GSAW 2012

TELMA: the Astrium Satellites framework for In-Orbit satellites support



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All the space you need

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In-Orbit Support team needs

- Astrium provides In-Orbit Support (IOS) services on a large and growing fleet (currently 38 Telecom satellites)
- Need of tools allowing a fast analysis of the satellites status and trend, including reprocessing of past data on long periods of time:
 - Basic telemetry analysis tools : decommutation, plots generation, statistics elaboration
 - Advanced telemetry monitoring and processing
 - Report generation

=> Need for a new high performance and evolutive system





Challenges

End-users configurability

- User-defined telemetry monitoring and processing functions.
- Performance
- Scalability
 - Integration of new satellites as fleet increases
 - Integration of new user-defined processing functions
- Reliability
- Reprocessing capability
- Accessibility
 - From users office via laptop or desktop PC



TELMA overview

A **Multi-satellite** telemetry data post processing system and a powerful data analysis environment

- Current use: Telecom satellites
 - In-orbit support
 - Monitoring
 - Investigation phases
- High number of automatic monitoring and processing treatments
- Telemetry analysis tools:
 - Statistics (Min, Max, Mean, Standard deviation)
 - Daily plots
 - Status telemetry plots
 - % Availability (cf. TM holes)

Complex generic / specific reports generation

- Monthly reports
 Yearly satellite health reports
- Insurers reports



Users' functions 1/5

Define and Visualize groups of statistics plots





All the space you need $_{\text{Feb. 2012}}$ $_{-5}$

Users' functions 2/5

- Define and Visualize groups of daily plots
- Allow fine investigations thanks to interactive plots.





Users' functions 3/5

Define end-users monitoring functions

- Complex expressions using TM data / generated data
- Check wrt to thresholds
- Trigger actions (e.g. send mail to a group of users)





Users' functions 4/5

Define end-users processing functions

- Extended programmatic capabilities
- Use TM data / generated data
- Generate data / store in database (possibly huge amounts)
- Generate specific plots

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Users' functions 5/5

Word or PDF reports generation

- Based on Word templates
- Plots and tables on-the-fly generation / insertion

Reports configuration

- Templates -> Only change the date span
- Data automatically processed / included in report (table, plots)
- Report editable after generation



Other features

TM decommutation function

- Various platforms : E2K, E3K, ISRO (future development)
- Various satellites
- Several database versions per satellite
- Satellites status overview
- Administration functions





Technical choices

Processing Unit

- Java application
- Dynamic class loading (decommutation libraries, monitoring and processing)
- Multi-threading
- Optimization of computing resources

Web server

- Tomcat + Apache
- Servlet + JSP
- Flex for interactive plots



Decommutation generator

- Currently supports 2 different platforms
- Focused on processing performance
 - E.g. avoids indirections to access data.



User-defined monitoring and processing

- No specific language:
 - Sub-set of Java + dedicated telemetry and database functions.
- Processing and monitoring functions can be defined, compiled, packaged and integrated toTelma through the web client
- Applicability can be defined per platform, per satellite, per groups of satellites
- Future development: graphical definition of functions



All the space you need

TELMA capacity

- Sizeable from 1 to 60 satellites
 - 38 satellites end 2011
- Multi-satellite and multi-platform
 - E2000 / E2000+ / E3000 / ISRO (planned)
- For each satellite, computation each day:
 - 3000 MMMS statistics
 - 3000 daily plots
 - 3000 status plots
 - 3000 monitoring functions
 - 750 processing functions
- Sized for 450 000 parameters daily (7000 per S/C)
- Over 25 billion values per day
- Own TM decommutation
- = SCC independent







Current status

- Fully operational on Astrium telecommunication satellites fleet.
- Daily use / 38 satellites telemetry processed
- Current hardware platform:
 - 4 Linux servers
 - SAN for data storage
 - 15 PCs



OPSWARE: Operations Unification / Automation

TELMA is integrated in Astrium set of interoperable products based on state of the art technologies Pluggable on top of any Control Centre core functions



Future activities

- New version tailored to fit earth observation satellites needs
- Graphical definition of monitoring and processing functions
- Web Services on top of TELMA

