OpenShift/Cloud Pak Strategy on IBM Z and LinuxONE

IDUG

March 2nd 2021

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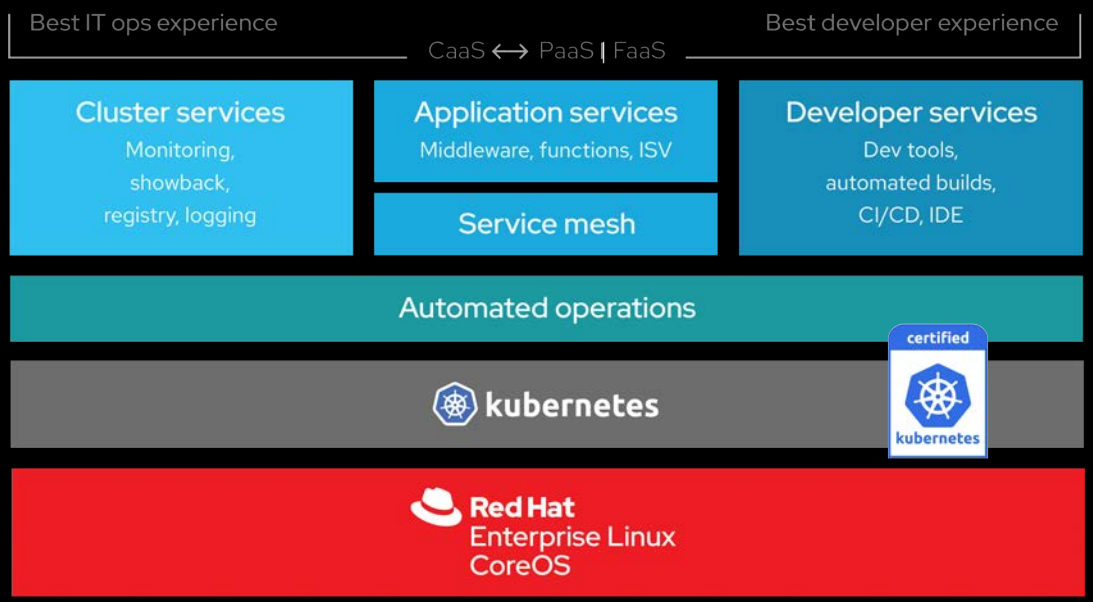
IBM Systems

IBM

Agenda

- OpenShift on IBM Z: Current status
- Changes to Cloud Paks in 2021
- Detailed Architecture
- Client Success Stories
- Integration with z/OS

Red Hat OpenShift Available on IBM Z, LinuxONE



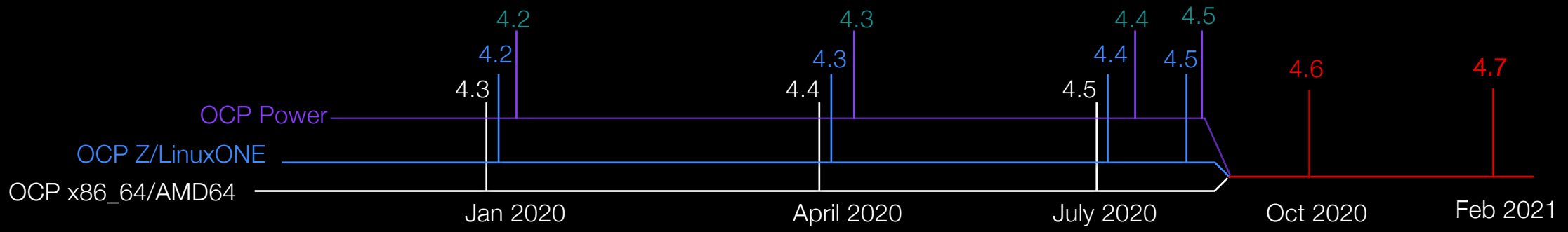
Automated, full-stack installation from the container host to application services

Seamless Kubernetes deployment to any cloud or on-premises environment

Autoscaling of cloud resources

One-click updates for platform, services, and applications

https://docs.openshift.com/container-platform/4.7/release_notes/ocp-4-7-release-notes.html

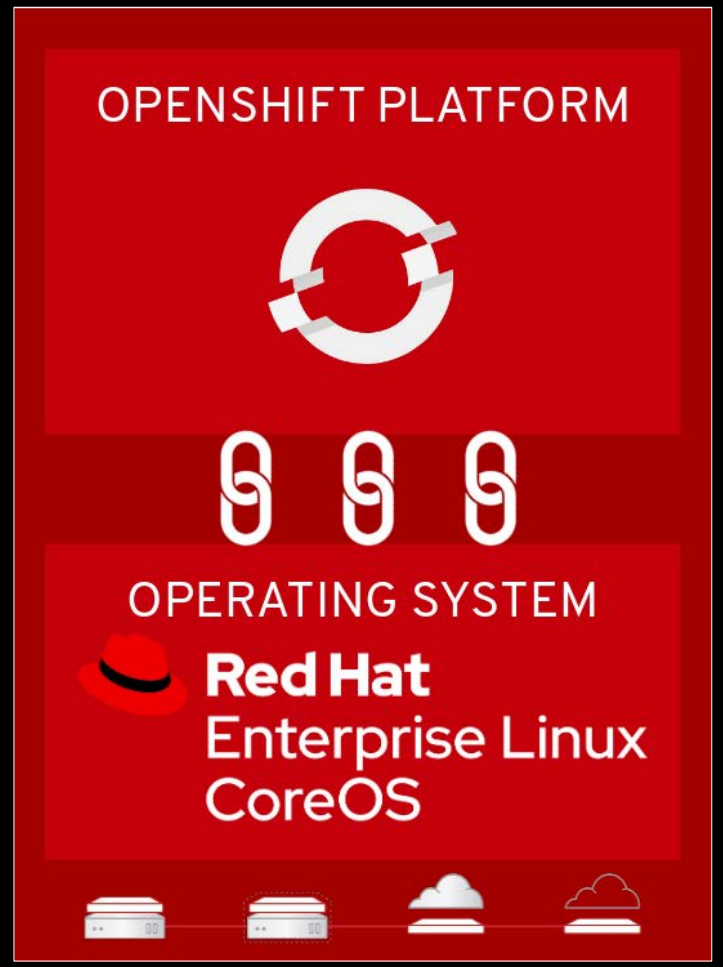


Introduction to RHEL CoreOS (RHCOS)

Immutable container host based on RHEL 8

- CoreOS is tested and shipped in conjunction with the OpenShift platform
- Immutable and tightly integrated with OpenShift
- Self-managing, over-the-air updates
- Host isolation is enforced via Containers and Security Enhanced Linux (SELinux)

CoreOS is operated as part of the cluster with config for components managed by operators.



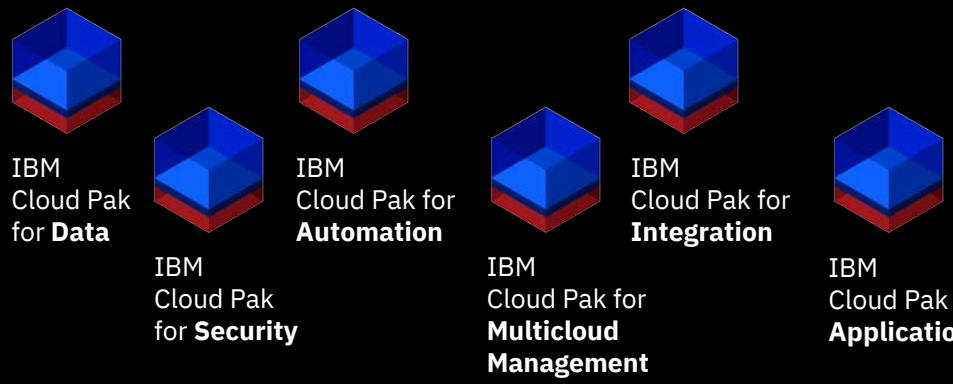
Cloud Paks

IBM Cloud Paks 2021

IBM delivers hybrid cloud software that **predict, secure,** and **automate** their businesses. They are packaged as **Cloud Paks** that include: Containerized software, foundational services and Red Hat OpenShift.

IBM Cloud Pak for Multicloud Management is available for Sale, not part of CP2.0 strategy

2020



IBM Cloud Pak for **Data**

IBM Cloud Pak for **Security**

IBM Cloud Pak for **Automation**

IBM Cloud Pak for **Multicloud Management**

IBM Cloud Pak for **Integration**

IBM Cloud Pak for **Applications**

Embedded inside each Cloud Pak:

- Containerized software
- Foundational services
- Red Hat OpenShift

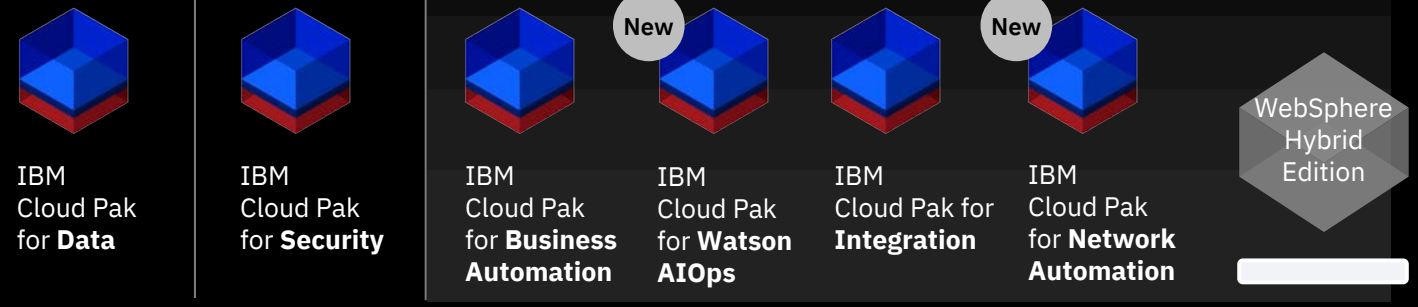
2021

Predict

Secure

Automate

Automation platform



IBM Cloud Pak for **Data**

IBM Cloud Pak for **Security**

IBM Cloud Pak for **Business Automation**

New

IBM Cloud Pak for **Watson AIOps**

IBM Cloud Pak for **Integration**

New

IBM Cloud Pak for **Network Automation**

WebSphere Hybrid Edition

Modernize

Embedded inside each Cloud Pak:

- Containerized software
- Foundational services
- Red Hat OpenShift

IBM Hybrid Cloud Software Portfolio

2021

Use cases

Incident Response Threat Hunting Data Security	Data Science Lifecycle Trust and Compliance AI powered Insights	Customer experience Business operations Workforce management	App and infra stability Platform operations AIOps optimization	Hybrid cloud integration Real-time interactions Transactional integrity	Site deployment automation 4G/5G telco cloud platform NFV lifecycle management

IBM Cloud Paks

IBM Cloud Pak for Security
- Threat Insights
- Intelligent Response
- Federated Search

IBM Cloud Pak for Data
- Data Science & Visualization
- AI and Machine Learning
- Data Warehousing

IBM Cloud Pak for Business Automation
- Workflow and decisions
- Content services
- Operational intelligence

IBM Cloud Pak for Watson AIOps
- Application impact avoidance
- Hybrid App management
- Observability

INSTANA

IBM Cloud Pak for Integration
- Application integration
- API management
- Messaging and events

IBM Cloud Pak for Network Automation
- Intent-driven orchestration
- Closed-loop operations
- Network optimization

Platform services

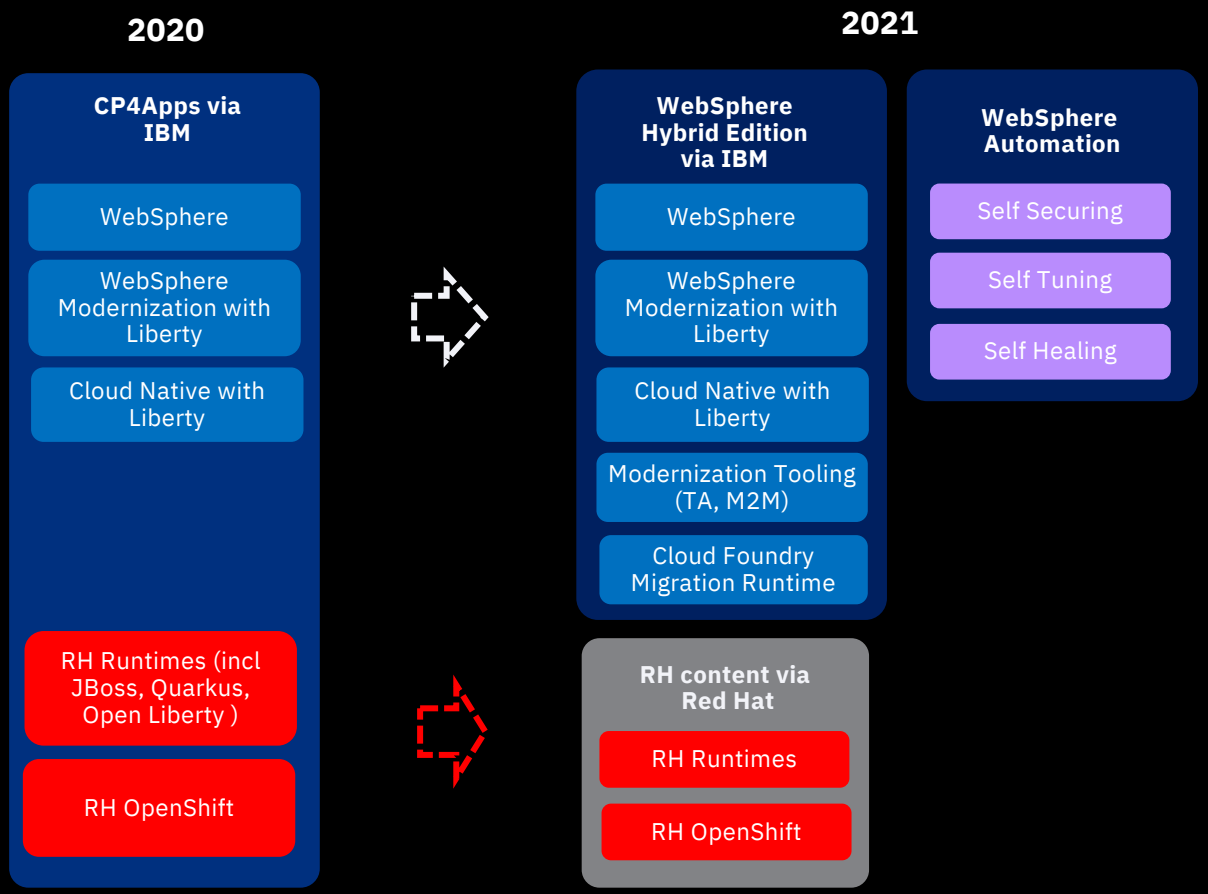
Automation foundation
- Robotic Process Automation
- Natural language interactions
- Process and task mining
- Event detection
- Machine learning
- 3rd Party integrations
- Operational models

Bedrock Services
- Application Services
- Security Services
- UI/UX Services
- Operational Services
- Data and Event Services

Red Hat OpenShift

IBM Cloud | AWS | Microsoft Azure | Google Cloud | VMware | Private | IBM **Z** IBM **LinuxOne** IBM **Power** Systems | End points

Cloud Pak for Applications:
Evolution to WebSphere Hybrid Edition and WebSphere Automation



Cloud Pak for Applications (CP4Apps)

- Continued support until 2030
- New sales redirected to WebSphere Hybrid Edition
- New value with new AI-powered automation (1Q 21)

WebSphere Hybrid Edition (WHE) – [Announced & GA]

- 50% lower cost of WHE + OCP vs. CP4Apps
- Clients use existing OCP entitlements or acquire new if needed
- Provides WebSphere runtimes, new Modernization capabilities with AI and Cloud Foundry Migration capabilities to lower TCO

WebSphere Automation [GA in March 2021]

- New AI-driven automation for WebSphere deployments running on bare metal, VMs or K8s
- Automated vulnerability detection and remediation, tuning and healing for common problems remediation
- Delivered as a solution on IBM Cloud Pak for Watson AIOps

IBM Cloud Pak for Data

Simplifies the delivery of data and AI to the business

Analyze Data & Infuse AI

50+ analytics services, AI apps, and industry solutions. Manage your favorite open-source capabilities along side IBM market leading differentiators

Organize Data

Catalog and govern all enterprise data, models, rules, and insights through a common experience

Collect Data

Virtually connect, manage and query data assets no matter where they live. Provision databases in minutes

Run anywhere

Public clouds, private clouds, on-premises, and hyperconverged systems

OpenShift

Run anywhere with OpenShift Container Platform

IBM Cloud Pak for Data

Cloud Pak for Data – Base Services
Cloud Pak for Data – Premium Services
Customer Investments Outside CPD

Data Sources

- Machine & Sensor data
- Image & Video
- Content Services
- Social Data
- Internet Data Sets
- Weather Data
- Commercial Data Sets
- Third-Party Data
- Transactional Data
- Application Data
- System of Record Data

Data acquisition & application access

Ingestion & Integration

- DataStage
- IBM Streams
- Apache Spark
- Db2 EventStore

Data Management & Storage

Data On CP4D

- Db2 Warehouse (SMP, MPP)
- Db2 Event Store

Premium Services:

- **Storage Suite for Cloud Paks** [+ Object Store]
- Db2 AESE
- MongoDB (partner)
- PostgreSQL (partner)

Data Anywhere

- IIAS (Sailfish)
- Hortonworks HDP
- Cloudera CDH
- Oracle
- Db2, Db2zOS
- MongoDB, PostgreSQL
- Netezza
- Teradata
- Microsoft SQL Sever
- Azure (Blob & File)
- Amazon S3
- Google BigQuery
- Google Cloud Storage
- **And many more**

Data Access

- Data Virtualization (DV)
- Data Gate for Z
- Big SQL
- Data volumes API *[from Control Plane]*

Discovery & Exploration & Self-Service

- Enterprise Search *powered by WKC*
- Knowledge Catalog *powered by WKC*
- Data Refinery *powered by Spark*

Actionable Insight

- Cognos Dashboards
- Watson Studio
- Watson ML & DL *Accelerators (WML/A)*
- Premium Data Science (SPSS Modeler, Decision Optimization)
- Watson OpenScale
- Watson AI Services
- Cognos Analytics

Enhanced Applications

- Customer Insights
- Conversational Analytics
- Planning & Analysis
- Compliance & Fraud
- Security
- Operations

Analytics In-Motion

IBM Streams | Apache Spark

Governance, Quality & Stewardship

WKC InstaScan | Master Data | Watson Knowledge Catalog (WKC) | Model Risk Management (Open Pages) | AI Governance (Open Scale)

Security

Access Management *powered by control plane* | Auditing *powered by control plane* | Tenancy & Network Policies *powered by OpenShift, Control Plane* | Data Policies *powered by WKC* | Data Protection *integration of WKC & DV*

Control Plane

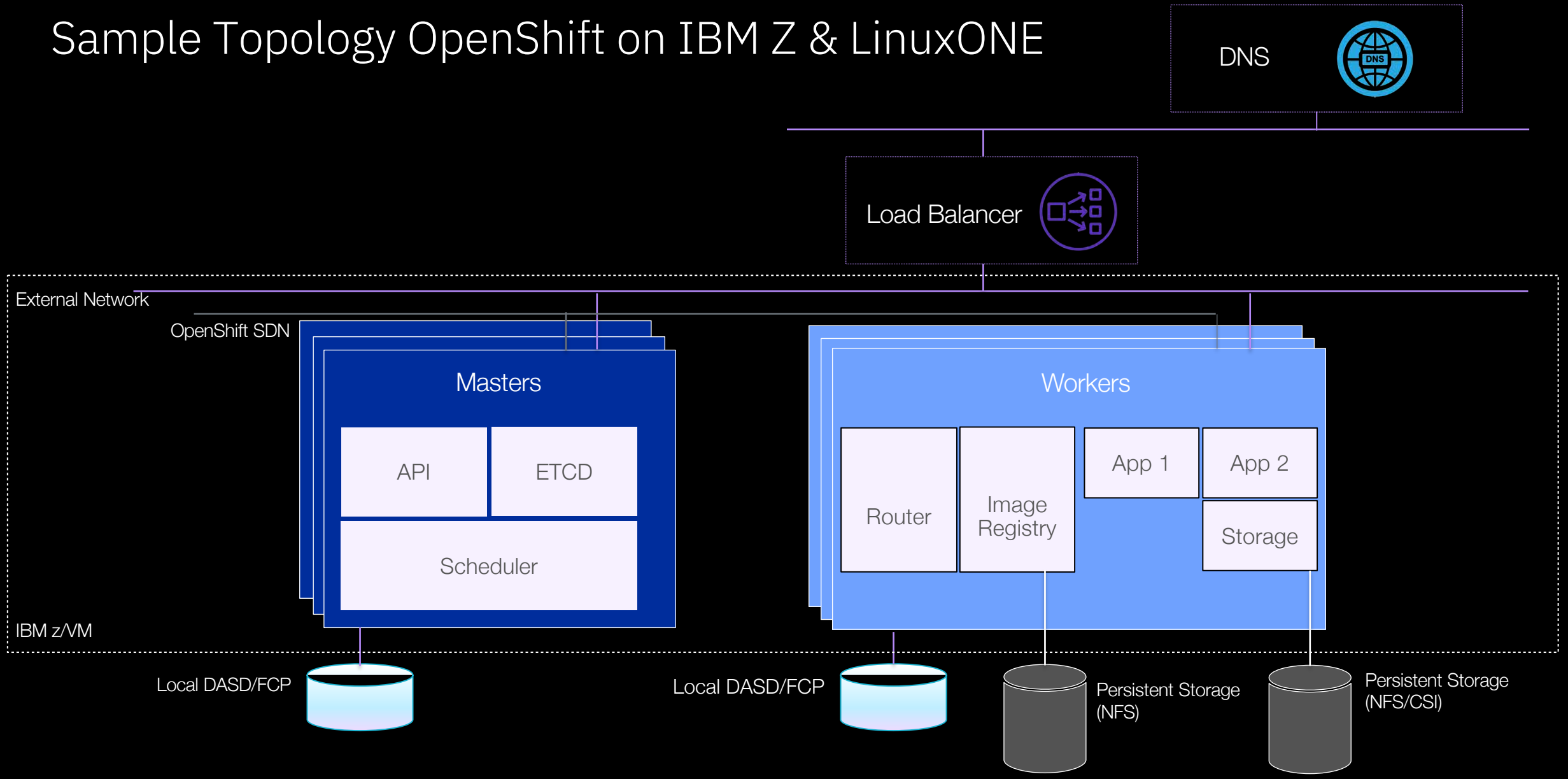
Tenancy, User Persona Roles and Authorization | **Metering instrumentation** | **Workload Health, Serviceability & Diag** | **Service Discovery & Integration and access tokens** | **User experience framework Nav, Boilerplates** | **User Activity/ Auditing** | **Add-ons & Extensions Registry** | **Ops: Install, Patch, Upgrade, Scale, Backup**

Platform

RED HAT OPENSHIFT Container Platform | **GPU management** | Storage Persistent Volumes | Software Defined Network | Cluster Management | Operations | Monitoring | Logging

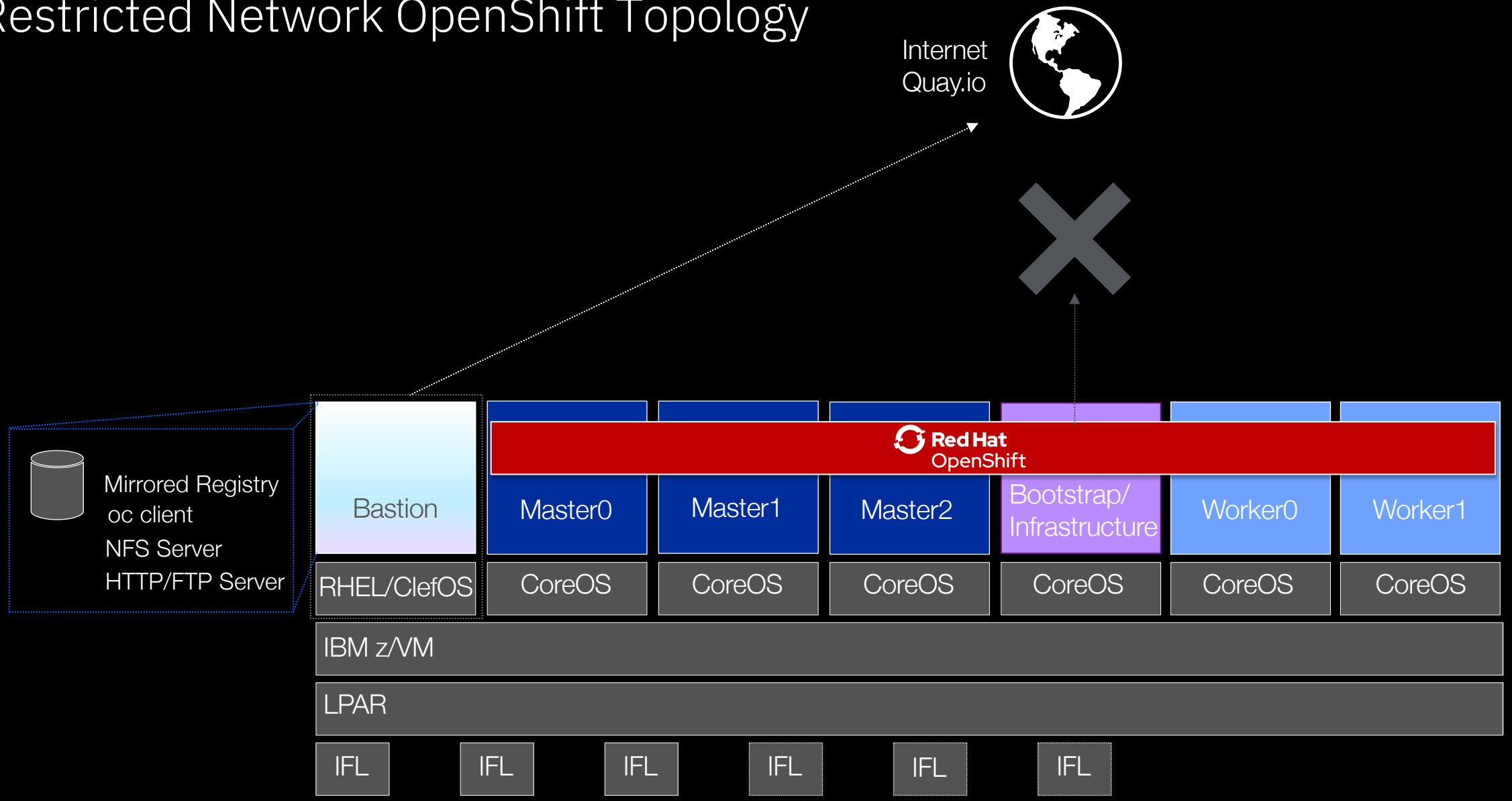
OpenShift Topology

Sample Topology OpenShift on IBM Z & LinuxONE



[OCP Reference Architecture]

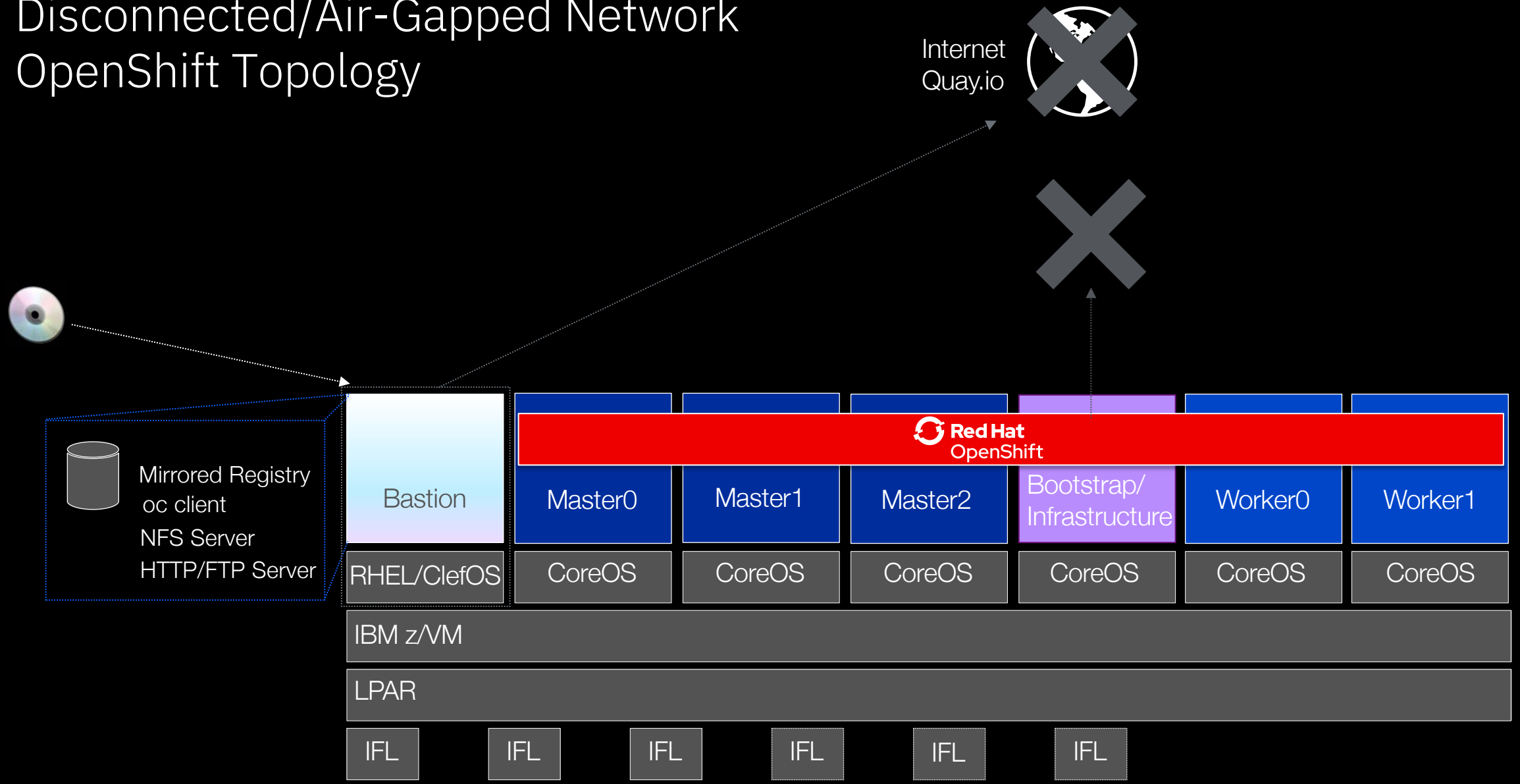
Restricted Network OpenShift Topology



[OCP Reference Architecture]

https://docs.openshift.com/container-platform/4.4/installing/installing_ibm_z/installing-restricted-networks-ibm-z.html

Disconnected/Air-Gapped Network OpenShift Topology



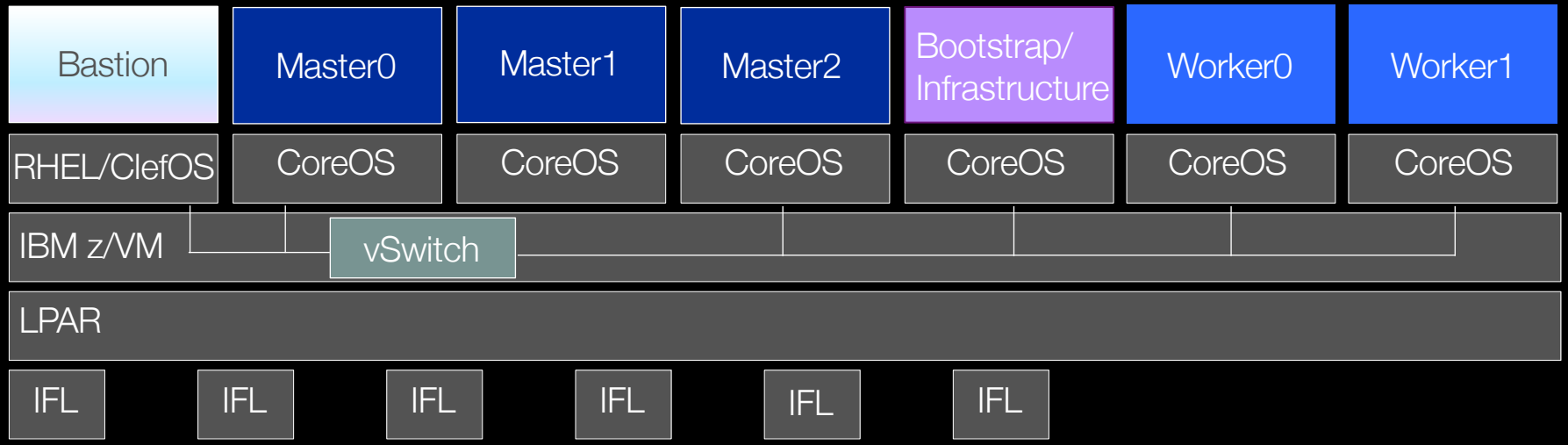
[OCP Reference Architecture]

https://docs.openshift.com/container-platform/4.4/installing/installing_ibm_z/installing-restricted-networks-ibm-z.html

Minimal Recommended OpenShift Topology (Connected Installs)

DNS

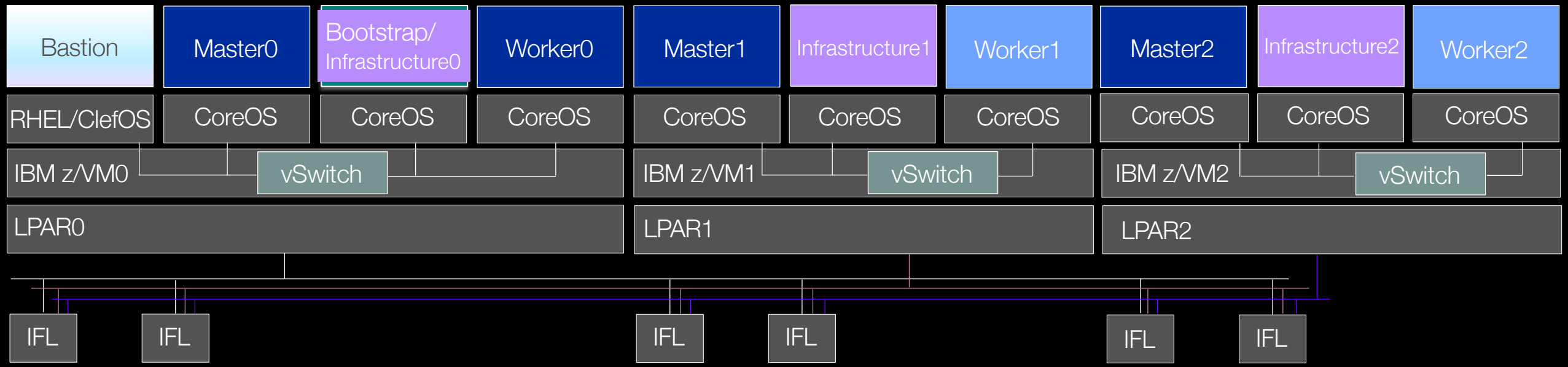
Load Balancer

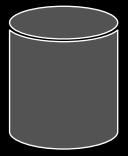


Persistent Storage (NFS/CSI)

[OCP Reference Architecture]

Sample Recommended OpenShift Topology (Connected Installs)

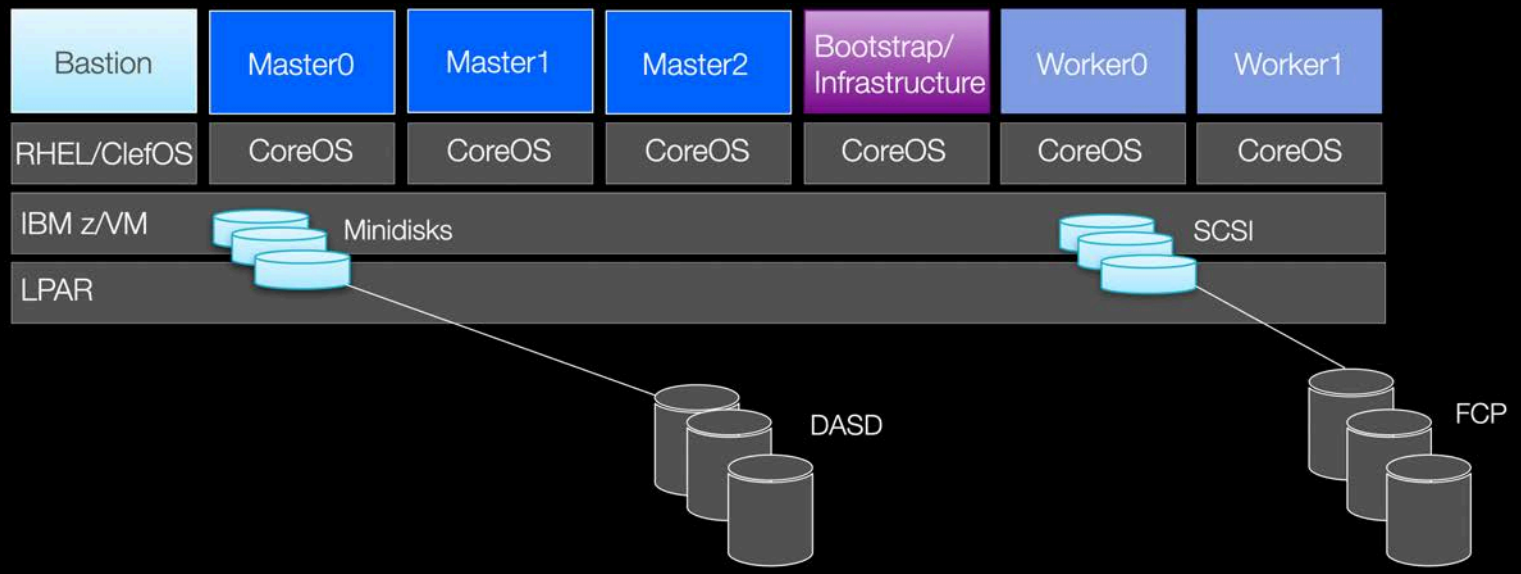




Persistent Storage
(NFS/CSI)

[OCP Reference Architecture]

Architecture Overview – Disk Storage Options for Installation



Disk storage considerations

Minidisks are a z/VM virtual resources and represent smaller chunks on a DASD; Linux sees them as individual disks (DASDs)

Consider HyperPAV for ECKD storage DASDs/FCP devices can be dedicated to a z/VM guest ("pass-through")

Consider using FCP multipath installations (future)

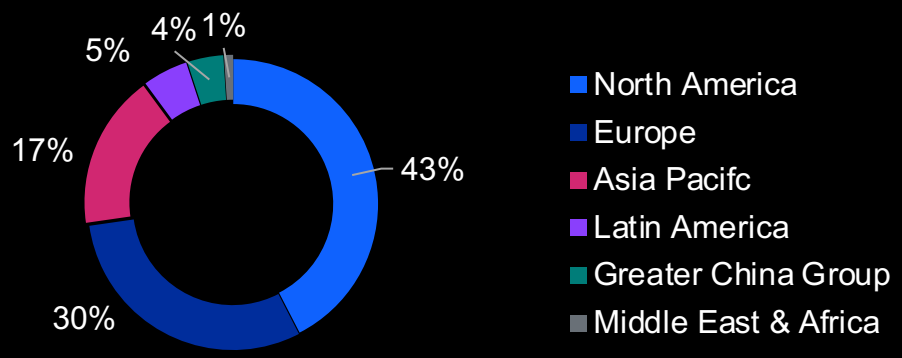
OCP Reference Architecture

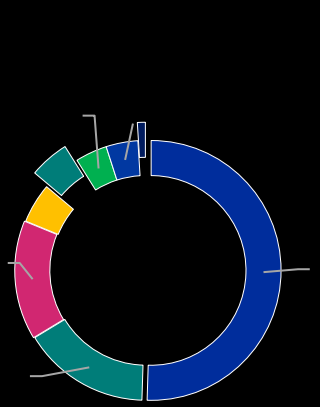
https://docs.openshift.com/container-platform/4.4/installing/installing_ibm_z/installing-restricted-networks-ibm-z.html#minimum-ibm-z-system-requirements_installing-restricted-networks-ibm-z

Client Success Stories

OpenShift on Z - Client engagements by Industries & Geo

- Customers in North America show the highest interest, followed by Europe
- Financial Services & Public are the industries with the highest OpenShift on Z adoption rate





180 + Clients interested in OpenShift on IBM Z / LinuxONE

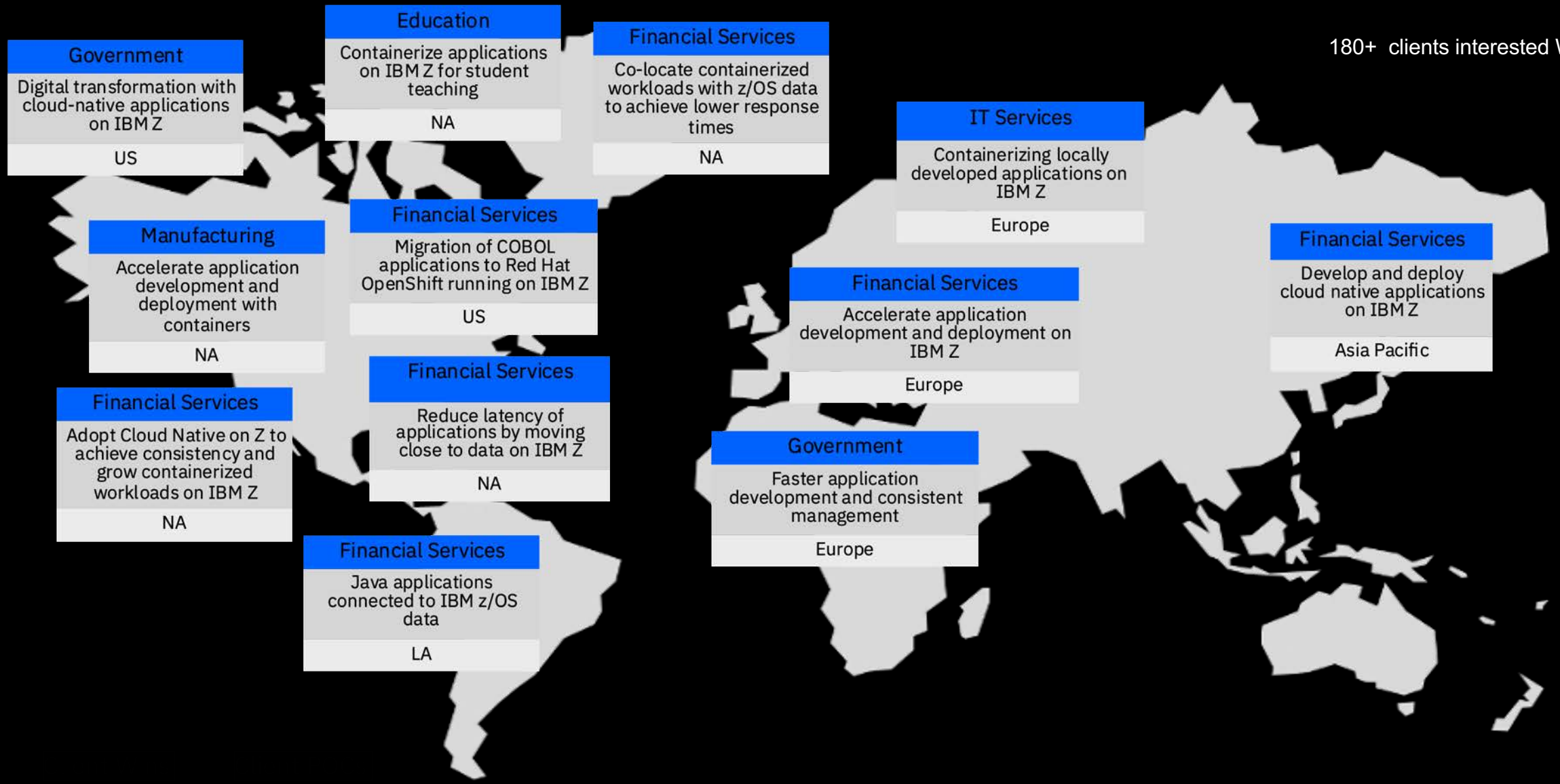
43 ↑ PoC In Planning

30 ↑ Installed / In-Progress

3 ↑ Clients in Production

Proof-of-Concept Momentum for Red Hat OpenShift and IBM CloudPaks on LinuxONE

180+ clients interested WW



Areas of interest

Co-location	Modernization	Platform Specific Advantages	z/OS Integration	Data and AI on Z	IBP on OCP on Z
Co-locate containerized workloads with z/OS data to achieve lower response time and meet enterprise SLA	Adopt Cloud Native on Z to achieve consistency and grow containerized workloads on IBM Z	Consolidation, Throughput, Security & Availability	Modernization and automation of z/OS with Hybrid Cloud on Z	Leverage AI to extract critical insights for business transformation and achieve agility	**IBM B**lockchain Platform on RH OpenShift on-prem

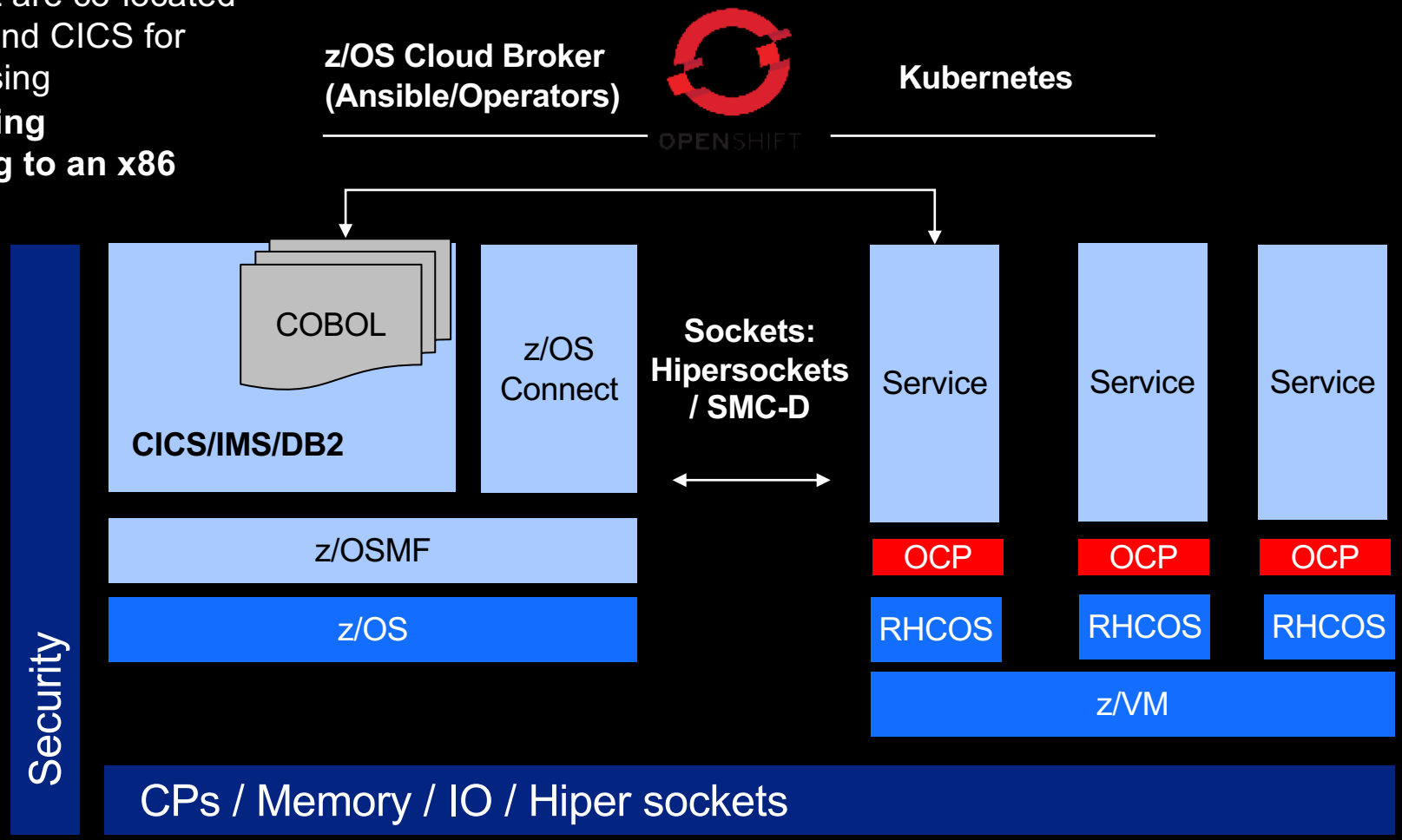
First example : Large NA FSS Company

Accelerate enterprise digital transformation

- Containerized services running in Linux on Z are co-located on the same hardware with z/OS Db2 data and CICS for low latency, high volume transaction processing
- **Achieve up to 7.3x lower latency co-locating applications on Z compared to connecting to an x86 server**

Modernize and digitally transform

- Modernize and extend mission-critical legacy assets incrementally while maintaining enterprise SLAs and keeping risk and cost low

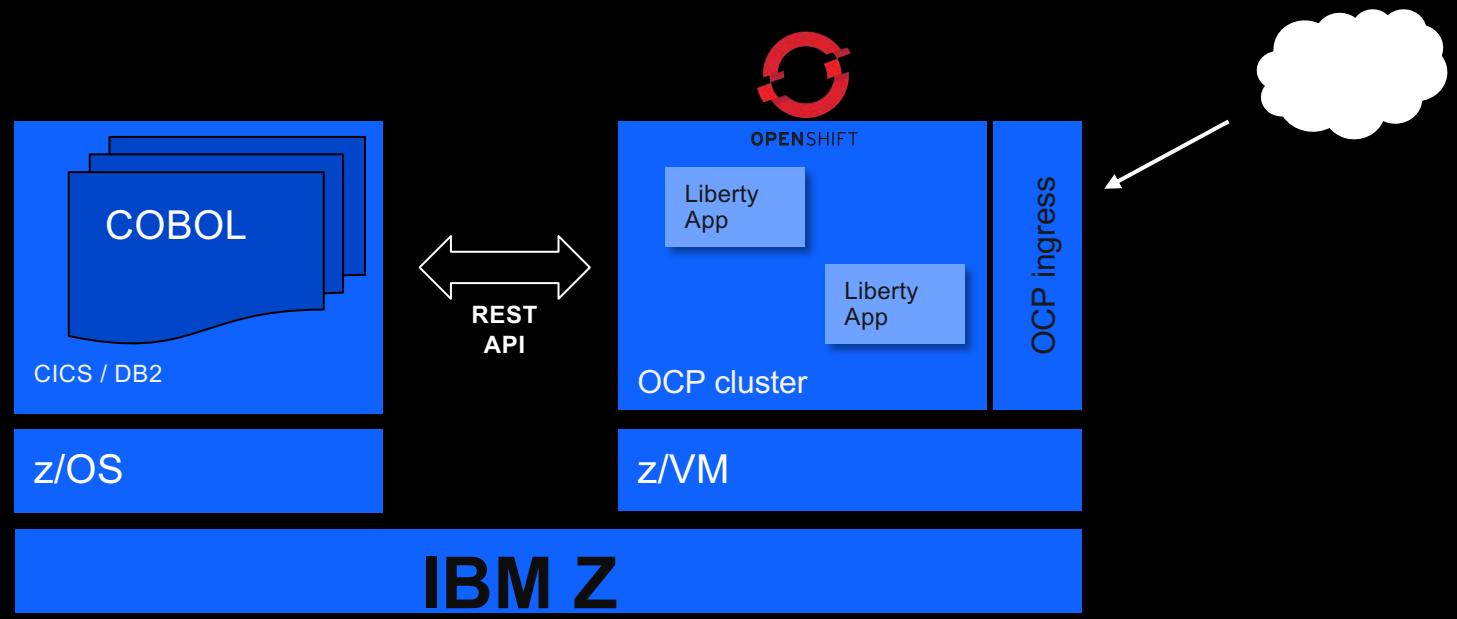


Second example : Large Credit Bureau in Latin America

Accelerate Enterprise Digital Transformation

- *CI/CD Pipeline Integration With OpenShift on Z*
- *Application Portability*
  - *WebSphere (x86) to Liberty (s390x)*
- *Better Scalability With OpenShift On Z*
- *From 1500 Queries/Min to 650,000 Queries/Min*
  - *43X improvement*

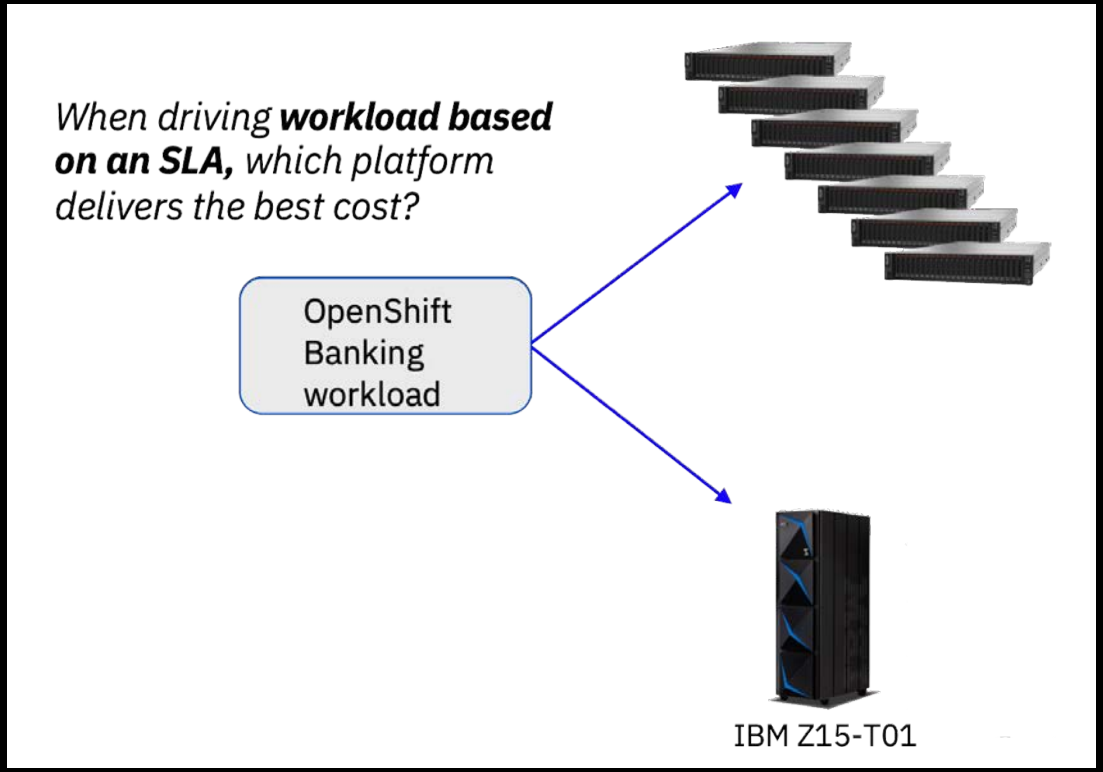
Customer driving digital transformation to a cloud and microservices world and needs reliability, security and performance, as well as an integrated and standard platform that allows software transformation and migration in an agile, flexible and easy way



OpenShift Container Platform (OCP)

Delivers better per core performance and cost less than x86 for z15

Achieve up to 37% lower cost on OpenShift Container Platform 4.2 versus x86

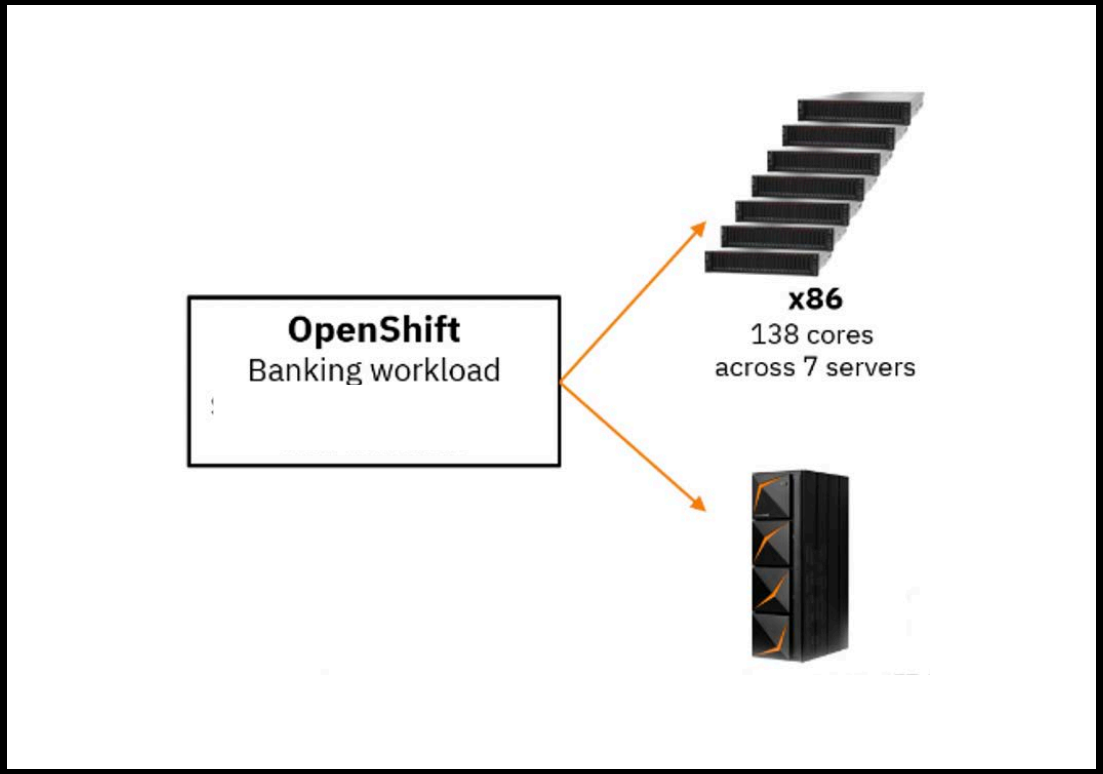


Disclaimer: This is an IBM internal study designed to replicate a typical IBM customer workload usage in the marketplace. It consists of IBM zR15-T01 with eight IFL (@5.2 GHz) across three LPARs. First LPAR is allocated three IFLs and 512GB memory, second LPAR is allocated four IFLs and 512GB memory and third LPAR is allocated one IFL and 128 GB Memory. IBM Storage DS8886 was used to carve out nine – 250GB DASD minidisks for each of the guest running in the LPARs. Each of the nine minidisks served one zVM guest totaling nine zVM guests. The OpenShift version 4.2.20 cluster was running across seven zVM guests, one guest was running the load balancer and 1 guest was running the bastion server. The cluster had three masters, four workers and one load balancer nodes. The load balancer was running in the lpar with one IFL and 128GB memory. Two masters and 2 workers were running in the LPAR with 3 IFLs and 512GB memory. One Master and two workers were running in the LPAR with four IFLs and 512GB memory. SMT was on across all the IFLs. The operating system for each worker and master nodes was Red Hat Enterprise Linux CoreOS (RHCOS) for Z. The x86 configuration consisted of seven servers with six servers running RHEL KVM with 16 guests spread across them and one server running RHEL 7.6. OpenShift cluster version 4.3.5 was running across the sixteen guests (three masters, twelve workers and one bastion server). The operating system for each worker and master node was Red Hat Enterprise Linux CoreOS (RHCOS) for x86. Each guest operating system was defined with a 100GB virtual disk except the bastion defined with 5GB virtual disk. Each guest had access to all of the vCPUs of the KVM server on which it was running. The master nodes were assigned 3 32GB memory and workers were assigned 32 and 64GB memory based on the server they were running on. The seven x86 server configurations were: 1) Sandybridge ep, Intel Xeon Processor E5-2650, 2.0GHz, 8 Cores, 2 processors, 384 memory, 2) Sandybridge ep, Intel Xeon Processor E5-2680 v3 12 Cores 2.5GHz, 2 processors, 384GB memory, 3) Haswell, Intel E52690 2.6GHz, 12 Cores, 1600MH 95W, 2 processors, 512GB memory, 4) Haswell, Intel E52690 2.6GHz, 12 Cores,1600MH 95W, 2 processors, 512 GB memory, 5) Ivybridge EP, Intel Xeon Processor E5-2630 v2 6Cores, 2.6GHz, 2 processors, 64GB memory, 6) Ivybridge EP, Intel Xeon Processor E5-2630 v2 6Cores, 2.6GHz, 2 processors, 64GB memory, 7) comparison based on a 3YR Total Cost of Ownership (TCO) includes all HW, SW, Networking, Hosting, Manpower, energy/cooling costs and 3 years of service & support.

OpenShift Container Platform (OCP)

Delivers better per core performance and cost less than x86 for LinuxONE III

Achieve up to 48% lower cost on OpenShift Container Platform 4.2 versus x86



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Importance of LinuxONE HA with cloud native workloads

- Kubernetes/OCP only handles pod failures not node failures
- OCP needs a majority (e.g. 2 out of 3 , 3 out of 5) masters running to maintain cluster stability. Recovery is non-trivial if a majority of masters go down and needs to be done manually.
- Persistent storage (OCS/Portworx etc) alone cannot achieve zero RTO & zero RPO that **mission critical stateful** workloads demand.

The HA capabilities in LinuxONE can ensure that Open Shift nodes do not go down while providing zero RTO & zero RPO for stateful workloads when combined with IBM Storage

DevOps

Cross Platform Application Development Consistency

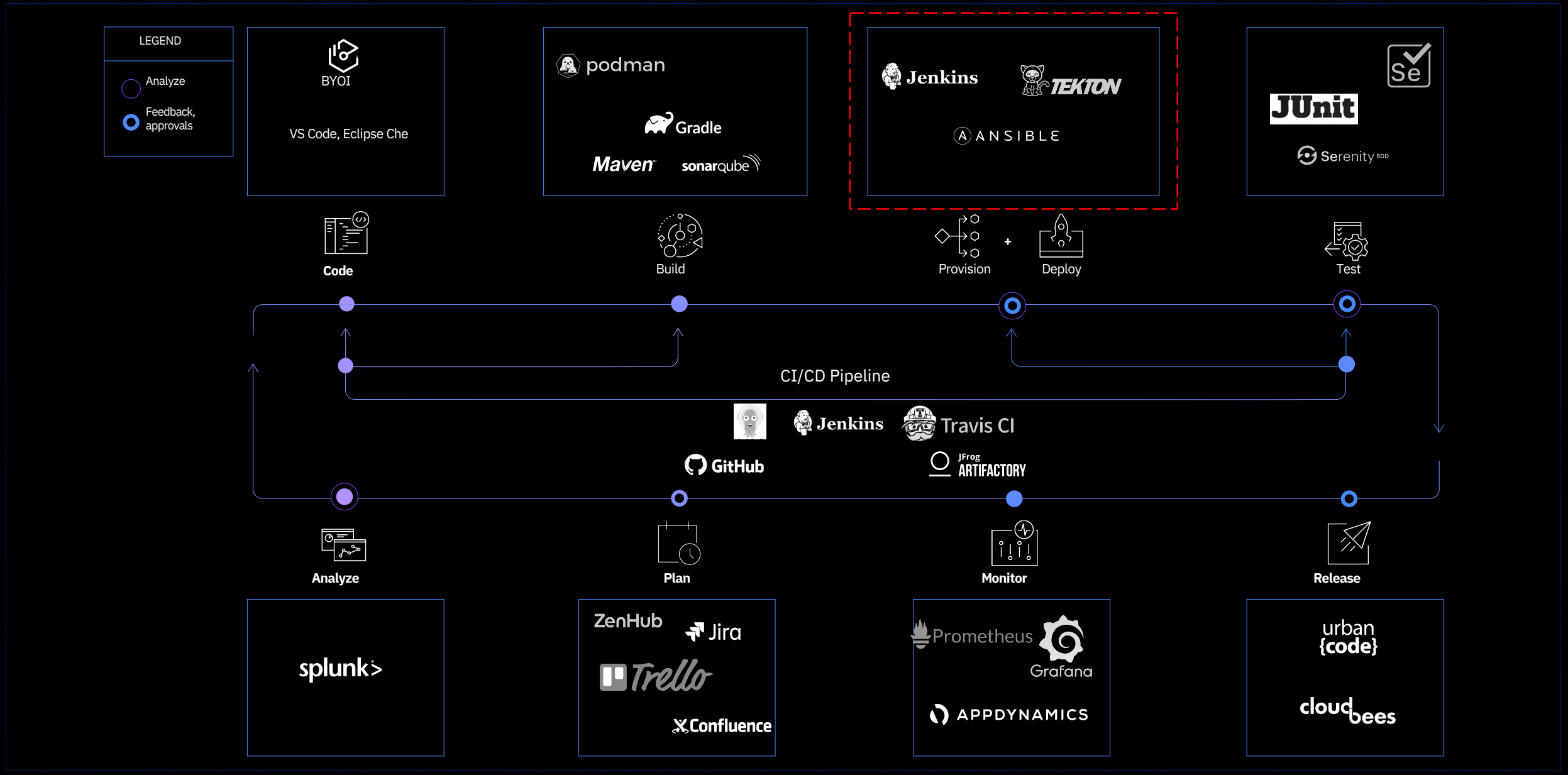
Multi-Architecture Manifests

- Pull Source Code
- Build container per platform
- Use multi-architecture manifests to map container to platform
- Push to existing registry
- Deploy as usual

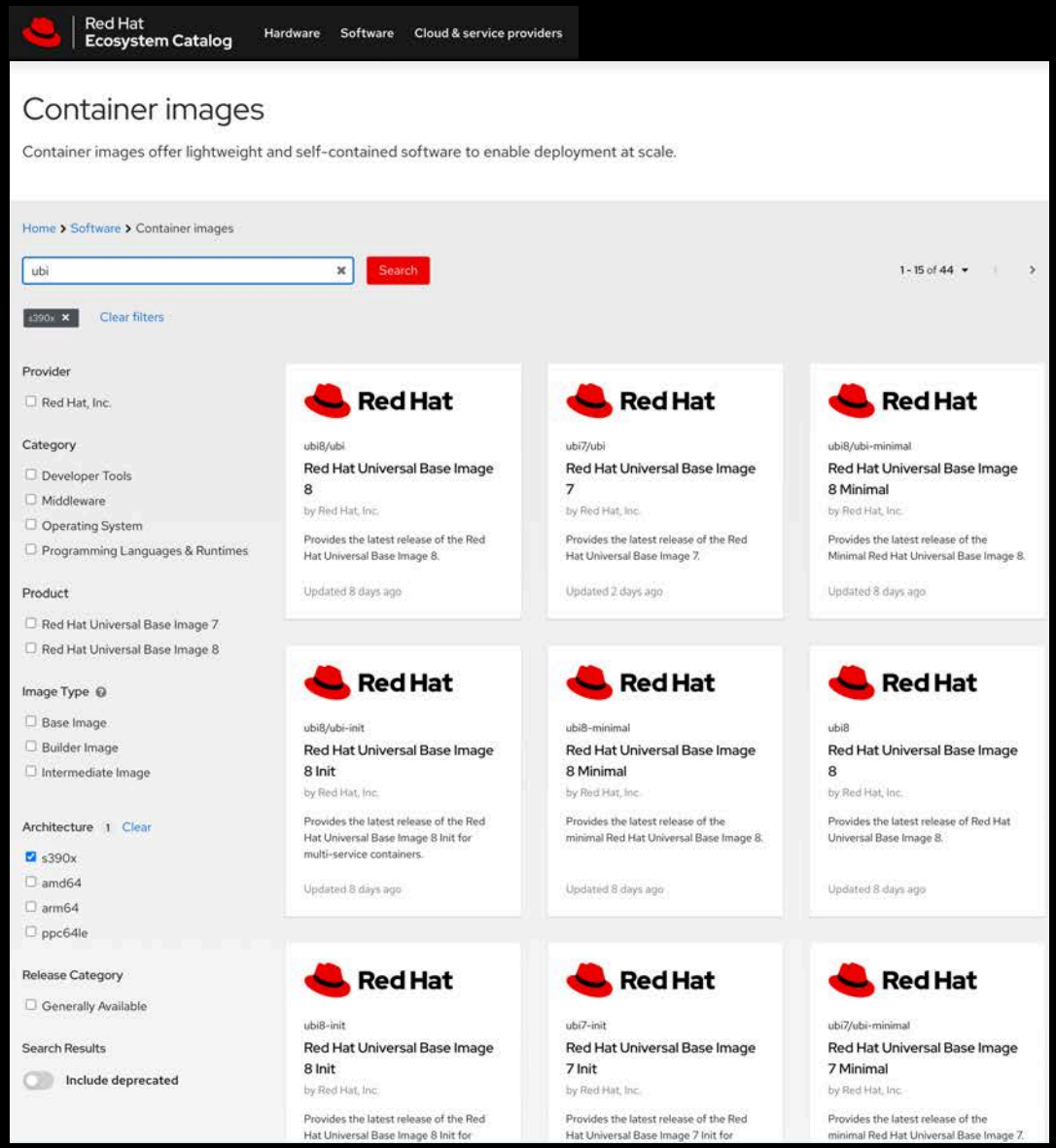
95% of the CI/CD pipeline stays the same as it is today.
The platform stays completely transparent to the developer.

https://www.opensourcerers.org/2020/11/16/container-images-multi-architecture-manifests-ids-digests-whats-behind/

Typical Cloud Native DevOps Pipeline

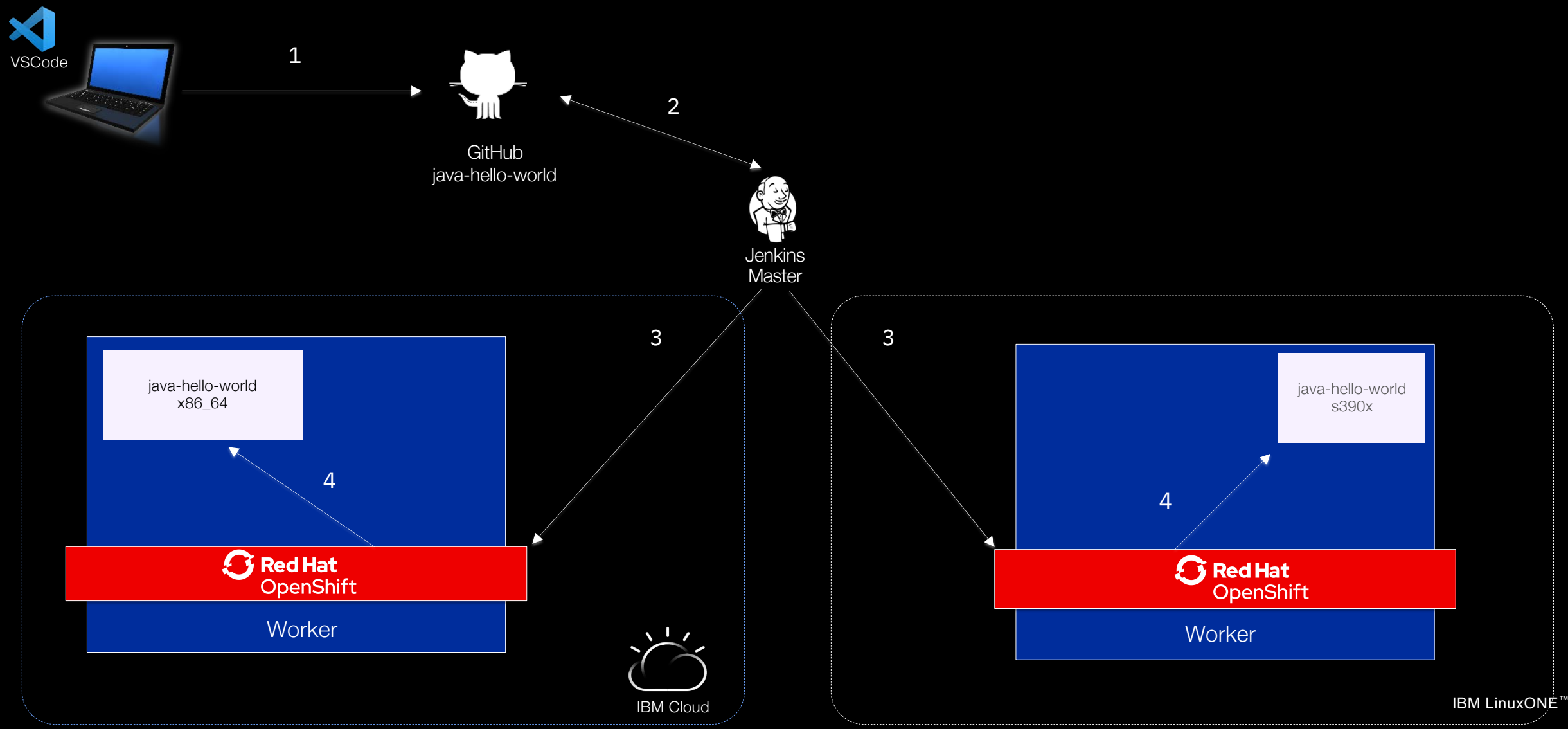


Red Hat Container Catalog provides 310+ s390x container images



https://www.linkedin.com/pulse/red-hat-container-catalog-access-270-images-s390x-from-filipe-miranda/

Multi-Architecture Pipeline

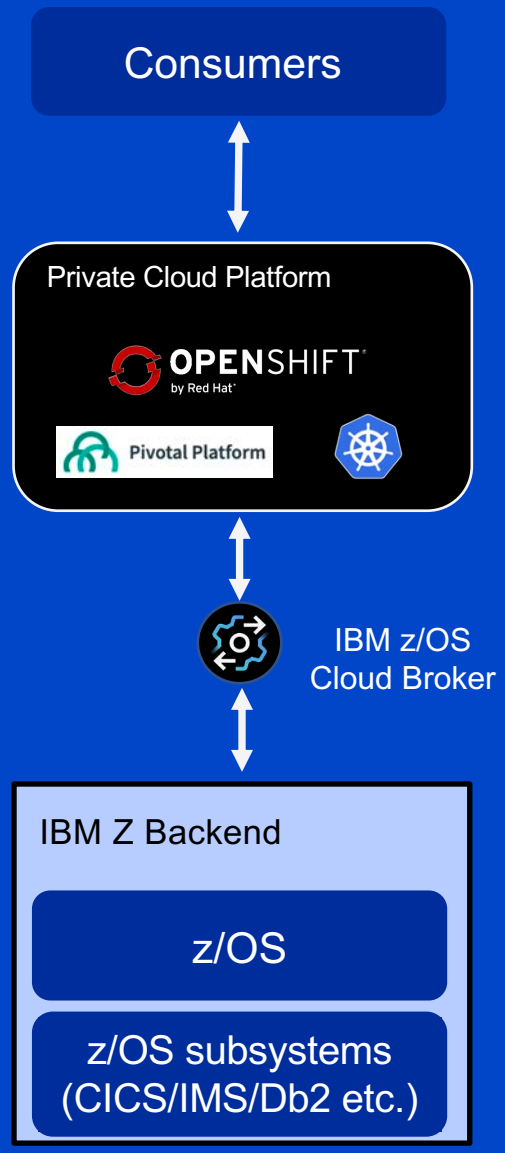


Integration with z/OS

IBM z/OS Cloud Broker

Integration of IBM Z z/OS into cloud through self-service access and deployment of z/OS services on OpenShift and other private cloud platforms

- Provides self-service access to managed IBM Z resources to all flavors of application developers
- Centralization and automation of IBM Z operations to provide Z resources to agencies or clients in their hybrid cloud
- Improve time to value through efficiencies in development and deployment

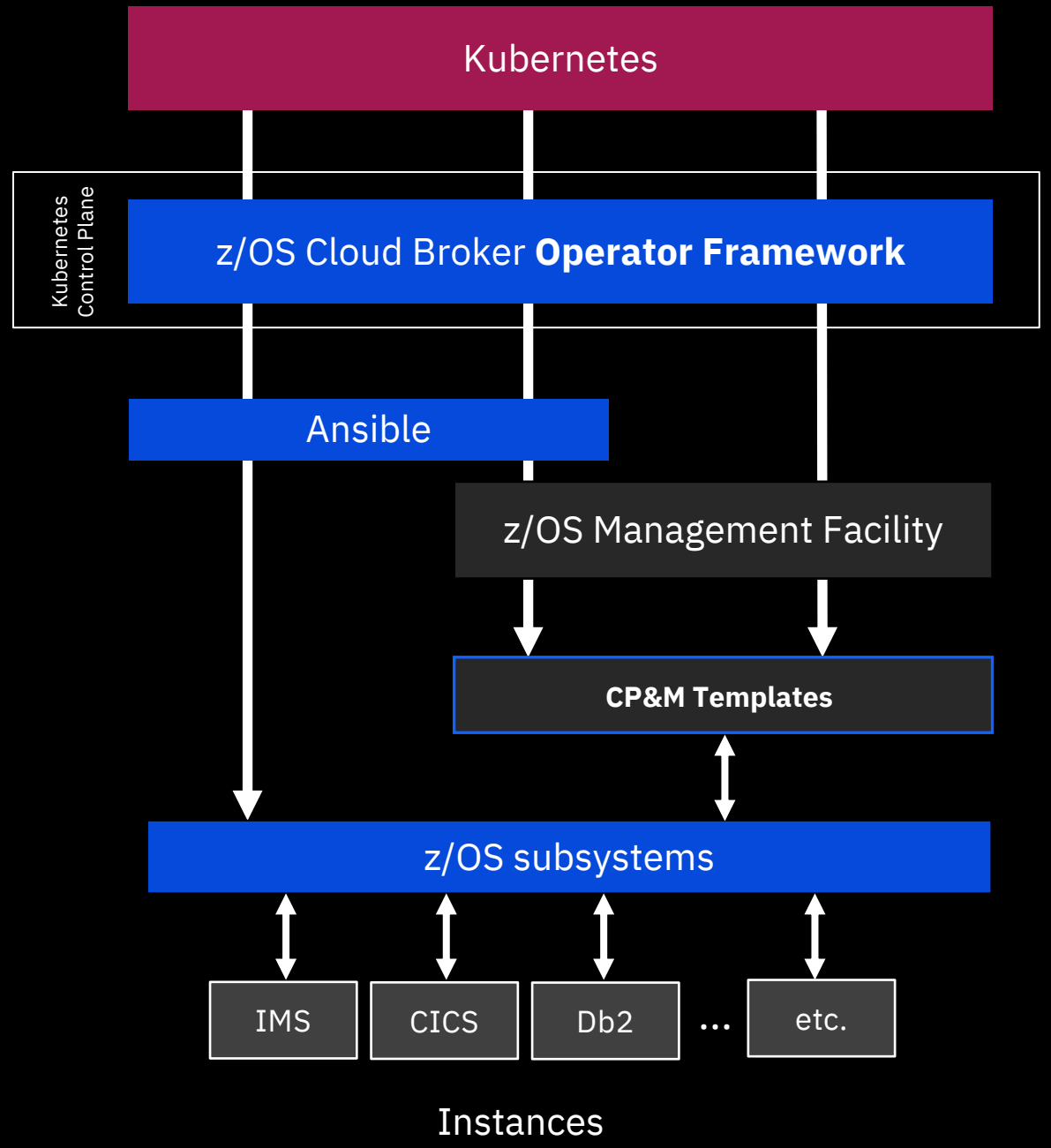


z/OS Cloud Broker

IBM z/OS Cloud Broker V1
Integration of IBM z/OS into Kubernetes through self-service deployment and access to z/OS resources

IBM z/OS Cloud Broker V2 (Future)
z/OS integration into Kubernetes powered by an Ansible Engine

- Integrating ’Day 2’ management and operations using Ansible interacting with existing z/OS solutions
- Seamlessly evolve to configuration management, orchestration, and application deployment using the Red Hat Ansible Certified Content for IBM Z



Red Hat Ansible Certified Content for IBM Z today

Certified content collections accelerate the use of Ansible with IBM Z and enable:

- **Improved efficiency** via the simplification and standardization of complex IT deployments and enterprise automation strategies
- **Visibility** of your z/OS automation – know what is being automated, when, and by whom
- **Simplicity** increases productivity with certified collections that codify system-specific knowledge and complexity

4500+

Downloads

IBM Ansible for Z Collections and Samples

9000+

Page Views

Ansible for Z webpage

18 Blogs and technical tutorials

800+

Attendees

Presentations & Webinars

40+

zTrial Requests in 3 weeks

Events Participations

AnsibleFest

think

SHARE EDUCATE • NETWORK • INFLUENCE

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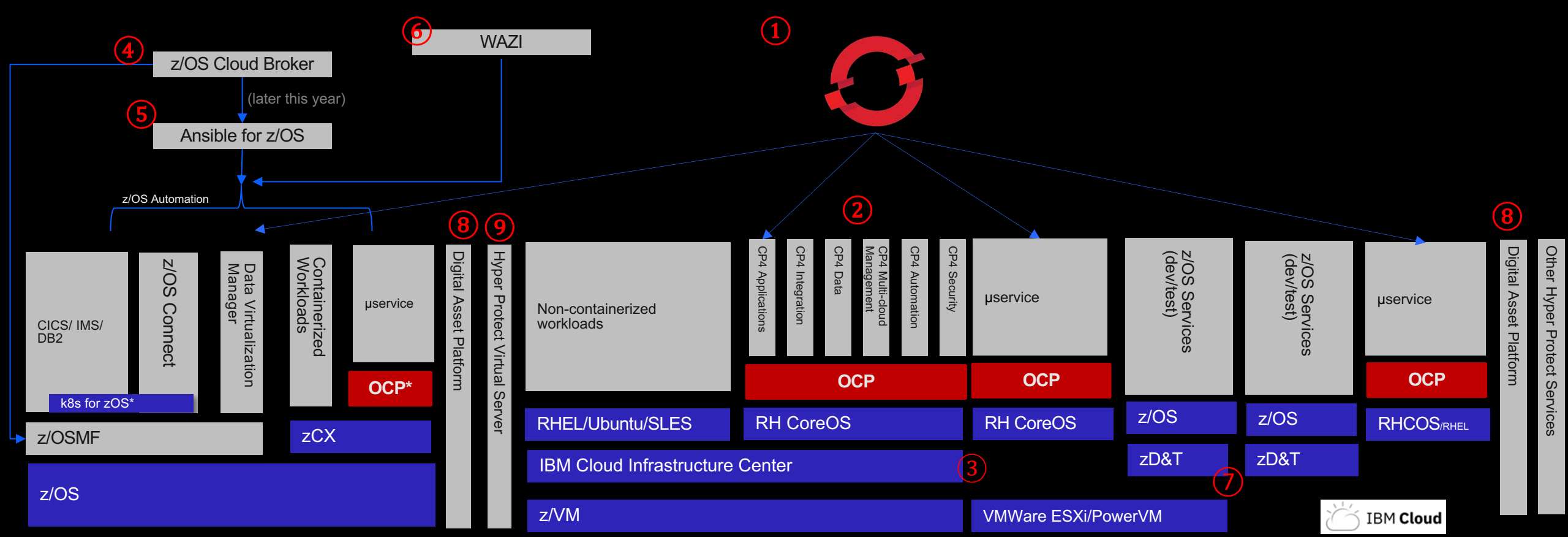
IBM Developer

ZDC

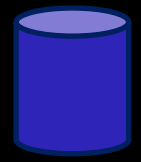
GMAC



1. RH OpenShift –the trusted hybrid cloud platform for containerized workloads
2. Cloud Paks – use case intended containerized software, certified to run on RH OpenShift
3. IBM Cloud Infrastructure Center – IaaS automation for end to end cloud like experience
4. z/OS Cloud Broker – self service access and consumption of z/OS services
5. Ansible – automation of z/OS through playbooks
6. IBM Wazi – RH CodeReady Workspace based cloud native developer experience for z/OS
7. zD&T – z/OS emulation environment
8. Containers and Kubernetes for zOS
9. Digital Asset Platform – trusted platform for secured digital assets
10. Hyper Protect Virtual Server – secure enclave for compliance sensitive workloads
11. OpenShift Storage (SDS/CNI plugin)

OpenShift Persistent Storage Options

10



NFS
Spectrum Virtualize
Spectrum Scale
OCS

Links

- OCP 4.7 Release Notes (https://docs.openshift.com/container-platform/4.7/release_notes/ocp-4-7-release-notes.html)
- OCP 4.7 Installation Notes for KVM (https://docs.openshift.com/container-platform/4.7/installing/installing_ibm_z/installing-ibm-z-kvm.html)
- Building multi-arch containers : https://developer.ibm.com/components/cloud-native-dev-tools-ibmz/tutorials/multi-architecture-cri-o-container-images-for-red-hat-openshift
- Ref Arch PDF (http://public.dhe.ibm.com/software/dw/linux390/docu/RHOCP-reference-architecture.pdf)

Thank you

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—
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