Evolving Cloud Native Landscape

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https://cncf.io
https://linuxfoundation.org
Agenda

• Introduction
• What is CNCF?
• From Virtualization to Containers and Cloud Native
• Evolving Cloud Native Landscape
• What’s Next?
  – An Analogy with Linux
  – Serverless
  – IoT/Edge
  – Nodeless Kubernetes
  – VNFs to CNFs
• Q&A
Hi, I’m Chris Aniszczyk (@cra)

› CTO/COO, Cloud Native Computing Foundation (CNCF)
› Executive Director, Open Container Initiative (OCI)
› VP, Developer Relations, Linux Foundation (LF)

› In a previous life…
  › Director of Open Source (@Twitter) / Sr. Eng Manager
  › Co-Founder of the TODO Group
  › Co-Founder of EclipseSource (via Code9)
  › Open Source Committer (Gentoo, Fedora, etc)
  › Principal Software Engineer, Red Hat
  › Senior Software Engineer, IBM
Been a crazy ~3 years for me… Google Trends + CNCF
What is Cloud Native? Definition v1.0

https://github.com/cncf/toc/blob/master/DEFINITION.md

Cloud native technologies empower organizations to build and run scalable applications in modern, dynamic environments such as public, private, and hybrid clouds. Containers, service meshes, microservices, immutable infrastructure, and declarative APIs exemplify this approach. These techniques enable loosely coupled systems that are resilient, manageable, and observable. Combined with robust automation, they allow engineers to make high-impact changes frequently and predictably with minimal toil.

The Cloud Native Computing Foundation seeks to drive adoption of this paradigm by fostering and sustaining an ecosystem of open source, vendor-neutral projects. We democratize state-of-the-art patterns to make these innovations accessible for everyone.
Why Organizations Are Adopting Cloud Native

1. Better resource efficiency lets you to run the same number of services on less servers
2. Cloud native infrastructure enables higher development velocity – improving your services faster – with lower risk
3. Cloud native allows multi-cloud (switching between public clouds or running on multiple ones) and hybrid cloud (moving workloads between your data center and the public cloud)
Cloud Native Computing Foundation

- Non-profit, part of the Linux Foundation; founded Dec 2015

Graduated
- kubernetes: Orchestration
- Prometheus: Monitoring
- envoy: Service Proxy
- OPENTRACING: Distributed Tracing API
- Notary: Security
- Vitess: Storage
- CoreDNS: Service Discovery

Incubating
- fluentd: Logging
- gRPC: Remote Procedure Call
- Container Runtime
- rkt: Container Runtime
- CNI: Networking API
- LINKERD: Service Mesh
- NATS: Messaging
- HELM: Package Management
- ROOK: Storage
- HARBOR: Registry

Platinum members:
- Alibaba Cloud
- AWS
- Cisco
- DELL Technologies
- Google Cloud
- Fujitsu
- IBM Cloud
- Intel
- JD.COM
- Microsoft Azure
- Oracle
- Pivotal
- redhat
- Samsung
- SAP
- VMware
CNCF Membership Growth
300+ Members and Growing

Platinum Members

Alibaba Cloud  aws  Azure  Cisco  Dell Technologies  docker  Fujitsu  Google Cloud  Huawei
IBM Cloud  Intel  JD.COM  Mesosphere  Oracle  Pivotal  redhat  Samsung  SAP  VMware

Gold Members

AT&T  Baidu  DigitalOcean  JFrog  NEC  NetApp  Salesforce  SumoLogic  SUSE  Tencent Cloud  ZTE

End User Members

ATlassian  Bloomberg  CapitalOne  Comcast  eBay  DENSO  Didi  Github  Goldman Sachs  Indeed  Intuit  JD.COM  Morgan Stanley

End User Supporters

Adidas  Box  Cruise  Form3  Kuelap  Layer  Nasdaq  PayPal  Pusher  Reddit  Ricardo.ch  SAP Concur  Shopify

Academic/Nonprofit

CableLabs  Cloudflare  Epic  Fintech  Goldfinch  Golden Gate  Hyperledger  Interop  Interpol  Kubernetes  Layer  Manta  NSR  NAIC  NPIR

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300+ Members and Growing (Silver 1)
300+ Members and Growing (Silver 2)
Certified Kubernetes Conformance

- CNCF launched a software conformance program for Kubernetes
  - Implementations run conformance tests and upload results
  - New mark and more flexible use of Kubernetes trademark for conformant implementations
  - Taking submissions now for K8s 1.11 & 1.12
  - https://www.cncf.io/certification/software-conformance/
Cloud Native Trail Map

Trail Map: lcnf.io
Evolving Cloud Native Landscape
Cloud native computing uses an open source software stack to:
- segment applications into microservices,
- package each part into its own container
- and dynamically orchestrate those containers to optimize resource utilization
What Have We Learned?

• Core Building Block:
  - Servers ➔ Virtual Machines ➔ Buildpacks ➔ Containers

• Isolation Units
  - From heavier to lighter weight, in spin-up time and size

• Immutability
  - From pets to cattle

• Provider
  - From closed source, single vendor to open source, cross-vendor
Try it now at https://l.cncf.io

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<tr>
<th>CNCF Cloud Native Interactive Landscape</th>
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<tbody>
<tr>
<td>You can also view CNCF’s static landscape and serverless landscapes. Please open a pull request to correct any issues. Greyed logos are not open source. Last Updated: 2018-03-14 12:05:52Z</td>
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<td>You are viewing 245 cards with a total of 940,008 stars, market cap of $4.29T and funding of $13.8B.</td>
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Example filters:
- Open source by first commit
- Landscape categories
- Open source by stars
- Offerings from China
- Certified K8s and KCSFs
- Sort by MCap/Funding
What’s Next in 2019+?
Cultivate Projects + Fill the Cloud Native Gaps

• The most important mission for CNCF is to make cloud native computing ubiquitous by continuing to sustain the existing ~30 projects.

• Also, The Cloud Native Landscape still has missing gaps where the CNCF doesn’t have any projects and we plan on filling those gaps as projects arise.
So what about 2019 and the future?

• Remember when Linux started?
  – “I’m doing a (free) operating system (just a hobby, won’t be big and professional like gnu)”
• Linux was just a hobby operating system that took over new markets as it evolved...

99% Supercomputer Market
82% Smartphone Market Share in Enterprise Customers
2nd To Windows
90% Mainframe Customers
90% Public Cloud Workload Systems Market
62% Embedded Internet
#1 Smartphone Market Share
#1 Internet Client

• Kubernetes will follow a similar pattern IMHO...
IoT + Edge + Kubernetes
In all seriousness, this approach gives us a unique kind of scale. Rather than a few large K8s clusters with tens-to-hundreds-of-thousands of containers, at full scale we will have more than 2000 clusters with tens of containers per cluster. And that number grows significantly as we open many new restaurants every year.

Our edge workloads include:

- platform services such as an authentication token service, pub/sub messaging (MQTT), log collection/exfiltration (FluentBit), monitoring (Prometheus), etc.
- applications that interact with “things” in the restaurant
- simple microservices that serve HTTP requests
- machine learning models that synthesize cloud-developed forecasts with real-time events from MQTT to make decisions at the edge and drive automation
Kubernetes: IoT+Edge Working Group

- [https://github.com/kubernetes/community/tree/master/wg-iot-edge](https://github.com/kubernetes/community/tree/master/wg-iot-edge)
- See the WG’s [whitepaper](https://github.com/kubernetes/community/tree/master/wg-iot-edge) on IoT+Edge Kubernetes
- This working group is a cross-SIG effort currently sponsored by sig-networking and sig-multicluster with a focus on improving Kubernetes IoT and Edge deployments
  - Provide reference architectures for various IoT/Edge environments.
  - Create and maintain conformance tests tailored towards performance and reliability requirements of the most popular IoT/Edge use cases.
  - Build end-to-end PoCs to validate overall design and provide examples to system integrators.
  - Evaluate and possibly extend k8s federation and network infrastructure to better suite IoT/Edge use cases over bandwidth constrained and unreliable WAN interconnects.
  - Evaluate and possibly improve connectivity and data ingestion options to better support various field protocols.
  - Evaluate and extend existing CLI tools to manage k8s clusters running in remote edge locations.
KubeEdge: Kubernetes + Edge Nodes

- https://github.com/kubeedge/kubeedge

KubeEdge is an open source system extending native containerized application orchestration and device management to hosts at Edge. It is built upon Kubernetes and provides core infrastructure support for network, app. deployment and metadata synchronization between cloud and edge. It also supports MQTT and allows developers to author customer logic and enable resource constrained devices communication at Edge.
Serverless + Nodeless
Serverless in CNCF

Decomposing Serverless

• Serverless Working Group published an influential whitepaper

• Attributes that developers love about closed serverless platforms (which already run on containers):
  ○ Infinite scalability
  ○ Microbilling
  ○ Easy app updates
  ○ Event-driven architectures
  ○ Zero server ops

• Several projects are decomposing these into features to be available on top of Kubernetes

Serverless Landscape & CloudEvents

• The Serverless Landscape s.cncf.io tracks all projects and products in the space

• CloudEvents, a new CNCF project, is a common model for event data to ease cross-provider event delivery
Nodeless Kubernetes + Virtual Kubelet

- [https://github.com/virtual-kubelet/virtual-kubelet](https://github.com/virtual-kubelet/virtual-kubelet)  
  - Becomes CNCF sandbox project today!

- Virtual Kubelet is an open source Kubernetes kubelet implementation that masquerades as a kubelet for the purposes of connecting Kubernetes to other APIs. This allows the nodes to be backed by other services like ACI, AWS Fargate, Hyper.sh, Azure IoT Edge etc. The primary scenario for VK is enabling the extension of the Kubernetes API into serverless container platforms like Alibaba ECI, ACI/GPU, Fargate, and Hyper.sh
Telco Transformation: VNFs to CNFs
Network Architecture Evolution

• **1.0:** Separate physical boxes for each component (e.g., routers, switches, firewalls)

• **2.0:** Physical boxes converted to virtual machines called Virtual Network Functions (VNFs) running on VMware or OpenStack

• **3.0:** Cloud-native Network Functions (CNFs) running on Kubernetes on public, private, or hybrid clouds [containers]
Network Architecture 3.0
(hardware is the same as 2.0)
Evolving from VNFs to CNFs

› Benefits of CNFs from VNFs
  – Cost savings due to resource efficiency (with public, private, and hybrid clouds)
  – Development velocity (cloud native)
  – Resilience (to failures of individual CNFs, machines, and even DCs)

› Virtual Network Functions (VNFs) are virtual machines that run on OpenStack or VMware, or can be run on K8s via KubeVirt or Virtlet
Getting Involved / Q&A
Contributing to CNCF

• See and contribute to the landscape
  – https://github.com/cncf/landscape

• Contributors guide
  – https://github.com/cncf/contribute

• Kubernetes IoT/Edge WG
  – https://github.com/kubernetes/community/tree/master/wg-iot-edge

• Cloud-native Network Functions (CNFs)
  – #cnfs on slack.cncf.io
  – https://github.com/cncf/cnfs
Online Kubernetes Exams

• Free edX Introduction to Kubernetes self-paced course!
• Certified Kubernetes Administrator (CKA)
  – Over 1,500 registrations already
• Certified Kubernetes Application Developer (CKAD)
  – Certifies that users can design, build, configure, and expose cloud native applications for Kubernetes
• Both tests
  – Tests consist of a set of scenarios to resolve from the command line over 3 hours; there is no multiple choice

• KCSP + KTPs in Japan: Creationline
KubeCon + CloudNativeCon 2019!

• **Barcelona** 2019: May 20-23, 2019

• **Shanghai** 2019: June 26-28, 2019

• **San Diego** 2019: November 18-21, 2019
FYI: Conference Attendance (Book Early!)

First CNCF-organized event
Thank you! Q&A?

Join now: https://cncf.io/join

or

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Membership: memberships@cncf.io