CamelOne

System Wide Information Management (SWIM) Program Office

By:	Linda Chen Federal Aviation Administration
Date:	May 24th, 2011

Agenda

- Introduction
- Overview of the SWIM Program
- Why Fuse?
- Fuse in SWIM
- Lessons Learned
- Challenges
- How to Learn More
- Q&A

SWIM Project Overview

SWIM is an IT infrastructure program that will operate in the background to provide data to authorized users

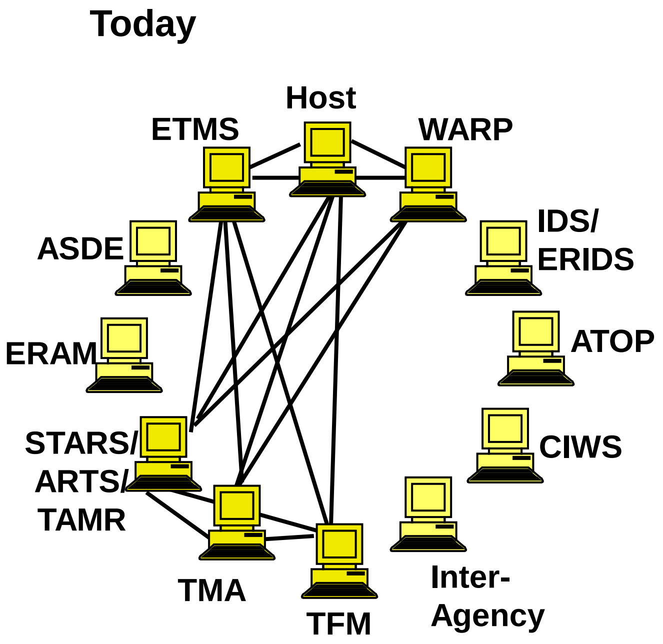
SWIM will:

- Implement a Service-Oriented Architecture (SOA) in the National Airspace System (NAS)
- Allow the FAA to create new system interfaces more quickly and cost effectively than is possible today
- Facilitate the data-sharing that is required for NextGen

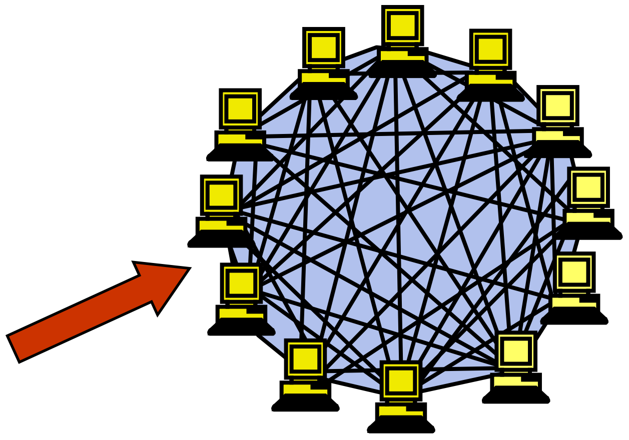
SWIM will *not*:

- Be a set of avionics equipment
- Substitute for NAS modernization programs
- Replace FAA Telecommunications Infrastructure (FTI)

SWIM Conceptual Overview



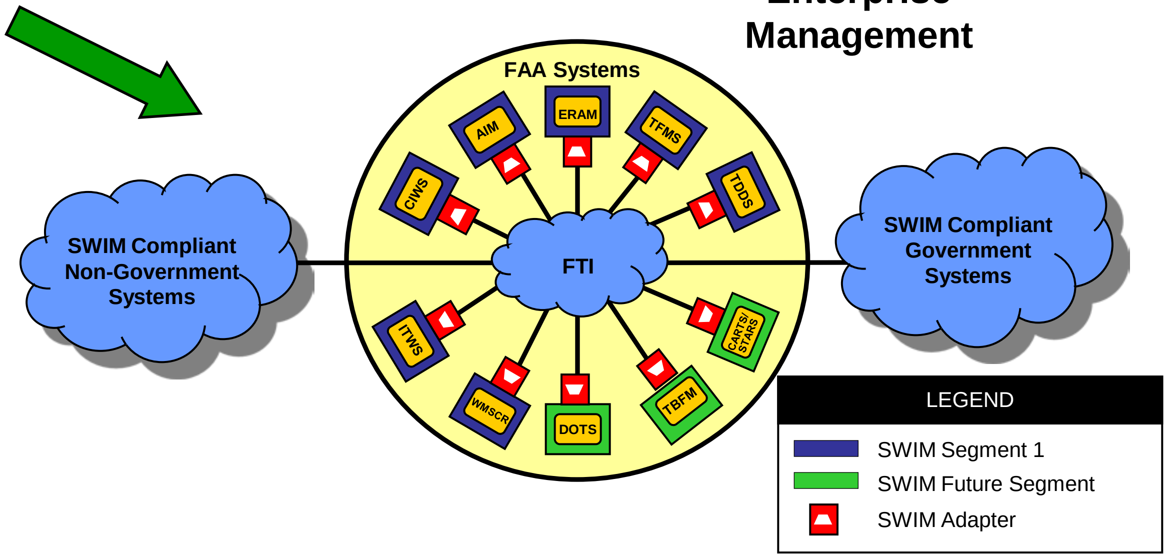
- Existing point-to-point hardwired NAS
- Unique interfaces, custom designs



Business as Usual

- More point-to-point unique interfaces
- Costly development, test, maintenance, CM
- New decisions linked to old data constructs
- Cumbersome data access outside the NAS

Enterprise Management

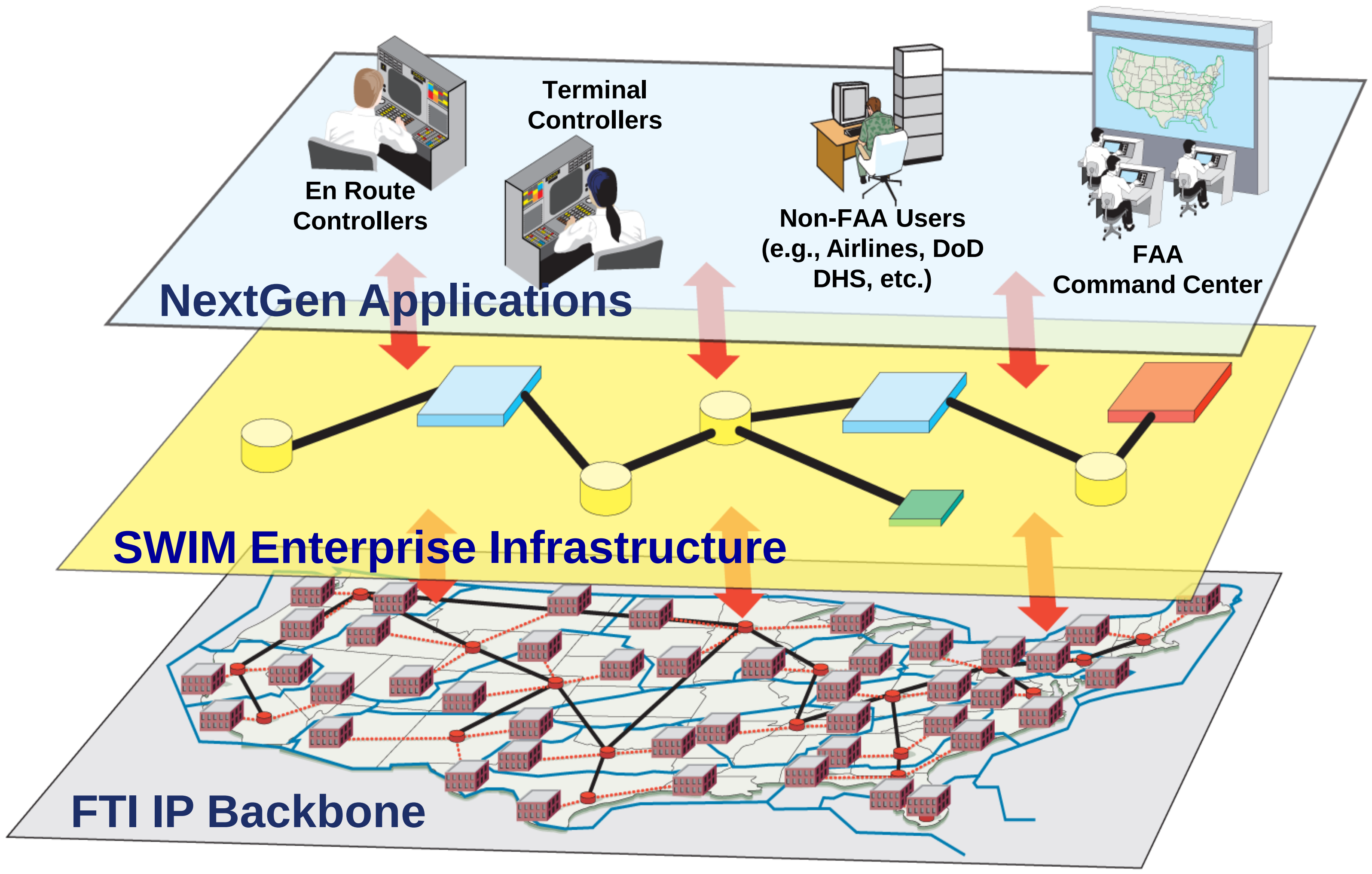


FAA Systems
ERAM
AIM
TFMS
CIWS
TDDS
FTI
ITWS
CARTS/ STARS
WMSCR
DOTS
TBFM
SWIM Compliant Non-Government Systems
SWIM Compliant Government Systems

LEGEND

🟦	SWIM Segment 1
🟩	SWIM Future Segment
🟥	SWIM Adapter

State of the System

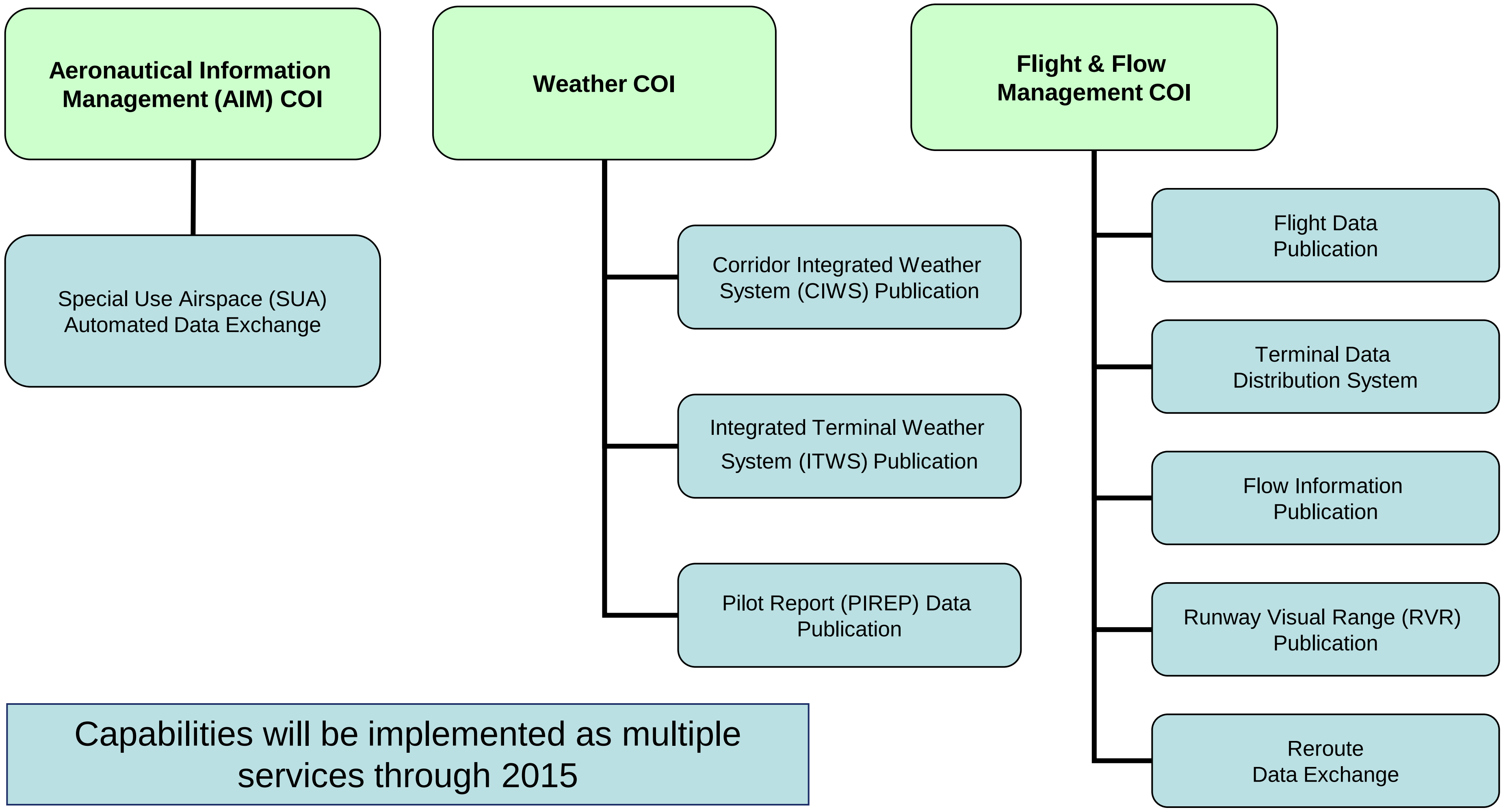


Segment 1 Overview

- Nine Segment 1 capabilities were derived from three Communities of Interest:
  - Aeronautical Information Management (AIM)
  - Flight & Flow Management (F&FM)
  - Weather

- SWIM will not implement a separate infrastructure for Segment 1
  - SWIM will leverage existing infrastructures, processes, resources, and logistics chains that are part of the program offices implementing the nine SWIM capabilities
  - SWIM Governance will ensure use of common protocols and interfaces, assisted by use of commercial software for some Core Services

SWIM Segment 1 Capabilities

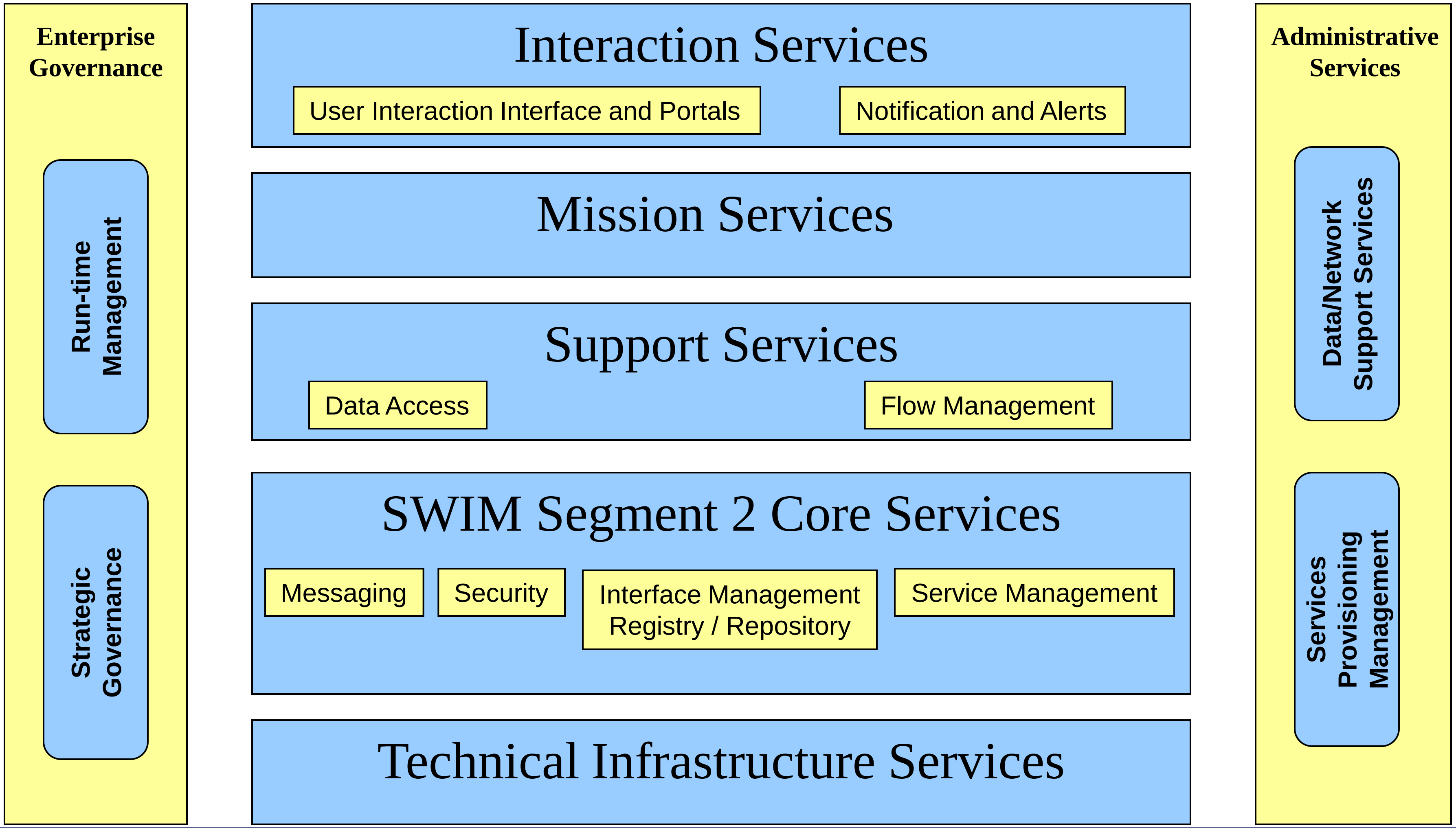

Aeronautical Information Management (AIM) COI
Special Use Airspace (SUA) Automated Data Exchange
Weather COI
Corridor Integrated Weather System (CIWS) Publication
Integrated Terminal Weather System (ITWS) Publication
Pilot Report (PIREP) Data Publication
Flight & Flow Management COI
Flight Data Publication
Terminal Data Distribution System
Flow Information Publication
Runway Visual Range (RVR) Publication
Reroute Data Exchange

Capabilities will be implemented as multiple services through 2015

SWIM Segment 2 Overview

- Requirements based mid-term (FY12-16) NextGen Operational Improvements (OIs), NextGen Segment Implementation Plan (NSIP) and NAS Enterprise Roadmap
- Focus on infrastructure core services of the NAS architecture vs business applications or capabilities
- SWIM implements the infrastructure to support the planned NEXTGEN architecture
- Continues provision of governance, standards, and software to NAS Programs

Simplified SWIM SV-4 Framework



Layered Architecture

- System Functionality Description for a Service Oriented NAS Architecture:
  - Identify NAS Functions
  - Describe Functions as Services
  - Layer the Functions to Show Abstraction of Service Types
- Abstraction (very) roughly analogous to OSI Layered Communication Model
  - Lower layers: physical/”on the wire”
  - Higher layers: human interaction/applications
- Layers used to show decoupling between service types
- Cross cutting Administrative and Governance Services support all layers

Why FUSE?

FuseSource provides products that support SWIM requirements

- Reuse of Boundary Interfaces
- Simplified Application Development
- Simplified Interface Maintenance
- Protocol Support HTTP, HTTPS, SSL/TLS
- JMS Support
- Security Support
- XML Support
- Implementation of Enterprise Integration Patterns
- Application Messaging Interoperability Assurance

Why Fuse? (Cont'd)

- **Minimum Coding Effort**
  - Much of the required functionality already exists in Fuse Suite
- **Flexible**
  - Hundreds of large enterprises worldwide rely on FuseSource solutions to deploy and manage integration and messaging infrastructure at a lower total cost of ownership than traditional commercial solutions
- **Open Source**
  - FuseSource is the expert in open source integration and messaging solutions
- **Technical Support**
  - FuseSource provides effective and reliable technical support through various means of traditional and online resources and maintains an expert staff that includes many committers of The Apache Software Foundation
- **Tools**
  - FuseSource provides enterprise-ready integration and messaging software combined with the tools, training and expertise sought by organizations implementing and managing integration projects

SWIM Software for SIPs

- **Apache Servicemix/FUSE ESB 4.x, including the following products embedded in the Service Mix version:**
  - Apache Camel/Fuse Mediation Router 2.2.x, 2.4.x, 2.6.x, or 2.7.x
  - Apache CXF/Fuse Services Framework 2.2.x or 2.3.x
  - Apache ActiveMQ/Fuse Message Broker 5.3.x, 5.4.x, or 5.5.x
- **Apache Servicemix/FUSE ESB 3.x, including the following products embedded in the Service Mix version:**
  - Apache Camel/Fuse Mediation Router 2.2.x or 2.4.x
  - Apache CXF/Fuse Services Framework 2.2.x
  - Apache ActiveMQ/Fuse Message Broker 5.3.x or 5.4.x
- **Artix Suite**
  - Artix Registry/Repository v1.5
  - Artix ESB v5.5
  - Artix Connect for WCF v1.0
  - Artix Security Advanced v5.5
  - Artix Enterprise Management 3rd Party Integration v5.5
- **DataXtend Semantic Integrator (DXSI) v8.4**
- **Progress Actional Team Server (formerly MindReef SOAPScope) v8.2**
- **FUSE Integration Designer v1.0**

Software Support

- **Support available for all products on contract**
- **Categories of support available:**
  - Developer
    - 9 x 5
    - Named User
  - Production (Test, Operation, Backup)
    - 24 x 7
    - Named Machine/# Cores
    - 2 Primary Names/1 Backup Name
    - Support for up to 16 cores available
- **Support is renewed on an annual basis**

Fuse products in SWIM

SWIM uses the following four Fuse products, taking advantage of their particular strengths.

1. Fuse Services Framework (CXF) for web services functionality
2. Fuse Message Broker (ActiveMQ) for JMS support
3. Fuse Mediation Router (Camel) for routing, validation, and transformation
4. Fuse ESB (Servicemix) as an integration environment

Some SWIM Implementation Programs use FUSE HQ to monitor their services

Examples: FUSE products used by CIWS

Fuse Services Framework (CXF)

- Used for SOAP Authentication and XML marshalling and unmarshalling
- SOAP Authentication:
  - Username/password authentication as well as timestamp verification
- XML Marshalling and Unmarshalling
  - Inbound interceptor chain takes OGC compliant request and unmarshals it to an XmlBeans request object
  - Outbound interceptor chain takes XmlBeans response object and marshals it to an OGC compliant response

Fuse Message Broker (ActiveMQ)

- Used for CIWS Publish/Subscribe mechanism
- One JMS topic per subscription
- When Service gets new data, it gets placed on appropriate topics in ActiveMQ
- ActiveMQ then pushes the data to clients listening on those topics

Ex.: FUSE products used by CIWS – Cont’d

Fuse Mediation Router (Camel)

- Camel route defined in Camel Context file
- Jetty Endpoint with SSL support
- Logging Processor to log client requests
- Load Balancing to CXF endpoints for WCS
- Camel-Security InInterceptor processor and OutInterceptor processor for WFS

FUSE ESB 4.2 (ServiceMix)

- Using Equinox/OSGi container for CIWS services
- One instance of ServiceMix for each of our two services (WCS and WFS) running on two separate computers (sharing a file system)
- Apache ActiveMQ, Apache Camel, and Apache CXF installed/running within ServiceMix

Ex.: FUSE products used by CIWS – Cont'd

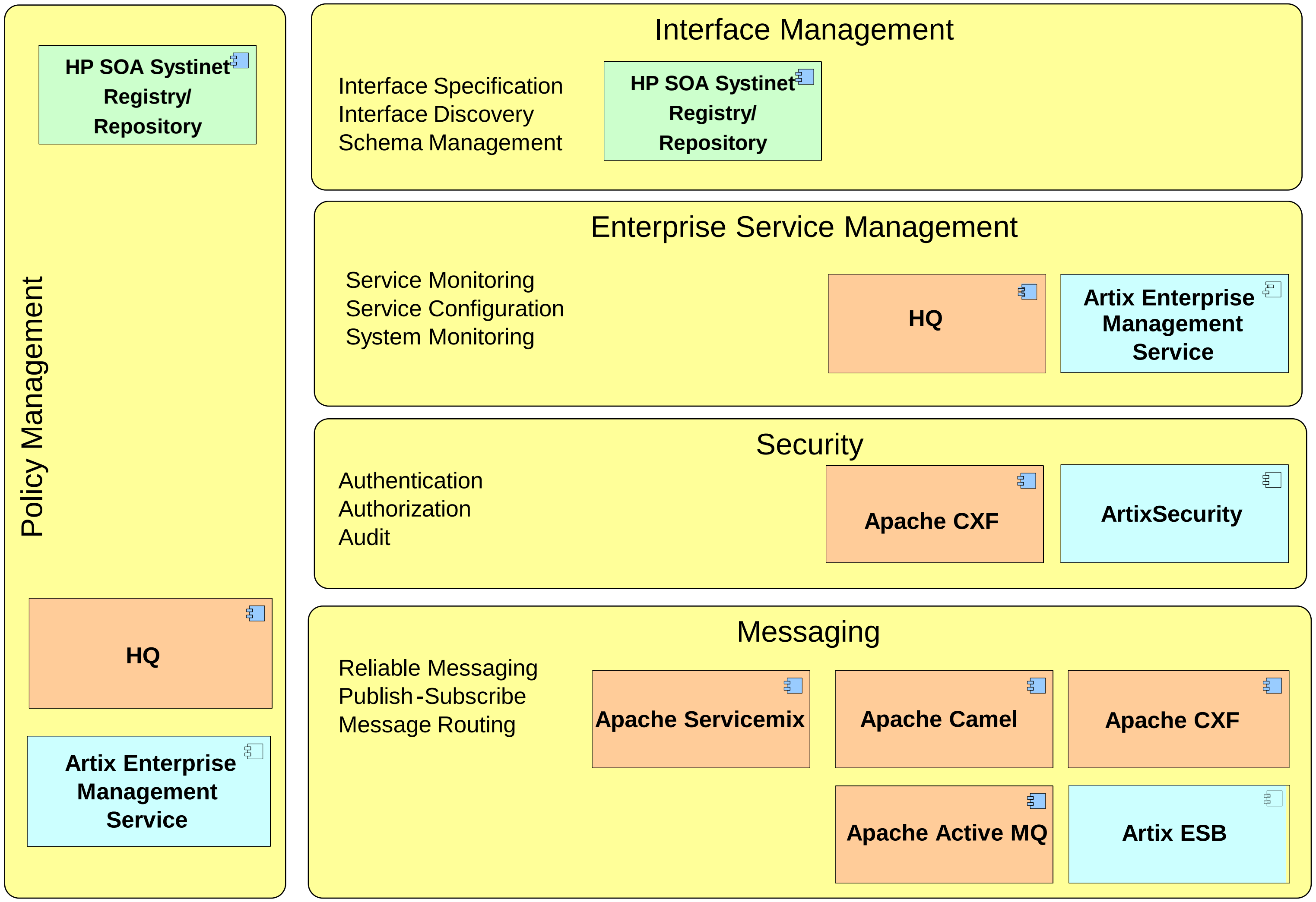
FUSE HQ

- Used to monitor CIWS two services
- Collects service statistics
- Tracks service availability
- Parses logs for errors and alerts via email

Performance Observations – TDDS

- **Observations from Performance Testing**
  - TDDS applications are not CPU intensive
    - Less than 20% CPU usage for the performance scenario
    - Target hardware is dual quad-core (4x)
  - 16GB memory in target hardware is adequate
    - About 30% free memory with 2GB physical memory in test configuration
  - Network Usage is minimal
    - Less than 1% usage on 100M LAN
    - Target hardware is 1G LAN (10x)
- **System performance is easily achieved using FUSE**
  - Selected hardware far exceeds needs
  - No performance or stability issues with FUSE

SWIM Services Product Stack



Requirements for SWIM Compliance

- **Use of FUSE Software**
  - SOAP Message Processing (Apache Servicemix/Apache CXF)
  - Java Message Service (JMS) Provider Standardization (Apache Servicemix/Apache ActiveMQ)
- **Supported Message Formats and Transports**
  - SOAP-over-HyperText Transfer Protocol (HTTP)/HyperText Transfer Protocol Secure (HTTPS)
  - eXtensible Mark-up Language (XML)-over-HTTP/HTTPS
  - SOAP-over-JMS
  - XML-over-JMS
- **SOAP Attachments**
  - Message Transmission Optimization Mechanism
- **JMS Message Type - Text message**
- **Registry / Repository**
  - Discoverability – Web Services Description Language (WSDL)
  - Categorization – SWIM Taxonomy
- **Service Management – Java Management Extensions (JMX)**

Lessons Learned

- **Create Camel Components**
  - Use Message Endpoint Pattern
    - Extend Camel Endpoints
  - Realize the Interface
- **Integration of components**
  - Capability components (e.g., web service, JMS Active MQ - Oracle AQ bridge, task sequence routing) work together, reducing integration effort
- **Camel-Only Service Framework**
  - With the right combination of interceptor components, Camel can be used as a Service Framework
- **Apache broker-to-broker technology**
  - Reduce per-user application bandwidth
  - Improve the stability of the Fuse Master Broker due to the isolation of the Master Broker from clients

Lessons Learned (Cont'd)

- **Use of JMS Queues and Topics**
  - provide an effective solution for high-performance, real- time, event-driven, data streaming applications
- **Configure don't code**
  - Once the requirements are understood, evaluate the "configure don't code" tradeoffs of your architecture. Much of the required functionality may already exist in Fuse
- **Trust but verify**
  - Due to configuration dependencies, an end-to-end implementation is needed to verify design feasibility, rather than just a collection of individual examples
- **Know where to get support**
  - See fusesource.com. Support is timely and helpful
  - JIRA tracking provides good visibility on issue status
  - On-site consultation

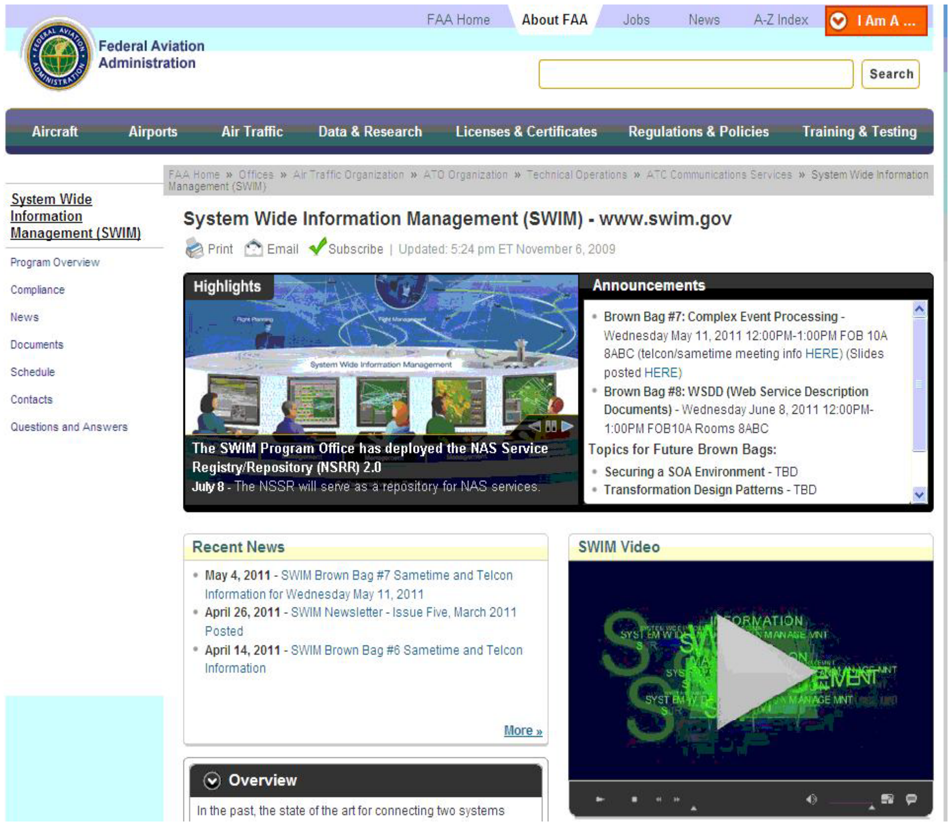
Challenges

- **Product documentation**
  - FUSE products are not well documented in new release versions.
  - Configuration examples are sparse, leading to trial-and-error design.
- **Rapid update cycle of products**
  - Changes are too frequent for long-cycle development, lead to substantial rework of software before it is even deployed
- **Difficult to manipulate data in the interceptor chain**
  - How can we modify messages between interceptors and have the modifications passed along the chain ?
- **Many default interceptors called automatically - what do they do ?**
  - 21 In Interceptors and 17 Out Interceptors

To learn more about SWIM visit www.swim.gov

www.swim.gov provides:

- Program overview
- News announcements
- Q&A
- Key documentation
    - Newsletters
    - Briefings
    - Compliance documents
    - and more….



FAA Home » Offices » Air Traffic Organization » ATO Organization » Technical Operations » ATC Communications Services » System Wide Information Management (SWIM)

System Wide Information Management (SWIM)

Program Overview
Compliance
News
Documents
Schedule
Contacts
Questions and Answers

System Wide Information Management (SWIM) - www.swim.gov

Print | Email | Subscribe | Updated: 5:24 pm ET November 6, 2009

Highlights

The SWIM Program Office has deployed the NAS Service Registry/Repository (NSRR) 2.0

July 8 - The NSSR will serve as a repository for NAS services.

Announcements

- Brown Bag #7: Complex Event Processing - Wednesday May 11, 2011 12:00PM-1:00PM FOB 10A 8ABC (telcon/sametime meeting info HERE) (Slides posted HERE)
- Brown Bag #8: WSDD (Web Service Description Documents) - Wednesday June 8, 2011 12:00PM-1:00PM FOB10A Rooms 8ABC

Topics for Future Brown Bags:

- Securing a SOA Environment - TBD
- Transformation Design Patterns - TBD

Recent News

- May 4, 2011 - SWIM Brown Bag #7 Sametime and Telcon Information for Wednesday May 11, 2011
- April 26, 2011 - SWIM Newsletter - Issue Five, March 2011 Posted
- April 14, 2011 - SWIM Brown Bag #6 Sametime and Telcon Information

More »

SWIM Video

Overview

In the past, the state of the art for connecting two systems

Questions and Comments?

BACKUP

Benefits of SWIM

- **Business and IT Alignment**
  - Systems design is driven by a market forces model (supply and demand)
  - Systems are grown to evolve with the environment rather than designed and built as a fixed structure (a city vs. a building)
- **Adaptability**
  - Agility: allow for rapid enhancement of services capability
  - Flexibility: enable on-demand composition and restructuring of services to meet business needs
- **Interoperability**
  - Priority on exposing capability for rapid consumption
  - Create ability for unanticipated utilization (emergent behaviors)
- **Reuse**
  - Maximize utility of the services provided
  - Maximize utilization of existing services (eliminate/reduce development)
- **Scalability**
  - Distribution of effort: widely distribute the development of capability
  - Distribution of value: enable wide access to capability