



EOSDIS

NASA'S EARTH OBSERVING SYSTEM
DATA AND INFORMATION SYSTEM

Cloud onboarding with NGAP

Cloud Onboarding Session
ESIP Summer Meeting 2017
11am July 27th 2016

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Agenda

- Three important things
- How things do (and don't) change
 - Deployment
 - Configuration
 - Security
 - External communications
 - Scaling
 - Logging
 - Monitoring
 - Metrics
 - Contingency and Recovery
- How did it go with the Common Metadata Repository?

THREE IMPORTANT THINGS

1. What is NGAP?

- **Next Generation Application Platform**
- NGAP is the **NASA Compliant General Application Platform**. It provides a cloud-based Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service (IaaS) for EOSDIS applications.

- Formulation
- Implementation
- Primary Ops
- Extended Ops

Sentinel-6A/B

Earth Science Instruments on ISS:

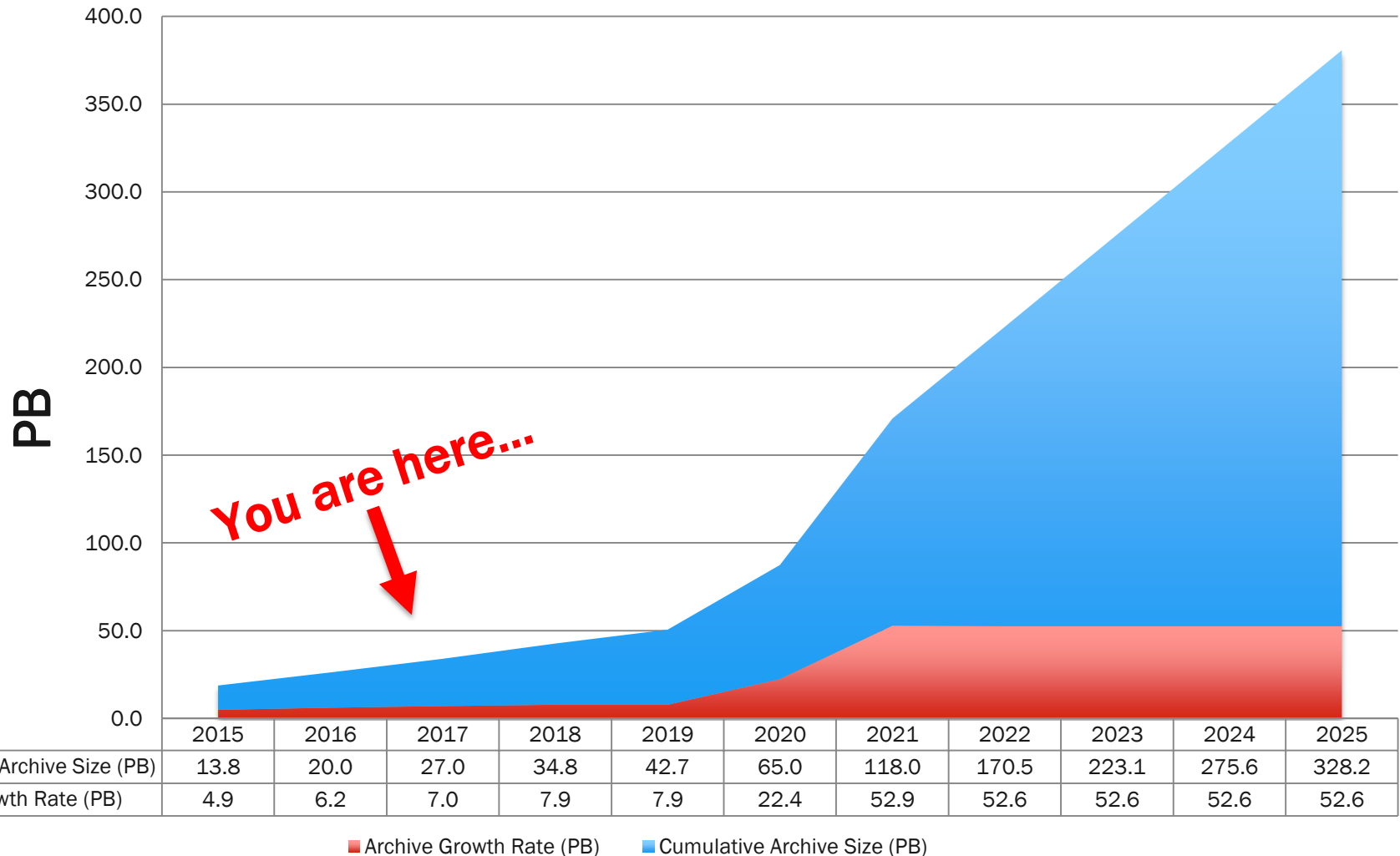
RapidScat, CATS,
 LIS, SAGE III (on ISS), TSIS-1, OCO-3, ECOSTRESS,
 GEDI, CLARREO-PF



12 Discipline Oriented DAACs



EOSDIS Archive Growth Estimate (Prime + Extended)





ExCEL Efforts and Project Prototypes



NGAP

NASA Compliant General Application Platform (NGAP), an operational, dev-ops, and sandbox AWS cloud based operating environment.

ASF WOS Prototype

AWS/NGAP Web Object Storage (WOS) prototyping large volumes of mission data dynamically between AWS S3, S3-IA, and Glacier object storage. Managed out of Alaska Satellite Facility

Earthdata Search Client to Cloud

NASA Earth Science data search by keyword and advanced filters such as time and space

Cumulus

Prototype addressing core EOSDIS capabilities including data ingest, archive, management, and distribution of large volumes of EOS data.

Getting Ready for NISAR (GRFN)

Integrated prototype of science product generation and delivery from a DAAC system focused on coupling ASF DAAC and JPL ARIA systems.

CATEES

Easy-to-use Python tools packaged to support EOSDIS cross-DAAC science workflows and analytics over large volumes of EOS data in AWS.

ECC to Cloud Study

Earth Code Collaborative (ECC) study to determine cloud ready capabilities to migrate into AWS/NGAP platform.



ExCEL Efforts and Project Prototypes Continued

GIBS in the Cloud

Migrating GIBS to the AWS/NGAP Cloud based on recommendations made in the “GIBS in the Cloud Study”

Earthdata Login to Cloud Study

Study to determine and recommend migrating the Earthdata Login into AWS/NGAP cloud environment

CMR to Cloud

Migration of the Common Metadata Repository, into the AWS/NGAP platform based on recommendations made in the CMR to Cloud study.

OPeNDAP/HDF Cloud Studies

Study to determine and recommend a cloud native integration of OPeNDAP accessing HDF5 and netCDF4 data on AWS/NGAP platform.

NEXUS

Prototype to accelerate end-user analysis of remote sensing data, highly parallel to better enable science discovery

Network Prototypes

Network prototypes to support to test security, monitoring, logging, and to perform R&D testing to support all ExCEL project prototypes.





(01) Full Scale Deployment (?)

Full scale enterprise deployment of EOSDIS services and infrastructure to the cloud

01

02

(02) Partial Deployment (?)

Select deployment of EOSDIS services and/or infrastructure to the cloud

(03) Cloud Stand-down (?)

No EOSDIS services or infrastructure operationally migrated to the cloud

03

(04) Decision Point (?)

More prototyping required, or cloud hybrid, or other next steps based on ExCEL prototyping and business analysis results

04

Determining Project Success

Project success is determined by viable outcomes of fully completed project prototypes and business analysis.

- or -

Technical and business results of the ExCEL project needed for strategic decision on EOSDIS and the cloud.



NGAP as a Platform

NGAP Services

(Monitoring, Logging, Security, Autoscaling, Billing, etc.)

NASA's Office of the Chief Information Officer
(AWS Reseller)

A Rough Look at Separation



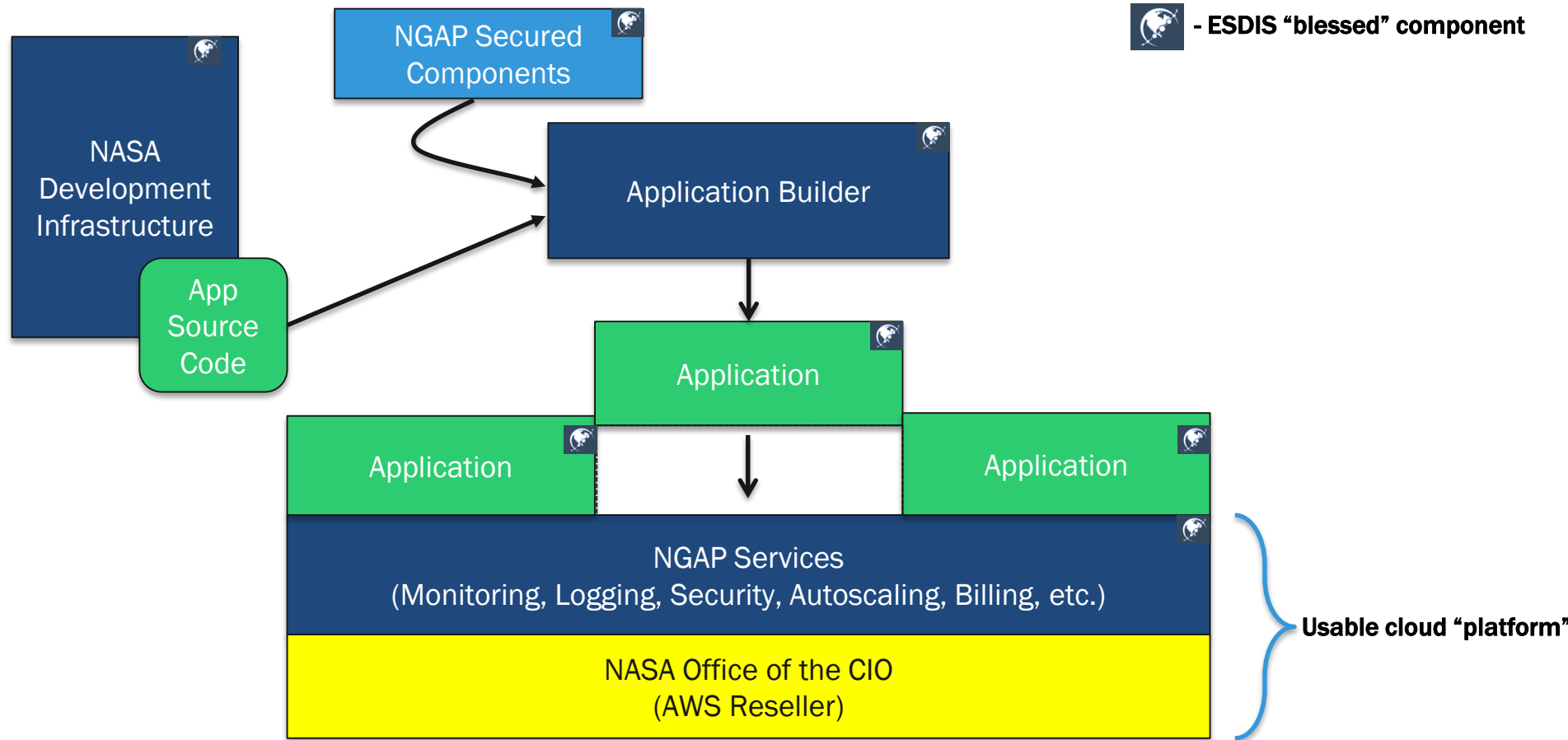
NGAP as a Platform

NGAP Services

(Monitoring, Logging, Security, Autoscaling, Billing, etc.)

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Layer security throughout the architecture



2. Instances are ephemeral

NGAP deployments follow a blue-green deployment process

To maximize the availability and performance of our applications, a deployment is spun up in parallel with the existing deployment. When the secondary deployment is ready it swaps with the existing deployment which is then discarded

NGAP application instances are not available in perpetuity

3. No ssh

To preserve the integrity of an application instance, ssh (secure shell) access is limited to NGAP personnel

**HOW THINGS DO (AND DON'T)
CHANGE**

Deployment

Bamboo is used to perform deployments

Production and UAT deployments are tightly controlled by the **DEVOPS** team

SIT deployments are controlled by the **development** team

Earthdata Operations maintain a [Deployment Doctrine](#) that is publicly available

Configuration

12-factor-app practices encourage the storage of configuration with the environment

We developed the Earthdata Environment Configuration Service (**EECS**) to configure our applications

EECS provides an API to read and write JSON-formatted configuration for our application on a per-environment basis

If an implementer chooses not to use EECS then configuration should be externalized from code

Security (1 of 2)

The responsibility for identifying and resolving security issues and software patches rests with the GP-MCE

They will release Amazon Machine Instances (AMIs) to NGAP

NGAP will release that AMI to NGAP PROD after SIT and UAT testing

The application team will deploy the new AMI with any deployment of their applications that exist in NGAP PROD

This approach has a number of elements that need to be allowed for

Security (2 of 2)

1. Not all applications have a presence in NGAP SIT and UAT
2. Once an AMI hits NGAP PROD all deployments there will use the new AMI*

*We plan to mitigate this by giving an operator choices in AMI at certain points

External communications

On-premises solutions generally have a static set of IP addresses that an external entity can expect traffic from

NGAP instances are ephemeral

NGAP applications have a range of possible IP addresses

Stick to standard ports if possible. Amazon Web Services (AWS)/GP-MCE/NGAP do not block outgoing traffic to standard ports.

Scaling

Manual scaling is extremely simple to achieve via the ngap-cli application.

```
> bundle exec ngap ps:scale <app name> 2
```

Logging (1 of 2)

No ssh access. No log files.

NGAP automatically generates all needed artifacts to analyze application and access logs with **Splunk**

Use Splunk

26

External monitoring (1 of 2)

External monitoring strategy **will not** be affected by the transition to NGAP

Monitoring of public APIs and applications do not change

External monitoring (2 of 2)

Uptrends - Monitor status

Search | Splunk 6.5.3 | Uptrends - Monitor status

Uptrends LLC (US) | https://app.uptrends.com/Report/ProbeStatus

Most Visited | Reverb | ECHO | Earthdata Search | Local ECHO tomcat | Local Rails App | Bugs | wiki | Reqs | CI | Team City | PRB Issues | ECC | ICI | Ruby on Rails: S...

Disable | Cookies | CSS | Forms | Images | Information | Miscellaneous | Outline | Resize | Tools | View Source | Options

UPTRENDS

New: Real User Monitoring! | What's new? | Douglas Newman | Log off

Monitors | Dashboards | Alerts | SLA | Account | Tools | Support

Monitor status | CMR | Last 24 hours

Monitors

Stop all monitors | Stop all alerts

Monitor	Type	Last check	Checkpoint	Total time	Active	Alerting active
CMR Browse Scaler	Https	6/19/2017 10:49 AM	Hong Kong	1.47	☒	☒
CMR Catalog-Rest	Https	6/19/2017 10:50 AM	Valencia	0.95	☒	☒
CMR CSW	Https	6/19/2017 10:51 AM	New York	0.75	☒	☒
CMR Ingest	Https	6/19/2017 10:50 AM	Orlando	2.14	☒	☒
CMR Legacy REST	Https	6/19/2017 10:50 AM	Luxembourg	0.84	☒	☒
CMR Open Search	Https	6/19/2017 10:52 AM	Chicago	0.67	☒	☒
CMR Search	Https	6/19/2017 10:48 AM	Stockholm	1.09	☒	☒

Internal monitoring (1 of 3)

Internal monitoring strategies **may** be affected by the transition to NGAP

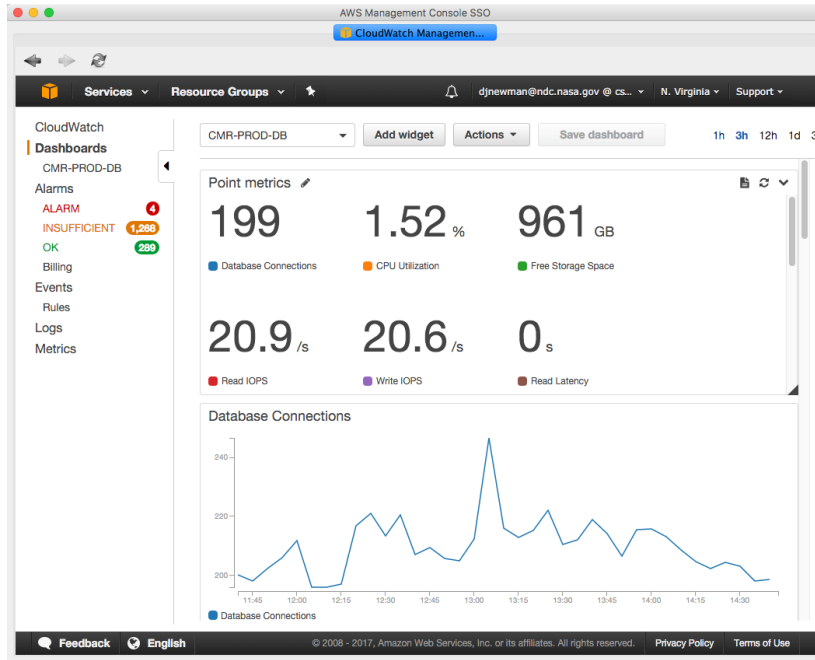
No ssh access.

Monitoring must be done using one of the following methods,

Internal monitoring (2 of 3)

1. NGAP provides an API to obtain a list of instance IP addresses for our applications
2. NGAP generates metrics, alarms and notifications for our ephemeral instances
 - Disk utilization
 - CPU utilization
 - Memory utilization
3. Custom alarms may also add alarms to metrics associated with static AWS resources

Internal monitoring (3 of 3)



The screenshot displays the AWS Management Console interface for the EC2 service. The left sidebar shows navigation options: Services, Resource Groups, EC2 Dashboard, Events, Tags, Reports, Limits, INSTANCES, Spot Requests, Reserved Instances, Scheduled Instances, Dedicated Hosts, IMAGES, AMIs, Bundle Tasks, ELASTIC BLOCK STORE, Volumes, Snapshots, NETWORK & SECURITY, Security Groups, and Elastic IPs. The main content area is titled 'EC2 Dashboard' and shows a table of instances. The table has columns for Name, Instance ID, Instance Type, Availability Zone, and Instance State. The instances listed are all 'NGAP prod App cmr-search-prod 4462' and are in a 'running' state. The bottom of the console shows a footer with 'Feedback', 'English', and copyright information.

Name	Instance ID	Instance Type	Availability Zone	Instance State
NGAP prod App cmr-search-prod 4462	i-05e771b62d3b4e78f	m4.large	us-east-1a	running
NGAP prod App cmr-search-prod 4462	i-0949a0971e1adc2c6	m4.large	us-east-1b	running
NGAP prod App cmr-search-prod 4462	i-0ae33c968d99b4c8f	m4.large	us-east-1b	running
NGAP prod App cmr-search-prod 4462	i-0bdb7eb3e9611901f	m4.large	us-east-1b	running
NGAP prod App cmr-search-prod 4462	i-0d5c244d9b640a94	m4.large	us-east-1a	running

Metrics

Metrics can be obtained using the following applications aligned with NGAP,

- Splunk
- AWS CloudWatch*

And external applications such as,

- Google Analytics
- Uptrends

These can be leveraged during issue triage, reporting and performance analysis

*We are looking into piping AWS metrics into Splunk

Contingency & Recovery

- NGAP can currently deploy our applications to multiple availability zones (AZ) within the US-East region for Platform as a service (PaaS) applications
- In the future, we could support deployment across multiple regions (within CONUS)
- If one AZ goes down the other one is still there. Our applications keeps working
- We expect to be able to leverage recovery capabilities provided by the cloud and NGAP

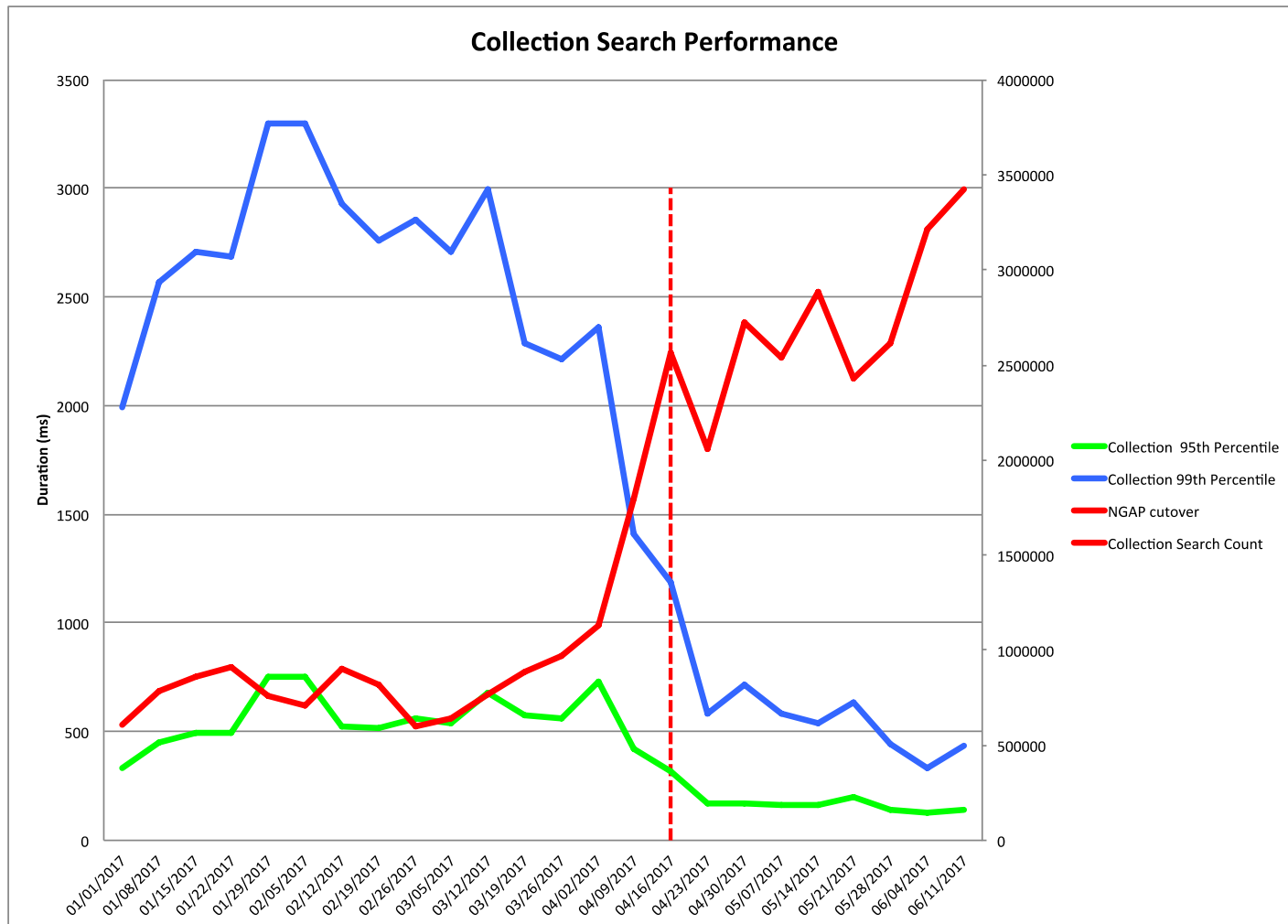
HOW DID IT GO WITH CMR?

CMR?

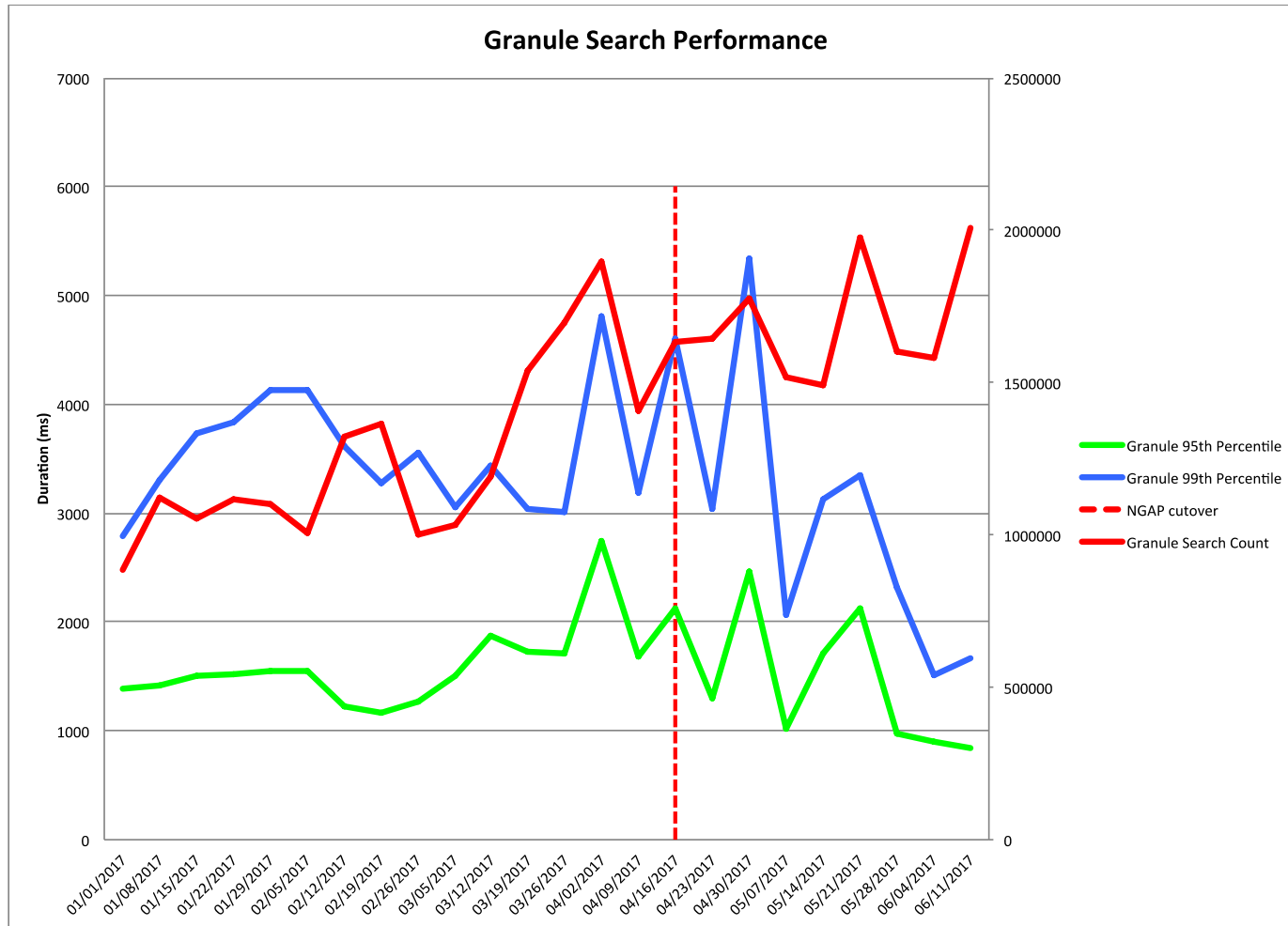
‘The Common Metadata Repository (CMR) is a high-performance, high-quality, continuously evolving metadata system that catalogs Earth Science data and associated service metadata records’

- 33K collections
- 380 million granules
- 95% of queries are resolved in less than 1 second
- 12 node elastic search cluster (1.4 TB) for search
- Oracle Relation Database Service (RDS) for metadata persistence
- 14 micro services
 - On premises – 5 hosts (1 instance on each)
 - NGAP – 42 application instances (varying numbers of redundancy)

Performance (1 of 2)



Performance (2 of 2)



Stability

- 2017 Prod uptime on-premises: 99.70%
- 2017 Prod uptime on-cloud: 99.93%
- 2017 UAT uptime on-premises: 99.76%
- 2017 UAT uptime on-cloud: 99.95%
- 2017 SIT uptime on-premises: 96.76%
- 2017 SIT uptime on-cloud: 99.79%

Scalability (1 of 2)

- New functionality in CMR has required the re-indexing of our granule inventory. This is a time-consuming process.
- While on-premises only recourse was to intelligently distribute the load of re-indexing across our 5 instances
- On the cloud we can, and have, spun up additional, temporary processing instances to reduce the time taken

Scalability (2 of 2)

- Re-indexing granules on premises: 7 days
 - 5 workers
- Re-indexing granules on cloud: **3 days**
 - 1 worker per provider (normally 5)

Miscellaneous

- CMR uses Uptrends for external monitoring
- CMR uses Uptrends, Google Analytics and Splunk for metrics
- CMR SIT, UAT and PROD are only deployed to NGAP PROD

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