EGS-CC Phase B a Report

M. Götzelmann, Telespazio VEGA Deutschland GmbH

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The EGS-CC Phase B Project

Tasks and Schedule

- SW Requirements Engineering
- Architecture and Interface Design
- Coordination with the POC project for technology selection

- Kick-off: Mar 2013
- SWRR: Dec 2013
- PDR: Apr 2014
- Final Delivery: May 2014

Team

- ESA Management
  - Mauro Pecchioli, ESOC
  - Juan María Carranza, ESTEC
- Industrial Consortium
  - Telespazio VEGA, Prime Contr.
  - CGI
  - GTD
  - Terma
  - Dutch Space
- EGS-CC SET (monitoring and review)

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What is EGS-CC?

See previous presentations

This presentation focusses on software design responding to the challenge of the EGS-CC wish list

What is EGS-CC?

- EGS-CC **is not** an MCS or EGSE System
- EGS-CC **is not** just a collection of infrastructure components that can be integrated into an M&C System
- EGS-CC **is**
  - A platform on which an M&C System can be built for a reference category of space systems, and which provides
    - Core monitoring and control functionality
    - Application support features
  - A set of components that allow adapting the core monitoring and control features to the operation environment
  - A test framework that can be used to validate EGS-CC itself and systems based on EGS-CC

Layered EGS-CC Architecture

- **Kernel**

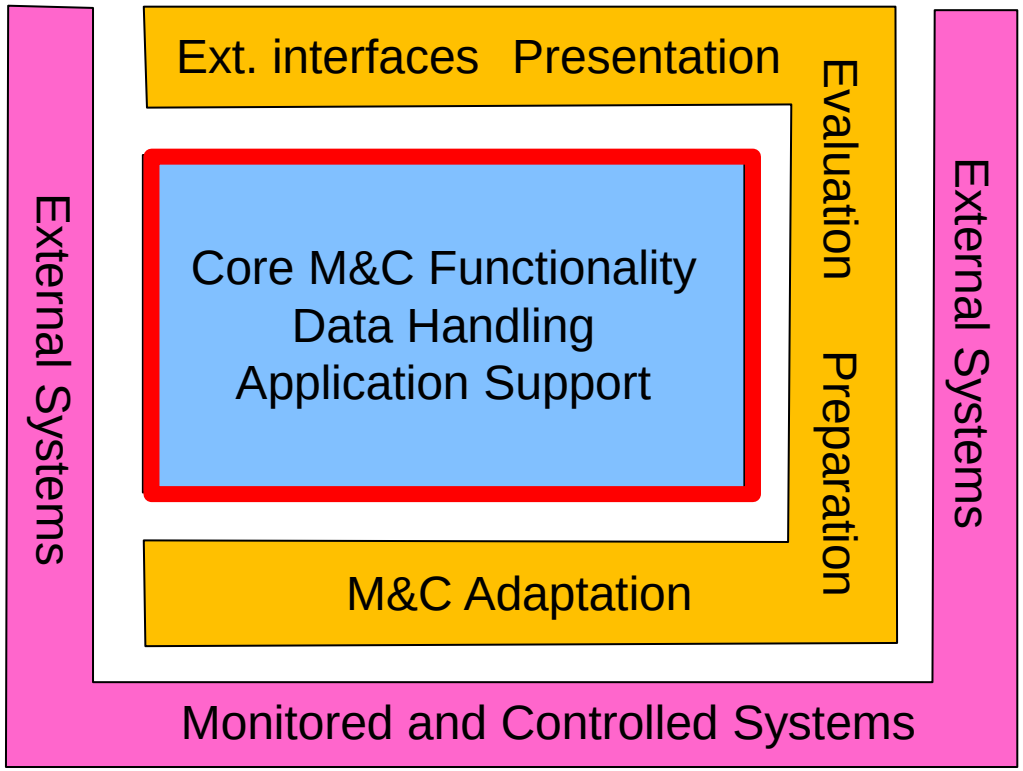
  Delivered as one package not to be modified but supporting extensions for specific needs

- **Reference Implementations**

  Components that may be replaced individually by alternative implementations without any impact on other components

- **Reference Test Facility**

  EGS-CC test environment



Key:

Kernel	Reference Implementations
Reference Test Facility	

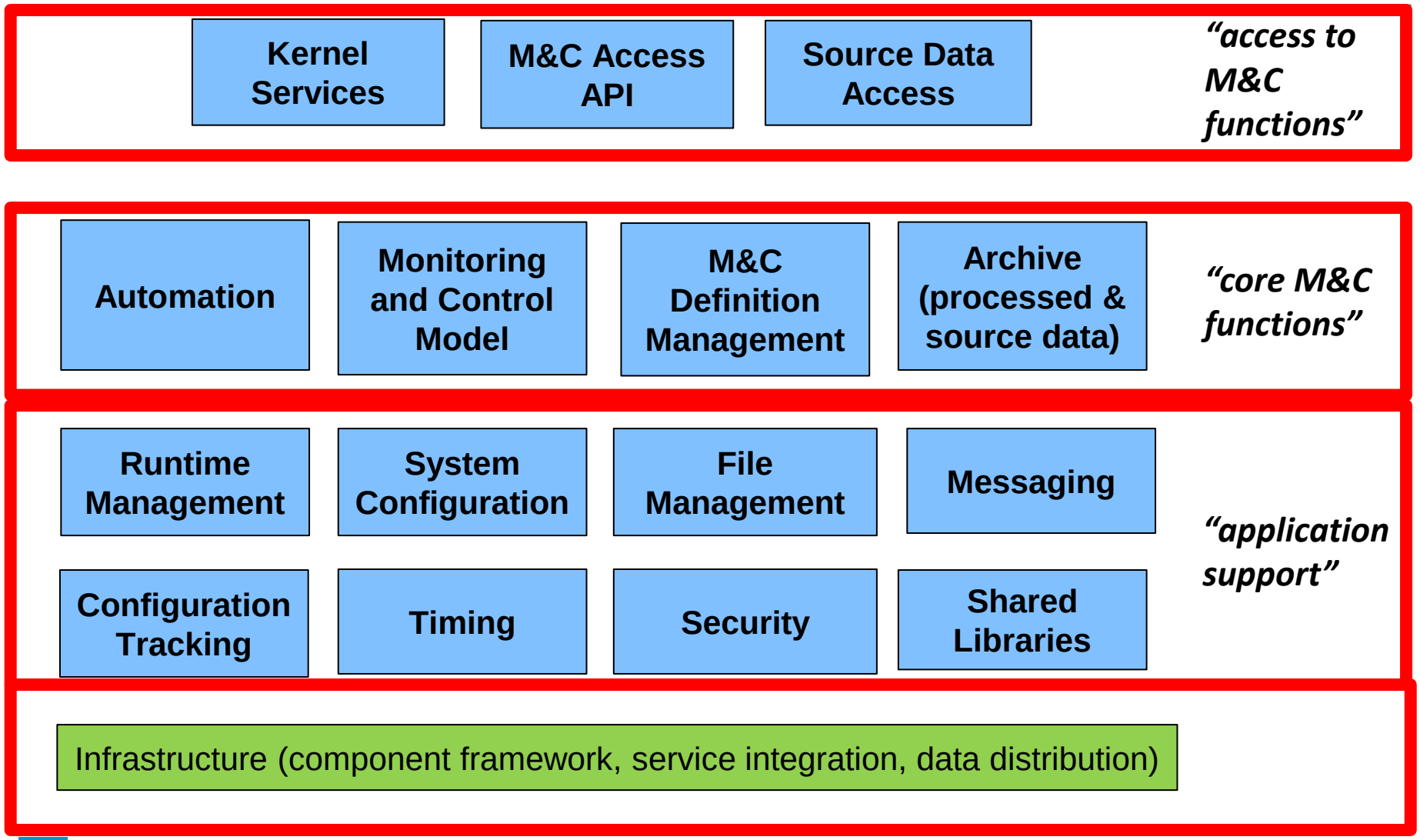
EGS-CC Kernel Functional Scope

- Core monitoring and control functionality that is independent of specific interfaces and protocols
  - Processing of monitoring information once decoded from transfer containers and presented by standard data types;
  - Processing of control actions to the extent possible independent of specific interfaces and protocols;
  - Management of monitoring and control data definitions;
  - Archiving of monitoring and control information;
  - Automation.
- Data access, distribution, and archiving services for source and processed M&C data
- General infrastructure, application support, and runtime management, provided to all EGS-CC components
- Support for external systems via a service integration platform

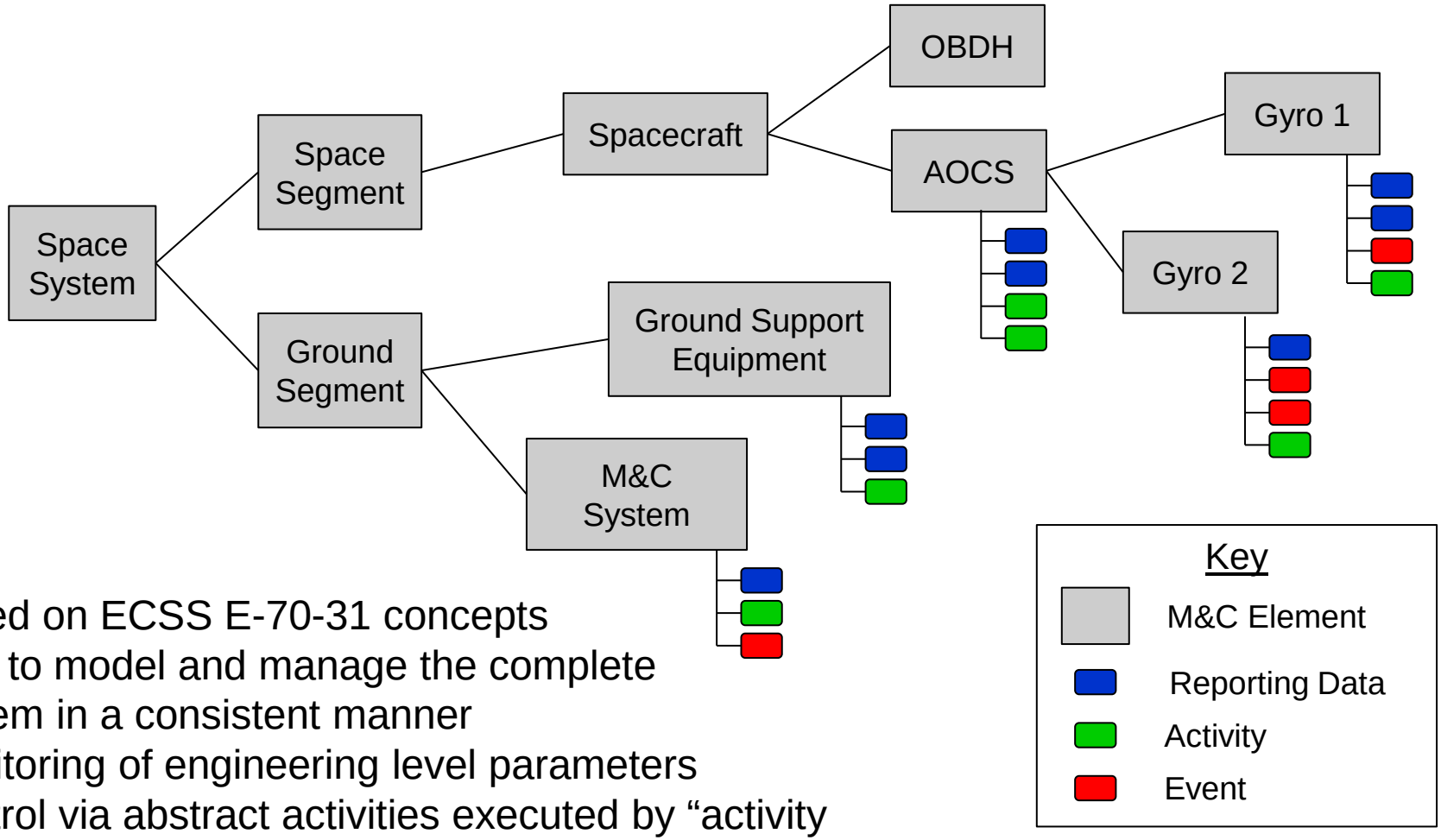
EGS-CC Kernel – Design Challenges

- Develop, enforce, and defend suitable abstractions for M&C functionality;
- Provide services that reflect client perception and needs;
- Ensure that the kernel can be easily customized through
  - Configuration;
  - Tailoring;
  - Scripting;
  - Software extensions when needed.

EGS-CC Kernel Decomposition

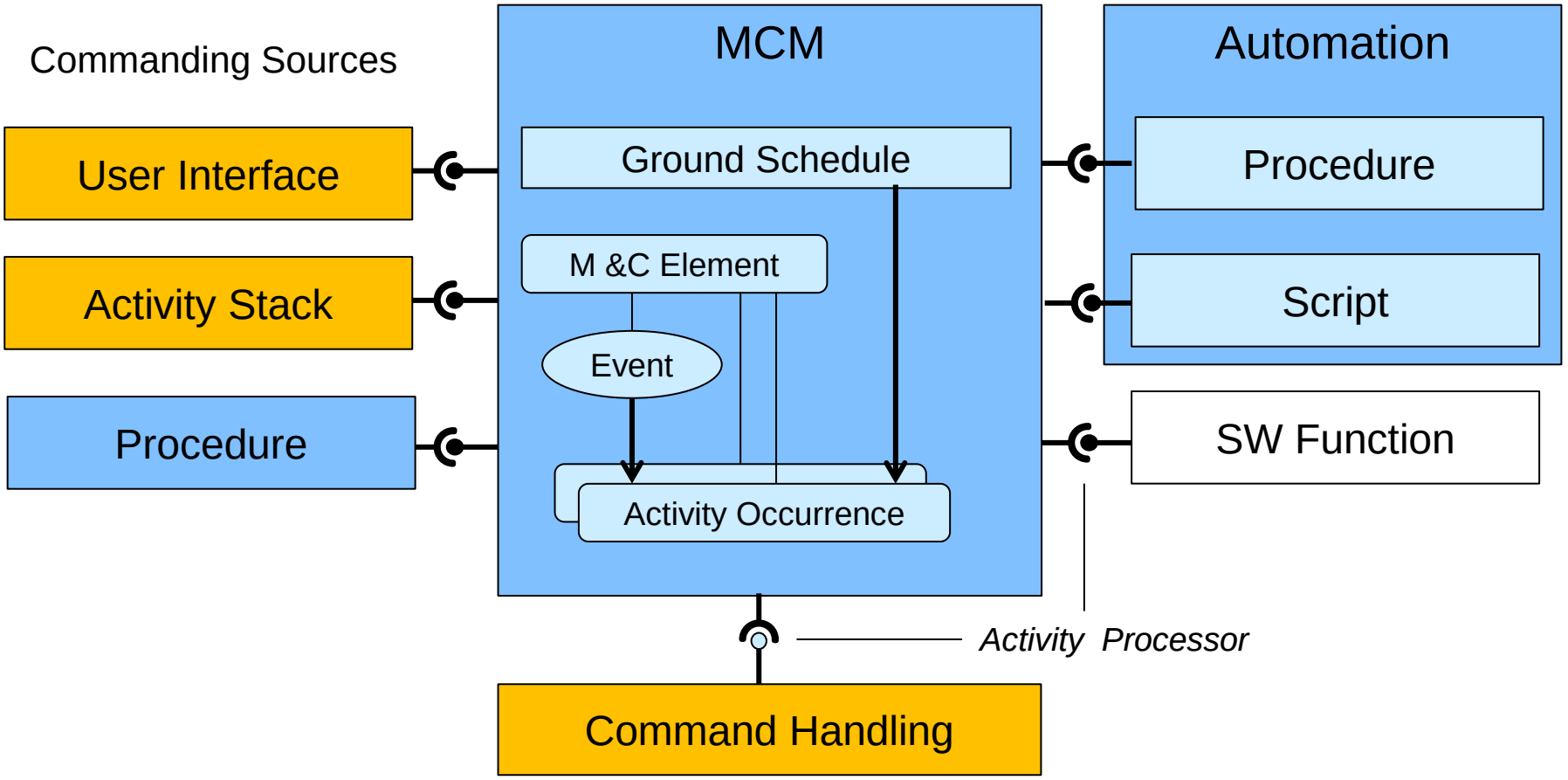


Hierarchical M&C Model (MCM)



- Based on ECSS E-70-31 concepts
- Able to model and manage the complete system in a consistent manner
- Monitoring of engineering level parameters
- Control via abstract activities executed by “activity processors”
- Agnostic of transport containers and encoding (e.g. packets)

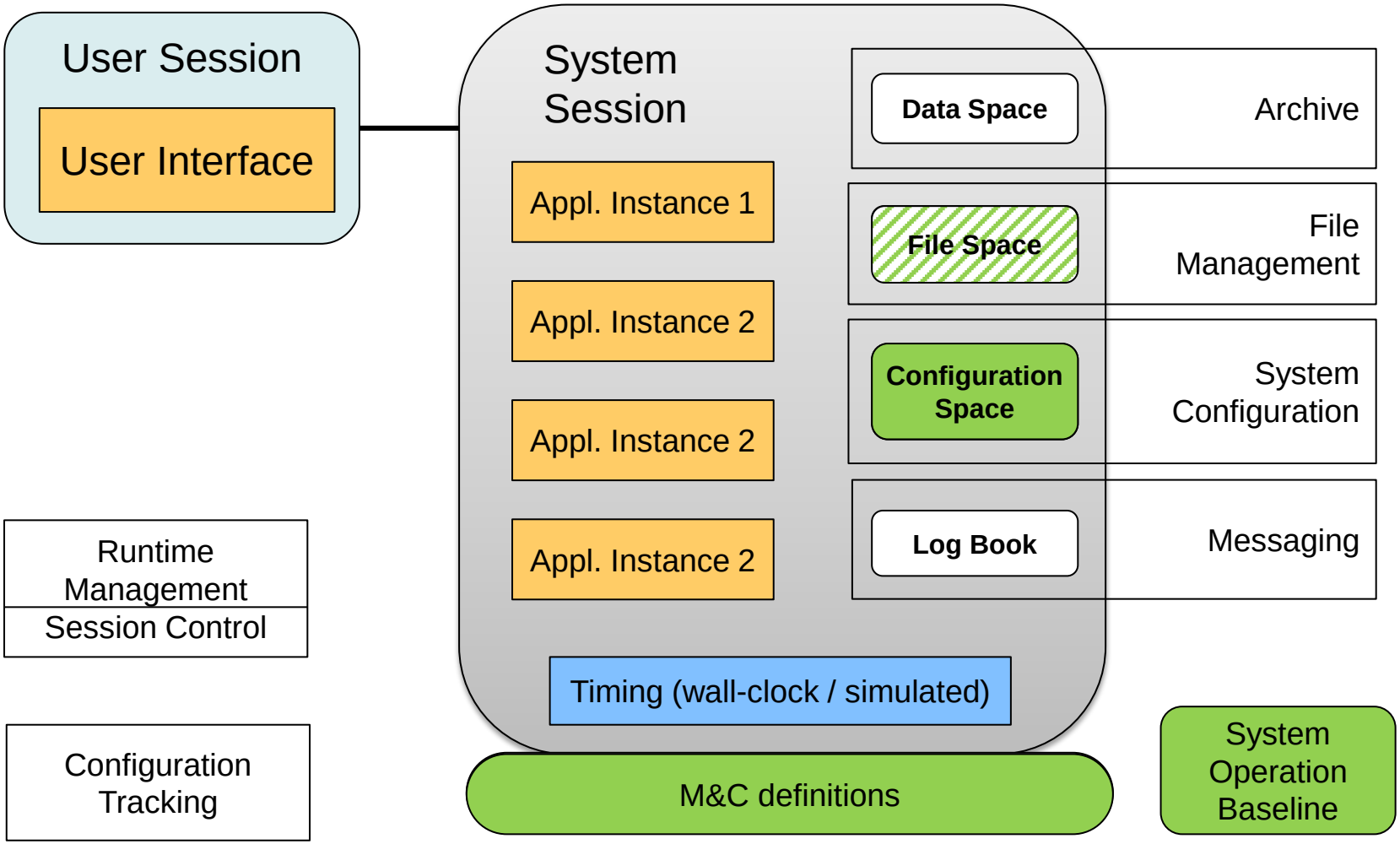
Activities and Automation



Monitoring and Control Data Access Services

- Provide access to monitoring data and their definitions independent of status (live, historical) and location
- Support direct queries as well as publish / subscribe access patterns
- Support invocation of activities “immediately” and at a scheduled time (for ground invocation or on-board execution)
- Support archiving, retrieval, and distribution of opaque data not known by the Kernel as a service to the components in the reference implementation
- Hide deployment details (e.g. MCM distribution) on the client interface

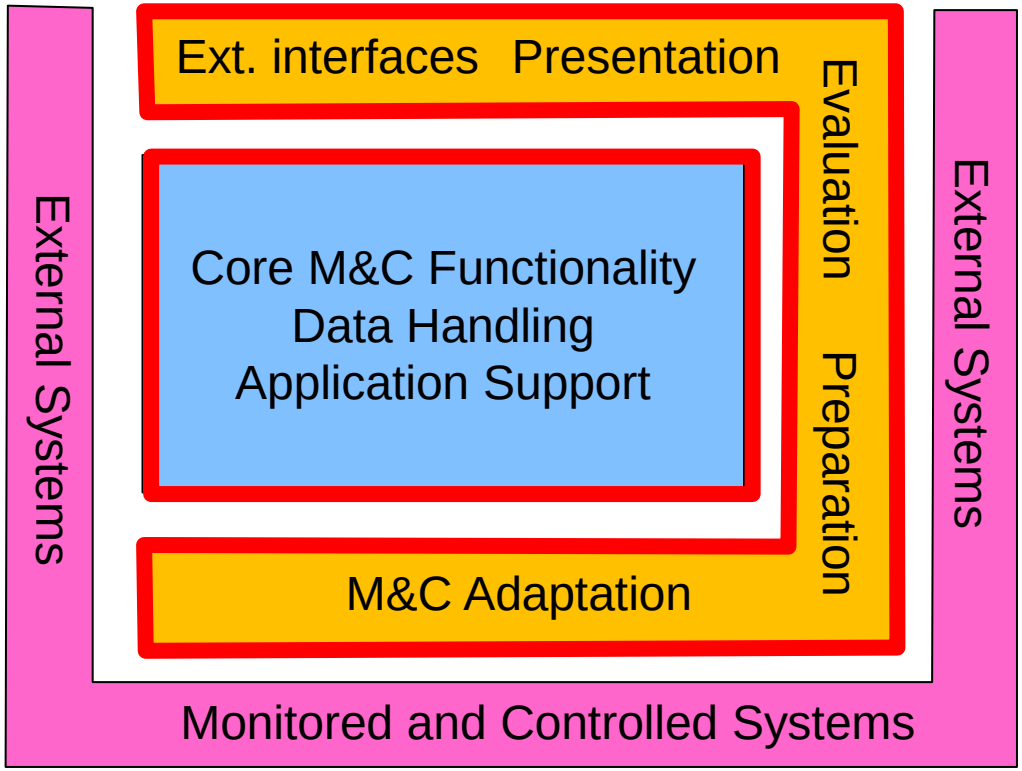
(M&C) System Session



Configuration Tracking

- Configuration Management is performed by external systems (outside of EGS-CC scope)
- Data imported into EGS-CC are structured according to Configuration Items (CI) defined and labelled by external Configuration Management
- EGS-CC keeps track of imported CIs including the supplied version tag and of online changes applied to the CI
- Tracked CIs include M&C Definitions, Configuration Data, and any files flagged as CI by EGS-CC users
- System Operation Baseline (SOB)
  - named set of Configuration Items intended for a specific use of the system
  - attached to a system session when it is created
  - may be constructed
    - In an M&C system session by including all CIs currently in use and modifications
    - Outside any M&C system session by identifying the CIs to include

EGS-CC Reference Implementations



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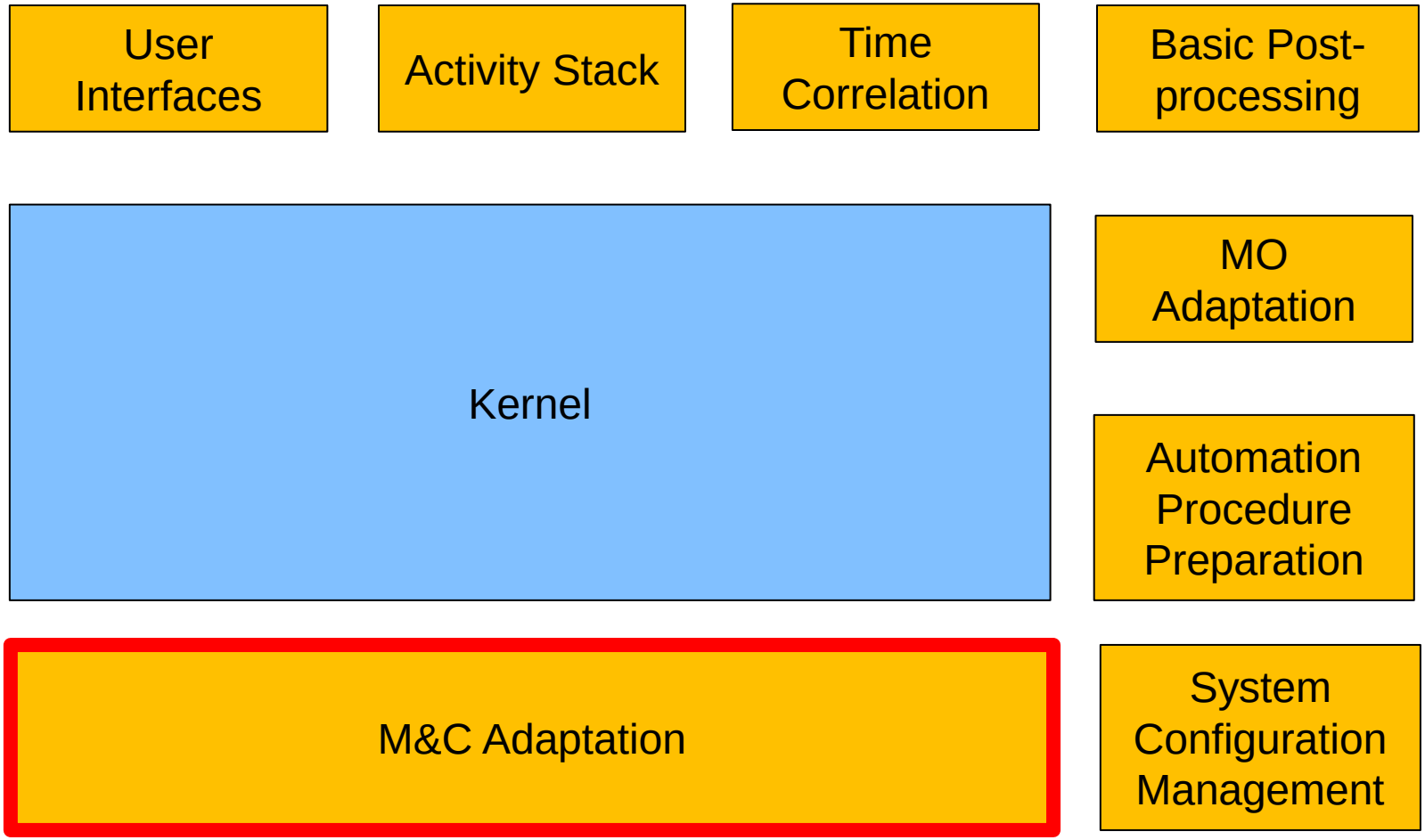
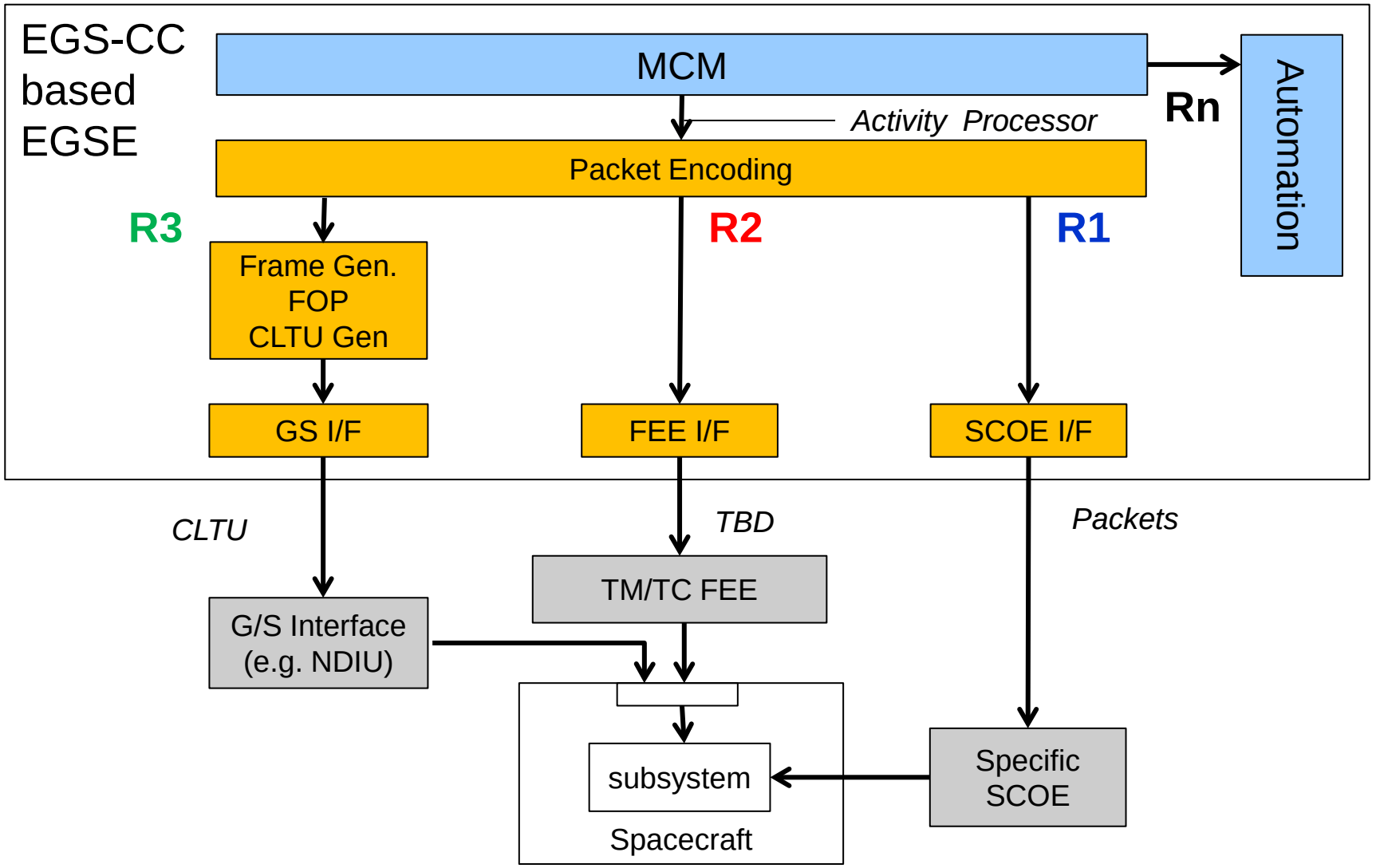
EGS-CC Reference Implementations

- Functional Scope
  - Adaptation of the Kernel to the operation context
    - Interfaces to controlled systems
    - Processing of M&C data to the extent this cannot be generalised
    - Modelling of M&C services of the controlled system (e.g. PUS)
    - Specific external interfaces (e.g. MO services)
  - User Interfaces
  - Selected preparation tools and evaluation tools (post-processing)
- Design Challenges
  - Anticipate interfaces and features that are not fully known today
  - Develop generalised processing concepts into which such features can be integrated
  - Decompose RI into components that are easily replaceable
  - Design interfaces that are generic enough to support diverse components but do not compromise validation requirements

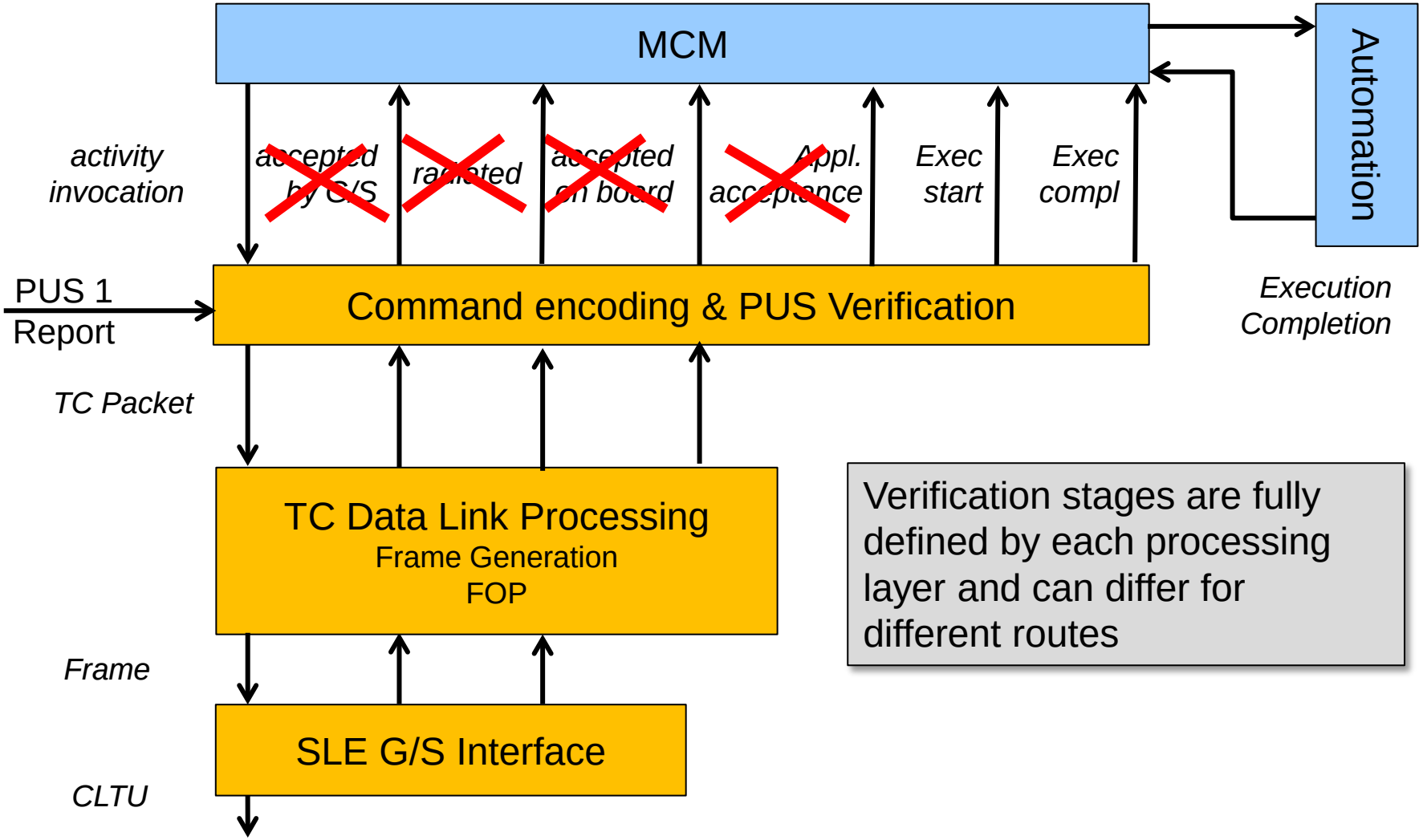
EGS-CC Reference Implementations



Transfer (Commanding) Routes

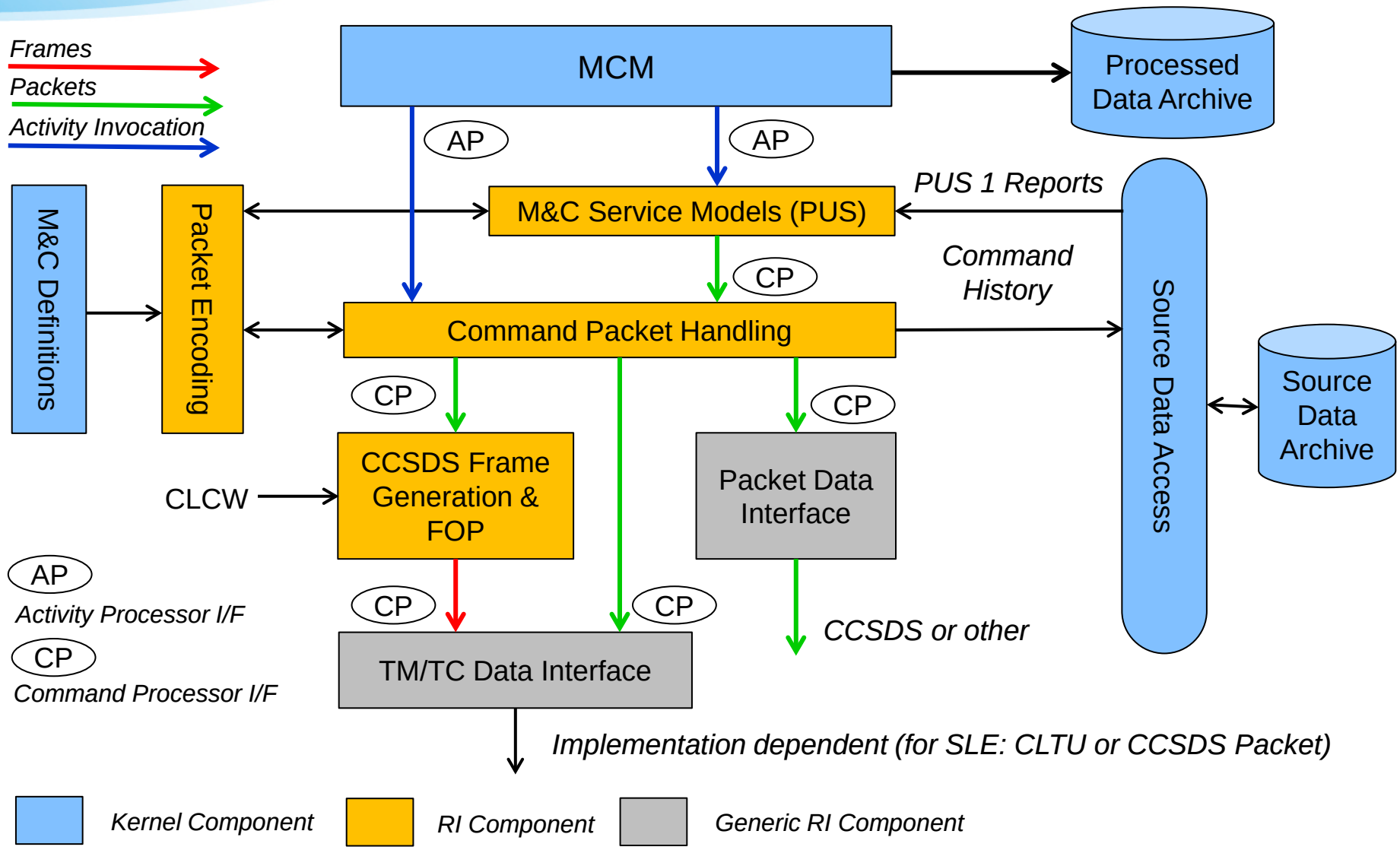


Verification of Activity Execution

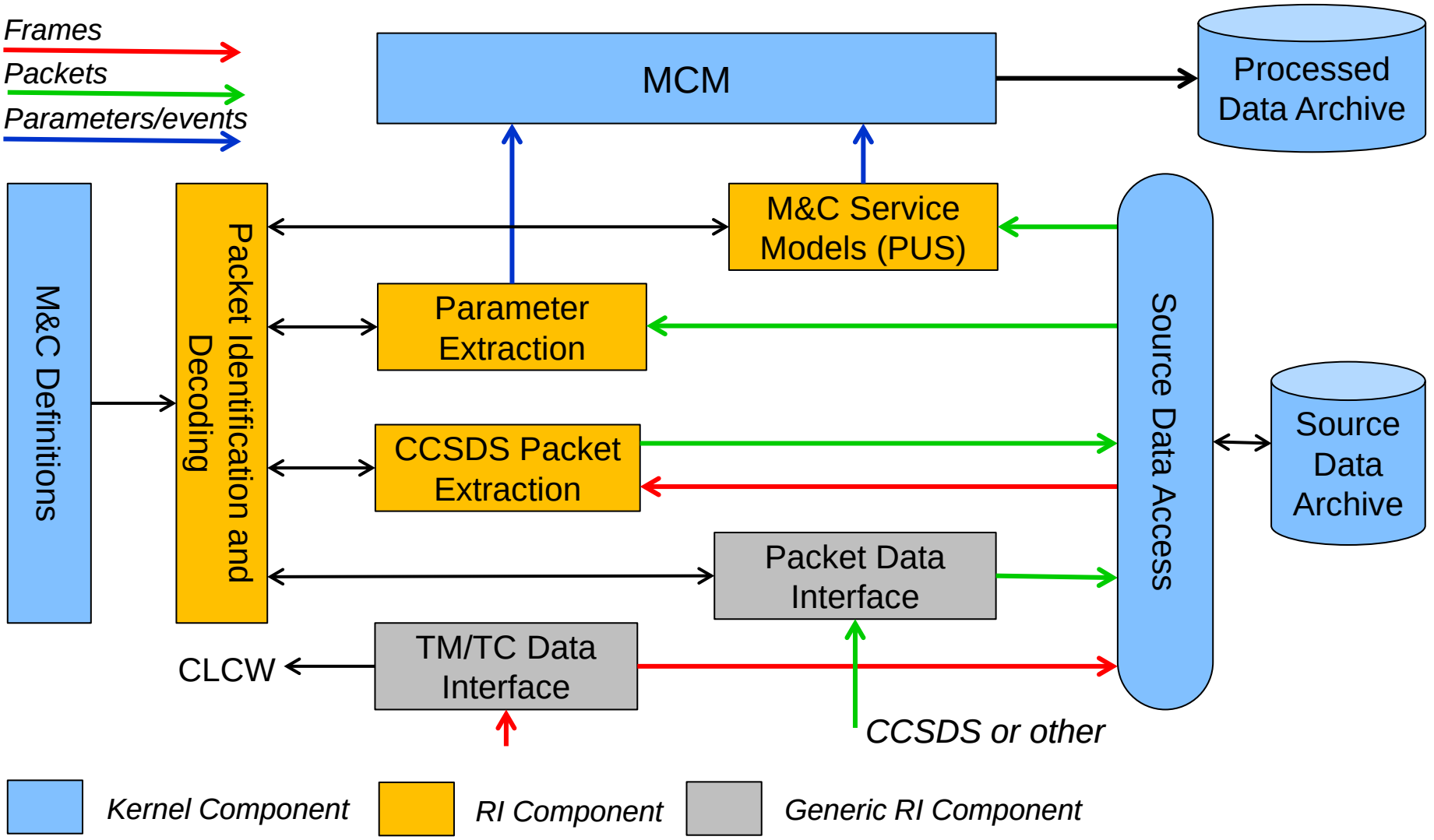


Verification stages are fully defined by each processing layer and can differ for different routes

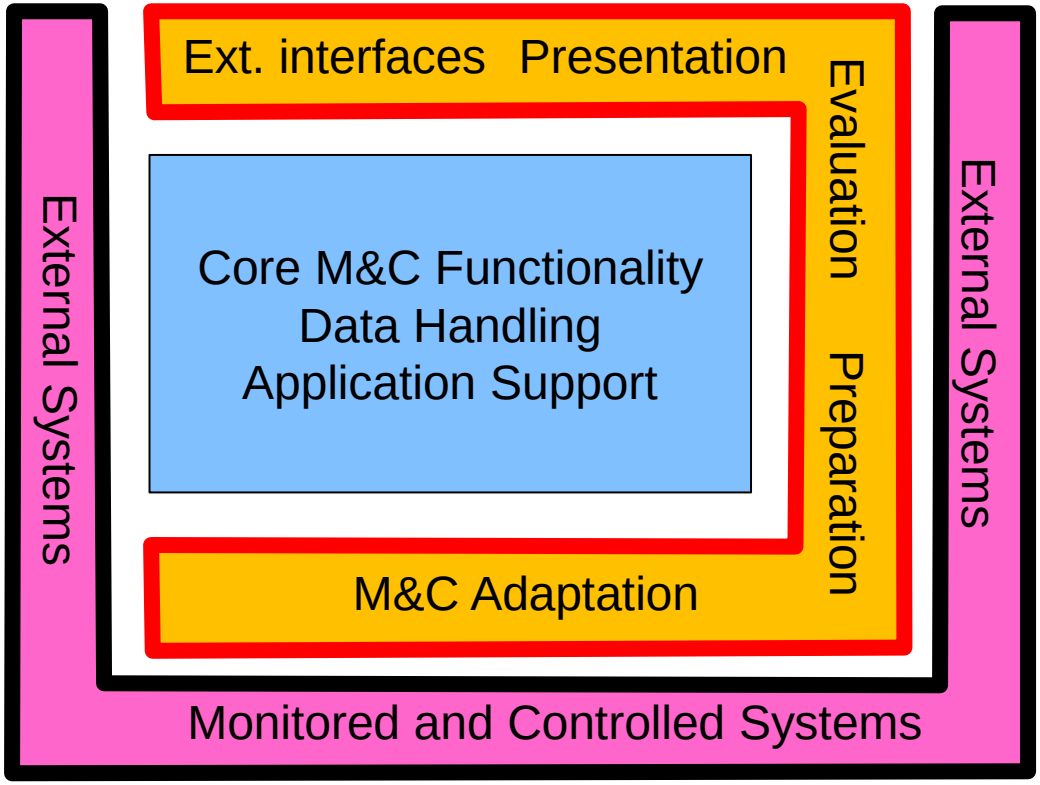
Commanding Chain



Monitoring Chain



EGS-CC Reference Test Facility



Key:

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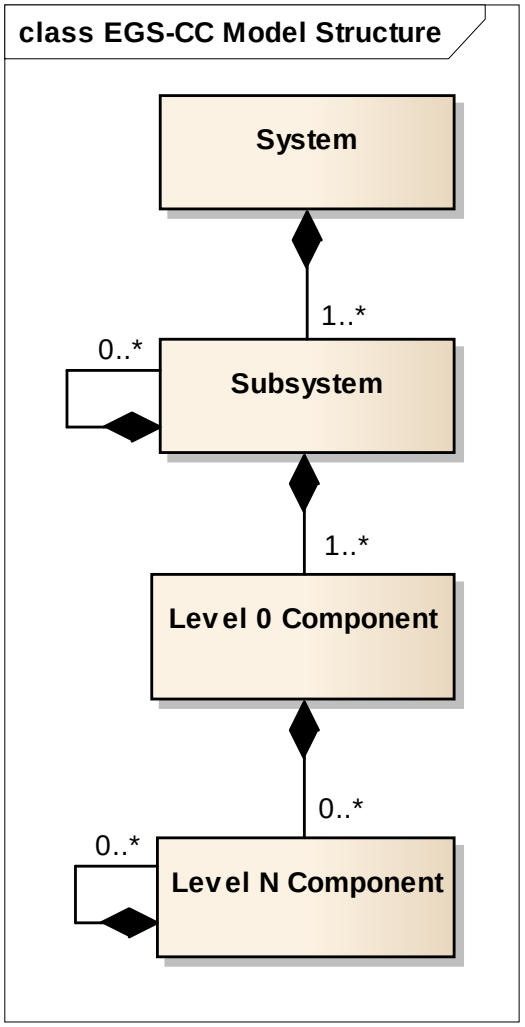
Reference Test Facility	

EGS-CC Reference Test Facility

- Functional Scope
  - Validation of EGS-CC product and EGS-CC systems
  - Exercise interfaces and simulate operational environment
  - Integrate external systems into test configuration
  - Automated test execution
  - Test management
- Design Challenges
  - Full automation of system level regression testing
  - Test the EGS-CC product in many system configurations
  - Support integration of new test models to enable testing of mission functionality in EGS-CC systems
- Complemented by a Component Test Framework

Component Based Architecture

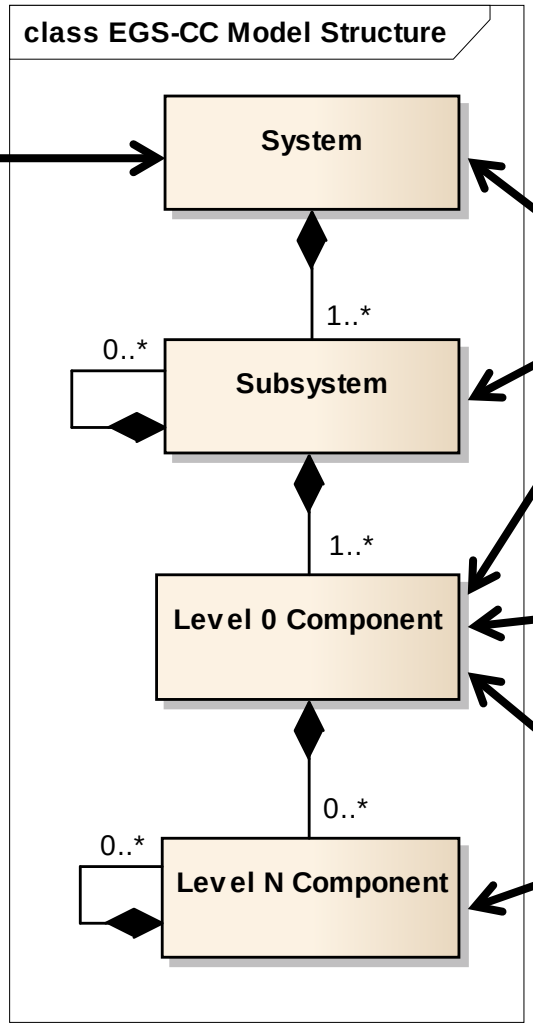


- Subsystem
  - "White Box" with decomposition visible from "outside"
  - Used for grouping of components
  - May have global interface definitions
- Level 0 Component
  - Component exposing well defined interfaces and encapsulating implementation including structure
  - Specification and interface design made available to developers using EGS-CC to implement MCS / EGSE systems
  - Self-standing with respect to documentation, configuration, and testing
- Level N Component
  - Component exposing well defined interfaces and encapsulating implementation including structure
  - **NOT** required to be known to developers using EGS-CC to implement MCS / EGSE systems

Documentation

SW Integration Test Plan

EGS-CC Validation against the Requirements Baseline



Specification & Design Document
- Overview
- Requirements
- Interfaces
- Decomposition (for subsystems)
- Configuration, Tailoring & Deployment

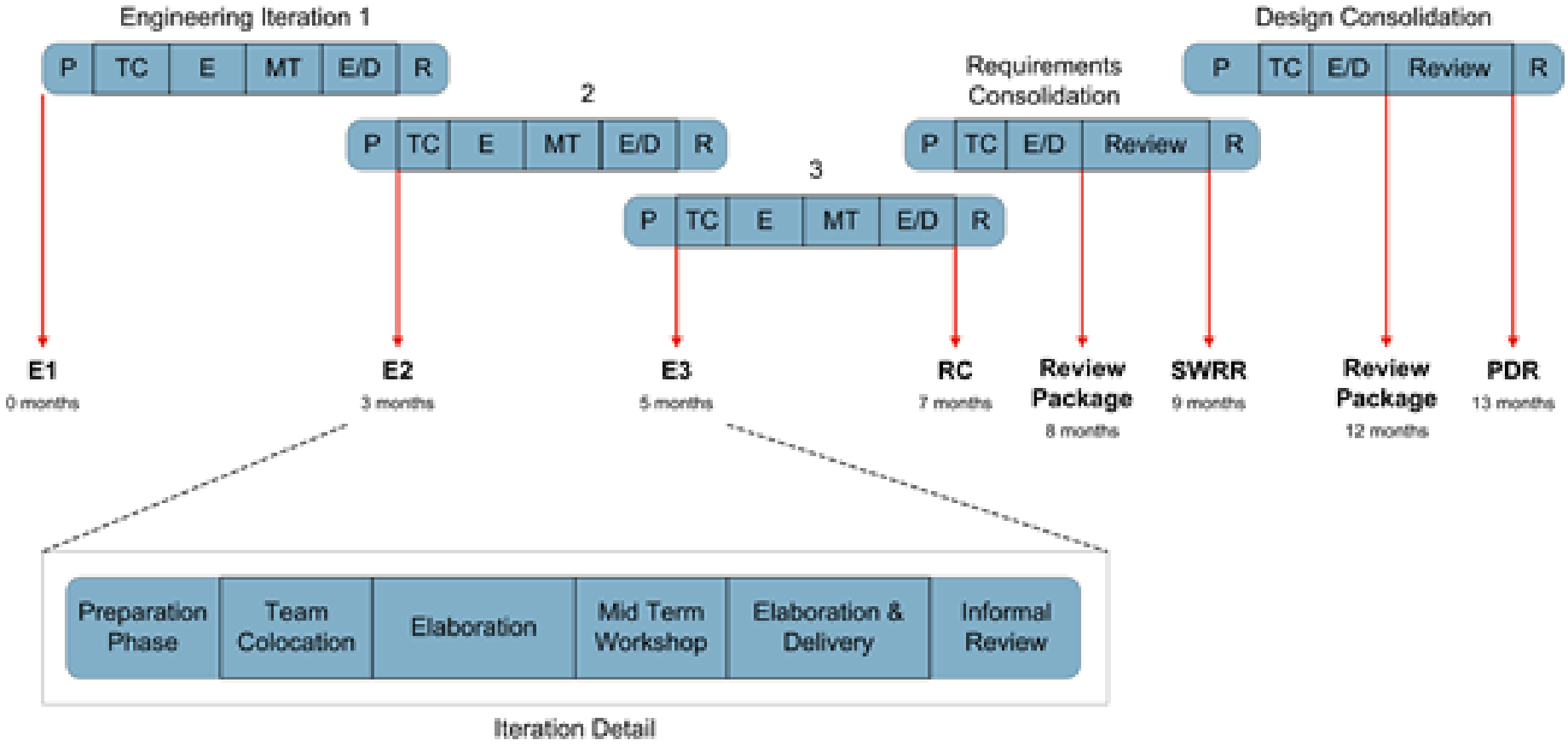
Software Validation against the Technical Specification

Hyperlinked HTML Files
Decomposition (structure)
- Internal Interfaces
- Implementation behaviour

Model Driven and Service Oriented

- Complete design developed as implementation technology platform independent model in UML
- Documentation largely generated from the model
- All interaction between components and with external systems designed as services modelled according SoaML principles
- Requirements included in the UML model to support verification of traceability
- Technology analysis performed by concurrent project
  - Regular coordination meetings during Phase B
  - Initial high level technology baseline established
  - Detailed consolidation between technology selection and architectural design still to be done

EGS-CC Phase B Engineering Approach



All milestones of the demanding schedule have been met with a maximum delay of a few days.

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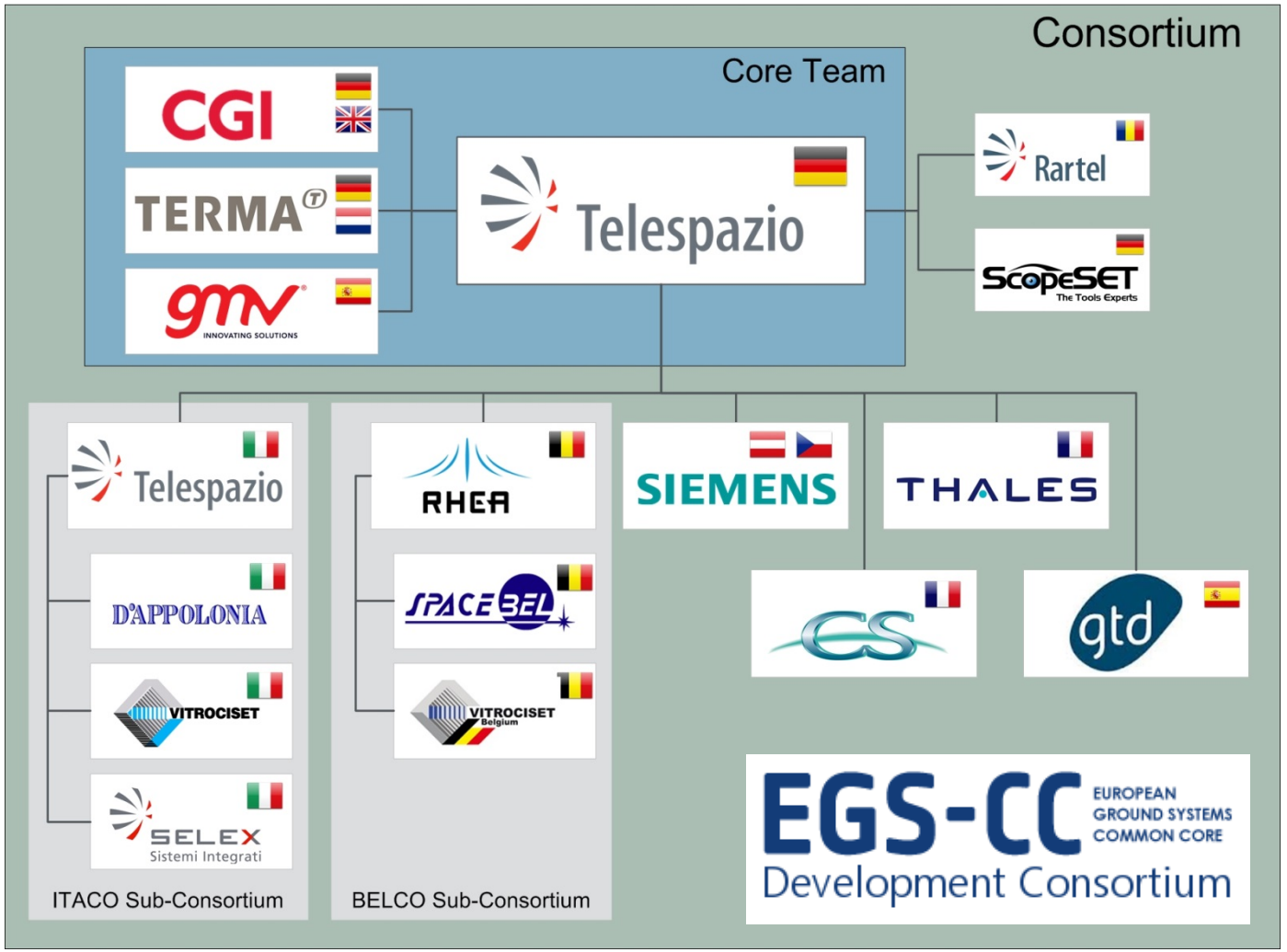
Conclusions and Outlook

- The “EGS-CC Wish List” has been a challenge for the Requirements Engineering and Architecture Design in Phase B
- We believe that the Technical Specification and Architecture Design lives up to the wish list and is a good foundation for development of EGS-CC. It is
  - Model driven
  - Service Oriented
  - Component Based
  - Technology neutral (as far as reasonable)
- The technology selection has been a concurrent activity and an initial technology baseline for the design has been established

Phase C/D Kicked off 28.11.2014



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Thank you for your attention

Questions?