Electronic Commerce:
A Killer (Application) for the Semantic Web?

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1 Semantic Web Technology

- I will skip this chapter
2 Web-based Electronic Commerce

Currently, electronic commerce is seriously hampered by the lack of proper standards:

- HTML does neither provide syntax and semantics of information.
- Existing standards like EDIFACT are isolated, cumbersome, and costly.

==> However, there is the largest economic potential of on-line technologies (80%).
Currently, XML takes over this market place: XML-based solutions for B2B have the following advantages:

- Understandability, i.e., human readability,
- Integration in other document exchanges,
- Maintenance is cheaper,
- and general tool support developed for all document processes can be applied to B2B EC.
2.1 Web-based Electronic Commerce: Business Documents and Product Catalogues

- ebXML provides a comprehensive set of standardized XML document formats, allowing buyers, suppliers, and service providers to integrate their existing systems into electronic marketplaces.

- xCBL provides a comprehensive set of standardized XML document formats, allowing buyers, suppliers, and service providers to integrate their existing systems into electronic marketplaces.

- cXML provides a comprehensive set of standardized XML document formats, allowing buyers, suppliers, and service providers to integrate their existing systems into electronic marketplaces.
Web-based Electronic Commerce:
Business Documents and Product Catalogues

- For example, the cXML standard contains one single 46 KB DTD to specify 27 documents used for B2B information exchange.

- The xCBL standard provides automation for the same business processes, but offers 594 DTDs with total size of 571 Kb to specify up to 40 documents.

- ... and there are much more.
2.2 Web-based Electronic Commerce: Product Standards

- UNSPSC: A five level hierarchy of around 15,000 concepts to classify products.
- UCEC: It enriches UNSPSC by attributes to describe products.
- ecl@ss: An alternative descriptive classification, however, mainly used in Europe only.
- RossettaNet
- ... and there are much more vertical and horizontal standards.
2.3 Web-based Electronic Commerce: Company Descriptions

- UDDI: The Universal Description, Discovery and Integration (UDDI) project creates a framework for describing services, discovering businesses, and integrating business services using the Internet.¹

- WSDL: The Web Service Description Language is an XML format for describing interfaces to business services registered with a UDDI database.

¹ Microsoft, IBM, Ariba
2.4 Web-based Electronic Commerce:
Open Problems

- There are more “standards” than you would like to have.

  ==> Serious translation effort to make E-Commerce working.

- All of these “standards” are based on semi-formal descriptions of content.

  ==> Identification of products, services, and the execution of business processes require the human in the loop.
Currently many people in E-commerce view XML as the end of the process. However, there are two angels where semantic web technology beyond XML can provide a significant contribution:

- Mapping between different “standards”, i.e., dealing with the problem of lacking standardization.
- Automizing business processes based on the formal semantics of descriptions.
3.1 Semantic Web and Electronic Commerce: Mapping and Integration

- Business_1
  - order information
    - <product>
      - <type>Car</type>
      - <name>Daimler 230 SE</name>
      - <price>23.000 $</price>
    - </product>

- Business_2
  - Bestellinformation
    - <Auto>
      - <Name>Daimler 230 SE</Name>
      - <Preis>40.000 DM</Preis>
    - </Auto>

- Ontology translation Server

- product catalogue_1

- product catalogue_2
Semantic Web and Electronic Commerce: Mapping and Integration

- It would be natural to write XSL-T rules to translate between various formats required by B2B marketplace.

- However, XSL-T Mapping rules become highly complex.
  - Difficult and expensive to program
  - Difficult and expensive to maintain
  - Nearly no reuse of implemented mappings.

=> This is caused by the fact, that these direct mappings interweave several different aspects into one transformation step.
Mapping terminology: PostalAddress to OrganizationAddress

Splitting is guided by element values

Transforming attribute values

Aligning granularity level: Street (mixed street name and house number) to Street (name) and HouseNumber

<xsl:for-each select="Address/PostalAddress">
  <OrganizationAddress>
    <xsl:variable name="addrline" select="Street"/>
    <xsl:choose>
      <xsl:when test="contains($addrline,', ')
        and (starts-with($addrline,'1') or starts-with($addrline,'2') or ...)">
        <!-- Address Line is (House, Street) -->
        <HouseNumber><xsl:value-of select="substring-before($addrline,', ')"/></HouseNumber>
        <Street><xsl:value-of select="substring-after($addrline,' ')"/></Street>
      </xsl:when>
      <xsl:when test="contains($addrline,', ')">
        <!-- Address Line is (Street, House) -->
        <Street><xsl:value-of select="substring-before($addrline,', ')"/></Street>
        <HouseNumber><xsl:value-of select="substring-after($addrline,' ')"/></HouseNumber>
      </xsl:when>
      <xsl:when test="contains($addrline,' ')">
        <!-- Address Line is (Street House) -->
        <Street><xsl:value-of select="substring-before($addrline,' ')"/></Street>
        <HouseNumber><xsl:value-of select="substring-after($addrline,' ')"/></HouseNumber>
      </xsl:when>
    </xsl:choose>
  </OrganizationAddress>
</xsl:for-each>

3. Semantic Web and Electronic Commerce
Semantic Web and Electronic Commerce: Mapping and Integration

Source
Data Model

transform

Target
Data Model

abstract

Source
XML Catalog

direct

refine
direct

Source
XML Catalog

Target
XML Catalog

transform
Semantic Web and Electronic Commerce: Mapping and Integration

Marketplace
- the unified document ontology (in RDF Schema)
  - RDF ontology instances

- transform
  - RDF data model of a source document
    - abstract
    - Source XML document, e.g. product catalog

- transform
  - RDF data model of a target document
    - serialize
    - Target XML document, e.g. product catalog

Exponential number of links is reduced by mapping via a single ontology

Complexity of transformation rules is reduced by mapping via document data
Semantic Web and Electronic Commerce: Mapping and Integration

- We abstract from syntactical XML variations and extract the information provided by the document.

- The information mapping is executed at the RDF and RDF Schema level.

- The simple object, property, value data model of RDF is used to represent the information.

  ==> Complex XSL-T rules are replaced by a short sequence of simple and reusable mapping rules.

  ==> We are currently developing and implementing RDFS-T to express these mappings.
Semantic Web and Electronic Commerce: Mapping and Integration

Direct communications between $m$ suppliers and $n$ customers $= n \times m$ mappings.

Mediated communications between $m$ suppliers and $n$ customers $= n + m$ mappings.

Chaos ... and ...

- RDF Schema is used to represent an intermediate ontology.

$\Rightarrow$ It reduces the number of mappings from $n \times m$ to $n + m$.
Semantic Web and Electronic Commerce: Mapping and Integration

GoldenBullet
3.2 Semantic Web and Electronic Commerce: Mechanization

• Currently all elements of Ecommerce are based on using XML to semi-structure natural language descriptions.

• Description of Products, Services, and Vendors are not machine processable and require the human in the loop.

  ==> This seriously limits the potential use of Ecommerce.

  ==> Semantic Web technology beyond XML can make it to a different story.
Semantic Web and Electronic Commerce: Mechanization

Services offered by advanced semantic web technology:

- Automatic vendor recognition.
- *Automatic product and service recognition.*
- *Price and quality comparison.*
- Automatic negotiation protocols.
- Automated coalition forming of vendor groups.
Semantic Web and Electronic Commerce: Mechanization

Semantic-Web enabled Ecommerce:
Automated support in product and service recognition, vendor selection, virtual enterprise formulation, information transformation and mapping, and automated price negotiation.

- UDDI
- WSDL
- SOAP
- UNSPSC
- ebXML

Ecommerce
4 Conclusions

• Currently, semantic web technology beyond XML cannot provide many applications.

• Most of them are topic map like stuff in information access, i.e., in knowledge management.

• The web used in Ecommerce is completely organized around XML.

• This is a danger for the semantic web, however, there is also an interesting challenge.

• Automatization in business processes and efficient integration service require semantic web technology beyond XML.