OGC
Open Geospatial Consortium

OGC Sensor Web Enablement

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What is OGC?

- **Open Geospatial Consortium (OGC)**
  - Not-for-profit, international voluntary consensus standards organization
  - 300+ industry, government, and university members
  - 16 adopted specifications deployed in hundreds of products worldwide
  - 20+ standards in development by membership
  - Founded in 1994

Mission

To lead the global development, promotion and harmonization of open standards and architectures that enable the integration of geospatial data and services into user applications and advance the formation of related market opportunities.

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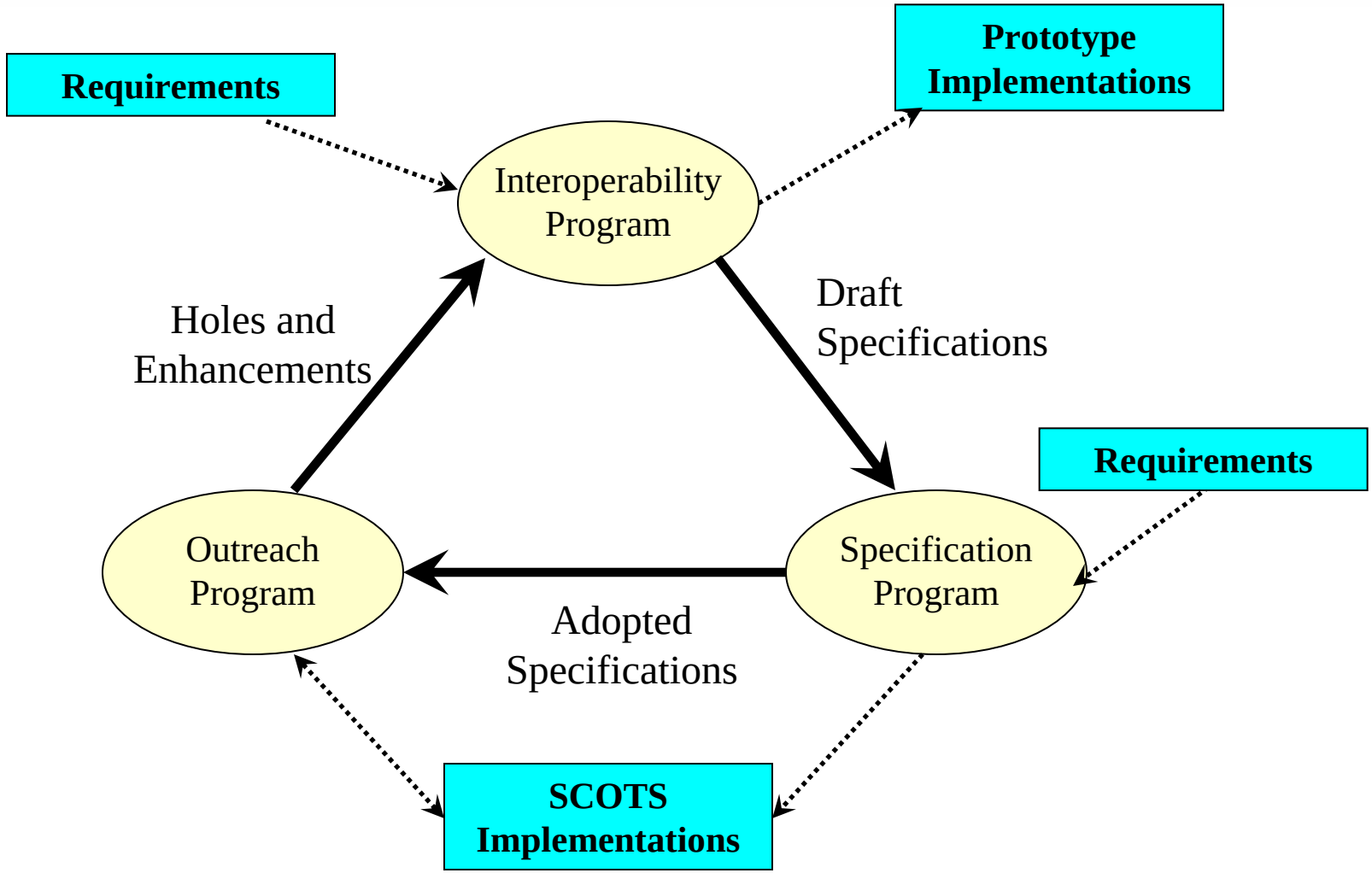
OGC Process - Iterative Development

Yielding Tested Specifications



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Sensor Web Enablement

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OGC Web Services Standards Architecture Overview

- OGC Technologies provide a Web and Location Based Services environment where:
  - Resource providers can advertise their resources **(Publish)**
  - End users can discover resources that they need at run-time **(Find)**
  - End users and their applications can access and exercise resources at run-time **(Bind)**

- This requires:
  - A forum where resources can advertise their capabilities and users can find the resources they need.
  - Self describing resources so that user applications can bind at run-time to the resources that they have found.

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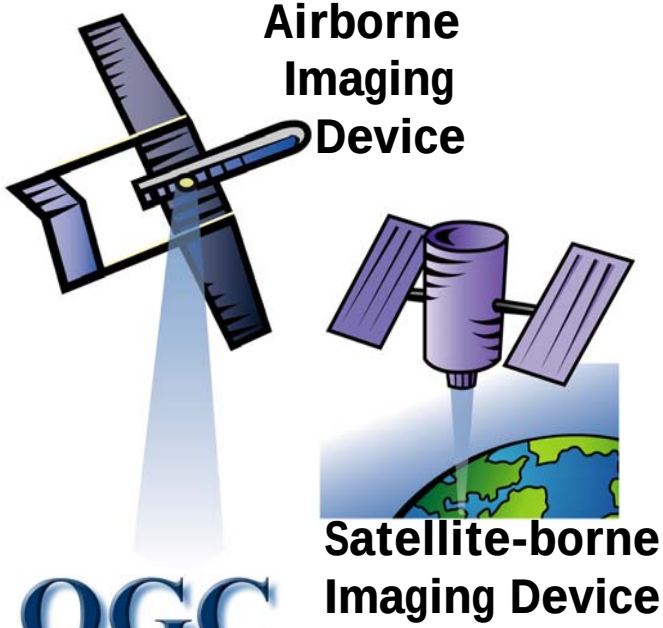
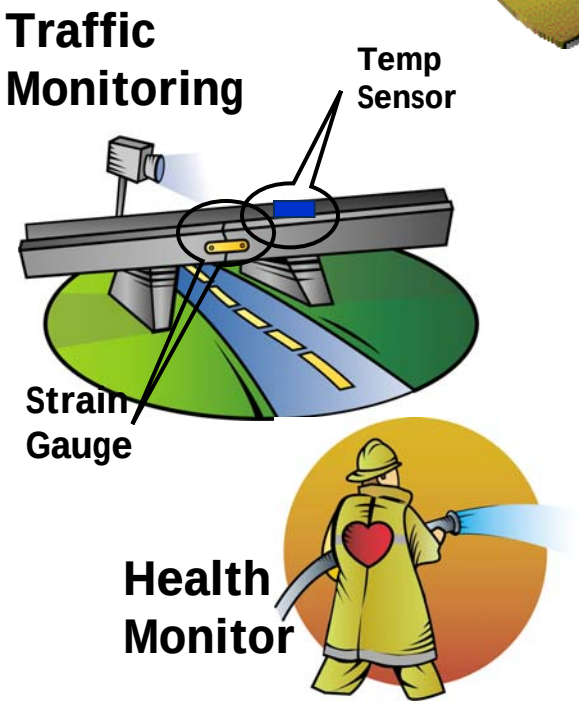
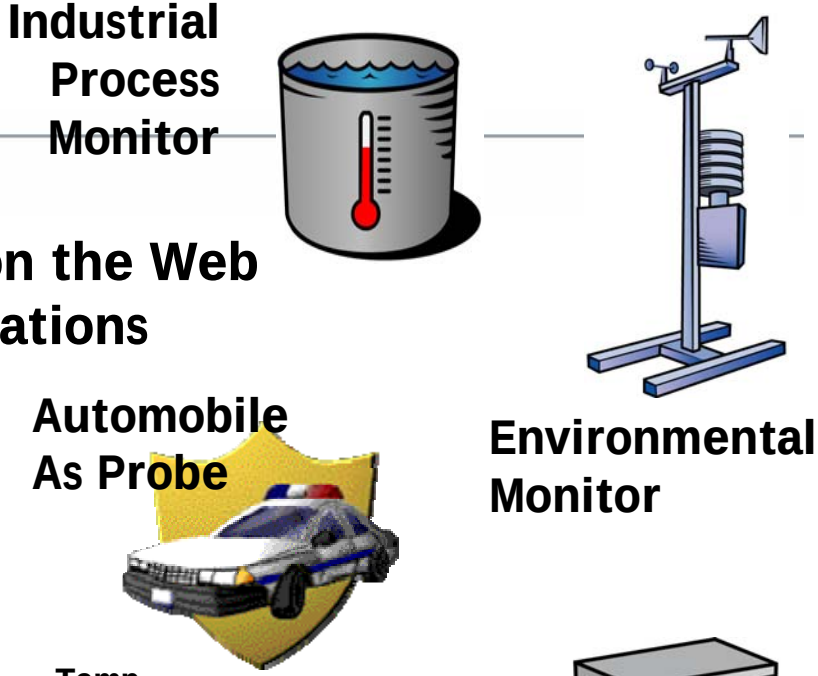
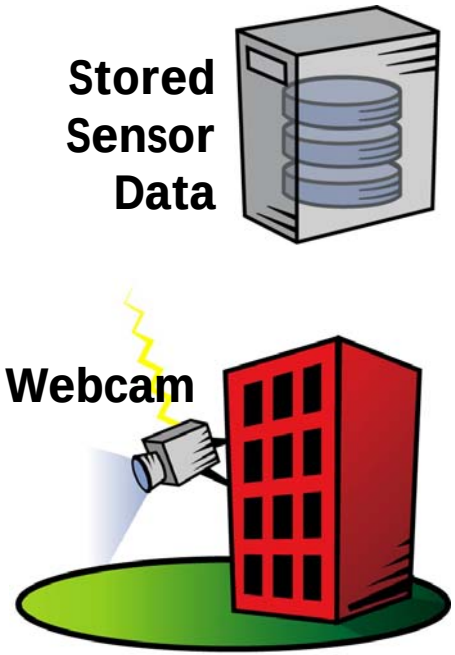
OGC Sensor Web

- Sensors connected to and discoverable on the Web
- Sensors have position & generate observations
- Sensor descriptions available
- Services to task and access sensors
- Local, regional, national scalability
- Enabling the Enterprise









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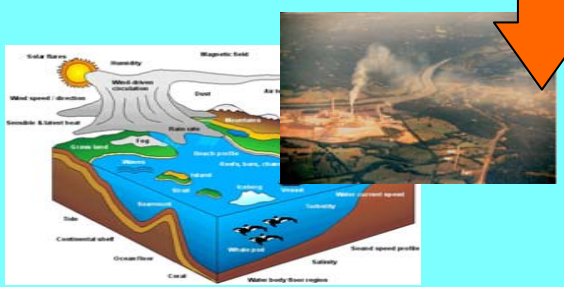
Sensor Web Enablement - Operations Concept

Heterogeneous sensor network

- sparse
- disparate
- mobile/in-situ
- extensible

Models and Simulations



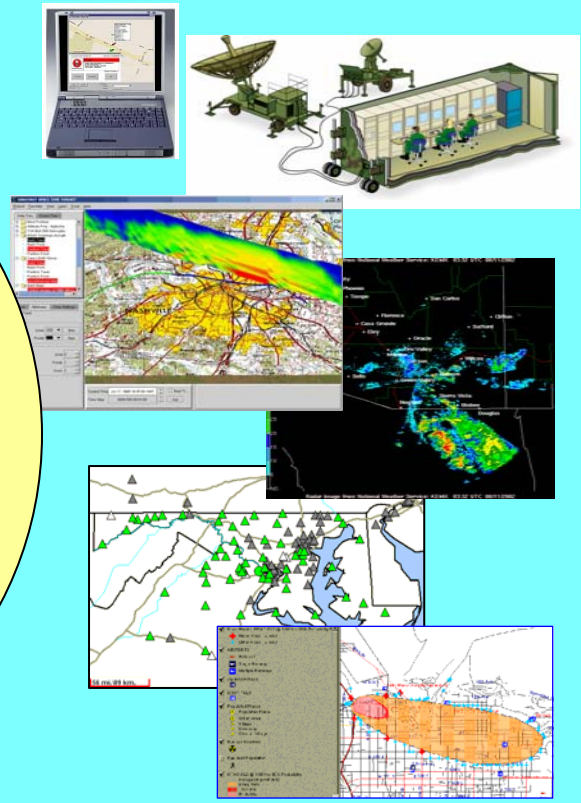
- nested
- national, regional, urban
- adaptable
- data assimilation

SWE Standards focus:

- Discovery
- Access
- Tasking
- Integration
- Alert / Notification

Based on:
(OGC, ISO, OASIS, IEEE)

Decision Support Tools



- vendor neutral
- extensive
- flexible
- adaptable

Source: Dr. Mike Botts -2004

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OGC Sensor Web Standards - Goals

- **Quickly discover sensors (secure or public) that can meet my needs – and learn about what they can do (location, observables, quality, ability to task)**
- **Obtain sensor information in a standard encoding that is understandable by the user and by software**
- **Readily access sensor observations in a common manner, and in a form specific to my needs**
- **Task sensors, when possible, to meet my specific needs**
- **Request and receive alerts / notification when a sensor measures a particular phenomenon, or completes a requested task**

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OGC Sensor Web Enablement -1-

- "High-level" OGC Services supporting sensor data
  - **Web Map Service** – request map (i.e. image)
  - **Web Coverage Service** – request binary gridded or aggregated data
  - **Web Feature Service** – request feature data
  - **Open Location Services (OpenLS)** – location / routing of mobile devices, mobile sensors

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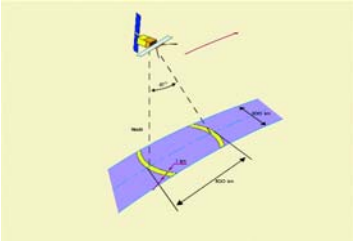
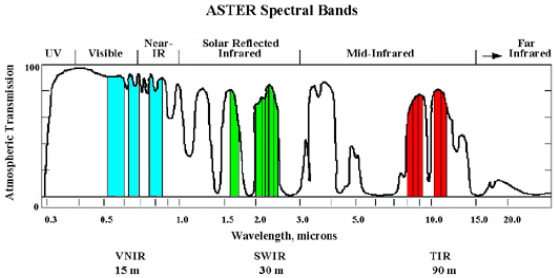
OGC Sensor Web Enablement -2-

- Sensor Web Enablement Framework - Schema
  - **SensorML –** models and schema for describing sensor characteristics (geolocation, response)





  - **Observation & Measurement** – models and schema for encoding sensor observations

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OGC Sensor Web Enablement -3-

- Sensor Web Enablement Framework – Services
  - **Sensor Observation Service** – access sensor information (SensorML) and sensor observations (O&M)
  - **Sensor Planning Service** – task sensors or sensor systems
  - **Web Alert Service** – asynchronous notification of sensor events (tasks, observation of phenomena)
  - **Sensor Registries** – discovery of sensors and sensor data

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OGC Sensor Web Enablement -4-

- Sensor Web Enablement
  - **TransducerML** – adds system integration and real-time streaming clusters of observations (blending with SensorML)
  - **Common Alert Protocol (CAP)** – being considered as standard encoding of sensor alerts in SAS
  - **IEEE P1451** – provides “plug-n-play” capabilities for sensors; looking at complimentary interaction between 1451, SensorML, and the SWE Framework

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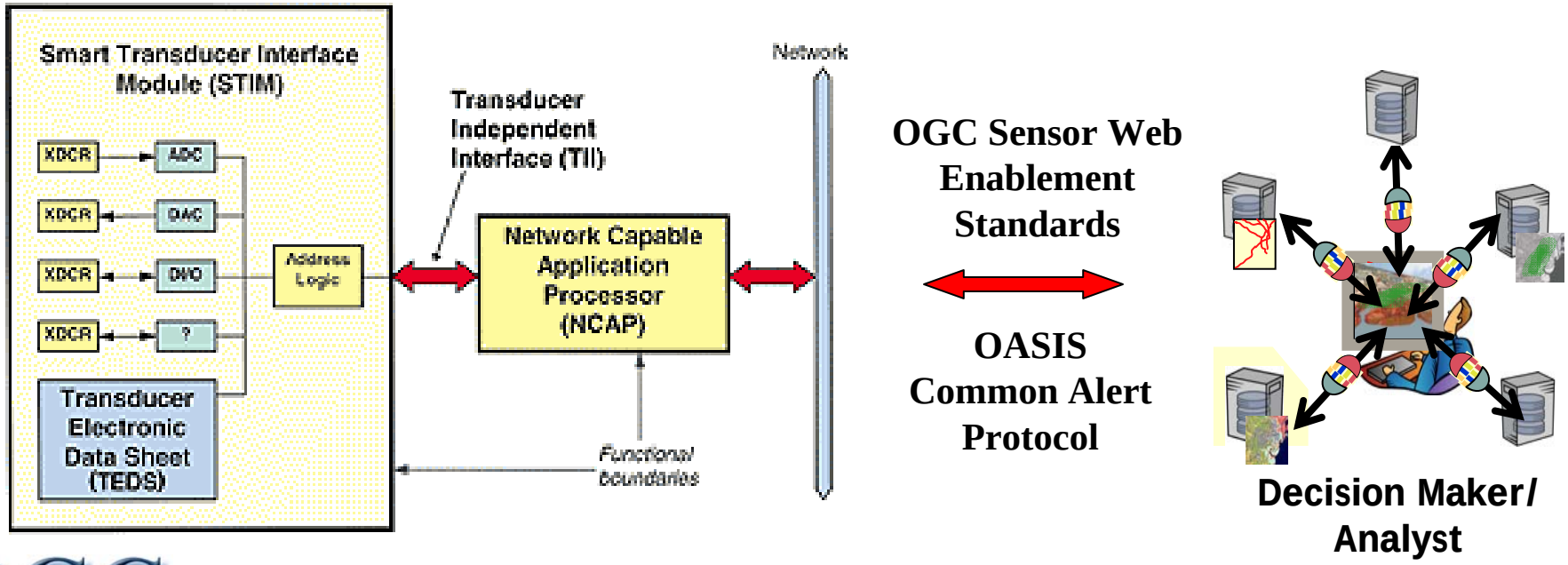
IEEE, OGC, OASIS Framework

- Transducer: A device converting energy from one domain into another. The device may either be a sensor or an actuator.
- Sensor: A transducer which converts a physical, biological, or chemical parameter into an electrical signal.



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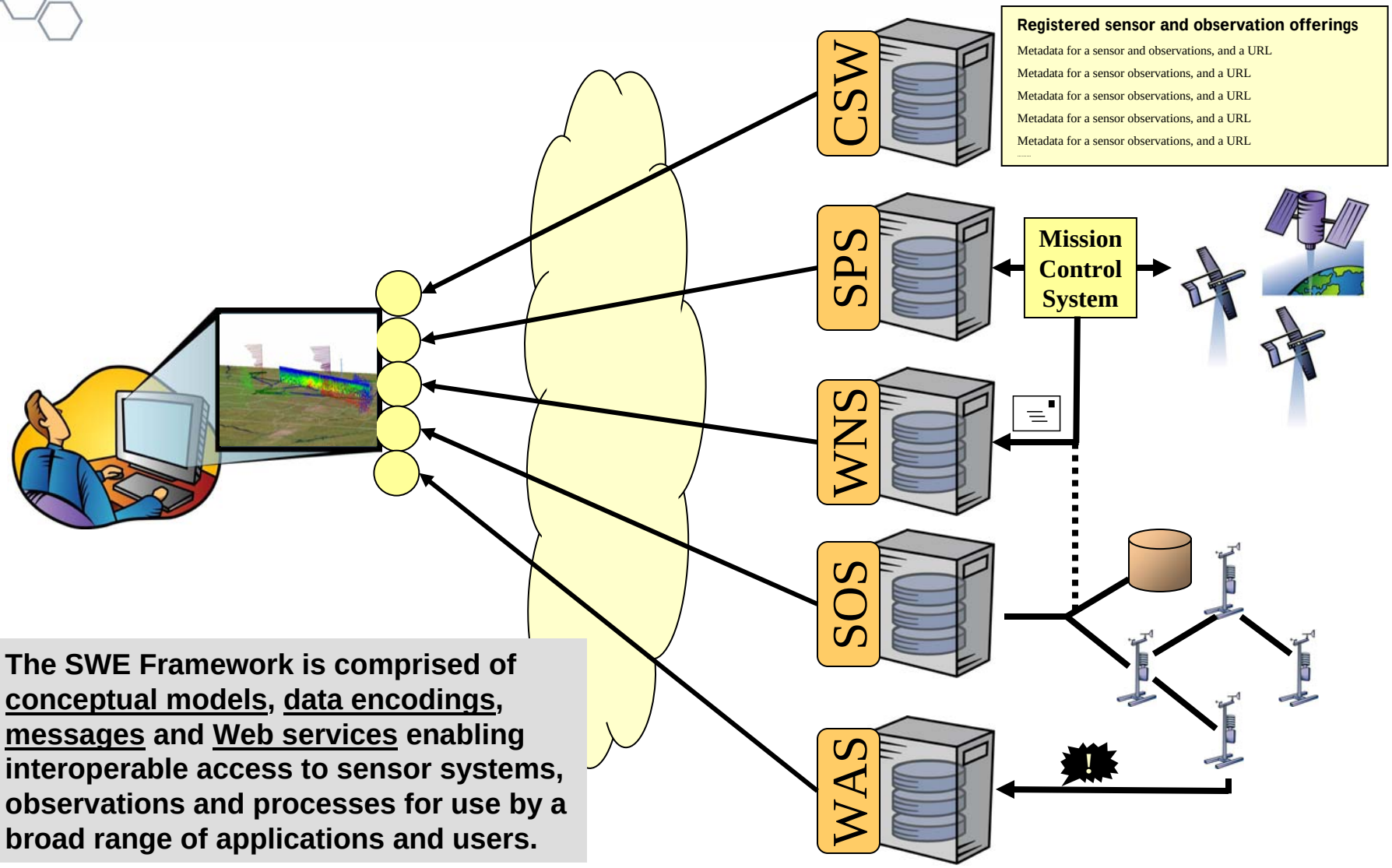
Enabling Sensor Webs with SWE Framework



The SWE Framework is comprised of <u>conceptual models</u>, <u>data encodings</u>, <u>messages</u> and <u>Web services</u> enabling interoperable access to sensor systems, observations and processes for use by a broad range of applications and users.

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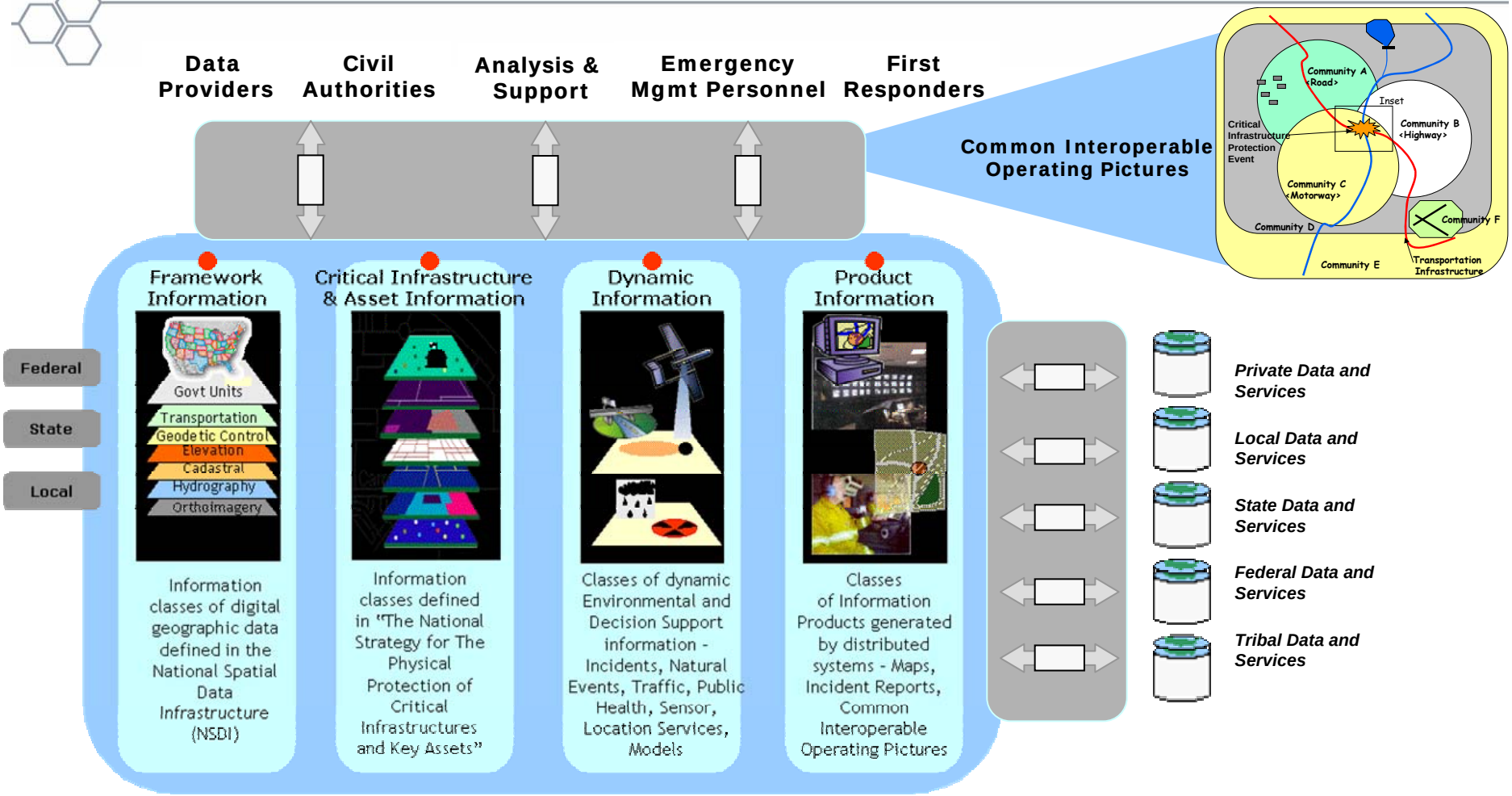
Common Geospatial Interoperability Framework
Multi-source Access and Integration (Homeland Security)



Information Architecture:
Models, Transforms, Application Schemas and Dictionaries

Service Architecture:
Standards, Certified Services for Accessing, Processing, Presenting Information

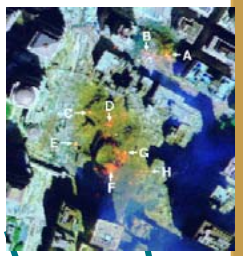
OGC

Standards-based Geospatial Interoperability Framework established via current OGC adopted standards, and is being expanded in ongoing Testbeds

OGC Sensor Web Enablement - Background

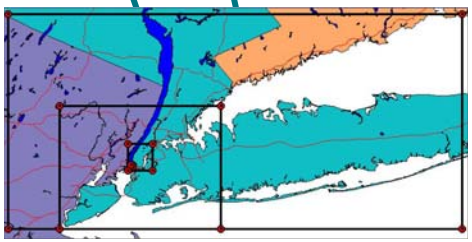
SensorML initiated at Univ. of Alabama

2000



OGC Web Services Testbed 1.1
- Sponsors: EPA, NASA, DOD
- Specs: SOS, O&M, SensorML
- Demo: NYC Terrorist
- Sensors: weather stations, water quality

2001



2002

OGC Web Services Testbed 1.2
- Sponsors: EPA, General Dynamics, NASA, DOD
- Specs: SOS, O&M, SensorML, SPS, WNS
- Demo: Terrorist, Hazardous Spill and Tornado
- Sensors: weather stations, wind profiler, video, UAV, stream gauges

2003-4

- Specs advanced through independent R&D efforts in Germany, Australia, Canada and US
- Sensor Web Work Group established
- Specs: SOS, O&M, SensorML, SPS, WNS, SAS
- Sensors: Wide Variety

2005

- OWS4 Testbed Matures Specs as an Enterprise Framework
- Formal collaboration with IEEE, OASIS
- Specs: TransducerML, integration with Location Based Services
- Sensors: Wide Variety

- SWE Standards to be introduced to OGC's Technical Committee for consideration as Adopted OGC standards

OGC

Helping the World to Communicate Geographically

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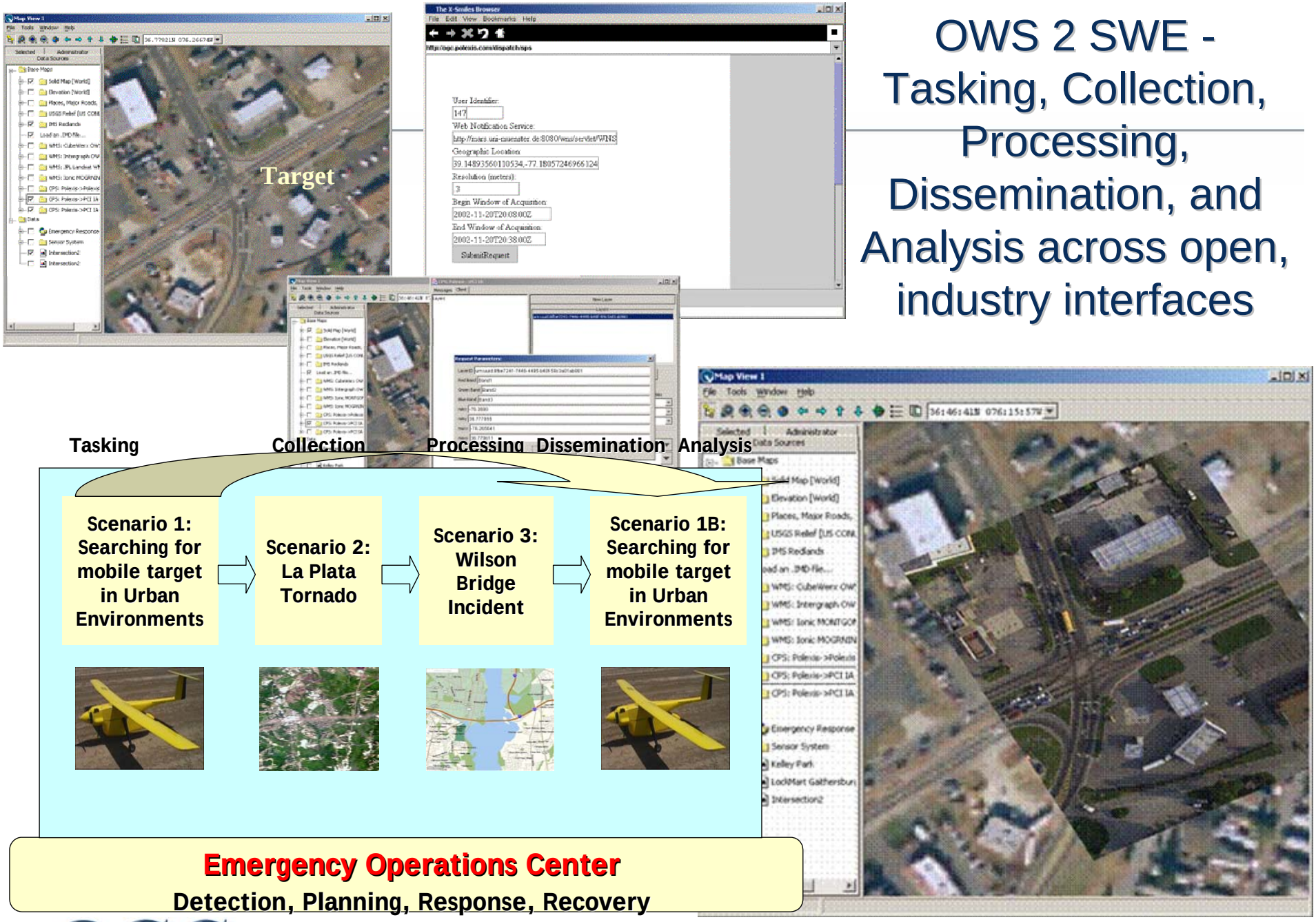
OWS 2 SWE - Tasking, Collection, Processing, Dissemination, and Analysis across open, industry interfaces



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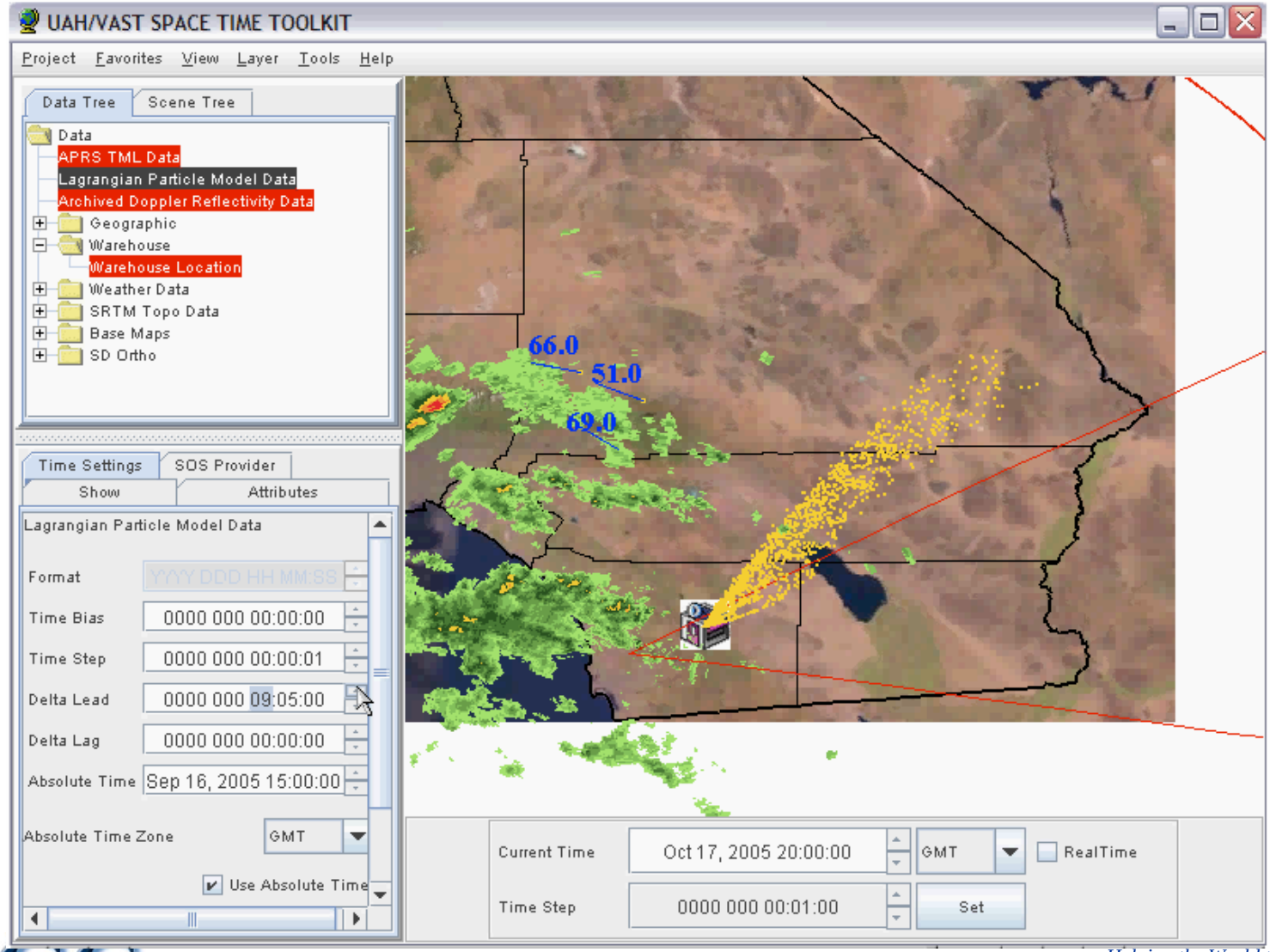
Display Plume (OGC Web Services 3 Testbed)



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TML Camera in warehouse

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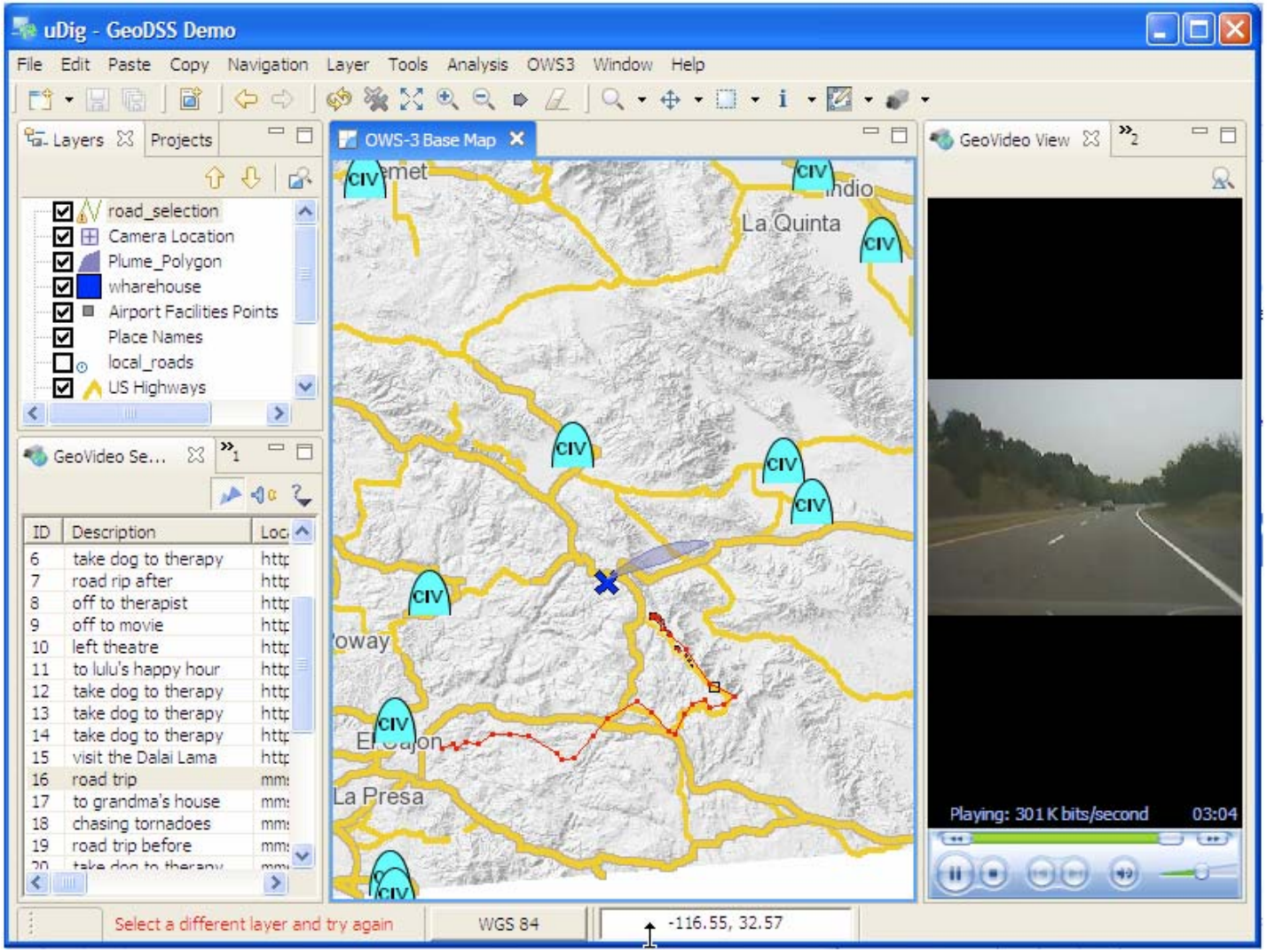
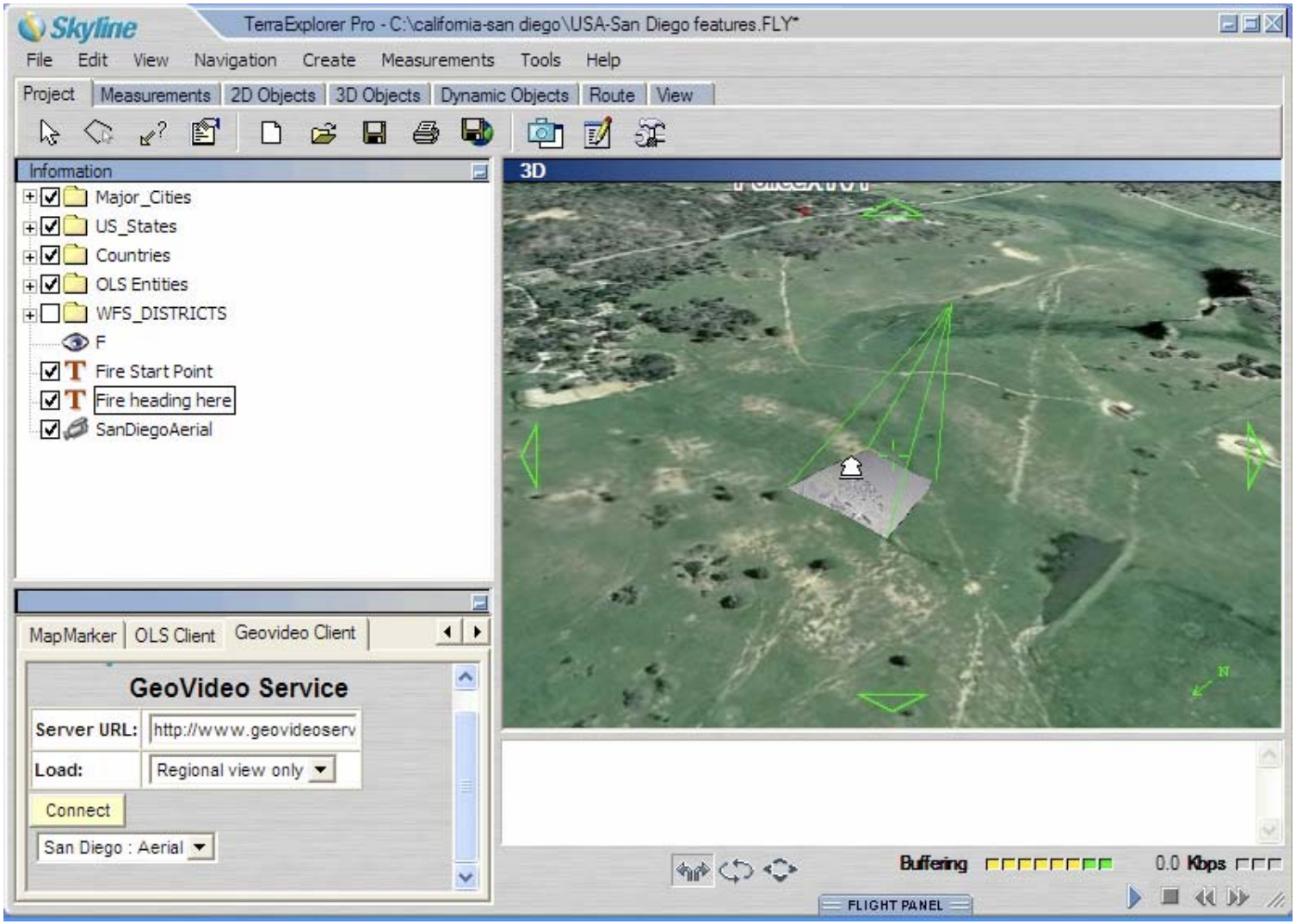
Deploy and Track Emergency Responders



UAV Video over Terrain



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OGC Key Partnerships for Geospatial Interoperability

- World Wide Web Consortium (W3C)
- Digital Geospatial Information Working Group (DGIWG)
- International Organization for Standards (ISO)
- OASIS
- Object Management Group (OMG)
- Open Mobile Alliance (OMA)
- Web3D
- Simulation Interoperability Standards Organization (SISO)
- International Alliance for Interoperability (IAI)
- IEEE Technical Committee 9 (Sensor Web)
- IEEE
- Others

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Summary

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OGC SWE Standards

- SWE standards Framework very mature, moving toward OGC adoption in early 2006
- SensorML, TML, and related SWE specifications are:
  - Being advanced by Oak Ridge National Labs, NAVTEQ for telematics, Questerra for Insurance, and various other OGC member organizations for integration of in-situ and mobile sensors
  - Supporting DOD airborne requirements
  - Identified in DHS Geospatial Enterprise Architecture
  - In use within the MASINT environment
  - In use within Common Battlespace Objects work ongoing by FIOP Data Engineering Group
  - Being applied in Ocean Systems research and monitoring
  - Identified as key specifications for the Geospatial COI (DISA)

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Relevant Links

- OGC
  - www.opengeospatial.org
- SWE Resource Page
  - http://www.opengeospatial.org/functional/?page=swe
- SWE mail list –
  - http://mail.opengeospatial.org/mailman/listinfo/swe.wg
- SensorML mail list –
  - http://mail.opengeospatial.org/mailman/listinfo/sensorml

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