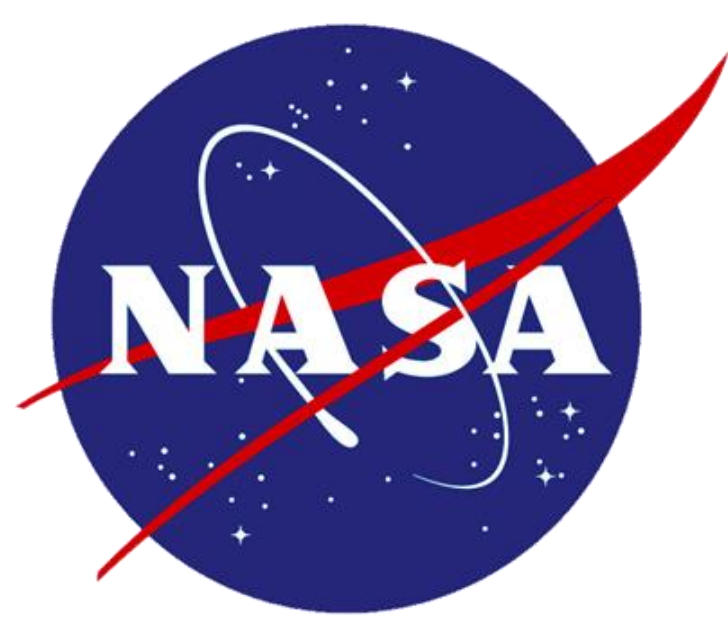




Common Web Mapping and Mobile Device Framework for Display of NASA Real-time Data

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Motivation

SPoRT and other NASA scientists produce data that can be used by others, such as the National Weather Service (NWS) and Federal Emergency Management Agency (FEMA). Two groups at MSFC are engaged in supporting disaster response:



The NASA Short-term Prediction Research and Transition (SPoRT) Center provides near real-time data for weather analysis and disaster response activities.



NASA's SERVIR Program, which integrates satellite observations, ground-based data, and forecast models to improve disaster response in Central America, the Caribbean, Africa, and the Himalayas.

In disaster response, SPoRT, SERVIR, and other NASA scientists need to be able to:

- Deliver data to collaborators in their Decision Support System (DSS) using:
 - web
 - mobile phones
 - native GIS applications
- Focus on science, not the delivery mechanism

Benefits of a Mobile Device Framework

- Supports web, mobile and GIS within one system
- Enables easy ingest of new datasets
- Enables science for decision making
 - Superstorm Sandy of 2012
 - Moore, Oklahoma Tornado of 2013.
- Control application maintenance costs by using a common web framework
- Open source reduces building and licensing costs.
- Provides data in open standards for easy integration.
 - Web Mapping Service (WMS)
- Supports static and animated imagery
- Supports location based services
- iOS and Android supported for mobile at a minimum.

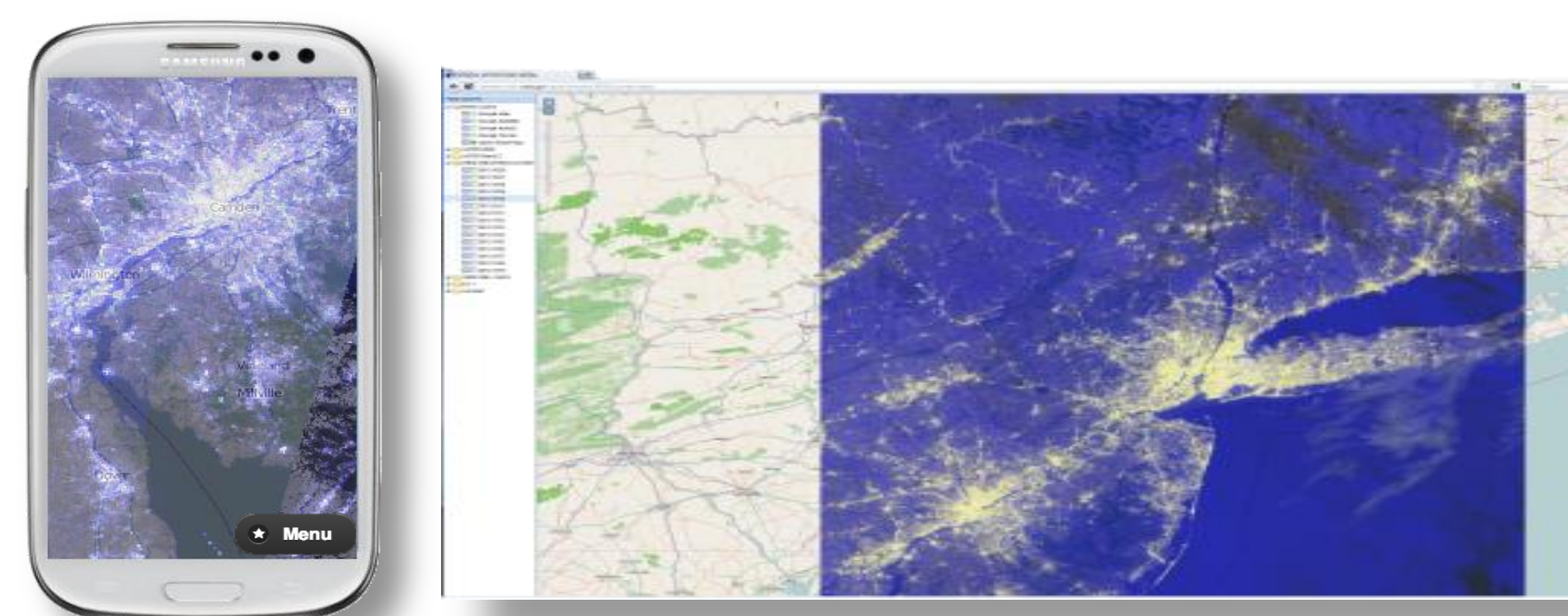


Figure 1. Sample mobile phone (left) and web browser (right) based application based on the framework. Data displayed is Day/Night Band difference from the Superstorm Sandy before and after the storm.

Server Architecture

- The main focus of the **ingest server** is to provide a system easy to configure and ingest data, and to provide output in open standards (Fig. 2).
 - We use WMS, widely used across the internet to server spatial data.
- The ingest system is configured using Extensible Markup Language (XML) files.
 - XMLs control control the flow of data within the server system.
 - Once configured, XMLs allow the data to be ingested, properly registered, and discoverable.

Client Architecture

Mobile applications supporting Android, iOS, and other platforms represent significant effort and cost. The client architecture was developed by wrapping a JavaScript client inside a simple shell application using a webview in each supported client. This method has several benefits:

- use of standard web development tools
- faster development cycle
- easier to maintain and develop
- styling using web standards such as Cascading Style Sheets (CSS)

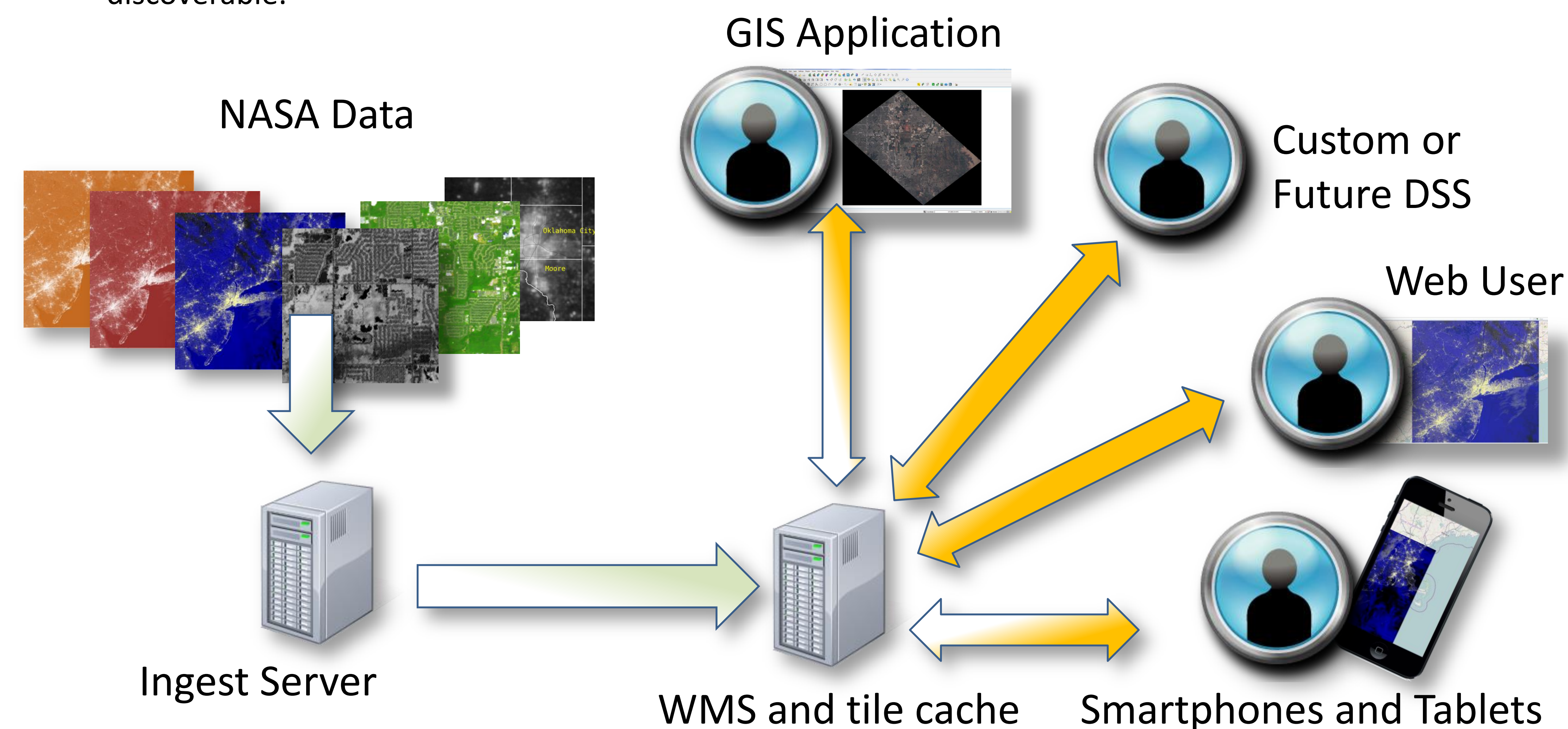


Figure 2. Overview of the common web mapping and mobile device framework for display of NASA real-time data, including ingest server, distribution to WMS for dissemination and tiling, and end-user applications.

Server Technology and Development

- Geoserver (WMS)
- GeoWebCache (WMS Cache)
- Camel (Enterprise Service Bus)
- Spring (Development Framework)
- Java Topology Suite
- PostgreSQL / PostGIS Database
- Additional development included a Restful API, which allows clients to query a list of times and layers specific to a given function.
- Allows categorization of imagery for a specific client and user, limiting data display to allow for a more focused distribution suiting end-user needs.
- Allow advertisement within framework to aid in discovery of data.
- Other WMS can be referenced within the system to allow inclusion into existing client.

Client Technology and Development

- jQuery and jQuery Mobile
- OpenLayers (Mapping)
- Easy development is completed within a normal web-based environment.
- The system supports time dimension of data delivery to support animations or display of single images.

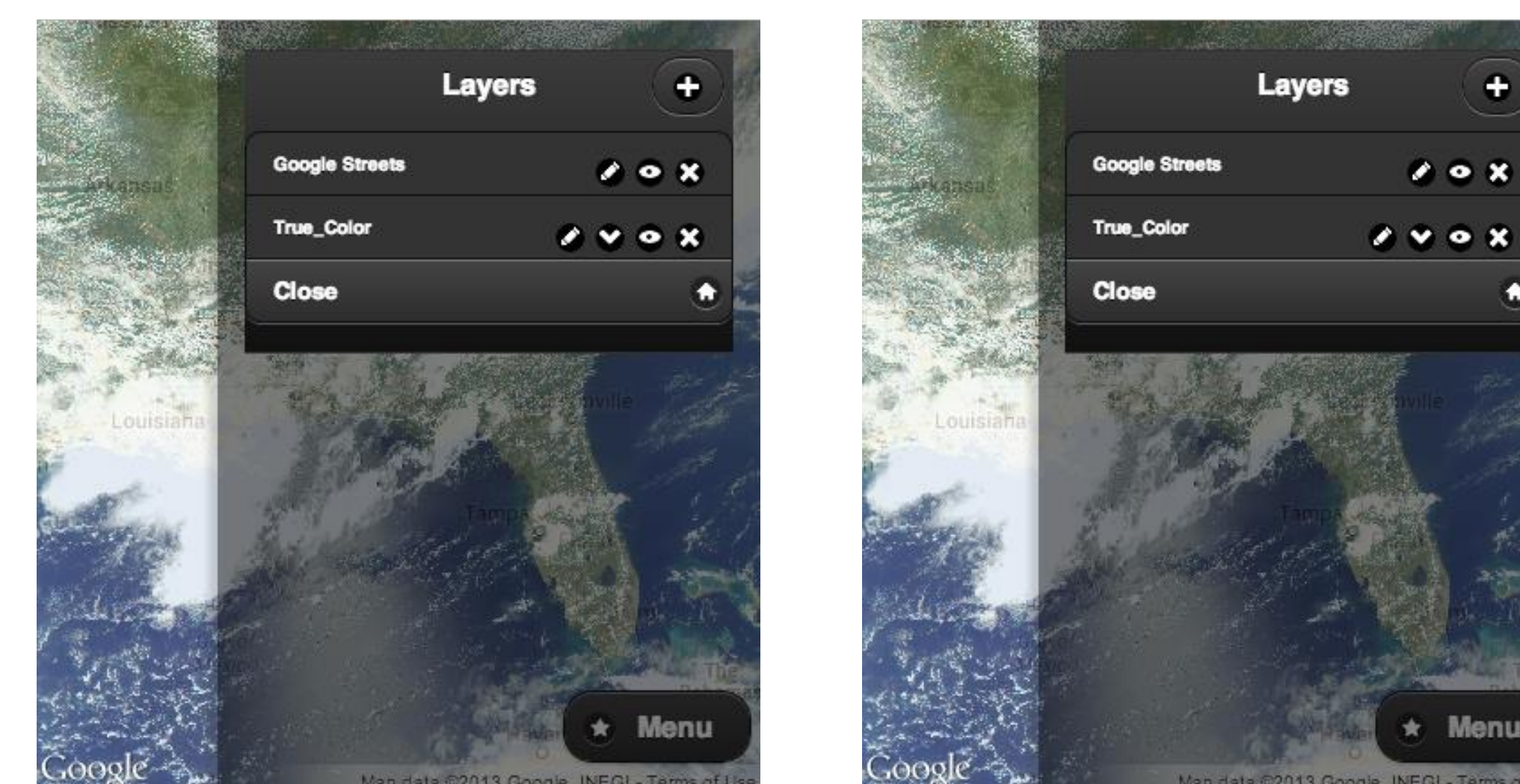


Figure 3. Sample web browser and smartphone interface.

Case Study of Web Mapping Service Applications

- Typhoon Haiyan (Yolanda) impacted the Philippines in November 2013.
- As a proof of concept, the SPoRT Disaster Team was able to easily deliver imagery to web and mobile clients with use of the system described here.
- The system dramatically reduced the level of effort and time it takes to provide NASA data in response to the disaster event.

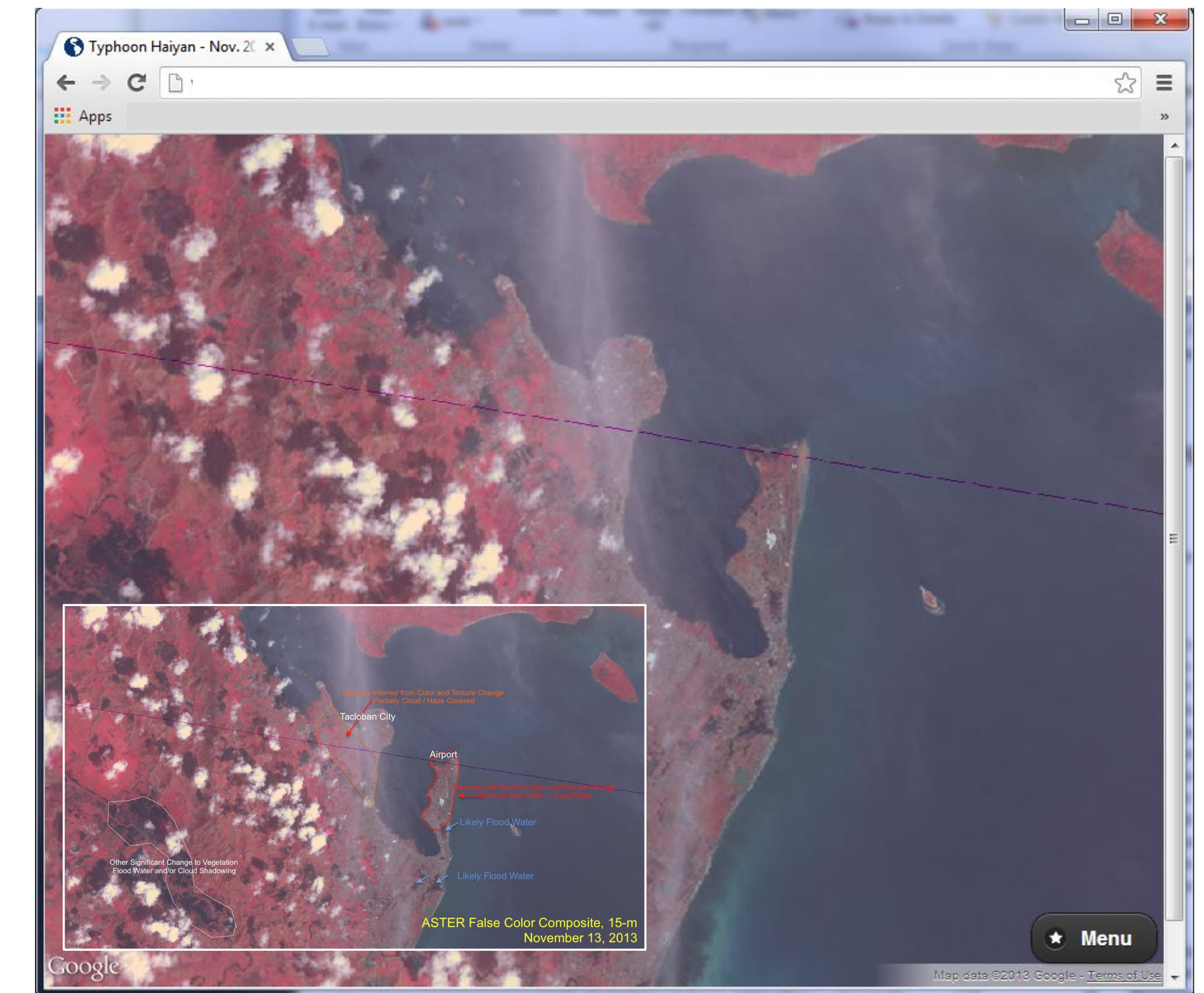


Figure 4. An example of post-event imagery displayed in a common web mapping framework. Here, an ASTER false color Image from 11/13/2013 at 0322Z, after Typhoon Haiyan with damage analysis (inset).

Continued Use of Web Mapping Service Application

Continued uses include the SPoRT Disasters Team analysis of events such as the Illinois/ Indiana Tornado Outbreak November 2013, the delivery of the SPoRT real-time imagery display, and integration of WMS-hosted imagery within the NOAA/National Weather Service Damage Assessment Toolkit.

Conclusions and Future Work

- The architecture demonstrated here provides a seamless, extendible way to deliver imagery to end-users on various platforms.
- System costs are contained by using open source projects a common JavaScript code base for mobile and web applications. Innovative client development can be performed using common web page development.
- Development of an Amazon-based cloud framework to address scaling of the architecture to handle large volumes of data and large numbers of end-users, including international users of the NASA SERVIR program.

Acknowledgements

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