

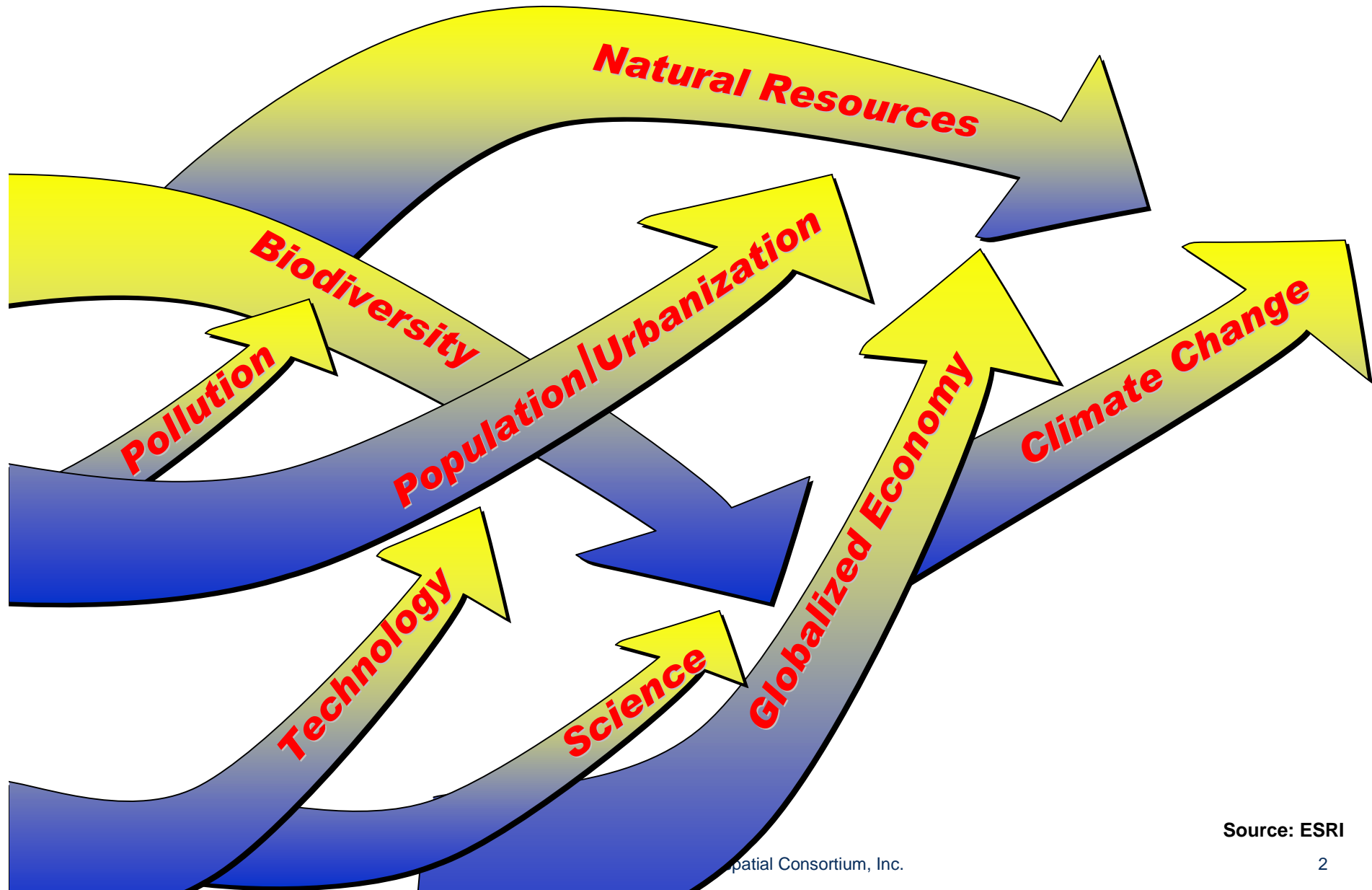
Toward interoperable information use across the geosciences

Presented 23 November 2009

Second Workshop on GIS/OGC Standards in Meteorology

Dr. David K. Arctur
Director, Interoperability Programs
Open Geospatial Consortium

How can we understand and communicate about all this?



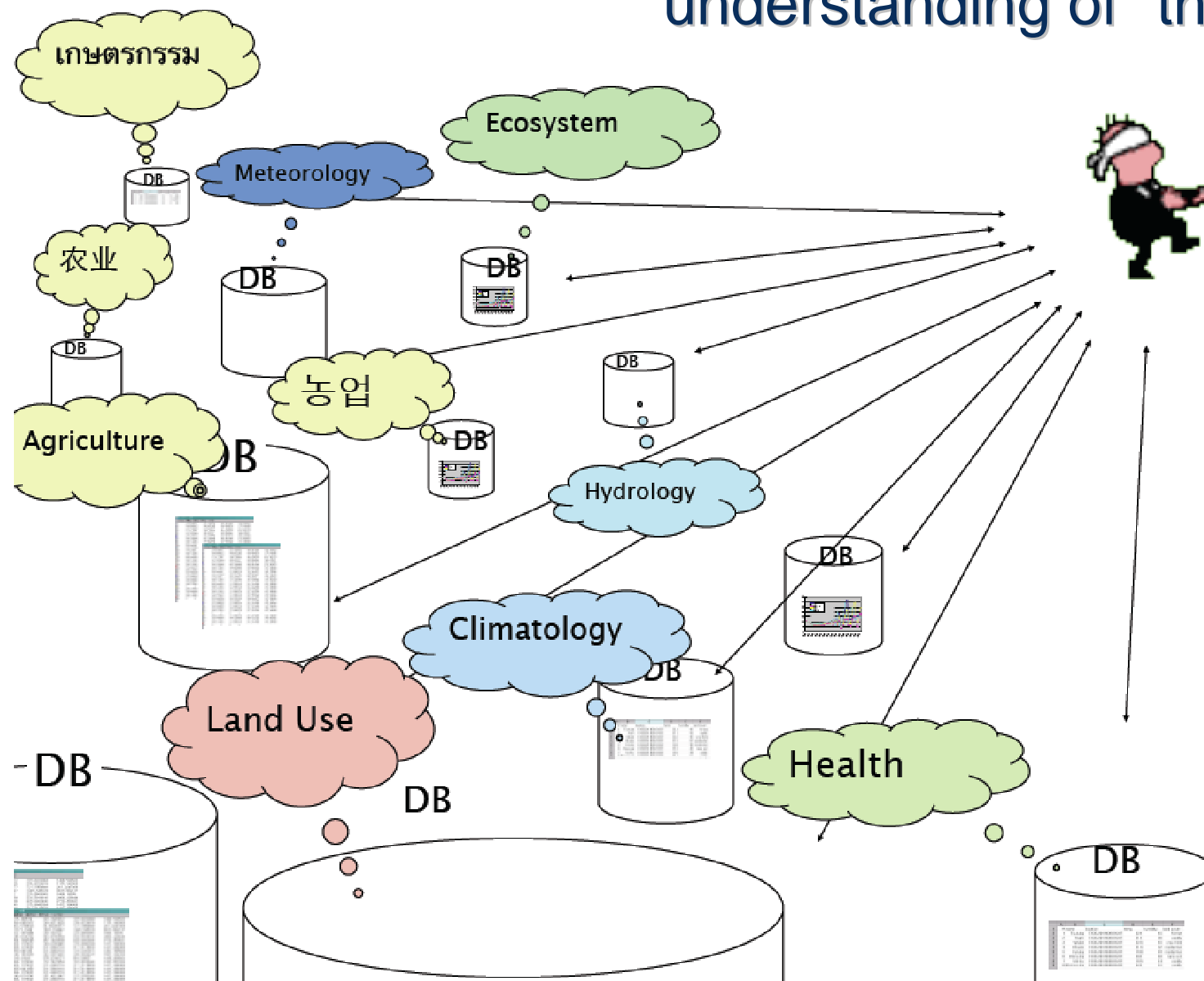
Source: ESRI

Meteorology is essential, and it's not just about the weather



- We **can't manage, much less improve** what's happening with these global issues **unless we KNOW what's happening**.
- We can't know what's happening without the ability to **share and make effective & combined use of interdisciplinary data sources, models, and processes**
- We need **interoperability of the knowledge and tools**, not just the data
 - This is complicated by the volumes of data being generated, by differing semantics, and institutional barriers

It's all interconnected, and we need better understanding of “the whole”



Source: The University of Tokyo

Getting There



- Working together across multiple disciplines, we can address these issues
- Each information community knows best how to define, collect, and use information within its frame of reference
- By working on open standards for information exchange, we can start to apply multi-disciplinary approaches to better understand and predict complex phenomena and their interactions

Why Open Standards?



- Rapidly mobilize new capabilities – plug and play
- Lower systems costs
- Encourage market competition
 - Choose based on functionality desired
 - Avoid “lock in” to a proprietary architecture
- Decisions to share information and services become policy decisions

What do we mean by “Open” Standard?

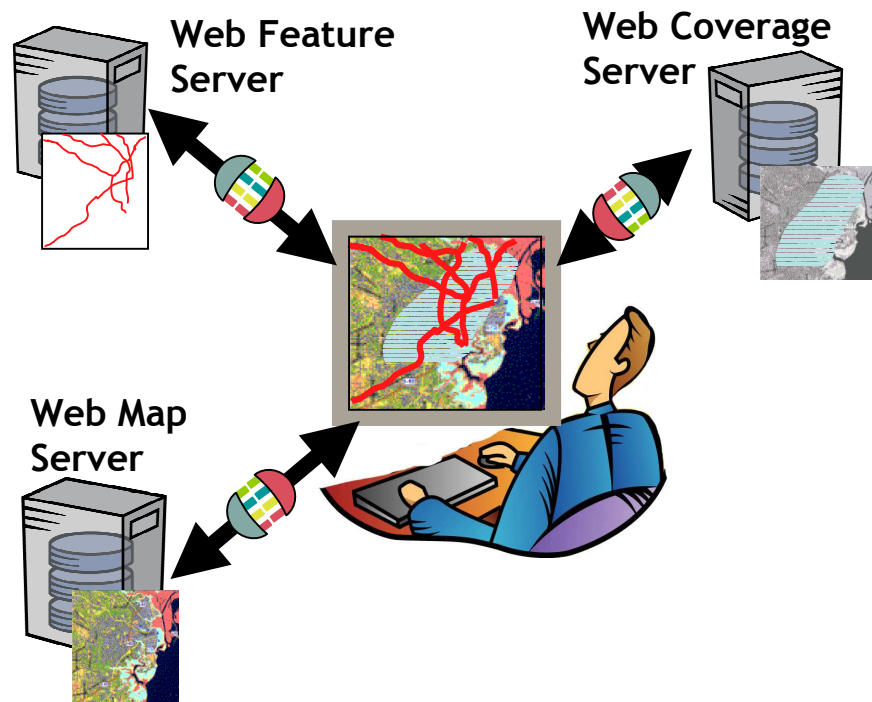


- Freely and publicly available
- Non discriminatory
- No license fees
- Vendor neutral
- Data neutral
- Agreed to by a formal consensus process

OGC Web Services (OWS)



Just as http:// is the dial tone of the World Wide Web, and html / xml are the standard encodings, the geospatial web is enabled by OGC standards:



Web Map Service (WMS)
Web Feature Service (WFS)
Web Coverage Service (WCS)
Catalogue (CSW)
Geography Markup Language (GML)
Web Map Context (WMC)
OGC KML
Others...

Relevant to geospatial information applications:

Critical Infrastructure, Emergency Management, Weather, Climate, Homeland Security, Defense & Intelligence, Oceans Science, others

OGC[®]

What is the OGC?



- **Open Geospatial Consortium, Inc. (OGC)**
 - **Not-for-profit, international voluntary consensus standards organization**
 - **Founded in 1994, incorporated in US, UK, Australia**
 - **385+ industry, government, research and university members**

OGC Mission

To lead in the development, promotion and harmonization of open geospatial standards ...

Liaison Open Standards / Organizations



- International Organization for Standards (ISO)
- World Wide Web Consortium (W3C)
- Digital Geospatial Information Working Group (DGIWG)
- OASIS
- Open Mobile Alliance (OMA)
- Internet Engineering Task Force (IETF)
- buildingSMART International / Alliance (bSi / bSa)
- IEEE Technical Committee 9 (Sensor Web)
- Web3D Consortium
- Others



Environmental Information Collaborations



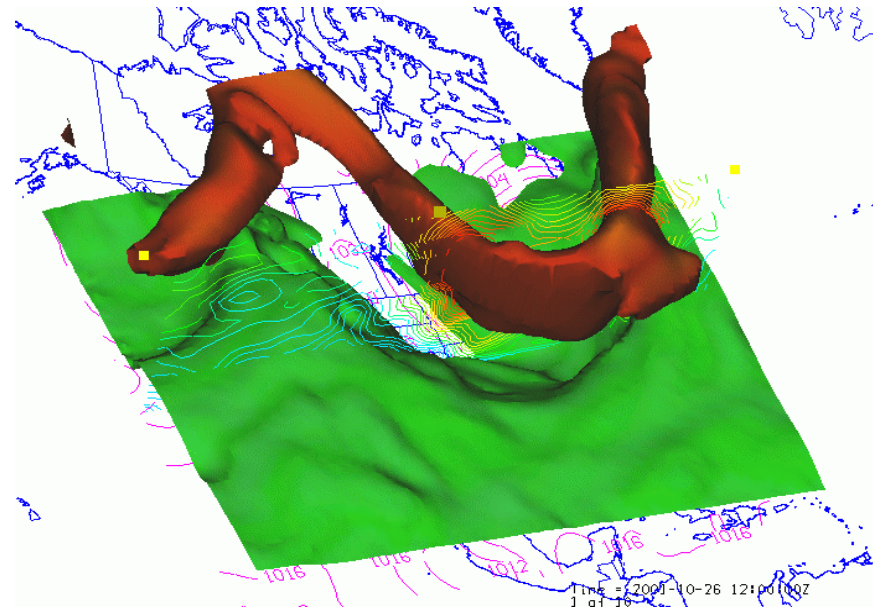
- **NCAR** – US National Center for Atmospheric Research
 - MoU with University Corporation for Atmospheric Research on behalf of NCAR established 2005
- **TDWG** – Taxonomic Data Working Group
 - MoU established 2006
- **WMO** – World Meteorological Organization
 - MoU is now signed
- **iEMSs** – international Environmental Modeling & Software society
 - MoU in process

OGC Interface to Geoscience Models



- Established geospatial interface with predictive models using Web Coverage Service (WCS) standard
- WCS Access to model outputs as 5D grids: parameters varying in three spatial dimensions with two time coordinates (model run time and forecast time)
- <http://www.opengeospatial.org/projects/initiatives/galeonie>

GALEON Interoperability Experiment Geo-interface to Atmosphere, Land, Earth, Ocean, NetCDF



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 Modelling 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>

Uncertainty Markup Language (UnCertML)

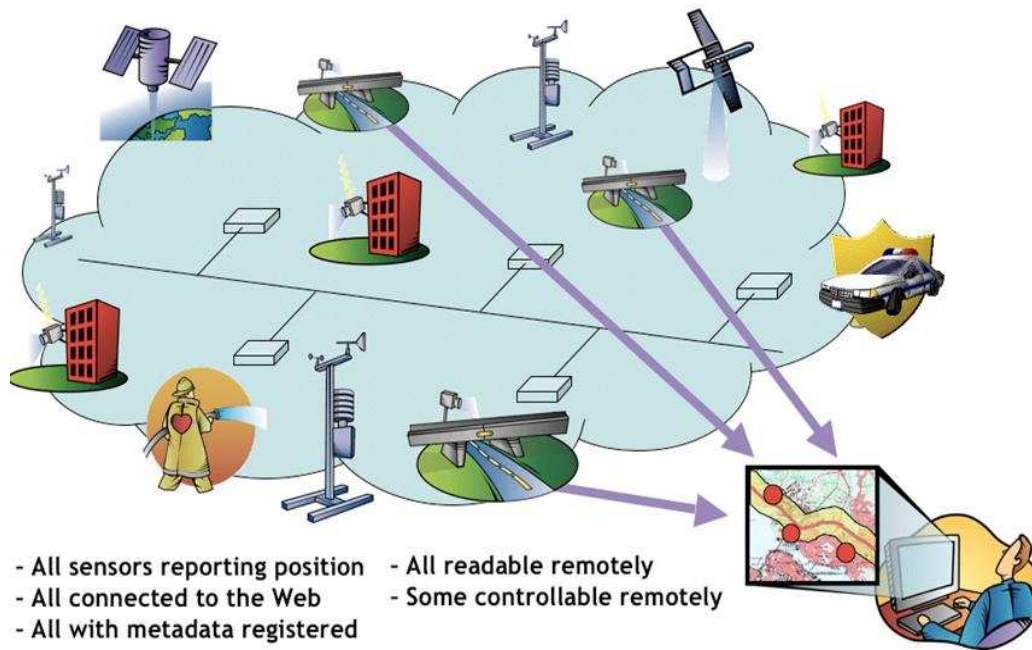


- XML schema for describing uncertain information
- Descriptive capabilities range from
 - Simple statistics, to more complex representations such as
 - Parametric distributions at each point of a regular grid, or
 - Jointly over the entire grid.
- Based on ISO/IEC guide to the expression of uncertainty in measurement (GUM)
- UnCertML available as an OGC Discussion Paper
 - Coordination with GML and SWE

Sensor Web Enablement (SWE)

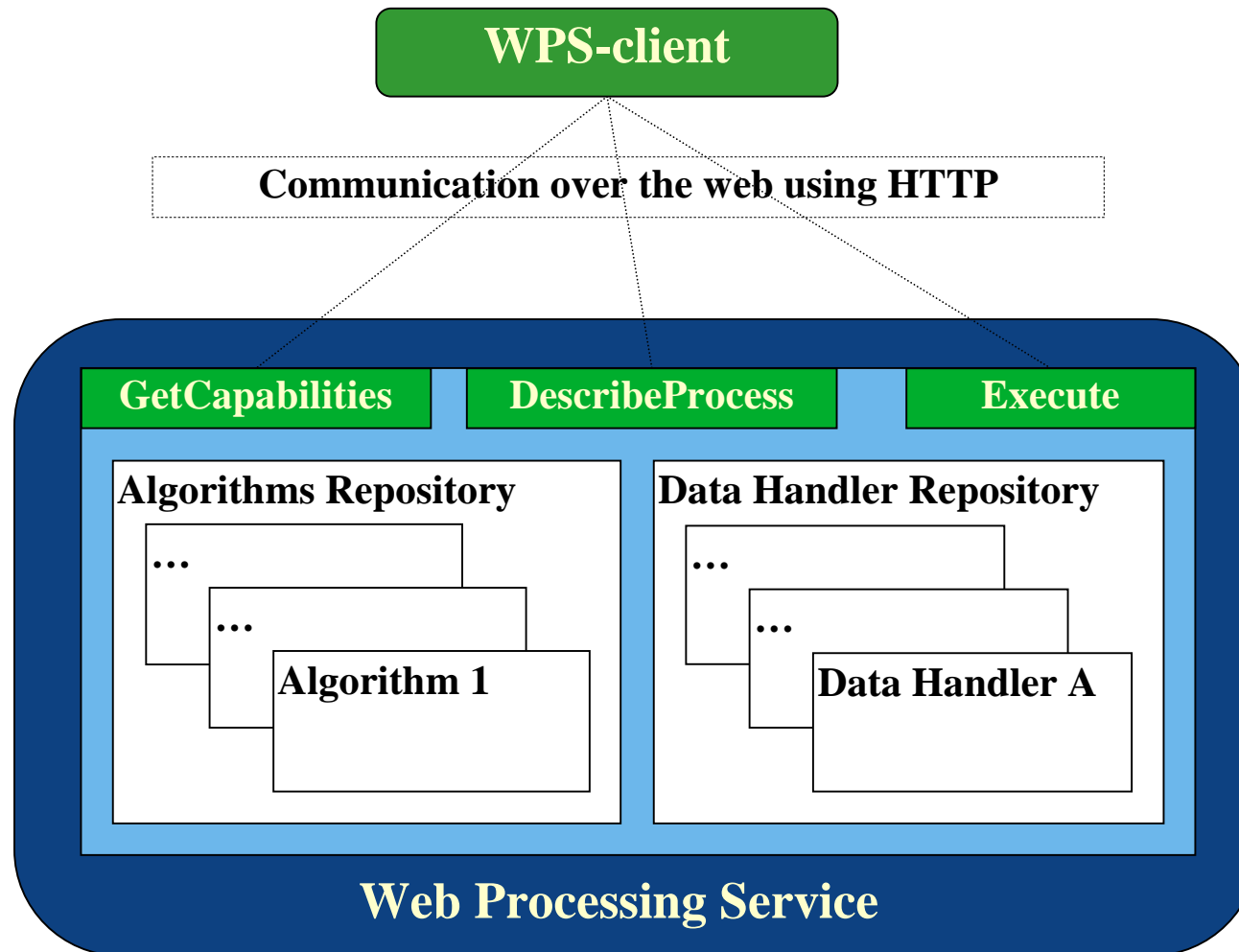


Enables discovery, access and application of real time sensor observations for enhanced situational awareness



- ✓ Sensor Model Language (SensorML)
- ✓ Transducer Markup Language (TML)
- ✓ Observations & Measurements (O&M)
- ✓ Sensor Planning Service (SPS)
- ✓ Sensor Observation Service (SOS)
 - Sensor Alert Service (SAS)
 - Web Notification Service (WNS)
- ✓ IEEE (sensor) and OASIS (alert) stds

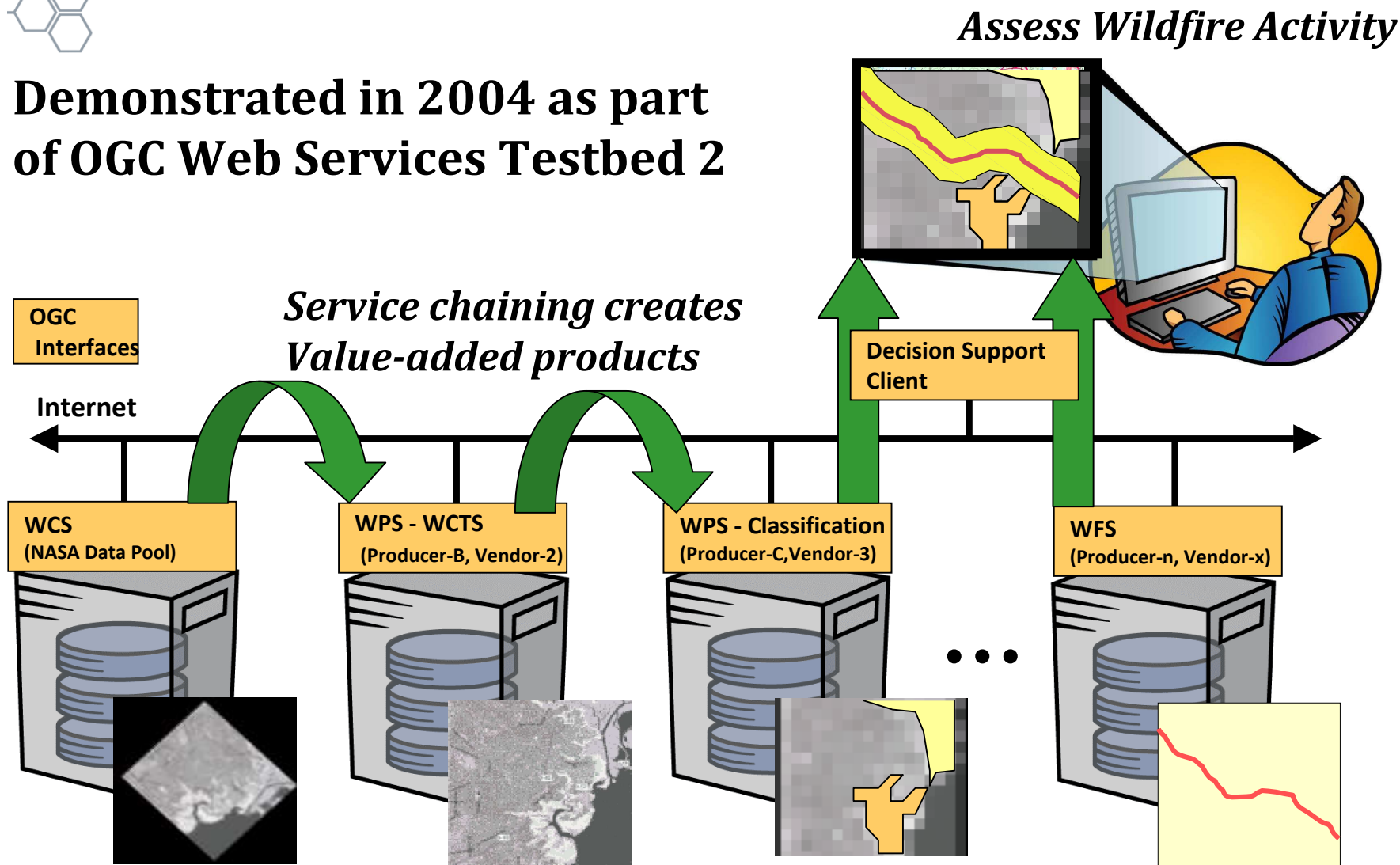
OGC Web Processing Service (WPS)



“Chaining” Web Services For Decision Support



Demonstrated in 2004 as part
of OGC Web Services Testbed 2

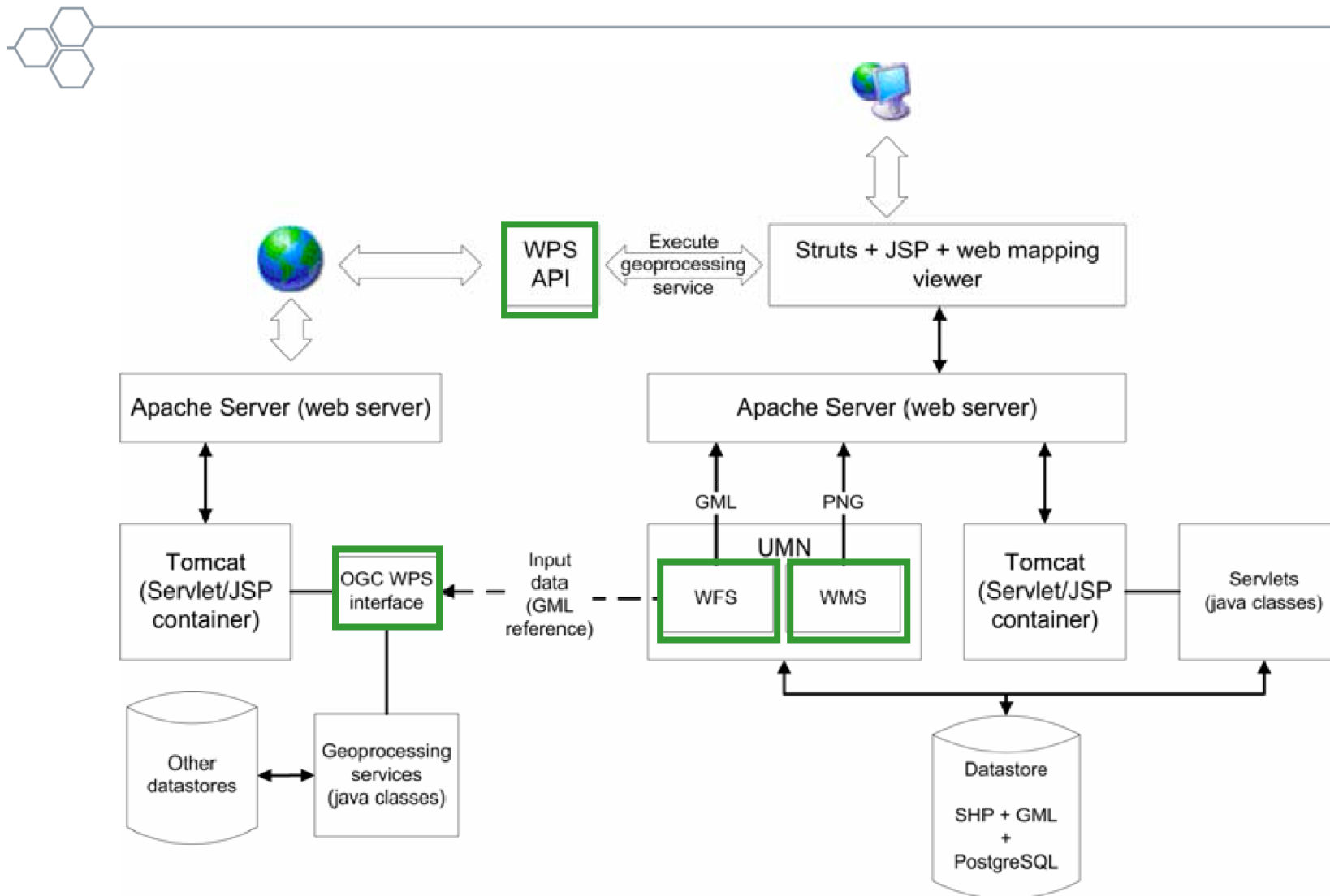


Models Types from Interface Perspective

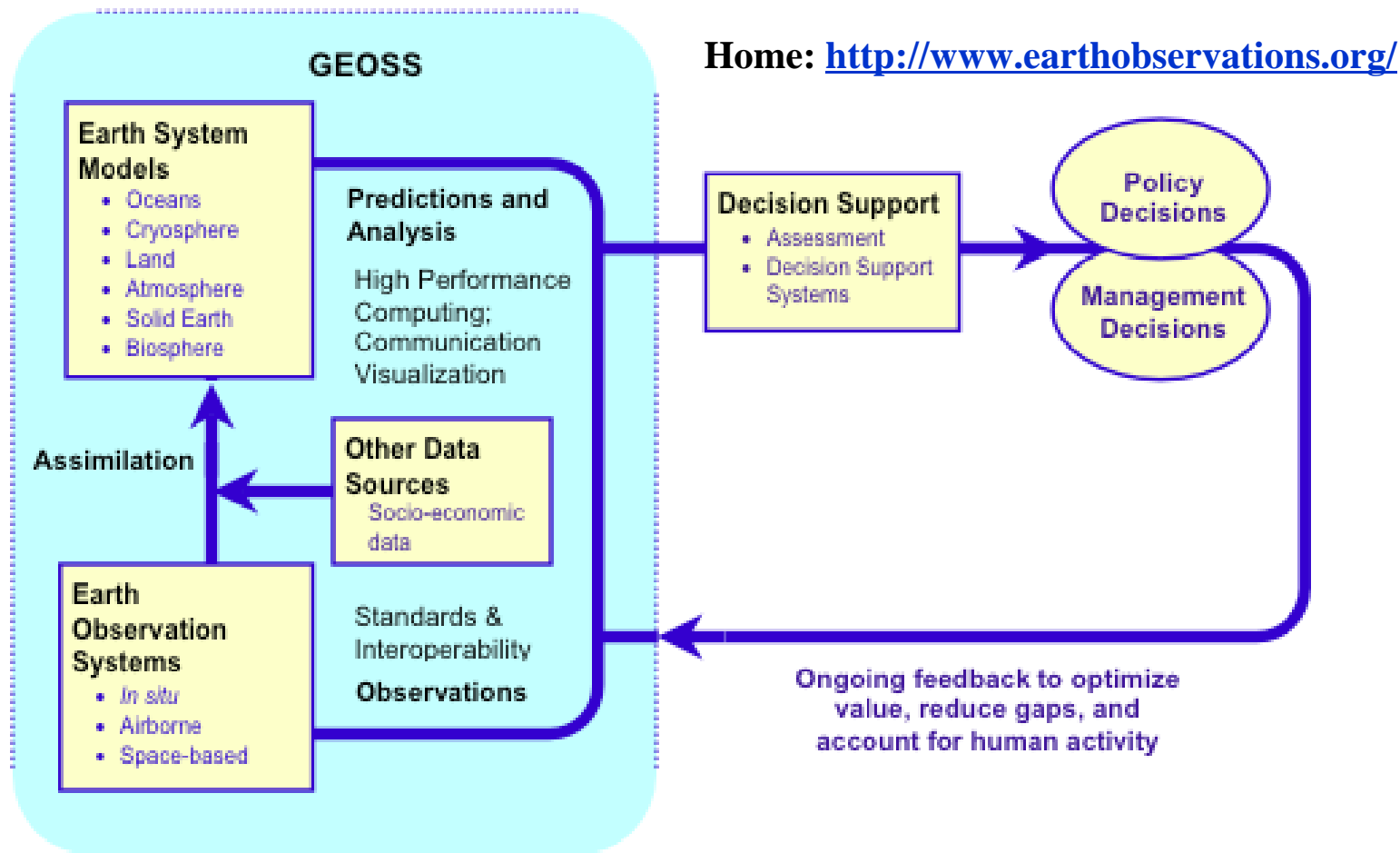


Does user request “run” the model?	Are source data & parameters fixed?	Example Model	Applicable OGC Service
No	Yes	Access to daily run of a large model	Access: WMS, WFS, WCS, SOS
Yes	Yes	Prediction based on moving window of input measurements	Access: WMS, WFS, WCS, SOS
Yes	No	Predictions based on several datasets	Processing: WPS

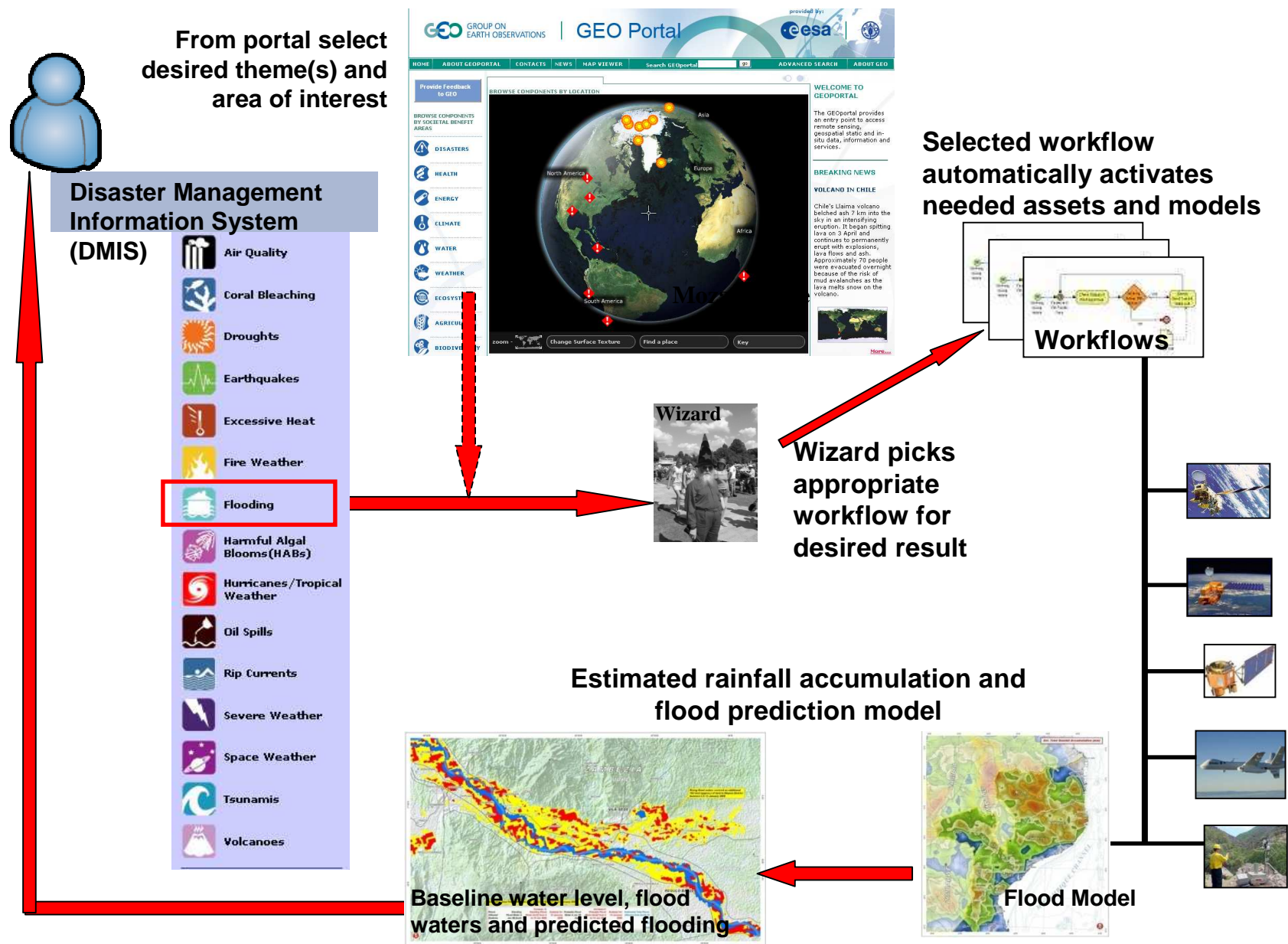
WPS for Hydrological Modelling



GEOSS Observations and Models



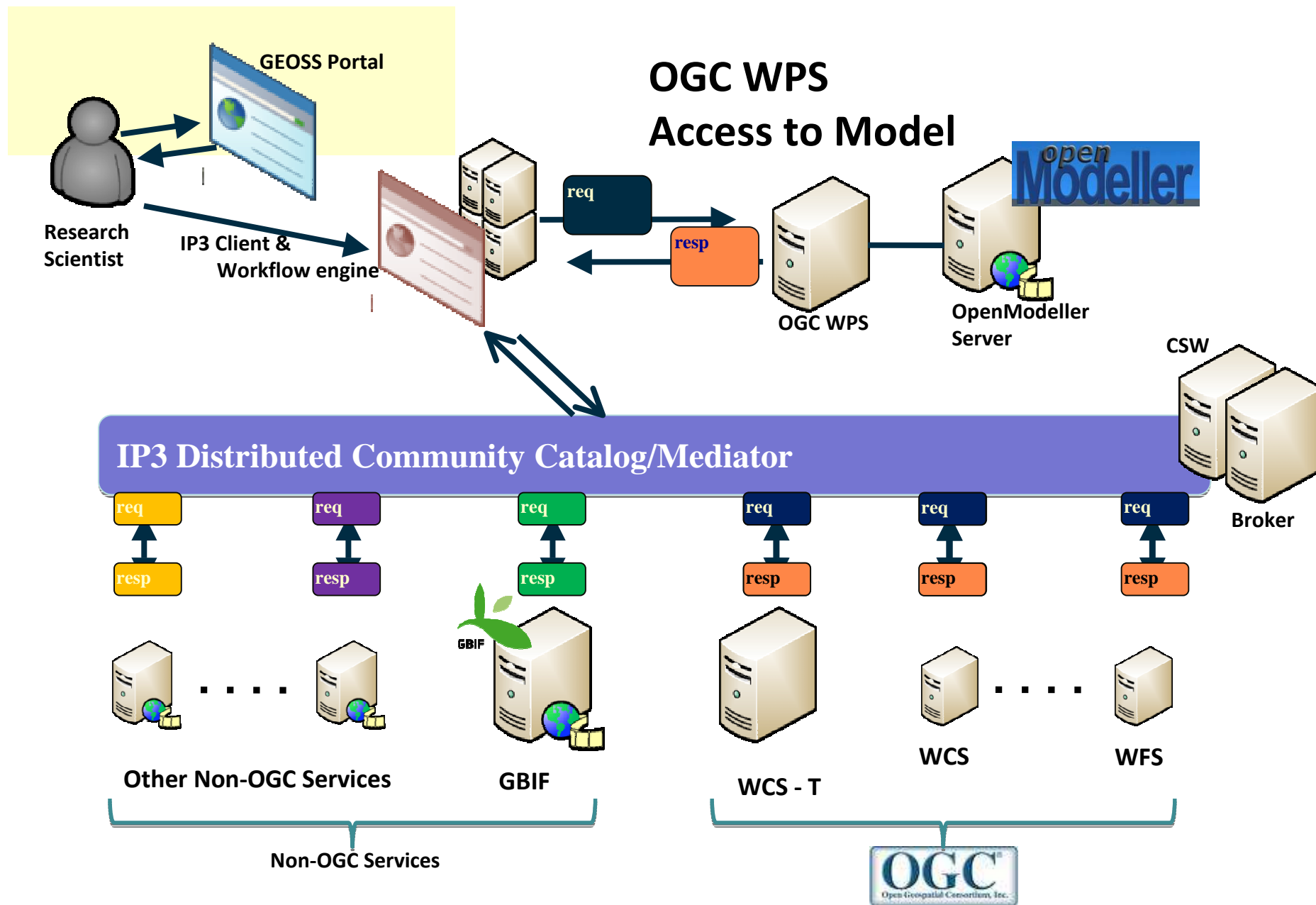
GEOSS Architecture Implementation Pilot (AIP)
develops and deploys new process and infrastructure for GEOSS
<http://www.ogcnetwork.net/AIpilot>



GEOSS AIP-2 Flood Prediction and Response

Led by NASA, Spot Image, Northrop Grumman, ERDAS

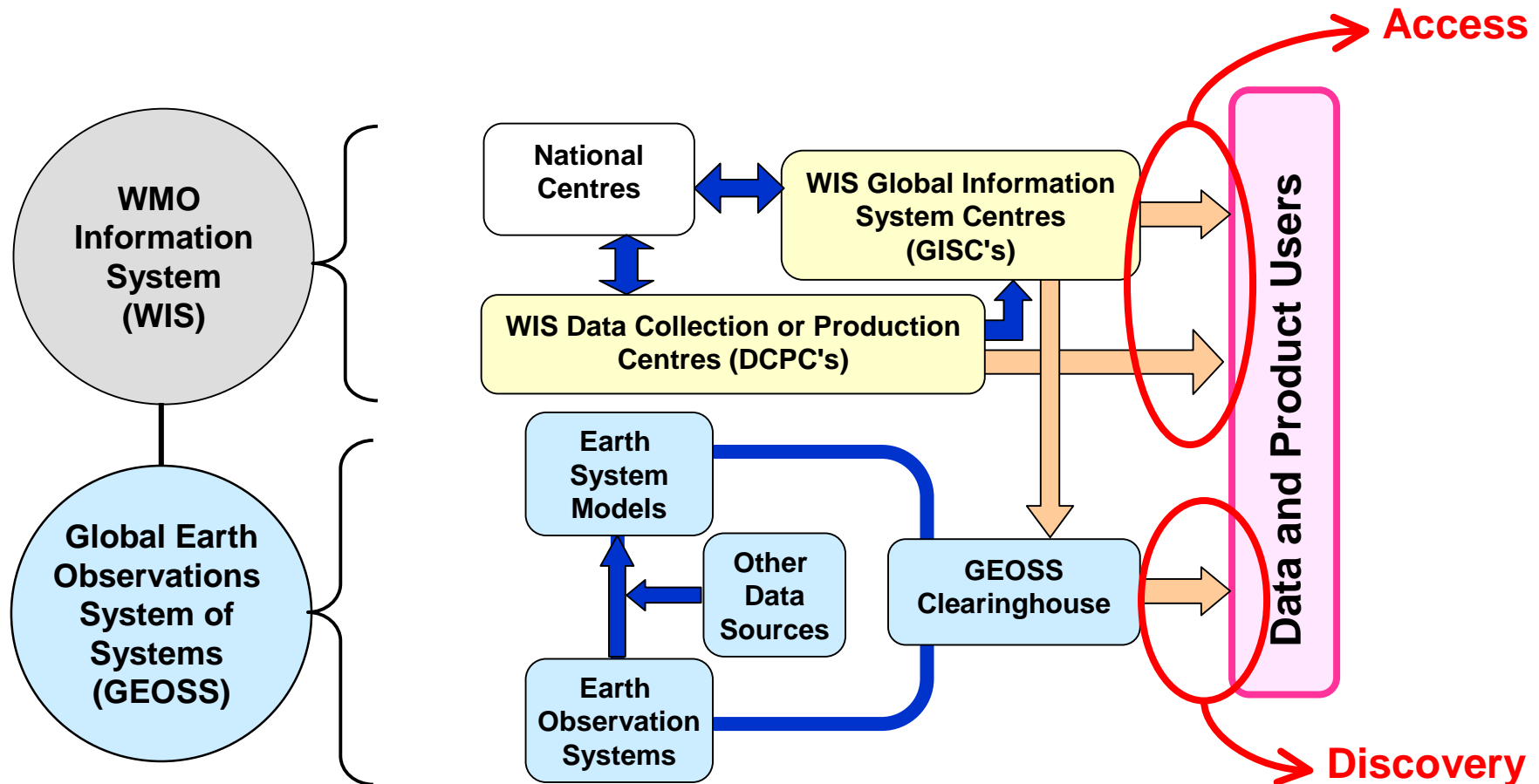
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GEOSS AIP-2 Biodiversity & Climate Change

Led by CNR, Univ of Colorado, GBIF

WMO Information System (WIS) and GEOSS



From presentation: "Interoperable Interfaces for Selected WMO Systems, WIS, and GEOSS," 26-Oct-06.

For more information see "Services Oriented Architecture Concepts Applied to Specific WMO Systems, E. Christian, 23 Jan 2007.

Interoperability is about Organizations



“Interoperability seems to be about the integration of information.
What it’s really about is the coordination of organizational behavior.”

David Schell
CEO and Chairman
OGC



Dr. David Arctur
Director, Interoperability Programs
Open Geospatial Consortium, Inc. (OGC)
arctur@opengeospatial.org

Questions?

