Demystifying a Red Hat OpenShift environment with z/OS or VSE knowledge

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Virtualization vs. application isolation

Virtualization and application isolation

Virtualization:

- Infrastructure oriented
- Virtual server resource management
- Several applications per server
- Isolation in virtual servers
- Persistence via Virtual server
- Security in virtual server

Application isolation:

- Service oriented
- Application resources managed inside a virtual server
- Solution decomposed into several application units / modules
- Isolation and persistence on application level depends on the implementation
- Security based on access security in OS and Virtualization layer

Virtualization vs. application isolation

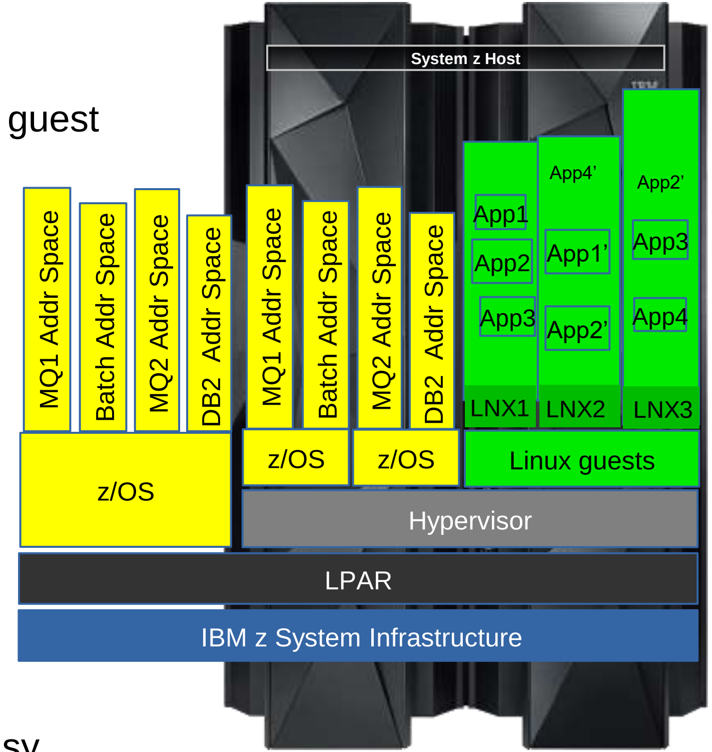
z/OS and Linux applications

In z/OS:

- LPAR or z/VM Hypervisor virtualizes z/OS & VSE Systems as guest
- applications are running in address spaces / partitions
- address space / partition characteristics:
  - isolate applications
  - enable application control, horizontal scalability
- applications can share data
- address space priorities allow application prioritization
- WLM the main component for workload and priorities

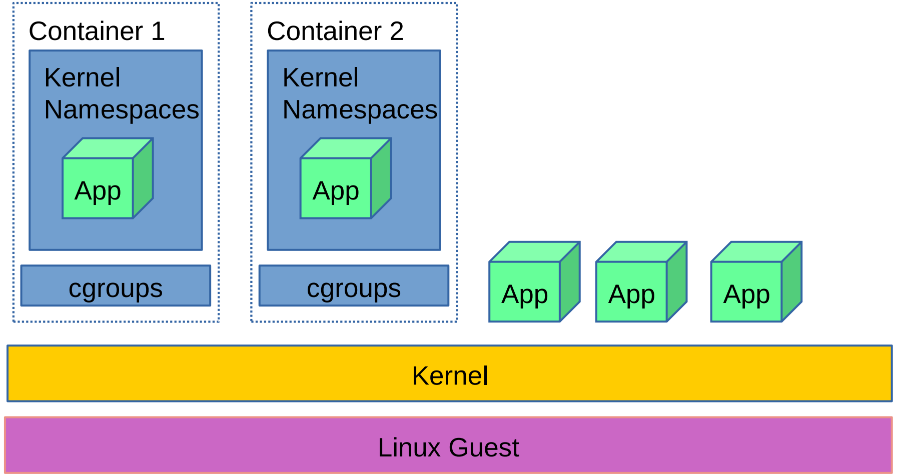
In Linux:

- LPAR or z/VM & KVM Hypervisors virtualization is for Linux guest systems not for pure application isolation
- applications are running as processes
- no hard isolation between processes
- multiple start of a single application on the same kernel not easy
- *Linux Containers – concept to improve application isolation their scalability and flexibility*



Linux control groups and namespaces demystified

- To simplify:
  - “**cgroups**” will allocate & control resources in your container
    - CPU
    - Memory
    - Disk I/O throughput
  - “**namespace**” will isolate
    - process IDs
    - Hostnames
    - User IDs
    - network access
    - interprocess communication
    - filesystems



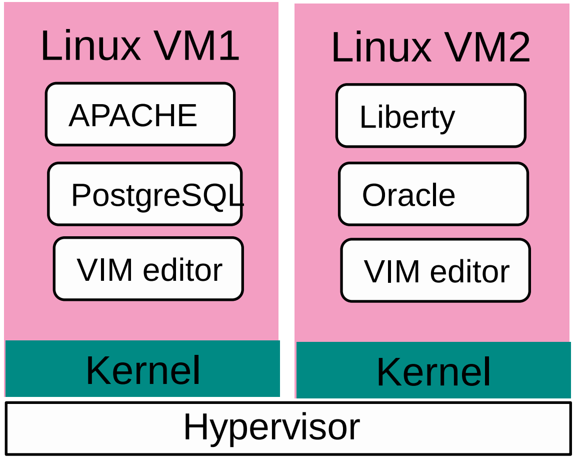
Linux applications in virtual servers vs. Containerized applications

Virtualization, usually provides a **high level of isolation** and security as all communication between the guest and host is **through the hypervisor**. Linux on IBM zSystems runs in LPAR or Virtual machines.

- ➢ It is also usually slower than containers and incurs some **overhead due to the infrastructure emulation**.

Containers, reduce the virtualization overhead, the level of virtualization called "**container virtualization**" was introduced which allows to run **multiple isolated user space instances on the same kernel**.

- ➢ **Containers is a layered approach and uses copy-on-write filesystems**



Linux VM1

APACHE

PostgreSQL

VIM editor

Kernel

Linux VM2

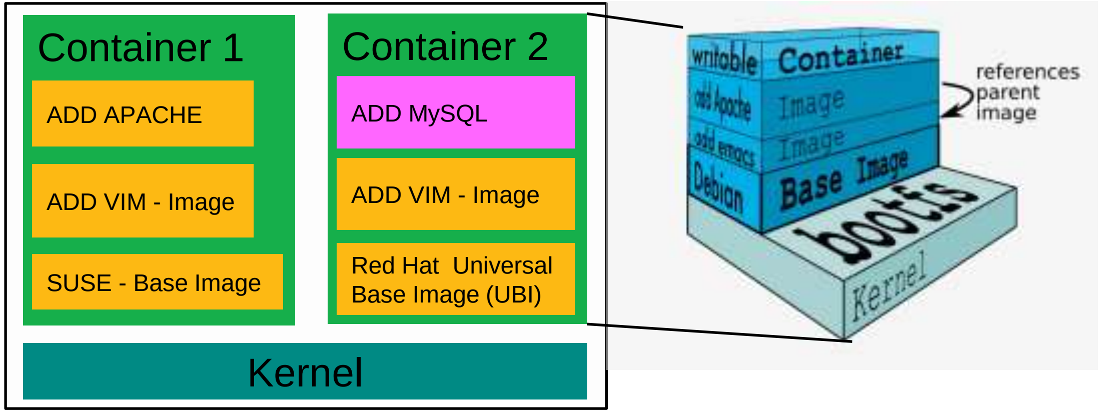
Liberty

Oracle

VIM editor

Kernel

Hypervisor



Container 1

ADD APACHE

ADD VIM - Image

SUSE - Base Image

Container 2

ADD MySQL

ADD VIM - Image

Red Hat Universal Base Image (UBI)

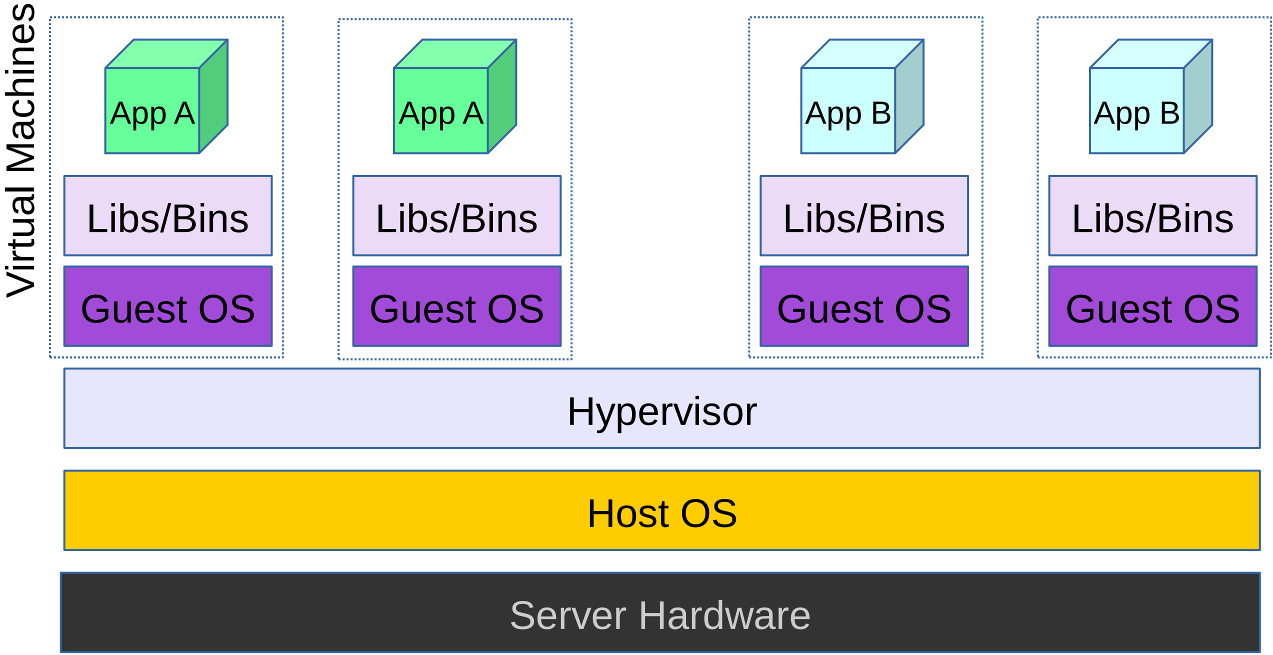
Kernel

Containers are orchestrated with other tools than VMs

Linux Virtual Machines & applications

Virtualization - Infrastructure oriented

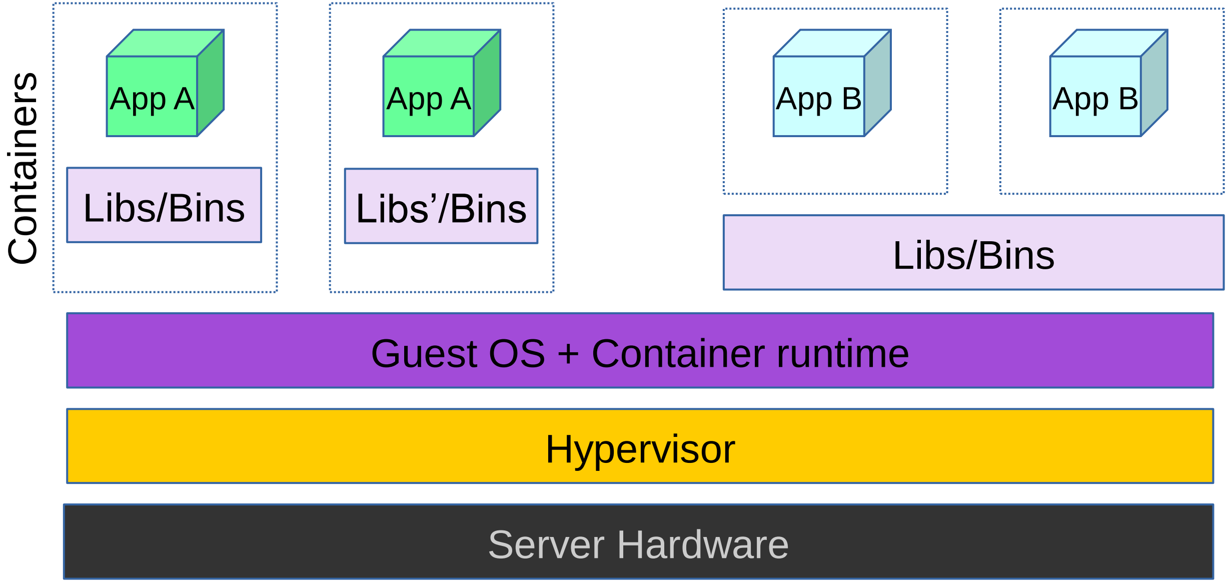
- ➢ Customers have virtualized their servers to gain efficiencies
- ➢ Focus is on virtual server resource management
- ➢ Few applications per Guest VM / Operating System instance
- ➢ Provides application isolation
  - An application failure does not adversely affect other applications residing in other guest VMs
- ➢ Provides persistence across server restarts



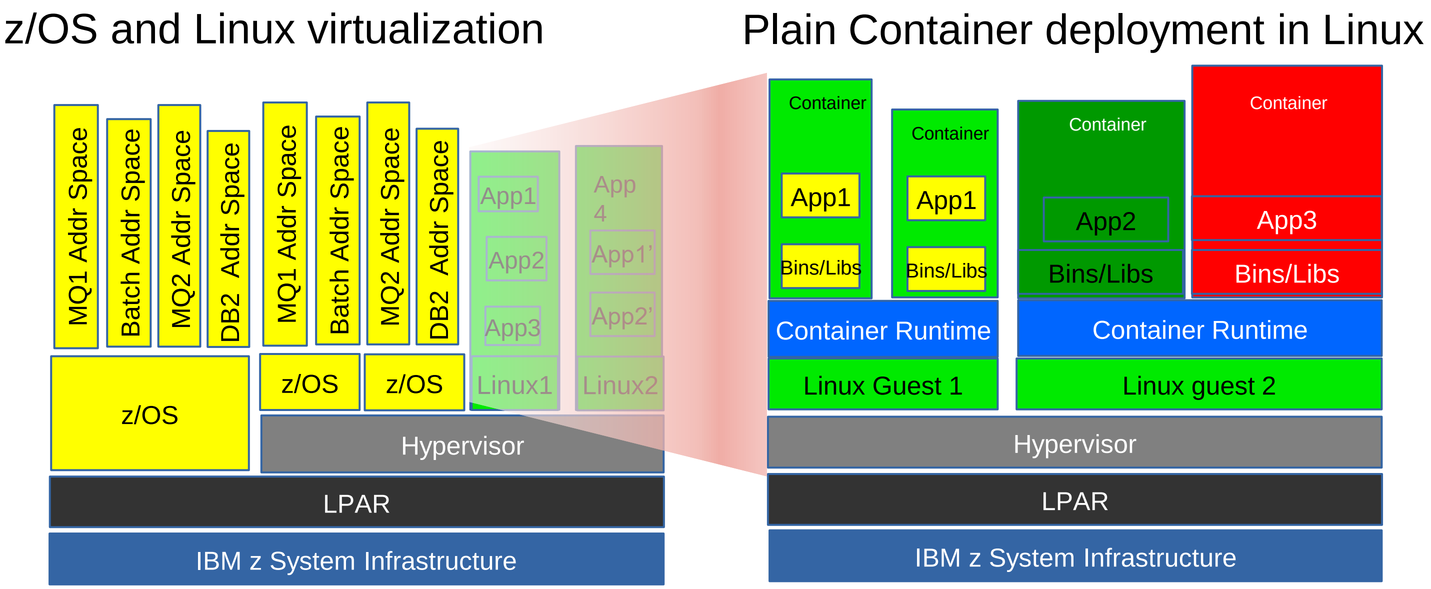
Linux Applications in Container

Containers - Service oriented

- Application-centric - infrastructure resources are assumed to be already in place
- Focus is on application isolation / management
- Containers need a Guest VM or Operating environment
- Have specific DevOps advantages
- Provide a very dynamic application deployment model



Virtualization vs. Container application isolation in IBM Z



Virtualization:

- Infrastructure oriented
- Virtual server resource management
- Several applications per server
- Isolation per virtual server

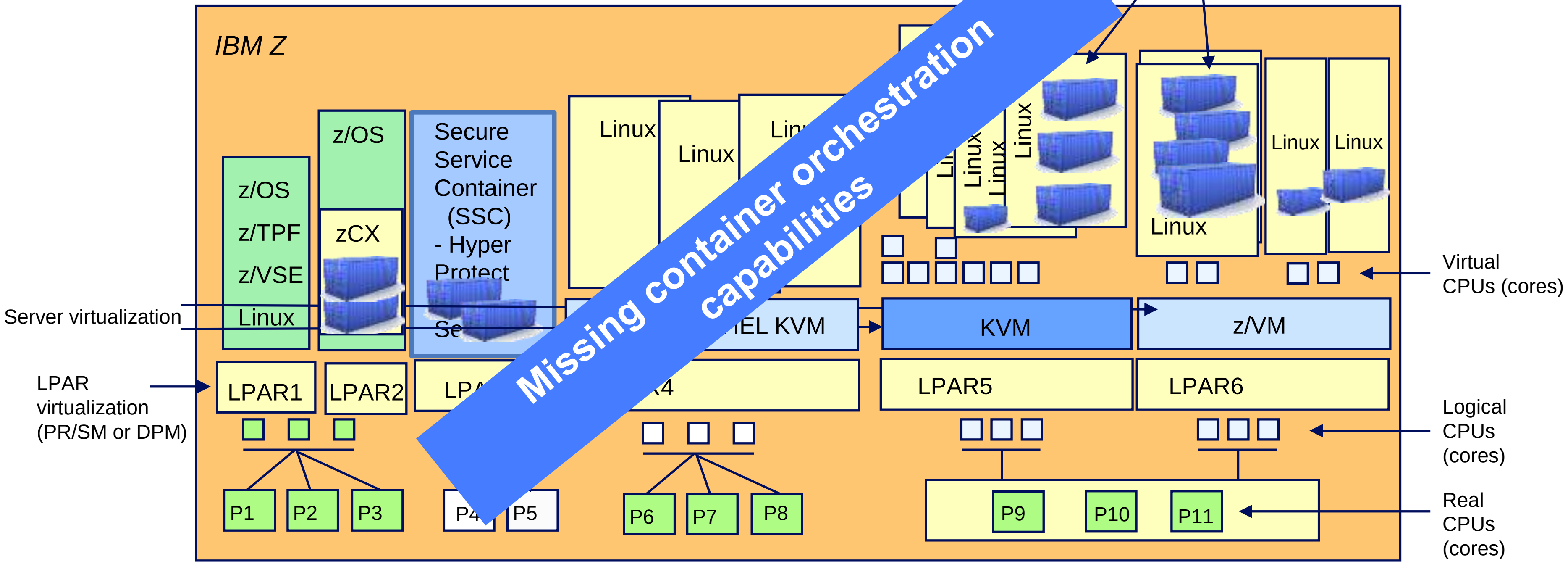
Containers:

- Service oriented
- Application management via container
- Solution decomposed into several units
- Dynamic, isolation in container

IBM zSystems Virtualization and Container options

Server virtualization. There are typically dozens or hundreds of Linux servers in a LPAR virtualized using z/VM or KVM or SSC.

Application isolation.
There ar typically thousands of
Cont n Linux on IBM Z.



Missing container orchestration capabilities

P1 – P11 are General Purpose Processor Units (GPU -> core) or Integrated Facility for Linux (IFL) Processors (IFL -> core)

Note: - LPARs can be managed by traditional PR/SM in IBM Z and additional with Dynamic Partition Manager (DPM) in LinuxONE

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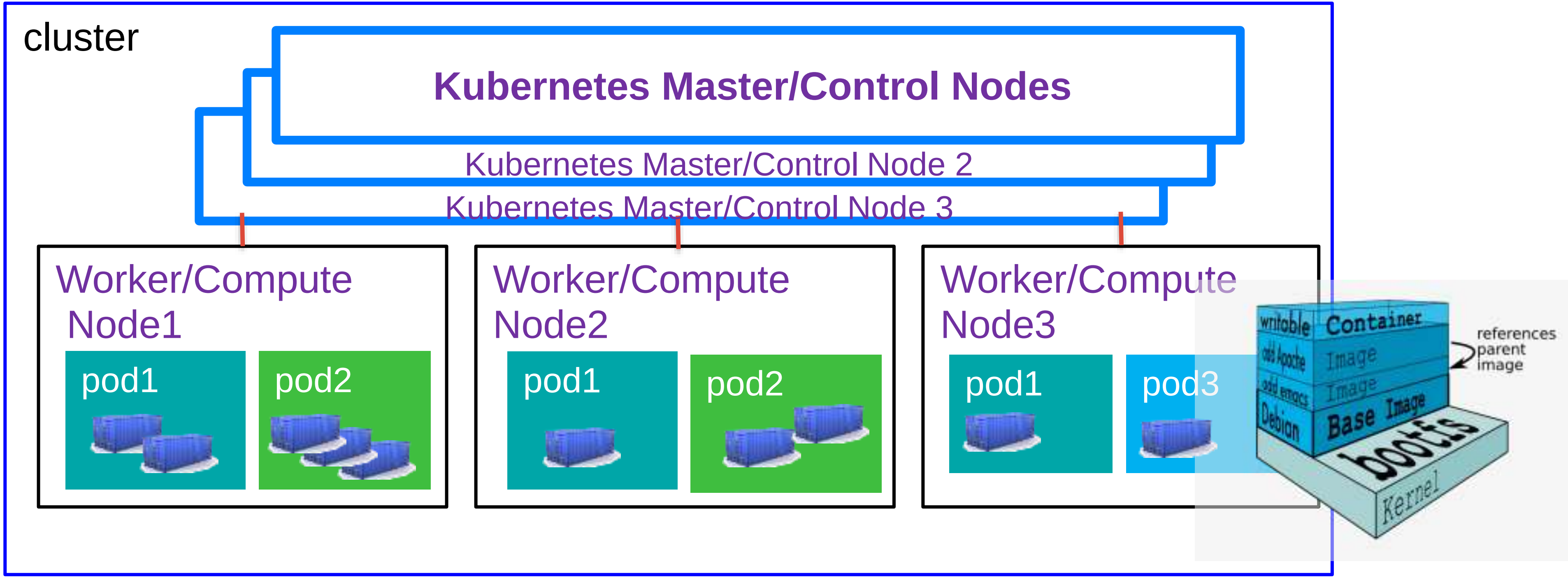
Kubernetes (K8S) – container orchestration

- defines itself in a cluster format for HA per design



cluster

Kubernetes Master/Control Nodes

Kubernetes Master/Control Node 2

Kubernetes Master/Control Node 3

Worker/Compute Node1

pod1

pod2

Worker/Compute Node2

pod1

pod2

Worker/Compute Node3

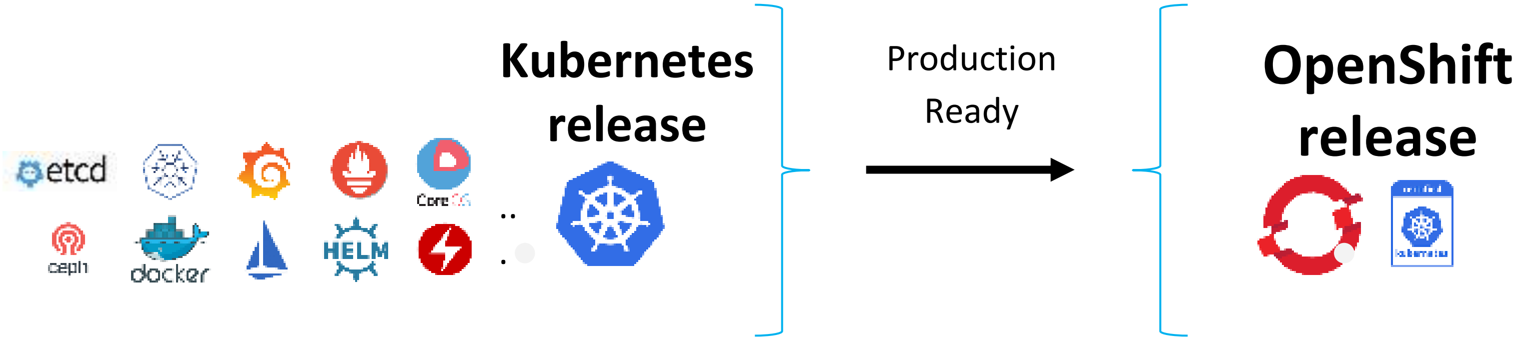
pod1

pod3

Kubernetes is not running container – it orchestrates them

Kubernetes is THE container Orchestration tool

Red Hat OpenShift is trusted enterprise Kubernetes



Kubernetes release

Production Ready

OpenShift release

- Hundreds of defect and performance fixes
- 200+ validated integrations
- Certified container ecosystem
- Over 9-years enterprise life-cycle management
- Red Hat is one of the leading Kubernetes contributor since day 1

Red Hat OpenShift Container Platform (RHOCP)

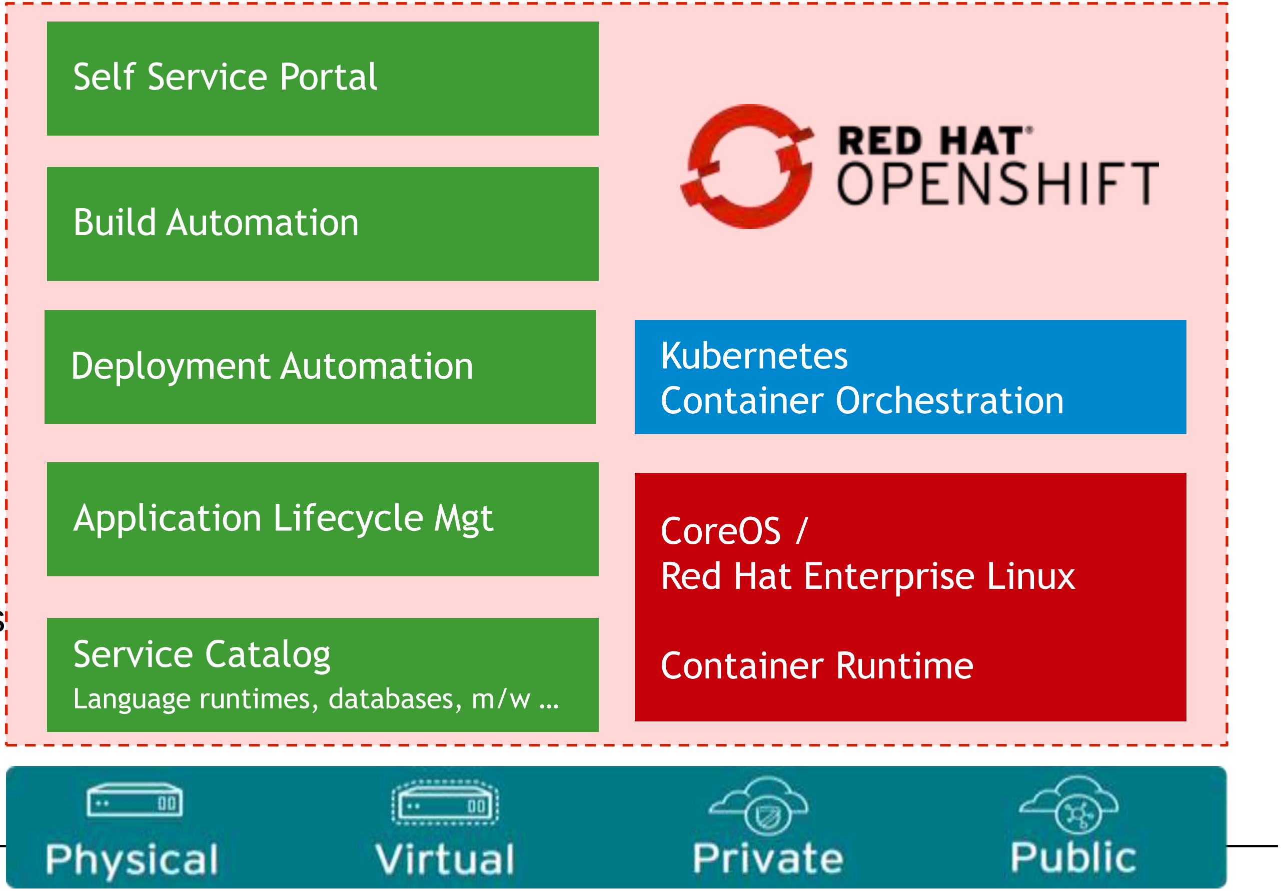
to Build, Deploy, Manage Containerized, Cloud Native Apps that can Run Anywhere

Red Hat OpenShift
- The enterprise
  Kubernetes Platform

- Runs on IBM zSystems, IBM Power, x86 and public clouds

- Is THE platform for
  Life cycle management
  of containerized applications

- Has capabilities for extensions
  to manage Clusters on
  different Architectures
  with RHACM



Self Service Portal

Build Automation

Deployment Automation

Application Lifecycle Mgt

Service Catalog
Language runtimes, databases, m/w …

RED HAT OPENSHIFT

Kubernetes
Container Orchestration

CoreOS /
Red Hat Enterprise Linux

Container Runtime

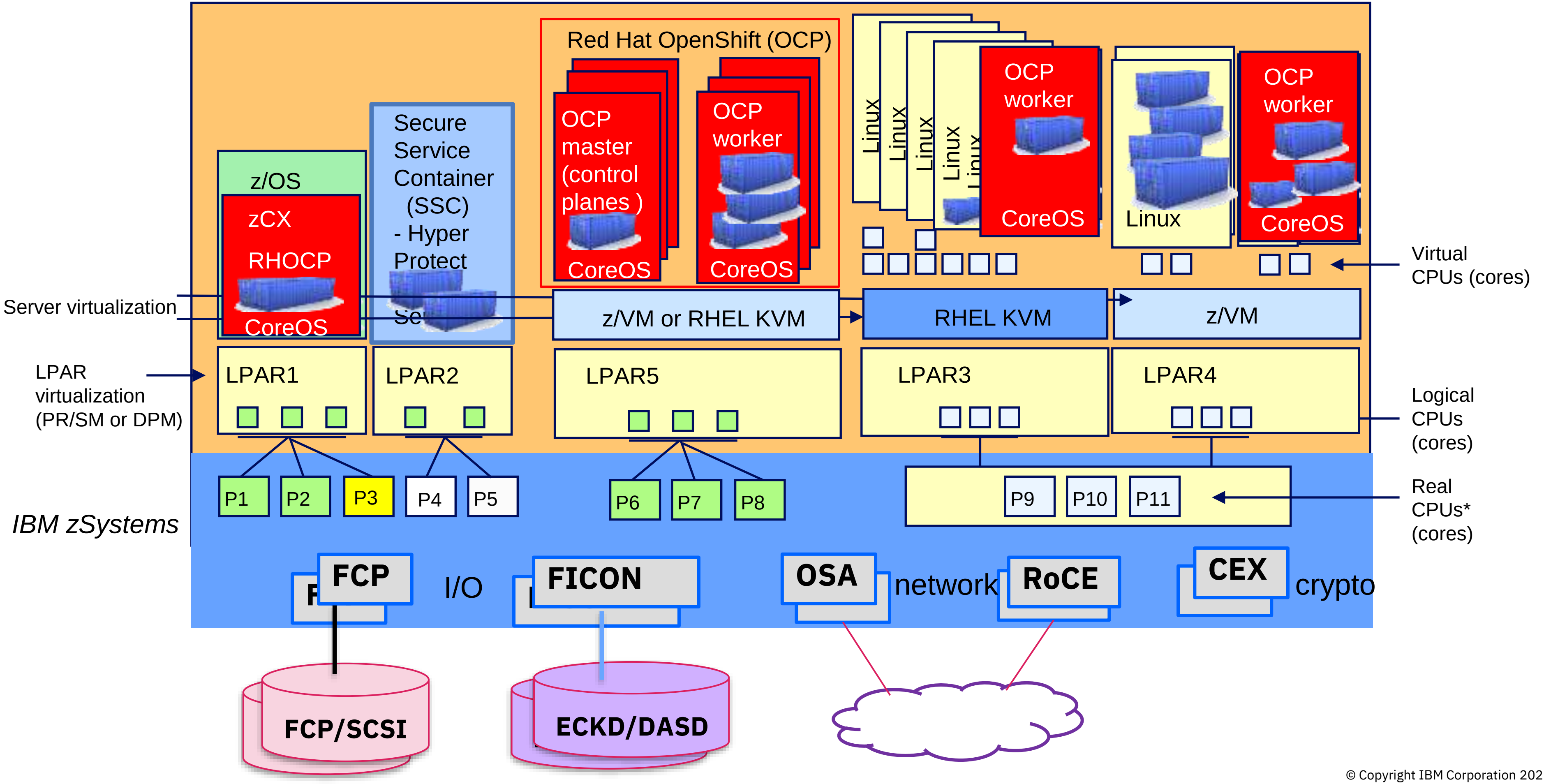
Physical

Virtual

Private

Public

IBM zSystems Virtualization and Container options



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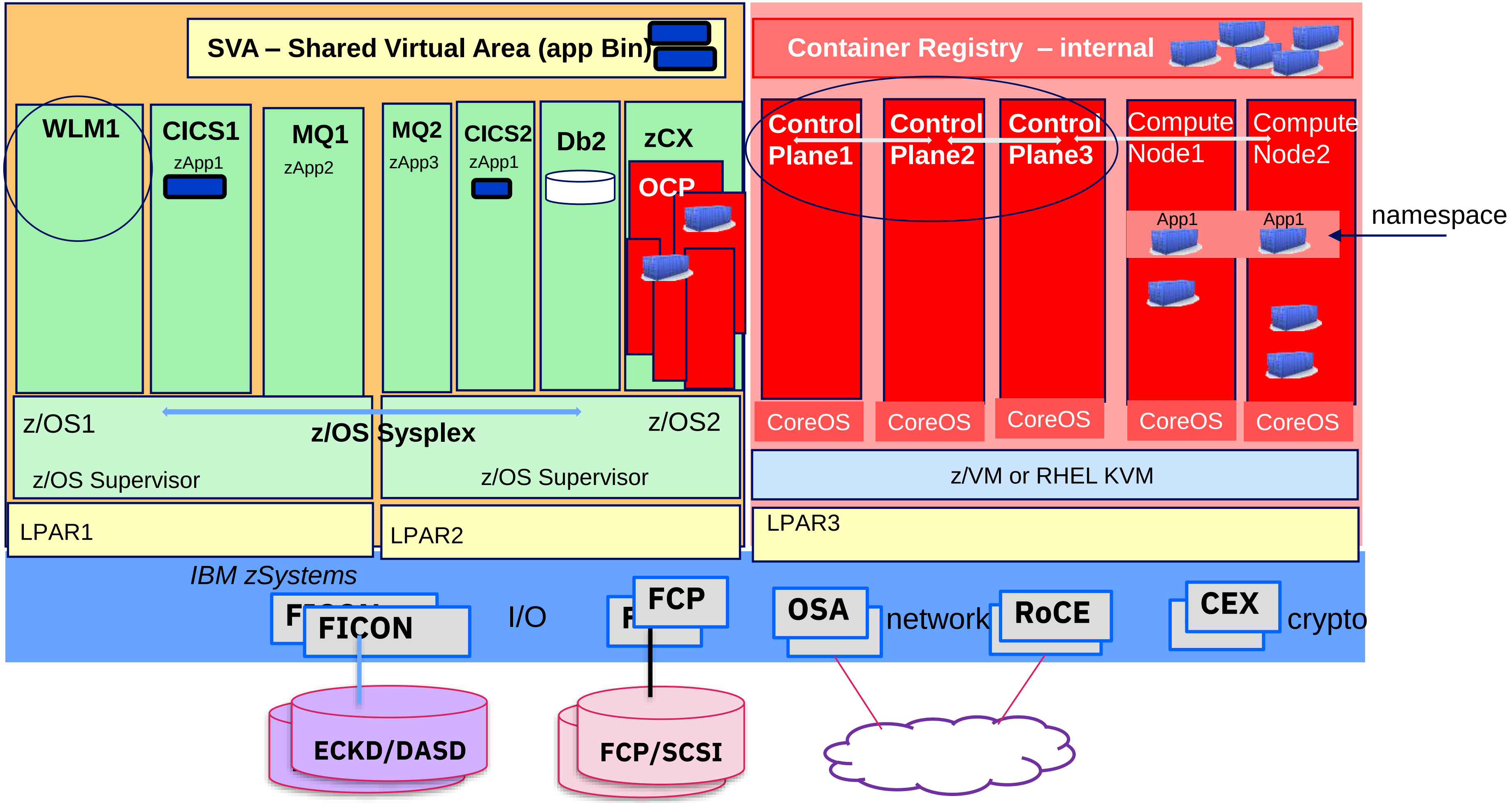
IBM zSystems Virtualization and Container options



SVA – Shared Virtual Area (app Bin)

WLM1

CICS1
zApp1

MQ1
zApp2

MQ2
zApp3

CICS2
zApp1

Db2

zCX
OCP

z/OS1

z/OS Sysplex

z/OS2

z/OS Supervisor

z/OS Supervisor

LPAR1

LPAR2

Container Registry – internal

Control Plane1

Control Plane2

Control Plane3

Compute Node1
App1

Compute Node2
App1

namespace

CoreOS

CoreOS

CoreOS

CoreOS

CoreOS

z/VM or RHEL KVM

LPAR3

IBM zSystems

FICON

I/O

FCP

OSA

network

RoCE

CEX

crypto

ECKD/DASD

FCP/SCSI

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Container and OpenShift on IBM zSystems and LinuxONE

Container and OpenShift to z/OS Terminology:

- **Openshift Cluster** is a Kubernetes cluster -> set of **3 Control Plane Nodes** represented by Virtual machines in z/VM or RH KVM and a number of min 2 **Compute Nodes**, VMs as well
  - z/OS Basic Sysplex - a cluster of tightly-coupled independent instances of the z/OS operating system environments with multiple Address Spaces – for high availability of z/OS applications in the Sysplex
- **Openshift Control Plane Nodes** – control and manage the status of the cluster and applications, controlling restart of failing applications
  - z/OS WLM in the Sysplex – controls prios, workload resources and dispatcher
- **Openshift Compute Nodes** – separate workload Nodes in the OCP cluster
  - z/OS Address Spaces across the Sysplex
- **Openshift Pod –** a group of containers, running in an Openshift Compute Node. Multiple Pods run per Node, one or multiple containers per pod
  - z/OS Address Space with multiple Applications running in it
- **Container Registry:** The library which contains the container images that can be instantiated in the OpenShift Cluster.
  - z/OS – a Shared Virtual Area (SVA) containing reentrant application binaries

Container and OpenShift on IBM zSystems and LinuxONE

Container and OpenShift to z/OS Terminology:

- **OpenShift or Kubernetes Namespace** – a logical group of pods which represent an application entity
  - z/OS application deployed highly available in a Sysplex
- **Container Image**: the image from which containers are instantiated. An image represents an App logic as read-only, layered – like a golden image. Images can be created with container dev tools.
  - Binary image (Phase), reentrant, in SVA, that can be instantiated in multiple Address Spaces at the same time
- **Container**: a running instance, from a container image.
  - z/OS – an running application in an Address Space (MQ App, DB2, COBOL app.)
- **Openshift High Availability –** per design Kubernetes and Openshift are implemented with high availability concepts for the container software and the cluster
  - z/OS Sysplex and GDPS build an unmatched entity for availability from infrastructure to the application level.

z/OS CICS is unique – > there is no transactional control component in OpenShift

*

Kubernetes and Openshift are designed primarily for stateless applications.

Globally: What is a container application related to z/OS concepts

- A Container is a form of isolation for individual applications or workloads
  - z/OS: Can be compared with a z/OS Address Space (new container tool: zospt tool)

- It is a flexible way of deployment of isolated applications
  - z/OS: starting an application in a certain Address Space

- The container is build via a Containerfile (Dockerfile), which contains instructions to include necessary components in the container image that is built
  - z/OS: Use of JCL, binary modules and link books to build applications

- Based on a Container image, a container can be instantiated or transferred
  - z/OS: Binary member copy – is not containing application dependencies like IP or runtime lib.

- A Container (runtime) is not persistent
  - z/OS: A workload in an Address Space can be HA in a Parallel Sysplex but is not persistent to itself

- A Container can be used as base to build another container image

Everything should be made as simple as possible,
but no simpler

– Albert Einstein

Questions?

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