A design for an advanced architecture of Satellite Ground Segments

PFC 2013/14 - Final Dissertation

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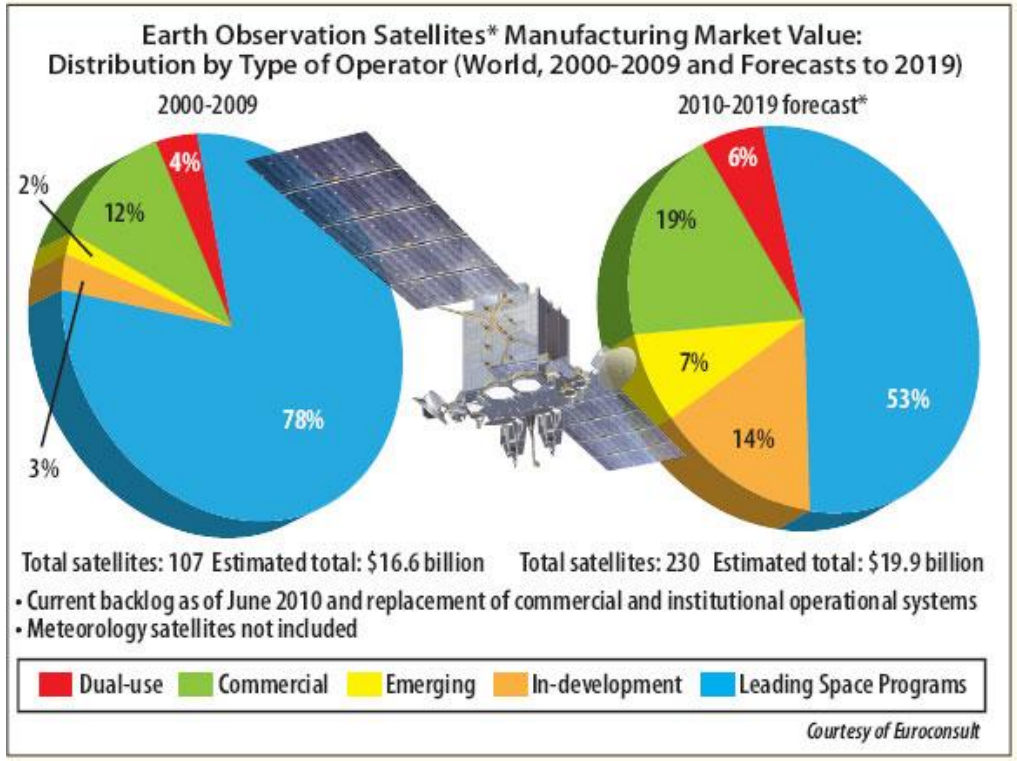
Contents

Introduction

- EO market is doubling its size.
- Non-traditional customers will launch 47% of total satellites.
- Upstream sector is not prepared because:
  - Excess of conservatism;
  - Lack of an integral approach to systems design;
  - Short-sighted design with no longer-term goals.
- EOGS will try to solve those problems.



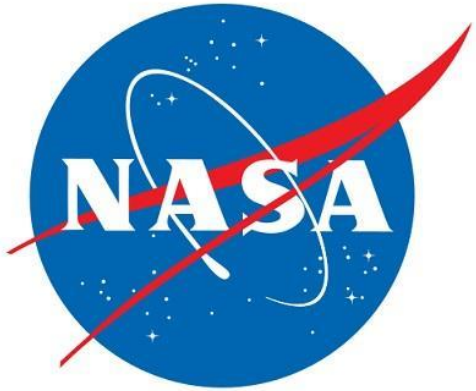
Goals

- To update essential systems in a highly technological niche sector;
- To enhance the classical development cycle;
- To enable cost and risk reductions;
- To give a reference architecture for Earth Observation ground systems.

- It is out of the scope of this project:
  - Details of Space-related High-level functions;
  - Systems development life cycle;
  - Satellite communications;
  - System sizing;
  - Security.

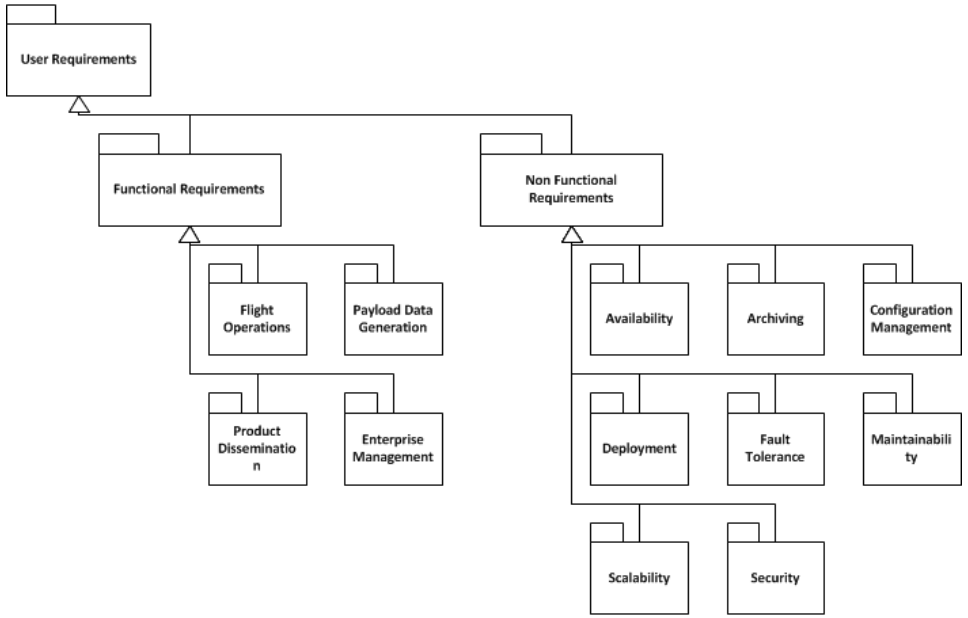
Approach

- Use of methods proposed by inter-agency committees and expert requirements: CC-SDS and NASA
- Disclaimer: EOGS is similar in goals and approach to the EGS-CC programme.



Enterprise Viewpoint (EV)

- Functional Requirements
  - Flight Operations
  - Payload Data Generation
  - Product Dissemination
  - Enterprise Management
- Non-functional requirements
- EOGS focuses mainly on the Enterprise Management functions



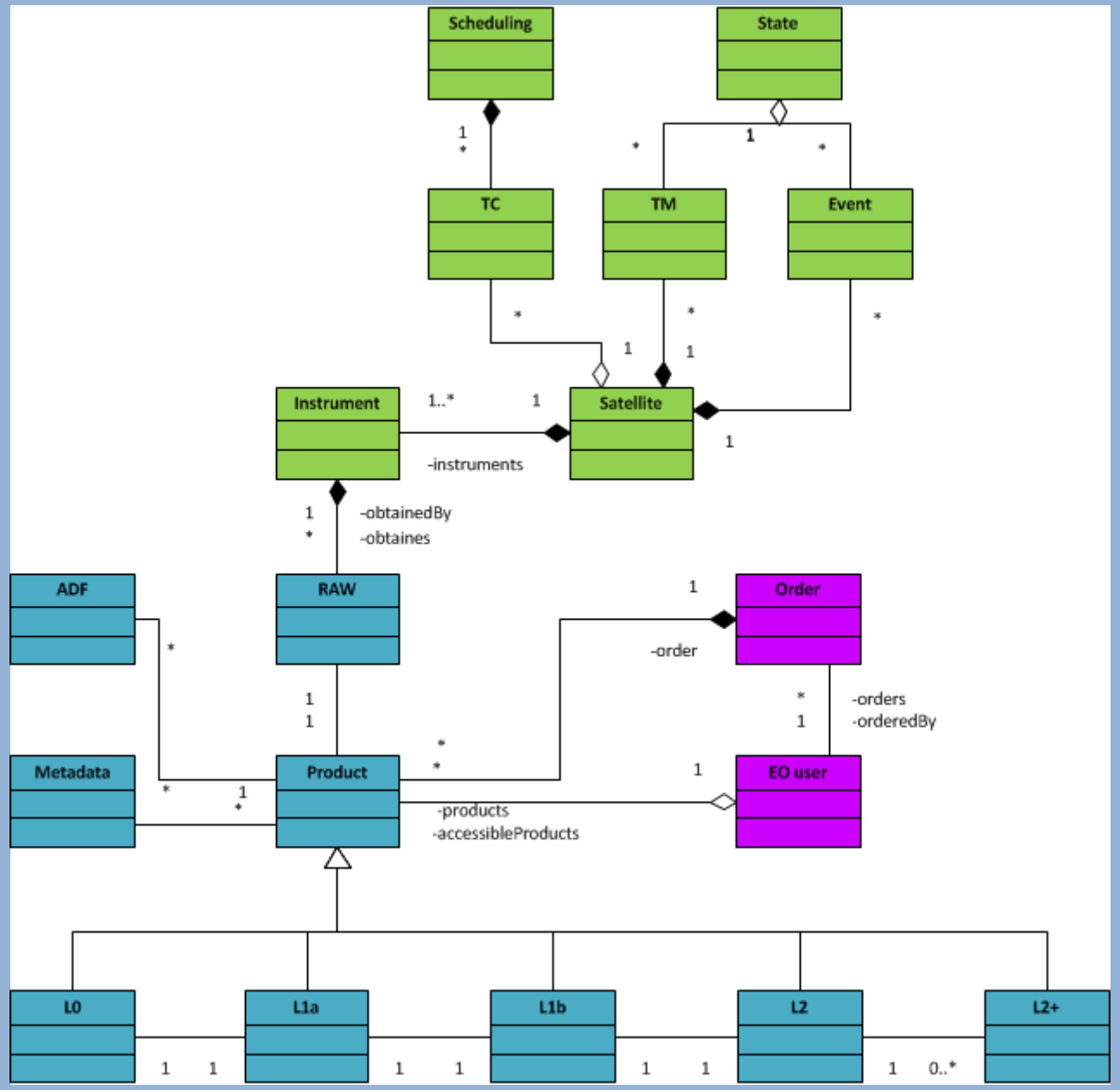
INFORMATION VIEWPOINT (IV)

FS and FOS - *TC*, *TM* and *events*.

PDGS - *products*, *metadata* and *ADF*.

PD – *products, EO users* and *orders*.

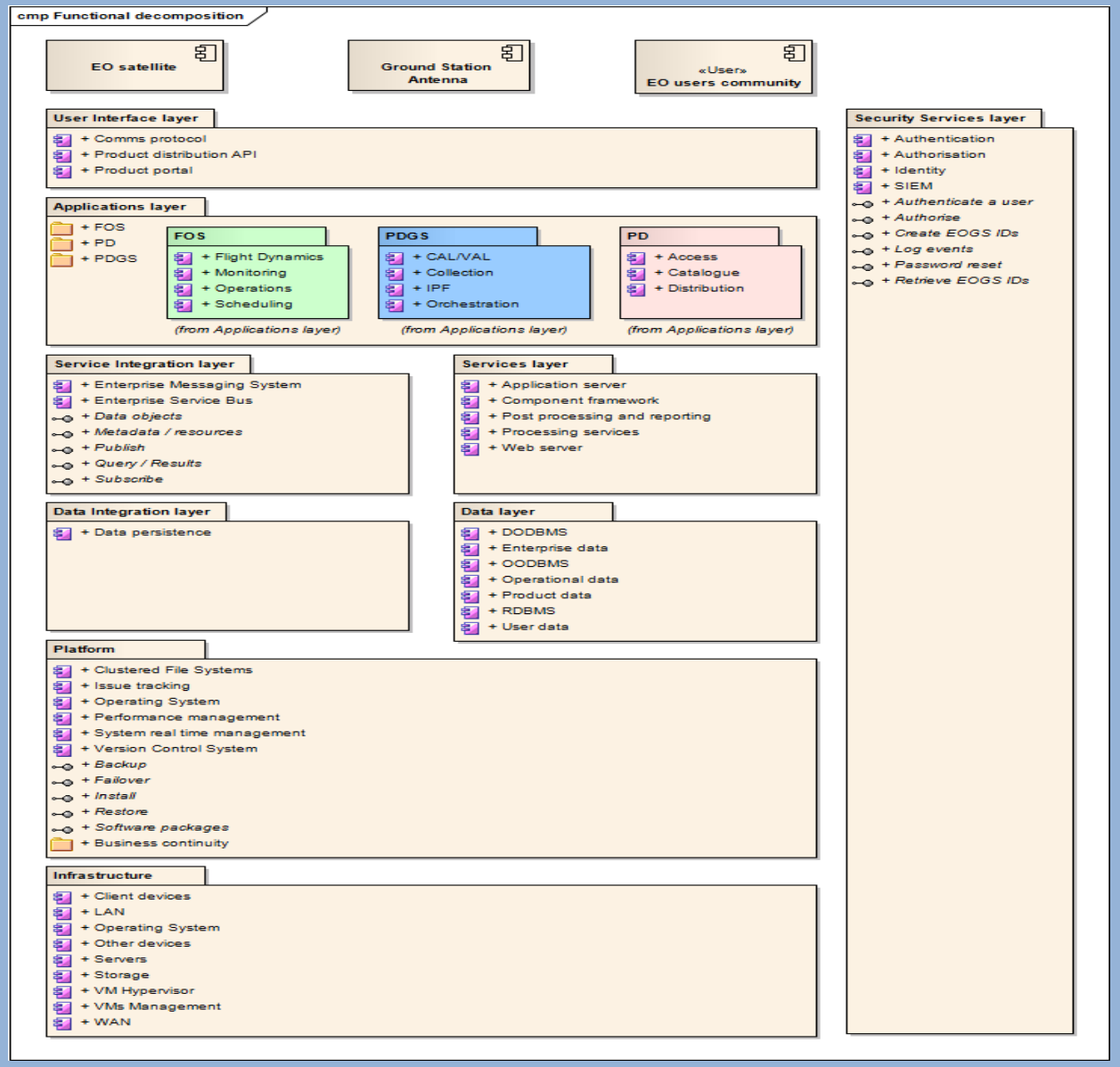
Inner data - *Data objects* and *Query/Results* and *Metadata/Resources*.



COMPUTATIONAL VIEWPOINT (CV)

Layered and component-based architecture providing:

- Simplicity
- Efficiency
- Portability
- Flexibility

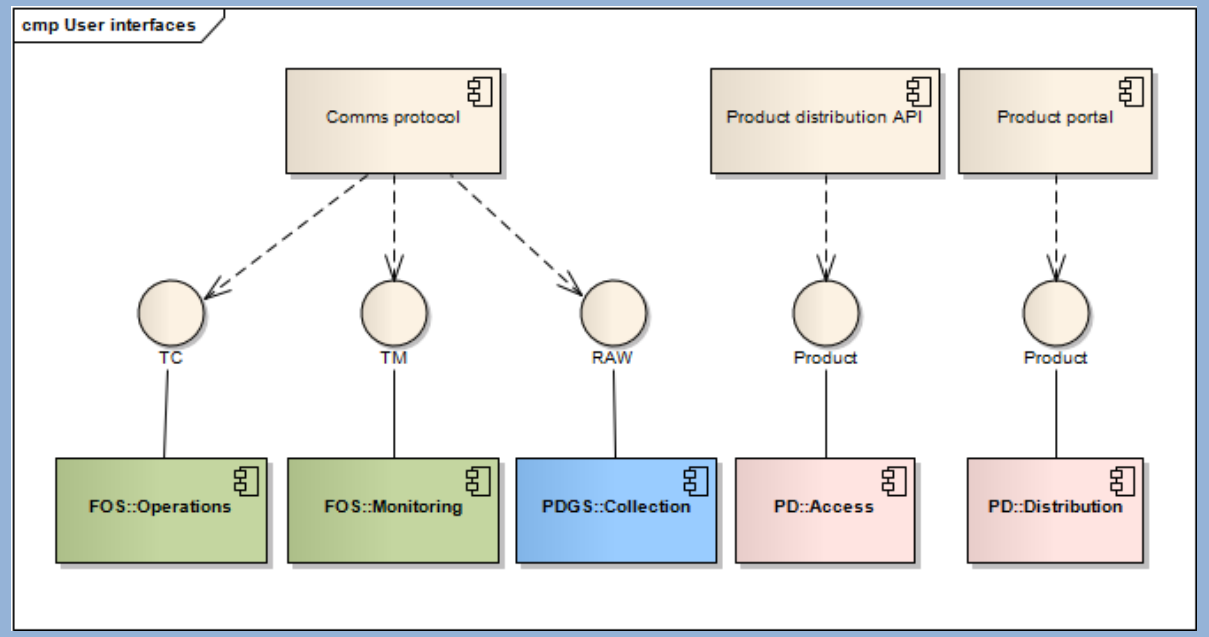


CV. USER INTERFACES LAYER

Single points of access.

FOS and PDGS uses specialized communication protocols.

PD provides product dissemination and data ordering.



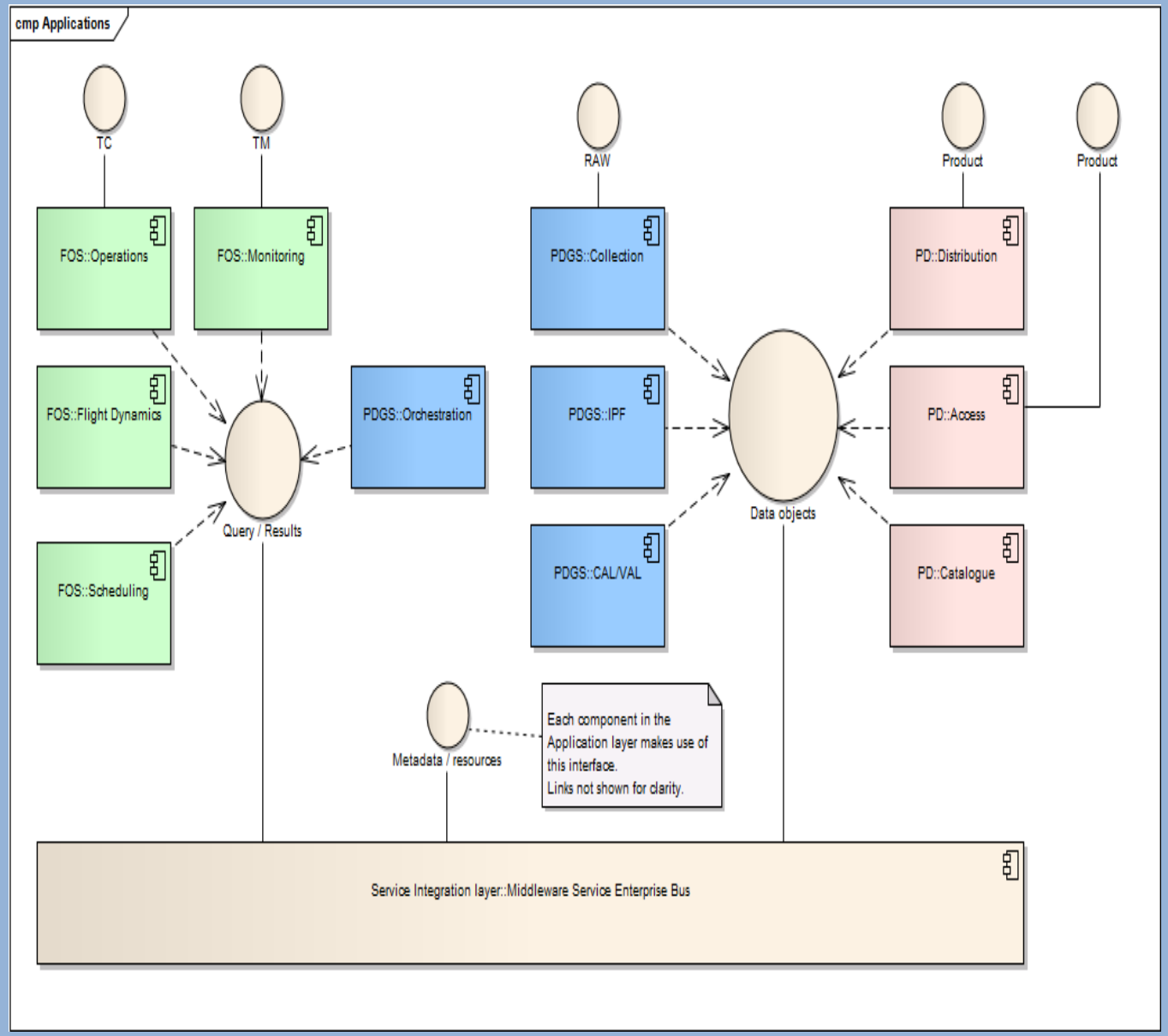
CV. APPLICATIONS LAYER

ACID space-related, high-level functions.

FOS interfaces with the TT&C Ground Antennas.

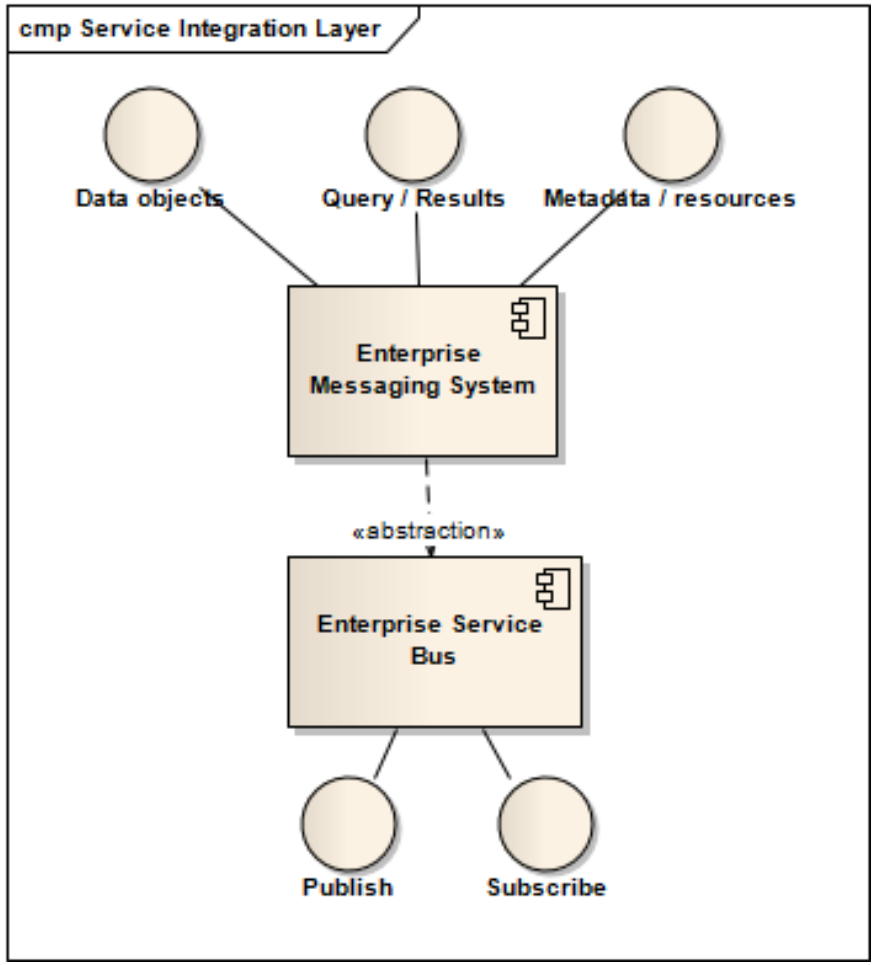
PDGS interfaces with the Data Ground Antennas.

PD interfaces with the external EO user community.



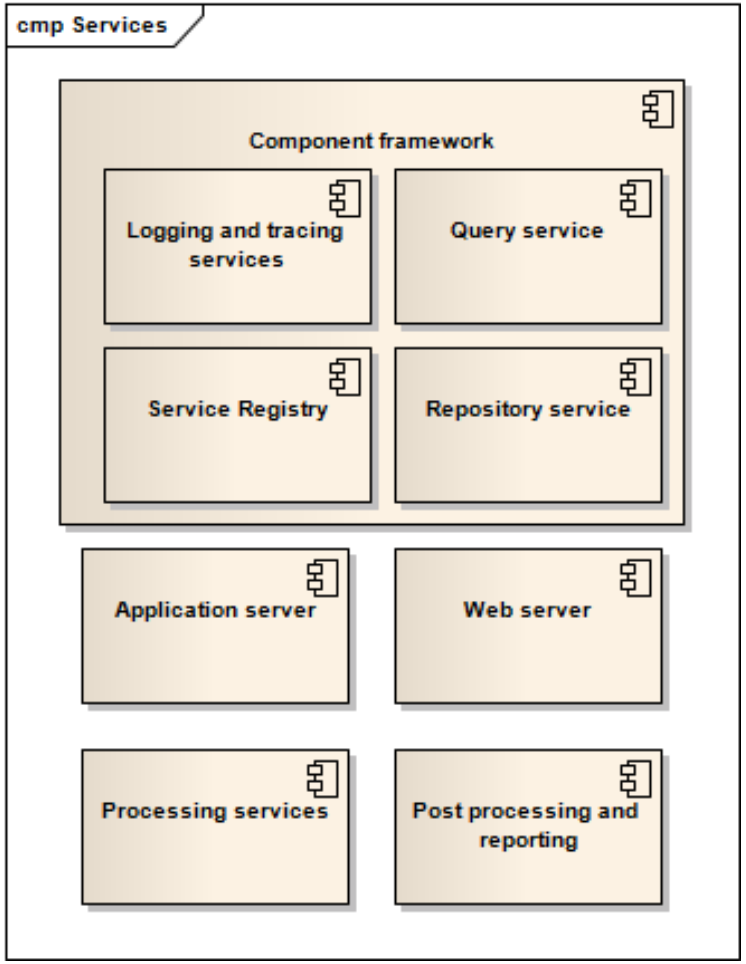
CV. Service Integration layer

- Exposes the services in the architecture.
- *Enterprise Service Bus* (ESB) architecture.
- *Publish/subscribe* messages.
- Defines *business rules*.
- No point-to-point communications.
- Knowledge of precise status of the whole system.



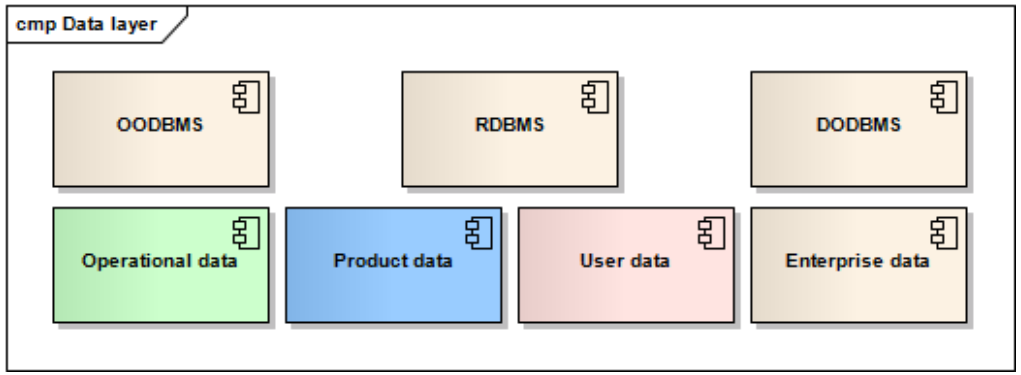
CV. Services layer

- Separates GS applications from services.
- Component-based architecture.
- *OSGi* is the selected component-framework.
- *Application server* for space-related applications.
- *Processing service* for large-scale processing.



CV. Data Integration and Data layers

› Consistent way of interacting with data domains.



› Data layer consolidates related data sets by data domains.

› Data domains: operational, product, user and enterprise data.

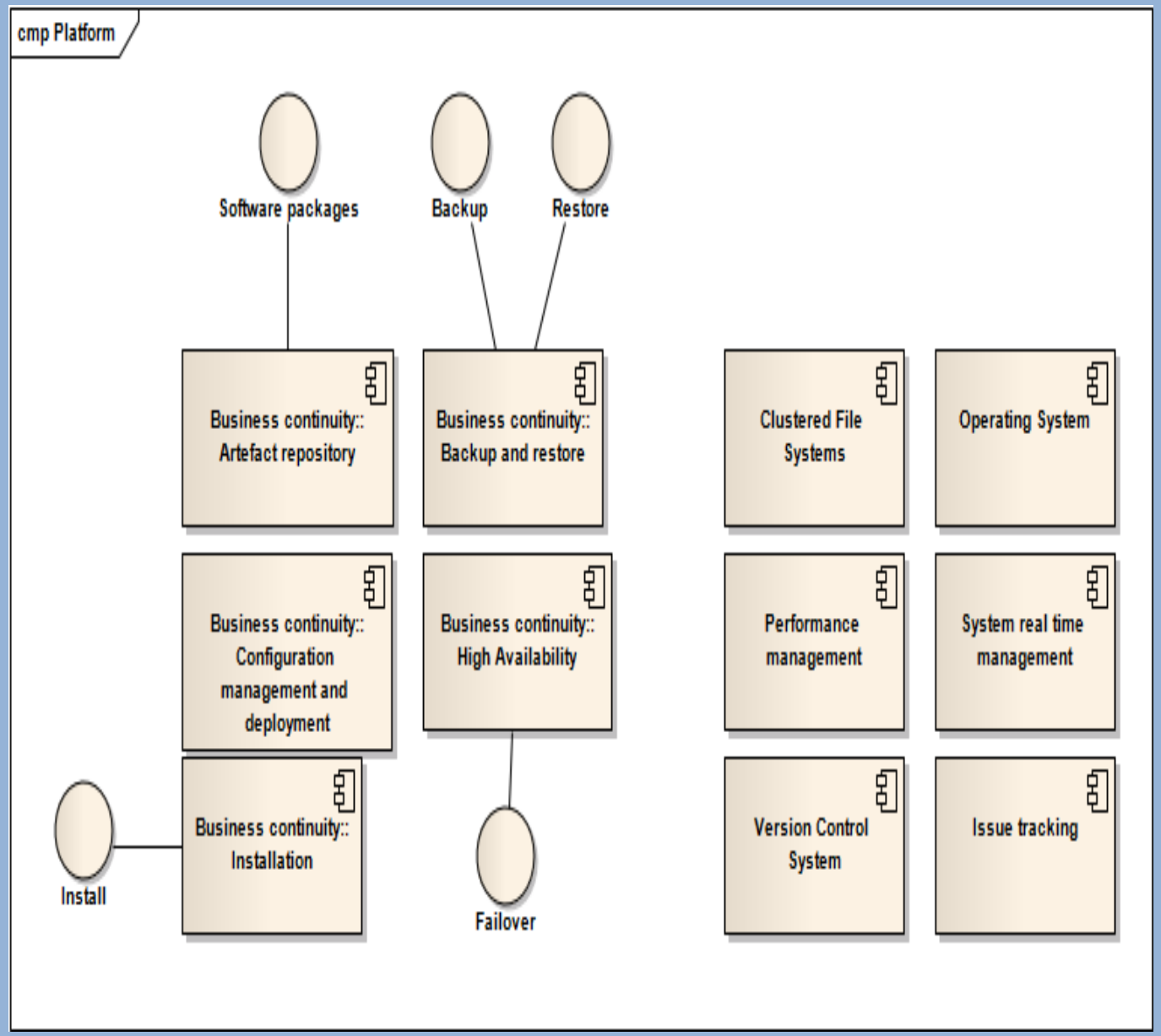
› Database Management Systems: *Relational; Object-Oriented and File-based*.

CV. PLATFORM LAYER

Systems software.

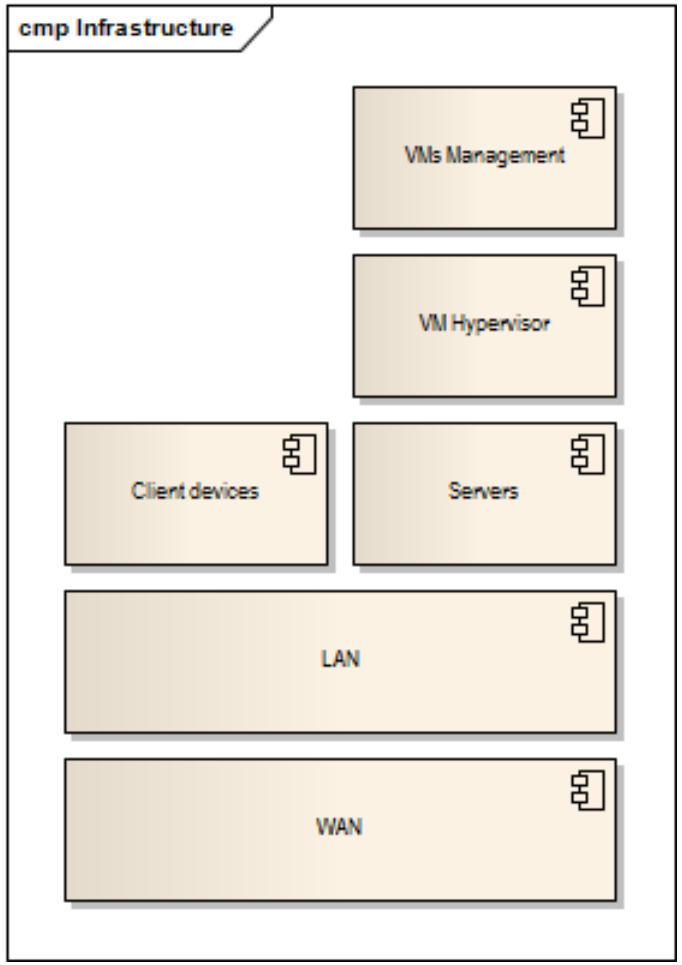
Business Continuity.

Core providers of data for high-level monitoring applications.



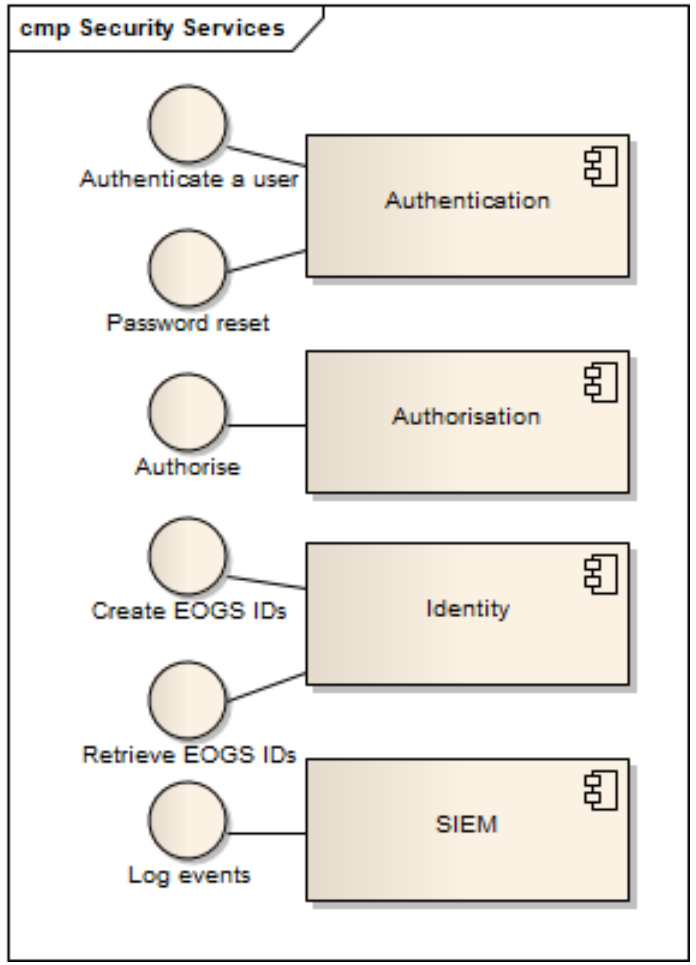
CV. Infrastructure layer

- GS hardware.
- Virtualized infrastructure.
- Processing services will not be virtualized.



CV. Security Services layer

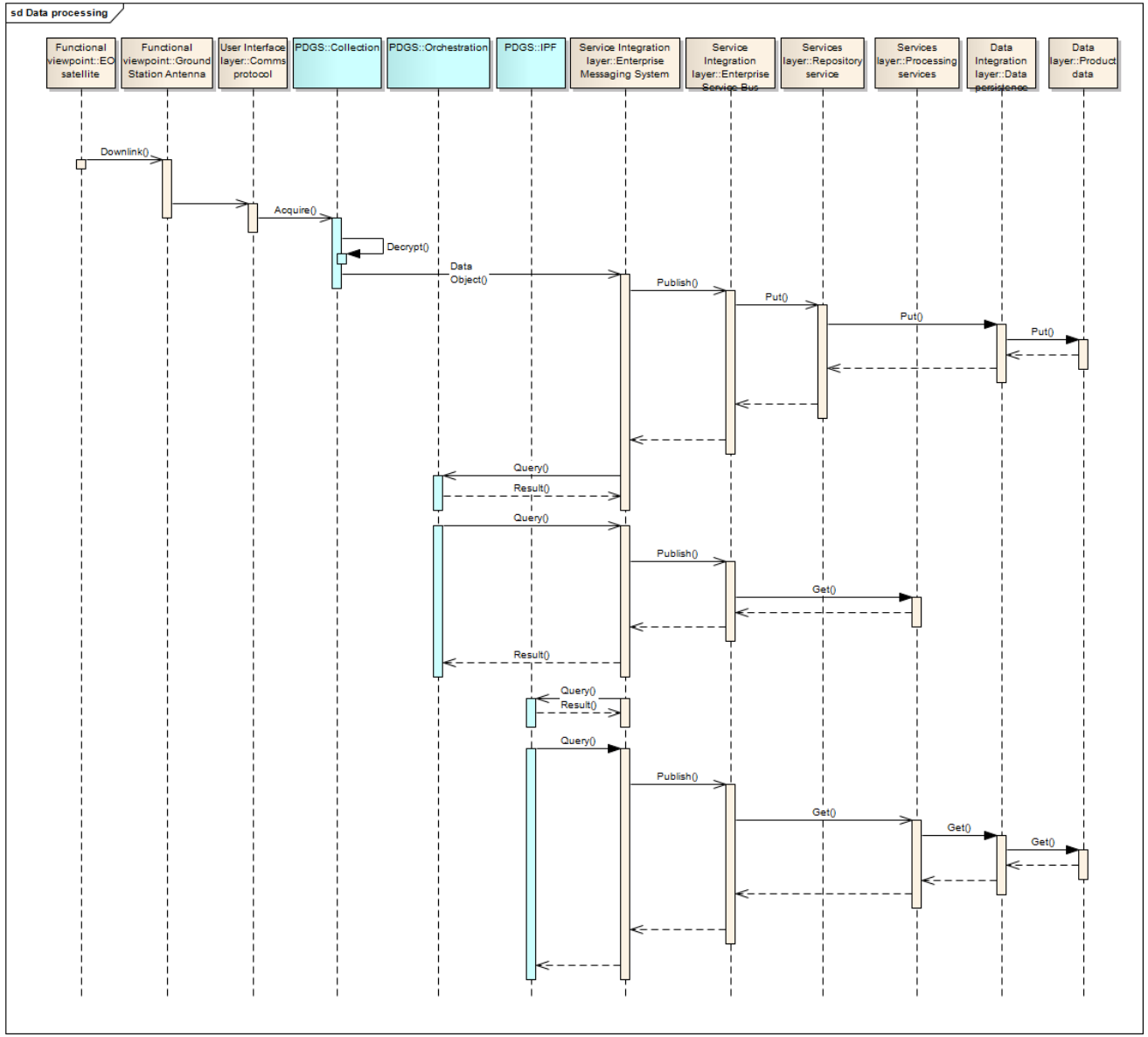
- Access and control security to all layers.
- Authentication.
- Authorisation.
- Identity.
- System Information and Events Management (SIEM) systems.



ENGINEERING VIEWPOINT (NV)

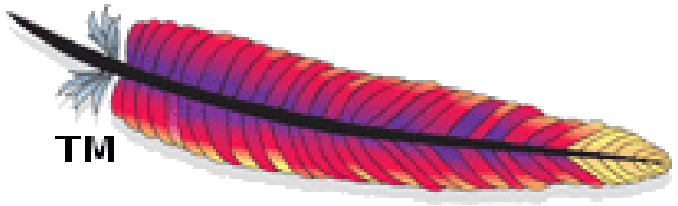
High-level atomic functions are asynchronous calls through a common bus.

Space-related business rules are defined in the Services Integration layer.



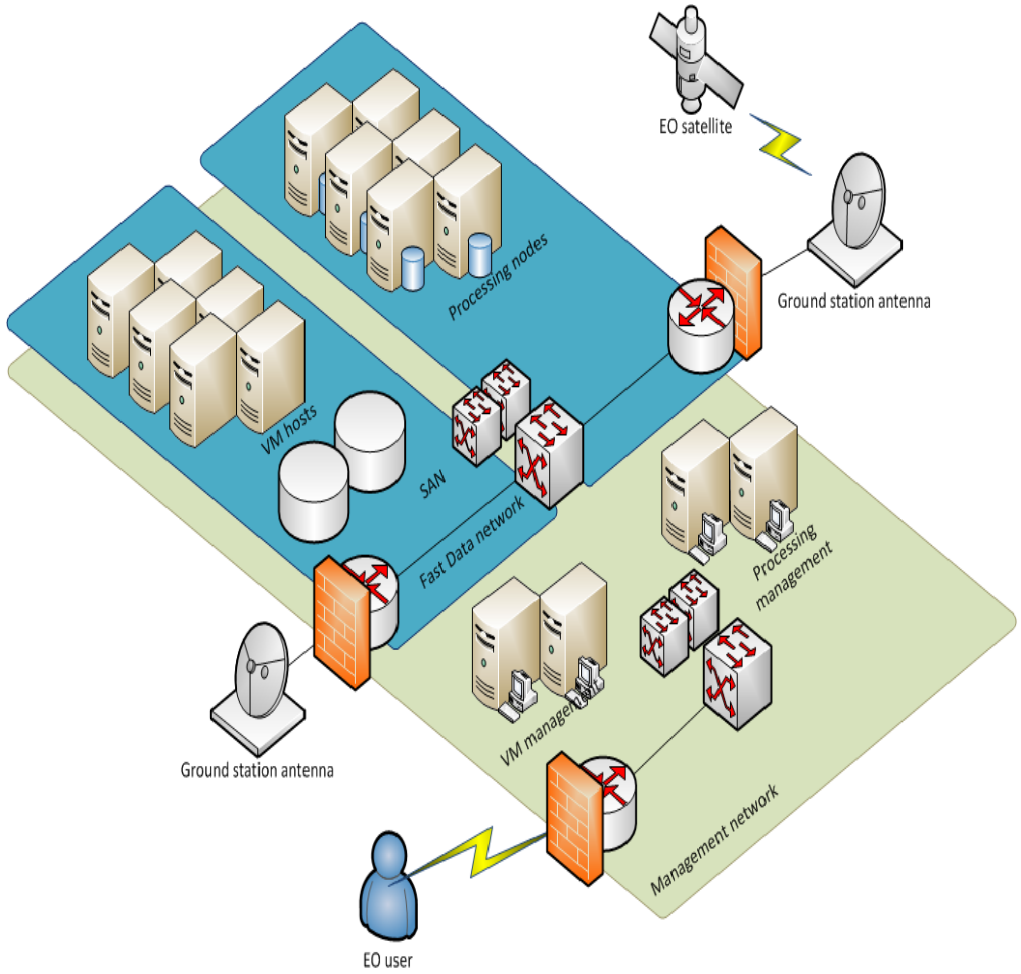
Technology Viewpoint (TV)

- Use of open technology.
- Isolated but cross-compatible tools.
- Seamless adaptation to new technologies.
- Use of several cutting-edge, open, leading software and system families.



TV. Network

- Networks for security segmentation and different performances.
- WAN to Space or to the Internet.
- LAN
  - Management network.
  - Fast data network.

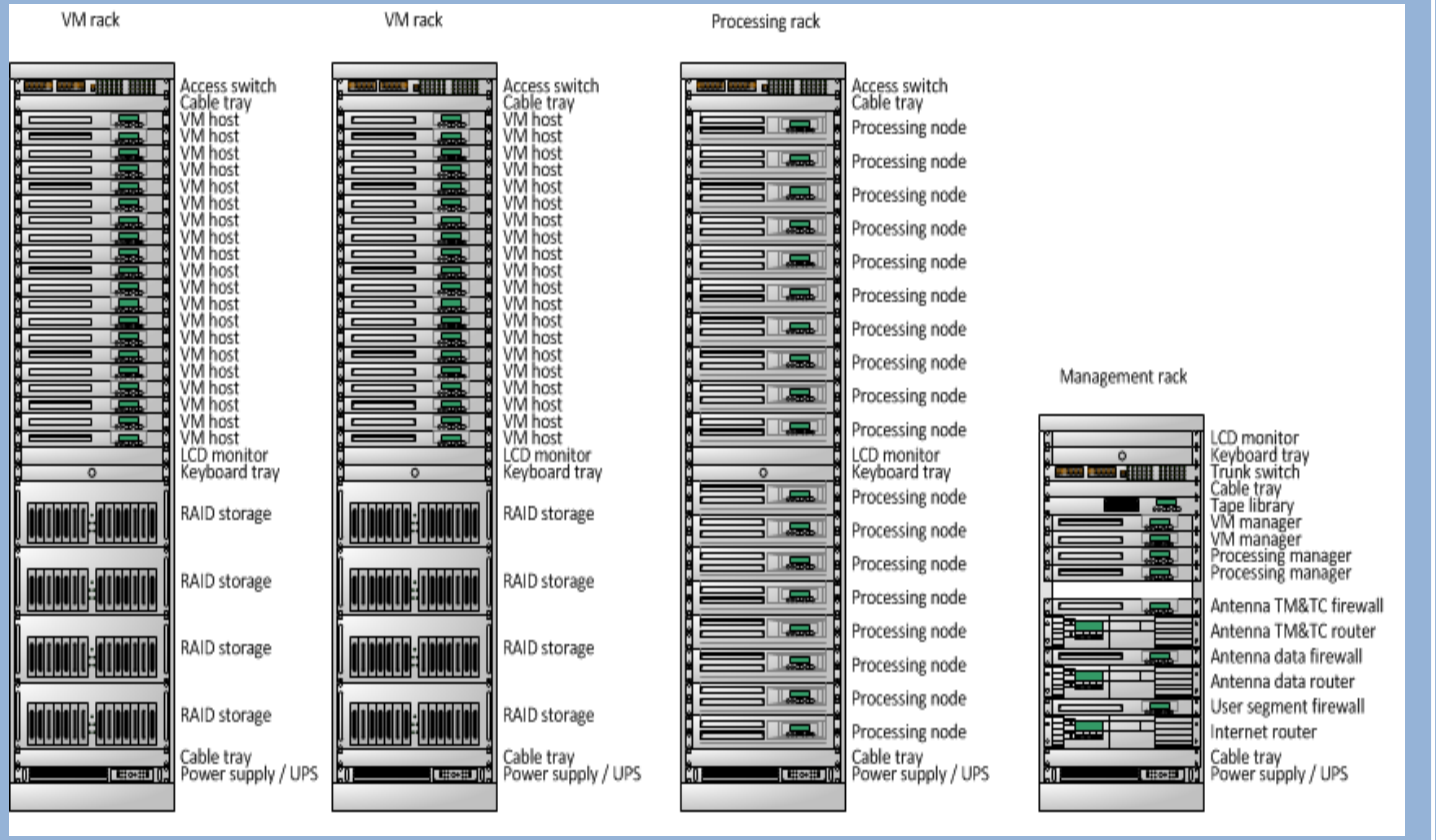


TV. HARDWARE

VM racks – Optimized as High-Availability clusters.

Processing rack – Optimized as High-Throughput clusters.

Management rack.



Conclusions

- Initial objectives are met:
  - State-of-the-art techs;
  - Use of common services;
  - Cost and risks are reduced;
  - Reference architecture useful for other EO missions.
- Nice added side effects:
  - Better performances and more efficient data storage;
  - Space-related functions as atomic methods and centralised business rules.
- Promising evolutions.

Thanks for your attention

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