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Open Geospatial Consortium

OGC Web Services Initiative, Phase 6 (OWS-6)

Aeronautical Information Management (AIM)

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Agenda

- OGC Testbed Process
- Goals of OWS-6 AIM
- Architecture of OWS-6 AIM
- OWS-6 AIM Demonstration Video
- OWS-6 AIM Lessons Learned
- Future Work
- Acknowledgments

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OGC's Approach for Advancing Interoperability

- ***Interoperability Program (IP)*** - a global, innovative, hands-on rapid prototyping and testing program designed to accelerate interface development and validation, and bring interoperability to the market

Demo & Reports

- ***Specification Development Program*** – Consensus standards process similar to other Industry consortia (World Wide Web Consortium, OMA, etc.)

- ***Outreach and Community Adoption Program*** – education and training, encourage take up of OGC specifications, business development, communications programs

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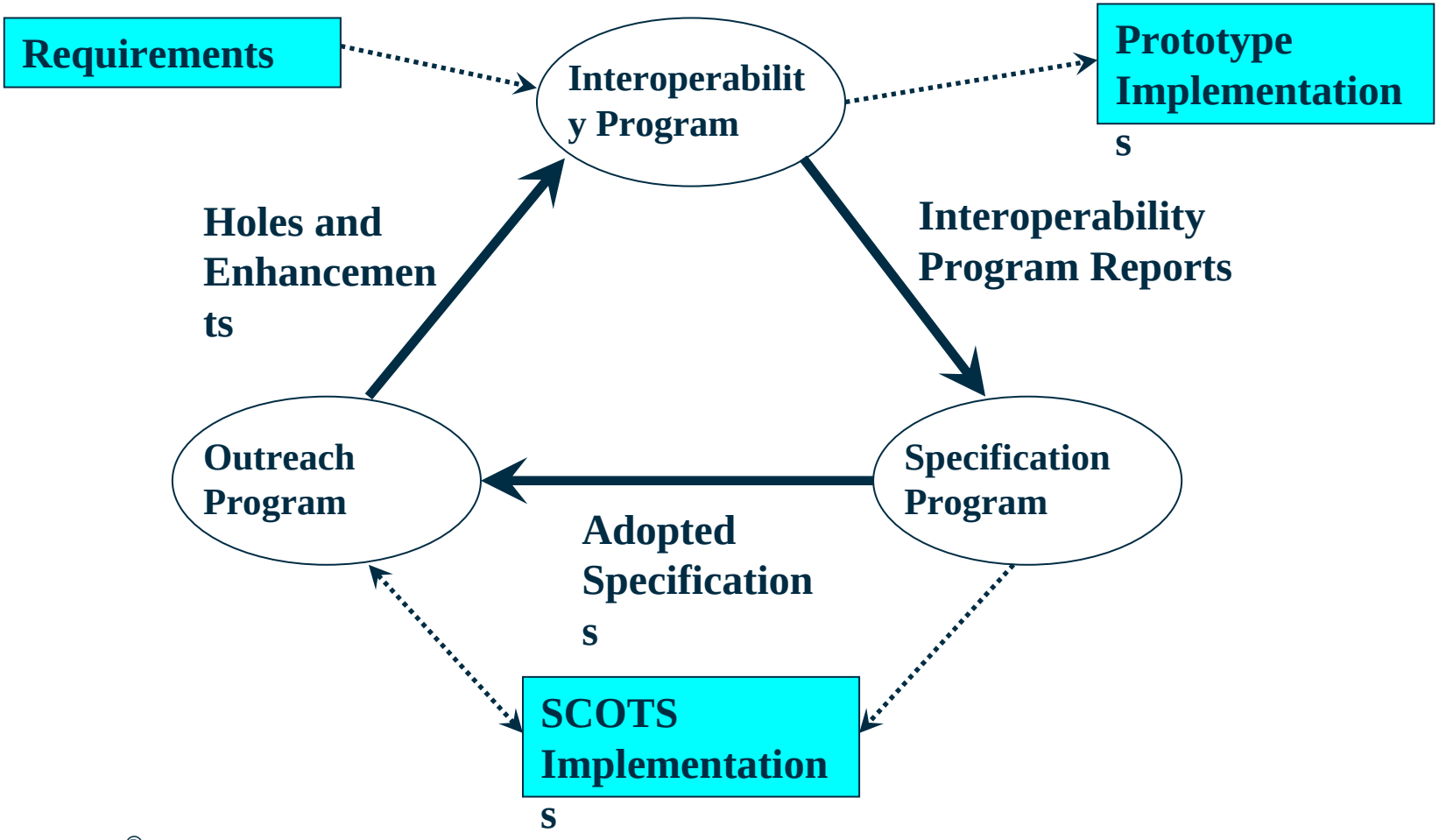
Iterative Development

Yielding Tested Specifications



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OWS-6 Themes & Threads

- Cross-cutting Themes
  - Event architecture, alerts, and notifications
  - Security and secured services within and across domains
  - Enterprise-oriented scenarios (gov/mil/large corporation)
  - Refinement of process integration and service chaining
- Threads
  - SWE (Sensor Web Enablement)
    - *Imagery services, information models, CCSI, catalog*
  - GPW (Geo-Processing Workflow)
    - *Asynchronous workflow, WPS grid processing, GML schema development*
  - DSS (Decision Support Services)
    - *WMTS, 3D indoor-outdoor routing / tracking, W3DS, flythrough client, integrated client, ISO 19117/SLD portrayal*
  - AIM (Aeronautical Information Management – *new thread*)
    - *Service orientation, AIXM, notifications, and flight operations*
  - CITE (Conformance and Interoperability Test & Evaluation)
    - *Complete WMS 1.3, and DGIWG Profile of WMS*

OWS-6 Sponsors

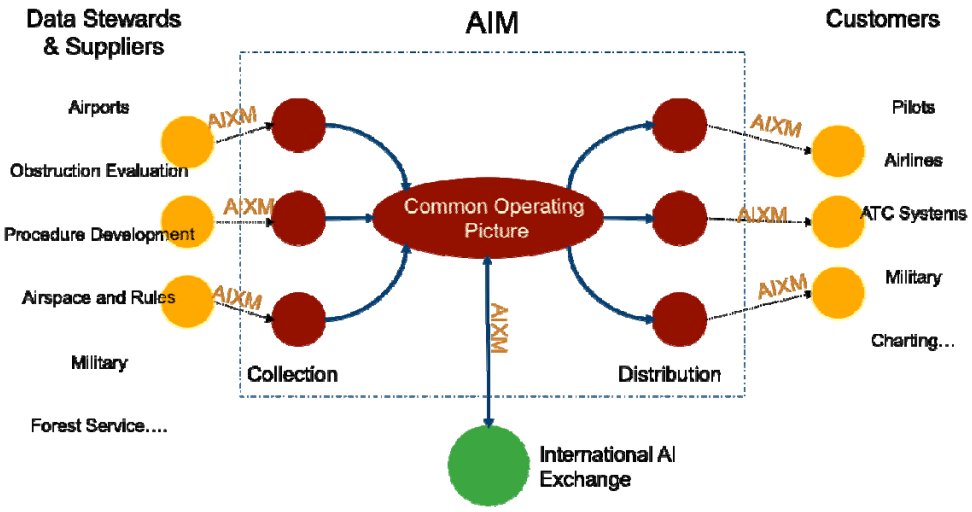
- U.S. National Geospatial Intelligence Agency (NGA)
- U.S. Dept of Defense - Joint Program Executive Office – Chemical & Biological Defense (JPEO-CBD)
- Natural Resources Canada (NRCan) GeoConnections
- U.S. Federal Aviation Administration (FAA)
- EUROCONTROL - The European Organization for the Safety of Air Navigation
- EADS Defence and Communications Systems (DCS)
- U.S. Geological Survey (USGS)
- BAE Systems
- ERDAS, Inc.
- Lockheed Martin Corporation

Aeronautical Information Management (AIM)

- New Thread for OWS-6 sponsored by FAA and Eurocontrol

- Develop and test standards-based service-oriented architecture to support the provision of valuable 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 the right time at the right place to the right user
  - End-to-end management of information



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Aeronautical Information Exchange Model AIXM 5.0

- Develop and demonstrate the use of AIXM 5.0 in an OGC Web Services Environment
- Evaluate and advance various AIXM 5.0 characteristics in realistic scenario setting

Standards-based data model and exchange format that can satisfy the aeronautical information exchange requirements for current and future aeronautical information applications; Models temporality

Accommodates ICAO standards and recommendations:
Accommodates industry requirements: ARINC 424/EUROCAE ED-99/ RTCA DO-272

•Uses XML and GML
•Is modular and extensible
•Supports current and future AIM IS requirements
Digital AIPs, automated charting and pubs, integrated digital NOTAMs, Aerodrome mapping databases and apps
Situational displays, etc

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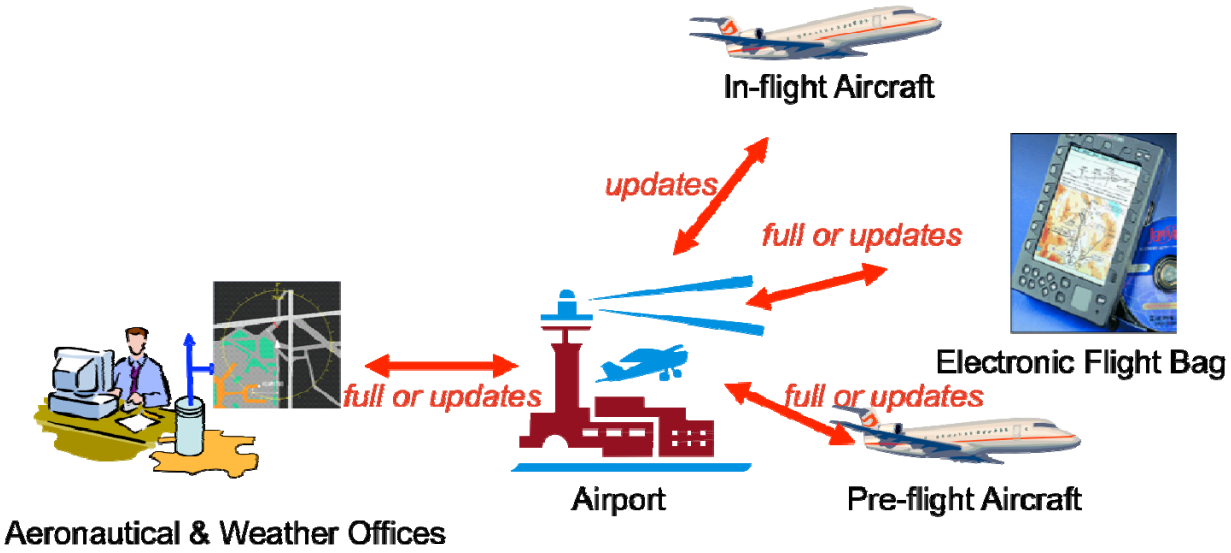
OWS-6 AIM Goals:
Right Data, Right Time, Right Place

1. Use and enhancement of Web Feature Service (WFS 2.0) and Filter Encoding (FE 2.0) in support of AIXM 5.0 features and 4-D flight trajectory filtering,

1. Architecture and demonstration of standards-based Event Alert mechanism to notify users of changes to selected relevant aeronautical information,

1. Prototype of Aviation Client for retrieval, integration and visualization of AIXM and Weather data based on relevant and up-to-date information in relation to a flight



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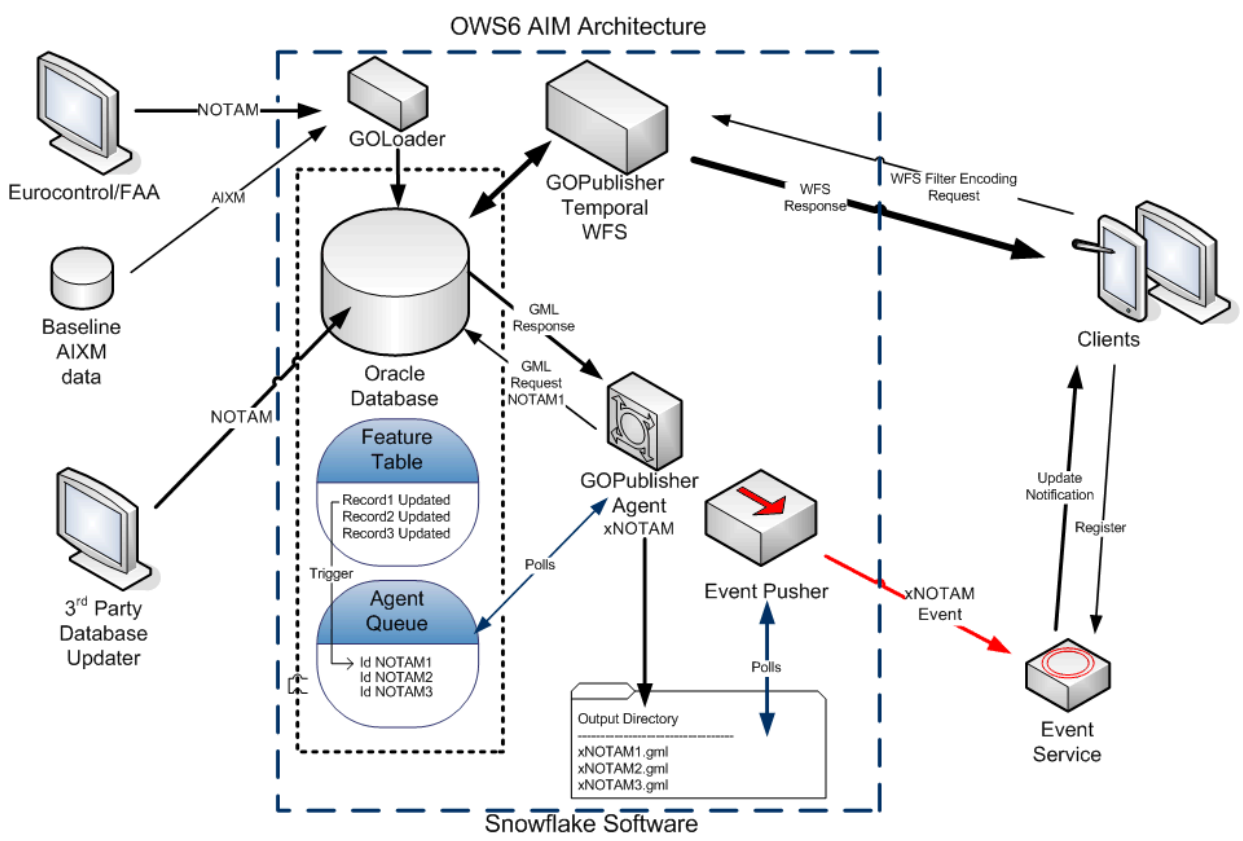
Snowflake AIXM WFS



1. GO Loader: Loading xNOTAM & AIXM5 baseline data
2. GO Publisher WFS: publishing AIXM5 over WFS
3. GO Publisher WFS: Temporal queries over FES2.0

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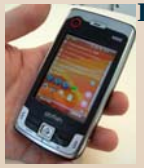
Aviation Clients

EFB

PDA



Aeronautical Information User

Avionics Systems

Carbon Project

Luciad

PCAvionics

Lufthansa Systems

U of Muenster

Event Service

Post Event

Queries/Updates

Aeronautical Information Custodians

-Subscribe to Events

-Receive Events

Post Event

Snowflake

-Retrieve updates

-Retrieve full AIXM data filtered by time and location

-Retrieve AIXM data for route of flight

AIXM WFS

Retrieve weather data

NOAA

WXXM TAF WFS

Retrieve weather data

NNEW

Weather WFS

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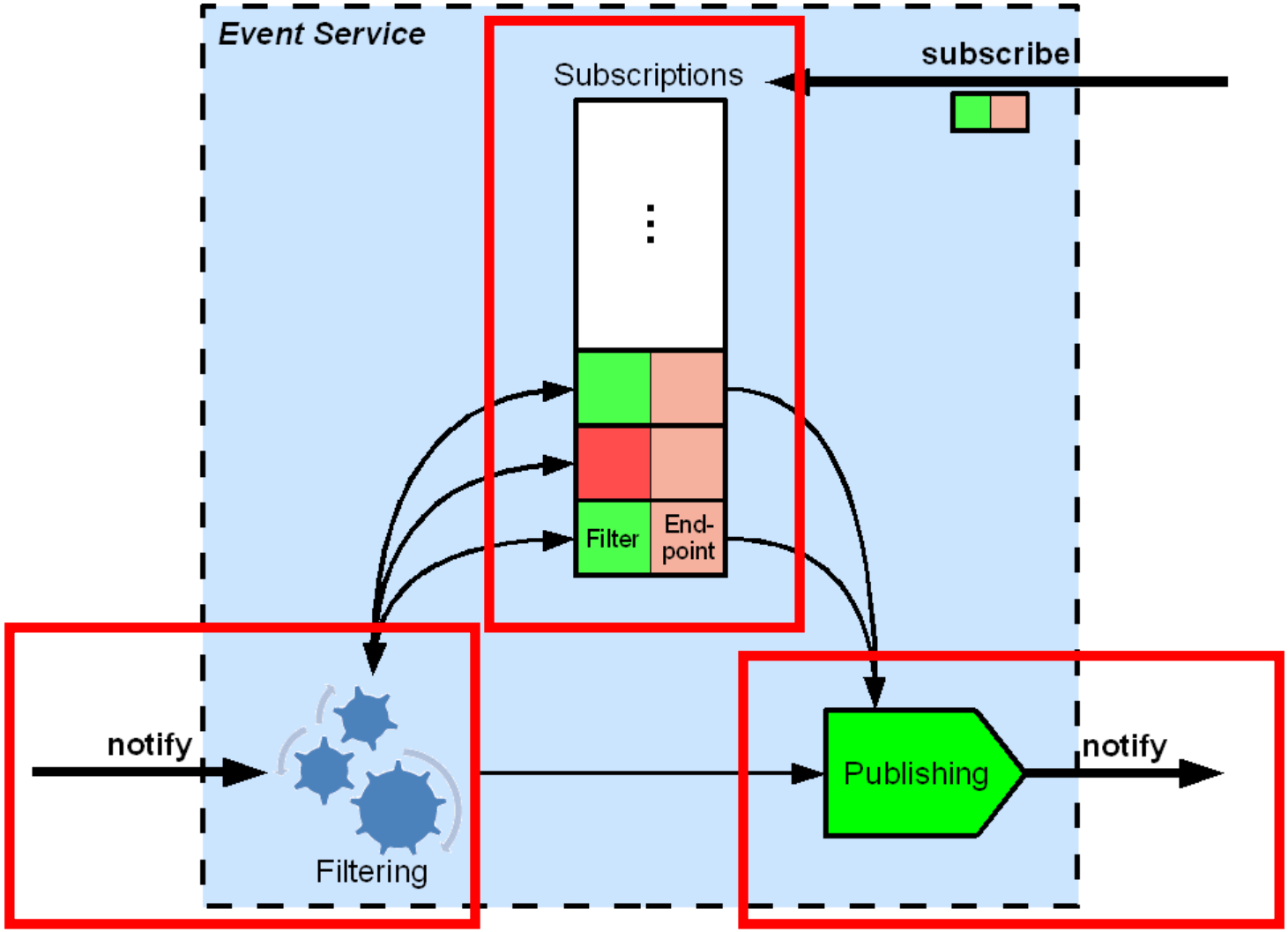
U of Muenster Event Service



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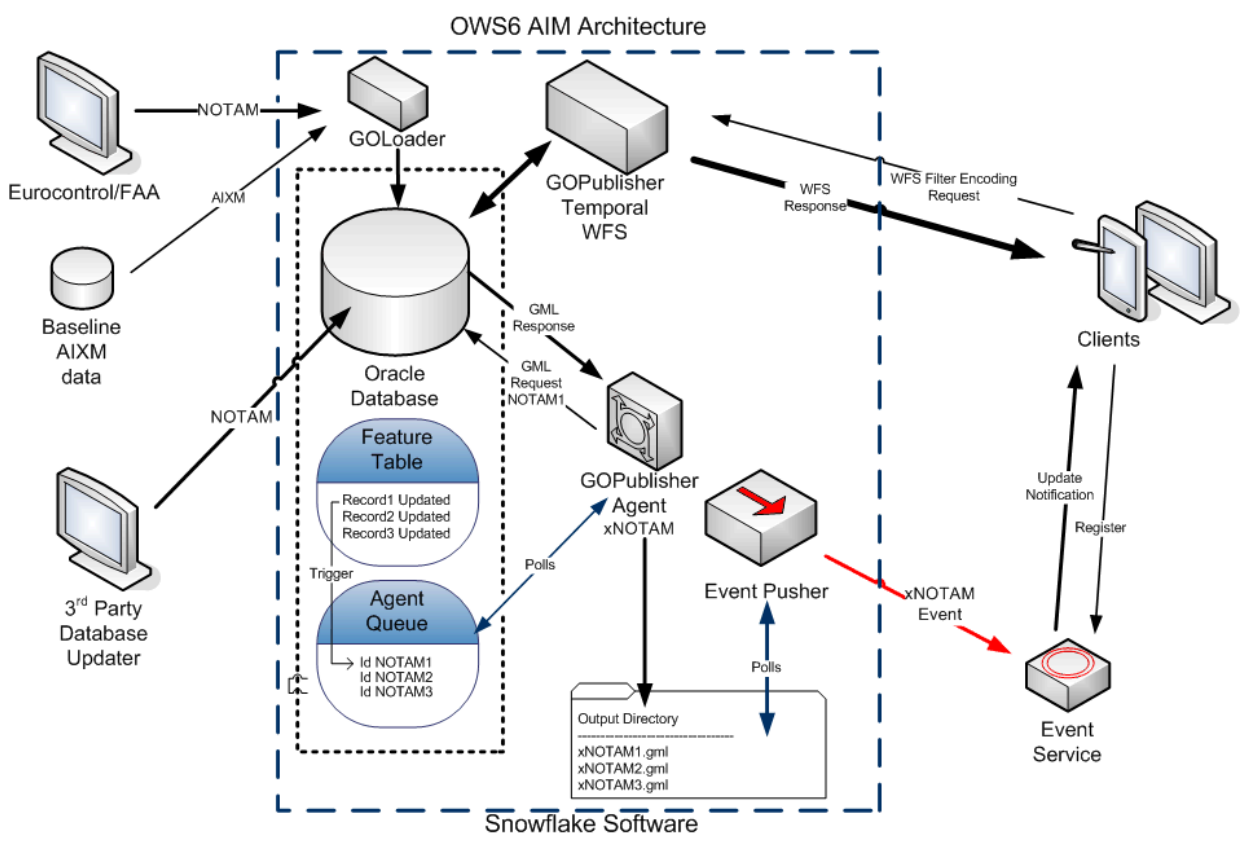
Snowflake AIXM WFS



1. GO Loader: Loading xNOTAM & AIXM5 baseline data
2. GO Publisher WFS: publishing AIXM5 over WFS
3. GO Publisher WFS: Temporal queries over FES2.0
4. **GO Publisher Agent: Bulk Publishing xNOTAM to the Event Service**

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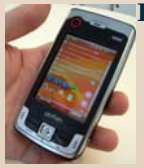
Aviation Clients

EFB

PDA



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AIXM WFS

Retrieve weather data

NOAA

WXXM TAF WFS

Galdos

AIM Engineering Report

-Architecture
-Scenario
-Lessons Learned

Retrieve weather data

NNEW

Weather WFS

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Demonstration Scenario

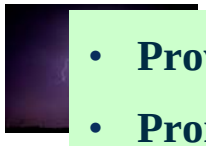
North America

Sweden

Destination Airport
Pilot notified during flight that airport is closed

ARN/ESSA

Pilot notified of bad weather over ILN



- **Provides a fictitious, but realistic context for a demonstration of the functionality**
- **Prompts the exercising of interfaces and the use of encodings that weredeveloped or enhanced within OWS-6**
  - **Demonstrates the ability of Web Feature Services (WFS) and the Filter Encoding (FE) Specification to distribute aeronautical data in AIXM 5.0 format in response to direct user queries or in response to alerts to a user when specific aeronautical information – as defined by that user – is updated**

ternate
stination
rport

ESSP

(Returned by WFS query)

Airport of Departure

DFW

CFE

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Lessons Learned

- **Demonstrated successful use of WFS and FE for on-demand access to AIXM 5.0 baseline and delta data**
  - Accurate and timely retrieval of information based on spatio-temporal filters
- **Demonstrated successful access and retrieval of WXXM and other GML-based weather data via WFS**
  - Same service for Aeronautical and Weather data = lower implementation barrier for clients
- **Demonstrated successful incorporation of standards-based architecture for Event handling and notification**
  - Feasibility of incorporating the OASIS WSN mechanism
  - SOAP approach creates overhead for clients
- **Demonstrated quick prototyping and implementation of AIXM Aviation Clients**
  - Issues encountered: parsing complex GML schemas; mapping existing data models to AIXM
  - Identified data integration and integrity issues
- **Submitted 2 Change Requests (CR) to support AIXM temporal queries**
  - FE: Supporting the return of features with estimated/unknown endpoints for timeslices
  - GML: Allowing “estimated” to be a valid value for indeterminatePosition

Future Work

- **Further improving/adapting underlying standards**
  - GML ISO metadata, WFS FE spatio-temporal filters
  - Simplification/decoupling of AIXM schemas
- **Understanding/improving metrics for system**
  - Performance of spatio-temporal filters, Latency of events and updates, Data integrity strategies
- **Investing in future client development**
  - Reusable components, More advanced data visualization (weather symbology, etc)
- **Improving the Event Architecture**
  - Weather events, Intermittent access issues
  - Other Event protocols (WS-Eventing), Transport and Message Level Security, Reliability, etc
- **Building on the OWS-6 AIM Architecture**
  - WFS-T, Intermittent access issues, elements of existing infrastructure
  - Validation of AIXM 5.1 in Web Services environment
- **Advancing incorporation and filtering of weather information**
  - WXXM over WFS, Probability in WXXM, 4D weather cube

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Peter Vretanos	WFS/FE 2.0 Editor

Questions & Comments

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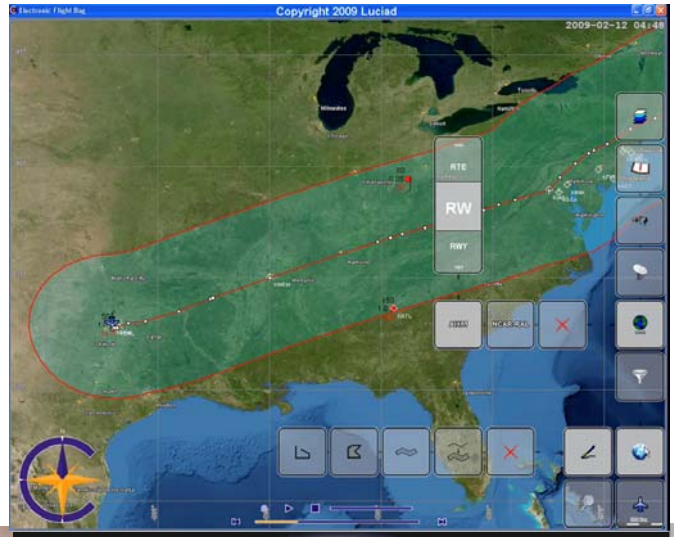

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