

User-Friendly Interface Developed for a Web-Based Service for SpaceCAL Emulations

A team at the NASA Glenn Research Center is developing a Space Communications Architecture Laboratory (SpaceCAL) for protocol development activities for coordinated satellite missions. SpaceCAL will provide a multiuser, distributed system to emulate space-based Internet architectures, backbone networks, formation clusters, and constellations. As part of a new effort in 2003, building blocks are being defined for an open distributed system to make the satellite emulation test bed accessible through an Internet connection.

The first step in creating a Web-based service to control the emulation remotely is providing a user-friendly interface for encoding the data into a well-formed and complete Extensible Markup Language (XML) document. XML provides coding that allows data to be transferred between dissimilar systems. Scenario specifications include control parameters, network routes, interface bandwidths, delay, and bit error rate. Specifications for all satellite, instruments, and ground stations in a given scenario are also included in the XML document.

For the SpaceCAL emulation, the XML document can be created using XForms, a Web-based forms language for data collection. Contrary to older forms technology, the interactive user interface makes the science prevalent, not the data representation. Required versus optional input fields, default values, automatic calculations, data validation, and reuse will help researchers quickly and accurately define missions. XForms can apply any XML schema defined for the test mission to validate data before forwarding it to the emulation facility. New instrument definitions, facilities, and mission types can be added to the existing schema.

The first prototype user interface incorporates components for interactive input and form processing. Internet address, data rate, and the location of the facility are implemented with basic form controls with default values provided for convenience and efficiency using basic XForms operations. Because different emulation scenarios will vary widely in their component structure, more complex operations are used to add and delete facilities.

The screenshot shows a web browser window with a menu bar (File, Edit, View, Bookmarks, Help) and navigation icons. The main content area contains a form with the following elements:

- Scenario Name:** A text input field containing "Scenario.xml".
- Facility:** A red horizontal bar with the label "Facility" above it.
- IP Address:** A text input field containing "255.255.255.255".
- Data Rate (Kbps):** A dropdown menu showing "100".
- Location:** A section with two rows of input fields:
 - Latitude:** Two input fields, both containing "0".
 - Longitude:** Two input fields, both containing "0".
- Buttons:** Two buttons labeled "Insert Facility" and "Delete Facility".
- Submit:** A red horizontal bar with the label "Submit" above it, and a button labeled "Submit Scenario" below it.

The status bar at the bottom of the browser window displays "Ready. (0.961 secs)".

Sample Web-based form for scenario input.

Long description. Window of an Xforms display for basic scenario input. Scenario name, IP address, data rate, and location are the input fields. Insert facility, delete facility, and submissions buttons are displayed.

Scenarios are submitted via a Common Gateway Interface (CGI) program. A Web server running in the SpaceCAL facility will need to execute the CGI program to validate user access rights and schedule emulation resources. These components are being put in place but are not complete yet. The next step in creating a next-generation distributed satellite emulation system will be to orchestrate lower-level Web services for interoperability and dynamic component testing. Incorporating standard protocols like the Simple Object Access Protocol (SOAP) will mean users do not need to change their development environment in order to use the emulation. The test-bed software should also allow users to generate a series of scripts to isolate one or more components (data collection satellites, high-speed communication satellites, ground stations, communication protocols, and onboard satellite software) and to replace default systems in the emulation system.

Find out more about this research at <http://scp.grc.nasa.gov/portfolio/ia/scal.html>

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Programs/Projects: CICT, Space Communications, Intelligent Architectures