APAC SWIM TI to Implement Different Message Exchange Patterns

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Agenda

1. SWIM MEPs

2. APAC SWIM TI

3. Approaches

4. MEP Tests

SWIM MEPs

➢ Message Exchange Patterns

MEPs	Process	Restriction
Synchronous Request/Reply	The consumer initiates a request to an information service; the service processes the request and generates a reply to the consumer.	During the period of waiting for this response, the consumer cannot send or receive any other requests or responses.
Asynchronous Request/Reply	The consumer initiates a request to an information service; the service processes the request and generates a reply to the consumer.	This MEP requires that the consumer be able to receive messages at any time and correlate them with prior requests.
One-way	The consumer initiates a message to an information service without expecting any response from the information service.	This MEP is particularly useful at the lower application layer, where message responses are not required.
Publish/Subscribe	Push: The consumer initiates a subscription request to an information service, and the information service sends necessary updates (publish) to the consumer.	This MEP requires that the consumer can receive messages at any time.
	Pull: The consumer initiates a subscription request to an information service, and the information service would keep necessary updates available to the consumer.	This MEP requires that the consumer send requests to the information service to receive the updates.

SWIM MEPs

➢ Message Exchange Patterns

MEPs	Application	Communication Protocol
Synchronous Request/Reply	• RESTful APIs for Real-time queries • Web services for transactional operations	• HTTP/HTTPS (RESTful APIs) • SOAP over HTTP (Web Services)
Asynchronous Request/Reply	• Distributed systems requiring delayed responses • Background processing tasks	• AMQP • AMQP WebSockets
One-way	• Event notifications • Sensor data transmission	• AMQP
Publish/Subscribe	• Real-time event distribution • Messaging systems	• AMQP

Agenda

1. SWIM MEPs

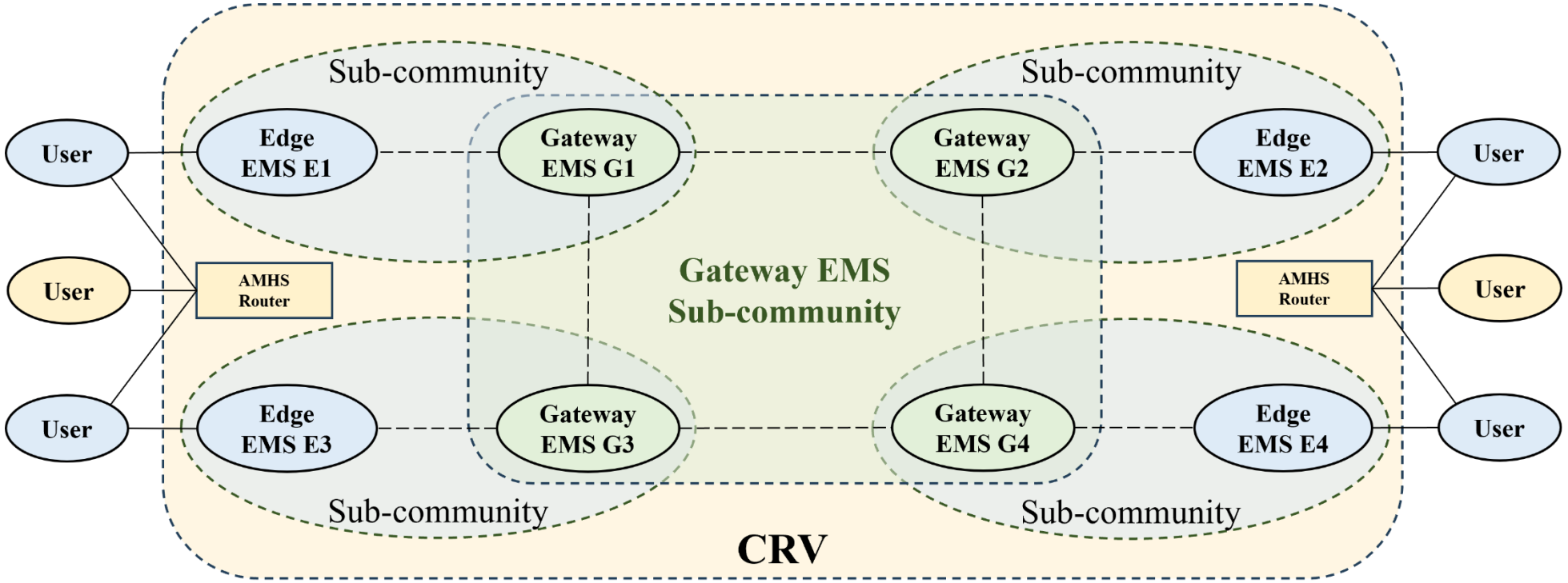
2. APAC SWIM TI

3. FF-ICE/R1 Services

4. MEP Tests

APAC SWIM TI

➢ Hierarchical Architecture



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

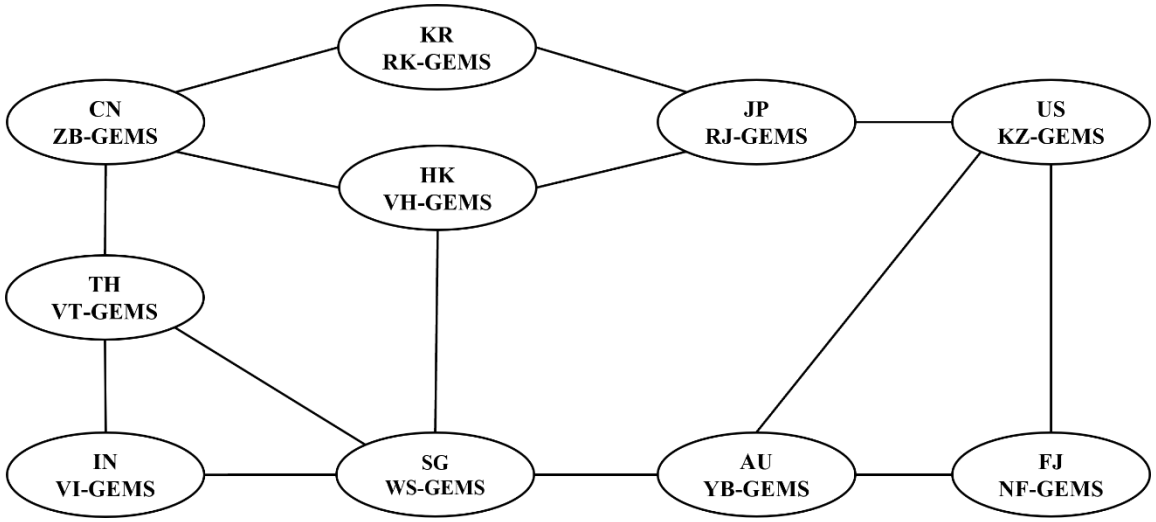
User — SWIM-enabled User

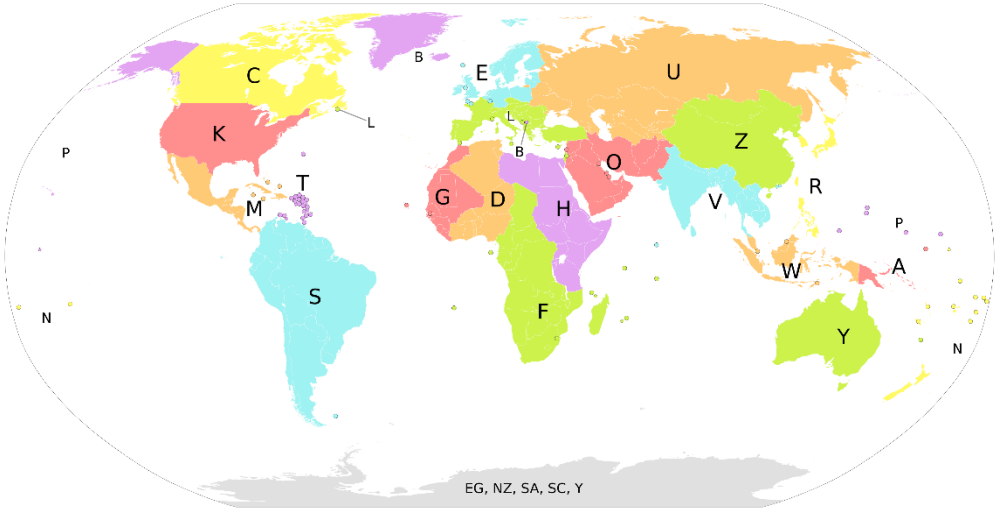
User — Legacy User

APAC SWIM TI

➢ Gateway EMS Connections

- **Connection policy between Gateway and Gateway EMSs:**
  - **Adjacent FIRs or major transit FIRs**
  - **More than two paths to other Gateway EMSs**
  - **Number of connections: 2~3, 4 for high-traffic or hubs FIRs**

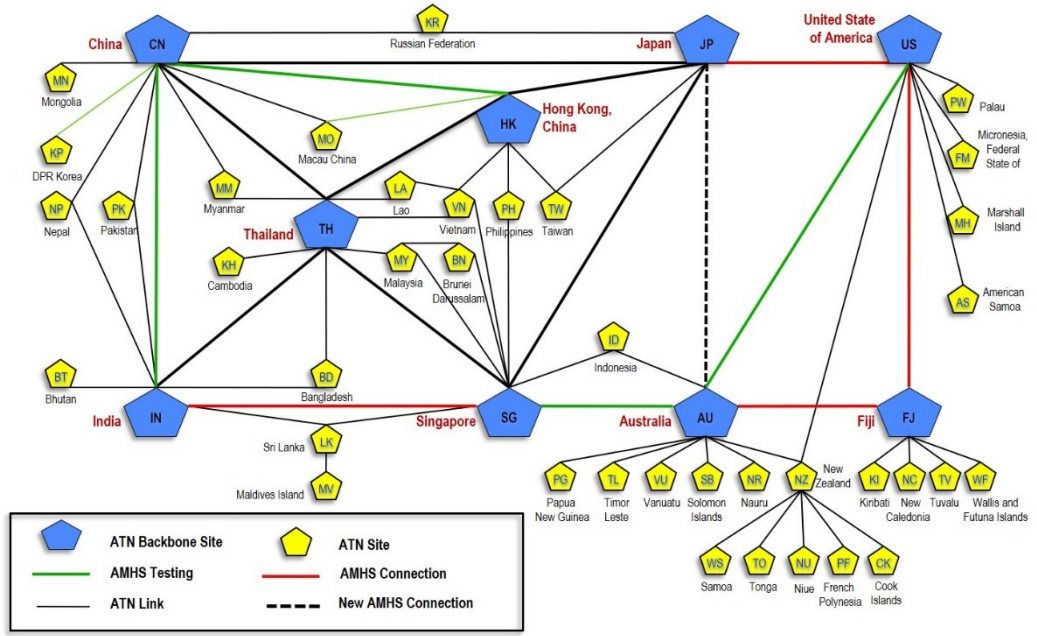


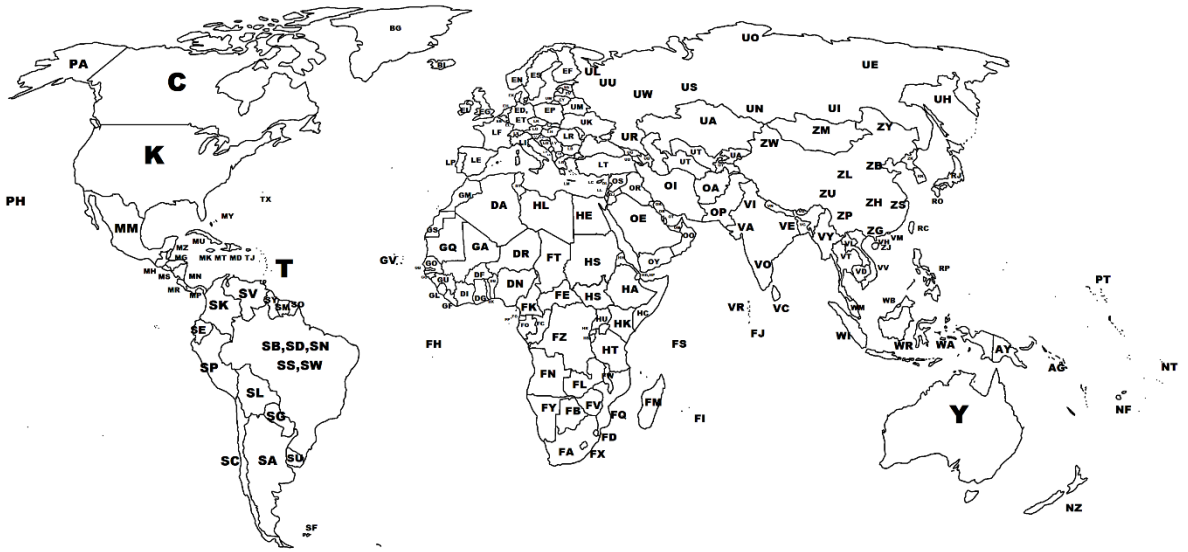


APAC SWIM TI

➢ Edge EMS Connections

- **Connection policy between Edge and Gateway EMSs:**
  - **Adjacent FIRs or within a unified FIR**
  - **Each Edge EMS connects to two different Gateway EMSs**





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Approaches: Asynchronous Request/Reply

➢ Header Section (AMQP 1.0): Required for reliable delivery

Property	Type	Default	Description	Recommendation
durable	boolean	false	Whether the message is durable (must be stored persistently by brokers).	true: survives broker restart
priority	uint8	4	Message priority (0~9). Brokers with priority queues will deliver high-priority messages first.	8 for FF-ICE messages
ttl (time-to-live)	milliseconds	no expiry	Message expiration time. Prevents stale messages from circulating indefinitely in a mesh.	3,600,000 for FF-ICE messages
first-acquirer	boolean	false	Whether the recipient is the first to acquire the message. Can help with routing logic or preventing re-processing in some topologies.	true
delivery-count	uint32	0	Count of delivery attempts. Used to detect duplicates or retries; important in multi-hop delivery.	10 within the APAC region

Approaches: Asynchronous Request/Reply

➢ Message Properties (AMQP 1.0): Required for efficient process

Field	Type	Description	Usage
message-id	string	Unique identifier for the message, useful for duplicate detection	Detect duplicates; Traceability
user-id	binary	Authenticated user ID of the original publisher	Traceability
to	string	Target address for the message	
subject	string	Message summary or title	
reply-to	string	Address for replies	
correlation-id	string	Used to correlate request/reply pairs	
content-type	string	MIME type of message body (e.g., application/json)	TRACK_JSON
content-encoding	string	Encoding of message body (e.g., base64)	TRACK_RAW
absolute-expiry-time	timestamp	Message expiration time	Prevents stale messages from circulating
creation-time	timestamp	When the message was created	Traceability
group-id	string	Publisher-defined grouping identifier for sequencing	
group-sequence	uint	Sequence number within a group	
reply-to-group-id	string	Groups responses to related messages	

Approaches: Asynchronous Request/Reply

➢ Message Headers (User defined): Required for operations

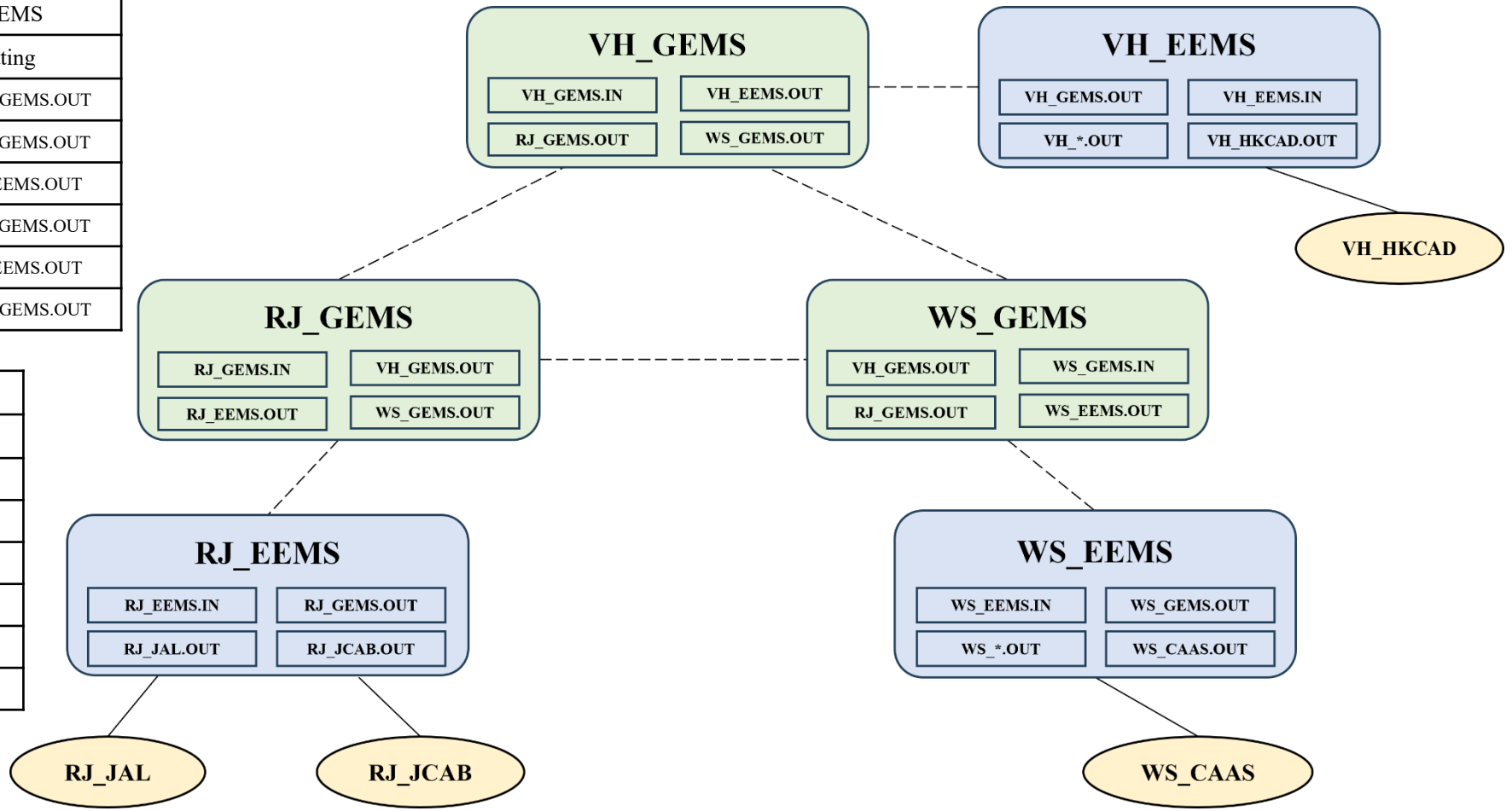
Header Name	Values	Descriptions	
APAC_SOURCE	RJ_JAL	Name of message publisher	Routing
APAC_RECIPIENT_LIST	RJ_JCAB,VH_HKCAD,WS_CAAS	Name list of recipients	
SYSTEM	RJ_JAL	Name of system	
APAC_CATEGORY	FIXM	Name of information exchange model (FIXM)	Information Service
APAC_CATEGORY_VERSION	FIXM_4_3_FF_ICE	Version of information exchange model (FIXM 4.3 version for FF-ICE Messages)	
APAC_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)	
SIGNATURE	Digital Signature and Certificate	Digital Signature	Security Service
DEP_AIRPORT	RJAA	Departure Airport	GUFI Service
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	
APAC_TIMESTAMP	RJ_EEMS_OUT:1746671426209	Timestamp of the message out or in the system	Management

Approaches: Asynchronous Request/Reply

➢ Message-header based routing

Routing Table of RJ_GEMS		
FROM	TO	Routing
RJ_*	WS_*	WS_GEMS.OUT
	VH_*	VH_GEMS.OUT
WS_*	RJ_*	RJ_EEMS.OUT
	VH_*	VH_GEMS.OUT
VH_*	RJ_*	RJ_EEMS.OUT
	WS_*	WS_GEMS.OUT

Routing Table of RJ_EEMS		
FROM	TO	Routing
RJ_JAL	RJ_JCAB	RJ_JCAB.OUT
	Others	RJ_GEMS.OUT
RJ_JCAB	RJ_JAL	RJ_JAL.OUT
	Others	RJ_GEMS.OUT
RJ_GEMS	RJ_JCAB	RJ_JCAB.OUT
	RJ_JAL	RJ_JAL.OUT



Message Headers:

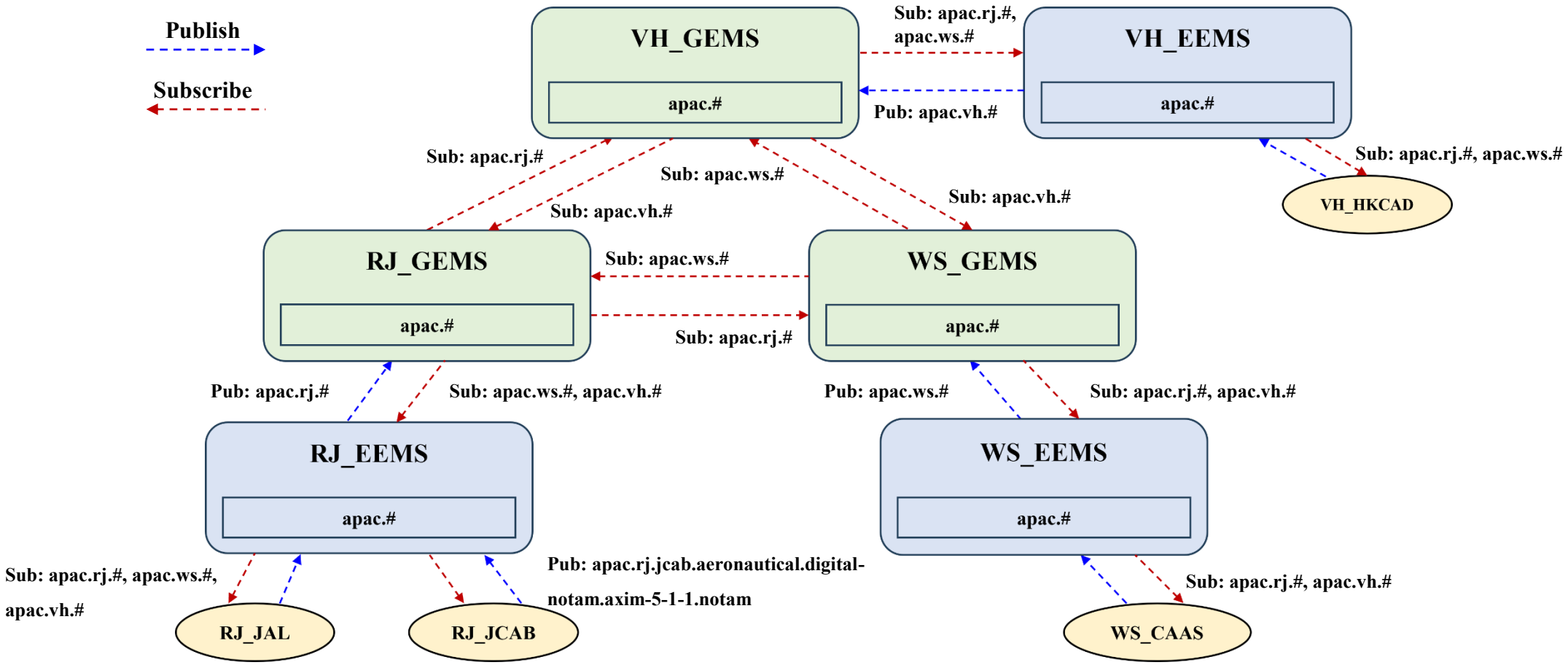
- APAC_SOURCE = RJ_JAL

- APAC_RECIPIENT_LIST = RJ_JCAB,WS_CAAS

Approaches: Publish/Subscribe

➢ Topic relay and filtering

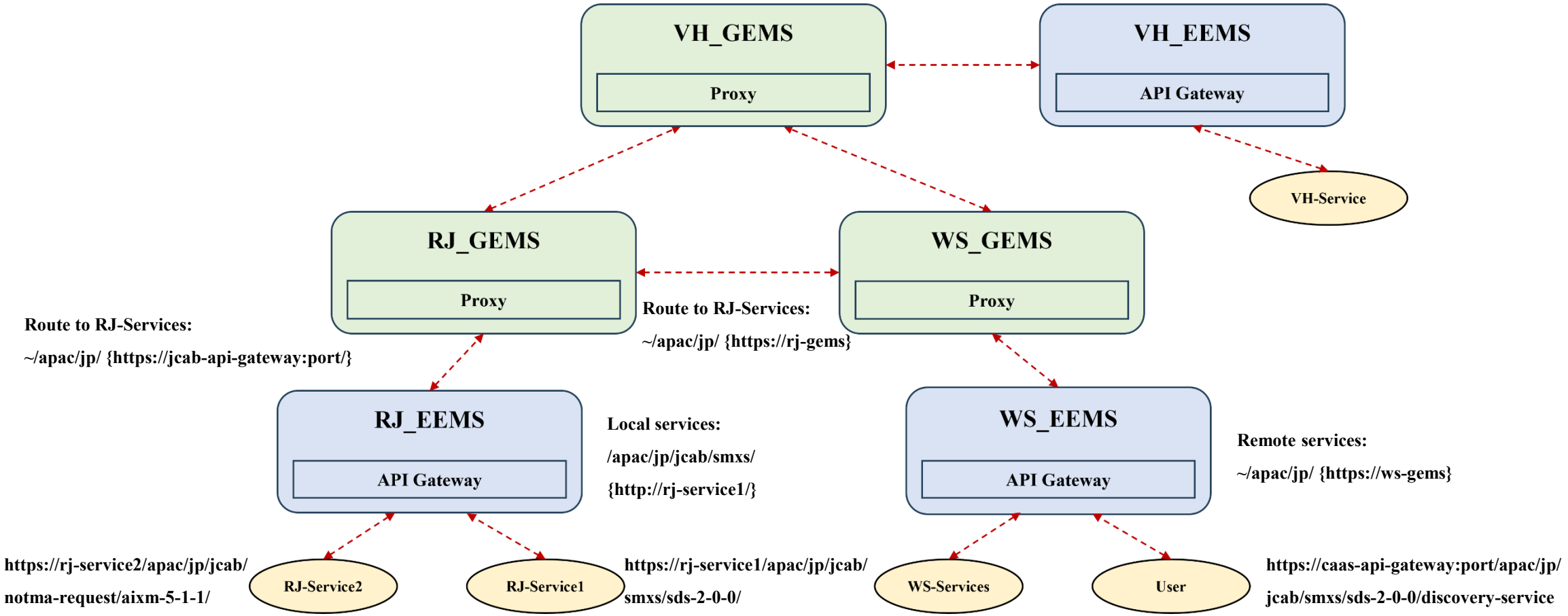
- Topic naming convention: <region name>.<icao indicator prefix>.<abbreviation of service provider>.<service category>.<service name>.<category version>.<message type>



Approaches: Synchronous Request/Reply

➢ Path based routing

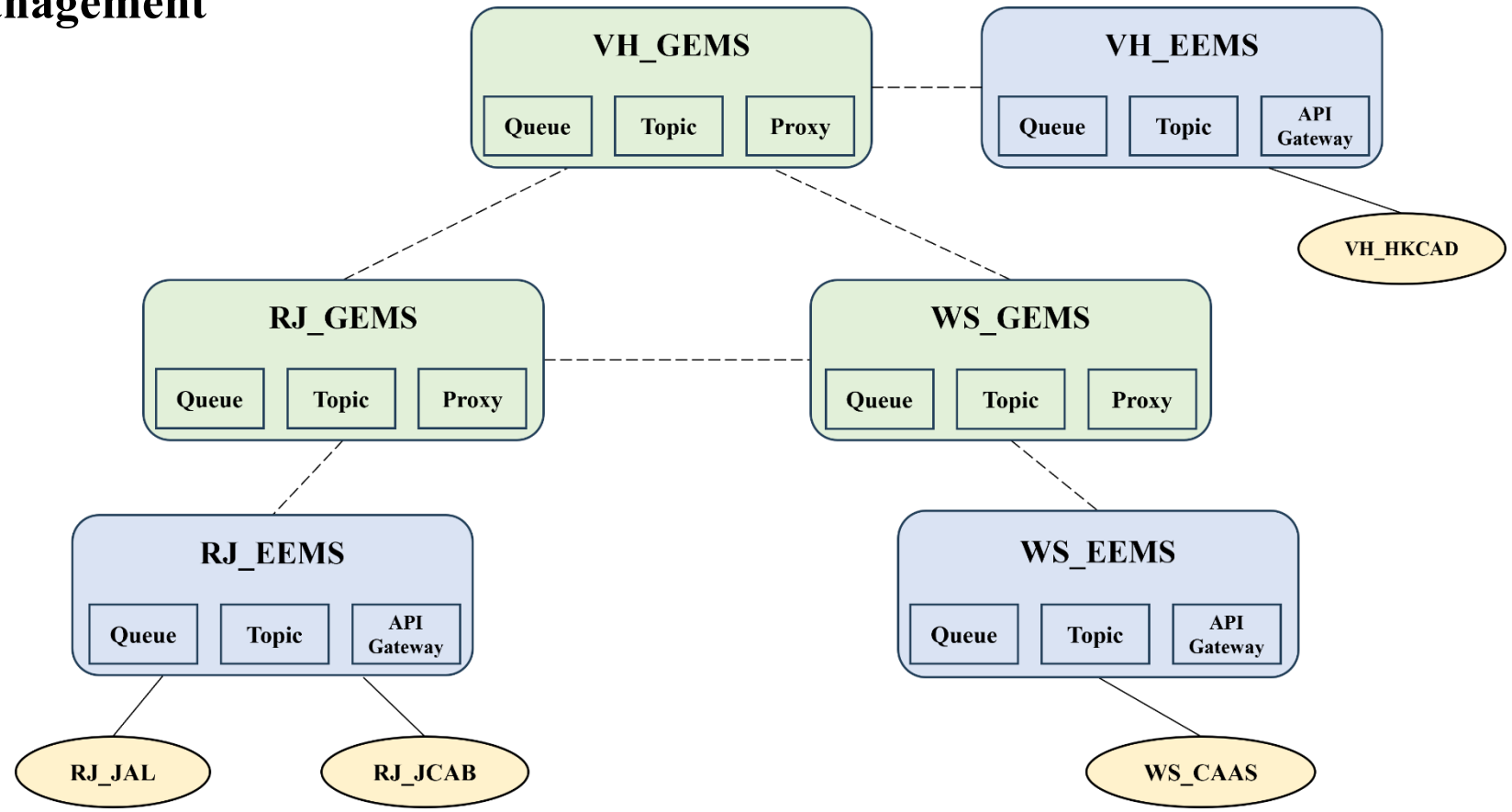
- **URI naming convention: http://{api-gateway-host}:{api-gateway-port}/{region-name}/{country-code}/{abbreviation-of-service-provider}/{service-name}/{category-version}/{resource}?{query-parameters}**



Approaches: Integration

➢ Considerations

- **Duplicate message handing**
- **Naming convention governance**
- **Policy management**



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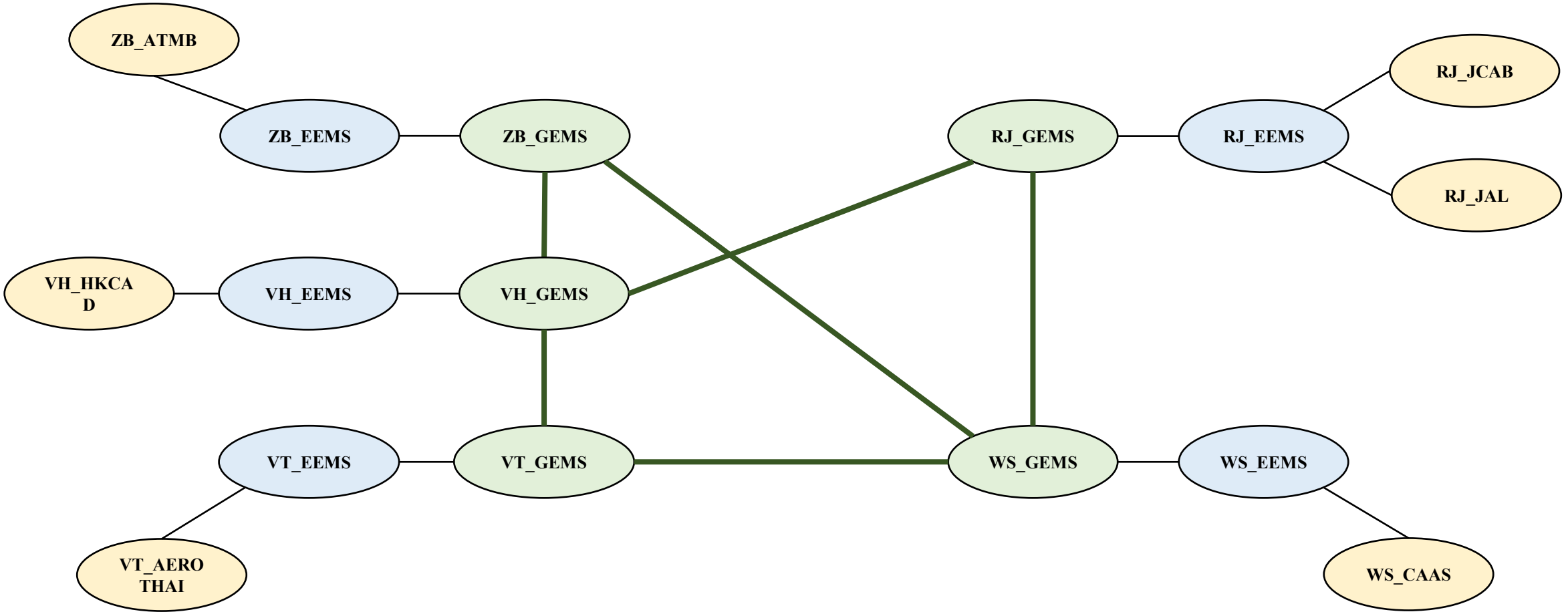
MEP Tests

➢ SIPG Task 2: Current connections



MEP Tests

➢ SIPG Task 2: Message exchange tests

Sender	Receiver	Asynchronous Request/Reply	Publish/Subscribe	Synchronous Request/Reply
RJ_JAL	RJ_JCAB	Filed Flight Plan: ○		NOTAM R/R: ○
	WS_CAAS	Filed Flight Plan: ○		
RJ_JCAB	RJ_JAL	Submission Response: ○	NOTAM P/S: ○	
	WS_CAAS		NOTAM P/S:	
WS_CAAS	RJ_JAL	Submission Response:		
	RJ_JCAB			NOTAM R/R:


Thank You!