



NOAA IOOS Data Integration Framework: Initial Implementation Report

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Outline



-
- **Introduction: IOOS and DIF**
 - **Web Services & Data Encodings**
 - **Architecture**
 - **Status**
 - **Next Steps**



NOAA IOOS Goals

- **Modernize the way NOAA collects, shares, and uses ocean information**
- **Increase data interoperability and efficiency of operations across NOAA and the eleven IOOS regions**
- **Expedite access to data for improved decision making**



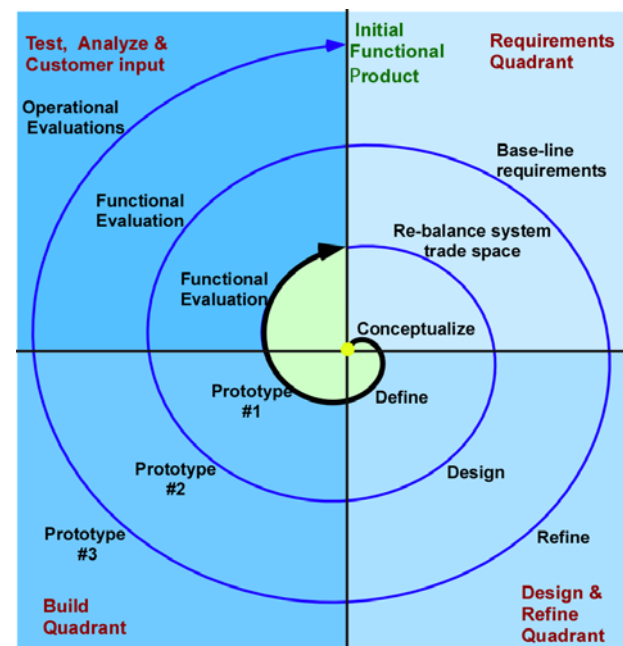
NOAA IOOS Program Components



- **Standards**
 - **Develop and maintain a process to document, coordinate, evaluate and accept standards**
- **Regions**
 - **Invest in Regional Association efforts that contribute to the definition and implementation of IOOS**
- **Data Integration Framework (DIF)**
 - **Conduct a limited-scope implementation of IOOS**
 - **Originally intended as a proof of concept and to gather lessons to inform the larger IOOS effort**

Data Integration Framework (DIF)

- **First spiral of IOOS development**
- **Standardize on small number of services & encodings**
- **Implement at selected provider & customer sites**
- **Start with several core variables**
 - **Currents**
 - **Temperature**
 - **Salinity**
 - **Water Level**
 - **Winds**
 - **Waves**
 - **Ocean Color (chlorophyll)**
- **Evaluate in FY 2010**



(Graphic by i3 Aerospace Technologies Pty Ltd
– used with permission)



Primary DIF Partners

- **Data Providers**
 - **NWS NDBC (National Data Buoy Center)**
 - **NOS CO-OPS (Ctr for Operational Oceanographic Prod & Svcs)**
 - **NESDIS CoastWatch**
- **Customer Focus Areas**
 - **HAB (Harmful Algal Bloom Forecast System)**
 - **IEA (Integrated Ecosystem Assessments)**
 - **CI (Coastal Inundation)**
 - **HI (Hurricane Intensification)**
- **Regional associations**
 - **As represented in web services working group**



Recommended Web Services and Data Encodings



Data Type

Web Service

Encoding

In-situ data (buoys, piers, towed sensors)

OGC Sensor Observation Service (SOS)

XML based on OGC Observations and Measurements (O&M)

Gridded data (model outputs, satellite)

OpenDAP and/or OGC Web Coverage Service (WCS)

NetCDF using Climate and Forecast (CF) conventions

Images of data

OGC Web Map Service (WMS)

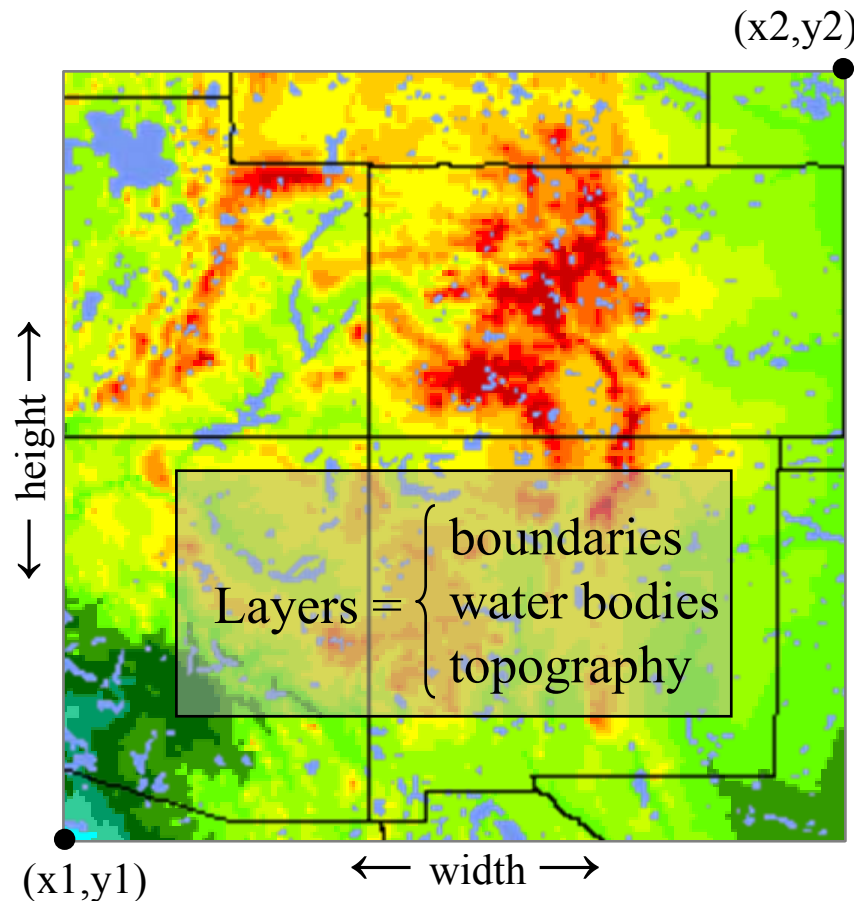
GeoTIFF, PNG etc.
-possibly with standardized styles

[*OGC = Open Geospatial Consortium]

WMS for Images of Data

OGC Web Map Service

- “Map” = georeferenced picture of data
- GetCapabilities operation: “table of contents” in standardized format
- GetMap operation: image of data customized according to:
 - Variable(s) of interest
 - User-specified bounding box
 - User-specified time
 - Image size
 - File format (e.g., PNG, GetTIFF, JPEG, GIF)





WCS for Gridded Data

OGC Web Coverage Service



- Coverage ~ array of gridded data values
 - (simplified viewpoint for this discussion – coverage can be more complex)
- GetCapabilities operation: “table of contents”
- GetCoverage operation: data file containing header and array(s) of numbers customized for:
 - Variable of interest
 - User-specified bounding box
 - User-specified time
 - File format (e.g, NetCDF, HDF, floating-point TIFF)
- DescribeCoverage operation: metadata about a specific dataset

(x2,y2)

27	1828	1828	4590	4523	5360	2874	7135	2662	4977
9676	2772	4076	6303	5354	7594	5713	8217	8525	1664
9218	1741	3596	6290	4357	2900	3342	9526	595	6307
2338	2988	753	1952	5101	9011	5738	3418	7930	7021
2447	6146	668	822	6480	168	4774	1185	3742	3454
695	5170	2761	8386	626	1331	3845	8300	752	449
2007	932	8709	1274	4374	7047	2306	9697	7209	3101
6574	6377	2111	2523	8978	4425	569	5369	6770	7854
9879	3163	6889	2300	9879	3127	7361	7821	5424	9992
1936	6803	3182	5288	6939	8496	4651	582	939	2398
1173	123	8197	684	1614	397	198	3767	9320	6832
3287	8250	9819	4558	1530	1756	7173	6133	2069	8112
3515	9888	8519	3458	727	3866	7385	8942	2879	2284
6104	8419	8444	3634	6324	4968	4875	6023	3624	8270
2353	436	9941	8491	4631	4093	4317	3814	3640	5462
167	6839	6424	3781	4059	2714	5635	4906	1303	1072
7041	7189	8610	6873	9696	5521	2671	5468	8957	350
3210	6817	121	56	2788	235	1930	3322	4745	158
5036	6041	6997	3297	2508	8687	6966	4035	5570	7162
7871	3419	5124	6652	103	592	1236	6771	9432	5278

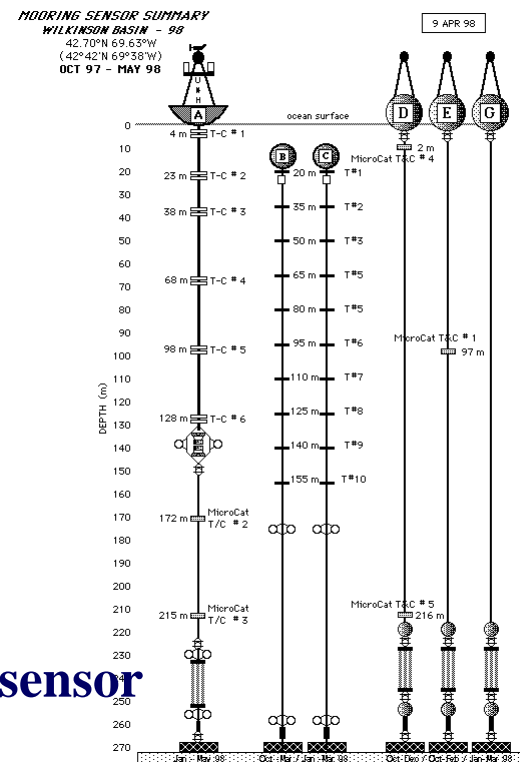
(x1,y1)



SOS for In-Situ Data

OGC Sensor Observation Service

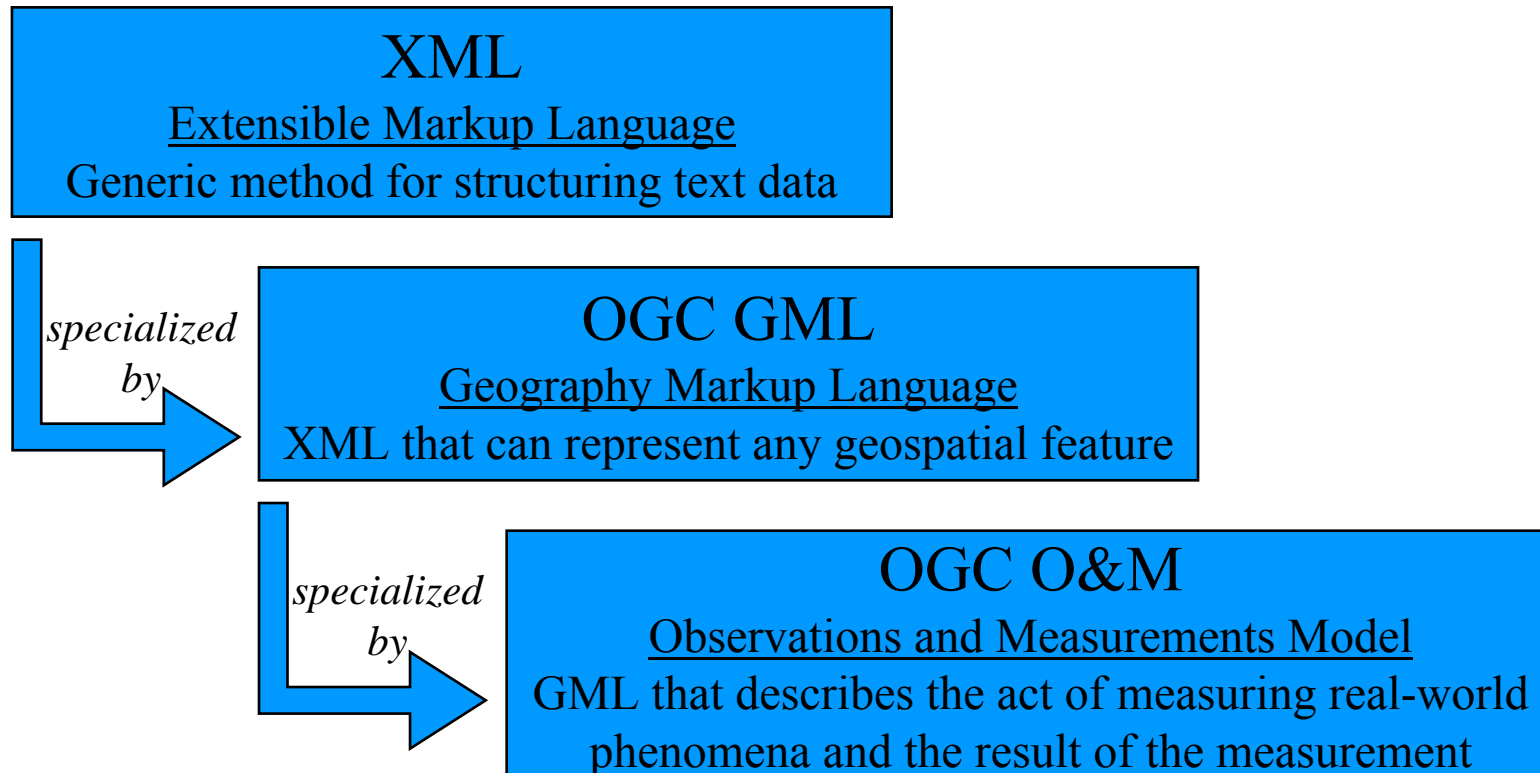
- **Sampling feature = discrete location(s) of measurements**
 - *Point, Vertical or Horizontal Profile, Trajectory (e.g., ship track)*
 - *...and Time Series or Collections thereof*
- **GetCapabilities operation: “table of contents”**
- **GetObservation operation: XML data file containing observation values for desired:**
 - **Variable(s) of interest**
 - **Bounding box**
 - Or perhaps named geographic feature of interest
 - Or perhaps a single sensor
 - **Time**
- **DescribeSensor operation: XML providing detailed information about a specific sensor**





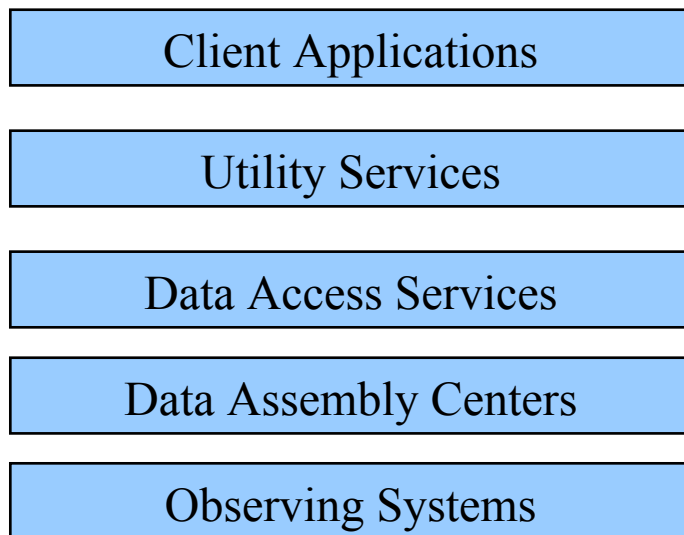
SOS GetObservation Result

XML Encoding of In-Situ Data





Architectural Layers



ISO 3-Layer Model

User Interface Tier

Business Process Tier

Data Access Tier

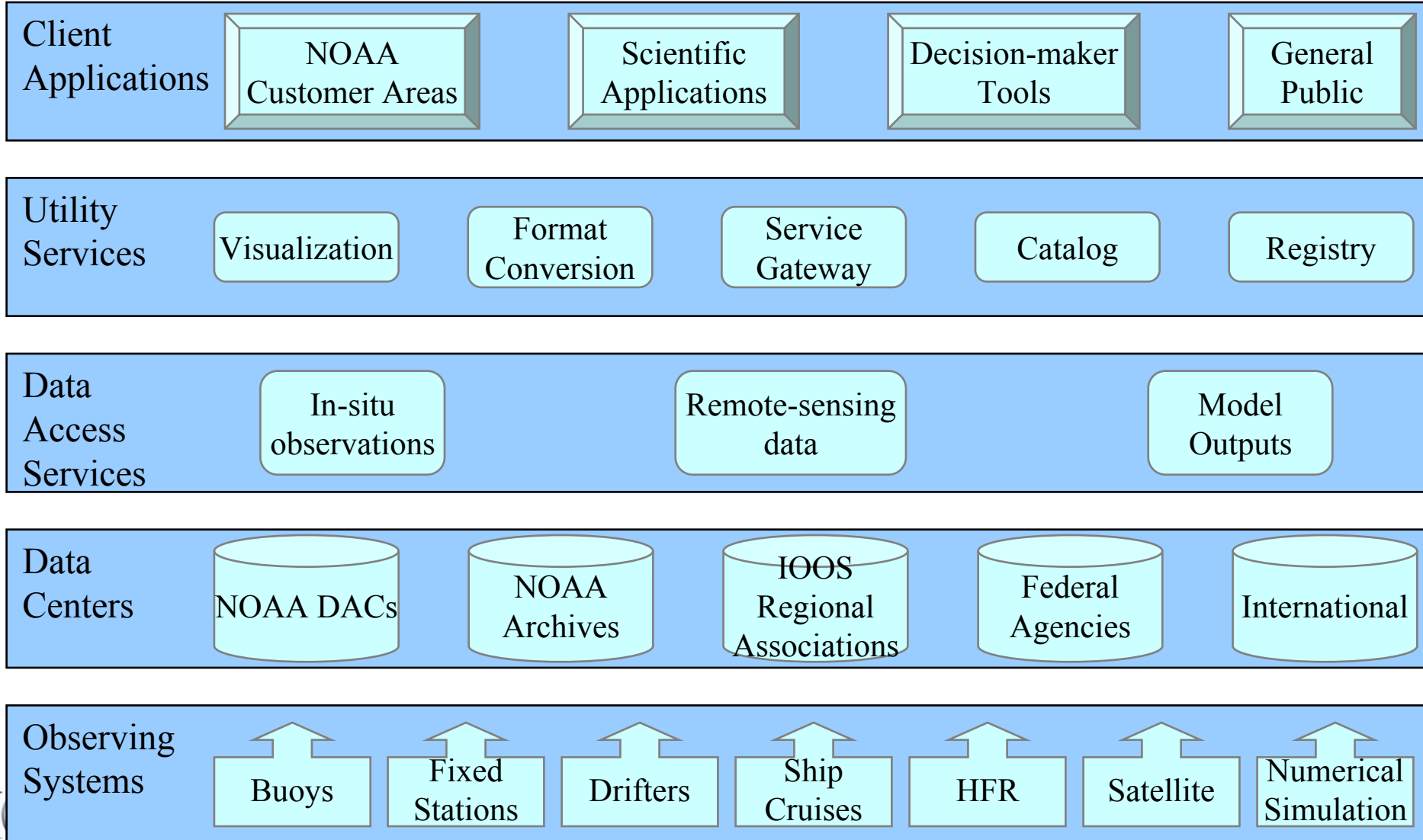


Reference Model for Open Distributed Processing (RM-ODP)



Engineering Viewpoint

- Necessary Component Types

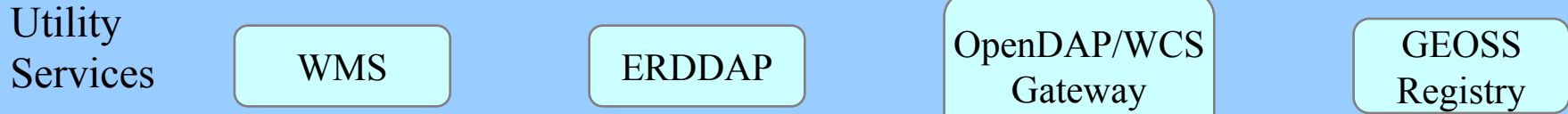




Reference Model for Open Distributed Processing (RM-ODP)



Technology Viewpoint - Component & Service Instances

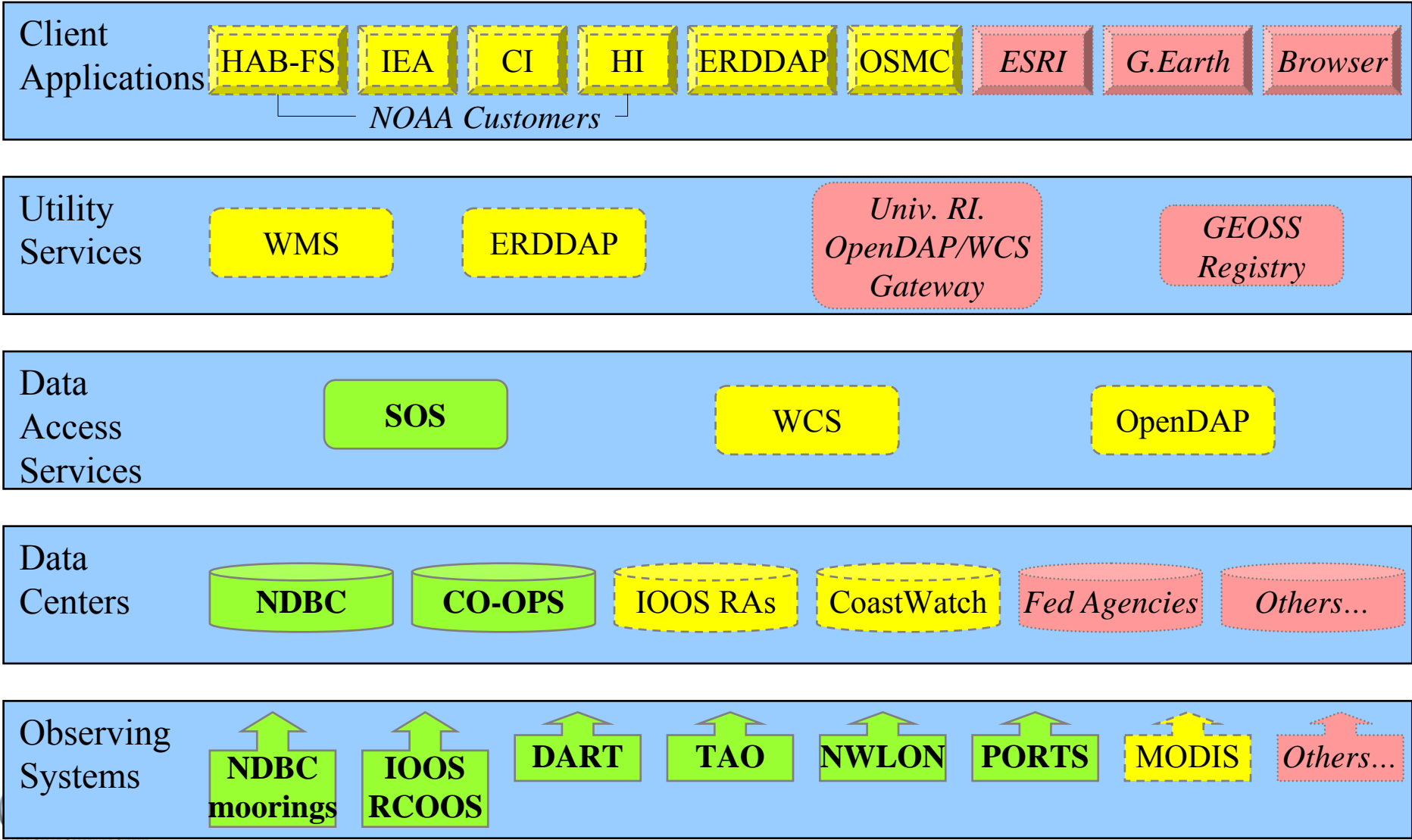




Status as of Sept 2008



Legend: **Testing** Starting Planning

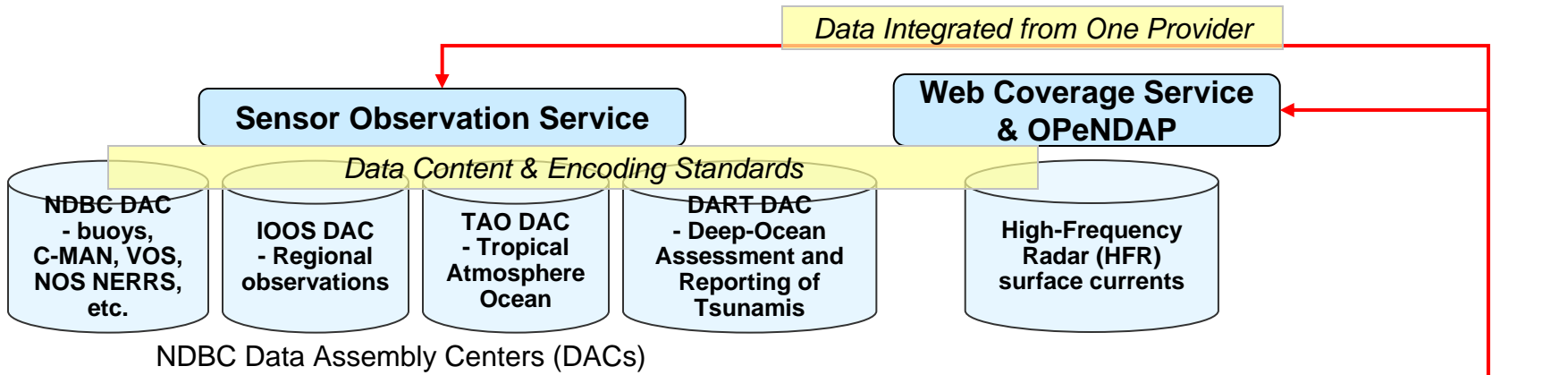




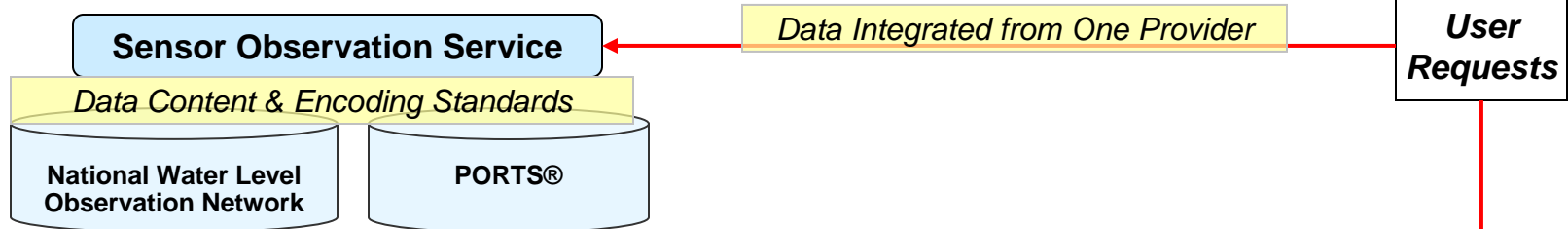
DIF Data Provider Status (expected by end of CY2008)



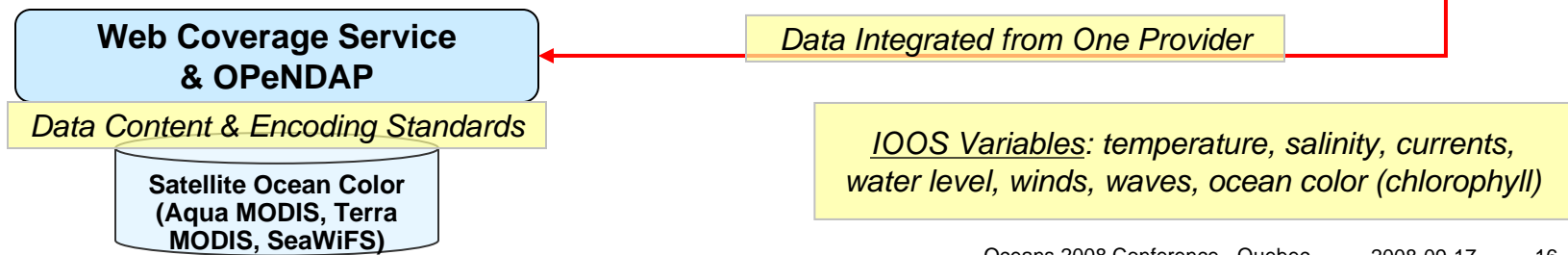
NDBC



CO-OPS



CoastWatch





Next Steps



- **SOS DescribeSensor implementation**
- **Testing/evaluation/refinement of existing work**
- **Software reference implementations**
- **Metadata for discovery and QA/QC**
- **Catalog of available data**
- **Registry of terms, relationships, sensors**
- **Data translation service (w/ERDDAP & OOI/CI)**
- **Additional customers (climate? Marine transpo?)**
- **Additional variables & data providers (biology?)**
- **Model Data Access (w/USGS & OOI/CI)**



Summary



- **NOAA IOOS working to promote interoperability**
- **SOS in beta-test at NDBC & CO-OPS**
 - <http://sdf.ndbc.noaa.gov/sos/>
 - *See SAIC booth for demo at this conference*
 - <http://opendap.co-ops.nos.noaa.gov/ioos-dif-sos/>
- **WCS, OpenDAP, WMS in progress**
- **Much work still to be done – comments and participation welcomed!**