The Reference Architecture for
Red Hat OpenShift Container Platform (RHOCP)
on IBM Z and IBM LinuxONE

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Integration Architectures & Digitalization
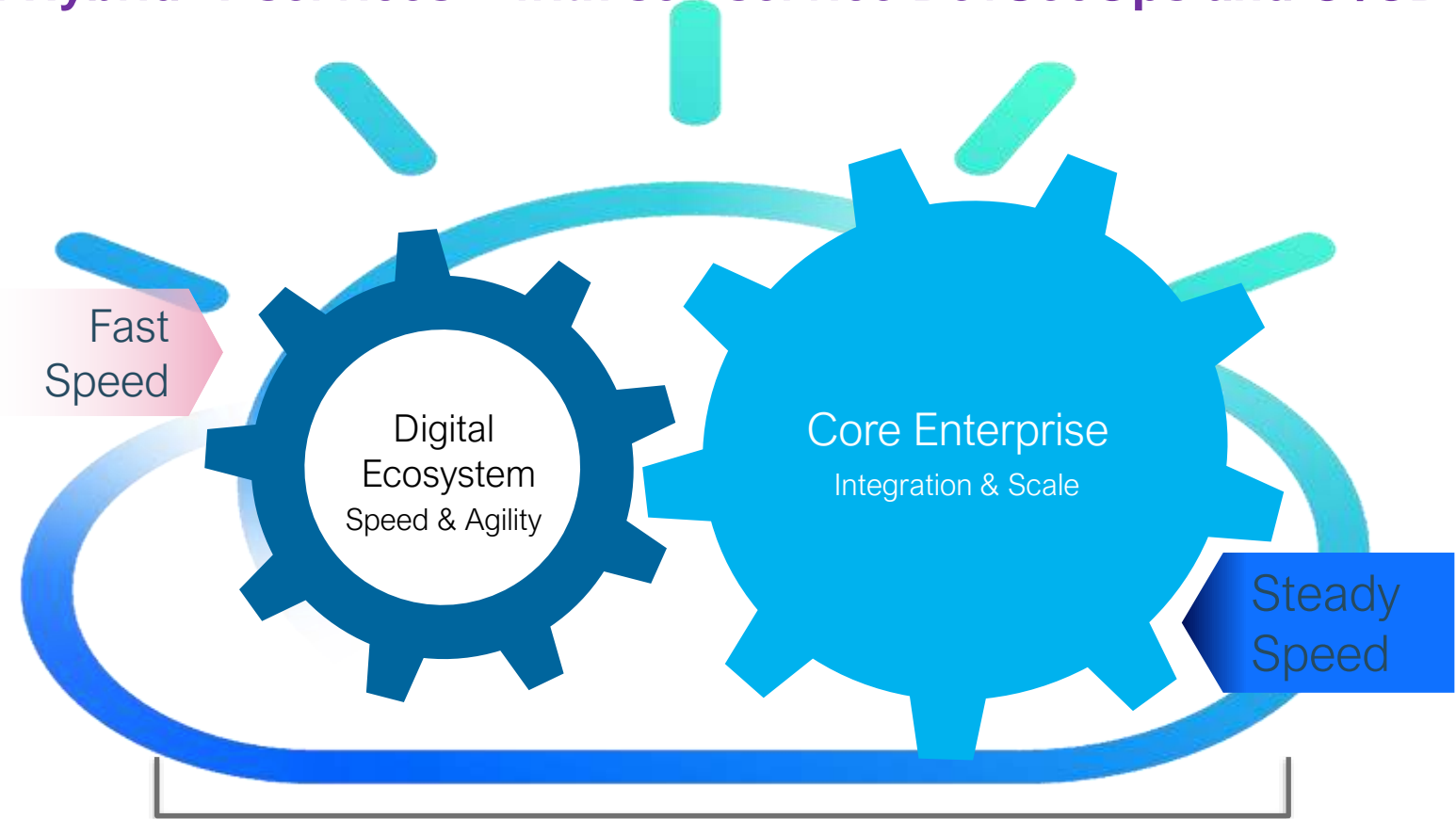IBM LinuxONE & IBM Z
IBM R & D Lab Germany

IBM

Agenda

➢ **Setting the stage**

➢ **The Reference Architecture for RHOCP on IBM Z and LinuxONE**

➢ **Outlook and how to start**

Reference Architecture for RHOCP on Z:
https://www.ibm.com/docs/en/linux-on-systems?topic=configuration-red-hat-openshift-reference

Vision: Hybrid IT services – with self service DevSecOps and CI/CD

Fast Speed

Digital Ecosystem
Speed & Agility

Core Enterprise
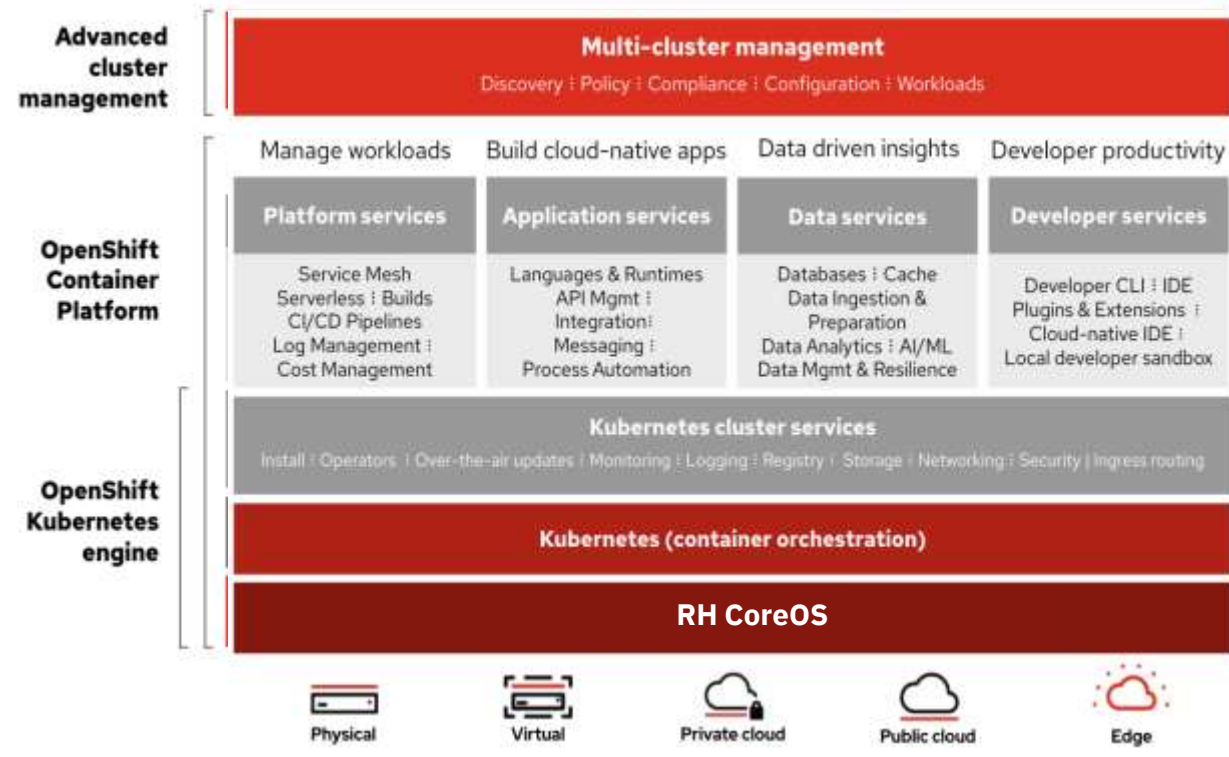Integration & Scale

Steady Speed

Hybrid Cloud Service orchestration and

traditional transactional & data services orchestrator

Red Hat Openshift Container Platform and Advanced Multi Cloud Management capabilities

Red Hat OpenShift Container Platform (RHOCP)

A smarter Kubernetes platform

Automated, full-stack installation from the container host to application services
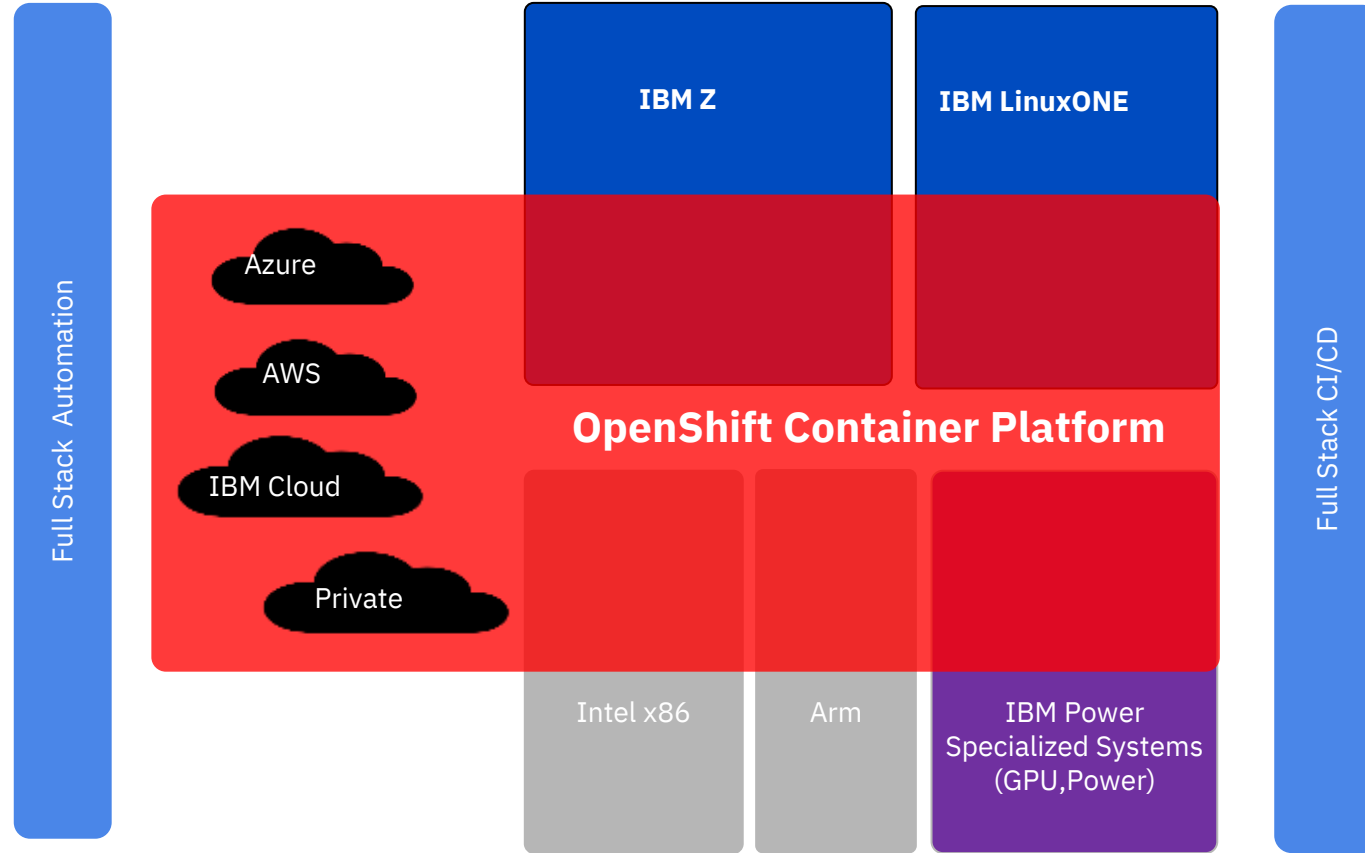
Seamless Kubernetes deployment to any cloud or on-premises environment

Autoscaling of cloud resources

One-click updates for platform, services, and applications

4

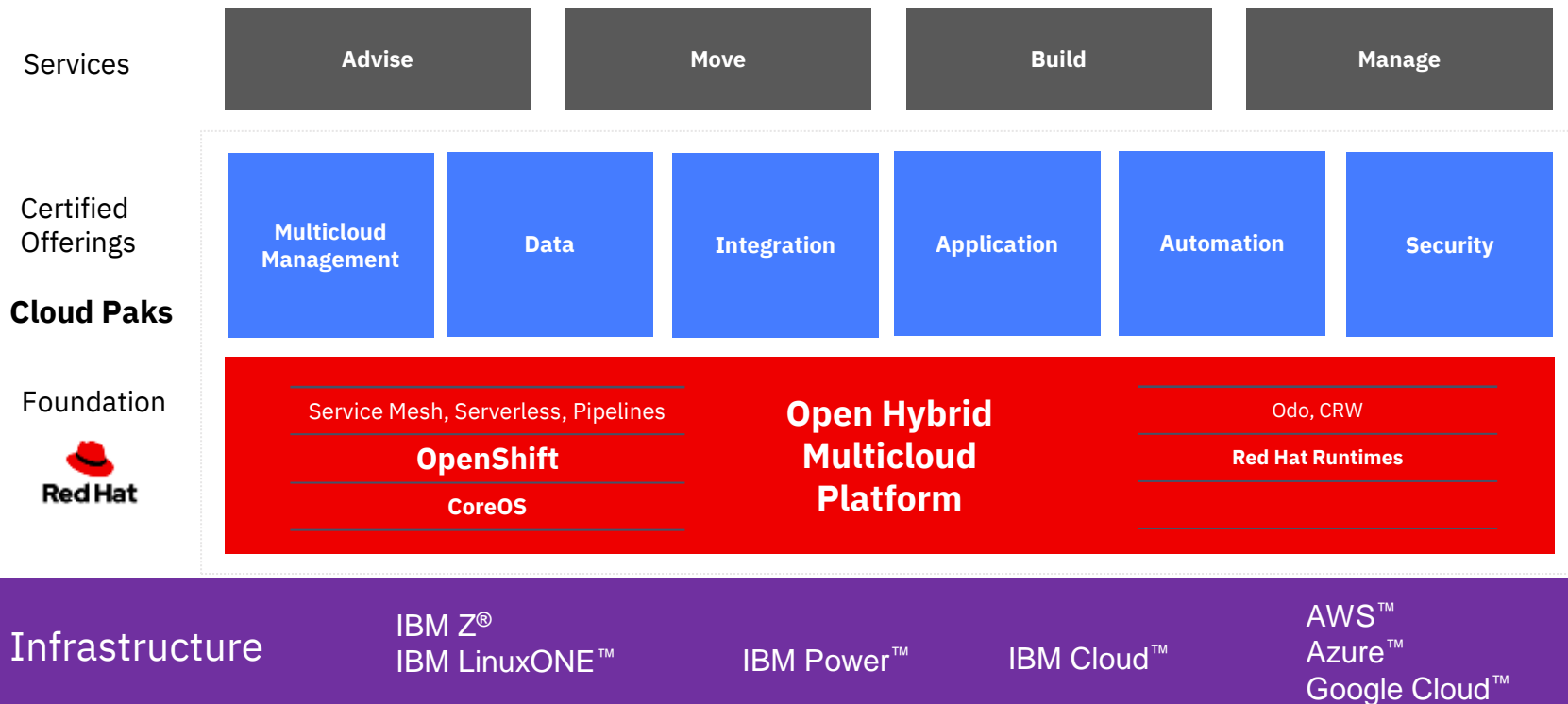Red Hat OpenShift - the only Container Platform across different hardware Architectures

Full Stack Automation

Azure

AWS

IBM Cloud

Private

IBM Z

IBM LinuxONE

OpenShift Container Platform

Intel x86

Arm

IBM Power
Specialized Systems
(GPU,Power)

Full Stack CI/CD

Creating the leading hybrid multi cloud provider

IBM® Hybrid Multicloud Strategy

Services

Advise	Move	Build	Manage

Certified Offerings

Cloud Paks

Multicloud Management	Data	Integration	Application	Automation	Security

Foundation

Service Mesh, Serverless, Pipelines

OpenShift

CoreOS

Open Hybrid Multicloud Platform

Odo, CRW

Red Hat Runtimes

Infrastructure

IBM Z®
IBM LinuxONE™

IBM Power™

IBM Cloud™

AWS™
Azure™
Google Cloud™

Agenda

➢Setting the stage

➢**The Reference Architecture for RHOCP on IBM Z and LinuxONE**

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Reference Architecture for RHOCP on Z:
https://www.ibm.com/docs/en/linux-on-systems?topic=configuration-red-hat-openshift-reference

The Reference Architecture for a
RHOCP on IBM Z & IBM LinuxONE covers many aspects

Chapter 1. About this document
Chapter 2. Value proposition
Chapter 3. Planning and architecting overview
Chapter 4. Design considerations
Chapter 5. Operational considerations
Chapter 6. Application considerations
Chapter 7. Summary
Chapter 8. Appendix
Chapter 9. References
Chapter 10. Contributors

Reference Architecture for RHOCP on Z:
https://www.ibm.com/docs/en/linux-on-systems?topic=configuration-red-hat-openshift-reference

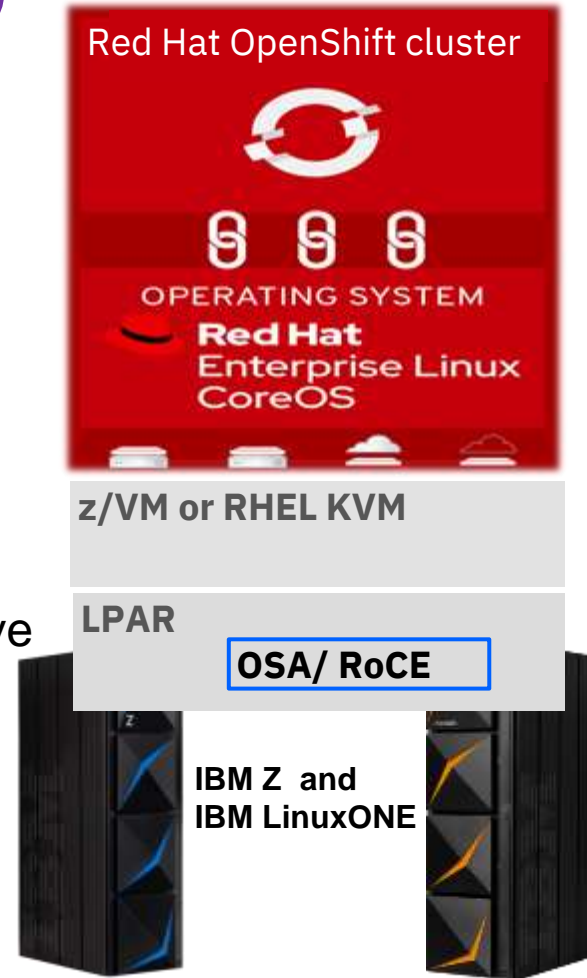# Business reasons that resonate towards a RHOCP on IBM Z & LinuxONE

- ✓ **It can solve business problems**
  - ✓ Faster time to market, perfect for dynamic workloads
- ✓ **It can solve the development challenges**
  - ✓ Develop once deploy multiple (CI/CD & DevSecOps)
- ✓ **It enables new ways for hybrid IT projects**
  - ✓ Best fit placement for applications
- ✓ **It helps in the Digitalization journey**
  - ✓ Global integration with standards and openness incl. IBM Z
- ✓ **Confidential computing is closer than ever**
  - ✓ Highly Secure workloads and Digital Asset Management
- ✓ **Business Continuity is empowered**
  - ✓ Inherit availability and stability from IBM Z

Why Red Hat OpenShift Container Platform (RHOCP) on IBM Z and LinuxONE

➢ Highest scalability
  ➢ grow to **thousands of Linux guests**
  ➢ and **millions of containers**
➢ Secured non-disruptively growth, vertical and horizontal
  ➢ including advanced security
  ➢ **confidential Cloud Computing**

These capabilities were highlighted with the announcement of the IBM z15 and IBM LinuxONE III. Running Red Hat OpenShift on IBM Z and LinuxONE also enables cloud native applications to easily integrate with existing data and applications on these platforms, reducing latency by avoiding network delays.

https://www.ibm.com/blogs/systems/get-ready-for-red-hat-openshift-on-ibm-z-and-linuxone/

Red Hat OpenShift cluster

OPERATING SYSTEM
**Red Hat
Enterprise Linux
CoreOS**

z/VM or RHEL KVM

LPAR

OSA/ RoCE

**IBM Z and
IBM LinuxONE**

Ideal Use Cases for RHOCP on IBM Z and IBM LinuxONE

1. **Data gravity on IBM Z**
   - co-location implementation of containerized applications with traditional workloads, like Datalakes, Enterprise databases, transactional services in z/OS or Linux on IBM Z

2. **Application Development Consistency**
   - DevSecOps to develop once and deploy options, SLA based, on the most securable platform with cross architecture portability, enabling / disabling and shifting compute capacity for highest dynamic workloads

3. **Consolidation and TCO Reduction**
   - Adopt 3-dimension scalability, vertical, horizontal and combined for highest flexibility without new hardware footprint and unpredicted growth

4. **Blockchain and Digital Asset Management with RHOCP**
   - Build Digital Assets and Blockchain extensions with Confidential Computing

5. **Business Continuity**
   - high predictability and resiliency on IBM Z vs. on distributed servers
   - latency between LPARs is much more predictable vs many distributed servers

The Use Cases Webcast: [The best Use Cases for RH Openshift Container Platform for IBM Z and LinuxONE](#)

RHOCP on IBM Z & LinuxONE exploits operational capabilities for hybrid

THE platform for Hybrid workload and multiple RHOCP environments on the same HW machine

External network & services

DNS

DHCP

NFS

- highest security
- highest isolation
- granular sharing
- 3D scalability
- hybrid environments

Router & Load Balancer

Hypervisor

Hypervisor

Linux

z/OS

RHOCP cluster 1

RHOCP cluster 2

- Transaction services
- Database
- DWH

- Db2
- CICS
- IMS

App1 | App2

App 3 | App 4

Storage

Storage

Local Volumes DASD/FCP

Shared FS

Local Volumes DASD/FCP

Shared FS

**IBM Z /
IBM LinuxONE**

Red Hat OpenShift V4 deployment options

Available now on
IBM Z and
IBM LinuxONE

OPENSHIFT CONTAINER PLATFORM

HOSTED OPENSHIFT

Full Stack Automated (IPI)

Simplified opinionated "Best Practices" for cluster provisioning

Fully automated installation and updates including host container OS.

Red Hat
Enterprise Linux
CoreOS

Pre-existing Infrastructure (UPI)

Customer managed resources & infrastructure provisioning

Plug into existing DNS and security boundaries

Red Hat
Enterprise Linux
CoreOS

Red Hat OpenShift on IBM Cloud

Deploy directly from the IBM Cloud console. An IBM service, master nodes are managed by IBM Cloud engineers.

Azure Red Hat OpenShift

Deploy directly from the Azure console. A MSFT service, jointly managed by Red Hat and Microsoft Azure engineers.

OpenShift Dedicated **

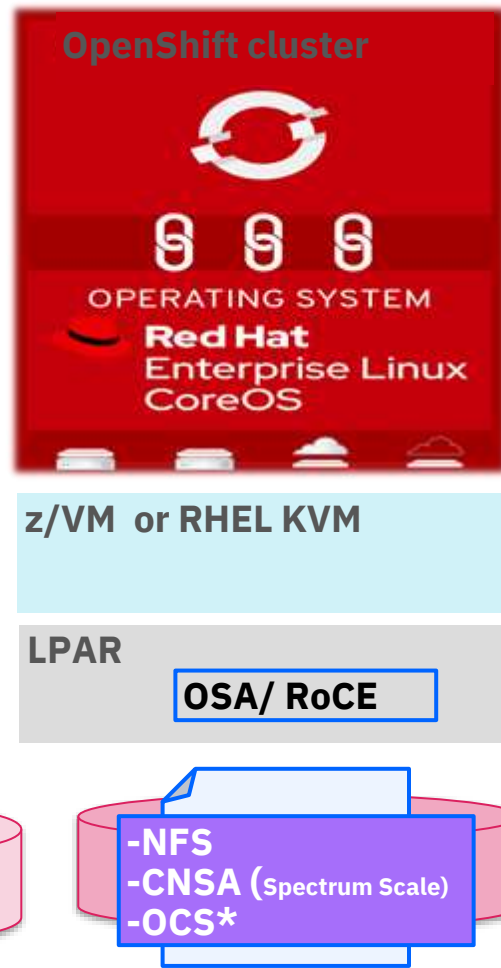Get a powerful cluster, fully managed by Red Hat engineers and support; a Red Hat service.

Planning: RHOCP on IBM Z & LinuxONE implementation topology

IBM

A) What is the Use Case
- ❑ PoC environment
  - ❑ *less resources*
- ❑ Productive like env.
  - ❑ *SLA based,*
  - ❑ *HA / DR*

B) What are the SLAs
- ❑ DevOps integration
  - ❑ *automation*
  - ❑ *shared content*
- ❑ Transactional load
  - ❑ *performance*
- ❑ HA variants
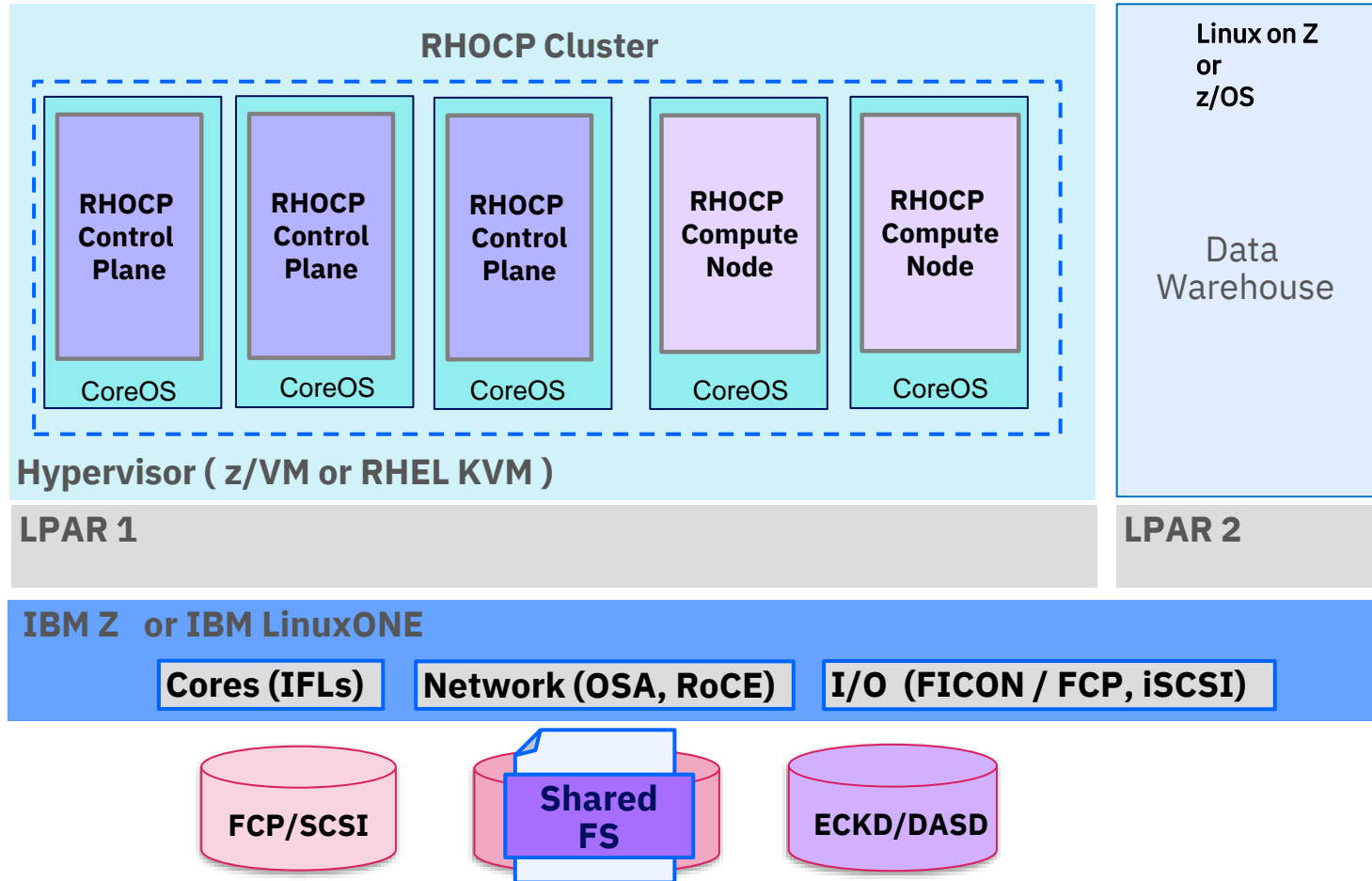 - ❑ *availability*
  - ❑ *resiliency*

OpenShift cluster

OPERATING SYSTEM
Red Hat
Enterprise Linux
CoreOS

z/VM or RHEL KVM

LPAR

OSA/ RoCE

FCP/SCSI

-NFS
-CNSA (Spectrum Scale)
-OCS*

ECKD/DASD

1. Deployment topology
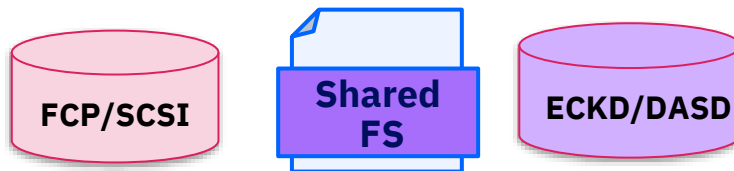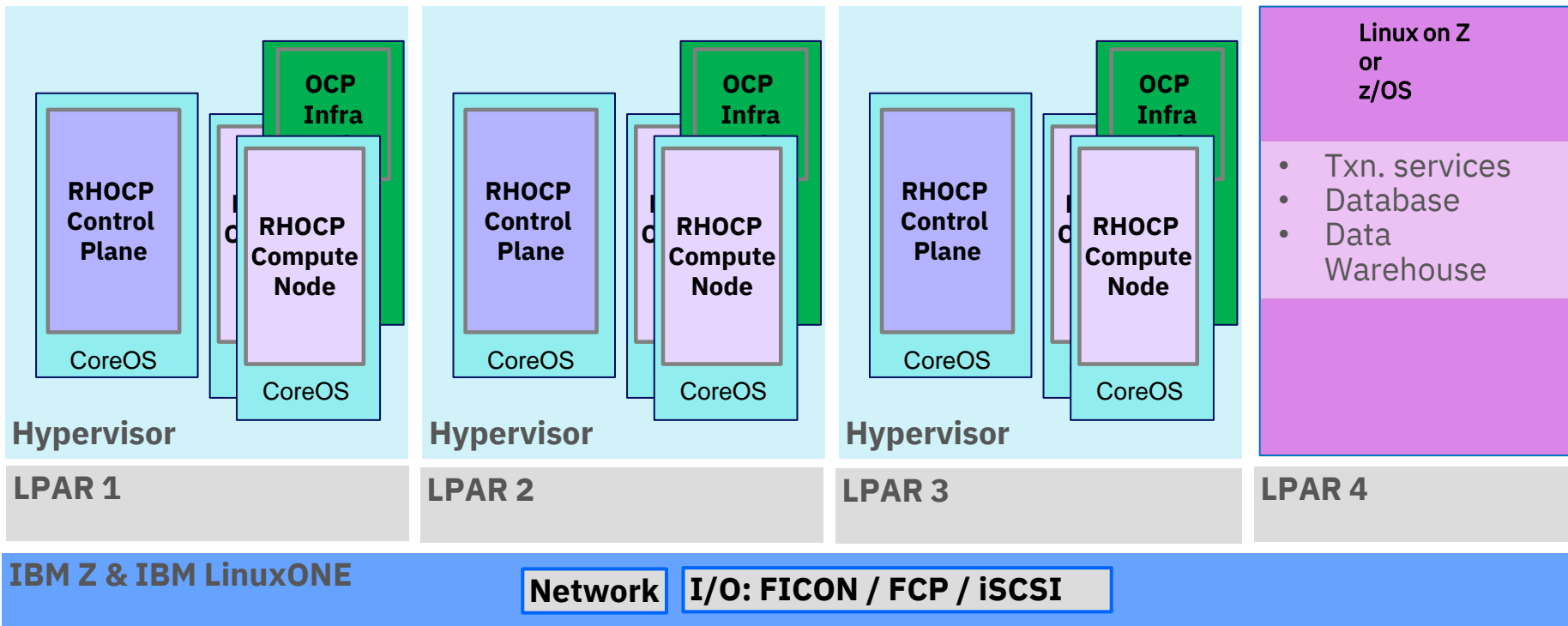- ❑ *RHOCP Standalone*
- ❑ *Co-located with z/OS*

2. HW topology
- ❑ On one HW machine
  - ❑ *One cluster / 1LPAR (PoC)*
  - ❑ *multiple LPARs*
- ❑ Multiple HW machines
  - ❑ *in same DC*
  - ❑ *across DC (with synchronous replication only)*

Minimal RHOCP cluster environment diagram

RHOCP cluster production like Overview diagram

IBM

LPAR 1

Hypervisor

- **RHOCP Control Plane**
- CoreOS
- **RHOCP Compute Node**
- CoreOS
- **OCP Infra**

LPAR 2

Hypervisor

- **RHOCP Control Plane**
- CoreOS
- **RHOCP Compute Node**
- CoreOS
- **OCP Infra**

LPAR 3

Hypervisor

- **RHOCP Control Plane**
- CoreOS
- **RHOCP Compute Node**
- CoreOS
- **OCP Infra**

LPAR 4

Linux on Z or z/OS

- Txn. services
- Database
- Data Warehouse

IBM Z & IBM LinuxONE

Network   **I/O: FICON / FCP / iSCSI**

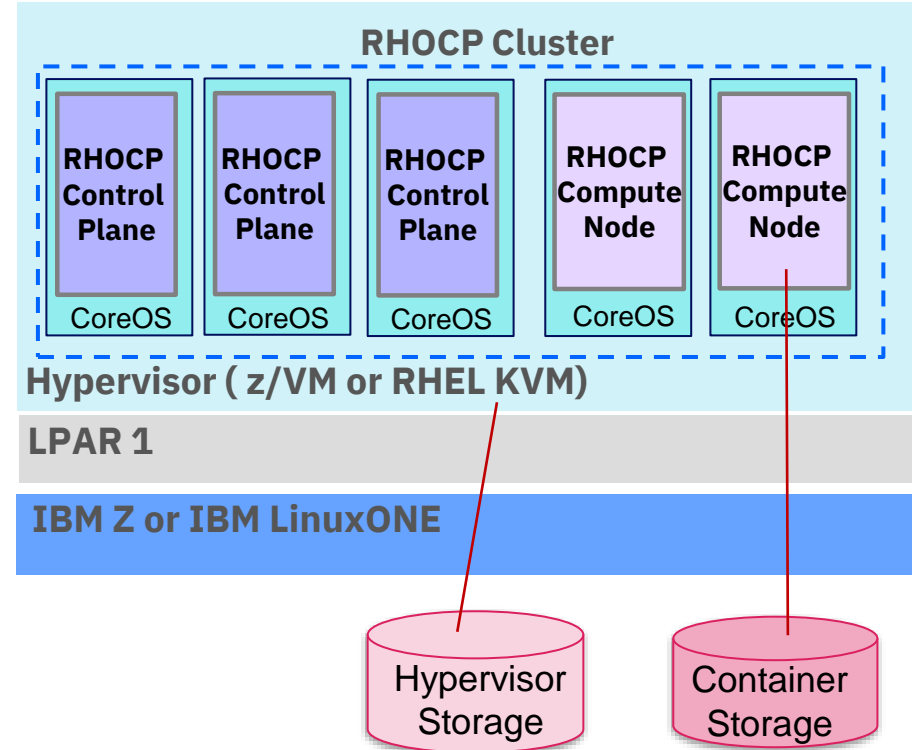**FCP/SCSI**   **Shared FS**   **ECKD/DASD**

Persistent storage options for RHOCP on IBM Z & LinuxONE

There are two different storage categories:

- Storage that hosts the hypervisor and its guests which represent the RHOCP nodes

- Container storage which hosts the data that the RHOCP container workload uses as persistent storage
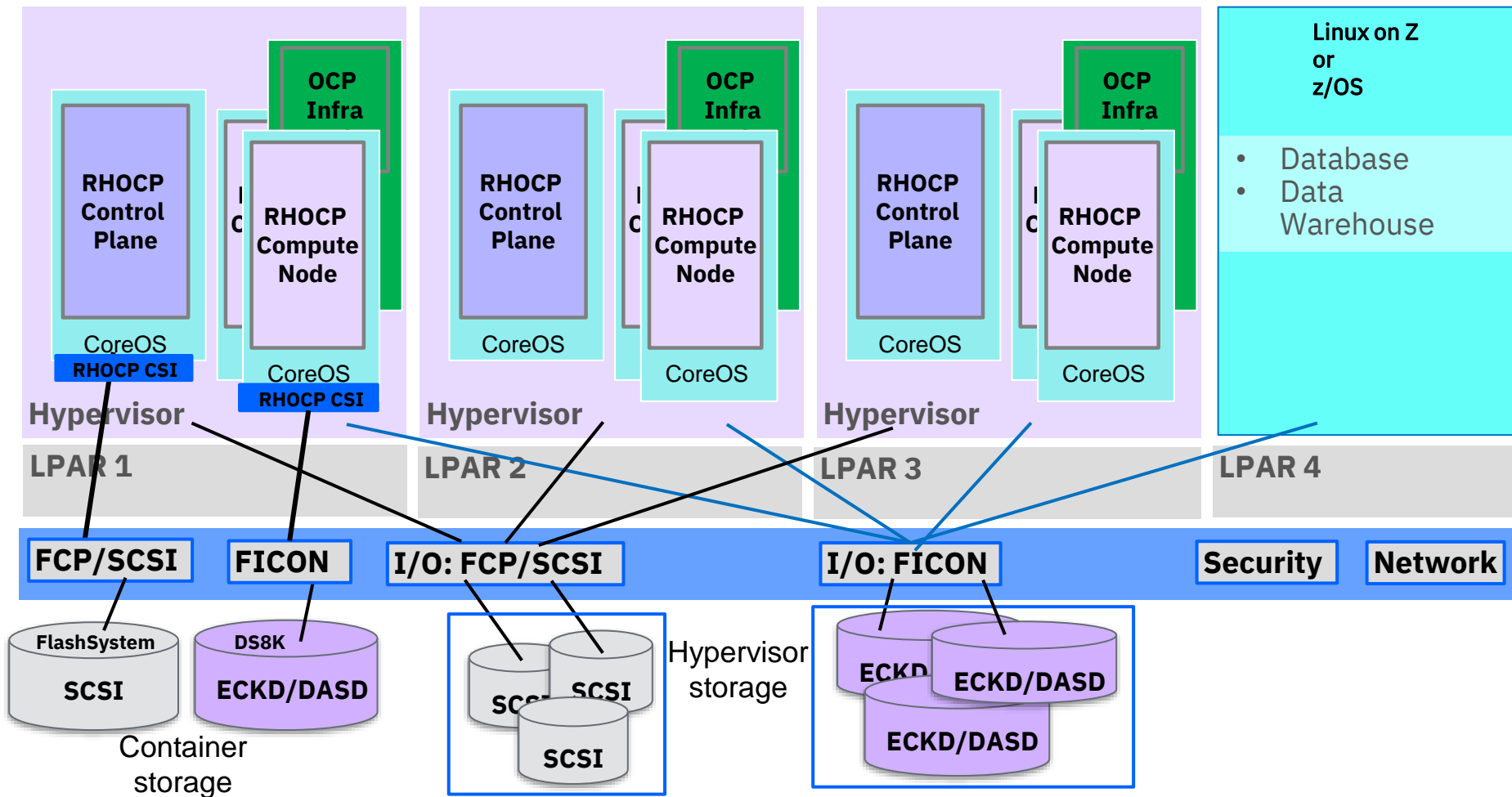
RHOCP Cluster

RHOCP Control Plane	RHOCP Control Plane	RHOCP Control Plane	RHOCP Compute Node	RHOCP Compute Node
CoreOS	CoreOS	CoreOS	CoreOS	CoreOS

Hypervisor (z/VM or RHEL KVM)

LPAR 1

IBM Z or IBM LinuxONE

Hypervisor Storage

Container Storage

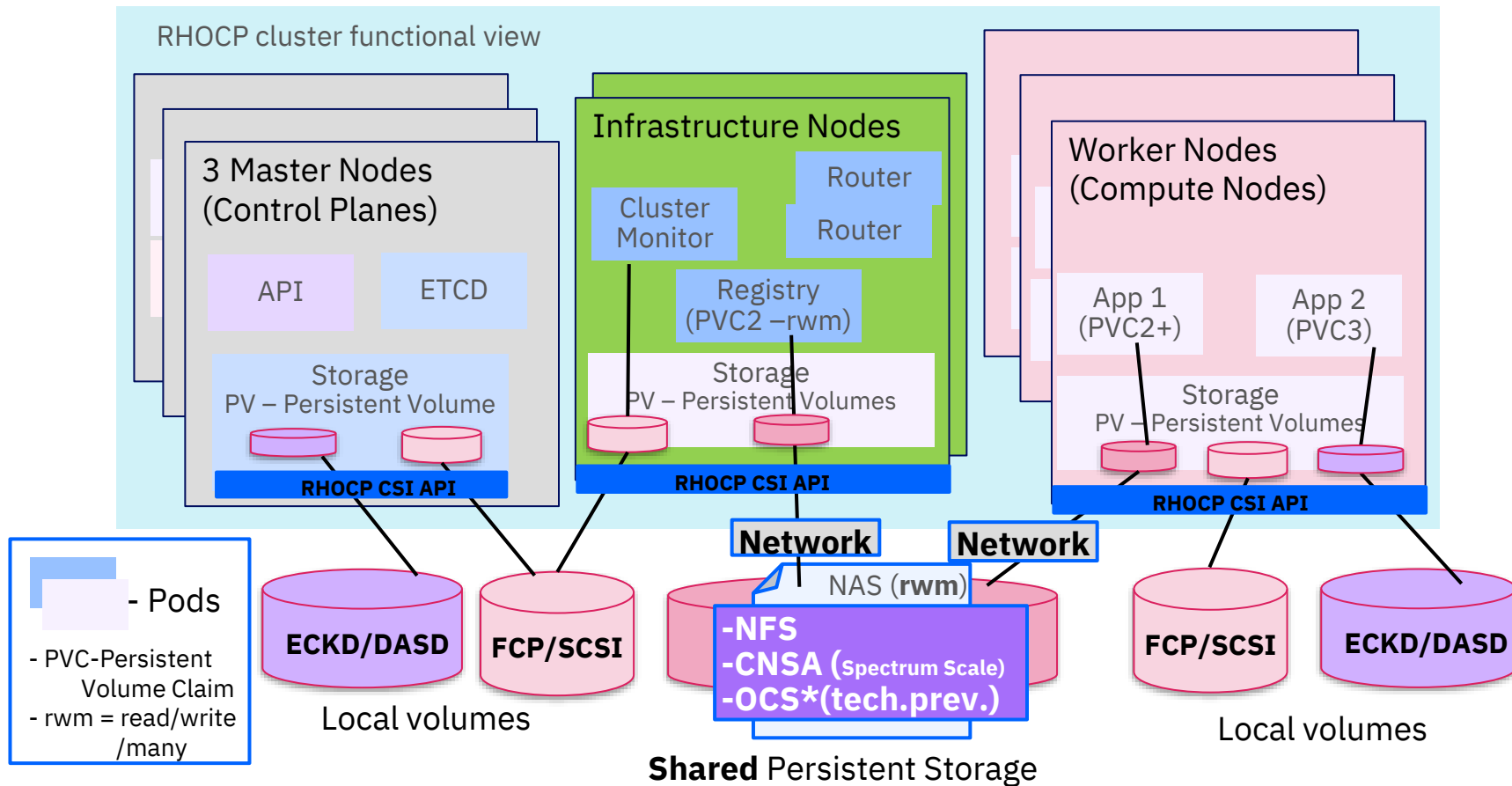# Storage for RHOCP on IBM Z and IBM LinuxONE

- **Control Plane and Compute Nodes** & **Infrastructure nodes** are virtual VMs
  - *They **need local storage** to be installed on*

- All VMs need to be virtualized with KVM or z/VM

- The base OS in all VMs / nodes is CoreOS

- The **local disks are made available to the hypervisor or to OCP via CSI API**
  - in the hypervisors you can have local storage
    - **Attached via FICON, FCP, iSCSI (oc client to CoreOS for z/VM)**

- *RHOCP needs shared persistent storage (rwm)* **for at least the container registry**
  - The shared storage is typically a Network Attached Storage (NAS)
  - The NAS sw/server part can reside on IBM Z or outside
  - The options for NAS attached with CSI driver are **NFS**, **IBM Spectrum Scale CNSA and OCS**(tech. preview)

- **Physical attached storage to RHOCP on Z can be via RHOCP CSI interface**
  - Local storage can be attached using an IBM CSI driver (DS8K, FCP, FlashSystem,…)

- The storage for RHOCP is represented by Persistent Volumes (PVs)

- The Pods on OCP initiate Persistent Volume Claims (PVCs) for PVs

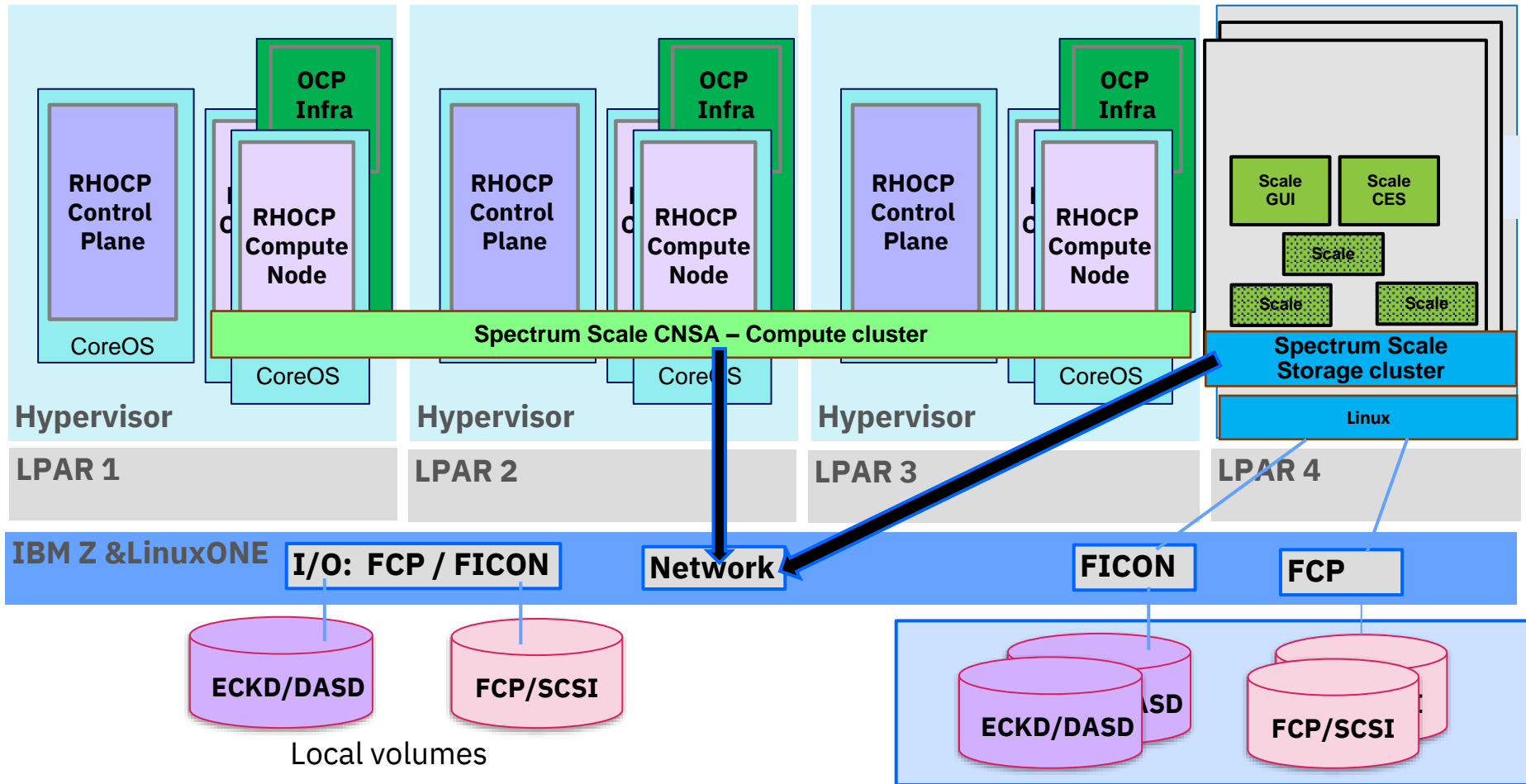# RHOCP cluster – hypervisor and container persistent storage on local disks

RHOCP Control Plane
CoreOS
RHOCP CSI

OCP Infra

RHOCP Compute Node
CoreOS
RHOCP CSI

Hypervisor

LPAR 1

RHOCP Control Plane
CoreOS

OCP Infra

RHOCP Compute Node
CoreOS

Hypervisor

LPAR 2

RHOCP Control Plane
CoreOS

OCP Infra

RHOCP Compute Node
CoreOS

Hypervisor

LPAR 3

Linux on Z or z/OS
- Database
- Data Warehouse

LPAR 4

FCP/SCSI   **FICON**   **I/O: FCP/SCSI**   **I/O: FICON**   **Security**   **Network**

FlashSystem
SCSI

Container storage

DS8K
ECKD/DASD

SCSI   **SCSI**   **SCSI**

Hypervisor storage

ECKD   **ECKD/DASD**   **ECKD/DASD**

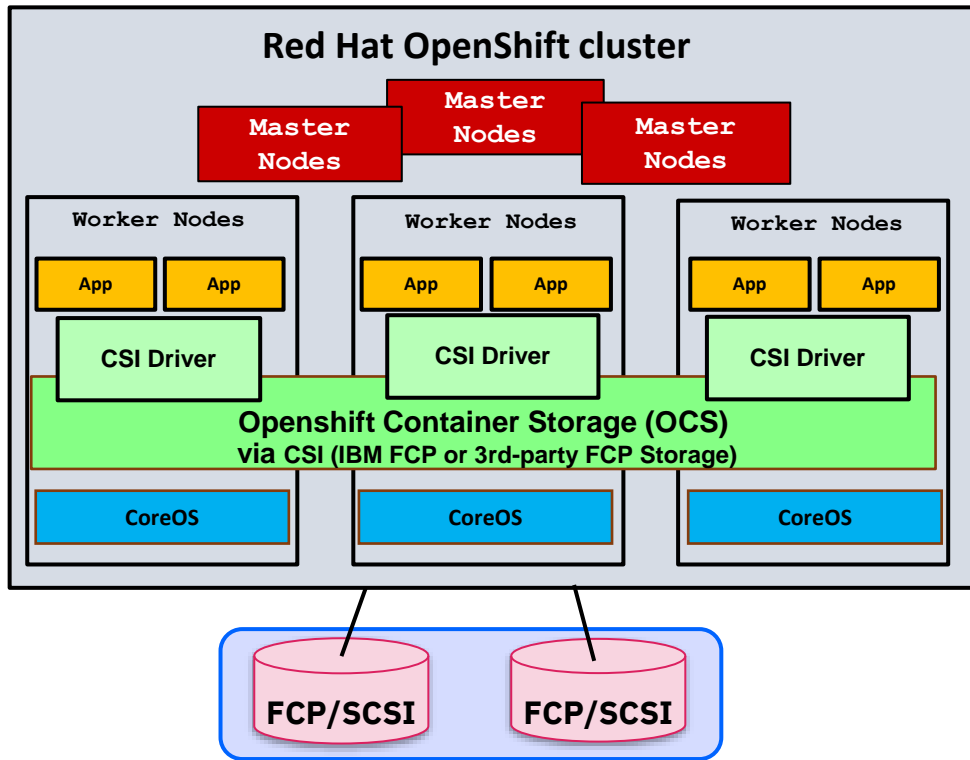# Major Operational Components for Container Persistent Storage

Shared Persistent Storage

IBM Spectrum Scale Container Native Storage Access (CNSA)
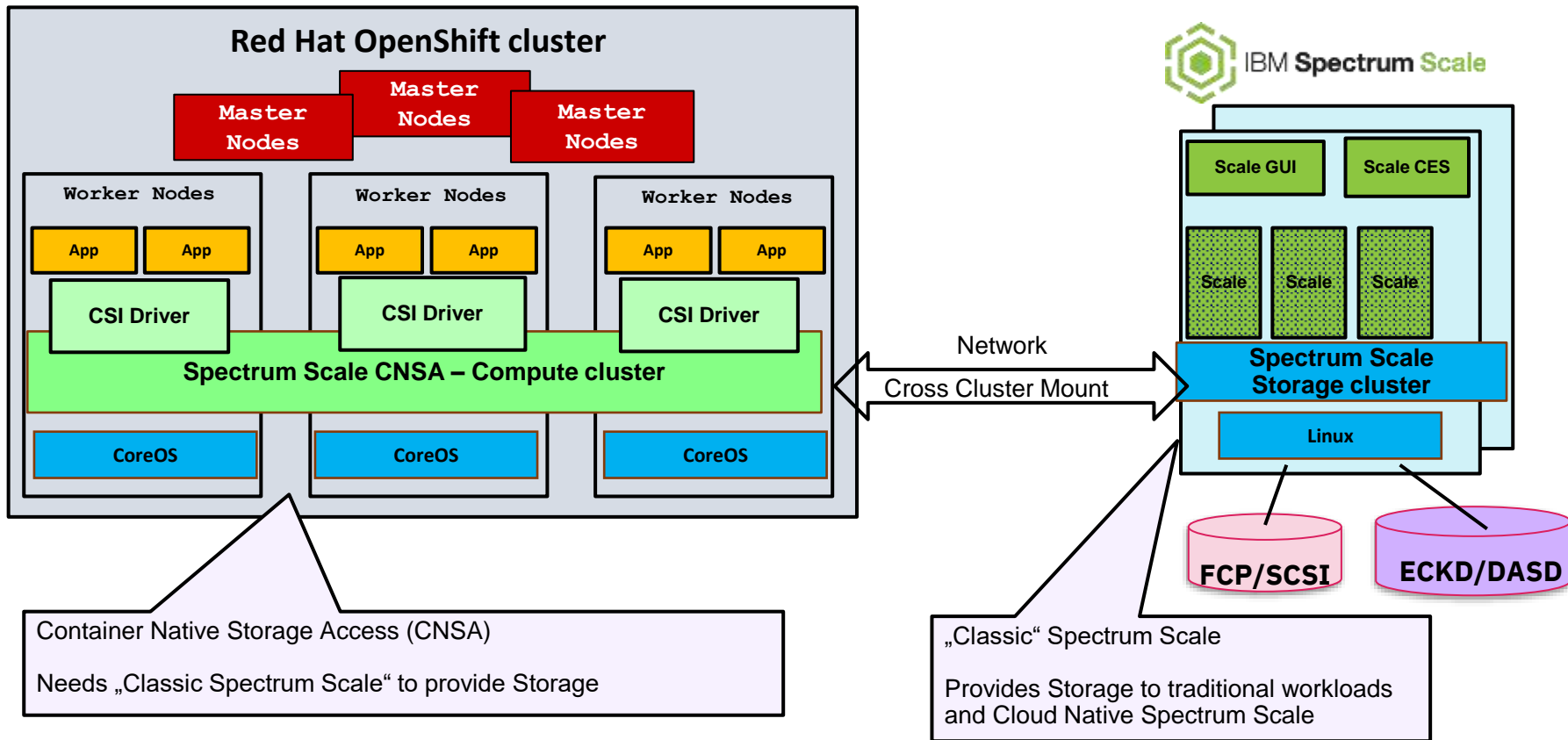
RHOCP cluster HA Architecture Overview diagram with Spectrum Scale

IBM

CNSA – IBM Spectrum Scale Cloud Native Storage Access

Red HAT Openshift Container Storage (OCS)* – internal mode

IBM

Red Hat OpenShift cluster

Master Nodes — Master Nodes — Master Nodes

Worker Nodes | Worker Nodes | Worker Nodes

App | App — App | App — App | App

CSI Driver — CSI Driver — CSI Driver

Openshift Container Storage (OCS)
via CSI (IBM FCP or 3rd-party FCP Storage)

CoreOS — CoreOS — CoreOS

FCP/SCSI — FCP/SCSI

Shared Persistent Container Storage

Red Hat OpenShift Container Storage Operator

Red Hat OpenShift Container Storage Environment

Rook Ceph Operator — **Noobaa Operator**

ceph — noobaa

Rook – storage orchestrator for Kubernetes
Nooba - Multi Cloud Object Gateway
ceph - Software Defined Storage Platform
    based on Rados (Reliable Autonomic
    Distributed Object Store)

(*) currently in technical preview on IBM Z and LinuxONE

Storage decisions for RHOCP on IBM Z and IBM LinuxONE

1. **Use Case 1: RHOCP Applications access z/OS Db2 or Oracle on Linux on Z**
   1. In this case the performance requirement is low for shared storage
   2. For just container images NFS might be feasible (not recommended)

2. **Use Case 2: RHOCP Apps are working with PostgreSQL in RHOCP**
   1. In this case the shared storage is performance relevant
   2. For PostgreSQL a NAS solution with IBM Spectrum Scale CNSA or OCS would fit and not an NFS approach

3. **Use Case 3: RHOCP Apps require shared storage and HA across 2 IBM HW machines**
   1. In this case the shared function of the storage is relevant & performance
   2. A NAS cluster solution with IBM Spectrum Scale CNSA or OCS would fit best
   3. If the 2 HW machines are in 2 datacenters – further considerations apply to stretch the NAS cluster or define 2 clusters and replication, logical or physical based

Shared persistent container storage comparison for RHOCP

IBM

	OpenShift Container Storage (OCS)	IBM Spectrum Scale Container Native Storage Access (CNSA)	NFS Storage
Key Value Proposition	• Cluster based on CEPH • Tightly integrated into Red Hat OpenShift Container Platform • Special developed for RHOCP	• Cluster based on General Parallel File System (GPFS) • Can share data between different architectures (x86, Power, IBM Z) • attached via CNSA	• Popular and common usage with same API for all HW architectures • Not highly performant • Great for tests & simple cases
Additional Aspects	• Software defined storage Rook in SAN • Can federate RHOCP storage across local and cloud environments via Noobaa • SAN using FCP/SCSI Storage	• Can host DB2, Oracle, … • Data Tiering included • Backup & HA / DR functions • Can use SCSI & ECKD disks • RHOCP attaches to an existing cluster	• Transparent access to data from different architectures • Not highly securable • No tiering or auto scaling • Not recommended for production
Scale	• Min of 3 Nodes for OCS • Min One disk for OCS • Maximum of 3 X 500 PVs	• Highly scalable to Petabytes • Implementation variations for scalability and performance	• Can scale based on the NFS limits
Storage Classes	• General purpose file, block or object Cloud native storage • Multicloud object store via MCG gateway (Noobaa)	• Shared, General file storage • Can be used for RHOCP or other data & solutions	• General purpose file storage

Network topology Best Practices for a RHOCP environment

1. **Consider the workload characteristics for the network topology**
   - high number of external requests to RHOCP
      e.g. Web Applications, Mobile Applications
   - high rate of network traffic to a co-located database
2. **Consider the SLAs for the network**
   - Highest performance for inter-pod communication
   - high performance to a System of Record
      in a co-location environment
3. **Consider the flexibility of Infrastructure changes**
   - Frequently changes in number of Nodes in the cluster
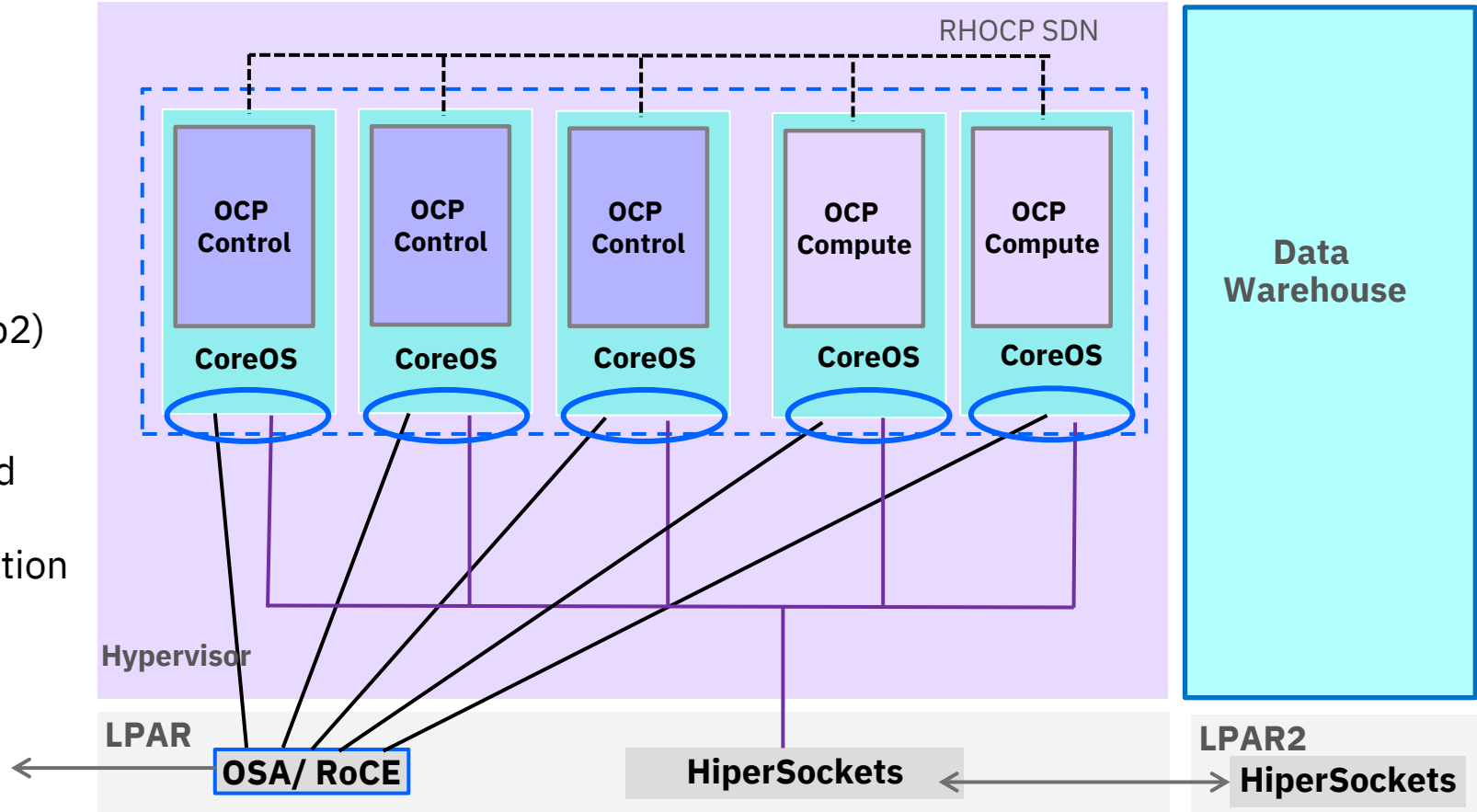   - Dynamic access to different back-end systems

RHOCP Cluster networking options with internal Virtual Switch

- Virtual Switch implementation for dynamic infrastructure

- With z/VM channel bonding for HA

- With KVM and BONDing for bandwidth enhancement and HA

- RHOCP Internal and external network traffic can use same technology
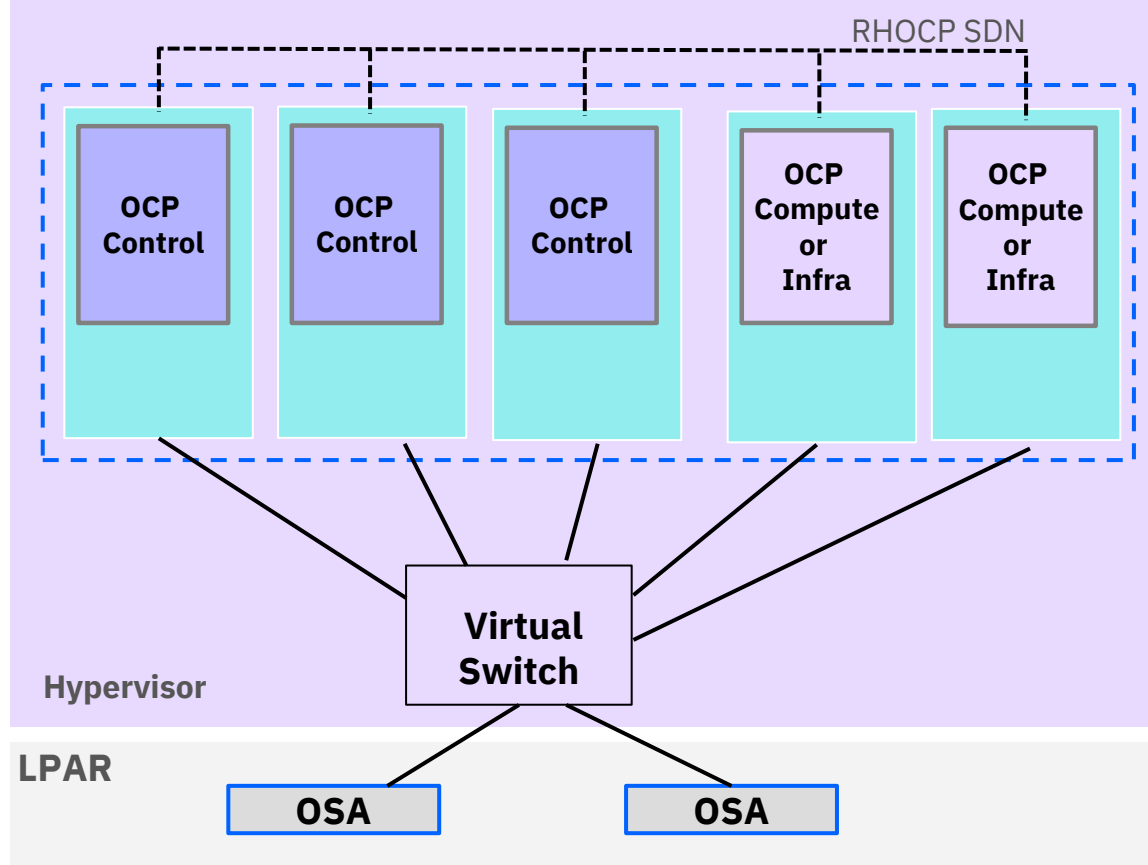
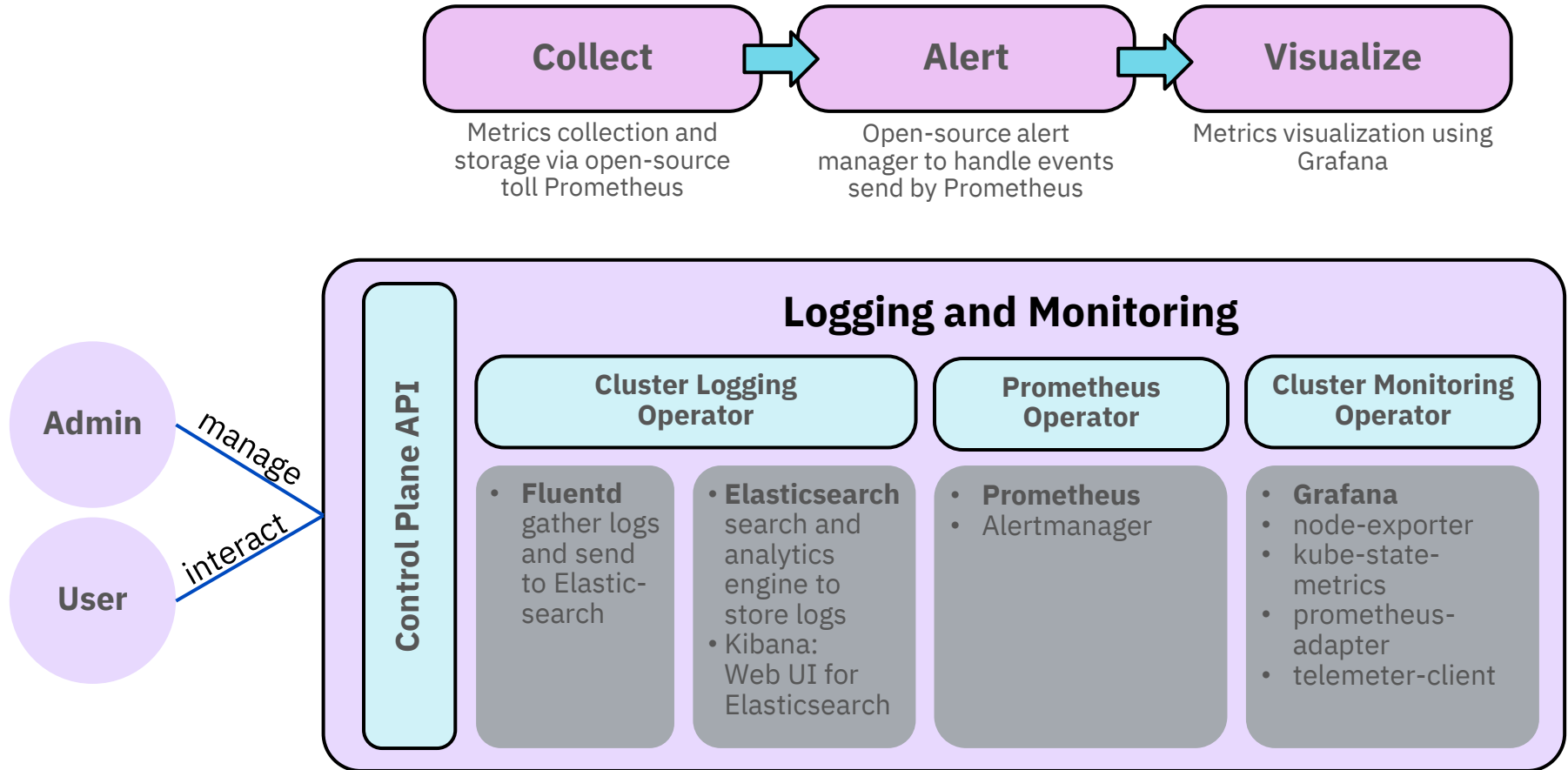# Red HAT Openshift networking with Multi-Nic option
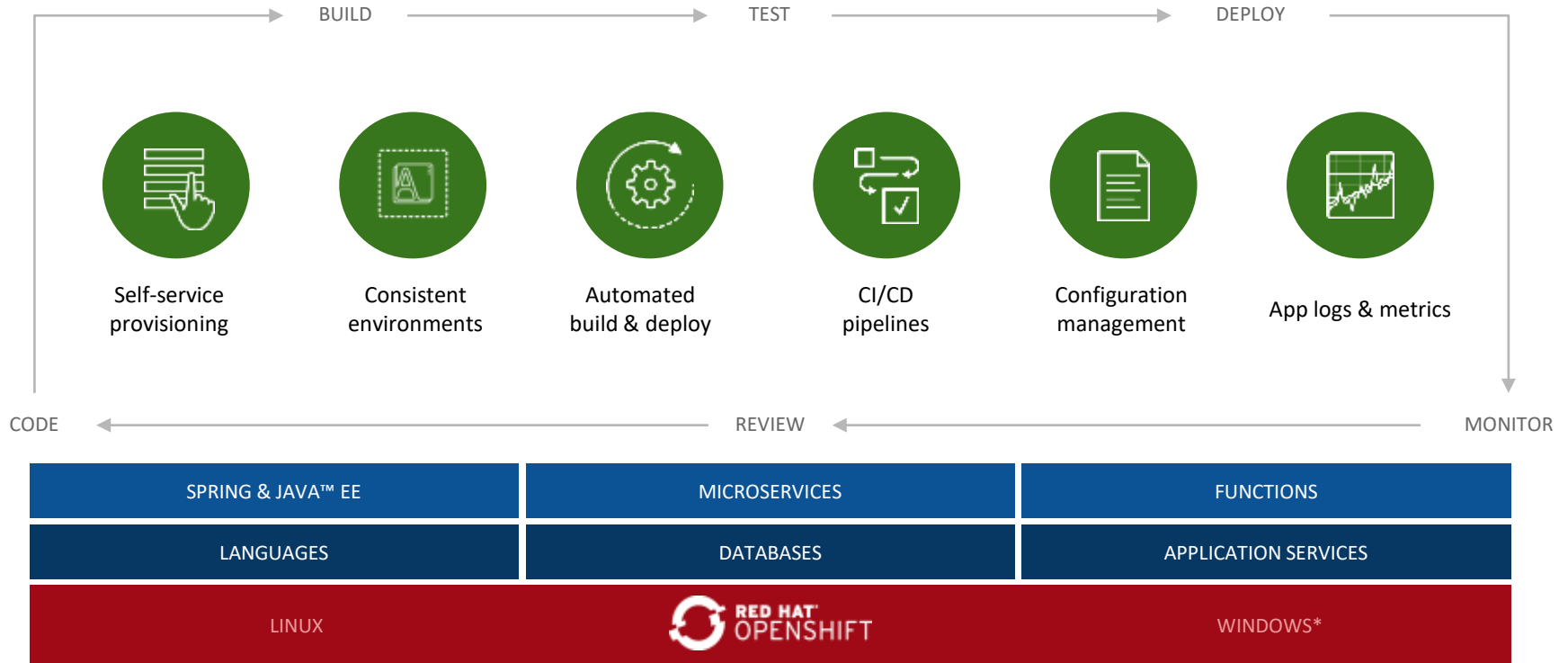
- Consider different metrics for traffic (e.g. HTTP vs. Db2)

- Isolation of external and internal communication

RHOCP SDN

OCP Control	OCP Control	OCP Control	OCP Compute	OCP Compute
CoreOS	CoreOS	CoreOS	CoreOS	CoreOS

Data Warehouse

Hypervisor

LPAR

OSA/ RoCE

HiperSockets

LPAR2

HiperSockets

Red HAT OpenShift operational experience included

Collect

Metrics collection and storage via open-source toll Prometheus

Alert

Open-source alert manager to handle events send by Prometheus

Visualize

Metrics visualization using Grafana

Admin — manage

User — interact

Control Plane API

Logging and Monitoring

Cluster Logging Operator

- **Fluentd** gather logs and send to Elastic-search
- **Elasticsearch** search and analytics engine to store logs
- Kibana: Web UI for Elasticsearch

Prometheus Operator

- **Prometheus**
- Alertmanager

Cluster Monitoring Operator

- **Grafana**
- node-exporter
- kube-state-metrics
- prometheus-adapter
- telemeter-client

OpenShift enables developer productivity

BUILD → TEST → DEPLOY

Self-service provisioning

Consistent environments

Automated build & deploy

CI/CD pipelines

Configuration management

App logs & metrics

CODE ← REVIEW ← MONITOR

SPRING & JAVA™ EE	MICROSERVICES	FUNCTIONS
LANGUAGES	DATABASES	APPLICATION SERVICES
LINUX	RED HAT OPENSHIFT	WINDOWS*

Red HAT OpenShift application development experience
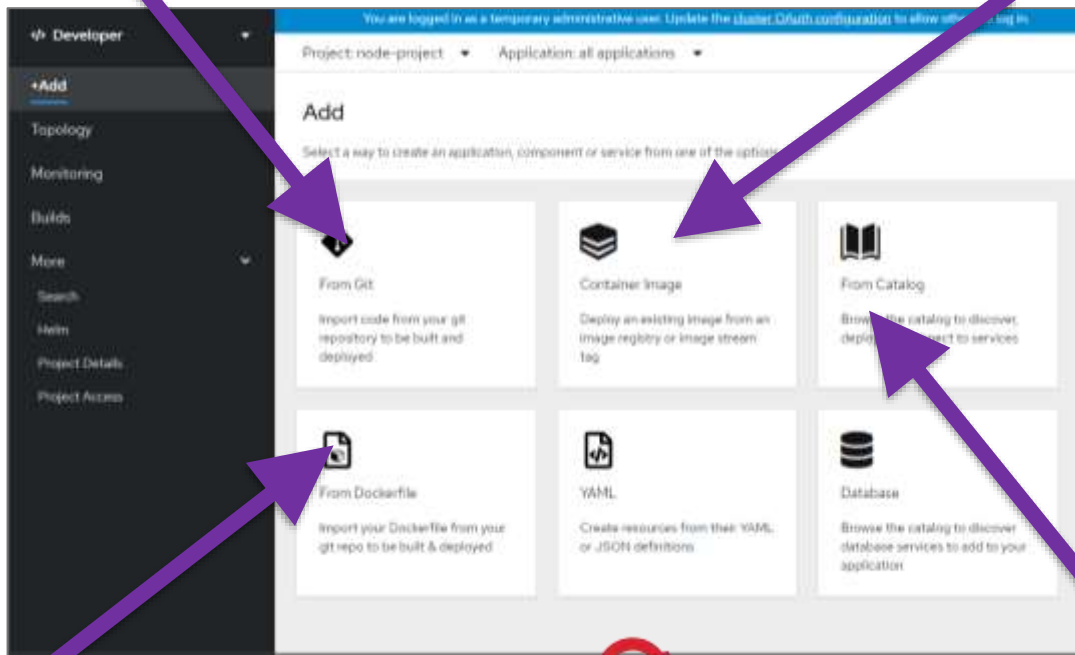
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➢The Reference Architecture for RHOCP on IBM Z and LinuxONE

➢**Outlook and how to start**

Reference Architecture for RHOCP on Z:
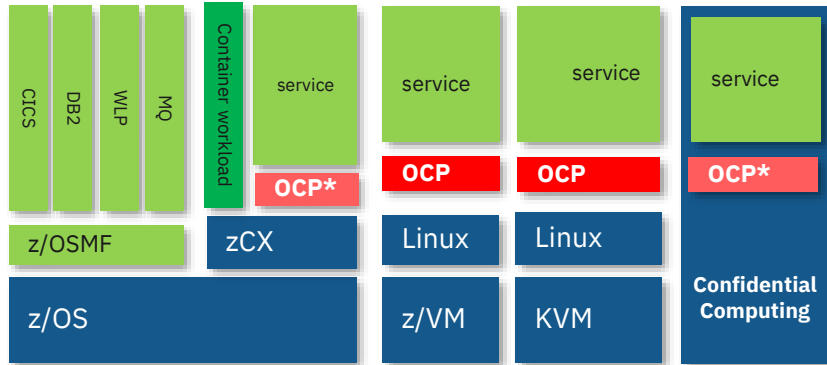https://www.ibm.com/docs/en/linux-on-systems?topic=configuration-red-hat-openshift-reference
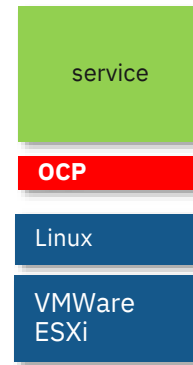
Outlook: The Hybrid Multicloud Vision with OpenShift
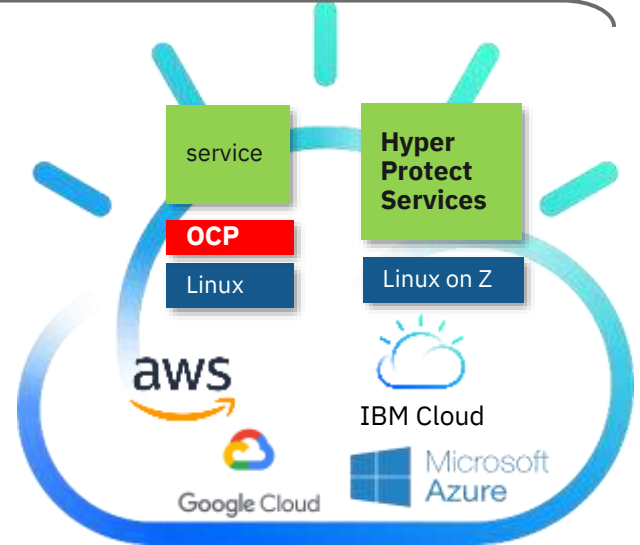

Advanced Cloud Management for multi cloud solutions

Use cases overview: Red Hat OpenShift Container Platform on IBM Z

Linux on Z

Data:
- Data Warehouse
- Oracle
- Analytics / AI

Services integration:
- Ansible Automation
- Web integration
- Mobile Integration
- Omnibus/Integr.

OpenShift cluster

OPERATING SYSTEM

Red Hat Enterprise Linux CoreOS

Data →

Services →

z/OS

Container Interaction → **zCX**

Management → **z/OSMF**

IMS

transactional services

CICS

REST → **z/OS Connect**

Data ← **DB2**

Ansible automation

Hypervisor

Hypervisor (z/VM / KVM)

LPAR 1

LPAR 2

LPAR 3

IBM Z

Security **Network** **I/O**

FCP/SCSI

-NFS
-CNSA (Spectrum Scale attachment)
-OCS*

ECKD/DASD

Red Hat OpenShift Container Platform collocated with Linux on IBM Z

- **RHOCP environment integrates with Linux on Z transactional systems**, bidirectional capabilities (e.g. Temenos T24 for banking)

- **RHOCP workload interacts with enterprise data**, like a Data Lake, Oracle or Db2 Data Warehouse

- **RHOCP implements the Front end for Web or Mobile applications**, for high dynamic workloads, scalability, resource sharing and reliability

- **RHOCP extends Linux on Z** Systems of Record with Open-Source technologies

Linux on Z

Data:
- Oracle
- Data Warehouse
- Analytics / AI

Services integration:
- Ansible Automation
- Web integration
- Mobile Integration
- Omnibus / Integr. Bus

Data

Services

OpenShift cluster

OPERATING SYSTEM
Red Hat Enterprise Linux CoreOS

Hypervisor

Hypervisor (z/VM, KVM)

LPAR 1

LPAR 2

IBM Z **Security** **Network** **I/O**

FCP/SCSI

Shared FS

ECKD/DASD
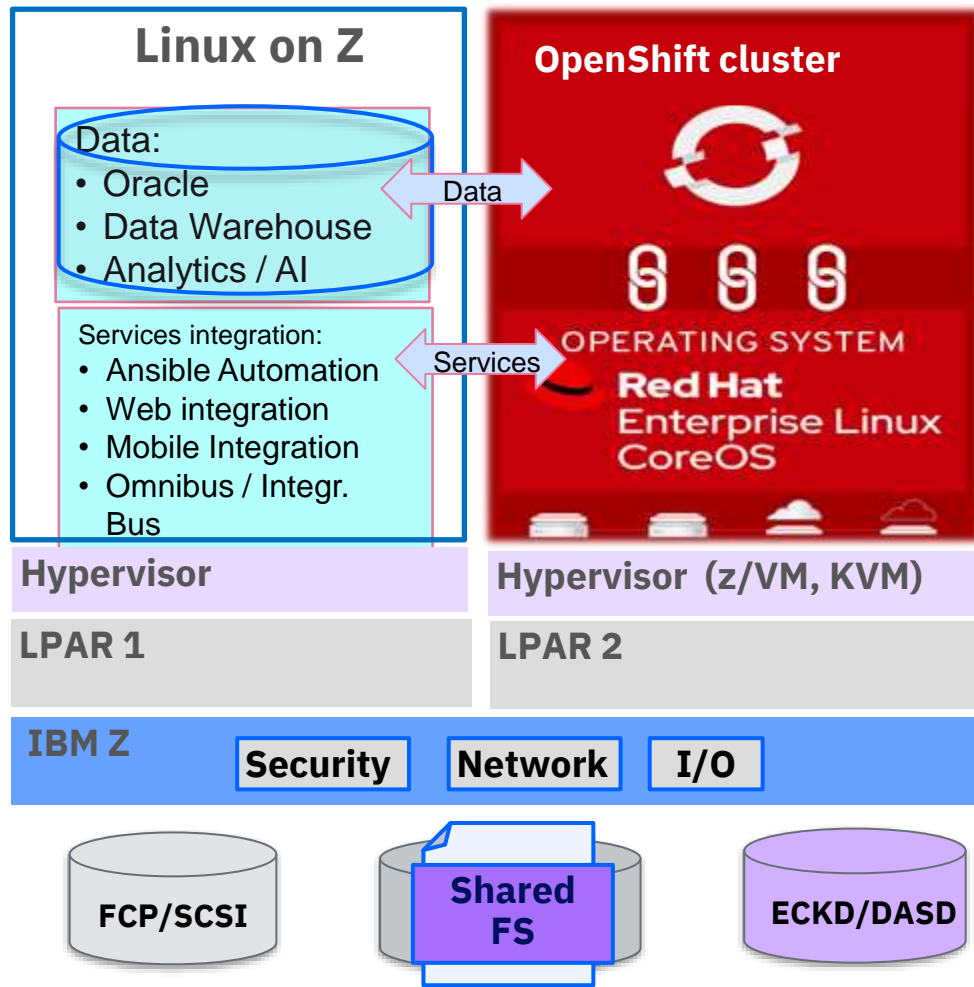
Use Cases for Red Hat OpenShift in colocation with z/OS

RHOCP co-location to z/OS major use cases:

- **Unpredicted scalable workload** in RHOCP accesses z/OS services & data

- RHOCP logic **access to DB2 z/OS**

- **RHOCP to provision z/OS subsystems,** using z/OS Cloud Broker

- **Development environment** integrates via x86 RHOCP with z/OS Wazi

- **RHOCP interacts with z/OS services** in CICS / IMS or via zCX with containerized applications and Open Source technology

- **Batch workload** executed in RHOCP with z/OS data access
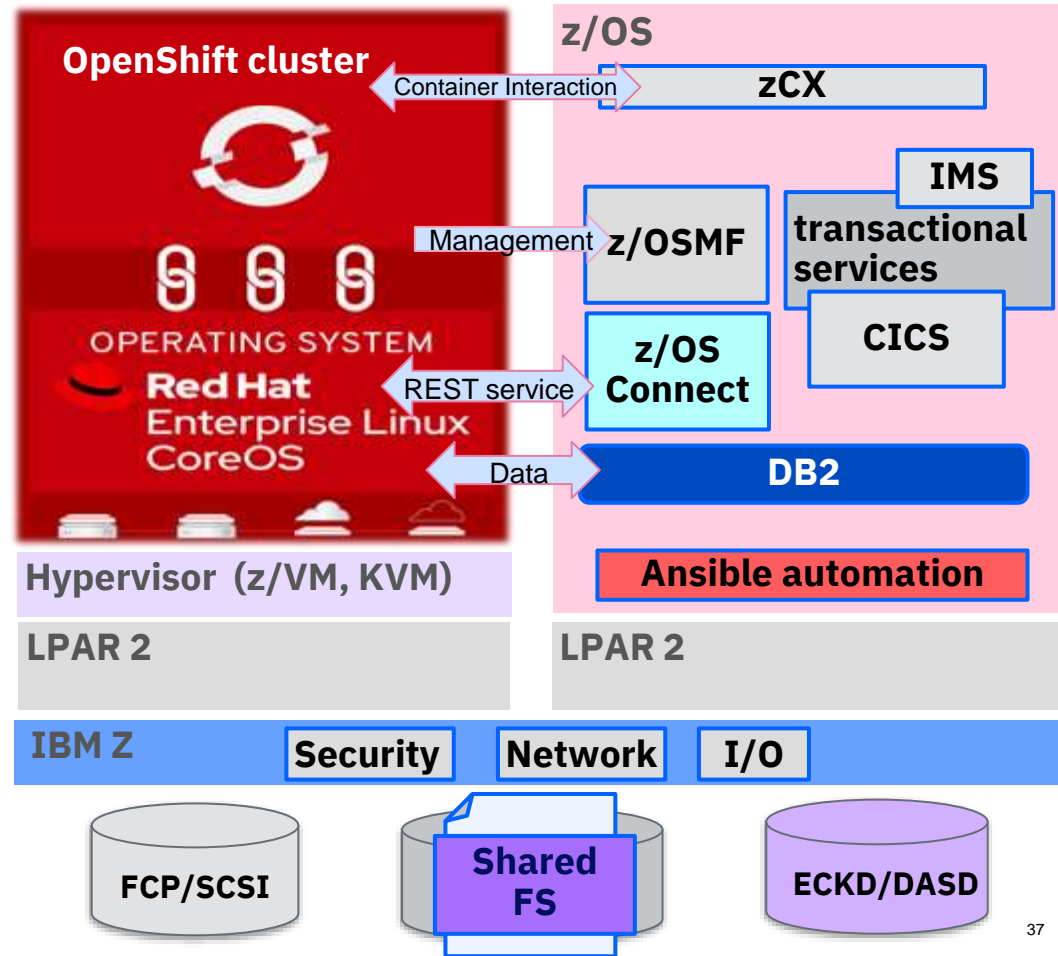
Start NOW: Enable the build of an RHOCP on IBM Z and IBM LinuxONE

1. **Find the challenges or pain points for the business**
   - goal is to position IT, as tool for the business not a cost center
   - find challenges of today & in future envisions or plans

2. **Define a representative workload for RHOCP**
   - Can be small, but representative not a playground
   - Decide to start the project in a production like environment
   - Consider Best practices (vs. a PoC as limited environment)

3. **Consider the characteristics of the workload**
   - High number of Requests to the RHOCP environment vs.
   - high dynamics inside the RHOCP cluster pods
   - A colocation with z/OS or Oracle in Linux on Z

4. **Define the SLAs including HA / DR requirements**
   - Number of physical machines
   - Number of sites and machines per site

Simple operational RHOCP layout
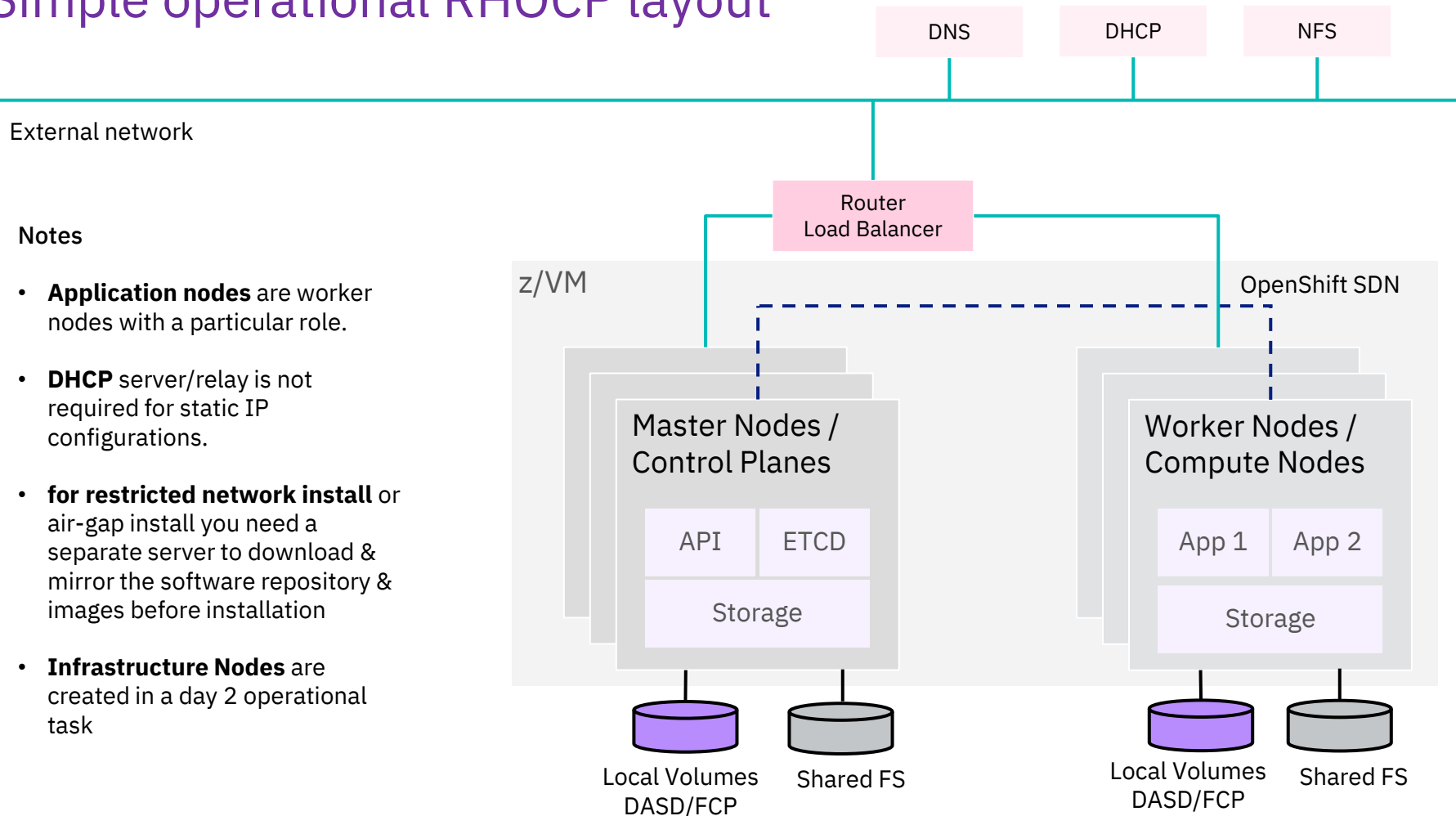
Notes

- **Application nodes** are worker nodes with a particular role.

- **DHCP** server/relay is not required for static IP configurations.

- **for restricted network install** or air-gap install you need a separate server to download & mirror the software repository & images before installation

- **Infrastructure Nodes** are created in a day 2 operational task

DNS

DHCP

NFS

External network

Router
Load Balancer

z/VM

OpenShift SDN

Master Nodes /
Control Planes

API   ETCD

Storage

Worker Nodes /
Compute Nodes

App 1   App 2

Storage

Local Volumes
DASD/FCP

Shared FS

Local Volumes
DASD/FCP

Shared FS

39

Basic environment: Minimum RHOCP cluster Nodes on IBM Z & LinuxONE

The minimum system requirements for an RHOCP cluster are:

➢ Hardware:
- IBM z13 or newer
- any IBM LinuxONE
- 1 LPAR, SMT2 with 3 IFLs,

➢ Memory
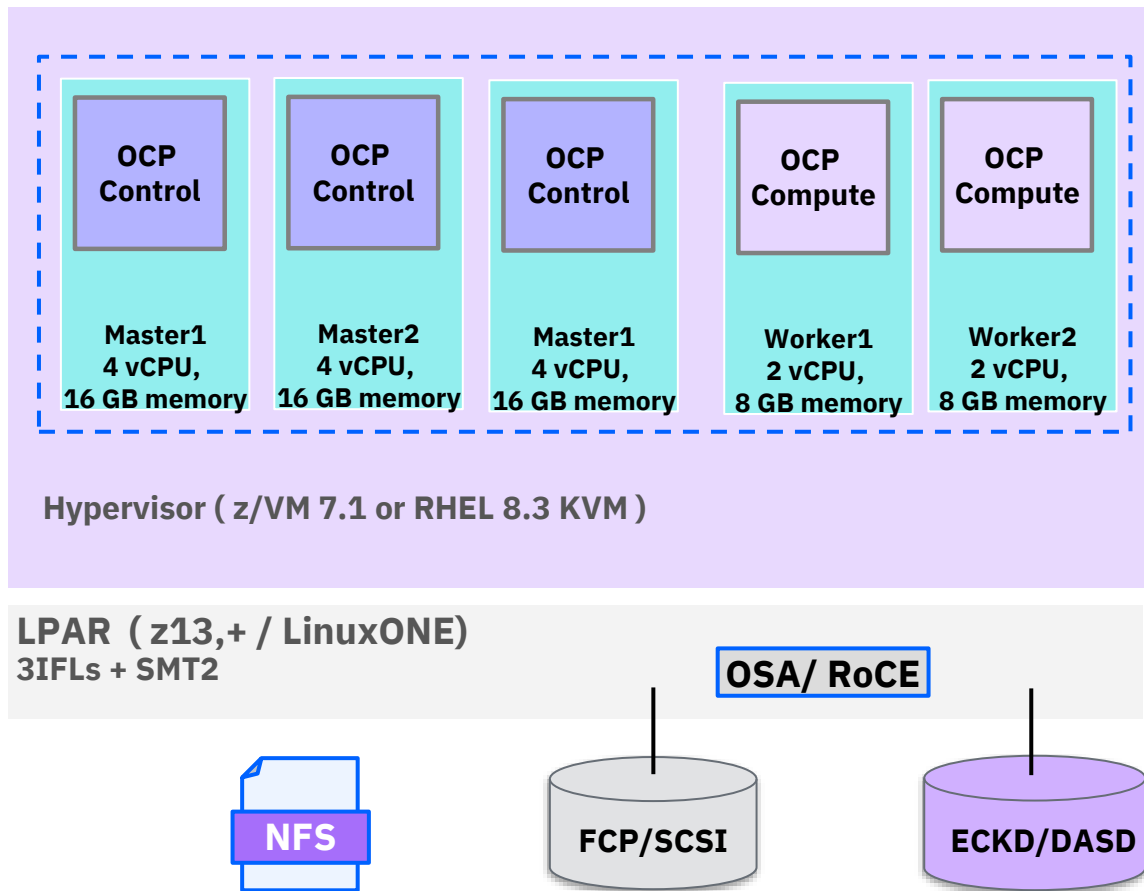- 72 GB RAM for nodes
- 16 GB RAM for temp bootstrap

➢ Hypervisor
- z/VM 7.1
  - EAV function (HyperPAV recom)
- RHEL 8.3 KVM

➢ Networking options
- OSA, RoCE
- 1 Network interface avail. per Node

➢ Storage
- RHOCP Master, 120 GB each
- RHOCP Worker, 120 GB workl. dep.
- NFS, min. 100 GB

OCP Control	OCP Control	OCP Control	OCP Compute	OCP Compute
Master1 4 vCPU, 16 GB memory	Master2 4 vCPU, 16 GB memory	Master1 4 vCPU, 16 GB memory	Worker1 2 vCPU, 8 GB memory	Worker2 2 vCPU, 8 GB memory

Hypervisor (z/VM 7.1 or RHEL 8.3 KVM)

LPAR (z13,+ / LinuxONE)
3IFLs + SMT2

OSA/ RoCE

NFS

FCP/SCSI

ECKD/DASD

Capacity Considerations for a basic / small environment

Hardware requirements

- ✓ IBM z13/z13s and later or IBM LinuxONE
- ✓ 1 LPAR with 3 IFLs with enabled SMT2

Network requirements

- ✓ 1 OSA or RoCE network adapter

Hypervisor requirements

- ✓ One instance of z/VM 7.1 or later

or

- ✓ one instance of RHEL 8.3 KVM (RHOCP 4.7)

On your Hypervisor instance, set up:

- ✓ 3 guest virtual machines for RHOCP control planes
- ✓ 2 guest virtual machines for RHOCP compute nodes
- ✓ 1 guest virtual machine for the temporary RHOCP bootstrap machine

Storage requirements (3x120GB + 2x100 = 560GB)

- ✓ FICON attached disk storage (DASDs)
  To reach the minimum required DASD size for RHOCP Linux CoreOS (RHCOS) installations, you need extended address volumes (EAV).
    If available, use HyperPAV for optimal performance.

- ✓ FCP attached disk storage

Storage / Main Memory (3x16+2x8+16=80GB)

- ✓ 16 GB for RHOCP control plane machines
- ✓ 8 GB for RHOCP compute machines
- ✓ 16 GB for the temporary RHOCP bootstrap machine

https://docs.openshift.com/container-platform/4.6/installing/installing_ibm_z/installing-ibm-z.html#minimum-resource-requirements_installing-ibm-z

Additional Requirements to Build an RHOCP cluster in z/VM

Required External services

FTP / HTTP for deployment (temporary)

Container Registry for airgap deployment & service (perm.)

Bastion services

Load Balancer

DNS

DHCP

NFS

Bootstrap For installation (temporary)

4 vCPU, 16 GB memory CoreOS

OCP Control

Master1 4 vCPU, 16 GB memory

OCP Control

Master2 4 vCPU, 16 GB memory

OCP Control

Master1 4 vCPU, 16 GB memory

OCP Compute

Worker1 2 vCPU, 8 GB memory

OCP Compute

Worker2 2 vCPU, 8 GB memory

Hypervisor (z/VM 7.1 or RHEL 8.3 KVM)

LPAR (z13, … / LinuxONE)
3IFLs + SMT2, 80GB

OSA/ RoCE

Bootstrap capacity:
- 4 vCPUs
- 16+ GB main memory
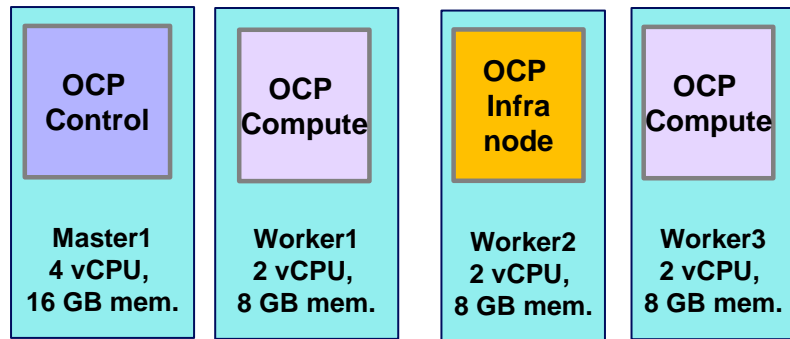- 120GB disk storage

NFS

FCP/SCSI

ECKD/DASD

Production like environment: RHOCP cluster with HA options

Distribute RHOCP nodes to different hypervisor instances on IBM Z / LinuxONE servers for HA, to avoid service outages
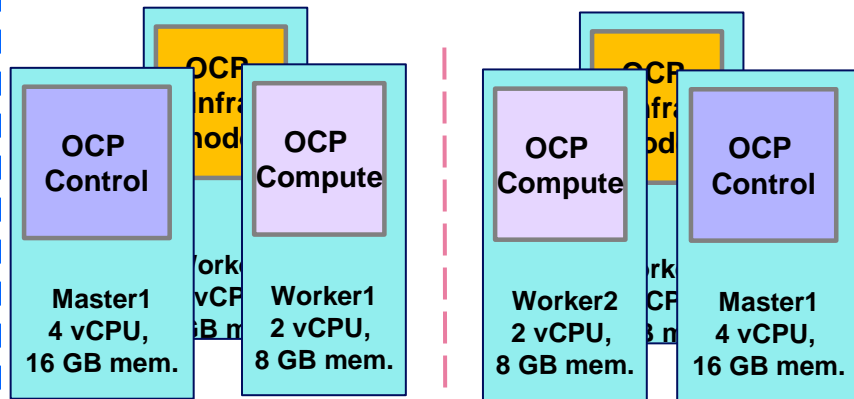
IBM

z/VM Isolation: EAL4+

OCP Control	OCP Compute	OCP Infra node	OCP Compute
Master1 4 vCPU, 16 GB mem.	Worker1 2 vCPU, 8 GB mem.	Worker2 2 vCPU, 8 GB mem.	Worker3 2 vCPU, 8 GB mem.

z/VM or RHEL KVM

LPAR   LACP

OSA/RoCE   **OSA/RoCE**

LPAR Isolation: EAL5+

OCP Control	OCP Infra node	OCP Compute
Master1 4 vCPU, 16 GB mem.	Worker... vCP... GB m...	Worker1 2 vCPU, 8 GB mem.

z/VM or RHEL KVM

LPAR

OSA/RoCE

OCP Compute	OCP Infra node	OCP Control
Worker2 2 vCPU, 8 GB mem.	Worke... CP... 8 m...	Master1 4 vCPU, 16 GB mem.

z/VM or RHEL KVM

LPAR

OSA/RoCE

For HA consider that (n/2)+1 Master Nodes need to be active to keep the cluster operable

Capacity Considerations for a Preferred Installation Scenario

Hardware requirements

✓ IBM z13/z13s and later or IBM LinuxONE

✓ 3 LPARs with 6 IFLs with enabled SMT2

Network requirements

✓ 2 OSA or RoCE network adapter

Hypervisor requirements

✓ 3 instances of z/VM 7.1 or later

or

✓ 3 instances of RHEL 8.3 KVM (RHOCP 4.7)

On your Hypervisor instance, set up:

✓ 3 guest virtual machines for RHOCP control planes

✓ 3 guest virtual machines for RHOCP compute nodes

✓ 3 guest virtual machines for Infrastructure nodes

✓ 1 guest virtual machine for the temporary RHOCP bootstrap machine

Storage requirements (6x120=720GB)

✓ FICON attached disk storage (DASDs)
To reach the minimum required DASD size for RHOCP Linux CoreOS (RHCOS) installations, you need extended address volumes (EAV).
If available, use HyperPAV for optimal performance.

✓ FCP attached disk storage

Storage / Main Memory (3x16+3x8+16= 88GB)

✓ 16 GB for RHOCP control plane machines

✓ 8 GB for RHOCP compute machines
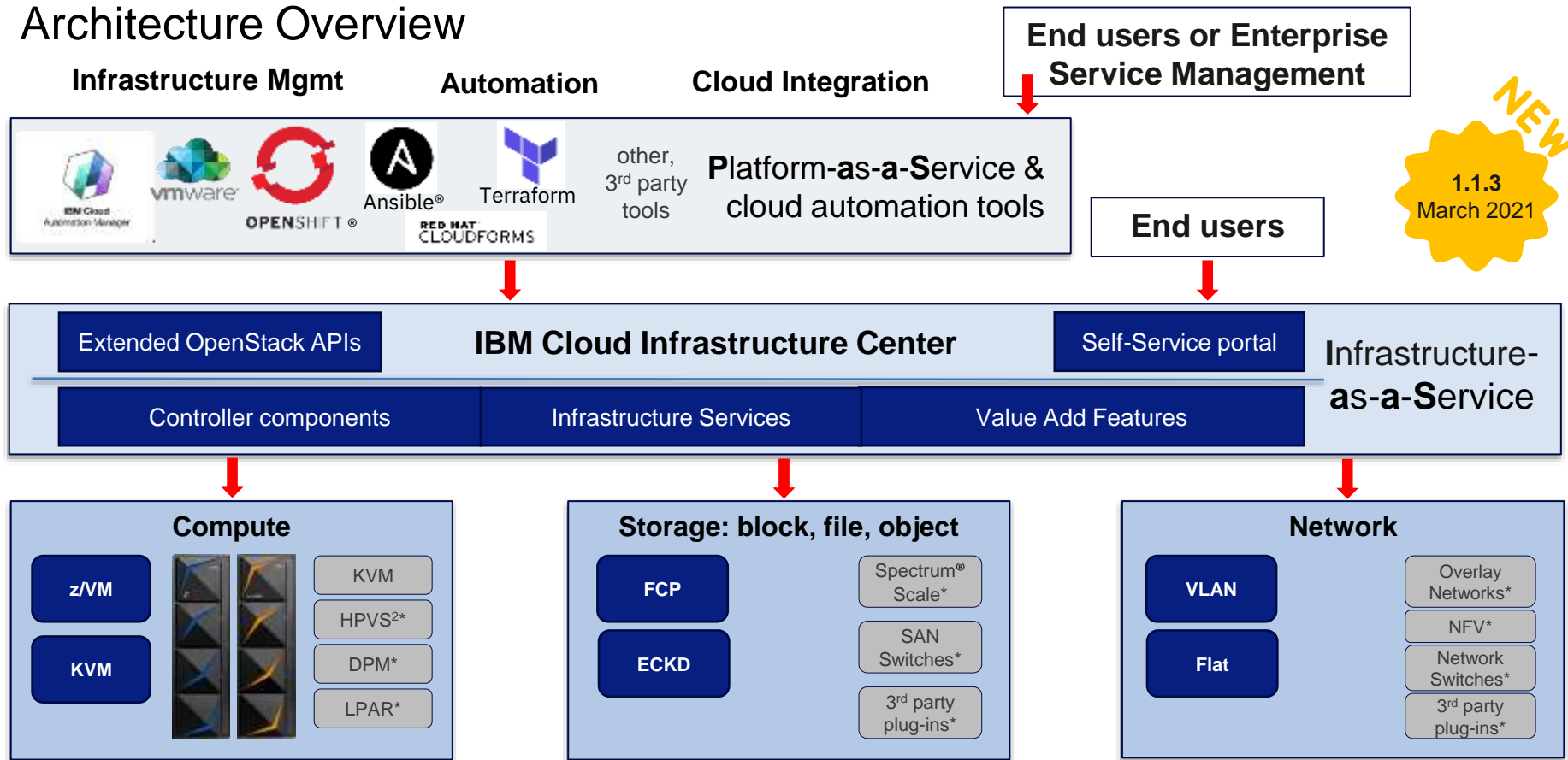
✓ 16 GB for the temporary RHOCP bootstrap machine

High availability and DR options for a RHOCP environments
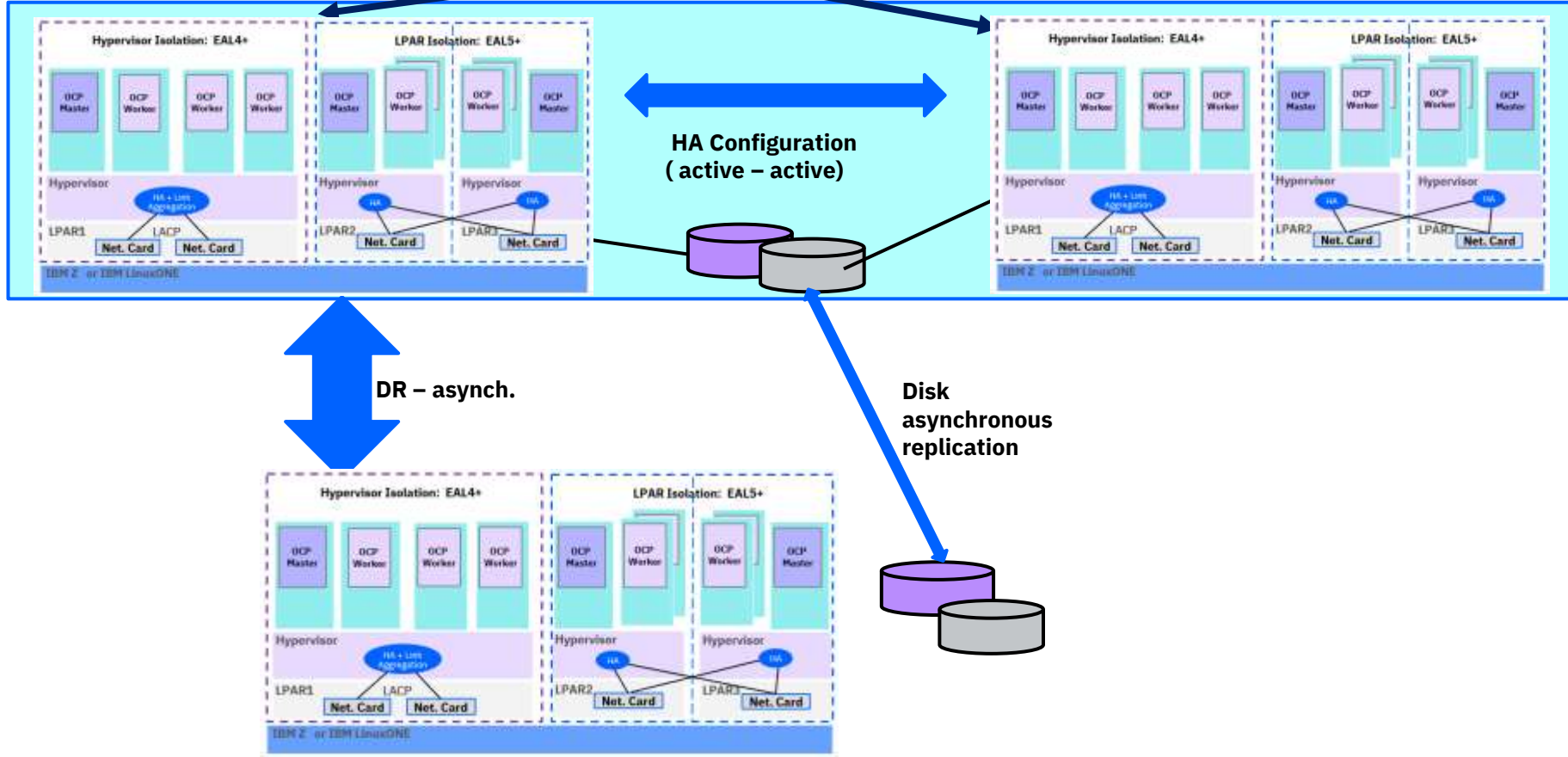
Infrastructure management with **IBM Cloud Infrastructure Center**
Architecture Overview

Infrastructure Mgmt   **Automation**   **Cloud Integration**

End users or Enterprise Service Management

Ansible®   Terraform   other, 3rd party tools   **P**latform-**a**s-**a**-**S**ervice & cloud automation tools

End users

NEW

1.1.3 March 2021

IBM Cloud Infrastructure Center

Extended OpenStack APIs   Self-Service portal   **I**nfrastructure-**a**s-**a**-**S**ervice

Controller components	Infrastructure Services	Value Add Features

Compute

z/VM	KVM
KVM	HPVS[2]*
	DPM*
	LPAR*

Storage: block, file, object

FCP	Spectrum® Scale*
ECKD	SAN Switches*
	3rd party plug-ins*

Network

VLAN	Overlay Networks*
Flat	NFV*
	Network Switches*
	3rd party plug-ins*

[1] IBM Hyper Protect Virtual Server

* All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

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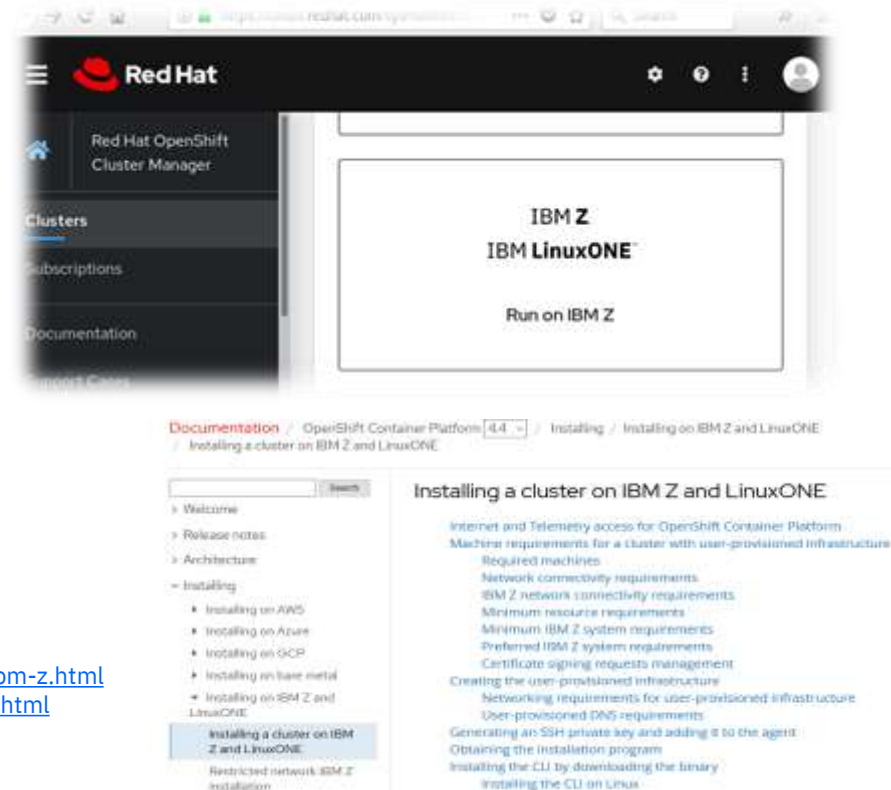Can provision RHEL, CoreOS, SLES 15 SP1 und Ubuntu 20.04 guests

Where can you download RHOCP?

try.openshift.com
cloud.redhat.com

OCP 4.7 on Z was released on 24/02/21
OCP 4.6 on Z was released on 27/10/20
OCP 4.5 on Z was released on 7/30/20
OCP 4.4 on Z was released on 6/22/20
OCP 4.3 on Z was released on 4/30/20
OCP 4.2 on Z was released on 2/11/20

https://docs.openshift.com/container-platform/4.6/installing/installing_ibm_z/installing-ibm-z.html
https://docs.openshift.com/container-platform/4.6/release_notes/ocp-4-6-release-notes.html

2020 IBM Corporation

Create your own OpenShift 4 cluster – https://cloud.redhat.com/openshift/install

Need access to IBM Z / LinuxONE for RHOCP ?
Try the **LinuxONE Community Cloud**

The IBM LinuxONE Community Cloud provides

- Free access for developers, students, and entrepreneurs

- Virtual servers and services for testing and piloting emerging applications for evaluation purposes

- Fast Start Guides
  https://www.ibm.com/community/z/linuxone-cc/faststart

Try OpenShift Container Platform on the LinuxONE Community Cloud

https://www.ibm.com/community/z/linuxone-cc/request-oc

https://developer.ibm.com/components/ibm-linuxone/gettingstarted/

IBM Z and IBM LinuxONE can be the core of your secure hybrid cloud

- Unparalleled trust and security for mission critical workloads and data

- Delivers single-point secure management and integration across environments and cloud platforms

- Agility in operations and development across the cloud ecosystem

- Remove skills barriers with open technology and tooling

- Support mobility of workloads, services and data across the hybrid cloud ecosystem
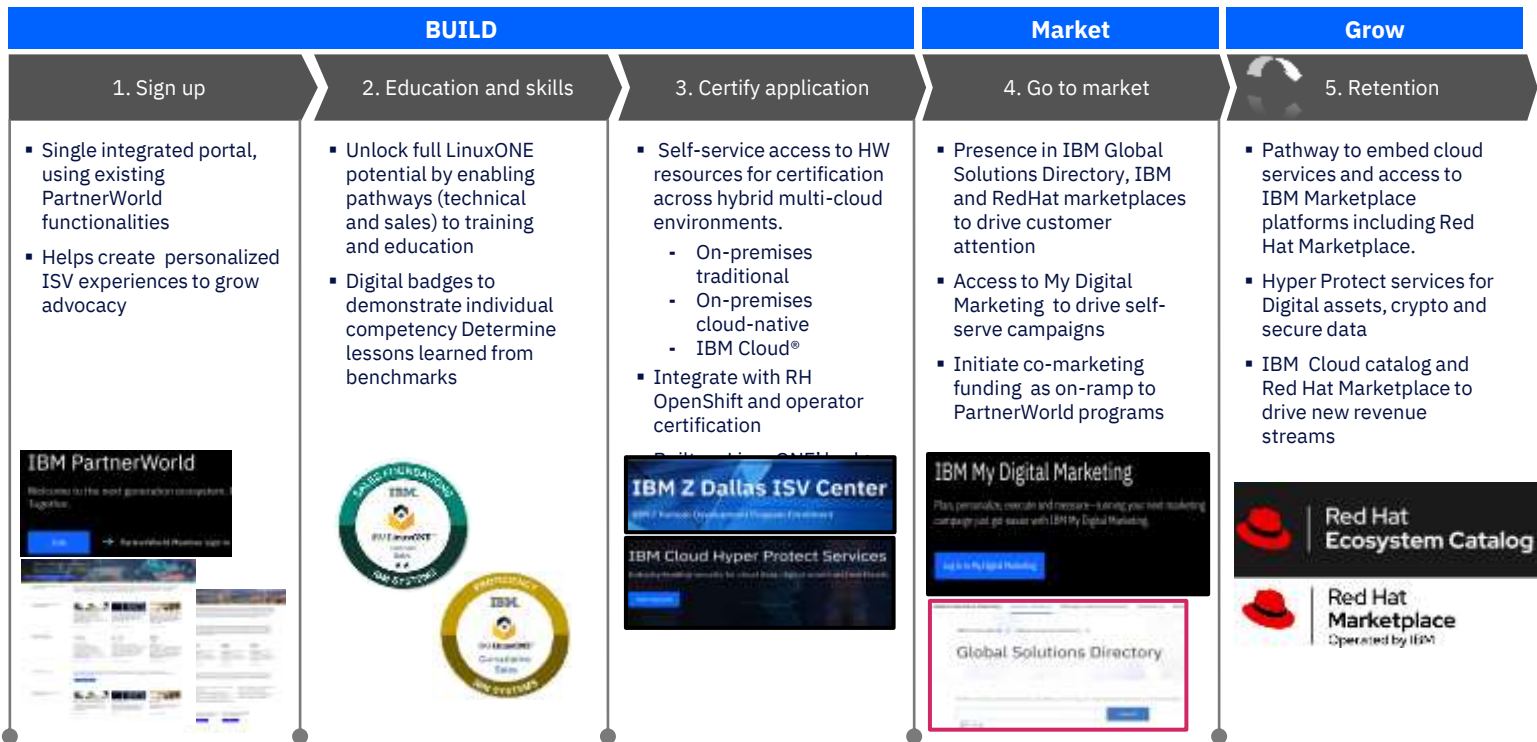
LinuxONE Partner Network (LPN)

Digital-first model

Let LinuxONE drive your business success

- Accelerate onboarding & certification (individuals & applications) via access to complimentary, self-service pathways
- Reduce time to market by accessing world-class partner marketing, enablement and sales resources
- Increase revenue via access to co-marketing funding

BUILD			Market	Grow
1. Sign up	2. Education and skills	3. Certify application	4. Go to market	5. Retention

1. Sign up
- Single integrated portal, using existing PartnerWorld functionalities
- Helps create personalized ISV experiences to grow advocacy

2. Education and skills
- Unlock full LinuxONE potential by enabling pathways (technical and sales) to training and education
- Digital badges to demonstrate individual competency Determine lessons learned from benchmarks

3. Certify application
- Self-service access to HW resources for certification across hybrid multi-cloud environments.
  - On-premises traditional
  - On-premises cloud-native
  - IBM Cloud®
- Integrate with RH OpenShift and operator certification

4. Go to market
- Presence in IBM Global Solutions Directory, IBM and RedHat marketplaces to drive customer attention
- Access to My Digital Marketing to drive self-serve campaigns
- Initiate co-marketing funding as on-ramp to PartnerWorld programs

5. Retention
- Pathway to embed cloud services and access to IBM Marketplace platforms including Red Hat Marketplace.
- Hyper Protect services for Digital assets, crypto and secure data
- IBM Cloud catalog and Red Hat Marketplace to drive new revenue streams

IBM PartnerWorld
Welcome to the next generation ecosystem. Together.

IBM Z Dallas ISV Center
IBM Z Remote Development Program Enrollment

IBM Cloud Hyper Protect Services

IBM My Digital Marketing
Plan, personalize, execute and measure – turning your next marketing campaign just got easier with IBM My Digital Marketing.

Global Solutions Directory

Red Hat Ecosystem Catalog

Red Hat Marketplace Operated by IBM

Visit LPN at: https://www.ibm.com/partnerworld/systems/ibm-linuxone-isv-partner-network-program

Contact LPN team via lpnhelp@us.ibm.com

Performance Experiences in the Linux on IBM Z & IBM LinuxONE Knowledge center

https://www.ibm.com/support/knowledgecenter/de/linuxonibm/liaaf/lnz_r_perf_latest.html

Red Hat OpenShift on IBM Z - Performance Experiences, Hints and Tips

- Performance measurement and tuning approach

- Observations and recommendations
  - CPU-intensive workloads
  - Network-intensive workloads

- General tips for cloud-native applications

http://public.dhe.ibm.com/software/dw/linux390/perf/OpenShift_on_IBM_Z_-_Performance_Experiences_V11.pdf

Useful links for RHOCP on IBM Z & LinuxONE

- **Technical Linux on Z and LinuxONE customer webinars from the Labs**
  - **http://ibm.biz/LinuxonZandLinuxONEwebcasts**

- **IBM Knowledge Center for Linux on Z and IBM LinuxONE**
  - News and tips for running Linux on IBM Z and LinuxONE
  - Best Practices and Performance optimization for RHOCP

  - OpenShift on IBM Z
  - **The Reference Architecture:**https://lnkd.in/dpdpz8V
  - Blog: https://www.openshift.com/blog/installing-ocp-in-a-mainframe-z-series

  - **Virtualization on IBM Z & LinuxONE**
  - z/VM resources
  - KVM on Z blog

- **Containers on IBM Z**
- **Trusted IBM Container Image Registry -Sign up now:** https://ibm.biz/zregeap
  - IBM Z container blog: Linux on Z and Containers

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https://ibm.biz/BdfzFY

Technology
Interchange
Community

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Get help and help others!

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2. Suggest topics that are interesting to you, vote topics
3. Join the event and share your view!

Join the crew and navigate the waters with CompassL!

Working with Linux on IBM Z or LinuxONE? Join the conversation!

Community **Pass** for **L**inux

next event
June 8th 2021

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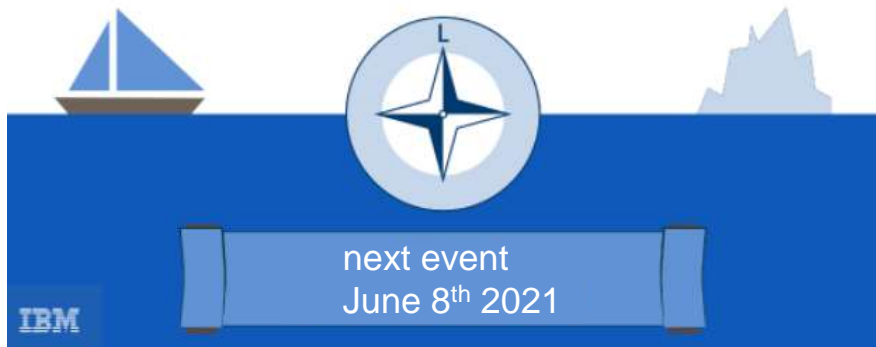
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Thanks to the additional content leaders for such a great cooperative work

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Thomas Stober   tstober@de.ibm.com

Ken Bell   kbell@redhat.com

➢**The RHOCP Reference Architecture:** https://lnkd.in/dpdpz8V

Questions?

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