STATUS OF THE TANGO ARCHIVING SYSTEM

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Abstract

The present paper provides the detailed status of a major functionality delivered as a Tango service: archiving.

The goal of this service is to maintain the archive history of thousands of accelerator or beamline control parameters, in order to correlate signals or to obtain and compare snapshots of the system at various times. For this purpose, three database services have been developed and fully integrated into Tango: a historical database with an archiving frequency of up to 0.1 Hz, a short-term database that provides a few hours of retention, but with higher archiving frequency (up to 10 HZ), and finally a snapshot database.

These services are available to end-users through two graphical user interfaces: Mambo (for data extraction/visualisation from historical and short-term databases) and Bensikin (for snapshot management).

The software architecture and design of the whole system is presented, as is the current status of deployment at Soleil [1].

REQUIREMENT ANALYSIS

A control system for a Synchrotron machine and its Beamlines generates a huge quantity of data each second. The data generated cannot all be analyzed online, therefore it is necessary to store these values and exploit them later. The goal is to help scientists or operators answer questions such as:

- Where can I retrieve information concerning the impact of earth tides on beam size due to deformation of the earth's crust (caused by the attraction of the moon and the sun) over the past five years?
- How can we satisfy the legal requirement for long-term storage and storage of data regarding the gamma radiation emission by the accelerators?

The data will be generated by equipment managed by Tango devices, thus readable via Tango attributes hosted by these devices.

The archiving system has been designed, to satisfy requirements of future users, and is provided as an integrated service in the Tango system [2].

One of the goals emphasized is to provide secured tools that provide users as much autonomy as possible in the archiving system configuration and in day-to-day operation.

OUR APPROACH

Three services have been designed:

- a long-term service called the Historical Data Base (HDB)
- a short-term service called the Temporary Data Base (TDB)
- a one-shot service called the Snapshot Data Base (SNAP)

For all these services, input data is collected from Tango attributes.

Long- and Short-term Description (HDB / TDB)

The principle is to store in a secured infrastructure all the control parameters that allow monitoring of critical equipment (such as vacuum or power supplies). The system provided must allow the user to readily configure the parameters to be archived, at what frequency, and under what conditions, as well to re-extract/plot/exploit stored data on demand.

The long-term service, also known as HDB archiving, allows permanent storage of Tango attribute values in a database, whereas in the short-term service, also known as TDB archiving, attribute values are kept for only for fixed periods of time (currently three days at Soleil). Archiving periods may be configured as required, if there is enough disk space to store the data.

Stored data may be in scalar format, spectrum format (one-dimensional tables), or image format (two-dimension tables). The attribute value types can be double, float, (numbers), strings, or other, defined in Tango (as a state, for instance).

HDB/TDB systems are configurable through a graphical user interface called Mambo (see Fig. 1). The application's main panel design is divided into two parts:

- Archiving configuration: this block allows choosing which attributes to archive and what their archiving modes are.
- View configuration: this block allows extraction of archived data.

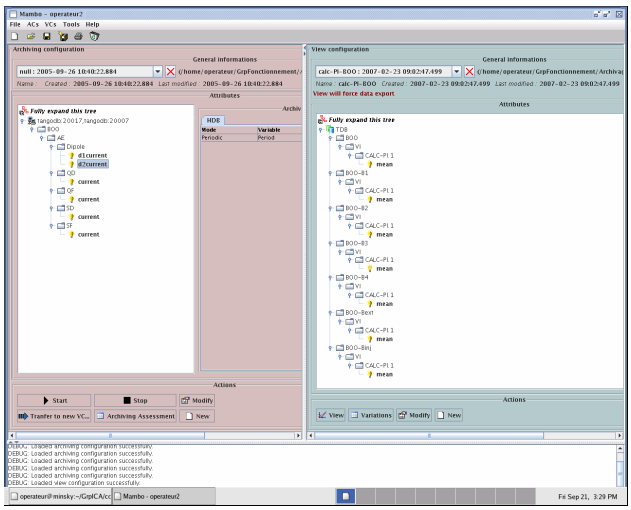

Figure 1: Mambo application.

After selecting the working database (HDB or TDB) to configure, an archiving configuration may be defined. This includes a list of attributes to archive, as well as the possibility of fixing the parameters of each, such as:

- The periodic archiving period (mandatory): the minimal period is 10 seconds for HDB archiving and 100 milliseconds for TDB archiving.
- The conditions to be added in order to log attribute values associated with abnormal equipment behavior (overheating, excessive pressure, etc). For this purpose, the following archiving modes can be combined:
  - Absolute mode: the current value is archived if its absolute value exceeds the previous value by a given amount;
  - Relative mode: the current value is archived if it exceeds the previous value by a given percentage;
  - Threshold mode: the current value is archived when it is above or below a defined threshold value.
  - Difference mode: the current value is archived if it is different from the previous one (with given precision).

Attribute history may be extracted from the database and viewed in different ways, depending on their type. Numerical values are plotted, whereas string and state attributes are presented in table form. Various parameters may be selected before extraction (see Fig. 2): extraction range (from when to when), whether logged values have to be averaged before presentation, plot coloring, etc.

All graphical components used to show historical data views (plots, images, and tables) are developed using the Tango ATK framework [3].

Figure 2: Example of extraction.

The two archiving systems are monitored by a Tango device server called Watcher. Its role is to alert if attributes are not well-archived. This can happen in two cases:

- something is broken in the archiving system itself (*problem at database level or inside the archiver devices in charge of data collection from the control system for the storage into the database*)
- the data source is lacking (*communication is lost with the device hosting the attribute to be archived. or even with the instrument controlled by this device*).

A mechanism for archiving error recovery is implemented in the Watcher. Messages are periodically sent to archivers to restart archiving missing attributes, in case communication with the devices hosting them is restored.

Snapshot Description (SNAP)

The principle of this service is to provide a way to take a picture of the control system (or part of it) configuration at a given time. A configuration may be viewed as a way to define a subset of the control system, and is called a context. One context example could be all motor positions of a beamline. Each different picture taken from the same context is called a snapshot. The context defines the group of Tango attributes, the values of which are to be registered each time a snapshot is requested. To guarantee data persistence, the snapshots are stored in a database.

One of the major uses of this service is to provide beamline scientists a tool for easily restoring their equipment to predefined configurations. This is particularly important in situations of recovery after power shutdown.

For this purpose, a graphical user interface called Bensikin (see Fig. 3) has been designed, which is divided into two parts:

- The context: contains the set of Tango attributes
- The snapshot: contains the list of snapshots for a defined context and its attributes values.

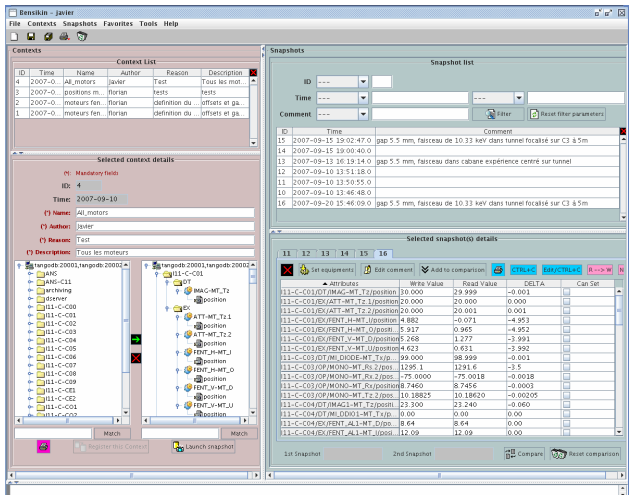

Figure 3: Bensikin application.

The context can therefore be created from this application, a snapshot may be taken (and compared with another), and a set-point may be applied. To provide all these functionalities Bensikin is assisted by archiving devices

CURRENT STATUS

All these archiving systems are widely deployed for use in controlling the machine, and are used in daily use by accelerators operators. The archiving infrastructure is composed of five Linux servers, two of which are dedicated to host the three Oracle databases, and the others dedicated to the Tango archiving devices.

Nearly 5,000 attributes are archived in the Historical DB at an average periodic period of 60 seconds and 4,800 attributes are archived in the Temporary DB at an average period of 1 second.

The current size of the Oracle HDB is 250 Go, whereas the Oracle TDB is configured for a constant size of 90 Go.

The snap archiving service is deployed on all beamlines. The TDB is also planned to be installed in the near future. The need for an HDB service not yet definitely planned.

NEXT STEPS

The following are planned for the archiving system:

- Due to the success of the HDB and TDB archiving systems for machine control, the number of attributes that must be archived has tripled (from 6,000 to 18,000) since initial specification. The existing technical infrastructure must therefore be reviewed.
- Full archiving system deployment on the beamlines
- Inclusion of certain functionalities in other client applications deployed in the control system, such as Global Screen or Passerelle[4] tools.

REFERENCES

[1] http://www.synchrotron-soleil.fr
[2] N. Leclercq & al, these proceedings, “Status of the Soleil Control System “
[3] K.Saintin & al, these proceedings, “ How to use a SCADA for high-level application development on a large-scale basis in a scientific environment “
[4] G. Abeillé & al, these proceedings, “ A graphical sequencer for Soleil beamline acquisitions “