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Information technology — Document Schema Definition Languages (DSDL) —

Part 3: Rule-based validation using Schematron

Technologies de l'information — Langages de définition de schéma de documents (DSDL) —

Partie 3: Validation basée sur des règles à l'aide de Schematron

Reference number
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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

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 document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see https://www.iso.org/directives or https://www.iec.ch/members_experts/refdocs).

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 34, *Document description and processing languages.*

This fourth edition cancels and replaces the third edition (ISO/IEC 19757-3:2020 [1]), which has been technically revised.

The main changes are as follows:

— a query language binding has been added for XQuery3 (Annex M);

— new elements `group` (5.4.5), `library` (5.4.8) and `rules` (5.4.16) have been added;

— new attribute `as` has been added to element `let` (5.4.7), to enable datatyping of variables;

— new attributes `schematronEdition` (5.5.15) and `severity` (5.5.16) have been added;

— `param` elements (5.4.11) are now allowed for schemas and abstract patterns and in the latter case their value can act as a default;

— attributes `flag` (5.5.6), `role` (5.5.14) and `severity` (5.5.16) are dynamically evaluated if their value is a variable reference;

— element `extends` (5.4.4) is made available at the top level of a schema;

— the methods of base URI fixup (6.8) and language fixup (6.7) are specified;

— a mapping of schema to SVRL structures is provided in Annex D.

A list of all parts in the ISO/IEC 19757 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.

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Introduction

ISO/IEC 19757 (all parts) [2] defines a set of Document Schema Definition Languages (DSDL) that can be used to specify one or more validation processes performed against Extensible Markup Language (XML 1.0[3]) or Standard Generalized Markup Language (SGML) documents. [XML is an application profile SGML (see ISO 8879 [4]).

A document model is an expression of the constraints to be placed on the structure and content of documents to be validated with the model. A number of technologies have been developed through various formal and informal consortia since the development of Document Type Definitions (DTDs) as part of ISO 8879 [4], notably by the World Wide Web Consortium (W3C) and the Organization for the Advancement of Structured Information Standards (OASIS). A number of validation technologies are standardized in DSDL to complement those already available as standards or from the industry.

Through the validation that a structured document conforms to specified constraints in structure and content, the potentially many applications acting on the document are relieved from duplicating the task of confirming that such requirements have been met. Historically, such tasks and expressions have been developed and utilized in isolation, without consideration of how the features and functionality available in other technologies can enhance validation objectives.

The main objective of ISO/IEC 19757 (all parts) [2] is to bring together different validation-related tasks and expressions to form a single extensible framework that allows technologies to work in series or in parallel to produce a single or a set of validation results. The extensibility of DSDL accommodates validation technologies not yet designed or specified.

In the past, different design and use criteria have led users to choose different validation technologies for different portions of their information. Bringing together information within a single XML document sometimes prevents existing document models from being used to validate sections of data. By providing an integrated suite of constraint description languages that can be applied to different subsets of a single XML document, ISO/IEC 19757 (all parts) [2] allows different validation technologies to be integrated under a well-defined validation policy.

The structure of this document is as follows. Clause 5 describes the syntax of a Schematron schema. Clause 6 describes the semantics of a correct Schematron schema; the semantics specify when a document is valid with respect to a Schematron schema. Clause 7 describes conformance requirements for implementations of Schematron validators. Annex A provides the ISO/IEC 19757-2 [5] (RELAX NG) schema for Schematron. Annex B provides the Schematron schema for constraints in Schematron that cannot be expressed by the schema of Annex A. Annex C provides the default query language binding to XSLT1. Annex D provides an ISO/IEC 19757-2 [5] (RELAX NG compact syntax) schema and corresponding Schematron schema for a simple XML language Schematron Validation Report Language. Annex E provides motivating design requirements for Schematron. Annex F specifies certain Schematron elements to be used in external vocabularies. Annex G provides a simple example of a multi-lingual schema. Annex H to Annex M provide query language bindings. Annex O shows example usage of Schematron properties.

This edition is backwards compatible with ISO/IEC 19757-3:2020 [1] to the extent that validation results produced by existing schemas are unaffected by the changes this edition makes, supersedes it and provides extra query language bindings, for XQuery3.

Considered as a document type, a Schematron schema contains natural-language assertions concerning a set of documents, marked up with various elements and attributes for testing these natural-language assertions and for simplifying and grouping assertions.

Considered theoretically, a Schematron schema reduces to a non-chaining rule system whose terms are Boolean functions invoking an external query language on the instance and other visible XML documents, with syntactic features to reduce specification size and to allow efficient implementation.

Considered analytically, Schematron has two characteristic high-level abstractions: the pattern and the phase. These allow the representation of non-regular, non-sequential constraints that ISO/IEC 19757-2 [5] cannot specify and various dynamic or contingent constraints.

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This document is based on the Schematron[6] assertion language. The `let` element is based on XCSL[7]. Other features arise from the half-dozen early open-source implementations of Schematron in diverse programming languages and from discussions in electronic forums by Schematron users and implementers.

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Information technology — Document Schema Definition Languages (DSDL) —

Part 3:
Rule-based validation using Schematron

1 Scope

This document specifies Schematron, a schema language for XML. This document establishes requirements for Schematron schemas and specifies when an XML document matches the patterns specified by a Schematron schema. Schematron uses query languages such as XPath for writing assertions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Extensible Markup Language (XML) 1.0 (Fifth Edition), 26 November 2008, https://www.w3.org/TR/2008/REC-xml-20081126/

ISO/IEC 19757-2, *Information technology — Document Schema Definition Language (DSDL) — Part 2: Regular-grammar-based validation — RELAX NG*

XML 1.1, *Extensible Markup Language (XML) 1.1 (Second Edition), 16 August 2006, https://www.w3.org/TR/2006/REC-xml11-20060816/*

XML Inclusions (XInclude) Version 1.0 (Second Edition), 15 November 2006, https://www.w3.org/TR/2006/REC-xinclude-20061115/

XML Path Language (XPath) 2.0, W3C Recommendation, 23 January 2007, https://www.w3.org/TR/xpath20/

XML Path Language (XPath) 3.0, W3C Recommendation, 8 April 2014, https://www.w3.org/TR/xpath-30/

XML Path Language (XPath) 3.1, 21 March 2017, https://www.w3.org/TR/xpath-31/

XML Path Language (XPath) Version 1.0, W3C Recommendation, 16 November 1999, https://www.w3.org/TR/xpath-10/

XPath and XQuery Functions and Operators 3.0, W3C Recommendation, 8 April 2014, https://www.w3.org/TR/xpath-functions-30/

XQuery 1.0 and XPath 2.0 Functions and Operators, W3C Recommendation, 14 December 2010, https://www.w3.org/TR/2010/REC-xpath-functions-20101214/

XQuery 3.0: An XML Query Language, 08 April 2014, https://www.w3.org/TR/xquery-30/

XQuery 3.1: An XML Query Language, 21 March 2017, https://www.w3.org/TR/xquery-31/

XSL Transformations (XSLT) Version 1.0, W3C Recommendation, 16 November 1999, https://www.w3.org/TR/xslt-10/

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XSL Transformations (XSLT) Version 2.0, W3C Recommendation, 23 January 2007, http://www.w3.org/TR/xslt20/

XSL Transformations (XSLT) Version 3.0, W3C Recommendation, 8 June 2017, https://www.w3.org/TR/xslt-30/

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
abstract pattern
pattern (3.13) in a *Schematron schema* (3.7) that has been parameterized to enable reuse

3.2
abstract rule
collection of *assertions* (3.5) which can be included in other *rules* (3.18) but which does not fire itself

3.3
active pattern
pattern (3.13) belonging to the *active phase* (3.4)

3.4
active phase
phase (3.14) whose *patterns* (3.13) are used for validation

3.5
assertion
natural-language statement with associated *assertion test* (3.6) and ancillary attributes

3.6
assertion test
query returning a Boolean value

Note 1 to entry: An assertion test "succeeds" or "fails".

3.7
Schematron schema
document that satisfies all the requirements of this document

3.8
diagnostic
named natural-language statements providing information to end-users of validators concerning the expected and actual values together with repair hints

3.9
elaborated rule-context expression
single *rule-context expression* (3.20) which explicitly disallows items selected by lexically previous *rule contexts* (3.19) in the same *pattern* (3.13)

3.10
implementation
instantiation of a Schematron validator

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3.11
name
mixture of characters with a restricted set of initial characters

Note 1 to entry: See Production 5 of XML 1.0[3].

3.12
natural-language assertion
natural-language statement expressing some part of a *pattern* (3.13)

Note 1 to entry: A natural-language assertion is "met" or "unmet".

3.13
pattern
collection of *rules* (3.18) with an optional identifier and ancillary information

Note 1 to entry: Patterns of a schema do not have a defined order.

Note 2 to entry: Patterns are represented in schemas by elements `pattern` (5.4.12) and `group` (5.4.5).

3.14
phase
named, unordered collection of *patterns* (3.13)

Note 1 to entry: Patterns may belong to more than one phase.

Note 2 to entry: Three strings, `#ALL`, `#ANY` and `#DEFAULT`, are reserved with particular meanings.

3.15
progressive validation
validation of constraints in stages determined or grouped to some extent by the schema author rather than, for example, entirely determined by the document order

3.16
property
named data giving additional metadata on an *assertion* (3.5) or report

3.17
query language binding
named set, specified in a document, of the languages and conventions used for *assertion tests* (3.6), *rule-context expressions* (3.20) and so on, by a particular Schematron *implementation* (3.10)

3.18
rule
unordered collection of *assertions* (3.5) with a *rule-context expression* (3.20) and ancillary attributes

3.19
rule context
element or other information item used for *assertion tests* (3.6)

Note 1 to entry: A *rule* (3.18) is said to fire when an information item matches the rule context.

3.20
rule-context expression
query to specify *subjects* (3.21)

Note 1 to entry: A *rule context* (3.19) is said to match an information item when that information item has not been matched by any lexically-previous rule-context expressions in the same *pattern* (3.13) and the information item is one of the information items that the query would specify.

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3.21
subject
particular information item which corresponds to the object of interest of the *natural-language assertions* (3.12) and typically is matched by the context expression of a *rule* (3.18)

Note 1 to entry: Subjects can be more precisely defined in schemas by the `subject` attribute (5.5.19).

3.22
valid
passing all *assertion tests* (3.6) in fired *rules* (3.18) of *active patterns* (3.3)

3.23
variable
constant value, represented by a *name* (3.11), evaluated within the parent schema, *phase* (3.14), *pattern* (3.13) or *rule* (3.18) and scoped within the parent schema, phase, pattern or rule

Note 1 to entry: Variables are represented in schemas by elements `let` (5.4.7) and `param` (5.4.11).

4 Notation

This document uses XPath to identify information items, to the extent that items in the XPath data model can be derived from those defined by XML Infoset[8], in Schematron schemas.

5 Syntax

5.1 Well-formedness

A Schematron schema shall be a well-formed XML document, according to the version of XML (XML 1.0 or XML 1.1) used.

5.2 Namespace

All elements shown in the grammar for Schematron are qualified with the namespace URI [IRI[9]]:

`http://purl.oclc.org/dsdl/schematron`

In this document, the prefix `sch` is taken as bound to the Schematron namespace URI for exposition purposes. The prefix `sch` is not reserved or required by this document. Any element can also have foreign attributes in addition to the attributes shown in the grammar. A foreign attribute is an attribute with a name whose namespace URI is neither the empty string nor the Schematron namespace URI. Any non-empty element may have foreign child elements in addition to the child elements shown in the grammar. A foreign element is an element with a name whose namespace URI is not the Schematron namespace URI. There are no constraints on the relative position of foreign child elements with respect to other child elements.

5.3 Whitespace

Any element can also have children strings that consist entirely of whitespace characters, where a whitespace character is one of U+0020, U+009, U+00D or U+00A. There are no constraints on the relative position of whitespace string children with respect to child elements.

Leading and trailing whitespace should be stripped from attributes defined by this document. Whitespace should be collapsed in elements defined by this document that allow text. Whitespace may be stripped from elements defined by this document that do not allow text.

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