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**REQUIREMENTS DEFINITION AND TESTING OF THE NEW VERSION OF
MULTI-MISSION GENERIC EVENT MONITORING SYSTEM (GEMS) V.4.4
FOR OPERATIONS AT EUMETSAT**

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Un ringraziamento ai miei genitori e mio fratello,
che mi sostengono sempre
e mi spingono a credere nei sogni.

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Abstract

EUMETSAT (www.eumetsat.int) is the European operational satellite agency for monitoring weather, climate and the environment. From the operations centre in Darmstadt (Germany), it controls a system of Geostationary and Polar Orbit meteorological satellites for observing the atmosphere, the ocean and land surfaces for a continuous service of 24/7.

A centralised monitoring service for multi-program systems running within EUMETSAT's Operational Environments is provided by GEMS (Generic Event Monitoring System). The system allows for multi-platform, cross environment monitoring with the ability to be extensible to further operational programmes.

The current GEMS Multi Media Interface (MMI) v.3.6, uses the standard Java Server Pages (JSP) and heavy use of direct Java code, and uses ASCII files for the filtering and display of data. Direct consequence is that information are not automatically updated but need a page reload. Moreover inputs for a new GEMS MMI come from several anomalies reported during daily use of the current software.

The work focuses on the definition of new requirements by EUMETSAT OPS Maintenance and Engineering Division for a new GEMS MMI (v. 4.4). For supporting the activities, the test environment set up at Solenix for GEMS has been used.

The new software will allow a rich web application approach allowing faster response times, automatic information update and full utilization of the GEMS database and its filtering capabilities, together with a mobile device application for supporting on-call operations.

The release is focused mainly on providing a fully re-implemented GUI for GEMS using modern technologies.

For an operational environment such as EUMETSAT, where reliability of the technology and longevity of the chosen approach are very important, not all of the currently available technologies are suitable and need improvements. At the same time, providing a modern interface in terms of visual design, interactivity and functionality is important for the GEMS MMI.

Abbreviations

AMSU-A	Advanced Microwave Sounding Unit -A
AOS	Acquisition Of Signal
API	Application Programming Interface
ASCAT	Advanced SCATterometer
AVHRR	Advanced Very High Resolution Radiometer
CALU	CALibration Unit
CDA	Central Data Acquisition
CGMS	Coordination Group for Meteorological Satellites
CPU	Central Processing Unit
CRS	Calibration Reference Source
DCP	Data Collection Platform
DEV	DEVELOPMENT
DOORS	Dynamic Object-Oriented Requirements System
DVB-S	Digital Video Broadcasting -Satellite
EARS	Eumetsat Advanced Retransmission System
EMI	European Meteorological Infrastructure
EoL	End of Life
EPS	EUMETSAT Polar System
EPS	Electrical Power Subsystem
EUMETSAT	European organization for the exploitation of METeorological SATellites
FES	Full Earth Scanning
GDS	Global Data Services
GEMS	Generic Event Monitoring System
GEO	Geostationary Orbit
GERB	Geostationary Earth Radiation Budget
GOME-2	Global Ozone Monitoring Experiment
GNSS	Global Navigation Satellite System
GRAS	GNSS Receiver for Atmospheric Sounding
GTS	Global Telecommunications System
GUI	Graphical User Interface
HIRS	High Resolution Infrared Radiation Sounder
HMI	Human Machine Interface
HKTM	Housekeeping Telemetry
HQ	Headquarter
KB	Knowledge Base
IASI	Infrared Atmospheric Sounding Interferometer
IEU	Instrument Electrical Unit

IMPF	Image Processing Facility
IJPS	Initial Joint Polar System
IOU	Instrument Optical Unit
JSF	Java Server Faces
JSP	Java Server Pages
LEO	Low Earth Orbit
LEOP	Lunch and Early Operation Phase
MASIF	Monitoring And Support Infrastructure Facility
MCC	Mission Control Centre
METOP	METerological OPERational satellite
MHS	Microwave Humidity Sounder
MLI	Multi Layered Insulation
MME	Multi Mission Element
MMI	Man Machine Interface
MPEF	Meteorological Product Extraction Facility
MPT	Mission Performance Team
MSG	Meteosat Second Generation
MTG	Meteosat Third Generation
MTP	Meteosat Transition Porgram
MVC	Model, View and Controller
NMS	National Meteorological Services
NOAA	National Oceanic and Atmospheric Administration
OCN	Office Computer Network
OPE	OPERational
OSSI	Operational Service Status Indicator
OSTM	Ocean Surface Topography Mission
PGF	Product Generation Facility
PGS	Primary Ground Station
PLM	Payload Module
RAL	Rutherford Appleton Laboratory
Regexp	Regular Expression
RSO	Real-time Services Operation
RSS	Rapid Scanning Service
SAF	Satellite Application Facilities
SEM	Space Environment Monitor
SEVIRI	Spinning Enhanced Visible and Infra-Red Imager
SLI	Single Layered Insulation
SMART	Scheduling, Monitoring, Analysis and Reporting Tool
SMS	Supervisor Monitoring System

SNI	Storage Network Infrastructure
SVM	Service Module
S&R	Search and Rescue
TM/TC	Telemetry /Telecommand
TSS	Technical Support and Services
TT&C	Telemetry Tracking and Command
UI	User Interface
UMARF	Unified Meteorological Archive And Retrieval Facility
UPS	Unified Propulsion Subsystem
URL	Uniform Resource Locator
VAL	VALidation
WMO	World Meteorological Organization

1 Introduction

1.1 Purpose of the Master Thesis

GEMS software was first thought in cooperation between the EUMETSAT Technical Support and Services (TSS) division and the Real-time Services and Operation (RSO) division, and it is in use since 2001.

The main goal is to provide a common monitoring for the different programs running in EUMETSAT, i.e. for both LEO and GEO missions; the tool is used within the EUMETSAT environments across operational components, but also it is visible to external partner organization when monitoring is required.

The current operational GEMS software v. 3.6, despite the overall good performances, has a few limitations, apart from specific functionalities that have not been implemented and that would improve the quality of GEMS.

Moreover, several anomalies have been identified during the years of use that need to be fixed.

For this reason together with the Mission Performance Team in EUMETSAT the user requirements for a new version of GEMS have been defined. The requirements have been described in the “On-event Monitoring User Requirements” document (confidential document) from which, some are reported in this thesis. The user requirements for the current GEMS v.3.6 have been analysed together with any anomalous behaviour that occurred in the years, and based on them, new requirements have been written (they can be seen in chapter 5).

In particular, requirements have been defined for several aspects of the tool. First regarding the accessibility of data: for example visibility from internal users and external partner with different restrictions. Then it has been defined the presentation of events and the browsers that can be used, together with what and how the tool should be organized and appear to the users. More requirements referred to practical

actions, such as user confirmation on closure of the HMI, or also the possibility of enabling/disabling facilities. Requirements have been defined also for query and retrievals of data and filtering for specific events.

It has been defined also the audible and visual notification for events such as alarms, and consequent capability of suppressing the latter.

New functionalities have been introduced such as the possibility of referring to the Knowledge Base (document describing the action required for any specific alarm), directly from the alarm window itself.

The agreement was that once the requirements would have been defined, they would have been passed to Solenix for implementing GEMS v. 4.4.

After the tool was finalised, the testing was done again at EUMETSAT by the Mission Performance Team, to verify that the new MMI would be able to support operations. Each of the requirements was tested, but a few discussions have been made with Solenix regarding the regressions from GEMS v.3.6. Solenix reported that some things were not specified in the user requirements and as such in order to have them they should be considered as “Evolutions” for a possible future GEMS version, or for the v. 4.4 behind extra payment for implementing the features. It has been clarified (and learnt for a next time) that a User Requirements guide cannot contain every single detail, but that it should be kept in mind that, except for when specified that certain functionalities should be changed, the requirements for the previous version should be kept.

From the reasons above and for other regulations within EUMETSAT, the Mission Performance Team will start to use IBM rational DOORS software, which is a Requirements Management Tool in order to keep traceability of requirements, and delta-requirements easily and clearer. What is currently planned is that the requirements for GEMS v. 4.4 will be re-written and transferred in DOORS and both EUMETSAT and Solenix can have access to them. Both of them can introduce delta-requirements to be implemented. Starting from v.4.4 on the requirements will all be followed in this way, such that for a possible future version of GEMS only

requirements plus delta-requirements will be considered and there is less risk of misunderstanding between the two parts.

One of the main issues was that the MMI in GEMS v.3.6 is implemented using standard Java Server Pages (JSP) and direct Java code, based on the processing of ASCII files for several functionalities. Consequently, for any update it is required to reload the full page, making the website slower and heavier. Moreover, this MMI can be classified as server-side dynamic web page which allows only a limited amount of interactivity.

Moreover, several anomalies have been identified during the years of use that needed to be fixed.

The previous ones, together with new requirements coming from evolutions in EUMETSAT (e.g. for security, for new type of partners, for new functionalities in the control room, etc.), required an improvement of the current GEMS v. 3.6.

1.2 Thesis outline

The thesis is divided into six chapters:

Chapter 2 shows the EUMETSAT environment and the mission definitions and spacecraft operations.

Chapter 3 focuses first on the description of the Generic Event Monitoring System (GEMS) functionalities, explaining why this is a key tool for the operations of both GEO and LEO satellites that are monitored in EUMETSAT. The concept of Multi Mission is analysed, where the importance of centralizing the monitoring of different system becomes a key point in a big organization like EUMETSAT, explaining the meaning and functionalities of hardware and software such as MASIF, GEMS and SMART.

GEMS will be explained in its structure, starting from the software characteristic until the Man Machine Interface (MMI) and the Graphical User Interface (GUI).

In a first phase, GEMS v. 3.6 will be analysed together with the anomalous behaviour and lack of capabilities for certain aspects. The new requirements from the Mission Performance Team are explained, together with the redesign causes.

Chapter 4 describes the new GEMS v.4.4 MMI implementation, with its improvements and new functionalities.

Chapter 5 describes the testing of the new GEMS version once it was delivered from SOLENIX back to EUMETSAT, in particular the mal-functionalities of the delivered version are shown, demonstrating the impossibility of making this version of GEMS operational yet.

Chapter 6 draws the conclusions including recommendations for future work. It shows the status of the software, which include not only technical issues, but also some discussions regarding the User Requirements document and, due to some confusion in the latter, a new tool (DOORS) has been identified to be used for better tracking changes in the requirements evolution.

2 EUMETSAT Operations

2.1 EUMETSAT - European Organisation for the Exploitation of Meteorological Satellites

EUMETSAT is a European Organisation that was founded in 1986. The organisation offers its service 365 days a year, 24 hours a day. The purpose of the agency is to supply data for weather and climate to the Member (29) and Cooperating (2) States and other users in the world.

EUMETSAT provides data through the meteorological satellites, regarding atmosphere, ocean and land surfaces. The aim of the organization is to help the safety of European citizens, helping the meteorologists in their study of weather conditions and help with near real time images in case of emergencies. Moreover, it provides data

for the scientific study of weather and climate (e.g. their changes, their effects on humans, etc) together with helping on the air, road and shipping traffic management.

As weather and climate are matters on international importance, EUMETSAT collaborates together with other agencies to specific programs such as the European Meteorological Infrastructure (EMI), it is also part of the Coordination Group for Meteorological Satellites (CGMS). Last but not least, EUMETSAT is part of the World Meteorological Organization (WMO), which provides agreements for international cooperation for the development of meteorological satellites and the use of their applications.

2.2 EUMETCAST

EUMETCast is a multi-service dissemination system for delivery the data to final users, together with Direct Dissemination. This is based on DVB-S technology (in transition towards DVB-S2 technology) based on a low cost reception stations concept (< 2K Euros). It consists of data providers and Service Provider (EUMETSAT), uplink provider (MediaBroadcast in Usingen), Turn around providers (Overon and Telespazio), commercial satellites (EUTELSAT EB9A, AB3, NSS806), reception stations and final users (see Figure 1).

Data Processing is not totally done in EUMETSAT, but Satellite Application Facilities (SAF) are used for de-centralized higher-level product generation since 1992. Typically, L1 (first processed) products are got via EUMETCast, then, the created L2 (re-processed) products are sent direct to EUMETCast uplink server for transmission. SAFs centers are distributed in Europe, such that the ability of EUMETSAT's Member States to exploit satellite data is improved. Moreover, it facilitates cost-effective exploitation by ensuring that services are distributed in the most appropriate way.

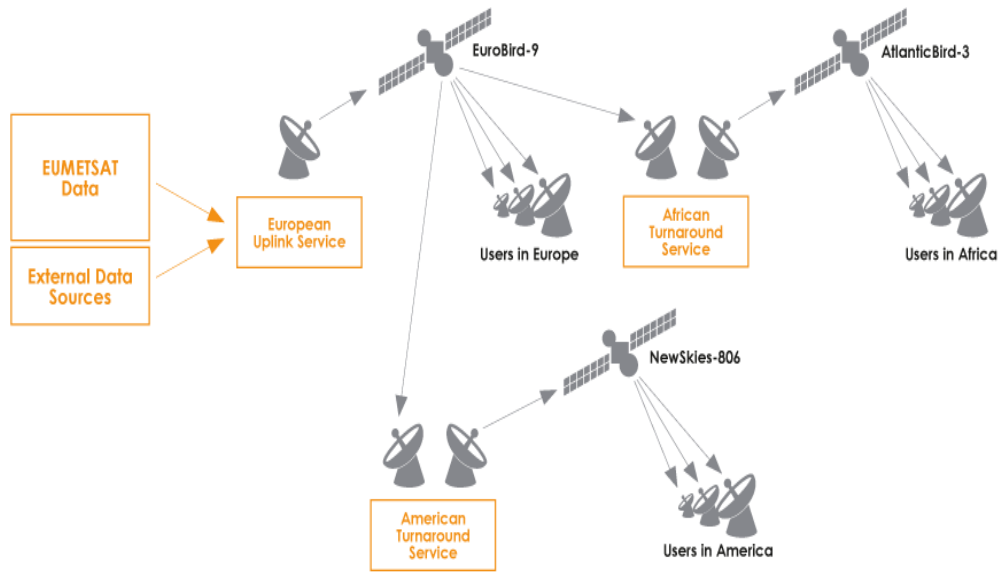


Figure 1: EUMETCast [1]

2.3 Missions' definition

The agency operates two types of satellites: Low Earth Orbit (LEO) and Geostationary (GEO) satellites, both at the operational centre in Darmstadt. While the operations are coordinated in Darmstadt, the ground stations are located around the world for the best satellite communications.

2.3.1 Low Earth Orbit (LEO) missions: MetopA and MetopB

The EUMETSAT Polar System (EPS) is the European contribution to the Initial Joint Polar System (IJPS) established with NOAA. EUMETSAT operates two EPS satellites: MetopA and MetopB which stay on the same orbit but phased in time, separated by 30 minutes relative to the nominal Local Solar Time.

Metop Satellites carry 13 instruments on board and travel along a Sun Synchronous orbit at 820 km. The missions were designed for a lifetime of about 5 years. On board autonomy is up to 36 hours, with on-board storage capacity of 24 GBit (EoL) sufficient for one orbit mission data. The Repeat Cycle is of 29 days and the cycle length of 412 orbits. The period is of 6081.5534 sec.

The ground stations used are located at Svalbard (Norway) and McMurdo (Antarctica). TM/TC are both done at SVALBARD for both the satellites, data acquisition is done in both the stations for MetopB, while for MetopA only Svalbard is used for this purpose (see Metop Visibility in Figure 2).

The EPS missions can be summarized as follow:

- a) **Local Mission:** real-time transmission of imaging and sounding data to local user stations.
- b) **Global Mission:** delivery of global sounding measurements to National Meteorological Services (NMS) of Member States, and to NOAA within 135 minutes of the instant of observation.
- c) **Search and Rescue (S&R) mission**
- d) **DCP (data collection) mission:** in-situ observational data.

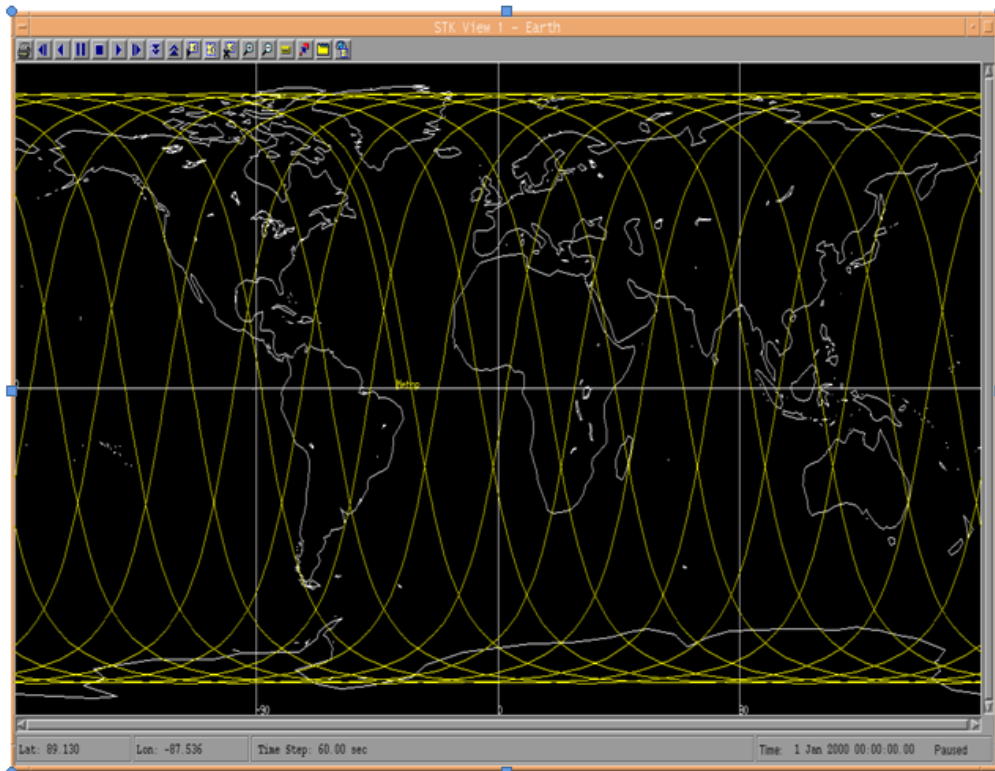


Figure 2: Metop Traceability [2]

2.3.2 Geostationary (GEO) missions: MSG1, MSG2, MSG3

Meteosat second generation are geostationary satellites covering Europe and Africa. The mission is currently composed by three satellites and a fourth one that will be launched in 2015. These satellites ensure weather monitoring and are essential for ensuring safety of lives, nature and infrastructures. These satellites are very important for providing images in near real time, fundamental for critical storms or volcanic ash clouds, etc.

The satellites' lifetime is expected to be of at least seven years each [3]. After the end of life of MSG satellites there is already a study in place for the Meteosat Third Generation (MTG) carried at EUMETSAT HQ.

The satellites are located at 36000 km above the equator. MSG3 is the prime satellite positioned at 0° , while MSG2 is at 9.5° East, and MSG1 is at 3.5° East.

2.4 Spacecraft Operations

2.4.1 Metop Operations

In order to understand the characteristics of Metop operations, the characteristics of the satellites orbit should be taken into account. In particular, remember that the satellites are in a near polar-sun synchronous orbit. The repeat cycle is of 29 days and the cycle length is 412 orbits. The period of the latter is 6081.5534 seconds. The satellites travels at a height of 822.250 km (at perigee) and of 849.516 km (at apogee), and with an inclination of 98.7022° .

For routine nominal operations, SVALBARD (Norway) ground station is used for TM/TC and GDS (global data services) data, which are collected via two Central Data Acquisition (CDA) Stations (see Figure 4). Visibility above the station is of about 10 minutes.

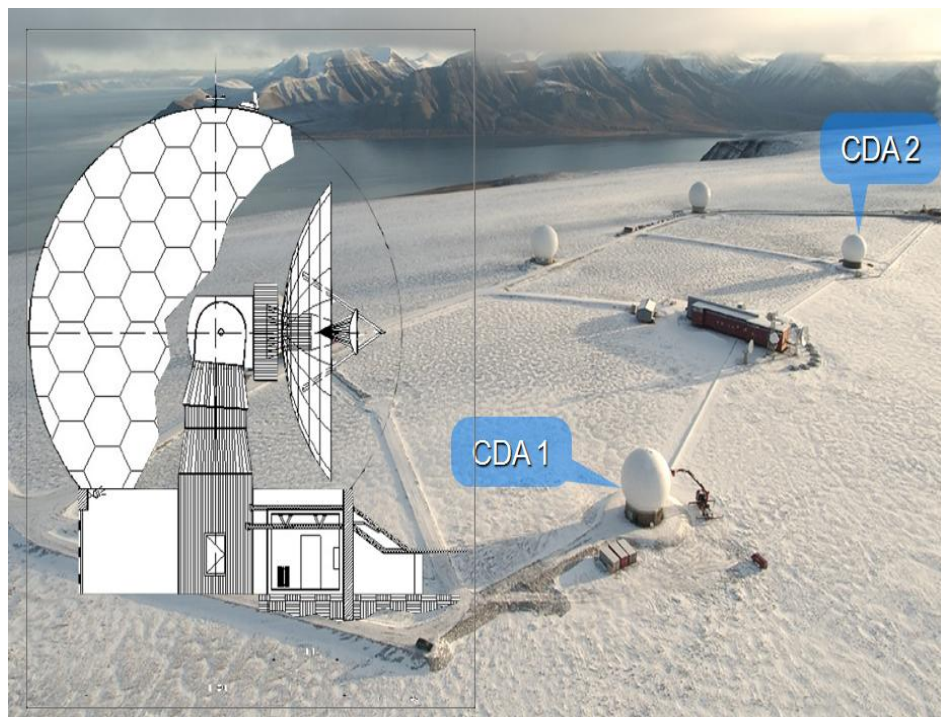


Figure 4: SVALBARD ground station [5]

For critical operations for the Spacecraft's health, such as emergency maneuvers, together with the Svalbard station also one of the three following Stations is used: Perth (Australia), or Kourou (French Guyana) or Fairbanks (USA).

In case of spacecraft anomalies, still Svalbard stays the main station. If there is co-visibility with other satellites, METOP has priority. Support is given also by Fairbanks (15 extra minutes of visibility).

As understood from above, Metop satellites are not continuously visible; this means that all the activities of commanding and dumping should be done within 10 minutes, which is the average length of the passes. For this reason, the spacecraft controllers should execute specific activities before, during and after the passes.

In particular, before the passes, there should be the planning/scheduling of the operations in non-visibility. Controllers should generate also TT-TCs and load them in the Mission Queue (MCS). Apart from extra commands or special commands, the other activities are normally planned and inserted in the Mission Planning and then executed automatically at a specific time.

During the passes they monitor the download of real-time Housekeeping Telemetry (HKTM), Reports Formats and Mission Data. There is the uplink of TT-TCs from the Mission Queue. Once the AOS (Acquisition of Signal) is received, there is the initial status assessment, and eventually decision and actions to do in specific cases. In case of anomalies, on-call support should be called immediately.

After the passes there is the full evaluation of acquired data (both platform and mission data) by Analysts and Ops Engineers. In case of anomalies, the latter have to take decisions on remedy activities relying in the spacecraft autonomy providing inputs to planning or controllers. In particular it should be kept in mind that satellites are designed such that they can survive even for some days without interventions from ground so within a limit there is no rush in intervening.

Special activities are LEOP (Lunch and Early Operation Phase) and Commissioning, but their interest goes behind the scope of this thesis.

2.4.1 MSG Operations

MSG operations carried at EUMETSAT control room (see Figure 5) are much simpler than Metop operations. MSG satellites, in being in a geostationary orbit are continuously visible from the Earth Ground Stations.

All the activities are again prepared in the mission planning and are loaded in the schedule. In case of anomalies or special test or emergency operations, controllers, with the support of analysts and engineers load commands to be sent to the satellites. For any other activity, included eclipse operations or manoeuvres, all the commands are in the queue and the role of the controllers is to monitor that no anomalies occur.

In case of anomalies, as for the Metop satellites, engineers have to take decisions on remedy activities. Also for geostationary satellites, one should remember that the latter are designed such that they can survive even for some days without interventions from ground so within a limit there is no rush in intervening. Constrains on intervention are done from the thermal monitoring: satellites should recover as soon as possible for avoiding the temperature to be too high or too low as this would damage the spacecraft.



Figure 5: MSG Control Room

2.5 Multi-mission architecture

The functions of the Multi Mission Systems are provided by a number of elements, such as also a number of software tools and packages that are used commonly across the Multi Mission Systems. These common software tools and packages provide an infrastructure layer and ensure a common approach for activities that are common across the Operational Ground Segments. Although built into the programme specific systems, these tools and packages are maintained as part of the Multi-Mission systems. In addition to the facilities and S/W packages that comprise the Multi Mission systems, there are often duplicated versions that allow the facilities to be used in different modes. These duplicated facilities are termed environments and each facility may provide one or more of the following environments:

- Operational (OPE);
- Validation (VAL);
- Development (DEV).

The Multi Mission Systems are composed of the components providing the functions that are common to more than one program – specifically, Archive and User Services, Dissemination, Monitoring and Infrastructure (see Figure 6)

3 Generic Event Monitoring Software – GEMS

3.1 General Requirements and functionalities

GEMS software was developed with the cooperation between TSS division and RSO division, in order to provide a common monitoring for the different programs running in EUMETSAT, i.e. for both LEO and GEO missions.

The system is based on several GEMS clients that send *text events* to the GEMS Server, where they are collected and stored. Data can then be accessed via an internet based browser interface or via HMI clients, both allowing real-time and history of events (see Figure 7).

GEMS is used for analysing log files sent from up to 180 different EUMETSAT (and non-EUMETSAT) servers, processing over 2 million events per day.

GEMS is used within the EUMETSAT environments across operational components, but also it is visible to external partner organizations when monitoring is required.

EUMETSAT hosts several machines where GEMS clients collect events, which are then forwarded to the GEMS Server. The events can come from log files, or be based on facilities processing events, or rise directly from monitoring tools or facilities. The GEMS Server is used for storage and archive of all generated events.

There are a few facilities, such as EXGATE or UMARF where the GEMS Servers are also their own Clients. This means that the GEMS processes are run for monitoring a specific facility and then are sent to the central Server communicating the output.

Users access the data through a dedicated web based HMI, which allows both real time and history of data. In addition, it is possible to subscribe to a notification system for periodical notifications via e-mails or HTTP request, both within EUMETSAT buildings and outside.

GEMS is expected to collect events from operational servers and workstations in the Operations system.

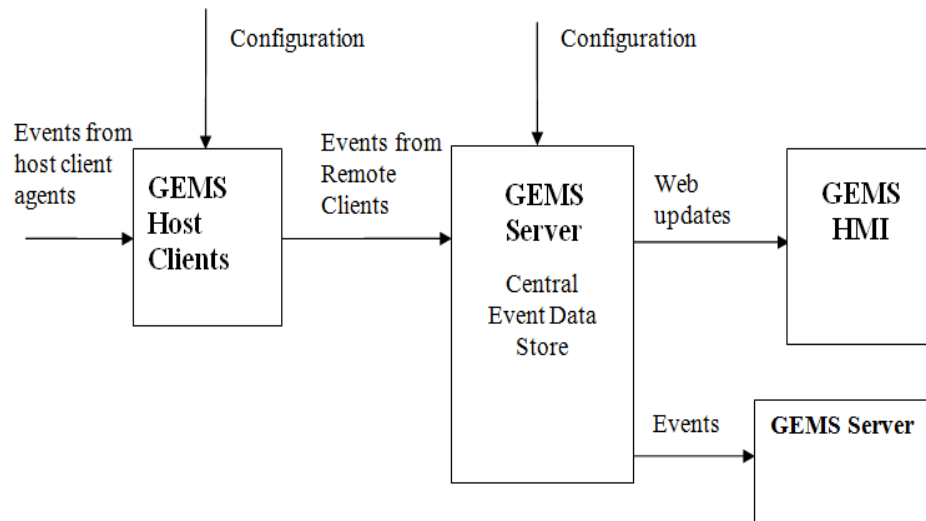


Figure 7: GEMS Functional Components diagram [6]

3.1.1 Software building

The language used is JAVA, because of the facility and the speed of development, also because of the availability of reusable components, and above all because it is simple to deploy across multi-platform Environments (See Annex A for the used Java packages) [6].

An API (Application Programming Interface) is provided, for C and Java, to enable GEMS Events to be raised within facility application software. Also for UNIX and Windows a set of GEMS process control scripts is provided. The database instead is done using the SQL structure; in particular two databases are implemented: Oracle and Apache Derby.

A few agents have been implemented, such as the real-time monitoring of log files, file system usage monitoring, etc. More agents can be added when required. The GEMS agents are background processes with no manual intervention, it is then important to check the *stability, the memory consumption and the CPU usage*.

The following java processes make up the GEMS server side Graphical User Interface (GUI) hosting:

- GEMS MMI contains the web files (.xhtml, .wav, .png) for the MMI.
- Apache Tomcat 6 in order to allow processing of Java Server Faces (JSF).

In order for a browser to support the GEMS Human Machine Interface (HMI), it should have the following characteristics:

- It must be set to enable Javascript and be capable of handling http GET/POST requests as well as the XmlHttpRequest (AJAX)
- It should support HTML5 audio tag or plug-in that enables the playing of sound files of type audio/wav and audio/mpeg.

The code was written and is maintained in the Eclipse environment and is supported by the following platforms:

- UNIX –AIX, HP, ...
- Linux (RedHat, SuSE)
- SUN Solaris x86
- Windows

3.1.2 Event storage

Operations require that no monitoring events are lost. As such, the events created on a client are not only locally stored, but they are also forwarded to the GEMS server. The write access to the files is secured by a file-locking mechanism. The last byte position in each file is stored in a modification (mod) file, which is always available in the same position even after a restart from a reading process.

Certainly GEMS events are stored in files (called “facility log files) according to the facility name of the events where a housekeeping mechanism is applied in order to avoid that they grow too large. Furthermore, this mechanism renames the existing facility log file and creates a new one with the facility name.

For example if we have a file named as

EXGATE.log file

then the housekeeping mechanism would rename the file as following:

EXGATE.YY.DDD.HH.MM.SS.mmm.log

where it is added the default timestamp in the format according to Table 1 [6].

3.1.3 GEMS Agent Classes

3.1.3.1 CheckEventAgent

One of the most used tasks is the GEMS CheckEventAgent. This is an optional internal task of the server whose main function is to search for expected events in the database and raise events against rules, in particular it is possible to detect if certain events have not been generated for a given time period with respect to the current time. The process uses filter rules for operating. First of all the rule defines the facility for which the events should be searched, then it defines the regular expression that should be used for searching the events, then the severity of the events to match (if it is a warning, an alarm or a normal message). Moreover, it specifies the host and the process of the events to match and the destination facility. Last important check is regarding the time, and in particular the maximum time allowed for matching an event before raising an alarm, and the minimum permitted time between two alarms for the same rules [1].

For each rule, the following processing sequence is applied:

Create and execute query for the rule

If no events are returned

If no delay is set or if the delay has expired

Raise GEMS Event

Else

Reset timers associated with rule

Abbreviation	Meaning
YY	year, e.g. 10
YYYY	year, e.g. 2010
MM	month, e.g. 11
Dd	day, e.g. 29
DDD	day of year, e.g. 243
HH	hour of the day, e.g. 16
Mm	minutes, e.g. 03
Ss	seconds, e.g. 55
SSS/SSSS/SSSSS/SSSSSS	fractions of second up to microseconds precision, e.g. 479, 342131
'T'	Literal "T"

Table 1: Nomenclature for GEMS events timestamp

3.1.3.2 Log File Agent

The LogFileAgent is an optional, client based, agent daemon process, whose task is to search for specific log files for key words and raises events when it finds any, as follow¹:

- if the read line contains a certain keyword from a positive list.
- if the line does not contain any keyword from a negative list.

The checking can then be done against a positive or a negative list and the behaviour can be summarized as follow:

- **Contain:** if at least one keyword is contained in the line of the file in a positive list will generate events, while the other lines that do not include the keywords will be ignored.
- **Ignore:** if none of the keywords are contained in the line of the file in a negative list will generate events.
- **Contain/Ignore:** it is a mixed case of positive and negative list. The process searches for positive keywords, but if it contains at least one negative keyword, the event will be ignored. This is a useful process for example when searching for the keyword “**error**”, but ignores specific errors that should be reported, such as “**error 409**”.

- **Ignore/Contain:** it is a mixed case of negative and positive list. The process searches for negative keywords, but if it contains at least one positive keyword it will report the event. This is a useful process for example when the messages containing “**info**” are ignored but those containing “**important info**” are reported.

3.2 Operative GEMS v. 3.6

3.2.1 GEMS Man Machine Interface (MMI)

The users access GEMS events in real time and the history via the GEMS Man Machine Interface (MMI). The events are sent from the GEMS Clients to the GEMS Servers, which also host the Web application providing the MMI. In particular, the events are first stored in a database by the GEMS Server and then are sent to the GEMS MMI for live display, where alarms, warnings and info are shown to controllers, engineers and external partners.

The GEMS MMI was built using standard JavaServer Faces (JSF) pages and the enterprise User Interface (UI) framework Prime Faces. The server and the browsers communicate using the Atmosphere library included in PrimePush (extension of Prime Faces), finally resulting in a standard Web page in HTML/CSS/JavaScript [7].

3.2.3 GEMS Graphical User Interface (GUI)

The GEMS Graphical User Interface (GUI) can be accessed online at the EUMETSAT website (<http://masif.eumetsat.int/GEMS/>) using specific username and password.

The page is accessible from the control room by the spacecraft controllers, by the users within the EUMETSAT infrastructure and by the external users. In the main page (see Figure 8), the top right corner shows regularly the connection check, displaying the time of the last check and the status of the connection (Status: OK means that there have not been interruption in the connection). The top left offers a

refresh button for re-loading the page, a printing button, the Help link and the possibility of managing filters (although the latter can be defined in other ways that will be explained below).

The table shows eight columns:

- Disable Facility
- Facility Name
- Sound
- Alarms
- Filters
- Last Event Reception
- Real-Time
- History

Enabled	Disabled	Facility	Sound	Alarms	Filter	Last Event Reception	Real-Time	History
Disable		COMMS	Sound+ON	0	Filter	14.059.15.20.07.000	Real-Time	History
Disable		DVAPSO	Sound+ON	5	Filter	14.059.15.16.06.000	Real-Time	History
Disable		DVB_CUBAND_AFR	Sound+ON	0	Filter	14.059.15.21.08.000	Real-Time	History
Disable		DVB_CUBAND_SAM	Sound+ON	10	Filter	14.059.15.21.08.000	Real-Time	History
Disable		DVB_EUR_UPLINK	Sound+ON	0	Filter	14.059.15.21.38.000	Real-Time	History
Disable		DVB_EUR_UPLINK_VAL	Sound+ON	0	Filter	12.178.23.55.43.000	Real-Time	History
Disable		DVB_KUBAND	Sound+ON	0	Filter	14.059.15.21.08.000	Real-Time	History
Disable		EARS	Sound+ON	0	Filter	14.059.15.21.38.000	Real-Time	History
Disable		EDS_TPDS_OPE_GNAS	Sound+ON	0	Filter	14.059.14.55.31.000	Real-Time	History
Disable		EDS_TPDS_OPE_IARS	Sound+ON	0	Filter	14.059.14.12.51.000	Real-Time	History
Disable		EO_PORTAL	Sound+ON	0	Filter	14.059.10.03.25.000	Real-Time	History
Disable		EO_PORTAL_VAL	Sound+ON	0	Filter	14.059.15.20.07.000	Real-Time	History
Disable		EPSKDS	Sound+ON	0	Filter	13.255.10.44.04.000	Real-Time	History
Disable		EPS_ADW_CS	Sound+ON	0	Filter	14.059.15.17.06.000	Real-Time	History
Disable		EPS_ADW_GS3	Sound+ON	0	Filter	11.151.09.34.53.000	Real-Time	History
Disable		EPS_COMMS	Sound+ON	0	Filter	14.059.06.44.37.000	Real-Time	History
Disable		EPS_DIF_COMMON	Sound+ON	0	Filter	14.059.15.21.38.000	Real-Time	History
Disable		EPS_DIF_GS1	Sound+ON	0	Filter	14.059.15.21.38.000	Real-Time	History
Disable		EPS_DIF_GS2	Sound+ON	0	Filter	14.059.15.21.38.000	Real-Time	History
Disable		EPS_DIF_GS3	Sound+ON	0	Filter	14.059.15.21.38.000	Real-Time	History
Disable		EPS_EXGATE	Sound+ON	0	Filter	14.059.15.21.38.000	Real-Time	History
Disable		EPS_GFT_CS	Sound+ON	0	Filter	14.059.15.21.38.000	Real-Time	History
Disable		EPS_GFT_GS3	Sound+ON	0	Filter	14.059.15.14.36.000	Real-Time	History
Disable		EPS_MCF	Sound+ON	0	Filter	11.053.13.09.54.000	Real-Time	History
Disable		EPS_MCF_GS1	Sound+ON	0	Filter	14.059.14.52.00.000	Real-Time	History
Disable		EPS_MCF_GS2	Sound+ON	0	Filter	14.045.13.11.16.000	Real-Time	History

Figure 8: GEMS Graphical User Interface (GUI)

3.3 The multi-mission operations tools

3.3.1 Facilities monitoring

At EUMETSAT Operation center there are four Geostationary satellites (3 MSG and 1 MTP), two Metop satellites and furthermore two American satellites (Jason2 and NOAA 19) are monitored in the LEO control room (although no commanding is allowed). EUMETSAT is not only operations, but there are several system that are around these satellites, which can be the archiving centers, the image processing facility (IMPF), the Extraction Facility (MPEF), etc. The facilities should all be connected between them, such that it is easy to communicate and to control. For this reason, EUMETSAT promoted the Multi Mission Element (MME) Monitoring.

The hardware of the monitoring system is called MASIF (Monitoring And Support Infrastructure Facility), whose operational platform can be accessed online (www.masif.eumetsat.int). The software is composed by the following elements:

- GEMS
- SMART
- SPRS
- SMS
- GMC/NAGIOS

3.3.2 MASIF

The hardware provides centralized monitoring, analysis and reporting portal for ground segment facilities, instrument performance and product quality.

As shown in Figure 9, MASIF can be thought like a big box where GEMS Server, SMART Server and SPRS are located. The GEMS Clients send the events to the GEMS Server and to the GEMS Server Relay. From the GEMS Server they are sent to the SMART Server and from here to the SPRS. From the SMART server, the Daily Logs, the Reports and the OSSI (Operational Service Status Indicator) are generated.

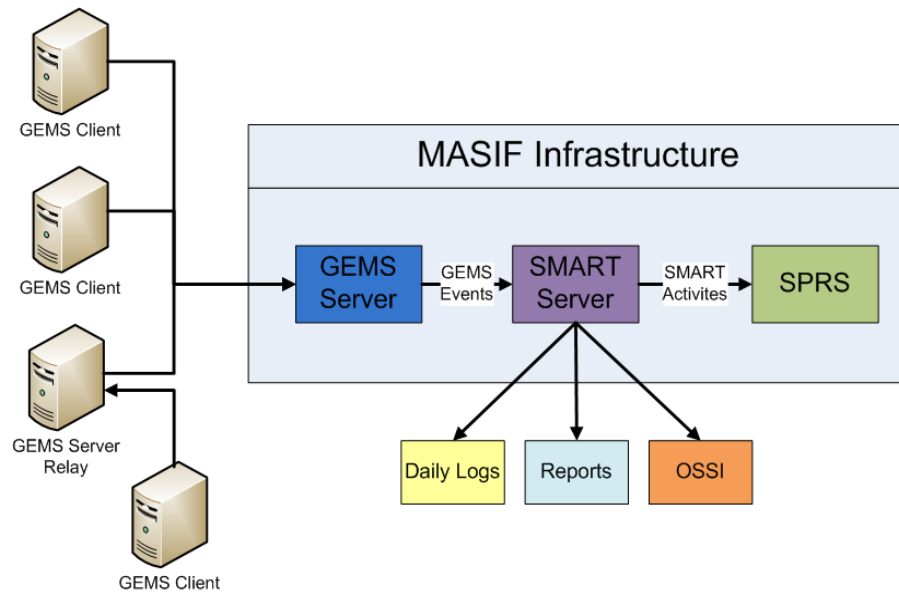


Figure 9: MASIF Hardware [1]

MASIF is composed by two chains: OPE 1 and OPE 2. OPE 1 represents the operational environment, while OPE 2 represents the validation environment. In particular OPE 2 is used for validating procedures, software and data units; OPE 2 is also configured as back-up for OPE 1: this means that it is connected for real time operations, although it is not normally able to send commands to the satellites, but in case of emergency, an OPE 1–OPE 2 swap is available and OPE 2 can become operational substituting OPE 1.

Each chain has two clusters, one is used for internal purpose (e.g. in control room), while the second one is used for external purpose (e.g. for on-call support outside working hours).

Figure 10 represents the MASIF architecture. Starting from the left side and going to the right the picture shows the reception from the satellites until the final delivery to the users.

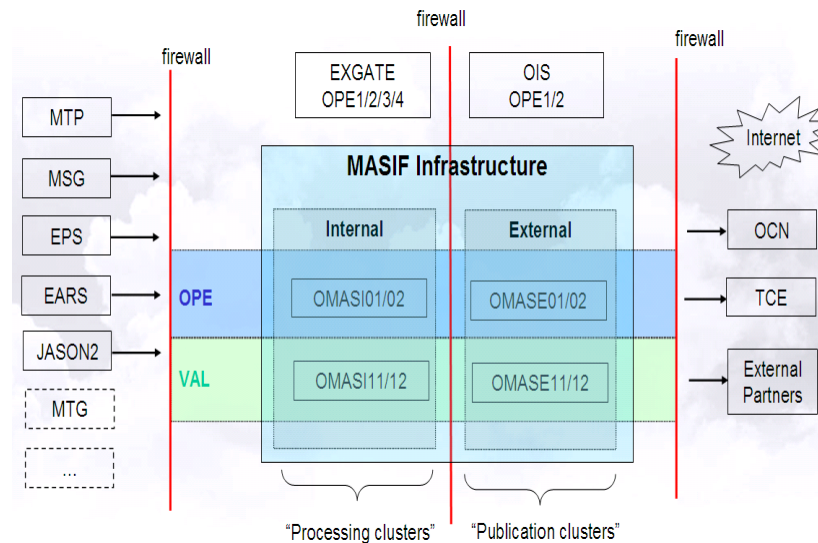


Figure 10: MASIF architecture [1]

When the data are received from the satellites via the first firewall they arrive to MASIF internal (see the *Processing clusters*). Already the two OPE and VAL chains (above defined as OPE 1 and OPE 2) are visible. Afterwards, the second firewall data are transferred to MASIF external (see the *Publication clusters*). Lastly, after the third firewall, the data are available on internet for the external users.

MASIF environment can be accessed on-line as follow:

- www.omasif.eumetsat.int, which represents OPE INT
- www.vmasif.eumetsat.int, which represents VAL INT
- www.omasif.eumetsat.org, which represents OPE EXT
- www.vmasif.eumetsat.org, which represents VAL EXT

The name structure is as follow:

OMASBBnn

Where *O* stands for Operational environment (OPE 1 and OPE 2), *MAS* marks the facility, *BB* indicates if it is MASIF internal (IS) or external (ES), and the *nn* are two numbers which indicate if the data are from operational or validation environment (01 is for operational and 11 is for validation).

The blue page represents the operational environment website, while the green page represents the validation environment website (see Figure 11).

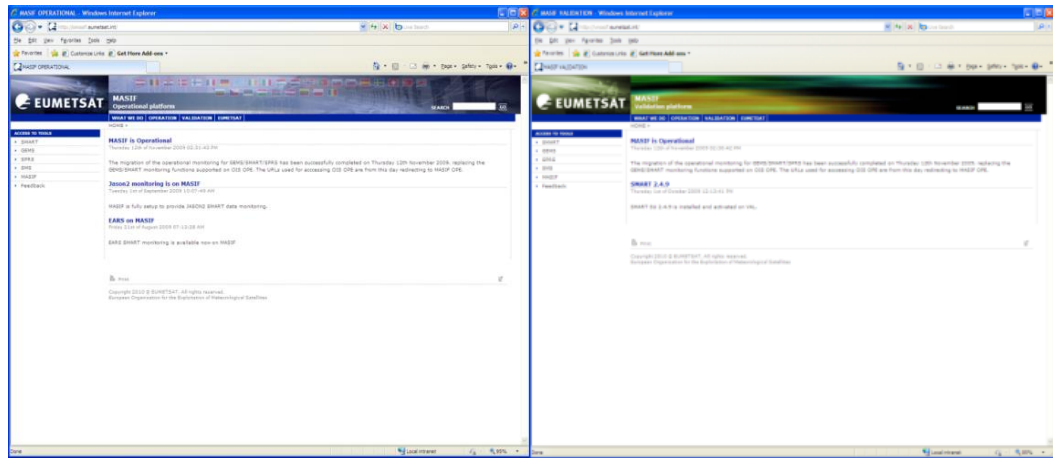


Figure 11: MASIF websites: the left one, in blue, represents the operational environment, while the right one, in green, represents the validation environment [1].

3.3.3 SMART

One of the software used for the Multi Mission Elements is SMART (Scheduling, Monitoring, Analysis and Reporting Tool). As mentioned above, its functions are based on the “communication” with GEMS software from which it receives the events. This software can be considered as the interface between the near-real-time monitoring and the reporting.

The SMART tool can be configured for any mission and for any facility. The software is based on schedules that are examined with back-processes that compare what is received with what is in the schedule. Normally on each Monday morning, the schedules are generated for the following ten days. It is also possible to run the schedules manually (in case an update is done during the week and there is the necessity of applying the new schedule immediately and not wait the next Monday).

The Smart Server runs continuously checking for GEMS logs to match using regular expressions. The information from the logs are extracted using defined mapping. Once the events are analysed and match (or not) with the schedule, then the latter is updated with the information. Using the drill-down capability, the *Smart Viewer* displays the

contents of the schedule files in a table format (see Figure 12). When all the files are received then the display is grey, when there are missing files, the box is coloured in red (*Smart Alert*), while the white means that the files are coming in and some time is still required before verifying if the files arrived or not.

From SMART, the SMART daily logs are generated: this mechanism extracts information from the schedule file and generate text files that are disseminated on EUMETCast. In a similar way the OSSI extract information and update the web page traffic light (see Figure 13).

Day	Ku Europe Received	Day
140303 062 08:55	44 of 44	08:55
140303 062 09:00	44 of 44	09:00
140303 062 09:05	44 of 44	09:05
140303 062 09:10	44 of 44	09:10
140303 062 09:15	44 of 44	09:15
140303 062 09:20	38 of 44	09:20
140303 062 09:25	0 of 44	09:25

Figure 12: SMART Viewer showing missing files

SERVICE STATUS INDICATOR		
Legend		
0° Service	MET-9	✓
9.5° RSS	MET-8	✓
57.5° IODC	MET-7	✓
GDS-Metop	Metop-A	✓
GDS-NOAA	NOAA-19	✗

Valid for: 2011/07/08 12:52:12 UTC

Figure 13: OSSI, Service Status Indicator indicating that all the services are ok but the NOAA-19, which is shown in red.

3.3.4 SMS

SMS (Supervisor Monitor Scheduler) is the viewer interface for the near-real-time monitoring and in-house control. It is not configured for specific missions, but for multi-mission processes.

Its functionality is based on the monitoring and control of the processes running in the multi-mission clusters. In particular, it checks the alarms, the colour code and sound, manuals, and also the start, stop and testing of specific processes (see Figure 14).

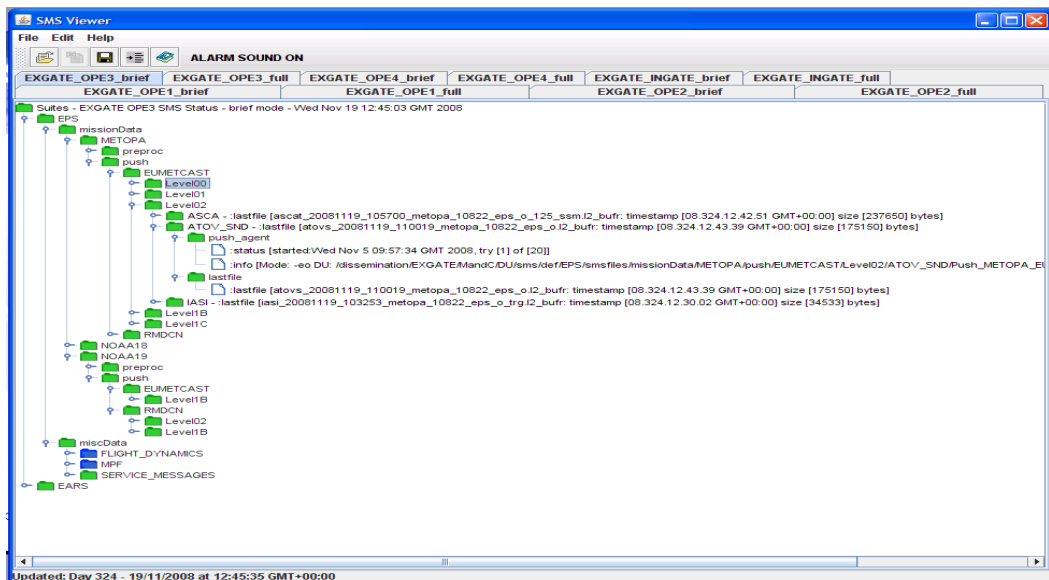


Figure 14: SMS showing METOP pushed to EUMETCast per level and product

3.4 User Concept

GEMS activities can be seen by different users with different purposes, which imply different configurable access rights for each group. In particular, the end users are:

- Spacecraft Operations Controllers
- Operations Analysts and Engineers

- External Partners (MeteoFrance, NOAA)
- Operations Administrators

The main users of GEMS are the Spacecraft Operations Controllers. They require a dedicated GEMS workstation with a GEMS client HMI permanently visible. They react to any alarm raised by the system and provide a first line analysis. They can perform some very high-level configuration such as setting filters. Operations components have different controllers requiring their own unique view of GEMS:

- MTP (Meteosat Transition Program, 1st Generation)
- MSG (Meteosat Second Generation)
- MTG* (Meteosat Third Generation)
- EPS (Eumetsat Polar System – Metop, NOAA)
- EARS (Eumetsat Advanced Retransmission System)
- OSTM (Ocean Surface Topography Mission - JASON2, 3¹, Sentinel¹, Oceansat¹)
- UMARF (Unified Metrological Archive and Retrieval Facility)
- S3¹ [1] (Sentinel-3)

The other main users of GEMS are the Operations Analyst and Engineers. They support the operations controller teams by providing further analysis of GEMS events. They also use GEMS to monitor the system during critical activities. They require the ability to view GEMS both onsite and offsite of EUMETSAT.

Under agreement with EUMETSAT, some external partner agencies require a GEMS viewer restricted to only information that is applicable to them. They may also perform some high-level configuration. By nature of their role, they require access from GEMS offsite from EUMETSAT.

¹ *Future Projects*

Last but not least, there are the operations administrators that are responsible for the overall configuration of GEMS, and for test and acceptance of new GEMS software versions. They require full access to GEMS configurable items.

4 GEMS v. 4.4

4.1 Redesign causes

The current operational GEMS software v. 3.6, despite the overall good performances, has a few limitations.

First of all, the MMI is implemented using standard Java Server Pages (JSP) and heavy use of direct Java code and it is based on the processing of ASCII files for filters and display of events. Direct consequence is that for any update it is required to reload the full page, making the website slower and heavier.

The current MMI can be classified as server-side dynamic web-page which allows only a limited amount of interactivity.

During the years of operations, also several anomalies have been identified that are limitations of the software and can be solved with a new release. In the following are reported the main ones.

- Occasionally it happens that when a GEMS alarm is received and the “real-time” button is clicked to bring up the alarm text, the viewer instead displays a different event (warning or information).
- An alarming GEMS facility can be muted by pressing the 'Sound=ON' button. This button then turns yellow and changes description to 'Sound=OFF'. This function is available from the GEMS Main Page for each facility and also from the Real-Time Events Window for each facility. If the sound is turned OFF or ON from the Real-Time Event Window then the button on the Main GEMS Page also changes with. But if the Sound is turned OFF/ON from the Main Page the button on the Real-Time Event does not change.

If the Sound was turned OFF from Real-Time Event Window and this window was closed after checking the alarm then the status of the Sound OFF/ON button is set to the last status of what was set on the Real-Time Event Window at each refresh (every minute) of the Main Page. This can lead to automatic switch OFF of the audible alarm of a GEMS facility without notice by the controller and therefore alarms can be missed.

- When using the "^" character in a regular expression in a GEMS viewer search then the regular expression returns incorrect or no results if the “^” character is not followed by a wildcard expression like ".*" (dot-star).

If used without wildcards the GEMS viewer does not return any result although there are GEMS events starting with the text followed by ^-character. Example: The reg. expression `^GTS_IN-SSMI.*Received$` does not return any GEMS events but the reg. expression `^.*GTS_IN-SSMI.*Received$` returns the correct GEMS events. The regular expression works correctly when used in a CheckEventAgent.

- Currently the filter management on GEMS allows inputting filters per facility either from a filter file or manually. Filters are then added to a filter list. Both methods allow setting a duration after which the filter expires. However the GEMS system only takes the duration from the last filter set and overwrites the duration to all other filters in the list. This can cause filters with shorter expiration than the last one to stay in the list and alarms will be missed. Moreover the current filter duration cannot be checked after the filter was input. This results in filter activities not being tracked and alarms to be missed.
- GEMS freezes when disabling many facilities. It is required to have a “Disable all” button.
- The pre-set filters used by MSG controllers for EXGATE, MSG_CF, SMART_OPE_GEO and UMARF MET7 eclipses are visible to Meteo France (RETIM) when "Filter Manager" is selected. This means that the internal settings are actually visible to external partners.

- The GEMS server is presently permanently polled for new events by the GEMS client, which results in an excessive server load.
- GEMS sometimes shows a "service temporarily unavailable" screen rather than the usual GEMS viewer (see Figure 15).



Figure 15: Service unavailable

4.2 New features

The new release mainly contains software changes to address the mal-functionalities mentioned above. Moreover, it includes some new features for improving the software [8].

The solution was a full re-implementation of the GEMS MMI following a rich web application approach, adjusting and optimizing the GEMS MMI for faster response times and also offers specific MMI elements for mobile devices in order to facilitate on-call support.

The main points have been:

- Development of a new user interface design and structure;

- Development of a database backend for user management, permissions, preferences, stored queries, etc.;
- Show real-time alarms view with enhanced acknowledgement and notification features;
- Allow query engine for historical searches including auto-refreshed open-ended queries;
- Allow extended possibilities for exporting and sharing events;
- Existence of a notification system for immediate and periodical notifications via emails or HTTP requests;
- Availability of filter management system with group sharing and server-side storage;
- Sound management system supporting MP3 and WAV with sound coordination between windows of the same group;
- Online help.

4.3 MMI Implementation

The GEMS MMI has been integrated as an additional module into the GEMS Server package. This approach allowed the direct interaction of the MMI with the GEMS data access layer and removed the need to use the networked endpoints between processes (see Figure 16).

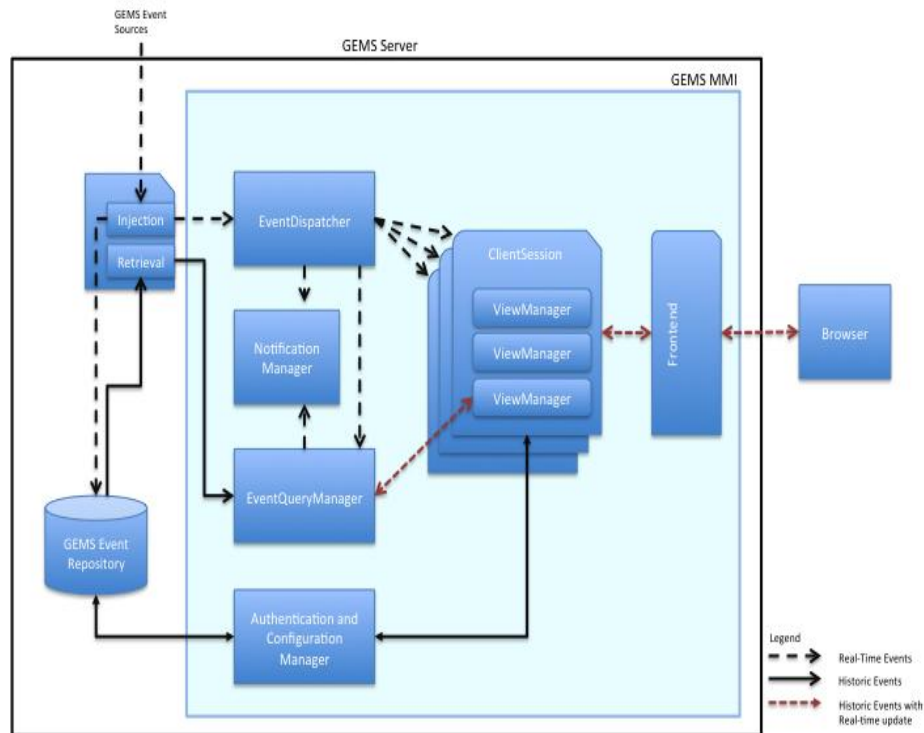


Figure 16: MMI Architecture Overview [9]

The GEMS MMI is intended as a web application that in order to store data efficiently makes full use of data caching and data scopes. The MMI implementation can be divided into the following main categories:

- **Backend**, which contains the business logic and data processing;
- **Frontend**, which provides the elements that are shown in the browser and interact with the user;
- **Administrator and User Management**, which is used for the storage of authentication and user preference information related to the MMI;
- **Data Query Extensions**, which covers the more advanced query features required by the MMI, including all of the currently available filtering requirements.

GEMS MMI was thought as a clear MVC (Model, View and Controller) (see Figure 17) type of application. As such, the Backend is the foundation of the Model, while

the Frontend extends on the Model and provides the View and Controller implementations. In the following, the four categories are explained.

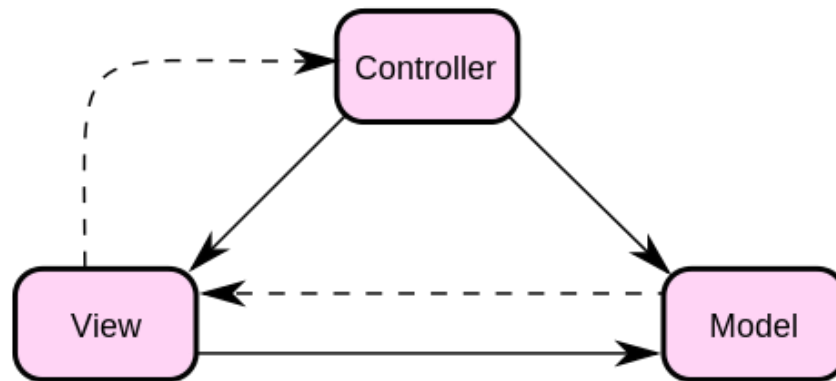


Figure 17: Model View Controller [10]

4.3.1 MMI implementation: Backend

The task of the *Backend* is to manage all data processing and state of the respective clients that are accessing the GEMS MMI. In order to do that, the following components are used:

- Event Dispatcher
- Client Session(s)
- View Manager(s)
- Event Query Manager
- Notification Manager

The *Event Dispatcher* runs immediate processing on the events that receives by the GEMS server. This processing is also mapped by the corresponding knowledge base rules. Each event is then forwarded to each individual Client Session (for Real Time Events), which represents a specific user session and corresponding setup of the GEMS MMI. These events are then used to populate the alarm count in the facility overview and for keeping track of the unacknowledged alarms per facility.

A Client Session represents a logged-in user in GEMS and manages the currently logged-in user, permissions, alarming counts and other state information. In addition, it manages the user's preferences and setting via the Authentication and Configuration Manager. Each *ClientSession* is related to a Servlet session and as such an open browser.

Each ClientSession instance contains post-processing routines, which can modify the events displayed to the users:

- Apply facility filters;
- Knowledge-Base Article Mapping.

When there are more than one GEMS MMI window in the same browser, they will be run the same session and the View Manager contains the information for distinguishing between the different open windows (e.g. for applying different filters in two different tabs).

The history view for a specific time period is allowed thanks to the Event Query Manager. In particular in the new MMI, this will support the “open-ended queries” which will give the update of the page with real time events coming in.

It is also possible to send notifications, such as e-mails containing alarms. This is done thanks to the Notification Manager. The latter also has an extension interface in order to add other notification mechanisms in the future via configurable HTTP requests, such as logbook [9].

4.3.2 MMI implementation: Frontend

The implementation of the frontend is done following the JSF specification:

- Design templates that contains JSF, HTML, CSS, etc., which define the visual appearance and view logic;
- Backing Beans containing the Controller and thus the interaction logic for working with the data in the model and controls shown in the View.

The user interface can be used across multiple browser tabs for the display of different functionalities. If the corresponding functionality is configured for a user (e.g. for users belonging to the Controller User Group), a confirmation dialog is presented when trying to close any of the tabs.

Each GEMS view contains information about the currently logged in user, the server connection state to the GEMS MMI server and the GEMS version in the top-right corner. The connection state of the MMI to the underlying server is monitored via JavaScript, thus removing the need for an Applet.

Each GEMS window on the main screen has a navigation (menu) bar on the top of the screen, which allows fast access to the respective functionality. It offers the following navigation items:

- Facilities: provides the “Facility Overview” screen, which shows alarm statistics and quick access for the currently enabled facilities.
- Administration (only shown for administrator users): allows access to the “Administration” set of functionalities as described below.
- Query: provides access to the event query view. This view can also be opened pre-configured from the facility overview by clicking the “Query” button next to a specific facility. Opening the Query view via the navigation menu will open a query window with the default values set up (e.g. number of events displayed per result page).

The facility overview, despite the new design, offers similar items to the ones currently implemented in GEMS v. 3.6. The following information are shown in the webpage (see Figure 18):

- Facility Name;
- Last Event Time, at which an event has been received for this facility;
- Sound controls;
- Number of Alarms;
- Quick links to history view and real-time view;

- Monitoring status
- Per-facility filters.

In the new software, the facilities can be grouped by environment, Operations and Components in a tree-structure, easily visible by the arrow on the left of the facility box and a Σ symbol next to the box in the Alarms column (see Figure 18).

Facilities	Alarms	Last Event Reception	Filters	Sound	Event Query
<input type="checkbox"/> DRAPSO	0		Apply Filter		Event Query
<input checked="" type="checkbox"/> DVB	Σ 0	14.063.10.27.06.636			Event Query
<input checked="" type="checkbox"/> CBAND	Σ 0	14.063.10.27.06.636			Event Query
<input type="checkbox"/> DVB_CBAND_AFR	0	14.063.10.27.06.636	Apply Filter		Event Query
<input type="checkbox"/> DVB_CBAND_SAM	0	14.063.10.27.06.636	Apply Filter		Event Query
<input type="checkbox"/> DVB_EUR_UPLINK	0		Apply Filter		Event Query

Figure 18: GEMS tree structure

Depending on user permissions, it is possible to persistently hide or show facilities (individually, in bulk or all at once) in this list. The user can also reset this list to the full list of facilities that the user (or any of the groups the user belongs to) has access to by selecting and enabling all disabled facilities.

As in v. 3.6., the list of disabled facilities below the active facilities list can be toggled on or off by clicking the “Disabled Facilities” label and is hidden by default. The disabled facilities can be found clicking on the “disabled facilities” bar (see Figure 19).

<input type="checkbox"/> VAL_EXGATE	2	14.063.10.39.37.882	Apply Filter		Event Query
<input type="checkbox"/> VAL_JASON2	2	14.063.10.34.34.758	Apply Filter		Event Query
<input checked="" type="checkbox"/> VAL_SNI	0	14.063.10.39.36.324	Apply Filter		Event Query
<input type="checkbox"/> VAL_UMARF	1	14.063.10.39.37.882	Apply Filter		Event Query

▶ Disabled Facilities

Figure 19: Disabled Facilities

Operators have the possibility of disabling audible alarm notifications for a specific facility or the complete list of facilities. Disabling is done for a limited time that is configurable by the operator. Alarming will be re-enabled automatically after this period. The default for this period is 10min (see Figure 20). A record will be kept indicating whenever an alarm has been disabled, tracking the time at which the disabling took place, its length, what facilities were affected and the responsible user (see Figure 21) . This record can be seen by administrators.

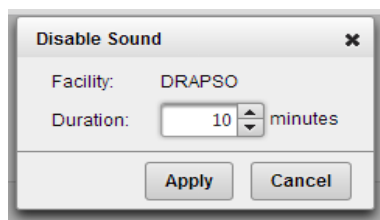


Figure 20: Disabling sound

Facilities	Alarms	Last Event Reception	Filters	Sound	Event Query
<input type="checkbox"/> DRAPSO		14.063.10.43.51.437		09:55	
<input checked="" type="checkbox"/> DVB		14.063.10.45.49.139			
<input checked="" type="checkbox"/> CBAND		14.063.10.45.49.139			

Figure 21: Disabled sound countdown to expire

The user profile view allows the user to view and configure the user's general data (see Figure 22). This includes:

- Changing password;
- Viewing/changing real name and e-mail (the latter for notifications);
- Viewing the groups that the user belongs to.

User Profile | Preferences | Notifications | Facility Grouping

User Name: admin

Real Name: Administrator

E-mail: gems@example.com

Fill out the fields below only if you wish to change your password

Password:

New Password:

New Password (repeat):

Member of: ADMINISTRATOR

Save

Figure 22: User Profile page

The user can also access and edit the current user preferences (see Figure 23) directly or, alternatively, override the current preferences with the default preferences from one of the groups the user belongs to via the “Restore Group Defaults” button.

User Profile | Preferences | Notifications | Facility Grouping

Enable Sound: Enable audible notifications for all facilities

Confirm Logout: Ask for confirmation before logging out

Confirm Page Quit: Ask for confirmation before leaving the facilities overview

Events per page: Default number of events per page for query results

[Restore All to Default Group Preferences](#) Save

Figure 23: User preferences page setup

Also, the user can define its own facility-grouping (see Figure 24) and the notification settings [9].

User Profile Preferences Notifications Facility Grouping		
Facility	User Group	Default Group
DRAPSO	<input type="text"/>	-
DVB_CBAND_AFR	<input type="text" value="DVB/CBAND"/>	- (reset)
DVB_CBAND_SAM	<input type="text" value="DVB/CBAND"/>	- (reset)
DVB_EUR_UPLINK	<input type="text"/>	-
DVB_KUBAND	<input type="text"/>	-
EARS	<input type="text"/>	-

Figure 24: Facility grouping user setup

4.4 MMI implementation: Administrator and User Management

The administrator view is only accessible to administrators and has as a main function allowing the creation, removal and editing of user accounts and user groups. For the latter, the administrator is able to configure the user list and the default preferences of each group.

The administrator webpage is used also for managing the Knowledge Base Mapping and the notifications. In addition, the filter records for each user are visible and also the Alarm Suppression Records (see Figure 25).

The mapping of events to knowledge base articles is achieved via rules containing the following information:

- Rule ID (0..n);
- Facilities (0..n);
- Event severities (0..n);
- Regular expressions (1..n);
- KB article title;
- KB article link.

Each incoming event, matching the defined severities, will be checked for the regular expressions. Each event will be augmented with the knowledge base rules it matches.

Notifications can be triggered either per event matching the specific rule definition or aggregated for a defined time period. Furthermore, notifications can be sent either via e-mail to a specified e-mail address or via HTTP to an external system, e.g. an electronic logbook.

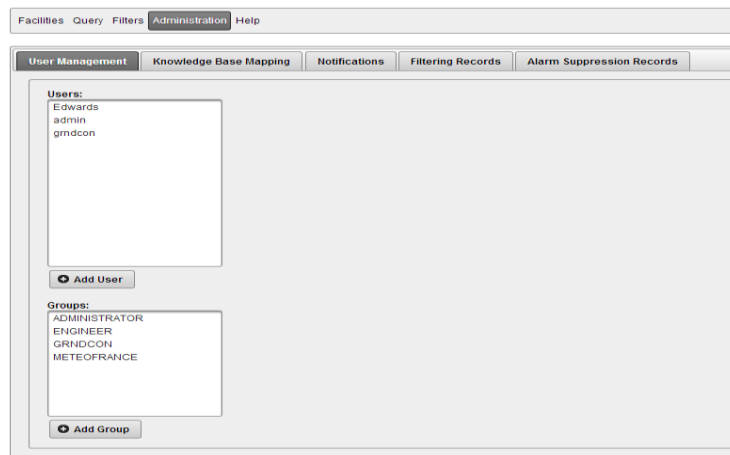


Figure 25: Administrator page

The User Management view in the Administration panel is providing access to users and group definitions. For the users, the following fields can be defined (see **Error! eference source not found.**):

- **Login Name:** which is the name used for logging in or to be specified for automated login.
- **Full Name:** which is the full name of the user for information purposes.
- **Password:** which can be changed by administrators or by the user via its user profile. Should a user forget a password, then an administrator can reset it via the user management.

- **Groups:** which contains a list of currently available groups. The administrator can select the groups, of which the user is a member.

By using the “Delete User” button, a user can be deleted following a user confirmation. Changes to the user can be applied via the “Save” button.

The screenshot displays a web application interface for user management. At the top, there is a navigation bar with tabs for 'Facilities', 'Query', 'Filters', 'Administration' (which is active), and 'Help'. Below this, a secondary navigation bar contains tabs for 'User Management', 'Knowledge Base Mapping', 'Notifications', 'Filtering Records', and 'Alarm Suppression Records'. The main content area is divided into two columns. The left column features a 'Users:' list with entries 'Edwards', 'admin', and 'grndcon', and an 'Add User' button. Below it is a 'Groups:' list with entries 'ADMINISTRATOR', 'ENGINEER', 'GRNDCON', and 'METEOFRACTANCE', and an 'Add Group' button. The right column contains a form for user details with fields for 'Login Name:', 'Full Name:', 'E-mail:', and 'Password:'. Below these is a 'Groups:' selection area with a list of groups: 'ADMINISTRATOR', 'ENGINEER', 'GRNDCON', and 'METEOFRACTANCE'. A note below the groups list states 'Use the ctrl key to select multiple groups'. At the bottom of the form are two buttons: a red 'Delete User' button and a 'Save' button.

Figure 26: User management

User groups as shown in Figure 26 contain the following fields:

- **Group name:** which can be used to assign users to a specific group.
- **Audible alerts:** this defines the default value for audible alerts per group. Using this property, e.g. the engineering group can disable audible alerts by default.
- **Administrator:** this defines whether the user has administrator privileges, and thus access to the “Administration” pages.

- **Visible Facilities:** this contains a list of all facilities known to the current GEMS instance. By selecting multiple of those, the user group is defining the visible facilities for its users. Should a user be part of multiple groups, the facilities lists are cumulative across all groups, of which the user is a member.

When selecting either a user or a group from the left hand lists, the right hand part of the “User Management” tab is updated to show the respective information immediately [9].

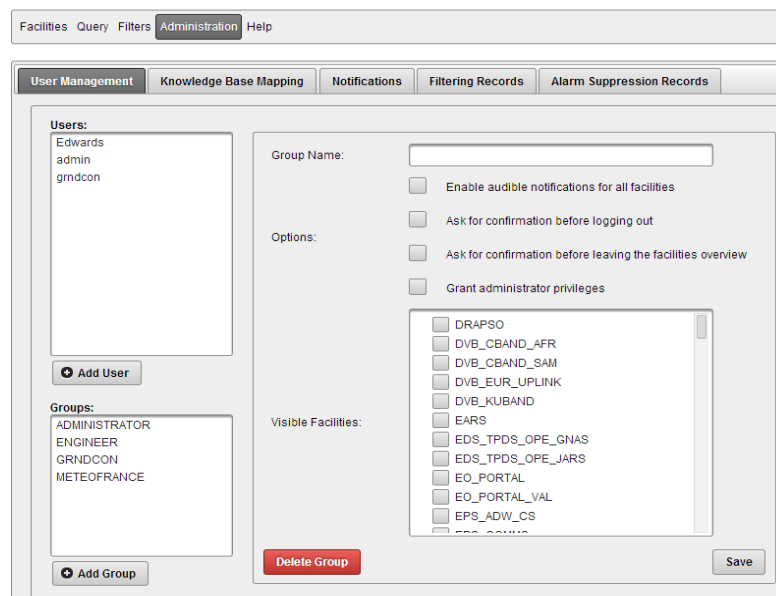


Figure 27: User group

4.5 Mobile Application

Another innovative feature of GEMS v.4.4 is the Mobile Application. This is based on the same core technology and data models as the full GEMS MMI. However, it contains customized views for mobile devices, using the ICEMobile framework, which allows the creation of near-native look-and-feel for mobile devices that operate in a browser (see Figure 28).



Figure 28: GEMS Mobile Application 100[11]

The Mobile application offers only those functionalities that are mandatory for on-call operation outside working hours:

- Facility overview with alarm display.
- Event querying with pre-defined and user-defined filters. Filter management and other functionalities will not be supported.
- User authentication in order to provide the visibility and preferences as defined in the GEMS MMI.

The user is automatically logged in as operator using a specific URL, or can use a login form to authenticate as specific user (e.g., as engineer). Also from a mobile device, notifications are done via e-mail and the references to specific queries and time periods can be transmitted via URL parameter, i.e. the e-mail can contain a link to a specific query, which is then shown on the mobile device via the optimized mobile view interface.

4.6 Testing approach

The most important feature that was tested for the MMI was the alarming capability to work with high reliability, being the GEMS MMI the central responsible element for

on-line monitoring and alarming of systems at EUMETSAT. The testing focused on the following items [12]:

- Facility Overview;
- Sound Management;
- Real-Time Alarm View;
- Notification System (e-mail);
- History Data View:
 - ❖ Query capabilities;
 - ❖ Export;
- Mobile View Adaptation and Device Compatibility;
- Performance:
 - ❖ Open-ended query with Push-update;
 - ❖ Historic Query;
 - ❖ Filtering performance;
 - ❖ Display performance during injection (high load, e.g. multiple browsers in a typical control room scenario, ongoing provision of data at peak data rates and data bursts (e.g. 10000 events bursts));
- Robustness:
 - ❖ Loss of GEMS server (data source), and reconnection;
 - ❖ Loss of Backend: Frontend notifies about loss of monitoring, and reconnection;
 - ❖ Large query/result set handling;
 - ❖ Input validation for user provided data
 - ❖ End-to-End verification:
 - ❖ Event completeness, incl. alarming and sound;
 - ❖ Event timeliness;
- Browser Compatibility;
- Web Server configuration for long-lasting polling connections (i.e. push).

4.7 Testing plan

The testing of the GEMS MMI from the Mission Performance Team in EUMETSAT was performed in two ways [12]:

- **Automated tests:** where most of the functionality of the backend itself were tested in an automated fashion, focusing on:
 - Data Persistence and Retrieval
 - Event Queries
 - Bulk Alarm Detection
 - Knowledge Base Mapping
 - Notifications
- **Manual tests,** which focused mostly on ensuring that the functionalities were correct according to the relevant GEMS requirements.

In Appendix B, several testing procedures for GEMS v.4.4 are reported.

5 Delivery of GEMS v 4.4

5.1 Functionality Issues

GEMS v. 4.4 was delivered by SOLENIX engineers the 31st January 2014. The testing phase by the EUMETSAT engineers started immediately the first week of February and showed several problems in the new MMI. Not only some of the new features were not working properly, but also many other were acting worse than the operative GEMS v.3.6. The testing of the functionalities was carried out for about one month at the end of which a meeting with Solenix was called in order to discuss the software issues.

For simplicity of comprehension, the issues will be presented ordered depending on the area of occurrence, and in particular:

- ❖ Login
- ❖ General look and feel
- ❖ Common to several areas
- ❖ Query
- ❖ Facility List
- ❖ Filters
- ❖ Report Page
- ❖ Help
- ❖ Alarms
- ❖ Real Time
- ❖ Mobile Application

Not all the found issues have been reported below, only the most relevant ones.

5.1.1 Login

Some issues that have been noted were already at the Login page. Several times, when inserting the username and password credentials an XML page error appeared showing an XML encoding declaration.

```
<?xml version="1.0" encoding="UTF-8" ?>
-<partial-response>
-<error>
  <error-name>classjavax.faces.application.ViewExpiredException</error-name>
-<error-message>
- <![CDATA[ viewId:/facilities.xhtml - View /facilities.xhtml could not be restored.
  ]]>
</error-message>
</error>
</partial-response>
```

Moreover, with the new GEMS version the “Autologin” option is available, which is the default login page, for example for the controllers, such that they do not have to insert the credentials every time. Nevertheless, the auto-login should be dependent on the IP address: users outside of EUMETSAT operational and corporate networks should not have an auto-login because external partners should only have certain rights for privacy policy.

5.1.2 General Look and feel

The overall first impression is that the MMI does not look extremely professional and also "depressing" with "extensive use of grey". In particular, some details can be seen in Figure 29 and Figure 30 (MMI_Facilities 1-9, MMI_Query 10-14).

The following issues have been noticed (the numbers below refers to the numbers in the figures):

1) Some EUMETSAT corporate branding colours and the EUMESAT logo could be added in order to give the page a more professional look and in keeping with other EUMETSAT pages. The full name of GEMS should be displayed as in the old MMI. The branding/title should propagate through all GEMS pages, also because the GEMS pages are visible to external partners and others outside of EUMETSAT.

2) The connection check does not stand out: it could be made larger and labelled. Moreover, in the GEMS v. 3.6 it was showing the last checking time, and the updates in time show the correct functionality. In case the viewer crashes, and the button stays green, GEMS v. 4.4 would not be able to give a signal of non-functioning.

3, 4, 5, 8, 9, 13, 14) These are problems in formatting, showing incorrect justification.

4) The sound button should be labelled.

6) The box next to facility name has no effect. It should show a tick symbol or similar, and select the facility/group. Moreover, when clicking generally on the facility row that is a group header, this should expand or collapse the facility/group.

7) It is not very obvious which rows are groups and which are facilities. For example the colour could be improved to make groupings clearer, and stronger colours should be for incremental group heading (currently it is the opposite). In addition, it could be considered the use of arrows next to the facility list, or also make the title bold or colour inverted font to make it obvious.

Moreover when considering a group facility, some options, such as the sound button, could be removed (consistently with for example the Filters button that does not appear unless it is a specific facility).

10) When looking at the query, the button next to times should have a calendar symbol or similar for showing its function.

11) In the Query, the time, the severities and the options texts, look out of place in the banner.

12) Instead of all greys, the use of corporate branding colours could be used here to break up the page.

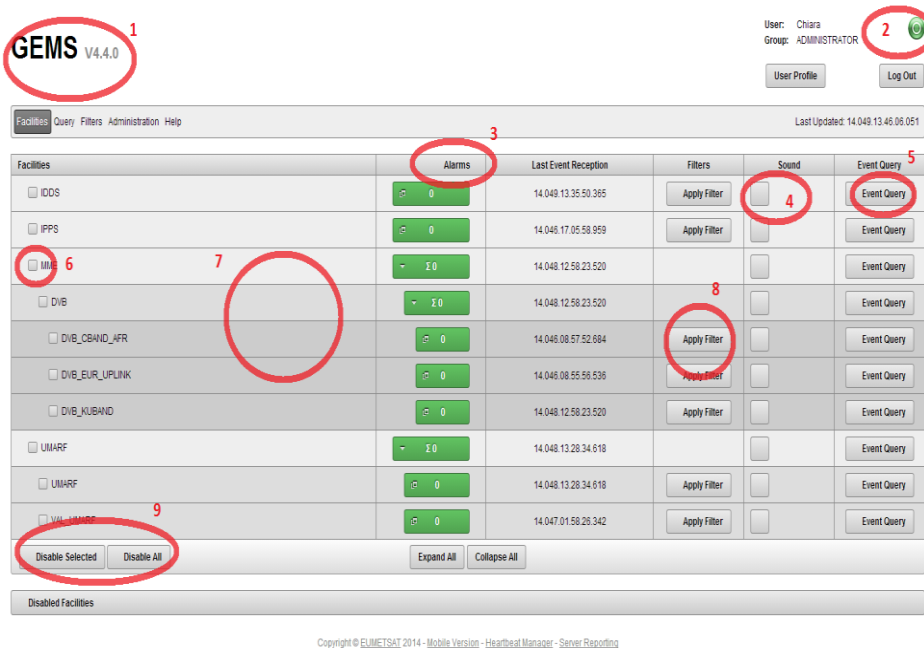


Figure 29: MMI Facilities

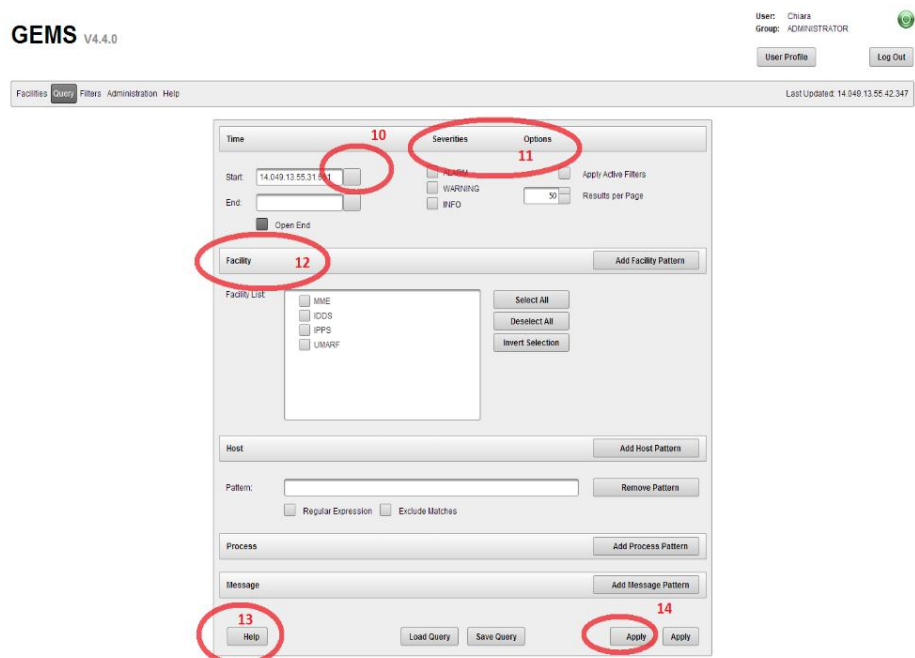


Figure 30: MMI Query

5.1.3 Common to several areas

The selected boxes sometimes show a dark grey colour or a light grey colour. As a result it is not immediately understood if the box (the item) is selected or not. It would be better for example to have a tick or a cross symbol (see Figure 31 the green circles).

Moreover when configuring the facilities, it was noticed that if a few facilities were in the list then the software was quite fast, but as soon as more facilities have been added, it became slower (even up to 10 seconds for loading the main page).

Also, when restarting the web server, the MMI often does not reconnect and when clicking the refresh button, first a “session expired” error appears and finally it is necessary to log in again.

One last important point is that the Knowledge Base mapping is not present in the MMI.

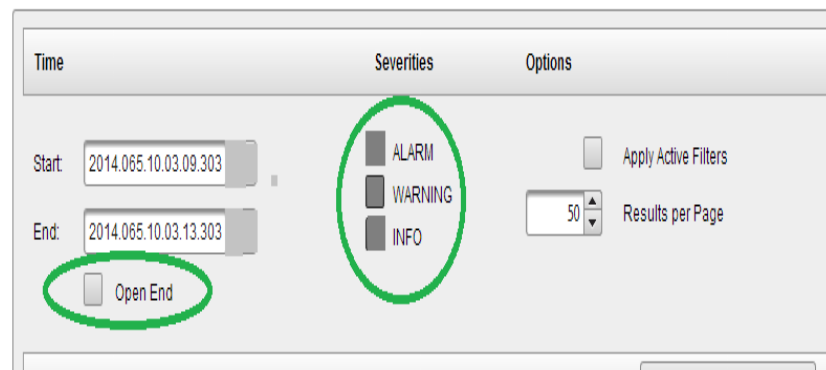


Figure 31: Selected boxes have dark or light grey colour

5.1.4 Query

The query page shows several issues that will be listed below.

- The first problems regard the selected severities. As a default, as currently in GEMS v. 3.6., the severities should all be selected. Instead, this version has the severities as non-selected (despite the dark grey shown in Figure 32, they are not selected).

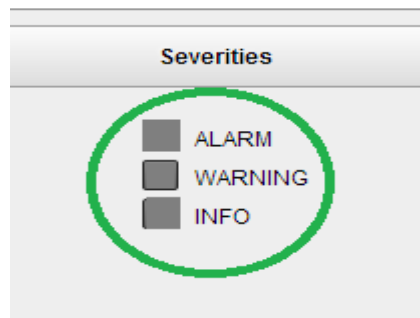


Figure 32: Severities are not selected as default

- When using the "event query" buttons on the facilities page, it does not show the facility launched as being selected, and when you try to select or deselect other facilities they do not show as selected as well.
- In specific cases, such as when selecting a filter via "New filter Definition", and select a facility, the latter changes colour, but it is not very apparent and the user is not sure if he has selected or not the facility in the end.
- When selecting a time-interval for a query search, the start time is equal to the current time. Instead, the default should be 10 minutes before, as in GEMS v. 3.6 (see Figure 33).

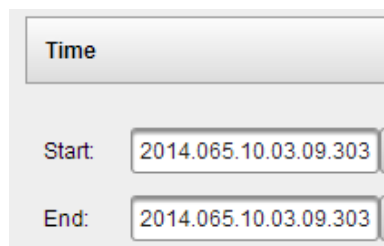


Figure 33: Start and End time are the same per default

- The new MMI gives the possibility of selecting “Open-End” queries, whose output is nevertheless a list with the wrong order: the events have the latest event on top, but new events are then added to the bottom.
- The MMI shows two “Apply” buttons at the bottom of the query page, meant for the same purpose. In particular, the one on the left is a popup, while the one on the right results in a “Refresh-page” (see Figure 34).

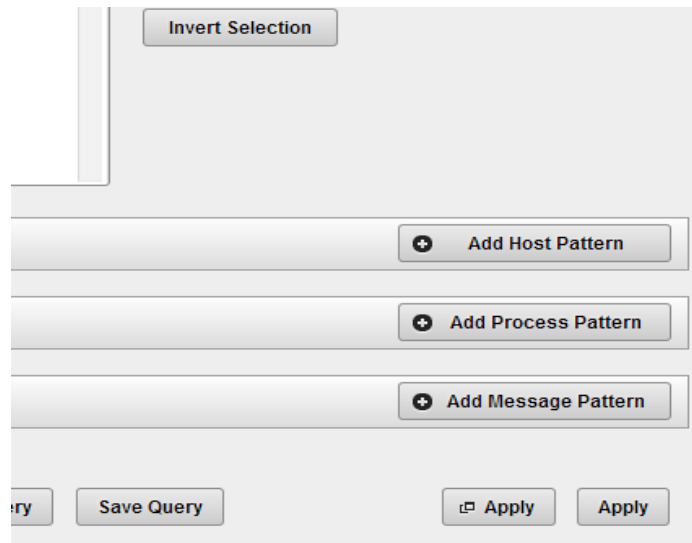


Figure 34: Two "Apply" buttons meant for the same functions

- When clicking on one or more facilities in the Facility list, if click on "Add Facility Pattern", the selected facilities will be deselected automatically.
- When selecting "add xx pattern" but do not fill in a pattern, the query will return an error that this field must be completed.
- When clicking on "Load Query", the pop-up box does not have an exit button (X) (see Figure 35).

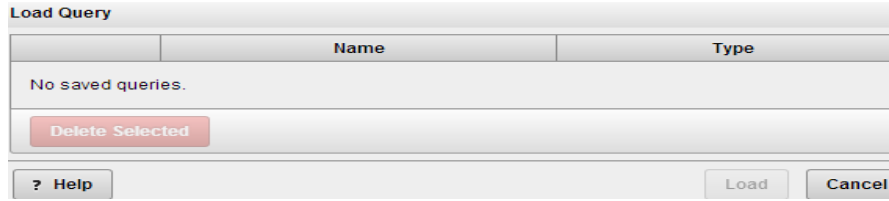


Figure 35: The pop-up window for the Load Query does not have an exit button

- For those facilities that have a VAL component labelled VAL_<facility>, any query for <facility> will return results for <facility> and VAL_<facility>. For example when selecting SNI, also events for VAL_SNI will be displayed even if the latter was not selected (see Figure 36).

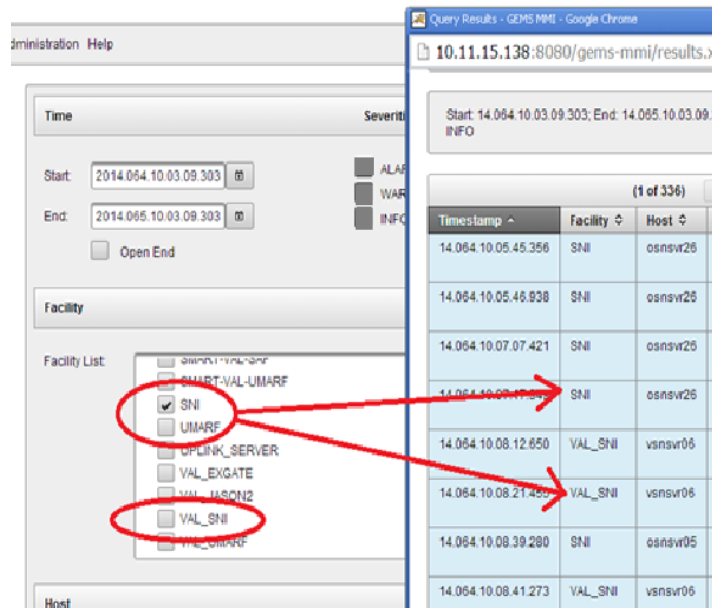


Figure 36: Queries for facilities having also a VAL component shows queries for both

- For selecting a facility sometimes it is required to click more than once.
- When selecting some facilities in the Facility list, and then clicking the "Invert Selection", it only deselects the selected facilities, not vice versa.

- It is assumed with the new facility list that selecting facilities by clicking on the name would deselect other facilities, but clicking the box next to the facility name would keep the facility until it is clicked again, but clicking the box has no separate effect.
- Large event queries are slower than current MMI or return a result "the server is unavailable". It was tested with 1 day of DVB_KUBAND (approx 500,000 events). The error in Figure 37 appears:

```

2014-02-11 13:24:08,463 ERROR - Exception while processing a JMS message. Cleaning up and restarting
javax.jms.InvalidDestinationException: Cannot publish to a deleted Destination: temp-queue://ID:sefduu01-50195-1392124579125-1:2:6
    at org.apache.activemq.ActiveMQSession.send(ActiveMQSession.java:1731)
    at org.apache.activemq.ActiveMQMessageProducer.send(ActiveMQMessageProducer.java:277)
    at org.apache.activemq.ActiveMQMessageProducer.send(ActiveMQMessageProducer.java:212)
    at org.apache.activemq.ActiveMQMessageProducerSupport.send(ActiveMQMessageProducerSupport.java:300)
    at de.eumetsat.gems.server.endpoints.jms.JMSRetriever.sendResponse(JMSRetriever.java:328)
    at de.eumetsat.gems.server.endpoints.jms.JMSRetriever.handleGetEvents(JMSRetriever.java:277)
    at de.eumetsat.gems.server.endpoints.jms.JMSRetriever.processMessage(JMSRetriever.java:130)
    at de.eumetsat.gems.server.endpoints.jms.JMSComponent.run(JMSComponent.java:112)
    at java.lang.Thread.run(Thread.java:736)

```

Figure 37: Error resulting from large queries

In the current MMI, despite the fact that the retrieval takes about 30 seconds for returning a result, it works fine.

- The "Select All" button does not work.

5.1.5 Facility list

A few issues have been found also in the Facility list and listed below:

- When clicking on the Header of a facility group it expands all the sub-facilities. Nevertheless for collapsing them again the same method should be available. Instead only by clicking on the button "Collapse all" it is possible to collapse the group (all of them if more are opened).
- Sometimes the timestamps shows future events with respect to current time.

- It is not clear when a facility has its sound off. Perhaps there should be a label as in the current MMI v. 3.6.

5.1.6 Filters

The main problem for the filters selection is that when having group facilities, it is possible to define a filter only for the header, which means that the filter will be applied to all the facilities under that header.

Another problem is similar to the one explained above for the “Load Query”, where a pop-up window opens but there is no button for exiting it.

5.1.7 Report Page

The report page has a different behaviour depending on the browser that is used. Indeed when using Chromes it all works fine, while when using Internet Explorer, the page is incorrectly formatted.

5.1.8 Help

The help button does not work. It only shows an HTTP status 500 page. The only “help” that works is the one for the Mobile Application, which is actually not implemented yet in mobile phones.

5.1.9 Alarms

As described above, when a facility shows an alarm, the entire row becomes red. It happens sometimes that when acknowledging the alarm, the facility shows the red colour for a while, even if there are no alarms anymore.

Very important is also that when a facility is alarming and a new tab is opened, when going back to the page with the MMI, the facility does not show the alarms anymore, causing the controller to miss them.

5.1.10 Real Time

When a Facility is alarming it is possible to open the “real-time” window which shows the current alarm. In particular the window of GEMS 4.4 shows less functionality with respect to GEMS 3.6 (apart from the “Notify” button that is a new functionality). In particular, the “log”, the “filter” and the “Help” buttons are not listed (see Figure 38).

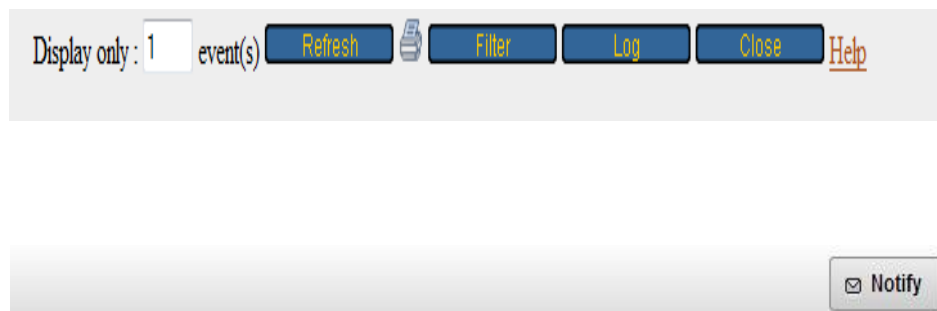


Figure 38: Real- time windows comparison: above the MMI v. 3.6, below the MMI v. 4.4

Moreover, when several "same" alarms occur, they are grouped and at the beginning it shows e.g. [2x]. But this happens only if they are consecutive. It would be preferable to group all the same ones together when the real time window is opened (see Figure 39). Also, when some alarms are the same and they are grouped together, e.g. [5x], it is not possible to click and expand. The Timestamp column only says the first and last event, but it is not possible to click and expand for seeing the occurring time if more alarms.

<input type="checkbox"/>	14.037.14.49.53.080	ooiss05	LogFileAgent	engine_A.log: Entry Detected:2014/02/06 14:49:15 VCS ERROR V-16-10001-6014 (ooiss05) MultiNCA/MNCA01_NIC1.monitor:No more Devices configured. All devices are down. Returning OFFLINE	Acknowledge
<input checked="" type="checkbox"/>	First: 14.037.14.49.53.082 Last: 14.037.14.49.53.117	ooiss05	LogFileAgent	[Zx] engine_A.log: Entry Detected:2014/02/06 14:49:16 VCS ERROR V-16-1-10205 Group vip_netbackup_vsg is faulted on system ooiss	Acknowledge
<input type="checkbox"/>	14.037.14.49.53.119	ooiss05	LogFileAgent	engine_A.log: Entry Detected:2014/02/06 14:49:16 VCS INFO V-16-1-50010 Group vip_netbackup_vsg is online or faulted on system ooiss05	Acknowledge
<input type="checkbox"/>	14.037.14.50.07.249	ooiss04	LogFileAgent	engine_A.log: Entry Detected:2014/02/06 14:49:15 VCS ERROR V-16-10001-6014 (ooiss05) MultiNCA/MNCA01_NIC1.monitor:No more Devices configured. All devices are down. Returning OFFLINE	Acknowledge
<input checked="" type="checkbox"/>	First: 14.037.14.50.07.251 Last: 14.037.14.50.07.252	ooiss04	LogFileAgent	[Zx] engine_A.log: Entry Detected:2014/02/06 14:49:16 VCS ERROR V-16-1-10205 Group vip_netbackup_vsg is faulted on system ooiss	Acknowledge
<input type="checkbox"/>	14.037.14.50.07.253	ooiss04	LogFileAgent	engine_A.log: Entry Detected:2014/02/06 14:49:16 VCS INFO V-16-1-50010 Group vip_netbackup_vsg is online or faulted on system ooiss05	Acknowledge

Figure 39: Alarms grouping

5.1.10 Mobile Application

The mobile application window can be accessed also online. The main problem is that once transferring to the web page for the Mobile Application, there is no button for going back to the main page. Also, when opening a query, the facility selected is not shown, only the events, which may cause confusion.

5.2 Requirements Discrepancies

A final analysis has been done by following each requirement from the “On-event Monitoring User Requirements” document and comparing with what is currently implemented in GEMS v. 3.6 and what should be (/have been) in GEMS v. 4.4 [11].

DAT-040 Locations for Data Access

GEMS events shall be:

DAT-040.1 Viewable by the controllers for each operations component from their respective control rooms in EUMETSAT.

DAT-040.2 Viewable on any OCN PC on site at EUMETSAT.

DAT-040.3 Viewable externally from EUMETSAT on non-EUMETSAT-owned equipment by EUMETSAT personnel.

DAT-040.4 Viewable externally by operations partners, for example MeteoFrance.

DAT-040.5 Accessible via newsfeed clients (e.g. RSS or Atom).

DAT-040.6 Accessible by a mobile phone application (i.e. Blackberry, iPhone, Windows 7 mobile, Android OS).

DAT-041 Presentation of events

Any event displayed by a GEMS HMI shall have its metadata clearly identifiable e.g. providing captions.

DAT-050 Format

The GEMS HMI shall be available in a web style interface, supported by the following browser types:

DAT-050.1 Internet Explorer v.6+

DAT-050.2 Mozilla Firefox v.3+

DAT-050.3 Safari All versions

DAT-050.4 Google Chrome All versions

DAT-051 GEMS Viewer Homepage Content

The following information shall be presented within the HMI:

DAT-051.1 A list of all monitored facilities configured as per requirements DAT-070, 080, 190.

DAT-051.2 A section where it is possible to query for historical events as specified in DAT-110.

DAT-051.3 Meta Data as identified in DAT-090.

DAT-051.4 A link to options to filter events as per DAT-130.

DAT-051.5 The timestamp for the last event received for each monitored facility.

DAT-060 Closure of HMI

The controller HMI shall prompt for user confirmation on closure.

DAT-070 Configuration of Facilities

The viewer shall give the option of which facilities are monitored, observing the constraints to certain user groups.

DAT-071 Enabling/Disabling Facilities

It shall be possible to persistently enable or disable facilities as follows:

DAT-071.1 Individually.

DAT-071.2 All at once.

DAT-071.3 In bulk from a multiple selection by the user.

DAT-071.4 Preconfigured per user / user group.

DAT-080 Administrator Grouping of Facilities in HMI home page

It shall be possible for a GEMS administrator to group facilities by Environment, Operations and Component in an expandable tree style.

DAT-081 Engineer Grouping of Facilities in HMI home page

Additionally to DAT-080, it shall be possible for the engineer users to group facilities further depending on their individual requirements under a user-defined name.

DAT-090 Metadata in HMI

In the facility overview page, the following additional metadata shall be available:

DAT-090.1 Current GEMS version.

DAT-090.2 Refresh time of HMI page i.e. last updated.

DAT-090.3 Connection status to GEMS server.

DAT-090.4 Filters active/filter management (see DAT-130).

DAT-100 Individual User Configuration of HMI

The HMI configuration (facilities monitored, filters, sound options) shall be automatically saved centrally on the users unique account, and reloaded the next time GEMS is accessed, if the user logs in with their own credentials

DAT-101 Retrieval of MASIF configuration settings

It shall be possible for users to select HMI configurations of other administrator configurable users, and apply these as a configuration to their own HMI.

DAT-102 Removal of MASIF configuration settings

It shall be possible for the GEMS administrator to remove any user unique account.

DAT-110 Retrieval of Historical Events

It shall be possible to query for historical events based on the following variables:

DAT-110.1 Time (duration or absolute)

DAT-110.2 Facility (single or multiple)

DAT-110.3 Exclusion of Facility (single or multiple)

DAT-110.4 Host (single or multiple)

DAT-110.5 Exclusion of Host (single or multiple)

DAT-110.6 Process (single or multiple)

DAT-110.7 Exclusion of Process (single or multiple)

DAT-110.8 Event Message Text for each combination of facility, host, severity and process specified.

DAT-110.9 Exclusion of Event Message Text for each combination of facility, host, severity and process specified.

DAT-110.10 Event Severity.

DAT-110.11 Exclusion of Event Severity.

DAT-111 Wildcards and Regular Expressions in query

For query variables defined in DAT-110.2 through DAT-110.9 it shall be also possible to search using options for wildcard characters and regular expressions.

DAT-112 Multiple Fields per variable

Upon entry of a variable feed, further fields linked with a query builder options shall be presented, allowing the user to build advanced queries, i.e. use of AND, OR, NOT, and bracketing .

DAT-115 Queried Events Output Content

The output from the query should contain for each event

DAT-115.1 Event Metadata in identifiable fields.

DAT-115.2 The event text in an identifiable fields.

DAT-115.3 A flag to show if there is a knowledge base entry, which can be selected to expand that information.

DAT-120 Queried Events Output Format

The results from the query in requirement DAT-110 shall be presented in the following formats selectable by the user:

DAT-120.1 Within the same window.

DAT-120.2 In a separate window.

DAT-120.3 In a format suitable for black and white A4 printing.

DAT-120.4 In a spreadsheet compatible downloadable format.

DAT-120.5 In Adobe PDF downloadable format.

DAT-120.6 As the content of an Email.

DAT-120.7 In a separate human readable file (ASCII, UTF-8/16/32).

DAT-121 Queried Events Output Order

Queried events shall be presented in chronological order, with oldest or newest first configurable by the user.

DAT-122 Dynamic Events Display

It shall be possible for a user to specify a dynamic mode, when query results are updated with latest events matching the query in real-time, providing no absolute end time as per DAT-110.1 has been specified.

DAT-123 Query Store and Recall

It shall be possible to save a query definition within the HMI, and recall or delete it at a later time.

DAT-124 Static Queries

It shall be possible for the GEMS Administrator user group as defined in ACE-020 to set up a static query available to any particular user group through their HMI.

DAT-126 Query Subscription Service

It shall be possible for GEMS users to store a query's information as a basis for incoming events via a newsfeed, delivered to them using the following methods:

- DAT 126.1 The native GEMS web application.
- DAT 126.2 Newsfeed (e.g. RSS or Atom).

DAT 126.3 Browser extension (IE, Firefox and Google Chrome).

DAT 126.4 Mobile Phone Application - Blackberry, iPhone,

Windows 7 mobile, Android OS.

DAT-127 Query Delivery Service

It shall be possible to save a query such that the results for a sliding time window are sent at a time and frequency to a user as an email.

DAT-128 External Reporting

GEMS shall provide an API allowing for an external reporting tool to connect to and query the database, in order to extract events for further analysis, plotting etc.

DAT-130 Event Filtering Overview

It shall be possible to create filters for alarm severity events, so that alarms generate no audible or visual warning for a configurable time period, while still being registered as alarm events in the GEMS history for later retrieval.

DAT-140 Event Filtering Configuration

GEMS shall allow alarm events to be individually filtered with the following options:

DAT-140.1 Time (duration, absolute finish time or times in a crontab style
e.g. every Monday 0800-1000)

DAT-140.2 Facility (normal and regexp, include/exclude)

DAT-140.3 Host (normal and regexp, include/exclude)

DAT-140.4 Process (normal and regexp, include/exclude)

DAT-140.5 Text (normal and regexp, include/exclude)

DAT-150 Event Filtering Saving

It shall be possible to save filters on the local user workstation or as an authenticated user under a unique name so that they can later be applied, modified or deleted.

DAT-151 Display of Filtering

It shall be visible on the GEMS facility viewer page which facilities have a current filter applied.

DAT-152 Event Filtering Grouping

It shall be possible for a logged in user to save more than one filter as per DAT-150 from different facilities as a set under a single unique name, so that by selecting a single name it shall apply multiple filters.

DAT-154 Filtering Reasons

The filter window shall contain a mandatory field for the user to add a reason that the filter is applied.

DAT-165 Severity Upgrade Mechanism

It shall be possible to upgrade a warning or info event to a higher severity i.e. alarm state, using the same filtering methods as specified in DAT-130 – 160.

DAT-180 Event Filtering Record

GEMS shall automatically keep a record of whenever any filter (local or global) is applied, edited or removed by the Controller User Group. The record shall contain:

DAT-180.1 Type of change.

DAT-180.2 Time of change.

DAT-180.3 Either New parameters if filter added/changed:

- New Facility
- New Host name
- New Process
- New Message text

DAT-180.4 Or if filter has been removed, the parameters listed in DAT-180.3 at the time the filter was removed.

DAT-185 Centralised Filter Management

GEMS Administrators shall be able to manage controller user group filters through an HMI. The HMI shall have the following attributes:

DAT-185.01 View the current filters applied by each controller group subset.

DAT-185.02 Add, edit and delete a group filter (DAT-152) so that it can be used by a controller user group.

DAT-185.03 View a history of any controller applied filters from DAT-180.

DAT-190 Audible and Visual Notification

If an alarm severity event is received by the GEMS server, GEMS shall present the event with an audible and visual notification for such time as the event remains unacknowledged.

DAT-191 Audible notification per facility

It shall be administrator configurable per facility the sound file used for the audible alarm.

DAT-200 Acknowledgement of Audible Alarms

The GEMS user shall be able to acknowledge the audible alarm from the main HMI screen for a particular facility, so long as they are presented with a list of alarms present for that facility in doing so.

DAT-210 Suppression of Audible Alarms

The GEMS user shall be able to suppress the alarm sound, in case other operations take priority over analysis of GEMS alarms. The user shall be able to configure a time from an option on the main HMI screen to suppress alarm sounds for a configurable time period for a particular facility, with an administrator configurable default.

DAT-211 Alarm Suppression Record

A record shall be kept whenever a GEMS controller user group suppresses or un-suppresses sound for a particular facility. The record shall contain:

DAT-211.01 Time of suppression/un-suppression.

DAT-211.02 Time set (for suppression).

DAT-211.03 Facility.

DAT-215 Audio notification for non-control room environments

The GEMS viewer for the operations engineers as defined in ACE-012 shall have as default all alarm notifications permanently suppressed with the option to switch on if necessary.

DAT-220 Alarm Analysis

Upon presentation by the HMI visually and audibly of an alarm severity event(s), the GEMS user shall be able to analyse the alarm content through an interface launched in the HMI, which shall present a list of any unacknowledged alarms in chronological order for a particular facility. By launching the alarm analysis window, the audible alarm should also be stopped.

The GEMS user shall then have the option of acknowledging individual or all alarms.

DAT-230 Alarm Forwarding

Upon presentation of an alarm or list of alarms, the controller shall have the options to forward the alarm:

DAT-230.1 As an email to the analyst/engineering teams.

DAT-230.2 To an electronic log-book system/events database system using an API.

DAT-240 Bulk Alarm Detection

GEMS shall use configurable regular expressions to detect duplicates of unacknowledged alarms, i.e. if multiple alarms are received where the only difference

is a timestamp in the metadata or event itself. Only one event shall be displayed, but with a flag indicating how many occurrences of this event there have been, with first and last event times.

DAT-245 Bulk Alarm Forwarding

On bulk alarm detection, only one occurrence of the event shall be forwarded as per DAT-230, but including the bulk detection flag as per DAT-240.

DAT-250 KB Concept

GEMS shall include functionality to provide a link via an API to a separate Knowledge Base tool, such that an administrator, using regular expressions can configure GEMS to display a link to the KB for any alarm that has a known response.

DAT-251 Mapping events to known actions

The KB shall be able to use multiple regular expression matches for the event text in combination to lookup and map an appropriate action.

DAT-260 Online Help

The HMI shall include an online help functionality for all pages and features.

DAT-261 Online Help Links

A link to the main help page shall be given on each GEMS web page.

DAT-262 Online Help Direct Links

Where user input is required, especially for complex functionality, an info/help button should appear with e.g. mouse over functionality giving information for that function. Upon selection, it will direct to the full help page for that functionality.

DAT-263 Online Help Index

The online help shall be properly indexed with dynamic linking, and a search functionality.

In **Error! Reference source not found.** the requirement are listed on the left and on the right the requirement is tested for GEMS v. 3.6 and v. 4.4. In particular, shows:

- Fully Compliance = FC
- Partially Compliance = PC
- Non Compliance = NC

Requirement Reference	Subrequirement Reference	3.6 Compliance	4.4 Compliance
DAT-041	n/a	FC	FC
DAT-050	DAT-050.01	FC	FC
DAT-050	DAT-050.02	FC	FC
DAT-050	DAT-050.03	FC	FC
DAT-050	DAT-050.04	FC	FC
DAT-051	DAT-051.01	PC	PC
DAT-051	DAT-051.05	FC	FC
DAT-060	n/a	NC	NC
DAT-070	n/a	FC	FC
DAT-071	DAT-070.01	FC	FC
DAT-071	DAT-070.02	NC	FC
DAT-071	DAT-070.03	NC	FC
DAT-071	DAT-071.04	FC	FC
DAT-080	n/a	NC	FC
DAT-081	n/a	NC	FC
DAT-090	DAT-090.01	FC	FC

DAT-090	DAT-090.02	FC	NC
DAT-090	DAT-090.03	FC	PC
DAT-090	DAT-090.04	FC	FC
DAT-100	n/a	FC	FC
DAT-101	n/a	NC	NC
DAT-102	n/a	FC	FC
DAT-110	DAT-110.01	FC	FC
DAT-110	DAT-110.02	FC	FC
DAT-110	DAT-110.03	NC	FC
DAT-110	DAT-110.04	FC	FC
DAT-110	DAT-110.05	NC	FC
DAT-110	DAT-110.06	FC	FC
DAT-110	DAT-110.07	NC	FC
DAT-110	DAT-110.08	FC	FC
DAT-110	DAT-110.09	NC	FC
DAT-110	DAT-110.010	FC	FC
DAT-110	DAT-110.11	NC	NC
DAT-111	n/a	PC	FC
DAT-112	n/a	FC	FC
DAT-115	DAT-115.01	FC	FC
DAT-115	DAT-115.02	FC	FC
DAT-115	DAT-115.03	NC	NC
DAT-120	DAT-120.01	NC	NC
DAT-120	DAT-120.02	FC	FC
DAT-120	DAT-120.03	PC	PC
DAT-120	DAT-120.04	NC	NC
DAT-120	DAT-120.05	NC	NC
DAT-120	DAT-120.06	NC	FC
DAT-120	DAT-120.07	NC	NC
DAT-121	n/a	FC	FC
DAT-122	n/a	NC	FC
DAT-123	n/a	NC	FC
DAT-124	n/a	FC	FC
DAT-126	DAT-126.01	NC	FC
DAT-126	DAT-126.02	NC	FC
DAT-126	DAT-126.03	NC	FC
DAT-126	DAT-126.04	NC	FC
DAT-127	n/a	NC	FC
DAT-128	n/a	NC	FC
DAT-130	n/a	FC	FC
DAT-140	DAT-140.01	FC	FC
DAT-140	DAT-140.02	FC	FC
DAT-140	DAT-140.03	FC	FC
DAT-140	DAT-140.04	FC	FC
DAT-140	DAT-140.05	FC	FC

DAT-150	n/a	NC	FC
DAT-151	n/a	FC	FC
DAT-152	n/a	NC	FC
DAT-154	n/a	NC	FC
DAT-165	n/a	NC	FC
DAT-180	DAT-180.01	NC	FC
DAT-180	DAT-180.02	NC	FC
DAT-180	DAT-180.03	NC	PC
DAT-180	DAT-180.04	NC	FC
DAT-185	DAT-185.01	NC	FC
DAT-185	DAT-185.02	NC	FC
DAT-185	DAT-185.03	NC	FC
DAT-190	n/a	FC	FC
DAT-191	n/a	FC	FC
DAT-200	n/a	FC	FC
DAT-210	n/a	FC	FC
DAT-211	DAT-211.01	NC	FC
DAT-211	DAT-211.02	NC	FC
DAT-211	DAT-211.03	NC	FC
DAT-215	n/a	NC	FC
DAT-220	n/a	FC	FC
DAT-230	DAT-230.01	NC	FC
DAT-230	DAT-230.02	NC	NC
DAT-240	n/a	NC	FC
DAT-245	n/a	NC	FC
DAT-250	n/a	NC	NC
DAT-251	n/a	NC	NC
DAT-260	n/a	FC	NC
DAT-261	n/a	FC	NC
DAT-262	n/a	NC	NC
DAT-263	n/a	FC	NC

Table 2: Requirements comparison

6 Conclusion and future work

After evaluation of the tests above explained, it has been decided from the Mission Performance Team that the new GEMS v. 4.4 was not ready for becoming operational.

In particular, some of the new functionalities have been partially or not implemented. However, despite the new ones that should have been improvements of GEMS, also a few regression from the current GEMS software have been noted, which would not allow normal routine operations.

Thinking of mal-functionalities such as two buttons for the same purpose or default settings, problems like connections failures or servers crashing (e.g., when large queries are applied) or impossibility of connecting to the MMI are not-acceptable when talking about real-time operations where immediate actions have to be taken in case of anomalies.

In particular, a few discussions have been made with Solenix regarding the regressions from GEMS v.3.6. Solenix reported that some things were not specified in the user requirements and as such in order to have them they should be considered as “Evolutions” for a possible future GEMS version, or for the v. 4.4 behind extra payment for implementing the features. It has been clarified (and learnt for a next time) that a User Requirements guide cannot contain every single detail, but that it should be kept in mind that, except for when specified that certain functionalities should be changed, the requirements for the previous version should be kept. One of the clearest examples regards the default colour that has been defined for alarms: red. The alarms should appear in red in every window when opened. Despite the fact that it was not specified in the requirements for v. 4.4, it was implicit that alarms cannot have the colour of an “info message” when opening for example the real time window and that this type of things don’t need to be specified in a new User Requirements guide. Currently a discussion is still opened with Solenix about these topics, and the Mission Performance Team is trying to make a few agreements in order to Solenix to implement the functionalities as part of the contract that was signed with them and not as an “extra”.

From the reasons above and for other regulations within EUMETSAT, the Mission Performance Team member will start to use IBM rational DOORS software which is a Requirements Management Tool in order to keep traceability of requirements, and delta-requirements easily and clearer. What is currently planned is that the requirements for GEMS v. 4.4 will be re-written and transferred in DOORS and both EUMETSAT and Solenix can have access to them. Both of them can introduce delta-requirements to be implemented. Starting from v.4.4 on the requirements will all be followed in this way, such that for a possible future version of GEMS only requirements plus delta-requirements will be considered and there is less risk of misunderstanding between the two parts.

Appendix A: Java packages

The GEMS system depends on the following Java packages [12]:

activation-1.1.jar
activemq-core-5.7.0.jar
activemq-optional-5.7.0.jar
activemq-protobuf-1.1.jar
asm-3.1.jar
common-1.0.7.jar
commons-cli-1.2.jar
commons-codec-1.6.jar
commons-httpclient-3.1.jar
commons-io-2.4.jar
commons-logging-1.1.1.jar
commons-net-3.1.jar
ant-contrib-0.6.jar
derby-10.10.1.1.jar
edtfp-2.0.4.jar
gems-client-logfileagent.jar
gems-client-heartbeat.jar
gems-server-api.jar
gems-server-clients-file.jar
gems-server-clients-jms.jar
gems-server-clients-restful.jar
gems-server-core.jar
gems-server-endpoints-jms.jar
gems-server-endpoints-restful.jar
gems-server-heartbeat.jar
geronimo-j2ee-management_1.1_spec-1.0.1.jar
geronimo-jms_1.1_spec-1.1.1.jar
grizzly-framework-2.2.16.jar
grizzly-http-2.2.16.jar
grizzly-http-server-2.2.16.jar
grizzly-rcm-2.2.16.jar
hamcrest-core-1.1.jar
hawtbuf-1.9.jar
hawtdispatch-transport-1.11.jar
hawtdispatch-1.11.jar
httpclient-4.2.1.jar
httpcore-4.2.1.jar

jackson-core-asl-1.9.2.jar
jackson-jaxrs-1.9.2.jar
jackson-mapper-asl-1.9.2.jar
jackson-xc-1.9.2.jar
jakarta-regexp-1.2.jar
jasypt-1.9.0.jar
jaxb-api-2.2.2.jar
jaxb-impl-2.2.3-1.jar
jdom.jar
jersey-client-1.14.jar
jersey-core-1.14.jar
jersey-grizzly2-1.14.jar
jersey-json-1.14.jar
jersey-server-1.14.jar
jettison-1.1.jar
jms-1.1.jar
jsr311-api-1.1.1.jar
junit-3.8.1.jar
junit-addons-1.1.jar
kahadb-5.7.0.jar
log4j-1.2.17.jar
maven-ant-tasks-2.1.0.jar
mqtt-client-1.3.jar
ojdbc6-11g-2.jar
servlet-api-2.4.jar
slf4j-api-1.7.5.jar
slf4j-log4j12-1.7.5.jar
org.springframework.aop-3.1.2.RELEASE.jar
org.springframework.asm-3.1.2.RELEASE.jar
org.springframework.beans-3.1.2.RELEASE.jar
org.springframework.context-3.1.2.RELEASE.jar
org.springframework.core-3.1.2.RELEASE.jar
org.springframework.expression-3.1.2.RELEASE.jar
spring-web-3.1.2.RELEASE.jar
stax-api-1.0-2.jar
xercesImpl-2.6.2.jar
xmlpull-1.1.3.1.jar
xpp3_min-1.1.4c.jar
xstream-1.4.3.jar

Appendix B: Validation Tests [12]

Test 1.1: Login and User Configuration Persistence

TEST 1.1	
Functionality to be Verified:	User login and persistence of user configuration between sessions
Software Version:	GEMS-4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	The GEMS MMI started without AUTO-LOGIN configuration and a user configured. GEMS MMI cookies cleared in browser.
Procedure Steps:	<p>Open GEMS MMI (http://vm-eum-solaris-01:9980/GEMS).</p> <p>Select the “Remember me” option and log in with the test/123456 credentials.</p> <p>Close the browser.</p> <p>Re-open the browser on the GEMS MMI page (http://vm-eum-solaris-01:9980/GEMS).</p> <p>Go to Profile > User Preferences, tick the option “Confirm before Log out” and press Save.</p> <p>Log out. Press yes in the confirmation dialog box.</p> <p>Stop GEMS MMI, enable auto-login for the configured user in mmi.xml and restart GEMS MMI.</p> <p>Access the GEMS MMI page (http://vm-eum-solaris-01:9980/GEMS).</p>
Expected Results:	<p>After step 1, the user should be logged in and the facilities page displayed.</p> <p>After step 3, the user should be logged in again without having to enter its credentials.</p> <p>At step 5, the user should be prompted for a confirmation.</p> <p>After step 7, the user should be logged automatically without having to enter its credentials.</p>
Comments:	-
Inputs	-

Test 1.2: Monitored Facilities and Grouping

TEST 1.2	
Functionality to be Verified:	Monitored facilities and their grouping
Software Version:	GEMS-4.4.0
Associated AR(s):	EUM/MSG/AR/17502
Regression Tests:	NO
Pre-Conditions:	A user must be logged in and have access to all test facilities from the sample data.
Inputs:	-
Procedure Steps:	<p>Open the facilities overview (Facilities in the menu)</p> <p>Press the “Expand All” button, select the OPE group and press the “Disable selected” button.</p> <p>Press the “Disable All” button.</p> <p>Expand “Disabled Facilities”, select GEMS INTERNAL and press “Enable Selected”.</p> <p>Press “Enable All”.</p> <p>Go to User Profile > Facility Grouping and change the group of DVB_CBAND_AFR and DVB_CBAND_SAM to MINE/DVB</p> <p>Go back to the Facilities Overview</p>
Expected Results:	<p>After step 1, the OPE group and all facilities in it should have been moved from the list of facilities and added to the list of disabled facilities.</p> <p>After step 2, the remaining facilities should have been moved to the list of disabled facilities.</p> <p>After step 3, GEMS INTERNAL should have been moved to the list of facilities.</p> <p>After step 4, all facilities should be moved to the list of facilities.</p> <p>After step 6, the facility tree should reflect the new grouping. DVB_CBAND_AFR and DVB_CBAND_SAM should be under MINE > DVB in the tree.</p>
Comments:	-

Test 1.3: Event Queries: Part I

TEST 1.3	
Functionality to be Verified:	Configuration, loading, saving and executing event queries.
Software Version:	GEMS-4.4.0
Associated AR(s):	EUM/MuMi/AR/476
Regression Tests:	NO
Pre-Conditions:	The GEMS MMI server must be started. The user must be logged in with the admin/123456 credentials.
Inputs:	Sample data for the period queried
Procedure Steps:	<p>Go to the Query page.</p> <p>Press “Save Query”, enter “query1” as the query name and press “Save”.</p> <p>Reload the Query page again to obtain a new query.</p> <p>Select 00:00 of the current day as the start date and the current date and time as an end date.</p> <p>Select “UMARF” from the facility list.</p> <p>Press “Add Facility Pattern” and type “DVB*” in the text box.</p> <p>Press “Add Facility Pattern”, type “DVB_CBAND_AF?” in the text box and check “Regular Expression”</p> <p>Press “Add Facility Pattern”, type “GEMS.*” in the text box and check “Exclude Matches”</p> <p>Press “Add Facility Pattern”, type “.*SAM.*” in the text box and check “Exclude Matches” and “Regular Expression”</p> <p>Mirror steps 5-8, for hosts using “Add Host Pattern” and the “oumacs?”, “oumacs05”, “oumap.*” and “.*maps0[6789]” values respectively.</p> <p>Mirror steps 5-8, for process using “Add Process Pattern” and the “Flow?enerator”, “LogFileAgent”, “.*Agent.*” and “Check.*” values respectively.</p> <p>Mirror steps 5-8, for process using “Add Message Pattern” and the “*dolor*”, “lorem dolor”, “.*lorem.*” and “.*ipsum.*” values respectively.</p> <p>Deselect INFO from the severities section.</p> <p>Press “Save Query”, enter “query2” as the query name, select all groups and press “Save”.</p> <p>Reload the Query page to obtain a new query and press “Load Query”.</p> <p>Select “query2” and press “Load”</p> <p>Press the “Apply” button with no icon.</p> <p>Select the current URL and open a new tab using it as an address.</p> <p>Log out and log in with the user/123456 credentials.</p> <p>Go to the Query page and press “Load Query”.</p> <p>Select “query2” and press “Load”</p> <p>Press the “Apply” button with an icon.</p>

<p>Expected Results:</p>	<p>After step 15, the list of queries should list “query1” and “query2”.</p> <p>After step 16, the query page should display the configuration for the query loaded.</p> <p>After step 17, a results page should be displayed in the same tab with 36 results respecting the selection criteria, namely including facilities “UMARF”, “GEMS INTERNAL”, “DVB_KUBAND”, the hosts “oumacs02” and “oumaps02”, the processes “FlowGenerator” and “EFTS_PollFtpAgent”, the message “dolor soleat eripuit apeirian” and WARNING and ALARM severities.</p> <p>After step 18, the same results should be displayed in the new tab.</p> <p>After step 20, the query list should display only “query”, the shared query.</p> <p>After step 21, the query page should display the configuration for the query loaded.</p> <p>After step 22, a new tab should have been opened with the same results as in step 17.</p>
<p>Comments:</p>	<p>-</p>

Test 1.4: Event Queries: Part II

TEST 1.4	
Functionality to be Verified:	Delete queries, sorting and exporting results
Software Version:	GEMS-4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	The GEMS MMI server must be started. The user must be logged in with the admin/123456 credentials. Test 1.4 must have been executed previously.
Inputs:	Sample data for the period queried
Procedure Steps:	<p>Go to the Query page.</p> <p>Press the “Load Query” button.</p> <p>Select “query1” and press “Delete Selected”</p> <p>Select “query2” and press “Load”.</p> <p>Press the “Apply” button.</p> <p>Press the timestamp header.</p> <p>Press the PDF link below the result table and open the file.</p> <p>Press the Excel link below the result table and open the file.</p> <p>Press the CSV ASCII link below the result table and open the file.</p> <p>Press the CSV UTF-8 link below the result table and open the file.</p> <p>Press the CSV UTF-16 link below the result table and open the file.</p> <p>Press the CSV UTF-32 link below the result table and open the file.</p> <p>Press the E-mail link below the result table and press “Send” on the open dialog.</p> <p>Press “Edit”, check the “Open End” option and press “Apply”.</p> <p>Raise an event using http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=UMARF&host=localhost&process=LogFileAgent&severity=I&message=event_text</p>
Expected Results:	<p>After step 3, “query1” should have been removed from the list.</p> <p>After step 5, the query results should be displayed.</p> <p>After step 6, the order of the sorting of the results should be reversed.</p> <p>After steps 7 to 12, the resulting file should be opened displaying the query results.</p> <p>After step 13, the results should have been received at the target e-mail address.</p> <p>After step 14, the same results as in step 5 should be displayed, but the export options should not be available.</p> <p>After step 15, a new event should be added to the existing results.</p>
Comments:	-

Test 1.5: Knowledge Base Mapping

TEST 1.5	
Functionality to be Verified:	KB management and links to KB entries in query results
Software Version:	GEMS-4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	The GEMS MMI server must be started. The user must be logged in with the admin/123456 credentials.
Inputs:	Sample data for the period queried.
Procedure Steps:	<p>Go to Administration > Knowledge Base Mapping</p> <p>Press “Add Rule”.</p> <p>Type “rule1” as the name and tick ALARM.</p> <p>Write “lorem*” as a message.</p> <p>Press “Add Pattern”, write “dolor*” as the new pattern and tick “Regular Expression”.</p> <p>Write “entry1” as title and “http://localhost/kb/entry1.html” as link.</p> <p>Press “Save”.</p> <p>Go to the Query page.</p> <p>Select 00:00 of the current date as a start date and press “Apply”</p> <p>Click on the KB entry icon on a row.</p> <p>Go to Administration > Knowledge Base Mapping</p> <p>Select “rule1”.</p> <p>Press “Delete Pattern” on one pattern and press “Save”.</p> <p>Press “Delete Rule”.</p>
Expected Results:	<p>After step 9, the results should be displayed and KB links should be displayed for each row.</p> <p>After step 10, the browser should have opened the configured link in a new tab.</p> <p>After step 14 the rule should have been deleted.</p>
Comments:	-

Test 1.6: User Profile and User Preferences

TEST 1.6	
Functionality to be Verified:	Viewing and editing user profile and user preferences
Software Version:	GEMS-4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	The GEMS MMI server must be started. The user must be logged in with the test/123456 credentials.
Inputs:	-
Procedure Steps:	<p>Go to User Profile</p> <p>Change the Real Name</p> <p>Change the password by typing the current password and the new password in corresponding text fields.</p> <p>Select the Preferences tab.</p> <p>Change the preferences values, changing the “Query” to 10 and the “Confirm Page Quit” to true.</p> <p>Press “Apply”.</p> <p>Log out.</p> <p>Try to login with previous password.</p> <p>Log in with the new password.</p> <p>Go to User Profile and repeat the step 3 to revert the password to the original value.</p> <p>Select the Preferences tab.</p> <p>Go to Facilities and try to close the tab.</p> <p>Click “Stay on Page”.</p> <p>Go to Query.</p>
Expected Results:	<p>After step 8, the login dialog should notify the credentials provided are not valid.</p> <p>After step 9, the user should be logged in.</p> <p>After steps 10 and 11, the changes made previously should still be there.</p> <p>After step 12, a dialog should be displayed asking if the user wishes to leave the page or not.</p> <p>After step 14, the value 10 should be displayed for Results Per Page.</p>
Comments:	-

Test 1.7: User and Group Management

TEST 1.7	
Functionality to be Verified:	Creating, editing and deleting users and groups
Software Version:	GEMS-4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	The GEMS MMI server must be started. The user must be logged in with the admin/123456 credentials.
Inputs:	-
Procedure Steps:	<p>Go to Administration > User Management</p> <p>Press “Add Group”.</p> <p>Fill in the group name.</p> <p>Select the UMARF facility from the facility list.</p> <p>Press “Save”.</p> <p>Change the group name.</p> <p>Press “Save”.</p> <p>Press “Add User”.</p> <p>Fill in the desired username, real name, e-mail and password.</p> <p>Select the previously created group from the group list.</p> <p>Press “Save”.</p> <p>Change some of the user details, including the username.</p> <p>Press “Save”</p> <p>Log out and log in with the created user’s credentials.</p> <p>Log out and log in with the admin credentials.</p> <p>Go to Administration > User Management</p> <p>Selected the previously created user and press “Delete User”</p> <p>Select the previously created group and Press “Delete Group”</p>
Expected Results:	<p>After step 5, the new group should be displayed in the group list.</p> <p>After step 7, the new group name change should be reflected on the group list.</p> <p>After step 11, the new user should be displayed in the user list.</p> <p>After step 13 the username change should be reflected in the user list.</p> <p>After step 14 only the UMARF facility should be visible.</p> <p>After step 17 the user should have been deleted from the user list.</p> <p>After step 18 the group should have been deleted from the group list.</p>
Comments:	-

Test 1.8: Mobile- Facility overview

TEST 1.8	
Functionality to be Verified:	Test the facility overview
Software Version:	GEMS-4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	The GEMS MMI server must be started. The user must be logged in with the admin/123456 credentials and using a mobile device.
Inputs:	-
Procedure Steps:	<p>Raise the five alarms (two of them duplicated) for UMARF and one for GEMS INTERNAL using the following URLs:</p> <p>http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=UMARF&host=localhost&process=LogFileAgent&severity=I&message=event_text1 http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=UMARF&host=localhost&process=LogFileAgent&severity=I&message=event_text_a http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=UMARF&host=localhost&process=LogFileAgent&severity=I&message=event_text_b http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=UMARF&host=localhost&process=LogFileAgent&severity=I&message=event_text_c http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=UMARF&host=localhost&process=LogFileAgent&severity=I&message=event_text2 http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=DVD_KUBAND&host=localhost&process=LogFileAgent&severity=I&message=event_text</p> <p>Click on the DVD_KUBAND facility.</p> <p>Click Back.</p> <p>Click on the MASIF group.</p> <p>Click on the OPE group.</p> <p>Click on the MASIF facility.</p>
Expected Results:	<p>After step 1, the display should show 1 alarm for DVD_KUBAND and 4 alarms for MASIF.</p> <p>After step 2, the details for the DVD_KUBAND alarm should be displayed.</p> <p>After step 3, the facility overview should be displayed again.</p> <p>After step 4, the path should be updated to “MASIF” and the list should display “OPE”.</p> <p>After step 5, the path should be updated to “MASIF > OPE” and the list should display “UMARF”</p> <p>After step 6 the four alarms for UMARF should be listed, including one corresponding to the event for which two duplicates were raised.</p>
Comments:	-

Test 1.9: Mobile- Query view

TEST 1.9	
Functionality to be Verified:	Test the facility overview
Software Version:	GEMS-4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	The GEMS MMI server must be started. The user must be logged in with the admin/123456 credentials.
Inputs:	Sample data for the period queried.
Procedure Steps:	<p>Go to the Query page pressing the Query Button on the footer.</p> <p>Set 00:00 of the current day as the start date and the current date and time as an end date (using the GEMS Date Format)</p> <p>Click on the "Facility: None" line.</p> <p>Press "Add" and type "DVB*" in the text box.</p> <p>Press "Add" and type "UMARF" in the text box.</p> <p>Press "Add", type "DVB_CBAND_AF?" in the text box and check "Regular Expression".</p> <p>Press "Add", type "GEMS.*" in the text box and check "Exclude Matches".</p> <p>Press "Add", type ".*SAM.*" in the text box and check "Exclude Matches" and "Regular Expression".</p> <p>Press "Back".</p> <p>Press "Host: None" and mirror steps 5-9, for hosts using the "Add Host Pattern" and the "oumacs?", "oumacs05", "oumap.*" and ".*maps0[6789]" values respectively.</p> <p>Press "Process: None" and mirror steps 5-9, for hosts using the "Flow?enerator", "LogFileAgent", ".*Agent.*" and "Check.*" values respectively.</p> <p>Press "Message: None" and mirror steps 5-9, for hosts using the ".*dolor*", "lorem dolor", ".*lorem.*" and ".*ipsum.*" values respectively.</p> <p>Press the "Apply" button.</p> <p>Go to the Query page pressing the Query Button on the footer.</p> <p>Press the "Apply" button.</p> <p>Raise an event using the following URL http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=UMARF&host=localhost&process=LogFileAgent&severity=A&message=lorem</p>

<p>Expected Results:</p>	<p>After step 9, the Facility section should be updated with the number of added patterns.</p> <p>After step 10, the Message section should be updated with the number of added patterns.</p> <p>After step 11, the Message section should be updated with the number of added patterns.</p> <p>After step 12, the Message section should be updated with the number of added patterns.</p> <p>After step 13, a results page should be displayed in the same tab with 54 results respecting the selection criteria, namely including facilities “UMARF”, “GEMS INTERNAL”, “DVB_KUBAND”, the hosts “oumacs02” and “oumaps02”, the processes “FlowGenerator” and “EFTS_PollFtpAgent” and the message “dolor soleat eripuit apeirian”.</p> <p>After step 14, a new query builder should be displayed.</p> <p>After step 15, an empty result should be displayed.</p> <p>After step 16 the raised alarm should be displayed.</p>
<p>Comments:</p>	<p>-</p>

Test 1.10: Script and SQL Injection

TEST 1.10	
Functionality to be Verified:	Tests the performance of the MMI under normal load circumstances
Software Version:	GEMS-4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	-
Inputs:	-
Procedure Steps:	<p>Log in with “admin” as username and "" or 1 == 1" as password.</p> <p>Log in with "" or 1 == 1" as username and "123456" as password</p> <p>Log in with the “test” and “123456” credentials.</p> <p>Raise an alarm containing HTML code: <a href="http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=DVD_KUBAND&host=localhost&process=TEST&severity=A&message=Evil+<script>alert(document.cookie);</script>">http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=DVD_KUBAND&host=localhost&process=TEST&severity=A&message=Evil+<script>alert(document.cookie);</script></p> <p>Open the DVD_KUBAN alarms view and then close it</p> <p>Go to the query builder (Query page)</p> <p>Search for the last event in DVD_KUBAND</p>
Expected Results:	<p>At step 1 and 2, the log in operation should fail.</p> <p>At step 5, there should be no popup message when the event is received and the HTML code is shown in the event message instead of being executed.</p> <p>At step 7, there should be no popup message when the results are displayed and the HTML code is shown in the event message instead of being executed.</p>
Comments:	-

Test 1.11: Long-running test

TEST 1.11	
Functionality to be Verified:	Tests the performance of the MMI under normal load circumstances over a longer period than regular tests.
Software Version:	GEMS-4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	The user must be logged in with the admin/123456 credentials.
Inputs:	-
Procedure Steps:	<p>Open the facilities overview and leave it open.</p> <p>Start the FlowGenerator for long-running: <code>java FlowGenerator long-running</code></p> <p>Wait for 24 hours.</p> <p>Stop the FlowGenerator.</p> <p>Open the alarms view of one of the facilities with alarms</p> <p>Acknowledge all alarms and close the alarms view</p>
Expected Results:	<p>After step 2, the last event reception is updated and alarms are being displayed in the overview.</p> <p>After step 4, the facilities overview is still up and alarms have been accumulated.</p> <p>After step 6, the alarms have been acknowledged for the selected facility (the button shows 0 and is green).</p>
Comments:	-

Test 1.12: High-load test

TEST 1.12	
Functionality to be Verified:	Tests the performance of the MMI under high load circumstances such as alarm storms
Software Version:	GEMS-4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	The user must be logged in with the admin/123456 credentials.
Inputs:	-
Procedure Steps:	<p>Open the facilities overview and leave it open.</p> <p>Start the FlowGenerator for high-load: <code>java FlowGenerator high-load</code></p> <p>Wait for 10 minutes.</p> <p>Stop the FlowGenerator.</p> <p>Open the alarms view of one of the facilities with alarms</p> <p>Acknowledge all alarms and close the alarms view</p>
Expected Results:	<p>After step 2, the last event reception is updated and alarms are being displayed in the overview.</p> <p>After step 4, the facilities overview is still up and alarms have been accumulated.</p> <p>After step 6, the alarms have been acknowledged for the selected facility (the button shows 0 and is green).</p>
Comments:	-

Test 1.13: Robustness test

TEST 1.13	
Functionality to be Verified:	The operator is informed of a loss of monitoring. The client-side of the MMI reconnects automatically when the server is up again.
Software Version:	GEMS-4.4.0
Associated AR(s):	EUM/MuMi/AR/409
Regression Tests:	NO
Pre-Conditions:	A running GEMS MMI.
Inputs:	-
Procedure Steps:	<p>Login and open the facilities overview</p> <p>Stop Tomcat using the control script</p> <p>Wait for the loss of monitoring to be detected</p> <p>Start Tomcat using the control script</p> <p>Wait for the monitoring to resume</p>
Expected Results:	<p>At step 3, the interface should lock (grey overlay) itself preventing the user to interact and a alert message is displayed informing the user of the loss of monitoring.</p> <p>At step 5, the interface should reconnect automatically and resume the monitoring where it was. The overlay and the message should disappear.</p>
Comments:	If Tomcat is not stopped properly using the control script, i.e. kill command, the session is not persisted and the current state of the monitoring is lost.

Test 1.14: GEMS raise event

TEST 1.14	
Functionality to be Verified:	Launching GEMS_raise_event works as before
Software Version:	GEMS 4.4.0
Associated AR(s):	EUM/MuMi/AR/677
Regression Tests:	YES
Pre-Conditions:	A correctly set up GEMS as defined in the maintenance guide.
Inputs:	-
Procedure Steps:	Launch the GEMS_raise_event process via the following command line: java -cp lib/GEMS.jar GEMS_raise_event facility host process I "Event Message".
Expected Results:	A FACILITY.log file is created in the folder defined with the property "GEMS.Client.LogPath" in the current default GEMS.properties file. If this value is not set, the file will be created in the current folder.
Comments:	This test ensures that the updated GEMS Raise Event implementation and its command line application wrapper GEMS_raise_event are fully functional.

Test 1.15: GEMS raise event, non-static API test application

TEST 1.15	
Functionality to be Verified:	GEMSRaiseEvent non-static API is now restored and allows the use of another GEMSRaiseEvent instance with custom properties.
Software Version:	GEMS 4.4.0
Associated AR(s):	EUM/MuMi/AR/677
Regression Tests:	None
Pre-Conditions:	A correctly set up GEMS as defined in the maintenance guide.
Inputs:	-
Procedure Steps:	<ol style="list-style-type: none"> 1. Create the dummy application as listed in section Error! Reference source not found. of this document. 2. Create the necessary GEMS.properties files (in the default search path and the one explicitly mentioned in the listing). The paths in the listing can be adapted of course. 3. Run the application.
Expected Results:	<p>3. The application should run without error messages and create the following files:</p> <ul style="list-style-type: none"> - FACILITY.log (in the default GEMS.Client.LogPath) - TEST.log (in the specifically configured GEMS.Client.LogPath) - DUMMYFACILITY.log (in the specifically configured GEMS.Client.LogPath) - STATIC.log (in the default GEMS.Client.LogPath). <p>Each of the files will also have a corresponding .log.lock file.</p>
Comments:	This test application demonstrates the static call to the GEMS RaiseEventAPI and automatic configuration via the PropertyManager mechanism, including default GEMS.properties file lookup. Furthermore an independent instance of the GEMSRaiseEvent is created and used, without interfering with the static version.

Test 1.16: LogFileAgent Housekept Property

TEST 1.16	
Functionality to be Verified:	Housekept property is now optional for the Date Rollover Strategy
Software Version:	GEMS 4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	A GEMS LogFileAgent with GEMS.Client.LogPath = "~/test" and two sample files named 2014010123456.log and 2014011123456.log in the home folder of the user (~).
Inputs:	-
Procedure Steps:	<p>Open the LogFileAgent configuration file (log-file-agent.xml) and add the following file definition:</p> <pre><file path="~/ {yyyyDDDhhmmss} .log" housekept="~/ {yyyyDDDhhmmss} .log" checkBehaviour="Contain" text="Entry detected:" facility="GEMS_INTERNAL" host="localhost" process="LogFileAgent" strategyBean="dateStrategy" transferBean="localEventTransfer"> <list> <contain severity="INFO"> <regex><![CDATA[INFO]]></regex> </contain> </list> </file></pre> <p>Run the LogFileAgent, wait for a cycle to complete and stop the agent.</p> <p>Move the content of ~/test: mv ~/test/* ~/first</p> <p>Remove the housekept property from the file definition.</p> <p>Run the LogFileAgent, wait for a cycle to complete and stop the agent.</p> <p>Compare the results in both ~/test and ~/first: diff ~/test* ~/first/*</p>
Expected Results:	<p>At step 2, the LogFileAgent performs its cycle without any errors.</p> <p>At step 3, the LogFileAgent starts and performs its cycle without any errors.</p> <p>At step 6, there are no differences in the result of the two runs.</p>
Comments:	This test demonstrated that the housekept property can safely be omitted when it is equal to the path for the Date Rollover Strategy.

Test 1.17: Logging settings

TEST 1.17	
Functionality to be Verified:	Logging level can be configured from the configuration file.
Software Version:	GEMS 4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	A GEMS Sender and its configuration file (sender.xml) without log level settings (GEMS.Logging.SettingX).
Inputs:	-
Procedure Steps:	<p>Start the sender and then stop it.</p> <p>Open the log file (as specified in GEMS.Logging.LogPath and LogFile) and check its content.</p> <p>Open the configuration file (sender.xml) and the following log level configuration:</p> <pre><logging ... (as before)> <list> <setting>ERROR GEMS_Sender</setting> </list> </logging></pre> <p>Start the sender and then stop it.</p> <p>Refresh the log file and check its content.</p>
Expected Results:	<p>At step 2, the log file contains only INFO or above log messages.</p> <p>At step 5, the log file should not contain INFO messages for the new start.</p>
Comments:	This also verifies that the location of the edFTPj library was fixed as the sender requires it.

Test 1.18: XML Configuration Validation and Facility Names

TEST 5.3	
Functionality to be Verified:	Validation of the configuration files can be disabled and facility names can contain the hyphen character (-)
Software Version:	GEMS 4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	A GEMS Sender and its configuration file (sender.xml).
Inputs:	-
Procedure Steps:	<p>Open the configuration file (sender.xml) and verify that it contains a schema declaration pointing to an existing schema: <code>xsi:schemaLocation="http://www.eumetsat.int/gems/4.4/configuration /etc/xsd/4.4/gems-configuration.xsd"</code></p> <p>Define a relay in the same configuration file for the facility MASIF-OPE-EXT:</p> <pre><relay beanXmlFile="file:/opt/facilities/GEMS/conf/spring/configuration-relay-sink-jms.xml" checkInterval="30000" defaultStartOffset="36000" modDir="/opt/facilities/GEMS/mod"> <list> <facility>MASIF-OPE-EXT</facility> </list> <source> <legacy /> </source> <sink> <mq uri="tcp://localhost:61616" password="" username="" injectionTopic="events.inject" batchSizeLimit="5000" /> </sink> </relay></pre> <p>Start the sender and then stop it.</p> <p>Open the configuration file (sender.xml) and remove the schema declaration.</p> <p>Start the sender and then stop it.</p>
Expected Results:	<p>At step 2, the sender starts properly.</p> <p>At step 4, the sender starts properly and does not complain about the missing schema declaration.</p>

Comments:	The relay will not actually run so dummy values can be provided. It will however validate, at step 2, that MASIF-OPE-EXT is accepted as facility name by the validator of the configuration file.
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Test 1.19: GEMS Server Facility Names

TEST 1.19	
Functionality to be Verified:	Support of the hyphen character in facility names as well as the non-creation of tables when a facility is rejected by configuration
Software Version:	GEMS 4.4.0
Associated AR(s):	-
Regression Tests:	NO
Pre-Conditions:	A running GEMS Server connected to an empty Oracle database with GEMS.Server.Injection.Validation.AcceptedFacilities = "FOO,FOO-BAR", GEMS.Server.Injection.RejectedFacilitySeverity="WARNING" and GEMS.ErrorFacility = "GEMS_INTERNAL"
Inputs:	-
Procedure Steps:	<p>Raise an event from facility FOO: http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=FOO&host=localhost&process=TEST&severity=I&message=test</p> <p>Raise an event from facility FOO-BAR: http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=FOO-BAR&host=localhost&process=TEST&severity=I&message=test</p> <p>Raise an event from facility BAR: http://vm-eum-solaris-01:9980/gems-server/rest/raiseEvents?facility=BAR&host=localhost&process=TEST&severity=I&message=test</p> <p>List all events in the database: http://vm-eum-solaris-01:9980/gems-server/rest/getEvents</p> <p>Open the database in Oracle SQL Developer and list all tables</p>
Expected Results:	<p>For steps 1, 2 and 3, no errors.</p> <p>At step 4, the following events should be visible:</p> <p>The one from facility FOO in the facility FOO</p> <p>The one from facility FOO-BAR in the facility FOO-BAR</p> <p>A warning regarding the event from BAR in the facility GEMS_INTERNAL</p> <p>At step 5, there should be no table named BAR_EVENT as the event was rejected.</p>
Comments:	-

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