IBM Cloud Infrastructure Center

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Hybrid Cloud is core to IBM’s strategy

IBM® Z and LinuxONE participates across the stack

Consulting

Business Transformation ● Technology Consulting ● Application Operations

System Integrator Partners

Software

Digital Labor ● IT Automation ● Security ● Sustainability ● Application Modernization ● Data and Transaction Processing

Software and SaaS Partners

AI and data platform

watsonx™

watsonx.ai ● watsonx.data ● watsonx.governance

Hybrid cloud platform

Red Hat®

OpenShift® ● Enterprise Linux ● Ansible® Automation Platform

IBM Cloud Infrastructure Center

Infrastructure

IBM® LinuxONE ● IBM Z® ● Distributed Infrastructure ● Infrastructure Support ● Quantum

Public Clouds

AWS ● Azure ● Others

Enterprise Infrastructure

Edge

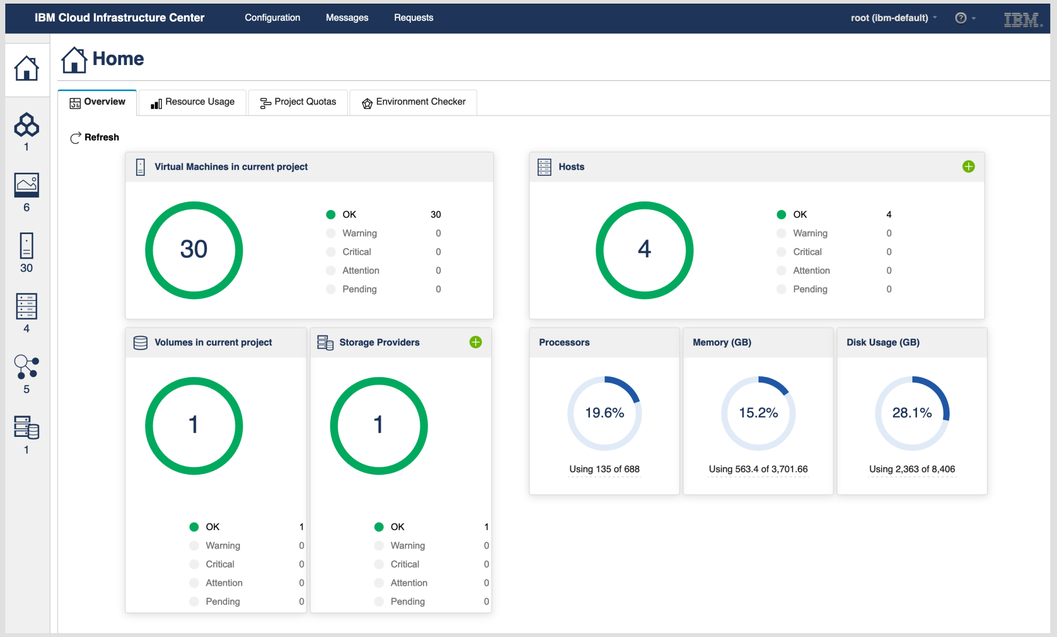
Infrastructure-as-a-Service for IBM Z/IBM® LinuxONE

Hybrid Cloud

IaaS layer for
hybrid cloud deployments

Guest provisioning for
noncontainerized
workloads

Foundation for scalable Infrastructure-as-a-Service (IaaS) management of traditional and cloud workloads across the enterprise and hybrid cloud



Infrastructure-as-a-Service for IBM Z/IBM® LinuxONE

Management dashboard for single system, multiple system, and multiple site administration

Capabilities

Modernize for hybrid cloud – empower how you manage, automate, and integrate infrastructure as a service

Infrastructure management

Instantiate, define, capture, and manage the full lifecycle of the virtual machines based on IBM z/VM® and Red Hat KVM on IBM Z / IBM® LinuxONE.

Service automation

Automate infrastructure management services for users via the Cloud Infrastructure Center self-service portal, while leveraging IBM Z / IBM® LinuxONE investments.

Cloud integration

Integrate the IBM Z / IBM® LinuxONE infrastructure across the enterprise and hybrid cloud by connecting the layers of cloud computing via OpenStack-compatible APIs.

Use cases

Simplified experience with virtualization

“Simplify”

Industry standard based and vendor-agnostic technology for simplified IaaS management

Deployment of Red Hat OpenShift clusters

“User Provisioned Infrastructure”

Support to help simplify and automate Red Hat OpenShift cluster deployments

IaaS management for service providers

“Tenant-safe services”

Service providers can offer tenant-safe IaaS, in a virtual environment

Deployment of on-premises database-as-a-service

“Data Gravity”

Select a database and automate deployments in an as-a-service model at scale.

Use case

Simplified experience with virtualization

As the platform's infrastructure solution, Cloud Infrastructure Center simplifies client experience with IBM Z / IBM® LinuxONE

Challenges

- Get started fast with first deployments
- New clients lack of skills
- Clients want to leverage exist skills and tooling

Solution

- Consistent, industry-standard user experience to manage lifecycle of virtual infrastructure based on IBM z/VM® and Red Hat KVM
- Built-in OpenStack compatible APIs enable usage of common mgmt. tools, such as IBM Cloud Paks, Red Hat tools, Terraform, or VMware vRealize Automation

Benefits

- Simplify client experience with virtualization
- Vendor-agnostic IaaS management
- Provide 'private cloud' infrastructure as a service via OpenStack for z/VM, KVM
- IaaS automation via Terraform, VMware vRealize, etc... using the API/CLI layer

Large retailer in US

Simple management of z/VM virtual machines and tooling integration

Challenge

The client has a large Linux environment running in z/VM based virtual machines (VM) and was looking to

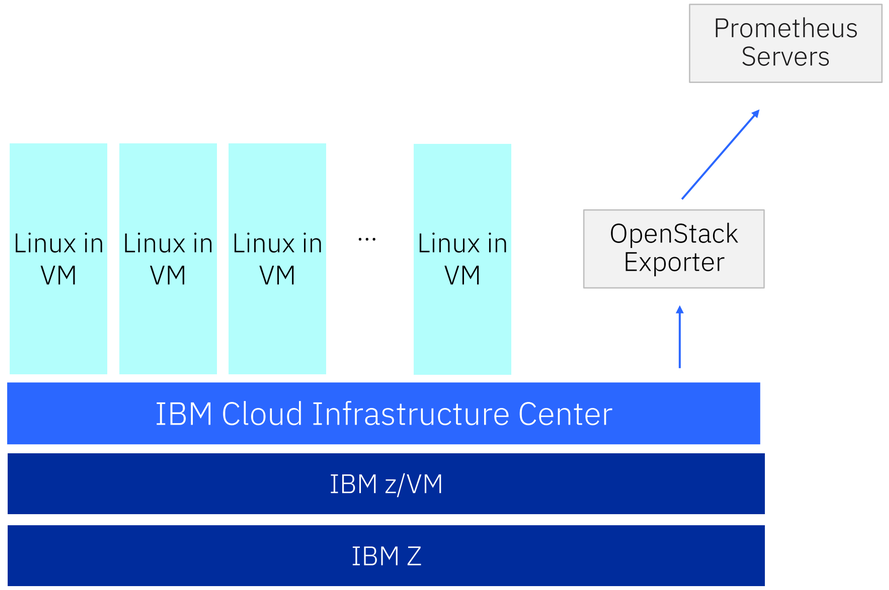
- simply the management of the existing environment, including the automation of services,
- benefit from Live Guest Relocation,
- build monitoring of the services with telemetry services, and
- integrate advanced tooling.

Solution benefits

IBM Cloud Infrastructure Center is used to

- Web user interface simplifies daily operations greatly: instantiate, define, capture, and manage the lifecycle of VMs
- provide Live Guest Relocation (LGR) for z/VM virtual machines
- manage monitoring data via monitoring/telemetry APIs
- easily expose and integrate IBM Z resources with other tools via OpenStack-compatible API

Solution



Use case

Deployment of Red Hat OpenShift clusters

Cloud Infrastructure Center supports the simplification and automation of Red Hat OpenShift Container Platform cluster deployments

Challenges

- Lack of automation for large deployments
- Manual deployment of Red Hat OpenShift cluster

Solution

- OpenStack compatible API, can be consumed by tools such as Red Hat Ansible, Red Hat CloudForms, or Terraform
- Ansible scripts can be written to support the Red Hat OpenShift cluster creation steps
- Deployment support for Red Hat OpenShift clusters

Benefits

- Simplification and automation of Red Hat OpenShift cluster provisioning
- Flexible and easier life-cycle management of Red Hat OpenShift
- No requirement for DHCP, FTP services for simple cluster creation

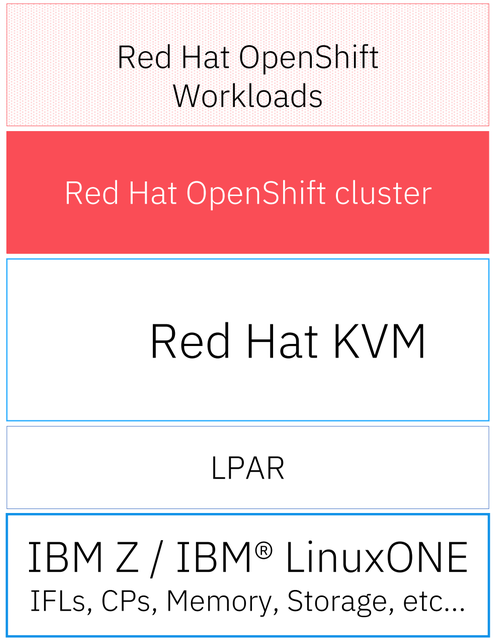
Blogs:

- Installing Red Hat OpenShift Container Platform (UPI) via IBM Cloud Infrastructure Center
- Using the Ansible playbook to operate IBM Cloud Infrastructure Center

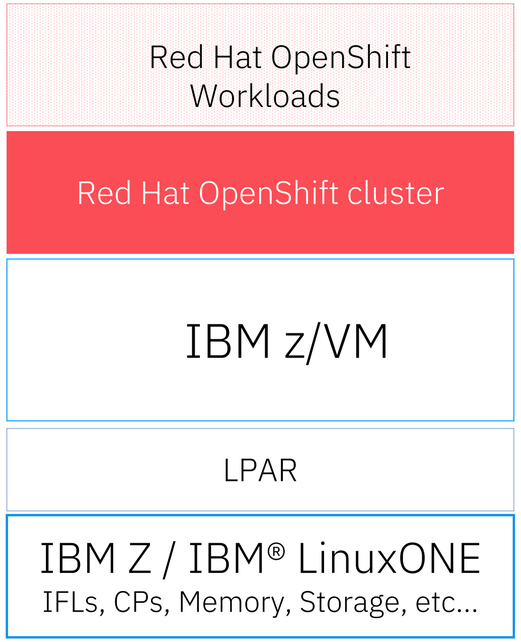
Download: Cloud Infrastructure Center OpenShift UPI Ansible Playbooks

- https://github.com/IBM/z_ansible_collections_samples/tree/master/z_infra_provisioning/cloud_infra_center/ocp_upi

Red Hat OpenShift deployment options and configuration possibilities on IBM Z and IBM® LinuxONE



- Standard 6 node cluster
- High availability cluster
- 3 node cluster
- SNO



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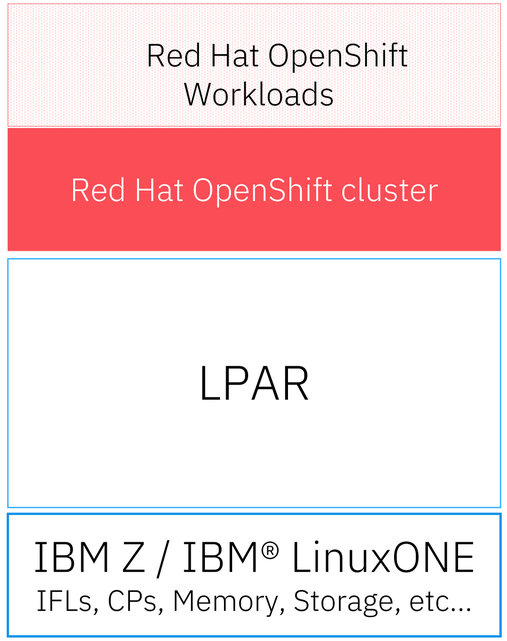
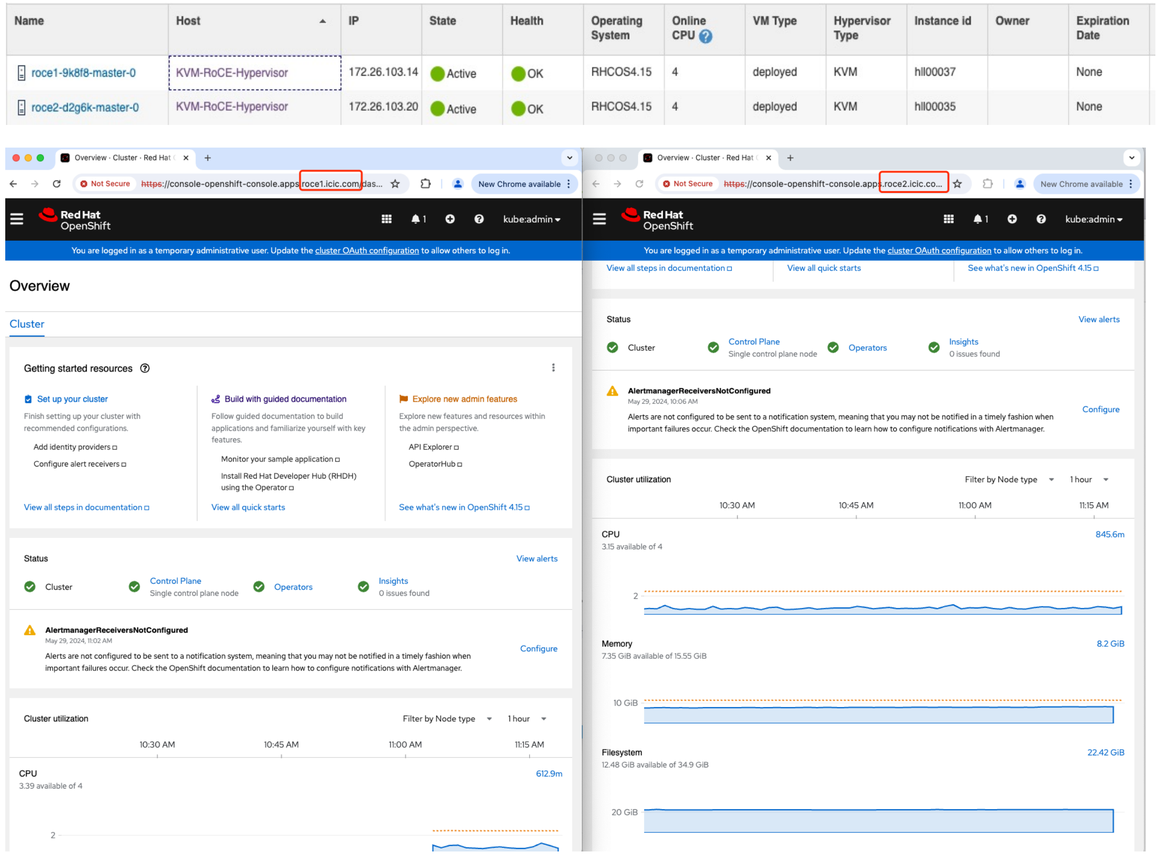


- Standard 6 node cluster
- High availability cluster
- 3 node cluster
- SNO

IBM Cloud Infrastructure Center 1.2.2 enhancements affecting Red Hat OpenShift

- RoCE card deployment on KVM
  - **Enhanced flexibility:** support of Red Hat OpenShift deployment through RoCE card on KVM offers a more efficient and flexible deployment option
  - **Automated DHCP server configuration:** including the port IP, MAC address, and DNS, reduces the manual setup time and minimizing errors
  - **Multi-cluster support:** the deployment of multiple Red Hat OpenShift clusters on a single RoCE card can optimize the resource utilization and simplifies the management
- Support for single-node OpenShift (SNO) deployment:
  - **Single-node deployment:** support of Red Hat OpenShift deployment on a single node, simplifying setups for small environments



Key new functions with Cloud Infrastructure Center 1.2.2

- Storage related:
  - Advanced storage scheduler with IBM FlashSystem FC host awareness
  - Customized filter with physical connectivity detection
  - Customized filter for each compute node’s storage providers
- New for KVM:
  - Enable KVM multi-attach capability
  - RoCE Express enablement in KVM compute node
- Security administrator and network administrator roles added.
- Attach/detach a NIC for a given VM
- Flexible resources customization for z/VM VMs:
  - Support to indicate the max memory during deployment for a z/VM virtual machine
  - Support to use a VDISK as swap disk for deployment of a z/VM virtual machine, optionally
- SMTP TLS client certificate enablement during the SMTP setup
- User experience improvements

Please see the IBM Cloud Infrastructure Center documentation to search and find detailed information about all capabilities : ibm.com/docs/en/cic

Advanced storage scheduler with IBM FlashSystem FC host awareness

- Advanced scheduler for volume creation with IBM FlashSystem FC host awareness.

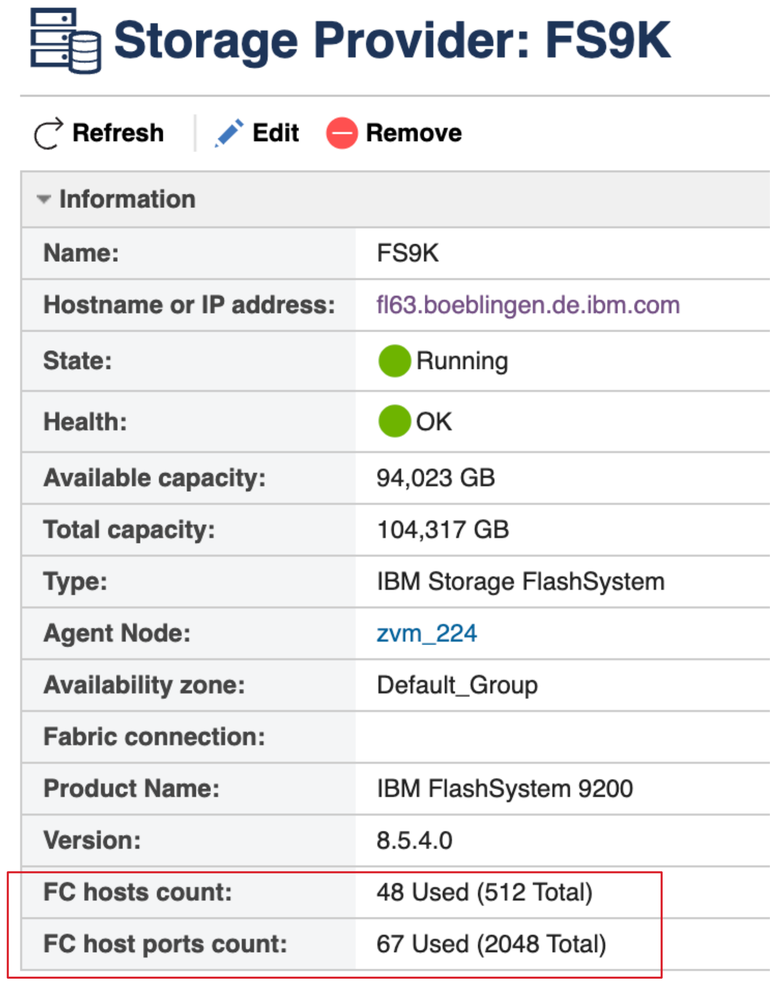
Business value

- Monitor and select best fit storage provider to schedule the volume creation and avoid overloading the FC Hosts and FC Host Ports of IBM FlashSystem , instead of planning ahead and rescue after over-allocation.

Use case:

Today’s problem: Overloading FC hosts and ports can lead to performance degradation, causing delays in data access and reducing overall system efficiency.

Solution: By intelligently scheduling volume creation and distributing the load, this feature prevents a wrong setup during the volume creation stage.

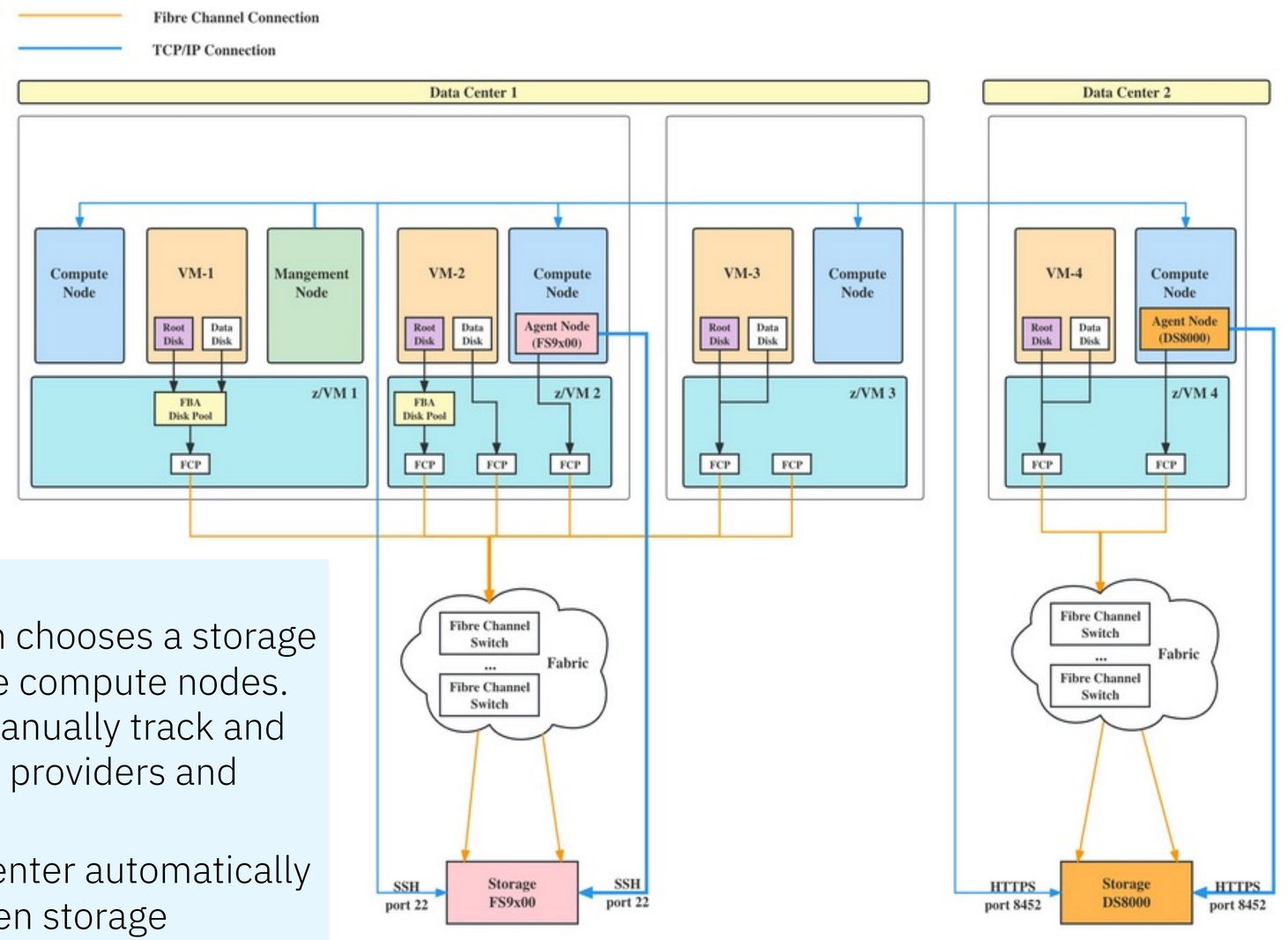


Customized filter with physical connectivity detection

- Automatically detect the physical connectivity between storage providers and compute nodes and filter out the storage providers which don’t have physical connectivity.

Business value

- Ensure the chosen storage provider has the physical connectivity with the compute node to prevent Boot from Volumes (BFV) failures stemming from FC connectivity issues. It saves effort and time by eliminating the need to manually pre-check connectivity before initiating a BFV operation.



Use case:

Today’s problem: BFV failures can occur when an admin chooses a storage provider that lacks proper physical connectivity with the compute nodes. It is complex and impractical for the administrator to manually track and remember physical connectivity among various storage providers and compute nodes.

Solution: With this feature, IBM Cloud Infrastructure Center automatically detects and verifies the physical FC connectivity between storage providers and the specified compute node.

Isolate compute nodes and storage providers

Customized filter for each compute node’s storage providers

- Support the setting of blocked storage providers or allowed storage providers per compute node.
- It isolates storage providers and compute hosts when you boot virtual machines from volumes or attach volumes to virtual machines.

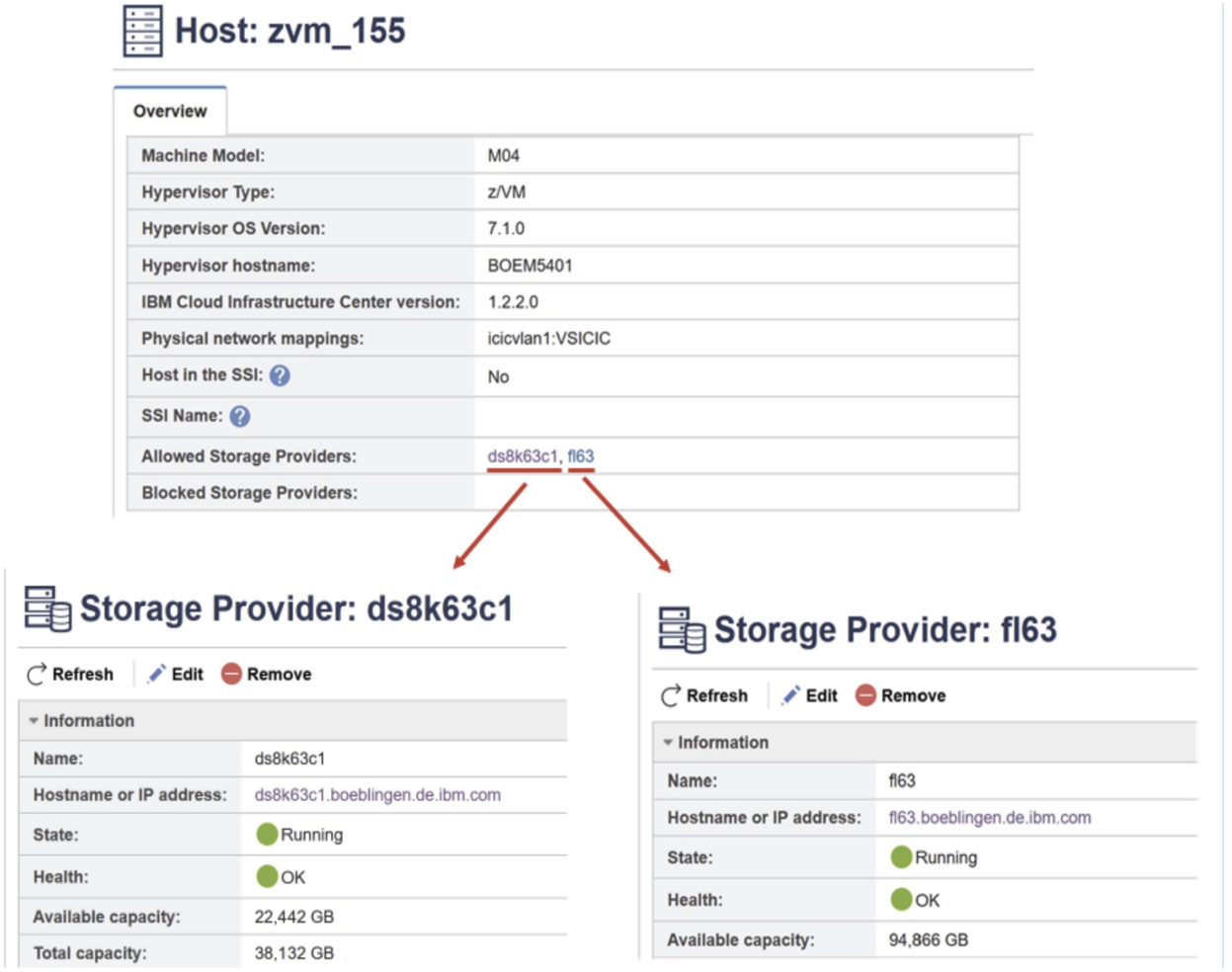
Business value

- Isolating storage providers per compute node simplifies the management of storage resources, reducing the complexity of storage configurations.

Use case:

Today’s problem: Managing multiple storage configurations for different compute nodes can be highly complex and error-prone, especially in large-scale environments where diverse workloads require different storage characteristics.

Solution: Isolating storage providers per compute node standardizes and simplifies the storage setup for each node. This isolation means that administrators can manage storage configurations independently, reducing the risk of misconfiguration and making the system easier to maintain.



Enable KVM multi-attach capability

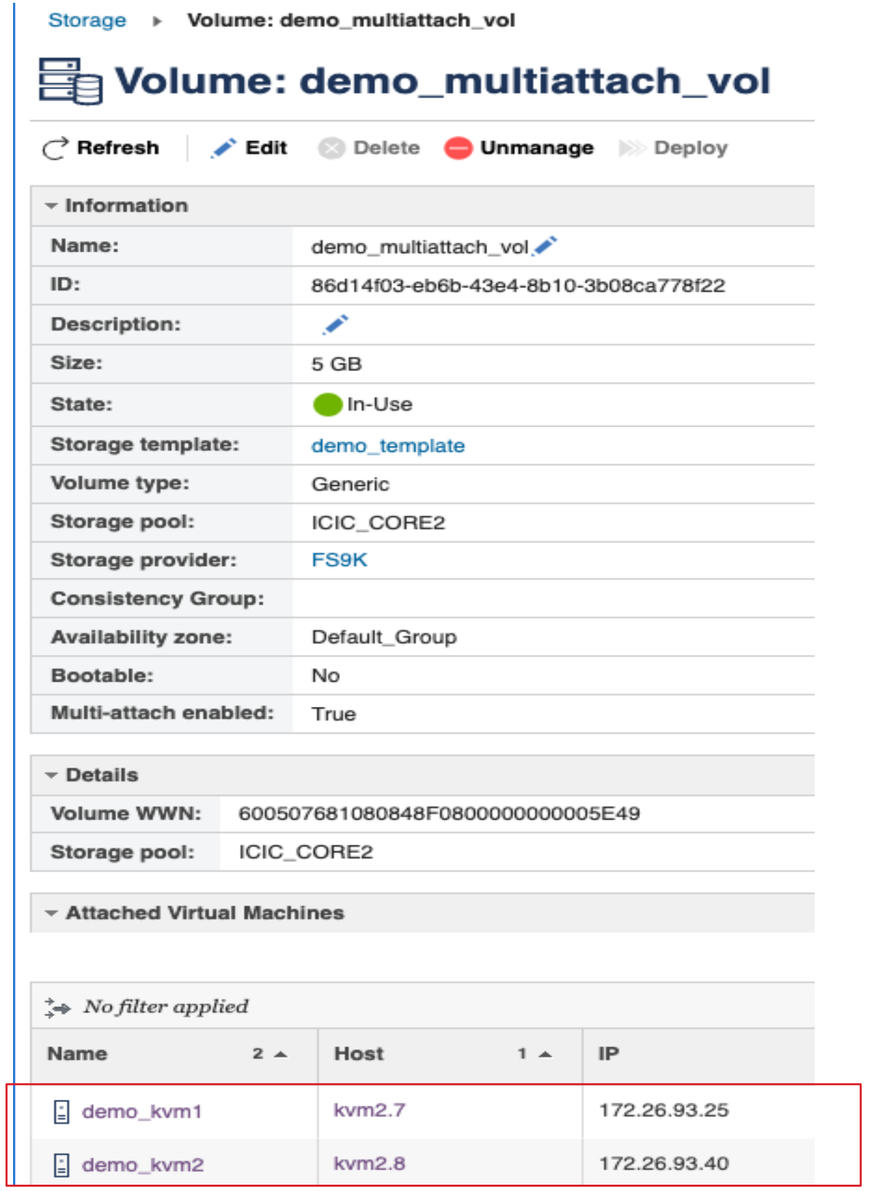
Share volumes among KVM VMs

- Enable to attach a volume with multi-attach capability to multiple KVM VMs.

Business value

- Multiple KVM VMs can access the same volume, allowing better load distribution. In case one VM fails, another can continue accessing the volume without interruption, improving system reliability.

```
root kvm_core2_ip_2_7 ~ virsh dumpxml RENP0006 | grep "type='block'" -A 8 | grep 5e49
      <source dev='/dev/disk/by-id/dm-uuid-mpath-3600507681080848f0800000000005e49' index='4'/>
root kvm_core2_ip_2_8 ~ virsh dumpxml RENP0007 | grep "type='block'" -A 8 | grep 5e49
      <source dev='/dev/disk/by-id/dm-uuid-mpath-3600507681080848f0800000000005e49' index='4'/>
```



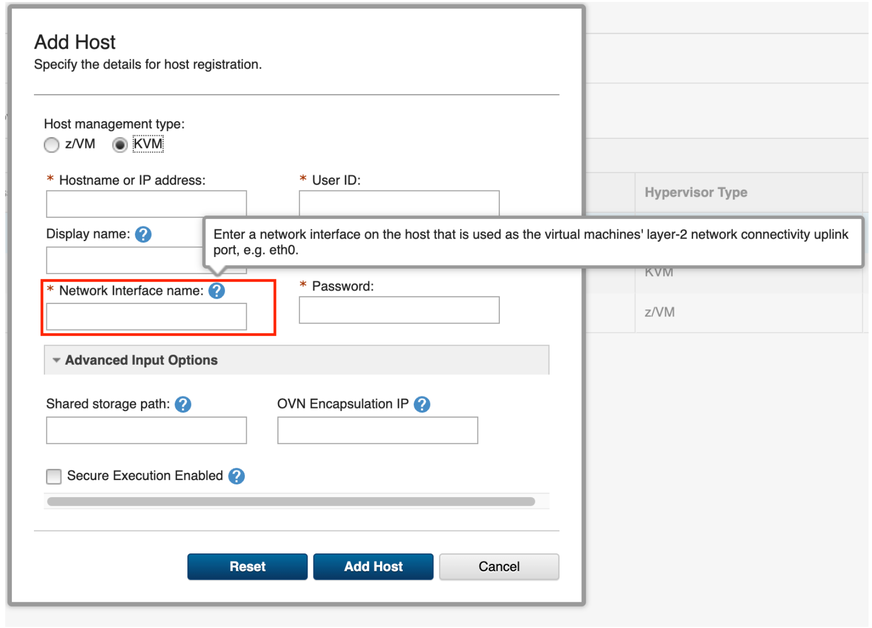
RoCE Express enablement in KVM compute node

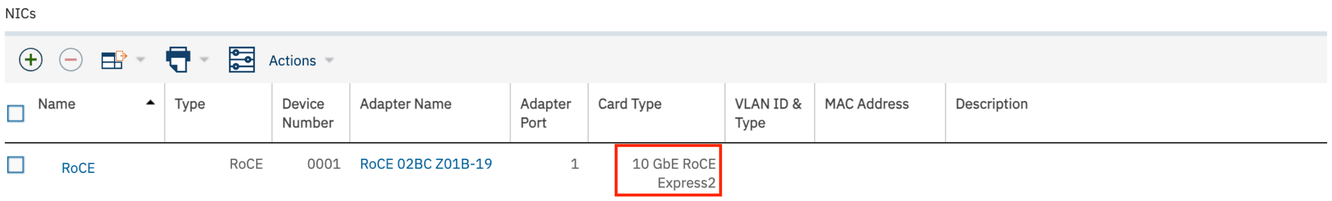
RoCE Express connection on IBM Z and IBM LinuxONE

- Ability to use RoCE Express as uplink port to KVM VMs

Business value

- Gain better performance by connecting Linux VMs via RoCE Express.





New roles supported in Cloud Infrastructure Center

Network Administrator and Security Administrator role

Business value

- Provide more precise authority division for roles.
- Improve the security strategy for enterprise to manage the access control to Cloud Infrastructure Center.

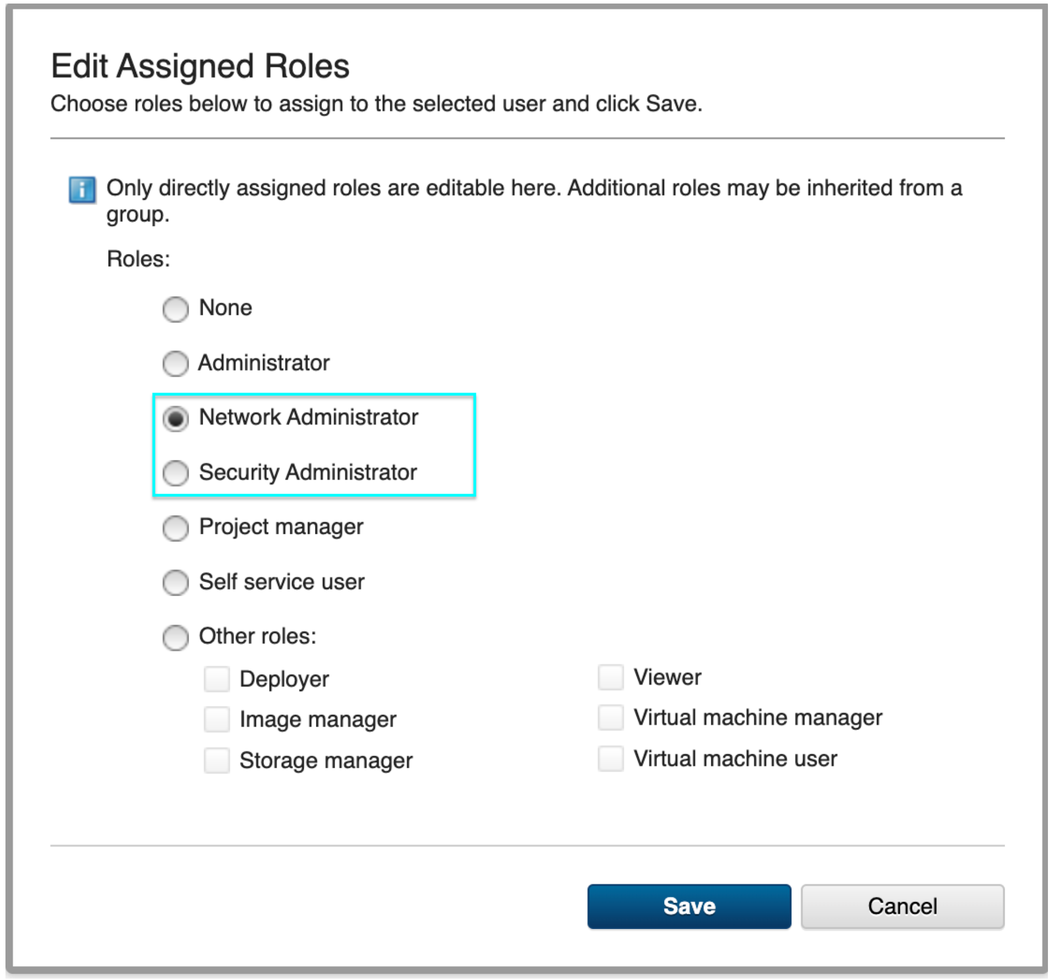
Use case:

Today's problem:

Enterprise services providers need to provide finer granularity authority access control of Cloud Infrastructure Center. Cloud Infrastructure Center already provides abilities for RBAC (Role-Based Access Control). However, more authority divisions are needed for network resources and security resources management.

Solution:

Enhance existing RBAC (Role-Based Access Control) with new roles for network and security management of Cloud Infrastructure Center.



Network administrator role

Cloud network administrator

Network administrator of `ibm-default` project.

They are able to manage all projects' networks related resources in ibm-default` project.

Network administrator

Network administrator of other project.

They are able to manage networks related resources of his own project , public or shared to the project

Network administrator responsibilities

- Creating, editing, or removing networks
- Locking or unlocking IP addresses of a network
- Viewing network topologies
- Creating, editing, or removing routers
- Setting or clearing gateway of a router
- Adding or removing interfaces of a router
- Adding or removing static routes of a router
- Allocating or releasing IP to a project
- Associating or disassociating IP
- Viewing all resources except users and groups, projects, storage-related configurations, email-notification-related configurations.

Security administrator role

Cloud Security Administrator

Security administrator of `ibm-default` project.

They are able to manage all projects' security groups related resources in ibm-default` project.

Security Administrator

Secuirty administrator of other project.

They are able to manage security groups related resources of his own project , public or shared to the project

Security administrator responsibilities

- Creating, editing, or removing security groups
- Managing security group rules of a security group
- Viewing all resources except users and groups, projects, storage-related configurations, email-notification-related configurations.

Attach/detach a NIC for a given VM

Dynamical network interface management

Enable to attach a new network interface card (NIC) to the given virtual machine on the fly or detach the NIC from the virtual machine dynamically.

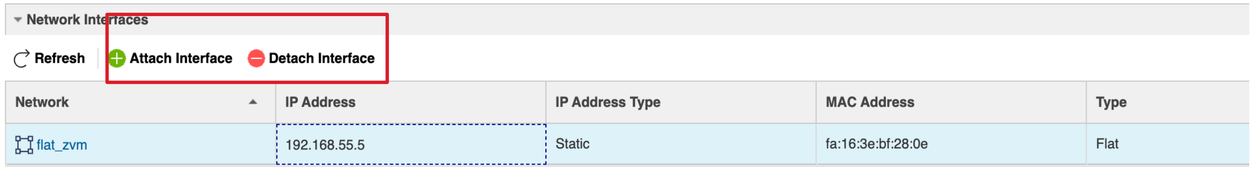
Business value

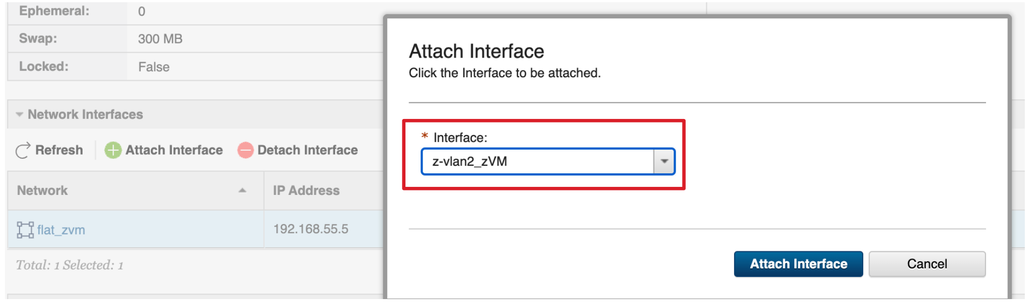
- The user can add the various NICs to the running virtual machines without breaking the current workload, so that they can use the new attached NIC to run the workload, and can remove the existing network NICs if not needed.

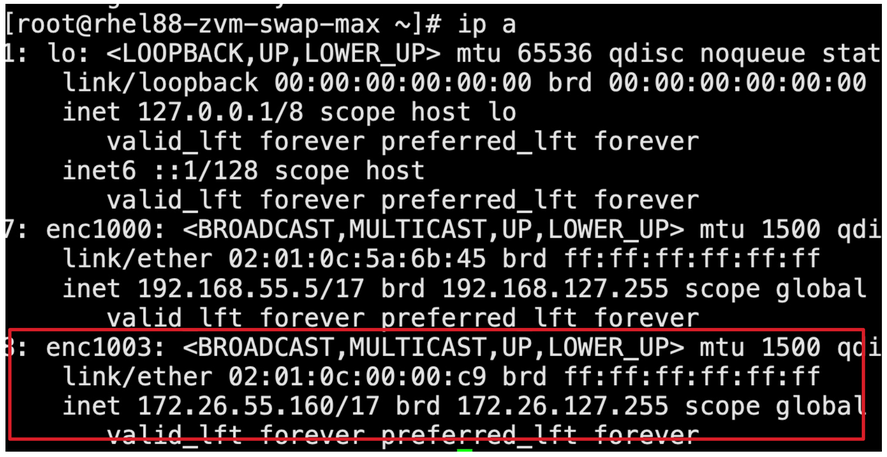
Use case:

Today's problem: After the VM is deployed, its network interfaces are immutable, the user can not add or remove the network interfaces for it.

Solution: Using this feature, the administrator can dynamically add or remove the network interfaces for the VM.





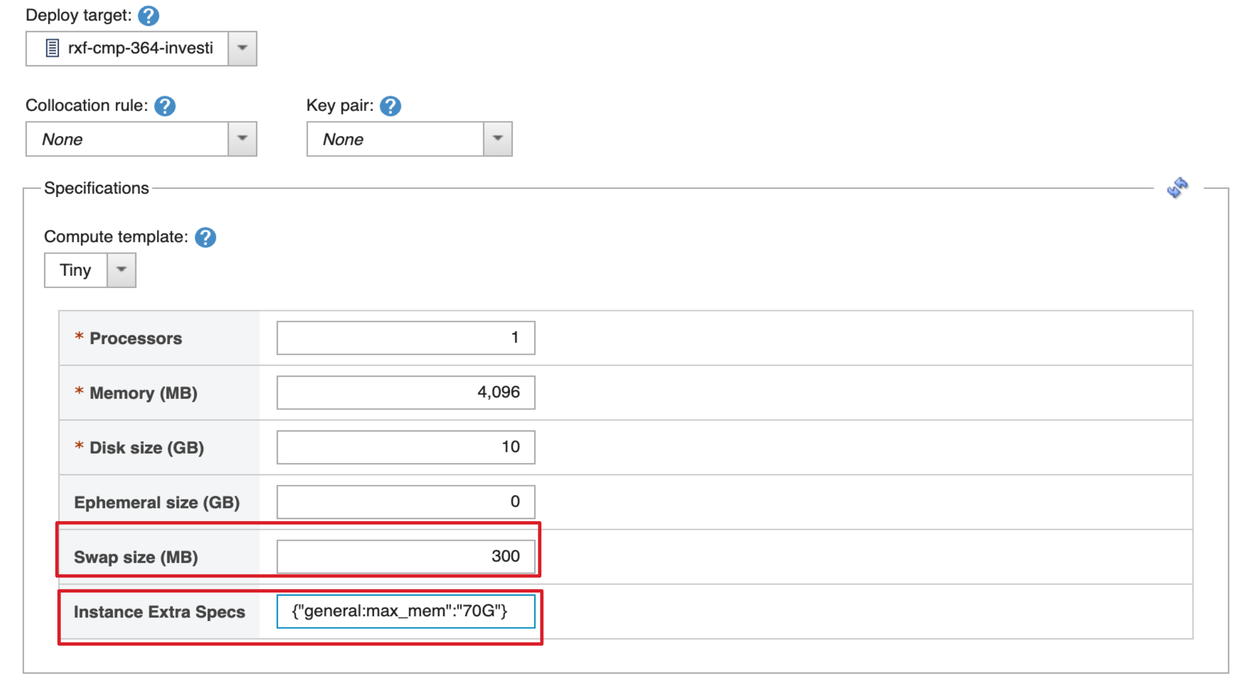


Flexible resources customization

Flexible resources customization

Business value

- Enable to use V-DISK as swap disk for the deployments of the z/VM virtual machines
- Enable to customize the max memory of the deployed z/VM virtual machines




```
[root@rhel88-zvm-swap-max ~]# lsblk
NAME     MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
loop0      7:0    0  482K  0 loop
dasda     94:0    0   10G  0 disk
└─dasda1  94:1    0   10G  0 part /
dasdb     94:4    0  300M  0 disk
└─dasdb1  94:5    0  300M  0 part [SWAP]
```

```
USER XY500030 LBYONLY 4G 70G G
INCLUDE ZCCDFLT
COMMAND SET VCONFIG MODE LINUX
COMMAND DEFINE CPU 00 TYPE IFL
COMMAND DEF STOR INITIAL STANDBY REMAINDER
IPL 0100
LOGONBY IAASADM
MACHINE ESA 32
SHARE RELATIVE 100
NICDEF 1000 TYPE QDIO DEVICES 3 MACID 5A6B45 LAN SYSTEM VSICIC
MDISK 0101 FB-512 V-DISK 614400 MWV
MDISK 0100 3390 262148 14564 T60103 MR
```

Integrating with Instana

Hypervisor Page:

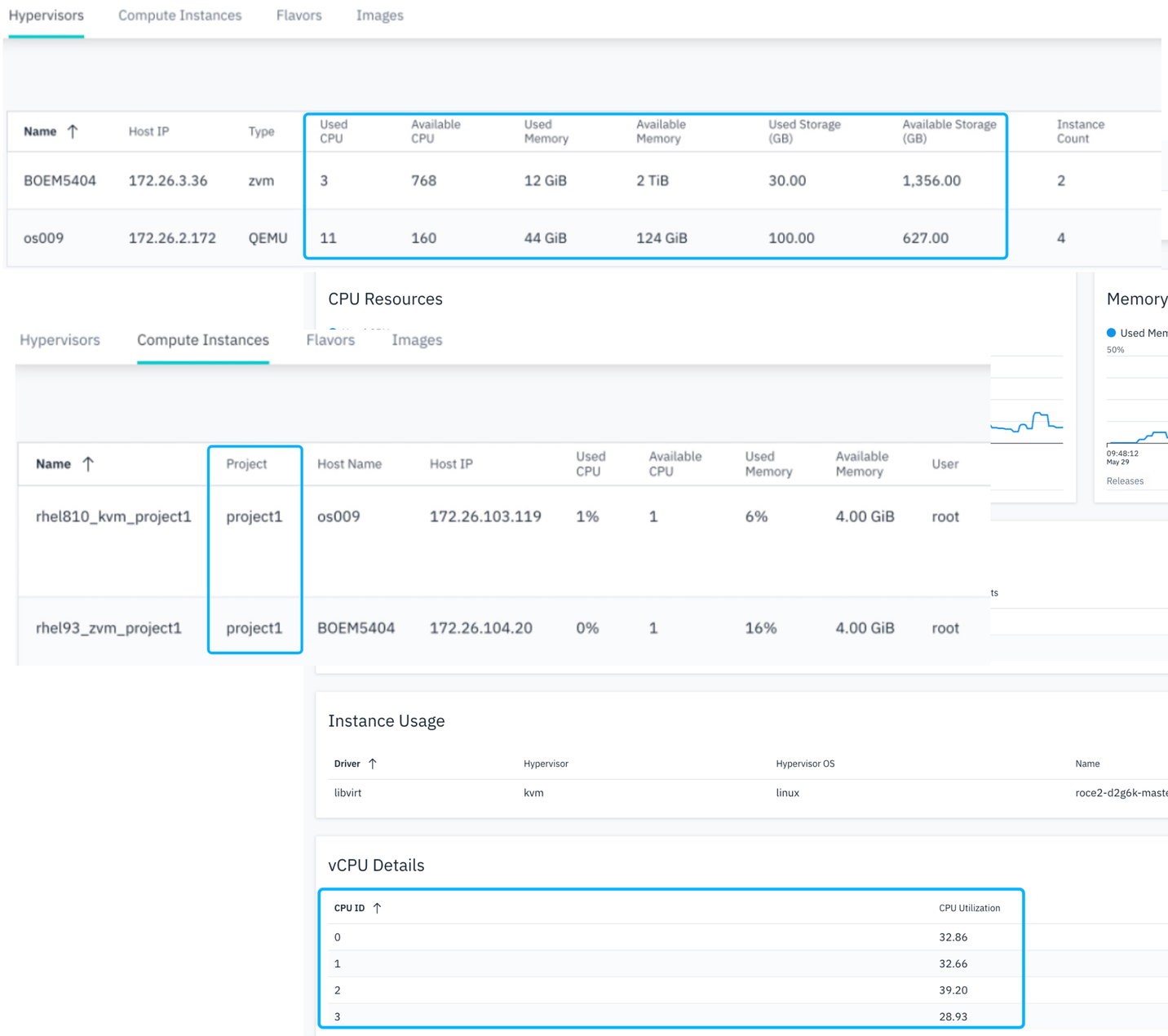
- **Enhanced Data Accuracy:** Adjusted the display of used and available hypervisor data. Users can now access precise and reliable hypervisor information.

Compute Instances Page:

- **Project-Specific Display:** The VM page now exclusively shows VMs associated with the current project, ensuring a clear and focused view.

Compute Instances Detail Page:

- **Details CPU metrics:** Added the ability to display CPU utilization for each individual CPU core, providing deeper insights into performance.



1.2.2 - supported hypervisors, operation systems & servers

As a managed hypervisor:
- z/VM 7.3 or z/VM 7.2
- KVM as part of RHEL 8.8 or 8.10

As a host environment on z/VM or KVM:
- RHEL 8.8 or 8.10

As a deployable guest operating system instance on z/VM:
- RHEL 7.9, 8.2-8.9, 9.0-9.3
- Red Hat CoreOS 4.12, 4.13, 4.14 or 4.15 as part of Red Hat OpenShift Container Platform
- SUSE Linux Enterprise Server 15 SP2 – SP4
- Ubuntu 20.04 or 22.04

As a deployable guest operating system instance on KVM:
- RHEL 7.9, 8.2-8.9, 9.0-9.3
- Red Hat CoreOS 4.12, 4.13, 4.14 or 4.15 as part of Red Hat OpenShift Container Platform

Hardware platforms:
- IBM z16™ (all models)
- IBM z15™ (all models)
- IBM z14® (all models)
- IBM® LinuxONE 4 (all models)
- IBM® LinuxONE III (all models)
- IBM® LinuxONE II (all models)

Key new functions with Cloud Infrastructure Center 1.2.1

- FCP device limit management
- z/VM Multipath IPL (alternative path)
- Remote console access (KVM)
- HiperSockets enablement for KVM
- Export host into into csv
- Storage agent High available support
- Chargeback support through Cloud Pak for AIOps
- Deploy z/VM instance with specified USERID
- allow_lun_scan enablement by default
- User experience enhancement

Please see IBM Cloud Infrastructure Center documentation to search and find all capabilities

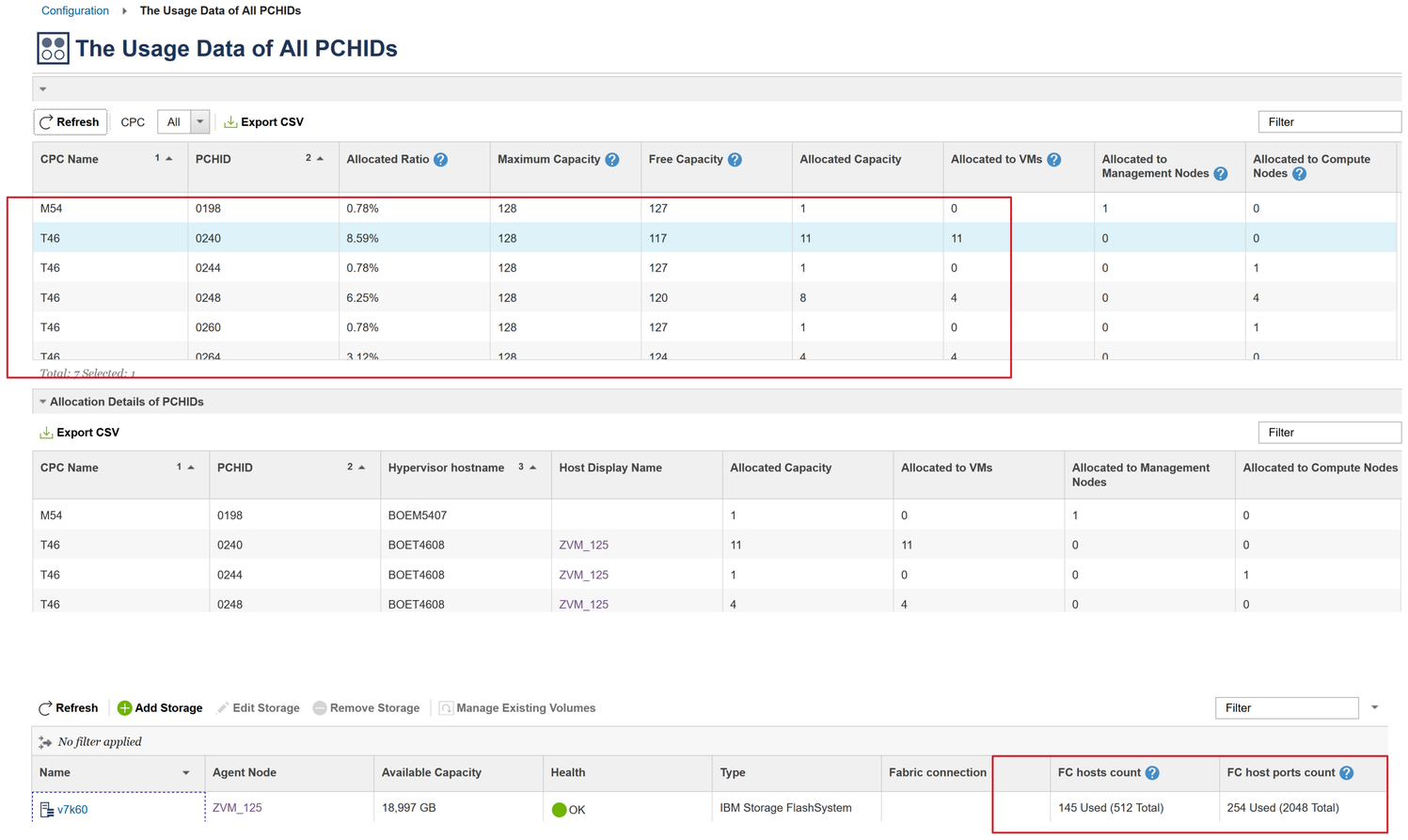
PCHID awareness FCP device allocation on z/VM hosts and storage FC host awareness on FS9x family

Efficient & flexible FCP device management

- PCHID awareness FCP device placement to select best fit FCP device and honor the pre-defined limit of FCP allocations on PCHID
- Report used FC hosts counts and ports information on FS9x storage

Business value

- Provide data about the FCP device usage per CHPID including allocation, free, maximum capacity
- Monitor and select best fit PCHID to schedule the workload and avoid overload the FCP card, instead of planning ahead and rescue after over-allocation of the FCP devices on the same PCHID



Multipath IPL enablement on z/VM VMs

High available for VM boot from FCP

Setup Multipath IPL on z/VM VM definition (USER DIRECT)

Business value

- Ensure for VMs (that boot from FCP devices) to automatically setup the multipath settings, avoiding a single point of failure that can be caused by FCP path issue at the boot phase of VMs
- Highly improved business continuity

```
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
```

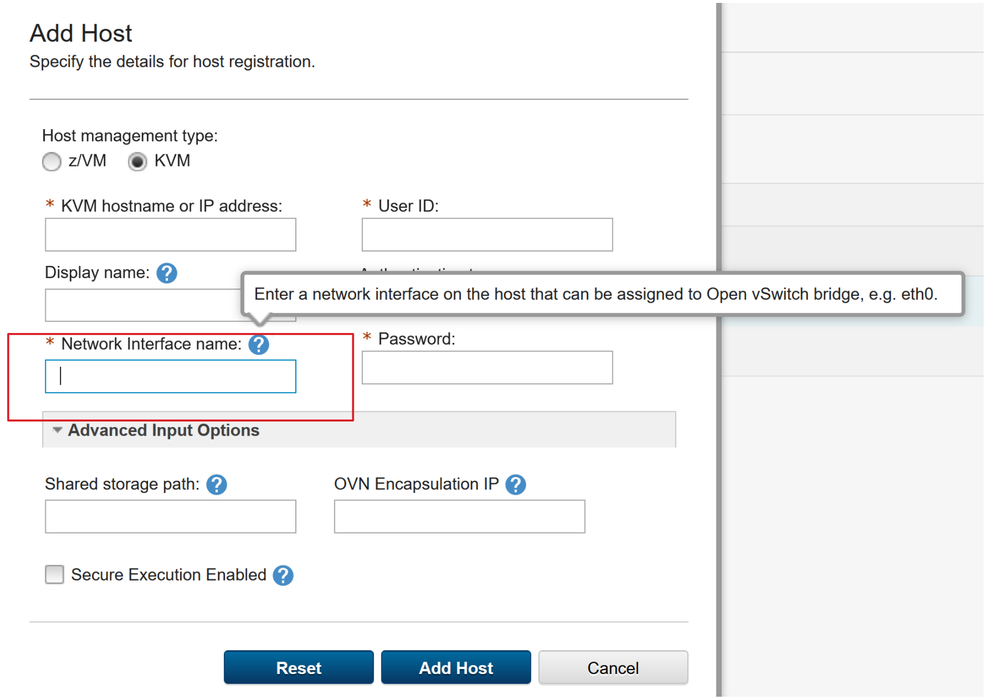
HiperSockets enablement in KVM compute node

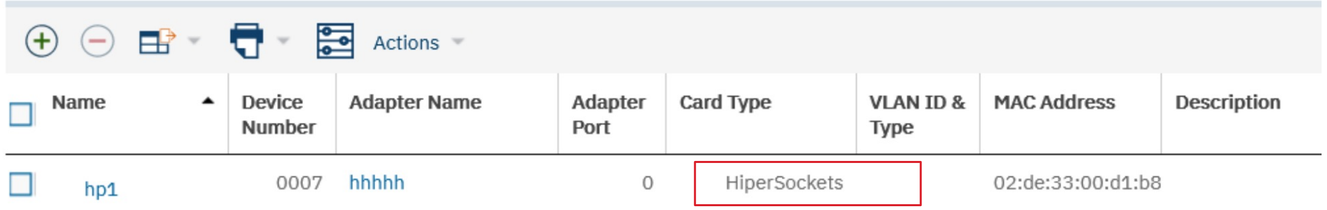
Ability to use HiperSockets as uplink port to KVM VMs

Business value

- Gain better performance by connecting Linux VMs and other OS such as IBM z/OS via HiperSockets on same IBM Z / IBM LinuxONE server

HiperSockets connection inside an IBM Z and IBM LinuxONE server





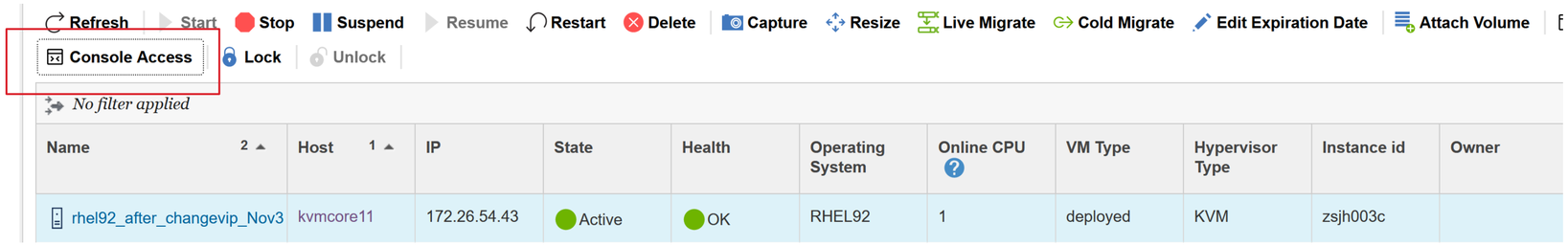
KVM VM remote console access

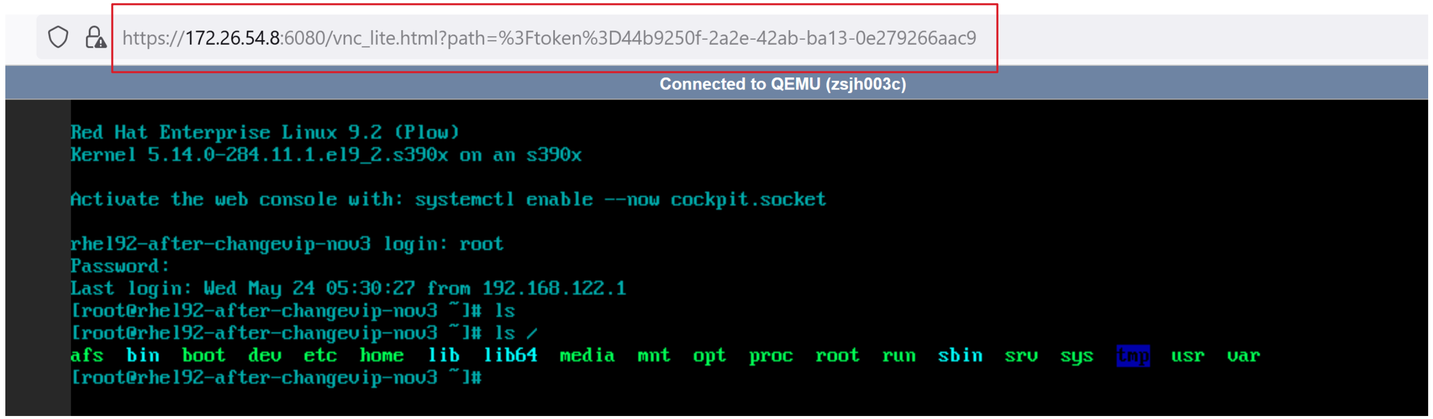
Access VM console through UI

Ability to access VMs through UI console (noVNC), even if there is no network

Business value

- Easier way to do daily operations on the VMs, admin/end user can access VMs via UI
- Rescue a VM through the UI, even the network of the VM is down (e.g., start network manager)





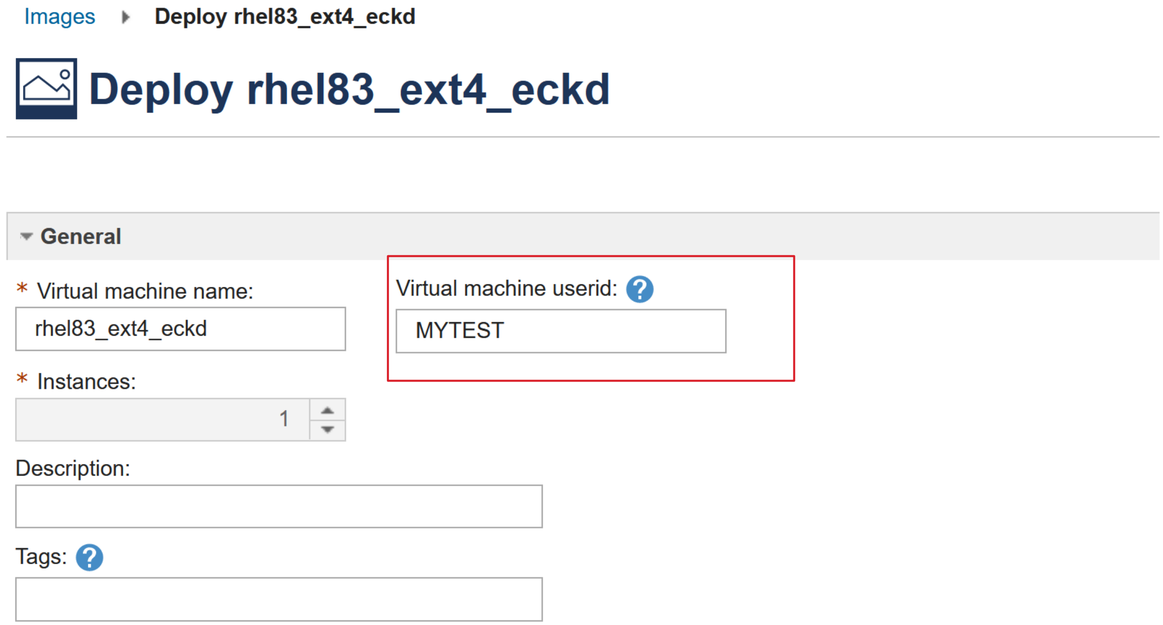
Input USER ID during z/VM VM deployment

Flexible z/VM USER ID Management

Enable to set alternative USER ID when deploying z/VM VM, instead of the default USER ID generated from the Cloud Infrastructure Center template

Business value

- Alignment of the VM naming convention with the company rules or existing best practice
- More flexibility for the naming of the USER ID




```
USER MYTEST LBYONLY 4G 100G G
INCLUDE ZCCDFLT
COMMAND SET VCONFIG MODE LINUX
COMMAND DEFINE CPU 00 TYPE IFL
COMMAND DEF STOR INITIAL STANDBY REMAINDER
IPL 0100
LOGONBY IAASADM
MACHINE ESA 32
SHARE RELATIVE 100
NICDEF 1000 TYPE QDIO DEVICES 3 MACID 8980D8 LAN SYSTEM VSICIC
MDISK 0100 3390 556350 14564 CI2102 MR
*DVHOPT LNK0 LOG1 RCM1 SMS0 NPW1 LNGAMENG PWC20231110 CRCXX
```

Storage agent high availability support

High availability of storage agent

Business value

- Automatic failover of storage agent to other nodes for business continuity

  (storage agent handles the storage resources such as volume, snapshot, create, read, update, delete operations)

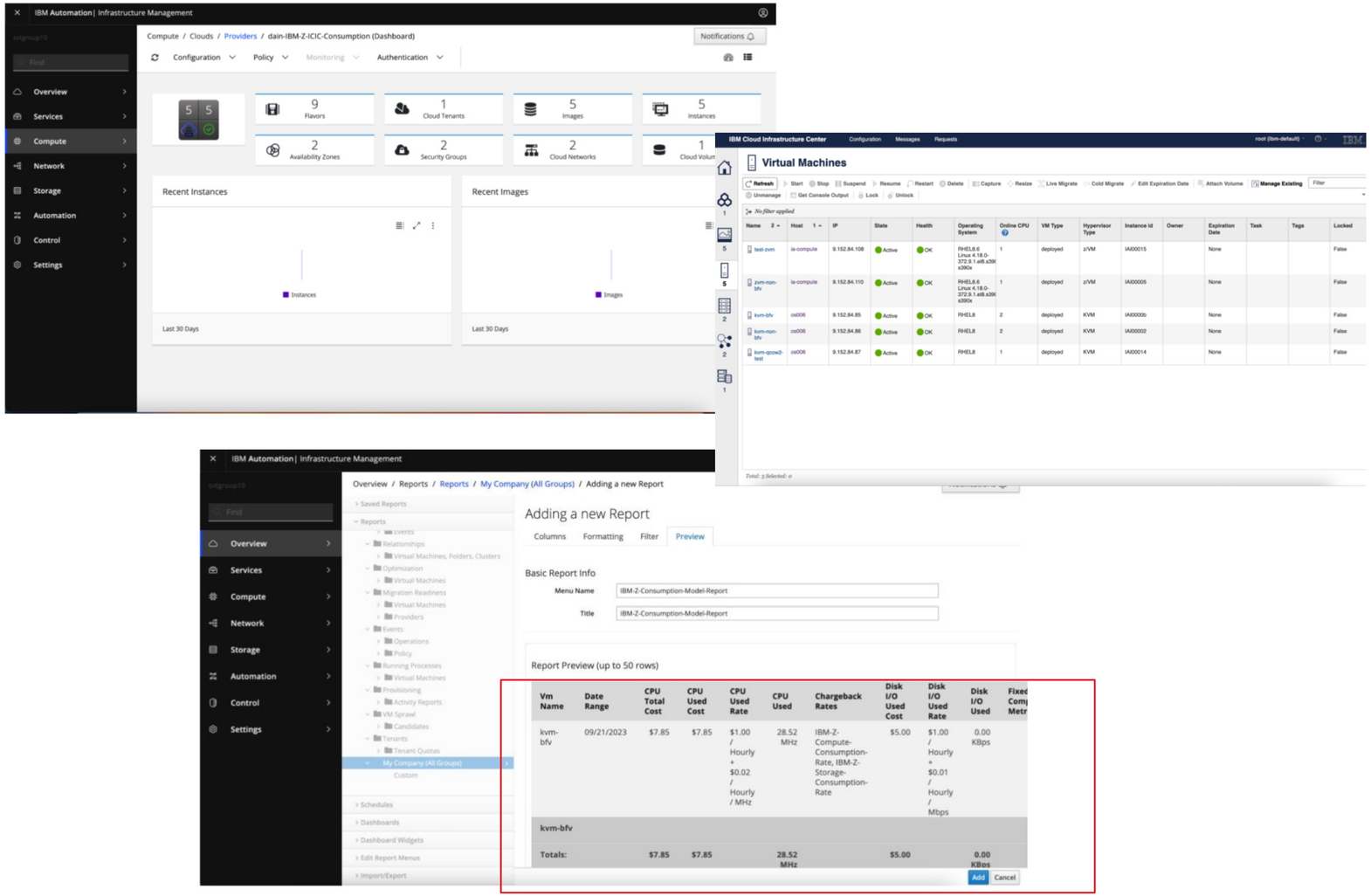
Chargeback support through IBM Cloud Pak for AIOps

Consumption based chargeback

Chargeback support through ‘IBM Cloud Pak for AIOps’ on RHEL KVM and z/VM hypervisor

Business value

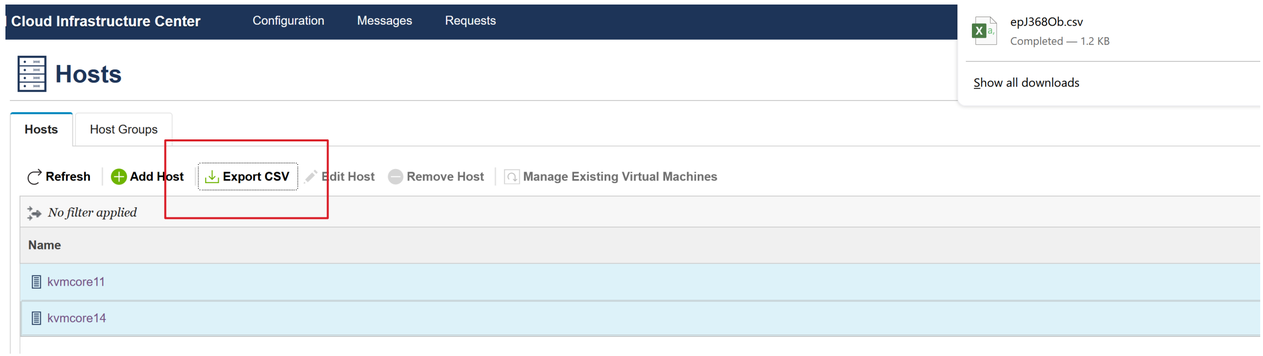
- Consumption based chargeback of used resources for internal / external tracking and audits



Export host info into csv file

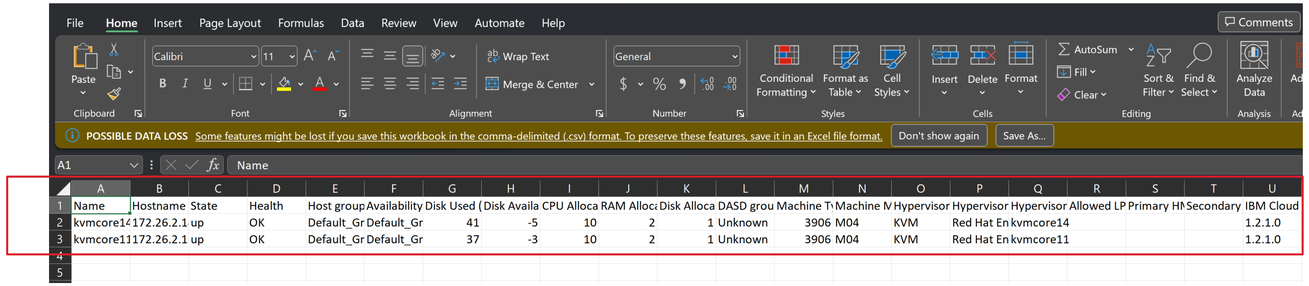
Summary of compute node (hypervisor)

Ability to expose the compute node (hypervisor) information into csv file



Business value

- Expose the compute nodes' information into a csv file
- Explore the status of all Cloud Infrastructure Center managed hypervisors



Default enablement of allow_lun_scan on compute and management nodes

Easier and flexible mgmt. of LUN settings

```
# cat /sys/module/zfcp/parameters/allow_lun_scan
Y
```

```
[root@kvmcore203 ~]# multipath -ll
mpatha (36005076306ffd3880000000000000003) dm-0 IBM,2107900
size=120G features='1 queue_if_no_path' hwhandler='1 alua' wp=rw
`-+- policy='service-time 0' prio=50 status=active
  |- 0:0:1:1073954816  sdc 8:32  active ready running
  `- 0:0:2:1073954816  sdd 8:48  active ready running
mpathh (36005076308ffd2cf0000000000000315) dm-6 IBM,2107900
size=10G features='1 queue_if_no_path' hwhandler='1 alua' wp=rw
`-+- policy='service-time 0' prio=50 status=active
  |- 0:0:10:1075134467 sdn 8:208 active ready running
  |- 0:0:12:1075134467 sdr 65:16 active ready running
  |- 0:0:8:1075134467  sdf 8:80  active ready running
  `- 0:0:9:1075134467  sdj 8:144 active ready running
mpathj (36005076308ffd2cf0000000000000222) dm-8 IBM,2107900
size=30G features='1 queue_if_no_path' hwhandler='1 alua' wp=rw
`-+- policy='service-time 0' prio=50 status=active
  |- 0:0:10:1075986434 sdm 8:192 active ready running
  |- 0:0:12:1075986434 sdq 65:0  active ready running
  |- 0:0:8:1075986434  sde 8:64  active ready running
  `- 0:0:9:1075986434  sdi 8:128 active ready running
mpathk (36005076308ffd2cf0000000000000a2a) dm-10 IBM,2107900
size=30G features='1 queue_if_no_path' hwhandler='1 alua' wp=rw
`-+- policy='service-time 0' prio=50 status=active
  |- 0:0:10:1076510730 sdo 8:224 active ready running
  |- 0:0:12:1076510730 sds 65:32 active ready running
  |- 0:0:8:1076510730  sdg 8:96  active ready running
  `- 0:0:9:1076510730  sdk 8:160 active ready running
mpatho (36005076308ffd2cf0000000000002904) dm-5 IBM,2107900
size=10G features='1 queue_if_no_path' hwhandler='1 alua' wp=rw
`-+- policy='service-time 0' prio=50 status=active
  |- 0:0:10:1074020393 sdp 8:240 active ready running
  |- 0:0:12:1074020393 sdt 65:48 active ready running
  |- 0:0:8:1074020393  sdh 8:112 active ready running
  `- 0:0:9:1074020393  sdl 8:176 active ready running
```

Business value

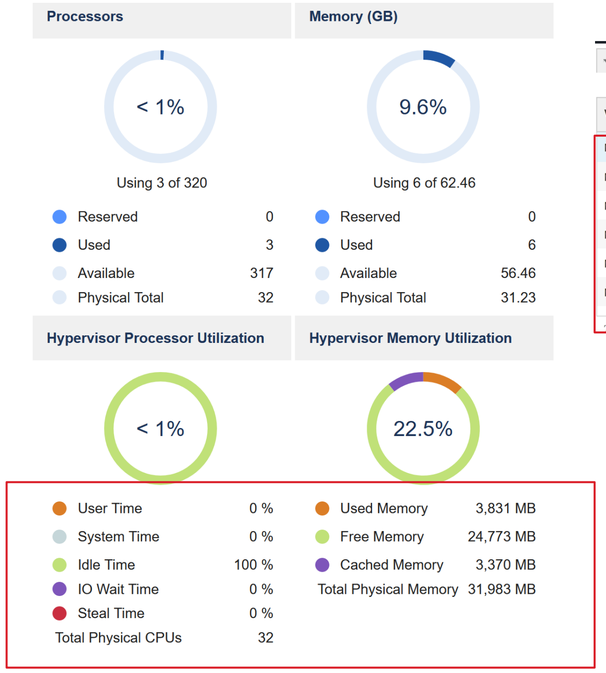
- Easy configuration of management and compute nodes, avoiding manual setup
- Automatic management of LUN

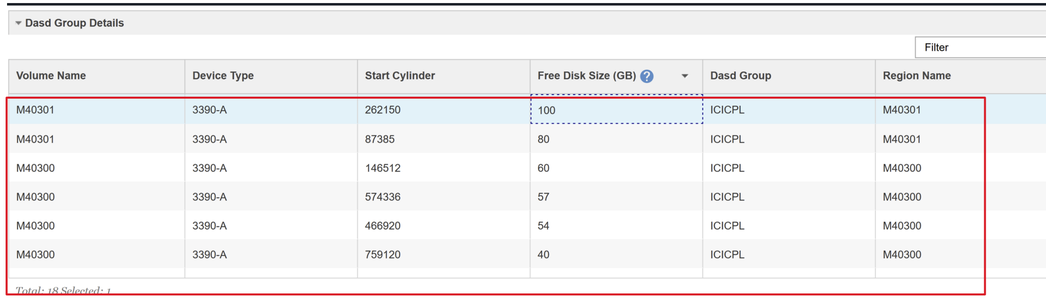
User experience improvement

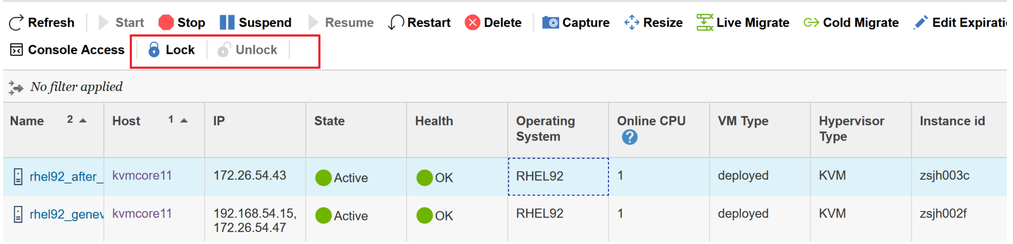
User experience improvement

Business value

- Compute node metrics include processor and memory utilization
- Lock and unlock of a VM, avoiding mis usage of critical VM
- Insights about what's configured and what's free, by showing z/VM DASD POOL in the UI







Questions?

Thank you!