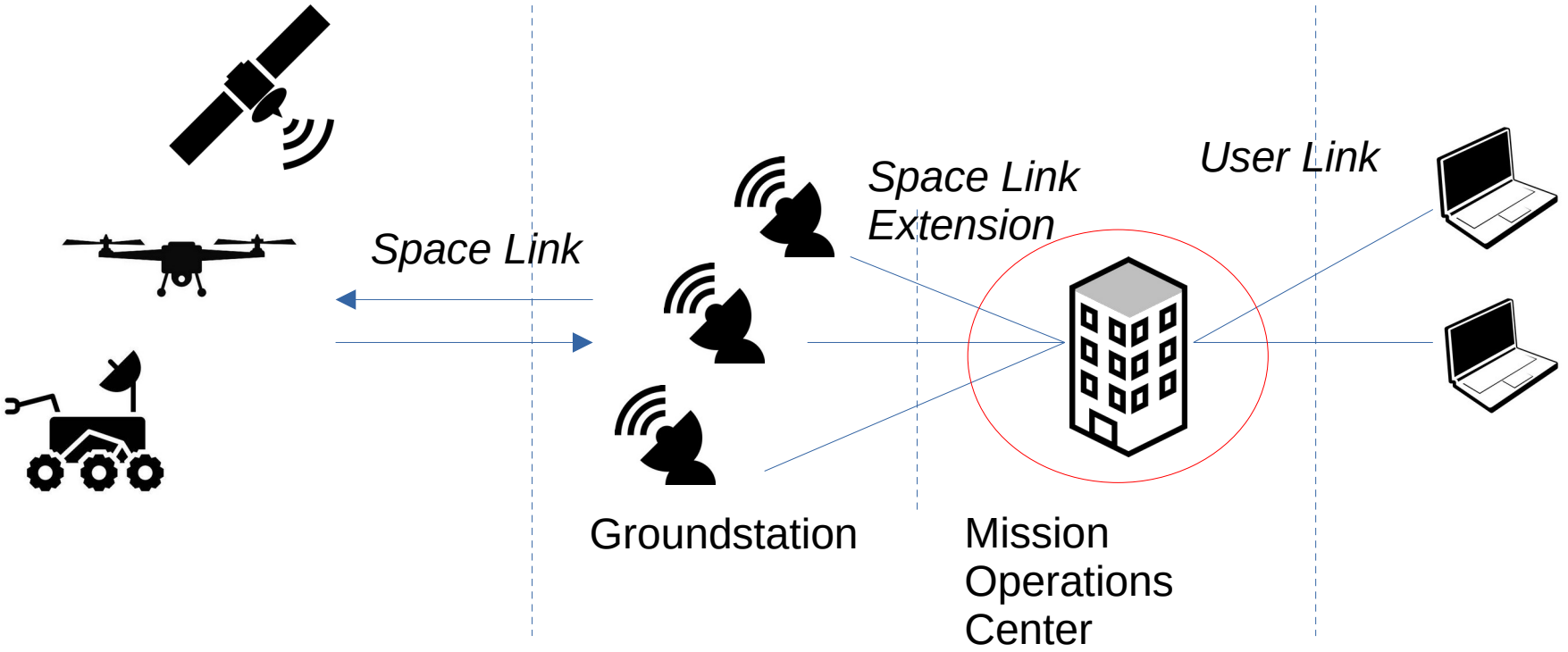
Open Source Mission Operations Systems

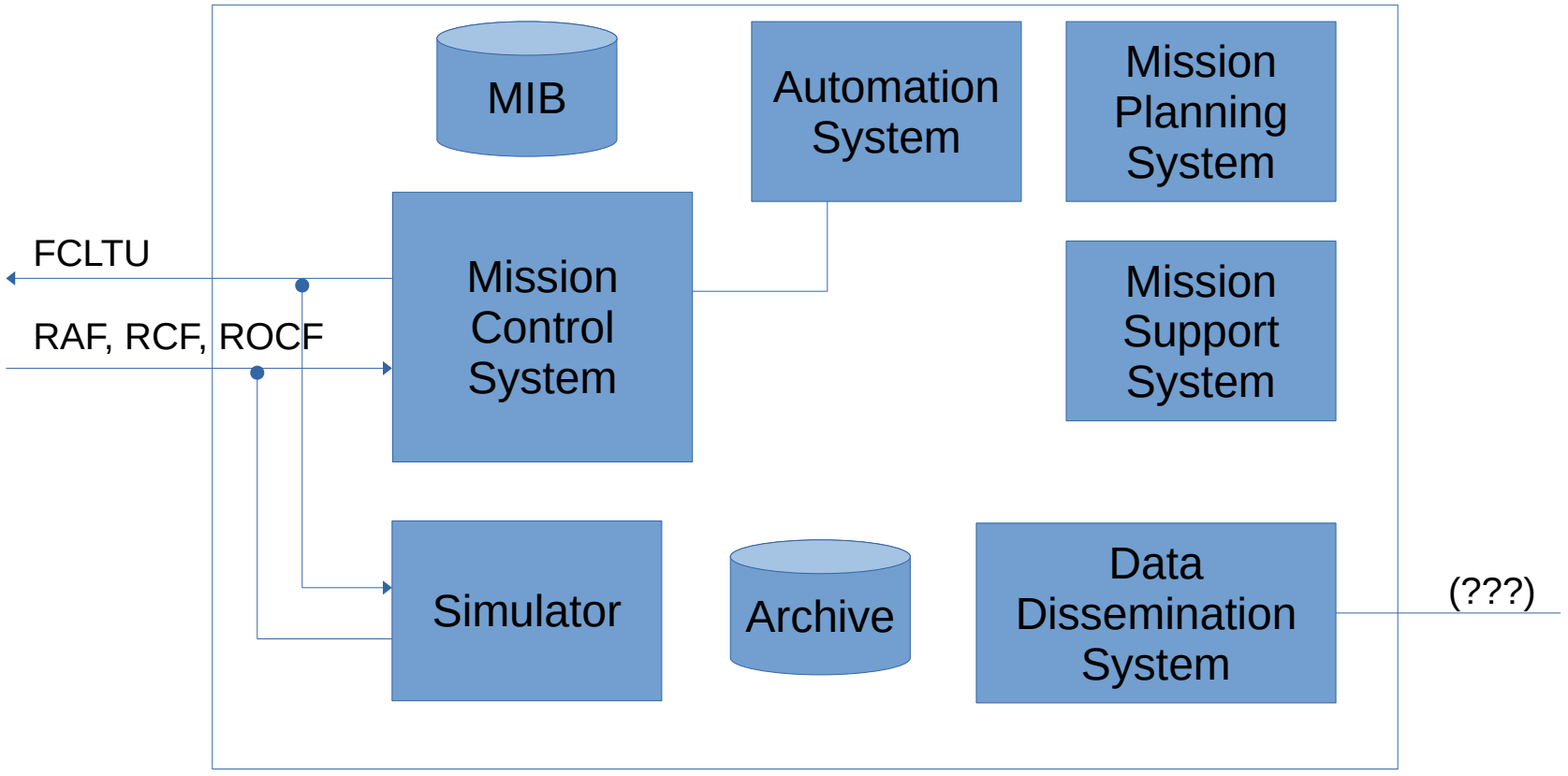
Segments


Space Link
Space Link
Extension
User Link
Groundstation
Mission
Operations
Center
Space/Remote Segment
Ground Segment
User Segment

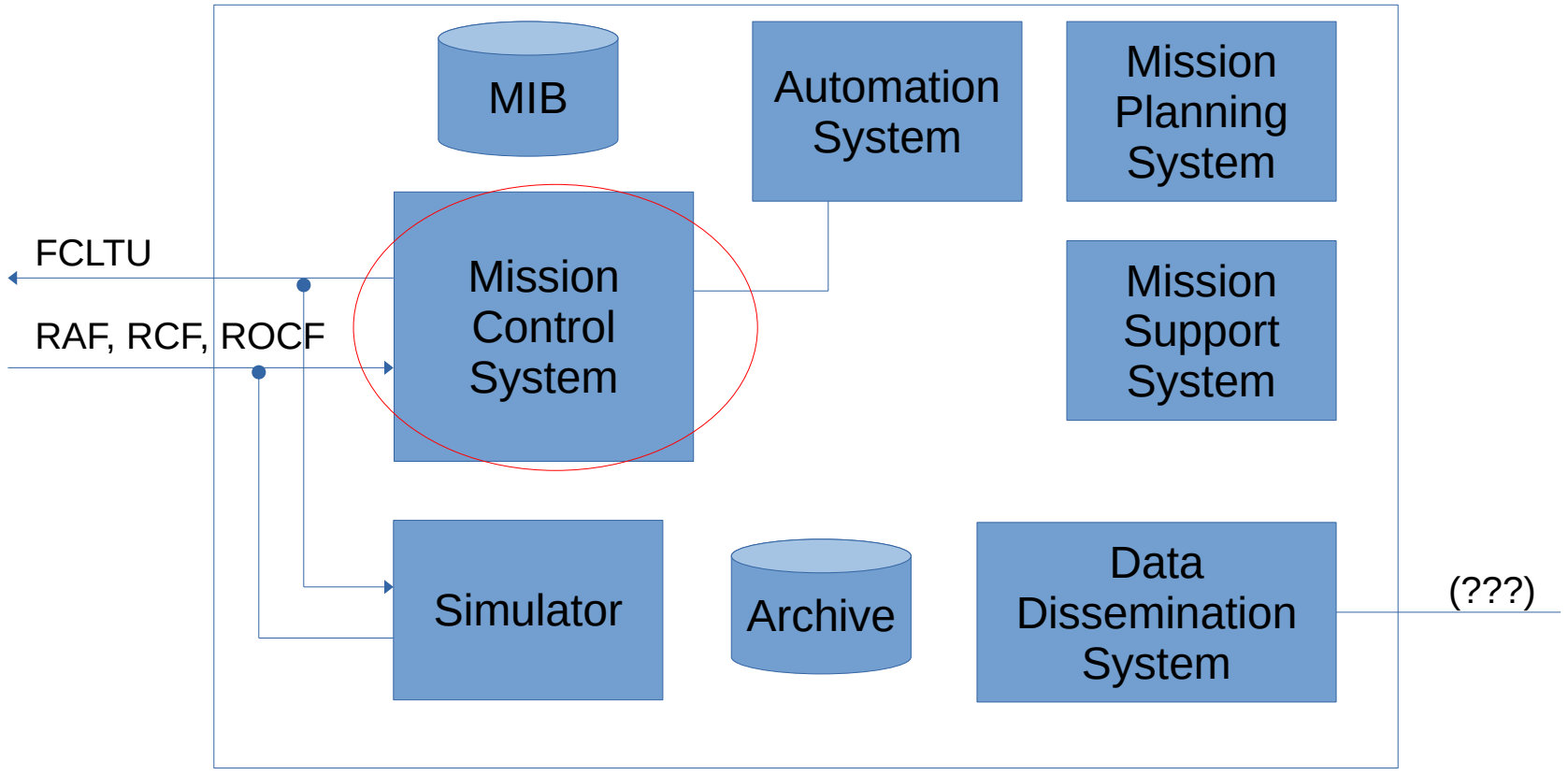

MISSION CONTROL CENTER
ISS D/L 1 LOS
ISS D/L 2 LOS
ADCO
SPARTAN
ETHOS
ISO
OPS PLANNER
FLIGHT DIRECTOR
CAPCOM
POSN 4272


esa
esoc
european space operations centre

Mission Operations Center

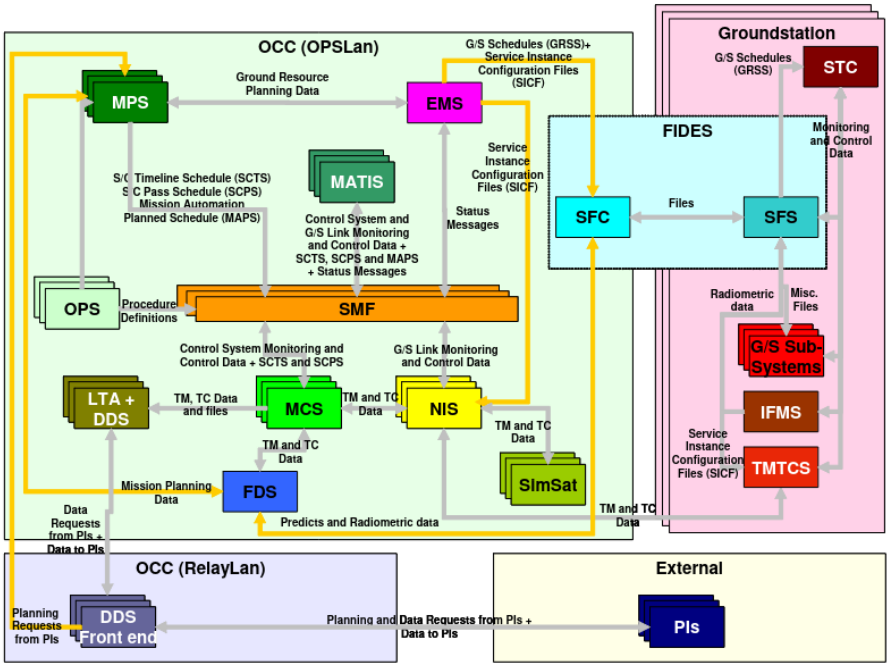


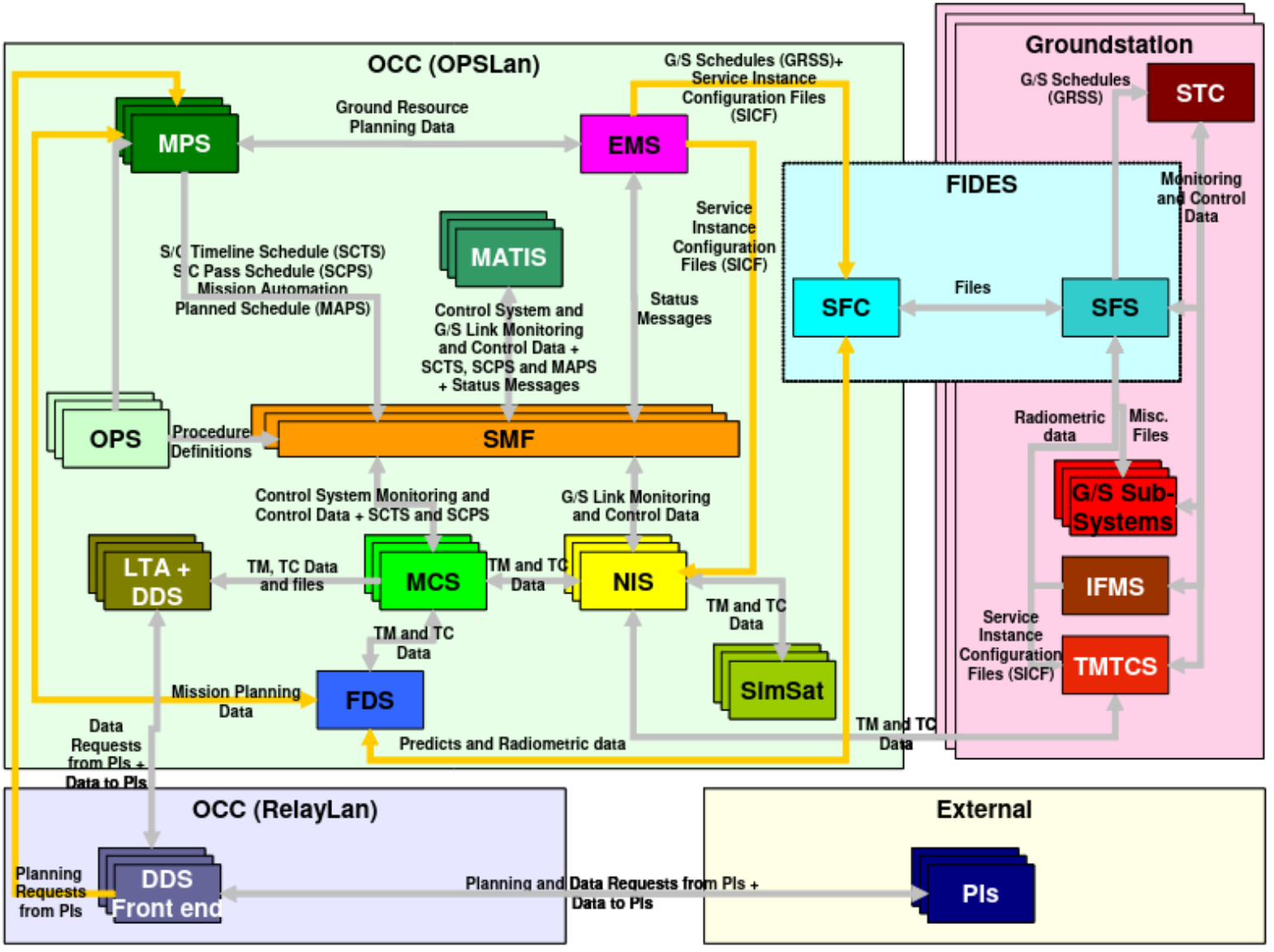
Mission Operations Center



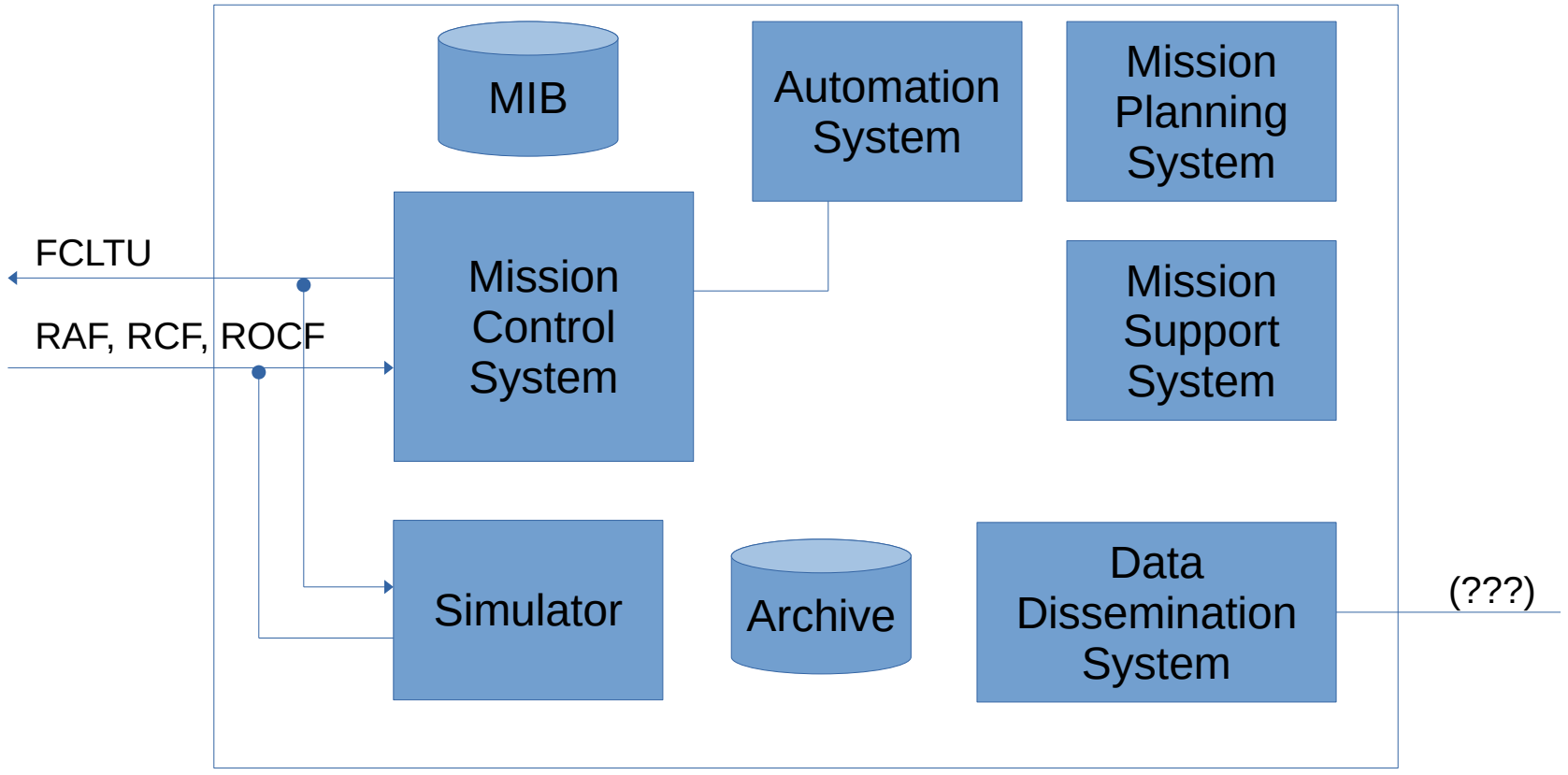
EGOS / ESA (not open source)

- http://iiis.org/cds2008/cd2008sci/CITSA2008/PapersPdf/I030TX.pdf

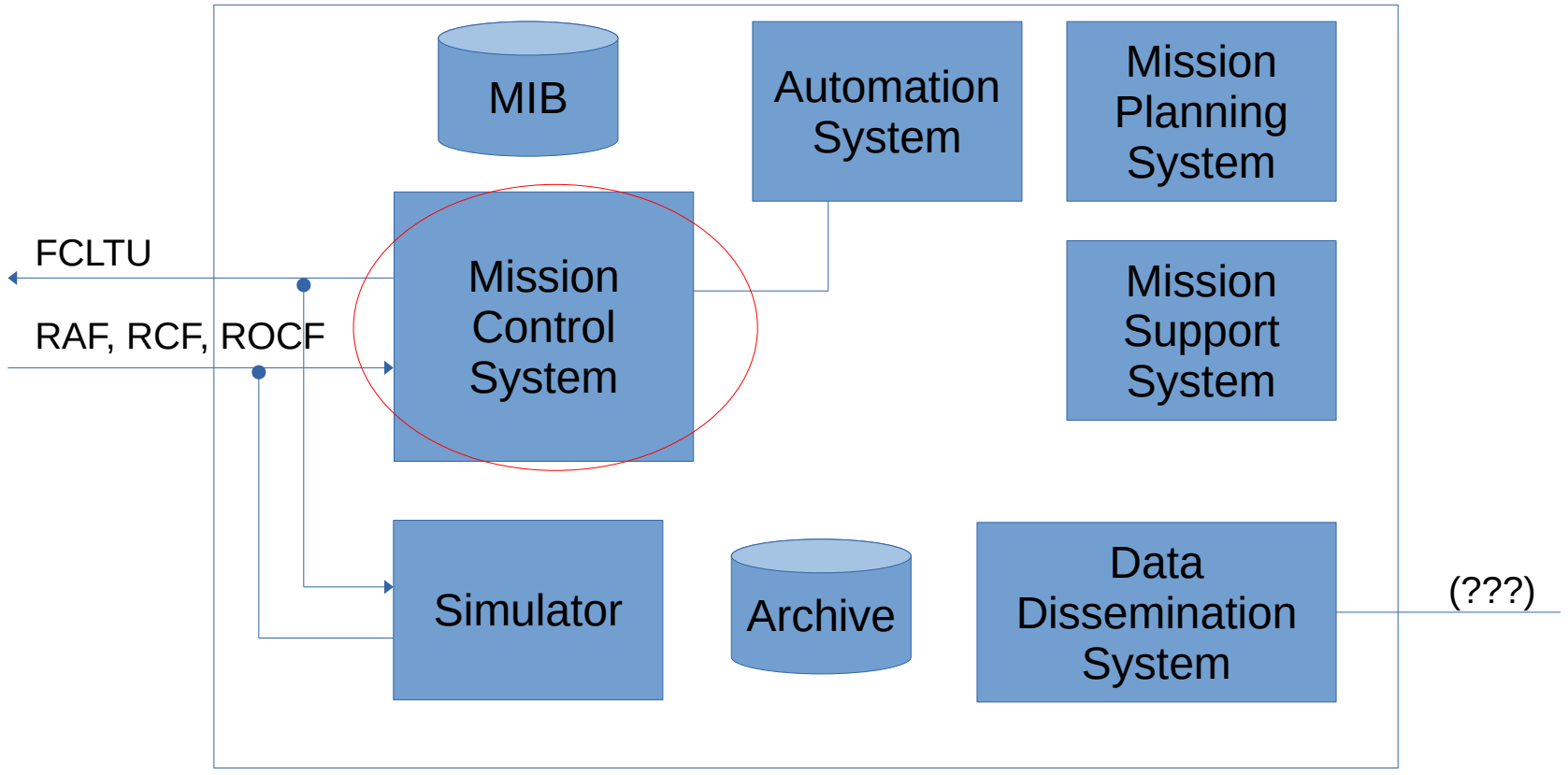



OCC (OPSLan)
Groundstation
MPS
Ground Resource Planning Data
EMS
G/S Schedules (GRSS)+ Service Instance Configuration Files (SICF)
G/S Schedules (GRSS)
STC
FIDES
Monitoring and Control Data
Service Instance Configuration Files (SICF)
S/C Timeline Schedule (SCTS)
S/C Pass Schedule (SCPS)
Mission Automation Planned Schedule (MAPS)
MATIS
Control System and G/S Link Monitoring and Control Data + SCTS, SCPS and MAPS + Status Messages
Status Messages
SFC
Files
SFS
OPS
Procedure Definitions
SMF
Radiometric data
Misc. Files
Control System Monitoring and Control Data + SCTS and SCPS
G/S Link Monitoring and Control Data
G/S Sub-Systems
LTA + DDS
TM, TC Data and files
MCS
TM and TC Data
NIS
IFMS
TM and TC Data
Service Instance Configuration Files (SICF)
TMTCS
TM and TC Data
SImSat
Mission Planning Data
FDS
Data Requests from PIs + Data to PIs
Predicts and Radiometric data
TM and TC Data
OCC (RelayLan)
External
Planning Requests from PIs
DDS Front end
Planning and Data Requests from PIs + Data to PIs
PIs

Mission Operations Center

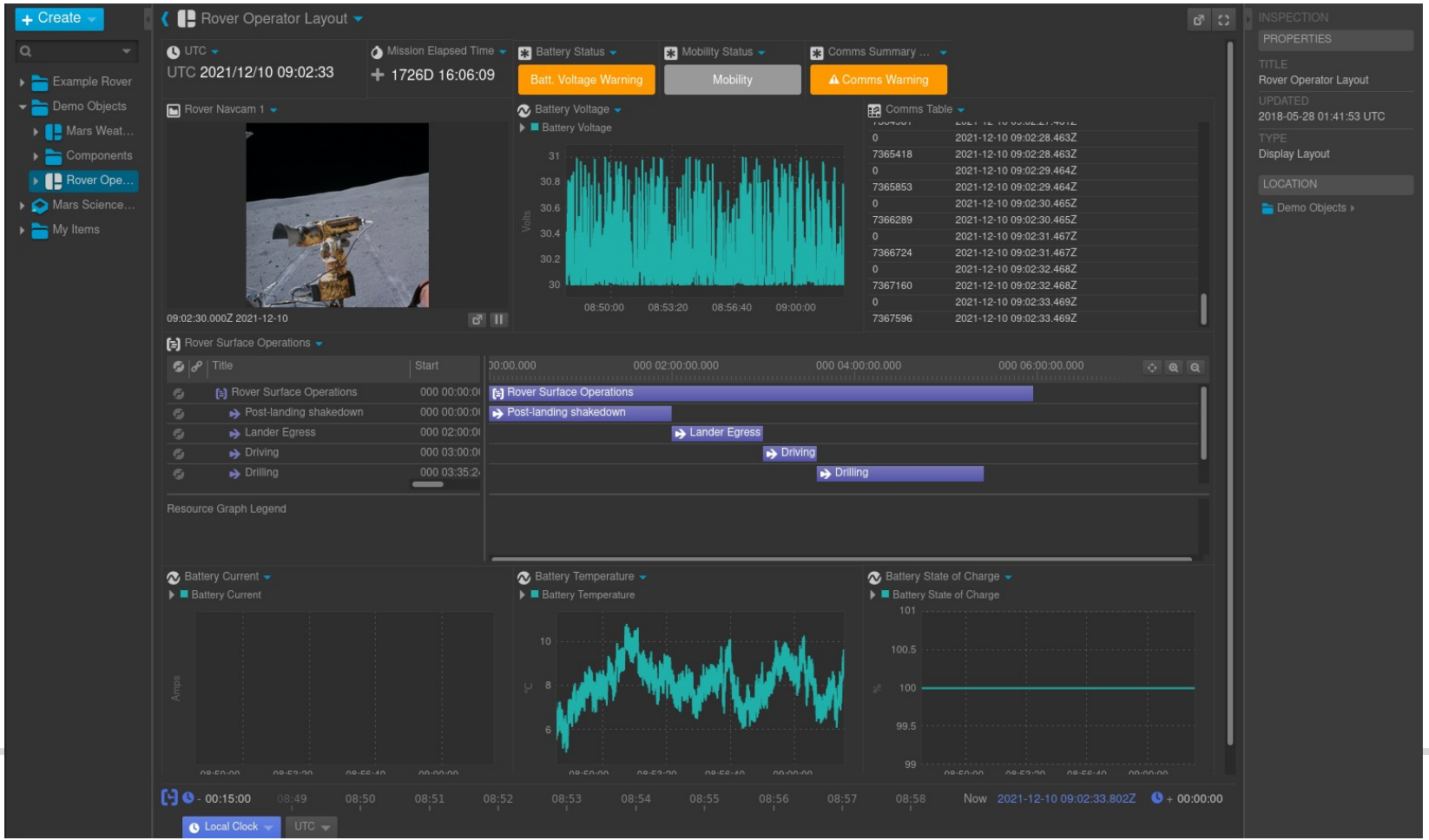


Mission Operations Center



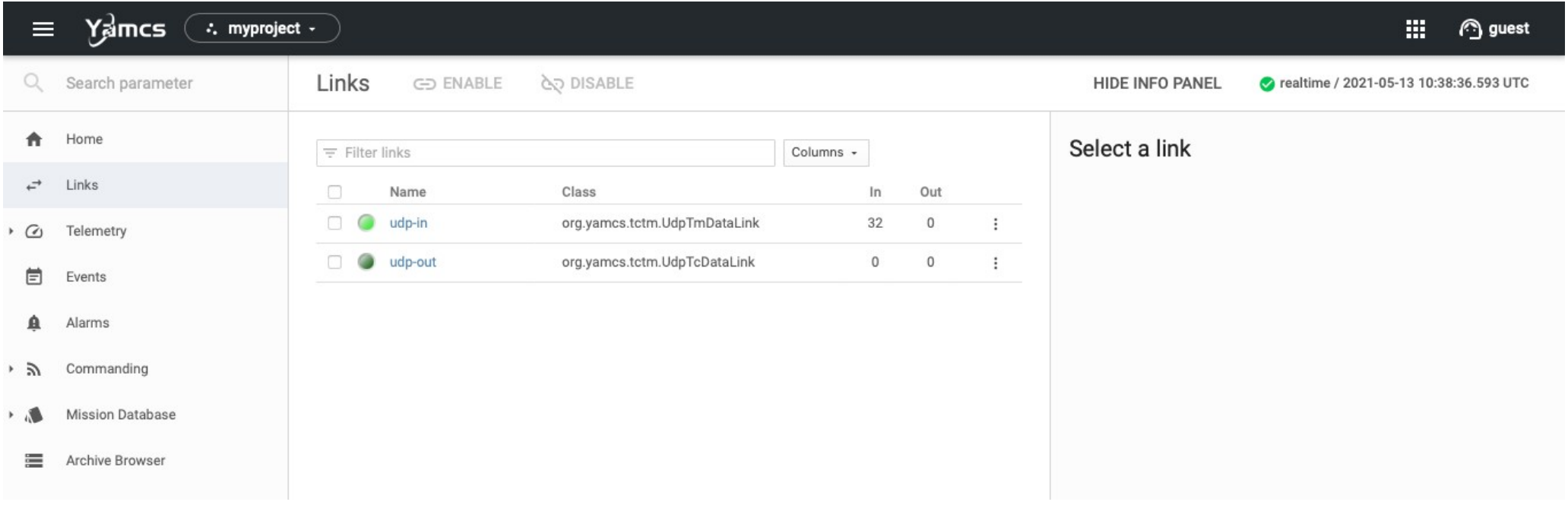
Examples of Open Source Mission Control Systems

OpenMCT / NASA

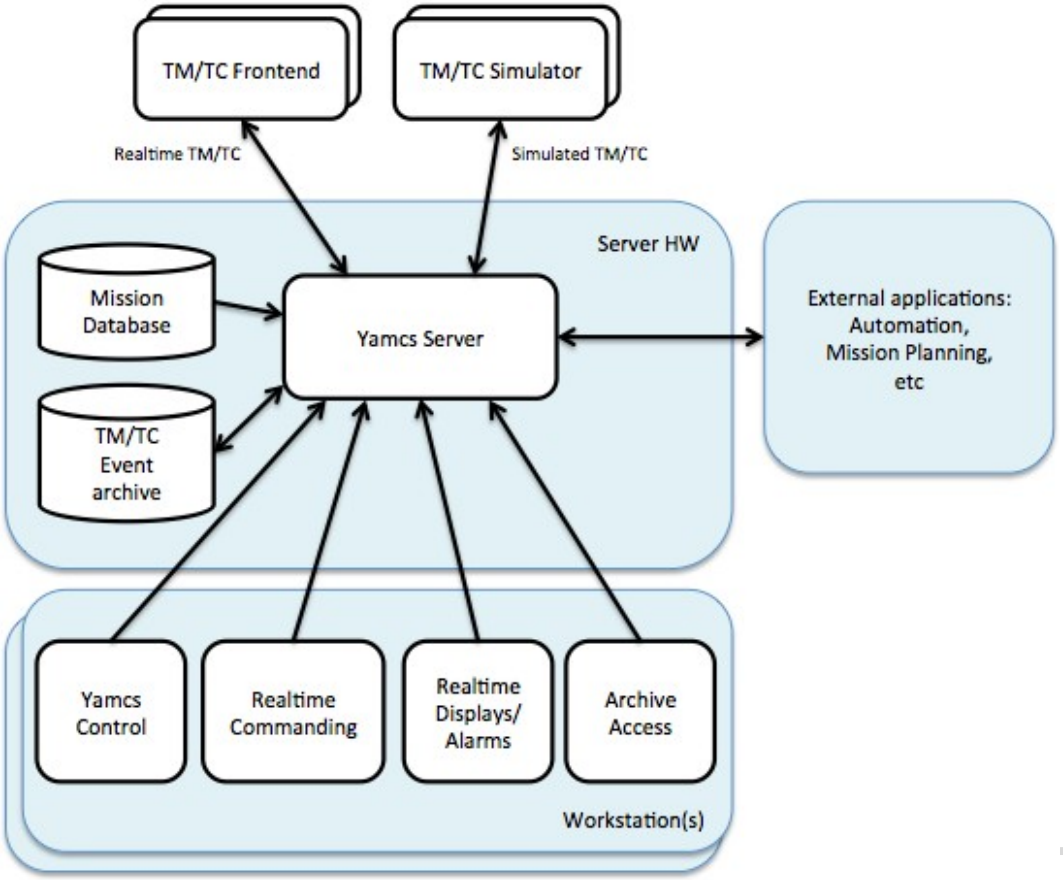


Yamcs / Space Applications Services

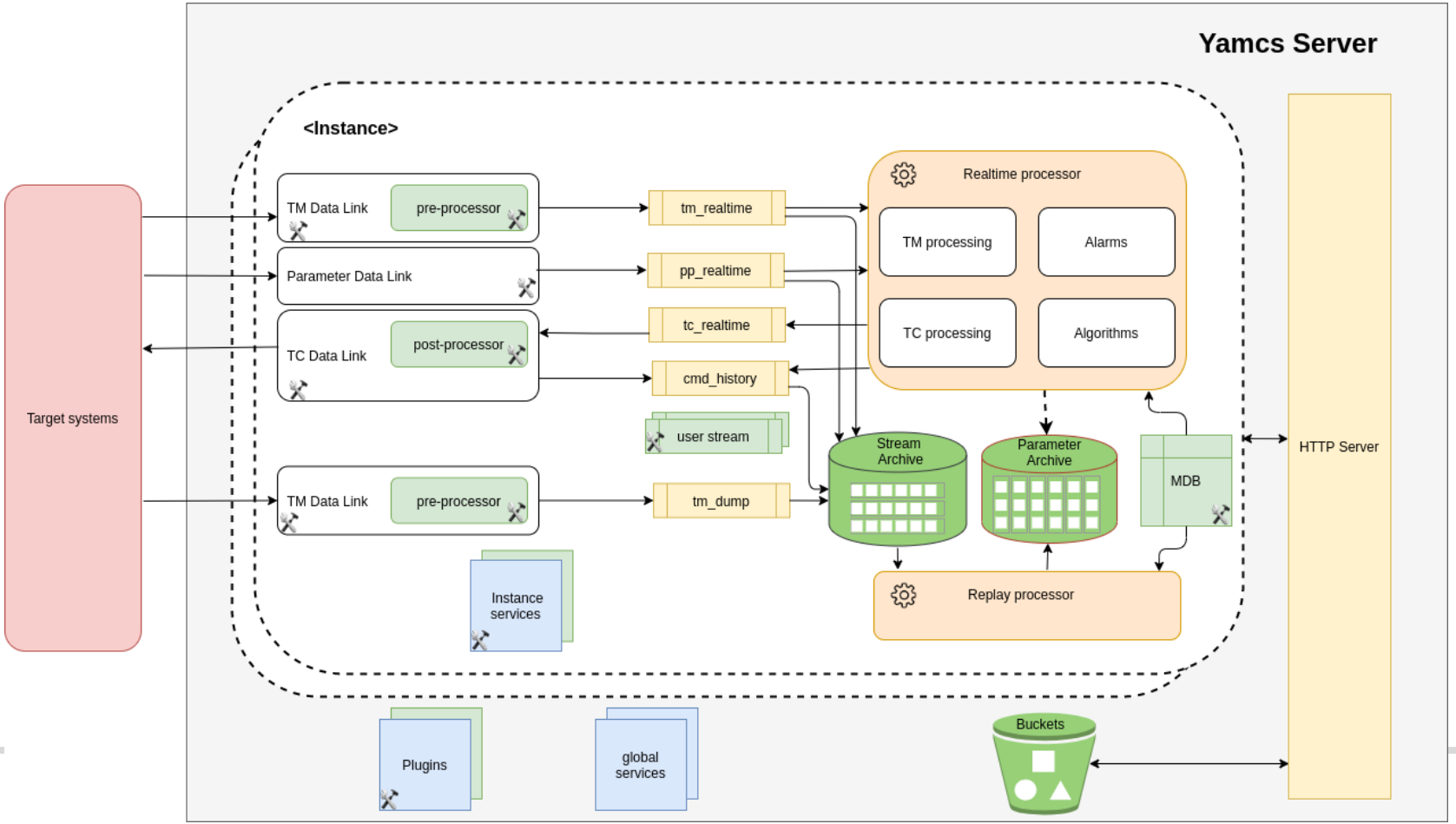
https://github.com/yamcs/quickstart



Yamcs / Space Applications Services

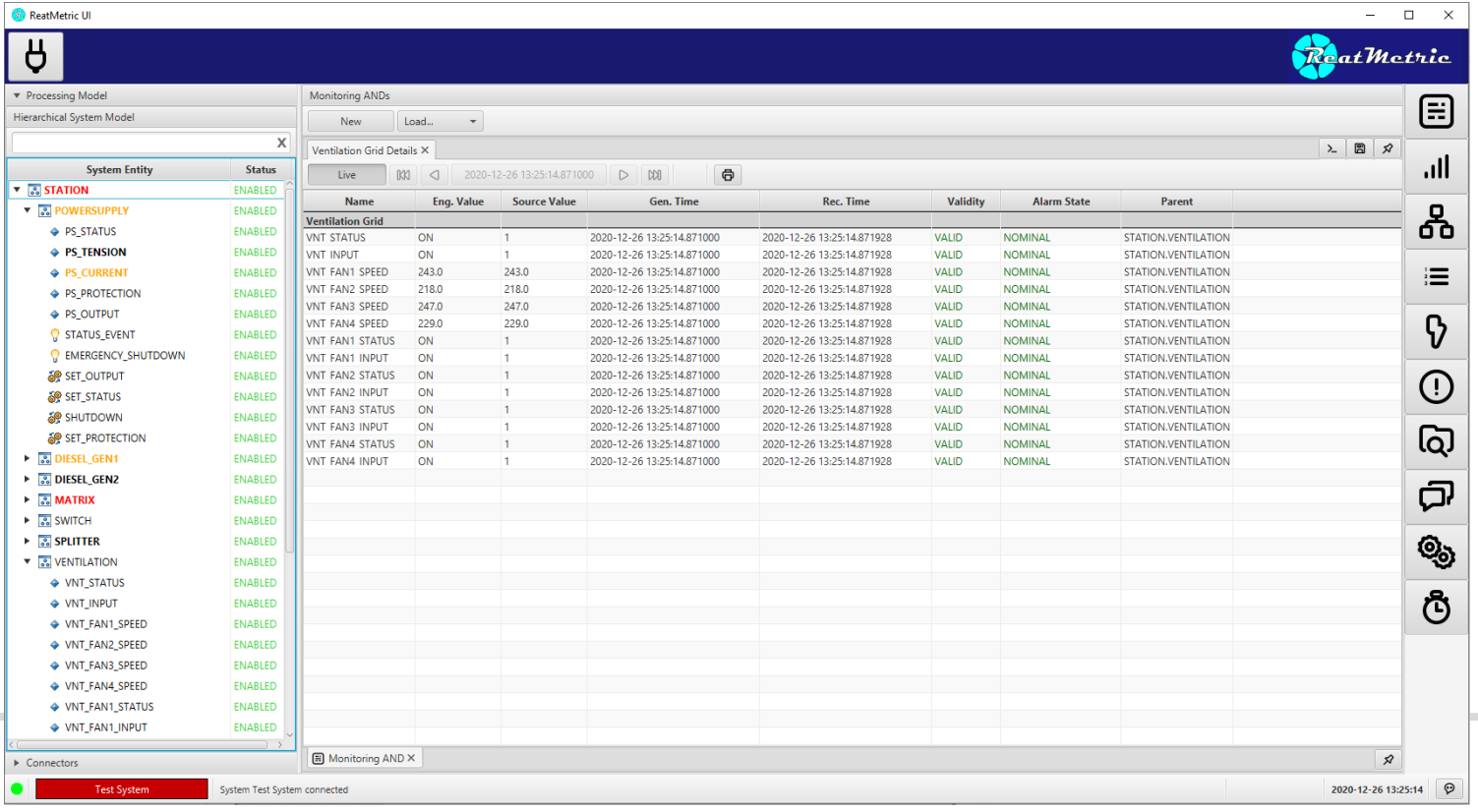


Yamcs / Space Applications Services

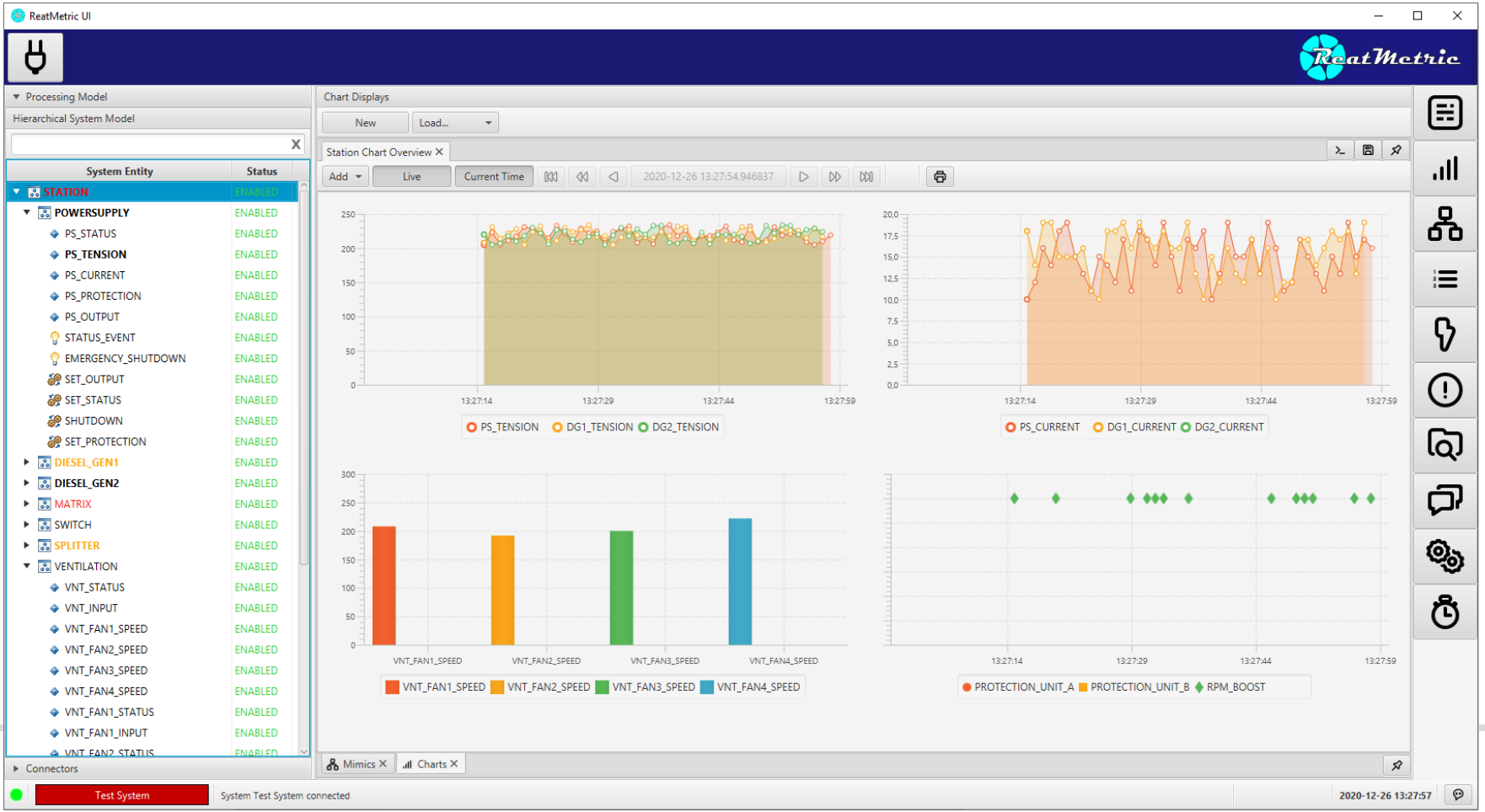


RealMetric / Dario Lucia

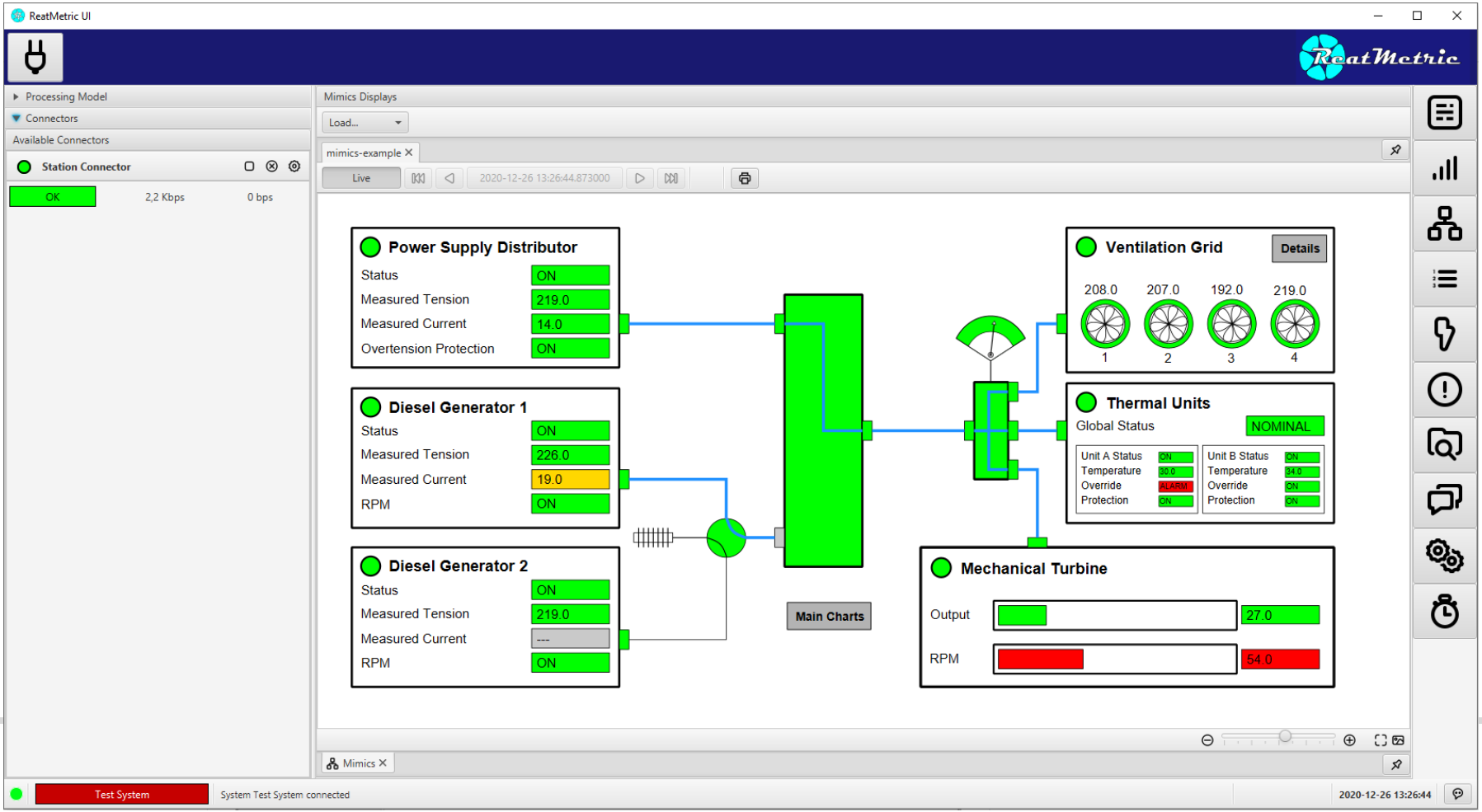
https://github.com/dariol83/realmetric



RealMetric / Dario Lucia

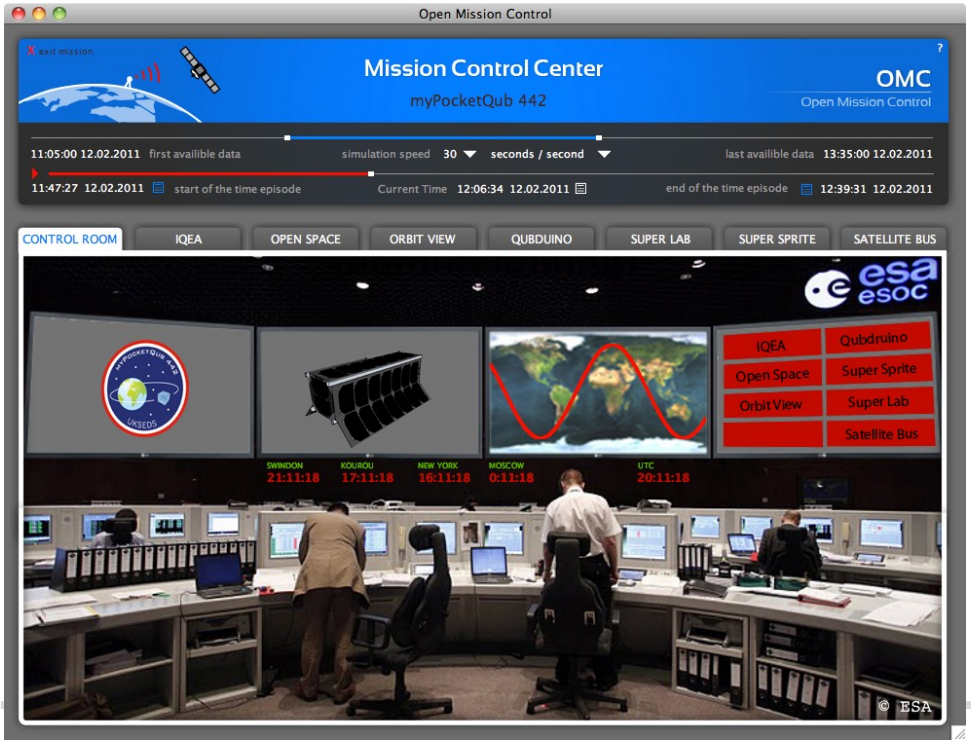


ReatMetric / Dario Lucia



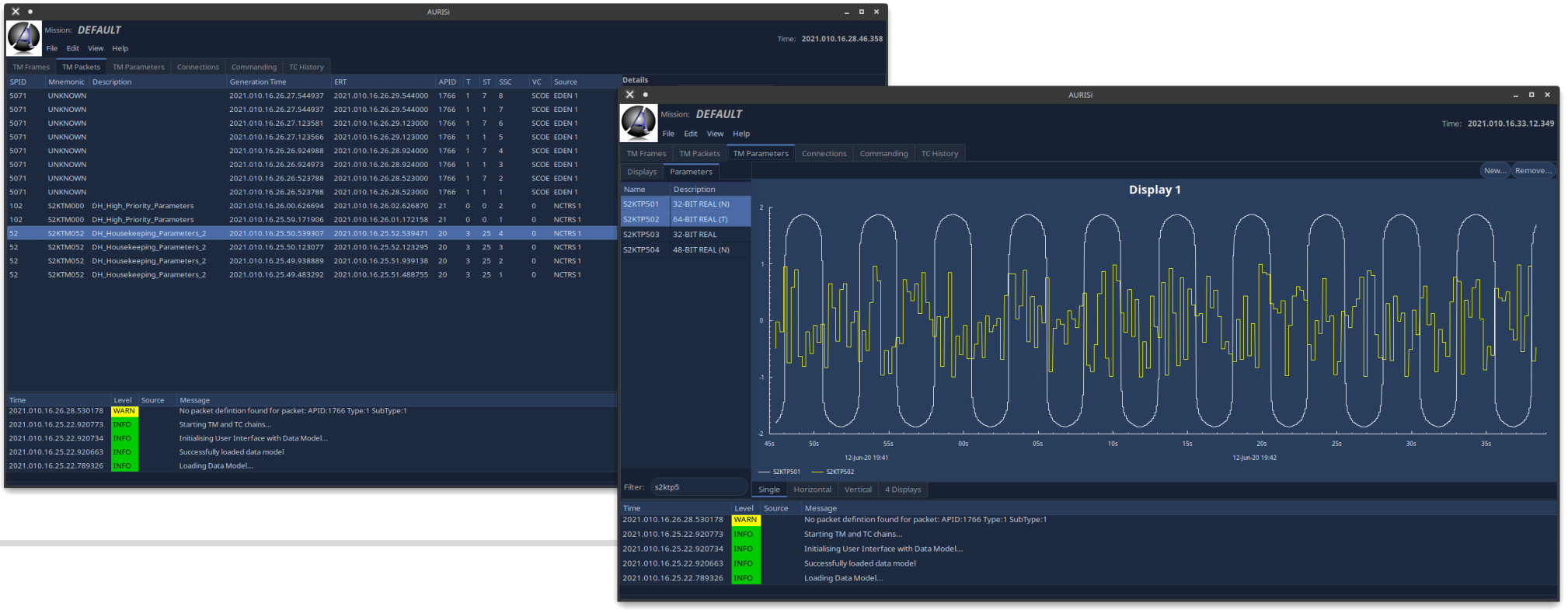
Open Mission Control

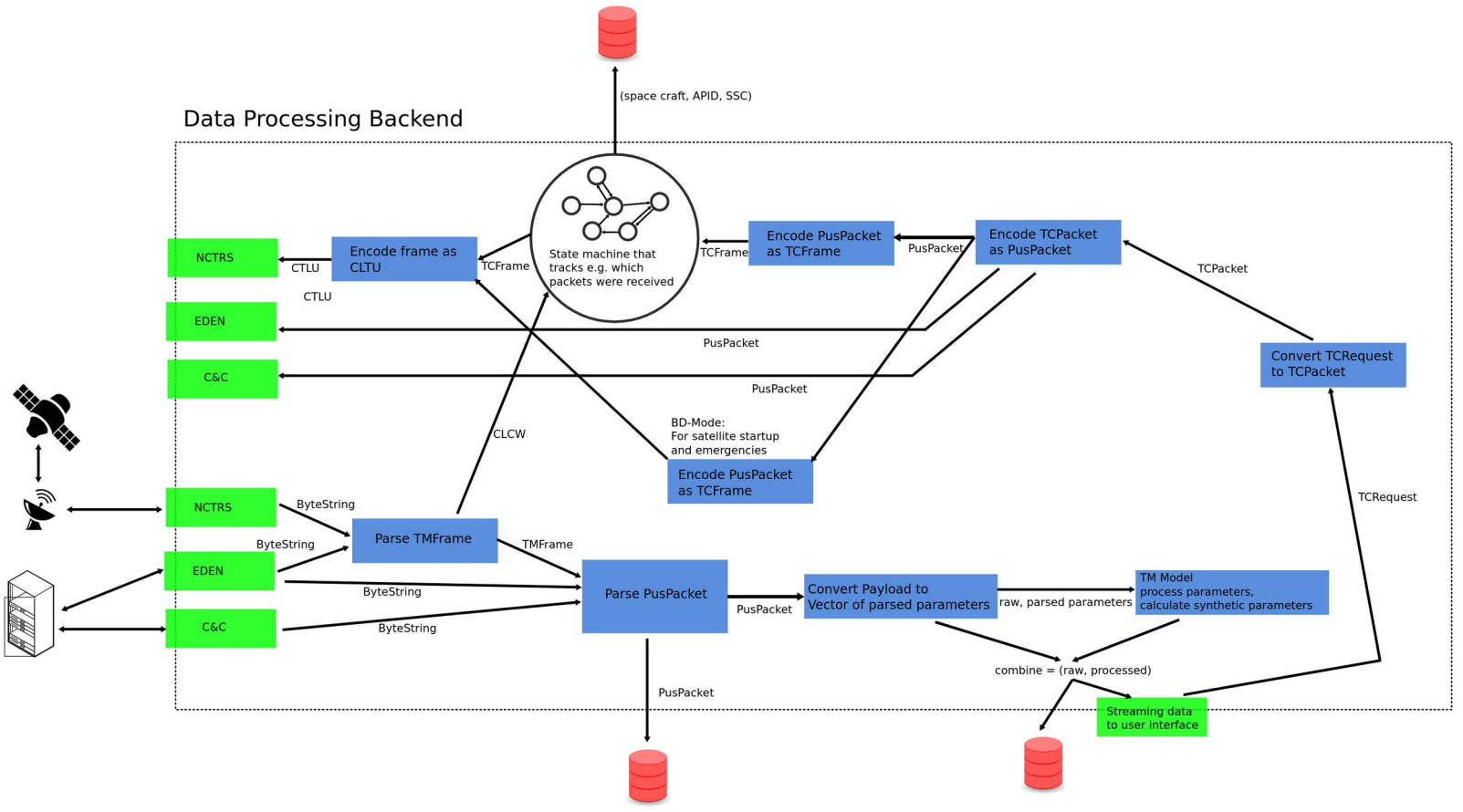
https://openmissioncontrol.wordpress.com



AURIS

https://github.com/OSWALD2/AURIS




Data Processing Backend
(space craft, APID, SSC)
State machine that tracks e.g. which packets were received
Encode frame as CLTU
Encode PusPacket as TCFrame
Encode TCPacket as PusPacket
NCTRS
EDEN
C&C
CTLU
TCFrame
PusPacket
TCPacket
Convert TCRequest to TCPacket
BD-Mode: For satellite startup and emergencies
CLCW
ByteString
Parse TMFrame
TMFrame
Parse PusPacket
Convert Payload to Vector of parsed parameters
raw, parsed parameters
TM Model process parameters, calculate synthetic parameters
TCRequest
combine = (raw, processed)
Streaming data to user interface

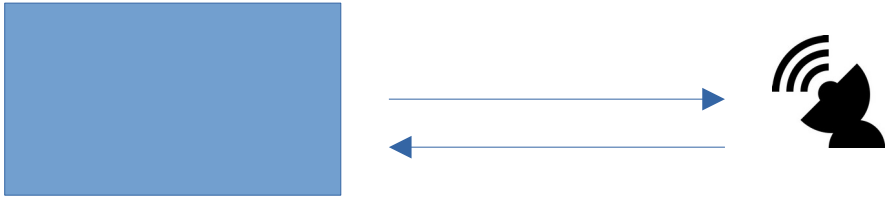
A Python / Dockerized Open Source Mission Control System?

What to consider

- Data Link Management for TC and TM (open / close)
- Telemetry Displays
- Telecomand Stack and History
- Database (aka Mission Information Base, MIB)
- Events Display
- Alarms
- …

What to consider

- Data Link Management for TC and TM (open / close)
  - CCSDS SLE protocol
  - Cortex (proprietary protocol)
  - Custom (eg. TCP)?



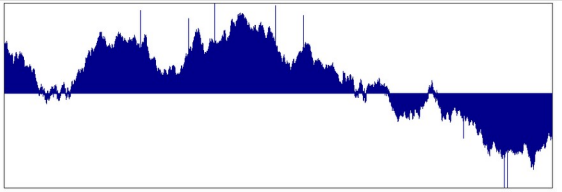
What to consider

- Telemetry Displays
  - ANDs (Alpha Numeric Displays)
  - GRDs (Graphical Displays)
  - MIMICs
  - 3D Views

What to consider

- Telemetry Displays
  - **ANDs**
  - GRDs
  - MIMICs
  - 3D Views

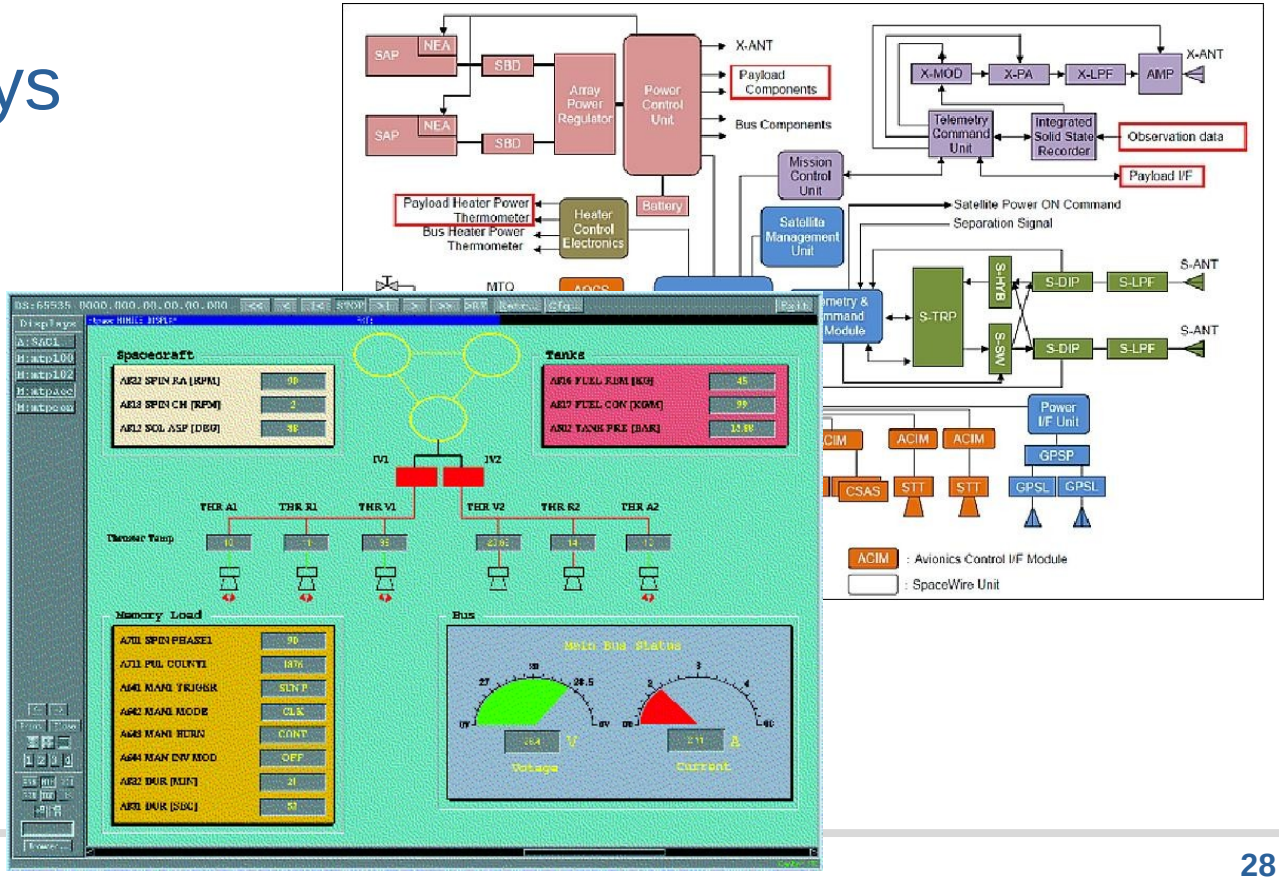
What to consider



- Telemetry Displays
  - ANDs
  - **GRDs**
  - MIMICs
  - 3D Views

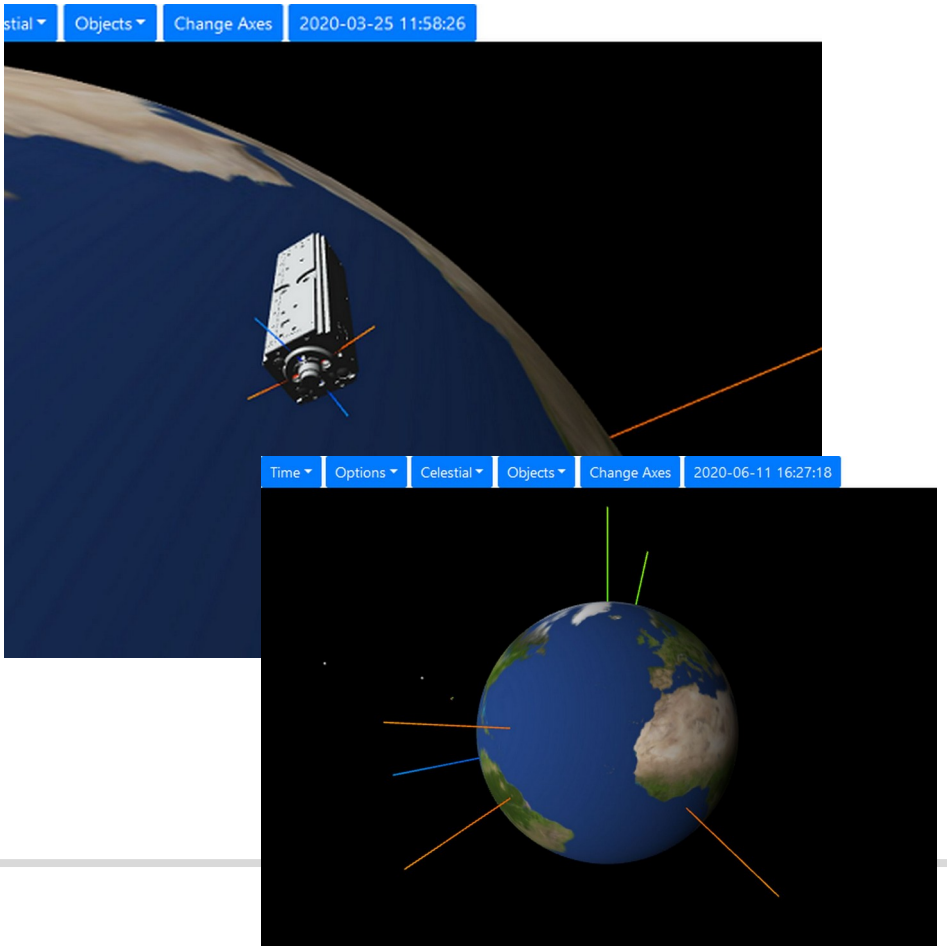
What to consider

- Telemetry Displays
  - ANDs
  - GRDs
  - **MIMICs**
  - 3D Views



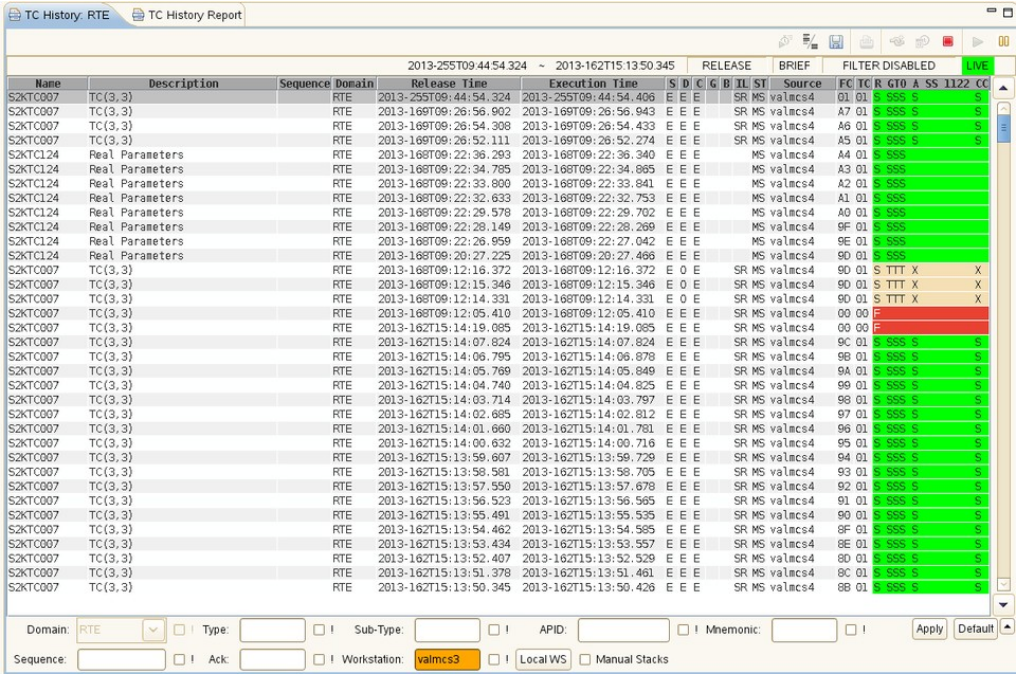
What to consider

- Telemetry Displays
  - ANDs
  - GRDs
  - MIMICs
  - **3D Views**



What to consider

- Telecomand Stack and History



What to consider

- Database (aka Mission Information Base, MIB)
  - What you receive: 0100110100011101010101...
  - What you want:
    - Frame Counter = 234
    - Batt Temp = 23 deg C
    - Solar Panel +X Current = 235 mA
    - ...

What to consider

- Database (aka Mission Information Base, MIB)
  - SCOS-2000 uses SQL Tables
  - CCSDS released **XTCE** (XML files)