THE Web2cToolkit: A FRAMEWORK FOR THIN AJAXIAN CONTROL SYSTEM CLIENTS

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Abstract

The Web2cToolkit is a framework for web-based control clients. This paper describes the conceptual design, the key features and the implemented tools of the framework and discusses security issues. Example applications from the PETRA 3 project at DESY will be presented.

INTRODUCTION

The Web2c toolkit is a collection of web-based tools designed to configure and visualize customer-specific client applications for accelerator control. It consists of a synoptic display, a corresponding graphical editor and a specific viewer for retrieving and rendering archived accelerator parameters.

The Web2c applications run as server-side JAVA applications and are published as dynamic web pages to the clients. The usage of the Web2c toolkit requires no specific programming skills by the users. By design, Web2c-based pages are accessible from every valid network address if not otherwise restricted. Web2c applications are not bound to any specific control system implementation.

Web2c pages are simple client applications. The typical use cases are overview or information panels, service panels for remote maintenance or user forms to access stored data for off-line analysis. The Web2c toolkit has been developed within the scope of the PETRA 3 controls project at DESY. It is used both for accelerator and beamline controls. For further details see http://web2cToolkit.desy.de.

CONCEPTUAL DESIGN AND BASIC FEATURES

The Web2c toolkit is founded on the JAVA servlet and the AJAX (**A**synchronous **J**avaScript **A**nd **X**ML) technology. By design, the toolkit is platform independent and only freely accessible open-source software libraries for XML parsing and data plotting have been used.

After passing a user authentication procedure Web2c pages are generated on user request by the corresponding servlet application and downloaded to the requesting client. The transmitted authentication password is MD5-encrypted. The pages are executed within the user's web-browser application and contain only pure HTML tags and JavaScript code snippets. The individual page components communicate asynchronously with the servlet through the http protocol and web port 80xx using the standard XMLHttpRequest / XMLHTTP method. A general re-loading of the complete page is not performed which avoids annoying page flickering.

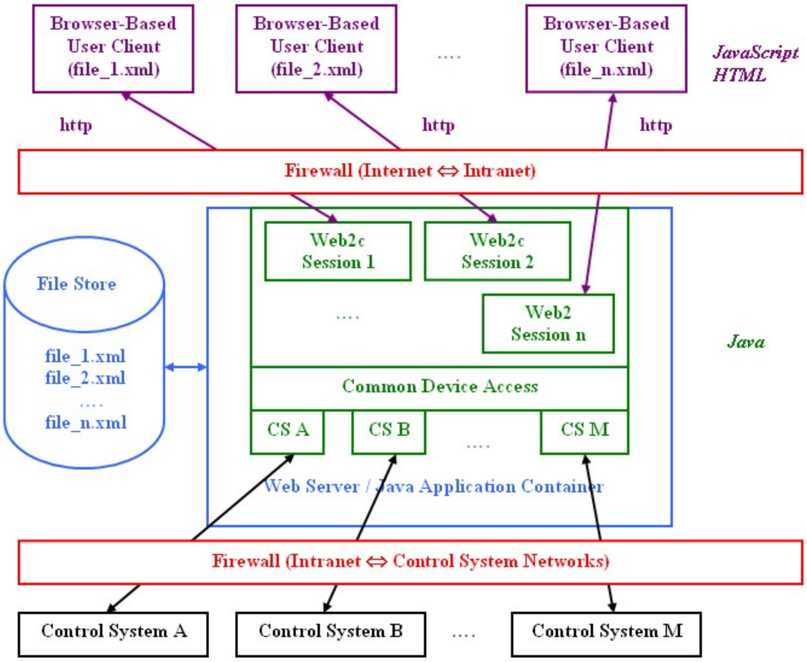
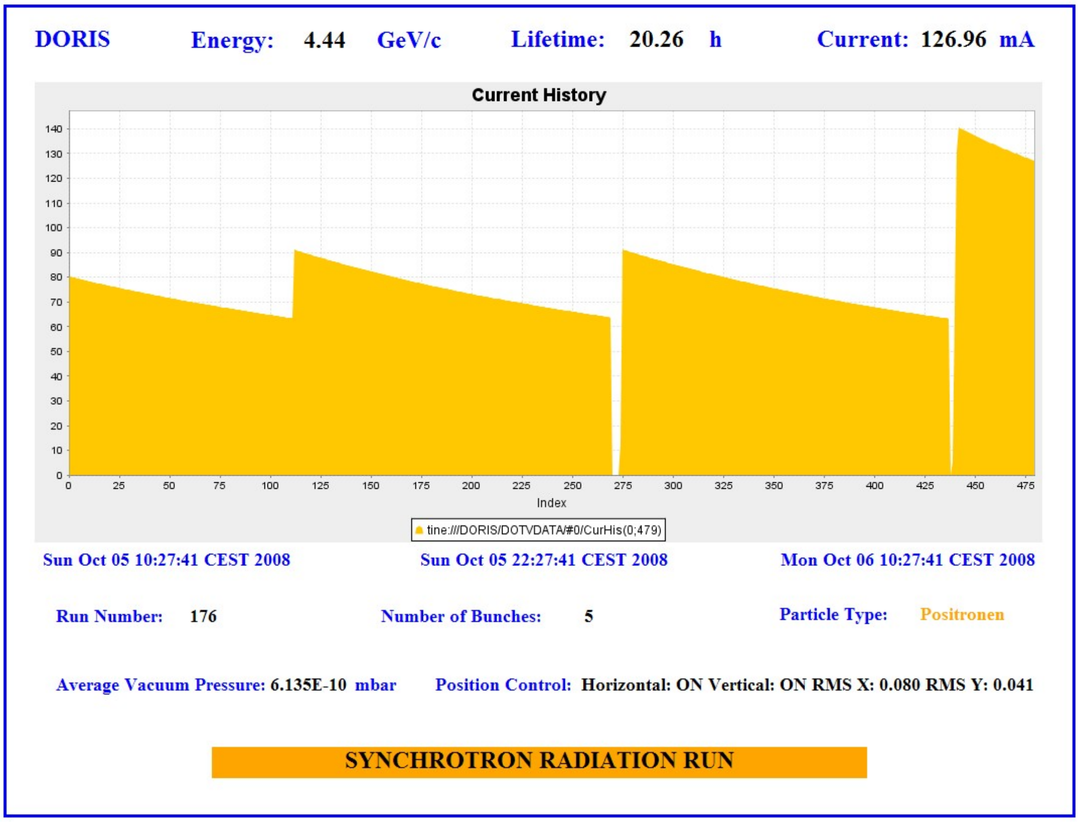

Browser-Based User Client (file_1.xml)
Browser-Based User Client (file_2.xml)
....
Browser-Based User Client (file_n.xml)
JavaScript HTML
http
http
http
Firewall (Internet ⇔ Intranet)
File Store
file_1.xml
file_2.xml
....
file_n.xml
Web2c Session 1
Web2c Session 2
....
Web2 Session n
Java
Common Device Access
CS A
CS B
....
CS M
Web Server / Java Application Container
Firewall (Intranet ⇔ Control System Networks)
Control System A
Control System B
....
Control System M

Figure 1: Software architecture of the Web2c toolkit.



DORIS Energy: 4.44 GeV/c Lifetime: 20.26 h Current: 126.96 mA

Sun Oct 05 10:27:41 CEST 2008 Sun Oct 05 22:27:41 CEST 2008 Mon Oct 06 10:27:41 CEST 2008

Run Number: 176 Number of Bunches: 5 Particle Type: Positronen

Average Vacuum Pressure: 6.135E-10 mbar Position Control: Horizontal: ON Vertical: ON RMS X: 0.080 RMS Y: 0.041

SYNCHROTRON RADIATION RUN

Figure 2: Web2c synoptic display page assembled by Web2cHisto, Web2cLabel, Web2cText, Web2cValue, Web2cTime and Web2cSection elements.

A standard web server with a JAVA application container hosts and runs the Web2c servlets. As indicated in Figure 1, each page request instantiates a request-specific Web2c session. A pre-configured, individual and user-application specific configuration file describes the attributes and methods of the components embedded in the requested page. The configuration files are stored on the web server's file system. Web2c supports three different user roles (layman, expert and supervisor). Prior to initial login, each user of the Web2c facilities has to register with an individual user name and associated password. Each registered user is per definition a layman. Laymen have only read-like device access. Each configuration file might contain an individual list of expert and supervisor names. Those persons have staged privileges to write-like access. In addition, configuration file specific network filter masks can be provided restricting write-like access to those network addresses only.

The running session instances communicate through a common interface (Common Device Access) with the control systems and the devices attached. By design, device access is implemented to be control system neutral. Monitor, set and history methods are provided. Control-system specific interface plugs grant access to the control systems connected. Presently, a plug for TINE-based control systems has been implemented. Through additional gateway processes integrated in TINE, seamless access to DOOCS-based, TANGO-based and EPICS-based control systems is feasible. However, native plugs for those control systems are not yet provided.

For security reasons, the networks housing the clients might be separated from the web-server's network by an additional network firewall and likewise the web-server's network from the control system network. The Web2c toolkit servlets are tested with Apache Tomcat ^{TM} 5.x running with JAVA virtual machine 1.6.0_xx. All client-side tools work properly with Microsoft Internet Explorer^{TM} 7.0.x.x (Windows), Mozilla Firefox^{TM} 3.0.x (Windows, Linux), Safari^{TM} 3.1.x (Windows) and Opera^{TM} 9.5x (Windows). Other web-browser implementations might also work but have not been tested.

WEB2C TOOLS

The Web2c toolkit consists of a synoptic display viewer, a corresponding graphical editor and an archive viewer

Synoptic Display

The Web2c synoptic display is a frame for simple controls applications. It provides web pages with active and passive components to visualize and control accelerator equipment. Table 1 lists the implemented components. All components can be tailored manifold with respect to colours, fonts, size etc. The components can be grouped in sections. Even complete pages can be embedded within other pages. Buttons that issue a write command to the control system, sliders and wheel switches are only visible for expert and supervisor users. If declared as super components, access is granted to supervisors only.

Table 1: List of Web2c synoptic display components

Web2cEmbeddedPage	Web2cValue/ Web2cValueList
Web2cSection	Web2cIndicator/ Web2cIndicatorList
Web2cLabel/ Web2cLabelList	Web2cText/ Web2cTextList
Web2cImage	Web2cAnimatedImage
Web2cTicker	Web2cButton
Web2cTime	Web2cSlider
Web2cTrend	Web2cWheelSwitch
Web2cHisto	

Each synoptic display page updates periodically with a rate as specified in the page's configuration file. Short histories of displayed read-back values are available on mouse click. Figure 2 shows a sample page.

Synoptic Display Editor

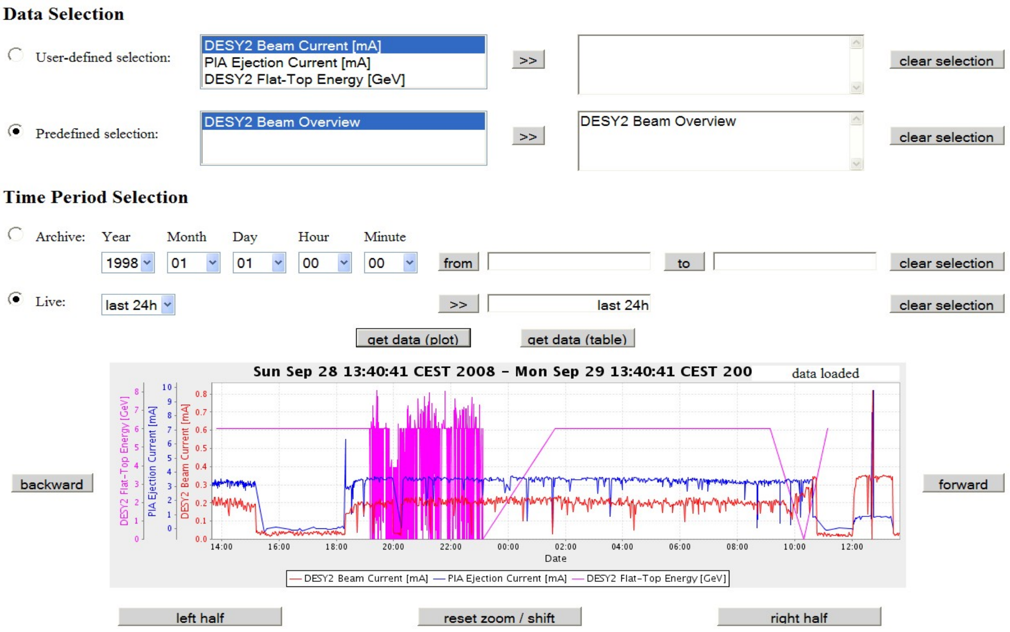
The synoptic display editor is a simple web-based editor to configure graphically synoptic display pages. It does not have full WYSIWYG capability, but it allows positioning and resizing of components in a drawing window by dragging the mouse. Reasonable default values for the various component attributes are provided. Changes have to be entered by typing. Pages can be modified and saved by expert users only.

Archive Viewer

The archive viewer is a web-based form to request data from a control system archive and to display the retrieved data as a plot chart or a table. All registered users have unrestricted access to the features of the archive viewer. The user can select individual data channels or groups of data channels as listed in the archive viewer configuration file. Besides the pre-configured "last 12h", "last 24h" and "last 48h" options, each time interval can be selected as required. Maximum 3600 data points will be plotted within the selected time interval. In addition, on-line zooming capability via mouse click is provided retrieving fresh data for the region of interest from the archive system. Figure 3 shows the archive viewer page displaying sample data.

The archive viewer page can be tailored manifold by the page designer with respect to size, colours etc. Various plot options such as linear, logarithmic, step-like or Gantt-chart like can be chosen for each data channel individually when setting up the configuration file.

The archive viewer can be used in two modes. In the manual mode, the user can select the data channels through the data selector form. In the automatic mode, the data selector form is hidden and only the chart with pre-selected data channels and time interval is displayed automatically after page download.



Data Selection

○ User-defined selection: DESY2 Beam Current [mA] / PIA Ejection Current [mA] / DESY2 Flat-Top Energy [GeV]

● Predefined selection: DESY2 Beam Overview → DESY2 Beam Overview

Time Period Selection

○ Archive: Year 1998, Month 01, Day 01, Hour 00, Minute 00

● Live: last 24h → last 24h

Sun Sep 28 13:40:41 CEST 2008 – Mon Sep 29 13:40:41 CEST 200

data loaded

Figure 3: Web2c archive viewer page displaying sample data (manual mode).