ENTERPRISE GROUND SYSTEM

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Space and Intelligence Systems

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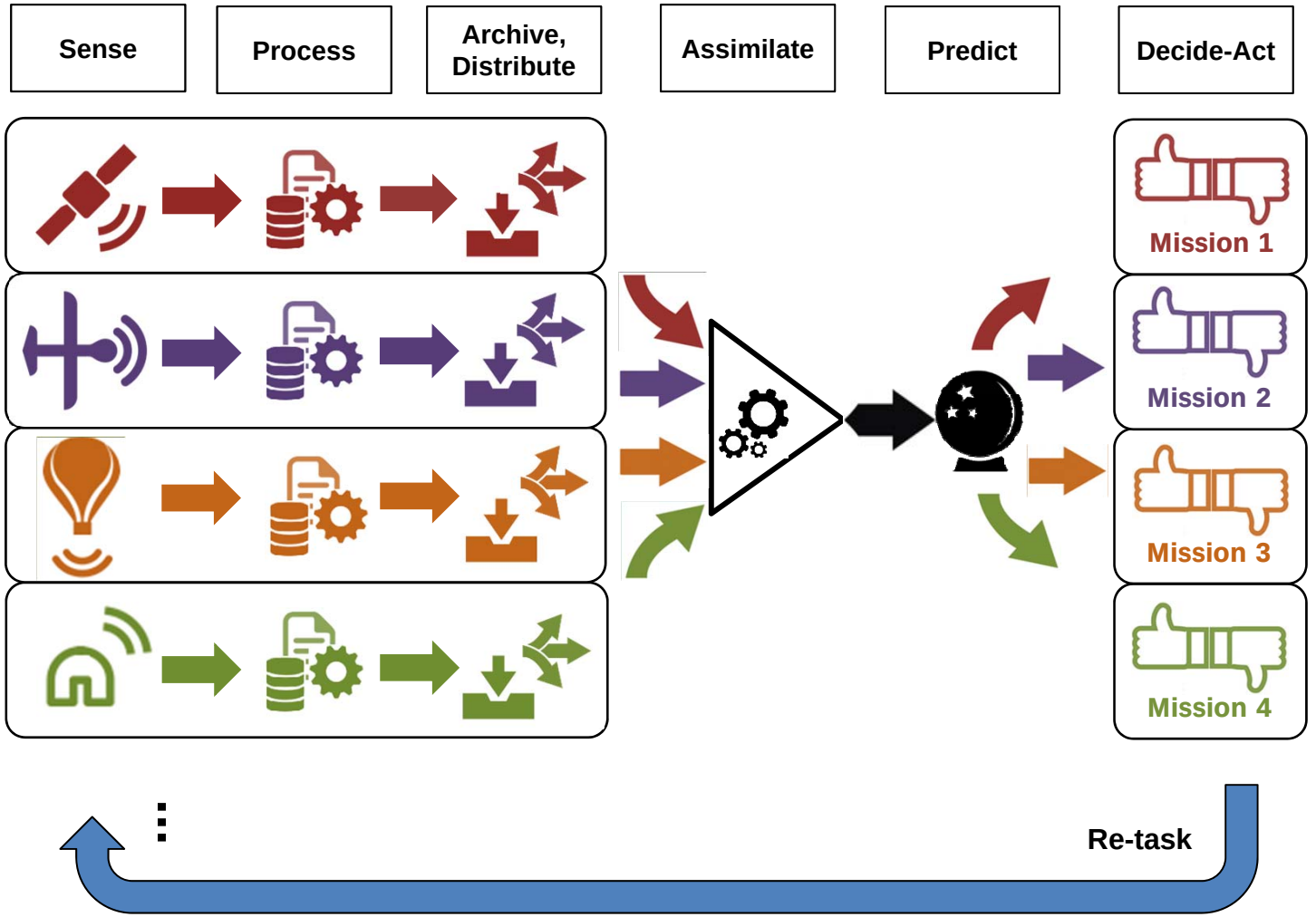
Enterprise Ground System Motivation

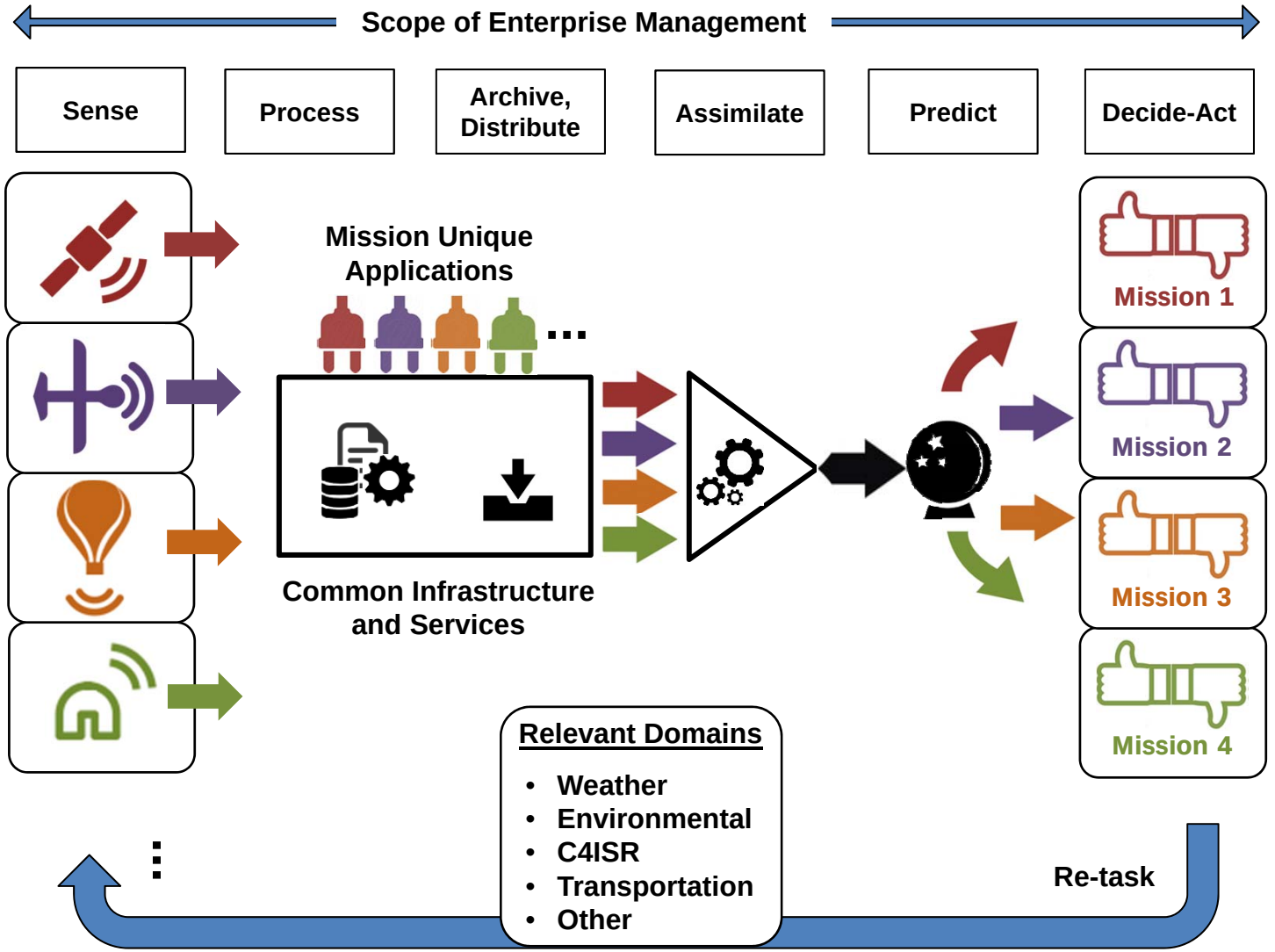
- Not cost effective to acquire, design, build, and test a unique ground system for each new mission
- High level of risk associated with the development of each new ground system
- Most ground systems share common needs and approaches
- Unique aspects of each mission tend to be isolated to specific parts of the ground system

A more efficient approach is to migrate to one Enterprise Ground architecture and leverage common infrastructure and services to reduce both lifecycle cost and risks for decades

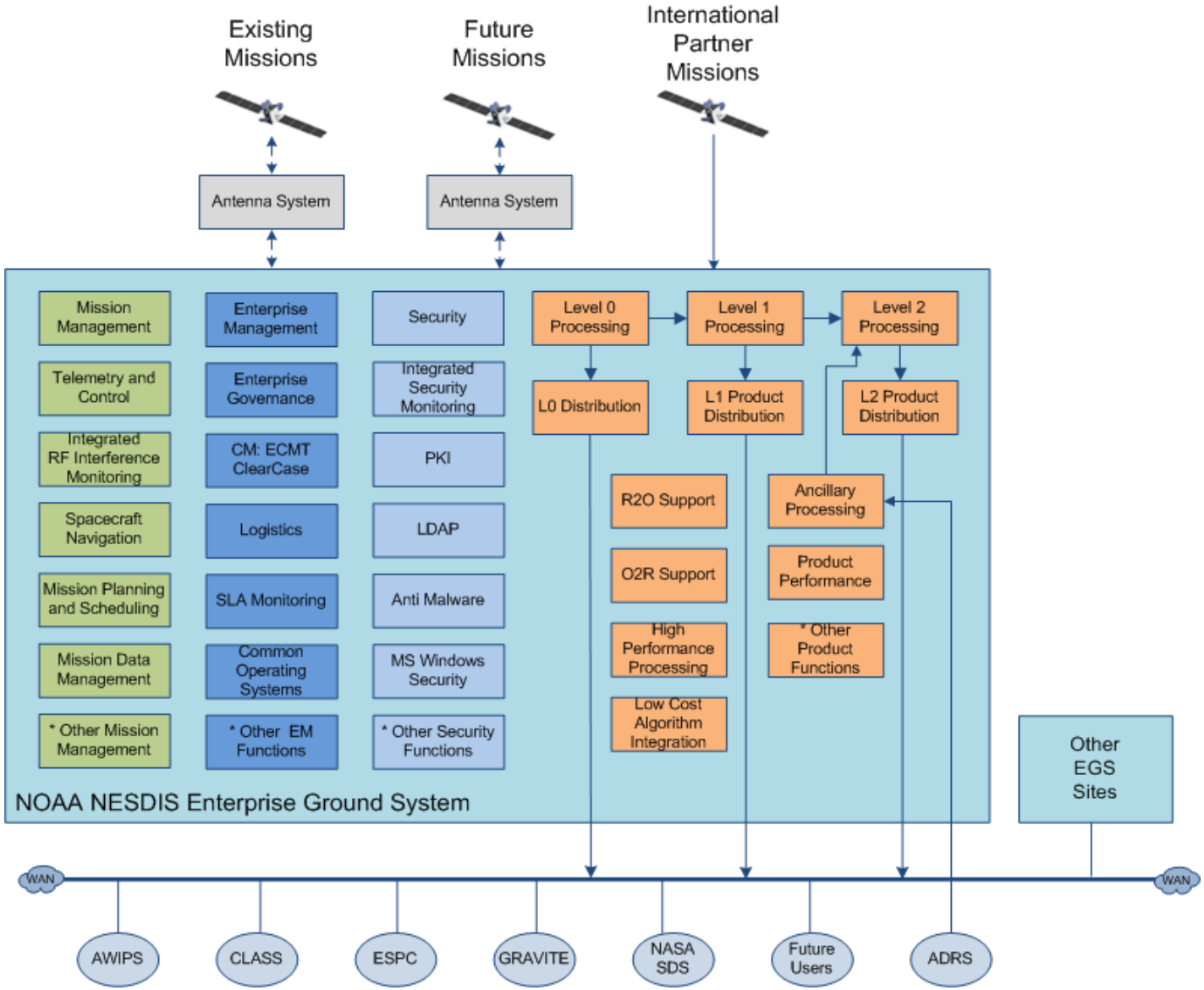
Capability Architecture - Current



Capability Architecture - Future



Notional Enterprise Ground Architecture



Leveraging Common Foundations

IT infrastructure

- Facility, power, uninterrupted power source, HVAC
- WAN connections, LAN, firewalls, load balancers
- SAN storage, backups, removable media
- Relational databases, web application servers, service busses

Security

- Information technology security: intrusion detection and prevention, malware detection and removal, authentication and authorization, PKI, two-factor cards
- Government markings: SBU, FOUO, security clearances, etc.
- Physical asset: facility, building, room, etc.

Process control

- Configuration management, problem tracking systems
- Help desk, service requests, maintenance schedules, sparing, HW repair
- System provisioning, system configuration auditing
- System administration, database administration, application administration
- Security patching, OTS patching

Enterprise management

- System monitoring, fault detection and isolation
- Performance and SLA monitoring

Each of these areas requires considerable investment that can be shared across all missions in an Enterprise Ground System

Common Mission Management Capabilities

Mission management

- Telemetry and command processing
- Space ground communications hardware and software
- Antenna control

Flight dynamics

- Flight planning
- Flight simulation
- Flight plan verification

Mission scheduling

- Schedule development and de-confliction
- Schedule simulation
- Schedule execution

Engineering data processing

- Telemetry archive and retrieval
- Engineering data analysis and trending

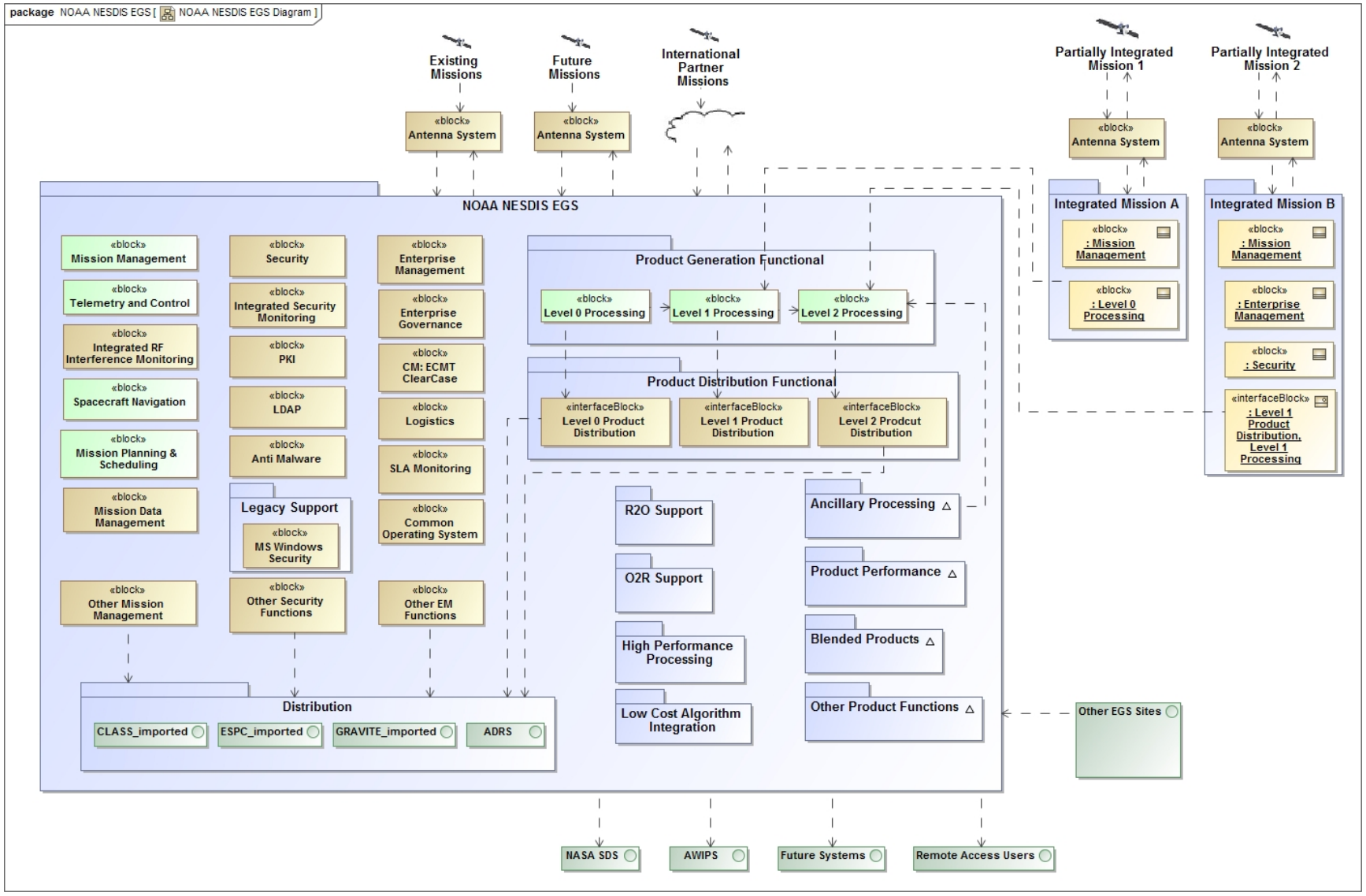
With proper planning and selection, these capabilities may be shared among different missions and mission types including GEO, HEO, MEO and LEO

Enterprise Ground Systems support more than one of each of these types of capabilities when needed

Common Product Processing Capabilities

- Flexible product processing capability to handle diverse processing requirements
- Ability to parallelize product processing to deliver product data quickly to algorithms for high performance, low latency missions and products
- Timely supply of input data to algorithms for high performance processing of modern algorithms using 50-80 different input sources for each pixel calculated
- Ability to integrate new science (research to operations) and to provide results back to researchers (operations to research)
- Flexible distribution
- Combined product generation
- Separate product processing and mission management
- Easily add new sensors

SysML Block Diagram of NESDIS/GEARS



Lessons/Technical Considerations

- Supporting a large data center environment is very costly without using modern management software to automate as much as possible
- Using open source stacks greatly reduces yearly license costs
- Open source for maintaining enterprise systems has matured considerably in the last five years
- New systems for deploying and auditing complex software across large numbers of servers reduces costs and human errors
- Using standard connection frameworks, such as GMSEC, can enable more plug and play of components over time

Lessons/Technical Considerations

- Public cloud deployment still suffers from security concerns and high pricing models for systems with high data input-output rates
- Important to choose carefully between more 9s of availability and resulting high system complexity and cost
- Design for the inevitable technology advancements including planned periodic technical refreshes of the IT infrastructure

Summary

- There are a surprising number of common capabilities required across apparently dissimilar ground systems – regardless of mission domain
- A capability architecture is used to capture common mission needs
- A solution architecture defines design patterns that support common operational threads
- Standards-based interfaces and service frameworks are essential
- Open source components often present compelling value when implementing an Enterprise Ground System
- Information assurance plays an increasingly important role, especially in a multi-mission environment