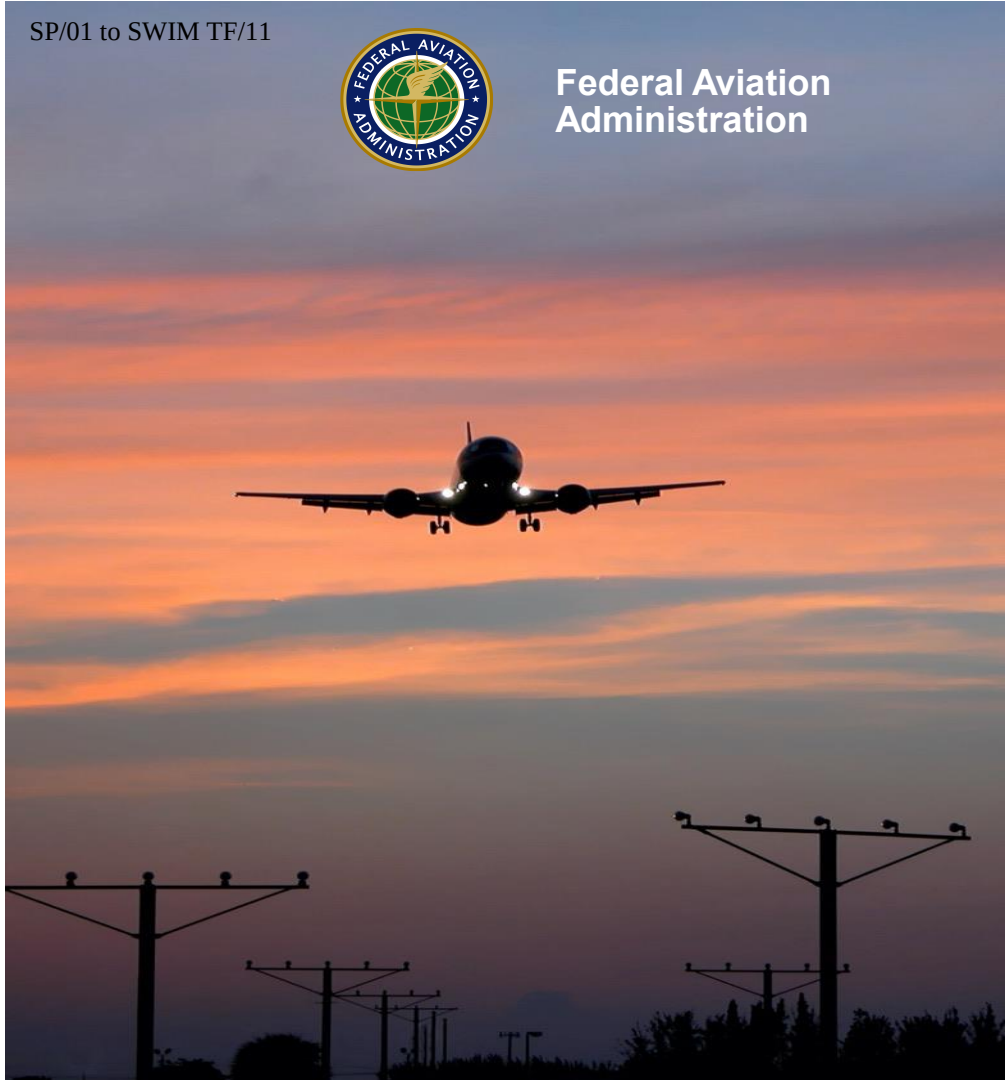
SWIM Discovery Service (SDS) Update

ICAO APAC SWIM Task-Force 11

May 25-29, 2026

Presented By:
APAC SWIM Task Force and FAA SWIM Program Office

Federal Aviation Administration



Introduction

- 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.

- **The paper emphasizes latest developments for schema development, harmonized metadata exchange protocols, and service discovery** among ICAO/APAC member states implementing SWIM registries. It also highlights **upcoming initiatives to develop operational scenarios, test cases, and implementation plan** for registry interconnection and adoption at both regional and global ICAO level.

- The **paper provides updates on SDS as a candidate global technical solution for implementing the SWIM registry interoperability cocnept.**

SWIM Discovery Service (SDS) and Registry Interoperability

- SWIM Discovery Service (SDS) is a standards-based web service that enables federated discovery of SWIM services across independently managed service registries.

- As SWIM implementation expands globally, **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 conceptual data interactions and objectives of the ICAO IMP SWIM Registry Interoperability Job Card

Envisioned end state of Interconnected registries

SDS History

- **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.**

- **In 2020, a trial was conducted between the FAA and Europe to demonstrate SWIM registry interoperability based on SDS/SDCM model.**

- **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.

- **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”

SDS History

- I**n 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.

- **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.**

- **FAA 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**

- **Open API spec and related JSON schemas were uploaded to SDS GitHub in April 2026. Latest artifacts are also available on Discovery SWIM Aero website.**

  https://github.com/faa-swim/swim-discovery-service , https://discovery.swim.aero/

IMP/4 SDS- Efforts for Global Adoption

- *WP012 SWIM Discovery Service (SDS) Update: Schema release, testing, and global adoption for Registry Interconnection* was presented to the Information Management Panel in April 2026.

- The meeting endorsed the Global SWIM Registry Interoperability concept updates and agreed to mark it as delivered (WPE 10334)The meeting agreed that the very valuable work done on SDS should be considered for the ongoing activities on registry interconnection and integration.

- Some concern was expressed that the follow-up should be processed first by and through WG I/S before requesting the Panel for endorsing and adopiting SDS principles.

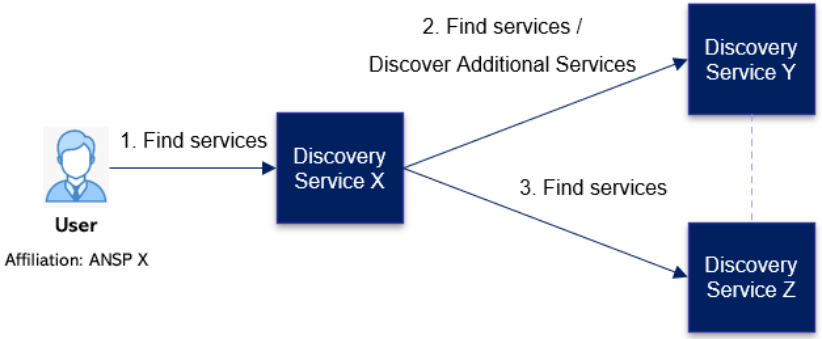
- The panel acknowledged the latest developments of the SWIM Discovery Service (SDS) as a candidate global technical solution to implement federated registry interoperability

- Actions:
  - P5/1: Consider the SDS concept and data exchange as candidate mechanism for the development of SWIM registry interconnection/integration provisions. (Assigned to: WG I/S - Target: Nov 2026)
  - Further review the SDS framework as candidate mechanism for implementation of SWIM Registry

SDS and Technical Alignment

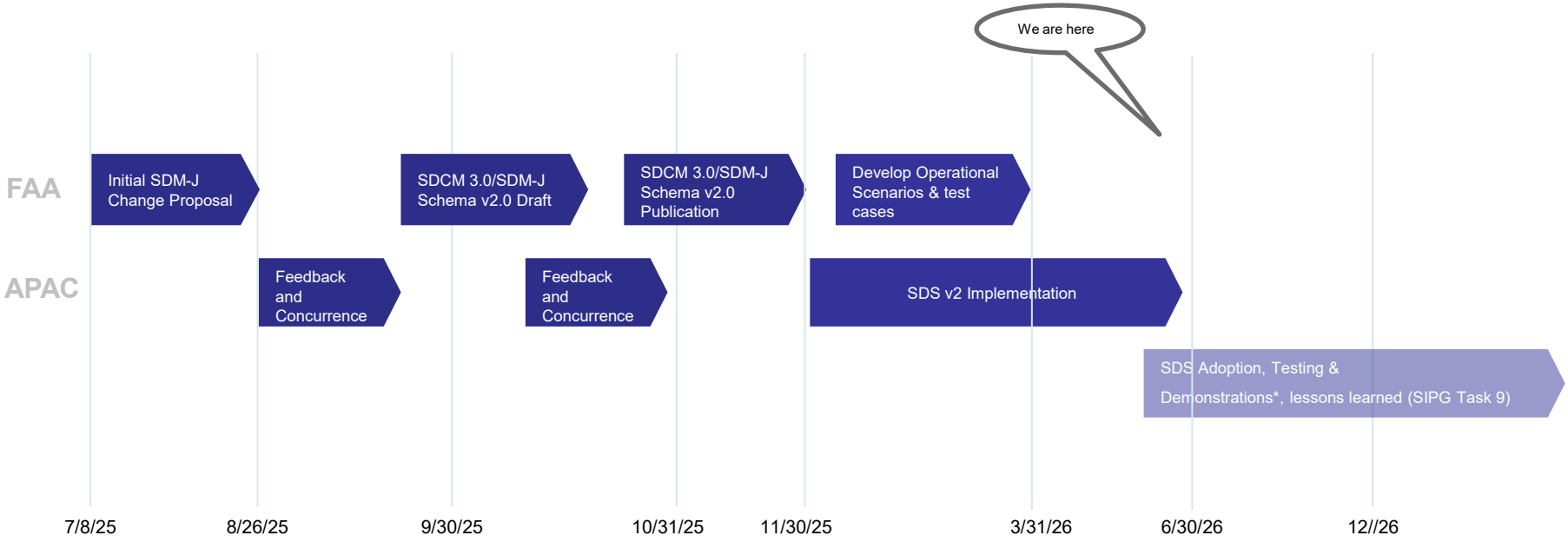
SDS provides a standardized, RESTful API approach for securely sharing service metadata across independent registries.

- 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



- An updated JSON schema model for SDS v.2.0 was released by the FAA in December 2025.
- The latest SDS version defines a JSON schema and endpoints for querying discovery services, peers, service catalogs, and individual service records, based on Service Description Conceptual Model (SDCM) and documented via OpenAPI.1
- The SDS v2.0 data model aligns with latest SDCM and PANS-IM guidance, enabling consistent, machine-readable Service Overviews and supporting global registry interoperability.
- More information is available at: https://discovery.swim.aero

Regional Timelines (APAC and FAA)

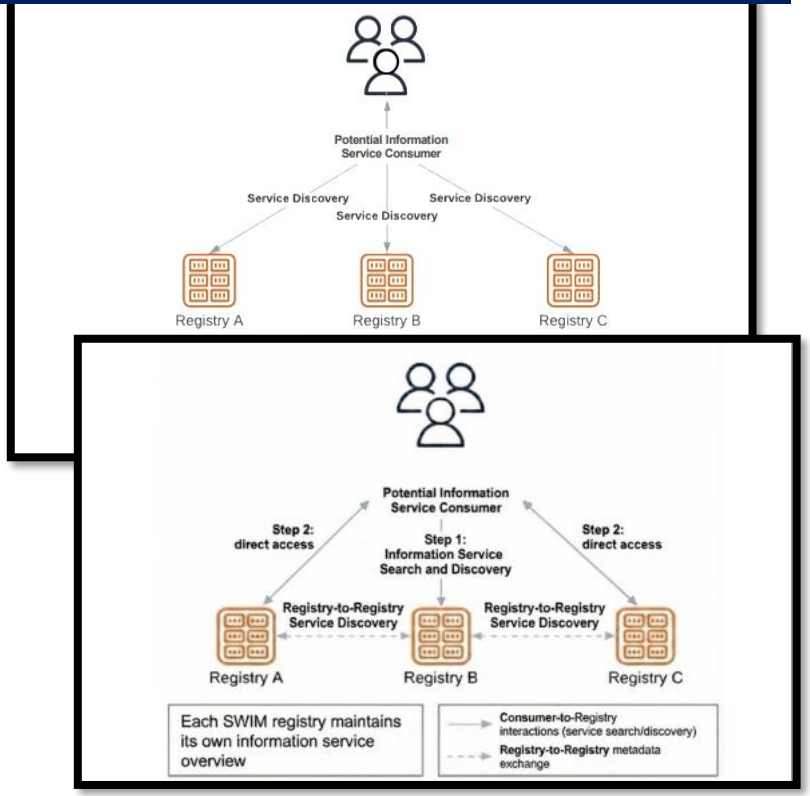


***Testing, demonstrations, and go-live dates are subject to change per individual SWIM registry and interconnection implementation. To be incorporated with Task 9.**

Federated discovery

- 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 RESTful API mechanics and security policies (OAuth, mTLS) can be applied equivalently with either user case
- This supports the service discovery and metadata synchronization and access policies depicted in the "*IMP/4, WP 008 SWIM Registry Interoperability Concept*"

SDS as an enabler of interconnected registries



Figures 1-2 "*IMP/4, WP 008 SWIM Registry Interoperability Concept*"

Current Focus

- **Collect feedback to formalize operational scenarios and test cases for SWIM service discovery**
- **Present working paper on SDS updates to the Information Management Panel and regional SWIM task force groups**
- **SWIM TF/11 (May 2026)**
  - Develop Joint Working Paper on framework for API Management and Gateway Governance, Standardization and Best Practices
  - Present working paper on SDS operational scenarios and implementation
- **Post TF/11**
  - Implementations, demonstrations, and lessons learned

SDS Ops Scenario #1 - Cross Registry Service Discovery

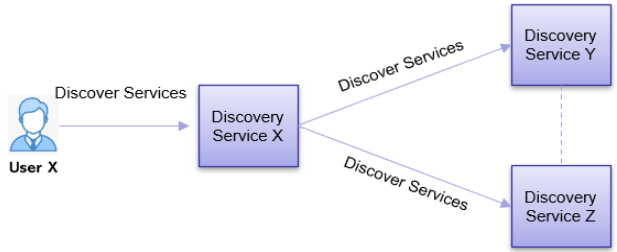
Description: Registry X automatically queries Registry Y (and other peers) to retrieve available service metadata. This is a backend registry-to-registry Application Programming Interface (API) call; no direct user interaction required.

Operational Outcome

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

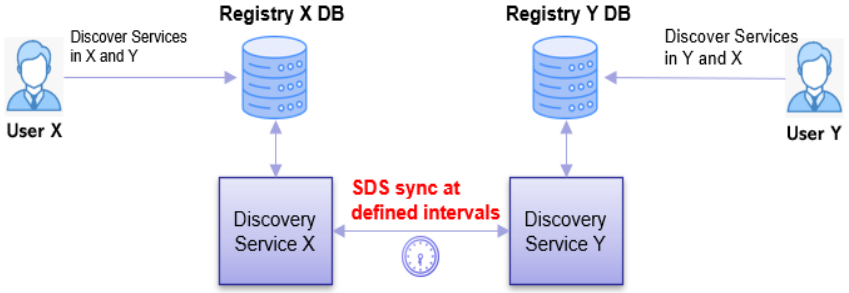
P2P Discovery

Every Discovery Service ("peer") is an equally privileged, equipotent participant with the same capabilities and responsibilities



SDS Ops Scenario #2 - Service Metadata Synchronization

Description: Registry X periodically retrieves and updates metadata from Registry Y (and other peers)

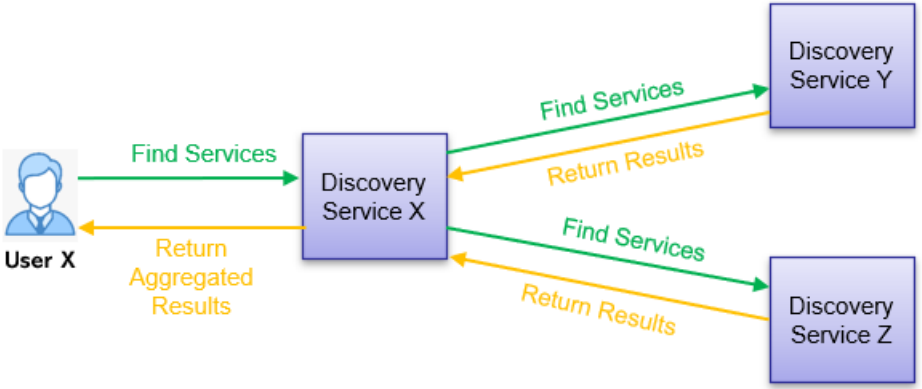


Operational Outcome:

- 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.

SDS Ops Scenario #3 - Federated Registry Search

Description: User initiates a search from Registry X. Registry X distributes a search request to peer registries and aggregates responses.



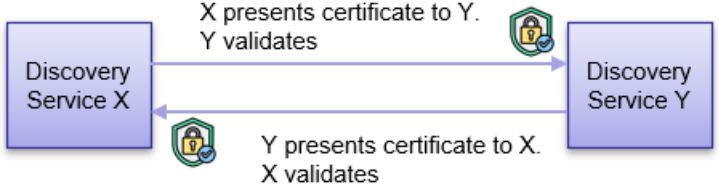
Operational Outcome

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

SDS Ops Scenario #4 - P2P Service Authentication and Establishing Trust

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

P2P Service Authentication using mTLS as example

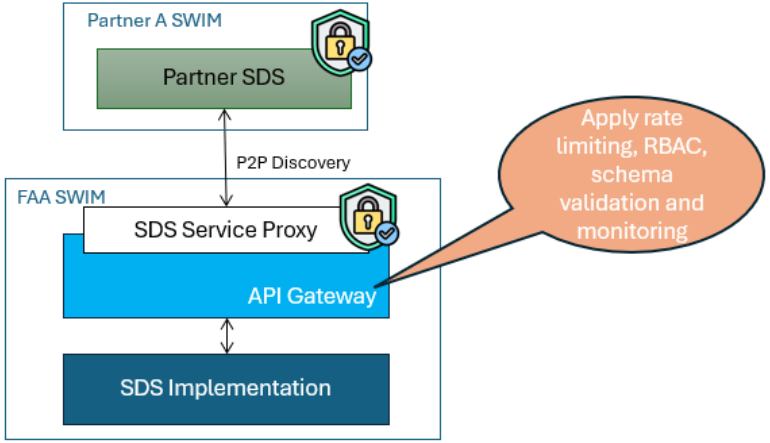


Operational Outcome

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

SDS Ops Scenario #5 - Enhanced P2P Service Security

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 malformed 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.

SDS Test Cases

Following the review of the SDS Operational Scenarios, we propose a collaborative, scenario-based testing approach using the following 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

SDS APAC Updates

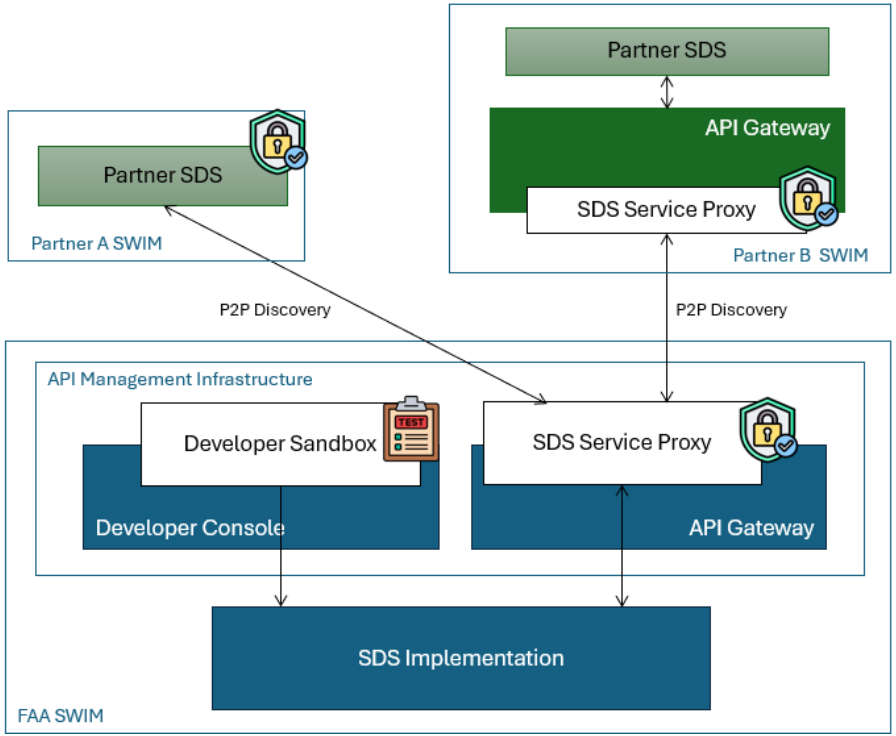
- Singapore has implemented the SDS in their SWIM Test environment using test SWIM Registry data. The service is exposed through an API Gateway.

- ROK had implemented SDS instance v1.0 in 2021 and, ROK is planning to deploy SDS instance v.2.0 (supporting baseline capability) to their SWIM test environment using mock metadata before ICAO APAC SWIM TF/11(May, 2026).
  - Further capabilities (e.g., cross-registry discovery) to support operational will be integrated incrementally into the SDS instance v2.0 in alignment with the test timeline when test cases are confirmed.

- Japan had developed a test SWIM Registry based on SDS specification 1.0.1, and conducted a joint demonstration with FAA and KAC. An update to SDS specification 2.0.0, along with an international demonstration over the APAC SWIM test platform, is planned for 2026.

SDS and FAA SWIM Modernization

- The FAA will be implementing SDS via an API Gateway that enforces OAuth 2.0 and mutual TLS for secure and harmonized connection with international registries.
- SDS will be integrated with an API Management (APIM) capability to enhance the design-time and runtime capabilities and governance for FAA's SWIM implementation.
- APIM will enable SDS by meeting key non-functional requirements, including security, rate limiting, throttling, caching, and message transformation.
- APIM will also provide robust API management and governance capabilities, such as policy enforcement, developer onboarding, as well as monitoring and analytics.



Path Towards Global Adoption

- Global SWIM registry interoperability needs a standardized, implementation-ready approach to unify how service metadata is structured, shared, and discovered; otherwise, inconsistencies hinder cross-border use.

- SDS provides this through a common metadata model and RESTful interfaces, enabling consistent, machine-readable service information across federated registries without centralization.

- With strong standards alignment and ongoing adoption/testing, SDS is a practical candidate for achieving sustainable global interoperability and harmonized data specifications.

Action by the Meeting

- ❑ Develop regional test cases and test plans for SDS testing and continued maturity.
- ❑ Socialize implementation plans and schedule for SDS development and service roll-out.
- ❑ Conduct cross-regional SDS demonstrations for global adoption.
- ❑ 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
- ❑ Incorporate approach and capabilities of SDS in other IMP work activities and guidance documents, as appropriate to implement the SWIM Registry Interoperabiltiy concept.

SDS data model will be iteratively updated per user feedback and latest changes to the PANS-IM Information Service Overview