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Integrated Modeling, Mapping, and Simulation Program

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IMMS Vision

A capability for linking together “best-in-class” modeling and simulation tools to enable analysts, emergency planners, and incident managers more effectively, economically, and rapidly prepare, analyze, train, and respond to real or potential incidents.

Capstone IPT Representative High Priority Technology Areas

March 2007

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Incident Management: Representative Technology Needs

- Integrated Modeling, Mapping and Simulation capability *(IP/Geophysical Division)*
- Personnel Monitoring (Emergency Responder Locator System) capability *(IP/Geophysical Division)*
- Personnel Monitoring (Physiological Monitoring of Firefighters) capability *(IP/Geophysical Division)*
- Incident Management Enterprise System *(IP/Geophysical Division)*
- Logistics management tool *(IP/Geophysical Division)*

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IMMS "gap" identified through IPT process.

IMMS Drivers

- **Modeling & simulation tools, along with vetted datasets, are an underutilized resource in the emergency preparedness & response community**
  - Wide variety of existing tools which capture specialized subject matter expertise
  - Can be used to bring realism, increase understanding, and develop common assumptions about infrequent events

- **Homeland Security Presidential Directive (HSPD) 8 call for continuous improvement of our Nation's preparedness to respond to catastrophic events**

IMMS Drivers (cont'd)

- **Need for widespread, affordable, and sustained use of analysis and exercise tools across DHS emergency response mission. Key enabling capabilities include:**
  - an integrating framework which links best-in-class models and "validated" data sources to address end-to-end emergency response scenarios
  - scalable delivery paths (e.g., distributed simulation-based exercises, serious games, virtual worlds and environments, web-based)

- **National Exercise Simulation Center (NESC) at FEMA Headquarters**
  - Broker access to national modeling and simulation tools through IMMS

IMMS Project Approach

R&D project: **Explore and demonstrate tools and frameworks for rapidly linking together models and data, and supporting collaboration across user communities.**

Project Elements:

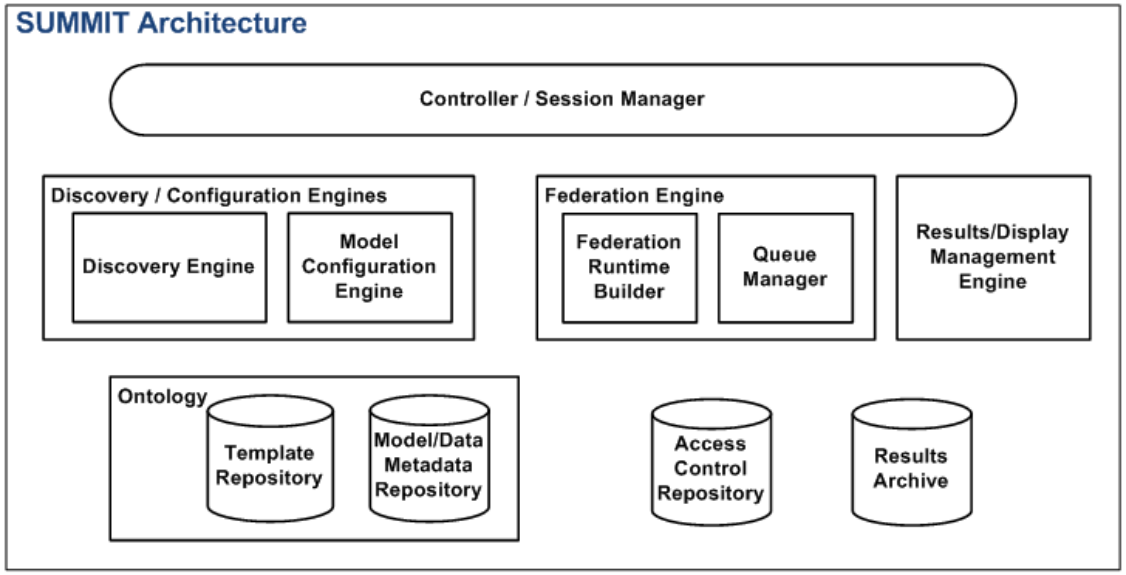
- **User Engagement:** work with user community, all-hazard domain experts, and model/data owners to develop technology requirements and concepts of operation.

- **SUMMIT (Standard Unified Modeling and Mapping Integration Toolkit)**
  - Distributed framework bringing together users and modeling resources from many locations; access to data/models controlled by resource owners
  - Discover models, simulations, data, and archived analyses that are relevant to a specific scenario
  - Provide “glue” for automatically linking together disparate modeling tools
  - Save and manage analysis results (including model configuration parameters)

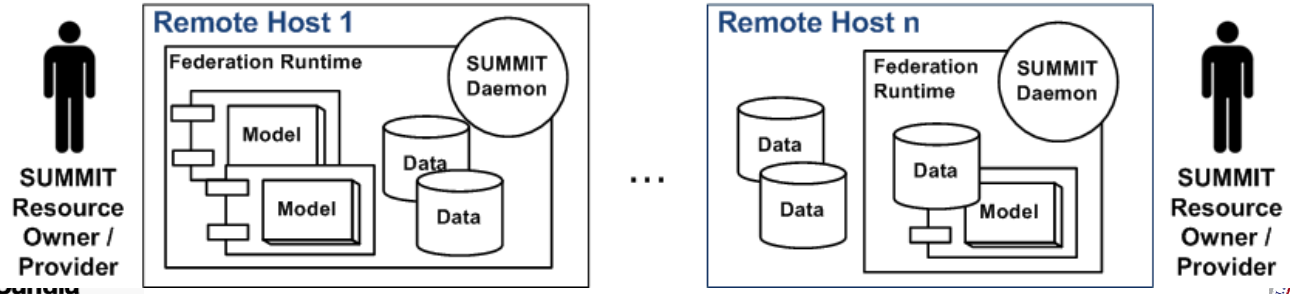
- **Capability Demonstrations:** Prototype these concepts in all-hazards analysis, planning, and training realms to demonstrate feasibility, gain feedback from end-user communities, and drive SUMMIT development.

SUMMIT Architecture Overview

Distributed clients



Core SUMMIT architecture services and metadata repositories



Data and models can be hosted by distributed providers; legacy models must be wrapped for compatibility

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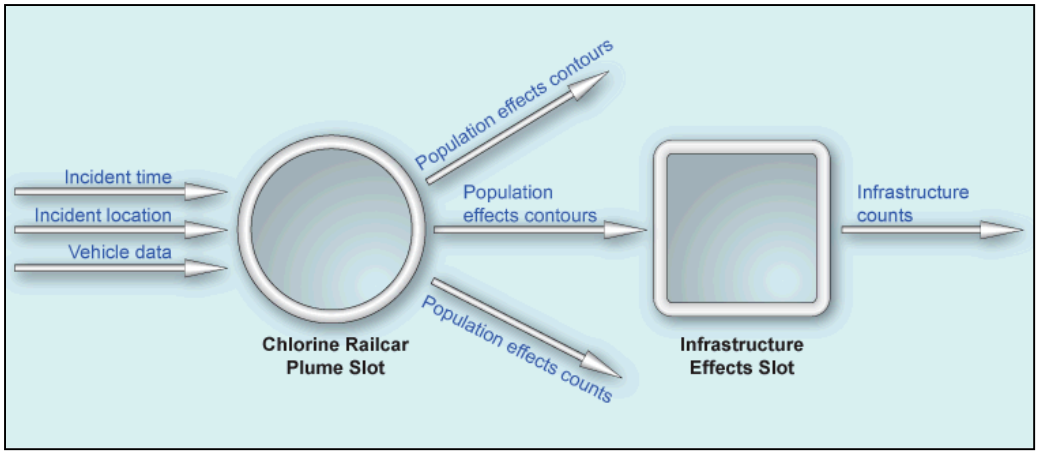
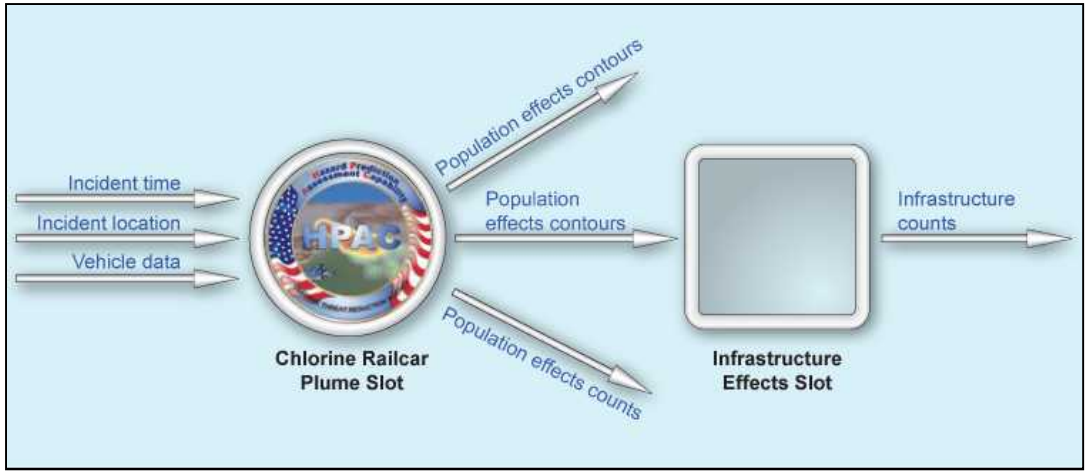
Simulation Template Concept



Generic pattern for linking together models and data.

Each "slot" includes type and format of data inputs and outputs.

Model and data owners will use the SUMMIT Software Development Kit to wrap their tools so they fit within a "slot".



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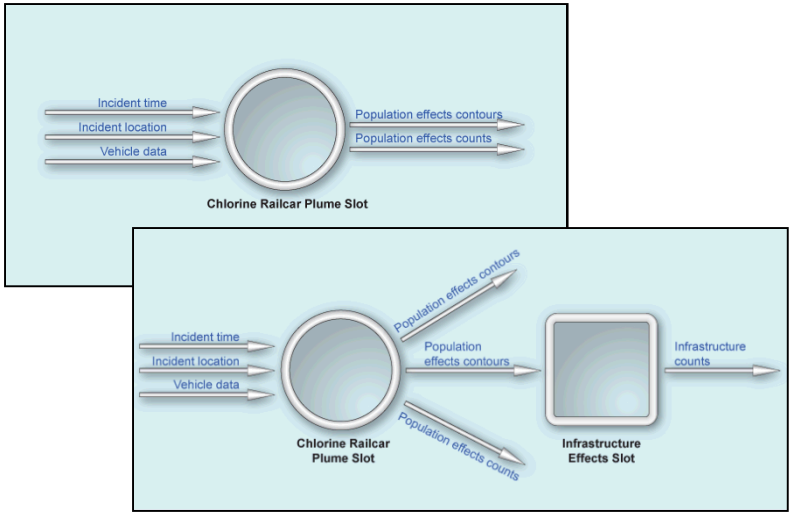
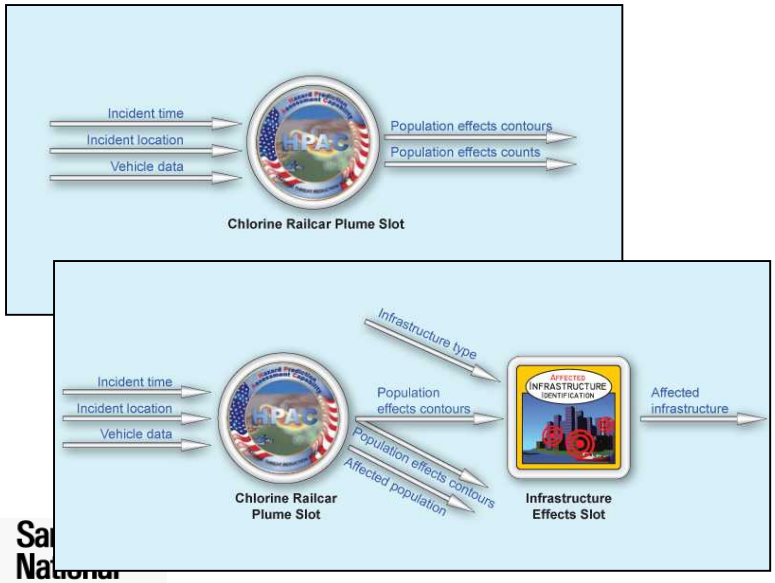
Discovery Mechanism

The SUMMIT Discovery engine walks users through a number of questions, and uses those answers to discover relevant simulation templates.

Multiple templates may be relevant.





The Discovery engine also finds models and data that can fit into the template slots.

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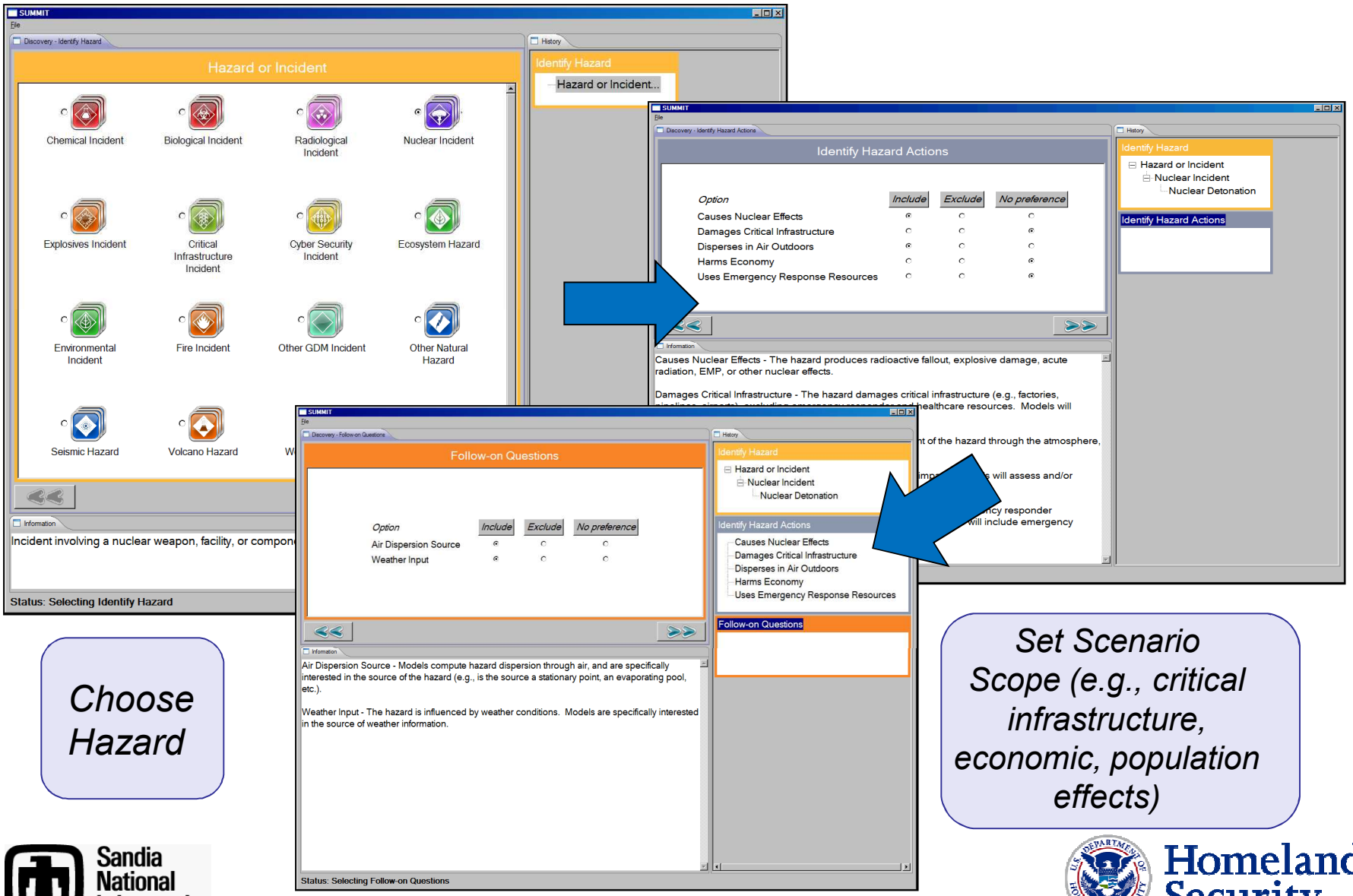
SUMMIT Prototype - Discovery



Choose Hazard

Set Scenario Scope (e.g., critical infrastructure, economic, population effects)

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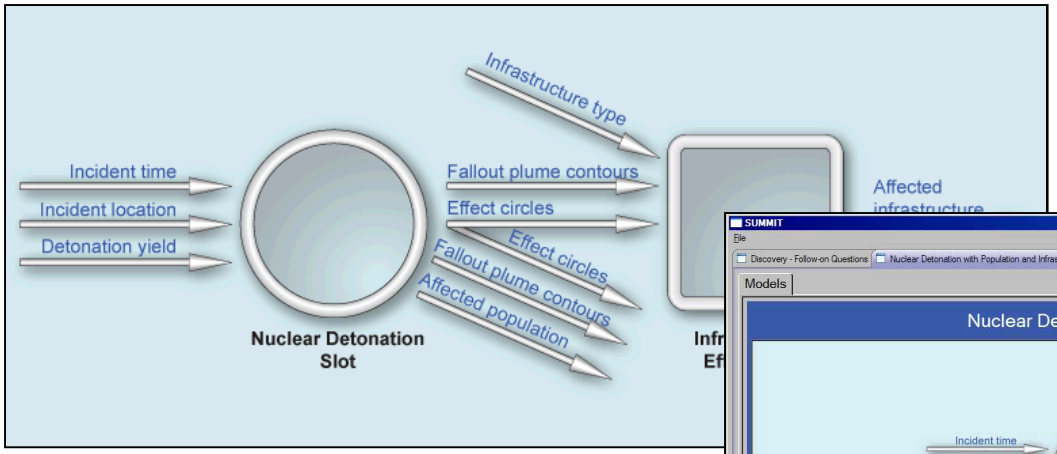
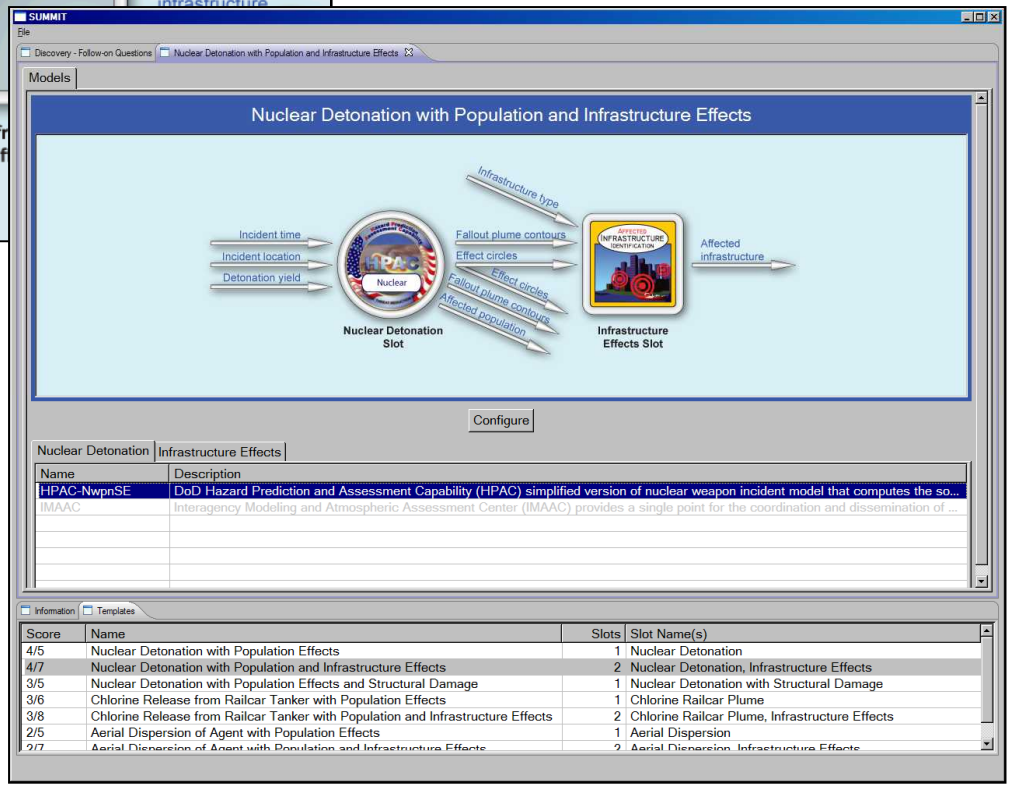
SUMMIT Prototype - Select Template and Models





Based on the selected hazard and other scenario parameters, SUMMIT identifies and ranks relevant simulation templates.

Metadata is provided for models that are not SUMMIT-compliant

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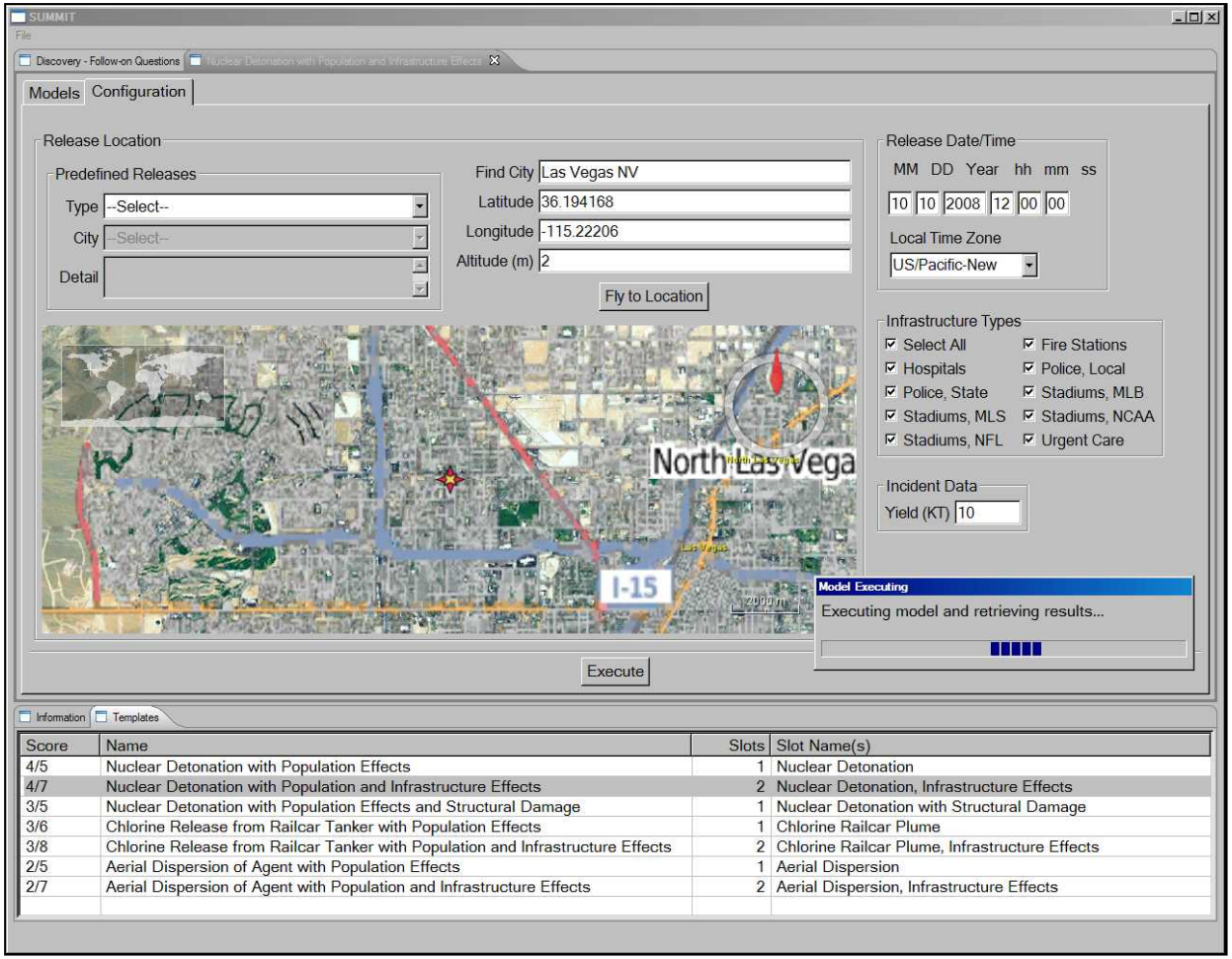
SUMMIT Prototype - Configure & Execute Scenario

If SUMMIT-compliant models are chosen, the system automatically integrates the models and seamlessly executes them.



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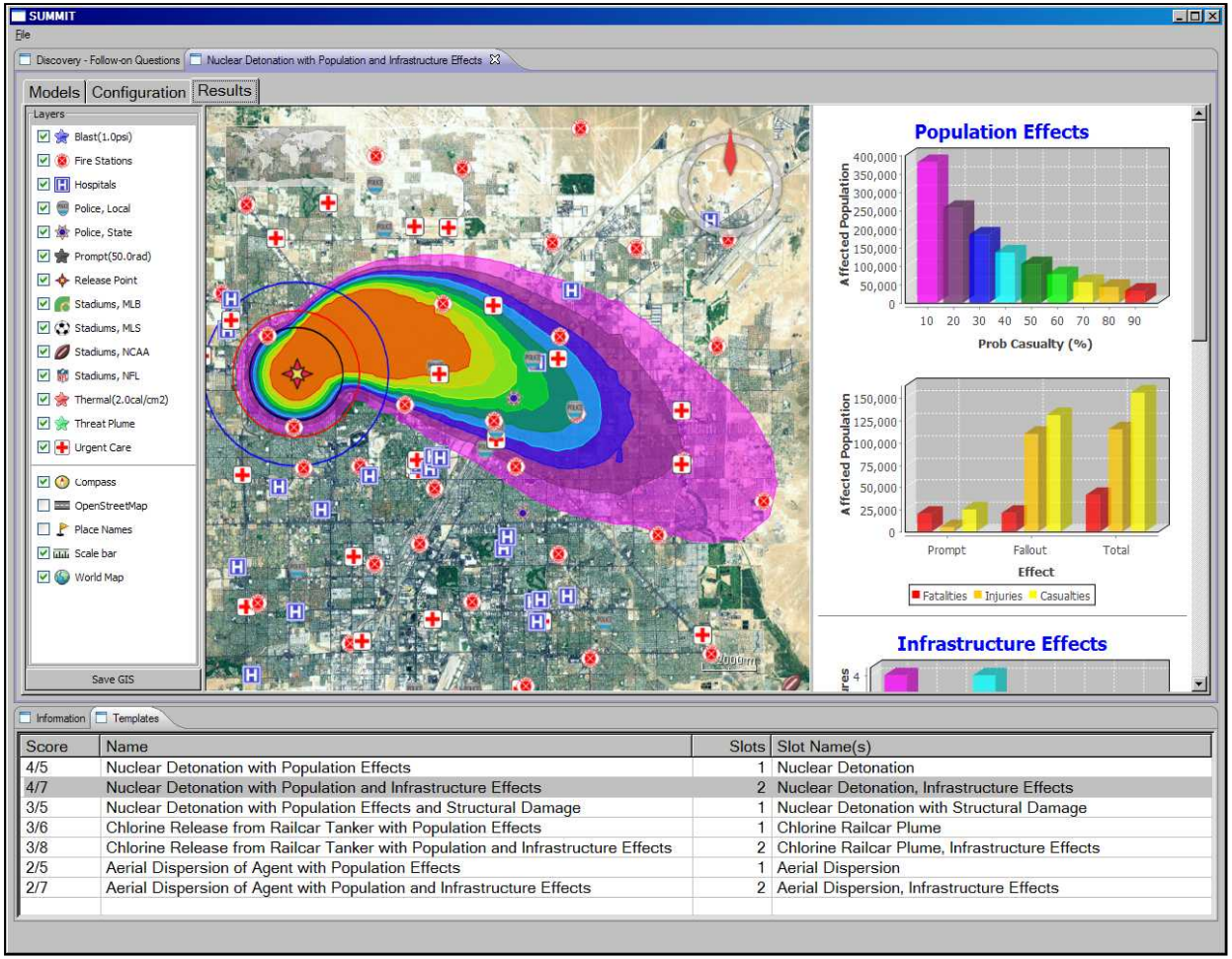
SUMMIT Prototype - View Integrated Results

SUMMIT Simulation Templates also support result integration.

Output from multiple models can be overlaid within GIS systems or displayed in other visualization tools.



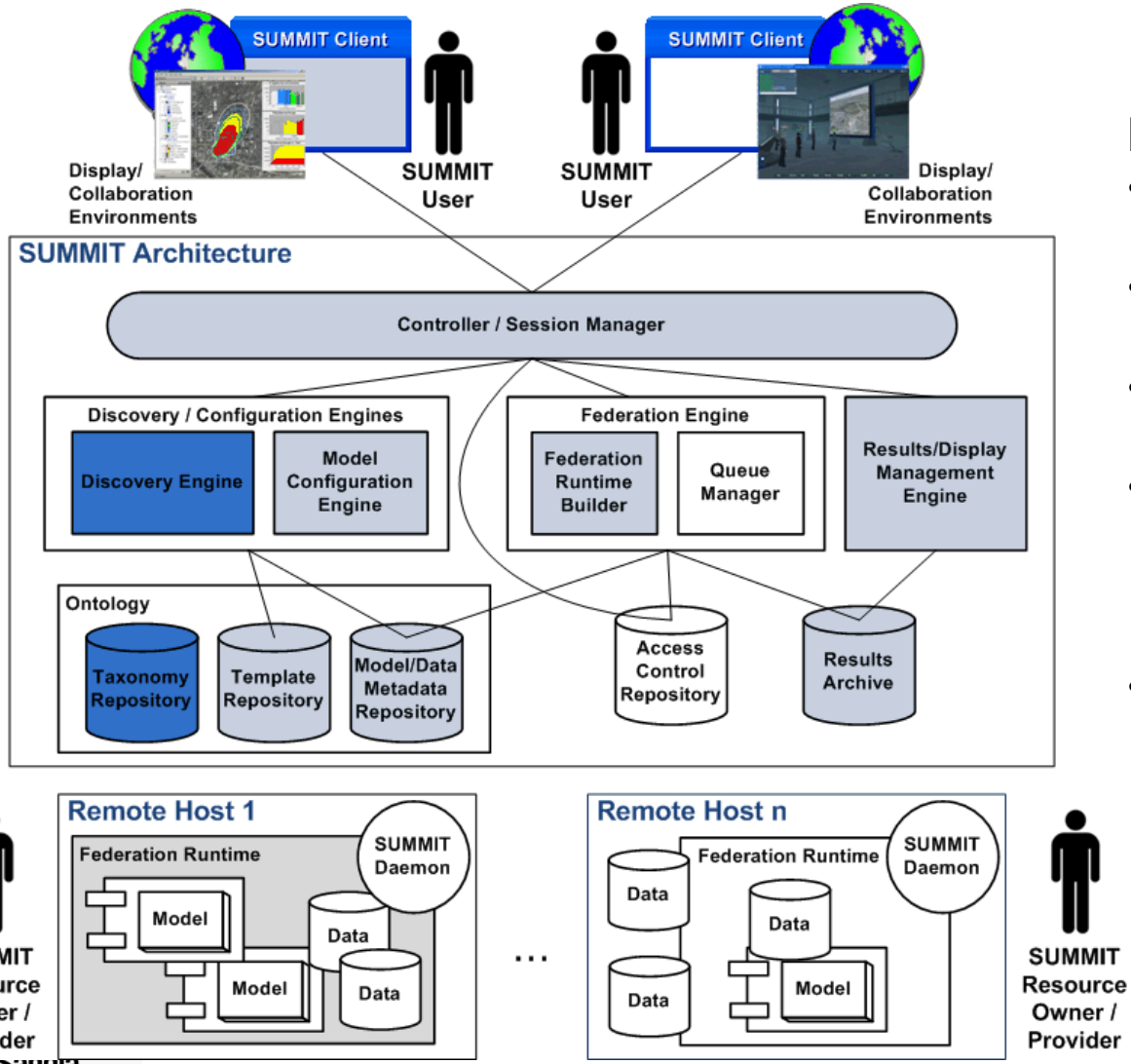
Score	Name	Slots	Slot Name(s)
4/5	Nuclear Detonation with Population Effects	1	Nuclear Detonation
4/7	Nuclear Detonation with Population and Infrastructure Effects	2	Nuclear Detonation, Infrastructure Effects
3/5	Nuclear Detonation with Population Effects and Structural Damage	1	Nuclear Detonation with Structural Damage
3/6	Chlorine Release from Railcar Tanker with Population Effects	1	Chlorine Railcar Plume
3/8	Chlorine Release from Railcar Tanker with Population and Infrastructure Effects	2	Chlorine Railcar Plume, Infrastructure Effects
2/5	Aerial Dispersion of Agent with Population Effects	1	Aerial Dispersion
2/7	Aerial Dispersion of Agent with Population and Infrastructure Effects	2	Aerial Dispersion, Infrastructure Effects

SUMMIT - Current Status

- **SUMMIT v1.0**
  - Design and reference implementation complete
  - Focused on discovery and basis model federation
  - Currently being used to integrate example models to support planning and exercise applications

- **SUMMIT Development Kit**
  - Provide a toolkit for model and data owners to make their tools SUMMIT-compliant
  - Evaluation version available in 2010

SUMMIT Architecture V1.0



Primary foci:

- Simulation template concept
- Simulation template discovery
- Basic model configuration
- Basic "cascade-style" federation of models and data based on simulation template
- Results integration and display

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