

# IBM Z Channels Architecture and Management Intro

Lee Daniels  
IBM zCTS  
[ldaniels@us.ibm.com](mailto:ldaniels@us.ibm.com)

**2019** IBM Systems Technical University  
4/29 – 5/3/2019 | Atlanta, GA, USA  
Session: z107741



Note: The information contained in this presentation contains high level concepts that may not be exactly accurate, or exactly accurate for all IBM mainframes. Please consult your IBM Z specialist and/or actual product documentation and manuals for information related to your particular system and environment.

Acknowledgements: I want to thank the following people for their comments and suggestions.

Tom Peele

Tony Mateus

Several anonymous clients who provided helpful suggestions and displays

---

## Trademarks

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

Not all common law marks used by IBM are listed on this page. Failure of a mark to appear does not mean that IBM does not use the mark nor does it mean that the product is not actively marketed or is not significant within its relevant market. Those trademarks followed by ® are registered trademarks of IBM in the United States; all others are trademarks or common law marks of IBM in the United States.

For a more complete list of IBM Trademarks, see [www.ibm.com/legal/copytrade.shtml](http://www.ibm.com/legal/copytrade.shtml):

\*BladeCenter®, CICS®, DataPower®, DB2®, e business (logo)®, ESCON®, eServer®, FICON®, IBM®, IBM (logo)®, IMS®, MVS®, OS/390®, POWER6®, POWER6+, POWER7®, Power Architecture®, PowerVM®, PureFlex®, PureSystems®, S/390®, ServerProven®, Sysplex Timer®, System p®, System p5, System x®, z Systems®, System z9®, System z10®, WebSphere®, X-Architecture®, z13™, z13s™, z14™, z Systems™, z9®, z10, z/Architecture®, z/OS®, z/VM®, z/VSE®, zEnterprise®, zSeries®, IBM Z®

The following are trademarks or registered trademarks of other companies.

Adobe, the Adobe logo, PostScript, and the PostScript logo are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States, and/or other countries.

Cell Broadband Engine is a trademark of Sony Computer Entertainment, Inc. in the United States, other countries, or both and is used under license therefrom.

Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

Intel, Intel logo, Intel Inside, Intel Inside logo, Intel Centrino, Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

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

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

ITIL is a registered trademark, and a registered community trademark of the Office of Government Commerce, and is registered in the U.S. Patent and Trademark Office.

IT Infrastructure Library is a registered trademark of the Central Computer and Telecommunications Agency, which is now part of the Office of Government Commerce.

\* 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 with 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

|                   |                                                                                                                                                                                                                                                            |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Channel</b>    | Connection to an external device                                                                                                                                                                                                                           |
| <b>CHP</b>        | Channel Path                                                                                                                                                                                                                                               |
| <b>CHPID</b>      | Channel Path Identifier                                                                                                                                                                                                                                    |
| <b>CSS / LCSS</b> | Channel Subsystem / Logical Channel Subsystem                                                                                                                                                                                                              |
| <b>CMOS</b>       | Complementary Metal-Oxide Semiconductor. A current semiconductor technology.                                                                                                                                                                               |
| <b>CU / LCU</b>   | Control Unit / Logical Control Unit. The logic and hardware in an external input output (I/O) device or subsystem that interfaces to a channel and manages attached devices                                                                                |
| <b>CUADD</b>      | Control Unit Address. An address parameter defined in a CU or LCU that must match the CUADD parameter in the I/O configuration dataset                                                                                                                     |
| <b>DASD</b>       | Direct Access Storage Device. Mainframe Disk Storage                                                                                                                                                                                                       |
| <b>ESCON</b>      | Enterprise Systems Connection. IBM's proprietary early fiber optic channel connection technology, now superseded by FICON channels                                                                                                                         |
| <b>FICON</b>      | Fibre Connection. IBM's current fiber optic channel connection technology, based on the Fibre Channel standard with IBM proprietary extensions                                                                                                             |
| <b>HCD</b>        | Hardware Configuration Definition. A panel driven input/output configuration tool used to create an input/output definition file                                                                                                                           |
| <b>HMC</b>        | Hardware Management Console. A special server used to manage one or more mainframes via its connection to the Support Element (SE) in each mainframe                                                                                                       |
| <b>HSA</b>        | Hardware System Area. Mainframe memory reserved exclusively for hardware system use, isolated from memory used by operating systems                                                                                                                        |
| <b>IOCDS</b>      | Input/Output Configuration DataSet. The hardware configuration information that is loaded into the Support Element and used to set up the IO Subsystem during Power On Reset processing                                                                    |
| <b>IODF</b>       | Input/Output Definition File. Contains the I/O configuration information used by z/OS (during IPL) and by the Channel Subsystem (after IOCP processing) during POR                                                                                         |
| <b>IOCP</b>       | Input Output Control Program. The program used to create an Input Output Configuration DataSet (IOCDS)                                                                                                                                                     |
| <b>LPAR</b>       | Logical Partition. An isolated environment in a mainframe that runs one instance of an operating system                                                                                                                                                    |
| <b>MIF / EMIF</b> | Multiple Image Facility / ESCON Multiple Image Facility. This enables multiple instances of an operating system to share channels in a mainframe Logical Channel SubSystem.                                                                                |
| <b>MSS</b>        | Multiple Subchannel Set. A Subchannel Set is a group of 64K addresses that can be used to manage access to I/O devices. MSS provides multiple 64K sets of addresses.                                                                                       |
| <b>PCHID</b>      | Physical Channel Identifier. This is the unique port address of a physical port on a mainframe.                                                                                                                                                            |
| <b>POR</b>        | Power On Reset. The process of initializing a mainframe processor to prepare it to load one or more instances of an operating system                                                                                                                       |
| <b>PR/SM</b>      | Processor Resource / System Manager. A type-1 Hypervisor (virtual machine monitor) that enables multiple logical partitions to share physical mainframe system resources.                                                                                  |
| <b>SCB</b>        | Subchannel Control Block. Contains information such as the channel program address, path selection controls, architected path masks, addressing information such as the device address and device number, and subchannel and device status. Related to UCW |
| <b>Subchannel</b> | An address and related control blocks in a channel subsystem used to manage access to an I/O device. It maps to a device address defined in the IOCDS. One I/O operation per subchannel.                                                                   |
| <b>UA</b>         | Unit Address. Defined in the external I/O device and maps to a corresponding Device Address in the IOCDS for the operating system                                                                                                                          |
| <b>UCB</b>        | Unit Control Block. Information in the operating system related to a specific device, including logical status of the device and status of I/O to the device                                                                                               |
| <b>UCW</b>        | Unit Control Word. Information in the Logical Channel SubSystem related to a specific subchannel address (i.e., I/O device). Related to SCB                                                                                                                |

Some of the above are copied from official IBM publications and some are my working definitions for this presentation.

---

## What Does This Mean?

**D M=DEV(0223)**

```
IEE174I 09.05.55 DISPLAY M 200
DEVICE 0223      STATUS=ONLINE
CHP              01
PATH ONLINE      Y
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL Y
```

D M command is in the Displaying System Configuration Information section of the MVS System Commands Reference manual

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages for IEE174I, especially noting Form 6 and Form 12



---

## Session Objectives

- Help you understand and manage your IBM Z System DASD Channel Paths
- Review IBM Z Channel Subsystem Architecture Concepts
  - Briefly review development of the IBM mainframe channel subsystem
  - Focus on DASD (i.e., disk) devices
- Review key concepts for defining a DASD channel path
- Review some commands to display and manage DASD channel paths and devices

This presentation was created to help identify commands that can be used to query and manage input/output devices. The concepts presented and the commands shown should be useful not only for day to day system operations, but also to assist with problem determination.

## Early Mainframes with Parallel Channels

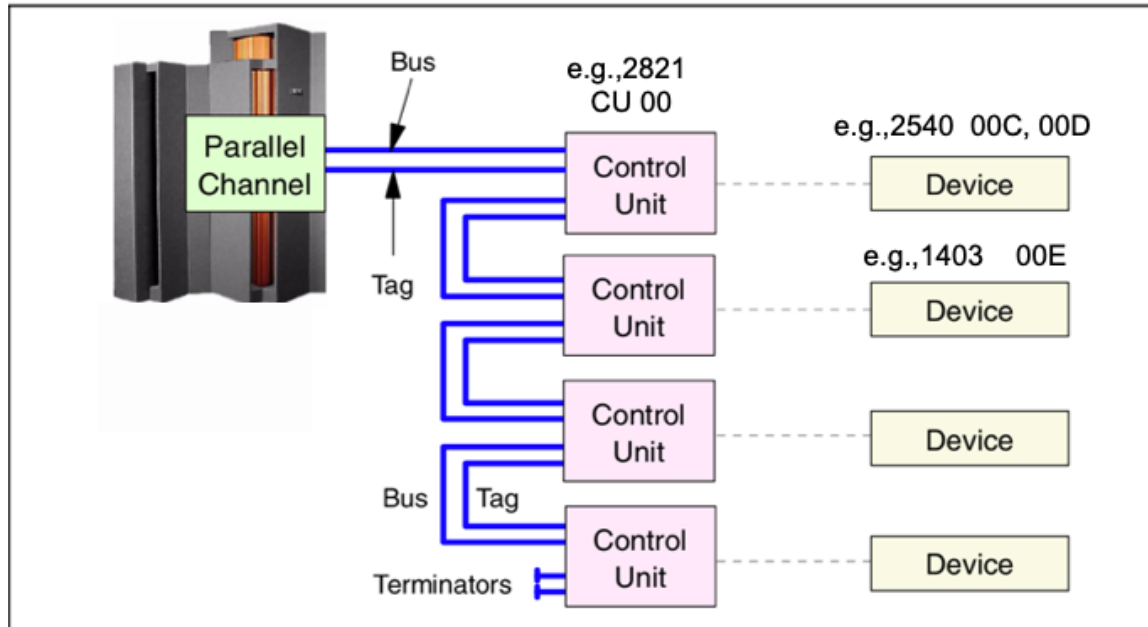


Figure 3-1 Parallel channel connectivity

### Key Concepts

- System
  - Single OS
- Channel
  - Hardware defined
  - Max 16 (0 – F)
  - Subchannel for I/O operation
  - No sharing
  - Single "path" to a device
- Device
  - Max 256 (FF) per channel
  - Thus 4096 total max

Source: SG24-5975 z900 Technical Guide

IBM introduced the parallel channel with System/360 during the early 1960s. The I/O devices were connected using two copper cables called *bus* and *tag* cables. Figure 3-1 shows bus and tag cables connected sequentially to the control units. This is often referred to as "daisy chaining." The last CU is equipped with channel terminator blocks.

The architectural limit to the number of control units in the chain is 256, but electrical

characteristics restrict the chain to a maximum of eight control units on a channel.

Daisy chaining better utilizes a channel that has slow control units attached, but a single

failing control unit or a bad cable connection can influence other control units chained on the channel.

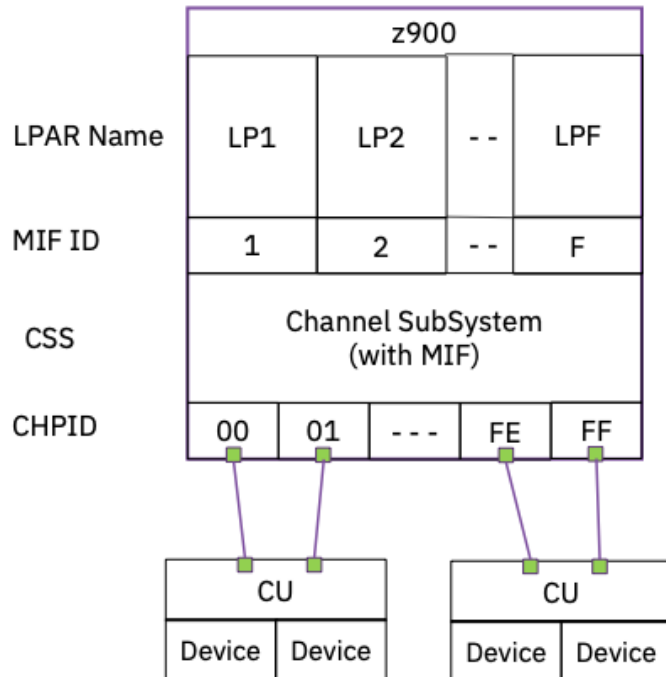
---

## Channel Architecture Progression

- S/360 Mod 50 circa 1964, parallel channels
- S/370 3168 circa 1970, max 16 parallel channels
- S/370/XA circa 1980, CHPIDs (256 max), Subchannels (65,536 max)
  - 3084 supports 48 channels max, 4080 subchannels max, IOCP Definitions
- ESA/370 circa 1988, PR/SM optional feature
  - 3090E supports 4 LPARs max, 128 channels max, 4096 devices max
- ESA/390 circa 1992, PR/SM Standard feature, MIF, ESCON
  - ES9000 supports 10 LPARs max, 256 channels max, Dynamic Reconfiguration Management
- ESA/390 CMOS G3/4 circa 1997, more LPARs
  - 9672-RA5 supports 15 LPARs max
- z/Arch CMOS G7 circa 2000, 64 bit addressing, single Channel SubSystem
  - Z900 supports 15 LPARs max and up to 256 Parallel, ESCON, and FICON channels total
- z/Arch CMOS G8 circa 2003, Multiple logical Channel SubSystems (MCSS/LCSS), PCHIDs
  - Z990 supports 4 LCSS max, 30 LPARs max, ESCON, FICON Express, OSA-Express, and Coupling channels

From the z990 Technical Guide SG24-6947 you find this history:  
IBM introduced the Processor Resource/Systems Manager™ (PR/SM) feature in February 1988, supporting a maximum of four logical partitions. In June 1992, IBM introduced support for a maximum of 10 logical partitions and announced the Multiple Image Facility (MIF, also known as EMIF), which allowed sharing of ESCON channels across logical partitions, and since that time, has allowed sharing of more channels across logical partitions (such as Coupling Links, FICON, and OSA). In June 1997, IBM announced increased support - up to 15 logical partitions on Generation 3 and Generation 4 servers. The evolution continues and IBM is announcing support for 30 logical partitions. This support is exclusive to z990 and z890 models.

## z900 Channel Architecture (circa Dec. 2000)



### Key Concepts

#### — System

- Single Channel Subsystem
- Max 15 Logical Partitions (LPARs)

#### — Channel

- Software defined paths (via HCD / IOCP Process)
- Max 256 Channel Paths (CHPIDs)
- Sharing of ESCON and FICON channels via MIF
- Multiple "paths" to a device possible

#### — Device

- Max 63.75K (subchannels)
- Subchannel represents device and tracks a single I/O operation to that device

Reference SG24-5975 z900 Technical Guide  
z900 GA December 18, 2000 (G7 CMOS Family)

One Channel Subsystem (CSS)

EMIF = Enhanced Multiple Image Facility (This enables channel sharing among Processor Resource/Systems Manager (PR/SM) Logical Partitions (LP) for certain channel types (e.g., FICON).)

Max active LPARS 15

Max defined LPARs 15

Max CHPIDs 256

Max subchannels per LPAR 63K

Max subchannels per z900 512K

FICON Express16S on z13 and z14 now supports up to 32K subchannels (UAs) per channel

Need IOCDS to define connections from LPARs to Devices

From the z990 Technical Guide SG24-6947 you find this history:

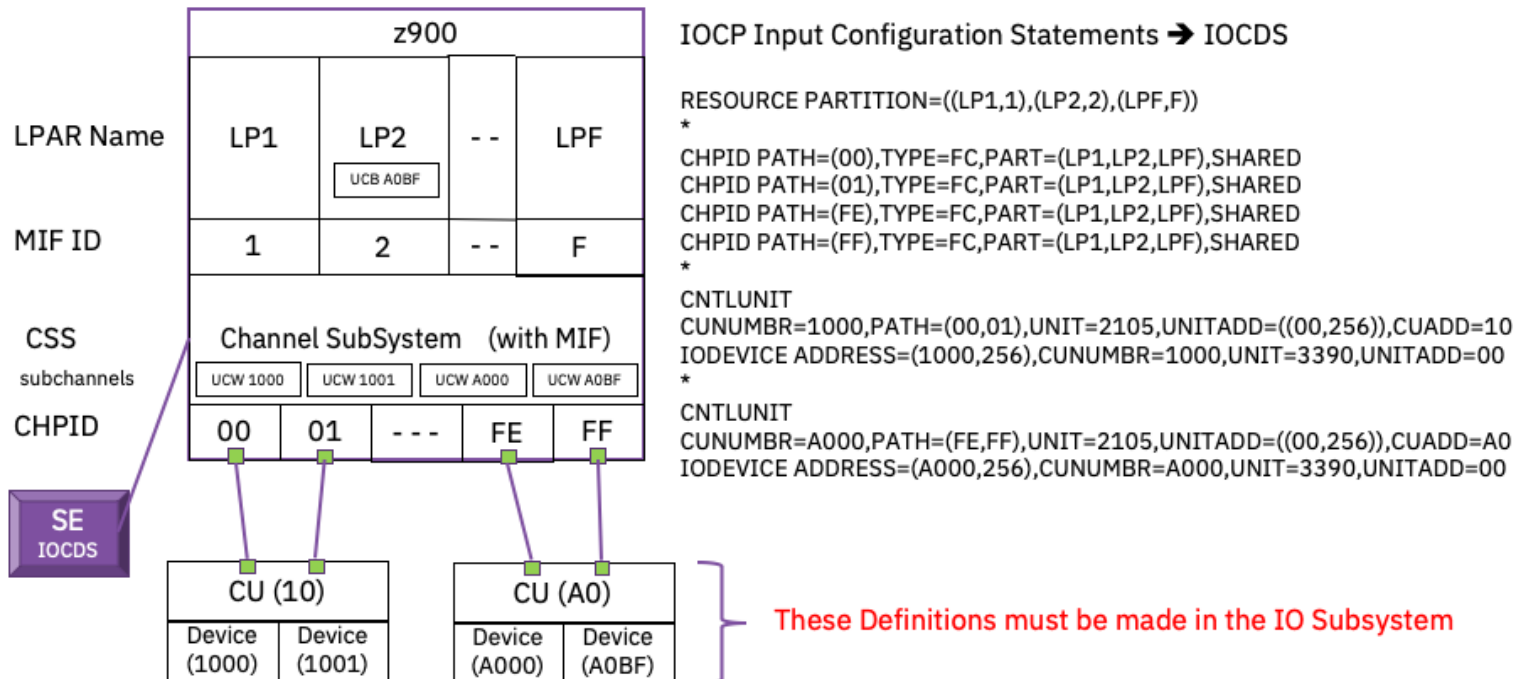
IBM introduced the Processor Resource/Systems Manager™ (PR/SM) feature in February

1988, supporting a maximum of four logical partitions. In June 1992, IBM introduced support for a maximum of 10 logical partitions and announced the Multiple Image Facility (MIF, also known as EMIF), which allowed sharing of ESCON channels across logical partitions, and since that time, has allowed sharing of more channels across logical partitions (such as Coupling Links, FICON, and OSA). In June 1997, IBM announced increased support - up to 15 logical partitions on Generation 3 and Generation 4 servers. The evolution continues and IBM is announcing support for 30 logical partitions. This support is exclusive to z990 and z890 models.



## Defining a z900 Path to a DASD Device (1/2)

HCD => IODF (z/OS and HW defs) => IOCP => IOCDS (copied to SE and loaded into HW at POR)



Reference SG24-5975 z900 Technical Guide  
z900 GA December 18, 2000 (G7 CMOS Family)

## One Channel Subsystem (CSS)

EMIF = Enhanced Multiple Image Facility (This enables channel sharing among Processor Resource/Systems Manager (PR/SM) Logical Partitions (LP) for certain channel types (e.g., FICON).)

Max active LPARS 15

Max defined LPARs 15

Max CHPIDs 256

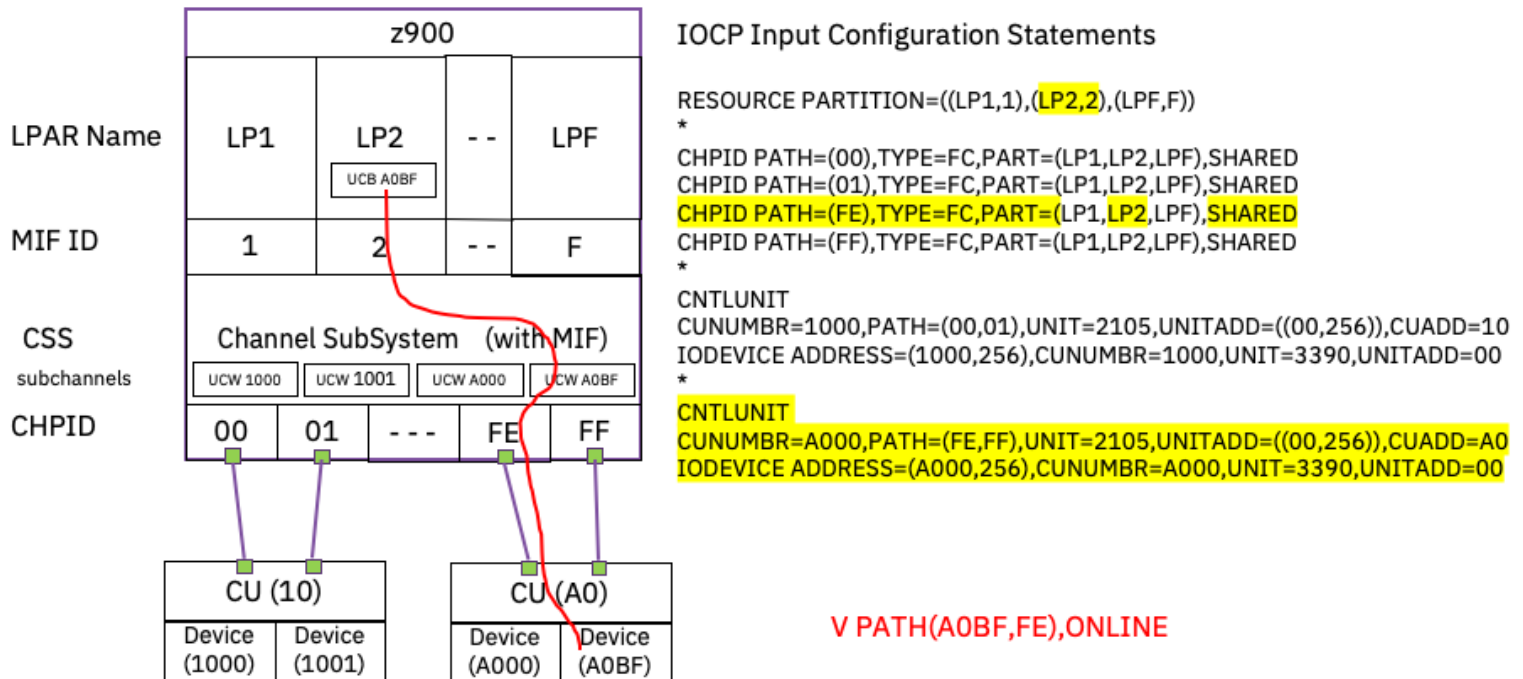
Max subchannels per LPAR 63K

Max subchannels per z900 512K

FICON Express16S on z13 and z14 now supports up to 32K subchannels (UAs) per channel

## Need IOCDS to define connections from LPARs to Devices

## Defining a z900 Path to a DASD Device (2/2)



Reference SG24-5975 z900 Technical Guide  
z900 GA December 18, 2000 (G7 CMOS Family)

One Channel Subsystem (CSS)

EMIF = Enhanced Multiple Image Facility (This enables channel sharing among Processor Resource/Systems Manager (PR/SM) Logical Partitions (LP) for certain channel types (e.g., FICON).)

Max active LPARS 15

Max defined LPARs 15

Max CHPIDs 256

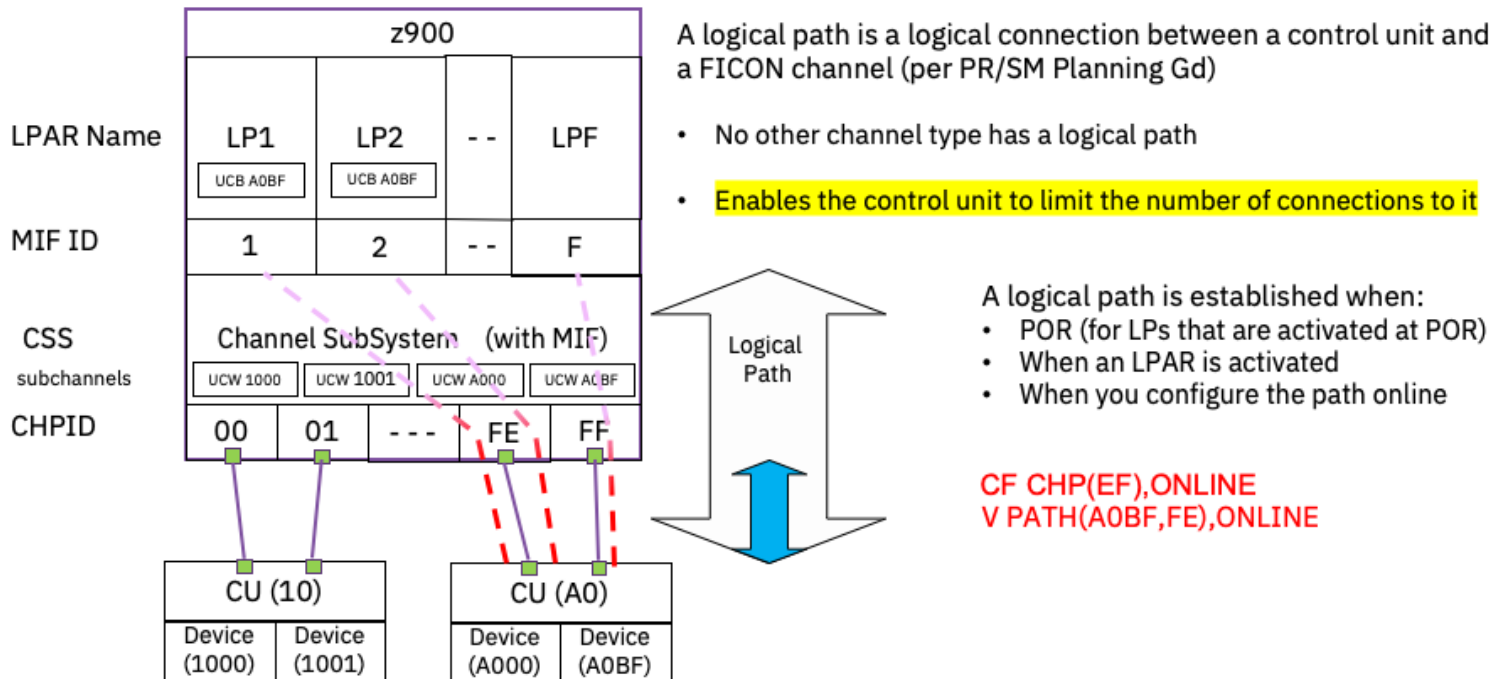
Max subchannels per LPAR 63K

Max subchannels per z900 512K

FICON Express16S on z13 and z14 now supports up to 32K subchannels (UAs) per channel

Need IOCDS to define connections from LPARs to Devices

## So, What is a Logical Path?



Reference SG24-5975 z900 Technical Guide  
z900 GA December 18, 2000 (G7 CMOS Family)

One Channel Subsystem (CSS)

EMIF = Enhanced Multiple Image Facility (This enables channel sharing among Processor Resource/Systems Manager (PR/SM) Logical Partitions (LP) for certain channel types (e.g., FICON).)

Max active LPARS 15

Max defined LPARs 15

Max CHPIDs 256

Max subchannels per LPAR 63K

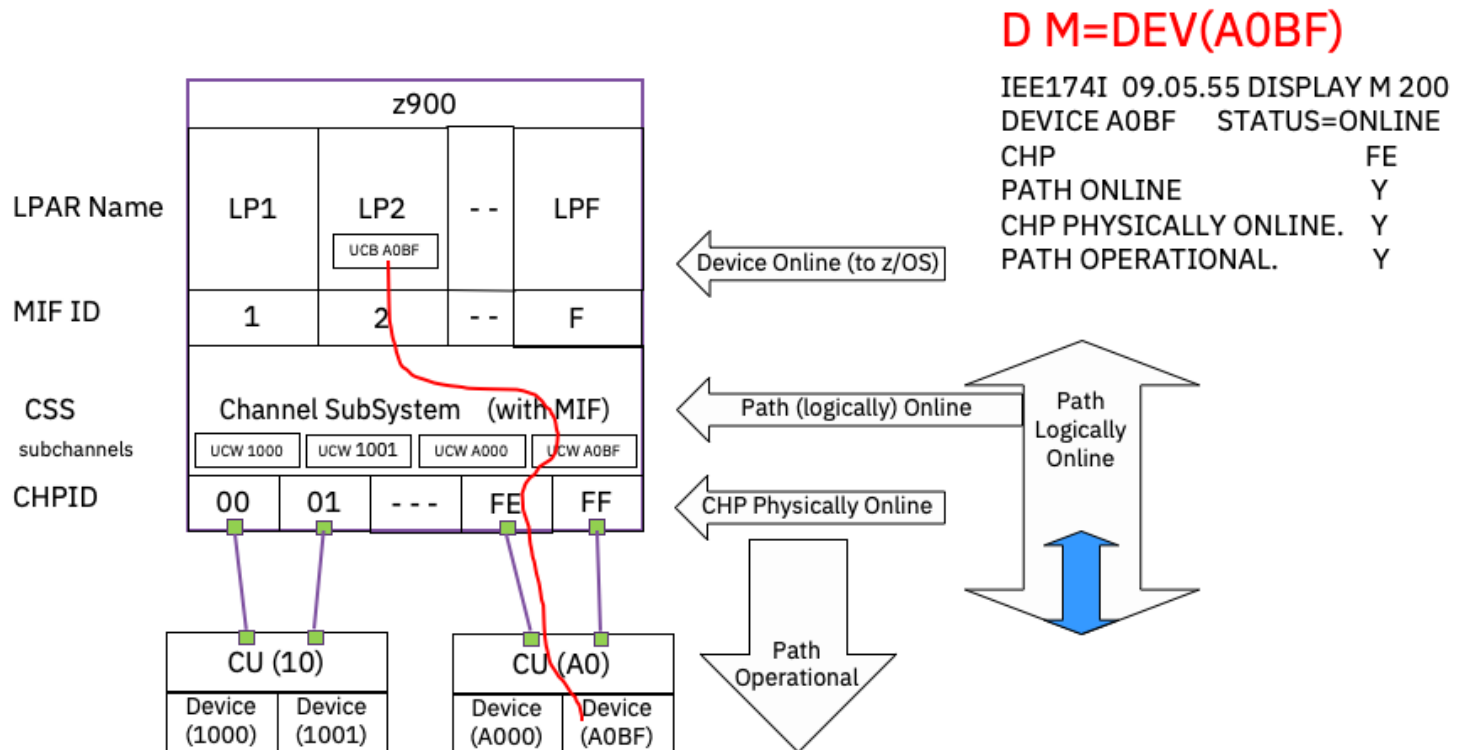
Max subchannels per z900 512K

FICON Express16S on z13 and z14 now supports up to 32K subchannels (UAs) per channel

Need IOCDS to define connections from LPARs to Devices

Max of 8 logical paths to any device (due to limit of 8 bit path mask in SCHIB)

## Device and Path Status Indications



Reference SG24-5975 z900 Technical Guide  
z900 GA December 18, 2000 (G7 CMOS Family)

One Channel Subsystem (CSS)

EMIF = Enhanced Multiple Image Facility (This enables channel sharing among Processor Resource/Systems Manager (PR/SM) Logical Partitions (LP) for certain channel types (e.g., FICON).)

Max active LPARS 15

Max defined LPARs 15

Max CHPIDs 256

Max subchannels per LPAR 63K

Max subchannels per z900 512K

FICON Express16S on z13 and z14 now supports up to 32K subchannels (UAs) per channel

Need IOCDS to define connections from LPARs to Devices

## Extensions: z990 added multiple LCSS

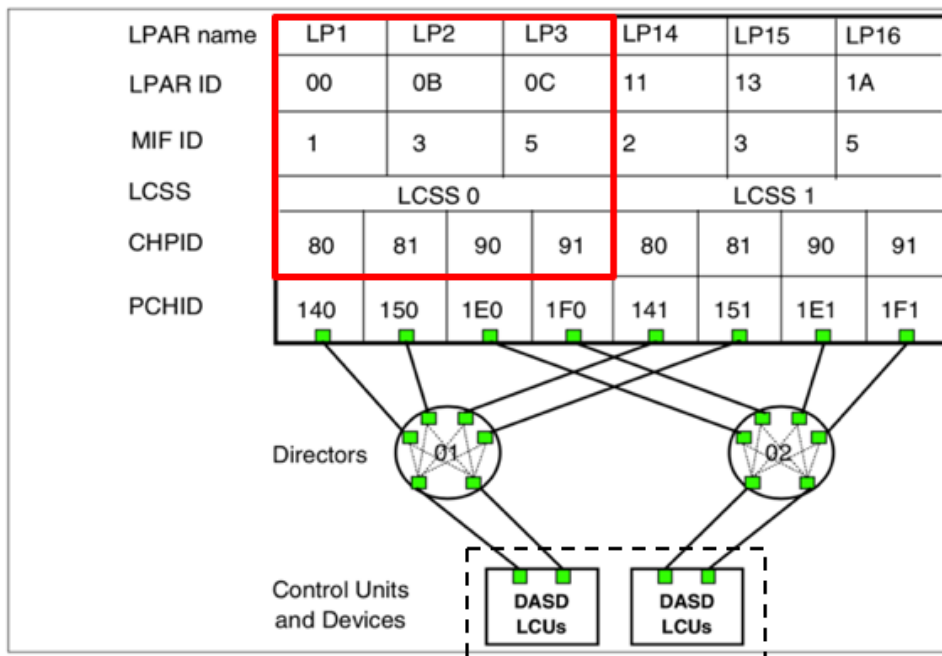


Figure 4-3 z990 LCSS connectivity

### Key Concepts

#### — System

- Multiple Channel Subsystems
- Max 15 Logical Partitions (LPARs) per LCSS

#### — Channel

- CHPID becomes logical representation of physical PCHID
  - Use CHPID Mapping Tool to map the two

#### — Device

- Max 63.75K (subchannels)
- Subchannel represents device and tracks a single I/O operation to that device

Source: z990 Technical Guide SG24-6947

Z990 GA 6/16/2003 (G8 CMOS Family)

Introduces LCSS and PCHID

Max LCSS 4. (0,1,2,3)

Max active LPARS 30

Max defined LPARs 30

Max CHPIDs 1024

From the z990 Technical Guide SG24-6947 you find this history:

IBM introduced the Processor Resource/Systems Manager™ (PR/SM) feature in February

1988, supporting a maximum of four logical partitions. In June 1992, IBM introduced support

for a maximum of 10 logical partitions and announced the Multiple Image Facility (MIF, also

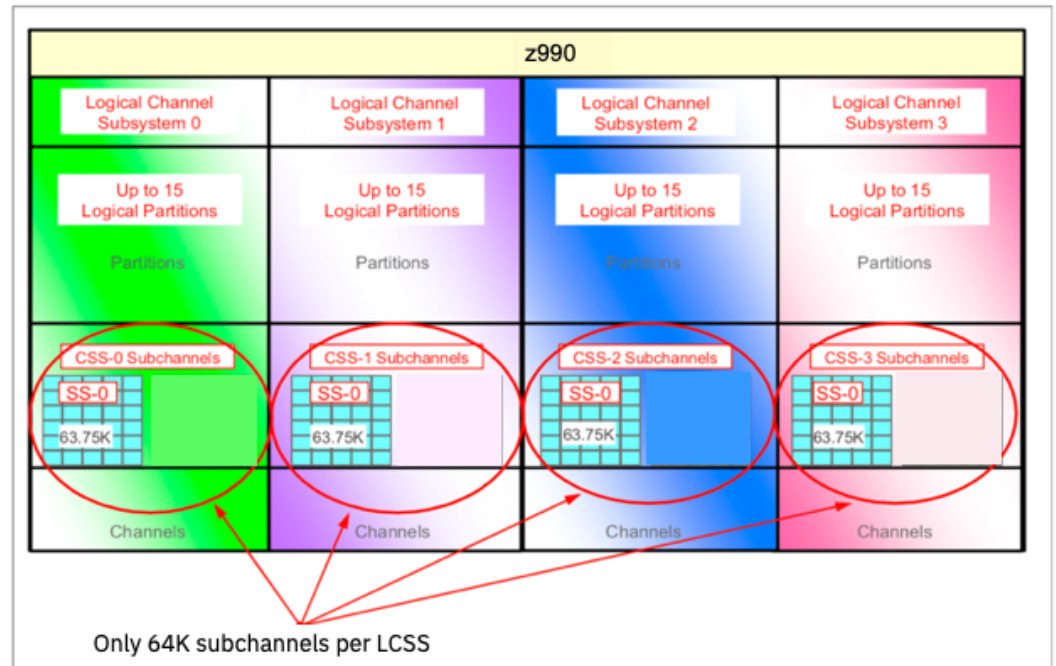
known as EMIF), which allowed sharing of ESCON channels across logical partitions, and



since that time, has allowed sharing of more channels across logical partitions (such as Coupling Links, FICON, and OSA). In June 1997, IBM announced increased support - up to 15 logical partitions on Generation 3 and Generation 4 servers. The evolution continues and IBM is announcing support for 30 logical partitions. This support is exclusive to z990 and z890 models.

## z990 Max of 64K Subchannels Became A Growth Limiter

- More channels can support more devices which need more subchannels
- Parallel Access Volumes (PAV) use alias subchannels
  - E.g.,
  - 3390B for base devices
  - 3390A for alias devices
- Growing data needs meant more DASD volumes (e.g., 3390-3 capacity of <3GB)



Source: SG24-7124 z9 Technical Guide

z9 EC GA 9/16/2005 (G9 CMOS Family)

Adds multiple subchannel sets, max of 2 (SS-0, SS-1) SS-1 only used for Aliases.

## Extensions: z9 adds Multiple Subchannel Sets

- Parallel Access Volumes (PAV) use alias subchannels

- E.g.,
- 3390B for base devices
- 3390A for alias devices

- Move the alias device definitions to subchannels in SS-1

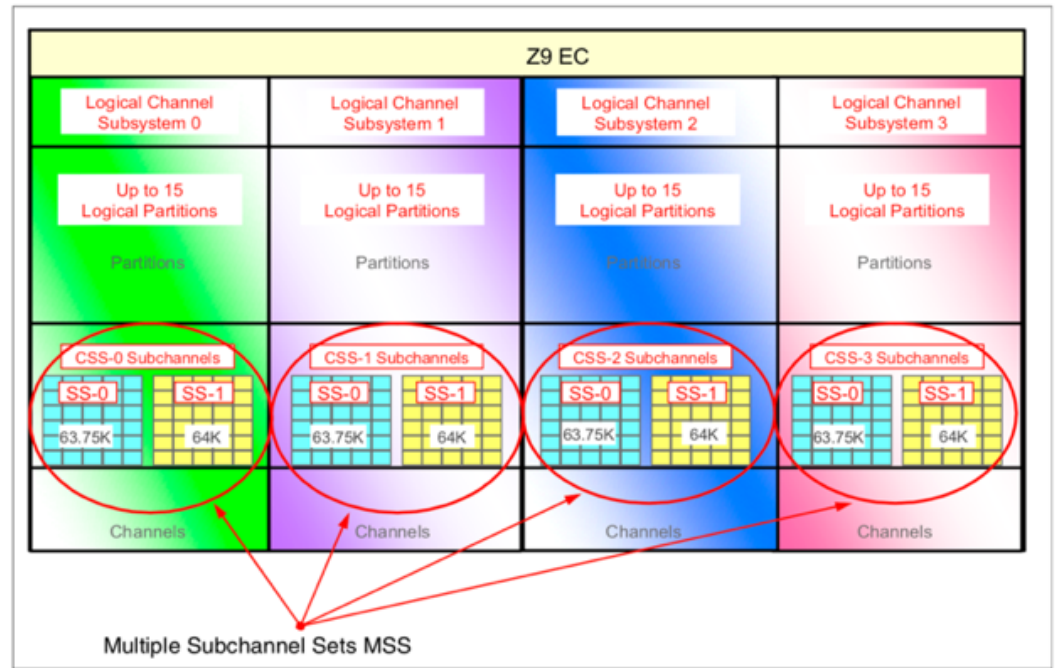


Figure 4-4 Multiple Subchannel Sets (MSS)

Source: SG24-7124 z9 Technical Guide

z9 EC GA 9/16/2005 (G9 CMOS Family)

Adds multiple subchannel sets, max of 2 (SS-0, SS-1) SS-1 only used for Aliases.

## Extensions: z13 adds more LCSS and MSS

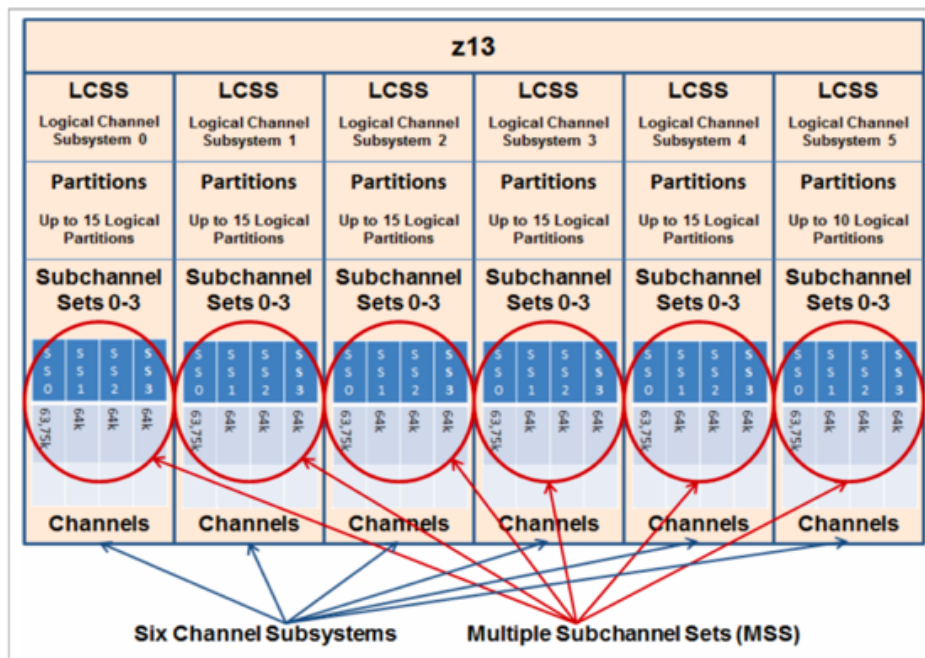


Figure 5-2 Multiple channel subsystems and multiple subchannel sets

Source: SG24-8251 z13 Technical Guide

Z13 GA 3/9/2015 (G13 CMOS Family)

Adds 2 more LCSS

Adds MSS SS-3

## Channel Sharing and Spanning

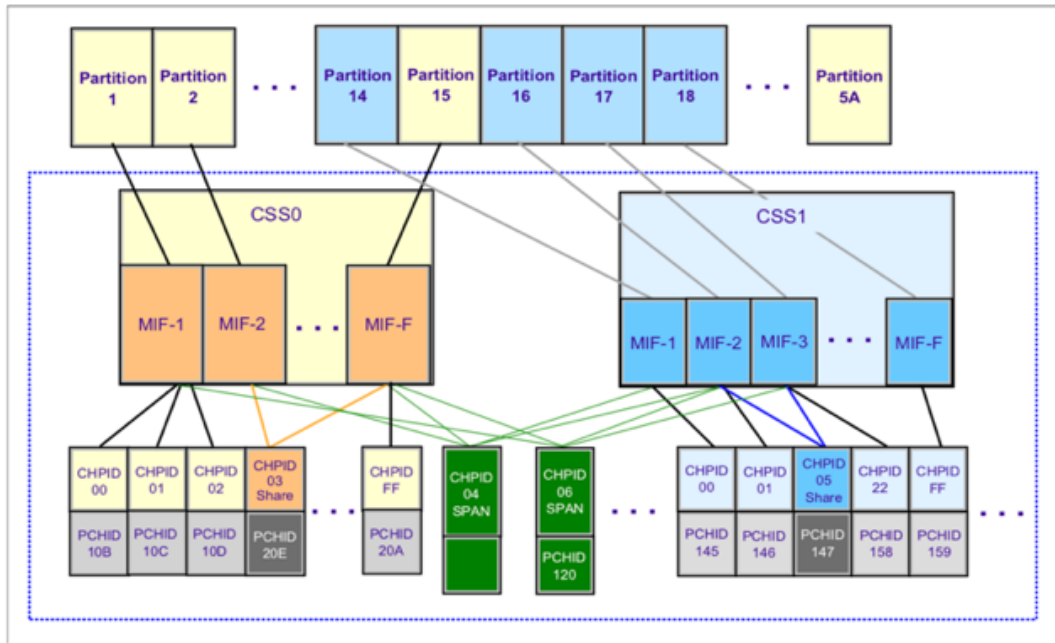


Figure 5-3 IBM Z CSS: Channel subsystems with channel spanning

Source: SG24-8451 z14 Technical Guide

Channel Sharing: Share a channel between LPARs within a LCSS

Channel Spanning: Share a channel between LPARs across LCSS

Parallel Channels could neither share or span

ESCON Channels could share

FICON Channels could share and span

Most (All?) current channel types can be shared and spanned across all LPARS though the mechanism to do so may be different (e.g., PCIe features).



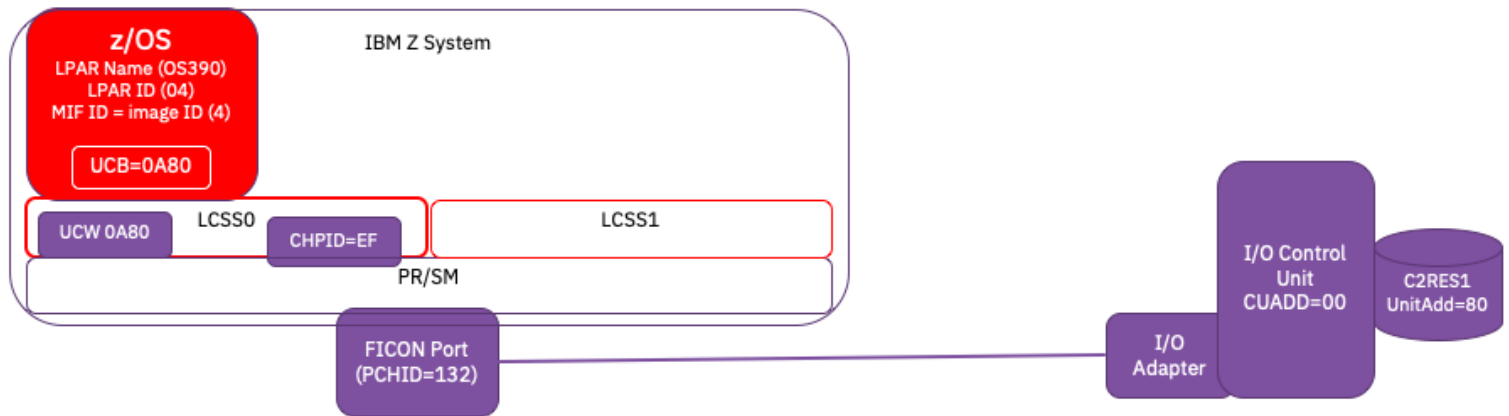
---

## Displaying Path and Device Status

- D IOS,CONFIG      Display I/O Configuration Information.
- D U                Display Device Status and Allocation.
- D M=CHP        Display System Configuration Information for a Path.
- D M=DEV        Display System Configuration Information for a Device.
  
- DEVSERV Commands for DASD and Tape Device Status.
  - DS PATHS
  - DS QDASD
  - DS QPAV
  - DS QTAPE (no example shown)

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

## Display Device Status and Allocation: D IOS,CONFIG



- **D IOS,CONFIG** Display I/O Configuration Information
  - Displays Active IODF Summary Information
  - Output: IOS506I
  - Quickly answers which IODF is being used on this system

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages

---

```
D ios,config
```

```
IOS506I 13.20.19 I/O CONFIG DATA 193
```

```
ACTIVE IOBF DATA SET = SYS7.IOBF20
```

```
CONFIGURATION ID = LSYSC          EDT ID = 01
```

```
TOKEN:  PROCESSOR DATE      TIME      DESCRIPTION
```

```
SOURCE: CPC1234 17-07-22 09:29:25 SYS8      IOBF20
```

```
ACTIVE CSS: 0      SUBCHANNEL SETS CONFIGURED: 0, 1, 2
```

```
CHANNEL MEASUREMENT BLOCK FACILITY IS ACTIVE
```

```
SUBCHANNEL SET FOR PPRC PRIMARY: INITIAL = 0      ACTIVE = 0
```

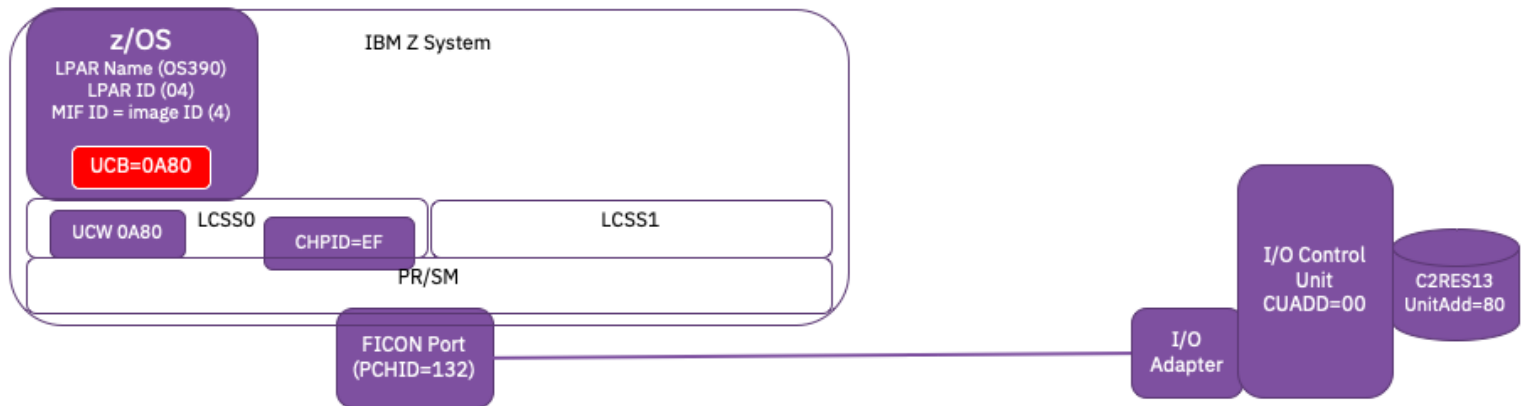
```
HYPERSWAP FAILOVER HAS OCCURRED: NO
```

```
LOCAL SYSTEM NAME (LSYSTEM): CPC1234
```

```
~~~~~
```

Source: z/OS display

## Display Device Status and Allocation: D U,,,ddd



### — D U,,,0A80,16      Display Device Status and Allocation

- Displays device status from UCB
- Output: IEE457I
- Good for finding VOLSER and Allocation status
- Favorite of Operators but online status may not be accurate
- Recommend using D M=DEV(0A80) instead for online info

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages

D U,,,A80,16

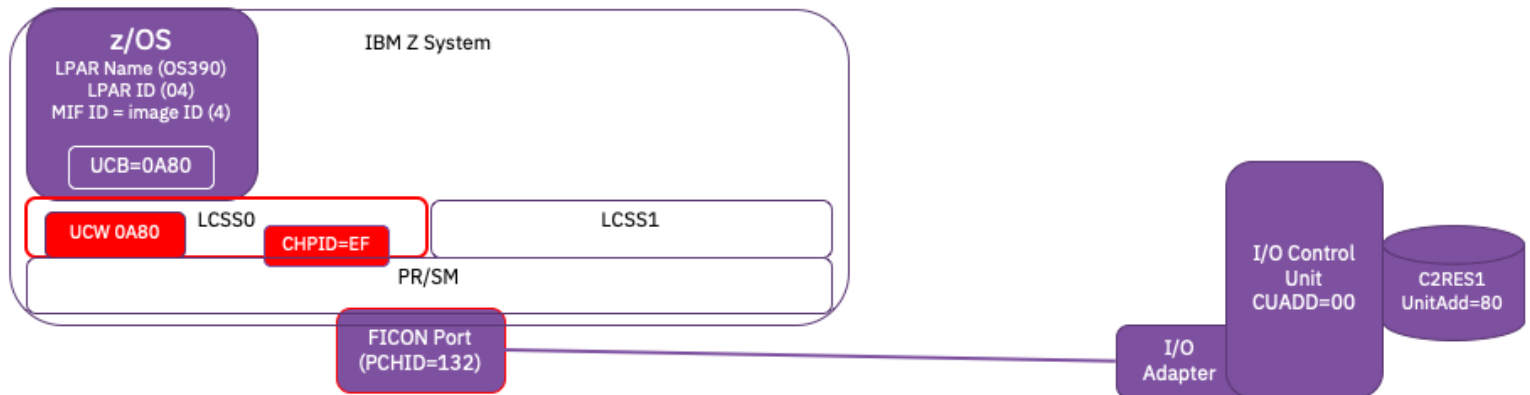
IEE457I 22.27.41 UNIT STATUS 130

| UNIT | TYPE | STATUS | VOLSER | VOLSTATE   | SS |
|------|------|--------|--------|------------|----|
| 0A80 | 3390 | S      | C2RES1 | PRIV/RSDNT | 0  |
| 0A81 | 3390 | A      | C2RES2 | PRIV/RSDNT | 0  |
| 0A82 | 3390 | A      | C2SYS1 | STRG/RSDNT | 0  |
| 0A83 | 3390 | A      | C2CFG1 | PRIV/RSDNT | 0  |
| 0A84 | 3390 | A      | C2USS1 | PRIV/RSDNT | 0  |
| 0A85 | 3390 | A      | C2USS2 | PRIV/RSDNT | 0  |
| 0A86 | 3390 | A      | C2PAGA | PRIV/RSDNT | 0  |
| 0A87 | 3390 | A      | C2PAGB | PRIV/RSDNT | 0  |
| 0A88 | 3390 | A      | C2PAGC | PRIV/RSDNT | 0  |
| 0A89 | 3390 | A      | C2PRD1 | PRIV/RSDNT | 0  |
| 0A8A | 3390 | A      | C2PRD2 | PRIV/RSDNT | 0  |
| 0A8B | 3390 | A      | C2PRD3 | PRIV/RSDNT | 0  |
| 0A8C | 3390 | 0      | C2DIS1 | PRIV/RSDNT | 0  |
| 0A8D | 3390 | 0      | C2DIS2 | PRIV/RSDNT | 0  |
| 0A8E | 3390 | 0      | SARES1 | PRIV/RSDNT | 0  |
| 0A8F | 3390 | F-NRD  |        | /RSDNT     | 0  |

Source: zPDT



## Display System Configuration Information for Path: D M=CHP



- D M=CHP Displays System Configuration Information for all Paths
  - Displays path status from Channel Subsystem (UCWs, other)
  - Output: IEE174I, IEE583I, IEE584I depending on parms used
  - Quickly shows status of all possible Paths/CHPIDs
- D M=CHP(xx) Displays Path status and all devices attached to that Path

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages

```
D M=CHP
IEE174I 19.33.53 DISPLAY M 049
CHANNEL PATH STATUS
  0 1 2 3 4 5 6 7 8 9 A B C D E F
0 . . . . . . . . . . . . . .
1 . . . . . . . . . . . . . .
2 . . . . . . . . . . . . . .
3 . . . . . . . . . . . . . .
4 . . . . . . . . . . . . . .
5 . . . . . . . . . . . . . .
6 . . . . . . . . . . . . . .
7 . . . . . . . . . . . . . .
8 . . . . . . . . . . . . . .
9 . . . . . . . . . . . . . .
A + . . . . . . . . . . . . . .
B . . . . . . . . . . . . . .
C . . . . . . . . . . . . . .
D . . . . . . . . . . . . . .
E . . . . . . . . . . . . . .
F + . . . . . . . . . . . . . .
***** SYMBOL EXPLANATIONS *****
+ ONLINE      @ PATH NOT VALIDATED  - OFFLINE      . DOES NOT EXIST
* MANAGED AND ONLINE  # MANAGED AND OFFLINE
```

Source: zPDT

This just shows the first part of the display. The next part shows the channel type for each CHPID

In this case, CHPID EF is an emulate device channel that is use for the DASD on this zPDT

PATHS NOT VALIDATED (info from IEE174I Form 6)

For devices that are defined to come up offline, one of the following occurred during NIP processing:

- The system did not validate the paths
- A failure occurred while the system was validating the paths.

For devices that are ‘genned’ online, during NIP processing

- A failure occurred while the system was validating the paths.

Use the VARY device command to validate the paths.

```

D M=CHP(A0,EF,F0)
IEE1741 19.39.01 DISPLAY M 067
CHPID A0: TYPE=11, DESC=OSA DIRECT EXPRESS, ONLINE
CHPID EF: TYPE=1F, DESC=EMULATED I/O, ONLINE
CHPID F0: TYPE=11, DESC=OSA DIRECT EXPRESS, ONLINE
DEVICE STATUS FOR CHANNEL PATH A0
  0 1 2 3 4 5 6 7 8 9 A B C D E F
040 + + + . . . . . . . . . .
SWITCH DEVICE NUMBER = NONE
DEVICE STATUS FOR CHANNEL PATH F0
  0 1 2 3 4 5 6 7 8 9 A B C D E F
040 . . . . + + + . . . . . . .
SWITCH DEVICE NUMBER = NONE
***** SYMBOL EXPLANATIONS *****
+ ONLINE      @ PATH NOT VALIDATED  - OFFLINE      . DOES NOT EXIST
* PHYSICALLY ONLINE  $ PATH NOT OPERATIONAL
DEVICE STATUS FOR CHANNEL PATH EF
  0 1 2 3 4 5 6 7 8 9 A B C D E F
070 + + + + + . . . . . . . . .
0A8 + + + + + + + + + + + + + +
0A9 . + . + . . . + + + . . . .
0AA . . . + + + . . . . . . . .
SWITCH DEVICE NUMBER = NONE
***** SYMBOL EXPLANATIONS *****
+ ONLINE      @ PATH NOT VALIDATED  - OFFLINE      . DOES NOT EXIST
* PHYSICALLY ONLINE  $ PATH NOT OPERATIONAL

```

Source: zPDT

This just shows the first part of the display. The next part shows the channel type for each CHPID

In this case, CHPID EF is an emulate device channel that is use for the DASD on this zPDT

D M=CHP(7B)

```
IEE174I 14.20.41 DISPLAY M 932
CHPID 7B: TYPE=1A, DESC=FICON POINT TO POINT, ONLINE
DEVICE STATUS FOR CHANNEL PATH 7B
  0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
0140 + + + + + + + + + + + + + + + +
0141 + + + + + + + + + + + + + + + +
0142 + + + + + + + + + + + + + + + +
0143 + + + + + + + + + + + + + + + +
0144 + + + + + + + + + + + + + + + +
0145 + + + + + + + + + + + + + + + +
0146 + + + + + + + + + + + + + + + +
0147 HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA
0148 HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA
0149 HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA
014A HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA
014B HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA
014C HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA
014D HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA
014E HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA
014F HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA HA
```

SWITCH DEVICE NUMBER = NONE

ATTACHED MD = NOT KNOWN

PHYSICAL CHANNEL ID = 05CD

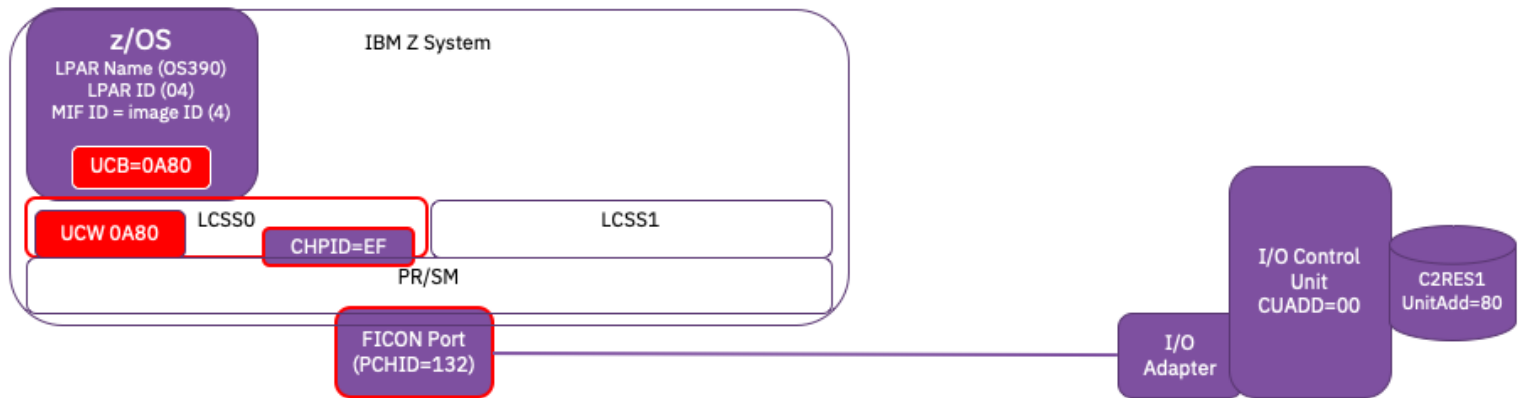
FACILITIES SUPPORTED = ZHPF

```
***** SYMBOL EXPLANATIONS *****
+ ONLINE      @ PATH NOT VALIDATED  - OFFLINE      . DOES NOT EXIST
* PHYSICALLY ONLINE  $ PATH NOT OPERATIONAL
BX DEVICE IS BOXED      SN SUBCHANNEL NOT AVAILABLE
DN DEVICE NOT AVAILABLE  PE SUBCHANNEL IN PERMANENT ERROR
HA DEVICE IS A HYPERPAV ALIAS HU HYPERPAV ALIAS UNUSABLE
```

Source: z/OS Displays  
CHPID 7B, PCHID 05CD  
HyperPAV Aliases defined



## Display System Configuration Information for Device: D M=DEV(dddd)



### — D M=DEV(0A80) Display System Configuration Information for a Device

- Displays device status from UCB, UCW
- Output: IEE174I, IEE583I, IEE584I depending on parms used
- Shows status of paths to a device

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages

```
D M=DEV(A80-A8F)
IEE174I 20.32.56 DISPLAY M 091
DEVICE 00A80 STATUS=ONLINE
CHP EF
DEST LINK ADDRESS 00
PATH ONLINE Y
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL Y
MANAGED N
CU NUMBER 0028
MAXIMUM MANAGED CHPID(S) ALLOWED: 0
DESTINATION CU LOGICAL ADDRESS = 00
SCP CU ND = NOT AVAILABLE
SCP TOKEN NED = 003990.C02.IBM.02.0000000000A80.0000
SCP DEVICE NED = 003390.A18.IBM.13.0000000000A80.0000
```

Source: zPDT

This just shows the first part of the display. The next part shows the channel type for each CHPID

In this case, CHPID EF is an emulate device channel that is use for the DASD on this zPDT

```
D M=DEV(1737)
IEE174I 13.14.55 DISPLAY M 081
DEVICE 01737 STATUS=ONLINE
CHP      78      79      7A      7B      7C      7D      7E      7F
ENTRY LINK ADDRESS      .:      .:      .:      .:      .:      .:      .:      .:
DEST LINK ADDRESS      0D      0D      0D      0D      0D      0D      0D      0D
PATH ONLINE      Y      Y      Y      N      Y      Y      Y      Y
CHP PHYSICALLY ONLINE Y      Y      Y      N      Y      Y      Y      Y
PATH OPERATIONAL      Y      Y      Y      N      Y      Y      Y      Y
MANAGED      N      N      N      N      N      N      N      N
CU NUMBER      1700 1700 1700 1700 1700 1700 1700 1700
INTERFACE ID      0400 0500 0600 0700 0430 0530 0643 0740
MAXIMUM MANAGED CHPID(S) ALLOWED: 0
DESTINATION CU LOGICAL ADDRESS = 07
SCP CU ND      = 002107.981.IBM.75.00000000| ZZZ12.0123
SCP TOKEN NED   = 002107.900.IBM.75.00000000| ZZZ12.0345
SCP DEVICE NED  = 002107.900.IBM.75.00000000| ZZZ12.0789
WWNN      = 5005076307FFD375
HYPERPAV ALIASES CONFIGURED = 144
FUNCTIONS ENABLED = MIDAW, ZHPF, XPAV
```

Source: z/OS display

Note: multiple paths to a device, but one of the paths (7B) is having problems.



## LINKINFO for Read Diagnostic Parameters (RDP)

```
IEE584I 13.37.13 DISPLAY M          FRAME LAST  F      E      SYS=S5A
DEVICE 0D800 STATUS=ONLINE
Link Information: First
Description      Channel      Entry Port      Exit Port      Cntl Unit
Identifier       01F0       2E              29            0032
Date Retrieved   04/06/2016  04/06/2016     04/06/2016    04/06/2016
Time Retrieved   08:52:29   08:52:29       08:52:29      08:52:29
Tx Power (dBm)   0.66        -0.73          0.39           0.29
Rx Power (dBm)   -0.35        -0.32          0.09           -9.05
Tx Bias (mA)     39.1        51.1           40.2           40.8
Temperature (C)  33.3        54             55             41.6
Voltage (V)      3.26        3.36           3.31           3.32
Capable Speed    16G         16G            16G            16G
Operating Speed  16G         16G            16G            16G
Buffer Credits   90          Not Avail      Not Avail      90
Link Failures    8           24             39             0
Loss of Sync     11          0              0              16
Loss of Signal   11          28             16             14
Primitive Seq Err 0            0              0              0
Invalid Trans Word 876         1005           10021285       172
Invalid CRC      9           464            0              409
FEC Uncorrected  242        Not Avail      Not Avail      363
```

Figure 2: FIRST - example: D M=DEV(D800,(94)),LINKINFO=FIRST

Source: Enterprise Tech Journal 2018/ Issue 4, “Cognitive and Your IBM Z FICON Environment” by Steve Guendert, Ph.D.

Requires FICON Read Diagnostic Parameters support provided by APAR OA49089

See also:

<https://www.ibm.com/developerworks/community/blogs/e0c474f8-3aad-4f01-8bca-f2c12b576ac9/entry/test?lang=en>

**Please note:** The RDP function is supported on z/OS V2R1/V2R2 running on z13 GA2(D27I) LPARs for all FICON channels. Contact your switch vendor for information about which switches support RDP and the required firmware level. RDP is supported on the DS8870 Control Unit with the 7.5 level of microcode or DS8880 Control Unit with the 8.1 level of microcode for 16 Gbs host adapter cards only.

Linkinfo Options:

**FIRST** - displays the link diagnostic information that was obtained during IPL or when the physical path was brought online for the first time after IPL.

**LAST** - Displays the link diagnostic information that was last retrieved by the system. The system retrieves new information for a physical path

every 24 hours or when LINKINFO=REFRESH is specified.

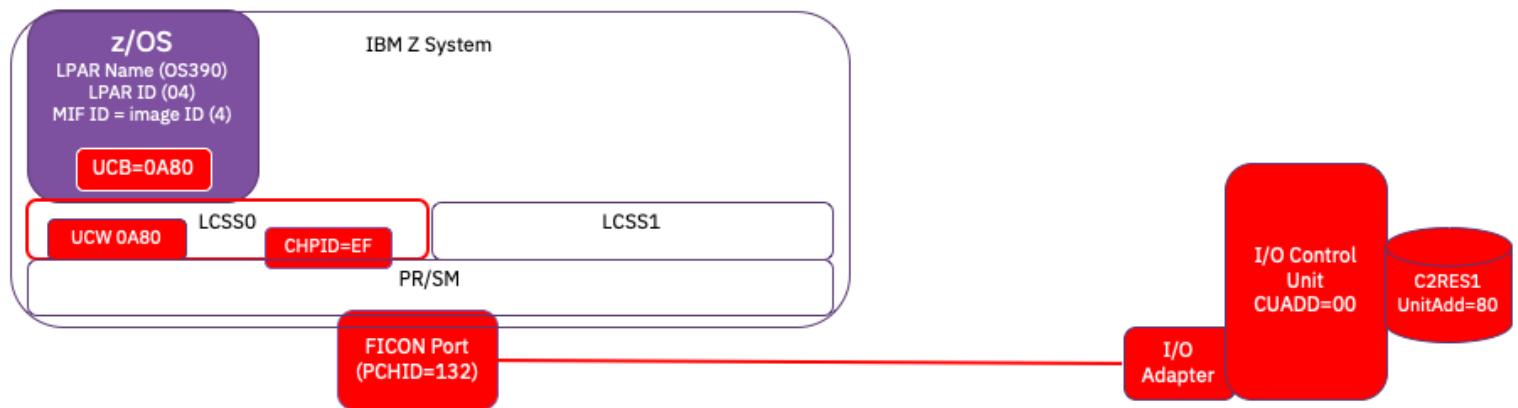
**REFRESH** - Requests that the system obtain new link diagnostic information for the physical path and then displays that information. This causes the prior information to be replaced and a subsequent LINKINFO=LAST request will also show this new information.

Note:

1. A REFRESH request does not cause the entry switch port, exit switch port and control unit port to retrieve new optical transceiver information. It simply causes the last retrieved values to be returned to the channel subsystem. The frequency that a port retrieves its own optical transceiver information is manufacturer and model specific.
2. A REFRESH request will be rejected if the channel specified in the command is already processing the maximum number of concurrent requests. These requests could be from this system or other systems on the same processor. The maximum number of concurrent requests allowed for a channel is model dependent.

**COMPARE** - Displays a comparison of the first and last set of link diagnostic information that was retrieved by the system.

## Display Info for DASD and Tape Paths: DEVSERV PATHS



- DS PATHS,A80,n Display Path and Device status for n devices
  - Displays latest device and path status from the specified device(s) (and UCB, UCW)
  - Output: IEE459I
  - Caution: These commands cause an I/O to each selected device, so limit the scope

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages

From the System Commands Reference manual:

The DEVSERV PATHS command can help you solve hardware or configuration

problems. The display includes the status of paths, the channel path ids, the logical

mode of devices, the number of data sets allocated on volumes, and volume serial

labels. Because the DEVSERV command causes the system to issue an I/O request

on paths to a device or devices, the resulting display reflects the current physical

state of the path. Comparable displays from the DISPLAY M command reflect less

recent information from the last use of MVS control blocks. For example, assume

that an I/O device is performing below normal and you suspect that some paths to the device are offline. The DISPLAY M command might tell you that there are four paths online to the device. The DEVSERV PATHS command might tell you that there is actually only one online path. The DEVSERV command is more current and thus more accurate. See “DEVSERV command” on page 236 for information about the DEVSERV command.

## DS PATHS.A80.8

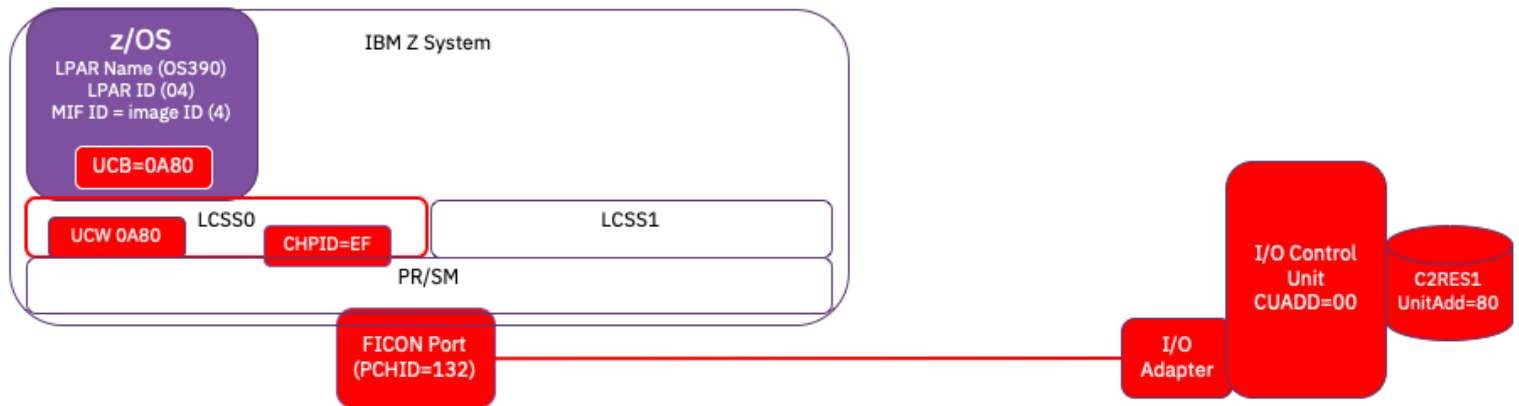
IEE459I 20.11.55 DEVSERV PATHS 461

| UNIT  | DTYPE | M    | CNT | VOLSER | CHPID=PATH | STATUS |          |     |     |       |         |
|-------|-------|------|-----|--------|------------|--------|----------|-----|-----|-------|---------|
|       | RTYPE | SSID | CFW | TC     | DFW        | PIN    | DC-STATE | CCA | DDC | CYL   | CU-TYPE |
| 00A80 | 33909 | .A   | 110 | C2RES1 | EF=+       |        |          |     |     |       |         |
|       | 3390  | 7437 |     |        |            |        |          | 80  | 00  | 10017 | 3990-2  |
| 00A81 | 33909 | .A   | 016 | C2RES2 | EF=+       |        |          |     |     |       |         |
|       | 3390  | 7437 |     |        |            |        |          | 81  | 00  | 10017 | 3990-2  |
| 00A82 | 33909 | .A   | 004 | C2SYS1 | EF=+       |        |          |     |     |       |         |
|       | 3390  | 7437 |     |        |            |        |          | 82  | 00  | 10017 | 3990-2  |
| 00A83 | 33909 | .A   | 022 | C2CFG1 | EF=+       |        |          |     |     |       |         |
|       | 3390  | 7437 |     |        |            |        |          | 83  | 00  | 10017 | 3990-2  |
| 00A84 | 33909 | .A   | 000 | C2USS1 | EF=+       |        |          |     |     |       |         |
|       | 3390  | 7437 |     |        |            |        |          | 84  | 00  | 10017 | 3990-2  |
| 00A85 | 33909 | .A   | 000 | C2USS2 | EF=+       |        |          |     |     |       |         |
|       | 3390  | 7437 |     |        |            |        |          | 85  | 00  | 10017 | 3990-2  |
| 00A86 | 33909 | .A   | 000 | C2PAGA | EF=+       |        |          |     |     |       |         |
|       | 3390  | 7437 |     |        |            |        |          | 86  | 00  | 10017 | 3990-2  |
| 00A87 | 33909 | .A   | 000 | C2PAGB | EF=+       |        |          |     |     |       |         |
|       | 3390  | 7437 |     |        |            |        |          | 87  | 00  | 10017 | 3990-2  |

\*\*\*\*\* SYMBOL DEFINITIONS \*\*\*\*\*  
A = ALLOCATED                      + = PATH AVAILABLE

Source: zPDT

## Display Detail Info for DASD: DEVSERV QDASD



- DS QDASD,1700,256 Displays VOLSER and device details
- DS QDASD,A80,8,CHKFAIL Show mismatches between device and MVS data
- DS QDASD,A80,8,VALIDATE Use device info to correct MVS data
  - Caution: These commands cause an I/O to each selected device, so limit the scope
  - Output: IEE459I

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages



DS QDASD,A80,8,CHKFAIL

IEE459I 21.26.31 DEVSERV QDASD 488

| UNIT                                               | VOLSER | SCUTYPE | DEVTYPE | CYL | SSID | SCU-SERIAL | DEV-SERIAL | EFC |
|----------------------------------------------------|--------|---------|---------|-----|------|------------|------------|-----|
| **** 0 DEVICE(S) FAILED EXTENDED FUNCTION CHECKING |        |         |         |     |      |            |            |     |

DS QDASD,A80,8,VALIDATE

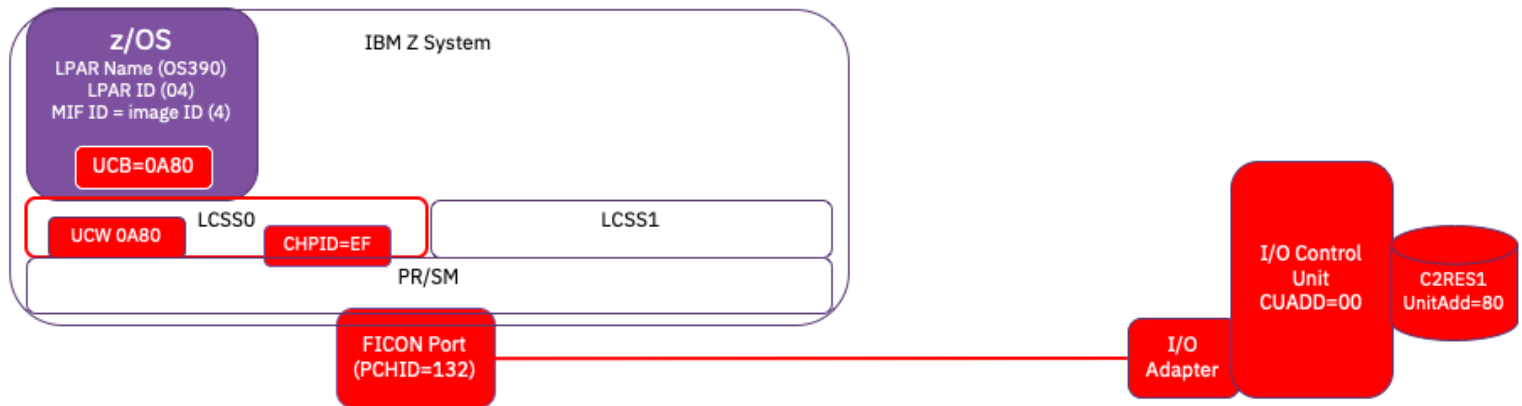
IEE459I 21.27.21 DEVSERV QDASD 490

| UNIT                                               | VOLSER | SCUTYPE | DEVTYPE | CYL   | SSID | SCU-SERIAL | DEV-SERIAL | EFC |
|----------------------------------------------------|--------|---------|---------|-------|------|------------|------------|-----|
| 00A80                                              | C2RES1 | 3990A18 | 3390A18 | 10017 | 0000 | 0113-00A80 | 0113-00A80 | BYP |
| 00A81                                              | C2RES2 | 3990A18 | 3390A18 | 10017 | 0000 | 0113-00A81 | 0113-00A81 | BYP |
| 00A82                                              | C2SYS1 | 3990A18 | 3390A18 | 10017 | 0000 | 0113-00A82 | 0113-00A82 | BYP |
| 00A83                                              | C2CFG1 | 3990A18 | 3390A18 | 10017 | 0000 | 0113-00A83 | 0113-00A83 | BYP |
| 00A84                                              | C2USS1 | 3990A18 | 3390A18 | 10017 | 0000 | 0113-00A84 | 0113-00A84 | BYP |
| 00A85                                              | C2USS2 | 3990A18 | 3390A18 | 10017 | 0000 | 0113-00A85 | 0113-00A85 | BYP |
| 00A86                                              | C2PAGA | 3990A18 | 3390A18 | 10017 | 0000 | 0113-00A86 | 0113-00A86 | BYP |
| 00A87                                              | C2PAGB | 3990A18 | 3390A18 | 10017 | 0000 | 0113-00A87 | 0113-00A87 | BYP |
| **** 8 DEVICE(S) MET THE SELECTION CRITERIA        |        |         |         |       |      |            |            |     |
| **** 0 DEVICE(S) FAILED EXTENDED FUNCTION CHECKING |        |         |         |       |      |            |            |     |

Source: zPDT



## Display Detail Info for DASD PAVs: DEVSERV PAV



- DS QPAV,0A80,256 Displays Bases and Parallel Access Volumes (PAV) that are defined
  - Caution: These commands cause an I/O to each selected device, so limit the scope
  - Output: IEE459I

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages

```
DS qpav,1700,256
IEE459I 12.40.34 DEVSERV QPAVS 656
HOST
CONFIGURATION
-----
UNIT      UA      TYPE      STATUS      SSID      UNIT      UA
NUM.      ADDR.    TYPE
-----
01700 00  BASE-H      1700 00  BASE
01701 01  BASE-H      1700 01  BASE
01702 02  BASE-H      1700 02  BASE

017B6(0E) 017B7(0E) 017B8(0E) 017B9(0E) 017BA(0E) 017BB(0E) 017BC(0E)
017BD(0E) 017BE(0E) 017BF(0E) 017C0(0E) 017C1(0E) 017C2(0E) 017C3(0E)
017C4(0E) 017C5(0E) 017C6(0E) 017C7(0E) 017C8(0E) 017C9(0E) 017CA(0E)
017CB(0E) 017CC(0E) 017CD(0E) 017CE(0E) 017CF(0E) 017D0(0E) 017D1(0E)
017D2(0E) 017D3(0E) 017D4(0E) 017D5(0E) 017D6(0E) 017D7(0E) 017D8(0E)
017D9(0E) 017DA(0E) 017DB(0E) 017DC(0E) 017DD(0E) 017DE(0E) 017DF(0E)
017E0(0E) 017E1(0E) 017E2(0E) 017E3(0E) 017E4(0E) 017E5(0E) 017E6(0E)
017E7(0E) 017E8(0E) 017E9(0E) 017EA(0E) 017EB(0E) 017EC(0E) 017ED(0E)
017EE(0E) 017EF(0E)
**** (0E) - DEVICE IS A HYPERPAV ALIAS
**** UNLISTED DEVICE(S) AND REASON CODES :
017F0(0E) 017F1(0E) 017F2(0E) 017F3(0E) 017F4(0E) 017F5(0E) 017F6(0E)
017F7(0E) 017F8(0E) 017F9(0E) 017FA(0E) 017FB(0E) 017FC(0E) 017FD(0E)
017FE(0E) 017FF(0E)
**** (0E) - DEVICE IS A HYPERPAV ALIAS
**** 112 DEVICE(S) MET THE SELECTION CRITERIA
***** Bottom of Data *****
```

Source: z/OS display

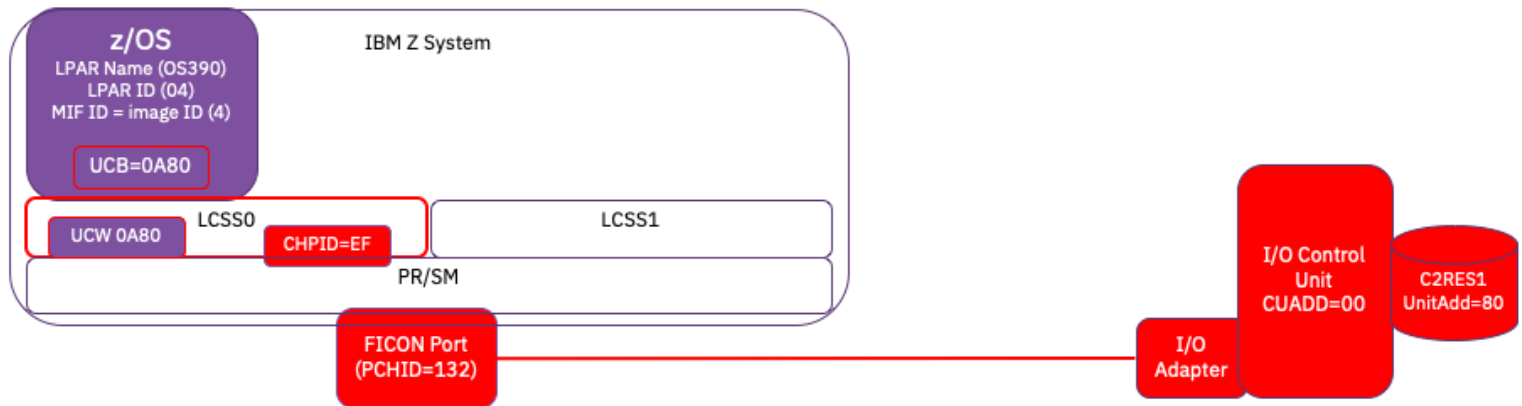
---

## Managing Path and Device Status

- CF CHP Change the status of physical (and logical) components of a path
- V PATH Bring a logical path online (or offline) to z/OS
- V device# Bring a device online (or offline) to z/OS

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

## Directly Change Channel Status: CF CHP



- CF CHP(EF),ONLINE Bring a channel path and associated logical paths online
- CF CHP(EF),ONLINE,NOVARY Bring only a physical channel path online
  - Output: IEE174I
  - Use to manage physical channels (e.g., bring a FICON port online)
  - Can be used to synch z/OS logical path status to LCSS physical path status (see Form 12 of msg)

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages for IEE174I, especially noting Form 6 and Form 12

If the use of HMC caused a physical vs. logical path status mismatch, bring the channel path status back in sync by using one of the following MVS™ operator commands:

If the physical status is online, CONFIG CHP (chp), ONLINE

If the physical status is offline, CONFIG CHP (chp), OFFLINE

## D M=DEV(0224)

```
IEE174I 09.05.30 DISPLAY M 200
DEVICE 0224 STATUS=OFFLINE
CHP      01
PATH ONLINE      N
CHP PHYSICALLY ONLINE N
PATH OPERATIONAL  N
```

To configure channel path 01 online without bringing online the paths to devices 223 and 224, issue the following command:

```
cf chp(1),online,novary
```

The system issues the following messages to indicate that not all paths were brought online:

```
IEE754I NOT ALL PATHS BROUGHT ONLINE WITH CHP(01)
IEE502I CHP(1),ONLINE
IEE712I CONFIG PROCESSING COMPLETE
```

To display the status of each device after configuring the channel path online, issue the following commands:

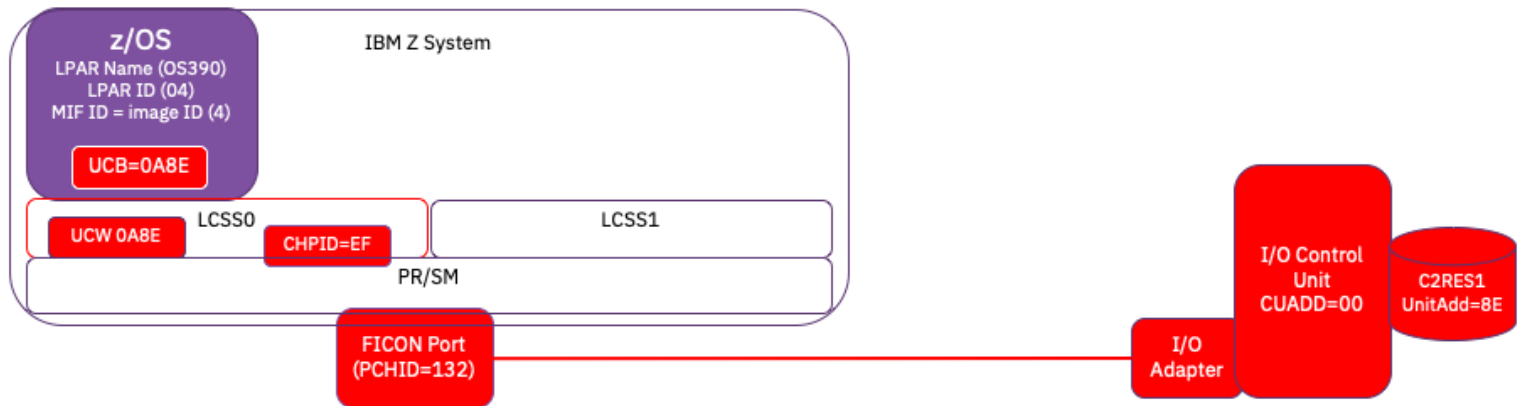
```
d m=dev(223)
d m=dev(224)
```

The output, which shows that the paths to the devices are not online but are operational, appears as follows:

```
IEE174I 09.05.40 DISPLAY M 200
DEVICE 0223 STATUS=OFFLINE
CHP      01
PATH ONLINE      N
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL  Y
```

Source: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

## Change z/OS Status of Paths and Devices: VARY



- V PATH(A8E,EF),ONLINE Bring a channel path online (or offline) to z/OS
- V A8E,ONLINE Bring a device online (or offline) to z/OS
  - Manages Path and Device status in UCB and UCW
  - Output: IEE302I, IEE025I
  - Use to manage physical channels and to synch z/OS status to LCSS status

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages

```
IEE002I PATH 002,EF / OFFLINE
D M=DEV(A8E)
IEE174I 03.00.04 DISPLAY M 618
DEVICE 00A8E STATUS=OFFLINE
CHP EF
DEST LINK ADDRESS 00
PATH ONLINE N
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL Y
MANAGED N
CU NUMBER 0028
MAXIMUM MANAGED CHPID(S) ALLOWED: 0
DESTINATION CU LOGICAL ADDRESS = 00
SCP CU ND = NOT AVAILABLE
SCP TOKEN NED = 003990.C02.IBM.02.000000000A8E.0000
SCP DEVICE NED = 003390.A18.IBM.13.000000000A8E.0000
VARY A8E,ONLINE
IEE025I UNIT 0A8E HAS NO LOGICAL PATHS
```

Source: zPDT



```

V PATH(A8E.EF).ONLINE
IEE302I PATH(0A8E.EF) ONLINE
D M=DEV(A8E)
IEE174I 02.26.33 DISPLAY M 591
DEVICE 00A8E STATUS=OFFLINE
CHP EF
DEST LINK ADDRESS 00
PATH ONLINE Y
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL Y
V A8E.ONLINE
IEE302I 0A8E ONLINE
D M=DEV(A8E)
IEE174I 02.28.05 DISPLAY M 595
DEVICE 00A8E STATUS=ONLINE
CHP EF
DEST LINK ADDRESS 00
PATH ONLINE Y
CHP PHYSICALLY ONLINE Y
PATH OPERATIONAL Y
MANAGED N
CU NUMBER 0028

```

Source: zPDT

Note: In this example the Vary Path online did not automatically bring the device online, most likely because the path was brought offline by the Vary Path offline command. In other cases the device may automatically come online when the logical path is brought online with the Vary Path command.

---

## Summary of Channel Management Commands

**D M=DEV(0223)**

IEE174I 09.05.55 DISPLAY M 200

DEVICE 0223 STATUS=ONLINE

V 0223,ONLINE

CHP 01

PATH ONLINE Y

V PATH(0223,01),ONLINE

CHP PHYSICALLY ONLINE Y

CF CHP(01),ONLINE,NOVARY

PATH OPERATIONAL Y

Indicates whether device responded  
to device selection sequence when  
bringing path online

Reference: MVS System Commands Reference (e.g., SA38-0666 for z/OS 2.1)

Reference: z/OS MVS System Messages for IEE174I, especially noting Form 6 and Form 12

Additional recovery info: Boxed Device  
(from z/OS 2.3 Knowledge Center, z/OS MVS System Commands, System Operations)

Device *boxing* is used by the MVS™ system during error recovery as a means of maintaining data integrity and preventing data corruption. A device is also boxed if the operator issues the VARY devnum,OFFLINE,FORCE command. When a device is boxed, all outstanding I/O operations for the device are ended with *permanent error* status, and no new allocations to the device are allowed.

It is very important to understand that in the case of shared DASD, the boxed device is boxed only to the system that originated the boxing. The device is still accessible from other systems. **This may lead to incorrect (or incomplete) data on the DASD volume.** Such a situation must be reported to the owner of the data on the boxed-DASD. If the data-files are shared with other systems, it is recommended to put the device in

offline status on all the sharing systems. Use VARY OFFLINE or OFFLINE,FORCE commands.

After the data sets are checked and recovered, the DASD volume may be put back online.

A device that is boxed *and offline* can be brought back online with the VARY devnum,ONLINE command. This will enable the UCB and perform online processing to the device. Assuming that the error condition has been resolved, the device will come online. If the error condition still exists, the device may remain in the boxed state.

A device that is *allocated boxed* may be brought back online with the VARY devnum,ONLINE,UNCOND command, if account procedures allow. Note that in this case, if the boxed device is DASD, volume verification (that is, VOLSER checking) is **not** performed. In this case, the VOLSER information can be obtained by entering a VARY devnum,ONLINE command to the DASD device or then entering a MOUNT command.

A DASD device that was offline (either boxed or not boxed) has the VOLSER details obtained from the device through the VARY devnum,ONLINE command. The VOLSER information is placed in the UCB as part of the vary online operation, if the vary online is successful, that is, that no out-of-line situations exist, for example, it is not a duplicate volume.

---

## Session summary

- Helped you understand and manage your IBM Z System DASD Channel Paths
- Provided a general review of the IBM Z Channel Subsystem Architecture
  - Via a short history of the development of the IBM mainframe channel subsystem
- Reviewed key concepts for defining a DASD channel path
- Reviewed some commands to display and manage DASD channel paths and devices

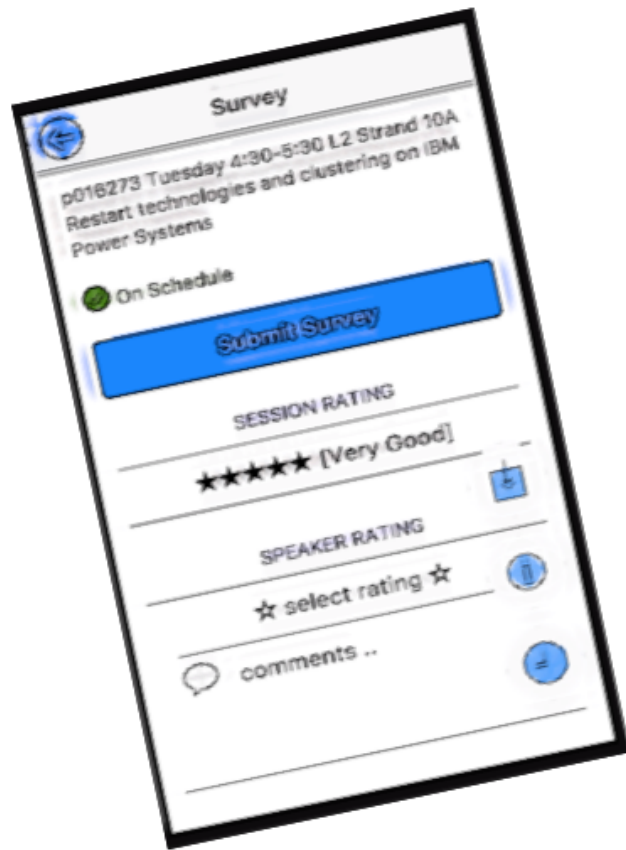
---

**Thank you!**

Lee Daniels  
IBM zCTS

ldaniels@us.ibm.com  
+1-561-376-3649  
ibm.com

**Please complete the Session  
Evaluation!**  
**Session: z107741**



---

## Notices and disclaimers

- © 2019 International Business Machines Corporation. No part of this document may be reproduced or transmitted in any form without written permission from IBM.
- **U.S. Government Users Restricted Rights — use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM.**
- Information in these presentations (including information relating to products that have not yet been announced by IBM) has been reviewed for accuracy as of the date of initial publication and could include unintentional technical or typographical errors. IBM shall have no responsibility to update this information. **This document is distributed “as is” without any warranty, either express or implied. In no event, shall IBM be liable for any damage arising from the use of this information, including but not limited to, loss of data, business interruption, loss of profit or loss of opportunity.** IBM products and services are warranted per the terms and conditions of the agreements under which they are provided.
- IBM products are manufactured from new parts or new and used parts. In some cases, a product may not be new and may have been previously installed. Regardless, our warranty terms apply.”
- **Any statements regarding IBM's future direction, intent or product plans are subject to change or withdrawal without notice.**
- Performance data contained herein was generally obtained in a controlled, isolated environments. Customer examples are presented as illustrations of how those
- customers have used IBM products and the results they may have achieved. Actual performance, cost, savings or other results in other operating environments may vary.
- References in this document to IBM products, programs, or services does not imply that IBM intends to make such products, programs or services available in all countries in which IBM operates or does business.
- Workshops, sessions and associated materials may have been prepared by independent session speakers, and do not necessarily reflect the views of IBM. All materials and discussions are provided for informational purposes only, and are neither intended to, nor shall constitute legal or other guidance or advice to any individual participant or their specific situation.
- It is the customer's responsibility to insure its own compliance with legal requirements and to obtain advice of competent legal counsel as to the identification and interpretation of any relevant laws and regulatory requirements that may affect the customer's business and any actions the customer may need to take to comply with such laws. IBM does not provide legal advice or represent or warrant that its services or products will ensure that the customer follows any law.

---

## Notices and disclaimers continued

- Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products about this publication and cannot confirm the accuracy of 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. IBM does not warrant the quality of any third-party products, or the ability of any such third-party products to interoperate with IBM's products. **IBM expressly disclaims all warranties, expressed or implied, including but not limited to, the implied warranties of merchantability and fitness for a purpose.**
- The provision of the information contained herein is not intended to, and does not, grant any right or license under any IBM patents, copyrights, trademarks or other intellectual property right.
- IBM, the IBM logo, ibm.com and [names of other referenced IBM products and services used in the presentation] are trademarks of International Business Machines Corporation, registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the Web at "Copyright and trademark information" at: [www.ibm.com/legal/copytrade.shtml](http://www.ibm.com/legal/copytrade.shtml)



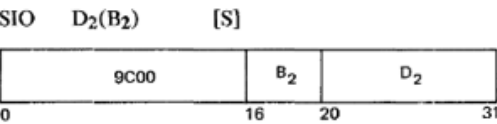
---

# Backup charts

# I/O Instructions

- START I/O (SIO)
  - S/360, S/370
  - B2 = Channel Address
  - D2 = Device Address (or subchannel and device)

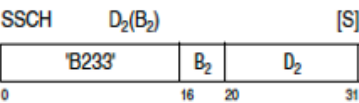
## Start I/O



- S/370 Channel => S/370/XA Channel Path
  - The physical connection from system to control unit

- START SUBCHANNEL (SSCH)
  - S/370XA
  - General register 1 contains Subchannel #

## START SUBCHANNEL



# z900 Channel Architecture (circa Dec. 2000)

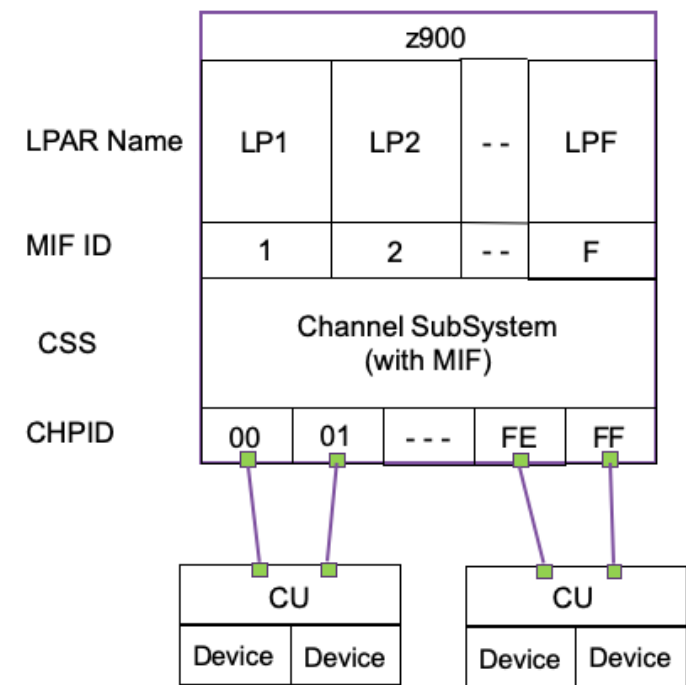


Table 3-1 Addressing limits for ESCON and FICON channels

|                            | ESCON channels | FICON channels<br>(FC or FCP modes) |
|----------------------------|----------------|-------------------------------------|
| CU images (CUADD) / CU:    |                |                                     |
| ▶ Architected              | 16             | 256                                 |
| ▶ Implemented              | 16             | 16                                  |
| UAs supported / channel:   |                |                                     |
| ▶ Architected              | 1M             | 16M                                 |
| ▶ Implemented              | 1K             | 16K                                 |
| UAs / physical CU:         |                |                                     |
| ▶ Architected              | 4K             | 64K                                 |
| ▶ CU implemented           | 4K             | 4K                                  |
| ▶ Addressable by a channel | 1K             | 4K                                  |
| UAs / logical CU (CUADD)   | 256            | 256                                 |

- Reference SG24-5975 z900 Technical Guide
- z900 GA December 18, 2000 (G7 CMOS Family)
- One Channel Subsystem (CSS)
- EMIF = Enhanced Multiple Image Facility (This enables channel sharing among Processor Resource/Systems Manager (PR/SM) Logical Partitions (LP) for certain channel types (e.g., FICON).)
- Max active LPARS 15
- Max defined LPARs 15
- Max CHPIDs 256
- Max subchannels per LPAR 63K
- Max subchannels per z900 512K
- FICON Express16S on z13 and z14 now supports up to 32K subchannels (UAs) per channel
- Need IOCDS to define connections from LPARs to Devices

From the z990 Technical Guide SG24-6947 you find this history:  
IBM introduced the Processor Resource/Systems Manager™ (PR/SM) feature in February

1988, supporting a maximum of four logical partitions. In June 1992, IBM introduced support for a maximum of 10 logical partitions and announced the Multiple Image Facility (MIF, also known as EMIF), which allowed sharing of ESCON channels across logical partitions, and since that time, has allowed sharing of more channels across logical partitions (such as Coupling Links, FICON, and OSA). In June 1997, IBM announced increased support - up to 15 logical partitions on Generation 3 and Generation 4 servers. The evolution continues and IBM is announcing support for 30 logical partitions. This support is exclusive to z990 and z890 models.

# IBM z14 Channel Subsystems – Where Defined

|                        |       |       |                        |       |       |           |      |           |       |           |       |           |                               |
|------------------------|-------|-------|------------------------|-------|-------|-----------|------|-----------|-------|-----------|-------|-----------|-------------------------------|
| CSS0                   |       |       | CSS1                   |       |       | CSS2      |      | CSS3      |       | CSS4      |       | CSS5      | Specified in<br>HCD / IOCP    |
| Logical Partition Name |       |       | Logical Partition Name |       |       | LPAR Name |      | LPAR Name |       | LPAR Name |       | LPAR Name |                               |
| TST1                   | PROD1 | PROD2 | TST2                   | PROD3 | PROD4 | TST3      | TST4 | PROD5     | PROD6 | TST55     | PROD7 | PROD8     | TST6                          |
| Logical Partition ID   |       |       | Logical Partition ID   |       |       | LPAR ID   |      | LPAR ID   |       | LPAR ID   |       | LPAR ID   | Specified in<br>Image Profile |
| 02                     | 04    | 0A    | 14                     | 16    | 1D    | 22        | 26   | 35        | 3A    | 44        | 47    | 56        | 5A                            |
| MIFID                  |       |       | MIFID                  |       |       | MIF ID    |      | MIF ID    |       | MIF ID    |       | MIF ID    | Specified in<br>HCD / IOCP    |
| 2                      | 4     | A     | 4                      | 6     | D     | 2         | 6    | 5         | A     | 4         | 7     | 6         | A                             |

Figure 5-4 CSS, LPAR, and identifier example

Source: SG24-8451 IBM z14 Technical Guide

---

## IBM z13 Channel Subsystems Summary 1/2

Table 5-1 z13 CSS overview

| Setting                                      | z13                                              |
|----------------------------------------------|--------------------------------------------------|
| Maximum number of CSSs                       | 6                                                |
| Maximum number of CHPIDs                     | 1536                                             |
| Maximum number of LPARs supported per CSS    | 15 (CSS0 - CSS4), 10 (CSS5)                      |
| Maximum number of LPARs supported per system | 85                                               |
| Maximum number of HSA subchannels            | 16298 K (191.75 K per partition x 85 partitions) |
| Maximum number of devices                    | 382.5 K (6 CSSs x 63.75 K devices)               |
| Maximum number of CHPIDs per CSS             | 256                                              |
| Maximum number of CHPIDs per LPAR            | 256                                              |
| Maximum number of subchannels per LPAR       | 255.74 K (63.75 K + 3 x(64 K - 1))               |

Source: SG24-8251 IBM z13 Technical Guide



# IBM z13 Channel Subsystems Summary 2/2

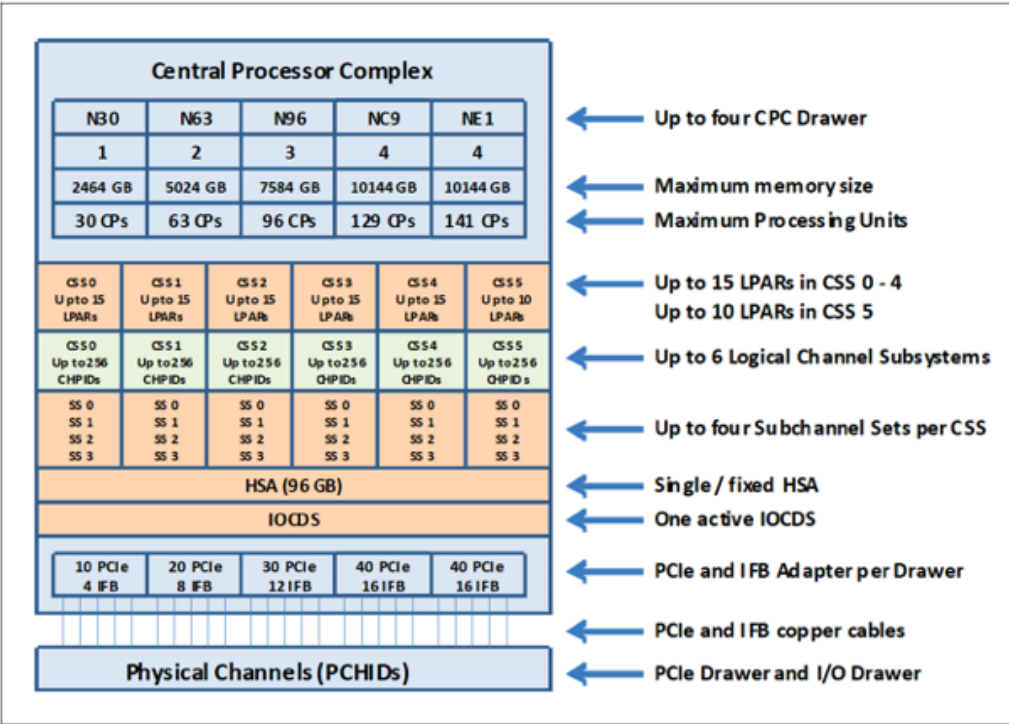


Figure 5-7 Logical view of z13 models, CSSs, IOCDS, and HSA

Source: SG24-8251 IBM z13 Technical Guide

```

DS qdasd,1700,256
IEE459I 12.37.37 DEVSERV QDASD 410
UNIT VOLSER SCUTYPE DEVTYPE CYL SSID SCU-SERIAL DEV-SERIAL EFC
01700 ABC123 2107981 2107900 1113 1700 0000-ABC12 0000-ABC12 *OK
01701 ABC456 2107981 2107900 1113 1700 0000-ABC12 0000-ABC12 *OK
01702 ABC789 2107981 2107900 1113 1700 0000-ABC12 0000-ABC12 *OK
**** UNLISTED DEVICE(S) AND REASON CODES :
01770(01) 01771(01) 01772(01) 01773(01) 01774(01) 01775(01) 01776(01)
01777(01) 01778(01) 01779(01) 0177A(01) 0177B(01) 0177C(01) 0177D(01)
0177E(01) 0177F(01) 01780(01) 01781(01) 01782(01) 01783(01) 01784(01)
01785(01) 01786(01) 01787(01) 01788(01) 01789(01) 0178A(01) 0178B(01)
0178C(01) 0178D(01) 0178E(01) 0178F(01) 01790(01) 01791(01) 01792(01)
01793(01) 01794(01) 01795(01) 01796(01) 01797(01) 01798(01) 01799(01)
0179A(01) 0179B(01) 0179C(01) 0179D(01) 0179E(01) 0179F(01) 017A0(01)
017A1(01) 017A2(01) 017A3(01) 017A4(01) 017A5(01) 017A6(01) 017A7(01)
017A8(01) 017A9(01) 017AA(01) 017AB(01) 017AC(01) 017AD(01) 017AE(01)
017AF(01) 017B0(01) 017B1(01) 017B2(01) 017B3(01) 017B4(01) 017B5(01)
017B6(01) 017B7(01) 017B8(01) 017B9(01) 017BA(01) 017BB(01) 017BC(01)
017BD(01) 017BE(01) 017BF(01) 017C0(01) 017C1(01) 017C2(01) 017C3(01)
017C4(01) 017C5(01) 017C6(01) 017C7(01) 017C8(01) 017C9(01) 017CA(01)
017CB(01) 017CC(01) 017CD(01) 017CE(01) 017CF(01) 017D0(01) 017D1(01)
017D2(01) 017D3(01) 017D4(01) 017D5(01) 017D6(01) 017D7(01) 017D8(01)
017D9(01) 017DA(01) 017DB(01) 017DC(01) 017DD(01) 017DE(01) 017DF(01)
017E0(01) 017E1(01) 017E2(01) 017E3(01) 017E4(01) 017E5(01) 017E6(01)
017E7(01) 017E8(01) 017E9(01) 017EA(01) 017EB(01) 017EC(01) 017ED(01)
017EE(01) 017EF(01)
**** (01) - DEVICE NOT CONFIGURED, UCB NOT FOUND
**** UNLISTED DEVICE(S) AND REASON CODES :
017F0(01) 017F1(01) 017F2(01) 017F3(01) 017F4(01) 017F5(01) 017F6(01)
017F7(01) 017F8(01) 017F9(01) 017FA(01) 017FB(01) 017FC(01) 017FD(01)
017FE(01) 017FF(01)
**** (01) - DEVICE NOT CONFIGURED, UCB NOT FOUND
**** 112 DEVICE(S) MET THE SELECTION CRITERIA
**** 0 DEVICE(S) FAILED EXTENDED FUNCTION CHECKING
***** Bottom of Data *****

```

Source: z/OS display

Note: All of the HyperPAVs show status of “01” – Devices not configured, UCB not found