COL/CE/15

Vector Graphics and Web Exchange

FY 2004 Proposal to the NOAA HPCC Program

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Principal Investigator: **John Hernandez**

Line Organization: OAR
Routing Code: R/OM12
Address:

NOAA-Boulder
325 Broadway
Boulder, Co 80305

Phone: (303) 497-6392
Fax: (303) 497-6005
E-mail Address: john.hernandez@noaa.gov

Jeff Smits
jeff.smits@noaa.gov

Proposal Theme: **Technologies for Collaboration, Visualization, or Analysis**

John Hernandez
Network Engineer
NOAA-Boulder NOC

Donald R. Mock
Executive Director
NOAA - OED

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Proposal for FY 2004 HPCC Funding

Prepared by: Jeff Smits

Executive Summary:

The evolution of the internet has made it an unmatched entity in the textual and visual reference arena. Web pages that once served up static information have become part of large scale distributed systems capable of transferring dynamic, real-time information to users on a global scale. Many of the web related technologies that have emerged over the last decade have greatly increased our capacity for data transfer, manipulation, and encryption. In the visual realm however, we are still using static images. Graphics transferred in these formats are hard coded, and cannot be manipulated or transformed by the client without some degradation of the original image. How do we distribute graphic documents in a scalable, efficient format, while at the same time co-existing with, and perhaps utilizing, many of the technologies in the textual arena? The answer is simple; Scalable Vector Graphics, or SVG.

This proposal will provide a SVG design template, via prototyping the NOAA baseline drawing, for enterprise deployment of web distributed graphic documents and services. SVG is an XML grammar for describing two-dimensional graphics. Elements for vector graphics, including lines, shapes, text, and animation are specified in a public Data Type Definition authorized by the W3C. Since SVG grammar is fully XML compliant, the technology can be utilized by XML parsers, editors, and will most likely be compiled straight into browsers down the road.

Problem Statement:

Three fundamental problems exist with graphic images transferred over the web today. One, they are little more than a collection of hard-coded points in space. Images embedded within HTML are nice for complimenting a web page, or providing a reference snap shot, but do little for a user who might want to zoom in, or otherwise manipulate the image. Hard-coded graphics formats like GIF, JPEG, and PNG can be slightly manipulated but they usually begin to pixelate almost immediately. Secondly, static images carry a lot of extra, worthless information making them bulky and inefficient. For example, an image displaying a line drawn on a white background carries the information for the space around the line and the line itself. Vector graphics represent mathematical points in space, so files are much smaller, and transfer rates are increased. In addition, vectors are scalable once they are transferred to the client. This means that they retain their resolution regardless of the zoom level, be it astronomical or microscopic. Lastly, static images are not nearly as portable to other forms of storage, distribution, formatting, or transfer technologies. Since SVG is embedded within XML, it can be easily ported to other web based technologies.

Referencing previously funded FY02 HPCC proposal (NGI/CE/01 - NOAA National Network Baseline), the attempt was made to baseline and graphically document the entire national NOAA network. A complex CAD program, supporting high detailed drawings, was used to document the network. The drawing was then exported to a vector based, light-weight distribution format (requiring a proprietary plug-in) that made it possible for national participants to view the drawing through a web browser, but did not provide a framework for offering regional administrators the ability to update the document to reflect their campus networks. Instead, changes and revisions had to come down through a series of administrative ladders that would eventually wind up at the desk of someone required to manually enter the changes.

Proposed Solution:

This proposal would provide a design template for the creation of dynamic vector-based graphical documents using SVG through prototyping the NOAA 2003 baseline. The web exchange of vector graphics using SVG allows for the dynamic updating of images, largely scalable formatting, integration with existing distribution systems, and wide area collaboration, all without using any proprietary or complex rendering systems.

Once a SVG framework is established, graphical documents can utilize many existing web technologies. For example, a SVG document could be used with a servlet technology (like JSP, ASP etc), a light-weight RPC protocol like SOAP etc, and/or send SQL queries to a database that returns information and rebuilds the image. Step one in this project would be to heavily research a modular framework for implementing SVG/XML. Once a framework is established, a prototype module can be built that would transform the Baseline 2003 drawing into SVG for wide area distribution and manipulation.

By taking early steps toward enabling web based vector graphics, NOAA as a corporation can immediately benefit from the work in three major ways. First off, vector graphics have potentially huge implications in GIS and two-dimensional mapping. Should a successful SVG framework emerge from this proposal, it would be portable into other service areas of the organization. Second, dynamically generated graphical web documents would encourage wide area collaboration of projects. Lastly, since SVG can co-exist with many text based transfer, and manipulation technologies, the SVG framework can reside on currently deployed distribution systems and databases, which means no major changes in systems infrastructure are required. As an organization wanting to stay on the forefront of internet computing, this proposal would promote NOAA as a leader in web-based, vector graphics exchange.

If successful, the SVG/XML framework could be ported to other areas of the organization along with a standardized method for designing a site specific module. In addition, the SVG framework could be integrated into a web services API that would enable graphics support for future implemented XML based web services. In short, the information gained from this project could help other NOAA sites bring SVG into their

existing visualization environment, or be integrated into existing web services to enable visualization.

Analysis:

This proposal is an exercise in the design, implementation, and re-distribution of an emerging web-based vector graphic technology incorporating SVG and XML. This solution would streamline distribution of dynamically generated, web-based graphics without the need for proprietary or complex server side rendering systems. It helps the organization in part by promoting NOAA as a leader in internet computing, by providing a SVG framework that can be ported internally to other organizations, and also by offering a visualization solution for existing or future implemented web services. In addition, the Baseline 2003 SVG module will transform a hard coded document, making it more accessible for both wide area collaboration and group study.

Performance Measures:

The success of this project relies heavily on establishing a solid foundation via thorough research and prototyping. The proposed project plan includes roughly a half-year of research and analysis before coding begins. Coding will follow a strict agenda based on findings during the analysis phase of the project.

Milestones:

Month 1	Planning and Organization
Month 2	Research XML framework
Month 3	Research SVG capabilities
Month 4	Finish Analysis
Month 5	Finish Design
Month 8	Design/Coding – Basic Framework
Month 9	Design/Coding – Baseline 2003 Module
Month 10	Testing/Debugging/Finalize coding
Month 12	Finalize Report

Deliverables:

Month 4	Analysis Document
Month 5	Design Document
Month 8	Basic Framework
Month 9	Baseline 2003 Module
Month 12	Package System for Distribution