



KubeCon



CloudNativeCon

North America 2018

Observability at Scale

A key tenet of multi-tenancy

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T-Mobile Cloud Team



About T-Mobile



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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



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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



Ingress Dashboard



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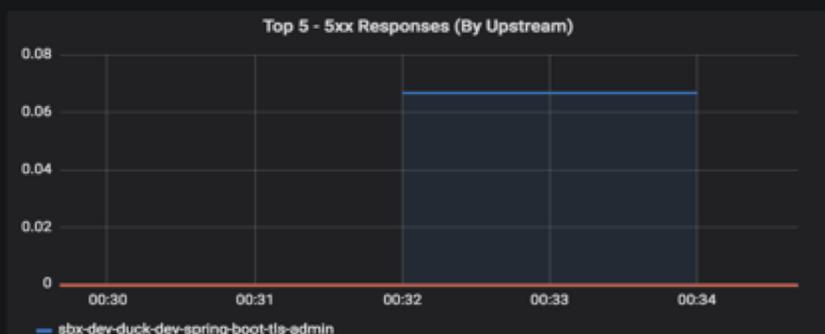
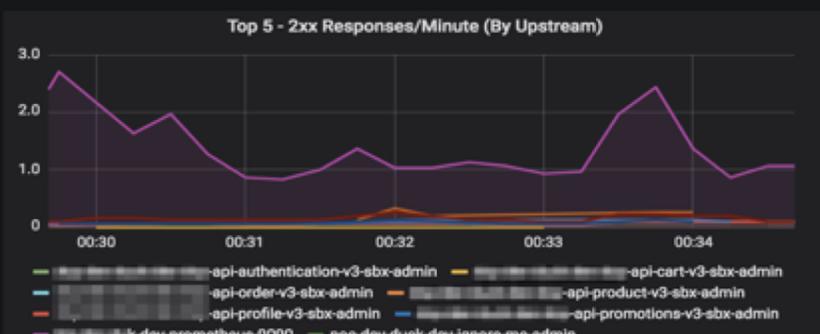
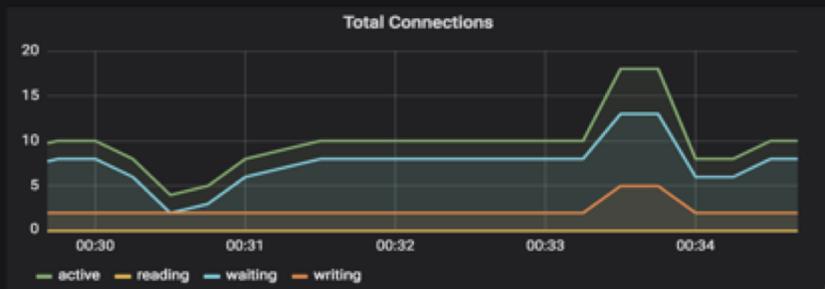
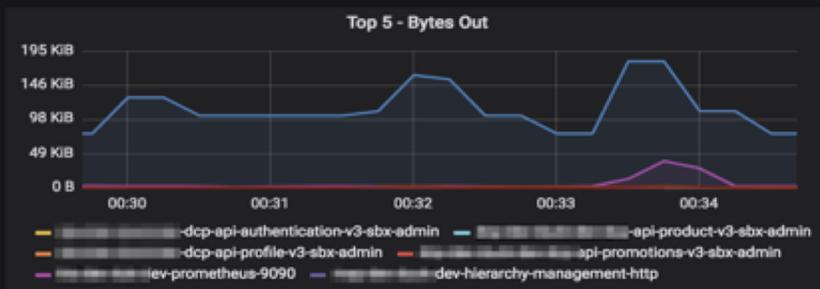
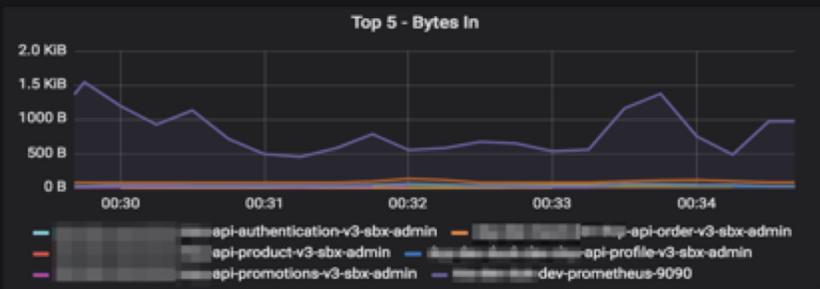
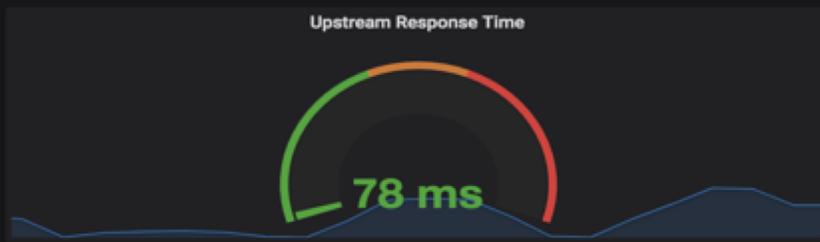
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K8S_DEV / DEV_K8S Nginx -

Navigation icons: bar chart, star, share, print, settings, chat, Last 5 minutes, search, refresh

Health status summary: Response Time, 5xx Errors, 4xx Errors, Connection Errors. All are **Healthy**.



Operational Dashboard



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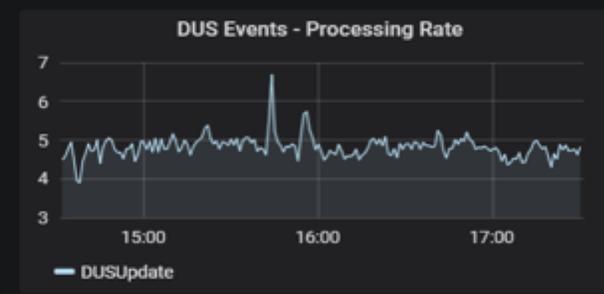
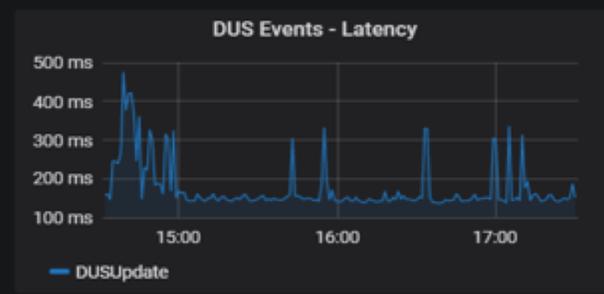
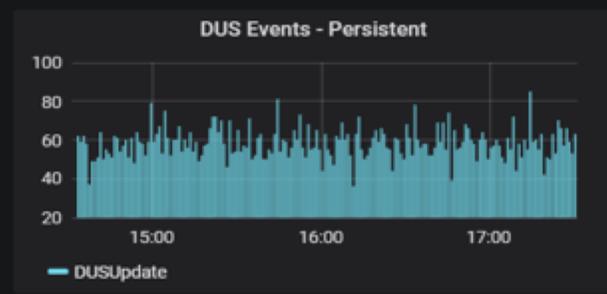
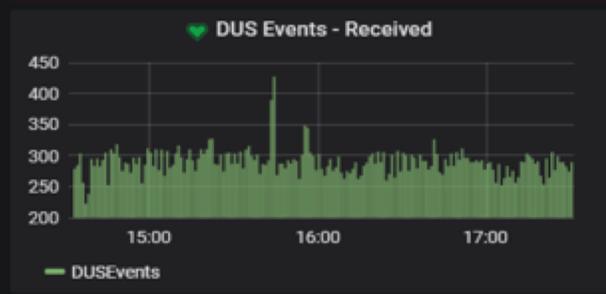
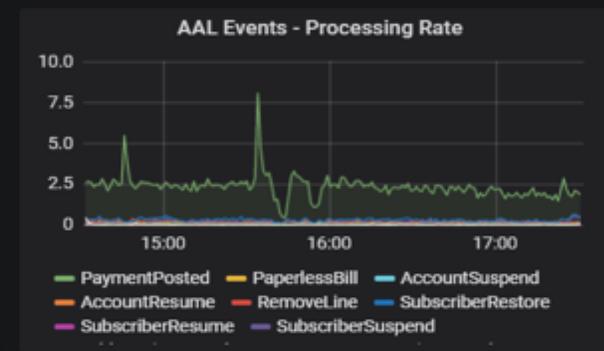
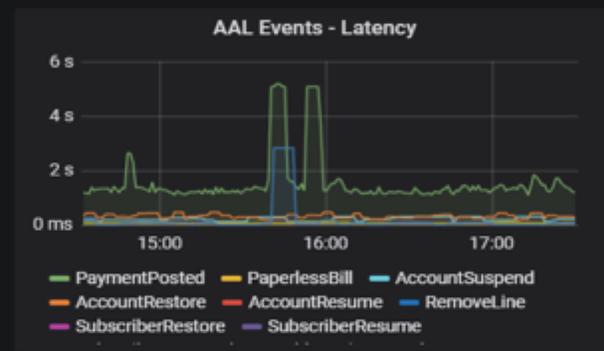
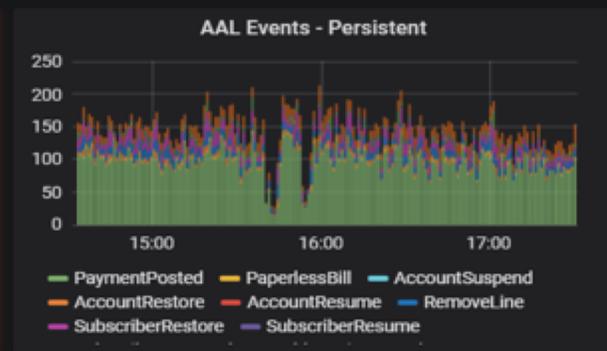
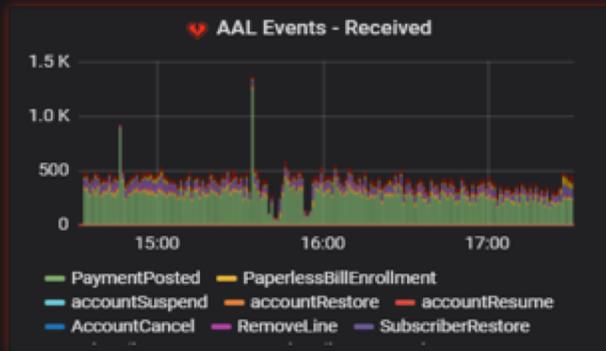
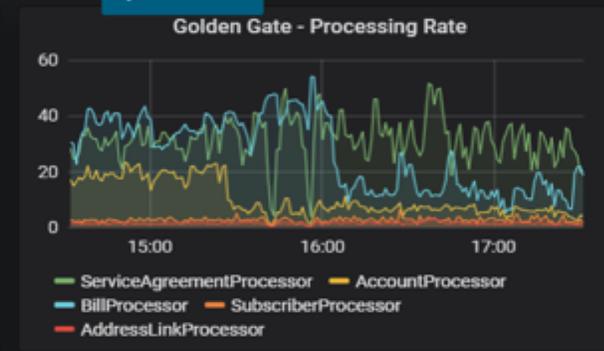
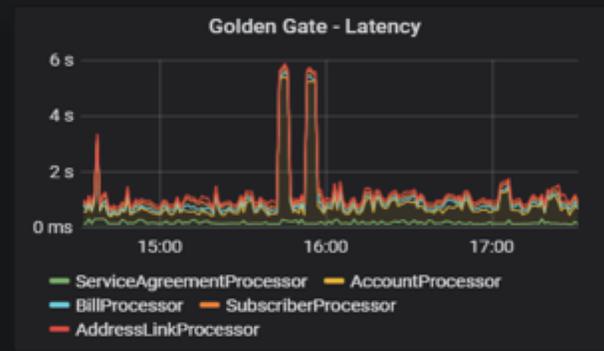
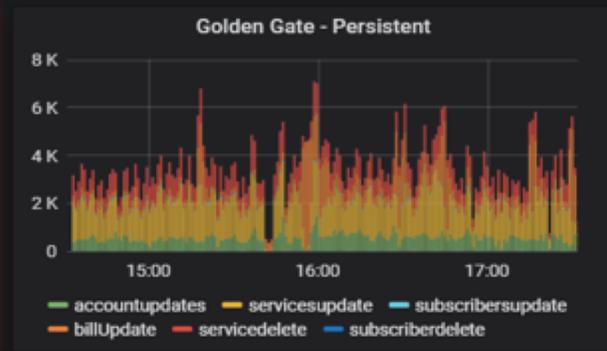
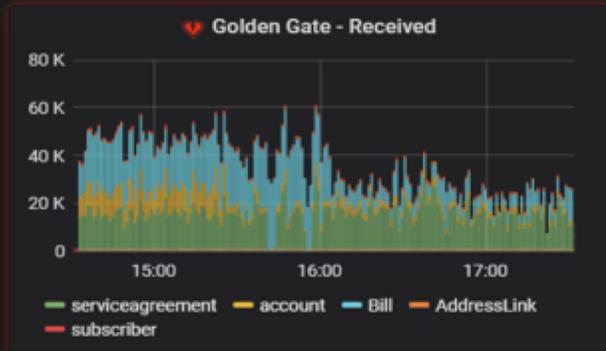
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App Redesign - Dashboard



Last 3 hours Refresh every 1m

Cycle view mode



API Dashboard



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App Redesign APIs



Last 3 hours

Refresh every 1m



GET Facts p99



501 ms

GET Customer p99



775 ms

GET Line-details p99



1.042 s

GET Usage p99



3.90 s

POST Seeder p99



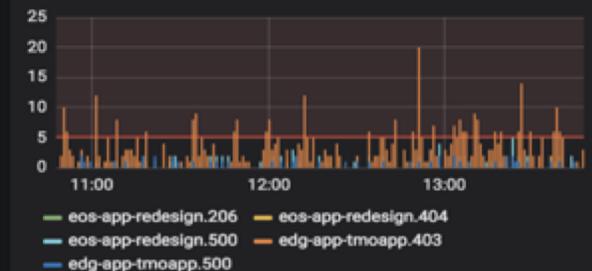
887 ms

GET PaymentArrangem...



615 ms

APIs Request Failures



Legend:
eos-app-redesign.206
eos-app-redesign.404
eos-app-redesign.500
edg-app-tmoapp.403
edg-app-tmoapp.500

Request Rate

33

Request Rate

30

Request Rate

43

Request Rate

1.7

Request Rate

9

Request Rate

30



600 ms
400 ms
200 ms
0 ms
12:00



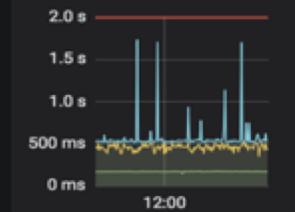
1.0 s
750 ms
500 ms
250 ms
0 ms
12:00



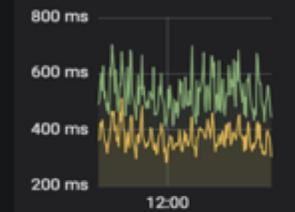
1.2 s
1.0 s
800 ms
600 ms
400 ms
12:00



6.0 s
5.0 s
4.0 s
3.0 s
2.0 s
12:00

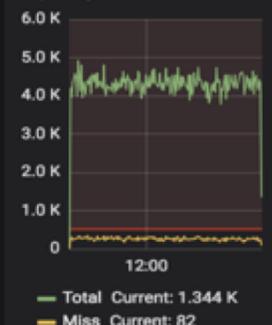


2.0 s
1.5 s
1.0 s
500 ms
0 ms
12:00



800 ms
600 ms
400 ms
200 ms
12:00

Edge Cache vs Direct...



Total Current: 1.344 K
Miss Current: 82

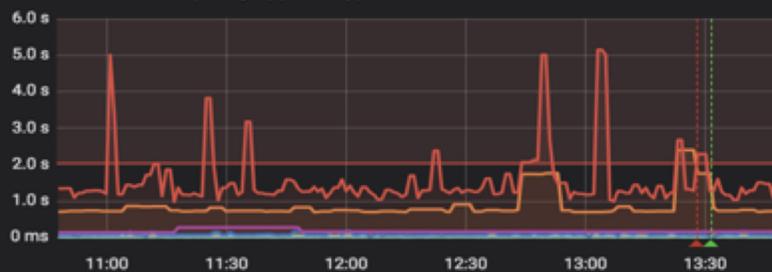
Cache HIT /MISS



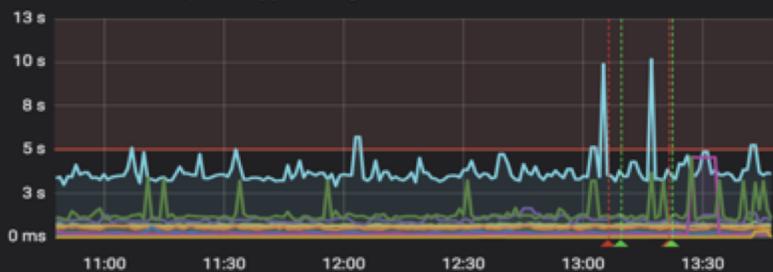
HIT 94.54%

MISS 5.46%

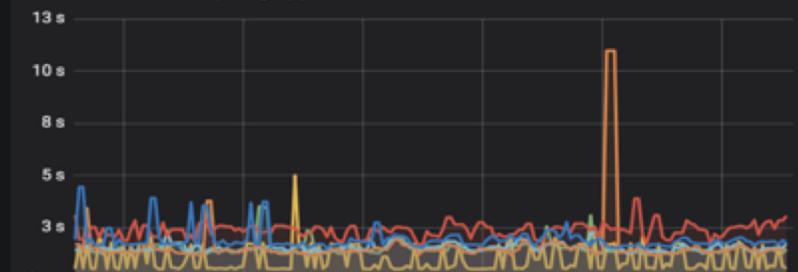
edg-app-tmoapp Backend API Performance



eos-app-redesign Backend API Performance



edg-app-seeder Backend API Performance



Service Dashboard



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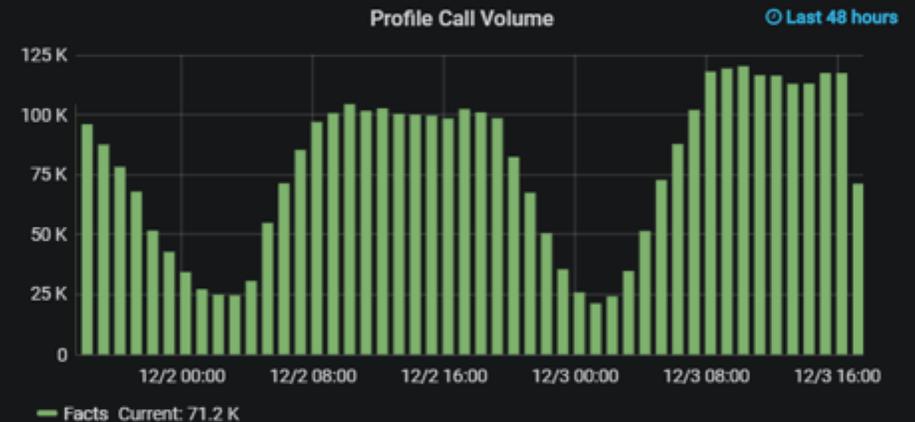
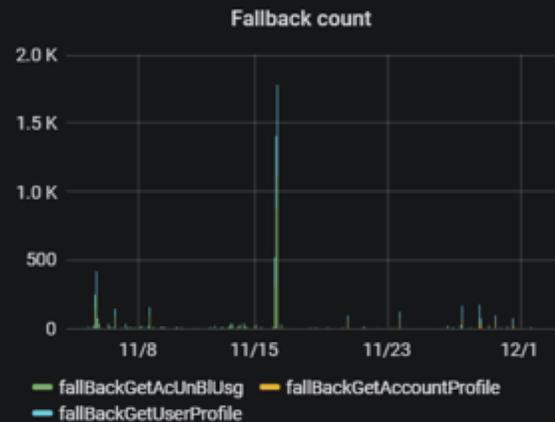
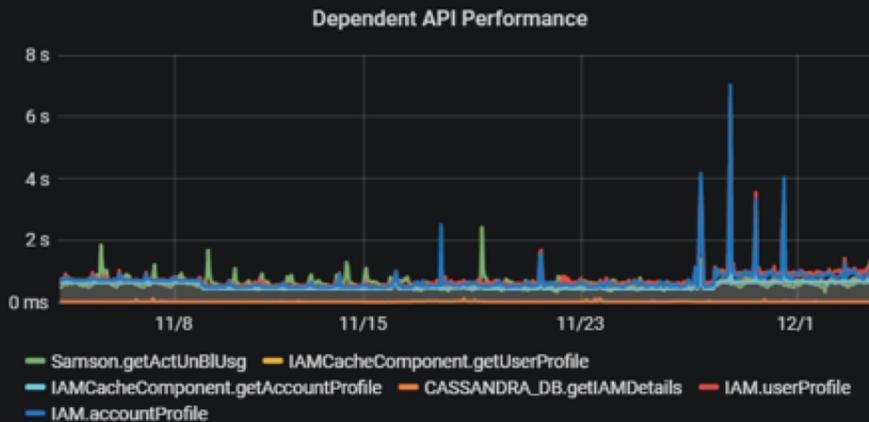
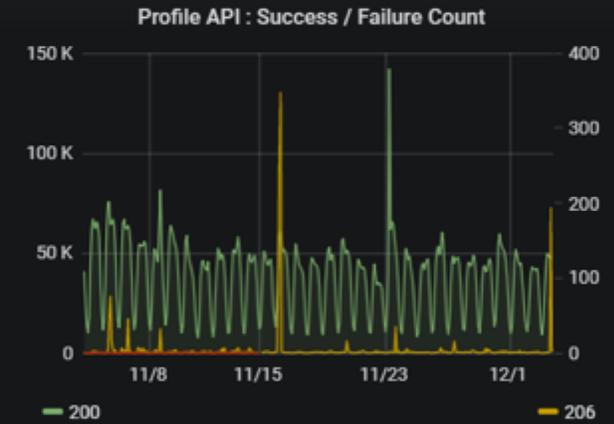
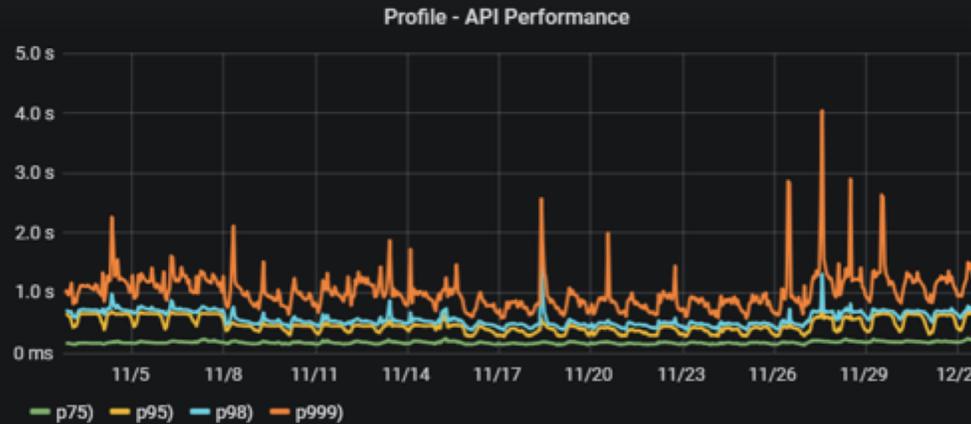
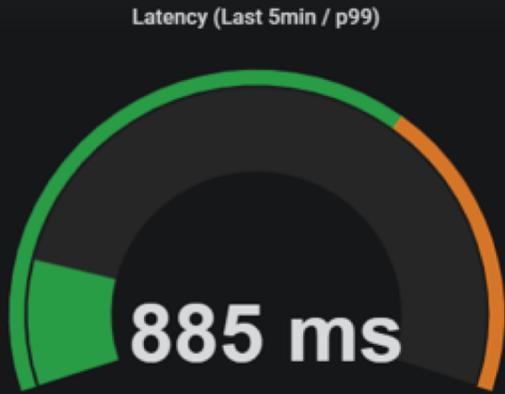
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App Redesign CustomerProfile



Last 30 days Refresh every 1m



Call Flow Dashboard



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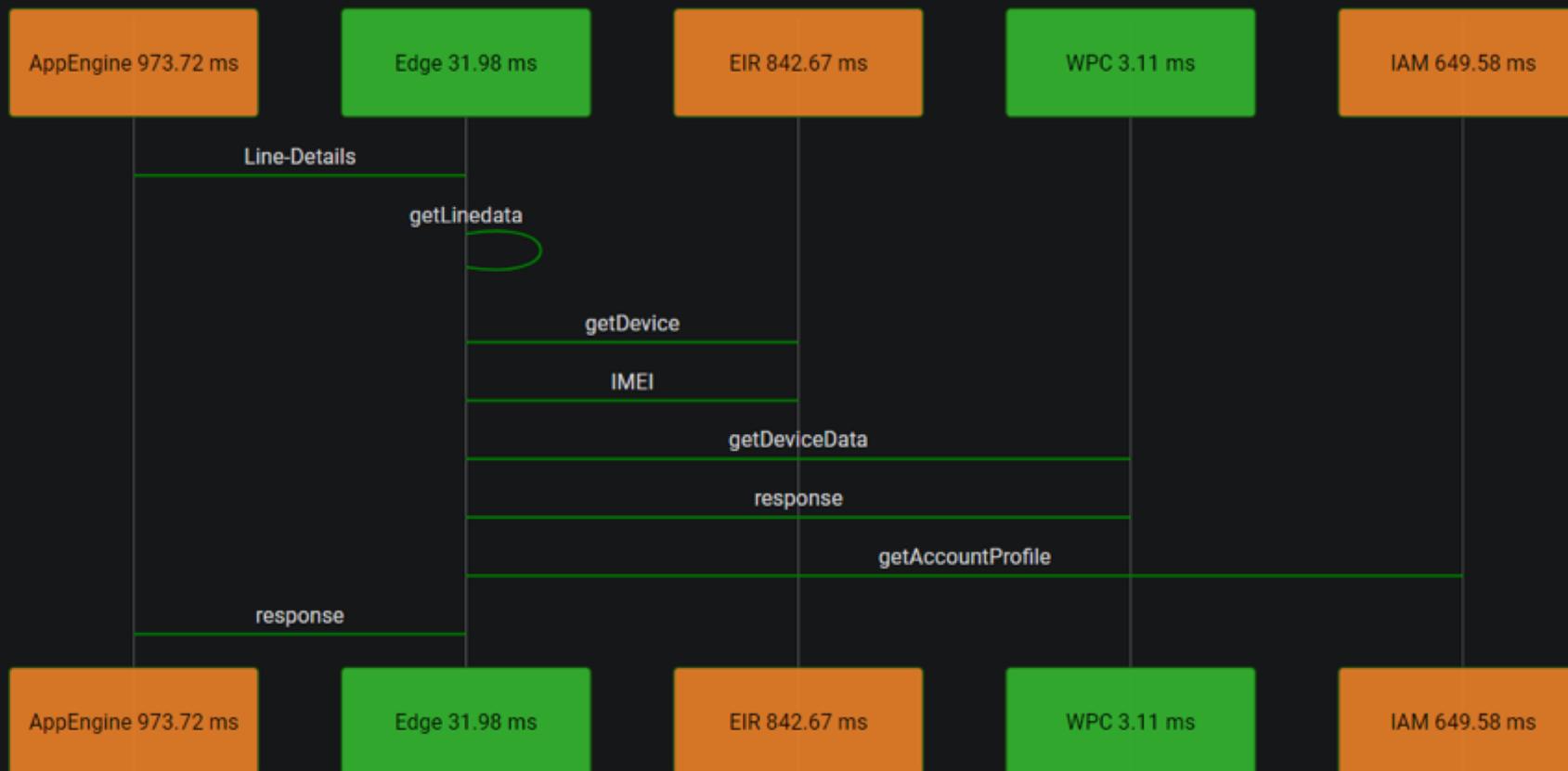


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Line-Details

Line-Details



Regional Service availability



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WEST

Login



Logout



Rate Plans



Devices



Customer Look-up



Order look-up



Accessories



Running Containers

12

EAST

Login



Logout



Rate Plans



Devices



Customer Look-up



Order look-up



Accessories



Running C...

12

Tabular example



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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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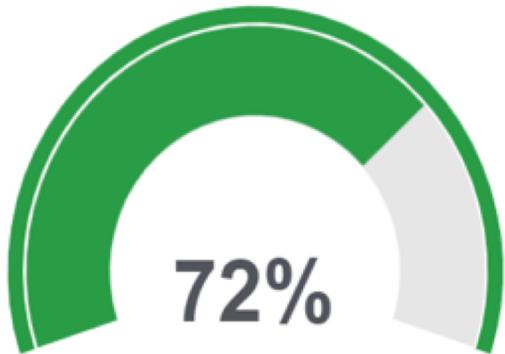


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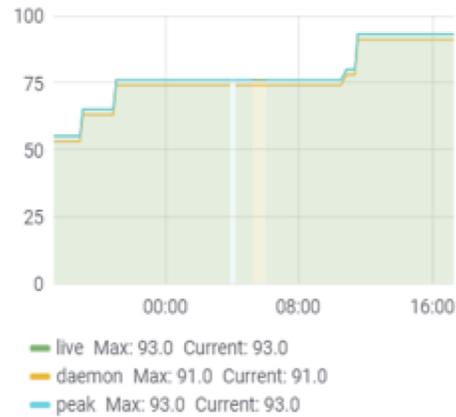
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Health

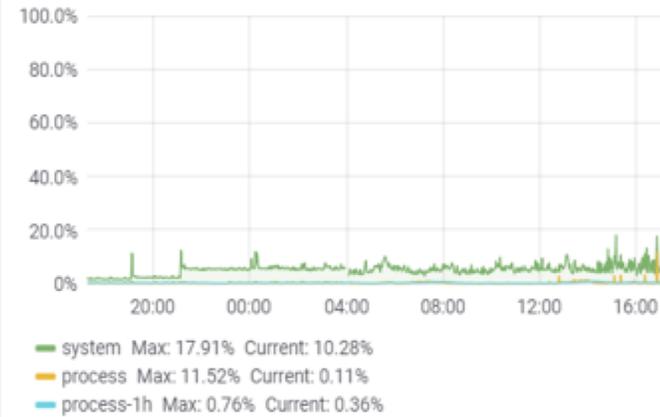
Free Memory



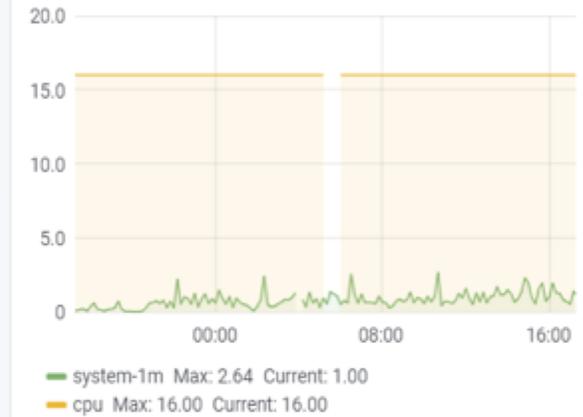
Threads



CPU

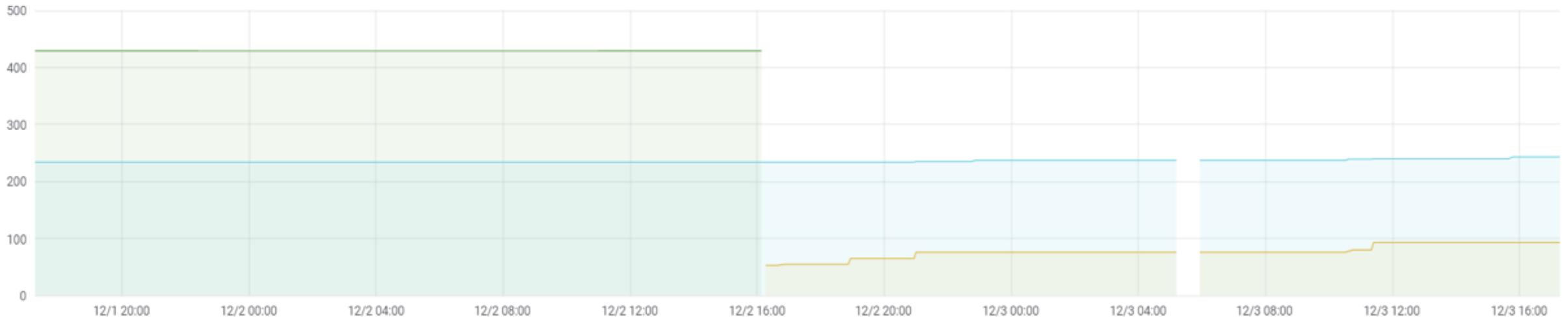


Load



Instances

Last 48 hours



Observe this: Cost

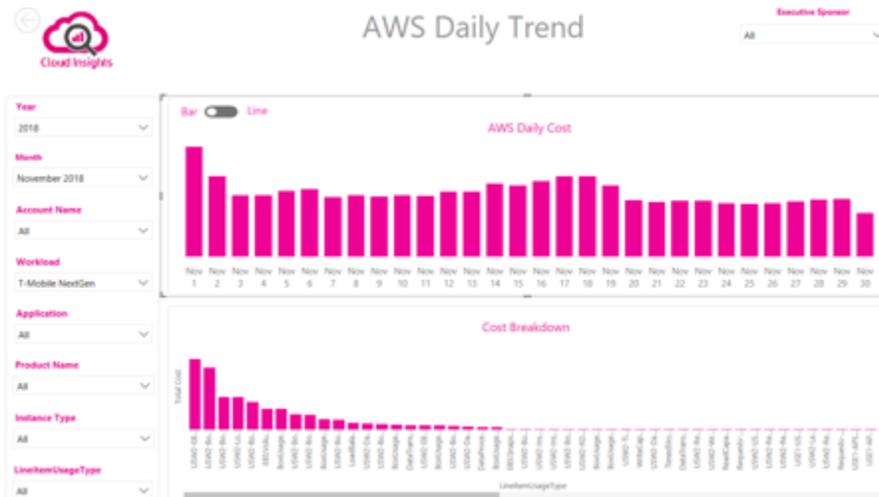
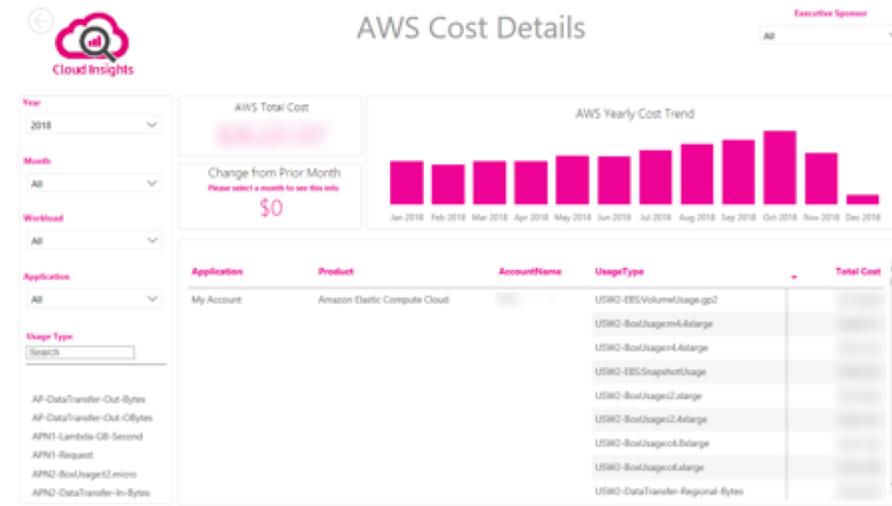


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Showback

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

What's your σ_{memUtil} ?



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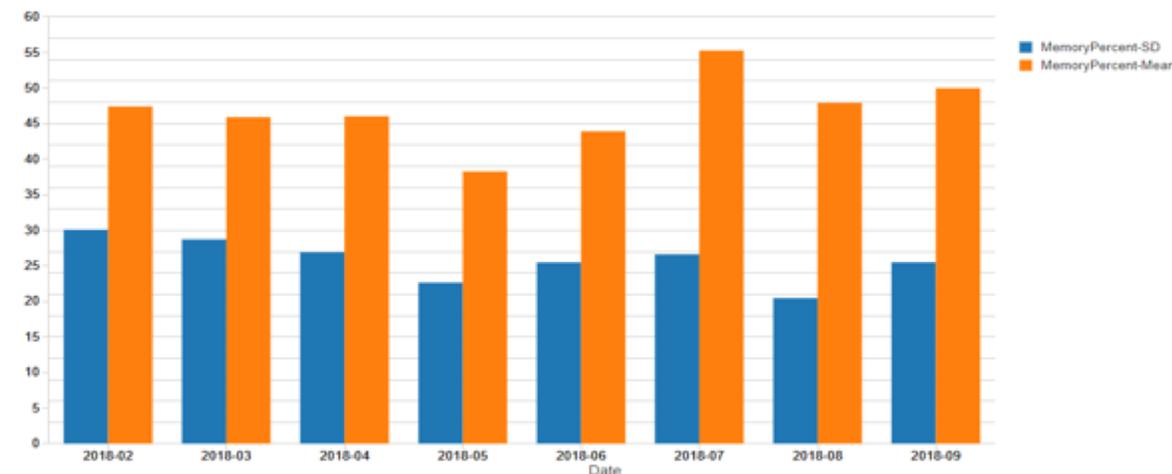
Data Lake

- 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



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Others / Dev_K8S Nodes Copy vmx -

Navigation icons: Home, Star, Refresh, Print, Settings, Chat, Last 5 minutes, Search, Reload

DEV Critical Pods

container_name	Image
weave	weaveworks/weave-kube:2.5.0
external-dns	registry.opensource.zalan.do/teapot/external-dns:v0.5.0
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
kube-state-metrics	quay.io/coreos/kube-state-metrics:v1.3.1
kubernetes-dashboard	k8s.gcr.io/kubernetes-dashboard-amd64:v1.8.3
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
coredns	k8s.gcr.io/coredns:1.2.2
cluster-autoscaler	k8s.gcr.io/cluster-autoscaler:v1.2.2
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

STG Critical Pods

container_name	Image
weave	weaveworks/weave-kube:2.4.1
external-dns	registry.opensource.zalan.do/teapot/external-dns:v0.5.1
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
kube-state-metrics	quay.io/coreos/kube-state-metrics:v1.3.1
kubernetes-dashboard	k8s.gcr.io/kubernetes-dashboard-amd64:v1.8.3
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
coredns	k8s.gcr.io/coredns:1.2.2
cluster-autoscaler	k8s.gcr.io/cluster-autoscaler:v1.2.2
kube2iam	jtblin/kube2iam:latest
ark	gcr.io/heptio-images/ark:latest
metrics-server	gcr.io/google_containers/metrics-server-amd64:v0.2.1

PLB Critical Pods

container_name	Image
weave	weaveworks/weave-kube:2.4.1
external-dns	registry.opensource.zalan.do/teapot/external-dns:v0.5.1
nginx-ingress-controller-internal	quay.io/kubernetes-ingress-controller/nginx-ingress-controller:0.10.2
nginx-ingress-controller-external	quay.io/kubernetes-ingress-controller/nginx-ingress-controller:0.10.2
kube-state-metrics	quay.io/coreos/kube-state-metrics:v1.4.0
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
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
kube2iam	jtblin/kube2iam:latest
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

Health check map of K8s cluster



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Dev/Stg Clusters

