Requirements for a National Information Exchange Model (NIEM) Information Exchange Package Documentation (IEPD) Specification

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Document Version 2.1

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1 Introduction

As the focal point of interoperability, the concept of Information Exchange Package Documentation (IEPD) is fundamental to the National Information Exchange Model (NIEM) reference architecture. We anticipate that using NIEM components, many IEPDs will be built for a variety of business exchanges. Because they will be composed of multiple files (hereafter referred to as IEPD *artifacts*), to ensure maximum consistency, all IEPDs must be defined by a simple, flexible template or specification.

An IEPD itself is a specification for a data exchange and defines a particular data exchange. For example, there is an IEPD that defines the information content and structure for an Amber Alert, a bulletin or message sent by law enforcement agencies to announce the suspected abduction of a child. When we refer to an *IEPD specification* in this paper, we do not mean a particular IEPD; instead, we mean a prescribed template for all IEPDs that defines content, structure, format, and packaging.

This document identifies baseline business requirements for IEPDs, justifies the need for an open standard to specify IEPD format, and outlines artifacts and metadata that should be included to satisfy the business requirements. This document does not formally specify an IEPD. However, it does provide a basis for a common specification, and it suggests aspects of that specification.

This document is meant for review by the NIEM Program Management Office (PMO) staff and potential IEPD developers who will share, adapt, and register IEPDs under NIEM.

2 Business Requirements

An IEPD is a complete definition of an Information Exchange Package (IEP). It is generally composed of schemas (for data exchange) and documentation (for understanding the business context and usage). The following business requirements were identified primarily to facilitate standardization, easy sharing, and use of IEPDs.

2.1 Reuse IEPDs within and across domains

Since IEPDs are data exchange specifications, they must be built to share and reuse easily. The IEPD specification must be designed to allow IEPDs to be registered, stored, searched, discovered, and retrieved. A core set of IEPD artifacts must be applied consistently by all NIEM users to facilitate discovery and reuse both within and across domains. The artifacts required in an IEPD must be sufficient to enable reuse by other

organizations without forcing the IEPD author to draft documentation or artifacts that may be unnecessary.

There are two basic intentions to balance: (1) encourage authors to share IEPDs by making them relatively easy to assemble and register, and (2) encourage potential users to reuse or adapt IEPDs by making it relatively easy to search and discover them.

2.2 Semi automate IEPD creation, processing, and registration

The IEPD specification must be simple enough and structured to allow automated or semi automated assistance in building NIEM-conformant IEPDs and associated artifacts in accordance with the NIEM Naming and Design Rules (NDR). IEPD artifacts must be easily imported for processing by tools and for registration. The specification for the template that defines IEPDs in general must be based upon open standards. Furthermore, the IEPD specification itself must be an open standard.

2.3 Enhance IEPD consistency and readability communitywide

An IEPD must be human-readable as well as machine-readable so that it can be parsed easily for automatic processing tasks such as registration, content assembly/disassembly, search and navigation, etc. The IEPD specification must provide a consistent format for identifying and defining each artifact contained in an IEPD. Furthermore, an IEPD may have mandatory, conditionally mandatory, or optional artifacts to support various business contexts for which it was designed.

2.4 Facilitate IEPD interoperability and portability

To maximize IEPD utility, the IEPD specification must enhance sharing and reuse. An IEPD must be portable, self-contained, and self-documented. It must contain its own documentation to explain specifically how it is to be used and its own metadata to enable it to be easily registered anywhere. It must be packaged in a common, open-standard format, and each artifact should be easy to identify, examine, understand, and use. An IEPD and the artifacts it contains should be independent of specific tools, applications, or systems to the maximum practical extent.

2.5 IEPDs capture business context

Business context is used for search, discovery, and navigation in a repository of IEPDs and to understand how and which IEPDs can be used in particular business exchanges. Examples of business context include purpose, business requirements, who uses, when to use, how to use, use cases, special procedures, how developed, tools and methods used to develop, who developed, and memorandums of understanding (MOU) between participating agencies. The IEPD specification must record key business context metadata and documentation about an IEPD in order to facilitate such capabilities. Furthermore, metadata enables harvesting or derivation of metrics for management, process, and quality control purposes.

2.6 Facilitate IEPD life-cycle management

Each IEPD is built to a particular NIEM release. Therefore, a new NIEM release does not immediately impact the ability to use and reuse IEPDs based on earlier releases. Obviously, the sender and receiver must use the same NIEM version. However, IEPD authors may want to take advantage of new features in subsequent NIEM releases by migrating to newer versions of NIEM. To the extent practical, the IEPD specification should be structured to help facilitate impact analysis and reporting of new NIEM releases on current IEPDs. Incorporation of mapping artifacts can assist with automated impact analyses. Mapping artifacts can also be used for analysis and reporting of cross-IEPD impacts (differences between IEPD versions) and validation. The e-mail address of the authoritative source's point of contact (POC) enables direct reporting of results to the authoritative source. The POC for the authoritative source must take action to notify all users of the IEPD or post these results in commonly known locations.

2.7 Capture requirements for new or modification to existing NIEM content

The Component Mapping Tool (CMT), a data mapping spreadsheet, was designed to map domain data requirements to corresponding NIEM components and to identify domain data requirements for which no NIEM components exist or for which only a partial mapping exists. This has been used as the primary means for identifying data requirements from established domains in order to insert the initial NIEM content. However, the CMT does not define an actual exchange. As a new content collection method, the IEPD specification improves on the CMT because it defines an actual exchange and also must identify both its reuse of existing NIEM components as well as its extensions. By incorporating the CMT as its mapping artifact, the IEPD specification provides the same ability to capture and identify potential additions to NIEM. However, the IEPD specification will also ensure that requests for new content are based upon actual exchange data requirements.

2.8 Support for capture and/or derivation of metrics

Metrics can assist the NIEM PMO with IEPD process management and quality control. Metrics may be captured directly as metadata or derived from metadata. Typical metrics are based on questions about usage patterns, exchange coverage, quality control, etc. For example, How many organizations use this IEPD? How many different domains use this IEPD? How many times has this IEPD been updated? How many universal components are used by this IEPD?

This document does not address the specific metrics that may be required by the NIEM PMO.

2.9 IEPD maturity and documentation guidelines

When an IEPD in development has reached a state whereby it has the minimum required artifacts and metadata to fill an IEPD specification, passes XML validation, and can be used to execute an exchange, even if only within in a tightly controlled experimental environment, it is registration-worthy. This does not mean that the work on it is finished or that the IEPD has been endorsed for operational use. However, at this stage, it is a useful example that can be reviewed and critiqued if its authors are prepared to share it.

Nonetheless, the IEPD specification must ensure that completed, tested, endorsed IEPDs are distinguishable from those that are not. A simple system of maturity level is required. IEPD maturity should be determined by development stage and available documentation. The proposed levels are:

1 Entry level—under development and has minimum documentation (see Artifacts)
2 Complete—being tested, is in limited use, and has draft documentation
3 In production—fully documented and endorsed for use in official exchanges

Note that this document does not address how these levels will be judged or certified for a given IEPD. This could be done by trusting authoritative sources or by instituting a formal certification process. This is a NIEM PMO decision.

Required documentation will likely vary with IEPD life cycle and business context. Therefore, it may eventually be necessary to develop a matrix to identify required documentation against IEPD life cycle and context. This matrix would determine what specific IEPD documentation is mandatory, conditionally mandatory, or optional at each level dependent on context and life cycle stage.

IEPD efforts being planned, under consideration, or in very early stages of development are outside the scope of the IEPD specification. An IEPD effort that cannot complete the minimum required items of the specification is NOT an IEPD. This rule ensures that each registered IEPD records and defines a meaningful, viewable IEPD, not simply a near empty shell. This does not preclude the registration or announcement of planned or early efforts within registries or at other Web sites. In fact, the announcement of such efforts is strongly encouraged. However, the scope of the specification must distinguish IEPDs that actually exist from those that do not.

2.10 Artifacts and metadata should be optional and over-inclusive

The IEPD specification should be optional and over-inclusive within reason. It should include all meaningful, but only meaningful, artifacts and metadata. Only a minimal set should be mandatory or conditionally mandatory. Artifacts are not limited to those listed in artifacts tab. For example, more documentation is usually better and welcome. However, artifacts should be useful and add to the utility and understanding of the IEPD.

Material that constitutes a user manual for a specific methodology or large volumes of testing data that are of little utility in understanding how to use an IEPD should be excluded. If such material is important to the IEPD, it can be cited by URL or as a reference within the documentation.

Only a few select artifacts are required for a minimal IEPD because IEPDs may span a wide range of complexity. A given IEPD may use only one or two NIEM components directly without extension. In such cases, there is no need for an extension schema. Furthermore, if the purpose of the IEPD or the source of requirements is derived directly from NIEM, the author may determine that there is no need for a mapping. The intent of the specification is both to record the minimum essential artifacts to understand the IEPD and to encourage registration and sharing.

3 IEPD Artifacts

An IEPD is a set of artifacts consisting of normative exchange specifications, examples, metadata, and documentation encapsulated by a catalog that describes each artifact. The entire package is archived as a single compressed file. When uncompressed, the catalog is a hyperlinked index into the IEPD and can be opened in a standard browser. The user may use the catalog to overview the IEPD contents or to open each individual artifact, provided the appropriate software required to open a given artifact is installed.

The artifacts in the NIEM IEPD specification are an extension of the work on IEPD guidelines done for the Global Justice XML Data Model, specifically Information Exchange Package Documentation Guidelines. Table 1 summarizes each IEPD artifact, while the sections below describe the three major types of artifacts.

3.1 Exchange Files

The *exchange definitions* are schemas that define the exchange instances this IEPD validates. These schemas constitute the normative specification for the IEPD. Sample instances and stylesheets for displaying instances may optionally be included.

3.2 Documentation

Documentation artifacts may contain a variety of information in many forms and formats. Textual documentation may be combined into a single file or logically sectioned into multiple files. Other forms of documentation that may be usable models, graphics, or outputs from development tools should, of course, be maintained as separate files.

3.3 Catalog Files

In accordance with business requirements, the IEPD should be portable, self-contained, self-documenting, and able to be registered anywhere. *IEPD specification* artifacts (the catalog and the metadata) are the key to these requirements. As previously described, the catalog is a hyperlinked index to the IEPD artifacts. This self-describing capability provides both XML for machine parsing of IEPD content and HTML for display for human review. The metadata artifact is described in more detail in Section 4.

Table 1. IEPD Artifacts

IEPD Artifact	Description	File Type Examples	Req / Option
3.1 Exchange Files (normative XML)			
Subset schema	Subset of the full NIEM schema—a compressed directory of schemas to distinguish from other schema sets.	xsd	R
Wantlist	User requirements—distinguishes user data components required by the user from components that they depend on for conformance. Generated by and uploaded to the Schema Subset Generation Tool (SSGT). This is an open specification and the SSGT is not required to create a wantlist, though it is easier.	xml	R
Exchange schema	Base document schema that defines the XML root element and is generally named after the IEPD itself. Also known as the document schema, reference schema, or root schema.	xsd	R
Constraint schema	Constraints for separate constraint validation path—a compressed directory of schemas to distinguish from other schema sets.	xsd	O
Extension schema	Specification for extended components—separate local namespace of components not contained in NIEM.	xsd	O
Sample XML instance	Example instance—may be multiple and may reference optional stylesheet.	xml	O
Sample stylesheet	Example stylesheet for display of instances, which may be multiple.	xsl	O
3.2 Documentation			
Master documentation	May include purpose, business requirements, what, when, why, how to, etc. Guidelines are needed for master documentation content, and the following indented items are possible documents that can be contained within the master documentation or broken out as individual files.	txt, doc	R
Business requirements	Itemized descriptions that may also contain business rules.	txt, doc	O

MOUs	Memorandums of understanding among participating agencies.	txt, doc	O
Endorsement letters	Documentation from professional or governmental organizations that confirm support. Refer to *Endorsement* in metadata.	txt, doc	O
Methodology and tools	Used to build IEPD and may contain URLs or references to tools, methodology, or documentation.	txt, doc	O
Testing and conformance	Description and results of validation and conformance testing performed—may include testing output or products.	txt, doc	O
Domain model	Domain model in standard open format (xmi, vsd, zargo) and standard open graphic (jpg, pdf, etc.) that is likely a Unified Modeling Language (UML) model.	vsd, xmi, zargo, jpg, pdf, etc.	O
Use case model	Use case diagram in standard open format and standard graphic, likely UML.	vsd, xmi, zargo, jpg, pdf, etc.	O
Business rules	May be (1) plain or structured English, (2) written into master documentation, (3) Schematron or other formal business rule language, or (4) generated by a development tool.	xml, txt, doc	O
Mapping (to NIEM components)	Mapping of domain components to NIEM components; tagged with constraints (i.e., cardinality, etc.); prefer Component Mapping Tool (CMT).	xls, csv	O
Extended components	Components created because they were not in NIEM—may be part of mapping spreadsheet and include structure and definitions of new components. Prefer CMT.	xml, xls, csv	O
Change log	Record of cumulative changes from previous IEPD versions. The initial IEPD simply records its creation date.	xml, txt, doc	R
3.3 Catalog Files			
Catalog	List of artifacts in the IEPD that is machine-readable; in an open, portable format; and browser-displayable.	xml, xhtml	R
Metadata	All metadata registered with the IEPD.	xml, xhtml	R

4 IEPD Metadata

The metadata artifact contains all metadata that the authoritative source wishes to register with an IEPD. This metadata should be specified by an XML schema so that an instance for a given IEPD can be parsed; loaded into a registry; and used to search, discover, and harvest business context and metrics on IEPDs and their artifacts.

The NIEM IEPD metadata identified in this document was seeded with the metadata vetted and used for IEPD work with the Global Justice XML Data Model (Global JXDM). Some of the business requirements for NIEM IEPDs differ from the Global JXDM requirements. For example, NIEM only provides a specification for IEPDs that are already in late stages of development and have the minimal artifacts sufficient to actually exercise an exchange, though perhaps under extremely controlled conditions, such as a laboratory provides. Planned IEPDs are outside the scope of the NIEM IEPD specification.

To meet requirements, we suggest a minimal set of mandatory metadata. Table 2 summarizes IEPD metadata described below.

4.1 Descriptive

These metadata items are fundamental to most catalogs of resources. The *Summary* is a brief, limited-length description for display purposes, whereas the *Description* provides a longer field for a more thorough description of the IEPD.

Any registry of IEPDs will track its holdings with a local, unique identifier, such as a database key. However, for the purposes of external cross-referencing and absolute identification, each IEPD should be addressable by a globally unique identifier—a URI, URN, or URL. Because many authoritative sources will likely have their own strategy for URIs, a mandatory one is not defined, although having a URI is mandatory metadata. Optional guidelines for devising URIs should be provided for those sources that may not have a plan for such.

4.2 Change Log

These items are dates and version numbers that track change events and identify compatibility. Some of these items will duplicate information in the change log artifact and should therefore be consistent with it.

4.3 Status

Status metadata provides a snapshot of the current state of an IEPD in terms of its life cycle. *Maturity* provides a quick understanding of an IEPD's development stage. Level 3 is the highest and most mature state. At this level, an IEPD must be endorsed or certified by at least one professional or governmental organization for the domain. The e*ndorsements* item identifies endorsing organizations. Level 1 is the lowest and least mature state. Level 1 IEPDs must be able to identify and include the minimally required mandatory artifacts and metadata for the IEPD specification.

4.4 Navigation

This set of metadata relates IEPDs through explicitly declared links or keywords that may or may not carry any particular business context or other means of making an association.

4.5 Business Context

The business context metadata is also important for navigation and discovery of IEPDs based on a number of usage factors. This set of metadata allows us to answer questions such as, Who is using this IEPD? and What IEPDs are used to do X business? All metadata in this category is optional except for *Domains* and *Purpose*. Therefore, communities or domains that have useful information to register in other items may use them; others may choose to ignore them. For example, the Justice domain will use and benefit from such metadata as *Process*, *Triggering Event*, and *Conditions* because this information is important to and collected extensively within that community.

4.6 Authoritative Source

Each IEPD must be sponsored by an authoritative source, an organization or professional group that takes responsibility for maintaining the IEPD in the format of the specification throughout its life cycle. The authoritative source may or may not be the authoring entity. However, it must have the responsibility to effect changes and apply updates to the specification when necessary. The authoritative source should also designate a point of contact (POC) in its behalf who can receive questions and issue replies about the IEPD.

Table 2. IEPD Metadata

Metadata item	Description	Req / Option
Descriptive		
URI	Universal Identifier—each IEPD version will have a distinct URI. NIEM will provide a suggested strategy for URIs, but use of strategy is NOT mandatory.	R
Name	Title of this IEPD (e.g., Amber Alert, Prosecutor Arrest Warrant).	R
Summary	Brief summary of this IEPD for short display purposes—maximum of 160 characters including spaces.	R
Description	Narrative description of this IEPD—may contain as much detail as you think useful to those with a potential interest in this IEPD.	O
Web site	URL of Web site where this IEPD and related artifacts (e.g., XML schema, documentation, mapping spreadsheets) are posted.	O
Security	Security label to indicate treatment/distribution of this IEPD; e.g., For Official Use Only (FOUO), classified, sensitive but unclassified (SBU), public. The default is public, unless otherwise noted.	R
Change log data (must be consistent with change log artifact)		
Creation date	Project start date—YYYY-MM that planning or work on this IEPD started. Do NOT confuse with date you submitted this IEPD information.	R
Version	Version of this IEPD.	R
NIEM version	NIEM version used for this IEPD.	R

Last revision date	Year and month (YYYY-MM) this IEPD information was last revised. Do NOT confuse with the date the IEPD itself was last revised, generating a new IEPD version.	O
Next revision date	Year and month (YYYY-MM) this IEPD information is expected to be revised.	O
Status		
Maturity	State of development: 1. Entry level; under development with minimum documentation (see artifacts). 2. Complete; being tested and in limited use with draft documentation. 3. In production; fully documented and endorsed for use in official exchanges.	R
Status	Description or additional information related to current state of this IEPD.	O
Schedule	Information about the development schedule for this IEPD; e.g., "Development started YYYY-MM; draft planned YYYY-MM; completion planned YYYY-MM."	O
Endorsements	Names and acronyms of professional or governmental organizations that support this IEPD as an official business information exchange package.	O
Sponsors	Name of organization(s) that sponsored, contributed, or participated in the development of the IEPD.	O
Navigation		
Lineage	IEPDs that this IEPD was derived or built from/with, identified by URI. This is not normal version control.	O
Relationships	URIs of other IEPDs and their relationship to this IEPD; should not duplicate other attributes such as Lineage, LoB, Organization, etc.	O
Keywords	Search terms that would not otherwise be in other metadata attributes (e.g., Georgia's *Levi's Call* for an Amber Alert).	O
Business Context		
Domains	Primary domains or line(s) of business (LoB) that this IEPD covers.	R
Purpose	A short description of the business reason for using this IEPD; may include brief statement of scope.	R
Message exchange patterns	Category of transaction this IEPD is designed and used for: query/response, message, publish/subscribe, document, etc.	O
Communications environment	Description of the primary communications environment(s) for which this IEPD was designed; for example, wireless, satellite, broadband, T1.	O
Exchange partner categories	Types of organizations that would use this IEPD.	O
Exchange partners	Names of the organizations that are using this IEPD.	O
Process	Business process(es) during which this IEPD is exchanged.	O
Triggering event	Event(s) that cause this IEPD to be exchanged.	O
Conditions	Condition(s) under which this IEPD is exchanged.	O
Authoritative Source		
Authoritative source organization name	Self-explanatory; include both full name and acronym, as appropriate, to enhance discovery.	R

Authoritative source organization Web site	URL of the Web site of the authoritative source.	O
Authoritative source address 1	Self-explanatory.	O
Authoritative source address 2	Self-explanatory.	O
Authoritative source city	Self-explanatory.	O
Authoritative source state	Self-explanatory.	O
Authoritative source zip	Self-explanatory.	O
Authoritative source country	Self-explanatory.	O
Authoritative source category	Category of authority to create IEPD (statutory) versus to conduct the business the IEPD involves (policy) or both or none.	O
Authoritative source POC name	Person designated as the POC for the authoritative source and who can provide information, effect change, etc.	R
Authoritative source POC e-mail	Self-explanatory.	R
Authoritative source POC organization name	Self-explanatory; include both full name and acronym (as appropriate) to enhance discovery.	O
Authoritative source POC address 1	Self-explanatory.	O
Authoritative source POC address 2	Self-explanatory.	O
Authoritative source POC city	Self-explanatory.	O
Authoritative source POC state	Self-explanatory.	O
Authoritative source POC zip	Self-explanatory.	O
Authoritative source POC country	Self-explanatory.	O
Authoritative source POC phone	Self-explanatory.	R
Authoritative source POC fax	Self-explanatory.	O