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BUSINESS INFORMATION EXCHANGE COMPONENTS

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1 Introduction

1.1 Purpose

Many organizations at all levels of government are developing and implementing NIEM-conformant information exchanges, documented in the format of an Information Exchange Package Documentation (IEPD).¹

However, it is rare that an information exchange uses only NIEM components. Generally, an information exchange uses some components from NIEM along with other components, referred to as “extension components” (because they extend the content of NIEM). These extension components are defined to meet the specific business needs of a particular information exchange for content that is not in NIEM. NIEM extensions are generally implemented through one or a combination of several approaches²:

1. Extend an existing NIEM data component (for example, through XML schema type extension).
2. Create a completely new data component that incorporates one or more existing NIEM components (for example, through composition).
3. Create a completely new data component without NIEM components.

Development of an IEPD involves discovering and defining the business data needs; mapping the business data to NIEM components and extension components; defining the extension components; developing NIEM subset schemas (to exclude NIEM content not used in a particular IEPD); developing extension schemas; and developing the exchange schema.

As an organization develops more and more IEPDs, and gains experience in the process, a number of questions inevitably arise:

- Performing all the steps to develop an IEPD can be time consuming, and developing many IEPDs can be costly. How can an organization realize economies of scale and reduce efforts as more IEPDs are developed?
- NIEM encourages the reuse of IEPDs as a whole, but in many cases information exchanges, even within the same general business area, are not exactly the same, and reuse of the entire IEPD may not be possible. Is there a better way to reuse artifacts developed for one IEPD in the development of another?
- NIEM has a great deal of content, most of which may not be applicable to a particular organization's business and won't be used by that organization for information sharing. It is often difficult for IEPD developers to find the appropriate NIEM content because there is so much to sift through. Is it possible to search only the NIEM components used by the organization's business?
- Many IEPDs have similar business content; but if the IEPDs are developed at different times and/or by different people, similar business content may be reflected in arbitrarily different ways. How can an organization ensure that similar business content is reflected the same way in all IEPDs with that content?

¹ As of the date of this paper, IEPDs are specified in *Requirements for a National Information Exchange Model (NIEM) Information Exchange Package Documentation (IEPD) Specification* [NIEM-IEPD], which will be superseded by a to-be released *NIEM Model Package Description (MPD) Specification* [NIEM-MPD].

² See *Techniques for Building and Extending NIEM XML Components* [NIEM-Extending] and *NIEM Naming and Design Rules (NDR)* [NIEM-NDR] for additional information.

- Extensions developed for one IEPD may be difficult to discover and reuse in another IEPD. How can organizations define and manage extensions specific to their business needs in a way that facilitates discovery and reuse of such extensions?

The purpose of this concept paper is to describe two related constructs that can help answer these questions. The constructs are:

- Business Information Exchange Component (BIEC).
- Enterprise Information Exchange Model (EIEM).

The development and use of BIECs and EIEMs is not required for NIEM conformance. However, because they are extensions to NIEM used as reference models for NIEM-conformant IEPDs, BIECs and EIEMs must be developed in a NIEM-conformant way and adhere to the *NIEM Naming and Design Rules (NDR)* [NIEM-NDR].

BIECs and EIEMs are not a part of the NIEM itself and are not a part of NIEM governance. BIECs and EIEMs are targeted for development and use by enterprises and organizations at all levels with specific business needs. Organizations are encouraged to evaluate the benefits of employing BIECs and EIEMs, but the decision of if and how BIECs and EIEMs are used is determined by each organization developing or governing the development of IEPDs. Considerations for adopting BIECs and EIEMs are included in this paper.

1.2 Scope

This concept paper covers:

- Background and definition of BIECs and EIEMs.
- Goals of adopting BIECs and EIEMs at all organizational levels.
- Creation and maintenance of BIECs and EIEMs.
- Descriptions of common BIEC and EIEM artifacts.
- Potential requirements for tools supporting BIECs and EIEMs.
- Considerations for adopting BIECs and EIEMs.

2 Background and Definition

2.1 Background

As an organization develops IEPDs, the organization may realize that many of its IEPDs have similar business content. A collection of closely related business data could be organized at an object level and defined as extension data components. These extension components could be referred to as Business Information Exchange Components (BIEC), because they are either specific to an organization's business or they represent a more general line of business that crosses organizational lines. Often they are business data components developed and used by multiple organizations within the same community of interest (COI).

The use of BIECs has the potential for simplifying IEPD development and increasing consistency of the business object definitions at all steps in the process, including exchange content modeling, mapping to NIEM, creating NIEM extension components, and generating XML schemas.

For example, an organization may define the business data for a "Court" as a subset or restriction of the NIEM `j:CourtType` (only containing the elements used in the organization's business) and an

augmentation with additional elements for business data that is not in NIEM (either because it was overlooked in the development of NIEM or is specific to the organization's business). The organization would designate this collection of court business data as a "Court" BIEC.

The Court BIEC artifacts would be similar to IEPD artifacts and would be developed in a similar manner; the Court BIEC would look like a "snippet" of an IEPD. The organization may create a graphical business representation of the Court BIEC that would look just like a piece of an IEPD Exchange Content Model. They may document a mapping of the business data to BIECs that would look just like a piece of a mapping spreadsheet (or other Exchange Content Mapping representation). Finally, the organization would develop the physical representation of the Court BIEC as extension type and element definitions in an Extension XML Schema.

This Court BIEC can then be used across all IEPDs developed by that organization that have "Court" business content. For subsequent IEPD development:

- The graphical depiction of the court business data has already been developed and can simply be copied and pasted to the IEPD Exchange Content Model. This reduces the effort required to develop the IEPD Exchange Content Model artifact.
- The mapping of the court business data to NIEM and extensions for a "Court" representation has already been accomplished and does not need to be repeated. This reduces the effort required to develop the IEPD mapping artifact.
- The extension components have already been defined in one or more extension XML schemas and do not need to be defined again. This reduces the effort required to develop the IEPD Extension XML schema.

In addition, the IEPDs developed by that organization for the same line of business will be more consistent with each other, because the content and structure of Court business data is the same across all IEPDs that use the Court BIEC.

Once an organization defines a number of BIECs, the collection of BIECs can either be used as a library of business components or can form the basis of an Enterprise Information Exchange Model (EIEM). Instead of developing each IEPD by mapping business data to NIEM and extension components, subsetting NIEM, and defining extensions, organizations can perform much of the IEPD development by mapping high-level business content to existing BIECs in their own EIEM. The concept is depicted in Figure 2-1.

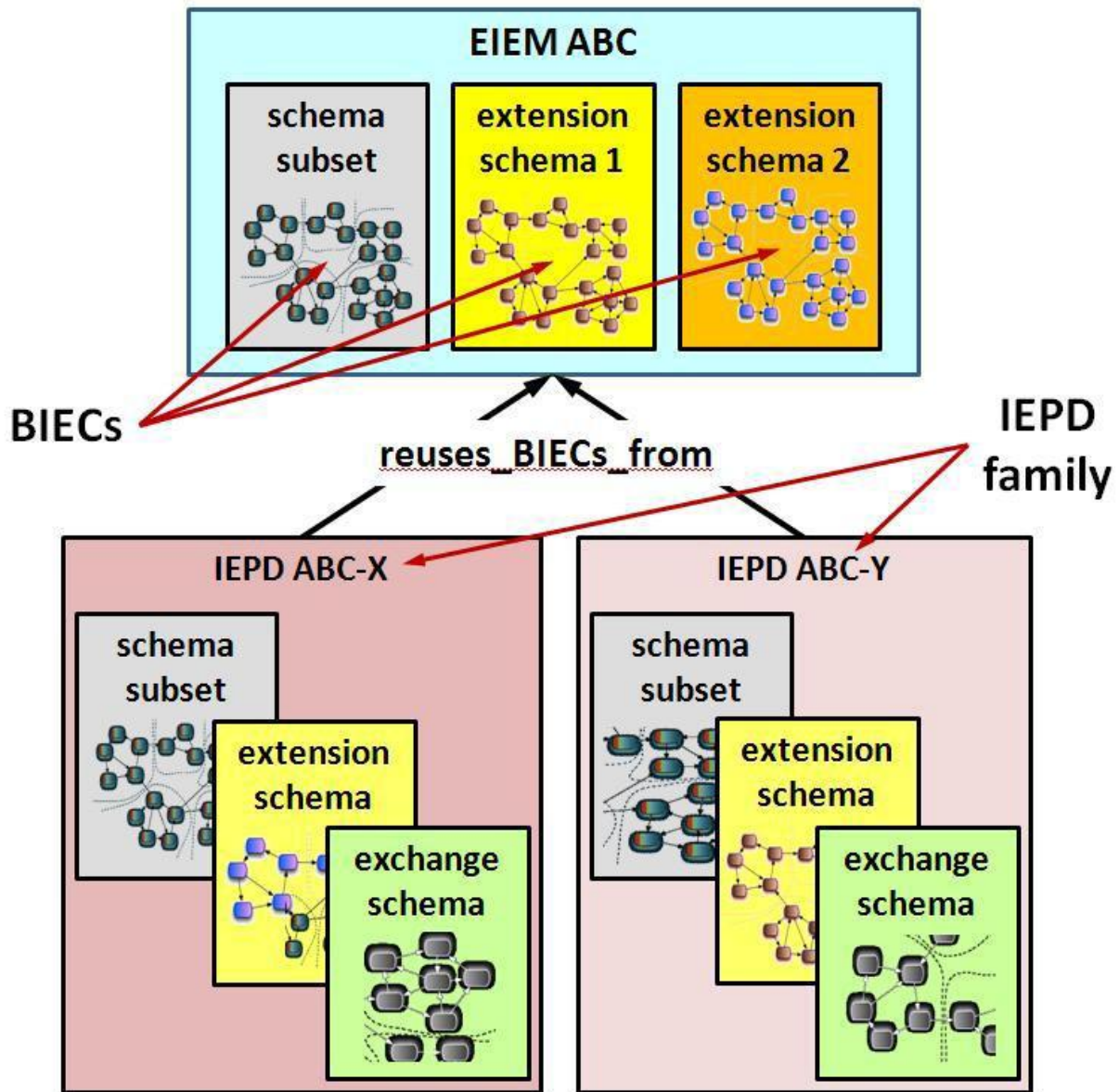


Figure 2-1 BIECs, EIEM, and a small family of IEPDs

Although the preceding discussion is in the context of an “organization,” it may more often be applicable in the context of an “information sharing enterprise.”³ An information sharing enterprise⁴ is a group of organizations with business interactions that agree to exchange information, often using multiple types of information exchanges. The member organizations have similar business definitions for objects used in an information exchange and can agree on common definitions for BIECs and an EIEM.

³ Not to be confused with the Information Sharing Environment (ISE) established as a result of Intelligence Reform and Terrorism Prevention Act of 2004; although the ISE could be viewed as an information sharing enterprise.

⁴ Henceforth in this paper, simple references to “enterprise” mean “information sharing enterprise.”

2.2 Business Information Exchange Component Definition

A Business Information Exchange Component (BIEC) is a content data model for one data object that meets specific business needs of an information sharing enterprise as a part of one or more information exchanges.

This object is intended to be reused across multiple IEPDs, providing common representation of the same real-life concept. This approach facilitates greater reuse of IEPD artifacts and code required for producing or consuming information exchange packages (IEPs) across the information sharing enterprise.

2.3 Enterprise Information Exchange Model Definition

An Enterprise Information Exchange Model (EIEM) is a content data model of data components that meets the specific information sharing business needs of an enterprise. In a sense it is a tailored adaptation of NIEM, subsetted, extended, and constrained to meet those needs. The EIEM consists of:

- A “master” subset of NIEM that contains all NIEM components used or expected to be used by the enterprise.
- One or more extension schemas that define BIECs and other extensions used or expected to be used by the enterprise.

For an enterprise that creates and maintains an EIEM, its IEPD development process is no longer required to create NIEM subsets or extensive mappings of business content to the XML data model—for the most part, this work has been accomplished in the process of EIEM development. IEPD developers can reuse definitions, the master NIEM subset, and business content mappings encapsulated in the BIECs that comprise the enterprise model.

3 Goals of BIECs and EIEMs

The goals of using BIECs and an EIEM are to reduce the effort required to create a set of IEPDs and the incremental cost of creating a new IEPD and to increase reuse and consistency among IEPDs used by an enterprise to exchange information. Specifically:

- Improve the consistency of information representation across multiple IEPDs developed by an information sharing enterprise.
- Define and manage extensions specific to an enterprise’s business needs in a way that the extensions can be discovered and reused.
- Reduce the efforts required to develop multiple IEPDs by:
 - Defining BIECs once and reusing them in multiple IEPDs.
 - Mapping IEPD business data primarily to NIEM and extensions at the BIEC level instead of lower levels.
- Make it easier to find NIEM content by limiting searches primarily to the NIEM components used by the enterprise.

The use of BIECs and EIEMs can extend the value of NIEM beyond its use in IEPD development.

3.1 Information Sharing Enterprise³ Level Activity

As stated in Section 2.1, an information sharing enterprise is a group of organizations with business interactions that agree to exchange information, often using multiple types of information exchanges.

Such enterprises may cross various levels of government and involve multiple business domains. Organizations involved in information sharing within such enterprises have similar business definitions for objects used in an information exchange and can agree on common definitions for BIECs and an EIEM. An information sharing enterprise is self-defining and can be formal (with specific governance) or informal/ad-hoc. An information sharing enterprise is the primary entity that supports the development and management of BIECs and an EIEM.

3.2 National Level Activity

BIECs are defined by an information sharing enterprise. NIEM itself could be considered as the EIEM at the national level, and certain, less granular NIEM components could be considered as BIECs at the national level.

Federal organizations may themselves be information sharing enterprises or be a part of one or more information sharing enterprises.

An information sharing enterprise may encompass multiple levels of government, so its activities could be considered national level, even though its IEPDs are governed by a federal agency (often with state and local involvement). For example, information sharing of criminal incident data in the FBI's Law Enforcement National Data Exchange (N-DEx) program occurs at the federal, state, and local levels. The N-DEx IEPDs use the Logical Entity Exchange Specification (LEXS) (developed by the US DOJ Law Enforcement Information Sharing Program (LEISP)), which defines a "digest" used across all LEXS-based IEPDs. The digest defines high-level entities (commonly used by law enforcement systems) that are examples of BIECs in the law enforcement information sharing enterprise.

3.3 State Level Activity

Development of BIECs and an EIEM is often a state-level activity because most states view themselves as information sharing enterprises, either among state agencies or among state agencies and local agencies in a state. The membership and scope of a state-level information sharing enterprise can be subject to state-specific legislation, policies, and business practices.

A number of states have defined or are beginning to define BIECs and an EIEM specific to their state's business needs, at least for a particular domain. Much of the time, these activities are driven by one or more state-level organizations with the direct involvement of local organizations. They may support state-specific information exchanges within a sub-domain, such as information sharing between all courts in a state; or they may reach across multiple domains, such as justice, homeland security, family services, etc. For example, the Texas Path to NIEM project brought state and local government organizations together to develop an EIEM and BIECs concurrently with the development of 27 IEPDs. These IEPDs are being used for information exchange between Texas state and local governments across several domains.

3.4 Organization Level Activity

An individual organization may be a member of a group of organizations that comprise an information sharing enterprise, or a large organization may itself be an information sharing enterprise, exchanging information among the various units of the organization. An individual organization may be a member of multiple information sharing enterprises.

4 Creation and Maintenance

Creation and maintenance of BIECs and an/or an EIEM are best managed through a program that transcends the development of individual IEPDs and persists over time as long as the information sharing enterprise continues to develop and update IEPDs. Depending on the size and scope of the information sharing enterprise and the number of IEPDs required, this program may be small or large. At first it may be larger as an initial set of IEPDs are developed, then become smaller as IEPD development drops off

and a documented, repeatable process is in place. The costs of establishing and maintaining the program should be weighed against the benefits of using BIECs. Some information sharing enterprises may find it difficult to fund or maintain such a program. Even without a formal program or governance, an information sharing enterprise is well served by promoting collaboration between IEPD developers working on different information exchanges, facilitating exchange of ideas, developing best practices, and sharing business component definitions. Even such loose collaboration in the absence of formal governance mechanisms can improve productivity and enable at least some reuse of BIECs across the enterprise.

The artifacts documenting BIECs and EIEMs are described in Section 5 of this paper.

4.1 Creation and Maintenance of Business Information Exchange Components

BIECs can be created using one or more of the following approaches (and possibly others):

- Top-down, by identifying the required BIECs and master NIEM subset through analysis, and specifying the details using the BIECs before IEPDs are created.
- Bottom-up, by analyzing existing IEPDs and data models for common business data content, harmonizing differences, and synthesizing the BIECs.
- Middle-out, by defining new BIECs at the same time a significant set of IEPDs is being developed.

4.1.1 Top-down Approach to BIEC Creation

Using the top-down approach, it is assumed that BIECs are defined before a significant number of IEPDs are developed. An enterprise developing BIECs using a top-down approach should have a common understanding of the information exchanges requiring development, applicable business requirements and rules, and the data used in the exchange.

The organizations in the information sharing enterprise may meet and use a business process specification tool. The tool is used to gain an understanding of the workflow driven by cross-organizational business processes, define the information exchange points and triggering events, identify individual information exchanges, and begin to define their content at a high level. At this point, the organizations examine the high-level information exchange content and identify candidate BIECs.

The organizations may meet to share documentation on their stored data. They develop more insight into the information available for sharing by senders and the information of interest to receivers. With this common knowledge, they work to agree on semantics and begin defining candidate content for each BIEC. This occurs before they begin defining the details of the data in the information exchanges themselves.

Once the BIECs are identified, the organizations define the content and structural details of each BIEC based on existing business data documentation and expectations as to what business data elements will be exchanged.

4.1.2 Bottom-up Approach to BIEC Creation

Using the bottom-up approach, existing IEPDs and data models are examined in detail for business data elements that are being or expected to be exchanged. A basic data dictionary is developed containing all data elements to be exchanged, having minimal structure. The data elements are examined for relationships; closely related data elements are grouped together; and BIECs are synthesized.

This after-the-fact approach makes sense only if more IEPDs need to be developed. It does not necessarily imply that existing IEPDs must be re-factored as the BIECs are distilled and harmonized.

4.1.3 Middle-out Approach to BIEC Creation

Using the middle-out approach, BIECs are identified and developed at the same time as a significant set of IEPDs. Initial exchange content modeling may be performed at a high level to identify candidates for BIECs, or BIECs may be discovered as IEPDs are in development and common business content is recognized. Differences are reconciled as necessary. The process of identifying and defining BIECs and developing IEPDs continues in parallel iteratively until the developers are satisfied that all IEPDs in the set have been fully defined and all common business content has been captured in BIECs. The potential content of IEPDs identified for later development can also be considered during the initial development of the BIECs.

4.1.4 Maintenance of BIECs

Once an initial set of BIECs has been developed and documented, the set may change over time as IEPDs are developed and new business content is discovered. Additional properties may need to be added to existing BIECs, existing BIEC property constraints may need to be relaxed, and new BIECs may need to be developed.

A governance and a versioning strategy should be established for maintaining BIECs. If BIECs are used in conjunction with an EIEM, the governance and versioning strategies for the EIEM should address the governance and versioning implications of BIEC maintenance. Additional information on versioning strategies can be found in the *NIEM High-Level Version Architecture [NIEM-HLVA]*.

Use and maintenance of BIECs can benefit from the use of tools and a repository. Tool and repository requirements are discussed in Section 6.3 of this paper.

4.2 Creation and Maintenance of Enterprise Information Exchange Models

Once an organization has developed one or more BIECs, it has the foundation for the development of an EIEM. If BIECs are developed over time, the EIEM is built incrementally over time. Once the information sharing enterprise has developed and harmonized all currently required BIECs and has generated a master NIEM subset schema, the EIEM is essentially complete. However, the EIEM may be a living model, controlled through versioning to meet new and changing business information exchange requirements.

During IEPD development, there may be business content identified for which there is no semantic match to a component in the EIEM. If the new content is likely to be used in other IEPDs, it can be added to the EIEM (resulting in a new version of the EIEM). Otherwise, the new content can be defined in the XML schemas specific to that IEPD. The new content may only require an addition to the master NIEM subset, or it may require the development of a new extension component (which is added to the existing EIEM extension schema), or both. The new content may also impact existing BIECs or necessitate the creation of new BIECs.

As with BIECs, it is important to establish a versioning strategy for maintaining the EIEM. An EIEM versioning strategy should address the versioning implications of BIEC maintenance. Additional information on versioning strategies can be found in the *NIEM High-Level Version Architecture [NIEM-HLVA]*.

Organizations that develop, use, and maintain an EIEM can benefit from the use of tools and a repository. Tool and repository requirements are discussed in Section 6.3 of this paper.

5 Artifacts

This section provides an overview of the artifacts that can be used to document BIECs and EIEMs, including potential development artifacts. Detailed specifications for BIECs and EIEMs are contained in the *NIEM Model Package Description Specification [NIEM-MPD]*¹.

To increase visibility and consistency in the use of BIECs, the NIEM program is drafting a normative specification for BIEC/EIEMs and their use with IEPDs. This specification will become a basis for implementing new and adapting existing support tools for BIECs and EIEMs.

5.1 Business Information Exchange Component Artifacts

A BIEC can be specified and documented in a manner similar to an IEPD, because it is essentially a “snippet” of an IEPD.

A BIEC is represented as an XML type and corresponding element. It is most often a complex type but may be a simple type or a code list. A BIEC is usually an extension to NIEM. It may contain other, lower-level BIECs, other extensions, and NIEM components. It may simply be a subset or restriction of a NIEM type, but may be an extension to a NIEM type with augmentations, or an entirely new type. It may be substitutable for a similar NIEM element.

The BIEC documentation can include a business content model of the component in the same graphical representation used for an IEPD Exchange Content Model. This allows the BIEC to be copied and pasted to (or otherwise referenced by) the Exchange Content Model of an IEPD that uses that component. The model can be referred to as the *BIEC Content Model*.

The BIEC documentation can also include a mapping of the component’s business content to the XML schema components (NIEM and extensions). This allows the BIEC to be copied and pasted to (or otherwise referenced by) the Exchange Content Mapping of an IEPD that uses that component. The mapping can be referred to as the *BIEC Content Mapping*.

5.2 Enterprise Information Exchange Model Artifacts

At a minimum, an EIEM is defined by one extension schema and a NIEM subset schema. However, the BIECs and other extensions may be organized into multiple extension schemas (each in their own namespace) in a manner that makes sense to the information sharing enterprise.

A master graphical model can be developed and maintained to contain all BIECs in the EIEM. This facilitates browsing and discovery of BIECs by business people, and can be a master source of BIECs copied to an Exchange Content Model for a specific IEPD.

A master spreadsheet can be developed that provides detailed information on the content of the EIEM in a format similar to the NIEM reference spreadsheet. The spreadsheet could also contain master mapping information.

If desired, a subset of the EIEM (a subset of the extension schemas and a subset of the master NIEM subset schemas) can be developed for each IEPD to more specifically constraint the EIEM components used in the IEPD.

6 Considerations for Adopting BIECs and an EIEM

Development and maintenance of BIECs and an EIEM may not be appropriate for every organization. However, almost any organization can benefit from the adoption of BIECs and EIEMs when available libraries of pre-developed business components exist that fit the needs of the given information exchange. Organizations are encouraged to consider both the benefits and the adoption costs before deciding to develop and implement BIECs and EIEMs. This section discusses considerations for making

such a decision. The decision to develop new BIECs or an entire EIEM depends in part on the information sharing enterprise's IEPD development scenarios. The decision to use an existing EIEM or BIEC library for IEPD development depends mostly on the availability and/or suitability of the artifacts and tool support.

An IEPD development scenario is a description of the nature of the IEPD development being performed or anticipated to be performed by an information sharing organization. For example, is only one IEPD being developed? Are only a few being developed? Are many being developed at the same time? Are many being developed, but over an extended period of time?

Depending on the IEPD development scenario, each benefit may have substantial value or little to no value. Therefore, the first step in considering adoption of BIECs or an EIEM is to determine if the benefits are significant enough for the IEPD development scenarios to even compare them to the costs. If there are costs, they can then be examined to determine whether the benefits outweigh the costs.

Section 6.1 reviews the benefits. Section 6.2 discusses some of the costs.

6.1 Benefits of Adopting BIECs and an EIEM

The potential benefits of BIEC and EIEM adoption have already been outlined in Sections 1 through 3. This section summarizes the potential benefits. Adoption benefits include:

- Improving the consistency of information representation across multiple IEPDs developed by an information sharing enterprise.
- Defining and managing extensions specific to an information sharing enterprise's business needs in a way that the extensions can be discovered and reused.
- Reducing the efforts required to develop multiple IEPDs by:
 - Defining BIECs once and reusing them in multiple IEPDs.
 - Mapping IEPD business data primarily to NIEM and extensions at the BIEC level instead of lower levels.
- Making it easier to find NIEM content by limiting searches primarily to the NIEM components used by the business.

6.2 Costs of Adopting BIECs and an EIEM

This section examines the costs of adopting BIECs and an EIEM when they are developed from the ground up and maintained through a dedicated governance program. Many of these considerations are not applicable to the case where an organization developing an IEPD simply uses existing BIEC libraries that match the business needs of the exchange.

Governance. Because BIECs and EIEMs are governed in some fashion by the information sharing enterprise using them, resources must be expended to initiate and maintain that governance. While some form of simple, perhaps informal governance must exist to develop a single IEPD, this governance may require significant expansion to encompass governance of an EIEM or a set of IEPDs. Governance may be centralized or distributed. If centralized, a source for governance resources must be identified and maintained. If distributed, each organization participating in governance must provide resources, and the governance must include coordination of resources across organizations.

Tools. The development and maintenance of BIECs and an EIEM may require tools beyond those needed to develop a single IEPD. These tools may cost more, in terms of purchase price, training, support, etc. As of the date of this paper, tool support for BIEC/EIEM development and use is available but not widespread. Unless such a tool is used, or until such tools become more widely available, BIECs

and an ELEM may need to be developed manually, potentially adding to overall IEPD development cost, depending on the reuse of BIECs.

IEPD Coupling. If multiple IEPDs use the same BIECs, those IEPDs are dependent on the particular version of the BIEC library (or ELEM). This can be a disadvantage, since these dependencies will constrain the ability to make changes that will not have cascading impacts to other IEPDs. On the other hand, looser coupling between IEPDs achieved by not using BIECs may result in less reuse and potentially repeated effort. Ultimately the developing organization must determine the trade-off between agility and reuse. Using versioning, there are a few approaches to mitigate this issue and better achieve both agility and reuse goals.

6.3 Real Examples of IEPD Development Through Business Information Exchange Components

To assist organizations with evaluating and deciding on the value of adopting a BIEC approach to IEPD development, several example cases of BIEC-like projects are summarized here.

National Center for State Courts (NCSC)—Court BIECs for IEPDs

NCSC worked with the court community to develop a service-oriented Court Information Model as a repository of court business processes and associated services. This model is based on the concept of reusable components to create a common understanding and language between court business leaders (domain experts) and technical experts. Work on the Court Information Model resulted in the development of the Court Component Library as the court's method of approaching the development of IEPDs. The Court Component Library (effectively an ELEM containing BIECs) provides a repeatable process for developing IEPDs that is accessible—both in terms of vocabulary and structure—to court domain experts. The Library applies open standards, encourages component reuse, is consistent with court business models, and provides an easy bridge to the GJXDM and NIEM. The model was used to develop five IEPDs (traffic citation, protection order, sentence order, warrant, and Court Statistical Guide).

State of Texas, Texas Path to NIEM project—BIECs for a Large, State-wide IEPD Set

The Texas Path to NIEM project was initiated by the Texas Department of Public Safety to coordinate the development and operation of justice systems maintained or managed by participating state and local justice entities using the NIEM standards. The goal is for these systems to share information consistently and accurately in a manner that maximizes the services provided to justice information users in Texas. The project involved dozens of state and local agencies to concurrently develop IEPDs for 28 high priority information exchanges. These exchanges are targeted for all types of justice agencies, including law enforcement, prosecutors, courts, court services, and corrections, plus family and child services.

Using the iterative “middle out” approach discussed in Section 4.1.3 of this paper, NIEM content, NIEM extensions, and common business components were identified as a part of the IEPD development process. Approximately 144 BIECs plus 34 code lists were identified, modeled, mapped, defined, and brought together into an ELEM and used across the 28 IEPDs. As a result, substantial reuse and commonality of semantics and structure were achieved for the 28 IEPDs, and the ELEM provides a solid foundation for continued reuse and reduction of efforts for additional IEPD development. The ELEM leverages NIEM extensively while supporting the specific business needs of the State of Texas for information exchanges.

Domestic Nuclear Detection Office (DNDO)—CBRN BIECs for IEPDs

The US Department of Homeland Security's DNDO is the domain steward of the NIEM Chemical, Biological, Radiological, and Nuclear (CBRN) domain. When developing the CBRN domain, the team identified the need for BIEC-like structures and incorporated this content into the domain model. The DNDO team refers to these constructs as “business objects.”

DNDO data architects had the advantage having a large number of existing information exchanges and messages that could be used for the future domain. By drawing upon these existing artifacts, the domain

architects were able to analyze current messages, identify commonalities, and extract data objects for use in the new domain.

Domain architects stressed the importance of documenting existing exchanges when creating any reference architecture. DNDO architects believe that developing a reference architecture becomes significantly easier when the business objects currently in use can be used as a starting point.

Customs and Border Protection (CBP)—International Trade BIECs for IEPDs

The DHS CBP stewards the International Trade (IT) domain. CBP estimates it currently has over 160 exchanges. CBP agencies participating in the IT domain contain diverse and often dissimilar elements. Due to the size and breadth of the enterprise data, architects identified the need for a method to group the data in smaller business units, to meet the needs of each sub-organization.

CBP data architects analyzed data across the enterprise to identify common data elements and develop an enterprise model incorporating EIEMs and BIECs, called CBP Enterprise Exchange Model (CEEM). The architects are in the process of developing and implementing the CEEM. They anticipate this approach will reduce IEPD development time, provide consistency across multiple IEPDs, and help similar business content to be modeled consistently across multiple exchanges.

New York City Health and Human Services Connect—City-wide BIECs for IEPDs

The mission of New York City (NYC) Health and Human Services (HHS) Connect is to provide citizens with better programs and services. Data sources across NYC, like any large organization, are not directly interconnected. Each department has its own data needs, data, and data management plan; however, many programs in the city require information sharing between departments.

HHS Connect used a model-driven process to define case studies and then exchange content models to define the data standards involved in each exchange. The standards created by HHS Connect to meet their needs are essentially as set of IEPDs focused around a particular business need. The reference architecture used in this project can be closely mapped to the BIEC concept.

7 Developing an IEPD Using BIECs and an EIEM

Development of a BIEC or EIEM by itself has no value; it is a means to an end. The value comes in using BIECs or an EIEM to facilitate development of an IEPD.

The process for developing an IEPD using BIECs and/or an EIEM follows the same IEPD Life Cycle process described in the *NIEM Concept of Operations [NIEM-ConOps]*. However, instead of just selecting components from NIEM and creating extensions for content not in NIEM, the developer can also select BIEC components and other EIEM content. Depending on how the BIECs and the EIEM are managed and documented, and on the tools used, this selection could occur at the exchange content modeling phase or during later phases. The developer may still need to select NIEM content that is not in the EIEM, and may have to create extensions that are not in NIEM. Tools that only support NIEM itself (such as the Schema Subset Generation Tool) can only be used to manage NIEM content and cannot be used to manage BIECs or other EIEM content that extend NIEM.

The specifics of the process for developing an IEPD using BIECs or and EIEM depends in part on the tools used, how the BIECs and the EIEM are managed, and the developing organization's process for developing IEPDs in general.

8 Recommendations for Tool Requirements

As with the development of IEPDs, the creation, maintenance, and use of BIECs and an EIEM can be facilitated by the use of tools. This section provides recommendations to tool developers considering providing support for BIECs and/or EIEMs.

In general, these tools should:

- Include metadata to help make BIECs and other EIEM components discoverable.
- Provide strategies for cataloging BIECs and other EIEM components to enhance discoverability and reusability.
- Capture business rules associated with BIECs.
- Facilitate composability of BIECs, EIEMs, and IEPDs that use them.

8.1 Tool Requirements for BIECs

Current tools that support the development of IEPD artifacts can be used to support the development of BIECs. These include tools to:

- Create exchange content models, for example, UML editors.
- Discover NIEM components.
- Create exchange content mappings.
- Define extension components and develop XML schemas.

However, there are additional tool requirements to consider for the use of BIECs in IEPDs. Developed BIEC artifacts should be made available in a repository in a way that they can be readily used by IEPD developers at all stages of IEPD development.

1. A discovery tool should provide a capability to discover and view BIECs for use in IEPDs.
2. A modeling tool should provide a capability to copy or reference a BIEC from a BIEC content model artifact to an exchange content model artifact.
3. A mapping tool should provide a capability to copy or reference a BIEC from a BIEC content mapping artifact to an exchange content mapping artifact.
4. An XML schema editing tool and/or a schema generation tool should provide a capability to reference (through import) the extension XML schema(s) containing the BIEC(s) used in the IEPD.

8.2 Tool Requirements for Enterprise Information Exchange Models

As previously stated, an EIEM is essentially a customized and extended version of NIEM to meet the needs of a particular information sharing enterprise. So tools used to develop, document, and maintain NIEM could also be used to develop, document, and maintain an EIEM. Such a tool would need to provide the following capabilities:

1. The capabilities of the BIEC tools described in the previous section.
2. A repository to store all components with metadata (such as a database).
3. Incorporate NIEM components, and perhaps generate a NIEM *wantlist* of the desired NIEM components (for the master NIEM subset).
4. Define and/or incorporate extension components (including BIECs).
5. Select components (including BIECs) for use in an IEPD.
6. Generate an exchange content mapping artifact for the IEPD using the selected components.

7. Generate XML schemas (NIEM subset, extension, and exchange schemas) for the IEPD using the selected components.

Appendix A: Acronyms and Abbreviations

BIEC—Business Information Exchange Component
CBP—Customs and Border Protection
CBRN—Chemical, Biological, Radiological, Nuclear
COI—Community of Interest
DHS—Department of Homeland Security
DNDO—Domestic Nuclear Detection Office
DOJ—Department of Justice
EIEM—Enterprise Information Exchange Model
HHS—Health and Human Services
HLVA—High Level Version Architecture
IEP—Information Exchange Package
IEPD—Information Exchange Package Documentation
ISE—Information Sharing Environment
IT—International Trade
LEISP—Law Enforcement Information Sharing Program
MPD—Model Package Description
NCSC—National Center for State Courts
NDR—Naming and Design Rules
NIEM—National Information Exchange Model
NTAC—NIEM Technical Architecture Committee
NYC—New York City
N-DEx—National Data Exchange
UML—Unified Modeling Language
XML—Extensible Markup Language

Appendix B: References

[NIEM-ConOps]: NIEM Concept of Operations, Version 0.5, NIEM Program Management Office, 9 January 2007.

Available from <http://reference.niem.gov/niem/guidance/concept-of-operations/>

[NIEM-Extending]: Techniques for Building and Extending NIEM XML Components, Version 2.0.1, 7 August 2007.

Available from <http://reference.niem.gov/niem/guidance/techniques-for-building-and-extending/2.0.1/>

[NIEM-HLVA]: NIEM High Level Version Architecture (HLVA), Version 1.0, NIEM Technical Architecture Committee, 2008.

Available from <http://reference.niem.gov/niem/specification/high-level-version-architecture/1.0/>

[NIEM-IEPD]: Requirements for a National Information Exchange Model (NIEM) Information Exchange Package Documentation (IEPD) Specification, Version 2.1, June 2006.

Available from http://niem.gov/files/NIEM_IEPD_Requirements_v2_1.pdf

[NIEM-MPD]: NIEM Model Package Specification, Version 1.0, NIEM Technical Architecture Committee (NTAC), 2 January 2011.

Available from <http://reference.niem.gov/niem/specification/model-package-description/1.0/>

[NIEM-NDR]: NIEM Naming and Design Rules (NDR), Version 1.3, NIEM Technical Architecture Committee (NTAC), 31 October 2008.

Available from <http://reference.niem.gov/niem/specification/naming-and-design-rules/1.3/>



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