SLR Station Riga Software Upgrade.

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Abstract

The SLR station Riga is currently being upgraded with the new windows based data management, prediction and on-site data processing software. The new software is designed as client-server applications for use at the station and as a 3-tier application to access part of the system functionality via WWW. Comparing to the previous version the prediction generation and on-site data processing workflow is improved. Upcoming implementation of CRD format and kHz ranging support is discussed as well.

Introduction

Organization of the currently used software of the SLR station Riga can be represented as a number of independent subsystems:

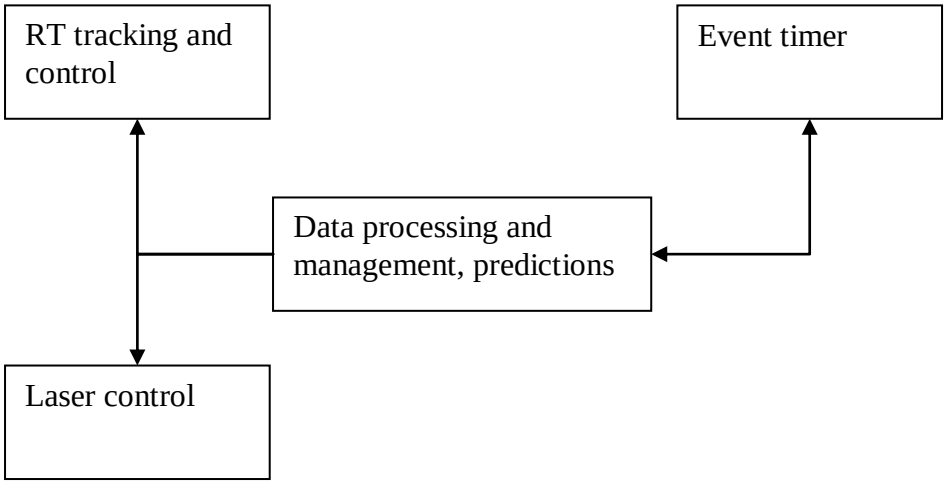

Figure 1. Software organization at SLR station Riga

1.Real time tracking and telescope control
2.Event timer software – handles RT-2006 event timer
3.Predictions, data post processing and management
4.Laser control

Data exchange between subsystems is implemented mostly on the file level e.g. prediction files are transferred to the telescope control and event timer and satellite ranging data are passed back later for the processing. The data management and processing subsystem is largely based on the developments dated back to the 1993 [Zarins, 1993] and it's starting to show its limitations. With the arrival of the new laser ranging data formats – CPF and CRD, the upgrading and maintaining the old, DOS based system, was not feasible anymore and it was decided to replace data management and post processing part with completely new,

Windows based system while maintaining compatibility with the other software and even keeping some parts of the previous subsystem like tracking scheduling, which may be upgraded later if necessary.

Functionality and design

The components of the new software are designed as a client-server and multitier applications and some of the solutions used are already previously tested in SLR operations. The software architecture overview is presented in the Figure 2.

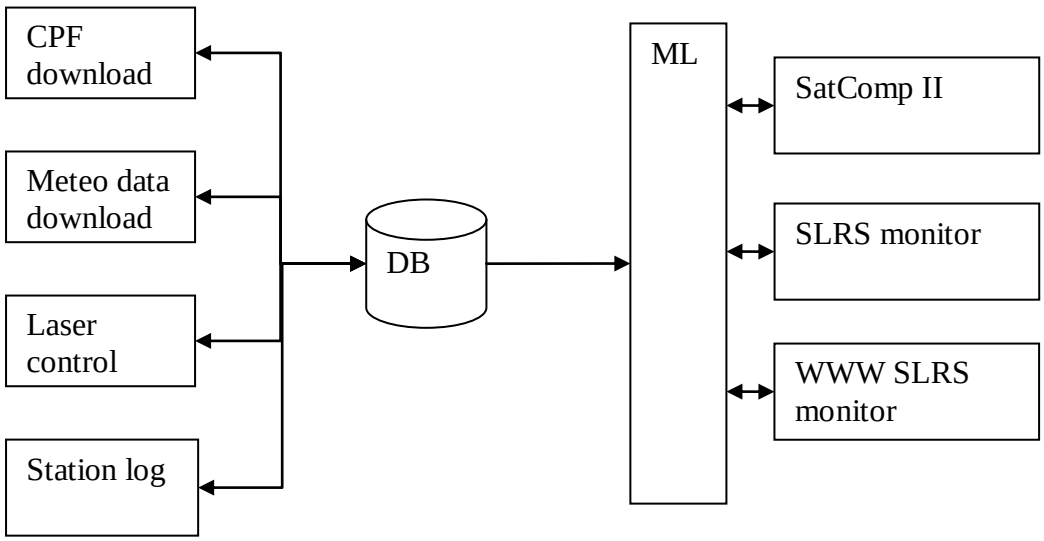

Figure 2. Data processing and management

The brief description of the components:

- DB – Firebird 2.1 [3] database where all SLR station relevant data is stored. All non-atomic data entities like satellite orbital data e.g. CPF, ranging data and produced reports are stored within the database in the compressed form using open source bzip2/libzip2 [4] compression library to save database disk space and reduce network traffic. For the ranging data is used XML based internal format [Salminsh, 2003].
- CPF Download – downloads latest CPF via FTP and stores in the database. Runs under scheduler each hour
- Meteo data download – each 10min reads Vaisala WXT-512 weather station and stores recorded data in the database. More than one sensor is supported so it's possible to record data from additional temperature sensors
- Laser control – implements restricted satellite tracking, can turn laser on/off according to the predefined pass segments and "Go/Nogo" flag settings.
- Station log – maintains history of the station activities like calibration history, satellite tracking statistics and additional parameters
- ML – software components, factoring out common data access functionality and providing services to other applications

- SatComp II – main application for data processing, predictions and data management. Calibration procedure now includes Engineering Data files (EDF) generation
- SLRS monitor – view station data like recorded meteorological data, EUROLAS station status etc.
- WWW SLRS monitor – similar to SLRS monitor but works in web browser.

All system components can run on the Windows 2000/XP based systems and most of them can be either operated remotely or can be installed on the remote computer and used from remote location. This flexibility allows setting up different configurations; easily replace computers in case of hardware failure and to work with the data from station and outside locations simultaneously. While it is possible to run all necessary software on a single computer for data safety and performance reasons the database and some of the service utilities are running around the clock on the separate Windows XP system. The Firebird database is a cross platform and can be also be run on any of the supported platforms like Linux. Additional feature is a capability to process the data from other stations. The only requirement is to convert ranging data to the defined XML format and enter station coordinates in the database.

Predictions and data processing

One of the important goals was to improve station workflow and to simplify routine operations: making predictions, calibration and ranging data post processing. After implementing automatic CPF download the prediction calculation is basically reduced to a few keystrokes and easily can be updated to the completely automatic mode. The prediction screenshot is shown in Figure 3.

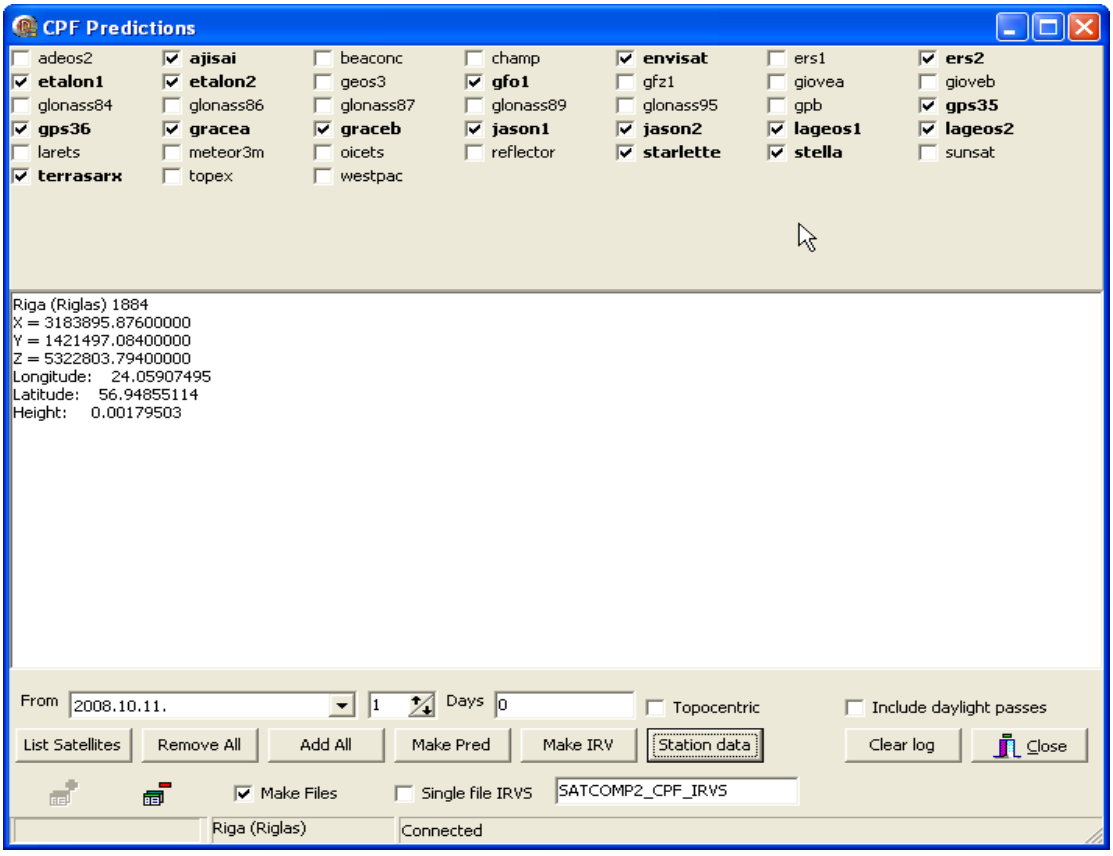

Figure 3. CPF predictions

For testing purposes generation of IRV's from CPF is also supported. Data processing organization (Figure 4) is also changed by adding generation of EDF and support for the new CRD format. CRD creation is based on using XSLT transformation from the internal XML format. Processed data can be sent directly to the analysis centre without using external mail client software.

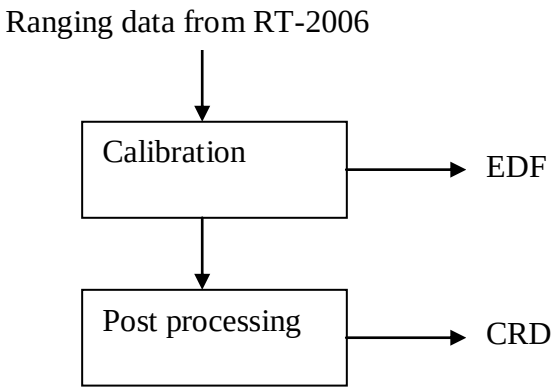

Figure 4. Data processing

Other improvements are mostly intended for testing and diagnostic purposes like error reporting in case of errors.

KHz ranging data handling

One of the requirements for the new software is to be able to work with the KHz ranging data, and this feature is currently under development. The tests were made to verify that the database and client software is able to handle large amount of the measurements in the KHz ranging data taking into the account that the XML size overhead which is negligible with the common ranging frequency 10Hz could be a performance problem in case of 2 KHz. Example of one of the preliminary test results: unprocessed Giove-A pass from Graz SLR station containing 248174 range measurements:

- Original size 9.8 Mb
- Size in XML format 18 Mb
- Compressed XML 2290 Kb
- Compressed original 2219 Kb
- Average time to parse XML 1-3 sec

Tests were done in virtual machine (Windows XP running under Window XP host system) approximately equivalent to 1.6GHz Intel Pentium dual core PC with 1Gb RAM. It should be noted that the size difference between compressed XML and compressed original plain text data is around 4-6 % while uncompressed XML file is about twice of the original size. Even in case of using full pass data when we can expect ~1,000,000 returns from Lageos [Kirchner and Koidl, 2004] the single pass dataset size and expected processing speed is still within estimated acceptable limits imposed by the local network speed (100 MBit), XML parser and typical client PC performance. While the latest versions of Firebird database

engine on NTFS file system used in Windows XP can handle database sizes in terabyte ranges [3] for practical reasons like performance and limitations of the typical computer used in SLR station it would be necessary to periodically offload the KHz ranging and associated data to the external storage to keep the database size within reasonable limits e.g. 4-10 Gb size.

References

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[5.] Kirchner, G., Koidl, F. Graz Khz SLR System: Design, Experiences and Results, 14th International Workshop on Laser Ranging, San-Fernando, Spain, June 7-11, 2004