International Civil Aviation Organization

THE ELEVENTH MEETING OF SYSTEM WIDE INFORMATION MANAGEMENT TASK FORCE (SWIM TF/11)

Bangkok, Thailand, 25 – 29 May 2026

Agenda Item 7: SWIM Task Force ToR, Programme, Work Plan, and Action Items review
- SDS schema update

SWIM DISCOVERY SERVICE (SDS) UPDATE: SCHEMA RELEASE, TESTING, AND GLOBAL ADOPTION FOR REGISTRY INTERCONNECTION

(Presented by the United States)

SUMMARY

This working paper discusses updates to the SWIM Discovery Service (SDS) development, a standardized approach to support registry interoperability and federated information service discovery across independently managed SWIM registry environments. Recent SDS developments (post APAC SWIM TF/10) include alignment with latest PANS-IM data model and standardization of protocols for registry metadata exchange and preparation for demonstration, testing, and implementation.

Originally developed as a collaboration between FAA and Korea Airports Corporation (KAC), SDS has been further matured and adopted in the Asia-Pacific (APAC) region and FAA both regionally and as members of the Information Management Panel (IMP) through collaborative initiatives. Recent schema release and updated service description artifacts now enables ICAO states implementing SWIM registries with harmonized metadata exchange and service discovery across individual registries.

The paper highlights how SDS aligns with the regional frameworks and ICAO Information Management Panel's (IMP) objectives under the SWIM Registry Interoperability Job Card, and upcoming initiatives to develop operational scenarios, test cases, and implementation plan for registry interconnection and adoption at both regional and global ICAO level.

This paper highlights importance of SDS implementation to achieve the global SWIM registry interoperability concept and enable SDS as a candidate global technical solution.

1. INTRODUCTION

1.1 SDS Background

SWIM Discovery Service (SDS) is a standards-based web service that enables federated discovery of SWIM services across independently managed service registries. Consistent with Service-Oriented Architecture (SOA) principles, SDS supports registry-to-registry interoperability by defining standardized mechanisms for exchanging service metadata. Initially developed in collaboration by the U.S. Federal Aviation Administration (FAA) and the Korea Airports Corporation (KAC) as depicted in figure 1, SDS has evolved into a foundational component of APAC region SWIM deployments and now intended for global adoption as previously introduced in the Working Papers, *IMP-WG/13-WP/17 – SWIM Discovery Service (SDS) Introduction* and *IMP-WG/13-WP/20 – Interconnected SWIM registries* , *and IMP/4WP/SDS Update* ASIA/PACIFIC region's approach at IMP WG/13, September 2025.

Figure 1 SDS Context

1.2 SDS and Registry Interoperability

As SWIM implementation expands globally, multiple States and regions are establishing SWIM registries. Without a standardized metadata format and discovery mechanism, cross-registry service discovery becomes constrained, limiting interoperability and reducing the effectiveness of global information sharing.

SDS addresses this challenge by:

- Enabling federated discovery without centralizing metadata storage
- Standardizing service models, metadata structures, and schemas
- Supporting the objectives of the ICAO IMP SWIM Registry Interoperability Job Card

1.3 SDS History

1.4 SDS was introduced via initial collaborations between the FAA and Korea Airports Corporation at SWIM Task Force 3 in 2019. There was a consensus on approach to improve the observability of SWIM services within APAC region, and the meeting approved a draft conclusion

"Interoperable Registry Model for SWIM Registry in APAC Region". With further maturity, SDS v1.0 specification and schema was presented to the APAC SWIM Task Force 4 panel in 2020.

Draft Conclusion SWIMTF/3/3 – Interoperable Registry Model for SWIM Registry in APAC Region		
What: The Interoperable Registry Model, which consists of independent registries that exchange registration data with each other, is adopted for the APAC SWIM Registry.		Expected impact: ☐ Political / Global ☐ Inter-regional ☐ Economic ☐ Environmental ☒ Ops/Technical
Why: The registration is required for SWIM implementation. The interoperable Registry Model is considered as a preferred model for use in the APAC Region	Follow-up:	☒Required from States
When: 6-Sep-19	Status:	Adopted by Subgroup
Who: ☒Sub groups ☒APAC States ☐ICAO APAC RO ☐ICAO HQ ☐Other		

1.5 At the SWIM TF/5 meeting in 2021, the FAA and the KAC jointly demonstrated how SDS enables bidirectional exchange of SWIM service information between the FAA's NAS Service Registry and Repository (NSRR) and the KAC SWIM registry.

1.6 At the SWIM TF/8 meeting in 2023, SDS was proposed as the regional approach to enable interoperable service discovery across the APAC region. And the meeting approved a draft conclusion "Adoption of SWIM Discovery Service as Global Standard for Globally Interoperable Service Discovery" and "Candidate Baseline SWIM Discovery Service Standard for Asia/Pacific"

Draft Decision SWIM TF/08/01 Adoption of SWIM Discovery Service as a Global Standard for Globally Interoperable Service Discovery		
What: To propose to the Information Management Panel (IMP) to consider adopting the SWIM Discovery Service (SDS) as a global standard for globally interoperable service discovery.		Expected impact: ☐ Political / Global ☐ Inter-regional ☐ Economic ☐ Environmental ☒ Ops/Technical
Why: Considering that Asia/Pacific regional SWIM will also be part of global SWIM and that SDS was studied and tested by the SWIM TF, the consideration of IMP on the possible adoption of SDS as a global standard is required to ensure cross-regional interoperability of SWIM service discovery.	Follow-up:	☐Required from States
When: 10-Nov-23	Status:	Draft to be adopted by PIRG
Who: ☒Sub groups ☐APAC States ☒ICAO APAC RO ☒ICAO HQ ☒Other: SWIM TF		

Draft Decision SWIM TF/08/02 Candidate Baseline SWIM Discovery Service Standard for Asia/Pacific		
What: To position the SWIM Discovery Service (SDS) specification as a candidate baseline standard for Asia/Pacific SWIM implementation.		Expected impact: ☐ Political / Global ☐ Inter-regional ☐ Economic ☐ Environmental ☒ Ops/Technical
Why: A candidate baseline standard for SDS is needed to support Asia/Pacific SWIM implementation within the regionally-agreed target implementation timeframe of 2024-2030.	Follow-up:	☐Required from States
When: 10-Nov-23	Status:	Draft to be adopted by Subgroup
Who: ☒Sub groups ☐APAC States ☐ICAO APAC RO ☐ICAO HQ ☐Other: SWIM TF		

1.7 In January 2025, the SIPG successfully completed a regional trial of SDS involving China, Japan, Korea, Singapore, and Thailand. This trial validated the feasibility of SDS as a cross-border registry discovery service, fully aligned with the SWIM architecture under construction for APAC.

1.8 In order to facilitate transition to SDS2.0, WP/21 "Comparison of SDS Implementation Specification between v1.0 and v2.0" was presented at APAC SWIM TF/10. The study recommended updates to the SDM-J for alignment with the SDCM 3.0. Recommendation from this study has been incorporated with latest SDS release.

1.9 Conducted working sessions to review and update SDCM 3.0 and SDS 2.0 changes with APAC members. SDCM and SDS changes were published to APAC members in November 2025

1.10 **SDS and Technical Alignment**

SDS defines a uniform approach for sharing service metadata across independent registries using standardized RESTful web services for secure data exchange. SDS has been iteratively developed and the latest SDS release specifies a JSON schema and endpoints for querying discovery services, peers, service catalogues, and individual service records, all structured according to the Service Description

Conceptual Model (SDCM) and rendered via OpenAPI. The SDS data model aligns with SDCM and PANS-IM registry interoperability schema and provides a foundational structure for exchanging a common, machine-readable Service Overview.

Information about SDS and SDCM can be found at `https://discovery.swim.aero`

2. DISCUSSIONS

2.1 Implementation and Testing

The APAC region and FAA, in collaboration with IMP stakeholders, intends on developing operational scenarios and performing interoperability testing for service discovery, metadata exchange, and security. Key functionalities implemented by SDS 2.0 include:

- Alignment with ICAO Doc 10203, including the Service Overview and metadata modelling structures.

- Enhanced security model, introducing OAuth 2.0 and support for delegated authorization.

- Modular schema definitions, increasing flexibility for implementers to customize and extend.

2.2 SDS Operational Scenarios

2.2.1 Cross Registry Service Discovery

- Description: Registry A queries Registry B (and other peers) to retrieve available service metadata, with respect to API security and access policies implemented by each registry. This is a registry-to-registry (machine to machine) API call; no direct user interaction required.

- Operational Outcome: Users accessing Registry A can discover services published in peer registries without manually accessing each registry.

2.2.2 Service Metadata Synchronization

- Description: Registry A periodically retrieves and updates metadata from Registry B (and other peers)

- Operational Outcome: Ensures that all participating peer registries continuously share the most current API definitions, versions, and metadata without manual intervention. This reduces human error, prevents version drift, and maintains consistent information across distributed systems in real time. It improves reliability and trust between peers, accelerates integration updates, and strengthens security and governance by ensuring changes propagate quickly and uniformly.

2.2.3 Federated Registry Search

- Description: User initiates a search from Registry A. Registry A distributes a search request to peer registries and aggregates responses, as depicted in figure 1 and 2. The federated discovery model will flexibly evolve as the architecture, security, and access procedures mature with ICAO standards for SWIM Registry Interoperability Concept. This enables Registry A to establish API access both directly with all partner SWIM registries (i.e. Registry A directly queries Registry B and C) or via single peer-to-peer discovery (Registry A only queries Registry B to discover both Registry B and C SWIM information services). The SDS technical implementation is agnostic of discovery method, as the API mechanics and policies can be applied equivalently with either user case.

- **REST**
  - Services based on Web architecture and described using OpenAPI
- **P2P Discovery**
  - Every Discovery Service ("peer") is an equally privileged, equipotent participant with the same capabilities and responsibilities

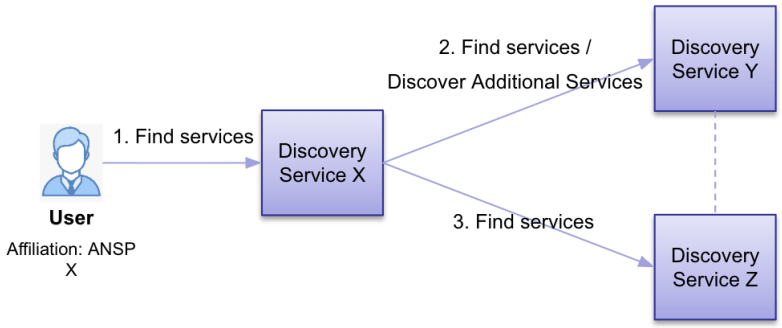

Figure 2 Federated Registry Search

- Operational Outcome: A single search returns services meeting defined criteria across multiple registries.

2.2.4 P2P Service Authentication and Establishing Trust

- Description: Registries authenticate each other using mutual TLS, OAuth 2.0, or certificate-based trust frameworks.

- Operational Outcome: Secure, trusted registry interconnection across States or regions. Machine-to-machine authentication without user involvement.

2.2.5 Enhanced P2P Service Security, Schema Validation, and Traffic Management

- Description: SDS will apply and enforce API security using common industry controls such as API rate limiting, Role-Based Access Control (RBAC), schema validation and real-time monitoring.

- Operational Outcome: Rate limiting and throttling can be applied per peer identity to prevent abuse or cascading failures, while RBAC ensures authenticated peers can only access permitted resources and operations. Strict schema validation should be enforced against defined API contracts (e.g., OpenAPI/JSON Schema) to reject invalid or malicious payloads before business logic executes. Continuous monitoring and logging of requests, errors, and anomalous patterns further strengthen security by enabling rapid detection and response to misuse or compromised peers.

2.3 SDS Test Cases

After reviewing the Operational Scenarios in Section 2.2, we propose a collaborative and scenario-driven test approach following these methods:

- Validate a shared understanding of each operational scenario

- Develop test cases for each operational scenario outcome

- Define standardized test case format

- Incorporate non-functional tests such as performance and security and responsiveness for timely metadata retrieval

2.4 APAC and FAA SDS Implementation

2.4.1 The Asia-Pacific region has been developing SWIM registries interconnection as part of the APAC SWIM Implementation Pioneer Group and APAC SWIM TF, and intends on implementing SDS throughout 2026 as predecessor activities for SWIM architecture, messaging, and security are completed.

2.4.2 The FAA plans on implementing SDS as part of a larger effort to modernize our SWIM Registry. Beyond SDS and compliance with Doc 10199 and Doc 10203, the modernization will feature an updated user interface and user experience, with support for discovering FAA's current pub/sub based SWIM services and future API based SWIM services to enable a unified information service discovery.

2.4.3 The FAA will be implementing SDS via an API gateway that enforces OAuth 2.0, mutual TLS for secure and harmonized connection with international registries. In this modernization, SDS provides a key role in a standards-based interface for discovery and federation of information services. This function will be integrated with an API Management (APIM) capability to enhance the design-time and runtime capabilities and governance for FAA's SWIM implementation.

2.4.4 While SDS handles metadata-level discovery and registry federation, APIM ensures the performance, security, and operational integrity of services once discovered, as illustrated in Figure 3. APIM will support SDS by addressing non-functional requirements such as security, rate limiting, throttling, caching, and message transformation. APIM will also support comprehensive management and governance of APIs, including policy enforcement, developer onboarding, monitoring and analytics.

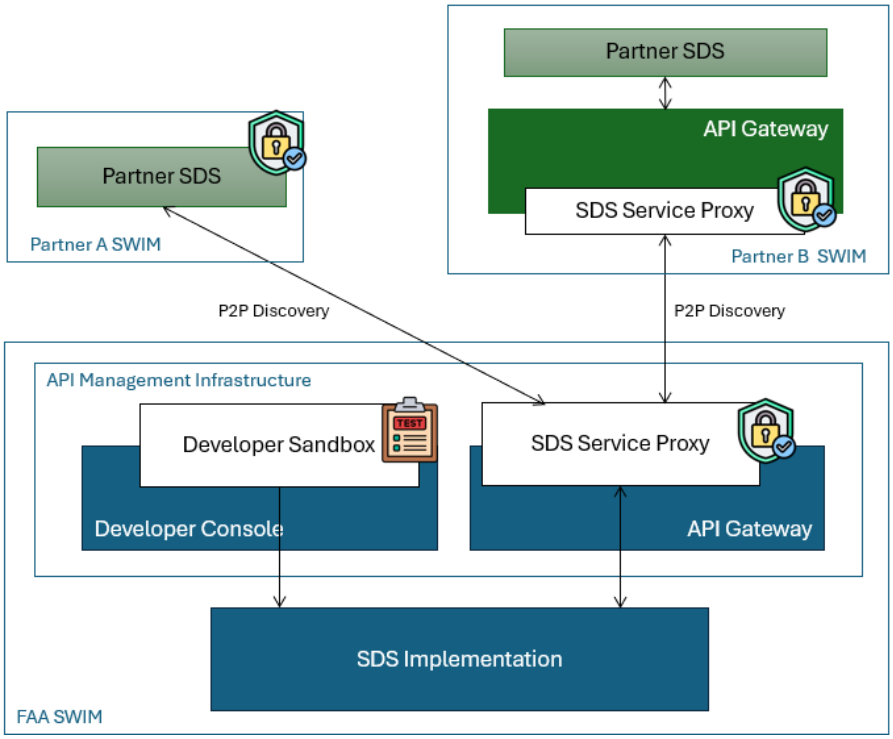

Figure 3 SDS in the context of APIM

2.5 PATH TOWARDS GLOBAL ADOPTION

2.5.1 SDS will be implemented across Asia Pacific region and FAA starting in 2026. Next steps include development of test cases based on operational scenarios above and demonstrations and testing at future SWIM TF and SIPG meetings. Demonstrations will also be provided to broader ICAO Information Management Panel to steer SDS as a proven implementation of the SWIM Registry Interoperability concept.

2.5.2 Global SWIM registry interoperability requires a common, implementation-ready technical solution to harmonize how service metadata is modelled, exchanged, and discovered across independently managed registries. Without standardization, differences in metadata structures and discovery mechanisms limit cross-border interoperability.

2.5.3 SDS addresses this need by providing a standardized, PANS-IM and SDCM-aligned service metadata model and RESTful interfaces that enable consistent, machine-readable Service Overviews across registries. As a federated solution, SDS supports global visibility without requiring centralized infrastructure and allows incremental adoption in line with ICAO SWIM governance principles.

2.5.4 Given its standards alignment, regional adoption, and planned operational testing, SDS represents a practical candidate solution for enabling sustainable global SWIM registry interoperability and should be considered by the IMP for harmonizing data specifications at the global level.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) Develop regional test cases and test plans for SDS testing and continued maturity.

b) Socialize implementation plans and schedule for SDS development and service roll-out.

c) Conduct cross-regional SDS demonstrations for global adoption.

d) Encourage continued socialization and adoption from both APAC and IMP stakeholders to implement SDS concept and data exchange mechanisms across each SWIM registry for global interoperability

e) Incorporate approach and capabilities of SDS in other IMP work activities and guidance documents, as appropriate to implement the SWIM Registry Interoperabiltiy concept.

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