ALBA CONTROL & CABLING DATABASE

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Abstract

CELLS has developed a database as a main repository for the cables and control devices in the ALBA facility. The strongest point of the database is the simplicity to produce reports. Those information was the basis not only for the cabling installation, but for all the computing installation (control devices, network, etc). Regarding cables, the database has all the information about the cable configuration (cable and connectors on both sides) and routing (trenches and cable length) as well as the devices where the cables are plugged in. The cables have different status, according to their installation process (received, installed, tested OK, tested error, etc). Regarding control devices, the database has all the information about the devices (serial numbers of computers and boards, DHCP address) and tests done (Operation system, drivers and Tango). This database has a friendly web interface for user access. It allows many types of filters for cable & devices: location in the tunnel or in the racks, by system (Storage Ring, Booster, BeamLine1, ...), by routing (name of trench).

INTRODUCTION

ALBA is the first Spanish Light Source which is intended to provide Spain with a powerful source of X-rays. The project is funded by the Spanish and Catalan Governments at equal parts. The first phase includes the construction and commissioning of a linear accelerator, a booster accelerator, a storage ring and 7 beamlines, with the start of operation planned for 2010.

ALBA is a 3rd generation 3 GeV light source, with a perimeter of 268 m, With such an energy the brilliance at 20 keV reaches 10^{19} Ph/s/mm2/mrad2/0.1%BW for in-vacuum undulators with 5 mm gap. For more information see reference [1].

The construction of such a complex facility involves many people from different profiles and groups (as well as external companies), and it is crucial for the success of the project that all the people share the same information.

BACKGROUND

In spite of the importance of accurate and complete documentation of a facility's cabling system, many accelerator facilities have incomplete and perhaps even worse, incorrect cable documentation. Usually, the cabling installation begins before standards for cable documentation have put in place, therefore temporary, unlabelled cables all too often become permanent fixtures, often without formal documentation.

ALBA decided to implement a Control & Cabling database before the tendering & construction phases, as a shared repository for the cables and hardware devices. The idea was that the developers and the users (accelerators & beamlines) could share the same information for the design, tendering/execution and the progress of the project, and to provide a multiple-view and global search capability.

We contacted and visited the most recent synchrotron facilities (Soleil, Diamond, SLS, ESRF) about the approach followed for the cabling installation. Most of the facilities worked with text and spreadsheet files. The ESRF had a database, but it was planned to be completely re-built and subcontracted to an external company.

As it was not found any commercial product, done by either a company or another institute, ALBA decided the in-house development of the Cabling database by the MIS (Management Information Systems) group.

The development of the database started in 2006, and the first release was ready in 2007. Since then, new features have been added, extending this database as the main repository for hardware & control devices.

EQUIPMENT, CONNECTOR & CABLE MODEL

The database was originally hardware oriented for the cabling.

Connector Type

A connector type represents a physical connector item. It has an ALBA reference (like CRC12F0) and it has associated a commercial item (like UT061412SH from Souriau, for the reference CRC12F0). A list of connector types is included in the database

Equipment Type

A template is done for each equipment type. This template has a list of channels. Each channel has associated a connector type, from a predefined list in the database. In addition to the channels, each equipment type has an associated documentation, like datasheets from the manufacturer, where is located each connector, etc.

Once a list of equipment types is available, instances of those equipments are created in the database, following the ALBA naming convention [2].

Cable Type

Similar to the connector types described previously, each cable type has an ALBA reference (like CX0108S) it has associated a commercial item (like LMR-100 from Times Microwave, for the reference CX0108A). A list of cable types is included in the database too.

Cable Configuration Type

A cable configuration is a patch-cord: an assembly of a cable and their connectors on both ends. A cable configuration type is created as an instance of a cable type

and two connector types. In addition, is included information for the manufacturing of the patch-cord, like the length of the pigtails for multiwires, the pinout for a subD connector or assembly instructions by the connector supplier.

Once equipment instances have been conceived, and a list of cable configurations is also added into the database, a cable configuration instance could be created.

Plugging

An essential point in the process of uploading cables into the database is the plugging. When a cable instance is created, a connector end is 'plugged' into the equipment connector. The database cross-checks the compatibility of the cable connector with the equipment connector type, and producing an error if they are not compatible. For example, if a cable configuration has a DB9 female on one side, and we try to plug it into another DB9 female, and error is produced, and that cable is not created.

This point minimizes the errors in the creation of cables into the database.

DATABASE TECHNOLOGY

The database application is integrated with ALBA's Intranet and can be accessed from anywhere at anytime. The technology used to build the application was: python, Plone/Zope and MySQL. The application has been developed under the new concept of Web 2.0 (AJAX, DOM, JS …).

In order to do fast updates and massive inserts, there are several Python scripts available to execute bulk operations from CSV files.

The application can also be accessed by mobile device thru a mobile portal. With these mobile devices (PDA), engineers and technicians are able to carry all test and maintenance processes "in situ" working with real data. All the cables are labelled with a bar code for their reading with the PDA.

There are different roles depending of the user that log on. All these permissions are controlled by ALBA Passport application.

REPORTS

One of the strongest points, which were a key-parameter during the design, is the reporting of the database.

Home

The home page of the cabling database indicates the number of racks uploaded, the equipment types, the equipment instances, the cable configuration types, the total number of cables, the cables inside a rack (internal cables) and the total length of the cables. The cable length was calculated from the 2D model of ALBA facility. The following shows a snapshot of the home page.

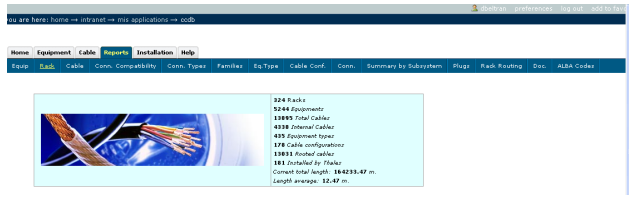

Figure 1: Cabling database home page.

Then, on the tab 'Report' there is several report types, which are described in the following.

Rack

A report of the equipments installed in a rack, and its height (in number of U) inside the rack, was used to the rack assembly. From this information, a label for each equipment in the rack was also produced.

The equipments in the rack have a status, indicating if they are installed or not.

There are multiple filters for the rack reporting: location (technical area or experimental hall), system (Storage Ring, Beamlines), and subsystem (control, vacuum). Those filters could be used independent or combined.

Cable

This is most used report in the database. There are the same filters than for the racks (location, system, subsystem), and many others like the routing (the trenches connecting the technical area and the tunnel), the type of cable configuration or the rack number.

This report lists all the cables included in the filter selected by the user, and for each cable it is reported: the equipment connected on each side, the cable length, the cable configuration, its status and comments about this cable instance (like the type of error during the test). The status indicates if the cable has been ordered, installed or tested. The following shows a snapshot of this report.

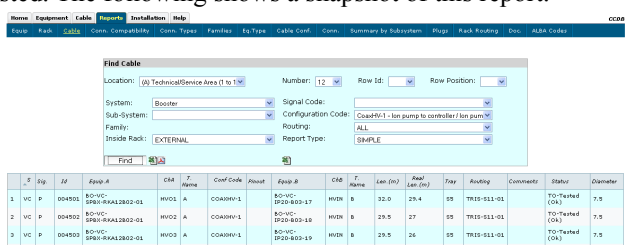

Figure 2: Cable report.

At the end of the cable report, the cables are grouped according to the type of signal transported (noisy, sensitive, etc). The area for each type is shown. That information was used for dimensioning the cable trays. The following shows a snapshot of this report.

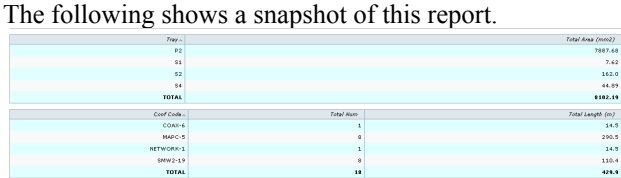

Figure 3: Cable report area.

CENTRAL REPOSITORY

The database has been extended to be the central repository for the Computing documentation & installation.

The database has all the equipment in the facility. This includes all the control and network devices. So all the information related with their installations is also included into the database.

Networking

All the equipments connected to the network have their IP addresses and host names The MAC addresses are also added, and the Host for the remote booting (when used) is also included. The following shows a snapshot of this part.

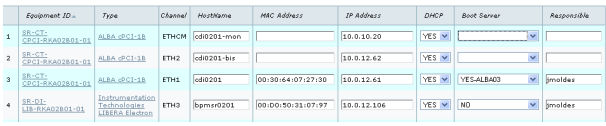

Figure 4: Network information.

Network configuration files like DNS, DHCP or Radius are automatically taken from here.

Hardware & Software Installation

The control devices (cPCI & industrial PCs) are first assembled in the test bench, where are also configured, booted and tested the software drivers. Also Tango servers are loaded into the ALBA Tango database and started.

All this process is reported into the database, with the dates, the staff in charge, the serial numbers, and the incidences occurred during the installation. The following shows a snapshot of this type of installation report.

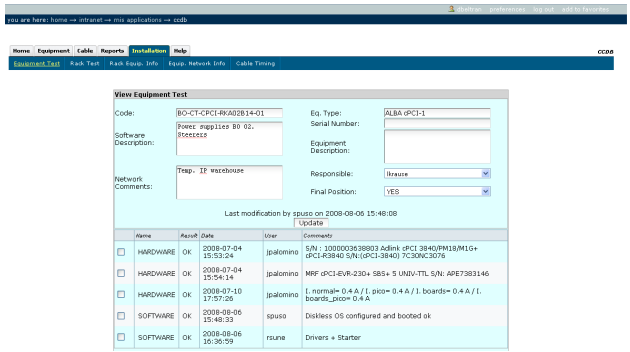

Figure 5: Hardware & software installation.

CONCLUSION

We have presented a database, which was created for the cabling installation, but it has been extended to be the central repository for the Computing installation. Now the database is the central repository for the whole computing installation, keeping the coherence between the different levels.

It was developed in the early phases of the ALBA construction, and it was ready for the cabling tender and installation. As it was developed in advance, it was used very successfully for the installation of the Linac-to-Booster transfer line cabling, and now it's been used in the Technical Area & Booster cabling installation.

The information uploaded by the different users is used by the Network group for the configuration of switches and the network devices.

The controls group also installs and starts the Tango servers in the computers, using the information about the network and equipments loaded into the database.

REFERENCES

[1] D. Einfeld, "Progress of ALBA", Proceedings of EPAC-08, Genoa 2008.

[2] X. Permanyer et al. "Equipment naming convention", Internal report, 2005.