



FAA
Air Traffic Organization



Technologies in Support of ATFM

For: MIDANPIRG ATFM TF/2
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Global ATM Program Manager
Date: March 17-18, 2019

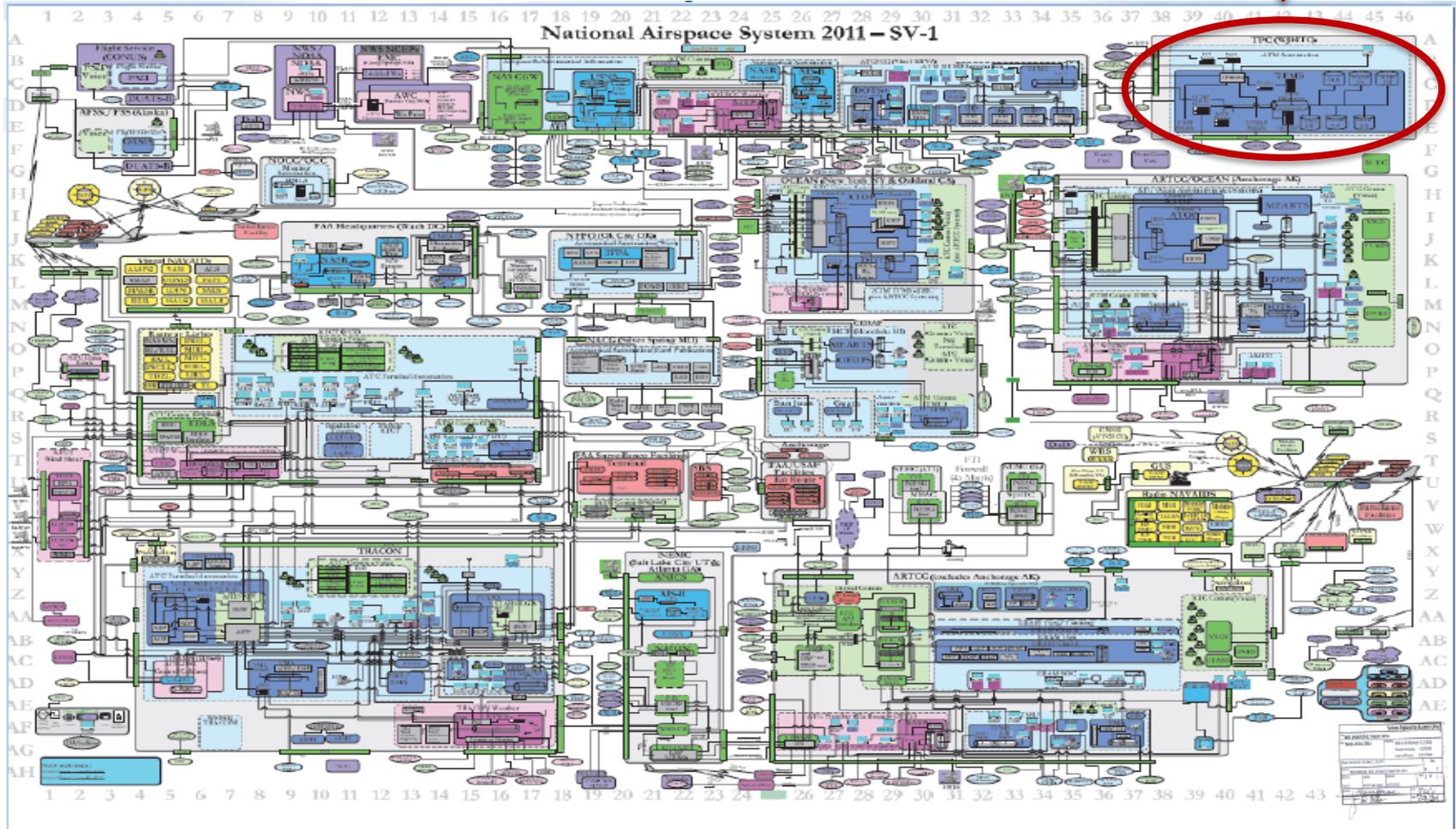
Session 2.1: Technology in Support of ATFM

Technical existing solutions to support automation and enable more efficient ATFM, with a look at the enablers such as SWIM, AIXM, etc.

- Automation – TFMS
- Enablers – SWIM and FIXM



Automation – TFMS

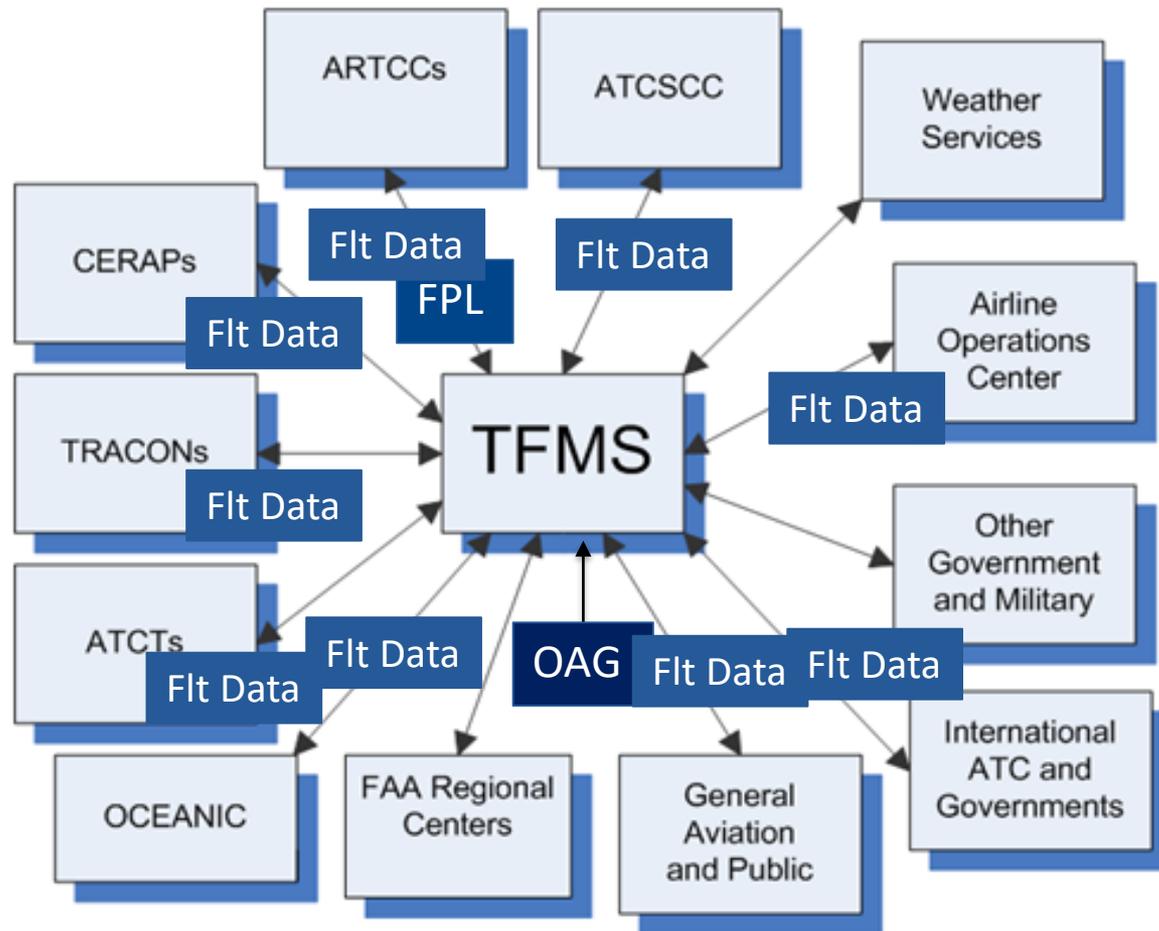


TFMS

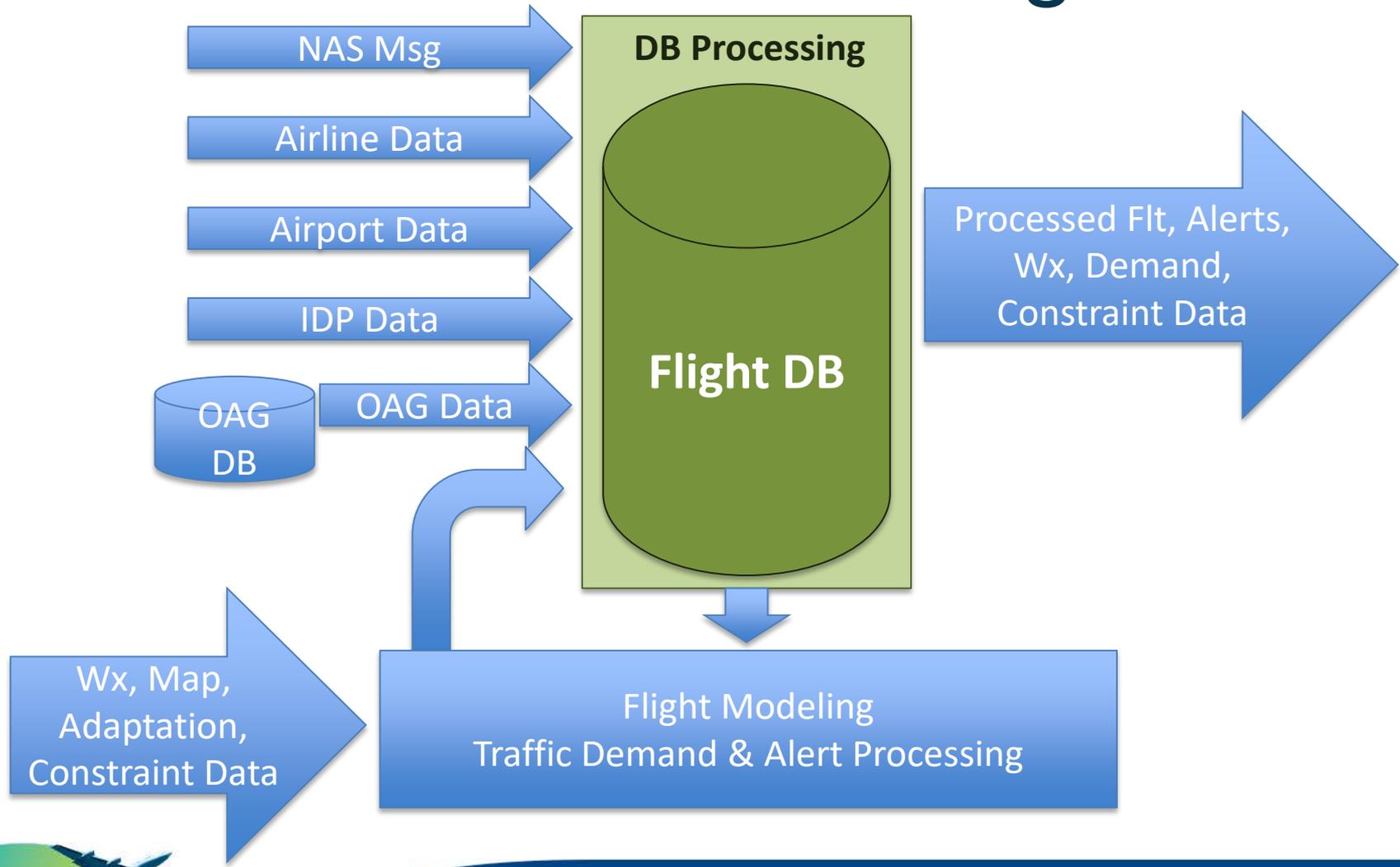
- Support data exchange system for the management and monitoring of national air traffic flow
 - TFMS gathers all available data describing flights
- Maintain flight database
 - Data Warehouse assembles TFMS flight messages into one record per flight
- Provide decision support capabilities to traffic flow managers
- Share flight and flow data



TFMS – Supporting Data Exchange



TFMS Data Processing and DB



TFMS – Collection of Systems and Interfaces

Display: Maps Flights Alerts Weather Routes FEAFCA Tools

TIME RANGE
Start Time: 08:07:06 18:00
End Time: 08:07:06 21:00
Look Ahead: 30 min
ALTIMETER RANGE
Ceiling: 500 Floor: 0
MOVING PARAMETERS
Heading: 0 Speed: 0
CHARACTERISTICS
Domain: Type: FSA
FSA: Public FCA
FMS: Reason: VOLUME
DRAWING CONTROL
Color: (Unk) (Dred)

Traffic Situation Display

Flight Schedule Monitor interface showing a graph of flight activity and a table of flight data.

Flight Schedule Monitor

Options Edit View Tools Information Print Reports Link Search Help

Misc: Paul Hawkins
MRSTIN: Entry Time: 2106
GStop

APRPT	Delay	Time	Type	Fac	Message	Status
RWY	✓	1748	RSTN	DCC	EVR ARR via WHITE 15 MI 1748-1900, WX:SNOWICE, ZDC:ZAU,ZNY,ZTL,RSTN:APVD	ZAU:Y ZNY:Y ZTL:Y
EQ	✗	1802	RSTN	DCC	DISAPPROVED: CLE ARR via WHITE 12 MI 1800-2100, WX:SNOWICE, ZDC:ZAU,ZNY,ZTL,RSTN	ZAU:Y ZDB:Y

National Traffic Mgmt Log

ESIS Display - Connected IPCOPS at: [ZDC_ARIAS] 01 Aug 2007 1728

Restrictions
BOS WHITE 6MIT JETS SPD: 210 ALT: AOA333 1900-2100 ZDC:ZBW
SEA WHITE 12MIT 2100-2200 ZDC:ZSE
MSP WHITE 5MIT 1939-1942 ZDC:ZMP

Ground Stops
GS All ARR BWI 1941-1945 WX:SNOWICE
GS All ARR DTW 2100-2200 WX:SNOWICE

MISC Entries
Blank spaces can be added before entries.

Outages
DCC ARTS 111-A OTS 1941-UFA

Hard returns may be added to ESIS entries.

Enhanced Status Info System

ATCSCC OIS SYSTEM ADTN 7/12/2012

CONTROL ELEMENT	START	END	SCOPE	REASON	AVG AAR	PR	ADVZ	DA
IAH	1159	1959	ALL	WEATHER THUNDERSTORMS	75	36	36	021 DA

Operational Info System

fly.faa.gov

fly.faa.gov

Playbook interface showing a network diagram of flight paths between airports.

Playbook

Airport Monitor EWR

ACID/CID	Type	Rwy	DSP	St	CS	Fk	Fk	Dest	Delay		
KEWR 0101	RES	41	1835	C	BRZZY	GREK	ETP	0			
COA229	T38	1238	H 41	1921	P	DEXIE	MARTA	MO5D	0		
COA229	042	17:00	19:40	41	1224	3:20	E	CAI	0121E	MATLZ	0:40

Departure Spacing Pgm

Display: Maps Flights Alerts Weather RAFT Routes FEAFCA CTDP Tools

Examine Alerts allows you to obtain more details about traffic demands on a particular airport, sector, or fix.

Monitor Alert



TFMS Data Producers, Decision Makers, & Users



Also International ANSPs and Aviation Stakeholders



Enablers – SWIM and FIXM

- **System Wide Information Management (SWIM)** is a global Air Traffic Management (ATM) industry initiative to harmonize the exchange of Aeronautical, Weather and Flight information for all Airspace Users and Stakeholders.
- The **Flight Information Exchange Model (FIXM)** is designed to enable the management and distribution of Flight and Flow data in a digital format that is globally standardized.



FIXM and AIRM



FIXM Releases

FIXM v1.0

- ICAO 2012 ATS – FPL message
- GUFID (Globally Unique Flight Identifier)
- NAS Flight Plan Data
- Initial ED-133 Element inclusion

Aug. 2012

FIXM 2.0

- ICAO 2012 ATS (15 remaining messages)
- ICAO 2012 AIDC messages
- TFM (Strategic)
 - TFM Data Exchange
 - ANSP-Airline CDM
 - Fleet Prioritization
- Airport CDM
- ANSP-ANSP boundary crossing

Aug. 2013

FIXM v3.0

- Surface data
- 4D Trajectories (1st package)

Aug. 2014

FIXM v4.0

- FF-ICE/1 Compliant
- Technical Improvements of Data Model
- Messaging support Guidance

Aug. 2016

FIXM v4.1

- Many small changes including the alignment with FF-ICE Terminology

Dec. 2017



Sample: Aircraft Type

Aircraft.xsd

Elements

fx:Aircraft
fx:AircraftType
fx:AircraftTypeReference
fx:IcaoAircraftTypeReference
fx:OtherAircraftTypeReference

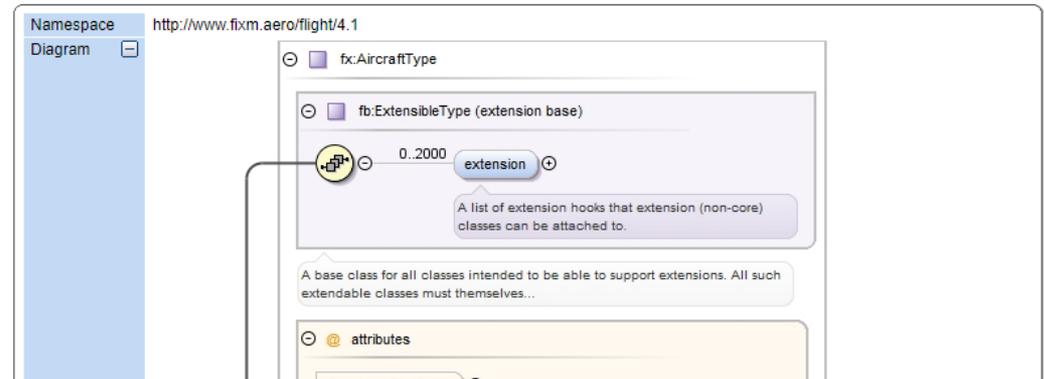
Complex Types

fx:AircraftType
fx:AircraftTypeReferenceType
fx:AircraftTypeType
fx:IcaoAircraftTypeReferenceT
fx:OtherAircraftTypeReference

Simple Types

fx:AircraftAddressType
fx:AircraftApproachCategoryT
fx:AircraftRegistrationType
fx:WakeTurbulenceCategoryTy

Element fx:Aircraft



Model	fb:extension{0,2000} , fx:aircraftColours{0,1} , fx:aircraftType{0,2000} , fx:capabilities{0,1}					
Children	fb:extension, fx:aircraftColours, fx:aircraftType, fx:capabilities					
Instance	<pre><fx:Aircraft aircraftAddress="" aircraftApproachCategory="" numberOfAircraft="" registration="" significantMarkings="" wakeTurbulence=""> <fb:extension>{0,2000}</fb:extension> <fx:aircraftColours>{0,1}</fx:aircraftColours> <fx:aircraftType numberOfAircraft="">{0,2000}</fx:aircraftType> <fx:capabilities standardCapabilities="">{0,1}</fx:capabilities> </fx:Aircraft></pre>					
Attributes	QName	Type	Fixed	Default	Use	Annotation
	aircraftAddress	fx:AircraftAddressType			optional	A unique combination of twenty-four bits available for assignment to an aircraft for the purpose of air-ground communications, navigation and surveillance. [ICAO Doc 4444]
	aircraftApproachCategory	fx:AircraftApproachCategoryType			optional	Classification of aircraft based on 1.3 times stall speed in

Source

```
<element name="Aircraft" type="fx:AircraftType" substitutionGroup="fb:Extensible"/>
```



v4.1 – Available

FIXM

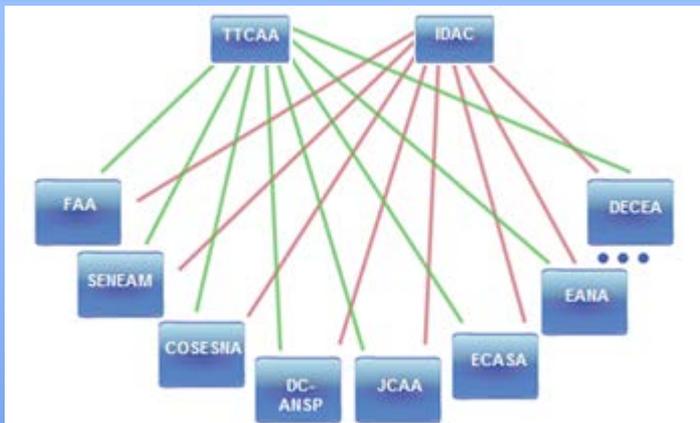
Flight Information Exchange Model

<https://www.fixm.aero/>

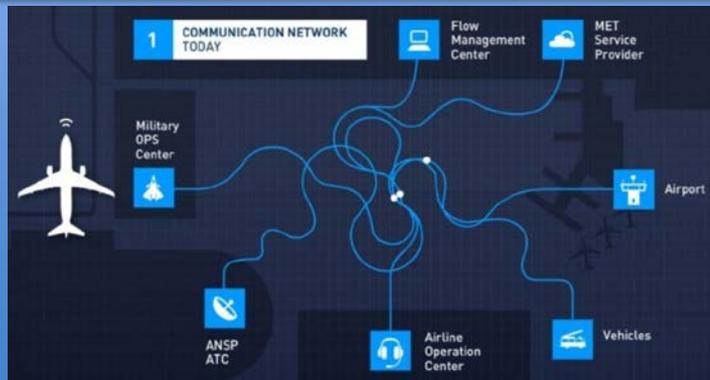


SWIM: Before and After

FAA



Eurocontrol
/SESAR



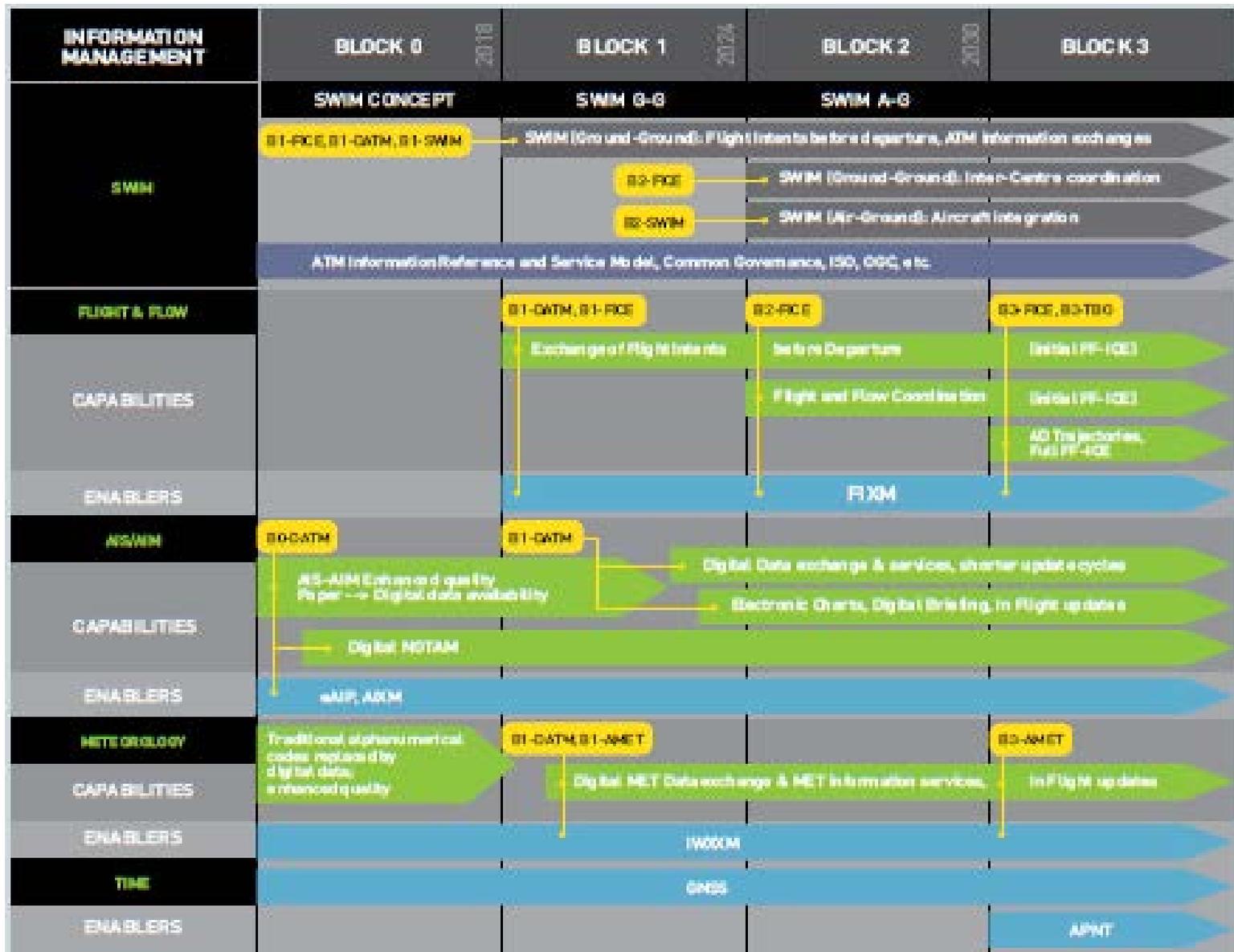
Before SWIM



After SWIM



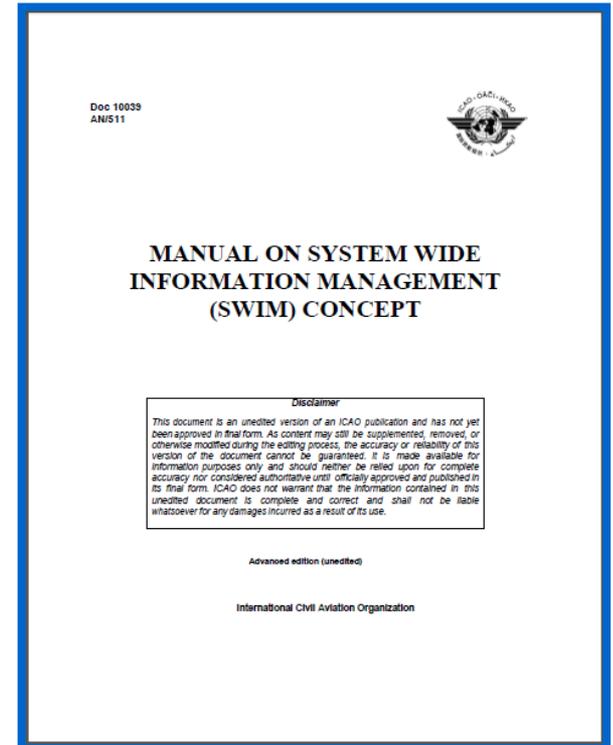
SWIM in GANP /ASBU



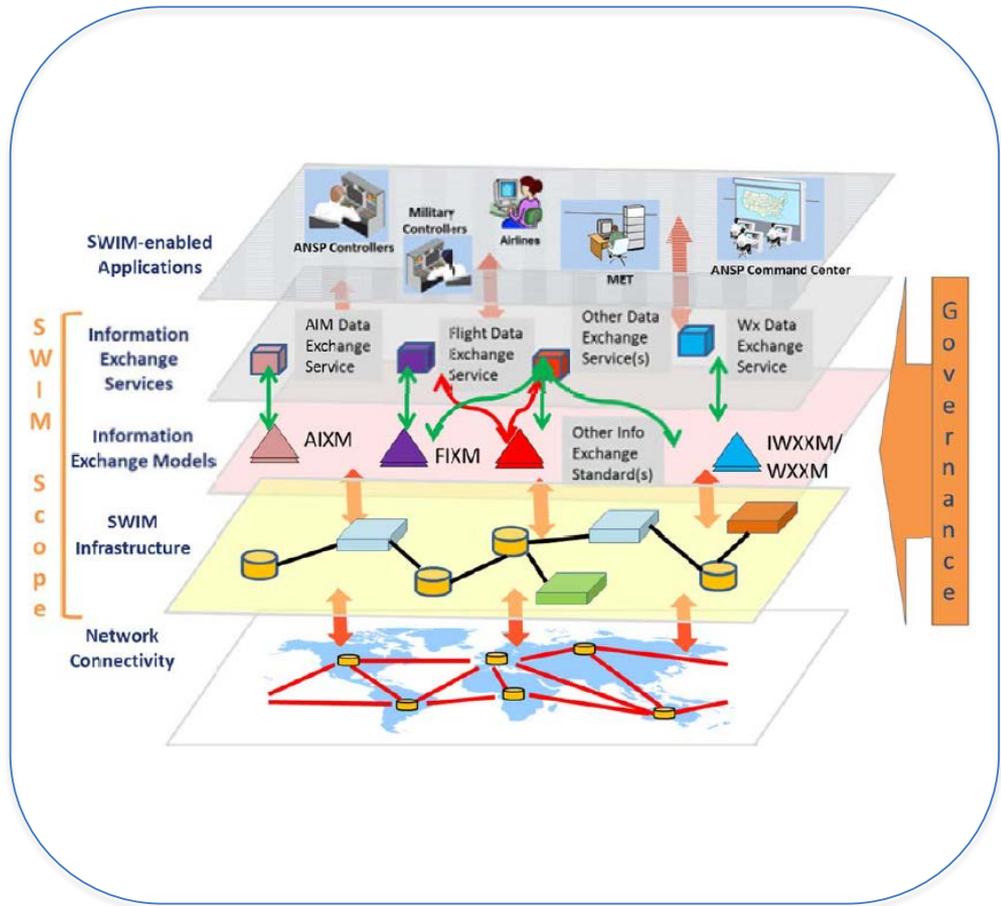
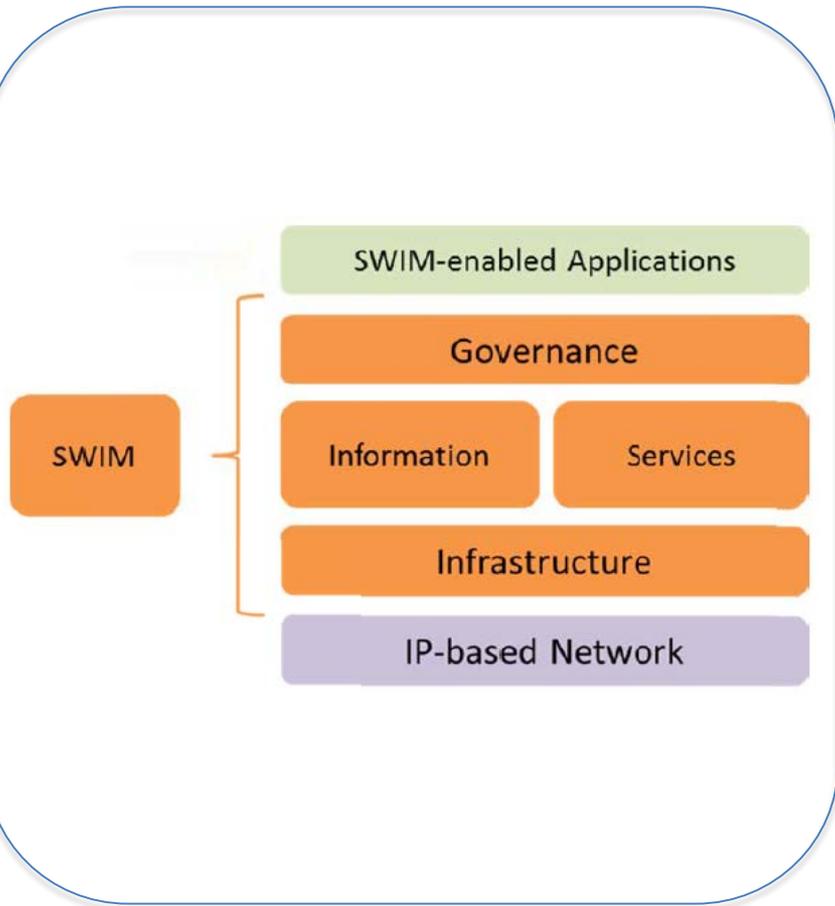
ICAO Doc 10039

Manual on System Wide Information Management (SWIM) Concept

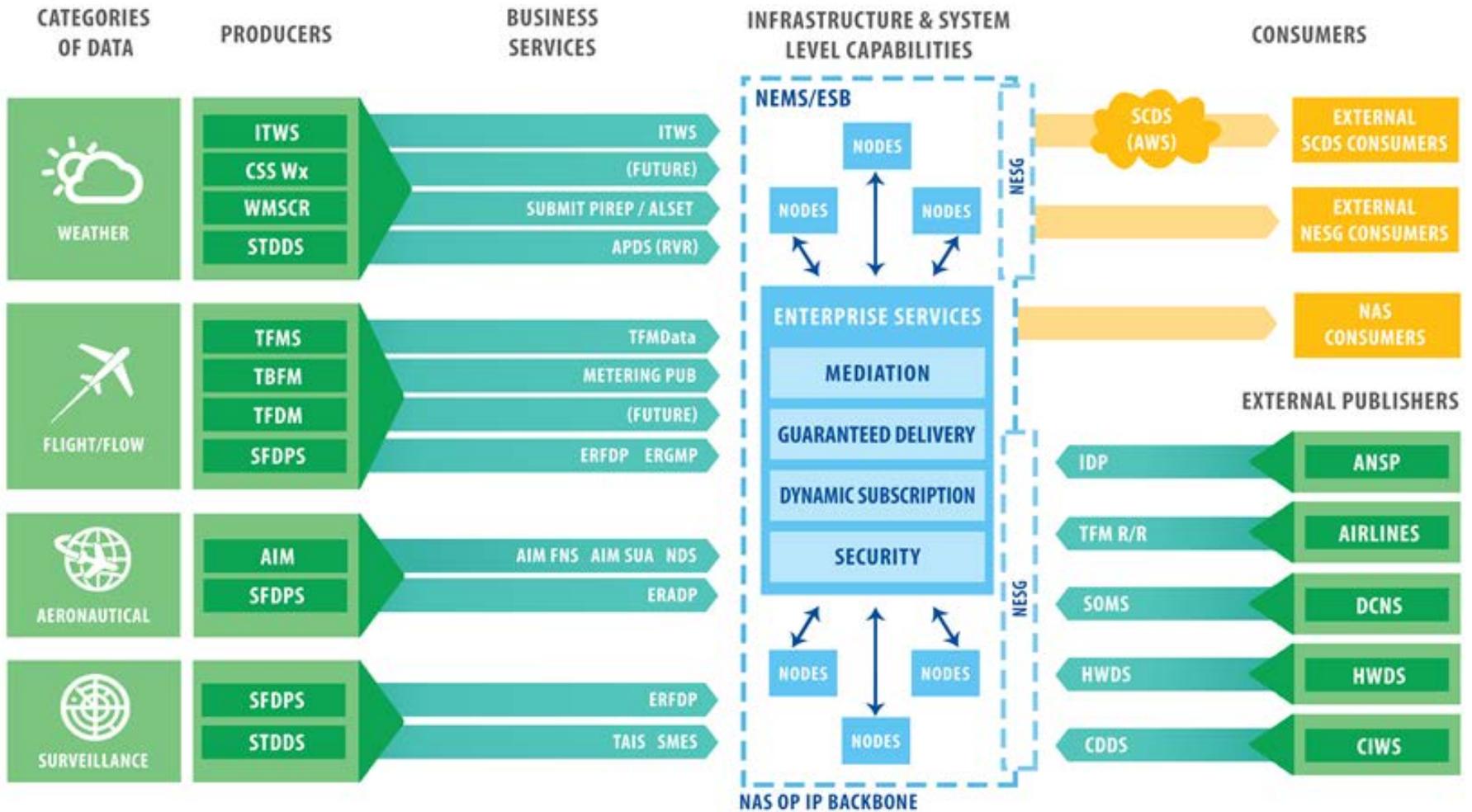
- Advanced edition
- Sep 19, 2017 draft – Vol. I only
- **Purpose:** Explain the vision for interoperable global information management by providing a clear picture of what SWIM is and how it can be implemented.



Scope of SWIM



SWIM Business Services



SWIM Data Sets



Flight and Flow Data

- **Traffic Flow Management System (TFMS):** Provides flight data and flow information
- **SWIM Terminal Data Distribution Systems (STDDS):** Collects and publishes data from 150+ airports; Provides Tower Departure, Airport Data, and Surface Movement Events
- **Time Based Flow Management (TBFM):** Provides Aircraft, Airport Configuration and Metering Status
- **SWIM Flight Data Publication Service (SFDPs):** Provides flight plan, track data and updates to clients for filed and active flight plans
- **Terminal Flight Data Management (TFDM):** Decision Support Tools for Airport and Terminal Airspace



Weather Data

- **Integrated Terminal Weather Service (ITWS)** Provides specialized weather products in the terminal area
- **SWIM Terminal Data Distribution System (STDDS):** Provides flight data and updates to clients for filed and active flight plans (e.g., Runway Visual Data (RVR))
- **Common Support Services- Weather (CSS Wx):** the single provider of weather data, products, and imagery within the National Airspace System (NAS)
- **Weather Message Switching Center Replacement (WMSCR) :** Provides NWS textual aviation weather products, altimeter data, and PIREPs



Aeronautical Information

- **Aeronautical Information Management (AIM) Federal NOTAMS Distribution System:** Provides notification and status via digital NOTAMs
- **AIM Special Activity Airspace status and updates**
- **AIM Modernization Segment Two:** Modernizes the ingestion, integration, management, maintenance, and distribution of AI by establishing the Aeronautical Common Services (ACS) and a one-stop-shop (OSS) portal



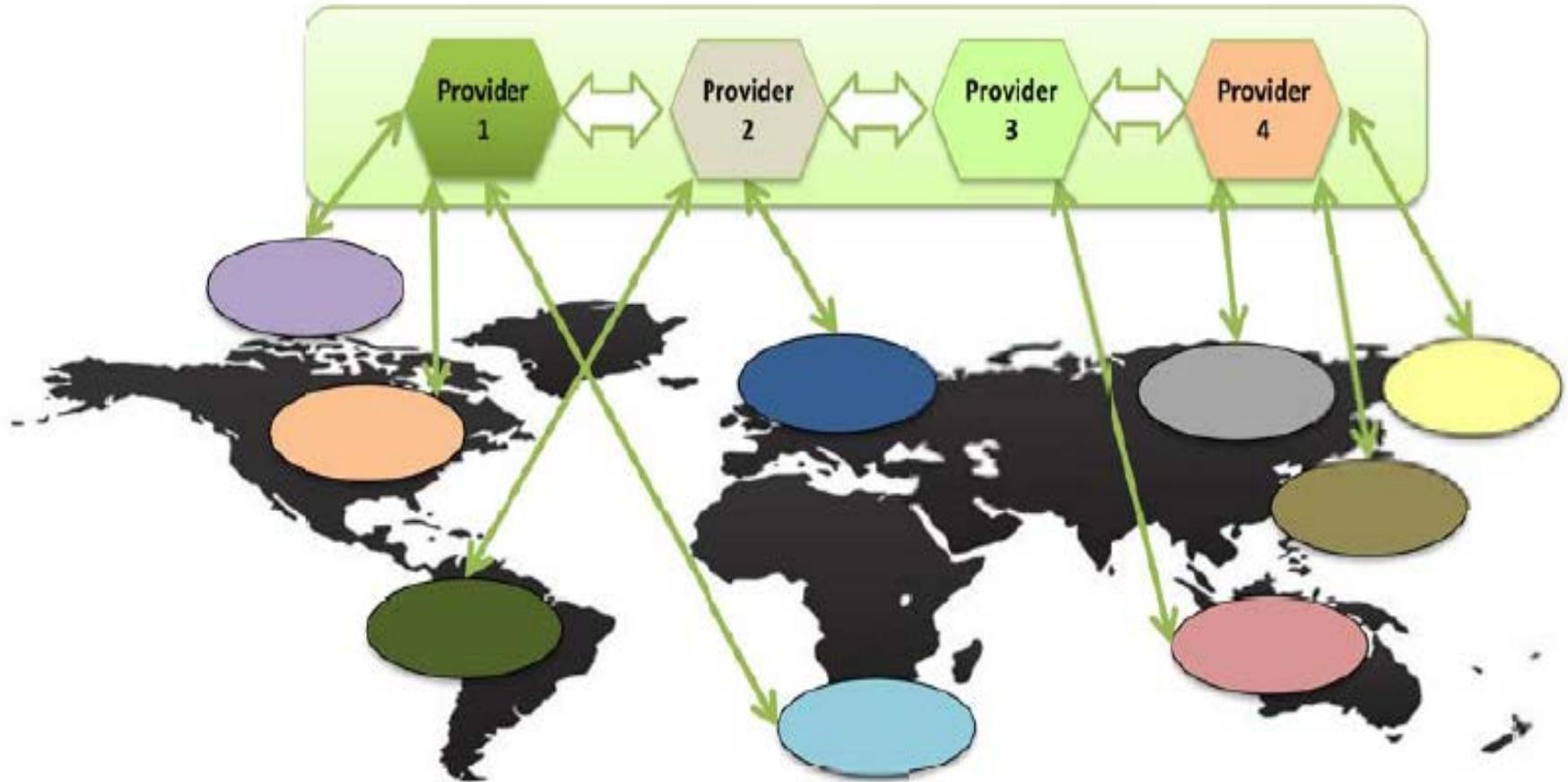
SWIM Cloud Distribution Service (SCDS)



- Address increasing external demand, while reducing bandwidth/impact to NESG, NEMS, and TIC
- Limit NESG exposure to external users
- User “criticality” determines method of data access (NESG vs. SCDS)
- Improved user experience
- Lower cost for service delivery through automation
- Platform for growth in services
- Smooth transition for users



Global SWIM





SWIM Data Sets



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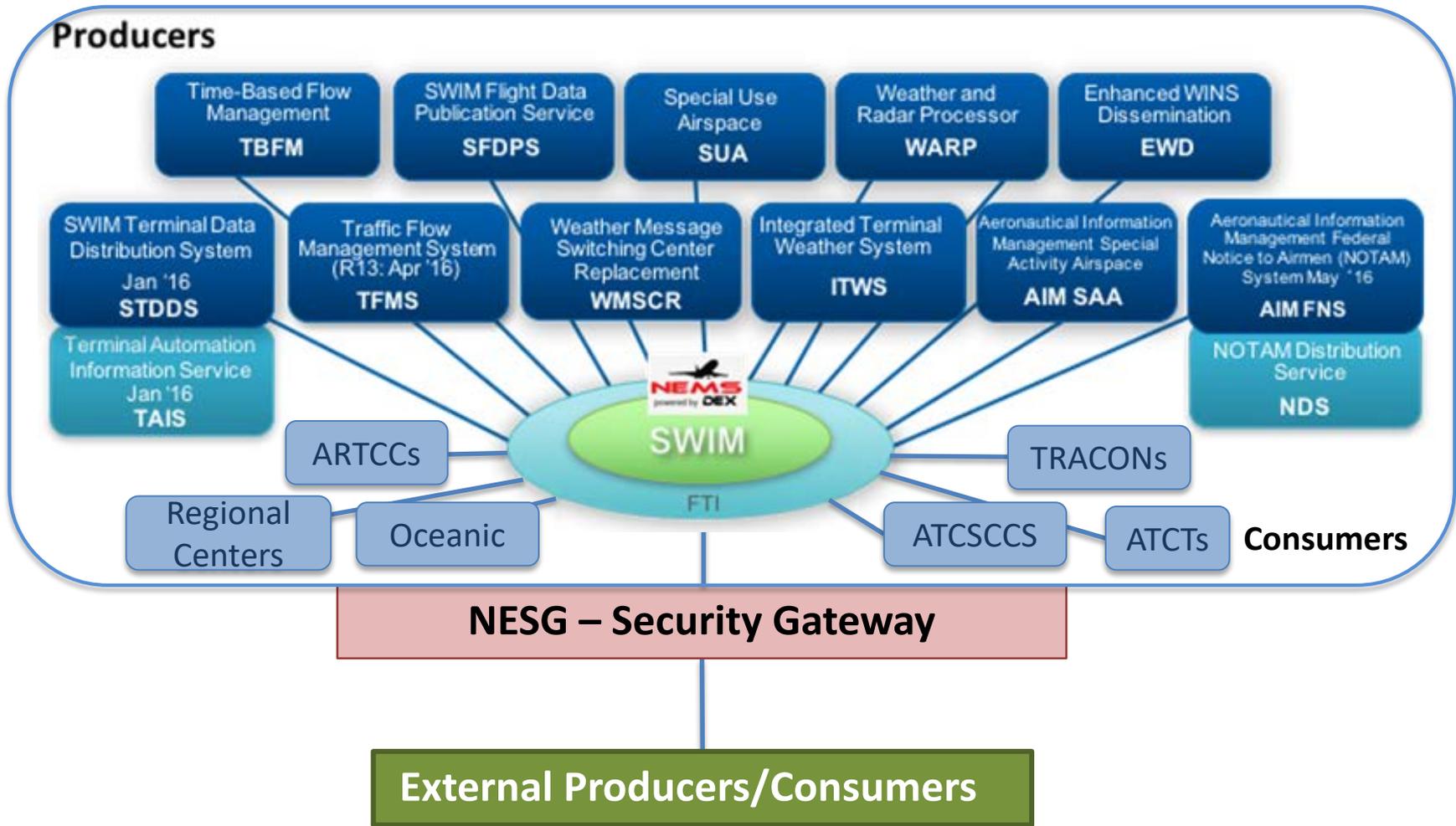


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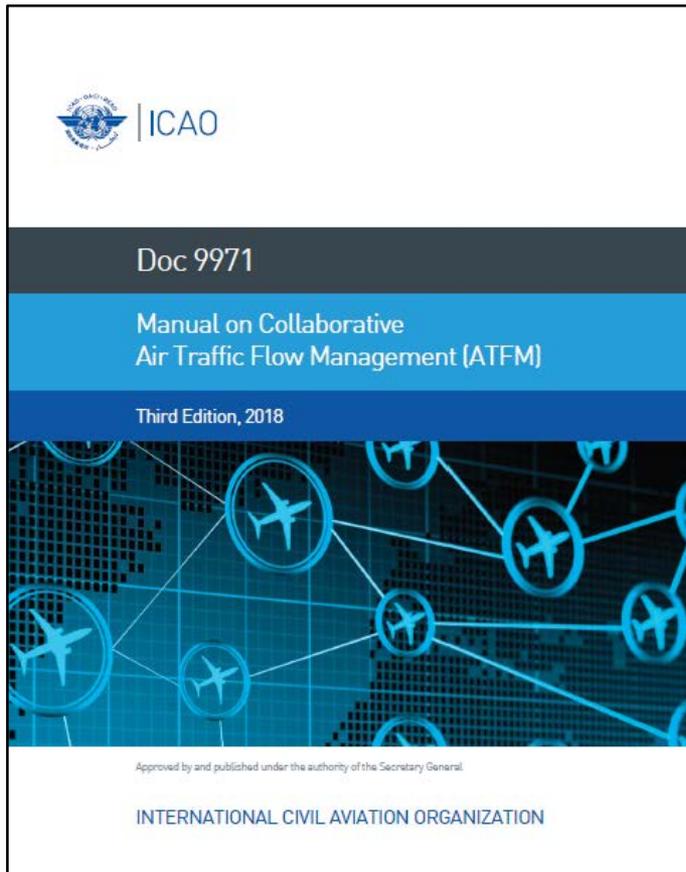
Why SWIM Works Well



SWIM

YES





ICAO Doc 9971 Manual on **Collaborative** Air Traffic Flow Management (ATFM)





Questions?

Thank you!

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