SAND2014-16190D

Exceptional service in the national interest

Sandia National Laboratories

SUMMIT STANDARD UNIFIED MODELING, MAPPING, & INTEGRATION TOOLKIT

Integrating SUMMIT with GeoServer

Charles Ding
University of California – Berkeley
B.S. Electrical Engineering and Computer Science, est. May 2017

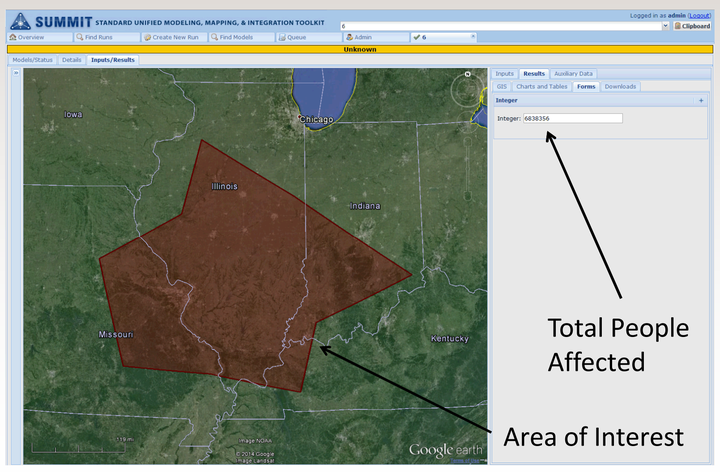
Mentor: Zach Heath
Department: System Analytics
Organization: 8958
Presentation Date: July 30, 2014

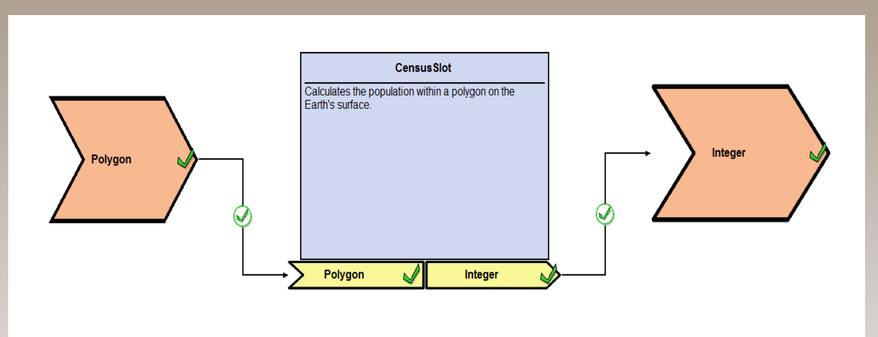
Objective:
The purpose of this project is to incorporate GeoServer as a new tool within the SUMMIT architecture. This project is broken down into many smaller tasks that test how well GeoServer and SUMMIT work with one another. However, the main goal is to allow the SUMMIT server to connect to, make requests, and upload, remove, and edit data on GeoServer. As a result, SUMMIT will benefit from having a place to store geospatial data and the vast data processing abilities and other capabilities offered by GeoServer.

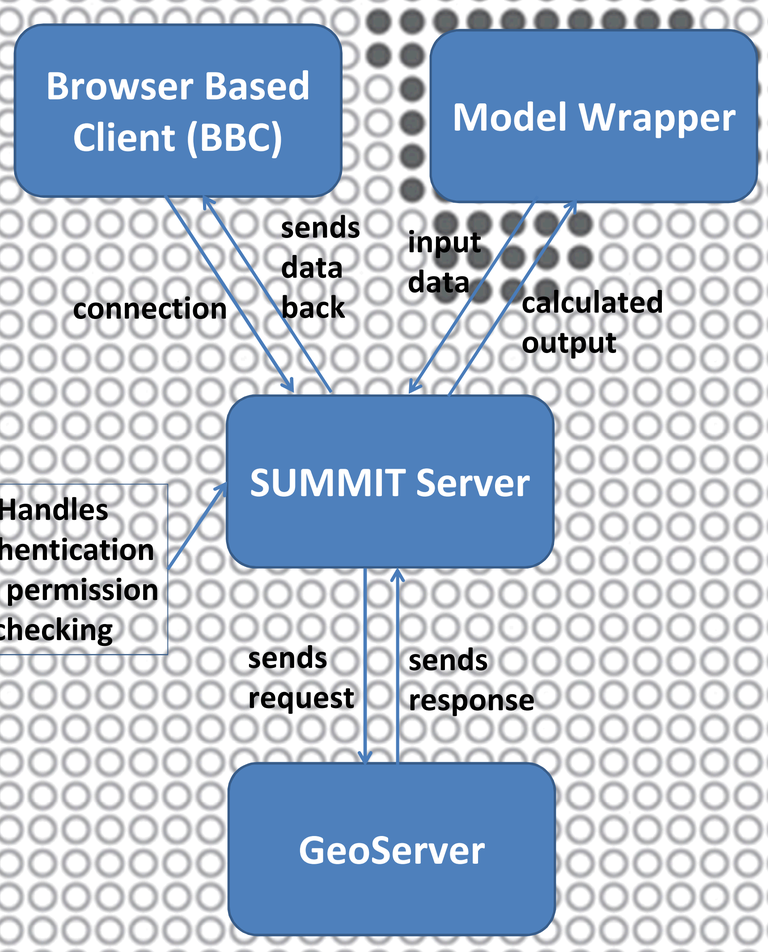
Introduction to SUMMIT and GeoServer:
The Standard Unified Modeling, Mapping, and Integration Toolkit (SUMMIT) is the central technical component of the Integrated Mapping, Modeling and Simulation (IMMS) program, a research and development effort spearheaded by the Department of Homeland Security Science and Technology Directorate (DHS/S&T). This modeling and simulation software environment enables users to access modeling tools and data sources for emergency planning and response. The SUMMIT architecture includes a server that houses most of its functionality and a browser based client (BBC), a webpage that allows users to run models.

GeoServer is an open source server written in Java for sharing and editing geospatial data. It allows users to upload data files known as "layers" thorough various means (usually another database or file on one's computer). A group of layers is known as a workspace. Data files can be read and edited through requests made by three services: Web Coverage Service (WCS) which supports requests for raster (coverage) data, Web Feature Service (WFS) which supports requests of geographical feature (vector) data, and Web Map Service (WMS) which allows requests of images generated from geographical data.

Method:
1. Set up GeoServer and upload key data files.
2. Create model wrappers, or Java programs within SUMMIT, that take in a polygon and calculate the total population inside that polygon according to:
   a. 2010 Census Tract Data from the US Census Bureau
   b. 2012 LandScan Data from Oak Ridge National Laboratory
3. Implement layer security on GeoServer.
4. Programmatically add, delete, and edit layers on to GeoServer.
5. Allow the SUMMIT Server to connect to and send requests to GeoServer.







Results:
- Set up an instance of GeoServer and uploaded county, state, national, world, etc. data files with demographics and other geographical data.
- Successfully implemented both the Census Tract and Land Scan Model Wrappers. Other SUMMIT model wrappers can call these model wrappers to retrieve population data. For example, if an earthquake or disease outbreak model calculated an affected region in the United States, then either population model wrapper will be able to estimate the population at risk.
- Tested and documented the GeoServer security system, which allows an administrative user to assign read, write, and admin permissions for any layer or workspace.
- Implemented proof-of-concept code (Java classes) that enables model wrappers to add and delete layers and workspaces as well as edit layers through WFS requests.
- Implemented a Java servlet that allows the SUMMIT server to act as a proxy to GeoServer. This allows the SUMMIT server to provide authentication and access control checks (in progress).

Future Steps:
- Use OpenLayers, a web development tool, to add another map view to the BBC based on data retrieved from GeoServer.
- Develop software that can make WMS and WCS requests on raster data.
- Explore other functionalities of GeoServer, such as Google Earth support and styling of geospatial data.

U.S. DEPARTMENT OF ENERGY | National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.
SAND No. 2011-XXXXP

SUMMIT Developed through the IMMS Program | GeoServer | Homeland Security