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# Exercise & Evaluation Division Data Standards Strategy

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**DHS PD Exercise & Evaluation Division Standards Strategy - DRAFT**

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**Approval Sign-Off**

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Additional/Supporting Documents
NIEM training slides
NIEM data model 1.0 MS Excel file
Appendix C – DHS PD E&ED Standards Creation Milestones Schedule .mpp file
Appendix B Sample IEPD content – Information Exchange Data Model - ArgoUml file

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# **1 Executive Summary**

## **Standards Overview**

In an effort to support the mission and goals of the Department of Homeland Security, Preparedness Directorate, Exercise and Evaluation Division (DHS PD E&ED), this document serves as a guideline for that office's standards strategy. Following a period of due diligence and research into the various methods and options available to an organization looking to adopt the use of standards, this strategy has been outlined to reflect current industry "best practices," and, therefore, a path leading to the highest likelihood of success.

The successful implementation of standards used in the data sharing process will effectively continue and expand on the progress that E&ED has made thus far in standardizing the overall HSEEP process. The following represent the four highest priorities adhered to in the design of this strategy and reflect those elucidated by E&ED:

1. Rapid publication of several data exchanges.
  - a. Initial efforts targeted toward the existing HSEEP Toolkit.
2. The NIEM Information Exchange Package Description (IEPD) development process will be used where it does not conflict or impede with E&ED's highest priorities and schedule milestones.
3. Efforts will be made to follow NIEM conformance guidelines for the technical definitions of exchange models and resultant schema documentation.
4. Succinct business process diagrams will be created describing the required inputs and outputs of specific HSEEP business processes and useful tools associated with each process.
  - a. This activity will be performed for appropriate business processes that affect the information exchanges contained in the pilot standards.

## **Benefits vs. Risks**

As with the adoption of any new system requiring broad external adoption, there are a set of benefits and risks that need to be taken into account. A series of these benefits and risks are outlined below and represent only a partial, overarching set that would naturally expand as the program is further investigated and/or implemented. Despite the validity of several of these risks, the risks are firmly outweighed by the potential benefits of a system of well-crafted standards that augments the mission and goals of the E&ED HSEEP program.

## **Compliance**

E&ED envisions the adoption of standards assisting in the HSEEP compliance process, which, naturally, it will. However, for the purposes of this strategy document, we will distinguish between the meanings of the terms "HSEEP compliance," and "standards compliance."

HSEEP compliance in this sense refers to adhering to the standard HSEEP business processes and methodology for the planning, conduct, and evaluation of exercises as outlined in the HSEEP volumes. This level of compliance does not require a technology solution, is human-verifiable, and is inherently more subjective.

Systems or tools achieve compliance by incorporating process flows, inputs and outputs which all align with prescribed HSEEP business processes and data standards. An example of a tool designed to achieve this is the HSEEP Toolkit. Measuring compliance of products produced using tools is also somewhat subjective, as there is inherent difficulty in verifying that users are strictly adhering to HSEEP business processes.

Finally, compliance with HSEEP data standards only is achieved by employing a tool that adheres to the approved HSEEP data standard model, regardless of the attendant business processes. As they are effectively independent considerations, adherence to the HSEEP data standard is completely objective and easily measurable.

### **NIEM**

Adhering to the National Information Exchange Model is recommended where applicable and beneficial, and where it does not conflict with or impede E&ED priorities for rapid standards delivery to stakeholders. The current NIEM model is the result of a great deal of effort on the part of stakeholders and Communities of Interest in a variety of fields, including Justice, Emergency Management and Infrastructure Protection. E&ED can benefit directly from this work and the existing NIEM infrastructure (e.g., available expertise, existing domains, the NIEM Help Desk, etc.) to more effectively implement its own data standard. E&ED would be utilizing a system that has emerged as a front-runner in the intergovernmental data exchange field.

### **E&ED Standards Development Process**

The standards development process outlined herein consists of several essential components designed to ensure an end product that conforms to E&ED HSEEP methodology and data requirements. These include identifying relevant stakeholders in the process and encouraging their participation in the formation of a robust community of interest (COI) that can accurately address both the business and technical architecture requirements; defining an IEPD development process that accommodates system developers and users; implementing existing NIEM tools where useful and possible; mapping efforts to the prescribed IEPD development phases; and incorporating data elements from external standards to save time and effort where valid.

### **E&ED Standards Approval and Distribution Process**

Following development, IEPDs will be put through an approval process to vet validity and usability before general distribution. This dynamic process helps E&ED ensure the quality of data standards against an evolving set of business requirements. This process includes the solicitation of comments from the HSEEP community; creation of an independent verification and validation entity within E&ED; careful vetting for accuracy of the standard through experts before widespread distribution to the public; implementation of a standards change management process to manage version updates and revisions; coordinating the standards development process with the

HSEEP Systems Steering Committee and other appropriate subcommittees to ensure that efforts remain aligned with E&ED goals; and the ability to validate and approve external systems' data exchanges that are HSEEP data standards compliant.

## **2 Standards Overview**

### **2.1 Importance of Standards**

In a very real sense, the DHS PD E&ED already understands the importance of adopting and promoting standards among parties with common interests and goals. This is evidenced by its creation of HSEEP and its rapid adoption at the State and local level throughout the country as the standard for the design, development, delivery and evaluation of first responder and disaster-themed exercises. The overall quality of these types of exercises has greatly improved since the implementation of HSEEP, as has the ability to cross-analyze and utilize the data that has emerged from them. Stakeholders can now access templates and take advantage of well-crafted examples to assist in the creation and execution of their own exercises. They are also assured that lessons-learned or after-action items pulled from other exercises will be directly translatable to their needs, as they were created using a common process.

The implementation of standards at the data sharing level is a natural extension of the concepts of HSEEP. It allows all stakeholders to both contribute and receive exercise-specific information from the greater HSEEP community while being assured that the context and meaning of this information is and will remain standardized regardless of the number of exchanges that take place. As such, data standards drastically reduce any ambiguity and/or opportunity for misinterpretation of data from the information sharing process.

### **2.2 DHS PD E&ED Standards Priorities**

The following priorities have been identified by E&ED for standards development and will be adhered to through the standards development process.

1. E&ED has defined its highest priority in relation to HSEEP data standards to be the rapid publication of several data exchanges. Initial efforts will be targeted toward the existing HSEEP Toolkit systems to establish standard data transfers for insertion of external data and transmission of data between existing systems which can be published in the near term. Examples include submission of a scheduled exercise into NEXS and submission of an Improvement Plan into CAPS.
2. During the development of these initial data exchange standards, the NIEM Information Exchange Package Description (IEPD) development process will be used where it does not conflict or impede with E&ED's highest priorities and schedule milestones.
3. Efforts will be made to follow NIEM conformance guidelines for the technical definitions of exchange models and resultant schema documentation (i.e. NIEM IEPD format will be adhered to). This will only be done in cases where these

activities can be done in parallel with the higher priorities and schedules for initial standards development activities.

4. To facilitate incorporating the first phase of NIEM IEPD development into the HSEEP data standards development cycle, succinct business process diagrams will be created describing the required inputs and outputs of specific HSEEP business processes and useful tools associated with each process. This activity will be performed for appropriate business processes that affect the information exchanges contained in the initial standards. As with the other activities being performed, these tasks will be done in a manner that does not conflict with E&ED priorities and schedules.

### ***2.3 Benefits and Risks of Using Standards***

The application of standards to HSEEP-related information transactions effectively furthers the goals and overall mission of E&ED by allowing stakeholders to more easily adapt to and, therefore, adopt the HSEEP system. Providing exercise documentation and other data becomes a much simpler system, requiring less effort and providing a superior product on the receiving end. This is made all the more important by the fact that, because the HSEEP stakeholder constituency numbers in the thousands and is found at all levels of government, HSEEP data must integrate with myriad systems of varying levels of sophistication.

The adoption of data standards will also likely improve the overall quality of HSEEP-related data gathered by E&ED. Information provided by one stakeholder would be rendered more immediately useful and relevant to any other stakeholder(s). This will assist HSEEP in its continual evolutions as a truly valuable tool in the design, development, and delivery of exercises.

Adopting any set of standards implies some risk. These risks should be taken into account fully when a final decision is being made as to the character and extent of the standards being applied. Some conceivable risks include the potential for a lack of understanding at the State, Local, and/or Tribal levels as to what is implied by standards and why E&ED is requiring their use, as well as the potential for a lack of sufficient technical expertise at the State, Local, and/or Tribal levels to effectively implement NIEM or other service-oriented architectures (SOAs) designed to implement standards. Other risks include the possible resistance to standards implementation among stakeholders and partners, essentially requiring E&ED to maintain multiple data integration and management systems, and, secondarily, the resistance to adoption from vendors due to one or more unanticipated factors.

### ***2.4 Types of Standards & Corresponding Types of HSEEP Compliance***

The nature of the current HSEEP documentation and information sharing system allows for a higher level of ambiguity than would be experienced under a system governed by a single set of standards. At present, HSEEP exercise process documentation requirements have a higher tolerance for data misinterpretation and subjectivity, as

there is no attendant data dictionary, or other resource that spells out the explicit data definition of every key term that could potentially be shared by stakeholders.

In contrast, all data submitted using the approved standard information exchanges would have an explicit meaning. HSEEP data standard compliance, therefore, becomes more objective. Standards also serve to equalize all stakeholder systems, regardless of technical sophistication, ensuring that data compliance is more universally achievable than in its current state.

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The terms “HSEEP Compliance” and “Standard” can be confusing, and can be thought of on several levels:

1. Compliance with the standard HSEEP business processes, as outlined in the HSEEP volumes. These are processes that fully define the HSEEP methodology for the planning, conduct, evaluation, and reporting of exercises. This has been designated as the standard exercise methodology by DHS. Compliance with this standard is technology independent, and can be measured against the “HSEEP Terminology and Compliance Guidelines” currently under development by E&ED.
2. Systems or tools (such as the HSEEP Toolkit) used to assist in the execution of the standard HSEEP business processes would be considered ‘standards compliant’ tools if their process flows, and inputs and outputs for each process step (including HSEEP data compliance of output) could be found to be compliant with the HSEEP process. Therefore, for a tool to be fully compliant, it must be compliant with both HSEEP business processes and HSEEP data standards. Because it is often difficult to ensure that a user is following desired business processes during the use of a tool, this compliance can be difficult to directly measure.
3. Compliance with HSEEP data standards only. This could be achieved by using a system that does not strictly enforce the HSEEP business processes, but still produces HSEEP compliant data. For example, a simple spreadsheet listing improvement plan action items does not in itself provide confidence that HSEEP business processes were followed in creation of the action items, although it may list all action item properties in the prescribed HSEEP data compliant standard format.

This standards strategy is focused on HSEEP data standards. Although standard HSEEP business processes are used in creation of these data standards, compliance with standard business processes is not addressed.



## **3 NIEM Overview**

### **3.1 What is NIEM?**

The National Information Exchange Model (NIEM) is a partnership of the U.S. Department of Justice (DOJ) and U.S. Department of Homeland Security (DHS). It is designed to develop, disseminate, and support enterprise wide Information Exchange Package Documentation (IEPD) and processes that will enable jurisdictions and agencies throughout the nation to effectively share critical information in both emergency and routine situations.

NIEM focuses on discrete information exchanges between agency information systems. NIEM will provide the information sharing structure necessary for first responders and decision makers to have the right information to prepare for, prevent, and respond to major terrorist events and natural disasters. Also, it will enhance the day-to-day capabilities of practitioners at all levels of government in making crucial decisions about border enforcement, passenger screening, port security, intelligence analysis, local law enforcement and judicial processing, correctional supervision and release, and a variety of other governmental functions.

The primary NIEM objectives are to:

- Bring stakeholders together to identify information sharing requirements for operational and emergency situations.
- Maintain a national model containing universal, common, and domain-specific data components that pertain to agency information needs in order to facilitate development of an IEPD.

Develop standards, a common vocabulary, and an online repository of IEPDs to support information sharing.

- Provide technical tools to support development, discovery, dissemination, and reuse of IEPDs.
- Provide training, technical assistance, and implementation support services, as appropriate.

Developing and implementing NIEM exchange standards means that major investments local, state, tribal, and federal governments have made in existing information systems can be leveraged, allowing these governments to efficiently participate in a truly national information sharing environment. NIEM standards enable different information systems to share and exchange information, irrespective of the particular technologies at use. Moreover, creating and adopting NIEM standards means that local, state, tribal, and federal organizations avoid the problem of rebuilding or significantly altering their systems to share information.

NIEM is not a software program or a computer system, nor does it contain specific information regarding people, events, and incidents. NIEM is designed to facilitate information exchange between different domains, such as justice, public safety, emergency and disaster management, intelligence, and homeland security. NIEM makes this possible by providing the data standards and exchange methods for defining these cross domain exchanges. As NIEM grows, the Web site will serve as a repository for tools and it will facilitate collaboration for technical personnel across the country. NIEM will be built on a practitioner-driven model, yet it will remain under the control of DOJ and DHS in terms of content, quality, and expansion of scope to other domains like Health and Transportation.

### **3.2 Background**

DOJ and DHS launched NIEM on February 28, 2005. It leverages the data exchange standards efforts successfully implemented by DOJ's Global Justice Information Sharing Initiative (Global) and extends the Global Justice XML Data Model (Global JXDM) to facilitate timely, secure information sharing across the whole of the justice, public safety, emergency and disaster management, intelligence, and the homeland security enterprise.

NIEM complies with the Homeland Security Presidential Directive (HSPD5), which assigns the Secretary of DHS the role of principal federal official for domestic incident management. The Homeland Security Act of 2002 charges the Secretary with the responsibility for coordinating federal operations within the United States to prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies. In 2004, Congress passed the Intelligence Reform and Terrorism Prevention Act (IRTPA) and in 2005 Executive Order 13388 was issued by the President. Both items direct U.S. government organizations to strengthen the sharing of terrorism information between organizations and appropriate authorities of local and state governments and the protection of the ability of organizations to acquire this additional information.

### **3.3 Data Model Overview**

#### **3.3.1 NIEM Data Components**

Rather than nationwide integration of all local, state, tribal, and federal databases, NIEM focuses on cross-domain information exchanges between COIs across all levels of government. As a consequence, not all data needs to be NIEM-compliant, only that data that is being shared across domains.

To effectively exchange information across domains, there must be a common semantic understanding of data among participating agencies, and the data must be formatted in a semantically consistent manner. For example, two agencies may each gather information about persons charged with committing a crime. If the agencies share information regarding these persons, there must be a common understanding of the terminology each agency uses. One agency, for example, may refer to the person as the "offender," while another refers to them as the "defendant." Agencies do not

necessarily need to entirely retool their information systems or adopt standards and coding schemes that impose an artificial uniformity in data collection that fails to meet their operational business needs, but there must be a common understanding and semantic consistency in the structure of the data that crosses agency lines, if it is to be successfully shared.

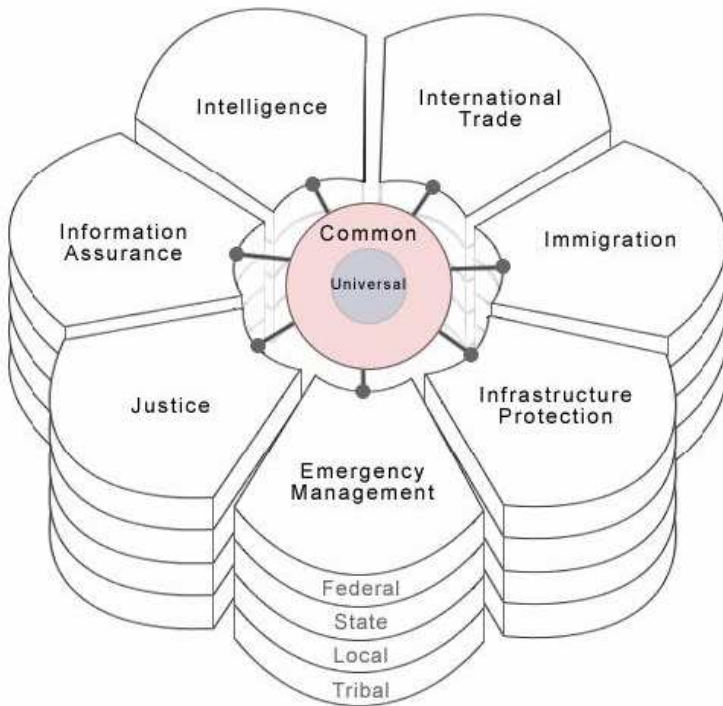


Figure 1 – NIEM Domains

The fundamental building block of NIEM is a *data component*. Data components are the basic business data items that describe common concepts used in general business activities. Information that is exchanged between agencies can be broken down into individual components—for example, information about people, places, material things, and events. Data components within an information exchange commonly shared and understood among all domains are identified as *universal (U) components* (e.g., person, address, and organization), while components used in exchanges between multiple domains, but not universally shared, are identified as *common (C) components* (e.g., offense, sentence, and disposition). Components managed by a specific COI (e.g., appellate case decision and arrest agency) are considered *domain-specific*.

By identifying common and universal information exchange components and building broad information sharing capabilities, NIEM will transform the way justice and public safety agencies do business and provide real-time, secure, enterprise-wide information exchange. First responders must be assured they can base decisions on timely, accurate, and complete information from a variety of sources. Creating, adopting, and adhering to NIEM standards will remove barriers to information sharing and will reduce the design and development time needed to build and implement robust, agile

information sharing capabilities, using NIEM's common standards, vocabulary, reusable data components, and tools. The common and universal component concepts will relieve agencies from the responsibility to define basic, well understood terms, while leaving them with flexibility and authority over those components that are specific to their business domain.

A data component, such as a *person*, represents a composite of attributes which describe something of interest—in this case, a *person*. The component may include such attributes as the person's name, date of birth, sex, race, ethnicity, height, weight, eye color, hair color, body type, etc. The *person* component is used in nearly all of the relevant domains in NIEM and carries the same meaning across all the COIs. Thus it is classified as universal. Each NIEM domain can extend universal for its own use, and *person* may have different attributes within these other domains.

Once the *person* component has been defined and validated for operational use, it can be stored in NIEM and made readily available for discovery, reuse, and extension by other interested COIs. As a consequence, COIs need not spend the time and effort ordinarily required to construct a component from scratch, and it facilitates greater information sharing, making connections more expansive and expedient. The full collection of information exchanged between agencies can be captured in an information exchange. For example, information regarding the arrest of a person will include not only descriptive and personal identification data regarding the individual—the *person* component described above—but also information about their alleged offense, the location of the offense, arresting officer, etc. An information exchange supports a specific set of business requirements in an operational setting. Additional information regarding this specific exchange can be further documented in the form of an IEPD, with data describing the structure, content, and other artifacts of the information exchange. As COIs develop and extend these universal and common components, they will be able to use them for domain-specific exchanges, effectively independent of NIEM, as well as to add extended content to NIEM for further use/reuse in cross-domain information exchanges. As COIs build new cross-domain information exchanges, this will likely identify additional common and universal data components for NIEM.

Through communication, outreach, and governance, stakeholders will be brought together to elaborate information exchange scenarios; map and model information exchange requirements; and will be provided with the operational methods, tools, and support services for development of their domain-specific components.

### **3.3.2 NIEM Architecture**

The NIEM architecture is described in terms of domains and the XML namespaces that are assigned to each. A namespace is a mechanism for uniquely identifying and associating terms with a specific vocabulary. All globally defined components in a given namespace must be uniquely named. However, namespaces allow different globally

defined components (each in a different namespace) to exist with identical base names while still distinguishing them (through namespaces). It is the solution to naming conflicts in XML.

As shown in *Figure 2: NIEM Namespace Architecture*, NIEM consists of two classes of namespaces: core and domains. NIEM also uses separate namespaces for code tables. *Core* namespaces contain data components that are under NIEM configuration control. Domain-specific namespaces are organized by domain and are controlled by representatives from COIs participating in the domain. Core consists of universal, common, and structures.

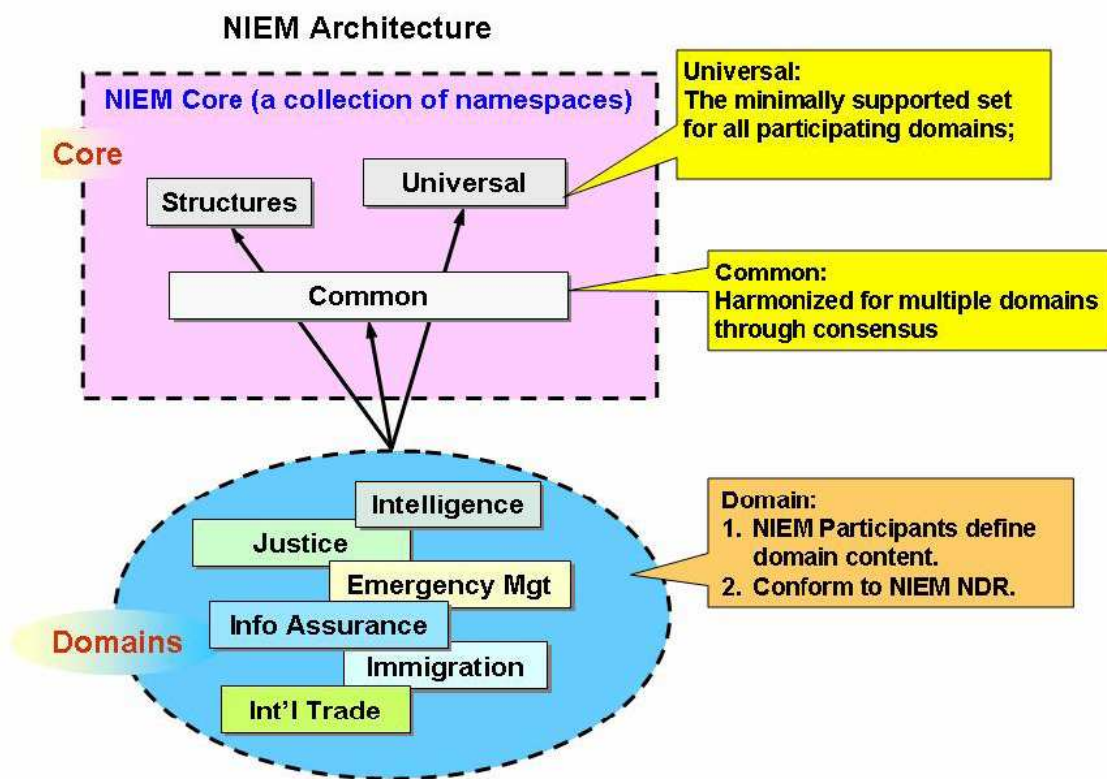


Figure 2 – NIEM Namespace Architecture

- *Universal* is the minimal set of components harmonized for and supported by all domains participating in NIEM. This set of components is universally understood, stable (once established), and relatively small.
- *Common* contains components that are harmonized for and used regularly by multiple domains. Components are approved to be added to this namespace upon consensus on the common semantics and structure for each such component. A NIEM domain may be considered authoritative for a component and, therefore, not all components used by more than one domain must be in common. However, a component in a domain must not

semantically conflict or overlap with any other component in universal, common, or domain-specific.

- *Structures* contains components that do not carry information content or have specific semantic meaning but are imported into other namespaces to be used for associations and other supporting infrastructure.

Components in any domain may be used by any NIEM participant but do not require harmonization in Universal or Common because they do not currently overlap or conflict with other components in NIEM. Participating COIs are not required to move their entire data model or all of their data components into a NIEM domain. However, all components integrated into NIEM domains must conform to the *NIEM NDR*, methodologies, and architectural specifications.

### 3.4 Conformance

All stakeholders in the HSEEP information exchange process are required to understand and implement NIEM conformance measures. This enables all parties to seamlessly share accurate and reliable information by ensuring that this information has the same meaning for the sender as it does for the recipient. Furthermore, because NIEM is a rapidly maturing data model, a great deal of the ground work has already been accomplished by other parties with identical goals to those of E&ED.

Developing and implementing NIEM exchange standards means that the major investments local, state, tribal, and federal governments have made in existing information systems can be leveraged and that these governments can efficiently participate in a truly national information sharing environment. NIEM standards enable different information systems to share and exchange information, irrespective of the particular technologies at use. Moreover, creating and adopting NIEM standards means that local, state, tribal, and federal organizations avoid the problem of rebuilding or significantly altering their existing systems to share information.

NIEM is not a software program or a computer system nor does it contain specific information regarding people, events, and incidents. NIEM is designed to facilitate information exchange between different domains, such as justice, public safety, emergency and disaster management, intelligence, and homeland security. NIEM makes this possible by providing the data standards and exchange methods for defining these cross-domain exchanges.

Ensuring technical conformance in NIEM requires the following:

1. Import and reference NIEM namespace or a correct subset
  - A large number of namespaces and subsets already exist within NIEM, making the task of locating and using an appropriate one easier and, in many cases, obviating the need to create new namespaces from scratch – a valuable timesaver

2. If it exists, use the appropriate NIEM namespace (i.e., do not duplicate one that already exists)
3. Be semantically consistent
  - Semantic consistency ensures that any and every term used in NIEM retains its exact meaning throughout all data exchanges. This is designed to help minimize the risk of misinterpretation of data on either end of the exchange
4. Use NIEM components in accordance with their definitions
  - NIEM components are all defined in the attendant data dictionary. All components in all exchanges must retain their original meanings per their data dictionary definition
5. Do not use an element to represent data other than what its definition describes
6. Apply XML Schema extension rules correctly and consistently
  - Should a required NIEM component not currently exist, users can create new ones through the use of extensions. Because the use of extensions ripples throughout the entire NIEM system, it is important that rules surrounding their creation and use are always followed. This also prevents confusion and misinterpretation on either end of the exchange
7. Conform to existing Naming and Design Rules (NDR)
8. Exchanges conform, NOT systems
  - This is an important consideration, and a common cause of concern, when evaluating standards systems. NIEM does not require any stakeholder parties to reconfigure or otherwise change their own systems, databases, etc. in any way to create a successful data exchange. Conformance is in no way impacted by how data is labeled, stored, defined, etc. in any particular system, but rather is only contingent on the consistent application of XML package data for the exchange
9. There is no concept of partial conformance

## **4 Exercise and Evaluation Division Standards Development Process**

This strategy document proposes the adoption of the NIEM Standards Development Process by DHS PD E&ED. Where certain steps in the process create conflicts with E&ED requirements or project schedules, they may be skipped or abbreviated as necessary. This process serves as a *guide* to the development of standards.

## **4.1 Business (COI) Processes**

The National Information Exchange Model (NIEM) Concept of Operations defines Communities of Interest (COIs) as follows:

Communities of Interest (COIs) are collectives of people comprised of practitioners and technical representatives (government and private sector) who, by virtue of their organizational affiliation, day-to-day operational responsibilities, or their provision of services and programs collectively, have a stake in NIEM information exchanges and who authoritatively represent their respective domains. Generally, COIs are formally constituted through an organizational charter, memorandum of understanding (MOU), articles of incorporation, or the Federal Advisory Committee Act (FACA).

These *stakeholders* may be members of a single COI or multiple COIs, depending on their interests and involvement. COIs can reuse data components and IEPDs and offer content into any domain. Additionally, multiple COIs can coordinate to develop new domain content. COIs typically meet, either personally or virtually, to articulate and define their business requirements and to plan, map, and model their inter-and intradomain information sharing requirements.

NIEM guidance recommends stakeholder groups of 5 – 9 persons. This allows for a significant amount of discussion regarding appropriate exchange architecture while also ensuring that the process does not get bogged down by a large group unable to achieve consensus. This group should consist of people with technical backgrounds as well as people with the business area expertise necessary to ensure that products of data exchanges are amenable to the needs of those receiving the information by addressing all relevant business requirements.

For this strategy, a list of potential stakeholders was compiled based on a number of considerations. This list contains stakeholders at all levels, from Federal Agencies, States, Counties, and Tribal governments, to local jurisdictions. Successful data sharing requires that all parties who actively share information understand and implement the process. This list is comprehensive of those parties and organizations with the greatest need for sharing exercise and evaluation related information with E&ED.

### **4.1.1 Potential Stakeholders**

#### *Federal Agencies*

- DHS, Exercise & Evaluation Division
- DHS, other agencies (FEMA, etc)
- DoD
- DOT
- DOJ
- HHS
- Others with roles under NRP/NIMS ESF structure according to priority

#### *Quasi-Governmental Agencies*

- Public Transit
  - Bus
  - Metrorail/Subway
- Airport and Seaport Authorities

*State, County, Tribal Level – Variable; dictated by relevant ESF structure and scope*

- Law Enforcement
  - Attorney General



- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>○ State Police</li><li>○ County Sheriff's Offices</li><li>○ Tribal Police</li><li>○ EOD/Bomb Squad</li><li>● Fire Marshal</li><li>● Emergency Management</li><li>● Health Department</li><li>● Medical systems</li><li>● DOT</li><li>● National Guard</li><li>● Others, as necessary</li></ul> | <ul style="list-style-type: none"><li>● Law Enforcement</li><li>● EOD/Bomb Squad</li><li>● Fire/Rescue</li><li>● HazMat</li><li>● Emergency Management</li><li>● Hospitals and Medical Facilities</li><li>● Public Works</li><li>● Disaster Relief Agencies</li><li>● Communications</li><li>● Others, as necessary</li></ul> |
|--|---|

*Local – Variable; dictated by relevant ESF structure and scope*

NIEM requires all new COIs to be vetted by the NIEM PMO. NIEM currently has several COIs that could be relevant to the work being done by E&ED, including Homeland Security and Emergency and Disaster Management, and this vetting process ensures that work is not duplicated. This process is as follows:

1. Once the NIEM PMO receives a request by a COI to represent a domain engaged in NIEM, the PMO will perform the necessary due diligence to ensure that the candidate COI does in fact represent an authoritative source for the relevant domain before formulating its recommendation.
2. The PMO then reviews the COI's draft components and IEPDs, relating them to what already exists in NIEM to determine if there are any overlaps between the candidate COI and an existing NIEM COI
3. Finally, the PMO evaluates whether the COI has the processes and tools needed to validate its IEPDs, prior to submitting those it would like to publish through NIEM
4. Based on this analysis, the PMO recommends to the NIEM Executive Steering Committee (ESC) to invite the COI to become a new participant in NIEM, invite the COI to join an existing NIEM COI, or to provide further feedback to the COI on other options available and/or actions it must complete to participate in NIEM.

Once established, COIs work to maintain the quality and integrity of the data exchanges taking place in their designated fields. This includes managing its release and Configuration Management processes as components are added.

## **4.2 IEPD Development Processes**

### **4.2.1 Overview**

The end product of the NIEM standard development process is the Information Exchange Package Documentation (IEPD) which contains all necessary components to implement and describe the standard's data exchange. Included are the appropriate NIEM XML Schema definitions representing the data supporting the business requirements of the exchange, as well as any additional resources such as required metadata or user manuals. The IEPD does not contain exact technical information describing the mechanism, such as a webservice definition, that the exchange will occur through. These implementation details are decided by each individual implementer.

Using NIEM IEPDs and the subsequent standardized data exchanges allow several distinct advantages to system developers and their users.

1. By using the NIEM defined processes, terminology and standard data elements a higher level of consistency will be observed between all IEPDs which are created. All IEPDs are both readable by humans in the artifact documentation as well as data system readable through the XML files.
2. NIEM IEPD generation ensures that the business requirements associated with each system and data exchange are considered from the earliest stages of the process. This allows for the most complete end product in the shortest development cycle saving time and cost.
3. Use of the NIEM IEPDs encourages agencies and system developers to reuse and leverage the core NIEM and any extensions created by other IEPD implementers. This is another way in which time and cost can be minimized using the NIEM processes.
4. Through the use of standard NIEM IEPDs third party systems developers or state and local jurisdictions can leverage the existing framework to quickly and easily create new interfaces to existing HSEEP Toolkit systems allowing consistent data collection and reporting without mandating the use of individual systems.

### **4.2.2 NIEM Tools**

Tools to help facilitate each implementer through more cumbersome portions of the process are being developed by the NIEM program office. Presently, the following tools are under development:

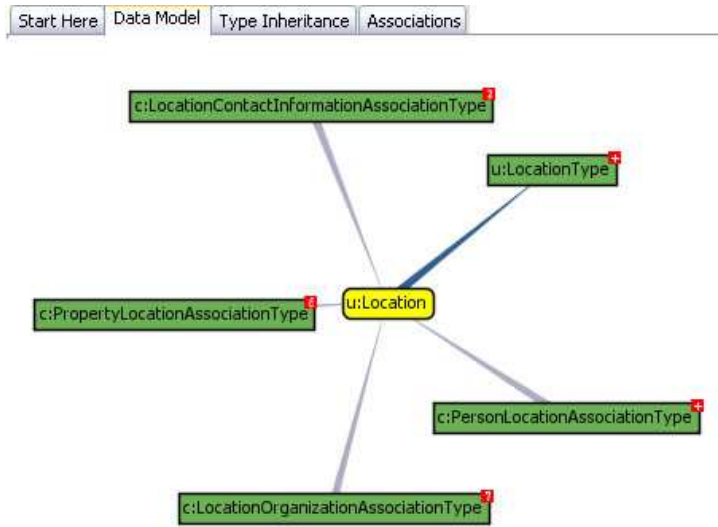


Figure 3 – NIEM Graphical Browser

### 1. Graphical Browser

The graphical browser allows users to view the NIEM data elements and their relationships to other data elements in a highly visual format. When an element is selected, the corresponding associated elements are shown. Any element can be selected to switch the view to that element's associations.

### 2. Data Mapping Spreadsheet

This Excel spreadsheet resource lists all NIEM data elements, types and inheritance information by domain. It is a useful tool during the data mapping phase for quickly identifying existing elements that can be reused for each IEPD.

### 3. NIEM Schema Subset Generation Tool (SSGT)

The schema subset generation tool assists the IEPD author by semi-automating the XML schema creation for elements currently existing in NIEM. Using the web interface, the author selects all elements that should be included in their IEPD that do not require manual extension. The SSGT then packages all necessary XML and artifact files for those elements for download.

### 4. IEPD Tool

The IEPD tool is used by IEPD authors to validate that at least the minimum documentation requirements for necessary schemas, metadata and artifacts are included in their package contents.

## 4.2.3 IEPD Development Phases

The IEPD development process contains six phases:

### 1. Conduct Business Analysis and Requirements Review

NIEM guidance recommends that each IEPD development cycle begin with the creation of a scenario to describe the business requirements that will be addressed with the data exchange. This scenario should include the full picture that will be covered by the data exchange, including all human participants as well as data systems involved. This

process ensures that the necessary business processes are examined and the resulting IEPD will be complete.

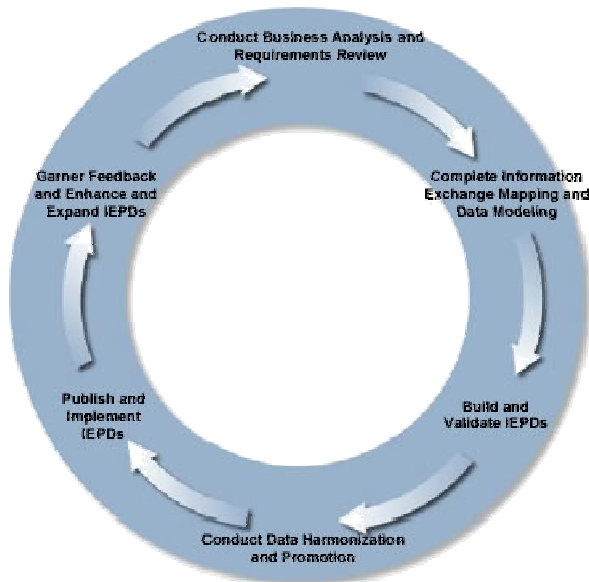


Figure 4 – NIEM IEPD Development Cycle

One way to facilitate the creation of these scenarios in accordance with the standard HSEEP methodology is to ensure the availability of succinct descriptions of each business process that should be followed when developing an exercise scenario to be conducted utilizing HSEEP. Currently the HSEEP volumes are the predominant resource for exercise planners. These resources may be augmented with the creation of process models describing the inputs, outputs and useful tools to be used for each HSEEP business process. An example of this is shown below in Figure 5.

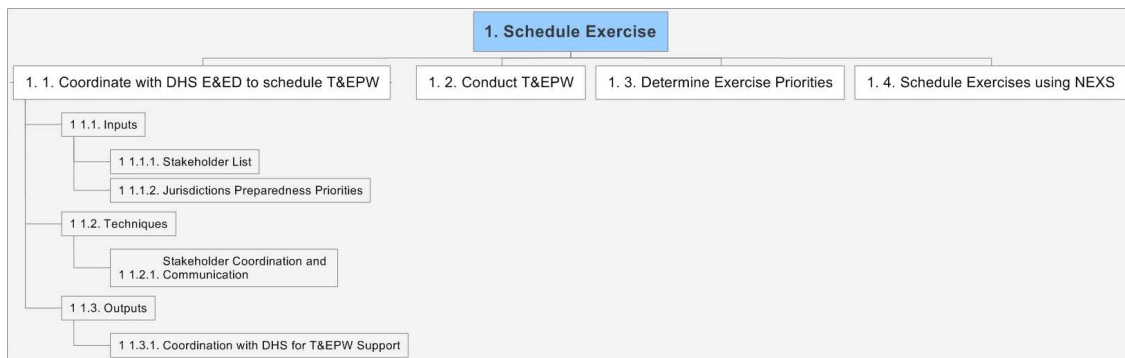


Figure 5 – Example HSEEP Standardized Business Process Diagram

**2. Complete Information Exchange Modeling and Data Mapping**

Two key activities in the creation of an IEPD are information exchange modeling and data mapping. The process of information exchange modeling allows the IEPD authors an opportunity to validate the business scenario previously created. Each piece of information is identified from the scenario and inserted into a visual data model which

will become the basis for further technical implementation of the data exchange. Data mapping takes these identified information pieces and compares them to the existing NIEM types and elements, linking each information piece directly with its NIEM analog if it exists. This process also exposes where the NIEM data model must be extended to meet the needs of the data exchange involved in the IEPD.

Established technologies such as UML Class Diagramming are used to model the information and how it will be exchanged between systems in this phase. Additionally, the necessary data elements are examined to determine whether they can be mapped back to existing data elements in NIEM, existing IEPDs created by other groups, or will be added as an extension to the NIEM model.

*a. Information Exchange Modeling*

Exchange modeling focuses on the structure of and relationships between each of the data entities involved in each specific data exchange. There are several mechanisms by which information exchange modeling can be performed, ranging from as simple as using pen and paper, spreadsheets, informal visual models and formal defined visual models. One formal visual model and the mechanism which is recommended for use by E&ED is UML modeling, specifically the UML Class diagram.

Exchange modeling takes the business scenario created in the first phase of the IEPD process and examines each entity that occurs in it. All people, locations, resources, roles and relationships are important to note. These items are then diagrammed to show the specific structure of the relationships and hierarchy of the necessary data.

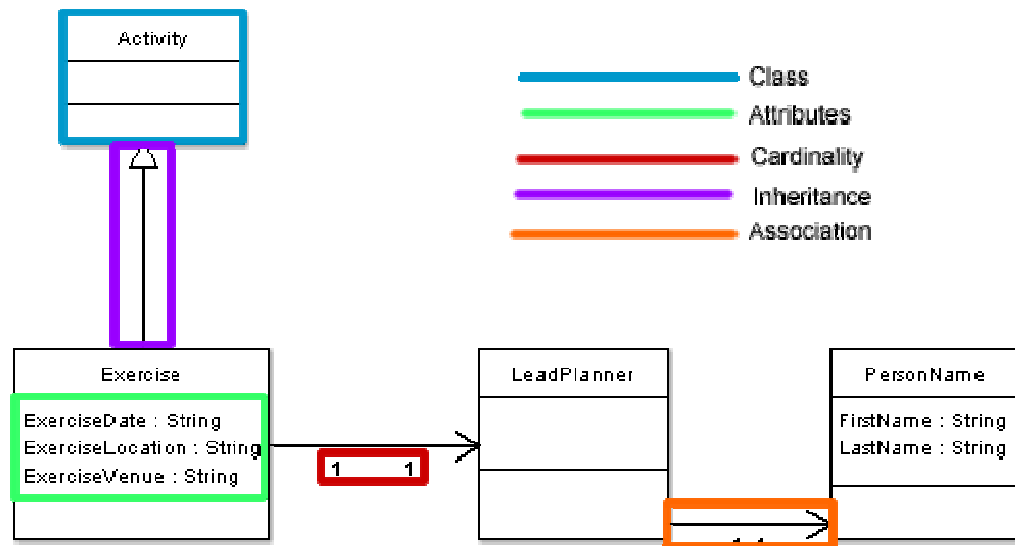


Figure 6 – Anatomy of the UML Class Diagram for Information Exchange Modeling

- Classes  
The UML class diagram may contain one or many classes. Each class in the diagram represents the equivalent of a noun in the scenario previously created.

For example, in the scenario of the HSEEP exercise cycle, an 'exercise' would be represented by a class.

Each class is modeled as a rectangular box, with the class title occupying the top third of the box.

- Attributes

Attributes in the UML Class Diagram represent the characteristics that define each class. Using the same example of the exercise class, observed attributes will contain descriptors such as exercise date, exercise location, exercise type, etc.

Each attribute is listed within the class box, occupying the middle third of the rectangle. Each attribute name as well as data type is displayed on the diagram.

- Associations

Associations in the UML Class Diagram express the relationships between the classes. Typically associations represent the verbs contained in the scenario with respect to the class nouns. Additionally, explicit relationships which are stated in the scenario are represented by these associations.

Associations are represented on the class diagram with an open ended arrow and may be either unidirectional or bidirectional.

- Cardinality

In the UML Class Diagram, cardinality represents the quantitative descriptors of each association, showing how many of one class relates to how many of the second class. Each association contains a numeric representation (0, 1 \*) at each end of the association arrow.

- Inheritance

In the UML Class Diagram, inheritance is used to represent specialized types of a more general class. Care should be used when identifying inheritance that the inherited class is truly a specialized version that cannot be represented by roles or shared attributes. Inheritance is commonly misused in class modeling if not understood correctly.

Inheritance is represented using a closed arrow originating from the inherited class and pointing toward the base parent class.

*b. Data Mapping*

After the data model has been constructed, the necessary data objects should be compared to the available NIEM types and elements to identify the places there are existing NIEM elements that should be reused, and where the NIEM needs to be specifically extended with new elements pertaining to the domain / exchange the IEPD is being created for.

Each IEPD will yield its own data mapping and should be treated as a separate extension of the data model.

Mapping the exchange model to the NIEM elements provides the framework and greatly facilitates the building of individual exchange schemas in the next phase.

Without performing thoughtful and detailed mapping, the schema creation process can become extremely difficult.

The data mapping process states that each class and property in the information exchange model must be directly mapped to a type or element in NIEM if an appropriate analogous term exists.

One of the most important issues to consider when asking whether each specific term can be mapped to an existing NIEM analog is semantic integrity. Terms which are mapped should both have the same semantic meaning. If there is any ambiguity as to whether the terms do not have the same meaning, the term should be mapped as an extension to the model.

Attempting to force fit entities from the information exchange model for the IEPD into the NIEM structure only leads to an increased potential for misunderstandings or different expectations of the data content which is passed in the exchange.

While conducting data mapping for an IEPD, two NIEM tools are especially helpful. The first is the NIEM spreadsheet of all types and elements and the second is the SSGT. These tools facilitate the identification of existing NIEM elements and describe their hierarchy and associations.

NIEM guidance recommends the use of a simple spreadsheet for the data mapping process. Below is an example of the information to be contained in the data mapping for elements directly mapped to existing NIEM types.

Business Class	Business Element	NIEM Element /Type	IEP Path	Notes
Incident Report		loc:IncidentReport	loc:IncidentReport	Derived from j:DocumentType
Incident		j:Incident	loc:IncidentReport/j:Incident	

*Figure 7 – Example NIEM data model mapping*

For elements which must be added to extend the existing NIEM elements and terms, there are two possible mechanisms for extension, dynamic and concrete. To best achieve the necessary level of standardization and general consistency between data exchanges, it is recommended that E&ED use concrete mapping techniques. These concrete mapping techniques also support the use of webservices such as the ones being developed for the HSEEP Toolkit applications, for data transmission better than more dynamic data mapping techniques.

### 3. Build and Validate IEPD

During this phase, the technical implementation of the required XML schemas and surrounding documentation occurs. This documentation should be created in line with NIEM guidance. At the end of this phase the IEPD should contain all necessary elements for validation and proper operation of the information exchange.

*a. Schema Creation*

Since the NIEM data model is so large, containing several thousand unique types and elements, the XML schema representing every piece of information in the model would be extremely large and cumbersome to work with. It is very unlikely that any specific information exchange will require the entirety of the data model to be described fully.

Each individual IEPD requires a set of XML schemas only be complete enough to describe the information involved in the exchange, resulting in much smaller and easier to manage subsets of the entire NIEM. This required subset of data will be equivalent to the information identified in the data mapping portion of the IEPD development process.

*b. Subset Schema*

The NIEM program office has created a very useful tool for the creation of valid subset schemas for data elements contained in the current NIEM. The SSGT allows the IEPD author to search for the data types and elements identified through the data mapping process and include them in the subset schema which is automatically generated once all appropriate data elements are included.

One distinct advantage of the use of subset schemas generated from the NIEM is that each subset schema will validate correctly against the full NIEM schema thus avoiding potential compatibility issues with manually created subsets of the existing NIEM data.

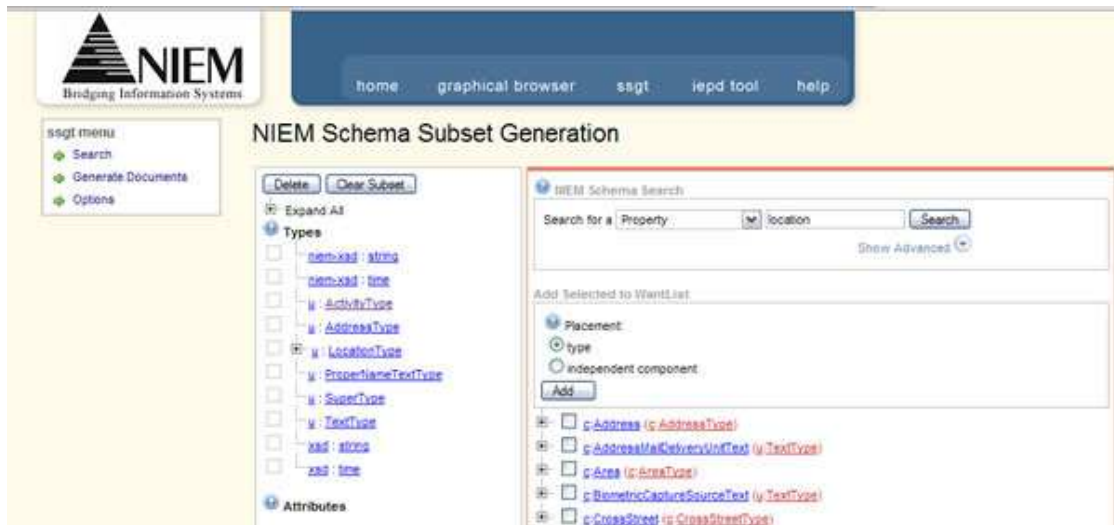


Figure 8 – NIEM Schema Subset Generation Tool

*c. Document Schema*

The document schema is the XML schema which defines the name and type of the root element of the entire information exchange. It is a necessary component as it describes the definitions and locations for all other appropriate namespaces used by the exchange.



Typically the document schema is very concise, containing only enough pertinent information about the base element of the exchange.

d. *Extension Schema*

The extension schema describes all types and elements that do not currently exist in NIEM to describe and support the information exchange in the IEPD. These elements are identified through the exchange modeling and data mapping phases, with final technical definitions being contained here in the extension schema. If all required data types and elements are contained in the existing NIEM, an IEPD may not require an extension schema.

e. *Constraint Schema*

The constraint schema is an optional component of the IEPD XML schemas discussed in this strategy. This schema is used to impose additional bounding restrictions on the values of specific elements in the subset schema. The most common use of the constraint schema is to explicitly define the cardinality of the elements in the data model.

Containing cardinality specifications in the constraint schema allows the core subset schema to be reused by other exchanges which may not require the same cardinality restrictions.

In its technical implementation, the constraint schema may be a copy of the subset schema with additional attributes describing minimum and maximum bounds for each element manually added.

f. *IEPD Validation*

Once the XML schemas and accompanying documentation have been created, the COI and/or working group responsible for the authoring of the IEPD may elect to review and validate the data components and implementation before approving the IEPD as complete and ready for distribution.

#### 4. *Data Harmonization and Promotion*

Once the IEPD creation has been completed, the IEPD is submitted to NIEM where the IEPD is evaluated and decisions are made as to whether any data element contained in the IEPD should be considered for inclusion in the more general common or universal classifications, rather than in the domain specific space.

#### 5. *Publish and Implement IEPD*

NIEM provides a central repository for the storage of non-sensitive IEPDs once they are complete and receive NIEM approval. Publication of each IEPD allows other stakeholders both from the same domain and other domains to reuse or extend existing IEPD data exchanges if appropriate, reducing the amount of parallel redundant standard creation.

a. *IEPD Tool for Publication and Storage of IEPDs*

The NIEM supplied IEPD tool may be used to both validate that all components necessary for the IEPD are present and to store IEPDs for future search and retrieval.

Once all appropriate business cases, models, mappings and schema have been created for an IEPD, this tool may be used for entry of basic IEPD metadata,

additional IEPD metadata, authoritative source metadata and upload of artifact files. The IEPD tool will verify all metadata and artifact files for completeness against the base set of IEPD requirements and identify any areas that should be examined.

The NIEM program office has also established this tool as a central repository for all completed and validated IEPDs. It is up to the IEPD author to make the final decision as to whether they will submit an IEPD to the clearinghouse and is not mandatory. There are definite benefits to publishing each IEPD to the clearinghouse making them available for other IEPD authors and interested parties to search and identify areas of future information exchanges which have already been defined, encouraging reuse of data model extensions and reducing the time and cost burden of creating future exchanges.

**6. Garner Feedback and Enhance and Expand IEPD**

IEPD development will be an iterative process, since both the business requirements creating the initial development of the IEPD and the NIEM processes will evolve over time. This phase of the IEPD cycle accounts for ongoing monitoring of both and coordination with the NIEM Program Office to ensure IEPDs are revised as appropriate.

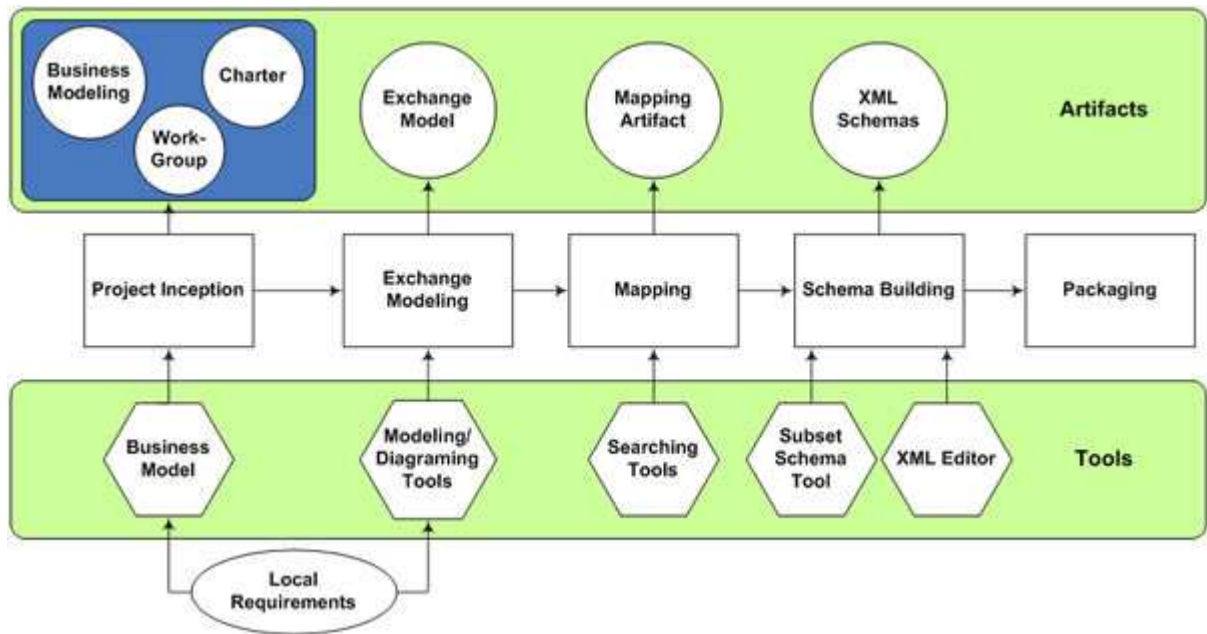


Figure 9 – NIEM IEPD Development Process, Tools and Outputs

**4.3 External Standard Adoption through NIEM**

During the initial creation of the NIEM IEPD standards development process, it was understood that there will always be standards enacted through different standards bodies that might be extremely useful to include as part of NIEM. As the IEPD development process emerged, care was taken to include ways for these external

standards to be made compatible with NIEM and used as part of NIEM IEPD generation, thus giving IEPD authors a wider selection of defined types and elements to work with, while not needing to manually create additional extensions.

One external standards body that is particularly applicable to the work being done by E&ED is the Organization for the Advancement of Structured Information Standards (OASIS) and their emergency management committee, led by the Emergency Information Consortium. This organization was responsible for the creation of several newly adopted data standards for the first responder community, including the Common Alerting Protocol (CAP) and the Emergency Data Exchange Language (EDXL). Standards currently under development from this group include the Hospital Availability Exchange (HAVE).

NIEM supports the use of both external standards which conform to the prescribed NIEM naming and design rules and ones that do not. The key requirement for a standard to be utilized in an IEPD is that the standard be fully represented in XML.

In the technical implementation, the inclusion of types and elements existing in an external standard is similar to the mechanism for creating an extension to the NIEM core schemas. The main difference is that there must be an XML container element to encapsulate the external standard elements.

The flexibility to include data elements from external standards offers additional benefits to the authors of new IEPDs. Reuse of data elements, whether from NIEM or these external standards increases the potential for interoperability with more systems, and promotion of the use of data standards in general. As long as the external standard authors comply with industry standard version management policies which generally prescribe the concept of forward compatibility, the linkages to external standards used in IEPDs should not require updating even as the external standard undergoes enhancement and change.

## **5 Exercise & Evaluation Division Standards Approval and Distribution Process**

These steps will occur after each IEPD has been deemed complete by the working group responsible for authoring the data exchange standard.

### ***5.1 Solicitation of Comments from the HSEEP Community***

During the creation of specific standards and information exchanges, IEPD authors and therefore E&ED may generate a significant portion of data definition elements for a certain part of the exercise or first responder community. When these significant data definitions become apparent, E&ED may elect to submit these definitions to a larger existing working group or to the exercise community at large for review and comment to ensure that the majority of the community also utilizes the data in question in the same ways and assigns the same semantic context to the data elements. This is another way to ensure the highest potential for acceptance and reuse of the data standards by all parties seeking to exchange data with E&ED HSEEP Toolkit systems, thus providing

E&ED the largest and most accurate set of data for all exercises utilizing digital systems to collect and store exercise data.

This working group or public review will most likely not be necessary for most data exchange standards created between existing systems or covering small subsets of readily understood and accepted data elements. One potential scenario where this more public review might be appropriate is during the creation of generic standards designed to incorporate entire exercise data exchanges or exchanges involving new subsections of HSEEP policy and the data surrounding them.

One advantage of conducting a public review period for data standards, especially in the early days of E&ED standards creation, is to increase the exposure of E&ED standards in general. Increasing the recognition of standards by the exercise community and enhancing users' participation in the standards process can facilitate a more immediate acceptance of data standards as they become available for use in the community.

### ***5.2 Independent Verification & Validation by E&ED***

Expanding on the earlier discussion of HSEEP compliance and data standards compliance, it is recommended that E&ED establish an independent verification and validation (IV&V) process for all data standards created for the purpose of collecting or transmitting HSEEP exercise data to E&ED digital systems.

Incorporating this IV&V process will ensure that all data exchanges and standards involving core E&ED digital exercise systems meet an acceptable level of excellence and that the information exchanges will operate smoothly and free from error or adverse effect on the systems involved.

One recommendation for implementation of an IV&V process for information exchanges involving E&ED systems is as follows: A single point of contact should be established to act as a facilitator of this IV&V process, with appropriate background knowledge of technology and the data flow requirements for E&ED systems. This individual would be responsible for educating stakeholders in the accepted process for testing potential information exchanges, to be validated through a new services oriented data architecture that would be developed by E&ED for the purpose of standardized information exchanges with and within the HSEEP Toolkit systems.

This services oriented data architecture would serve as the main IT entry point for all interactions with the HSEEP Toolkit systems. A successful test of the information exchanges would validate that there are no technical errors in the mechanism of transmission, the webservice definitions, and technical security requirements. This validation would also assess the documentation associated with each information exchange to ensure that each data element conforms to the same semantic definition and intention as the corresponding HSEEP terms. This serves as a final assurance that data submitted to the systems will be accurate in the context of the HSEEP methodology, assuming that the exercise was conducted within proper HSEEP guidelines. A representative from E&ED or an individual knowledgeable in HSEEP methodology should perform this validation. Once these two validation steps have been

performed and deemed successful, E&ED may grant a certification to the standard to denote that this standard has met all requirements to be used on a daily basis.

### ***5.3 Distribution of the Standard to the Public***

It is recommended that external standards creators do not publish IEPDs to the public NIEM clearinghouse until final HSEEP data standard compliance is issued by E&ED to prevent the distribution of non-working or incomplete information exchanges or misunderstood terms. For data standards created with the purpose of communicating information to E&ED systems, E&ED may find it beneficial to work closely with NIEM representatives to ensure that information exchanges involving E&ED systems and interests have been properly approved before becoming available to the public, wherever possible.

### ***5.4 Standards Change Management Process***

Due to the continuous evolution of the HSEEP methodology, HSEEP systems, and external agency systems, it should be anticipated that a change management process for HSEEP data standards will be a necessary implementation. The goal of this change management process would be to ensure the future compatibility of all existing HSEEP data standards and IEPDs, or to create a roadmap for external standards developers to follow for updating existing standards or IEPDs, if significant HSEEP methodology changes are made, or if the HSEEP systems or services-oriented data architecture must be modified.

The standards change management process should define different categories of version updates, such as minor vs. major revisions, and set expectations for all appropriate stakeholders. Accepted IT industry standard definitions of minor vs. major versions indicate that minor version changes are released more frequently and involve only changes to data standards which will not break compatibility with existing exchanges. This would include making additions to base E&ED schema definitions and data elements. One example of this might be the addition of new, common sponsoring agencies or exercise scenario types. Any change which will break compatibility with existing standards or systems exchanging data should be released less frequently, with ample notice being given to technical stakeholders to prepare for necessary changes to their exchanges and systems. E&ED may find it helpful to hold a working group meeting with affected parties prior to releasing major version enhancements.

### ***5.5 Effects on HSEEP Systems Integration Processes***

It is understood that all new HSEEP data and business standard development must occur in line with current E&ED priorities and not hamper the continued efforts underway to enhance HSEEP Toolkit systems and their use. The processes of standards development should be closely coordinated with entities such as the HSEEP Systems Steering Committee, and appropriate subcommittees, including the systems integration subcommittee.

One key aspect of the proposed standards development process contained in this strategy is that it does not require systems developers to modify any existing database structures or underlying software code pertaining to normal system use. All information exchanges created through this process may be implemented through services interacting in a proposed new E&ED services-oriented architecture. This may require the new architecture backbone to include an adapter component capable of interfacing with the existing systems and their defined methods for receiving appropriate system data. This reduces the labor that must be performed by systems developers to participate in important information exchanges.

### ***5.6 External Systems HSEEP Data Standards Compliance Validation***

Additionally, IV&V processes described above allow external agencies or other stakeholders creating external systems apart from the core E&ED HSEEP Toolkit to receive an appropriate 'seal of approval' from DHS which can then be used to increase awareness of streamlined interoperability of the systems and promote widespread use of the external systems. This again increases the amount and accuracy of the data available to E&ED for later reporting and analysis to agencies such as OMB for required PART reporting. Compliance validation would consist of Verification and Validation by a designated E&ED authority to ensure the external system was conforming to the standard. Compliance would consist, in short, of the external system's data exchange package conforming to the standard IEPD's data exchange schema.

## **6 Appendix A - References**

Portions of this document were taken or adapted from the references below.

1. NIEM Program Management Office, "National Information Exchange Model Concept of Operations", July 17, 2006
2. NIEM Program Management Office, "Introduction to the National Information Exchange Model", June 30, 2006
3. Georgia Tech Research Institute, "Use of External Standards within NIEM", March 28, 2006

## 7 Appendix B - Sample IEPD Content

### 7.1 Sample Exercise Related Scenario

The State of California has developed an independent exercise scheduling system. They have decided that it would be beneficial to create a mechanism to insert data about their exercise schedule into NEXS to quickly identify any potential conflicts with DHS.

For this potential data exchange, the first actions taken when planning for the exercise include the identification of basic exercise information. This information includes the exercise date and location, as well as the name of the lead exercise planner responsible for exercise coordination.

### 7.2 Sample Information Exchange Model

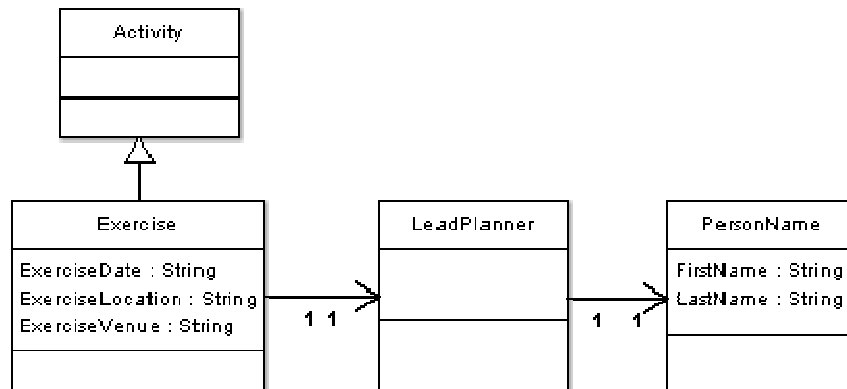


Figure 10 – Sample Information Exchange Model

### 7.3 Sample Data Mapping

Preliminary sample data mapping files will be submitted separately.

### 7.4 Sample Schema

Preliminary sample schema files will be submitted separately.



## **8 Appendix C - E&ED Strategy Implementation Milestones**

Contained in Appendix C is the proposed strategy implementation schedule to accomplish rapid data standards development in line with E&ED goals and priorities. After examining the recommended timeframes for accomplishing HSEEP data standards development, it is recommended that E&ED approve the creation of three initial data standards, and examine the applicability of one of the standards to ongoing efforts by external agencies with regard to creation of an external exercise scheduling system through a working group.

The first standard proposed is a generic interface to the National Exercise Schedule (NEXS) system, which would allow external exercise scheduling systems to automate the insertion of new data into NEXS, once exercises at the state or local level have been scheduled.

The second standard proposed is a generic interface to the Corrective Action Program (CAP) system, which would allow external corrective action and improvement planning systems to automate the insertion of new data into CAP system once exercises have been evaluated and results reported.

Upon acceptance of this proposed implementation strategy, tasking activities must be reconciled with the existing work plan to update the full spectrum of tasks that will be accomplished under the HSEEP Policy & Guidance Exercise Technology Subtask.

# DHS PD Exercise & Evaluation Division Standards Strategy - DRAFT

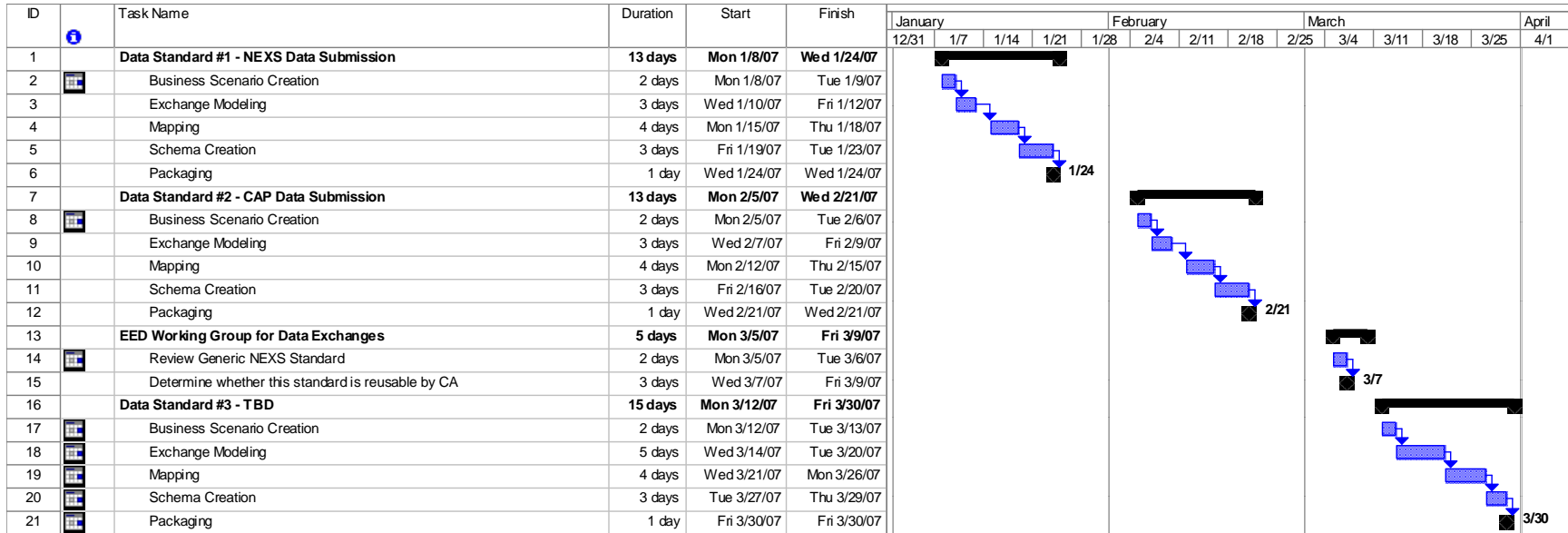


Figure 11 – E&ED Strategy Implementation Milestones