Cloud Enabled Architecture for the NESDIS Ground Enterprise
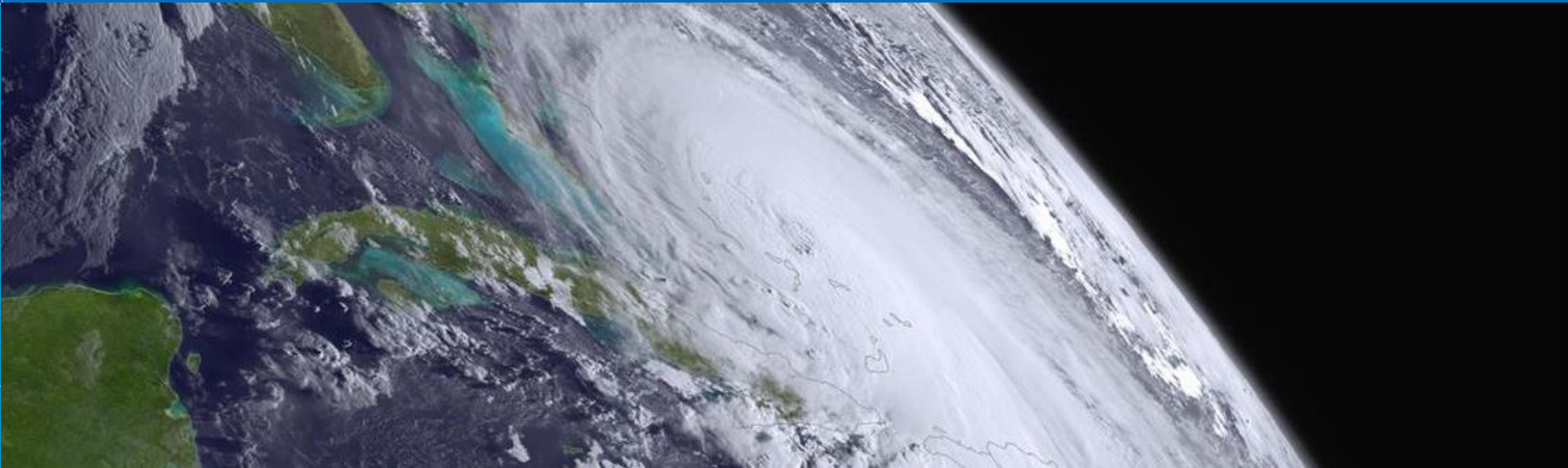
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NOAA

Satellite and Information Service

End-to-End Data Management for NOAA's Weather Enterprise

All aspects of product and data management should be taken into consideration when exploring enterprise cloud solutions
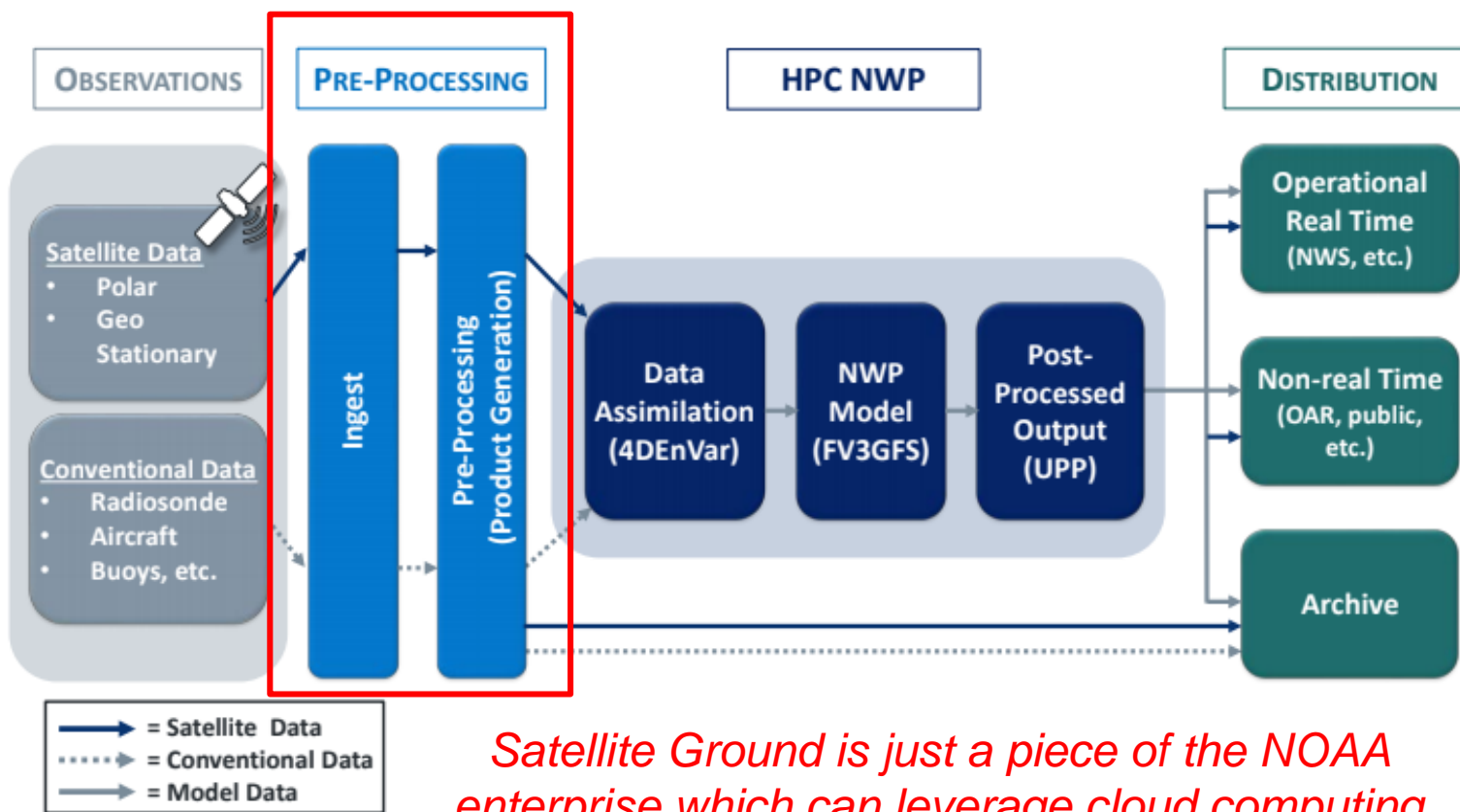
Satellite Ground is just a piece of the NOAA enterprise which can leverage cloud computing

Mission and Vision of NESDIS

The National Environmental Satellite, Data and Information Service (NESDIS)

OUR MISSION

… is to provide secure and timely access to global environmental data and information from satellites and other sources to both promote and protect the Nation's environment, security, economy and quality of life.

OUR VISION

…is to expand understanding of our dynamic planet as the <u>trusted</u> source of <u>environmental</u> data.

NESDIS Cloud Strategic Objectives

Establish an approach to investigate the potential for hosting all NESDIS ground functions in the cloud

Define strategic goals to outline a path for an integrated ground enterprise to leverage cloud technologies

Cloud Pilot Projects to support Experimentation, Migration, and Transformation activities
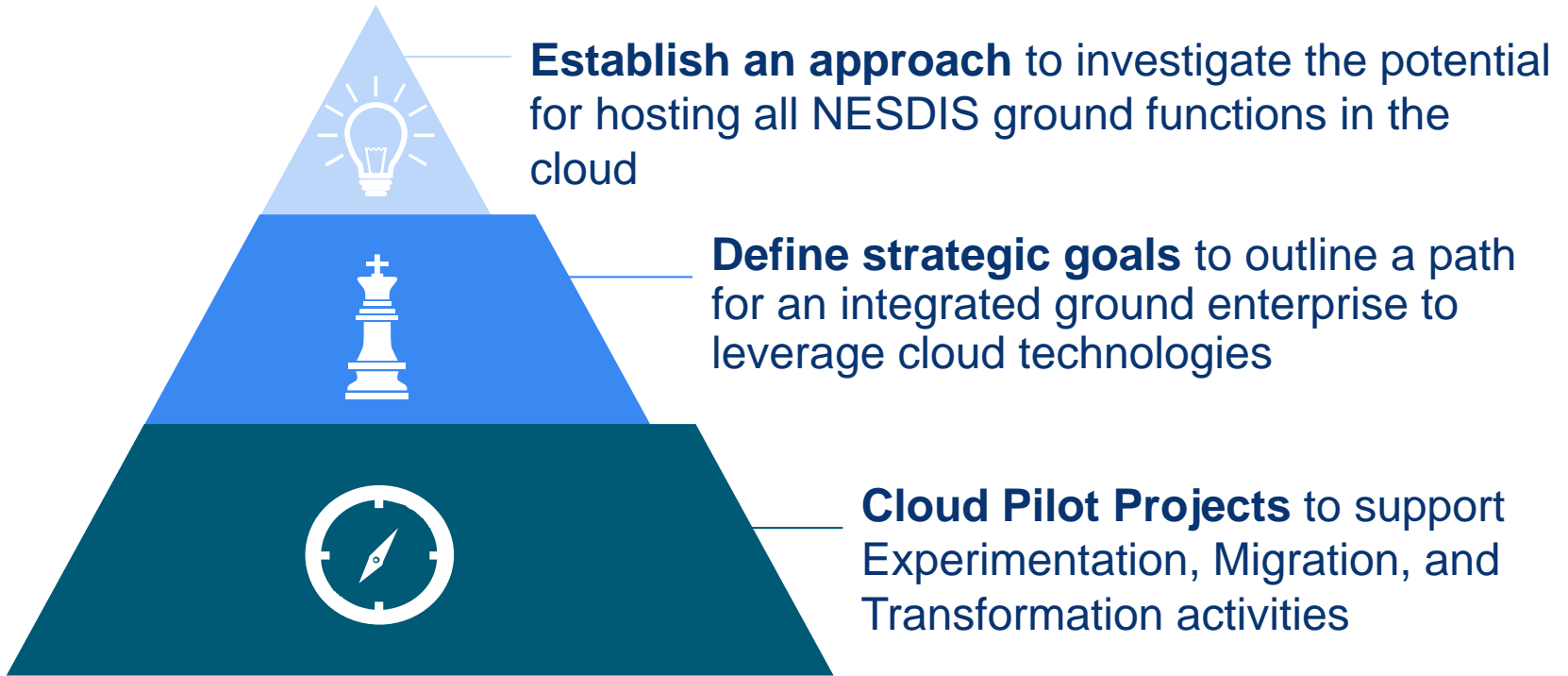
NESDIS first established a Cloud Strategy Document to guide all cloud computing assessment, development and operationalization by asking:
Why not the cloud?

NESDIS Cloud Strategy

<u>Vision</u>: Implement cloud-enabled end-to-end ground service capabilities that are secure, scalable, lifecycle cost effective, and data source agnostic

Strategic goals for NESDIS Cloud Computing:
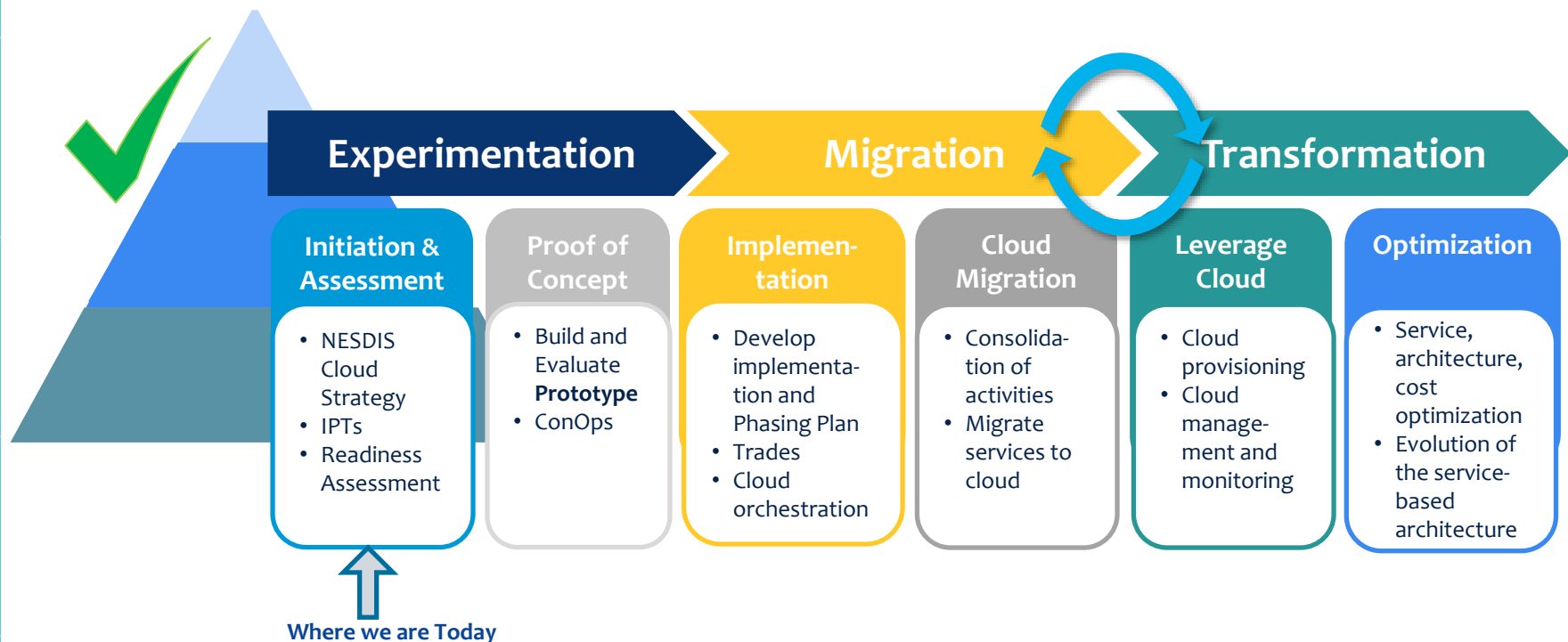
1. **Maintain continuity of operations**, products, and services

2. **Evaluate the benefits** of migrating the end-to-end ground architecture to the cloud based on trade studies, cost-benefit analysis and enterprise risk assessment

3. **Maximize use of cloud-native capabilities**

4. Implement clear governance by **defining roles and responsibilities**

5. **Define requirements** for the cloud architecture to **include confidentiality, integrity and availability**

6. **Compliant with security, data and acquisition regulations**

7. **Collaborate with NOAA OCIO and Line Offices** to develop a NOAA cloud utility contract

NESDIS Cloud Migration Roadmap

| Experimentation		Migration		Transformation	
Initiation & Assessment	**Proof of Concept**	**Implemen-tation**	**Cloud Migration**	**Leverage Cloud**	**Optimization**
• NESDIS Cloud Strategy • IPTs • Readiness Assessment	• Build and Evaluate **Prototype** • ConOps	• Develop implementa-tion and Phasing Plan • Trades • Cloud orchestration	• Consolida-tion of activities • Migrate services to cloud	• Cloud provisioning • Cloud manage-ment and monitoring	• Service, architecture, cost optimization • Evolution of the service-based architecture

Where we are Today

- Cloud computing has already been demonstrated as a viable implementation for satellite ground compute, storage and dissemination

- Adoption of commercial cloud computing fundamentally changes the culture – and change is HARD

- NESDIS will leverage commercial cloud computing to our toolkit going forward

Imagine a World where NESDIS Ground is Completely in the Cloud

- NESDIS is focusing on the architectural level, not current system implementation:
    1. Approach the cloud from **architectural functionality**
    2. Assume those functions are **done completely in the cloud**

- What are the *technical barriers* prohibiting a NESDIS migration to the cloud?
    - The resulting barriers we formulated into pilot projects

- Pilot results will guide NESDIS cloud implementation decisions

NESDIS End-to-End Ground Architecture Conceptual View
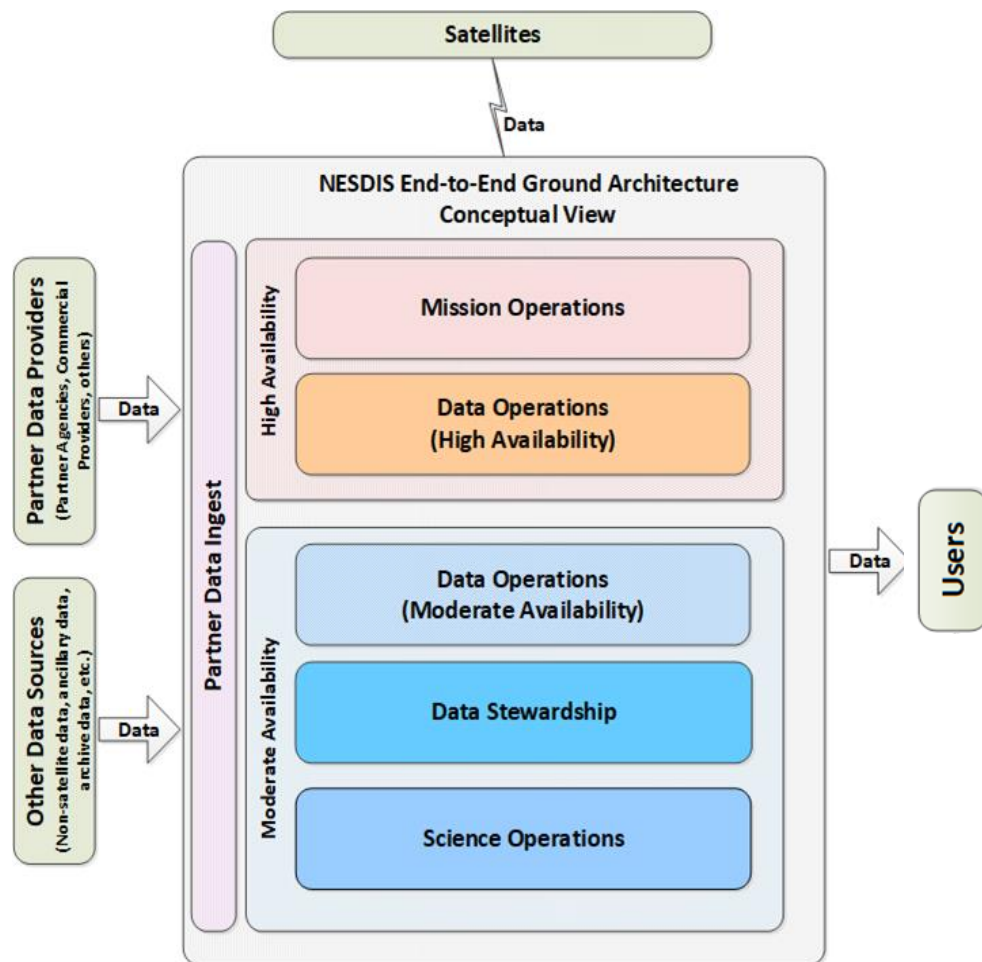
NESDIS Cloud Pilot Projects in Execution

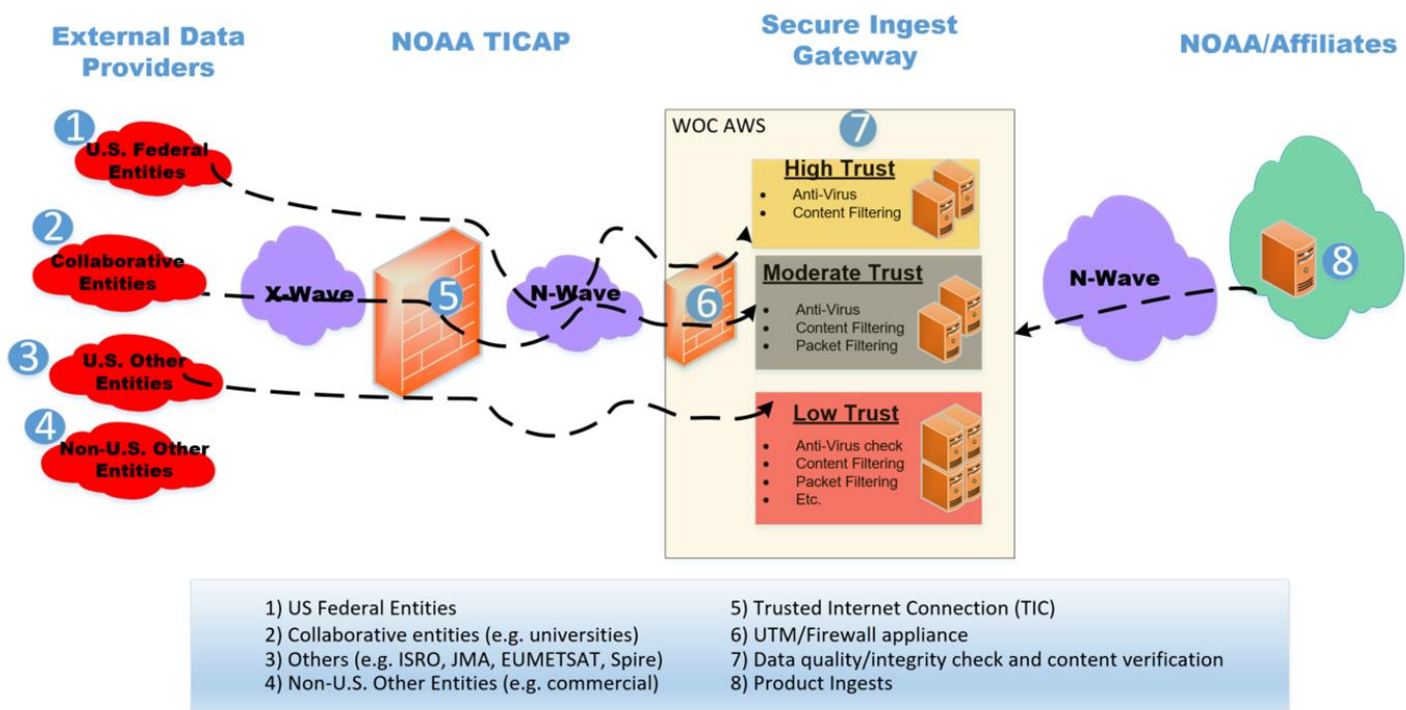| Project	Function	New Project Scope
1	**Security in the Commercial Cloud**	Develop NESDIS **Authority to Operate (ATO)** methodology to meet security standards in the commercial FedRAMP Moderate cloud by tailoring up security controls
2	**Extension of Common Ingest, Cataloging, and Discoverability to the Cloud**	Extend the **NESDIS-built common data ingest**, cataloging, and discoverability functionality to near-real time ingest and calibration/validation enterprise and demonstrate this capability in the commerical cloud
3	**Native Ingest, Product Generation and Science Development in the Cloud**	Demonstrate that **industry cloud-native approaches for compute, storage and dissemination** can be utilized in a common architecture to meet all current NESDIS system needs
4	**Distribution Framework**	Examine NESDIS **common architecture for cloud-based data distribution** that limits egress cost from the commercial cloud

End-to-end Ground Architecture
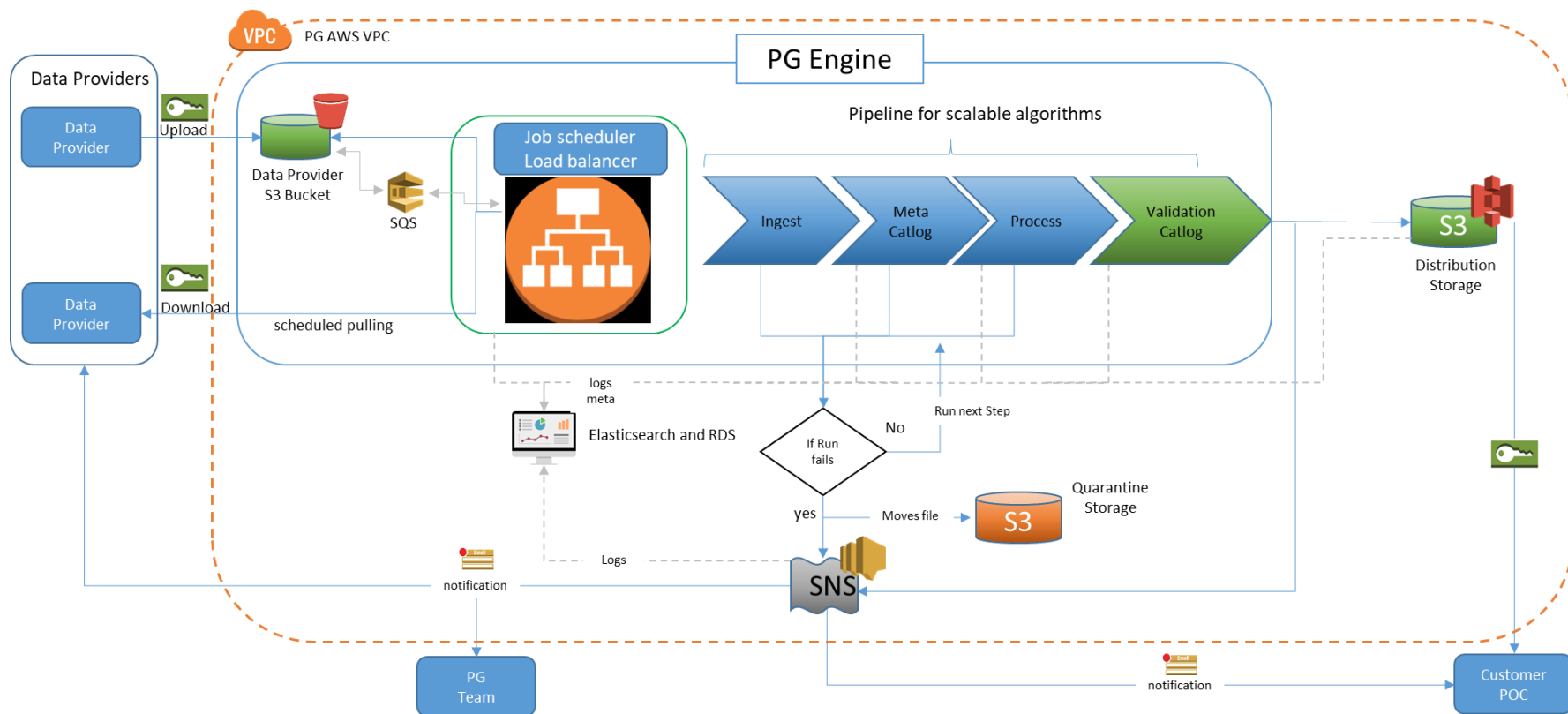
- Cloud Pilot 3 will demonstrate **cloud-native industry approaches** applied to ingest, product generation, distribution and science support

- Evaluation of operationalization will be on how well the approach meets NESDIS' performance needs

Secure Ingest Gateway Pilot (SIGP)

External Data Providers

1. U.S. Federal Entities
2. Collaborative Entities
3. U.S. Other Entities
4. Non-U.S. Other Entities

NOAA TICAP

X-Wave — 5

Secure Ingest Gateway

N-Wave — 6

WOC AWS — 7

High Trust
- Anti-Virus
- Content Filtering

Moderate Trust
- Anti-Virus
- Content Filtering
- Packet Filtering

Low Trust
- Anti-Virus check
- Content Filtering
- Packet Filtering
- Etc.

NOAA/Affiliates

N-Wave — 8

1) US Federal Entities
2) Collaborative entities (e.g. universities)
3) Others (e.g. ISRO, JMA, EUMETSAT, Spire)
4) Non-U.S. Other Entities (e.g. commercial)
5) Trusted Internet Connection (TIC)
6) UTM/Firewall appliance
7) Data quality/integrity check and content verification
8) Product Ingests

- SIGP on Amazon Web Services (AWS) provides:
  - Enterprise secure methods for ingesting data from external providers
  - Agility to modify the compute resources to meet new data source needs
  - Scalability for compute resources
- NESDIS is transitioning SIGP into an operational capability

NESDIS Lessons Learned

TECHNOLOGY

- Commercial cloud services **can support** satellite data products & formats
- Future programs may no longer provide **end-to-end solutions**
- **Lift and shift** migration works, but is the *least* effective approach*
- **Future architectures must leverage cloud native tools**

RISK

- **Security controls strategy** needs to be adopted
- **Confidentiality, Integrity, Availability (CIA)** must be considered

PEOPLE

- Federal IT staff require **cloud training**
- Organizational culture needs to change to **realize the benefits of cloud technology**

ACQUSITION

- **Procurement strategy and processing times** need to be change to realize the benefits of the cloud

In the case of operational HPC, the results can vary. This bullet is NESDIS-specific.

THANK YOU

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