

Understanding SWIM Related ICAO Provisions and Manuals

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Understanding ICAO Documents

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Doc 10039 Manual on System Wide Information Management (SWIM) Concept

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Doc 10199 Procedures for Air Navigation Services – Information Management (PANS–IM)

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Doc 10203 Manual on System Wide Information Management (SWIM) Implementation

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What it means for you

Introduction

- **SWIM Related documents**

- Manual on SWIM Concept (Doc 10039)
- PANS – Information Management (Doc 10199)
- Manual on SWIM Implementation (Doc 10203)

- **Agenda**

- SWIM Concept Manual to introduce the basic concepts
- PANS-IM for regulations related to SWIM and necessary compliance
- SWIM Implementation Manual to formulate a SWIM implementation plan.

- **Q&A**

- 10 Mins Q&A session between each document





Doc 10039 Manual on System Wide Information Management (SWIM) Concept

Doc 10039 - SWIM Concept Manual

- **Detailed description of the SWIM Concept**
 - The need for SWIM
 - Definition
 - Interoperability Principles
 - Benefits of SWIM
- **Breakdown of the SWIM Concept**
 - Components, context and scope
 - Identification of stakeholders and roles
 - Information domains
 - Global interoperability
 - Quality management
- **Definition of Information and Information Services**
 - Exchange models
 - Metadata
 - Information service definition
 - Registry
- **Governance**
- **SWIM Technical Infrastructure**



What is Doc 10039?

Detailed Description of the SWIM Concept

- **Articulates the need for SWIM**

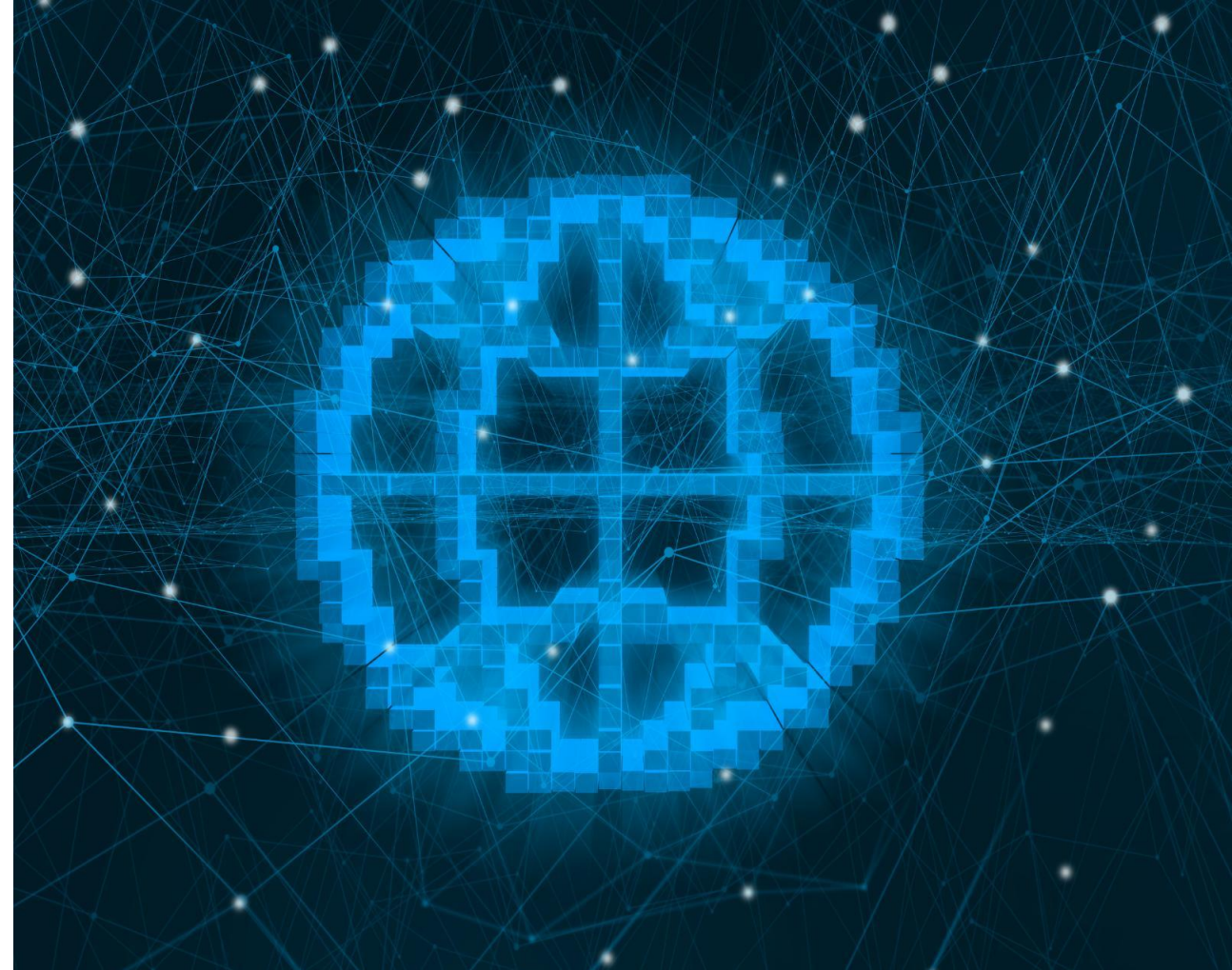
- Advancements in information technology
- Aviation and ATM systems increasing reliance on automated systems require accurate data
- Reduce duplicated efforts or misinterpretation of data by moving towards digital data at origination
- Increased agility with service orientation

- **Definition of SWIM**

- Service-oriented architecture
- Standardized Interfaces
- Decoupling of information producers from information consumers
- Data Centric and Network Centric

- **Interoperability Principles**

- Use of interoperable information services
- Separation of information provision and consumption
- Loose coupling
- Discoverability
- Use of open standards
- Secure Information exchange



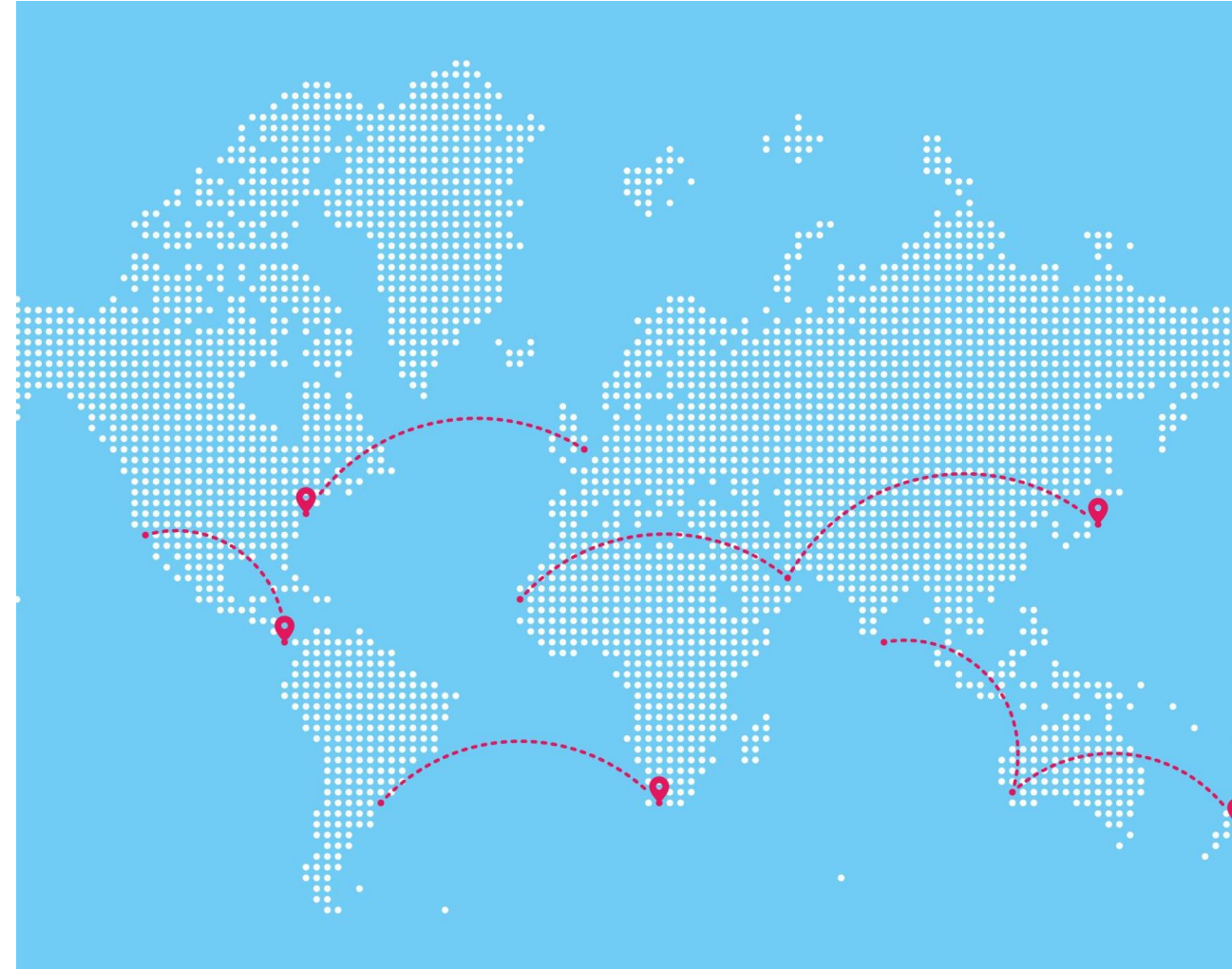
Benefits of SWIM

- **Improved safety**
 - Providing right information to the right place at the right time
- **Improved efficiency**
 - Enabling performance-based operations
- **Improved collaborative decision making**
 - Share situational picture
 - Availability of quality information from authoritative sources
 - Access to dynamic data
- **Increase ATM system performance**
 - Through operational efficiencies
- **Flexible, cost-effective communications**
- **Lower development and maintenance costs**
- **Improved information interoperability**



Benefits of SWIM - Use Case illustration

- **APAC Global Air Navigation Plan Workshop**
 - Minimum Implementation Path (MIP) – Common baseline of minimum air navigation capabilities
 - Time-Based ATFM requires information about flights
 - Long range
 - Medium range
 - Require shared situational awareness
 - Collaborative Decision Making to arrive at optimal solution
 - Shared information through SWIM
- **Improved situational awareness**
- **Improved overall efficiency**
- **Improved safety**
- **SWIM is the baseline infrastructure that is required by most of the operational concepts on the MIP**



Breakdown of the SWIM Concept

- **Components of SWIM**

- Information
- Information Services
- SWIM Technical Infrastructure
- Governance Framework
- Supported by IP Based Network

- **Key stakeholders and roles in SWIM**

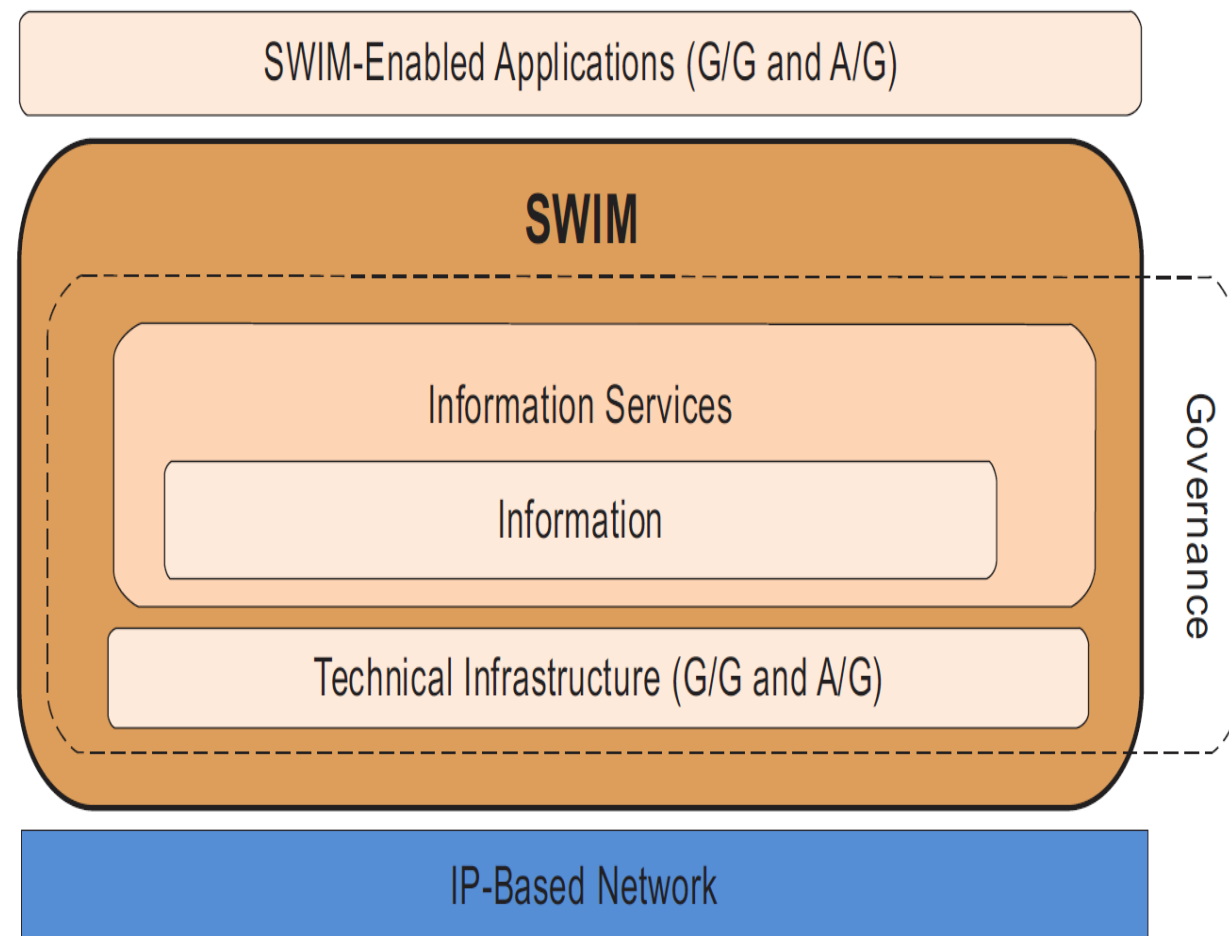
- Information Originators
- Information Consumers
- Regulatory Oversight
- Global Coordination

- **Global Interoperability**

- Common data models
- Cross Border Information Exchange
- Global Interoperability Framework

- **Quality Management**

- Service Level Agreements for Information Services
- Quality of the SWIM TI



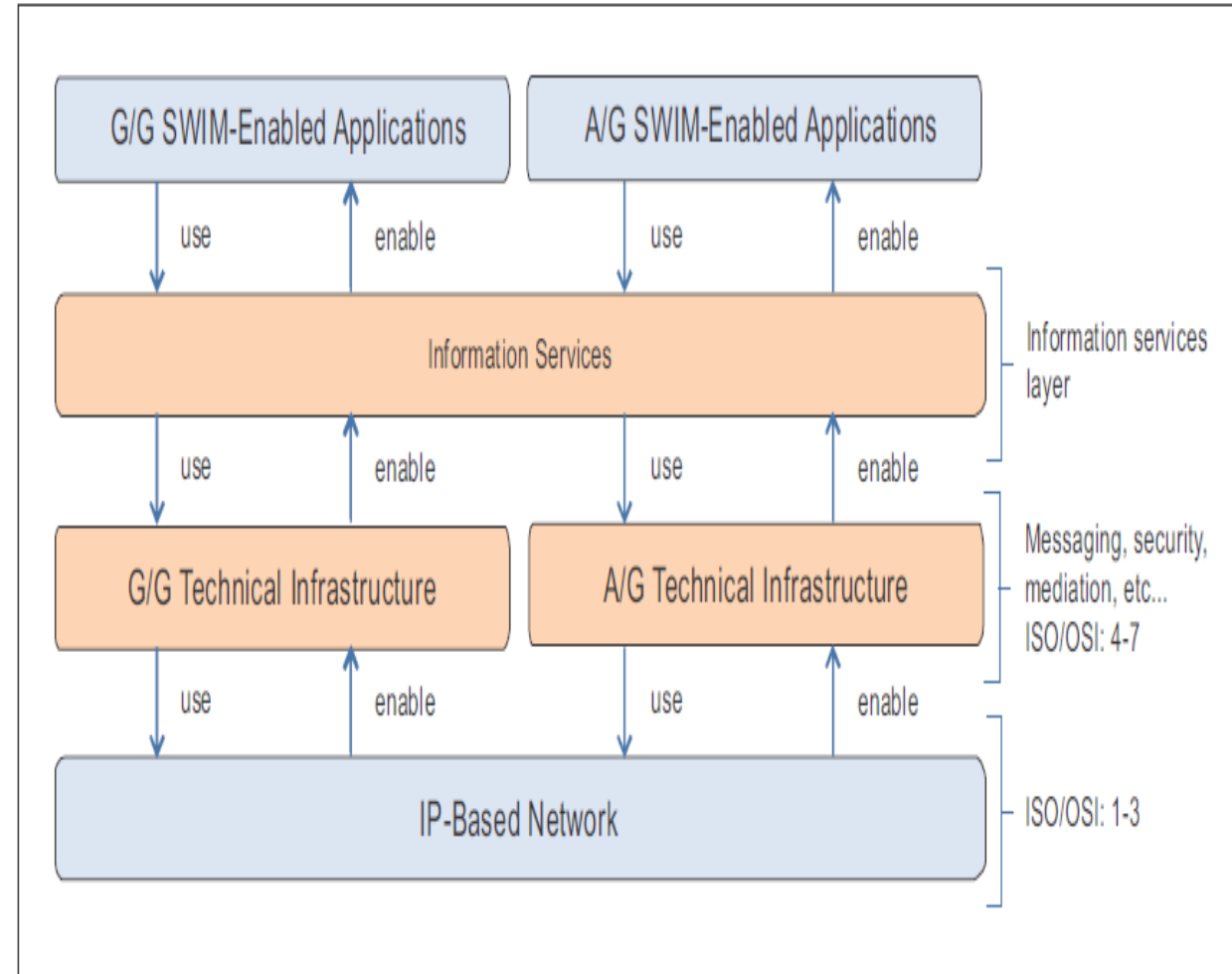
Definition of Information and Information Services

- **3 key components to interoperability**
 - ATM Information Reference Model (AIRM)
 - Information Exchange Models
 - Metadata
- **AIRM**
 - Maintain semantic interoperability
- **Exchange models**
 - XML formatted data model
 - Flight, Aeronautical and Weather domains
- **Metadata**
 - Data about data
 - Enables consumers to make informed decisions
 - Essential to understand, process and deliver the information
- **Information service definition**
 - Machine accessible end-point to access information
 - Follows either the Publish / Subscribe or Request / Reply Message Exchange Pattern
 - Uses the exchange models where defined.
- **Registry**
 - Where discovery occurs
 - The description of the information services
 - First point of contact for consumers



Technical Infrastructure

- **Collection of software and hardware that enable Information Services**
 - Either ground-ground or air-ground or both
- **SWIM requires the Technical Infrastructure (TI) to exchange information**
- **SWIM TI consists of several infrastructure services**
 - Messaging
 - Security
 - Mediation
 - Interface management
 - Enterprise service management
- **Relies on mainstream ICT systems and IP-based network connectivity**
 - Standardised protocol and interfaces
 - Service-Oriented Architecture







Doc 10199 Procedures for Air Navigation Services – Information Management (PANS–IM)

Global Approach to Information Management

- **Need for Global Harmonization**
 - Unified global approach to ensure interoperability across all information domains
- **PANS-IM Procedures (Doc 10199)**
 - Outlines procedures for managing existing and emerging information domains in aviation
 - Supports transitioning to a global air navigation system network
 - Governs SWIM implementation(s) and operations to ensure interoperable information exchange among all ATM stakeholders
 - Includes information security requirements to protect data and ensure end-to-end security in SWIM.



SWIM Principles for Global Interoperability

Interoperable Information Services

- Interoperable services enable essential information exchanges based on operational needs and process analysis.

Separation of Provision and Consumption

- Clear separation between providers and consumers enhances flexibility and isolates implementation details.

Loose Coupling Principle

- Components maintain minimal dependencies with each other
- Ensure modular and flexible information service interfaces

Discoverability and Open Standards

- Information services must be discoverable
- Built on open standards that are freely accessible

Secure Information Exchange

- Secured using a comprehensive cybersecurity framework

Quality Management Requirements and Implementation

- **Information Service Provider Role**

- Service providers must maintain Quality Management System (QMS) to assure and provide required quality of information service.

- **QMS ensures information quality meets domain-specific requirements through effective implementation and maintenance.**

- ISO 9000 defines QMS to meet stakeholder needs, address risks, optimize resources, and promote continuous improvement.



Information exchange requirements

- **Information providers must consider intended information use to meet exchange requirements effectively**
 - Providers and consumers need a shared meaning via exchange models or a global reference model
 - Common understanding of the data exchange schema is essential between service providers and consumers
- **Use of Domain-specific Models**
 - Information services should use domain-specific information exchange models and business rules for their payloads
 - Requests for changes can be made if models do not meet requirements.
- **If domain-specific models are not used**
 - Align payload data with a global reference model, (AIRM)
 - Use standardized exchange schemas



Metadata Requirements for Information Services

- **Importance of Metadata**

- Essential for understanding and exchanging information in information services effectively.
- Providers **must** supply metadata describing both the information service and its payload for clarity and management.

- **Domain-Specific Metadata Collection**

- Should align with specific domain requirements during information management activities.

- **Standards and Procedures**

- Requirements are governed by standards and procedures detailed in related annexes and documentation.



Information Service Publication and Service Overview

- **Providers must publicize the information services they offer to ensure visibility and accessibility.**
- **Service overviews must use standardized metadata fields to improve discoverability and facilitate comparisons.**
 - Standardize information service overview template is found in the PANS
 - Examples of how service overview is used are found in the SWIM implementation manual (Doc 10203)
 - Providers are required to give full descriptions of all metadata fields for each service version.
- **Providers must inform consumers where to find service overviews and related metadata for easy access.**
 - Where the services overviews can be found must be published in the AIP
 - If a SWIM Registry is used the URL of the registry needs to be published in the AIP



SWIM Registry Functions and Requirements

- **Purpose of SWIM Registries**

- Enable information providers to publicise their information services
- Enable information consumers to discover information services

- **Access control**

- Registries enforce access control for registering information services

- **Search and Notification**

- Registries must provide search functionalities
- Notification for changes to information services

- **Public Availability**

- Registries should be publicly accessible
- Promote ease of information sharing and transparency



Technical Infrastructure Requirements for SWIM

- **Internet Protocol Suite Foundation**

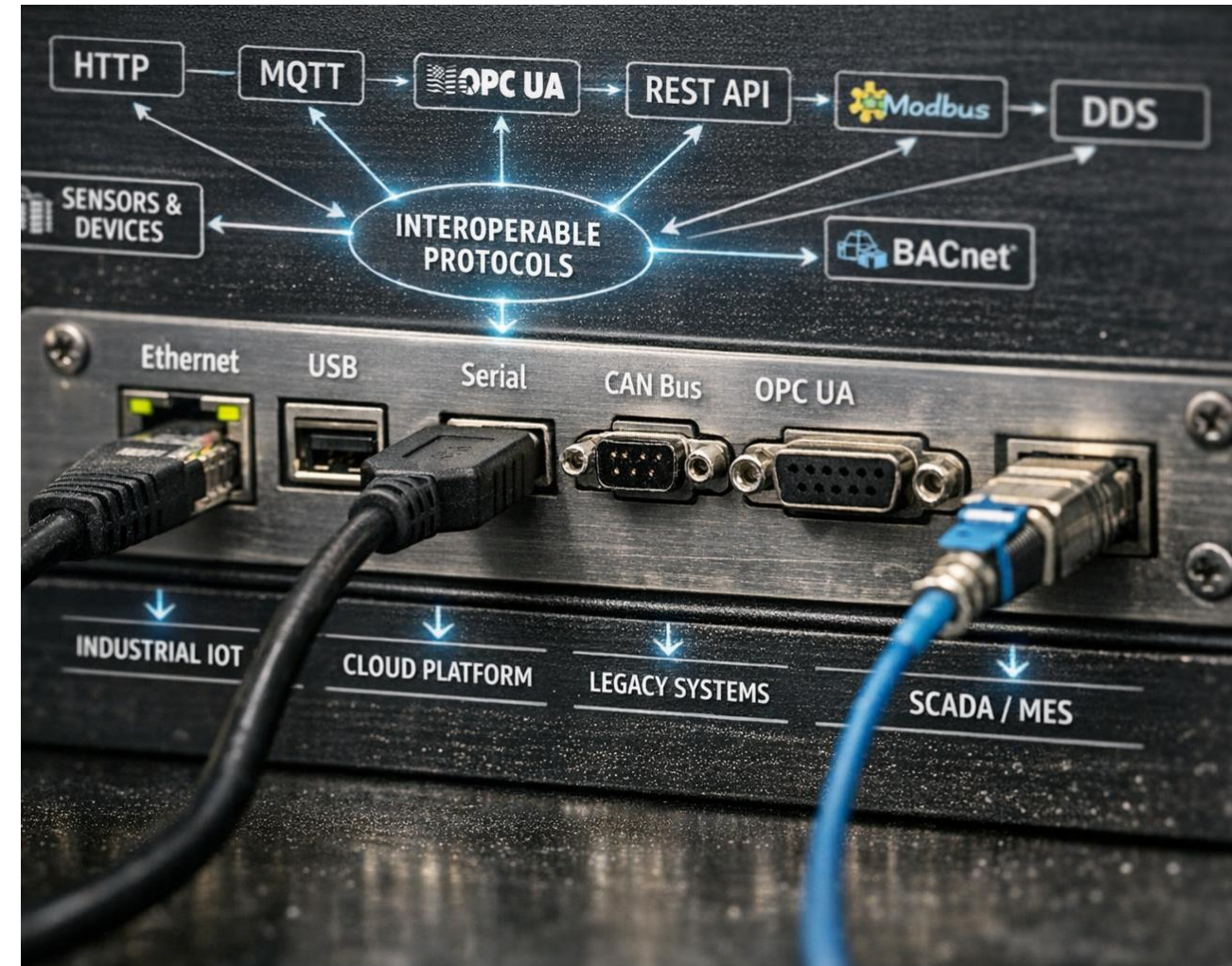
- SWIM must use Technical Infrastructure (TI) based on Internet Protocol Suite (IPS)

- **Standardized Protocols**

- Interface bindings enable an information service to interact with the SWIM TI efficiently and reliably
- Bindings must use widely supported protocols to ensure interoperability and loose coupling between systems

- **When different protocols are used**

- Mediation is needed to ensure that messages preserve integrity during conversion.



Information Security Framework and Requirements

- **Stakeholders must implement security frameworks**
 - Ensure confidentiality, integrity, and availability of information.
 - Applies to IPS networks, infrastructure, information services, and applications in an integrated manner
- **Information Classification**
 - Information must be classified into security categories for proper protection
 - Security measures should match classification level to protect information appropriately
- **Classification considerations**
 - Assess impact of loss of confidentiality, integrity and availability on security and safety
 - Loss of security can directly affect operational safety and must be carefully evaluated
- **Doc 10204 provides further guidelines for assessment**



Significance of Doc 10199

SWIM Framework Importance

SWIM enables global, interoperable information exchange, improving aviation communication and coordination worldwide.

Key Components

Fundamentals, governance, technical infrastructure, and security are essential for SWIM's successful implementation.

Question & Answer





Doc 10203 Manual on System Wide Information Management (SWIM) Implementation

Doc 10203 – SIWM Implementation Manual

- **SWIM Implementation Overview**

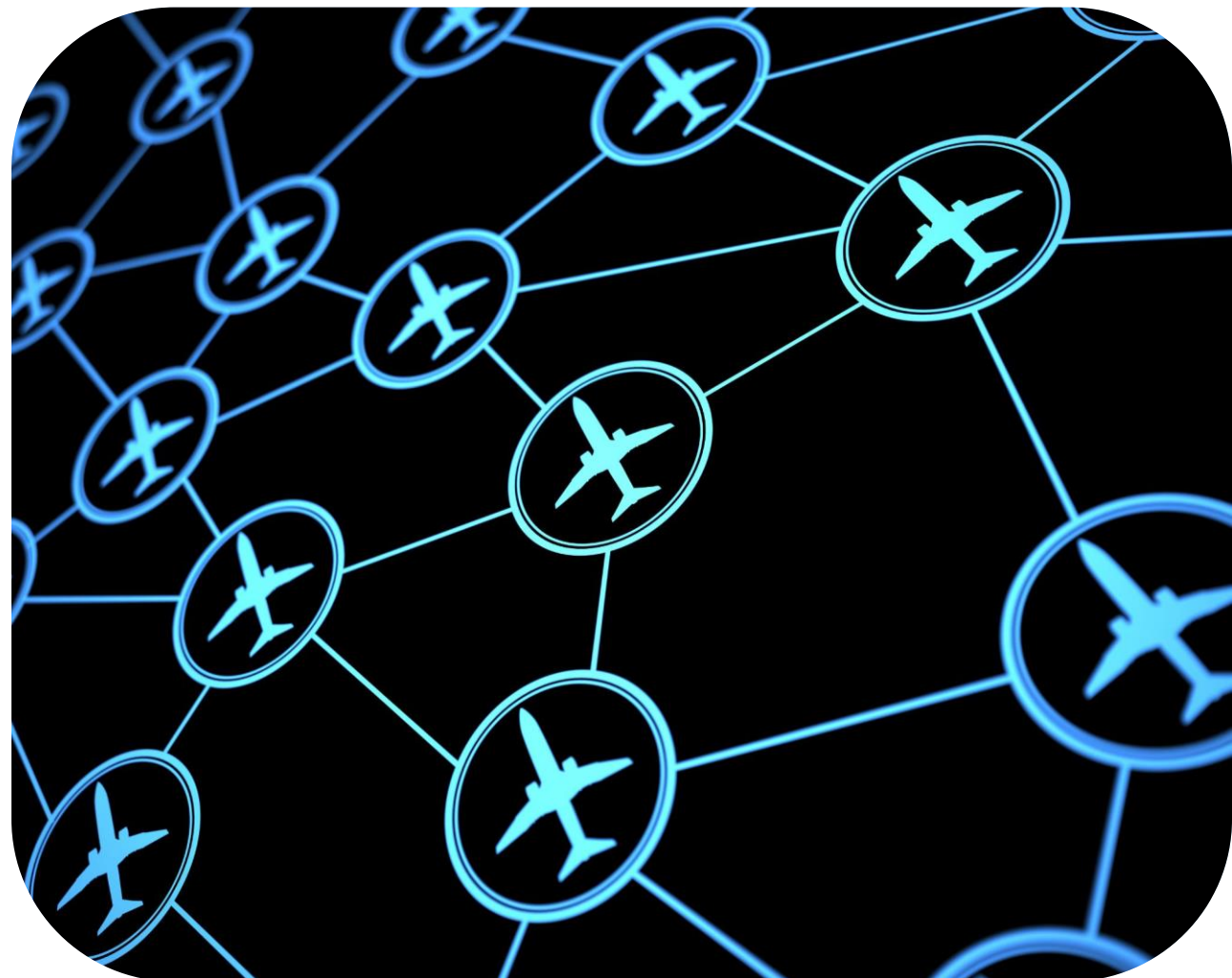
- Doc 10203 provides practical guidance for implementing SWIM
- Translates SWIM concepts (doc 10039) and regulations (doc 10199) into actionable steps

- **Transformation to Collaborative Environment**

- SWIM enables a shift from fragmented data exchange to interoperable service-oriented information sharing across the ATM ecosystem

- **Supporting Infrastructure**

- Governance, technical infrastructure, standardized data models, and lifecycle management all support SWIM implementation.



From Concept to Implementation

- **Conceptual Foundation**

- Doc 10039 defines SWIM's vision, principles and interoperability
- Highlights the importance of SWIM

- **Regulatory Framework**

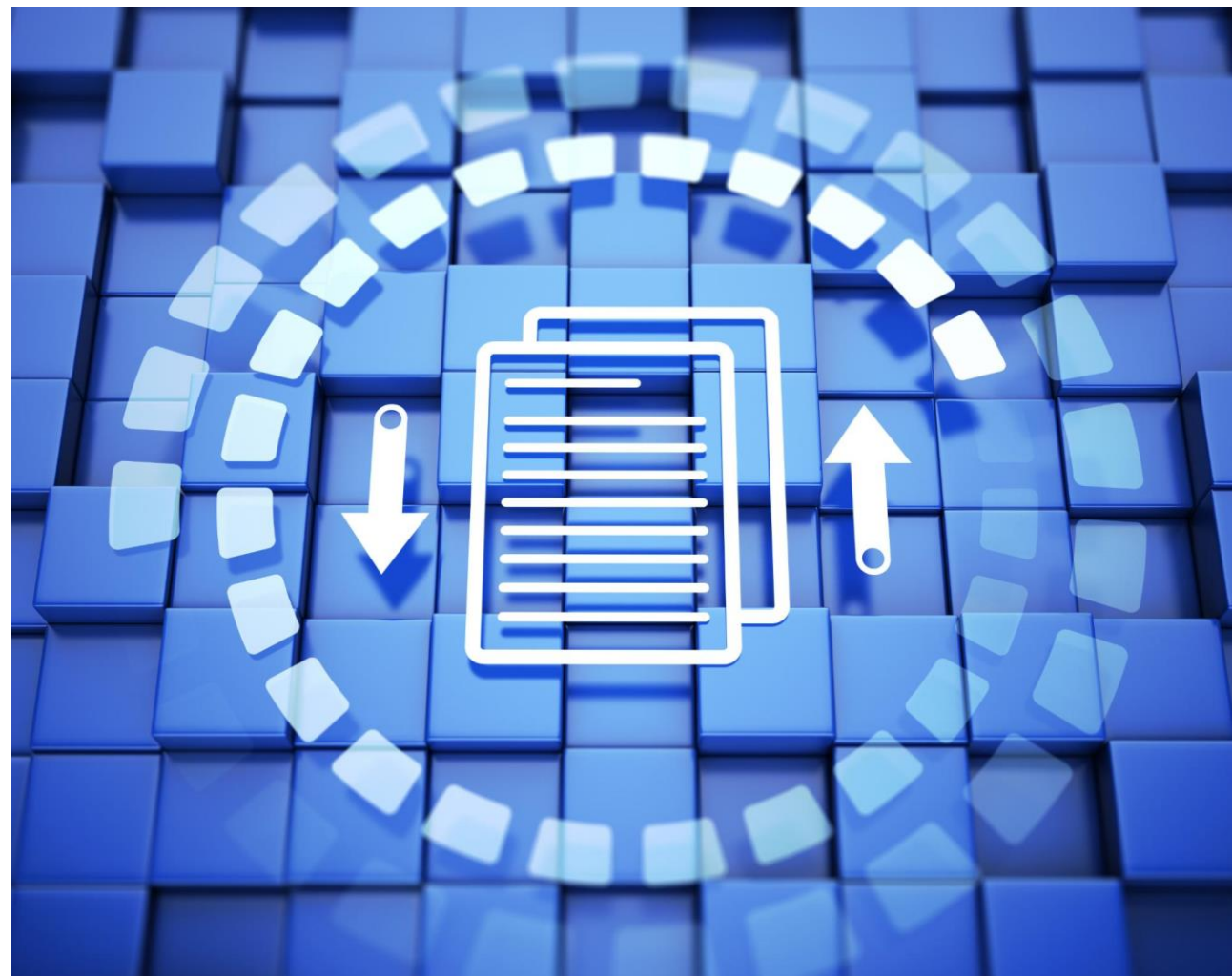
- Doc 10199 establishes harmonized procedures and compliance requirements.
- Ensures safe and secure information exchange.

- **Implementation Guidance**

- Doc 10203 provides step-by-step guide on how to implement SWIM
- Includes governance and technical infrastructure

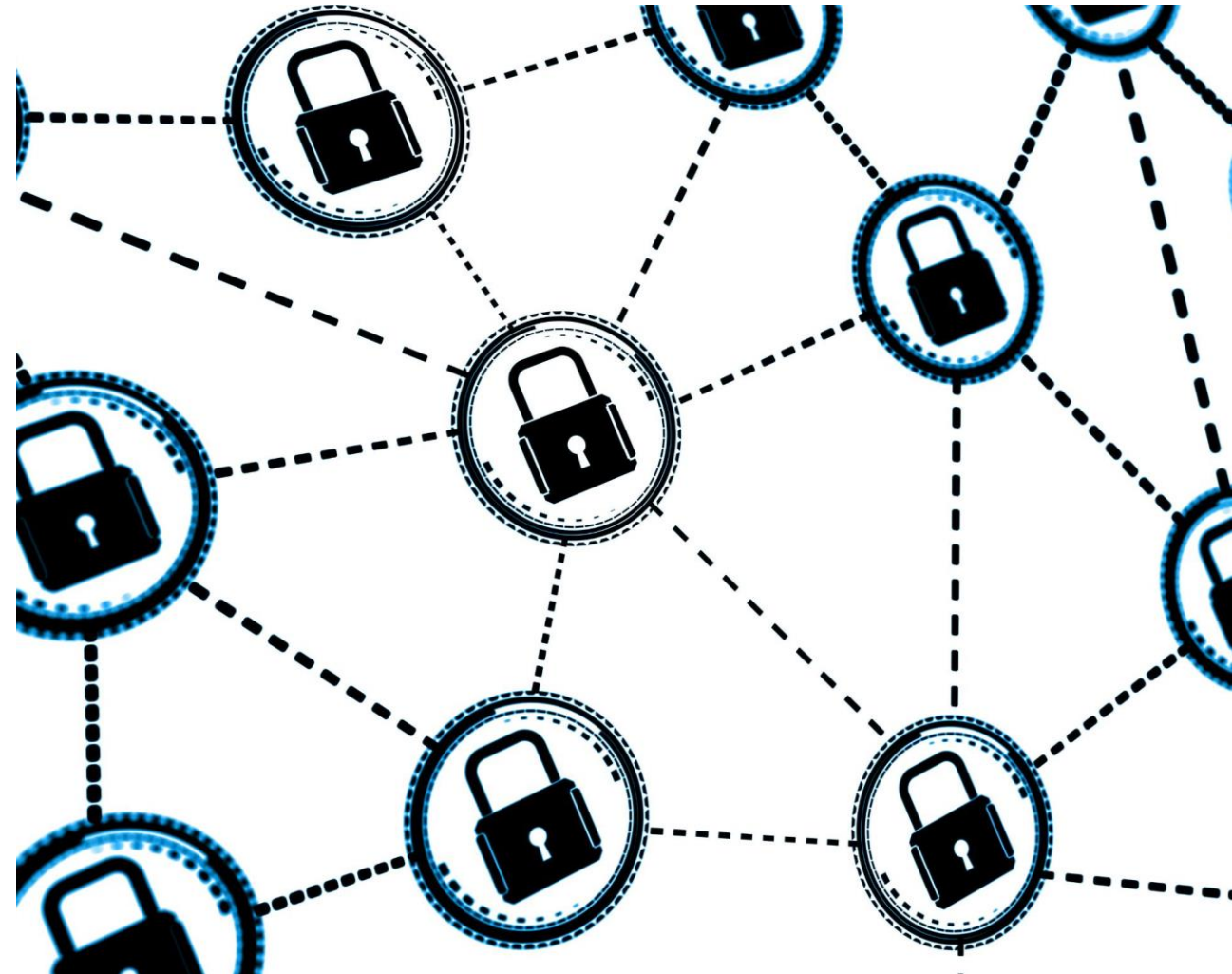
- **Coordinated Global Effort**

- SWIM implementation is part of a global movement towards interoperability and digital transformation in ATM.



Key Components of SWIM Implementation

- **Governance Structure**
 - Governance sets policies, standards, and roles to ensure trust and collaboration among stakeholders
- **Standardized Information Exchange Models**
 - Information exchanged using standardized information exchanged models to maintain interoperability.
 - Where none exists, information exchange should align with reference models (i.e. AIRM) for semantic interoperability.
- **Information Services**
 - Enables modular and reusable data access using well defined interfaces
- **Technical Infrastructure**
 - Supports messaging, security, and system monitoring using standard protocols



Service-Oriented Implementation Process

- **Identify Operational Needs**
 - Analyse and define operational needs
 - Collaboratively identify information exchange requirements among stakeholders
- **Design Information Services**
 - Define services structures, interfaces, message formats and message exchange patterns
 - Align message formats with appropriate information exchange models.
- **Implement and Test Services**
 - Develop services using technologies that ensure interoperability
 - Validation and testing according to requirements
- **Deploy and Manage**
 - Make the services operational
 - Register them for discoverability
 - Operations and maintenance.



Information Services and Quality Assurance

- **Core Functions of Information Services**

- Information services facilitate ATM-related data exchange with defined interfaces and metadata
- Essential for SWIM implementation.

- **Quality of Service**

- Service needs to meet performance, reliability and security standards.
- Also includes capacity, availability and data integrity.

- **Validation Methods**

- Validation builds trust
- Methods include
 - Independent
 - Collaborative
 - User-based
 - Self-validation

- **SWIM Registries**

- Enables the discovery of services
- Publishes information service descriptions



Technical Infrastructure for SWIM

- **SWIM Technical Infrastructure (TI) must be based on the Internet Protocol Suite (IPS)**
- **Interoperable Standards**
 - Standard interface protocols for seamless integration between independently developed systems
- **Messaging Capabilities**
 - Supports various types of communication patterns to meet operational needs
 - E.g. Request / reply, publish / subscribe
- **Security Mechanisms**
 - Measures to protect information exchange
 - Authentication
 - Authorization
 - Encryption
 - Access control



- [illegible]

What This Means for You

- **Shift to Service-based Model**
 - SWIM replaces traditional system-to-system direct interface
 - Flexible, standardized service-based information exchange
- **Adoption of Standard Information Exchange Models**
 - Must use of standard models wherever applicable
 - AIXM, FIXM, IWXXM
 - Where none exists, data models must align with the AIRM
- **Emphasis on Data Quality and Governance**
 - Critical to have accurate and timely data with proper metadata
 - Users must understand the context and limitations of the data
- **Interoperability and Responsibilities**
 - SWIM improves organizational interoperability
 - Requires managing security, service lifecycle and governance.



