters

MBAs

2064 Model 100 (GA 2/2000)
(or GP models)

1GB STI
500MB STI
333MB STI

G5/G6 - MBAs

9672 Model R06
(or GP models)

New I/O Cage FC2023 Top View
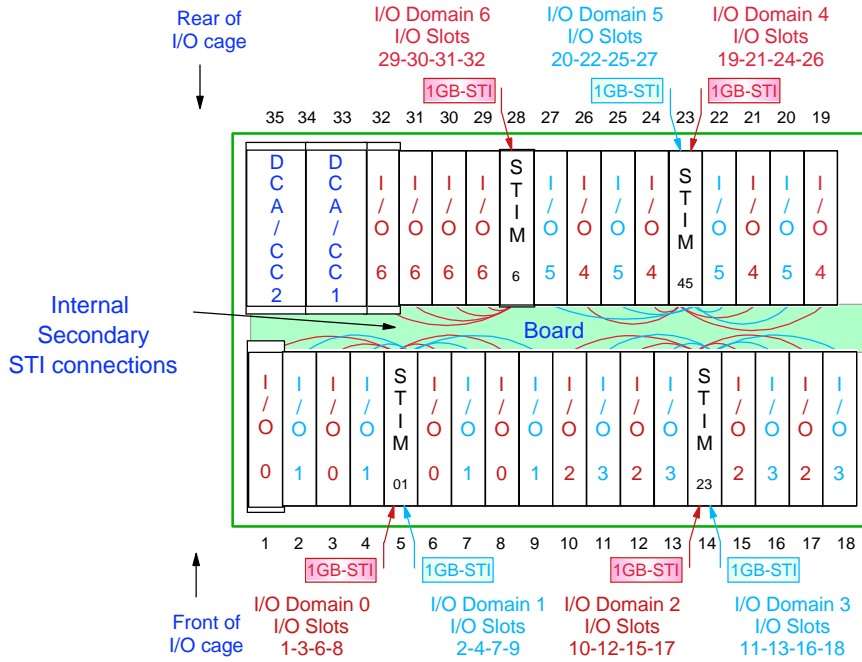
Rear of
I/O cage

I/O Domain 6
I/O Slots
29-30-31-32

I/O Domain 5
I/O Slots
20-22-25-27

I/O Domain 4
I/O Slots
19-21-24-26

1GB-STI   1GB-STI   1GB-STI

35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19

| D C A / C C 2 | D C A / C C 1 | I/O 6 | I/O 6 | I/O 6 | I/O 6 | STIM 6 | I/O 5 | I/O 4 | I/O 5 | I/O 4 | STIM 45 | I/O 5 | I/O 4 | I/O 5 | I/O 4 |

Internal
Secondary
STI connections

Board

| I/O 0 | I/O 1 | I/O 0 | I/O 1 | STIM 01 | I/O 0 | I/O 1 | I/O 0 | I/O 1 | I/O 2 | I/O 3 | I/O 2 | I/O 3 | STIM 23 | I/O 2 | I/O 3 | I/O 2 | I/O 3 |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

1GB-STI   1GB-STI   1GB-STI   1GB-STI

Front of
I/O cage

I/O Domain 0
I/O Slots
1-3-6-8

I/O Domain 1
I/O Slots
2-4-7-9

I/O Domain 2
I/O Slots
10-12-15-17

I/O Domain 3
I/O Slots
11-13-16-18

New I/O Cage FC2023 - Front view
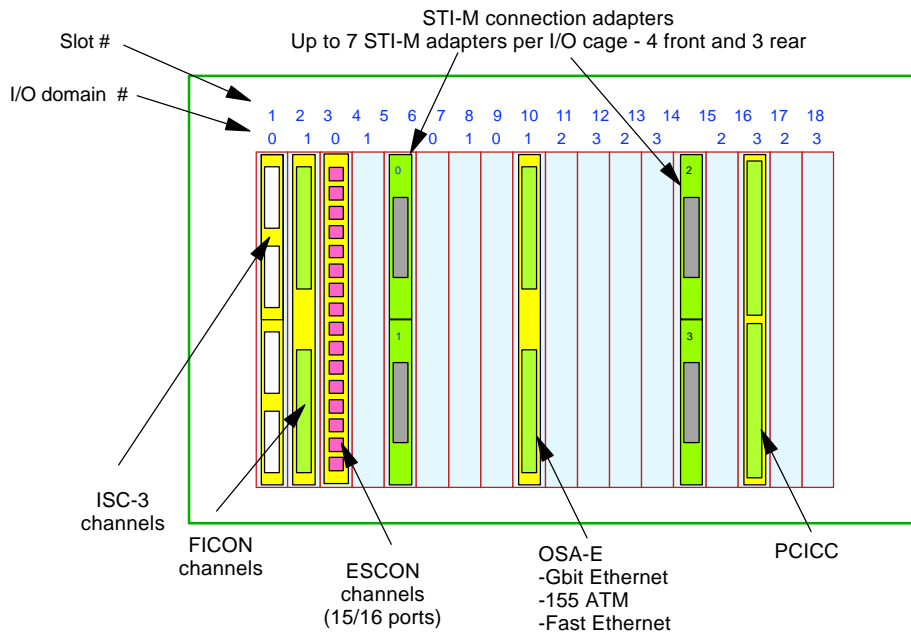
Slot #

I/O domain #

STI-M connection adapters
Up to 7 STI-M adapters per I/O cage - 4 front and 3 rear

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 0 | 1 | 0 | 1 | | 0 | 1 | 0 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |

ISC-3
channels

FICON
channels

ESCON
channels
(15/16 ports)

OSA-E
-Gbit Ethernet
-155 ATM
-Fast Ethernet

PCICC

New I/O Cage FC2023 - Rear view
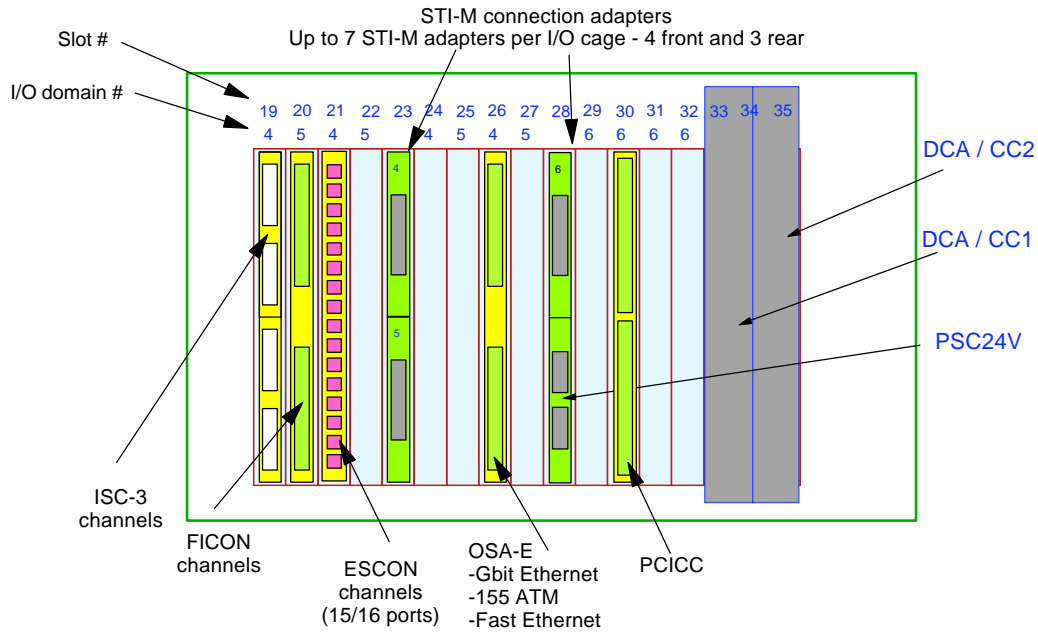
Slot #

I/O domain #

STI-M connection adapters
Up to 7 STI-M adapters per I/O cage - 4 front and 3 rear

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
4	5	4	5	5	4	5	4	5	6	6	6	6	6			

DCA / CC2

DCA / CC1

PSC24V

ISC-3 channels

FICON channels

ESCON channels (15/16 ports)

OSA-E
-Gbit Ethernet
-155 ATM
-Fast Ethernet

PCICC

Frame and Cage Configurations

A-Frame

CEC

#2023 only
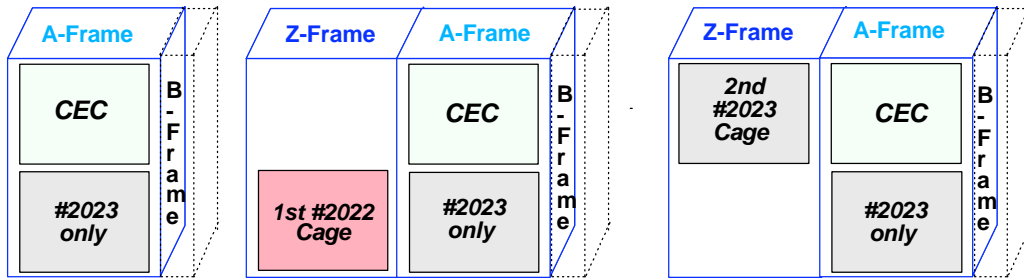
B-Frame

★ **One I/O Cage**
- 28 New Slots
- 7 Domains

Z-Frame   **A-Frame**

1st #2022 Cage

CEC

#2023 only

B-Frame

★ **Two I/O Cages**
- 28 New Slots
- 22 Old Slots
- 10 Domains

Z-Frame   **A-Frame**
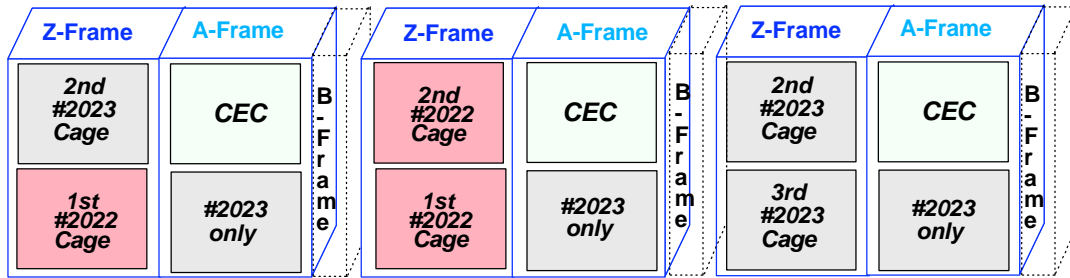
2nd #2023 Cage

CEC

#2023 only

B-Frame

★ **Two I/O Cages**
- 56 New Slots
- 14 Domains

- B-Frame required for IBF Features
- #2022 - Compatibility Cage: Parallel, OSA-2 (TR/EN, FDDI), ESCON 4-Port, 3 domains, 22 slots
- #2023 - New I/O Cards, 7 domains, 28 slots

Frame and Cage Configurations

Z-Frame	A-Frame		Z-Frame	A-Frame		Z-Frame	A-Frame	
2nd #2023 Cage	CEC	B-Frame	2nd #2022 Cage	CEC	B-Frame	2nd #2023 Cage	CEC	B-Frame
1st #2022 Cage	#2023 only		1st #2022 Cage	#2023 only		3rd #2023 Cage	#2023 only	

★ **Three I/O Cages**
- 56 New Slots
- 22 Old Slots
- 17 Domains

★ **Three I/O Cages**
- 28 New Slots
- 44 Old Slots
- 13 Domains

★ **Three I/O Cages**
- 84 New Slots
- 21 Domains
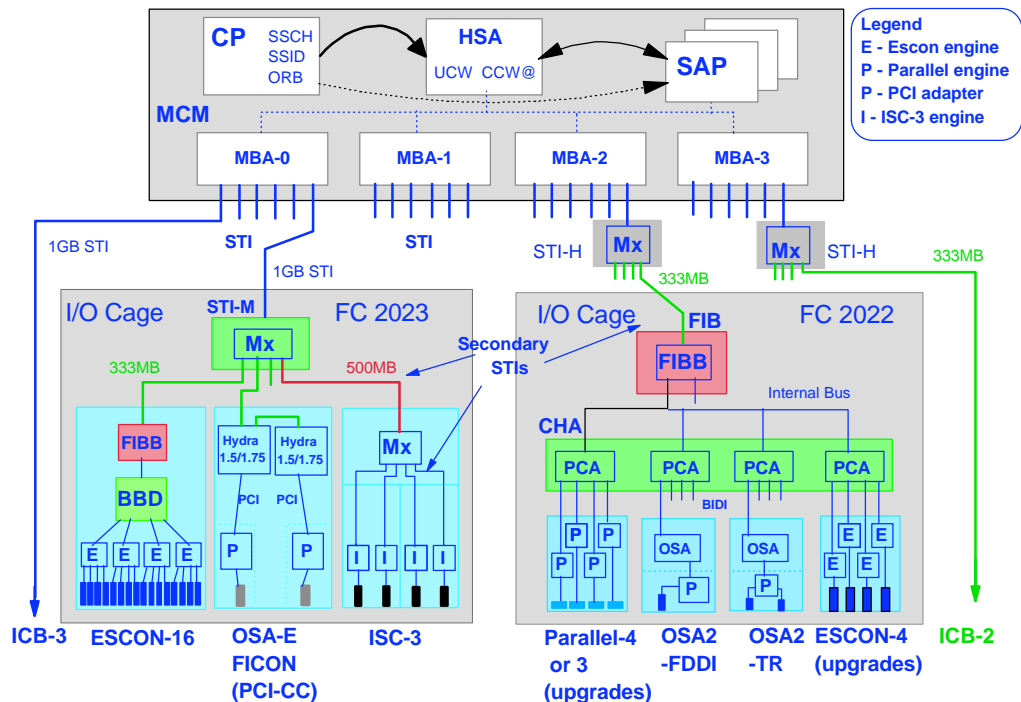- Note: No more than 20 domains ever needed for 256 channels.

- B-Frame required for IBF Features
- #2022 - Compatibility Cage: Parallel, OSA-2 (TR/EN, FDDI), ESCON 4-Port, 3 domains, 22 slots
- #2023 - New I/O Cards, 7 domains, 28 slots

Channel Subsystem Structure

Legend
E - Escon engine
P - Parallel engine
P - PCI adapter
I - ISC-3 engine

Compatibility I/O Cage FC #2022

STI- 333MB/Sec
From STI-H

From STI-H **STI- 333MB/Sec**
STI- 333MB/Sec
From STI-H

#	Left		#	Right
1			35	CC-EXT
2	DCA/CC1		34	I/O
3	DCA/CC2		33	I/O
4	CHA		32	I/O
5	FIBB		31	I/O
6	I/O		30	CHA
7	I/O		29	I/O
8	I/O		28	I/O
9	CHA		27	I/O
10	I/O		26	I/O
11	I/O		25	I/O
12	FIBB		24	CHA
13	FIBB		23	CHA
14	I/O		22	I/O
15	I/O		21	I/O
16	CHA		20	I/O
17	I/O		19	I/O
			18	I/O

BOARD

I/O Domain 2
I/O Domain 0
I/O Domain 1
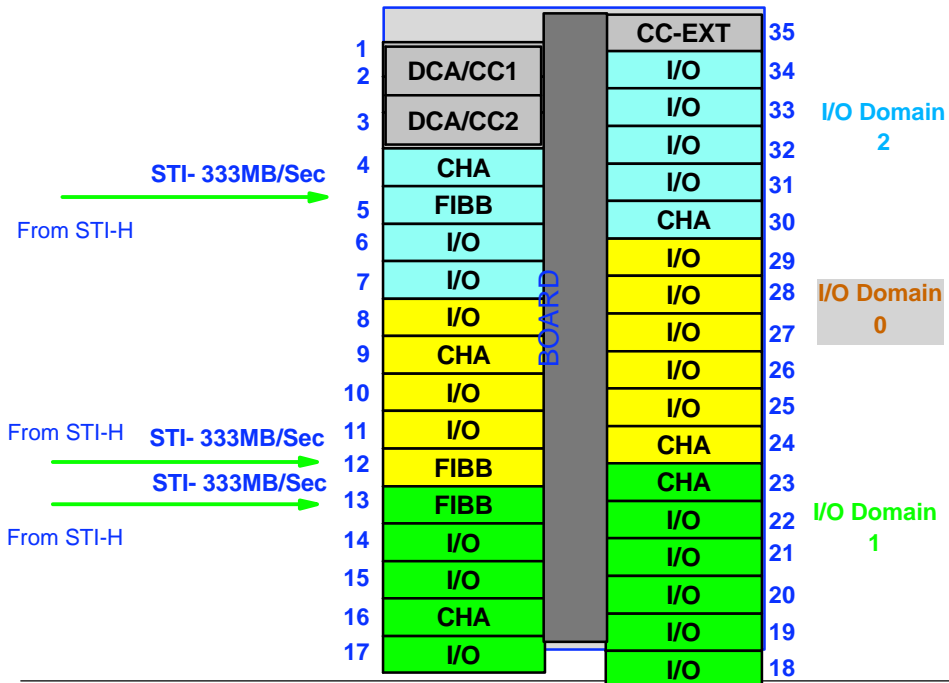
Modes and Memory

- Notes:
  - ► 64GB CS limit is based on maximum 2064 storage NOT an architectural limit
  - ► IBM intends to release Linux for 2064 "soon"
  - ► VIF for Linux will NOT support Linux for Fwy VM/NP will support Linux for Fwy

CPC Mode

Basic Mode

LPAR Mode

ESA/390 Mode
- CPs *only*
- Def. CS <= 64GB
- Def. ES = Yes

ESA/390 TPF Mode
- CPs *only*
- Def. CS <= 64GB
- Def. ES = Yes

Coupling Facility Mode
- ICFs *and/or* CPs
- Def. CS <= 64GB
- Def. ES = No

ESA/390 Linux Mode
- IFLs *only*
- Def. CS <= 64GB
- Def. ES = Yes
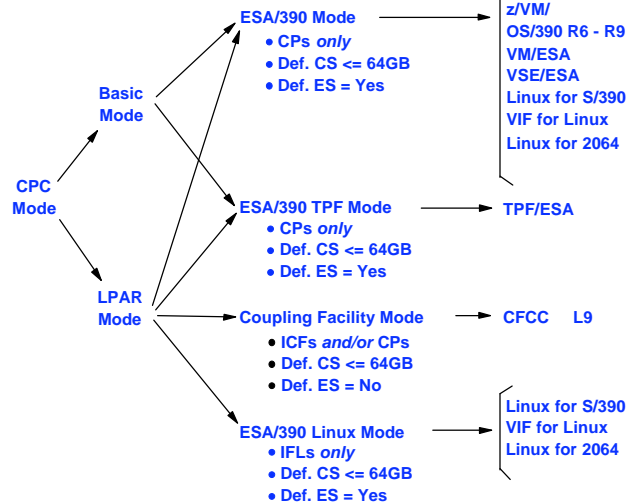
	Addr. Mode	CS Usage Limit	ES Usage
z/OS	64-bit	64GB	No
OS/390 R10	64-bit	64GB	No
OS/390 R10	31-bit	2GB	Yes
z/VM	64-bit	64GB	Yes
z/VM/	31-bit	2GB	Yes
OS/390 R6 - R9	31-bit	2GB	Yes
VM/ESA	31-bit	2GB	Yes
VSE/ESA	31-bit	2GB	No
Linux for S/390	31-bit	2GB	No
VIF for Linux	31-bit	2GB	Yes
Linux for 2064	64-bit	64GB	No
TPF/ESA	31-bit	2GB	Yes
CFCC L9	31-bit	2GB	Yes
Linux for S/390	31-bit	2GB	No
VIF for Linux	31-bit	2GB	Yes
Linux for 2064	64-bit	64GB	No