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SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT-GENERATION NETWORKS

Next Generation Networks – Service aspects: Service
capabilities and service architecture

NGN convergence service model and scenario using web services

Recommendation ITU-T Y.2232

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Recommendation ITU-T Y.2232

NGN convergence service model and scenario using web services

Summary

The 'convergence service' in NGN implies the integration of services in NGN in a unified manner to access each service in order to interwork with each service. Recommendation ITU-T Y.2232 defines the convergence model for NGN based on web services and provides a detailed scenario of each convergence model in the form of web services.

Source

Recommendation ITU-T Y.2232 was approved on 25 January 2008 by ITU-T Study Group 13 (2005-2008) under Recommendation ITU-T A.8 procedure.

FOREWORD

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Introduction

The NGN service architecture has the three main functional characteristics of (i) agnosticism, (ii) support for legacy capabilities and features, and (iii) support for an open service interface (Recommendation ITU-T Y.2012). Among these, the third characteristic implies that the NGN service platform is required to provide an open service interface, which provides an abstraction of the network capabilities.

NGN users can create and provide enhanced services, which enables application of NGN capabilities using the "applications" functional group known as the application-to-network interface (ANI) (Recommendation ITU-T Y.2012). ANI provides a channel for interactions and exchanges between applications and NGN elements. ANI offers the capabilities and resources needed for the realization of applications. Also, NGN provides open service environment (Recommendation ITU-T Y.2201) for application developers.

This Recommendation proposes the NGN convergence models and scenario of (i) interactions among web services-enabled NGN services, and (ii) interaction with web services-enabled NGN services, along with NGN services, which does not have a web services feature. The overall value proposition of this Recommendation lies in extending the space of application developers for the NGN services interface to include members of IT communities and others who are in skills areas other than programming language developers, such as web developers. The various perspectives on the value proposition are as follows:

- The end user is the consumer of the services. The end user is provided with more services in a timelier manner, and services may be delivered that are more personalized to their unique market segments.
- The application developer is the person programming the application who makes use of web services to deliver application functionality to the end user. The developer benefits from (i) access to NGN capabilities using an intuitive function, (ii) the ability to use a common application framework that supports web services to build and deploy their applications.
- A service provider is an entity that operates the NGN services. The value proposition of web services for the service provider is (i) to offer a wide range of services rapidly and inexpensively, (ii) to differentiate itself by means of offering specialized services and serving strategic niche markets, (iii) to reach customers who are only interested in niche applications, and possibly cross-sell them, and (iv) to build customer loyalty by providing a means to customize services and assistance with this.
- The network operator is the entity that supports the network resources that support the web services. The value proposition for the network operator is the increased use of network resources and hence, increased revenue.

Recommendation ITU-T Y.2232

NGN convergence service model and scenario using web services

1 Scope

The objective of this Recommendation is to describe the NGN convergence service model and scenario using web services. This Recommendation defines the convergence model for NGN based on web services and provides a detailed scenario of each convergence model in the form of web services.

The term 'convergence' in NGN has focused mainly on the convergence of media, such as voice, data and video. However, to realize the ultimate convergence of services in NGN, it is necessary to develop detailed requirements to allow for the convergence of services. It is also important to clearly identify the value being added by a convergence service. The 'convergence services' in NGN imply the integration of services in NGN in a unified manner to access each service in order to interwork with each service.

Implementing the convergence service in current networks may be restricted or impossible due to the capabilities of the installed equipment. Moreover, service provisioning of the convergence service to implement new functionalities is essentially restricted to equipment vendors, as the APIs are typically proprietary [ITU-T Y.2012]. Thus, for the open service interface of NGN, NGN is required to support standard ANI API and a unified manner for accessing the NGN services from the IT side.

Currently, the capabilities and requirements [b-ITU-T Y.2000-Sup.1] [ITU-T Y.2201] for open services environments have been described. Web services is one of the technologies of open services environments. The use of web services is expanding rapidly as the need for application-to-application communication and interoperability grows. In NGN, web services provide a standard means of communication among different software applications of NGN services to the users. To address these capabilities among these applications in NGN environments, and to allow them to be combined for more complex services, a standard reference convergence model is needed in an NGN environment.

The scope of this Recommendation is to address a convergence service scenario in NGN using web services. This Recommendation covers:

- Requirements to support convergence services model and scenario.
- A web services deployment model for NGN.
- NGN convergence services model and its scenarios using web services.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Y.2012] Recommendation ITU-T Y.2012 (2006), *Functional requirements and architecture of the NGN release 1*.

[ITU-T Y.2013] Recommendation ITU-T Y.2013 (2006), *Converged services framework functional requirements and architecture*.

- [ITU-T Y.2091] Recommendation ITU-T Y.2091 (2008), *Terms and definitions for Next Generation Networks*.
- [ITU-T Y.2201] Recommendation ITU-T Y.2201 (2007), *NGN release 1 requirements*.
- [ITU-T Y.2701] Recommendation ITU-T Y.2701 (2007), *Security requirements for NGN release 1*.
- [W3C SOAP 0] W3C Recommendation (2007), *SOAP Version 1.2 Part 0: Primer (Second Edition)*. <http://www.w3.org/TR/soap12-part0/>
- [W3C SOAP 1] W3C Recommendation (2007), *SOAP Version 1.2 Part 1: Messaging Framework (Second Edition)*. <http://www.w3.org/TR/soap12-part1/>
- [W3C WSDL 0] W3C Recommendation (2007), *Web Services Description Language (WSDL) Version 2.0 Part 0: Primer*. <http://www.w3.org/TR/wsdl20-primer/>
- [W3C WSDL 1] W3C Recommendation (2007), *Web Services Description Language (WSDL) Version 2.0 Part 1: Core Language*. <http://www.w3.org/TR/wsdl20/>

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

- 3.1.1 access** [b-ITU-T X.1142]: Performing an action.
- 3.1.2 access control** [b-ITU-T X.1142]: Controlling access in accordance with a policy.
- 3.1.3 access control information** [b-ITU-T X.812]: Any information used for access control purposes, including contextual information.
- 3.1.4 gateway** [b-ITU-T H.310]: A function that converts transmission formats and/or protocols between different network environments.
- 3.1.5 principal** [b-ITU-T X.811]: An entity whose identity can be authenticated.
- 3.1.6 service** [ITU-T Y.2091]: A set of functions and facilities offered to a user by a provider.
- 3.1.7 service convergence** [ITU-T Y.2013]: The coordination of a set of services such that the end user's view is that of a single service. The component services may have different providers.
- 3.1.8 SOAP** [W3C SOAP 1]: The formal set of conventions governing the format and processing rules of a SOAP message. These conventions include the interactions among SOAP nodes generating and accepting SOAP messages for the purpose of exchanging information along a SOAP message path.
- 3.1.9 SOAP intermediary** [W3C SOAP 1]: A SOAP intermediary is both a SOAP receiver and a SOAP sender and is targetable from within a SOAP message. It processes the SOAP header blocks targeted at it and acts to forward a SOAP message towards an ultimate SOAP receiver.
- 3.1.10 WSDL** [W3C WSDL 1]: Web services description language Version 2.0 (WSDL 2.0) provides a model and an XML format for describing Web services. WSDL 2.0 enables one to separate the description of the abstract functionality offered by a service from concrete details of a service description such as "how" and "where" that functionality is offered.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

- 3.2.1 convergence service:** A service resulting from service convergence.

NOTE – In this Recommendation, service convergence is realized using web services technologies.

3.2.2 service composition: Service composition is the capability of creating a new NGN service from other existing NGN services.

3.2.3 service provider: An entity that provides services.

3.2.4 service substitution: Service substitution is a capability for replacing a service when an original requested service is not available.

3.2.5 web services: Web services is a service provided using web services systems.

3.2.6 Web services gateway (WSG): A gateway which handles the web services message between the WSP and WSR.

3.2.7 Web services provider (WSP): A service provider that exposes a capability for use to create web services.

3.2.8 Web services requester (WSR): Client software that makes use of the services provided by a WSP.

3.2.9 Web services registry: An entity that stores web services information (e.g., WSDL).

3.2.10 Web services system: A web services system is a software system designed to support interoperable machine-to-machine interaction over a network using web services standards.

NOTE – It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the web services in a manner prescribed by its description using SOAP-messages, typically conveyed using HTTP with an XML serialization in conjunction with other web-related standards.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ANI	Application-to-Network Interface
API	Application Program Interface
AS	Application Server
ASP	Application Service Provider
BP	Basic Profile
BSP	Basic Security Profile
MEP	Message Exchange Pattern
NGN	Next Generation Network
NWSP	Non-Web Services Provider
NWSR	Non-Web Services Requester
PEP	Policy Enforcement Point
SIP	Session Initiation Protocol
SOAP	Simple Object Access Protocol
SSP	Service Support Provider
TLS	Transport Layer Security
UE	User Equipment
WSDL	Web Services Description Language
WSG	Web Services Gateway
WS-I	Web Services Interoperability Organization

WSP	Web Services Provider
WSR	Web Services Requester
WSS	Web Services Security
XML	eXtensible Markup Language

5 Conventions

This Recommendation uses the following assumptions:

- The convergence service is required to utilize various kinds of NGN capabilities.
- If an NGN does not support web services interfaces for the service, the web services system can take into account adaptation mechanisms in WSG.
- The target services of convergence are not only the NGN service but also non-NGN services.
- Convergence services are required to enable timely service creation.
- SOAP is assumed for the binding mechanism, although other binding mechanisms can be used for web services.

In this Recommendation, the term "web services" is not used as plural, but as a proper noun developed by W3C.

6 Requirements to support convergence services model and scenario

This clause describes the requirements to support the convergence services model and scenario using web services. For the convergence service scenario using web services, the following requirements are necessary.

- NGN is required to provide an open interface for application providers to support web services.
- A unified service discovery mechanism is required to be able to find the service, which is the target service for convergence.
- It is required to support the WSDL for the convergence service. In the WSDL, a set of information that describes the interface to and semantics of a service are described.
- It is required to provide service level interoperability underlying various different networks, operating systems and programming languages.
- It is required to provide general security capability for the service, which is opened to make a convergence service.
- Service discovery and invocation is required to support service provider and consumer policies.

7 Web services deployment model in NGN

Web services systems enable business entities and applications to intercommunicate openly with each other over a network. Web services systems have program-language-independent properties, use message-driven communication, and are easily bound to different transport protocols. In NGN services, it is possible to make common interfaces for service integration using web services technology.

7.1 Characteristics of web services

The characteristics of web services for the convergence scenarios in NGN are as follows:

- Loosely coupled connections between services

Web services systems communicate by passing XML messages via a service externalization layer. The service abstraction layer facilitates the task of developing services that consumes NGN exposed services.

- Interoperability across open and proprietary platforms

Web services systems are of high value to the enterprise as they provide, at their core, interoperability among hardware platforms, operating systems, databases, middleware and applications. These allow large organizations to benefit from a flexible IT architecture built on well-established standards without limiting the flexibility of individual lines of business to implement technologies that provide the business capabilities they need.

- A new approach to programming and application development

SOAP is a programming protocol that can be used to expose services and contents, thereby creating a dynamic medium (the web, intranet, extranets, and others) for programmable information exchanges. This translates into faster development cycles and lower costs enabled by component reuse, increased developer collaboration, component sharing, and business agility that allow firms to respond to changes in the business environment without being held back by long implementation and deployment cycles on the IT side.

- An open and flexible technique to deliver services to users anywhere

Using web services, a company can provide access to inventory transactions, financial data, insurance claim processing, or any type of information, transaction, or process in a reusable and open fashion.

7.2 Web services deployment model

The basic web services defines an interaction [W3C SOAP 0] [W3C SOAP 1] between service requesters and service providers as an exchange of messages, as shown in Figure 1.

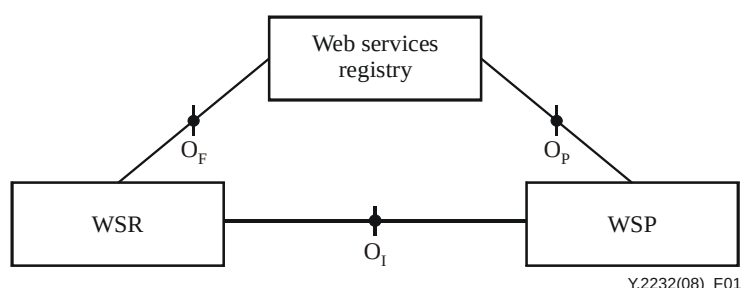


Figure 1 – General architecture of web services

In the WSDL, a service and services descriptions are described [W3C WSDL 0]. A service is enabled by a software module deployed on network-accessible platforms provided by the service provider. The service description contains the details of the interface and implementation of the service including the data types, operations, binding information and network location. The service description is supported by WSP.

In order for an application to take advantage of web services, three behaviours must take place: the publication of service descriptions, the finding and retrieval of service descriptions, and the binding or invoking of services based on the service description. These behaviours can occur singly or iteratively, with any cardinality between the roles. In detail, these operations are:

- O_I execution (binding or invoking) of services based on the service description
- O_F finding and retrieval of service descriptions
- O_P publication of service descriptions

The basic web services architecture models the interactions between three roles (WSP, web services registry and WSR). The entire procedure of web services usage can be divided into publish, find (or discovery) and bind (or interaction) phases.

In the publish phase of web services, the WSP develops its applications and creates a service description, publishes that service description (WSDL) to one or more web services registry to allow discovery with an O_p operation, as shown in Figure 2, and the web services ready to receive messages from the WSR.

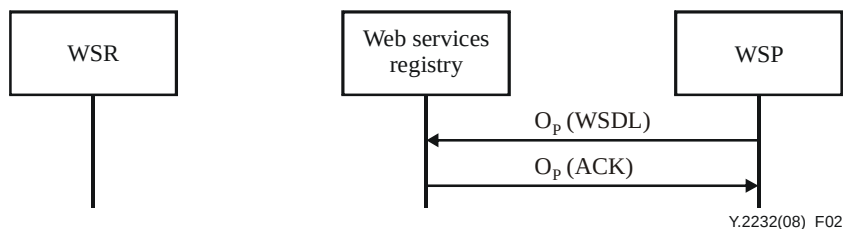


Figure 2 – Information flow of O_p in web services

In the find phase of web services, the WSR finds the service description of interest and uses this service description with the O_F operation.

The web services registry advertises the web services descriptions published to it by WSPs with the O_p operation to help WSRs search through its registry to find a service description of interest with the O_F operation.

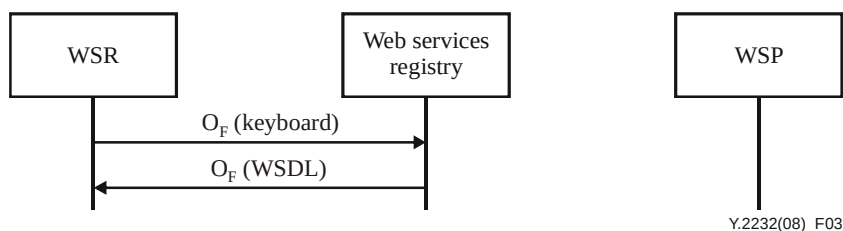


Figure 3 – Information flow of O_F in web services

In the bind phase of web services, the WSR interacts with the services provided by the WSP with the O_I operation.

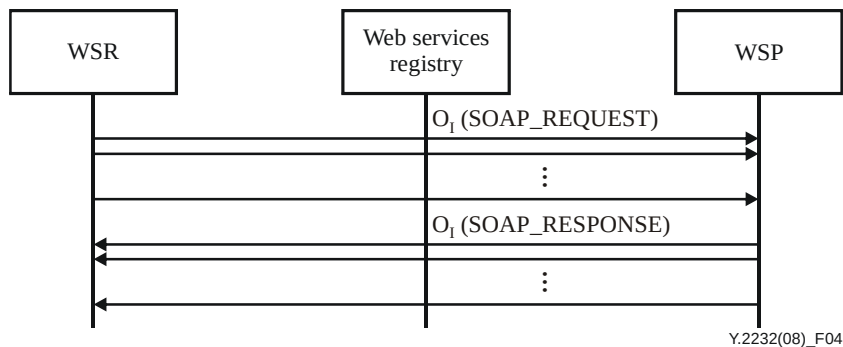


Figure 4 – Information flow of O_I in web services

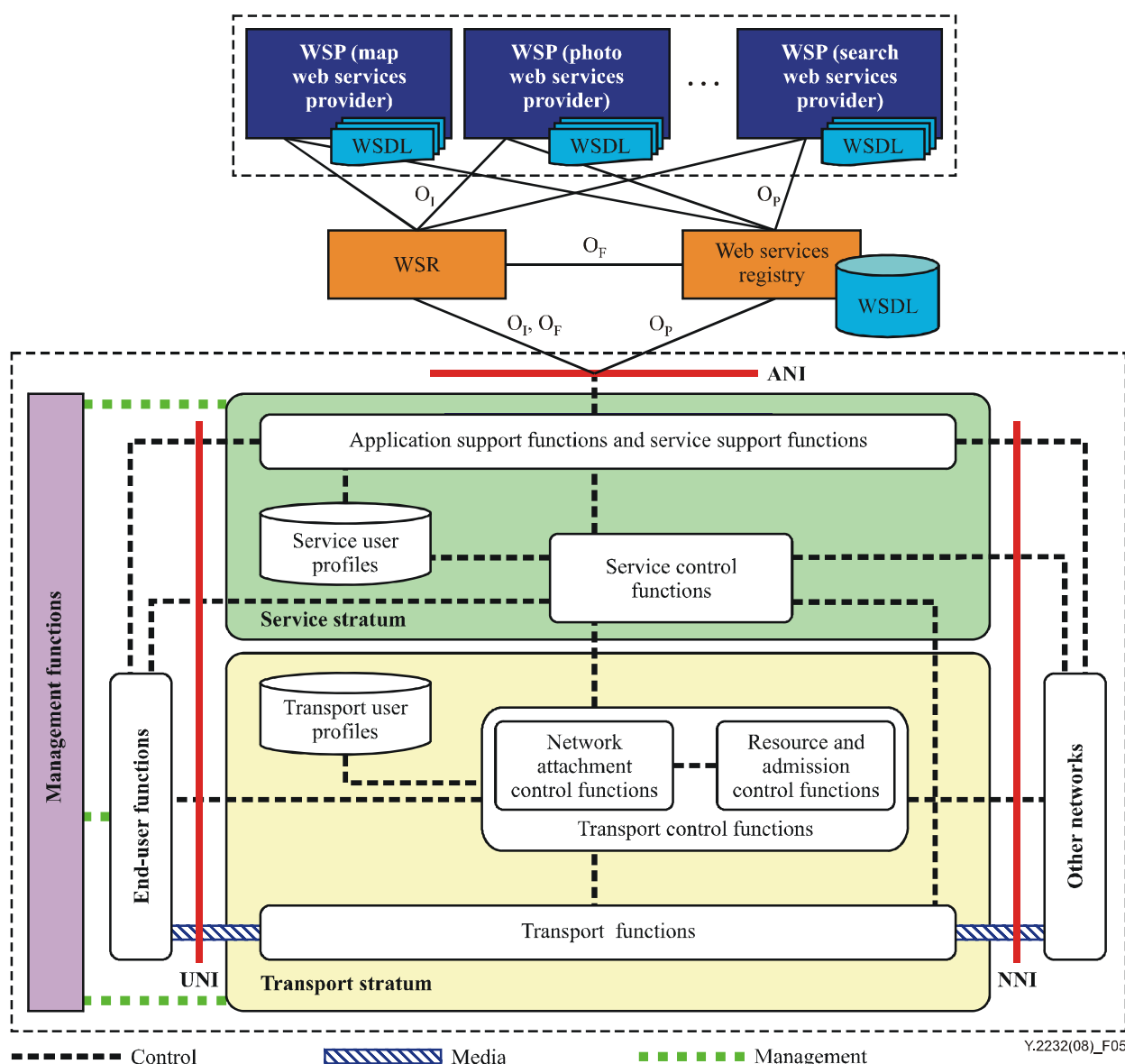


Figure 5 – Conceptual diagram of the NGN architecture with an extension of web services

NOTE – Figure 5 assumes that the WSP for NGN is located inside NGN.

For an NGN architecture extension with web services, as shown in Figure 5, ANI can be used as the interface of WSPs, and registers their interfaces (WSDL) to the web services registry, as shown in Figure 5. The WSR can find the interfaces (WSDL) of an NGN service from the web services registry, and invokes the interface of the ANI with a web services access method such as SOAP. Before the interaction, the interface of an NGN service can be registered in the web services registry to access their open interfaces (WSDL) by web services. In WSDL, the location of service, API name, the parameter and its type, and other information for the service are described. If web services are deployed in NGN, various types of services in NGN could combine the services of non-NGN environments such as maps, photos and searches related to web services in a unified manner, implying that additional value-added services are created for NGN end-users.

7.3 Web services gateway (WSG)

The WSG is a component that has functionalities of not only enabling web services features for non-web services, but also performs intermediate work between the WSR and WSP. Therefore, the main roles of the WSG are to transform messages in a value-added manner among the WSR, WSP, NWSP and NWSR, and to perform certain functions associated with the messages such as security