Herschel Ground Segment

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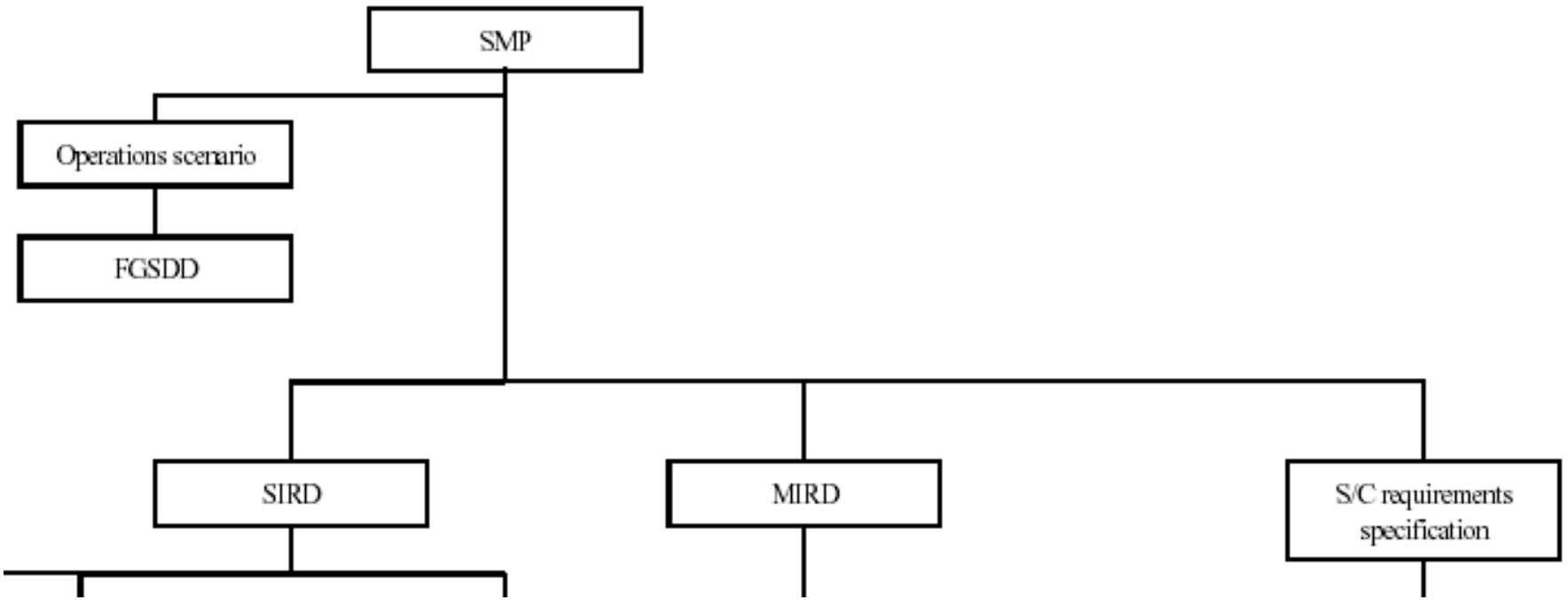
Operations Concepts

- Minimise total overall operations effort
- Maximise the utilisation of expertise
- Address instrument operations and data processing requirements early on
- Minimise overheads and the need for dedicated infrastructure
- Exploit commonality between instruments (commanding and telemetry)
- Geographical distribution of the ground segment

Top Level Ground Segment Documents

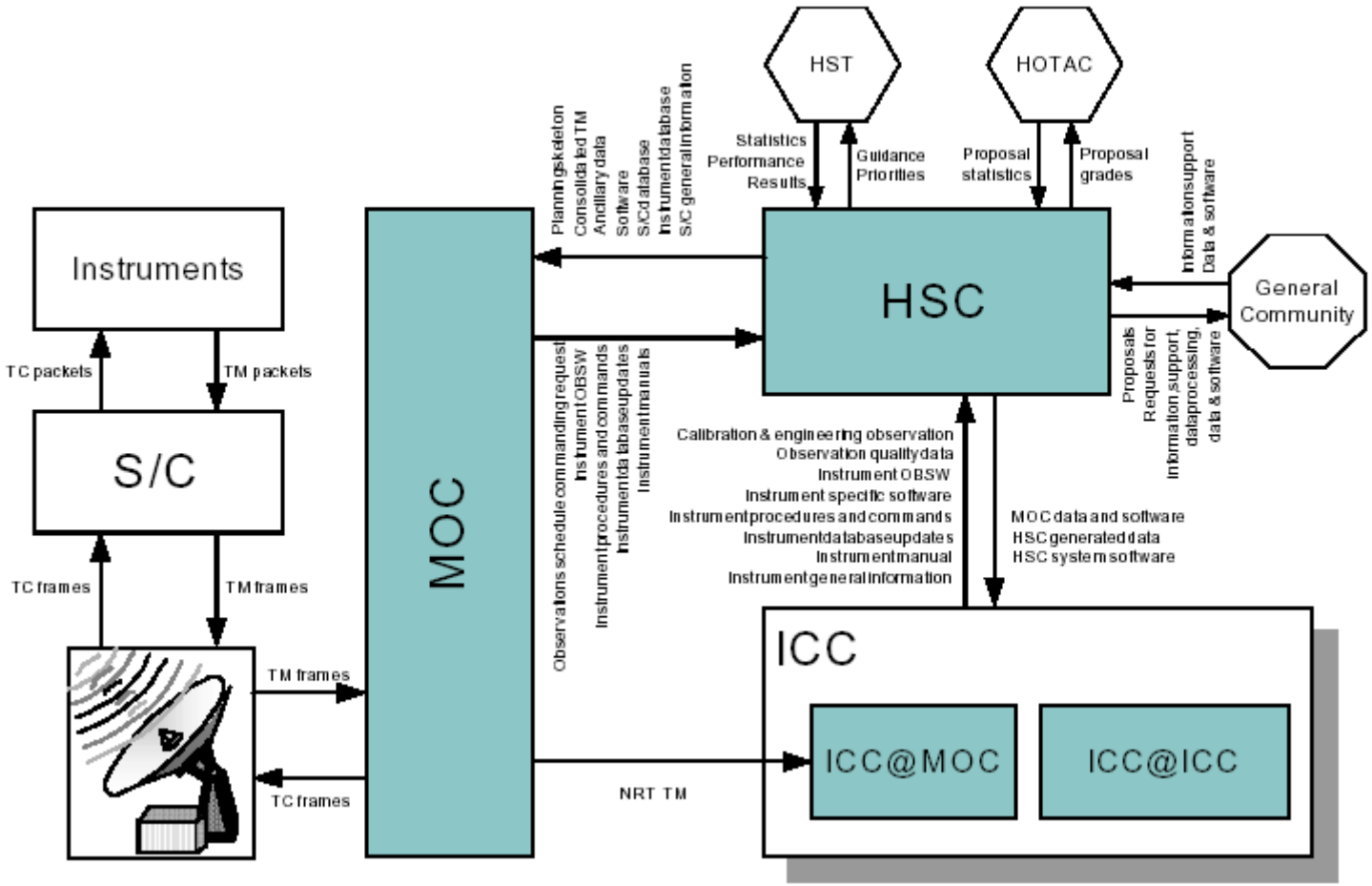


Herschel GS System Engineering (HGSSE) Group

- Consists of GS system engineers from ESA (HSC+MOC) and the three ICCs.
- Regular meetings every 6-8 weeks
- Three key GS documents produced by the HGSSE:
  - HGS Design Description (HGSDD)
  - HGS Interface Requirements Document (HGS IRD)
  - HGS List of ICDs
- The HGSDD and the HGS IRD were formally signed off last January.

Herschel Ground Segment Centres

- **Mission Operations Centre (MOC) -** responsible for S/C operation and instrument safety during in-orbit phase. Assumed to be located at ESOC (Germany).
- **Herschel Science Centre (HSC)** - general astronomical community's interface with the Herschel Observatory (issuing of AOs, proposal handling, etc). Assumed to be located at Vilspa (Spain).
- **Instrument Control Centres (ICCs)** - responsible for operation of their instrument and data processing software. Located at (or near) the PI institutes.


HST
HOTAC
Instruments
S/C
MOC
HSC
General Community
ICC
ICC@MOC
ICC@ICC
TC packets
TM packets
TC frames
TM frames
TM frames
TC frames
NRT TM
Statistics
Performance
Results
Guidance
Priorities
Proposal statistics
Proposal grades
Planning skeleton
Consolidated TM
Ancillary data
Software
S/C database
Instrument database
S/C general information
Observations schedule commanding request
Instrument OBSW
Instrument procedures and commands
Instrument database updates
Instrument manuals
Calibration & engineering observation
Observation quality data
Instrument OBSW
Instrument specific software
Instrument procedures and commands
Instrument database updates
Instrument manual
Instrument general information
MOC data and software
HSC generated data
HSC system software
Information support
Data & software
Proposals
Requests for
information support,
dataprocessing,
data & software

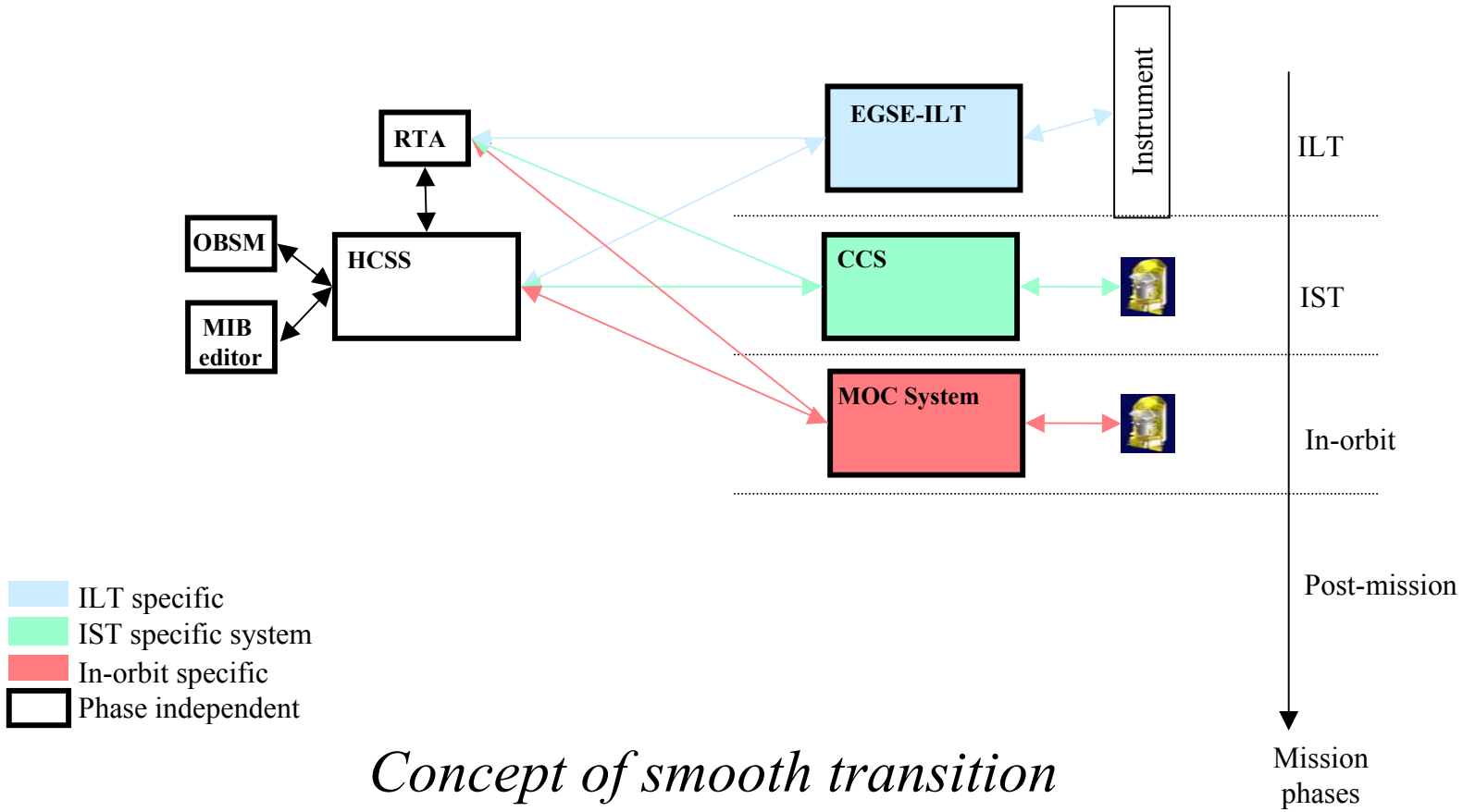
Herschel Common Science System (HCSS)

- Introduction: Why the HCSS?
- What is the HCSS?
- How does the HCSS work (main relevant concepts for observations)?
- How is it supporting ILT and interfacing with the EGSE-ILT?
- How is it meant to support IST and to interface with the Central Checkout System (CCS)?
- Who is developing the HCSS?
- When is the HCSS to be delivered?

Introduction: Why the HCSS? (1)

- In all mission phases (ILT, IST, in orbit operation) there is need for a system to:
  - generate instrument command sequences (vs.. individual commands)
  - archive instrument TM for science or instrument test purpose
  - analyse instrument TM.
- Traditionally the system supporting these functions in operation (Science Operation Centre) is developed separately from the system supporting instrument tests (instrument EGSE)
- For Herschel it has been decided (1999-2000) to support these common functions with a common system : the common science system (HCSS). This is known as the ***smooth transition*** concept
- Advantages:
  - reduce overall development effort
  - allow smooth transfer of data from one phase to another
  - validate system at an early stage

Introduction: Why the HCSS? (2)



Concept of smooth transition

Principal HCSS Components

CUS – definition of observation templates and command generation

PHS – definition of proposals and observations

MPS – scheduling of observations

CC – configuration control of SW, data and documentation

IA – interactive analysis SW for an instrument

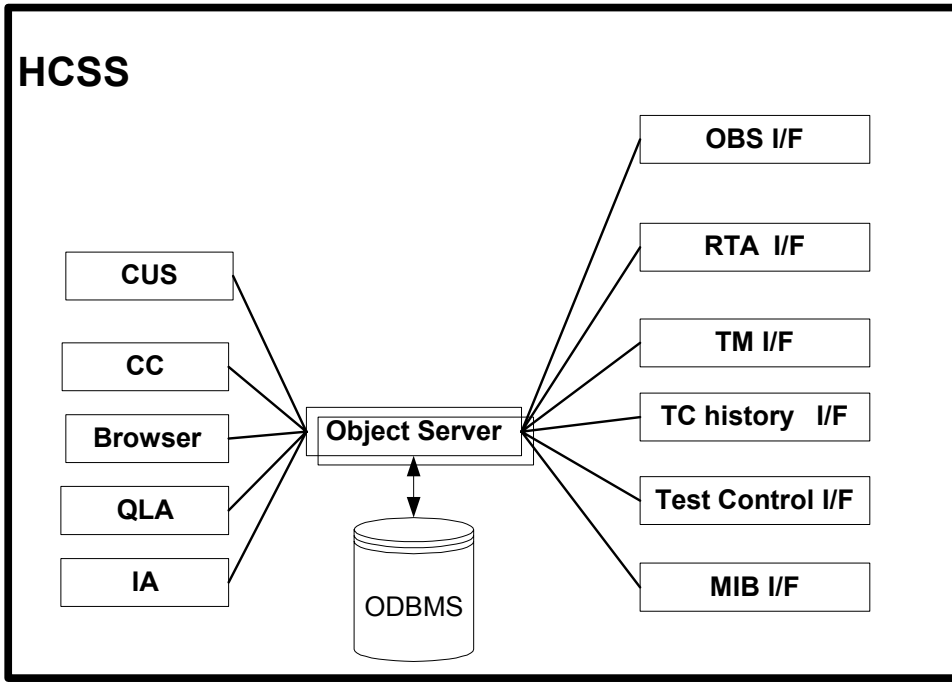
QLA – Quick Look S/W for assessment of test data and science observations (Not strictly part of HCSS but uses HCSS infrastructure).

SPG/QCP – S/W for producing standard data products and for assessing quality of data from observations. Built from IA modules.

Browsers

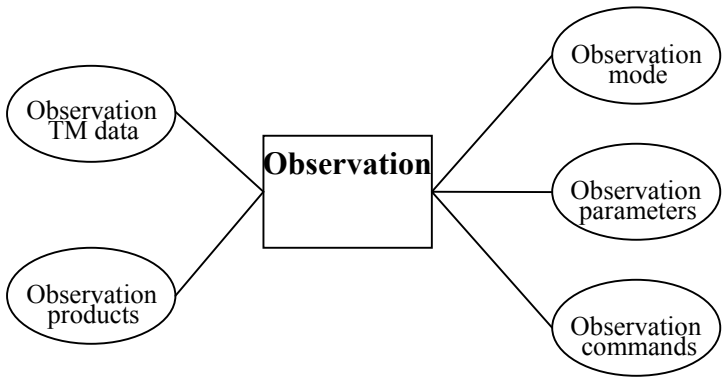
What is the HCSS? (1)

- **HCSS architecture**:
  - The HCSS is an OO client/server system written in JAVA with an ODBMS (Versant)
  - Implements mission phase independent core services (object servers)
  - Implements a set of applications mission phase independent or dependent
  - Implements a set of I/F to external systems



How does the HCSS work for observations? (1)

- **Concept of observation**
  - extension of the concept of astronomical observation to cover test "observation"
  - define the generation of instrument and Test Execution command sequences
  - relate uplink and downlink data



How does the HCSS work for observations? (2)

- **Generation of commands sequence (1):**
  - An observing mode is defined as a logical structure (script) of commands. An observing mode can be instantiated to define an observation by supplying parameter values. In particular running the script with parameters will yield the sequence of commands corresponding to the observation.
  - The HCSS supports the definition of observing mode (CUS), the instantiation of an observation mode into an observation and the generation of the corresponding commands

How does the HCSS work for observations? (3)

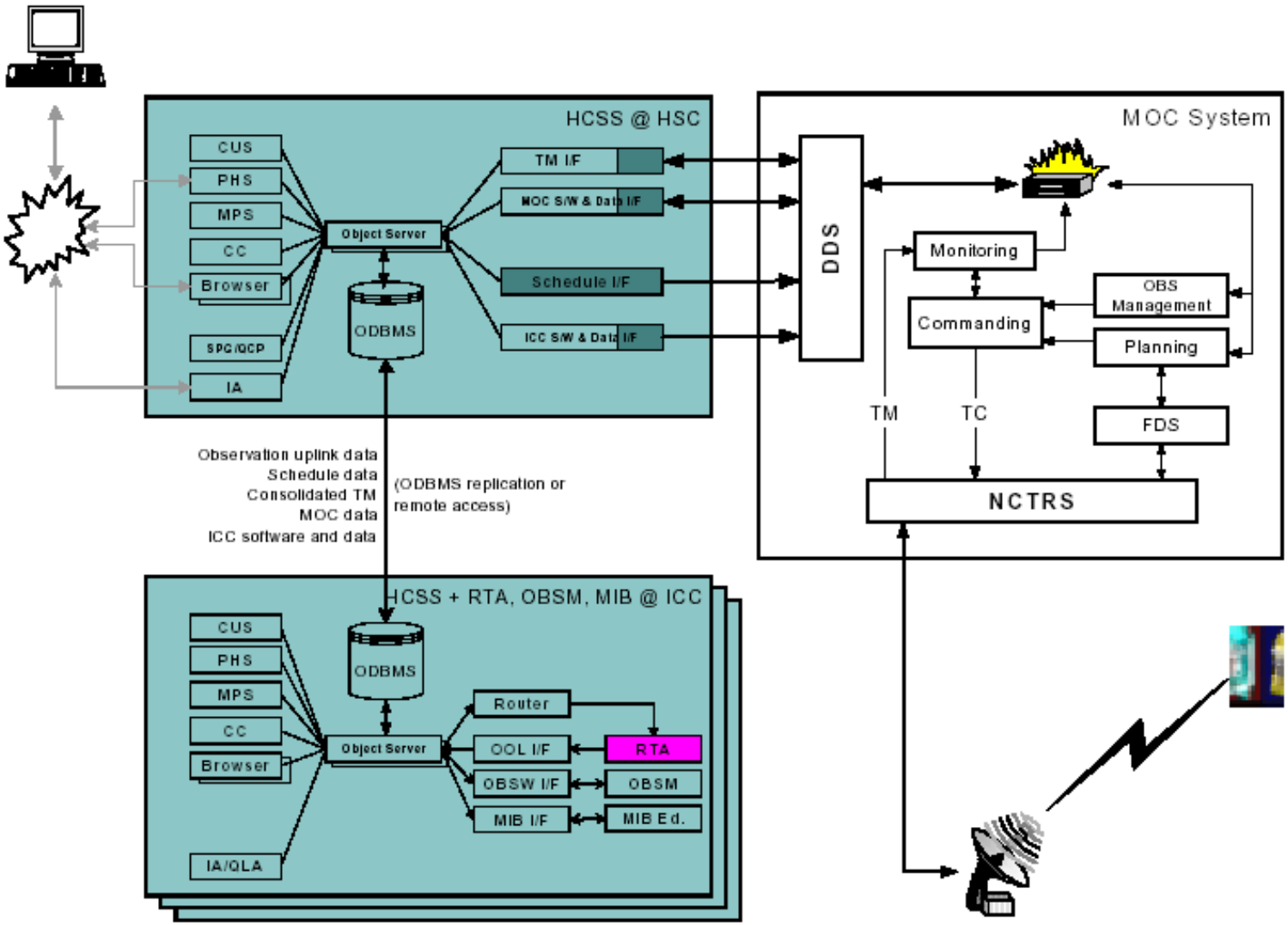
Generation of commands sequence (2):

- Observing modes, e.g.:
  - Point source photometry
  - Fully sampled spectral map: continuous scan
- Observing mode parameters, e.g.:
  - integration time
  - wavelength band (spectroscopy)
  - chopper throw
  - resolution (spectroscopy)
- Instrument command sequences, e.g.:
  - T_0: Initiate_Observation (ObsId), $CmdId_0$
  - ΔT_1: Configure (), $CmdId_1$
  - ΔT_2: Calibrate (), $CmdId_2$
  - ΔT_3: Start_spec_map(), $CmdId_3$
  - ΔT_4: Measure(), $CmdId_4$
  - ΔT_5: Configure(), $CmdId_5$

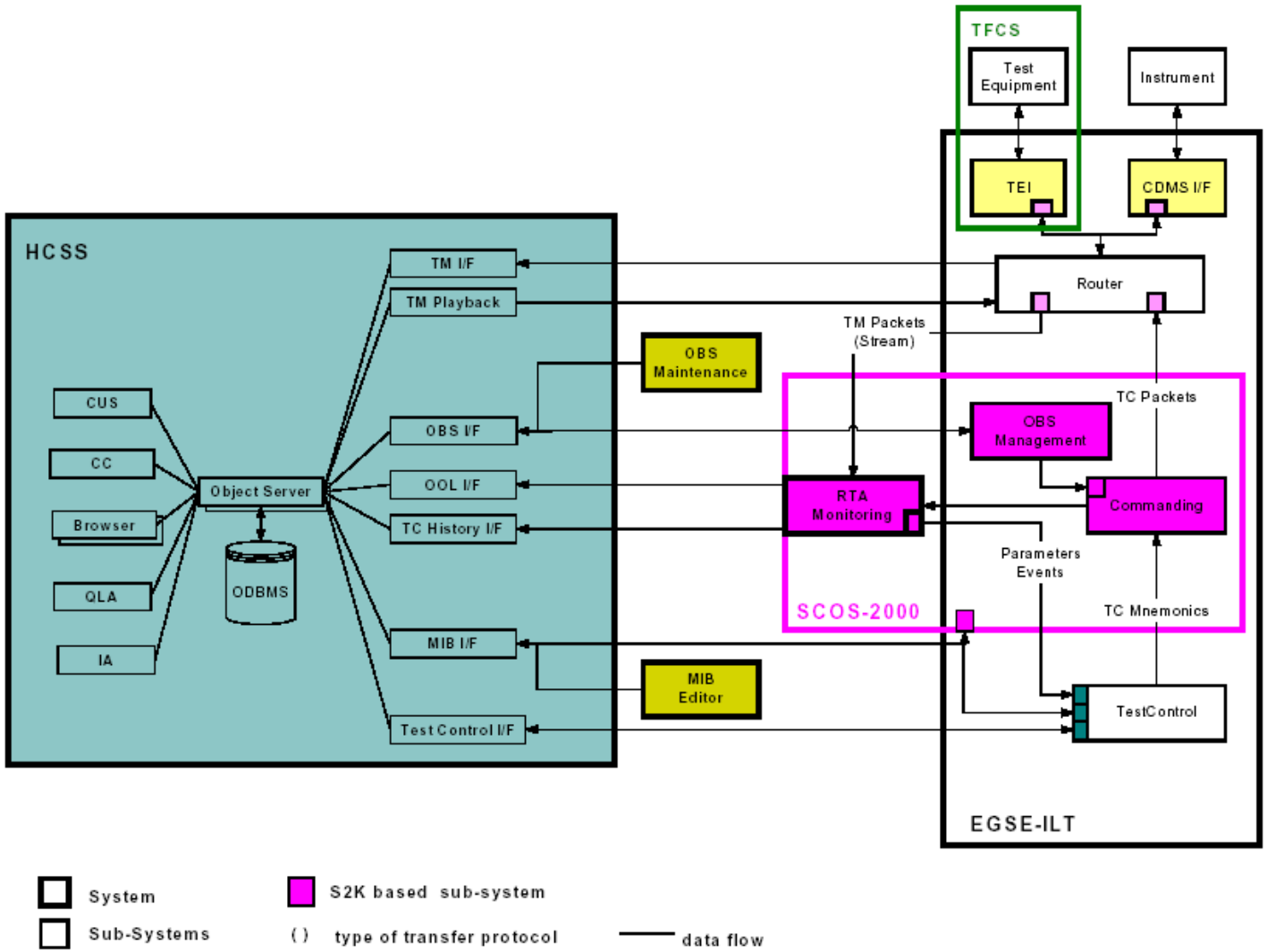
How does the HCSS work for observations (4)?

- **Relating Downlink to Uplink:**
  - needed for archiving purposes
  - needed for data analysis and calibration
  - done at observation level for TM data
    - using a unique identifier (ObsId) per (execution of an) observation
  - done at command level for command verification
    - using a unique id (CmdId) per instrument command to be appended to the TC history as generated by SCOS-2000 (2.3e)
  - for ObsId the following has been agreed with the instrument teams:
    - each command sequence for a given observation will start with a specific instrument command (service 8) to set the ObsId
    - The ObsId will be reflected in the following instrument TM packets:
      - HK & diagnostic (service 3)
      - Event (service 5)
      - Science (service 21)

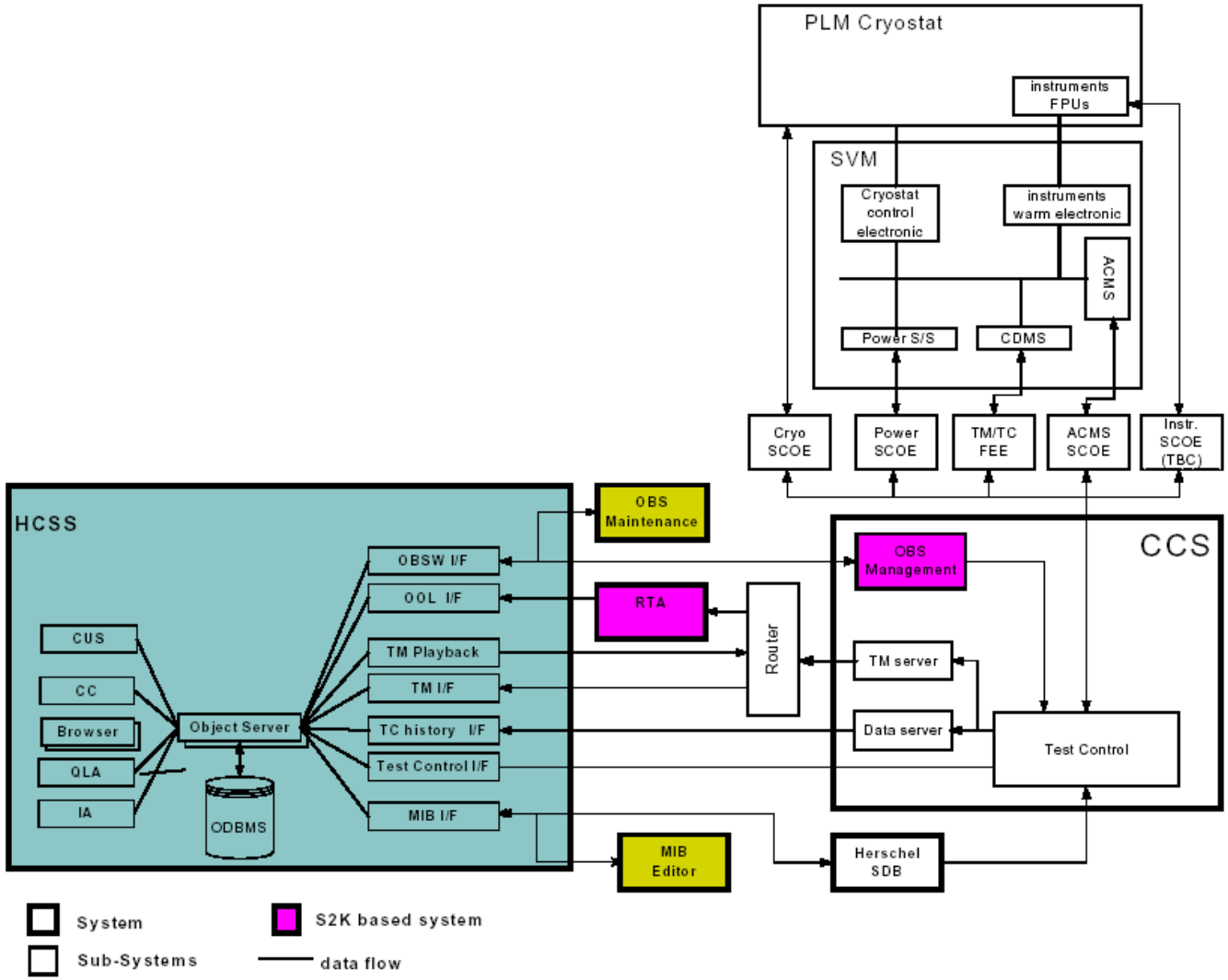
Herschel GS in Routine Phase



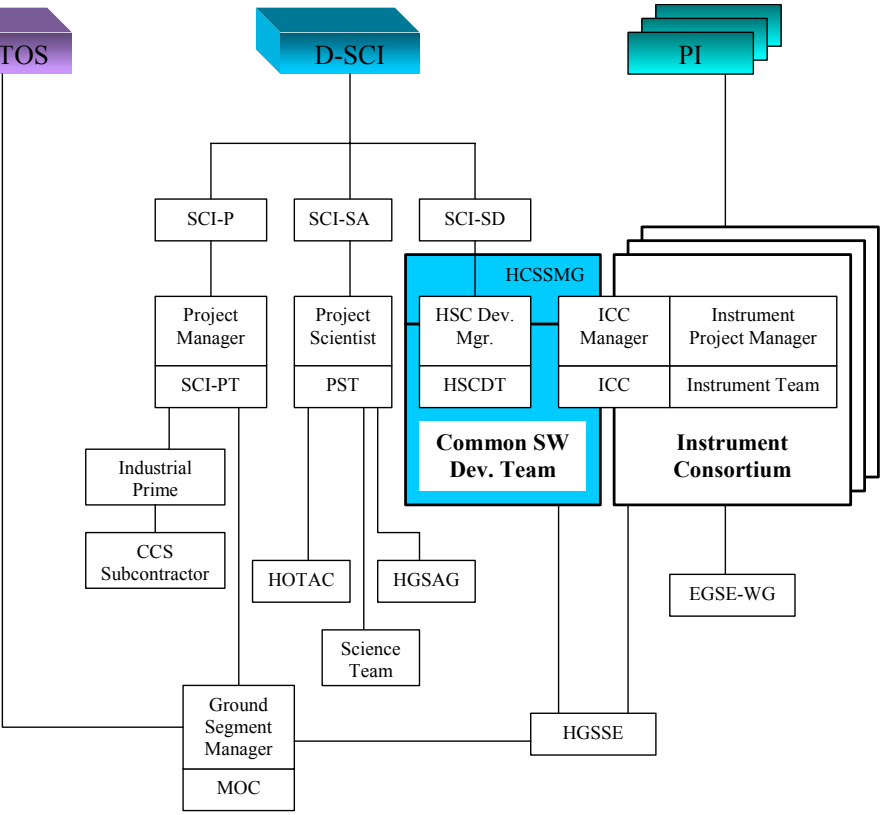
Herschel GS in ILT



HGS in IST (extrapolation from ILT)



Who is developing the HCSS?



The Common SW Development Team (CSDT) is comprised of :

- 7 f.t.e. in ESTEC
- 3+ f.t.e. in ICCs
- Some IPAC involvement

When is the HCSS to be delivered?

- **HCSS v0.1**
  - to support ILT
  - to be delivered in June 02
  - CUS, TM ingestion and extraction, MIB ingestion, etc are prototyped
- **HCSS v0.2**
  - to support ILT & IST
  - to be delivered in December 02
- ….
- **HCSS v1.0**
  - to support operation
  - to be delivered in December 06

SPIRE ICC Contribution to HCSS v0.1

- TM Data Extractor: On demand retrieves TM packets and data frames from the HCSS database (Steve Guest).
- TC history ingestor: Reads TC history records from SCOS-2000 and ingests them into the HCSS database as objects (Matthew Graham).
- Out Of Limit (OOL) data ingestor: Retrieves OOL packets from SCOS-2000 and ingests them into the HCSS database as objects (Matthew Graham).