

WEB-BASED TOOLS FOR REAL-TIME ASSESSMENT OF EARTHSOPE'S TRANSPORTABLE ARRAY STATE-OF-HEALTH: INTEGRATION OF THE ANTELOPE REAL TIME SYSTEM, RRDTOOL, AJAX AND PHP

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Abstract

Over the past three years the Array Network Facility (ANF) has developed a robust, extensible web-based toolkit for monitoring the state-of-health of Earthscope's Transportable Array. The tools are constructed within a framework of the Antelope Real Time System (ARTS) and the Antelope interface to the PHP Hypertext Processor (PHP), an inline scripting language. Exporting data from Datascope databases and Object Ring Buffer (ORB) packets into XML allows comprehensive client-side interaction via Asynchronous Javascript And XML (AJAX) calls. Navigating and displaying the resultant XML Document Object Model (DOM) trees are done using eXtensible Stylesheet Language Transformation (XSLT) and PHP's built-in DOM classes.

Tools include regional and individual station and event maps, state-of-health statistics, waveform plots, and datalogger monitoring. Combined with real-time graphing of state-of-health parameters from status ORB packets using Round Robin Database Tool (RRDtool), this toolkit allows analysts, station engineers, scientists, and the general public to view, assess, interact with, and download data collected from the 250+ stations in the Transportable Array (TA) seismic network.

Tools are available at the Array Network Facility website, <http://anf.ucsd.edu>.

Toolkit Architecture

Figure 1 below shows the backend framework for the toolkit. Data flows from the TA station to the ANF, where it is parsed and presented in different formats.

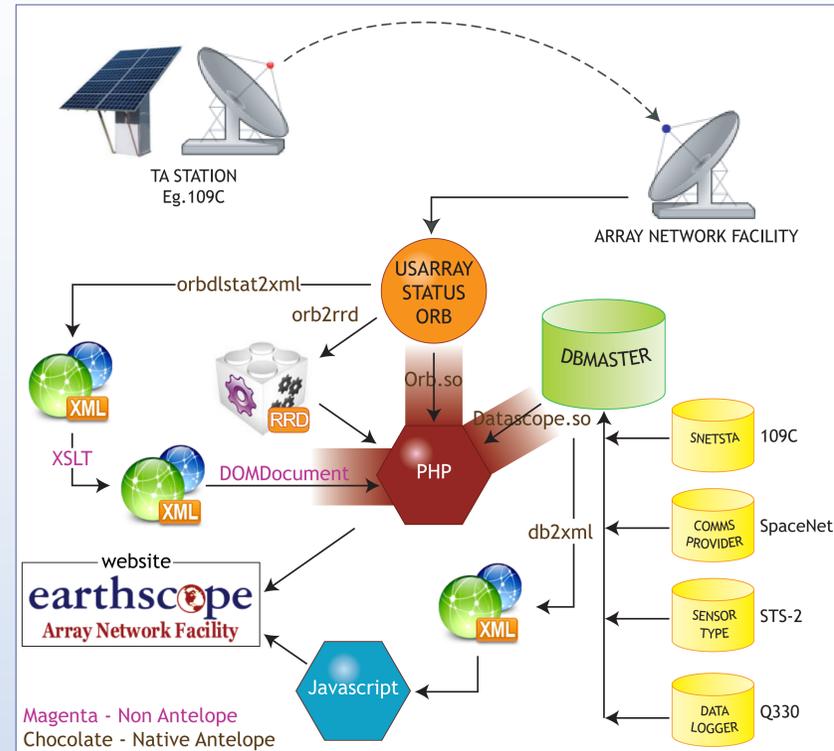


Figure 1. Backend architecture for the interactive tools on the ANF website.

Case Study: Google maps & SOH plots

Providing an intuitive interface for station analysts and engineers to instrument State-Of-Health (SOH) is critical to assist in diagnostics. The ANF website provides several interfaces to SOH information. The stations page (Fig. 2) is split into multiple tabs for network, communications, sensor and datalogger types. Each tab has an interactive map and associated table, both of which display if the station is on- or off-line, or in warning mode. The SOH plots page (Fig. 3) has an AJAX driven Google map upper-pane, populated by an XML feed of station metadata. Clicking a station shows its metadata and the plot options available. Selecting plot parameters dynamically displays the contents of an RRD archive for the variable and time period below the map. XML feeds are updated every 5 minutes from the database master table using db2xml.

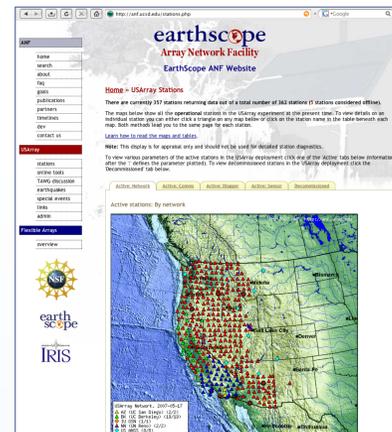


Figure 2. Screenshot of stations page. Multiple tabs and tables portray the status of all stations in the experiment. Based on their data latencies, stations can be online, in warning mode, or offline. Maps are automatically updated when a change in the master database table occurs.

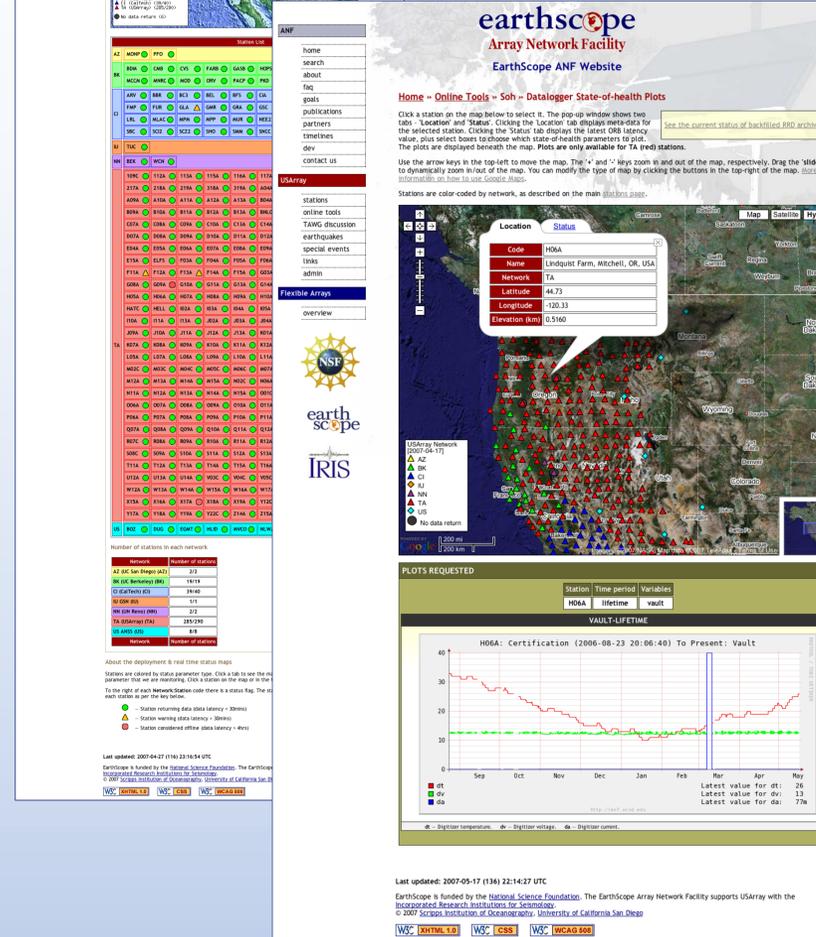


Figure 3. Screenshot of Google map of USArray stations & State-Of-Health plots. Note the pop-up tabbed-window displaying station metadata. The 'Status' tab shows data latency and plot types.

Case Study: webdlmon

Webdlmon is a web-based clone of the ARTS Tcl/Tk application dlmon. Datalogger status packets from an ORB are collected and stored with two different processes: orbd1stat2xml and orb2rrd. The former reads packets and converts them to XML files. The latter converts packets into time:value pairs and populates an RRD archive.

XSL transforms the XML files and PHP is used to parse and display the XML file as an HTML table. Client side Javascript allows dynamic sorting of the table. Webdlmon can be individually customized through cookies, allowing users to choose which state-of-health parameters they are interested in monitoring (Fig. 4).

Clicking values results in an RRD plot overlaying webdlmon. This is achieved using stylesheets and asynchronous Javascript. You can choose to view hourly, daily, weekly, monthly, yearly or lifetime plots for the station and channel selected.

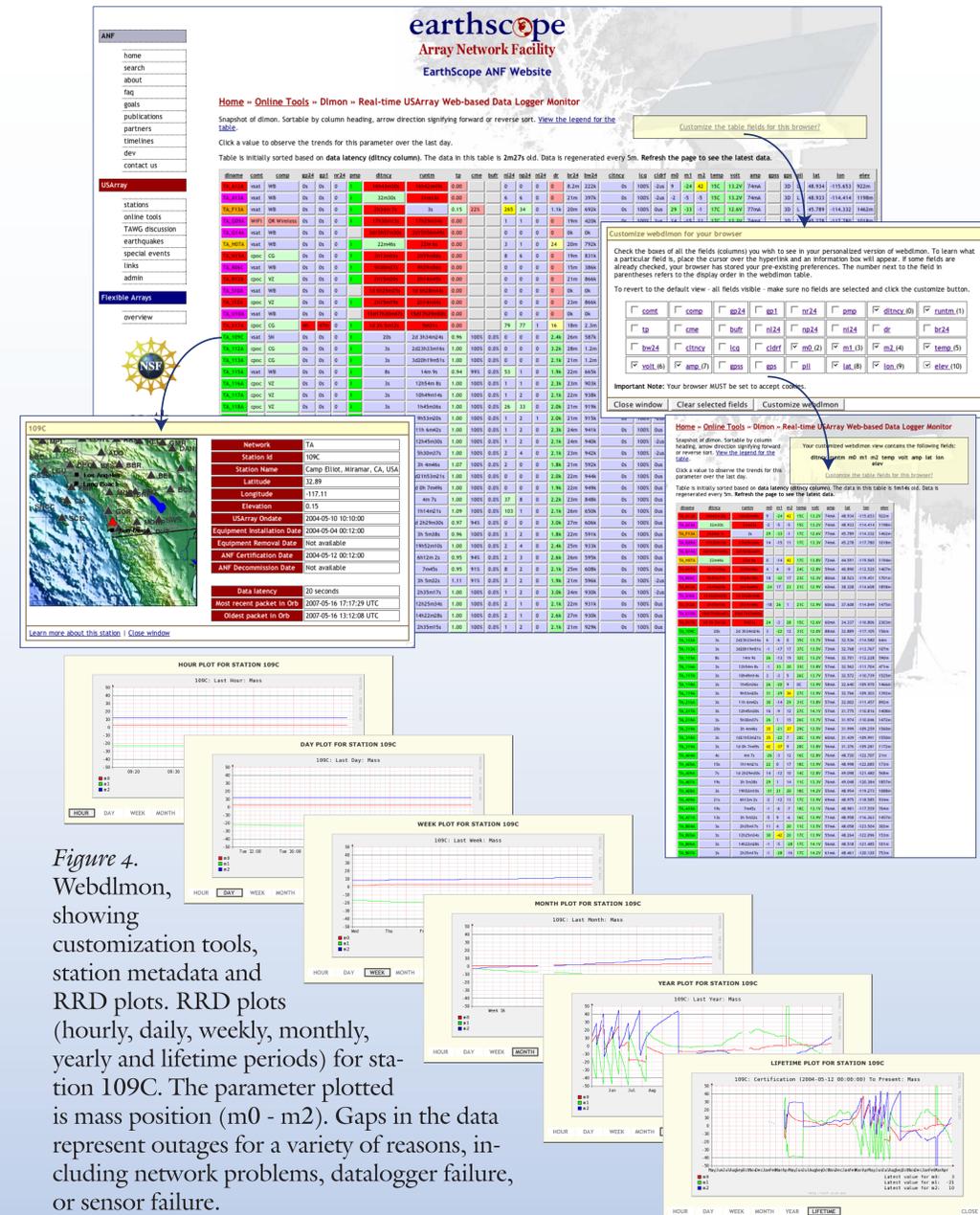


Figure 4. Webdlmon, showing customization tools, station metadata and RRD plots. RRD plots (hourly, daily, weekly, monthly, yearly and lifetime periods) for station 109C. The parameter plotted is mass position (m0 - m2). Gaps in the data represent outages for a variety of reasons, including network problems, datalogger failure, or sensor failure.