



<http://earthdata.nasa.gov>

NASA Earthdata Cloud

Mark McInerney

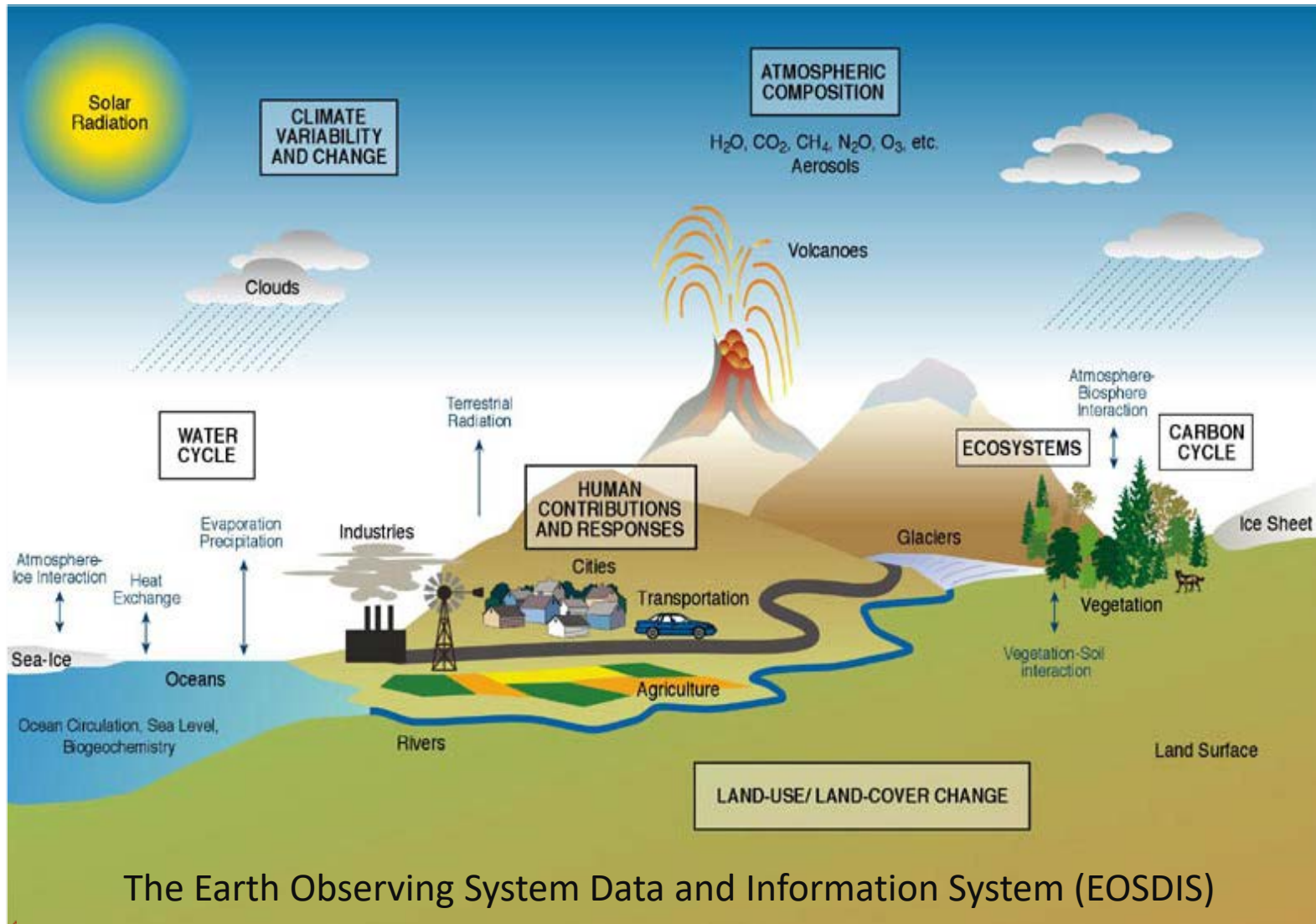
Deputy PM - Technical

Earth Science Data & Information System (ESDIS)

February 2020



EOSDIS Comprises Data of the Whole Earth System



Atmosphere

- Winds & Precipitation
- Aerosols & Clouds
- Temperature & Humidity
- Solar radiation

Ocean

- Surface temperature
- Surface wind fields & Heat flux
- Surface topography
- Ocean color

Cryosphere

- Sea/Land Ice
- Snow Cover

Land

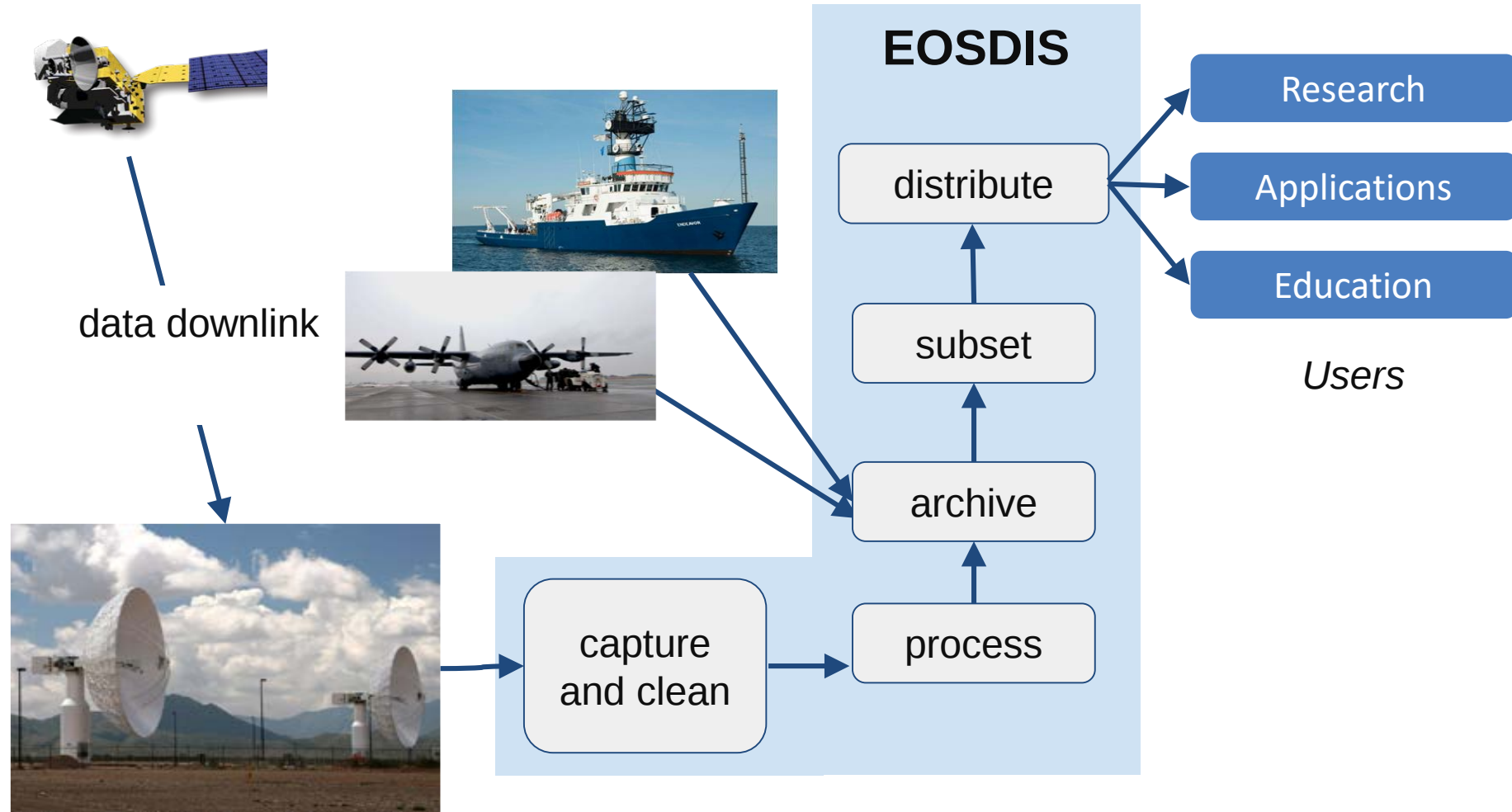
- Cover & Usage
- Soil Moisture
- Topography & elevation
- Temperature

Human Dimensions

- Population & Land Use
- Human & Environmental Health

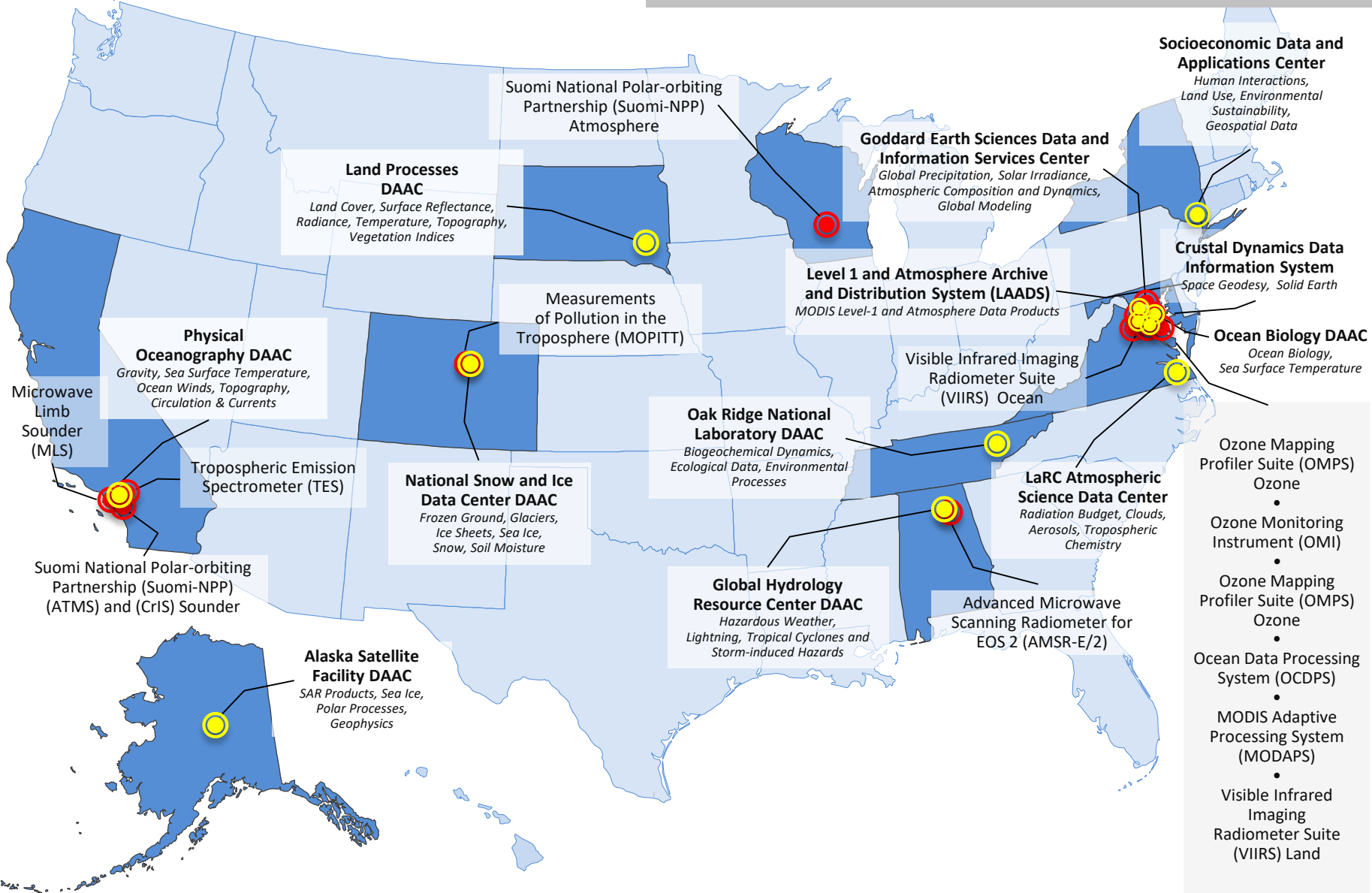


Components of EOSDIS End-to-End



EOSDIS Organization

EOSDIS 12 Distributed Active Archive Center (DAACs) and 13 Science Investigator-led Processing Systems (SIPS)



Motivation for Commercial Cloud

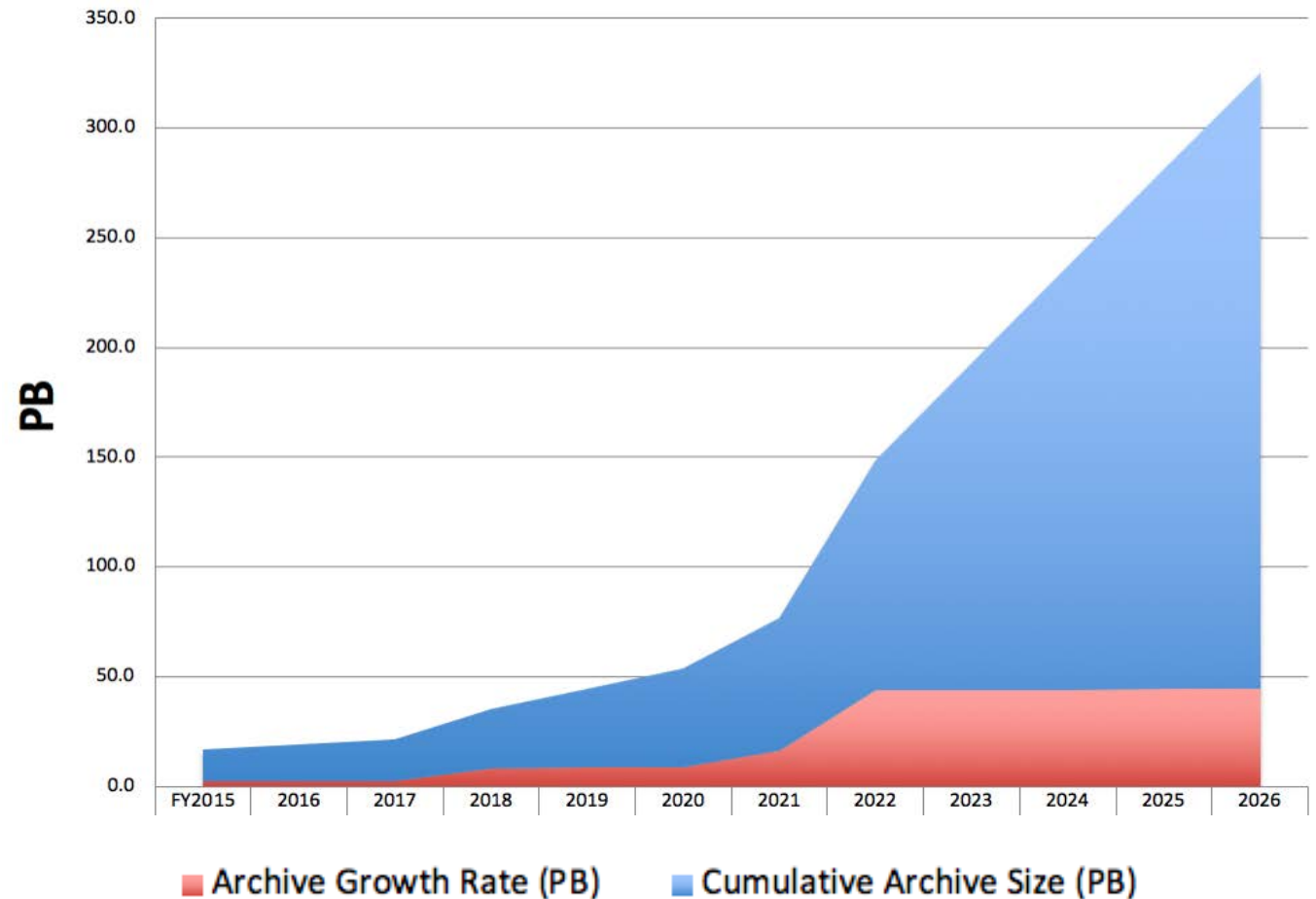
Motivation for Cloud

Growth of Mission Data & Processing: Projected rapid archive growth and the need to effectively process significantly larger volumes of new mission data requires **rethinking existing architectures**.

Data Systems: More cost-effective, flexible, and scalable data system ingest, archive, and distribution solutions are needed to **keep pace with new mission advancement**.

Science Users: Significantly larger data volumes requires **additional ways to access and utilize this data**, with “Data Close to Compute” or Data Lake”.
Bring Algorithms to the cloud

Projected Data Volumes

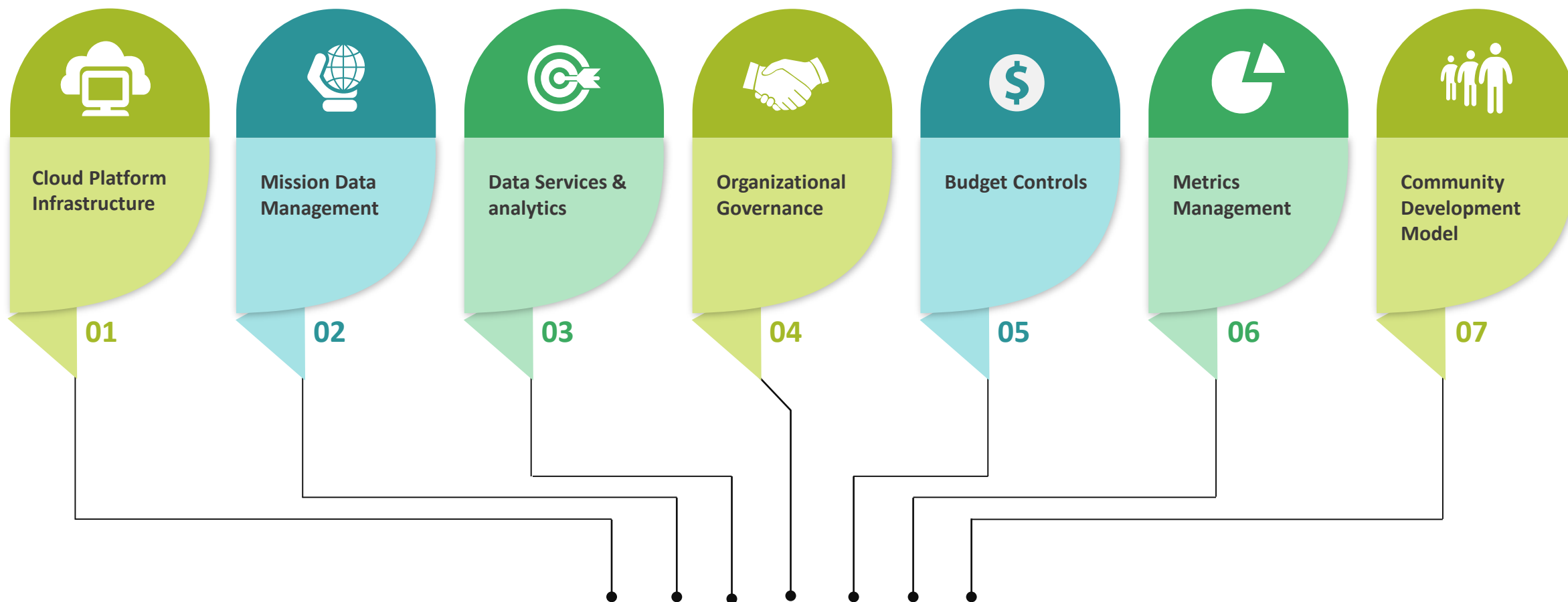




Earthdata Cloud (EDC)

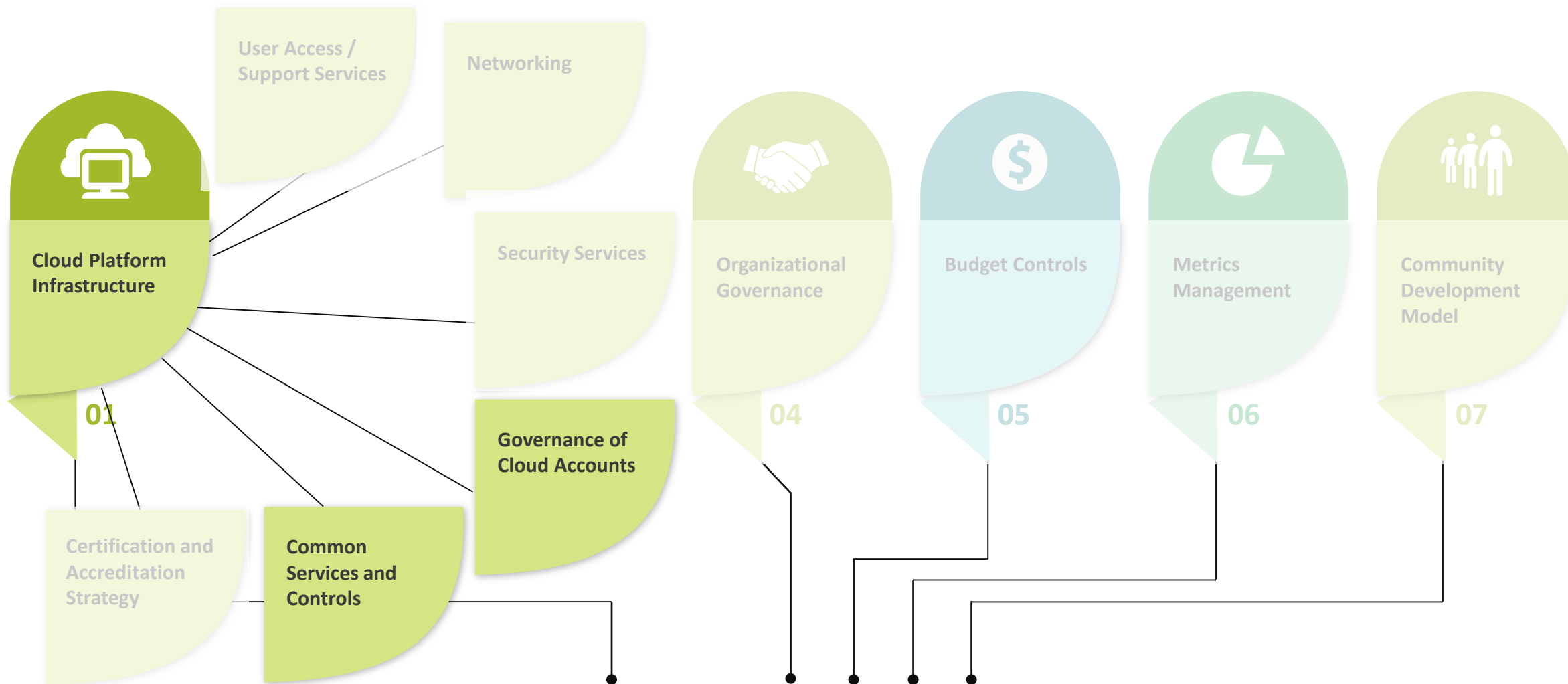
- “Managed” commercial cloud for EOSDIS on AWS
- Improves the efficiency of NASA’s data systems operations – maintaining free/open data policy
- Designed architecture for EOSDIS applications and mission data ingest, archive, distribution
- Operational July 2019. Common Metadata Repository (CMR) Application, Earthdata Search Application, 6 PB Sentinel-1 mission data.
- Currently onboarding 11 mission datasets, 20 PB, next 8 months for initial strategic build out the “data lake”.





Components of the Earthdata Cloud

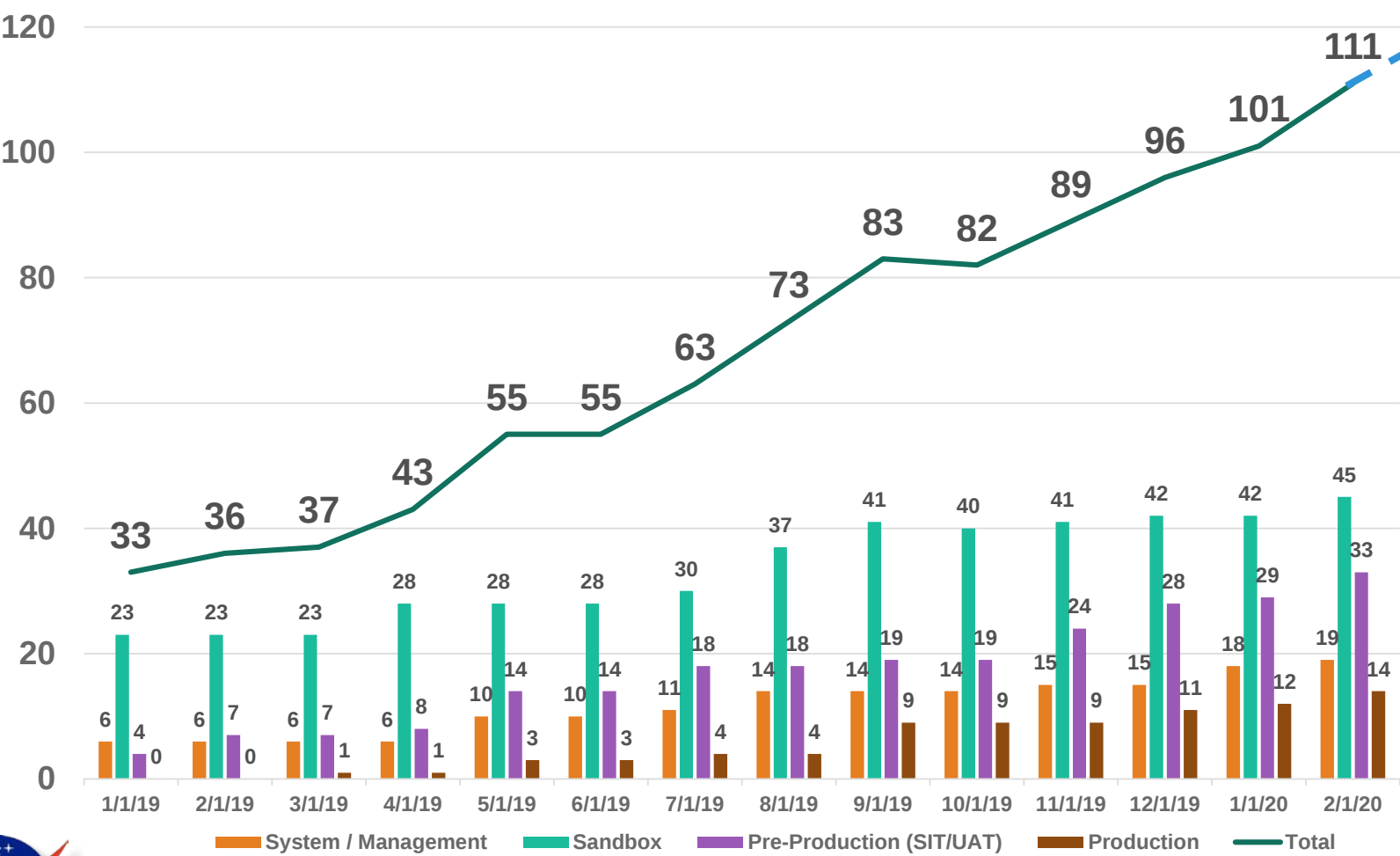




Project Level Components and Core Elements

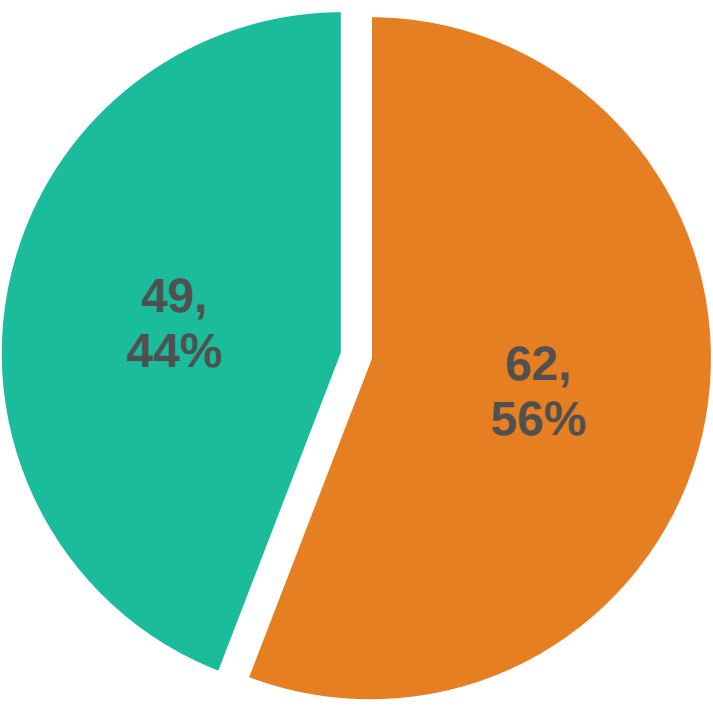
AWS Accounts Metric

EDC AWS Account Totals



Est 200 AWS Accounts
Fall 2020

AWS Regions by Accounts



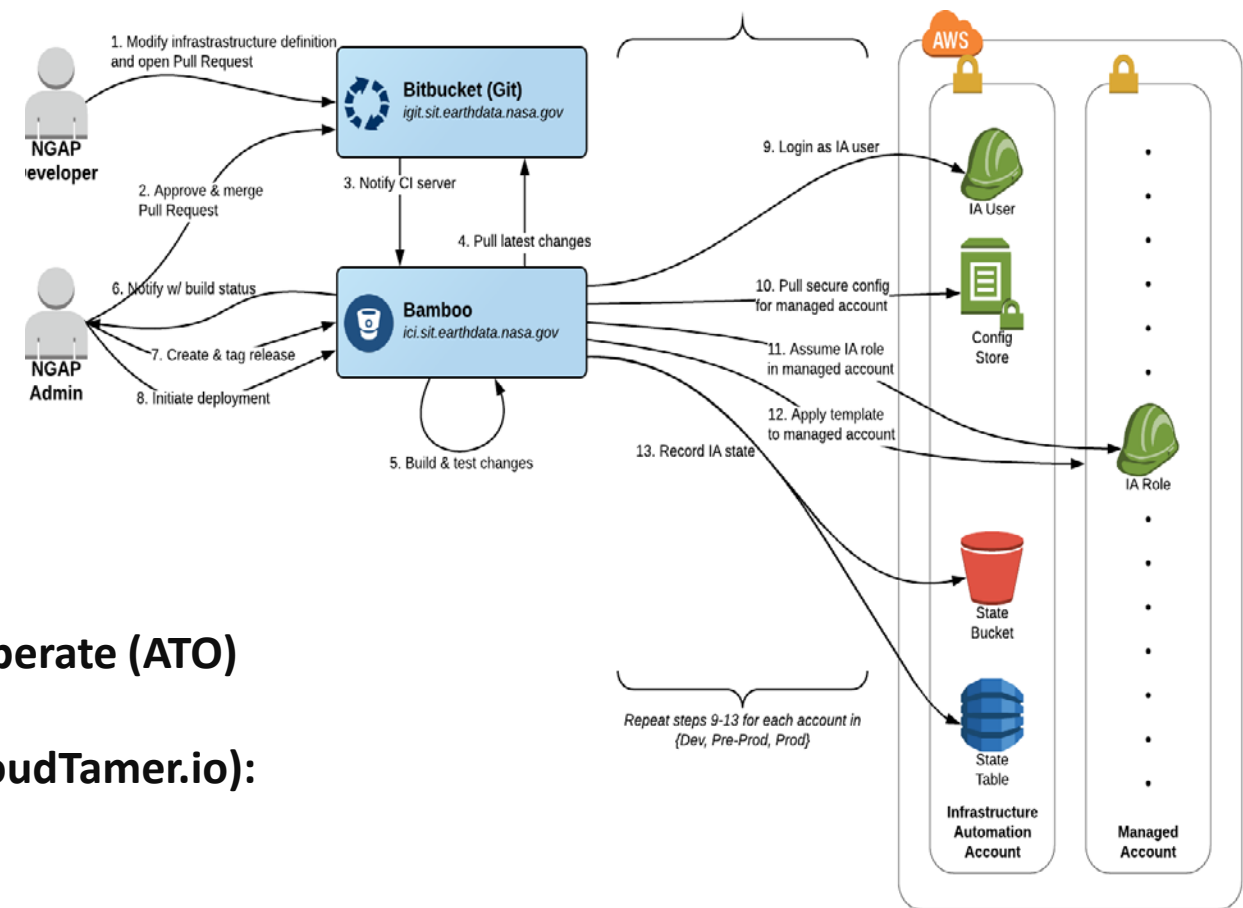
us-east-1 (N. Virginia) us-west-2 (Oregon)

174 Unique Users with 228 Roles



Common Services and Controls

- 1. NASA-Approved Amazon Services:** vetted AWS and third- party SAAS services and process to add new. Focus is on using AWS cloud-native services
- 2. Code Deployment Services:** DevOps Continuous Delivery Continuous Integration CI/CD Pipeline to security scan, build, and deploy code
- 3. Use of Infrastructure as Code:** including re-useable template to define a multi-account ecosystem
- 4. Single System Security Plan (SSP) and Authority to Operate (ATO)**
- 5. Single Identity and Access Management Solution (CloudTamer.io):**
 - Rotate AWS access keys
 - Apply session limits
 - Provide role-based access control
 - two-factor authentication

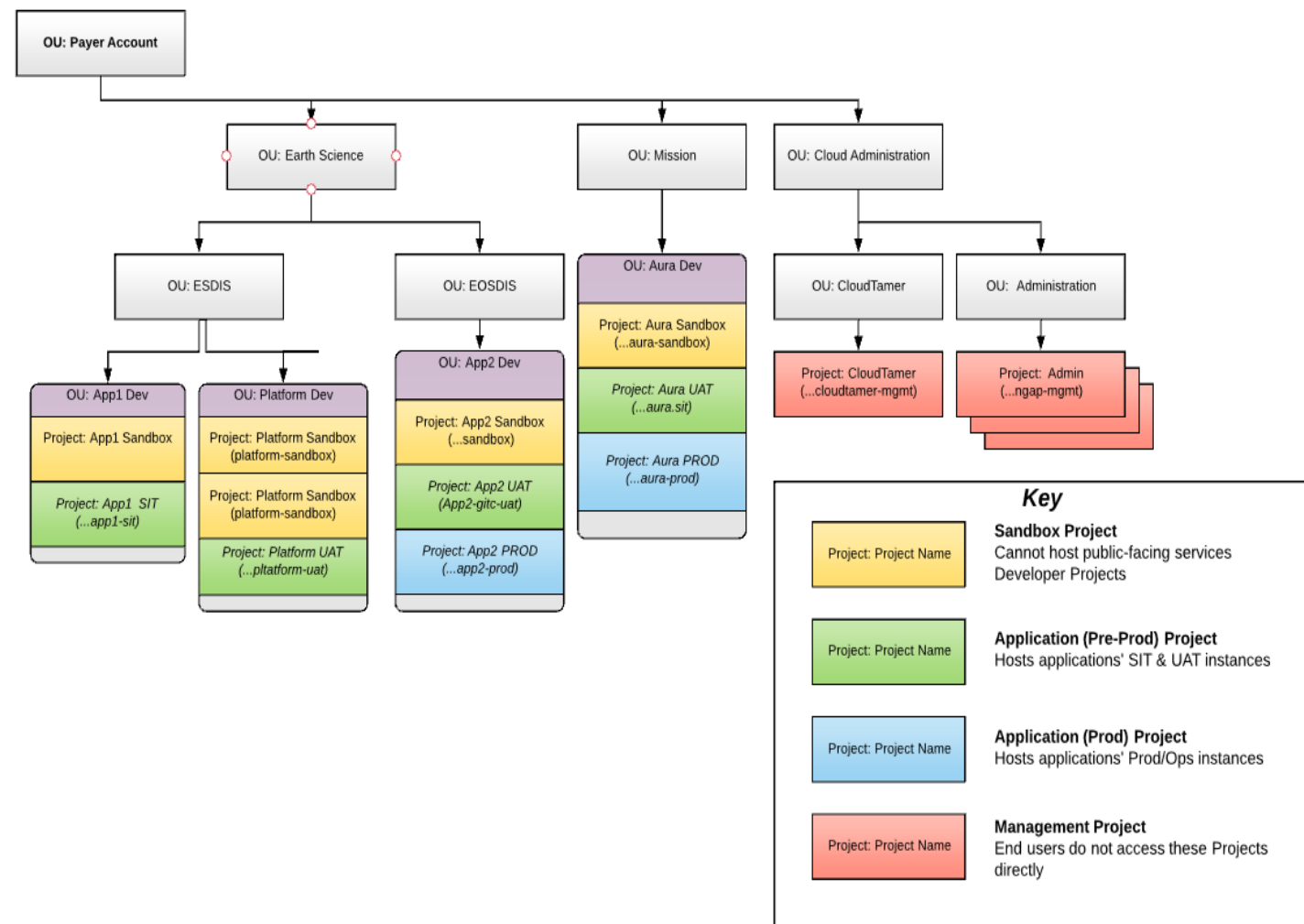


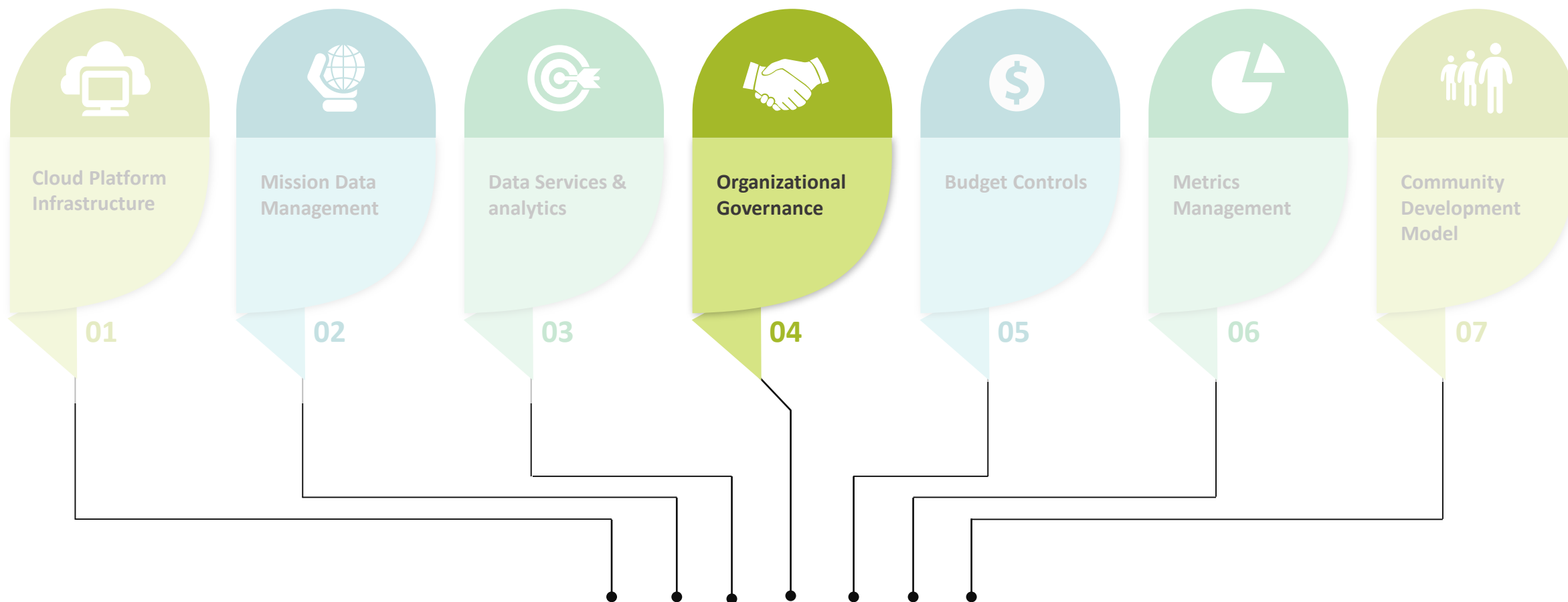
* While providing most flexibility to EOSDIS organizations



Account Structure Architecture

- Single Payer Account using AWS Organization and Consolidated billing
- Multi-account structure divided by organizational units & projects
 - Isolation based on organizational units
 - Isolation based on project or application development, test, and production accounts
 - Isolation of Management and Security accounts from end user environment
 - Track AWS expenses to NASA organizations and funding sources

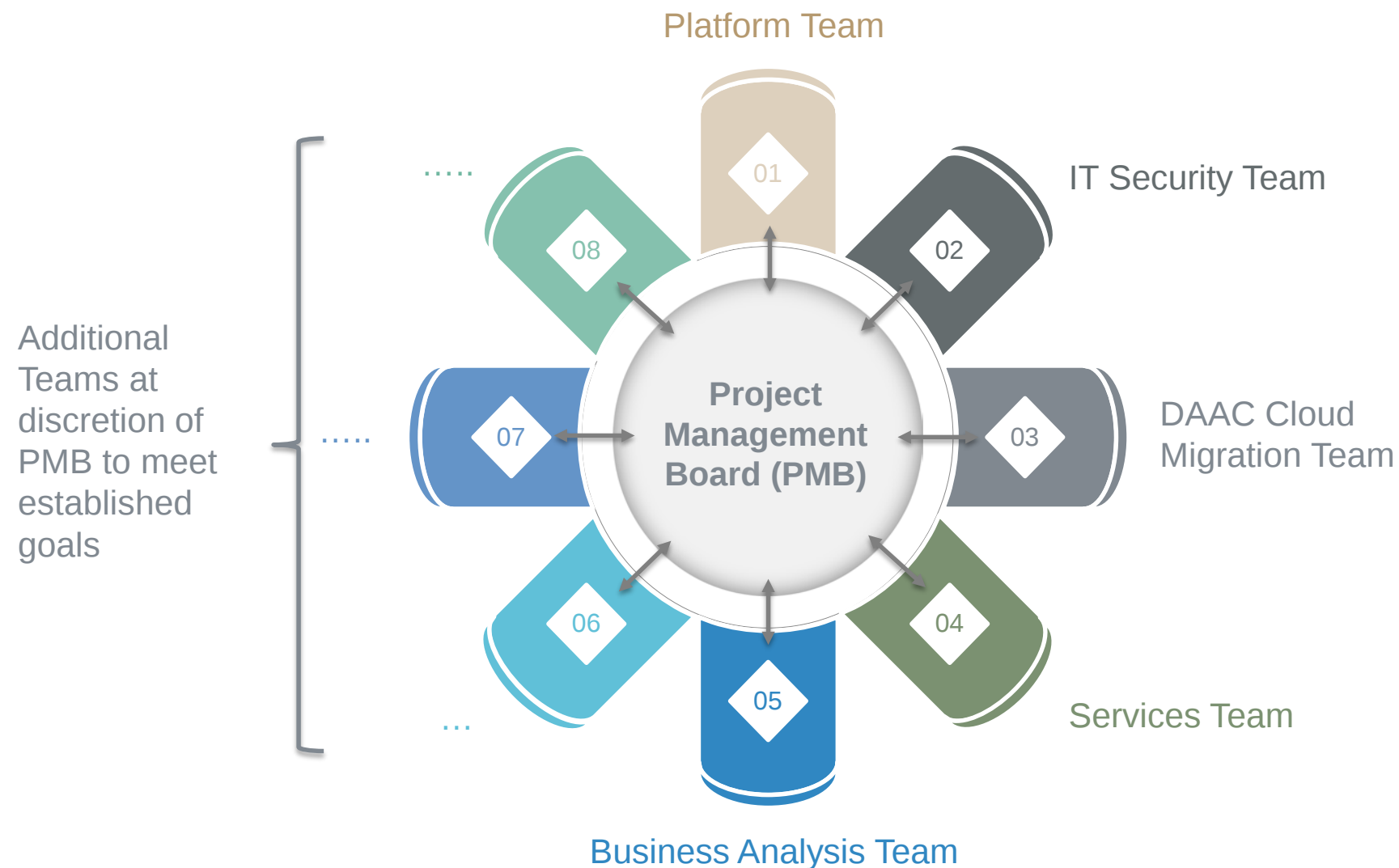


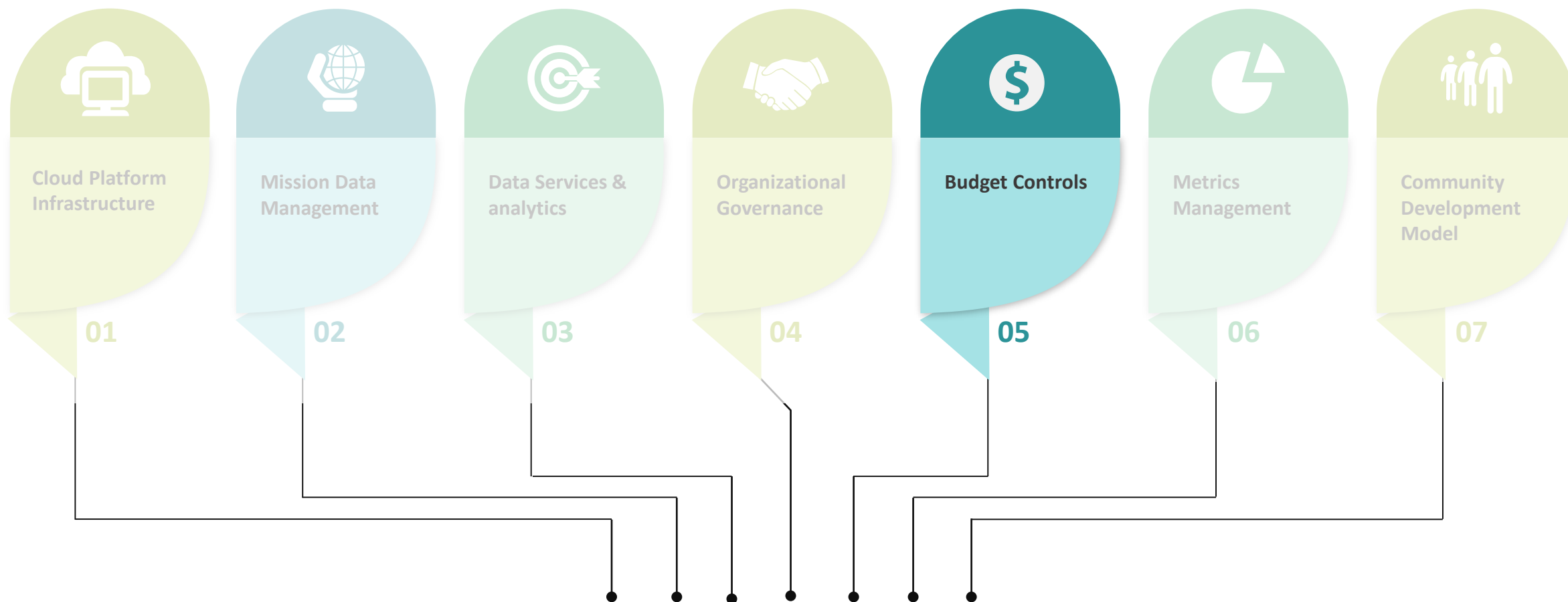


Components of the Earthdata Cloud



Project Management Board Framework





Components of the Earthdata Cloud



The Antideficiency Act (ADA) and Pay-as-You-Go

The ADA act prohibits federal agencies from obligations or expending federal funds in advance or in excess of an appropriation, and from accepting voluntary services.

Federal employees who violate the Antideficiency Act are subject to two types of sanctions: administrative and penal. Employees may be subject to appropriate administrative discipline including, when circumstances warrant, suspension from duty without pay or removal from office. In addition, employees may also be subject to fines, imprisonment, or both.



EOSDIS today has over
33.5 Petabytes
of accessible Earth science data

EOSDIS delivered over
1.9 Billion data products
to over **3.1+ Million**
science users from around the world



... with over
462 Million
Science data files in the repository



Cloud Resource & Cost Model

Cost accounting begins with first capturing individual mission/application level required AWS resources and cost for execution year and out to year 5.

Used to:

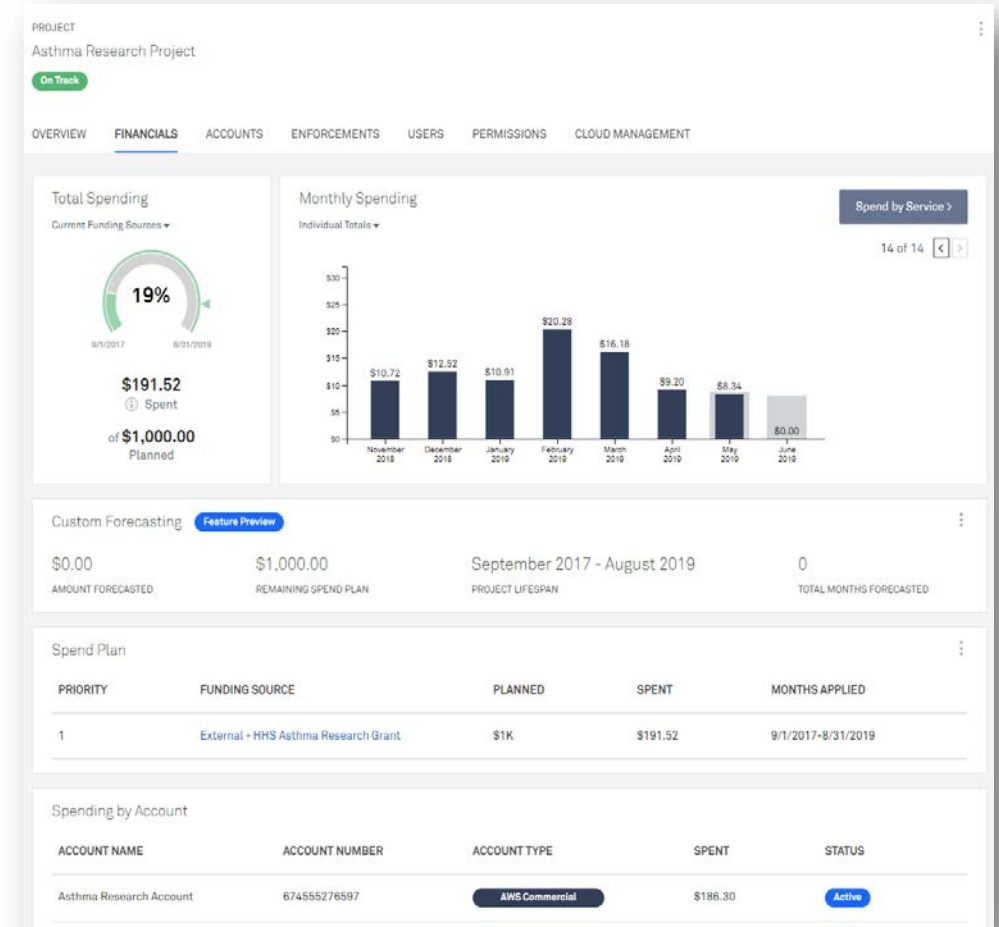
1. Project level cloud resource and cost capture
2. Feed NASA's Planning, Programming, Budgeting and Execution (PPBE) 5 year budget request / cycle
3. Input into execution year monthly "cost phasing plan" and account level budget caps
4. Support performance and cost optimization processes, routine cloud account auditing
5. Initial capture of AWS service needs, vetting for availability and metrics for reserved instance purchases

The screenshot displays a complex spreadsheet titled "Cloud Resource & Cost Model". It features a "FY13 Budget" section on the left with input fields for Project Name, Organization Name, Project ID, Submission Date, Approved For, and Approved Date. The main table lists various AWS services and their associated costs. The table has columns for "AWS Services", "AWS Description Category", "Type", "Cost per Hour", "Cost per Month", "Quantity", "Delta", "Total Cost", and "Notes". The data is organized into rows for different services like Amazon EC2, Amazon S3, Amazon ElastiCache, etc., with specific instance types and configurations listed. The bottom of the spreadsheet includes summary rows for "Total Cost", "Total Cost per Hour", and "Total Cost per Month".



The “CloudTamer.io” account-level view

- CloudTamer tool to push & fund individual AWS accounts under a single AWS payer account
- Enforces individual AWS account-level budget through “budget caps”
- Provides account alert spend monitoring and budget & egress control actions
- Allows for flexible access levels:
 - Top-level view for management & business teams
 - Account view for local managers & Developers





EOSDIS

NASA'S EARTH OBSERVING SYSTEM
DATA AND INFORMATION SYSTEM

<http://earthdata.nasa.gov>

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November 2019

