The software SpaceMaster is focused on data processing, the visualization of telemetry data, and the generation of telecommands or telecommand sequences, respectively.

System Architecture

SpaceMaster is a software system with a client / server architecture. In contrast to classic software architectures, both the server and the client consist of relatively small core units with a large variety of plug-in components. A plug-in in this case is a special software framework which implements additional interfaces and functions to facilitate a software module for a specific purpose. These individual plug-ins in conjunction together extend the software system to a powerful processing platform which can be customized according to the needs of the specific project. The addition of a new plug-in does – normally – not affect other plug-ins or the server infrastructure. Communication interfaces or protocols are provided by one of the core modules, so that a newly added server plug-in does not have to duplicate these services; they are automatically inherited from the underlying plug-ins. If for example the Secure Socket Layer (SSL) is enabled for communication, each server plug-in will benefit from it.

On the client side, a similar plug-in structure is available. Note that all clients' plug-ins are located on the server side and distributed to the client side during startup. This way, it is ensured that the client program will always receive the correct plug-ins, matching the corresponding server version or meeting the specific user rights and roles. This is useful since e.g. a system administrator might need a special processing lookup table editor, whereas a standard operator just needs access to specific views or visualization plug-ins.

Each plug-in, no matter if it is a server or a client plug-in, automatically resolves version dependencies, in order to validate the system integrity. The SpaceMaster platform and all the related plug-in modules are individually version controlled, thus the specific setup can be frozen into a certain revision. At present, more than 100 plug-ins are available for specific tasks like procession, distribution or system status.

Processing & Calibration

Once an incoming data stream (might be TCP-IP, UDP, FTP,...) delivers a telemetry packet, an event is triggered to start the individual processing sequence for data extraction, calibration, persistency, and distribution. Process sequences can run sequentially or in parallel and can also initiate new processing sequences. The processing rules for a certain incoming data stream can be defined in two different ways, via:

- Master Database Definition, or via
- Variable Sequence Definition

The easiest way to define processing rules is to use the Master Database which provides a comfortable user interface. The system administrator can define telemetry channels, ranges, units etc. and standard processing functions with predefined channel attributes and meta information.

These functionalities consist of precondition, byte- and bit mask extraction, formulas, persistency information for the data storage and a lot of more functionality to define common up to complex processing rules. The Master Database is based on a Domain Specific Language (DSL) which is accessed via a graphical user interface. The user may configure the processing information as text code or within user friendly input forms which automatically create the text code definition in the background. The forms and text editors both are interchangeable. They are supported by configuration wizards and several helper views. The helper views show the dependencies of the process within a tree, outline view and cross references between the defined processing elements. Defining the master database by DSL or via the user interface is done within the so called configuration layer.

Data Storage & Archive

Processed data is stored in various ways. Besides raw data storage, data may also be stored in calibrated form. The design decision to store calibrated data was taken, to allow high performance operations such as: searching, sorting and exporting of channel data and meta data. Additionally each telemetry processing result can be stored with customizible meta information. The set of meta information includes the generation and reception time and the source sequence counter. The advantage of this meta information is, that a certain telemetry data value can be traced back to the original data file or telemetry packet or to other related information, like the receiving ground station etc.

Depending on the processing power of the available hardware platform, the software can:

- Process several million operations per seconds
- Store more than 50,000 parameters per second on standard desktop pc
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Visualization & Export

The visualization can be achieved with a

- Desktop client based on Eclipse
- Synoptic displays (Mimics.)
- Modern web technology (based on RAP / AJAX)

The operator can detach individual data displays to be used on multi monitor work stations.

Visualized data points can be traced back to its origin. Anomalies i.e. as the result of a bit error in the source data can be traced back to the original source packet, and can be manually corrected and overwritten.