



KubeCon

CloudNativeCon

— North America 2018 —

Observability at Scale

A key tenet of multi-tenancy

Thom McCann & Amreth Chandrasehar
T-Mobile Cloud Team

About T-Mobile

The Un-carrier:

- Netflix on Us
- Real humans for Customer Service
- Taxes included in bill
- Unlimited Voice, Data and Text
- T-Mobile Tuesdays

77 million customers

Operating two flagship brands:
T-Mobile and Metro by T-Mobile

50,000+ employees



Running at Scale



Customer Experience driving Un-carrier moves

- 10,000 APIs across 100s of applications
- Massive adoption of cloud native technologies in data center and public cloud over last 3 years

Public Cloud

- 6 years, 70+ Applications, AWS, Azure with data center network integration
- 40 container-based applications using shared “multi-tenant” orchestration
 - Netflix integration, Retail agent application, T-Mobile for Business, Commerce, Biometric login, Team of Experts, On Device upgrade, Coverage Maps, Social messaging

Multi-tenancy drives quick adoption



Shared clusters for multiple app team

- Enable consistency across applications

7,200 Containers	31 Billion Requests in 2018 (Dec)	2K – 14K RPS
0 Minutes Downtime (Prod) 29+ Months		0 P1s



Integrated Services

Integrated CI/CD
Logging
Telemetry
Load Balancing / Networking
DNS
Security / Scanning
Service Discovery
Secrets Management
Certs



Observability promise land

Build the culture, drive towards intelligent ops

- Encourage application teams, proactive engagement
- Begin at the beginning, don't skip steps
- Be where developers are: CLI, chat, pipelines,

Data Collection	Information	Proactive Culture	Analytics and Intelligent Ops
Logging	Telemetry	Default path	Trend Analysis
Metrics	Dashboards	Chat Ops / Slack	Optimization (performance and cost)
Request tracing	Reports	Integration into tools	Machine Learning
Cost	Service Health	Alerting: noise to signal	Embedded Analytics / decisions

The toolbox

Prometheus infra supports

- 28 Clusters, 1.5M metrics, 4K RPS
- “Infinite” storage using Thanos and S3

Grafana

- 150 Orgs, 1,000+ dashboards, 820 alerts
- Drive a culture of DevOps success

High availability, multi-region, isolated failure domains

- Prometheus, Grafana and Service Health



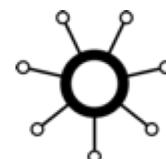
Prometheus



Grafana



fluentd



elasticsearch



kibana



splunk>



Thanos



influxdb

Telemetry everywhere



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Internal “public” alert stream of clusters in slack, Application specific channels provides for **proactive** alerting and support

RCEID	HEALTH_STATUS	APPLICATION	ENVIRONMENT	WORKLOAD	STACK	ROLE
	Healthy	k8s	Non-Production::plab	Cloud Core	K8s-PLAB-Master	Master
	Healthy	k8s	Non-Production::plab	UNTAGGED	K8s-PRD-Prometheus-Agent	Prometheus
	Healthy	k8s	Non-Production::NPE	Cloud Core	K8s-DEV-ES-Agent	ES
	Healthy	k8s	Production::prd	Cloud Core	K8s-PRD-Ingress-EX-Agent	K8s Agent
	Healthy	k8s	Non-production::dev	UNTAGGED	K8s-L3-DEV-Etcd	Etcd
	Healthy	k8s	Non-Production::dev	Cloud Core	k8s-agent	K8s Agent
	Healthy	k8s	Non-Production::dev	Cloud Core	k8s-agent	K8s Agent
	Healthy	k8s	Non-production::stg	lyr	K8s-L3-STG-Prometheus-Agent	Prometheus
	Healthy	k8s	Non-production::dev	Cloud Core	K8s-PRD-GenAgent	K8s Agent
	Healthy	k8s	Non-Production::plab	UNTAGGED	K8s-PLAB-Etcd	Etcd
	Healthy	k8s	Non-Production::dev	Cloud Core	K8s-DEV-Etcd	Etcd
	Healthy	k8s	Production::prd	Cloud Core	K8s-PRD-Master	Master
	Healthy	k8s	Non-Production::DEV	UNTAGGED	K8s Master	Master
	Healthy	k8s	Non-production::dev	Cloud Core	K8s-PRD-GenAgent	K8s Agent
	Healthy	k8s	Non-Production::PRD	Cloud Core	K8s-PRD-ES-Agent	ES
	Healthy	k8s	Non-Production::dev	Cloud Core	k8s-agent	K8s Agent
	Healthy	k8s	Non-production::NPE	Cloud Core	K8s-STG-Grafana	K8s Grafana
	Healthy	k8s	Non-production::dev	Cloud Core	K8s-PRD-GenAgent	K8s Agent
	Healthy	k8s	Production::prd	Cloud Core	K8s-PRD-Master-Upgrade	Master
	Healthy	k8s	Non-Production::NPE	Cloud Core	K8s-DEV-ES-Agent	ES

#duck-k8s-alerts-ddped

[OK] PRD K8S DD-ETCD - Disk Usage [All Partitions] alert

Grafana v5.3.3 Dec 5th (63 KB)

[Alerting] PRD K8S DD-ETCD - Disk Usage [All Partitions] alert

ETCD Disk usage is High. Please Check.

Grafana v5.3.3 Dec 5th (63 KB)

[OK] PRD K8S DD-ETCD - Disk Usage [All Partitions] alert

Grafana v5.3.3 Dec 5th (63 KB)

ETCD Disk usage is High. Please Check.

Grafana v5.3.3 Dec 5th (63 KB)

Process Status Alert

n alert for master. Please check

prd

```
# duck-app-dcp
# duck-app-dd
# duck-app-ftl
# duck-app-idc
# duck-app-isp
# duck-app-joi
# duck-app-lyr
# duck-app-map
# duck-app-pcc
# duck-app-tvs
# duck-k8s-alerts-ddprd
# duck-k8s-alerts-ddstg
# duck-k8s-alerts-dev
# duck-k8s-alerts-l3dev
# duck-k8s-alerts-l3prd
# duck-k8s-alerts-l3stg
# duck-k8s-alerts-plab
# duck-k8s-alerts-prod
# duck-k8s-alerts-stg
```

Ingress Dashboard



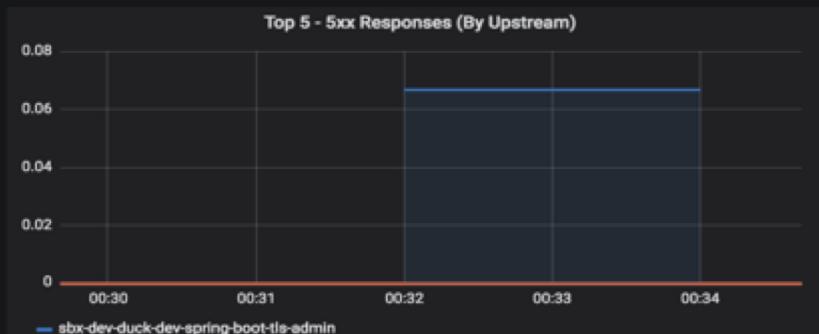
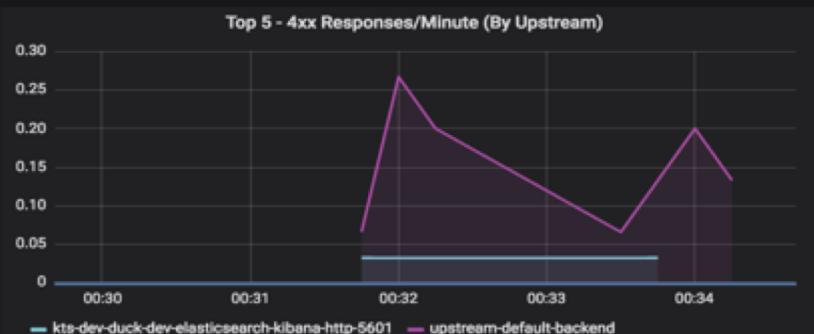
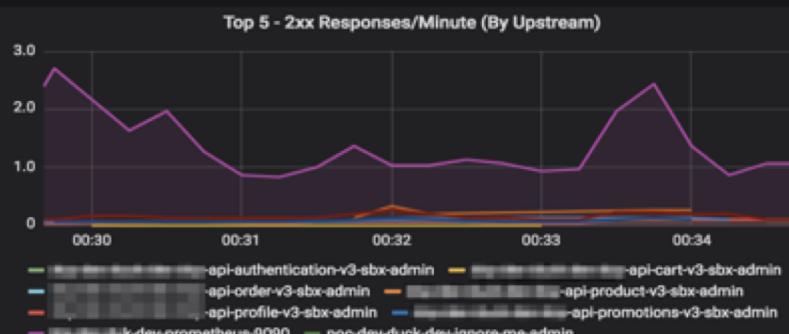
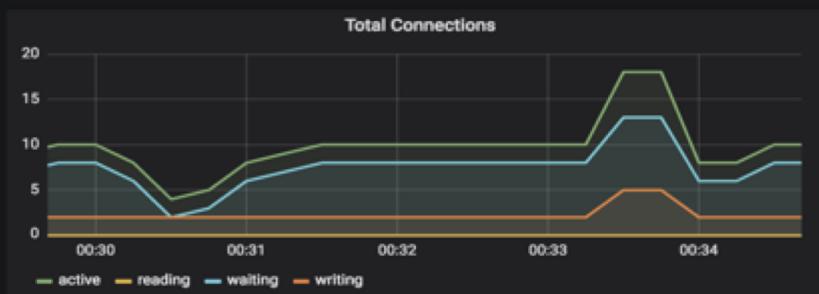
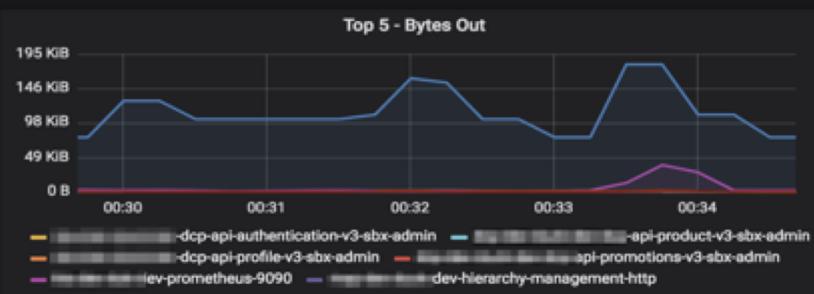
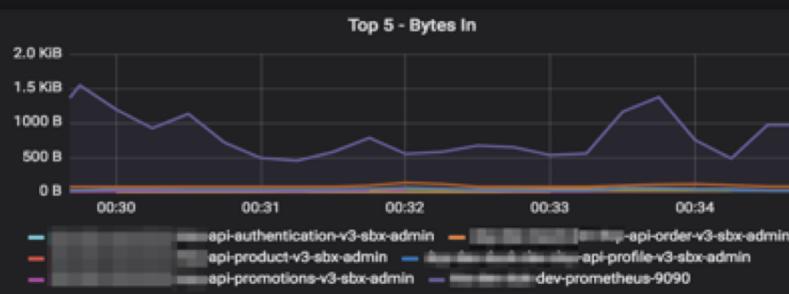
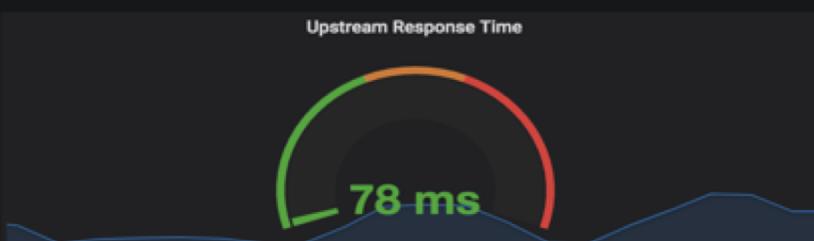
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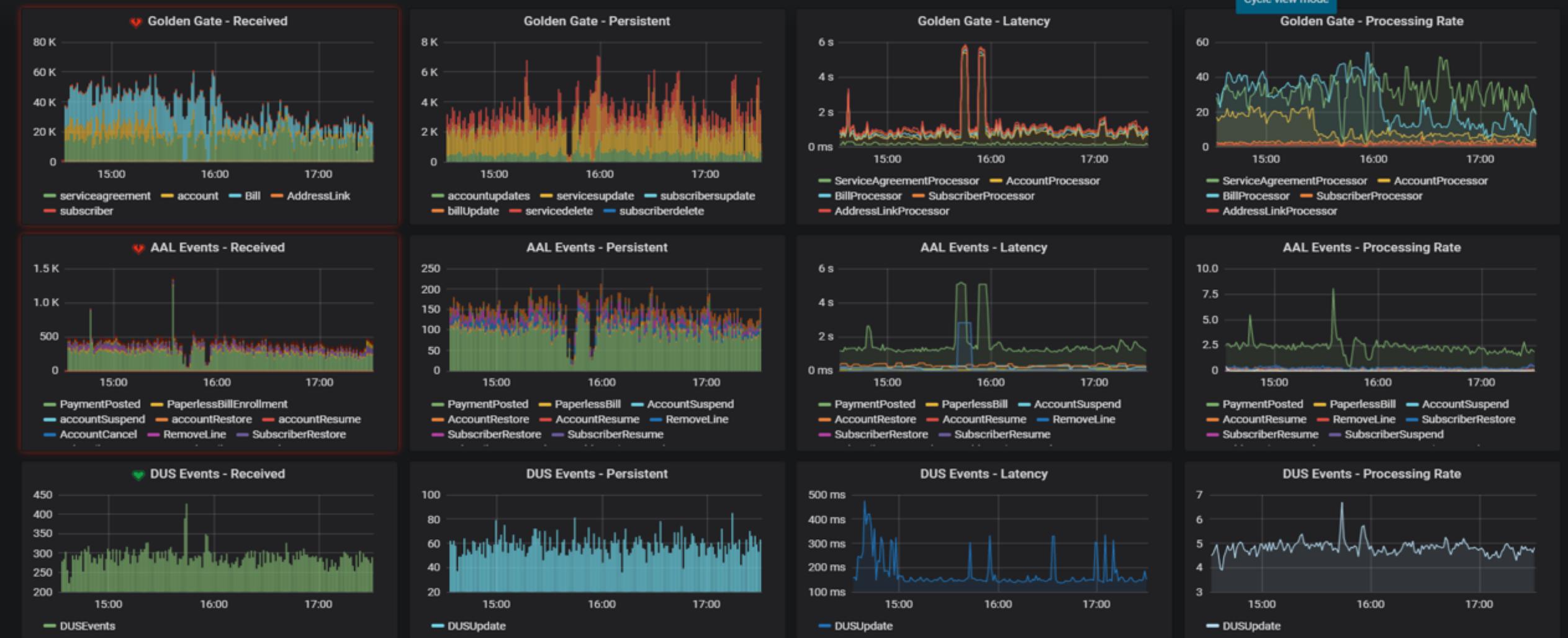
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K8S_DEV / DEV_K8S Nginx -



Operational Dashboard

App Redesign - Dashboard



API Dashboard



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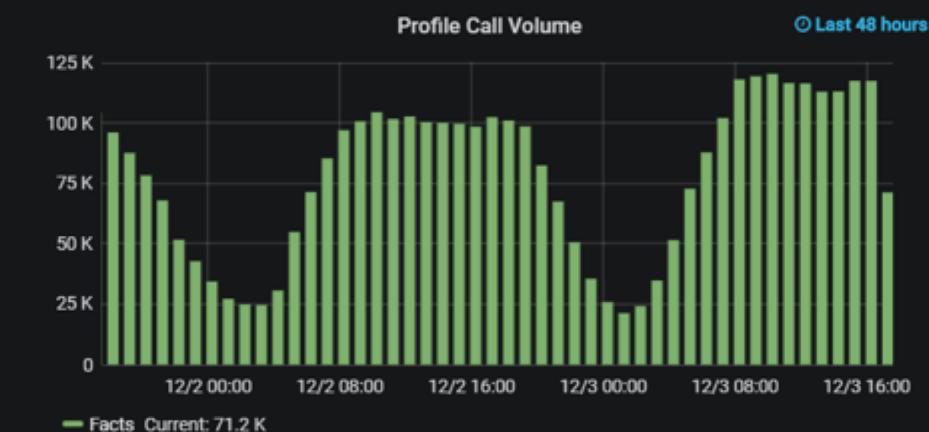
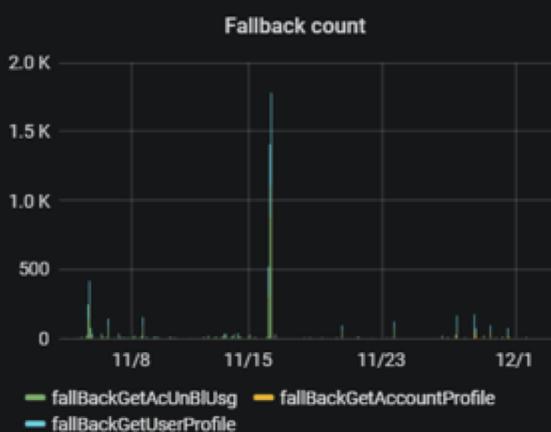
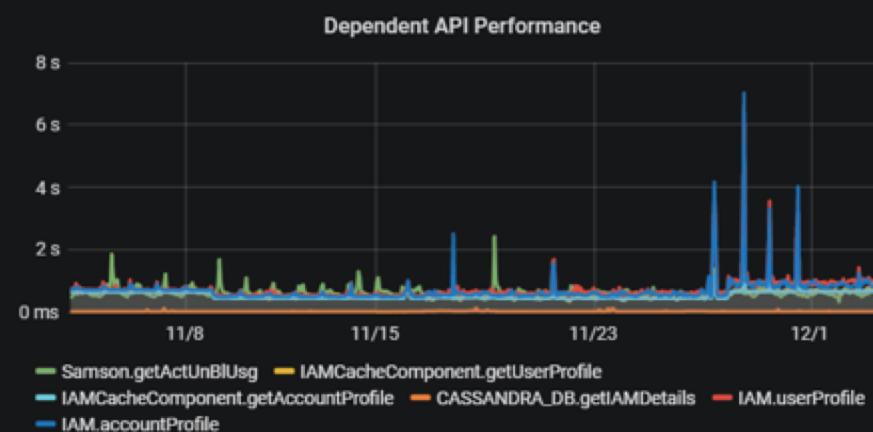
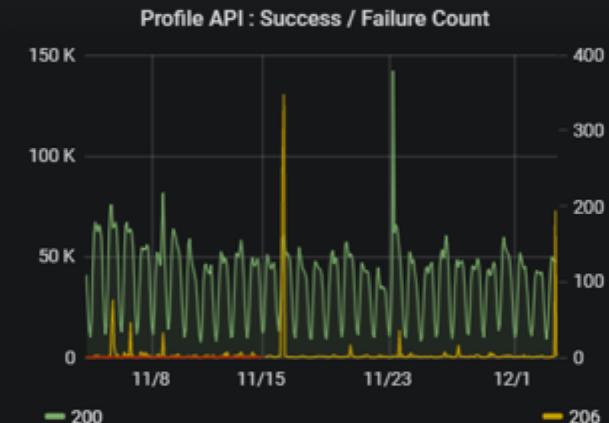
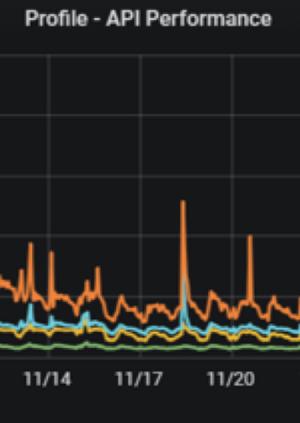
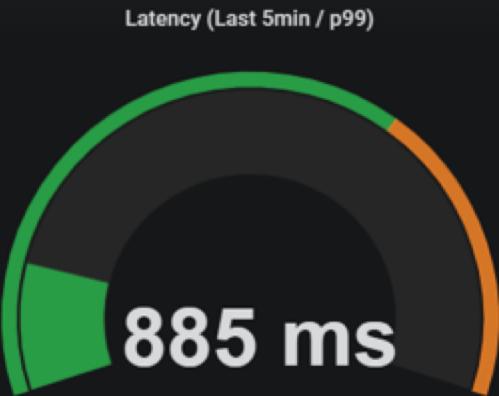


Service Dashboard

App Redesign CustomerProfile



Last 30 days Refresh every 1m



Call Flow Dashboard



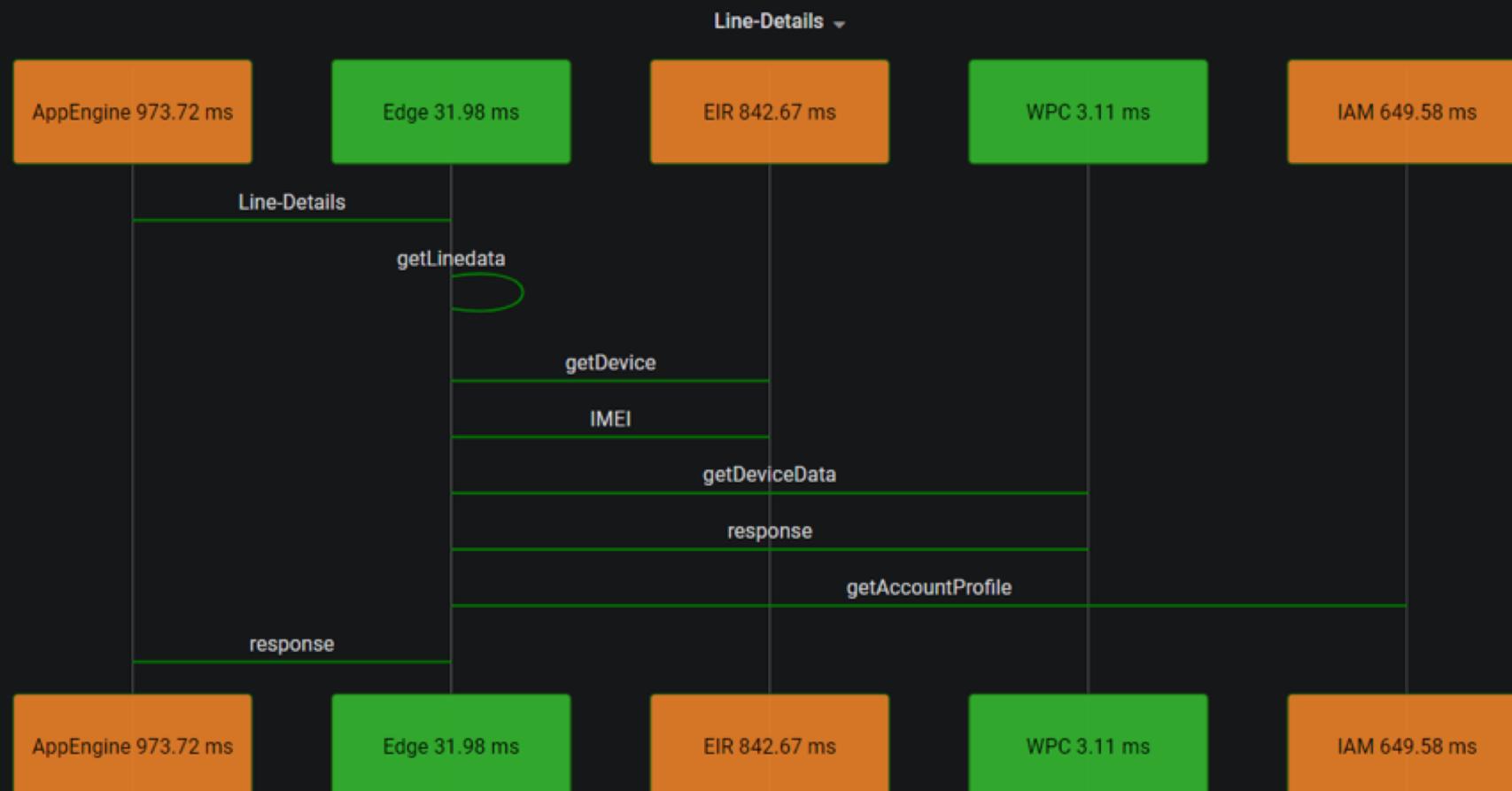
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Line-Details



Regional Service availability



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WEST

Login



Logout



Rate Plans



Devices



Customer Look-up



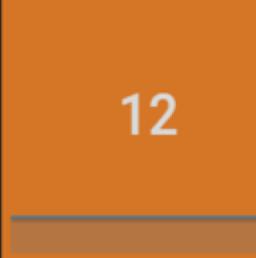
Order look-up



Accessories



Running Containers



EAST

Login



Logout



Rate Plans



Devices



Customer Look-up



Order look-up



Accessories



Running C...

12

Tabular example

Order API events														
Order Num ▾	Store	Order Indicators	Start Time	Status	GSM RP	GSM Device	MI RatePlanCart	MI Device	Review	Pay	Submitted	Error		
80291094	10553		2018-12-04T00:54:47.943Z	Success										
80291093	10553		2018-12-04T00:53:24.574Z	Success	✓	✓ FRP	✓			✓				
80291092	10553		2018-12-04T00:52:11.39Z	Success	✓	✓ EIP								
80291091	10553	EIP	2018-12-04T00:51:41.665Z	Success	✓	✓ EIP				✓				
80291089	10553		2018-12-04T00:50:17.987Z	Success										
80291085	10553		2018-12-04T00:48:34.147Z	Success						✓				
80291082	10553		2018-12-04T00:47:55.453Z	Success	✓	✓ FRP				✓				
80291079	10553		2018-12-04T00:45:53.51Z	Success						✓		✓		
80291074	10553	EIP	2018-12-04T00:42:24.443Z	Success			✓	✓ FRP	✓			✓		
80291070	10553	EIP	2018-12-04T00:41:52.551Z	Failure						✓	✓	✗	✗	Show Error
80291068	10553	EIP	2018-12-04T00:41:15.046Z	Failure						✓	✓	✗	✗	Show Error
80291060	10553		2018-12-04T00:44:33.91Z	Success										
80291058	10553	EIP	2018-12-04T00:55:36.225Z	Success						✓	✓			
80291052	10553	EIP	2018-12-04T00:41:15.654Z	Failure						✓	✓	✗	✗	Show Error
80291049	10553		2018-12-04T00:42:37.214Z	Success										
80290143	10553		2018-12-04T00:49:48.711Z	Success						✓		✓		
80290142	10553		2018-12-04T00:53:27.924Z	Success										

Background FTW



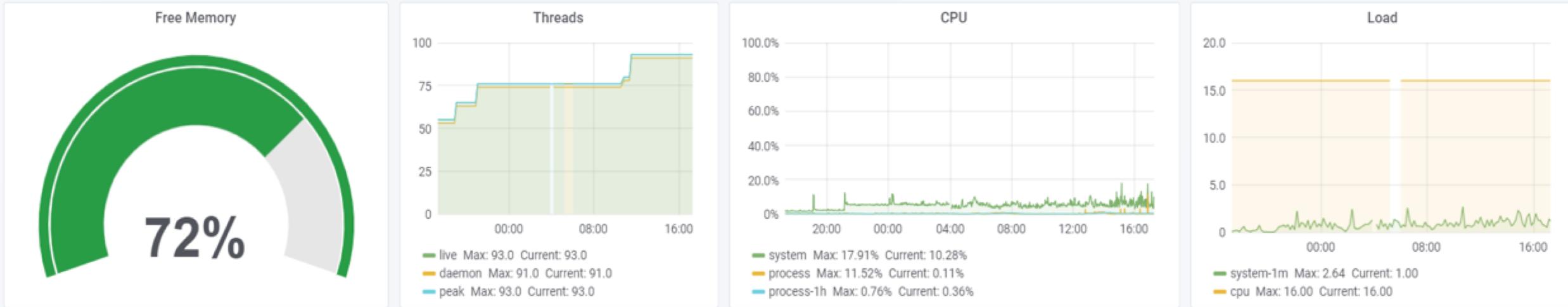
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▼ Health



Observe this: Cost

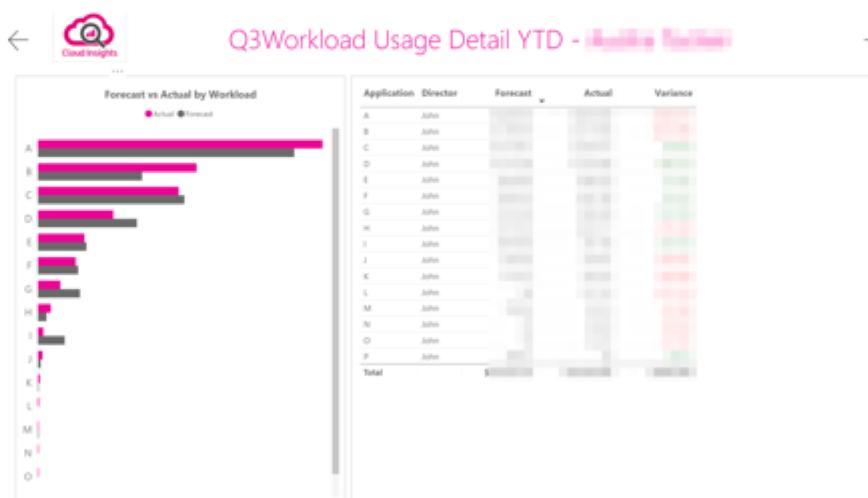
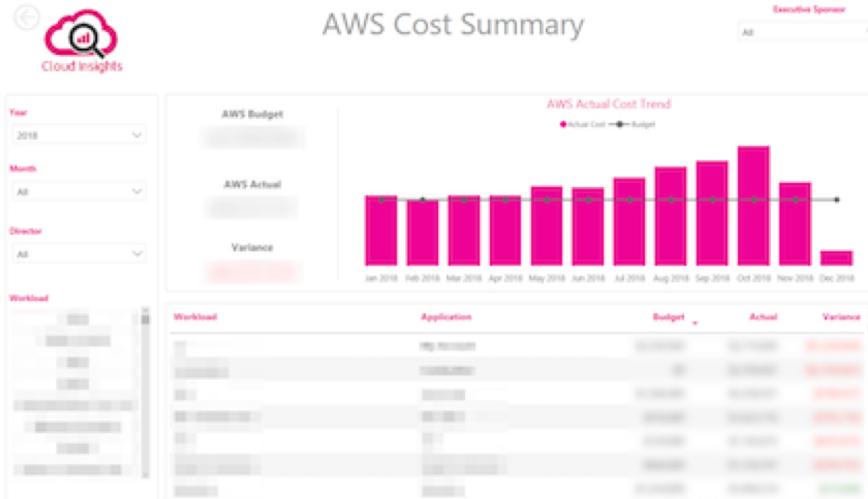


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Observe this: Cost

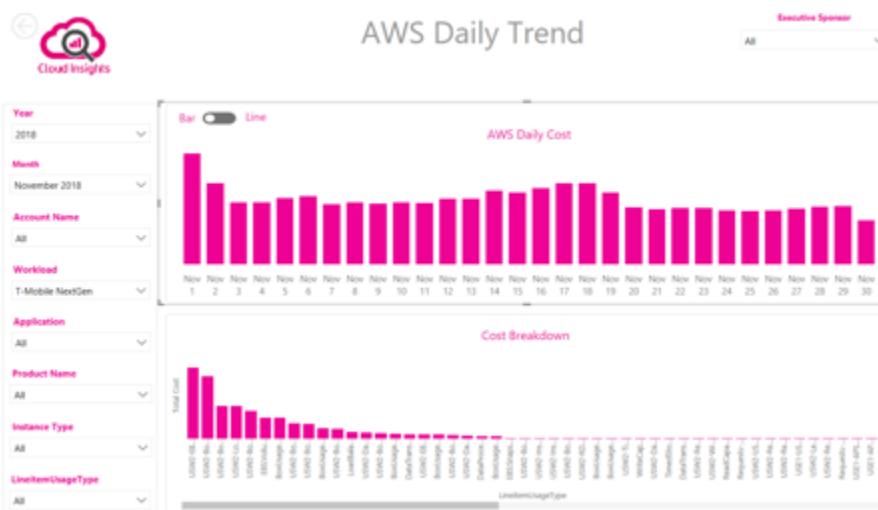
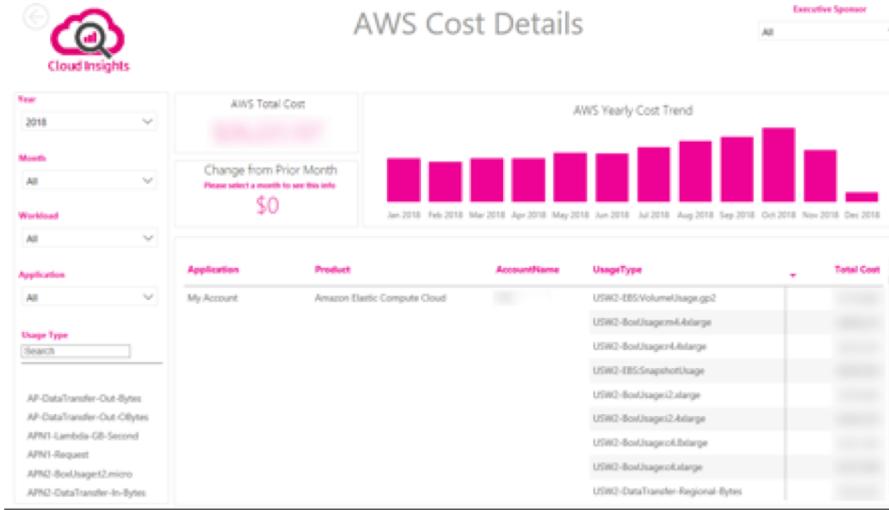


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Showback

- Proactive recommendations
 - Create a culture of cost awareness
 - Give execs and developers decision tools

What's your σ_{memUtil} ?

Data Lake

- Prometheus data and cost data
- Utilization analysis in Spark

Short run containers

- 600k unique containers run in a month >90% less than a day
- CPU not a factor, but memory....

Avg. Utilization	Std. Deviation
51.49%	31.35%





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Reference of images

Others / Dev_K8S Nodes Copy vmx -		DEV Critical Pods		STG Critical Pods		PLB Critical Pods	
container_name	Image ▾	container_name	Image ▾	container_name	Image ▾	container_name	Image ▾
weave	weaveworks/weave-kube:2.5.0	weave	weaveworks/weave-kube:2.4.1	weave	weaveworks/weave-kube:2.4.1	weave	weaveworks/weave-kube:2.4.1
external-dns	registry.opensource.zalan.do/teapot/external-dns:v0.5.0	external-dns	registry.opensource.zalan.do/teapot/external-dns:v0.5.1	external-dns	registry.opensource.zalan.do/teapot/external-dns:v0.5.1	external-dns	registry.opensource.zalan.do/teapot/external-dns:v0.5.1
nginx-ingress-controller-internal	quay.io/kubernetes-ingress-controller/nginx-ingress-controller:0.15.0	nginx-ingress-controller-external	quay.io/kubernetes-ingress-controller/nginx-ingress-controller:0.10.2	nginx-ingress-controller-internal	quay.io/kubernetes-ingress-controller/nginx-ingress-controller:0.10.2	nginx-ingress-controller-internal	quay.io/kubernetes-ingress-controller/nginx-ingress-controller:0.10.2
nginx-ingress-controller-external	quay.io/kubernetes-ingress-controller/nginx-ingress-controller:0.10.2	kube-state-metrics	quay.io/coreos/kube-state-metrics:v1.3.1	kube-state-metrics	quay.io/coreos/kube-state-metrics:v1.3.1	nginx-ingress-controller-external	quay.io/kubernetes-ingress-controller/nginx-ingress-controller:0.10.2
kube-state-metrics	quay.io/coreos/kube-state-metrics:v1.3.1	kubernetes-dashboard	k8s.gcr.io/kubernetes-dashboard-amd64:v1.8.3	kubernetes-dashboard	k8s.gcr.io/kubernetes-dashboard-amd64:v1.8.3	kube-state-metrics	quay.io/coreos/kube-state-metrics:v1.4.0
kubernetes-dashboard	k8s.gcr.io/kubernetes-dashboard-amd64:v1.8.3	kube-proxy	k8s.gcr.io/kube-proxy:v1.12.3	kube-proxy	k8s.gcr.io/kube-proxy:v1.12.3	kubernetes-dashboard	k8s.gcr.io/kubernetes-dashboard-amd64:v1.10.0
kube-proxy	k8s.gcr.io/kube-proxy:v1.12.3	heapster	k8s.gcr.io/heapster-amd64:v1.4.2	heapster	k8s.gcr.io/heapster-amd64:v1.4.2	kube-proxy	k8s.gcr.io/kube-proxy:v1.12.3
heapster	k8s.gcr.io/heapster-amd64:v1.4.2	fluentd-es	k8s.gcr.io/fluentd-elasticsearch:v2.2.0	fluentd-es	k8s.gcr.io/fluentd-elasticsearch:v2.2.0	heapster	k8s.gcr.io/heapster-amd64:v1.4.2
fluentd-es	k8s.gcr.io/fluentd-elasticsearch:v2.2.0	coredns	k8s.gcr.io/coredns:1.2.2	coredns	k8s.gcr.io/coredns:1.2.2	fluentd-es	k8s.gcr.io/fluentd-elasticsearch:v2.2.0
coredns	k8s.gcr.io/coredns:1.2.2	cluster-autoscaler	k8s.gcr.io/cluster-autoscaler:v1.2.2	cluster-autoscaler	k8s.gcr.io/cluster-autoscaler:v1.2.2	coredns	k8s.gcr.io/coredns:1.2.2
cluster-autoscaler	k8s.gcr.io/cluster-autoscaler:v1.2.2	kube2iam	jtblin/kube2iam:latest	kube2iam	jtblin/kube2iam:latest	cluster-autoscaler	k8s.gcr.io/cluster-autoscaler:v1.2.2
kube2iam	jtblin/kube2iam:latest	ark	gcr.io/heptio-images/ark:latest	ark	gcr.io/heptio-images/ark:latest	kube2iam	jtblin/kube2iam:latest
ark	gcr.io/heptio-images/ark:v0.9.8	metrics-server	gcr.io/google_containers/metrics-server-amd64:v0.2.1	metrics-server	gcr.io/google_containers/metrics-server-amd64:v0.2.1	ark	gcr.io/heptio-images/ark:latest
metrics-server	gcr.io/google_containers/metrics-server-amd64:v0.2.1	DEV Nodes					
container_runtime_version	kernel_version ▾	kubelet_version	label_nodegroup	node			
docker://17.3.1	3.10.0-957.1.3.el7.x86_64	v1.12.3	elasticsearch-cluster	ip-10-65-63-83.us-west-2.compute.internal			
docker://17.3.1	3.10.0-957.1.3.el7.x86_64	v1.12.3	elasticsearch-cluster	ip-10-65-61-175.us-west-2.compute.internal			
docker://17.3.0	3.10.0-957.1.3.el7.x86_64	v1.12.3		ip-10-65-57-237.us-west-2.compute.internal			
docker://17.3.1	3.10.0-957.1.3.el7.x86_64	v1.12.3	elasticsearch-cluster	ip-10-65-62-239.us-west-2.compute.internal			
docker://17.3.0	3.10.0-957.1.3.el7.x86_64	v1.12.3		ip-10-65-57-218.us-west-2.compute.internal			
docker://17.3.0	3.10.0-957.1.3.el7.x86_64	v1.12.3		ip-10-65-57-196.us-west-2.compute.internal			

container_runtime_version	kernel_version ▾	kubelet_version	label_nodegroup	node
docker://17.3.1	3.10.0-957.1.3.el7.x86_64	v1.12.3	elasticsearch-cluster	ip-10-65-63-83.us-west-2.compute.internal
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docker://17.3.1	3.10.0-957.1.3.el7.x86_64	v1.12.3	elasticsearch-cluster	ip-10-65-62-239.us-west-2.compute.internal
docker://17.3.0	3.10.0-957.1.3.el7.x86_64	v1.12.3		ip-10-65-57-218.us-west-2.compute.internal
docker://17.3.0	3.10.0-957.1.3.el7.x86_64	v1.12.3		ip-10-65-57-196.us-west-2.compute.internal

Health check map of K8s cluster

Dev/Stg Clusters

