THE EQUIPMENT DATABASE FOR THE CONTROL SYSTEM OF THE NICA ACCELERATOR COMPLEX

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Abstract

The report describes the equipment database for the control system of the Nuclotron-based Ion Collider fAcility (Dubna, JINR, Russia). The database will contain information about hardware, software, computers and network components of the control system, their main settings and parameters, and the responsible persons. The equipment database should help implement the Tango system as a control system for the NICA accelerator complex. The report also describes a web service to display, search, and manage the database.

INTRODUCTION

The Nuclotron is the first superconductive synchrotron, constructed by the Joint Institute for Nuclear Research in Dubna, Russia. Its purpose is to accelerate nuclei and heavy ions. It has a maximum energy of particles up to 6 GeV/u.

The Nuclotron-based Ion Collider fAcility (NICA) is a new accelerator complex being constructed at JINR aimed to provide collider experiments with heavy ions at a maximum energy equal to 4,5 GeV/u. It includes a linear accelerator, booster, upgraded superconducting synchrotron Nuclotron and collider, consisting of two superconducting rings [1].

The Tango control system is a free open source device-oriented controls toolkit for controlling any kind of hardware or software and building SCADA systems. It is used for controlling synchrotrons, lasers and physics experiments in over 20 sites. It is being actively developed by a consortium of research institutes [2,3].

The Tango system has been chosen as a basis for the control system [4]. Tango introduction to NICA has started with Nuclotron. Several subsystems (beam injection control [5], beam slow extraction control) have been converted to the Tango-based structure. Several Tango-based subsystems are being developed now.

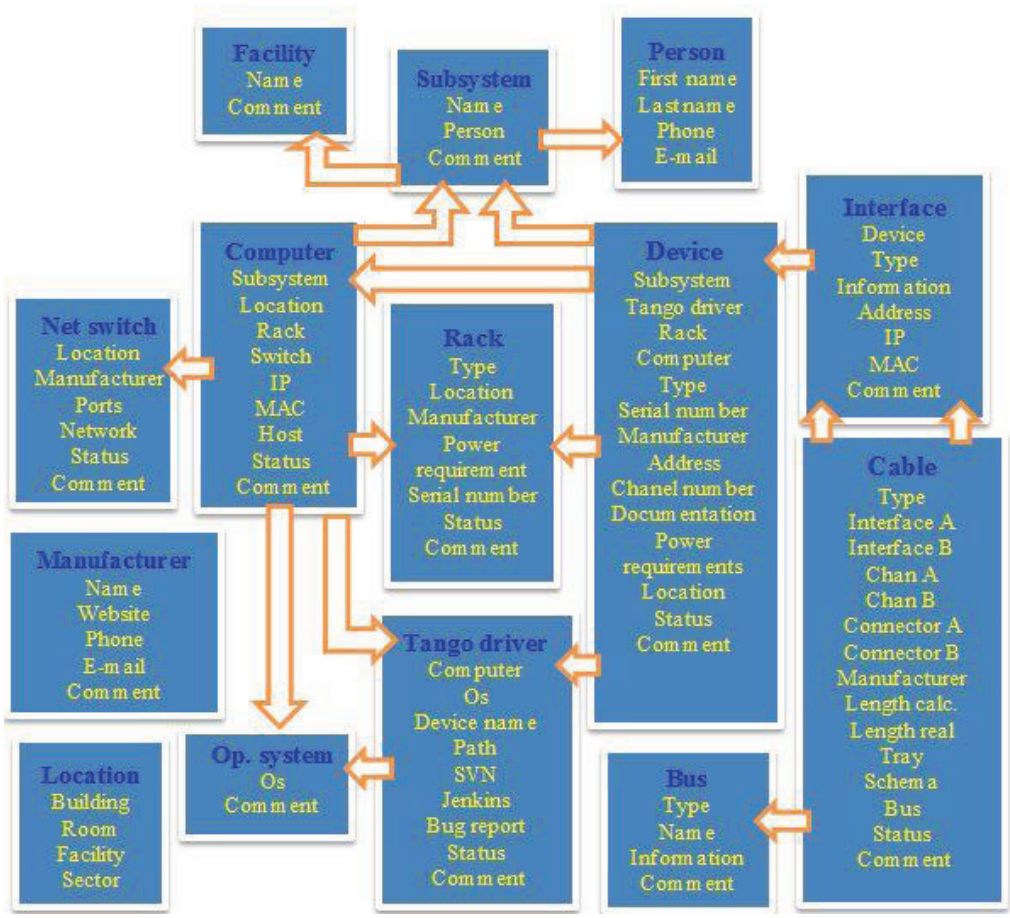

Figure 1: General structure of the NICA control system equipment database.

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THE CONTROL SYSTEM EQUIPMENT DATABASE

To implement the Tango control system as a control system of the NICA accelerator complex the 4 main tasks there were performed:

1) The control equipment database was designed and created.
2) The web-tool for using and managing of the control equipment database was developed.
3) Servers were purchased and configured.
4) The necessary toolbox for development, storing, documenting and using of Tango-based software was set up.

The Control System Equipment Database

The general NICA control system equipment database structure is shown in Fig. 1.

Each facility consists of a number of subsystems. It could be a vacuum subsystem, an injection control subsystem or any other. The subsystem is the main component of control equipment database. Each subsystem has a responsible person. The subsystem combines devices, computers and software. Devices could be standalone or be installed in the rack. Device has a number of interfaces. Devises can commute to each other or to the data bus by means of connection cables. The computer has its operating system, IP and MAC addresses and a host name. It is connected to the network switch and could be connected to the rack. The software component stores necessary information for using it. There are links to documentation, to subversion repository where the sources are hosted, to jenkins build directory where different binaries are being built, to bug tracking system. There is a computer address where his software runs. There is also information about the components' physical location and manufacturers. It is possible to obtain the necessity of extending the database or making certain structure changes during operation.
The database was developed in MySQL technology.

Control Equipment Database Web Manager

To provide easy and user-friendly access to the database the web interface has been developed. By means of this service the user is able to browse the hierarchy of components, find the record he is interested in, add a new component and edit or delete existing ones. There are three types of users with different privileges. The Guest can only view and browse entries, the User is able to manage his own records and add the new one, and there is an Admin who can do everything. For the most convenience usage one can apply live-search, live-resizing and live-reordering of columns. The advanced search mechanism is being developed. It is possible to obtain the necessity of or make changes in the web tool, or add new improvements during operation.

The web tool has been developed in Java Server Faces technology with using Java Persistence API and PrimeFaces library.

It is deploying under the Glassfish server. It is available at the address http://nuclotango.jinr.ru/NC.

The database manager general view is shown in Fig. 2.

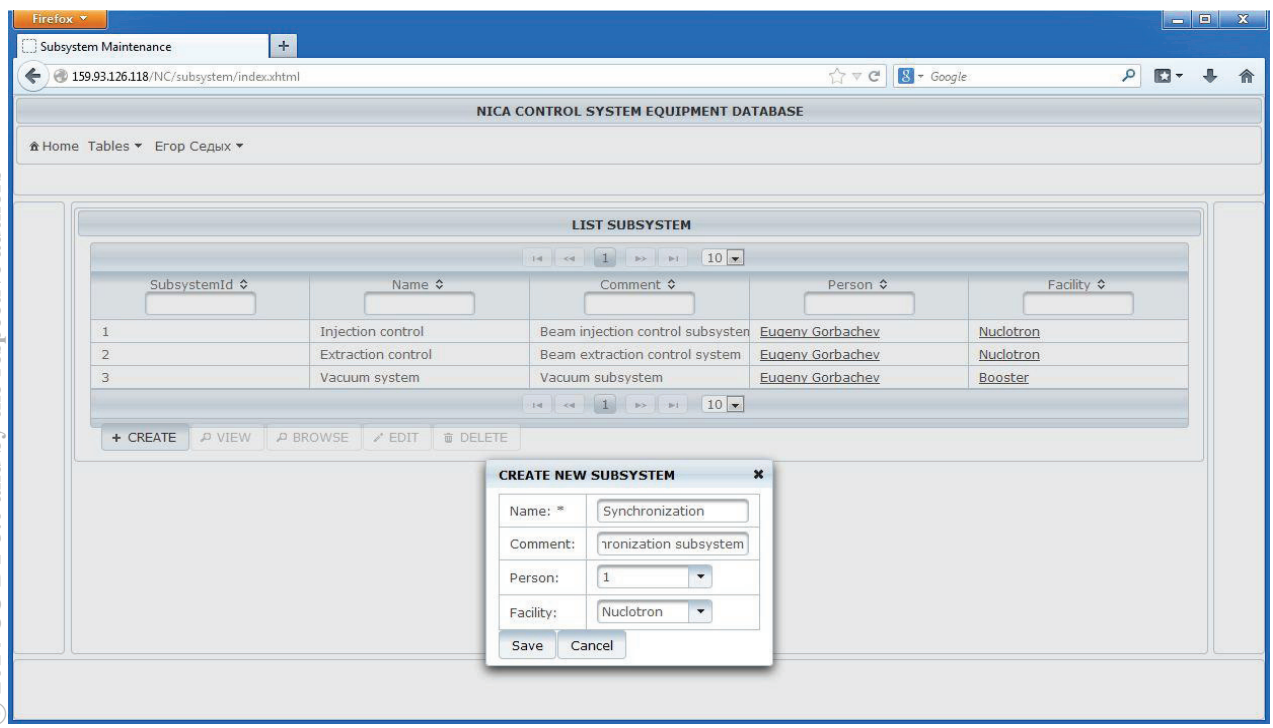

Figure 2: The NICA control system database web manager.

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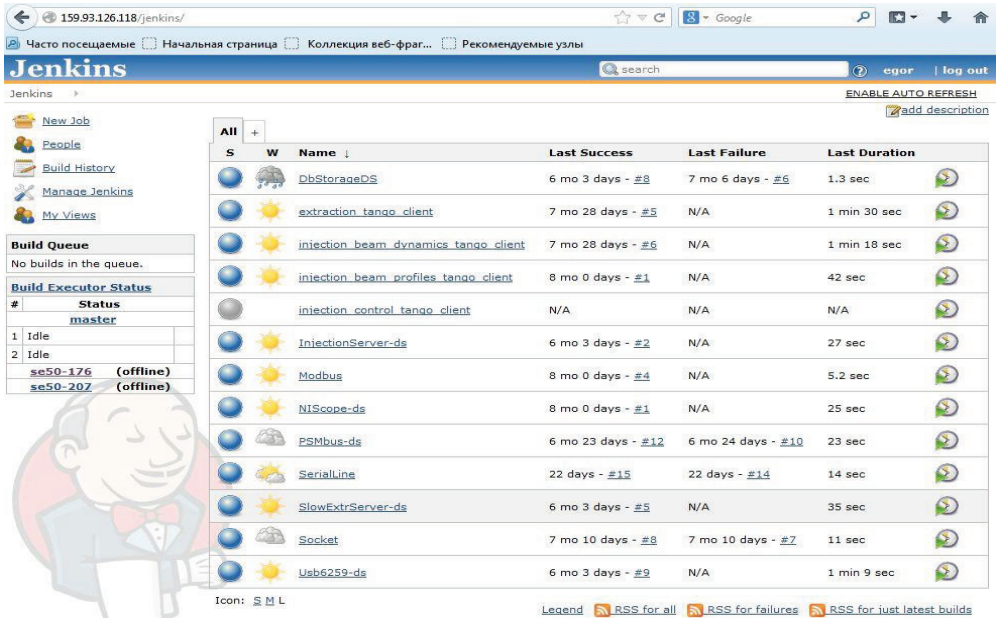

Figure 3: Jenkins for Tango-based software components on NICA.

Servers

Several servers were configured for the Tango services usage:

- Tango database server.
- Tango database backup server.
- Tango archiving server.
- Linux development server.
- Windows development server.
- Server for control equipment database hosting, documentation, source codes and binaries storing and bug tracking.

The server partition is virtual. It uses Proxmox virtualization management solution for servers. Currently two new powerful hardware servers are used.

The domain http://nuclotango.jinr.ru has been allocated for the tango-based software development for Nuclotron and NICA.

Development Toolbox

There have been set up several tools for Tango-based software development:

- Wiki service for control system description and tango-based software components documentation.
- SVN repository for storing of actual tango-based software source codes.
- Jenkins (Fig. 3) for testing and making of actual binaries for different platforms.
- Bug tracker for detection, registration and checking of errors and anomalous behavior in software.

PLANS

- To extend database and make certain structure changes considering the user's wishes.
- To make changes in the web tool, or add new improvements considering the user's wishes.
- To put into operation an advanced search mechanism for the control equipment database.
- To keep Tango implementation to the NICA control system.

SUMMARY

All described components (servers, control equipment database, database web manager, wiki service, subversion repository, jenkins service and bug tracking system) should help to implement the Tango system as a control system of the accelerator complex NICA.

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