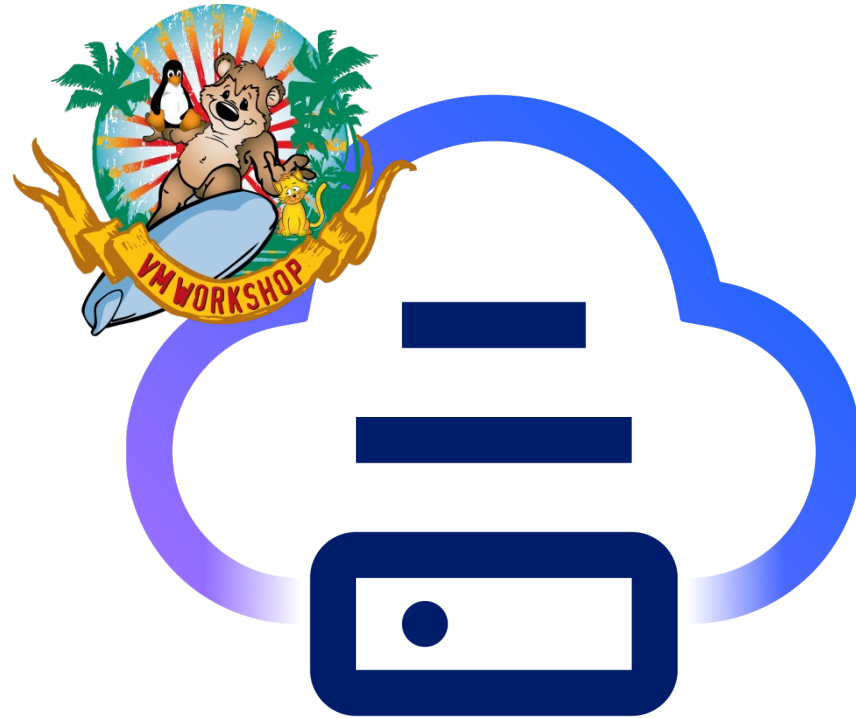# IBM Cloud Infrastructure Center

Deep Dive

Michael Snihur
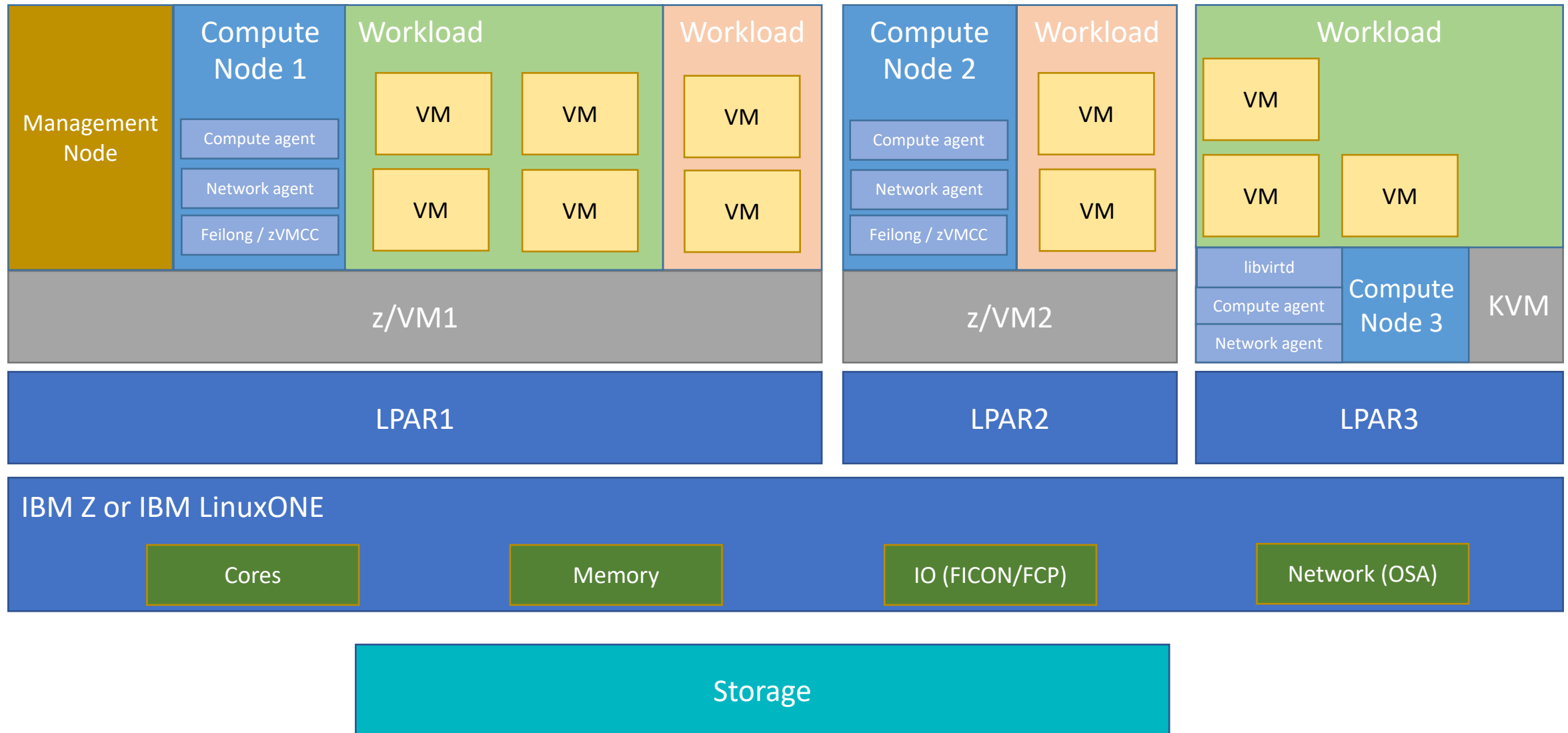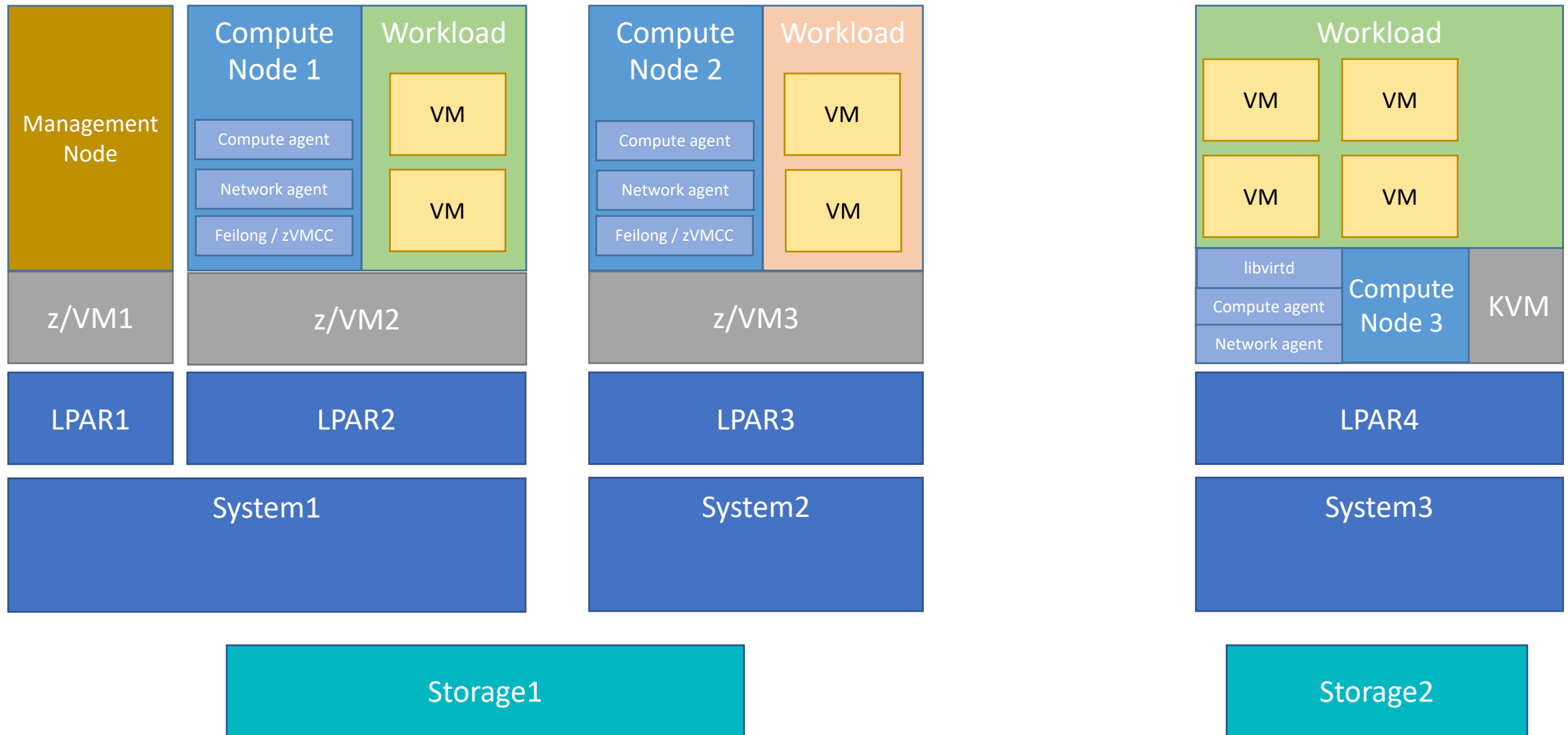
Solutions Architect

snihurm@us.ibm.com

Agenda

- Overall ICIC architecture

- Storage types

- Boot From Volume Image types

- Migration

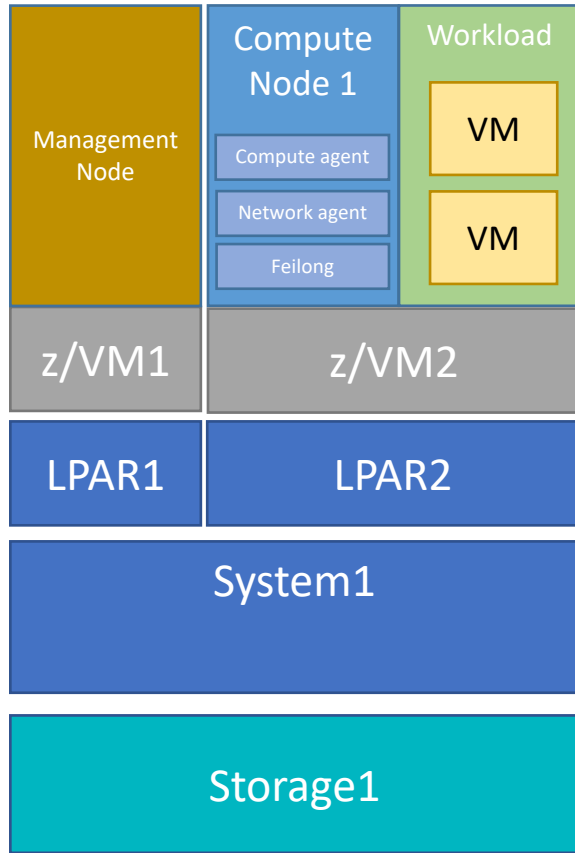- Allocation model and overcommit
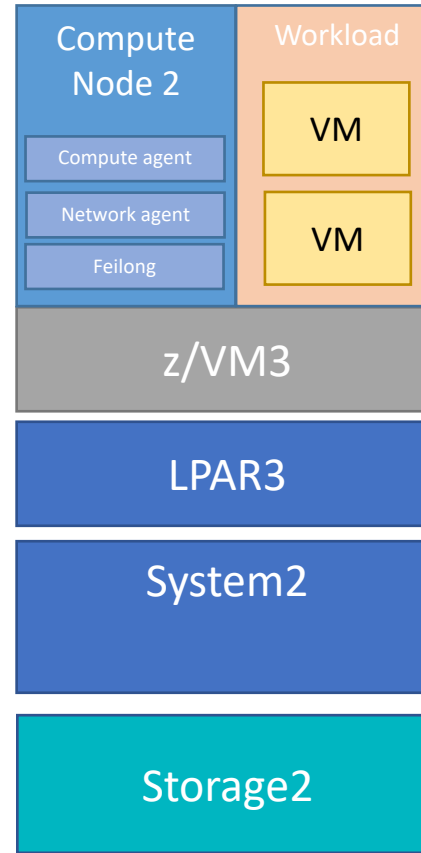
ICIC architecture – single system

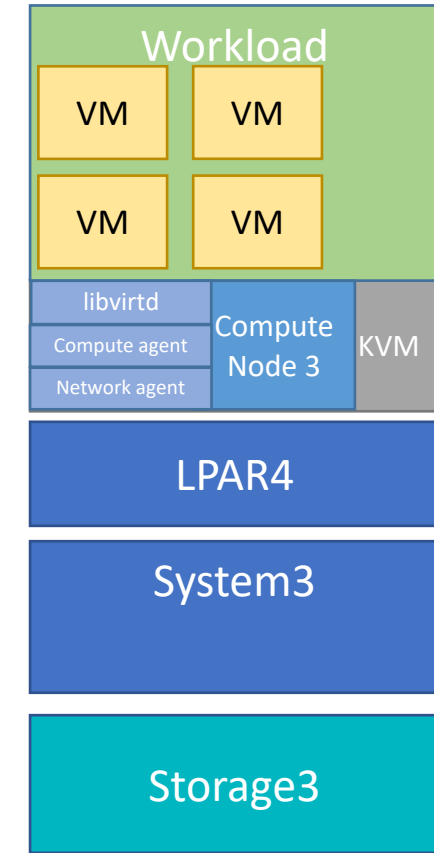# ICIC architecture – multi system

ICIC architecture – multi site

Site 1

Site 2

Site 3

Storage

Local

Managed by hypervisor

Allocated as part of virtual machine deployment

Lifecycle dependent on owning virtual machine

Persistent

Storage object created on storage device

Dynamic access rights and bindings between vm and storage objects

Volumes available after vm decommissioned
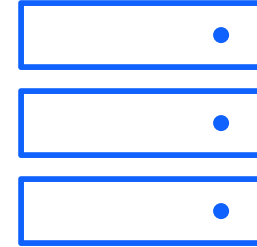
Local Storage

z/VM

Create DASD group in DirMaint

Enter DASD group during ICIC add host

ICIC will create the disk from the DASD group and adds to the user directory of deployed guest

Disk is destroyed when vm is decommissioned

Local Storage

z/VM

Create DASD group in DirMaint

Enter DASD group during ICIC add host

ICIC will create the disk from the DASD group and adds to the user directory of deployed guest

Disk is destroyed when vm is decommissioned

```
:GROUPS.
  *GroupName RegionList
  $ZVMRES    V6172I
  $COMMON    V6172C
  $RELEASE   V6172P
  USER       V61M01
  ICICPOOL   ICA414 ICA415 ICA416 ICA427 ICA428 ICA429
  ICICPOOL   ICA41A ICA41B ICA41C
  ICICPOOL   ICA41D ICA41E ICA41F ICA420 ICA421 ICA422
  ICICPOOL   ICA423 ICA424 ICA425 ICA426 ICA427 ICA428 ICA429
  ICICPOOL   ICA42A ICA42B ICA42C ICA42D
* EAVs
  ICICPOOL   IC9100 IC9101 IC9102 IC9103 IC9104 IC9105 IC9106
  ICICPOOL   IC9107 IC9108 IC9109 IC910A IC910B IC910C IC910D
  ICICPOOL   IC910E IC910F IC9110 IC9111 IC9112 IC9113 IC9114
  ICICPOOL   IC9115 IC9116 IC9117 IC9118 IC9119 IC911A IC911B
  ICICPOOL   IC911C IC911D IC911E IC911F IC9120 IC9121 IC9122
  ICICPOOL   IC9123 IC9124 IC9125 IC9126 IC9127 IC9128 IC9129
  ICICPOOL   IC912A IC912B IC912C IC912D IC912E IC912F IC9130
  ICICPOOL   IC9131 IC9132 IC9133 IC9134 IC9135 IC9136 IC9137
  ICICPOOL   IC9138 IC9139 IC913A IC913B IC913C IC913D IC913E
  ICICPOOL   IC913F IC9140 IC9141 IC9142 IC9143 IC9144 IC9145
  ICICPOOL   IC9146 IC9147 IC9148 IC9149 IC914A IC914B IC914C
  ICICPOOL   IC914D IC914E IC914F IC9150 IC9151 IC9152 IC9153
:END.
```

Local Storage

z/VM

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Enter DASD group during ICIC add host

ICIC will create the disk from the DASD group and add it to the user directory of deployed guest

Disk is destroyed when vm is decommissioned

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Local Storage

z/VM

Create DASD group in DirMaint

Enter DASD group during ICIC add host

ICIC will create the disk from the DASD group and add it to the user directory of deployed guest

Disk is destroyed when vm is decommissioned

Deploy rhel83

Collocation rule: ❓

None ▾

Key pair: ❓

None ▾

Specifications

Compute template: ❓

Tiny ▾

* **Processors**	1
* **Memory (MB)**	4,096
* **Disk size (GB)**	10
Ephemeral size (GB)	0
Swap size (MB)	0
Instance Extra Specs	{}

*Disk size of 0 will result in the image size being set as the disk size

Local Storage

z/VM

Create DASD group in DirMaint

Enter DASD group during ICIC add host

ICIC will create the disk from the DASD group and add it to the user directory of deployed guest

Disk is destroyed when vm is decommissioned

```
USER CIC00183 LBYONLY 4G 64G G
    INCLUDE ZCCDFLT
    COMMAND SET VCONFIG MODE LINUX
    COMMAND DEFINE CPU 00 TYPE IFL
    COMMAND DEF STOR INITIAL STANDBY REMAINDER
    IPL 0100
    LOGONBY MAINT
    MACHINE ESA 32
    SHARE RELATIVE 100
    NICDEF 1000 TYPE QDIO DEVICES 3 MACID 5C967D LAN SYS
    NICDEF 1000 PORTTYPE ACCESS
    NICDEF 1000 VLAN 133
    MDISK 0100 3390 43693 14564 V55CI1 MR
```

Local Storage

z/VM

Create DASD group in DirMaint

Enter DASD group during ICIC add host

ICIC will create the disk from the DASD group and adds to the user directory of deployed guest

Disk is destroyed when vm is decommissioned
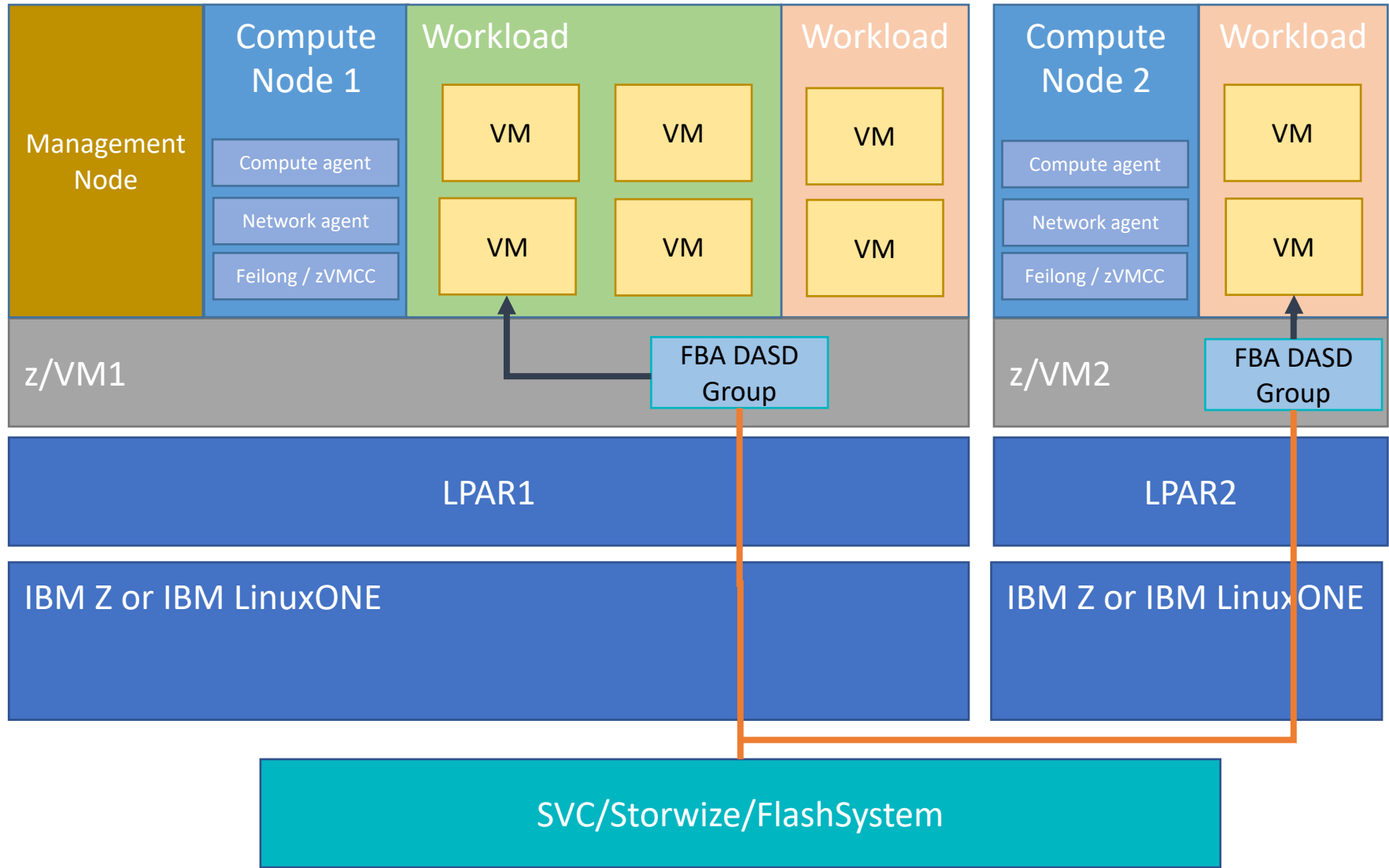
Local Storage

Local Storage

Local Storage

KVM
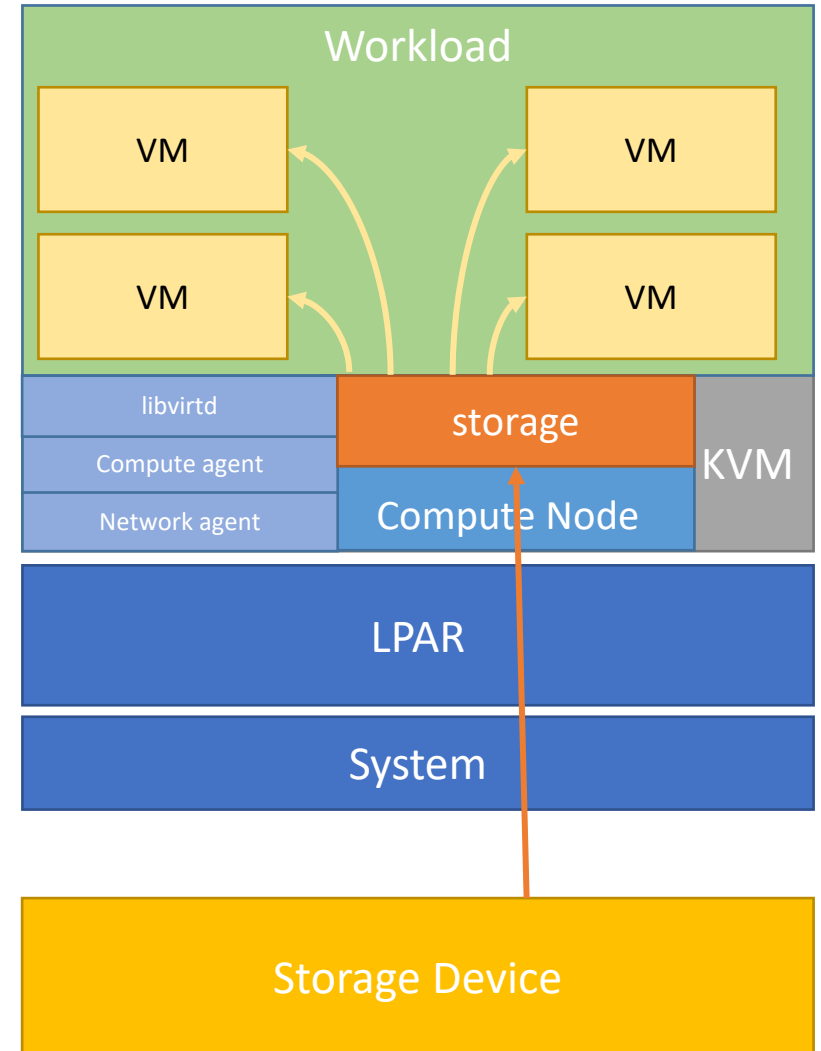
Map disk to KVM host (Ficon, FCP, GPFS, NFS)

During deployment disk is created through xml definition

```
<disk type='file' device='disk'>
    <driver name='qemu' type='qcow2' cache='none'/>
    <source file='/var/lib/libvirt/images/nova/instances/ef3ad432-ae41-49fa-80e5-95dafd6340f0/disk' index='2'/>
    <backingStore type='file' index='3'>
     <format type='raw'/>
     <source file='/var/lib/libvirt/images/nova/instances/_base/d38a968c459f026dac001375d167668c1d1195e1'/>
     <backingStore/>
    </backingStore>
    <target dev='vda' bus='virtio'/>
    <alias name='virtio-disk0'/>
    <address type='ccw' cssid='0xfe' ssid='0x0' devno='0x0000'/>
</disk>
```

Persistent Storage

z/VM

Add Storage Provider

FCP pool and templates

On deployment, volume created
dynamically

FCP dedicated to the VM and mapped to
created volume

Define VM user directory to boot from FCP

Persistent Storage

z/VM

Add Storage Provider

FCP pool and templates

On deployment, volume created dynamically

FCP dedicated to the VM and mapped to created volume

Define VM user directory to boot from FCP

Persistent Storage

z/VM

Add Storage Provider

FCP pool and templates

On deployment, volume created dynamically

FCP dedicated to the VM and mapped to created volume

Define VM user directory to boot from FCP

Add Storage

For each new storage provider, a default storage template is created. You can modify the template after the storage provider has been added.

Specify a storage controller

Type: IBM Storage FlashSystem
Name: fs93

Select a storage pool for the default template

The selected storage pool is used in the default storage template. To use a different storage pool, create a new template on the *Configuration* page.

Name	Capacity (GB)	Available (GB) ▼
Pool0	17,759	16,294
ICIC	500	367

Total: 2 Selected: 1

Add Storage   Cancel

Persistent Storage

z/VM

Add Storage Provider

FCP pool and templates

Deploy Boot From Volume image

FCP dedicated to the VM and mapped to created volume

Define VM user directory to boot from FCP

Persistent Storage

z/VM

Add Storage Provider

FCP pool and templates

Deploy Boot From Volume image

FCP dedicated to the VM and mapped to created volume

Define VM user directory to boot from FCP

1. Create volume on storage provider

2. Download image from glance service

3. Map the created volume to the compute node

4. Use **dd** to copy the image to the volume

5. Unmap the volume from the compute node

Persistent Storage

z/VM

Add Storage Provider

FCP pool and templates

Deploy Boot From Volume image

FCP dedicated to the VM and mapped to created volume

Define VM user directory to boot from FCP

```
Bootable has been volume created
1. Allocate and reserve FCP devices from FCP
   template
2. Map the volume to allocated devices
3. Dedicate FCP devices on the compute node
4. Select valid path of FCP and WWPN to
   access the LUN
5. Mount the volume to tmp directory
6. Update zipl.conf with volume path
7. Unmount and Undedicate FCPs
```

Persistent Storage

z/VM

Add Storage Provider

FCP pool and templates

Deploy Boot From Volume image

FCP dedicated to the VM and mapped to created volume

Define VM user directory to boot from FCP

```
USER HLP00006 LBYONLY 4G 64G G
INCLUDE ZCCDFLT
COMMAND SET VCONFIG MODE LINUX
COMMAND DEFINE CPU 00 TYPE IFL
COMMAND DEF STOR INITIAL STANDBY REMAINDER
IPL LOADDEV
LOADDEV DEVICE 1a0a <-- base IPL device
LOADDEV PORTname 50050768103391d8 <-- base IPL port
LOADDEV LUN 0000000000000000
LOADDEV SCSI ALTERNATE 1a0a PORT 50050768102491e1 <-- alternate path1
LOADDEV SCSI ALTERNATE 1b0a PORT 50050768102391e1<-- alternate path2
LOADDEV SCSI ALTERNATE 1b0a PORT 50050768102391d8<-- alternate path3
LOGONBY DEVCORE2
MACHINE ESA 32
SHARE RELATIVE 100
DEDICATE 1A0A 1A0A
DEDICATE 1B0A 1B0A
NICDEF 1000 TYPE QDIO DEVICES 3 MACID 8A1355 LAN SYSTEM VSICIC
```

Persistent Storage
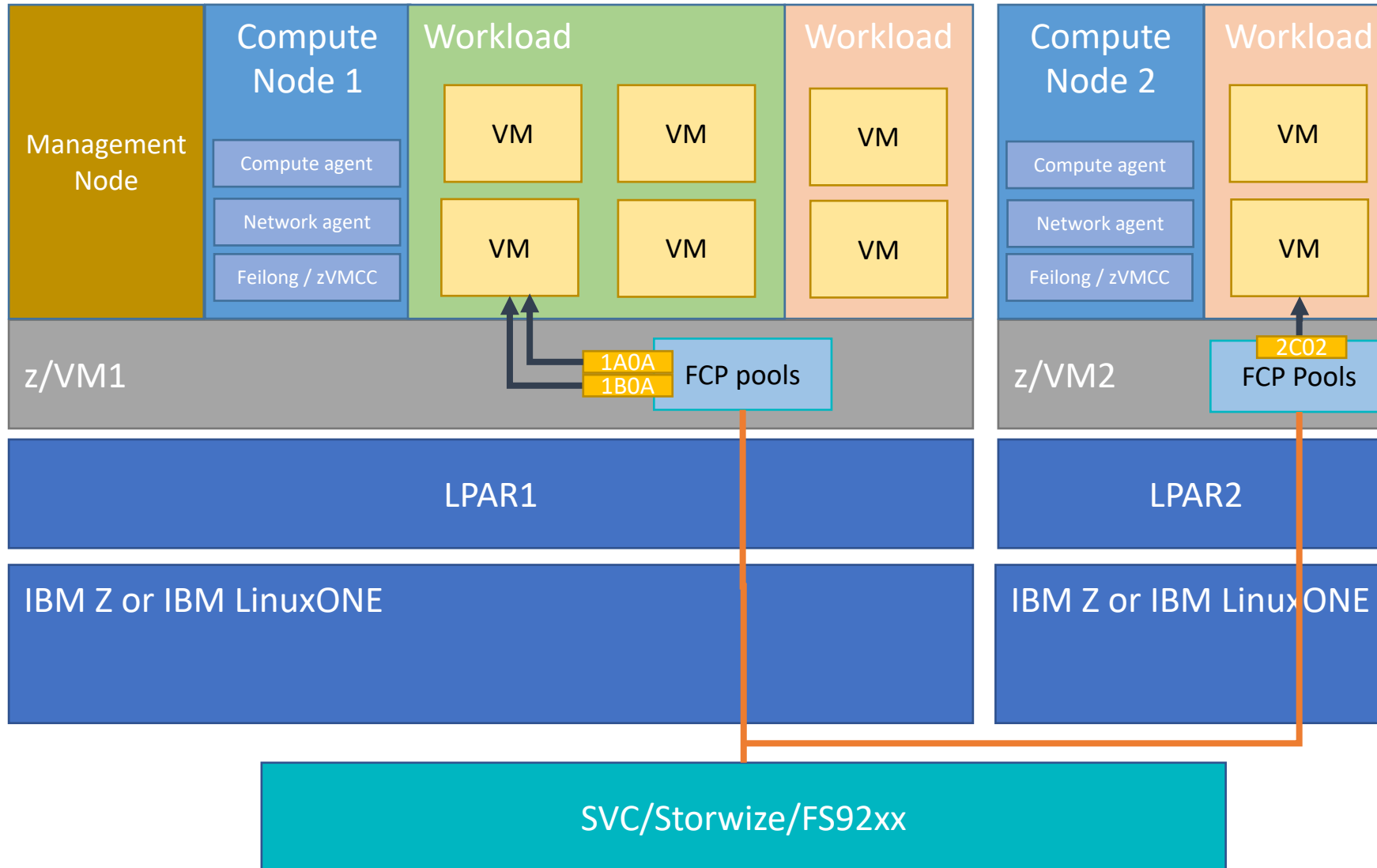
Persistent Storage

KVM with FCP

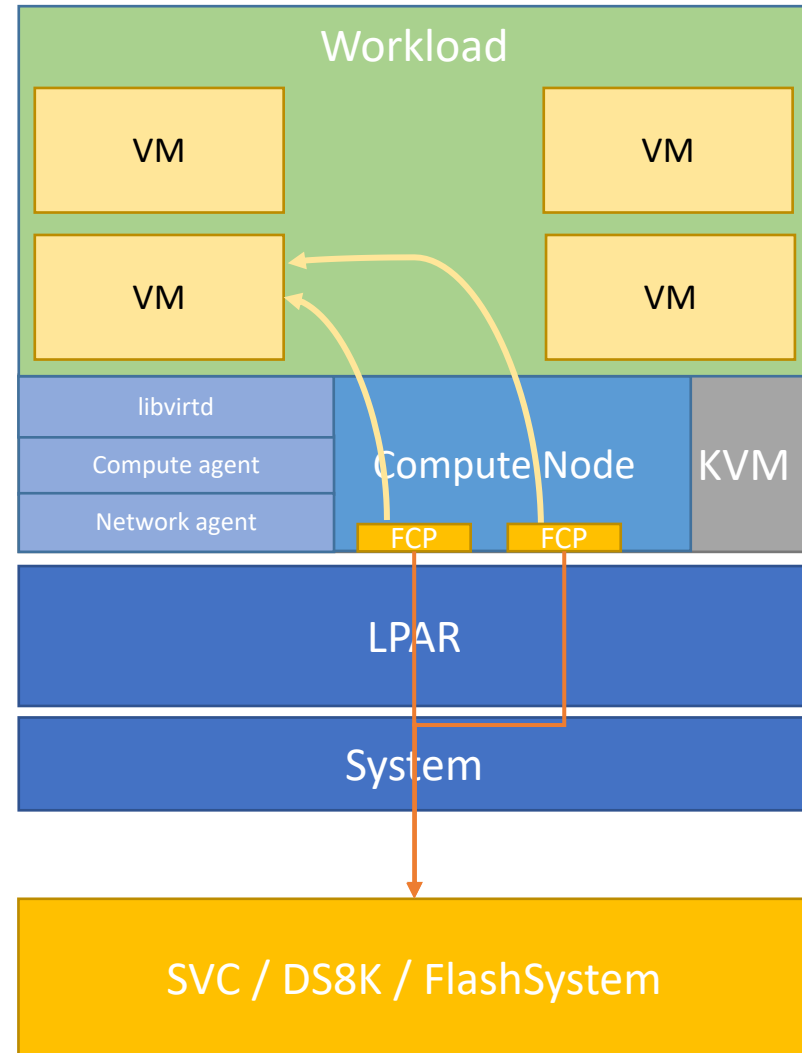Create volume on storage

Map to KVM host using multipath

Map storage from the KVM host to the guest VM

```
<disk type='block' device='disk’>
    <driver name='qemu' type='raw' cache='none' io='native’/>
    <source dev='/dev/disk/by-id/dm-uuid-mpath-
36005076308ffd2cf000000000000290a' index='6’/>
    <backingStore/> <target dev=‘vda' bus='virtio’/>
...
 </disk>
```
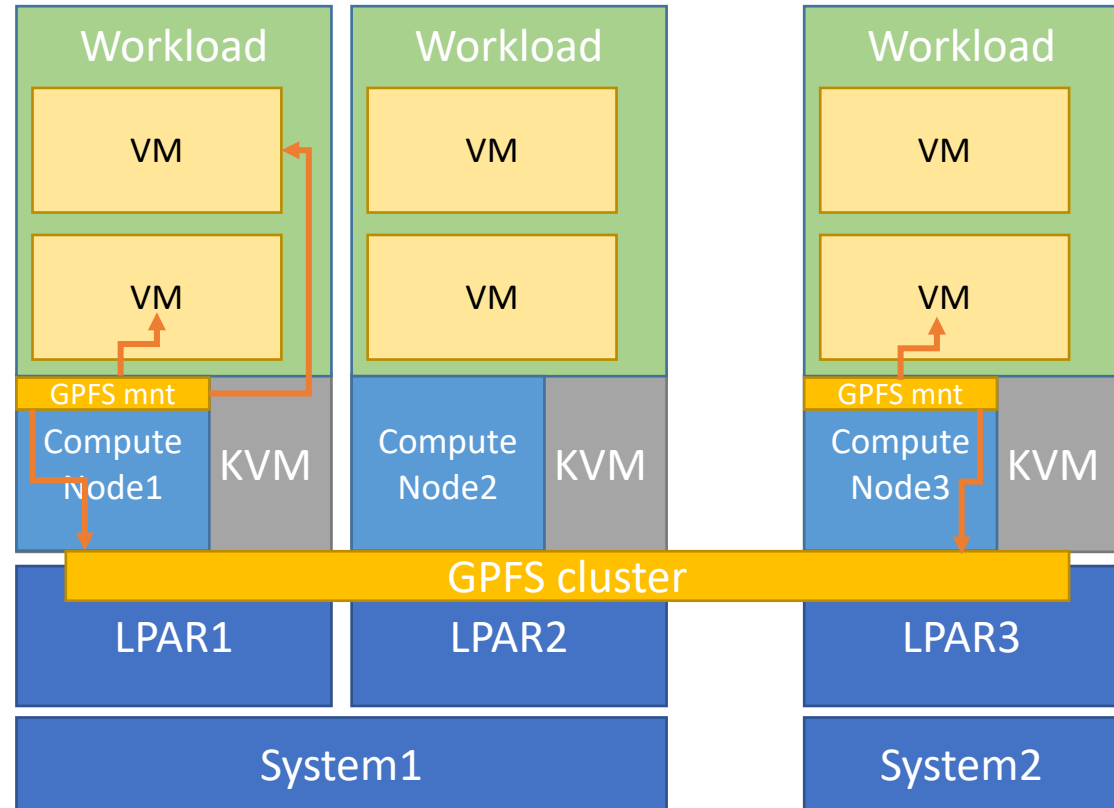
Persistent Storage

KVM with GPFS

Create volume file through GPFS
backend directly on kvm host
`/<gpfs mnt>/icic/<volume-id>`

map the created volume from KVM
host to the KVM guest


```
<disk type='file' device='disk'>
    <driver name='qemu' type='raw' cache='none'/>
    <source file' index='1'/>
    <backingStore/>='/gpfs/icic_gpfs/icic/consisgroup-1dfe0bfa-bb6c-41de-b98e-53db9164b8b3/volume-rhel90_kvm12-boot-29-04ece809-d4ab
    <target dev='vda' bus='virtio'/>
    ....
    </disk>
```
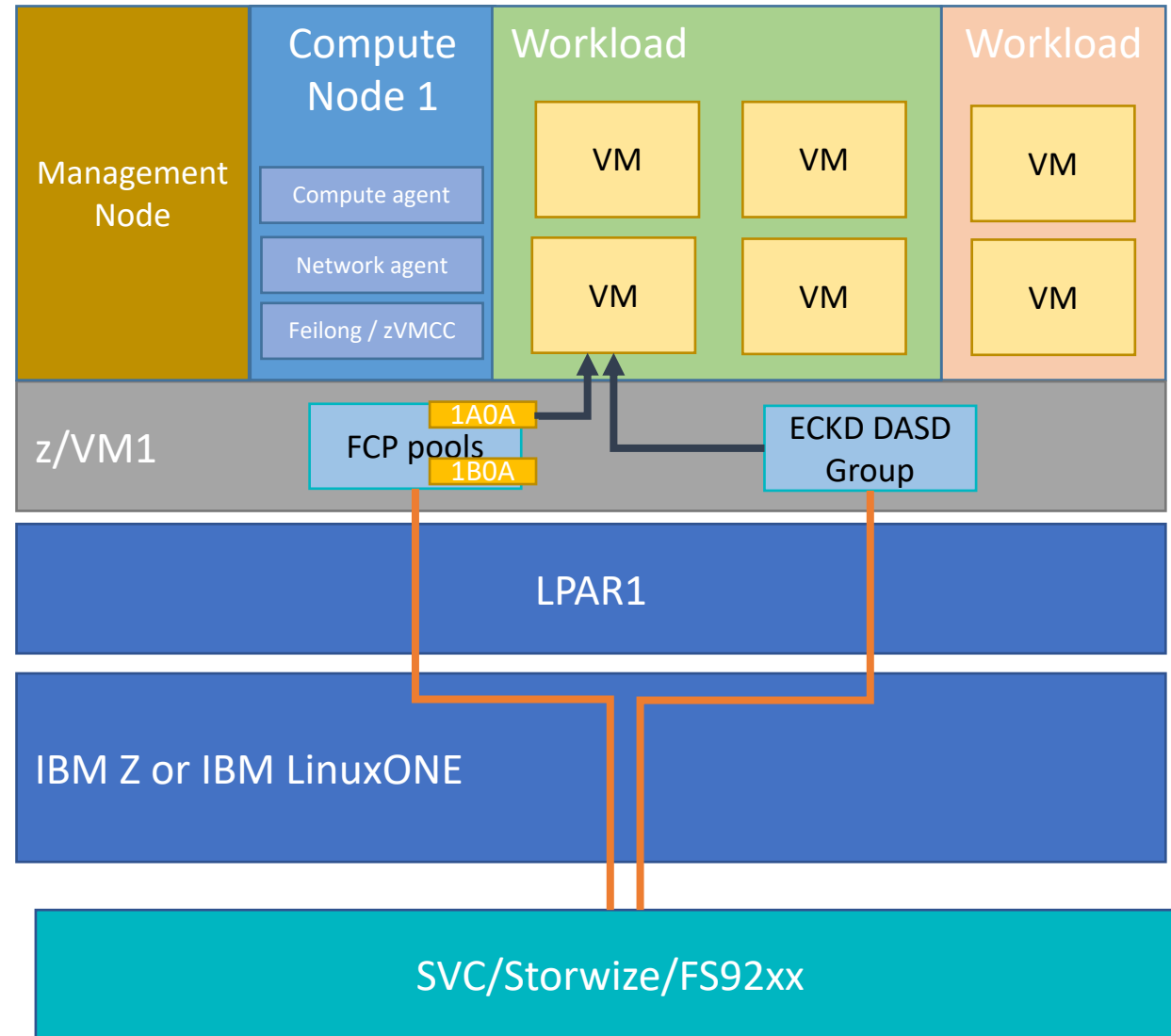
Hybrid Storage

z/VM

Root disk from DASD group

Data volume on Storage Device

Management Node	Compute Node 1	Workload		Workload
	Compute agent	VM	VM	VM
	Network agent			
	Feilong / zVMCC	VM	VM	VM

z/VM1

FCP pools — 1A0A / 1B0A

ECKD DASD Group

LPAR1

IBM Z or IBM LinuxONE

SVC/Storwize/FS92xx

Boot from Volume Image Types

File Backed Image

- BFV Image file uploaded to ICIC

- During deployment, a volume is created, and the image is copied using 'dd'

Volume Backed Image

- Volume created from BFV image

- During deployment, a new volume is created

- A temporary flashcopy mapping is used to copy the volume image into the new volume

Snapshot Backed Image

- Capture snapshot image from running BFV server

- Image volume is created and captured vm is flashcopied to newly created volume

Volume Backed Image

Volume Backed Image

- **Volume created from BFV image**

- During deployment, a new volume is created

- A temporary flashcopy mapping is used to copy the volume image into the new volume

Volume Backed Image

Volume Backed Image

- **Volume created from BFV image**

- During deployment, a new volume is created

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Volume Backed Image

Volume Backed Image

- Volume created from BFV image

- **During deployment, a new volume is created**

- A temporary flashcopy mapping is used to copy the volume image into the new volume

Volume Backed Image

Volume Backed Image

- Volume created from BFV image

- During deployment, a new volume is created

- A temporary flashcopy mapping is used to copy the volume image into the new volume

Volume Backed Image

What happens in FS9x00 backend

(a temporary FlashCopyMapping)

1. Create a volume with specified size

2. Create FlashCopyMapping between the new-volume and the image-volume with autodelete

3. Prestart fcmap

4. Start fcmap

5. Mkhost

6. mkvdiskhostmap

Sequence Number ↓	Date and Time	User Name	Command
121448	4/19/2024 3:28:10 PM	admin_icic	svctask mkvdiskhostmap -force -host BOET4601_HLPS0033-41256537 -scsi 0 volume-BFV_Volume_Img-boot-66-7b2c7a76-c34f
121447	4/19/2024 3:28:08 PM	admin_icic	svctask mkhost -force -hbawwpn c05076fecd8047fc -iogrp 0 -name BOET4601_HLPS0033-41256537
121445	4/19/2024 3:27:56 PM	admin_icic	svctask startfcmap 10
121444	4/19/2024 3:27:54 PM	admin_icic	svctask prestartfcmap 10
121443	4/19/2024 3:27:53 PM	admin_icic	svctask mkfcmap -source volume-jacky_boot_vol-8ff77e5c-c7ec -target volume-BFV_Volume_Img-boot-66-7b2c7a76-c34f -copyrate 100 -autodelete
121442	4/19/2024 3:27:52 PM	admin_icic	svctask mkvdisk -name volume-BFV_Volume_Img-boot-66-7b2c7a76-c34f -mdiskgrp ICIC_CORE2 -iogrp 0 -size 10737418240 -unit b -easytier on

Snapshot Backed Image

Snapshot Backed Image

- **Capture snapshot image from running BFV server**

- Image volume is created and captured vm is flashcopied to newly created volume

- Deploy vm from snapshot volume

Snapshot Backed Image

Snapshot Backed Image

- Capture snapshot image from running BFV server

- **Image volume is created and captured vm is flashcopied to newly created volume**

- Deploy vm from snapshot volume

Snapshot Backed Image

What is happening in FS9x00 backend

(2 permanent FlashCopyMappings without Consistency Group)

1. Create 2 image-volumes with the same size of the being-captured VM's volumes

2. Create 2 FlashCopyMappings between the image-volumes and the VM's volumes, one for each volume with copyrate 0

3. Prestartfcmap

4. Startfcmap

Note:
As no consistency group is involved during the process,

there is no guarantee for the data consistency between bootable volume and data volumes

Suggest capturing the VM after shutdown the VM to keep data consistency.

IBM FlashSystem 9200	FS63	Audit Log		

Q admin_icic

Sequence Number	Date and Time ↑	User Name	Command
124365	4/24/2024 6:48:36 AM	admin_icic	svctask mkvdisk -name snapshot-352fbe43-9afc-4ca2-9c39-2c756 -mdiskgrp ICIC_CORE2 -iogrp 0 -size 10737 -unit b -easytier on
124366	4/24/2024 6:48:36 AM	admin_icic	svctask mkfcmap -source volume-BFV_Volume_Img-boot-66-7b2c7a76-c34f -snapshot-352fbe43-9afc-4ca2-9c39-2c756 -copyrate 0
124372	4/24/2024 6:48:37 AM	admin_icic	svctask startfcmap 36
124370	4/24/2024 6:48:37 AM	admin_icic	svctask startfcmap 35
124371	4/24/2024 6:48:37 AM	admin_icic	svctask prestartfcmap 36
124369	4/24/2024 6:48:37 AM	admin_icic	svctask mkfcmap -source volume-jacky_t-1-c894d83b-93a1 -target snapshot-9f74eb9f-883c-48ab-a6a8-9d978c58fda9 -copyrate 0
124367	4/24/2024 6:48:37 AM	admin_icic	svctask prestartfcmap 35
124368	4/24/2024 6:48:37 AM	admin_icic	svctask mkvdisk -name snapshot-9f74eb9f-883c-48ab-a6a8-9d978c58fda9 -mdiskgrp ICIC_CORE2

Snapshot Backed Image

Snapshot Backed Image

- Capture snapshot image from running BFV server

- Image volume is created and captured vm is flashcopied to newly created volume

- **Deploy vm from snapshot volume**

Snapshot Backed Image

Snapshot Backed Image

- Capture snapshot image from running BFV server

- Image volume is created and captured vm is flashcopied to newly created volume

- **Deploy vm from snapshot volume**

Migration of virtual machines

z/VM

Live migrate of virtual machine to another compute node

Requires both compute nodes to be in SSI cluster

KVM

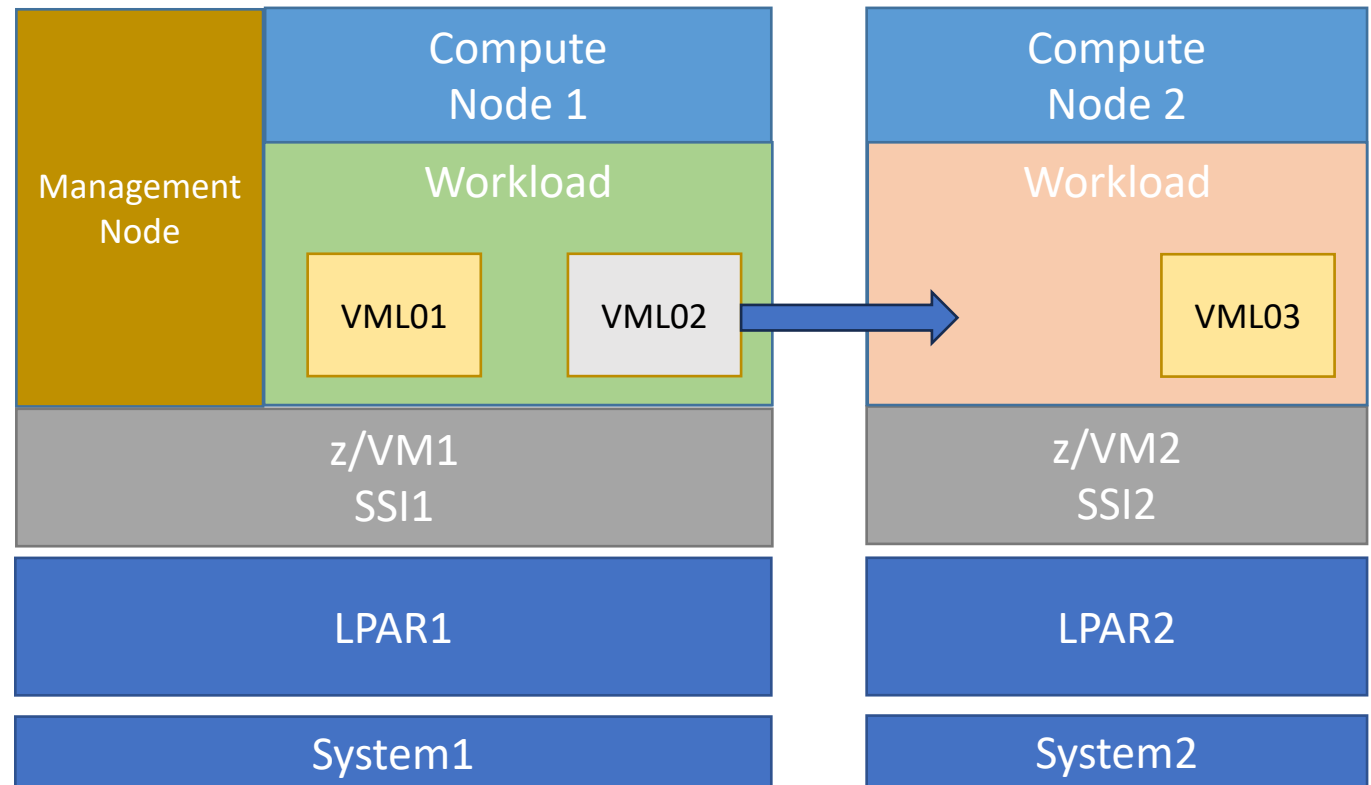Live migrate of virtual machine to another compute node

Cold migration of virtual machine to another compute node

Migration on z/VM

Live Migration on z/VM with SSI

VMRELOCATE command used

Migration of virtual machines

Virtual Machines

Refresh | Start | ● Stop | Suspend | ▶ Resume | ↺ Restart | ✕ Delete | ▣ Capture | ✛ Resize | ⊞ **Live Migrate** | Cold Migrate | ✏ Edit Expiration Date

Unmanage | ▣ Console Output | ⊠ Console Access | 🔒 Lock | 🔓 Unlock | ⬇ Export CSV | ☐ Show All Projects' Vms ❓

⇄ *No filter applied*

Name 2 ▲	Host 1 ▲	IP	State	Health	Operating System	Online CPU ❓	VM Type	Hypervisor Type	Instance id	Owner
▤ rhcos-4.15-zvm	ia-compute	9.152.84.107	● Active	● OK	RHCOS4.15	2	deployed	z/VM	IAI00001	
▤ rhel7.7	ia-compute	9.152.84.102	● Active	● OK	RHEL7.7 Linux 3.10.0-1062.el7.s390x s390x	1	deployed	z/VM	IAI0001f	
▤ rhel9-tt	ia-compute	9.152.84.109	● Active	● OK	RHEL9.3 Linux 5.14.0-362.8.1.el9_3.s s390x	4	deployed	z/VM	IAI00018	
▤ lynn-rhle88	os006	9.152.84.86	● Active	● OK	RHEL8.8	4	deployed	KVM	IAI00012	

- KVM: virsh migrate --live --auto-converge --unsafe <vm id> qemu+ssh://<dest>/system

- z/VM: smcli VMRELOCATE -T <vm id> -k <option>

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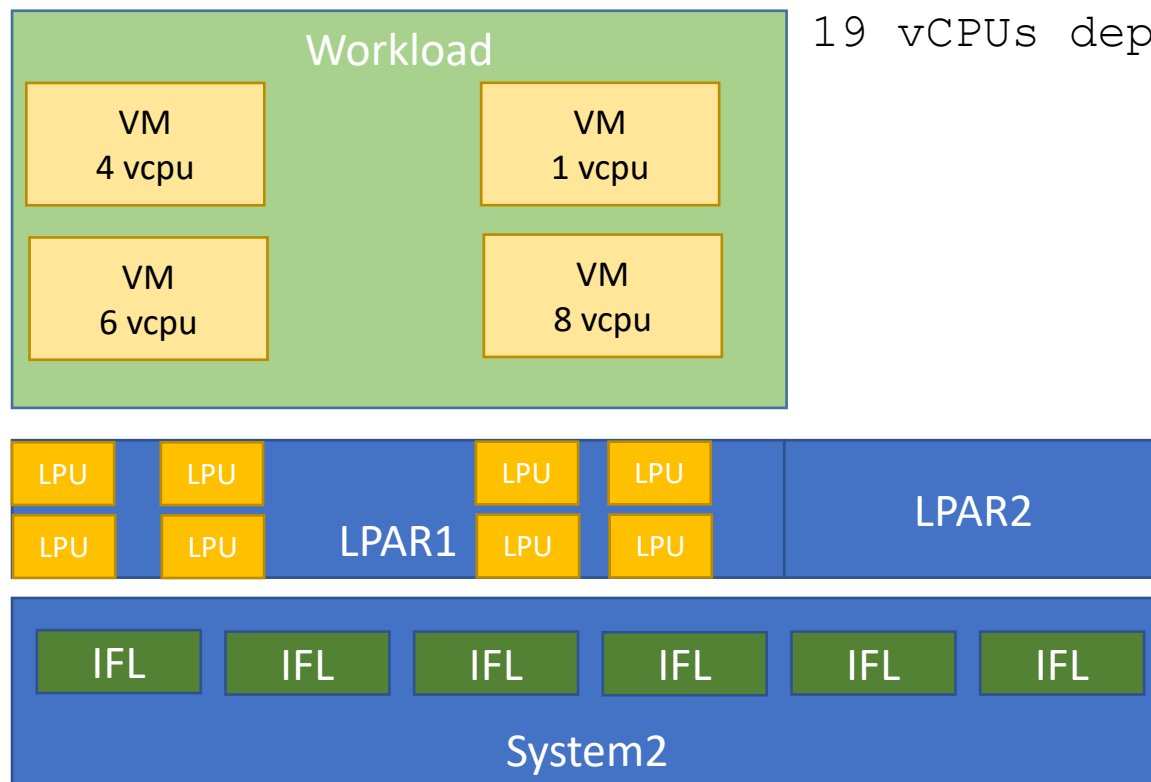
Allocation Model

8 LPUs defined to LPAR

19 vCPUs deployed

IBM Cloud Infrastructure Center utilizes
an allocation model for resource
provisioning

Overcommit ratios for cpu, memory, disk

Minimum cpu deployment of 1 vcpu

Maximum cpu deployment of total
number of LPUs per LPAR

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Resources

- Watch [IBM Cloud Infrastructure Center](#) webpage
- Read the [technical blogs and announcements](#)
- Check out the [technical details](#) at the IBM Documentation
- Get started using the [Content solution](#)
- Leverage the IBM Redbook®: [Hybrid cloud with on-premises cloud on IBM Z or IBM® LinuxONE](#)

Thank you!