containerd update

FOSDEM 2019 - Containers Devroom
Sunday, 3 February 2019
Phil Estes (IBM Cloud, Distinguished Engineer)

Containerd Overview

'…but many platform builders and operators are looking for "boring infrastructure": a basic component that provides the robust primitives for running containers on their system, bundled in a stable interface, and nothing else.' - Docker Blog, containerd announcement

- **Project Goal**: Provide a "*{boring} core container runtime*" for the industry, allowing Docker and Kubernetes to both have a strong base on which to innovate at higher layers

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KEY TENETS

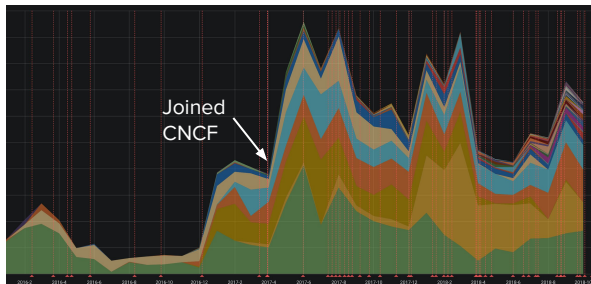- Reliability/Stability   - Clean/usable client API   - Strong Compatibility Guarantees   - Performance

jessie frazelle 👩‍💻✔ @jessfraz · Oct 29
Seriously you can build and iterate on custom infra very easily from the **containerd** APIs why bloat when you can build something minimal and nice

💬 3   ↺ 3   ❤ 40   ✉

Ahmet Alp Balkan @ahmetb · 7 Aug 2017
Containerd Getting Started guide is dope. Having a clean **API** matters, folks!

Michael Crosby @crosbymichael
If you want to try out @containerd we added a quick Getting Started Guide: github.com/containerd/con…

💬   ↺   ❤ 6   ✉

Brian Goff @cpuguy83 · 7 Aug 2017
Replying to @crosbymichael @containerd
API looks so nice and clean. Great job!

💬 1   ↺ 1   ❤ 1   ✉

Containerd Community

- **3,418 GH stars** (up 1000+)

- **165 contributors** (up 50+)

- **12 maintainers**, representing 8 organizations/vendors

- **6 reviewers**, representing 5 organizations/vendors

- **720** Slack channel members

- **3,441** Twitter followers (@containerd)

Joined CNCF

|

Containerd Usage

- **Broad Usage:** containerd receives significant production usage as a core component of every release of Docker engine since early 2016. In 2018 we now see containerd used in two public cloud managed Kubernetes offerings (GKE and IBM Cloud IKS), and a long list of additional adopters found in the TOC graduation proposal PR
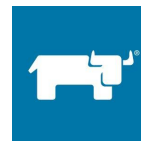
https://github.com/cncf/toc/pull/165

Add containerd graduation review proposal #165

Edit

Open **estesp** wants to merge 1 commit into `cncf:master` from `estesp:containerd-graduation`

Conversation 15 | Commits 1 | Checks 0 | Files changed 1

Changes from **all commits** ▾ | File filter... ▾ | Jump to... ▾ | +66 −0 ■■■■■

Diff settings ▾ | **Review changes** ▾

66 ■■■■■ reviews/graduation-containerd.md

Copy path | View file

Containerd Graduation Proposal

Since the March 2017 announcement at KubeCon Berlin that containerd would be joining the CNCF, the containerd community has been busy continuing the development and testing of a stable, core container runtime for cloud native use cases.

In late 2017, containerd announced its 1.0 release, followed in early 2018 by a 1.1 release that has been updated with several minor fix releases through 2018. The containerd team has just completed the next major release, 1.2.0, with more complete Windows runtime support and a new runtime shim v2 API that is proving valuable for runc alternatives like Kata containers.

At this time, we believe containerd is ready for the graduation stage within the CNCF, and per the guidelines listed there, we detail our readiness in the section below.

CNCF Graduation Criteria

Committers from at least two organizations.

Containerd has had a variety of maintainers and reviewers since its inception, and currently have 12 committers representing Docker, NTT, Google, IBM, Microsoft, Facebook, Tesla, and Cruise Automation. We also recognize **LGTM** rights for a group we

History of containerd

containerd 0.2
- Integrated in Docker 1.11
- Simple runtime manager on top of runc

containerd to CNCF
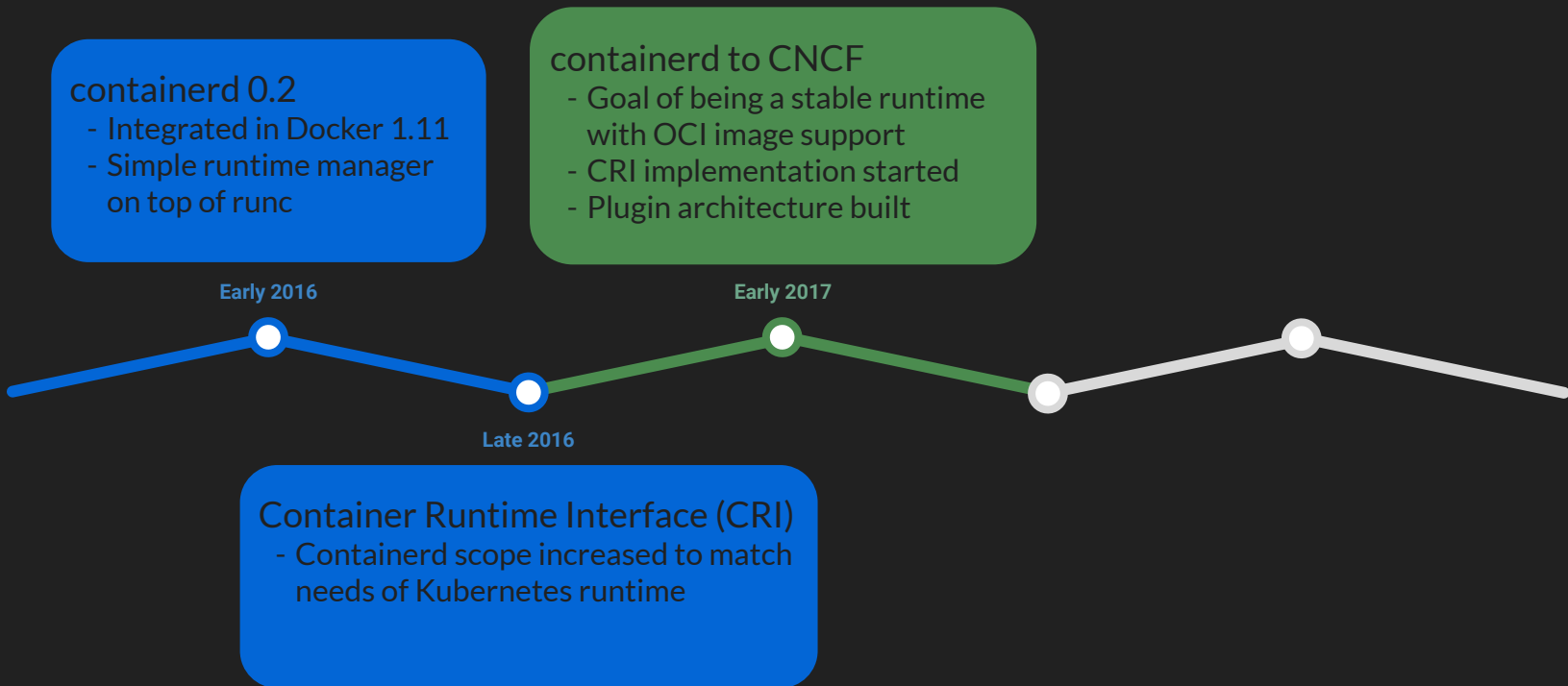- Goal of being a stable runtime with OCI image support
- CRI implementation started
- Plugin architecture built

Early 2016

Early 2017

Late 2016

Container Runtime Interface (CRI)
- Containerd scope increased to match needs of Kubernetes runtime

History of containerd

containerd 1.0
- Released in December '17
- API stabilized
- CRI implementation goes alpha in November

containerd 1.2
- Released in October 2018
- Runtime shim API stabilized
- Focus on stability and extensibility

Late 2017

Late 2018

Early 2018

Containerd 1.1
- Released in April 2018
- CRI implementation goes BETA
- CRI added to containerd as built-in plugin

Created in December 2015
> 55 releases (v1.2.2 latest release)
> 165 contributors
> Docker contributed to CNCF in 2017
> Significant and growing list of adopters

Current Status

- Several major clouds adopting containerd as the Kubernetes CRI runtime
- Security audit performed in 4Q2018; extremely positive report of code quality and security posture
- Containerd presented to CNCF TOC for graduation in 4Q2018; all graduation criteria met; waiting on TOC vote
- Integration with and growth in broader array of use cases (HPC, AWS Firecracker VMM) proving out usefulness and capability of pluggable design and clean API

Architecture Overview

Smart Client Design

Container platform 🐦 P**o**uch 🐳 docker | ⬛ ctr

≡GO containerd client

Smart client
- Higher level interface provided by client library
- Responsible for push and pull
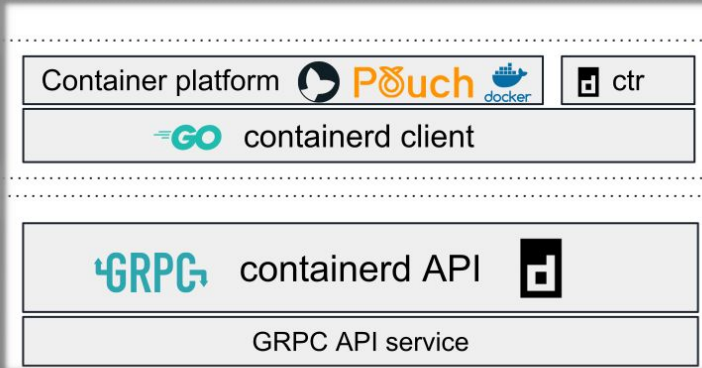- Direct access to low level resources (e.g. snapshots)
- Creates container OCI configuration

gRPC API

Container platform Pouch ctr
GO containerd client

GRPC containerd API

GRPC API service

gRPC API
- Low level access to components
- Mirrors internal component interfaces
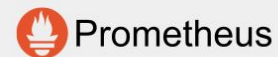- Snapshots, Content, Containers, Task, Events, etc
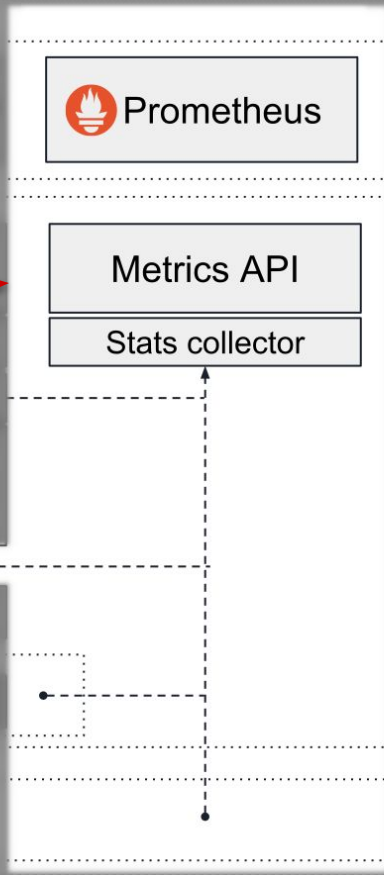
Metrics

Metric API
- Metrics exposed through Prometheus API
- Exposes metrics for containerd process AND container level metrics
- Enabled in containerd config `/etc/containerd/config.toml`

```
[metrics]
    address = "localhost:9090"
```
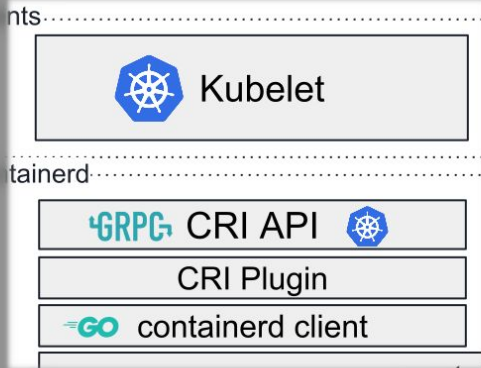
Prometheus

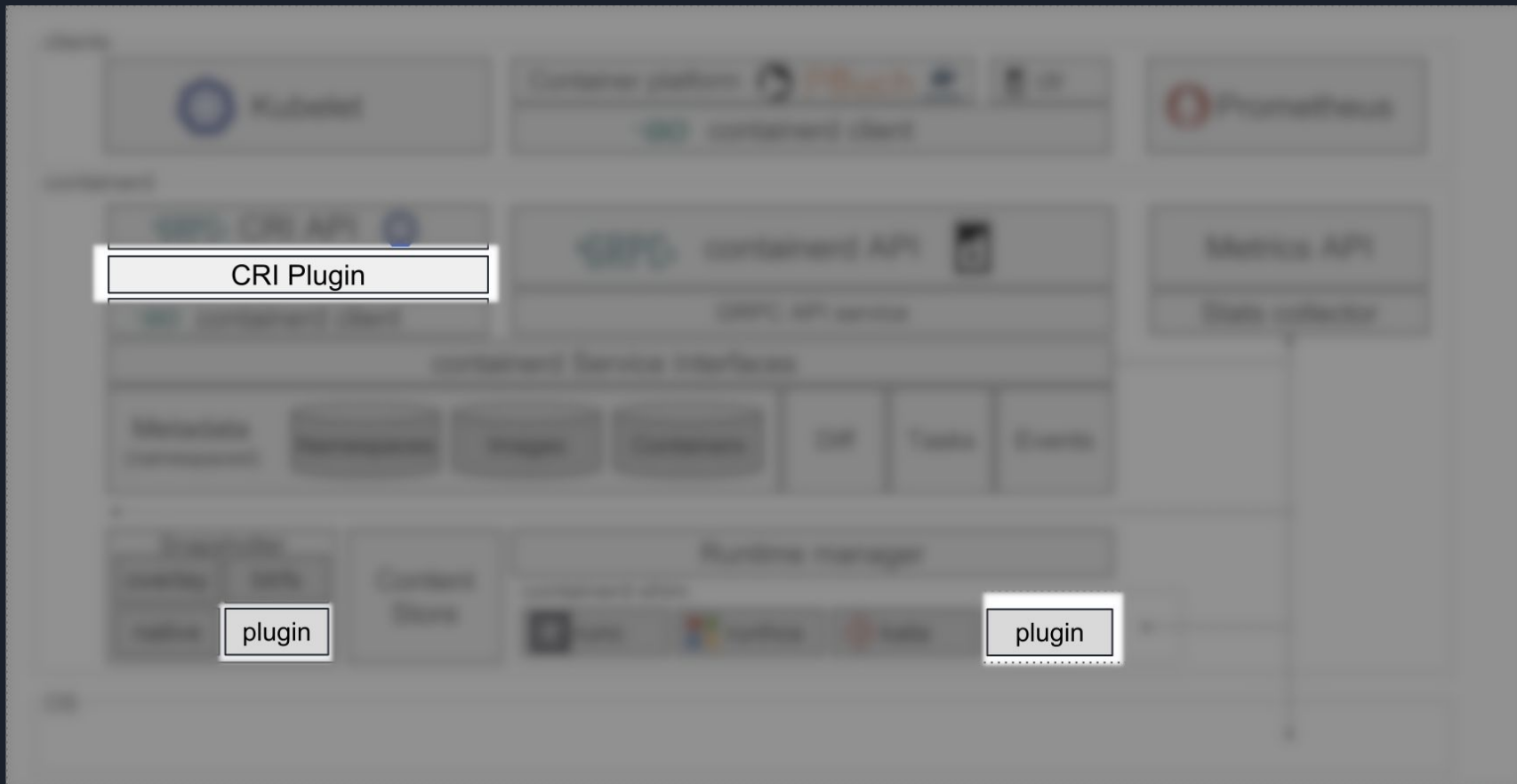Metrics API

Stats collector

Kubernetes Support

Kubernetes Runtime Support
- CRI GRPC API exposed from containerd
- Kubelet can be configured to use containerd as runtime

Plugins

Plugins (CRI)

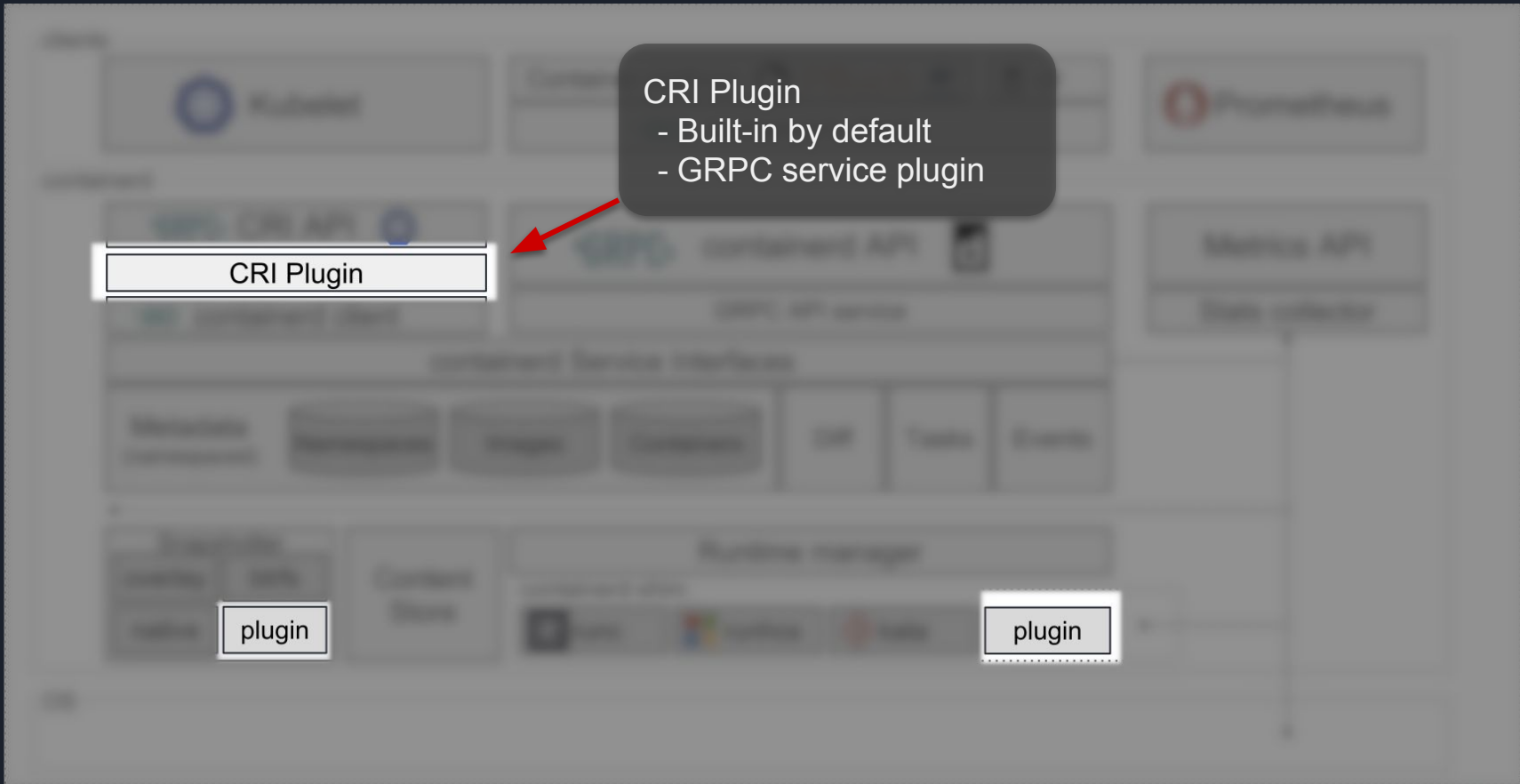**CRI Plugin**
- Built-in by default
- GRPC service plugin

CRI Plugin

plugin

plugin

Plugins (Snapshotter)

CRI Plugin

Snapshotter Plugin
- Built-in (overlay, btrfs, aufs)
- Supports custom plugins over GRPC in 1.2

plugin

plugin

Plugins (Runtime)

Runtime plugin
- Support for custom shims in 1.2
    - Binary which implements runtime API
    - Useful for VM runtimes
- Support for OCI runtimes
- Install through `ctr install`

More Extensibility

- **Smart client model (Golang)**
    - Resolver interface allows custom pull flow
    - Direct access to containerd interfaces
- **Server plugin architecture**
    - All services are self registered
    - Custom gRPC services
        - CRI is a gRPC plugin
    - Direct access to internal services

containerd Adoption

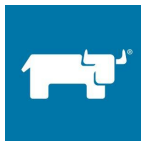▨ Kelsey Hightower's "Kubernetes the Hard Way" deploys **containerd** as the kubelet runtime

Maturity and Integrations

> **CRI-containerd**
- A gRPC plugin, calls into containerd services

> **Docker**
- Use containerd's client
    - Using runtime since 17.12+
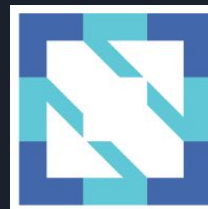   - Using image backend in 2019

> **Moby Buildkit**
- Using containerd's client
- Uses containerd interfaces directly for standalone mode

> **Alibaba Pouch**
- Uses containerd 1.0.x as container runtime, integrated with image and runtime

> **Other Examples**
- CloudFoundry Garden runtime
- Kata containers; AWS Firecracker
- Michael Crosby's "boss" project
- Evan Hazlett's "stellar" project

CNCF Maturity/Status

> **Security Review**
- Completed security review thanks to CNCF funding in Dec. '18
- Report is published online

> **CNCF Project Graduation**
- TOC proposal created Oct '18
- https://github.com/cncf/toc/pull/165
- Presented to TOC Nov '18
- Expect graduation vote early 2019

Thank you!

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