Managing and Monitoring Symmetrix for Linux on System z

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Objectives

At the end of this session, you will be able to

• Describe the considerations needed for Linux on System z with EMC Symmetrix storage

• Define the drive emulation that best serves your Linux on System z environment

• Perform storage monitoring and management operations of a Symmetrix system in a Linux on System z environment
Agenda

- Discuss the basic tasks needed to configure Linux on System z to run with an EMC Symmetrix DMX™ system
- Discuss FBA and CKD relationship to z/VM and Linux
- Describe the processes available for managing Linux on System z with EMC Symmetrix DMX Storage
z/VM and Linux: Match Made in Cyber Heaven

• z/VM
  – Mature virtualization
  – Removing physical limitations dynamically

• Linux
  – Linux is an enterprise operating system based on UNIX standards
  – Innovative and built upon mainframe concepts
  – Open source
  – Community driven

• Linux on z/VM - brings the best of both worlds together
  – High-performance data access
  – Enables throughput benefits for Linux guest images and enhances overall system performance and scalability
Why Linux on z/VM

• Consolidation
  – Workload - replaces the need for many application servers doing the same work which optimizes your given assets
  – Physically reduces the number of servers, footprint, power usage

• Administration
  – z/VM's support for scheduling, automation, performance monitoring and reporting and virtual machine management

• Manageability
  – Centralized management
  – Efficient use of existing resources
  – Dynamic data mobility
  – Accelerate application deployment (cloning)
Linux on System z Host Options

• What is Linux on System z?
  – Linux on System z is provided by Redhat and SUSE

• Linux on System z native in an LPAR (Logical Partition)
  – Single image
  – Dedicated system resources for a large application environment

• Linux on System z in a virtual machine (under z/VM)
  – More flexibility
    ▪ Configuration
    ▪ Easy expansion
  – Many virtual machines, easily cloned
  – Sharing of physical resources

“…160 Linux guests on 26 IFLs under 4 z/VM instances in production. In test we have 320 Linux guests on 17 IFLs under 5 z/VM instances.”
Disk Devices are Used to Store Data but They Aren’t Always Referred to by the Same Name

- **Open Systems**
  - LUN, Logical Unit Number - Open Systems storage device

- **Symmetrix**
  - SLV, Symmetrix Logical Volume - EMC Symmetrix storage device

- **Mainframe**
  - DASD, Direct Access Storage Device - Mainframe storage device
  - mdisk (minidisk) - z/VM storage abstraction (partial or full device)
Linux on System z Connectivity

- **FICON — Fibre Connection**
  - Follow-on from ESCON supporting full duplex data transfers enabling greater throughput
  - ESCON Multiple Image Facility (EMIF)

- **FCP — Fibre Channel Protocol**
  - Providing access to Open Systems SCSI FBA devices
  - New CHPID – FCP for IOCDS
  - Ability to save System z device numbers

- **IO definitions**
  - z/VM – IOCDS, IOCP description
    - CHPID (Channel Path Identifier Information)
    - CNTLUNIT (Control Unit Information)
    - IODEVICE (Device Information)
  - Linux on System z – sysfs
    - Device address
Linux on System z Disk Options

- CKD (Count Key Data)
- Fibre Connection (FICON) Protocol
- Direct attached or dedicated
- Minidisks on Extended CKD (ECKD) via FICON channel
  - Full
  - Partial
- Manageability

- FBA (Fix Block Architecture)
- Fibre Channel Protocol (FCP)
- Direct attach or dedicated
  - SCSI via zFCP driver
- Minidisks on emulated FBA via FCP (9336)
  - Full
  - Partial
- Performance
Linux on System z Disk Options

- **ECKD** – familiar to mainframe
  - HyperPAV support
  - Dedicated or attached to a virtual machine
    - IO handled by Linux
    - Multipath support handled by System z
  - Minidisks – full or partial
    - IO handled by z/VM
    - Storage can be primarily managed and monitored from z/VM
    - Multipath support handled by System z

- **FBA** – familiar to open systems
  - Dedicated or attached to a virtual machine
    - IO handled by zFCP driver (SCSI) on Linux on System z
    - More like x86 open systems environment
    - Multipath handled by Linux on System z
  - Minidisks – full or partial (edev)
    - IO handled by z/VM
    - Storage can be primarily managed and monitored from z/VM
    - Multipath support handled by z/VM
<table>
<thead>
<tr>
<th></th>
<th>DMX-2</th>
<th>DMX-3, DMX-4</th>
<th>V-Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enginuity</td>
<td>5671</td>
<td>5771</td>
<td>5772</td>
</tr>
<tr>
<td>SUSE on System z</td>
<td>9,10</td>
<td>9,10,11</td>
<td>9,10,11</td>
</tr>
<tr>
<td>Red Hat on System z</td>
<td>4.5, 4.6, 4.7</td>
<td>4.5, 4.6, 4.7</td>
<td>4.5, 4.6, 4.7</td>
</tr>
<tr>
<td></td>
<td>5.0, 5.1, 5.2, 5.3</td>
<td>5.0, 5.1, 5.2, 5.3</td>
<td>5.0, 5.1, 5.2, 5.3</td>
</tr>
</tbody>
</table>

Symmetrix supports I/O from a Linux on System z host to CKD (FICON) or FBA (Fiber Channel)

Check eLab for latest support:
http://www.emc.com/products/interoperability/elab.htm
Symmetrix V-Max™ Series with Enginuity – 3X More Scalability for Hyper Consolidation

Direct Matrix Architecture

- Separate purpose-built directors
- 16 I/O directors w/4 slices each
- 64 total slices, 128 ports
- Up to 64 FE ports
- Up to 256 GB useable global memory
- Up to 585 TB useable storage capacity

Virtual Matrix Architecture

- Next High Availability Node
- One to eight V-Max engines (16 directors)
- Quad-core 2.3 GHz processors to provide more than twice the IOPS
- 128 total slices, 256 ports
- Up to 128 FE ports
- Up to 1 TB (512 GB useable) global mirrored memory
- Up to 2.1PB useable capacity
• The director bit settings can be modified by SYMCLI or Symmetrix Management Console (SMC)
• A qualified storage administrator should make these changes!
• When attaching to the Symmetrix array, the Front End Adapter (FA) settings for FCP should be

**Director bit settings for Linux on System z:**

- **PP**  Point-to-Point
- **SPC2**  SPC2 SCSI Primary
- **EAN**  Enable Auto Negotiation
- **C**  Common Serial Number
- **SC3**  SCSI 3 Interface
- **UWN**  Unique Worldwide Name
Linux on System z View of the Symmetrix System

• The Symmetrix system emulates disk drives
  – Open systems hosts see the Symmetrix system as one or more FBA SCSI disk drives
  – z/OS systems see the Symmetrix system as a Logical Control Unit and one or more CKD disk drives
  – z/VM and Linux on System z see both FBA and CKD devices

• Other than basic query data, the host has no knowledge of the Symmetrix internal configuration

• EMC provides the tools to provide visibility and control
EMC Storage Management Options

• Solutions Enabler
  – On Linux on System z  SLES 10
  – Open Systems hosts – Windows, Linux, UNIX
  – Used for general operations

• Mainframe Enablers
  – z/OS
  – Used for general operations and SRDF

• Symmetrix Management Console (SMC)
  – Windows, Linux, UNIX
  – Used for general and SRDF operations

• EMC z/OS Storage Manager (EzSM)
  – ISPF Panel Menu Interface

• EMC products for TPF
  ▪ TimeFinder® Controls for TPF
  ▪ SRDF® Controls for TPF
  ▪ ResourcePak for TPF
Symmetrix Storage – CKD or FBA

- **Configure DASD – CKD**
  - For Solutions Enabler support on SUSE gatekeeper devices need to be setup as rdev unsupported DASD

- **Configure Linux on System z FCP (zfcp driver) Disks – FBA**
  - Channel Number
  - WWPN – worldwide port name

- **Create gatekeeper devices as dedicated communication path to the Symmetrix system from a management host**
  - Allows Symmetrix management software to retrieve configuration and status information without interfering with normal Symmetrix I/O
FCP Connectivity Example
FCP Test Environment

<table>
<thead>
<tr>
<th>Symmetrix Volumes</th>
<th>DMX FA Port</th>
<th>LUN Address</th>
<th>z/VM Address*</th>
<th>CYL/ MBs</th>
</tr>
</thead>
<tbody>
<tr>
<td>020-0e7</td>
<td>1c Port 0</td>
<td>000-0c7</td>
<td>6580-6598</td>
<td>958/898</td>
</tr>
<tr>
<td>020-0e7</td>
<td>16c Port 0</td>
<td>000-0c7</td>
<td>6680-6698</td>
<td>958/898</td>
</tr>
</tbody>
</table>

*Only one IODEVICE is required to address FCP LUNs
Linux on System z FBA Device Relationship Path

- Linux LVM and/or filesystem
- Linux Device Address /dev/sdX
- Linux LUN(s)
- Linux WWPN
- Linux Device Address
- z/VM I/O Device Address
- z/VM CHPID
- System z adapter (WWPN)
- SAN
- FA port (WWPN) attached SAN
- DMX SLV Assigned LUN Address, mapped and masked FA Port
- DMX SLV w/Internal Address
- DMX Physical disks
- Symmetrix DMX
- System z
- Linux

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Linux on System z FBA Device Relationship

Path

- Symmetrix – FBA device created and mapped
  - Group of physical disks grouped to be a Symmetrix Logical Volume (SLV) and assigned an internal device address
  - SLV is assigned an external LUN address that the host will reference
  - SLV is mapped and masked out a Front Adapter port (FA, aka Director) which has a unique WWPN
  - FA port (WWPN) attached to a SAN switch

- SAN – switch connects the Symmetrix system to the mainframe
  - Symmetrix FA port (WWPN) is “zoned” together with the System z adapter (WWPN)
  - VM adapter (channel) is attached to SAN switch

- z/VM
  - Physical System z adapter assigned a CHPID as an FCP with WWPN
  - z/VM CHPID has IODEVICE associated to it
  - z/VM IODEVICE attached to Linux on System z as real or virtual device address

- Linux on System z
  - Assigned z/VM IODEVICE number recognized by Linux on System z via hotplug routine
  - Linux on System z device has a channel associated to it or control unit/target
  - Channel/control unit has a WWPN
  - IODEVICE address is associated with WWPN
  - LUN address(es) are assigned to a WWPN
  - LUN is associated to a Linux device - /dev/sdX
  - Linux device is associated to LVM and/or a Linux filesystem

- NOTE: all WWPNs are unique
Symmetrix to System z to Linux FBA Relationship

CHPID-DMX

FA - WWPN
1c:0 - 5006048ad5f066c0
16c:0 - 5006048ad5f066cf

SAN

CHPIDs/WWPNs
8A
8B
8C/5005076401a22154
8D/ 5005076401e221e9

CHPID-DMX zone

Redhat
CHPID 8C/8D

SUSE
CHPID 8C/8D

z/VM

Linux (SUSE)
CHPID 8C/IODEVICE 6580
-> WWPN
(5006048ad5f066c0)

z/OS LPAR – 8A
z/VM LPAR - 8C

WWPN
5006048ad5f066c0
LUNs:
0000
0001
...
0080
....
008F
Steps to Adding FCP Devices to Linux on System z

1. Setup hardware and make all physical connections between the Symmetrix array, System z, and SAN switch
2. Setup zoning on the switch to associate the appropriate components with the System z channel
3. On the Symmetrix define Symmetrix FBA LUNs, map and mask to the appropriate front end adapter port
4. Add I/O definitions to z/VM through IOCDS
5. Create z/VM virtual machine directory entries with assigned disk in the directory
6. Install Linux on System z in newly allocated Linux guest virtual machine
7. Add additional disk to the Linux on System z virtual machine via directory entry or CP attach command
   - Vary devices online
   - Associate WWPN with device address
   - Associate LUN(s) (SLV) with WWPN
8. Partition the Linux device, /dev/sdX
9. Add the Linux device (/dev/sdX) to LVM and/or create filesystem
z/VM: IOCDS Example for Symmetrix – FCP

CHPID PATH=(CSS(0),8C),SHARED,PARTITION=((0),(V109)), PCHID=392,TYP=FCP
CHPID PATH=(CSS(0),8D),SHARED,PARTITION=((0),(V109)), PCHID=503,TYP=FCP

CNTLUNIT CUNUMBR=0600,PATH=((CSS(0),8C)),UNIT=FCP
IODEVICE ADDRESS=(6580,25),CUNUMBR=(0600),UNIT=FCP
CNTLUNIT CUNUMBR=0640,PATH=((CSS(0),8D)),UNIT=FCP
IODEVICE ADDRESS=(6680,25),CUNUMBR=(0640),UNIT=FCP
Example Linux on System z z/VM Directory Entry – FCP Devices

USER LN142197 LINUX 512M 1024M G

INCLUDE LNXDFLT

OPTION QUICKD

DEDICATE 0191 6C03

DEDICATE 6580 6580

DEDICATE 6680 6680
z/VM View — Query FCP Devices

- View from z/VM of FCP devices attached to Linux on System z guest, ln142197

```
q fcp att ln142197
```

```
FCP  6580 ATTACHED TO LN142197 6580 CHPID 8C
```
Linux on System z FBA Device Relationship Path

- Linux Device Address
- Linux LVM and/or filesystem
- Linux Device /dev/sdX
- Linux LUN
- Linux WWPN
- Linux Device Address
- z/VM I/O Device Address
- z/VM CHPID
- System z adapter (WWPN)
- FA port (WWPN) attached SAN
- DMX SLV Assigned LUN Address, mapped and masked FA Port
- DMX SLV w/Internal Address
- DMX Physical disks
- SAN
- Symmetrix DMX
- System z
- Linux
Adding FCP Devices from the Command Line

• Attach the FCP device to the virtual machine under z/VM
  – May be dedicated device in virtual machine’s directory also
    attach 6580 ln142197

• Verify attachment of iodevice, from Linux on System z, via the vmcp command

vmcp q v all

```
FCP 6580 ON FCP  6580 CHPID 8C SUBCHANNEL = 0010
6580 TOKEN = 000000001EDDE580
6580 DEVTYPE FCP CHPID 8C FCP
6580 QDIO ACTIVE QIOASSIST ACTIVE QEBSM
6580
6580 INP + 01 IOCNT = 00000002 ADP = 128 PROG = 000 UNAVAIL = 000
6580 BYTES = 0000000000000000
6580 OUT + 01 IOCNT = 00000011 ADP = 000 PROG = 018 UNAVAIL = 110
6580 BYTES = 000000000010D40
```
Bring FCP Devices Online

- Bring the device online to Linux on System z with echo or chccwdev command

```bash
ln142197:/sys/bus/ccw/devices/0.0.6580 # cat online
0
ln142197:/sys/bus/ccw/devices/0.0.6580 # echo 1 > online

ln142197:/sys/bus/ccw/devices/0.0.6580 # cat online
1

ln142197:/sys/bus/ccw/devices # chccwdev --online 0.0.6580
Setting device 0.0.6580 online
```
Adding FCP Devices from the Command Line

- Message appears on the virtual machine console when device is online
- Shows establishment of communication between z/VM, Linux on System z and the FCP device

```
scsi4 : zfcp
zfcp: The adapter 0.0.6580 reported the following characteristics:
WWNN 0x5005076400c6cefe, WWPN 0x5005076401a22154, S_ID 0x007b7813,
adapter version 0x4, LIC version 0x70b, FC link speed 2 Gb/s
zfcp: Switched fabric fibrechannel network detected at adapter 0.0.6580.
```

- The above message is from z/VM adapter standpoint and not the Symmetrix system
  - WWNN, WWPN
  - FC link speed
FCP – Determine the WWPN

• Determine the WWPN from the SAN switch or from EMC Solutions Enabler (on another host)

• WWN information is used during addition of FCP LUNs and IPL from FCP device via set loaddev command

   symcfg -fa 1c list -sid 571 -v -P 0

where -fa is the director you are using for FCP
where -sid is the Symmetrix identifier
where -P is the port being used on the director

Director Symbolic Number : 01C
Director Numeric Number : 33
Director Slot Number : 1
Director Port: 0

WWN Node Name : 5006048AD5F066C0
WWN Port Name : 5006048AD5F066C0

Redhat FBA
SLES 10 FBA
z/VM 5.4
Adding FCP Devices from the Command Line

- Now add the Symmetrix system WWPN for the FCP device

  ```
  echo 0x5006048ad5f066c0 > /sys/bus/ccw/drivers/zfcp/0.0.6580/port_add
  ```

  NOTE: port_add may not be necessary depending upon the Linux kernel version

- Manually add the LUN using the WWPN and LUN number
  - The LUN number is the first 4 bytes

  ```
  echo 0x0080000000000000 > /sys/bus/ccw/drivers/zfcp/0.0.6580/0x5006048ad5f066c0/unit_add
  ```
Virtual machine console message shows device assignment “sde”

Vendor: EMC       Model: SYMMETRIX         Rev: 5773
Type: Direct-Access         ANSI SCSI revision: 04
SCSI device sde: 1839360 512-byte hdwr sectors (942 MB)
sde: Write Protect is off
SCSI device sde: drive cache: write through
SCSI device sde: 1839360 512-byte hdwr sectors (942 MB)
sde: Write Protect is off
SCSI device sde: drive cache: write through
  sde: unknown partition table
sd 0:0:0:128: Attached scsi disk sde
sd 0:0:0:128: Attached scsi generic sg4 type 0
List New SCSI Device

- List SCSI device for `fdisk` command

```
ln142197:/sys/bus/ccw/devices/0.0.6580 # lsscsi -v
```

```
....
......
[0:0:0:128] disk  EMC  SYMMETRIX  5773  /dev/sde
  dir: /sys/bus/scsi/devices/0:0:0:128
  [/sys/devices/css0/0.0.0001f/0.0.6580/host0/rport-0:0-0/target0:0:0/0:0:0:128]
```
You can also see the new device under udev

```
ln142197:/dev/.udev/db # cat block\@sde
N:sde
S:disk/by-id/scsi-360060480000190300571533030304130
S:disk/by-path/ccw-0.0.6580-zfcp-0x5006048ad5f066c0:0x0080000000000000
M:8:64
E:ID_VENDOR=EMC
E:ID_MODEL=SYMMETRIX
E:ID_REVISION=5773
E:ID_SERIAL=360060480000190300571533030304130
E:ID_TYPE=disk
E:ID_BUS=scsi
E:ID_PATH=ccw-0.0.6580-zfcp-0x5006048ad5f066c0:0x0080000000000000
```
ln142197:/ # fdisk /dev/sde

Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel
Building a new DOS disklabel. Changes will remain in memory only, until you decide to write them. After that, of course, the previous content won't be recoverable.

Command (m for help): n
Command action
    e   extended
    p   primary partition (1-4)

p
Partition number (1-4): 1
First cylinder (1-1023, default 1):
Using default value 1
Last cylinder or +size or +sizeM or +sizeK (1-1023, default 1023):
Using default value 1023
Partition SCSI Device — continued

Command (m for help): p

Disk /dev/sde: 941 MB, 941752320 bytes
29 heads, 62 sectors/track, 1023 cylinders
Units = cylinders of 1798 * 512 = 920576 bytes

<table>
<thead>
<tr>
<th>Device</th>
<th>Boot</th>
<th>Start</th>
<th>End</th>
<th>Blocks</th>
<th>Id</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/sde1</td>
<td></td>
<td>1</td>
<td>1023</td>
<td>919646</td>
<td>83</td>
<td>Linux</td>
</tr>
</tbody>
</table>

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
Create a Filesystem

- Create a filesystem on the partitioned device

```
[root@ln142197 / ]# mke2fs -j /dev/sde1
mke2fs 1.39 (29-May-2006)
..............

Writing inode tables: done
Creating journal (4096 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 32 mounts or 180 days, whichever comes first. Use tune2fs -c or -i to override.
```
CKD Connectivity Example
**CKD Test Environment**

<table>
<thead>
<tr>
<th>Symmetrix CKD Volumes</th>
<th>z/VM Address</th>
<th>Type</th>
<th>CYL</th>
<th>MBs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0e8-1aF</td>
<td>1200-12c7</td>
<td>3390-1</td>
<td>1113</td>
<td>57740</td>
</tr>
<tr>
<td>027a-283</td>
<td>12c8-12d1</td>
<td>3390-9</td>
<td>10017</td>
<td>519656</td>
</tr>
<tr>
<td>284-297</td>
<td>12d2-12e5</td>
<td>mod27</td>
<td>32760</td>
<td>1699505</td>
</tr>
</tbody>
</table>
IOCDS Example for Symmetrix — CKD

CHPID PATH=(CSS(0), 8E), SHARED,  
PARTITION=((0), (V101, V102, V103, V104, V105, V106, V107, V108, V109)), PCHID=593, TYPE=FC  
CHPID PATH=(CSS(0), 8F), SHARED,  
PARTITION=((0), (V101, V102, V103, V104, V105, V106, V107, V108, V109)), PCHID=5E0, TYPE=FC

CNTLUNIT CUNUMBR=0680, PATH=((CSS(0), 8E, 8F)),  
UNITADD=((00, 256)), CUADD=0, UNIT=2105

IODEVICE ADDRESS=(6C00, 250), CUNUMBR=(0680), STADET=Y, UNIT=3390
Linux on System z CKD Device Relationship Path

DMX SLV
Assigned device address, mapped to EF Port

DMX SLV w/Internal Identifier

DMX Physical disks

Symmetrix DMX

System z

Linux

LVM and/or filesystem

Linux Device
/dev/dasdX

Linux IO device

Linux Device Address

z/VM

IODEVICE Address

z/VM

CHPID

System z channel
Linux on System z CKD Device Relationship Path

- Symmetrix – CKD device created and mapped
  - Group of physical disks grouped to be a Symmetrix Logical Volume (SLV) and assigned an internal device address
  - SLV is assigned an address
  - SLV is mapped out a Front Adapter port (FA, aka Director) which is FICON
  - FA port attached directly to mainframe, or optionally to a switch

- Optional switch connects the Symmetrix system to the mainframe

- z/VM
  - Physical System z channel adapter assigned a CHPID as FC
  - z/VM CHPID has IODEVICEs associated to it
  - z/VM IODEVICE attached to Linux on System z guest virtual machine as real or virtual device address

- Linux on System z
  - Assigned z/VM IODEVICE number recognized by Linux on System z via kernel hotplug routine
  - Linux on System z device has a subchannel associated to it (control unit)
  - Linux on System z device (LUN) is associated to a Linux device - /dev/dasdX
  - Linux device name, /dev/dasdX, is formatted via dasdfmt
  - Linux DASD is associated to LVM and/or a Linux filesystem
Steps to Adding ECKD Devices to Linux on System z

1. Setup hardware and make all physical connections
2. Add ECKD I/O definitions to z/VM via IOCP deck
3. Create z/VM directory entries with assigned disk dedicated to the virtual machine
4. Logon on to new virtual machine user
5. Install Linux on System z in new Linux guest virtual machine
6. Add additional disk to Linux on System z virtual machine via directory entry or CP attach command
7. Bring Linux on System z devices online
8. Format Linux on System z DASD devices using dasdfmt
9. Partition devices using fdasd
10. Add to LVM or create a filesystem directly on the partitioned device
z/VM View of CKD DASD

vmcp q v all

- DASD 6cca attached as virtual address 0100

  DASD 0100 ON DASD 6CCA R/W 0X6CCA SUBCHANNEL = 000F
  DASD 0101 ON DASD 6CCB R/W 0X6CCB SUBCHANNEL = 0010

- DASD attached as real address 6c50

  DEV 6C50 ON DEV 6C50 SUBCHANNEL = 000C
  DEV 6C51 ON DEV 6C51 SUBCHANNEL = 000D
Bring CKD Devices Online and Format

- Bring the CKD device online
  
  `chccwdev --online 0.0.6c50`

  Setting device 0.0.6c50 online

  Done

- Examine the status of the device via the `cat` command which will show a “1”, meaning it’s online

  
  ```
  ln142196:/sys/bus/ccw/devices/0.0.6c50 # cat /
  /sys/bus/ccw/devices/0.0.6c50/online
  1
  ```

- Determine Linux device name for the dasdfmt via the `ls` command

  ```
  ln142196:/sys/bus/ccw/devices/0.0.6c50 # ls
  alias       bus       devtype       eer_enabled       Readonly       use_diag
  availability cmb_enable discipline       modalias       uevent
  vendor
  block:dasdc      cutype       driver       online       uid
  ```
Format CKD Device — dasdfmt

ln142196:/sys/bus/ccw/devices/0.0.6c50 # dasdfmt -b 4096 -d
cdl -l sym138 -v -f /dev/dasdc

Retrieving disk geometry...
Drive Geometry: 1113 Cylinders * 15 Heads =  16695 Tracks

I am going to format the device /dev/dasdc in the following way:
    Device number of device : 0x6c50
    Labelling device        : yes
    Disk label              : VOL1
    Disk identifier         : SYM138
    Extent start (trk no)   : 0
    Extent end (trk no)     : 16694
    Compatible Disk Layout  : yes
    Blocksize               : 4096

------ ATTENTION! <<---
All data of that device will be lost.
Type "yes" to continue, no will leave the disk untouched: yes
Inl42196:~ # lsdasd
0.0.0100(ECKD) at ( 94:  0) is dasda :active at blocksize 4096, 1803060 blocks,
0.0.0101(ECKD) at ( 94:  4) is dasdb :active at blocksize 4096, 1803060 blocks,
0.0.6c50(ECKD) at ( 94:  8) is dasdc :active at blocksize 4096, 200340 blocks,
0.0.6c51(ECKD) at ( 94: 12) is dasdd :active at blocksize 4096, 200340 blocks,
0.0.6c52(ECKD) at ( 94: 16) is dasde :active at blocksize 4096, 200340 blocks,
0.0.6c53(ECKD) at ( 94: 20) is dasdf :active at blocksize 4096, 200340 blocks,
0.0.6c54(ECKD) at ( 94: 24) is dasdg :active at blocksize 4096, 200340 blocks,
dasdfmt and CMS Format with Symmetrix (RAID5/6)

- Linux dasdfmt performance
  - Linux fixes are complete – Red Hat and SuSE
    - Redhat: Bugzilla 486432 for RHEL 5.2, 486431 for RHEL 5.3
    - SUSE: Bugzilla 450989 for SUSE 10 SP2, 477816 for SUSE 11
    - For more information see Primus cases
  - For minidisks, also require z/VM APAR VM64603

- CMS format performance
  - Two IBM APARs should be applied to z/VM
    - VM64602: CMS FORMAT OF A MINIDISK IS MUCH SLOWER THAN CPFMTXA
      CMS FORMAT of a minidisk or a full pack minidisk is slower than using CPFMTXA. This is due to the fact that the CCW chain created by CMS FORMAT does not set define extent byte 7 bit 5.
    - VM64603: CCW TRANSLATION CHANGE FOR CMS FORMAT
      VM's CCW fast translation fails to allow guest IO to a minidisk to use a performance feature related to writing out an entire track.
Multipathing

- DASD devices via ESCON or FICON attach
  - Multipathing is available via System z
  - Transparent at Linux on System z level

- FCP handled by the Linux v2.6.x kernel multipathing solution, DM-MPIO

- DM-MPIO requires packages
  - The device-mapper, udev, hotplug, udev, device-mapper-multipath

- Native Multipath Failover Based on DM-MPIO for v2.6.x Linux Kernel and EMC Storage Arrays, Red Hat Enterprise Linux 4 - U3, SuSE Linux Enterprise Server Configuration Guide
  - Available at http://powerlink.emc.com
EMC Storage Management Options

• Solutions Enabler
  – On Linux on System z  SLES 10
  – Open Systems hosts – Windows, Linux, UNIX
  – Used for general operations

• Mainframe Enabler
  – z/OS
  – Used for general operations and SRDF

• Symmetrix Management Console (SMC)
  – Windows, Linux, UNIX
  – Used for general and SRDF operations

• EMC z/OS Storage Manager (EzSM)
  – ISPF Panel Menu Interface

• EMC products for TPF
  – TimeFinder Controls for TPF
  – SRDF Controls for TPF
  – ResourcePak for TPF
EMC Solutions Enabler Introduction

- Symmetrix Command Line Interface (SYMCLI)
  - Provides a host with a comprehensive command set for managing a Symmetrix storage environment
    - Invoked from the host OS command line
    - Scripts that may provide further integration with OS and application
  - Separate components licenses
  - Security and access controls
    - Monitor only
    - Host-based and user-based controls
  - Solution Enabler (SE) current support environment
    - Novell SUSE Linux Enterprise 10, including Service Pack 1 and 2
Solutions Enabler Installation for Linux on System z

- Install Solutions Enabler from the rpm
- Install the Solutions Enabler kernel module via insmod
- Choose the correct module based upon your SUSE version.

The modules can be found in one of the following directories
- /opt/emc/SYMCLI/V6.5.2/ioctl/……/s390ioctl.ko
  - suse10
  - suse10sp1
  - suse10sp2
- Load the kernel module
  - insmod  s390ioctl.ko
- Verify the s390ioctl.ko module is loaded via lsmod command

    ln142196:/opt/emc/SYMCLI/V6.5.2/ioctl # lsmod |grep s390
    s390ioctl              26112  0
    dasd_mod              127852  13 s390ioctl,dasd_eckd_mod
If SUSE is running under z/VM, CKD gatekeeper devices must be defined as “unsupported” DASD via the rdev command:

```
set rdev XXXX type unsupported devclass dasd dps yes reserve_release yes
```

Devices will be seen as type, CGK

```
ln142196:~ # syminq

<table>
<thead>
<tr>
<th>Device</th>
<th>Product</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/dev/dasdc</td>
<td>CGK</td>
<td>EMC</td>
</tr>
<tr>
<td></td>
<td>SYMMETRIX</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5773</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7100138340</td>
</tr>
<tr>
<td>/dev/dasdd</td>
<td>CGK</td>
<td>EMC</td>
</tr>
<tr>
<td></td>
<td>SYMMETRIX</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5773</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7100139340</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5760</td>
</tr>
</tbody>
</table>
```
### CKD sympd List

```
ln142196:~ # sympd list

Symmetrix ID: 000190300571

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Directors</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cap</th>
<th>Physical</th>
<th>Sym</th>
<th>SA :P</th>
<th>DA :IT</th>
<th>Config</th>
<th>Attribute</th>
<th>Sts (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/dasdc</td>
<td></td>
<td>0138</td>
<td>02C:0</td>
<td>15B:D4</td>
<td>2-Way Mir</td>
<td>N/Grp'd</td>
<td>RW</td>
</tr>
<tr>
<td>/dev/dasdd</td>
<td></td>
<td>0139</td>
<td>02C:0</td>
<td>02A:D6</td>
<td>2-Way Mir</td>
<td>N/Grp'd</td>
<td>RW</td>
</tr>
<tr>
<td>/dev/dasde</td>
<td></td>
<td>013A</td>
<td>02C:0</td>
<td>15B:C5</td>
<td>2-Way Mir</td>
<td>N/Grp'd</td>
<td>RW</td>
</tr>
<tr>
<td>/dev/dasdf</td>
<td></td>
<td>013B</td>
<td>02C:0</td>
<td>15A:D5</td>
<td>2-Way Mir</td>
<td>N/Grp'd</td>
<td>RW</td>
</tr>
</tbody>
</table>
```
There are no special requirements for SE for FCP devices on SUSE

```
lnl42197:/sys/bus/ccw/devices # syminq
```

<table>
<thead>
<tr>
<th>Device</th>
<th>Product</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/sda</td>
<td>EMC SYMMETRIX</td>
<td>5773 71002C4000 17677440</td>
</tr>
<tr>
<td>/dev/sdb</td>
<td>EMC SYMMETRIX</td>
<td>5773 71002C5000 17677440</td>
</tr>
<tr>
<td>/dev/sdc</td>
<td>EMC SYMMETRIX</td>
<td>5773 71002C6000 17677440</td>
</tr>
<tr>
<td>/dev/sdd</td>
<td>EMC SYMMETRIX</td>
<td>5773 71002C7000 17677440</td>
</tr>
<tr>
<td>/dev/sde</td>
<td>EMC SYMMETRIX</td>
<td>5773 71000A0000 919680</td>
</tr>
</tbody>
</table>
Symmetrix Management Console (SMC)

- Device manager for the Symmetrix
  - Light-weight, web-based application
  - Intuitive browser interface

- Monitor, configuration and operational control of one or more arrays
  - Supports all configuration capabilities as Solutions Enabler CLI
  - Real-time reporting – No historical data
  - No SAN or Host monitoring and control

- Bundled with EMC Control Center Symmetrix Manager

- Requires Solutions Enabler server access
SMC Management Capabilities

**Discovery**
- Array and internals config
- Logical and physical devices

**Monitoring**
- Properties, Status, Alerts

**Administration**
- User-level security, logging, auditing
- Access-control management

**Configuration**
- Device creation, configuration, masking
- Supports Solutions Enabler code for Open Systems and Mainframe
- Symmetrix Priority Controls

**Replication**
- Configuration and control
- Discovery of objects and status
- SRDF monitoring
SMC – Director View

- View the Director bit settings for Linux on System z

<table>
<thead>
<tr>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director ID</td>
</tr>
<tr>
<td>Director Port</td>
</tr>
<tr>
<td>Initiator</td>
</tr>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Initiator Alias</td>
</tr>
<tr>
<td>Visibility</td>
</tr>
<tr>
<td>FCID Lockdown</td>
</tr>
<tr>
<td>FCID Value</td>
</tr>
<tr>
<td>LUN Offset</td>
</tr>
<tr>
<td>Offset Value</td>
</tr>
<tr>
<td>Base Value</td>
</tr>
<tr>
<td>Heterogeneous Host</td>
</tr>
<tr>
<td>Host Type</td>
</tr>
<tr>
<td>Port Flag Overrides</td>
</tr>
<tr>
<td>Enabled HBA Port Flags</td>
</tr>
<tr>
<td>Disabled HBA Port Flags</td>
</tr>
<tr>
<td>HBA and Port Flags in Effect</td>
</tr>
<tr>
<td>Dynamic Addressing</td>
</tr>
<tr>
<td>Originator Node WWN</td>
</tr>
<tr>
<td>IP Address</td>
</tr>
<tr>
<td>FCID</td>
</tr>
<tr>
<td>On Fabric</td>
</tr>
<tr>
<td>Last Active Log-in</td>
</tr>
</tbody>
</table>

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EMC TimeFinder Solutions

TimeFinder/Mirror
• Provides a full-volume mirror of the source

TimeFinder/Clone
• Provides a full-volume copy of the source

TimeFinder/Snap
• Provides a pointer-based snapshot copy of the source
TimeFinder Functions Panel

- TimeFinder functions available through the EzSM panel interface
Synchronous and Asynchronous Options

**SRDF/Synchronous**
- RPO = 0 (No data exposure)
- Some performance impact
- Limited distance
- Mission Critical Applications

**SRDF/Asynchronous**
- RPO in Seconds
- Data transfer in Delta Sets
- No performance impact
- Unlimited distance

**SRDF/Data Mobility**
- Data Transfer between Symmetrix
- No performance impact
- Write ordering **NOT** maintained
- Unlimited distance
SRDF Host Component — EzSM Panel Interface

- Query, Configure, Display, Manage, CLI, Session Options
Summary and Questions

- Linux on System z Connectivity options – FICON or FCP
- Linux on System z Disk options – CKD and/or FBA
- Integration of Symmetrix devices
- Management of Symmetrix system
  - Solutions Enabler
  - Symmetrix Management Console (SMC)
  - Host Component on z/OS
  - EMC products for TPF
Related Technical Documentation

- **Linux on IBM System z: RHEL 5.x and SLES 10.x Installation and Configuration Guide, P/N 300-007-955, REV A01**
- **EMC Solutions Enabler, Version 6.5.2 Installation Guide P/N 300-002-289 REV A06**
- **Native Multipath Failover Based on DM-MPIO for v2.6x Linux Kernel and EMC Storage Arrays, Red Hat Enterprise Linux 4 - U3 and SuSE Linux Enterprise Server 9 - SP3, Configuration Guide**