What Is A Container?
Virtual Machine
## Containers vs VMs

<table>
<thead>
<tr>
<th>Containers</th>
<th>Virtual Machines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared resources</td>
<td>Isolated resources</td>
</tr>
<tr>
<td>Lighter weight</td>
<td>Full OS + application</td>
</tr>
<tr>
<td>Faster installation</td>
<td>Several minutes to boot</td>
</tr>
<tr>
<td>No hypervisor</td>
<td>Hypervisor-based</td>
</tr>
<tr>
<td>Linux and Windows</td>
<td>No underlying OS</td>
</tr>
<tr>
<td>Microservices</td>
<td>Monolithic</td>
</tr>
</tbody>
</table>
Why: New Application Architectures

<table>
<thead>
<tr>
<th>Monolithic Apps</th>
<th>Cloud Native Apps</th>
</tr>
</thead>
<tbody>
<tr>
<td>server / hypervisor</td>
<td>server clusters, containers</td>
</tr>
<tr>
<td>dependencies</td>
<td>easy upgrade</td>
</tr>
<tr>
<td>stateful</td>
<td>microservices</td>
</tr>
<tr>
<td>waterfall development</td>
<td>agile devops teams</td>
</tr>
</tbody>
</table>

[Diagrams and logos of monolithic apps, microservices, and cloud native technologies]
Linux Containers

- Group of processes on a Linux machine
- Isolated environment
- Linux system within another Linux system
- Inside the container, it looks like a VM
- Outside the container, it looks like normal processes running on the machine
Industry trends

Container Adoption & Usage

- 34% Not Currently Using Containers
- 31% Evaluating Deploying Containers
- 22% Currently Using Containers
- 13% Don’t Know

- Already mainstreamed: 16%
- Within the next year: 15%
- At least a year or more: 5%
- Unsure: 64%

n=374
What Is Docker?
What is Docker?

Docker is a software technology providing containers, promoted by the company Docker, Inc. Docker provides an additional layer of abstraction and automation of operating-system-level virtualization on Windows and Linux.

[Source: Wikipedia]

Docker is an open platform that helps companies build, ship and run their applications anywhere.

[Source: Docker, Inc]
Virtualization Technologies Comparison

- Docker provides a unified access to:
  - Linux container technology (cgroups, namespaces)
  - Various container implementations (lxc, libvirt, libcontainer, etc.)

- ‘libcontainer’ is Docker’s implementation of container technology
Why Docker Containers?

• Standardization of the container format

• Development of an ecosystem for sharing containers
Dockerhub

- Sign up for an account on dockerhub
- Public repository of Docker images
  - [https://hub.docker.com/](https://hub.docker.com/)
  - docker search [term]
Docker+Cisco Partnership

Joint Engineering, Sales and Marketing

Contiv Network Plugin

Docker Datacenter On FlexPod CVD

Docker Datacenter On Cisco UCS

Stronger Together
Open Source community and technology partners to build solutions
What Is Docker Networking?
Docker Networking Architecture

- Service Discovery
- Load Balancing
- Libnetwork(CNM)
- API
- Docker Engine
- Native Drivers (bridge, overlay, MACVLAN, IPVLAN)
- Remote Drivers (Contiv, Calico, Weave)
- IP Address Mgmt (IPAM)
Docker networking: single host versus multi host
Docker Networking: MACVLAN Driver

Existing network

VLAN 200
192.168.128.0/24

VLAN 200
192.168.129.0/24

VLAN 200
192.168.129.10/24

VLAN 200
192.168.128.10/24

Eth0.100

Docker Engine

Eth0.200

VLAN 200
192.168.129.0/24

VLAN 200
192.168.128.0/24

eth0
What Is Contiv?
What is Contiv

100% Open Source

The Most Powerful Container Networking Fabric
L2, L3, Overlay or ACI

Rich Policy Model
Production-Grade Network and Security Policies

- Multi-Tenant, Multi-Host Network Connectivity
- Network Security and Isolation (White/Black List Rules)
- Traffic Prioritization and Bandwidth Allocation
- Network Monitoring (Live Connectivity Graphs and Stats)
- Integration with External Network (Cloud | Nexus | Cisco ACI)
- Micro-Services Load Balancing
- Integrated IPAM, Service Discovery
- Performance and Scale

Available at https://github.com/contiv/netplugin
Contiv Integration with Cisco Products

Application-Centric Infrastructure (ACI)
- Containers integrated with APIC policies
- Physical services integration

Nexus Standalone or Any Network
- BGP interop (standard routing protocol)
- EVPN-based multi-tenancy and automation

Unified Compute Systems: B and C Series
- Leveraging vNICs for control, data, management, and storage traffic
- Offload encapsulation function

Contiv Leverages Underlying Infrastructure Capabilities for Applications
Cisco Integrated Infrastructure for Containers

Cisco UCS with Docker Datacenter 1.x

- Enterprise Ready
- Design choices
- Scalable Architecture
- Jointly Engineered
- Delivered by Partners

FlexPod with Docker Datacenter 2.x

NetApp Docker Vol Plugin

Container and Microservices Solutions on Cisco UCS Integrated Infrastructure
Cisco Container Solutions

- Infinite Video
- Mobile Evolved Packet Core (EPC)
- OpenStack Network Function Virtualization Infrastructure (NFVi) aka Project Mercury
- Lindt (open network operating system)
- Virtual Managed Services (VMS)
- Digital Network Architecture Center (DNA-C) open, programmable architecture
- Installation Containers
Project Contiv and ACI

Contiv Enables Policy Based Distributed Container Networking

Available as Open Source

Project Contiv

- Provides policy-based container networking
- Multiple deployment options including overlay, L3, and ACI
- Integrates with multiple orchestration tools
- Support option to be made available from Cisco
- Learn more:
  - https://github.com/contiv
ACI + Kubernetes Integration

**Kubernetes**
Kubernetes is open source container mobility among on-premises, hybrid, or public cloud ("multicloud") infrastructure, letting you effortlessly move workloads to where it matters to you.

**ACI + Kubernetes Integration**
- APIC GUI integration / VMM Domain specifically designed for Kubernetes
- Visibility / statistics / health metrics for containers
- OVS + OpFlex provides Docker host datapath
- Flexible mapping of Kubernetes into ACI policies
  - Container teams set Kubernetes network policies
  - Network team retains control of ACI policies for EPGs / contracts
- Distributed load balancing
  - Symmetric PBR in ACI fabric for north-south LB
  - OVS + OpFlex for distributed east-west LB
## Solution Support for Contiv Open-source

<table>
<thead>
<tr>
<th>How We Help</th>
<th>Engineer Expertise</th>
<th>What’s Unique</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Our customers can rely on us to keep their container networking fabric environments operating</td>
<td>• Container Networking Fabric • Virtual Network Per Tenant • Segment Per Microservice • Network-based Service Routing • Security Policies</td>
<td>• Solution Support Service for Cisco Contiv Open-source • Embedded Basic Support with Cisco Smart Account entitlement • Supports container networking fabric interoperability from solution partners</td>
</tr>
<tr>
<td>• Fewer physical network devices to manage and operate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Easier to manage container networking services on demand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Container automation of security and application policies</td>
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</tr>
</tbody>
</table>
Service Provider Use Cases
Flexible Connectivity to Place Containers Anywhere

Native Connectivity
Infra Policy: [Bridged | Routed]
VLAN | IP (BGP) Handoff to Access Node

Overlay Connectivity
Infra Policy: [Overlay] [Bridge | Routed]
Overlays for Inter-Container Traffic

Use Case: Private Cloud

Use Case: Private Cloud

Any Network Topology and Container Visibility Across Physical Network
Scalable, Secure Microservices Deployments

1. Allow Grouping of Containers/Pods
2. Specify Policies Between Groups or from Outside the Network

Ability to Provide Granular Micro-Service Security in a Scalable Way
Multi-Tenancy
Separation of Policy/Network

Ability to Support Many Secure Tenants with Individual Policies or Overlapping IP
Telemetry and Monitoring

Live Application Connectivity Graph

Ability to Troubleshoot Micro-Service Application
Roadmap
Cisco and Google: Best of Both Worlds

Oct 2017: Cisco's hyper-converged platform, Cisco HyperFlex, will provide a cloud-ready solution for Kubernetes and containers, and management tools to enforce security and consumption policies (Q2CY18).

Networking and Security
Private Cloud Infrastructure
Multicloud Management
Enterprise Class Sales and Support

Cloud Services
Microservices / Containers
API Gateway for Existing Services
Developer Community
Harmony Kubernetes Architecture

- Kubernetes Lifecycle Management
- AuthN and AuthZ
- Monitoring / Logging

Kubernetes

K8s master 1

K8s master n

K8s Node

Overlay Network

Secure Communication

Persistent Storage

External Communication

HyperFlex IAAS/Storage

Storage

External Network

Load Balancer
Nexus 9000 Container-based ISSU

• Software runs inside separate Linux container (LXC) for the supervisor and linecard
• A third container is created as part of the ISSU procedure and is brought up as a standby supervisor
• During enhanced ISSU: control plane downtime is < 3-5 seconds. No data plane traffic disruption
• Requires 16G memory on switch
• Requires switch reload when enabling enhanced ISSU for the first time
• The supervisor is upgraded first, then linecard is upgraded