SDN Contribution

Getting Started with UN/CEFACT XML NDR for CCTS

Summary

The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) XML Naming and Design Rules Technical Specification (UN/CEFACT XML NDR) describes how ISO 15000-5 CCTS (Core Component Technical Specification) syntax independent components are systematically represented in XML schema and XML instances. This specification is a CCTS implementation profile for the W3C XML Schema Definition (XSD) Language Recommendation, and schema developed in accordance with the XML NDR specification will be fully XSD conformant. Included are rules to ensure that CCTS conformant components are consistently expressed as XML – regardless of the business context or purpose.

The specification contains a set of rules governing extension and restriction, version management, design, and runtime to ensure that components remain fully interoperable. A key aspect of the extension and restriction approach is that all changes to the underlying data model components are always made first to the data models and then expressed in the schema. As such, xsd:redefine and xsd:extension are tightly controlled. This approach guarantees the general consistency for the unambiguous and common understandable composition of semantic information at every syntax level, not just its XML expression.

The specification also provides for the XML instantiation of the predefined CCTS Core Data Types (CDTs) as a fixed set of XML Schema types. These CDTs represent the basis for all CEFACT element declarations and must be used in a CCTS conformant XML Schema.

The XML instantiation of CCTS components can be used for representing internal data structures, for accomplishing internal data flows and external business message data exchange, and for every aspect of XML based frameworks, such as web services. CCTS conformant SAP Global Data Types (GDTs) provided by SAP NW for SAP ESA's business oriented interfaces are being represented in XML Schema following the guidelines of the XML NDR technical specification.

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Author Bios

Gunther Stuhec

Since his master's degree (MSC, 1993) Gunther Stuhec has worked with communications and EDI technologies. As a consultant in a software house for middleware and EDI systems he developed strategic concepts for customers and was responsible for various EDI projects. He joined SAP SI as a consultant in 1999, where he was responsible for implementing XML/EDI projects in conjunction with SAP systems. Since 2001 Mr. Stuhec works for SAP AG as a “Standards Architect” and has been involved in standardizing business standards on both semantic and syntax levels.

He is the chair of the UN/CEFACT Techniques and Methodologies Group (TMG) that is responsible for the development and maintenance of the UN/CEFACT CCTS standard. He is also a member of various international and national standardization bodies like UN/CEFACT, ISO, and DIN. He is actively involved in developing standards and serves as an interface between these bodies and SAP, introducing SAP's requirements into their work and incorporating their latest findings into SAP's development activities.

Mark Crawford

Mark Crawford joined SAP in October 2005. He is an architect in the Technology Standards Group focusing on industry standards and methodologies. Prior to joining SAP, Mark was a Senior Research Fellow for a Washington D.C. government think tank where he specialized in XML, eBusiness standards, and Semantic Data Modeling. Before that he spent 23 years as a U.S. Naval Officer with extensive experience in Logistics, IT, Supply Chain, Procurement and Finance. Mark has been involved in both cross and vertical industry business standards, and the underlying methodology standards that support them. He is actively involved in UN/CEFACT standards activities as vice chair of Applied Technologies Group and chair of UN/CEFACT XML Syntax Group, editor for UN/CEFACT CCTS, chair of UN/CEFACT Core Components Harmonization Project, as well as Co-Chair of the ISO 15000-5 Core Components Technical Specification work in ISO TC154. He previously was involved in the X12 Communications and Controls Subcommittee, vice chair of the X12 XML Working Group, and Chair of the joint X12/CEFACT Core Components initiative.

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About UN/CEFACT XML NDR

One of the greatest impediments to realizing a global and dynamic e-collaboration environment is the ever-vexing question of how to consistently and systematically represent business information in a manner that all enterprises – large and small – can use and share it. A major step in solving this question has been taken with the development of the Joint United Nations (UN) Centre for Trade Facilitation and Electronic Business (UN/CEFACT) and International Organization for Standardization (ISO) Core Components Technical Specification (CCTS)[1]. The CCTS specification is the first proven methodology for developing syntax independent data building blocks that can be combined and customized to suit varied business and information system requirements. Apart from allowing the users to construct their business information documents dynamically, these building blocks contain functions that make them ideal for much more than just document sharing. However, to fully utilize these syntax neutral building blocks, they must be expressed using a syntax for instantiating, processing, storing and exchanging. Given its wide spread adoption across the full gamut of information systems architecture, The XML syntax is perfectly suited for this task.

The UN/CEFACT – *XML Naming and Design Rules* (XML NDR) Technical Specification describes and specifies rules and guidelines that will be applied when developing XML schema and instantiating XML expressed data in accordance with ISO 15000-5 CCTS. The XML NDR is fully conformant to all aspects of the World Wide Web Consortium (W3C) XML Schema Definition (XSD) Language recommendation. With its basis in both CCTS and XSD, the XML NDR specification is really an optimized XSD implementation profile for CCTS.

Readers of this article who are not familiar with CCTS are encouraged to first read the introductory CCTS article – How to Solve the Business Standards Dilemma - CCTS Key Model Concepts[2],

Organization of the Specification

- Sections 1 through 3 – Administrative: status, team members, and table of contents
- Section 4 – General information about the document itself and definition of normative conformance
- Section 5 – Relevant information on guiding principles, dependency and relationship to CCTS, modularity approach designed to maximize reuse of business information expressed as XML schema components, and the general naming conventions applied. (Normative)
- Section 6 – General conventions applied with respect to the use of the XML schema language. (Normative)
- Section 7 – Detailed rules applicable to each of the schema modules defined by the modularity approach. (Normative)

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[1] See SDN link to UN/CEFACT Core Components Technical Specification (UN/CEFACT CCTS) – https://www.sdn.sap.com/irj/sdn?rid=/webcontent/uuid/1baa57f9-0a01-0010-1684-c42a08982294

[2] SDN article: How to Solve the Business Standards Dilemma - CCTS Key Model Concepts – https://www.sdn.sap.com/irj/servlet/prt/portal/prtroot/docs/library/uuid/1b873fc3-0901-0010-f7bc-9518e1aed0cf

- Section 8 – Guidelines and rules related to XML instance documents. (Normative)
- Section 9 – Use cases and solutions for code lists and identifier lists. (Informative)
- Appendix A – Related Documents (Informative)
- Appendix B – Overall Schema Structure (Normative)
- Appendix C – ATG Approved Acronyms and Abbreviations (Normative)
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- Appendix E – Unqualified Data Type Schema Module (Normative)
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- Appendix G – Mapping of CCTS Representation Terms to CCT and UDT Data Types
- Appendix H – Summary of Naming and Design Rules
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Scope of the Specification

The XML NDR specification can be employed wherever business information is being shared or exchanged among and between enterprises, government agencies, and/or other organizations in an open and worldwide environment using XML schemas for

- defining business documents dynamically to suit the users needs
- leveraging CCTS based information content to design intuitive user interfaces
- describing partner profiles and catalogs that can be re-used without prior conversion, and
- using XML dependent objects in internal and external workflows.

Audience

The primary audience for the XML NDR specification is the UN/CEFACT Applied Technologies Group (ATG). ATG will use this specification to create and maintain XML schema in support of the CEFACT standards development role. A broader audience includes developers who wish to:

- create optimized CCTS component based schema
- leverage best practices for the creation of non CCTS based data components
- leverage best practices for creation of their own XML NDR specification.

Guiding Principles

Specification development consisted of a comprehensive design methodology that included reviewing and documenting XSD best practices from a number of public and private sector sources. To guide that review, and to ensure the resultant XML NDR specification was consistent in its purpose, a number of guiding principles were established that include:

- “Relationship to UMM – UN/CEFACT XML Schema Definition Language (XSD) Schema will be based on UMM metamodel adherent Business Process Models.
- Relationship to Information Models – UN/CEFACT XSD Schema will be based on information models developed in accordance with the UN/CEFACT – *Core Components Technical Specification*.
- Schema Creation– UN/CEFACT XML design rules will support schema creation through handcrafting as well as automatic generation.

- Interchange and Application Use – UN/CEFACT XSD Schema and instance documents are intended for business-to-business and application-to-application use.
- Tool Use and Support – The design of UN/CEFACT XSD Schema will not make any assumptions about sophisticated tools for creation, management, storage, or presentation being available.
- Schema Features – The design of UN/CEFACT XSD Schema should use the most commonly supported features of W3C XSD Schema.
- Technical Specifications – UN/CEFACT XML Naming and Design Rules will be based on Technical Specifications holding the equivalent of W3C recommended status.
- Schema Specification – UN/CEFACT XML Naming and Design rules will be fully conformant with W3C XML Schema Definition Language.
- Interoperability – The number of ways to express the same information in a UN/CEFACT XSD Schema and UN/CEFACT XML instance document is to be kept as close to one as possible.
- Maintenance – The design of UN/CEFACT XSD Schema must facilitate maintenance.
- Context Sensitivity – The design of UN/CEFACT XSD Schema must ensure that context-sensitive document types are not precluded.
- Relationship to Other Namespaces – UN/CEFACT XML design rules will be cautious about making dependencies on other namespaces.
- Legacy formats – UN/CEFACT XML Naming and Design Rules are not responsible for sustaining legacy formats."

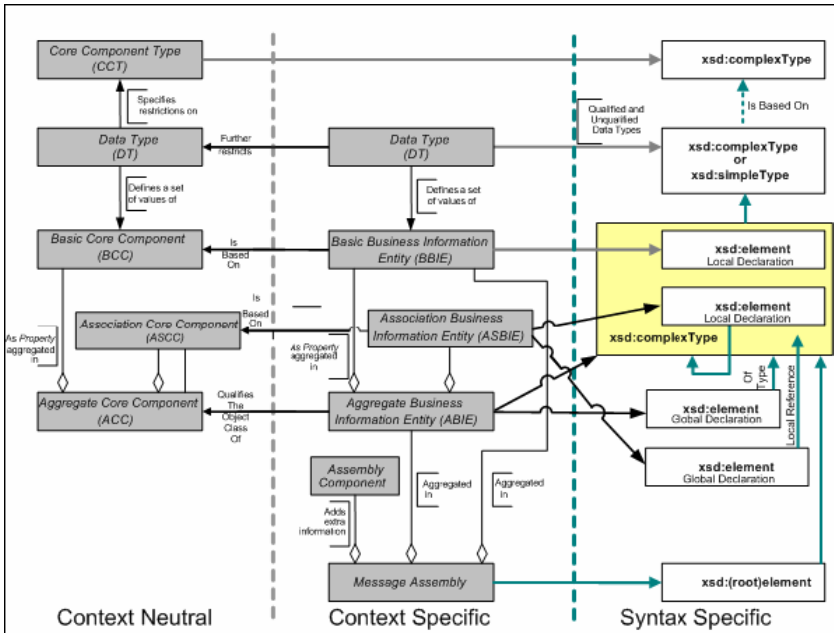

Figure 1 - Relationship between CCTS and XSD Artifacts in UN/CEFACT XSD Schema

Transforming CCTS Artifacts into XSD Artifacts

In CCTS we create conceptual data models that consist of Core Components. The application of business context transforms these artifacts into physical/logical data constructs called Business Information Entities (BIEs). As shown in figure 1, by applying the NDRs, the CCTS based BIE artifacts are exactly and unambiguously transformed through direct relationships into XML Schema relevant types, attributes and elements. CCTS Core Data Types are exactly and unambiguously transformed through direct relationships into xsd:simpleTypes and xsd:complexTypes. The xsd:element and xsd:complexTypes that represent BIEs, are always of type xsd:simpleType or xsd:complexType that represent the CCTS Core Data Type. The result of this approach is to ensure developed schema only consist of, and are perfectly aligned with, the underlying conceptual and physical/logical data models.

As the specification began to emerge, the expression of BIEs as XML artifacts was a pure type based approach – with Aggregate Business Information Entities (ABIEs) being defined as xsd:complexTypes, and Basic Business Information Entities (BBIEs) and Association Business Information Entities (ASBIEs) being declared as local elements within the complex type. However, during implementation verification of the specification this approach was determined to be too limited in its ability to reuse elements, especially in technologies such as Web Services Description Language (WSDL) expressions. As a result, the XML NDR finalized on what is called a "hybrid approach" for the modeling of XML Schemas. This hybrid approach provides significant benefits over a purely type based approach by increasing the reusability of documented content both at the data modeling and XML instantiation level.

Figure 2 shows an example of a syntax independent CCTS based model that should be transformed into a XML Schema following the XMLNDR rules. It defines several BIEs that constitute ABIEs, BBIEs, ASBIEs and it illustrates their relationships. Applying the hybrid approach for these BIEs creates specific XSD artifacts as follows:

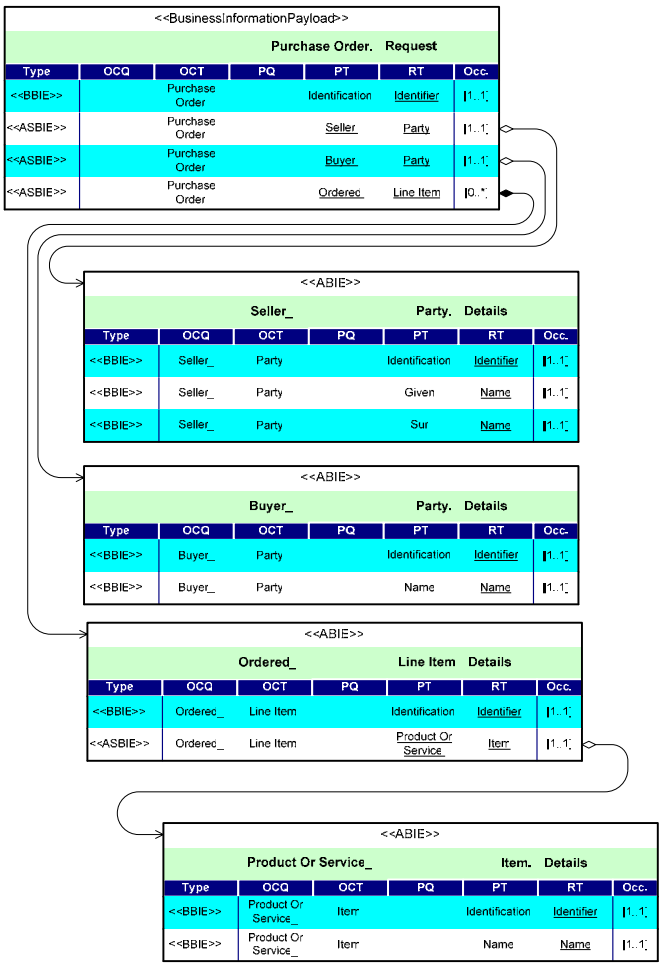

Figure 2 - Sample Core Component Artifacts

- The *Purchase Order. Request* document level message assembly component is globally declared as an xsd:element and defined as an xsd:complexType
- All ABIEs (data model classes) – *Seller_ Party. Details*, *Buyer_ Party. Details*, *Ordered_ Line Item. Details* and *Product Or Service_ Item. Details* – are declared as an xsd:complexType.
- All attributes of data model classes – *Purchase Order. Identification. Identifier, Seller_ Party. Identification. Identifier Seller_ Party. Given. Name, Seller_ Party. Sur. Name, Ordered_ Party. Identification. Identifier*, and are declared as a local xsd:element within an xsd:complexType.
- Composite ASBIEs – *Purchase Order. Ordered. Line Item* – are locally declared as an xsd:element within an xsd:complexType. Composite associations are those associations that only exist as long as the parent class exists. A composite ASBIE is defined as a specialized type of ASBIE that represents a composition relationship between the associating ABIE and the associated ABIE.
- ASBIEs other than composites – *Purchase. Buyer. Party*, *Purchase Order*. *Seller*. *Party* – are globally declared as an xsd:element.

The code for this transformation would look something like this:

```
<xsd:element name="PurchaseOrderRequest"
type="rsm:PurchaseOrderRequestType"/>
<xsd:element name="OrderedLineItem" type="ram:OrderedLineItemType"/>
<xsd:element name="ProductOrServiceItem"
  type="ram:ProductOrServiceItemType"/>
<xsd:element name="SellerParty" type="ram:SellerPartyType"/>
<xsd:element name="BuyerParty" type="ram:BuyerPartyType"/>
<xsd:complexType name="PurchaseOrderRequestType">
  <xsd:sequence>
        <xsd:element name="ID" type="udt:IDType"/>
        <xsd:element ref="ram:SellerParty"/>
        <xsd:element ref="ram:BuyerParty"/>
        <xsd:element name="OrderedLineItem" type="ram:OrderedLineItemType"
         maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="BuyerPartyType">
  <xsd:sequence>
        <xsd:element name="ID" type="udt:IDType"/>
        <xsd:element name="Name" type="udt:NameType"/>
  </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="OrderedLineItemType">
  <xsd:sequence>
        <xsd:element name="ID" type="udt:IDType"/>
        <xsd:element name="ProductOrServiceItem"
          type="ram:ProductOrServiceItemType"/>
  </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="ProductOrServiceItemType">
  <xsd:sequence>
        <xsd:element name="ID" type="udt:IDType"/>
        <xsd:element name="Name" type="udt:NameType"/>
  </xsd:sequence>
</xsd:complexType>
<xsd:complexType name="SellerPartyType">
  <xsd:sequence>
        <xsd:element name="ID" type="udt:IDType"/>
        <xsd:element name="GivenName" type="udt:NameType"/>
        <xsd:element name="Surname" type="udt:NameType"/>
  </xsd:sequence>
</xsd:complexType>
```

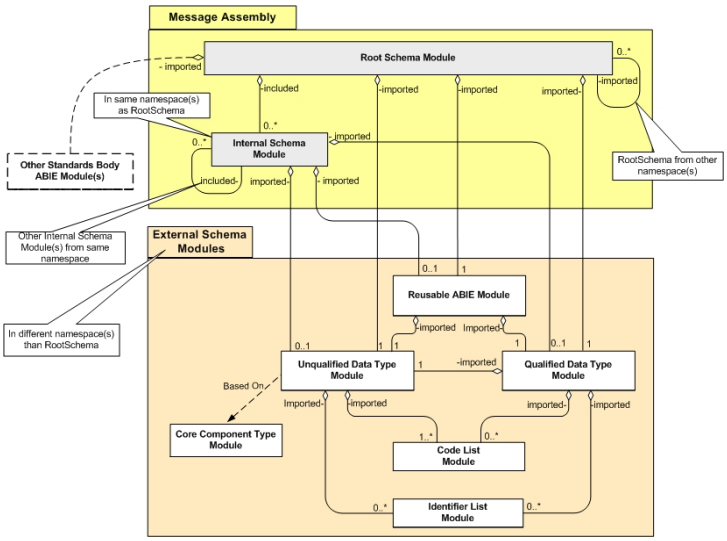

Figure 3 - Modularity and Namespace Model

Modularity and Namespaces

The specification defines a robust modularity and namespace model that compartmentalizes data types, code and identifier lists, common reusable components, and schema for specific information exchanges. As shown in figure 3, root schema that reflect specific business processes and their supporting internal schema, are defined in their own namespaces.

All other schema modules, to include:

- Unqualified (Core) Data Type
- Qualified (Core) Data Type
- Reusable ABIE
- Code List(s)
- Identifier List(s)

are created and assigned to their own unique namespaces. Namespaces are versioned along with the schema that defines the contents of the namespace. Additional imports of external schema modules defined elsewhere, such as vertical standards organizations or SAP unique core data types, is allowed under this approach. Additionally, a flattened root schema approach by implementers other than CEFACT is considered conformant. Under a flattened approach, the common reusable components are drawn from the common reusable schema, but are actually declared/defined in either the root schema directly, or in an intermediate internal schema module. This flattening approach has the benefit of avoiding the import of the common reusable schema module, which due to its ever increasing size will have a significant impact on system memory. However, this flattening approach does loose the maintenance functionality a common reusable schema affords.

UN/CEFACT XML NDR Intellectual Property

The UN/CEFACT XML NDR specification is royalty free. To the best knowledge of UN/CEFACT, there are no hidden patents as part of the specification, nor have any patent claims surfaced. However, as with all UN/CEFACT standards and specifications, users are not indemnified by the UN for use of their standards.

UN/CEFACT XML NDR Conformance

Conformance to the CEFACT XML NDR specification is addressed in the specification as follows:

> "Applications will be considered to be in full conformance with this technical specification if they comply with the content of normative sections, rules and definitions."

Although SAP is working towards full conformance to the CEFACT XML NDR specification, there are certain rules and methodologies that are CEFACT unique and that can not be complied with by external organizations. These include namespace and schema location declarations and approaches. To ensure consistency in use, implementers other than UN/CEFACT are encouraged to use the applicable rules in the XML NDR specification as the basis for developing their own rules for appropriate deviations.

Organization – Responsible Standards Body

The UN/CEFACT XML NDR specification was developed, and is being maintained, by the XML syntax group (ATG2) of the UN/CEFACT Applied Technology Group (ATG). The ATG is responsible for developing syntax

specific solutions – such as UN/EDIFACT messages and XML schema – in support of business message models developed by UN/CEFACT business groups. The ATG is one of five permanent groups under the auspices of the UN/CEFACT Forum, which in turn is the operation arm of UN/CEFACT for trade facilitation. SAP currently acts as vice chair of ATG, chair of ATG2, project lead and lead editor for the XML NDR project.

Copies of UN/CEFACT XML NDR

The specification and supporting schema are freely available on the ATG website at:
http://www.disa.org/cefact-groups/atg/downloads/index.cfm

Official UN/CEFACT XML NDR Status

The specification was approved by the UN/CEFACT Forum in March 2006 as a forum approved technical specification. It was subsequently ratified as an approved UN/CEFACT Technical Specification in May of 2006.

UN/CEFACT XML NDR Implementations

During the implementation verification (IV) phase of the XML NDR development process, several successful implementations were identified that allowed the specification to move forward. Information about IV is available from the ATG website. Additional implementations are happing daily, and the specification is also being used as the basis for other standards body and public and private sector XML NDRs – such as the Open Applications Group and U.S. Government,

Role of UN/CEFACT XML NDR in SAP

The UN/CEFACT XML NDR specification plays an important role in the SAP Standards Strategy. Under that strategy, SAP development is transitioning from proprietary expressions to standard based solutions to maximize the interoperability of SAP products, increase customer value, and reduce total cost of operations. In line with that strategy, SAP Global Data Types in NetWeaver are being defined in conformance with the ISO 15000-5 Core Components Technical Specification, and expressed as XML artifacts using the UN/CEFACT XML NDR specification. For a more detailed discussion concerning the SAP standards strategy, see the document Building Standards Based Business Applications.

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