



ICAO

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of APANPIRG**

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Agenda Item 5: Information Management (IM)

- 5.2 Review Report of the First and Second Working Session of the SWIM Implementation Pioneer Ad-Hoc Group (SIPG WS/1 and SIPG WS/2)

**OUTCOMES OF THE FIRST AND SECOND WORKING SESSION OF THE SWIM
IMPLEMENTATION PIONEER AD-HOC GROUP (SIPG WS/1 AND SIPG WS/2)**

(Presented by the Secretariat)

SUMMARY

This paper presents outcomes of the First and Second Working Session of the SWIM Implementation Pioneer Ad-Hoc Group (SIPG WS/1 and SIPG WS/2).

1. INTRODUCTION

1.1 The SIPG under the System-Wide Information Management Task Force (SWIM TF) was established by **the Decision SWIM/TF/07/03** during the SWIM TF/7 Meeting in 2023 to develop an initial version (prototype) of the Asia/Pacific regional SWIM.

1.2 Based on the 15 SIPG teleconferences held since its inception in June 2023 and the lessons learnt from the Joint Event of SWIM over CRV Demonstration and Surveillance Data over SWIM Trial conducted in Hong Kong China from 28-29 May 2024, the SIPG has identified critical tasks for the construction and implementation of SWIM in the Asia/Pacific region. Many of these tasks, which are related to the design of the regional SWIM, require in-depth discussions that are not feasible during 1.5-hour monthly teleconferences.

1.3 To expedite progress toward the regional SWIM implementation target as agreed through **Conclusion APANPIRG/33/9**, the SWIM TF Task Leads Meeting in August 2024 agreed to the need for an in-person SIPG working session.

1.4 The First Working Session of the SWIM Implementation Pioneer Ad-Hoc Group (SIPG WS/1) was held from **14 to 17 January 2025** in the ICAO Asia Pacific Regional Office, Bangkok, Thailand. The meeting was attended by **51** Participants from **13** States/Administrations and **2** International Organizations. The Working Session report and presentations can be accessed at:
<https://www.icao.int/APAC/Meetings/Pages/2025-SWIM-SIPG-Working-Session.aspx>

1.5 The Second Working Session of the SWIM Implementation Pioneer Ad-Hoc Group (SIPG WS/2) was held from **26 to 30 May 2025** in the ICAO Asia Pacific Regional Office, Bangkok, Thailand. The meeting was attended by **64** Participants from **20** States/Administrations and **2** International Organizations. The Working Session report and presentations can be accessed at:
<https://www.icao.int/APAC/Meetings/Pages/2025-SWIM-Seminar-and-SWIM-TF10-SIPG2.aspx>

1.6 This paper summarized the outcomes of the First and Second Working Session of the SWIM Implementation Pioneer Ad-Hoc Group (SIPG WS/1 and SIPG WS/2) for CNS SG/29 Meeting information.

2. DISCUSSION

2.1 The summary of the discussion in the Working Session is given in the following paragraphs.

Outcomes of SIPG WS/1

SWIM Related Information Security – ICAO Doc 10204 Manual on Information Security

Trust Framework Panel Progress Report – Japan (SP/02)

2.2 Japan presented the work that is being done by the Trust Framework Panel (TFP). ICAO established the TFP to address the issues of cybersecurity in Civil Aviation Operations.

2.3 The objectives of the TFP are to

- a) Develop and maintain provisions and guidance materials to support enabling trusted data and information exchange;
- b) Develop governance principles, policies, procedures and requirements for a globally harmonized framework;
- c) Define a global architecture and principles for interconnecting networks.

2.4 It was reported that the TFP currently has three job cards, which are looked after by three working groups: WG – Identity Management, WG – Trust Framework Considerations, and WG – Information Security.

2.5 The TFP has been focusing on developing three guidance documents: one on information security, one on certificate policy, and one on trust framework implementation. Specifically, ICAO Doc 10204: Manual on Aviation Information Security (MAIS) was published in December 2024. The other two documents, i.e., Doc 10169: Aviation Common Certificate Policy (ACCP) and the Manual on Trust Framework Implementation (pending document number), are expected to be published in December 2025.

2.6 The ACCP outlines how the X.509 Public Key Infrastructure (PKI) can be applied in civil aviation, including within the SWIM environment. It also describes the policies and certification practices that govern its use. The meeting was informed that the draft ACCP manual revolves around the concept of a Trust Framework Instance (TFI).

2.7 During the discussions, the need to establish a TFI to support SWIM implementation in the Asia/Pacific region was raised. However, it was emphasized that SWIM is just one of several use cases requiring the establishment of TFI and that PKI is needed for all TFIs within APAC, not only for SWIM. Other use cases identified by the TFP include Controller Pilot Data Link Communication (CPDLC), Satellite Based Augmentation System (SBAS), Electronic Personal Licenses, etc. This suggests that PKI implementation should not be the sole responsibility of the SWIM TF.

Action WS-1-1: For SIPG to table a paper to the SWIM TF/10, articulating the need to implement PKI and to identify the responsible body for its implementation under CNS SG/APANPIRG. **Which was presented by Japan as WP/15 in SWIM TF/10.**

2.8 Additionally, the question of whether the PKI is necessary for all information types was raised. Using meteorological information as an example, it was argued that such information may not require certification for security. It was suggested that only safety-critical information would need to be secured with PKI, while other information types would not. However, the classification of information as safety-critical or not-safety-critical has not yet been decided.

2.9 While the implementation approach for PKI within APAC is still under discussion, it was suggested that the SIPG could continue exploring the use of certificates to establish trust, potentially through self-signed certificates. Once the PKI implementation is finalized, self-signed certificates could be easily replaced with PKI certificates.

***Action WS-1-2:** SIPG to explore the use of self-signed certificates and conduct trials of using such certificates to ensure secure information exchange within the SWIM environment.*

2.10 It was raised that, as the contributory body responsible for the APAC regional network, the CRV OG should also be informed of the development of the ACCP.

Action WS-1-3:** Singapore to prepare a paper for the CRV OG/13 to inform the CRV OG of the ACCP document and the SWIM TF's need for PKI. **Which was presented by Singapore as WP/27 in CRV OG/13.

SWIM Architecture

2.11 Four presentations and one working paper were presented under this agenda item with the objective of clarifying the proposed SWIM architecture for the construction of the APAC regional SWIM. Most of the discussions focused on addressing the issues raised in SWIM TF/9-WP/10, which highlighted the challenges of using the hierarchical SWIM architecture for the joint SWIM-over-CRV demonstration and Surveillance Data Sharing over SWIM technical trial.

SWIM Architecture – SIPG Lead (SP/03)

2.12 Singapore presented the SIPG Lead advocated for adopting a complete mesh architecture to resolve 2 of the 5 issues highlighted in SWIM TF/9-WP/10. It was pointed out that, even if a fully-meshed architecture is used for the APAC regional SWIM, issues would still arise when interconnection between different regional SWIMs needs to be established to form a Global SWIM.

Suggestion for Regional SWIM Architecture – China (SP/07)

2.13 China compared the implementation of a fully-meshed architecture and a hierarchical architecture. It concluded that the hierarchical architecture would require a shorter implementation cycle and lower cost than a fully-meshed one. Furthermore, by adjusting the design of the hierarchical architecture, some of the issues highlighted in SWIM TF9-WP/10 could also be addressed.

Implementation Approach for SWIM Message Exchange over CRV – Japan (SP/04)

2.14 Japan advocated for the hierarchical architecture for the regional SWIM implementation. Details on how each of the issues raised in SWIM TF9-WP/10 could be resolved within the implementation of the hierarchical architecture implementation was also provided.

Adopting Multiple Message Exchange Patterns to Optimize SWIM Information Services – China (WP/01)

2.15 China proposed the adoption of multiple Message Exchange Patterns (MEP) to optimize SWIM Information Services, designing different MEP application scenarios for both data

sharing and system interoperability services, with the aim of reducing the reliance on guaranteed message delivery by EMS in a hierarchical architecture.

ICAO APAC SWIM TF SIPG Working Session 1 Recommendation – CANSO (SP/09)

2.16 CANSO provided seven recommendations for the implementation of the hierarchical SWIM architecture.

2.17 These presentations and working papers generated extensive deliberations on the appropriate architecture for regional SWIM, especially the pros and cons of fully meshed versus hierarchical options. The meeting concluded that a modified version of the hierarchical architecture used during the joint event would be the most suitable for implementation within APAC, considering the various recommendations and solutions proposed and discussed under this agenda item.

Action WS-1-4: *SIPG to propose to the SWIM TF/10 a modified version of the hierarchical architecture for regional SWIM implementation.*

2.18 The need for specific performance requirements of the Gateway EMS was discussed, given the importance of its core functions in routing SWIM messages between all users. Particularly, it was agreed that more than one Gateway EMS is necessary and redundancy should be implemented to ensure continuous operation of the regional SWIM. Additionally, it was discussed that a key function of the Gateway EMSs was to route SWIM messages between the Edge EMSs connected to them.

2.19 The meeting deliberated on the requirements for the Gateway EMS and identified two categories: (i) the requirements for the Gateway EMS itself and (ii) the requirements for the Gateway EMS provider. The requirements discussed by the meeting can be summarized as follows.

System Level Requirements	Provider Specific Requirements
1. Gateway EMS is responsible for: a. Messaging and routing b. Forwarding c. Failover 2. Gateway EMS must have the following Quality of Service (QoS) a. Availability $\geq 99.00\%$ b. Throughput $\geq$ TBD c. Latency $\leq$ TBD	1. Gateway EMS providers shall provide runtime governance. 2. Gateway EMS providers must implement the Gateway EMS on a different device than their internal EMS. This means that the provider's internal EMS will function like an Edge EMS, 3. Gateway EMS providers may choose to offer AMHS/SWIM protocol conversion service.

Action WS-1-5: *SIPG to propose these requirements for the consideration of the SWIM TF/10.*

ACTION WS-1-4, WS-1-5 were completed, China and Hong Kong China presented WP/17 in SWIM TF/10 to propose the improvement of the hierarchical architecture for Regional SWIM implementation and requirements for Gateway EMS.

2.20 Regarding the latency and throughput requirements, more studies were required before concluding on the specific numbers. It was proposed that the performance numbers collected during the joint event could be used as a starting point. At the same time, SIPG should also consult the US-FAA on how latency and throughput are addressed in the US-FAA's operational SWIM. **Action WS-1-6**

2.21 The discussion on latency and throughput led to further considerations of the applicability of these QoS parameters in the SWIM environment. It was highlighted that SWIM-enabled

applications/SWIM information services considered safety critical may require higher QoS than non-safety critical ones. However, it was emphasized that the justification for safety criticality largely depends on the use cases of the SWIM-enabled application/SWIM information services. Moreover, it was discussed that operational expert groups, who are users of these SWIM-enabled applications/SWIM information services, would be the qualified bodies to determine criticality.

Action WS-1-7: *SWIM TF coordinates with the operational expert groups to determine the safety critically of SWIM-enabled applications/SWIM information services.*

2.22 Based on the SWIM TF Terms of Reference, which specifies that the APAC regional SWIM is to be constructed principally over CRV and other IP-based networks, the meeting discussed the possible options to establish the APAC regional SWIM over CRV and the Internet as follows.

- 1) One or more Edge EMS can be connected to the Internet. The Edge EMS can then publish services as well as consume services from the Internet. Any information flows that are needed between CRV and the Internet layer will be handled by the Edge EMS.
- 2) The SWIM TI is constructed over both CRV and the Internet. Each Gateway EMS provider will need to span their Gateway EMS over both CRV and Internet links with the appropriate security mechanisms to segregate between these two zones of network traffic. Traffic can then be routed based on the needs.
 - 2.1) If both the information producer and information consumer are in the same zone, the Gateway EMS only needs to route the SWIM traffic within that zone.
 - 2.2) If the information producer and information consumer are in different zones, the Gateway EMS should be able to handle routing of SWIM traffic across the zones.
- 3) CRV service provider is also to provide connectivity to the Internet.

Action WS-1-8: *SWIM TF to coordinate with CRV OG on various options proposed and discussed by the SIPG.*

2.23 After extensive deliberation, the meeting concluded that further consideration is needed before deciding on the specific option. However, the meeting agreed that Option 1 could serve as an interim solution and should be considered for the early implementation of regional SWIM while discussions for a more permanent solution continue.

Action WS-1-9: *SIPG to continue deliberating on options 2 and 3 while implementing option 1 for the early APAC SWIM. Proposal paper on the possible options to be submitted for the consideration of SWIM TF.*

Action WS-1-9 was completed, SIPG presented WP/08 in SWIM TF/10.

2.24 The meeting recalled that the requirement for Internet connectivity in the APAC SWIM was from the MET/IE WG. To determine the appropriate options for Internet connectivity, the clarification of these requirements with the MET/IE WG is needed. It was also noted that examples of meteorological use cases would help clarify the requirements.

Action WS-1-10: *SWIM TF clarifies the requirements for Internet connectivity with the MET/IE and requests examples of meteorological use cases to help clarify the needs.*

2.25 Due to time constraints, the following outstanding items related to SWIM architecture were identified for future discussion by SIPG.

- a) PKI requirements for the APAC SWIM use case.
A paper on the need for PKI within APAC to support APAC SWIM implementation for the consideration for CNS SG.
- b) Routing Mechanisms.
An approach for Gateway EMS to transfer SWIM messages between Edge EMSs, e.g. use of message headers, message properties or topics.
- c) Limits on the total number of Gateway EMS in the APAC SWIM
- d) Minimum performance requirements for Gateway EMS, e.g., latency and throughput.
- e) Approach to enforce consistent runtime governance on Gateway EMS.
- f) Common set of Queues for Gateway EMS
- g) Testing requirements and procedures for onboarding Gateway EMS

SWIM Traffic in CRV

SWIM Traffic Priority – Thailand (SP/08)

2.26 Thailand presented SP/08, which discussed the possibility of using Differentiated Services Code Point (DSCP) markings to ensure the reliable delivery of SWIM messages in the physical network. This idea was introduced and discussed at the Workshop for Preparation of New-CRV Requirements and Specifications for Future SWIM/Other Aviation Services in September 2024. Specifically, the CRV OG proposed that SWIM traffic could be tagged with the DSCP markings to ensure guaranteed delivery, similar to how Voice-over-IP traffic and AFTN/AMHS traffic are currently handled in the CRV. It was noted that all SWIM traffic exchanged over CRV at the moment, using the residual bandwidth, is delivered on the “Best Effort” basis with no specific prioritization.

2.27 Six options for marking SWIM traffic with DSCP markings were presented and deliberated. The meeting concluded that the most appropriate approach would be to put all SWIM traffic into a new QoS queue, with the network marking the traffic based on the IP address (Option 2). Further priority segregation could then be applied at the messaging level by assigning AMQP priorities. It was also agreed that the DSCP marking for all SWIM traffic should be “AF21”, the same as the AFTN/AMHS traffic.

Action WS-1-11: ICAO Secretariat to inform the CRV OG of these conclusions for the new CRV.

SWIM Transition

SWIM Transition – SIPG Lead (SP/05)

2.28 The SIPG lead presented SP/05 to the meeting. The presentation highlighted the challenges of transitioning from a non-SWIM environment to a SWIM environment, in particular, from AMHS to SWIM. It is foreseen that the transition period might be a significant duration, and this highlighted the need to address how such a mixed-mode environment can work.

2.29 The presentation generated a lot of discussions on mixed-mode environments and how long such an environment is likely to exist. There was also discussion over the types of data currently being carried on AMHS that are not represented by the existing SWIM data models. After some deliberation, it was clear that there are some data types in AMHS that have a clear mapping to the SWIM data models. Some data models do not have similar mappings but have expert bodies working

on migrating them to SWIM. Finally, there is at least 1 data type that does not have a SWIM mapping or a migration plan to SWIM. There are some AMHS data types that have a clear sunset date attached to them, e.g., FPL2012. There are some that have a migration target date set but no sunset date and others that have no dates set.

2.30 During the discussion, it was highlighted that the ACSICG has a group looking at the AMHS to SWIM transition. It would be good for the SWIM TF to work with this group to map the transition plan together.

2.31 After many discussions, the following conclusions were reached for this agenda item:

- 1) Reach out to the relevant expert groups governing each data type within AMHS for their SWIM migration strategy, if any, and the proposed sunset date for the AMHS data type. E.g., AAITF, FF-ICE Ad-hoc group, MET IE, ATFM ad-hoc group, etc.)
- 2) Work closely with the ACSICG AMHS to SWIM transition group to map out a transition plan together. One of the topics to clarify is the need for AMHS to SWIM conversion.
- 3) Explore more on SWIM implementation using legacy formats. Starting with the list of common SWIM services, looking for services that can quickly be turned into SWIM information services using legacy data formats. Reference to the ATM Information Reference Model (AIRM) is necessary to maintain semantic interoperability.
- 4) Inform the ATM Automation Systems Task Force (ATMAS TF) of the need for ATM automation Systems to integrate into SWIM.

Action WS-1-12: *SIPG to capture the above conclusions in a working paper and present them at the SWIM TF/10 meeting. Which was presented by SIPG as WP/09 in SWIM TF/10.*

Next Meeting Dates and Any Other Business

2.32 Two additional action items were raised during the various discussions during the working session. These action items do not fall under any of the agenda items of the working session but rather were a result of the various deliberations. They are as follows:

- 1) Operational SWIM Governance, e.g., establishing a regional SWIM office or a SWIM Operations Group.
- 2) Provide the link between the SWIM TI document and the SWIM Architecture that was proposed during this working session.

Action WS-1-13: *ICAO Secretariat to present these outcomes to the SWIM TF/10 for further actions by the SWIM TF*

2.33 The scheduling of the next SIPG working session was deliberated. To minimize travel difficulties, it was decided to hold the next session back-to-back with SWIM TF/10 (19–23 May 2025),

the date for the second working session of SIPG was 26-30 May 2025 at the ICAO APAC Regional Office in Bangkok, Thailand.

Outcomes of SIPG WS/2

Review of Action Items and Prioritization

Action Items from SWIM TF 10 – SIPG Lead (SP/08)

SWIM Timeline Proposal – SIPG Lead (SP/02)

2.34 SIPG Lead presented the new action items that had been assigned by the SWIM TF/10 meeting to the SIPG. A total of 9 additional action items were reviewed and categorized in [SP/07](#).

2.35 The Meeting then considered the various tasks of the SIPG in light of these additional action items in an attempt to merge the action items into the SIPG tasks. The result is the list of tasks shown in the table below.

Task ID	Task
Task 1	Define Functionality and requirements for Edge and Gateway EMS
Task 2	Review of the revised hierarchical architecture
Task 3	SWIM Architecture – Req/Rep MEP and guidance for Async and Sync
Task 4	Use of CRV Residual Bandwidth or CRV Test network (If Provisioned)
Task 5	SWIM architecture construction
Task 6	SWIM Security Implementation – Self-signed certs
Task 7	SWIM Registry Interconnection
Task 8	AMHS Protocol converters
Task 9	Testing of the APAC SWIM Prototype
Task 10	Measurement of performance metrics
Task 11	Conditions for SWIM Operationalization

2.36 After further deliberation, the Meeting decided that Task 4 and Task 8 should be excluded from the prioritization. Task 4 was excluded as it required input from the CRV OG to confirm if and when a CRV Test Network would be provisioned, or, barring that, whether the CRV residual bandwidth could be used for testing. Task 8 was excluded as the Meeting decided that the AMHS Protocol conversion should not be treated as part of the SWIM Technical Infrastructure but rather as a service that an EMS provider may or may not offer.

2.37 The Meeting also proposed that Task 5 be renamed “SWIM Technical Infrastructure Integration” to properly reflect the nature of the task. Similarly, Task 9 is to be renamed “APAC SWIM Integration Testing.”

2.38 The finalized task list with associated priorities is listed in the table below.

Task ID	Task	
Task 1	Define Functionality and requirements for Edge and Gateway EMS	Priority 1
Task 2	Refine the revised hierarchical architecture	
Task 3	SWIM Architecture – Req/Rep MEP and guidance for Async and Sync	
Task 6	SWIM Security Implementation – Self-signed certs	
Task 7	SWIM Registry Interconnection	
		Priority 2
Task 5	SWIM Technical Infrastructure Integration	
Task 9	APAC SWIM Integration Testing	Priority 3
Task 10	Measurement of performance metrics	
Task 11	Conditions for SWIM Operationalization	

2.39 Task 7 in the table spanned both priorities 1 and 2 because there were two stages to the task. The first stage was to determine the version of the SWIM Discovery Service (SDS) specification to use that would be most suitable for the APAC region and the second stage was the actual implementation of the SDS and the interconnection of the different registries in the APAC SWIM.

2.40 The Meeting then proceeded to develop a work plan based on the above-prioritized task list. The target deadline to complete Tasks 1 through 10 is the **end of December 2026**. Task 11 is the development of a set of acceptance criteria for the operationalization of the APAC SWIM and that work is likely to extend beyond the end of 2026.

2.41 The diagram representing the SIPG work program can be found in **Attachment A**.

2.42 The Meeting deliberated on the composition of the various task groups and task leads for each task group. It was decided that leads would be assigned for Tasks 1, 2, 3, 5, 6 and 7 at this Meeting since the work is starting almost immediately.

2.43 Task leads for tasks 9, 10, and 11 will be assigned at a later date once the earlier tasks are completed. This is so that the SIPG has enough resources to properly commit to a task.

2.44 The table of task assignments is captured in **Attachment B**.

SWIM Architecture: Routing Mechanism

APAC SWIM Routing – CANSO (SP08)

APAC SWIM Architecture and Message Exchange over CRV – Japan (SP04)

2.45 CANSO presented the use of Topics as a means of message routing to the Meeting. The presentation started with the definitions of terms like EMS, Message Broker, Message Properties, Message Header, Message Topic, and Message Topic Model. This is to establish a common understanding of what each of these terms mean.

2.46 The presentation then delved into the use of Message Properties for routing and compared that with the use of Message Topics. It was noted that some message brokers do not support routing via Message Properties directly, so additional work needs to be done to modify the message brokers to do so.

2.47 However, Message Topics are supported by virtually all messaging protocols and message brokers. Message Topics use far less space than Message Properties and are similarly extensible. Further advantages of using Message Topics are listed below.

- There is no need to establish a naming convention to prevent name collisions, but it does require a topic model to ensure proper usage.
- Topics have the same proven structure as file and URL paths
- Topics allow for simple parallel processing that enables hardware acceleration.

2.48 The presentation went on to show how message routing could be achieved with Message Topics in the Gateway EMS and how message routing would work across the whole architecture. This was followed by an example using FF-ICE filing as a use case to demonstrate how the routing of an FF-ICE flight plan would work with Message Topic Routing.

2.49 CANSO went on to highlight the challenges faced by SIPG when it comes to message routing.

- The SIPG is attempting to develop, test, operate, maintain, and govern the most difficult distributed and federated features of individual message broker products that have the luxury of extreme homogeneity.
- The SIPG needs to make this work across a diverse and likely changing set and number of message broker products, product versions and related capabilities.

2.50 Therefore, given these challenges, it was recommended in the presentation that the Gateway EMS be kept as simple as possible. Similarly, for the Edge – Gateway interface and service.

2.51 The Meeting proceeded to have a lengthy discussion about the pros and cons of using message topics versus message properties, with many queries about the potential drawbacks that topics might have. It was noted that Japan, Singapore and Thailand have used Message Topics in their local SWIM implementation. However, this mechanism has not been tried at the APAC level.

2.52 After much deliberation, it was decided that Task 2 would conduct a trial on the use of Message Topics and Message Header for message routing and coordinate with Task 1 to flesh out the necessary requirements on the Gateway and Edge EMS. **ACTION ITEM WS2-1**

2.53 Japan presented on the APAC SWIM Architecture and Message Routing over CRV. This presentation covered two topics regarding APAC SWIM Architecture. Namely how internet connectivity should be provisioned in the APAC SWIM Architecture and how message routing can be implemented using Message Properties.

2.54 As this agenda item pertained to routing mechanisms, the record here will concern only the discussions on the use of Message Properties for routing.

2.55 Regarding the use of Message Properties as a routing mechanism, it was pointed out in the presentation that there may be advantages for specific use cases, specifically for the FF-ICE use case.

2.56 The presentation then showed how different configurations of Message Properties can affect message routing and the various trade-offs and considerations that we must make when deciding how Message Properties are to be used to address a particular use case.

2.57 The Meeting proceeded to discuss the presentation and the pros and cons of using Message Properties as a routing mechanism. It was pointed out that since the past SWIM demonstrations have already used Message Properties as a means of routing, the SIPG has an understanding of how that works. While we should not ignore the use of message properties, the focus is now on exploring the use of message topics, as that is an unknown area. The comparison between Message Properties and Message Topics will thus be work assigned to task 2. **ACTION ITEM WS2-2**

SWIM Architecture: Requirements on Gateway EMS providers

*SWIM Architecture – Requirements on Gateway EMS - Singapore (SP/03)
Requirements Specification Template for GEMS and Global SWIM Service – Korea (WP/04)*

2.58 Singapore presented the Requirements for Gateway EMS. The presentation covered the following topics: SIPG APAC SWIM Architecture, Groupings for Gateway EMS Communities, Functional Requirements for Gateway EMS, Non-Functional Requirements for Gateway EMS, Testing Requirements and Procedures for Onboarding a Gateway EMS, Runtime Governance for Gateway EMS.

SIPG APAC SWIM Architecture

2.59 Under the SIPG APAC SWIM Architecture, the presentation looked at the revised hierarchical architecture compared with the original hierarchical architecture. It compared the vulnerabilities of the original hierarchical architecture as raised in SWIM TF/9 WP/10 against the solutions proposed by China and Japan in SWIM TF/10 WP17 and SWIM TF/10 WP14, respectively.

2.60 The following presentation presented the Gateway and Edge EMS configuration that was used for the Joint Event held in June 2024. This configuration consisted of 4 Gateway EMS and 3 Edge EMS.

2.61 Under the topic of Functional Requirements of the Gateway EMS, the presentation grouped the solutions proposed by China and Japan in SWIM TF/10 WP17 and SWIM TF/10 WP14, respectively, into nine categories. They are Message Persistence, Acknowledgement and Confirmation, Retry and Redelivery, High Availability and Redundancy, Routing and Security, Monitoring and Logging, Network Failure Handling and Auto-recovery, Protocol Translation, and Additional Message Functionality.

2.62 Singapore talked about some existing Gateway EMS requirements and whether they remain relevant for the SIPG SWIM Prototype.

2.63 Next, the minimum non-functional Gateway EMS requirements were presented. Material presented in SWIM TF/10 WP/17 and SWIM TF/10 WP31 were extracted and presented here. It was noted that the current agreed overall availability for the APAC SWIM is set at 99.0% or greater. How this would translate to actual bandwidth and latency requirements for the Gateway EMS still needs to be determined. However, the presentation highlights that the values for these attributes would necessarily be higher for the Gateway EMS as compared to the Edge EMS due to the higher volume of traffic expected at the Gateway EMS.

2.64 The presentation also defined the boundaries with which Latency should be measured. It should be measured from the time a message arrives at an EMS to the time it is transmitted from the EMS.

2.65 The presentation talked about testing requirements and procedures for onboarding a Gateway EMS. The presentation proposed four categories under which these tests can fall: connectivity testing, latency testing, bandwidth testing, and cybersecurity testing. For each category, the presentation also proposes considerations.

2.66 The presentation also mentioned Runtime Governance for Gateway EMS. However, this is to highlight that this topic is not within the purview of the SIPG but rather Task 5 – Governance of the SWIM Task Force.

2.67 There were a lot of discussions on the requirements of Gateway EMS. Particular focus was given to the issue of assigning priorities to messages and how this could be done. It was pointed out to the Meeting that an agreed principle that this Meeting should abide by when considering requirements for Gateway EMS is that SWIM information services are not being used for aircraft separation. Therefore, any constraints and requirements proposed must consider the above principle. This is to prevent over-engineering of the requirements.

2.68 The discussion proceeded to discuss various options to implement priorities in messaging, using the “Time-to-Live” (TTL) parameter to manage orphaned messages and the use of multiple queues. The question of how priorities should be defined was considered and discussed. However, it was finally agreed that the SIPG does not have enough knowledge on how priorities should be assigned. It was also agreed that the SIPG is only responsible for delivering the capability to do message prioritization. How priorities are to be assigned should be left to the expert groups to decide.

2.69 The Meeting decided that the discussions all boil down to 3 questions.

1. Can we use multiple queues in the Gateway and Edge EMS?
2. Is it acceptable for the Gateway EMS to delete a message whose TTL parameter is expired?
3. How should message priority be implemented?

2.70 The Meeting agreed that these questions should be undertaken by tasks 1 and 2 for an answer. There was a suggestion to look at the AFTN/AMHS priorities as inputs for this question.
ACTION ITEM WS2-3

2.71 The Meeting then continued to discuss the solutions associated with guaranteed message delivery in the event of an EMS failure. There were several solutions proposed in the presentation, and all revolved around the failover mechanism or message persistence capability within the EMS. It was noted that this issue of guaranteed message delivery impacts not just the Gateway EMS but the Edge EMS as well.

2.72 Japan introduced the concepts of the Pull mechanism and Push mechanism for putting messages onto message queues. It was added that these have an impact on guaranteed message delivery and need to be properly explored. This is something for Task 1 to explore. **ACTION ITEM WS2-4**

2.73 The Meeting proceeded to discuss the issue of a failure in the message delivery chain. Failure could occur at the network level or at the EMS level. These could be mitigated with a retry logic and message detouring. Both these solutions should work in concert, i.e., after a set number of retries, it should be deemed that the selected route is no longer viable and rerouting should occur. This was assigned to Task 2. **ACTION ITEM WS2-5**

2.74 It was noted after all the discussion on the SIPG APAC SWIM Architecture that the material in this presentation, as well as the points discussed during the Meeting, should serve as inputs for Task 1 and Task 2. These tasks should then decide on the appropriate proof-of-concept trials to run to help progress their work. ***ACTION ITEM WS2-6***

Groupings of Gateway EMS communities

2.75 During the SWIM TF/10 meeting, it was proposed that the existing ATN Network Topology could be used as an initial reference for establishing the Gateway EMS providers. The proposal was for the current BBIS providers to take on the role of the Gateway EMS providers as well.

2.76 Australia highlighted that we should aim for a good geographical spread of Gateway EMS to reduce message transmission latency due to geographical distance. From the current ATN Topology, it seems that the candidate Gateway EMS providers are well spread out.

2.77 The SIPG Chair pointed out that the new hierarchical architecture only requires the Gateway EMS to connect to **2 or more other Gateway EMS** and does not mandate a mesh-type connection between all the Gateway EMS. Also highlighted was that this is the initial set of Gateway EMS. There is nothing inherently preventing a state that is not a BBIS from volunteering to be a Gateway EMS.

2.78 The list of initial Gateway EMS providers was as follows:

- Australia (Tentative)
- China
- Fiji
- Hong Kong China
- India
- Japan
- Republic of Korea
- Singapore
- Thailand
- USA

2.79 Australia was listed as tentative as they still need to confirm if they are able to support this role. The Republic of Korea and USA have volunteered to be a Gateway EMS provider despite not being an ATN BBIS provider. Malaysia will be an edge EMS while New Zealand is planning to be the Edge EMS providers.

2.80 There was a question about whether a Gateway EMS provider needs to provide another Edge EMS. The SIPG chair reminded the Meeting that at the SIPG WS/1 session, it was highly recommended to keep the functions of the Gateway EMS dedicated to performing Gateway message routing functions. That means that a separate Edge EMS is recommended for the Gateway EMS providers.

Functional Requirements for Gateway EMS, Non-Functional Requirements for Gateway EMS, and Testing Requirements and Procedures for Onboarding a Gateway EMS

2.81 It was decided by the Meeting that the material for the three topics should serve as inputs to task 1. Further, all tasks that specify requirements should use the requirements specification template as provided in the SWIM TF/10 WP/29 to specify the requirements. **ACTION ITEM WS2-7**

Runtime Governance

2.82 No material was presented on this topic; instead, the Meeting reminded that there is a Governance Task under the SWIM Task Force. Work on runtime governance needs to be taken under the Governance Task and not at the SIPG level.

2.83 Japan presented on APAC SWIM Architecture and Message Exchange over CRV. It covered the following topics: Internet Connectivity, SWIM Architecture, and Message Routing. The discussions on Message Routing have been captured in section 3. Therefore, only Internet Connectivity and SWIM Architecture discussions will be addressed in this section.

Internet Connectivity

2.84 The presentation compared the differences between the Internet and the CRV when implementing the SWIM Technical Infrastructure. It gave two options for providing Internet connectivity to the SWIM TI. It was recommended that the SWIM Technical Infrastructure should not be built on the Internet.

SWIM Architecture

2.85 The table listing SWIM Technical Infrastructure Principles was presented at the Meeting. It contained five proposed principles, their description, and what system needs the principles address.

2.86 Also shown was a diagram of how AMHS can integrate with the SWIM Technical Infrastructure.

2.87 The Meeting discussed both topics and noted the options provided for Internet connectivity. It was noted in the diagram showing how AMHS can integrate with the SWIM TI that the user/consumer is isolated from the Gateway EMS by the Edge EMS. It was agreed that this was a good design principle and should be followed.

2.88 In the same diagram, it was clarified that the AMHS Router is actually an AMHS protocol conversion Information Service and treated as outside of the SWIM TI.

2.89 It was decided that this presentation should serve as a reference and input to tasks 1 and 2. **ACTION ITEM WS2-8**

SWIM Architecture: PKI Requirements for APAC SWIM Use Case

SWIM Self-Signed Certificate Trial – Malaysia (SP/10)

2.90 Malaysia presented the current results of the self-signed certificate trial that they have been conducting. The objective is to study the feasibility of using self-signed certificates to enable secured and encrypted communication between EMS.

2.91 Currently, the tests were carried out only between Malaysia and Singapore. It was expected that Thailand and Hong Kong China would join the trial soon. New Zealand expressed interest in joining the trial and China shared intention to be an observer.

2.92 The Meeting discussed the results of the trial so far and the pros and cons of using self-signed certificates. It was highlighted that the lack of a central certificate authority makes it difficult to manage the exchange of certificates and to establish trust between agencies.

2.93 It was further pointed out that the Aviation Common Certificate Policy (ACCP) document is due to be published by the ICAO by the end of June 2025.

2.94 After deliberation, it was decided that the continuation of the Self-Signed Certificate Trial should be assigned to Task 6 and continue until August 2025. At which point the ACCP document is expected to be published. The review of the ACCP document is also assigned to Task 6. **ACTION ITEM WS2-9**

Request / Reply Architecture

Request-Reply Message Exchange Pattern – Singapore (SP09)

Approach to Global API Gateway For SWIM Web Services (WP01)

2.95 Singapore presented an explanation for the Request-Reply Message Exchange Pattern (MEP) in an attempt to define clearly what the Request-Reply MEP is. The concepts of Synchronous and Asynchronous Request-Reply were introduced and the differences between the two were listed in a table.

2.96 The presentation highlighted that there was confusion over the understanding of the Request-Reply MEP, using the FF-ICE use case to help highlight the source of confusion. Essentially, the confusion centered around the terms Synchronous and Asynchronous and how, depending on viewpoints, the understanding differs.

2.97 The Meeting debated what should be done to help resolve the matter and clear up the confusion.

2.98 It was concluded that there is a need for a common understanding among the SIPG members when these terms are used. Therefore, a clear definition of what is meant by Synchronous Request-Reply and Asynchronous Request-Reply needs to be developed. There is a high-level definition given in ICAO Doc 10203, and the SIPG definition should be aligned with the high-level definition in Doc 10203. **ACTION ITEM WS2-10**

2.99 Secondly, a set of questions needed to be developed to query the different expert groups on how they expect their information services to behave. These questions should avoid using technical language such as Publish / Subscribe or Request / Reply. **ACTION ITEM WS2-11**

2.100 These two tasks were assigned to Task 3.

2.101 SIPG lead reminded the Meeting that the Republic of Korea had presented the paper titled, Approach to API Gateway for SWIM Web Services, at the SWIM Task Force. This paper has been forwarded to the SIPG for consideration.

2.102 The paper highlighted that, to date, most of the trials and demonstrations have centered around the Publish / Subscribe MEP and the Request / Reply MEP was not explored. The paper also introduced the concept of an API Gateway and proposed various deployment models and approaches to how API Gateways could be deployed in SWIM. The paper stated that there was a need to agree on a consistent implementation of the Request / Reply MEP within the APAC SWIM and called for more work to be done in this Area.

2.103 The Meeting deliberated on the paper, especially on the need for API Gateways in the SWIM TI. It was decided that there was indeed a need for API Gateways in the SWIM TI. However, work needs to be done to explore how API Gateways should be deployed.

2.104 How HTTP RESTful Request / Reply can be done in the SWIM TI was discussed in the Meeting. It was agreed that more work also needed to be done to explore implementation options.

2.105 The above work to explore API Gateway deployment and HTTP RESTful Request / Reply implementation was assigned to Task 3. The SIPG WS/2 WP/01 should be used as input for these tasks. **ACTION ITEM WS2-12**

Standardized Nomenclature – Naming Conventions

2.106 No material was submitted for this agenda item.

2.107 SIPG Led informed the Meeting that given the discussions from SWIM TF/10 and this Meeting, it was clear that this agenda item was not mature enough to be discussed. It has dependencies on the results of Task 2 before we can begin deliberations. Hence, this agenda item will be put on hold for now.

Conditions for SWIM Operationalization

Strategies To SWIM Operationalization in the Aspect of Validation – Republic of Korea (WP03)

Minimum Conditions for APAC SWIM Operationalization – Singapore (SP06)

2.108 SIPG Led listed the main points presented in WP/03, which was also presented in the SWIM TF/10 meeting. The paper highlighted that while Doc 10203 gives some guidance to the testing and validation of information services, no such guidance for testing and validation of the SWIM TI exists. However, reference could be made to the same guidance for testing information services when the SIPG develops test cases and procedures for testing the SWIM TI.

2.109 The paper then proposed three possible approaches to developing test cases. As well as the approaches to conducting these tests. The paper also recommends some form of certification to improve the objectivity of the tests.

2.110 SIPG Lead then went on to present the Minimum Conditions for APAC SWIM Operationalization. He informed the Meeting that this presentation was prepared prior to the SWIM TF/10 meeting and that since the rewriting of the SIPG Terms of Reference, some of the material in this presentation may no longer be relevant.

2.111 The presentation introduced the need for SWIM operationalization, stating that there needs to be an agreed method for determining the readiness and suitability of the APAC SWIM Technical Infrastructure for operational use. SWIM Architecture, SWIM Security, and SWIM Governance all need to be considered for testing and validation.

2.112 SWIM Information Services no longer needs to be considered since it is no longer the responsibility of the SIPG to implement Information Services.

2.113 The Meeting debated both the paper and the presentation. It was agreed that the paper and the presentation would serve as inputs to Task 11.

2.114 After further discussions, it was decided that the scope of Task 11 is as follows:

- Take the outputs from Tasks 1, 2, 3, 5, 6, and 7 and develop a set of test procedures for the SWIM TI.
- Present these procedures to the SIPG and SWIM Task Force for acceptance and approval.
- Work with Tasks 5, 9 and 10 to execute the test procedures and obtain the results.
- Prepare a test report based on the results and present them to the SWIM Task Force for acceptance.

2.115 It was noted that the consequence of accepting these test results would take the SWIM TI from a prototype phase into the production phase. There is still a need to transmit it into the operational phase. The SWIM Task Force should define what this operational phase should be. SIPG will share this information with SWIM TF. **ACTION ITEM WS2-12**

2.116 There was a suggestion that the AFTN to AMHS transition document could be used as a reference to help define how SWIM should transition from Production into operation.

2.117 The Meeting also decided that the timeline for Task 11 should start in February 2026 and end no later than April 2027. This is so that the SWIM Task Force can meet its deadline of having an operational SWIM by the end of 2030. **ACTION ITEM WS2-13**

Next Meeting Dates and Any Other Business

2.118 Japan presented a draft version of the proposed DGCA/60 paper. The paper highlighted the work being done by the SWIM Task Force and the SIPG. It also presented the future work of the SWIM Task Force and emphasized the importance of SWIM for global aviation.

2.119 The paper called for states to be more involved in APAC SWIM implementation and for states to participate in SWIM-related workshops and seminars.

2.120 The Meeting provided feedback and comments on the paper. Japan requested the Meeting to review the paper and to send them all feedback and comments before 6 June 2025. **ACTION ITEM WS2-14**

2.121 The Meeting discussed the need for one more In-person working session after SIPG WS/3. It was reminded that the initial plan was to conduct three In-Person working sessions; however, based on progress in the next session, the need for another in-person session will be deliberated further. It was agreed that the next SIPG working session will be planned for **26-30 January 2026**. The venue of the Meeting was tentatively set at the ICAO Regional Office in Bangkok, Thailand. A reply from Australia or Singapore regarding their availability to host the next SIPG Working Session is pending.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information given in the paper;
- b) review the outcomes of the SIPG WS/1 and SIPG WS/2; and
- c) discuss any relevant matter as appropriate

CNS SG/29
Attachment A to WP/07
High Level Timeline for SIPG Work Program

Timelines	25 June	25 July	25 August	25 September	25 October	25 November	25 December	Remarks
Task 1 - Req of Edge and Gateway EMS								
Task 2 - New hierarchical architecture								
Task 3 - Req/Rep guidance (Async and Sync)								
Task 5 - SWIM TI Integration								
Task 6 - SWIM Security requirements and implementation.								Aug - End of self-signed certificate trial. Review ACCP after trial.
Task 7 - SWIM Registry req and implementation								

(Legend)

Requirements Group	Sys Engineering Group	Test and Validation Group
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CNS SG/29
Attachment A to WP/07
High Level Timeline for SIPG Work Program

Timelines	Jan 26	Feb 26	Mar 26	Apr 26	May 26	Jun 26	
Task 5 - SWIM TI Integration							
Task 7 - SWIM Registry Interconnection							

Timelines	26 July	26 August	26 September	26 October	26 November	26 December	
Task 5 - SWIM TI Integration							
Task 9 - APAC SWIM Integration testing							
Task 10 - Performance Testing							
Task 11 - SWIM Operationalization Guidance Material							

(Legend)

Requirements Group	Sys Engineering Group	Test and Validation Group
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Table of Task Assignments

Task ID	Tasks Description	Team
Task 1	Requirements and Functionalities of the Edge EMS and Gateway EMS - Coordinate with Task 2 for requirements on Topics. - Standardizing of the topic structure and / or message properties. - Consider the treatment of message TTL within the Gateway EMS and Edge EMS - How to do guaranteed message delivery. Push vs Pull method. - To include maintenance requirements and procedures for the Gateway and Edge EMS - o Updates of software - o Updates of the configuration - o Updates of certificates	Lead: Thailand Members: Australia, China, Hong Kong China, India, Japan, Fiji, Singapore, Malaysia, USA, Republic of Korea, New Zealand, CANSO
Task 2	New proposed hierarchical architecture refinement - Use SWIM TF/10 WP/17 as inputs - Routing via Topics - Explore the use of Multiple Queues and how that can be configured. (e.g. by data domain, by QoS) - How is message priority going to be implemented. SIPG's task is to look at how priority can be achieved. What priorities should each message type have is up to the domain and operational expert groups - Message transmission retry mechanism. - o What is the logic for failover - o Scope is limited to Edge-Gateway-Gateway-Edge message transmission - o Methodology for redelivery. Who gets informed of the tx failure? How many retries? What are the rules for rerouting? - Comparison between use of Message Properties and Message Topics for Routing.	Lead: China Members: Australia, Hong Kong China, India, Japan, Fiji, Singapore, Thailand, Malaysia, USA, Republic of Korea, New Zealand CANSO
Task 3	Guidance for the Sync Req / Rep and Async Req / Rep Message Exchange Pattern	Lead: Republic of Korea

Table of Task Assignments

Task ID	Tasks Description	Team
	- Most important task is to get alignment within the SIPG on what we mean by Sync Req /Rep and Async Req / Rep. Need to tie back to the definition found in Doc 10203 - Should not pose technical questions to other expert groups but rather ask them to state how they believe their information services should behave. - Use Korea's paper SWIM TF/10 WP 18 as inputs - Consider the use of API Gateways and how they can be deployed. - How to support RESTful Req/Rep MEP?	Members: Australia, China, Hong Kong China, India, Japan, Fiji, Singapore, Thailand, Malaysia, USA, New Zealand CANSO
Task 5	SWIM Technical Infrastructure Integration	Lead: Singapore Members: Australia, China, Hong Kong China, India, Japan, Fiji, Thailand, Malaysia, USA, Korea, New Zealand CANSO
Task 6	SWIM Security Requirements and Implementation - Review of the ACCP when published by the TFP - Continue with the Self-signed certificate testing with more participants - Explore how trust can be established across different entities using self-signed certificates - To consider how the renewal of certificates should be handled. - To use Malaysia's presentation at SIPG as input to this task	Lead: Malaysia, Members: Singapore, Thailand, Vietnam, Hong Kong, USA, Japan Philippines, China (Observer), New Zealand (Observer)
Task 7	SWIM Registry Requirements and Implementation	Lead: USA

Table of Task Assignments

Task ID	Tasks Description	Team
		Members: China, Sri Lanka, Philippines, Republic of Korea, Thailand, Singapore, Japan, <i>Hong Kong China (Observer)</i>
Task 9	APAC SWIM Integration Testing - To develop Use Cases and test scenarios to test the SWIM TI. - Propose to use the TBO Pathfinder Use Case as a starting point. - To remember to include Surveillance Use cases	Lead: TBD Members: Australia, China, Hong Kong China, India, Japan, Fiji, Singapore, Thailand, Malaysia, USA, Republic of Korea, New Zealand CANSO
Task 10	Performance Testing SWIM TI - Latency - Functional Capacity - Data Integrity	Lead: TBD Members: Republic of Korea, India, Singapore, USA.
Task11	Regional SWIM TI Production Readiness Document - Scope: 1) Propose the test procedures for the SWIM TI 2) Report of the test results based on agreed test procedures - To include the requirements, test procedures and key performance indicators as captured in the above tasks 1, 2, 3, 6 & 7.	TBD?

CNS SG/29
Attachment B to WP/07

Table of Task Assignments

Task ID	Tasks Description	Team
	- Prepare the acceptance criteria for the SWIM TI	