



# **Earth Science data access and analytics in OGC Testbeds**

**ESIP Winter Meeting – January 2016**

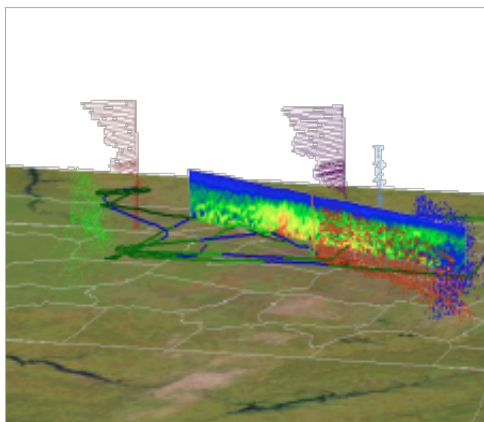
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# The OGC Mission

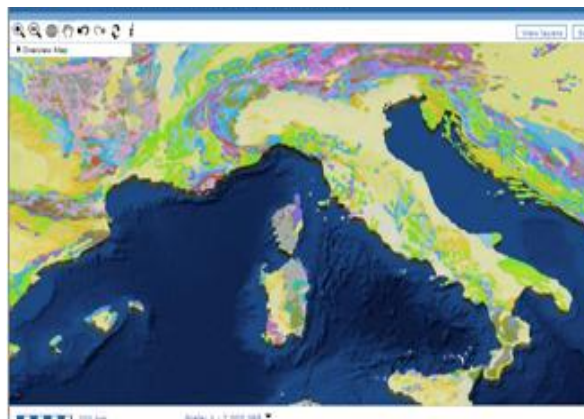


*Global forum for collaboration of developers and users of spatial data products and services*

*Advance development of international standards for geospatial interoperability.*



Source: Space Time Toolkit



Source: One Geology



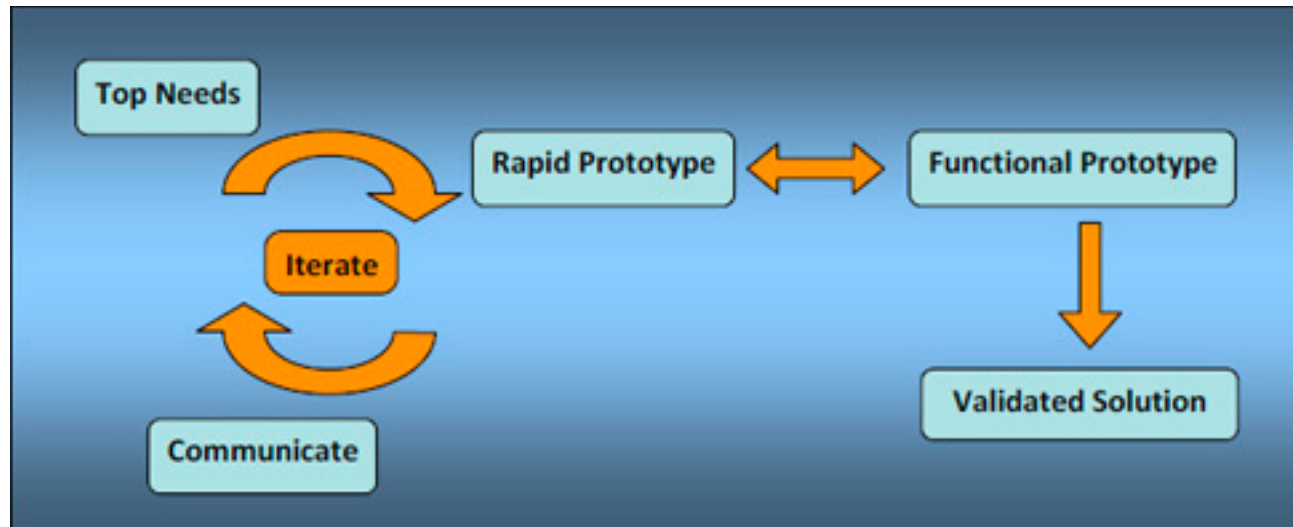
Source: 3d Stadtmodell Berlin

# Innovation through prototyping



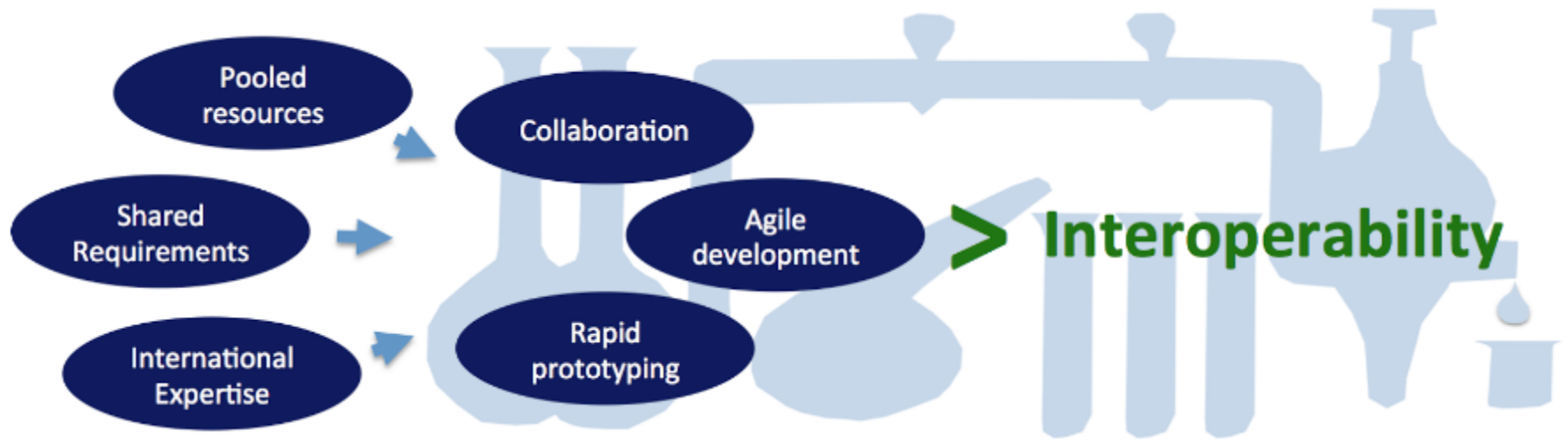
As a rule, the more prototypes and prototyping cycles per unit of time, the more technically polished the final product.

Serious Play, M. Schrage



**Agile, Scrum Iterative, Evolutionary Development**

# OGC Interoperability Program



# OGC Interoperability Program



## COLLABORATION

- *Aligns technology users and providers to work collaboratively*

## INNOVATION

- *Agile development environment to develop, test, and validate standards under marketplace conditions and foster innovation in the community*

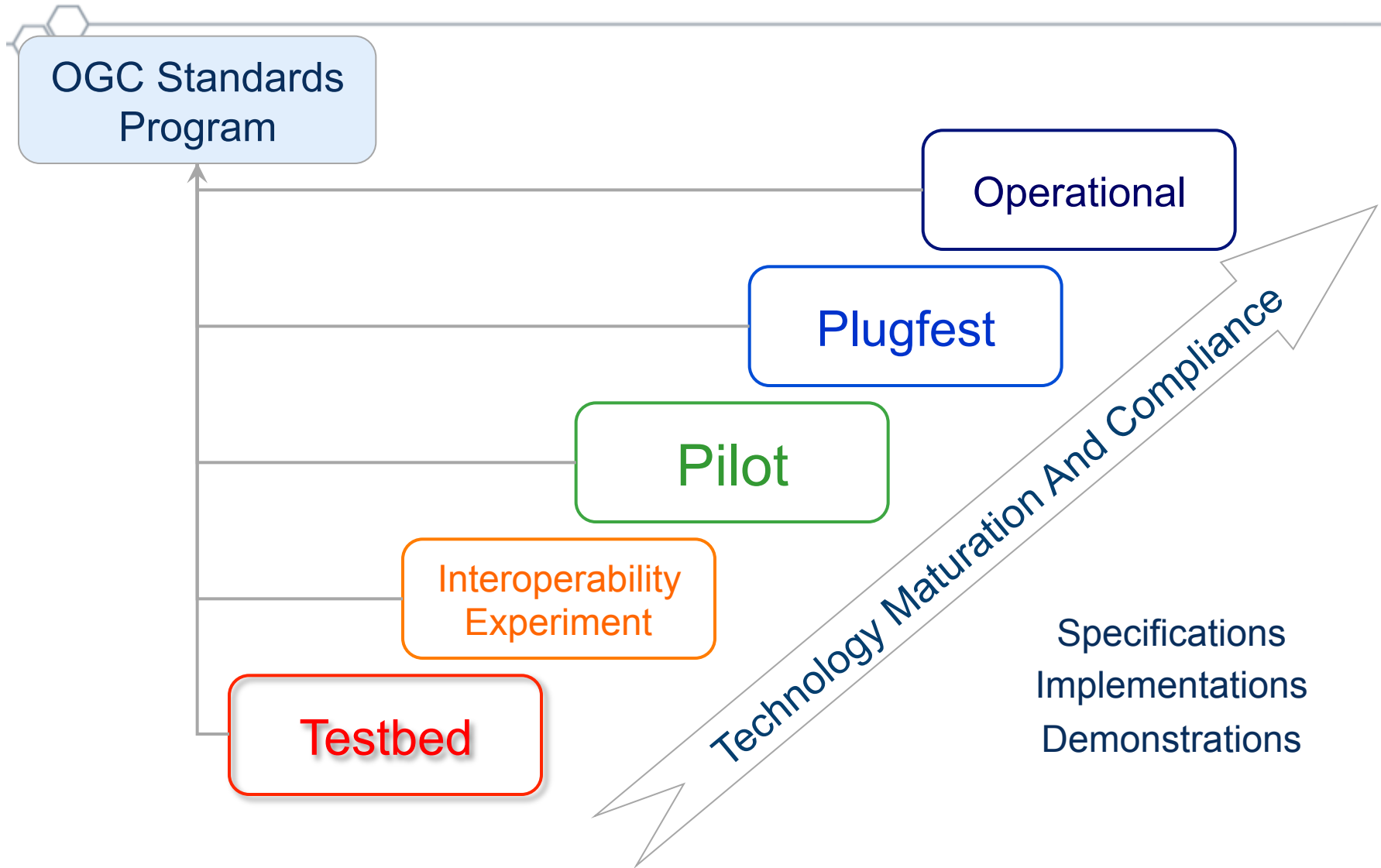
## SHARED COSTS

- *Effective way to share the costs of developing well-crafted standards that provide concrete foundations for future enterprise architectures*

## REPEATABLE PROCESS

- *Repeatable process for building & exercising private-public partnerships to drive global trends in technology and interoperability*

# The Interoperability Program Continuum



Types of Interoperability Program Initiatives



# Office of Science and Technology Policy

THE WHITE HOUSE  
Office of Science and Technology Policy

FOR IMMEDIATE RELEASE

December 9, 2014

## **FACT SHEET: Harnessing Climate Data to Boost Ecosystem & Water Resilience**

*"We're going to have to all work together in the years to come to make sure that we address the challenge and leave this incredible land embodied to our children and our grandchildren in at least as good shape as we found it." – President Barack Obama, Remarks on the California Drought, February 14, 2014*

In March 2014, the Obama Administration launched the Climate Data Initiative, unleashing troves of open government data about our climate and calling on America's innovators to leverage data in ways that can make our Nation's communities and businesses more resilient to climate change.

To date, an array of datasets focused on the resilience of our coasts and America's agricultural sector have been made available on [climate.data.gov](http://climate.data.gov) and a host of collaborators across Federal agencies and in the nonprofit, philanthropic, and private sectors have stepped up, committing to leverage their resources, expertise, and technical capabilities to turn these data into products and services that can assist people on the ground.

Today, the Administration is making a new tranche of data about ecosystems and water resilience available as part of the Climate Data Initiative—including key datasets related water quality, streamflow, land cover, soils, and biodiversity.

In addition to the datasets being added today to [climate.data.gov](http://climate.data.gov), the Department of Interior (DOI) is launching a suite of geospatial mapping tools on [ecosystems.data.gov](http://ecosystems.data.gov) that will enable users to visualize and overlay datasets related to ecosystems, land use, water, and wildlife. Together, the data and tools unleashed today will help natural-resource managers, decision makers, and communities on the front lines of climate change build resilience to climate impacts and better plan for the future.

To continue momentum under the Climate Data Initiative, the Obama Administration is today renewing its call to America's private-sector innovators to leverage open government data and other resources to build tools that will make U.S. ecosystems and water resources more resilient to climate change. In response to this call, today's launch includes a number of commitments by Federal agencies and private-sector organizations to combat climate change and support ecosystem and water-resource resilience through data-driven innovation.

**NASA. Climate Resilience Data Challenge.** With over \$35,000 in prizes, NASA, in partnership with United States Geological Survey (USGS), will host the Climate Resilience Data Challenge — an effort to spur data innovation in support of resilience in communities

<http://www.whitehouse.gov/sites/default/files/microsites/ostp/cdi-ecosystems-12-9.pdf>

## OGC Commitment to OSTP

- OGC enables open access to climate change information using open standards
- “Testbed 11, will integrate spatial information needed when a population is displaced due to coastal inundation.”

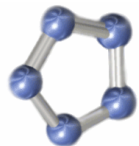
# Testbed 11 Sponsored by



- European Organization for the Safety of Air Navigation (EUROCONTROL)
- Land Information New Zealand (LINZ)
- National Aeronautics and Space Administration (NASA)
- National Geospatial-Intelligence Agency (NGA)
- Program Manager, Information Sharing Environment (PM-ISE)
- UAE Ministry of Interior Abu Dhabi Police GIS Center for Security (UAE ADP-GIS SC)
- UK Defense Science and Technology Lab (UK-DSTL)
- US Geological Survey (USGS)



# Testbed Participants



The Carbon Project



Secure Dimensions



# Interoperability Program (IP) Team



**Terry Idol**  
**OGC Executive Director,**  
**Interoperability Program**



**Lew Leinenweber**  
**OGC Testbed 11**  
**Initiative Director**



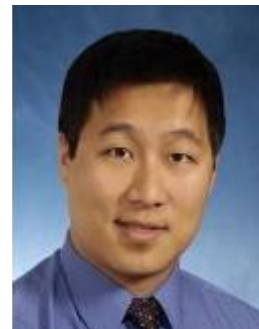
**Luis Bermudez**  
**OGC Executive Director,**  
**Compliance & E-Learning**



**Ingo Simonis**  
**UCR Architect**



**Josh Lieberman**  
**CCI Architect**



**Charles Chen**  
**Aviation Architect**



**Greg Buehler**  
**Geo4NIEM Architect**

# OGC Testbed 11 Threads & Tasks



## Urban Climate Resilience (UCR)

- Climate/Big Data processing - WPS
- Hi-Res Flood Model
- JSON/GeoJSON
- WFS-T with REST
- GeoPackage, GeoSync
- Georeferenceable Grid Harmonization
- And more...

## Cross-Community Interoperability (CCI)

- REST and SOAP
- JSON/GeoJSON
- Semantic Broker: Social Media, Linked Data, GeoSPARQL
- SPARQL for Symbology
- Compliance
- And more...

## Aviation

- NOTAM, AFX
- WFS Data Broker
- Semantics and Rules (SBVR)
- Validate: AIXM and D-NOTAM
- D-NOTAM Enrichment Service
- And more...

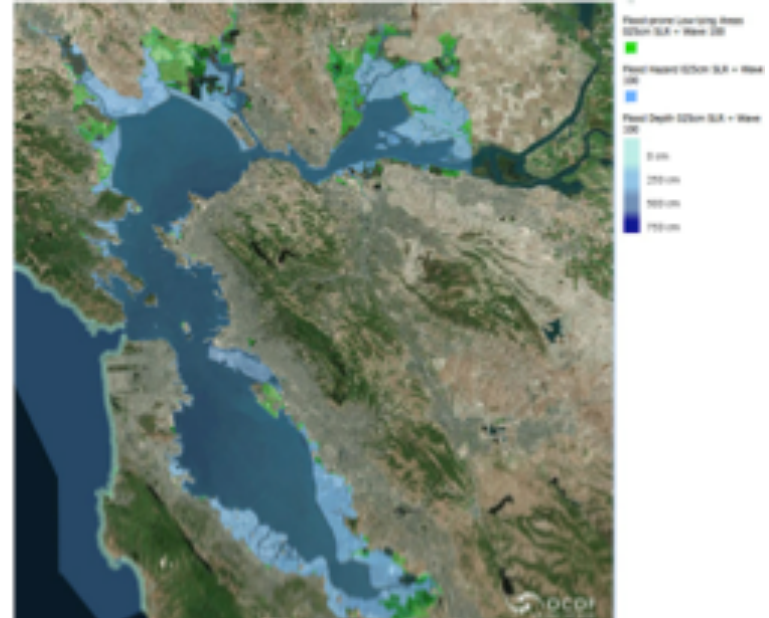
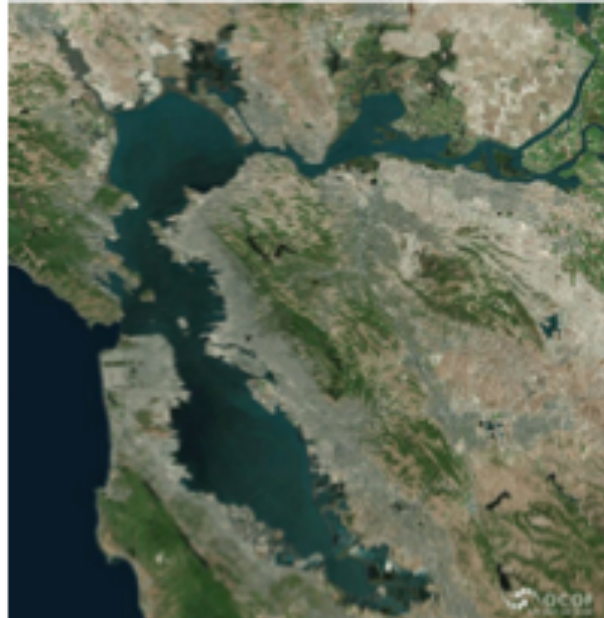
## Geo4NIEM and Security

- NIEM V3.0 IEPD Geoprocessing Round-Trip
- NIEM Tagging, Enhancements
- NIEM-GML Processing
- Security: Identification Authorization, Access
- And more...

# Urban Resilience with Coastal Inundation



## Coastal Inundation as a result of Sea-Level Rise – 2025 Projection



### Climate and Human Security:

- Social unrest with displaced population due to climate change
- Integrating spatial and non-spatial models of human geography
- OGC Web Processing Service (WPS) for model interoperability

# What to look for in the Testbed 11 video



- Simplified interaction with predictive models for anticipation of warnings and opportunities
- Data collection from network-challenged field operations to test models and fill in gaps in context
- Integrated security and open data together providing content and context to all customers
- Web-first strategy based on multi-vendor interoperability

***Unique innovation process to advance  
open access through standards***

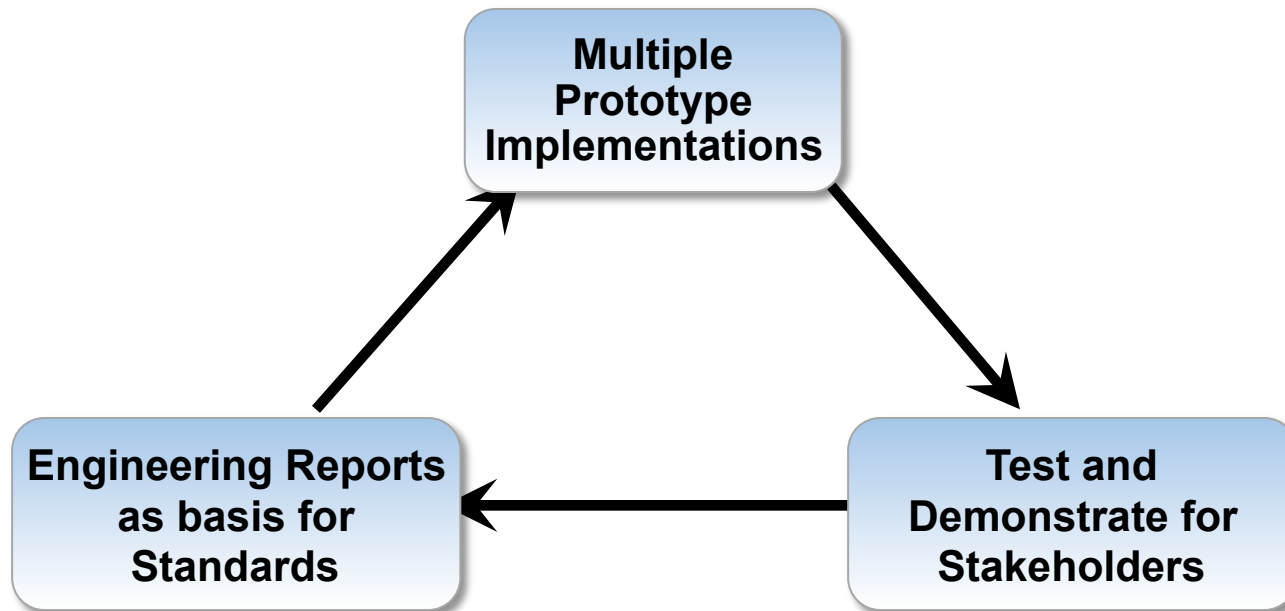
# Testbed 11 Video



**[Video available here: OGC Testbed 11 YouTube Playlist](#)**

# Iterative Development

## Yielding Tested Specifications



## Urban Climate Resilience Thread ERs

High Resolution Flood Information Scenario ER

Georeferenceable Grid Harmonization ER

Change Requests for Georeferenceable Grid

OGC OWS Context Change Requests

OGC GeoPackage Change Requests

Multi-dimensional GeoPackage Supporting Terrain & Routes

WFS-T Information Exchange Architecture ER

Reference Case Study of Multiple WFS-T Interoperability ER

Geopackaging ER

DGIWG GMLJP2 Testing Results ER



## Cross-Community Interoperability Thread ERs

REST Interface ER

REST Change Requests

Implementing JSON/GeoJSON in an OGC Standard ER

JSON/GeoJSON Change Requests

Linked Data and Semantically Enabling OGC Services ER

Linked Data for National Map NHD and Gazetteer Data ER

Catalogue Service Analysis and Recommendation ER

Incorporating Social Media in Emergency Response ER

Symbology Mediation ER

# Prototyping Versus Specifying



**Prototyping  
yielded products  
with roughly  
equivalent  
performance, but  
with about 40%  
less code and  
45% percent less  
effort.**

**The prototyped  
products rated  
some what lower  
on functionality  
and robustness,  
but higher on  
ease of use and  
ease of learning.**

**Specifying  
produced more  
coherent designs  
and software that  
was easier to  
integrate.**



Boehm, Gray, Seewald (1984)  
IEEE Transactions of Software  
Engineering, Vol 10, 1984

# OGC Standards from the Interop Program



- Of 42 OGC standards, 14 originated in an OGC-IP initiative
  - first draft of the OGC standard was written as a report in an OGC-IP Initiative.
- The 14 OGC Standards initiated in the OGC-IP are
  - Web Map Service (WMS)
  - Web Map Tile Service (WMTS)
  - Web Feature Service (WFS)
  - Web Coverage Service (WCS)
  - Web Coverage Processing Service (WCPS)
  - Geography Markup Language (GML)
  - Sensor Model Language (SensorML)
  - Sensor Observation Service (SOS)
  - Sensor Planning Service (SPS)
  - OWS Context
  - Styled Layer Descriptor (SLD) Profile of the WMS
  - Symbology Encoding (SE)
  - Filter Encoding
  - GeoPackage

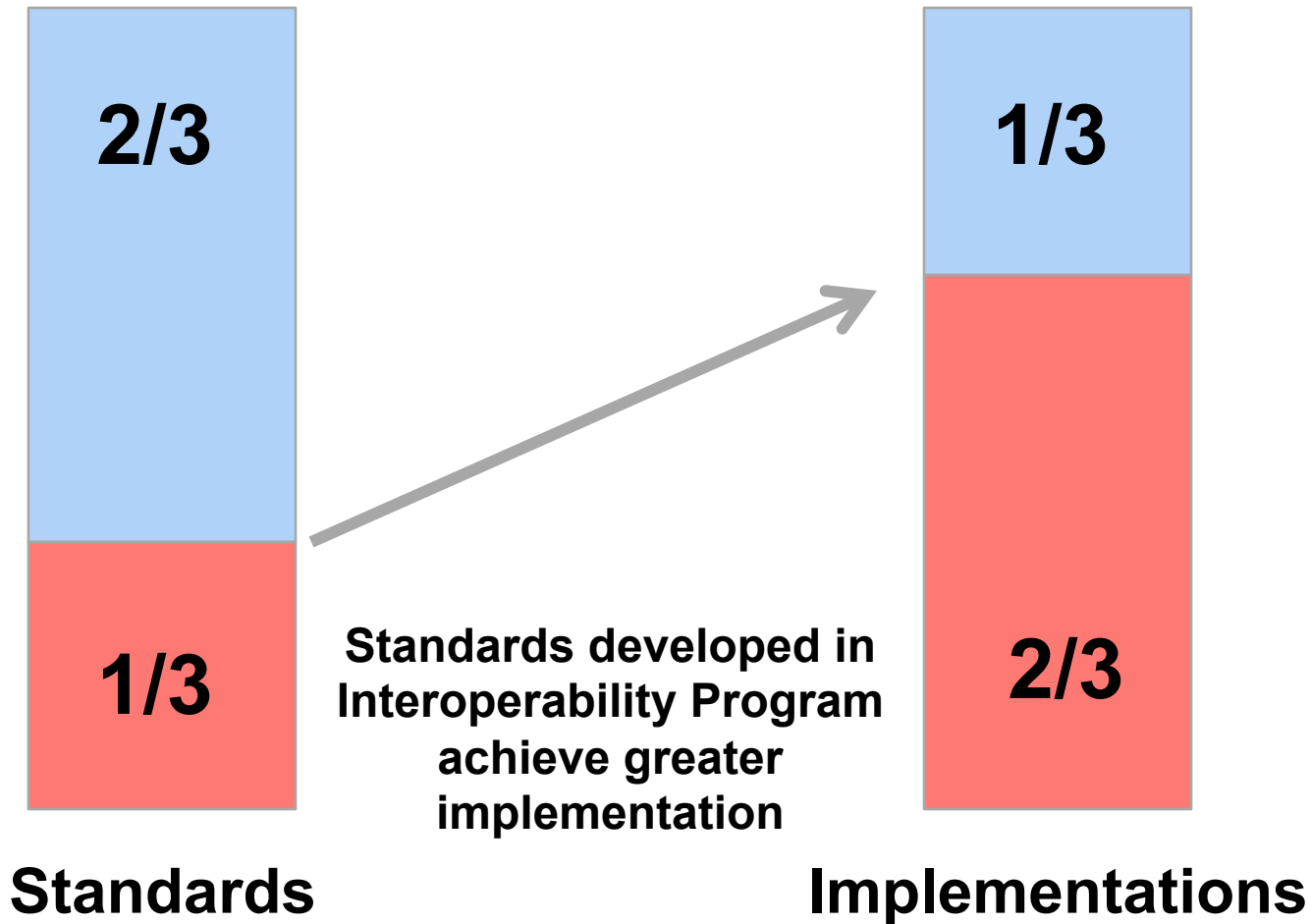
# Effectiveness of Prototyping to Standards



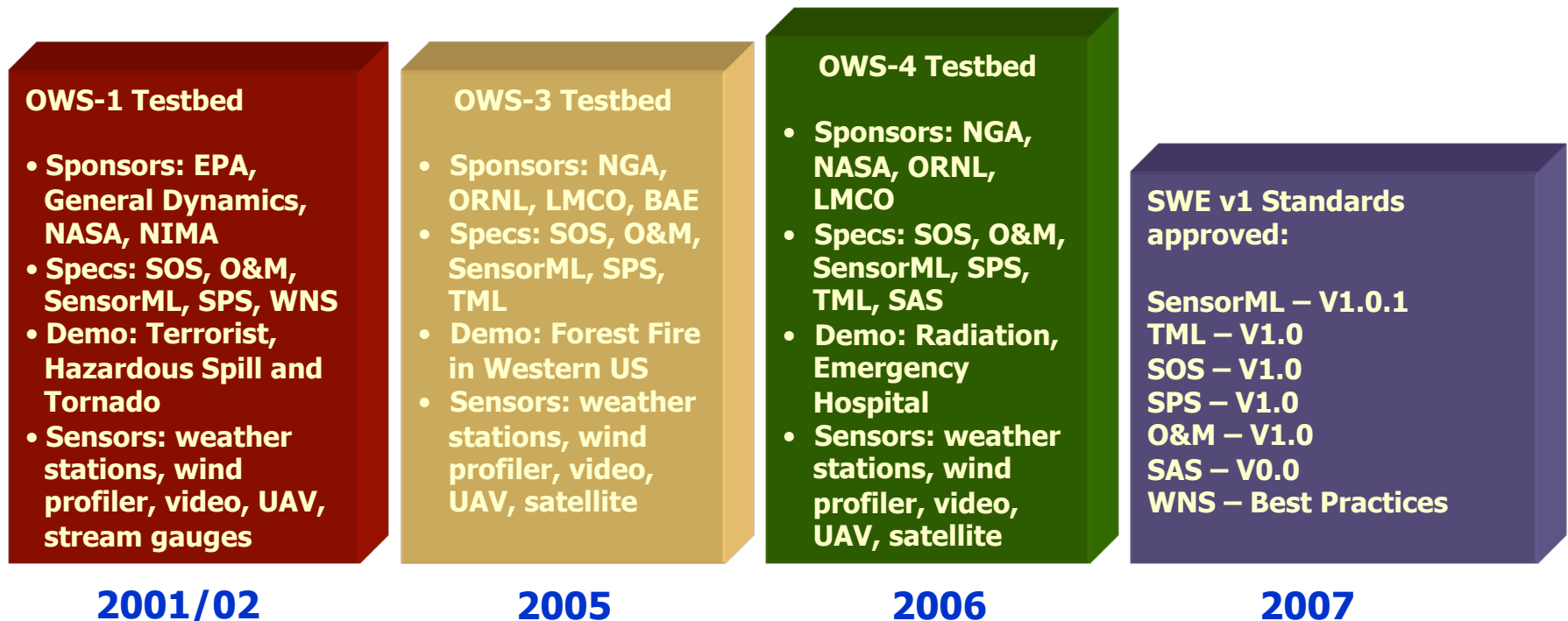
- One-third of OGC standards - those initiated in OGC-IP - account for 80% of the implementations and 67% of the compliant products.
- These statistics indicate the additive value of the OGC-IP process towards implementations of OGC standards.

	Implementing	Compliant
All OGC Standards	6653	784
14 OGC Standards Initiated in OGC-IP	5292	521
Percentage of all Implementations	80%	67%

# Effectiveness of Prototyping to Standards

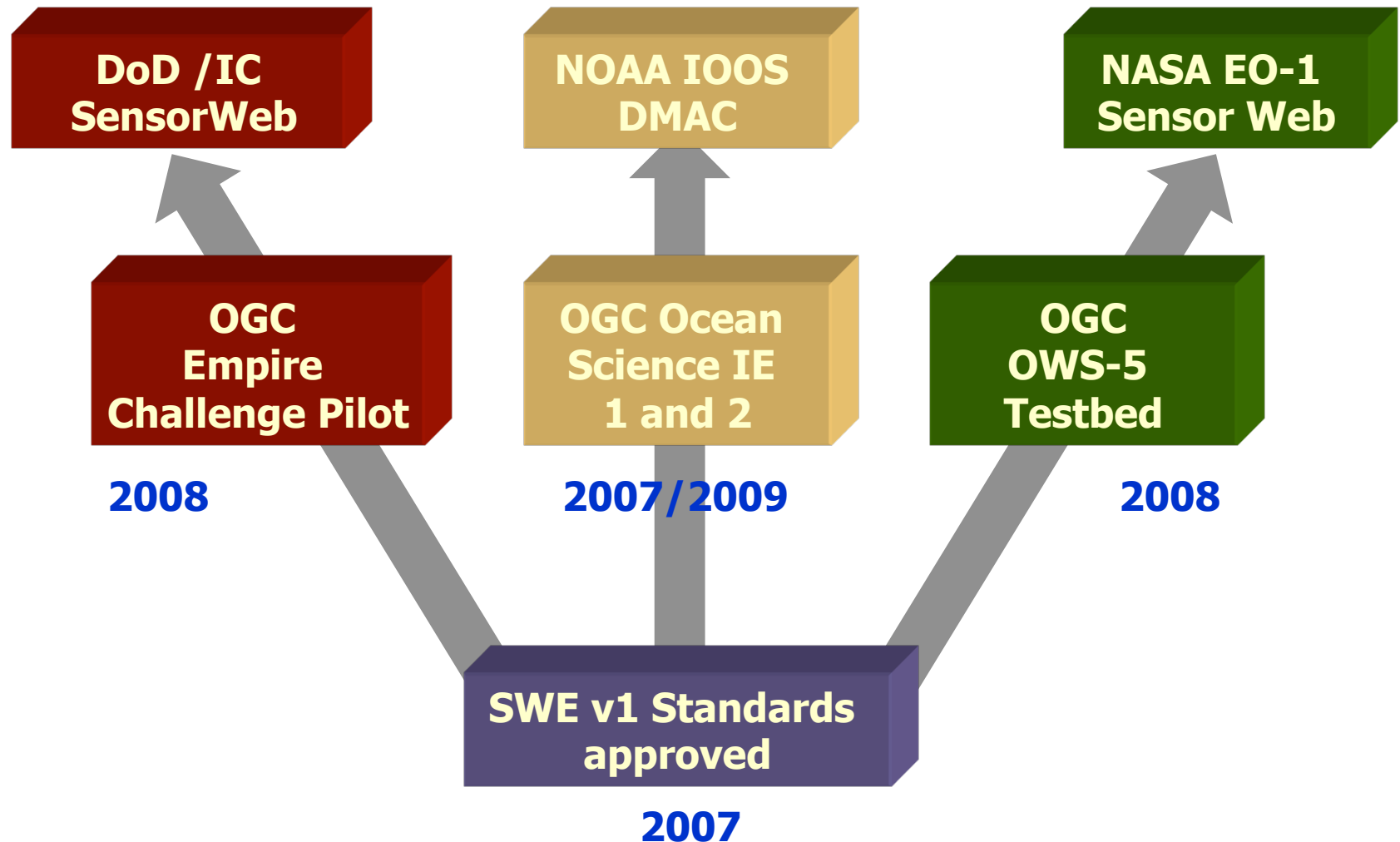


# OGC Testbed support of SWE Development

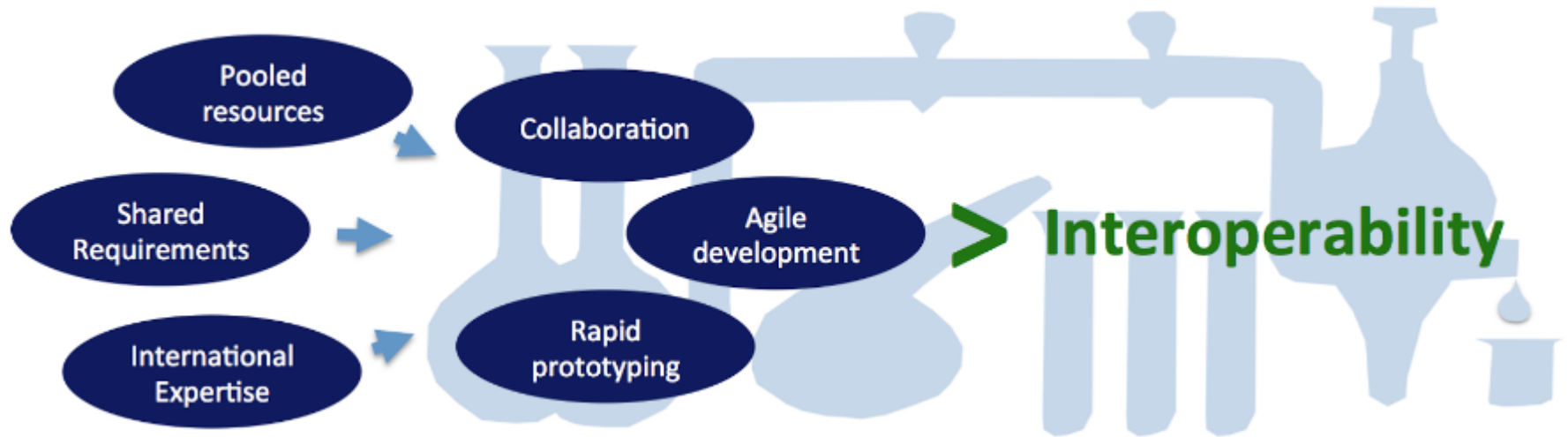


Source: M. Botts

# OGC IP influence on SWE deployments



# Join Testbed 12



## OGC's interoperability innovation lab

Contact Dr. Terry Idol, [tidol@opengeospatial.org](mailto:tidol@opengeospatial.org)  
Executive Director, OGC Interoperability Program  
Or

Dr. Scott Serich, Ph.D, JD, Testbed 12 Initiative Director  
[sserich@opengeospatial.org](mailto:sserich@opengeospatial.org)



# Testbed 12 Initiative



- Major Milestones

- 19-21 Jan.: Aviation Kickoff (Washington)
- First week of March: Non-Aviation Kickoff (Reston)
- December: Demonstration Event

- Sponsors

- NASA, USGS, NGA, UK-DSTL, Digital Globe, Eurocontrol, FAA,

- Threads

- **Large-Scale Analytics (LSA)**
- Linked Data and Advanced Semantics for Data Discovery and Dynamic Integration (LDS)
- Field Operations (FO), Command Center (CMD)
- Compliance Testing (CMP), Consolidation (CNS)
- Aviation (AVI)

# TB12 Large Scale Analytics (LSA) Thread



- Help investigators discover, retrieve, process, and visualize data in an optimal way
- Complemented by data provision aspects: including conversion of conceptual models into application models.
- Work-Items
  - Visualization of Earth Observation Data
  - Big Data and Tile Stores
  - Coverage Data Access and Analysis
  - Geospatial Imagery Quality Framework
  - Async. Service Interaction
  - Conflation and UML Shape Change
  - Clients

**WCS and  
OPeNDAP**

# Benefits of Involvement



## For Participants

### *Business potentials*

- Early insights and skill building
- Early visibility
- Early market deployment
- Direct influence
- Broaden market reach

## For Sponsors

### *Significant efficiencies*

- Ability to Determine Market Interest
- Accelerated process - workable interface specifications in 4-6 months
- Vendors test, validate and demonstrate interface integrity – Rapid time to market
- Leverage of other sponsor' funding to solve common/similar problems
- Significant ROI 2-3.5 overall (and as high as 25 for individual sponsors)

# For Details on OGC ...



## OGC Standards

- Freely available
- [www.opengeospatial.org/standards](http://www.opengeospatial.org/standards)

## OGC Innovation

- <http://www.opengeospatial.org/ogc/programs/ip>



## George Percivall

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@percivall



- Details on Testbed 11 flood model interoperability in ESIP session tomorrow:
- Session: Interoperability among Earth Observations and Earth Science Models
- Thursday 2:00 pm

