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Intelligent transport systems — Using web services (machine-machine delivery) for ITS service delivery —

Part 2: Elaboration of interoperable web services' interfaces

Utilisation des services du Web (livraison de machine à machine) pour la livraison de services ITS

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

ISO 24097 consists of the following parts, under the general title *Intelligent transport systems — Using web services (machine-machine delivery) for ITS service delivery*:

— *Part 1: Realization of interoperable web services*

— *Part 2: Elaboration of interoperable web services' interfaces* [Technical Report]

The following parts are under preparation:

— *Part 3: Quality of service* [Technical Report]

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Introduction

ITS services have been evolving from single functional and limited area services, to services in which many systems co-operate to provide effective and efficient services across a wide area. In today's world, ITS services are required to communicate not just with other parts of the same ITS service provision, but between different ITS services, and even with non-ITS services or a user's system directly. (Some examples of these systems are communication with/between traffic management, route guidance systems, security systems, environment protection systems, private freight management systems, and transport-related electronic payment service with banking or credit industry.)

These systems (even those limited to ITS services) are usually deployed in a heterogeneous circumstance, use different hardware, different operating systems (OS), middleware, or development (programing) languages. This therefore creates a challenge in order to realize system coordination across the organizations in a way that is flexible, quick, and at reasonable cost. Web services (WS) are a recent methodology that overcomes these difficulties. Using WS technology for ITS services can significantly simplify and reduce the cost of internet based service provision, which may well affect the level and speed of take up of use of ITS services.

WS require a lot of functionalities, and as a result, architecture is indispensable. WS standardization organizations construct standards by Service-Oriented Architecture (SOA). SOA is an evolutional form of distributed computing and object orientation.

By applying SOA based standards to the ITS services, the following effects are expected.

From a business viewpoint:

— increased service value;

— internationalization;

— expansion to the business automation.

From a system development viewpoint:

— Easy and quick development of ITS service coordination and service area expansion;

— WS enables system developer focus on "WHAT" not "HOW". "HOW" is covered by standard-based tools. This enables quick and easy system software development;

— WS standards have a composable structure, and so promote reusability of software by SOA;

— Easy connection to a legacy system.

In the ITS sector, message standardization of many applications have already been completed, are well-advanced, or are determined regionally. Message standardization is intended to improve system coordination, interoperability, and re-use. So the conditions for WS are considered already mature. In addition, the use of WS will increase the flexibility of ITS services to interoperate and communicate beyond the ITS sector and in areas where the delineation between ITS services and general commercial services converge.

From the viewpoint of WS standards evolution, 2007 was an epoch-making year. Web Service Description Language (WSDL) 2.0 became a W3C recommendation. Corresponding with this, relevant WS specifications were standardized by open standard bodies (W3C and OASIS). These standards cover all functional layers. Using these standards, the ITS sector has a sound base for interoperable WS.

ITS service collaboration with other sectors is expected to increase mutual effectiveness. Globalization of economies also requires communication across the domains and jurisdictions. All these collaborations rely on the interoperability of services. Interoperability can be achieved if based on open international standards.

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WS was created to use distributed network resources in an interoperable way. However, to realize interoperable WS various functionalities are required.

In most ITS services, availability and quick recovery from a fault is critical. Business process management and monitoring help to realize these requirements. Business Process Execution Language (BPEL) is considered one method. It is based on web services. BPEL also enables various services combination and automatic execution of business process. All these apply to web services.

This Technical Report presents a base of high quality ITS services with easy and quick development as well as a base for further service expansion.

"Using web services (machine-machine delivery) for ITS service delivery" has been developed considering these requirements. ISO 24097 consists of three parts: ISO 24097-1, ISO 24097-2, and ISO 24097-3. ISO 24097-1 is an International Standard. ISO 24097-2 and ISO 24097-3 are Technical Reports.

ISO 24097-1 focused on an approach to realize interoperable ITS WS. ISO 24097-2 and ISO 24097-3 are example based documents that show how to realize interoperable ITS web services that are already described in ISO 24097-1.

Fundamental concept

Metadata, as this term reminds us, may be considered a higher level description of requirements and constraints of a web service. Metadata are, by its nature, declarative. Declarative means one **does not care about how to realize requirement**, but only about **what functionality is wanted in a WS**.

ISO 24097-1 proposed to construct metadata description based on standards. Recap key points of ISO 24097-1 are as follows:

a) To construct interoperable WS, standards-based **metadata description** is mandatory. This also implies a technical contract between service provider and service consumers.

b) WS service description metadata consists of ***interface metadata*** and Quality of Services (***QoS) metadata***. Only by describing both metadata could WS be interoperable. In addition to interoperability, this metadata provides the following:

   1) easy development of WS starting from requirements and constraints (top down approach);

   2) quick and effective and high quality system delivery of service from metadata with support from a software tool called a generator (especially this feature is especially important for a service consumer);

   3) readily realize service evolution and maintenance throughout its lifecycle.

c) ***Interface*** metadata describes the interface between a service program and a service consumer program. Therefore, this metadata represents interface contract between service provider and consumer. This information is published by the service provider and evaluated by potential consumers. This metadata are expressed in Web Service Description Langage (WSDL).

d) ***QoS*** metadata are composite of domain specific requirements and constraints such as security, reliable messaging, message addressing, Simple Object Access Protocol (SOAP) message transmission optimization. ***QoS*** metadata are described using WS-Policy. WS-Policy is constructed by two standards; "WS-Policy 1.5 — Framework" and "WS-Policy 1.5 — Attachment".

Figure 1 depicts web service descriptive language metadata USE Case and its role in web services.

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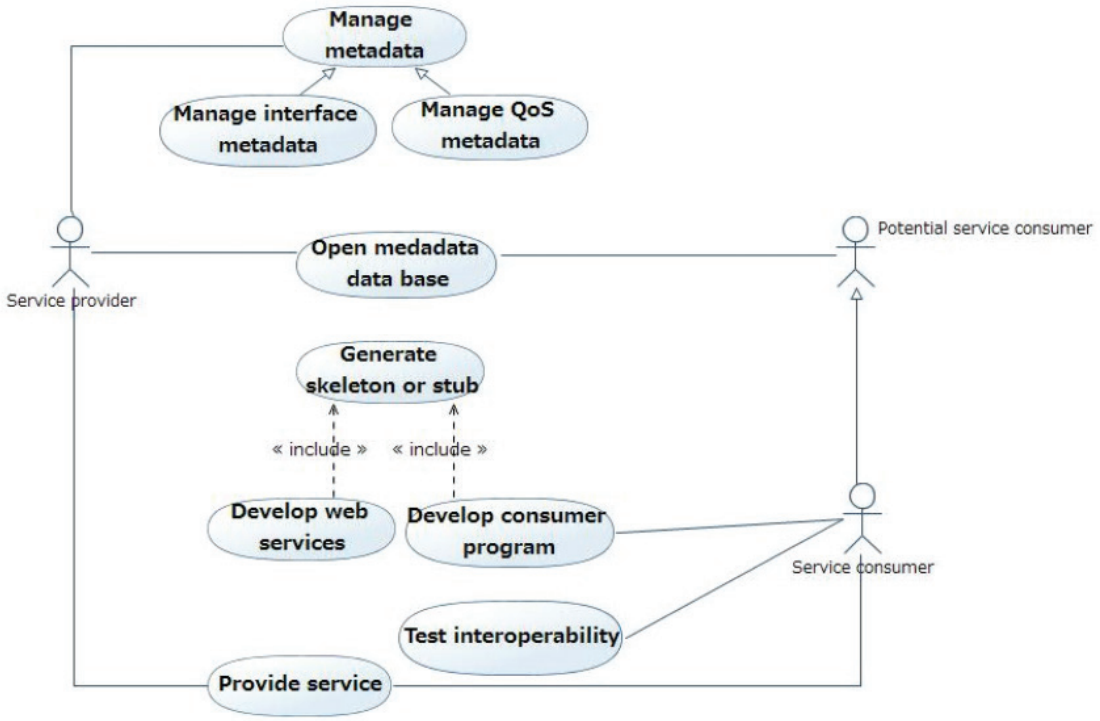

Figure 1 — High level ITS web service metadata role

Table 1 is a high-level use case description of ITS web service metadata's role.

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Table 1 — Use case description of ITS WS metadata's role in high level

Use case description (Level 1)	
Name	ITS Web Services metadata role
Actors	Service provider Potential service consumer Service consumer
Description	This use case depicts a high level ITS WS metadata role through an ITS WS lifecycle.
Main scenario	1. Service provider creates standard-based interface and QoS metadata, and gives version number individually. (See Alt-1 for alternative scenario) 2. Service provider publishes metadata through Universal Description, Discovery, and Integration (UDDI), Service end point, web page, etc. 3. Service provider develops web service, including (Generating skeleton or stub). 4. Service provider provides the service. 5. Potential service consumer estimates the service from the view point of business value to him and/or interoperability realization difficulty. 6. If potential user decides to utilize the service, he develops client WS program, including the generation of a skeleton or stub. 7. Service consumer tests his program interoperability to the service program. 8. After successful interoperability test consumer utilizes the service.
Alternative scenario	Alt-1: In the case of the service provider service 1. He changes the metadata and the relevant version number. 2. Publishes revised metadata. 3. Resume.
Use case description (Level 2)	
Name	Generate skeleton or stub
Description	Service provider or service consumer creates skeleton or stub, respectively. Usually this process is done by using WS development tools. This enables stakeholder to quickly develop program and go sooner to interoperability test.
Main scenario	1. A tool reads interface metadata and QoS metadata. 2. It creates the interface part and run time data for required QoS.

e) "WS-Policy 1.5—Framework" acts as a structure for connecting domain specific metadata in one policy document. Each domain specific metadata has its own vocabulary and is identified by its namespace. Joining service side policy and service consumer policy, interoperability can then be tested. If join is not empty, then service provider program and service consumer program are interoperable.

f) "WS-Policy 1.5—Attachment" gives mechanism to attach policy to WSDL that policy is effective at runtime. Figure 2 exhibits WS-Policy's role to connect QoS to ***Interface metadata.***

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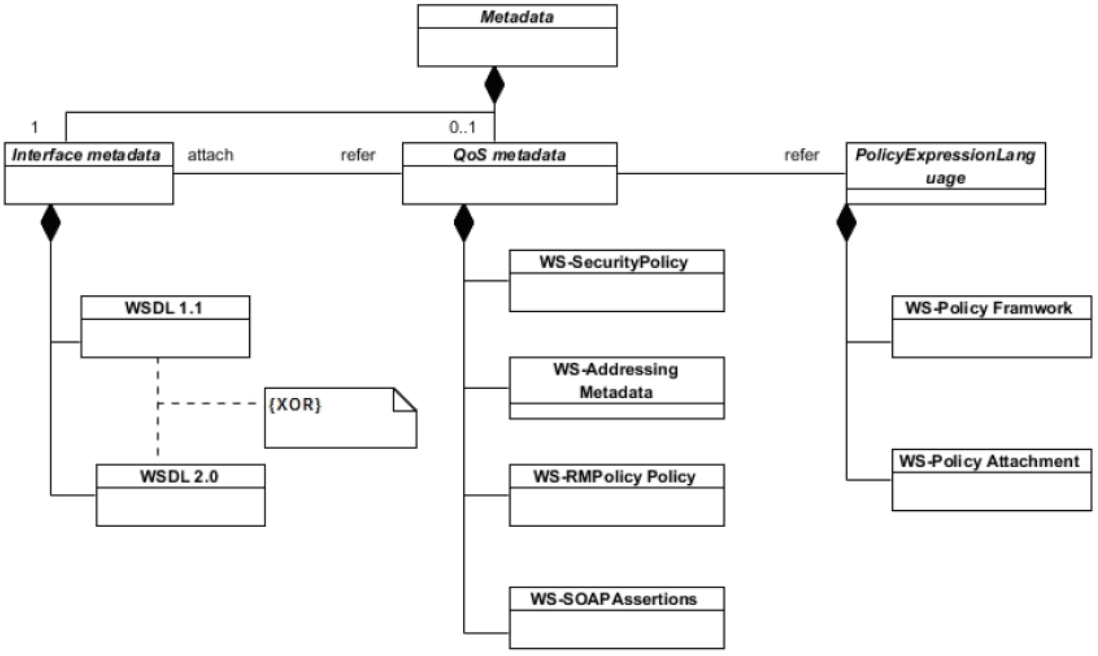

Figure 2 — Web service policy roles

g) For policy reuse, promotion of maintainability, and readability, policy description as an independent document from the interface document is recommended. Then combine both documents in a wsp:PolicyReference element in a WSDL.

h) When WS evolves, backward compatibility is recommended strategy.

NOTE WS-Policy related issues are to be elaborated in ISO 24097-3.

The second phase standards of web services metadata were delivered through 2007 to 2014 from standardization organizations like W3C and OASIS, and continue to evolve. There have been, to date, few documents that explain how to apply new metadata standards in a consistent and comprehensive manner. Without such assistance it is not easy to use relevant standards in a consistent manner.

In addition, making WS secure is essential, but realizing secure WS requires quite vast cryptography technologies in the background, such as basic XML signature and XML encryption. So applying these fundamentals could become a major hurdle to overcome.

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Intelligent transport systems — Using web services (machine-machine delivery) for ITS service delivery —

Part 2: Elaboration of interoperable web services' interfaces

1 Scope

This part of ISO/TR 24097 elaborates on ISO 24097-1 by discussing ***Interface metadata***.

This part of ISO/TR 24097 covers the following:

— interface metadata standard version selection (WSDL 1.1 or WSDL 2.0);

— SOAP version selection (SOAP 1.1 or SOAP 1.2);

— WSDL 1.1 SOAP 1.2 binding;

— WS-I conformant WS development.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 24097-1, *Intelligent transport systems — Using web services (machine-machine delivery) for ITS service delivery — Part 1: Realization of interoperable web services*

3 Terms and definitions

For the purposes of this document, the terms and definitions in ISO 24097-1 and the following apply.

3.1
claim
declaration made by an entity

Note 1 to entry: Entity is a name, identity, key, group, privilege, capability.

3.2
claim confirmation
process of verifying that a claim applies to an entity

3.3
domain
specific area to which a policy applies

EXAMPLE Security, message transmission reliability.

3.4
integrated development environment
software that provides comprehensive facilities for application development

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3.5
instance document
XML document that conforms to a particular schema

Note 1 to entry: If schema is WSDL, XML document is WSDL instance document.

3.6
metadata
meta data
descriptive data of an instance WS behavior

Note 1 to entry: WS consists of *interface metadata* (WSDL description) and *QoS metadata*.

3.7
policy assertion
requirement, capability, or other property of a web service (WS-Policy)

3.8
policy subject
entity with which a policy assertion can be associated (WS-Policy)

EXAMPLE An endpoint, message, resource, operation.

4 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

BP	(WS-I) Basic Profile
BPEL	Business Process Execution Language
HTTP	Hypertext Transfer Protocol
IDE	Integrated Development Environment
OASIS	Organization for the Advancement of Structured Information Standard
QoS	Quality of Services
rpc	remote procedure call
SOA	Service-Oriented Architecture
SOAP	Simple Object Access Protocol (SOAP 1.1)
URI	Uniform Resource Identifier
URL	Universal Resource Locator
UDDI	Universal Description, Discovery and Integration
W3C	World Wide Web Consortium
WS	Web Service
WS-I	Web Services Interoperability Organization
WSDL	Web Services Description Language
WTP	Web Tool Platform

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