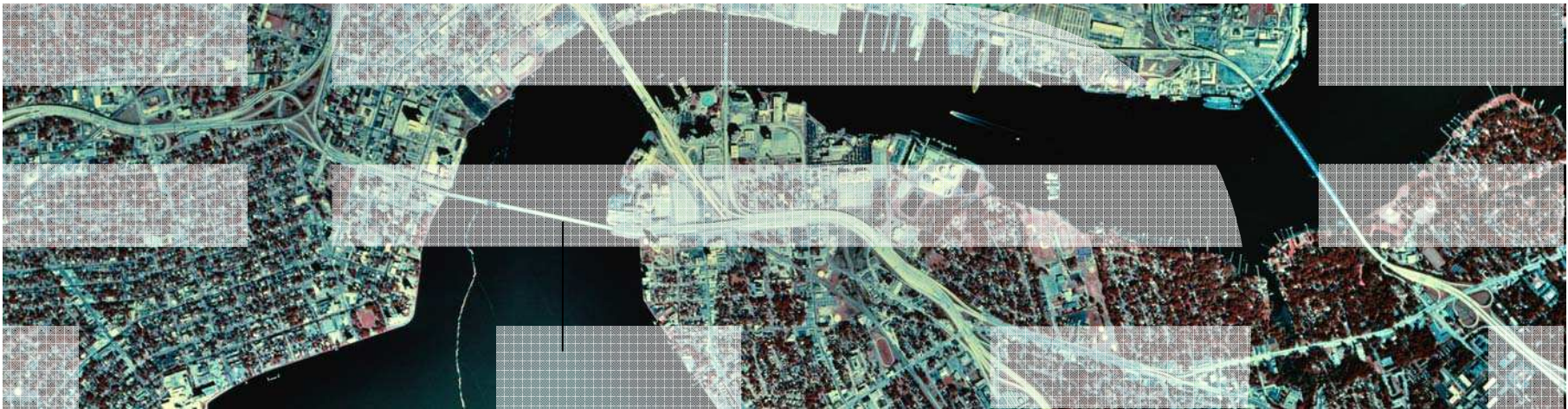


# z/VM Live Guest Relocation - Planning and Use

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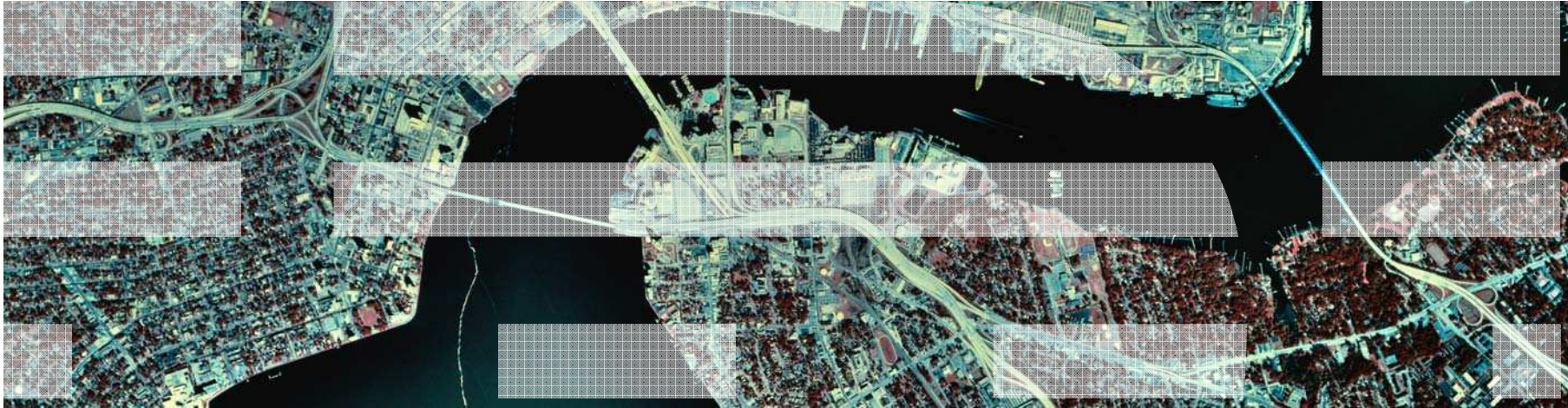
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## Agenda

- Planning for Live Guest Relocation (LGR)
  
- Relocation Domains
  
- Performing Live Guest Relocations
  - Demo
  
- Helpful Hints



# Planning for Live Guest Relocation

## LGR - General Planning Guidelines

*Make sure all resources used by the virtual machine are available on the destination member*

- Devices
- Facilities (will be handled automatically if you are relocating within a domain)
- Crypto cards
- Capacity for the virtual machine's memory and processor requirements
- Equivalency ids (**EQIDs**) are defined for devices that need them
  - OSAs and FCPs
- Make sure that the devices really are equivalent
  - OSAs should be connected to the same LAN segment
  - FCPs should have access to the same SAN fabric
  - WWPNs and LUNs
  - If possible, use the same device numbers to refer to equivalent devices
- If connecting to a VSWITCH, make sure the same VSWITCH is defined on the destination and the OSAs have been assigned EQIDs.
- If the virtual machine has an FCP, make sure the “queue\_if\_no\_path” option is specified in Linux
- In the directory entry, **OPTION CHPIDVIRTUALIZATION ONE** should be specified

## Guest Configuration for Live Guest Relocation

- In order to be eligible to relocate, a guest must be:
  - Defined as a single configuration virtual machine
  - Running in an ESA or XA virtual machine in ESA/390 or z/Architecture mode
  - Logged on and disconnected
  - Running only type CP or type IFL virtual processors
  - IPLed from either a
    - Device
    - Named saved system (NSS)
  
- If a guest is using a DCSS or NSS:
  - Identical NSS or DCSS must be available on the destination member
  - It cannot have the following types of page ranges
    - SW (shared write)
    - SC (shared with CP)
    - SN (shared with no data)

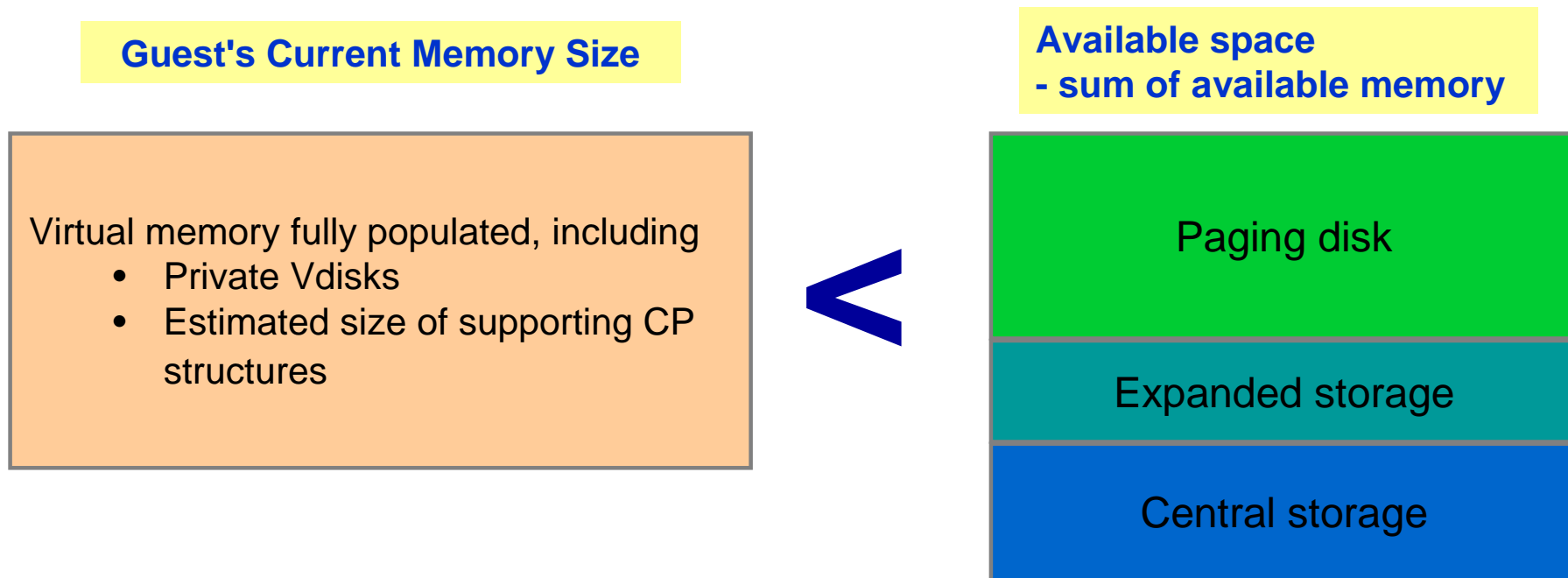
## Guest Configuration for Live Guest Relocation (cont.)

- A guest can relocate if it has any of the following:
  - Dedicated devices
    - Equivalent devices and access must be available on destination member
  - Private virtual disks in storage (created with DEFINE VFB-512 command)
  - No open spool files other than console files
  - VSWITCHes
    - Equivalent VSWITCH and network connectivity must be available on destination
  
- A relocating guest can be using any of the following facilities:
  - Cryptographic adapter
    - Crypto cards for shared domains on source and destination must be same AP type
  - Virtual machine time bomb (Diag x'288')
  - IUCV connections to \*MSG and \*MSGALL CP system services
  - Application monitor record (APPLDATA) collection
    - If guest buffer is not in a shared DCSS
  - Single Console Image Facility
  - Collaborative Memory Management Assist (CMMA)



## Memory Requirements for Live Guest Relocation

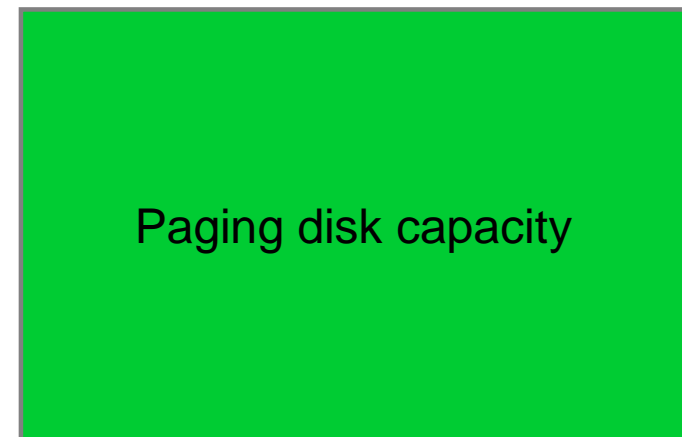
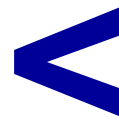
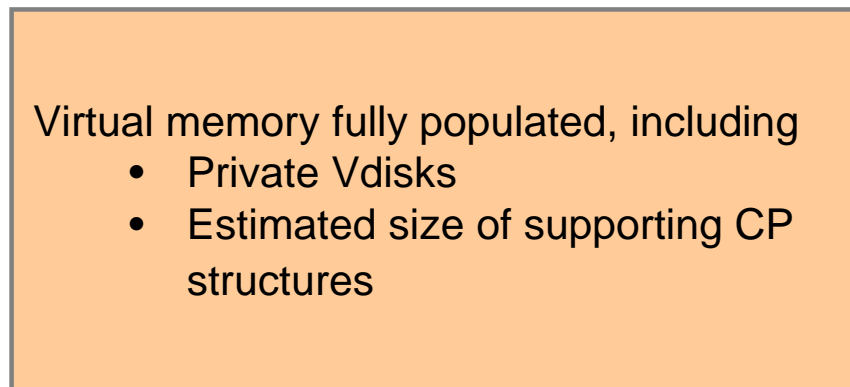
- A relocating guest's current memory size **must** fit in available space on the destination member



## Memory Requirements for Live Guest Relocation...

- Additional checks
  1. Does the guest's current memory size exceed paging capacity on the destination?

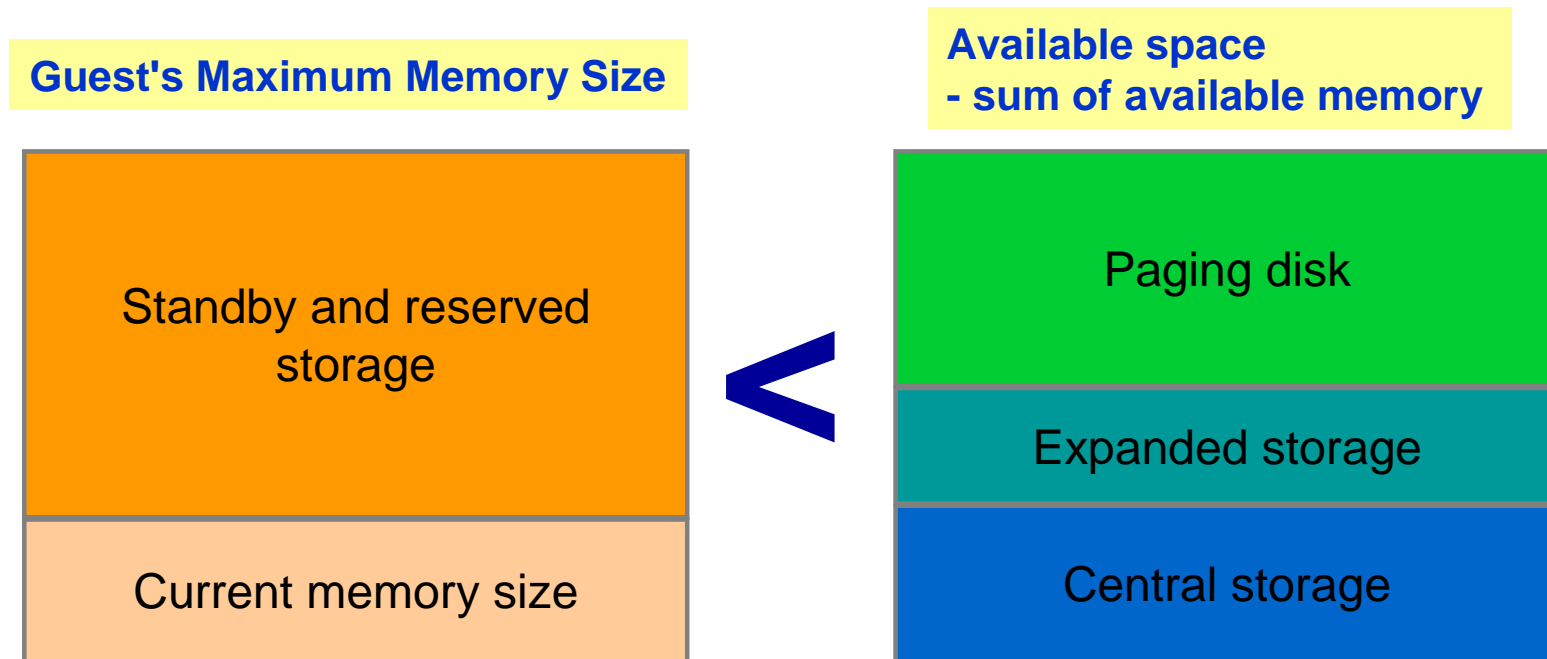
### Guest's Current Memory Size



*May be overridden if you are certain that this is not applicable to your environment*

## Memory Requirements for Live Guest Relocation...

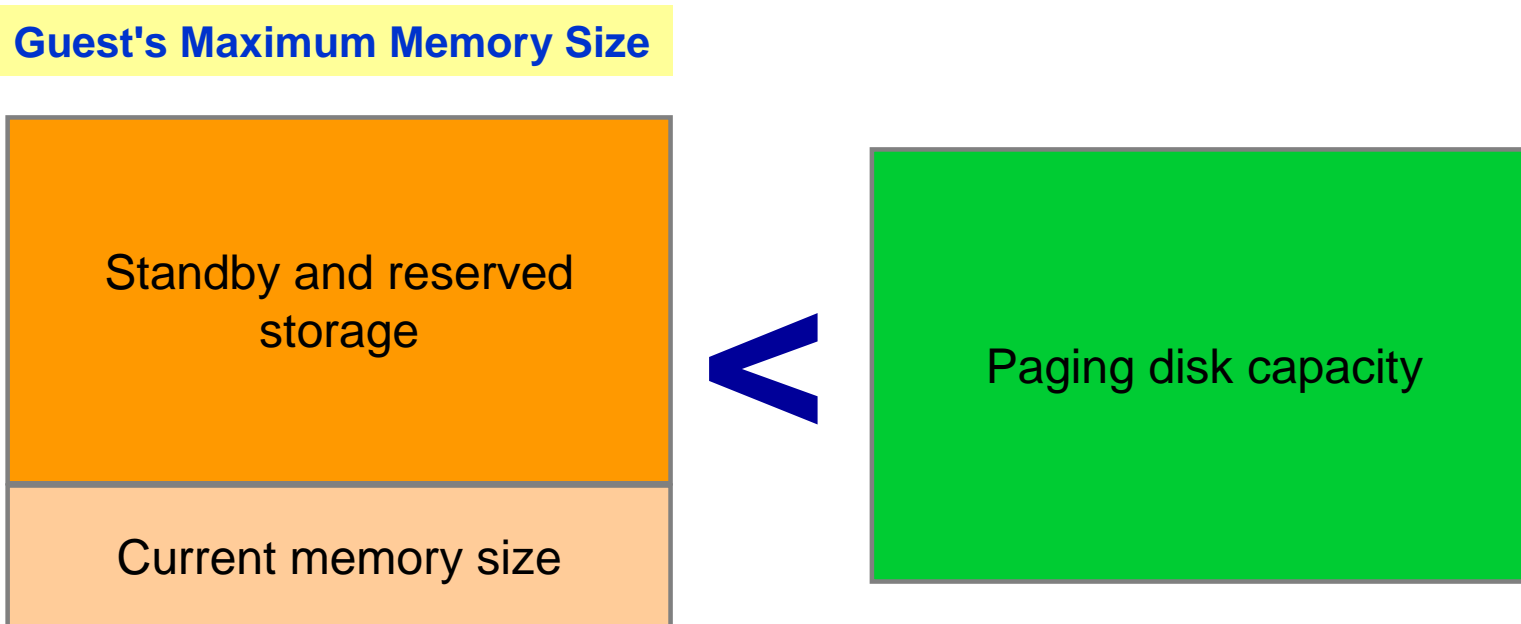
- Additional checks
  2. Does the guest's maximum memory size exceed available space on the destination?



*May be overridden if you are certain that this is not applicable to your environment*

## Memory Requirements for Live Guest Relocation...

- Additional checks
  3. Does the guest's maximum memory size exceed paging capacity on the destination?



*May be overridden if you are certain that this is not applicable to your environment*

## Memory Requirements for Live Guest Relocation...

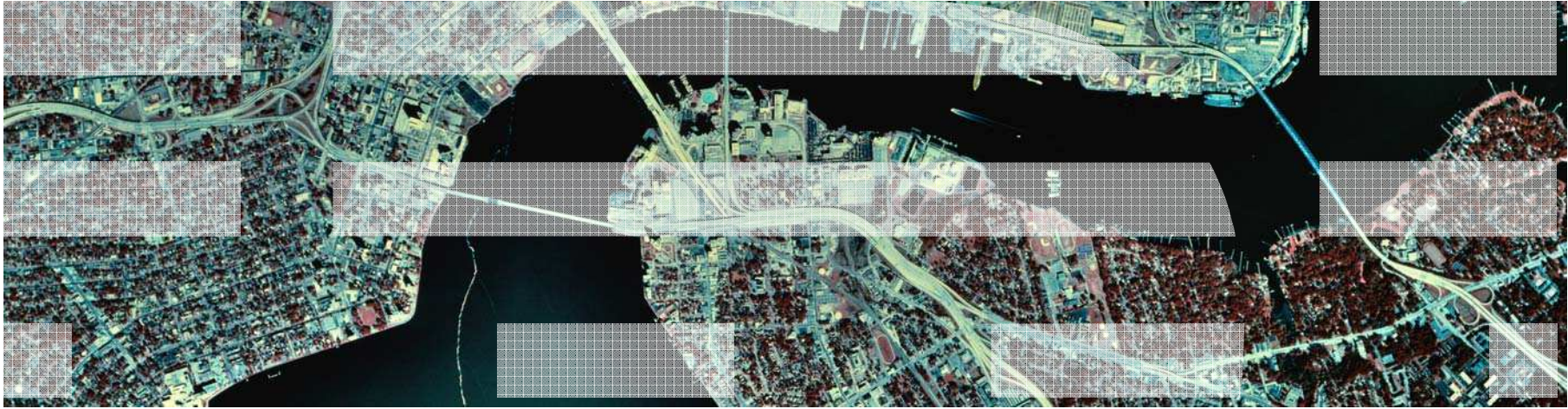
- Include standby and reserved storage settings when calculating maximum memory size for a guest
  
- Relocations may increase paging demand
  - Available paging space should be at least 2x total virtual memory of all guests
    - Including guests to be relocated to this member
  
  - Avoid allocating more than 50% of available paging space
    - If size of guests to be relocated increase in-use amount to > 50%, system performance could be affected

q alloc page

VOLID	RDEV	EXTENT START	EXTENT END	TOTAL PAGES	PAGES IN USE	HIGH PAGE	% USED
L24B66	4B66	0	3338	601020	252428	252428	42%

## Conditions That Prevent a Relocation

- Conditions in the following categories could prevent a relocation from completing:
  - Guest State Conditions
  - Device Conditions
  - Device State Conditions
  - Virtual Facility Conditions
  - Configuration Conditions
  - Resource Limit Conditions
  - Other...
  
- Entire list of conditions documented in CP Planning and Administration
  - "Preparing for Live Guest Relocation in a z/VM SSI Cluster"



# Relocation Domains

## Relocation Domains

- What is a relocation domain?
  
- Do I need them?
  
- How do I define them?
  
- How do I put guests in them?

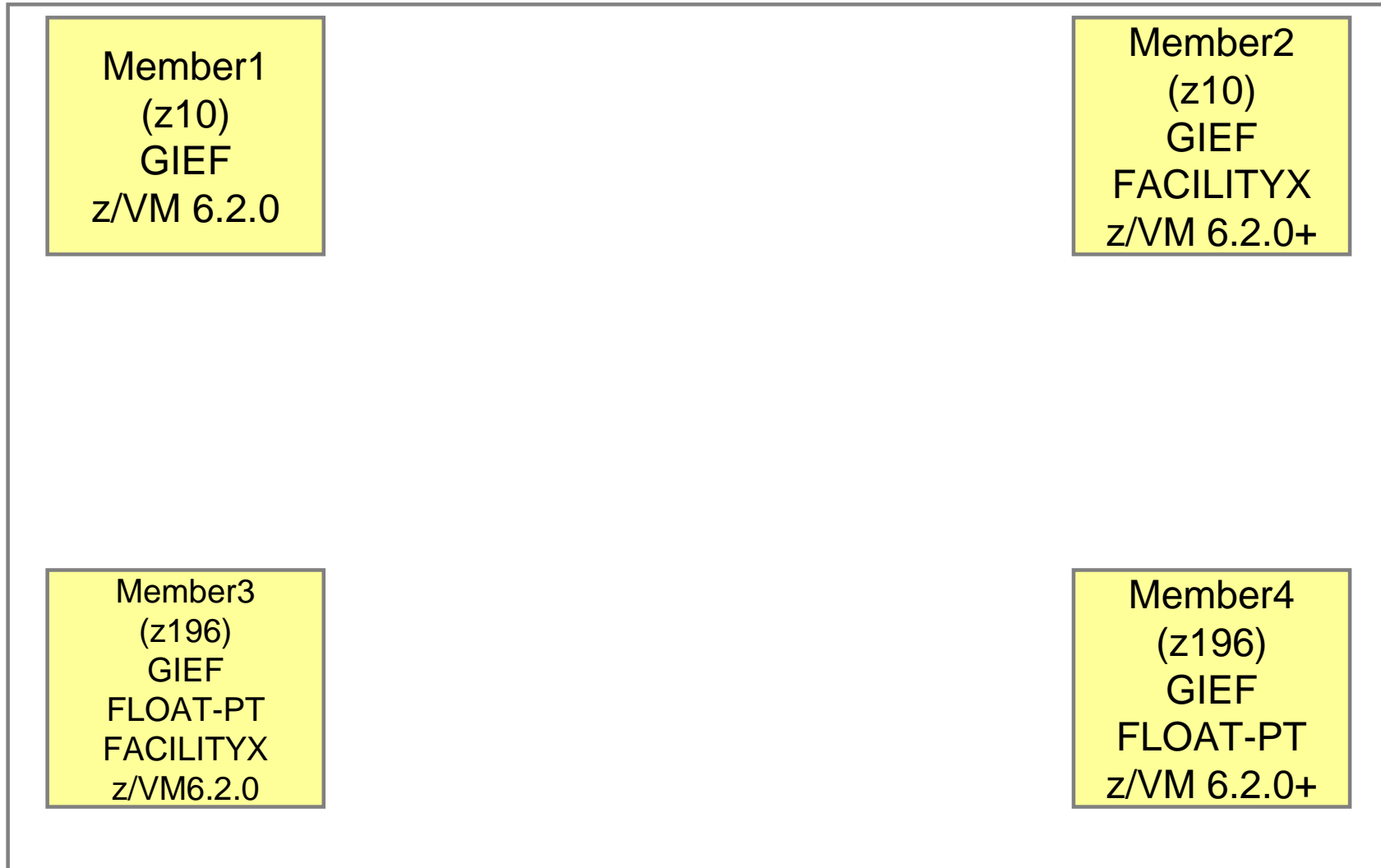


## What is a Relocation Domain?

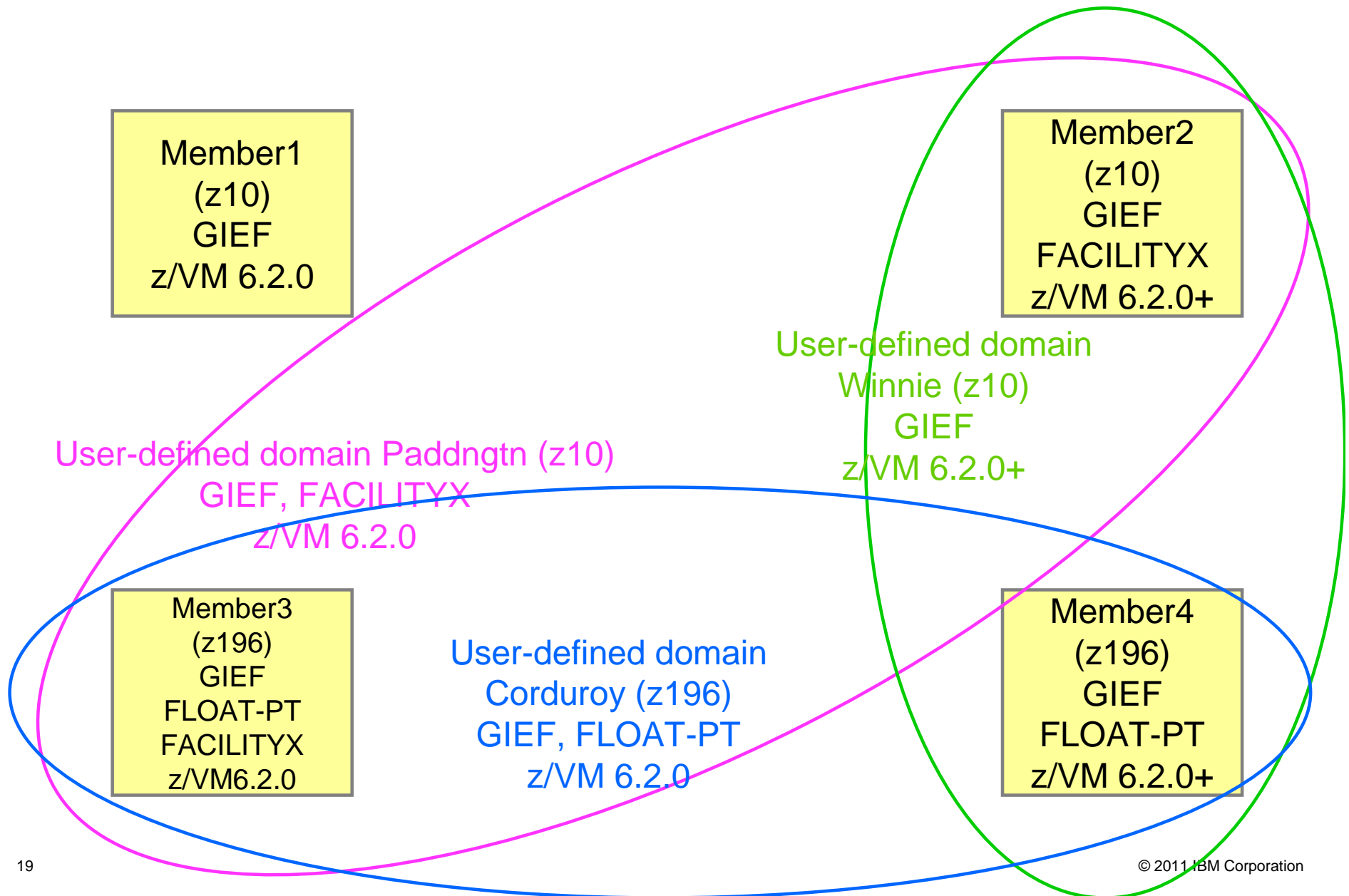
- A relocation domain defines a set of members of an SSI cluster among which virtual machines can relocate freely
  
- Relocation domains can be defined for business or technical reasons
  
- Regardless of differences in the facilities of the individual members, a domain has a common architectural level
  - This is the maximal common subset of all the members' facilities
  
- Several default domains are automatically defined by CP
  - Single member domains for each member in the SSI
  - An SSI domain that will have the features and facilities common to all members
  
- Defining your own domains is useful in a 3+ member cluster
  - In a 1 or 2 member cluster, all possible domains are defined by default

## Relocation Domains

SSI Domain (z10)  
GIEF  
z/VM 6.2.0



# Relocation Domains



## Defining Relocation Domains

- In *SYSTEM CONFIG* on **PMAINT**'s *CF0* disk
- Dynamically via a **DEFINE** command

```
88  
89 RELOCATION_DOMAIN PADDNGTN MEMBER2 MEMBER3  
90 RELOCATION_DOMAIN WINNIE MEMBER2 MEMBER4  
91 RELOCATION_DOMAIN CORDUROY MEMBER3 MEMBER4  
92
```

```
define relodomain paddngtn members member2 member3  
Ready; T=0.01/0.01 15:12:08  
define relodomain winnie members member2 member4  
Ready; T=0.01/0.01 15:12:43  
define relodomain corduroy members member3 member4  
Ready; T=0.01/0.01 15:13:38
```

## Assigning Relocation Domains

- Virtual machines may be assigned to a domain in their directory entry
  - Default for single configuration virtual machines is the SSI domain
  - Default for multiconfiguration virtual machines is their single member domain, which cannot be changed
  
- Virtual machines are assigned a virtual architecture level when they log on, according to what domain they are in
  
- They cannot use facilities or features not included in the domain even if the member they are on has access to those features
  - We call this “fencing”
  
- Examples of commands/instructions with “fenced” responses:
  - **Q CPUID** -the model number will always reflect the virtual architecture level, the processor number is set at logon and not affected by relocation or relocation domain changes
  - **Diagnose x'00'** – will reflect the virtual CPLEVEL
  - **STFLE**

## Assigning Relocation Domains - Directory

```
dirm for lgrrh56 vmrelocate on domain winnie
```

```
DVHXMT1191I Your VMRELOCATE request has been sent for processing to
DVHXMT1191I DIRMAINT at MEMBER1 via DIRMSAT2.
```

```
Ready; T=0.01/0.02 11:32:46
```

```
DVHREQ2288I Your VMRELOCATE request for LGRRH56
```

```
DVHREQ2288I at * has been accepted.
```

```
DVHBIU3450I The source for directory entry
```

```
DVHBIU3450I LGRRH56 has been updated.
```

```
DVHBIU3424I The next ONLINE will take plac
```

```
DVHBIU3424I immediately.
```

```
DVHRLA3891I Your DSATCTL request has been
```

```
DVHRLA3891I for processing.
```

```
DVHRLA3891I Your DSATCTL request has been
```

```
DVHRLA3891I for processing.
```

```
DVHRLA3891I Your DSATCTL request has been relayed
```

```
DVHRLA3891I for processing.
```

```
DVHRLA3891I Your DMVCTL request has been relayed
```

```
DVHRLA3891I for processing.
```

```
DVHRLA3891I Your DMVCTL request has been relayed
```

```
DVHRLA3891I for processing.
```

```
DVHRLA3891I Your DMVCTL request has been relayed
```

```
DVHRLA3891I for processing.
```

```
DVHBIU3428I Changes made to directory entry LGRRH56
```

```
DVHBIU3428I have been placed online.
```

```
DVHREQ2289I Your VMRELOCATE request for LGRRH56
```

```
DVHREQ2289I at * has completed; with RC = 0.
```

```
USER LGRRH56 E 2G 3G ABCDEFG
```

```
INCLUDE LGRDFLT
```

```
IPL 150
```

```
VMRELOCATE ON DOMAIN WINNIE
```

```
LINK PMAINT 0193 0F93 RR
```

```
MDISK 0150 3390 1 END FL4BC8 MR ALL WRITE MULTI
```

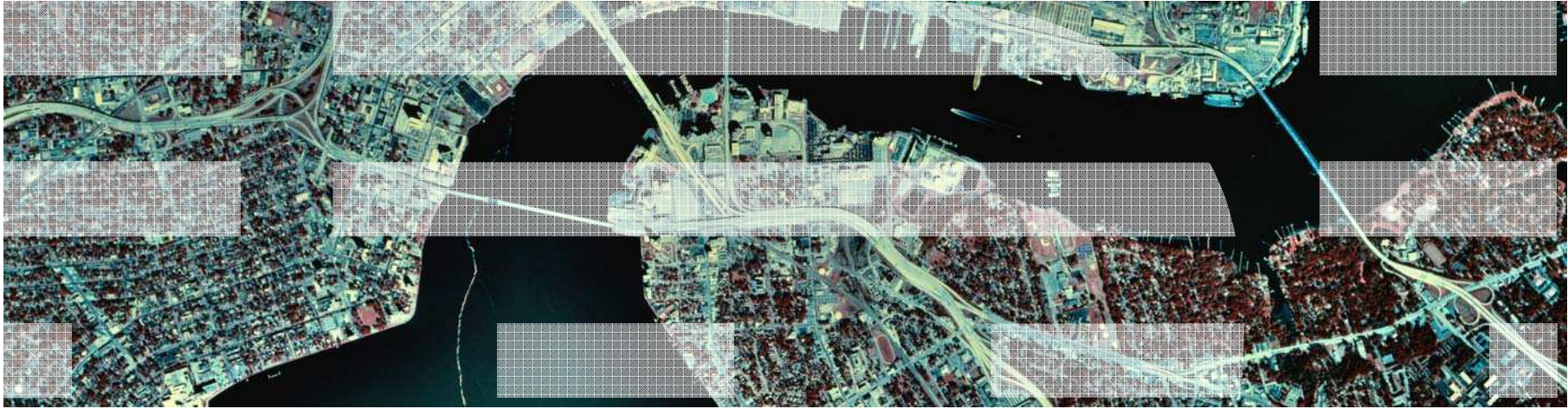
```
MDISK 0151 3390 1 END FL4BC9 MR ALL WRITE MULTI
```

```
MDISK 0152 3390 1 END FL4BCA MR ALL WRITE MULTI
```

## Assigning Relocation Domains - Dynamic

- A running virtual machine may be dynamically reassigned to a domain with the same or greater facilities, so long as the member he is currently on has access to those facilities
- For example, a guest may be in the SSI domain, but relocate to a member with access to more facilities, so you may want to reassign him to a domain with higher facilities

```
set vmrelocate * domain ssi
Running on member GDLRCTS2
Relocation enabled in Domain SSI
Ready;
q cpuid
CPUID = FF3B6D8520978000
Ready;
define relodomain winnie gdlrcts1 gdlrcts2
Ready;
set vmrelocate * domain winnie
Running on member GDLRCTS2
Relocation enabled in Domain WINNIE
Ready;
q cpuid
CPUID = FF3B6D8528178000
Ready;
```



# Live Guest Relocation



## Live Guest Relocation

- Once your relocation domains are set up and your virtual machines are assigned to domains, it is time to start relocations!
  
- What to know before starting relocations
  
- Demo and Helpful Hints

## Live Guest Relocation – What to know before starting relocations

- CP moves the virtual machine in several different stages
  
- While the majority of the virtual machines' memory is being moved, the virtual machine is running
  
- Then the virtual machine is stopped (quiesced), checked again for eligibility and the final state is moved
  
- If there are any eligibility failures at any point until after the final state is moved, the relocation cancels and the virtual machine is resumed on the source member
  
- At any point until after the final state is moved, the relocation can be canceled
  - By the **VMRELOCATE CANCEL** command, from the source or destination
  - **CPHX** will cancel a **VMRELOCATE SYNC** command

## Live Guest Relocation – What to know before starting relocations

- Use the **VMRELOCATE TEST** command before you try a **VMRELOCATE MOVE**
  
- Choose one class A user to always issue your **VMRELOCATE** commands from and only issue one **VMRELOCATE** command at a time
  - Use the default option, **SYNCHRONOUS** to enforce one-at-a-time relocations
  
- Use the **AT** command to issue **VMRELOCATEs** on another member in your SSI cluster
  
- Know how long your Linux machine can be quiesced, look at applications and when they will timeout (30 seconds? 5 seconds?)
  - Use the **MAXQUIESCE** option to tell CP how long quiesce time can be
  - If this is exceeded, the relocation will be canceled and the virtual machine resumed on the source member

## Live Guest Relocation – Demo

```
q ssi
SSI Name: SSITEST
SSI Mode: Stable
Cross-System Timeouts: Enabled
SSI Persistent Data Record (PDR) device: FL4B84 on 4B84
SLOT SYSTEMID STATE      PDR HEARTBEAT      RECEIVED HEARTBEAT
  1 GDLLCPX1  Joined      2011-10-13 15:10:18 2011-10-13 15:10:18
  2 GDLLCPX2  Joined      2011-10-13 15:10:12 2011-10-13 15:10:12
  3 GDLLCPX3  Joined      2011-10-13 15:10:26 2011-10-13 15:10:26
  4 GDLMCPX4  Joined      2011-10-13 15:10:35 2011-10-13 15:10:35
Ready; T=0.01/0.01 15:10:41
```

## Live Guest Relocation – Demo

```
formssi display 141
HCPPDF6618I Persistent Data Record on device 0141 (label FL4B84) is for
HCPPDF6619I PDR state: Unlocked
HCPPDF6619I time stamp: 10/13/11 15:10:42
HCPPDF6619I cross-system timeouts: Enabled
HCPPDF6619I PDR slot 1 system: GDLLCPX1
HCPPDF6619I state: Joined
HCPPDF6619I time stamp: 10/13/11 15:10:18
HCPPDF6619I last change: GDLLCPX1
HCPPDF6619I PDR slot 2 system: GDLLCPX2
HCPPDF6619I state: Joined
HCPPDF6619I time stamp: 10/13/11 15:10:42
HCPPDF6619I last change: GDLLCPX2
HCPPDF6619I PDR slot 3 system: GDLLCPX3
HCPPDF6619I state: Joined
HCPPDF6619I time stamp: 10/13/11 15:10:26
HCPPDF6619I last change: GDLLCPX3
HCPPDF6619I PDR slot 4 system: GDLMCPX4
HCPPDF6619I state: Joined
HCPPDF6619I time stamp: 10/13/11 15:10:35
HCPPDF6619I last change: GDLMCPX4
Ready; T=0.01/0.01 15:10:48
```

## Live Guest Relocation – Demo

```
xautolog lgmlin21
Command accepted
Ready; T=0.01/0.01 15:11:44
AUTO LOGON ***          LGMLIN21 USERS = 21
HCPCLS6056I XAUTOLOG information for LGMLIN21: The IPL command is verifi
set secuser lgmlin21 *
HPCPCFX6768I SECUSER of LGMLIN21 initiated.
Ready; T=0.01/0.01 15:11:50
LGMLIN21: Booting default (ipl)...
LGMLIN21: Linux version 2.6.16.60-0.21-default (geeko@buildhost) (gcc ve
UTC 2008
Up and running under VM (64 bit mode)
```

■ ■ ■

```
Welcome to SUSE Linux Enterprise Server 10 SP2 (s390x) - Kernel 2.6.16.6
"
"
linux-nxpt login:
```

## Live Guest Relocation – Demo

```
q lgrlin21 at all
GDLLCPX2 : LGRLIN21 - DSC
Ready; T=0.01/0.01 15:44:52
```

```
vmrelocate test lgrlin21 to gdllcp1
User LGRLIN21 is eligible for relocation to GDLLCPX1
Ready; T=0.01/0.01 15:45:21
VMRELOCATE MOVE LGRLIN21 TO GDLLCPX1 MAXQ 5 SEC
```

```
VMRELOCATE MOVE LGRLIN21 TO GDLLCPX1 MAXQ 5 SEC
Relocation of LGRLIN21 from GDLLCPX2 to GDLLCPX1 started
User LGRLIN21 has been relocated from GDLLCPX2 to GDLLCPX1
LGRLIN21: User LGRLIN21 has been relocated from GDLLCPX2 to GDLLCPX1
```

## Live Guest Relocation – Demo

```

LGRLIN21: qeth: check on device 0.0.0700, dstat=x0, cstat=x2 <4>qeth: ir
qeth: irb: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
qeth: irb: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
qeth: irb: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
qdio : received check condition on activate queues on device 0.0.0702 (c
qeth: Recovery of device 0.0.0700 started ...
qeth: Device 0.0.0700/0.0.0701/0.0.0702 is a OSD Express card (level: 03
with link type OSD_100 (portname: whatever)
qeth: Hardware IP fragmentation not supported on eth0
qeth: VLAN enabled
qeth: Multicast enabled
qeth: IPV6 enabled
qeth: Broadcast enabled
qeth: Using SW checksumming on eth0.
qeth: Outbound TSO enabled
USER DSC LOGOFF AS LGRLIN21 USERS = 20 FORCED BY SYSTEM
Ready; T=0.01/0.01 15:45:52
LGRLIN21: qeth: Device 0.0.0700 successfully recovered!
Oct 13 15:45:51 linux-nxpt kernel: qeth: check on device 0.0.0700, dstat
00 00 00 80 e0 80"
Oct 13 15:45:51 linux-nxpt kernel: qeth: irb: 00 00 00 00 00 00 00 00
Oct 13 15:45:51 linux-nxpt kernel: qeth: irb: 00 00 00 00 00 00 00 00
Oct 13 15:45:51 linux-nxpt kernel: qeth: irb: 00 00 00 00 00 00 00 00
LGRLIN21: Oct 13 15:45:51 linux-nxpt kernel: qdio : received check condi
Oct 13 15:45:51 linux-nxpt kernel: qeth: Recovery of device 0.0.0700 sta
Oct 13 15:45:56 linux-nxpt kernel: qeth: Device 0.0.0700/0.0.0701/0.0.07
Oct 13 15:45:56 linux-nxpt kernel: with link type OSD_100 (portname: wha
Oct 13 15:45:56 linux-nxpt kernel: qeth: Using SW checksumming on eth0."

```



## Live Guest Relocation – Demo


```
q lgmlin21 at all
GDLLCPX1 : LGRLIN21 - DSC
Ready; T=0.01/0.01 15:46:35
```

```
AT GDLLCPX1 CMD VMRELOCATE MOVE LGRLIN21 TO GDLLCPX2 MAXQ 5 SEC
Relocation of LGRLIN21 from GDLLCPX1 to GDLLCPX2 started
LGRLIN21: User LGRLIN21 has been relocated from GDLLCPX1 to GDLLCPX2
User LGRLIN21 has been relocated from GDLLCPX1 to GDLLCPX2
LGRLIN21: qeth: check on device 0.0.0700, dstat=x0, cstat=x2 <4>qeth: ir
qeth: irb: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
qeth: irb: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
qeth: irb: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
qdio : received check condition on activate queues on device 0.0.0702 (c
qeth: Recovery of device 0.0.0700 started ...
qeth: Device 0.0.0700/0.0.0701/0.0.0702 is a OSD Express card (level: 03
with link type OSD_100 (portname: whatever)
qeth: Hardware IP fragmentation not supported on eth0
qeth: VLAN enabled
qeth: Multicast enabled
qeth: IPV6 enabled
qeth: Broadcast enabled
qeth: Using SW checksumming on eth0.
qeth: Outbound TSO enabled
Ready; T=0.01/0.01 15:47:10
LGRLIN21: qeth: Device 0.0.0700 successfully recovered!
Oct 19 15:47:08 Linux-vm1: kernel: qeth: check on device 0.0.0700, dstat
```

## Live Guest Relocation – Demo

```
q LGRLIN21 AT ALL
GDLLCPX2 : LGRLIN21 - DSC
Ready; T=0.01/0.01 15:47:41
```

## Live Guest Relocation – Helpful Hints



*Help! My relocation hasn't completed yet!*



Try  
**VMRELOCATE STATUS  
DETAILS**

## Live Guest Relocation – Helpful Hints

```
vmrelocate test lgrcp021 gdlrcts1
User LGRCP021 is eligible for relocation to GDLRCTS1
Ready; T=0.01/0.01 15:28:09
vmrelocate move lgrcp021 gdlrcts1 asynchronous maxquiesce 10
Relocation of LGRCP021 from GDLRCTS2 to GDLRCTS1 started
Ready; T=0.01/0.01 15:28:15
vmrelocate status
User      From      To      By      Status      Elapsed
LGRCP021 GDLRCTS2 GDLRCTS1 CELESKEY Moving Memory 00:00:05
Ready; T=0.01/0.01 15:28:21
vmrelocate status lgrcp021 details
User      From      To      By      Status      Elapsed
LGRCP021 GDLRCTS2 GDLRCTS1 CELESKEY Moving Memory 00:00:10

Options: ASYNCH IMMED NO
Max Total Time NO LIMIT
Max Quiesce Time 10 sec

Total pages sent 702176 in 1 passes; 524320 pages sent in pass 2
Ready; T=0.01/0.01 15:28:25
User LGRCP021 has been relocated from GDLRCTS2 to GDLRCTS1
```

## Live Guest Relocation – Helpful Hints

*Help! My relocation always exceeds my quiesce time!*

Are you issuing relocations one at a time?

Check system constraints, are you trying to relocate to a member that really can't handle another user?

How many CTCs do you have between your members? How fast are they? How many devices do you have on each CHPID?

## Live Guest Relocation – Helpful Hints

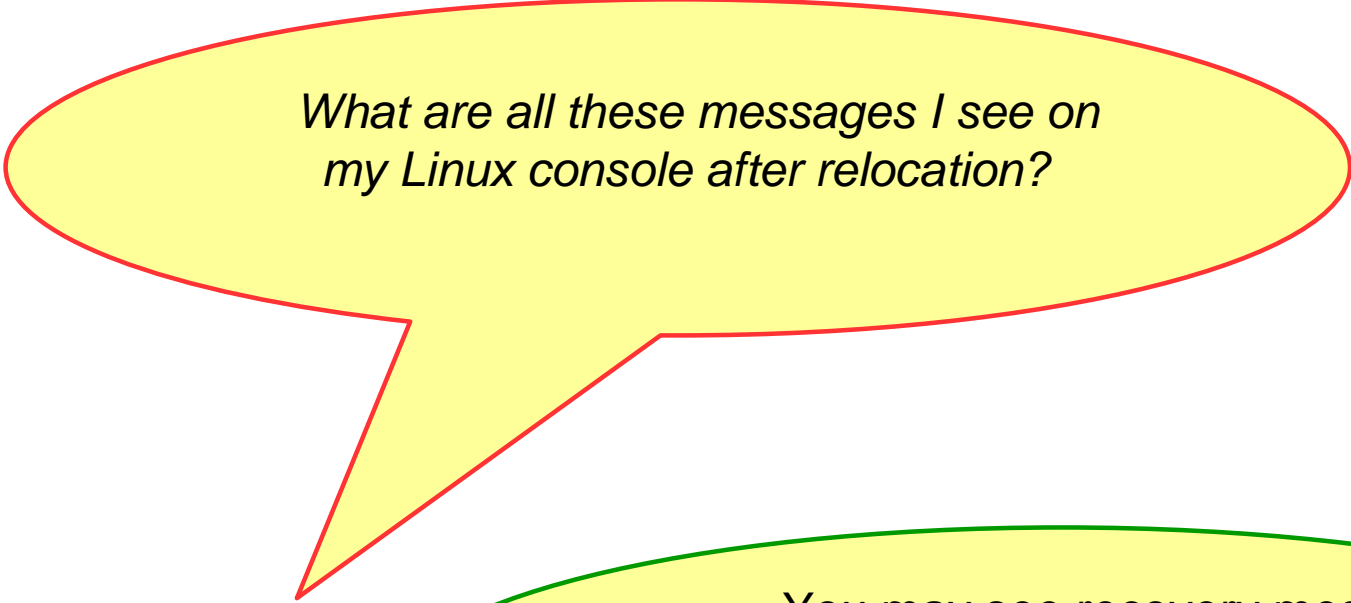
*I don't trust that you're really leaving the guest running, I want to see what my guest is doing as he relocates!*

Use SCIF from another single configuration virtual machine -  
**SET OBSERVER LINUX01 \***

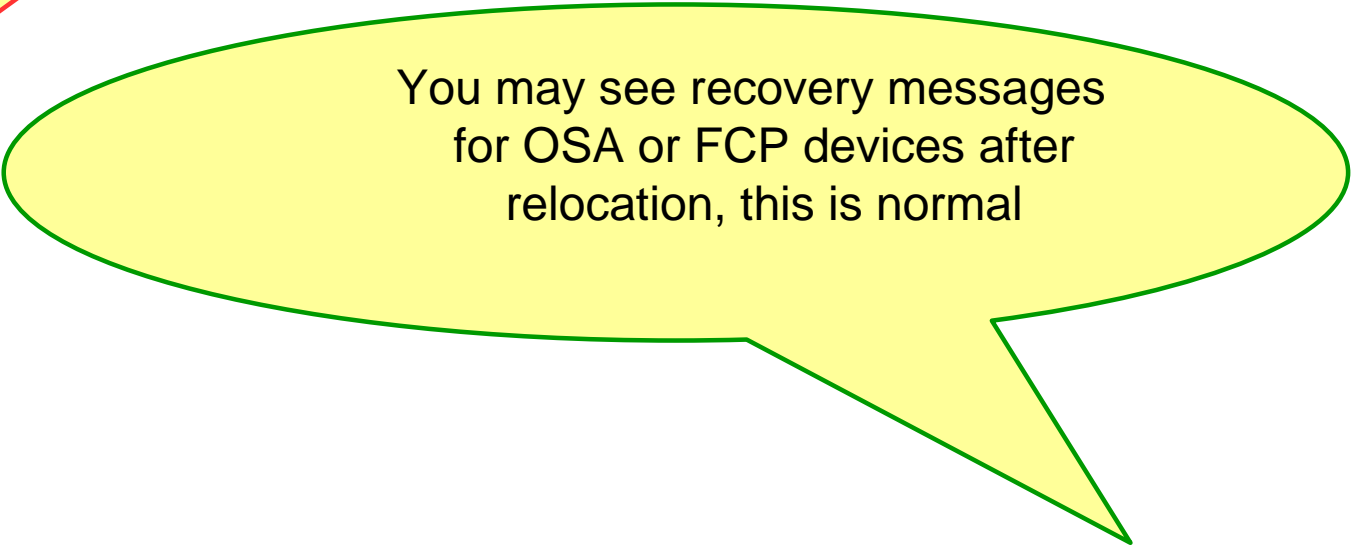
Have the virtual machine spool his console  
**SPOOL CONS \* START**

Connect to Linux via SSH or VNC

## Live Guest Relocation – Helpful Hints



*What are all these messages I see on my Linux console after relocation?*



You may see recovery messages for OSA or FCP devices after relocation, this is normal

# Thanks!

*Contact Information:*

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