Container native Monitoring

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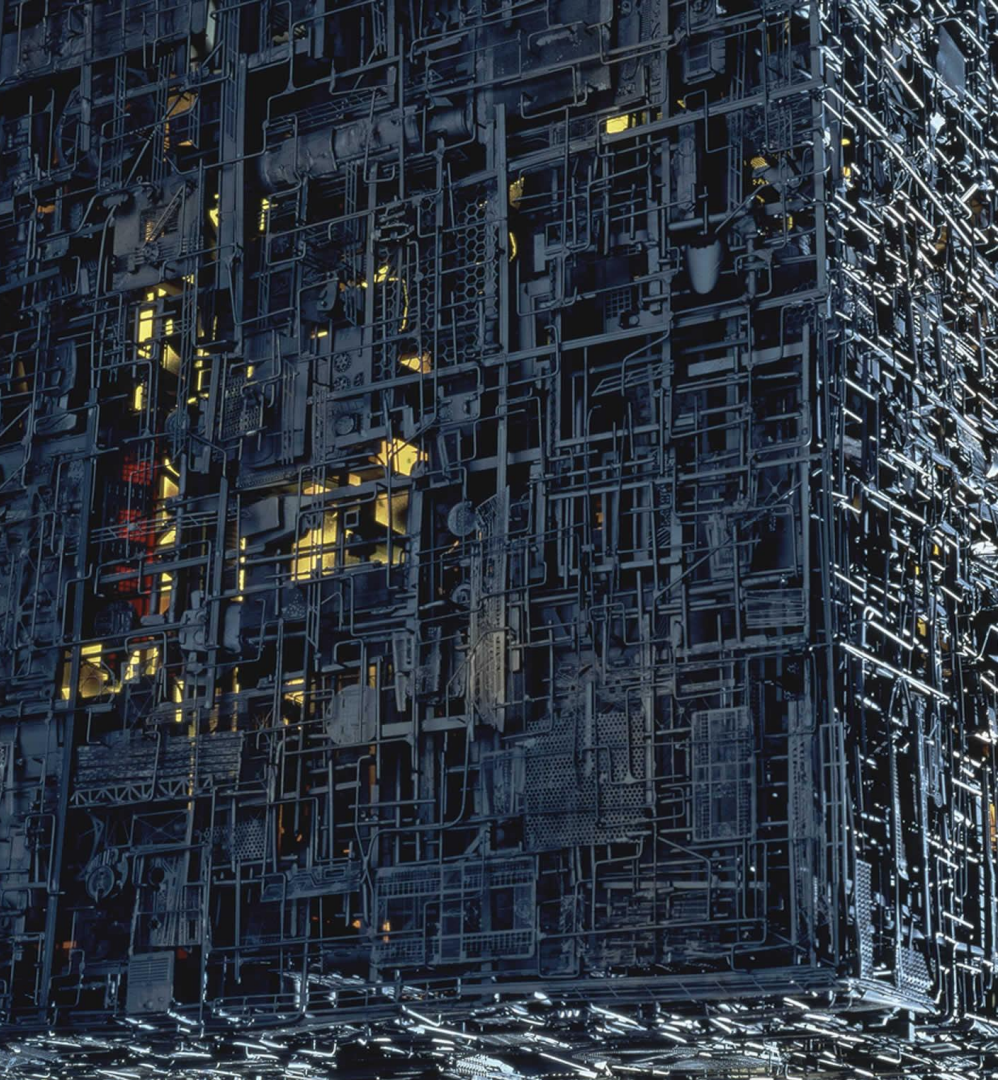
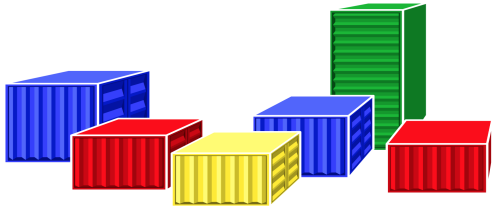
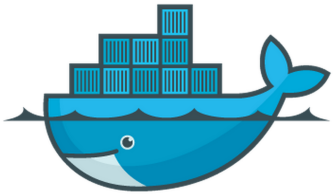




cAdvisor



Outline

Overview

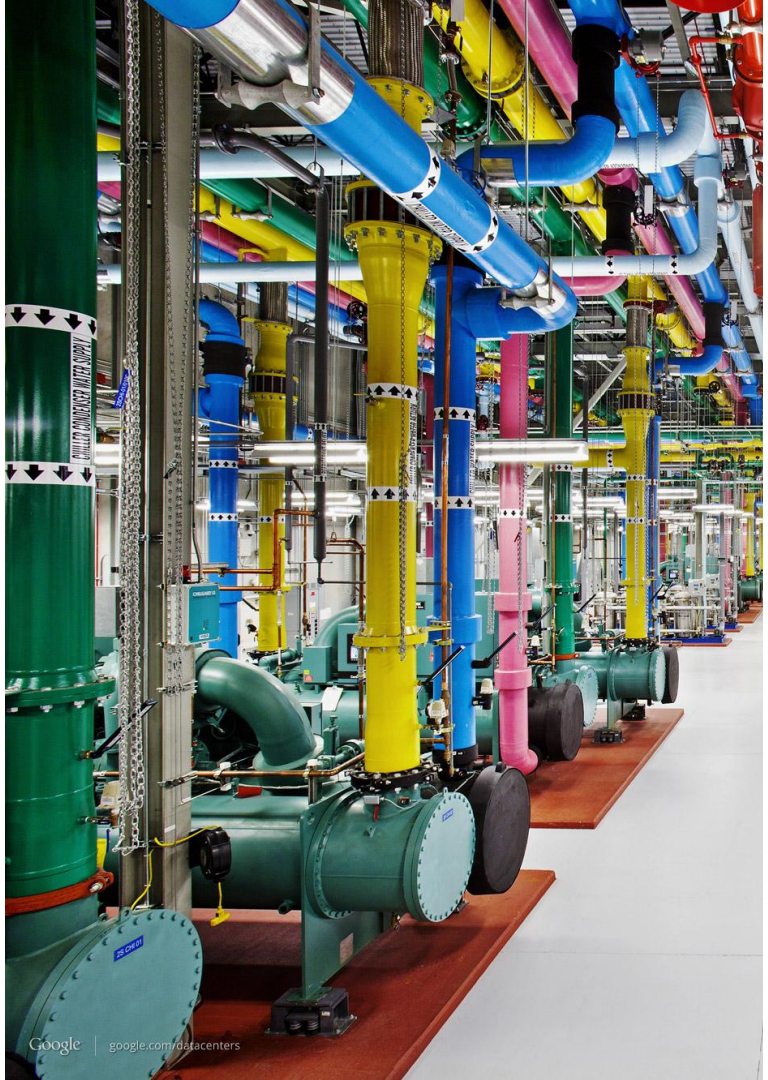
- Monitoring for containers
- Monitoring in a distributed system
- cAdvisor

Application Metrics

- In cAdvisor
- Plumbing through a cluster

Future Work

- Heapster/Kubedash
- Templates



Monitoring in three parts

Collection

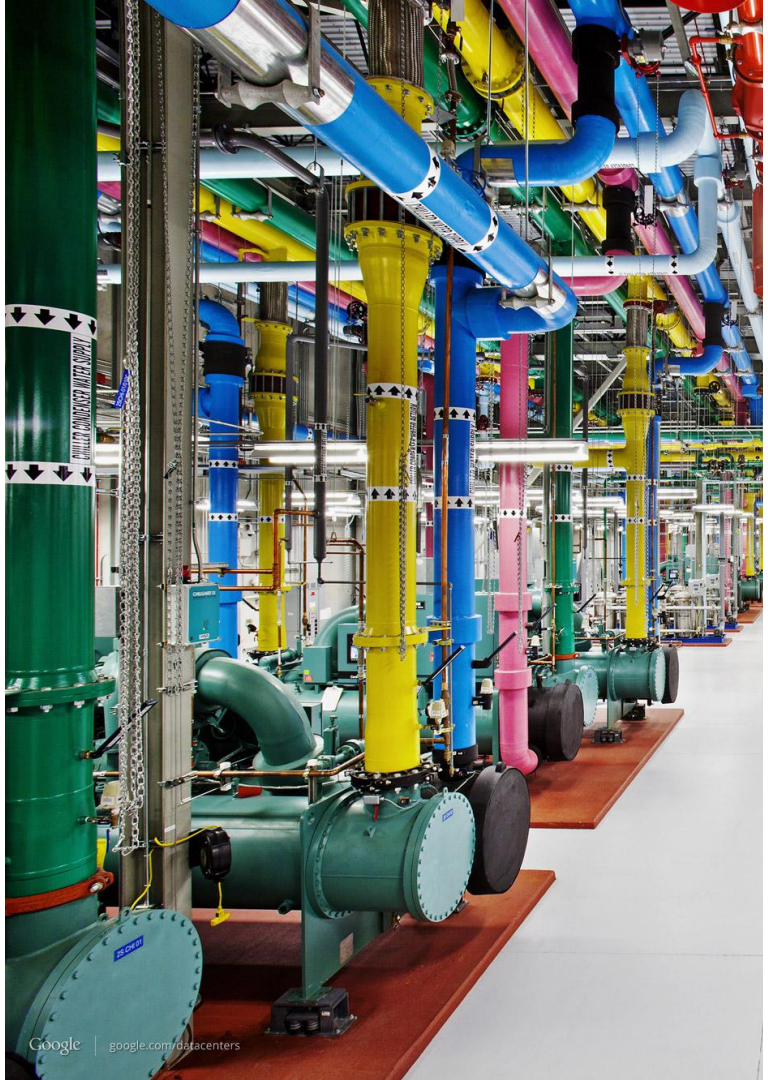
- collecting data and metrics
- making it discoverable
- plumbing it to higher-level systems

Processing

- Ingesting, aggregation
- Analytics

Managing

- Actions based on signals
- Alerts. Pagers!



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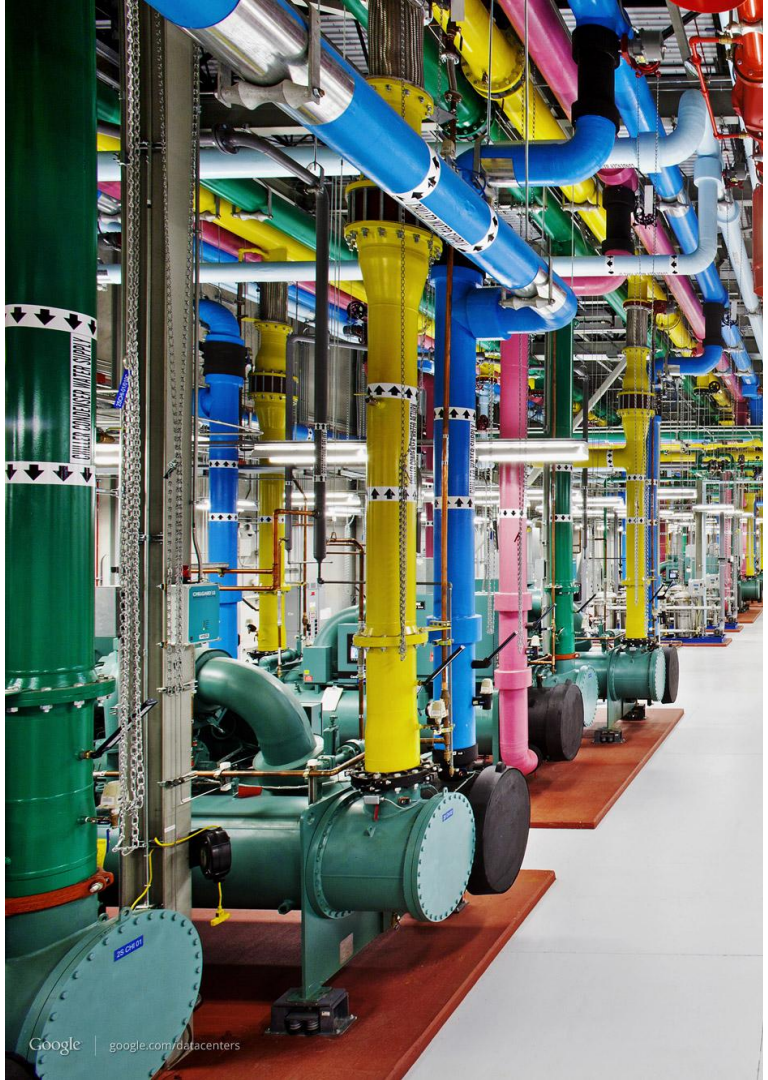


Collection in servers/VMs

- Node agent
- Knows the binary to monitor
- Monitoring logic plugged into agent

Moving to containers

- Same node agent - understands multiple applications.
- Applications can push data to agent.
- Sidecars
- Applications publish data. Pulled off by off-host agents.

consumers

Near-instant data

- schedulers in cluster management tools
- load balancers
- Alerting systems

Slower feedback loops

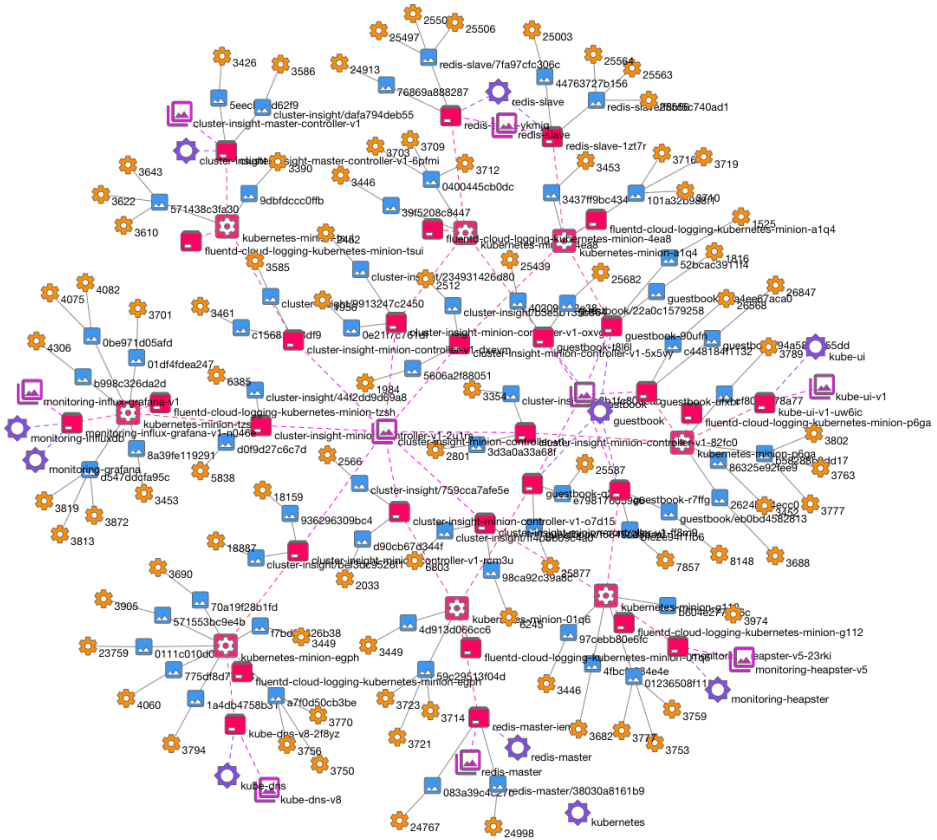
- Autoscaling / Autoupdaters
- CPI^2

Historical Data

- Offline analysis.

Monitoring in distributed environment

- Hosts are invisible
- Containers can hop around
- Monitoring needs to track and correlate multiple containers



In Action!

cAdvisor

cAdvisor

Analyzes resource usage and performance characteristics of running containers

Native Docker support, work with LXC and any other container format

Knows containers deeply and monitors their performance

github.com/google/cadvisor

Running cAdvisor

```
docker run
  --volume=/:/rootfs:ro
  --volume=/var/run:/var/run:rw
  --volume=/sys:/sys:ro
  --volume=/var/lib/docker/:/var/lib/docker:ro
  --publish=8080:8080
  --detach=true
  --name=cadvisor
  google/cadvisor:latest
```

API

Node and container spec

http://host:8080/api/v2.0/machine

http://host:8080/api/v2.0/spec/redis?type=docker

Hierarchical Container stats:

http://host:8080/api/v2.0/stats/nginx?type=docker

http://host:8080/api/v2.0/stats?recursive=true

Others:

/summary, /events, /storage, /attributes, /ps

Storage Backends

graphite

cAdvisor

StatsD

Coming soon ...

Application Metrics

Every container is packaged with its monitoring data.

Monitoring moves with the container.

Use container composability to stack up metrics from all layers.

Use metadata in image or runtime (Docker labels!) to configure monitoring

Configuring containers

```
FROM redis

ADD redis_config.json /var/cadvisor/redis_config.json

LABEL io.cadvisor.metric.redis="/var/cadvisor/redis_config.json"
```

In cAdvisor

read Labels **“io.cadvisor.metric.*”**
read /rootfs/proc/<pid>/root/<config path>

Monitoring Configuration

Holds metadata about metrics

- Endpoint (Location to collect metrics from)
- Name of metric
- Type (Counter, Gauge, ...)
- Data Type (int, float)
- Units (kbps, seconds, count)
- Polling Frequency
- Regexps (Regular expressions to be used to collect a metric)

Sample Configurations

Get all prometheus metrics:

```
{
        "endpoint" : "http://localhost:9100/metrics",
}
```

Get selected prometheus metrics:

```
{
        "endpoint" : "http://localhost:8000/metrics",
        "metrics_config"  : [
                { "scheduler_binding_latency",
                  "scheduler_e2e_scheduling_latency",
                  "scheduling_algorithm_latency"
                }
        ]
}
```

```
{
        "endpoint" : "http://localhost:8000/nginx_status",
        "metrics_config"  : [
                { "name" : "activeConnections",
                  "metric_type" : "gauge",
                  "units" : "number of active connections",
                  "data_type" : "int",
                  "polling_frequency" : 10,
                  "regex" : "Active connections: ([0-9]+)"

                },
                { "name" : "reading",
                  "metric_type" : "gauge",
                  "units" : "number of reading connections",
                  "data_type" : "int",
                  "polling_frequency" : 10,
                  "regex" : "Reading: ([0-9]+) .*"
                }
        ]
}
```

App Metrics in action

API

Endpoint for custom metrics:

http://localhost:8080/api/v2.0/appmetrics/containerName

Application metrics being collected can be discovered from the spec:

http://localhost:8080/api/v2.0/spec/containerName

Regular stats api also reports application metrics:

http://localhost:8080/api/v2.0/stats/containerName

Kubernetes

Open-source Container orchestration from Google

Declarative pattern for managing containers
Physical hosts abstracted out as resources

Inspired and informed by Borg

Kubernetes UI powered by cAdvisor

github.com/kubernetes/kubernetes

App Metrics for Kubernetes

All kubernetes components run in containers

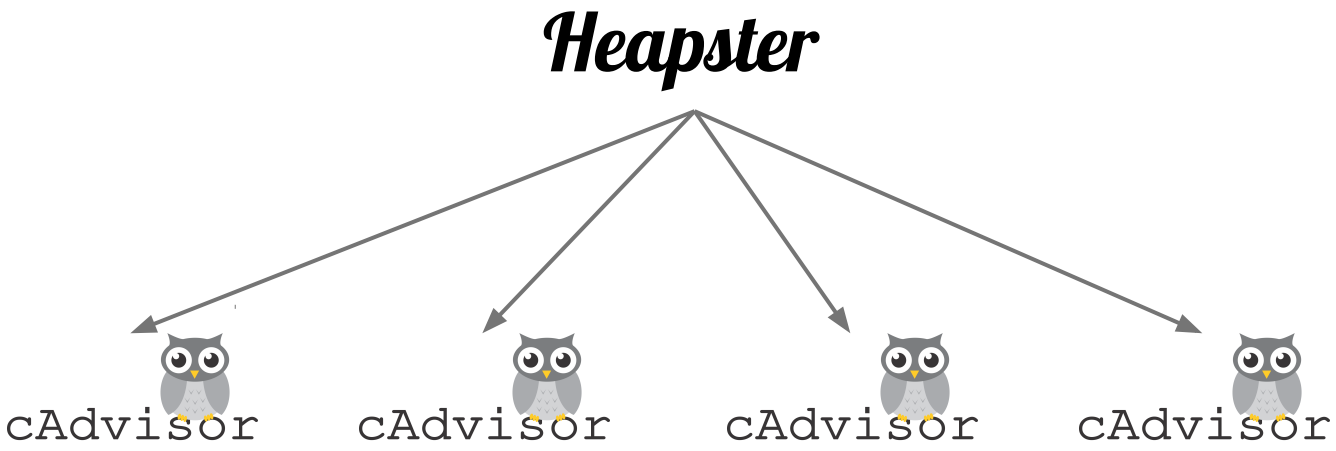
All system services on node runs in containers

All kubernetes nodes run cAdvisor (built into kubelet)

All kubernetes components expose prometheus metrics

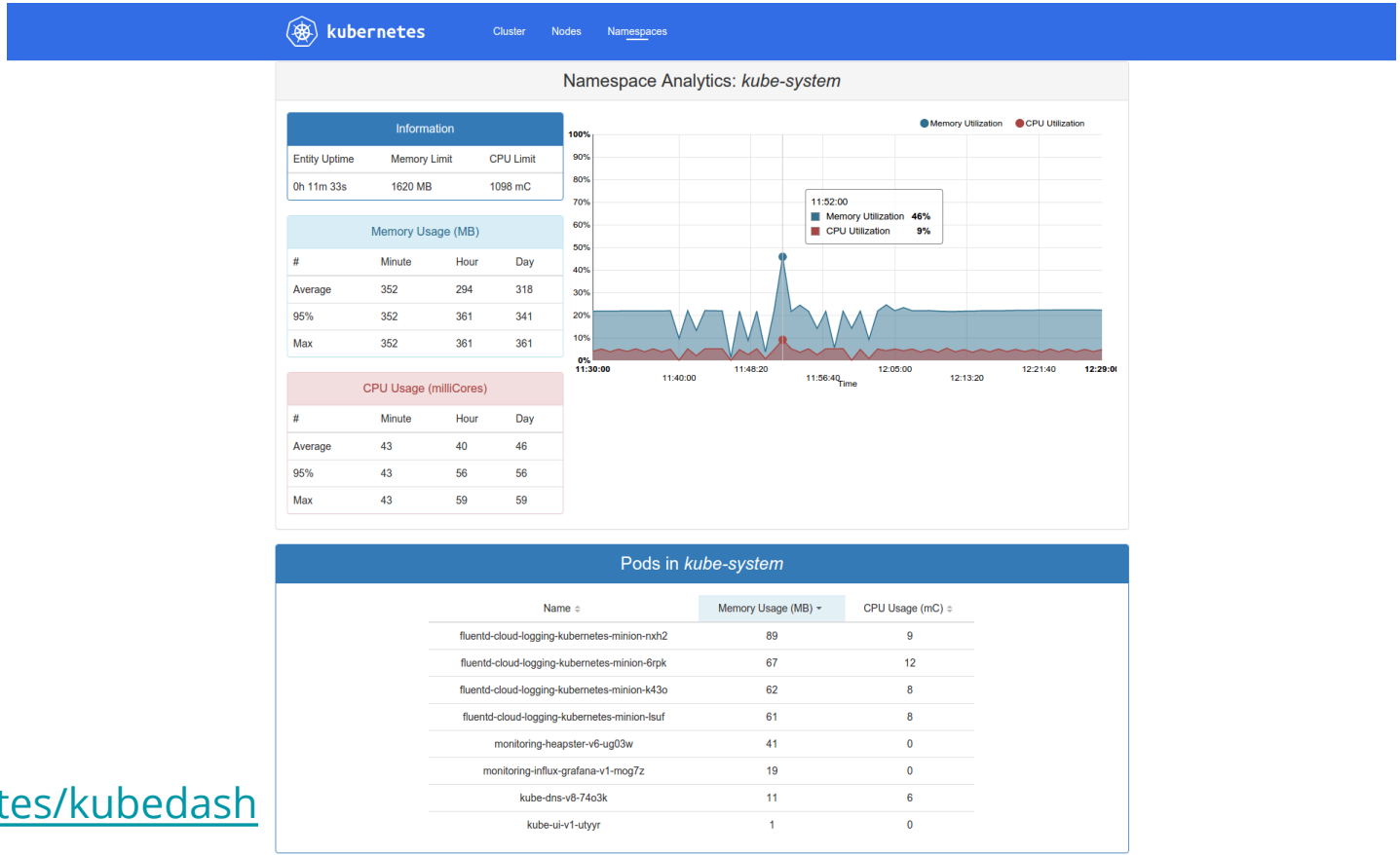
App-metrics for kubernetes components!

Heapster



github.com/kubernetes/heapster

Kubedash



github.com/kubernetes/kubedash

Templates

Add templates for applications that have stable stats API

```
LABEL io.cadvisor.metric.type=redis
```

Infer monitoring information

- Lookup ports through docker inspection
- hit known endpoints (e.g.: /metrics for prometheus)
- overrides through config

Tags

Adding tags to specific metrics
Convey metric intent to processors
eg. Autoscalers

Ongoing work

Endpoints
Storage drivers
Standard config syntax
Automagic

Plumbing through heapster/kubedash/kubernetes/...

Thank you!

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cAdvisor github.com/google/cadvisor
kubernetes kubernetes.io
irc #google-containers