



Standards for Information Sharing A Location Perspective

Session: Supporting Standardized Information Exchanges Across Government

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5 December 2011

Cross-Boundary Cross-Domain Information Sharing

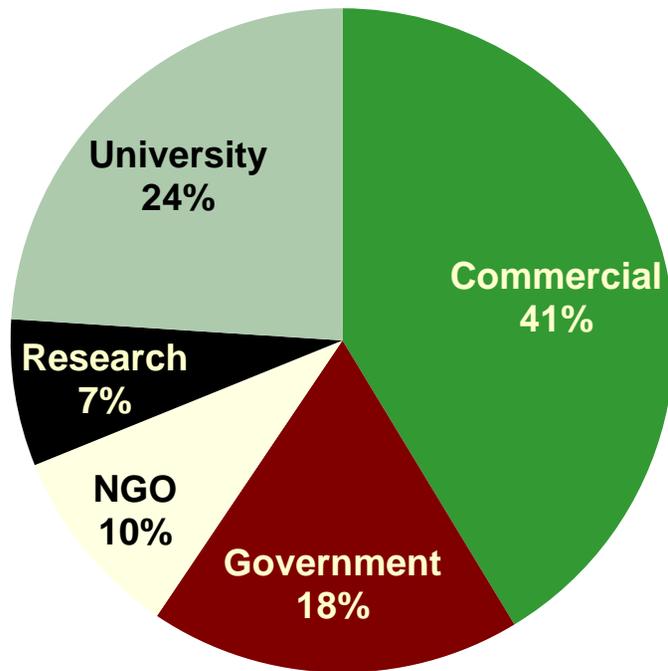


Source: David Rydevik, Thailand Tsunami, 2004

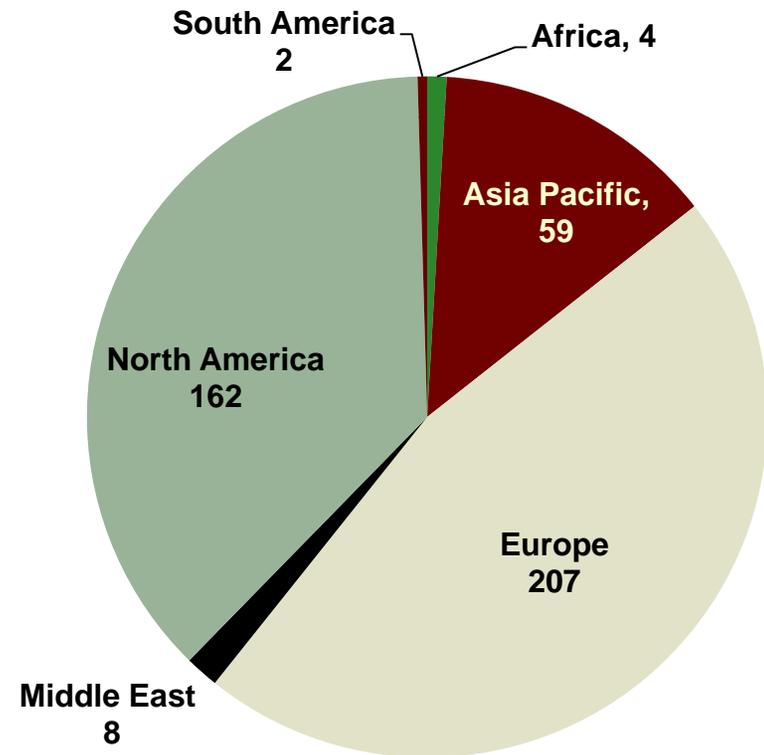


The ability to access, fuse
and apply diverse data
sources is critical to
situational awareness

Key to SDO Success – Broad Representation



442 Members as of 5 December 2011
<http://www.opengeospatial.org/ogc/members>



Open Standards Driven By Community Requirements



Defense & Intelligence



Research & Education



Sustainable Development



Energy & Utilities



Geosciences



Homeland Security / Emergency Services



Consumer Services / Mass



Aviation



E -Government



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Example OGC Commercial Members



NORTHROP GRUMMAN

ORACLE Google™



BAE SYSTEMS

LOCKHEED MARTIN



INTERGRAPH

Spacemetric



DIGITALGLOBE

TASC



NAVTEQ™



Microsoft

Raytheon



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Example Government Members



- **DOD Australia**
- **Geoscience Australia**
- **NSW Dept of Environment and Climate Change (Australia)**
- **Eurocontrol**
- **European Environment Agency**
- **European Satellite Centre**
- **European Space Agency**
- **EU Joint Research Centre**
- **UK MOD**
- **UK MET Office**
- **METEO France**
- **BRGM (France)**
- **Ordnance Survey (UK) ...**
- **State Land Agencies (Germany)**
- **US DHS**
- **US DISA**
- **US EPA**
- **US FAA**
- **US NASA**
- **USGS**
- **US NGA**
- **US Census**
- **US NOAA**
- **US JPEO**
- **Oak Ridge National Lab**
- **Natural Resources Canada**
- **North Carolina Dept of Environment & Natural Resources**
- **Dept. Science & Technology (India)**
- **Ministry of Land, Transport and Maritime Affairs (S. Korea)**

Why Open Standards?

User Perspective



- **Rapidly mobilize new capabilities**
- **Lower system lifecycle costs**
- **Encourage market competition**
 - Choose solutions based on functionality desired
 - Avoid “lock in” to a proprietary architecture
- **Decision to share information and services becomes a policy decision**

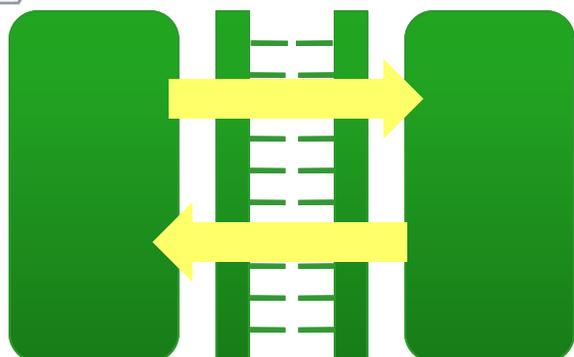
“What OGC brings to the table is...everyone has confidence we won’t take advantage of the format or change it in a way that will harm anyone”

Michael Weiss-Malik,
Google KML product
manager

What is an OGC Standard?



Interface standards



Client

Interface standard Enables communication. (Client request is understood by server. Server returns data in correct parameters, correct ordering, correct data types, etc.)

Server

Encoding standards (XML apps)

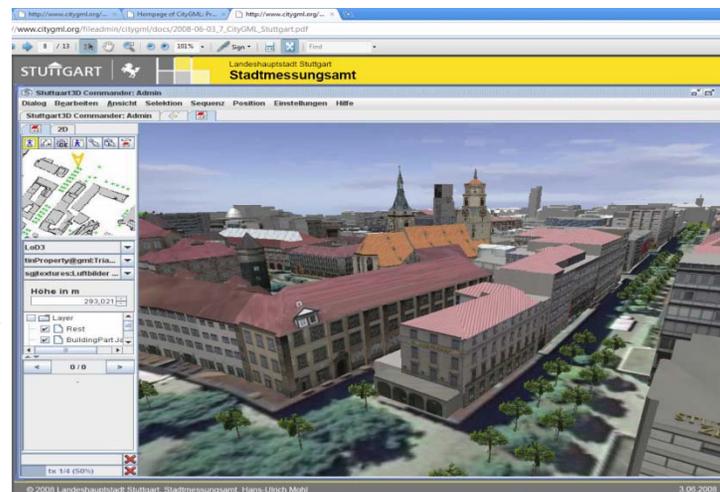


A GML Application Schema defines a vocabulary of geographic objects for a particular application domain. (CityGML is a GML application schema for the representation, storage and exchange of virtual 3D city and landscape models.)

GML is an XML encoding for spatial data.

SensorML is an XML for describing and encoding sensors.

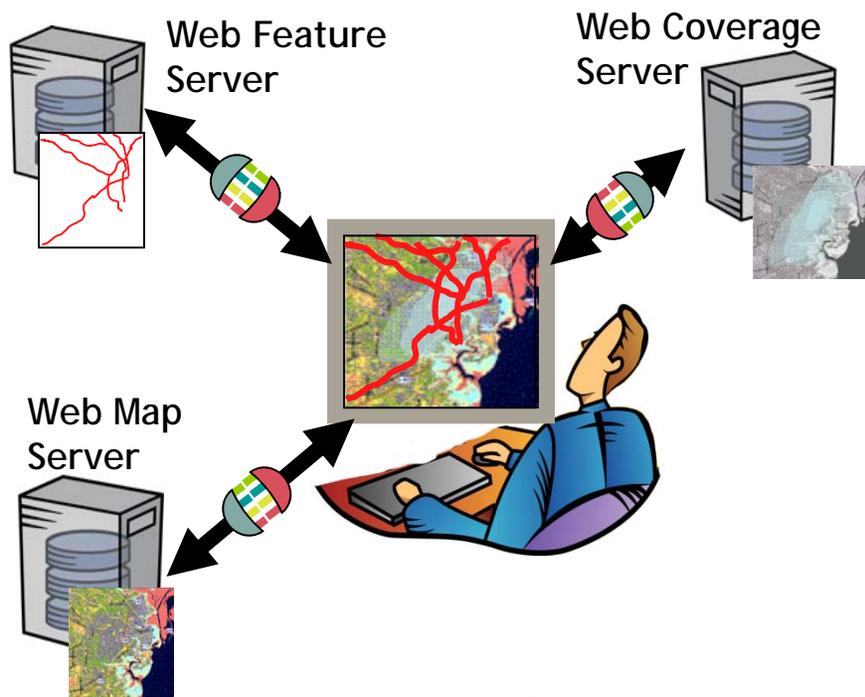
Observations and Measurements Encoding Standard (O&M) defines an abstract model and an XML encoding for observations.



Geospatial Interoperability Through Open Standards



Just as http:// is dial tone of World Wide Web, geospatial web is enabled by OGC standards:



Web Map Service (WMS)
Web Map Tile Service (WMTS)
Web Feature Service (WFS)
Web Coverage Service (WCS)
Catalogue (CSW)
Geography Markup Language (GML)
KML
Others...

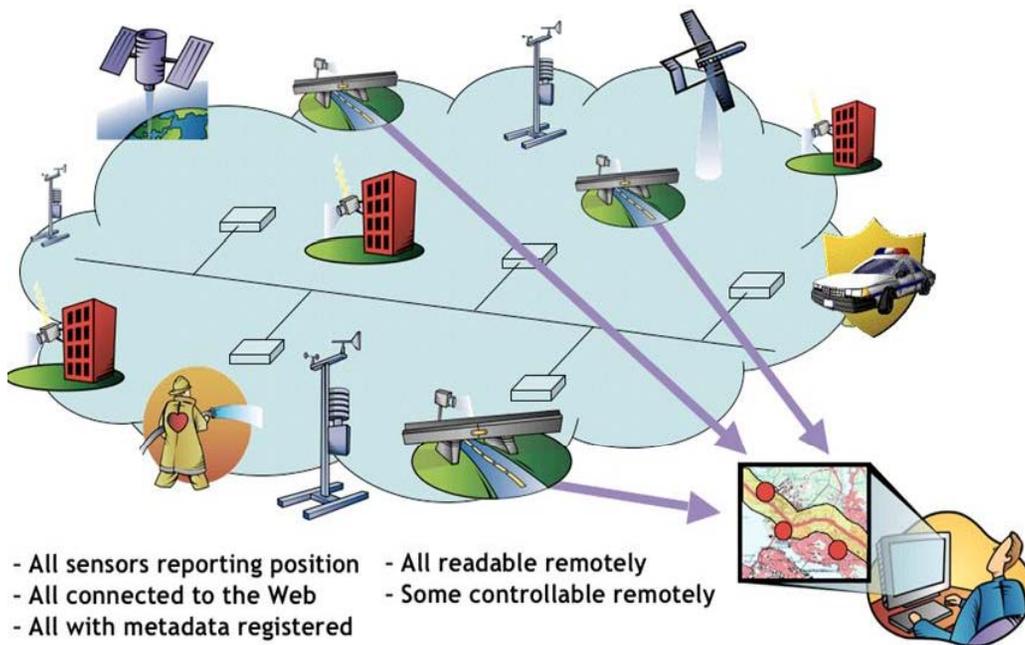
Relevant to geospatial information applications: Critical Infrastructure, Emergency Management, Weather, Climate, Homeland Security, Defense & Intelligence, Oceans Science, others

Important Sensor Standards

OGC Sensor Web Enablement



Enables discovery and tasking of sensor assets, and access and application of sensor observations for enhanced situational awareness



- ✓ Sensor Model Language (SensorML)
- ✓ Observations & Measurements (O&M)
- ✓ Sensor Planning Service (SPS)
- ✓ Sensor Observation Service (SOS)
- ✓ Catalogue Service
- ✓ Sensor Alert Service (SAS)

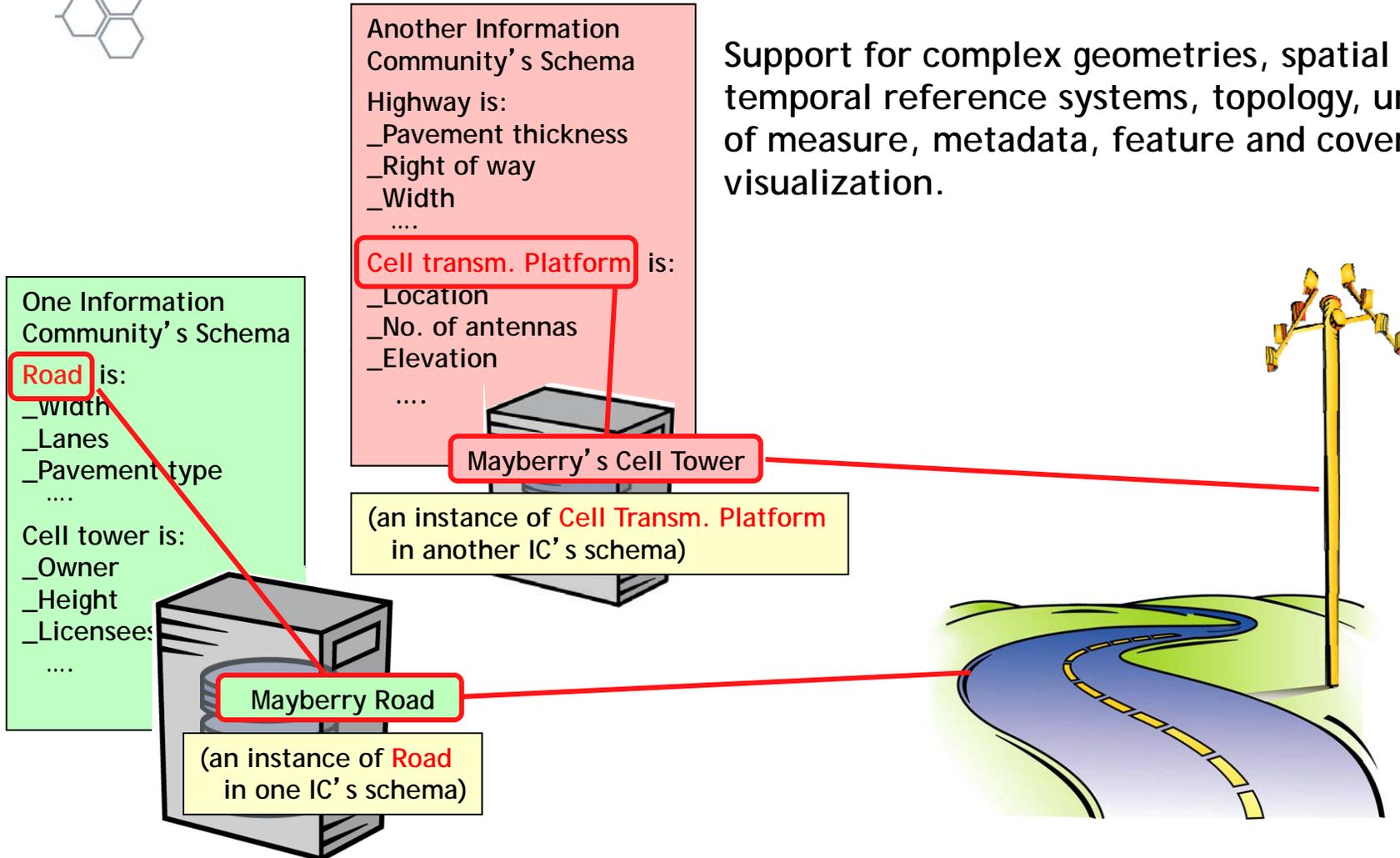
--Complementary Standards--

- ✓ IEEE 1451 smart sensor standard
- ✓ OASIS (alert) standards

GML: Representing Geographic Features



Support for complex geometries, spatial and temporal reference systems, topology, units of measure, metadata, feature and coverage visualization.



GML defines a data encoding in XML that allows geographic data and its attributes to be moved between disparate systems with ease

OGC Geography Markup Language (GML)



- GML an application of eXtensible Markup Language (XML)
 - XML specified by World Wide Web Consortium (W3C)
 - GML specifies XML Schemas that specify XML encoding of geographic features, their geometry, and their attributes
- GML encodes digital feature data
 - Encodes features, attributes, geometries, collections, etc.
 - Applications require specifying more specific Application XML Schemas
 - GML v3, supports 2 1/2 and 3D geometry as well as complex geometry and topology
- GML 3 is also ISO 19136

GML Application Activities



Profiles

- GML Point Profile
- GML Simple Features Profile
- GML GeoShape for use in IETF
- GML in JPEG2000
- GeoRSS: GML Serialization

US NSDI GML Schemas for Framework Datasets

- Base Transportation
- Roads
- Governmental Units
- Linear Reference Systems
- Dictionaries
- Hydrology

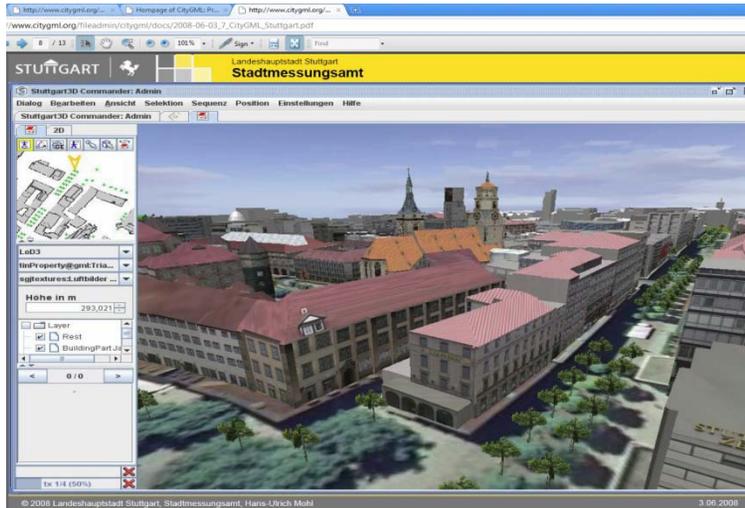
Community Application Schemas

- Climate Science Modeling Language (CSML)
- CityGML
- CleanSeaNet
- NcML/GML (NetCDF and GML)
- TDWG Biodiversity GML
- GeoSciML - Geological Sciences ML
- MarineXML
- Ground Water Modeling Language
- WaterML

Further information on OGC Network

<http://www.ogcnetwork.net/node/210>

CityGML - 3D Urban Models



www.3d-stadtmodell-berlin.de



Source; Thomas Kolbe, Berlin TU

- Urban Planning / Operations
- Emergency Mgt / Response
- Transportation / Routing / Logistics
- Indoor navigation
- Retail Site analysis
- Sustainable / Green Communities
- City Services Management
- Noise abatement
- Telecommunications placement
- Many other uses...

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Geospatial in NIEM

Geospatial (NIEM Conformant Schema)



- [geospatial](#): Defines NIEM adapter types for external geospatial components defined by OGC and ISO. It references local copies of unmodified schemas from external standards in local directory tree fragments that mirror the directory structures of the canonical schema sources on the world wide web, and a profile of the OGC Open Location Services (XLS) schema that is based on GML version 3.2.1.

Schema Document Information

Namespace: http://niem.gov/niem/geospatial/2.1	Property: NIEM Pro
File Path: geospatial/2.1/geospatial.xsd	<ul style="list-style-type: none"> • NIE Cor

Elements

[geo:Arc](#)
[geo:ArcByCenterPoint](#)
[geo:Circle](#)
[geo:CircleByCenterPoint](#)
[geo:Curve](#)
[geo:Ellipse](#)
[geo:Envelope](#)
[geo:LineString](#)
[geo:MultiCurve](#)
[geo:MultiGeometry](#)
[geo:MultiPoint](#)
[geo:MultiSurface](#)
[geo:Point](#)
[geo:Polygon](#)
[geo:Surface](#)

Complex Types

[geo:ArcByCenterPointType](#)
[geo:ArcType](#)
[geo:CircleByCenterPointType](#)
[geo:CircleType](#)
[geo:CurveType](#)
[geo:EllipseType](#)
[geo:EnvelopeType](#)
[geo:LineStringType](#)
[geo:MultiCurveType](#)
[geo:MultiGeometryType](#)
[geo:MultiPointType](#)
[geo:MultiSurfaceType](#)
[geo:PointType](#)
[geo:PolygonType](#)
[geo:SurfaceType](#)

Multi-source fusion for Actionable Situational Awareness Via Common Standards Baseline



OGC Web Services Phase 4 Testbed (2006)
Port Authority of New York / New Jersey, Emergency Operations
Center

Web based
integration of
geospatial data from
multiple distributed
sources

Discovery, tasking,
access and
integration of real-
time sensors and
sensor data- fixed
and mobile sensors

Standards-based
Decision Support Services
available to support
Actionable Situational
Awareness

Fusion of Building
Information Models
and other engineered
information



Compliance Testing & Certification



<http://www.opengeospatial.org/resource/products>

1) Select a specification

City Geography Markup Language (CityGML) Encoding Standard v.1.0.0

OpenGIS City Geography Markup Language (CityGML) Encoding Standard 1.0.0

2) Jump to Organization -

Bentley Systems Inc.	
Product Name	OGC Spec
Bentley Map v8i	GML 2.1.2, GML 3.1.1, GMLsf 1.0.0, 1.0.0

ESRI	
Product Name	OGC Spec
ArcGIS 9.3	WMS 1.3.0, WMS 1.1.1, WMC 1.0, WCS 1.1.0, WCS 1.0, SLD 1.0, GML 2.1.2, GML 3.1.1, GMLsf 1.0.0, CAT CS/W 2.0.1, CAT 2.0.2

interactive instruments GmbH	
Product Name	OGC Spec
XtraServer 3.2	GML 2.1.2, WMS 1.1.1 (compliant) , Filter 1.0, GML 3.1.1, Filter 1.1, 3.2.1, CityGML 1.0.0, UTDS-CityGML

1) Select a specification

Sensor Observation Service v.1.0.0

OpenGIS Sensor Observation Service 1.0.0

2) Jump to Organization -

1Spatial Group Ltd		
Product Name	OGC Spec	Type
OSCAR Sensor Observation Service (SOS) 1.0.0	SOS 1.0.0, SensorML Corr 1 1.01, OM 1.0	Server

52 North		
Product Name	OGC Spec	Type
52N OX-Framework 52N Sensor Observation Service	WMS 1.1.1, WMS 1.1, WMS 1.0, WCS 1.1.1 c1, WCS 1.0.0, SPS 1.0.0, SOS 1.0.0, SAS 0.9	Client
52N Sensor Observation Service	OM 1.0, OM Sampling 1.0, SensorML 1.0.0, SensorML Corr 1 1.01, SOS 1.0.0	Server

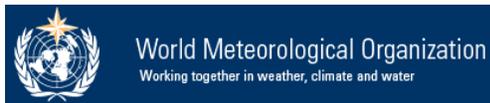
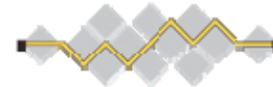




Coordination Across the Standards "Stack"

Alliance Partnerships

A Critical Resource for Advancing Standards



IJIS Institute



... and others

www.opengeospatial.org/ogc/alliancepartners



Standards Alliances / Coordination



- **GEORSS GML**
 - OASIS HAVE (Hospital Availability)
 - OASIS EDXL-DE
 - OASIS CIQ-xAL (eXtensible Address Language)
- **GML Simple Features 3.2.1**
 - OASIS Technical Note for EM TC standards (EDXL-DE, EDXL-RM)
 - Adopted for next version of Common Alert Protocol
- **IETF**
 - Using GML Geodetic (Coordinate) Encoding
- **ITU**
 - GEOSMS submitted to ITU for adoption

Alliance - OASIS



- Organization for the Advancement of Structured Information Standards
- OGC and OASIS have a formal MoU.
- Collaborating since 2004.
- Mostly involved in the Emergency Management, Customer Information, and SOA Architecture Technical Committees.
- OGC CTO Chairs the GIS/Geospatial Subcommittee of the Emergency Management TC

EDXL *Family of OASIS Emergency Messaging Standards*



- **Common Alerting Protocol (CAP 1.1)** - The original “model” for this standards process prior to “EDXL” nomenclature. An XML message for exchange of emergency alerts, notifications, and public warnings
- **Distribution Element (DE 1.0)** – Easy wrap and route any EDXL or other emergency information (XML and non-XML). “Address” the package in flexible ways to support intelligent routing by roles, geographic area, or keywords
- **Resource Messaging (RM 1.0)** - OASIS standard in November 2008. A suite of 16 standard XML formats for exchange of emergency resource information (equipment, supplies, people, and teams). Expedite all activities associated with resources needed to respond and adapt to emergency incidents.
- **Hospital Availability Exchange (HAVE 1.0)** - OASIS standard in November 2008. An XML message for exchange of hospital status, services and resources. Assists hospital coordination and routing of patients to facilities for care during emergencies
- **Situation Reporting (SitRep)** – Committee Draft expected October 2010. An XML message for exchange of situation / incident / event and response information. Increase effectiveness of preparation, response, and coordination providing a basis for incident management decision-making.

OASIS and GML



- HAVE – Hospital Availability: Currently uses GeoRSS GML
- CIQ-xAL (eXtensible Address Language): Currently uses GeoRSS GML
- OASIS EM TC just approved a profile of GML Simple Features 3.2.1 – Technical Note for use in all EM TC standards
 - EDXL-DE
 - EDXL-RM
- Next version of Common Alert Protocol will use same profile

OGC and OASIS standards



- OGC has tested and demonstrated Business Process Execution Language (BPEL) standard to organize OGC Web Services workflows.
- XACML is the core standard for the OGC GeoXACML standard
- ebRIM is used for a profile of Catalog
- Several OASIS authentication standards have been tested with OGC web interface standards
- KML uses CIQ-xAL

Collaboration with Internet Engineering Task Force (IETF)



- Participated in the GeoPriv Working group since 2004
 - www.ietf.org
- OGC Staff participated in the definition, content model, and encodings for the Location Object.
 - Civic
 - Geodetic
- The Geodetic (coordinate) encoding is a GML 3.1 application schema.
- Now also specified as a mandatory internet standard for the Next Generation 9-1-1 system

OGC and IETF Collaboration



- Presence Information Data Format (RFC 4119 and subsequent revisions)
 - The PIDF LO RFC extends PIDF to allow encapsulation of location information within a presence document.
 - (PIDF) is a common presence data format for CPP-compliant presence protocols, allowing presence information to be transferred across CPP-compliant protocol boundaries without modification, with attendant benefits for security and performance.
- Why?
 - Without this standard, cannot provide sufficient Presence Service
 - Driving use case was emergency service calls (Enhanced 911)
- GeoPriv Working Group in IETF developed a GML **GeoShape** Application Schema for use in internet standards.
 - Approved as OGC Best Practices paper, December 2006
- Now a mandatory requirement for expressing location in a variety of internet standards (SIP, ECRIT, RADIUS).

OGC and NENA – US National Emergency Numbering Authority



- OGC Staff participating in several Next Generation 911 Working groups
 - NG – 911 is the next generation emergency calling and dispatch architecture (known as i3)
 - Designed to work with both landlines and the mobile, wireless world.
- PIDF-LO a key internet standard that is mandatory to implement
- The Data Modeling Working Group defined a GIS interchange data mode. The encoding is GML 3.2.1
- Another working group has specified Web Feature Service (WFS) as the mandatory interface for accessing feature data using the GIS model encoding.
- They are now interesting in OGC Geosync work

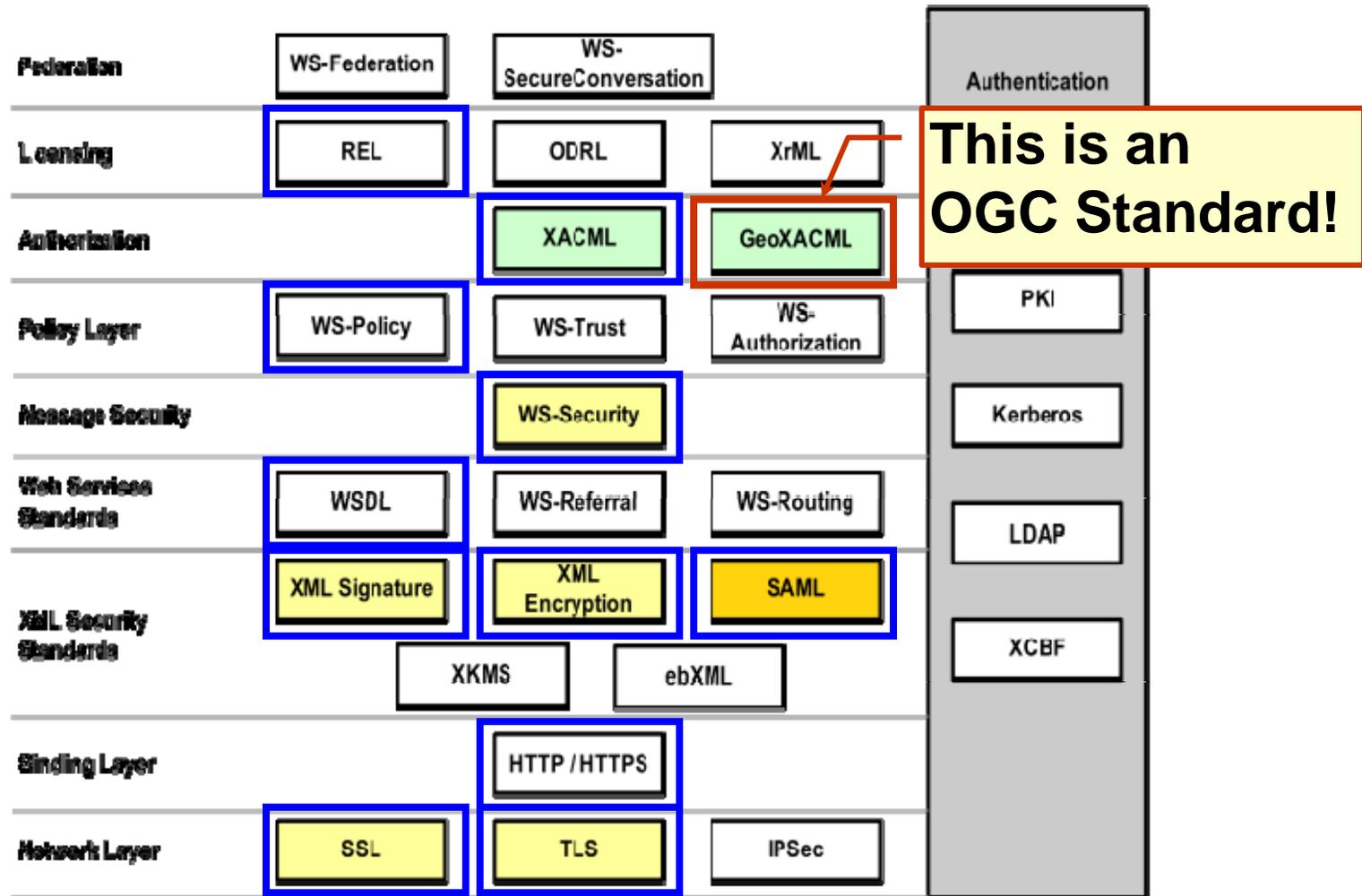
Data Sharing and Security



- Need: Securely exchange authentication information to allow authorized individuals, or processes operation on their behalf, to access, read, write, create or delete information.
- Service layer is on top of OGC Services (data/processing..)
- Security implementation requires combination of different technologies (SAML, SOAP, HTTPS, XACML / GeoXACML, Shibboleth, etc) to address ISO 10181 frameworks:
 - Access Control
 - Non-Repudiation
 - Security Audit and Alarms
 - Confidentiality
 - Integrity

Data Sharing and Security

OGC Experience



eXtensible Access Control Markup Language XACML



- Standard from OASIS
<http://www.oasisopen.org/specs/index.php#xacmlv2.0>
- Rule-based access control
 - Define conditions to permit or deny access
 - RBAC profile of XACML defines Role Based Access Control
- Defines the means for restricting access to XML encoded information
 - Policy language: <Rule>, <Policy>, <PolicySet>, ...
 - Data flow: Deriving an authorization decision
 - Message structure: Authorization decision request / response

GeoXACML – OGC Extension of XACML



- Enable Class-based restrictions: GML feature type(s)
 - Associated to all features of a given feature type
 - E.g.: All features of the type Building
- Enables Object-based restrictions: feature(s)
 - Associated to all features, selected by non-spatial characteristics – attribute(s) of the feature
 - E.g.: All features of type Building, painted black
- Enables Spatial restrictions: geometry of feature(s)
 - Associated to all features, selected by spatial characteristics – geometry attribute(s) of the feature
 - E.g.: All features of type Building, within the administrative boundary of St. John's



Standards Process / Approach

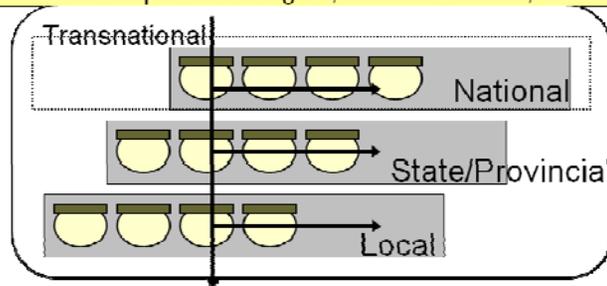
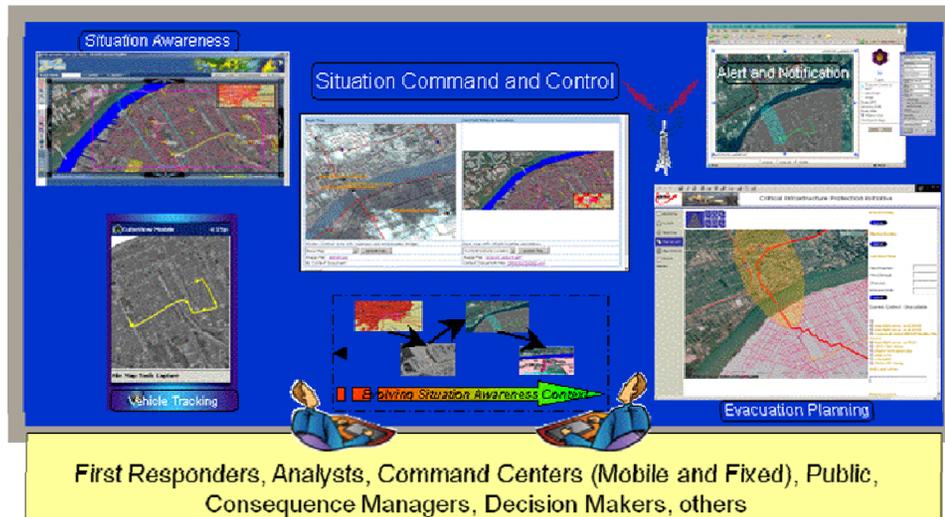
The Standards Consensus Process



- SDO Committees and Working Groups enable member focus on interoperability issues specific to communities of interest or areas of technology
- User involvement critical to success



Interoperability Program Testing, Prototyping and Validation



Critical Infrastructure Protection Initiative

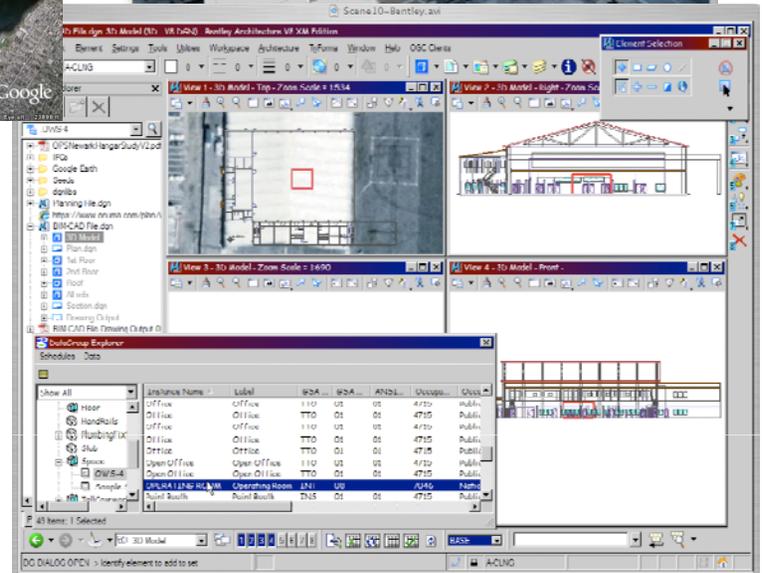
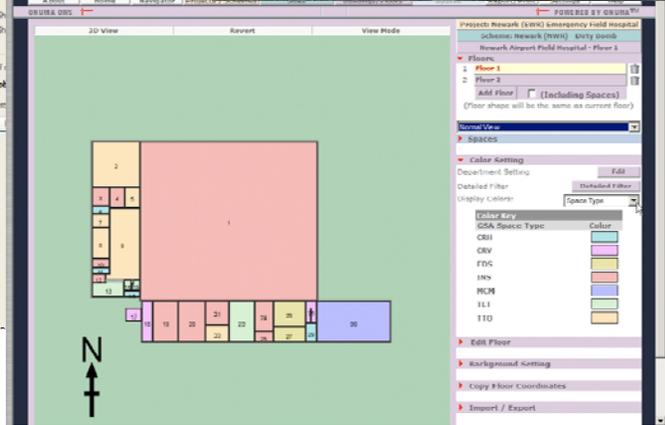
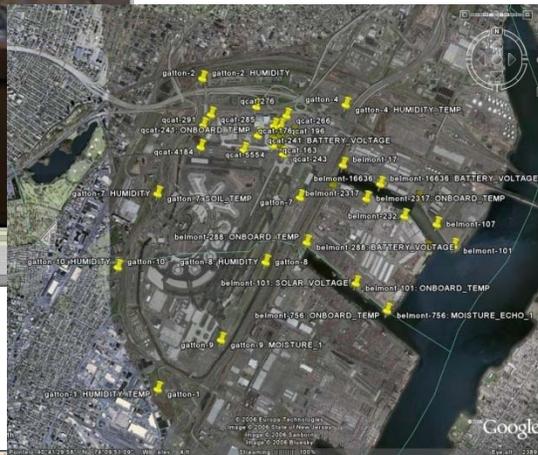
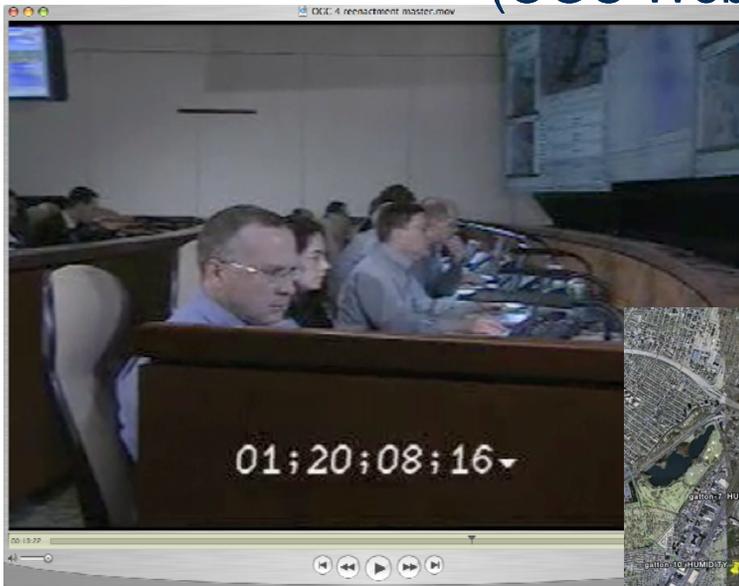
OGC®

- Testbeds, Pilots, Experiments and Plugfests
 - Join technology providers and users
 - Driven by user community requirements / scenarios
 - Deliver:
 - Tested and validated draft standards
 - Industry technology implementations
 - Best Practice recommendations
 - Live demonstrations to validate utility of standards in user context

Open Standards for Urban Monitoring / Operations (OGC Web Services Phase 4 Testbed)

Dirty bomb scenario in Port of NY/NJ

<http://www.opengeospatial.org/pub/www/ows4/index.html>



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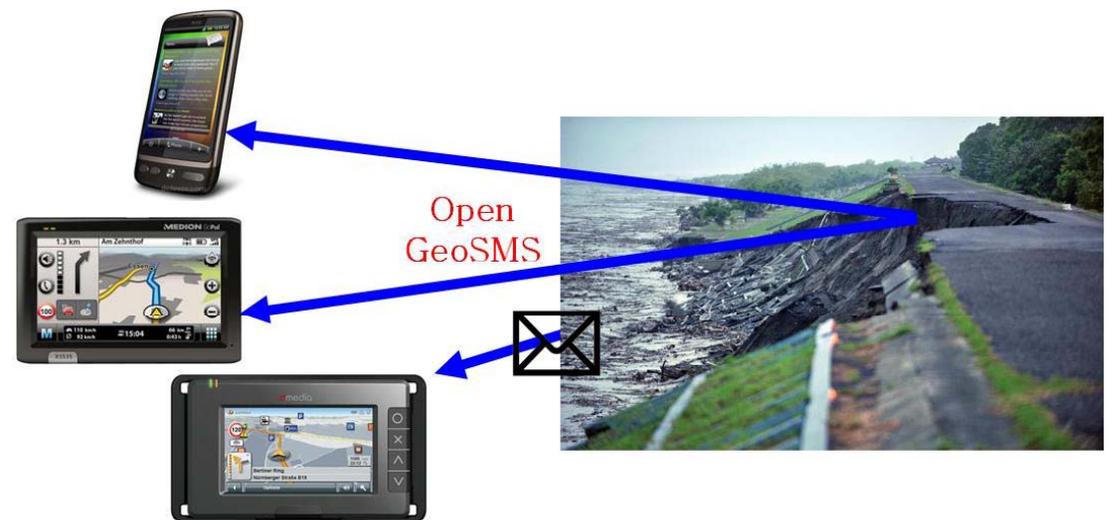
Areas of Current Focus OGC

Examples of Active Prototyping Between User
Community and Industry

Location Enabling SMS Messaging: GeoSMS



- Significant potential for many applications
- Characteristics
 - Multilingual
 - Multi-device
 - Harmonized with many existing applications
 - Incorporates relevant ISO standards
- Adopted in 2011



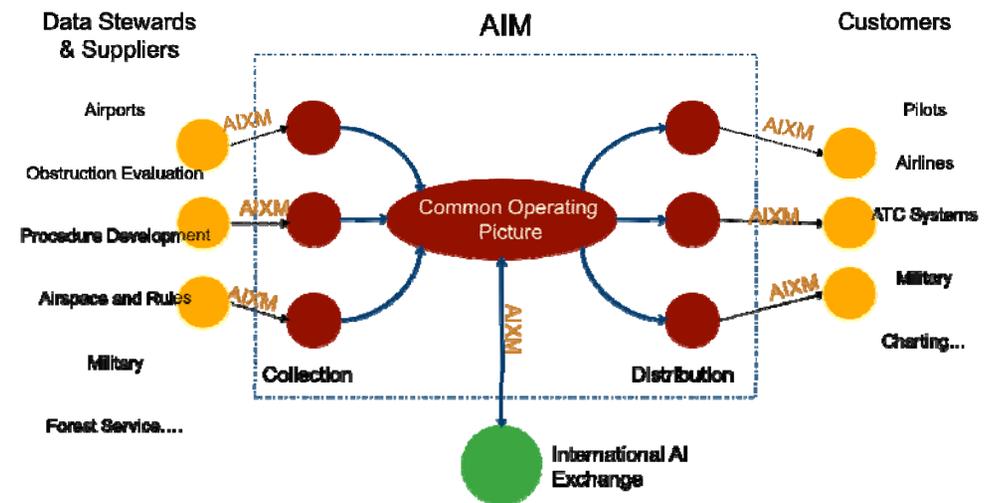
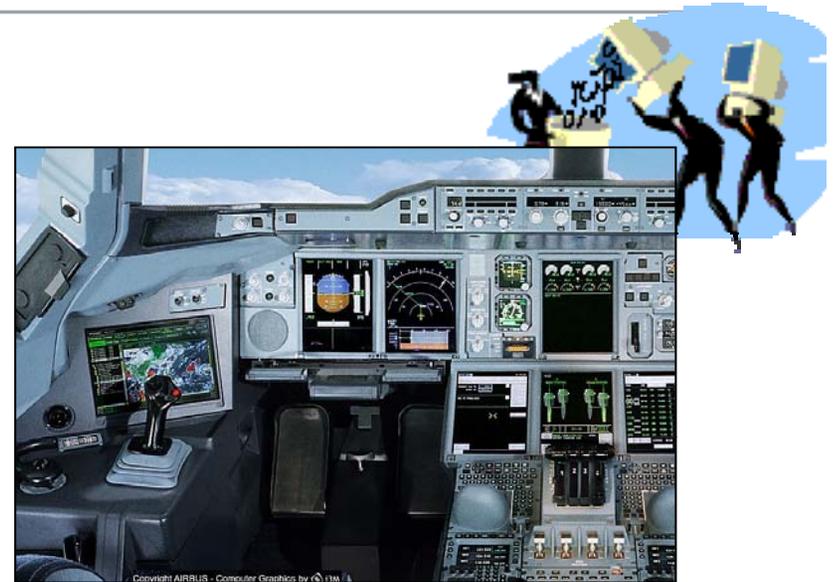
Emergency Real-time Alert or Update

Aeronautical Information Management (AIM)

(OGC Web Services Phase 6 & 7 Testbeds)

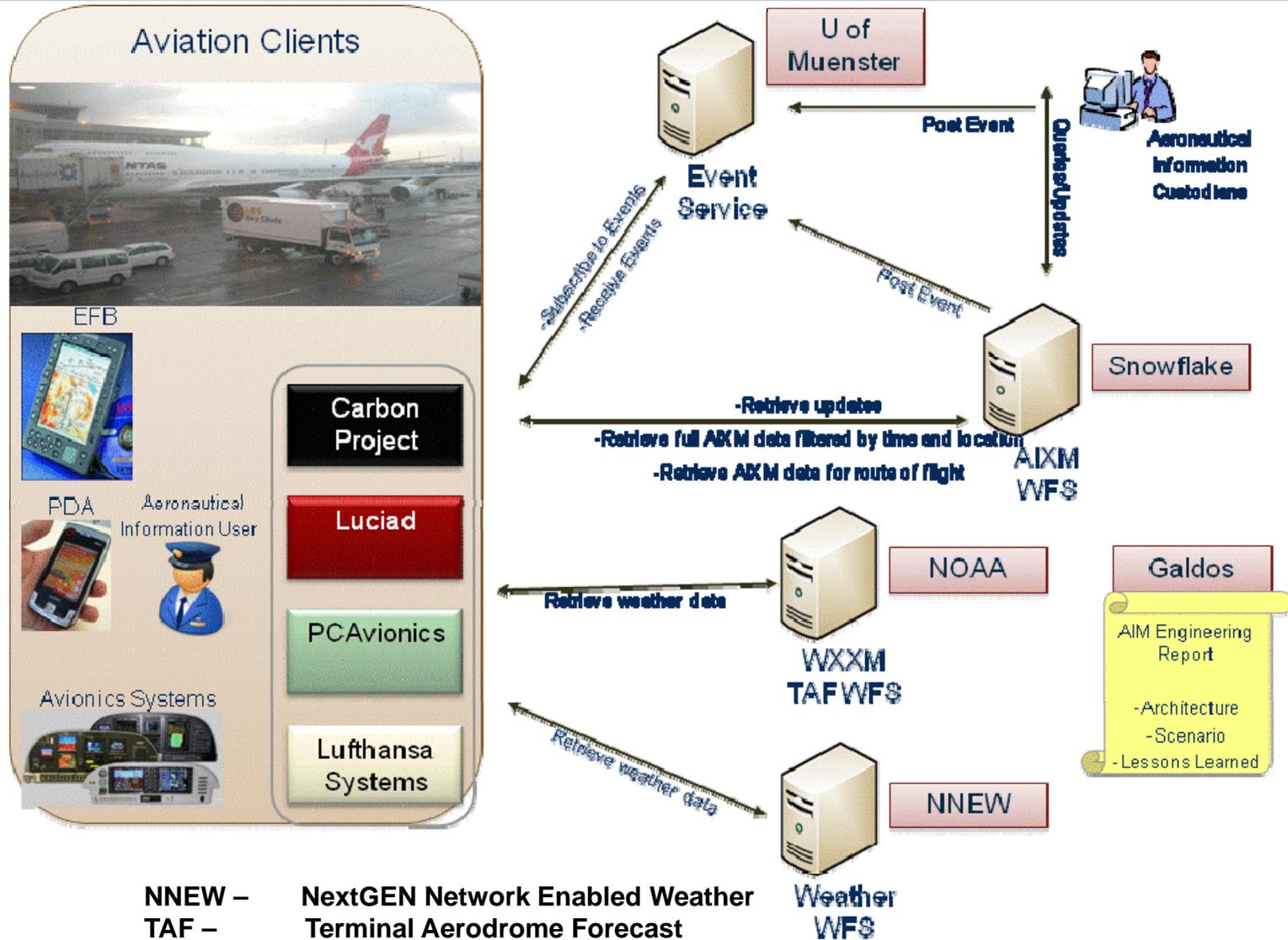


- Develop and test standards-based service-oriented architecture to support provision of aeronautical information directly to flight decks and Electronic Flight Bags (EFB)
- Support vision for Aeronautical Information Management
 - Interconnected systems with many actors and many users
 - Need for real-time information used in flight planning, navigation, rerouting, etc
 - Right information at right time at right place to right user
 - End-to-end management of information



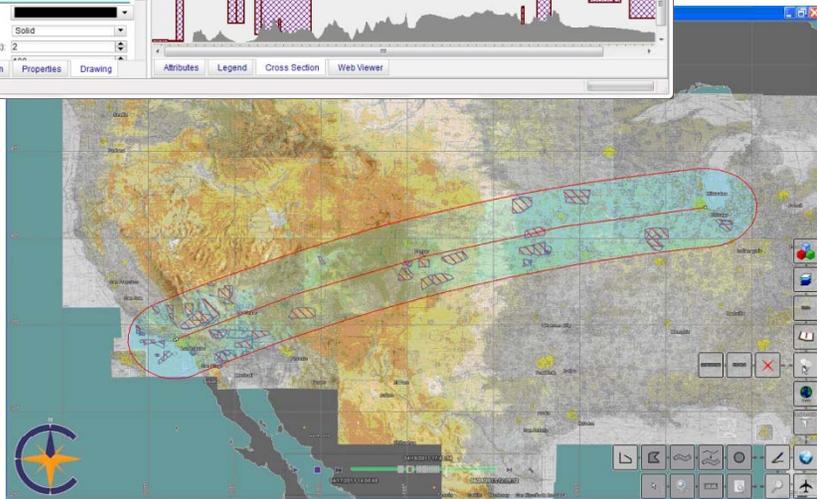
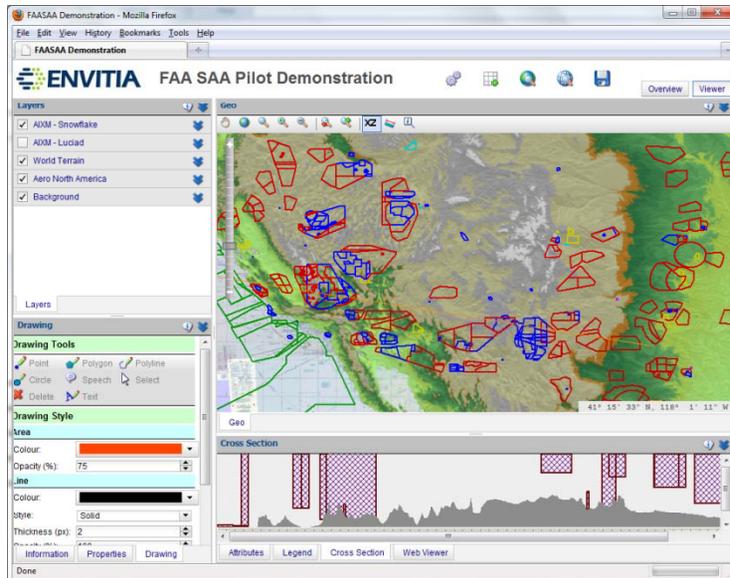
© 2011, Open Geospatial Consortium

OWS-6 Aeronautical Information Management Architecture



NNEW – NextGEN Network Enabled Weather
TAF – Terminal Aerodrome Forecast
WXXM – Weather Info. Exchange Model
WFS – OGC Web Feature Service

FAA Special Access Airspace (SAA) Pilot



SAA Pilot Demo page

<http://www.opengeospatial.org/pub/www/saa/index.html>

OGC Aviation Domain Working Group

<http://www.opengeospatial.org/projects/groups/aviationdwg>

More OGC Areas of Focus



Uncertainty
Data-Quality Sensor-Fusion
Decision-Fusion Cloud-Computing
Data-Preservation Mass-Market-Standards
Semantic-Mediation Embedded-Mobile-Sensors
Cross-Community-Interoperability Internet-of-Things
Compliance-Testing Water-Resources-Best-Practices
Earth-Observation-Best-Practices Aviation-Information-Management
Geosynchronization Modeling-and-Simulation
Augmented-Reality Geo-Rights-Management
Oblique-Imagery 3D-Portrayal Compliance-Certification
3D-Urban-Models Mobile-Internet
Indoor-Location
Linked-Data

NIEM Core

Inconsistent with International Standards



```
<xsd:element name="GeographicCoordinateLatitude"
type="nc:LatitudeCoordinateType" nillable="true" minOccurs="1" maxOccurs="1" base="nc:LatitudeCoordinateType" />
<xsd:annotation>
  <xsd:documentation>A measurement of the angular distance between
a point on the Earth and the Equator. </xsd:documentation>
</xsd:annotation>
</xsd:element>
```

```
<xsd:complexType name="LatitudeCoordinateType">
  <xsd:annotation>
    <xsd:documentation>A data type for a measurement of the angular
distance between
  a point on the Earth and the Equator.</xsd:documentation>
  <xsd:appinfo>
    <i:Base i:namespace="http://niem.gov/niem/structures/2.0"
i:name="Object"/>
  </xsd:appinfo>
</xsd:annotation>
  <xsd:complexContent>
    <xsd:extension base="s:ComplexObjectType"/>
  </xsd:complexContent>
</xsd:complexType>
```

```
<complexType name="ComplexObjectType" abstract="true">
  <attribute ref="s:id"/>
  <attribute ref="s:metadata"/>
  <attribute ref="s:linkMetadata"/>
</complexType>
```

Opportunity for Greater SDO Involvement



Scope of IEPDs



IEPDs contain design specifications for an information exchange but may not include supplementary information such as implementation decisions.

IEPDs do

- Include the XML schemas that define the XML message structure
- Contain standardized artifacts that document an information exchange
- Have a defined development methodology (IEPD Lifecycle)
- Ease the documentation process for reuse



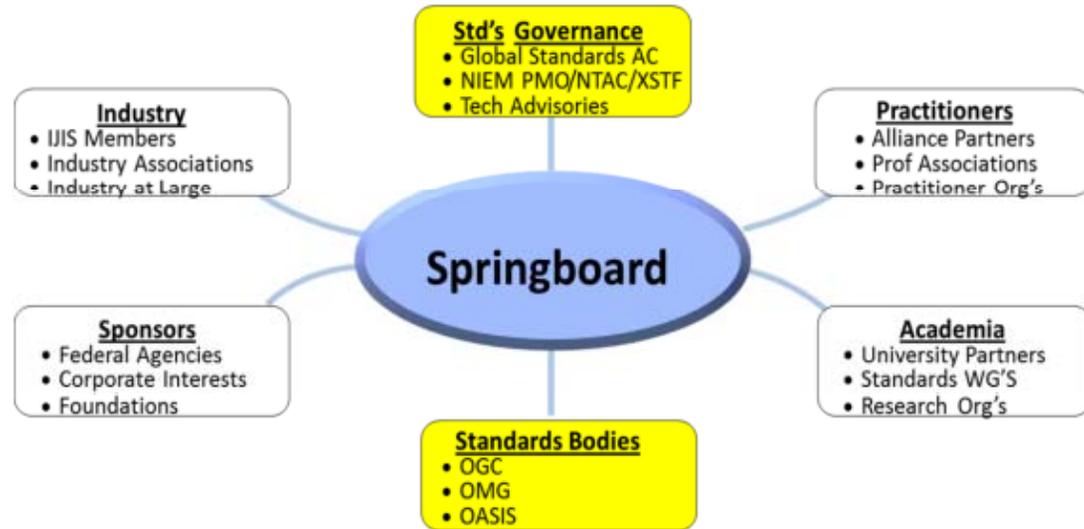
IEPDs do not

- Specify how exchange data is physically transferred between entities
- Describe an interface or Interface Control Document (ICD)
- Specify any technical information outside of the message structure



Governance / Process Opportunity

IJS SpringBoard



Engineering Reports – Reference Implementation – Best Practices

Source: <http://www.ijis.org>

Some Important Questions for Discussion



- How might we further improve interoperability / sharing through greater user involvement with the SDO community?

- How might we improve collaboration between SDO's on common goals of the community?

Summary



- Location is a critical underpinning of the information sharing
- A comprehensive framework of open geospatial and sensor standards have been advanced by industry to establish consistent, effective handling of location across the community
- Prototyping and piloting is key to success
 - Collaboration between Users, Industry, Academia, SDOs
 - IJIS SpringBoard offers a platform
- Greater user involvement in the SDO process