From Mission-Centric towards Infrastructure-Centric Processes and Services

Ground System Architectures Workshop 2021

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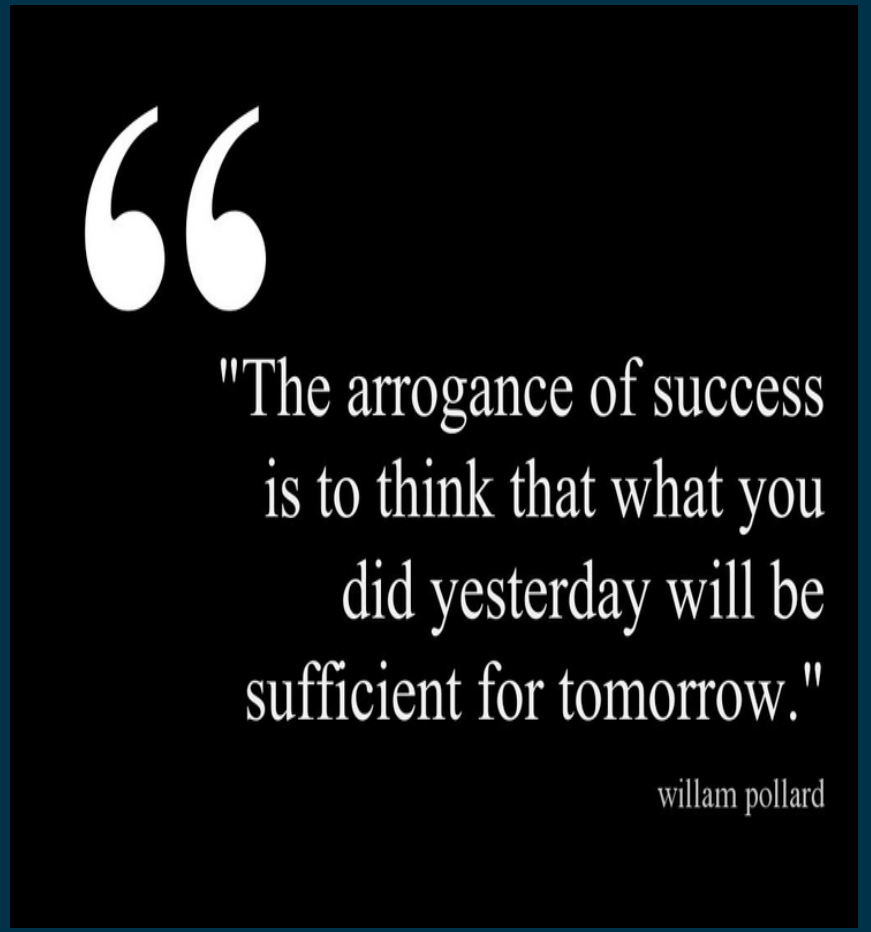
Ground System Architectures Workshop - GSAW 2021

Background

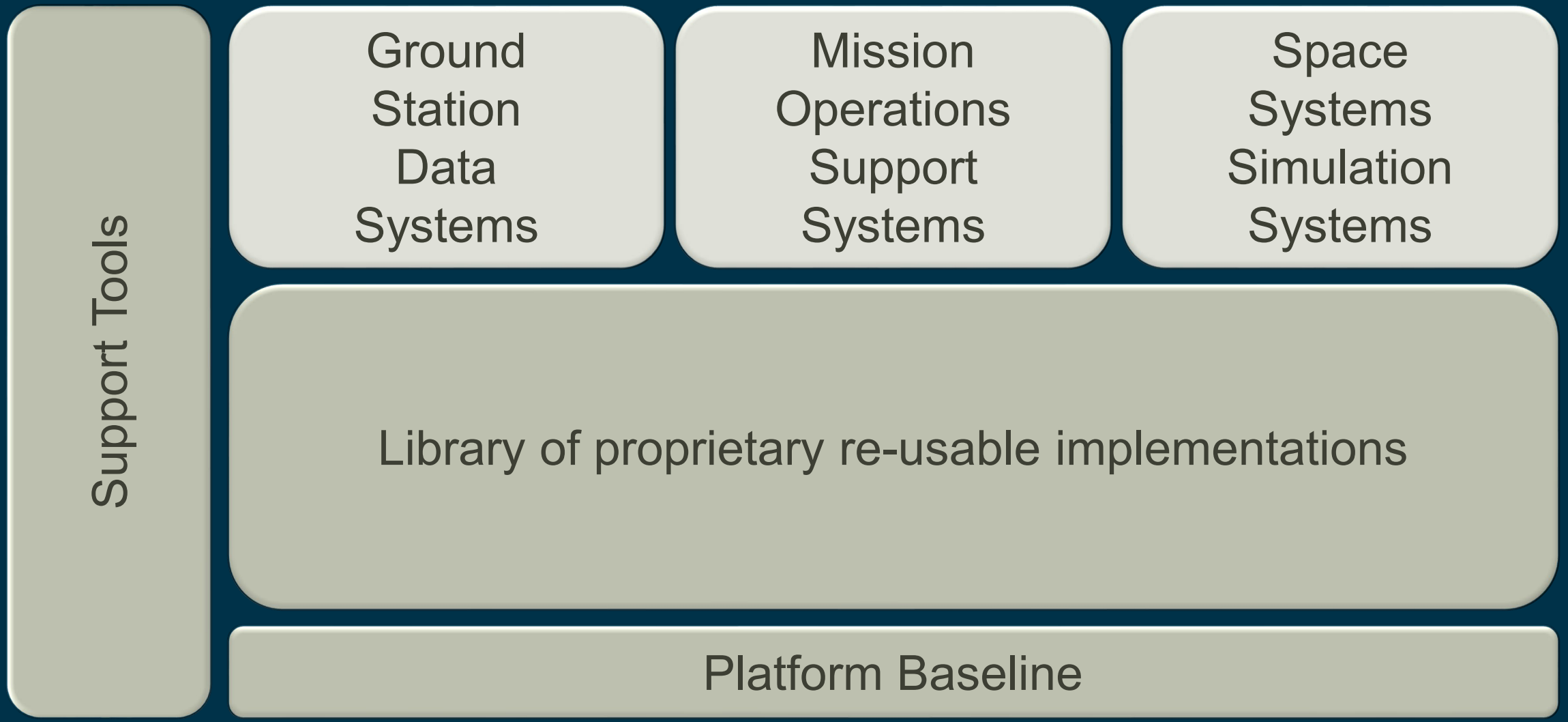
At ESOC ground systems are developed by re-using generic implementations designed and maintained to support the common needs of our mission model. This approach has demonstrated to provide many benefits:

- Cost, delivery time and risk reductions for new missions
- It promotes commonality across missions
- It supports capturing the operational culture/knowledge of an organisation

The current generation of re-usable software implementations is functionally rich, able to support all categories of missions and operationally mature



Ground Data Systems at ESOC



Deficiencies of the current approach

The current approach is based on '**Mission-centric**' lifecycle of engineering processes. This prevents the full exploitation of the benefits enabled by the level of commonality achieved across missions, due to:

- Lack of strict layering in implementations and associated governance
- Replication of effort in the set-up and execution of engineering processes (in particular integration and validation)
- Need of maintaining highly specialized expertise in multiple and diverse teams
- Unaffordable efforts to implement a coherent strategy to tackle obsolescence and security threats
- Problematic support of low-cost missions

EGOS-MG: From ‘Dedicated’ towards ‘Shared’ Resources

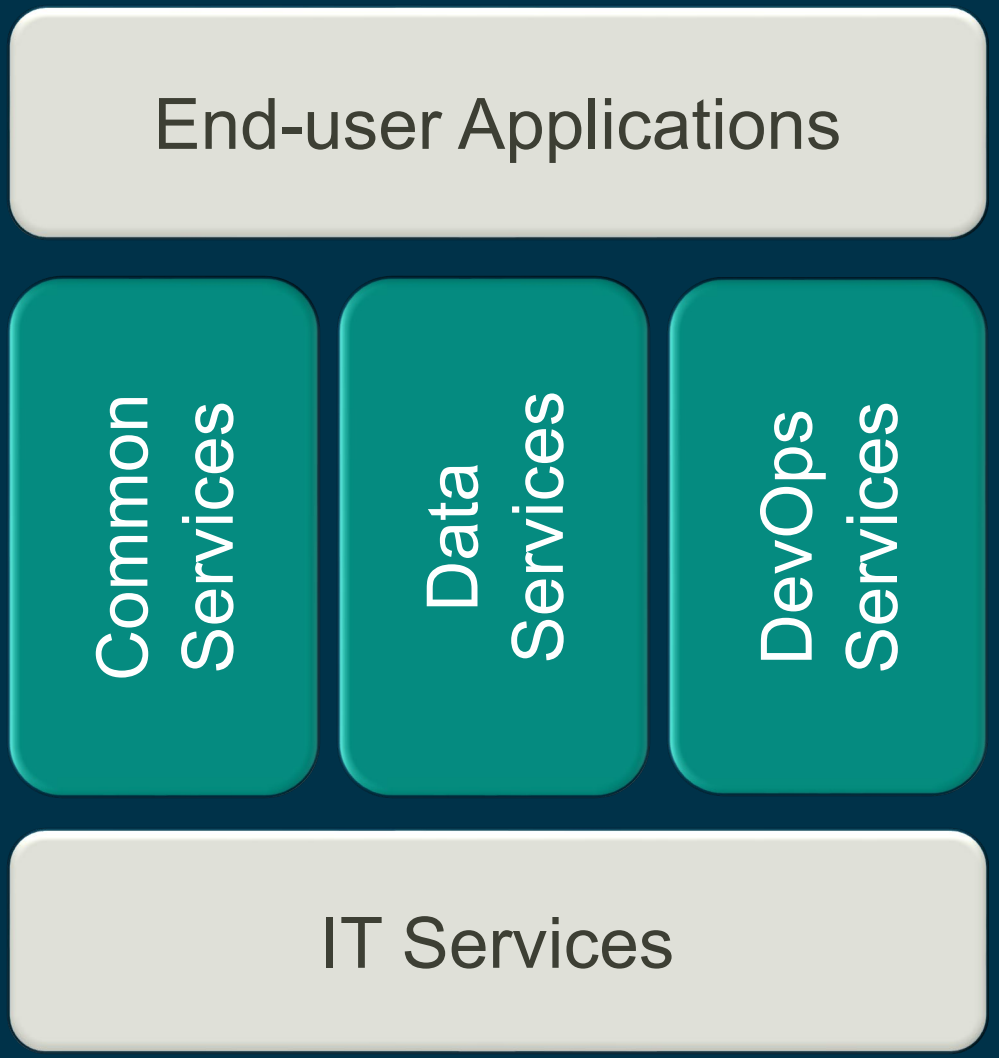
- Significant expansion of the **Middleware infrastructure** shared by the operational teams
- Set-up of coherent **Environments** supporting the engineering and operations processes for all missions
- Provision of applications supporting multiple targets at various degrees of ‘**Multi-Missionisation**’

EGOS-MG: From ‘Generic’ towards ‘Common’ Products

- Definition of centre-wide governance based on a clear separation between **Common** and **Target specific** processes
- Set-up of stakeholders ‘**Communities**’ looking after the various layers of re-usable products
- Design and implementation of highly automated **DevOps Processes** supporting the full lifecycle (from system design up to operational validation and deployment)

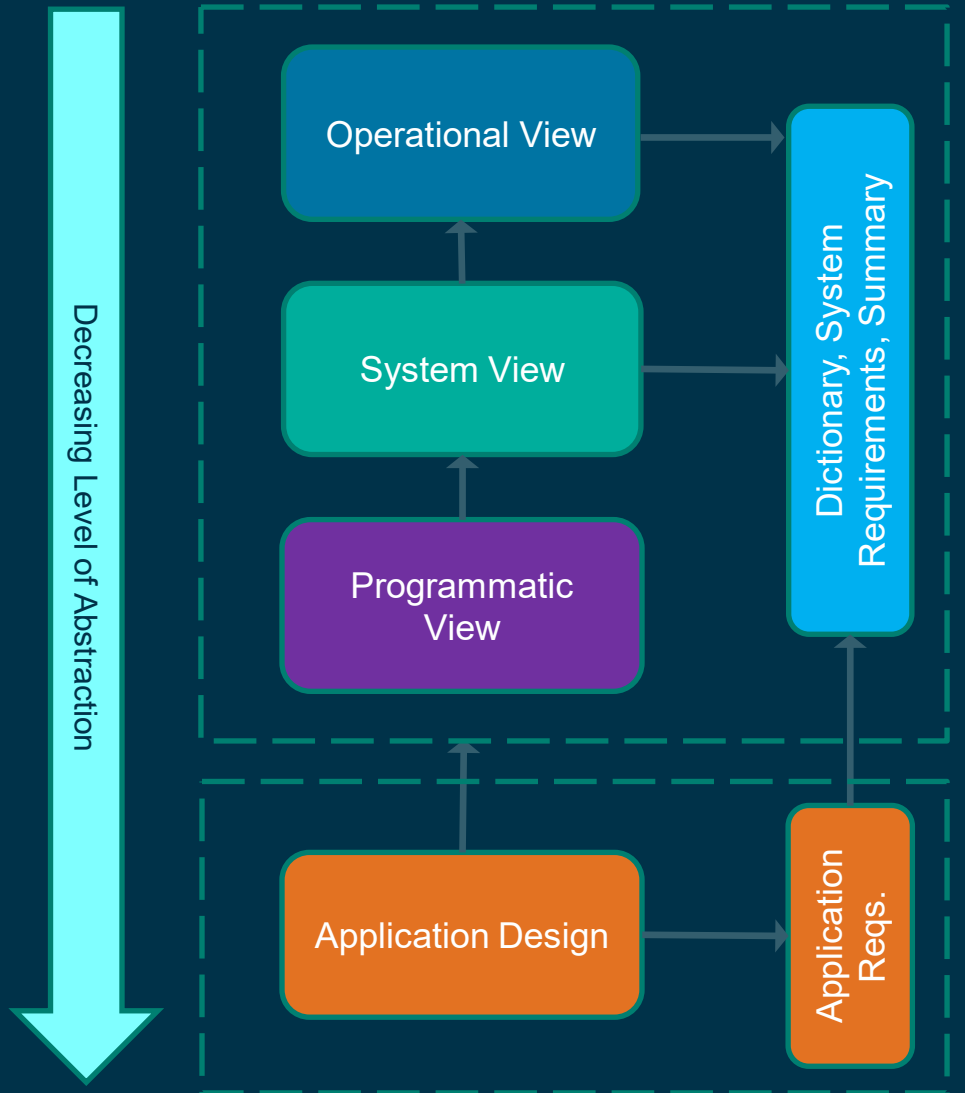
EGOS-MG: From ‘Functions and Processes’ towards ‘Services’

- Set-up and provision of ‘**Services**’ for:
  - **DevOps** supporting off-line processes
  - Data Services supporting storage, retrieval and transfer of operational data
  - **Common Services** providing cross-cutting functions at run-time
- Shared services will be focused on specific functions/processes and be responsible ‘**End-to-end**’ (i.e. covering all related activities, from software development up to operational support)



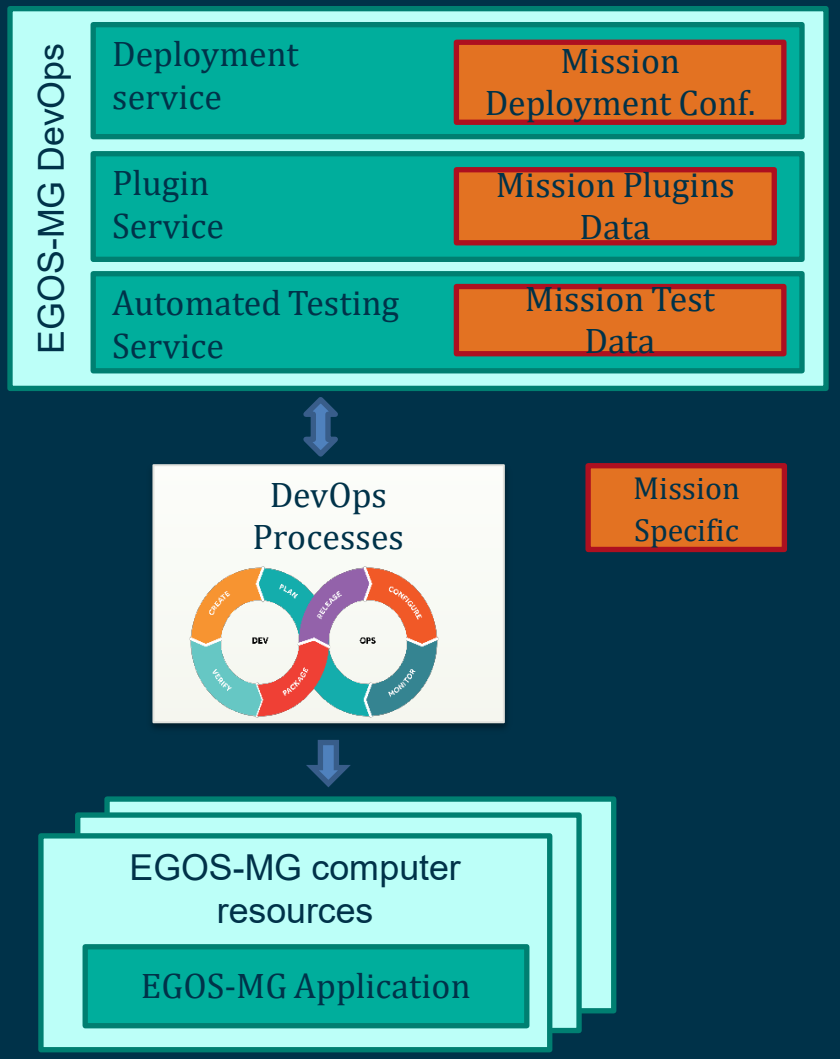
Model Based Engineering Approach

- EGOS-MG adopts a model rather than documentation centric approach to the system level specification and design
- The model captures the system from different viewpoints, each addressing different stakeholder concerns (i.e. user needs, system solutions, system evolution and delivery)
- Based on Unified Architecture Framework (UAF) concepts - https://www.omg.org/uaf/
- System level specification is elaborated and refined by application requirements and designs



Common Processes

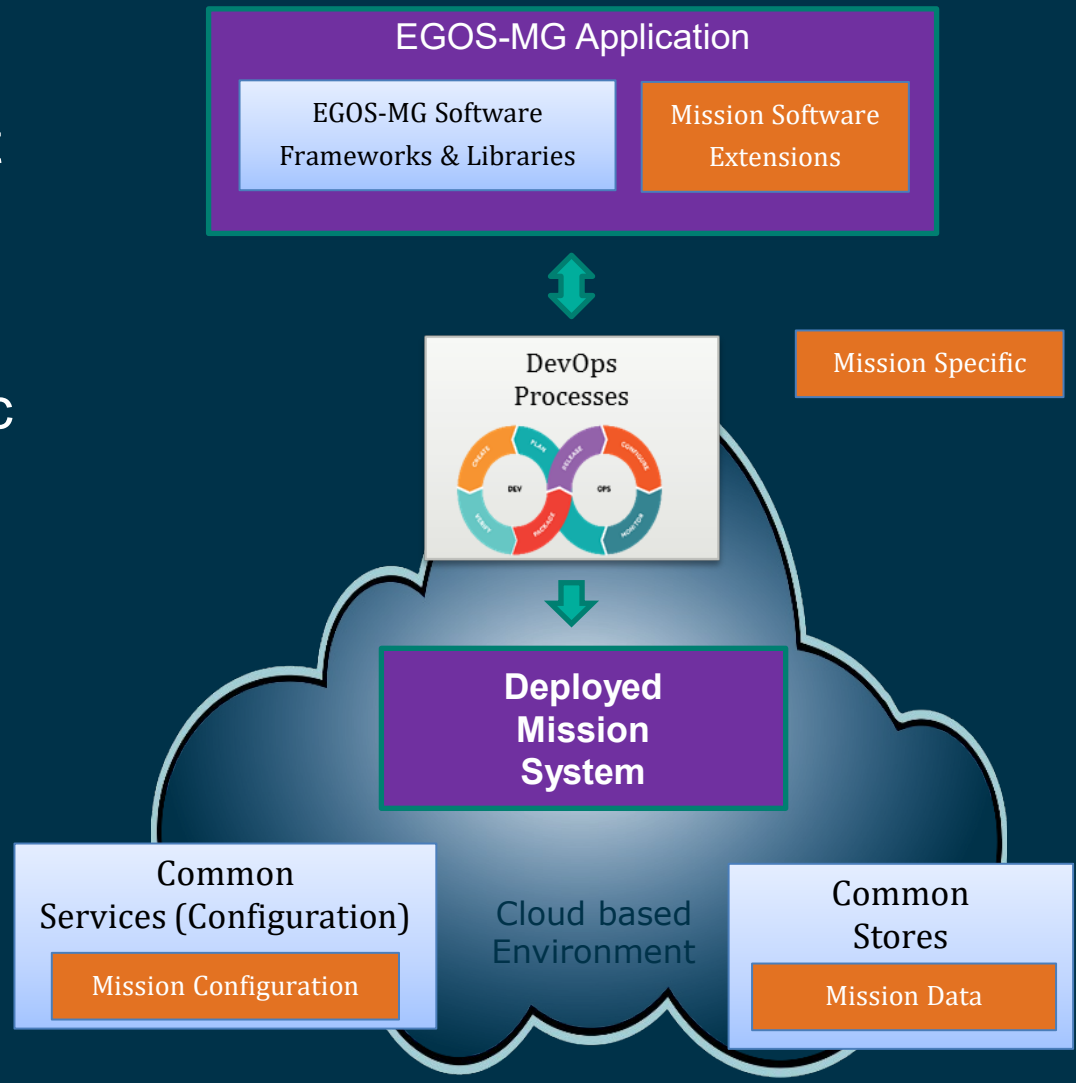
- EGOS-MG adopts DevOps approach; a set of practices that combines software development (Dev) and operations (Ops)
- DevOps shortens the systems development life cycle with continuous delivery and high quality
- Provides a common platform to design, develop, test, deploy and operate software applications
- Delivery pipelines streamline the flow from “developing software” to “using software”
- Automated deployment brings a repeatable, reliable process for installing software artefacts and applying configuration and tailoring



Application Software Customisation

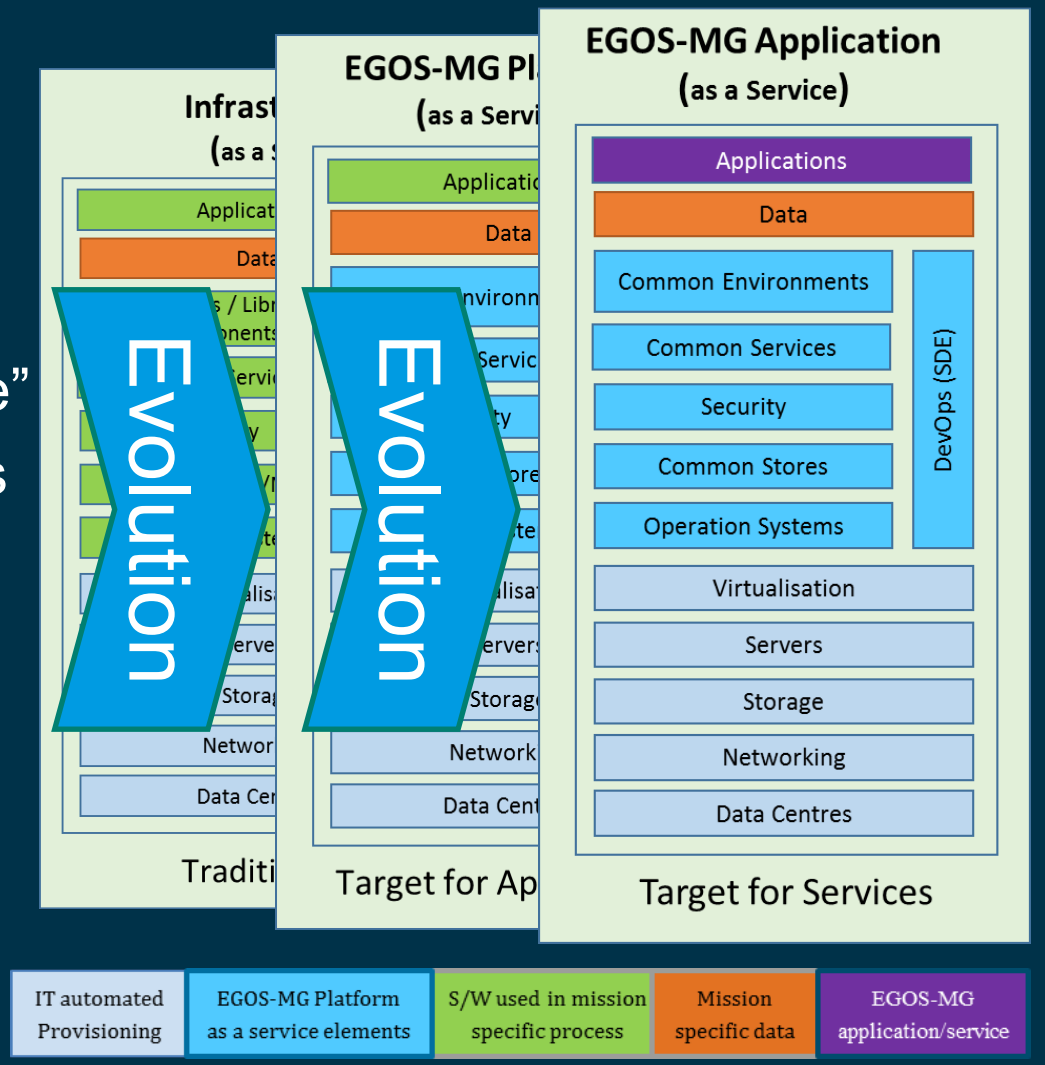
Goal of “EGOS-MG Applications as a service” stage, requires common customisation approach to support mission specific functions

- EGOS-MG application composed from common frameworks and libraries with thin mission specific extension layer (if any)
- Clear separation of application logic from mission data, allowing the application restart using any dynamically allocated computer resource but at a known consistent state
- Clear separation of application configuration managed by common configuration service

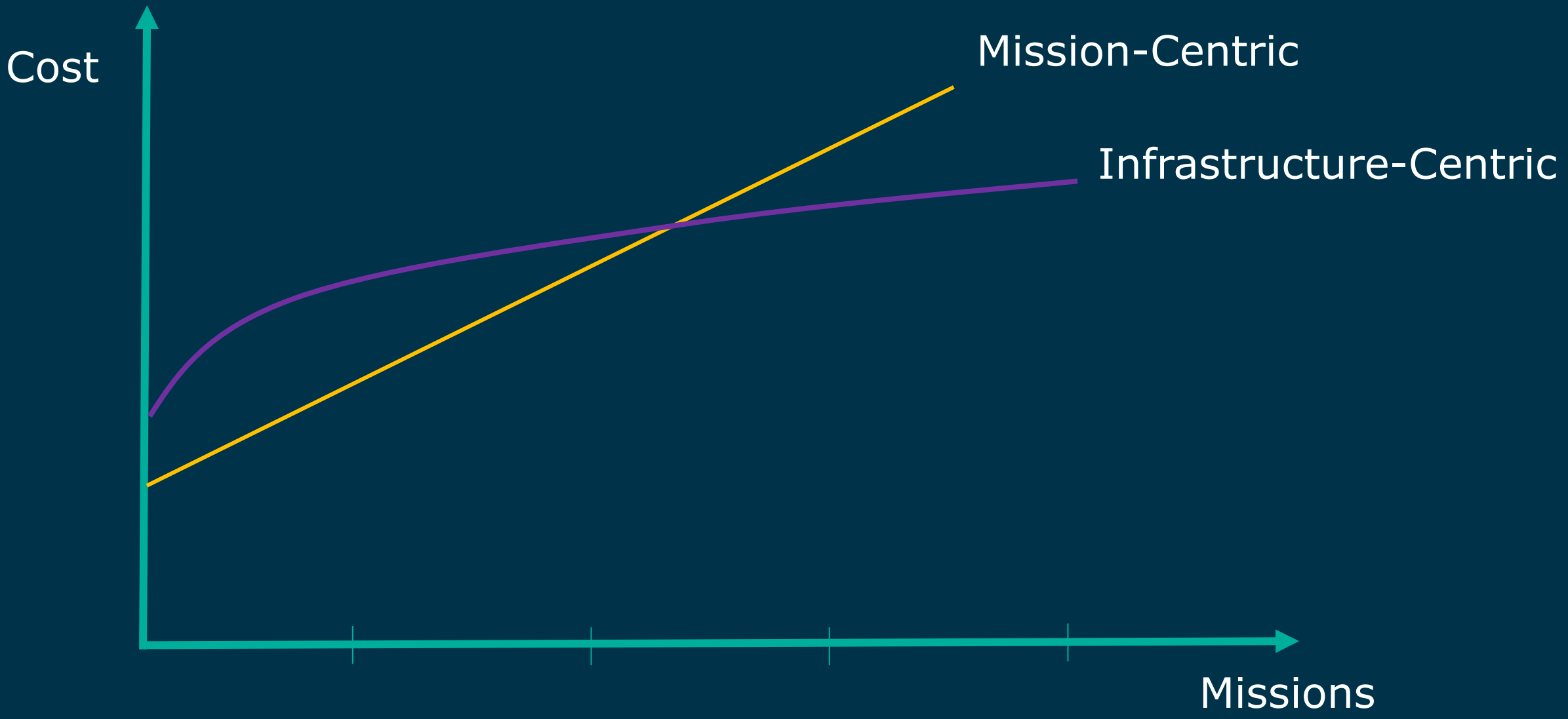


Evolution to Services

- The first stage of evolution to “IT Infrastructure as a Service” is being realized with existing systems and covers the complete transparent provisioning of the IT services
- The second stage “EGOS-MG Platform as a Service” provides a service covering the elements of DevOps pipeline, EGOS-MG Common services, EGOS-MG Common stores and EGOS-MG Common environments
- The final goal is the “EGOS-MG Applications as a service” stage, where the application layer is also provided as a service. Special considerations are required for mission customisation



Systems Set-up and Operating Costs



Conclusions

The EGOS-MG Project at ESOC aims at a radical change in the way that mission systems are managed (from 'Mission-centric' towards '**Infrastructure-centric**')

This revolution is expected to take place in logical steps:

- From 'Dedicated' towards '**Shared**' Resources
- From 'Generic' towards '**Common**' Products
- From 'Functions and Processes' towards '**Services**'

A cultural shift from 'My mission' to '**Our assets**' is required. This is the biggest challenge

The expected benefits in the medium-long term are significant and justify the relevant efforts and up-front investments

The best way to predict your future is to create it

Abraham Lincoln

We would like to acknowledge the excellent work of all the Multi-Mission Infrastructure Project Team members

Mauro Pecchioli (ESA), Anthony Walsh (ESA)

GSAW 2021