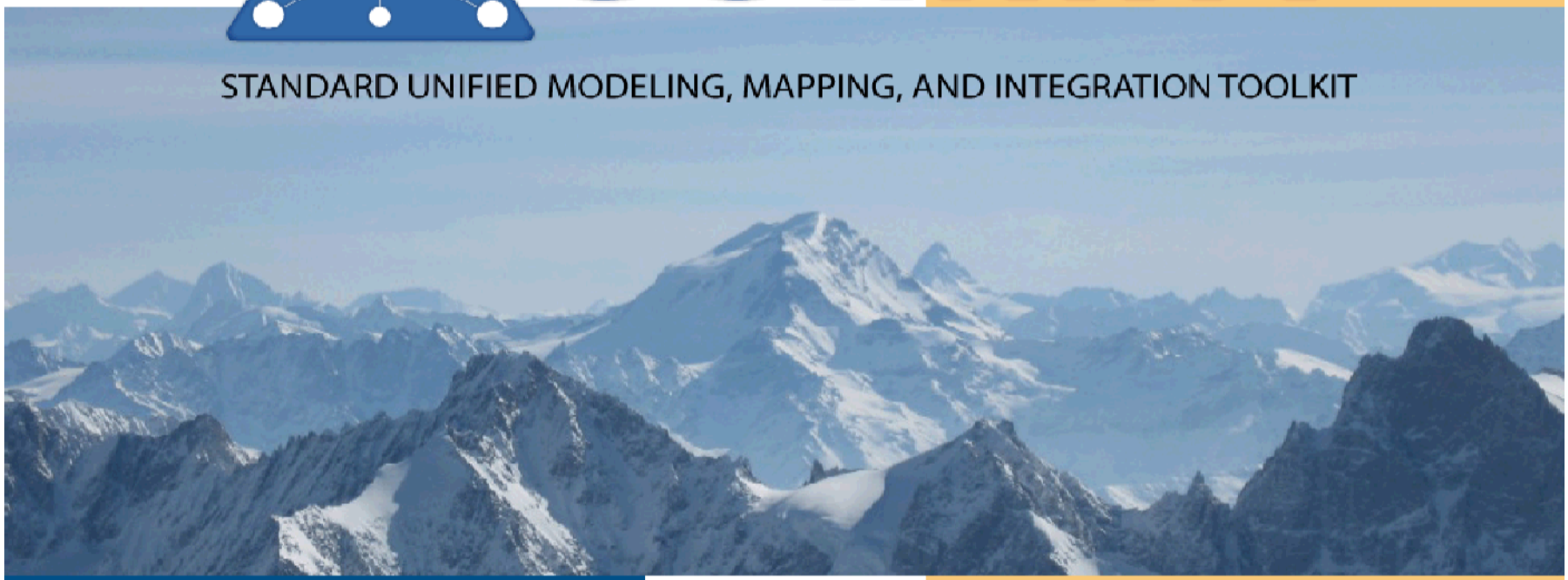
SUMMIT

SAND2013-8021C

STANDARD UNIFIED MODELING, MAPPING, AND INTEGRATION TOOLKIT



Homeland Security

Science and Technology

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10/29/2013

Developed By

Sandia National Laboratories

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SUMMIT

Standard Unified Modeling, Mapping, & Integration Toolkit

- **Sponsored By**:
  Jalal Mapar of the DHS
  Science & Technology Directorate

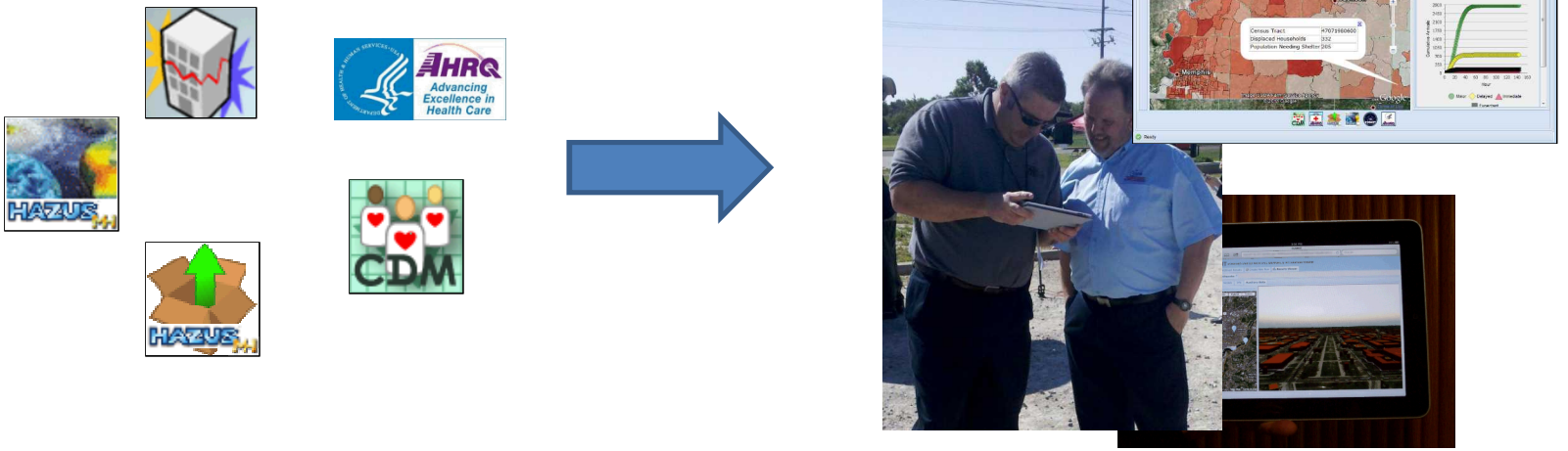
Homeland Security
Science and Technology

- **Transitioning To:**
  FEMA/National
  Exercise Division

FEMA

SUMMIT's Purpose

- Allow emergency preparedness community to **discover**, **configure**, **execute**, and **view** the results of the nation's modeling and simulation capabilities



- Provide model developers a **platform** and set of **standards** to make their capabilities **available** to emergency preparedness community for **reuse**

What Kind of Models and Users?

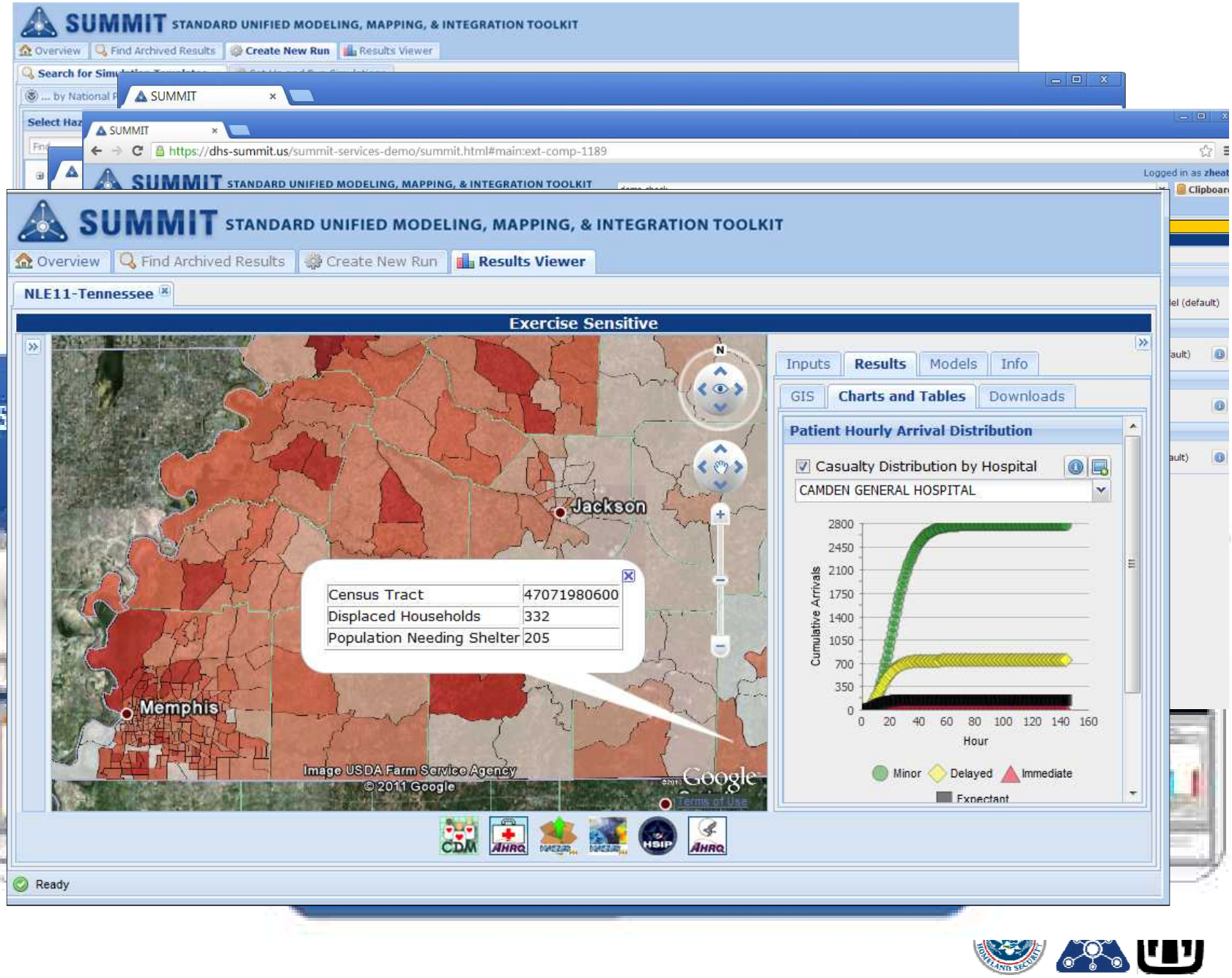
Models

- Earthquake, Chemical Plume, Medical Resource Needs, Evacuation, etc…

Users

- Running Models: Exercise Planners, Inject Controllers
- Downstream Results: Inject Controllers, Player, Actor, Virtual News Network, etc…

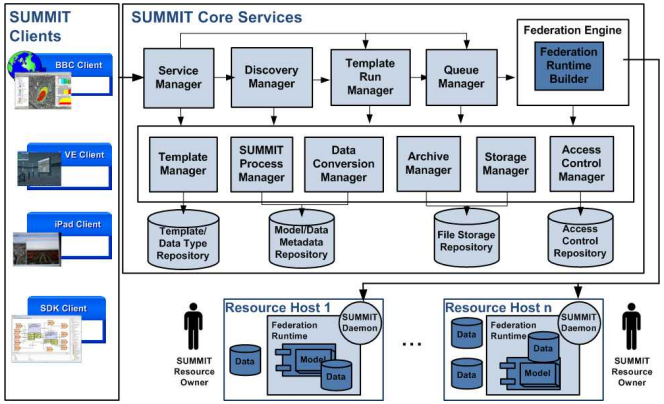


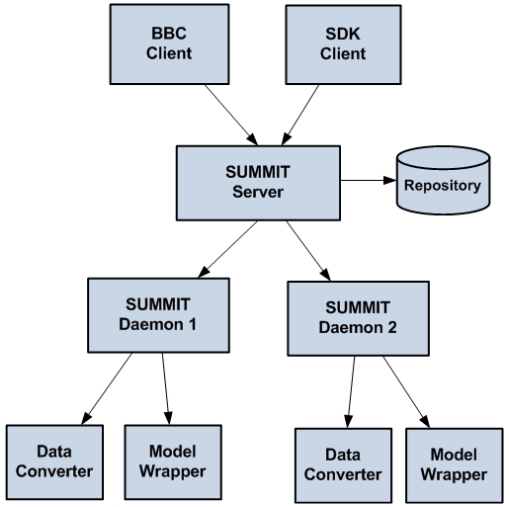


SUMMIT
STANDARD UNIFIED MODELING, MAPPING, & INTEGRATION TOOLKIT
Overview
Find Archived Results
Create New Run
Results Viewer
NLE11-Tennessee
Exercise Sensitive
Jackson
Memphis
Census Tract 47071980600
Displaced Households 332
Population Needing Shelter 205
Image USDA Farm Service Agency
© 2011 Google
Inputs
Results
Models
Info
GIS
Charts and Tables
Downloads
Patient Hourly Arrival Distribution
Casualty Distribution by Hospital
CAMDEN GENERAL HOSPITAL
Cumulative Arrivals
Hour
Minor
Delayed
Immediate
Expectant
Ready

How we do it

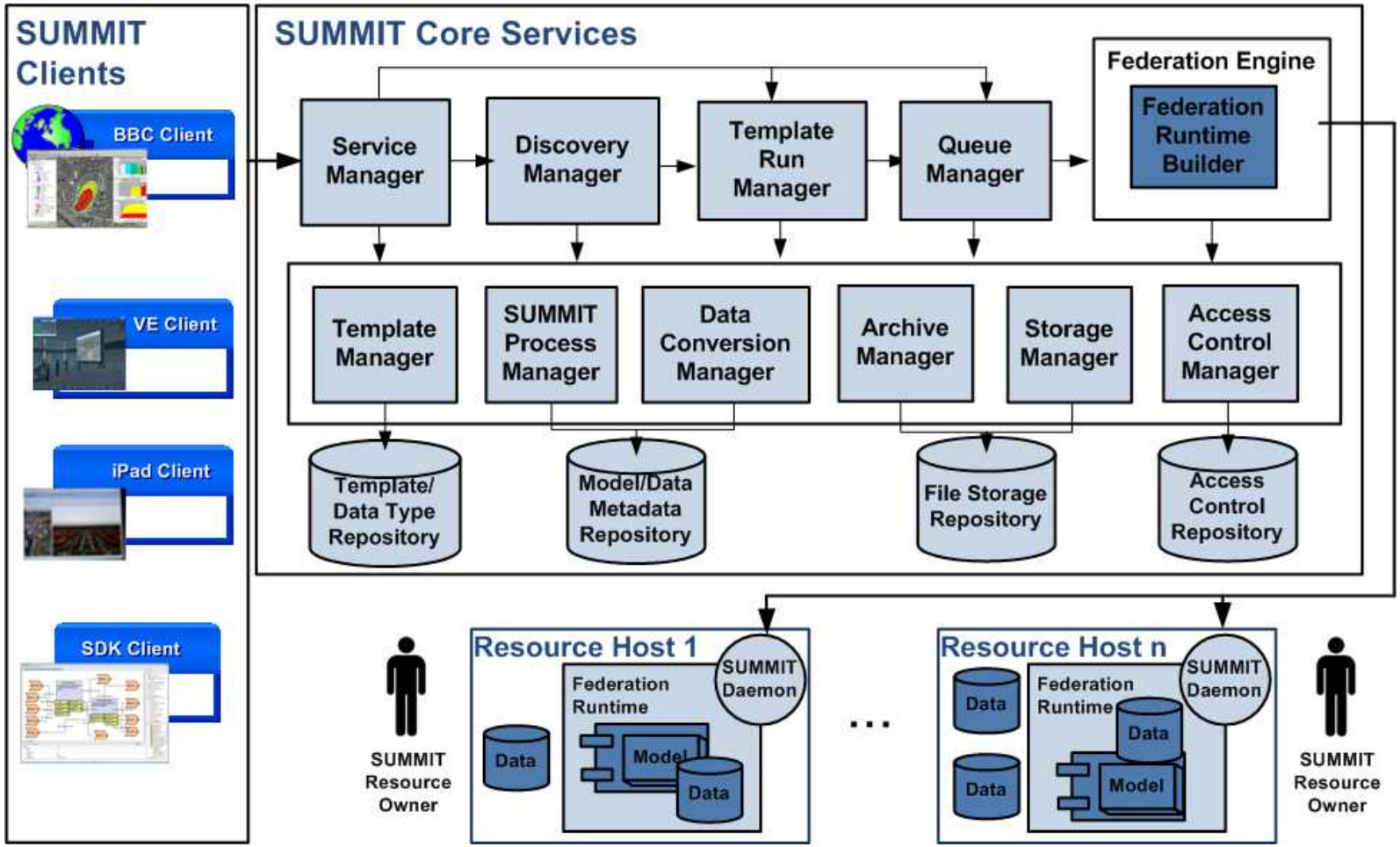
Set of Web Services, standards, and user clients that answer common M&S functionality needs

- Data Type Library
- Template/Model Catalog
- Discovery
- Data Representation/Configuration
- Federation Runtime Builder
- Results Archive
- User Permissions
- SUMMIT Software Development Kit





SUMMIT Architecture



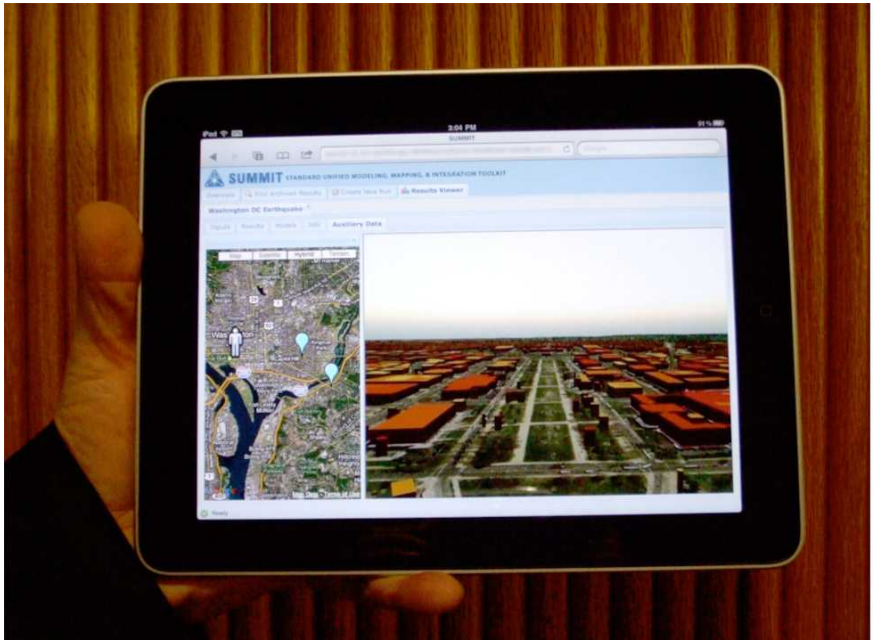
Key Benefits: Access and Reuse

- Find and connect models in new ways
- View how others have used modeling and simulation capabilities
- Quickly reuse model configurations for new locations
- Data is freed from the model implementation
- Data Visualization techniques can be reused across a variety of models and clients
- Flexible Web Services allow external clients to use M&S in new, unanticipated ways

Key Benefits: Access and Reuse

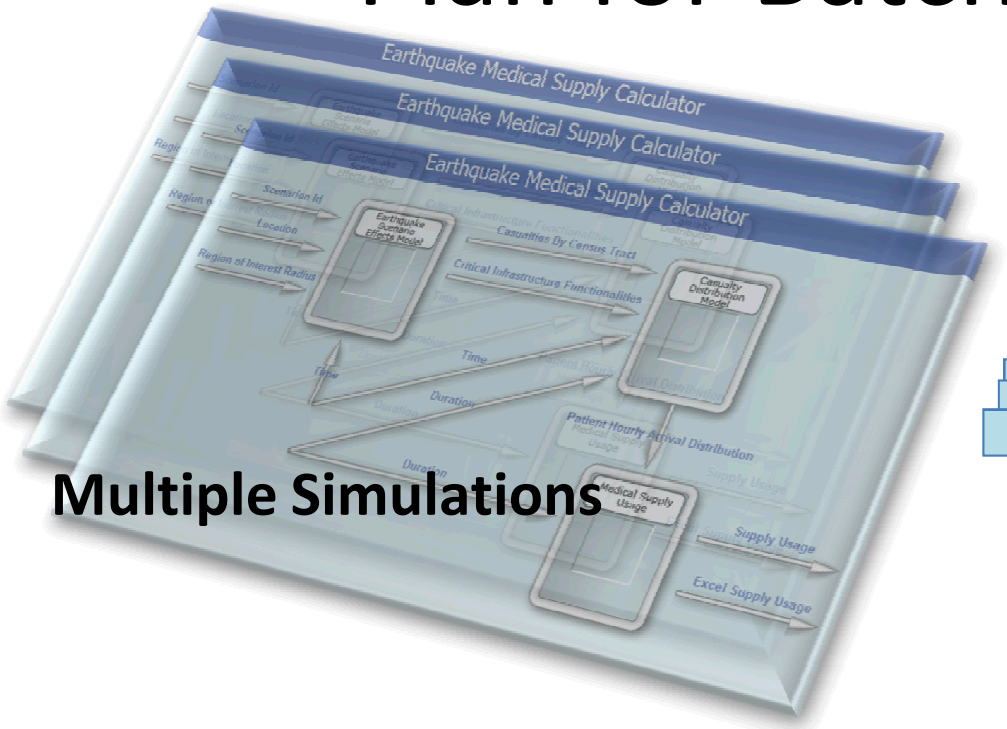
- **Flexible Web Services and freeing the data from the model implementation allow external clients to use M&S in new, unanticipated ways**

Building damage editor for scenario data generation

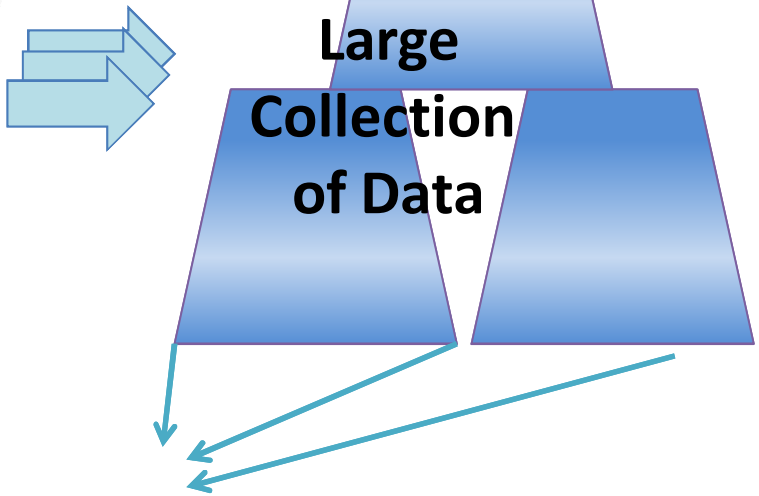


Mobile client for 3d building damage view

Plan for Batch Execution



Multiple Simulations



Summarizing Analysis

Batch: Multiple Simulation Generation

- User creates Data Sets containing the values they want to vary the inputs of the template over
- User can provide custom operators or make use of existing operators to produce a Data Set
- User creates parameter groups to organize how the inputs for each Data Set are selected to produce a single template run

Batch: Multiple Simulation Generation

- All generated Template Runs for a Batch Run are grouped together as a Template Run Group
- Template Runs are submitted to Queue Manager. Runs are independent making them ideal for parallel computing
- SUMMIT API is open to allow external tools to generate Template Run Groups using their own techniques

Batch: Data Analysis

- The results for a Template Run Group can be stored on or pushed to a Hadoop Cluster
- Users provide custom analysis operators using Hadoop API to generate results for the user

Batch Needs

- How do we make it easier for users to define custom analysis operators?
- Are there alternative frameworks to Hadoop we should be looking at?
- How do we visualize all this data?
  - Common statistics and views to provide users
  - Mechanisms to allow users to produce their own visualizations

SUMMIT Summary

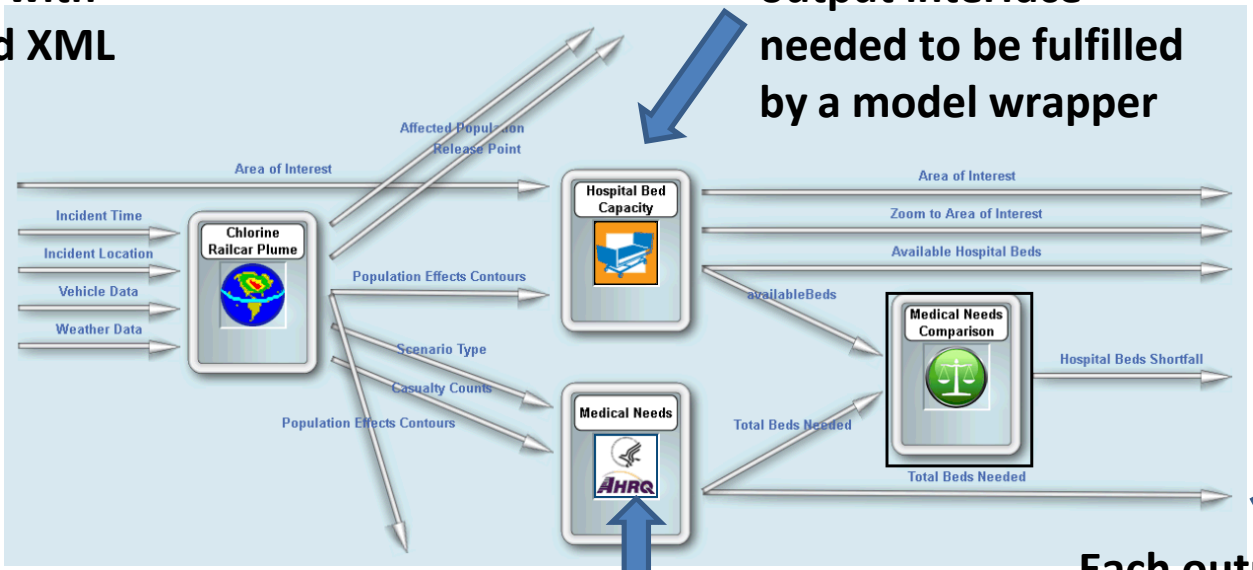
- SUMMIT is a flexible Toolkit for making modeling and simulation accessible to users
- Batch capability will add a lot of power to users
- Users will need help making sense of all of this data
- Please contact me if you have models or analysis tools that could improve SUMMIT
  - zheath@sandia.gov

Backup Slides for Questions

Template encodes workflow of model execution and input and output interface to produce scenario data in a repeatable and reusable manner

Each input has a data type with associated XML Schema

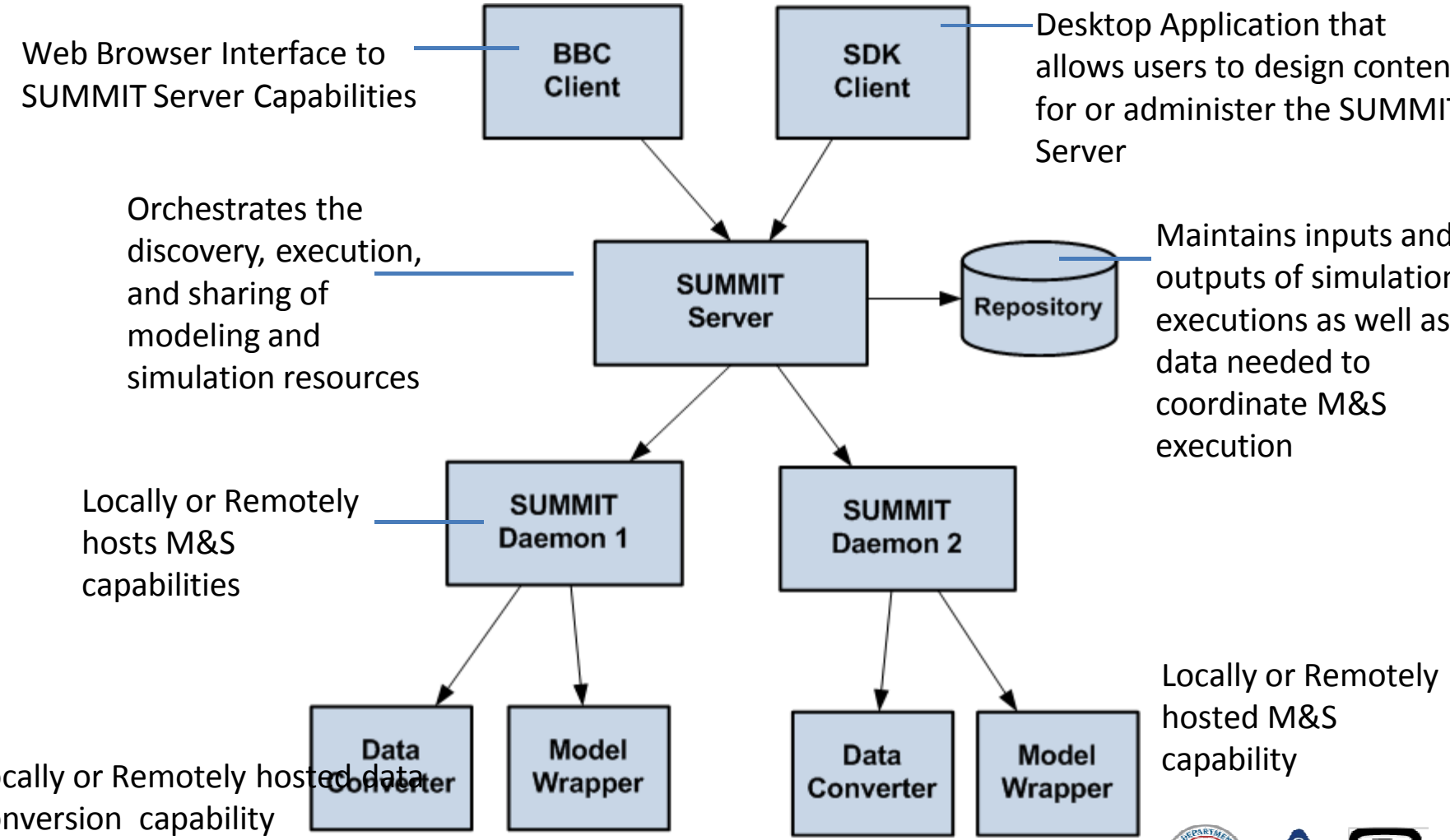
Slot defines input and output interface needed to be fulfilled by a model wrapper



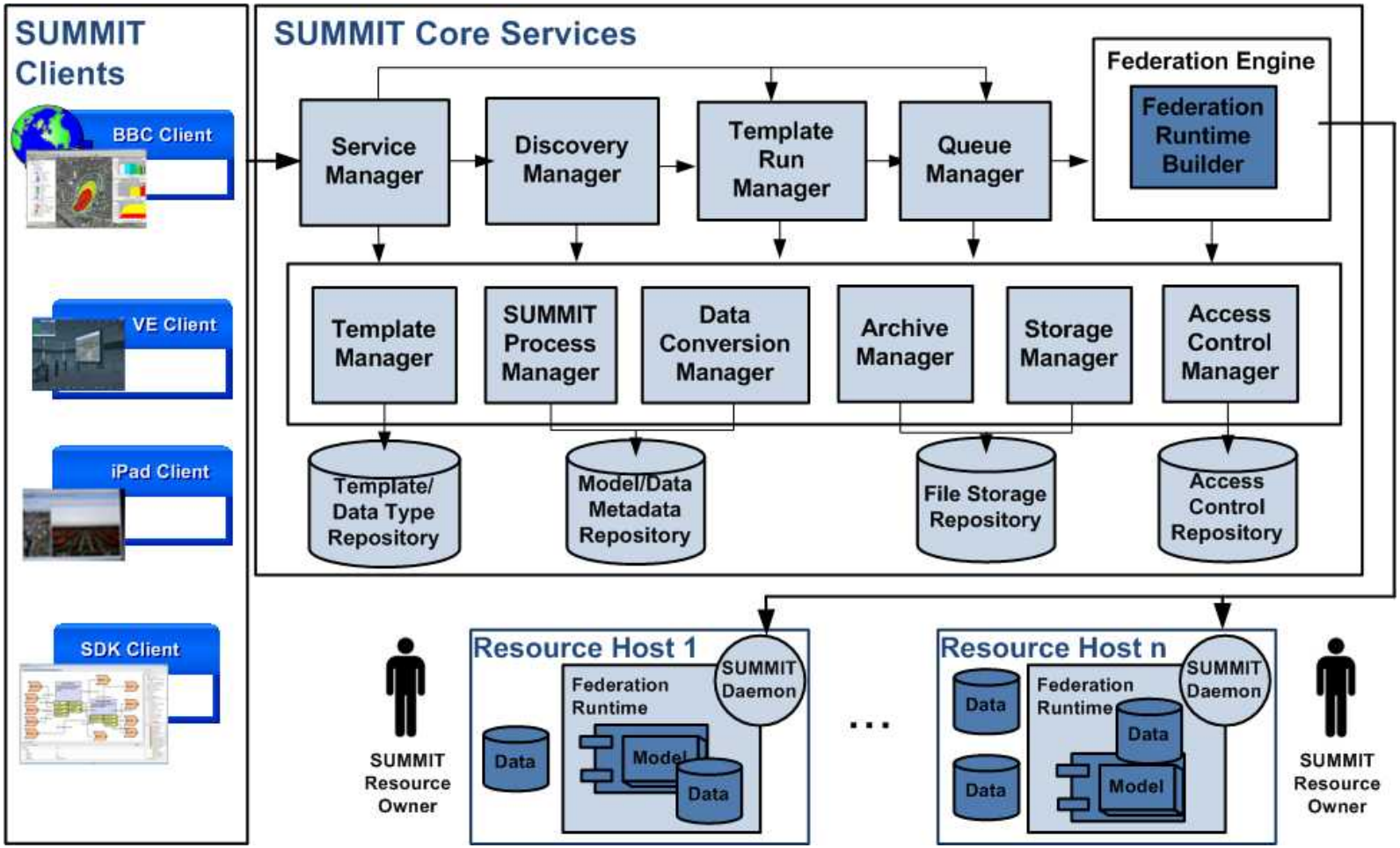
SUMMIT calls upon model wrapper to produce its piece of simulation data

Each output has a data type with associated with XML Schema

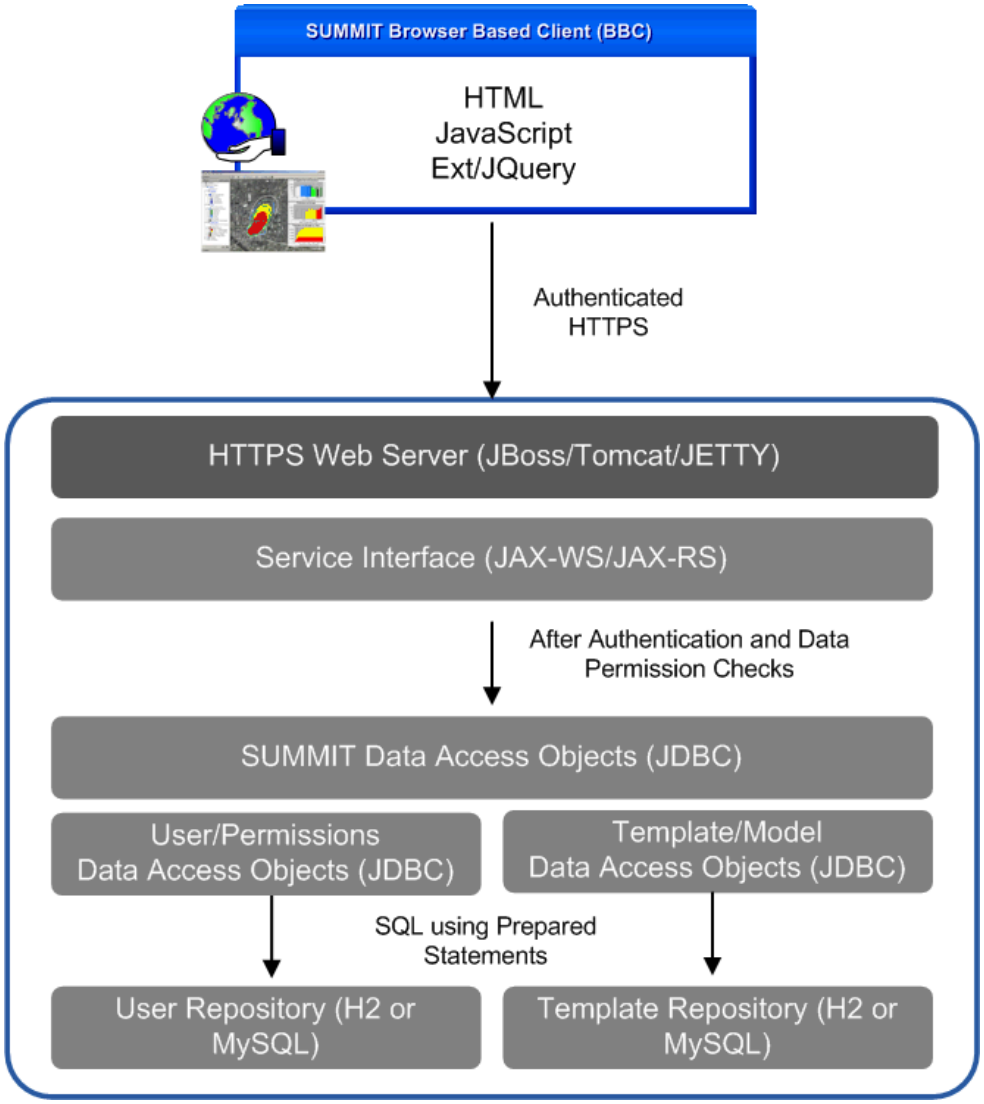
SUMMIT Component Diagram



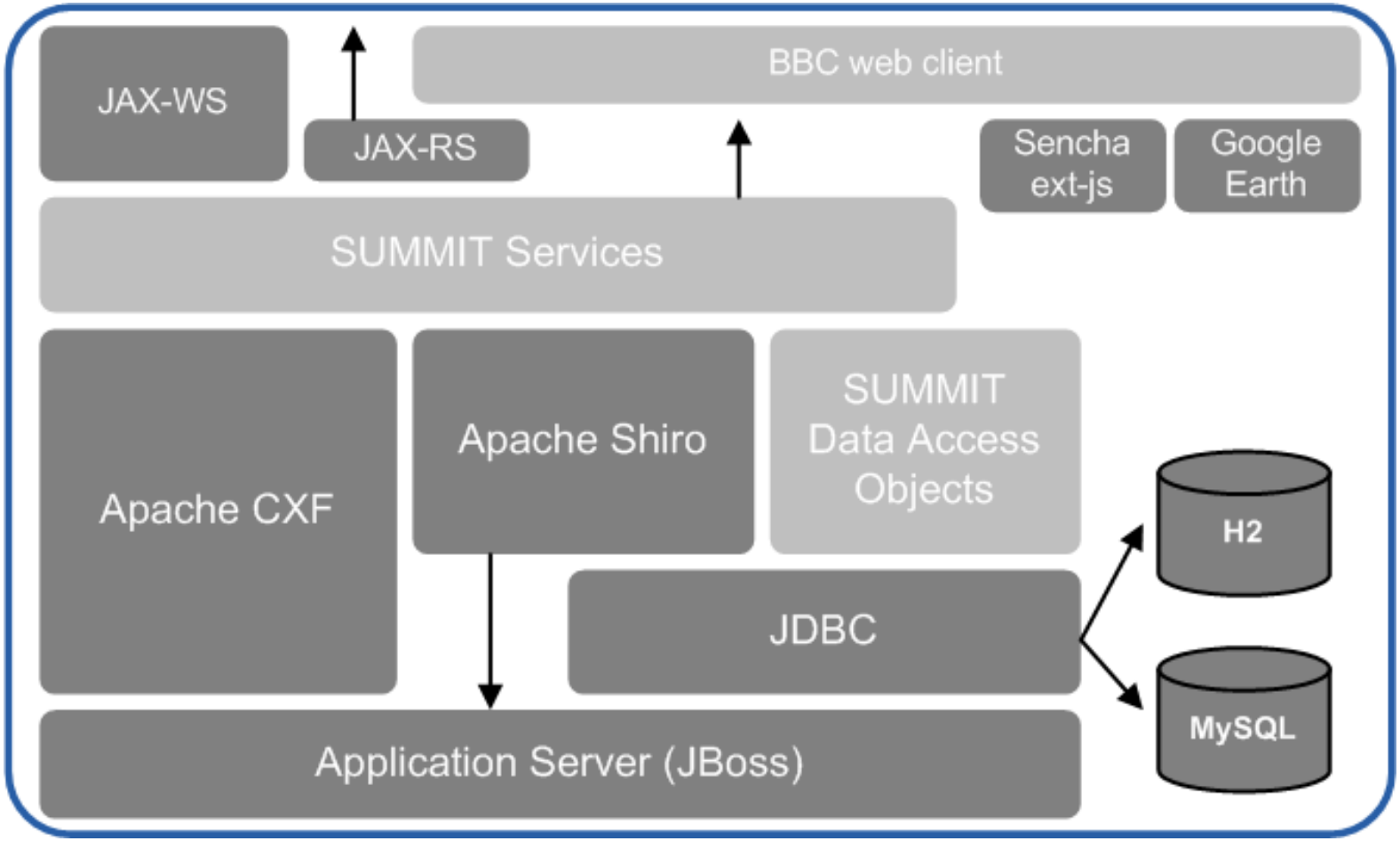
SUMMIT Architecture



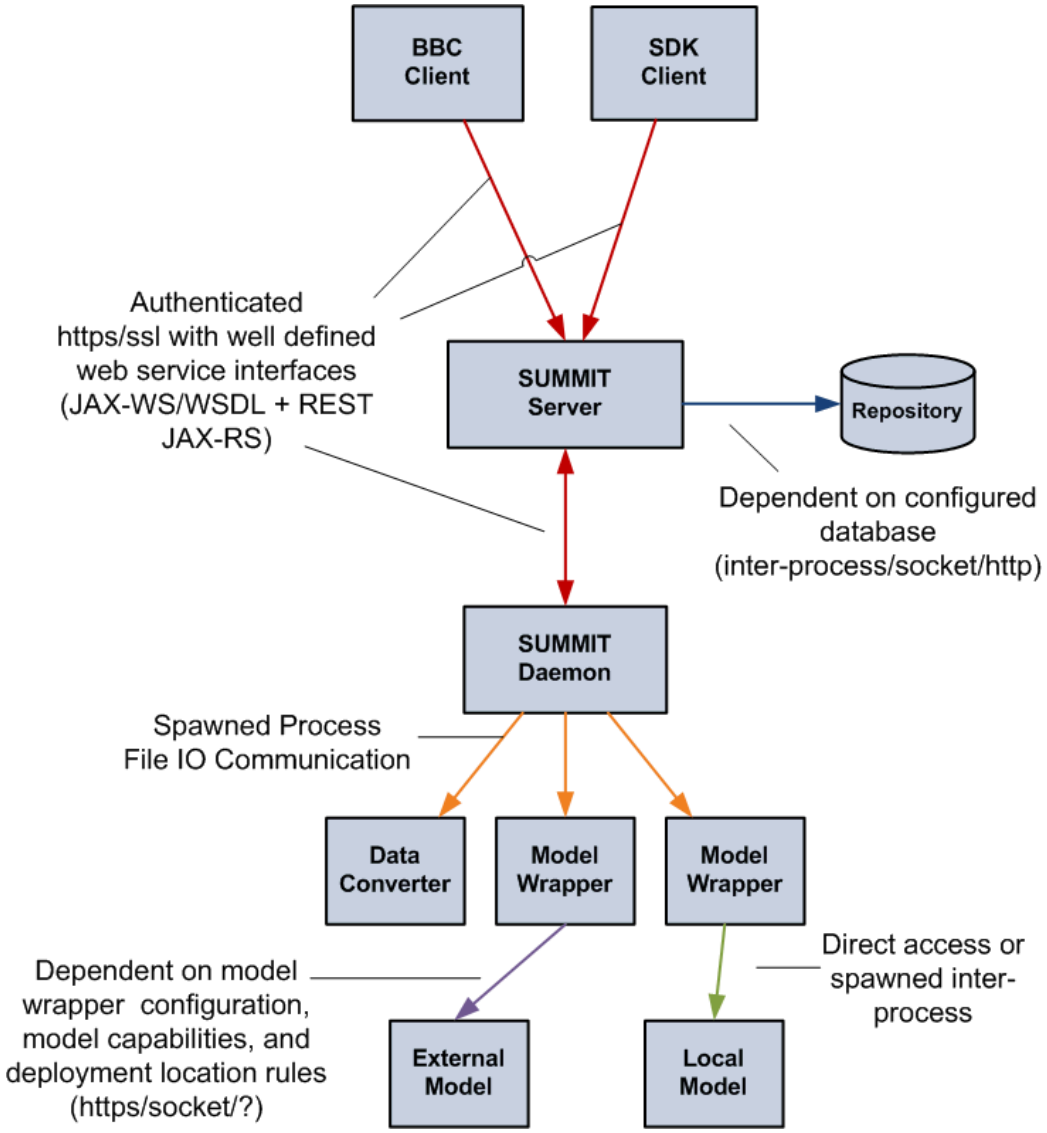
Service Layers



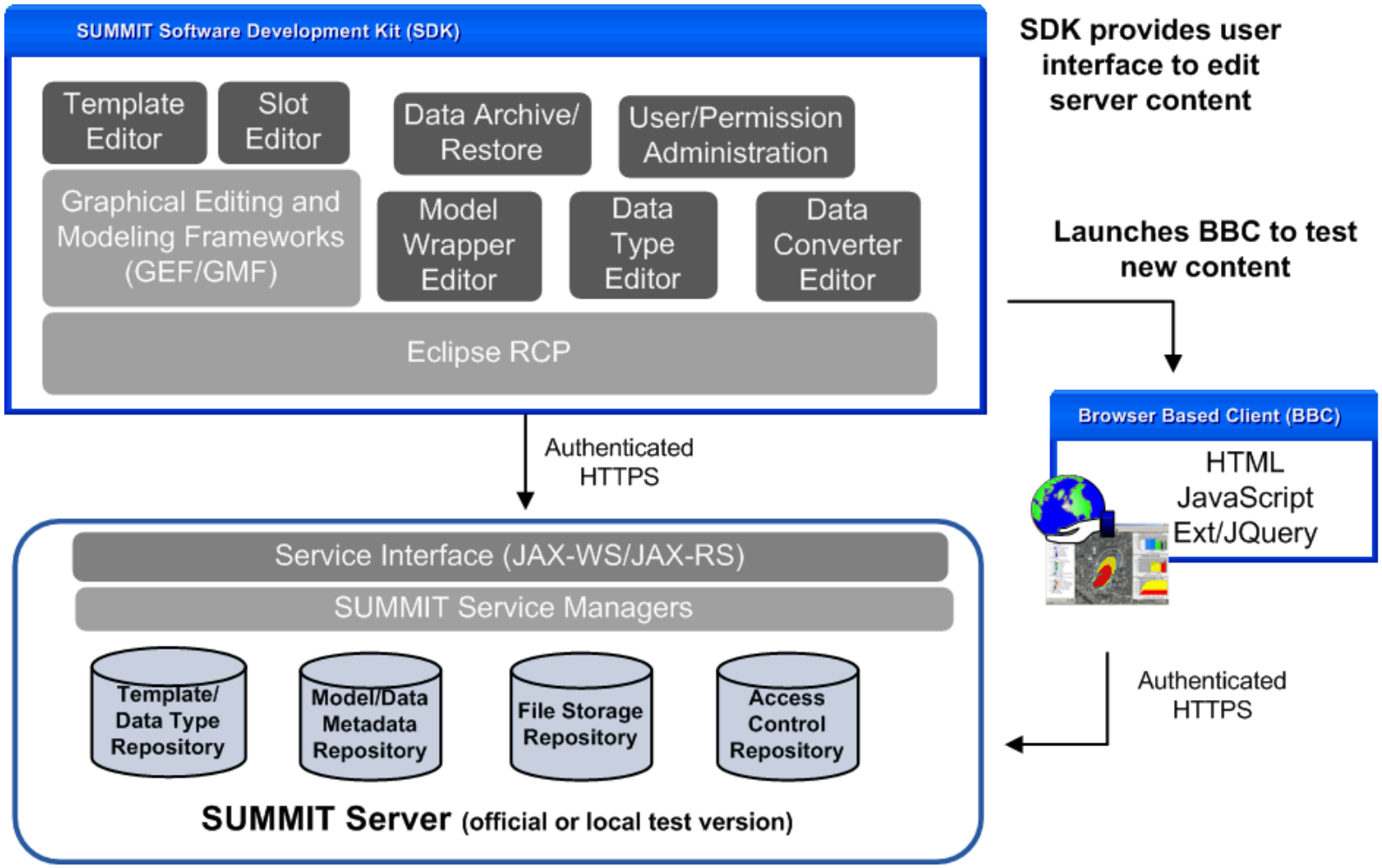
Technology Layers



Communication



SDK Layers


SUMMIT Software Development Kit (SDK)
Template Editor
Slot Editor
Data Archive/ Restore
User/Permission Administration
Graphical Editing and Modeling Frameworks (GEF/GMF)
Model Wrapper Editor
Data Type Editor
Data Converter Editor
Eclipse RCP
SDK provides user interface to edit server content
Launches BBC to test new content
Browser Based Client (BBC)
HTML
JavaScript
Ext/JQuery
Authenticated HTTPS
Service Interface (JAX-WS/JAX-RS)
SUMMIT Service Managers
Template/ Data Type Repository
Model/Data Metadata Repository
File Storage Repository
Access Control Repository
Authenticated HTTPS
SUMMIT Server (official or local test version)

Model Wrapping Process

1. **Determine if Model is a good fit for SUMMIT**
2. **Determine how Model will be accessed**
3. **Get a copy of the SDK**
4. **Find or Define new slots, and input and output data types**
5. **Create Model Wrapper**
6. **Create additional Data Representations for inputs and outputs**
7. **Testing**
8. **Submit Model Wrapper Archive**
9. **Maintenance**