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XML

XML

Prof. Dr.-Ing. Martin Gaedke

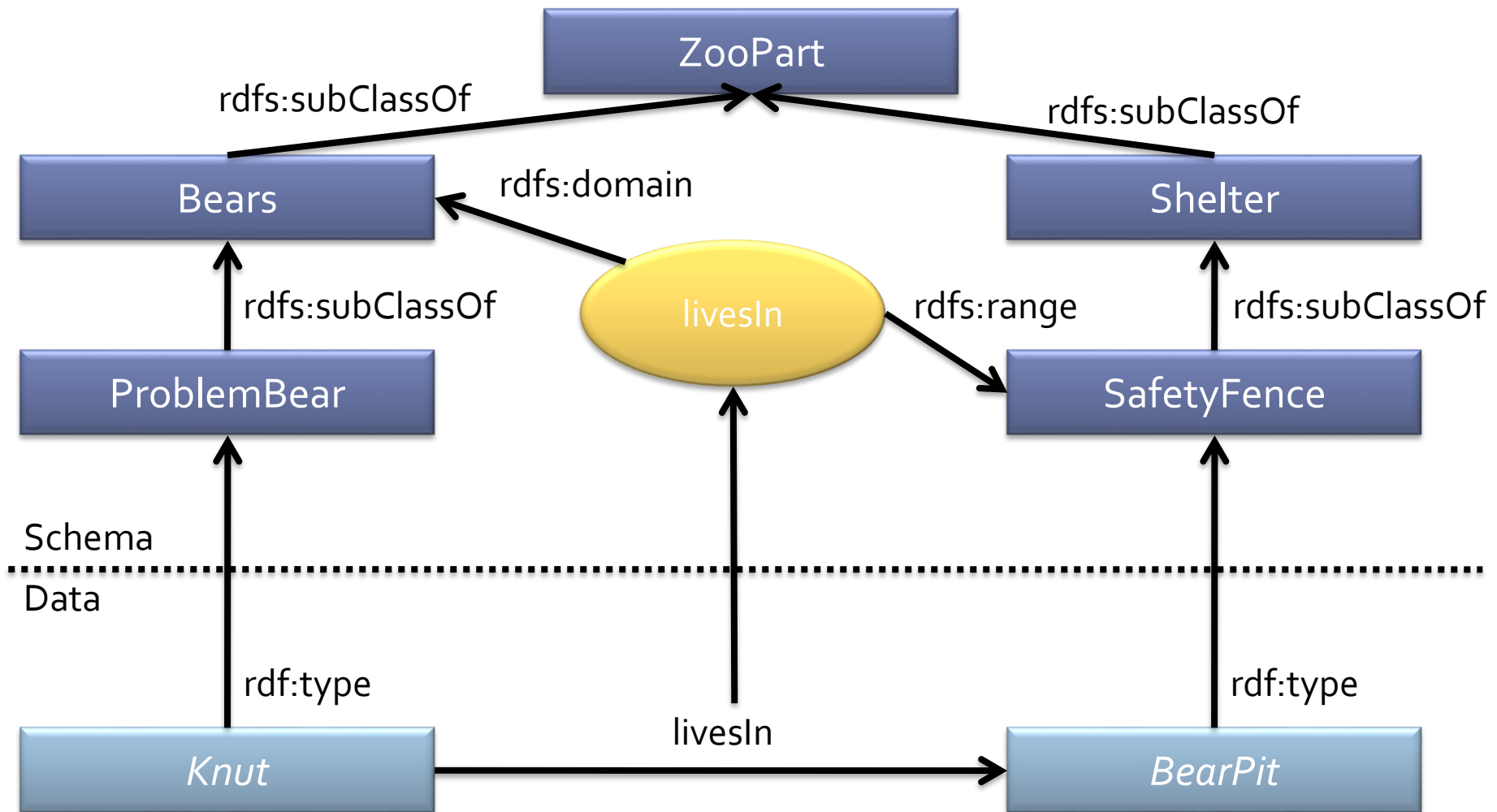Technische Universität Chemnitz

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http://vsr.informatik.tu-chemnitz.de

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RDF Schema Example (1)

ZooPart

rdfs:subClassOf

rdfs:subClassOf

Bears

rdfs:domain

Shelter

rdfs:subClassOf

livesIn

rdfs:range

rdfs:subClassOf

ProblemBear

SafetyFence

Schema

....

Data

rdf:type

livesIn

rdf:type

Knut

BearPit

RDF Schema Example (2)

- Example: Schema in XML

- RDF data can now be interpreted using this schema

  - Cardinality becomes clear through merging of further RDFS statements and RDF(S) systems

```xml
<?xml version="1.0" encoding="utf-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#">
  <rdf:Property rdf:Id="wohntIn">
    <rdfs:range rdf:resource="#Sicherheitsgehege"/>
    <rdfs:domain rdf:resource="#Baeren"/>
  </rdf:Property>
</rdf:RDF>
```

RDF Schema Further Concepts

- RDF Schema describes a variety of further properties and classes – which, thus, also belong to the concepts, i.e.
  - Collections (in the sense of lists)
  - Container: sequence, bag etc.
  - Reification: rdf:subject, rdf:predicate, rdf:object, rdf:value

- Example:

```xml
<?xml version="1.0" encoding="utf-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
         xmlns:zt="http://zoo.../ev#">
  <rdf:Description rdf:about="#Gefahrenlist">
    <zt:bestehtAus rdf:parseType="Collection">
      <!--Erst Bären-->
      <rdf:Description rdf:about="#Knut"/>
      <rdf:Description rdf:about="#Teddy"/>
      <!--Dann Löwen-->
      <rdf:Description rdf:about="#Partyloewe"/>
    </zt:bestehtAus>
  </rdf:Description>
</rdf:RDF>
```

Literals (1)

- Literals can have a data type
  - i.e. integer, boolean etc. and other XML schema data types
  - Complex structures and restrictions via XML schema data types
  - XML fragments
- Natural language can be specified
  - Via xml:lang

```xml
<?xml version="1.0" encoding="utf-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
         xmlns:zt="http://zoo.../ev#">
  <rdf:Description rdf:about="#Baer">
    <zt:istGefaehrlich
      rdf:datatype="http://www.w3.org/2001/XMLSchema#boolean">
      True
    </zt:istGefaehrlich >
  </rdf:Description >
</rdf:RDF>
```

Literals (2)

- Literals enable binding of XML vocabularies
  - Object of the statement is an XML fragment

```xml
<?xml version="1.0" encoding="utf-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
         xmlns:zt="http://zoo.../ev#">
  <rdf:Description rdf:about="#Baer">
    <zt:alterImVergleichZumMenschen rdf:parseType="Literal">
      <m:math xmlns:m="...">
        <m:apply>
          <m:plus/>
          <m:ci>x</m:ci>
          <m:ci>12</m:ci >
        </m:apply>
      </m:math >
    </zt:alterImVergleichZumMenschen>
  </rdf:Description>
</rdf:RDF>
```

Chapter 17
RDF(S) IN ACTION

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RDF in Practice

- Registered mime-type for RDF/XML
  - application/rdf+xml
- Suggested data name extension: .rdf
- RDF in XML resources
  - Application of RDF is possible by use of the RDF namespace

```xml
<?xml version="1.0" encoding="utf-8"?>
<svg>
  ...
  <metadata>
    <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
             xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
             ...>
      ...
    </rdf:RDF>
  </metadata>
</svg>
```
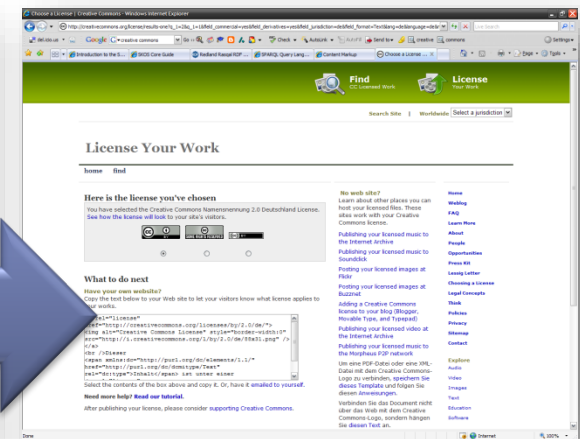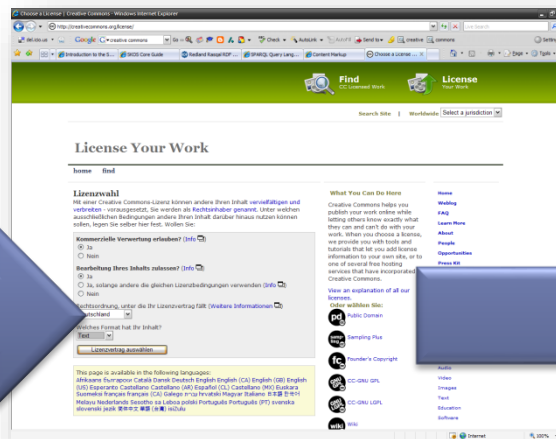
RDF in XHTML

- **XHTML is based on DTD**

  - RDF within XHTML header is, therefore, not validated

- **Current approaches (workarounds)**

  - Use of "**link/meta**" to avoid the problematic – only convention, no namespaces

  - Another approach - RDF as comments (Example Creative Commons)

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Example Creative Commons (1)

- Idea of CreativeCommons.org (CC):

  - *Creative Commons develops sample license contracts, by means of which the author can provide some freedom to his/her creation: "some rights reserved" rather than "all rights reserved"*

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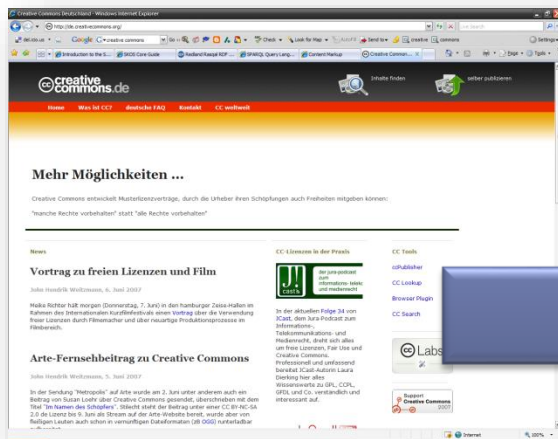
Example Creative Commons (2)

- Use in HTML *(via RDFa)*

  <**a** *rel="license" href="http://creativecommons.org/licenses/by/2.0/de/"*>

  <**img** alt="Creative Commons License" style="border-width:0" src="http://i.creativecommons.org/l/by/2.0/de/88x31.png" />

  </**a**>

  <**br** />This

  <**span** xmlns:dc="http://purl.org/dc/elements/1.1/" *href="http://purl.org/dc/dcmitype/Text" rel="dc:type"*>content</**span**>
  is licensed under the

  <**a** *rel="license" href="http://creativecommons.org/licenses/by/2.0/de/"*>
  Creative Commons License</**a**>.

Various Tools for RDF, etc.

- Graphical editors
  - RDF: IsaFiz (Xerox Research / W3C), RDFAuthor, Longwell (MIT)
  - OWL: Protege 2000 (Stanford University), SWOOP (University of Maryland), IBM Integrated Ontology Development Toolkit (for Eclipse) by IBM Alphaworks, Altova…
  - Further Tools: http://projects.semwebcentral.org/
- Programming environment
  - Jena, rdflib, etc.
- Validators (*Good to learn*;-)
  - W3C RDF Validator (http://www.w3.org/RDF/Validator/)
  - Pellet (http://www.mindswap.org/2003/pellet/demo.shtml)
- Schema/Ontology/RDF Data Registries
  - http://www.rdfabout.com/data.xpd
  - http://rdfdata.org/
  - Many RDF datasets for learning, z.B. WordNet, DBLP, CIA World Fact Book, W3C Glossary and Dictionary Entries, Music, Flickr etc.
- Semantic Web Search
  - http://swoogle.umbc.edu/

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Database etc. Support

- Oracle Database 10g

  - Supports storing RDF statements

  - Queries in use with SDO_RDF_MATCH (in connection with SQL)

  - Support similar to SPARQL at the API level

  - http://www.oracle.com/technology/tech/semantic_technologies/index.html

- IBM and Semantic Web

  - In the field of Life Sciences

  - http://www.alphaworks.ibm.com/topics/semantics

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Semantic Web Applications...

- Mostly still predominantly centralized
- First interesting development
  - RDF version of Wikipedia
  - US Congress (Tracking database with over 25 million triples) → http://www.govtrack.us/data/rdf/
- Commercialization
  - Alongside Oracle, IBM, further diff.
  - Semantic Technology Conference (commercial conference): http://www.semantic-conference.com/
- In use @ Boeing, MITRE Corp., Elsevier, EU projects

In Use @ Boeing...

- **RDF Representation of Metadata for Semantic Integration of Corporate Information Resources**, von Tom Barrett, David Jones, Jun Yuan, John Sawaya, Mike Uschold, Tom Adams, Deborah Folger, *The Boeing Company*

```xml
<?xml version='1.0' encoding='ISO-8859-1'?>
<!DOCTYPE rdf:RDF [
        <!ENTITY rdf 'http://www.w3.org/1999/02/22-rdf-syn
        <!ENTITY a 'http://mct.pw.boeing.com/qry#'>
        <!ENTITY b 'http://mct.pw.boeing.com/pdm#'>
]>
<rdf:RDF xmlns:a="&a;"
        xmlns:rdf="&rdf;"
        xmlns:b="&b;">
<a:Request rdf:about="&a;Request1">
        <a:RequestedClassReference rdf:resource="&a;CR1"/>
</a:Request>
<a:ClassReference rdf:about="&a;CR1">
        <a:HasClass rdf:resource="&b;AircraftPartDesign"/>
</a:ClassReference>
<a:PropertyReference rdf:about="&a;PR1">
        <a:HasClassReference rdf:resource="&a;CR1"/>
        <a:HasProperty rdf:resource="&b;PartDescription"/>
</a: PropertyReference>
<a:PropertyReference rdf:about="&a;PR2">
        <a:HasClassReference rdf:resource="&a;CR1"/>
        <a:HasProperty rdf:resource="&b;PartOf"/>
</a: PropertyReference>
</rdf:RDF>
```
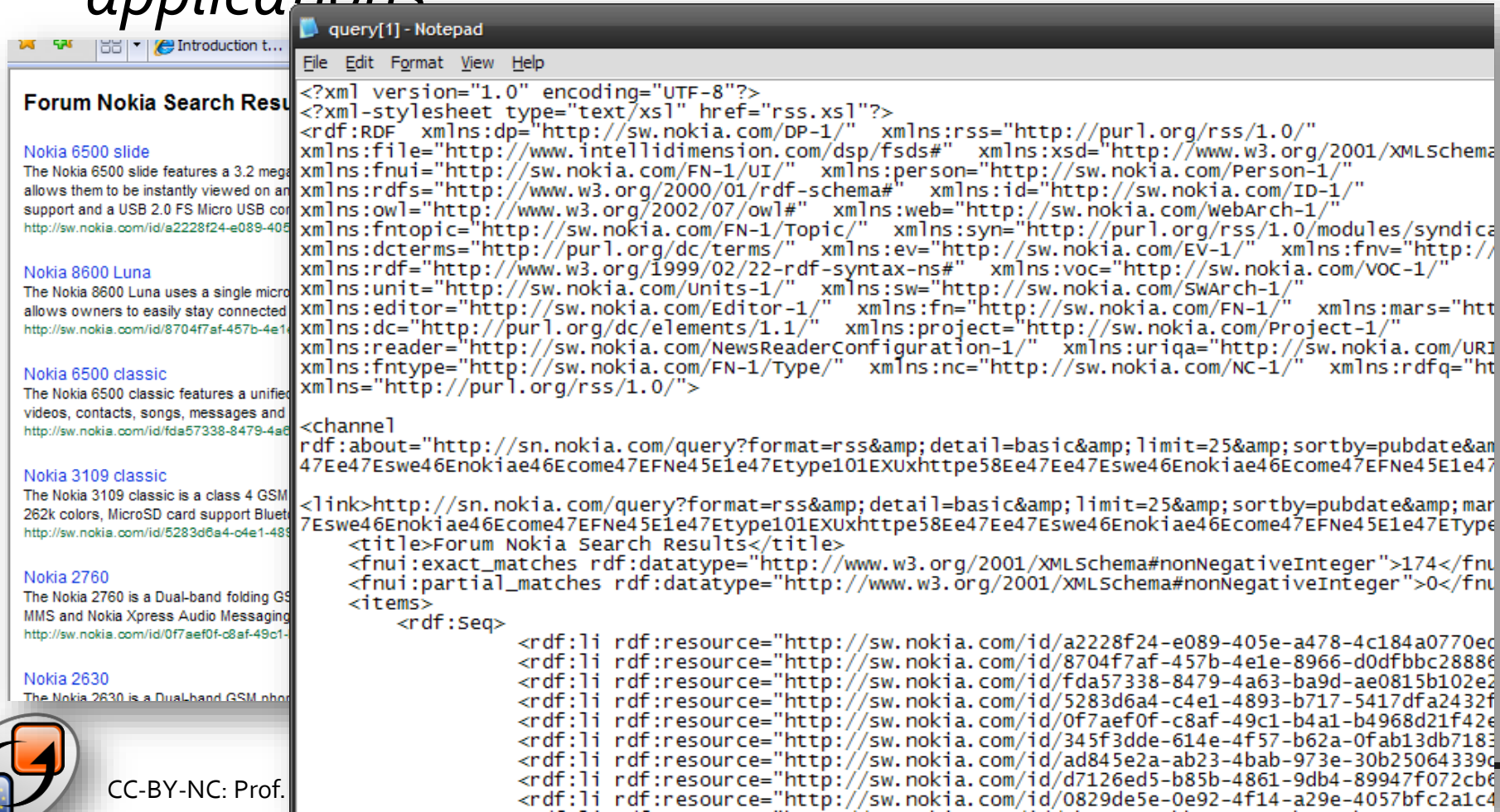
Figure 3 – Example Query

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In Use @ NOKIA...

- *For example to support search and other applications*

Forum Nokia Search Resu...

Nokia 6500 slide
The Nokia 6500 slide features a 3.2 mega
allows them to be instantly viewed on an
support and a USB 2.0 FS Micro USB con
http://sw.nokia.com/id/a2228f24-e089-405

Nokia 8600 Luna
The Nokia 8600 Luna uses a single micro
allows owners to easily stay connected
http://sw.nokia.com/id/8704f7af-457b-4e14

Nokia 6500 classic
The Nokia 6500 classic features a unified
videos, contacts, songs, messages and
http://sw.nokia.com/id/fda57338-8479-4a6

Nokia 3109 classic
The Nokia 3109 classic is a class 4 GSM
262k colors, MicroSD card support Bluet
http://sw.nokia.com/id/5283d6a4-c4e1-489

Nokia 2760
The Nokia 2760 is a Dual-band folding G5
MMS and Nokia Xpress Audio Messaging
http://sw.nokia.com/id/0f7aef0f-c8af-49c1-

Nokia 2630
The Nokia 2630 is a Dual-band GSM phon

query[1] - Notepad

File   Edit   Format   View   Help

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="rss.xsl"?>
<rdf:RDF  xmlns:dp="http://sw.nokia.com/DP-1/"  xmlns:rss="http://purl.org/rss/1.0/"
xmlns:file="http://www.intellidimension.com/dsp/fsds#"  xmlns:xsd="http://www.w3.org/2001/XMLSchema
xmlns:fnui="http://sw.nokia.com/FN-1/UI/"  xmlns:person="http://sw.nokia.com/Person-1/"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"  xmlns:id="http://sw.nokia.com/ID-1/"
xmlns:owl="http://www.w3.org/2002/07/owl#"  xmlns:web="http://sw.nokia.com/WebArch-1/"
xmlns:fntopic="http://sw.nokia.com/FN-1/Topic/"  xmlns:syn="http://purl.org/rss/1.0/modules/syndica
xmlns:dcterms="http://purl.org/dc/terms/"  xmlns:ev="http://sw.nokia.com/EV-1/"  xmlns:fnv="http://
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"  xmlns:voc="http://sw.nokia.com/VOC-1/"
xmlns:unit="http://sw.nokia.com/Units-1/"  xmlns:sw="http://sw.nokia.com/SWArch-1/"
xmlns:editor="http://sw.nokia.com/Editor-1/"  xmlns:fn="http://sw.nokia.com/FN-1/"  xmlns:mars="htt
xmlns:dc="http://purl.org/dc/elements/1.1/"  xmlns:project="http://sw.nokia.com/Project-1/"
xmlns:reader="http://sw.nokia.com/NewsReaderConfiguration-1/"  xmlns:uriqa="http://sw.nokia.com/URI
xmlns:fntype="http://sw.nokia.com/FN-1/Type/"  xmlns:nc="http://sw.nokia.com/NC-1/"  xmlns:rdfq="ht
xmlns="http://purl.org/rss/1.0/">

<channel
rdf:about="http://sn.nokia.com/query?format=rss&amp;detail=basic&amp;limit=25&amp;sortby=pubdate&am
47Ee47Eswe46Enokiae46Ecome47EFNe45E1e47Etype101EXUxhttpe58Ee47Ee47Eswe46Enokiae46Ecome47EFNe45E1e47

<link>http://sn.nokia.com/query?format=rss&amp;detail=basic&amp;limit=25&amp;sortby=pubdate&amp;mar
7Eswe46Enokiae46Ecome47EFNe45E1e47Etype101EXUxhttpe58Ee47Ee47Eswe46Enokiae46Ecome47EFNe45E1e47EType
        <title>Forum Nokia Search Results</title>
        <fnui:exact_matches rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">174</fnu
        <fnui:partial_matches rdf:datatype="http://www.w3.org/2001/XMLSchema#nonNegativeInteger">0</fnu
        <items>
            <rdf:Seq>
                    <rdf:li rdf:resource="http://sw.nokia.com/id/a2228f24-e089-405e-a478-4c184a0770ed
                    <rdf:li rdf:resource="http://sw.nokia.com/id/8704f7af-457b-4e1e-8966-d0dfbbc28886
                    <rdf:li rdf:resource="http://sw.nokia.com/id/fda57338-8479-4a63-ba9d-ae0815b102e2
                    <rdf:li rdf:resource="http://sw.nokia.com/id/5283d6a4-c4e1-4893-b717-5417dfa2432f
                    <rdf:li rdf:resource="http://sw.nokia.com/id/0f7aef0f-c8af-49c1-b4a1-b4968d21f42e
                    <rdf:li rdf:resource="http://sw.nokia.com/id/345f3dde-614e-4f57-b62a-0fab13db7183
                    <rdf:li rdf:resource="http://sw.nokia.com/id/ad845e2a-ab23-4bab-973e-30b25064339c
                    <rdf:li rdf:resource="http://sw.nokia.com/id/d7126ed5-b85b-4861-9db4-89947f072cb6
                    <rdf:li rdf:resource="http://sw.nokia.com/id/0829de5e-0e92-4f14-a29e-4057bfc2a1c4
```
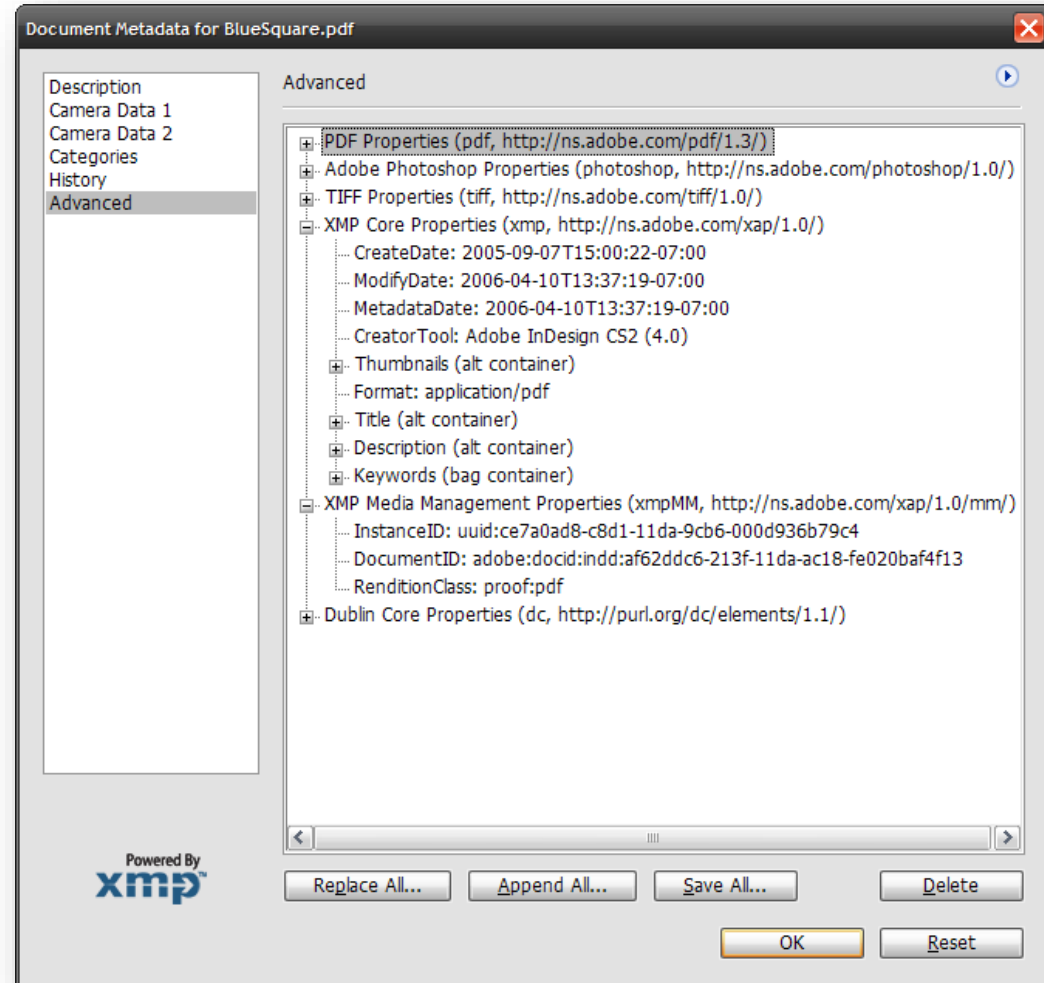
In Use @ ADOBE...

- For example, via XMP

  - Embedding metadata in documents, XMP uses RDF

xmp™
Adding Intelligence to Media

Document Metadata for BlueSquare.pdf

Description
Camera Data 1
Camera Data 2
Categories
History
Advanced

Advanced

- PDF Properties (pdf, http://ns.adobe.com/pdf/1.3/)
- Adobe Photoshop Properties (photoshop, http://ns.adobe.com/photoshop/1.0/)
- TIFF Properties (tiff, http://ns.adobe.com/tiff/1.0/)
- XMP Core Properties (xmp, http://ns.adobe.com/xap/1.0/)
    - CreateDate: 2005-09-07T15:00:22-07:00
    - ModifyDate: 2006-04-10T13:37:19-07:00
    - MetadataDate: 2006-04-10T13:37:19-07:00
    - CreatorTool: Adobe InDesign CS2 (4.0)
    - Thumbnails (alt container)
    - Format: application/pdf
    - Title (alt container)
    - Description (alt container)
    - Keywords (bag container)
- XMP Media Management Properties (xmpMM, http://ns.adobe.com/xap/1.0/mm/)
    - InstanceID: uuid:ce7a0ad8-c8d1-11da-9cb6-000d936b79c4
    - DocumentID: adobe:docid:indd:af62ddc6-213f-11da-ac18-fe020baf4f13
    - RenditionClass: proof:pdf
- Dublin Core Properties (dc, http://purl.org/dc/elements/1.1/)

Powered By
xmp™

Replace All...   Append All...   Save All...   Delete

OK   Reset

Further developments

- SPARQL
- OWL
- RDFa
- GRDDL

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