z/VM shared segments implementation for Linux on LinuxONE and IBM z

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Agenda

- Large Discontiguous Saved Segment (DCSS) definition.

- DCSS building steps.
  - z/VM defintions
  - Linux definitions

- Linux exploitation of the DCSS through ***dcssblk*** driver.
  - Sharing
  - Formatting
  - Filling
  - Saving

- Shared Segments with Docker (Demo).

Session Objectives

- Explain z/VM Shared Segment technology.
- Implement z/VM Shared Segment with Linux
- Illustrate Shared Segment usage with Docker (Demo)

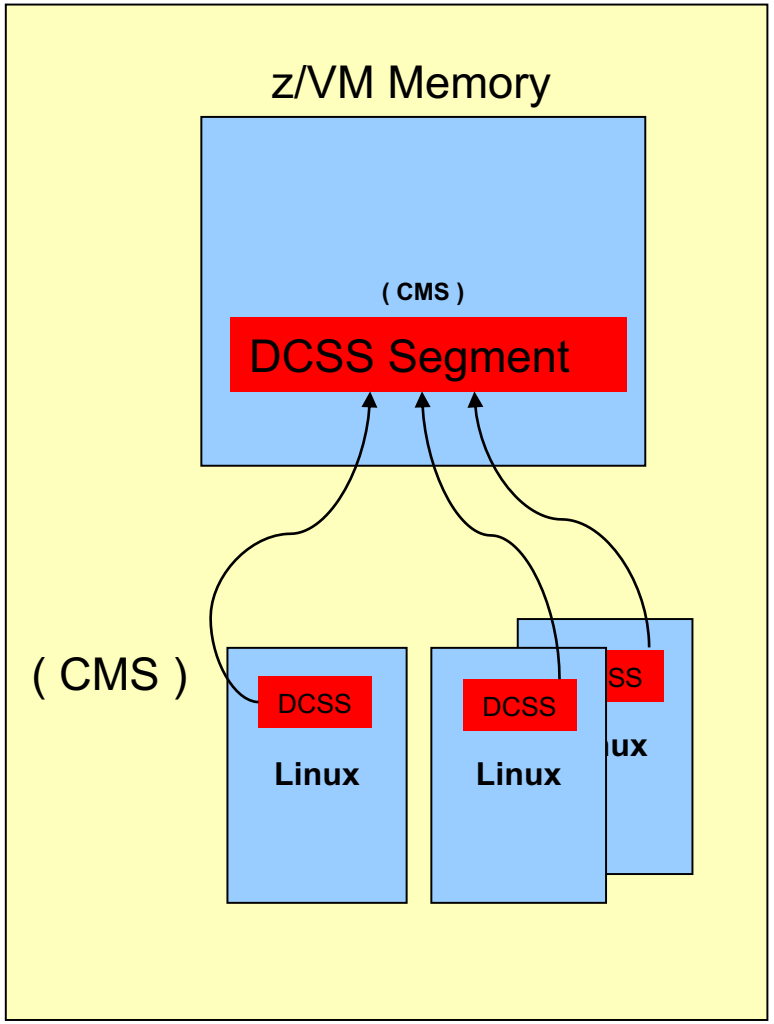
For more information on Large Discontiguous Shared Segment, see

z/VM Saved Segments Planning and Administration

Large Discontiguous Saved Segment (DCSS) definition.

Principles

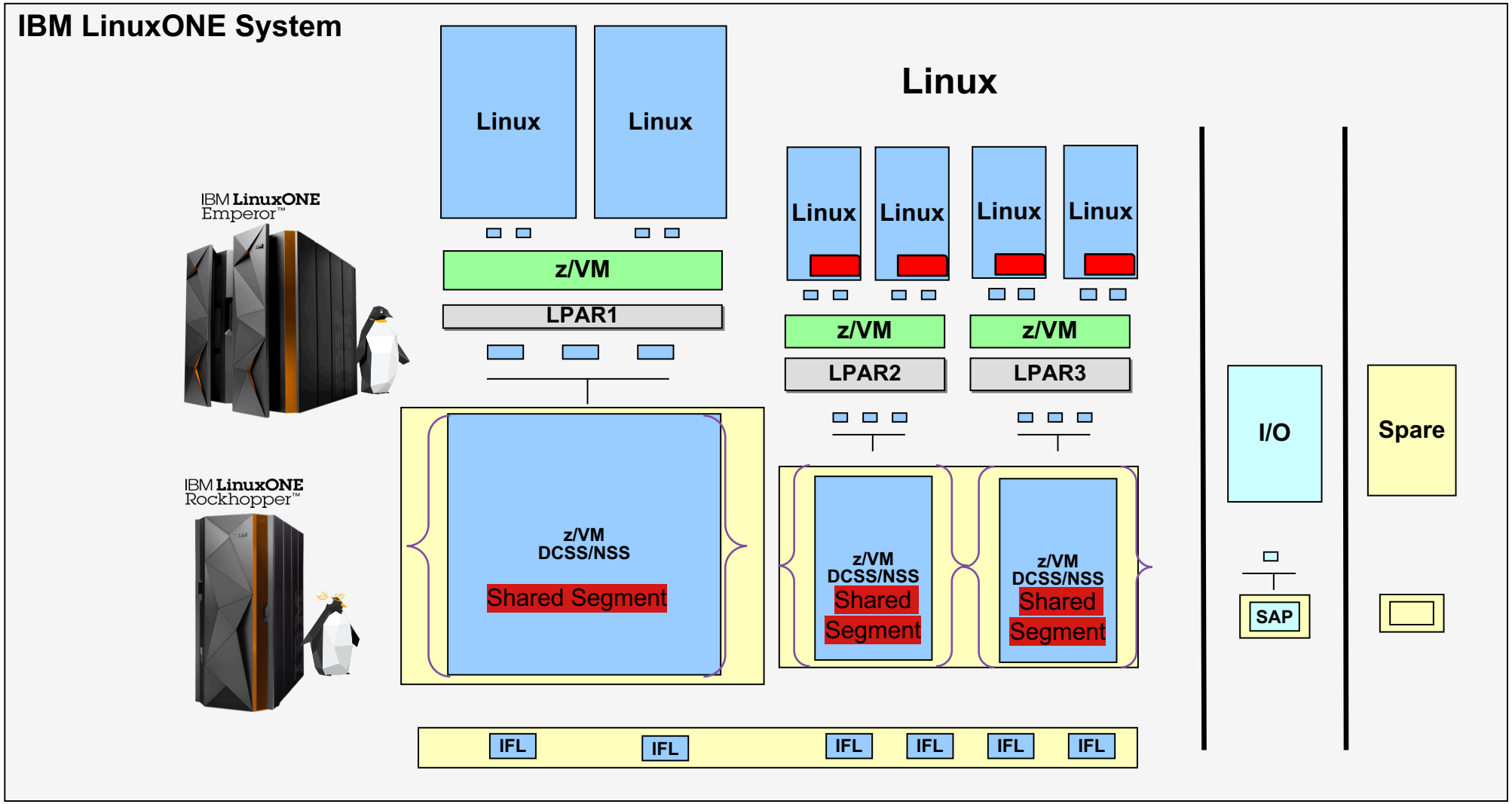
- A *saved segment* is a range of pages of virtual storage that you can define to hold data or re-enterable code (programs).



- Holds frequently used data and code.
- Can be dynamically attached to and detached from a VM.
- Permits re-enterable code to be shared by concurrently operating virtual machines.
- Using saved segments decreases the I/O rate.
- CMS : Internal subsystem for interactive interface with z/VM.

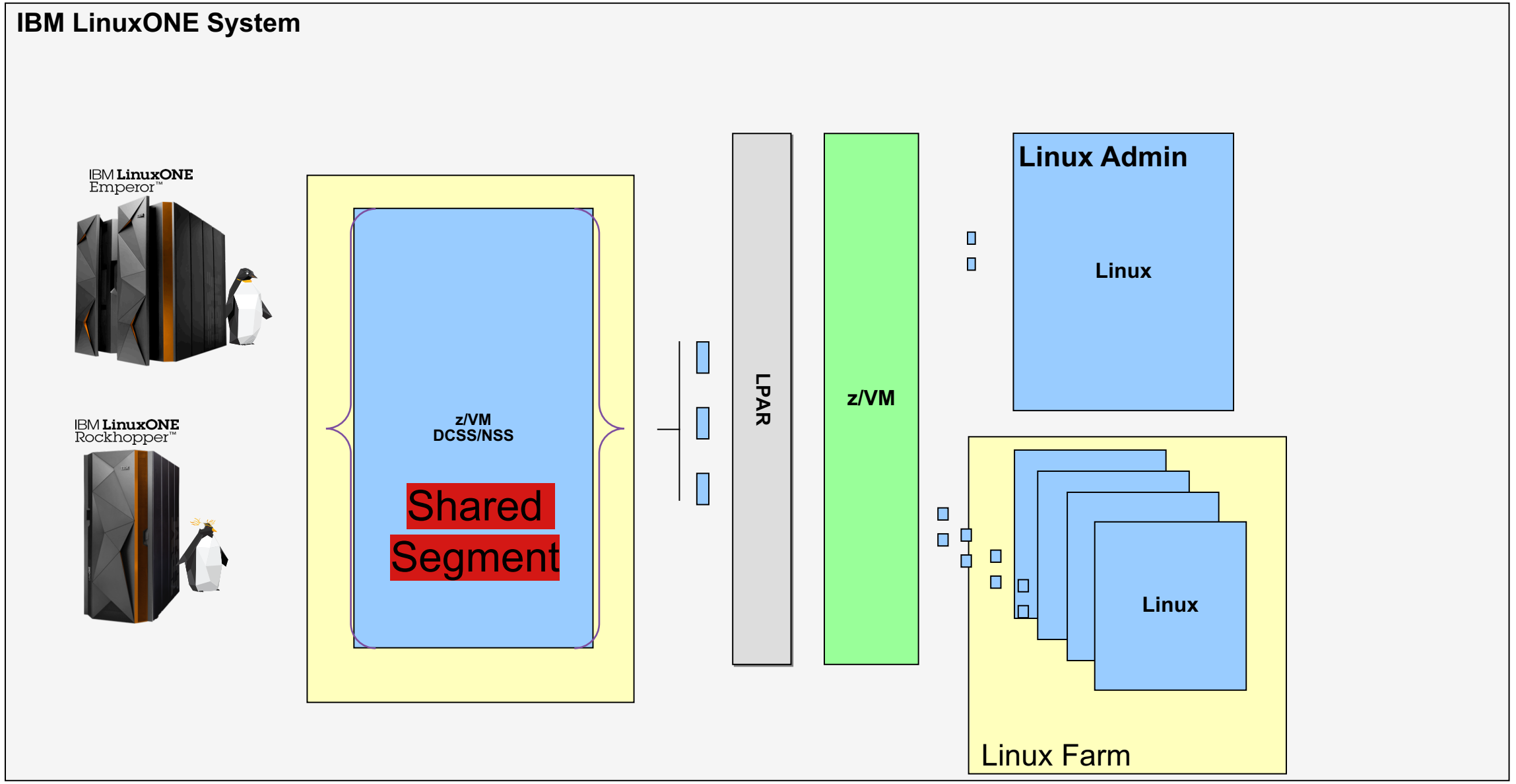
Linux OS exploits DCSS technology through a specific driver called ***DCSSBLK***

DCSS Exploitation with Linux



NSS : Name Saved System
DCSS : Load Discontiguous Saved Segment

Shared Read/Only access segment with Linux



DCSS building steps.

z/VM definitions

- A shared segment required available contiguous memory

- It must be defined from a suitable CMS virtual machine
  - Class E
  - Sufficient virtual memory in Virtual Machine

Building steps in z/VM :

- Decide for DCSS size and boundaries in z/VM memory.
- Create DCSS.
- Save the DCSS
- Modify Linux guest memory configuration.
- Add privilege class E for Linux guest (Administrator Role only) .

Commands to create the DCSS (z/VM)

- DEFSEG DOCK1803 40A00-49FFF SR LOADNSHR

HCPNSD440I Saved segment DOCK1803 was successfully defined in fileid <# fileid>

- SAVESEG DOCK1803

HCPNSS440I Saved segment DOCK1803 was successfully saved in fileid <# fileid>

Value are expressed as an address range in memory, in hexadecimal notation.
In this sample the segment size is 157 MB.
SR : Shared read-only access.
LOADNSHR …….

```
q nss map
FILE  FILENAME  FILETYPE  MINSIZE   BEGPAG  ENDPAG  TYPE  CL  #USERS  PARMREGS  VMGROUP
0029  DOCK1712  DCSS        N/A     5A000   61BFA    SR   A   00000    N/A       N/A
0032  DOCK1805  DCSS        N/A     4A000   51BFA    SR   A   00000    N/A       N/A
0035  DOCK1804  DCSS        N/A     53000   53EEE    SR   A   00000    N/A       N/A
0017  NLSUCENG  DCSS        N/A     02000   020FF    SR   A   00000    N/A       N/A
0016  NLSKANJI  DCSS        N/A     02000   020FF    SR   A   00000    N/A       N/A
0026  CMS       NSS     0000256K    00000   00D0D    EW   A   00016    00-15     NO
0001  CMSPIPES  DCSS        N/A     02100   022FF    SR   A   00021    N/A       N/A
0002  TCPIP     DCSS        N/A     10000   100FF    SN   R   00006    N/A       N/A
0007  DOCK1803  DCSS        N/A     40A00   49FFF    SR   A   00001    N/A       N/A
FILE  FILENAME  FILETYPE  BEGPAG          ENDPAG          TYPE  CL  #USERS
0013  DOCK1806  DCSSG     00000000080000  00000000080FFF   SR   A   00000
```

Starting address in Bytes for DOCK1803 : 1084227584 Bytes (>= 1GB)
Ending address in Bytes for DOCK1803 : 1241509888 Bytes (<= 1.3 GB)

For more information on DCSS, see
z/VM: CP Commands and Utilities Reference

Types of z/VM Shared Segments

Code	Meaning
EW	Exclusive read/write access.
EN	Exclusive read/write access, no data saved.
ER	Exclusive read-only access.
SW	Shared read/write access.
SN	Shared read/write access, no data saved.
SR	**Shared read-only access.**

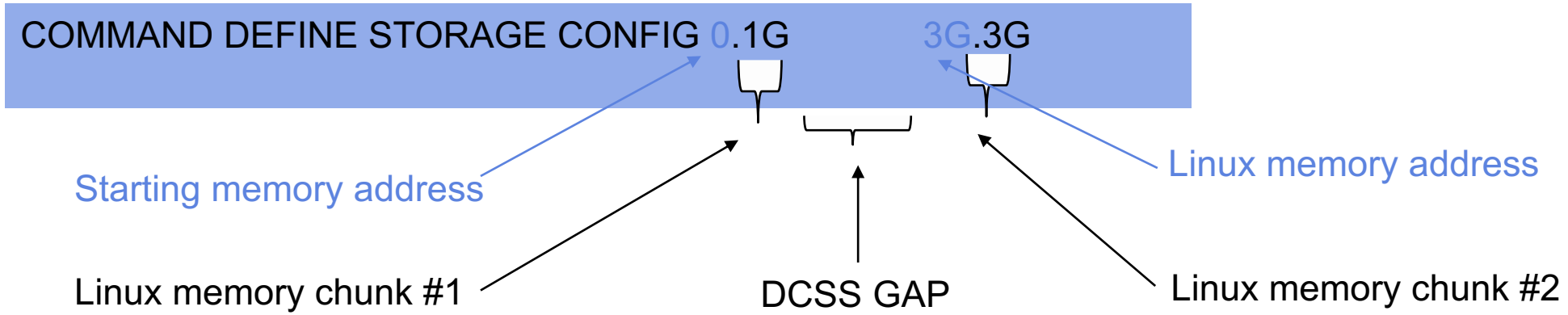
Comparaison of DCSS type SN and SR

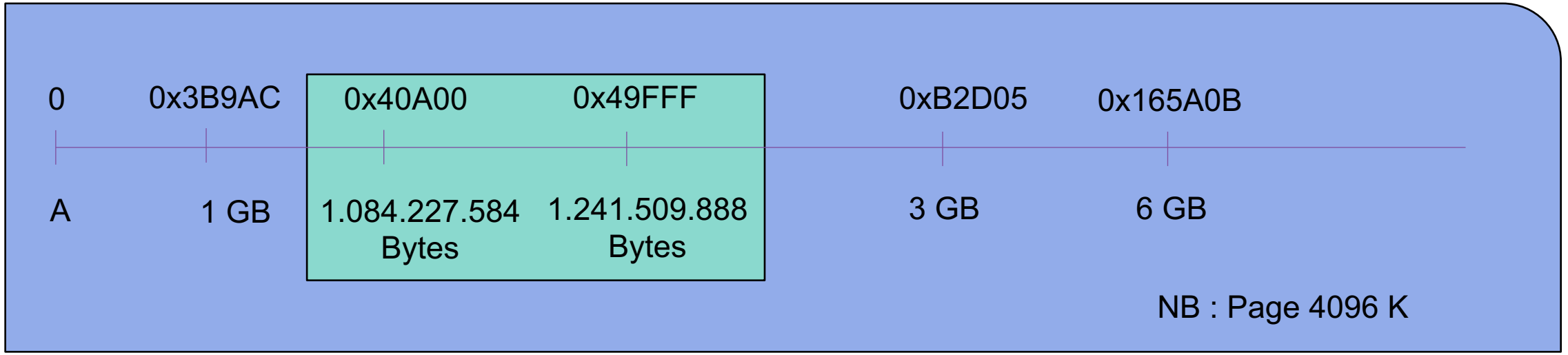
Consideration	DCSS Type	
	SN : Shared R/W	SR : Shared R/O
File system loaded into DCSS is written to z/VM spool	No	Yes
Spool processing for DCSS can delay other spool activity	No	Yes
Persistent after system restart	No	Yes

Change linux directory z/VM directory to redefine memory configuration

Example given for a 4GB linux virtual memory size

Linux guest of 4 Gb user definition





Linux exploitation of the DCSS through dcssblk driver.

Linux Tasks in Administrator / Linux Farm

Statements for Linux Administrator

- Load the DCSS

#echo DOCK1803 > /sys/devices/dcssblk/add

- *Share the DCSS*

echo 0 > /sys/devices/dcssblk/DOCK1803/shared

- *Format the DCSS*

mkfs -t ext4 /dev/dcssblk0

- Mount the DCSS as filesystem

mount /dev/dcssblk0 /usr/local/docker

- *Save the DCSS*

echo 1 > /sys/devices/dcssblk/DOCK1803/save

- Umount the DCSS

umount /dev/dcssblk0

- Unload the DCSS

echo DOCK1803 > /sys/devices/dcssblk/remove

Statements for Linux Farm

- Load the DCSS

echo DOCK1803 > /sys/devices/dcssblk/add

- Mount the DCSS as filesystem

mount /dev/dcssblk0 /usr/local/docker

mount: /dev/dcssblk0 is write-protected, mounting read-only

For Information :

- Umount the DCSS

umount /dev/dcssblk0

- Unload the DCSS

echo DOCK1803 > /sys/devices/dcssblk/remove

NB : The guest needs to have privclass E to save the DCSS contents

Industrialisation/Automation

rc.local script example :

```
#!/bin/bash

SEGMENT="DOCK1803"

echo ${SEGMENT} > /sys/devices/dcssblk/add

# Binaries Docker Segment Mounting
if [ -d /sys/devices/dcssblk/${SEGMENT}/ ]; then
        dcssID=`ls /sys/devices/dcssblk/${SEGMENT}/block/ | sed
          's/^.\{7\}//g'`
        mount -o ro /dev/dcssblk${dcssID} /usr/local/docker
fi
```

Advantages/Use cases/Recommendations

- Carrefully decide for DCSS content
- Heavily used binairies (Performance/optimisation)
- Farm of identical binairies (Server quantity)

- Same physical storage
- Swap disk
- A single administrator in charge of update DCSS content

Shared Segments with Docker (Demo).

Presenter demonstration

Demo Docker Demo with binary installation

docker version
docker images
docker run -it ubuntu /bin/bash
hostname
exit
docker ps | grep ubun
docker ps -a | grep ubun
docker restart baa194ad0029
docker ps |grep ubun
docker exec baa194ad0029 hostname
docker attach baa194ad0029
exit
docker ps | grep ubuntu
docker ps -a | grep baa194ad0029
docker rm baa194ad0029
docker rmi ubuntu:latest
Docker images

Linux Farm IPL log

- When the Linux farm starting, the storage configuration

```
Storage cleared - system reset.
STORAGE = 4G
Storage Configuration:
0.1G 3G.3G
Extent Specification                    Address Range
---------------------------------------- ----------------------------------------
                  0.1G                  0000000000000000 - 000000003FFFFFFF
                3G.3G                   00000000C0000000 - 00000017FFFFFFFF
Storage cleared - system reset.
```

- Boot starting

```
zIPL v2.4.0-1.el7 interactive boot menu

  0. default (4.14.0-115.2.2.el7a.s390x)

  1. 4.14.0-115.2.2.el7a.s390x
  2. linux
  3. linux-0-rescue-fbe272327ebc41a1ac2a6cb1a6dcc172
Note: VM users please use '#cp vi vmsg <input>'
Please choose (default will boot in 5 seconds):
Booting default (4.14.0-115.2.2.el7a.s390x)
```

- DCSS DOCK1803 loading

```
[  [32m  OK  [0m] Started System Logging Service.
[    7.087968] extmem: DCSS DOCK1803 of range 0000000040a00000 to 0000000049fff
```

- rc.local script executing
- DCSS DOCK1803 mounting

```
ff and type SR loaded in shared access mode
[    7.088045] dcssblk: Loaded DOCK1803 with total size 157286400 bytes and capa
city 307200 sectors
[  [32m  OK  [0m] Started Permit User Sessions.
[  [32m  OK  [0m] Started Command Scheduler.
[  [32m  OK  [0m] Started Job spooling tools.
[  [32m  OK  [0m] Started OpenSSH server daemon.
[    7.255525] EXT4-fs (dcssblk0): mounted filesystem with ordered data mode. Op
ts: (null)
[  [32m  OK  [0m] Started /etc/rc.d/rc.local Compatibility.
[  [32m  OK  [0m] Started Serial Getty on ttysclp0.
[  [32m  OK  [0m] Started Serial Getty on ttyS0.
[  [32m  OK  [0m] Started Getty on tty1.
         Starting Terminate Plymouth Boot Screen...
[  [32m  OK  [0m] Started Serial Getty on hvc0.
[  [32m  OK  [0m] Reached target Login Prompts.
[    8.434317] Bridge firewalling registered
[    8.641075] IPv6: ADDRCONF(NETDEV_UP): docker0: link is not ready

CentOS Linux 7 (AltArch)
Kernel 4.14.0-115.2.2.el7a.s390x on an s390x

berlin-user login:
```

Session summary

- See DCSS exploitation of the Read Only Shared Segment
- Spoke about general recommendation
- Heavily used binary
- Linux farm that uses the same things
- No need to connect another hardware
- Relatively easy to implement
- Maybe only thing is you need a calculator

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