APAC SWIM Architecture and Message Exchange over CRV

Xiaodong Lu
Surveillance and Communications Department
Electronic Navigation Research Institute, Japan

May 26~30, 2025

Agenda

1. Internet Connectivity
2. SWIM Architecture
3. Message Routing
4. Summary

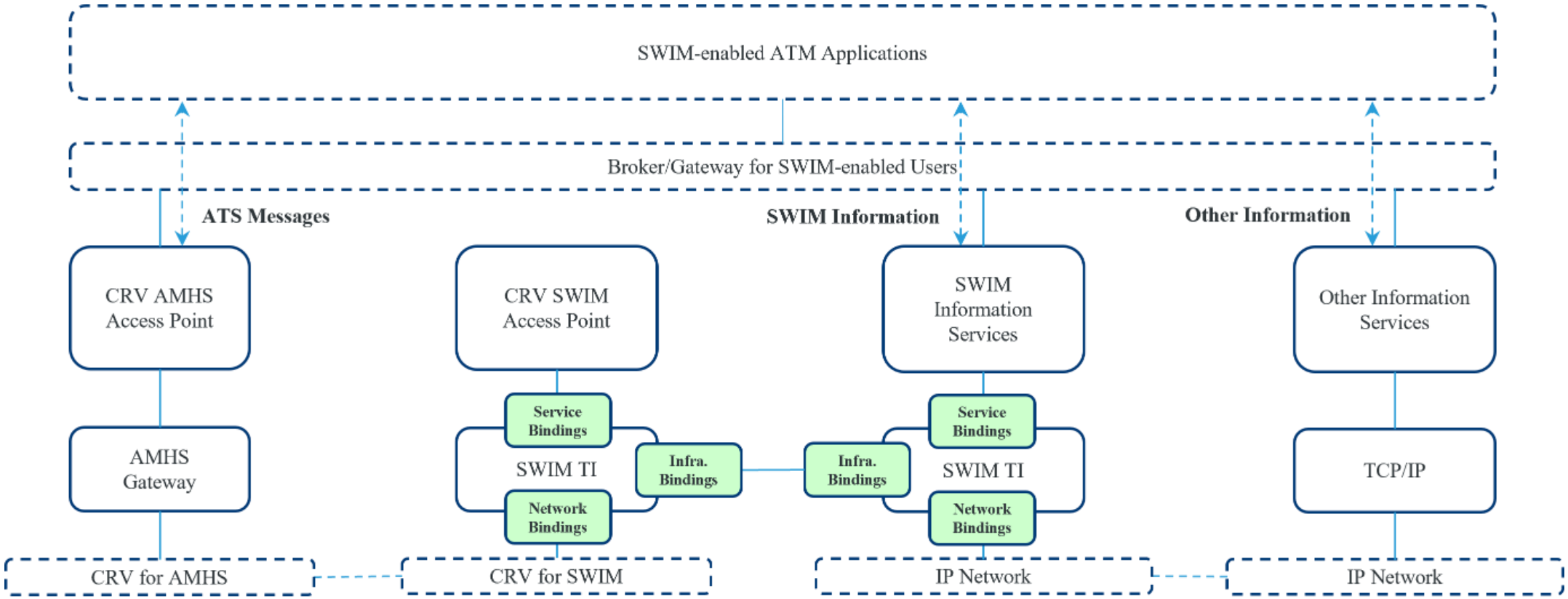
Internet Connectivity

➢ Prerequisites for SWIM TI

Indicator	SWIM TI Requirement	CRV	Internet
Performance	High-speed IP network connection with large bandwidth and low latency for various kinds and a large mass of information exchange among SWIM-enabled systems	△	○
Accessibility	Open and easy connected platform not only for traditional aviation partners but also for new entrants for the initial development of SWIM	×	○
Connectivity	Cross-border network connections not only for other SWIM-enabled systems in the APAC region but also to other SWIM platforms that have been deployed in other ICAO regions	△	×
Cost	Reduced cost for conventional message exchange, and low cost or free of cost for SWIM information exchange and sharing	△	×
Cybersecurity	Protection for IP-based networks, SWIM-enabled systems and information from cyber threats	○	×

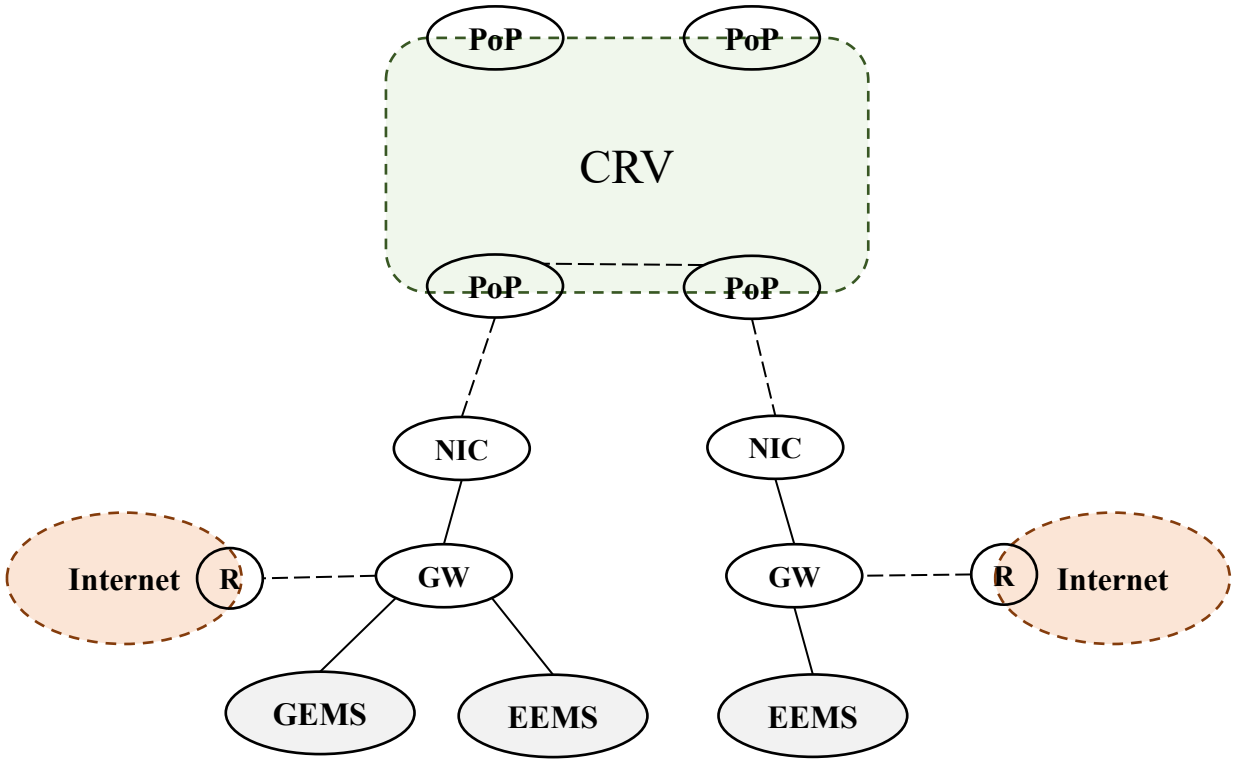
Internet Connectivity

➢ Through Infrastructure Bindings

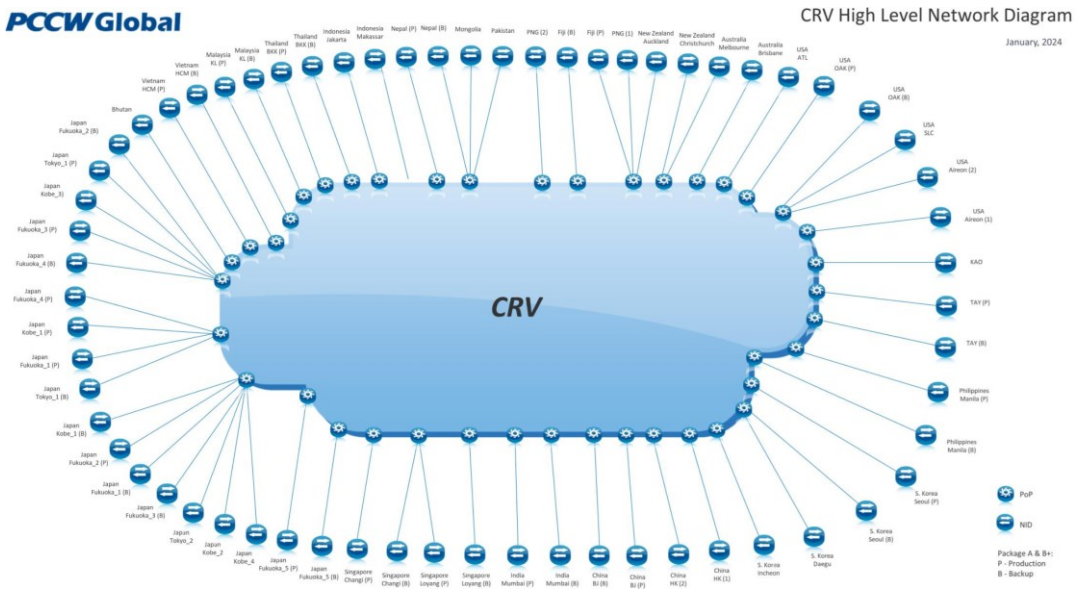


Internet Connectivity

➢ Different Options



- Option 2 is the same as Option 1



- CRV cannot provide connection to Internet

Agenda

1. Internet Connectivity

2. SWIM Architecture

3. Message Routing

4. Summary

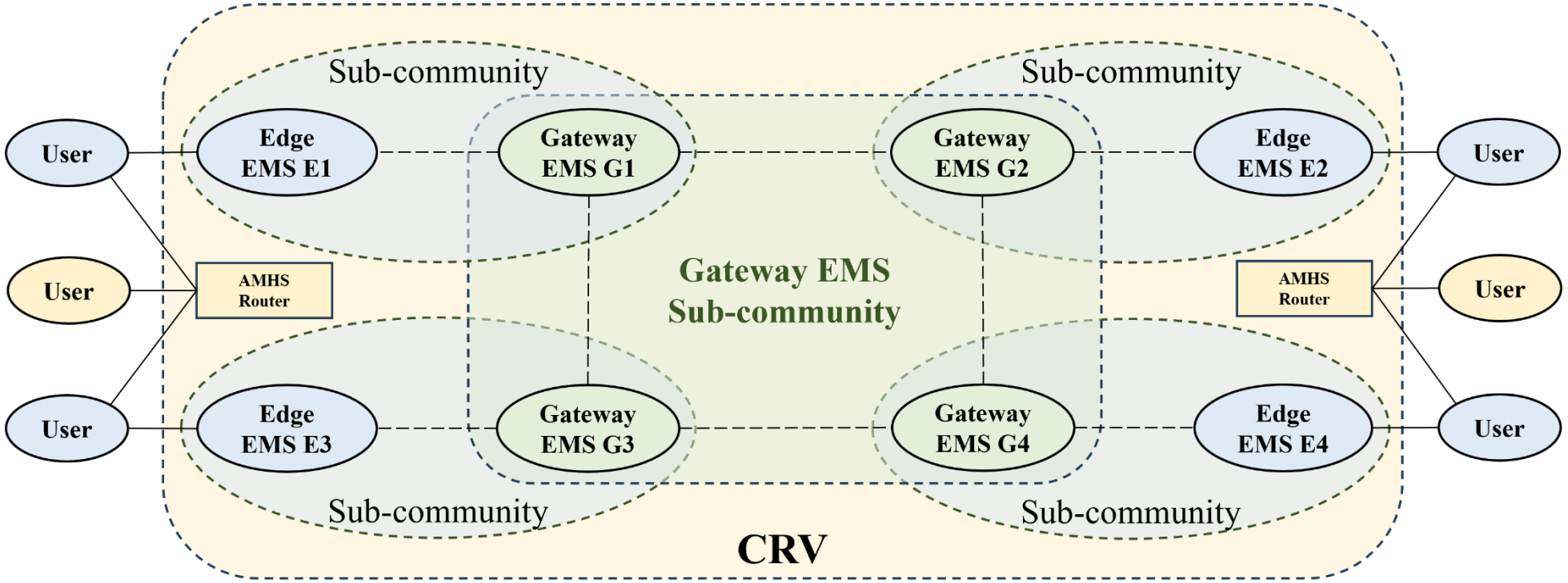
SWIM Architecture

➢ SWIM TI Principles

Principle	Description	System Needs
Managed technical diversity	Technical diversity is managed to minimize the significant costs to maintain expertise while allowing flexibility to accommodate new technologies and select technologies that best meet ATM needs.	Coexistence
Standards based TI	SWIM TI implementation is based on open standards that promote technical interoperability.	Interoperability
Established ICT standards	SWIM TI implementation is based on widely deployed and supported ICT standards that enable economical and efficient information services implementation and operation.	Reliability
Modularity	SWIM TI implementation is modular, enabling progressive deployment of SWIM TI functional capabilities and bindings, which will allow a fit for purpose, flexible and agile implementation and evolution.	Expandability
Platform independent interfaces	Interfaces between systems do not create dependencies imposed by implementation platforms, such as operating system or programming language.	Portability

SWIM Architecture

➢ Coexistence with AMHS



* EMS: Enterprise Messaging Service
* AMHS: ATS Message Handling System
* CRV: Common aeRonautical VPN

User — SWIM-enabled User

User — Legacy User

SWIM Architecture

➢ Selection policy for Gateway EMS providers

- **ATN Backbone Site ANSPs**
- **FIRs with high International air traffic volume**

➢ Connection policy between Gateway and Edge EMSs

- **Adjacent FIR priority**
- **Air traffic volume priority**

Agenda

1. Connect to Internet
2. SWIM Architecture
3. Message Routing
4. Summary

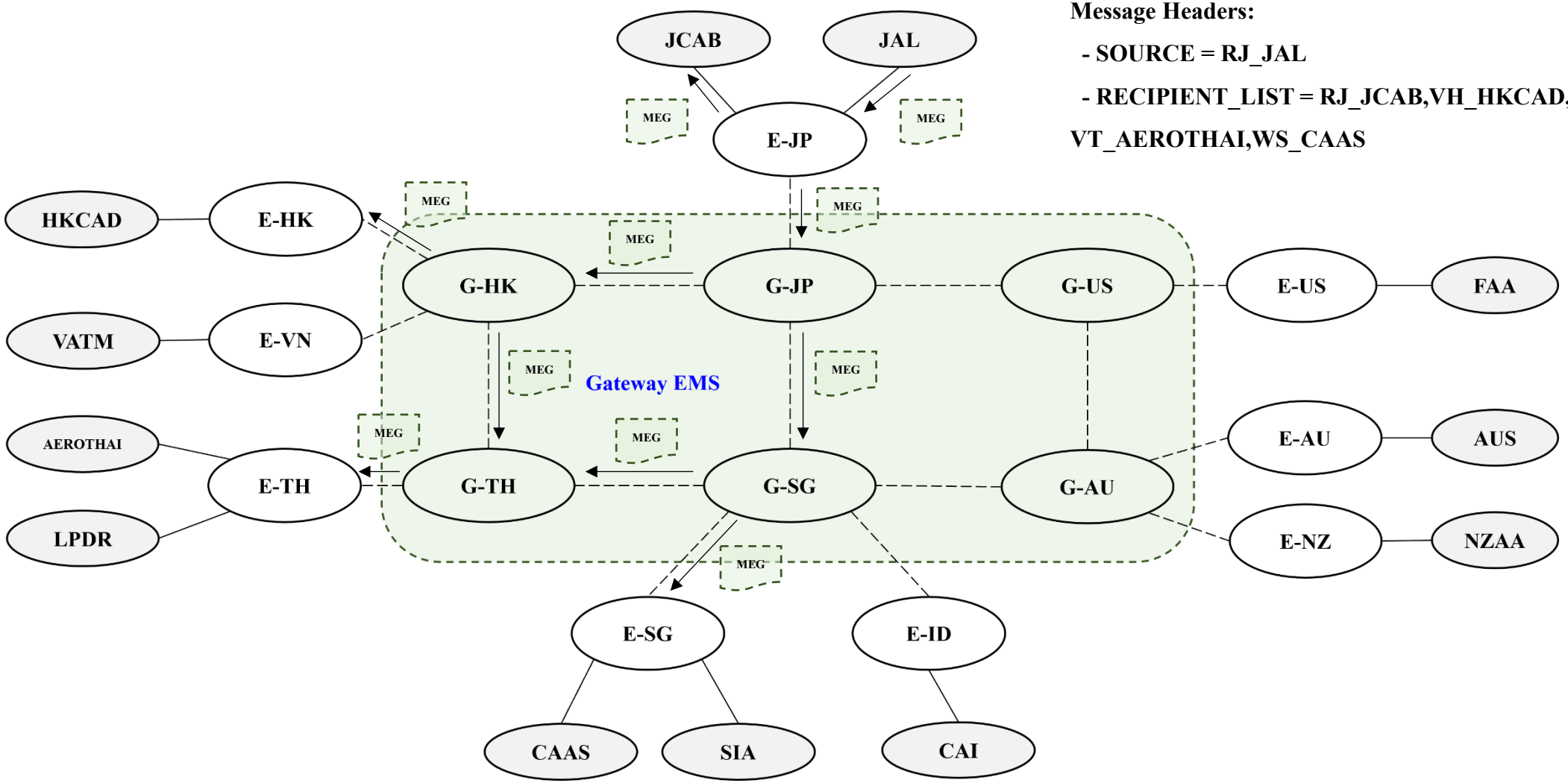
Message Routing

➢ Message Headers

Header Name	Values	Descriptions
SOURCE	RJ_JAL	Name of message publisher (ICAO Country Code_Organization Name)
RECIPIENT_LIST	RJ_JCAB,VH_HKCAD,VT_AEROTHAI,WS_CAAS	Name list of recipients
SYSTEM	JAL	Name of system
CATEGORY	FIXM	Name of information exchange model (FIXM)
CATEGORY_VERSION	FIXM_4_3_FF_ICE	Version of information exchange model (FIXM 4.3 version for FF-ICE Messages)
MESSAGE_TYPE	FILED_FLIGHT_PLAN	Message type of information exchange model (FIXM FF-ICE message types)
FFICE_PHASE	FILED	Flight plan phase of FF-ICE (PRELIM or FILED)
DEP_AIRPORT	RJAA	Departure Airport
ARR_AIRPORT	VTBS	Arrival Airport
AIRLINE	JAL	Name of airline
ACID	JAL707X	Aircraft Identification
GUFI	0248982c-4384-49f4-bdb3-7956bd553383	Globally Unique Flight Identifier
EOBT	2025-05-08T05:00:00Z	Estimated Off-Block Time
TIMESTAMP	JAL_OUT:1746671426209	Timestamp of the message out or in the system

Message Routing

➢ One message with multiple recipients



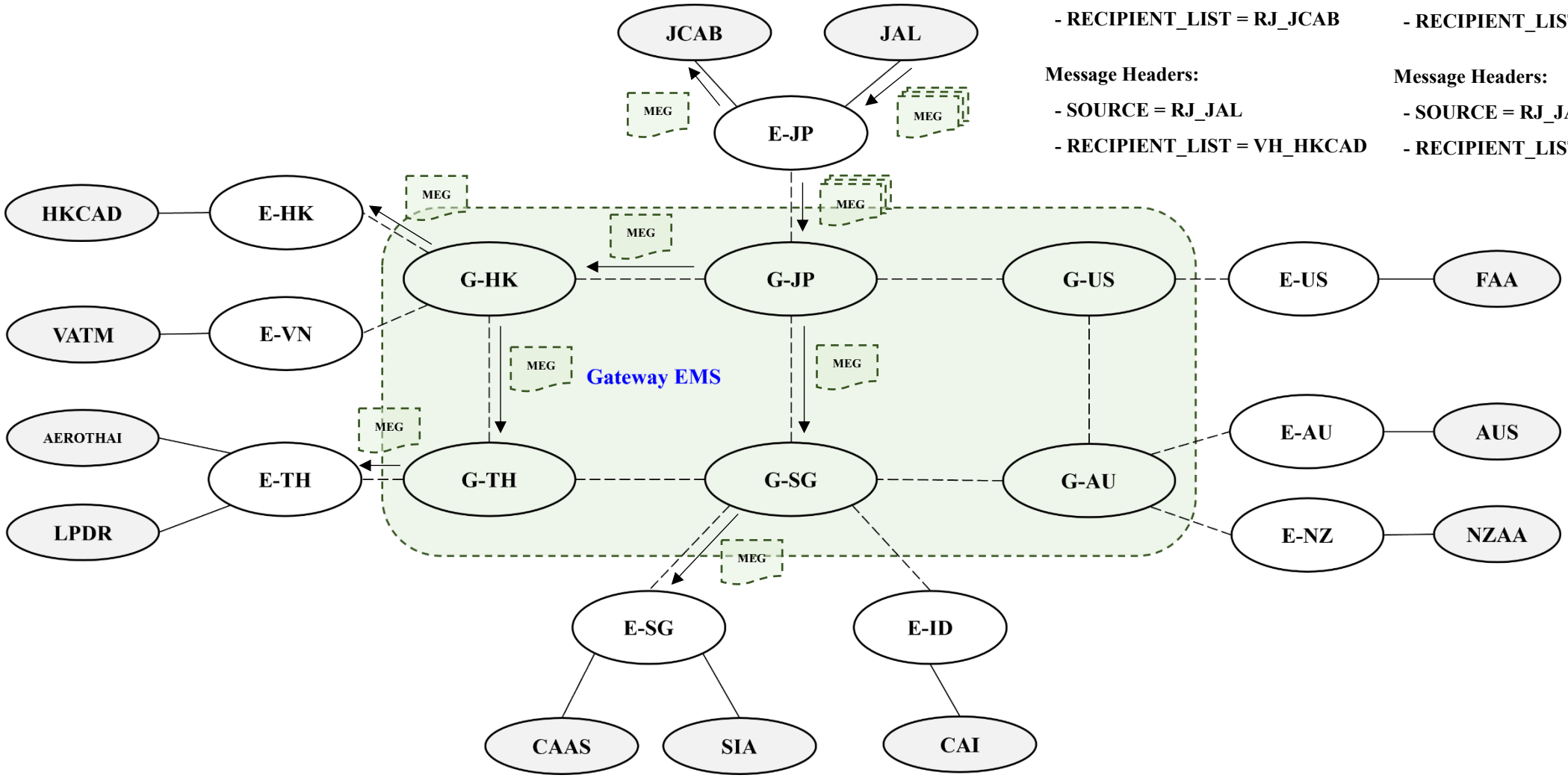
Message Headers:

- SOURCE = RJ_JAL

- RECIPIENT_LIST = RJ_JCAB,VH_HKCAD, VT_AEROTHAI,WS_CAAS

Message Routing

➢ One message for one recipient



Message Headers:
- SOURCE = RJ_JAL
- RECIPIENT_LIST = RJ_JCAB

Message Headers:
- SOURCE = RJ_JAL
- RECIPIENT_LIST = VT_AEROTHAI

Message Headers:
- SOURCE = RJ_JAL
- RECIPIENT_LIST = VH_HKCAD

Message Headers:
- SOURCE = RJ_JAL
- RECIPIENT_LIST = WS_CAAS

Message Routing

➢ Comparisons

Aspect	One-to-Multi	One-to-One
Efficiency	Less bandwidth and processing	More bandwidth and processing
Routing Policy	Comprehensive rules for message routing	Simpler rules for message routing
Delivery Control	Harder to avoid message duplication	Easier to avoid message duplication
Error Handling	More complex retry mechanisms	More robust retry mechanisms
Network Load	Reduce total number of messages	Increase total number of messages

Agenda

1. Connect to Internet
2. SWIM Architecture
3. Message Routing
4. Summary

Summary

System Architecture

- Interconnection between SWIM TIs
- Connectivity to the Internet
- Coexistence with AMHS

Message Exchange

- Message exchange patterns
- Metadata for message headers
- Message routing policies

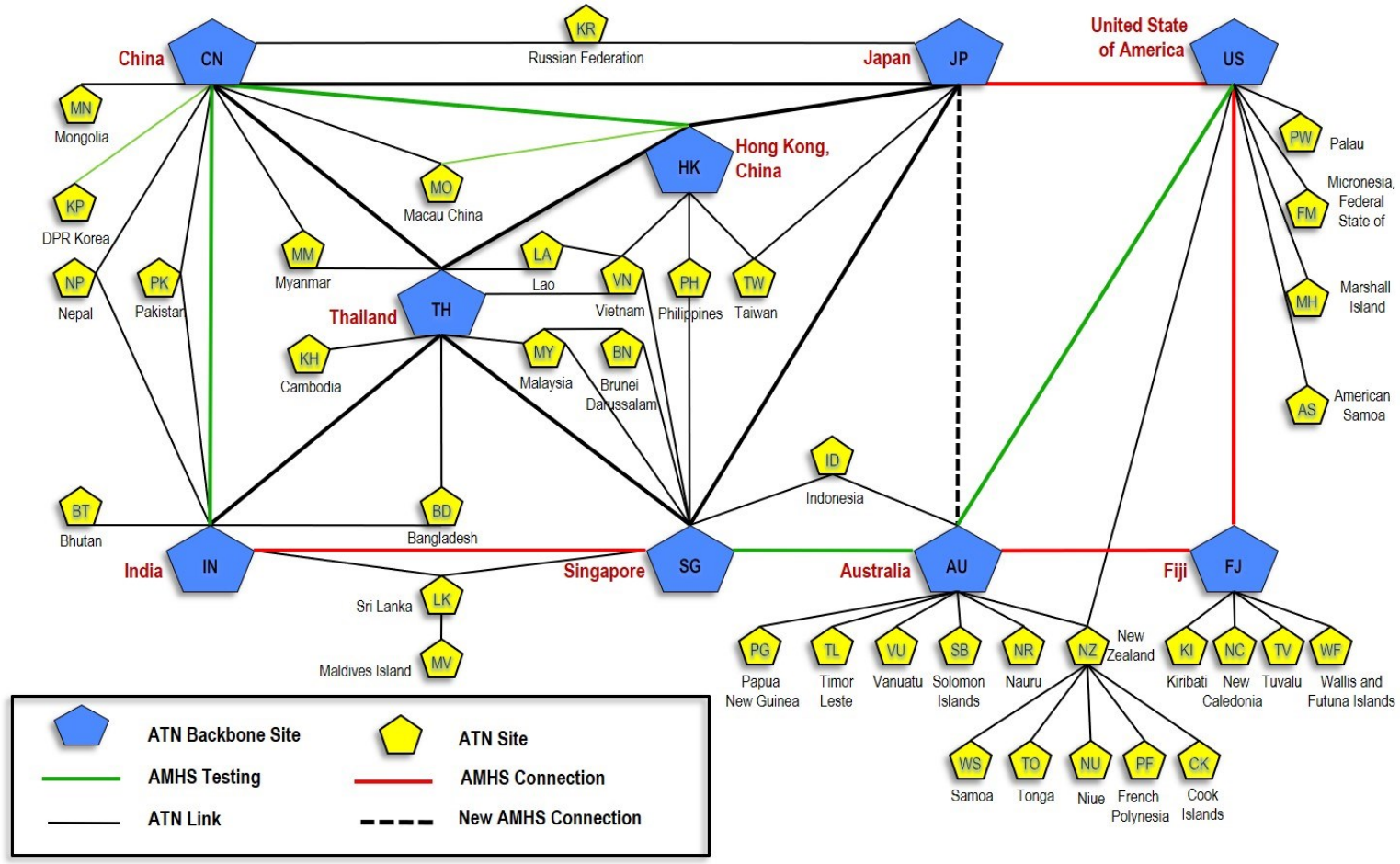
Information Service

- Information exchange models
- Message types and mandatory elements
- Message processing flow


Thank You!

Implementable Approach

➢ AMHS-based Operations with SWIM



Requirements:

- **No impact on current AMHS based message exchange**
- **Easy to implement SWIM based information sharing**
- **Low cost to maintain and manage both systems**

Same Structure with various Interface Bindings