



## CLASSIFICATION OF PRODUCTS AND SERVICES TO SUPPORT BUSINESS PROCESS ENGINEERING AND E-COMMERCE

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**Abstract:** Decades ago individual approaches to classify products and services had been introduced within companies to unify products and to reduce stocks and costs. Other approaches had been introduced to support international trade and tariff systems. Today new approaches are introduced to support e-commerce and improve business processes. All these approaches are different in the way how to classify, what to classify, and what results to get – and the language they use. The harmonization of all these approaches is very difficult. But especially companies that want to take part in B2B-business need bridges between the different approaches

In this paper we first present a new XML-based system to remove the language barrier within classification systems and to improve data exchange.

In the second part we present an implementation of classification systems based on topic maps according to the XTM standard to implement single classification systems and establish mappings between corresponding classes of different classification systems.

**Keywords:** - Classification, e-Commerce, Topic Map

### 1. CLASSIFICATION OF PRODUCTS AND SERVICES FOR E-COMMERCE

#### 1.1 INTRODUCTION

In Europe the most important product and service classification for e-commerce is ecl@ss <sup>1</sup>, built by a network of supporting industries and managed by the Cologne Institute for Business Research <sup>2</sup> – the authors of this paper are associated to this institute. In America UNSPSC <sup>3</sup> is the classification system that is generally preferred. A lot of other classification systems exist for special industries and within companies.

eCl@ss features a four level, hierarchical classification key with a keyword index containing 14,000 terms. The hierarchical levels are: segment, main group, group and commodity class. This system provides a structure for classifying all materials and services, with a degree of detail that is well suited to the requirements of the industry to improve procurement and other processes.

In ecl@ss classes are linked to a set of attributes that can be used to describe the products of the class in a uniform way – to improve the communication

between suppliers and buyers. In the middle of the year 2003 ecl@ss is available in German, English, Spanish, Italian, Czech and French. The Russian version is available as a prototype – at the State Economical University Minsk and at the Fachhochschule in Dortmund we work on this version.

20	Packing material
21	Tools, machine tools
22	Construction technology
23	Machine element, fixing
24	Communication technology, office
25	Service
26	Energy, basic chemicals, aux. agents
27	Automation, electrical-engineering,.
27-11	Lighting installation, device
27-11-01	Lighting installation (interior)
27-11-02	Lighting installation (outside)
27-11-03	Interior light
27-11-04	Exterior lamp
27-11-05	Explosion proof light
27-11-06	Light medium
27-11-06-01	Fluorescent light
27-11-06-02	Energy saving light
27-11-06-03	Lightbulb (fluorescent)
28	Automotive technology
29	Home economics, technology
30	Operating, cleaning material,

<sup>1</sup> www.eclass.de

<sup>2</sup> http://www.iwkoeln.de/

<sup>3</sup> www.unspsc.com/

	equipment
31	Polymers
32	Laboratory material, technology
33	Installation (complete, turnkey)
34	Medicine, medical technology
35	Semifinished products, materials
36	Machine, apparatus
37	Pipeline technology
38	Chemical product (inorganic)
39	Chemical product (organic)
40	Occupational safety, accident prevention
41	Advertising

**Fig. 1 - All segments and some main groups, groups and commodity classes of ecl@ss.**

Some classes are linked to synonyms. For commodity class 27-11-06-03 lightbulb, light bulb, general purpose lamp (bulb) are keywords - synonyms. All keywords can be used to search for classes.

Classes are linked to attribute sets. The commodity class 27-11-06-03 is linked to attributes like capacity, color of glass body, product type, and voltage. These attributes are used for the specification of a lightbulb in a tender or in an order. If buyer and supplier use the same attribute sets offers, orders and other documents can be selected and handled more or less automatically.

## 1.2 THE NEW ECL@SS-XML-JSP-APPROACH

The ecl@ss-approach used so far separates the different language modules totally. If a German buyer for example selects a class and its attributes based on the German classification and wants to send an order to a Spanish company, he is not able to switch from the class descriptions and attributes in German to the corresponding descriptions and attributes in Spanish – or any other language.

In his master thesis Gerd Rosarius<sup>4</sup> presented a new system based on XML and JSP to support the classification of products and services according to ecl@ss with additional assistance to work in different languages. This prototype system is also the first step to improve data exchange.

The following figure shows the XML-specification of the class for lightbulbs. There are “universal” elements that hold the identification and the classification number, and there are elements for specific languages – the descriptions of the lightbulb in Russian, German and English, and keywords in

several languages.

```

<subclass featurelist="2" id="AAB808001"
      revision="001" version="001">
  <identification>AAB8008</identification>
  <classification_no>27110603</classification_no>
  <description lang="ru">Лампа накаливания
    </description>
  <description lang="en">Lightbulb (fluorescent)
    </description>
  <description lang="de">Glyhlampe
    (Leuchtmittel)
    </description>

  <keyword lang="en">General purpose
    lamp
    (bulb)</keyword>
  <keyword lang="en">Light
    bulb</keyword>

  <keyword lang="de">Glyhbirne
    (Leuchtmittel)</keyword>
  <keyword lang="de">Allgebrauchslampe
    (Glyhbirne)</keyword>
</subclass>

```

**Fig. 2 - XML representation of ecl@ss class 27-11-06-03.**

Based on this approach the user of ecl@ss-XML-JSP can follow the classification tree in his language. If he comes to the class he needs he can switch at that node to any description that is implemented and can send this description to his foreign partner.

## 2. CLASSIFICATION OF PRODUCTS AND SERVICES BASED ON TOPIC MAPS

XTM provides an XML-based notation for representing information based on topics, and the relationships between topics. A topic map defines a multidimensional topic space — a space in which the locations are topics, and in which the distances between topics are measurable in terms of the number of intervening topics which must be visited in order to get from one topic to another, and the kinds of relationships that define the path from one topic to another. A topic map provides links to any kind of documents including URLs related to the topics mentioned in the topic map. Topic map engines for web browsers are available to navigate through topic maps based on XTM – for example OMNIGATOR<sup>®5</sup>, USU<sup>®6</sup> or EMPOLIS K42<sup>®7</sup>.

<sup>4</sup> Gerd Rosarius: Entwicklung eines Anwendungssystems zur Darstellung einer mehrsprachigen Klassifikation von Waren und Dienstleistungen im e-Commerce basierend auf XML und JSP, Dortmund 2003.

<sup>5</sup> <http://www.ontopia.net>

<sup>6</sup> [www.usu.de](http://www.usu.de)

## 2.1 A MONO-HIERARCHICAL APPROACH FOR ECL@SS

Topic maps can be used to implement classification systems. In the first step metadata are defined to prepare the tree for any hierarchical classification. First we start with a mono-hierarchical representation for **ecl@ss**. Using the OMNIGATOR<sup>®</sup> topic map engine and the Internet Explorer<sup>®</sup> we can navigate through the frames or the graphical representation of the class hierarchy.

The class hierarchy is based on a general metadata definition for a topic **superclass** and a topic **subclass** according to XTM.

```
<topic id="superclass">
<subjectIdentity>
<subjectIndicatorRef
  xlink:href="http://www.topicmaps.org/xtm/
    1.0/core.xtm#superclass"/>
</subjectIdentity>
<baseName>
<baseNameString>superclass</baseNameString>
</baseName>
</topic>
<topic id="subclass">
<subjectIdentity>
<subjectIndicatorRef
  xlink:href="http://www.topicmaps.org/xtm/
    1.0/core.xtm#subclass"/>
</subjectIdentity>
<baseName>
<baseNameString>subclass</baseNameString>
</baseName>
</topic>
```

Fig. 3 - First group of metadata in the topic map.

Thereafter topic types and topics for individual classes can be introduced. **eClass classes** is the root element for classification tree representing **ecl@ss**.

```
<topic id="eClass classes">
<baseName>
<baseNameString>eClass
  classes</baseNameString>
</baseName>
</topic>
<topic id="eClass attributes">
<baseName>
<baseNameString>eClass
  attributes</baseNameString>
</baseName>
</topic>
<topic id="20">
<baseName>
```

```
<baseNameString>Packing
material</baseNameString>
<variant>
<parameters>
<topicRef xlink:href="#eClass ID"/>
</parameters>
<variantName>
<resourceData>20</resourceData>
</variantName>
</variant>
</baseName>
</topic>
```

Fig. 4 - Some topics to implement ecl@ss.

The following figures show the OMNIGATOR-Internet Explorer-presentation of a topic map with a partial representation of **ecl@ss**.

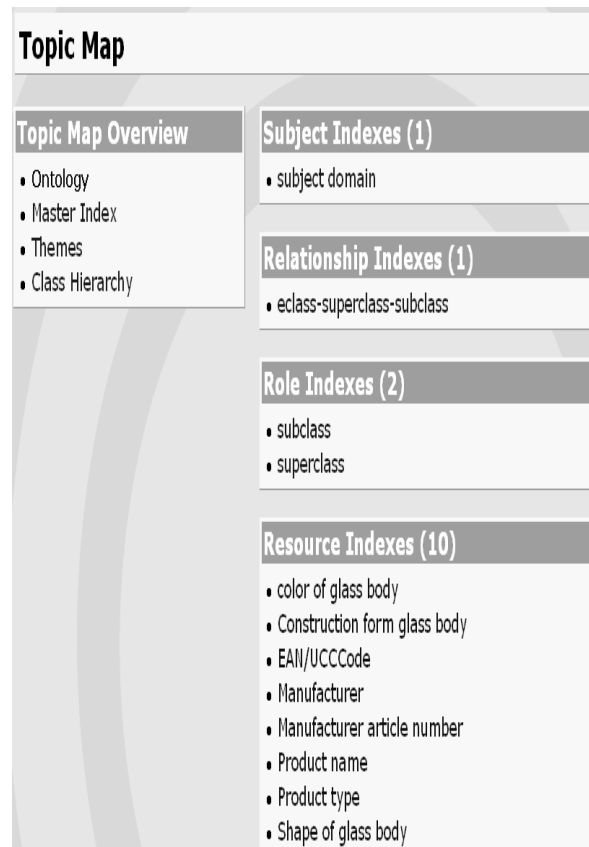


Fig. 5 - Top level representation of a topic map for **ecl@ss**.

The graphical representation shown above is only available for one and only one hierarchy within the topic map. That is a restriction, but no problem. The graphical representation for classification systems is often useless because of the branching type of these trees, where one node may have about 50 successors. The following approach ignores graphical representations but supports multiple hierarchies. All approaches are open to the representation of synonyms, attributes, ... .

<sup>7</sup> <http://k42.empolis.co.uk/>

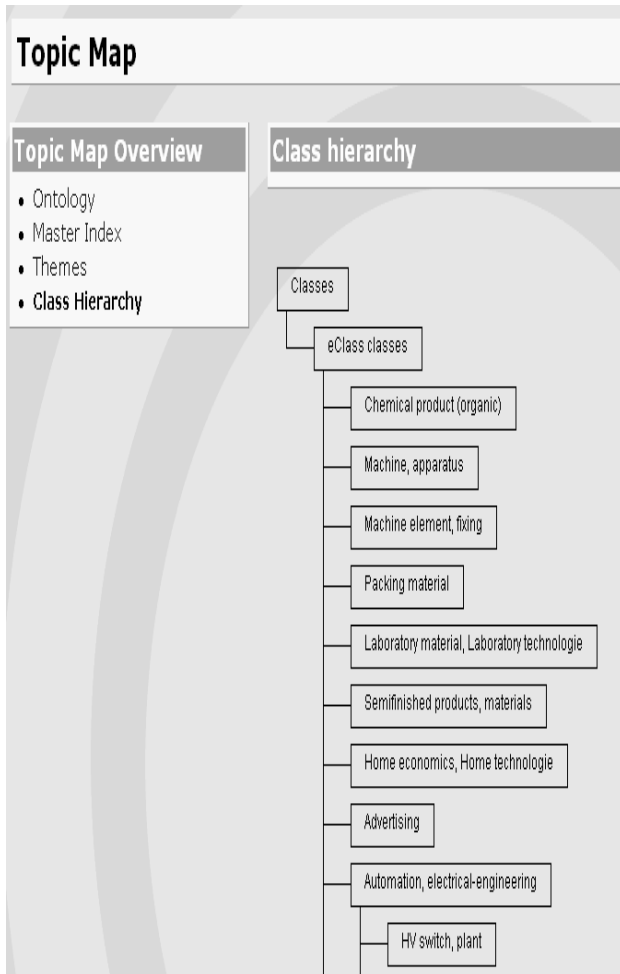


Fig. 6 - Top level representation of a topic map for ecl@ss – graphical class hierarchy.

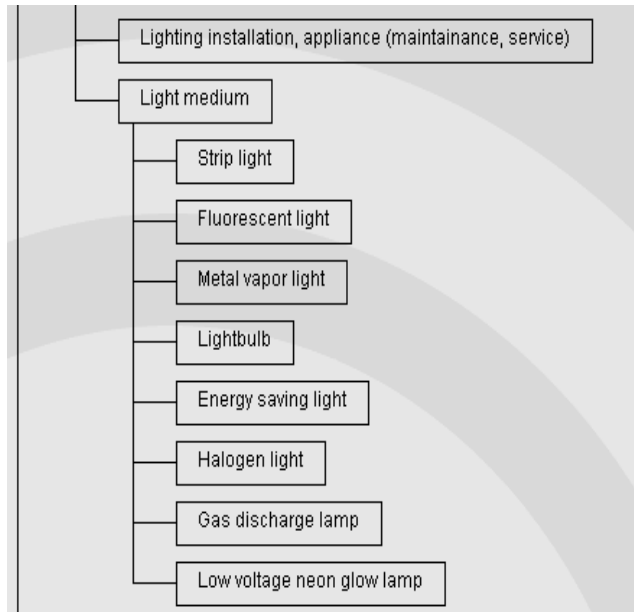


Fig.8 - Graphical representation of the class Lightmedium with some commodity classes.

## 2.2 AN OPEN APPROACH FOR UNSPSC

The UNSPSC-approach for the classification of products and services is quite different from ecl@ss. The following figure shows some segments and some families, classes and commodity classes of UNSPSC.

10000000	Live Plant and Animal Material and Accessories and Supplies
11000000	Mineral and Textile and Inedible Plant and Animal Materials
12000000	Chemicals including Bio Chemicals ..
13000000	Resin and Rosin and Rubber and Foam and Film and Elastomeric Mat.
14000000	Paper Materials and Products
15000000	Fuels and Fuel Additives ...
20000000	Mining Machinery and Accessories
21000000	Farming and Fishing and Forestry and Wildlife Machinery ...
22000000	Building and Construction Machinery
23000000	Industrial Manufacturing and Processing Machinery
24000000	Material Handling and Conditioning and Storage Machinery ..
25000000	Commercial and Military and Private Vehicles and their Accessories ...

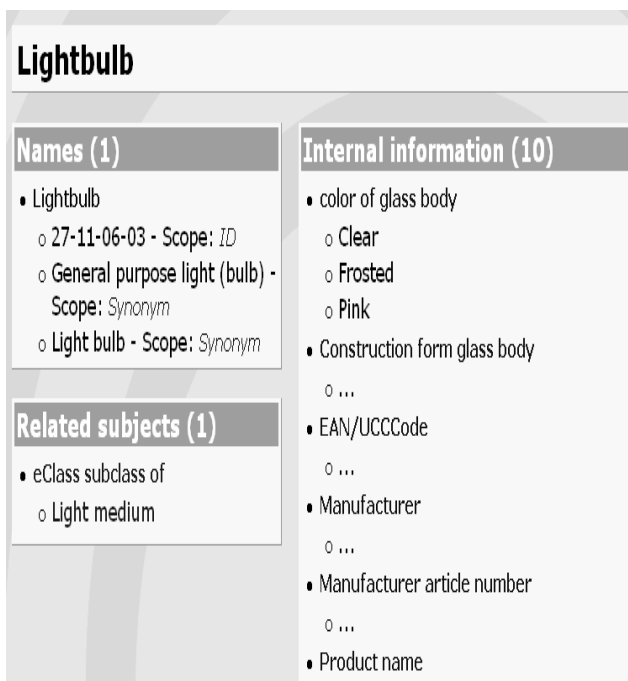


Fig.7 - Bottom level representation of the commodity class Lightbulb – subclass of Light medium.

26000000	Power Generation and Distribution Machinery and Accessories	</topic> <topic id="commodity"> <baseName> <baseNameString>UNSPSC Commodity </baseNameString>
27000000	Tools and General Machinery	</baseName>
30000000	Structures and Building and Construction and Manufacturing Components and Supplies	</topic> <topic id="entry.10.10.15.01"> <instanceOf> <topicRef xlink:href="#commodity"/> </instanceOf> <subjectIdentity> <subjectIndicatorRef xlink:href="urn:x- unspsc:10.10.15.01"/> </subjectIdentity>
31000000	Manufacturing Components ...	<baseName>
32000000	Electronic Components and Supplies	<baseNameString>Cats</baseNameString> </baseName>
39000000	Lighting and Electrical Accessories and Supplies	</topic>
39100000	Lamps and lightbulbs and lamp components	<baseNameString>Cats</baseNameString> </baseName>
39101600	Lamps	</topic>
39101601	Halogen lamps	
39101602	Medical lamps	
39101603	Solar lamps	
39101604	Alcohol lamps	
39101605	Fluorescent lamps	

Fig. 9 - Some segments and some families, classes and commodity classes of UNSPSC

Most segments in UNSPSC have no corresponding element in ecl@ss - for example **10000000**. Some parts of the classification trees are similar, for example the parts for lamps and light media. But it is really a hard problem for those who need both classification systems to build the bridges between them.

A first topic map-approach for UNSPSC is available at [http://www.techquila.com/tmsamples/xtm/unspsc/unspsc\\_11.zip](http://www.techquila.com/tmsamples/xtm/unspsc/unspsc_11.zip). There are topic types for segments, families, classes and commodities, and topics for the individual occurrences of these types.

```
<topic id="segment">
<baseName>
<baseNameString>UNSPSC Segment
</baseNameString>
</baseName>
</topic>
<topic id="family">
<baseName>
<baseNameString>UNSPSC Family
</baseNameString>
</baseName>
</topic>
<topic id="class">
<baseName>
<baseNameString>UNSPSC Class
</baseNameString>
</baseName>
```

Fig. 10 - Topics for UNSPSC.

There are topics to define association types, for example the following topic to define an association type between segments and families.

```
<topic id="assoc-segment-family">
<baseName>
<baseNameString>UNSPSC Segment Consists Of
Families</baseNameString>
</baseName>
<baseName><scope>
<topicRef xlink:href="#segment"/></scope>
<baseNameString>Families</baseNameString>
</baseName>
<baseName><scope>
<topicRef xlink:href="#family"/></scope>
<baseNameString>Belongs To Segment
</baseNameString> </baseName>
</topic>
```

Fig. 11 - Topic for an association type.

There are associations defined according to the topic types, for example the following association between segment **10000000 Live Plant and Animal Material and Accessories and Supplies** and family **10100000 Live Animals**.

```
<association>
<instanceOf>
<topicRef xlink:href="#assoc-segment-family"/>
</instanceOf>
<member>
<roleSpec><topicRef
```

```

xlink:href="#segment"/></roleSpec>
<topicRef
xlink:href="#entry.10.00.00.00"/></member>

<member>
<roleSpec><topicRef
xlink:href="#family"/></roleSpec>
<topicRef
xlink:href="#entry.10.10.00.00"/></member>

</association>

```

Fig. 12 - Topic for an association.

The following figure shows the OMNIGATOR® view of the complete topic map for UNSPSC – top level view.

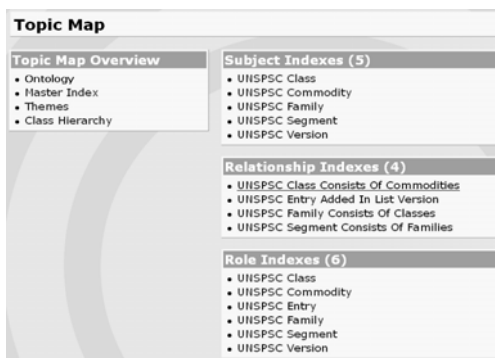


Fig. 13 - UNSPSC topic map OMNIGATOR® view.

The following figure shows the OMNIGATOR® view of the UNSPSC segment 39000000.

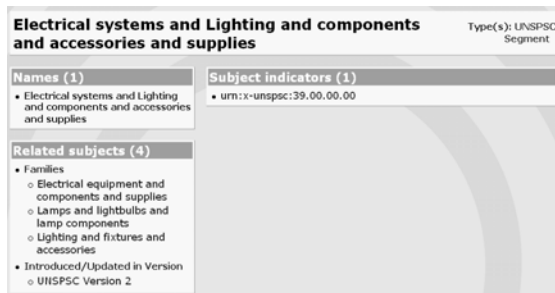


Fig. 14 - UNSPSC topic map OMNIGATOR® view – detail.

This approach is appropriate for UNSPSC, but not appropriate if we want to build a topic map including several classification systems and bridges between corresponding elements. To open the topic map we have to find a unique way to define the topics of all included classification systems. The following figure shows a first step to get unique topic types.

```

<topic id="unspsc-segment"><baseName>
<baseNameString>UNSPSC Segment
</baseNameString></baseName></topic>

```

```

<topic id=" unspsc-family"><baseName>
<baseNameString>UNSPSC Family
</baseNameString></baseName></topic>

```

```

<topic id=" unspsc-class"><baseName>
<baseNameString>UNSPSC
Class</baseNameString>
</baseName></topic>

```

```

<topic id=" unspsc-commodity"><baseName>
<baseNameString>UNSPSC Commodity
</baseNameString></baseName></topic>

```

```

<topic id="eclass-segment"><baseName>
<baseNameString>eclass Segment
</baseNameString></baseName></topic>

```

```

<topic id="eclass -main-group"><baseName>
<baseNameString>eclass Main Group
</baseNameString></baseName></topic>

```

```

<topic id=" eclass-group"><baseName>
<baseNameString>eclass
Group</baseNameString>
</baseName></topic>

```

```

<topic id=" eclass-commodity"><baseName>
<baseNameString>eclass Commodity
</baseNameString></baseName></topic>

```

Fig. 15 - Unique topic types.

Based on these topic types different association types can be defined to build different kind of bridges between corresponding elements of various classification systems.

```

<topic id="assoc-unspsc-commodity-eclass-
commodity">

```

```

<baseName>
<baseNameString>Corresponding Commodities
UNSPSC-eclass</baseNameString>
</baseName>

```

```

<baseName><scope>
<topicRef
xlink:href="#eclass-
commodity"/></scope>
<baseNameString>eclass Commodity
</baseNameString> </baseName>

```

```

<baseName><scope>
<topicRef
xlink:href="#unspsc-
commodity"/></scope>
<baseNameString>UNSPSC Commodity
</baseNameString> </baseName>
</topic>

```

Fig. 16 - Association type

Based on such association types concrete links

between corresponding classes can be defined.

### 3. CONCLUSION

#### 3.1 RESULTS

XML gives us the key to use classification systems in a multilingual environment. Topic maps give us the key to a representation of classification systems supporting associations between different classification systems.

This result is important to support “standards” like UNSPSC or ecl@ss, it is even more important today to support mappings between in-house-systems and “standards”. In-house-systems are used in any bigger company to support workflows and reduce stocks and costs. It is a hard job and it will take a lot of years to convert from the in-house-system to a “standard”. And most companies will not even start to convert now, because all “standards” are still weak in some aspects and the evolution of the “standards” is going on and in some aspects is far away from the level some companies need. So in the time of globalization and mergers the mapping of in-house-systems and “standards” is necessary to support business processes and e-commerce.

The topic map approach is appropriate for all classification systems used. For a single classification system like ecl@ss about  $10^5$  topics are necessary to implement the system - language versions implemented as variants and separated by scopes.

That is within the range of topic map engines and similar approaches. So that is a key to solve the problem to integrate different classification systems and different language versions.

An essential point is that topic maps are appropriate for a precise description of complex topics and associations with a lot of different roles and many kinds of relations.

#### 3.2 FURTHER RESEARCH

There are so many classification systems for products, processes, services, patents, job etc. one has to use almost every day in a bigger company for customs documents or patent registration<sup>8</sup> or the statistical organizations<sup>9</sup> – and they all are different – and there are no appropriate mappings between them. Even the mappings between UNSPSC and the Harmonized Classes of the World Customs Organization<sup>10</sup> failed so far<sup>11</sup>. Both classification

systems have common roots – but passed through an evolution that made the systems incompatible.

A unification of these classifications will not come within our generation. The structure of the classification systems is based on different needs and interests. The Harmonized Classes of the WCO for example do not include services because one does not need that for customs documents. And a lot of branches starting at similar segments are expanded in different ways.

If we are not able to unify these classification systems, we must build mappings between them. For mass mappings we need high sophisticated methods and tools – classifiers, text miners, a new kind of dictionaries, etc.

### 4. REFERENCES

- [1] Peter J. R. Reusch e.a.. *Klassifikation von Waren und Dienstleistungen*. Dortmund 2003.



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<sup>8</sup> <http://www.european-patent-office.org/>

<sup>9</sup> <http://europa.eu.int/comm/eurostat/>

<sup>10</sup> <http://www.wcoomd.org/ie/En/en.html>

<sup>11</sup> <http://www.eccma.org/unspsc/crosswalk.htm>

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