



# **An Innovative Monitoring- and Control-System at GSOC and Weilheim Ground Station**

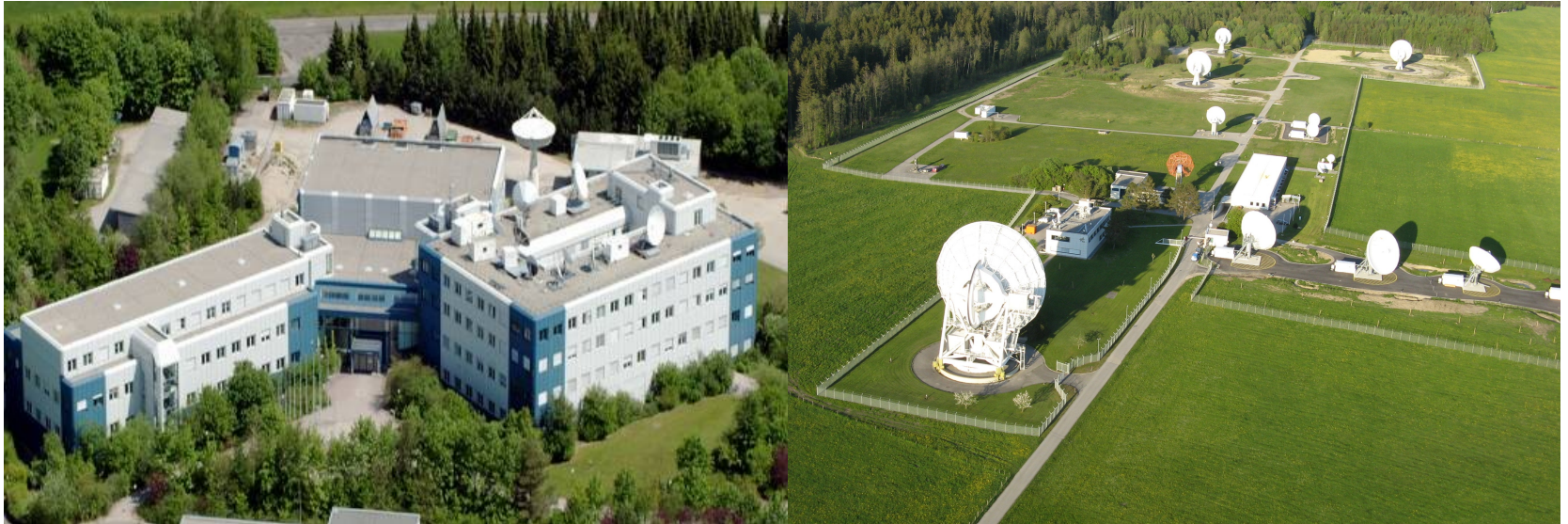
**Dr. Armin Hauke,  
Thomas Ohmüller and Dr. Udo Häring**

**German Space Operations Center (GSOC)  
German Aerospace Center - DLR**

**© 2012 by DLR**

**Published by The Aerospace Corporation with permission.**

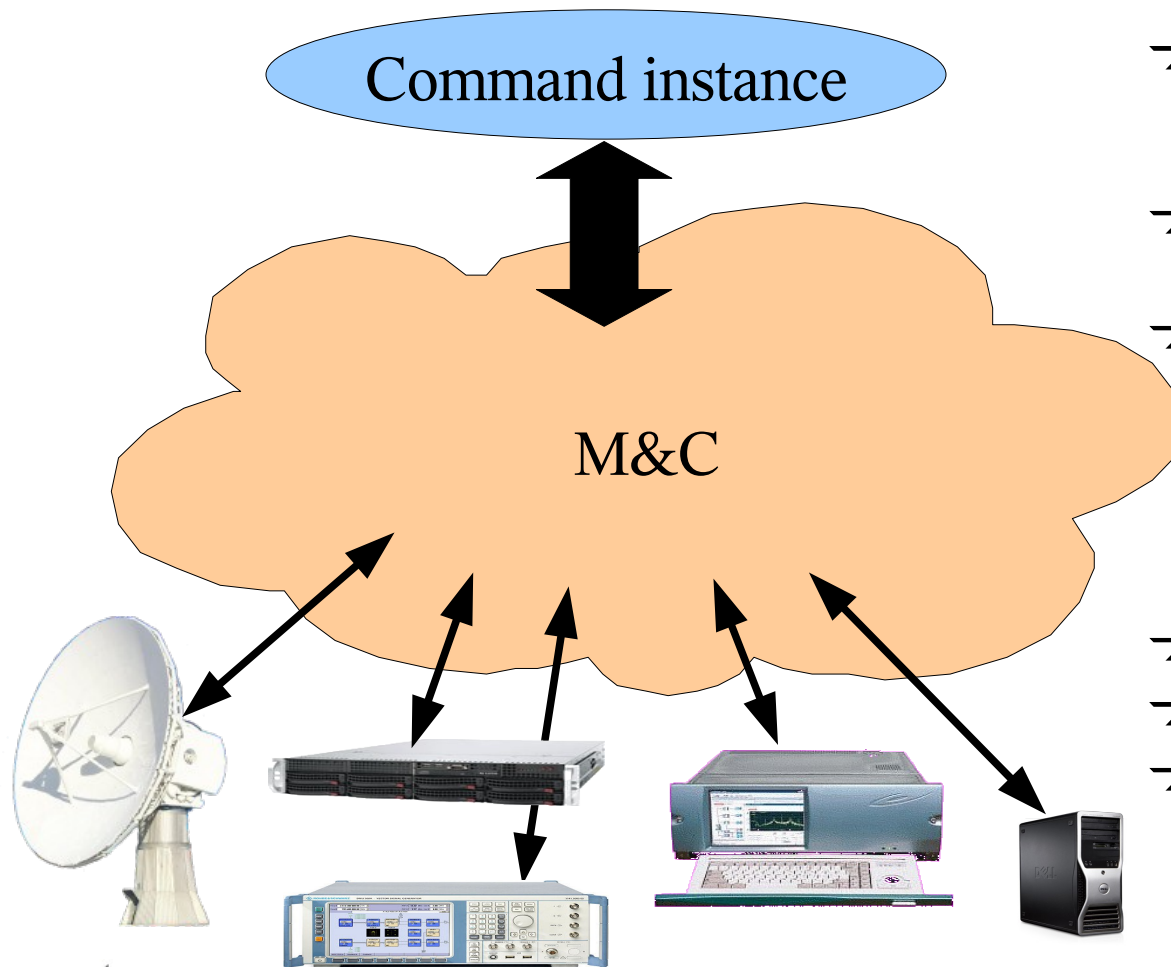
# An Innovative M&C-System at GSOC and Weilheim



- What we all need to do:
- What we intended to do:
- What we are actually doing:
- What we now can do:

Requirements for a generic M&C-System  
Our realization of a generic M&C-System  
First implementations  
Benefits and future plans

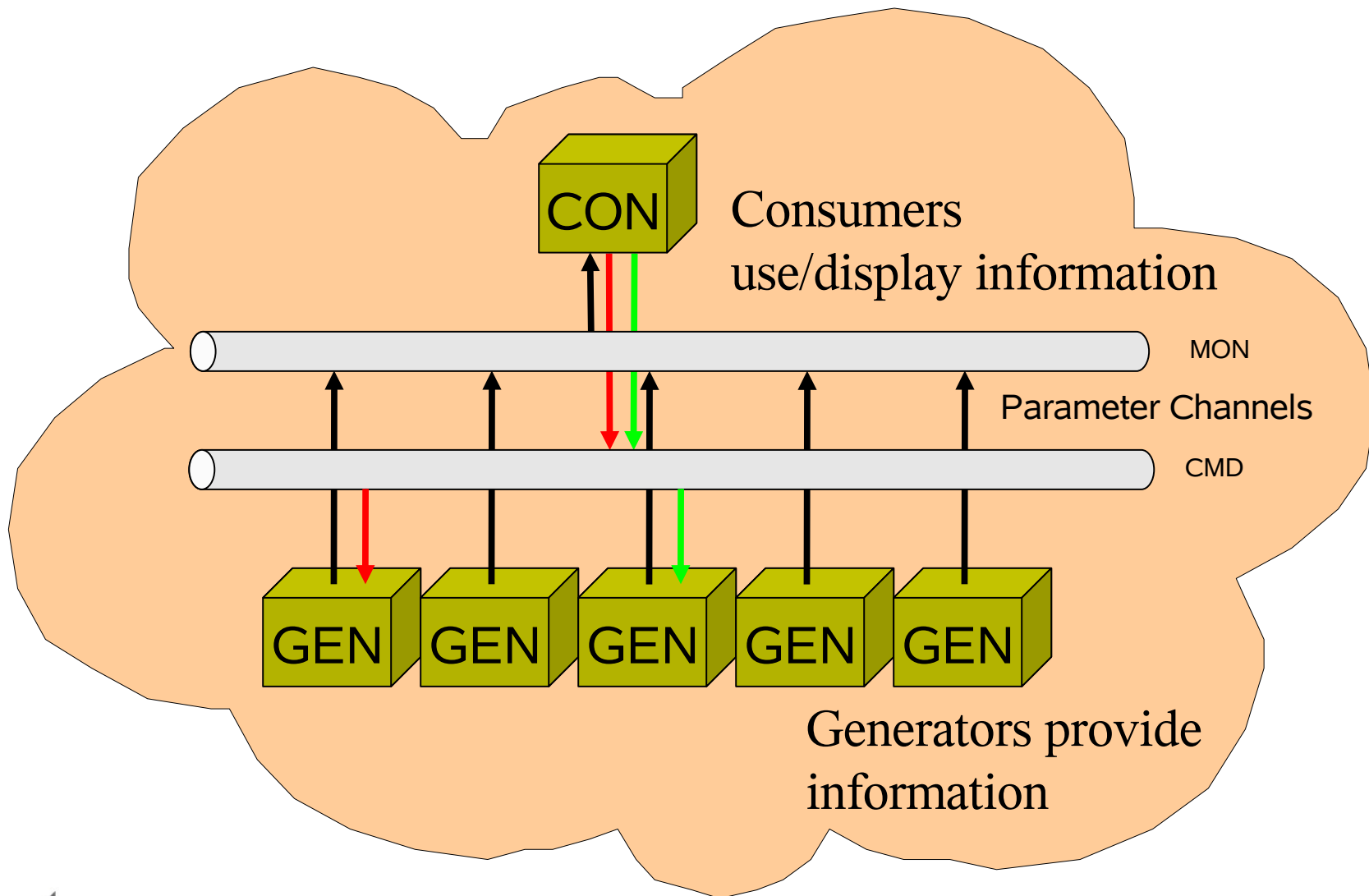
# Requirements for a Generic M&C-System



- Access to all hardware capabilities, especially all commands
- Hierarchical structure in monitoring and command
- Manually or automated

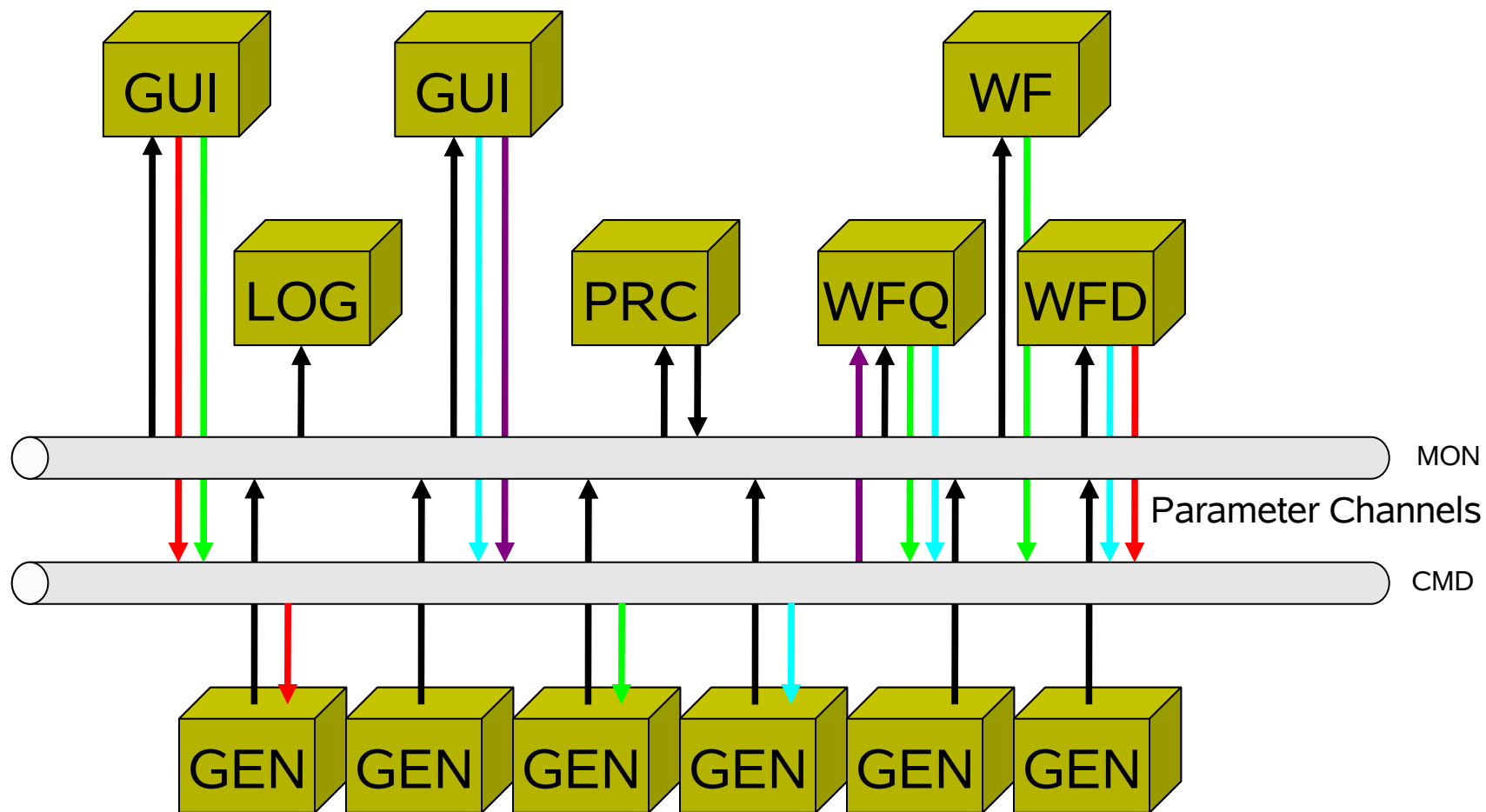
- Platform independent
- Scalable, distributed
- Fast and reliable

# A Generic M&C-System - Design Principle (1)

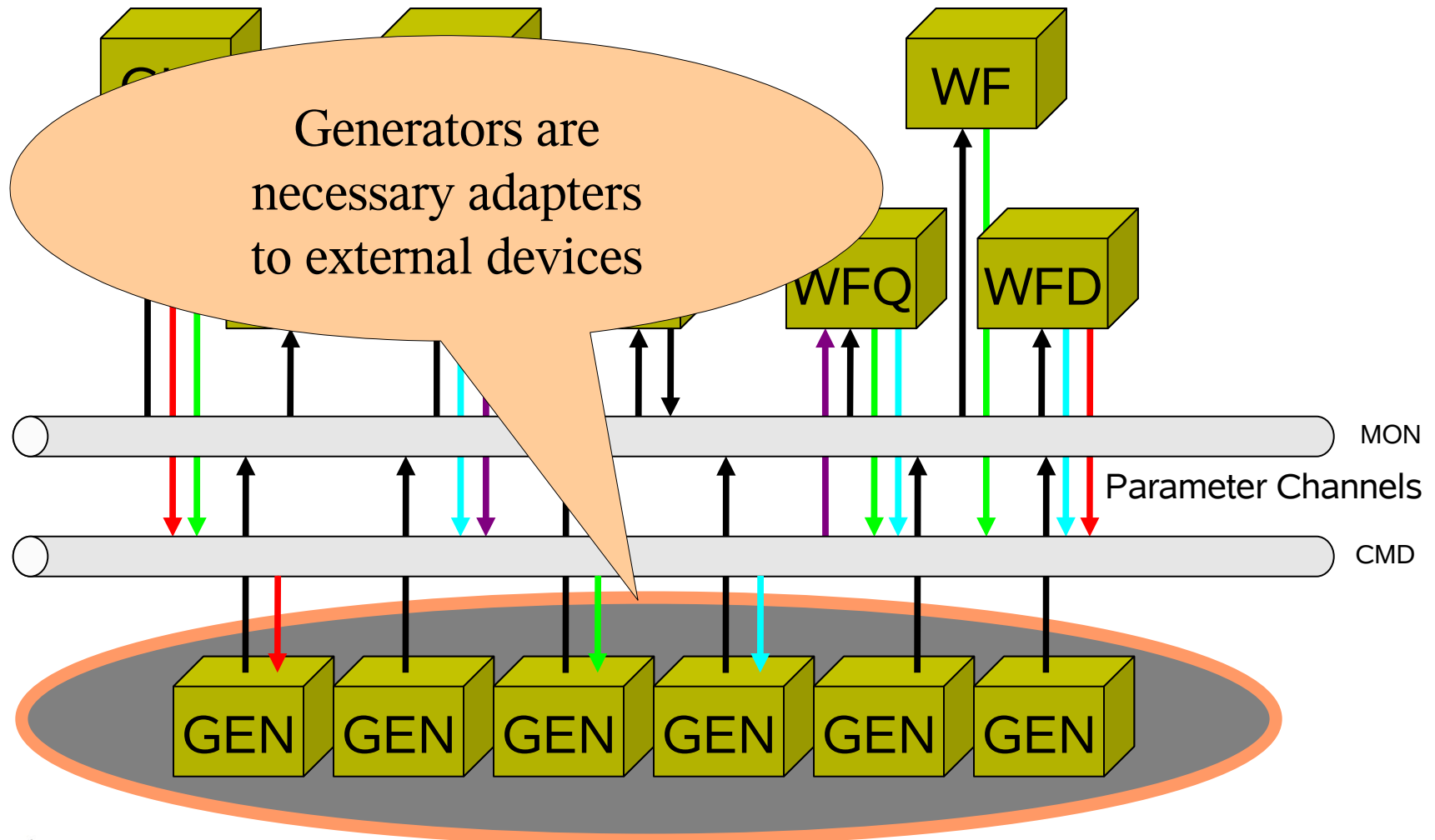




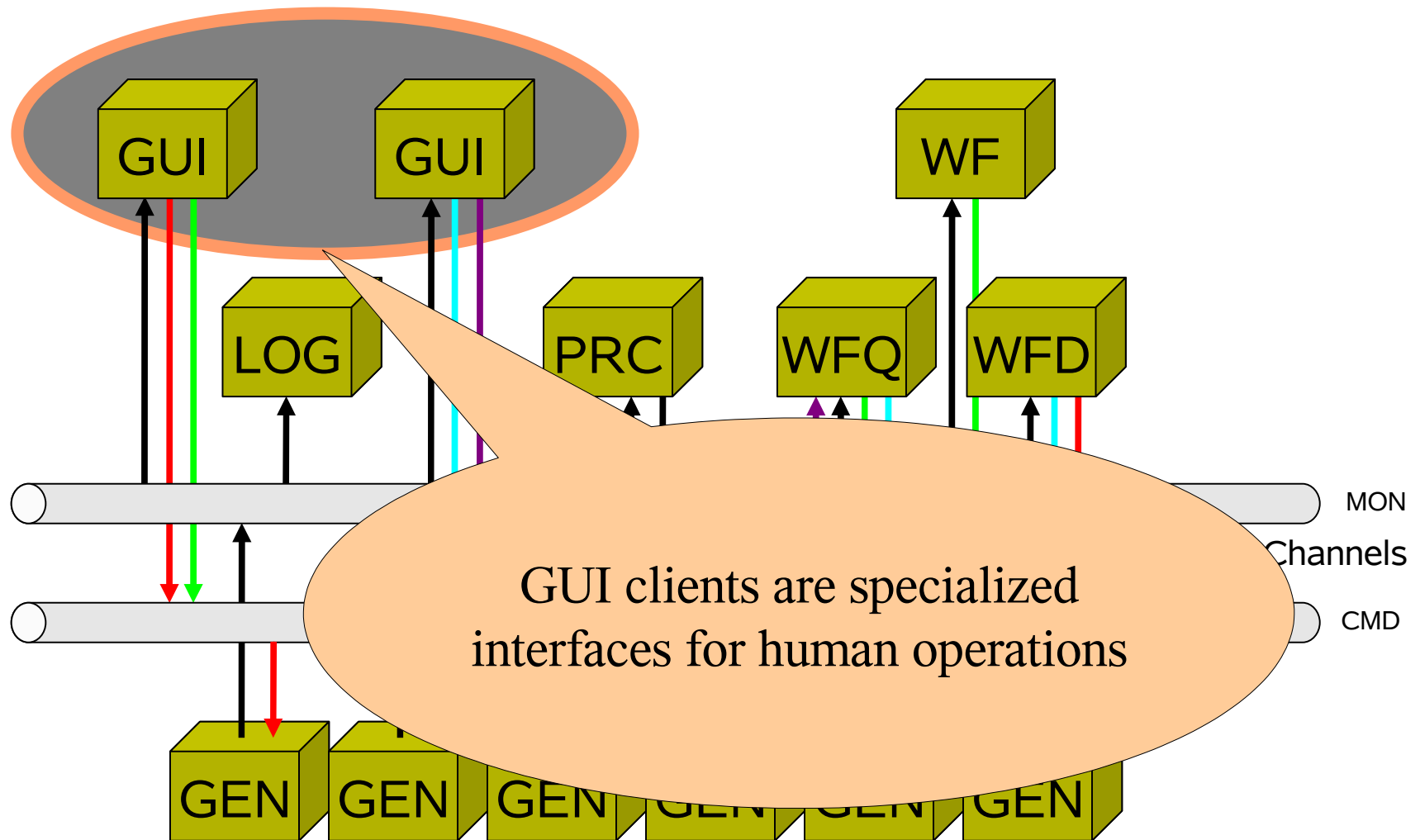
## A Generic M&C-System - Design Principle (2)

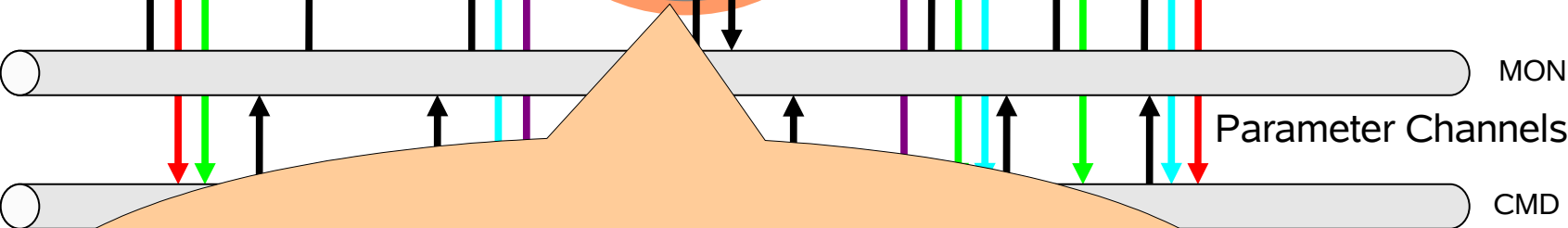


## A Generic M&C-System - Design Principle (2)



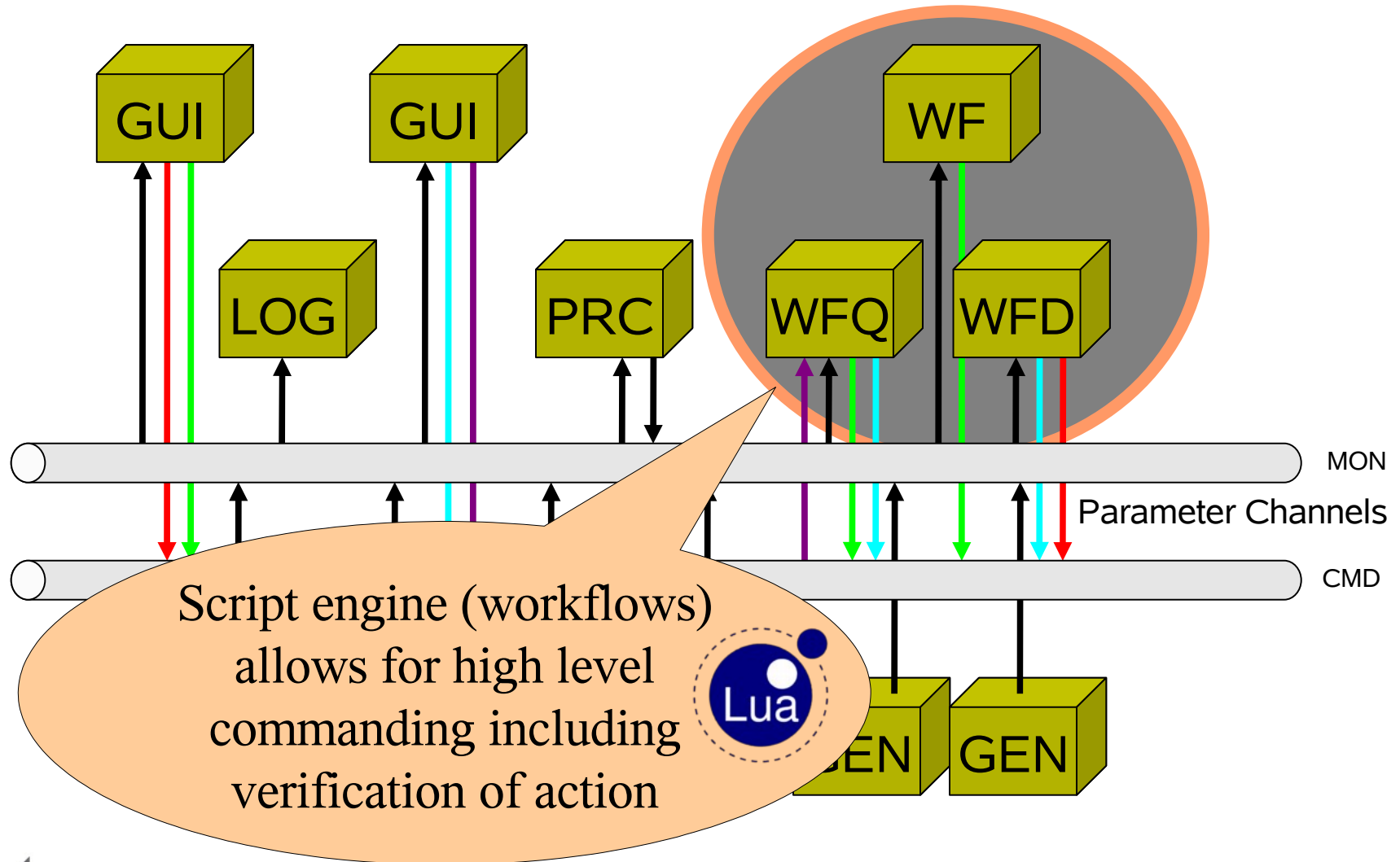
## A Generic M&C-System - Design Principle (2)



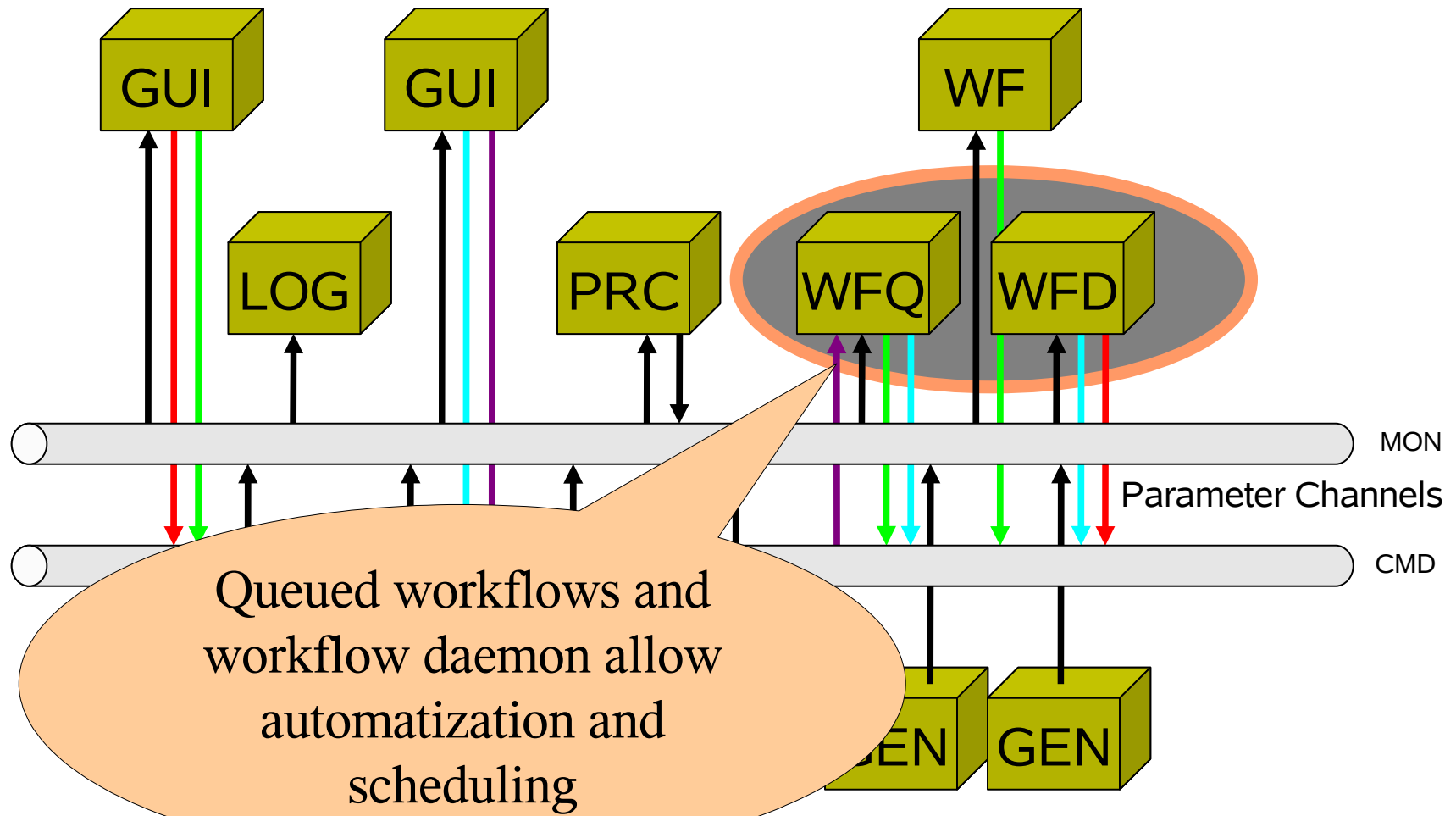




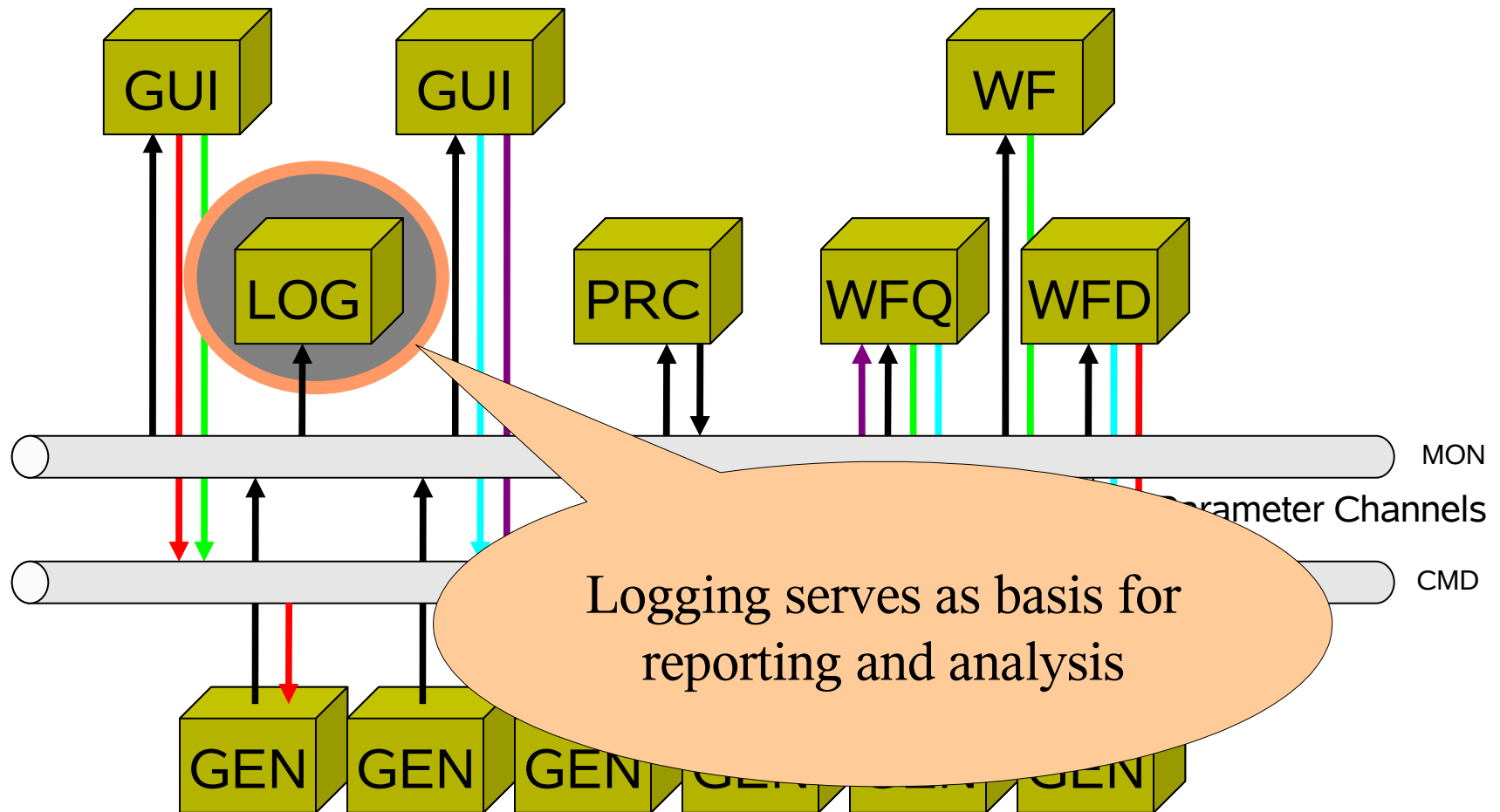
## A Generic M&C-System - Design Principle (2)



## A Generic M&C-System - Design Principle (2)



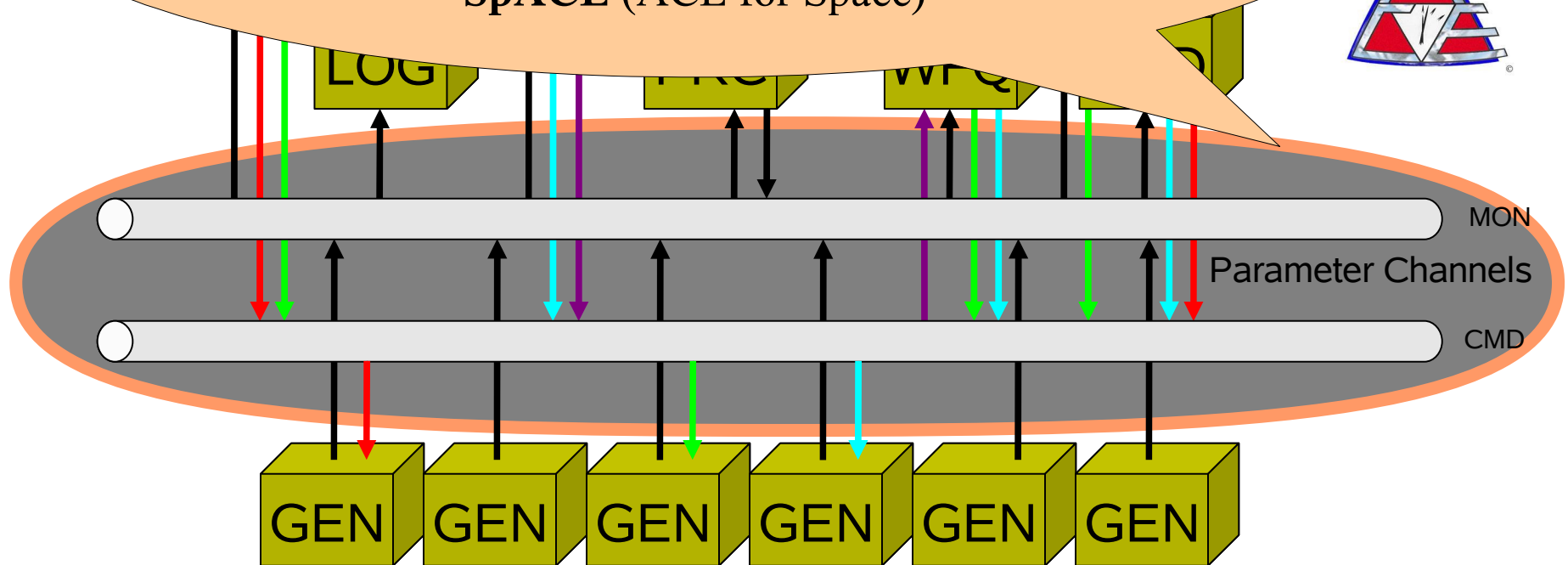
## A Generic M&C-System - Design Principle (2)




## A Generic M&C-System - Design Principle (2)

Standardized parameter exchange provides  
platform independent and distributed setup

SpACE (ACE for Space)



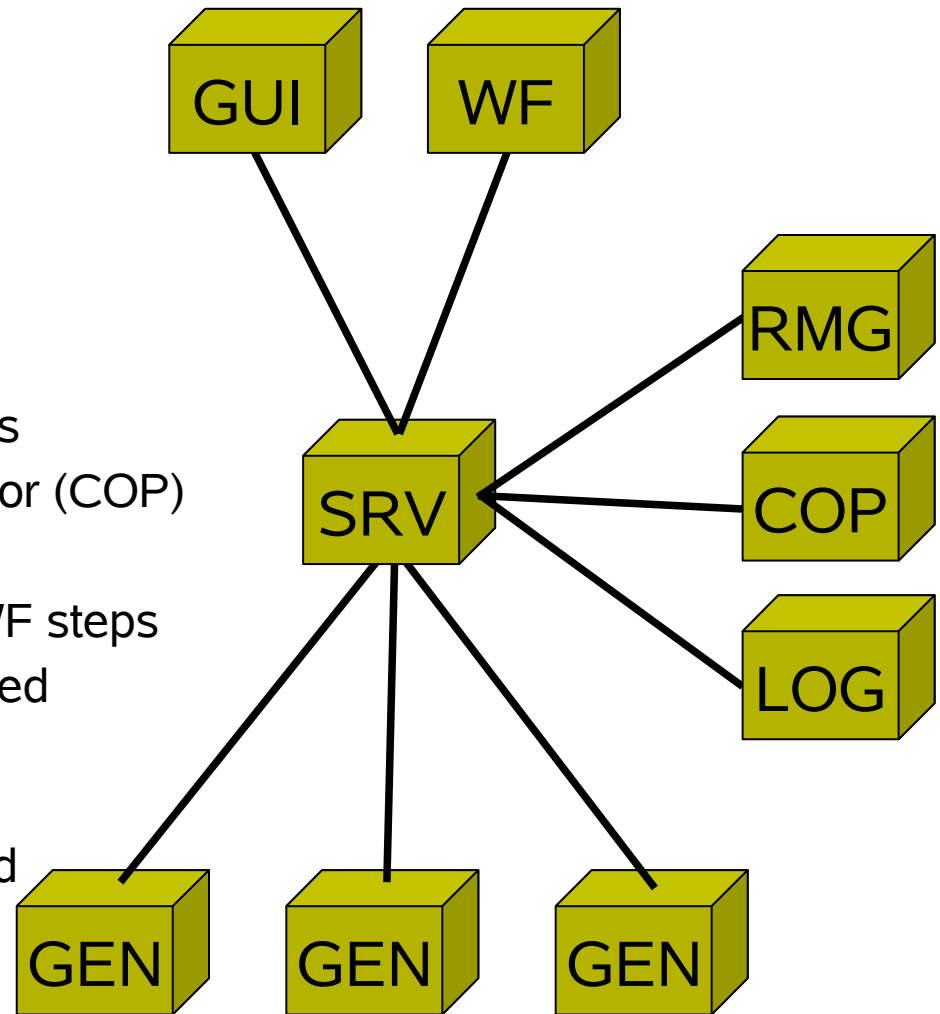
# The SpACE-Framework

- Classic three tier architecture
- Technology
  - Running on Linux, Solaris, Windows and other posix compliant platforms
  - Internal data exchange by TCP/IP
  - Written in C++ using OpenSource libraries only
- Core performance:
  - Tested for up to 12000 updates/second base load
  - Even more in bursts
- Interfaces
  - GUI applications based on Qt 
  - Various external protocols
    - ✓ TCP, UDP, SNMP, Corba, XML ...



# Toolkit

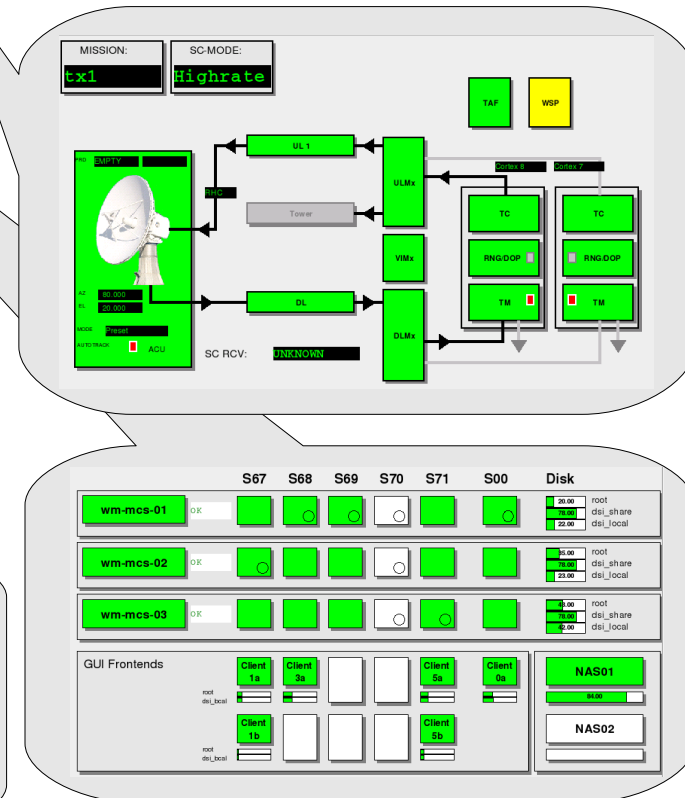
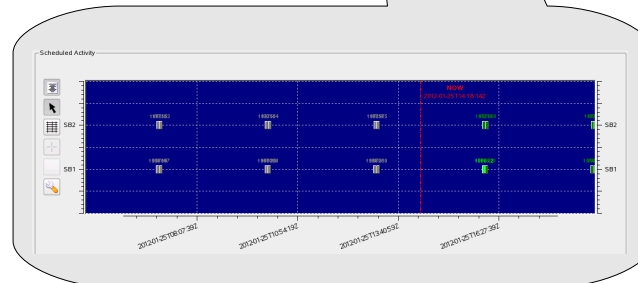
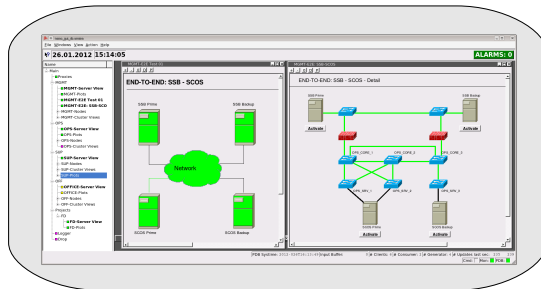
- Resource Manager (RMG)
  - Declares devices as
    - present
    - maintained
    - faulty
  - Informs WFs to ignore devices
- Configuration Observation Processor (COP)
  - State machine
  - Allows/Forbids WFs and/or WF steps
  - Reports deviations from desired settings
- Reporting
  - Fills a template (LaTeX) based on parameter logging
  - Automatically generated



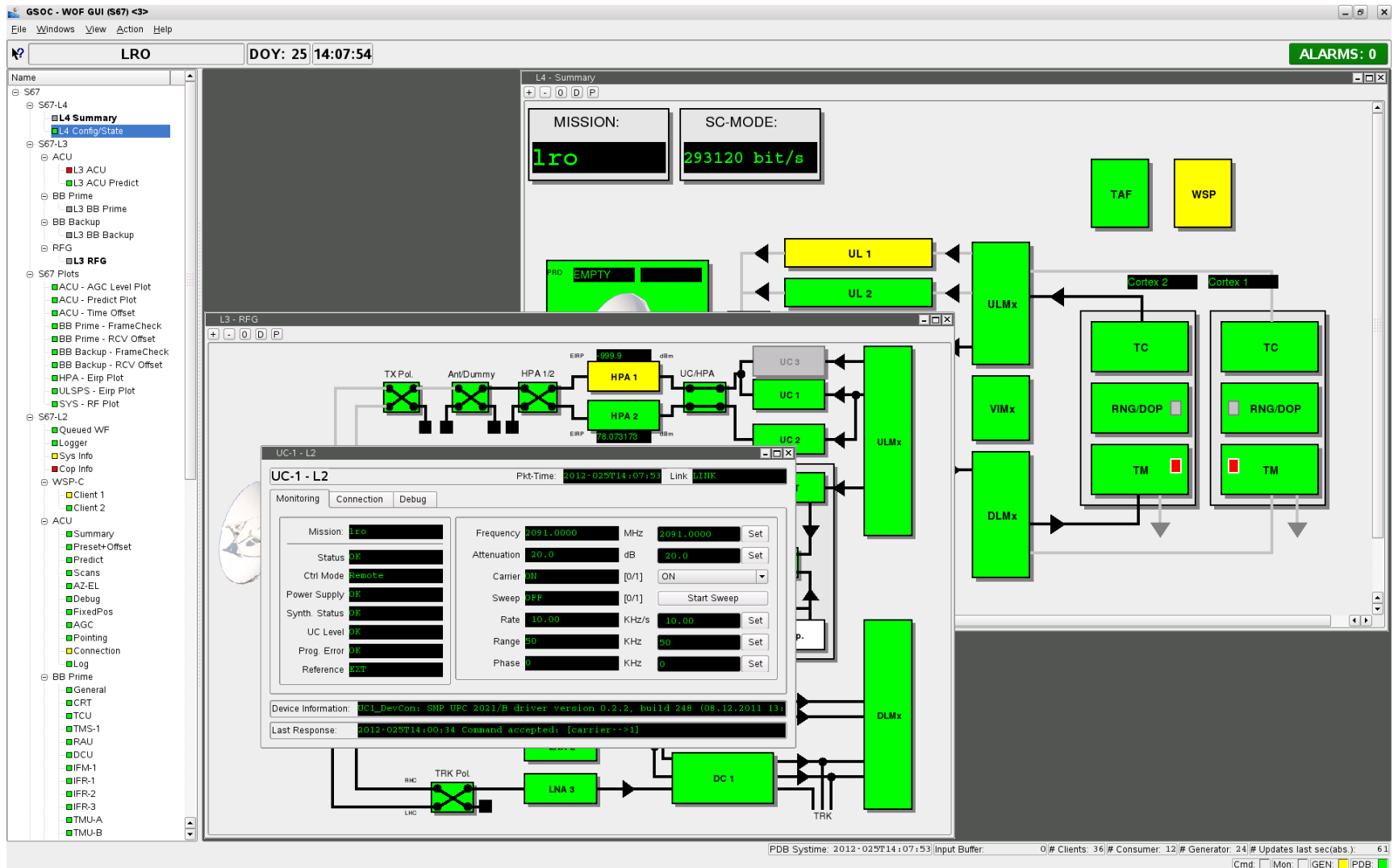


# Operational Instances of the SpACE-Framework

- Weilheim Antenna Remote Processing (WARP)
- Process Monitoring for WARP
- Automated Ranging for SatComBW
- Network Monitoring (NEMO) in GSOC



# WARP - Example: Structured Monitoring



# WARP - Example: High Level Commanding (1)

GSOC\_DSI\_WOF\_Workflow\_s67 - [Execute]

File Windows View Action Help

Missions: lro

Antenna Connect OK  
Acquire Pooled Cortex OK  
Mission Activate OK  
Setup DIR  
Antenna Preset OK  
Mission Setup OK  
HPA Prepare OK  
Predict Handling for current Mission OK  
Detailed Predict Handling DIR  
Spectrum Analysis DIR  
Trouble Shooting DIR  
Pre-Pass DIR  
Data Flow Test ON - Longloop OK  
UCT Reset OK  
Data Flow Test OFF - Longloop OK  
Ranging Calibration OK  
Prepare for Pass OK  
SC Modes DIR  
Pass DIR  
Post-Pass DIR  
Mission De-Activate OK  
Release Pooled Cortex OK  
Secure Antenna OK  
Antenna Disconnect OK  
Miscellaneous DIR  
Test DIR

Re-Read

Activities: Mission Setup

Name Valid

Antenna Connect OK  
Acquire Pooled Cortex OK  
Mission Activate OK  
Setup DIR  
Antenna Preset OK  
Mission Setup OK  
HPA Prepare OK  
Predict Handling for current Mission OK  
Detailed Predict Handling DIR  
Spectrum Analysis DIR  
Trouble Shooting DIR  
Pre-Pass DIR  
Data Flow Test ON - Longloop OK  
UCT Reset OK  
Data Flow Test OFF - Longloop OK  
Ranging Calibration OK  
Prepare for Pass OK  
SC Modes DIR  
Pass DIR  
Post-Pass DIR  
Mission De-Activate OK  
Release Pooled Cortex OK  
Secure Antenna OK  
Antenna Disconnect OK  
Miscellaneous DIR  
Test DIR

Apply

Activate Reset

Stop Start

Cmd: Mon: GEN: PDB:

LRO lro DOY: 25 14:03:03 ALARMS: 0

SysTime: 2012-02-25T14:03:02

Current Workflow: Mission Setup

Active Step: ---

#	Progress	ID	Name	Message
00001	100%		mission_setup_start	00004 ID:000-- --Script finished
00002	100%		mission_setup_check_precond	00010 ID:000-- --Script finished
00003	100%		store_mission_params	00107 ID:000-- --Script finished
00004	100%		cortex_reset	01386 ID:001-- --Script finished
00005	100%		mission_setup_check_CTXreset	00010 ID:000-- --Script finished
00006	100%		mission_setup	00649 ID:000-- --Script finished
00007	100%		mission_setup_set_CONmission	00009 ID:000-- --Script finished
00008	100%		mission_setup_check_ULmission	00010 ID:000-- --Script finished
00009	100%		mission_setup_uplink_setup	00029 ID:000-- --Script finished
00010	100%		switch_vmx_default	00016 ID:000-- --Script finished
00011	100%		mission_setup_set_ULmission	00009 ID:000-- --Script finished
00012	100%		Cond001	00005 ID:000-- --Script finished
00013	0%		mission_setup_check_DATAmission	
00014	0%		sle_on	
00015	0%		mission_setup_set_DATAmission	
00016	100%		mission_setup_runSpec	00016 ID:000-- --Script finished
00017	100%		mission_setup_finish	00004 ID:000-- --Script finished

Workflow

# Progress ID Name Message

00001 100% mission\_setup\_start 00004 ID:000-- --Script finished

00002 100% mission\_setup\_check\_precond 00010 ID:000-- --Script finished

00003 100% store\_mission\_params 00107 ID:000-- --Script finished

00004 100% cortex\_reset 01386 ID:001-- --Script finished

00005 100% mission\_setup\_check\_CTXreset 00010 ID:000-- --Script finished

00006 100% mission\_setup 00649 ID:000-- --Script finished

00007 100% mission\_setup\_set\_CONmission 00009 ID:000-- --Script finished

00008 100% mission\_setup\_check\_ULmission 00010 ID:000-- --Script finished

00009 100% mission\_setup\_uplink\_setup 00029 ID:000-- --Script finished

00010 100% switch\_vmx\_default 00016 ID:000-- --Script finished

00011 100% mission\_setup\_set\_ULmission 00009 ID:000-- --Script finished

00012 100% Cond001 00005 ID:000-- --Script finished

00013 0% mission\_setup\_check\_DATAmission

00014 0% sle\_on

00015 0% mission\_setup\_set\_DATAmission

00016 100% mission\_setup\_runSpec 00016 ID:000-- --Script finished

00017 100% mission\_setup\_finish 00004 ID:000-- --Script finished

00001 Starting script

00002 ID:000-- OK--Starting script

00003 ID:000--NTC--2012-02-25T14:00:32--Starting script

00004 ID:000--DBG--2012-02-25T14:00:32--Class : lro

00005 ID:000--DBG--2012-02-25T14:00:33--Instance: WOF

00006 ID:000--DBG--2012-02-25T14:00:33--Antenna : S67

00007 ID:000--DBG--2012-02-25T14:00:33--File : uplink\_setup

00008 ID:000--DBG--2012-02-25T14:00:33--Table : UPLINK

00009 ID:000--INF--2012-02-25T14:00:33--Wof Class:execute\_data\_table: Check param S67\_L2\_ULSPS\_MON

00010 ID:000--NTC--2012-02-25T14:00:33-- [S67\_L2\_ULSPS\_MON|txSignalDestination]: Success: set to

00011 ID:000--INF--2012-02-25T14:00:33-- Wof Class:verifyGroup: Successfully set 1 params to the

00012 ID:000--DBG--2012-02-25T14:00:33--Wof Class:execute\_data\_table: Operation on group S71\_L2\_H

00013 ID:000--DBG--2012-02-25T14:00:33--Wof Class:execute\_data\_table: Set param S67\_L2\_CTX1\_CMD

00014 ID:000--DBG--2012-02-25T14:00:33--Wof Class:execute\_data\_table: Set param S67\_L2\_CTX2\_CMD

00015 ID:000--DBG--2012-02-25T14:00:33--Wof Class:execute\_data\_table: Set param S67\_L2\_CTX1\_CMD

00016 ID:000--DBG--2012-02-25T14:00:33--Wof Class:execute\_data\_table: Set param S67\_L2\_CTX2\_CMD

00017 ID:000--DBG--2012-02-25T14:00:34--Wof Class:execute\_data\_table: Set param S67\_L2\_UC1\_CMD

00018 ID:000--DBG--2012-02-25T14:00:34--Wof Class:execute\_data\_table: Set param S67\_L2\_UC2\_CMD

00019 ID:000--INF--2012-02-25T14:00:34-- Wof Class:execute\_data\_table: VERIFY params marked with

00020 ID:000--NTC--2012-02-25T14:00:34-- [S67\_L2\_CTX1\_MON|ifm1\_ModulationEnable]: Success: set t

00021 ID:000--NTC--2012-02-25T14:00:34-- [S67\_L2\_CTX2\_MON|ifm1\_ModulationEnable]: Success: set t

00022 ID:000--NTC--2012-02-25T14:00:34-- [S67\_L2\_UC1\_MON|carrier]: Success: set to ON (0 cycles)

00023 ID:000--NTC--2012-02-25T14:00:34-- [S67\_L2\_UC2\_MON|carrier]: Success: set to ON (0 cycles)

00024 ID:000--NTC--2012-02-25T14:00:35-- [S67\_L2\_CTX1\_MON|ifm1\_CarrierEnable]: Success: set to 1

00025 ID:000--NTC--2012-02-25T14:00:35-- [S67\_L2\_CTX2\_MON|ifm1\_CarrierEnable]: Success: set to 1

00026 ID:000--INF--2012-02-25T14:00:36-- Wof Class:verifyGroup: Successfully set 6 params to the

00027 ID:000--DBG--2012-02-25T14:00:36--Wof Class:include\_data\_table: File not found /opt/dsi/ev

00028 ID:000--NTC--2012-02-25T14:00:36--Exiting script

00029 ID:000-- --Script finished

00011 ID:000-- --Script finished

00009 ID:000-- --Script finished

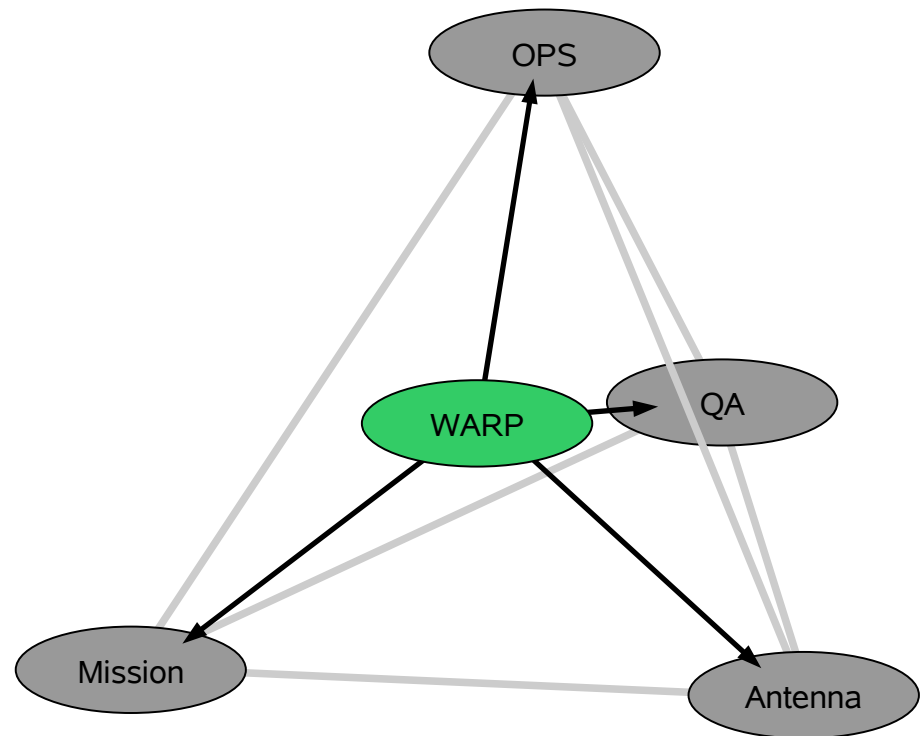
00005 ID:000-- --Script finished

# WARP - Example: High Level Commanding (2)

```
GSOC_DSI:_WOF_Workflow_(s69) - [Execute]
File Windows View Action Help
TD1 td1 DOY: 24 21:32:55 ALARMS: 0
SysTime: 2012-024T22:32:55
Current Workflow: Antenna Preset Active S ---
Workflow
Message
00021 Starting script
00022 ID:009-- OK--Starting script
00041 ID:009--NTC--2012-024T20:59:45--Starting script
00045 ID:009--DBG--2012-024T20:59:45--Class : tdl
00067 ID:009--DBG--2012-024T20:59:45--Instance: WOF
00077 ID:009--DBG--2012-024T20:59:45--Antenna : S69
00093 ID:009--DBG--2012-024T20:59:45--File : default_uc1
00103 ID:009--DBG--2012-024T20:59:45--Table : DEFAULT_UC1
00120 ID:009--DBG--2012-024T20:59:48--Wof_Class:execute_data_table: Set param S69_L2_UC1_CMD|frequency to 2075
00131 ID:009--DBG--2012-024T20:59:49--Wof_Class:execute_data_table: Set param S69_L2_UC1_CMD|attenuation to 4
00149 ID:009--DBG--2012-024T20:59:49--Wof_Class:execute_data_table: Set param S69_L2_UC1_CMD|carrier to OFF
00152 ID:009--DBG--2012-024T20:59:49--Wof_Class:execute_data_table: Set param S69_L2_UC1_CMD|sweepRate to 1
00164 ID:009--DBG--2012-024T20:59:49--Wof_Class:execute_data_table: Set param S69_L2_UC1_CMD|sweepRange to 5
00175 ID:009--DBG--2012-024T20:59:49--Wof_Class:execute_data_table: Set param S69_L2_UC1_CMD|sweepPhase to 0
00179 ID:009--INF--2012-024T20:59:49-- Wof_Class:execute_data_table: VERIFY params marked with ALL now
00204 ID:009--NTC--2012-024T20:59:50-- [S69_L2_UC1_MON|frequency]: Success: set to 2075 | 2075+/-0.25 (0 cycles)
00217 ID:009--NTC--2012-024T20:59:50-- [S69_L2_UC1_MON|attenuation]: Success: set to 4 (0 cycles)
00226 ID:009--NTC--2012-024T20:59:50-- [S69_L2_UC1_MON|carrier]: Success: set to OFF (0 cycles)
00237 ID:009--NTC--2012-024T20:59:50-- [S69_L2_UC1_MON|sweepRate]: Success: set to 1 | 1+/-0.05 (0 cycles)
00248 ID:009--NTC--2012-024T20:59:50-- [S69_L2_UC1_MON|sweepRange]: Success: set to 5 (0 cycles)
00259 ID:009--NTC--2012-024T20:59:51-- [S69_L2_UC1_MON|sweepPhase]: Success: set to 0 (0 cycles)
00294 ID:009--INF--2012-024T20:59:51-- Wof_Class:verifyGroup: Successfully set 6 params to their limits after 0 cycles of 500 ms
00306 ID:009--DBG--2012-024T20:59:52--Wof_Class:include_data_table: File not found (/home/hauke/SpACE/p_wof/etc/wof/lua/data/s69/default_uc1.lua)
00312 ID:009--NTC--2012-024T20:59:52--Exiting script
00316 ID:009-- --Script finished
Activate Reset Stop Start
Cmd: Mon: GEN: PDB:
```

# WARP - An Object Oriented Design for Operations

- Mission Definition
  - Abstract parameters like
    - Frequencies
    - Bitrates
- Antenna Definition
  - Applicable devices
    - Do's and dont's
    - Calibrations
    - Parameter ranges
- Operations Concept
  - Unified procedures for
    - ✓ Various antennas
    - ✓ Various missions
- QA
  - Few inputs
  - Checkable against settings



# WARP - An Object Oriented Design for Operations

- Mission Definition
  - Abstract parameters like
    - Frequencies
    - Bitrates
- Antenna Definition
  - Applicable devices
    - Do's and dont's
    - Calibrations
    - Parameter ranges
- Operations Concept
  - Unified procedures for
    - ✓ Various antennas
    - ✓ Various missions
- QA
  - Few inputs
  - Checkable against settings

Antenna Specific Settings

File Help

Antenna Settings Fixed Positions Clystron Settings TRK Phase Calibration

Desc.	S67	S69	S71
1 LAT	47.88006944	47.88119889	47.88119889
2 LONG	11.08530250	11.08361889	11.08361889
3 H	663.392	663.374	663.374
4 FD ID	3267	3271	3271
5 FD MNE	WHM1	WHM2	WHM3
6 MNE	S67	S69	S71
7 GAIN	46.40	47.20	47.20
8 GAIN COR	0.00	0.00	0.00
9 CableLoss	0.00	0.00	0.00
10 HPA1 CableLoss	0.00	0.00	0.00
11 HPA2 CableLoss	0.00	0.00	0.00
12 HPA1 EIRP MIN	46.40	47.20	47.20
13 HPA1 EIRP MAX	69.41	70.21	70.21
14 HPA1 UC Attenuation	7	7	7
15 HPA2 EIRP MIN	46.40	47.20	47.20
16 HPA2 EIRP MAX	79.41	80.21	80.21
17 HPA2 UC Attenuation	7	7	7
18 UC1 CableLoss	3	3	3
19 UC2 CableLoss	0	0	0
20 UC3 CableLoss	3	3	3
21 Channel1 DL1 GAIN	55.40	58.00	58.00
22 Channel2 DL1 GAIN	55.40	58.00	58.00
23 Channel3 DL1 GAIN	55.40	58.00	58.00
24 Channel1 DL2 GAIN	55.40	58.00	58.00
25 Channel2 DL2 GAIN	55.40	58.00	58.00
26 Channel3 DL2 GAIN	55.40	58.00	58.00
27 LEO DC Attenuation	7.0	7.0	7.0
28 GEO DC Attenuation	2.0	2.0	2.0
29 RINGSYN LEVEL	10.00	-10.00	-10.00
30 UCT Attenuation	20	20	20
31 PRD POINTS MAX	2900	2900	2900
32 AZ MIN	0.00	0.00	0.00
33 AZ MAX	360.00	360.00	360.00
34 EL MIN	6.00	2.00	2.00
35 EL MAX	174.00	177.00	177.00
36 EL PRD MIN	6.30	3.00	3.00
37 EL PRD MAX	173.70	176.00	176.00

Mission Editor

File Edit Help

Mission: **BIR** ...

Parameter

Default Lowrate Highrate Default @ S67

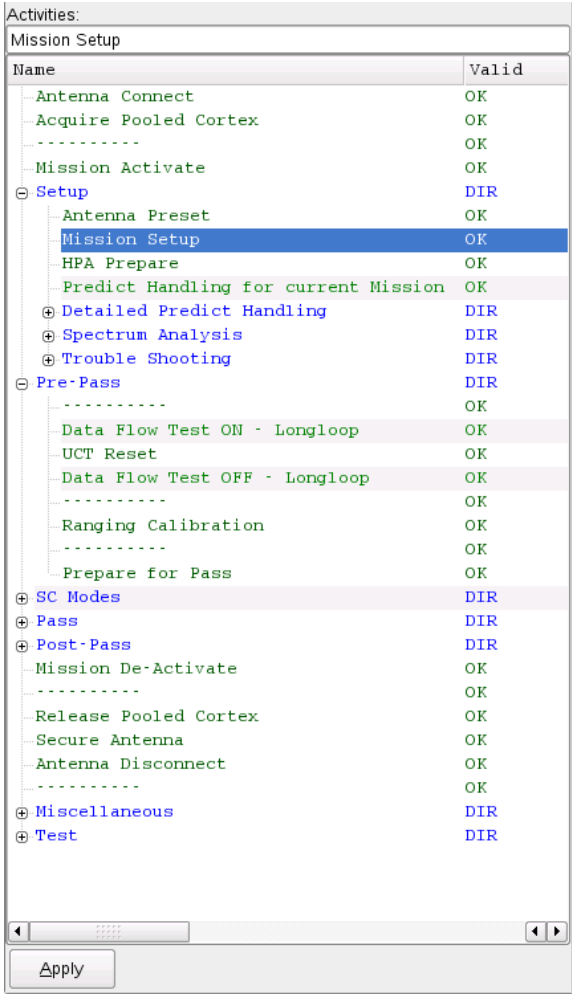
Name	Value
27 r_LoopFilterBandwidth	2
28 r_AcquisitionRange	100000
29 r_AGCTimeConstant	0
30 r_SubcarrierFrequency	0
31 r_SubcarrierDemodulationType	0
32 r_PSKDemodulatorLoopBandwidth	1
33 r_PCMLCode	0
34 r_HRdirectPCMMatchFilter	0
35 r_HRdirectPCMRollOffFactor	0.1
36 r_Bitrate	137500.000
37 r_ConvolutionalCoding	0
38 r_TMFormat	1
39 r_AttachedSyncMarker	1ACFFC1D
40 r_AttachedSyncMarkerLength	32
41 r_FrameLength	508
42 r_FrameChecking	0
43 r_Randomization	0
44 r_FrameEncoding	0
45 r_ReedSolomonInterleavingDepth	0
46 r_DiversityCombining	1
47 r_DiversityCombiningMode	1
48 r_DiversityCombiningOut1	2
49 r_DiversityCombiningOut2	0
50 r_ChannelAPort	0
51 r_ChannelBPort	1
52 r_FrameECFPresent	1
53 r_FrameOCFPresent	1
54 r_spectralBandwidth	2500
55 f_EIRP	68.0
56 f_ModulatingSignal	6
57 f_Polarization	1
58 f_HPAPrime	0
59 f_UplinkFrequency	2032.5
60 f_UplinkIntermediateFrequency	70.000000
61 f_Sweep	0
62 f_SweepRange	50
63 f_SweepRate	50
64 f_ModulationType	1
65 f_ModulationIndex	1.6
66 f_FrequencyDeviation	0.0
67 f_PulseShapingFilterRC	0
68 f_PulseShapingFilterRCRollOffFactor	0.1





# WARP - An Object Oriented Design for Operations

- Mission Definition
  - Abstract parameters like
    - Frequencies
    - Bitrates
- Antenna Definition
  - Applicable devices
    - Do's and dont's
    - Calibrations
    - Parameter ranges
- Operations Concept
  - Unified procedures for
    - ✓ Various antennas
    - ✓ Various missions
- QA
  - Few inputs
  - Checkable against settings

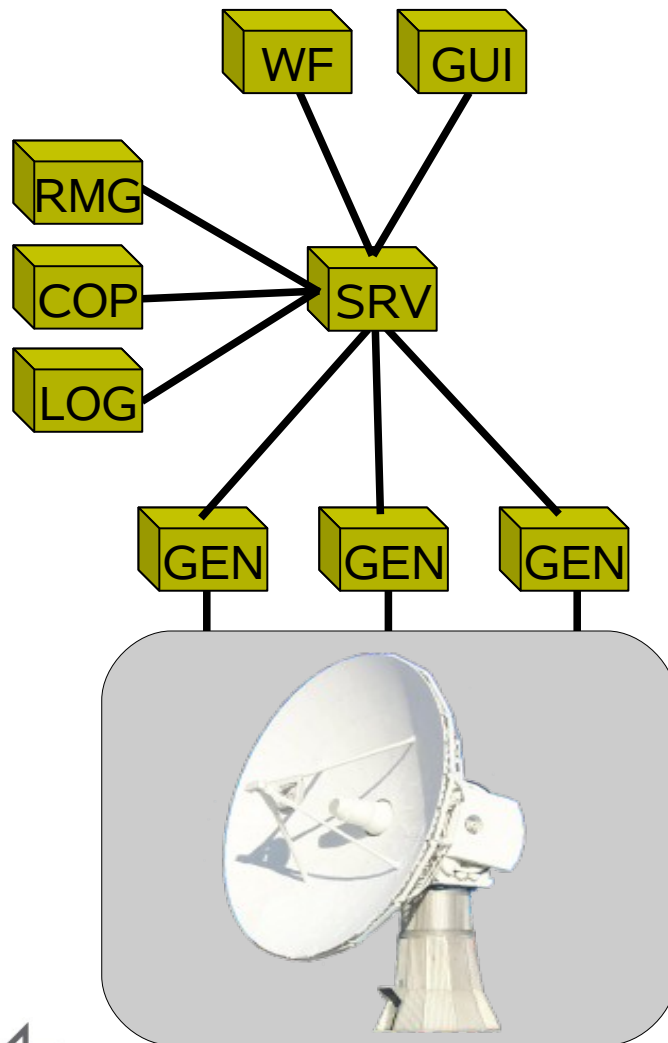


The screenshot shows a software interface titled 'Activities: Mission Setup'. It contains a table with two columns: 'Name' and 'Valid'. The table lists various mission activities, some of which are expanded to show sub-activities. The 'Valid' column indicates the status of each activity, with 'OK' in green and 'DIR' in blue.

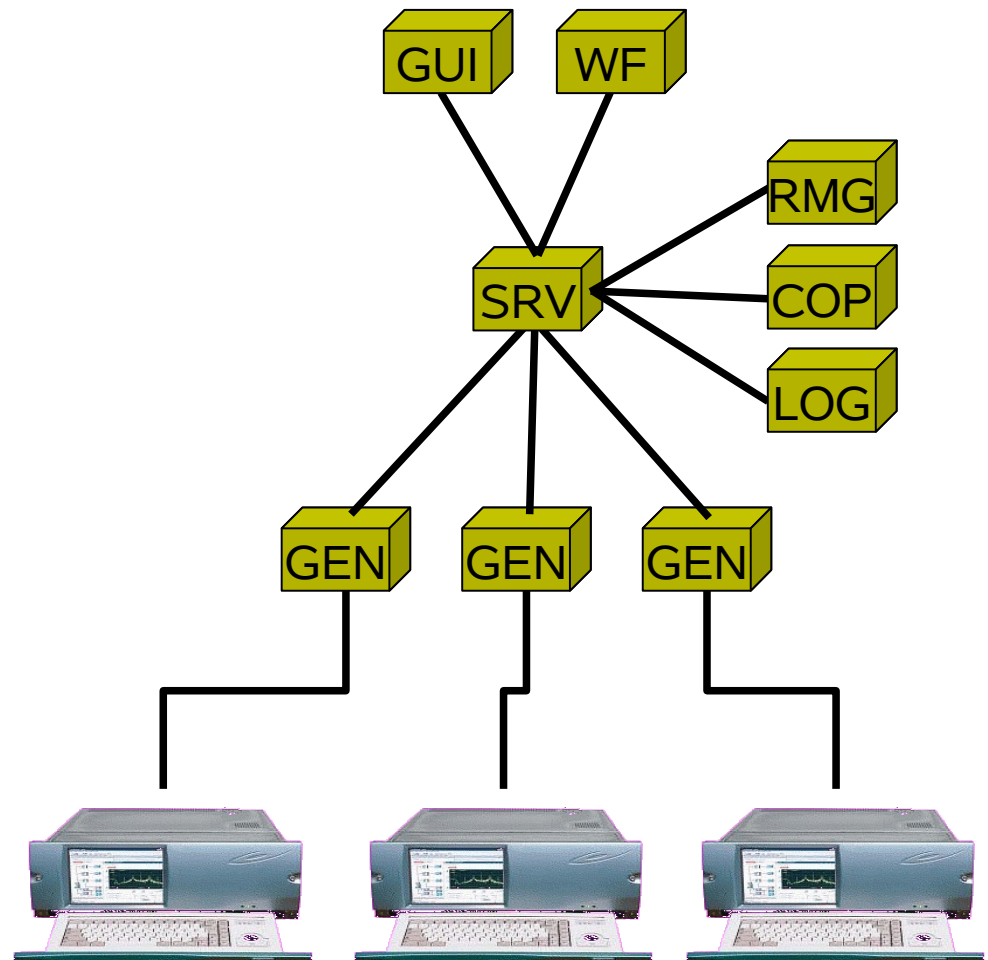
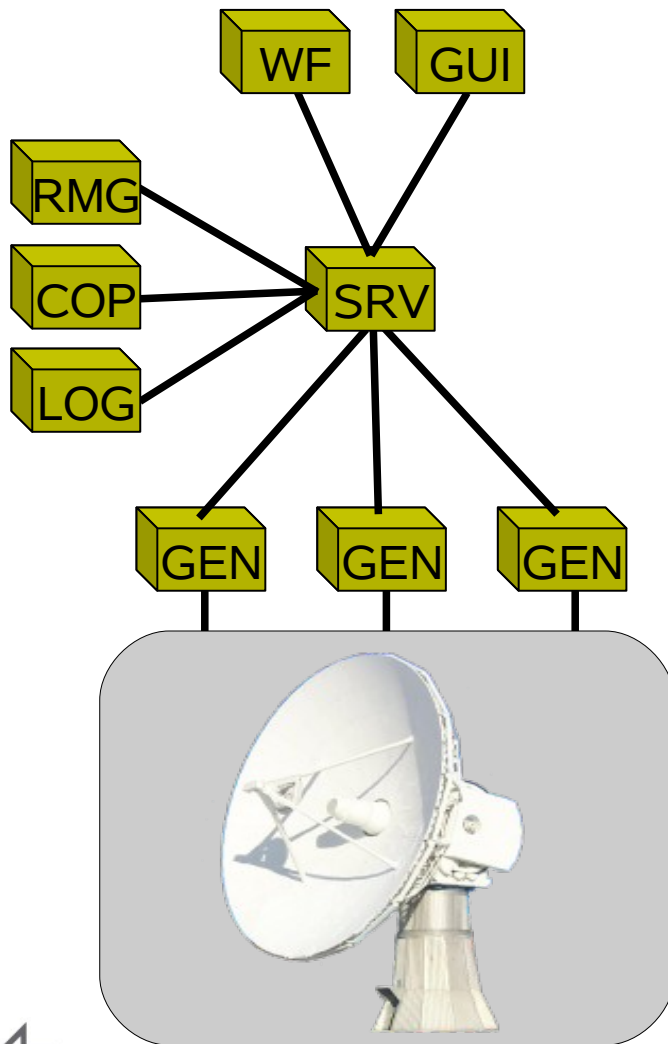
Name	Valid
Antenna Connect	OK
Acquire Pooled Cortex	OK
-----	OK
Mission Activate	OK
⊖ Setup	DIR
Antenna Preset	OK
Mission Setup	OK
HPA Prepare	OK
Predict Handling for current Mission	OK
⊕ Detailed Predict Handling	DIR
⊕ Spectrum Analysis	DIR
⊕ Trouble Shooting	DIR
⊖ Pre-Pass	DIR
-----	OK
Data Flow Test ON - Longloop	OK
UCT Reset	OK
Data Flow Test OFF - Longloop	OK
-----	OK
Ranging Calibration	OK
-----	OK
Prepare for Pass	OK
⊕ SC Modes	DIR
⊕ Pass	DIR
⊕ Post-Pass	DIR
Mission De-Activate	OK
-----	OK
Release Pooled Cortex	OK
Secure Antenna	OK
Antenna Disconnect	OK
-----	OK
⊕ Miscellaneous	DIR
⊕ Test	DIR

At the bottom of the interface, there is a scroll bar and an 'Apply' button.

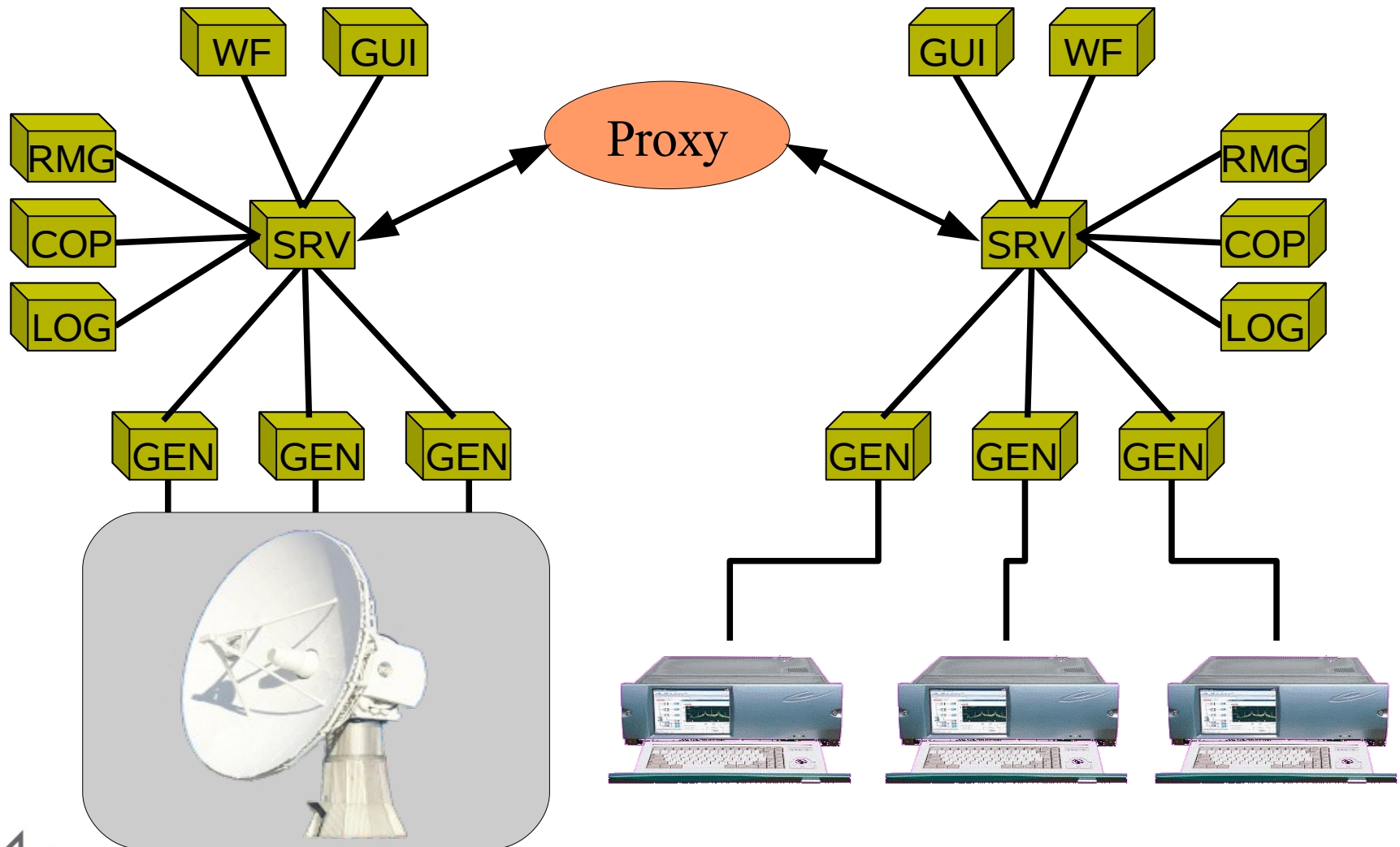
# Connecting SpACEs - The Grand Picture



# Connecting SpACEs - The Grand Picture



# Connecting SpACEs - The Grand Picture



# Connecting SpACEs - The Grand Picture

GSOC - WOF GUI (S00)

File Windows View Action Help

DOY: 25 14:56:21

ALARMS: 0

Name

- S00
  - S00-L4
    - Station Sum.
  - S00-L2
    - Logger
    - Sys Info
    - Cop Info
    - ULS
    - DLS
    - DLS\_NOV
    - VMX
    - TAF

ULS

Monitoring Connection Debug

General

Remote Control Enabled ☐ Power Supply #1 Alarm ☐

Matrix

	S67U1	S67U2	S69U1	S69U2	S70U1	TOWER	S71U1	SPE
BB001								
BB002								
BB003								
BB004								
BB005								

S71 **w03**

State: **PASS**  
**DOWNLINK**

BB prime: **Cortex 8**  
BB backup: **Cortex 7**

S69 **gr1**

State: **STANDBY FOR PASS**  
**UP/DOWNLINK**

BB prime: **Cortex 4**  
BB backup: **Cortex 3**

S70

State: **UNKNOWN**

BB prime: **---**  
BB backup: **---**

STATION RMG - L2

Station Resources

Pkt-Time: 2012-02-25T14:56:19.4795

Class	Resource	State	Owner	Task	Start	Stop	Desc.	ID
CTX	129.247.245.53 POOL_LOCKED S67	BACKUP	2012-02-25T14:55:54.882011Z	3000-001T00:00:00.000000Z	Cortex 1	1,1		
CTX	129.247.245.54 POOL_LOCKED S67	PRIME	2012-02-25T14:55:54.884074Z	3000-001T00:00:00.000000Z	Cortex 2	1,2		
CTX	129.247.245.55 POOL_LOCKED S69	BACKUP	2012-02-25T14:55:54.885446Z	3000-001T00:00:00.000000Z	Cortex 3	1,3		
CTX	129.247.245.56 POOL_LOCKED S69	PRIME	2012-02-25T14:55:54.887010Z	3000-001T00:00:00.000000Z	Cortex 4	1,4		
CTX	129.247.245.57 POOL_FREE	SYSTEM POOLED	2012-02-25T14:55:54.892561Z	3000-001T00:00:00.000000Z	Cortex 5	1,5		
CTX	129.247.245.58 POOL_FREE	SYSTEM POOLED	2012-02-25T14:55:54.894876Z	3000-001T00:00:00.000000Z	Cortex 6	1,6		
CTX	129.247.245.59 POOL_LOCKED S71	BACKUP	2012-02-25T14:55:54.895335Z	3000-001T00:00:00.000000Z	Cortex 7	1,7		
CTX	129.247.245.77 POOL_LOCKED S71	PRIME	2012-02-25T14:55:54.895665Z	3000-001T00:00:00.000000Z	Cortex 8	1,8		
CTX	129.247.245.67 POOL_FREE	SYSTEM POOLED	2012-02-25T14:55:54.898840Z	3000-001T00:00:00.000000Z	Cortex 10	1,9		
ULS	129.247.245.38 PRESENT	SYSTEM	---	2012-02-25T14:55:54.902319Z	3000-001T00:00:00.000000Z	ZUL Switch Matrix	2,1	
DLS	10.21.2.174 PRESENT	SYSTEM	---	2012-02-25T14:55:54.902739Z	3000-001T00:00:00.000000Z	ZDL Switch Matrix	3,1	
VMX	129.247.245.71 PRESENT	SYSTEM	---	2012-02-25T14:55:54.906979Z	3000-001T00:00:00.000000Z	Video Matrix	4,1	
TAF	129.247.245.27 PRESENT	SYSTEM	---	2012-02-25T14:55:54.907408Z	3000-001T00:00:00.000000Z	Time and Frequency	5,1	
TUC	129.247.245.17 POOL_FREE	SYSTEM	---	2012-02-25T14:55:54.907850Z	3000-001T00:00:00.000000Z	Tower Upconverter	6,1	

DLS [Novotronic]

Monitoring Device Information Connection Debug

General

Status: **Nominal**

Manual Control Alarm ☐

Matrix

	BB01A	BB01B	BB02A	BB02B	BB03A
Idle					
S67R1					
S67L1					
S69R1					
S69L1					
S70RC					
S70LC					
S71RC					
S71LC					
S67R2					
S67L2					
S69R2					
S69L2					
Spare					
Spare					
Spare					
S73C1					
S73C2					
S73E1					
Spare					

S67 **tx1**

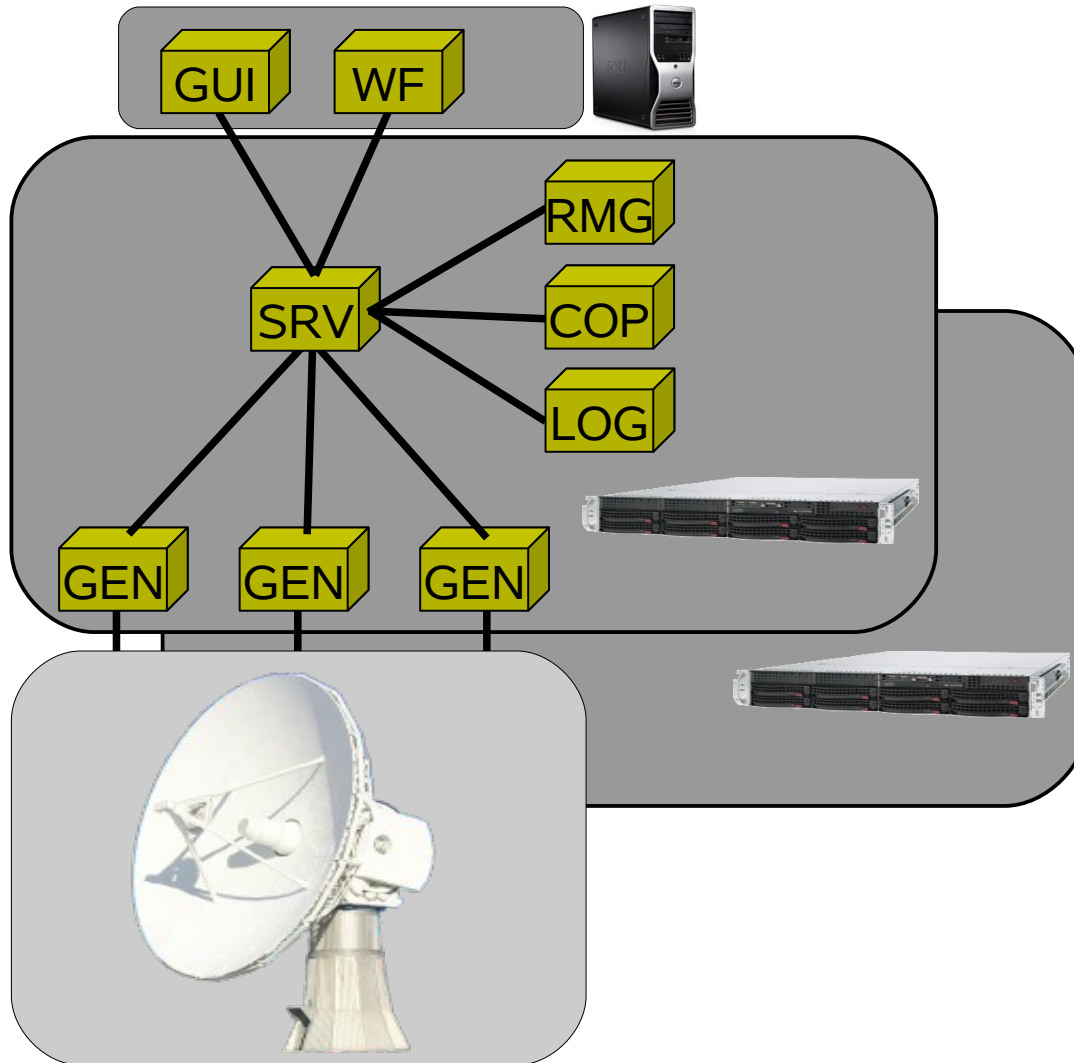
State: **SETUP FOR MISSION**  
**DOWNLINK**

BB prime: **Cortex 2**  
BB backup: **Cortex 1**

PDB System: 2012-02-25T14:56:21 Input Buffer: 0 # Clients: 16 # Consumer: 9 # Generator: 7 # Updates last sec(abs.): 5

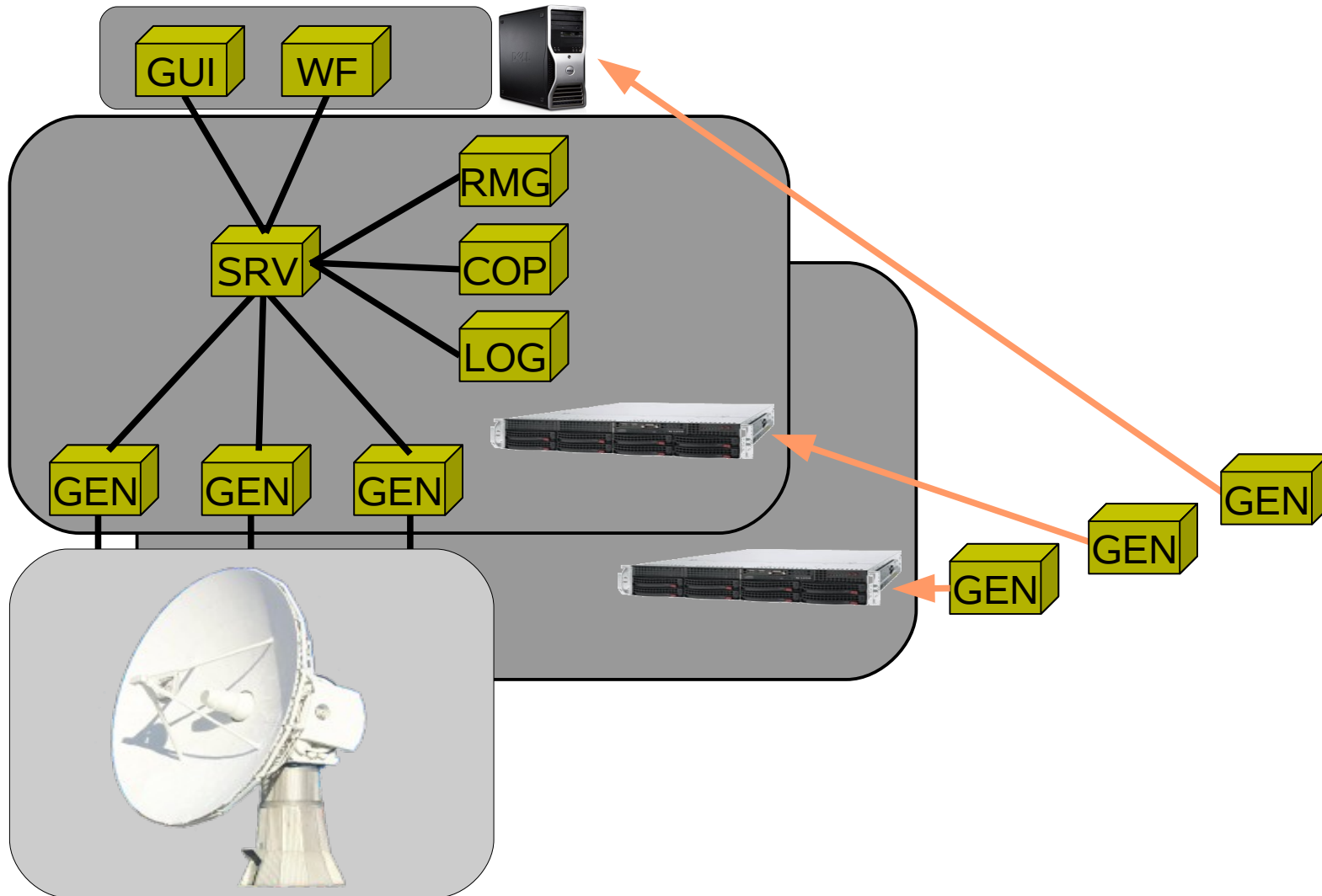
Cmd: Mon: GEN: PDB:

## Process Monitoring and Control - SpACE on SpACE

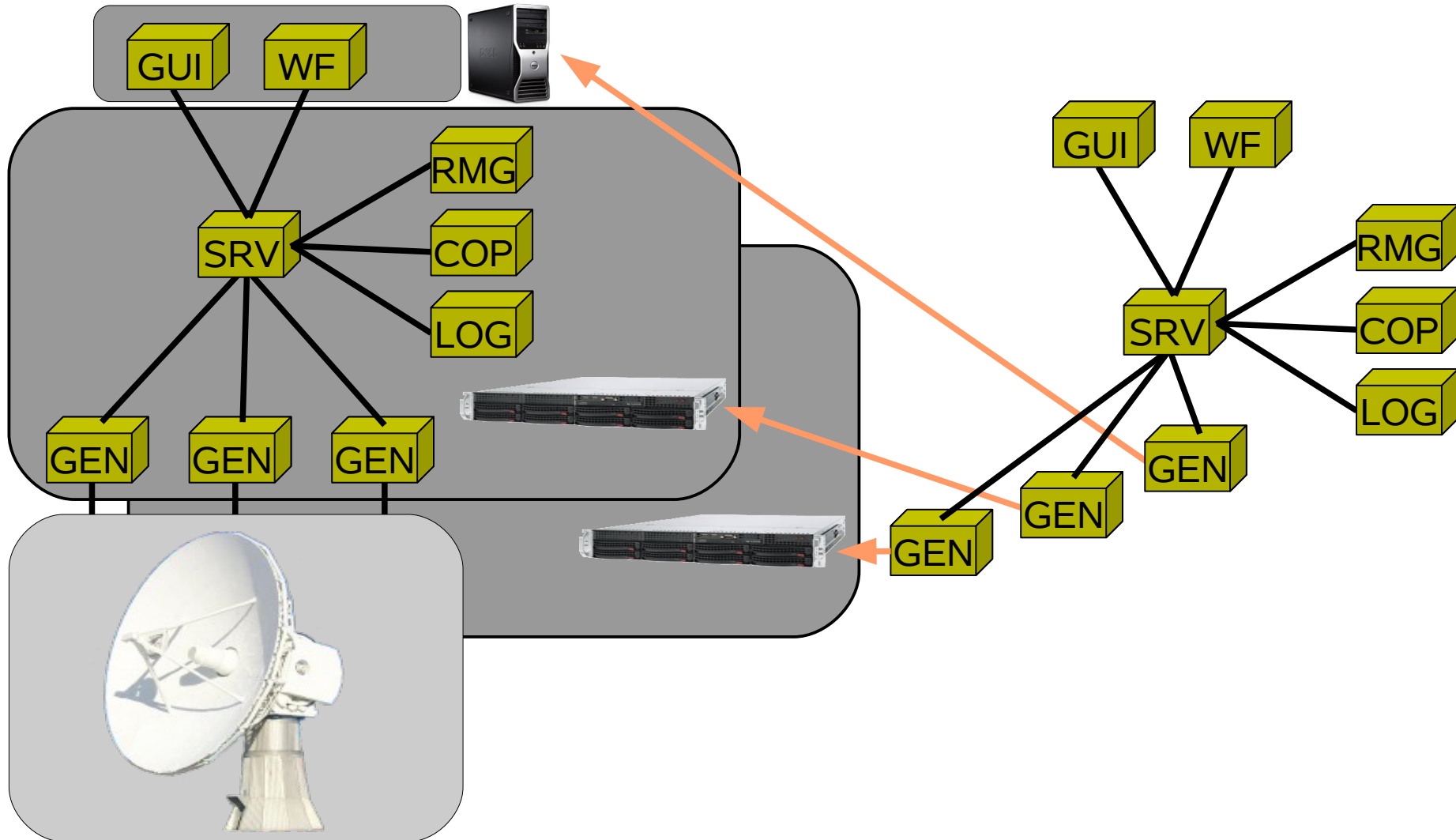




# Process Monitoring and Control - SpACE on SpACE



# Process Monitoring and Control - SpACE on SpACE



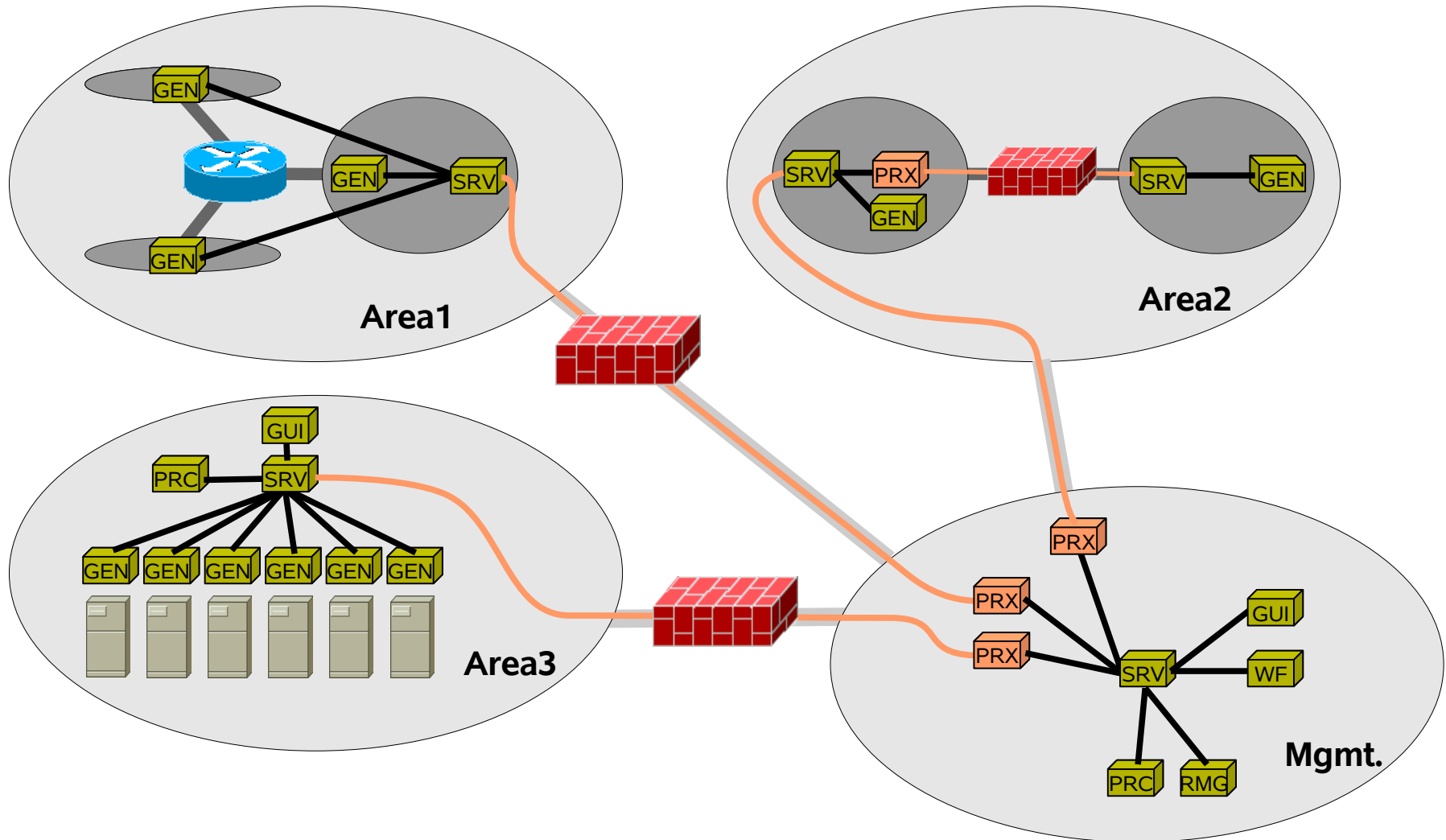
# Process Monitoring and Control - SpACE on SpACE

The screenshot displays the GSOC - DSI: WHM Nemo interface, which is used for monitoring and controlling processes on the SpACE system. The interface is divided into several panels:

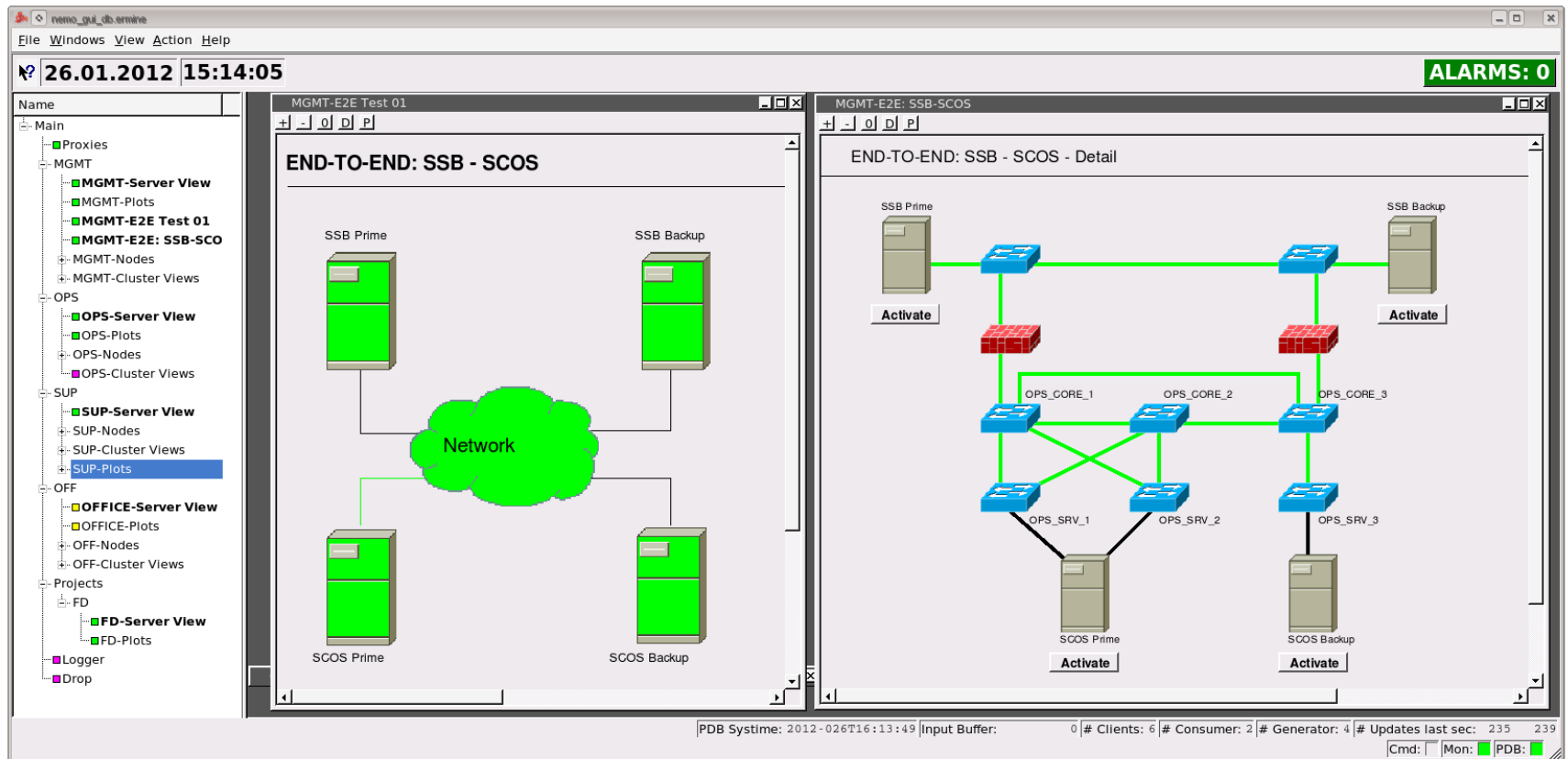
- Top Panel:** Shows the date and time (25.01.2012 13:50:39) and the number of alarms (ALARMS: 0).
- Left Panel:** A tree view showing the system hierarchy, including Overview, Antenna-Instance, Host, and GUI. The GUI section is expanded, showing various GUI components like GUI-01 (1a), GUI-02 (1b), etc.
- Summary Panel:** Displays a summary of the system status, including a table of processes and their states. The table has columns for Desc., State, Last Check, Message, Value, EC, and Commanding. The processes listed include S67, S68, S69, S70, S71, S00, and Disk.
- Monitor Panel:** Shows a detailed view of the system's status, including a table of processes and their states. The table has columns for Desc., State, Last Check, Message, Value, EC, and Commanding. The processes listed include S67, S68, S69, S70, S71, S00, and Disk.
- Bottom Panel:** A command line interface for entering commands and viewing the system's response. It includes buttons for 'Apply', 'Activate', 'Reset', 'Stop', and 'Start'.

The interface is designed to provide a comprehensive overview of the system's status and allow for real-time monitoring and control of the processes running on the SpACE system.

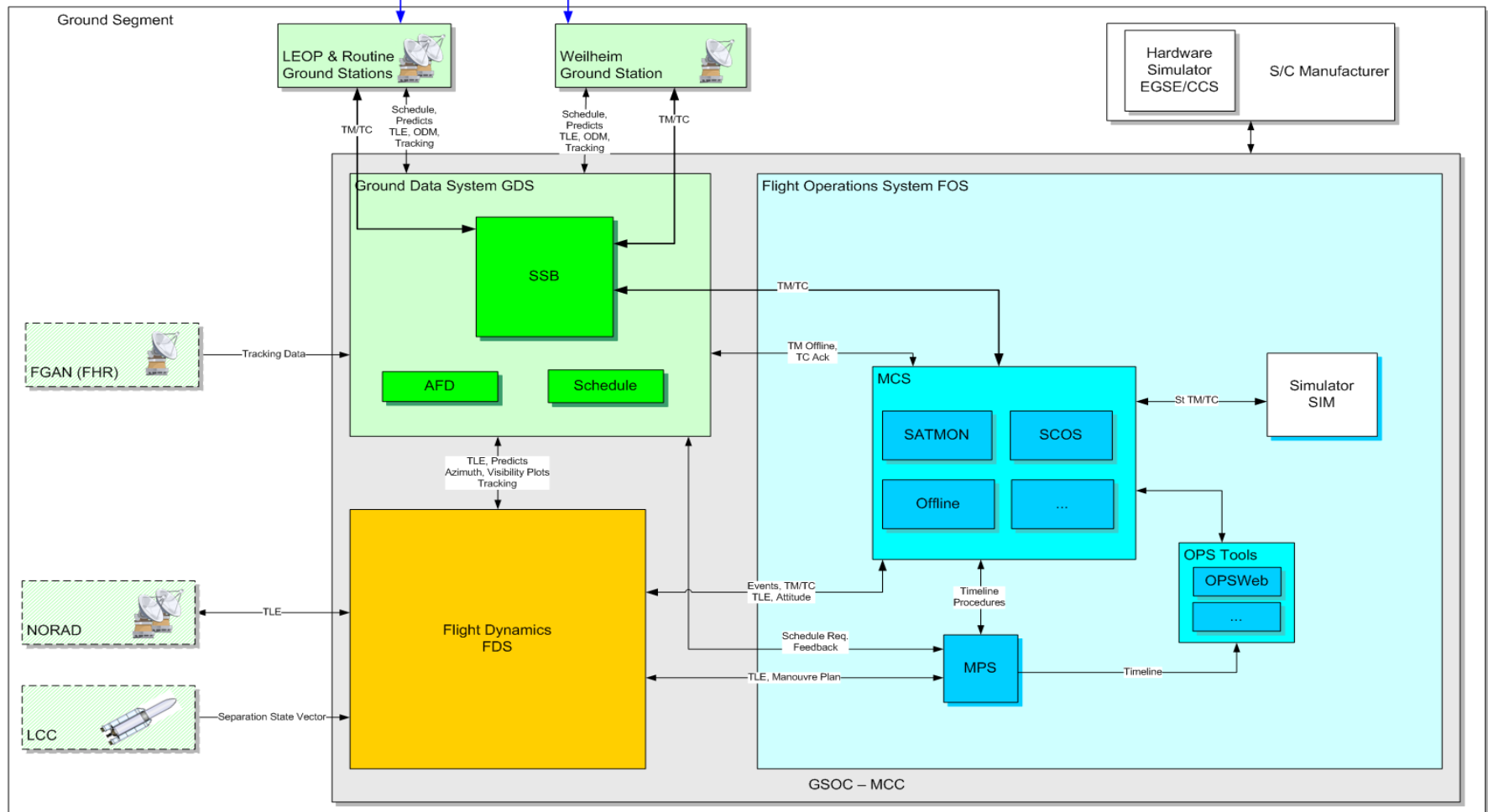
# Network Monitoring - NEMO at GSOC



# Network Monitoring - NEMO at GSOC



# Extending SpACE - Towards an End-to-End Service M&C



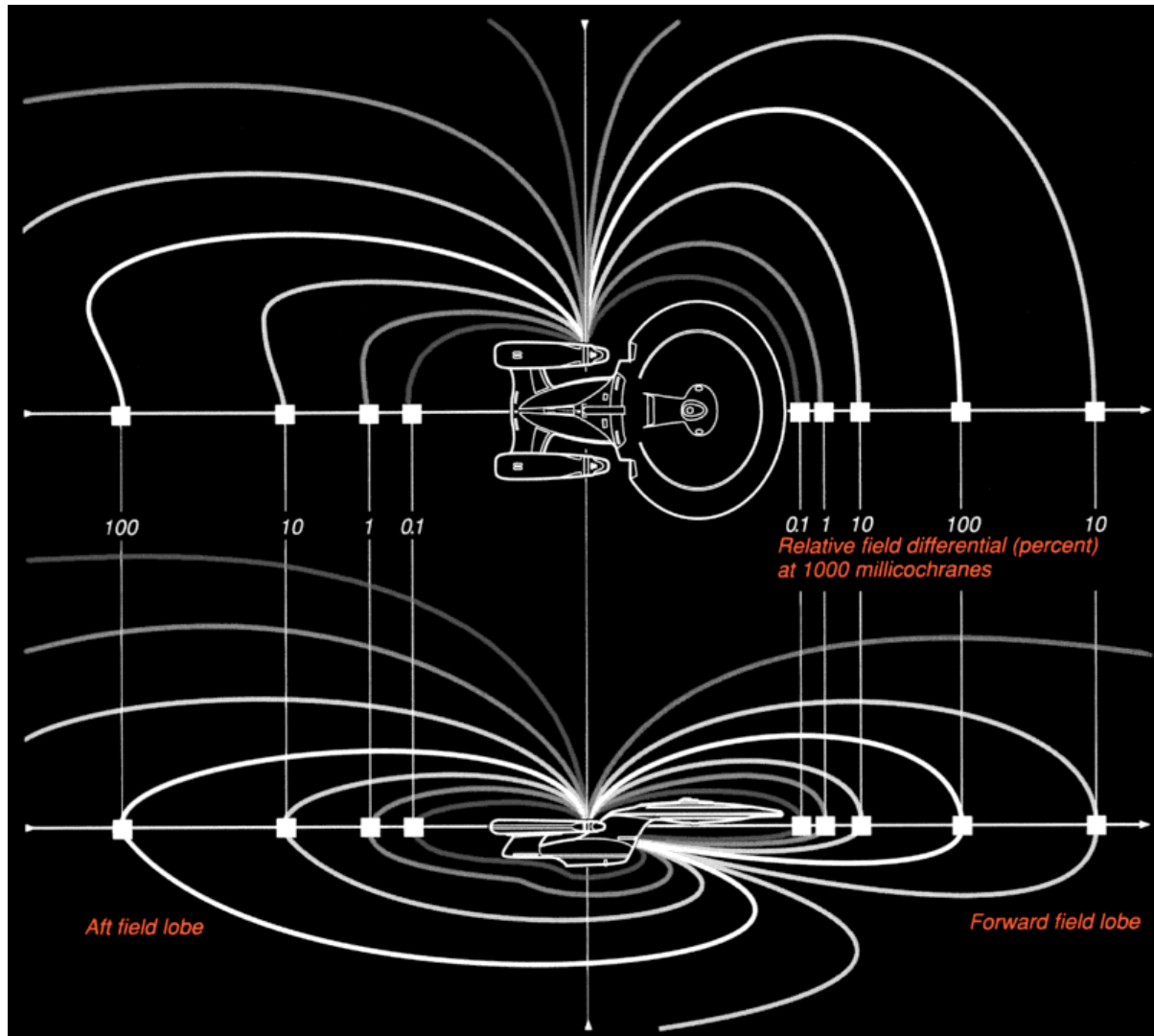




# Summary and Outlook

- Due to a generic approach we achieved
  - enabling commanding where usually only monitoring exists
  - enabling crossing network boundaries and firewalls
  - enabling end-to-end monitoring/commanding of complex systems
- Due to generalization we achieved
  - common procedures for quite different tasks
  - straight forward implementation of automation and scheduling
- Due to hierarchical structures we achieved
  - service oriented monitoring and commanding
  - possibilities of inter-process communication
  
- We plan to generalize our parameter approach
- We participate in CCSDS to
  - share our experience
  - standardize internal and external protocols

# Helm, Maximum Warp! Engage!





# Backup



# WARP - Configuration Observation Processor

GSOC - WOF GUI (S67) <3>

File Windows View Action Help

LRO DOY: 25 13:51:59 ALARMS: 0

Name S67

- S67-L4
  - L4 Summary
  - L4 Config/State
- S67-L3
  - ACU
    - L3 ACU
    - L3 ACU Predict
  - BB Prime
    - L3 BB Prime
  - BB Backup
    - L3 BB Backup
  - RFG
    - L3 RFG
- S67 Plots
  - ACU - AGC Level Plot
  - ACU - Predict Plot
  - ACU - Time Offset
  - BB Prime - FrameCheck
  - BB Prime - RCV Offset
  - BB Backup - FrameCheck
  - BB Backup - RCV Offset
  - HPA - Eirp Plot
  - ULSPS - Eirp Plot
  - SYS - RF Plot
- S67-L2
  - Queued WF
  - Logger
  - Sys Info
  - Cop Info
- WSP-C
  - Client 1
  - Client 2
- ACU
  - Summary
  - Presets/Offset
  - Predict
  - Scans
  - AZ-EL
  - Debug
  - FixedPos
  - AGC
  - Pointing
  - Connection
  - Log
- BB Prime
  - General
  - CRT
  - TCU
  - TMS-1
  - RAU
  - DCU
  - IFM-1
  - IFR-1
  - IFR-2
  - IFR-3
  - TMU-A
  - TMU-B

L4 - Summary

MISSION: lro SC-MODE: 293120 bit/s

TAF WSP

UL1 UL2

Tower

ULMx

TC TC

RNG/DOP RNG/DOP

TM TM

DL

DLMx

SC RCV: UNKNOWN

L3 - RFG

TX Pol AntDummy HPA 1 HPA 2 UCHPA UC3 UC1 UC2 ULMx

REFCON

Test In 1 Test In 2 Test Mode

SYNTH 1 SYNTH 2 Comp.

LNA1 LNA2 LNA3 DC 2 DC 1 DLMx

TRK Pol

TRK

COP - L4

Antenna State Antenna State SETUP FOR MISSION

Antenna Operations Mode UPLINK

Antenna Config

Source	Severity	ParGroup	ParName	Desired	Range	Value
1	RESconnect	COH_ALARM	S67_L2_CT11_MON	deviceNonConnected	Link	Link
2	RESconnect	COH_ALARM	S67_L2_CT11_MON	deviceCtrlConnected	Link	Link
3	RESconnect	COH_ALARM	S67_L2_CT11_MON	deviceTmsbConnected	Link	Link
4	RESconnect	COH_ALARM	S67_L2_CT11_MON	deviceTmsbConnected	Link	Link
5	RESconnect	COH_ALARM	S67_L2_CT12_MON	deviceNonConnected	Link	Link
6	RESconnect	COH_ALARM	S67_L2_CT12_MON	deviceCtrlConnected	Link	Link
7	RESconnect	COH_ALARM	S67_L2_CT12_MON	deviceTmsbConnected	Link	Link
8	RESconnect	COH_ALARM	S67_L2_CT12_MON	deviceTmsbConnected	Link	Link
9	RESconnect	COH_ALARM	S67_L2_ACU_MON	deviceConnected	LINK	LINK
10	RESconnect	COH_ALARM	S67_L2_RTC_MON	deviceNonConnected	LINK	LINK
11	RESconnect	COH_ALARM	S67_L2_ULSPS_MON	deviceNonConnected	LINK	LINK
12	RESconnect	COH_ALARM	S67_L2_ULSPS_MON	deviceNonConnected	LINK	LINK
13	RESconnect	COH_ALARM	S67_L2_DLSPS_MON	deviceNonConnected	LINK	LINK
14	RESconnect	COH_ALARM	S67_L2_DLSPS_MON	deviceCadConnected	LINK	LINK
15	RESconnect	COH_ALARM	S67_L2_HPA_MON	deviceConnected	LINK	LINK
16	RESconnect	COH_ALARM	S67_L2_DC1_MON	deviceConnected	LINK	LINK
17	RESconnect	COH_ALARM	S67_L2_DC2_MON	deviceConnected	LINK	LINK
18	RESconnect	COH_ALARM	S67_L2_UC1_MON	deviceConnected	LINK	LINK
19	RESconnect	COH_ALARM	S67_L2_UC2_MON	deviceConnected	LINK	LINK
20	RESconnect	COH_ALARM	S67_L2_UCT_MON	deviceConnected	LINK	LINK
21	RESconnect	COH_ALARM	S67_L2_TRK_MON	deviceConnected	LINK	LINK
22	RESconnect	COH_ALARM	S67_L2_RSY1_MON	deviceConnected	LINK	LINK
23	RESconnect	COH_ALARM	S67_L2_RSY2_MON	deviceConnected	LINK	LINK
24	RESconnect	COH_ALARM	S67_L2_RSY1_MON	deviceConnected	LINK	LINK
25	RESconnect	COH_ALARM	S67_L2_WSP2_MON	deviceConnected	LINK	LINK
26	RESmission	ERROR	S67_L2_SYS_MON	gen_Mission	---	---
27	DLreset	WARNING	S67_L2_DLSPS_MON	testMode	UCT	UCT
28	DLreset	ERROR	S67_L2_DLSPS_MON	testChainNoise	OFF	OFF
29	DLreset	ERROR	S67_L2_DLSPS_MON	testChainNoise	OFF	OFF
30	DLreset	ERROR	S67_L2_UCT_MON	carrier	OFF	OFF
31	DLreset	ERROR	S67_L2_RSY1_MON	outputActive	no	no
32	DLreset	ERROR	S67_L2_RSY2_MON	outputActive	no	no
33	ACUreset	ERROR	S67_L2_ACU_MON	powerOn	1	1
34	ACUreset	ERROR	S67_L2_ACU_MON	mode	Preset	Preset
35	ACUreset	ALARM	S67_L2_ACU_MON	targetAZ	20	0.01
36	ACUreset	ALARM	S67_L2_ACU_MON	targetAZ	80	0.01
37	ACUreset	WARNING	S67_L2_ACU_MON	actualAZ	20	0.1
38	ACUreset	WARNING	S67_L2_ACU_MON	actualAZ	80	0.1
39	ACUreset	ERROR	S67_L2_ACU_MON	actualEL	20	1
40	ACUreset	ERROR	S67_L2_ACU_MON	actualAZ	80	1

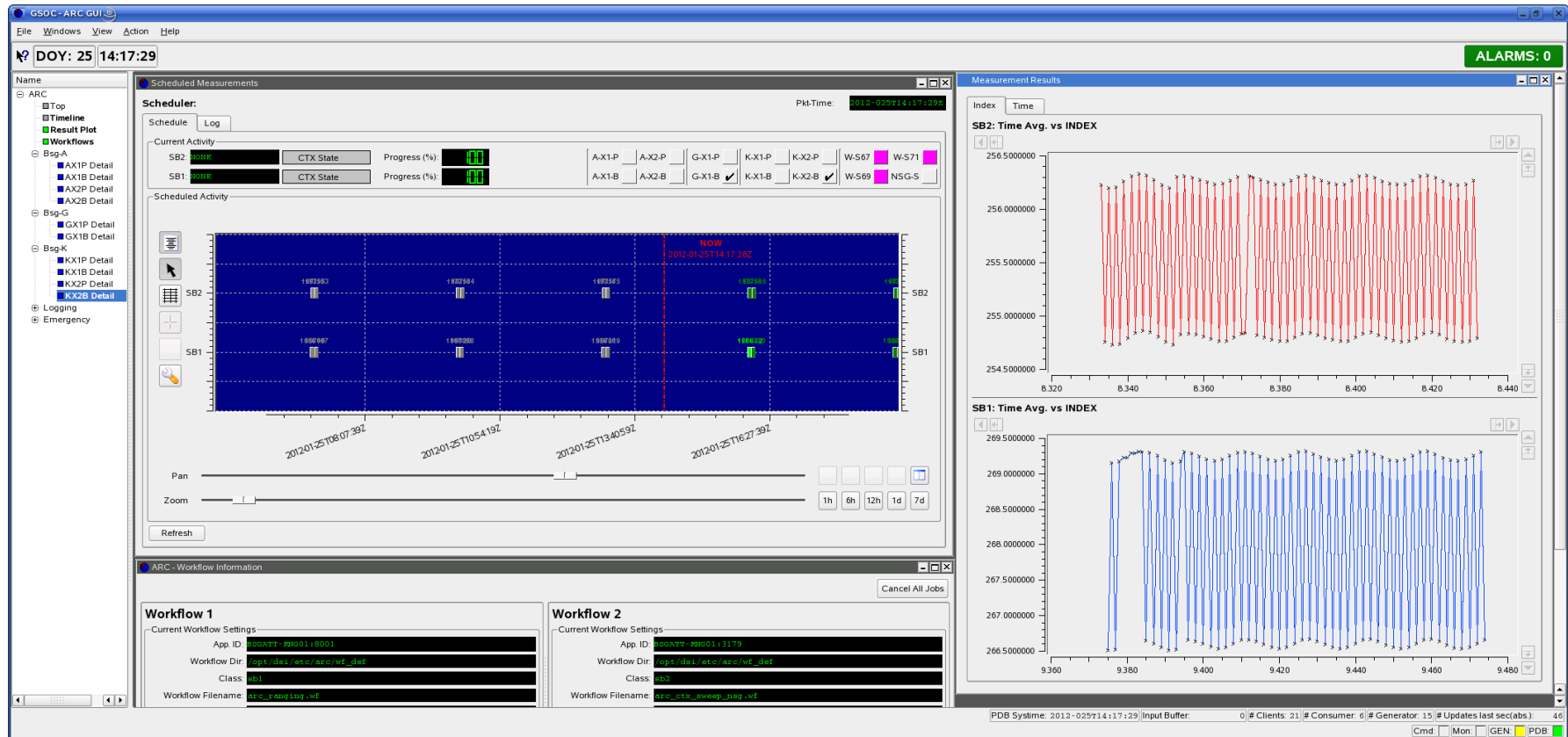
Sort Key: RESULT RESULT Refresh Table Reset Statistics

Last Response: 2012-025T13:51:59.779591 Inspection of updated param (S67\_L2\_ACU\_MON)targetEL done

PDB Syste: 2012-025T13:51:59 Input Buffer: 0 # Clients: 35 # Consumer: 11 # Generator: 24 # Updates last sec(s): 51

Cmd: Mon GEN: PDB:

# Automated Ranging for SatComBW1/2



# Configuration Management - Example NEMO @ GSOC

