

NEW ACOP BEANS AND TINE GENERAL PURPOSE DIAGNOSTIC APPLICATIONS

I. Kriznar, J. Bobnar, T. Kusterle, COSYLAB, Ljubljana, Slovenia
 P. Duval and M. Lomperski, DESY, Hamburg, Germany
 S. Weisse, DESY, Zeuthen, Germany

Abstract

One of the strengths of the TINE [1] control system is the ability to easily make 'simple-client' and 'rich-client' applications. All applications are based on an extensive Java graphics library ACOP [2], which provides a vast set of Java Beans for presenting and setting the control system values, such as a Slider, Wheelswitch, Button etc. Using any of the standard Rapid Application Development Tools the operators can easily design their own 'simple-client' applications, which are now only a few mouse clicks away. In addition, there are also a large number of 'rich-client', general purpose applications, which offer extensive interactions with the standard TINE systems, such as the archive, alarm, and post-mortem system, as well as scope trace, multi-channel and video analysis, FEC statistics, and general configuration management. Available for many years, these applications have recently been implemented as Java applications using the ACOP beans. They have been iteratively improved and refined after many months of being used by the operators and other users. We offer here a description of these applications as well as the description of the newest ACOP beans available in the ACOP library.

ACOP BEANS

Acop Beans is a set of java components that can be used to build control system applications for TINE. They are designed as pure java beans, meaning that they can be used by numerous java rapid application development tools whether to create simple clients or using them as building blocks for rich client applications. Combined together with COMA [3] or jddd [4] they make a powerful tool for operators to create their own applications with just a few mouse clicks and without any programming knowledge required.

ARCHIVE SYSTEM

TINE offers three different ways for archiving data: event-driven archiving, local archiving with tolerance filtering, and central archiving with adjustable state and tolerance filtering [5].

Event Archive System

The event-driven archives are archive snapshots, which are based on scripts specifically targeting the event in question. In particular, post-mortem data frozen in the hardware, which is normally not found in the machine-parameter archive can be collected. This is typically a set of transient data sampled on a very fine time raster centered at the time of the event. In a similar vein, data

kept in short-term storage in a server's local history repository at a much higher sampling rate than on the central archiver can be retrieved and stored in association with an event.

All such events can be post processed using one of two designated Java applications: the Event Archive Viewer (EAV) and the Transient Recorder Viewer (TRV). The EAV enables the operator to explicitly select a device property from the naming service for which the available events will be displayed, while the TRV properties are based on predefined configurations read from the TINE archive server. The selected event data are shown on an ACOP chart, which offers numerous features, such as zooming, axis scaling etc. in order to inspect the data and look for the details that one is interested in.

Local and Central Archive System

Central archiving offers a more standard way of data archiving, whereby the specified data is acquired, checked against relevant filters, and written to disk if necessary. Local archiving is similar to central archiving except that local archiving takes place directly on the device server and can be configured to maintain an archive of properties both on a short-term basis (in main memory) or on a long-term basis (on disk). The local archive normally stores a much larger amount of data over a given time interval. However in contrast to the central system, the data on the local system are not permanently stored. There are several Java applications which make use of these two archive systems.

The Archive Viewer (AV) is a powerful tool for inspecting data in the standard archive. Data selection for display can either occur via simple browsing of the archive database or selecting one or more pre-defined configuration sets. These configuration sets prove to be most useful for the machine operators and engineers who do not want to repeat the same data selections each time they start the viewer. Individual user configurations can also of course be saved.

All selected properties are visible on the same trend chart as seen in Figure 1 and are available for further analysis. Analysis and inspection are made easy by providing a vast set of features to visually adjust the appearance of the graphs and charts, axis scale etc. For instance, one can even show two completely different properties on the same trend (e.g. temperature and vacuum pressure) despite the fact that one property has values several orders of magnitude higher than the other. For such cases AV offers a "normalized mode" in which all visible properties are scaled to show percentage of

their maximum value. Such features become useful when the AV is used to show the accelerator overview. If necessary, logarithmic scaling of all or just some of the graphs can also be applied.

If the user zooms on the selected time-range, the archived data are reacquired for the new time-boundaries (an optical zoom and not a digital zoom). TINE provides extremely fast archive data acquisition. Single channels over a time range typically require on the order of 100 micro-seconds per channel; Time-centric access of a single multi-channel array is even more impressive: a few micro-seconds per channel. This coupled with the optical zooming tactic mean that browsing the archived data is extremely fast and available as an on-line tool. ‘Glitches’ that might otherwise be missed in a coarse raster are also guaranteed to be displayed, as the TINE archive offers a ‘points-of-interest’ algorithm which assures that they won’t be missed.

The AV also allows the correlation between any two selected channels. The channels will be plotted one against the other and if time stamps of the channels do not match, the values will be interpolated to show the proper correlation.

In TINE, channels can be defined as multi-channels, meaning that there can be several devices, all having the same property and settings, which are dealt with as an atomic vector object. All common properties of these devices can be arranged into an array, where each index in the array represents a single device. The AV allows the inspection of such multi-channels using the array history chart. For each time stamp in the past one can request a snapshot from the archive for the whole multi-channel array and show the values on the array chart. It is even possible to cycle through the history trend chart of a single property and while doing so to display the multi-channel that that property belongs too. In this case the snapshot is loaded for each selected time stamp in the trend chart.

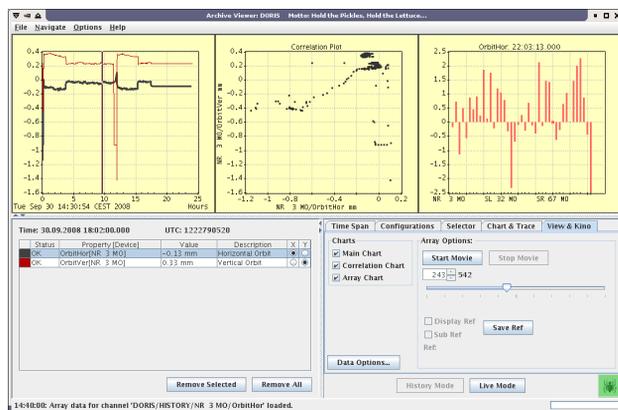


Figure 1: Archive viewer.

Another application based on both live data and the archiving system is the Multi-Channel Analyser (MCA), which deals specifically with multi-channel arrays (e.g. all the vacuum pressures, all the magnet power supply currents, the beam orbit, etc.). It is a bit more than ‘just

another archive viewer’ as it offers other display tools dedicated to multi-channel arrays, such as reference displays, threshold displays, peak-hold, etc.. There are also rules for splicing together multiple data sources into a single viewable multi-channel array. The MCA also offers tools for the comparison of individual device traces and other features employed also by the AV.

Both the Archive Viewer and the Multi-Channel Analyser can work in two different modes: the history mode (default for the AV) where all data are loaded from the archive system and the live mode (default for the MCA) where live data are acquired from the device servers, or both modes in combination (giving a complicated trend viewer).

ALARM SYSTEM

The Alarm System is an important component for diagnosing problems in the control system.

TINE alarms are processed at two levels. The first level is located directly at the front end and is known as the Local Alarm Server (LAS). The LAS is mostly responsible for generation of the alarms, determining oscillations, heartbeats etc. The second level of processing occurs at a dedicated middle layer TINE server known as the Central Alarm Server (CAS). Here, alarms are collected, filtered, sorted, and made available for client-side review. The CAS also performs several additional tasks more appropriate to central level processing. It can determine whether ‘server-down’ alarms need to be issued in the case of a non-responsive server. It can also take actions following the receipt of particular alarms. For instance, it can issue post-mortem triggers, send e-mails, or write reports, etc.

The TINE Alarm Viewer retrieves data entirely from the central alarm server and is a powerful application replete with different features implemented in collaboration with the operators to make the alarm system as useful as possible.

The Alarm Viewer works in several modes or views in order to fulfil the requirements proposed by the machine operators. It was designed in a way that it shows only the most important data required by the operators and hides the information which is not required at a particular level. One can of course expand the view at any time to match his requirements.

The Alarm Viewer works primarily as a live alarm monitor. It monitors the systems of a particular machine and shows the quantity and severity of the alarms as they occur (it is even possible to turn on sound notification).

Once an alarm is registered by the CAS it will appear in the viewer under the designated alarm system. By selecting the appropriate view the user can inspect the details of the alarm, such as the device and server of origin, as well as the start time and duration. It is even possible to inspect the history of a give alarm – this will show all occurrences of the alarm (heartbeats, data change termination, reappearances) in the recent past (defined as a two hour window considered to be representative of live, i.e. non-archived data).

Furthermore, the alarm viewer offers the ability to suspend the entire view, to acknowledge those alarms which the operator is not interested in, or to disable specific alarm categories entirely. Suspending the view means that the alarm tables will not be updated (allowing easier inspection when alarms occur rapidly), while the latter option means that all currently selected alarms will be suppressed and rendered invisible until the next occurrence/heartbeat of the particular alarm or the user decide to un-acknowledge them. Disabling an alarm amounts to suppressing it entirely at the CAS. Operators will sometimes resort to this if for instance hardware is known to be in need of repair and viewing alarms from the corresponding device server would only amount to an unnecessary distraction.

In addition, the Alarm Viewer also offers the possibility of examining the archived alarms. By specifying the time frame in the past all archived alarms from that window will be loaded and the user has the same features at his disposal as when monitoring live alarms.

SPECIAL PURPOSE TOOLS

Other general display and analysis tools are listed below.

The Trend Viewer is more or less a stripped down Archive Viewer. It allows the selection of numerous properties and presenting their values in the trend chart together with their history as we already mentioned in the Archive Viewer section.

The Scope Trace Viewer is oriented in displaying the scope traces, which are special TINE properties. They consist of several hundreds or even thousands of points, which have to be presented in a chart (similar to oscilloscope traces). As with other applications which use

ACOP beans, the Scope Trace Viewer also offers numerous tools for data visualization as well as some specific features which are usually employed by oscilloscope (e.g. trace persistence).

Another special type of property in the TINE control system is the video type. The TINE Video Application is capable of displaying a live feed from a designated camera integrated into the control system. By using the Huffman Compression methods [6] TINE employs fast transfer rates between the server and client. The drawing of the image is implemented in pure Java and can be realized with refresh rates of a few hertz.

Beside the aforementioned applications TINE also offers a set of tools for statistical analysis of the machine history and availability. The Operation History application gathers data from both the alarm and archive servers and performs various calculations (defined by specific configurations) to present the machine operation history. The user has the option to examine the running, standby and other states of the machine operation during any specified time frame, rendered at the top most level as a pie chart.

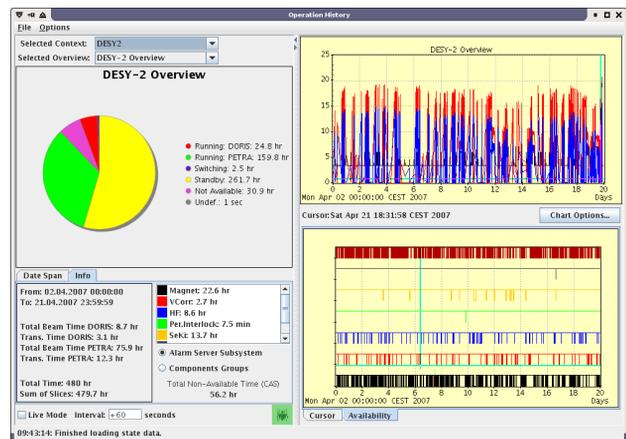


Figure 2: Operation history viewer.

ADMINISTRATION TOOLS

There are several applications designed for monitoring front end computers as well as configuring the TINE control system

The FEC Remote Control Panel is intended to monitor the Front End Controllers (FEC) as well as the device servers on those computers. The user is allowed to monitor the processes on the FEC, inspect the alarm data, log files etc. The privileged user can also login to a server and/or control the processes on the host computer, or even restart the server process.

The ENS Administration tool is used for administering the naming services, such as registering new device servers or front-ends as well as removing them from the system or simply grouping them in a particular way.

The Archive Database Manager allows one to create and maintain the archive system configuration files, which are loaded onto archive servers and define how certain properties should be archived. The application also assures the consistency of all the database entries.

CONCLUSION

When it comes to diagnostics the operators require reliable applications for analysis of the data. TINE now offers a comprehensive set of java-based tools for live and post-mortem analysis of the control system operation, thus making the analysis and operation overview much easier and more fun.

REFERENCES

- [1] <http://tine.desy.de>.
- [2] <http://cosylib.cosylab.com/pub/acop/site>.
- [3] P. Bartkiewicz et al, "The Run-Time Customization of Java Rich Clients with COMA class", ICALEPCS 2007.
- [4] E. Sombrowski et al, "JDDD: A Java Doocs Data Display for the XFEL", ICALEPCS 2007.
- [5] M. Lomperski, "TINE Archive and Alarm Services", TINE Workshop 2007, http://adweb.desy.de/mcs/TINE_Workshop_2007_Agenda.html.
- [6] <http://en.wikipedia.org/wiki/Huffman>.