Distributed Timing Diagnostic Applications

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Abstract

The CERN timing system delivers events to the accelerator complex via a distribution network to receiver modules located around the laboratory. These modules generate pulses for nearby equipment and interrupts for the local host. Despite careful planning, hardware failure and human error can lead to anomalies within the control system. Diagnosing such errors requires a formal description of the logical and topological timing layout. This paper describes the design and implementation of a suite of timing diagnostic software applications which allow users to quickly diagnose and remedy faults within the CERN timing system. Note that the web based diagnostic suite has been implemented using AJAX style technologies which results in a behavior that is typical of traditional desktop applications.

1

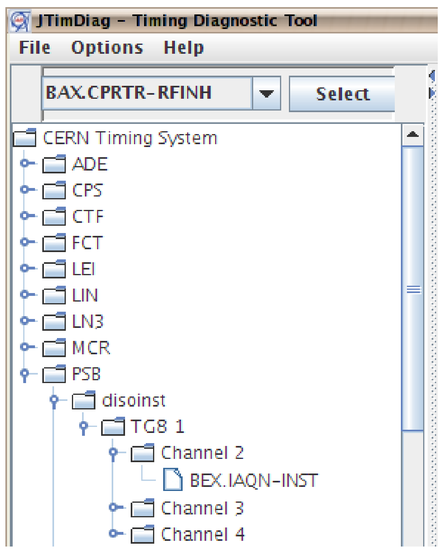
When a timing pulse either fails to arrive at the end user equipment, or arrives at the wrong time, the chains of counters on which it depends in the timing network may need to be analyzed. The JTimDiag timing diagnostic application aids this task by displaying the counter chains in a map.

As shown in the screen shot, the Web based timing diagnostics suite contains a link to the JTimDiag application. Clicking on this link downloads and launches the application.

2

The JTimDiag application implements a selection mechanism that displays timings hierarchically by machine, front-end computer, timing receiver card or channel. It permits selection of individual timings as well as of groups of timings contained in the same network.

A counter output may start one or more other counters, and this relationship results in a network of dependencies for an output pulse. For a given counter, the selection mechanism permits selecting all counters in its network. The selected counters are displayed in the selection pool window, and some of them may later be removed if not needed.



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The web based presentation tier receives data in XML format. The Document Object Model interface is used to extract the diagnostic information from the XML which is then displayed in tabular form as shown in the screenshot below.

The presentation tier provides facilities which allow the table items to be ordered, masked or highlighted based on criteria specified by the user.

Facilities are also provided which allow the table to be saved as a reference to be compared with future values.

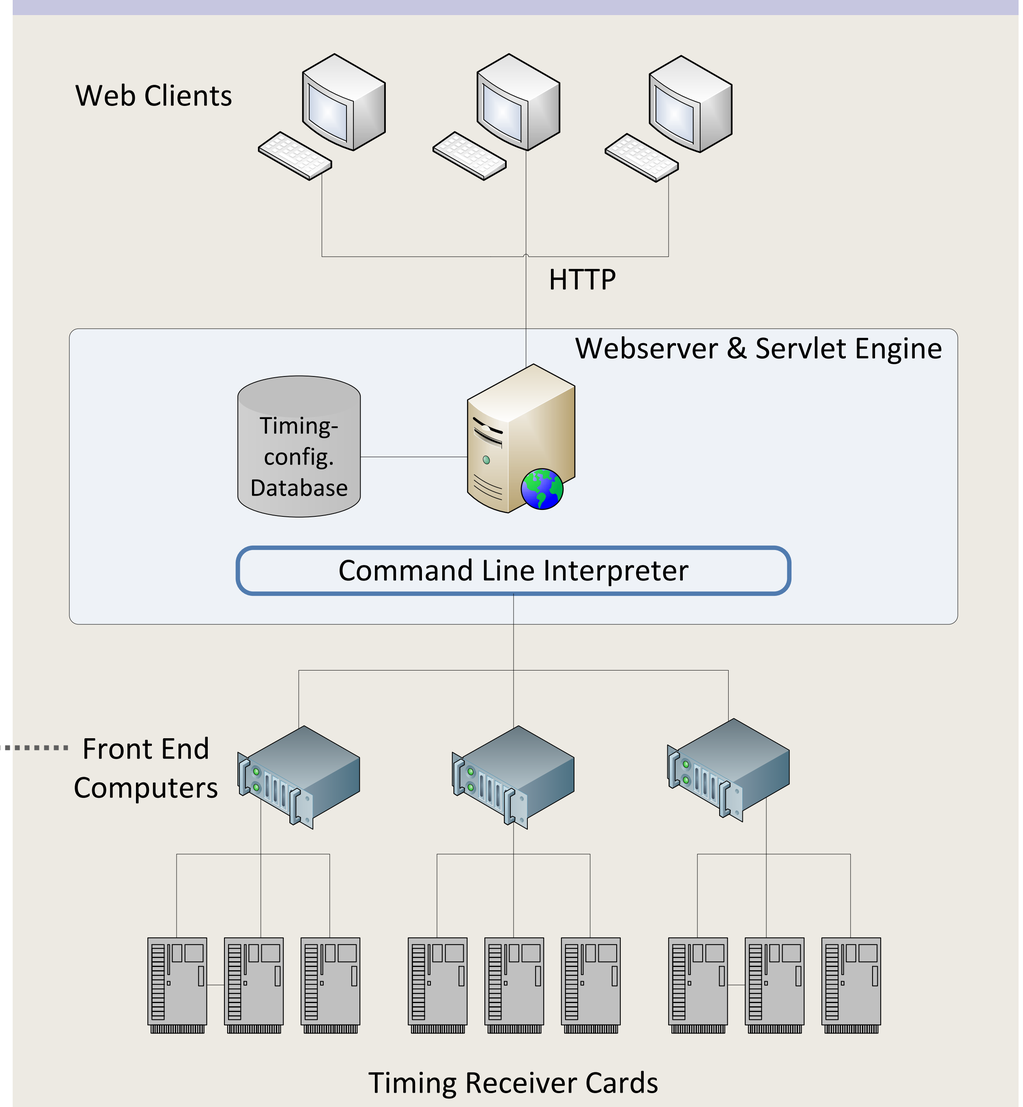
This kind of interactive behaviour is made possible due to the utilization of both the XMLHttpRequest object, which facilitates asynchronous HTTP requests and the Document Object Model interface which allows dynamic manipulation of a web page without the need for a complete page refresh.

Future enhancements include the possibility to download the data within the table in either a comma separated variable or excel spreadsheet format. With the introduction of the HTML <Canvas> tag there is also the possibility of displaying data graphically within charts and graphs.

Timing diagnostics AB-CO-HT

User	PTIM	CTIM	AQN	Clock	C-Time	Start	PLN	Channel	Delay
EARLY=0x2	EEX.EKFA	EX.SCY-CT	LEI	40MHz	30	Nor	USER.EARLY	3	1199920
EARLY=0x2	EEX.WKFA	EX.SCY-CT	LEI	1KHz	258	Nor	USER.EARLY	1	258
EARLY=0x2	EEX.SKFA	EX.SCY-CT	LEI	40MHz	265	Nor	USER.EARLY	2	10596800
EARLY=0x2	EEX.W10SYNCPS	EEX.W30-CT	LEI	Ext2	1670	Ext1		2	0
EARLY=0x2	EEX.MW8RF	EEX.W30-CT	LEI	Ext1	1672	Ext2	USER.EARLY	3	2846
EARLY=0x2	EEX.W2RF	EEX.W30-CT	LEI	Ext1	1678	Chnd	USER.EARLY	4	8496
EARLY=0x2	EEX.DEKFA	EEX.W30-CT	LEI	40MHz	1680	Nor	USER.EARLY	7	1189920
EARLY=0x2	EEX.DSKFA	EEX.W30-CT	LEI	40MHz	1680	Nor	USER.EARLY	6	1200000
EARLY=0x2	EEX.DAKFA	EEX.W30-CT	LEI	1KHz	1700	Nor	USER.EARLY	8	50
EARLY=0x2	EEX.AKFA	EX.SCY-CT	LEI	1KHz	1750	Nor	USER.EARLY	4	1750
EARLY=0x2	EX.ECY-KFA	EX.FCY600-CT	LEI	1KHz	1800	Nor	USER.EARLY	1	0
FL_OU_MD=0x14	EEX.AKFA	EX.SCY-CT	LEI	1KHz	50	Nor	USER.FL_OU_MD	4	50
FL_OU_MD=0x14	EEX.W10SYNCLEI	EEX.W30-CT	LEI	10MHz	1540	Nor		1	200000
FL_OU_MD=0x14	EEX.MW8RF	EEX.W30-CT	LEI	Ext1	1542	Ext2	USER.FL_OU_MD	3	2846
FL_OU_MD=0x14	EEX.W2RF	EEX.W30-CT	LEI	Ext1	1548	Chnd	USER.FL_OU_MD	4	8496
NOMINAL=0x3	EEX.W10SYNCLEI	EEX.W30-CT	LEI	10MHz	2870	Nor		1	200000
NOMINAL=0x3	EEX.MW8RF	EEX.W30-CT	LEI	Ext1	2872	Ext2	USER.NOMINAL	3	2846
NOMINAL=0x3	EEX.W2RF	EEX.W30-CT	LEI	Ext1	2878	Chnd	USER.NOMINAL	4	8496
NOMINAL=0x3	EEX.AKFA	EX.SCY-CT	LEI	1KHz	2919	Nor	USER.NOMINAL	4	2919
MDNOM=0xc	EEX.WKFA	EX.SCY-CT	LEI	1KHz	20	Nor	USER.MDNOM	1	20

Web Application Architecture



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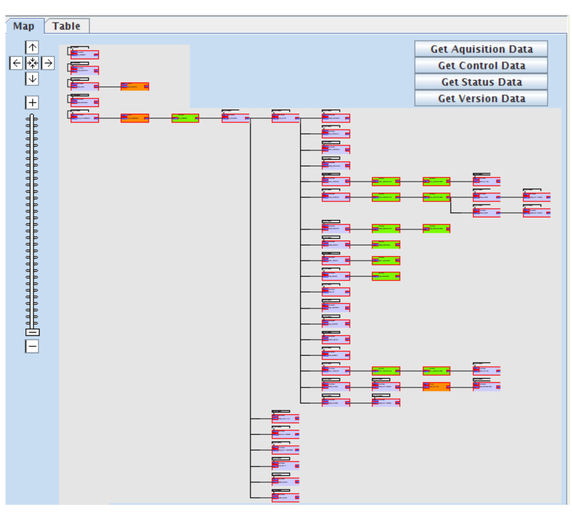
Once the selection has been made, the application displays a network of counters in a logical map. The logical map also shows static data associated with each counter that includes: its name, type, load event and output destination. When an output pulse fails to arrive at the end user equipment or arrives at the wrong time, the map can used to determine the chains of counters that must be investigated to discover the cause of the problem.

It is often not possible to display a complete timing map on the screen, therefore facilities have been provided to assist navigation:

- A scrolling facility allows the user to view portions of the logical map which are not currently displayed on the screen.
- A zooming facility allows users to reduce the size of the logical map allowing a greater area of the map to be displayed.
- Clicking on the name of a timing in the selected list causes the map display to center on it.



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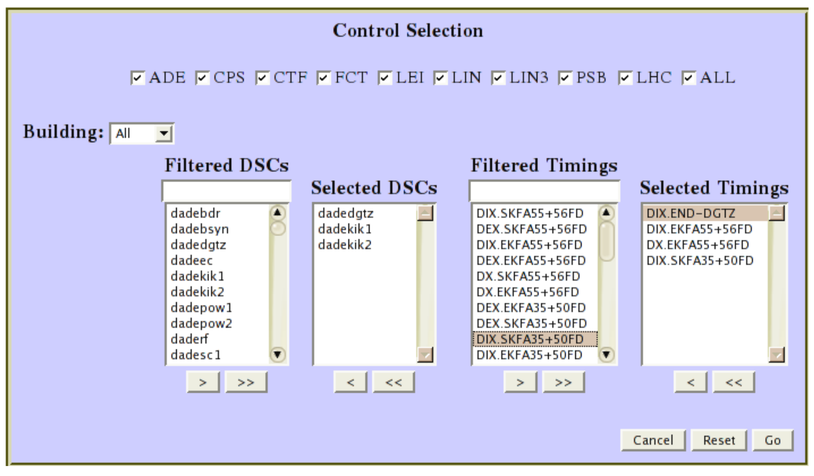

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Having discovered the network of counters on which an output depends, the user knows which configurations and hardware need inspection.

The web based diagnostics suite displays information needed to diagnose the fault such as the counter's acquisition and control values. It also includes the current status, driver version, library version and the VHDL version of each receiver card.

The web based applications can be started directly from the JTimDiag mapping application or they can be launched using a web based selection mechanism.

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