Introduction to Virtualization and Containers

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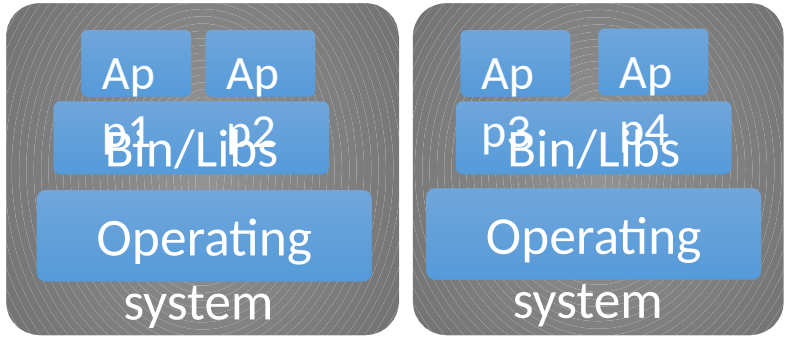
Virtualization – What is it?

Introduction to Virtualization and Containers

What the heck is a hypervisor? Why are there so many of them? What is a container and all the related bits and pieces? Why would we want to use them? And what is Metal-as-a-Service, Infrastructure-as-a-service, Platform-as-a-Service, or Storage-a-a-S, or all the other *aaS? How about OPNFV and Cloud Foundry? What do I need to know and how does this all fit together? This presentation will answer these questions.

Virtualization

Virtualization is an abstraction of computer resources. Access to the resources are consistent before and after abstraction. Resource abstraction is not limited by implementation, including the underlying physical implementation.



Type 2 Hypervisor

A Virtual Machine is a software construct that mimics the characteristics of a physical server

Types of Virtualization

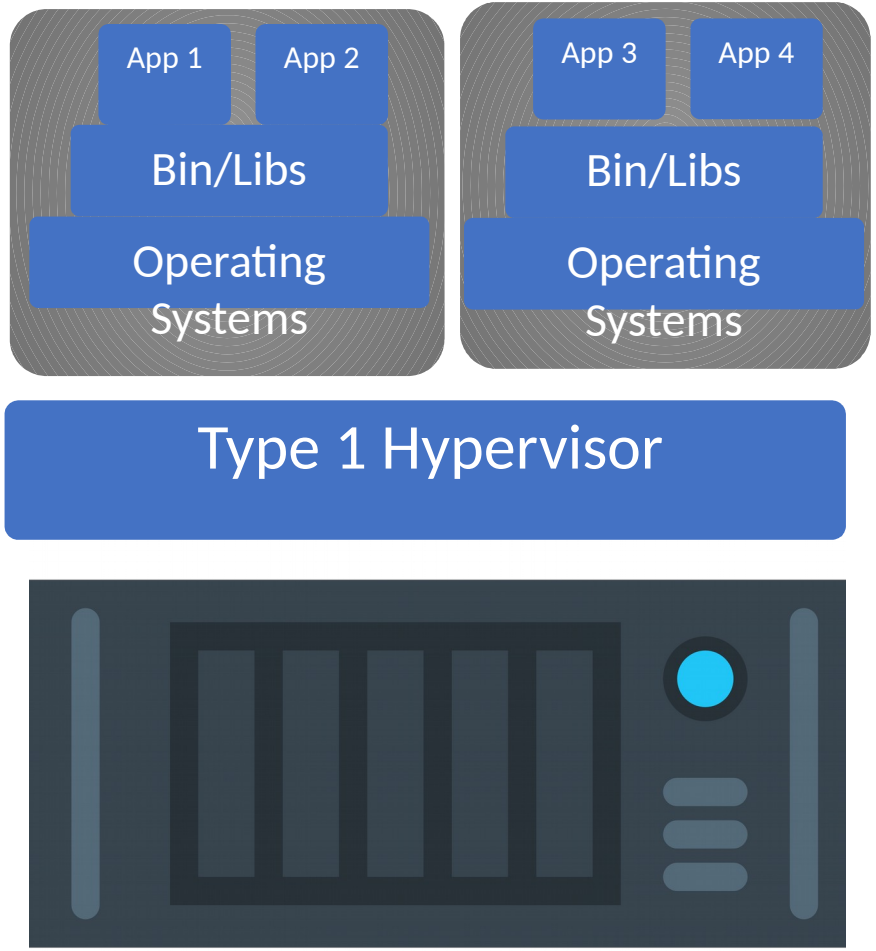
- Server Virtualization
- Client / Desktop / Application Virtualization
- Network Virtualization
- Storage Virtualization
- Service / Application Infrastructure Virtualization

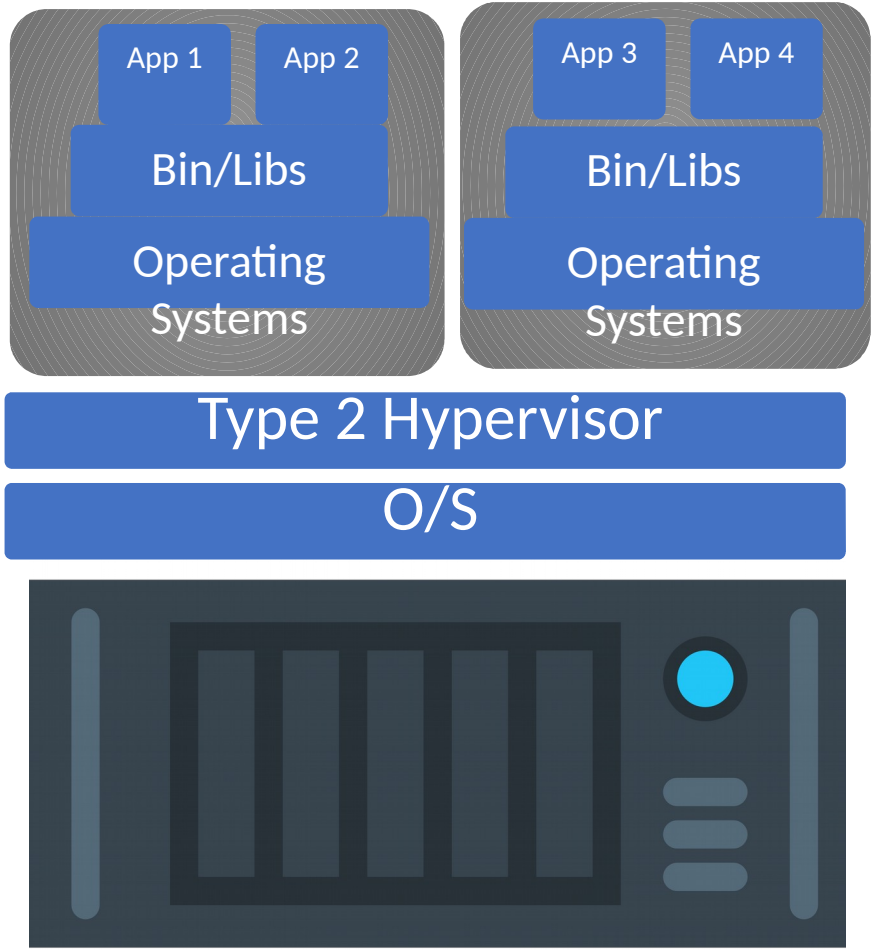
2 ways to achieve server virtualization

- Emulators
  - Linux - Bochs, QEMU
  - Very Slow
- Segmented Use of the Host Processor
  - Most virtualization hypervisors use this technique
  - Provided by a Hypervisor
  - Faster

Hypervisors

- Type-1, native or bare-metal hypervisors
  - XEN
- Type-2 or hosted hypervisors
  - VirtualBox
- KVM on Linux has been classified as both a type 1 and a Type 2


App 1
App 2
Bin/Libs
Operating Systems
App 3
App 4
Bin/Libs
Operating Systems
Type 1 Hypervisor


App 1
App 2
Bin/Libs
Operating Systems
App 3
App 4
Bin/Libs
Operating Systems
Type 2 Hypervisor
O/S

Paravirtualization

- Provides specialized APIs to virtual machines to optimize their performance
  - Similar yet not identical to the underlying hardware-software interface
- Support as part of the kernel
  - drivers
- Support has been offered as part of many of the general Linux distributions since 2008

Cloud Computing

- Provides software interface to the hypervisor
- Allows remote creation and management of virtual environments
- Usually includes sever types of virtualization
  - Storage
  - Network
  - Machine
- Examples:
  - AWS, OpenStack

Containers


chroot
1979/1982
jail
2000
Process Containers
2006
NameSpaces
Present

`global` (i.e. root) namespace

MNT NS

```
/
/proc
/mnt/fsrd
/mnt/fsrw
/mnt/cdrom
/run2
```

UTS NS

```
globalhost
rootns.com
```

PID NS

```
PID   COMMAND
1 /sbin/init
2 [kthreadd]
3 [ksoftirqd]
4 [cpuset]
5 /sbin/udevd
6 /bin/sh
7 /bin/bash
```

IPC NS

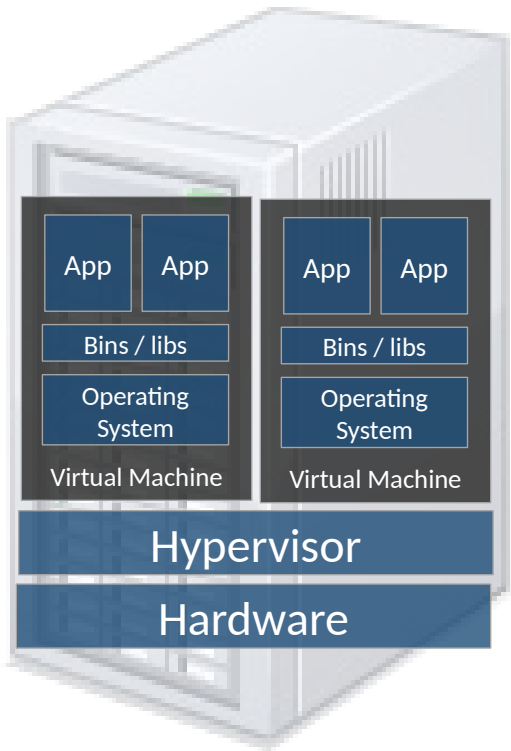
```
SHMID   OWNER
32452   root
43321   boden

SEMID   OWNER
0    root
1    Boden

MSQID   OWNER
```

NET NS

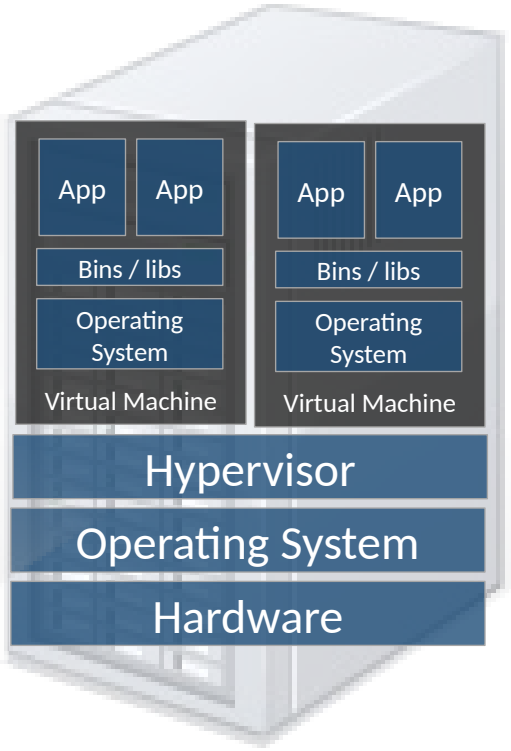
```
lo: UNKNOWN…
eth0: UP…
eth1: UP…
br0: UP…

app1 IP:5000
app2 IP:6000
app3 IP:7000
```

USER NS

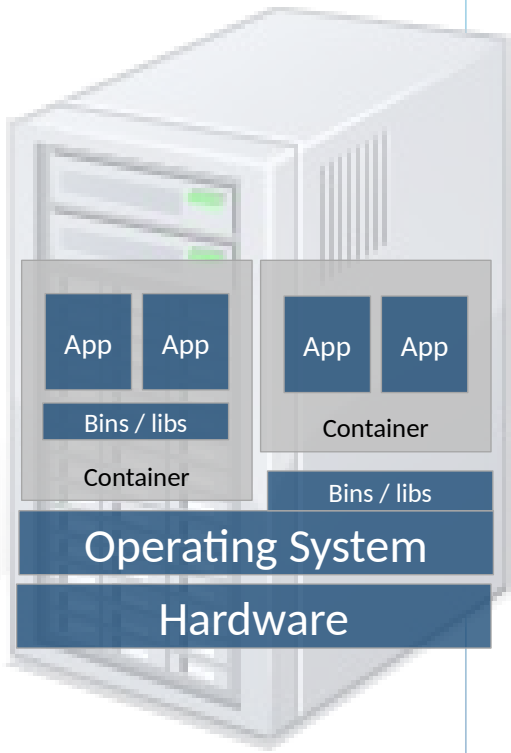
```
root 0:0
ntp 104:109
mysql 105:110
boden 106:111
```



Type 1 Hypervisor



Type 2 Hypervisor



Linux Containers

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Why? It's still virtualization!

- Each container has:
  - its own network interface (and IP address)
    - can be bridged, routed... just like $your_favorite_vm
  - its own filesystem
    - Debian host can run Fedora container (&vice-versa)
  - isolation (security)
    - container A & B can't harm (or even see) each other
  - isolation (resource usage)
    - soft & hard quotas for RAM, CPU, I/O...

Kubernetes

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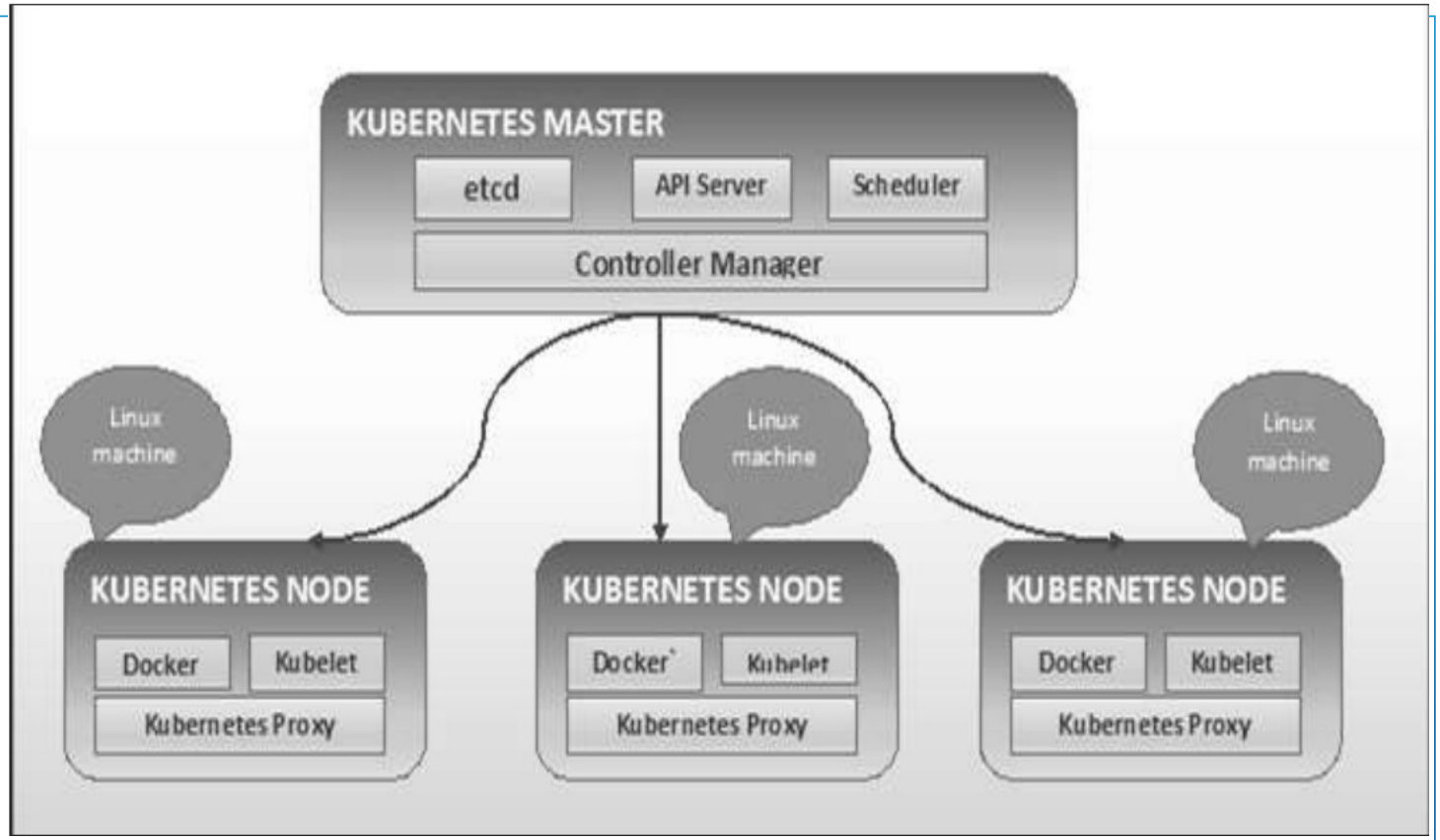
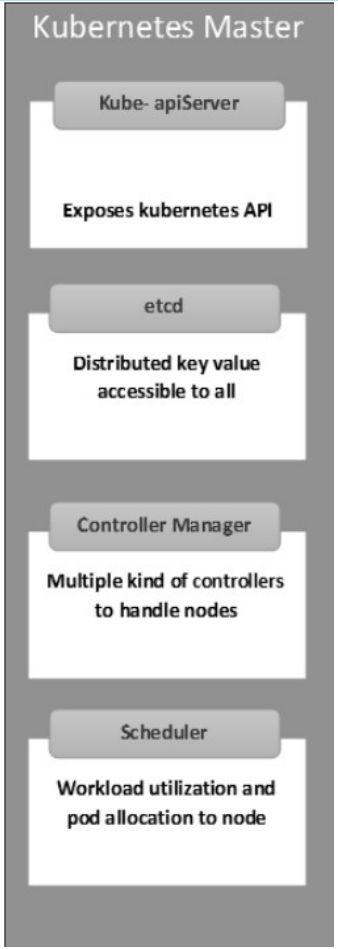
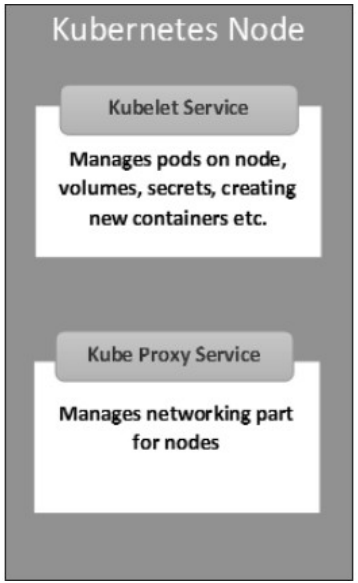
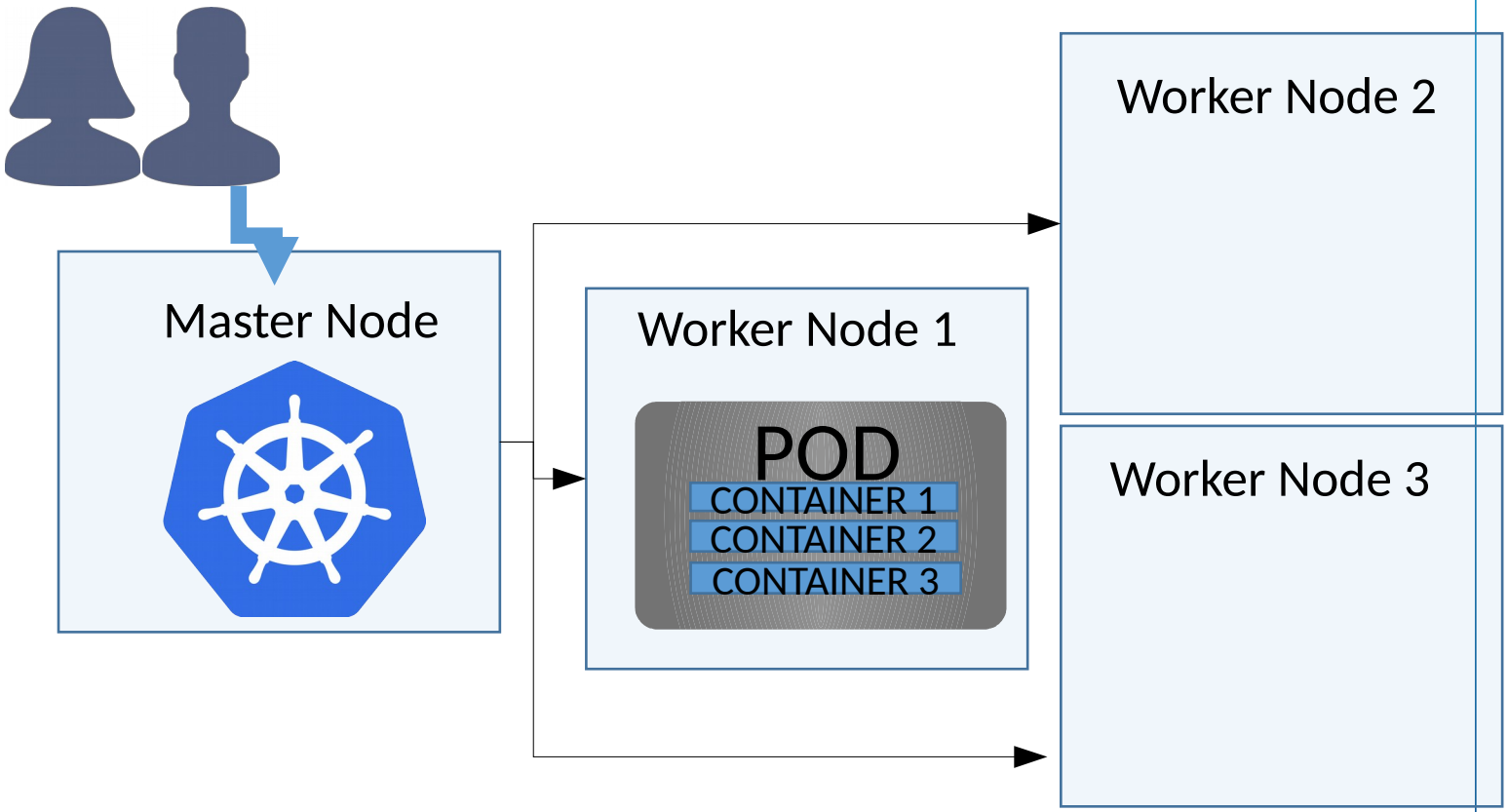
Kubernetes Features

- Containerized infrastructure
- Application-centric management
- Auto-scalable infrastructure
- Environment consistency across development testing and production
- Loosely coupled infrastructure, where each component can act as a separate unit
- Higher density of resource utilization
- Predictable infrastructure which is going to be created








Worker Node 2
Master Node
Worker Node 1
POD
CONTAINER 1
CONTAINER 2
CONTAINER 3
Worker Node 3
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XaaS - *Everything as a Service

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Where did XaaS come from?

- Software as a Service (SaaS) — provider's applications running on a cloud infrastructure.
- Platform as a Service (PaaS) — Deploys variousacquired applications onto the cloud infrastructure.
- Infrastructure as a Service (IaaS) — processing, storage and other computing resources Available for operating systems and applications.

Also called Servicizing

- Product-service systems (PSS)
  - cohesive delivery of products and services
- Servicizing
  - transaction value from a combination of products and services
  - provide the function of the product
  - also the service component of a product
  - customers just want the function that the product provides

What do we see today?

- Software-as-a-Service (SaaS)
- Infrastructure-as-a-Service
- Platform-as-a-Service
- Storage-as-a-Service
- Desktop-as-a-Service
- Disaster recovery-as-a-Service
- Others

OPNFV

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What is it?

- NFV
  - Network Functions Virtualization
- OP
  - Open Platform
- Collaborative open source platform for network functions virtualization
- Started by the Linux Foundation in 2014

NFV - What is it?

- Implement Network Functions in Software
  - load balancers
  - Firewalls
  - Customer Premises Equipment (CPE)
  - Evolved Packet Core (EPC)
  - IP Multi-media Subsystem (IMS)
  - Broadband Network Gateways (BNG)
  - And more
- Lowers TCO by virtualizing these functions
- Avoids restrictions the hardware implementations create

OPNFV Objectives

- Create an integrated and verified open source platform that can investigate and showcase foundational NFV functionality
- Provide proactive cooperation of end users to validate OPNFV's strides to address community needs
- Form an open environment for NFV products founded on open standards and open source software
- Contribute and engage in open source projects that will be influenced in the OPNFV reference platform

Cloud Foundry

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What is it?

- Platform as a service (PaaS)
- Governed by the Cloud Foundry Foundation
  - Sponsored by the Linux Foundation
- Originally developed by VmWare
- Open Source
  - Source code is under an Apache License 2.0

What is PaaS?

- Usually delivers a computing platform
  - including operating system
  - programming-language execution environment
  - database
  - web server
- Deploys cloud applications
- Applications are created using provider tools:
- Programming languages
- Libraries
- Services
- Other tools
- Users can not manage or control the underlying cloud infrastructure
- Users have control over the deployed applications

Cloud Foundry Projects

- Application Runtime Project Management Committee (PMC)
  - Directs strategy, development and quality control of the core components
- BOSH PMC
  - release engineering, deployment, lifecycle management, and monitoring of distributed systems
- Extensions PMC
  - extensions to the Cloud Foundry Runtime and BOSH platform
- Open Service Broker API PMC
  - a single, simple way to deliver services to applications running within cloud native platforms

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OPEN SOURCE SUMMIT

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