Development of Software Tools for Health Status Evaluation of the Geodynamic Observation Network of the Far Eastern Branch of the Russian Academy of Sciences

Aleksei SOROKIN¹, Sergey KOROLEV¹,∗, Igor URMANOV¹ and Nikolay SHESTAKOV²,³

¹Information and Telecom Systems Laboratory, Computer Center, Far Eastern Branch, Russian Academy of Sciences, 65, Kim U Chen st., Khabarovsk, Russia
²Department of Geodesy, Land Management and Cadastre, School of Engineering, Far Eastern Federal University, Russky Island, Vladivostok, Russia
³Institute of Applied Mathematics, Far Eastern Branch of the Russian Academy of Sciences, 7, Radio st., Vladivostok, Russia

*Corresponding author

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Abstract. The paper describes the concept and implementation of the software for health status evaluation of the geodynamic observation network of the Far Eastern Branch of the Russian Academy of Sciences (FEB RAS). The operation check of the observation network includes checking the health and availability of all its components, as well as data archive completeness verification.

Introduction

The geodynamic observation network of the Far Eastern Branch of the Russian Academy of Sciences (FEB RAS) [1], established in the south of the Russian Far East, contains more than 20 GPS/GLONASS Trimble Net R5 and Net R9 receivers. The network is designed to generate a continuous measured data flow for studying modern geodynamics, active geological structures and natural hazards in the region.

The authors are developing a software platform AIS “Signal” [2,3], which should provide a single information environment for working with data of various observation networks of FEB RAS and controlling their resources.

As part of this work, a set of systems have been created that monitor geodynamic observation network component status (tools for data registration, transfer and storage) and synchronization of distributed data archives. The paper provides a brief description of the developed software and the basic principles of its functioning.

Problem Formulation

The observation network structure includes not only the registration tools (e.g., seismic stations, GPS receivers, camcorders, etc.), but also the IT infrastructure components to ensure data transmission, storage and processing, as well as the software to control these processes and network resources.

The operational mode implies a continuous measured data supply from the local archives, organized at the observation sites, to a single data center in Khabarovsk (hereinafter the Data Center) [4] for further processing and storage. In this regard, the key issues are the monitoring and assessment of the network components and control of the information flow to the central data archive [5].

These tasks are performed using the relevant information subsystems whose work is affected by the following features of the observation sites:

• the absence of reliable communication;
• heterogeneous network equipment and the lack of specialized storage facilities [4].
Based on these features, the following key subsystem requirements have been formulated.

1. The need to control the network accessibility to basic network components, their resources and services. This primarily includes GPS/GLONASS receivers (http port), the router (http port) and the router FTP-server (ftp port).
2. The presence of a flexible schedule of data collection from the observation sites, taking into account the instability or periodic absence of connection.
3. The presence of a common user interface for working with the monitoring system logs and data archive tools.

**Methods and Technologies of Problem Solving**

The solution for the key requirements has been achieved through the creation of a set of specialized software tools and their incorporation, as a separate unit, into the automated information system "Signal" (Fig. 1).

The proposed software interface components correspond to the "Model-View-Controller" (MVC) concept [6], which is used on the Yii framework basis.

This approach to subsystem implementation allowed a complex solving of the problems concerned with the geodynamic observation network administration, the status evaluation of its components and the data archive completeness. The AIS "Signal" has provided an additional support, namely:

- issuing passports for the study objects and the appropriate observation facilities;
- centralized information storage for all types of studies and works;
- multiple user mode, control of the user access rights for data files, launch services, information processing, operations of object accounting, etc.;
- remote data search and retrieval from the archive via restful web services.

Specialized part of AIS “Signal” is associated with the solution for the problems of observation network infrastructure monitoring developed using the Nagios system.

A console command was created and executed by a built-in Nagios scheduler that inspects new instrumental data on the ftp server at the observation sites. In case of the presence of new data, the tasks are generated for data synchronization and queued for further processing. Having received a list of files, the Gearman worker checks their availability in the Data Center. All missing or new files are then downloaded and stored in the archive.

The types and number of inspections are specified by the administrator when creating an observation site and a description of its hardware equipment in AIS “Signal”. For each site, the message log is maintained (Fig. 2), containing the information on data transfer from receivers to the local archives and the hardware installed at the observation site.
As a result, the primary data archive has been formed at each observation site. The access to the files can be achieved through AIS “Signal” search tools, or through a separate page containing the information on the number of files and the operation time (Fig. 3).

Figure 2. Example of AIS “Signal” screen with the message log on OKHB site.

Figure 3. Example of AIS “Signal” screen with information on data archive on CHMN site.

**Summary**

The developed software and the proposed methods of work with instrumental data have been implemented in the created information system to assess the health status of the geodynamic...
observation network of FEB RAS. The system makes it possible to inspect the availability of the network devices and their resources, as well as to perform the data archive completeness verification. The operations on monitoring the IT infrastructure components, copying files, and documenting all the actions are performed automatically and integrated into a single unit in AIS “Signal”.

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