



I/O Auto-configuration with IBM zEnterprise using HCD

z/OS Discovery And Autoconfiguration (zDAC)

Session 9683

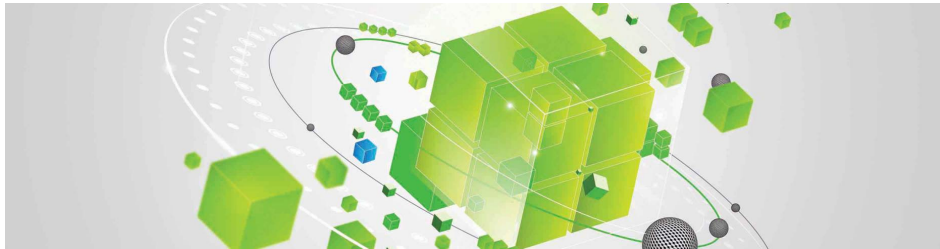
SHARE in Orlando, 2011

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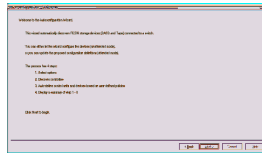
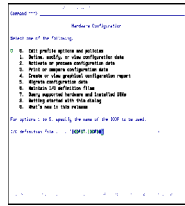


Agenda

- **What is Discovery and Autoconfiguration (zDAC)?**
- **Discovery and Autoconfiguration Overview**
- **Discovery and Autoconfiguration Techniques**
- **Tips**
- **Demo**
- **Q&A**

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What is Discovery and Autoconfiguration (zDAC)?

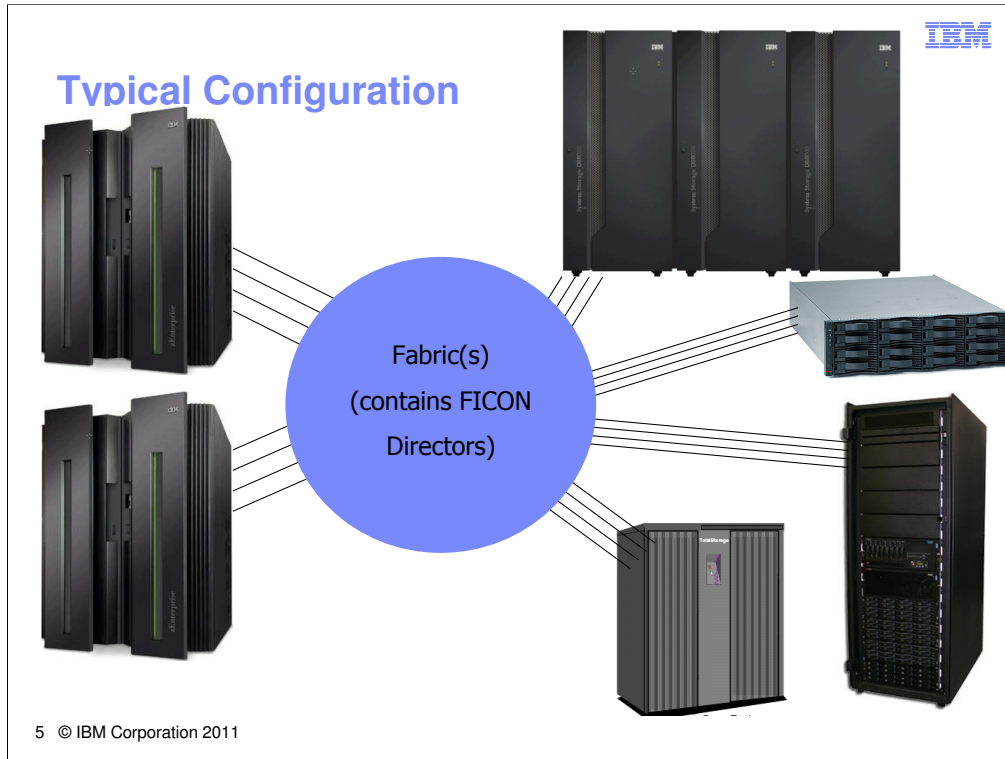


- **New feature of z196**
 - ▶ **Invoked as a new option Hardware Configuration Dialog (HCD) and Hardware Configuration Manager (HCM)**
- **Provides capability to discovery attached disk and tape controllers connected in switched FICON fabrics**
- **Detects new controllers (storage subsystems)**
- **Detects new control units on existing controllers**
- **Detects new devices on existing control units**
- **Proposes control unit and device numbering**
- **Proposes paths for all discovery systems to newly discovered control units**

In z/OS Release 12, Hardware Configuration Dialog (HCD), an ISPF application, and Hardware Configuration Manager (HCM), a workstation application, allow for the exploration of switched fibre channel channels in order to determine what physical storage controllers are attached and reachable. Disk and tape controllers can now be automatically detected and added to the I/O configuration.

zDAC Goals

- **Reduce complexity and skill required to configure devices**
- **Reduce the time it takes to make I/O configuration changes**
- **Ensure the defined configuration aligns with reality**
- **Ensure that high availability expectations are met in the configuration**
- **Discover new and older controllers**
- **Verification Tool**



Shown here is a sample configuration. Processors and controllers are interconnected using one or more fabrics.

A fabric consists of one or more interconnected directors or switches.

On the left side of the picture, processors are shown connecting to the fabric(s) with multiple fibre optic cables. On the right, A selection of newer and older Disk and Tape Controllers are shown connecting to the fabric with fibre optic cables



Some Things to Consider...

- **Physical planning is still up to you**
- **Logical definitions on the controller are still up to you**
- **What z/OS images should be allowed to use the new devices?**
- **How should new devices be numbered?**
- **How many paths to new control units should be configured?**

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Existing controllers with new control unit definitions can be discovered without physical changes, provided that architectural capacity permits connectivity over existing paths.

New controllers require new cables connecting to ports on either new or existing switches.

The System z connectivity must also be considered – is there enough channel capacity and enough architectural capacity?

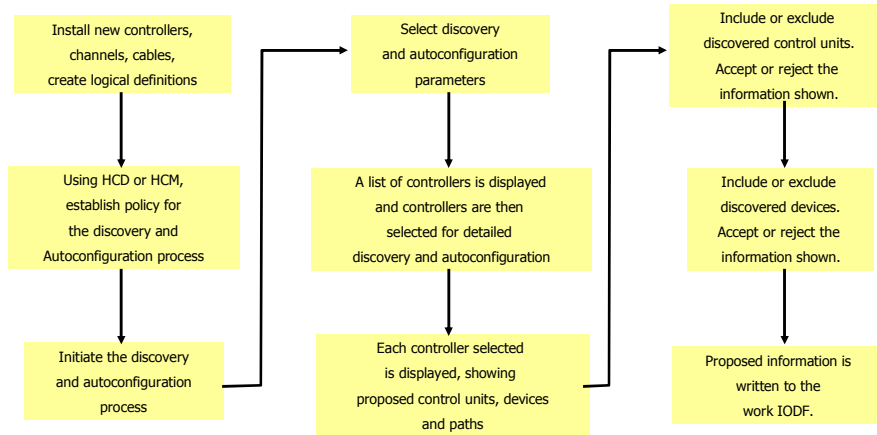
Discovery can be scoped at the sysplex level, or can be a subset of those systems.

You may also want to control the device number and control unit number ranges that are used.

Finally, you may want to control how many paths you need to ensure that you have the availability and performance characteristics you need for the new devices and control units.

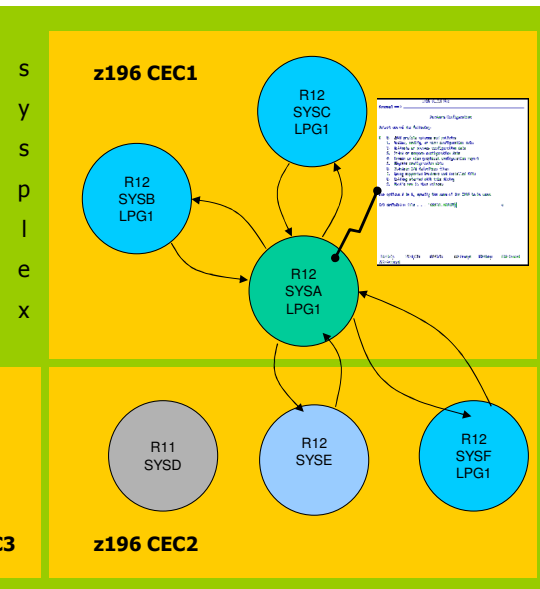
The physical cables and the controller updates are up to you. The rest of the considerations listed here are controlled by you by establishing policy.

Discovery and Autoconfiguration Steps



Controlling Discovery Scope

- **AUTO_SUG_LPGROUP**
- **Specify LPARs that will participate in the discovery attempt**
- **Specify LPGROUP in policy**
- **Isolate scope to those systems and processors that have the capability to perform the function.**
- **Isolate scope to those systems to have access to discovered items**



HCD/HCM policy option `AUTO_SUG_LPGROUP` allows the user to specify a named LPAR group (LPGROUP) that contains LPARs defined on one or more CECs. It is simply a list of LPARs in a named group. LPGROUPs are created and maintained using HCD and HCM policy options. Many LPGROUPs can be created ahead of time and used as necessary when you wish to control the scope of discovery operations.

In the Autoconfiguration Policy, you may then identify an LPGROUP that will be used during discovery. If no LPGROUP is specified, the default scope is the entire sysplex.

The requirements for an LPAR to have discovery capability are to have:

- z/OS Version 1 Release 12
- z196 processor
- At least 1 LPAR at z/OS Version1 Release 12 level with authorization to make dynamic I/O configuration changes.
- User must have authority to make I/O configuration changes (UPDATE access to MVS.ACTIVATE OPERCMDS resource)

The example shown shows LPARs on 3 CECs, two of which are z196 and have discovery capability. On those z196 CECs, some systems are running at z/OS Version1 Release 12. The HCD and HCM capability is present in the z/OS Version 1 Release 12 level. Here, an HCD user running on SYSA can initiate a discovery request using an LPGROUP "LPG1" which contains SYSA, SYSB, SYSC and SYSF. Any proposed control units and devices would only be added to those systems identified in the LPGROUP.



Controlling Control Unit & Device Numbering

Add 2 new control units, each with 64 bases and 64 aliases

- **AUTO_MATCH_CU_DEVNUM**
 - ▶ YES - CU Number matches 1st base
 - ▶ NO – Does not have to match the 1st base
- **AUTO_SS_ALTERNATE**
 - ▶ Controls where aliases are placed
- **AUTO_SS_DEVNUM_SCHEME**
 - ▶ Identifies how devices are to be numbered
 - PAIRING (default)
 - CONSECUTIVE
 - DENSE
- **AUTO_SUG_CU_RANGE**
- **AUTO_SUG_DEV_RANGE**

PAIRING Example

**CUNUM=2000, BASES=02000-0203F,
ALIASES=120C0-120FF**
**CUNUM=2080, BASES=02080-020BF,
ALIASES=12040-1207F**

CONSECUTIVE Example

**CUNUM=2000, BASES=02000-0203F,
ALIASES=12040-1207F**
**CUNUM=2100, BASES=02100-0213F,
ALIASES=12140-1217F**

DENSE Example

**CUNUM=2000, BASES=02000-0203F,
ALIASES=12000-1203F**
**CUNUM=2100, BASES=02100-0213F,
ALIASES=12100-1213F**

Policy options can help you control the way control units and devices are numbered.

However, if some definitions for the control units are found in the IODF, policy options may not be followed in order to use numbers previously defined in the IODF. For example, you may be discovering on SYSA only, and discovery processing may find that the control units discovered are already defined on SYSB. If possible, those numbers will be used instead of creating new ones using the policy options in effect.

If no existing definitions are found, policy options are used to determine appropriate control unit and device numbers.

AUTO_MATCH_CU_DEVNUM is a policy setting that indicates whether the CU number should match the 1st base UA. The default is YES and is generally the recommended approach.

AUTO_SS_ALTERNATE is a policy option that indicates which subchannel set (0, 1, 2) should be used to contain alias device numbers. In the examples on the right, the option used was "1"

AUTO_SS_DEVNUM_SCHEME controls how alias numbering is to be done. This can also affect how base device numbering is done, depending on how constrained your device number space is. The following options are allowed:

- **CONSECUTIVE** The alias device numbers in an alternate subchannel set are consecutive to the base device numbers.
- **DENSE** The device numbers in an alternate subchannel set are densely assigned, that is the next free device numbers in the assigned device number range will be used.
- **PAIRING** Base and alias device numbers are assigned alternatively starting with for example device numbers xx00 and xx80 versus xx80 and xx00. PAIRING is the default.

Within each numbering scheme, there are many attempts to use each scheme, relaxing scheme rules each time a pass fails to satisfy the current numbering operation.

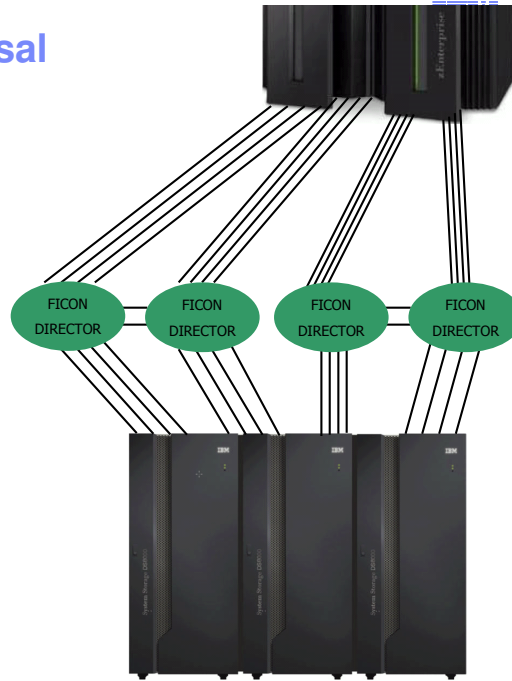
You can also control the available number ranges for control units and devices to suggest to the proposal processing how the device should be numbered. If free ranges exist within these policy suggestions, they will be used.

In the end, if you don't like what numbers are proposed, you can change them in the work IODF to be what you think is a better numbering scheme.

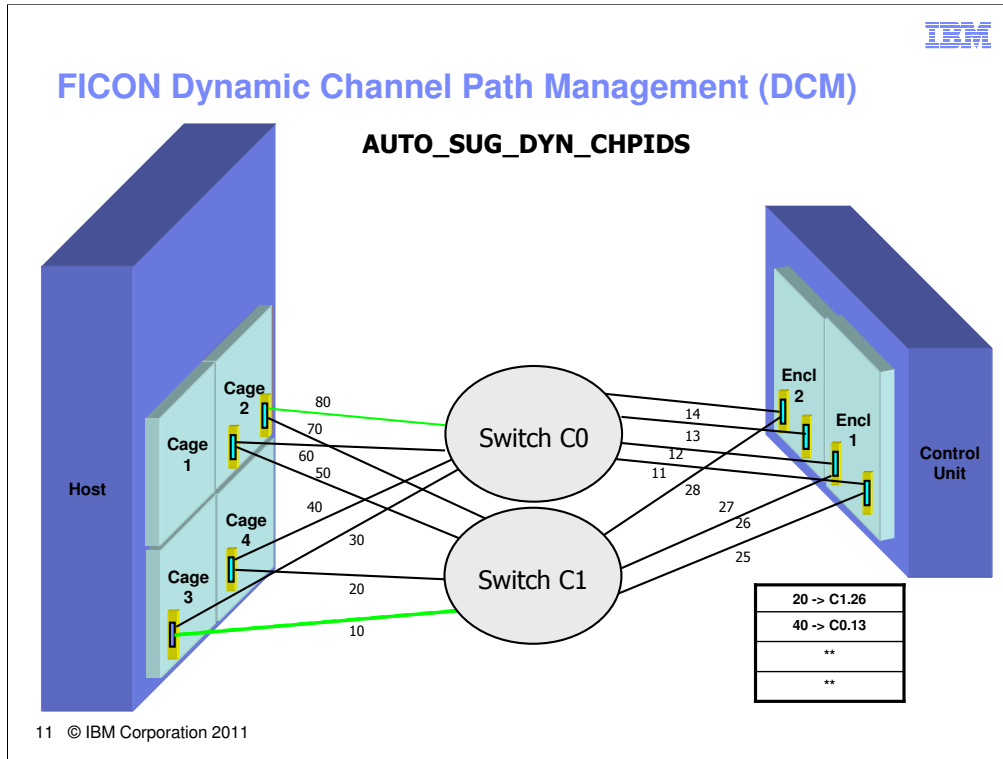
Controlling Path Proposal

- **AUTO_SUG_STAT_CHPIDS**
 - ▶ 1 – 8, indicating the number of static paths that should be proposed for new control units
- **AUTO_SUG_DYN_CHPIDS**
 - ▶ 0-7, indicating the number of dynamic paths that should be proposed for new control units
- **AUTO_SUG_STAT_CHPIDS + AUTO_SUG_DYN_CHPIDS <= 8**
- **Cascading Switches Are OK**

More on Path Proposal
Processing Later...



Policy options allow you to identify how many paths should be configured to newly discovered control units.



In the zDAC Policy, you specify how many static channels that should be configured for each new control unit.

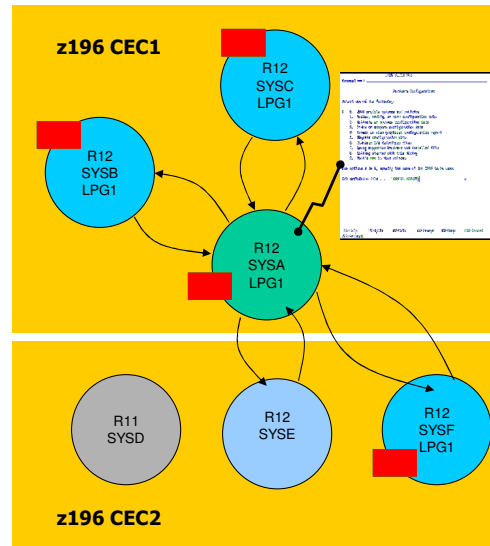
Static channels are chosen primarily based on availability characteristics. Performance is not a factor when paths are selected.

The AUTO_SUG_DYN_CHPID options allows for the specification of managed channels that can be added and removed to accommodate spikes in I/O workloads that cause temporary increases in I/O response times. The way this works in HCD is that channels can be identified as managed, and control units are defined with one or more "*" indicating managed channel path placeholders. As workloads change, z/OS monitors response times and, if necessary, will add and remove channels to/from those managed placeholder path positions. In the example, 2 static paths are configured (Channel 20 connects to switch C1 and switch port 26, channel 40 connects to switch C0 and switch port 13) and there are two paths identified as managed. z/OS could use channel 10 or channel 80 (managed channels shown in green) to connect to one of the shown ports if the need arises.

z/OS DCM can make path changes to help with both performance and availability. zDAC can propose configurations for availability. Together, the two can produce configurations that have continuous availability and performance in mind.

How Discovery Works – Fabric Discovery

- Discovery is initiated using HCD or HCM
- Through policy, the scope of the discovery is defined
- Discovery devices are added to the target systems using dynamic I/O configuration changes
- To explore the connected fabrics, the devices are connected to channels using dynamic I/O configuration changes and I/O commands are performed to determine what is “out there.”
- Discovered information is compared against the target IODF to determine what is new
- Information is organized and a list of discovered controllers is displayed to the user



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Use an LPGROUP to ensure that the discovery scope only includes those systems capable of performing the discovery (ie., systems running z/OS V1R12 or later and those running on z196 processors or later).

In order to explore the fabrics, temporary discovery devices are added to each discovery system and subsequently connected to channels to enable the discovery. These additions are done using dynamic I/O configuration changes. At least 1 system running z/OS V1R12 (or later) on each CEC involved in the discovery must have authority to make dynamic I/O changes on behalf of the processor. The temporary discovery device is connected to all switched FICON channels (one at a time) for the discovery of destination ports.

Fabric discovery is the discovery phase where all reachable destination ports are queried to determine what is there. First, an I/O command to the fabric name server is used to retrieve any destination port that was registered as a FICON channel. This is important because only those controllers (and processors) that register ports/channels as FICON channels will be returned. Check with your storage controller manufacturers to determine if their controllers will support this discovery capability.

Once all the destination ports are known, each one is queried to obtain a node descriptor. The node descriptor identifies the type of controller, model, manufacturer and serial number.

After all channels have been explored and all controllers have been discovered, the information is compared against the target work IODF to gain understanding of what is new and what is previously configured.

How Discovery Works – Fabric Discovery...

- The controller list has a line for each discovered controller
- Information displayed is read from each controller
- New: Yes or No – set based on whether the controller has any control unit definitions within the discovery scope
- One or more controllers can be selected for Controller Discovery

```

z/OS V1.12 MCD
Discovery and Autoconfiguration Options
-----
Discovered New or Changed Controller List
-----
Backup Query Help
-----
Row 1 of 72
Command ==> Scroll ==> CSR
Select one or more controllers to be defined, then press
Enter.

Manufacturer
-----
# Type Model Name Plant Serial-# New Processed
- 1750 511 IBM 13 ANFGA Yes No
- 1750 511 IBM 13 00438 Yes No
- 1750 511 IBM 13 00541 Yes No
- 1750 511 IBM 13 49460 Yes No
- 1750 511 IBM 58 81071 Yes No
- 1750 511 IBM 68 84881 Yes No
- 2105 F20 IBM 13 12628 Yes No
- 2105 F20 IBM 13 13001 Yes No
- 2105 F20 IBM 13 17533 Yes No

F1=Help F2=Split F3=Exit F4=Prompt
F7=Backward F8=Forward F9=Swap F10=Actions
F12=Cancel F22=Command
  
```

A list of controllers is then displayed to the user.

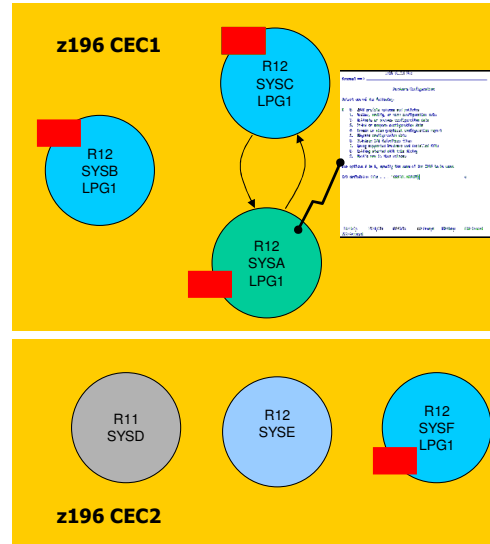
In order to make this list, a controller must be a tape or disk controller, must have properly registered with the fabric name server, and must have been reachable from all discovery systems.

Note that the new=yes/no column may indicate that a controller is new even though some definitions exist in the IODF. The yes/no indicator is correct for the systems within the scope of the discovery. For example, on the previous chart, controllers defined only to SYSD and SYSE (which are outside of the discovery scope specified by LPGROUP **LPG1**) will appear as new.

One or more controllers can be selected for controller discovery. Depending on the discovery options selected, proposed definitions will either be displayed to the user or will be added to the target work IODF.

How Discovery Works – Controller Discovery

- To explore the controller, the devices on a *single* system are connected to channels using dynamic I/O configuration changes and I/O commands are performed to determine what is “on there.”
- Most I/O commands used have existed for a long time
- Discovered information is compared against the target IODF to determine what is new
- Paths are proposed for new control units
- New control units and devices are displayed to the user



Controller discovery works with one controller at a time. If multiple controllers are selected, they are discovered serially.

Again, dynamic I/O configuration changes are made, this time on a single system where discovery of the selected controller(s) will take place.

If a selected controller is not new (ie., it has some devices configured on the discovery system), those existing devices may be able to be used for discovery, circumventing the need to make some or all of the necessary I/O configuration changes.

For any new control units, paths must be proposed. New control units will have paths proposed for each unique processor/channel subsystem that contains a discovery system.

How Discovery Works – Controller Discovery...

```

| S | Backup Query Help |
|-----|-----|-----|
Proposed Control Unit List
|-----|-----|-----|
Command ==>  | Row 1 of 16
|-----|-----|-----|
Control unit type . . . : 2105-F20      Serial number : 12620
Proposed switch.ports : 47.70 46.74 47.72 46.7C

To accept the proposed values, press Enter. To modify them, edit the
fields, or select one or more control units to change, exclude or include
the corresponding definitions, then press Enter.

  CU  CU  # of  LPAR
 / ADD number+ devices Access+ New Description I
- 00  8000  256  M205  Yes  _____ Y
- 01  8000  256  M205  Yes  _____ Y
- 02  9100  256  M205  Yes  _____ Y
- 03  9200  256  M205  Yes  _____ Y
- 04  9400  256  M205  Yes  _____ Y
- 05  9500  256  M205  Yes  _____ Y
F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset
F7=Backward  F8=Forward    F9=Swap      F12=Cancel     F22=Command

```

Here, the list of discovered controllers is displayed.

On this panel, you can select a control unit to see more detail on the definition, including what paths were selected. If there are control units presented that you do not want to add to the IODF, you can exclude them on this panel.

Pressing enter will show proposed devices.

How Discovery Works – Controller Discovery...

- **Types of discovery**
 - ▶ **Single device**
 - ▶ **Control unit**
 - ▶ **Controller**
- **Disk controllers**
 - ▶ **Most controllers support control unit level discovery**
 - ▶ **Some newer controllers support controller level discovery (faster)**
- **Tape controllers**
 - ▶ **Single device discovery**

The time it takes to discover a controller depends on the controller type and the capabilities of the controller.

There are 3 types of discovery

-Single device discovery – in this mode, a device must be configured for each device to be discovered, and I/O commands must be performed to each device to determine if it is configured.

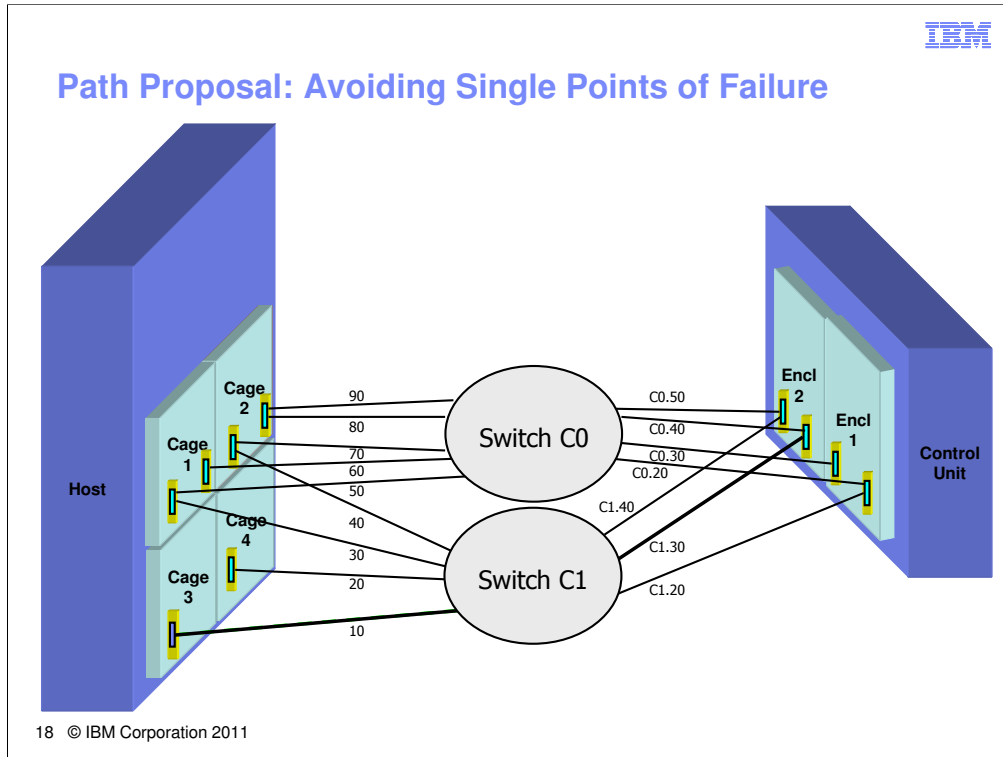
-Control unit discovery – in this mode, all devices attached to a control unit can be discovered using I/O commands delivered to a single device in the control unit

-Controller level discovery – in this mode, multiple control units and devices attached to them can be discovered using I/O commands delivered to a single device.

One thing to note is that during controller discovery, information is read from the devices and can automatically be configured in the IODF. Types of information discovered is control unit model, device type (ie., base or alias disk devices), whether compaction is supported (tape), library ID (tape) and library port ID (tape).

Philosophy on Path Proposal

- Policy suggests # of paths to be selected (ie., 4 statics)
- The channels that can reach the controller are compared against each other to determine the best channels to use
 - ▶ Single points of failure (common hardware components)
 - Switch
 - Channel card
 - I/O cage
 - ▶ Current definitions (how many unit addresses and control units are currently configured to use the channel)
- Once a set of channels is selected, destination link addresses are chosen in a similar manner



This is kind of like a “find the hidden objects” picture. Look at the diagram and try to find why pairs of paths that would not be good choices.

For example, picking channels 80 & 90 as a pair would not be a good choice to get to this control unit because they share many common components. They are channels on the same adapter card, they share the same I/O cage, the same switch. A better pair would be channel 10 and channel 90, which do not share common components.

When a channel is selected, it carries with it a set of control unit ports that can be used to complete the path. Similar logic is applied when picking control unit ports. Path proposal would avoid selecting two destination ports that are on the same adapter card, same enclosure, etc.

Discovery Tips

- **SYS1.PARMLIB(DIAGxx), add TRAPS NAME(IOUSZDACMSG)**
- **If multiple sysplexes are on the same CEC, only run 1 discovery attempt at a time to avoid I/O configuration change collisions**
- **If not all LPARs defined on a channel subsystem have access to control units, discovery is not the way to add them – simply update the access list to add the LPARs that need access using HCD or HCM**
- **Check what has been proposed**
- **Cascaded switches and link addresses**
- **Channels must be online to be discovered**
- **A full list of restrictions and suggestions is given in the HCD User's Guide**

SYS1.PARMLIB(DIAGxx) TRAPS NAME(IOUSZDACMSG) causes some diagnostic messages to be written to the SYSLOG, which can help avoid recreates if you need to contact IBM support. It also allows you to see some progress during discovery attempts.

In order to discover new controllers and control units, it is required that dynamic I/O configuration changes be made on each CEC hosting a discovery system. You want to make sure that conflicting changes are not performed simultaneously, which could adversely affect the discovery attempts. You should also avoid activating an IODF configuration change while discovery attempts are being made.

Another case where conflicts may arise in I/O configuration changes can occur when partition access lists are used to limit control unit access to a subset of LPARs on a channel subsystem. When a discovery attempt occurs on a partition that does not have access, attempts to add discovery devices could fail because other LPARs already have the control unit defined. The only way to add the control units to LPARs that don't have access is to remove the access list (granting all LPARs access to it on the channel subsystem), or grant access to the specific LPARs needing access.

You also will want to ensure that the devices are defined properly in the configuration. No esoterics are assigned to newly discovered devices, and defaults are taken for many device and control unit settings. One example is the LOCANY setting, which defaults to NO. This can be overridden using the HCD profile option 1 with the OS_PARM_DEFAULT = LOCANY,YES policy setting.

Architecture requires that link addresses be used consistently on a channel. If a channel has an existing path configured using only switch port addresses (a one-byte link address), cascading switch paths are not allowed to be defined on that channel. Using two-byte link address will allow for greater connectivity options (and will allow zDAC to propose cascaded paths).



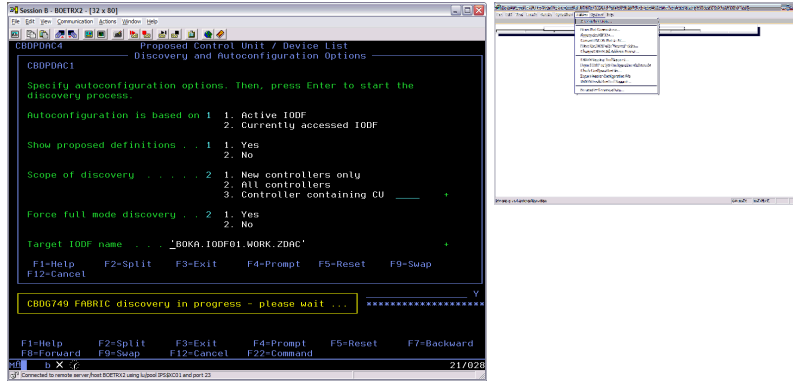
Requirements

- **Systems running z/OS Version 1 Release 12**
- **z196 Processor**
- **LPAR authorized to make dynamic I/O configuration changes on each processor hosting a discovery system**
- **HCD or HCM user authorized to make dynamic I/O configuration changes (has UPDATE authority for MVS.ACTIVATE OPERCMDS resource)**

Just reaffirming the environment required for discovery and autoconfiguration:

- z/OS Systems must be running V1R12 or later
- Those systems must be running on a z196 processor or later
- At least 1 LPAR on each processor hosting discovery systems must be running z/OS V1R12 and must be capable of making dynamic I/O configuration changes
- The User must have authority to make those changes. This is the same resource (MVS.ACTIVATE) previously required to activate an IODF or IOCDS using HCD or HCM.

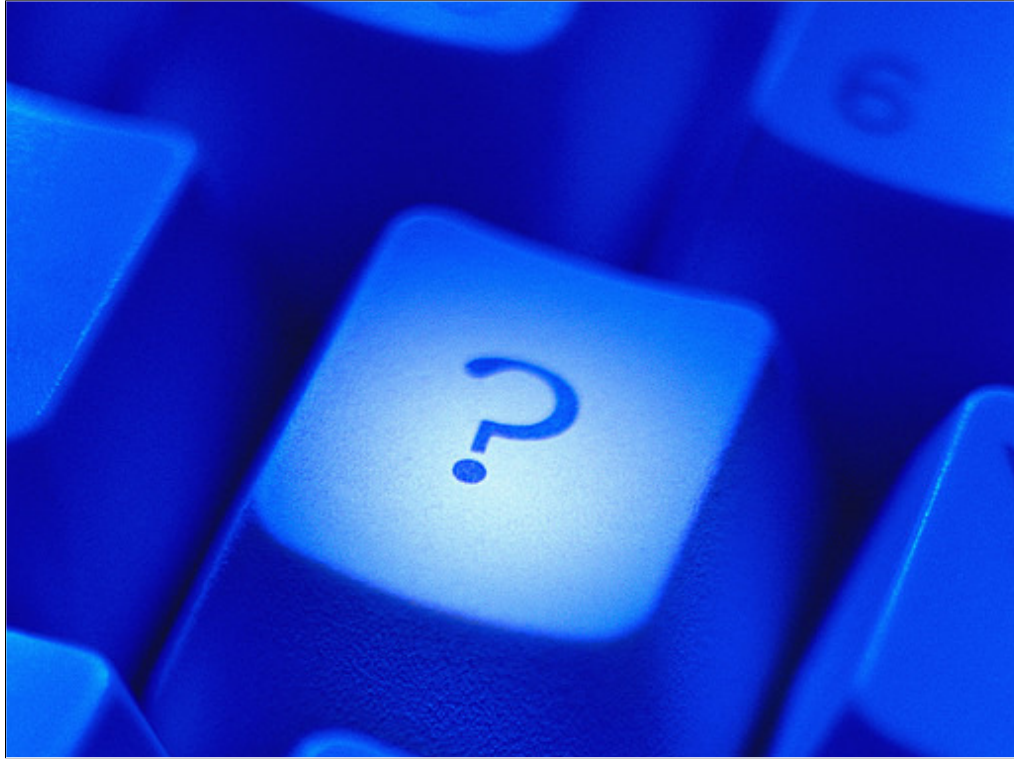
Demo





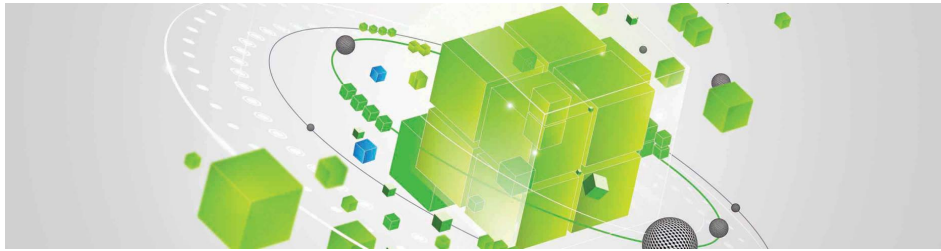
Reference Material

- **z/OS V1R12.0 HCD User's Guide, SC33-7988**
- **z/OS V1R12.0 and z/VM V6R1.0 HCM User's Guide, SC33-7989**
- **IBM zEnterprise 196 Configuration Setup, SG24-7834**
- **z/OS Intelligent Resource Director, SG24-5952**



Backup Screen Shots

If demo is not available...





Discovering with HCD

Command ==> _____

Hardware Configuration

Select one of the following.

- 0. Edit profile options and policies
- 1. Define, modify, or view configuration data
- 2. Activate or process configuration data
- 3. Print or compare configuration data
- 4. Create or view graphical configuration report
- 5. Migrate configuration data
- 6. Maintain I/O definition files
- 7. Query supported hardware and installed UIMs
- 8. Getting started with this dialog
- 9. What's new in this release

For options 1 to 5, specify the name of the IODF to be used.

I/O definition file . . . 'IODFST.IODF68' +

F1=Help F2=Split F3=Exit F4=Prompt F9=Swap F12=Cancel
F22=Command

Show here is the main HCD panel. Option 0 allows the user to establish policy information.

Discovering with HCD...

```
C      Profile Options and Policies
S
O
Select type of data to define.
1. HCD profile options
2. Autoconfiguration policies
3. LP groups for autoconfiguration
4. OS groups for autoconfiguration

F1=Help  F2=Split  F3=Exit  F9=Swap  F12=Cancel

7. Query supported hardware and installed UIMs
8. Getting started with this dialog
9. What's new in this release

For options 1 to 5, specify the name of the IODF to be used.
I/O definition file . . . 'IODFST.IODF68' *
```

Here, 4 options are available to the user. Discovery and Autoconfiguration processing can be tailored using options 2, 3 and 4. First, we will select option 3 to define which active LPARs will be in the discovery operation.



Discovering with HCD...

```
z/OS V1.12 HCD
Autoconfiguration LP Group List
Row 1 of 14
Command ==> _____ Scroll ==> CSR
To view assigned partitions, select one or more LP groups,
then press Enter. To add an LP group, use F11.

/ LP group name      Description
- PLX5              R87/R89 MAS'A' / MAS 'B'
- PLX5ALL           R87/R89 MAS'A' / MAS 'B'
- R87MASB           R87-S50,1,2,5,8,9
- R87R89A           R87-S58,C,E,H R89-S5A,D,F,G,6
- R87R89B           R87-S50,1,5 R89-S52,8,9
- R87R89G           R87/S5089C R89/S51257
- R87S5015          R87-S50,1,5
- R87S55            R87-S55
- R87S589           R87 S58, S59
- R89MASA           R89-S5A,D,F,G,6
- R89MASB           R89-S50,1,2,5,8,9
- R89R87N           S50,S51 R87, R87 S58,S59
F1=Help      F2=Split      F3=Exit      F4=Prompt
F7=Backward  F8=Forward    F9=Swap      F11=Add
F12=Cancel   F22=Command

z/OS V1.12 HCD
Autoconfiguration LP Group Assignment
Command ==> _____ Sc
Select one or more logical partitions, then pre
add, use F11.
LP group name : R87S589      R87 S58, S59

/ Partition Name      Description
- R87.2.S58           LPAR S58 on R87 - PLX5
- R87.3.S59           LPAR S59 on R87 - PLX5
***** Bottom of data *****

F1=Help      F2=Split      F3=Exit      F4=Prompt      F9=Swap
F7=Backward  F8=Forward    F9=Swap
F12=Cancel   F22=Command

F1=Help      F2=Split      F3=Exit      F4=Prompt      F9=Swap
F7=Backward  F8=Forward    F9=Swap
F12=Cancel   F22=Command

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```

If a list of LPAR Groups already exists, you can select one and modify it. If none exist, LPAR groups can be defined using F11. Once an LPAR group is selected, navigating through the panels will allow partitions to be included in the LPAR group. Shown here are two panels, one containing the list of LPAR groups defined, and the other an LPAR group definition showing two LPARs in the group.

LPAR Groups can contain LPARs from many different processors. They will be used to define the scope of the discovery operation.

Likewise, an OS group is a collection of OS configurations which is used by autoconfiguration to determine to which operating systems of type MVS the auto-defined devices should be assigned. They can be created and modified using option 4 of the main policy panel.



Discovering with HCD...

z/OS V1.12 HCD

Autoconfiguration Policies

Row 1 of 9 More: >

Command ==> |

Scroll ==> CSR

Edit or revise autoconfiguration policies.

HCD Profile : SBC1.HCD.PROFILE

Policy keyword	Value +
AUTO_MATCH_CU_DEVNUM	YES
AUTO_SS_ALTERNATE	1
AUTO_SS_DEVNUM_SCHEME	PAIRING
AUTO_SUG_CU_RANGE	4000-FFFF
AUTO_SUG_DEV_RANGE	4000-FFFF
AUTO_SUG_DYN_CHPIIDS	2
AUTO_SUG_LPGRROUP	R87S55
AUTO_SUG_OSGROUP	PLX5
AUTO_SUG_STAT_CHPIIDS	2

***** Bottom of data *****

F1=Help F2=Split F3=Exit F4=Prompt F5=Reset
F7=Backward F8=Forward F9=Swap F12=Cancel F20=Right
F22=Command

F1=Help F2=Split F3=Exit F4=Prompt F9=Swap F12=Cancel
F22=Command

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Profile option 2 allows you to define discovery and autoconfiguration policy. You can control things such as device and control unit numbering, how many paths should be added to new control units, which subchannel set alias devices should be added to, and the LPAR group or OSGROUP that you wish to use to control the scope of the discovery.

This information is stored in the user profile dataset.

Note here that 2 static channel paths and 2 dynamic (or managed) channel paths are requested, allowing DCM to manage paths to optimize performance for new control units.

Discovering with HCD...

```

z/OS V1.12 HCD
Define, Modify, or View Configuration Data

Select type of objects to define, modify, or view data.

1. Operating system configurations
   consoles
   system-defined generics
   EDTs
   esoterics
   user-modified generics
2. Switches
   ports
   switch configurations
   port matrix
3. Processors
   channel subsystems
   partitions
   channel paths
4. Control units
5. I/O devices
6. Discovered new and changed control units and I/O devices

F1=Help  F2=Split  F3=Exit  F9=Swap  F12=Cancel

F1=Help  F2=Split  F3=Exit  F4=Prompt  F9=Swap  F12=Cancel
F22=Command
  
```

Once the policy has been established, the Discovery and Autoconfiguration process can be started by selecting option 1 (Define, modify, or view configuration data) and then option 6 (Discovered new and changed control units and I/O devices).

Discovering with HCD...

z/OS V1.12 HCD

Discovery and Autoconfiguration Options

Specify autoconfiguration options. Then, press Enter to start the discovery process.

Autoconfiguration is based on **2** 1. Active IODF
2. Currently accessed IODF

Show proposed definitions . . . **1** 1. Yes
2. No

Scope of discovery **2** 1. New controllers only
2. All controllers
3. Controller containing CU +

Force full mode discovery . . . **2** 1. Yes
2. No

Target IODF name . . . **I**IODFST.IODF88.ZDAC.SCOTT.WORK' +

F1=Help F2=Split F3=Exit F4=Prompt F5=Reset F9=Swap
F12=Cancel

F1=Help F2=Split F3=Exit F4=Prompt F9=Swap F12=Cancel
F22=Command

Here, more discovery options are presented to give the user more control.

If the target work IODF is not yet created, it will be copied from the source IODF (either the active IODF or the currently accessed IODF, based on the first option selected).

You have the option of seeing what is proposed, or it can actually just be added directly to the target work IODF.

Once enter is pressed, the fabric discovery phase begins. Switch-attached FICON channels are explored to determine what controllers are reachable.



Discovering with HCD...

z/OS V1.12 HCD

Discovery and Autoconfiguration Options

Specify autoconfiguration options. Then, press Enter to start the discovery process.

Autoconfiguration is based on 2 1. Active IODF
2. Currently accessed IODF

Show proposed definitions . . . 1 1. Yes
2. No

Scope of discovery 2 1. New controllers only
2. All controllers
3. Controller containing CU _____ +

Force full mode discovery . . . 2 1. Yes
2. No

Target IODF name . . . IODFST.IODF68.ZDAC.SCOTT.WORK' _____ +

F1=Help F2=Split F3=Exit F4=Prompt F5=Reset F9=Swap
F12=Cancel

FABRIC discovery in progress - please wait ...

F1=Help F2=Split F3=Exit F4=Prompt F9=Swap F12=Cancel
F22=Command

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Once you press enter, a message is displayed indicating fabric discovery is in progress.

Discovery processing involves multiple address spaces. The TSO user waits on the foreign processes to complete. Pressing attention is allowed, but being a former TSO/E developer, it isn't something that I like.

Fabric discovery times will vary depending on the number of channels that need to be connected and explored, and will also depend on how many switch ports need to be explored. The I/Os do not take very long, but the I/O configuration changes can take a second or two. Patience is always a good thing here. A guess at expected times would be 1 to 2 minutes. If it hurts to wait, consider running with the suggested DIAGxx TRAP and watch SYSLOG to see progress.



Discovering with HCD...

z/OS V1.12 HCD

Discovery and Autoconfiguration Options

```
-----
                Discovered New or Changed Controller List
-----
Backup Query Help
-----
Row 10 of 84
Command ==> _____ Scroll ==> CSR
Select one or more controllers to be defined, then press
Enter.

S /  Type  Model  Manufacturer
- / 2105  F20   IBM       75       14566     Yes No
- / 2105  F20   IBM       75       14640     Yes No
- / 2105  F20   IBM       75       14662     Yes No
F - / 2105  F20   IBM       75       14931     Yes No
- / 2105  F20   IBM       13       17533     Yes No
- / 2105  F20   IBM       75       17534     Yes No
T / 2105  800   IBM       13       22212     Yes No
- / 2105  800   IBM       13       22220     Yes No
- / 2105  800   IBM       13       22230     Yes No
F

F1=Help      F2=Split    F3=Exit     F4=Prompt
F7=Backward  F8=Forward  F9=Swap     F10=Actions
F12=Cancel   F13=Instruct F22=Command
```

F1=Help F2=Split F3=Exit F4=Prompt F9=Swap F12=Cancel
F22=Command

When fabric discovery is complete and successful, a list of controllers common to all discovery systems is displayed. One or more controllers can be selected for controller discovery.



Discovering with HCD...

```
z/OS V1.12 HCD
Discovery and Autoconfiguration Options

Discovered New or Changed Controller List
Backup Query Help
-----
Command ==> | Scroll ==> CSR
Row 10 of 84
Select one or more controllers to be defined, then press
Enter.

S / Type Model Name Plant Serial-# New Processed
- 2105 F20 IBM 75 14566 Yes No
- 2105 F20 IBM 75 14640 Yes No
- 2105 F20 IBM 75 14662 Yes No
F - 2105 F20 IBM 75 14931 Yes No
- 2105 F20 IBM 13 17533 Yes No
- 2105 F20 IBM 75 17534 Yes No
T / 2105 800 IBM 13 22212 Yes No
- 2105 800 IBM 13 22220 Yes No
- 2105 800 IBM 13 22230 Yes No
F F1=Help F2=Split F3=Exit F4=Prompt
F7=Backward F8=Forward F9=Swap F10=Actions
F12=Cancel F13=Instruct F22=Command

CONTROLLER discovery in progress - please wait ...

F1=Help F2=Split F3=Exit F4=Prompt F9=Swap F12=Cancel
F22=Command
```

When fabric discovery is complete and successful, a list of controllers common to all discovery systems is displayed. One or more controllers can be selected for controller discovery. Patience please!

As was mentioned in the main presentation, the time it takes to do controller discovery depends on the capability of the controller. 2105 disk controllers have only 16 control units and typically support control unit discovery mode. 2107 disk controller that do not support the controller level discovery can take a long time, often several minutes if it contains a lot of control unit definitions. The DS8700 is a disk controller that does contain controller level discovery can discover an entire controller in seconds. And finally, tape controllers are relatively quick (usually less than a minute) even though they are discovered using single device discovery mode.

When controller discovery is complete and new control units and/or devices are found, the control unit list is displayed.



Discovering with HCD...

Command ==> _____ Select Processor / CU Row 1 of 22 More: >
Scroll ==> CSR

Select processors to change CU/processor parameters, then press Enter.

Control unit number . . . : 4E00 Control unit type . . . : 2105

Proc. CSSID	1	2	3	4	5	6	7	8
R87.1	BF.7325	8B.7424 *	*					
H89.0								
H89.1								
H89.2								
H89.3								
MR29.0								
MR29.1								
R87.0								
R87.2								
R87.3								
R89.0								
R89.1								
R89.2								
R89.3								
R92.0								
R92.1								
R92.2								
R92.3								
T72.0								
T72.1								
T72.2								

F1=Help F2=Split F3=Exit F4=Prompt F5=Reset F6=Previous
F7=Backward F8=Forward F9=Swap F12=Cancel F20=Right F22=Command

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The selected control unit is displayed. You can see that my discovery system S55 runs on processor R87 and channel subsystem 1, and 2 static paths are proposed. Also note that 2 dynamic paths are proposed as well, denoted with '*'.

Here, you also see that both channels (BF and 8B) use 2 byte switch port addressing for destination ports.



Discovering with HCD...

Proposed Control Unit / Device List

Row 1 of 16

Command ==> | Scroll ==> CSR

Control unit type . . . : 2105-800 Serial number : 22212

To accept the proposed values, press Enter. To modify them, edit the fields, or select one or more device ranges to change, exclude or include the corresponding definitions, then press Enter.

-----Device-----		S	CU	UA	OS		
/ Number	Type+	S Num	Range	Access+	N	Description	I
- 4E00,110	3390B	0	4E00 00-6D	PLX5	Y	_____	Y
- 4E6E,146	3390A	1	4E00 0E-FF	PLX5	Y	_____	Y
- 5000,51	3390B	0	5000 00-32	PLX5	Y	_____	Y
- 5034,204	3390A	1	5000 34-FF	PLX5	Y	_____	Y
- 5100,110	3390B	0	5100 00-6D	PLX5	Y	_____	Y
- 516E,146	3390A	1	5100 0E-FF	PLX5	Y	_____	Y
- 5200,51	3390B	0	5200 00-32	PLX5	Y	_____	Y
- 5234,204	3390A	1	5200 34-FF	PLX5	Y	_____	Y
- 5300,110	3390B	0	5300 00-6D	PLX5	Y	_____	Y
- 536E,146	3390A	1	5300 0E-FF	PLX5	Y	_____	Y
- 5400,53	3390B	0	5400 00-34	PLX5	Y	_____	Y
- 5447,185	3390A	1	5400 47-FF	PLX5	Y	_____	Y
- 5500,74	3390B	0	5500 00-49	PLX5	Y	_____	Y
- 554A,182	3390A	1	5500 4A-FF	PLX5	Y	_____	Y
- 5600,74	3390B	0	5600 00-49	PLX5	Y	_____	Y
- 564A,182	3390A	1	5600 4A-FF	PLX5	Y	_____	Y

***** Bottom of data *****

F1=Help F2=Split F3=Exit F4=Prompt F5=Reset F7=Backward
F8=Forward F9=Swap F12=Cancel F22=Command

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Here, the list of devices to be added to the target work IODF is displayed.

Pressing enter will accept the proposed device numbers. Pressing F3 will not accept the proposed devices.



Discovering with HCD...

```
Proposed Control Unit / Device List
Device / Processor Definition
Row 1 of 1
Command ==> |                               Scroll ==> CSR

Select processors to change device/processor definitions, then press
Enter.

Device number . . . : 4E00      Number of devices . . : 110
Device type . . . . : 3390B

/ Proc.CSSID SS+ UA+ Time-Out STADET Preferred Device Candidate List
_ R87.1      _ 00 No Yes CHPID + Explicit Null
***** Bottom of data *****

F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset
F6=Previous  F7=Backward   F8=Forward   F9=Swap        F12=Cancel
F22=Command

_ 554A,182 3390A 1 5500 4A-FF PLX5 Y _____ Y
_ 5600,74 3390B 0 5600 00-49 PLX5 Y _____ Y
_ 564A,182 3390A 1 5600 4A-FF PLX5 Y _____ Y
***** Bottom of data *****

F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset      F7=Backward
F8=Forward   F9=Swap        F12=Cancel   F22=Command
```

You can select a device and look at its proposed definition. Note that all disk devices are defined as 3390B or 3390A depending on its configuration on the controller. The discovery processing will never propose a 3390 or 3380 device type. If this is what you want, you will need to change this manually.



Discovering with HCD...

```
Proposed Control Unit / Device List
C [-----] Discovered New or Changed Controller List [-----] 1 ==> CSR
  [-----] Backup Query Help [-----]
Proposed Control Unit List
Command ==> _____ Scroll ==> CSR Row 1 of 8
Control unit type . . : 3490-C2A Serial number : B2902
Proposed switch.ports : 32.06 32.19 5B.44 5B.45
To accept the proposed values, press Enter. To modify them, edit the
fields, or select one or more control units to change, exclude or include
the corresponding definitions, then press Enter.
CU  CU  # of  LPAR
/ ADD number+ devices Access+ New Description I
_ 00 5700 16 R87S55 Yes Tape Library 5700 Y
_ 01 5800 16 R87S55 Yes _____ Y
_ 02 5900 16 R87S55 Yes _____ Y
_ 03 5A00 16 R87S55 Yes _____ Y
_ 04 5B00 16 R87S55 Yes _____ Y
_ 05 5C00 16 R87S55 Yes _____ Y
F1=Help F2=Split F3=Exit F4=Prompt F5=Reset
F7=Backward F8=Forward F9=Swap F12=Cancel F22=Command
```

F1=Help F2=Split F3=Exit F4=Prompt F5=Reset F7=Backward
F8=Forward F9=Swap F12=Cancel F22=Command

Shown here is a control unit list that was displayed when I selected a tape controller for discovery. Notice that you can edit CU numbers and description fields. You can also exclude control units by using the “e” command.



Discovering with HCD...

Proposed Control Unit / Device List

Row 1 of 8

Command ==> _____ Scroll ==> CSR

Control unit type . . . : 3490-C2A Serial number : B2902

To accept the proposed values, press Enter. To modify them, edit the fields, or select one or more device ranges to change, exclude or include the corresponding definitions, then press Enter.

```
-----Device----- S CU  UA  OS
/ Number  Type+  S Num Range Access+ N Description  I
- 5700,16 3490   0 5700 00-0F PLX5  Y _____  Y
- 5800,16 3490   0 5800 00-0F PLX5  Y _____  Y
- 5900,16 3490   0 5900 00-0F PLX5  Y _____  Y
- 5A00,16 3490   0 5A00 00-0F PLX5  Y _____  Y
- 5B00,16 3490   0 5B00 00-0F PLX5  Y _____  Y
- 5C00,16 3490   0 5C00 00-0F PLX5  Y _____  Y
- 5D00,16 3490   0 5D00 00-0F PLX5  Y _____  Y
- 5E00,16 3490   0 5E00 00-0F PLX5  Y _____  Y
***** Bottom of data *****
```

F1=Help F2=Split F3=Exit F4=Prompt F5=Reset F7=Backward
F8=Forward F9=Swap F12=Cancel F22=Command

Show here is a list of tape devices proposed.



Looking in the IODF after Discovery

```
Goto Filter Backup Query Help
-----
Control Unit List
Command ==> _____ Scroll ==> CSR
View Control Unit Definition
Row 1 of 1 More: >
Command ==> _____ Scroll ==> CSR
Control unit number . : 5700      Tape Library 5700
Control unit type . . : 3490      Serial number . . . : B2902
Connected switch.ports: 32.06 32.19 5B.44 5B.45
ENTER to continue.
-----Channel Path ID . Link Address-----
Proc.CSSID 1----- 2----- 3----- 4----- 5----- 6----- 7----- 8-----
87.1    89.06  8C.7719
***** Bottom of data *****
F1=Help      F2=Split    F3=Exit     F7=Backward F8=Forward
F9=Swap      F12=Cancel  F20=Right   F22=Command
_ 5A00 3490    3    1    B2902
_ 5B00 3490    4    1    B2902
F1=Help      F2=Split    F3=Exit     F4=Prompt   F5=Reset    F7=Backward
F8=Forward   F9=Swap     F10=Actions F11=Add     F12=Cancel  F13=Instruct
F22=Command
```

Using HCD option 4 (Control Units), you can select one of the discovered controllers and inspect the control unit definition.



Looking in the IODF after Discovery

```
Goto Filter Backup Query Help
- View Device / OS Configuration Definitions
- View Device Parameter / Feature Definition
Command ==> _____ Scroll ==> CSR
Row 1 of 10
Configuration ID . . : PLX5          OS Config for SVPLEX5
Device number . . . : 5700         Device type . . . . : 3490
Generic / VM device type . . . . : 3490

ENTER to continue.

Parameter/
Feature      Value      R Description
OFFLINE     No         Device considered online or offline at IPL
DYNAMIC     Yes        Device supports dynamic configuration
LOCANY      No         UCB can reside in 31 bit storage
LIBRARY     Yes        Device supports auto tape library
AUTOSWITCH No         Device is automatically switchable
LIBRARY-ID  60453     5 digit library serial number
LIBPORT-ID  01        2 digit library string ID (port number)
MTL         No         Device supports manual tape library
SHARABLE    No         Device is Sharable between systems
F1=Help     F2=Split   F3=Exit     F7=Backward  F8=Forward
F9=Swap     F12=Cancel F22=Command

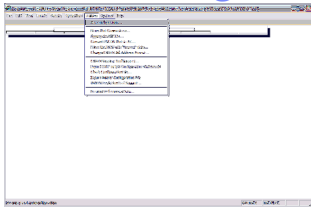
***** Bottom of data *****

F1=Help     F2=Split   F3=Exit     F4=Prompt    F5=Reset     F7=Backward
F8=Forward  F9=Swap    F10=Actions F11=Add      F12=Cancel   F13=Instruct
F20=Right  F22=Command
```

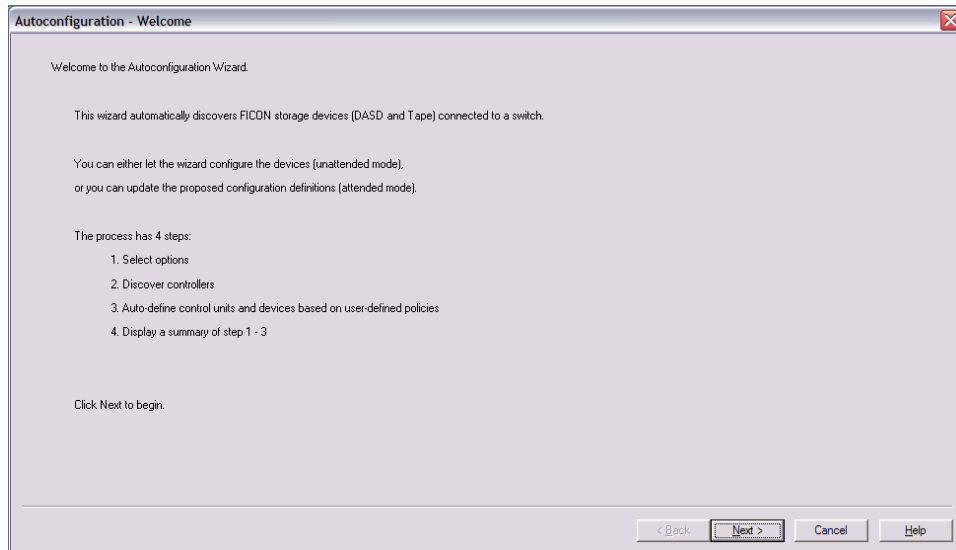
Show here are the device parameters and features. Some of these use defaults defined in the UIM for the devices, and some are discovered using I/O commands to the devices.



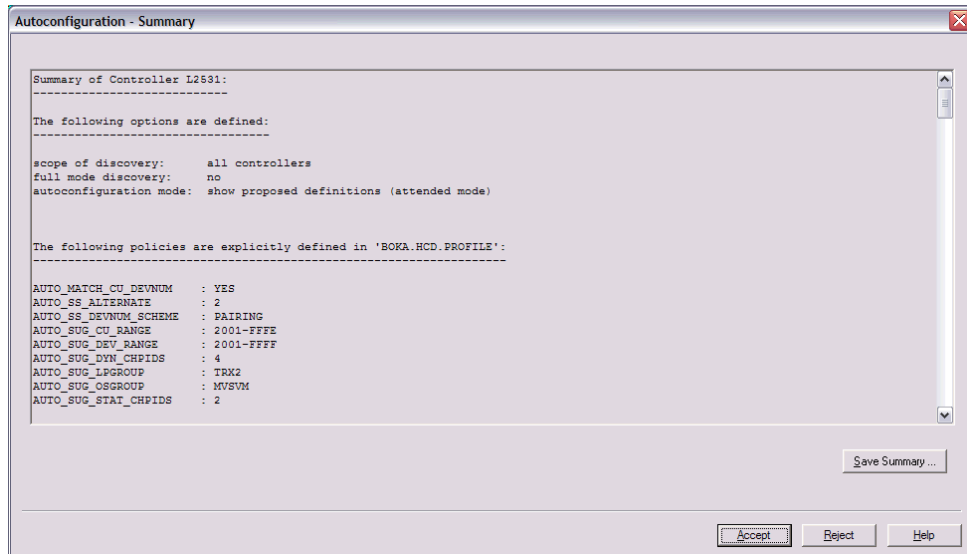
Discovering with HCM



Discovering with HCM...



Discovering with HCM...





Discovering with HCM...

Autoconfiguration - Discovered Controller List

Scope of discovery: All controllers
Full mode discovery: No

Autoconfiguration operation mode

Show proposed definitions
 Automatically configure control units and devices

Select one or more controllers to be defined:

Include	Type	Model	Manufacturer	Plant	Serial Number	New	Processed
	2107	922	IBM	75	10671	Yes	No
	2105	800	IBM	75	29410	Yes	No
	2105	800	IBM	75	29592	Yes	No
	1750	511	IBM	13	70340	Yes	No
	2107	942	IBM	75	74012	Yes	No
	2107	941	IBM	75	88821	Yes	No
	2107	922	IBM	75	92481	Yes	No
	1750	511	IBM	13	AFAPA	Yes	No
	3590	J70	IBM	78	C4433	Yes	No
	3590	C06	IBM	78	C5182	Yes	No
	2107	922	IBM	75	CV8M1	Yes	No
	2107	932	IBM	75	CW931	Yes	No
<input checked="" type="checkbox"/>	2107	931	IBM	75	L2531	Yes	No
	2107	931	IBM	75	58251	No	No
	2107	942	IBM	75	74011	No	No

Columns...
Exclude...
Include...
Number of objects listed: 20

< Back Next > Cancel Help



Discovering with HCM...

Autoconfiguration - Proposed Control Unit List

Controller Type: 2107 - 931
Controller Serial Number: L2531

Connected Switch Ports: 14.0A 14.1A 14.9A 14.0A

Include	CUADD	CU Number	Type	Serial Number	# Devices	LPAR Access	New	Description
<input checked="" type="checkbox"/>	00	2500	2107	L2531	176	TRX2	Yes	
<input checked="" type="checkbox"/>	01	2600	2107	L2531	256	TRX2	Yes	
<input checked="" type="checkbox"/>	02	2E00	2107	L2531	256	TRX2	Yes	
<input checked="" type="checkbox"/>	04	3200	2107	L2531	28	TRX2	Yes	
<input checked="" type="checkbox"/>	08	3400	2107	L2531	188	TRX2	Yes	
<input checked="" type="checkbox"/>	0A	3800	2107	L2531	128	TRX2	Yes	
<input checked="" type="checkbox"/>	20	D800	2107	L2531	32	TRX2	No	LSS2107 D800 CU20 96B/...
<input checked="" type="checkbox"/>	21	D880	2107	L2531	32	TRX2	No	LSS2107 D800 CU21 96B/...
<input checked="" type="checkbox"/>	22	D900	2107	L2531	32	TRX2	No	LSS2107 D800 CU22 96B/...
<input checked="" type="checkbox"/>	23	D980	2107	L2531	32	TRX2	No	LSS2107 D800 CU23 96B/...

Number of objects listed: 10

< Back Next > Cancel Help



Discovering with HCM...

Autoconfiguration - Proposed Device List

Controller Type: 2107 - 931
Controller Serial Number: L2531

Include	Device Number	Type	SCHS	CU Number	UA Range	OS Access	New	Description
<input checked="" type="checkbox"/>	2500.48	3390B	0	2500	00-2F	MVSVM	Yes	
<input checked="" type="checkbox"/>	2540.128	3390A	2	2500	40-BF	MVSVM	Yes	
<input checked="" type="checkbox"/>	2600.256	3390B	0	2600	00-FF	MVSVM	Yes	
<input checked="" type="checkbox"/>	2E00.256	3390B	0	2E00	00-FF	MVSVM	Yes	
<input checked="" type="checkbox"/>	3200.3	3390B	0	3200	00-02	MVSVM	Yes	
<input checked="" type="checkbox"/>	3210.4	3390B	0	3200	10-13	MVSVM	Yes	
<input checked="" type="checkbox"/>	3240.9	3390A	2	3200	40-48	MVSVM	Yes	
<input checked="" type="checkbox"/>	3270.12	3390A	2	3200	70-78	MVSVM	Yes	
<input checked="" type="checkbox"/>	3400.188	3390B	0	3400	00-BB	MVSVM	Yes	
<input checked="" type="checkbox"/>	3800.128	3390B	0	3800	00-7F	MVSVM	Yes	
<input checked="" type="checkbox"/>	D800.32	3390B	0	D800	00-1F	MVSVM	No	
<input checked="" type="checkbox"/>	D880.32	3390B	0	D880	00-1F	MVSVM	No	
<input checked="" type="checkbox"/>	D900.32	3390B	0	D900	00-1F	MVSVM	No	
<input checked="" type="checkbox"/>	D980.32	3390B	0	D980	00-1F	MVSVM	No	

Columns...
Edit...
Exclude...
Include...

Number of objects listed: 14

< Back Next > Cancel Help