INTERNATIONAL STANDARD

ISO/IEEE 11073-20702

First edition
2018-09

Health informatics — Point-of-care medical device communication —

Part 20702: Medical devices communication profile for web services

Informatique de santé — Communication entre dispositifs médicaux sur le site des soins —

Reference number
ISO/IEEE 11073-20702:2018(E)

© IEEE 2017



COPYRIGHT PROTECTED DOCUMENT

© IEEE 2017

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from IEEE at the address below.

Institute of Electrical and Electronics Engineers, Inc
3 Park Avenue, New York
NY 10016-5997, USA

Email: stds.ipr@ieee.org
Website: www.ieee.org

Published in Switzerland

© IEEE 2017 – All rights reserved

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 (see www.iso.org/directives).

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. The IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While the IEEE administers the process and establishes rules to promote fairness in the consensus development process, the IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

ISO/IEEE 11073-20702 was prepared by the IEEE 11073 Standards Committee of the IEEE Engineering in Medicine and Biology Society (as IEEE Std 11073-20702-2016) and drafted in accordance with its editorial rules. It was adopted, under the “fast-track procedure” defined in the Partner Standards Development Organization cooperation agreement between ISO and IEEE, by Technical Committee ISO/TC 215, *Health informatics*.

A list of all parts in the ISO/IEEE 11073 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

© IEEE 2017 – All rights reserved

IEEE Std 11073™-20702-2016

Health informatics—Point-of-care medical device communication

Part 20702: Medical Devices Communication Profile for Web Services

Sponsor

IEEE 11073™ Standards Committee
of the
IEEE Engineering in Medicine and Biology Society

Approved 22 September 2016

IEEE-SA Standards Board

Abstract: Within the context of the ISO/IEEE 11073 family of standards for point-of-care (PoC) medical device communication, a communication protocol specification for a distributed system of PoC medical devices and medical IT systems that need to exchange data, or safely control networked PoC medical devices by profiling Web Service specifications, is defined by this standard. Additional Web Service specifications are part of this standard.

Keywords: Devices Profile for Web Services, DPWS, Efficient XML Interchange, EXI, IEEE 11073-20702™, ISO/IEEE 11073, MDC, medical device communication, PoC, point-of-care, safety, Simple Object Access Protocol, SOAP, Streaming Web Services, WS-Discovery

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

Copyright © 2017 by the Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 26 May 2017. Printed in the United States of America.

IEEE is a registered trademark in the U.S. Patent & Trademark Office, owned by the Institute of Electrical and Electronics Engineers, Incorporated.

W3C is trademarks or registered trademarks of the W3C®, (registered in numerous countries) World Wide Web Consortium. Marks of W3C are registered and held by its host institutions: Massachusetts Institute of Technology (MIT), European Research Consortium for Information and Mathematics (ERCIM), and Keio University, Japan.

PDF: ISBN 978-1-5044-2324-3 STD21112
Print: ISBN 978-1-5044-2325-0 STDPD21112

IEEE prohibits discrimination, harassment, and bullying.
For more information, visit http://www.ieee.org/web/aboutus/whatis/policies/p9-26.html.
No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page, appear in all standards and may be found under the heading "Important Notices and Disclaimers Concerning IEEE Standards Documents." They can also be obtained on request from IEEE or viewed at http://standards.ieee.org/IPR/disclaimers.html.

Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents

IEEE Standards documents (standards, recommended practices, and guides), both full-use and trial-use, are developed within IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association ("IEEE-SA") Standards Board. IEEE ("the Institute") develops its standards through a consensus development process, approved by the American National Standards Institute ("ANSI"), which brings together volunteers representing varied viewpoints and interests to achieve the final product. IEEE Standards are documents developed through scientific, academic, and industry-based technical working groups. Volunteers in IEEE working groups are not necessarily members of the Institute and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE Standards do not guarantee or ensure safety, security, health, or environmental protection, or ensure against interference with or from other devices or networks. Implementers and users of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, and interference protection practices and all applicable laws and regulations.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims all warranties (express, implied and statutory) not included in this or any other document relating to the standard, including, but not limited to, the warranties of: merchantability; fitness for a particular purpose; non-infringement; and quality, accuracy, effectiveness, currency, or completeness of material. In addition, IEEE disclaims any and all conditions relating to: results; and workmanlike effort. IEEE standards documents are supplied "AS IS" and "WITH ALL FAULTS."

Use of an IEEE standard is wholly voluntary. The existence of an IEEE standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

Translations

The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official statements

A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered or inferred to be the official position of IEEE or any of its committees and shall not be considered to be, or be relied upon as, a formal position of IEEE. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in revisions to an IEEE standard is welcome to join the relevant IEEE working group.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854 USA

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

IEEE draft and approved standards are copyrighted by IEEE under U.S. and international copyright laws. They are made available by IEEE and are adopted for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making these documents available for use and adoption by public authorities and private users, IEEE does not waive any rights in copyright to the documents.

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

Photocopies

Subject to payment of the appropriate fee, IEEE will grant users a limited, non-exclusive license to photocopy portions of any individual standard for company or organizational internal use or individual, non-commercial use only. To arrange for payment of licensing fees, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Updating of IEEE Standards documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect.

Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE Xplore at http://ieeexplore.ieee.org/ or contact IEEE at the address listed previously. For more information about the IEEE-SA or IEEE's standards development process, visit the IEEE-SA Website at http://standards.ieee.org.

Errata

Errata, if any, for all IEEE standards can be accessed on the IEEE-SA Website at the following URL: http://standards.ieee.org/findstds/errata/index.html. Users are encouraged to check this URL for errata periodically.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at http://standards.ieee.org/about/sasb/patcom/patents.html. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

Participants

At the time this standard was submitted to the IEEE-SA Standards Board for approval, the Point-of-Care Devices Working Group had the following membership:

Jan Wittenber, *Chair*
Stefan Schlichting, *SubGroup Chair*

Bjoern Anderson
Malcolm Clarke
Todd Cooper
Chris Courville
Gion Durisch
Michael Faughn
Kenneth Fuchs
John Garguilo
David Gregorczyk
Kai Hassing
John Hatcliff
Stefan Karl
Martin Kasparick
Daniel Krahenbuhl
Koichiro Matsumoto
Joerg-Uwe Meyer
Ali Miller
Robert Mortonson
Stephan Poehlsen
Tracy Rausch
John Rhoads
Paul Schluter
Janek Schumann
Masato Tanaka
Eugene Vasserman
Stan Wiley

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Bjoern Andersen
Charles Barest
Lyle Bullock
Todd Cooper
Sourav Dutta
Kenneth Fuchs
Joel Goergen
Frank Golatowski
Eric W. Gray
David Gregorczyk
Randall Groves
Kai Hassing
John Hatcliff
Werner Hoelzl
Noriyuki Ikeuchi
Atsushi Ito
Stefan Karl
Piotr Karocki
Martin Kasparick
William Lumpkins
Joerg-Uwe Meyer
Stephan Poehlsen
Beth Pumo
Bartien Sayogo
Stefan Schlichting
Paul Schluter
Eugene Stoudenmire
Walter Struppler
J. Wiley
Jan Wittenber
Oren Yuen
Daidi Zhong

When the IEEE-SA Standards Board approved this standard on 22 September 2016, it had the following membership:

Jean-Philippe Faure, *Chair*
Ted Burse, *Vice Chair*
John D. Kulick, *Past Chair*
Konstantinos Karachalios, *Secretary*

Chuck Adams
Masayuki Ariyoshi
Stephen Dukes
Jianbin Fan
J. Travis Griffith
Gary Hoffman
Ronald W. Hotchkiss
Michael Janezic
Joseph L. Koepfinger*
Hung Ling
Kevin Lu
Annette D. Reilly
Gary Robinson
Mehmet Ulema
Yingli Wen
Howard Wolfman
Don Wright
Yu Yuan
Daidi Zhong

*Member Emeritus

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

Introduction

This introduction is not part of IEEE Std 11073-20702-2016, Health informatics—Point-of-care medical device communication—Part 20702: Standard for Medical Devices Communication Profile for Web Services.

ISO/IEEE 11073 standards enable communication between medical devices and external computer systems. They provide automatic and detailed electronic data capture of patient vital signs information and device operational data. The primary goals are to:

— Provide real-time plug-and-play interoperability for patient-connected medical devices

— Facilitate the efficient exchange of vital signs and medical device data, acquired at the point-of-care (POC), in all healthcare environments

This standard defines a discovery, messaging, and event propagation method for a distributed POC medical device communication system. It serves as communication transport layer related to the existing ISO/IEEE 11073 standards series (ISO/IEEE 11073-10101:2004 [B6], ISO/IEEE 11073-10201:2004 [B7], and ISO/IEEE 11073-20101:2004 [B8]).[1] Moreover, a set of protocols is defined that allows transmission of real-time streams (e.g., waveforms) and remote control of a medical device in a safe way. For this purpose, it introduces implementation constraints and extensions on the Devices Profile for Web Services (DPWS) standard (OASIS DPWS V1.1) in order to allow the utilization of DPWS in such an environment.

Furthermore, this standard is intended to be compatible with the Integrating the Healthcare Enterprise (IHE) International's technical framework specifications for using Web Services for achieving interoperability in healthcare [e.g., Web Services Basic Profile 2.0 (WS-I Basic Profile V2.0)], which is used by Information Technology Infrastructure (ITI) Technical Framework Volume 2, Appendix V: Web Services for IHE Transactions, and further referenced for device information exchange in the Patient Care Device (PCD) Technical Framework Volume 2 [B5].

In the IHE Patient Care Device (PCD) domain, Web Services are used to wrap IHE PCD HL7 messages. Beyond that, this standard adds the capability of providing a plug-and-play and publish-subscribe supporting Web Services infrastructure to create a service-oriented architecture in distributed systems of medical devices.

The non-normative name of this standard is "Medical Devices Profile for Web Services" (MDPWS).

[1]The numbers in brackets correspond to those of the bibliography in Annex E.

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

Contents

1. Overview 10
1.1 Scope 10
1.2 Purpose 10

2. Normative references 10

3. Definitions, terminology, notational conventions, and normative statements 12
3.1 Definitions 12
3.2 Terminology 13
3.3 Notational conventions 13
3.4 XML namespaces 16

4. General messaging 17
4.1 Introduction 17
4.2 SOAP-over-UDP 17
4.3 SOAP-over-HTTP 17

5. Dynamic discovery 18

6. Service description 18
6.1 General 18
6.2 Web Services Description Language (WSDL) 18

7. Eventing 19

8. Streaming 20
8.1 General 20
8.2 Advertising stream information 20
8.3 Stream types and stream descriptions 20
8.4 Retrieving stream descriptions 22
8.5 SOAP-over-UDP Multicast Stream Binding 23

9. Safe data transmission 24
9.1 General 24
9.2 Advertising safety requirements 24
9.3 Retrieving safety requirements 28
9.4 Transmitting safety information 28
9.5 Qualified Names 30

10. Security considerations 32

11. Message serialization 33
11.1 General 33
11.2 Advertising compact transmission 33

12. Conformance 34
12.1 General 34
12.2 General format 35
12.3 ICS tables 35

Annex A (normative) Constants 37

Annex B (informative) Scope of streaming specification 38

Annex C (informative) Streaming and safe data transmission examples 39

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

Annex D (informative) Discovery and description retrieval sequence diagrams..... 44

Annex E (informative) Bibliography..... 47

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

Health informatics—Point-of-care medical device communication

Part 20702: Medical Devices Communication Profile for Web Services

1. Overview

1.1 Scope

The scope of this standard is a communication protocol specification for a distributed system of point-of-care (PoC) medical devices and medical IT systems that need to exchange data or safely control networked PoC medical devices by defining a profile for Web Service specifications and defining additional Web Service specifications as part of this standard.

1.2 Purpose

Currently, there is no part of the 11073 standard series that allows plug-and-play-enabled communication of medical devices in an Internet Protocol (IP)-based distributed PoC medical device communication system. Therefore, this standard defines a discovery, messaging, and event propagation method for a distributed PoC medical device communication system based on Web Services. Moreover, it proposes a set of protocols that allow advertisement of STREAMs (e.g., waveforms) as well as provision of remote control in a safe way. For this purpose, the Devices Profile for Web Services (DPWS) is used as a communication foundation and tailored to be utilized in a distributed PoC medical device communication system.

This standard can be used for any diagnostic, therapeutic, or monitoring communication needs where PoC medical devices shall be able to discover communication partners, exchange virtual device descriptions, provide and consume event-driven data, and enable safe remote control.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they shall be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

IETF RFC 2119, Key Words for Use in RFCs to Indicate Requirement Levels, March 1997. Available at http://www.ietf.org/rfc/rfc2119.txt.[2]

IETF RFC 2616, Hypertext Transfer Protocol—HTTP/1.1, June 1999. Available at https://tools.ietf.org/html/rfc2616.

IETF RFC 3987, Internationalized Resource Identifiers (IRIs), January 2005. Available at https://tools.ietf.org/html/rfc3987.

OASIS Devices Profile for Web Services (DPWS) Version 1.1, 1 July 2009. Available at http://docs.oasis-open.org/ws-dd/dpws/1.1/os/wsdd-dpws-1.1-spec-os.html.

OASIS SOAP-over-UDP Version 1.1, 1 July 2009. Available at http://docs.oasis-open.org/ws-dd/soapoverudp/1.1/os/wsdd-soapoverudp-1.1-spec-os.html.

OASIS Web Services Dynamic Discovery (WS-Discovery) Version 1.1, 1 July 2009. Available at http://docs.oasis-open.org/ws-dd/discovery/1.1/os/wsdd-discovery-1.1-spec-os.html.

OASIS Web Services Security, SOAP Message Security 1.0 (WS-Security 2004), March 2004. Available at https://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-soap-message-security-1.0.pdf.

W3C® Web Services Description Language (WSDL) 1.1, Note, 15 March 2001. Available at http://www.w3.org/TR/2001/NOTE-wsdl-20010315.[3]

W3C Web Services Eventing (WS-Eventing), Member Submission, 15 March 2006. Available at http://www.w3.org/Submission/2006/SUBM-WS-Eventing-20060315/.

W3C Web Services Metadata Exchange (WS-MetadataExchange) 1.1, Member Submission, 13 August 2008. Available at http://www.w3.org/Submission/2008/SUBM-WS-MetadataExchange-20080813.

W3C Efficient XML Interchange (EXI) Format 1.0 (Second Edition), Recommendation, 11 February 2014. Available at http://www.w3.org/TR/2014/REC-exi-20140211/.

W3C Exclusive XML Canonicalization Version 1.0, Recommendation, 18 July 2002. Available at http://www.w3.org/TR/2002/REC-xml-exc-c14n-20020718/.

W3C Extensible Markup Language (XML) 1.0 (Fifth Edition), Recommendation, 28 November 2008. Available at https://www.w3.org/TR/2008/REC-xml-20081126/.

W3C Namespaces in XML 1.0 (Third Edition), Recommendation, 8 December 2009. Available at http://www.w3.org/TR/REC-xml-names/.

W3C SOAP Version 1.2 Part 1: Messaging Framework, Recommendation, 27 April 2007. Available at http://www.w3.org/TR/soap12-part1/.

W3C Web Services Addressing 1.0 (WS-Addressing), Recommendation, 9 May 2006. Available at http://www.w3.org/TR/ws-addr-core.

W3C Web Services Policy 1.5—Attachment (WS-Policy Attachment), Recommendation, 4 September 2007. Available at http://www.w3.org/TR/ws-policy-attach.

[2]IETF documents (i.e., RFCs) are available for download at http://www.rfc-archive.org/.

[3]W3C is trademarks or registered trademarks of the W3C®, (registered in numerous countries) World Wide Web Consortium. Marks of W3C are registered and held by its host institutions: Massachusetts Institute of Technology (MIT), European Research Consortium for Information and Mathematics (ERCIM), and Keio University, Japan.

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

W3C Web Services Policy 1.5—Framework (WS-Policy), Recommendation, 4 September 2007. Available at http://www.w3.org/TR/ws-policy/.

W3C XML Information Set (Second Edition), Recommendation, 4 February 2004. Available at https://www.w3.org/TR/xml-infoset/.

W3C XML Path Language (XPath) Version 1.0, Recommendation, 7 September 2015. Available at http://www.w3.org/TR/1999/REC-xpath-19991116.

W3C XML Schema 1.1, Recommendation, 28 October 2004. Available at http://www.w3.org/TR/xmlschema-1, http://www.w3.org/TR/xmlschema-2/.

W3C Web Services Addressing 1.0—Metadata, Working Draft, 16 May 2007. Available at https://www.w3.org/TR/2007/WD-ws-addr-metadata-20070516/.

WS-I Basic Profile Version 2.0, 9 November 2010. Available at http://ws-i.org/profiles/BasicProfile-2.0-2010-11-09.html.

3. Definitions, terminology, notational conventions, and normative statements

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.[4]

ASSERTION: A WS-Policy assertion. A policy assertion identifies a behavior that is a requirement or capability of a policy subject. A policy subject is an entity (e.g., an endpoint, message, resource, operation) with which a policy can be associated. (adapted from W3C WS-Policy 1.5 Framework, Section 3.1)

ATTRIBUTE: References the attribute in a normative outline that is currently described.

NOTE—See normative outlines in 3.3.1.[5]

CLIENT: A network endpoint that sends MESSAGEs to and/or receives MESSAGEs from a SERVICE. (OASIS DPWS V1.1)

DEVICE: A distinguished type of SERVICE that hosts other SERVICEs and sends and/or receives one or more specific types of MESSAGEs. (OASIS DPWS V1.1)

ELEMENT: References the element in a normative outline that is currently described.

NOTE—See 3.3.1.

HOSTED SERVICE: A distinguished type of SERVICE that is hosted by another SERVICE. The lifetime of the HOSTED SERVICE is a subset of the lifetime of its host. The HOSTED SERVICE is visible (not encapsulated) and is addressed separately from its host. Each HOSTED SERVICE has exactly one host. The relationship is not transitive. (OASIS DPWS V1.1)

[4]The *IEEE Standards Dictionary Online* is available at: http://dictionary.ieee.org.
[5]Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

MESSAGE: Protocol elements that are exchanged, usually over a network, to affect a Web Service. Always includes a SOAP ENVELOPE. Typically also includes transport framing information such as HTTP headers, TCP headers, and IP headers. (OASIS DPWS V1.1)

RECEIVER: A CLIENT or SERVICE that receives a MESSAGE. (OASIS DPWS V1.1)

SECURE CHANNEL: A SECURE CHANNEL is a point-to-point transport-level TLS/SSL connection established between a CLIENT and a SERVICE.

SENDER: A CLIENT or SERVICE that sends a MESSAGE. (OASIS DPWS V1.1)

SERVICE: A software system that exposes its capabilities by receiving and/or sending MESSAGEs on one or several network endpoints. (OASIS DPWS V1.1)

SOAP ENVELOPE: An XML Infoset that consists of a document information item (W3C XML Information Set) with exactly one member in its [children] property, which MUST be the SOAP Envelope (W3C SOAP V1.2 Part 1) element information item. (OASIS DPWS V1.1)

STREAM: A STREAM designates MESSAGEs that are periodically delivered from a networked DEVICE over an IP-based transmission medium to one or more CLIENTs.

STREAMING: A mechanism to periodically deliver MESSAGEs from networked DEVICEs over an IP-based transmission medium to one or more CLIENTs.

TEXT SOAP ENVELOPE: A SOAP ENVELOPE serialized as application/soap+xml. (OASIS DPWS V1.1)

3.2 Terminology

The keywords “MUST NOT,” “REQUIRED,” “SHALL,” “SHALL NOT,” “SHOULD,” “SHOULD NOT,” “RECOMMENDED,” “MAY,” and “OPTIONAL” in this document are to be interpreted as described in IETF RFC 2119.[6]

3.3 Notational conventions

3.3.1 Normative outlines

According to OASIS DPWS V1.1, this standard uses the following syntax to define normative outlines:

- The syntax appears as an XML instance, but values in italics indicate data types instead of literal values.
- Characters are appended to elements and attributes to indicate cardinality:
  - “?” (0 or 1)
  - “*” (0 or more)
  - “+” (1 or more)
  - The character “|” is used to indicate a choice between alternatives.
- The characters “(“ and “)” are used to indicate that contained items are to be treated as a group with respect to cardinality or choice.
- The characters “[“ and “]” are used to call out references and property names.

[6]Information on references can be found in Clause 2.

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

— Ellipses (i.e., "...") indicate points of extensibility. Additional children and/or attributes MAY be added at the indicated extension points but SHALL NOT contradict the semantics of the parent and/or owner, respectively. By default, if a receiver does not recognize an extension, the receiver SHOULD ignore the extension; exceptions to this processing rule, if any, are clearly indicated below.

— XML namespace prefixes (see Table 1) are used to indicate the namespace of the element being defined.

Any normative outline is described in more detail by giving a set of XPath expressions followed by a description. The XPath expressions point to elements or attributes in the foregoing outline.

Example:

```
(01)   <SampleElement SampleAttribute="xs:string"? >
(02)     <NestedElement ...>
(03)       ...
(04)     </NestedElement> +
(05)   </SampleElement>
```

The remainder of this subclause describes additional, normative constraints on the previously listed outline.

`/SampleElement`
Detailed description of SampleElement. By definition, SampleElement is referenced here by using the keyword ELEMENT.

`/SampleElement/@SampleAttribute`
Detailed description of SampleElement's attribute SampleAttribute. By definition, SampleAttribute is referenced here by using the keyword ATTRIBUTE.

`/SampleElement/NestedElement`
Detailed description of NestedElement.

3.3.2 Normative statements

According to the notation given in OASIS DPWS V1.1, normative statements of requirements are presented in the following manner:

Rnnnn: Statement text here.

where "nnnn" is replaced by a number that is unique among the requirements in this standard, thereby forming a unique requirement identifier.

Requirements can be considered to possess a namespace qualifier, in such a way as to be compatible with QNames from Namespaces in XML (W3C Namespaces in XML 1.0). If there is no explicit namespace prefix on a requirement's identifier (e.g., "R9999" as opposed to "dpws:R9999"), it should be interpreted as being in the namespace identified for this standard. A prefixed requirement refers to the specification that defines that prefix. For example, dpws:R9999 refers to requirement R9999 defined in OASIS DPWS V1.1.

3.3.3 Extended Backus-Naur Form

This standard makes use of a simple Extended Backus-Naur Form (EBNF) notation to specify a grammar for XPath expressions. The simple EBNF notation is cited from W3C XML 1.0. Each rule in the grammar defines one symbol, in the form:

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

`symbol ::= expression`
Symbols are written with an initial capital letter if they are the start symbol of a regular language, otherwise with an initial lowercase letter. Literal strings are quoted. Within the expression on the right-hand side of a rule, the following expressions are used to match strings of one or more characters:

`#xN`
Where N is a hexadecimal integer, the expression matches the character whose number (code point) in ISO/IEC 10646 is N. The number of leading zeroes in the #xN form is insignificant.

`[a-zA-Z], [#xN-#xN]`
Matches any Char with a value in the range(s) indicated (inclusive).

`[abc], [#xN#xN#xN]`
Matches any Char with a value among the characters enumerated. Enumerations and ranges can be mixed in one set of brackets.

`[^a-z], [^#xN-#xN]`
Matches any Char with a value outside the range indicated.

`[^abc], [^#xN#xN#xN]`
Matches any Char with a value not among the characters given. Enumerations and ranges of forbidden values can be mixed in one set of brackets.

`"string"`
Matches a literal string matching that given inside the double quotes.

`'string'`
Matches a literal string matching that given inside the single quotes.

These symbols may be combined to match more complex patterns as follows, where A and B represent simple expressions:

`(expression)`
Expression is treated as a unit and may be combined as described in this list.

`A?`
Matches A or nothing; optional A.

`A B`
Matches A followed by B. This operator has higher precedence than alternation; thus A B | C D is identical to (A B) | (C D).

`A | B`
Matches A or B.

`A - B`
Matches any string that matches A but does not match B.

`A+`
Matches one or more occurrences of A. Concatenation has higher precedence than alternation; thus A+ | B+ is identical to (A+) | (B+).

`A*`
Matches zero or more occurrences of A. Concatenation has higher precedence than alternation; thus A* | B* is identical to (A*) | (B*).

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved

3.3.4 Abbreviated notations

If not defined otherwise, this standard uses the following properties to designate SOAP parts:

[Action] The value to be used for the wsa:Action IRI.

[Body] A MESSAGE body.

These properties bind to a SOAP Envelope as follows:

```
<s12:Envelope>
  <s12:Header>
    <wsa:Action>[Action]</wsa:Action>
    ...
  </s12:Header>
  <s12:Body>[Body]</s:Body>
</s12:Envelope>
```

3.4 XML namespaces

Table 1 lists XML namespaces that are used in this standard. Although the choice of the namespace prefix is arbitrary and not semantically significant (W3C XML Information Set), it is RECOMMENDED by this standard that the prefixes shown in the left-most column are used.

Table 1—Namespace prefixes, their corresponding XML namespaces, and specifications

Prefix	XML namespace	Specification(s)
mdpws	http://standards.ieee.org/downloads/11073/11073-20702-2016 [a]	This standard
dpws	http://docs.oasis-open.org/ws-dd/ns/dpws/2009/01	OASIS DPWS V1.1
s12	http://www.w3.org/2003/05/soap-envelope	W3C SOAP V1.2 Part 1
wsa	http://www.w3.org/2005/08/addressing	W3C WS-Addressing 1.0
wsam	http://www.w3.org/2007/05/addressing/metadata	W3C Web Services Addressing 1.0—Metadata
wsdl	http://schemas.xmlsoap.org/wsdl/	W3C WSDL 1.1
wsp	http://www.w3.org/ns/ws-policy	W3C WS-Policy 1.5 Framework
wssu	http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd	OASIS WS-Security 2004
wsx	http://schemas.xmlsoap.org/ws/2004/09/mex	W3C WS-Metadata Exchange 1.1
xs	http://www.w3.org/2001/XMLSchema	W3C XML Schema 1.1

[a]The xml schema files necessary to ease the understanding of this standard are available at the following URL: http://standards.ieee.org/downloads/11073/11073-20702-2016/MDPWS.xsd.

Copyright © 2017 IEEE. All rights reserved.

© IEEE 2017 – All rights reserved