Open Source Science for ESO Mission Processing Study

Identify a system architecture that meets the ESO mission processing objectives, supports open science, enables system efficiencies, and promotes earth-system science.

Workshop #1
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NISAR Mission Data Processing System Perspective

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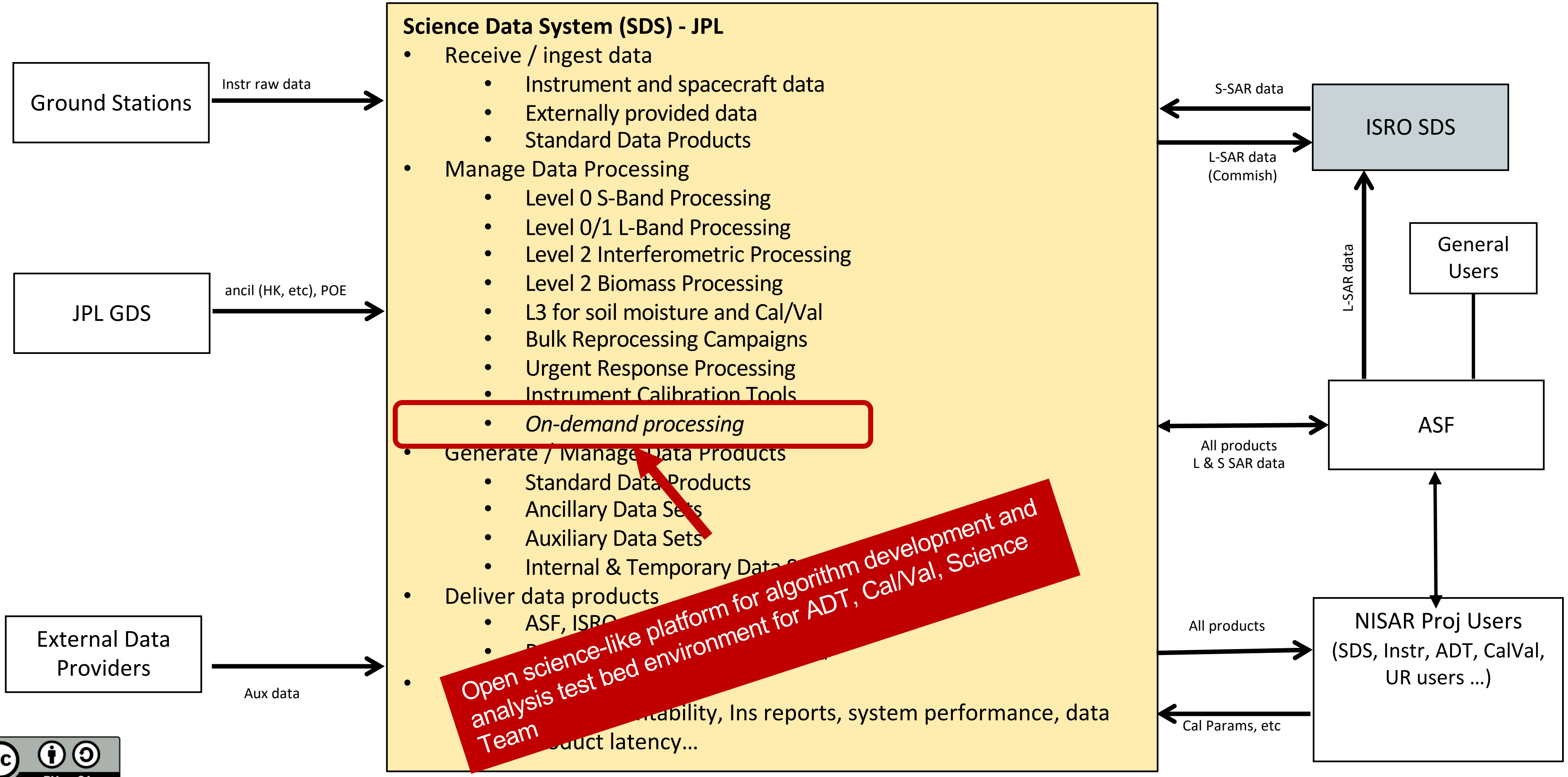
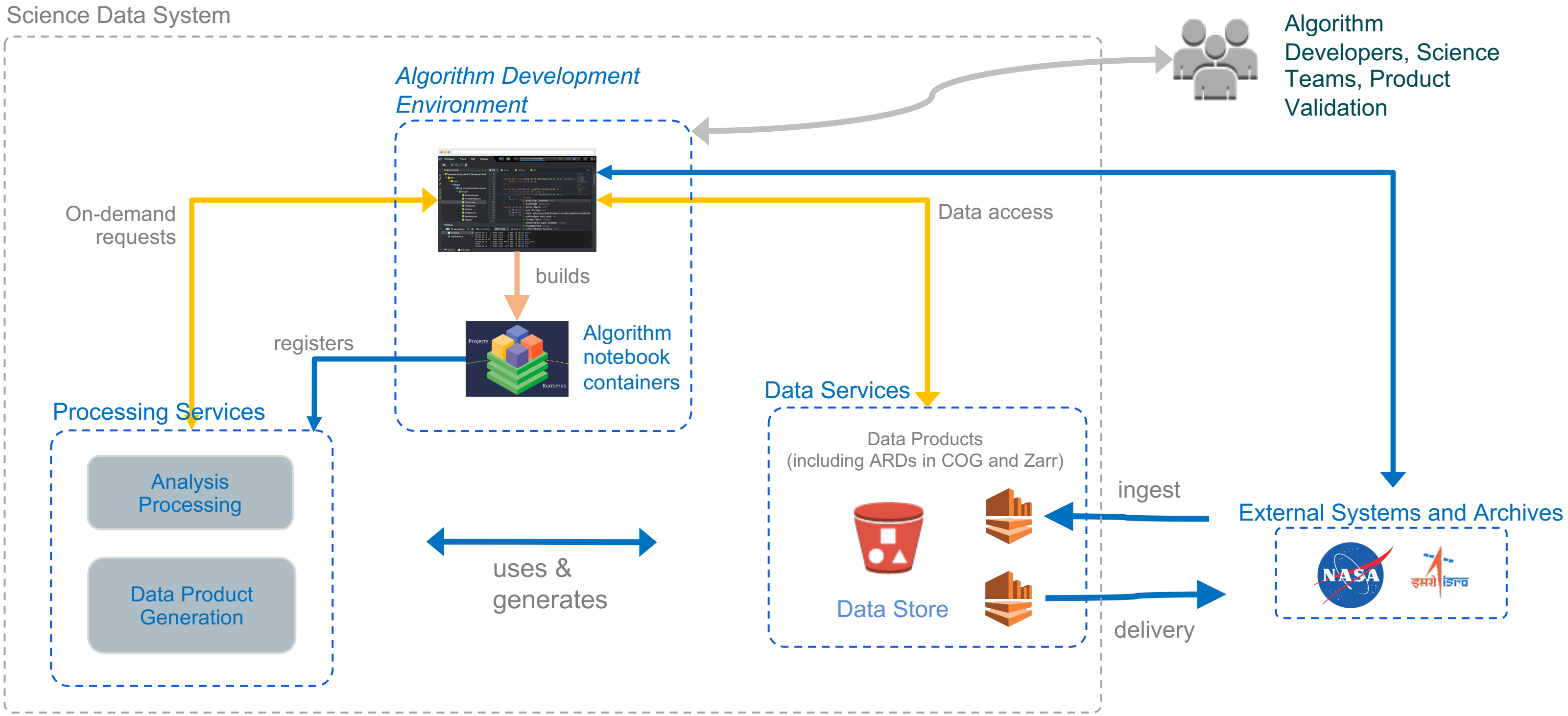
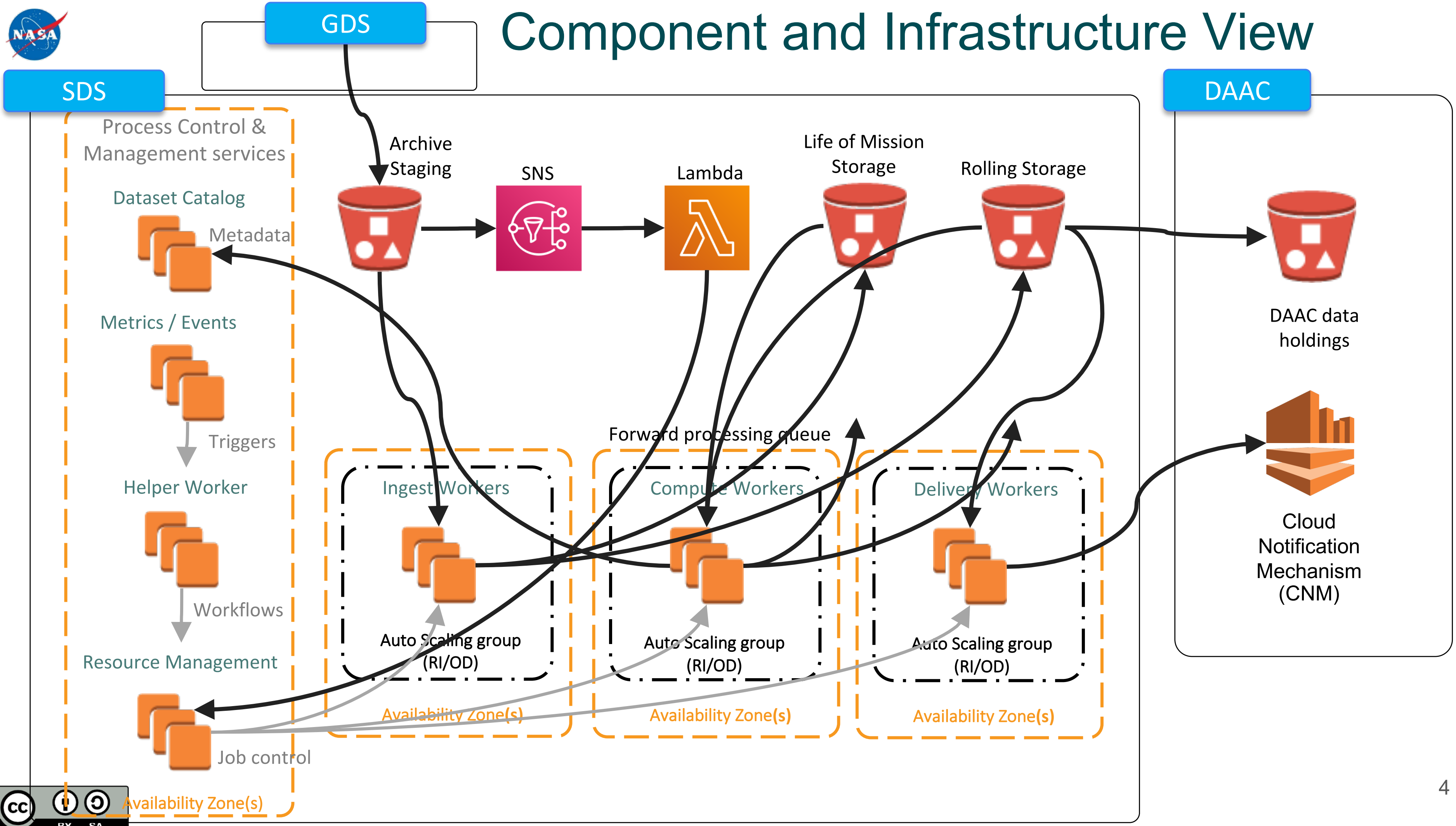
Data Processing System Architecture



Component View

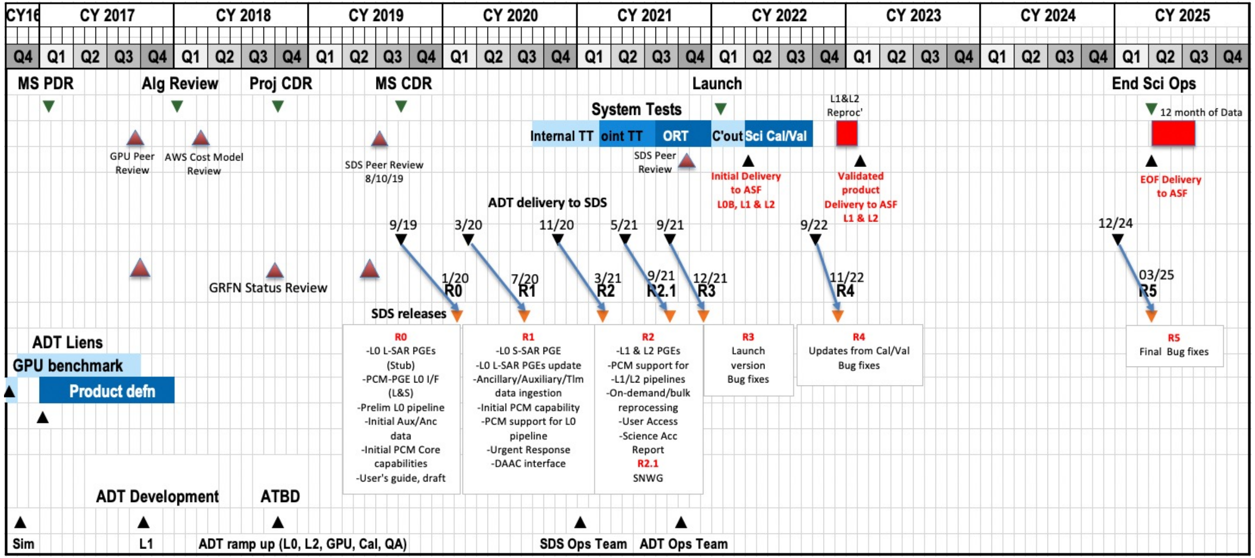


Component and Infrastructure View



Implementation Plan

Project Schedule (from pre-MCR to end of Science phase)



This is an older schedule from 2019 that contained items of interest from before phase C/D.

Road to MS-CDR

- ADT L5 requirements Peer Review
- PGE L5 Requirements Peer Review (internal Team)
- L0-L2 PGE Design Peer Review
- Cyber Security Peer Review
- Design Benchmark tests between NEN, GDS and SDS
- PCM subsystem LPR
- ADT Algorithm Peer Review
- GRFN review/status
- PPQA Process products Review
- GPU Peer Review
- AWS Cost Review using Resource Utilization Tool
- SDS Pre-CDR Peer Review
- MS CDR

Inherited software capabilities

- Open source ISCE used by ADT
- Open source HySDS used by SDS

Supporting Earth System Science

- Does your MDPS use/share any data, algorithms, etc from other ESO projects to support Earth System Science?
    - NISAR SDS **artifacts** (data, algorithms, IT security plans, processes, procedures, workforce and expertise) are **shared across** Integrated Earth Mission Systems (IEMS)
        - Shared with SWOT, SMAP, OPERA, MAAP
    - NISAR standard products will be **used by** SNWG/OPERA for displacement and water extent products to the applications communities
- What are your barriers to enabling collaboration to support Earth System Science within your ESO MDPS? (e.g., firewalls, access, schedule, developments costs, etc)
    - Current policies on **Authentication and Authorization** are **barriers to opening up of systems** for access and collaboration. e.g. access by public users (US and Foreign Nationals) working with Project
    - Current **clearance process** is not equipped to deal with modern complex web tools that are used to generate new datasets with a rapid turnaround time
    - Creating any **new web tools or an online presence** for NASA-funded systems is hampered by the current NASA moratorium on new website domains.
- What are the opportunities for improved support of Earth System Science?
    - **Opening up NASA data and platforms** to NISAR science users
    - Opening up NISAR project algorithms, data, workflows, etc to open science community to foster **transparency and *reproducibility by other systems and platforms***
    - ***Systematic*** *processing of standard products for future missions may be costly. Opportunities for more* ***on-demand processing****.*

Supporting Open Science

SMD defines open science as a collaborative culture enabled by technology that empowers the open sharing of data, information, and knowledge within the scientific community and the wider public to accelerate scientific research and understanding.

- What does this definition of Open Science mean in the context of data processing systems?
  - **Algorithm development** is done in **collaborative open science platforms** per project scope
  - **Data products** during development, Cal/Val, product validation, and on-demand requests are open and accessible
  - **Algorithms, workflows, ancillary/auxiliary data** are open
  - Data products are **reproducible outside canonical SDS**
- What do you feel are the most beneficial opportunities for improvement in the MDPS to support Open Science?
  - Updates to Flight **project scope, requirements (and therefore funding)** to support open science
  - Updates to **cybersecurity policies and procedures** to improve open science procedures (e.g. accessibility)
- What are the barriers to supporting open science?
  - Current authentication and authorization policies required for **open access**
  - Development of algorithms **in open science context** requires updates to mission requirements
- What components (Data system, PGEs, algorithms, data) of your system will be developed in the open (open source from the outset)?
  - For NISAR SDS, the algorithms and core processing system are open sourced and **developed in the open**
  - NISAR SDS is **contributing** to the open source software
  - SNWG/OPERA will be **inheriting** from this open source software as a starting point

Other

- What are your **pain points** in support of this mission?
  - Current NASA policies and cybersecurity restrictions are providing hurdles **to open access to members of science teams.**
  - To support science team, algorithm development team (ADT), and Cal/Val needs, setting up an accessible on-demand algorithm development and processing environment allowing users to develop, deploy, test, and generate on-demand data products.
- What does **system efficiency** mean in the context of an MDPS? (cost, data storage, processing time, etc.)
  - Processing of L0 to L2 data products are done in most **compute and storage** efficient manner.
    - Algorithm implementation optimally matches with deployed compute sizes. (e.g. single core, 36-core, GPU, etc)
    - Intermediate and standard products generated are **cloud-optimized**
  - Additional **economies of scale** can be achieved if there is a multi-mission processing capability
    - **Reuse** of processing, common pre-processing, more cost-efficient cloud costs models, sharing of ops workforce
  - Harmonized approach of **algorithm development-deployment-execution** use in standard product production, algorithm development, and analysis for Cal/Val and product validation.
    - Allows algorithm developers to harness the large-scale compute powers of MDPS
- Is there anything else you'd like to share that you feel would be helpful in our study?
  - **Cost constraints** and estimated **peak throughput** were drivers for early architecture design
    - Desirement for High Availability **(HA) design vs requirements**
  - Need for **common processing platform** for ESO-era missions.
    - Helps to address barriers mentioned above
    - Minimizes need to have MDPS formulation early on
  - Evaluation of **systematic processing vs on-demand processing** of standard products