Evolving Cloud Native Landscape

Chris Aniszczyk, CTO (@cra)

https://cncf.io

https://linuxfoundation.org

CLOUD NATIVE
COMPUTING FOUNDATION

Agenda

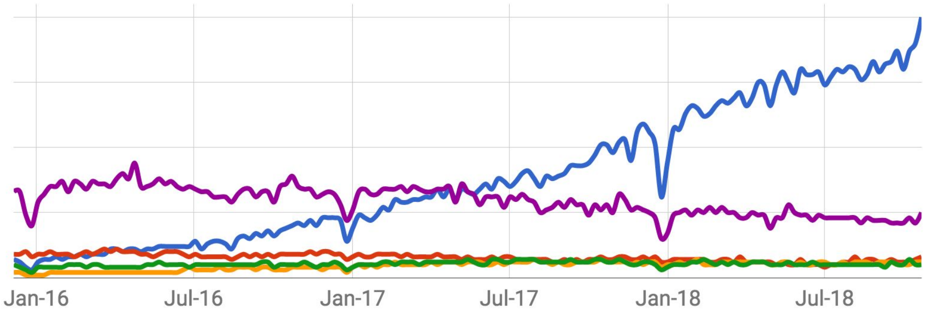
- Introduction
- What is CNCF?
- From Virtualization to Containers and Cloud Native
- Evolving Cloud Native Landscape
- What's Next?
  - An Analogy with Linux
  - Serverless
  - IoT/Edge
  - Nodeless Kubernetes
  - VNFs to CNFs
- Q&A

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



Kubernetes OpenStack Mesos Docker
Swarm Cloud Foundry

YOU FOUGHT IN THE CONTAINER WARS?
YES. I WAS ONCE A DEVELOPER, THE SAME AS YOUR FATHER
imgflip.com
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Drew Petersen
@KirbySaysHi

Regarding the Docker/Rocket stuff

5:26 PM - 2 Dec 2014

85 46

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

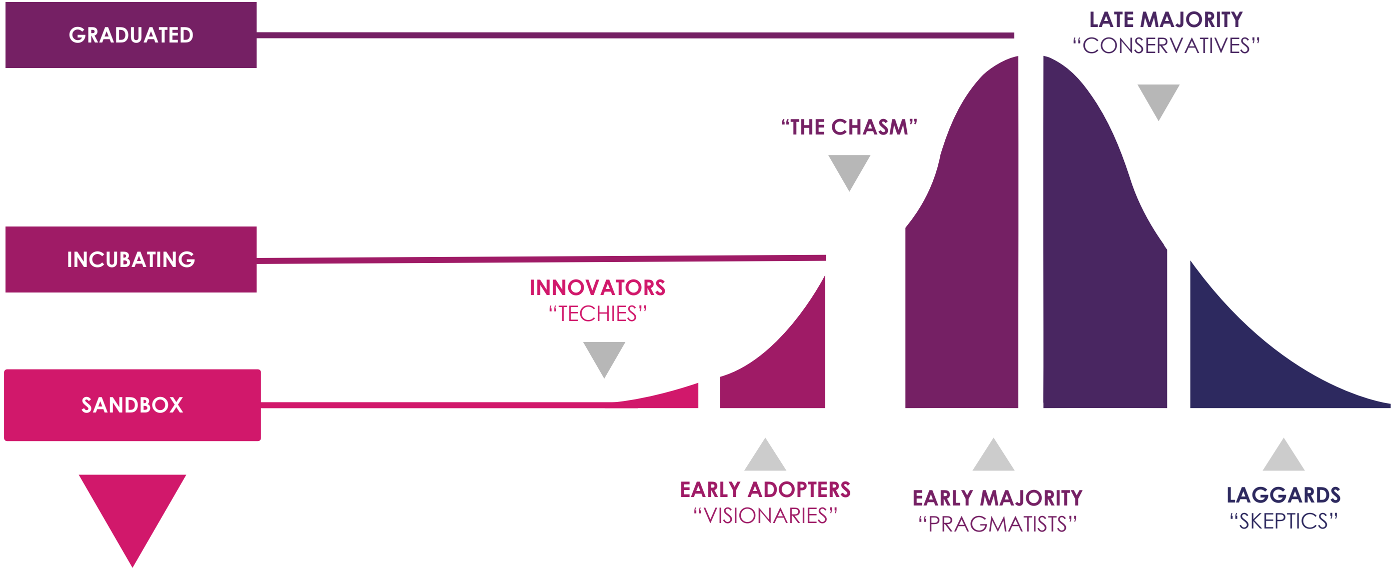
Incubating

- OPENTRACING
  Distributed Tracing API
- fluentd
  Logging
- GRPC
  Remote Procedure Call
- containerd
  Container Runtime
- rkt
  Container Runtime
- CNI
  Networking API
- JAEGER
  Distributed Tracing
- TUF
  Software Update Spec
- Notary
  Security
- Vitess
  Storage
- CoreDNS
  Service Discovery
- NATS
  Messaging
- LINKERD
  Service Mesh
- HELM
  Package Management
- ROOK
  Storage
- HARBOR
  Registry

- Platinum members:

Alibaba Cloud, aws, cisco, DELL Technologies, docker, FUJITSU, Google Cloud, HUAWEI, IBM Cloud, intel, JD.COM, MESOSPHERE, Microsoft Azure, ORACLE, Pivotal, redhat, SAMSUNG SDS, SAP, vmware

CNCF Project Maturities: cncf.io/projects



GRADUATED

INCUBATING

SANDBOX

INNOVATORS
"TECHIES"

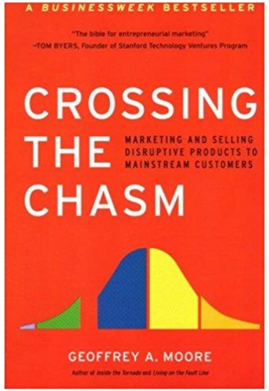
EARLY ADOPTERS
"VISIONARIES"

"THE CHASM"

EARLY MAJORITY
"PRAGMATISTS"

LATE MAJORITY
"CONSERVATIVES"

LAGGARDS
"SKEPTICS"



A BUSINESSWEEK BESTSELLER

"The bible for entrepreneurial marketing"
–TOM BYERS, Founder of Stanford Technology Ventures Program

CROSSING THE CHASM

MARKETING AND SELLING DISRUPTIVE PRODUCTS TO MAINSTREAM CUSTOMERS

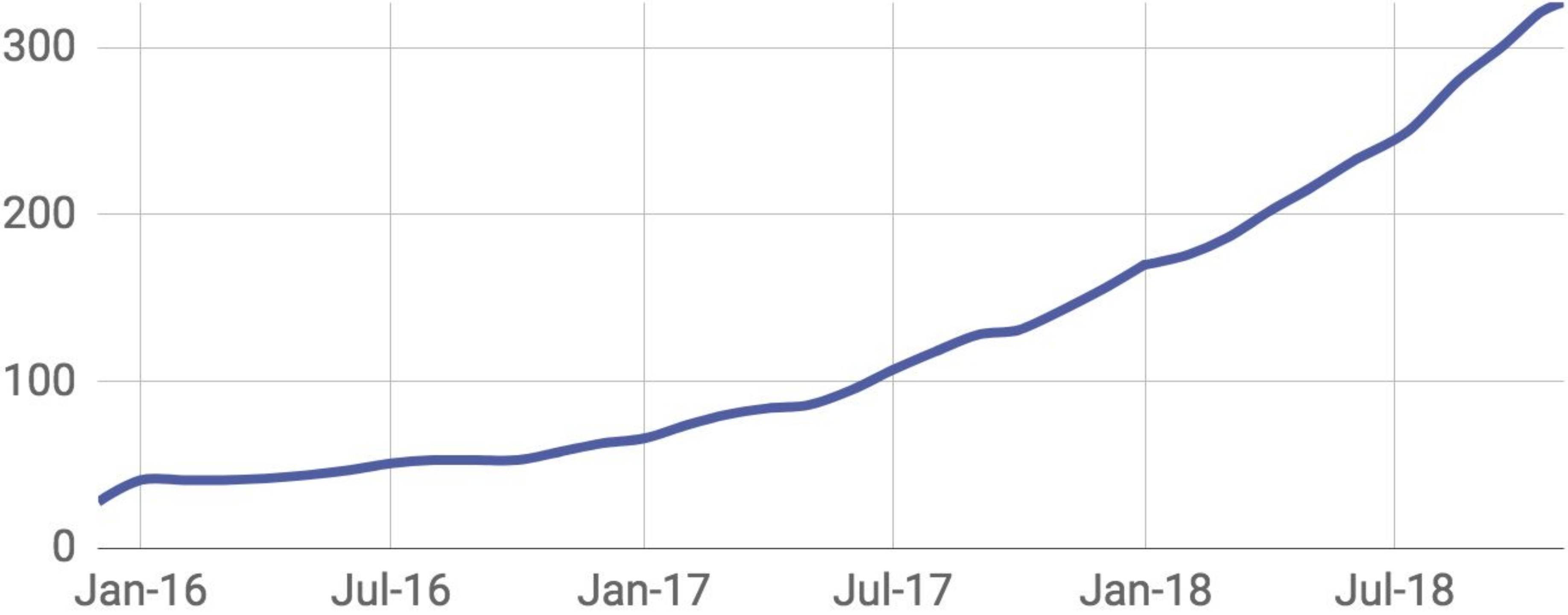
GEOFFREY A. MOORE

Author of Inside the Tornado and Living on the Fault Line

SANDBOX

spiffe	SPIRE	Open Policy Agent	cloudevents	TELEPRESENCE	OPENMETRICS	TiKV	cortex	Buildpacks.io	Falco	Dragonfly
Identity Spec	Identity	Policy	Serverless	Tooling	Metrics Spec	Distributed K/V	Monitoring	Packaging Spec	Container Security	Image Distribution

CNCF Membership Growth



300+ Members and Growing

Platinum Members

Alibaba Cloud · aws · Azure · cisco · DELL Technologies · docker · FUJITSU · Google Cloud · HUAWEI

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INTERNET2 · NAIC National Association of Insurance Commissioners · NIPR NATIONAL INSURANCE PRODUCER REGISTRY

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300+ Members and Growing (Silver 1)

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ACEDEMAND
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CANONICAL
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Cockroach LABS
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Container Solutions
Couchbase
CREATIONLINE, INC.
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DaoCloud
DATADOG

DATAWIRE
Datica
DENSO
DIAMANTI
DEFINESYS
DeployHub
DiDi
DoiT INTERNATIONAL
dynatrace
EasyStack open cloud computing
eBaoTech make insurance easy

ebay
EDGEWISE ZERO TRUST YOUR CLOUD
eKing Technology 易 | 建 | 科 | 技
elastisys
ELASTX
eldarion
EMQ
Exon LV
EXOSCALE
f5
GALACTIC FOG

Ghostcloud
Giant Swarm
GitHub
GitLab
Goldman Sachs
Grafana
GRAVITATIONAL
Gremlin
GRONAU IT CLOUD COMPUTING
H3C The Leader in New IT
HAPROXY
HASURA

谐云科技 HARMONY CLOUD
heptio
Hewlett Packard Enterprise
Humio
iguazio
indeed
Infoblox CONTROL YOUR NETWORK
influxdata
InfoSiftr
INFRACLOUD
inspur

300+ Members and Growing (Silver 2)

INSTANA
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inwinSTACK
IoTium
JETSTACK
Joyent
JUNIPER NETWORKS
kaloom
kasten
kinvolk
Kong
KONTENA

KubeMQ
kublr Stress-free Kubernetes
kumina MANAGED OPERATIONS
LACEWORK
Landa 蓝灯数据
LIGHTSTEP
LIVEWYER
logdna
loodse
MAYADATA
MINIO
MIRANTIS

mLab
mobilise
Mobingi
monostream
Morgan Stanley
NCSOFT
NetEase Cloud
NeuVector
NexClipper
NGINX
nirmata
NOKIA
NUTANIX YOUR ENTERPRISE CLOUD

OCTARINE
OCTO Technology There is a better way
One Convergence
opsani
OVH
packet
中国平安 保险·银行·投资
平安科技 PING AN TECHNOLOGY
Pinterest
PipelineAI
PLATFORM9
portworx
PRAQMA
PRODYNA

PROTEON Your container playground
pulumi
puppet
QAWARE SOFTWARE ENGINEERING
轻元科技 QINGYUAN
QINIU
QUALCOMM
rackspace
RANCHER
R&D CHINA 神州锐达 互联网＋解决方案领导者
Reactive Ops
replex
REPLICATED

resin.io
RiseML
ROBIN
ROOKOUT
RX-M Cloud Native Consulting
SAFE WRD PARTNER FOR INNOVATION
SAKURA internet
SAMSUNG
SCALITY
SCALYR
Sensu
serverless
数人云 shurenyun.com

SignalFx
snaproute
Sonatype
splunk>
Spotify
SQUARESPACE
STACKPOINT
STORAGEOS
Styra
SUPERGIANT
SYNADIA
sysdig
SysEleven

时速云 tenxcloud.com
TIGERA
TRANSWARP
TREASURE DATA
TURBINE LABS
turbonomic
twilio
Twistlock
twitter
UNIVA
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Virtuozzo
Volterra EDGE SERVICES
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wavemaker
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沃趣 WOQUTECH
WSO2
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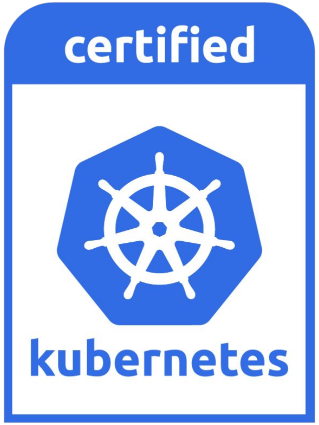
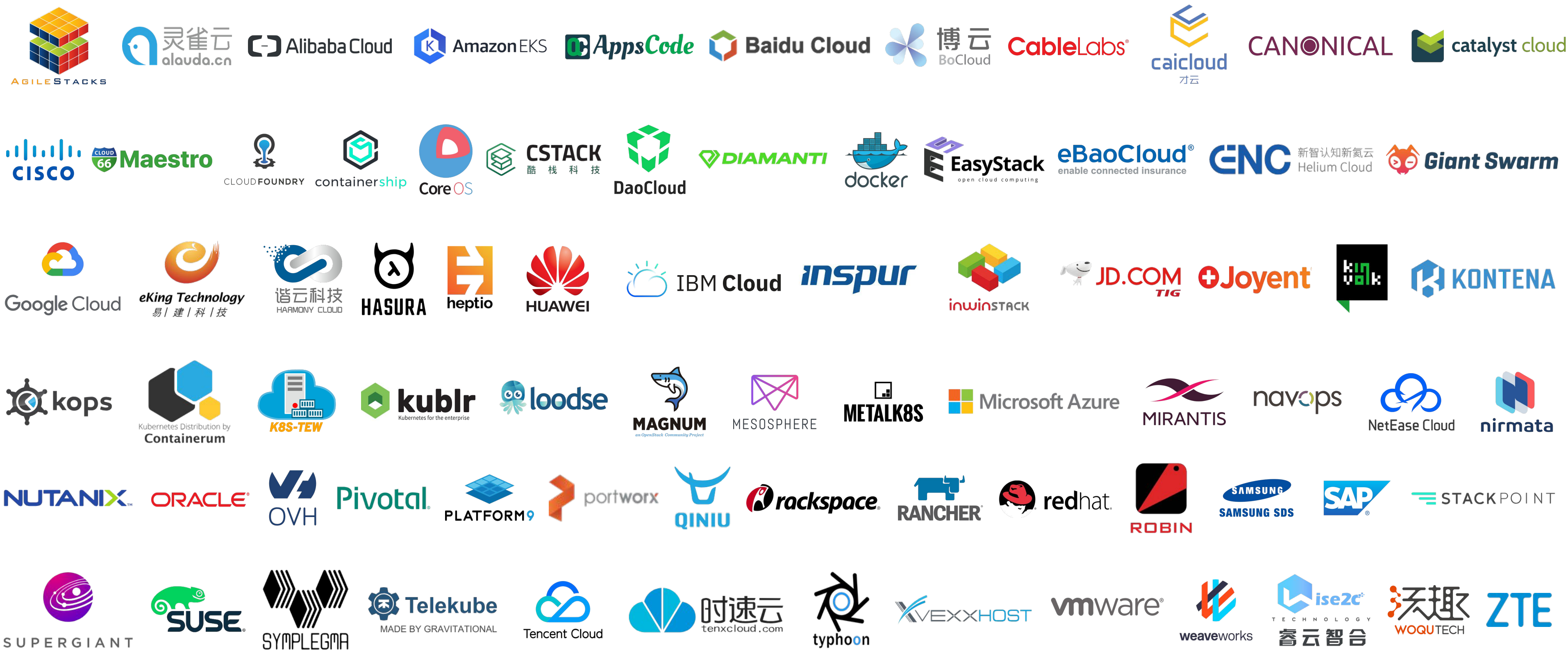
焱融云 YAN RONG
yld
YugaByte

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/

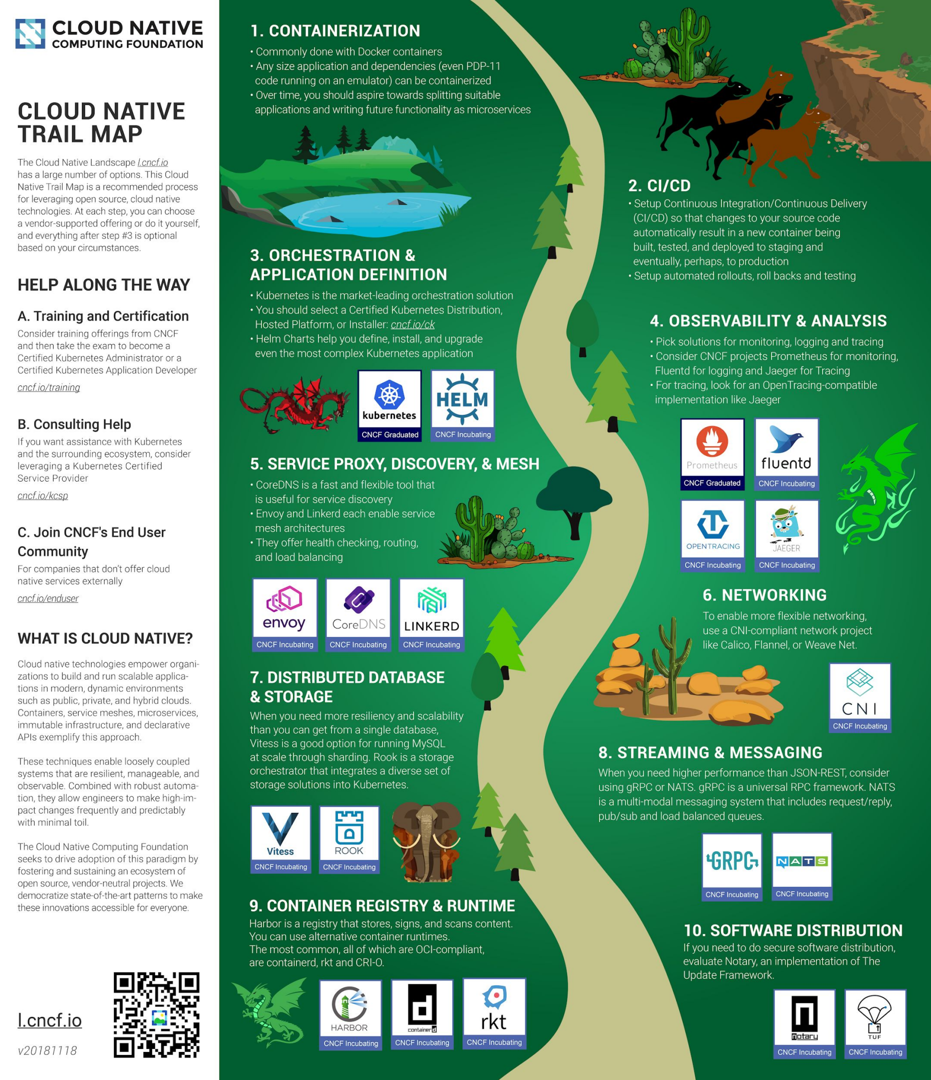


78 Certified Kubernetes Partners



Cloud Native Trail Map

Trail Map: l.cncf.io



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CLOUD NATIVE TRAIL MAP

The Cloud Native Landscape l.cncf.io has a large number of options. This Cloud Native Trail Map is a recommended process for leveraging open source, cloud native technologies. At each step, you can choose a vendor-supported offering or do it yourself, and everything after step #3 is optional based on your circumstances.

HELP ALONG THE WAY

A. Training and Certification

Consider training offerings from CNCF and then take the exam to become a Certified Kubernetes Administrator or a Certified Kubernetes Application Developer

cncf.io/training

B. Consulting Help

If you want assistance with Kubernetes and the surrounding ecosystem, consider leveraging a Kubernetes Certified Service Provider

cncf.io/kcsp

C. Join CNCF's End User Community

For companies that don't offer cloud native services externally

cncf.io/enduser

WHAT IS CLOUD NATIVE?

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.

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l.cncf.io

v20181118

1. CONTAINERIZATION

- Commonly done with Docker containers
- Any size application and dependencies (even PDP-11 code running on an emulator) can be containerized
- Over time, you should aspire towards splitting suitable applications and writing future functionality as microservices

2. CI/CD

- Setup Continuous Integration/Continuous Delivery (CI/CD) so that changes to your source code automatically result in a new container being built, tested, and deployed to staging and eventually, perhaps, to production
- Setup automated rollouts, roll backs and testing

3. ORCHESTRATION & APPLICATION DEFINITION

- Kubernetes is the market-leading orchestration solution
- You should select a Certified Kubernetes Distribution, Hosted Platform, or Installer: cncf.io/ck
- Helm Charts help you define, install, and upgrade even the most complex Kubernetes application

4. OBSERVABILITY & ANALYSIS

- Pick solutions for monitoring, logging and tracing
- Consider CNCF projects Prometheus for monitoring, Fluentd for logging and Jaeger for Tracing
- For tracing, look for an OpenTracing-compatible implementation like Jaeger

5. SERVICE PROXY, DISCOVERY, & MESH

- CoreDNS is a fast and flexible tool that is useful for service discovery
- Envoy and Linkerd each enable service mesh architectures
- They offer health checking, routing, and load balancing

6. NETWORKING

To enable more flexible networking, use a CNI-compliant network project like Calico, Flannel, or Weave Net.

7. DISTRIBUTED DATABASE & STORAGE

When you need more resiliency and scalability than you can get from a single database, Vitess is a good option for running MySQL at scale through sharding. Rook is a storage orchestrator that integrates a diverse set of storage solutions into Kubernetes.

8. STREAMING & MESSAGING

When you need higher performance than JSON-REST, consider using gRPC or NATS. gRPC is a universal RPC framework. NATS is a multi-modal messaging system that includes request/reply, pub/sub and load balanced queues.

9. CONTAINER REGISTRY & RUNTIME

Harbor is a registry that stores, signs, and scans content. You can use alternative container runtimes. The most common, all of which are OCI-compliant, are containerd, rkt and CRI-O.

10. SOFTWARE DISTRIBUTION

If you need to do secure software distribution, evaluate Notary, an implementation of The Update Framework.

Evolving Cloud Native Landscape

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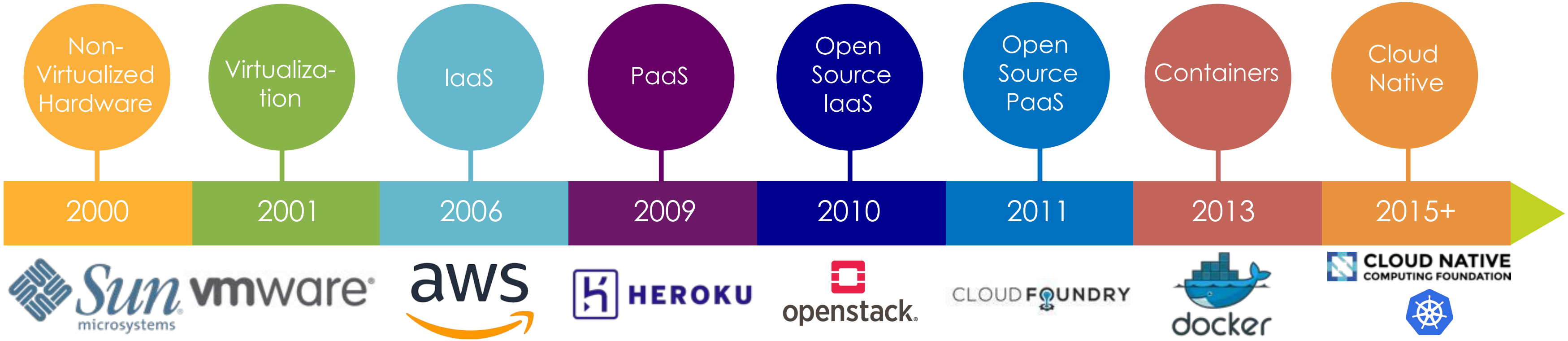
CNCF? From Virtualization to Cloud Native

CLOUD NATIVE COMPUTING FOUNDATION

kubernetes

- 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



Non-Virtualized Hardware – 2000

Virtualization – 2001

IaaS – 2006

PaaS – 2009

Open Source IaaS – 2010

Open Source PaaS – 2011

Containers – 2013

Cloud Native – 2015+

What Have We Learned?

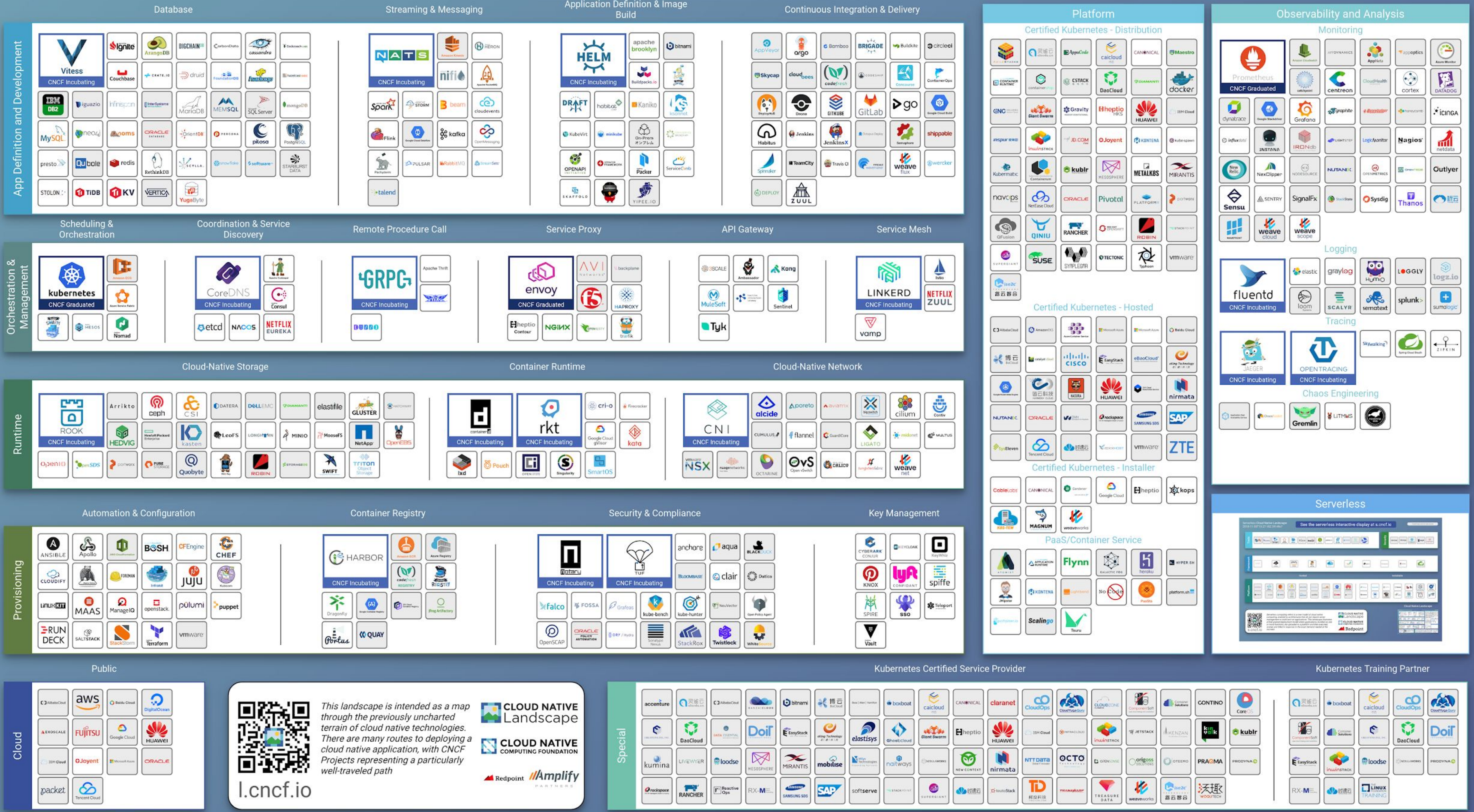
- Core Building Block:
  - Servers ➡ Virtual Machines ➡ Buildpacks ➡ Containers
- Isolation Units
  - From heavier to lighter weight, in spin-up time and size
- Immutability
  - From pets to cattle
- Provider
  - From closed source, single vendor to open source, cross-vendor

Cloud Native Landscape

2018-11-30T13:27:18Z 3914fe7

See the interactive landscape at l.cncf.io

Greyed logos are not open source



This landscape is intended as a map through the previously uncharted terrain of cloud native technologies. There are many routes to deploying a cloud native application, with CNCF Projects representing a particularly well-traveled path

CLOUD NATIVE Landscape

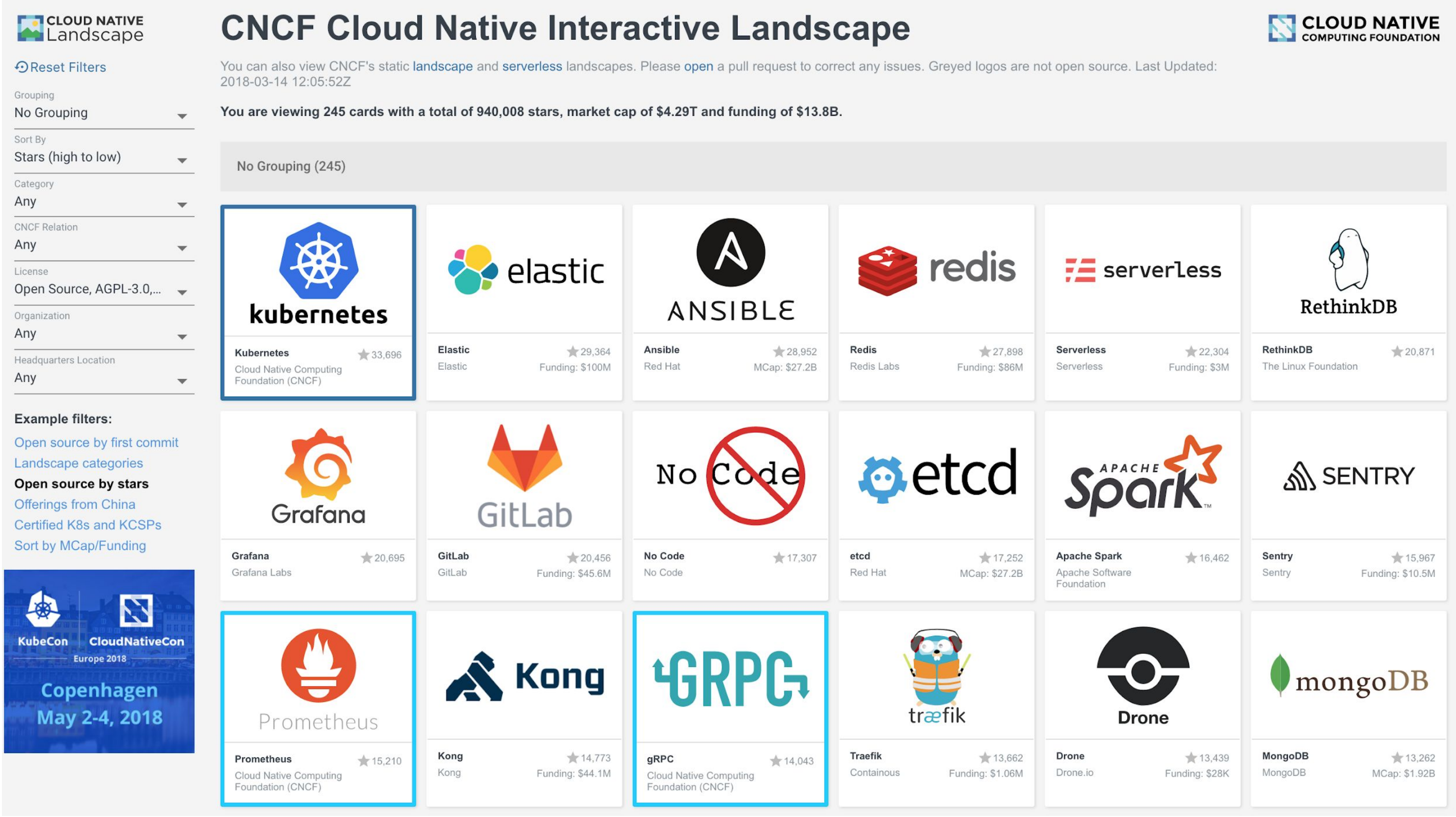
CLOUD NATIVE COMPUTING FOUNDATION

Redpoint

Amplify PARTNERS

l.cncf.io

Try it now at https://l.cncf.io



CLOUD NATIVE Landscape

Reset Filters

Grouping: No Grouping

Sort By: Stars (high to low)

Category: Any

CNCF Relation: Any

License: Open Source, AGPL-3.0,...

Organization: Any

Headquarters Location: Any

Example filters:

- Open source by first commit
- Landscape categories
- **Open source by stars**
- Offerings from China
- Certified K8s and KCSPs
- Sort by MCap/Funding

KubeCon CloudNativeCon Europe 2018 Copenhagen May 2-4, 2018

CNCF Cloud Native Interactive Landscape

CLOUD NATIVE COMPUTING FOUNDATION

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

You are viewing 245 cards with a total of 940,008 stars, market cap of $4.29T and funding of $13.8B.

No Grouping (245)

Kubernetes — Cloud Native Computing Foundation (CNCF) — ★33,696

Elastic — Elastic — ★29,364 — Funding: $100M

Ansible — Red Hat — ★28,952 — MCap: $27.2B

Redis — Redis Labs — ★27,898 — Funding: $86M

Serverless — Serverless — ★22,304 — Funding: $3M

RethinkDB — The Linux Foundation — ★20,871

Grafana — Grafana Labs — ★20,695

GitLab — GitLab — ★20,456 — Funding: $45.6M

No Code — No Code — ★17,307

etcd — Red Hat — ★17,252 — MCap: $27.2B

Apache Spark — Apache Software Foundation — ★16,462

Sentry — Sentry — ★15,967 — Funding: $10.5M

Prometheus — Cloud Native Computing Foundation (CNCF) — ★15,210

Kong — Kong — ★14,773 — Funding: $44.1M

gRPC — Cloud Native Computing Foundation (CNCF) — ★14,043

Traefik — Containous — ★13,662 — Funding: $1.06M

Drone — Drone.io — ★13,439 — Funding: $28K

MongoDB — MongoDB — ★13,262 — MCap: $1.92B

What’s Next in 2019+?

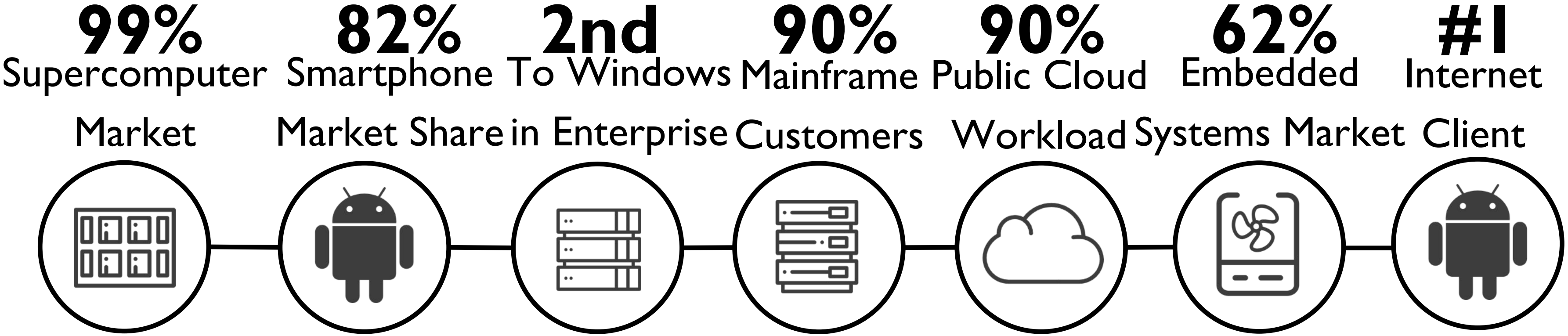
Cultivate Projects + Fill the Cloud Native Gaps

- 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

2nd To Windows in Enterprise

90% Mainframe Customers

90% Public Cloud Workload

62% Embedded Systems Market

#1 Internet Client

- **Kubernetes will follow a similar pattern IMHO...**

IoT + Edge + Kubernetes

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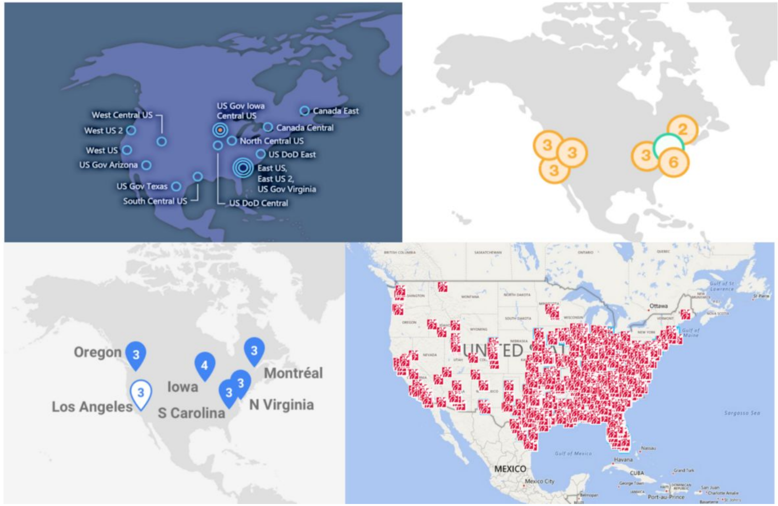
Kubernetes: Pushed to the Edge (Chick-fil-A)

- https://medium.com/@cfatechblog/edge-computing-at-chick-fil-a-7d67242675e2

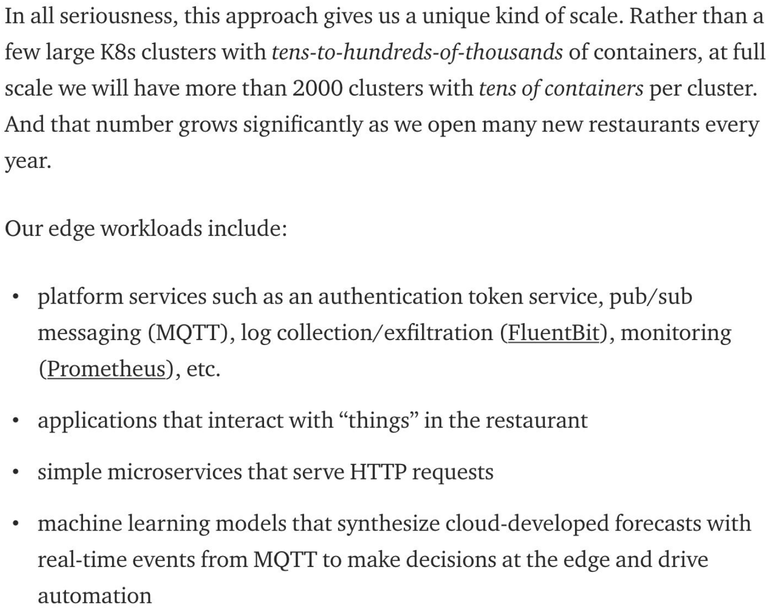


Azure

AWS

Google Cloud

Cloud-fil-A



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
- See the WG’s whitepaper 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

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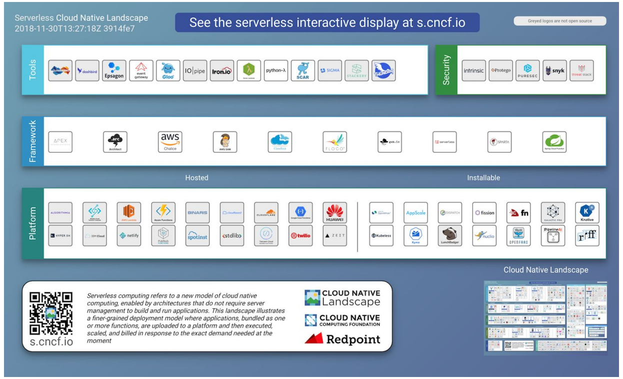
Serverless in CNCF

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



Serverless Cloud Native Landscape
2018-11-30T13:27:18Z 3914fe7

See the serverless interactive display at s.cncf.io

Greyed logos are not open source

Serverless computing refers to a new model of cloud native computing, enabled by architectures that do not require server management to build and run applications. This landscape illustrates a finer-grained deployment model where applications, bundled as one or more functions, are uploaded to a platform and then executed, scaled, and billed in response to the exact demand needed at the moment

s.cncf.io

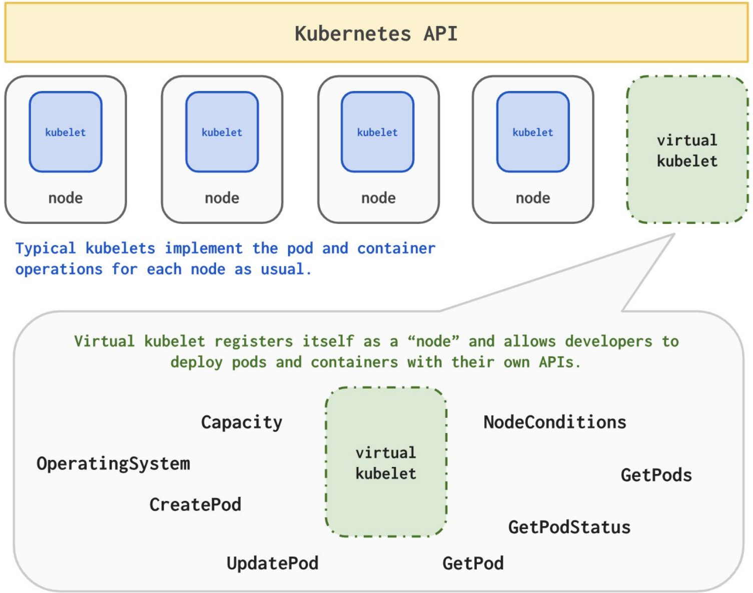
- CloudEvents, a new CNCF project, is a common model for event data to ease cross-provider event delivery

cloudevents

Nodeless Kubernetes + 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



Typical kubelets implement the pod and container operations for each node as usual.

Virtual kubelet registers itself as a “node” and allows developers to deploy pods and containers with their own APIs.

Telco Transformation: VNFs to CNFs

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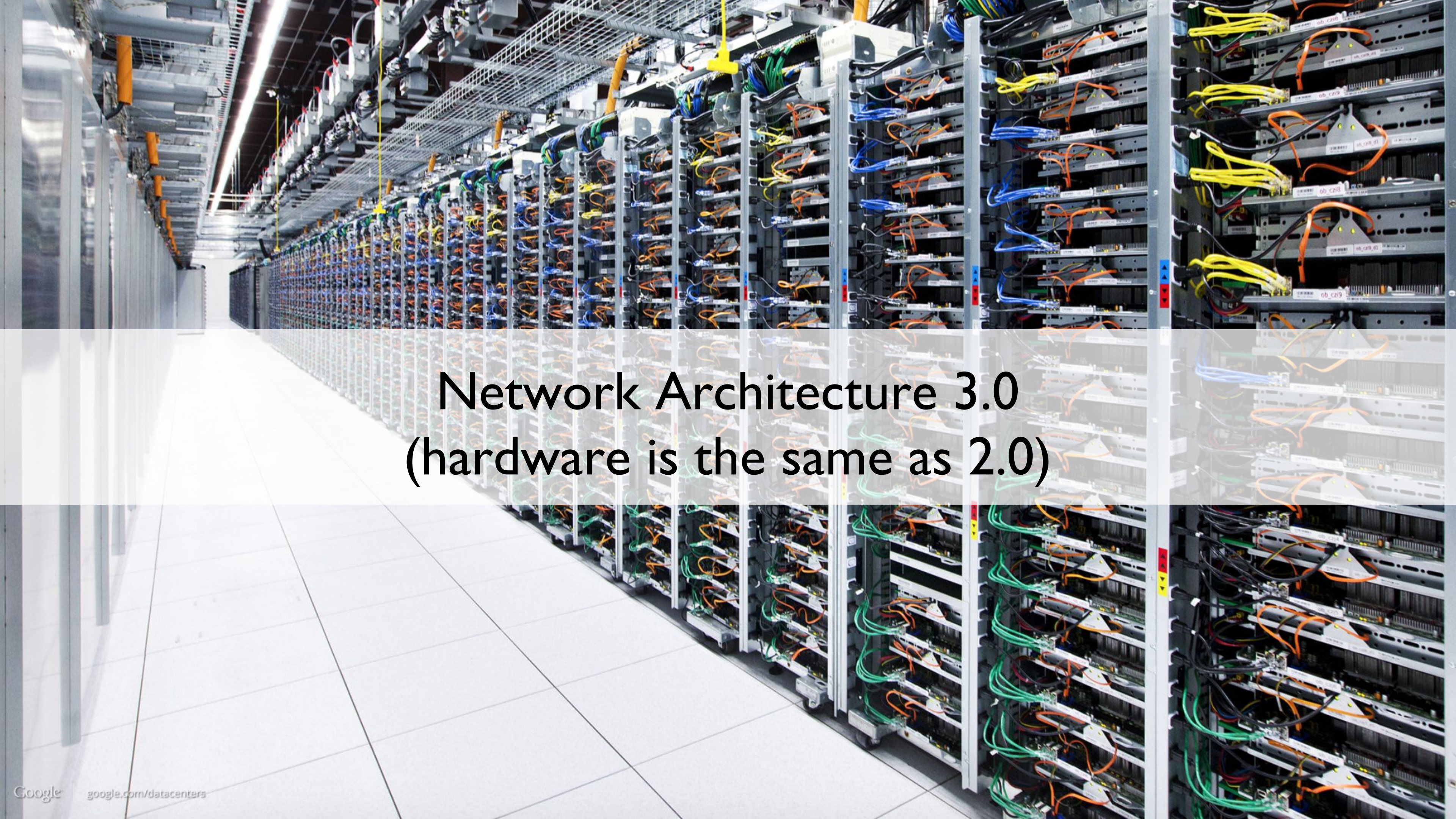
Network Architecture Evolution

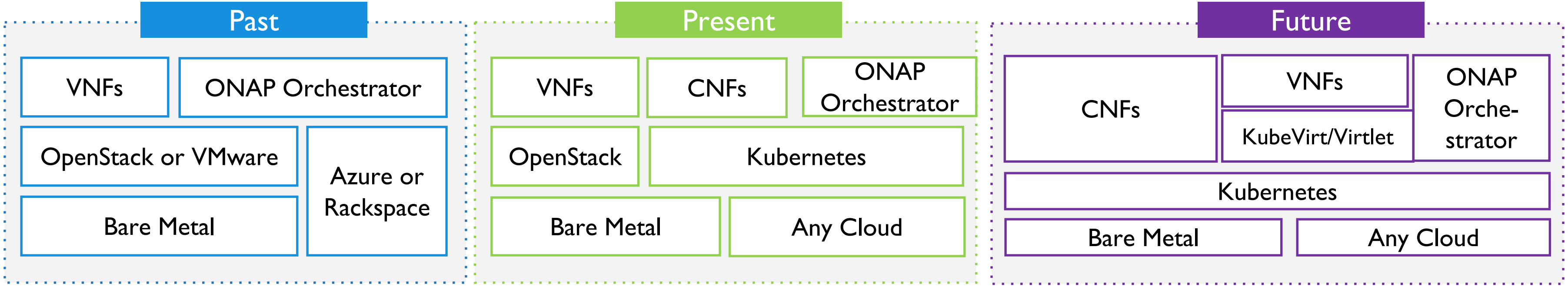
- **1.0:** Separate physical boxes for each component (e.g., routers, switches, firewalls)
- **2.0:** Physical boxes converted to virtual machines called Virtual Network Functions (VNFs) running on VMware or OpenStack
- **3.0:** Cloud-native Network Functions (CNFs) running on Kubernetes on public, private, or hybrid clouds [containers]



Google google.com/datacenters

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

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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
  - https://www.cncf.io/certification/expert/cka/
- **Certified Kubernetes Application Developer (CKAD)**
  - Certifies that users can design, build, configure, and expose cloud native applications for Kubernetes
  - https://www.cncf.io/certification/expert/cka/ckad/
- **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*

CERTIFIED
kubernetes
ADMINISTRATOR

CERTIFIED
kubernetes
APPLICATION DEVELOPER

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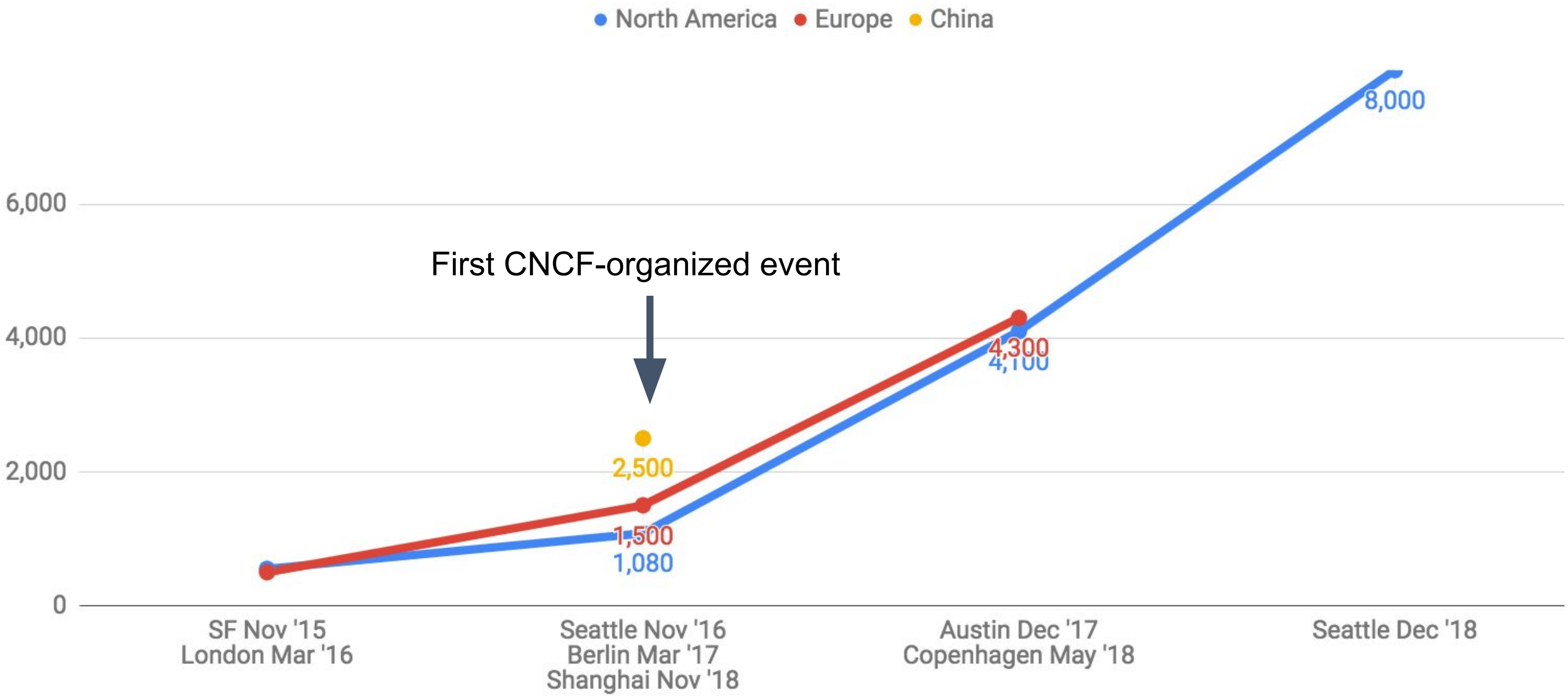
KubeCon + CloudNativeCon 2019!

KubeCon | CloudNativeCon

- Barcelona 2019: May 20-23, 2019
- Shanghai 2019: June 26-28, 2019
- San Diego 2019: November 18-21, 2019

FYI: Conference Attendance (Book Early!)



Thank you! Q&A?

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