e-Invoice Interoperability Framework: Semantic Model Assessment

Prepared by the Business Payments Coalition e-Invoice Work Group

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1 Executive Summary

The Business Payments Coalition (BPC) is coordinating a multi-year initiative with industry stakeholders to assess e-Invoice interoperability frameworks established in other regions of the world and provide recommendations for the U.S. market. The desired outcome of this initiative is to increase the exchange of e-Invoices by U.S. businesses, which is an important driver to increase adoption of electronic payments and improve overall business-to-business (B2B) payment efficiency and straight-through processing.

U.S. businesses recognize the benefits of e-Invoicing, and are striving to increase the adoption rate for both their own business and their supply chains. However, the lack of standardization has been a significant barrier. While there are considerable challenges to facilitate broad exchange of e-Invoices, there are promising models and standards emerging from other countries based on the establishment of electronic delivery (e-Delivery) networks and e-Invoice semantic data models. In Europe, and elsewhere, e-Invoice interoperability frameworks are using common standards and protocols between federated networks of access points\(^1\), creating a scalable ecosystem that is easier and more cost-effective to implement, thus enabling broader adoption. The United States can leverage the learnings and implementation strategies from those frameworks to create an interoperable ecosystem that enables service providers and accounting technology systems to seamlessly exchange electronic invoices with trading partners across the network.

An e-Invoice interoperability framework is a set of policies, standards and guidelines that enables the exchange of e-Invoices, documents and messages independent of the payment, accounting and Enterprise Resource Planning (ERP) systems. The primary concept and strategy of the framework is to establish exchange access points that facilitate document delivery among an open network of providers. The access points leverage e-Delivery standards\(^2\) and a common e-Invoice semantic data model, which defines the actors and roles, business functions, processes, rules and terms and information elements for composing an invoice. This approach supports existing stakeholder business models, reduces accounting and ERP system change requirements and significantly reduces the cost and complexity to exchange across disparate systems.

In 2018, the BPC initiated two work groups to study the technical architecture, standards and supporting legal and operational requirements of existing e-Invoice interoperability frameworks:

- The e-Invoice Semantic Model Work Group assessed established e-Invoice semantic data model standards.
- The e-Invoice Technical Feasibility Work Group assessed the technical architecture, standards and supporting legal and operational requirements of existing e-Delivery networks.

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\(^1\) Access point describes a node on a delivery network connecting two service providers (corners 2 and 3) in a four-corner model and providing trading partners (corners 1 and 4) with access to that network. Access point functions are described in the *Overview of an e-Invoice Interoperability Framework*, Business Payments Coalition, November 2019.

The semantic data model assessment focused on reviewing the *European Committee for Standardization (CEN) European Norm (EN) 16931 Electronic invoicing - Part 1: Semantic data model of the core elements of an electronic invoice (EN 16931)*, which is the baseline semantic data model standard used in other interoperability frameworks. See section 4 Semantic Data Model Assessment for additional details.

This report presents the findings and recommendations of the e-Invoice Semantic Model Work Group.

Several key findings from the assessment include:

- The treatment of taxes is the primary difference between EN 16931 and U.S. requirements. The U.S. semantic data model will need to replace the Value Added Tax rules with rules for sales and use tax.

- In the absence of a government directive or legal definition to drive the requirements of an invoice in the United States, continuous stakeholder input and validation of the semantic data model will need to occur.

- The EN 16931 semantic data model would work well as a baseline for constructing a U.S. semantic data model.

- Additional core invoice information elements and requirements were identified for a U.S. semantic data model and should be shared with the committee responsible for maintaining EN 16931.

- No unique invoice requirements were identified for cross-border invoicing between the United States, Canada, and Mexico. A single semantic data model could be constructed to enable cross-border invoicing amongst the three countries.

- The semantic data model should be developed initially with the use of one syntax, ISO/IEC 19845 - OASIS Universal Business Language (UBL), due to its widespread global use and growing adoption.

- Implementation guides should be created to help the U.S. market adopt the semantic data model.

- There is a need for a cross-industry multi-stakeholder forum to monitor and provide input into the development and maintenance of the semantic data model.

- The United States should monitor and collaborate with OpenPeppol’s efforts to develop a definition of an international invoice, including a semantic data model.

- The United States should monitor and collaborate with the Global Interoperability Framework.

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3 Please note that CEN does not distribute or sell standards. European Standards (ENs) and other approved documents may be purchased from CEN National Members and Affiliates. See Obtaining standards.

4 The BPC e-Invoice Semantic Model Work Group is a group of experts representing corporations, industry associations, standards bodies, service providers, and others. See 6.1 Appendix A – Work Group Members.

5 EN 16931 was created to conform to the *European Directive VAT Council Directive 2006/112/EC of the 28th November 2006*, which specifies who (taxable parties) and what (items and services) are responsible for VAT, how the VAT is calculated and what information is required for invoices when VAT is charged in the invoice.

6 OpenPeppol is a European membership organization that is responsible for the Peppol Network that enables businesses to communicate electronically with any European government institution in the procurement process.
The BPC e-Invoice Semantic Model Work Group (work group) will continue to collaborate with the industry to develop the strategy, policy, and support for next steps toward establishing a U.S. e-Invoice interoperability framework.

For additional information on this initiative or to share ideas, please contact:

Business Payments Coalition
e-Invoice Work Group
Email: business.payments.smb@mpls.frb.org

For more information about the BPC, visit the website at https://businesspaymentscoalition.org/.

1.1 Audience

The BPC e-Invoice Interoperability Framework – Semantic Model Assessment report is intended for business and technology stakeholders in the private and public sector markets involved in the implementation and support of accounting technology systems that process invoices. This report provides business and technology stakeholders an understanding of the high-level requirements and standards required to establish an e-Invoice semantic data model for the U.S. market.

Business Stakeholders (Primary Audience)
- Individuals who are responsible for implementing and supporting accounting technology systems
- Individuals who are responsible for identifying, defining, and supporting business requirements for accounting technology systems that support accounts receivable, accounts payable and electronic exchange of business documents

Technology Stakeholders (Secondary Audience)
- Individuals who are responsible for the design, implementation, and support of accounting technology systems and solutions for electronic exchange of business documents
- Individuals who are responsible for the design, integration and operational support of business applications dealing with invoicing

1.2 Disclaimers, Copyright, and Acknowledgements

Views expressed here are not necessarily those of, and should not be attributed to, any particular Business Payments Coalition participant or organization. They are not intended to provide business or legal advice, nor are they intended to promote or advocate a specific action, payment strategy, or product. Readers should consult with their own business and legal advisors.

Readers are free to republish this report in whole or in part without further permission, as long as the work is attributed to the BPC, and in no way suggests the BPC sponsors, endorses or recommends any organization or its services or products. Other product names and company names referenced within this

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7 GIF is an effort being proposed by EESPA, OpenPeppol, ConnectOnce and the BPC to identify and implement common components that can be widely adopted by service providers to increase automation, reduce the cost of adoption and accelerate digital trade.
document may be either trademarks or service marks of their respective owners.

The BPC would like to acknowledge the work group members and other contributors, including the Pan European Public Procurement Online (PEPPOL) and the European e-Invoice Service Provider Association (EESPA), for their contributions during the assessment process.

2 Background

The BPC seeks to facilitate discussion with the broader industry by framing industry challenges and business recommendations and suggesting next steps to achieve broader adoption of e-Invoicing and straight-through processing for the United States. The following work led the BPC to identify e-Invoice interoperability frameworks in other parts of the world and recommend further assessment of the feasibility of establishing a similar framework for the U.S. market.

The BPC and Federal Reserve Bank e-Invoicing publications to date include:

- **U.S. Adoption of Electronic Invoicing: Challenges and Opportunities**, a Federal Reserve Bank white paper study of the business environment and e-Invoicing adoption in the United States and internationally.

- **Catalog of Electronic Invoice Technical Standards in the U.S.**, a BPC workgroup report that documents e-Invoice technical standards that exist in the U.S. market. The report describes the current fragmentation in the U.S. market usage of e-Invoices and the interoperability challenges among the standards.

- **Summary Report from the e-Invoice Interoperability Framework Preliminary Assessment Work Group**, a 2018 BPC report that reviewed interoperability framework concepts and assessed the appropriateness of developing a similar framework for the United States.

- **Overview of an e-Invoice Interoperability Framework**, a 2019 BPC report that introduces the concept of an e-Invoice interoperability framework as well as market challenges and benefits of addressing them, and a path forward for the BPC work assessing U.S. market needs.

- **e-Invoice Interoperability Framework: e-Delivery Network Feasibility Assessment Report**, a 2019 BPC report that provides business and technology stakeholders with an understanding of the high-level requirements and standards required to establish an open, federated network

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8 To move from a European infrastructure to a global brand, the acronym of PEPPOL (Pan-European Public Procurement Online) has been replaced with a new name Peppol.

9 Documents cited here are available at businesspaymentscoalition.org, in the e-Invoicing section.

10 **U.S. Adoption of Electronic Invoicing: Challenges and Opportunities**: Payments, Standards and Outreach Group, Federal Reserve Bank of Minneapolis, June 2016.

11 **Catalog of Electronic Invoice Technical Standards in the U.S.**, Business Payments Coalition and Federal Reserve Bank, October 2017.


13 **Overview of an e-Invoice Interoperability Framework**, Business Payments Coalition, November 2019

of access points for the U.S. market.

In the United States, approximately 75 percent of invoices submitted to buyers are paper-based\textsuperscript{15}. For the most part, established B2B networks successfully deliver e-Invoices. However, these networks currently suffer from limited reach and little interoperability, which prevents greater adoption of e-Invoices. An evolution towards an interoperable ecosystem of service providers and networks is required for sellers and buyers to exchange invoices and related documents with each other cost effectively. Reducing setup, connection management and integration costs are critical success factors for an e-Invoice interoperability framework.

Globally, countries with similar adoption challenges have successfully connected the community of service provider platforms and networks through e-Invoice interoperability frameworks designed to leverage, rather than supplant, existing investments in technology infrastructure and service relationships.

An e-Invoicing interoperability framework refers to a set of policies, standards and guidelines that address four essential layers of interoperability (Table 1) enabling businesses to exchange e-Invoices, documents and messages independent of the accounting and ERP systems they use.

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal</td>
<td>Addresses the requirements at the business network, legislative and policy levels</td>
</tr>
<tr>
<td>Business</td>
<td>Describes the business processes, capabilities and discovery process to facilitate the exchange of a document</td>
</tr>
<tr>
<td>Semantic</td>
<td>Standardizes the meaning of the data creating a common understanding among trading parties involved in the exchange</td>
</tr>
<tr>
<td>Technical</td>
<td>Defines the delivery standards and protocols enabling secure and reliable exchange of documents between trading partners via a federated network</td>
</tr>
</tbody>
</table>

Much like email, which is globally interoperable due to its format and delivery standards, the framework uses a set of standards that enable document delivery among an open network of service providers, B2B networks and platforms. Through the use of standards, the framework allows for easy integration and minimal disruption to existing processes and promote wider adoption of e-Invoicing and electronic payments. Similar to email, the framework provides additional business benefits:

- Reduced operating expenses by eliminating paper and manual data entry, and automating workflow such as invoice routing, purchase order matching and approval
- Increased on-time payments\textsuperscript{16}
- Optimized cash management by speeding up processing workflows to enable buyers to take advantage of early payment discounts and/or to enable sellers to provide invoices in a timelier manner leading to improved cash flow and working capital
- Minimized risk of overpayments, duplicate payments and fraudulent payments
- Improved real-time, on-line view and traceability of all invoice-related documents and the ability to archive online

\textsuperscript{15} \textit{U.S. Adoption of Electronic Invoicing: Challenges and Opportunities}, Payments, Standards and Outreach Group, Federal Reserve Bank of Minneapolis, June 2016.

\textsuperscript{16} \textit{2016 Data Capture and Mailroom Technology Insight Report}, PayStream Advisors
- Improved data quality and accuracy, and reduced time to access business information
- Reduced complexity of working with trading parties in multiple countries through enhanced, standard processes that improve compliance with tax requirements and other country or regional directives

2.1 Terms and Definitions

The following important key terms and definitions are used throughout the report.

Access point: Describes a node on a delivery network connecting two service providers (corners 2 and 3) in a four-corner model and providing trading partners (corners 1 and 4) with access to that network.

Business Terms: Label assigned to a given information element which is used as a primary reference in the semantic data model.

Core Invoice Objects: Set of required and optional information elements that are essential to enable electronic invoice interoperability, including cross-border capabilities.

Core Invoice Model: Semantic data model of the core elements of an e-Invoice.

Digital Business Council (DBC): The Digital Business Council (DBC) developed an e-Invoicing interoperability framework in Australia that is based on international standards.

Electronic Invoice: An invoice issued by the seller, transmitted and received by the buyer in a structured digital format that allows for automated processing.

European Committee for Standardization (CEN): A standards body comprised of 34 European national standard bodies. CEN is officially recognized by the European Union and by the European Free Trade Association as being responsible for developing and defining voluntary standards for Europe.

European E-invoicing Service Providers Association (EESPA): A trade association for European e-Invoicing service providers.

Four-corner model: A networking model that connects four parties to deliver documents and messages: the sender (corner 1), the sender’s access point (corner 2), the receiver’s access point (corner 3), and the receiver (corner 4).

Information Elements: The data associated with each component of a document (e.g. business term, cardinality, or description) that can be defined independent of the syntax.

OpenPeppol Association: A European membership organization that is responsible for the Peppol Network that enables businesses to communicate electronically with any European government institution in the procurement process.

Semantics: The meaning of the data or information elements used in digital exchanges.

Semantic Data Model: Defines the components of a document including parties and roles, business functions, processes, rules, and information elements (e.g. for composing an invoice). This includes a set of logically interrelated information elements.

Service Provider: An organization that provides its customers with services for the creation, delivery and processing of e-Invoices and related electronic business documents and transactions, as well as supporting software and services.

Syntax: The means by which semantic information elements are expressed in machine-readable technical languages (e.g. XML).
3 Assessment Approach and Baseline Requirements

The BPC is undertaking a multi-year initiative to assess existing e-Invoice frameworks established in other markets to determine applicability of the approach for the U.S. market. The objective of the assessment is to determine the feasibility, high-level requirements and recommendations for establishing an e-Invoice interoperability framework in the United States. To support this initiative, the work group specifically focused on the semantic layer of an interoperability framework and assessed it in relation to EN 16931. The semantic layer creates a common understanding of the information exchanged between parties through use of a standardized data exchange model. A semantic data model:

- Describes the parties and roles involved in processing invoices
- Defines the business functions, processes, terms and rules
- Determines the required information elements and their assigned data types

The work group focused on unified e-Invoicing standards, processes and common automated tools that support originating and receiving e-Invoice information based on:

- Standardized and uniform semantic data models
- Use of one or more syntaxes
- Easy integration into existing software (including ERP systems), platforms and service provider systems

This report:

- Articulates the guiding principles used by the work group members
- Describes the assessment process
- Lists the baseline business and technical requirements
- Describes the fundamental components of the semantic data model
- Summarizes the findings, recommendations, topics that should be addressed in the future, and proposed next steps

An assessment of the e-Delivery network technical architecture of an interoperability framework, another essential layer of the framework, is found in the e-Invoice Interoperability Framework: e-Delivery Network Feasibility Assessment report.

3.1 Guiding Principles

Work group members adhered to the following set of guiding principles for analyzing semantic data models to determine the applicability and consistency with U.S. requirements:

1. Involve a broad cross-section of industry stakeholders to validate requirements for a U.S. semantic data model, including those necessary for cross-border trade with Canada and Mexico.
2. The semantic data models assessed have a set of published and transparent specifications.
3. The components incorporated in the semantic data model meet current U.S. market capabilities and industry direction for adoption.
4. The semantic data model components have been successfully implemented and are actively
driving adoption in another country.

5. The semantic data models use standards that are open, royalty-free, vendor-agnostic, and do not require a singular platform or solution.

6. The semantic data models are independent of any payment system and are payment method agnostic.

3.2 Baseline Business and Technical Requirements

The work group identified the following fundamental and critical business and technical requirements for establishing a U.S. e-Invoice semantic data model. The model should support:

1. A core invoice that covers a broad set of invoicing scenarios while providing extensibility into specific business processes and domains.

2. Ease of implementation through use of a common data model, enabling a set of cost-effective tools and solutions to support implementation by small and medium-size businesses.

3. The use of standards that are open, royalty free and vendor agnostic to support independence from any specific accounting technology system or B2B platform that is used between trading partners.

4. The use of proven standards and models to reduce the risk and improve the likelihood of adoption.

5. Integration with existing automated processes without disruption, increasing the likelihood of achieving interoperability with other markets.

6. Lessons learned and best practices from established semantic data models to help drive U.S. market adoption.

7. Extensibility and flexibility to accommodate backward compatibility and future requirements without burdensome rework or costly investment.

8. Well-established non-proprietary standards-based syntax, business terms, protocols and operational tools that are easily deployed and maintained without significant technology development or adaptation.

4 Semantic Data Model Assessment

The assessment objective was to conduct a comprehensive analysis of existing published semantic data models. The work group established a process and tools to assess the models to meet the business and technical requirements indicated above while adhering to the guiding principles. The following parts were evaluated through collaborative discussions held weekly over several months.

- Parties and Roles
- Business Functions
- Business Processes
- Constructs of a Business Document
- Data Model
- Syntax

Each part was reviewed to determine applicability for the U.S. market, gaps and recommendations. In addition, a draft XML schema template was created to further assist in the assessment (Appendix C).
Standards and criteria used to determine which model(s) to evaluate are outlined in Table 2.

Table 2
Semantic Data Models Considered for the Assessment

<table>
<thead>
<tr>
<th>Standard</th>
<th>Non-Proprietary</th>
<th>Based on International Standards</th>
<th>Number of Business Process Scenarios</th>
<th>Published Semantic Data Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committee for European Standards (CEN) European Norm (EN) 16931</td>
<td>Yes</td>
<td>Yes</td>
<td>12</td>
<td>Yes</td>
</tr>
<tr>
<td>Peppol Business Interoperability Specifications (BIS)</td>
<td>Yes(^{17})</td>
<td>Yes</td>
<td>11(^{18})</td>
<td>Yes</td>
</tr>
<tr>
<td>Digital Business Council (DBC) e-Invoicing Semantic Model</td>
<td>Yes</td>
<td>Yes</td>
<td>4(^{19})</td>
<td>Yes</td>
</tr>
<tr>
<td>ISO 20022 – The Clearing House Implementation Guide for Request for Payment (RfP)</td>
<td>No(^{20})</td>
<td>Yes</td>
<td>1</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Initially the work group set out to conduct a comprehensive analysis of the Committee for European Standards (CEN) European Norm (EN) 16931 Semantic Data Model and the Digital Business Council (DBC) e-Invoice Semantic Model to determine what was applicable for the U.S. market. Given that the DBC e-Invoice Semantic Model is based on EN 16931, the work group chose to focus solely on the CEN model.

EN 16931 establishes a B2B and Business-to-Government (B2G) semantic data model of the core information elements of an electronic invoice. It includes only those information elements that are essential to ensure fiscal and legal compliance while enabling semantic interoperability for cross-border, cross-sector and domestic trade. The following EN 16931 guiding principles aligned with those of the BPC:

1. Neutral relative to any specific technology and vendor systems
2. Compatible with relevant international electronic invoicing standards
3. Incorporates a broad set of industry needs, including those of small and medium-size businesses
4. Independent of any payment system and payment method agnostic

Below are the results and recommendations from the work group review of each component of the EN 16931 semantic data model.

4.1 Parties & Roles

A semantic data model supports the information required by the two primary parties involved in the

\(^{17}\) BIS is designed for use in the OpenPeppol network. It is aligned with CEN and has been certified as conformant to the EU directive.

\(^{18}\) The Self-Billing business process is not supported in BIS.

\(^{19}\) Business processes supported include: Invoicing, Receipt Created Tax Invoicing, Adjustment Invoicing, and Response.

\(^{20}\) The Market Implementation Guide (MIG) is specific for use in the Real-Time Payments (RTP) platform developed by The Clearing House.
Procure-to-Pay process, customers and suppliers. The exchange of information between parties is essential to supporting the underlying invoice business process (see section 4.3). The relationship between parties and roles is found in Figure 1.

The customer, in the roles of buyer, receiver and payer is responsible for supporting the business processes as follows:

- Initiating the order process
- Receipt of goods and services in the delivery process
- Invoice and payment processes

The supplier, in the roles of seller, delivery and payee, is responsible for supporting the business processes as follows:

- Receiving the order
- Delivery of goods and services
- Issuance of the invoice and receipt of payment

During the review of EN-16931, the parties and roles involved with taxes\(^\text{21}\) were determined as not applicable for invoice processing in the United States, Canada and Mexico. These parties and roles are used in Europe to help process and collect Value Added Tax (VAT).

During the review of EN-16931, the parties and roles involved with taxes\(^\text{21}\) were determined as not applicable for invoice processing in the United States, Canada and Mexico. These parties and roles are used in Europe to help process and collect Value Added Tax (VAT).

\(^\text{21}\) The taxable representative party declares and pays VAT on behalf of the supplier. The taxable person role declares, pays or reclaims VAT for the customer and supplier.
4.2 Business Functions

The semantic data model supports invoice processing across several primary business functions, including accounting, procurement, receiving, tax reporting, auditing and payment. Other secondary business functions adjacent to invoice processing include inventory management, delivery processes, customs clearance, marketing and reporting.

EN 16931 explicitly identifies the in scope requirements needed in the semantic data model to support the primary functions in invoicing. In addition, it identifies the requirements that are out of scope for both primary and secondary business functions. There are no in scope requirements within the semantic data model for the secondary business functions. The work group reviewed each primary and secondary business function, and its list of in and out of scope requirements.

It was concluded that the primary and secondary business functions involved in invoice processing in the U.S. are in line with EN 16931 with minor modifications to the supporting requirements. The results illustrated in Table 3 indicate the modifications recommended to the business functions.

### Table 3

<table>
<thead>
<tr>
<th>Business Functions</th>
<th>Description</th>
<th>Key Findings: U.S. Requirements</th>
</tr>
</thead>
</table>
| Invoice Verification    | The invoice may contain information referencing purchase orders, contracts, and other related procurement documents. Reference information can occur at the document and line level. Validation of this information is controlled by the buyer. | • Modify applicable business requirements to include:
  o Sales and use tax.  
  o Country of origin for goods and services at the invoice line level.  
• Consider modifying requirements to include:  
  o Multiple reference documents at the header and line item level.  
  o References to multiple purchase orders. At the document level, a single blanket order (or contract) may be used with subsequent release orders, purchase orders or delivery notes at the line level.  
• Conduct additional research to ensure compliance with import/export requirements. |
| Tax Reporting           | The invoice should carry sufficient information to record the sales and use tax information into the accounting system. Tax information must be accurately recorded at the document and/or line level. | • Modify applicable business requirements to include sales and use tax.  
• Conduct additional research to ensure all necessary sales and use tax reporting requirements are |
Business Functions | Description | Key Findings: U.S. Requirements
--- | --- | ---
**Customs Clearance** | The invoice may contain information for use in the customs clearance process. | • Conduct additional research to determine if requirements are needed for optional capturing of reference information for customs clearance.

**Payments** | The invoice represents the request for payment from the seller and may include payment related information such as preferred method, account information, and due date. | • Consider requiring invoices to include a payment method and payment account information, if applicable.

4.3 Business Processes

The semantic data model supports multiple business process invoicing scenarios including, but not limited to, purchases that reference contracts and invoices with no reference to purchase orders. The primary function of the semantic data model in these processes is to define the fundamental information elements required to send and receive invoices between businesses. The scenarios and required information elements within the semantic data model vary from simple to complex, depending on the purchase, legal, logistics, product and technical requirements.

The work group reviewed and agreed that the 12 business processes defined and supported by EN 16931 need to be accommodated by a U.S. semantic data model. However, they identified a new business process requirement to support a common scenario in the United States: an invoice without a purchase order (non-PO) or contract reference. Organizations with less formal processes, such as small and medium-size businesses, may purchase goods or services via online, e-mail or phone. Although the invoice may include a reference person, it typically doesn’t reference a purchase order or contract. An example of the business process flow is found in Figure 2.

**Figure 2**

Non-PO/Contract Reference Business Process

Source: Business Payments Coalition
The assessment concluded that although EN 16931 implies support for an invoice without reference to a purchase order or contract, clear language supporting this process is required for the U.S. semantic data model. As a result, the addition of a new business process (#13) is recommended to support an invoice without reference to a purchase order or contract.

The following business processes should be supported by a U.S. semantic data model:

1. Invoicing the delivery of goods and services against purchase (release) orders, based on a contract
2. Invoicing the delivery of goods and services based on a contract
3. Invoicing the delivery of goods and services against a purchase order
4. Invoicing the delivery of goods and services against a pre-payment
5. Invoicing the delivery of goods and services against a spot payment
6. Payment in advance of delivery
7. Invoices with references to a dispatch advice
8. Invoices with references to a dispatch advice and a receiving advice
9. Credit notes or invoices with negative amounts
10. Cancellation/corrective invoicing
11. Partial and final invoicing
12. Self-billing
13. Invoicing the delivery of goods and services without reference to a purchase order and/or contract

In addition, there may be other business processes such as multi-party invoicing, complex product and/or project invoices, or vendor managed inventory that are out of scope for EN 16931, but should be considered for a U.S. semantic data model.

4.4 Constructs of a Business Document

A business document is a collection of information elements that contain data necessary for the recipient to perform an automated task. Many different business document types exist in the supply chain, including the invoice. Information elements, such as Seller and Buyer, are common across many business document types, whereas other information elements, such as Transport Equipment Identifier, may be common to a single business document type. In aggregate, the collection of information elements from the business document types create the Business Object Library. For example, ISO/IEC 19845 Universal Business Language (UBL) Business Object Library contains over 4,500 information elements that are used by 81 business document types. Due to its widespread global use and growing adoption, the work group recommends leveraging the ISO/IEC 19845 Universal Business Language (UBL) standard semantic business object library.

A business document semantic data model is based on a constant and common meaning of the information elements through re-use with the intent to make electronic processing more efficient than manual processing (e.g., paper invoices). A business document semantic data model enables semantic interoperability by providing parties in the exchange with a common understanding of the terms and information elements used.

In the case of the invoice, a collection of information elements selected from the business object library creates the Core Invoice Objects. The core invoice objects are the information elements required to support the business processes identified in the semantic data model. Each invoice business process (Section 4.3) defines a subset of information elements that are constructed from common objects from the core invoice objects, industry/sector specific objects from the business object library, and/or
industry/sector specific extensions that reside outside of the business object library. An example of the constructs of an invoice is found in Figure 3.

The semantic data model defined in EN 16931 identifies only the mandatory and optional core information elements necessary to ensure business, legal and fiscal compliance of the invoice. Defining a core set of information elements enables business system interoperability for invoice exchange. Additionally, business rules for each information element may be established based on the business function and the business process that the invoice is supporting.

To achieve semantic interoperability, access points are required to support and conform to the business rules for both sending and receiving an invoice that contains the mandatory and optional core information elements in that business process. Examples of mandatory core information elements include Invoice Number and Monetary Totals. Examples of optional core information elements include Invoice Note, Preceding Invoice Reference and Credit Transfer.

An invoice\(^\text{22}\) (Figure 3) that supports a business process represents a sub-selection (restriction) of the information elements from the core invoice objects selected for the semantic data model. This approach defines specifications for guidance when implementing the invoice standard for exchange (i.e., the 12 identified business processes in EN 16931 to meet legal and fiscal requirements between trading parties). In addition, the semantic data model may support industry or sector specific information elements. In this case, the invoice may be extended to include the additional information elements. Extension information elements may or may not reside in the Business Object Library and can be defined as either mandatory or optional.

In the case of extensions to the core, access points within existing frameworks generally are not required to support or conform to any extended information elements. Senders and receivers must pre-arrange the acceptance of an extension to the core. Otherwise, access points who receive extensions of information elements are not obliged to interpret, support, or translate them in any way. Thus, an access point sending

\(^{22}\) EN 16931 refers to this as the Core Invoice Usage Specification (CIUS)
the extended information elements cannot expect the data to be recognized by the receiving access point without prior agreement. Examples of extension of information elements may include the *Buyer's Accounting Cost Center Code* or an *Invoice Line Item Commercial Brand Name*.

EN 16931 defines a set of properties for each information element found in Table 4.

### Table 4
Properties of the Core Information Elements of the Semantic Data Model

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Term Identifier</td>
<td>Used to identify the reference number associated with the business term.</td>
</tr>
<tr>
<td>Cardinality</td>
<td>Used to constrain the numbers in a group of information elements in an XML document. It indicates whether the information element is mandatory, optional, repeatable, or not repeatable.</td>
</tr>
<tr>
<td>Business Term</td>
<td>Common term used to refer to each information element.</td>
</tr>
<tr>
<td>Business Term Definition</td>
<td>The definition of the business term of the information element.</td>
</tr>
<tr>
<td>Usage Note</td>
<td>Additional descriptive information regarding the definition or usage of the business term.</td>
</tr>
<tr>
<td>Requirement Identifier</td>
<td>Used for traceability to the information element against the business requirements to support a business function.</td>
</tr>
<tr>
<td>Semantic Data Type</td>
<td>The data format that applies to the information element.</td>
</tr>
</tbody>
</table>

### 4.5 Data Model

The data model assessment included review of core information elements, general business rules, tax business rules, standards and code lists.

**Core Semantic Data Model Information Elements**

The work group’s review of the core semantic data model elements in EN 16931 resulted in the following recommendations:

- Add 22 new information elements
- Modify the name, description, required status or value limit for 34 existing elements
- Exclude 7 information elements that are not applicable for the U.S. model

Detailed results can be found in Tables 5-7. All elements in the tables below should be reevaluated and finalized during the requirements phase.

During the assessment, the work group explored multiple scenarios related to the number of invoice reference documents and found the EN 16931 requirements to be too constraining for the U.S. market. To avoid significant disruption in current billing practices, the U.S. model should support multiple reference documents, such as purchase orders and delivery documents, within an invoice. As a best practice, sellers (billers) may want to consider one invoice to one reference document to help automate the buyer (receiver) system. This creates an opportunity for access point providers to find solutions to accommodate this scenario and provide additional value added services to customers.

The UBL syntax is tax model agnostic and can be used within any tax scheme that a country or location levies. EN 16931 uses VAT in the business terms for tax information elements. A U.S. semantic data model would need to change the VAT business terms, and use a more generic term such as Tax. Additionally, many of the tax business rules do not apply, and therefore, would need to be removed from or ignored in the semantic data model.
The following table lists the information elements identified as requiring modifications of the business term label, description and/or usage information in a U.S. semantic data model. The underlying syntax, unless noted, remains unchanged.

<table>
<thead>
<tr>
<th>Business Term</th>
<th>Business Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Order Reference</td>
<td>Capture the date the order is received by the supplier or sent by the buyer.</td>
</tr>
<tr>
<td>Additional Document Reference</td>
<td>Reference to additional documents such as shipping, material, and customs documentation.</td>
</tr>
<tr>
<td>Profile Execution Identifier</td>
<td>Add a U.S. profile execution identifier that identifies the U.S. schema of a semantic data model.</td>
</tr>
<tr>
<td>Job Title/Role</td>
<td>Identify the sending contact’s position in the company.</td>
</tr>
<tr>
<td>Department code</td>
<td>Identify the sending contact’s department code.</td>
</tr>
<tr>
<td>Note</td>
<td>Add unstructured data field to add information such as fax number, job title, etc.</td>
</tr>
<tr>
<td>Remit To Address</td>
<td>Create new business group to capture postal address and contact information of a payee.</td>
</tr>
<tr>
<td>Payee Postal Address</td>
<td>Capture postal address of payee.</td>
</tr>
<tr>
<td>Payee Address Line 1</td>
<td></td>
</tr>
<tr>
<td>Payee City</td>
<td></td>
</tr>
<tr>
<td>Payee Post Code</td>
<td></td>
</tr>
<tr>
<td>Payee Country Subdivision</td>
<td></td>
</tr>
<tr>
<td>Payee Country Code</td>
<td></td>
</tr>
<tr>
<td>Payee Contact</td>
<td>Capture payee contact information.</td>
</tr>
<tr>
<td>Payee Contact Point</td>
<td></td>
</tr>
<tr>
<td>Payee Contact Telephone Number</td>
<td></td>
</tr>
<tr>
<td>Payee Contact Email Address</td>
<td></td>
</tr>
<tr>
<td>Allowance Indicator</td>
<td>Add indicator to specify if allowance value is positive or negative (vs. negative and positive values).</td>
</tr>
<tr>
<td>Charge Indicator</td>
<td>Add indicator to specify if allowance value is positive or negative (vs. negative and positive values).</td>
</tr>
<tr>
<td>Document Reference</td>
<td>Tie invoice back to related documents (e.g., billing, dispatch, receipt, originator, project, sales).</td>
</tr>
<tr>
<td>Manufacturer Identification Number</td>
<td>Add to support importation of manufactured goods from Mexico and Canada. This identifier is allocated by U.S. Customs to each manufacturer importing goods into the United States.</td>
</tr>
<tr>
<td>Item Instance</td>
<td>Add to support an identifier that is used to track the movement of an asset through its lifecycle, including in the invoice process.</td>
</tr>
</tbody>
</table>
### Table 6
**Modified Information Elements**

<table>
<thead>
<tr>
<th>Business Term</th>
<th>Business Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seller Address</td>
<td>Use unstructured data model for the address fields.</td>
</tr>
<tr>
<td>Buyer Address</td>
<td></td>
</tr>
<tr>
<td>Deliver to Address</td>
<td></td>
</tr>
<tr>
<td>Buyer Name</td>
<td>Change label to Customer - Accounts Payable.</td>
</tr>
<tr>
<td>Buyer Trading Name</td>
<td></td>
</tr>
<tr>
<td>Scheme Identifier</td>
<td></td>
</tr>
<tr>
<td>Buyer Legal Registration Identifier</td>
<td></td>
</tr>
<tr>
<td>Scheme Identifier</td>
<td></td>
</tr>
<tr>
<td>Invoice Currency Code</td>
<td>Update description to reflect U.S. sales and use tax.</td>
</tr>
<tr>
<td>Seller VAT Identifier</td>
<td></td>
</tr>
<tr>
<td>Seller Tax Registration Identifier</td>
<td></td>
</tr>
<tr>
<td>Buyer VAT Identifier</td>
<td></td>
</tr>
<tr>
<td>Document Level Allowance Amount</td>
<td></td>
</tr>
<tr>
<td>Document Level Allowance VAT Category Code</td>
<td></td>
</tr>
<tr>
<td>Document Level Allowance VAT Rate</td>
<td></td>
</tr>
<tr>
<td>Document Level Charge Amount</td>
<td></td>
</tr>
<tr>
<td>Document Level Charge VAT Category Code</td>
<td></td>
</tr>
<tr>
<td>Document Level Charge VAT Rate</td>
<td></td>
</tr>
<tr>
<td>Invoice Total Amount without VAT Tax</td>
<td></td>
</tr>
<tr>
<td>Invoice Total VAT Amount</td>
<td></td>
</tr>
<tr>
<td>Invoice Total Amount with VAT</td>
<td></td>
</tr>
<tr>
<td>VAT Category Taxable Amount</td>
<td></td>
</tr>
<tr>
<td>VAT Category Tax Amount</td>
<td></td>
</tr>
<tr>
<td>VAT Category Code</td>
<td></td>
</tr>
<tr>
<td>VAT Category Rate</td>
<td></td>
</tr>
<tr>
<td>VAT Exemption Reason Text</td>
<td></td>
</tr>
<tr>
<td>VAT Exemption Reason Code</td>
<td></td>
</tr>
<tr>
<td>Invoice Line Allowance Amount</td>
<td></td>
</tr>
<tr>
<td>Invoice Line Charge Amount</td>
<td></td>
</tr>
<tr>
<td>Item Gross Price</td>
<td></td>
</tr>
<tr>
<td>Invoiced Item VAT Category Code</td>
<td></td>
</tr>
<tr>
<td>Invoiced Item VAT Rate</td>
<td></td>
</tr>
<tr>
<td>Seller Identifier</td>
<td>Limit allowable entries to one.</td>
</tr>
<tr>
<td>Buyer Country Code</td>
<td></td>
</tr>
</tbody>
</table>

The following table lists the information elements deemed not applicable for a U.S. semantic data model.

### Table 7
**Non-Applicable Information Elements**

<table>
<thead>
<tr>
<th>Business Term</th>
<th>Business Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seller Tax Representative Name</td>
<td>Remove. Seller Tax Representative is not used in the U.S. tax system.</td>
</tr>
<tr>
<td>Seller Tax Representative VAT Identifier</td>
<td></td>
</tr>
<tr>
<td>Tax Representative Address</td>
<td></td>
</tr>
</tbody>
</table>
### Business Rules

Business rules verify the integrity of the business terms to support the semantic data model. These rules may place a constraint on the presence or value of a particular information element, for example “an invoice shall have an invoice number” or they may be conditional, such as “If amount due is positive, then payment due date must be present”.

The semantic data model will need to support specific integrity constraints and conditions within the data models for the electronic invoice. Further refinement of the business rules should occur during the development of the semantic data model.

### Tax Rules

Value Added Tax (VAT) rules, an important component of EN 16931, are governed by the European Directive VAT Council 2006/112/EC. The directive provides trading parties with the legal requirements for taxable transactions such as specifying roles and responsibilities, what goods and services are subject to VAT, the standard VAT rate, and required VAT information on an invoice.

Given that VAT is not applicable in the United States, work group members analyzed the tax code list and rules, United Nations Directories for Electronic Data Interchange (UNTDID 5153), used in EN 16931. It was determined that the following existing codes appear applicable for tax scheme ID use in the United States, Canada, and Mexico:

- Local Sales Tax Assessment (LOC)
- State/Provincial Sales Tax (STT)
- Harmonized Sales Tax, Canadian (AAG)
- Quebec Sales Tax (AAH)
- Canadian Provincial Sales Tax (AAI)
- Goods and Services Tax (GST)

The work group concluded that a U.S. semantic data model will need to support capturing tax category codes, as well as amounts and totals of sales and use tax (e.g. Federal, State, and Local), as applicable.

### Code Lists and Standards

Code lists contain values that are specific for each business term, such as invoice type code, invoice currency code, scheme identifier, and specification identifier.

Many information elements reference a code list to populate possible value selections. Code lists contain values that have specific meaning for a business term and can be defined by standards organizations, such as International Standards Organization (ISO) or the United Nations Trade Data Interchange Dictionary (UNTDID). For example, the information element *invoice currency code* references the International Standards Organization (ISO) 4217 Currency Code list for implementers to select the appropriate code to

---

23 Including the three tax codes for Canada in the semantic data model would allow for the use of the semantic data model between Canadian businesses. Mexico uses a clearance tax model between Mexican businesses; the semantic data model would only be applicable in cross-border invoicing.
populate currency code value.

Table 12 (Appendix D) provides the standards and code lists reviewed during the assessment. The use of these standards is strongly recommended for the U.S. semantic data model.

### 4.6 Syntax

Syntax is the means by which semantic information elements are expressed in machine-readable technical languages, such as XML. Standards describe the use of a syntax for a semantic data model. One of the primary challenges in the market today is the use of multiple e-Invoice standards. The complexity of supporting multiple standards and syntaxes creates overhead and additional cost to manage multiple data integration maps, slows adoption, and decreases interoperability.

The ISO/IEC 19845 - OASIS Universal Business Language (UBL) standard use of XML syntax is in widespread use globally and adoption is growing. Therefore, it is recommended that the initial U.S. semantic data model use ISO/IEC 19845 (UBL) as a single XML syntax.

The BPC created a prototype U.S. semantic data model schema using the ISO/IEC 19845 (UBL 2.1) syntax during the assessment process for initial market validation (Appendix C).

### 5 Recommendations and Next Steps

This report provides an inventory of the essential components and requirements to support a semantic data model for an e-Invoice interoperability framework for the U.S. market. Below are recommendations, key considerations for governance and next steps for establishing a semantic data model in the U.S. market.

#### 5.1 Recommendations

EN 16931 largely addresses the needs for the U.S. market with a few exceptions as previously covered in this report. Table 8 provides a summary of recommendations to accommodate the U.S. market requirements.

<table>
<thead>
<tr>
<th>Component</th>
<th>Recommendation(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parties &amp; Roles</td>
<td>Do not incorporate the taxable person and taxable representative roles, as they are not applicable for the procure-to-pay process in the United States.</td>
</tr>
<tr>
<td>Business Functions</td>
<td>Incorporate additions and modifications that address requirements identified for the U.S. market (Table 3) related to invoice verification, tax reporting and customs clearance. Conduct additional research to: • Ensure all necessary sales and use tax reporting requirements are included in development of a semantic data model.</td>
</tr>
</tbody>
</table>

---

24 A set of schema validation artifacts were created as part of the assessment and can be made available upon request. If interested in learning more or to access these tools, please send a request to: business.payments.smb@mpls.frb.org
Component | Recommendation(s)
--- | ---
**Business Process** | Adopt a new business process that supports invoicing without reference to a purchase order or contract, a common practice among organizations with less formal processes, especially small and medium-size businesses.

**Business Documents** | Leverage the semantic business object library from Universal Business Language (UBL), standardized as ISO/IEC 19845, to define a set of core information elements that must be used to create outgoing invoices and interpret incoming invoices to ensure interoperability.

Allow participants to further specify or restrict required elements and support extended invoices for industry or sector specific information elements not present in the core invoice objects.

**Business Terms** | Incorporate the addition, modification and non-applicable information element changes outlined in Tables 5-7.

**Business Rules** | Support specific conditions and integrity constraints within the data models for the electronic invoice. Replace Value Added Tax business rules with sales and use tax business rules for the U.S. model, as required.

Conduct additional research of the non-VAT business rules against the business functions, processes, and terms for possible inclusion in a U.S. semantic data model.

**Tax Rules** | Support capturing tax category codes, including those outlined in section 4.5 – Tax Rules, as well as amounts and totals of sales and use tax (e.g., Federal, State, and Local), as applicable.

**Code Lists and Standards** | Use the standards and code lists identified in Table 12 for the U.S. semantic data model to increase global business document interoperability.

**Syntax** | Use ISO/IEC 19845 (UBL) as a single model in XML syntax in the semantic data model to support interoperability and adoption.

### 5.2 Key Considerations for Governance

A governance body, which plays an essential role in establishing and maintaining standards, would need to be established for the U.S. market. The work group recommends the following as key considerations for that body to address. While this report provides guidance and insights, a governance body should make final implementation determinations for the U.S. market.

**Table 9**

<table>
<thead>
<tr>
<th><strong>Key Consideration</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation of the model</td>
</tr>
<tr>
<td>Input into the model</td>
</tr>
</tbody>
</table>
### Maintenance of the model
Develop a schedule for major and minor updates that balances necessary changes while minimizing disruption for participants to comply.

### Maintenance of the standard
Develop a process or liaison to provide input into the OASIS UBL Technical Committee on any new business object requirements or defects uncovered to support the semantic data model.

## 5.3 Next Steps
The work group recommends the following next steps:

- The BPC should develop and publish a U.S. semantic data model.
- The BPC should initiate a validation test of the requirements and recommendations in this report and the *e-Invoice Interoperability Framework: e-Delivery Network Feasibility Assessment* report for establishing an e-Delivery network. The validation will allow for a rigorous analysis of the recommendations from this report and determine the final technical requirements for an e-Delivery network utilizing a federated registry model.
- The BPC should establish a new work group to assess how interoperability frameworks are governed and their approach to manage an e-Delivery network.
- The BPC will continue to support work group efforts and foster industry dialogue to increase e-Invoice adoption in the United States.
- The BPC will continue to participate in work underway by several international associations to develop a standard international semantic data model. Continued U.S. participation in this work is encouraged as it provides an opportunity to collaborate and further U.S. efforts to develop a U.S. semantic data model. Participation in this and other global efforts is also important as it affords the opportunity to collaborate and shape a future global semantic data model.

### Figure 4
**Interoperability Framework Initiative Work Group Timelines**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Q2 2019</th>
<th>Q3 2019</th>
<th>Q4 2019</th>
<th>Q1 2020</th>
<th>Q2 2020</th>
<th>Q3 2020</th>
<th>Q4 2020</th>
<th>Q1 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semantic Model Work Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete e-Invoice Semantic Model and Publish Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete Semantic Model Requirements and Publish Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Work Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete e-Delivery Technical Feasibility Assessment and Publish Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete Technical Validation Assessment and Publish Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governance Framework Assessment Work Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct Governance Framework Assessment and Publish Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6 Appendices

6.1 Appendix A — Work Group Members

The BPC would like to thank all work group members who contributed to the assessment.

Table 10
Work Group Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrei Lozada</td>
<td>Indicium Solutions</td>
</tr>
<tr>
<td>Andrew Stewart</td>
<td>Individual</td>
</tr>
<tr>
<td>Anna Tujuen</td>
<td>Dooap Inc.</td>
</tr>
<tr>
<td>Bo Shevchik</td>
<td>Federal Reserve Bank of St. Louis</td>
</tr>
<tr>
<td>Britta Holland</td>
<td>Federal Reserve Bank of Minneapolis</td>
</tr>
<tr>
<td>Cassandra Gordon</td>
<td>Individual</td>
</tr>
<tr>
<td>Caston Jackson</td>
<td>SurePay Financial Services</td>
</tr>
<tr>
<td>Chris Ellingworth</td>
<td>Federal Reserve Bank of Minneapolis</td>
</tr>
<tr>
<td>Daniel Liesenfeld</td>
<td>Basware</td>
</tr>
<tr>
<td>Dylania Grant</td>
<td>Accenture</td>
</tr>
<tr>
<td>Georg Birgisson</td>
<td>Midran</td>
</tr>
<tr>
<td>German Peguero</td>
<td>Edicom</td>
</tr>
<tr>
<td>Greg Bartels</td>
<td>IPS</td>
</tr>
<tr>
<td>Jason Vincelette</td>
<td>Basware</td>
</tr>
<tr>
<td>Jesus Pastran</td>
<td>ATEB Servicios SA de CV</td>
</tr>
<tr>
<td>Joel Leetzow</td>
<td>Individual</td>
</tr>
<tr>
<td>Jose Luis Ortiz</td>
<td>Indicium Solutions</td>
</tr>
<tr>
<td>Ken Holman</td>
<td>Crane Softwrights Ltd.</td>
</tr>
<tr>
<td>Matt Vickers</td>
<td>Xero</td>
</tr>
<tr>
<td>Michael Jasper</td>
<td>Velocity Procurement</td>
</tr>
<tr>
<td>Mike Dignen</td>
<td>High Radius</td>
</tr>
<tr>
<td>Michael Owens</td>
<td>Coretex</td>
</tr>
<tr>
<td>Omar Valencia</td>
<td>eKomericio</td>
</tr>
<tr>
<td>Pam Rhoads</td>
<td>Accenture</td>
</tr>
<tr>
<td>Patti Ritter</td>
<td>Federal Reserve Bank of Minneapolis</td>
</tr>
<tr>
<td>Peter Kozak</td>
<td>IBM</td>
</tr>
<tr>
<td>Robert Gallo</td>
<td>Edicom</td>
</tr>
<tr>
<td>Roger Hatfield</td>
<td>Cloud-Trade</td>
</tr>
<tr>
<td>Ryan Enright</td>
<td>Tungsten Network</td>
</tr>
<tr>
<td>Severin Blenkush</td>
<td>Individual</td>
</tr>
<tr>
<td>Susan Stallings</td>
<td>Tungsten Network</td>
</tr>
<tr>
<td>Todd Albers (Convener)</td>
<td>Federal Reserve Bank of Minneapolis</td>
</tr>
<tr>
<td>Tom Jones</td>
<td>LBMX</td>
</tr>
</tbody>
</table>
### 6.2 Appendix B — Overview of Business Object Definition Properties

#### Table 11
Overview of Business Object Definition Properties

<table>
<thead>
<tr>
<th>Business Document</th>
<th>Mandatory (Must be present in the business document)</th>
<th>Optional (May be present in the business document)</th>
</tr>
</thead>
</table>
| **Core Business Object**  
(Required to be interpreted by an Access Point) | Core - Mandatory | Core - Optional |
| **Discretionary Business Object**  
(Not Required to be interpreted by an Access Point) | UBL Library - Mandatory  
Non-UBL Extension - Mandatory | UBL Library - Optional  
Non-UBL Extension - Optional |
6.3 Appendix C — Selected BPC Information Elements in an Example XML Document

```xml
<?xml version="1.0" encoding="UTF-8"?>
  <cbc:UBLVersionID>2.1</cbc:UBLVersionID>
  <cbc:ID>TOSL108</cbc:ID>
  <cbc:IssueDate>2009-12-15</cbc:IssueDate>
  <cbc:InvoiceTypeCode listID="UN/ECE 1001 Subset" listAgencyID="6">380</cbc:InvoiceTypeCode>
  <cbc:Note languageID="en">Ordered in our booth at the convention.</cbc:Note>
  <cbc:AccountingCost>Project cost code 123</cbc:AccountingCost>
  <cac:InvoicePeriod>
    <cbc:StartDate>2019-11-01</cbc:StartDate>
  </cac:InvoicePeriod>
  <cac:OrderReference>
    <cbc:ID>123</cbc:ID>
  </cac:OrderReference>
  <cac:AccountingSupplierParty>
    <cac:Party>
      <cbc:EndpointID schemeID="GLN" schemeAgencyID="9">1234567890123</cbc:EndpointID>
    </cac:Party>
  </cac:AccountingSupplierParty>
</Invoice>
```

Nota: Los detalles de la imagen no fueron proporcionados.
<cac:AccountingSupplierParty>
  <cac:AccountingCustomerParty>
    <cac:Party>
      <cbc:EndpointID schemeID="GLN" schemeAgencyID="9">1234567987654</cbc:EndpointID>
      <cac:PartyIdentification>
        <cbc:ID schemeID="ZZZ">345KS5324</cbc:ID>
        <cac:PartyName>
          BuyerCompany Ltd</cac:PartyName>
        </cac:PartyIdentification>
      </cac:PartyName>
      <cac:PostalAddress>
        <cbc:CityName>Anytown</cbc:CityName>
        <cbc:PostalZone>101</cbc:PostalZone>
        <cbc:CountrySubentity>RegionB</cbc:CountrySubentity>
        <cac:AddressLine>
          P.O Box 123</cac:AddressLine>
      </cac:PostalAddress>
    </cac:AccountingCustomerParty>
  </cac:AccountingSupplierParty>
</cac:Party>


<cbc:CompanyID schemeAgencyID="ZZZ">BE54321</cbc:CompanyID>
<cbc:TaxScheme>
  <cbc:ID schemeID="UN/ECE 5153">VAT</cbc:ID>
</cbc:TaxScheme>

<cbc:CompanyID schemeAgencyID="ZZZ">5645342123</cbc:CompanyID>
<cbc:RegistrationAddress>
  <cbc:CityName>Mainplace</cbc:CityName>
  <cbc:CountrySubentity>RegionB</cbc:CountrySubentity>
</cbc:RegistrationAddress>
</cac:Country>
</cac:PartyLegalEntity>
</cac:Contact>
  <cbc:Telephone>5121230</cbc:Telephone>
  <cbc:Telefax>5121231</cbc:Telefax>
  <cbc:ElectronicMail>john@buyercompany.eu</cbc:ElectronicMail>
</cac:Contact>
</cac:Party>
</cac:AccountingCustomerParty>
</cac:PayeeParty>
  <cac:PartyIdentification>
    <cbc:ID schemeID="GLN" schemeAgencyID="9">098740918237</cbc:ID>
  </cac:PartyIdentification>
</cac:PayeeParty>
</cac:Delivery>
  <cbc:ActualDeliveryDate>2009-12-15</cbc:ActualDeliveryDate>
</cac:DeliveryLocation>
  <cbc:ID schemeID="GLN" schemeAgencyID="9">6754238987648</cbc:ID>
  <cbc:CityName>DeliveryCity</cbc:CityName>
  <cbc:PostalZone>523427</cbc:PostalZone>
  <cbc:CountrySubentity>RegionC</cbc:CountrySubentity>
  <cbc:Country>
  </cbc:Country>
</cac:DeliveryLocation>
</cac:Delivery>
</cac:PaymentMeans>
  <cbc:PaymentMeansCode listID="UN/EDIFACT EDED 4461" listValue="31"/>
  <cbc:PaymentDueDate>2009-12-31</cbc:PaymentDueDate>
  <cbc:PaymentChannelCode>IBAN</cbc:PaymentChannelCode>
  <cbc:PaymentID>Payref1</cbc:PaymentID>
  <cbc:PayeeFinancialAccount>
    <cbc:ID>DK1212341234123412</cbc:ID>
  </cbc:PayeeFinancialAccount>
<cac:FinancialInstitutionBranch>
  <cac:FinancialInstitution>
    <cbc:ID>DKDKABCD</cbc:ID>
  </cac:FinancialInstitution>
</cac:FinancialInstitutionBranch>
</cac:PaymentMeans>
<cbc:Note>Penalty percentage 10% from due date</cbc:Note>
</cac:PaymentTerms>
<cac:AllowanceCharge>
  <cbc:ChargeIndicator>true</cbc:ChargeIndicator>
  <cbc:AllowanceChargeReason>Packing cost</cbc:AllowanceChargeReason>
  <cbc:Amount currencyID="USD">100</cbc:Amount>
</cac:AllowanceCharge>
<cac:AllowanceCharge>
  <cbc:ChargeIndicator>false</cbc:ChargeIndicator>
  <cbc:AllowanceChargeReason>Promotion discount</cbc:AllowanceChargeReason>
  <cbc:Amount currencyID="USD">100</cbc:Amount>
</cac:AllowanceCharge>
</cac:AllowanceCharge>
</cac:PaymentTerms>
<cac:TaxTotal>
  <cbc:TaxAmount currencyID="USD">292.20</cbc:TaxAmount>
  <cac:TaxSubtotal>
    <cbc:TaxableAmount currencyID="USD">1460.5</cbc:TaxableAmount>
    <cbc:TaxAmount currencyID="USD">292.1</cbc:TaxAmount>
    <cac:TaxCategory>
      <cbc:ID schemeID="UN/ECE 5305" schemeAgencyID="6">S</cbc:ID>
      <cbc:Percent>20</cbc:Percent>
      <cac:TaxScheme>
        <cbc:ID schemeID="UN/ECE 5153" schemeAgencyID="6">VAT</cbc:ID>
      </cac:TaxScheme>
    </cac:TaxCategory>
  </cac:TaxSubtotal>
  <cac:TaxSubtotal>
    <cbc:TaxableAmount currencyID="USD">1</cbc:TaxableAmount>
    <cbc:TaxAmount currencyID="USD">0.1</cbc:TaxAmount>
    <cac:TaxCategory>
      <cbc:ID schemeID="UN/ECE 5305" schemeAgencyID="6">AA</cbc:ID>
      <cbc:Percent>10</cbc:Percent>
      <cac:TaxScheme>
        <cbc:ID schemeID="UN/ECE 5153" schemeAgencyID="6">VAT</cbc:ID>
      </cac:TaxScheme>
    </cac:TaxCategory>
  </cac:TaxSubtotal>
  <cac:TaxSubtotal>
    <cbc:TaxableAmount currencyID="USD">-25</cbc:TaxableAmount>
  </cac:TaxSubtotal>
</cac:TaxTotal>
<cbc:TaxAmount currencyID="USD">0</cbc:TaxAmount>
<cac:TaxCategory>
  <cbc:ID schemeID="UN/ECE 5305" schemeAgencyID="6">E</cbc:ID>
  <cbc:Percent>0</cbc:Percent>
  <cbc:TaxExemptionReasonCode listID="CWA 15577" listAgencyID="ZZZ">
    AAM</cbc:TaxExemptionReasonCode>
  <cbc:TaxExemptionReason>Exempt New Means of Transport</cbc:TaxExemptionReason>
</cac:TaxScheme>
</cac:TaxCategory>
</cac:TaxTotal>
</cac:LegalMonetaryTotal>
<cac:InvoiceLine>
  <cbc:ID>1</cbc:ID>
  <cbc:Note>Scratch on box</cbc:Note>
  <cbc:InvoicedQuantity unitCode="C62">1</cbc:InvoicedQuantity>
  <cbc:LineExtensionAmount currencyID="USD">1273</cbc:LineExtensionAmount>
  <cbc:AccountingCost>BookingCode001</cbc:AccountingCost>
  <cac:OrderLineReference>
    <cbc:LineID>1</cbc:LineID>
  </cac:OrderLineReference>
  <cac:AllowanceCharge>
    <cbc:ChargeIndicator>false</cbc:ChargeIndicator>
    <cbc:AllowanceChargeReason>Damage</cbc:AllowanceChargeReason>
    <cbc:Amount currencyID="USD">12</cbc:Amount>
  </cac:AllowanceCharge>
  <cac:AllowanceCharge>
    <cbc:ChargeIndicator>true</cbc:ChargeIndicator>
    <cbc:AllowanceChargeReason>Testing</cbc:AllowanceChargeReason>
    <cbc:Amount currencyID="USD">10</cbc:Amount>
  </cac:AllowanceCharge>
  <cac:TaxTotal>
    <cbc:TaxAmount currencyID="USD">254.6</cbc:TaxAmount>
  </cac:TaxTotal>
</cac:InvoiceLine>
<cac:Item>
  <cbc:Description languageID="EN">Processor: Intel Core 2 Duo SU9400 LV</cbc:Description>
</cac:Item>
(1.4GHz). RAM:

- 3MB. Screen 1440x900
- Labtop computer

<p_PCI:Product class="Product" />
<p_PCI:ProductDescription>
- <cbc:Description>Labtop computer</cbc:Description>
- <cac:SellersItemIdentification>
  - <cbc:ID>JB007</cbc:ID>
- <cac:StandardItemIdentification>
  - <cbc:ID schemeID="GTIN" schemeAgencyID="9">1234567890124</cbc:ID>
- <cac:CommodityClassification>
  - <cbc:CommodityClassificationCode listAgencyID="113" listID="UNSPSC" codeID="12344321">12344321</cbc:CommodityClassificationCode>
  - <cbc:CommodityClassificationCode listAgencyID="2" listID="CPV" codeID="65434568">65434568</cbc:CommodityClassificationCode>
- <cac:ClassifiedTaxCategory>
  - <cbc:ID schemeID="UN/ECE 5305" schemeAgencyID="6">S</cbc:ID>
  - <cbc:Percent>20</cbc:Percent>
  - <cac:TaxScheme>
    - <cbc:ID schemeID="UN/ECE 5153" schemeAgencyID="6">VAT</cbc:ID>
      - <cac:AdditionalItemProperty>
        - <cbc:Name>Color</cbc:Name>
        - <cbc:Value>black</cbc:Value>
    - <cac:AdditionalItemProperty>
  - <cbc:PriceAmount currencyID="USD">1273</cbc:PriceAmount>
  - <cbc:BaseQuantity unitCode="C62">1</cbc:BaseQuantity>
</cbc:Item>
</cbc:InvoiceLine>
</cbc:InvoiceLine>
</cbc:Invoice>

<cbc:OrderLineReference>
  - <cbc:LineID>5</cbc:LineID>
</cbc:OrderLineReference>
<cbc:TaxTotal>
  - <cbc:TaxAmount currencyID="USD">-0.396</cbc:TaxAmount>
</cbc:TaxTotal>
<cbc:ItemTotal>
<cbc:Name>Returned "Advanced computing" book</cbc:Name>
<cac:SellersItemIdentification>
  <cbc:ID>JB008</cbc:ID>
</cac:SellersItemIdentification>
<cac:StandardItemIdentification>
  <cbc:ID schemeID="GTIN" schemeAgencyID="9">1234567890125</cbc:ID>
</cac:StandardItemIdentification>
<cac:CommodityClassification>
  <cbc:ItemClassificationCode listAgencyID="113" listID="UNSPSC">
    >32344324</cbc:ItemClassificationCode>
</cac:CommodityClassification>
</cac:Item>
<cac:Price>
  <cbc:PriceAmount currencyID="USD">3.96</cbc:PriceAmount>
  <cbc:BaseQuantity unitCode="C62">1</cbc:BaseQuantity>
</cac:Price>
</cac:InvoiceLine>
<cac:InvoiceLine>
  <cbc:ID>3</cbc:ID>
  <cbc:InvoicedQuantity unitCode="C62">2</cbc:InvoicedQuantity>
  <cbc:LineExtensionAmount currencyID="USD">4.96</cbc:LineExtensionAmount>
  <cac:OrderLineReference>
    <cbc:LineID>3</cbc:LineID>
  </cac:OrderLineReference>
  <cac:TaxTotal>
    <cbc:TaxAmount currencyID="USD">0.496</cbc:TaxAmount>
  </cac:TaxTotal>
</cac:InvoiceLine>
<cac:Item>
  <cbc:Name>"Computing for dummies" book</cbc:Name>
  <cac:SellersItemIdentification>
    <cbc:ID>JB009</cbc:ID>
  </cac:SellersItemIdentification>
</cac:Item>
</cbc:Invoice>
<cac:StandardItemIdentification/>
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  </cbc:ItemClassificationCode>
</cac:CommodityClassification>
<cac:CommodityClassification>
  <cbc:ItemClassificationCode listAgencyID="2" listID="CPV">
    65434566
  </cbc:ItemClassificationCode>
</cac:CommodityClassification>
<cac:ClassifiedTaxCategory>
  <cbc:ID schemeID="UN/ECE 5305" schemeAgencyID="6">AA</cbc:ID>
  <cbc:Percent>10</cbc:Percent>
  <cac:TaxScheme>
    <cbc:ID schemeID="UN/ECE 5153" schemeAgencyID="6">VAT</cbc:ID>
  </cac:TaxScheme>
</cac:ClassifiedTaxCategory>
</cac:Item>
<cac:Price>
  <cbc:PriceAmount currencyID="USD">2.48</cbc:PriceAmount>
  <cbc:BaseQuantity unitCode="C62">1</cbc:BaseQuantity>
</cac:Price>
</cac:InvoiceLine>
<cac:InvoiceLine>
  <cbc:ID>4</cbc:ID>
  <cbc:InvoicedQuantity unitCode="C62">-1</cbc:InvoicedQuantity>
  <cbc:LineExtensionAmount currencyID="USD">-25</cbc:LineExtensionAmount>
  <cac:OrderLineReference>
    <cbc:LineID>2</cbc:LineID>
  </cac:OrderLineReference>
  <cac:TaxTotal>
    <cbc:TaxAmount currencyID="USD">0</cbc:TaxAmount>
  </cac:TaxTotal>
</cac:InvoiceLine>
<cac:Item>
  <cbc:Name>Returned IBM 5150 desktop</cbc:Name>
  <cac:SellersItemIdentification>
    <cbc:ID>JBO10</cbc:ID>
  </cac:SellersItemIdentification>
  <cac:StandardItemIdentification>
    <cbc:ID schemeID="GTIN" schemeAgencyID="9">
      1234567890127
    </cbc:ID>
  </cac:StandardItemIdentification>
  <cac:CommodityClassification>
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      12344322
    </cbc:ItemClassificationCode>
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      12344322
    </cbc:ItemClassificationCode>
  </cac:CommodityClassification>
</cac:Item>
<cac:InvoiceLine>
  <cbc:ID>5</cbc:ID>
  <cbc:InvoicedQuantity unitCode="C62">250</cbc:InvoicedQuantity>
  <cbc:LineExtensionAmount currencyID="USD">187.5</cbc:LineExtensionAmount>
  <cbc:AccountingCost>BookingCode002</cbc:AccountingCost>
  <cac:OrderLineReference>
    <cbc:LineID>4</cbc:LineID>
  </cac:OrderLineReference>
  <cac:TaxTotal>
    <cbc:TaxAmount currencyID="USD">37.5</cbc:TaxAmount>
  </cac:TaxTotal>
</cac:InvoiceLine>

<cac:InvoiceLine>
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  <cbc:InvoicedQuantity unitCode="C62">250</cbc:InvoicedQuantity>
  <cbc:LineExtensionAmount currencyID="USD">187.5</cbc:LineExtensionAmount>
  <cbc:AccountingCost>BookingCode002</cbc:AccountingCost>
  <cac:OrderLineReference>
    <cbc:LineID>4</cbc:LineID>
  </cac:OrderLineReference>
  <cac:TaxTotal>
    <cbc:TaxAmount currencyID="USD">37.5</cbc:TaxAmount>
  </cac:TaxTotal>
</cac:InvoiceLine>

<cbc:Name>Network cable</cbc:Name>
<cbc:SellersItemIdentification>
  <cbc:ID>JB011</cbc:ID>
</cbc:SellersItemIdentification>
<cbc:StandardItemIdentification>
  <cbc:ID schemeID="GTIN" schemeAgencyID="9">1234567890128</cbc:ID>
</cbc:StandardItemIdentification>
<cbc:CommodityClassification>
  <cbc:ItemClassificationCode listAgencyID="113" listID="UNSPSC">
    12344325</cbc:ItemClassificationCode>
</cbc:CommodityClassification>
<cbc:CommodityClassification>
  <cbc:ItemClassificationCode listAgencyID="2" listID="CPV">
    65434564</cbc:ItemClassificationCode>
</cbc:CommodityClassification>
<cbc:CommodityClassification>
  <cbc:ItemClassificationCode listAgencyID="113" listID="UNSPSC">
    12344325</cbc:ItemClassificationCode>
</cbc:CommodityClassification>

<cbc:CommodityClassification>
  <cbc:ItemClassificationCode listAgencyID="2" listID="CPV">
    65434564</cbc:ItemClassificationCode>
</cbc:CommodityClassification>
<cbc:ID schemeID="UN/ECE 5153"
schemeAgencyID="6">VAT</cbc:ID>
</cac:TaxScheme>
</cac:ClassifiedTaxCategory>
<cac:AdditionalItemProperty>
  <cbc:Name>Type</cbc:Name>
  <cbc:Value>Cat5</cbc:Value>
</cac:AdditionalItemProperty>
</cac:Item>
<cac:Price>
  <cbc:PriceAmount currencyID="USD">0.75</cbc:PriceAmount>
  <cbc:BaseQuantity unitCode="C62">1</cbc:BaseQuantity>
</cac:Price>
</cac:InvoiceLine>
</Invoice>
### 6.4 Appendix D — Standards and Code Lists Reviewed

#### Table 12

<table>
<thead>
<tr>
<th>Standard</th>
<th>Link</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Organization for Standardization (ISO) ISO 3166-Country Codes</td>
<td><a href="https://www.iso.org/iso-3166-country-codes.html">https://www.iso.org/iso-3166-country-codes.html</a></td>
<td>Codes for the representation of names of countries and their subdivisions</td>
</tr>
<tr>
<td>United Nations Economic Commission for Europe (UNEC) - (UNTDID) D.18A – Element 1153 (Reference code qualifier)</td>
<td><a href="http://www.unece.org/trade/untdid/d18a/tred1153.htm">http://www.unece.org/trade/untdid/d18a/tred1153.htm</a></td>
<td>Code List (Scheme Identifier Reference Qualifier)</td>
</tr>
<tr>
<td>United Nations Economic Commission for Europe (UNEC) - (UNTDID) D.18A – Element 4451 (Text subject code qualifier)</td>
<td><a href="http://www.unece.org/trade/untdid/d18a/tred4451.htm">http://www.unece.org/trade/untdid/d18a/tred4451.htm</a></td>
<td>Invoice Note Subject Code</td>
</tr>
</tbody>
</table>
6.5 Appendix F — Resource Links

Links to more detail about e-Invoicing frameworks are included below.

CEF: Get Started with eDelivery
https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/Get+started+eDelivery

ConnectONCE
https://connect-once.com

DBC: The Interoperability Framework

EESPA
https://eespa.eu/

OASIS Standards
https://www.oasis-open.org/standards

OpenPeppol eDelivery Network Specifications

6.6 Appendix G — References

Catalog of Electronic Invoice Technical Standards in the U.S., Business Payments Coalition and Federal Reserve Bank, October 2017.

CEN EN16931-1:2017 Electronic invoicing – Part 1: Semantic data model of the core elements of an electronic invoice
e-Invoice Interoperability Framework: Semantic Model Assessment

December 2019

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documents may be purchased from CEN National Members and Affiliates. See Obtaining standards.
https://www.cencenelec.eu/standards/ENpurchase/Pages/default.aspx

2016 Data Capture and Mailroom Technology Insight Report, PayStream Advisors

Digital Business Council (DBC) eInvoicing Semantic Model Version 1.0, Digital Business Council, July 27,
2016.

e-Invoice Interoperability Framework: e-Delivery Network Feasibility Assessment Report, Business
Payments Coalition, November 2019.
assessment.pdf

https://www.iso.org/standard/66370.html

Overview of an e-Invoice Interoperability Framework, Business Payments Coalition, November 2019

Post-Award ‘BIS’ Specifications and Guidelines: Peppol BIS Billing 3.0 - Europe
https://peppol.eu/downloads/post-award/

Summary Report from the e-Invoice Interoperability Framework Preliminary Assessment Work Group,
Business Payments Coalition, June 2018.
2018.pdf

The Clearing House Implementation Guide for Request for Payment (RfP)
https://www.theclearinghouse.org/payment-systems/rtp/-
/media/30ef24a893324095bb2ea5df08a156dc.ashx

U.S. Adoption of Electronic Invoicing: Challenges and Opportunities, Payments, Standards and Outreach
Group, Federal Reserve Bank of Minneapolis, June 2016.

6.7 Appendix H — Interoperability Framework Assessment Reports

The e-Invoice Interoperability Framework: Semantic Model Assessment report is the third report of a three
part series of the BPC e-Invoice Interoperability Framework assessments.