

PA200 - Cloud Computing Concepts

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Virtualization

Warm-up

- What is cloud computing?
- Cloud traits?
- Cloud deployment models?

What is cloud computing?

1. Usage model of computer resources
2. Networked computers
3. Distributed computing technology
4. A collection of heterogeneous computers

Cloud traits?

1. High availability
2. On-demand self-service
3. High performance
4. Broad network access
5. Resource pooling

6. Rapid elasticity
7. Measured Service

Cloud service models?

1. Software as a Service
2. Application as a Service
3. Platform as a Service
4. Infrastructure as a Service
5. Data as a Service

Cloud deployment models

1. Public Cloud
2. Private Cloud
3. Hybrid Cloud
4. Personal Cloud
5. Community Cloud
6. Enterprise Cloud

History of virtualization

- How old is virtualization?

History of virtualization

- Early 1960: batch processing
- 1967: first time-sharing system - IBM S/370-67
- 2005: Intel VT-x, AMD-V - new instruction set
- 2005-: VMware, VirtualBox, KVM...

What exactly is virtualization?

- Multi-programming vs multi-tasking
- Multi-threading vs multi-tasking vs virtualization?
- Containers vs OS virtualization
- CPUs: Multi-core vs Hyper-threading

How did virtualization work before 2005?

- Well, sloooowly...
- Basing on 80386 CPU features

Is it cloud already?

- What is virtualization?
- What is cloud?

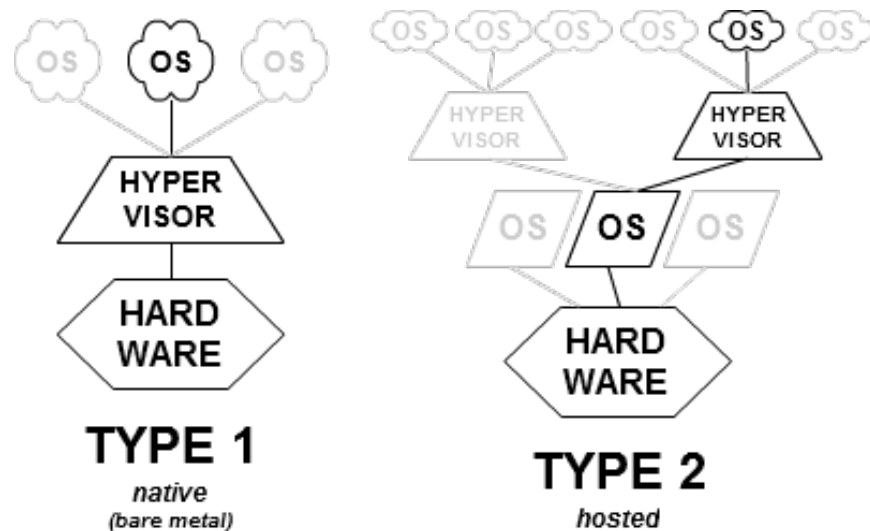
Is it cloud already?

- Hypervisors
- Virtualization management and services

Hypervisors

- Native or bare-metal
- Hosted

Hypervisors



Full or para-virtualization

- Full: unmodified OS on top of hypervisor
- Para: modified OS calls hypervisor API

Examples of native hypervisors

- XEN
- MS Hyper-V
- VMware ESXi

Examples of hosted hypervisors

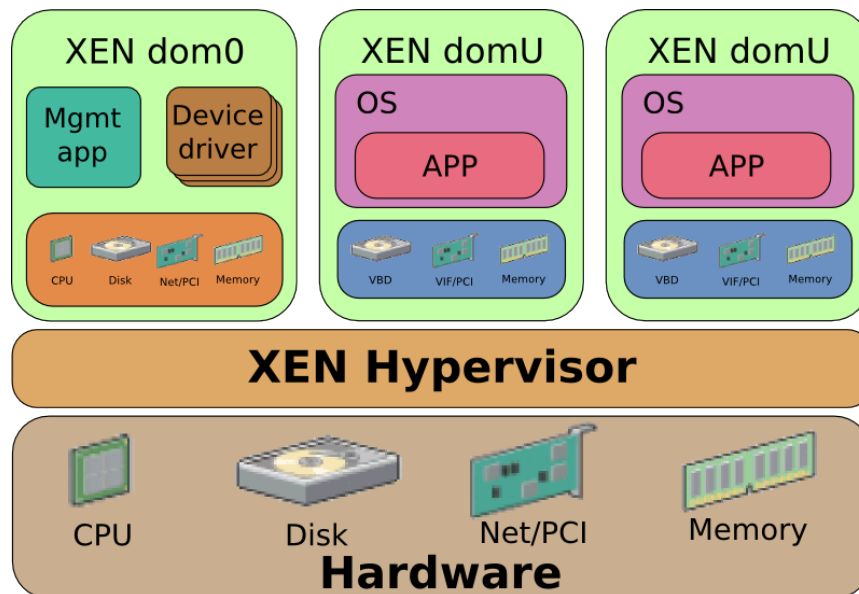
- QEMU
- KVM
- VirtualBox
- VMware Workstation

- FreeBSD bhyve

XEN

- founded in 2003 by XenSource, bought in 2007 by Citrix
- 2013 under Linux Foundation as Xen Project
- native hypervisor

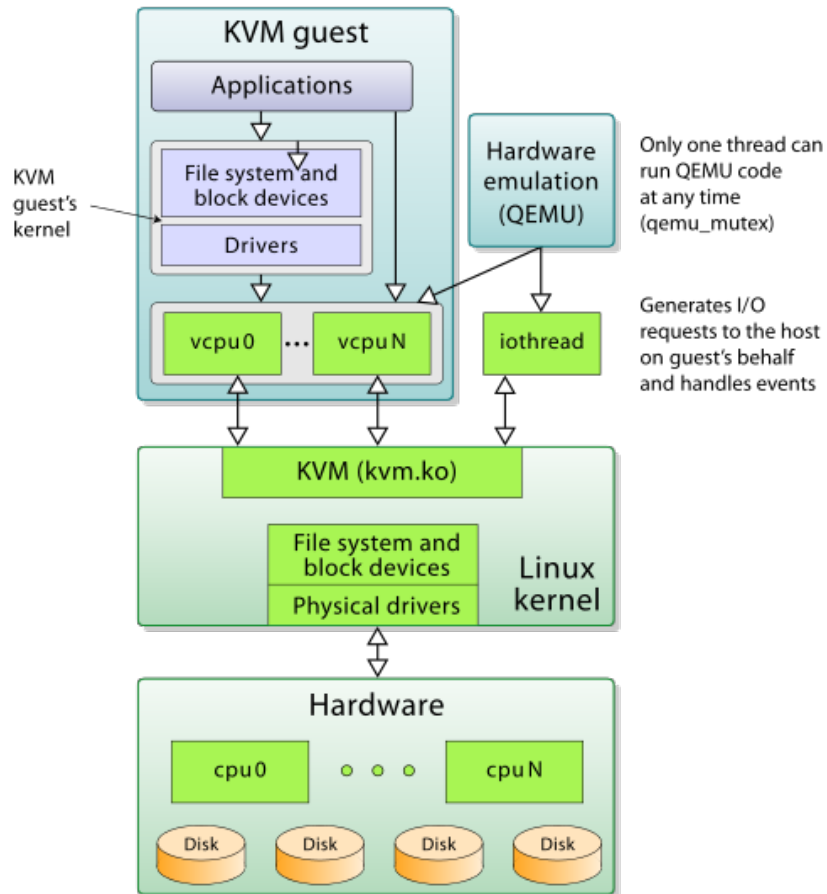
ZEN



KVM

- Modular kernel virtualization
- provides user space access to hw virtualization
- started by Qumranet
- 2007 merged into linux kernel

KVM



QEMU

- hosted hypervisor
- provides CPU and/or hardware emulation
- can be used with KVM (hardware-only emulation)

QEMU

- Other practical QEMU use-cases?

Type 1 vs type 2 confusion

- Linux with KVM
- FreeBSD with bhyve

Full vs para-virtualization

- Full: run unmodified OS image
- Para: OS explicitly calls hypervisor

Para-virtualization

- Why?

Why is it called Hypervisor?

- What's behind the name?

Virtualization management

- Common API to different hypervisors
- High-level VM lifecycle abstraction
- Cloud services: networks, storage...

Cloud services

- OS image deployment
- Centralized OS configuration
- Automated network configuration
- Instance backup/snapshot/migration
- Centralized user authentication
- Centralized storage
- User interface

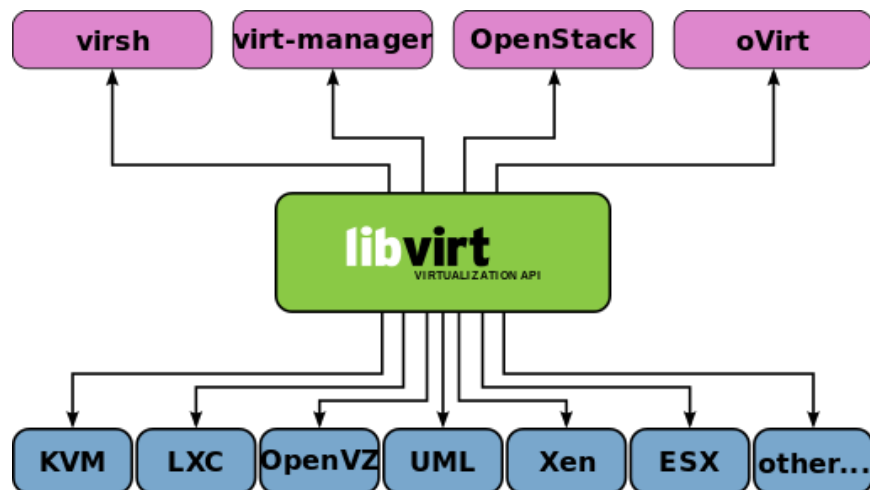
Examples of virtualization software

- libvirt
- oVirt
- OpenStack

Libvirt

- Common API for hypervisor type abstraction supports
- LXC
- KVM/QEMU, Xen, VirtualBox
- VMware ESXi and Workstation
- MS Hyper-V, IBM PowerVM

Libvirt



oVirt

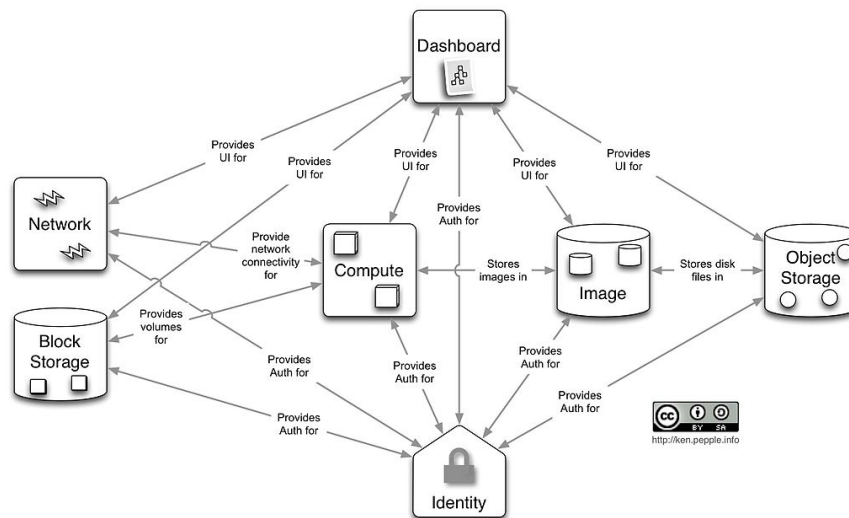
- Virtualization management platform
- On top of KVM

- Upstream for RHV
- Engine
- Node
- VDSM - virtual desktop and server manager

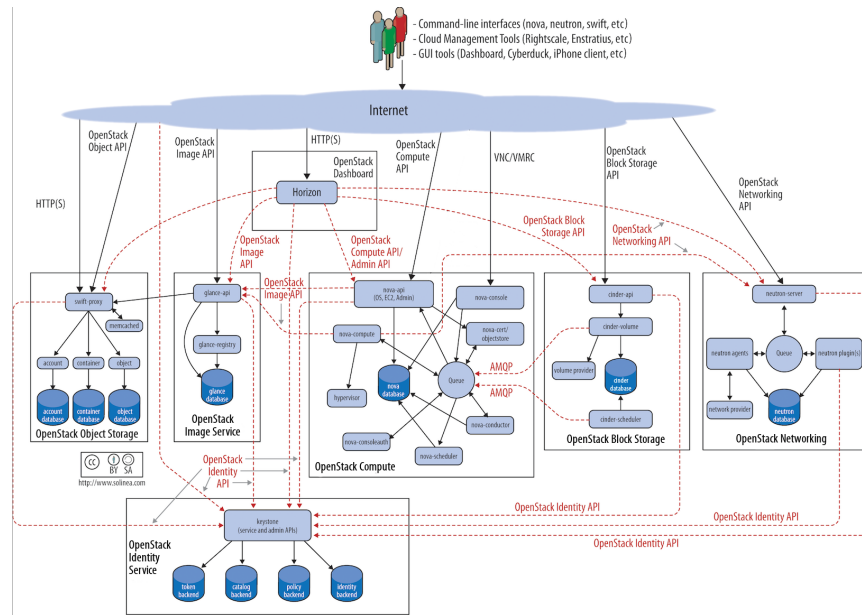
OpenStack

- Software platform for cloud computing
- Started in 2010 by Rackspace and NASA
- In 2012 founded OpenStack Foundation

OpenStack



OpenStack



Hypervisors vs Containers

- Hypervisors spawn VMs
- Containers isolates apps to namespaces

Example container software

- Docker
- LXC
- OpenVZ
- chroot

Cloud features

- Easy provisioning and configuration
- Movable resource: snapshot/backup/live migration

- Consolidation of resources: scale up/down

Cloud features

- Isolation from host HW and OS
- Virtual vs Physical machine monitoring
- Easier testing and evaluation
- Duplication of environments

Recap: the age of virtualization?

1. IBM 700/7000, since 1952
2. CP-40 research project, early sixties
3. IBM S/370-67, 1966
4. Gameframes, since 2007
5. Intel VT-x, AMD-V, since 2005

Recap: virtualization technologies?

1. Multi-tasking
2. Multi-threading processes
3. Containers
4. Hyper-threading CPU
5. Multi-core CPU
6. Intel VT-x, AMD-V
7. Multi-programming

Recap: hypervisor types?

1. Hybryd
2. Bare-metal
3. Native
4. Hosted
5. Para-hypervisor

Recap: what makes up a cloud?

1. One hypervisor
2. One or more hypervisors
3. Baremetal computers
4. Baremetal switches and routers
5. Networking service

Recap: virtualization vs containers?

1. We can run OS in a container
2. We can run different OS'es in containers
3. We can run VM in a container
4. Containers are more secure than VM
5. Containers consume less resources than VM
6. We can run Windows app in Linux container

Bonus question: matreshka cloud?

- Can you run a cloud in a cloud?