Evolution of Net-Centric Data Services at the Air Force Weather Agency (AFWA)

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Agenda

• AFWA Mission Overview
• Background
• AFWA Evolution - First: Joint Meteorological and Oceanographic (METOC) Services
  • Joint METOC Services Lessons Learned
• AFWA Evolution - Next: Enterprise Geographic Information System (e-GIS) Services
  • e-GIS Services Lessons Learned
• AFWA Evolution - Current: Air Force Weather Web-Services (AFW-WEBS)
  • AFW-WEBS Lessons Learned
• Conclusion
AFWA Mission Overview

Maximizing America’s Power through the Exploitation of Timely, Accurate, and Relevant Weather Information; Anytime, Everywhere
AFWA Mission Overview

• AFWA Headquarters (HQ) provides centralized support for:
  – Fine scale weather modeling.
  – Global cloud analysis and forecasts.
  – Space weather observations, analysis, and forecasts.
  – Climatological products, services, and storage of USAF Climatic Data.
  – Armed Forces Network regional Long Range Forecasts/Outlooks.
  – Weather analysis and forecasting for the National Intelligence Community.
  – Global volcanic ash monitoring, modeling and prediction.
  – Host a single web portal of Air Force (AF) weather and climatology information.

• Appropriate information needed at each level of the organization’s structure
  – Central HQ
  – Regional Hubs
  – Unit Support Flights

Complex, data dense, mission
Background

• Department of Defense (DoD) Net-Centric Services Strategy directive
  – Stemming from Gulf War conflict inability to share information
  – Standards based Services Oriented Architecture (SOA) to promote interoperability
  – Discoverable services
    • Reuse in multiple applications
    • Use authoritative sources

The need for Net-Centric, Sharing of Data Drove Evolution
Background

- AFWA historically produces 800,000+ products per day – primarily for human consumption
  - Data collected globally
  - Terrestrial and space based sensors
  - High amounts of time sensitive data
  - Products created often unused

- Data historically pushed via File Transfer Protocol (FTP) to end systems which had to process weather specific data formats
  - Weather Products Management Distribution System (WPMDS), Weather Secured (WS) FTP1, Multiple specialized systems
  - Minimal control and monitoring of endpoints and subscriptions

- Multiple web sites to display prebuilt imagery and text products
  - Imagery lacks geospatial references and other metadata
  - Text products require domain knowledge or decoder to interpret

Need to modernize through netcentric approaches
- Streamline & centralize ops
- Focus on services
- Machine-to-machine interoperability

Need to modernize and streamline through netcentric approaches
AFWA Evolution
First: Joint METOC Services

• First AFW effort at discoverable web based services
  – Joint METOC Broker Language (JMBL) services
    • Simple Object Access Protocol (SOAP)-based web services
    • Very complex for ad hoc data pulls
    • Implementation required significant integration efforts
    • Extensible Markup Language (XML) schema very verbose
  – Consolidated Dissemination Capability (CDC)
    • Data push
    • End user management of data subscriptions
    • Improved organizational control of endpoints/subscriptions
Joint METOC Services Lessons Learned

• Service complexity has costs
  – Difficult adoption and integration
  – Higher costs to maintain complex systems
  – Higher costs to support user base
  – Lower performance/throughput

• No universal standard
  – Limited interoperability between applications and services

• Legacy systems have challenges
  – Not service capable
  – Avoid service adaptors
    • Increased coupling and complexity

• DoD services registry and discovery incomplete
  – Goal of easy search and addition of services not yet achievable
• Technology Overview
  – Implementation based on Commercial Off-the-shelf (COTS) GIS tools and services
  – Focus on implementing Web Mapping Service (WMS)
    • Imagery service gives information above raw data
    • Common Operational Picture integration
    • Discoverable using getCapabilities
    • Compliant with Open Geospatial Consortium (OGC) standards
      – WMS
      – Keyhole Markup Language (KML)
e-GIS Services Lessons Learned

- COTS solution required a lot of tuning to support high data volumes and highly-perishable data

- Initial frameworks and standards not well positioned for weather services
  - For example, time, elevation, and other dimensions not defined

- AFWA saw quick adoption
  - WMS and KML integration much easier
  - Simple Universal Resource Locator (URL) request vs. SOAP envelope
  - Loose coupling – no adaptors needed

- Generated interest in additional services
  - Expanded imagery services
  - Data services

- Demonstrated benefits to enterprise architecture of on-demand services
  - Reduced processing
  - Less file routing
  - Reduced latency of information to users
AFWA Evolution: Current: AFW-WEBS

• Technology Overview
  – OGC Services based solution
    • Utilized COTS weather solution designed for services
  – Refreshed front end web presence
    • Modern interfaces exploiting services
    • Replacing web sites and legacy imagery production
  – Services
    • WMS and KML
    • Web Feature Service (WFS) for point information
    • Evaluating Web Coverage Service (WCS) for data exposure
  – Caching
    • Image tile caching
    • Performance and scalability needed for services to be relevant
AFW-WEBS Lessons Learned

• COTS weather service solution was successful
  – Easier to increase service offerings
  – Performance and scalability tuning still important

• Evolving OGC standards
  – WCS standard lacking
  – Extensible standards flexible, but at the cost of interoperability

• Legacy applications need to be phased out
  – Gradual transition allows for user adoption
  – Training, documentation, and communication
    • Collaboration tools help organization and users stay in sync

• Need to move some business logic into the services
  – Web Processing Services (WPS)
    • Reduced application complexity
    • Improved customization of services
    • Move from information to impacts
Conclusion

• AFWA is continuing to work on evolving net-centric data services
  – Improving and expanding existing services
  – Data services using WCS
  – Investigating WPS

• Challenges
  – Ability of legacy systems to adapt
    • User community and organization need to evolve together
    • Coordination and communication are musts
    • Organization needs commitment to change
      – Upgrade or replace legacy systems
  – High data volumes, highly-perishable data
    • Performance and scalability require constant improvement
    • Improved data density and latency will always be desirable
  – Evolving Standards
    • Extensions and improvements to standards can help expand capabilities
    • Keeping up with standards while minimizing service impacts a challenge

Services need to continue to evolve to stay relevant
THE VALUE OF PERFORMANCE.

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BACKUPS
AFWA Mission Overview

- Provide regional scale analysis and forecast products, data and services through subordinate Operational Weather Squadrons and Weather Squadrons.
  - Operational Weather Squadrons provide regional support
    - Issue site forecasts
    - Mission planning weather analyses
  - Weather Flights provide unit level support
    - Flight briefings
    - Observations
  - Special Operations Weather and Army Weather Units support isolated deployments
    - Direct mission support
  - Space Weather Operations
    - Space weather analyses, forecasts and alert notifications