CIWS Data Distribution Service

Carol Kelly

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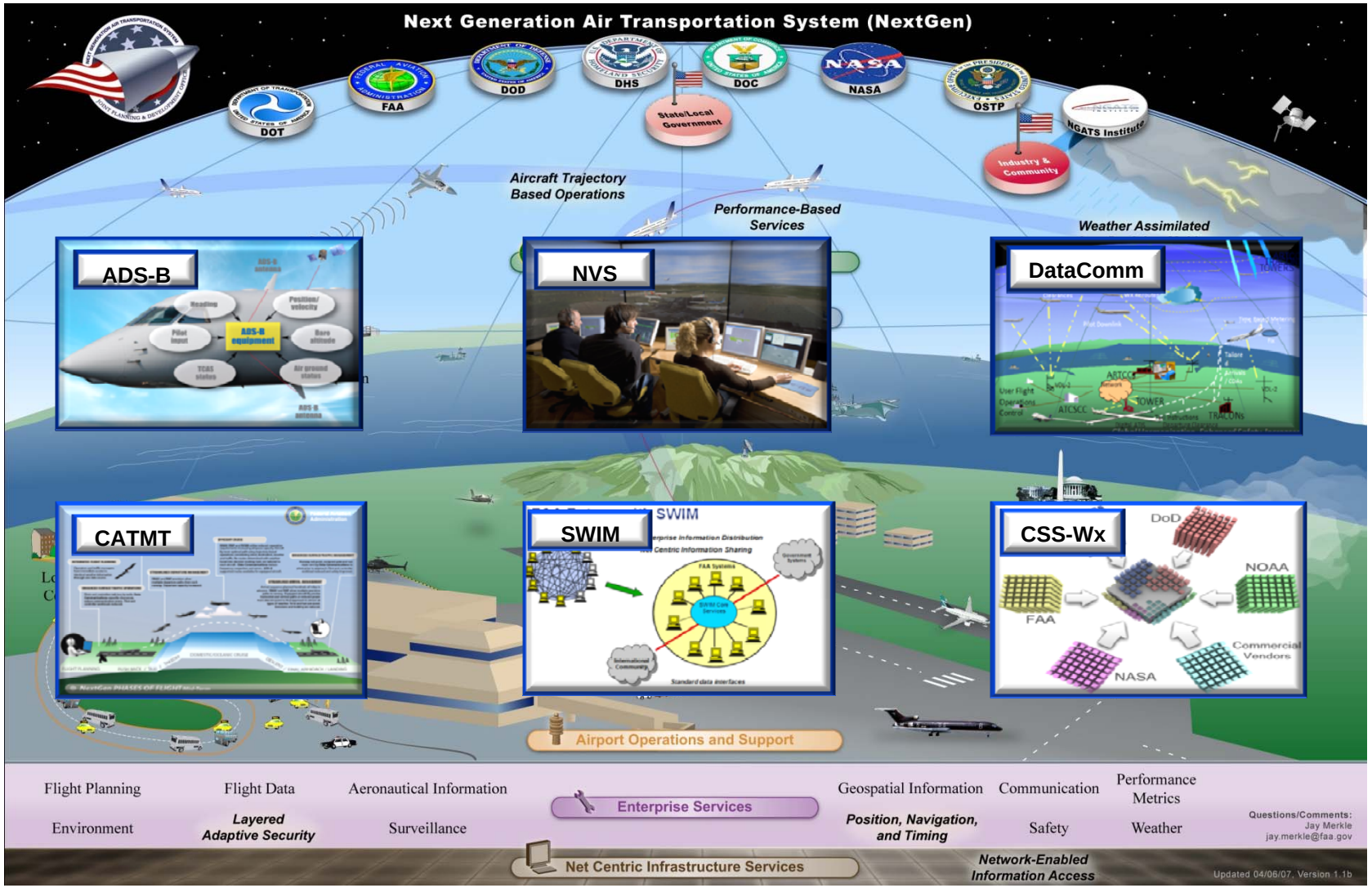
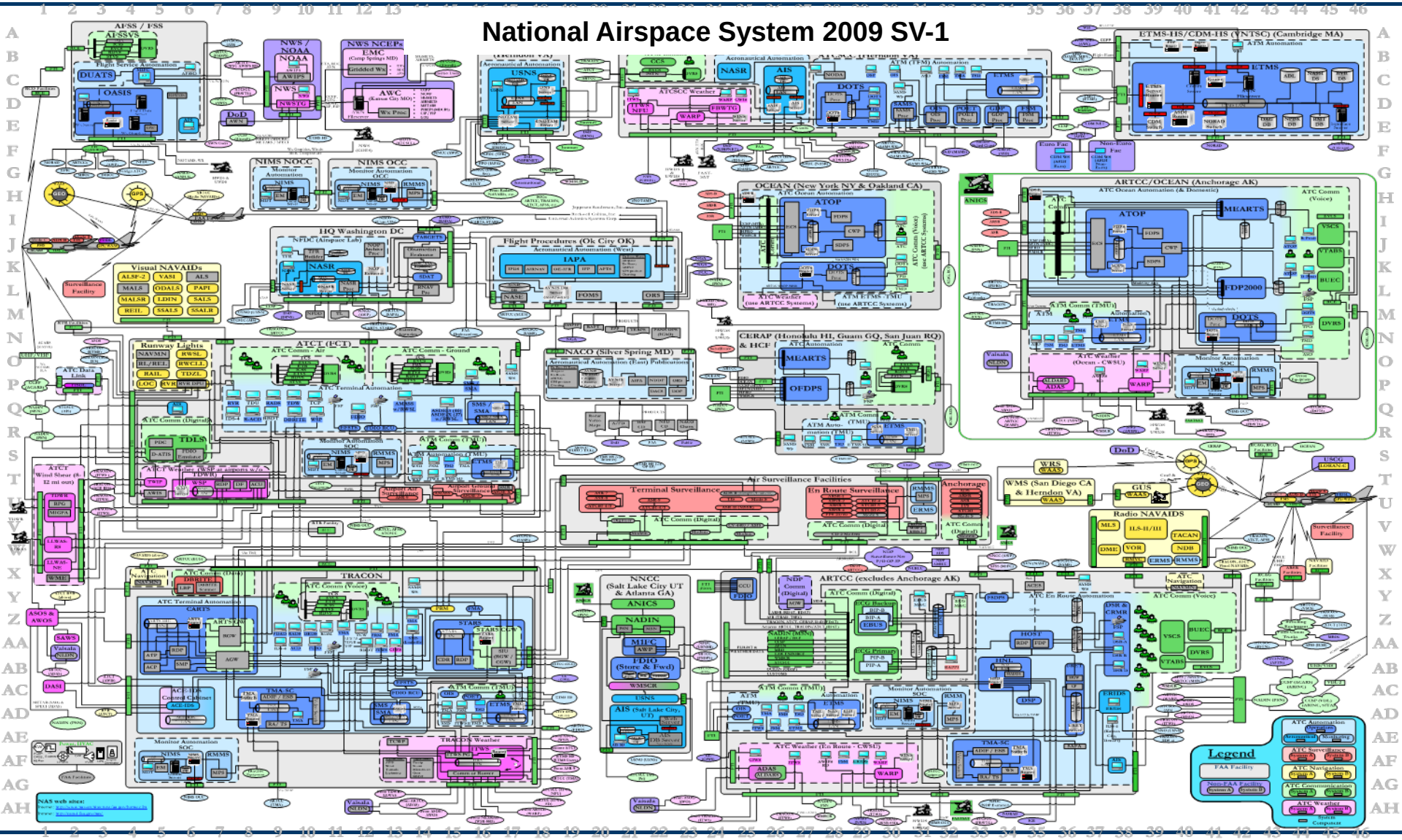
FAA NextGen 2012-2025 Transformational Programs



ADS-B: Automatic Dependent Surveillance-Broadcast **NVS:** NAS Voice Switch
SWIM: System Wide Information Management **CSS-Wx:** Common Support Services -- Weather **CATMT :** Collaborative Air Traffic Management Technologies

FAA Programs Across the NAS



Lincoln Laboratory Air Traffic Control Workshop 2012
CIWS Data Distribution Service - 3
CAK 12/11/12

Blue Boxes: Air Traffic Automation Systems
Purple Boxes: Weather Systems

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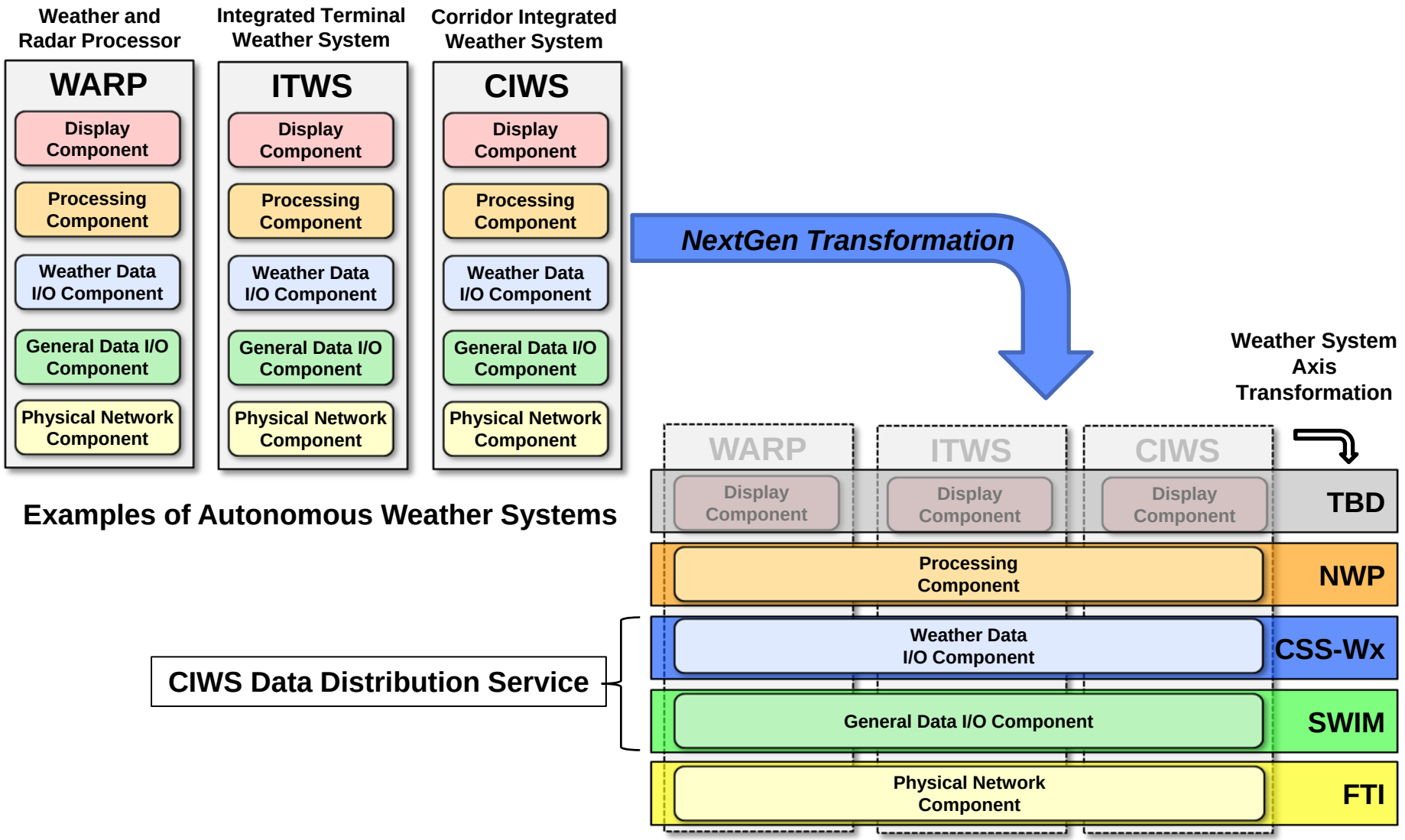
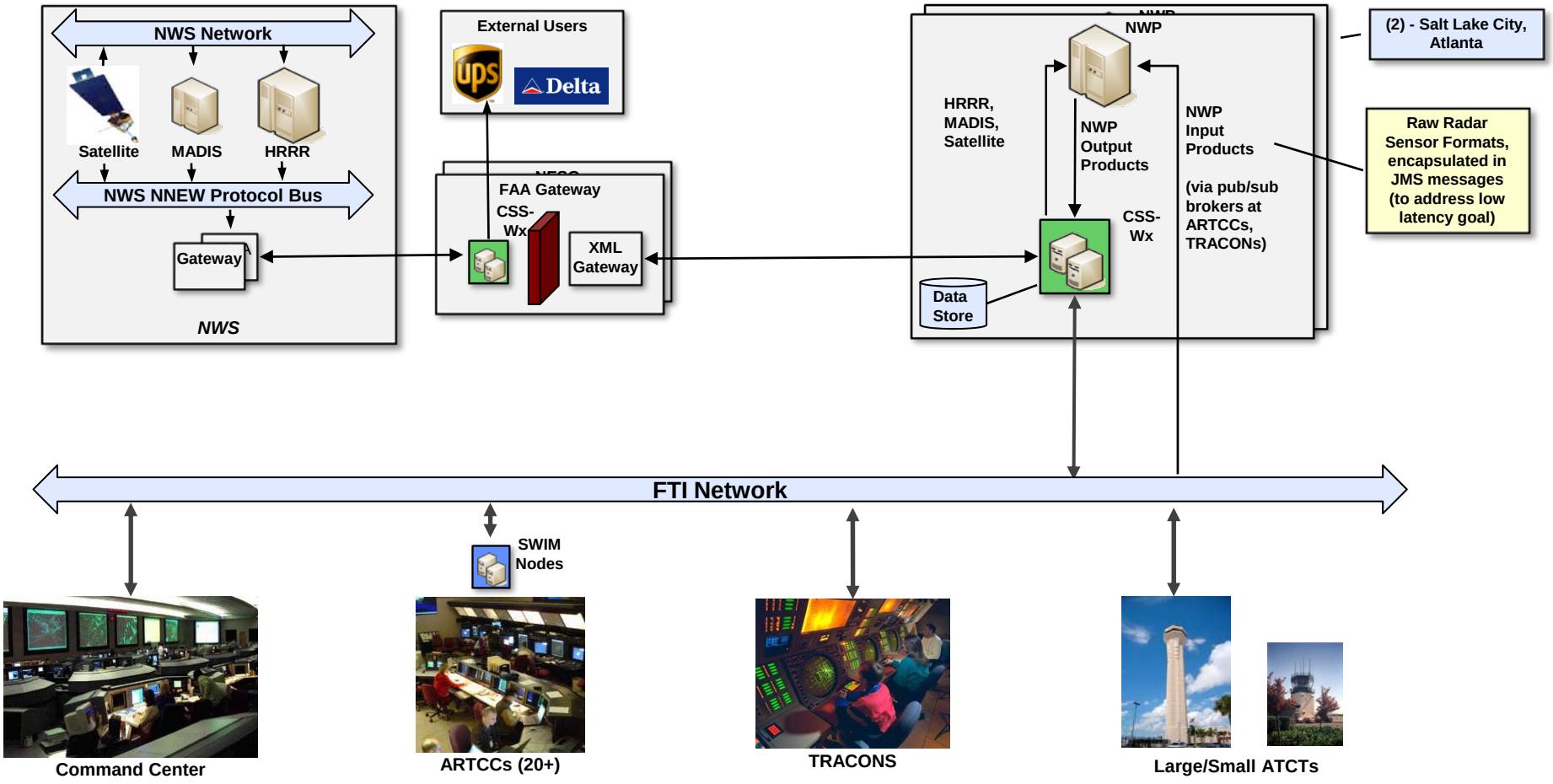
FAA Weather System Transformation



High-Level Architecture



NWS: NationalWeatherService **HRRR:**HighResRapidRefresh **MADIS:**MetAssimDataIngest
ARTCC: AirRouteTrafficControlCenter **ASR:**AirportSurveillanceRadar
TRACON:TerminalRadarApproachControl **ATCT:** AirportTrafficControlTower

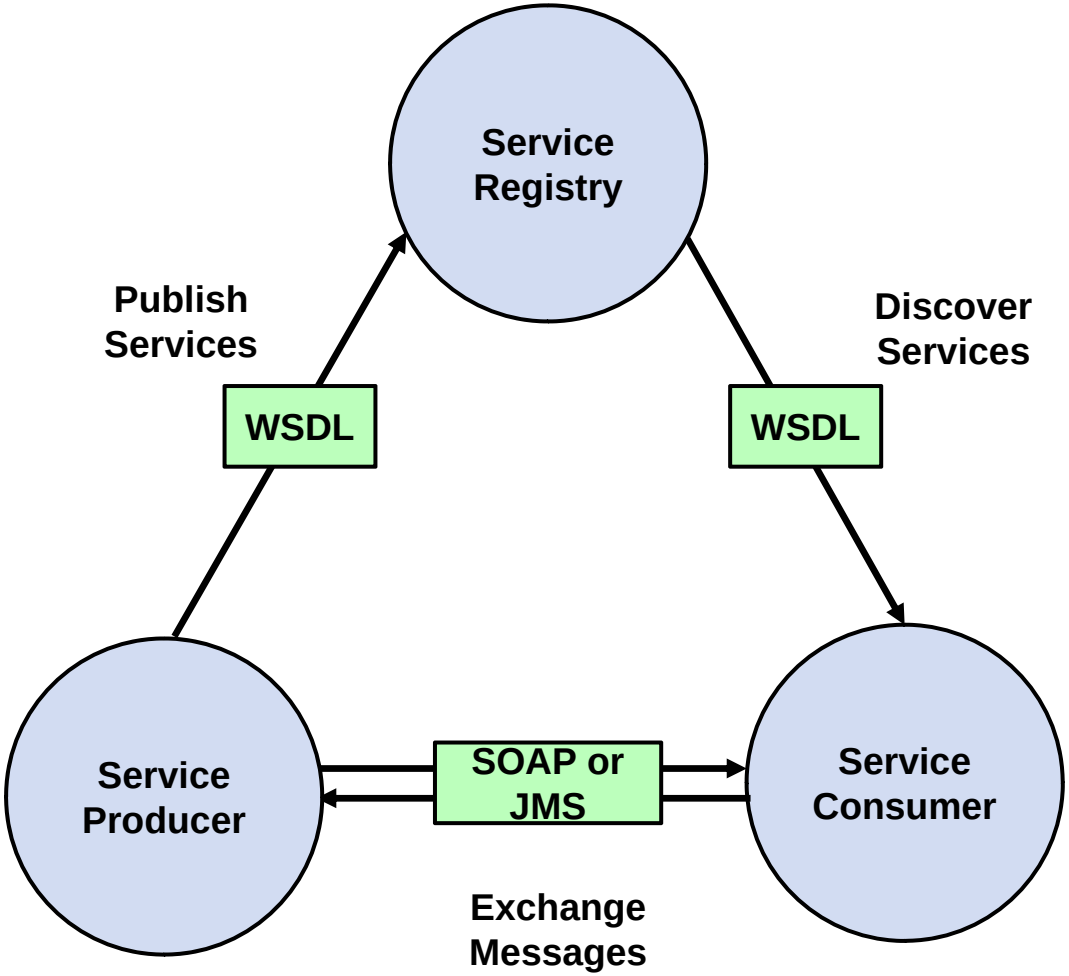
Outline

- Background
- SWIM Program Overview
- CIWS Data Distribution Service (CDDS) Implementation
- CDDS Current And Future Subscribers

What Is SWIM ?
System Wide Information Management

- **Motivation:**
  - **Facilitate data sharing and ensure interoperability between FAA systems**
  - **Reduce time to establish new interfaces**
  - **Increase common situational awareness**
- **Development Plan:**
  - **Segment 1**
    - **Implement a Service-Oriented Architecture (SOA) in the NAS**
    - **Identify industry standards, best practices and COTS products for use by NAS programs**
    - **Establish governance policies, processes, and metrics**
  - **Segment 2**
    - **Implement enterprise messaging service for NAS programs (NEMS)**

FAA Service-Oriented Architecture



WSDL: Web Service Definition Language
SOAP: Originally defined as Simple Object Access Protocol

The SWIM Segment 1 Programs

- **Segment 1 (FY09-FY15): Seven SWIM Implementing Programs**

Federal Aviation Administration	AIM	Aeronautical Information Management	Aeronautical Information
	CIWS	Corridor Integrated Weather System	Weather
the VOLPE center	ITWS	Integrated Terminal Weather System	
Baldwin Hackett & Meeks, Inc.	WMSCR	Weather Message Switching Center Replacement	
LOCKHEED MARTIN We never forget who we're working for™	ERAM	En Route Automation Modernization	Flight and Flow Management
Raytheon	TDDS	Terminal Data Distribution System	
CSC	TFM	Traffic Flow Management	

- **Goal: Create SWIM-Compliant Net-Centric Services to access existing FAA data**

What Does It Mean To Be "SWIM-Compliant"

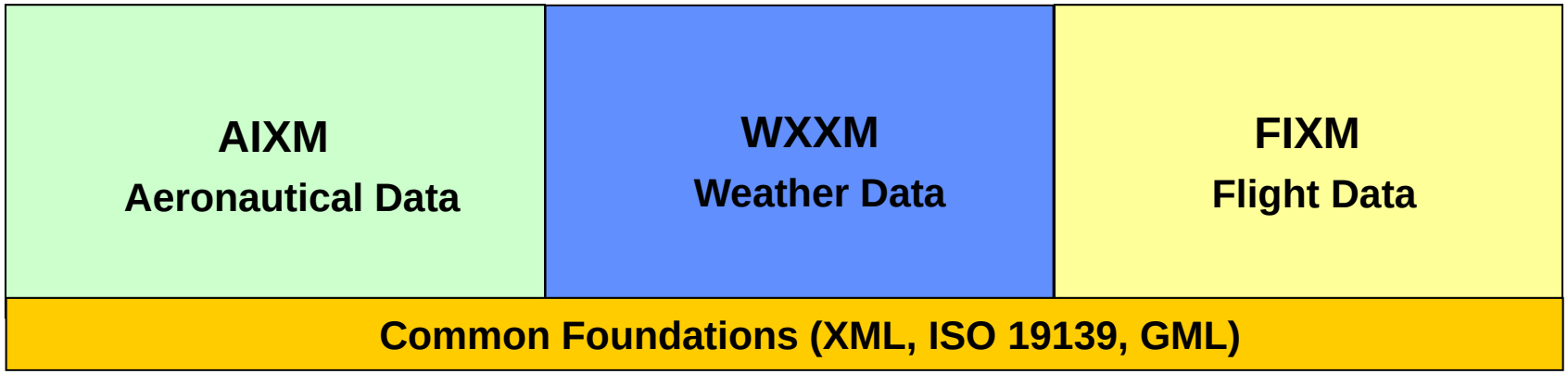
- **SWIM-approved COTS products must be used and a security solution must be provided**
  - **Apache Service Mix, Apache Camel, Apache CXF, Active MQ**
  - **Segment 2 programs may use non-Apache products**

- **SWIM services must be registered in the NAS Service Registry/Repository and must follow the Service Lifecycle Management Process:**

- **Share lessons-learned via monthly meetings**
  - **COTS WG, Architecture WG, TIMs, Apache User Forums**

SWIM Will Encourage Data And Service Standards

- **Data Exchange Models developed jointly with FAA, DoD, NOAA, Eurocontrol**



- **Service standards provide access to data of all types using spatial/temporal queries**
  - **OGC Web Coverage Service – Gridded data access**
  - **OGC Web Feature Service – Non-gridded data access**

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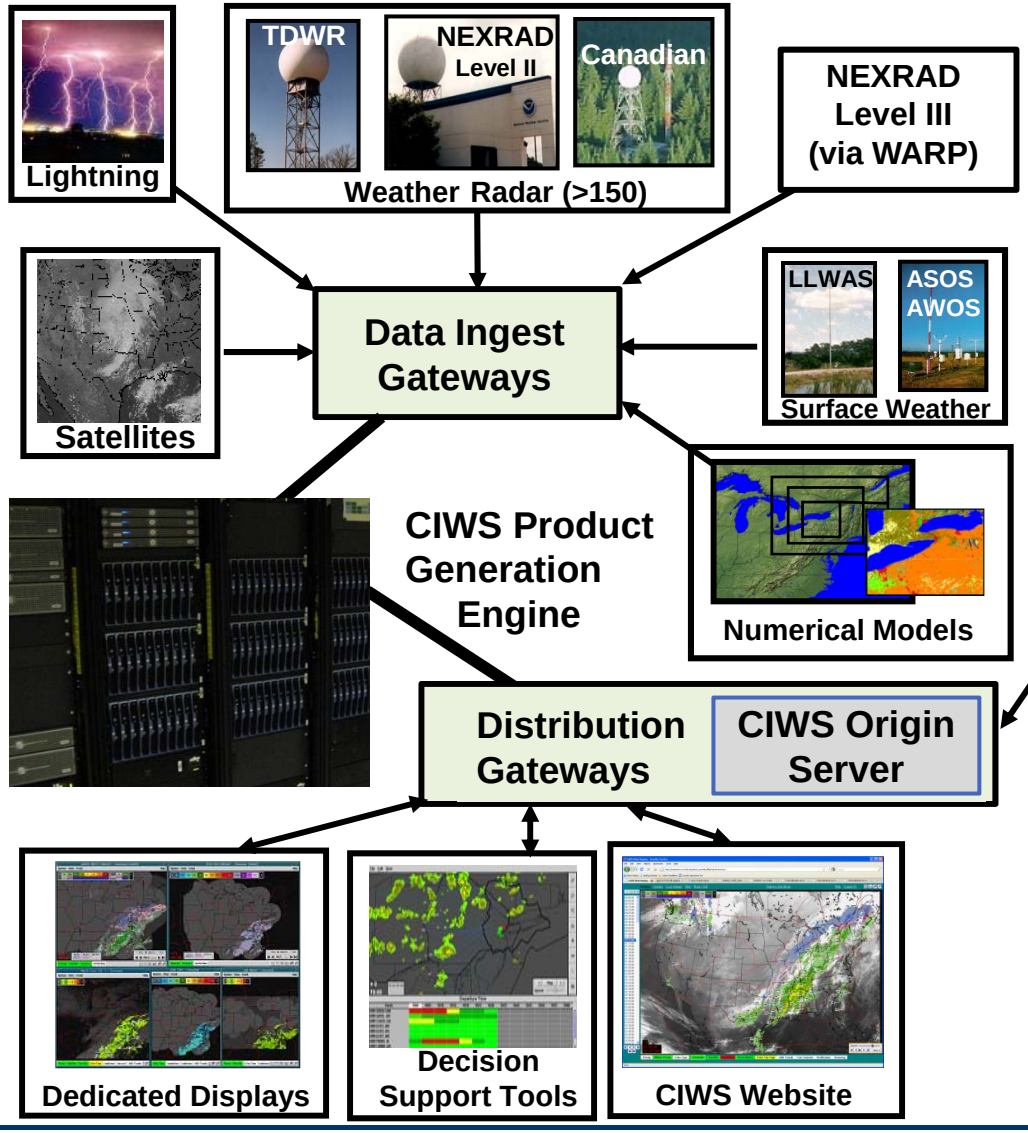
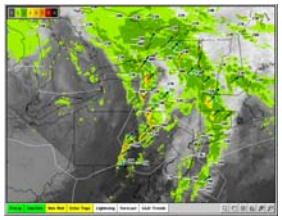
Corridor Integrated Weather System Operational Prototype Architecture



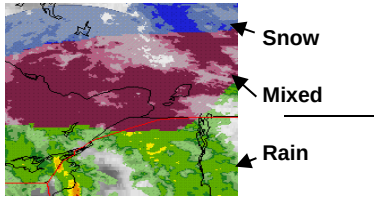
CIWS Products

Gridded



Precipitation Mosaic

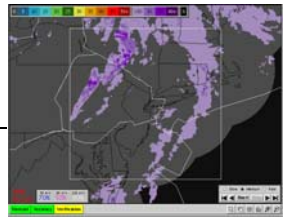
Precipitation Forecast



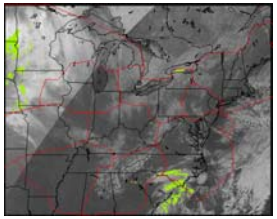
Winter Precipitation Mosaic

Winter Precipitation Forecast

Echo Tops Mosaic

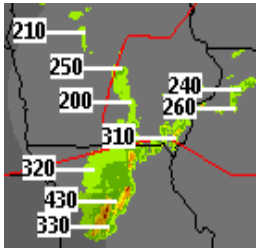


Echo Tops Forecast

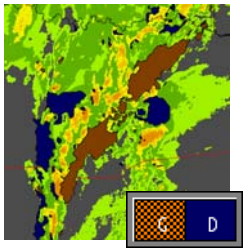


Satellite Mosaic

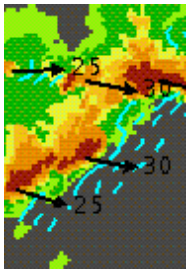
Non-gridded



Echo Tops tags

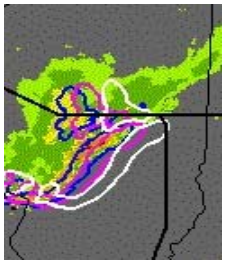


Storm Growth and Decay



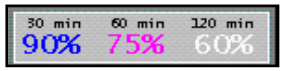
Storm Motion

For each forecast type (Precipitation, Winter Precipitation, and Echo Tops), contours and scores are provided (Precipitation shown below):



30, 60 and 120 min Forecast Contours

30, 60 and 120 min Verification Contours



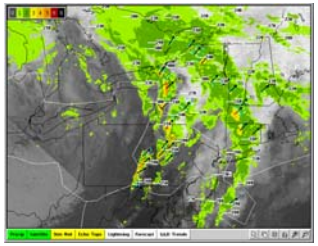
30, 60 and 120 min Forecasts Accuracy Scores

What is CDDS ?

- CIWS Data Distribution Service
- Provides CIWS products as web services
- Uses
  - CSS-Wx NetCDF/WXXM Data Model Definitions
  - CSS-Wx OGC WCS/WFS Data Services
  - SWIM Messaging Infrastructure
  - SWIM Security Guidelines
  - SWIM Service Repository
- First SWIM Program to have an Operational Capability

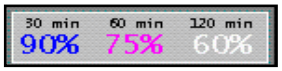
CDDS Data And Service Definitions

Gridded (Web Coverage Service)



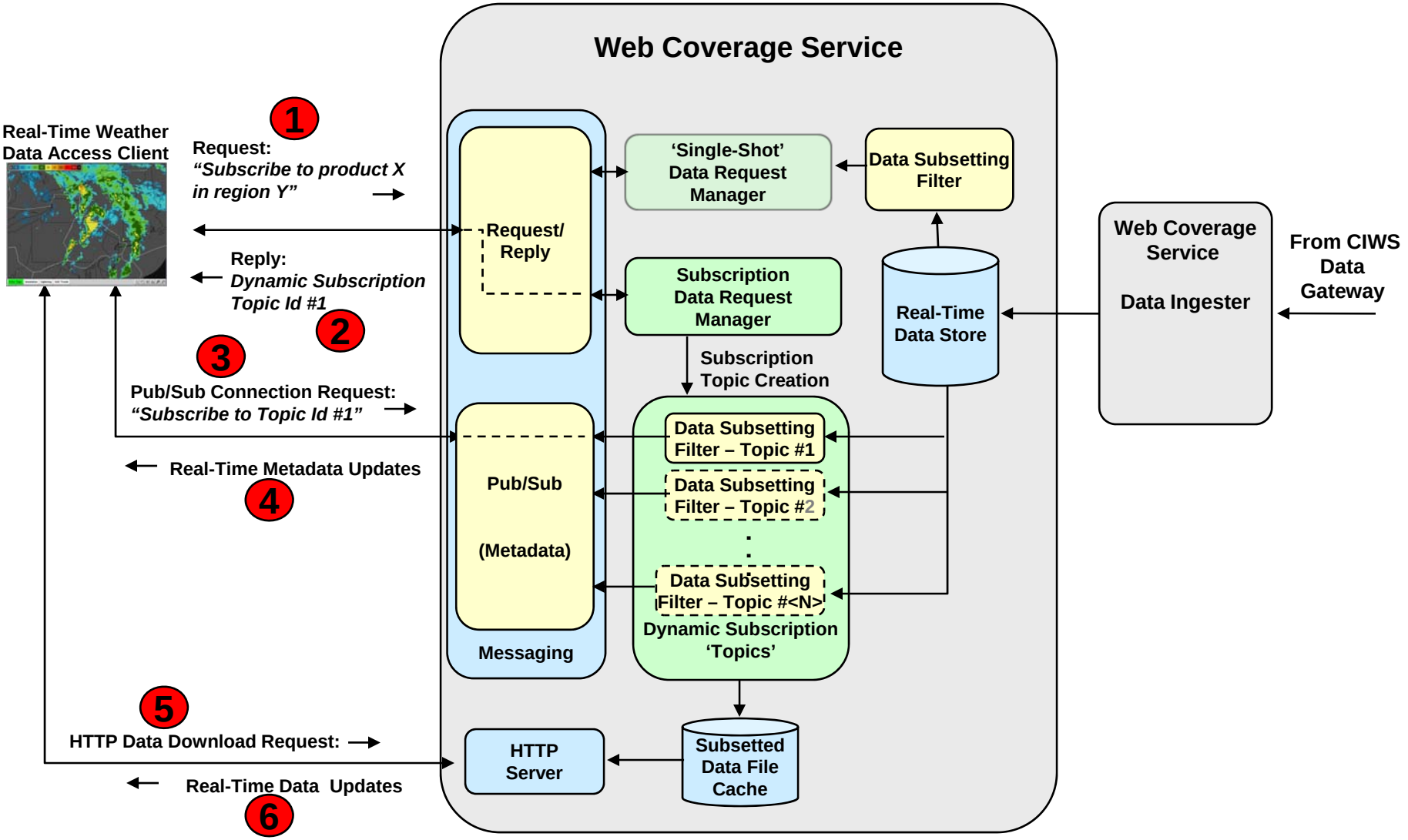
- **Gridded data is converted from an internal CIWS format to the CSS-Wx-specified NetCDF format**
- **CDDS then uses the CSS-Wx Web Coverage Service Reference Implementation (WCSRI) software**

Non-gridded (Web Feature Service)

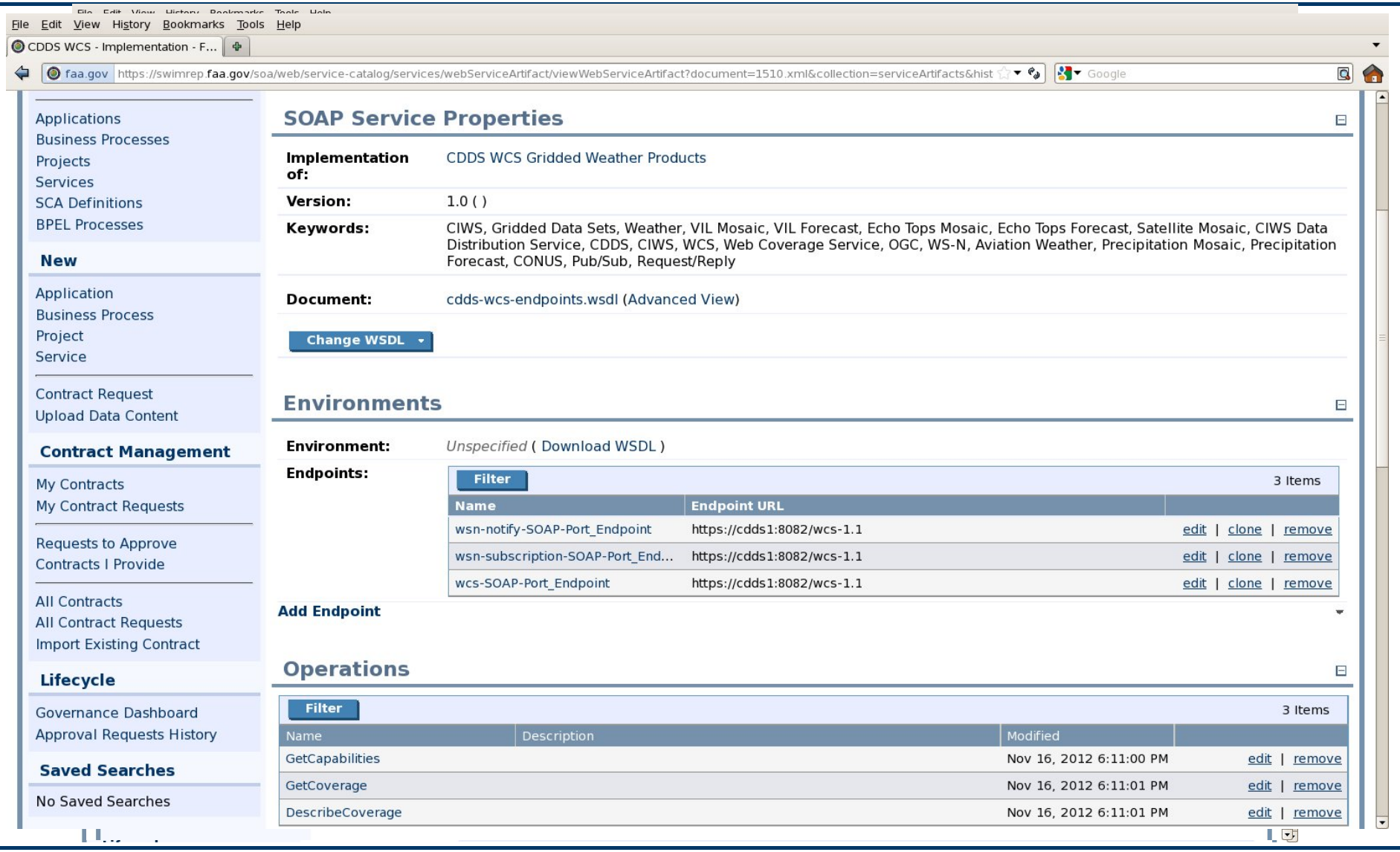


- **Non-gridded data is converted from an internal CIWS format to the CSS-Wx-specified WXXM format**
- **CDDS then uses the CSS-Wx Web Feature Service Reference Implementation (WFSRI) software**

WCS
Filtered Data Access Model



FAA NAS Service Registry Repository



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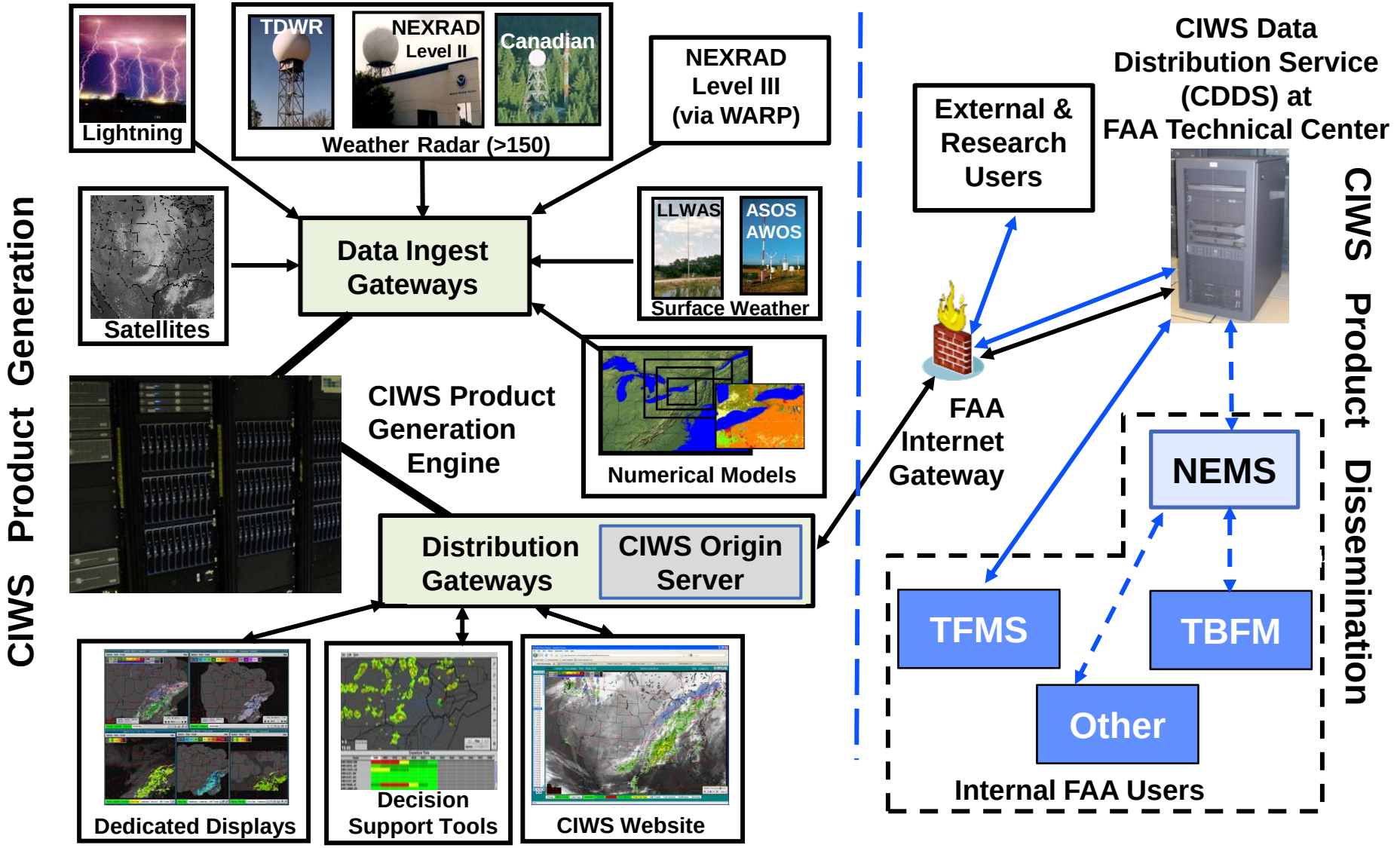
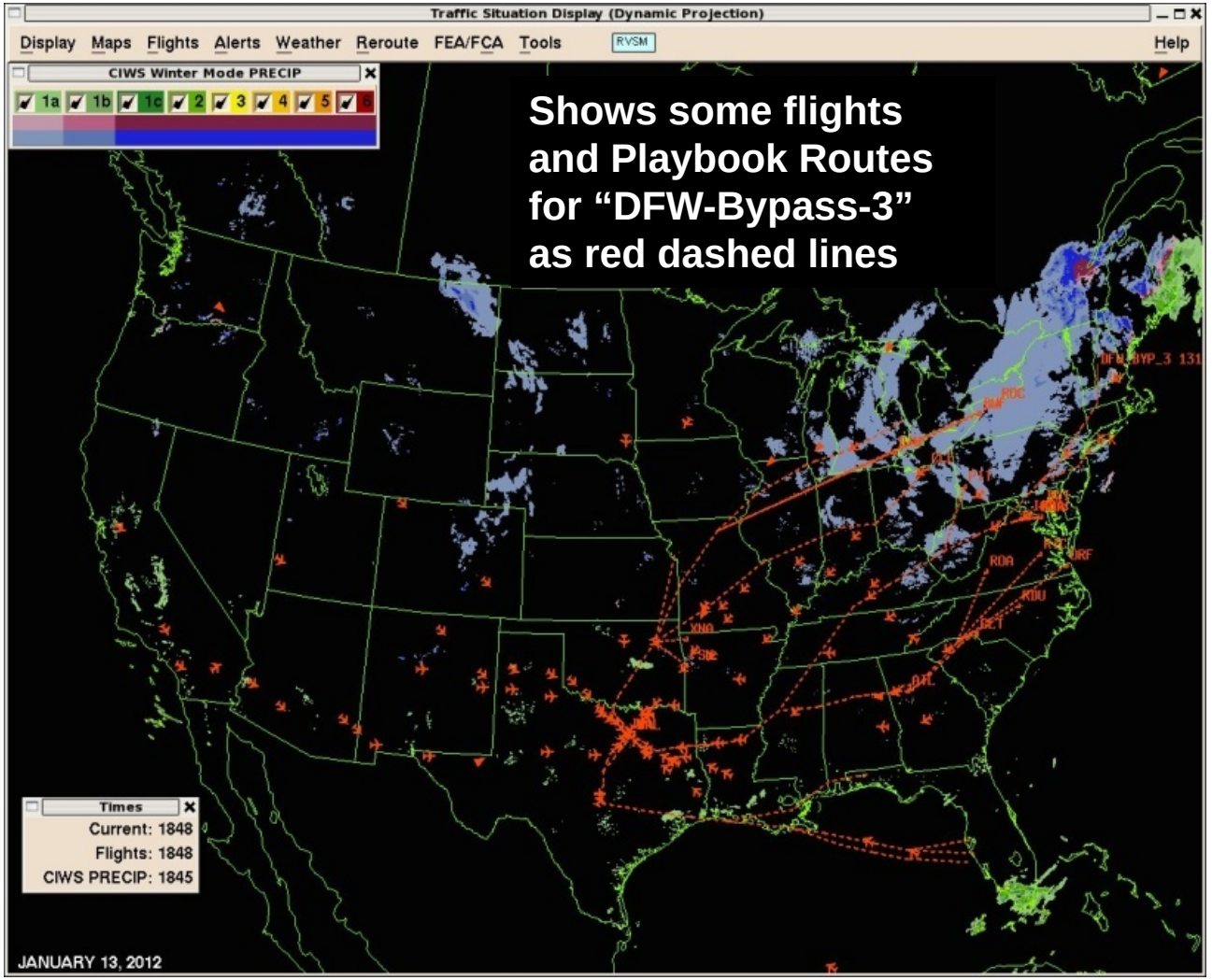
CDDS NAS Subscribers

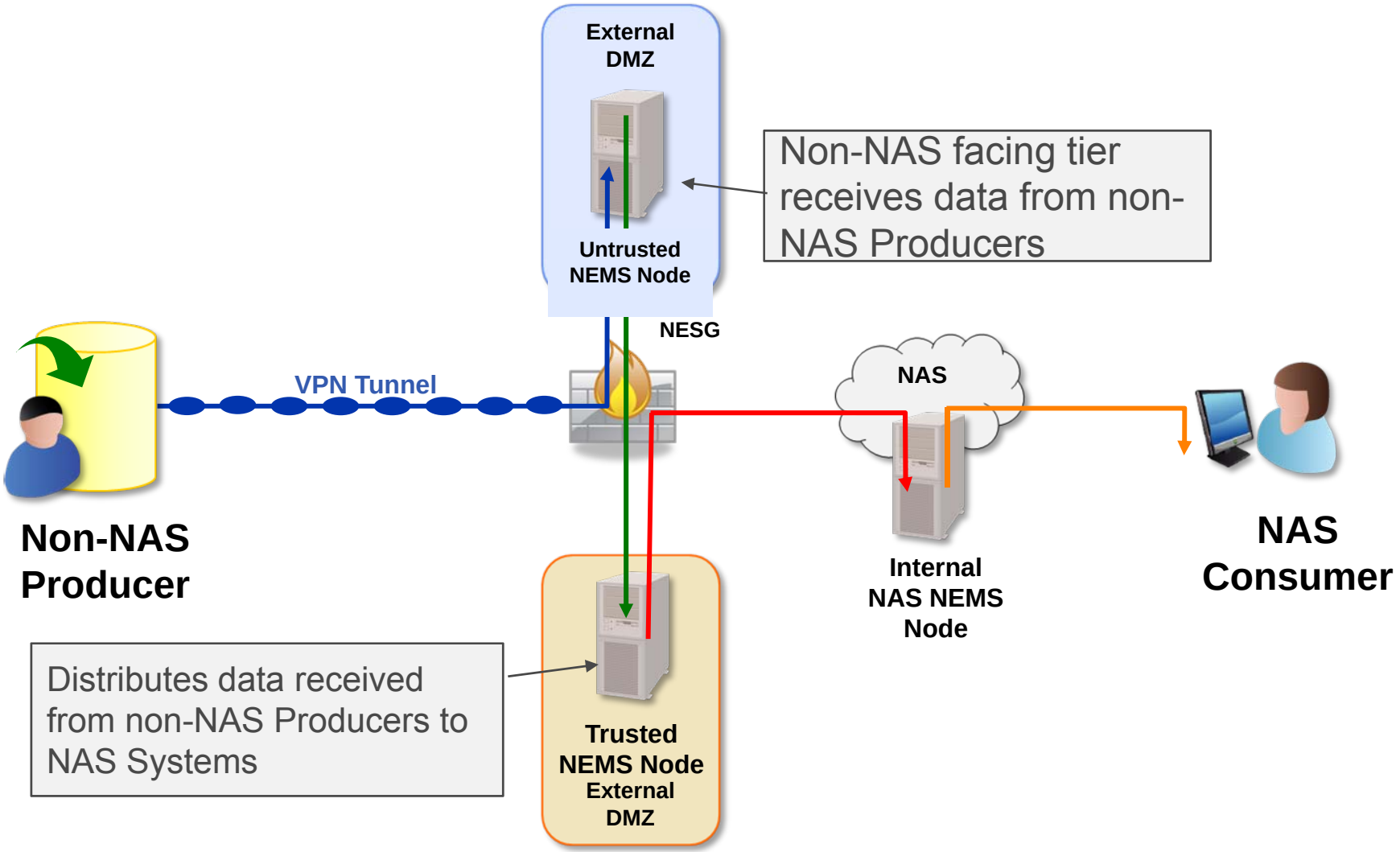


Traffic Flow Manager TSD Playbook Routes & CIWS

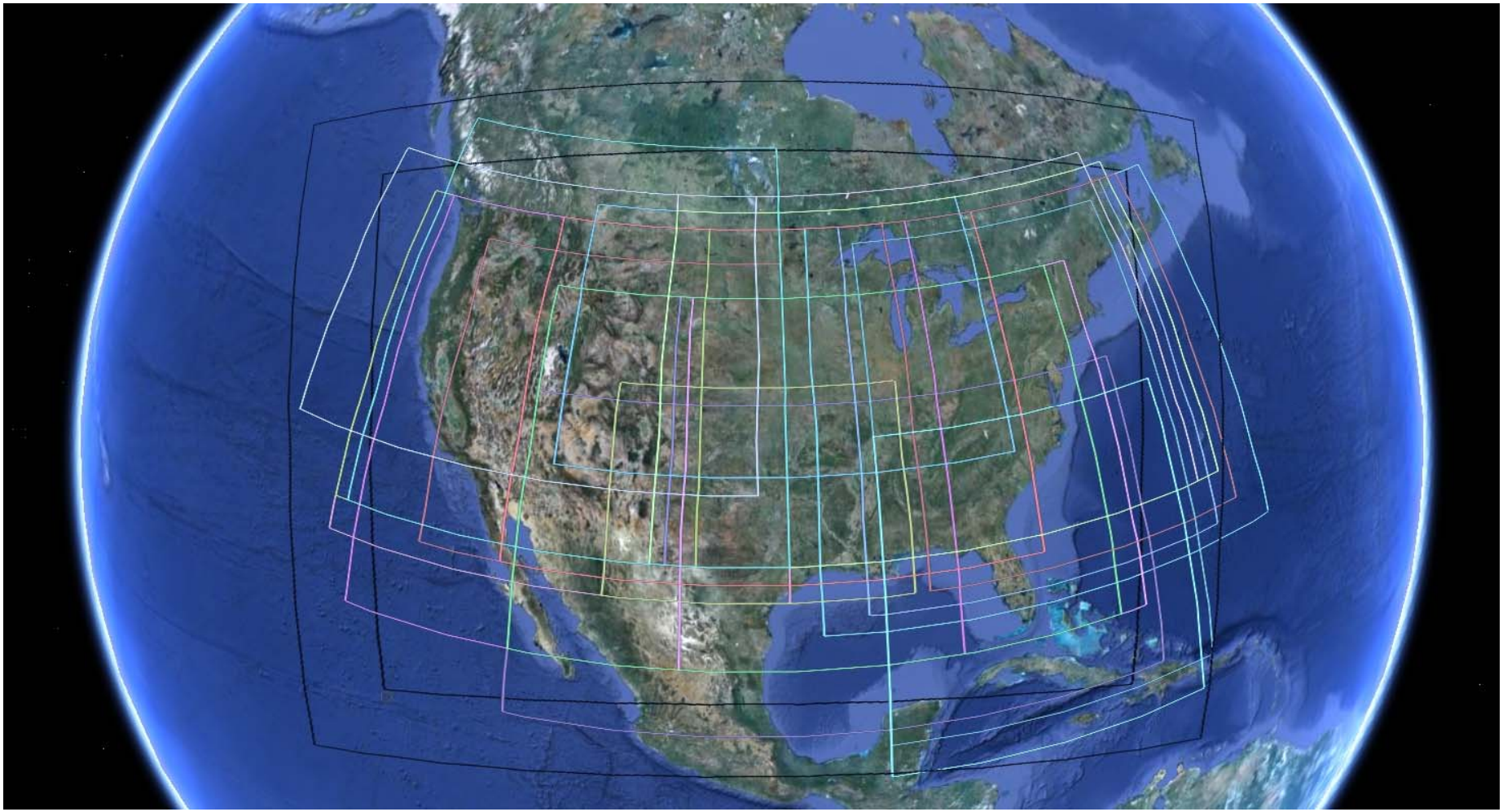


CIWS Winter Precip Added In Nov 2011

NEMS Data-flows: Non-NAS Producer



TBFM 20 ARTCC Subsets



Large subsets for large number of weather data products very CPU-intensive

CDDS Dynamic Resource Provisioning "Cloud Computing"

- Investigating cloud and virtual technologies
  - Additional compute nodes to be configured as virtual machines
  - Use VMware vCloud to enable dynamic resource provisioning based on demand

- Can provision services elastically
  - If demand for services exceeds a threshold, can reconfigure the number of services without human intervention
    - Can create/destroy additional VMs dynamically
    - Can balance work load using new servers automatically
    - In the event of a hardware failure, can transfer services to other virtual machines automatically

CDDS Subscribers

- **Traffic Flow Management System (TFMS) now uses CIWS data on their Traffic Situation Displays (TSDs) operationally across the NAS**
  - **20 ARTCCs, over 60 TRACONs/Terminals**
- **Time-Based Flow Management program (TBFM) to add CIWS to their PGUI displays in September 2013 via SWIM NEMS**
- **FAA Tech Center display team (NWP Displays/Mobile Apps)**
- **Possible Future Clients**
  - **DHS-Customs and Border Protection Secure Border Initiative**
  - **DoD ERSA (accessing internally now; may transition to CDDS)**
  - **NASA Dynamic Weather Routing Demonstration**

Summary

- **Seven Segment 1 programs have collaborated together to help the FAA understand how best to create and govern net-centric services**
- **CDDS is the first operational SWIM capability and demonstrates that weather products can be distributed through the NAS using standardized data models and data services**
- **Going forward with SWIM Segment 2 (2011-2017), CDDS will be an early adopter of SWIM's new messaging solution (NEMS)**
  - **CDDS publishes data to SWIM messaging nodes**
  - **SWIM messaging nodes communicate with consumers (TBFM)**
  - **SWIM handles security and monitoring inside the NAS**