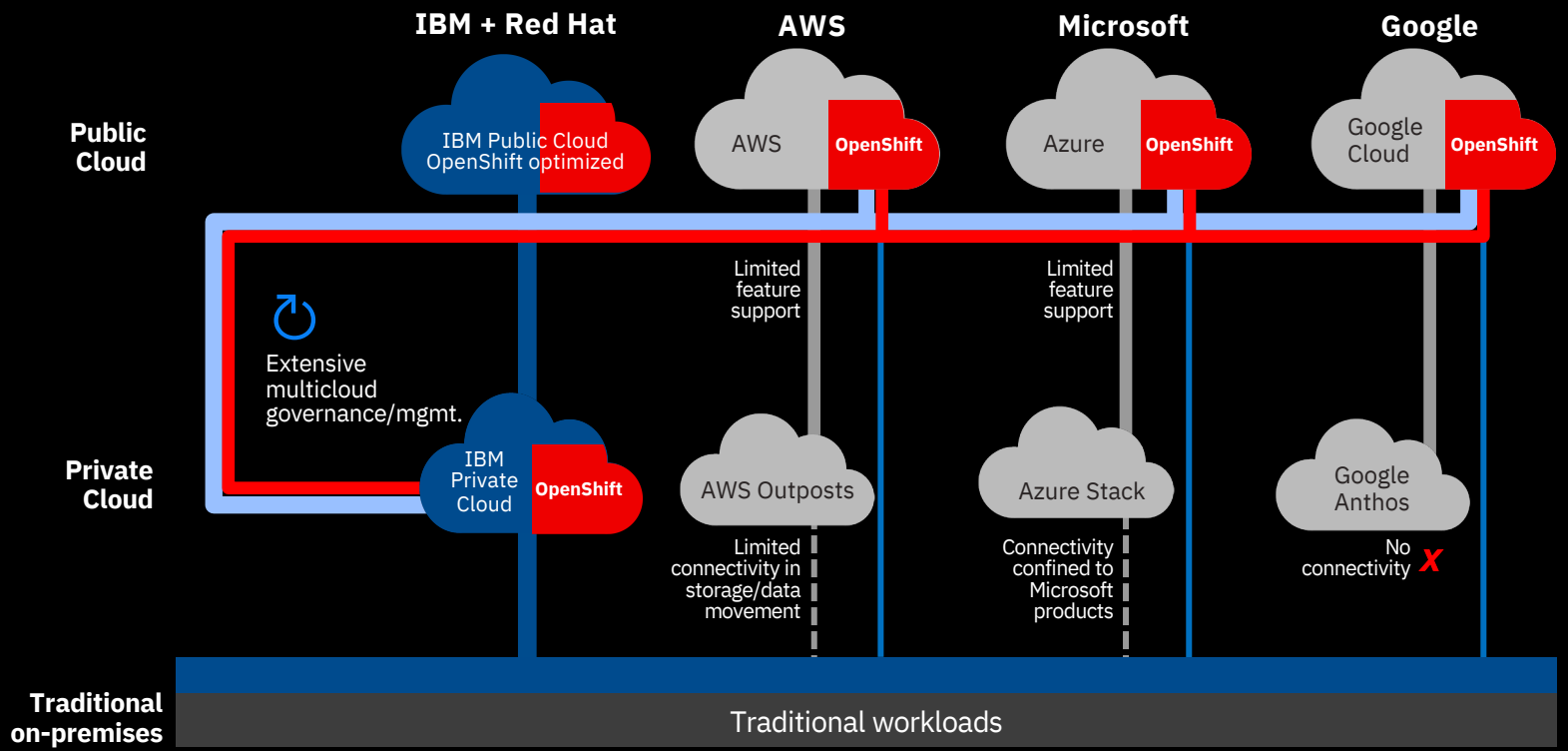
Hybrid Cloud on IBM Z and LinuxONE
Enabled with Red Hat

Elton De Souza
Chief Architect - Cloud Native Client Success

IBM

IBM + Red Hat deliver the industry's only true hybrid multicloud platform



Hybrid Multicloud Strategy for IBM Z and LinuxONE

Build your Hybrid Multicloud with the platform that provides …

Flexibility and Confidence
- 100% service level compliance
- Superior reliability, scalability and security

Protected Future
- 100% of data protection everywhere
- Privacy with policy

PRIVATE

RED HAT OPENSHIFT

HYBRID MULTICLOUD PLATFORM

Self-Service
Multi-language
Automation
Collaboration
Enterprise Grade

Standards-based
Web-scale
Open Source
Multi-tenant
Secure

PUBLIC

Build Once
- Optimize IT to accelerate Digital Transformation
- Modernize applications to increase agility

Deploy Anywhere
- Build cloud native to accelerate innovation
- Unleash Data and AI for competitive advantage

Offerings designed for journey to cloud …

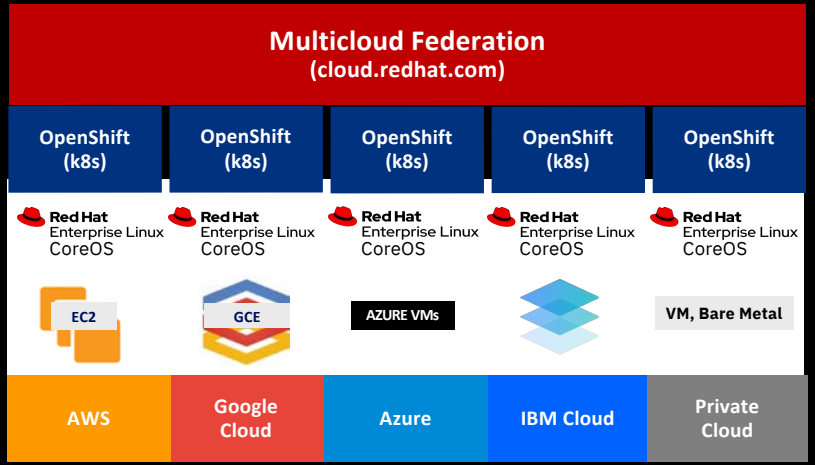
API Management & Cloud Native Development

- IBM ADDI
- IBM z/OS® Connect EE
- IBM Z Operations Insight Suite NEW
- IBM Z APM Connect
- IBM Z Open Development NEW
- IBM Z Open Unit Test
- IBM z/OS Container Extensions
- IBM Z Distribution for Zowe NEW

IBM Cloud Hyper Protect Services

- OpenShift Container Platform NEW
- IBM Cloud Paks NEW
- IBM z/OS Cloud Broker
- IBM Hyper Protect Virtual Servers NEW
- IBM Blockchain Platform SW
- IBM Cloud Infrastructure Center NEW
- IBM z/VM 7.1
- Crypto Services
- DBaaS MongoDB
- DBaaS PostgreSQL
- Virtual Servers NEW

OpenShift
Multi-cluster, full stack, autonomous, secure



Red Hat is supporting OpenShift 4.6 on IBM Z

Cloud.redhat.com

- Install new clusters
- View capacity

OpenShift (k8s)

- Full-stack auto install (Master & Nodes)
- Zero-downtime full-stack updates
- Full-stack configure K8S and CoreOS
- Auto-scale cluster nodes

Red Hat Enterprise Linux CoreOS

- Secure, immutable container OS
- RHEL 8 kernel and core libraries
- Autonomous updates & config

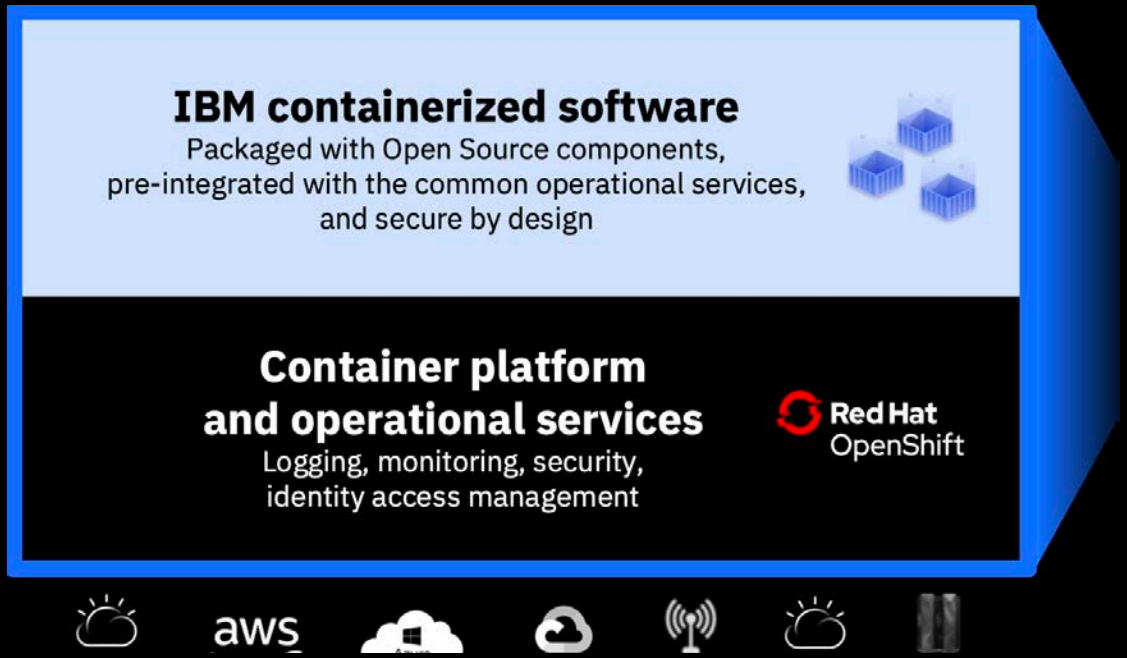
Bare Metal, VW, Private, Public Cloud

Roadmap & Delivery

Red Hat OpenShift Container Platform on Z Roadmap & Deliveries

OCP V.4.2	OCP V.4.3	OCP V.4.4	OCP V.4.5	OCP V.4.6	OCP V.4.x
Feb 11, 2020	Apr 30, 2020	Jun 22, 2020	Jul 30, 2020	November	tbd
z/VM UPI Support	Bridged hypersockets via VSWITCH	Kubernetes 1.17	Kubernetes 1.18	Full release schedule equivalency with x86	tbd
Deliver scaling proof points	Disconnected Install support	RedHat Runtimes		Additional features lock-in under discussion	
Deliver performance proof points	Improved networking				
Support for HyperPAV	Kubernetes 1.16				

Addons	Code Ready Workspaces	ODO	Service Mesh	Serverless	Tekton/Pipelines
Status	Available	Available	Coming soon	Coming soon	Coming soon



Cloud Paks – Middleware anywhere

Cloud Paks – Pre-Integrated for Cloud Use Cases

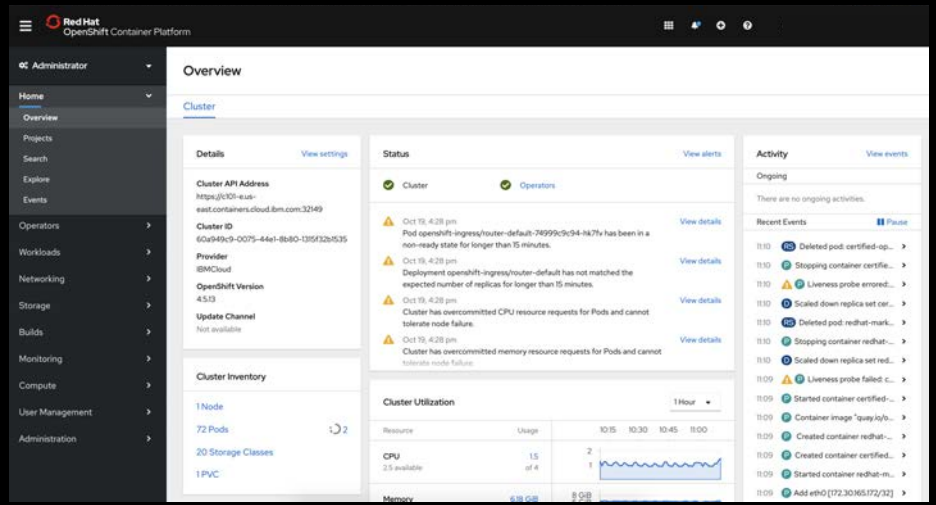
A faster, more secure way to move your core business applications to any cloud through enterprise-ready containerized software solutions

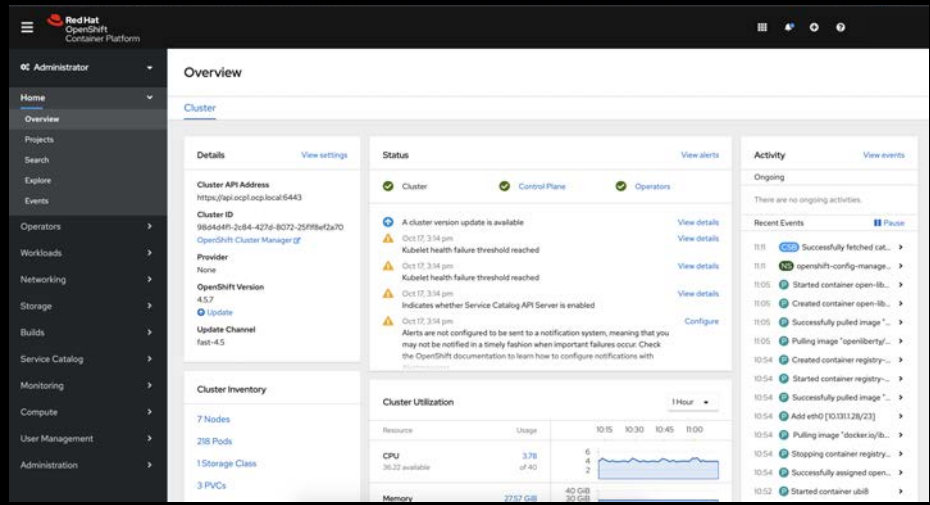
Complete yet simple - *Application, data and AI services, fully modular and easy to consume*

IBM certified - *Full software stack support, and ongoing security, compliance and version compatibility*

Run anywhere - *On-premises, on private and public clouds, and in pre-integrated systems*

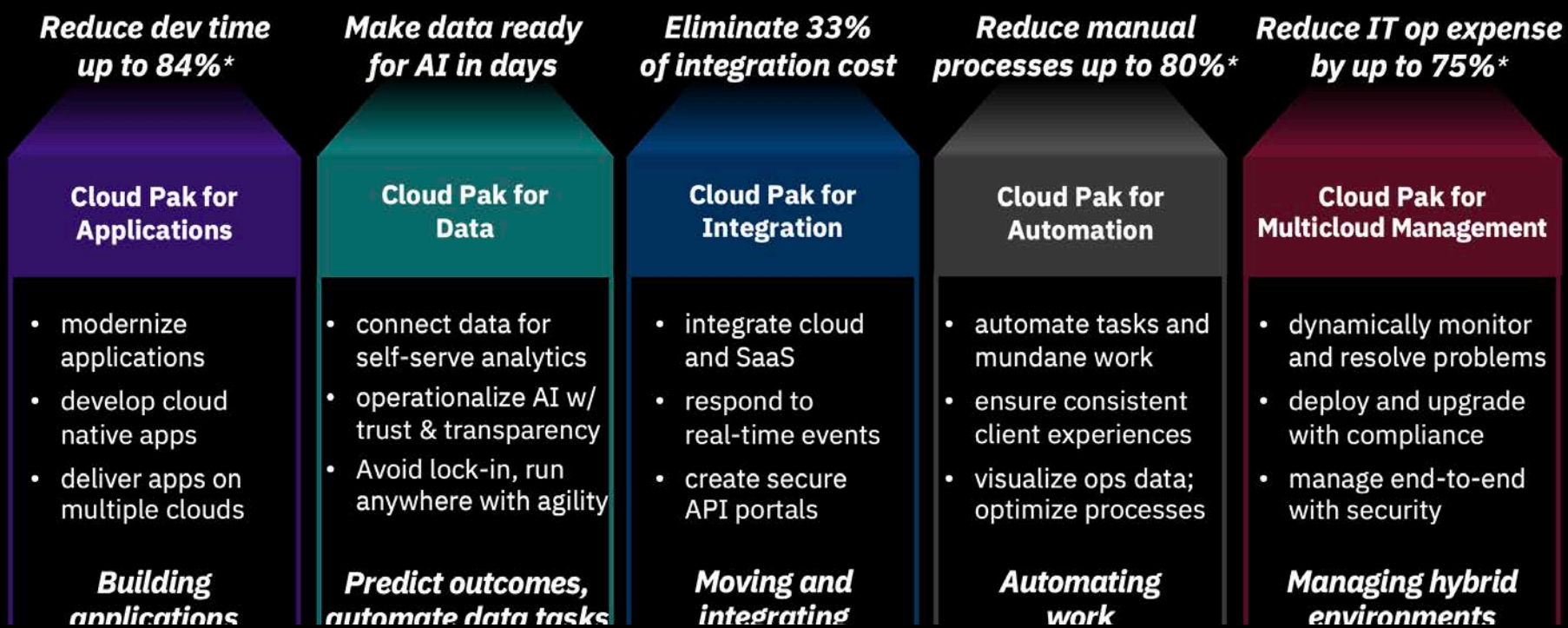
A Common Cloud Experience



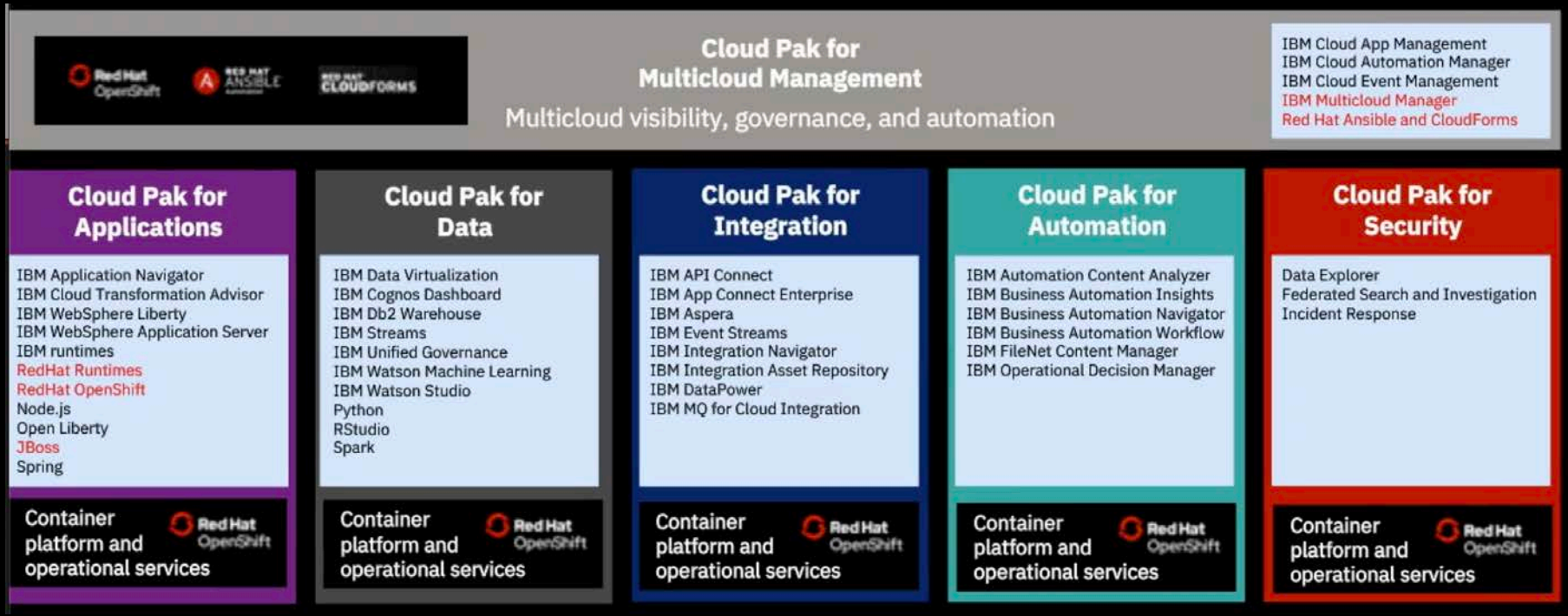


Take the OpenShift taste test -- which of these is OpenShift on Intel vs OpenShift on IBM Z?

https://developer.ibm.com/components/ibmz/tutorials/red-hat-openshift-container-platform-linuxone-community-cloud-web-server

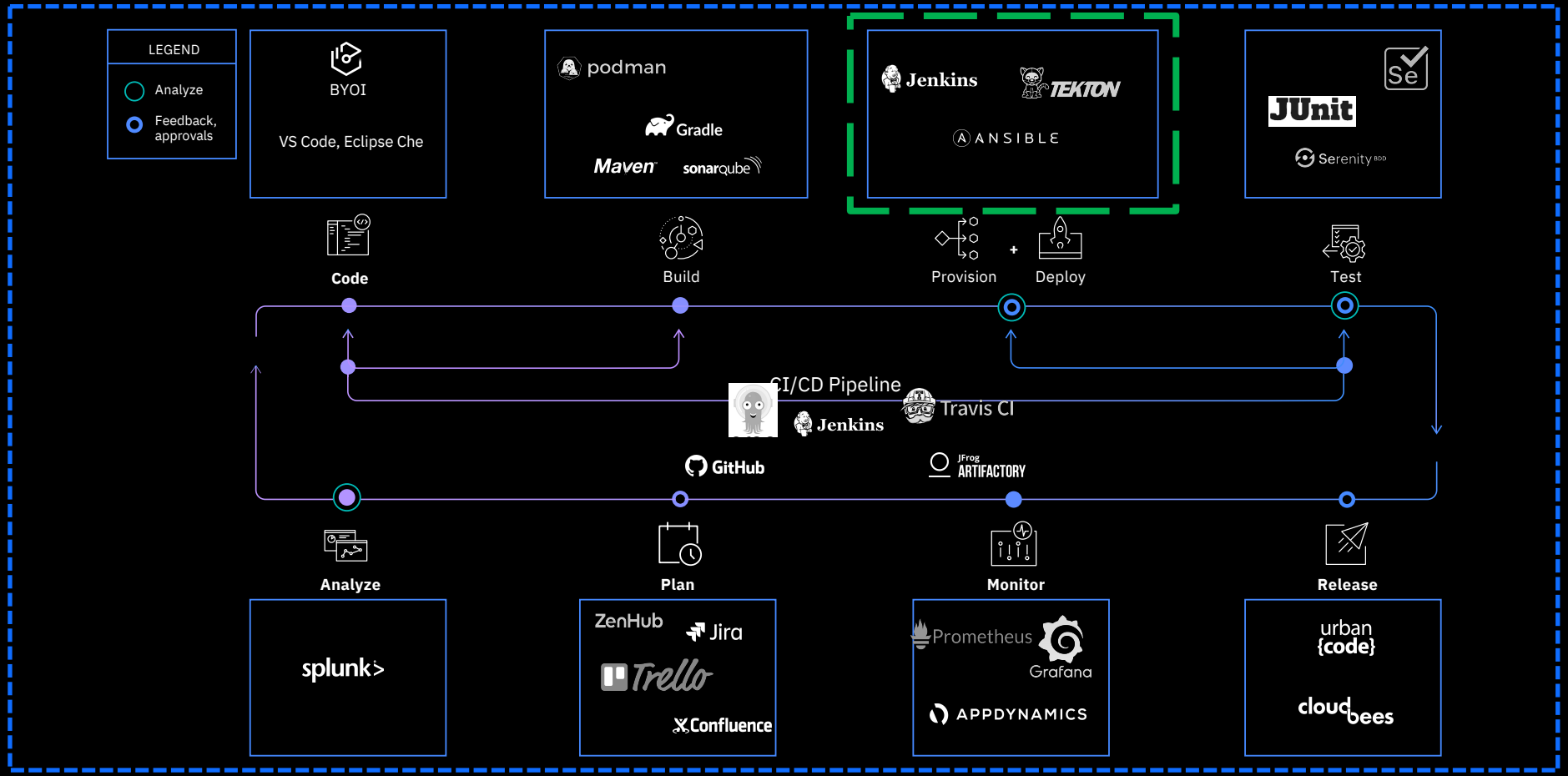


Cloud Paks – Accelerate your journey to cloud



IBM Cloud Paks – Enterprise Capability on OpenShift

Typical Cloud Native DevOps Pipeline

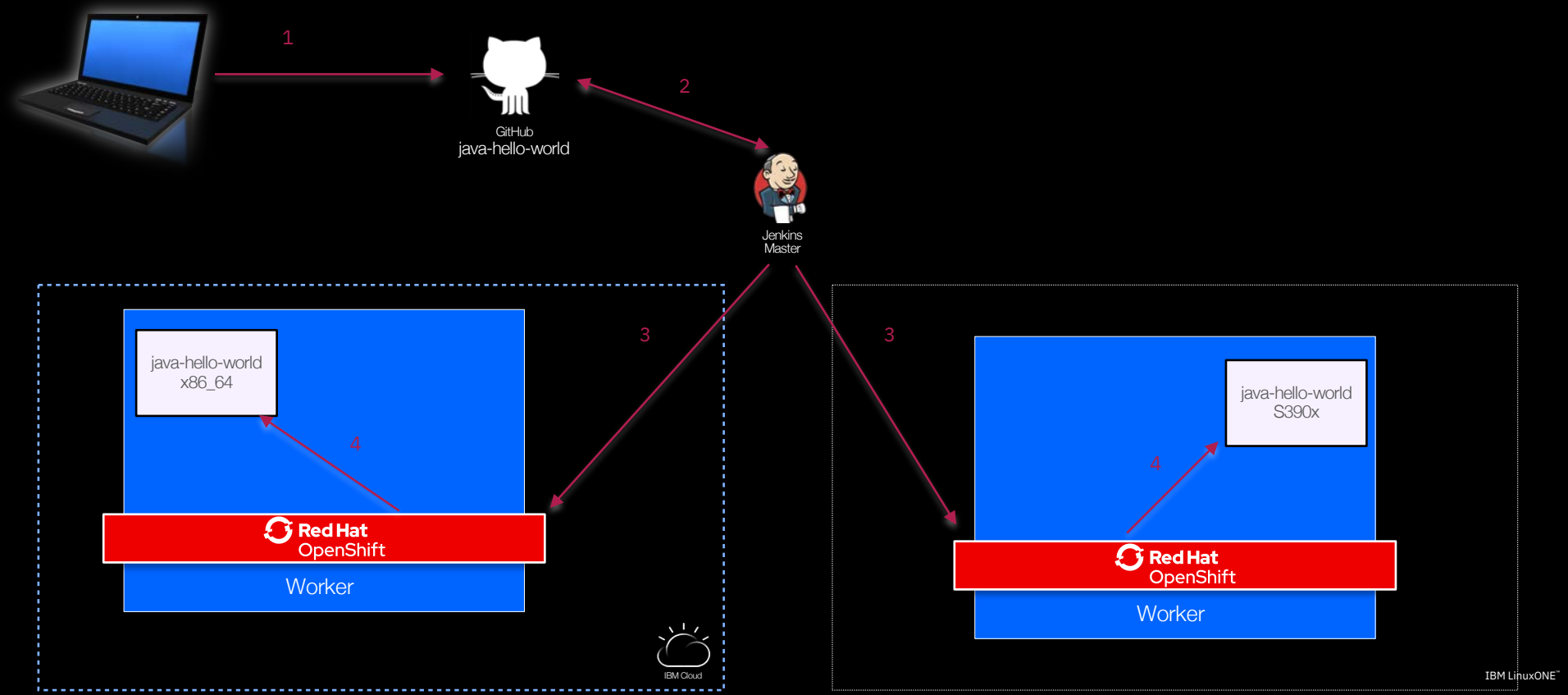


Multi-architecture manifests

- 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.

Demo: Multi architecture pipeline



Demo

Primary Use Case & Adoption Patterns – *Additional Detail*

Workload Modernization and Digital Transformation	The most common requirement for all existing IBM Z clients
Co-location with z/OS backend to achieve lower latency	Co-location analysis results at a client shows 7x better application response time
Cloud-in-a-box: Extreme consolidation and scalable data serving	Leverage IBM Z consolidation ratio to migrate workloads to Z for better TCO and availability
Consistent DevOps experience across platforms & Full stack Automation of Z environment	Modernize the platform and bring devops consistency across platforms
z/OS Integration with OpenShift and Modernization	Data gravity is key and z/OS modernization is strategic for clients
Integrated containerized solutions for faster time to market - IBM Cloud Paks with OpenShift and Blockchain on OpenShift	E2E Cloud solution designed for agility and day 2 operations is one of most common patterns of

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

- 15 client PoCs in progress
- 14 client PoCs in planning
- 136 client engagements

Government
Digital transformation with cloud-native applications on IBM Z
US

Education
Containerize applications on IBM Z for student teaching
NA

Financial Services
Co-locate containerized workloads with z/OS data to achieve lower response times
NA

IT Services
Containerizing locally developed applications on IBM Z
Europe

Financial Services
Develop and deploy cloud native applications on IBM Z
Asia Pacific

Manufacturing
Accelerate application development and deployment with containers
NA

Financial Services
Migration of COBOL applications to Red Hat OpenShift running on IBM Z
US

Financial Services
Accelerate application development and deployment on IBM Z
Europe

Financial Services
Adopt Cloud Native on Z to achieve consistency and grow containerized workloads on IBM Z
NA

Financial Services
Reduce latency of applications by moving close to data on IBM Z
NA

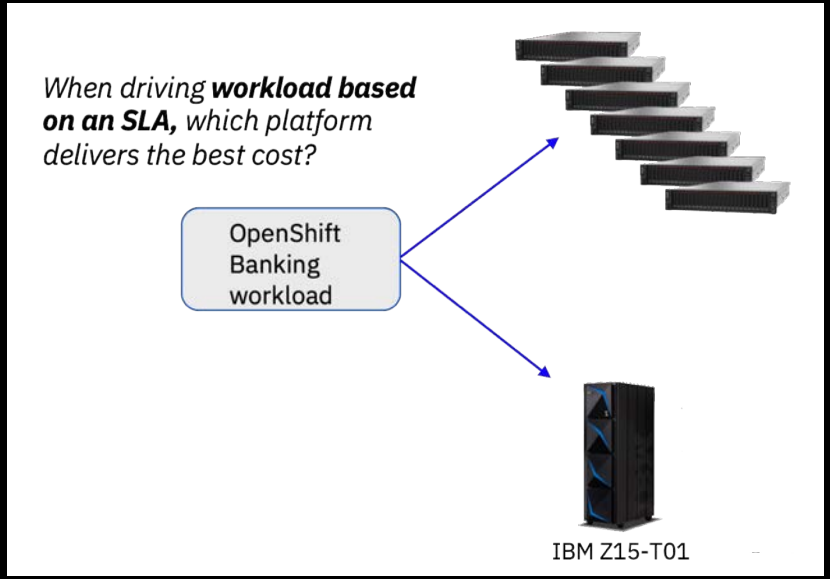
Government
Faster application development and consistent management
Europe

Financial Services
Java applications connected to IBM z/OS data
LA

OpenShift Container Platform (OCP)

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

Achieve up to, 16x consolidation and 37% lower cost on OpenShift Container Platform 4.2 on z15 versus x86

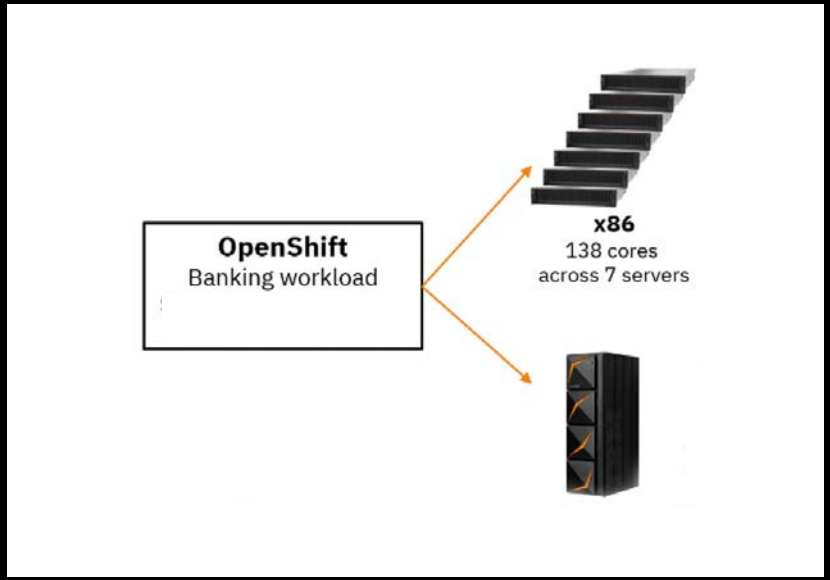


Disclaimer: This is an IBM internal study designed to replicate a typical IBM customer workload usage in the marketplace. It consists of IBM zR15-T01 with eight IFL (@5.2 GHz) across three LPARs. First LPAR is allocated three IFLs and 512GB memory, second LPAR is allocated four IFLs and 512GB memory 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 17x consolidation and 48% lower cost on OpenShift Container Platform 4.2 on z15 versus x86



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Use Case – Response Time/Latency reduction

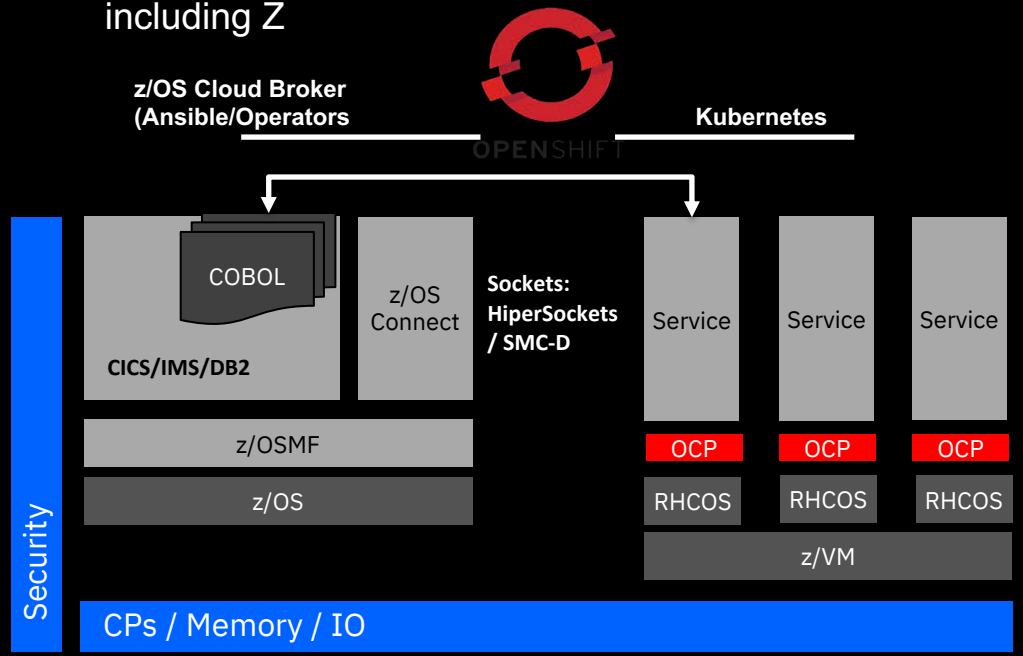
- Containerized services running in Linux on Z are co-located on the same hardware with z/OS Db2 data and CICS for low latency, high volume transaction processing
- Achieve up to 7.3x lower latency co-locating applications on Z compared to connecting to an x86 server

Modernize and digitally transform

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

OpenShift experience: better SLAs at lower cost

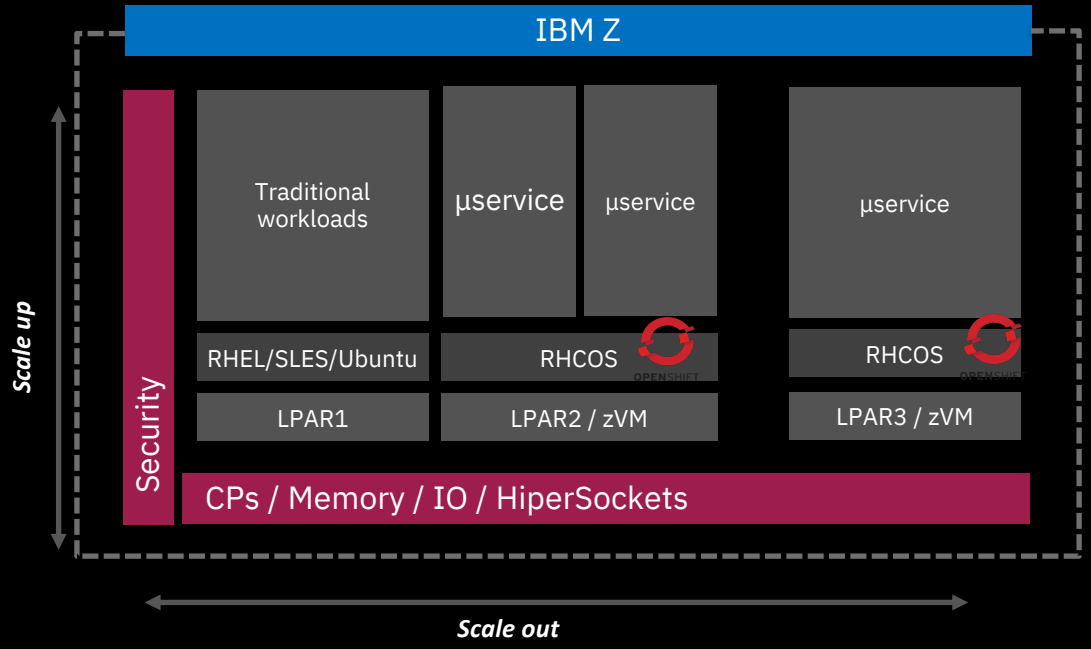
- Seamless integration of IBM Z with OpenShift DevOps and developer experience
- Common cloud control plane across the enterprise – including Z



Use Case – Private Cloud in a Box

Super elastic system
- Combine horizontal and vertical scaling
- Non-disruptively add or remove resources from Linux guests
- Non-disruptively add or remove Linux guests
- Digital transformation - Develop new applications, using microservices
- Elastic diagonal scale for cloud (scale-up and -out in a single footprint)
- Consolidation - save s/w licensing, power and space

Typically offered as an alternative to moving to public cloud within client organizations

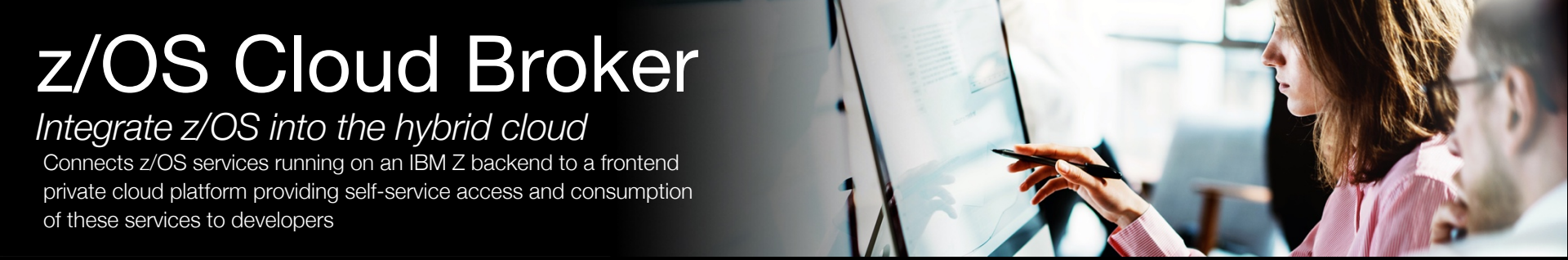


Scalable, elastic and highly available cloud in a box

z/OS Cloud Broker

Integrate z/OS into the hybrid cloud

Connects z/OS services running on an IBM Z backend to a frontend private cloud platform providing self-service access and consumption of these services to developers



Challenge

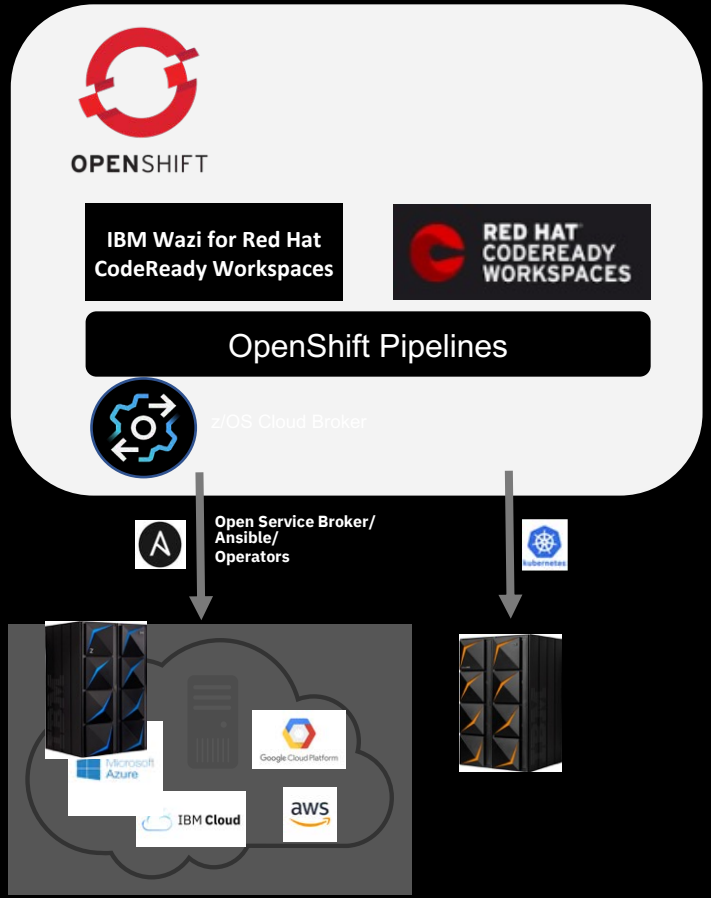
Business critical applications running on z/OS are isolated, and installation of any Cloud platform will not integrate my z/OS subsystem within same control planes.

Client Value

- 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

IBM Wazi for Red Hat CodeReady Workspaces

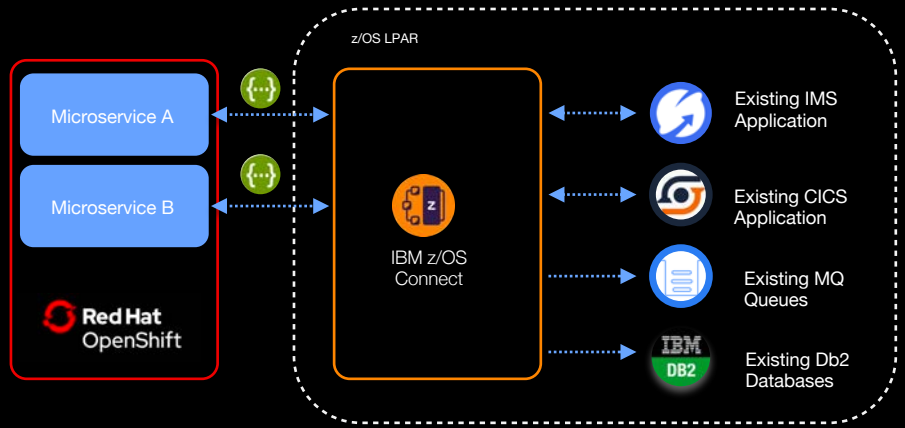
Single development experience for hybrid applications spanning IBM Z and other cloud platforms



z/OS Connect EE

Truly RESTful APIs to and from the Cloud for IBM Z Services

IBM® z/OS® Connect Enterprise Edition enables you to empower a wide community of developers with a simple and intuitive way to consume data and services hosted on IBM Z®. It provides a single, common way to unleash your existing market-differentiating assets on IBM with RESTful APIs



Client Value

- Speed application development

Empower app developers with critical data and services through RESTful APIs designed to be easily consumable.

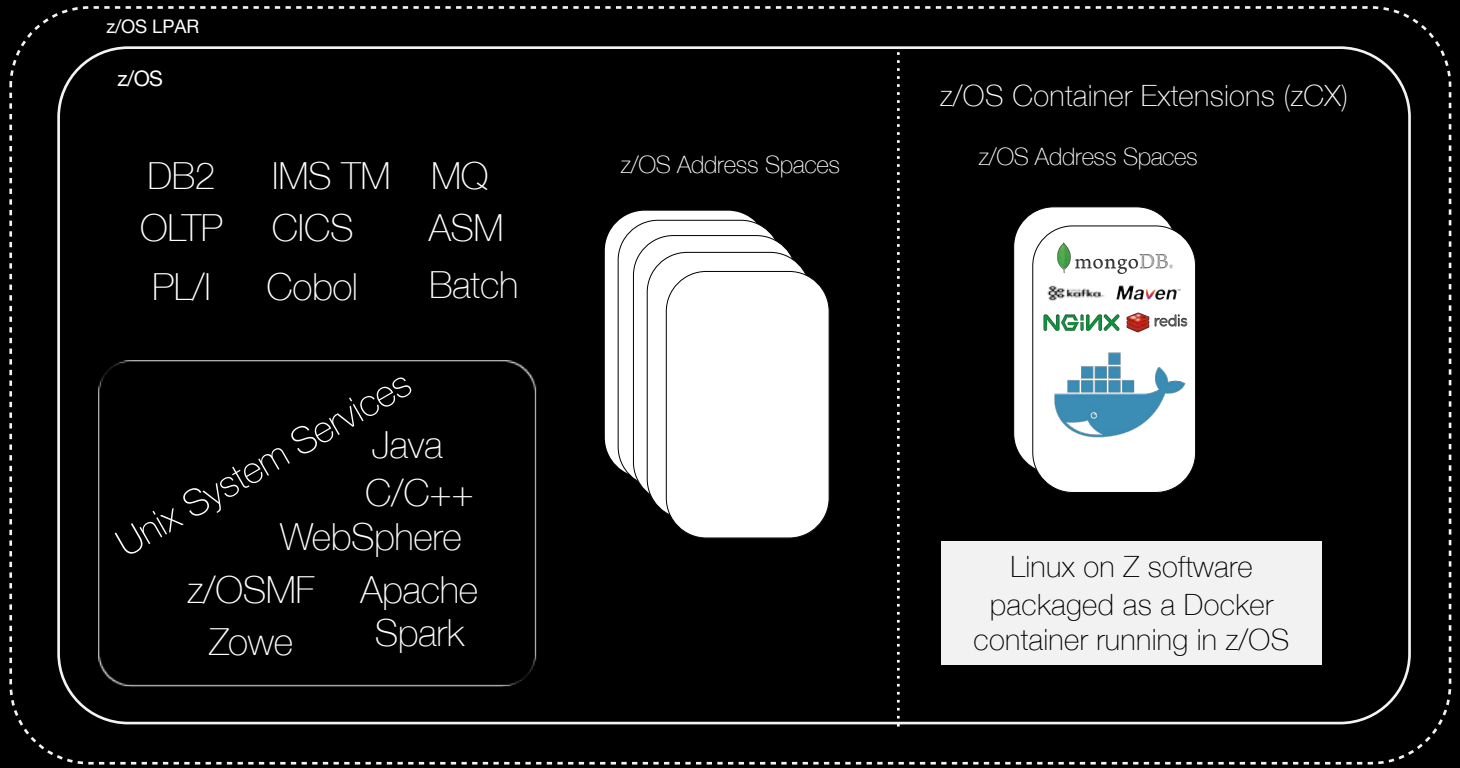
- Harness new opportunities

Expose IBM Z assets as APIs without changing your backend applications. Use these APIs to leverage the API economy, creating new opportunities with developers and cultivate new customers.

- Secure and control

Host APIs on one of the world's most trusted platforms with enhanced security through pervasive encryption on IBM z14/15®.

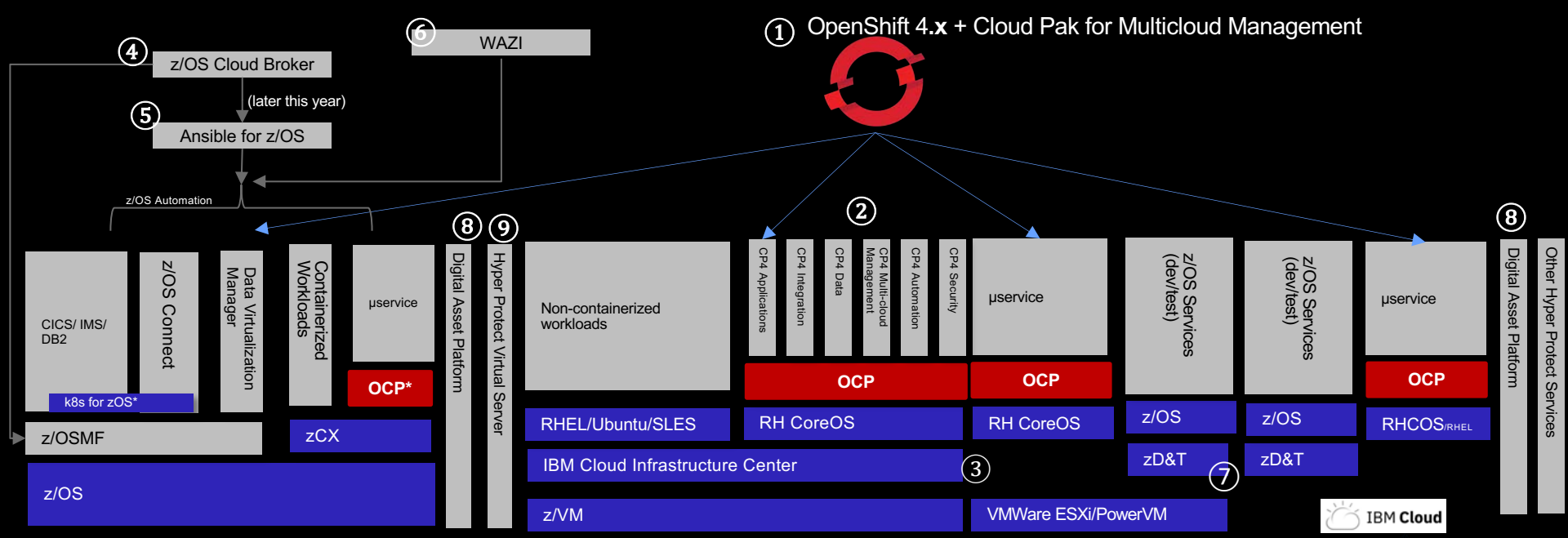
z/OS Container Extensions



Traditional z/OS workloads, middleware, subsystems and programming languages

Unix System Services provided z/OS with a Unix personality enabling porting of Unix applications and new programming languages to the platform

z/OS Container Extensions (zCX) provides the next big evolution – unmodified Linux on Z Docker images running inside z/OS



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 (beta ongoing)
OCS (coming soon)

* tentative