



OGC Testbed 12 Aviation Thread Results

Presented to: ATIEC 2016

By: Charles Chen, Skymantics

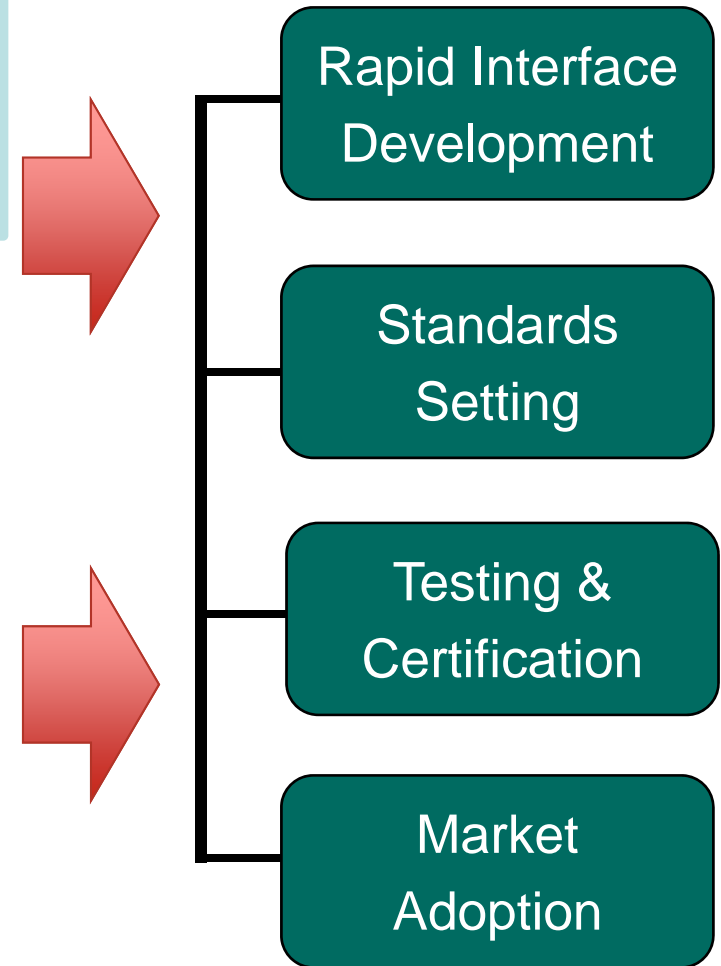
Date: September 22, 2016

Aviation Information World - Forecasting the Future



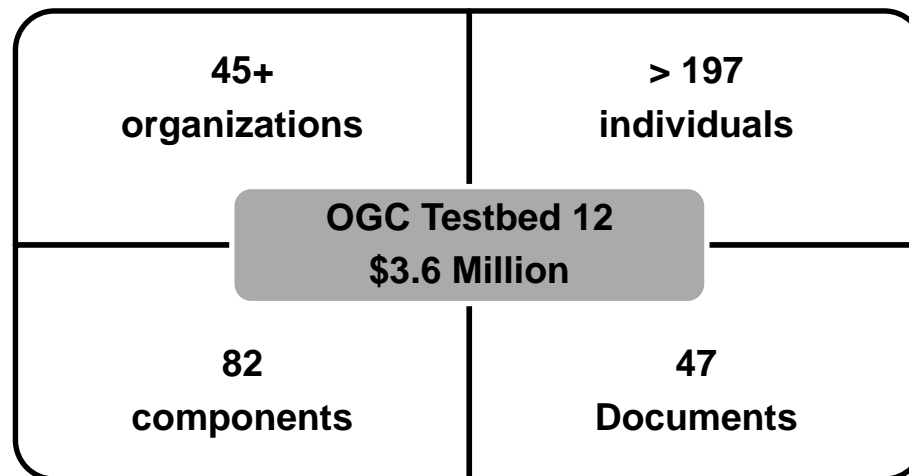
Open Geospatial Consortium

- **Interoperability Program (IP)** – a global, innovative, hands-on rapid prototyping and testing program designed to unite users and industry in accelerating interface development and validation, and the delivery of interoperability to the market
- **Standards Program** – Consensus standards process similar to other Industry consortia (World Wide Web Consortium, OMA, etc.).
- **Compliance Testing and Certification Program** – allows organizations that implement an OGC standard to test their implementations with the mandatory elements of that standard
- **Communications and Outreach Program** – education and training, encourage take up of OGC specifications, business development, communications programs



OGC Testbed 12 Overview

OGC Testbeds provide an environment for collaborative, fast-paced, multi-vendor, rapid prototyping efforts to define, design, develop, and test candidate interface and encoding specifications.



Benefits of Involvement

For Participants

Business potentials

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

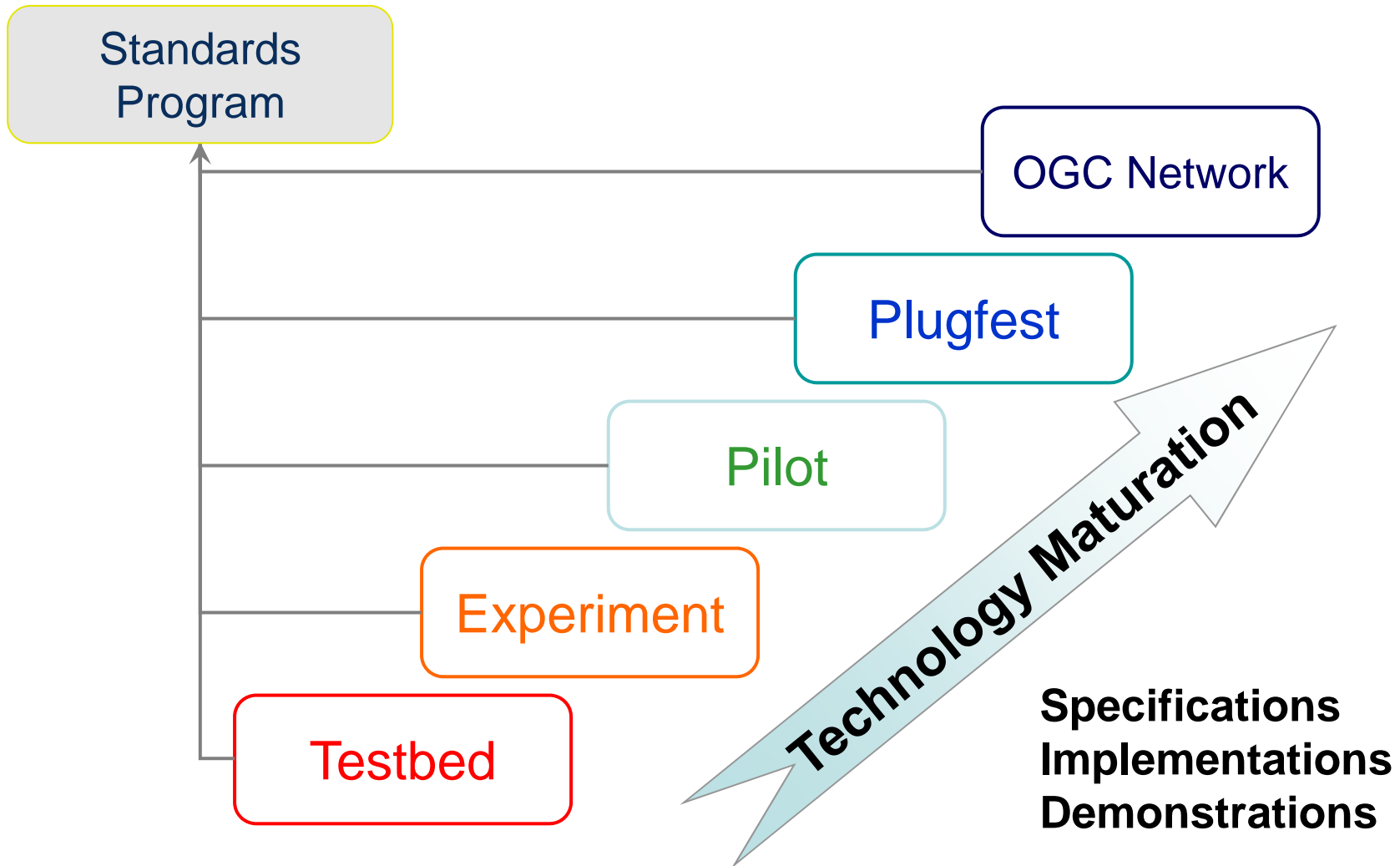
For Sponsors

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
- Collaborative environment with other sponsors and participants

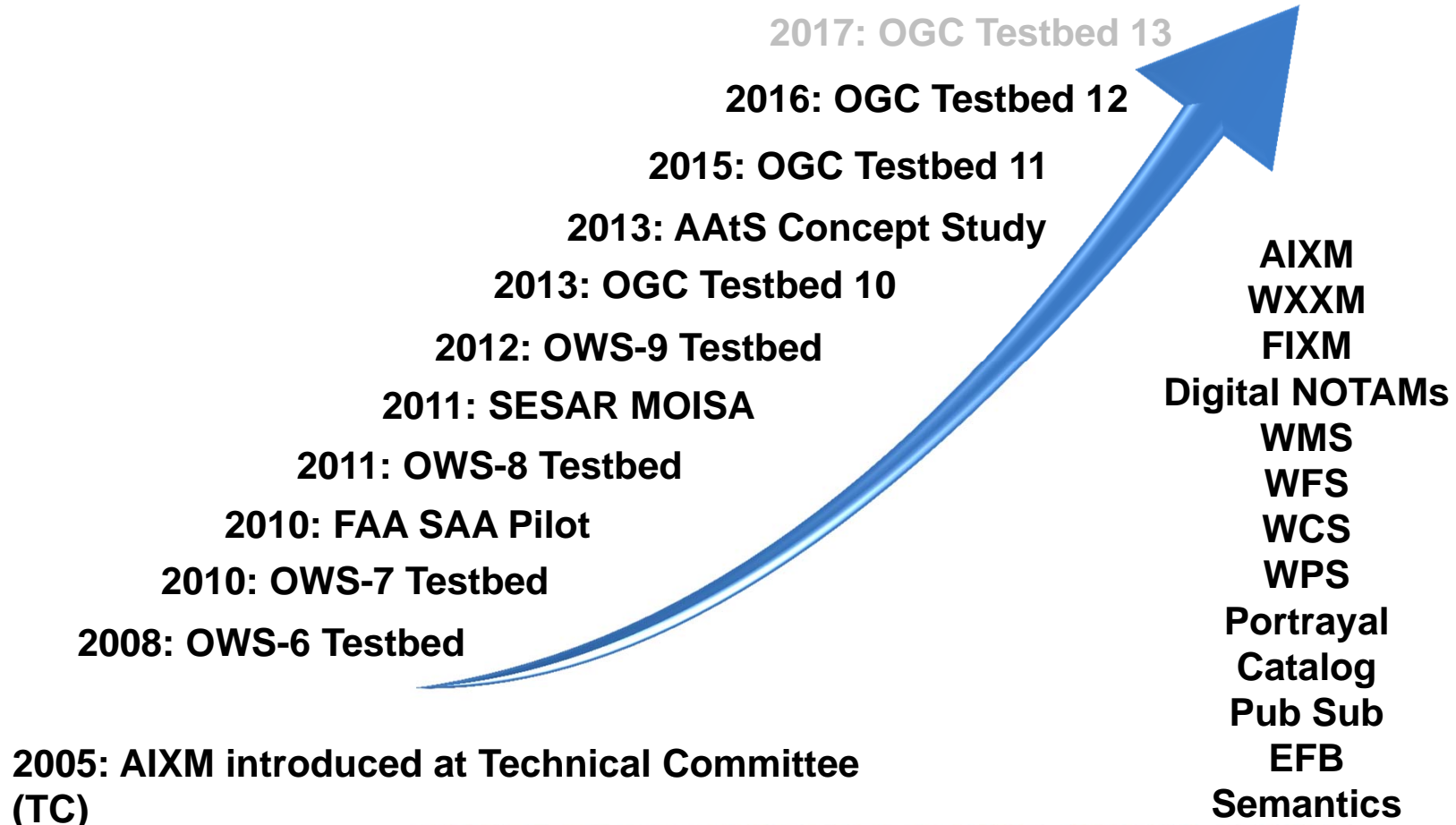


85+ IP Initiatives Since 1999



OGC Aviation Testbeds

Operational Requirements for
OGC Standards in Aviation



OGC Testbed Deliverables

1. Technical Documents

(draft standards, best practices, change requests, etc.)

2. Prototype Implementations

(services, clients, tools, etc.)

3. Demonstrations



OGC Testbed 12 Sponsors

- Digital Global, Inc.
- European Organization for the Safety of Air Transportation (EUROCONTROL)
- National Aeronautics and Space Administration (NASA)
- UK Defense Science and Technology Lab (UK-DSTL)
- US Federal Aviation Administration (FAA)
- US Geological Survey (USGS)
- (Other US Agency)



Aviation Thread Participants

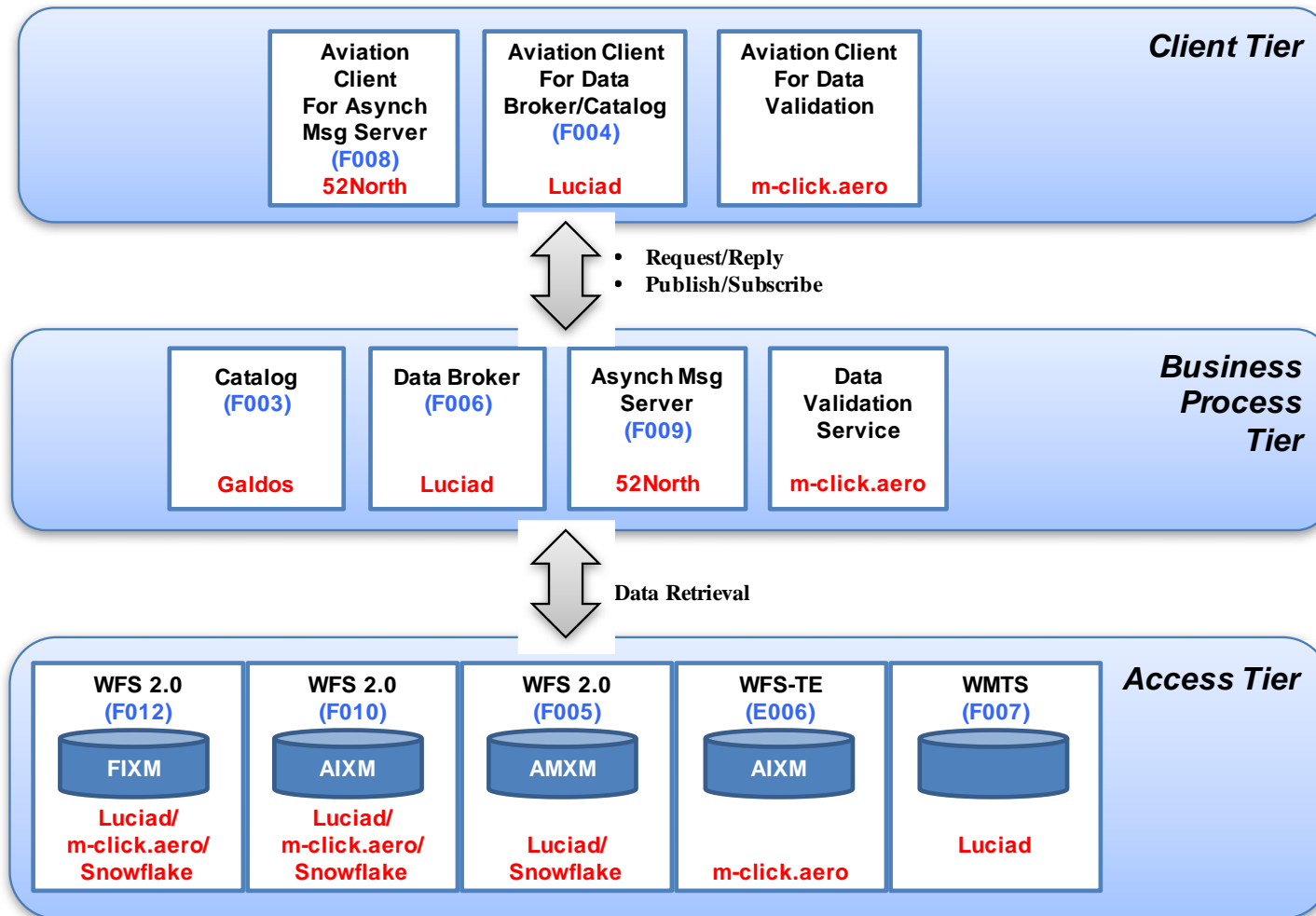


Aviation Thread Topics

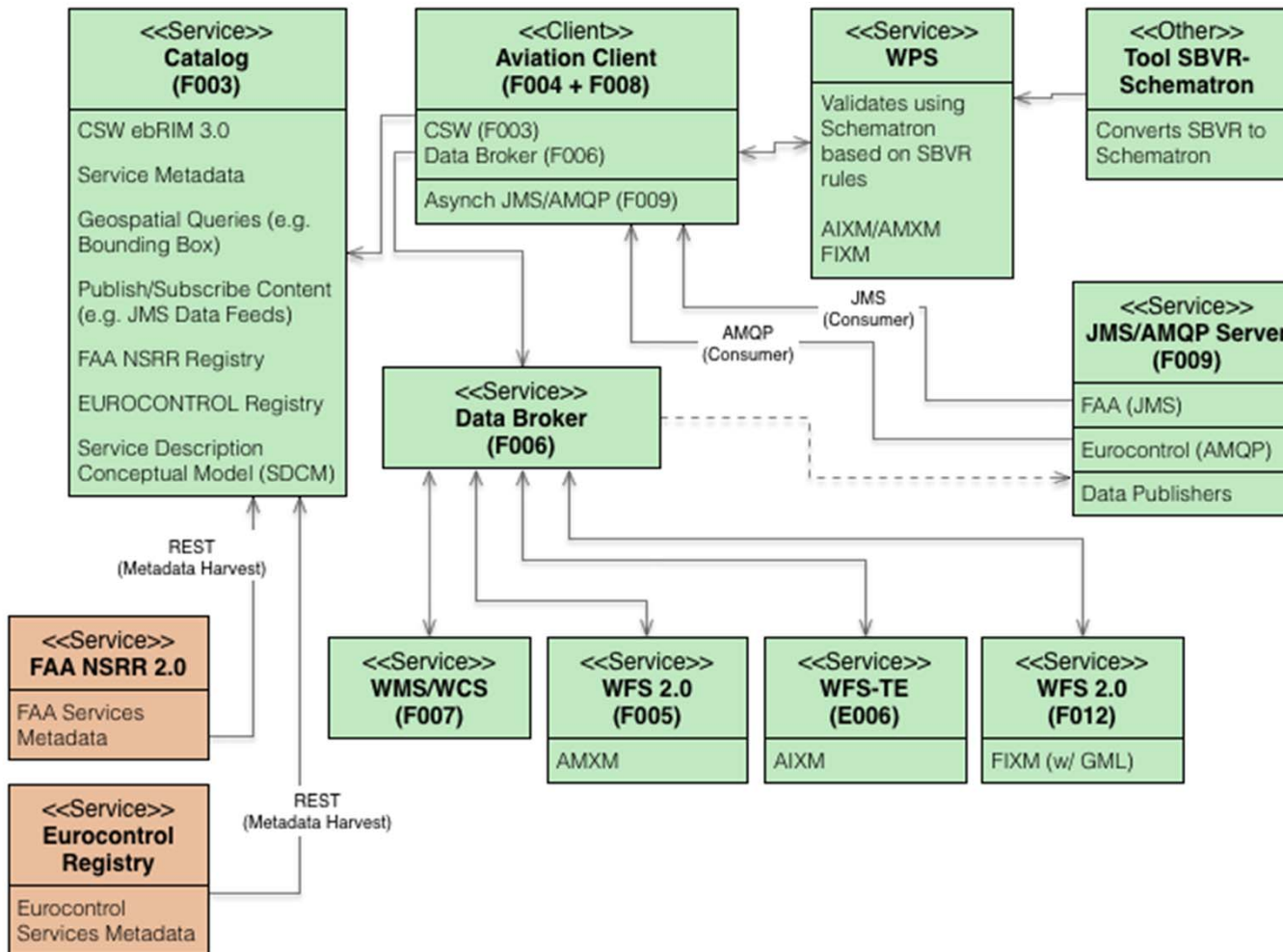
- **Semantics**
 - Advance use of Catalog Service for Web
 - Advance use of Semantic Business Vocabulary and Rules (SBVR) for Data Validation
 - Advance use of Data Broker
- **Integration of GML into FIXM**
 - Implementation of FIXM in Web Feature Service (WFS)
- **Asynchronous Messaging for Geospatial Aviation Data**
 - Implementation of prototype using PubSub 1.0 Specification



T-12 AVI Component Architecture

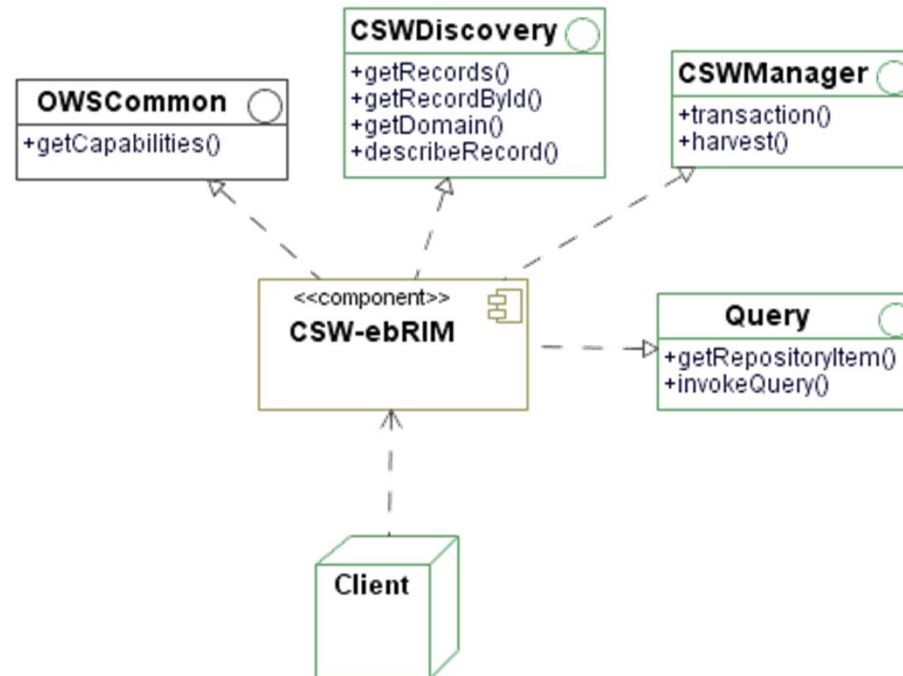


T-12 AVI Service Architecture



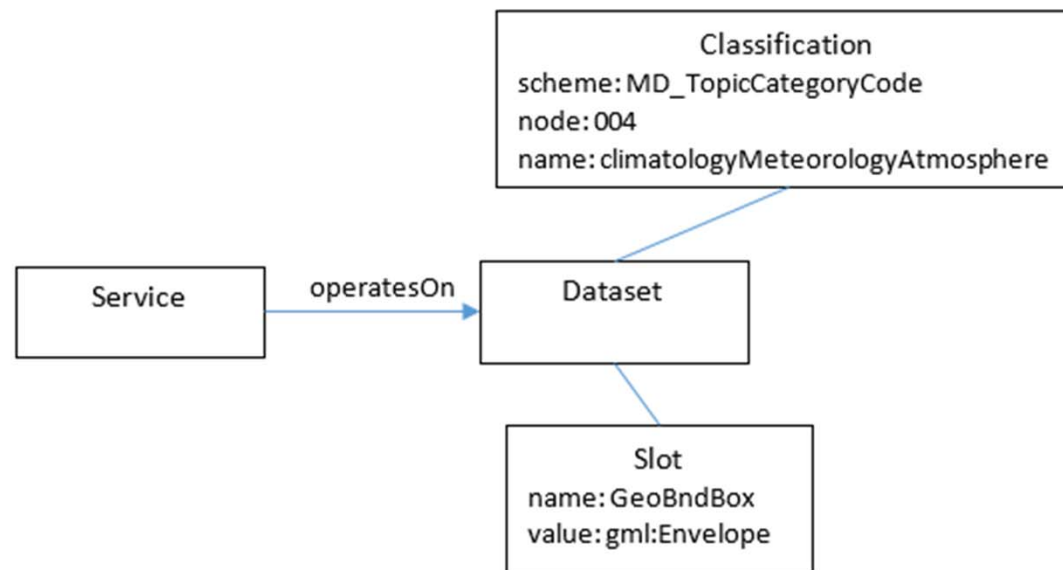
OGC Catalog Service

- The OGC defines the Catalog Service for Web (CSW) interface that is designed to be tailored for particular application domains using a profiling mechanism



Searching Registry Content

- The registry may be searched using the CSW query interface with filter criteria (spatial and non-spatial predicates)
- **Example:** Find services that offer meteorological data for some area of interest



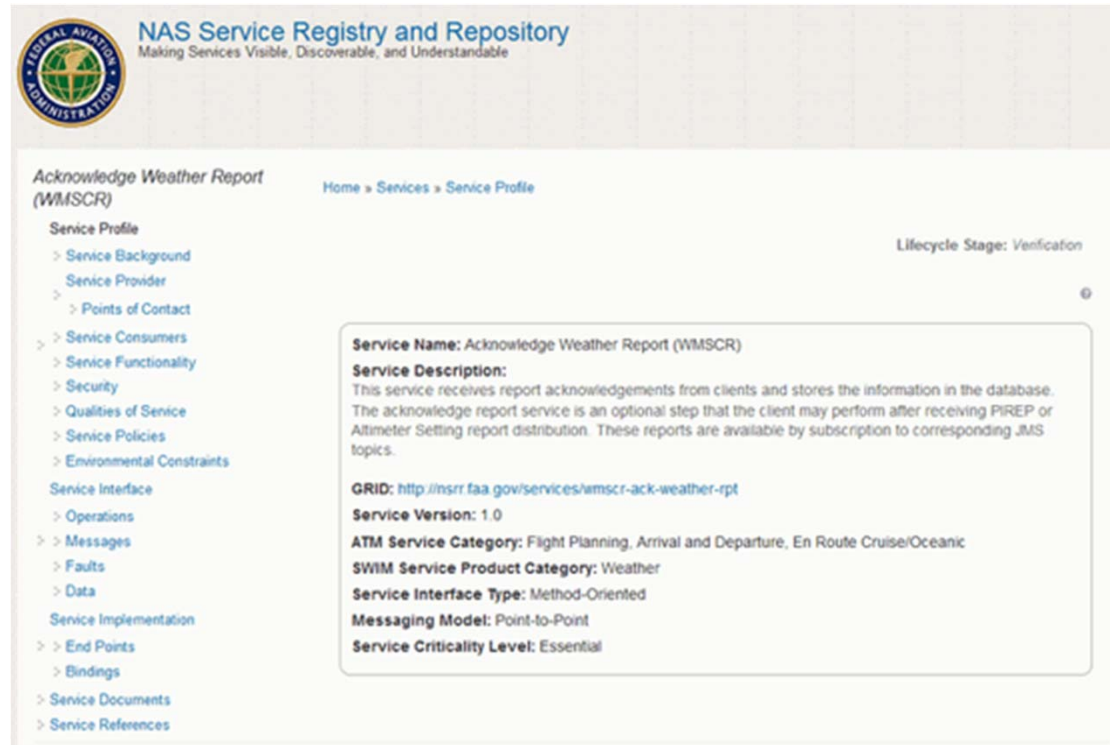
Search interface – Web client

The screenshot displays the INdicio WRS Client search interface. The header includes the logo and navigation links: Home, Advanced Query, Stored Query, Dashboard, Map Layers, Create Record, and a user profile for 'admin'. The main search area includes a 'Contains' field with 'Terms', a 'Classified as' dropdown menu showing a tree view of classification schemes, an 'Inside' field with '49.18799 -123.2789' and a 'Map' button, and an 'Id' field with 'Id'. A 'Query' button is visible. Below the search fields is an 'Object Types' section with a 'Filter object types' input and a table with 'View' and 'Object Type' columns. A 'Records' section is also present.

A demo client is available at: <http://ows.galdosinc.com/>



Recommendations for NSRR v2



The screenshot displays the NAS Service Registry and Repository interface. At the top left is the Federal Aviation Administration logo. The main header reads "NAS Service Registry and Repository" with the tagline "Making Services Visible, Discoverable, and Understandable". The page title is "Acknowledge Weather Report (WMSCR)" and the breadcrumb trail is "Home » Services » Service Profile". A "Lifecycle Stage: Verification" indicator is present in the top right. A left-hand navigation menu lists various service profile sections such as "Service Background", "Service Provider", "Points of Contact", "Service Consumers", "Service Functionality", "Security", "Qualities of Service", "Service Policies", "Environmental Constraints", "Service Interface", "Operations", "Messages", "Faults", "Data", "Service Implementation", "End Points", "Bindings", "Service Documents", and "Service References". The main content area contains the following details:

- Service Name:** Acknowledge Weather Report (WMSCR)
- Service Description:** This service receives report acknowledgements from clients and stores the information in the database. The acknowledge report service is an optional step that the client may perform after receiving PIREP or Altimeter Setting report distribution. These reports are available by subscription to corresponding JMS topics.
- GRID:** <http://nsrr.faa.gov/services/wmscr-ack-weather-rpt>
- Service Version:** 1.0
- ATM Service Category:** Flight Planning, Arrival and Departure, En Route Cruise/Oceanic
- SWIM Service Product Category:** Weather
- Service Interface Type:** Method-Oriented
- Messaging Model:** Point-to-Point
- Service Criticality Level:** Essential

1. Implementing the OpenSearch GeoTemporal extensions can enable a spatial search capability for a SWIM registry, but does not conform to OGC standards
2. Implementing a CSW adapter for the SDCM information model permits CSW clients to search SWIM registries.

Data Validation using SBVR

- **SBVR work began in Testbed 11**
 - See ATIEC presentations from ATIEC 2015
- **Testbed 12 continued work in SBVR engineering report**
- **Demonstrated TFR NOTAM validation based on issues raised in the RTCA Graphical TFR Task Group**





- [TFR List](#)
- [TFR Map](#)
- [Map Airports](#)
- [TFR Help](#)
- [PilotWeb](#)
- [SUA](#)

NOTAM

Number : FDC 6/9747 Download shapefiles
Issue Date : September 10, 2016 at 1924 UTC
Location : 20 NM SE OF MONTEREY, California
Beginning Date and Time : September 10, 2016 at 1900 UTC
Ending Date and Time : October 30, 2016 at 0400 UTC
Reason for NOTAM : TO PROVIDE A SAFE ENVIRONMENT FOR FIRE FIGHTING AIRCRAFT OPERATIONS
Type : Hazards
Replaced NOTAM(s) : N/A
Pilots May Contact : OAKLAND (ZOA) ARTCC, 510-745-3331



Jump To: [Affected Areas](#)
[Operating Restrictions and Requirements](#)
[Other Information](#)

Affected Area(s) [Top](#)

Airspace Definition:

Region bounded by:

	Latitude:	Longitude:	FRD:
From:	36°26'53"N	121°49'12"W	SNS202016.6
To:	36°28'06"N	121°34'33"W	SNS157011.8
To:	36°08'26"N	121°16'01"W	SNS136035.3
To:	35°58'18"N	121°32'54"W	SNS159041.6
To:	36°17'39"N	121°55'42"W	SNS198027.2

Altitude: From the surface up to and including 9000 feet MSL

Effective Date(s):

From September 10, 2016 at 1900 UTC
To October 30, 2016 at 0400 UTC

Operating Restrictions and Requirements [Top](#)

No pilots may operate an aircraft in the areas covered by this NOTAM (except as described).

Other Information: [Top](#)

ARTCC: ZOA - Oakland Center
Point of Contact: LOS PADRES NATIONAL FOREST
 Telephone 805-961-5727
 Frequency 119.125
Authority: Title 14 CFR section 91.137(a)(2)

Depicted TFR data may not be a complete listing. Pilots should not use the information on this website for flight planning purposes. For the latest information, call your local Flight Service Station at 1-800-WX-BRIEF.




Aeronautical Data Validation Service

The screenshot displays the Aeronautical Data Validation Platform interface. At the top, the mclick logo and platform name are visible. The main area shows an XML document being validated. A central banner indicates the validation status: "Well-formed, No schema issues, Has rules issues, No rule definition issues." Below this, a "Report" section provides a summary of the validation results.

Name	Value
Validity	False
Well-formedness violations	0
Schema violations	0
Rule violations	1
Rule definition issues	0

The m-click validator checks against the business rules data set and discovers a violation of a rule.

TFR NOTAM Graphical Verification

 mclick
zero
WFS-TE Aviation Client

Feature Query

Baseline File:

Overlay File:

Server:

Feature Type:

Options:

XY-CRS

Time: from to

BBox:

ID:

Res. Depth:

Limit results:

Feature List (7)

Timeslice	S	C	G	Begin	End
Airspace	HAZARD AREA1		id		
BASELINE	1	✓		2016-08-26T22:45:00Z	2016-10-26T07:00:00Z
InformationService			id		
BASELINE	1	✗		2016-08-26T22:45:00Z	→
InformationService			id		
BASELINE	1	✗		2016-08-26T22:45:00Z	→
RadioCommunicationChannel			id		
BASELINE	1	✗		2016-08-26T22:45:00Z	→
Event	6/3158		id	Load	
BASELINE	1	✗		2016-08-26T22:45:00Z	2016-10-26T07:00:00Z

Details

Request (XML) Response (XML) Feature (XML) Feature Metadata

Event

identifier	6/3158
id	event.1


Time slice

id	event.1.1
validTime	
id	event.1.1.validTime
beginPosition	2016-08-26T22:45:00Z
endPosition	2016-10-26T07:00:00Z
interpretation	BASELINE
sequenceNumber	1
name	6/3158
encoding	DIGITAL
scenario	SAA.NEW
version	2.0
revision	2016-08-27T02:29:00.0000000Z

textNOTAM

id	event.1.1.textNOTAM
purpose	TO PROVIDE A SAFE ENVIRONMENT FOR FIRE FIGHTING AIRCRAFT OPERATIONS
location	FDC
text	IFDC 6/3158 ZOA CA, AIRSPACE 10 NM SOUTH OF MONTEREY, CA, TEMPORARY FLIGHT RESTRI...

Map

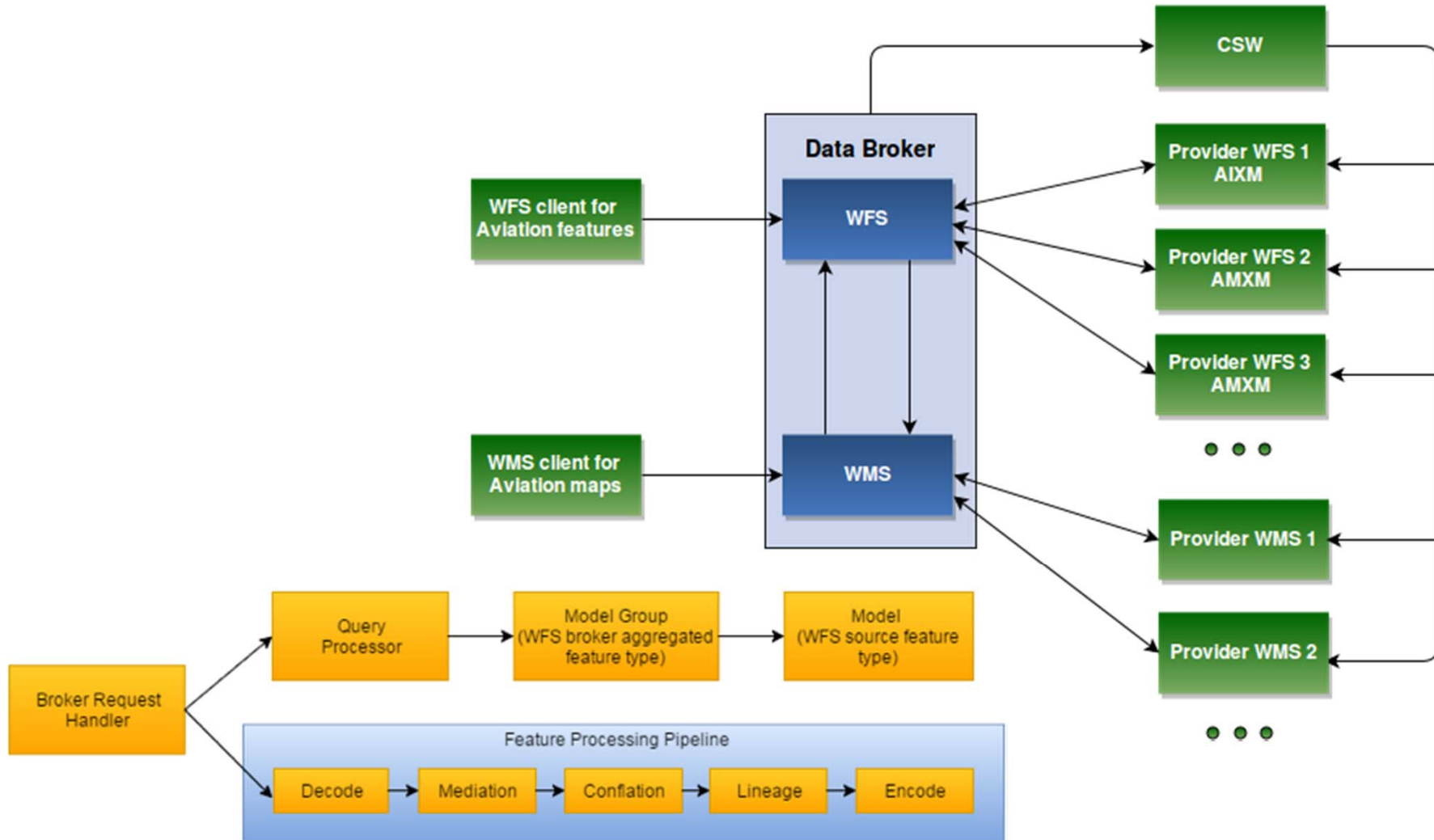


Data Broker Concept

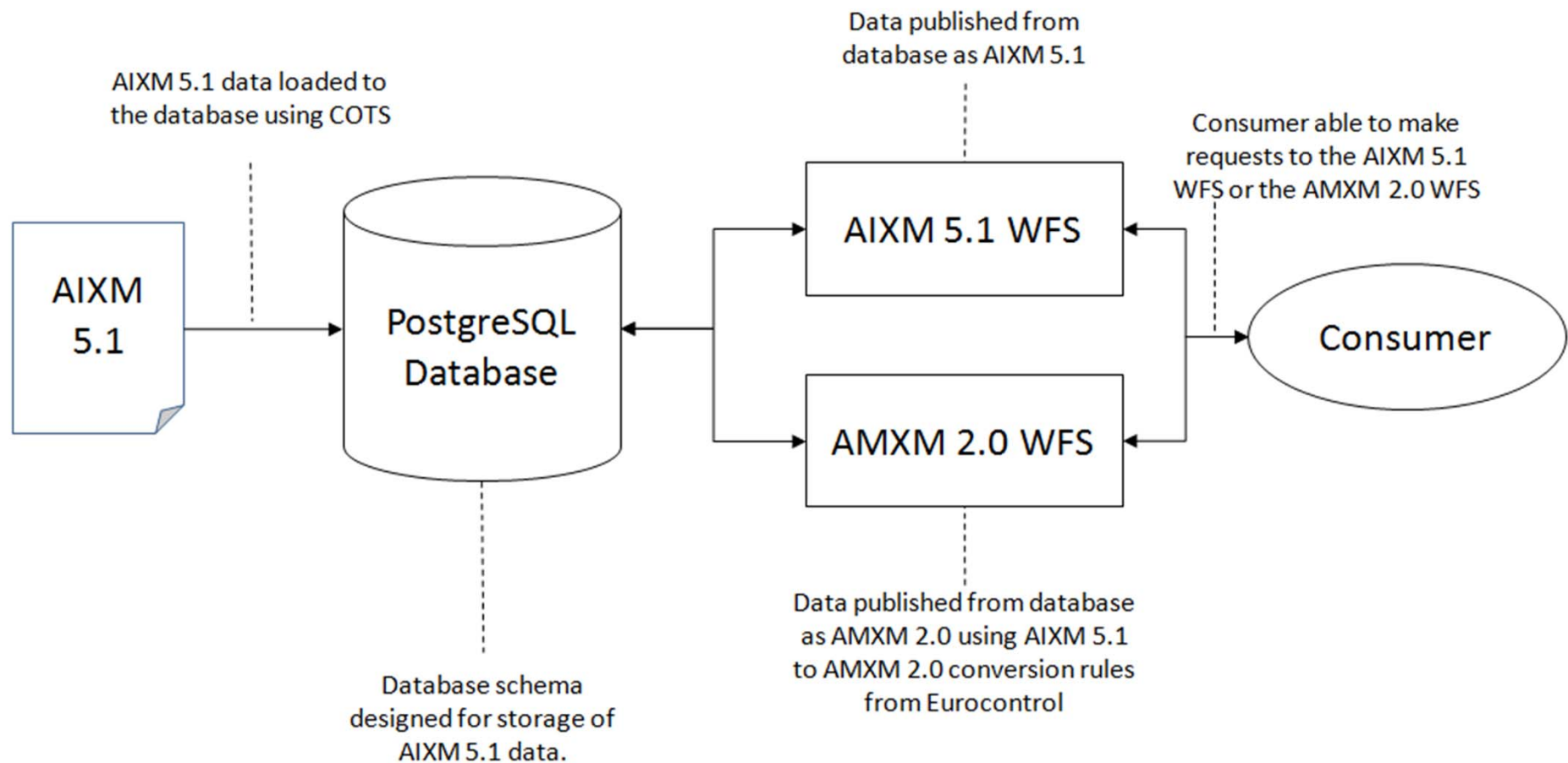
- Support for brokering of OGC WFS data sources
 - Complies with WFS 1.1.0/2.0.0
 - Supports AIXM 5.1 and AMXM 2.0.
- Automated data source discovery via OGC CSW
- Conflation of data based on unique identifiers
- Aggregation of similar features types from different WFS data sources in to one feature type
- Semantic mediation between AIXM 5.1 and AMXM 2.0 feature data
- Addition of provenance by integrating lineage information by adding ISO 19115-based lineage metadata to AIXM 5 features



Data Broker Architecture



AMXM 2.0 to AIXM 5.1 Mediation





Mediation of AMXM 2.0 to AIXM 5.1

The screenshot displays the LUCIAD software interface. The main window shows a map of an airport with a yellow line highlighting a runway. The interface includes a top menu bar (DATA, EDIT, VIEW, PROJECTION), a search bar, and a right-hand sidebar with various data loaders and filters. Two property tables are open in the foreground, showing metadata for a feature.

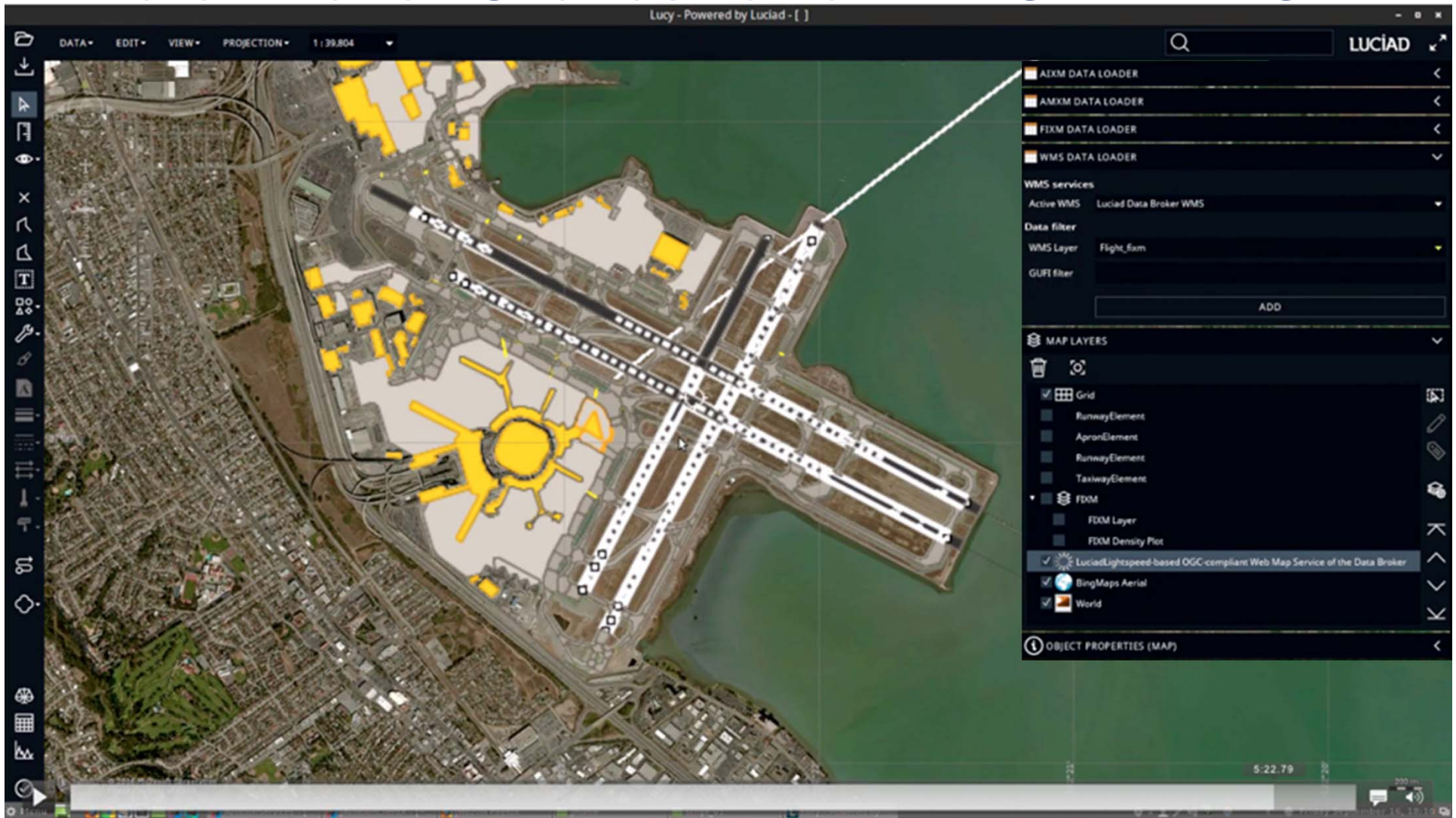
Property name	Value
id	LOCAL_ID_14
stvalid	2016-09-01T12:28:57.321Z
interp	1
featype	0
idnumber	1bbed25f-4c9f-45eb-bedd-421b580e5abb
idarge	Unknown
source	FAA
revdate	2016-09-01T12:28:57.321Z
hacc	Unknown
hires	
integr	

Property name	Value
featureMetadata	
owns	
Metadata	
contact [List]	
dateStamp	2016-09-16T18:08:02.452+02:00
dataQualityInfo [List]	
DQ_DataQuality_Type [1]	
scope	
lineage	
source [List]	
LI_Source_Type [1]	
description	
sourceCitation	
sourceStep [List]	
LI_ProcessStep_Type [1]	
description	Transformed from AMXM 2.0.
value	
dateTime	2016-09-16T18:08:02.452+02:00
processor [List]	
CI_ResponsibleParty_Type [1]	
ggn:originName	
contactInfo	

ATHEC Aviation Information World - Forecasting the Future



Data Broker Orchestration WFS → WMS



FIXM-GML in OGC Testbed 10

- Testbed 10: Issues with “bloating” of XML due to object property model

```
...
<route routeText="KATL.PNUTT7.MCN..AMG.J45.OMN..KDAB">
  <segment airway="S1">
    <routePoint>
      <point xsi:type="base:LocationPointType">
        <location srsName="urn:ogc:def:crs:EPSG::4326">
          <pos>33.63333333 -84.41666667</pos>
        </location>
      </point>
    </routePoint>
  </segment>
  ...
</route>
...
```

```
...
<route>
  <Route routeText="KATL.PNUTT7.MCN..AMG.J45.OMN..KDAB">
    <segment>
      <RouteSegment airway="S1">
        <routePoint>
          <RoutePoint>
            <point>
              <fb:LocationPoint>
                <fb:location>
                  <gml:Point gml:id=
"KATL.PNUTT7.MCN..AMG.J45.OMN..KDAB..S1" srsName="urn:ogc:def:crs:EPSG::4326">
                    <gml:pos>33.63333333 -84.41666667</gml:pos>
                  </gml:Point>
                </fb:location>
              </fb:LocationPoint>
            </point>
          </RoutePoint>
        </RouteSegment>
      </segment>
    </Route>
  </route>
  ...
  ...
```

FIXM-GML in OGC Testbed 12

- **Testbed 12 FIXM ER provides observations and recommendations on**
 - Use of Object-Property Model (Keep, Modify, or Discard)
 - GML Abstract Feature (WFS-compatible)
 - Use of gml:id Attribute
 - Use of <gml:identifier> element
 - Temporal Values (such as xs:dateTime)
 - Use of xsi:type
 - Referencing using Xlink (e.g. Reference to AIXM elements)
 - Removing restrictions on Natural Keys and Coordinates
 - Reducing the FIXM XML file size
 - **Ten** Change Requests (CR) to send to FIXM CCB
- **First implementation of an OGC conforming WFS serving FIXM 4.0(draft) with minimal GML elements**
 - Maintains "compactness" of FIXM



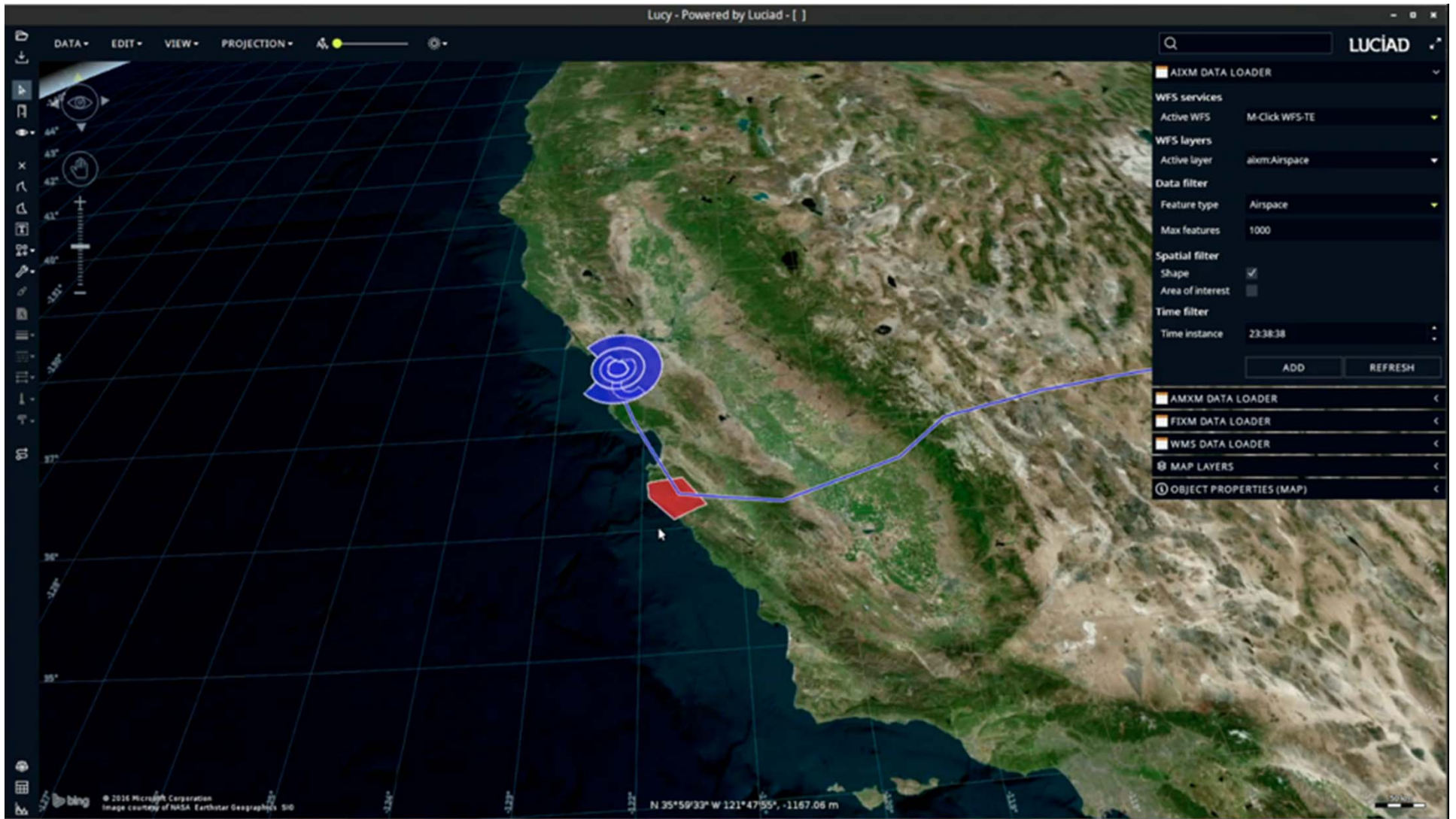
FIXM Flight Plan using WFS

The screenshot displays a GIS application interface. The main map shows a flight plan route (a purple line) across the United States. The interface includes a top menu with 'DATA', 'EDIT', 'VIEW', and 'PROJECTION'. On the right, there is a 'LUCIAD' search bar and a list of data loaders: 'AIXM DATA LOADER', 'AMXM DATA LOADER', 'FIXM DATA LOADER', and 'WMS DATA LOADER'. Below these are 'MAP LAYERS' and 'OBJECT PROPERTIES (MAP)'. The 'OBJECT PROPERTIES' panel shows a table of metadata for a selected object.

Property name	Value
id	LOCAL_ID_0916747916955500841
identifier	
agreed	
aircraft	
arrival	
actualTimeOfArrival	
value	2016-09-15T08:46:27.000Z
timeReference	UTC
aerodrome	
linkInfo	
locationIndicator	KATL
departure	
aerodrome	
linkInfo	
locationIndicator	KSFO
estimatedOffBlockTime	

At the bottom of the screen, there is a banner for 'ATHEC Aviation Information World - Forecasting the Future'. The banner includes the ATHEC logo, the text 'Aviation Information World - Forecasting the Future', the Federal Aviation Administration logo, and a stylized 'E' logo.

Query on WFS-TE with FIXM Route



OGC PubSub 1.0 Specification

Publications

- Identify which kind of data is provided
 - US Airspace
 - AIXM, FIXM



Delivery Methods

- How data is delivered via asynchronous messaging patterns
 - AMQP 1.0
 - JMS
 - → NEMS



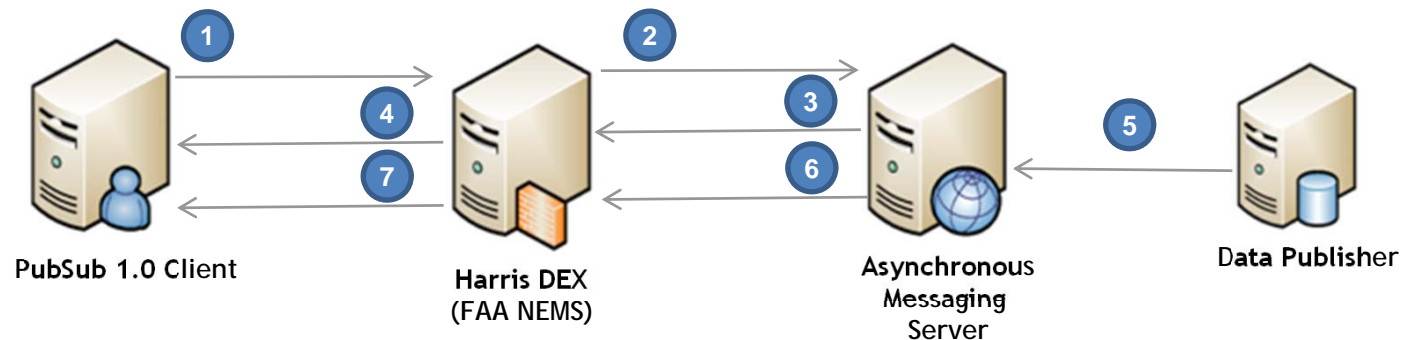
Filtering Capabilities

- Sub-setting of data
 - Spatial Filter (using Airspace extents)
 - Specific Flight (GUFI filter)

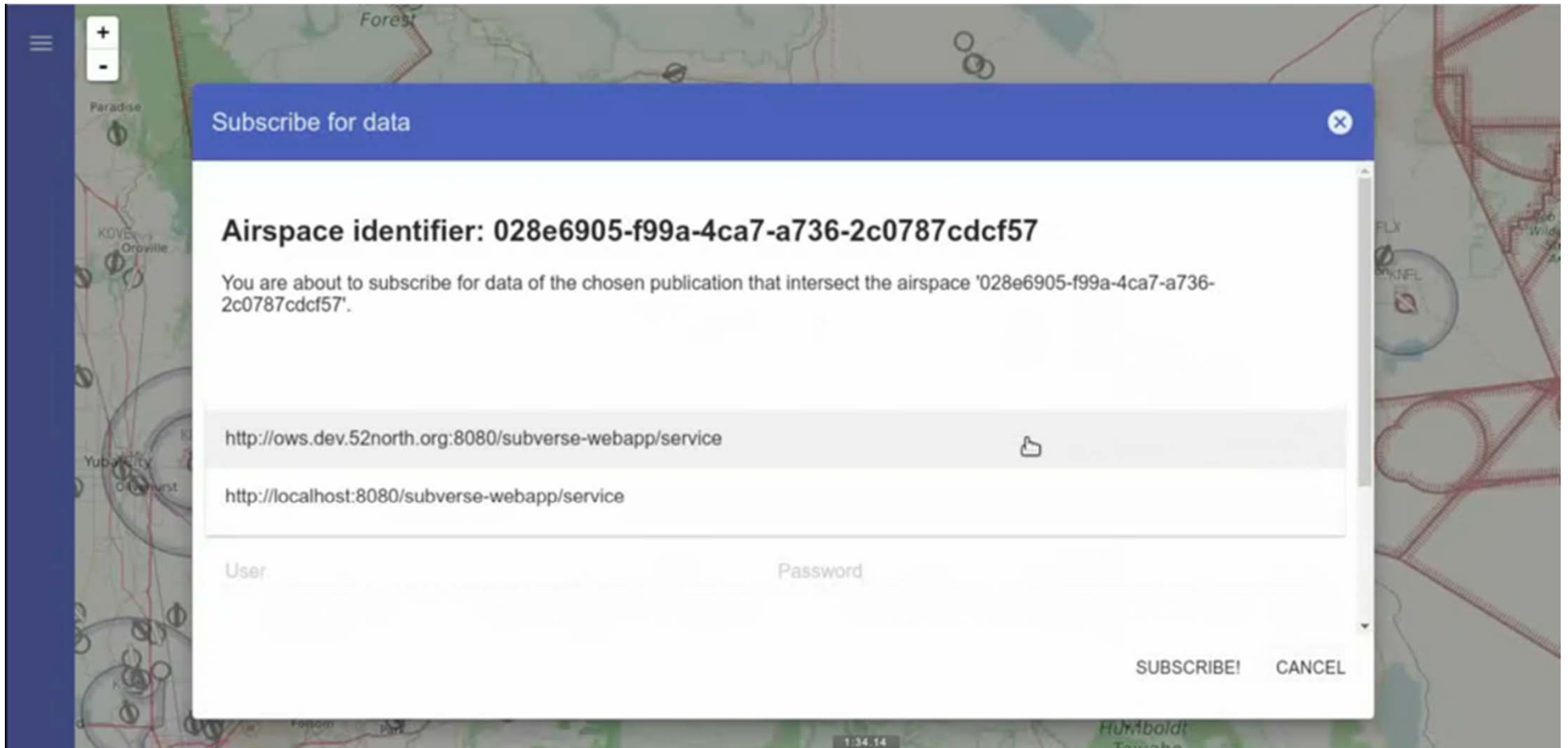
52North provides an Open Source implementation for OGC Testbed 12

Request/Reply vs Publish/Subscribe

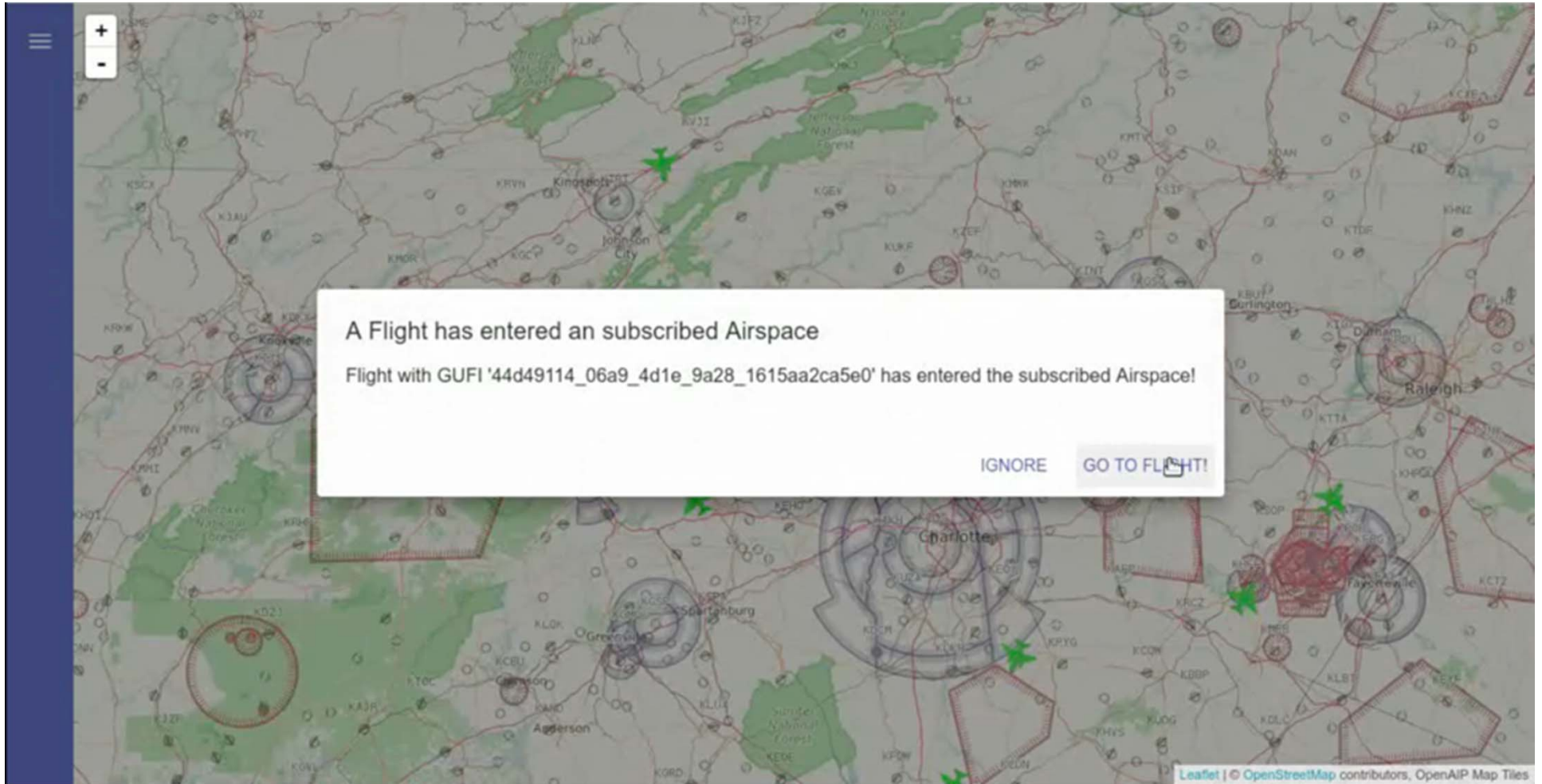
- OGC Web Services (WFS, WMS, WCS, WPS, etc.) use request/reply “synchronous” messaging patterns
- OGC PubSub Standard Working Group (SWG) developed the PubSub 1.0 Specification for subscription-based messaging
- OGC Testbed 12 implements a PubSub 1.0 service prototype with integration to Harris DEX™ (i.e. FAA NEMS)
 - Conforms with FAA SWIM B-12 Dynamic Subscription service



PubSub 1.0 Demo (1/3)



PubSub 1.0 Demo (2/3)



Aviation Engineering Reports

- 16-018 Testbed-12 Aviation Architecture ER
 - 16-024 Testbed-12 Catalog ER
 - 16-045 Testbed-12 Data Broker ER
 - 16-017 Testbed-12 Asynchronous Messaging ER
 - 16-061 Testbed-12 SBVR ER
 - 16-040 Testbed-12 Aviation Security ER
 - 16-059 Testbed-12 Aviation Semantics ER
 - 16-028 Testbed-12 FIXM GML ER
- Drafts available at docs.opengeospatial.org/per/



<http://www.opengeospatial.org/docs/er>



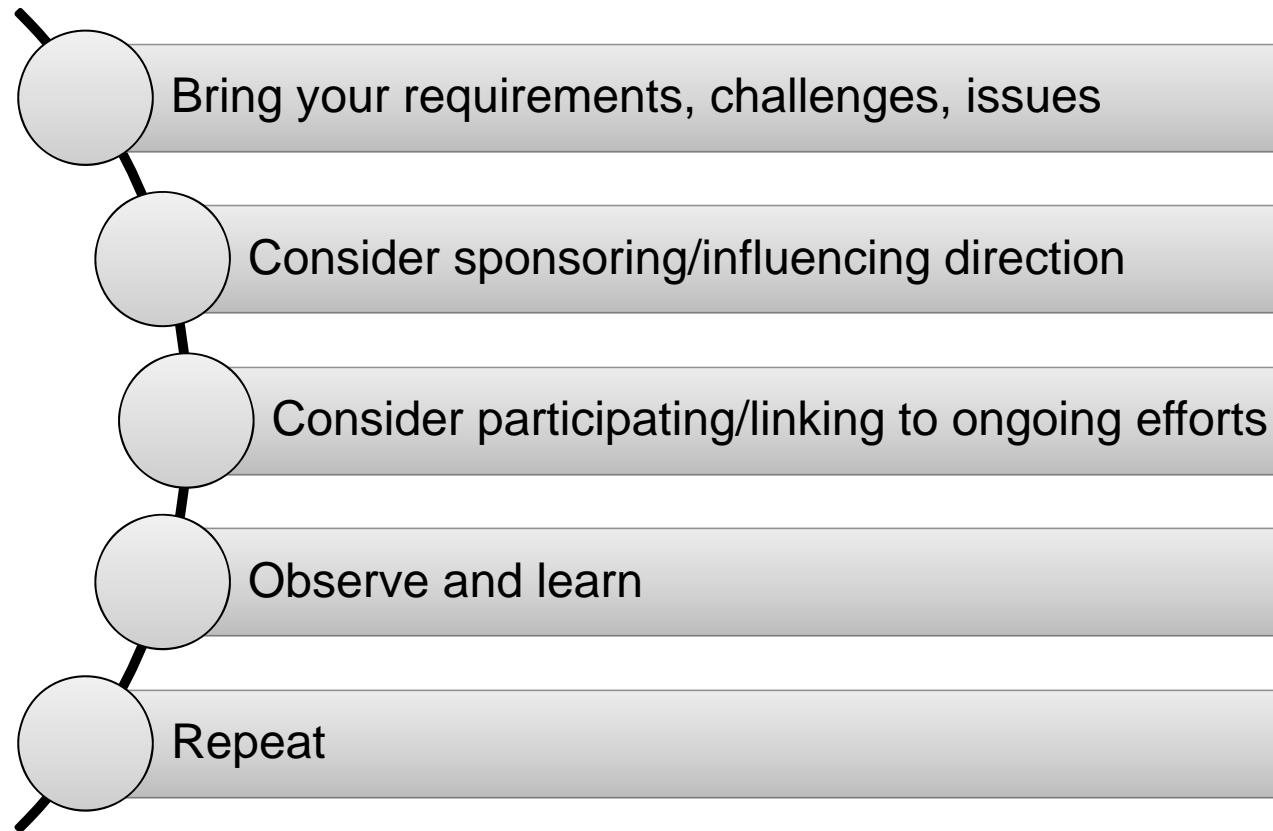
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- OGC Network
- Discussion Papers
- Data
- Education
- Guide to Role of Geospatial Standards
- OGC Validator
- Have an Idea?
- Endorsements
- Guide for Software Acquisition



OGC Testbed 13 – Bring your ideas!



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