The Equipment Database for the Control System of the NICA Accelerator Complex

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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 .

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 .

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

TANGO IMPLEMENTATION TO NICA CONTROL SYSTEM

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** and using of Tango-based software was set up.

1) The control system equipment database

The general 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 software component stores necessary information for using it. There are links to documentation, to subversion repository, to jenkins building 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.

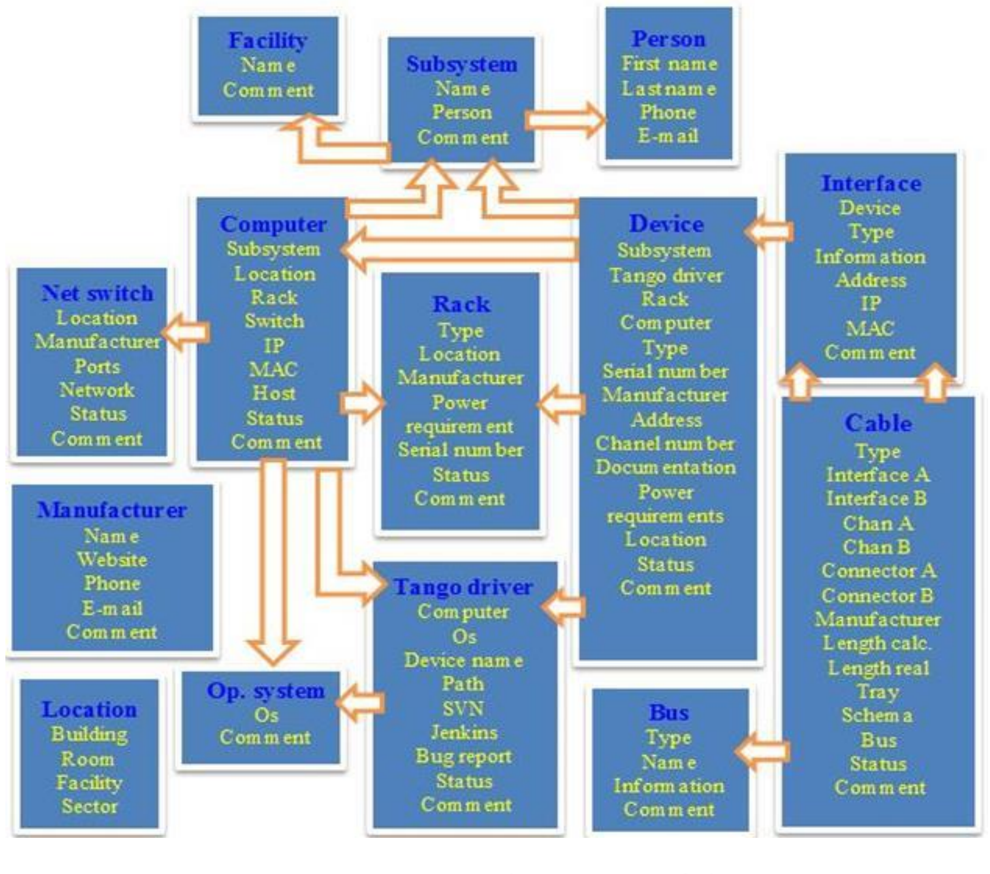

Figure 1: General structure of the NICA control system equipment database.

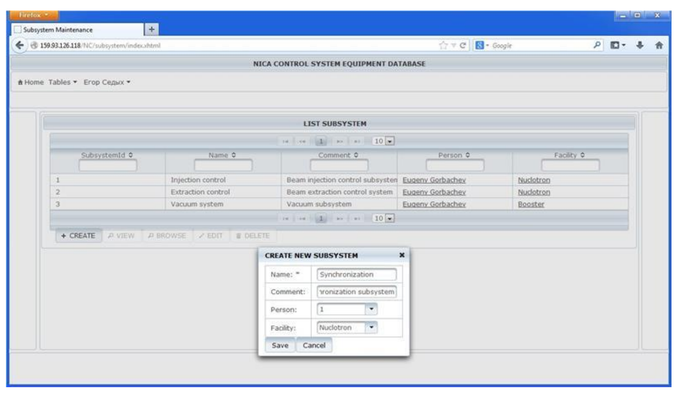

Figure 2: The NICA control system database web manager.

2) Control equipment database web manager

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

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: guest, user, admin. 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.

3) 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.

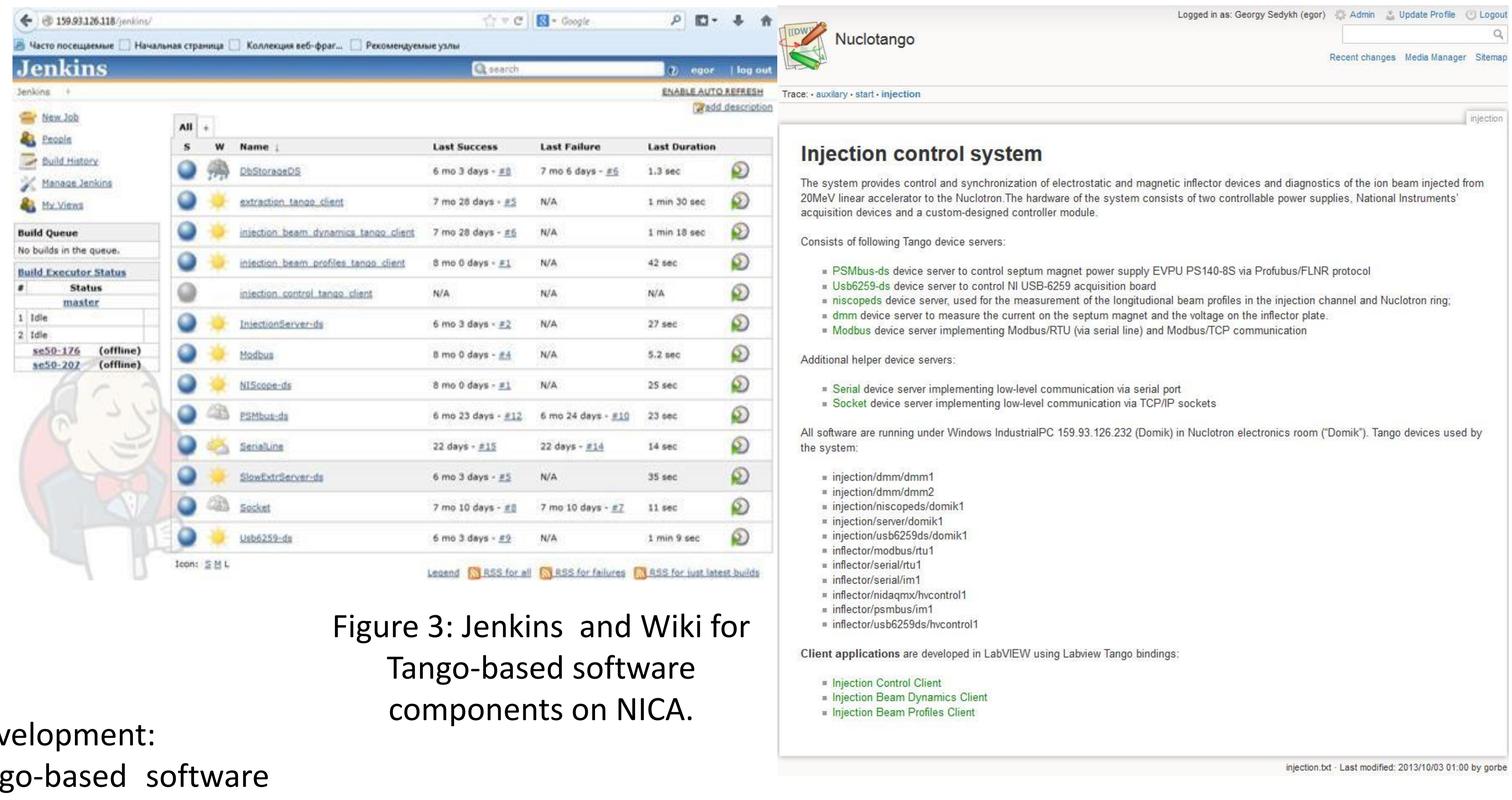

Figure 3: Jenkins and Wiki for Tango-based software components on NICA.

4) Development toolbox

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

- Wiki service (Fig. 3) 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.

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.

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.