

Implementation of WIS2 Node at JMA

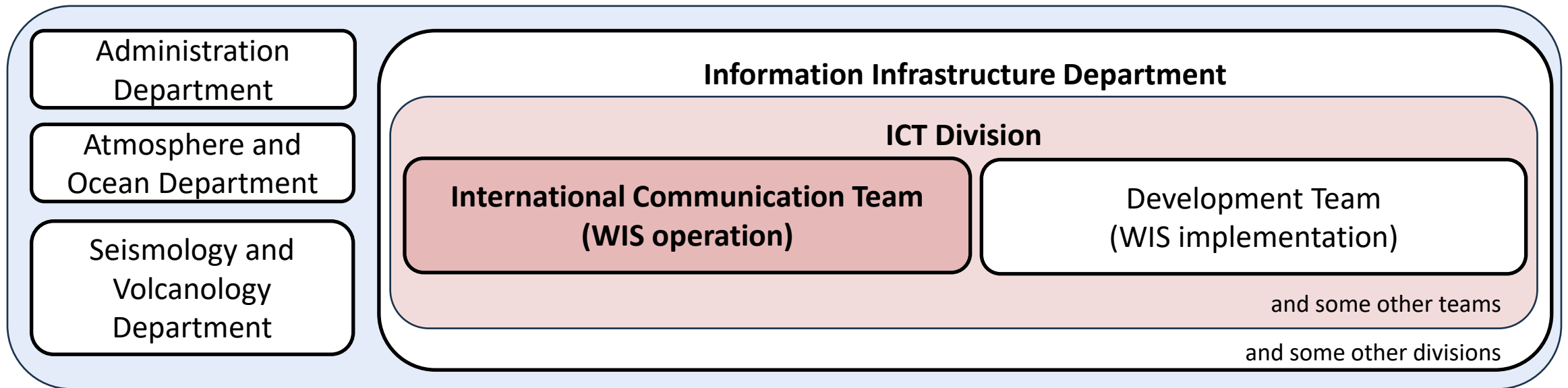
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Overview of JMA's organization

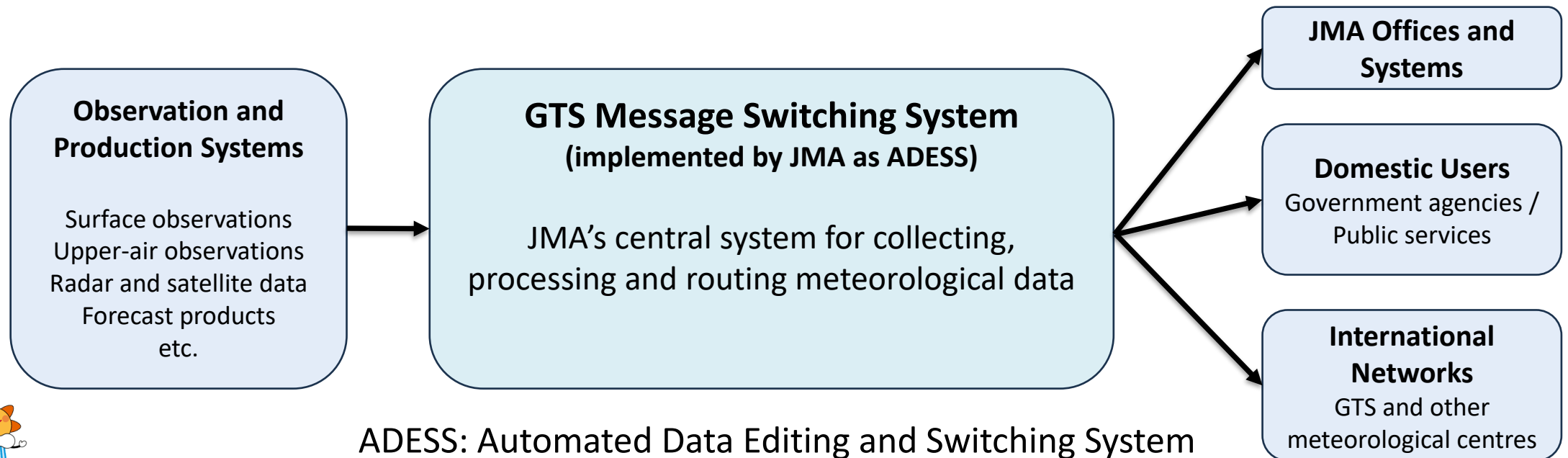
- GISC Tokyo team belongs to the International Communication Team in the Information and Communications Technology Division.
- We are mainly responsible for WIS operations.
- Our WIS2 services were implemented in-house by JMA's Development Team.



JMA Headquarters

Overview of JMA's data communication environment

- JMA operates its own GTS Message Switching System (MSS), called ADESS, to collect, process and exchange meteorological data.
- Our WIS2 services are connected to these existing operational systems through JMA's communication infrastructure.



Transition of our WIS2 Implementation

- We initially implemented our WIS2 Node with **wis2box** in 2024.
- We later decided to deploy our WIS2 services in **Japan's Government Cloud**.
 - Japan's Government Cloud is a common cloud service usage environment for information systems operated by individual ministries and agencies.
 - JMA uses it for various services, including its website.
- The Government Cloud requires the use of managed cloud services, and **virtual servers are not permitted** in principle.
- To meet these requirements, we implemented our WIS2 services (WIS2 Node, Global Cache, and GTS to WIS2 Gateway) using **AWS managed services** in December 2025.

AWS Services related to our implementation

- These managed services allow us to build the Node without operating virtual servers.



Amazon S3 (Simple Storage Service)

Object storage for input, working and published data



AWS Lambda

Runs processing only when triggered



Amazon ECS (Elastic Container Service)

Keeps applications running continuously



Amazon SQS (Simple Queue Service)

Queues processing requests and supports retries



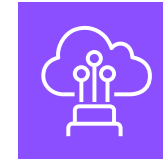
Amazon DynamoDB

Stores metadata information used by the Node



Amazon CloudFront

Provides HTTPS access to published data



AWS Direct Connect

Allows dedicated line to access cloud environment

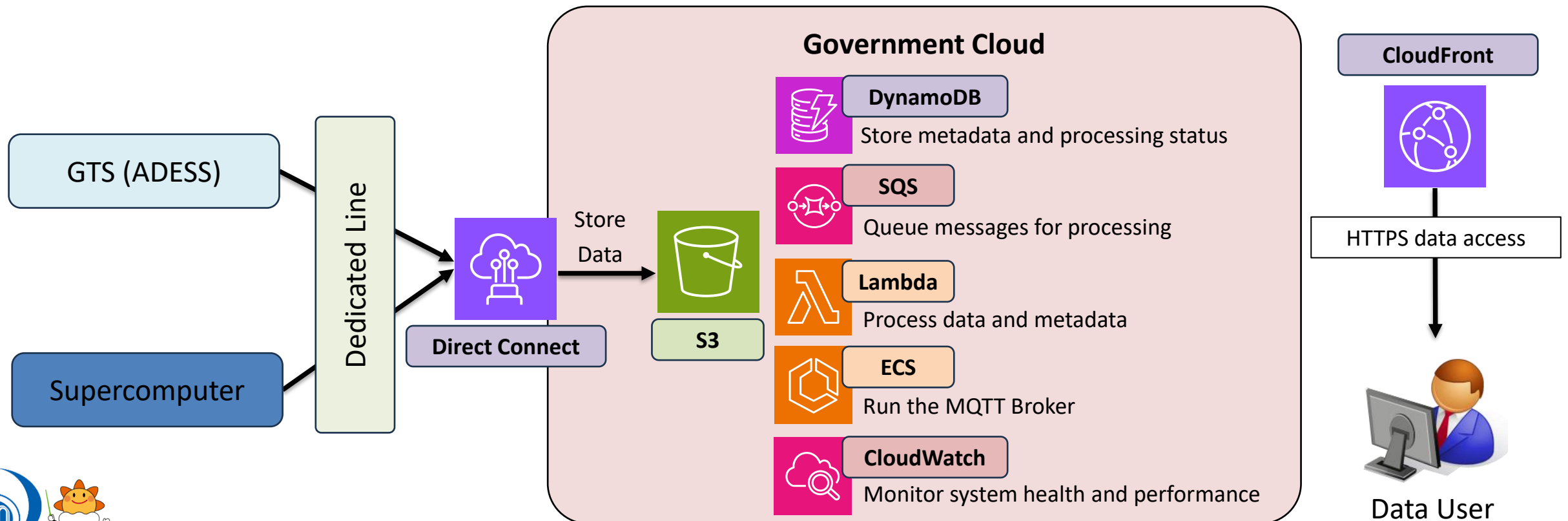


Amazon CloudWatch

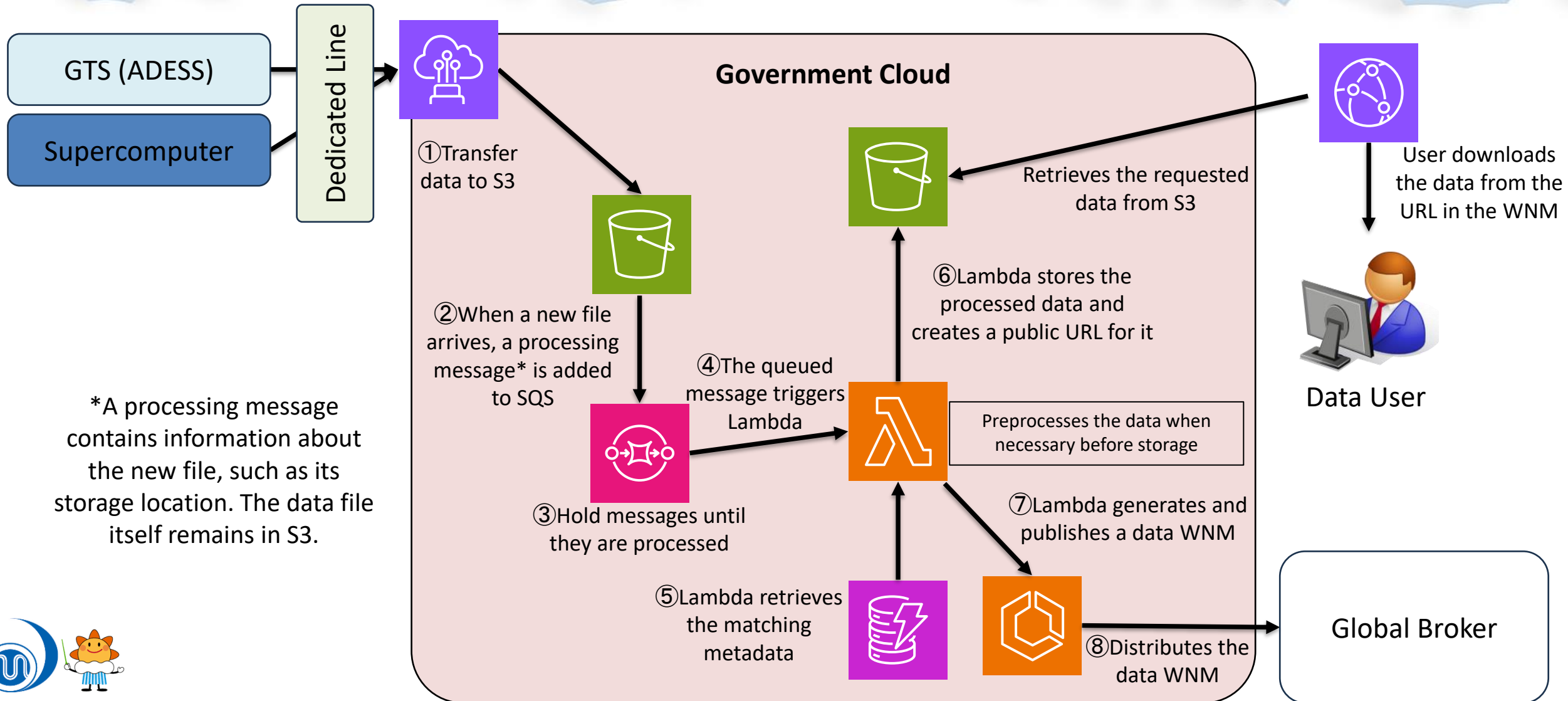
Provides logs, monitoring and alarms

WIS2 Node Architecture on AWS

- The main WIS2 Node functions are separated into independent components using AWS managed services.



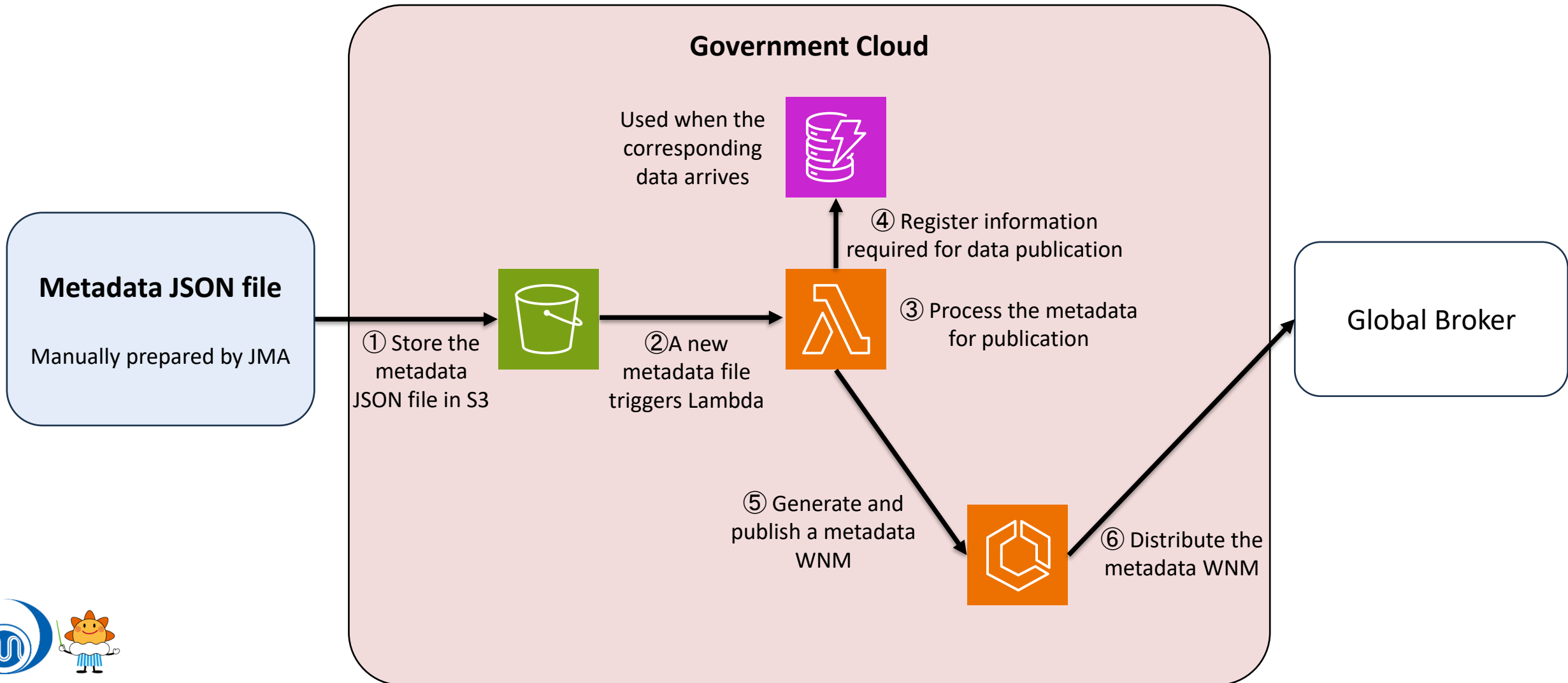
Data Publication Flow



Data processing for WIS2 publication

- Example: preprocessing of domestic SYNOP data
 - JMA receives domestic SYNOP BUFR containing observations from approximately 154 stations.
 - The message is separated into individual station data.
 - **wis2box-api** (wis2box-bufr2bufr) is then used to generate station-based BUFR4 with the required station information, including the WIGOS Station Identifier.
 - The resulting data is returned to the common routing process and published through the WIS2 Node.

Metadata Publication Flow



How the WIS2 Node Uses Metadata

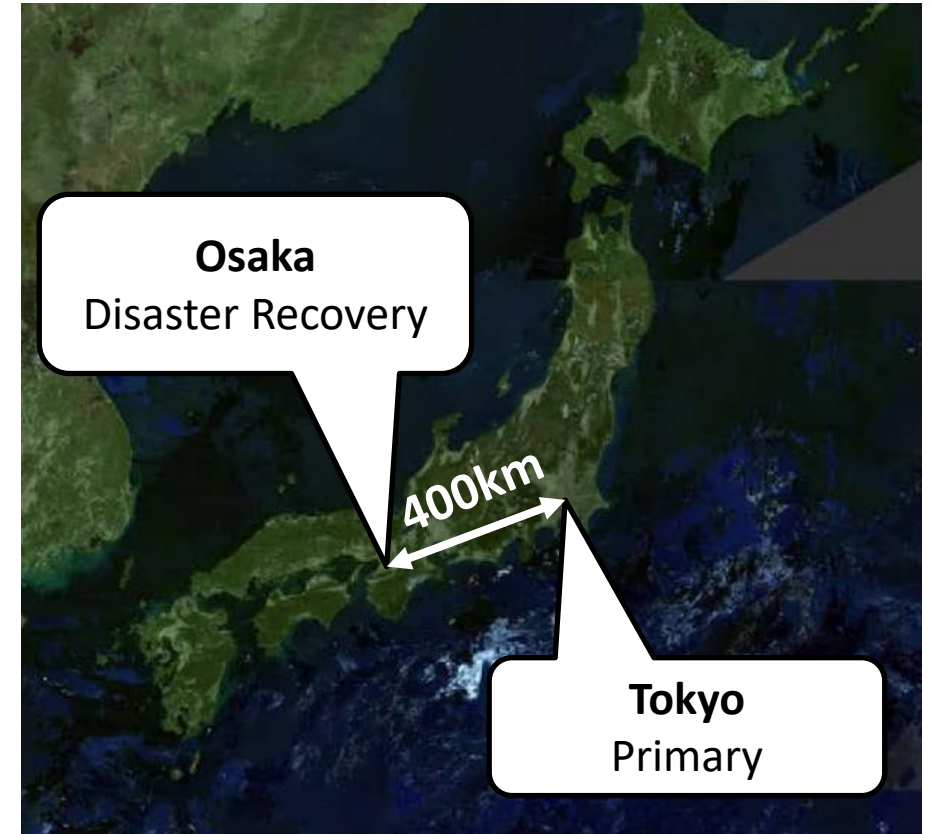
- A Lambda  function publishes the metadata WNM and registers the information required for data publication in DynamoDB .
- When observation data arrives, the WIS2 Node looks up the corresponding metadata before publication.
- The Node uses the registered metadata to:
 - determine the topic for publishing the data WNM
 - determine where the data is stored in S3
 - set the location information in the data WNM
 - link the data WNM to the corresponding metadata record

Error Handling and Monitoring

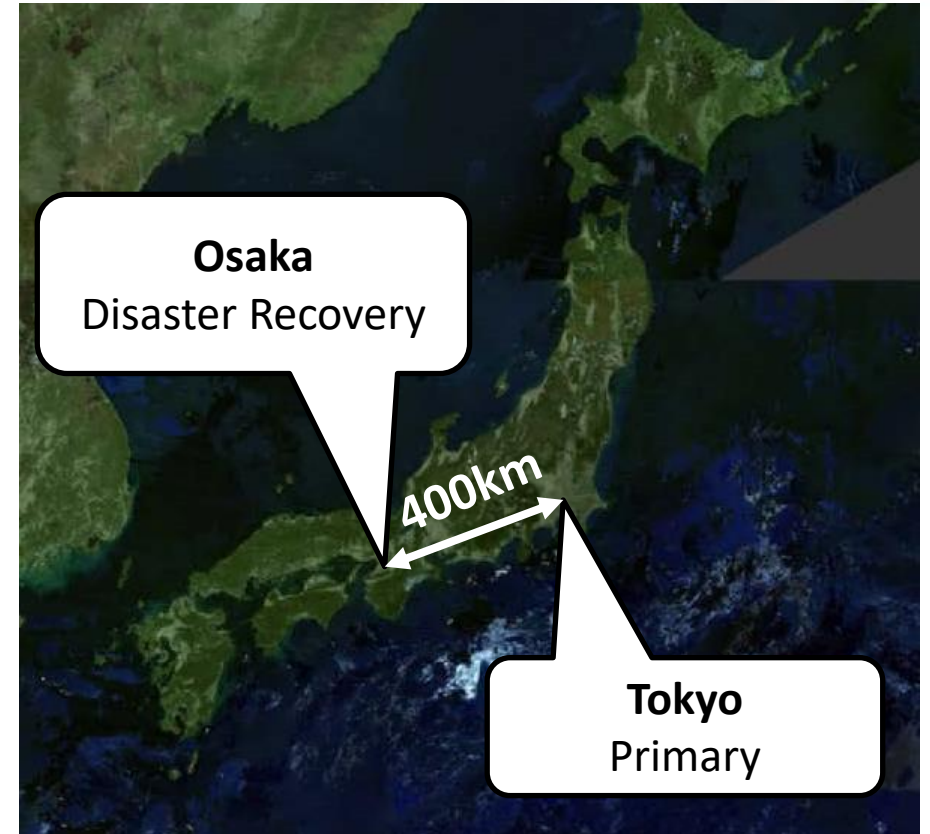
- Error Handling: **Separate failed messages to keep normal processing running**
 - Processing components are connected through SQS  queues.
 - Temporary failures are retried automatically.
 - Messages that repeatedly fail are moved to a Dead-Letter Queue (DLQ) for operational handling.
 - MQTT publication also reconnects and retries when a runtime error occurs.
- Monitoring: **Use AWS monitoring services** 
 - CloudWatch Logs: records processing and error logs.
 - CloudWatch Alarms: monitor selected queue and error conditions.

Redundancy

- JMA ensures geographical redundancy for its critical systems by operating network systems at separate sites in Tokyo and Osaka.
- The WIS2 services follow the same concept by using **AWS Regions in Tokyo and Osaka**.
- The same functional components are deployed in both regions, reducing dependency on a single Region.



Redundancy



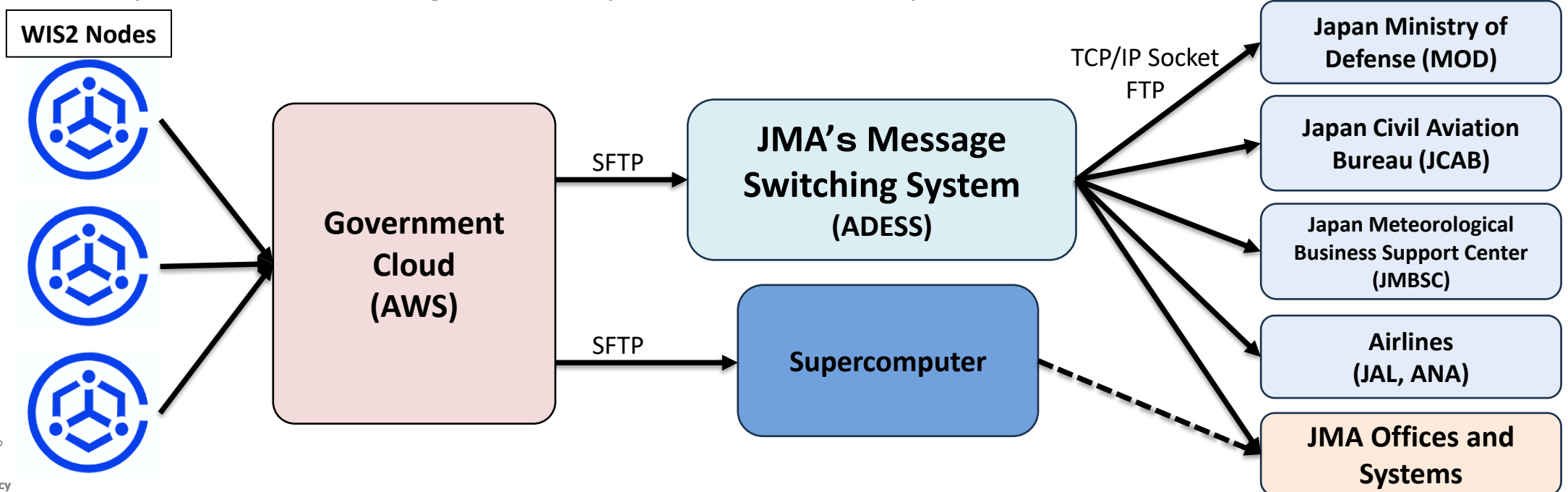
For comparison:
Frankfurt–Hamburg: 393 km

Current Operation and Future Expansion

- Current Operation
 - SYNOP (154 stations, hourly) is currently published through JMA's WIS2 Node.
- Adding new data
 - Prepare or update WIS2 metadata
 - Add data-specific preprocessing only when necessary
 - Planning to publish the following data
 - Upper-Air Observations (TEMP), Wind Profiler
 - Climate (CLIMAT, Daily CLIMAT)
 - Oceanographic Data (TESAC, TRACKOB)
 - Surface Observations (BUOY, SHIP)
 - Aircraft-based Meteorological Observations (AMDAR)
 - Satellite Observations (SAREP, Clear Sky Radiance (CSR), Atmospheric Motion Vector (AMV), DBNet)
 - Numerical Weather Prediction (NWP) Data
 - Warnings

WIS 2.0 Data Usage

- JMA is considering providing WIS 2.0 data to internal users and external organizations using the existing connection methods.
- The WIS 2.0 data obtained should be transferred as files, and therefore file naming conventions are important.
- Some data are already available only through WIS 2.0, and therefore it is necessary to establish internal procedures and begin data acquisition as soon as possible.



Thank you for your attention