



Service Description Conceptual Model (SDCM) Usage Scenarios

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1 Introduction

Jointly developed by the U.S. Federal Aviation Administration (FAA) Next Generation Air Transportation System (NextGen) System Wide Information Management Program (SWIM) and the Single European Sky Air Traffic Management (ATM) Research Programme (SESAR) Joint Undertaking (SJU), the Service Description Conceptual Model (SDCM) [SDCM] provides a graphical and lexical representation of the properties, structure, and interrelationships of all service metadata elements, collectively known as a *service description*. Published as a Working Draft in 2014, SDCM 1.0 defines a conceptual model based on the consistent application of Service-Oriented Architecture (SOA) principles, with the primary goal of supporting SWIM governance at both FAA and SESAR. SDCM 1.0 also establishes consistent semantics for concepts used in documentation for SOA-based services.

This document presents a set of scenarios for the future use of SDCM. These scenarios are envisioned to be used to assess the completeness of the SDCM specification, and guide its further enhancement and expansion.

2 Background

SOA governance intersects with a number of information technology (IT) areas such as enterprise architecture, software and system development, as well as IT infrastructure administration, each with its own modeling standards and practices. The service description serves as a common representation of service-related metadata throughout the service's lifecycle. As such, SDCM is integral to establishing resource-to-resource interoperability among SOA components and critical to supporting various aspects of SOA governance in the context of SWIM implementation.

SDCM leverages significant efforts that academia and industry have invested in developing standards and best practices for describing services. The most fundamental and recognizable standard in this area is the Web Services Description Language (WSDL) specification [WSDL] set forth by the World Wide Web Consortium (W3C). Other notable developments include the Open Geospatial Consortium (OGC) Web Services Common Standard [OGC-STD], W3C's Web Application Description Language (WADL) specification [WADL] and W3C's OWL-S: Semantic Markup for Web Services [OWL-S].

Both NextGen and SESAR had made parallel efforts in SOA and had already established their own methodologies for the consistent description of services. Under the umbrella of SJU Coordination Plan CP2.1, the two organizations agreed on the need to develop a shared conceptual vision of a SOA service description, leading to the publication of SDCM 1.0 in April 2014. Since then, SDCM has played an important role in the development of a number of NextGen and SESAR initiatives, including supporting the publication and discovery of SOA services in the National Airspace System (NAS) through the NAS Service Registry and Repository (NSRR).

3 Motivation and Approach for SDCM 2.0

As the aviation community embraces SOA, services have become the primary means through which IT capabilities are delivered in air transportation systems. This trend has presented both challenges and opportunities for SDCM. On the one hand, services may be modeled differently by organizations according to their own governance structures and policies. On the other hand, effective discovery and reuse of services require exchange of service descriptions across organizational boundaries despite these differences.

To address these challenges, NextGen and SESAR have adopted a usage-driven approach to evolve SDCM. In this approach, potential usage scenarios to be supported by SDCM 2.0 will be collaboratively identified. Revisions to the model will be made to identify common metadata elements required for the scenarios.

3.1 SDCM Evolution Approach

Usage scenarios focus on specific needs for the description of services in a particular context. As different scenarios influence the evolution of SDCM, certain principles need to be followed to reconcile conflicting requirements. The SDCM:

- a. Shall reuse existing standards as much as possible;
- b. Shall not impose design constraints on services;
- c. Shall not be specific to a single community;
- d. Shall not define the optionality of its elements (e.g., an element is only mandatory when understood in a particular usage scenario with a specific governance context);
- e. Shall be technology agnostic.

3.2 SDCM Usage Approach

When in a particular usage scenario there is the need for describing a service based on SDCM, the following is recommended:

- a. In the case of not all information being relevant for the particular usage scenario: create a subset of the SDCM that is applicable to the scenario.
- b. Identify the optionality of the selected elements. Some of the selected elements might be applicable although the particular usage scenario does not consider them as mandatory.
- c. Create the data format specific to the usage scenario (e.g., XML Schema Definition, Text). As SDCM is technology agnostic, it is not intended to have an associated physical model.

4 Usage Scenarios

4.1 Service Registry Development

SDCM can be used for the implementation of registry data structures as well as for the implementation of an application program interface (API) that would allow the exchange of

data between registries. In today's service registry market, there is no standard specific to services.

SDCM provides a common data model for the publication of services in a service registry. Developers of a service registry can use SDCM as the basis for developing logical and physical data models. The platform-independent service description, expressed in Unified Modeling Language (UML) [OMG-UML], can be transformed to a number of database schemas supported by relational and non-relational databases.

4.1.1 Information Exchange between Service Registries

Registry developers can use SDCM to develop common representations of SWIM-enabled services so that the service descriptions can be exchanged among registries. Such a capability is critical to support the SWIM Common Registry (SCR) vision [SCR-CONOP] articulated by NextGen and SESAR.

As SOA-based services are developed and published in registries, the SCR is envisioned to be a comprehensive, systematic, and dynamic mechanism for publishing, discovering, and understanding information catalogued in different service registries. The SCR will provide SWIM stakeholders in both organizations with a shared view and insight into all known SWIM-enabled services, help service implementers to improve reuse by taking advantage of parallel efforts, support software developers in building interfaces to services, and facilitate governance efforts in the context of participating organizations.

SDCM supports establishing interoperability between SWIM registries at various levels, including legal, organizational, semantic, and technical. The rich set of metadata defined in SDCM can be used to further enforce information access policies established by each organization.

4.2 Semantic Web and Linked Data Application Development

Ontologists can use SDCM as a commonly agreed upon conceptualization of a service description to develop artifacts that can be utilized in Semantic Web and Linked Data applications. Service information structured according to SDCM can be serialized into a Resource Description Framework (RDF) format and stored in a triple store.

Once in an RDF format, the service information can be linked to other data sources to provide a rich context for services. For example, a service could be tagged with concepts from an aviation ontology or taxonomy (such as a "phases of flight" taxonomy), or linked to organization records describing service stakeholders. This context can then be used to implement advanced query capabilities to allow service discovery based on the likely intent of the user instead of the ordinary keyword search.

4.3 Service Artifact Mapping and Translation

SDCM can be used to create a number of different service description artifacts. For example, communication of service information with stakeholders and business units often requires human-readable, formal service description documents. However, having the service description concurrently developed as both a human-readable document and a set of service

registry metadata may not only lead to duplicate maintenance efforts, but could also result in introducing information inconsistencies.

SDCM addresses this issue by offering a canonical model for services that can be used for developing various service description artifacts. In addition to producing human-readable documents, other artifacts can also be created from SDCM, including:

- WSDL-based service descriptions and XML schemas for service payloads;
- Enterprise architecture artifacts based on standards such as the NATO Architecture Framework and Unified Profile [NAF] or the Department of Defense Architecture Framework (DODAF) [UPDM].

4.4 Controlled Vocabulary Development

Taxonomy and vocabulary developers can use SDCM as a basis for developing a controlled vocabulary or a set of taxonomies to promote a technical means for describing all relevant aspects of a service in a manner suitable for both human-readable and machine-processable representations. SDCM itself provides a comprehensive list of terms with clear and unambiguous definitions that can be reused to create more controlled vocabularies, which could then be related to SDCM through the application of principles of Semantic Web and Linked Data initiatives.

5 References

[NAF] NATO Architectural Framework, <http://nafdocs.org/>

[OGC-STD] OGC Web Services Common Standard, Version 2.0.0, Open Geospatial Consortium Inc., 7 April 2010. <http://www.opengeospatial.org/standards/common>

[OMG-UML] OMG Unified Modeling Language TM (OMG UML), Infrastructure, Version 2.4.1, August 2011. <http://www.omg.org/spec/UML/2.4.1/Infrastructure/PDF>

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[SCR-CONOP] FAA/SESAR, Concept of Operations for the SWIM Common Registry, April 2015. <http://www.faa.gov/nextgen/programs/swim/governance/outreach/media/SCR%20CONOPS%20FINAL%20DRAFT%2004042015.pdf>

[SDCM] Service Description Conceptual Model (SDCM 1.0), SESAR CP 2.1 Working Draft March 28 2014. <http://www.faa.gov/nextgen/programs/swim/governance/servicesemantics/view/SDCM%20Mach%2028%202014/SDCM%20March%2028%202014.html>

[UPDM] Unified Profile For The Department Of Defense Architecture Framework (DoDAF) And The Ministry Of Defence Architecture Framework (MODAF), Version 2.1. <http://www.omg.org/spec/UPDM/>

[WADL] Web Application Description Language, W3C Member Submission 31 August 2009, <http://www.w3.org/Submission/wadl/>

[WSDL] Web Services Description Language (WSDL) Version 2.0 Part 1: Core Language, W3C Recommendation, 26 June 2007. <http://www.w3.org/TR/wsdl20/>