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Standardised Ground Data Systems Implementation: A Dream?

Y. Doat, C. R. Haddow, M. Pecchioli and N. Peccia
ESA/ESOC, Robert Bosch Straße 5, 64293 Darmstadt, Germany

Ground Data Systems at ESA/ESOC: The current approach

- Based on re-used infrastructure which is customised/tailored for the different missions
- The existing ground data systems infrastructure covers most of the domains typically required by ESA/ESOC missions
- This approach has proven to be effective in the past in terms of:
  - Reduced cost of ground segment developments for new missions
  - Increased cross-fertilisation between missions
  - Enabling the development of mission dedicated ground segments within a reasonable time-frame
  - Ensuring maturity and operational suitability of mission systems.

Ground Data Systems at ESA/ESOC: Lack of standardisation

- The current approach has enabled a high degree of standardisation across missions i.e. all missions are based on similar implementations of the ground segment (as they all share the same infrastructure systems)
- However, no standardisation/harmonisation has been achieved between the different ground data systems, not even between infrastructure systems produced by the same divisions
- This has lead to a proliferation of solutions that imply very high maintenance costs

Rational for More standardisation: If it's working why fix it ?

- Lack of common approach on hardware platforms, operating system and 3rd party products → Proliferation of platform baselines
- Lack of technology harmonisation → Proliferation of dependencies, Heterogeneous HCI (Human Computer Interface) look and feel, Overhead in maintaining the required expertise
- Lack of common design → Proliferation of different solutions for the same problem…
- Lack of consistency across data systems → Increased familiarisation, validation and maintenance efforts
- Lack of synergy across developments → Increased risk and development time to reach mature implementations.

What is the "ESA Ground Operations S/W (EGOS)" ?

- Target implementation of ESA ground segment infrastructure systems
  - Aims at standardising and harmonising existing systems
  - Improve interoperability
  - Reduce overall costs
- Constraint: Evolutionary approach required due to size/maturity of existing code base

ESA/ESOC Ground Data Systems Context

OPS –Operations Preparation System

MPS – Mission Planning System

MCS – Mission Control System

FDS – Flight Dynamics System

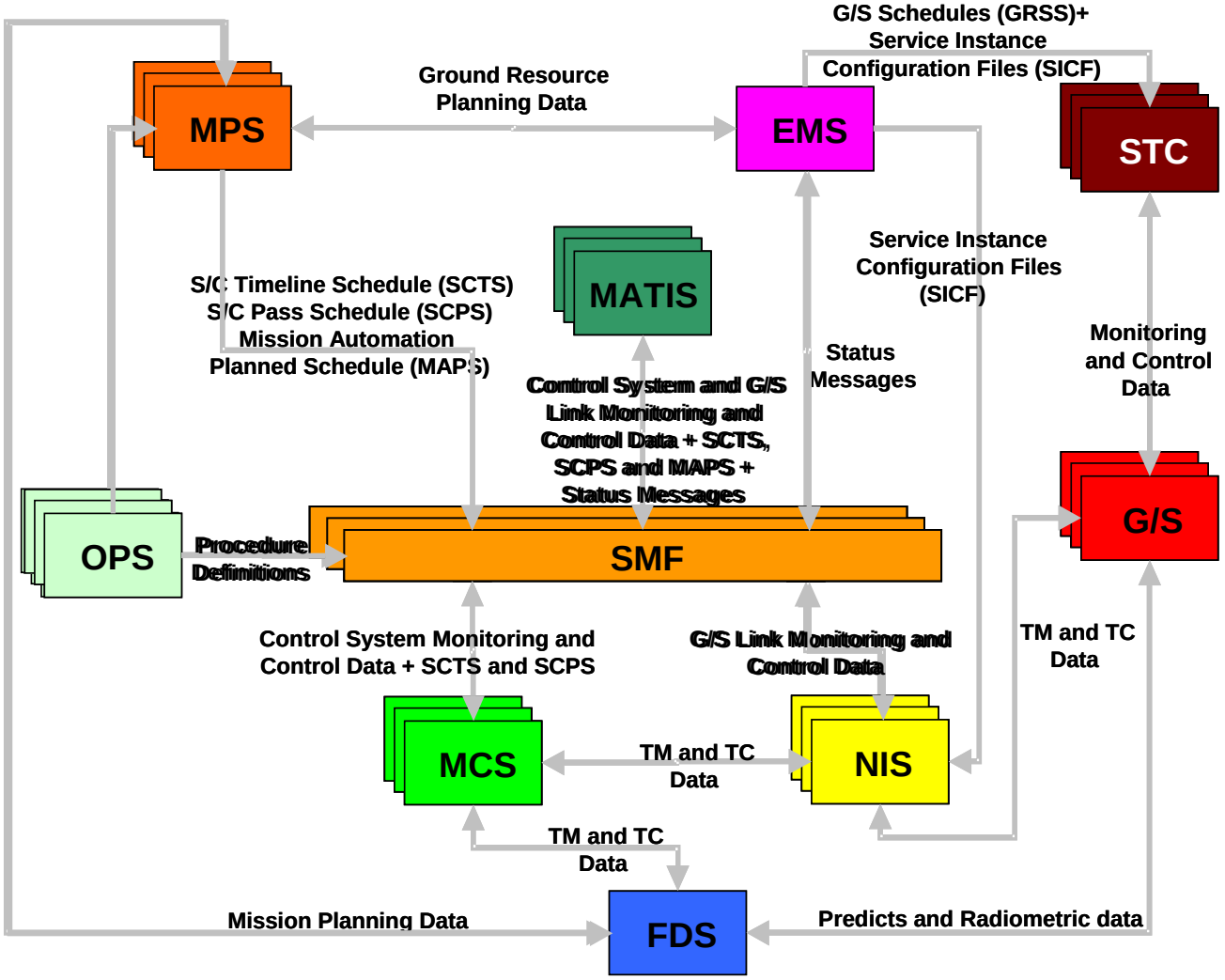
NIS – Network Interface System

MATIS- Mission Automation System

SMF- Service Management Framework

STC – Station Computer

G/S – Ground Station



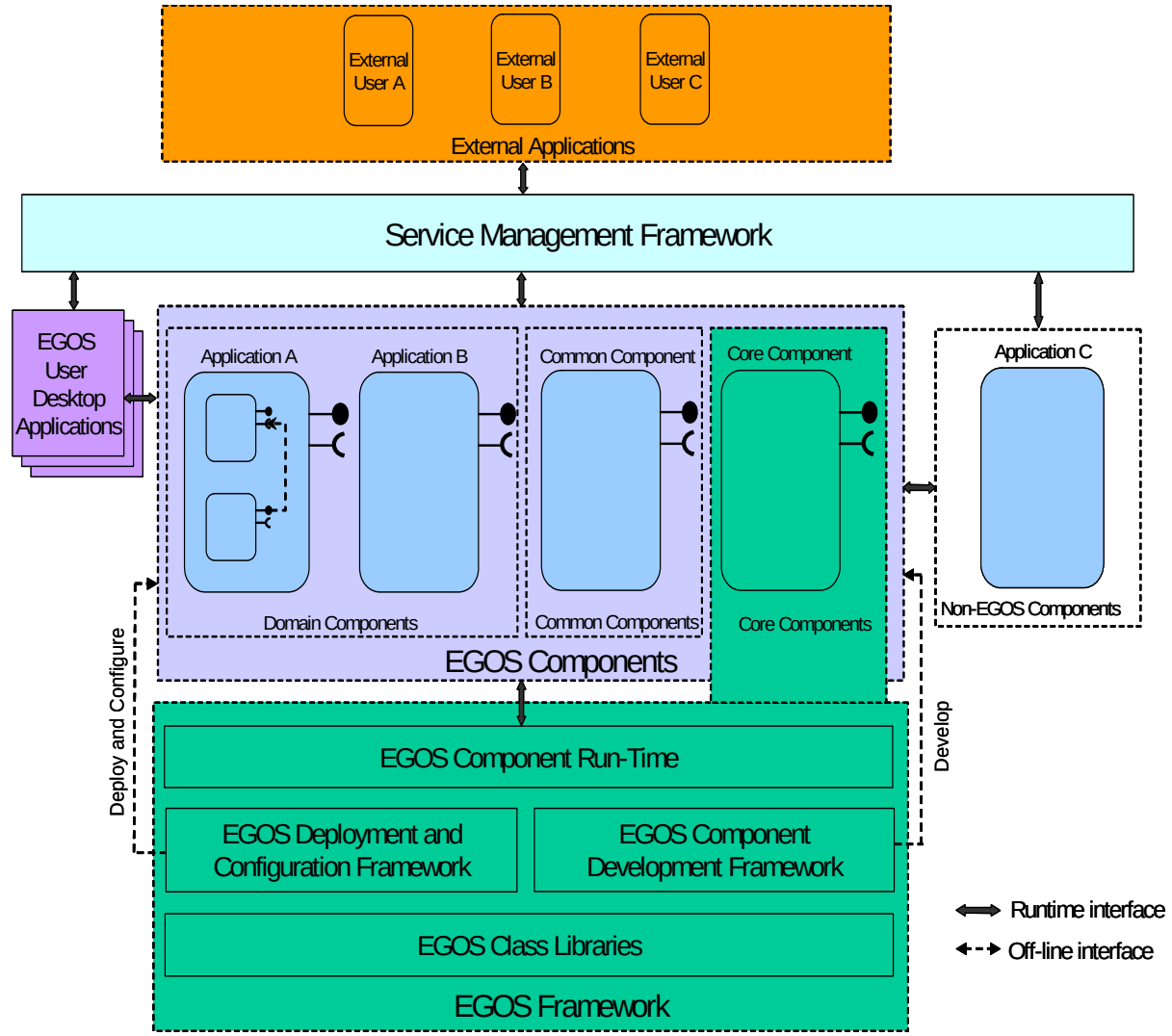
EGOS Ground Data Systems Scope

- Spacecraft Control Systems
- Simulators
- Ground Station Equipment
  - SLE Service Provider
  - Ground Station Monitoring and Control
- Mission Planning Systems

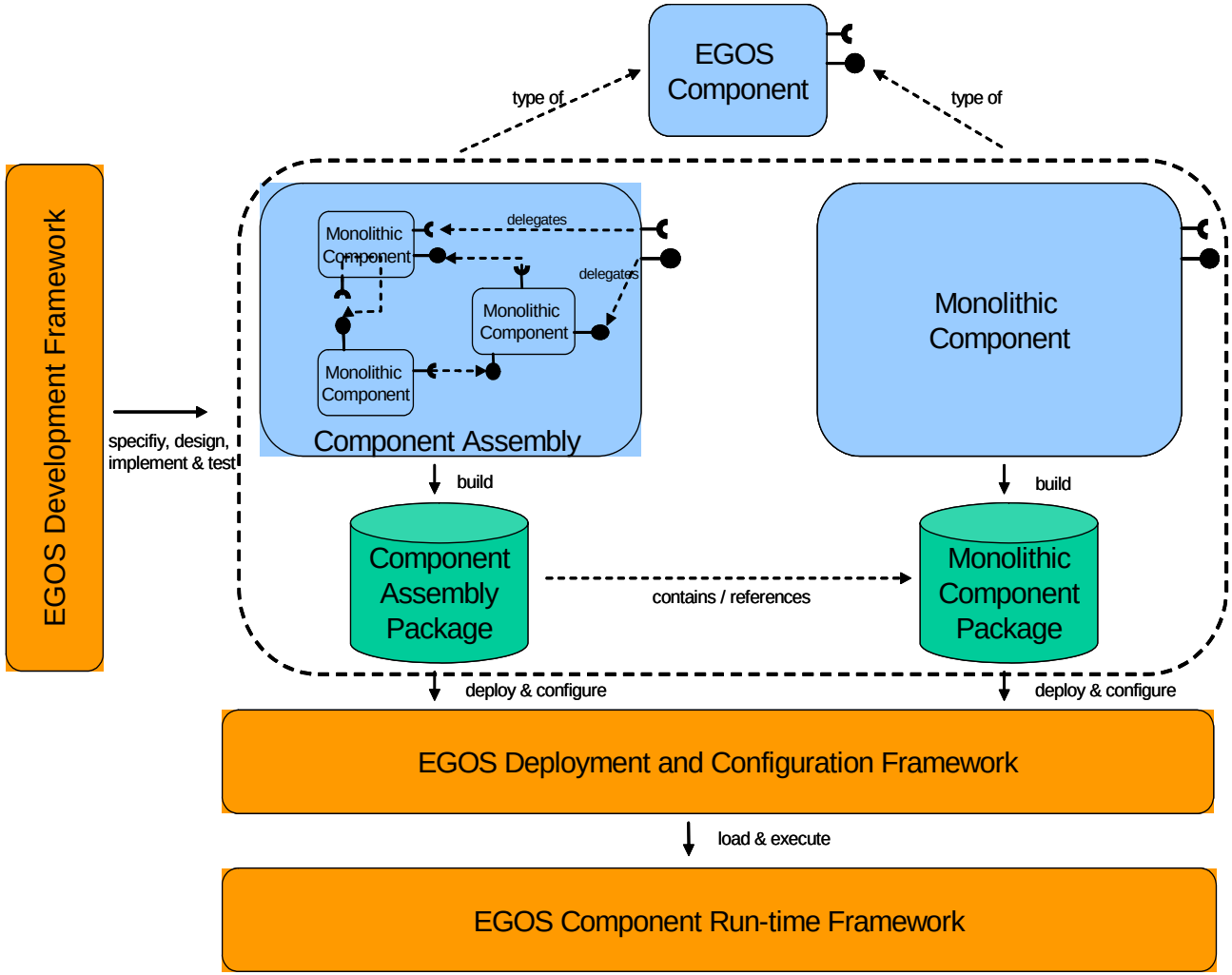
EGOS Architecture: Approach

- Move from a ‘vertical’ implementation of the different systems to the ‘horizontal design of common layers’
- Provide development and run-time frameworks for the application layer
- Minimise investment in low-level (middleware) components by re-using suitable 3rd party platforms (e.g. CCM, RCP)
- Maximise re-use of the existing implementation of the application layer (evolutionary approach).

EGOS Architecture Overview



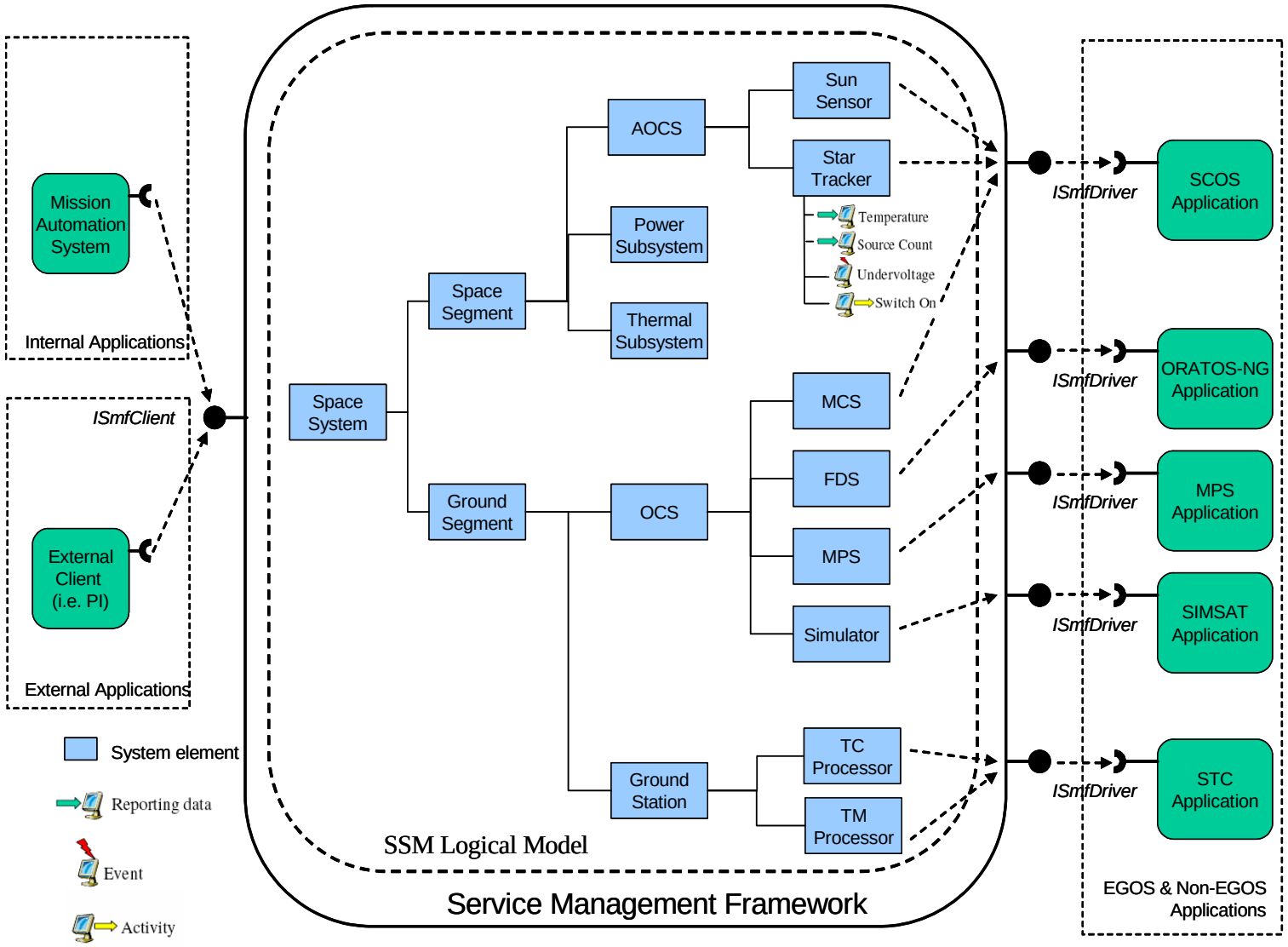
EGOS Component Overview



Service Management Framework

- Exposes services to external users/systems in standardised manner
- Enables ‘transparent’ access to the services provided by a system (interoperability)
- Controls access to exposed services
- Interfaces to internal services via drivers that handle required protocol conversion

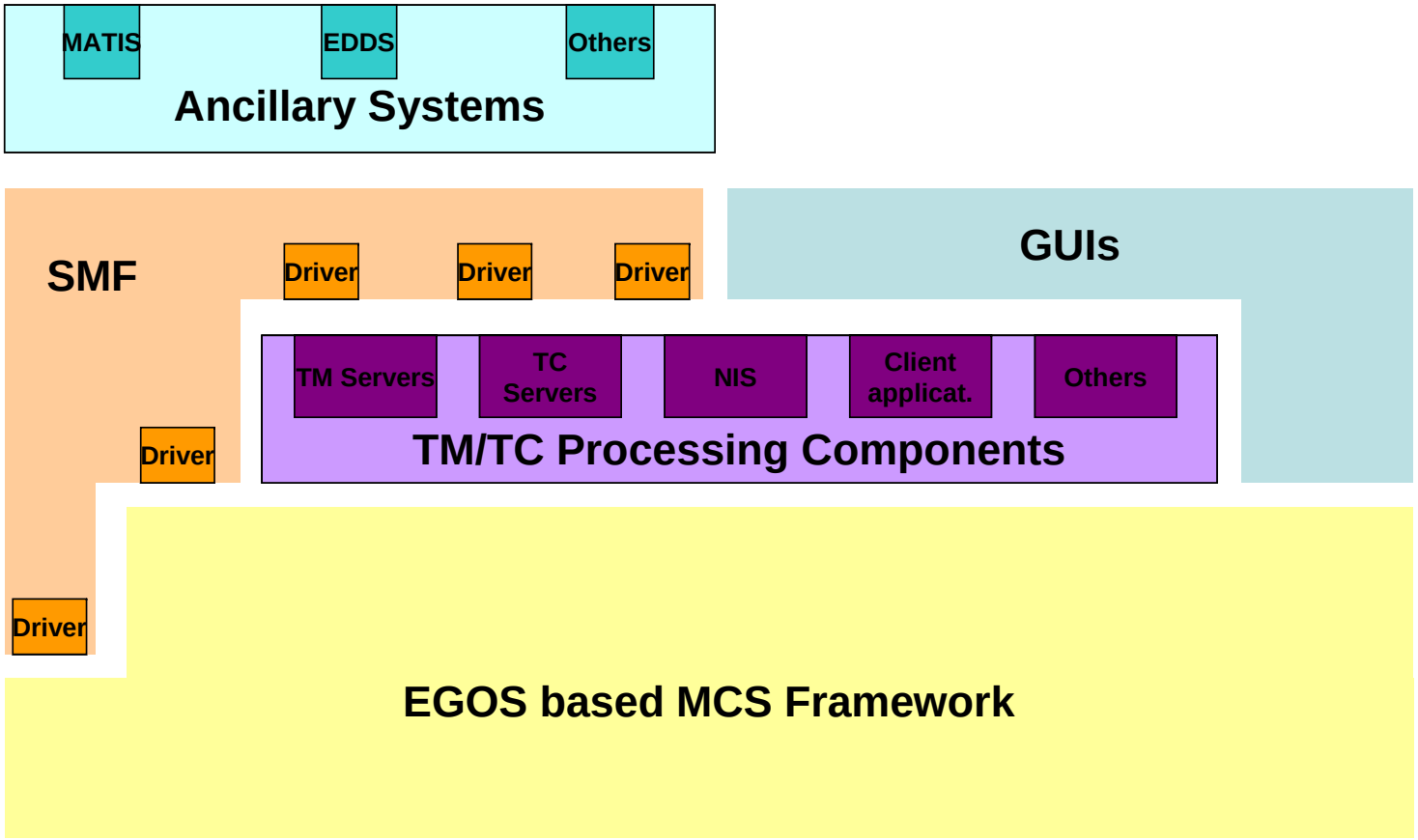
Service Management Framework Overview



EGOS Technologies

- Target platform:
  - PC Linux (SLES)
- Languages:
  - C++
  - JAVA
- Middleware
  - Corba Component Model
- Adaptive Communication Environment (ACE)
- Eclipse/SWT, Rich Client Platform (RCP)

Infrastructure Migration towards EGOS: the MCS example



Current Status

- EGOS High Level architecture is being finalised
- Service Management Framework implemented and accepted
- New systems being developed adopt EGOS concepts and wherever possible already existing components
- EGOS Target Architecture taken into account in the evolution of the existing infrastructure systems
- Design of the EGOS Framework (Development and Run-time) has been finalised.
- Implementation for Core Components expected to start in Q3/2007
- User Desktop design currently being finalised. Implementation will start in Q2/2007
- Identification and redesign of Common Components will start in Q2/2007

Can a Dream become a Nightmare?

- High-level components lifecycle/maintenance
  - →Avoid massive re-use of low-level components until they are fully validated and robust
- Technology Lifecycle is too short
  - →Identify mechanisms to 'slow down' e.g. platform independent technologies, isolate the proprietary implementation, use of virtual machines?
- Avoid to re-implement what already exists
  - → 'Sandwich' re-engineering i.e. replace middleware and visualisation layers but not the 'core' implementation of existing applications (business logic)

Thank you for your attention.
Questions ?