# Architectural Case: SAS

2004-12-13

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SERVIAM-ARC-08

Version 1.0

5 pages

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# 1  Introduction

This document describes the use of web services in the airline company SAS. The IT experience in SAS ranges back to 1966. The work with web services started in 2001 when they and implemented one of the first web services in the world and the first to use MS UDDI. The material in this report is based on presentations and discussions from a meeting with representatives from SAS in May 24, 2004. The main material is provided by Björn Fagerstedt, who hosted the meeting. The document describes the way SAS currently approaches web services.

# 2  The IT organization

SAS  is a conglomerate of several whole and partly owned airline companies. They also own hotels, and land-based transport companies. The internal IT department mainly works with system acquisition and maintenance. There are about 100 employees with profiles like project managers, system specialists, and architects. The major part of development and operation has been outsourced to CSC. It was formerly a subsidiary, Scandinavian IT Group / SAS Data

## 2.1  IT platforms

The early IT-systems ran on Unisys mainframes. Many important applications still run on this platform although there are plans for replacing some of the more heavy systems. Here COTS solutions are considered.

Beside Unisys there are nowadays several other platforms. Current development is based on .NET and Websphere.

# 3  Use of Web services

The first web application in spring 2001 was for mobile rebooking and used PDAs as clients. This service was made available to external users and used UDDI.  It has since been abandoned and replaced by other solutions.

Later use of web services has been for internal use. Lately however SAS has taken an interest in also providing external services as described below.

## 3.1  Internal web services

Several web services have been implemented based on the existing applications. Examples are Station Area (check in), Marketing and Sales, and Customer Operational Data Store.

### 3.1.1  Web Check in

The web check in service is basically an encapsulation of existing Unisys-based transactions using Open TI from Unisys and the Tibco integrator. Additional functionality is built using Websphere and made available on SAS website. This has been a successful implementation and additional services are being added.

### 3.1.2  Marketing and Sales

Services in the Marketing and Sales area are based on a common customer data base and are developed using .NET. Some applications are also using BizTalk. The architecture principle is SOA, Service Oriented Architecture. Several other technical platforms are also connected to the

database such as MQ, DB2, and AS400. Several batch applications have been replaced. This consolidation has revealed inconsistencies in the business logic.

### 3.1.3  Customer Operational Data Store

The Customer Operational Data Store is built with SQL server, C#, and .NET. The web services are modeled according to the SAS Enterprise Information Model (see below). Synchronization with other customer data sources is done using BizTalk.

A SOA "microstrategy" is also being used to encapsulate several common functions in the business Intelligence area.

## 3.2  SAPI – Self-booking API

The Self-booking API, SAPI, is a set of public web services directed to customers with agreement relations and "intermediaries". They offer the same business logic as is available on SAS Internet booking platform (s.net). Examples of services are Seat Availability, Reservation, and Ground Transport. SAPI uses SSL with client certificates. It is developed on .NET. Fig 1 shows SAPI in its environment. PCI is the Departure Control System running on Unisys. SAPI uses another set of web services – the "web check in" which is the previously mentioned encapsulation of the Unisys systems.

SAPI represent a recent change in SAS web service offerings. Except from the first experiment all services up to SAPI have been internal. SAPI services are external.
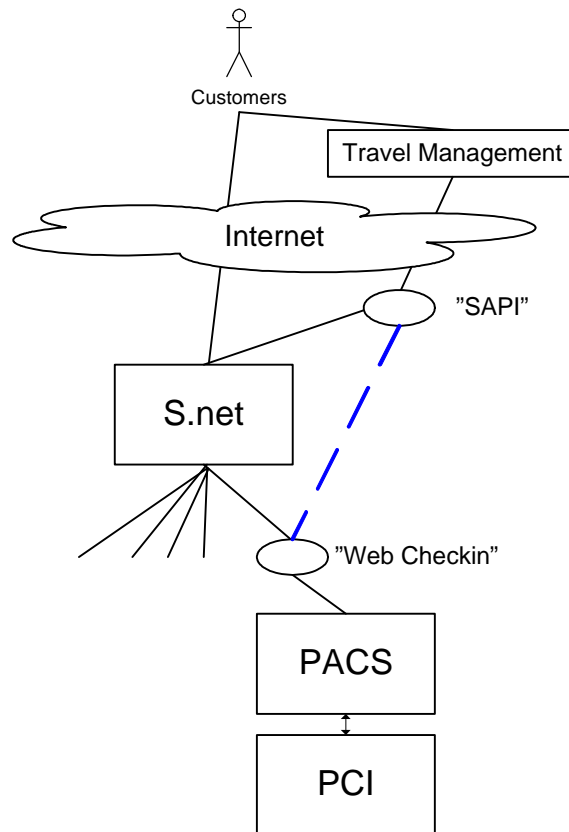
*Figure 1, The SAPI web services*

### 3.3 SOA and WS

SAS IT is currently working on the future direction of the web service work. First they focus on the definition of services from a SOA perspective. Other issues are to decide on how the development and maintenance of SOA should be managed and when and by whom the services should be used. The need for a web service catalogue is also recognized.

Current experience with maintenance of SOA is that the multi tier structure makes it difficult to debug.

## 4   WS related work

The over all IT architecture is based on the idea with business objects, large grain enterprise specific building blocks. Many of the web services relate to specific business objects. A common feature of most business objects is that they encapsulate data about important business concepts such as customers and products.

The data situation in SAS is similar to many other large companies with a long IT history. The data base inventory has grown with little central control resulting in duplicates and differences in data definitions and encodings. SAS estimate that they have data redundancy factors between 6 and 10, and they also suffer from varying data quality. As an example SAS have identified 36 different customer data bases.

To improve on this situation the SAS Information Management, IM, initiative has been launched. Its goal is to develop a common data model where all data are defined. The ultimate goal is also to provide a single source and a single owner for each data item.

Company data are partitioned in ca 15 subject areas (i. e. basics for business objects) which together form the Enterprise Information Model (EIM). Each subject area contains 50-100 entities. Models will be developed on the conceptual, logical, and physical levels. The models will be based on the existing systems and on the common IATA standard. The EIM will not contain enterprise data that does not exist in any IT-system. The detailed data definition is done by separate projects. The corporate Data Manager handles problems resulting from crossing boundaries and differences in opinion.

The proposed future service oriented architecture will build on the EIM and its subject areas. Each subject area will offer services via service components that form a layer above the data bases.

The current IM project works bottom up. The services are based on functionality in the existing IT-systems. There is no connection to any business processes. The reason is historic. Previous work on process definition has not had any follow up and is therefore outdated and in practice not reliable.

## 5   Summary

SAS has been active in web services practically since its start. The main effort has been for internal use. Recently they have begun to expose services externally.

The over all SAS IT architecture will be transformed to a SOA style. This reflects the increased interest in both data consolidation and external connections. Web services will be an  important technology when implementing this architecture.

## 6   References

Fagerstedt B. SAS Web service work. Powerpoint presentation. In Swedish.