



PJ.17 Open Day on 17+18/02/2020 (@Roma)

PJ.17-03 presentation

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Founding Members



indra

FREQUENTIS



SITA
Create success. Together

THALES

Agenda



Introduction

Context

Execution process

Main results

PJ.17 synergies, future of GP & wrap-up

Questions & answers

Starter

SWIM = System-Wide Information Management

SWIM TI = SWIM Technical Infrastructure

SWIM TI profile simplified definition: Middleware technology supporting interactions between SWIM service providers and consumers → May have a look at the spare slide for the SWIM context

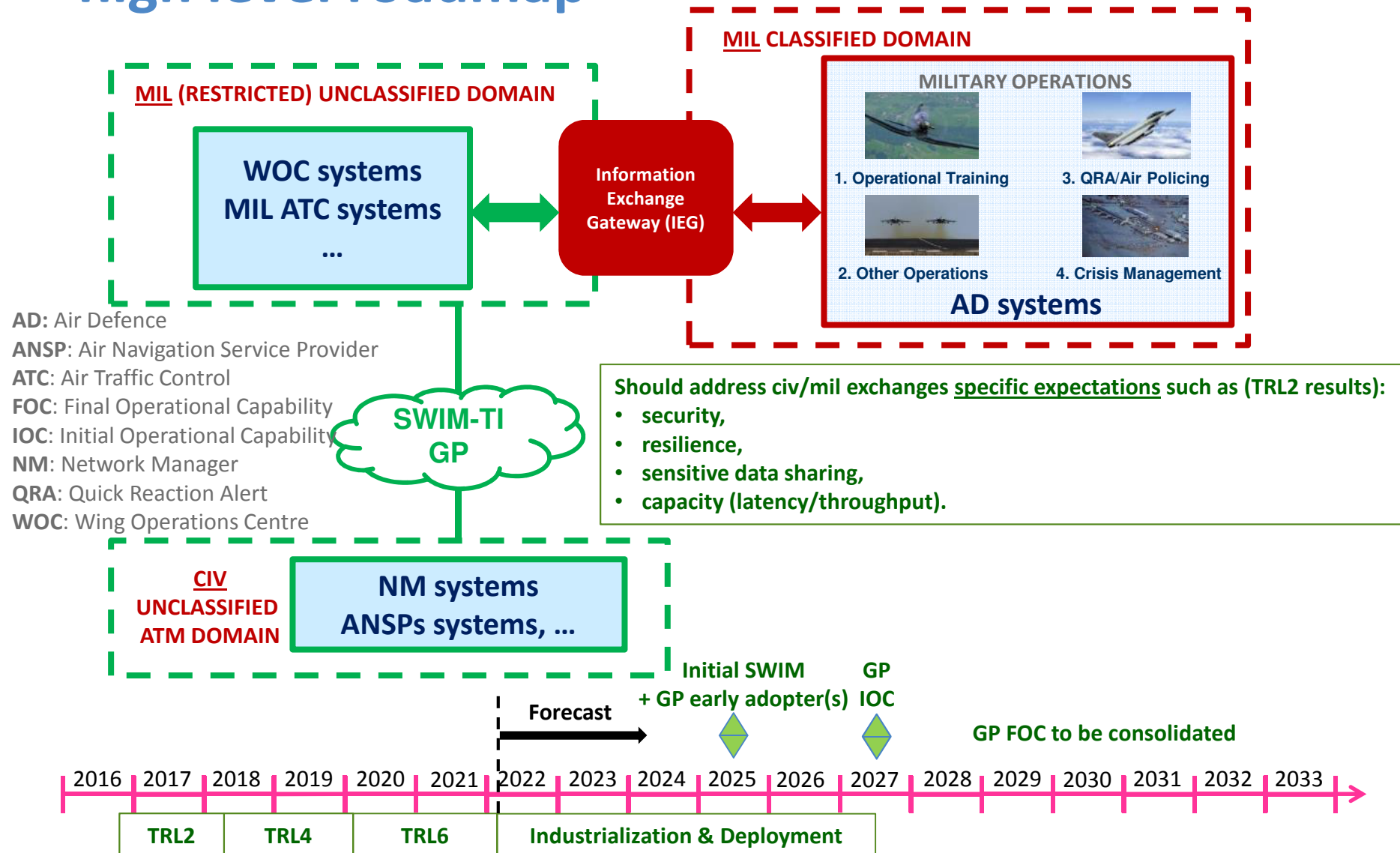
TRL = Technology Readiness Level

Introduction – Overview



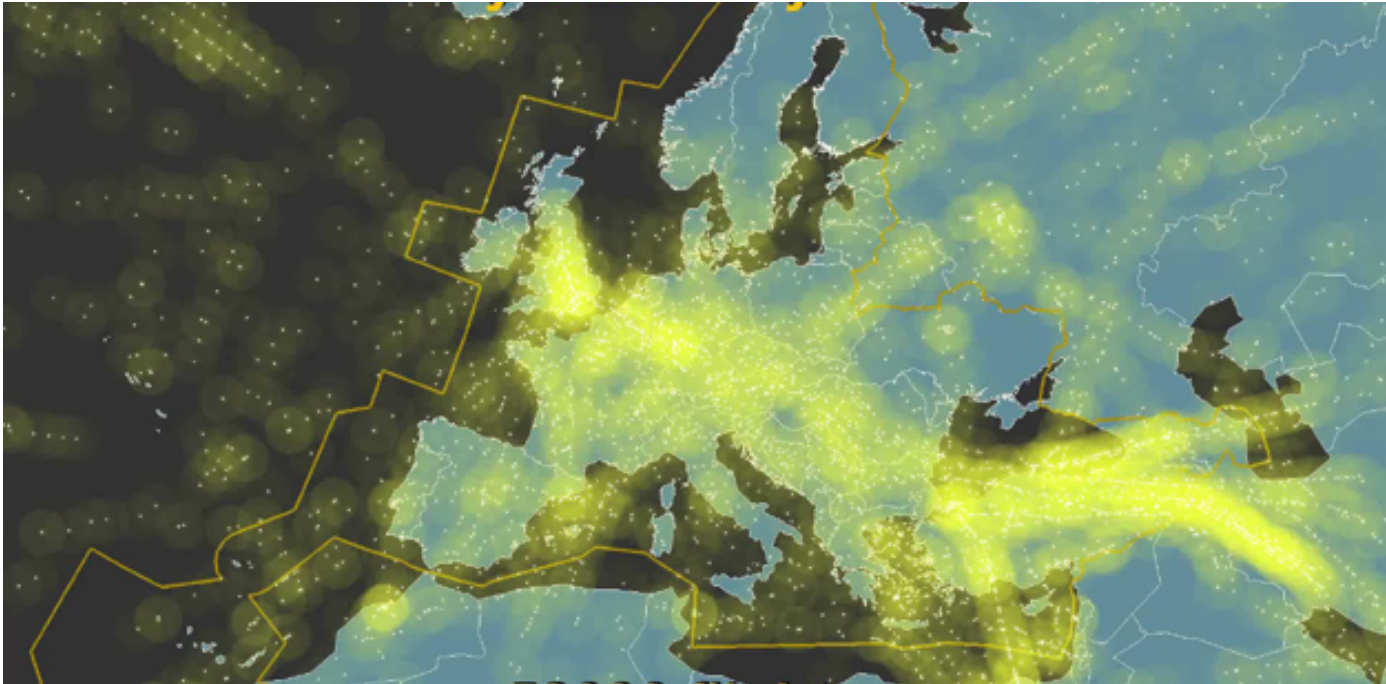
- Wave 1 SESAR 2020 **PJ.17** project → **SWIM TI**
- Wave 1 **PJ.17-03** technological solution → **TRL2 & TRL4**
 - PJ.17-03 technology
 - Is an enabler at SWIM TI level → **Green Profile (GP)**
 - Targets → **Ground/Ground (G/G) civil-military SWIM-based coordination & cooperation on its full scope** (SWIM services between civ & mil applications)
 - GP is designed to
 - **Suit expectations of military stakeholders** (STKs), such as security or resilience, needed for some SWIM-based data exchanges between civil and military applications
 - **Take into account civil stakeholders needs**, e.g. bidirectional exchanges
 - **GP exclusively targets civ/mil interoperability** (out of civ/civ or mil/mil scope) → YP (Yellow Profile) and BP (Blue Profile) do not care about the nature of peers at producer/consumer sides
- This presentation provides an overview of the solution objectives, execution and results together with some insight into GP future

Introduction – GP operational target and high level roadmap



Context – Civilian military ATM (1/3)

Traffic
over
European
airspace



Enhancing airspace Safety and airspace Security to facilitate civil and military demands



Developing more military and civil interactions

Context – Civilian military ATM (2/3)



Operational Training,
Exercise



Air Policing,
Quick Reaction Alert

“Higher levels of resilience”
“Higher levels of performance”
“Higher levels of data sensitivity”



Other Operations



Crisis Management,
Search&Rescue

Context – Civilian military ATM (3/3)



- Military Organization acquired a significant experience in **Automation** and **Digitalization** of their systems supporting all types of missions in peacetime, crisis time, war time
- For Air Operations, automation and digitalization started around mid 80's with objectives to improve operational effectiveness
- Projects offices have focused their developments and implementation towards mission critical and safety critical use cases



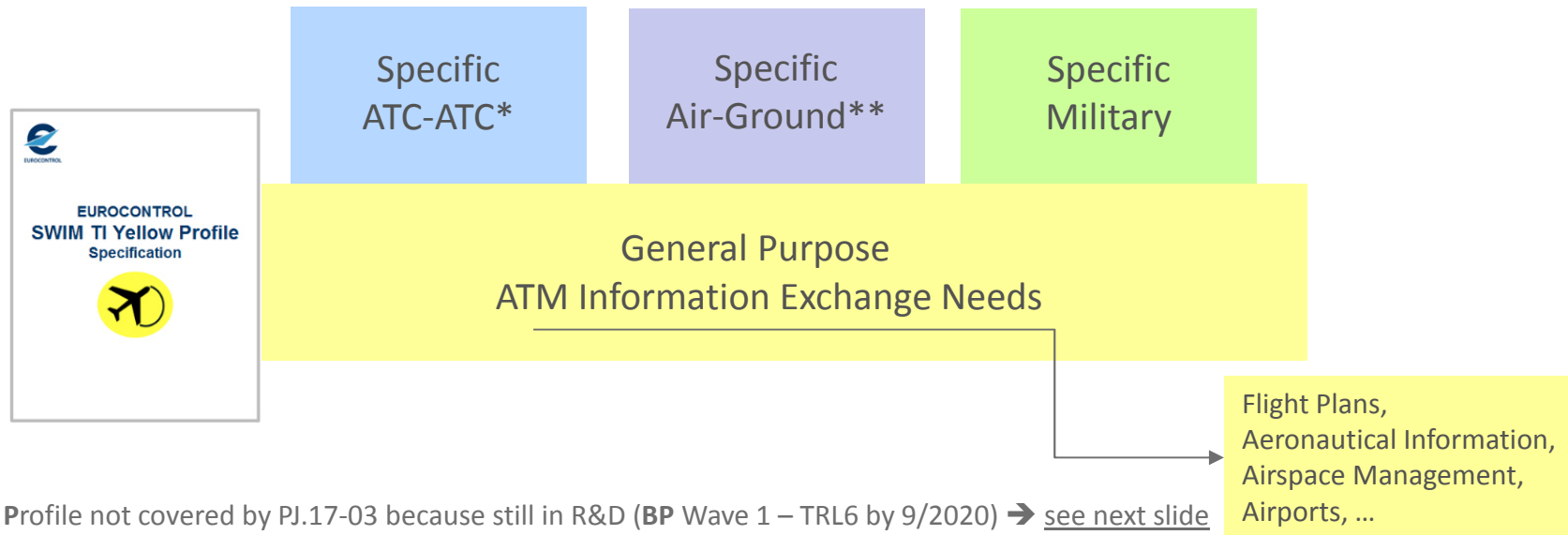
Voice has gradually been replaced by data exchanges

- For routine operations, extensive use of data
- For exceptional circumstances, data supports voice

With SWIM, the military should pursue its digitalization for ATM civ-mil coordination

Context – SWIM infrastructure specifications

Post R&D specifications



* Blue Profile not covered by PJ.17-03 because still in R&D (**BP** Wave 1 – TRL6 by 9/2020) → see next slide

** Purple Profile out of PJ.17-03 scope because **PP** is A/G only (**GP** is G/G)

Upstream R&D contribution

- **ATM Master Plan 2015** encompasses civ-mil interoperability (including at SWIM TI level)
 - Target civ-mil interoperability at lowest cost
- **ATM Master Plan 2020** addresses “§3.2.6 Military contribution to network performance” including “interoperability between civil and military systems”
 - The military should maintain the ability to protect the confidentiality of mission-critical information
 - A resilient and robust ATM system, including a data-sharing network and relevant cyber-protection and relevant cyber-resilience measures, is essential to ensure that the military can perform its duties 24/7, notably in the event of a crisis

Execution process – TRL2



- **Scoping of Functional Requirements**
 - Identification of key military expectations
 - Four military workshops
 - Identification of existing G/G SWIM services in the scope of GP
 - Identification of new exchange needs based on GP
 - Initial Security Assessment Report (SAR)
 - Initial impact assessment on primary assets matching SWIM services over GP
 - Fifth military workshop (TRL4 / June 2018)
 - Sharing of TRL2 key results
 - Consolidation of the impact assessment on primary assets
- **Definition of the Solution Orientation**
 - GP is not a entirely new profile → complements existing G/G profiles
 - **GP** = Extension of Eurocontrol Yellow Profile 1.0 Specification (**YP-MIL**) + extension of the future standardized Blue Profile (**BP-MIL**)
 - SESAR 2020 Wave 1 / Wave 2: **GP is limited to YP-MIL** (Blue Profile at R&D stage)
- **Creation of Functional Requirements** (Functional Requirements Document – FRD)

Execution process – TRL4



- **TS/IRS** (Technical Specification / Interface Requirements Specification)
 - Modelling of GP in the scope of the European ATM Architecture (EATMA)
 - Initial (final post exercise – EXE) TS/IRS Part I: technical requirements
 - PJ.17-03 provided to the Eurocontrol SWIM Unit possible improvements to the Eurocontrol YP Specification when working on GP technical requirements
 - Initial (final post EXE) TS/IRS Part II: SAR at TRL4 maturity
- **TVALP** (Technical Validation Plan)
 - Laboratory tests
 - Technical validation objectives → full coverage of technical requirements
 - Key aspects (security, resilience, data sensitivity, performance) in traceability
 - Complementary EXE 1 Thales + EXE 2 Indra + EXE 3 Frequentis → full coverage of val. objectives
- **TVALR** (Technical Validation Report)
 - Analysis and consolidation of results of EXE executions
 - Qualitative High Level Economic Appraisal (HLEA) instead of a Cost-Benefit Analysis
- **Initial TRL 6 TVALP** (for Gate TRL4)
 - Based on TRL4 TS/IRS Part I & TRL4 TVALR & Wave 2 GP DoW (Description of Work)

Main results – TRL2 FRD



- Yellow Profile standard not sufficient to cover the full extent of G/G civil-military SWIM-based operational interoperability → **GP needed for some civ-mil SWIM services**
- **GP functional requirements** target YP-MIL with an intersection with YP, they are structured through 3 sets:
 - **Messaging Between SWIM-Enabled Applications (MBSEA)**
 - SWIM-TI level interoperability between providers and consumers of a SWIM service;
 - Synchronous and asynchronous exchanges with Message Exchange Patterns (MEPs);
 - Security facet and Quality of Service (QoS) considerations;
 - Resilience facet not mature enough in TRL2 => no functional requirements (but technical requirements in TRL4)
 - **Sensitive data** (not classified)
 - Only for (civil) trusted recipients with the right to know;
 - Special focus on confidentiality and integrity.
 - **Performance** (capacity QoS)
 - Based on operational expectations from a SWIM service viewpoint

Main results – TRL4 TS/IRS Part I



- **Interoperability requirements** → target “out of the box” interoperability (incl. a technical architecture view suitable to system/software architects)
 - Information exchanges between SWIM-Enabled Applications (SEAs);
 - Underlying technology is transparent for SEAs
 - Enable interaction between consumers & providers;
 - 5 different bindings relying on AMQP, SOAP, HTTP and associated MEPs;
 - Binding = SEA service interface + network interface + protocol stack + security;
 - AMQP and SOAP advanced bindings → provide additional security for example suitable to sensitive data exchanges;
 - AMQP (asynchronous fire & forget MEP) + Message Queues (MQ) → provide time-decoupled, synchronization-decoupled and/or space-decoupled interactions.
- **Quality of Service requirements**
 - Coverage of security of data;
 - Coverage of performance based on real capacity needs;
 - Contribute to resilience.
- **Behavior requirements**
 - Scope: single SWIM Node (no interoperability);
 - Mainly contribute to resilience.

AMQP: Advanced Message Queuing Protocol

HTTP: HyperText Transfer Protocol

SOAP: Simple Object Access Protocol

Time decoupling: Interacting parties do not need to actively participate in the interaction at the same time

Synchronization decoupling : Providers not blocked while producing an event and consumers can be asynchronously notified (concurrent activity)

Space decoupling: Interacting parties do not need to know each other

Main results – TRL4 TVALR



- **Solution reached TRL4 maturity level (Gate TRL4 passed on 05/02/2020)**
 - Good level of confidence in technical validation positive results;
 - Consolidation of TRL4 technical requirements
 - From a technical perspective, results are all considered significant.
 - Contribute to satisfaction of operational needs
- **Qualitative High Level Economic Appraisal**
 - Identification of reference and solution scenarios to assess impact on KPAs (Key Performance Areas) considered relevant to the solution;
 - No negative impact;
 - High impact (most concerned KPAs): safety, security, interoperability, civil-military coordination and cooperation;
 - Significant impact: access and equity, predictability and punctuality.
- **Some recommendations for the next step (TRL6 – Validation in ATM environment)**
 - Scope extension: sensitive military data between civil entities?
 - Test interoperability between GP prototypes of different sources and with other SWIM-TI entities (e.g. Public Key Infrastructure – PKI);
 - Improve resilience, safety and security;
 - Involve civil stakeholders.

PJ.17 synergies



- As a technological solution of PJ.17, **PJ.17-03**:
 - **Contributed to project coordination** and most of project level deliverables
 - **Coordinated with PJ.17-01 (PP) on several technical/process facets**, mainly:
 - Common SWIM TI functional decomposition to instantiate per profile
 - EATMA modelling for SWIM TI consistency (modelling per solution), in coordination with PJ.19-03
 - Solution level Change Request (CR) management, e.g. in the scope of Data Set 19 (DS19)
 - Way to address SJU expectations (e.g. safety process not applicable to technological solutions in case of SWIM TI profiles without adaptations)

Future of GP – R&D scope



- Reminder: TRL6 is the limit of R&D, then usually starts the industrialization phase
- GP R&D work will continue with SESAR 2020 / Wave 2 → Technological solution **PJ.14-W2-101** in the scope of **PJ.14 W2** (Integrated Communication, Navigation and Surveillance System – I-CNSS)
- **PJ.14-W2-101 main characteristics**
 - **Targets TRL6** (initially planned end-January 2022)
 - Thales is the main partner with the support of Eurocontrol and Enaire (**civil STK**)
 - **Will demonstrate the GP maturity at overall system level**, so encompassing:
 - The civil IP network infrastructure,
 - A more complete SWIM TI (e.g. add needed PKI),
 - Civil and military most significant systems (applications).
 - **Technical Specification complements on**: security, resilience and performance when appropriate – incl. a TRL6 SAR
 - **One exercise focusing on**: “civil ATM + military ATM/AD” level with “close to the real world” civ/mil systems relying on realistic middleware and IP network layers

Future of GP – Industrialization & deployment



- Once GP (YP-MIL) reached TRL6 → **GP (YP-MIL) IOC and FOC have to be considered**
 - IOC: 1st capacity deployed in some countries between civil and military systems
 - FOC: GP deployed (almost) all over EUR based on the target functional level
- R&D on the BP facet of GP (BP-MIL)
 - **To be envisaged once BP is standardized → Rest of the slide focused on YP-MIL**
- **1st step → GP standardization** as complement (extension) to the Eurocontrol SWIM TI YP Specification (so **YP-MIL**), should occur during the months following Gate TRL6
- **2nd step → Other GP industrialization** aspects will start once YP-MIL is approved
- **3rd step → GP deployment** depending on YP deployment
 - **Initial SWIM (civ-mil interoperability) in 2025:** limited to YP (Pilot Common Project (PCP) target without BP) → Possibly including **GP (YP-MIL) early adopter(s)**
 - **GP (YP-MIL) IOC forecast:** around 2027 (SESAR 2020 current forecast)
- **4th step → GP (YP-MIL) FOC** is not yet consolidated (incl. GP functionalities to come)

Conclusion



- **GP goal** → Civ-mil interoperability at SWIM-TI level on the full scope of civ-mil coordination and cooperation
- **GP orientation** → YP-MIL (on-going) + BP-MIL (future target to consolidate)
 - Civ-mil interoperability partially covered with YP
 - YP-MIL operational target (SWIM services) identified and should evolve
- **GP (YP-MIL) improvements compared to YP** → More security & resilience plus performance facet (capacity: latency/throughput)
- **GP (YP-MIL) TRL4 Gate just passed** → Next step to get GP (YP-MIL) deployed is “SESAR 2020 PJ.14-W2-101 for TRL6” (Gate TRL6 initially planned in 1/2022)
- **GP (YP-MIL) possibly operational for early adopter(s) in 2025**, with an **IOC** in 2027 (S2020 forecast) and **FOC** to consolidate → Current estimated roadmap

Questions & Answers



PJ17-03 – Presentation at the PJ.17 Open Day in Roma (LDO) on 17/02/2020

Thank you very much for your attention!



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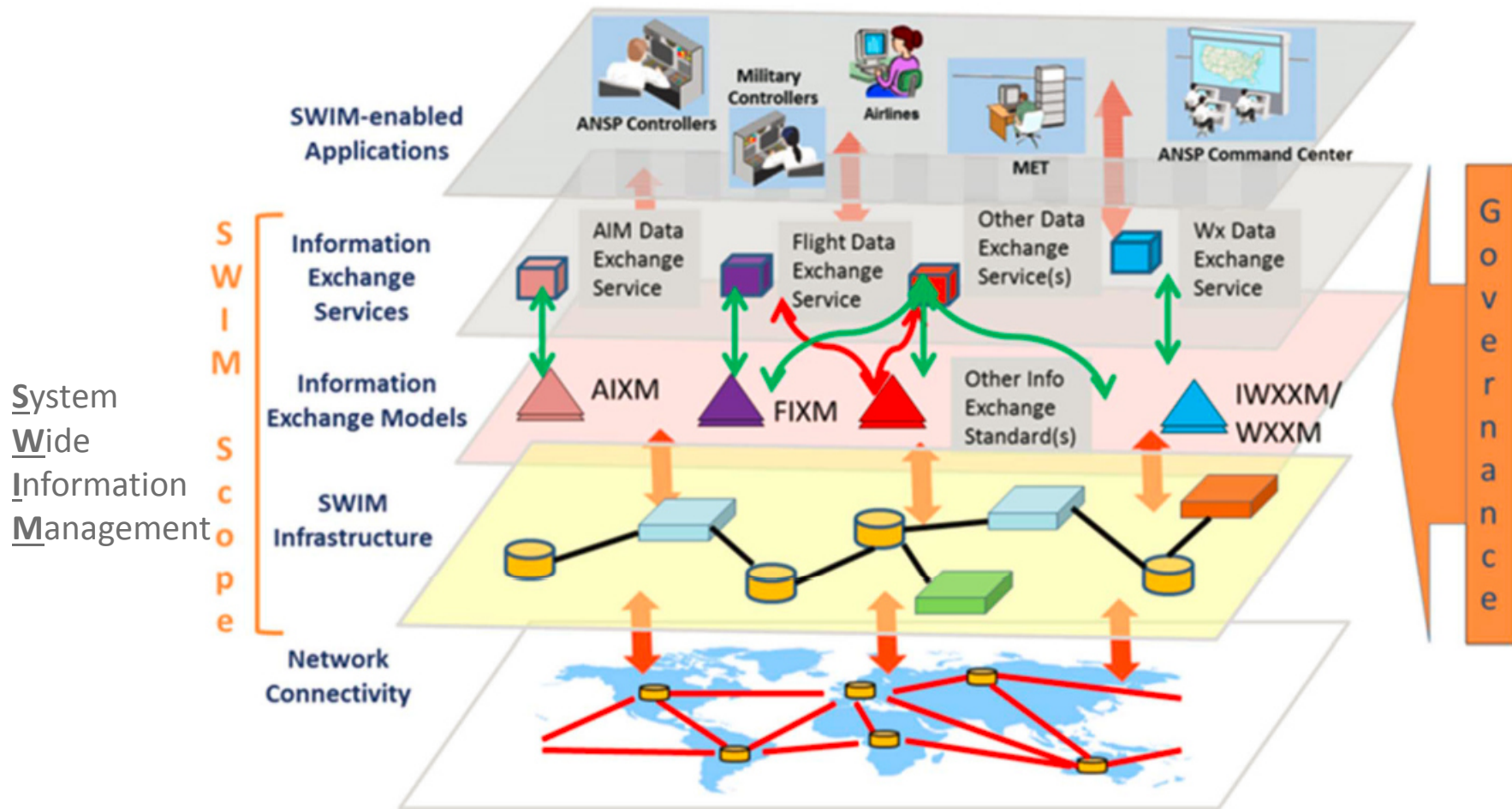
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SWIM, a Service Oriented Architecture (SOA)



Picture from ICAO Doc 10039 "Manual on the System Wide Information Management (SWIM) Concept"