



Architecture and Capabilities of a Data Warehouse for ATM Research

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Outline

- Motivation
- Architecture
- Data Sources and Management
- Data Search and Download
- Queries and Reports
- Other Services
- Usage Examples
- Future Directions



Motivation

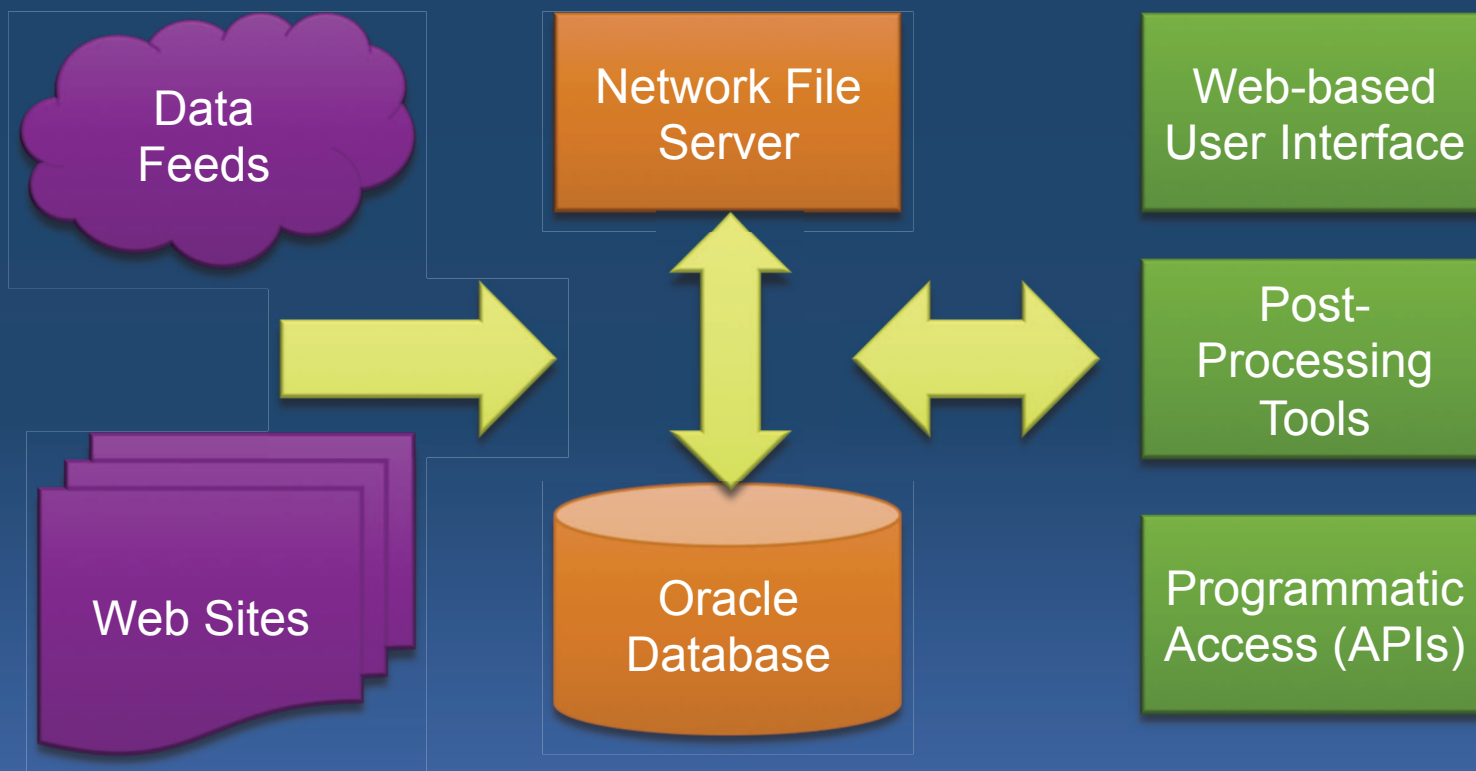
- Live FAA, NOAA data streams
- Ad hoc data archiving
- Data source discontinuities
- Difficulty of sharing, discovery, ingestion



Sherlock, an ATM
Data Warehouse



Sherlock Simplified Architecture





Data Source Categories

Source Category	Acquisition
FAA flight data: Center, TRACON, ASDI, Exelis (commercial)	Streaming data over VPN, recorded continuously
FAA strategic advisories	Retrieved daily from FAA website
FAA performance data	Retrieved monthly from FAA website
FAA TBFM metering information	Received from FAA system daily
FAA convective weather forecasts	Retrieved 24 times/hour from FAA FTP site
NOAA/NWS wind forecasts, weather observations	Retrieved from NOAA sites at various of update rates
CTAS automation system recordings	Daily recordings of Center/TRACON pairs



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Data Management

- Retrieval and monitoring
- Missing data recovery
- File renaming, relocation
- Nightly loading into Oracle



Search and Download

- Oracle Application Express (APEX) interface
- Search across datasets, sub-sets
- Search over dates of interest
- Assess data completeness
- Download selected datasets



Search and Download Demo

Welcome: MESHOW [\(Logout\)](#) [What's New?](#) [Feedback](#)

[Home](#) | [Raw Data \(Search and Download\)](#) | [Processed Data \(Analysis\) v](#) | [Date Cart](#) | [Tools v](#) | [Administration v](#)

[About Raw Data](#)

Raw Data

Data Sources:

- ASDI*
- Center
- CIWS*
- CTAS
- METAR*
- RUC*
- RR*
- TRACON

Date Selection Date Range **Start Date** **End Date**

Date Cart (0 Days)

*Time Between and (for ASDI, CIWS, METAR, RUC and RR only)

Note: File size limit per download is 5 GB.

Raw Data Report

Reports Rows Actions



Search by Date Cart

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Home Raw Data (Search and Download) Processed Data (Analysis) Date Cart Tools Administration

Announcements

- The pull-down menu is changed from a mouse-over to mouse-click selection scheme. This should offer a better UI experience. Some code changes were made behind the Raw Data (Search & Download) page. The binary files are retrieved from the /home/data file system instead of from the database.
- When decoded METAR data (airport ground observations) was made available in Version 2.1, only the Body section of a METAR report was decoded. In this release, both Body and Remarks sections of the text in a METAR report is decoded resulting in about 200+ queryable fields. You can now specify specific severe weather phenomena (e.g. lightning, thunderstorm, freezing rain/fog, sand storm, volcanic ash) in your query. Also in this release, 10 days worth Exelis data is added (from 9/9/2013 to 9/19/2013).
- NASA collected 42 days of ITT Exelis data which was made up of NAS wide IFR, VFR and ground traffic data. The track data was from radar sources as well as ADS-B sources when available. The collected data was cleaned and saved in the Data Warehouse for download in various export formats. Available export formats are CmSim File, HLA CSV File, Track Only CSV file, and Google Earth KML file.
- Aircraft Reports are now available under the "Processed Data" tab in the pull down menu. Aircraft Reports describe weather conditions encountered by aircrafts. They are made up of PIREP (Pilot Reports) and AIREP (Air Reports) messages and are available starting from 01/13/2013.
- The following tabs from the pull down menu bar are renamed to better reflect contents:
 - "Search and Download" is renamed to "Raw Data".
 - "Analysis" is renamed to "Processed Data".
- Ad Hoc SQL Query is now available. Click the pull-down menu Tools > SQL Query. Click the link What's New? located on the upper right hand corner to learn more.

Data Warehouse Size (Terabyte)

Current Total Size of Data Warehouse



Data Source Summary

Data Source	First Available Date	Last Available Date	# of Days	Total File Size (TB)	Total File Count
ASDI	2009-01-01	2014-09-11	2050	1.473	2,889,620

Home

Welcome to the Nextgen Warehouse Application. This application is designed to provide a centralized search and analysis of data.



Query and Reporting

- Database queries on parsed sources
- Filtering, grouping, charting
- Download results



Query and Reporting Demo

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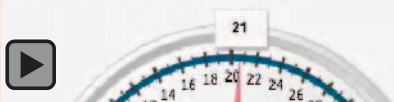
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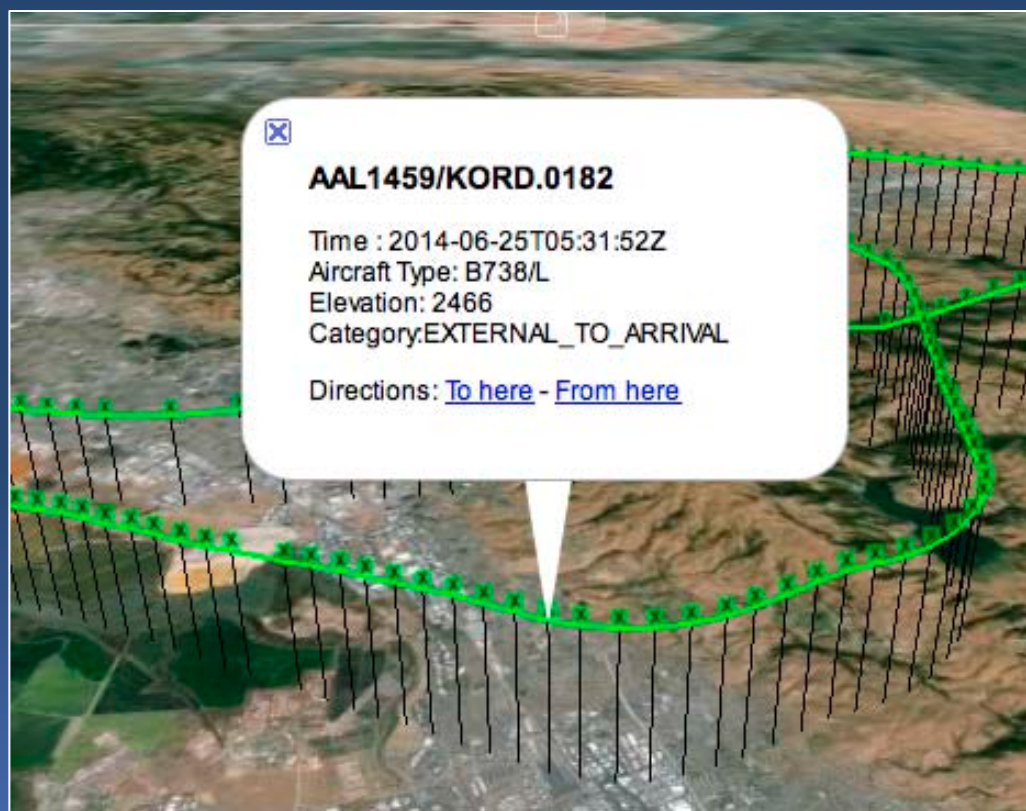
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CTAS Parser, Track Visualizer

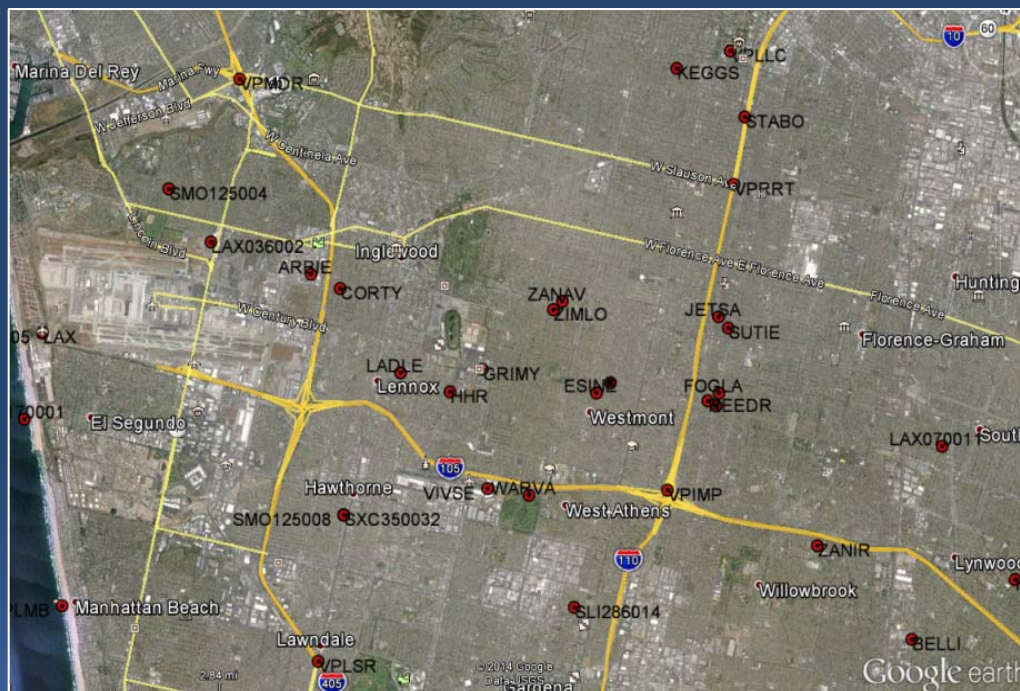
- CTAS output file used widely by NASA, partners
- Java-based parser reads CTAS files, writes many formats
- Visualizer writes KML for Google Earth





Geospatial Service

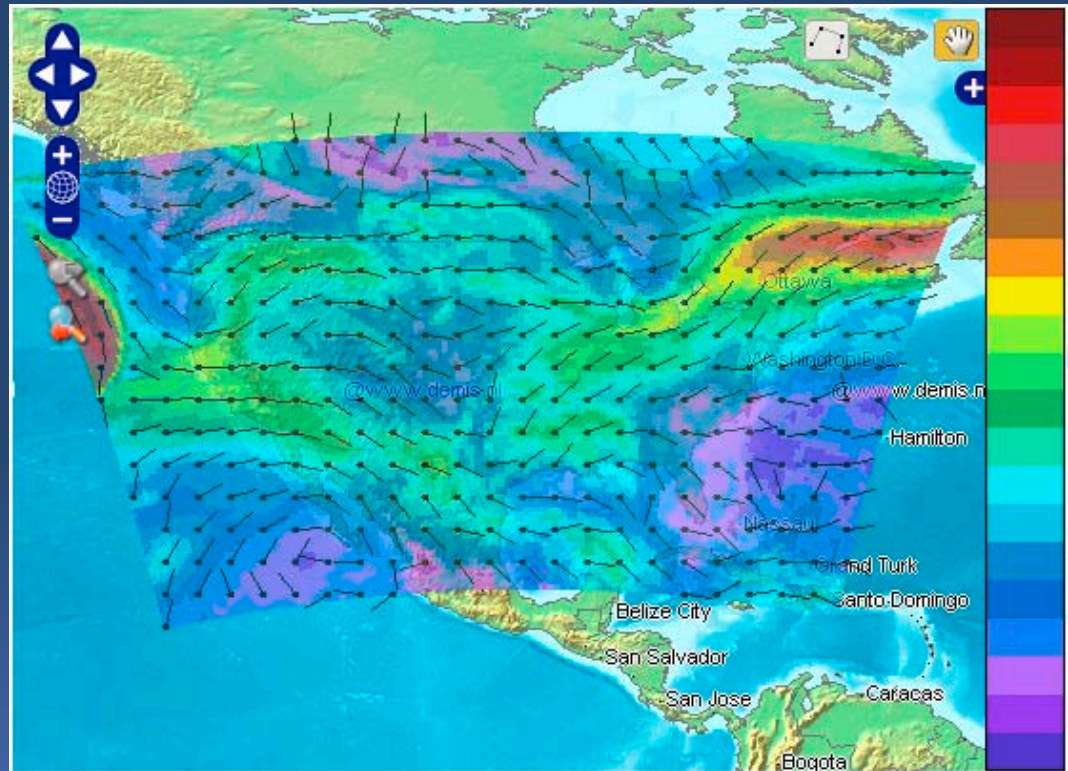
- Open-source GeoServer
- Airspace features
- Convective weather 'polygons'
- Query, view, save





Weather Server

- Open-source
THREDDS
software reads
weather datasets
- WMS query,
visualization, export





Usage Examples

- Predict strategic re-routes and ground delay programs using data mining and machine learning
- Create realistic simulation scenarios
- Validate automation algorithms
- Debug and validate software



National Aeronautics and Space Administration



Tracks on Google Earth





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Future Directions

- End-to-end flight records
- Integrated search across sources
- Big data infrastructure



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Questions?



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