



Intelligence Community Technical Specification

XML Data Encoding Specification for Data Element Definition

Version 2019-MAR

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Chapter 1 - Introduction

1.1 - Purpose

This *XML Data Encoding Specification for Data Element Definition* (DED.XML) defines detailed implementation guidance for using Extensible Markup Language (XML) to encode DED data. This Data Encoding Specification (DES) defines the XML elements and attributes, associated structures and relationships, mandatory and cardinality requirements, and permissible values for representing DED data concepts using XML.

The exchange of Data Element Definitions (DED) across the Enterprise is critical to creating a common understanding of data fields and structures. Standardizing DEDs is anticipated to greatly facilitate both human and machine understanding of data.

1.2 - Scope

The *Intelligence Community Technical Specification Framework* (IC-SF.XML^[5]) defines the basic conceptual structure and outlines the core philosophy of Intelligence Community (IC) technical specifications. For convenience, a copy of this framework is included in every package.

This specification is applicable to the IC and information produced by, stored, or shared within the IC. This DES may have relevance outside the scope of intelligence; however, prior to applying outside of this defined scope, the DES should be closely scrutinized and differences separately documented and assessed for applicability.

1.3 - Enterprise Need

Information sharing with the national intelligence enterprise is increasingly dependent on the exchange of information about an exchange format. Systems, users, and developers all need a more consistent machine processable format for exchanging information describing data. This specification is a reaction to that need.

Both enterprise needs and requirements for this specification can be found in the following policies and implementation guidance:

- 500 Series:
 - Intelligence Community Directive (ICD) 500, *Director Of National Intelligence Chief Information Officer*^[6]
 - Intelligence Community Standard (ICS) 500-20, *IC Enterprise Standards Compliance*^[7]

1.4 - Conventions

Certain technical and presentation conventions are used in the creation of the IC technical specifications to ensure readability and understanding. For details, please see the "Specification Conventions" chapter in the IC-SF.XML^[5].

1.4.1 - XML Namespaces

Namespaces referenced in this document and the prefixes used to represent them are listed in the following table. The namespace prefix of any XML Qualified Name used in any example in this document should be interpreted using the information below.

Table 1 - XML Namespaces

Prefix	URI
ded	urn:us:gov:ic:ded

1.4.2 - Multiplicity

Throughout this document, references are made to the multiplicity of attributes and parameters. Multiplicity defines the allowed number of occurrences of an attribute value, and whether the attribute is required or optional.

Table [Table 2](#) follow Object Management Group (OMG)'s UML, *Unified Modeling Language* [\[11\]](#) and International Organization for Standardization (ISO) 11179-3, *SO/IEC 11179, Information Technology -- Metadata registries (MDR), Part 3: Registry metamodel and basic attributes* [\[8\]](#).

Table 2 - Definitions of Multiplicities

Multiplicity	Description
[1..1]	Indicates the attribute is mandatory and must contain one and only one value.
[0..1]	Indicates the attribute is optional and may contain at most one value.
[0..*]	Indicates the attribute is optional and may contain any number of values, including none.
[1..*]	Indicates the attribute is mandatory and may contain one or more values.
[0..n]	Indicates the attribute is optional and may contain at most n values, where n is a finite integer. An example in this specification is the multiplicity of auditRoutingOrganization , which is [0..10].
[n..m]	Indicates the attribute is mandatory having at least n values, and may contain at most m values, where n and m are finite integers.

In some cases within this specification, attribute value multiplicity requirements for an attribute will vary depending on whether the entity is a person entity or a non-person entity. In these situations, multiplicity requirements will be noted with "PE" for person entities, and "NPE" for non-person entities.

1.5 - Dependencies

Specifications often rely on other specifications, components or artifacts, either directly or indirectly. For specific definitions of dependency terminology used throughout this section, please see the “Dependency Definitions” chapter in the IC-SF.XML^[5].

1.5.1 - Specification Dependencies

This technical specification directly depends on the technical specifications, documentation, and implementations listed in [Table 3](#). The dependencies listed below are directly referenced in this specification (e.g., Schema, Schematron), and are normative or informative as indicated.

The subsequent figure, [Figure 1](#), is an informative graphical representation of all of the Intelligence Community Chief Information Officer (IC CIO) specifications related to this specification. The graphic depicts dependencies. However, the representations may not match an exact schema import tree or dependency diagram that an analysis of the Schema, Schematron or other documents would yield. For example, the graphic only shows a given specification once even though it may actually be imported by many specifications or be a direct dependency. All IC CIO specifications listed in [Table 3](#) will be shown in [Figure 1](#); however not all IC CIO specifications listed in [Figure 1](#) may appear in [Table 3](#). [Figure 1](#) is to aid users in gaining a general understanding of all dependencies whether direct or transitive.

Table 3 - Direct Dependencies

Name	Dependency Description
<i>XML Data Encoding Specification for Intelligence Community Identifier (IC-ID.XML.V1+^[4])</i>	The specification does not depend on a specific version of IC-ID.XML ^[4] ; versions later than version 1 MAY be used. The minimum version was based on the earliest non-retired version; Enterprise Standards Baseline (ESB) 18-3.0 was used for determining the version.
<i>XML Data Encoding Specification for Enterprise Data Header (IC-EDH.XML.V2019-MAR+^[3])</i>	This specification does not depend on a specific version of IC-EDH.XML ^[3] ; versions later than version 2019-MAR MAY be used. The minimum version was based on a technical dependency; The merging of ARH and NTK into ISM.
<i>XML Data Encoding Specification for Information Security Marking Metadata (ISM.XML.V2019-MAR+^[9])</i>	This specification does not depend on a specific version of ISM.XML ^[9] ; versions later than version 2019-MAR MAY be used. The minimum version was based on a technical dependency; The merging of ARH and NTK into ISM.

Name	Dependency Description
<i>Intelligence Community Specification Framework</i> (IC-SF.XML.V2019-MAR+ ^[5])	This specification does not depend on a specific version of IC-SF.XML^[5]; versions later than version 2019-MAR MAY be used, however, the newest version of IC-SF.XML SHOULD be used as IC-SF.XML is expected to always replace its preceding version. The minimum version was based on technical dependencies on IC-SF.XML; IC-SF.XML is the basic structure of and philosophy behind intelligence community technical specifications.
Schematron ^[10]	Schematron — ISO/International Electrotechnical Commission (IEC) 19757-3:2006 — is a rule-based document schema definition language. In this specification Schematron is a formal language used to express normative business rules, so this reference is normative. The Schematron rules are normative in the sense that they convey criteria that a document MUST adhere to, exactly as English may be used to convey normative criteria. It is not necessary for implementers to use the specific Schematron encoding in this specification. Implementers MAY use any encodings, tools, or languages desired to implement validation schemes for conformance to this specification. Note: The Schematron rules in this specification use Transformations (XSLT) 2.0^[12] query binding.
XSLT 2.0^[12] implementation of Schematron^[10] by Rick Jelliffe (2010-04-14) Note: The only available identifying descriptors for this implementation are the implementer's name and date of release. This implementation may be found at the following Uniform Resource Locator (URL): http://code.google.com/p/schematron/.	The International Organization for Standardization does not create nor endorse reference implementations of its standards. For the purposes of this specification the <i>behavior</i> of the implementation created by Mr. Jelliffe is normative. Implementers MAY use any encodings, tools, or languages desired to implement validation schemes for conformance to this specification. To conform to this specification, a validator MUST find a document valid <i>if and only if</i> the Schematron implementation by Mr. Jelliffe would find the document valid according to the Schematron rules in this specification.

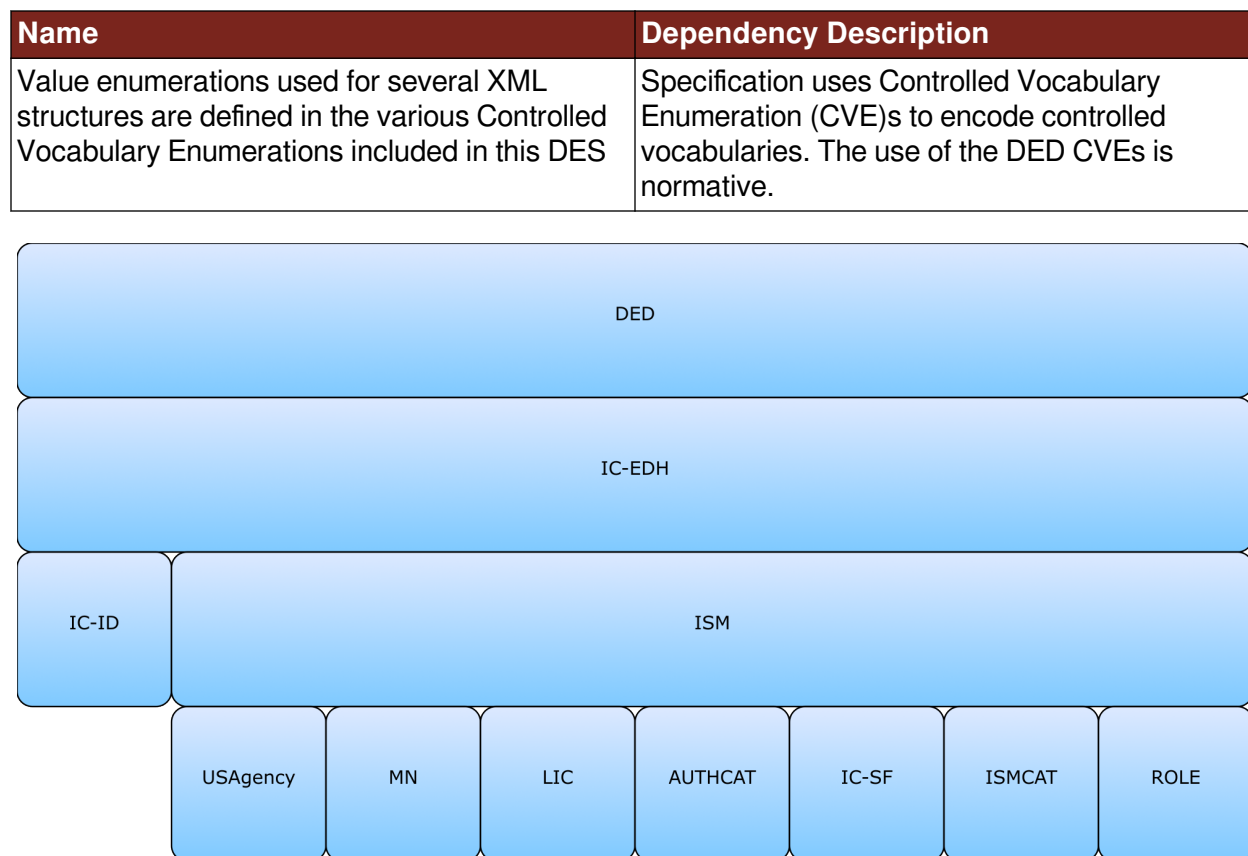


Figure 1 : Related Specifications

1.5.2 - Inverse Dependencies

Generally, it is only necessary to think of the *dependencies* in the dependency tree. However, with the specification versions being decoupled, it is also important to consider the *inverse dependencies*, for compatibility with newer versions of a given specification. The changes introduced to a given specification can sometimes make it incompatible with current versions of its inverse dependencies (specifications that uses the given specification).

This specification is not used by other specifications released by the IC CIO, and therefore does not contain an Inverse Dependency Diagram.

Chapter 2 - Development Guidance

For information on the structure and content of the specifications, please see the “Specification Overview” chapter in the IC-SF.XML^[5] framework document. This chapter is intended to expand upon the common information that the framework specifies providing specific development guidance that is specific to the implementation of this specification.

2.1 - Additional Guidance

This section provides additional guidance for encoding data in specific situations. In particular, situations for which there is not clearly a single method of encoding the data are documented here. The content of this section will evolve over time as additional situations are identified. Implementers of this DED.XML are encouraged to contact the maintainers of this DED.XML for further guidance when necessary.

The DED.XML structure is broken into three distinct parts, described below:

Overall DedHeader Metadata	Metadata that occurs only once per DED.XML, where the intent is to characterize the DED.XML in it’s entirety.
DataElement Metadata	Metadata that occurs one or more times per DED.XML, where the intent is to completely characterize each DED.XML keyword or definition.
Relationship Metadata	Metadata that occurs zero or more times per DED.XML, where the intent is to characterize how two Data Elements interact with each other.

2.1.1 - Rendering

Using the DED.XML may be useful to software but without a rendering DED.XML is more difficult to help humans. There is an XSLT provided to transform DED.XML into Docbook^[1] for a rendering. This rendering is not required but was thought to be a exemplar of how rendering might look.

To convert a DED.XML instance to Docbook, simply run the “Ded-to-Docbook.xsl” provided in the XSL folder of this specification against the DED.XML instance. That Docbook file can then be rendered into other formats (e.g. PDF, HTML) using your preferred Docbook publishing solution, or by utilizing the instructions and tools provided in the *XML Data Encoding Specification for Intelligence Community Docbook* (IC-Docbook.XML^[2]) specification.

An example of this being done can be seen in the Examples/ folder of this specification. The “DEDAExampleDED.xml” file is a sample DED.XML instance that describes the DED.XML specification produced from the schema using the annotation markup and the “Xsd-to-Ded.xsl” from the XSL folder. To this XML file, the “Ded-to-Docbook.xsl” was applied and the resulting Docbook instance, “DEDAExampleDED-Docbook.xml”, can be seen in the Example/Rendering folder. A rendering of that Docbook file to PDF is also made available as a peer to the file, “DEDAExampleDED.pdf”.

Chapter 3 - Constraints

3.1 - Data Validation Constraint Rules

3.1.1 - Purpose

The DED.XML schema defines the data elements, attributes, cardinalities and parent-child relationships for which XML instances must comply. Validation of these syntax aspects is an important first step in the validation process. An additional level of validation is needed to ensure that the content complies with the constraints as specified in applicable IC policy guidance and codified in these constraint rules. Traditional schema languages are generally unable to effectively represent these additional constraints. For more information, please see the “Data Validation Constraint Rules” chapter in the IC-SF.XML^[5] framework document.

3.1.2 - Value Enumeration Constraints

Several elements and attributes of the DED.XML model use CVEs to define the data allowed in the element or attribute. In some cases the specific CVE is specified via an attribute, which may include a default CVE. Further, in some of the cases where the CVE can be specified, the attribute may restrict the list of CVEs allowed and some may allow for the author to specify their own CVE. For each of these, the value must be in the specified external CVE or the default CVE.

Some CVEs are not available on all networks. A subset CVE will be provided for use on networks not approved for the entire list. If the processing will occur on a network where the entire CVE is not available, the subset CVE may be substituted in the constraint rules since the excluded values would be excluded from use on the lower network.

As noted in the specific rules, a failure of validation against a CVE will generate an Error.

3.1.3 - Additional Constraints

3.1.3.1 - DES Constraints

The DES version is specified through attributes on the root element. The schema constrains the values of these attributes. The **@DESVersion** attribute enables systems processing an instance document to be certain which set of constraint rules, schema, CVEs and business rules are intended by the author to be used.

3.1.4 - Constraint Rules

The detailed constraint rules for the DED.XML schema can be found in a separate document inside the Documents/DED directory, in the “DED_Rules.pdf” file. This document is generated from the individual Schematron files to provide a single searchable document for all of the constraint rules encoded in Schematron. Obsolete rule numbers are listed in the “DED_Rules.pdf” file.

3.2 - Data Rendering Constraint Rules

3.2.1 - Purpose

Rendering rules define constraints on the rendering and display of DED.XML documents. The intent is to inform the development of systems capable of rendering or displaying DED.XML data for use by individuals not familiar with the details of the DED.XML markup. While expressed in a similar manner to the data validation constraint rules above, there is no expectation that evaluation of these rules can be automated; rather these rules should inform the evaluation of a system's capabilities and functionality.

3.2.2 - Rendering Constraint Rules

The following table contains the information for the DED.XML data rendering constraint rules.

Table 4 - Constraint Rules

Rule Number	Severity	Description	Human Readable Description
There are no Data Rendering Constraint rules at this time.			

Appendix A Feature Summary

The following table summarizes major features by version for this DED.XML and all dependent specs.

Table 5 - Feature Summary Legend

Key	Description
F	Full (able to comply and verified by spec to some degree)
P	Partial (Able to comply but not verifiable)
N	Non-compliance (Can't comply)
N/A	Not Applicable. Feature is no longer required.
Cell Colors represent the same information as the Key value	

A.1. DED Feature Summary

Table 6 - DED Feature comparison

Required date	Feature	V2019-MAR
	Initial set of data element definitions.	F

Appendix B Change History

The following table summarizes the version identifier history for this DES.

Table 7 - DES Version Identifier History

Version	Date	Purpose
2019-MAR	March 8, 2019	Initial Release. For details, see Section B.1 - V2019-MAR Initial Release Summary

B.1 - V2019-MAR Initial Release Summary

Significant drivers for Version V2019-MAR include:

- Creation of DED.XML specification.

The following table summarizes the initial release in V2019-MAR.

Table 8 - Data Encoding Specification V2019-MAR Initial Release Summary

#	Change	Artifacts changed	Compatibility Notes
1	Creation of DED.XML specification.(CR-2018-107, CR-2017-155)	Documentation Schema Schematron CVE	Initial Release.

Appendix C List of Abbreviations

This appendix lists all the acronyms and abbreviations referenced in this encoding specification.

CVE	Controlled Vocabulary Enumeration
DES	Data Encoding Specification
DNI	Director of National Intelligence
ESB	Enterprise Standards Baseline
IC	Intelligence Community
IC CIO	Intelligence Community Chief Information Officer
ICD	Intelligence Community Directive
IC ESB	Intelligence Community Enterprise Standards Baseline
ICS	Intelligence Community Standard
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
OMG	Object Management Group
URL	Uniform Resource Locator
XML	Extensible Markup Language
XSL	Extensible Stylesheet Language
XSLT	XSL Transformations

Appendix D Bibliography

[1] Docbook

OASIS. *Docbook*.

OASIS Docbook home: https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=docbook

Docbook.org home: <https://docbook.org>

StyleSheets: <https://github.com/docbook/xslt10-stylesheets/releases>

[2] IC-Docbook.XML

Office of the Director of National Intelligence. *XML Data Encoding Specification for Intelligence Community Docbook (IC-Docbook.XML)*.

Available online Intelink-TS at: <https://go.ic.gov/DQJhr2S> (case sensitive – Delta Quebec Juliet hotel romeo 2 Sierra)

Available online Intelink-U at: <https://w3id.org/ic/standards/IC-Docbook>

Available online at: <https://w3id.org/ic/standards/public>

[3] IC-EDH.XML

Office of the Director of National Intelligence. *XML Data Encoding Specification for Enterprise Data Header (IC-EDH.XML)*.

Available online Intelink-TS at: <https://go.ic.gov/5Pg1r8s> (case sensitive – 5 Papa golf 1 romeo 8 sierra)

Available online Intelink-U at: <https://w3id.org/ic/standards/EDH>

Available online at: <https://w3id.org/ic/standards/public>

[4] IC-ID.XML

Office of the Director of National Intelligence. *Text and XML Data Encoding Specification for Intelligence Community Identifier (IC-ID.XML)*.

Available online Intelink-TS at: <https://go.ic.gov/aKlfr9y> (case sensitive – alpha Kilo lima foxtrot romeo 9 yankee)

Available online Intelink-U at: <https://w3id.org/ic/standards/IC-ID>

Available online at: <https://w3id.org/ic/standards/public>

[5] IC-SF.XML

Office of the Director of National Intelligence. *Intelligence Community Specification Framework (IC-SF.XML)*.

Available online Intelink-TS at: <https://go.ic.gov/pNFyuVg> (case sensitive – papa November Foxtrot yankee uniform Victor golf)

Available online Intelink-U at: <https://w3id.org/ic/standards/IC-SF>

Available online at: <https://w3id.org/ic/standards/public>

[6] ICD 500

Office of the Director of National Intelligence. *Director of National Intelligence Chief Information Officer. Intelligence Community Directive 500. 7 August 2008.*

Available online Intelink-TS at: <https://go.ic.gov/U7v6ZRL> (case sensitive – Uniform 7 victor 6 Zulu Romeo Lima)

Available online at: http://www.dni.gov/files/documents/ICD/ICD_500.pdf

[7] ICS 500-20

Director of National Intelligence Chief Information Officer. *Intelligence Community Enterprise Standards Compliance*. Intelligence Community Standard 500-20. 16 December 2010.

Available online Intelink-TS at: <https://go.ic.gov/kh8NMVJ> (case sensitive – kilo hotel 8 November Mike Victor Juliet)

Available online Intelink-U at: <https://w3id.org/ic/standards/policy/ICS500-20>

[8] ISO 11179-3

International Organization for Standardization (ISO). *ISO/IEC 11179, Information Technology -- Metadata registries (MDR), Part 3: Registry metamodel and basic attributes*.

Available online at: <https://www.iso.org/standard/50340.html>

[9] ISM.XML

Office of the Director of National Intelligence. *XML Data Encoding Specification for Information Security Markings (ISM.XML)*.

Available online Intelink-TS at: <https://go.ic.gov/qoNICy7> (case sensitive – quebec oscar November India Charlie yankee 7)

Available online Intelink-U at: <https://w3id.org/ic/standards/ISM>

Available online at: <https://w3id.org/ic/standards/public>

[10] Schematron

International Organization for Standardization (ISO). *Information technology -- Document Schema Definition Language (DSDL) -- Part 3: Rule-based validation -- Schematron*.

ISO/IEC 19757-3:2006.

ISO Spec Available online at: <http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html>

StyleSheets for compiling Available online at: <http://code.google.com/p/schematron/>

[11] UML

Object Management Group (OMG). *Unified Modeling Language*. 6 December 2017.

Available online at: <https://www.omg.org/spec/UML/2.5.1/PDF/changebar>

[12] XSLT2

World Wide Web Consortium (W3C). *XSL Transformations (XSLT) Version 2.0*. W3C Recommendation 23 January 2007.

Available online at: <http://www.w3.org/TR/xslt20/>

Appendix E Points of Contact

The Intelligence Community Chief Information Officer (IC CIO) facilitates one or more collaboration and coordination forums charged with the adoption, modification, development, and governance of IC technical specifications of common concern. This technical specification was produced by the IC CIO and coordinated with these forums, approved by the IC CIO or a designated representative, and made available at the following Director of National Intelligence (DNI)-sponsored web sites.

Public Website: <https://w3id.org/ic/standards/public>

Intelshare: <https://w3id.org/ic/standards/data-specs>

Direct all inquiries about this IC technical specification, IC technical specification collaboration and coordination forums, or IC element representatives involved in those forums, to the IC CIO.

E-mail: ic-standards-support@odni.gov.

Appendix F IC CIO Approval Memo

An IC CIO Approval Memo should accompany this enterprise technical data specification bearing the signature of the IC CIO or an IC CIO-designated official(s). If an IC CIO Approval Memo is not accompanying this specification's version release package, then refer back to the authoritative web location(s) for this specification to see if a more complete package or a specification update is available.

Specification artifacts display a date representing the last time a version's artifacts as a whole were modified. This date most often represents the conclusion of the IC Element collaboration and coordination process. Once the IC Element coordination process is complete, the specification goes through an internal IC CIO staffing and coordination process leading to signature of the IC CIO Approval Memo. The signature date of the IC CIO Approval Memo will be later than the last modified date shown on the specification artifacts by an indeterminable time period.

Upon signature of the IC CIO Approval Memo, IC Elements may begin to use this specification version in order to address mission and business objectives. However, it is critical for IC Elements, prior to disseminating information encoded with this new specification version, to ensure that key enterprise services and consumers are prepared to accept this information. IC Elements should work with enterprise service providers and consumers to orchestrate an orderly implementation transition to this specification version in concert with mandatory and retirement usage decisions captured in the Intelligence Community Enterprise Standards Baseline (IC ESB) as defined in ICS 500-20^[7].