

DIP

DIGITAL INFORMATION PLATFORM



SWIM

Weather





Ground Rules



- Please **turn off your mic and camera** (for bandwidth issue)
- There will be Q&A forum throughout the session and at the end
 - Encouraged to use the Conferences.io link to post questions: <https://arc.cnf.io/sessions/nedn/#!/dashboard>
 - You may also post questions in the chat box
- This workshop session will be recorded, and the recording & slides will be available on DIP website after the workshop
- There will be no break



Goals of DIP Workshop Series



- **Objective**

- Obtain informed technical feedback to DIP design
- Prepare participants for what they could expect for the demo

- **Target Audience**

- Flight Operators and Service Providers interested in partnering by adding their services to DIP and/or consuming data and services
- Technical enough to understand DIP system requirements and how they would be applied to their own services and business model

- **Approach**

- Present DIP at a more detailed level of what it "actually" looks like
- Walk through the capability and ask prompting questions



DIP Workshop Series: #2

DIP for Service Providers

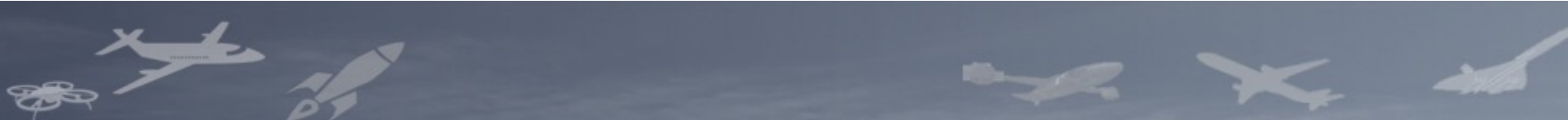
January 12, 2022



Agenda



- Recap of Workshop #1 – DIP Architecture and Data Integration Services
- Onboarding Process
- Catalog Service Capabilities
- API Requirements and Service Specifications
- NASA Services and Access Points
- Data Requirements for Service Providers
- Technology Plan and Schedule
- Q&A
- Next Steps & Closing Remarks



Recap of Workshop #1: DIP Architecture and Data Integration Services

Shawn Gorman

shawn.m.gorman@nasa.gov

Pallavi Hegde

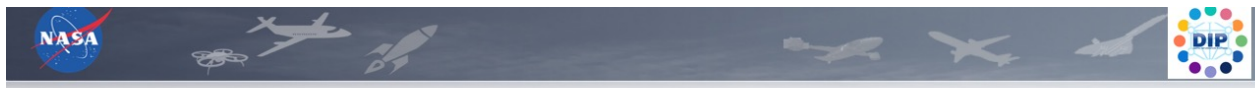
pallavi.hegde@nasa.gov



Recap of Workshop #1



- DIP architecture
- DIP data integration services
- Alignment with FIXM



DIP Workshop Series: #1 DIP Architecture and Data Integration Services

November 17, 2021



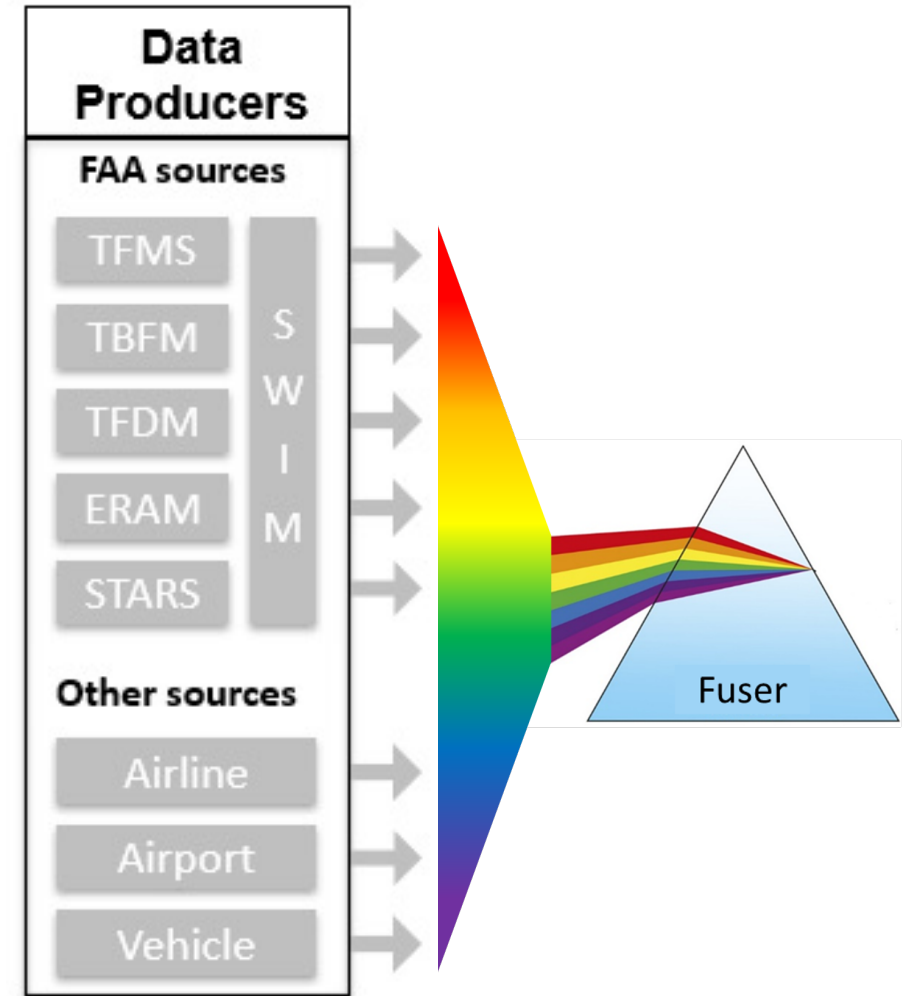
Data Integration Services



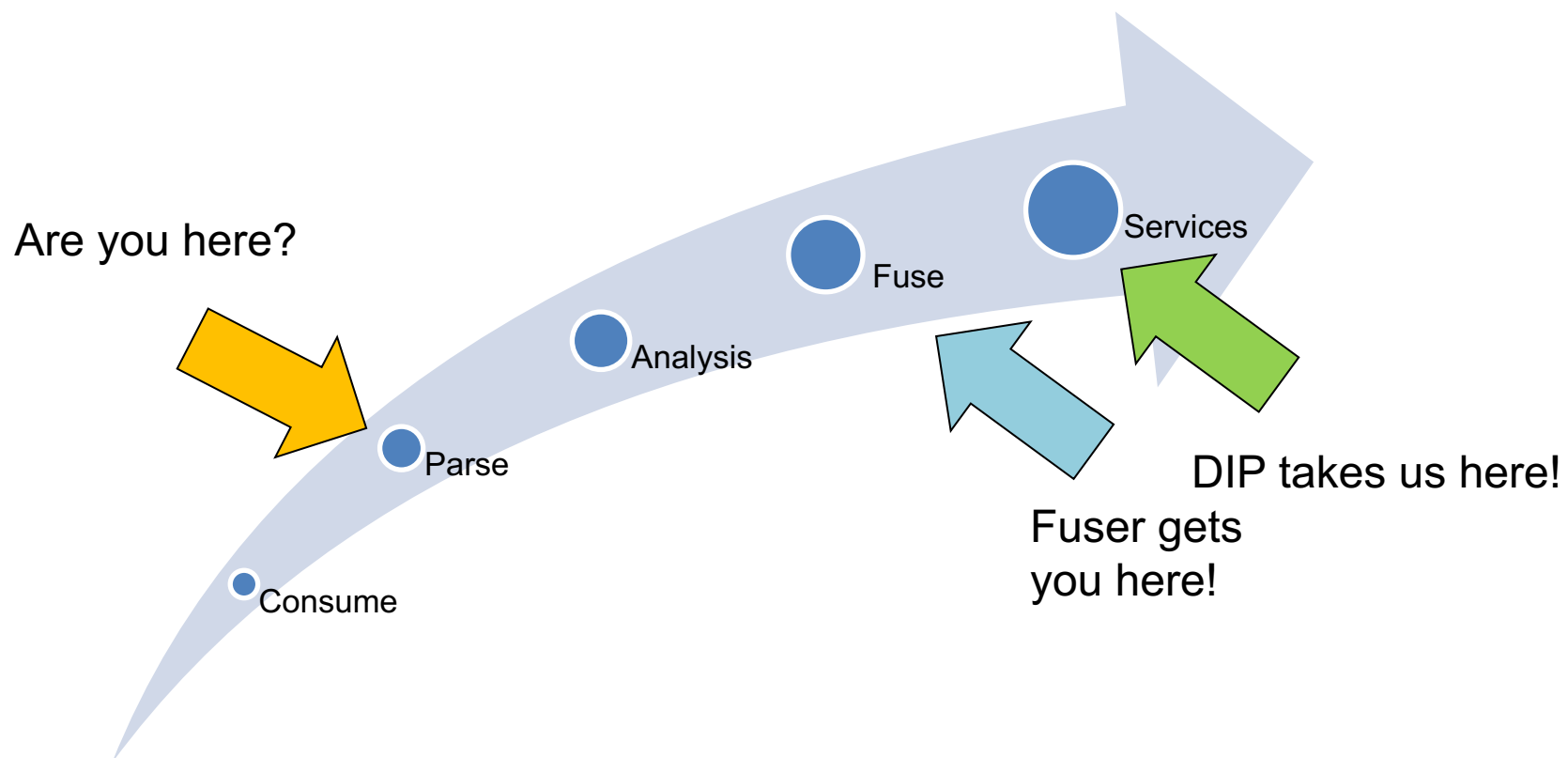
- NASA planned data integration services
 - Flight data integration (Fuser)
 - Does currently include surveillance data from SWIM sources
 - TMI data integration
- Future/potential data integration services
 - Weather data integration
 - Surveillance data integration
 - Potentially could be a feed into a flight data integration service
 - Other data integration



- System that can mediate between disparate sources of data, pulling in the *right data, at the right time*
- Composed of multiple components providing
 - Parsers for various data sources
 - Matching Services providing a global unique identifier (GUFI)
 - Fusion Services
 - Transformation
 - Filtering
 - Updating
 - Mediation
 - Common well-defined schema



- Fuser gets you closer to where you want to be faster
- Build data services on top and make them available





Aligning with FIXM



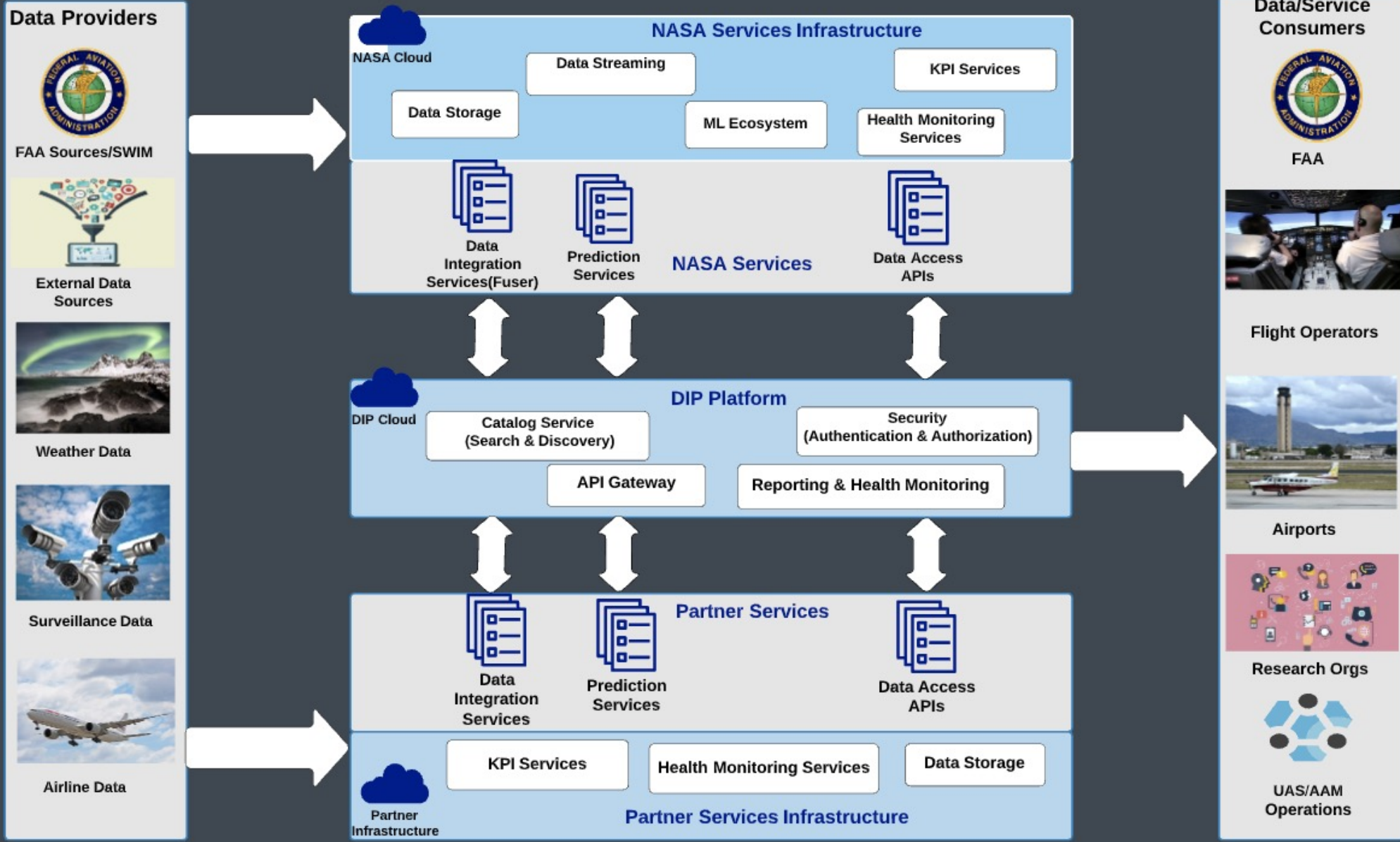
Goal: Align DIP streaming Fuser data feed with FAA FIXM standards

Approach:

- Multi-year crawl, walk, run approach to alignment in collaboration with FAA and Flight Operator community
- FIXM Alignment:
 - FY22 adopt FIXM standard for streaming Fuser data elements in FIXM core and US Extension. Exclude additional data elements that are not currently part of FIXM core or US Extension
 - FY23 adopt FIXM standard for additional Fuser data elements and use FIXM extension. NASA will work with FAA and Flight Operator community to adopt appropriate standards for an additional FIXM extension
 - FY24 align Fuser standards with CSS-FD standards. NASA will work with FAA and flight operators to define scope of alignment (could a version of Fuser act as CSS-FD fused data feed prototype?)



DIP Platform Functional Architecture



Common, simplified interface to integrated, processed information



Partnership & Agreements

George Szatkowski

george.n.szatkowski@nasa.gov



Partnership Agreement Processes



1. Announcement of Collaboration Opportunity (ACO) for Conventional Flight Operators for Sustainable Aviation (SA) demos

- Participate to define, test and evaluate NASA reference airspace management services beginning in FY22
- Each partner will sign a non-reimbursable Space Act Agreement (SAA)* included in the ACO response to cover 5-year partnership with NASA

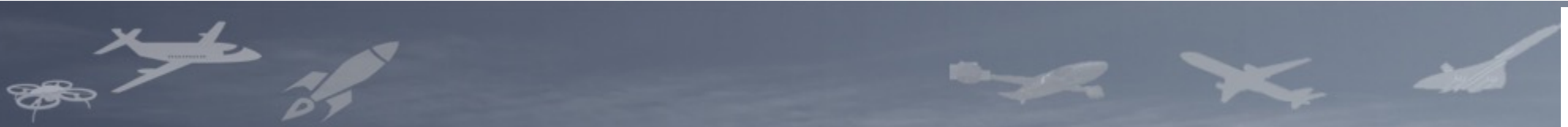
2. ACO for Partner Services Demos with Data Integrators, Service Providers, and Cloud/Infrastructure Providers

- Participate in the design, development, demonstration and validation of the Partner Services (PS) demonstrations. Solutions for traditional flight operations, advanced air mobility and urban air mobility operations are encouraged
- Each partner will sign a non-reimbursable 5-year Umbrella SAA and 2-year initial Annex* included in the ACO
- The partners will also be required to submit an ACO questionnaire which describes the respondent's intended contributions to the requirements and PS demonstrations with NASA

3. Interconnection Security Agreement (ISA) for all Partners

- The ISA specifies the technical and security requirements for establishing, operating, and maintaining an interconnection between two or more systems. ISA supports a Memoranda of Understanding/Agreement (MOU/A) between the organizations.
- ISA is required prior to connecting to DIP system and will be completed after the ACO/SAA process

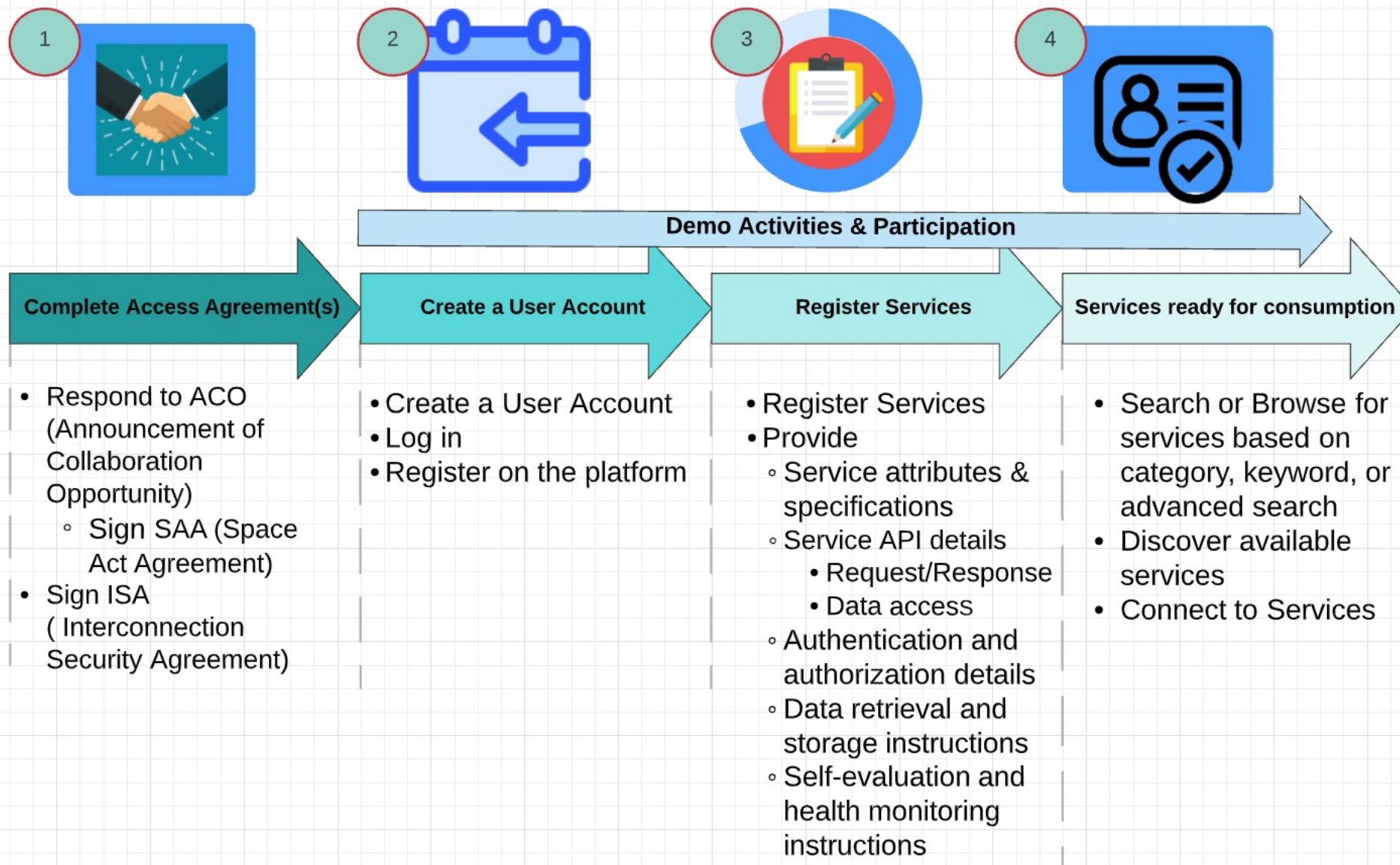
***Signed agreements are required prior to connecting to DIP system. Proposed changes to the SAA or Annex may be considered and may delay your ability to access DIP**



Onboarding Process & DIP Portal Preview

Pallavi Hegde

pallavi.hegde@nasa.gov





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of aviation service and data offerings

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Get Started

Need Help? >



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Learn more about the
Digital Information Platform



CATALOG SERVICE

Discover available services
Connect to services



UPCOMING EVENTS

Updates on the latest
industry events



Register

Documentation

Advanced Search

Try It Now

Usage Reports

Support

Recently Viewed



Keyword search: e.g., "Data Fusion"

Filters

Clear X

- Capability
- Category
- Data Type
- Domain
- Features
- Provider
- Users

SEARCH

NEW THIS MONTH

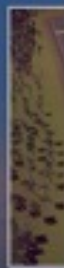
Surveillance Data Updates



Uploaded On: 03/10/1987

View provider

HIGHLIGHTS



SERVICES

Runway Prediction

users per month

the prediction of real-time runway status is key to enabling safe and efficient air traffic planning services

Registered Services by Category

Flight Data Services

Traffic Management Initiative(TMI) Services

Fuser Services

TOS Services

Surface Management

Weather Services

Conflict Detection Services

Request Help | Submit Feedback

Discover More APIs



Configuration Prediction Service



Weather Service



TMI Service



Unimpeded Taxi Time Service



Runway Prediction Service



Estimated On Time Service



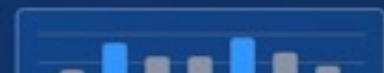
Conflict Detection Service

Recommended

All Recommendations



My Reports



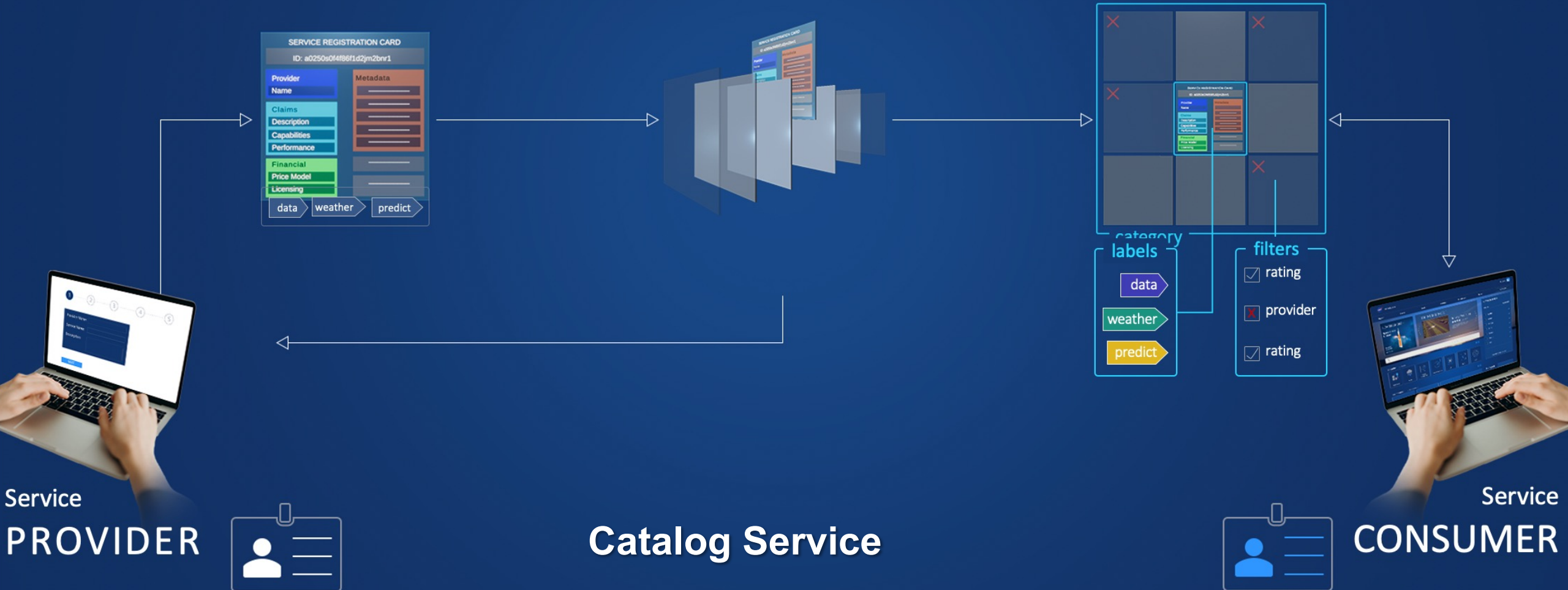
REGISTRATION

Enter service information
Into a registration form/document
(Automation under consideration)

Digital Information Platform
- verifies document
- Persists information
- confirms registration

DISCOVERY

Search or browse for a service
- category/keyword/advanced search
- verifies document
- checks visibility





Catalog Service Capabilities

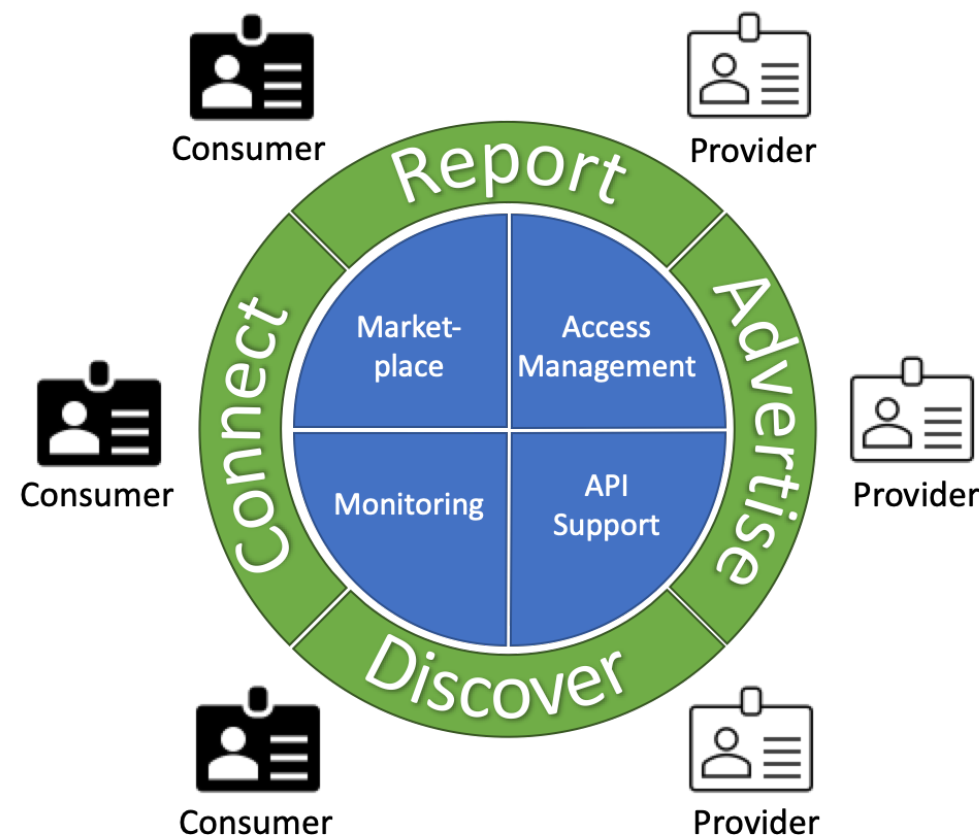
Mohamad Refai

mohamad.s.refai@nasa.gov

'Marketplace' for service and data offerings

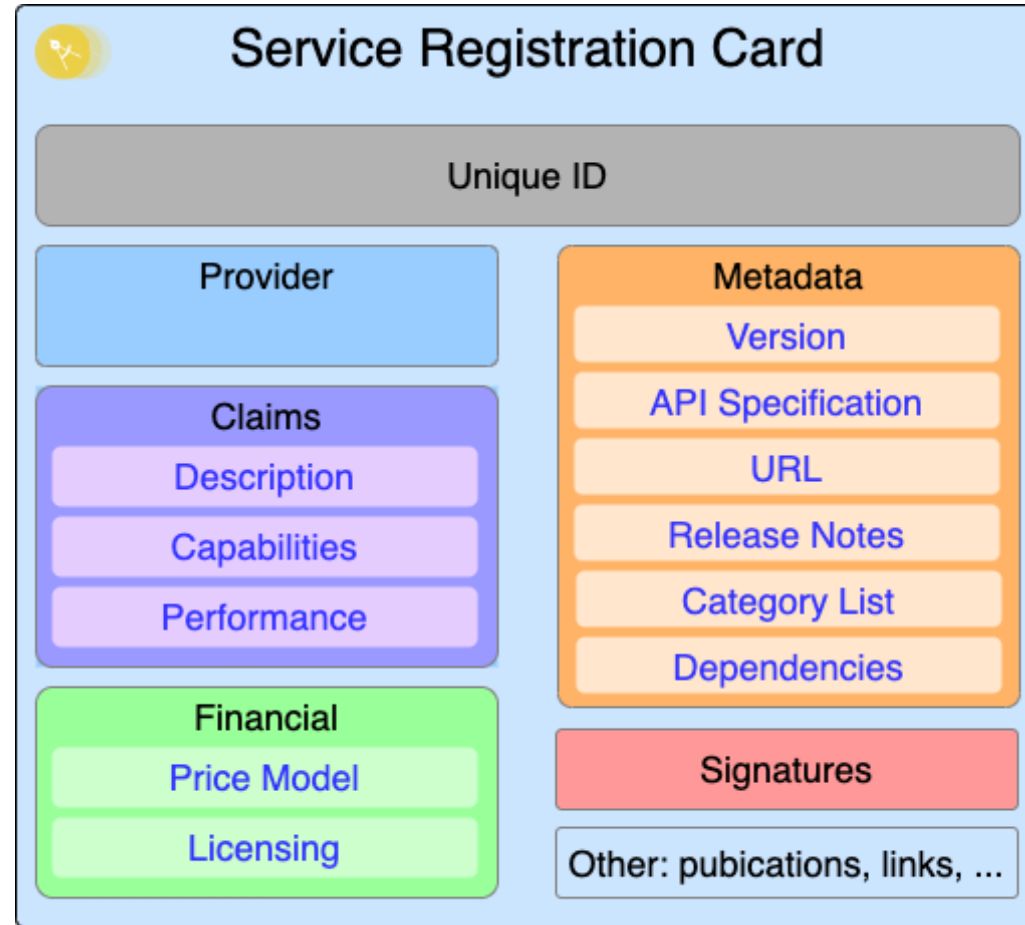
- Service Providers
 - List service and data offerings
 - Specify who can view offerings

- Service Consumers
 - Discover available services
 - Connect to services





Service Information





Discovering a Service



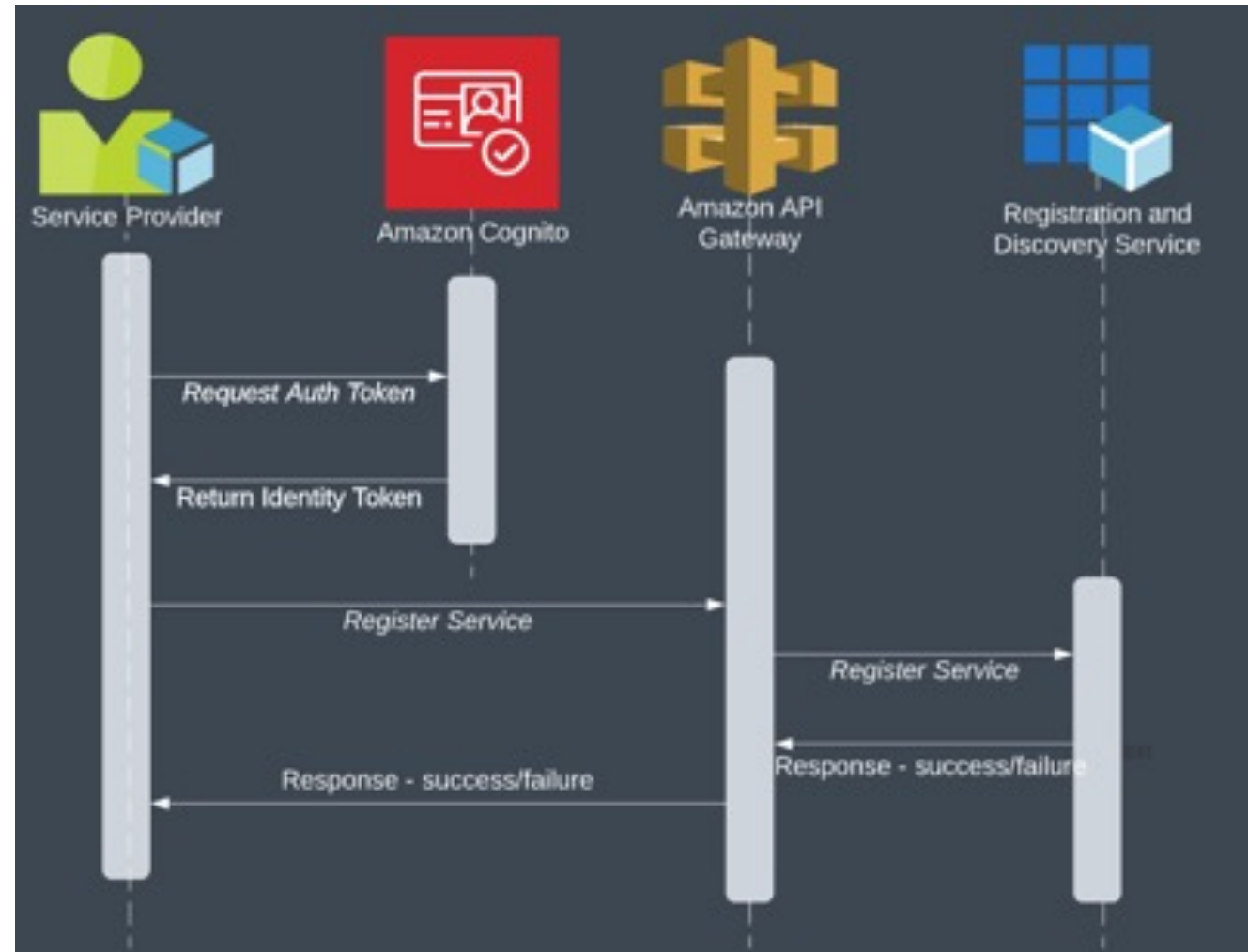
- Search by Category
 - Scope of search: service category list
 - Analogous to a database query on category column
- Categories
 - Curated key phrases: flat list
 - Descriptive of area of interest
 - Collaboratively defined
 - e.g.: ATM, AAM, Wx, CD, CR, Surface Management, ...
- Advanced Search
 - Multiple criteria search
 - Scope: all metadata
 - Analogous to a library search
- Search by Random Keyword or Phrase
 - Scope of search: all metadata (structured and unstructured)
 - Analogous to a web search



Register a Service



- Enter service information into a registration form/document
 - Entered by DIP team (initially)
 - A UI will be provided to allow providers to register
 - Automation is under consideration
- DIP
 - Verifies the document
 - Persists the information
 - Confirms registration

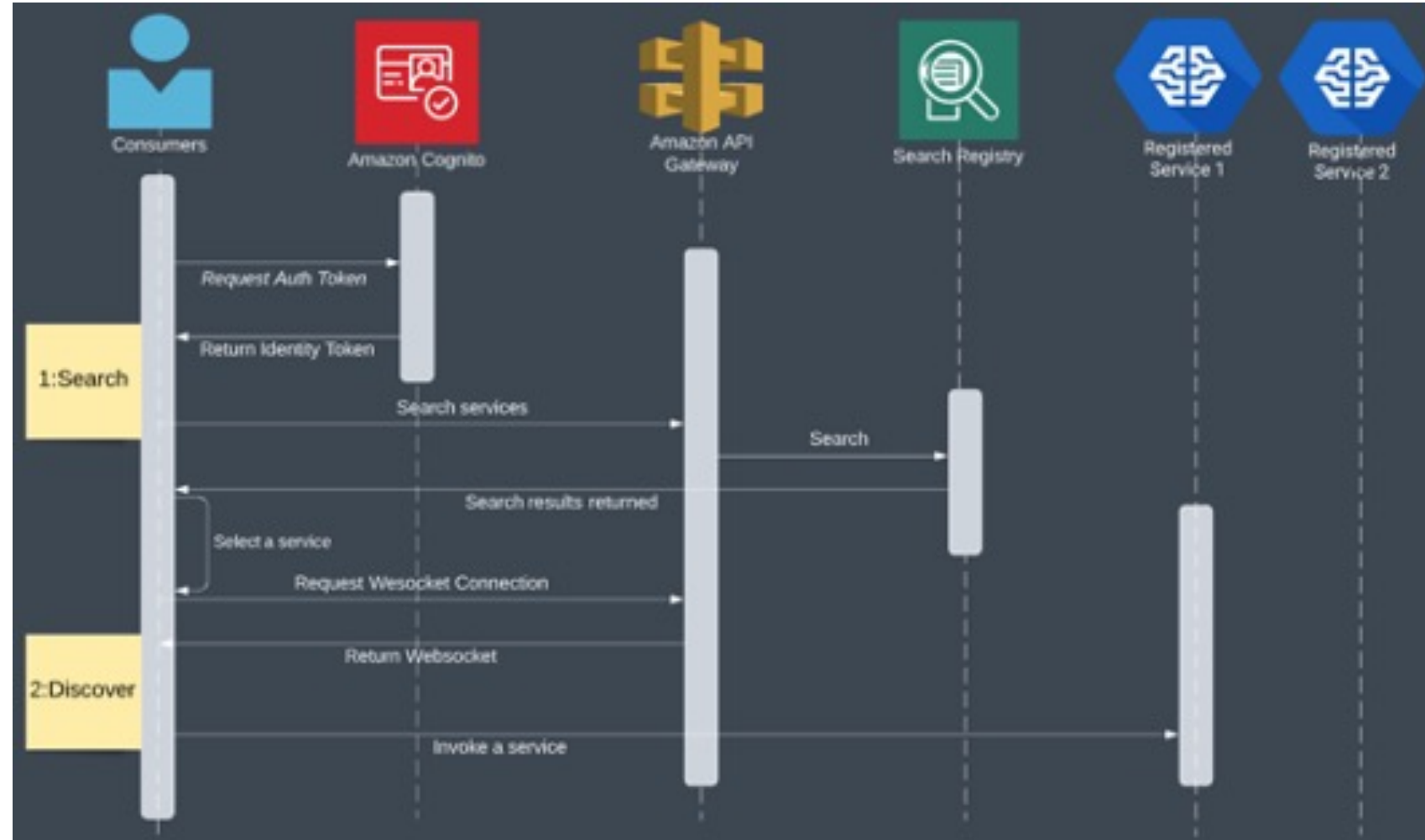




Search a Service

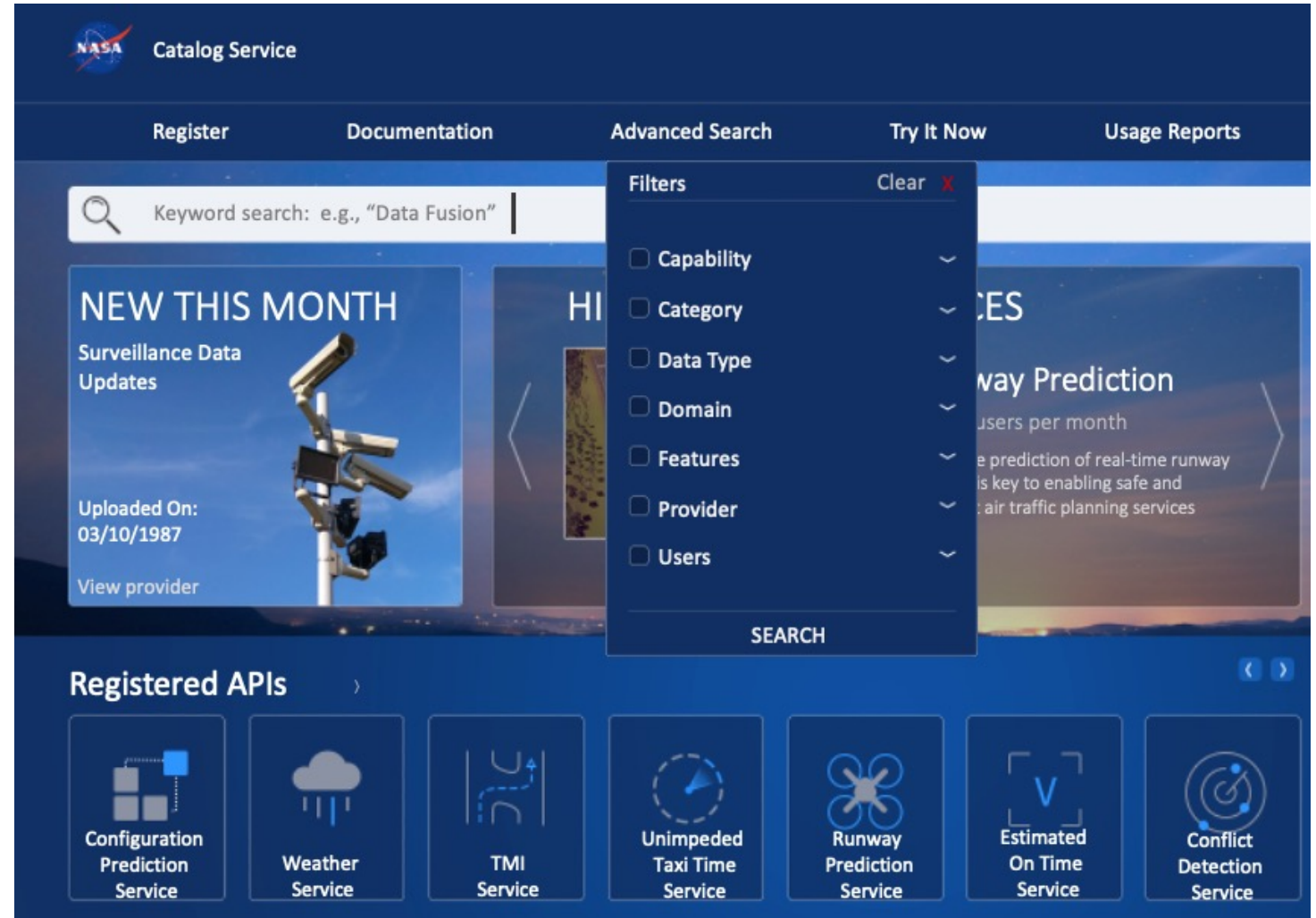


- Category Search
 - Results limited to category list
- Keyword Search
 - Search scope includes unstructured data
- Advanced Search
 - Multiple criteria search





- Sortable list of services
- Grouping capability (provider, category, etc.)
- Catalog Service landing page presents the browse view



Try It Now

- Only if provider opts in
- Allows a limited number of invocations through a DIP UI
- How it works:
 - Populate the request form
 - DIP will populate sample request
 - User can modify request
 - Send the request
 - Inspect the response

The screenshot shows a REST client interface with the following details:

- Method:** POST
- URL:** `{{api_url}}/time/taxi-in/impeded`
- Body:** JSON (raw view)

```
1 {
2   ... "acid": "AAL1469",
3   ... "departure_aerodrome_icao_name": "KRSW",
4   ... "arrival_aerodrome_icao_name": "KDFW"
5 }
```

- Response:** 200 OK, 306 ms, 676 B
- Response Body (JSON view):**

```
1 {
2   "acid": "AAL1469",
3   "departure_aerodrome_icao_name": "KRSW",
4   "arrival_aerodrome_icao_name": "KDFW",
5   "igtd": "2022-01-04 16:54:00",
6   "taxi_in_time_ramp_millis": 114000.0,
7   "taxi_in_time_ramp_source": "actual",
8   "taxi_in_time_ama_millis": 254000.0,
9   "taxi_in_time_ama_source": "actual",
10  "taxi_in_time_full_millis": 368000.0,
11  "taxi_in_time_full_source": "actual",
12  "timestamp": "2022-01-04 19:38:52"
13 }
14 }
15 }
```



- Any additional clarification for registration, or any suggestions for improvement?
- What are the governance processes and rules that are needed to ensure the quality and privacy of data and service offerings? For example, how do we ensure that a provider is a valid entity and that the services offered do not violate secure and private access to data?



API Requirements and Service Specifications

Shawn Gorman

shawn.m.gorman@nasa.gov

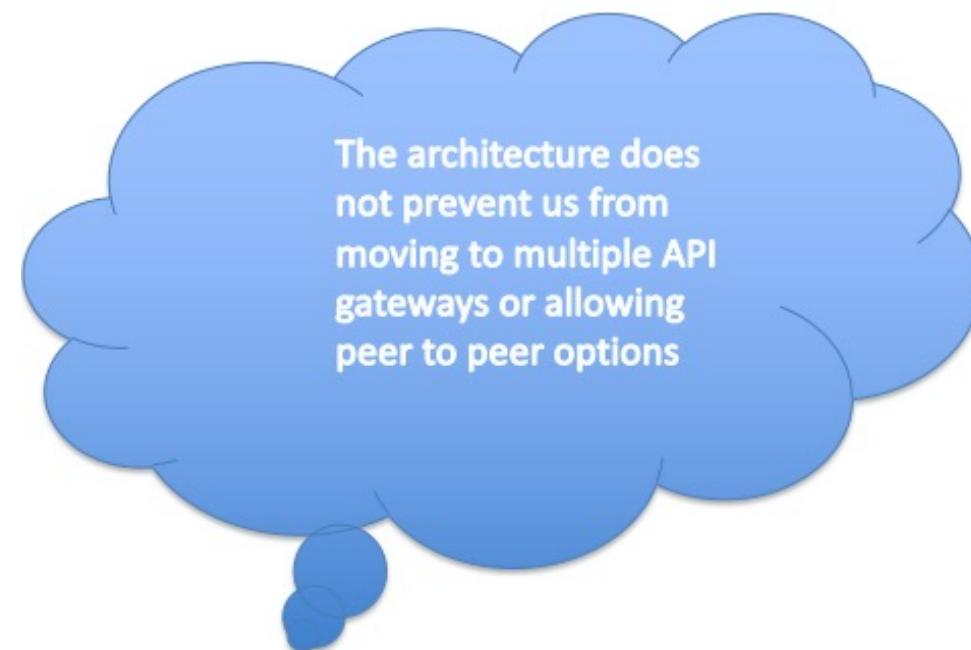
Daniel Mulfinger

daniel.g.mulfinger@nasa.gov

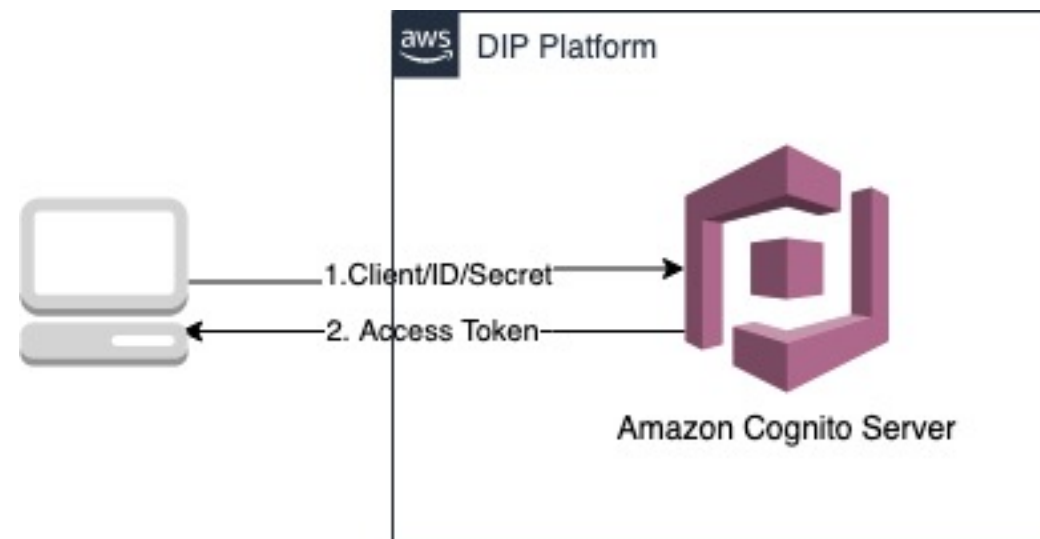


API Management Benefits:

- Centrally managed but
 - Services are not centrally hosted
 - Ownership is decentralized and partners completely own the administration of their own services
- Hybrid or multi-cloud
- Proxy services
- Secure regardless of where hosted
- Manage client access
- Monitoring
- Consistent process to access services
- Cons:
 - API Gateway does provide a single point of failure



- DIP Platform Authentication
 - AWS Cognito Service
 - OAuth2 Client Credentials flow
 - Client submits credentials to OAuth2 server
 - Server returns time-sensitive token
 - Client presents token with all requests to DIP platform
- Credentials issued
 - After SAA and ISA completed
 - Client ID and secret (machine->machine)

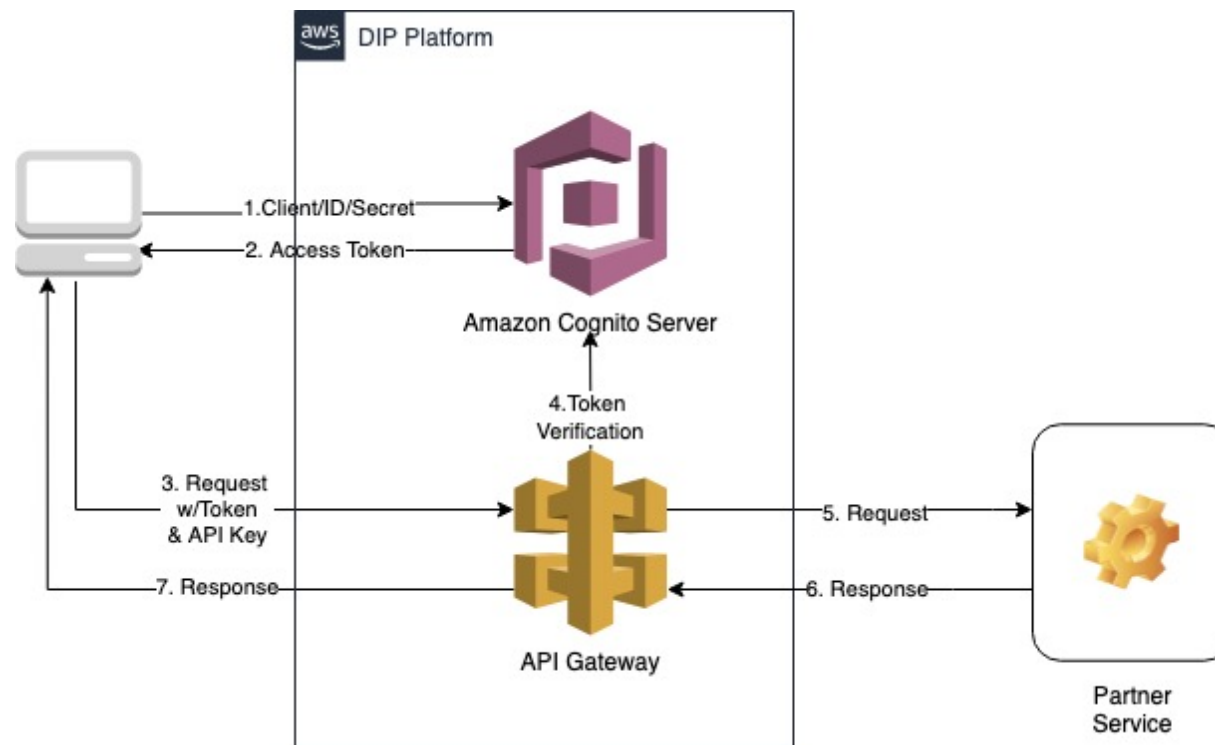




DIP API Proxy



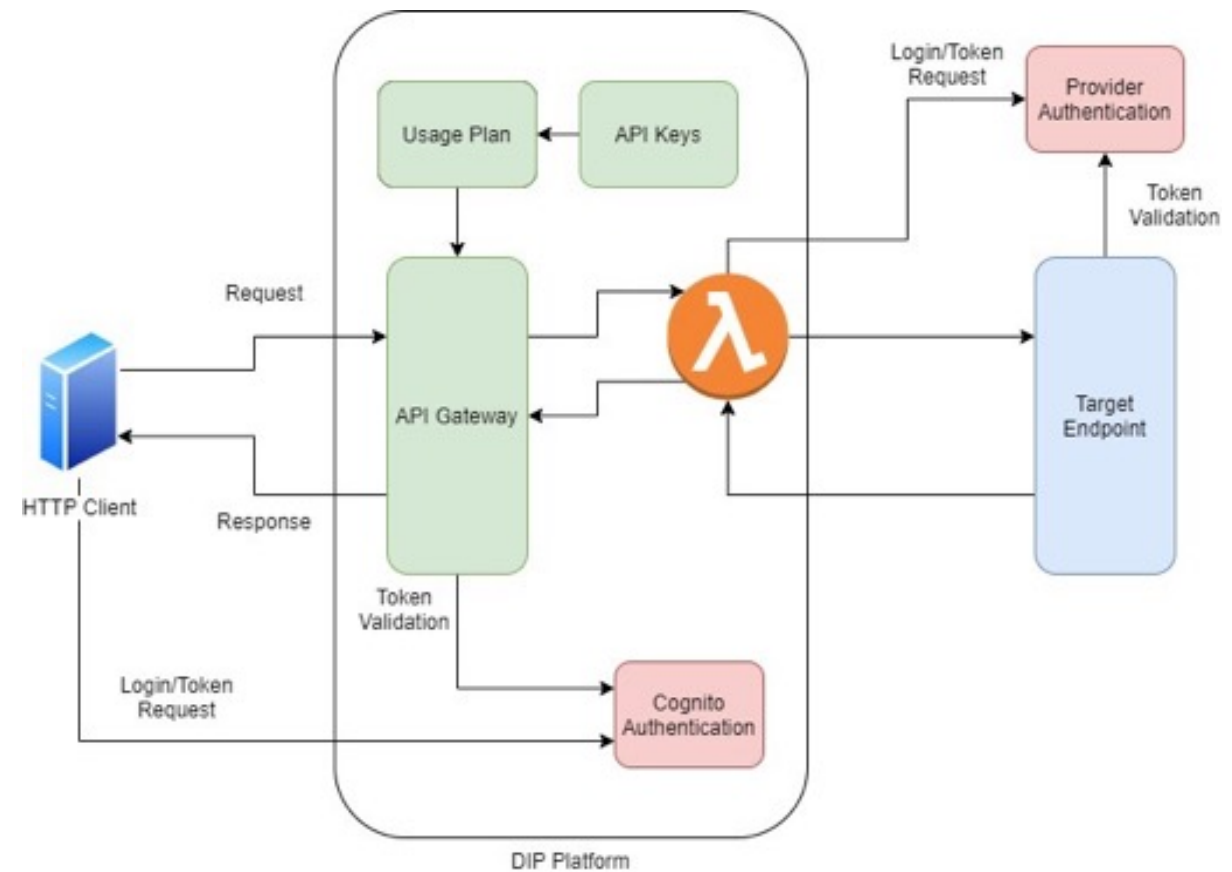
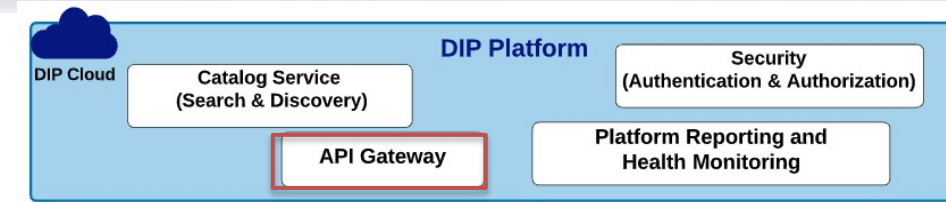
- Partner Service APIs available to clients through DIP Platform
 - Matching API endpoints created in DIP platform
 - Calls are proxied to partner service
 - Usage plan(s) created for each API
- Client-Side Authorization: API Keys
 - API Key controls access to APIs
 - Each user issued a unique API Key
 - Access enabled when API Key is added to API Usage Plan
- Server-Side Authentication/Authorization
 - API Key
 - OAuth2 Client Credentials Flow

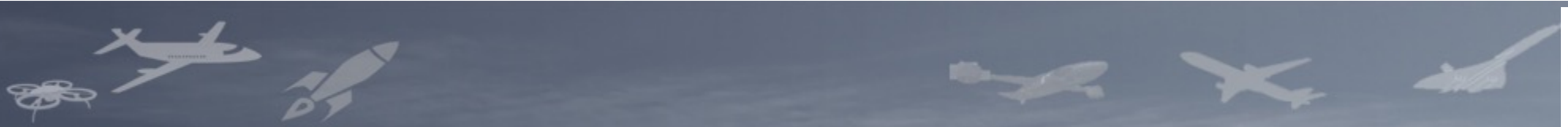




API Gateway REST API with Lambda integration to Target endpoint

- Proxy to existing services
- Caller authenticates with DIP Cognito
- API Gateway authorizer validates tokens
- API Gateway lambda handles authenticating with provider and caching credentials
- Lambda makes the http call and returns response
- Target endpoint may be a NASA hosted service, or a partner hosted service





NASA Services and Access Points

Shawn Gorman

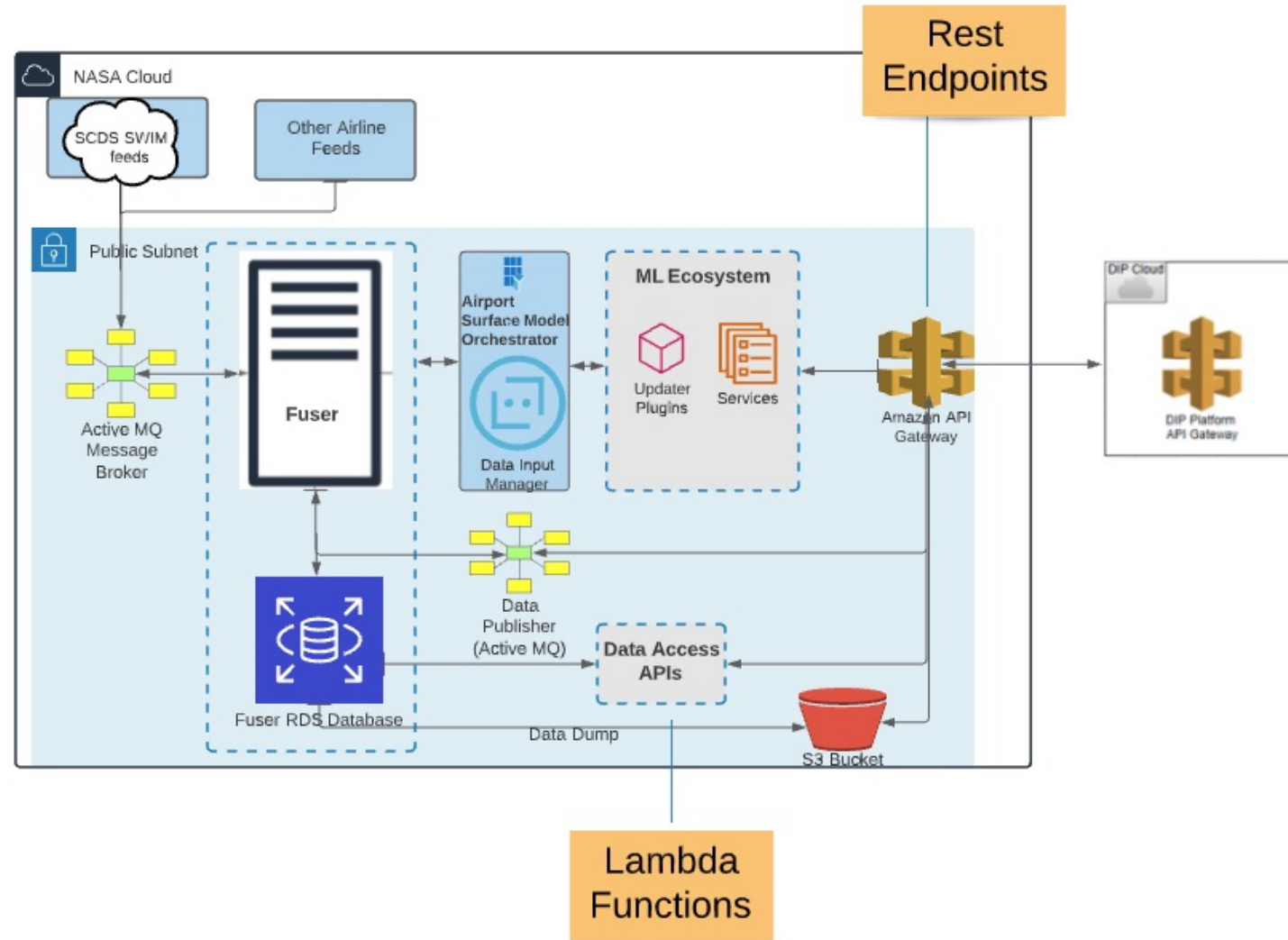
shawn.m.gorman@nasa.gov



NASA Services | Data Access APIs



- REST API endpoints defined on the API Gateway
- Data access code executed via Lambda function
- Provide access to:
 - Fused data
 - ML model output orchestrated by the Airport Surface Model
 - Counts and metrics
- Available in near real time and post operations
- Examples:
 - Predicted departure runway
 - Landing time prediction
 - All current ML predictions
 - Departure runway utilization





Data Access APIs vs ML Prediction Services



Data Access APIs

- Returns data produced by the NASA services infrastructure
- Minimal inputs required
- Inputs needed to produce a prediction were provided and orchestrated by the NASA service infrastructure

Departure Runway (Data Access API)

Inputs

- Flight Ids
 - Call sign
 - Departure airport
 - Arrival airport
 - Departure time
 - or
 - GUF1
- Departure Time

Outputs

- Flight Ids
- Runway (Predicted or Actual)

ML Prediction Services

- Can be used to what-if different combinations of inputs
- More inputs required
- Returns a prediction based on those inputs
 - beware: Garbage in/Garbage out

Departure Runway ML Service

Inputs

- Flight Ids
- Aircraft Engine Class
- Airport Configuration
- Departure Fix
- Filed
- Lookahead
- Wake Turbulence Category

Outputs

- Flight Ids
- Predicted Runway

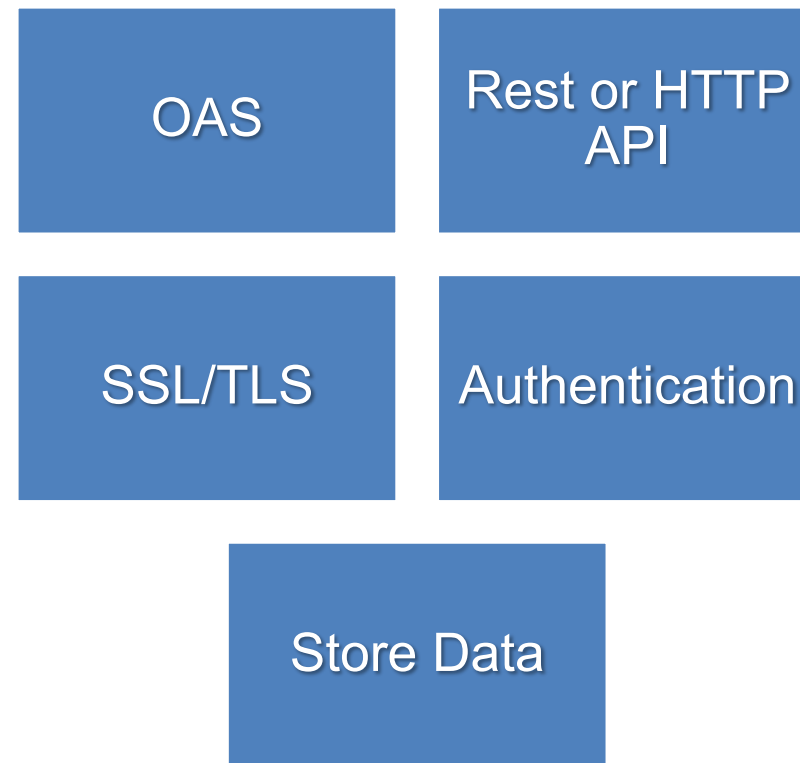


Initial API Requirements



- API specifications using the Open API Specification (OAS)
- REST or HTTP API
- Target endpoint accessible via DIP API Gateway
- Use SSL/TLS
- Support standard authentication approaches like API Keys, OAuth 2.0
- Store results of service for analysis

- Recommended
 - JSON output preferred
 - Provide health endpoint
 - Provide service health status
 - Status should include status of downstream dependencies (ex. database connection)





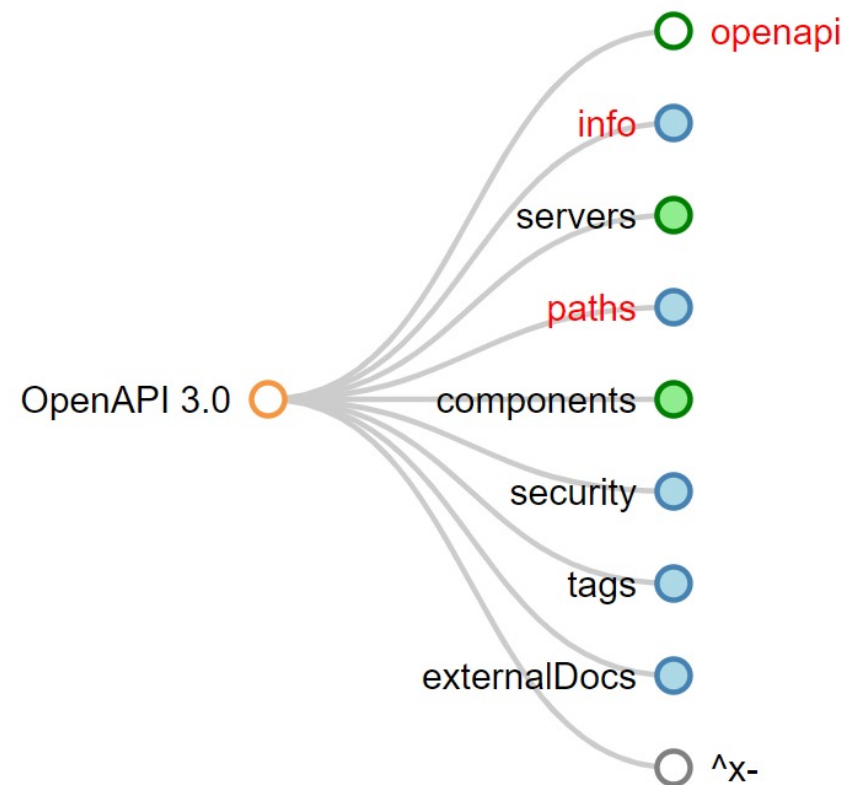
Open API Specification (OAS)



- **Vendor neutral** description format for HTTP-based remote APIs
- An **API description file** (sometimes called Contract) is a **machine-readable** specification of an API.

Key Fields:

- **Info** – Provides general information about the API
 - Title, version, description
- **Servers** – Provides server information and various environment URL of API
- **Security** – Provides details about how API is secured, API keys, Authorization information
- **Paths** – Describes all the endpoints of the API
- **Tags and external docs** – Tags that could be grouped for API operations
- **Components** – Set of reusable objects which could be used during API definition



- **Data Storage**

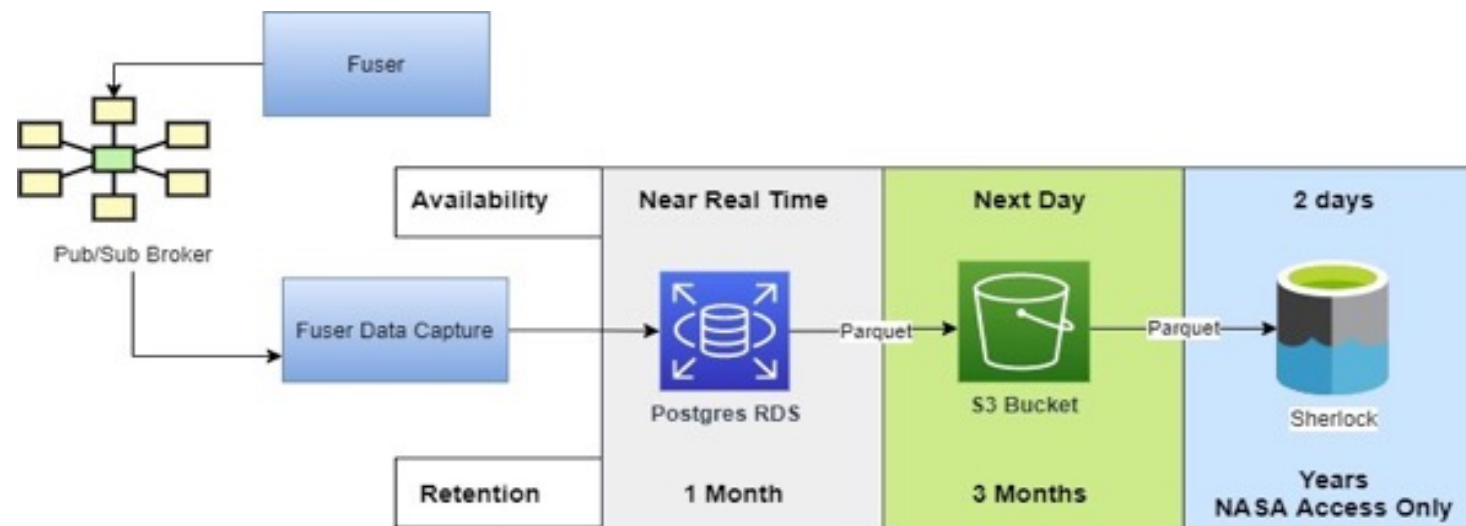
- Types
 - Fuser Flight Data
 - TMI Data
 - Lamp Weather Data
 - D-ATIS Airport Configurations

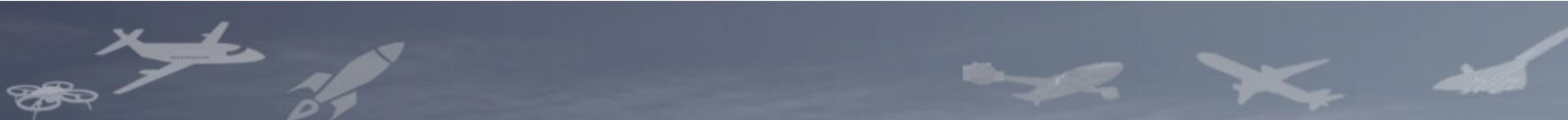
- Process

- Postgres
 - Loaded continuously
 - Data will roll off after 1 month
- S3 Buckets
 - Nightly process to export from Postgres, convert to parquet, load to S3
 - Data will roll off after 3 months
- Sherlock
 - Process to copy from S3 buckets and store in Sherlock

- **Data Access**

- Access via Data Access APIs
- S3 bucket access
- Sherlock (requires NASA identity and access)





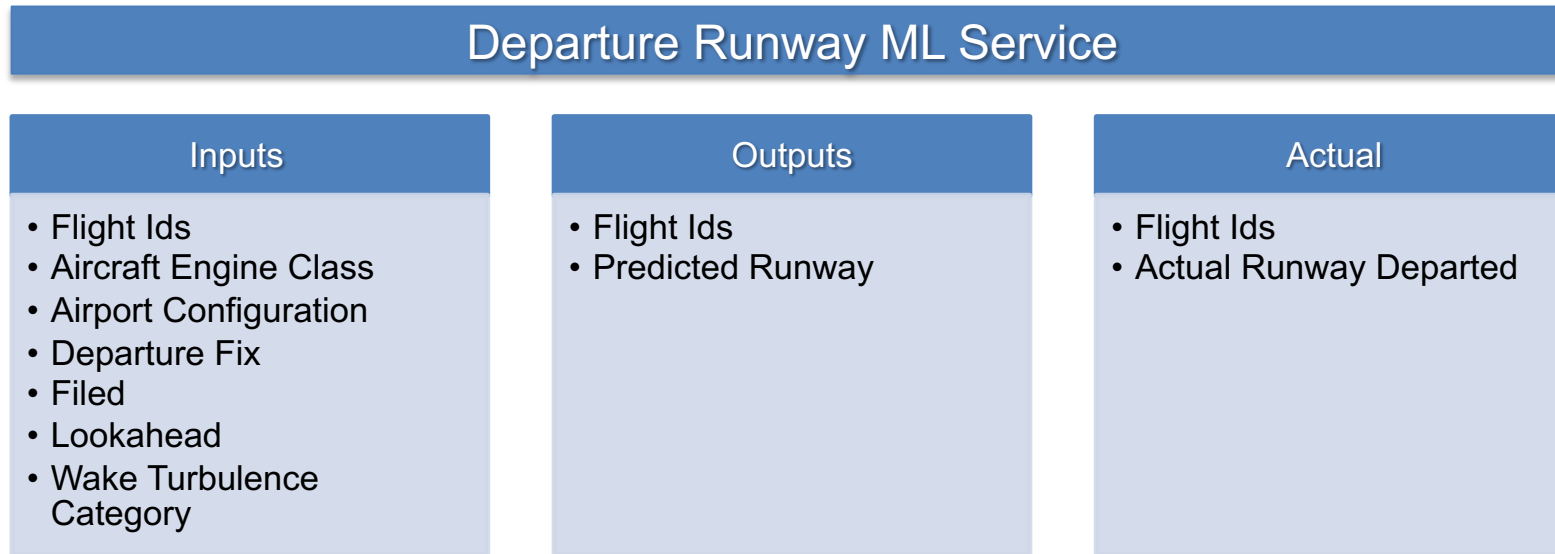
Data Requirements for Service Providers

Shawn Gorman

shawn.m.gorman@nasa.gov

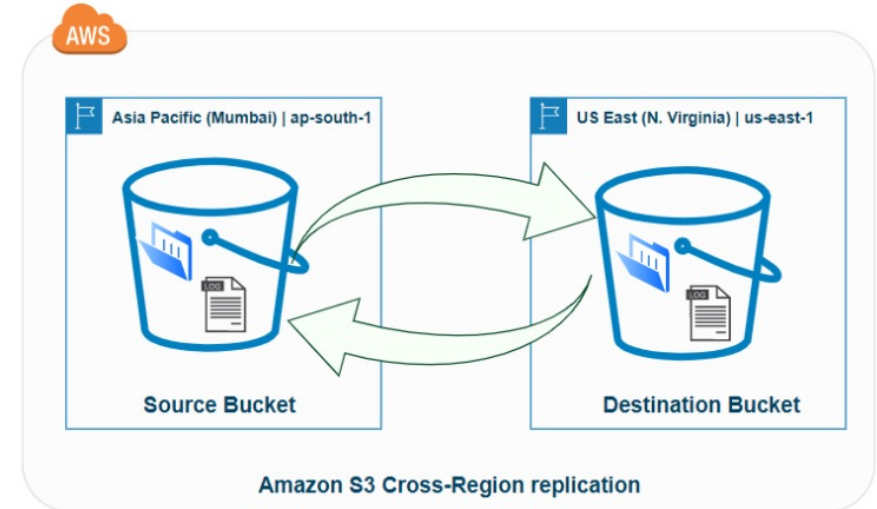
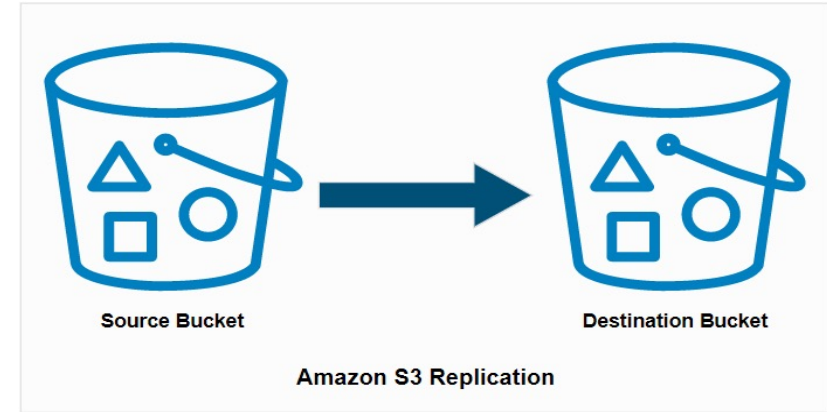


- Store and expose data to support the performance of your service
 - Include inputs, your prediction/result, and the actual value that occurs



- Minimum 3 months' worth

- Challenges
 - Cost \$\$
 - Accessibility
- NASA approaches being considered
 - Data Access APIs
 - Good for accessing small amounts of data
 - S3 access
 - Requestor pay access
 - S3 DataSync
 - S3 Data replication





Preliminary Technical Plan and Schedule



- Fuser system in the cloud
- ML Services deployed in the Cloud
- Prototype development -Congnito authentication, Websocket data streaming

- Services available for integration testing
 - FIXM Fuser Stream
 - Data Access Services
 - ML Services

- Catalog service deployed
- Service creation and registration
- Search capability
- Try it now (sample)
- API Gateway endpoints
- Centalized API gateway for service routing

- Automation of Service registration
- Expand Catalog service Capabilities
- Point-to-point service support



- Documentation on services and Capabilities
- Open API Spec

- Partner services manual setup & support

- Partner 22 Demo
- Partner Onboarding support



Questions and Answers

Please post your questions either in the chat box or
the Conferences.io link

<https://arc.cnf.io/sessions/nedn/#!/dashboard>



- Is three months of data a reasonable target?
- What are other cost-effective ways to store and share large volumes of data that should be considered?
- Other concerns related to storing and exposing data?



Questions for the Audience



- What feature is missing in our development plan that is important to you?
- In the initial year of DIP (FY22) the platform will not have a built-in capability to allow for the monetization of services and data. This is a planned capability to be considered in FY23. We would like to explore your willingness to engage with the DIP platform with the understanding a monetization capability will not be ready in FY22. Additionally, we are interested in hearing your thoughts on long term monetization capabilities the platform should support or enable.



Questions for the Audience



- We will present our initial approach to securing the services using Amazon Cognito and API keys. We would like to understand what authentication approaches you think need to be supported by the platform to access your services.
- Help DIP determine service specification needed for the catalog service. If you wanted to find a “taxi time prediction service” for example, how would you search for it.



Next Steps and Closing Remarks

Mirna Johnson

mirna.g.johnson@nasa.gov



- Schedule
 - DIP Workshop Series #3: DIP for Flight Operators: TBD
 - Flight Operator Announcement for Collaborative Opportunity: TBD
 - Service Provider Announcement for Collaborative Opportunity: TBD
- Please email to ARC-DIP-EXT@mail.nasa.gov for questions or comments
- Visit <https://nari.arc.nasa.gov/atmx-dip> for more information regarding DIP sub-project and future events



Thank you!