SSA Data Centers
From Concept to Reality

GSAW 2015, Los Angeles – USA

Vicente Navarro, European Space Agency (ESA)

03/03/2015

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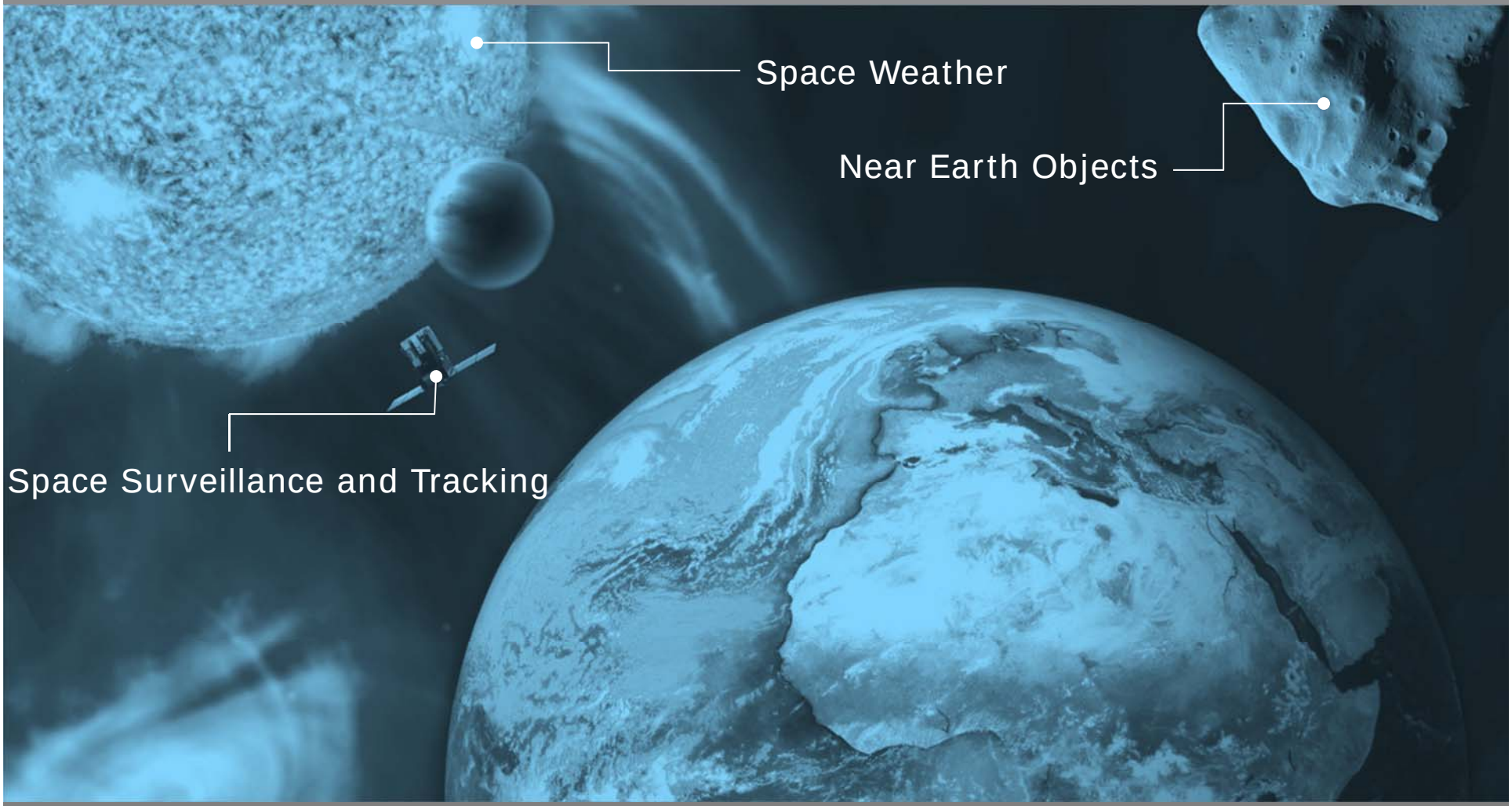
ESA's Space Situational Awareness



User Community

European Space Agencies
ESA
National

European Governments
EU, EC
National
Regional

Spacecraft Operators
Commercial
Academic
Governmental

Space Insurance

Space Industry

Network Operations

Telecommunications

Energy
Surveying
Electrical Grid
Power Supply

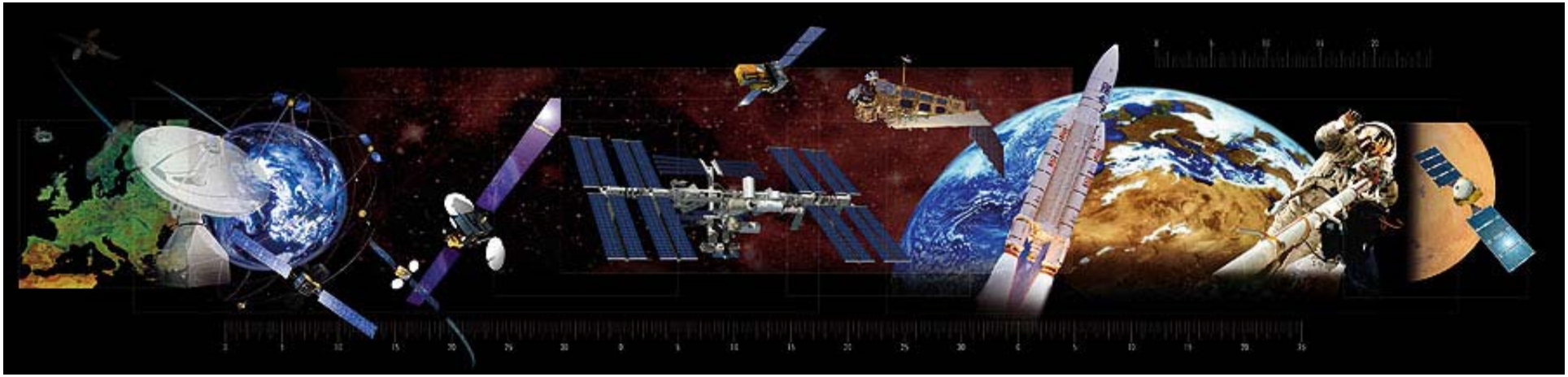
Air Traffic Control

Search and Rescue Entities

United Nations

Defence

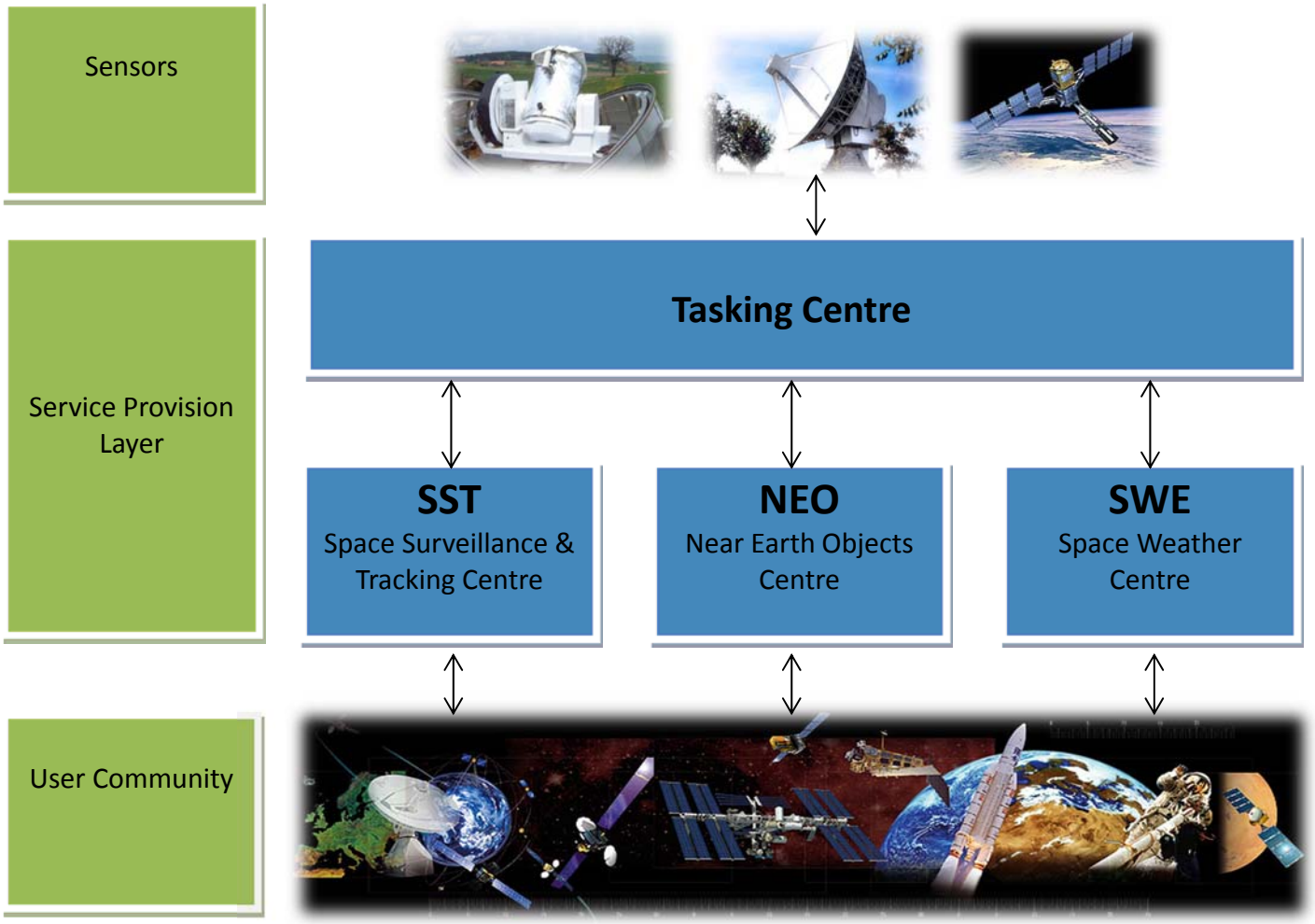
Civil Protection



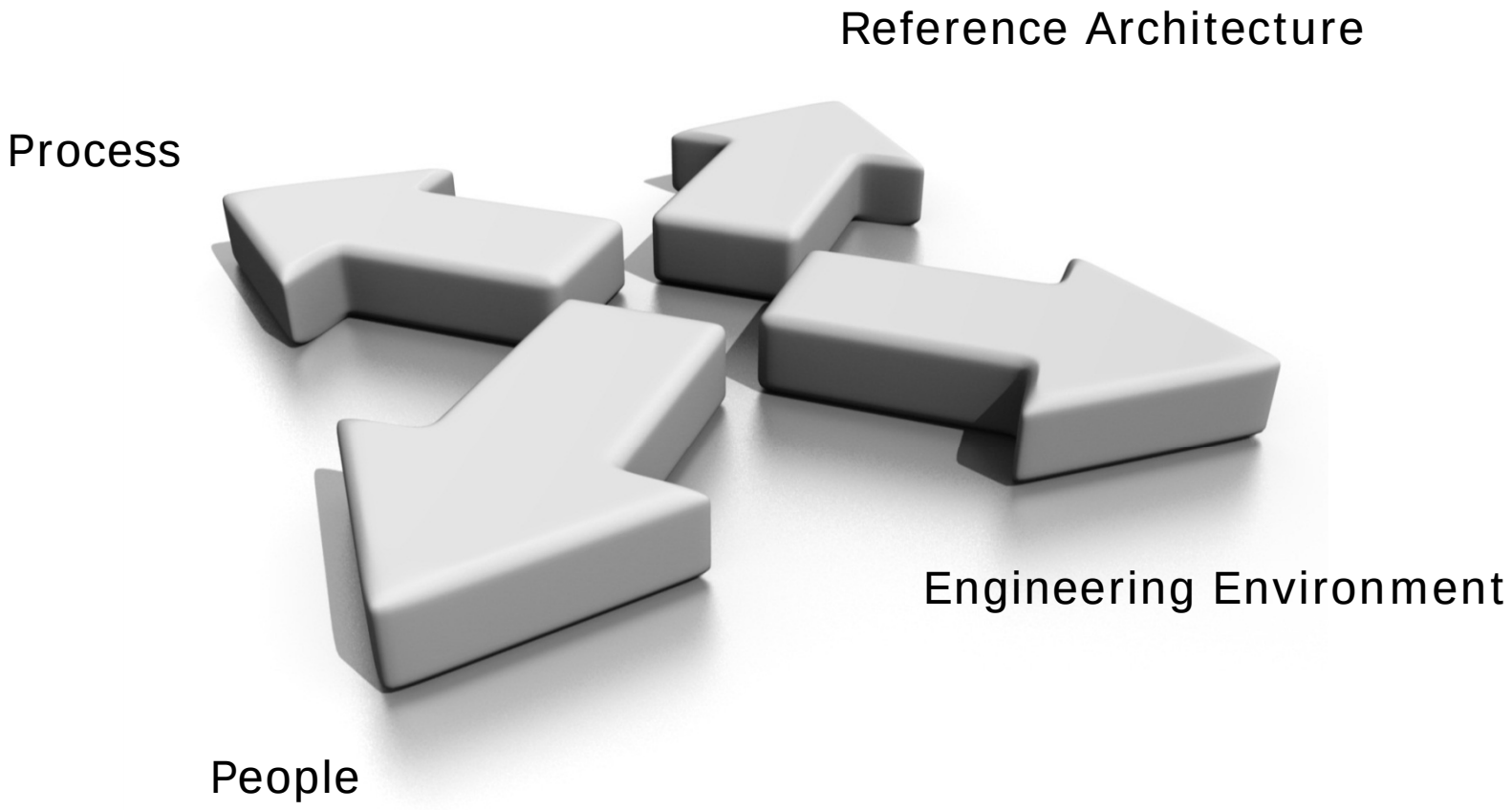
Sensor Assets

Software Assets

Operational Concept

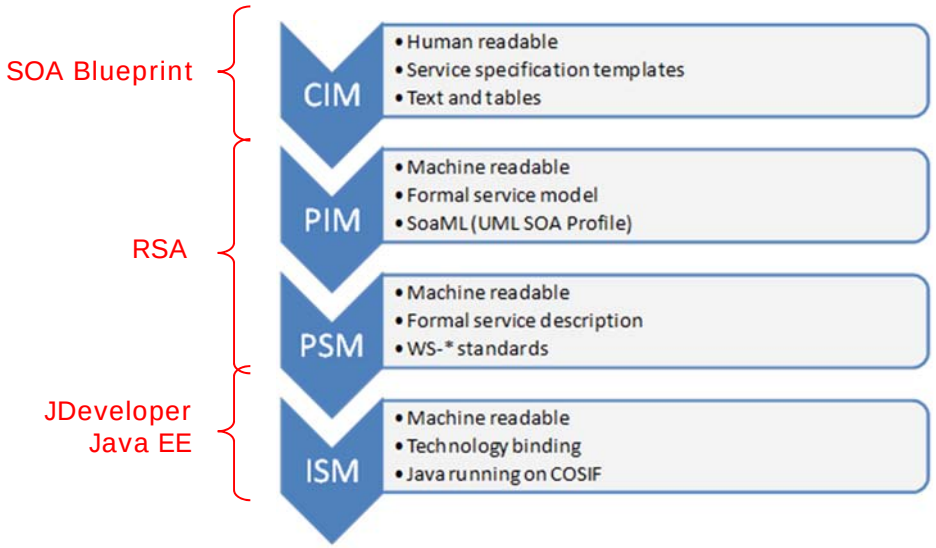


System Engineering Approach



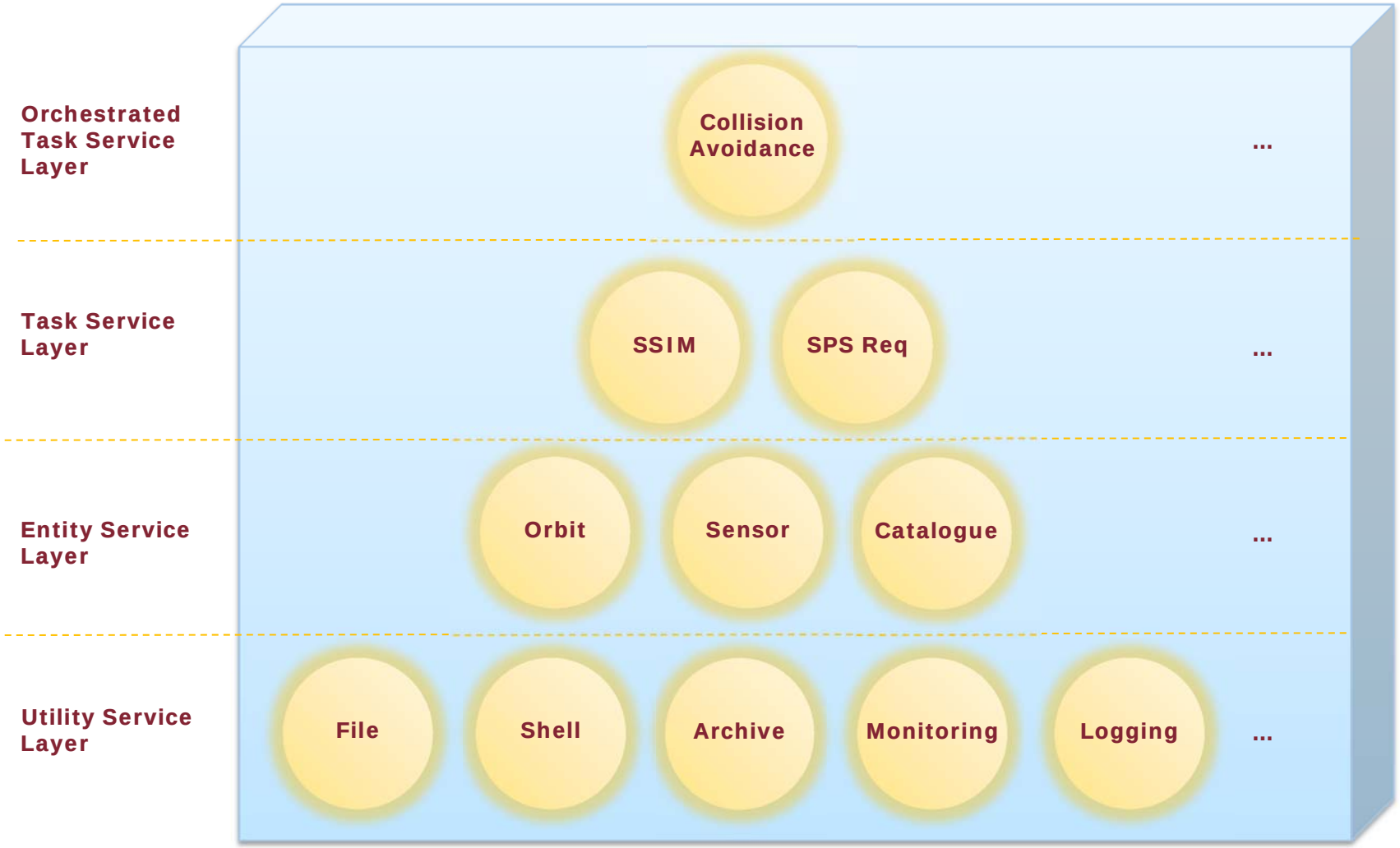
Process

Model-Driven Architecture (MDA) + Service Oriented Architecture (SOA)

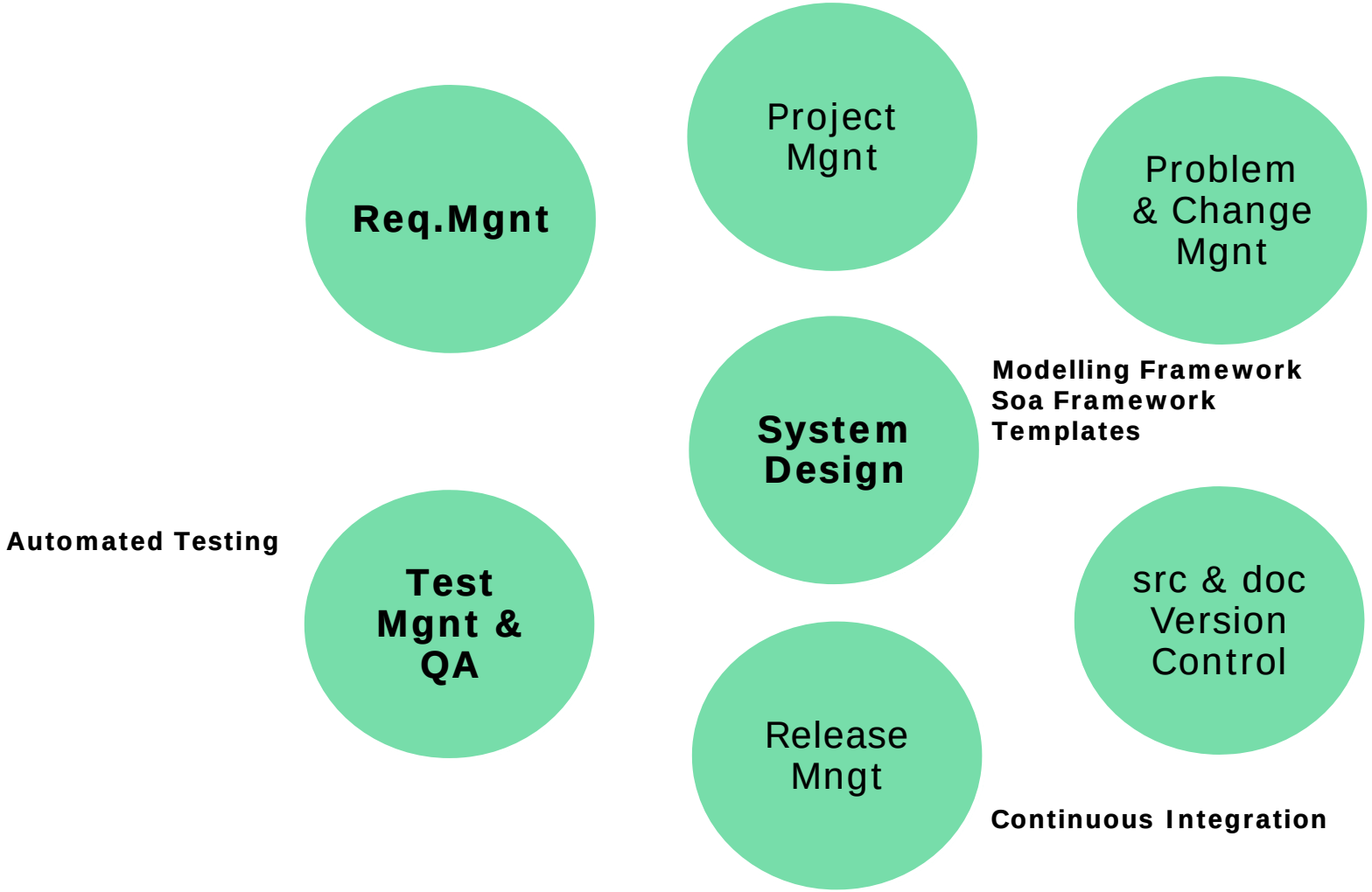


	Information/Data	Services	Processes
CIM	Templates	Templates	Templates
PIM	SoaML UML class diagrams	SoaML	BPMN SoaML
PSM	XML Schema SQL DDL/DML	WSDL	BPMN
ISM	EJB/JPA Relational Database Vendor-specific	JAX-WS BPEL Vendor-specific	~~BPMN~~ **BPEL** Vendor-specific

Reference Architecture

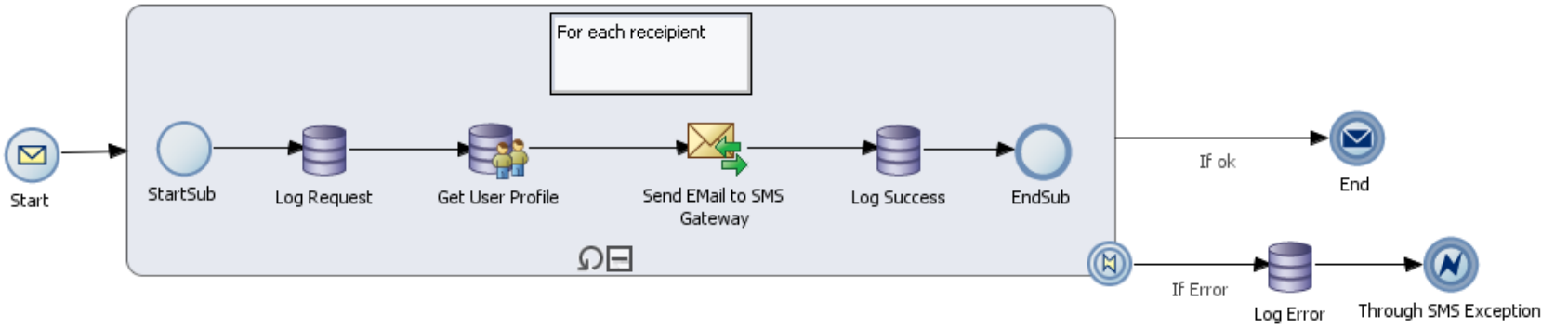


Engineering Environment: Overview



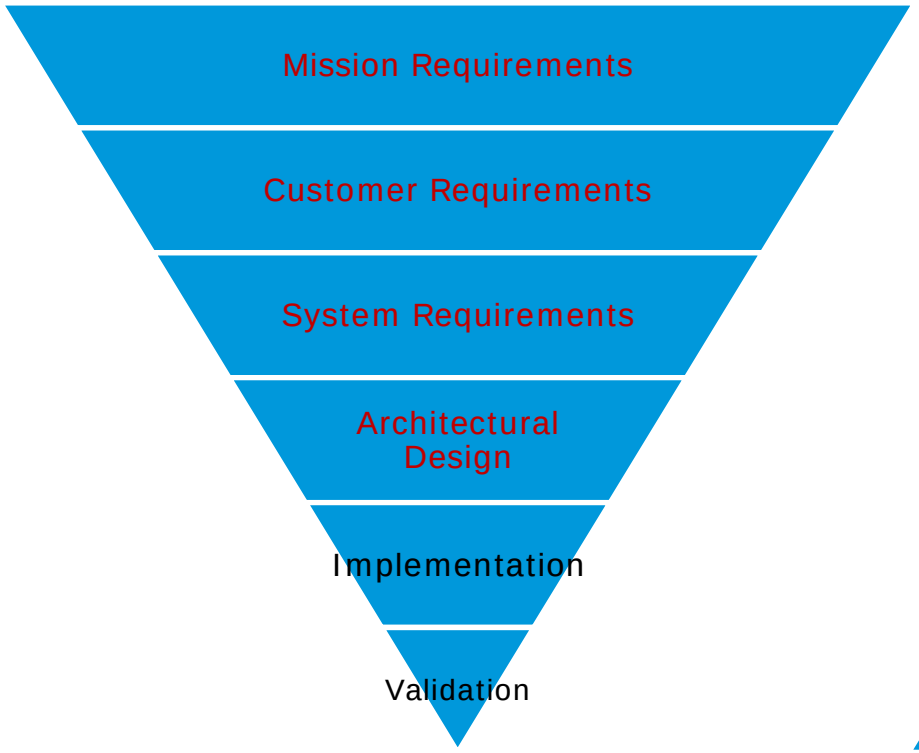
Engineering Environment: Key Principles

- Service Candidate Forms – Building Service Inventory
- Common Data Model enforcement through Modelling Tool
- SSA Development Guidelines
- Model-driven Definition of Interfaces and Data Types
- ICDs based on: WSDL and XSD
- Continuous Integration: Management of services, documentation and dependencies
- Code Generation from Model, fully integrated in Build Automation
- Deployment Plans for Provisioning

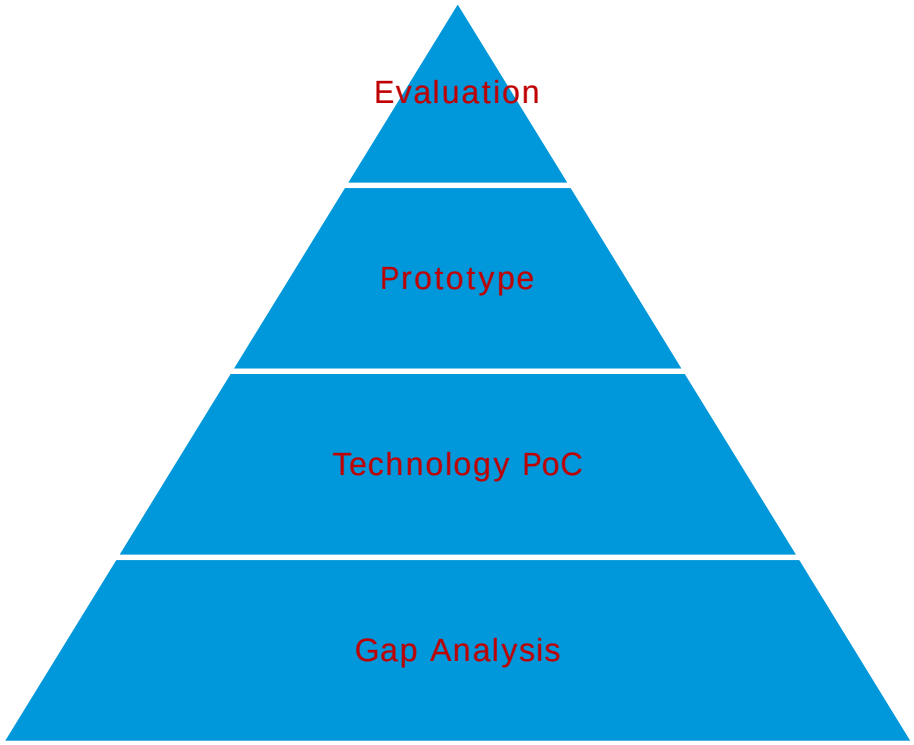


Evolution Path:

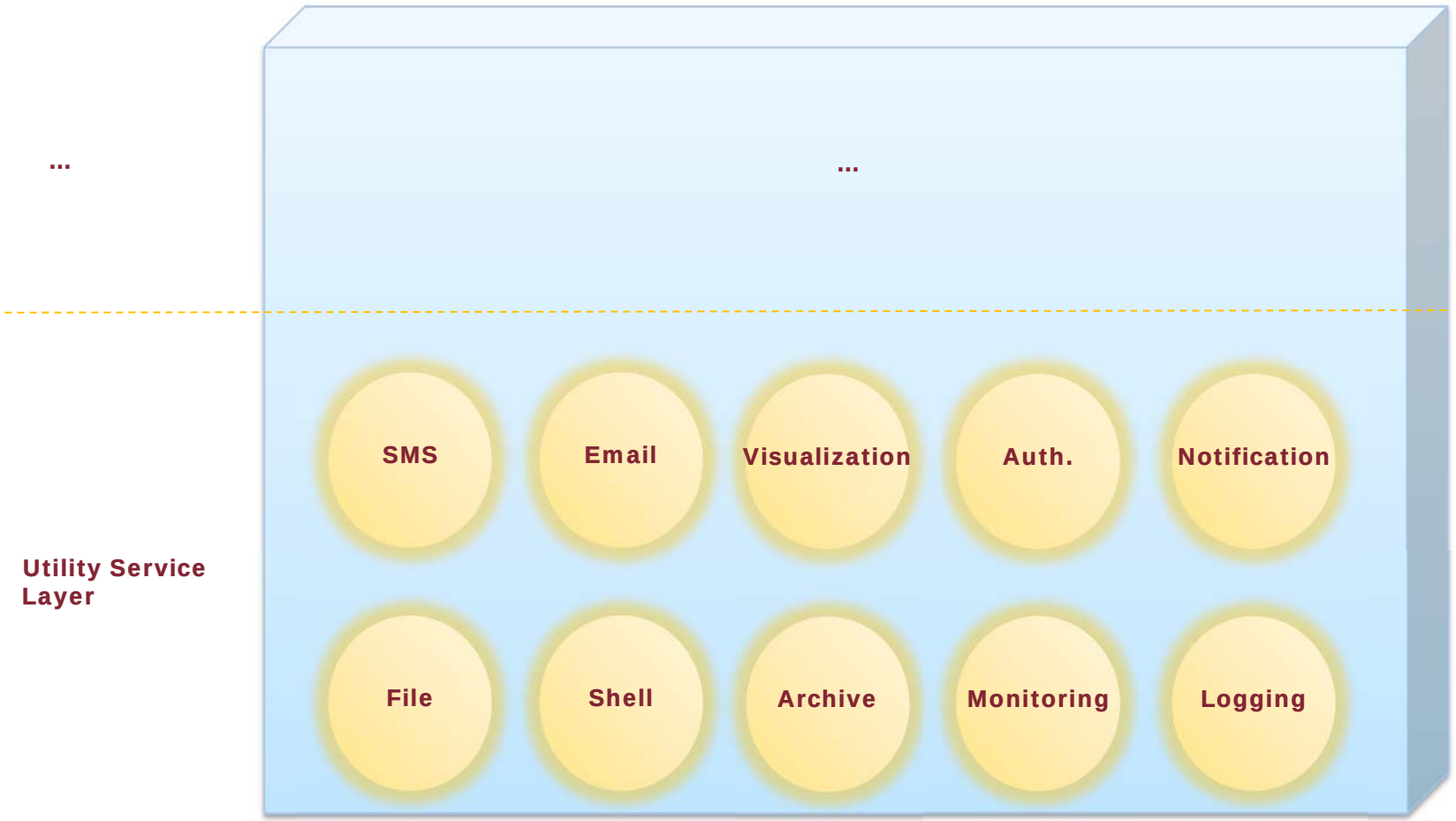
Top Down



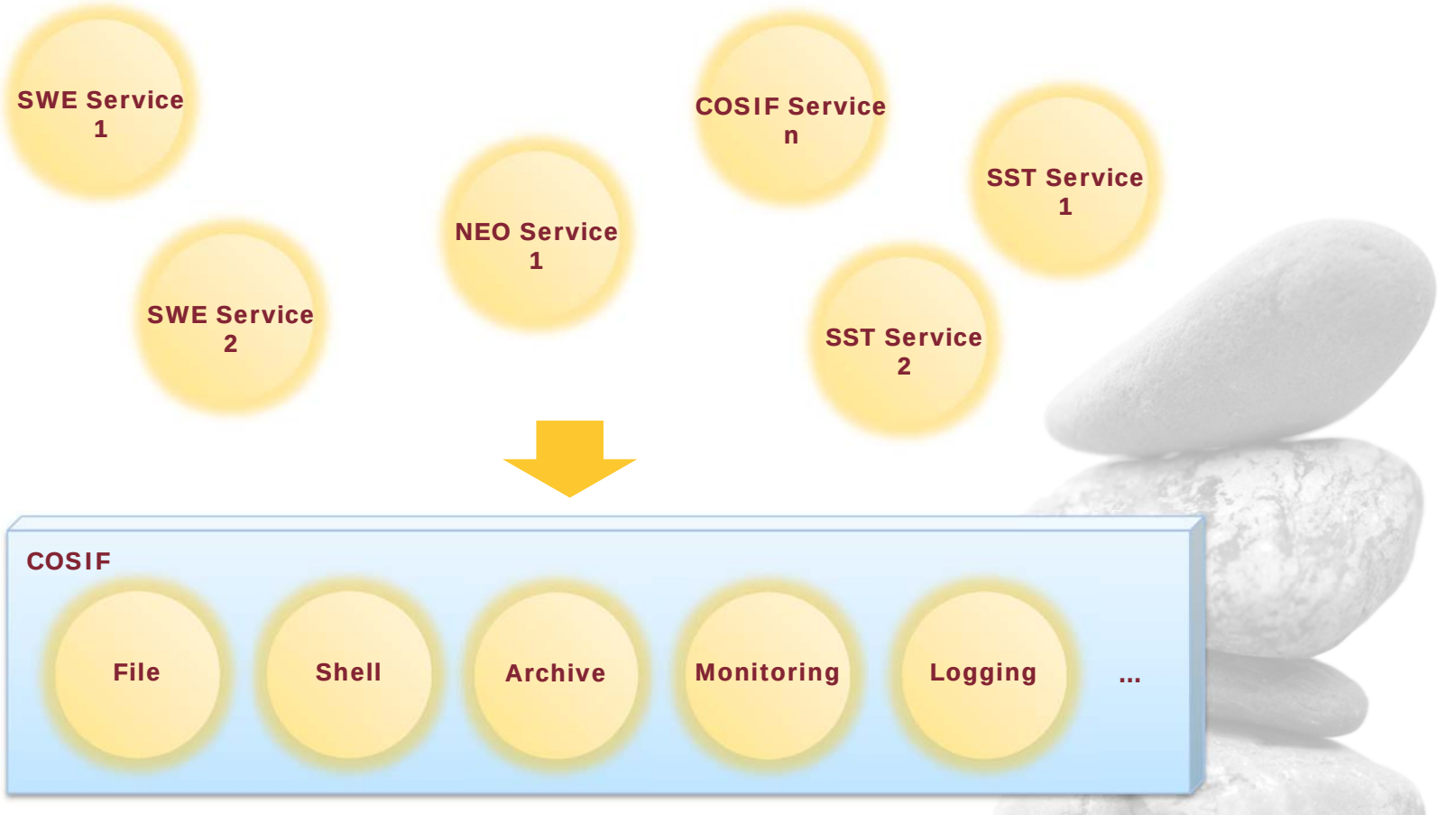
Bottom Up



From Service Inventory 1.0



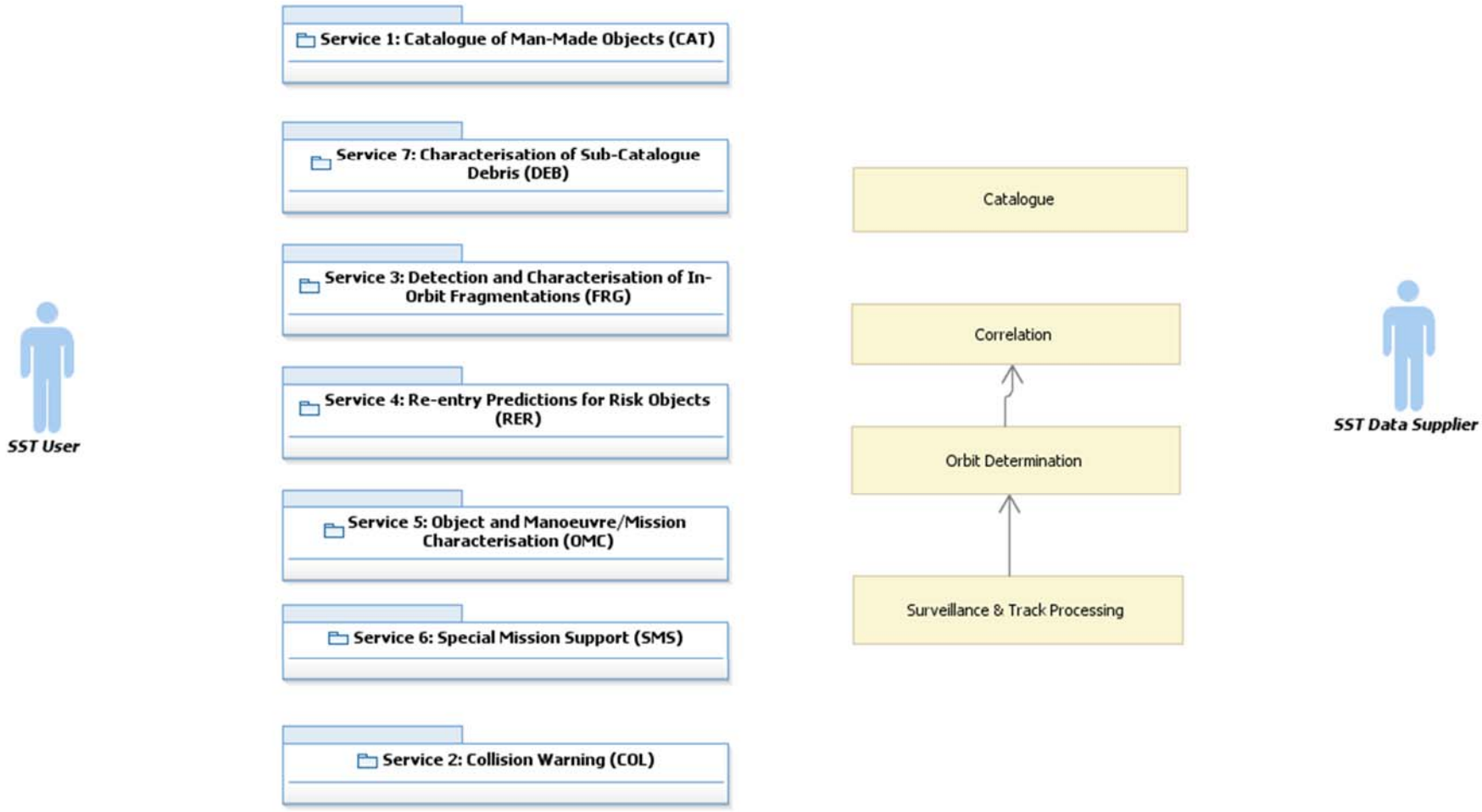
To Service Inventory 2.0



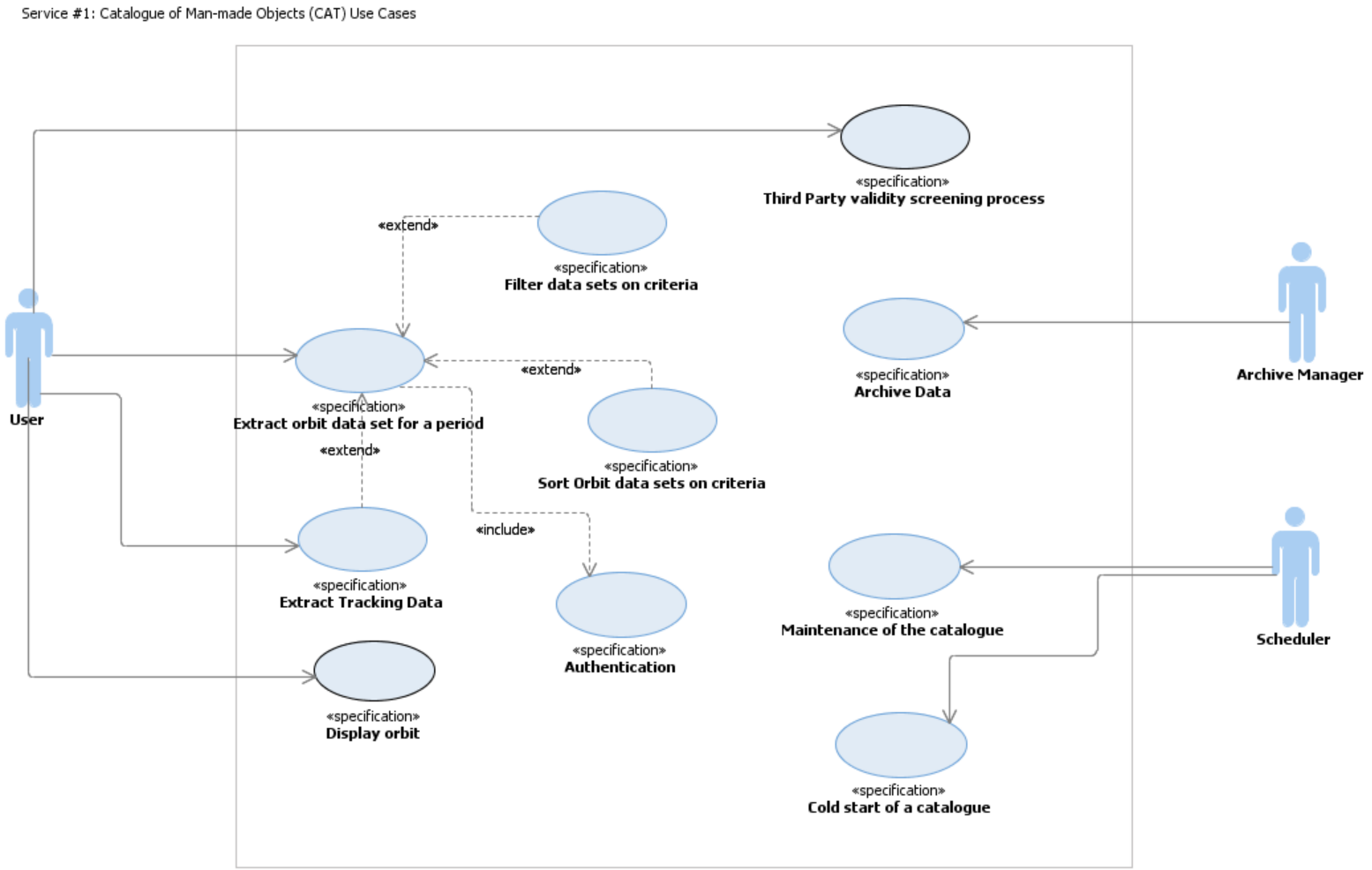
Key Architectural Patterns

- Foundational Inventory Patterns
- Logical Inventory Layer Patterns
- Inventory Centralization Patterns
- Inventory Implementation Patterns
- Inventory Governance Patterns

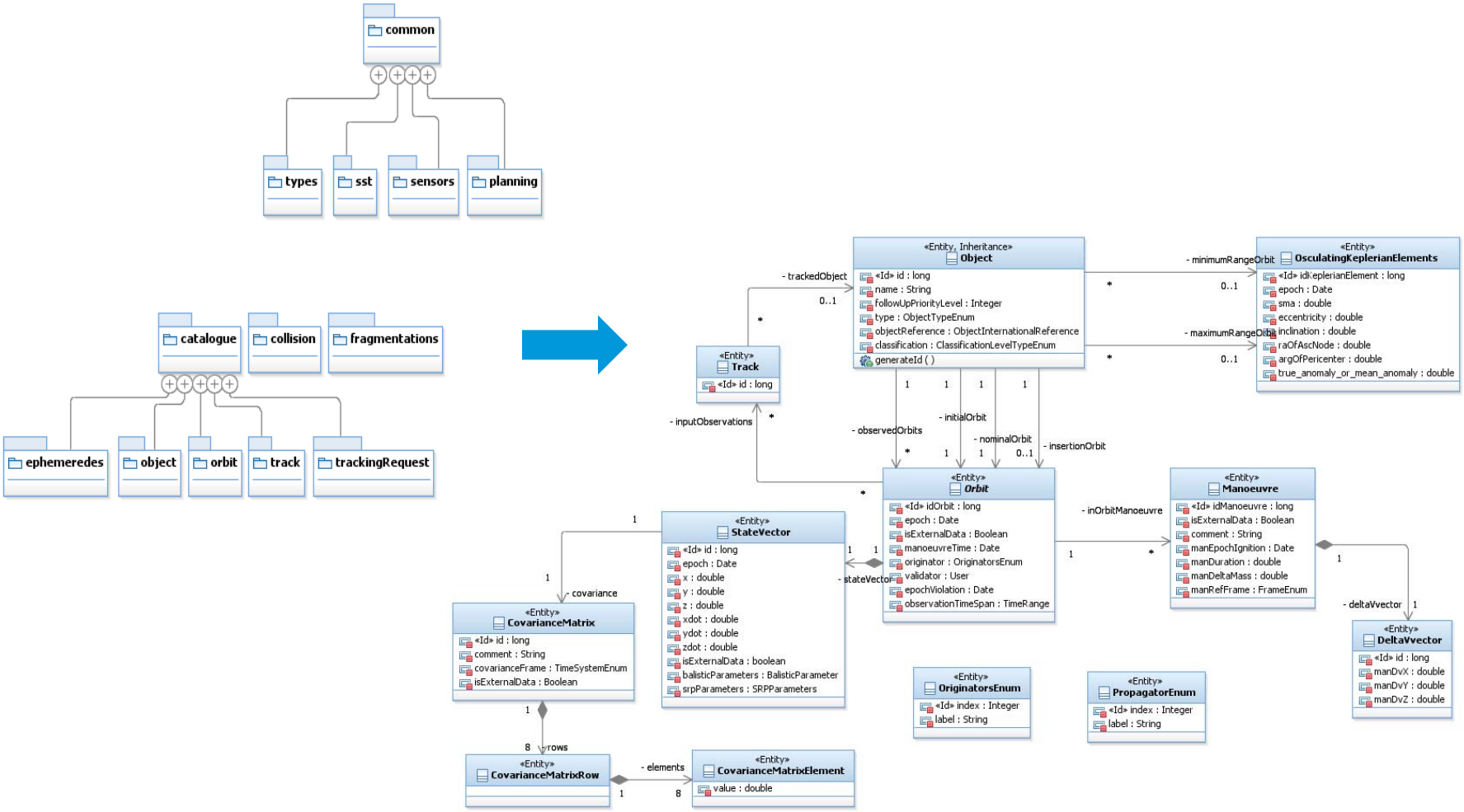
Implementation I



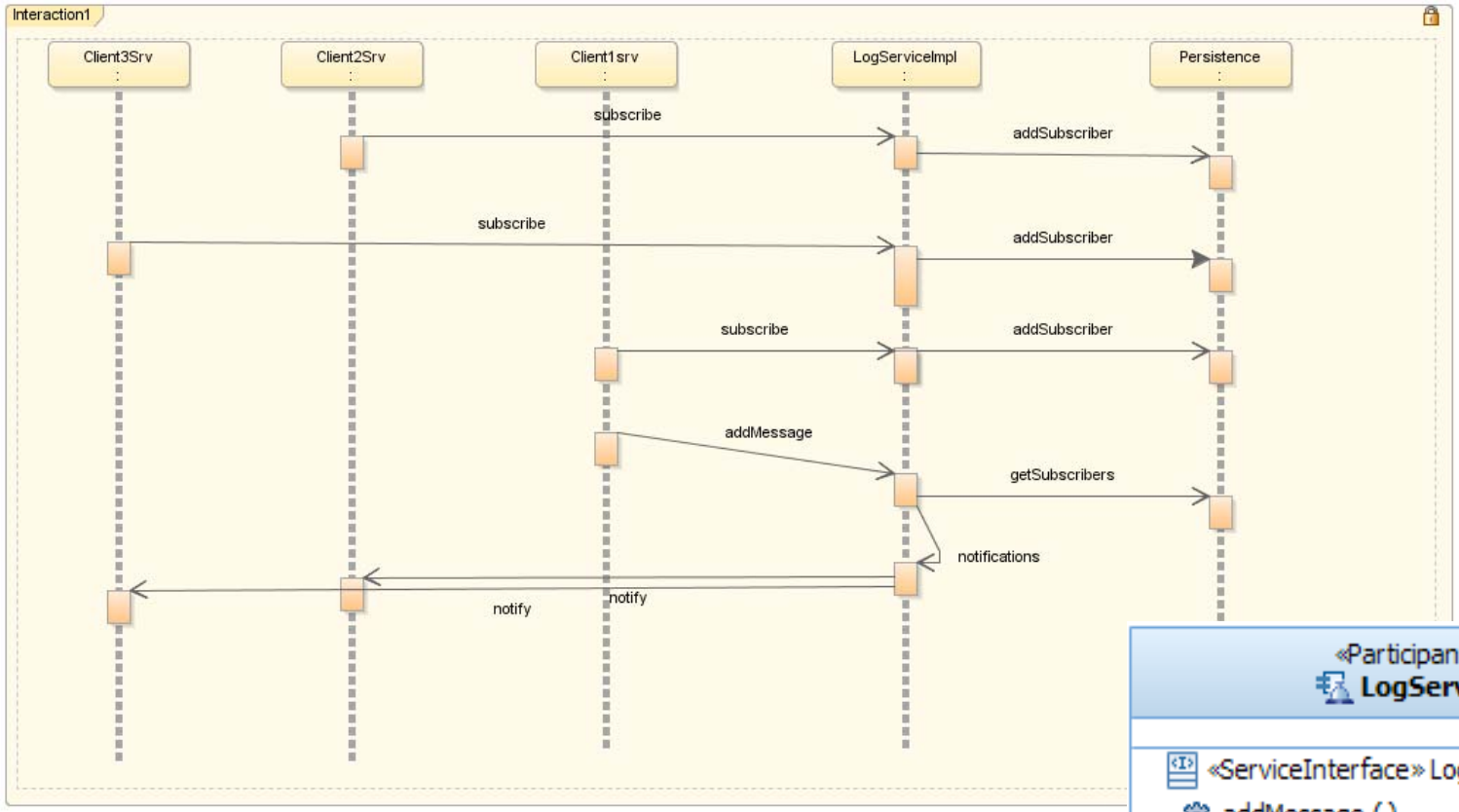
Implementation II

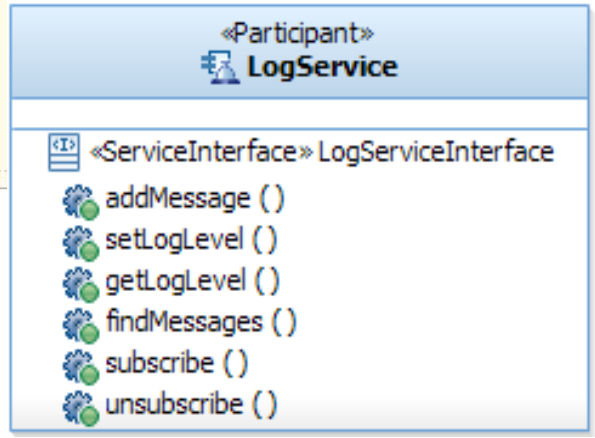


Implementation III



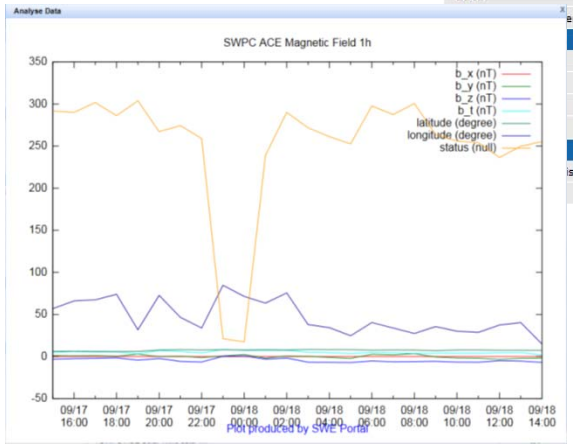
Implementation IV

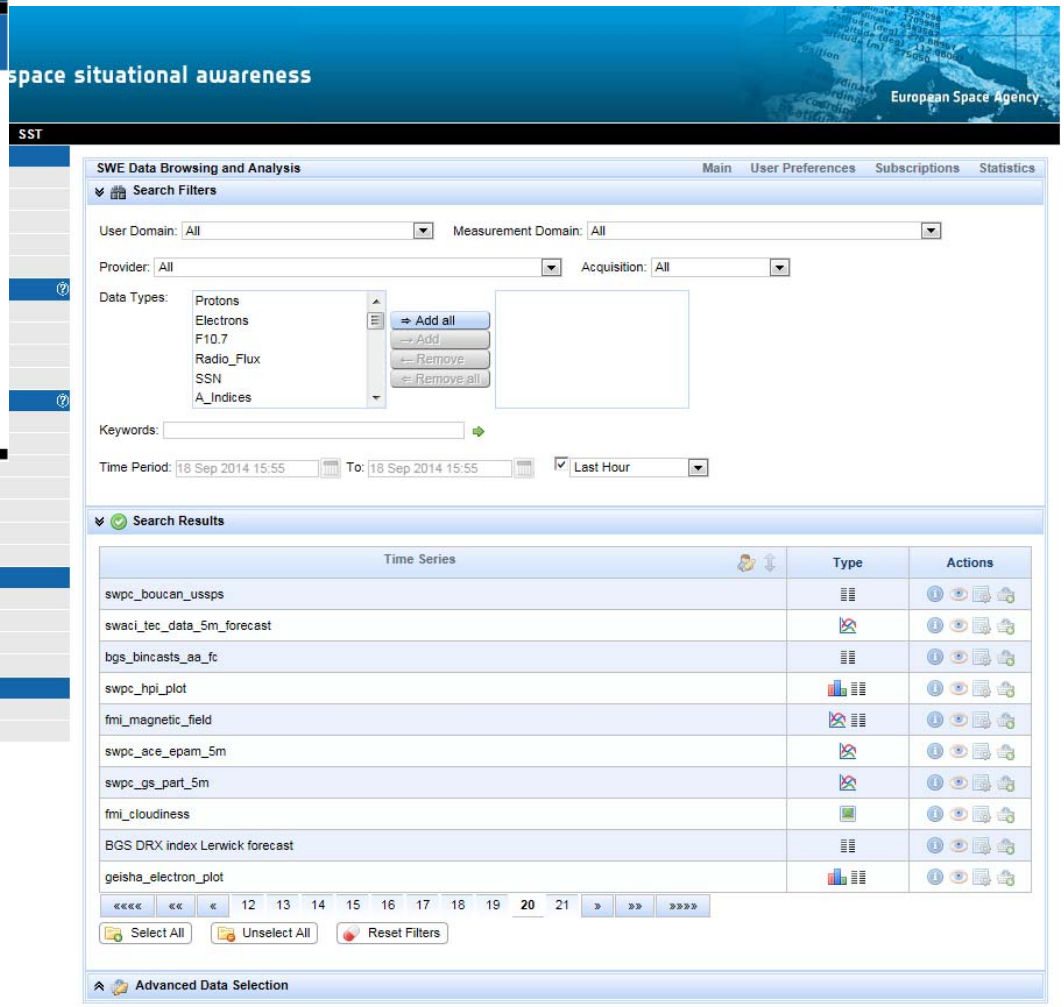




Results

space situational awareness
Welcome to the SSA Space Weather Service Network
Please note that all SSA-SWE Services are under review/construction
Latest solar image with active regions
Latest data from SWE network. For a full overview of current conditions follow the links to Expert Service Centres.


SWPC ACE Magnetic Field 1h
b_x (nT)
b_y (nT)
b_z (nT)
b_t (nT)
latitude (degree)
longitude (degree)
status (null)
Plot produced by SWE Portal


space situational awareness
European Space Agency
SST
SWE Data Browsing and Analysis
Main
User Preferences
Subscriptions
Statistics
Search Filters
User Domain: All
Measurement Domain: All
Provider: All
Acquisition: All
Data Types:
Protons
Electrons
F10.7
Radio_Flux
SSN
A_Indices
Add all
Add
Remove
Remove all
Keywords:
Time Period: 18 Sep 2014 15:55 To: 18 Sep 2014 15:55
Last Hour
Search Results
Time Series
Type
Actions
swpc_boucan_ussps
swaci_tec_data_5m_forecast
bgs_bincasts_aa_fc
swpc_hpi_plot
fmi_magnetic_field
swpc_ace_epam_5m
swpc_gs_part_5m
fmi_cloudiness
BGS DRX index Lerwick forecast
geisha_electron_plot
Select All
Unselect All
Reset Filters
Advanced Data Selection
SEISOP
SEDAT
IONMON
EDID
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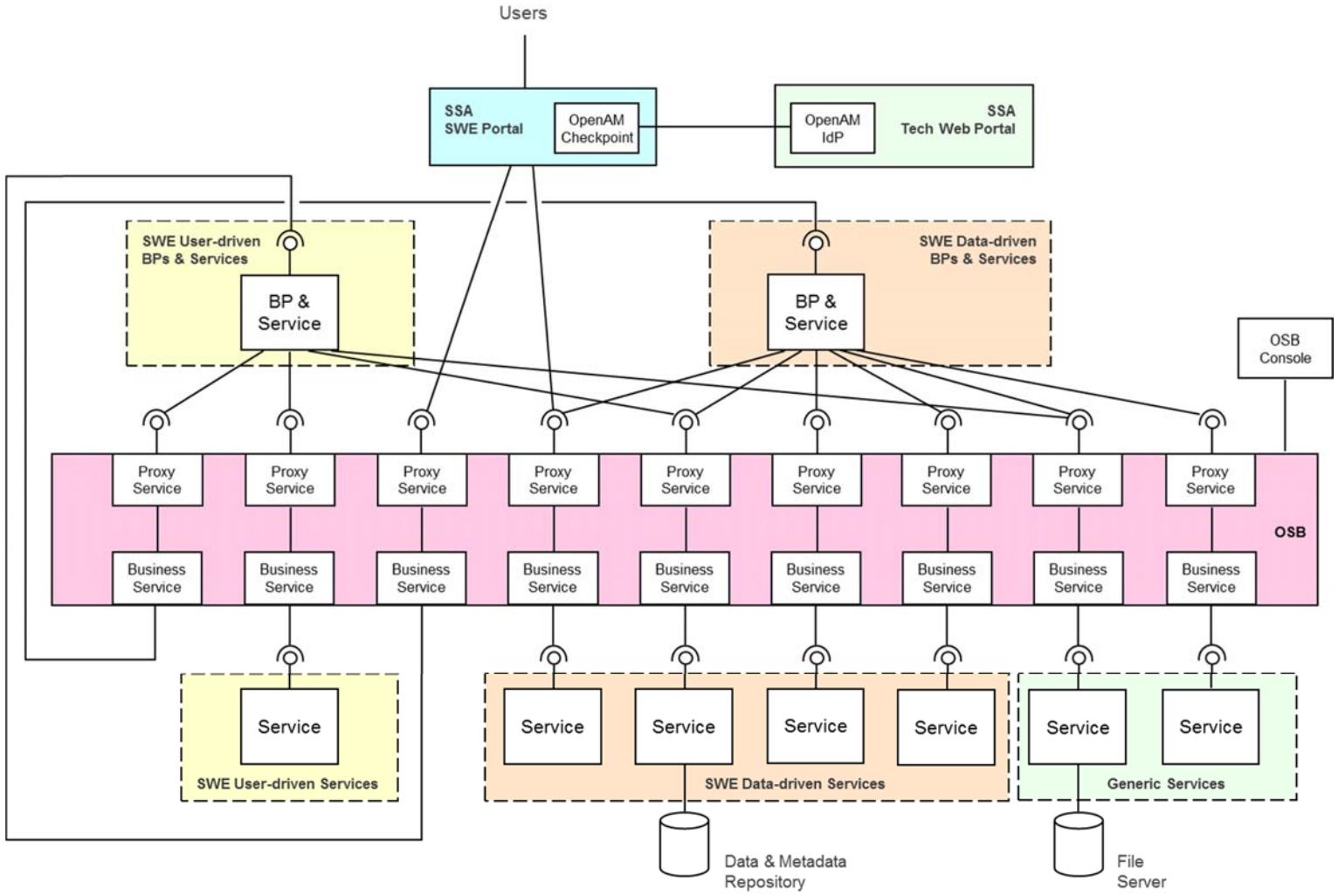
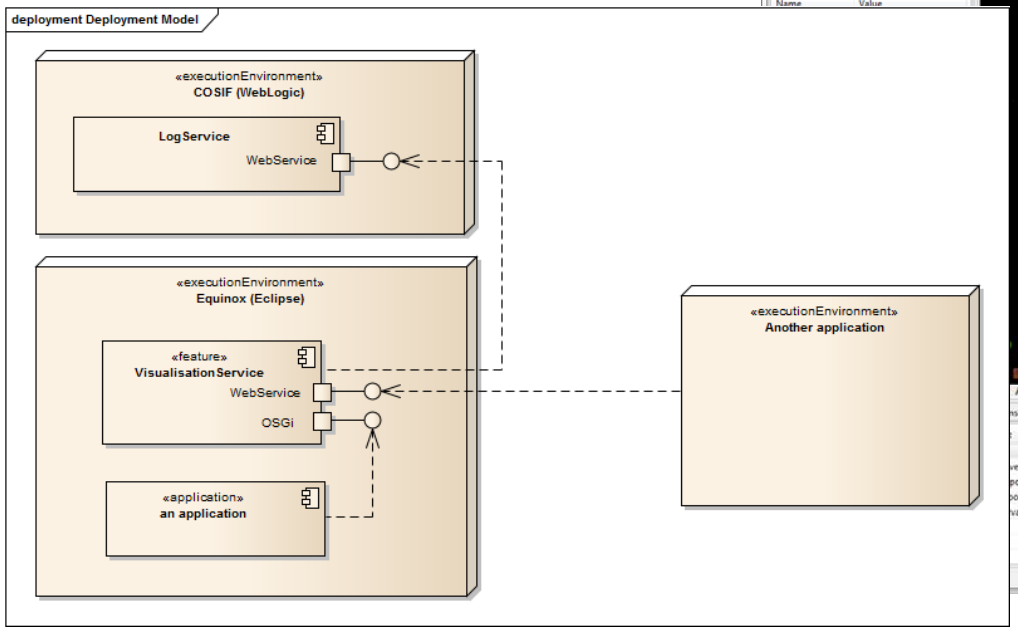
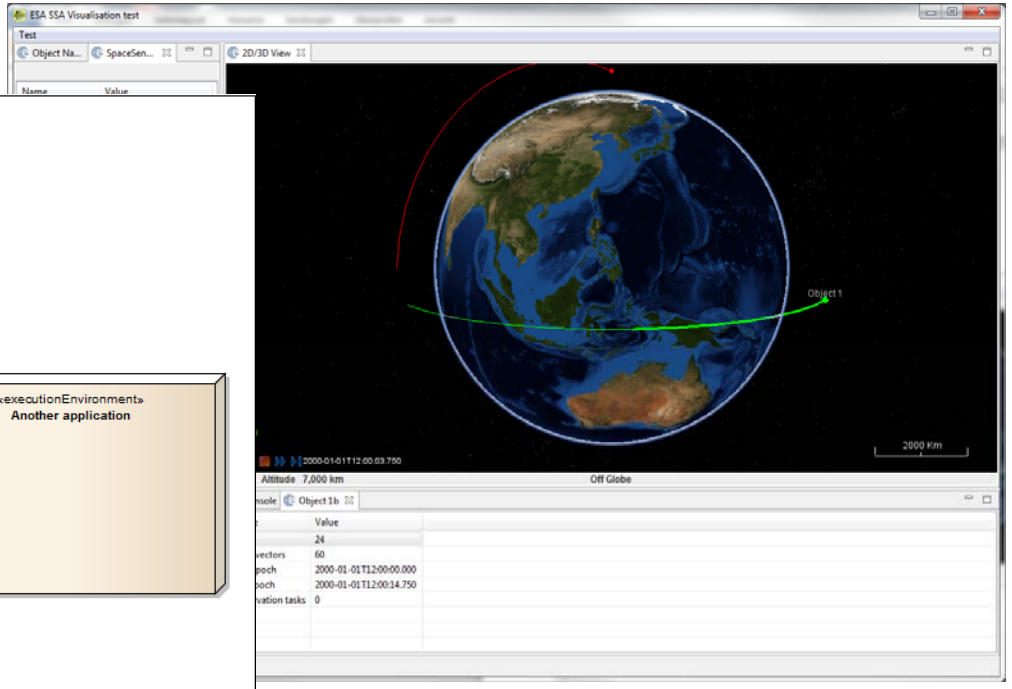
Results: Business Process and Services



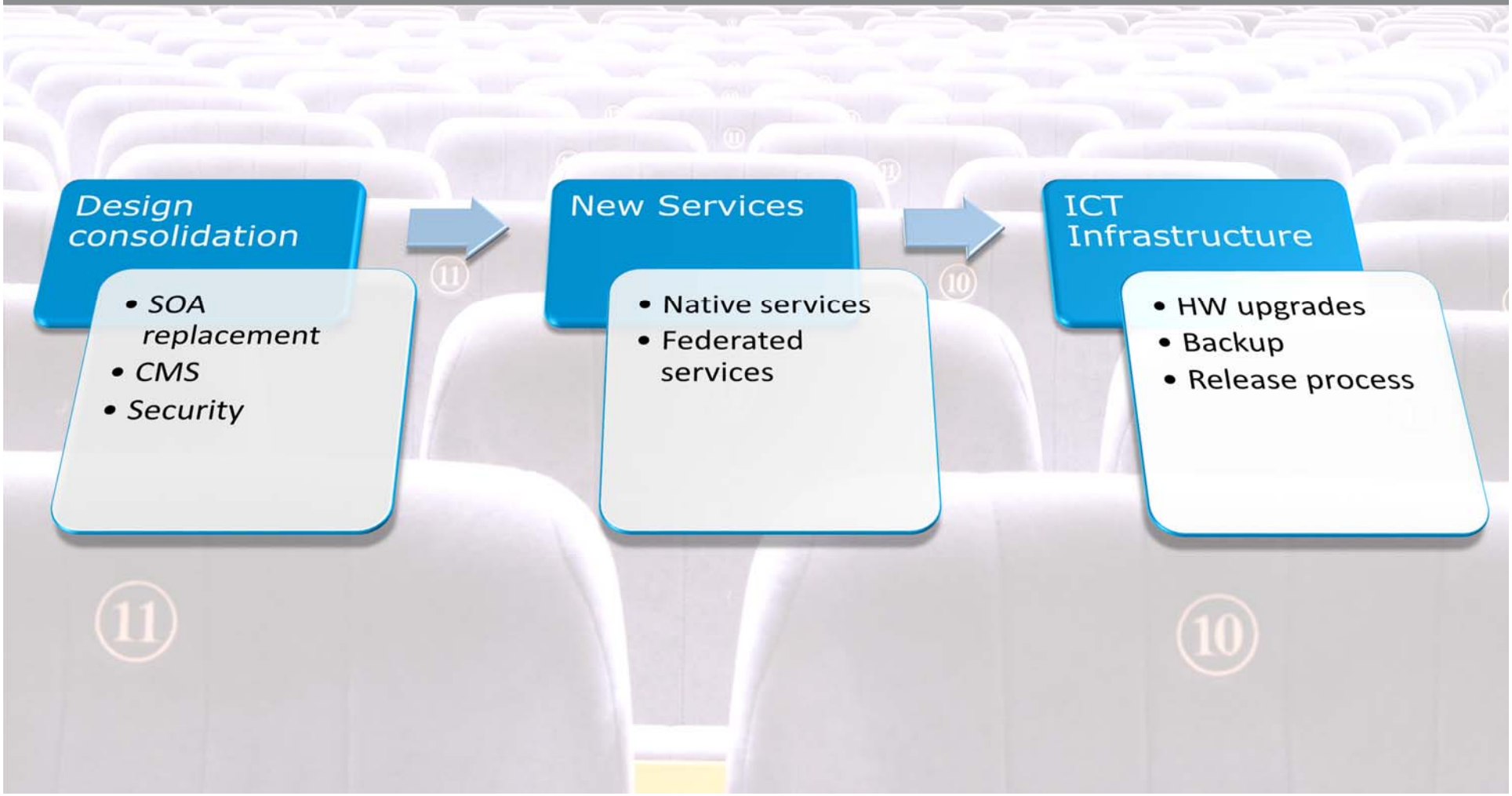
Results: Integration Modes

- Java-based Web-App/Service (same or other container, data center,...)
- Java-based Application
- W3C web service standard support
- BPEL (Business Process Execution Language)
- BPMN (Business Process Modelling Language)





Future work


Design consolidation
• SOA replacement
• CMS
• Security
New Services
• Native services
• Federated services
ICT Infrastructure
• HW upgrades
• Backup
• Release process

Conclusions

1. Decomposition into BPs and Services at the start
2. Modelling Framework: good forward engineering
3. SOA Framework: steep learning curve, complex
4. BPEL: service granularity required fine tuning
5. Complex dependency management
6. Definition of a Common Data Model is quite a challenge
7. Extremely difficult to asses ROI
8. Engineers and Management ‘Buy-in’ is critical
9. Evolutionary path for our systems

Acknowledgements

ESA SSA's Core Team

Detlef Koschny, Emmet Fletcher, Gian Maria Pinna, Juha-Pekka Luntama, Nicolas Bobrinsky, Serge Moulin

ESA SSA's Support Team

Alexej Luginin, Mehran Sarkarati, Norrie Wright

SSA's Contractor Companies

Hauke Ernst, Juan Pablo Arregui, Noelia Sanchez, Patrick Jacques, Pablo Beltrami, Ole Kverneland and many others

esa
THANK YOU!
sst.ssa.esa.int
neo.ssa.esa.int
swe.ssa.esa.int
www.esa.int/ssa
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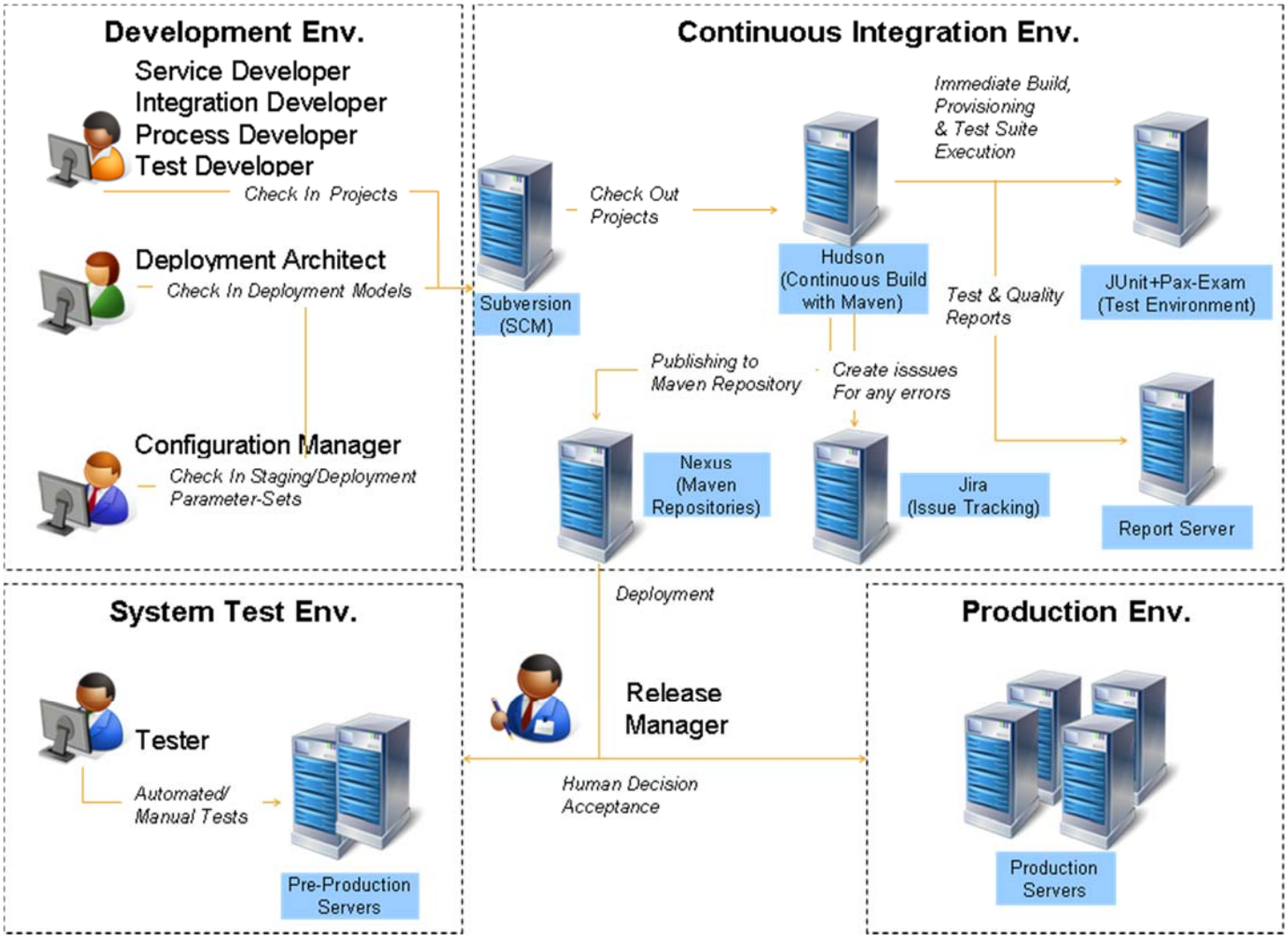
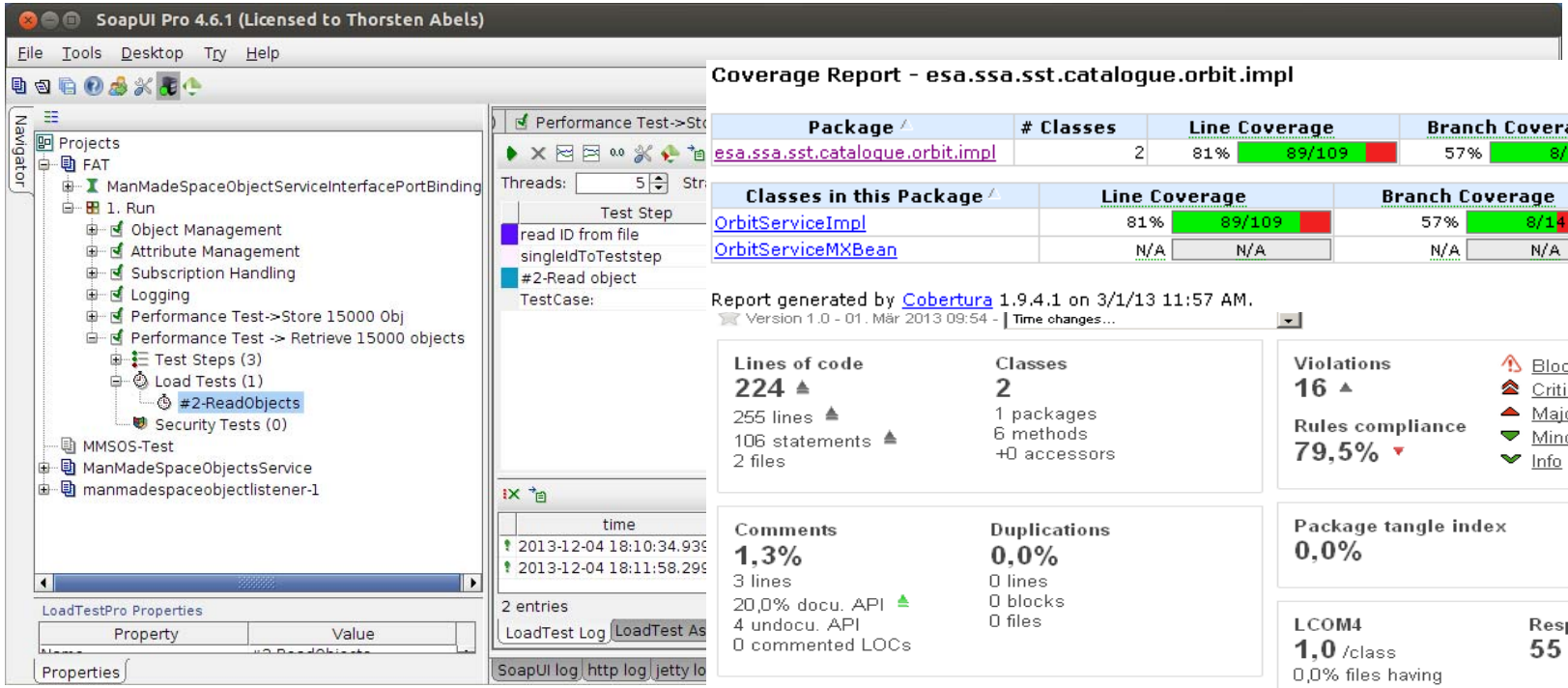
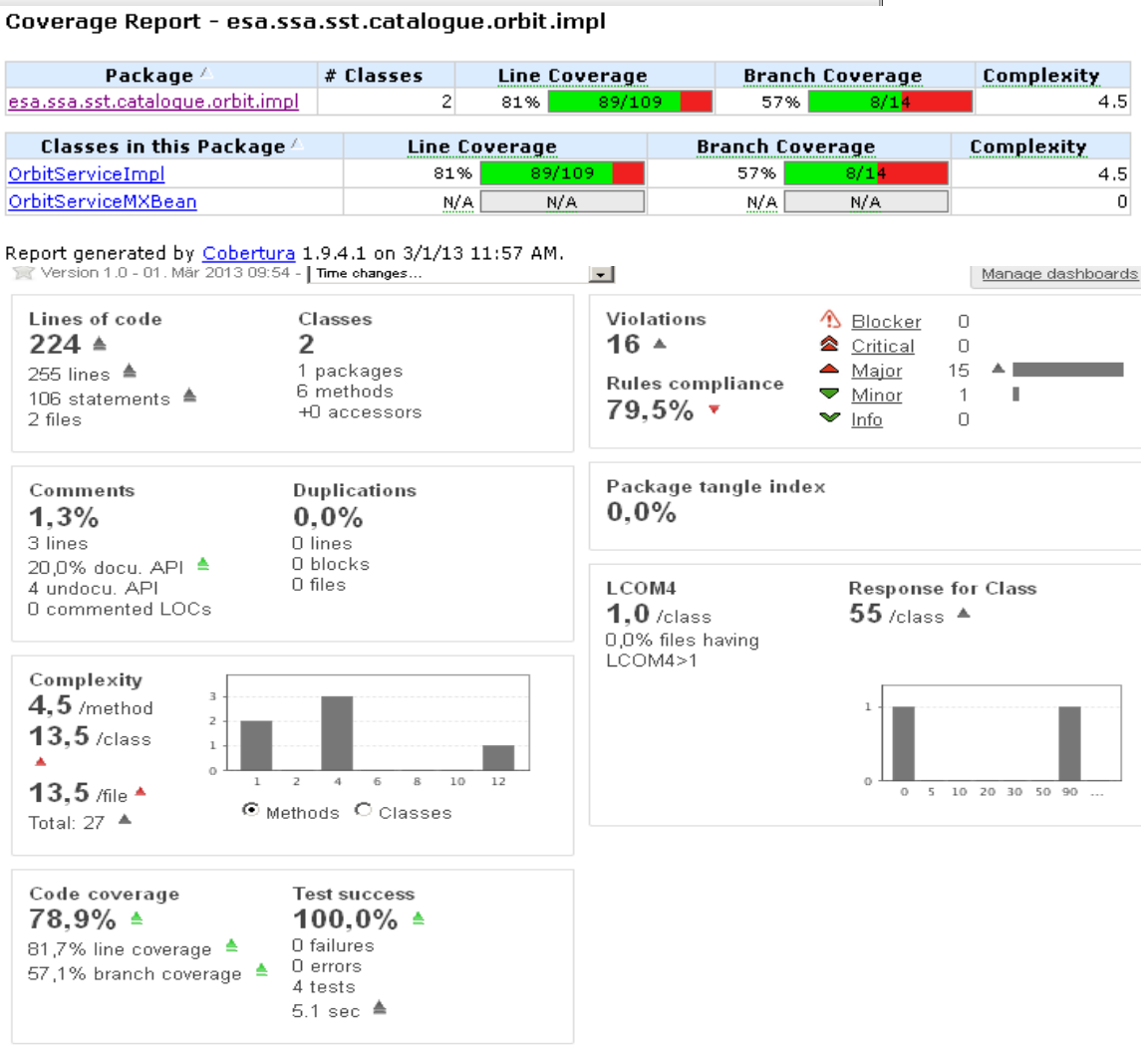
Backups

Engineering Environment: CI



Engineering Environment: Monitoring