



Intelligence Community Technical Specification

XML Data Encoding Specification for Need-To-Know Metadata

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Table of Contents

Chapter 1 - Introduction	1
1.1 - Purpose	1
1.2 - Scope	1
1.3 - Background	1
1.4 - Enterprise Need	2
1.5 - Audience and Applicability	3
1.6 - Conventions	3
1.7 - Dependencies	4
1.7.1 - Standalone and Convenience Packages	4
1.8 - Conformance	5
Chapter 2 - Development Guidance	6
2.1 - Understanding Access Control	6
2.2 - Relationship to Abstract Data Definition and other encodings	7
2.3 - NTK and Access Control	7
2.4 - Additional Guidance	8
2.4.1 - Integration into a schema	8
2.4.2 - Basic usage model	8
2.4.3 - Guidance for the specification of constraints for a particular access system	9
2.4.4 - Guidance for systems processing data containing NTK metadata	10
Chapter 3 - Definitions, Interfaces, and Constraints	12
3.1 - Constraint Rule Types	12
3.2 - "Living" Constraint Rules	12
3.3 - Classified or Controlled Constraint Rules	12
3.4 - Terminology	12
3.5 - Errors and Warnings	13
3.6 - Rule Identifiers	13
3.7 - Data Validation Constraint Rules	13
3.7.1 - Purpose	13
3.7.2 - Schematron	13
3.7.3 - Non-null Constraints	14
3.7.4 - Inherited Constraints	14
3.7.5 - Value Enumeration Constraints	14
3.7.6 - Additional Constraints	14
3.7.6.1 - DES Constraints	14
3.7.7 - Constraint Rules	15
3.8 - Data Rendering Constraint Rules	15
3.8.1 - Purpose	15
3.8.2 - Rendering Constraint Rules	15
Chapter 4 - Conformance Validation	16
4.1 - Schema Validation	16
4.2 - Business Rule Validation	16
Chapter 5 - Generated Guides	17
5.1 - Schema Guide	17
5.2 - Schematron Guide	18
Appendix A - Feature Summary	19

A.1 - NTK Feature Summary	19
Appendix B - Change History	20
B.1 - V10 Change Summary	20
B.2 - V9 Change Summary	21
B.3 - V8 Change Summary	21
B.4 - V7 Change Summary	22
B.5 - V6 Change Summary	23
B.6 - V5 Change Summary	23
B.7 - V4 Change Summary	24
B.8 - V3 Change Summary	24
B.9 - V2 Change Summary	25
Appendix C - Acronyms	26
Appendix D - Bibliography	32
Appendix E - Points of Contact	35
Appendix F - IC CIO Approval Memo	36

List of Tables

Table 1 - Dependencies	4
Table 2 - Constraint Rules	15
Table 3 - NTK Dependency over time	19
Table 4 - Feature Summary Legend	19
Table 5 - NTK Feature comparison	19
Table 6 - DES Version Identifier History	20
Table 7 - Data Encoding Specification V10 Change Summary	20
Table 8 - Data Encoding Specification V9 Change Summary	21
Table 9 - Data Encoding Specification V8 Change Summary	22
Table 10 - Data Encoding Specification V7 Change Summary	22
Table 11 - Data Encoding Specification V6 Change Summary	23
Table 12 - Data Encoding Specification V5 Change Summary	23
Table 13 - Data Encoding Specification V4 Change Summary	24
Table 14 - Data Encoding Specification V3 Change Summary	24
Table 15 - Data Encoding Specification V2 Change Summary	25
Table 16 - Acronyms	26

Chapter 1 - Introduction

1.1 - Purpose

This *XML Data Encoding Specification for Need-To-Know Metadata* (NTK.XML) defines detailed implementation guidance for using Extensible Markup Language (XML) to encode metadata necessary to facilitate automated systems making a "need-to-know" (NTK) determination. This Data Encoding Specification (DES) defines the XML elements and attributes, associated structures and relationships, mandatory and cardinality requirements, and permissible values for representing NTK data concepts using XML.

These metadata are used to represent the system-specific properties assigned to an information resource that will be used, in conjunction with information about the user, and possibly other information, to determine the user's access to the data. A single information resource may include multiple occurrences of these metadata in order to specify (NTK) information according to multiple, different access systems. Each of the access systems will provide the specifics about the metadata to be captured.

1.2 - Scope

This specification is applicable to the Intelligence Community (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 - Background

The IC Chief Information Officer (IC CIO) is leading the IC's enterprise transformation to an "interoperable federated architecture." Intelligence Community Directive (ICD) 500, *Director of National Intelligence Chief Information Officer* ^[4] grants the IC CIO the authority and responsibility to:

- Develop an IC enterprise architecture.
- Lead the IC's identification, selection, development, and management of IC enterprise standards.
- Incorporate technically sound, deconflicted, interoperable enterprise standards into the enterprise architecture.
- Certify that IC elements adhere to the architecture and standards.

In the area of enterprise standardization, the IC CIO is called upon to establish common IT standards, protocols, and interfaces, to establish uniform information security standards, and to ensure information technology infrastructure, enterprise architecture, systems, standards, protocols, and interfaces support the overall information sharing strategies and policies of the IC as established in relevant law, policy, and directives.

Enterprise standards facilitate the information exchanges, service protocols, network configurations, computing environments, and business processes necessary for a service-

enabled federated enterprise. As the enterprise develops and deploys shared services employing approved standards, not only will information and services be interoperable, but significant efficiencies and savings will be achieved by promoting capability reuse. As detailed in Intelligence Community Standard (ICS) 500-21, *Tagging of Intelligence and Intelligence-Related Information* [\[10\]](#) the extensive and consistent use of Extensible Markup Language (XML) within data encoding specifications allows for improved data exchanges and processing of information, thereby achieving the IC's data discovery, data sharing, and interoperability goals.

An encoding specification defines how to implement the abstract data elements in the IC Abstract Data Definition (ADD) in a particular physical encoding (e.g., data or file format). For example:

- Encoding specifications for textual markup formats, such as XML and HyperText Markup Language (HTML), define markup elements and attributes, their relationships, cardinalities, processing requirements, and use.
- Encoding specifications for display formats, such as text and Adobe Portable Document Format (PDF), define text and typographic conventions, cardinalities, processing requirements, and use.
- Encoding specifications for application-specific formats, for e.g. Microsoft Word, define document properties, styles, fields, cardinalities, processing requirements, and use.

1.4 - Enterprise Need

Information sharing within the national intelligence enterprise frequently relies on being able to determine an individual's need-to-know as one component in determining whether to allow access to data. The enterprise will increasingly rely on need-to-know metadata to allow users and systems to find and access a wide-range of data throughout the enterprise. A successful information sharing enterprise depends on the ability of the data creator and/or providers to specify the means by which need-to-know can be established in a manner to facilitate discovery and access via automated means.

This DES provides a common specification for the means by which a data producer can encode, in their data, the information an access system needs to determine how to grant access. This DES enables a comprehensive capability that can appropriately protect data across the enterprise while also allowing access by individuals having appropriate need-to-know. The nature of the information to be encoded will vary by system and could include lists of individuals or groups permitted access, descriptions of subject matter in terms defined by the access policy, or other traits to be used in evaluating the access an individual has to the data.

This DES provides that common specification. Currently the particulars of any access system's data needs are not defined. Details for specifying access information and documenting access parameters for particular access systems are to be added in the near future. The systems for which access information will be recorded and constrained will be expanded as their applicabilities are identified to the enterprise.

Enterprise needs and requirements for this specification can be found in the following Office of the Director of National Intelligence (ODNI) policies and implementation guidance.

- IC Information Technology Enterprise (IC ITE)
 - Intelligence Community Information Technology Enterprise (IC ITE) Increment 1 Implementation Plan^[1]
- 500 Series:
 - Intelligence Community Directive (ICD) 501, Discovery and Dissemination or Retrieval of Information within the IC^[5]
 - Intelligence Community Standard (ICS) 500-21, Tagging of Intelligence and Intelligence-Related Information^[10]
- 200 Series:
 - Intelligence Community Directive (ICD) 208, Write for Maximum Utility^[2]
 - Intelligence Community Directive (ICD) 209, Tearline Production and Dissemination^[3]
 - Intelligence Community Policy Memorandum (ICPM) 2007-200-2, Preparing Intelligence to Meet the Intelligence Community's Responsibility to Provide^[8]
- 700 Series:
 - Intelligence Community Directive (ICD) 710, Classification and Control Markings System^[6]
 - Intelligence Community Policy Guidance (ICPG) 710.1, Application of Dissemination Controls: Originator Control^[7]

1.5 - Audience and Applicability

DESSs are primarily intended to be used by those developing tools and services to create, modify, store, exchange, search, display, or further process the type of data being described.

The conditions of use and applicability of this technical specification are defined outside of this technical specification. IC Standard (ICS) 500-20, *Intelligence Community Enterprise Standards Compliance*,^[9] defines the IC Enterprise Standards Baseline (IC ESB) and the applicability of such to an IC element.

The IC ESB defines the compliance requirements associated with each version of a technical specification. Each version will be individually registered in the IC ESB. The IC ESB will define, among other things, the location(s) of the relevant artifacts, prescriptive status, and validity period, all of which characterize the version and its utility.

Additional applicability and guidance may be defined in separate IC policy guidance.

1.6 - Conventions

Certain technical and presentation conventions were used in the creation of this document to ensure readability and understanding.

The keywords "MUST," "MUST NOT," "REQUIRED," "SHALL," "SHALL NOT," "SHOULD," "SHOULD NOT," "RECOMMENDED," "MAY," and "OPTIONAL" in this technical specification are to be interpreted as described in the IETF RFC 2119^[11]. These implementation indicator keywords are thus capitalized when used to unambiguously specify requirements over protocol and application features and behavior that affect the interoperability and security of implementations. When these words are not capitalized, they are meant in their natural-language sense.

Certain typography is used throughout the body of this document to convey certain meanings, in particular:

- *Italics* – A title of a referenced work or a specialized or emphasized term
- Underscore – An abstract data element
- **Bold** – An XML element or attribute

1.7 - Dependencies

This technical specification depends on the additional technical specifications or additional documentation listed in the following table. The documents listed below are referenced in this encoding specification, and are normative or informative as indicated in the dependencies table.

Table 1 - Dependencies

Name	Dependency Description
<i>XML Data Encoding Specification for Information Security Marking</i> (ISM.XML.V9+) ^[12]	Depends on Information Security Markings (ISM). Starting with ISM v9, the version of ISM imported is no longer normative, so any ISM version 9 or above may be used.
ISO Schematron ^[14] implementation by Rick Jelliffe (2010-04-14)	Conformance to the logic of the business rules listed in this DES is normative. The business rules are expressed in the Schematron language in terms of the features and behavior of the ISO implementation. While the use of Schematron is informative, any conformant implementation of this specification MUST match the behavior of the ISO Schematron implementation for validation.
Value enumerations used for several XML structures are defined in the various Controlled Vocabulary Enumerations included in this DES.	Specification uses CVEs to encode controlled vocabularies. The use of the NTK CVEs is normative.

1.7.1 - Standalone and Convenience Packages

The standalone packaging of this specification does not include the specifications that it is dependent on since the version that may be used could be later than this packaging. There is a

convenience packaging of the specification that includes all the most recent versions of the dependent specifications at the time it's generated. It is anticipated that this convenience package will be updated when any of the dependent specifications change but it will not be signed as a formal package. In order to obtain all the necessary standalone packages you will have to follow this specification's dependencies, and subsequently, their dependencies. These packages will have to be downloaded and copied into the appropriate directories for paths to the schema and CVE to work. Should you mix versions of the CVE schema you will have to separate the sets of CVEs by Schema or edit the CVEs to point to the correct schema file.

Convenience packages are the easier way to go as they come with all dependencies pre-packaged together and are tested as interoperable. When trying to mix and match versions that have not been pre-packaged together there is always risk that a particular combination may not be compatible, especially when mixing with versions of specifications that were not available at the time of this specification's release.

1.8 - Conformance

For an implementation to conform to this specification, it **MUST** adhere to all normative aspects of the specification. For the purposes of this document, normative and informative are defined as:

Normative: considered to be prescriptive and necessary to conform to the standard.

Informative: serving to instruct or enlighten or inform.

The XML schemas (unless noted otherwise), CVE values from the XML CVE files, and the Schematron^[14] code version of the constraint rules are normative for this specification. The rest of this document and the rest of this package, including the descriptive content referenced within the XML Schema Guide, the XSL transformations, the SchematronGuide, and HTML CVE value files, are informative. Additionally, the use of keywords defined in IETF RFC 2119^[11] is considered normative within the scope of the sentence. All other parts of this document are informative.

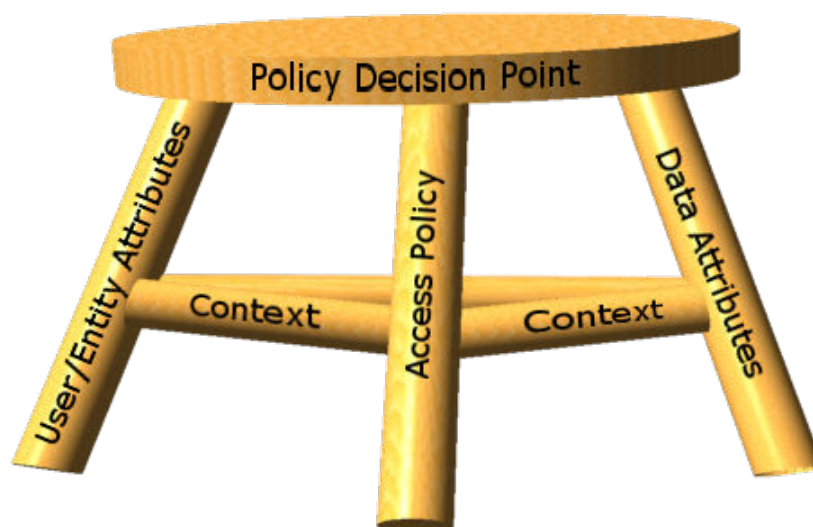
The XML schemas provided may import other specifications. The versions of dependency specifications imported are not normative in that to import a different version of a component specification you could modify the import or substitute a different version of the component using the existing import path. This could be done by changing the schema file or by using XML Catalogs.^[16] For example, a schema could be changed to incorporate a different version of a dependency like ISM by changing the attribute declaration of `ism:DESVersion='9'` to `ism:DESVersion='10'` in the `xsd:schema` statement. The ability to import different versions of dependent specifications decouples parent specifications like PUBS and TDF from changes to dependency specifications such as ISM CVE updates. The decoupling of dependency versions is not retroactive; see the dependency table for allowed dependency versions.

Additional guidance that is either classified or has handling controls can be found in separate annexes distributed to the appropriate networks and environments as necessary. Systems and services operating in those environments must consult the appropriate annexes.

Chapter 2 - Development Guidance

2.1 - Understanding Access Control

Technical specifications or information guidance documents are used to make access control decisions. Control decisions comprise three components (data attributes, user attributes, and access control policies) and are held together by the context in which the access control decision is made. The context itself includes various elements, such as the environment, temporal state, and method of access, that together provide the Where, When, and How details of the access request. The context, together with the user making the request and the data being requested (the Who and What respectively), make up the framework that supports an access control decision. A Policy Decision Point (PDP) uses this framework to make a grant or deny access decision. The following is a depiction of the concept of access control decision framework.



All of these parts come together to create a tri-legged stool of access control. When a stool is missing one of the components of its frame, it is unable to function properly. The same is true of access control. Without each component of the framework, access control falls apart. Each component is crucial to make accurate, reliable, and automated access control decisions. Each Enterprise Integration and Architecture (EI&A) document will address a piece of the framework of access control decisions.

This specification addresses matters dealing with data and it falls into the data attributes leg of the access control framework. Data attribute specifications include: Access Rights and Handling (ARH), Information Security Marking (ISM), CVE Encoding Specification for ISM Country Codes and Tetragraphs (ISMCAT), Need-To-Know Metadata (NTK), Intelligence Only NTK Profile (ICO-NTK), and Originator Control NTK Profile (OC-NTK).

2.2 - Relationship to Abstract Data Definition and other encodings

The relationship of the XML structures defined in this encoding specification to the abstract terms defined in the IC.ADD are described using a mapping table in the IC.ADD. The mapping tables generally show the mapping to the encoding specification where a structure is defined, not where it is used. These mappings are provided for reference only. The complete set of encoding specification artifacts, both normative and informative, should be consulted in order to gain a complete understanding of this encoding specification.

The mappings in the IC.ADD provide a starting point for the development of automated transformations between formats defined by the encoding specifications. However, it should be noted that when these transformations are used between formats with different levels of detail there might be some data loss.

2.3 - NTK and Access Control

This section defines the relationship NTK has to ISM and Policy Encoding Documents for the purposes of automated access control. An ISM / NTK access control system relies on three core elements

1. Markings about the resource such as classification

ISM represents markings about the resource and implies a relationship to a set of rules encoded in a Access Control Encoding Specification (ACES).

NTK represents additional rules that may or may not require additional data.

2. Markings about the Person or Non-Person Entity (NPE) desiring access

Unified Authorization and Attribute Services (UAAS) is an example of a specification of markings about Persons and NPEs

3. Rules or policy for granting access based on the markings (ISM-ACES, NTK Policies)

The ACES associated with ISM is the Access Control Encoding Specification for ISM (ISM-ACES).

A resource can have NTK expressed for the entire resource using one or more of the elements **AccessProfile**, **AccessIndividual**, or **AccessGroup**. Each of these must have an **ProfileDes**, which is the URI of the profile for that NTK statement, and an **AccessPolicy**, which is the URI of the ACES for that NTK statement. Each ACES must be taken into account for access to the resource based on its location within either the **RequiresAllOf** element or the **RequiresAnyOf** element.

An access control decision uses all three elements as inputs to a function or series of functions determining access.

There are some select cases where the **AccessPolicy** and the **ProfileDes** may have identical values (i.e. legacy systems). However, it is prescribed that for all modern NTK Access Profiles

there should be separate documentation; one defining how to populate the data tags and one defining the access control logic.

If a document containing an unfamiliar NTK Access Profile enters a system, it must be immediately rejected if:

- The unfamiliar NTK Access Profile is a member of **RequiresAllOf** and not contained in an **RequiresOneOf**, or
- The unfamiliar NTK Access Profile is a member of a **RequiresOneOf** and there are no familiar NTK Access Profiles as members of the `ntk:RequiresOneOf`.

2.4 - 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 DES are encouraged to contact the maintainers of this DES for further guidance when necessary.

2.4.1 - Integration into a schema

The NTK schema is not designed nor intended to be used as a stand-alone schema. In order to use the capabilities of this DES, the XML schema that is part of this DES must be incorporated into another XML schema. For purposes of this documentation, we will refer to this other schema as the “resource” schema. Additionally, the “resource” schema must include the XML schema of the XML Data Encoding Specification for Information Security Marking (ISM.XML). The basic process for incorporation is as follows:

- Import this schema into the “resource” schema
- Define a namespace prefix
- Allow for the **DESVersion** attribute to be used in the “resource” schema
- Ensure (Information Security Marking Metadata) ISM is incorporated into the “resource” schema
- Add the **Access** element to the “resource” schema model at an appropriate location
- Add the **ntk:access** attribute to applicable portions in the “resource” schema model.

The specification is designed to record NTK information for an entire resource. The resource includes the NTK information itself. This means that those that have access to the resource will have access to all of the NTK information.

2.4.2 - Basic usage model

In order for this DES to be effectively implemented in the enterprise, the following usage model description should be used.

First, an access system that wishes to provide access control services to the enterprise must define the parameters they need to make decisions and/or the specific syntax by which individuals and/or groups are referenced. This information should also be published and made accessible to those who create resources and who wish to control access to those resources via that system. These specifications can be documented as per **Section 2.2.3**.

Next, the creators of resources who wish to control access to their resources via one of these access systems must specify the access to the resource using the specifics defined by the desired access system. The resource creator can decide to specify access in terms of more than one access requirement describing separate individuals, groups, or profiles.

This DES is initially published without specifying Controlled Vocabulary Enumerations (CVEs) or many constraint rules. It is expected that as enterprise systems are recognized and adopt this model the CVEs and constraints will be fleshed out. The expectation is to have a small number of enterprise access systems.

2.4.3 - Guidance for the specification of constraints for a particular access system

When an access system desires to use the capabilities of this DES to document how access information should be specified by resource producers, the access system owner shall define an NTK Access Profile that contains:

- The URI of the access requirement to be used; this value will be defined this via the element **AccessPolicy**
- A syntax, pattern, or CVE for the elements **AccessIndividualValue**, **AccessGroupValue**, and **AccessProfileValue**
- The URI to the NTK-Profile via the element **ProfileDes**
- Guidance on encoding, in the syntax of this DES, for all parameters necessary to be specified on the resource and in portions when applicable, other than those encoded via ISM

Data producers and owners who wish to place resources within the access system are responsible for including the NTK Access Profile.

Note

There are cases, such as legacy NTK Access Profiles, when the **AccessPolicy** and the **ProfileDes** elements may contain identical values. This is strongly discouraged and is not expected in newly created or future revisions of existing NTK Access Profiles.

When it is desired or required to denote access control information at the portion level, the implementing system must define how the portions roll-up to the resource level access control requirements. Without a roll-up scheme there is a great risk that the resource level access controls may not sufficiently restrict access to the data. NTK does not currently enforce or implement any roll-up from portion level NTK attributes.

Depending on the data format for the resource, data used for access control may be duplicated; one instance in the resource's usual encoding, the other in the access model. The benefit of this

possible duplication is that the explicit specification of the access information in a consistent manner allows for resources to implement this DES in multiple different schemas that may locate the duplicate information in many different elements or attributes.

More information about systems and their vocabularies can be found in their documentation external to this DES.

- IC-CO14: https://gimmee.cia.ic.gov/help/service_specification.doc Often referred to as GIMMEE or Mission Need Profile.
- COMPLIANCE: To be determined. An NSA system often referred to as LAC/MAF.

2.4.4 - Guidance for systems processing data containing NTK metadata

It is important to note that data may have multiple access system requirements expressed (e.g., system A profile, system B profile, etc.). Each access system requirement is considered separately. Logical structures are used to describe situations where more than one access requirement is needed ("AND"), or where any one of multiple access requirements ("OR") is sufficient for access:

- The element **RequiresAllOf** indicates that all of the access requirements specified must be present in order to have access to the resource.
- The element **RequiresAnyOf** is used to indicate that any one of the access requirements must be present in order to have access to the resource.
- The **ntk:access** attribute provides the capability to indicate when all access requirements must be specified and/or one of multiple access requirements must be specified for a portion.

These logical structures are used within the NTK structure with the following restrictions:

- The **Access** and **ExternalAccess** elements must contain either a **RequiresAllOf** or **RequiresAnyOf** element as the first child element.
- A **RequiresAllOf** element may optionally have one **RequiresAnyOf** child element.
- A **RequiresAnyOf** element may not include any **RequiresAllOf** or **RequiresAnyOf** elements as child elements.
- **RequiresAllOf** and **RequiresAnyOf** elements require at least one List element (i.e. **AccessIndividualList**, **AccessGroupList**, or **AccessProfileList**) as a child element. Each List element may be comprised of one or more access elements, each with its own access policy (e.g., an **AccessProfileList** could contain one or more **AccessProfile** child elements).

Systems handling data containing NTK metadata must assess and understand the NTK metadata in order to protect the data appropriately. A best practice for addressing this issue is to first examine any NTK metadata that may exist within the data being received. If NTK metadata is present, the receiving system should look for NTK metadata expressed in terms of an access requirement it understands. When a logic structure is present indicating that all of the access requirements are required, the receiving system must understand all of the access

requirements listed within this structure. When a logic structure exists indicating that one of the access requirements is required, then the receiving system must understand at least one of the access requirements. If no understandable NTK metadata is located, the files should be segregated and protected via the most restrictive manner available, and the submitter should be contacted to understand any possible ramifications.

Chapter 3 - Definitions, Interfaces, and Constraints

3.1 - Constraint Rule Types

Data constraint rules fall into two categories - validation and rendering constraints. Data validation constraints explicitly define policy validation constraints, describing how data should be structured and encoded in order to comply with IC policy. Validation constraint rules are implemented as a combination of basic XML Schema constraints and supplemental constraints for more complex rules. Complex constraint rules contain technical rule descriptions, Schematron rule implementations, and *Human Readable* descriptions. The human readable text describes the intent and meaning behind the more technical rule description. The semantics of the constraint rules are normative, whereas the use of the Schematron implementation is informative. Implementers developing alternative validation code should follow the technical rule descriptions and Schematron logic. Should there be a perception of conflict, implementers should bring it to the attention of the appropriate configuration control body to be resolved. Rendering constraint rules define constraints on the display and rendering of documents. While expressed in a similar manner to the data validation constraint rules, 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 - "Living" Constraint Rules

These constraint rules are a "living" rule set. The constraint rules provided are a valid starter set and do not attempt to address the full scope of business rules addressed by authoritative guidance. These rules will be expanded and modified as the model matures, and as applicable security marking policies change.

Since these constraint rules are only a subset of the entire rule base, an XML document that is compliant with these rules may still not be fully compliant with all of the business rules defined in the authoritative guidance. An XML document that is not compliant with these rules is not compliant with the authoritative guidance.

3.3 - Classified or Controlled Constraint Rules

Additional rules that are either classified or have handling controls can be found in separate annexes closely associated with the encoding specification artifacts wherever they are located.

3.4 - Terminology

For the purposes of this document, the following statements apply:

- The term "is specified" indicates that an attribute is applied to an element and the attribute has a non-null value.
- The term "must be specified" indicates that an attribute must be applied to an element and the attribute must have a non-null value.
- The term "is not specified" indicates that an attribute is not applied to an element, or an attribute is applied to an element and the attribute has a null value.

- The term “must not be specified” indicates that an attribute must not be applied to an element.

3.5 - Errors and Warnings

The severity of a constraint rule violation is categorized as either an “Error” or a “Warning.” An “Error” is more severe and is indicative of a clear violation of a constraint rule, which would be likely to have a significant impact on the quality of a document. A “Warning” is less severe although noteworthy, and may not necessarily have any impact on the quality of a document. The severity of a constraint rule violation is indicated in brackets preceding each constraint rule description.

Each system responsible for processing a document (e.g., create, modify, transform, or exchange) must make a mission-appropriate decision about using a document with errors or warnings based on mission needs.

3.6 - Rule Identifiers

Each constraint rule has an assigned rule ID, indicated in brackets preceding the constraint rule description. The rule IDs from 00001 to 10000 are unclassified and 10001 to 20000 are “for official use only” (FOUO). IDs from 20001 to 30000 are reserved for “Secret” rules and 30001 and above for more classified rules. NTK.XML data validation constraint rule IDs are prefixed with “NTK-ID-”.

As the constraint rules are managed over time, IDs from deleted rules will not be reused.

3.7 - Data Validation Constraint Rules

3.7.1 - Purpose

The NTK.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.

3.7.2 - Schematron

Schematron^[14] was selected as the language in which to encode these additional rules. The provided Schematron^[14] is used to define the constraint rules; it is NOT a required implementation. Implementers can use any tools at their disposal as long as the data complies with the rules expressed. To facilitate testing and understanding of the rules they are executable in either *oXygen*®^[13] or the XML Stylesheet Language for Transformation (XSLT) 2.0^[18] implementation of International Organization for Standardization (ISO) Schematron^[14] provided by Rick Jelliffe at <http://schematron.com/> [<http://schematron.com/>]. Constraint rules are dependent on XPath 2.0^[17] and XSLT 2.0^[18] features. According to Mr. Jelliffe, one of the editors of Schematron^[14] for ISO:

“By default, Schematron uses the XPath language as used in XSLT 1.0, and is typically implemented by converting the schema into an XSLT 1.0 script which is

run against the document being validated. However, ISO Schematron also allows XSLT 2.0 to be used, and this is becoming an increasingly popular choice because of the extra expressive convenience of XPath 2.0: a different skeleton is available for this."

Included in the package are the ISO Schematron^[14] implementation and XSLT 2.0^[18] files provided as a convenience along with a compiled version of the rules.

3.7.3 - Non-null Constraints

XML syntax allows all elements with content declared to be of data type "string" to have zero or more characters of content, meaning elements can be empty or null. According to this specification, all required elements (and certain conditional elements) must have content, other than white space.¹ Elements, which are allowed to only have text content, must have text content specified.

3.7.4 - Inherited Constraints

In an instance of NTK.XML, the use of attributes and elements from supplementary data encoding specifications must be fully conformant with the constraint rules defined in those specifications. For a full list of supplementary specifications, see [Section 1.7 - Dependencies](#).

3.7.5 - Value Enumeration Constraints

Several elements and attributes of the NTK.XML model use Controlled Vocabulary Enumerations (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.

3.7.6 - Additional Constraints

3.7.6.1 - 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.

¹"white space" is defined in XML 1.0^[15] as "(white space) consists of one or more space (#x20) characters, carriage returns, line feeds, or tabs."

3.7.7 - Constraint Rules

The detailed constraint rules for the NTK.XML schema can be found in a separate document inside the SchematronGuide directory, in the NTK_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 SchematronGuide.

3.8 - Data Rendering Constraint Rules

3.8.1 - Purpose

Rendering rules define constraints on the rendering and display of NTK.XML documents. The intent is to inform the development of systems capable of rendering or displaying NTK.XML data for use by individuals not familiar with the details of the NTK.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.

3.8.2 - Rendering Constraint Rules

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

Table 2 - Constraint Rules

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

Chapter 4 - Conformance Validation

An instance is considered conformant with this specification if it passes all of the following normative validation steps. The following steps do not dictate how this validation strategy is implemented.

4.1 - Schema Validation

This first step in validation is to ensure that an instance document is compliant against the normative schema of this specification as well as those of this specification's dependencies.

If an instance is determined to be non-compliant with schema in this step then results from the future steps may be indeterminate. As such, schema compliance should always be ensured prior to taking action on results from other validation steps.

4.2 - Business Rule Validation

The second step in validation is to ensure that an instance document complies with the business rules expressed in this specification as well as those of this specification's dependencies. It should be noted that while the business rules for this specification are expressed in Schematron, the Schematron is informative but the constraints they express are normative. As such, any languages or tools may be used to perform the validation as long as the results are consistent with results of the Schematron included in this specification and its dependencies.

Chapter 5 - Generated Guides

5.1 - Schema Guide

The detailed description and reference documentation for the NTK.XML schema can be found as a collection of HTML files inside the SchemaGuide directory. These files comprise a guide that serves as an interactive presentation of the NTK.XML schema as well as an implementation-specific data element dictionary.

The guide was generated with a commercially available product named *oXygen*® [\[13\]](#), produced by SyncRO Soft.

The guide provides an interactive index to:

- Global Elements and Attributes
- Local Elements and Attributes
- Simple and Complex Types
- Groups and Attribute Groups
- Referenced Schemas

Where applicable, the guide provides:

- Diagram
- Namespace
- Type
- Children (Child Elements)
- Used by
- Properties
- Patterns
- Enumerations
- Attributes
- Annotations
- Source Code

The guide is published in a folder consisting of the master HTML file *SchemaGuide.html* with supporting graphics.

5.2 - Schematron Guide

The detailed description and reference documentation for the NTK.XML Schematron rules can be found in a separate document named *NTK_Rules.pdf*, which is located inside the SchematronGuide directory. This document is generated from the individual Schematron files to provide a single searchable document for all of the constraint rules encoded in Schematron.

Appendix A Feature Summary

The following table shows the version dependencies for NTK on other DES.

Table 3 - NTK Dependency over time

Dependent DES	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
ISM	V3	V4	V5	V6	V7	V8	V9	V9+	V9+	V9+

The following table summarizes major features by version for NTK.

Table 4 - 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. NTK Feature Summary

Table 5 - NTK Feature comparison

NTK Feature Comparison											
Required date	Feature	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
	Schematron ^[14] Implementation of rules	N	N	F	F	F	F	F	F	F	F
	Portion Level NTK	N	N	N	N	N	N	F	F	F	F
	Support multiple versions of ISM.XML (V9 - Current)	N	N	N	N	N	N	N	F	F	F
	Support Allof and OneOf structures	N	N	N	N	N	N	N	N	F	F

Appendix B Change History

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

Table 6 - DES Version Identifier History

Version	Date	Purpose
1	11 May 2010	Initial Release
2	7 September 2010	Routine revision to technical specification. For details of changes, see Section B.9 - V2 Change Summary
3	6 December 2010	Routine revision to technical specification. For details of changes, see Section B.8 - V3 Change Summary
4	11 April 2011	Routine revision to technical specification. For details of changes, see Section B.7 - V4 Change Summary
5	19 September 2011	Routine revision to technical specification. For details of changes, see Section B.6 - V5 Change Summary
6	27 February 2012	Routine revision to technical specification. For details of changes, see Section B.5 - V6 Change Summary
7	17 July 2012	Routine revision to technical specification. For details of changes, see Section B.4 - V7 Change Summary
8	21 January 2013	Routine revision to technical specification. For details of changes, see Section B.3 - V8 Change Summary
9	5 April 2013	Routine revision to technical specification. For details of changes, see Section B.2 - V9 Change Summary
10	16 August 2013	Routine revision to technical specification. For details of changes, see Section B.1 - V10 Change Summary

B.1 - V10 Change Summary

Significant drivers for Version 10 include:

- Access Control Policy URIs
- Profile URIs

The following table summarizes the changes made to V9 in developing V10

Table 7 - Data Encoding Specification V10 Change Summary

Change	Artifacts changed	Compatibility Notes
New attribute additionalAccessControlReference added to reference relevant access control policies.	Schema	Data generation and ingestion systems need to be updated to use the new attribute.

Change	Artifacts changed	Compatibility Notes
New element Profile added to AccessGroupType, AccessIndividualType, and AccessProfileType. This element is an IC-ID reference to the Profile used by the NTK statement. Currently, it also contains attributes with human readable values for the Profile name and version number.	Schema	Data generation and ingestion systems need to be updated to use the new element.

B.2 - V9 Change Summary

Significant drivers for Version 9 include:

- CMSTT for addition of AND logic

The following table summarizes the changes made to V8 in developing V9

Table 8 - Data Encoding Specification V9 Change Summary

Change	Artifacts changed	Compatibility Notes
Added RequiresAnyOf and RequiresAllOf elements and portion marking "AND" delimiter	Schema Examples Schematron NTK-ID-00002 Changed	Data generation and ingestion systems need to be updated to use the new values and adhere to the new rule.
Changed element name from "AccessSystemName" to "AccessPolicy"	DES Schema Examples	Data generation and ingestion systems need to be updated to use the new value.

B.3 - V8 Change Summary

Significant drivers for Version 8 include:

- See ISM V10 drivers

The following table summarizes the changes made to V7 in developing V8

Table 9 - Data Encoding Specification V8 Change Summary

Change	Artifacts changed	Compatibility Notes
Added schematron rules to ensure that the versions of the imported specs meet the minimum allowed versions.	Schematron NTK-ID-00009 Added	Data generation and ingestion systems need to be updated enforce the new rules.
Update ISM to V10	Schema Constraint Rules	Data generation and ingestion systems need to be updated to comply with all constraint rules in this sub-specification.
Version decoupling, allowing import of any version of ISM and other dependent specifications at or above ISMv9	DES	Data ingestion systems need to be aware of this change and ensure they check appropriate dependent spec versions for validation.

B.4 - V7 Change Summary

Significant drivers for Version 7 include:

- See ISM V9 drivers

The following table summarizes the changes made to V6 in developing V7

Table 10 - Data Encoding Specification V7 Change Summary

Change	Artifacts changed	Compatibility Notes
Update ISM to V9	Schema Constraint Rules	Data generation and ingestion systems need to be updated to comply with all constraint rules in this sub-specification.
Update mapping to ADD	DES	Should not impact data
Added support for alphanumeric @DESVersion identifiers [artf12167].	Schema	Should not impact data but ingestion systems may need to account for it.
Changed declaration of AccessProfileValueType from complexContent to simpleContent [artf12153].	Schema	Should only impact some code generation systems.
Added external reference attribute to indicate ntk refers to external content	Schema	Ingest and data generation systems should be updated

Change	Artifacts changed	Compatibility Notes
Added support for @ntk:access portion marking group [artf12287].	Schema NTK-ID-00005 Added NTK-ID-00005 Removed	Data generation and Ingestion systems need to be updated to properly enforce the new constraint rule
Added support for @DESVersion and Need to Know for external documents [artf12449].	Schema NTK-ID-00006 Added NTK-ID-00007 Added	Data generation and Ingestion systems need to be updated to properly enforce the new constraint rule
Added ntk:ExternalAccess element for use when the NTK is about an external resource.	Schema NTK-ID-00002	Data Ingestions systems need to be updated to properly enforce the new element and associated constraints.

B.5 - V6 Change Summary

Significant drivers for Version 6 include:

- See ISM V8 drivers

The following table summarizes the changes made to V5 in developing V6

Table 11 - Data Encoding Specification V6 Change Summary

Change	Artifacts changed	Compatibility Notes
Update ISM to V8	Schema Constraint Rules	Data generation and ingestion systems need to be updated to comply with all constraint rules in this sub-specification.

B.6 - V5 Change Summary

Significant drivers for Version 5 include:

- See ISM V7 drivers

The following table summarizes the changes made to V4 in developing V5

Table 12 - Data Encoding Specification V5 Change Summary

Change	Artifacts changed	Compatibility Notes
Update ISM to V7	Schema Constraint Rules	Data generation and ingestion systems need to be updated to comply with all constraint rules in this sub-specification.

Change	Artifacts changed	Compatibility Notes
Fixed type errors generated when using a schema-aware processor.	Constraint Rules	Should not affect data.

B.7 - V4 Change Summary

Significant drivers for Version 4 include:

- See ISM V6 drivers

The following table summarizes the changes made to V3 in developing V4

Table 13 - Data Encoding Specification V4 Change Summary

Change	Artifacts changed	Compatibility Notes
Change encoding of constraint rules from text to Schematron.	Documentation Constraint Rules	Other than rules whose changes are noted below this should only result in more clarity of definition for the rules.
Use ISM V6	Schema	Data generation and Ingestion systems need to be updated to properly enforce the new constraint rule
Replaced NTK-ID-00001 with NTK-ID-00004	Documentation NTK-ID-00001 Remove NTK-ID-00004 Add	Data generation and Ingestion systems need to be updated to properly enforce the new constraint rule Note: Data valid under previous releases may not be valid under this release.

B.8 - V3 Change Summary

Significant drivers for Version 3 include:

- See ISM V5 drivers

The following table summarizes the changes made to V2 in developing V3

Table 14 - Data Encoding Specification V3 Change Summary

Change	Artifacts changed	Compatibility Notes
Use ISM V5	Schema	Data generation and Ingestion systems need to be updated to properly enforce the new constraint rule

Change	Artifacts changed	Compatibility Notes
Remove Appendix H Reading the Schematics	Documentation	Knowledge of how to interpret these schema images is common making this appendix unnecessary.

B.9 - V2 Change Summary

Significant drivers for Version 2 include:

- See ISM V4 drivers

The following table summarizes the changes made to V1 in developing V2

Table 15 - Data Encoding Specification V2 Change Summary

Change	Artifacts changed	Compatibility Notes
Use ISM V4	Schema	Data generation and Ingestion systems need to be updated to properly enforce the new constraint rule
Use schema to enforce DES version number	NTK-ID-00003	Data Ingestion systems need to be updated to use the new schema instead of constraint rules.

Appendix C Acronyms

This appendix lists all the acronyms referenced in this encoding specification and lists other acronyms that may have been used in other encoding specifications. This appendix is a shared resource across multiple documents so in any given encoding specification there are likely acronyms that are not referenced in that particular encoding specification.

Table 16 - Acronyms

Name	Definition
A&A	Assessment and Authorization
AAS	Authoritative Attribute Sources
ABAC	Attribute Based Access Control
ABNF	Augmented Backus-Naur Form
ACSS	Allied Collaborative Shared Services
ADD	Abstract Data Definition
AICP	Authorized IC Person
AOI	Area of Interest
AOR	Area of Responsibility
API	Applications Programming Interface
APS	Attribute Practice Statement
ARH	Access Rights and Handling
AS	Attribute Service
ATO	Authority To Operate
BBOX	Bounding Box
BNF	Backus-Naur Form
CA	Certification Authority
CAPCO	Controlled Access Program Coordination Office
CAT	Catalog Services Interface Standard
CDR	Content Discovery and Retrieval
CF-NetCDF	Climate and Forecast - Network Common Data Format
CIA	Central Intelligence Agency
CIO	Chief Information Officer
CMS	Cryptographic Message Syntax
CNWDI	Critical Nuclear Weapons Design Information
COMET	Completely Open Mapping Environment
CONOPS	Concept of Operations
CORBA	Common Object Request Broker Architecture

Name	Definition
CQL	Common Catalog Query Language (CQL)
CRL	Certificate Revocation List
CSW	Catalog Service for Web
CTM	Conformance Test Matrix
CUI	Controlled Unclassified Information
CVE	Controlled Vocabulary Enumeration
D & R	Discovery and Retrieval
DAA	Designated Approval Agent
DC MES	Dublin Core Metadata Element Set
DCMI	Dublin Core Metadata Initiative
DDMS	Department of Defense Discovery Metadata Specification
DES	Data Encoding Specification
DI	Digital Identifier
DIA	Defense Intelligence Agency
DISR	DoD Information Technology Standards Registry
DN	Distinguished Name
DNI	Director of National Intelligence
DNS	Domain Name System
DOD	Department of Defense
DOE	Department of Energy
DOI	Digital Object Identifier
DOMEX	Document and Media Exploitation
EA	Enterprise Architecture
EI&A	Enterprise Integration and Architecture
E.O.	Executive Order
EBNF	Extended Backus-Naur Form
EDH	Enterprise Data Header
EPR	Endpoint Reference
ES&IS	Enterprise Search & Integration Services
ESB	Enterprise Standards Baseline
FD&R	Foreign Disclosure & Release
FOUO	For Official Use Only
FSD	Full Service Directory
FTP	File Transfer Protocol
FY	Fiscal Year

Name	Definition
GENC	Geopolitical Entities, Names, and Codes
GeoRSS	Geographic Really Simple Syndication
GeoTIFF	Geographic Tagged Image File Format
GIF	Graphics Interchange Format
GIS	Geospatial Information System
GML	Geography Markup Language
GNS	Geographic Names Server
GUIDE	Globally Unique Identifiers for Everything
GVS	GEOINT Visualization Services
HDF-EOS	Hierarchical Data Format - Earth Observing System
HTML	HyperText Markup Language
HTTP	Hypertext Transfer Protocol
I2	Information Integration
IC	Intelligence Community
IC.ADD	Intelligence Community Abstract Data Definition
IC CIO	Intelligence Community Chief Information Officer
IC EA	IC Enterprise Architecture
IC ESB	Intelligence Community Enterprise Standards Baseline
IC ITE	IC Information Technology Enterprise
ICD	Intelligence Community Directive
ICEA	Intelligence Community Enterprise Architecture
ICPG	Intelligence Community Program Guidance
ICS	Intelligence Community Standard
ICSR	Intelligence Community Standards Registry
ICTS	Intelligence Community Technical Specification
IdAM	Identity and Access Management
IDM	Interface Data Model
IDMView	Interface Data Model View
IETF	Internet Engineering Task Force
IOC	Initial Operating Capability
IP	Internet Protocol
IPT	Integrated Project Team
IRM	Information Resource Metadata
ISBN	International Standard Book Number
ISM	Information Security Marking

Name	Definition
ISO	International Organization for Standardization
ISOO	Information Security Oversight Office
ITE	Information Technology Enterprise
JPEG	Joint Photographic Experts Group
JPIP	JPEG 2000 Interactive Protocol
JSON	JavaScript Object Notation
JWE	JSON Web Encryption
JWICS	Joint Worldwide Intelligence Communications System
JWT	JSON Web Token
KA	Knowledge Assertion
KML	Keyhole Markup Language
KOS	Knowledge Organization System
KVP	Key Value Pair
LDAP	Lightweight Directory Access Protocol
LIMDIS	Limited Distribution
LNI	Library of National Intelligence
MAC	Multi Audience Collection
MC&GIL	Mapping, Charting, and Geodesy Information Library
MC&GView	Mapping, Charting, and Geodesy View
MIME	Multipurpose Internet Mail Extensions
MTOM	Message Transmission Optimization Mechanism
NARA	National Archives and Records Administration
NATO	North Atlantic Treaty Organization
NCES	Net-Centric Enterprise Services
NGA	National Geospatial Intelligence Agency
NGDS	Net-Centric GEOINT Discovery Services
NGIC	National Ground Intelligence Center
NGT	Next Generation Trident
NIPRNet	Non-Classified Internet Protocol Router Network
NIEM	National Information Exchange Model
NIST	National Institute of Standards and Technology
NITF	National Imagery Transmission Format
NPE	Non-Person Entity
NMEC	National Media Exploitation Center
NRO	National Reconnaissance Office

Name	Definition
NSA	National Security Agency
NSG	National System for Geospatial Intelligence
NSI	National Security Information
NTK	Need-To-Know Metadata
OCIO	Office of the Intelligence Community Chief Information Officer
OCSP	Online Certificate Status Protocol
ODNI	Office of the Director of National Intelligence
OGC	Open Geospatial Consortium
OGCA	Open Geospatial Consortium Australia
OGCE	Open Geospatial Consortium Europe
ONEMail	Optimized Network Email
OPM	Office of Personnel Management
OWS	OGC Web Services
PAP	Policy Administration Point
PAYL	Payload
PDP	Policy Decision Point
PEP	Policy Enforcement Point
PK	Private Key
PKI	Public Key Infrastructure
PNG	Portable Network Graphics
PUBS	Intelligence Publications
PURL	Persistent Uniform Resource Locator
RA	Reference Architecture
RDBMS	Relational Database Management System
REST	REpresentational State Transfer
RFC	Request for Comments
RR-ID	REST Security Encoding Specification for End-to-End Identity Propagation
SAML	Security Assertion Markup Language
SAP	Special Access Program
SCI	Sensitive Compartmented Information
SIPRNet	Secret Internet Protocol Router Network
SLA	Service Level Agreement
SOAP	Simple Object Access Protocol
SQL	Structured Query Language
SSD	Special Security Directorate

Name	Definition
SSL	Secure Sockets Layer
STIL	St Louis Information Library
TCP/IP	Transmission Control Protocol/Internet Protocol
TDC	Trusted Data Collection
TDF	Trusted Data Format
TDO	Trusted Data Object
TGN	Thesaurus of Geographic Names
TIFF	Tagged Image File Format
TIN	Triangulated Irregular Network
TLS	Transport Layer Security
TS	Top Secret
UAAS	Unified Authorization and Attribute Services
UIAS	Unified Identity Attribute Set
UDDI	Universal Description, Discovery and Integration
UML	Unified Modeling Language
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
URN	Uniform Resource Name
US	United States
UUID	Universal Unique Identifier
VIRT	Virtual Coverage
W3CDTF	World Wide Web Consortium Date Time Format
WARP	Web Based Access and Retrieval Portal
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Map Service
WSDL	Web Service Definition Language
XACML	eXtensible Access Control Markup Language
XML	Extensible Markup Language
XPath	XML Path Language
XPointer	XML Pointer Language
Xquery	XML Query
XSLT	XML Stylesheet Language for Transformations

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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 DNI-sponsored web sites. Direct all inquiries about this IC technical specification to the IC CIO, an IC technical specification collaboration and coordination forum, or IC element representatives involved in those forums.

Public Website: <http://purl.org/ic/standards/public>

E-mail: <ic-standards-support@intelink.gov> .

Appendix F IC CIO Approval Memo

An Office of the Intelligence Community Chief Information Officer (OCIO) Approval Memo should accompany this enterprise technical data specification bearing the signature of the Intelligence Community Chief Information Officer (IC CIO) or an IC CIO-designated official(s). If an OCIO 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 OCIO staffing and coordination process leading to signature of the OCIO Approval Memo. The signature date of the OCIO Approval Memo will be later than the last modified date shown on the specification artifacts by an indeterminable time period.

Upon signature of the OCIO 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 IC Enterprise Standards Baseline as defined in Intelligence Community Standard (ICS) 500-20.^[9]