Raytheon

A Data Processing System Designed for the Cloud

JPSS-CGS

Raytheon IIS - NWS

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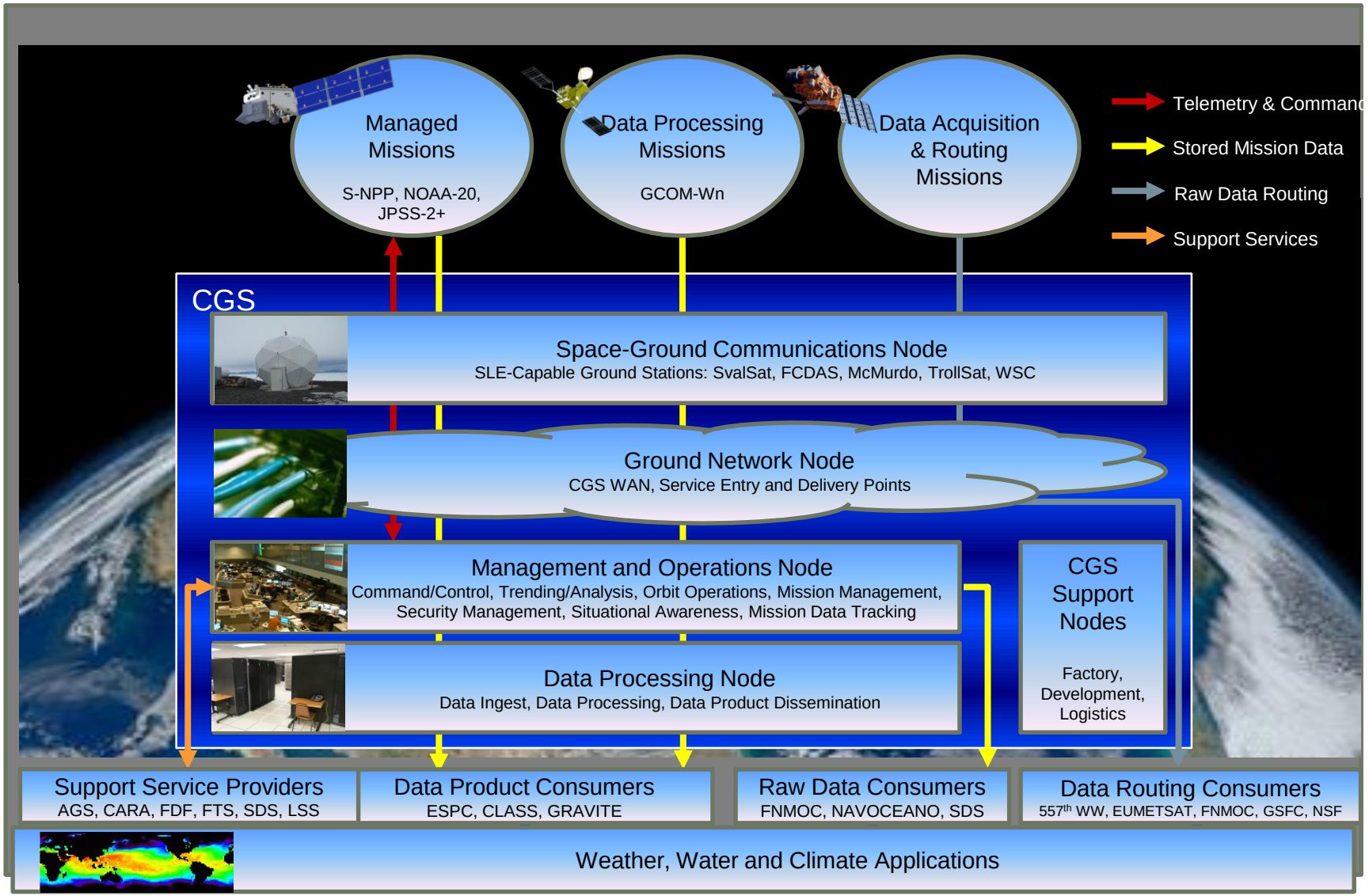
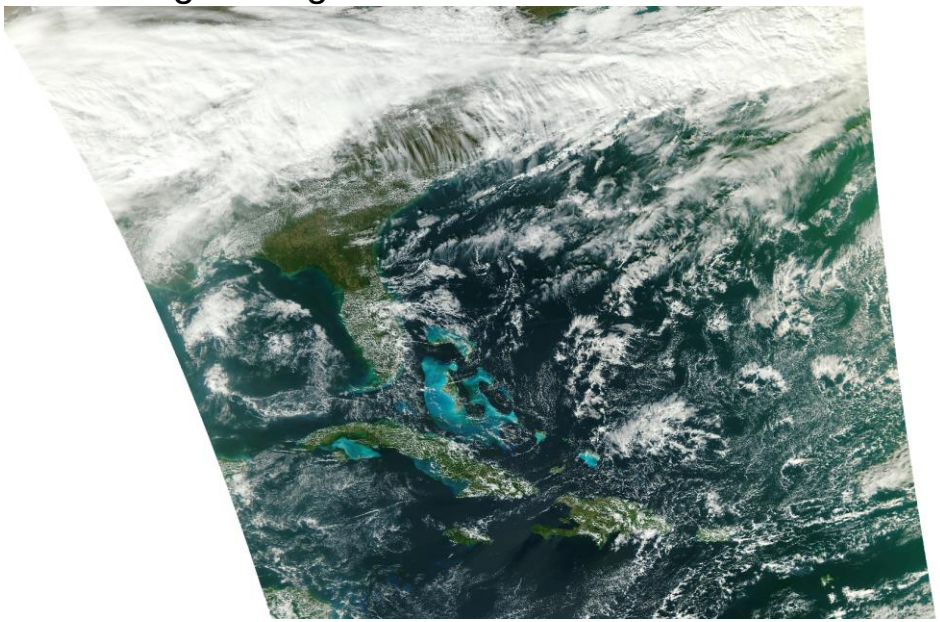
JPSS CGS IDPS – what is it?



JPSS CGS IDPS – Products

- IDPS produces extremely high quality products from the Suomi-NPP and NOAA20 Spacecraft as part of the JPSS Common Ground System.

- First Light Image from S-NPP VIIRS



Source: *https://earthobservatory.nasa.gov*

- First Light Image from NOAA-20 VIIRS Captures Thomas Fire in California

Source: https://www.nesdis.noaa.gov/JPSS-1

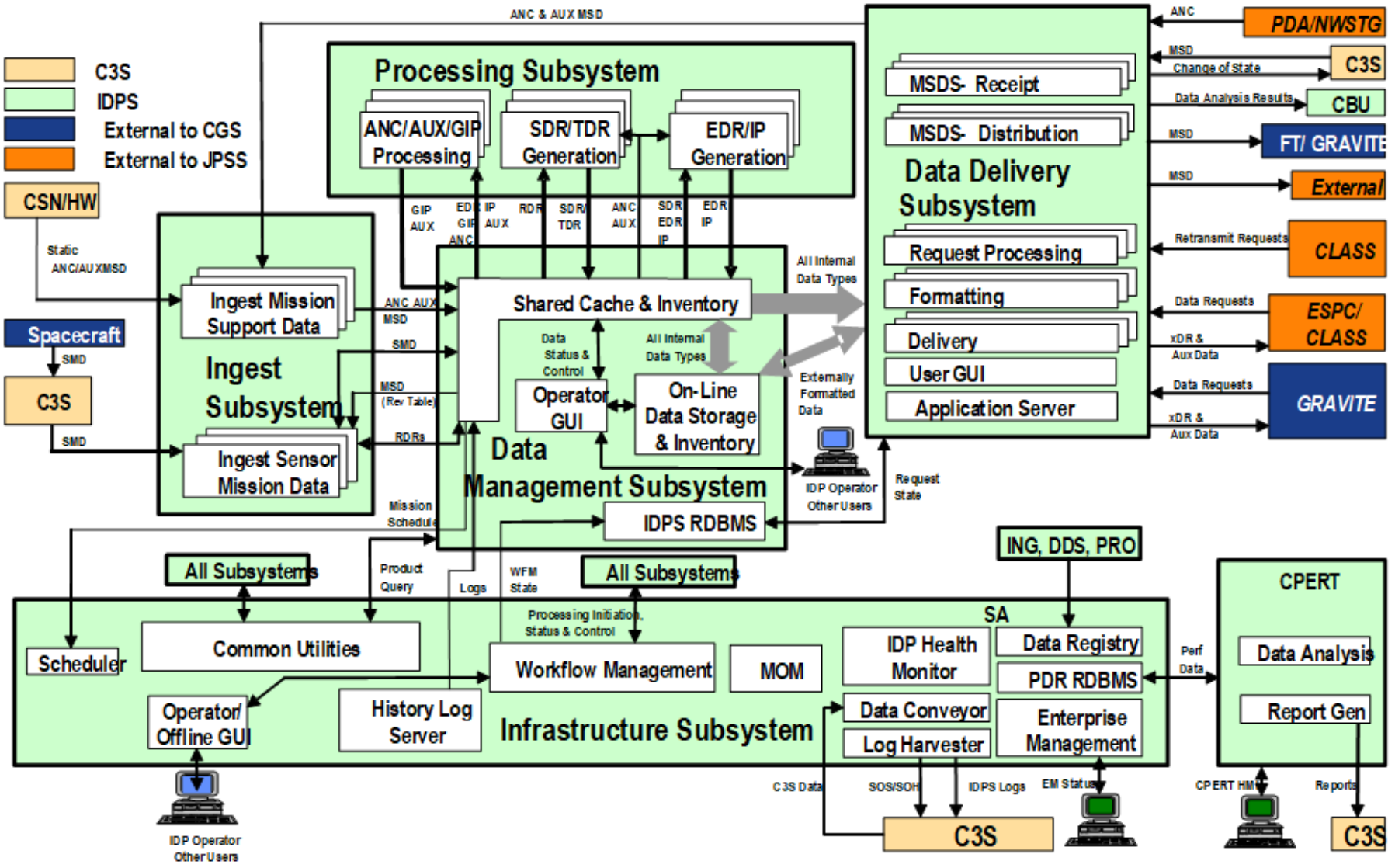
JPSS CGS IDPS – Details

- Interface Data Processing Segment
  - IDPS is the Joint Polar Satellite System - Common Ground System segment responsible for providing the ground data processing capability to create the S-NPP and JPSS data products from raw sensor data. The IDPS receives Application Packets (APs) from the Command, Control & Communications Segment (C3S), generates and stores Raw Data Records (RDRs), converts RDRs into Sensor DRs (SDRs), Temperature DRs (TDRs) and Environmental DRs (EDRs), then pushes all required data into the Central's computers.
  - All of this has to occur with extremely low latency and high quality
  - IDPS receives ~400 Gigabytes of data from 3 spacecraft and delivers over 7 Terabytes of data out to the Mission Partners every day

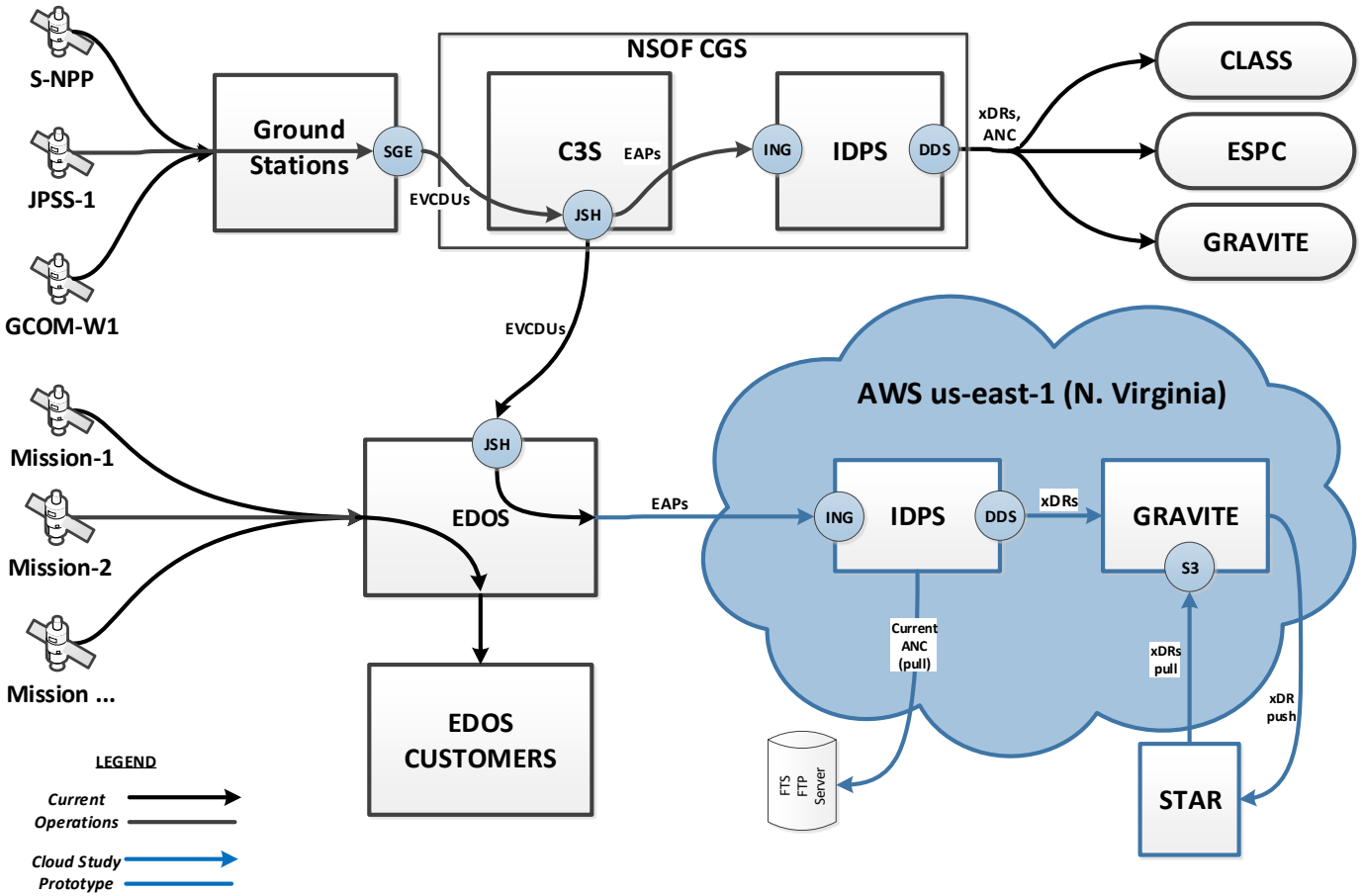
JPSS CGS IDPS – History

- IDPS was first worked as a concept starting in the early 2000's
- Original Design was for a large mainframe computer
  - Fun Fact: The building that these computers would go in was not completed at the time and once completed the Server room could not support the weight of the mainframe!
- As Hardware options matured IDPS was able to move to a blade architecture that began to allow significant flexibility
- The Software followed along nicely with a very configurable setup allowing you to easily change HW resource utilizations
- Configuration changes now can be made to select how many different virtual servers are available for each portion of IDPS

JPSS CGS IDPS – Current Design



IDPS Cloud Technical Demo



- Technical demonstration of IDPS to a Cloud Env.
- Live S-NPP & JPSS-1 SMD Contacts
- Continuous Flow with a controlled Ops-Like Demonstration

Moving IDPS Ops into the Cloud

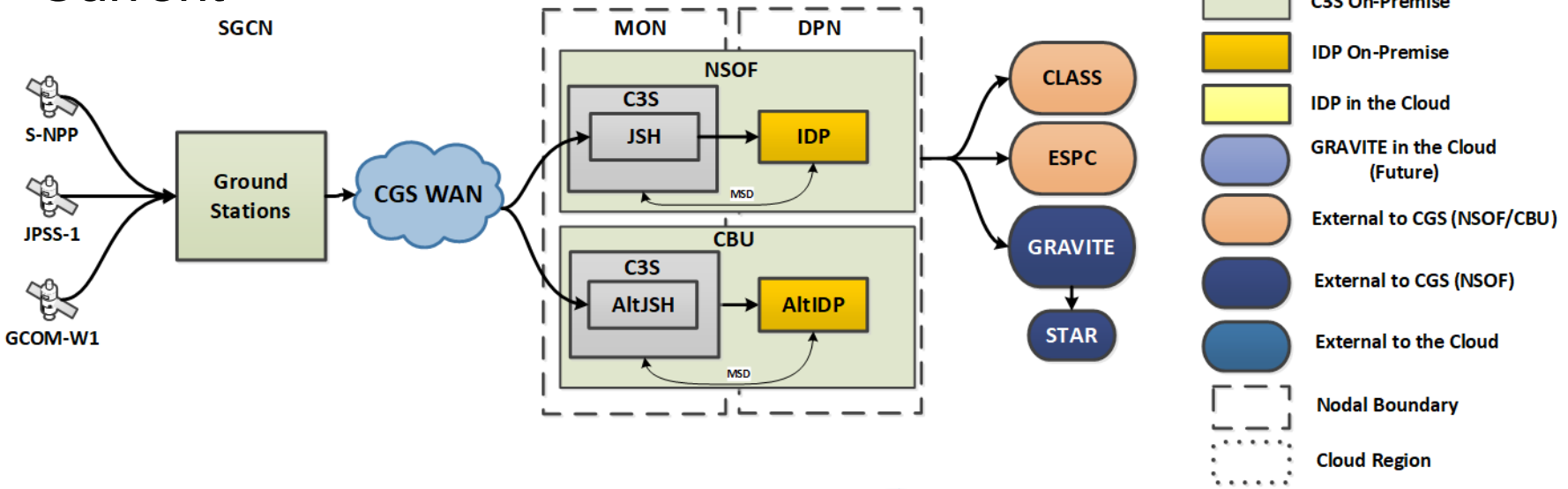
- Working with the JPSS Ground Project IDPS team we were able to obtain access to a NASA managed portion of Amazon Web Service's "Pub Cloud" (Public Access Cloud)
- This allowed us to install IDPS into the Amazon Web Services (AWS) environment with a live data flow from the JPSS System
  - The initial estimate was roughly 1 month to get IDPS running once the instance was setup (COTS ready)
  - It ended up being much more straight forward then thought and only took 4 days!
- We delivered to a Mission Partner within the same cloud without any issues
- We then successfully migrated into an AWS GovCloud instance to prove additional Security Capabilities
  - This included a demonstration of Failover between two AWS Availability Zones

How did IDPS do going into the Cloud?

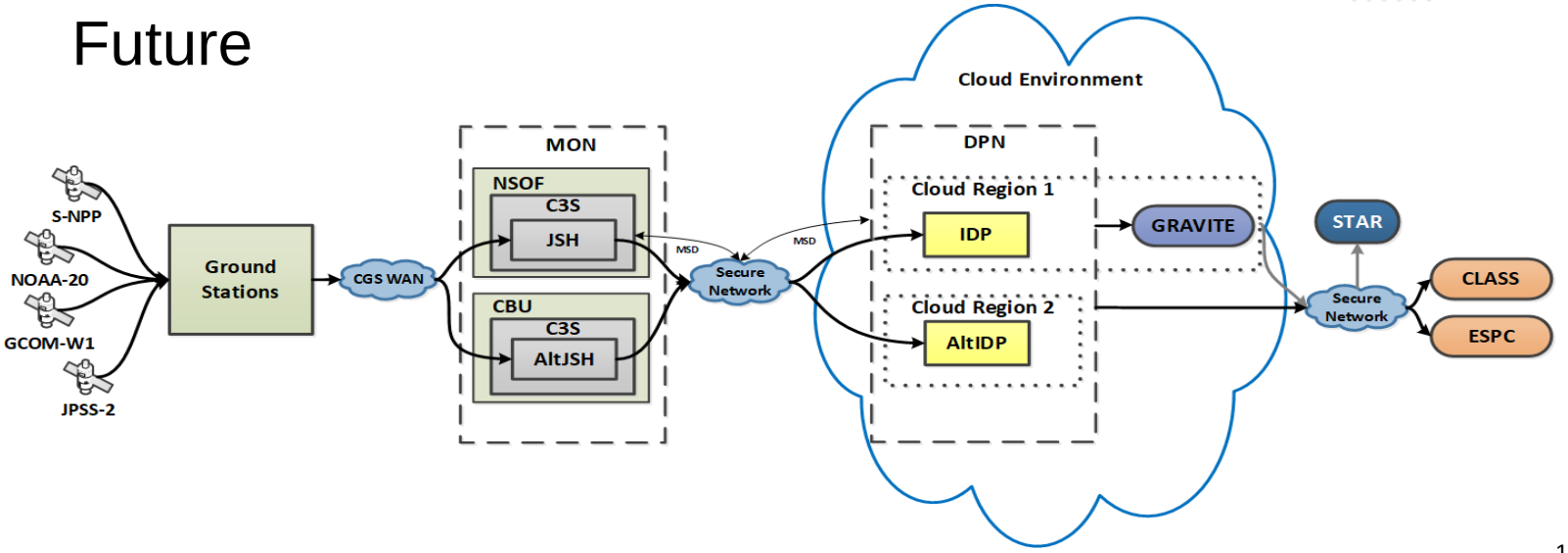
- Advantages
  - Scalability
    - Near instant interchange of Resources (e.g. VM with CPU/Memory via Machine Images). Ideal for scenarios such as “Meltdown / Spectre Case Study” & Tech Refresh.
    - Storage easily added/reduced based on processing plans
  - Agility/Efficiency
    - Initial/Manual IDPS cloud infrastructure setup and software deployment & integration extremely fast
    - Cloudformation templates showed automated/rapid deployment of cloud infrastructure
    - Ability to stop/terminate resources that are not used
  - Accessibility
    - Secure Console & VM access established (Expand/Control Anywhere, good for COOP options and overall access to any string)

The Future of IDPS in the Cloud

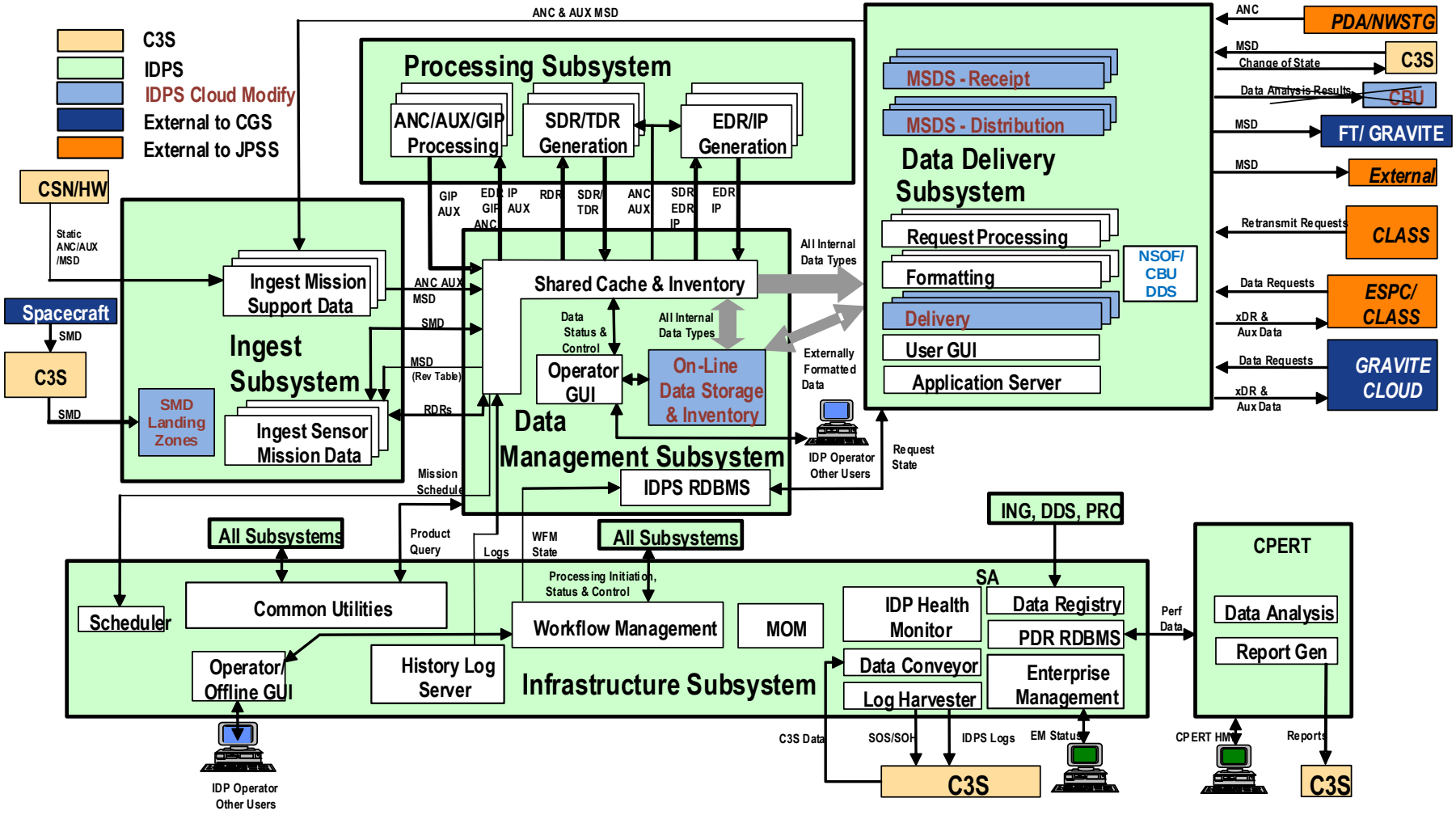
Current



Future



IDPS Architecture modifications for Cloud



Changes to IDPS are minimal for cloud migration

IDPS – Designed for the Cloud

- As demonstrated in the initial efforts IDPS does not require significant modifications to execute in a cloud environment.
- The Key Areas that require SW Architecture modifications in the Ingress and Egress portions of IDPS
  - Data Delivery - Data out (and in)
  - Ingest - Data In
- Other modifications are for optimization to better utilize cloud architecture
  - Dynamic Algorithm Resource Allocation
- ATO in the Cloud
  - Help to define the processes and tools that are necessary to reach the correct security levels
- Currently working with the JPSS Program Representatives to the NOAA NESDIS Cloud Initiative

IDPS – Benefits: Failovers and COOPs

- Currently the JPSS CGS primary facility is located at the NSOF in Suitland, Md, and the backup facility is located at the CBU in Fairmont, WV.
  - The backup facility is unmanned by any program personnel
  - The operations teams have 12 hours to get to the site and get the system nominal
- Data Processing in the Cloud COOP
  - With replicated data between two geographically separated Zones we can be ready to process data within minutes instead of hours
    - No travel time
    - Replicated Data
    - Can be either a Warm or Hot backup

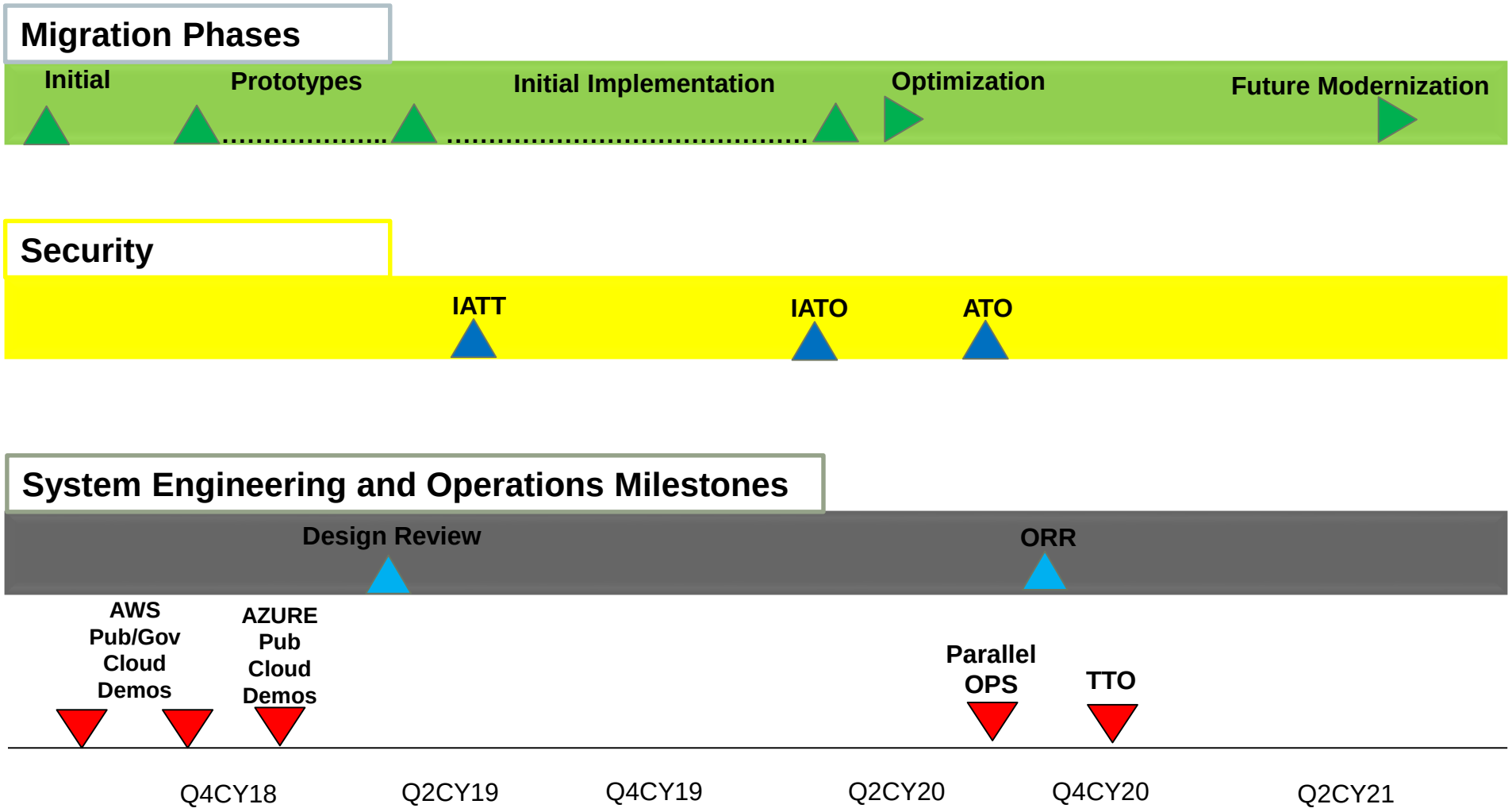
IDPS: Benefits - Faster to Operations

- Currently there is a 12 week cycle once a software release is ready to proceed to operations before it goes operational
  - This includes 4 weeks within the Factory
  - 2 Weeks for Operational Board Approvals
  - 6 Weeks on Site Strings
- Our estimates for a software release in a Cloud instance is around 6 weeks (with potential to decrease)
  - Factory Time will be cut down with automation updates
  - Board Approvals can be concurrent with Parallel OPS activities

IDPS - Other Cloud Benefits

- Moving IDPS into the cloud will allow even more flexibility with resource allocations allowing:
  - Faster modifications to algorithms (Significant decrease in durations for Science Modification to Operations)
  - Simple capabilities to add new Polar Missions
    - Spin up a few more Nodes
  - Capability to handle Non-Polar Missions
  - Flexible Testing
    - Ability to setup a new instance for tailored test data flows to partners on demand

Notional Timeline for IDPS in the Cloud



Summary

- IDPS requires only minor modifications to begin taking advantage of many features available only in a cloud environment

- IDPS is a perfect demonstration of a flexible and modular system that fits beautifully into a cloud environment

IDPS was designed for the Cloud long ago on a sunny day!

Who has the first question?

Suomi NPP
VIIRS Blue Marble Stamp
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