Cloud-Based Planetary Ephemerides

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Motivation

IMPROVING THE EFFICIENCY OF NASA SATELLITE DATA

The system NASA uses to search its satellite image data has a couple problems:

- Cost
- Performance
- Time
- Data size

NASA's Spacecraft Planetary Instrument C-Matrix Events (**SPICE**) database is used to generate Image Support Data (**ISD**) which is used to match images to satellites.

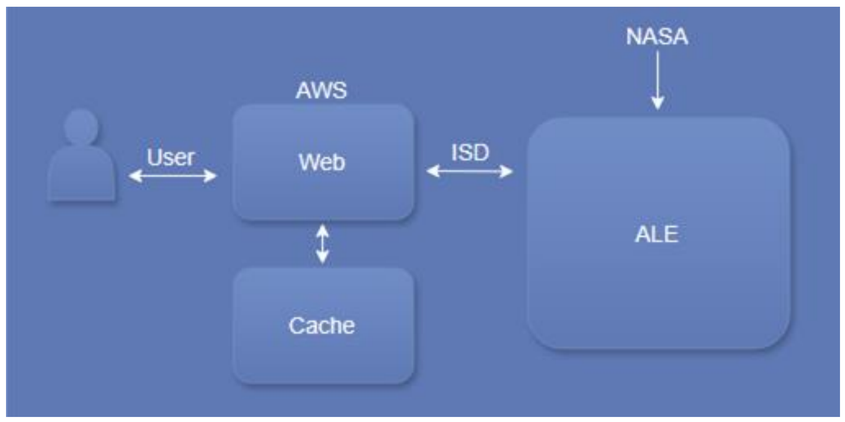
The current process requires users to download large datasets (up to a terabyte) and also costs USGS upwards of $10,000 a month.

We aimed to develop a system to improve the efficiency of this process for NASA researchers.

Architecture

- **RESTful Web Service:** Fast API enables high performance, scalability, asynchronous requests, and auto-generated documentation.
- **Amazon Cloud Services:** Our solution utilizes ECS for scalable management of high user requests, while DynamoDB reduces response times by caching ISD data.
- **Testing Framework:** Docker ensures consistent, isolated environments for effective large dataset processing.

Our Solution



Solution Overview

Our solution is a web service that generates ISDs and stores them in a caching server for quick retrieval

- Web Service that generates and returns ISDs to user
- Uses ALE for ISD generation
- Caching Server that stores ISDs for quick retrieval
- Utilizes Amazon ECS container

Challenges

- **Efficient Data Retrieval**: Quick access to ISDs.
- **Scalability**: Scaling up to 200,000 simultaneous requests.
- **ISD Retrieval**: Generate and return ISD on demand.
- **Optimized Data Transfer**: Minimize data size.
- **Queryable**: Enable users to retrieve specified ISDs

Technologies Used

- Amazon ECS (EC2)
- Amazon DynamoDB
- FastAPI
- Docker
- ALE (Abstraction Layer for Ephemerides)
- ISIS (Integrated Software for Imagers and Spectrometers)

Future Work

Our solution significantly improves research efficiency by streamlining access to NASA ISDs. USGS will expand upon it in the following ways:

- **Scalability:** Supporting over 200,000 simultaneous ISD requests.
- **Dataset Growth:** Expanding beyond the Viking mission to include all NASA missions.