

OpenStack enablement for IBM Z DPM

Sreeram Vancheeswaran

Team lead, Nova for DPM

Andreas R Maier

Architect, OpenStack for DPM

Marco Pavone

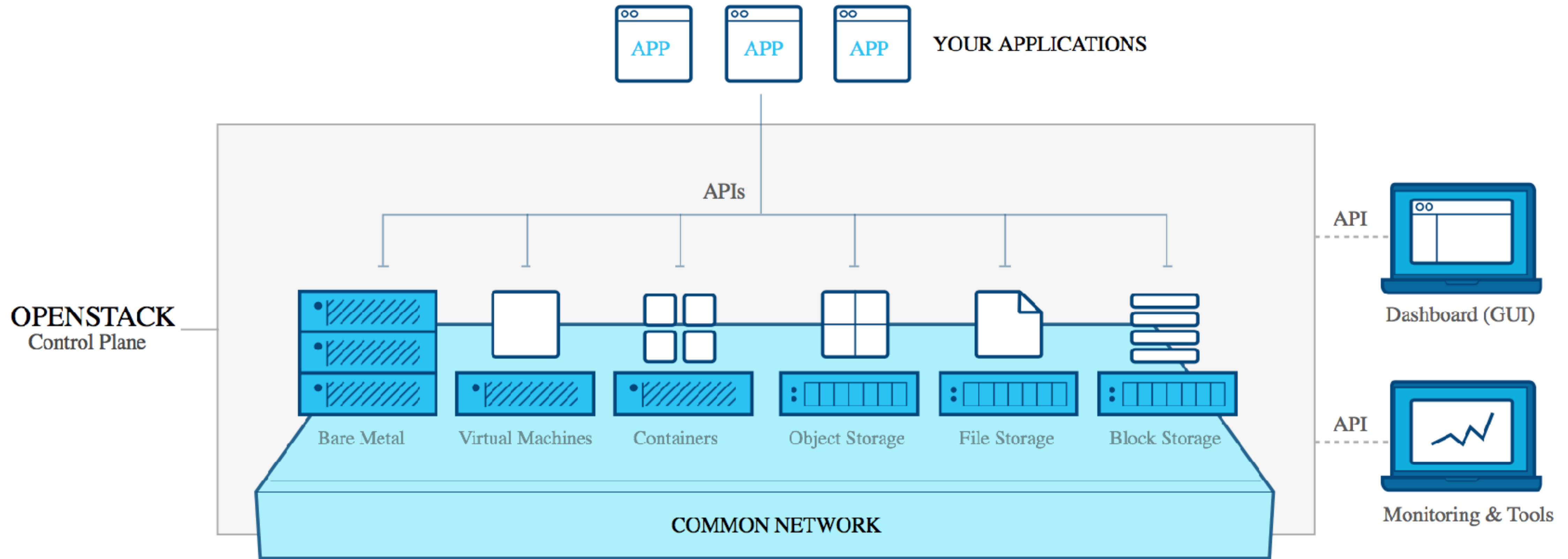
Team lead, OpenStack for DPM and KVM

Agenda

- Brief introduction to OpenStack
- Introducing IBM Z PR/SM hypervisor in DPM Mode
- OpenStack enablement for IBM Z PR/SM hypervisor in DPM Mode

Brief introduction to OpenStack

What is OpenStack?



What can OpenStack Automate?



Compute

6 OpenStack Projects



Storage, Backup & Recovery

5 OpenStack Projects



Networking & Content Delivery

7 OpenStack Projects



Data & Analytics

3 OpenStack Projects



Security, Identity & Compliance

4 OpenStack Projects



Management Tools

6 OpenStack Projects



Deployment Tools

6 OpenStack Projects



Application Services

4 OpenStack Projects



Monitoring & Metering

5 OpenStack Projects

OpenStack abstracts platform resources

OpenStack provides abstracted resources:

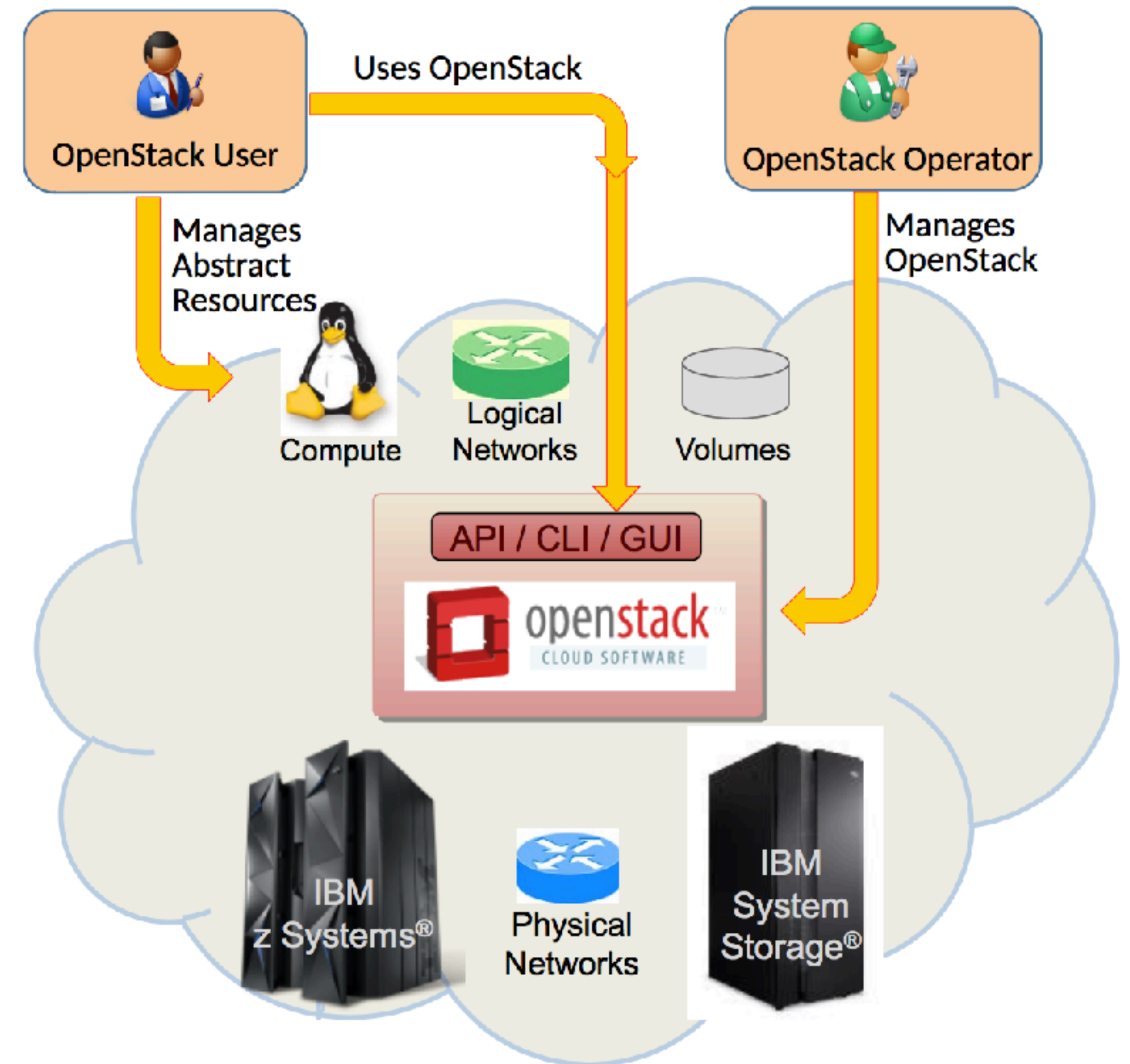
- Compute
- Logical Networks
- Block Storage (Volumes)
- Object Storage

OpenStack users

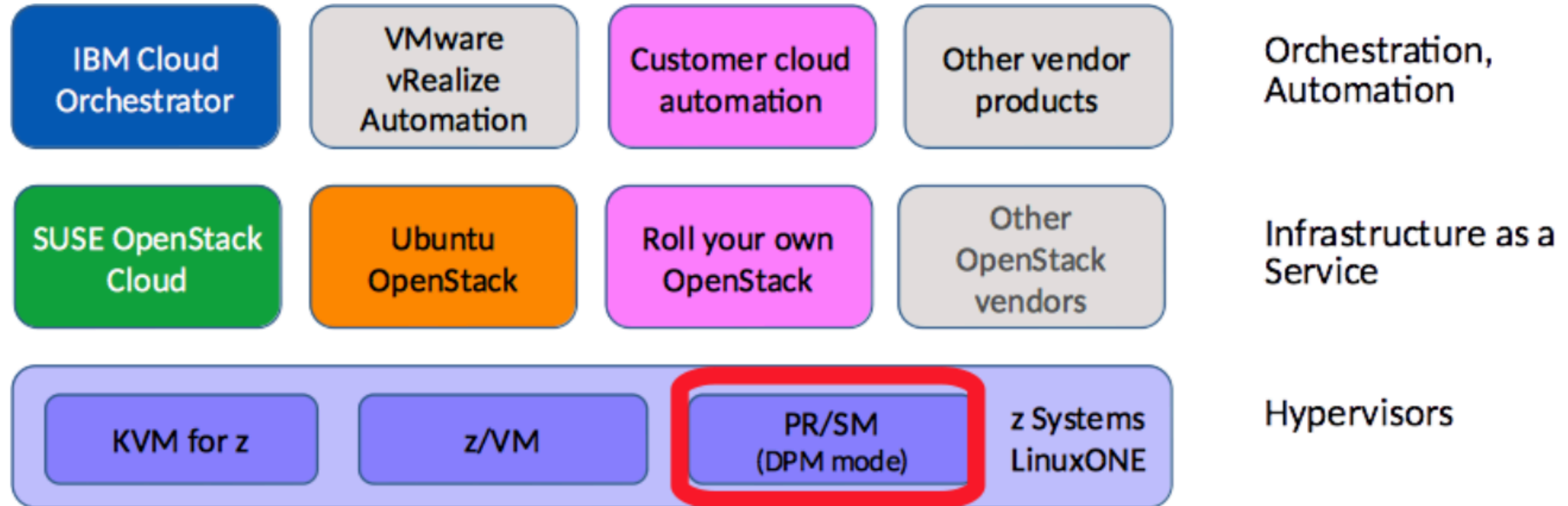
- can manage abstracted resources
- without having to understand details about the z platform

OpenStack admin

- has to understand the z platform
- maps OpenStack resource abstractions to platform resources



OpenStack ecosystem on IBM Z

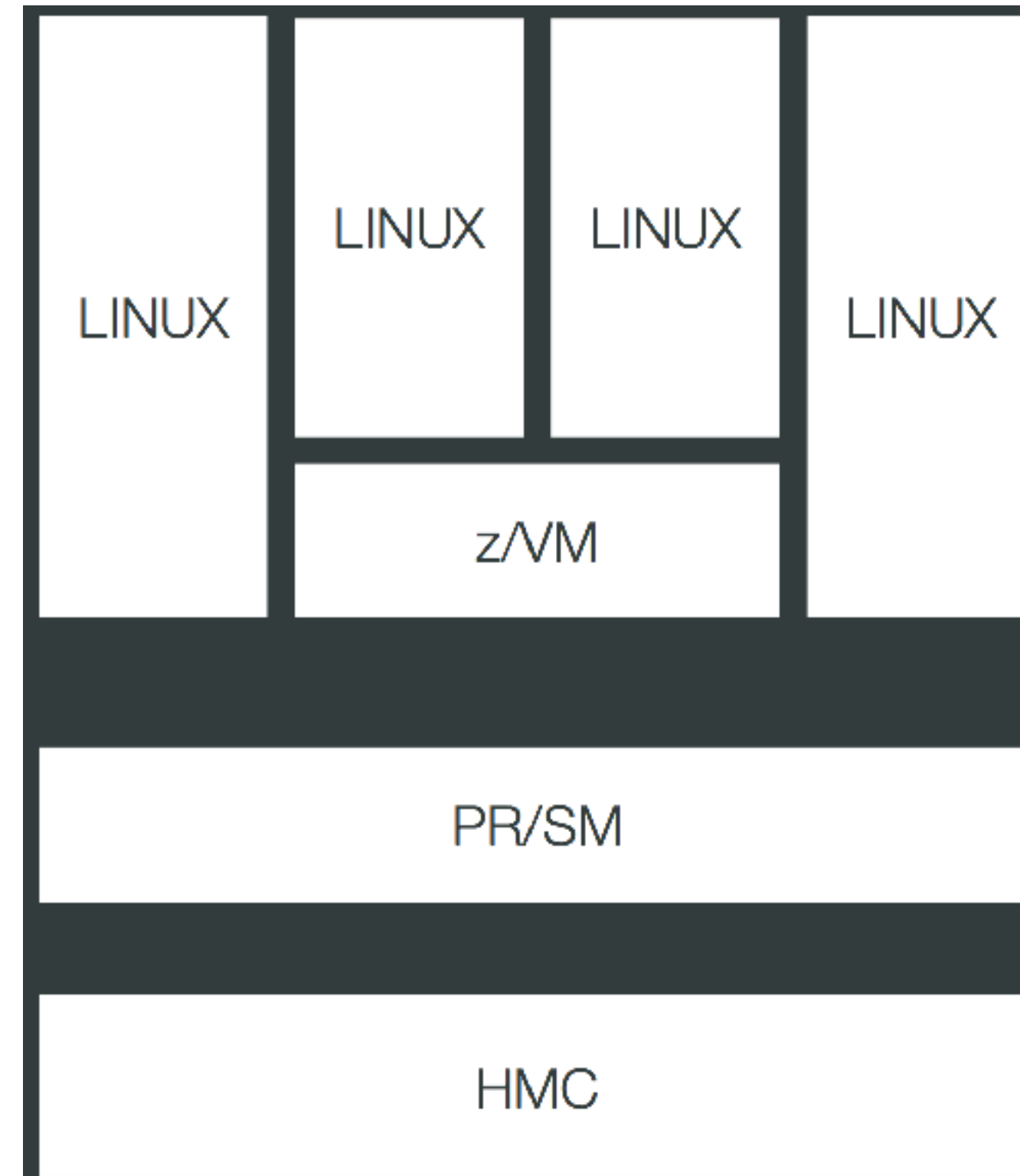
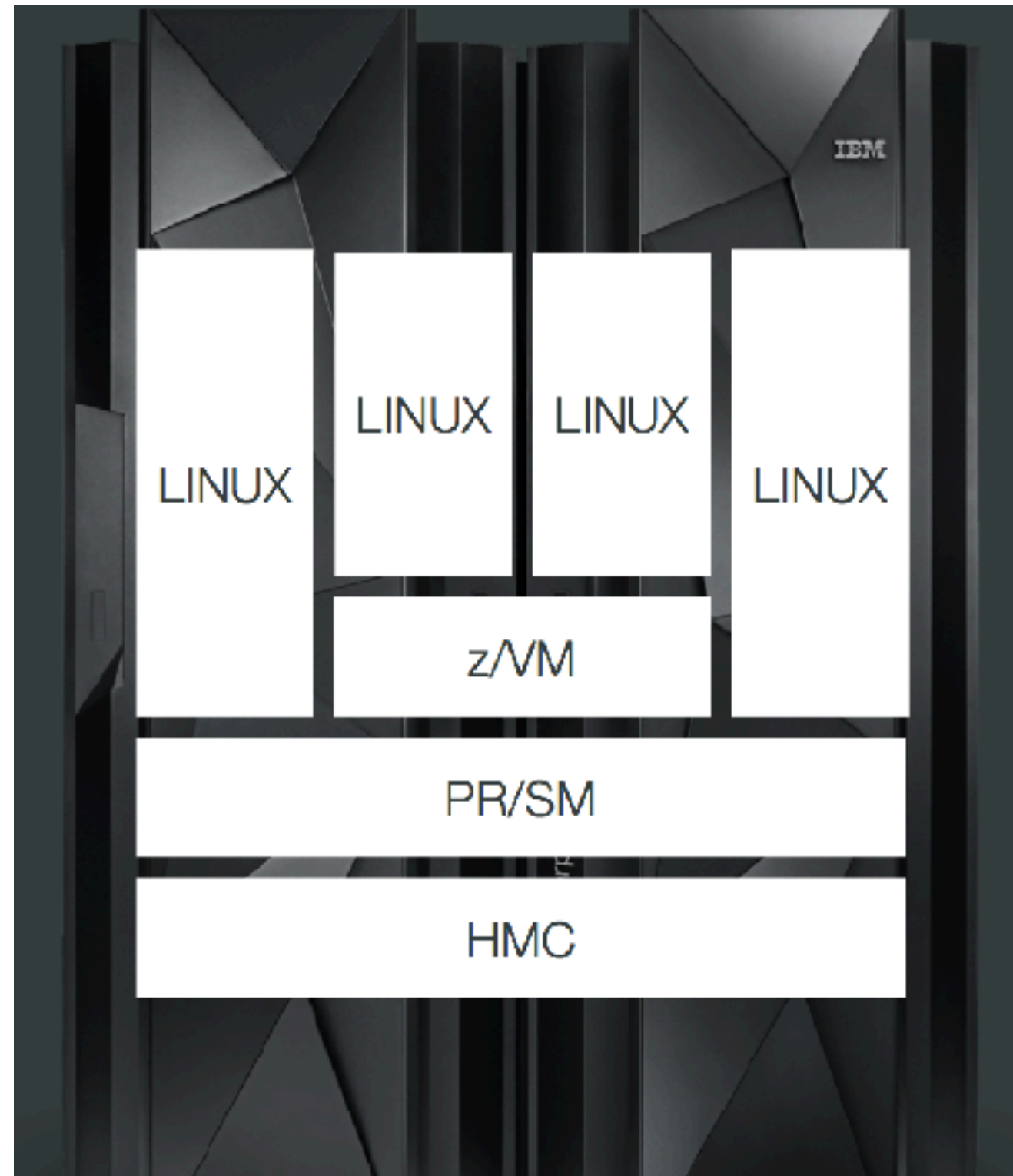


IBM Z hypervisors supported by OpenStack

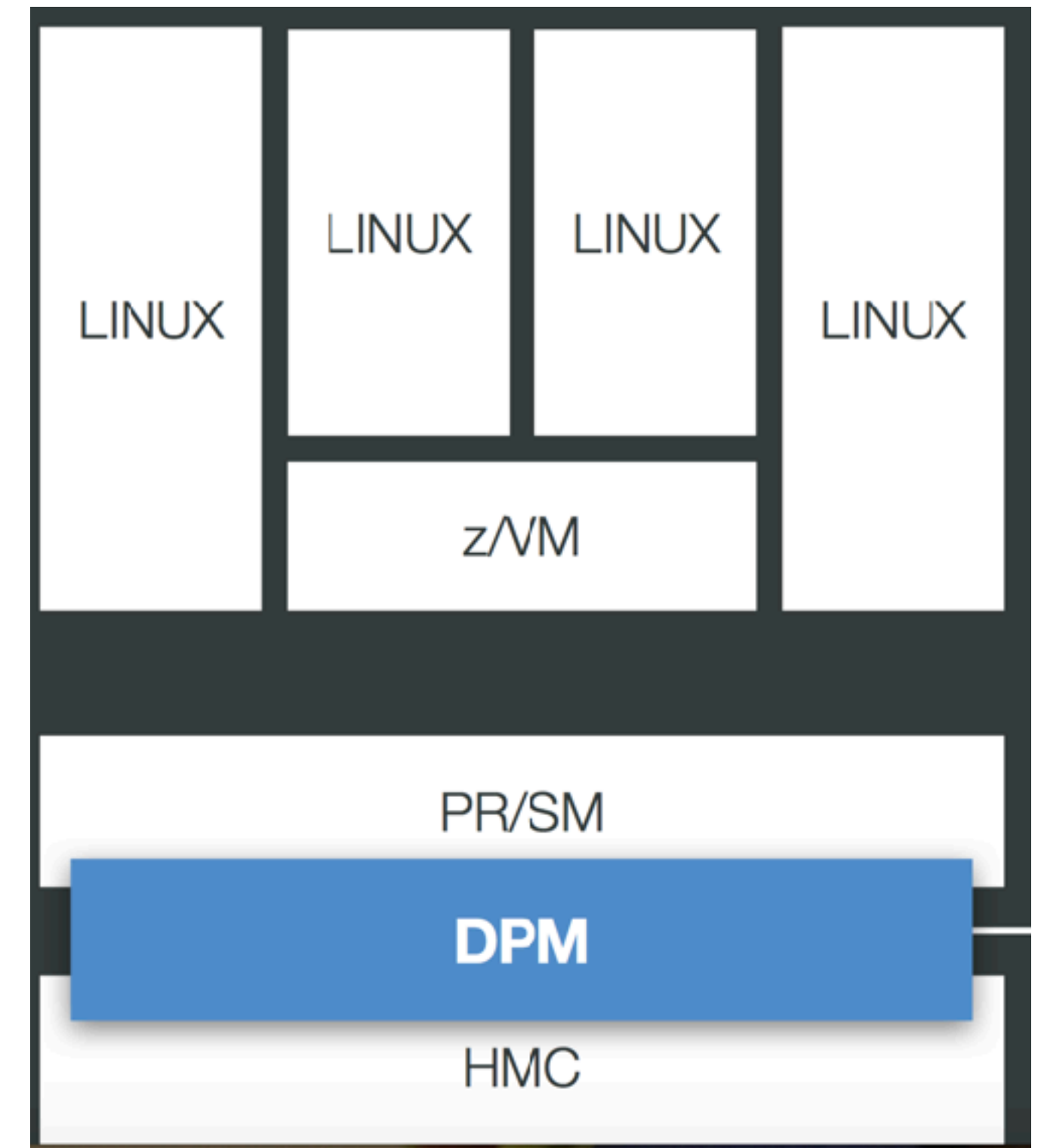
- KVM on IBM Z
 - Supported in product \geq Mitaka
 - Supported OpenStack product \rightarrow Ubuntu OpenStack
- z/VM
 - Supported in product \geq Liberty
 - Supported OpenStack products
 - Cloud Manager Appliance (IBM) - a component of IBM z/VM 6.3 or higher,
 - SUSE OpenStack Cloud
- **PR/SM in DPM Mode**
 - Supported \geq Ocata
 - As-is community support

Introducing IBM Z PR/SM hypervisor in DPM Mode

Dynamic Partition Manager



PR/SM
Powerful but complex



PR/SM + DPM
Powerful and *easy*

Introducing the IBM DPM

- A new administrative mode, IBM **D**ynamic **P**artition **M**anager (DPM), is introduced for Linux only systems for IBM z13, IBM z13s, IBM LinuxONE Emperor™ (Emperor), and IBM LinuxONE Rockhopper™ (Rockhopper)
- A system can be configured in either DPM mode or PR/SM mode. The mode is enabled prior to system power-on reset (POR)
- This new mode provides dynamic I/O management capabilities using the Hardware Management Console (HMC).

Capabilities of DPM

- **Create and provision an environment** - Creation of new partitions, assignment of processors and memory, configuration of I/O adapters (network, FCP storage, crypto, and accelerators).
 - New Partition
 - Partition Details
 - Manage Adapters
 - Manage Processor Sharing
- **Manage the environment** - Modification of system resources without disrupting running workloads
- **Monitor and troubleshoot the environment** - Source identification of system failures, conditions, states, events that may lead to workload degradation.

DPM in a Nutshell - Re-thinking Mainframe management jointly with our users

- **Dynamic** Mainframe infrastructure management including dynamic I/O management allowing for end-to-end automation.
- **Integrated** workflow by replacing existing tooling that today is spread across multiple management end points.
- **Simplified** and consumable Mainframe experience reducing the barriers of adoption for new and existing clients.
- User experience is inspired by industry standard methodology and terminology.

Integrated and consistent User Experience

The screenshot displays the IBM Hardware Management Console (HMC) interface. At the top, the title "Hardware Management Console" is visible on the left, and the IBM logo is on the right. Below the title bar, there are navigation links for "pedebug", "Help", and "Logoff".

The main content area is titled "Welcome (HMC Version)" and features three large circular gauges representing system status:

- Systems:** A gauge showing "1 Total" with a solid orange ring.
- Partitions:** A gauge showing "29 Total" with a ring composed of blue, orange, green, and purple segments.
- Adapters:** A gauge showing "52 Total" with a ring composed of blue, orange, green, and red segments.

To the right of these gauges is a legend with colored dots and labels:

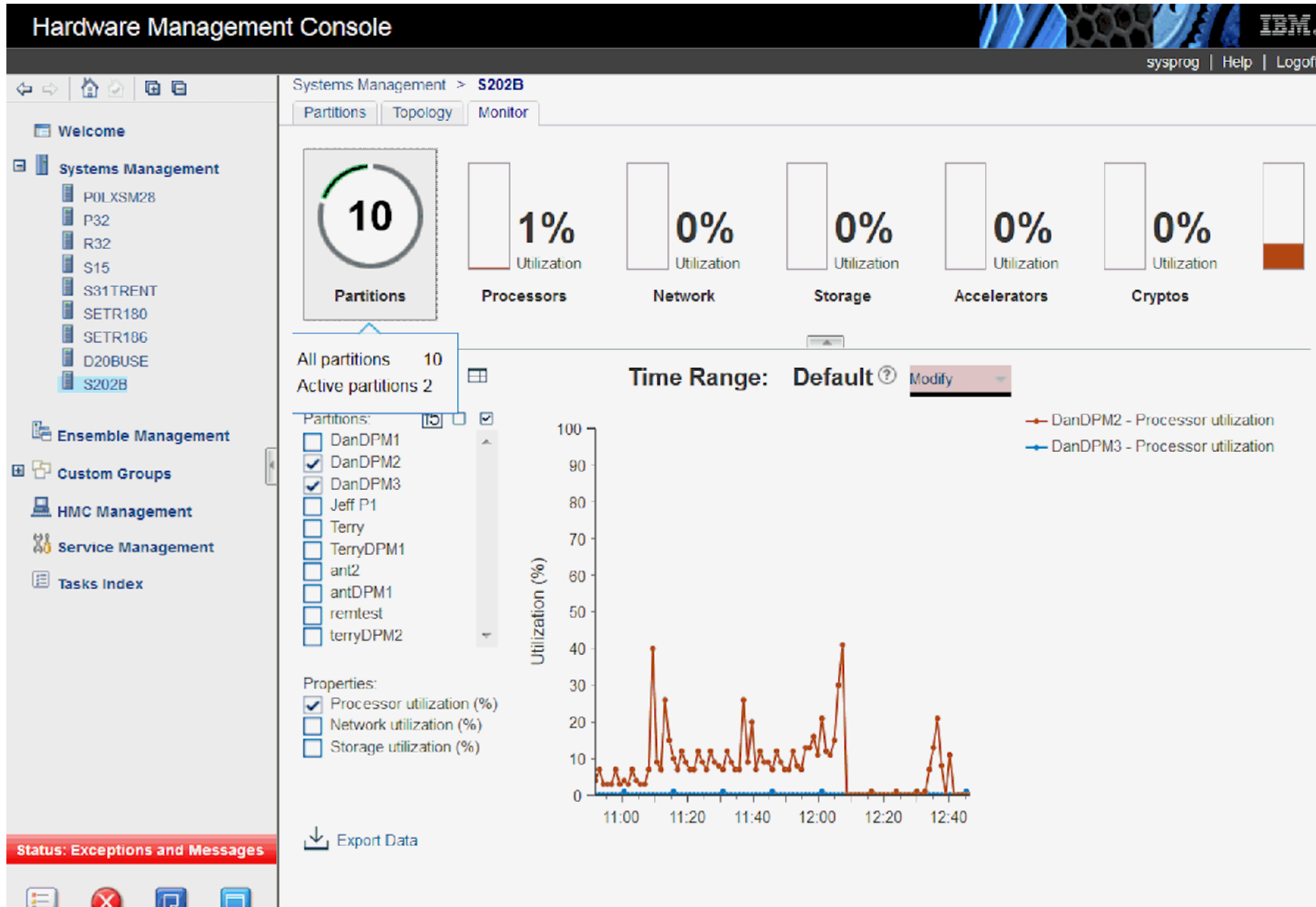
- Blue: Not active...
- Orange: Degraded...
- Green: Active
- Purple: Paused
- Red: Exceptions

Below the gauges are three navigation icons:

- Get Started:** A compass icon.
- Guides:** A book icon.
- Learn More:** An information icon.

At the bottom left, a red status bar reads "Status: Exceptions and Messages". Below this bar are several small icons, including a red 'X' and a blue document icon.

DPM System monitoring



Power of DPM

- Creation of partitions
 - Several days —> 10 minutes
 - Several System Administrators —> Single System Administrator
- Modify resources
 - Several hours —> minutes
 - Several System Administrators —> Single System Administrator
- Gain Insights
 - Monitoring data —> Insights over time

OpenStack enablement for IBM Z PR/SM Hypervisor in DPM Mode

Vision

DPM OpenStack integration - Vision

Provide a unified cloud management interface for images running in Partitions, KVM and z/VM with the possibility to deploy them where they fit best at a given point in time

Deliver OpenStack Nova driver for DPM providing life-cycle management tooling for Linux administrators with no mainframe knowledge, and to enable integration into standard cloud tooling

Hills

Hill #1

Elena, an OpenStack user can deploy a mainframe partition and get Linux OS running in that partition within 10 minutes

Who

What

Wow

Hill #1 - Use cases

- Elena, an OpenStack user can use OpenStack (dashboard/command-line/API's) to:-
 - Provision DPM partitions (aka "launch instance") and boot using any of the following operating systems
 - SLES 12 SPI
 - Ubuntu 16.04
 - RHEL 7.1
 - Perform the below guest lifecycle operations on the DPM partitions
 - Stop/shutdown instance
 - Restore instance
 - Reboot instance
 - Set admin password
 - Get instance status
 - Resize instance
 - Attach/detach block volumes to partitions (using FCP LUN)
 - Support OSA/RoCE/HiperSockets adapters for partitions with OpenStack networking

Hill #2

Sindhu, a cloud administrator can delegate mainframe partition management into cloud tooling to enable Infrastructure As A Service consistent with her organisation's cloud strategy

Who

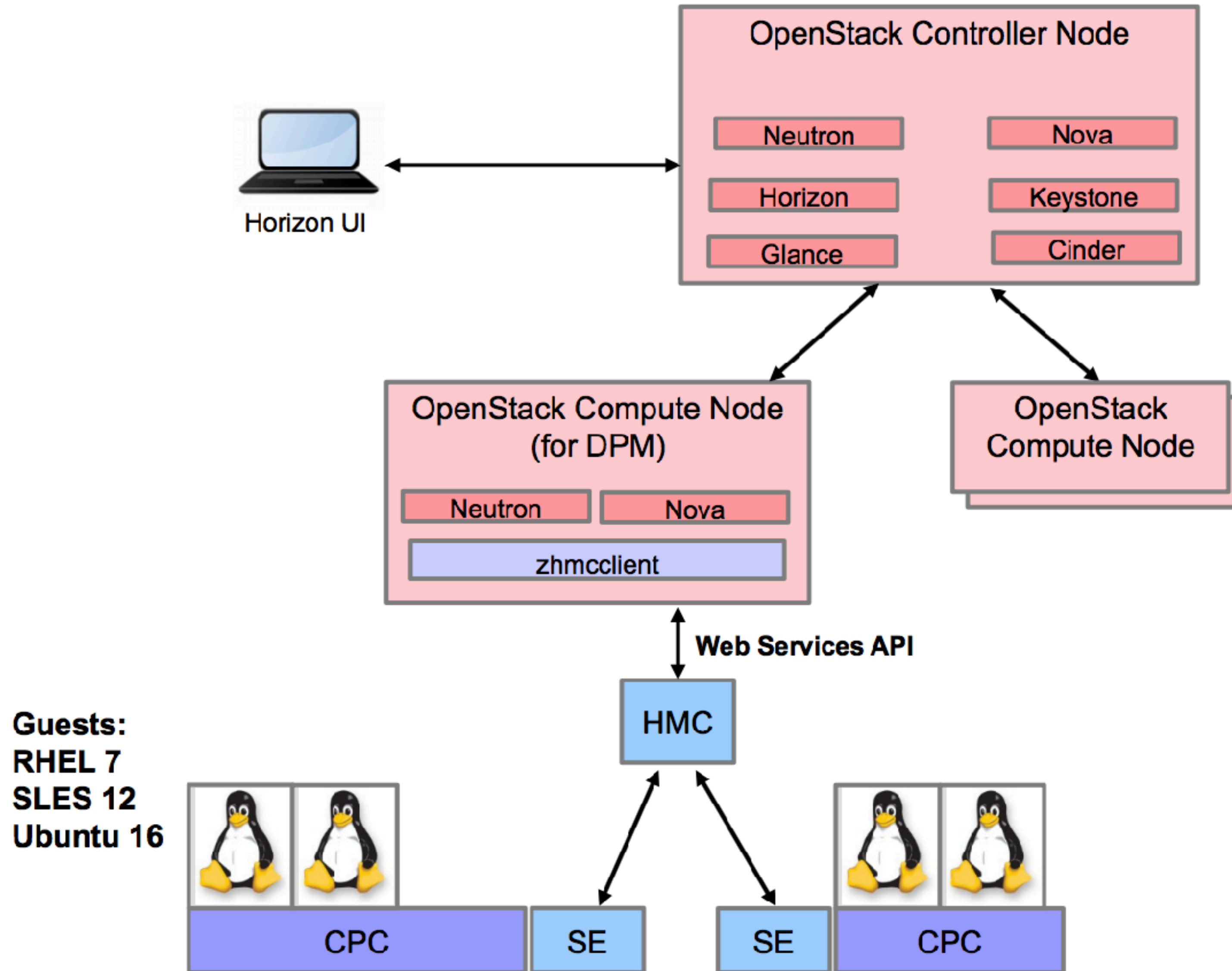
What

Wow

Hill #2 - Use cases

- Sindhu, a cloud administrator can
 - Integrate IBM Z hardware to standard cloud tooling such as vRA, HP-OO, ICO using the OpenStack compute driver
 - Integrate storage devices which can be provisioned to partitions using OpenStack FCP LUN
 - Integrate OSA/RoCE/HiperSocket adapters which can be provisioned to partitions using OpenStack

OpenStack for DPM topology



zhmcclient- New python client library for HMC Web Services API

- Client library written in Python to make HMC Web Services API easier to consume
- Encapsulates REST over HTTPS and JMS protocols
- Supports CPCs in DPM mode and in standard mode
- Initiated as part of the OpenStack for DPM work
- Great for automation with Ansible, Salt, Chef, Puppet, ...
- Includes CLI with Interactive mode & Command mode
- Download and try today: <https://github.com/zhmcclient>

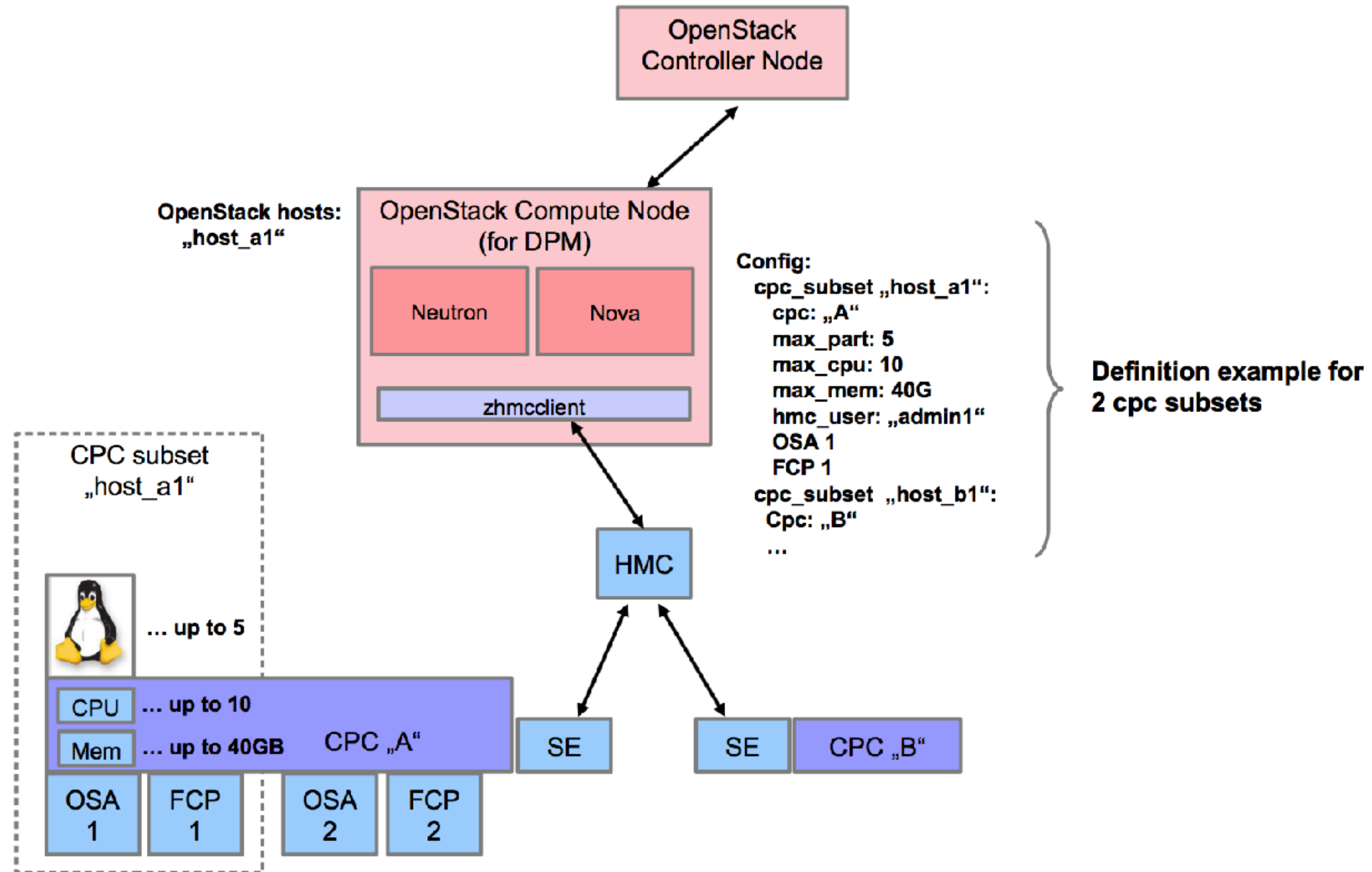
zhmcclient - Currently supported HMC resources

- CPC's (DPM mode and Classic mode) - Start, Stop, Update properties, export WWPN etc
- DPM Mode
 - Partitions - Start, Stop, Delete, Update properties, PSW restart, Mount/Unmount ISO image etc
 - Adapters - (Network, Storage, Accelerator and Crypto adapters)
 - Ports - Physical port of an Adapter
 - NICs - Network Interface Cards (Connects a partition with a Network Port or Virtual Switch) - Create, Delete, Update properties etc
 - HBAs - Host Bus Adapter (HBA connects a Partition with an Adapter Port on an FCP Adapter) - Create, Delete, Update properties etc
 - Virtual Functions (Provides Partition with access to Accelerator Adapters) - Create, Delete, Update properties etc
 - Virtual Switches - Get connected NICs, Update Properties
- Classic Mode
 - Activation Profiles (Rest, Image and Load)
 - LPAR's - Activate, Deactivate, Load etc

CPC Subsetting

- OpenStack manages the compute resources:
 - You give compute HW to OpenStack
 - OpenStack uses all of it for hosting virtual servers
- OpenStack for DPM supports “CPC subsetting”
 - Give only a portion of a CPC to OpenStack
- OpenStack treats each CPC subset as a hypervisor host
- CPC subsets are defined
 - by OpenStack configuration

Definition of CPC subsets

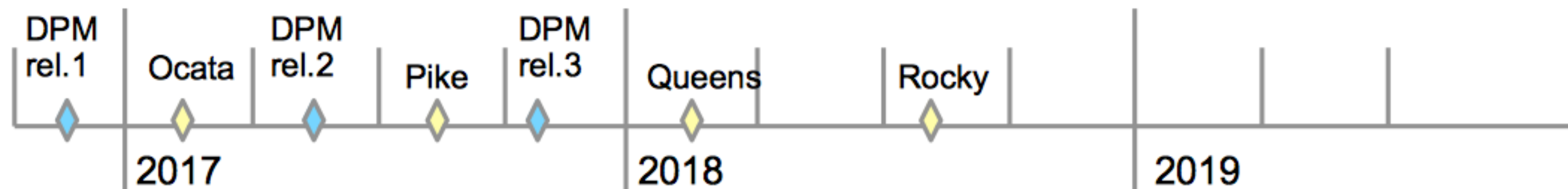


Currently supported functionalities in OpenStack for DPM

- Configure a compute node to manage and consume only a subset of a IBM Z CPC in DPM mode.
- CPC subsetting is hidden from users and they are treated like normal hosts in OpenStack.
- Spawn instance from FCP volume.
- Instance lifecycle management.
- Usage of flat networking.

OpenStack releases supporting DPM - Roadmap

- OpenStack Ocata (2/2017):
 - Initial release for DPM, with limitations
 - Based on DPM rel.1 (introduced with z13 GA2) or higher
- OpenStack Pike (8/2017):
 - Based on DPM rel.2 (z13 post GA2 level from 04/2017) or higher
- OpenStack Queens (2/2018):
 - Requires DPM rel.2 as minimum, and exploits DPM rel.3 (z14 GA1) if present
- OpenStack „R“ (8/2018):
 - Requires DPM rel.2 as minimum, and exploits DPM rel.3 (z14 GA1) if present



Documentation

- Documentation is hosted in

- <http://nova-dpm.readthedocs.io/en/latest/>
- <http://networking-dpm.readthedocs.io/en/latest/>

Table Of Contents

- Welcome to nova-dpm's documentation!
- Overview
- Using the driver
- Creating DPM Images
- Contributing to the project
- Links

Next topic

- [Release Notes](#)

This Page

- [Show Source](#)

Quick search

Welcome to nova-dpm's documentation!

On IBM z Systems and IBM LinuxOne machines, certain workloads run better in a partition of the firmware-based PR/SM (Processor Resource/System Manager) hypervisor, than in a virtual machine of a software hypervisor such as KVM or z/VM.

This project provides a Nova virtualization driver for the PR/SM hypervisor of IBM z Systems and IBM LinuxOne machines that are in the DPM (Dynamic Partition Manager) administrative mode.

The DPM mode enables dynamic capabilities of the firmware-based PR/SM hypervisor that are usually known from software-based hypervisors, such as creation, deletion and modification of partitions (i.e. virtual machines) and virtual devices within these partitions, and dynamic assignment of these virtual devices to physical I/O adapters.

The z/VM and KVM hypervisors on z Systems and LinuxONE machines are supported by separate Nova virtualization drivers:

- KVM is supported by the standard libvirt/KVM driver in the [openstack/nova](#) project.
- z/VM is supported by the z/VM driver in the [openstack/nova-zvm-virt-driver](#) project.

Overview

- [Release Notes](#)
- [Topology](#)
 - [Topology for a single OpenStack cloud](#)
 - [General Topology](#)
 - [Interaction between OpenStack compute node and HMC](#)
- [Feature Support Matrix](#)
- [Storage Support](#)
 - [Supported Storage types](#)
 - [Block Storage setup](#)
 - [DPM FCP Architecture](#)
 - [References](#)

OpenStack for DPM - Feature Support Matrix

<i>Feature</i>	<i>Status</i>	IBM DPM
Guest instance status	mandatory	✓
Launch instance	mandatory	✓
Reboot instance	optional	✓
Shutdown instance	mandatory	✓
Block storage support	optional	✓
Block storage over fibre channel	optional	✓
Image storage support	mandatory	✓
Flat networking	<i>choice</i>	✓

OpenStack with DPM support in action

OpenStack for DPM support in action

openstack. admin

Project > Admin > System > Overview

Admin / System / All Hypervisors

All Hypervisors

Hypervisor Summary

VCPU Usage
Used 1 of 6

Memory Usage
Used 2GB of 108.5GB

Local Disk Usage
Used 0Bytes of 2TB

Hypervisor [Compute Host](#)

Displaying 2 items

Hostname	Type	VCPUs (used)	VCPUs (total)	RAM (used)	RAM (total)	Local Storage (used)	Local Storage (total)	Instances
host2	PRSM	1	3	2GB	54.3GB	0Bytes	1TB	2
storage-test	PRSM	0	3	0Bytes	54.3GB	0Bytes	1TB	0

Displaying 2 items

System Information

OpenStack for DPM support in action

openstack. admin

Project / Compute / Volumes

Volumes

Volumes Volume Snapshots

Filter + Create Volume ⇌ Accept Transfer 🗑 Delete Volumes

Displaying 15 items

<input type="checkbox"/>	Name	Description	Size	Status	Type	Attached To	Availability Zone	Bootable	Encrypted	Actions
<input type="checkbox"/>	test_test	-	15GiB	Available	v7kuni		nova	Yes	No	Edit Volume
<input type="checkbox"/>	sree_demo4	-	15GiB	In-use	v7kuni	/dev/sda on None	nova	Yes	No	Edit Volume
<input type="checkbox"/>	sree_demo3	-	15GiB	In-use	v7kuni	/dev/sda on None, /dev/sda on None	nova	Yes	No	Edit Volume
<input type="checkbox"/>	sree_demo2	-	15GiB	In-use	v7kuni	/dev/sda on None	nova	Yes	No	Edit Volume
<input type="checkbox"/>	sree_demo1	-	15GiB	In-use	v7kuni	/dev/sda on None, /dev/sda on None	nova	Yes	No	Edit Volume

OpenStack for DPM support in action

- Project
- Compute
- Overview
- Instances
- Volumes
- Images**
- Key Pairs
- API Access
- Network
- Admin
- Identity

Images

Click here for filters. + Create Image Delete Images

Displaying 5 items

<input type="checkbox"/>	Owner	Name ^	Type	Status	Visibility	Protected	Disk Format	Size	
<input type="checkbox"/>	admin	cirros-0.3.4-x86_64-uec	Image	Active	Public	No	AMI	24.00 MB	Launch
<input type="checkbox"/>	admin	cirros-0.3.4-x86_64-uec-kernel	Image	Active	Public	No	AKI	4.75 MB	Edit Image
<input type="checkbox"/>	admin	cirros-0.3.4-x86_64-uec-ramdisk	Image	Active	Public	No	ARI	3.57 MB	Edit Image
<input type="checkbox"/>	admin	rhel71_small_cloudinit_v10	Image	Active	Public	No	QCOW2	1.03 GB	Launch
<input type="checkbox"/>	admin	rhel_dpm	Image	Active	Public	No	QCOW2	10.00 GB	Launch

Displaying 5 items

OpenStack for DPM support in action

openstack. admin admin

Project / Network / Networks

Networks

Name = Filter [+ Create Network](#) [Delete Networks](#)

Displaying 2 items

<input type="checkbox"/>	Name	Subnets Associated	Shared	External	Status	Admin State	Actions
<input type="checkbox"/>	public	• public-subnet 172.24.4.0/24	No	Yes	Active	UP	Edit Network ▼
<input type="checkbox"/>	provider	• provider_net 192.168.220.0/24	Yes	No	Active	UP	Add Subnet

Displaying 2 items

Project Compute Network Network Topology **Networks** Routers Security Groups Floating IPs Admin Identity

OpenStack for DPM support in action

openstack. admin

Project / Compute / Overview

Overview

Instances

Volumes

Images

Key Pairs








API Access

Network

Admin

Identity

Limit Summary

 <p>Instances Used 13 of 100</p>	 <p>VCPUs Used 13 of 20</p>	 <p>RAM Used 13GB of 50GB</p>	 <p>Floating IPs Used 0 of 50</p>	 <p>Security Groups Used 1 of 10</p>	 <p>Volumes Used 16 of 100</p>
 <p>Volume Storage Used 285GB of 1000GB</p>					

OpenStack for DPM support in action

openstack. admin admin

Project / Compute / Instances

Instances

Instance ID = Filter [Launch Instance](#) [Delete Instances](#) [More Actions](#)

Displaying 3 items

<input type="checkbox"/>	Instance Name	Image Name	IP Address	Flavor	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	prabhat6	-	192.168.220.3	dpm_new	-	Error		None	No State	6 days, 4 hours	Edit Instance ▼
<input type="checkbox"/>	prabhat5	-	192.168.220.12	dpm_new	-	Active	nova	None	Running	6 days, 4 hours	Create Snapshot ▼
<input type="checkbox"/>	prabhat4	-	192.168.220.14	dpm_new	-	Active	nova	None	Running	6 days, 4 hours	Create Snapshot ▼

Displaying 3 items

OpenStack for DPM support in action

Launch Instance ✕

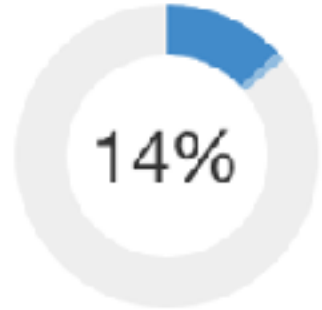
Please provide the initial hostname for the instance, the availability zone where it will be deployed, and the instance count. Increase the Count to create multiple instances with the same settings. ?

Instance Name *

Availability Zone

Count *

Total Instances (100 Max)



14%

- 13 Current Usage
- 1 Added
- 86 Remaining

✕ Cancel < Back Next > Launch Instance

OpenStack for DPM support in action

Launch Instance ✕

[Details](#)

Source

[Flavor *](#)

[Networks *](#)

[Network Ports](#)

[Security Groups](#)

[Key Pair](#)

[Configuration](#)

[Server Groups](#)

[Scheduler Hints](#)

Instance source is the template used to create an instance. You can use an image, a snapshot of an instance (image snapshot), a volume or a volume snapshot (if enabled). You can also choose to use persistent storage by creating a new volume. ?

Select Boot Source

Volume

Delete Volume on Instance Delete

Yes No

Allocated

Name	Description	Size	Type	Availability Zone
> test_test		15 GB	qcow2	nova

Available 5 Select one

Click here for filters.

Name	Description	Size	Type	Availability Zone
> andreas4		15 GB	qcow2	nova

✕ Cancel < Back Next > Launch Instance

OpenStack for DPM support in action

Launch Instance ✕

Details

Flavors manage the sizing for the compute, memory and storage capacity of the instance. ?

Source

Flavor

Allocated

Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public	
> dpm_new	1	1 GB	0 GB	0 GB	0 GB	Yes	↓

Networks *

▼ Available 12

Select one

Network Ports

🔍 Click here for filters. ✕

Security Groups

Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public	
> m1.tiny	1	512 MB	1 GB	1 GB	0 GB	Yes	↑
> m1.small	1	2 GB	20 GB	20 GB	0 GB	Yes	↑
> m1.medium	2	4 GB	40 GB	40 GB	0 GB	Yes	↑
> m1.large	4	8 GB	80 GB	80 GB	0 GB	Yes	↑

Key Pair

Configuration

Server Groups

Scheduler Hints

✕ Cancel

< Back

Next >

Launch Instance

OpenStack for DPM support in action

Launch Instance ✕

Details ?

Source

Flavor

Networks

Network Ports

Security Groups

Key Pair

Configuration

Server Groups

Scheduler Hints

Metadata

Networks provide the communication channels for instances in the cloud.

▼ Allocated 1 Select networks from those listed below.

	Network	Subnets Associated	Shared	Admin State	Status	
↕ 1	➤ provider	provider_net	Yes	Up	Active	↓

▼ Available 1 Select at least one network

🔍 Click here for filters. ✕

	Network	Subnets Associated	Shared	Admin State	Status	
➤	public	public-subnet	No	Up	Active	↑

✕ Cancel < Back Next > ☁ Launch Instance

OpenStack for DPM support in action

The screenshot shows the OpenStack dashboard interface. At the top, there is a navigation bar with the OpenStack logo, the text 'openstack.', and a user profile 'admin'. Below this is a sidebar menu with options like Project, Compute, Overview, Instances (highlighted), Volumes, Images, Key Pairs, API Access, Network, Admin, and Identity. The main content area is titled 'Instances' and shows a breadcrumb 'Project / Compute / Instances'. Below the title, there are search and action buttons: 'Instance ID =', 'Filter', 'Launch Instance', 'Delete Instances', and 'More Actions'. A table displays 4 items with columns: Instance Name, Image Name, IP Address, Flavor, Key Pair, Status, Availability Zone, Task, Power State, Time since created, and Actions. The instances listed are demo1 (Build), prabhat6 (Error), prabhat5 (Active), and prabhat4 (Active). Each row has a checkbox and a dropdown menu for actions.

<input type="checkbox"/>	Instance Name	Image Name	IP Address	Flavor	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	demo1	-		dpm_new	-	Build	nova	Block Device Mapping	No State	0 minutes	Associate Floating IP
<input type="checkbox"/>	prabhat6	-	192.168.220.3	dpm_new	-	Error		None	No State	1 week	Edit Instance
<input type="checkbox"/>	prabhat5	-	192.168.220.12	dpm_new	-	Active	nova	None	Running	1 week	Create Snapshot
<input type="checkbox"/>	prabhat4	-	192.168.220.14	dpm_new	-	Active	nova	None	Running	1 week	Create Snapshot

OpenStack for DPM support in action

openstack. admin

Project / Compute / Instances

Instances

Instance ID = Filter [Launch Instance](#) [Delete Instances](#) [More Actions](#)

Displaying 4 items

<input type="checkbox"/>	Instance Name	Image Name	IP Address	Flavor	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	demo1	-		dpm_new	-	Build	nova	Spawning	No State	0 minutes	Associate Floating IP
<input type="checkbox"/>	prabhat6	-	192.168.220.3	dpm_new	-	Error		None	No State	1 week	Edit Instance
<input type="checkbox"/>	prabhat5	-	192.168.220.12	dpm_new	-	Active	nova	None	Running	1 week	Create Snapshot
<input type="checkbox"/>	prabhat4	-	192.168.220.14	dpm_new	-	Active	nova	None	Running	1 week	Create Snapshot

Displaying 4 items

Q&A

Thank you

**Andreas R Maier
Andreas Scheuring
Arne Recknagel
Marco Pavone
Markus Zoeller
Prabhat Ranjan
Sreeram Vancheeswaran
Sreeteja Mogilisetti
Stefan Amann**