AWS Processing Pipeline for MAVEN IUVS

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AWS Architecture

- Lambda
- EC2 (& EFS)
- RDS
- S3
- SDC API
AWS Architecture recap

- **Lambda serverless code**
  - Pull L0/ancillary files from SDC API
  - Upload L0 and ancillary files to S3
  - Insert metadata into RDS
  - Spin up EC2 instance

- **S3 object store**
  - Storage of L0 files
  - Storage of ancillary files
  - Storage of L1 files

- **EC2 Virtual Machine**
  - Pull L0 and ancillary files from S3
  - Process files into L1 products
  - Insert data into RDS
  - Upload L1 files to S3

- **RDS Postgres database**
  - Store L0 data
  - Keep track of L0 files that have been ingested
  - Keep track of L1 files that have been produced
  - Keep track of processing runs
  - Keep track of file metadata

- **Maven SDC API**
  - Serve L0 files
  - Serve SPICE & ancillary files
Cloud Processing of PDS Archival Products with Amazon Web Services, Kubernetes, and Elasticsearch

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Cloud Processing of PDS Archival Products

- Nearly 2 PB of data at PDS Imaging Node (and growing!)
- **Challenge**: Making large amounts of data searchable and accessible as quickly as possible

  - **Option A** – on-prem
    - Buy more hardware
    - Hire more system administrators

  - **Option B** – the cloud
    - AWS Cloud
    - Managed services
    - Microservices architecture
    - Containerization

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https://bit.ly/3j76cGO
Cloud Processing of PDS Archival Products

Solution: Microservices on Kubernetes

- Build application components into Docker images
- Each “microservice” is built of multiple Docker containers
- Microservices communicate with each other via Kubernetes service interfaces
- High availability, zero-downtime upgrades
- Running on AWS’s managed Kubernetes-as-a-service, Elastic Kubernetes Service
- Replica of system on-premises for development

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References


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MIGRATION TO THE CLOUD: LESSONS LEARNED FROM THE PROJECT

“Development and Operation of the Astromaterials Data System”

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AstroMat is a comprehensive data system for laboratory analytical data generated by the study of astromaterials curated at the NASA Johnson Space Center. It is designed as an ecosystem of interconnected applications that provide human- and machine-readable interfaces to the data gathered and managed in AstroMat's databases.
## Resource Mapping Checklist

<table>
<thead>
<tr>
<th>Definition</th>
<th>Tech Options</th>
<th>AWS Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front-end tier</td>
<td>Applications with UI</td>
<td>Angular/React/Vue</td>
</tr>
<tr>
<td>Middle tier</td>
<td>The glue between data and UI</td>
<td>NodeJS/...</td>
</tr>
<tr>
<td>Back-end tier</td>
<td>Data layer</td>
<td>Postgresql/MySQL/ElasticSearch</td>
</tr>
</tbody>
</table>

## What We Learned

**Challenges:**

- Tech changes
- Responsibility and Role changes
- Development approach changes

**Solutions:**

- Cloud knowledge and skills
- Guidelines and workflows for development, deployment and management
- Collaboration and code reviews
KDP: A Distributed Pipeline Processing Tool for Kubernetes

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Wednesday, June 30, 2021
KDP: A Distributed Pipeline Processing Tool for Kubernetes

Overview

- Introduction
  - What is PDS IMG
  - Data Processing Use-Cases
  - Operational Challenges
  - Problem Statement
- KDP: “Kubernetes Does Pipelines”
  - Overview
  - Kubernetes Primer
  - KDP Architecture
  - Case Study – Mars 2020
- Conclusion
KDP: “Kubernetes Does Pipelines”

Overview

• **Distributed processing made easy**
  • Processing pipelines described in lightweight YAML¹ syntax
  • Reusable processing steps allows for creation of complex pipelines

• **Built on Kubernetes**²
  • State-of-the-art container orchestration framework
  • Open-source software (OSS)
  • Deployable virtually anywhere

• **Infinite horizontal scalability**
  • Scale processing jobs to thousands of CPUs with a single command
  • Negligible overhead achieves near-linear scaling

• **Data-location agnostic**
  • Data can be anywhere with an S3³ interface
  • Most cloud providers, on-prem using services like MinIO⁴

• *Still a work in progress.*

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[1]: https://yaml.org/
[2]: https://kubernetes.io/
[4]: https://min.io/

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EXPERIMENTS IN TRANSFERRING, VALIDATING, AND RELEASING MARS 2020 MISSION ARCHIVAL MULTI-MEDIA & IMAGERY DATA DELIVERIES IN THE CLOUD

Presenter: Rishi Verma
Co-Authors: Kevin M. Grimes, Zachary M. Taylor, Michael McAuley, Minh Le, Rafael Alanis
Additional Support: Kate Crombie, Brad Lunsford, Tariq Soliman, Anil Natha

5th Planetary Data Workshop & 2nd Planetary Science Informatics and Data Analytics Meeting
Wednesday, June 30th 2021
MOTIVATION

Problem Statement

“How do we reduce the time it takes to accept, validate, and release mostly cloud-provided M2020 bundle(s) to the public while reducing system-wide data transfer, processing, and backup costs?”
MOTIVATION

Strategy: Bring IMG Data Releases into the Cloud

M2020 Data Providers on the Cloud / External Sources

PDS IMG on the Cloud

Public Community

PDS IMG Cloud-Based Data Validation
DATA FLOW

Nominal State: Delivering and Validating New M2020 Data Bundles while Permitting Access Only to Previously Delivered Bundles