OD24A-3426 Integrating Cloud Services for Real-Time Wave Buoy Array Monitoring and Data Management

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Introduction

The need to create a highly reliable and cost efficient wave monitoring system motivated the integration of cloud based services with our existing infrastructure.

Docker® containers provide a means to ensure that both CDIP developed programs and services, and other standard services, run identically on all platforms including Amazon Web Services™ (AWS).

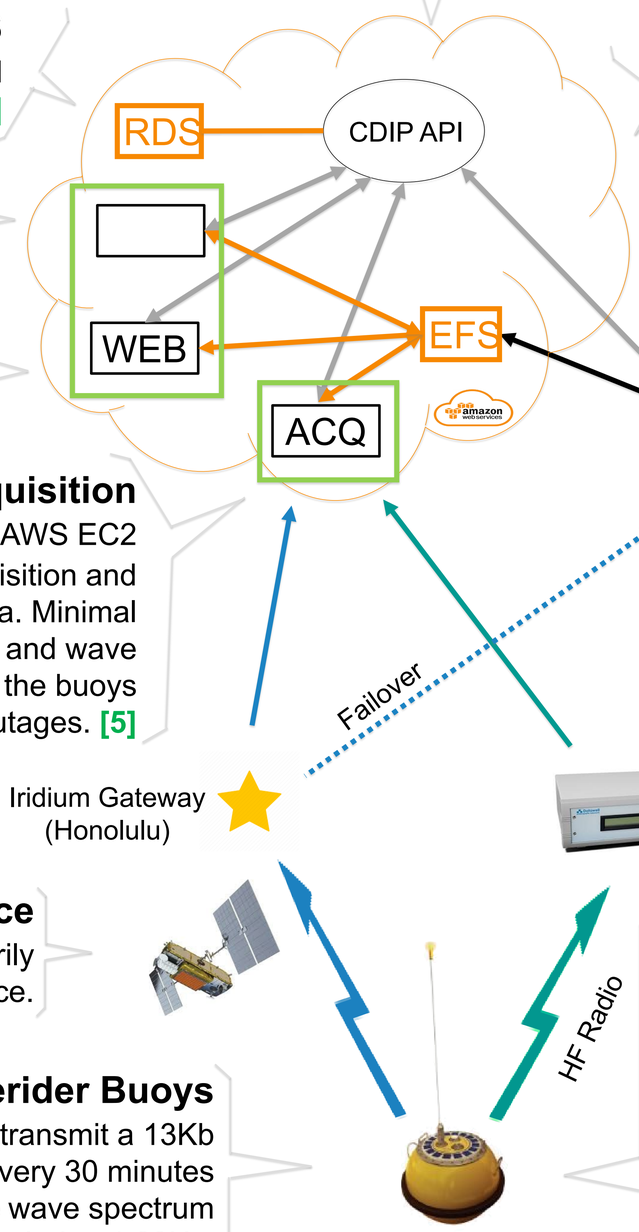
The new system relies heavily on a cloud-based highly available application programming interface (API) accessing data from the AWS relational database service (RDS) providing information for both data center and cloud servers.

Lessons Learned

1. EFS is expensive. Data transfer within subnet is free.
2. Data ingress is free, upload copies of data.
3. Glacier storage is cheap, fast recovery is expensive!
4. Run applications with high data egress locally.
5. EC2 instances are extremely reliable, easy to deploy and easy to scale. KISS and start small.
6. Use DNS (Route 53) for quick and easy failover.
7. Keep EC2 instance configuration to a minimum when deploying Docker containers. Use CloudWatch.
8. RDS is easy to use, easy to manage and highly available.
9. Learning curves for multiple technologies can slow progress and become overwhelming. REST API within Django, within Docker, within EC2 instance …

- EC2 Instance
- Docker container
- AWS service

CDIP API Django REST API providing station and buoy metadata for processing and data acquisition. [9]



RDS

Stores buoy deployment and processing metadata. [8]

Docker containers

within EC2 instances run a variety of applications. [7]

Web server failover

Manual failover (DNS) for the CDIP web server. [6]

Centralized data acquisition

A highly reliable and portable AWS EC2 instance for initial acquisition and storage of buoy data. Minimal processing to obtain position and wave parameter information to track the buoys during local outages. [5]

Iridium satellite service

Data are transmitted primarily via Iridium satellite service.

Datawell Waverider Buoys

70+ buoys collect and transmit a 13Kb wave data record every 30 minutes containing a complete wave spectrum and buoy motion sampled at 1.28Hz.

EFS Stores CDIP real-time wave data (~1T), application/instance logs and other data needed globally. [1]

Data sync (black arrow)

Continuous synchronization of complete buoy real-time and archive datasets using ”aws sync". [2]

Data archive

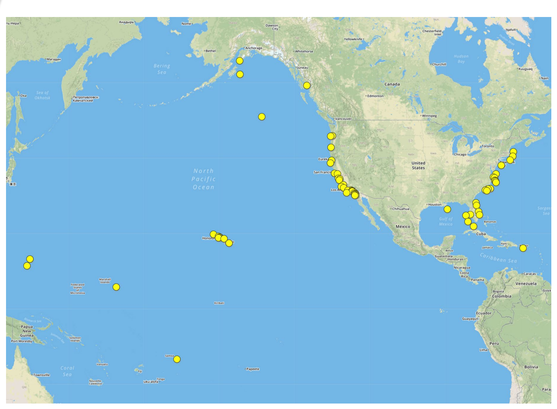
All data are stored locally due to cost of AWS services. Quarterly offsite backups to Glacier. [3]

CDIP web server

Identical to the AWS failover instance. [4]

Data acquisition failover

Automatic failover to node identical to AWS instance.



AWS Glossary

EC2 – Elastic computer cloud virtual server.

EFS – Elastic File System. A highly available and scalable file system.

RDS – An easy to manage highly available relational database service.

Route 53 – A highly available and scalable domain name service.

S3 – Simple storage service, a scalable object storage service.

Glacier – Archival storage service.

CloudWatch – Application and infrastructure monitoring.

Conclusions

1. AWS performs as advertised, consistent and reliable.
2. Motivation to migrate functionality should be based on leveraging cloud properties such as scalability, portability, reliability and scalability.
3. Migrate to the cloud incrementally and carefully to gauge costs and performance of the new system.
4. Data synchronization between your data center and the cloud will require good planning to keep cost and latency low.
5. Docker containers provide portability and standardization.

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