Virtualization Options for IBM z Systems

Introduction to KVM for IBM z Systems

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Agenda

- KVM

- Why KVM for IBM z

- What is KVM for IBM z

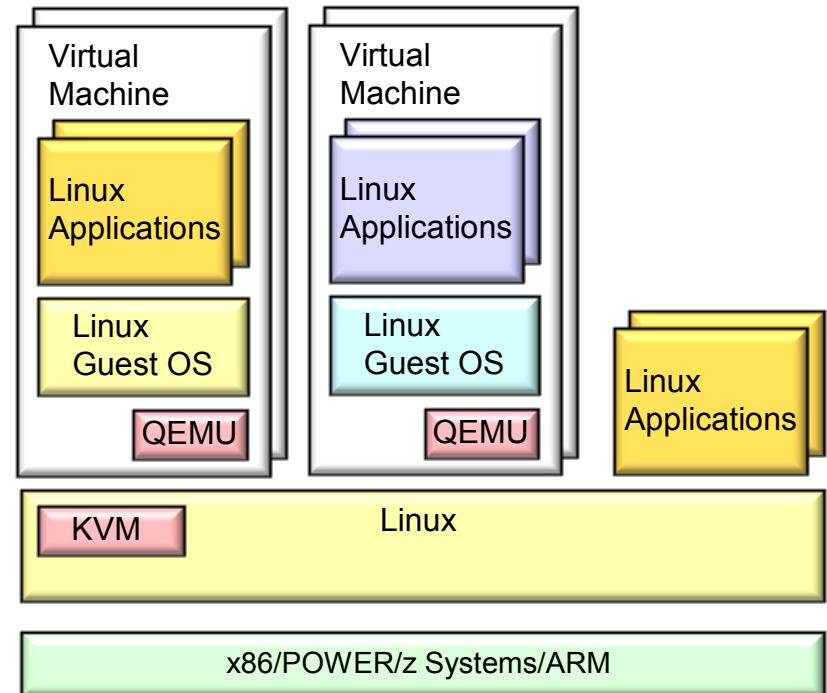- Systems Management Tooling for KVM for IBM z

Kernel Based Virtual Machine (KVM)

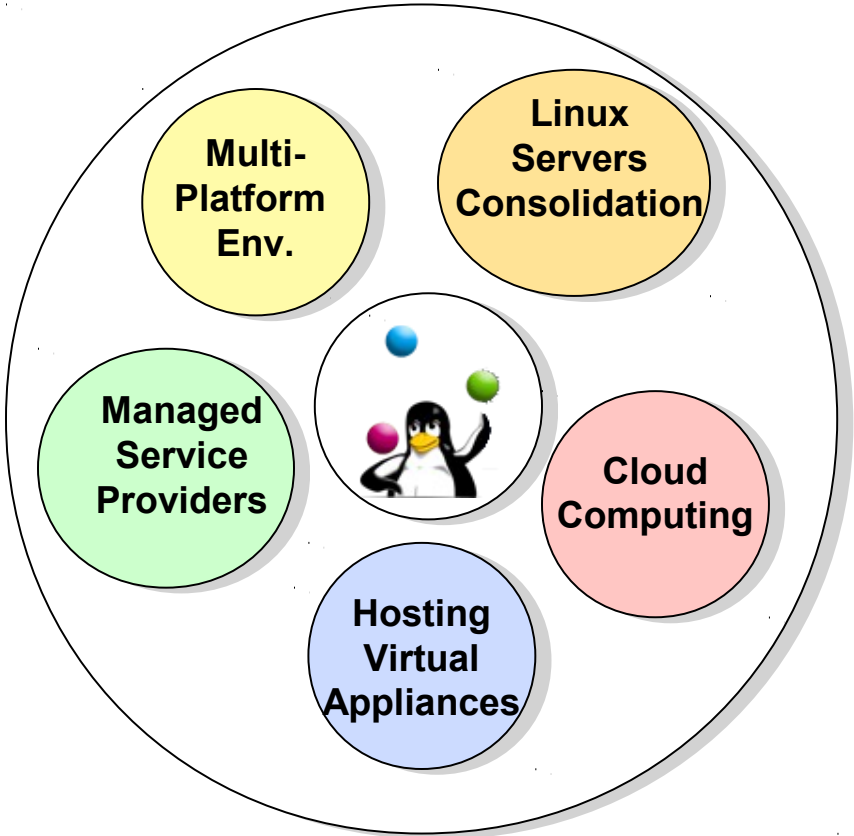▪ **An open source hypervisor based on Linux**

- Linux provides the base capabilities
- KVM turns Linux into a hypervisor
- QEMU provides I/O device virtualization and emulation

▪ **Provides flexibility in technology choices**
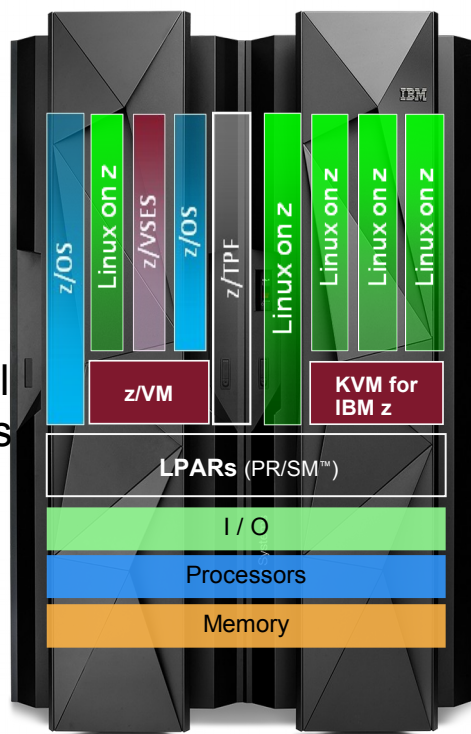- Open
- Scalable
- Economical

Virtual Machine	Virtual Machine	
Linux Applications	Linux Applications	
Linux Guest OS	Linux Guest OS	Linux Applications
QEMU	QEMU	
KVM	Linux	
x86/POWER/z Systems/ARM		

IBM

KVM Use Cases

IBM z/VM and KVM for IBM z

z/VM

- World class quality, security, reliability - powerful and versatile
- Extreme scalability creates cost savings opportunities
- Exploitation of advanced technologies, such as: Hipersockets, Hiperswap, ...
- Highly granular control over resource pool
- Provides virtualization for all z Systems operating systems

KVM for IBM z*

- Simplifies configuration and operation of server virtualization
- Leverage common Linux administration skills to administer virtualization
- Flexibility and agility leveraging the Open Source community
- Provides an Open Source virtualization choice

z/OS | Linux on z | z/VSES | z/OS | z/TPF | Linux on z | Linux on z | Linux on z | Linux on z

z/VM

KVM for IBM z

LPARs (PR/SM™)

I / O

Processors

Memory

Expanding the audience for z Systems

Target Customers for KVM for IBM z
(New) Linux Clients that …

- Sold on Open Technologies, Open Source Oriented
- x86 centric – familiar with KVM
- Linux admin skills
- Need to integrate into a distributed Linux/KVM environment, using standard interfaces

Target Customers for z/VM
Linux Clients that …

- Already use z/VM for Linux workloads
- Skilled in z/VM and prefer proprietary model
- Invested in tooling for z/VM environment
- Require technical capabilities in z/VM (e.g. I/O pass-through, HiperSockets, Hiperswap, SMC-R, ...)
- Installed pre-zEC12/zBC12 machines
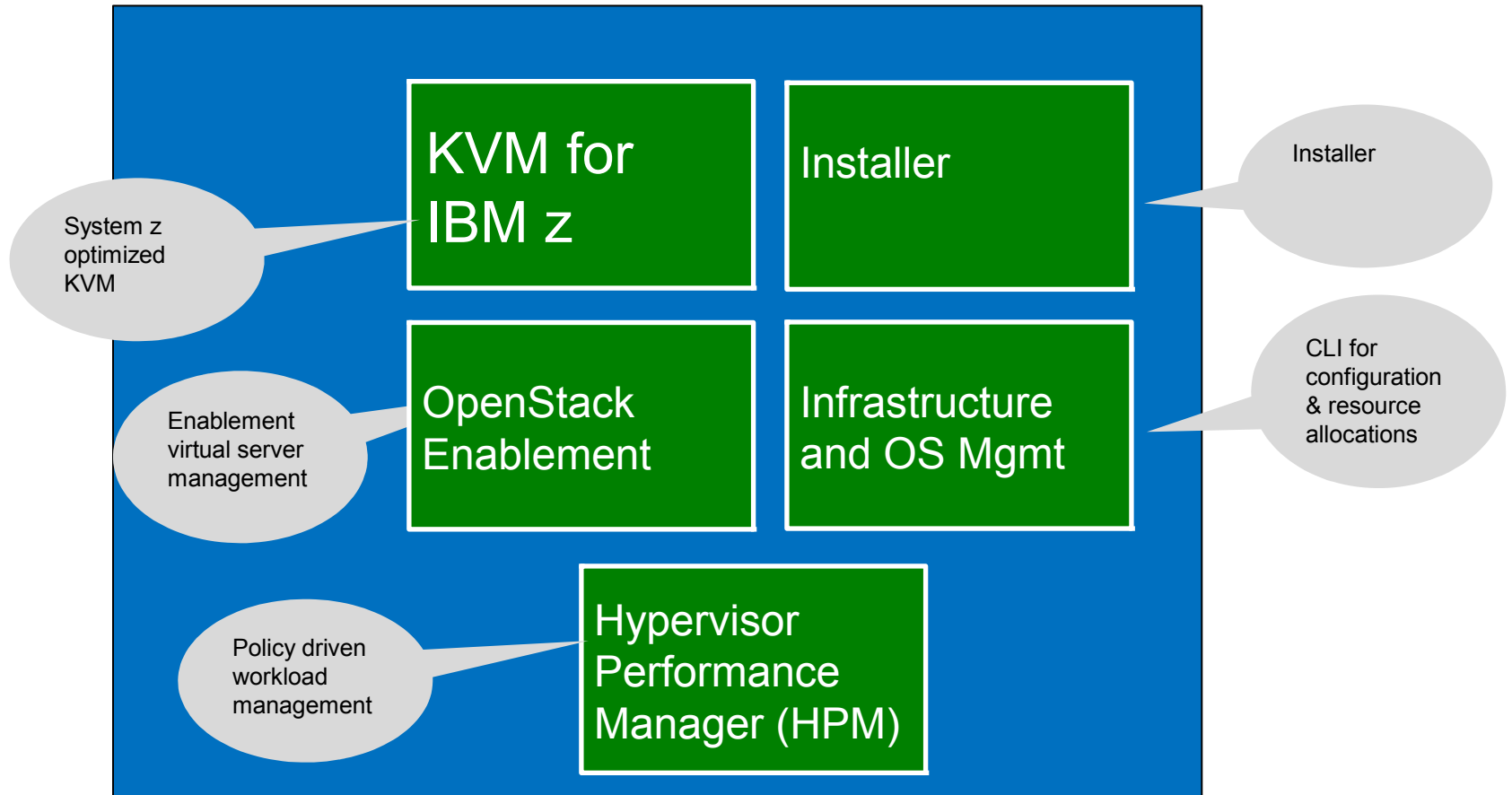
When is KVM for IBM z the right fit ?

For a new Linux client that is … Open Source oriented; Not z/VM knowledgeable; KVM already in use; x86 Linux centric admins

For existing IBM z Systems customers who … do not have z/VM, but have KVM skills and ptentially large x86 environments

KVM for IBM z Systems

- Product Names:

  - Long Name: KVM for IBM z Systems / Short Name: KVM for IBM z

- First released 9/2015, an update roughly every 6 months

- Available via ShopZ: 5648-KVM
  Charges for S&S only 5648-KVS; www.ibm.com/support/fixcentral/

- Platforms supported

  - zBC12/zEC12 or LinuxONE Rockhopper

  - z13 or LinuxONE Emperor

- Supported Networking:

  - OSA plus following MCLs

    - z13: N98805.010 D22H Bundle 20a

    - EC12/BC12: H49525.013 D15F Bundle 45a

- Supported storage platforms

  - DS8K, XIV, SVC, SV7K, Flash Systems

  - ECKD

- Initial Guest Support: SUSE SLES12SP1

- IBM currently in negotiation with

  - Ubuntu on guest OS support

  - RedHat on guest OS support

A look inside

System z optimized KVM

KVM for IBM z

Installer

Installer

Enablement virtual server management

OpenStack Enablement

Infrastructure and OS Mgmt

CLI for configuration & resource allocations

Policy driven workload management

Hypervisor Performance Manager (HPM)

Installer

- KVM for IBM z Systems: 1.1.0

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# KVM for IBM z Functionality

KVM for IBM z

- Virtual Machine life cycle and device management

- Live Guest Mobility / Live Migration

- Memory/CPU overcommit

- Thin provisioned virtual servers

- Hypervisor optimizations
  - virtio dataplane, scheduler

- RAS capabilities

- Transactional execution support

- I/O:
  - Block-based and File-based (raw, qcow2)
  - Networking Virtualization via OpenVSwitch and MacVTap

Add-on's

- Perl, Ruby, PHP, Python

- SELinux policies

- EPPIC Scripts

- s390-utils

- vhostmd

- nagios, AD-Client, ...

Solution View
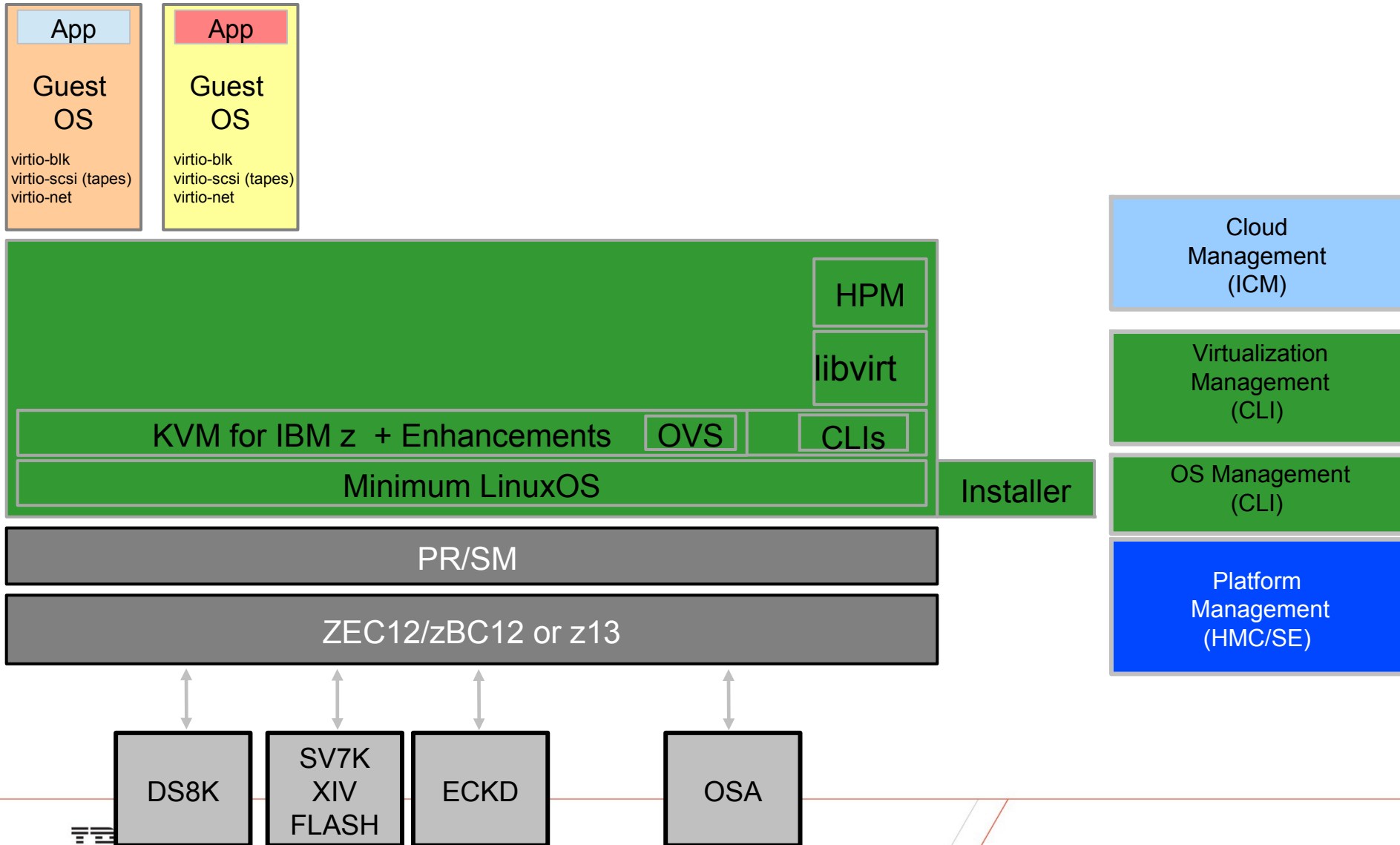
Standard Interfaces for Infrastructure/OS Management

- Tasks performed by Linux HostOS/Hypervisor Administrator to manage a system

- Boot / Shutdown the Host operating system

- Setup Security and Crypto support
  - Firewalls, SELinux, PAM config

- Manage System Resources
  - configure systemd
  - automate system tasks

- Manage Users and Groups

- Configure Network
  - configure attached devices including bonding
  - focus on administering connectivity via libvirt between guest/host network

- Configure Storage
  - format/partition devices, configure attached devices including multipathing
  - manage file systems, LVM,

- Standard Linux CLIs and config files

Scope
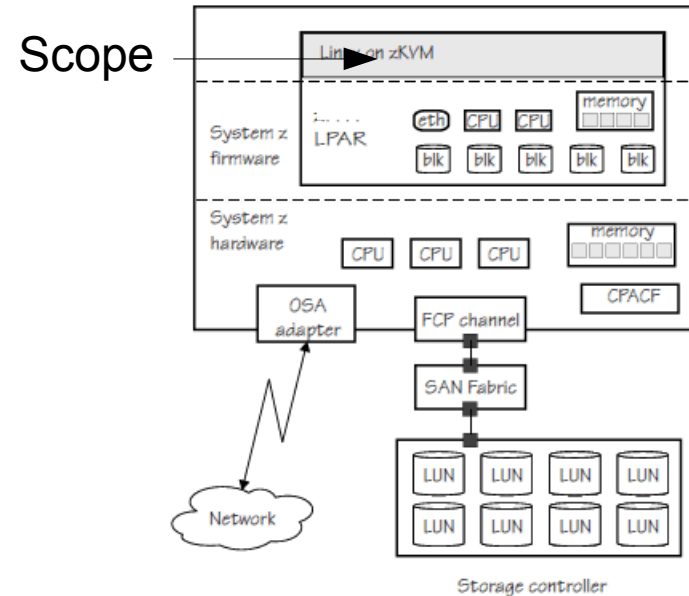
Standard Interfaces for Infrastructure/OS Management (cont...)

- Enable FFDC/Problem Determination
    - Configure on panic behavior
    - sosreport / logs / logrotate / dumps

- Performance Measurement and Diagnosis

- Optionally manage client side of services like dns, dhcp, OpenLDAP, …

Standard Interfaces for KVM Virtualization Management

- c-library to interact with hypervisors
  - **KVM**, Xen, LXC

- Virtual machine management API
  - create, destroy, start, stop, suspend, resume VMs
  - basic support for static and live migration

- Basic management of virtual networks and storage

- **virsh** is a command-line front-end to libvirt
  - **Virt-manager is a simple UI**

- Support for Linux Control Groups, i.e. fine grained resource management

- SELinux Support with sVirt

- Every KVM management application uses libvirt
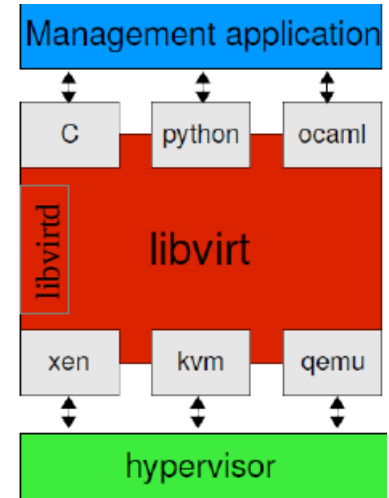
Standard Interfaces for Cloud Management

OpenStack Enablement

SD Infrastructure APIs
- Services and Resources
- Server, Storage and Network
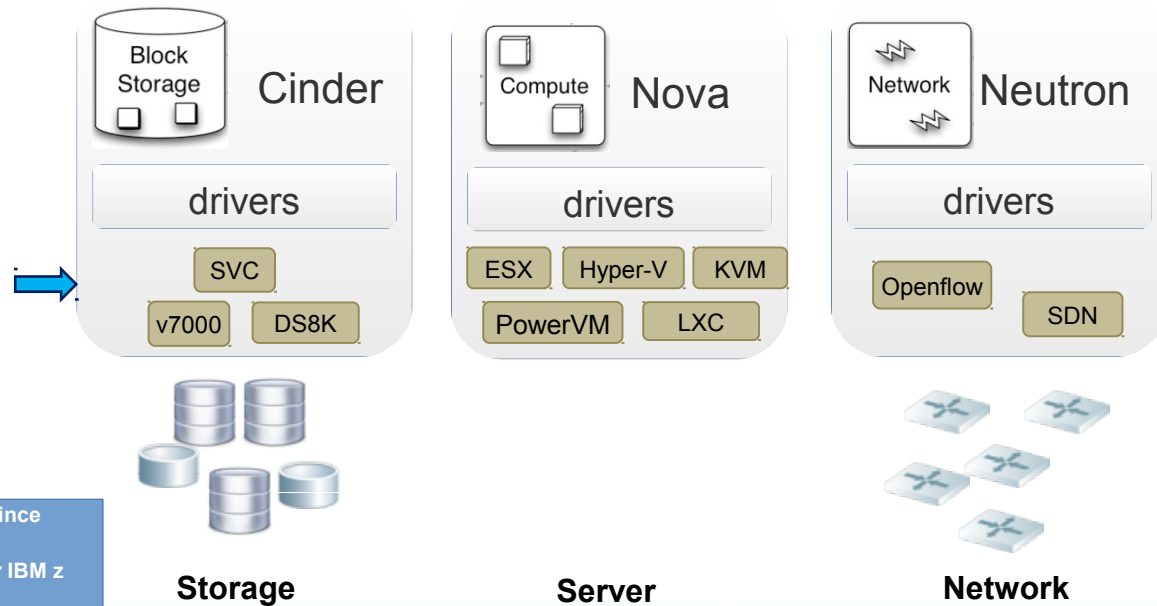- Broad Ecosystem Forming

SD Infrastructure Services
- Software Image Services
- Infrastructure Patterns
- VM Placement Intelligence

Vendor Led Scalable Model
- Drivers provided by the vendors
- Broad Ecosystem
- Management standardization

OpenStack API

openstack™
CLOUD SOFTWARE

Block Storage Cinder

drivers

| SVC |
| v7000 | DS8K |

Compute Nova

drivers

| ESX | Hyper-V | KVM |
| PowerVM | LXC |

Network Neutron

drivers

| Openflow |
| SDN |

Storage

Server

Network

Code enabling KVM for IBM z is in the upstream code base since the OpenStack Kilo release*
OpenStack distribution vendors can add support for KVM for IBM z based on that code
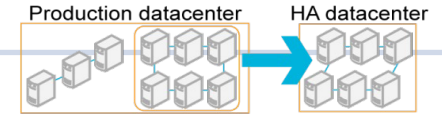
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*http://docs.openstack.org/developer/nova/support-matrix.html
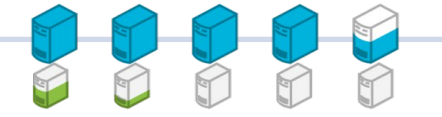
IBM Cloud Manager (ICM)

- ICM 4.3 based on OpenStack Kilo release -   GAed in 6/2015

- ICM 4.3.0.3 FixPack supports KVM for IBM z

- for KVM for IBM z: Compute Node support only
  - Nova libvirt driver
  - Neutron Agent for OpenVSwitch
  - Ceilometer support

- Cinder Support
  - for SVC and SV7K
  - for XIV
  - for DS8K (FCP only)
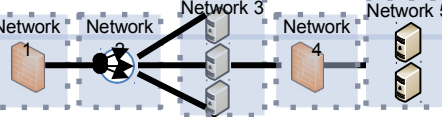
Placement and Optimization with Platform Resource Scheduler

Packing	■ Pack workload on fewest number of physical servers ■ Maximizes usable capacity, reduces fragmentations, reduce energy consumption	
Striping	■ Spread workload across as many physical servers as possible ■ Reduce impact of host failures, higher application performance	
Load-Aware	■ Allocate physical servers with lowest load to new workloads ■ Higher application performance	
HA-Aware	■ Allocate HA-enabled resources to critical workloads ■ Match availability levels to service requirements and costs	
Energy-Aware	■ Place workload according to energy indices and datacenter hot spots ■ Reduce energy consumption	
Affinity-Aware	■ Place workload close to critical resources such as storage ■ Higher application performance	
Server Model- Aware	■ Allocate resource to workload according to model types ■ Maximize utilization of higher performing & more expensive resources	
Topology-Aware	■ Allocate resources on the same interconnect to the same application ■ Improve application performance	
Service Chain Aware	■ Allocate a multi-tier virtual infrastructure, including network appliances used between those tiers. ■ Configure all the associated virtual infrastructure (VMs, virtual appliances, virtual storage)	

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VMware vRA support

IBM and VMware have each announced a cooperative effort to give our shared clients the ability to provision and manage virtual machines and applications running on IBM Power Systems and IBM z Systems with VMware's vRealize™ Automation™ 6.2 (vRA) solution through OpenStack enabled APIs.
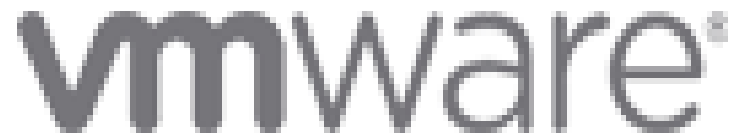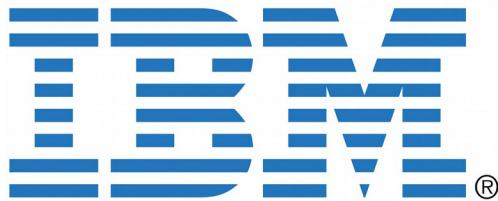
Support Details – Matrix, Post-Deploy Action Options

Platform	VM Guest	Post-deploy Actions	Pre-Requisites	OpenStack Version
PowerVM*	AIX & Linux	Power On, Off, Destroy, Reboot	PowerVC 1.2.2	Juno
PowerKVM	Linux	Power On, Off, Destroy, Reboot	ICM 4.2	Juno
z/VM	Linux	Power On, Off, Destroy, Reboot	ICM 4.2	Juno
KVM for IBM z	Linux	Power On, Off, Destroy, Reboot	ICM 4.3	Kilo

Managing Resources across Virtual Servers on KVM for IBM z via zHPM

- Manage CPU resources across virtual servers to achieve performance goals

    - Detect that a virtual server when a member of a Workload Resource Group is not achieving goals

    - Determine that the virtual server performance can be improved with additional resources

    - Project impact on all affected virtual servers of reallocating resources

    - If good trade-off based on policy, redistribute processor resources

    - Current support for CPU management, potential to extend to other resources
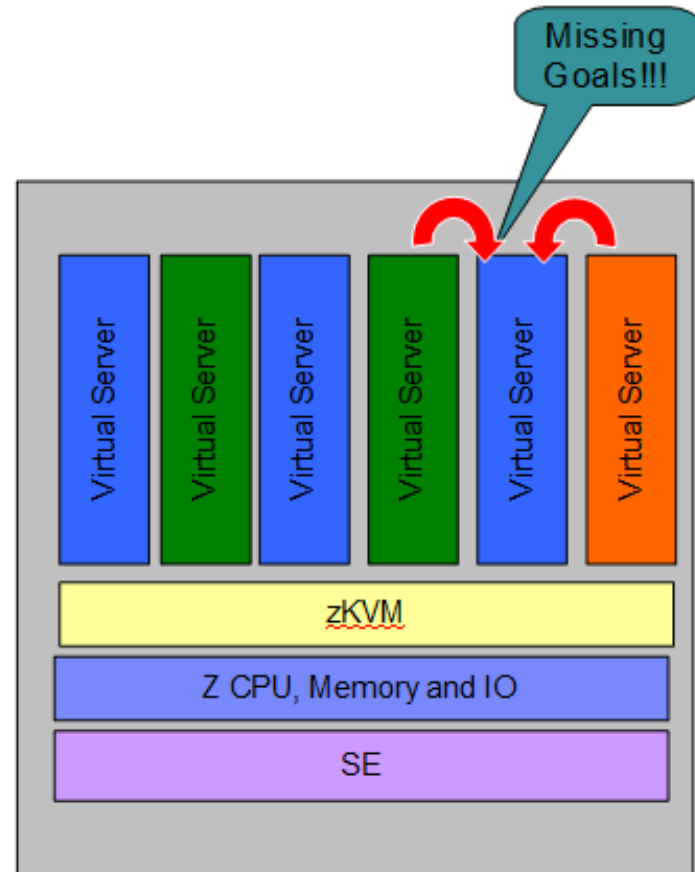
System z Hypervisor Performance Manager

- Supports policy-based goal-oriented monitoring and management of CPU resources

- Shipped as part of the KVM for IBM z delivery
  - ➢ Optionally enabled

- Scope of management is single KVM for IBM z instance
  - ➢ zHPM will have no knowledge outside of its KVM for IBM z instance

- Controlled through RESTful Web Services APIs and CLI
  - APIs
    - ➢ Point of integration with higher-level virtualization management solutions
    - ➢ Support for scripting
    - ➢ Fully documented external interface

  - CLIs provide support for local administration

SAP Application Server on KVM for IBM z

Monitoring Category	Description	Value	Unit
	Manufacturer	IBM	
	Model	KVM/Linux	
Info	Operating system	Linux ihlskvg5 3.12.43-52.6.1.8830.2.PTF-default	
	Timestamp	Mon Aug 3 11:01:38 2015	
	Hostname	ihlskvg5	
Virtualization Configuration	Enhanced Monitoring Access	TRUE	
	Enhanced Monitoring Details	ACTIVE	
	Host System Information	ihlskvm1	
	Solution	VIRT_METHOD_LINUX_KVM	
	Solution Version	QEMU 1.2.13	
	Type	Virtual Machine	
CPU	Average processes waiting (5 min)	0,35	
	Number of CPUs	2	
	System Utilization	12	%
	User Utilization	10	%
	Idle	77	%
CPU Virtualization Virtual System	Available Capacity	2,00	CPUs
	Additional Capacity Available	1,84	CPUs
	Guaranteed Capacity	0,00	CPUs
	Capacity Maximum	2,00	CPUs
	Capacity Consumed	0,16	CPUs
	Available Capacity Consumed	8,0	%
Memory	Physical memory	8.250.904	KB
	Configured swap size	762.876	KB
	Free swap size	762.876	KB
	Maximum swap size	762.876	KB
	Actual swap size	762.876	KB
	Physical	8.057	MB
	Free (Value)	5.573	MB
	Swap Free	744	MB
	Swap Configured	744	MB
	Swap Size	744	MB
	Swap Maximum Size	744	MB
	Free Including Fs Cache	6.613	MB
	Free	69	%
	Page In	0	KB/s
	Page Out	0	KB/s
	Page In of RAM	0	%/h
	Page Out of RAM	0	%/h
Memory Virtualization Virtual System	Memory Consumed	8.192	MB
	Guaranteed Memory	0	MB
	Memory Limit	8.192	MB

* http://scn.sap.com/docs/DOC-28742

KVM for IBM z Systems

Open source virtualization hypervisor

KVM for IBM z Systems provides open source virtualization for IBM z Systems and the LinuxONE platforms. Using the combination of KVM virtualization and IBM z Systems and LinuxONE, you have the performance and flexibility to address the requirements of multiple, differing Linux workloads. KVM's open source virtualization on IBM z Systems and LinuxONE allows businesses to reduce costs by deploying fewer systems to run more workloads, sharing resources and improving service levels to meet demand.

Highlights

- **Open virtualization:** Take advantage of the performance, scalability and security built into Linux and KVM and gain a cost effective alternative to proprietary x86 virtualization.

- **Quality of service:** Gain easy provisioning for predictability of delivery of service at high utilization rate.

- **Operational efficiencies:** Use familiar Linux interface to gain greater operational efficiency.

Benefits

- Reduce operating costs through x86 server consolidation and deployment of Linux workloads.

- Simplify systems management through familiar interfaces to enable a single cross platform virtualization.

- Accelerate cloud deployments by seamlessly working with OpenStack.

- Run your Linux workloads on the most trusted, scalable, available, and secure platform.

- Meet changing server demands with automatic provisioning of computing resources.

- Gain high virtualization and consolidation for price performance advantage, scalability on demand, security and extreme availability.

Learn more

- → Announcement letter
- ⬛ Data sheet (192KB)
- ⬛ FAQ (1.55MB)
- ⬛ Technical Information (250KB)

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→ Join the webcast

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For More Information

- **Portal**
  http://www.ibm.com/systems/z/solutions/virtualization/kvm/

- **Documentation** at **http://www-01.ibm.com/support/knowledgecenter/linuxonibm/liaaf/lnz_r_kvm.html**
  - KVM for IBM z Systems: Planning and Installation Guide SC27-8236-00
  - KVM for IBM z Systems: Administration Guide SC27-8237-00
  - Linux on z Systems: Virtual Server Management SC34-2752
  - Linux on z Systems: Virtual Server Quick Start SC34-2753
  - Linux on z Systems: Device Drivers, Features, and Commands for Linux as a KVM Guest SC34-2754
  - Linux on z Systems: Installing SUSE Linux Enterprise Server 12 as a KVM Guest SC34-2755

- **Performance Data / Planning Tools**
  - Large Systems Performance Reference (LSPR):
    - https://www-304.ibm.com/servers/resourcelink/lib03060.nsf/pages/lsprITRKVMonZv110?OpenDocument
  - zPCR
    - http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS1381

Questions?