



# The Galileo GMS Programme A new AIV Platform

SESP Conference,  
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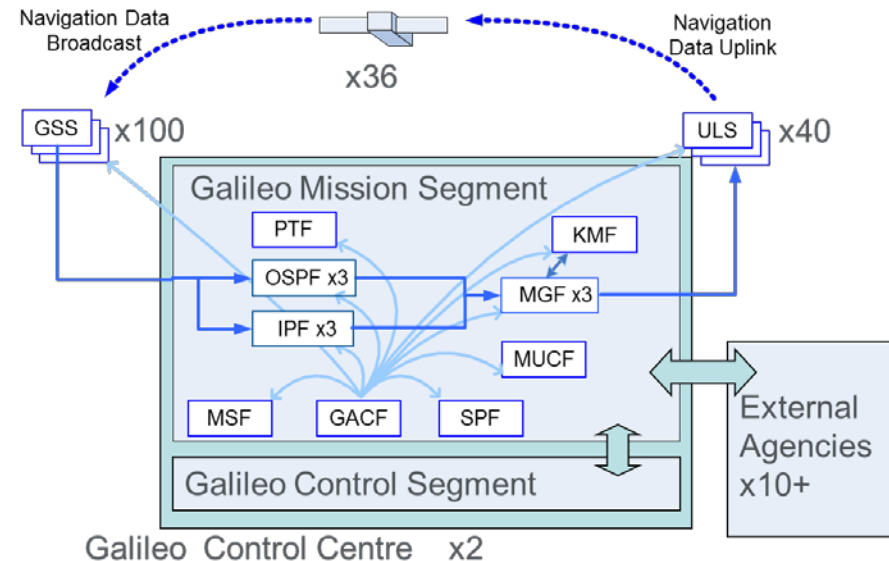




# The AIVP Requirement

# Galileo Mission Segment

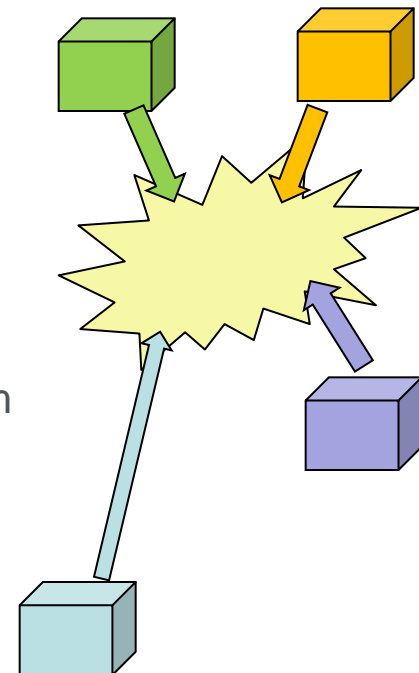
- Galileo - Europe's own Global Positioning system
- Split into three segments – each with its own Prime contractor
- Mission Segment
  - Responsible for production and integrity of Galileo broadcast message
  - 100+ globally distributed sensor stations
  - 40 Uplink Antennas
  - Two control centres (GCC), comprising
    - Data processing elements
    - Monitoring and Control elements
    - Crypto / Authentication elements
    - Archiving
    - Time Reference
    - External Interface elements



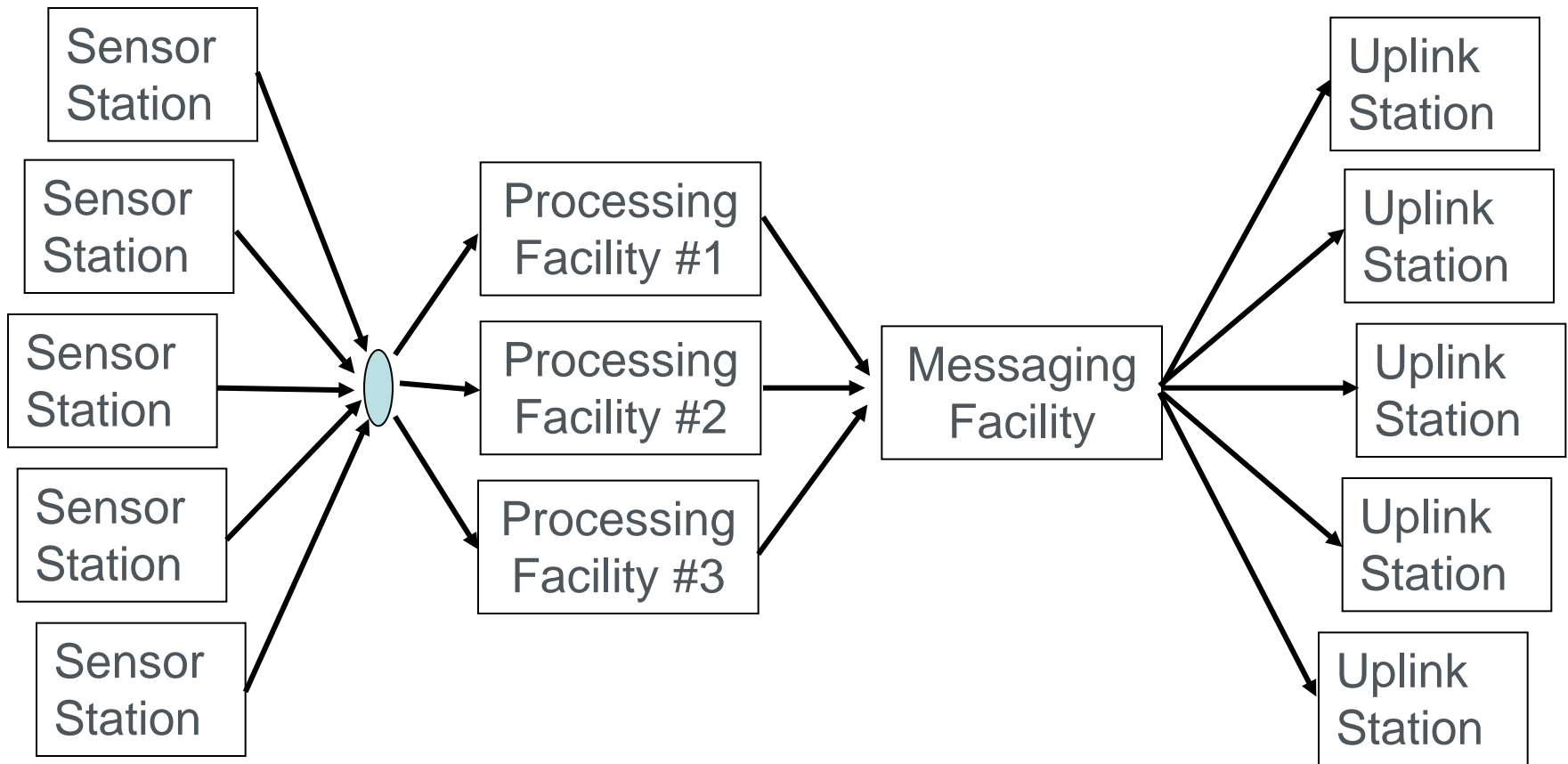
# Motivation(s) for an AIVP

- Assembly, Integration and Verification Platform
- Each GMS Element developed by a different European contractor
  - Varying delivery **schedules (and slips)**
  - Varying states of **maturity**
  - Varying **Interface Implementations**
  - Varying **quality** of implementation
- AIV Platform
  - breaks dependencies between schedules for the AIV team
  - Gives a 'reference' implementation for interfaces
  - Can check / substitute for faulty elements
  - Can substitute for incomplete elements

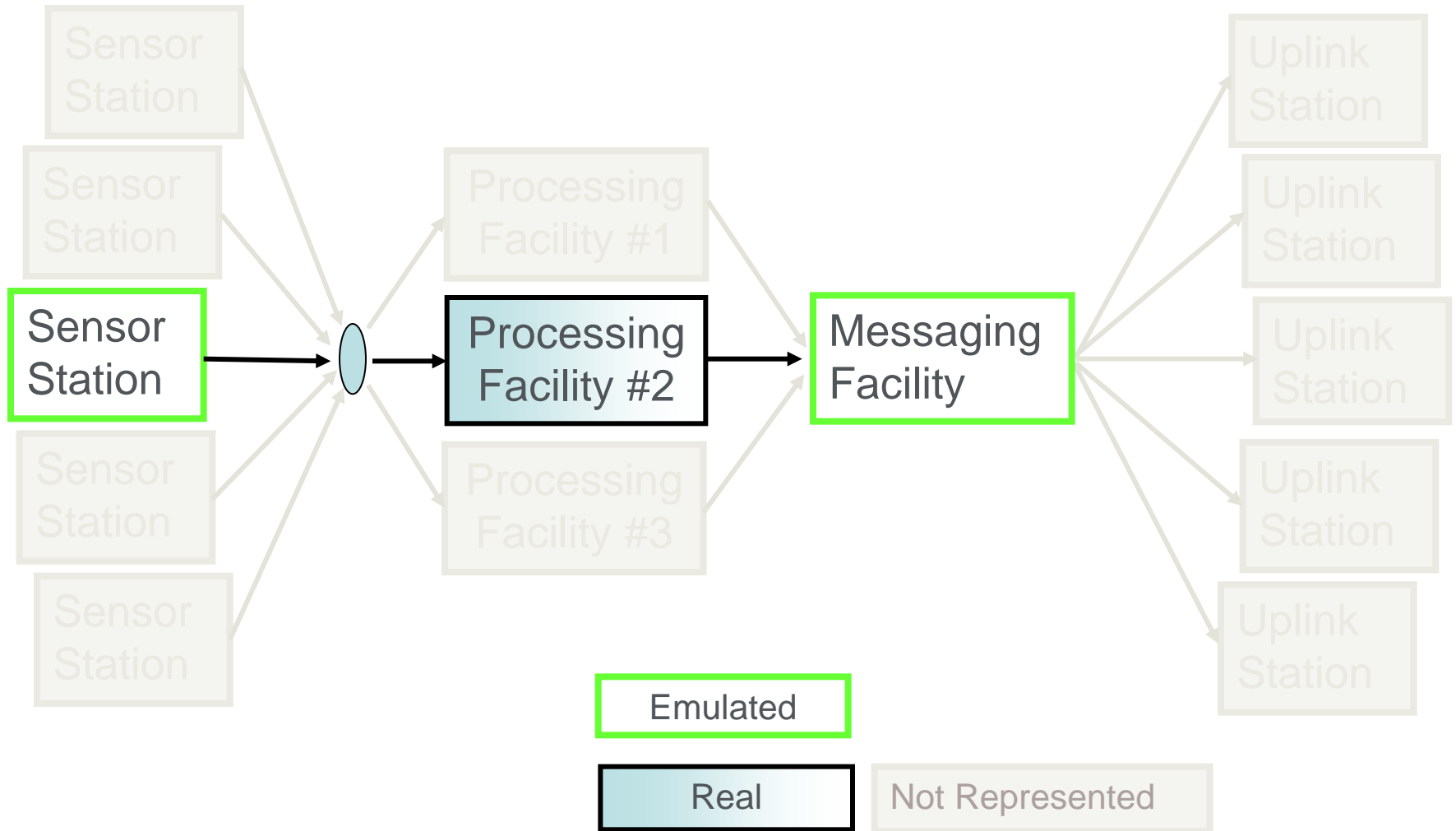
...and more...



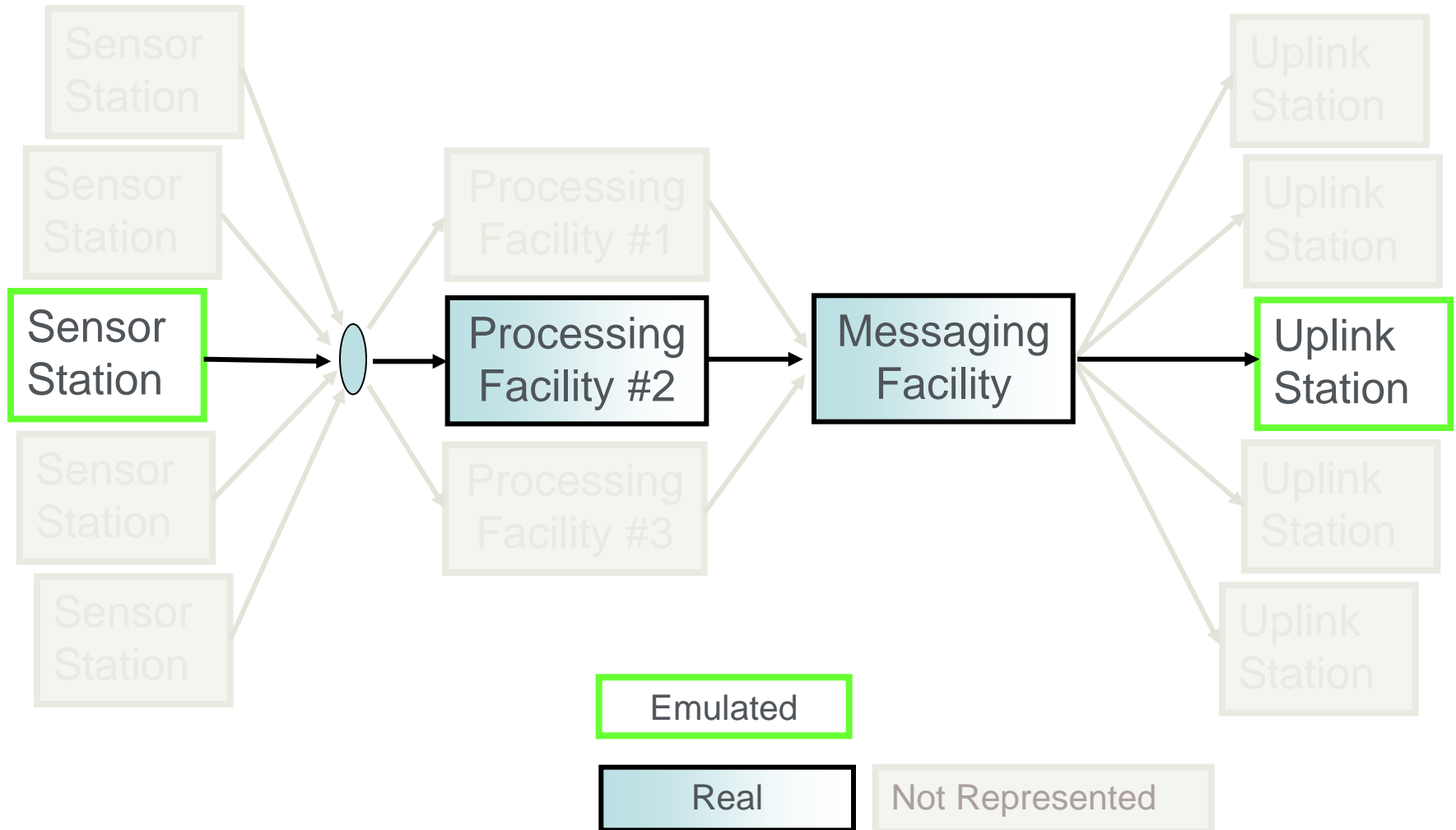
# Galileo GMS (simplified)



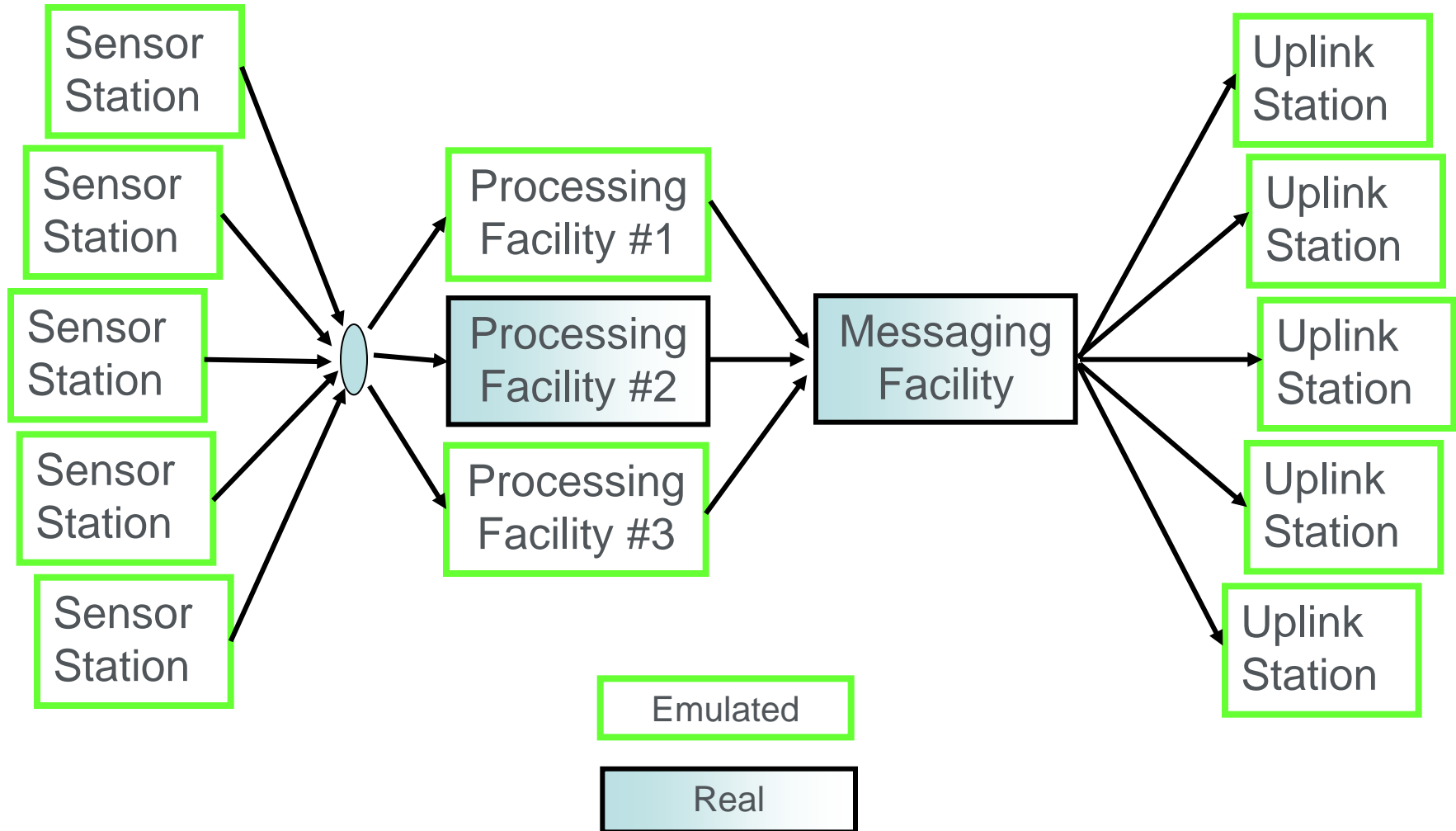
# Elements Check-out on delivery



# Chain Integration & Gap Filling



# Performance Testing







# Galileo GMS AIVP Development

# Development Background

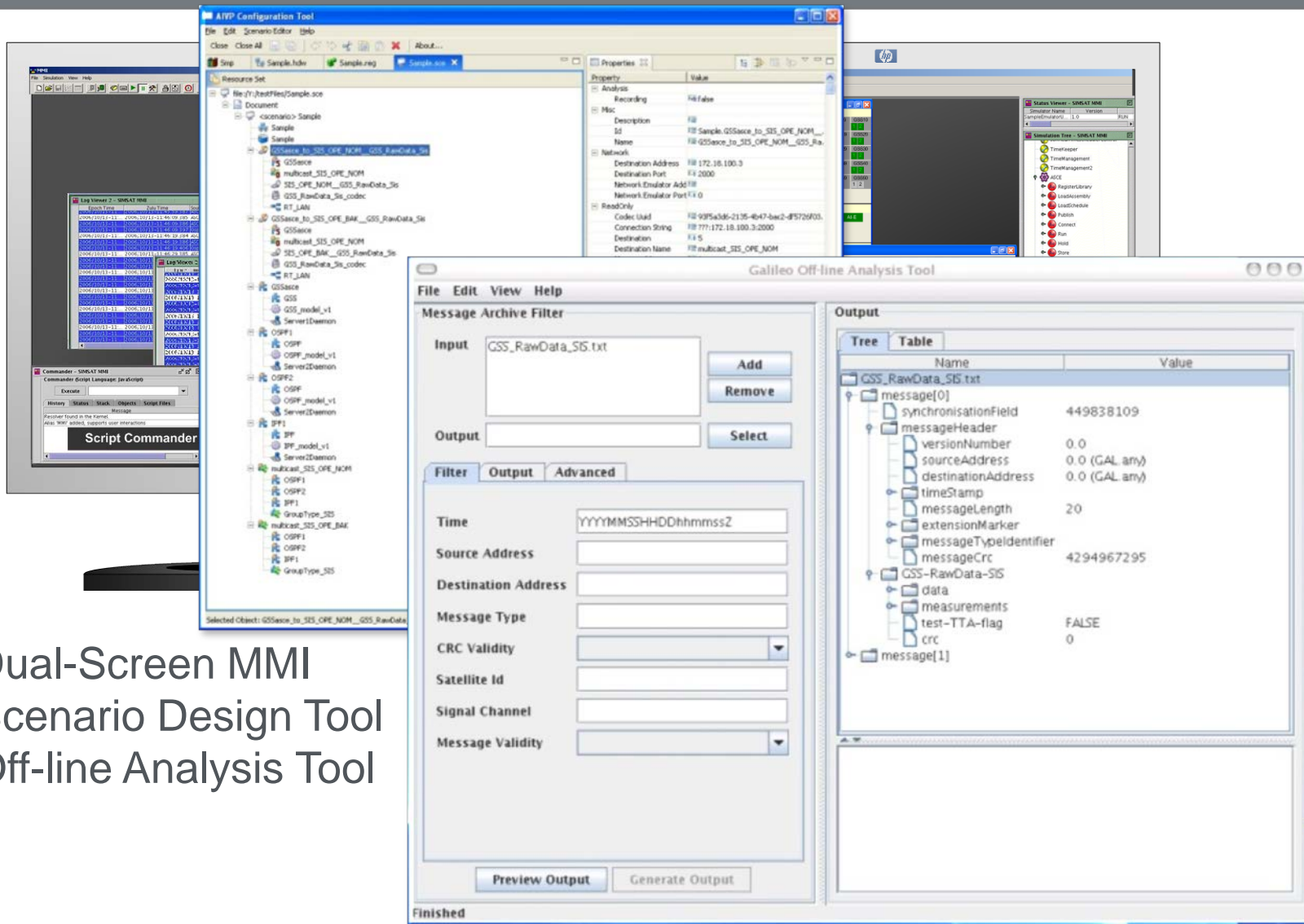
- Commissioned by Thales Alenia Space (GMS Prime [Fr] & AIV Partner [De])
- Programme in 7<sup>th</sup> year:
  - Multi-million Euro development
  - Initial system development – 4 years
  - Operational deployment and evolution – 2 years
  - Upgrade programme for Galileo FOC phase – 2 years (then maintenance)
- Five original (IOV) systems produced (each as 2x19” racks), plus 5 ‘light’ laptop instances
- Four upgraded (FOC) systems in production (each as 1x19” rack), plus 4 ‘light’ laptop instances
- Original IOV systems upgraded to new FOC S/W standard

# Qualified for Qualification

- The GMS AIVP has been designed with Qualification processes at its heart.
  - **Configuration Control** is built in, to ensure test results are traceable and repeatable
  - **Scripting** of user commands aids repeatability, efficiency and knowledge capture. Scripts themselves can be qualified, if needed
  - **Recording** of interface traffic enables test results to be analysed and kept as qualification records
  - AIVP itself is developed and **qualified** to Galileo Software Standard (GSWS).

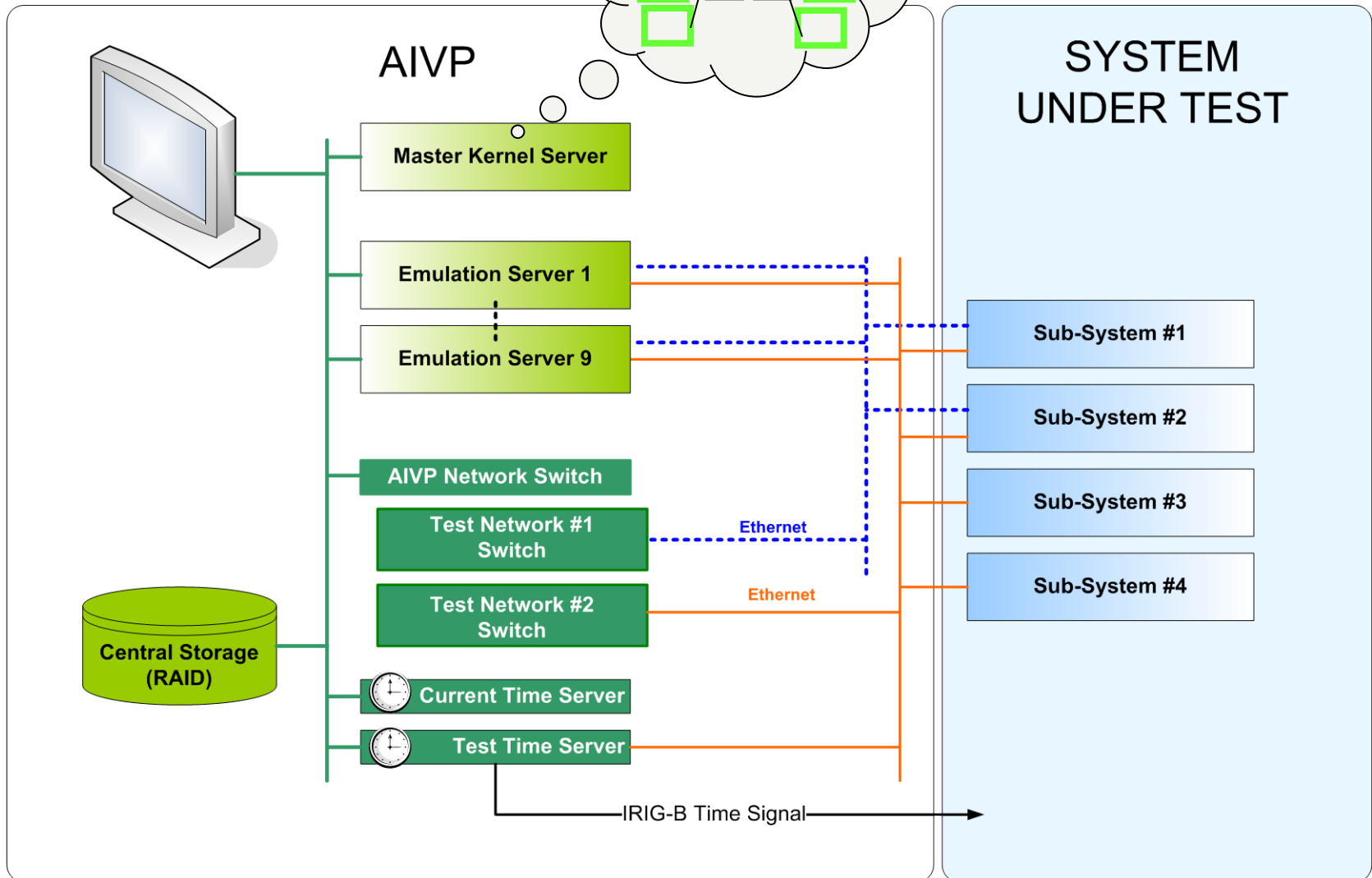
System Qualification results obtained with AIVP are trusted

# User Interfaces

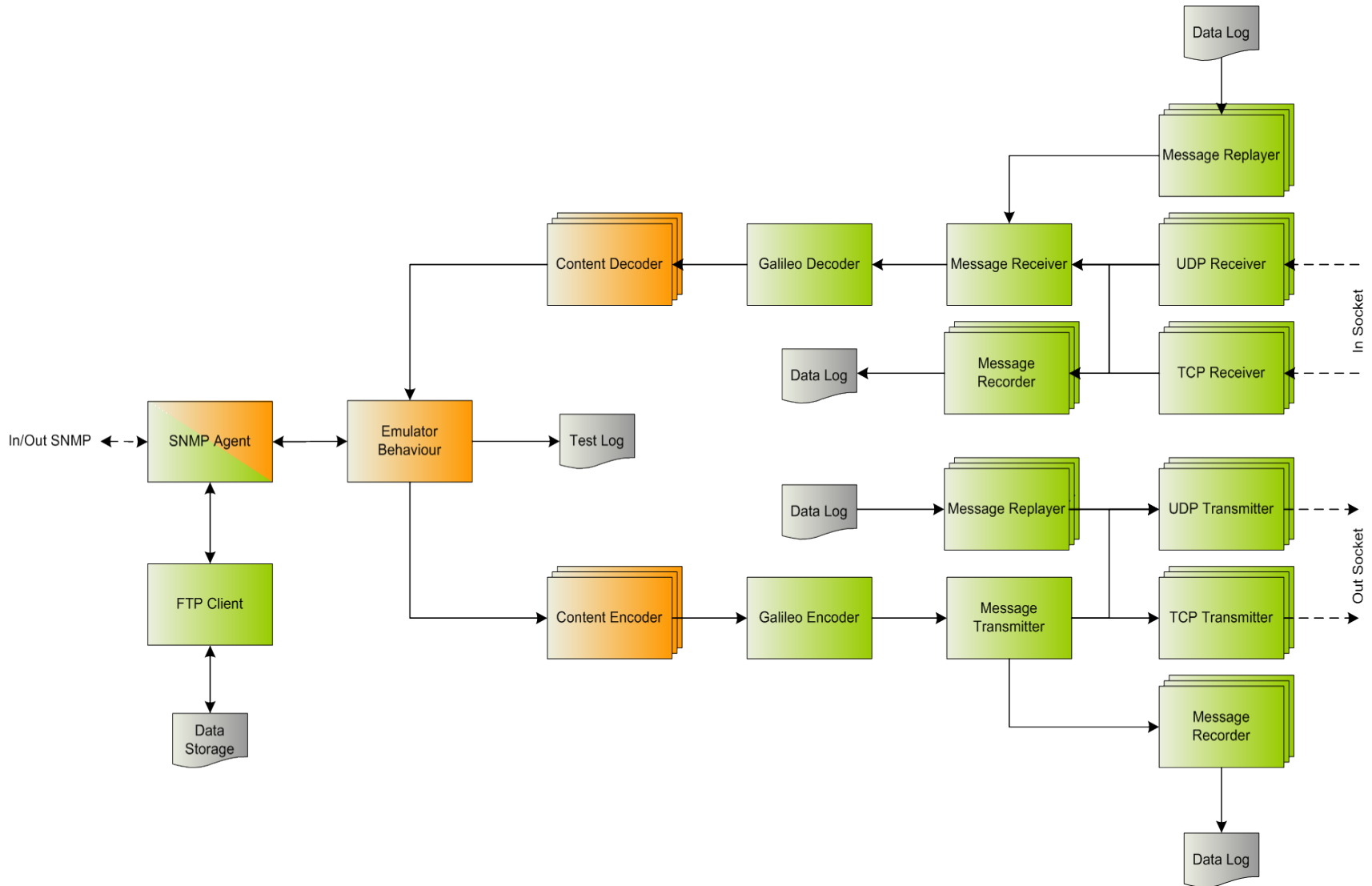


- Dual-Screen MMI
- Scenario Design Tool
- Off-line Analysis Tool

# System Architecture

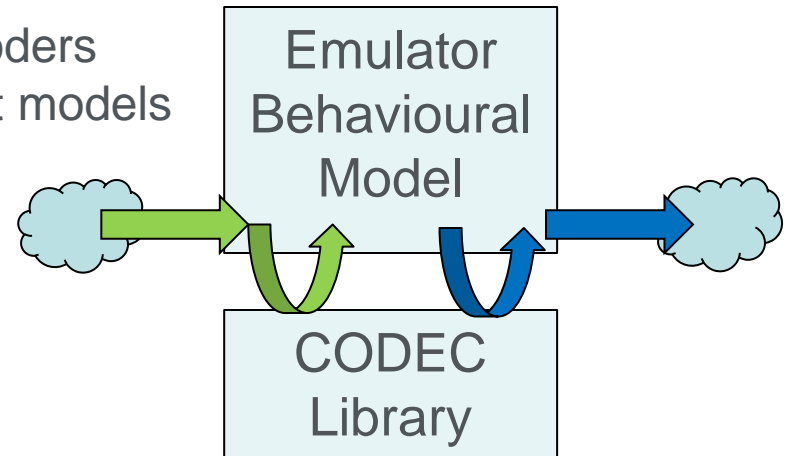


# Emulator Internal Architecture



# Auto-Generation of CODECs

- Emulator message encoders / decoders auto-generated as SMP2-compliant models from:
  - XSD Schemas
  - ASN.1 Schemas



- Allows rapid update of AIVP in response to re-issue of interface specification by element developers
- Common CODEC libraries used by all emulators
- Emulator behavioural models interface with message CODECs in a way that supports forward / backward compatibility (limits apply)
- CODEC (re)generation capability delivered to GMS Factory



# Present and Future



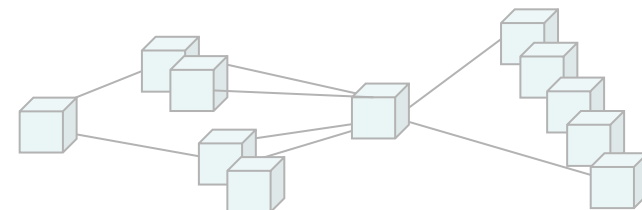
# In use at Pforzheim (GMS Factory)

- GMS has ~3000 requirements
- ~70% of all verification tests performed using the AIVP
- In daily use, with three separate platforms available to the TAS AIV team
- Currently supporting Galileo Full Operational Capability (FOC) qualification
- Will be deployed as operational component of GMS for through-life support...
  - Long term GMS corrective maintenance support
  - Training system for GMS operators and engineers
  - (Re)Qualification of GMS design evolutions



# Future Applications

- The design is tailored to GMS, but not specific to it
- AIVP has strong potential for re-use in other integration programmes (for Space industry or beyond).
  - **General architecture**, so suitable for application outside Galileo programme
  - **Protocol support**, and customisation, is extendable
  - **Scalable** from laptop to multi-rack deployment
  - **Element Behavioural modelling** can be entirely omitted\* or developed to high fidelity or complexity\*\*
- Applicable to wide range of network-based systems-of-systems



\*e.g. GMS PTF Emulator \*\*e.g. GSS Emulator



# Summary

# Summary of GMS AIVP



The Galileo GMS integration programme has produced a new AIV infrastructure, based on SIMSAT, and suitable for general re-use on IT systems.

The Assembly, Integration and Verification Platform (AIVP) incorporates:

- **Network distributed modelling** supporting many model instances (>100) of many types of entity
- **Auto-generation** of message encoder / decoder (CODEC) models based on ICD schemas (XSD, ASN.1)
- **Element Behavioural Models** at generic and custom-coded levels
- **Protocol support** for UDP, TCP/IP; FTP, SNMP, ASN.1, XML (more could be added)
- **Application specific protocol use** (e.g. GMS rules for FTP use)
  
- **Timing accuracy** for events to (at least) +/-10ms
- **Scenario design** and deployment via rapid user-friendly MMI
  
- **Built-in Configuration Management**, Results capture and Analysis capability
- **Central SIMSAT-based GUI** for Scenario control
  
- GSWS Qualified implementation

