LOCAL SWIM

Avitech is striving to address the needs of both system-wide information management data providers and consumers through its own localized solution

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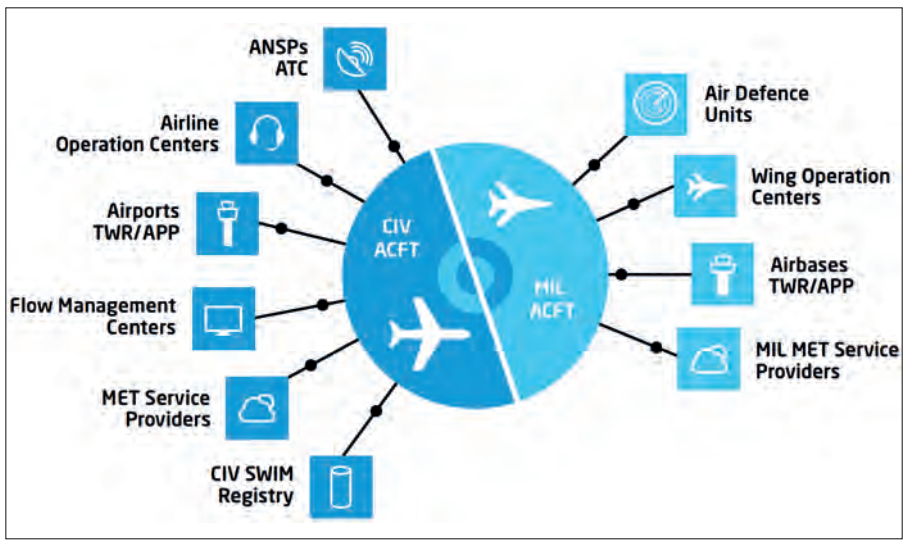
Information is the essential commodity for any ATM stakeholder and its timely provision over interoperable means is key to the success of any enterprise. While this has been recognized in the past, it is becoming more and more important with the ever-increasing demand to accommodate air traffic, while needing to reduce the aviation industry's environmental footprint.

The singular means of meeting this demand is if all information is managed on a system-wide basis and made available to the relevant ATM stakeholders at the right time. This is the vision also presented in ICAO's Global ATM Operational Concept (GATMOC) and supported in its manual on ATM system requirements, where system-wide information management (SWIM) is defined as an explicit requirement for the future ATM system.

But what is the actual problem? The required data, which can make a huge difference in the improvement of ATM operations, is often locked within different organizations in systems that provide only proprietary interfaces. Many such systems are developed using a silo approach, which often makes it impossible to exchange the same information between two different systems in the same organization. This leads to multiple versions of the same data locked in different systems, and a loss of time and resources that usually leads to inconsistencies in the data and ultimately poses an increased safety threat.

Where is SWIM?

Since the publication of GATMOC, many advances have been achieved with SWIM on a global scale. Modernization programs such as NextGen and SESAR consider the introduction of SWIM a fundamental pillar for the future of ATM and provide detailed concepts and validation results. ICAO has explicitly dedicated two modules to SWIM in its Aviation Service Block Upgrades (ASBU), namely B1-SWIM and B2-SWIM. The ASBU methodology stresses the importance of SWIM and how essential it is for other ATM improvements, such as the provision of integrated meteorological information, trajectory-based operations, Flight and Flow Information for a Collaborative Environment (FF-ICE) concept, A-CDM, and so on.



The vendor industry has also made considerable progress on a local level and in the framework of international modernization programs like SESAR and NextGen. For example, providing instant and accurate MET data related to the approach control areas between en-route and terminal sectors presents a considerable challenge to air traffic controllers, especially when making critical decisions under bad weather conditions.

To tackle this issue using SWIM principles, research project Weather in ATM and CDM (WeAC) was initiated via a high-profile consortium consisting of Selex, Deutsche Flugsicherung (DFS), Air Traffic Control & Business Systems (AC-B), Deutscher Wetterdienst (DWD), and Avitech as the provider of SWIM technologies.

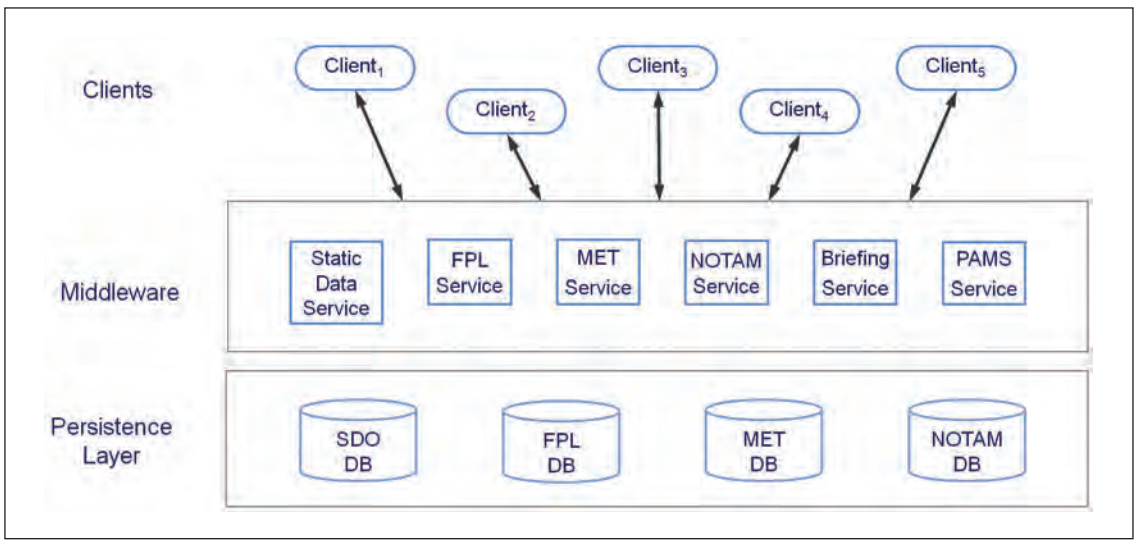
The consortium has developed a comprehensive SWIM MET solution, which provides air traffic controllers with essential MET data in a SWIM-compliant manner, using service-oriented architecture (SOA) and open standards.

Problem solver?

The definition of SWIM suggests that true global interoperability can only be achieved through the usage of standards for infrastructure, data and interoperable services. The introduction of SOA and industry standards fosters the reusability of components and simplifies the integration and interfacing between systems. With SWIM in place, applications can almost seamlessly connect to different standard services and mix the data they receive, possibly extracting new information.

The use of open technology standards makes it possible to reuse available software, simplifies integration and considerably reduces the overall cost for users. Finally, the loose coupling between different components supports their independent evolution by making the barriers between them essentially disappear.

In all concepts and studies, the focus has mainly been on the information providers who make their data available through interoperable services, while the way



Opposite: Bridging the information needs of all ATM stakeholders
Left (figure 2): Illustrates the standard three-layer SWIM system architecture
Below (figure 3): Direct connection to third-party systems

consumers interact falls short. Even in ICAO's Global Interoperability Framework, clients or SWIM-enabled applications are considered outside of SWIM.

The question is whether it would make sense or if it is feasible for each consumer application to establish its own connection to all relevant services. Avitech believes that for an optimal deployment scenario for large organizations such as ANSPs with consumer and provider applications, a 'local' SWIM deployment will be essential.

Local SWIM

In a standard SWIM deployment, the system architecture consists of at least three layers: a persistence layer where all the data is stored, and middleware which follows the SOA principles and offers services to the clients in the layer above (see figure 2).

This architecture is fine for central data providers where the different clients are implemented by different organizations, but in aviation and especially in a SWIM world, it is likely that the organization will have clients that need the same data and hence connectivity to the same third-party systems.

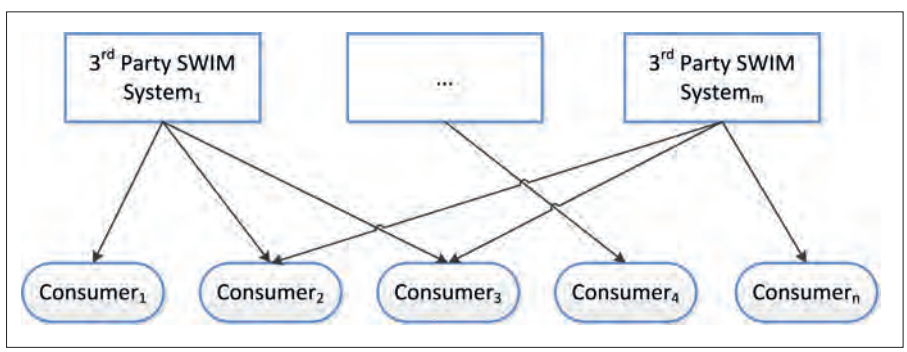
If each internal system in one organization relies on its own connection to each external system, the risk for failure or loss of service increases while wasting resources, since all of them will require the same implementation.

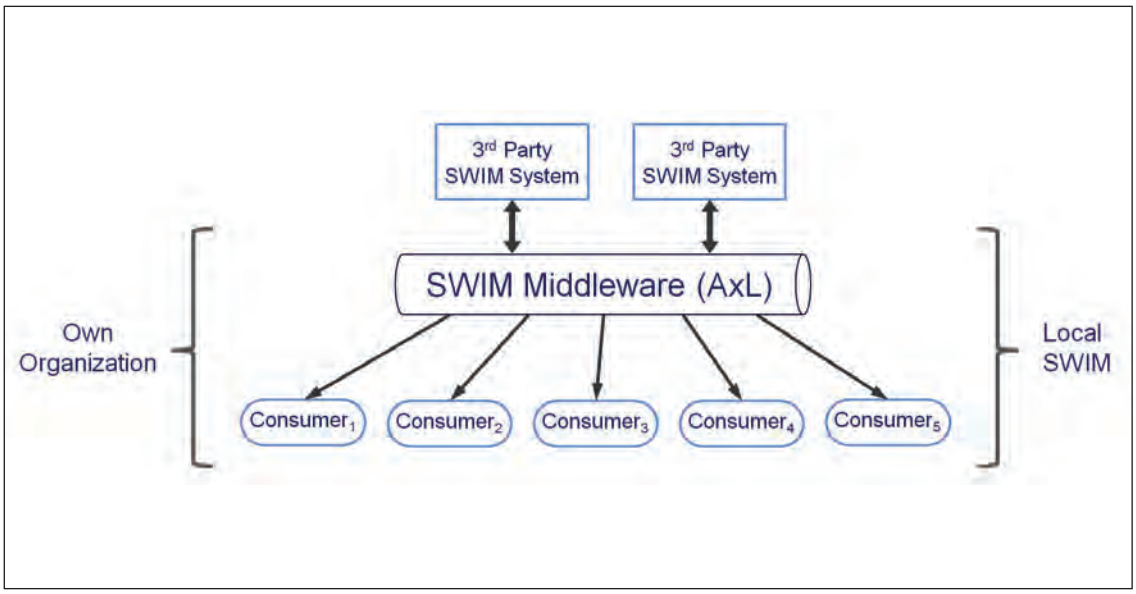
With the help of an advanced SWIM middleware solution like the Aeronautical Exchange Layer (AxL) from Avitech, organizations can implement a cost efficient, reliable and flexible solution that allows for quicker deployment and enables experts to focus on their specific tasks. The advantages of the proposed solution include its ability to be used for local data consumers from third-party systems, while the same architecture can be used to host the services and data provided by the same organization.

Encapsulating the SWIM technical infrastructure in a middleware solution such as AxL is advantageous for both consumers and producers of information. It removes the need to research standards and properly implement the required technical interfaces by already providing reusable components and subordinating the individual details of the actual standards.

This approach also has the advantage that changes to external interfaces over time, or implementation of new ones, need only to be addressed in the middleware and remain completely transparent to internal clients.

In the future, compliance testing will nonetheless continuously grow in





Left: Consumers communicating through a local SWIM middleware
Centre: Latest AxL WFS v2.0 compliance badge
Below: Local SWIM deployment in the case of network manager (NM) B2B connectivity

importance for both clients and middleware, and will be essential for a smooth integration in a heterogeneous environment. AxL comes with a client and server compliance test-suite to ensure proper client behavior and to verify and confirm backward compatibility. AxL adheres to external compliance certification and offers one of the three OGC WFS v2.0 reference implementations, while being one of the world's first products to pass all compliance tests for all conformance classes.

Following the SWIM principles and using open standards for the deployment of SWIM middleware fosters total interoperability of the organization. It is also clear that a generic implementation will not suit all needs, especially during the transition phase to a complete SWIM environment. AxL supports SWIM-specific interfaces but goes above and beyond, offering bridging and mediation between existing AFTN/AMHS and future SWIM clients.

This functionality will be essential as migration to SWIM will not take place in a one-step, short-term approach, but will likely involve lengthy transition phases to accommodate the different renewal lifetimes of the various systems.

Deployment

It is no secret that the deployment of SWIM and SOA in an organization does not provide a sole direct financial benefit. Rather, it lays the foundation to implement and perform activities with a positive ROI. Nonetheless, studies and discussions about SWIM have seen the consumer side come up short. The feasibility in practical terms related to required communication bandwidth, the number of supported connections, or economic rationality of having clients implement all sorts of interfaces, are best left for a discussion at a later stage.

Avitech's solution is to deploy a local SWIM solution to aggregate information, limit the number of messages that need to be exchanged, and provide a single access point to third-party systems. This allows new systems to connect to the local middleware, eases evolution of the systems, helps with backward compatibility, removes the need for multiple implementations of the same interfaces, and concurrently helps solve the problems of producers and consumers of information in a data-centric environment. ❖