



RDF & FRBR Applications

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RDF & Internet standards

- TCP/IP: Transmission
- HTTP: Transport
- HTML: Layout & Presentation
- XML: Data structure
- RDF: Semantic Relationships
- SOAP: Remote Procedure Calls
- WSDL: Web Services Description



RDF Overview

- Describe semantic relationships between (electronic) resources
- Independent of any specific ontology
- Oriented labelled graph representation
- Triple structure representation
- XML Serialization syntax
- RDF Schema to describe ontologies



RDF Semantic Model

- Objects (*Resources*) are linked together by typed relationships (*Properties*)
- RDF triples:
- *Subject* = Resource being described
- *Predicate* = Property of the resource
- *Object* = Value of the property



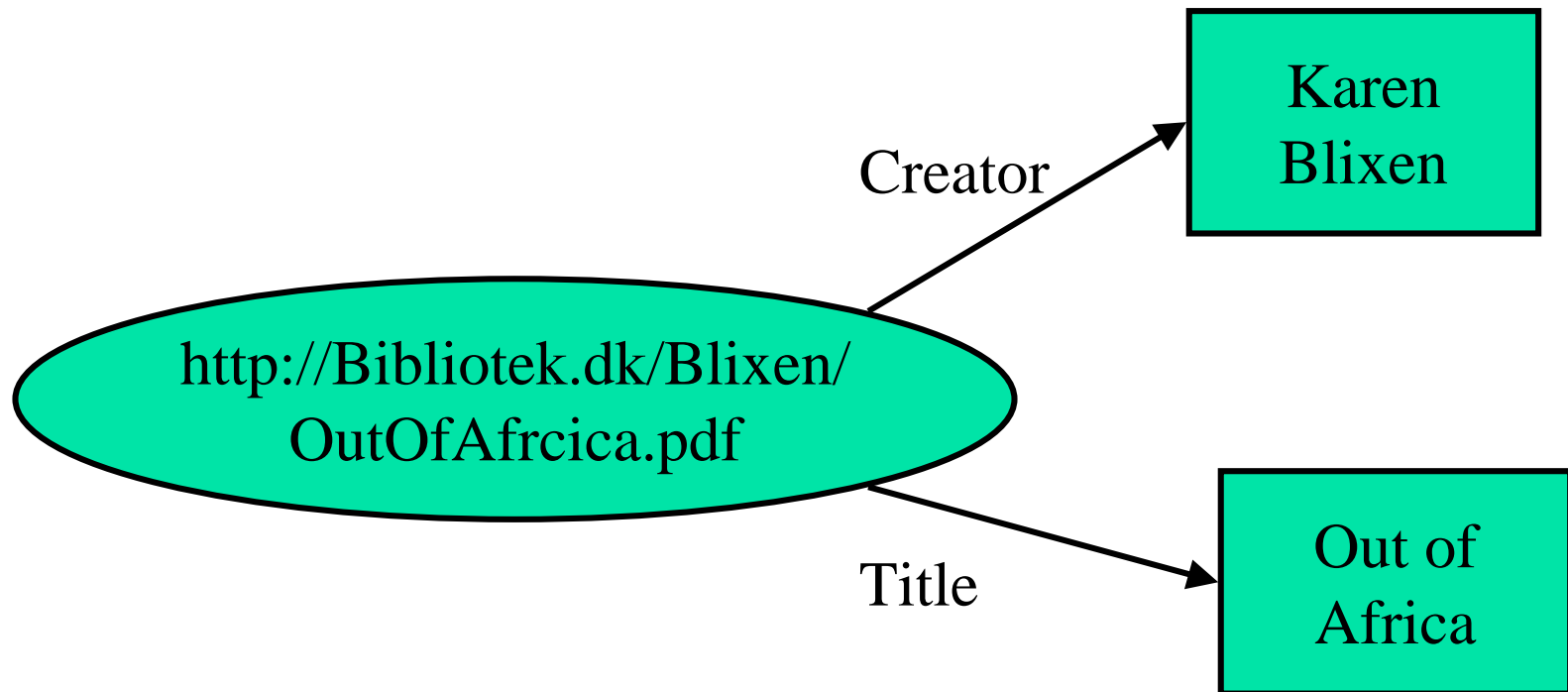
RDF Statement

- The resource

<http://Bibliotek.dk/Blixen/OutOfAfrica.pdf> (*Subject*).

- has the Title (*Property*) = "Out of Africa" (*Value*)
- has the Creator (*Property*) = "Karen Blixen" (*Value*)

RDF graph





RDF XML Serialization

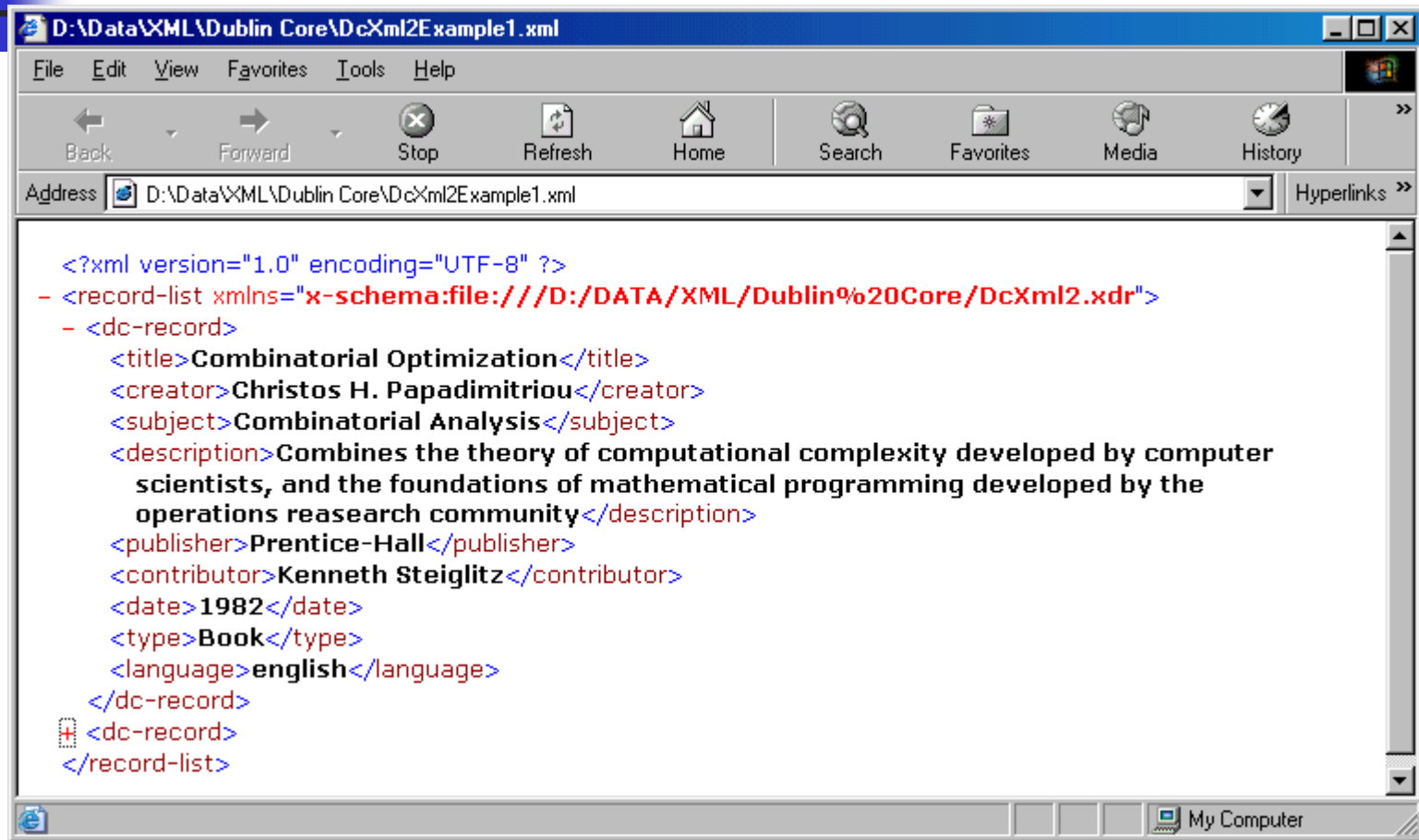
```
<rdf:Description
  rdf:about="http://Bibliotek.dk/Blixen/OutOfAfrica.pdf" >
  <dc:title> Out of Africa </dc:title>
  <dc:creator> Karen Blixen
  </dc:creator>
  <dc:language> en </dc:language>
</rdf:Description>
```



RDF XML Schema

- RDF XML Schema describe the XML syntax of RDF XML Serialization
- The syntax of RDF documents can be validated against the RDF XML Schema
- <http://www.portia.dk/pubs/RDF/RdfSerial20020321a.xsd>

RDF Dublin Core Example



The screenshot shows a web browser window with the address bar containing the file path: D:\Data\XML\Dublin Core\DcXml2Example1.xml. The browser's address bar also shows a 'Hyperlinks' button. The main content area displays the XML code for a Dublin Core record. The XML is as follows:

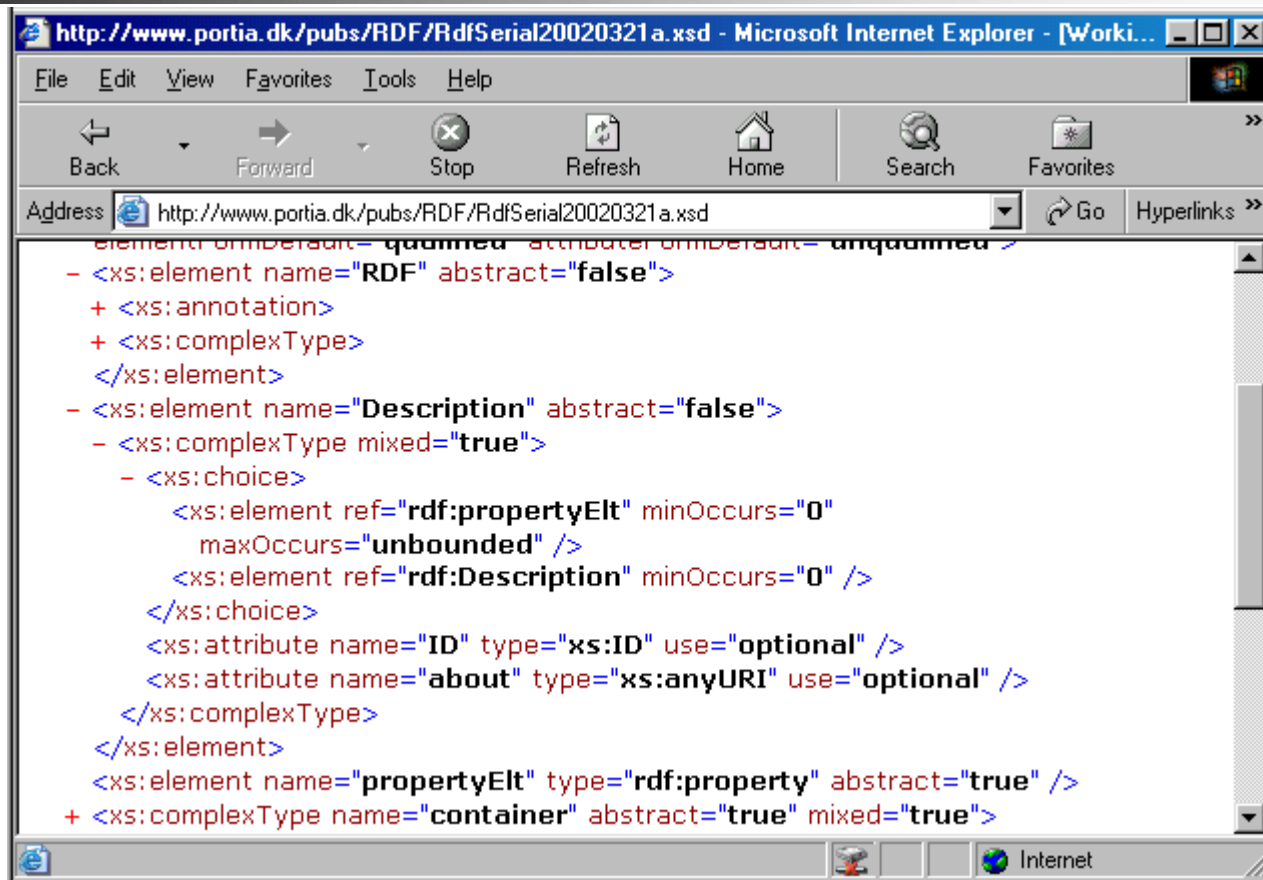
```
<?xml version="1.0" encoding="UTF-8" ?>
- <record-list xmlns="x-schema:file:///D:/DATA/XML/Dublin%20Core/DcXml2.xdr">
- <dc-record>
  <title>Combinatorial Optimization</title>
  <creator>Christos H. Papadimitriou</creator>
  <subject>Combinatorial Analysis</subject>
  <description>Combines the theory of computational complexity developed by computer
    scientists, and the foundations of mathematical programming developed by the
    operations research community</description>
  <publisher>Prentice-Hall</publisher>
  <contributor>Kenneth Steiglitz</contributor>
  <date>1982</date>
  <type>Book</type>
  <language>english</language>
</dc-record>
+ <dc-record>
</record-list>
```



RDF Schema

- RDF Schema is an established W3C standard to describe ontologies
- RDF Schemas can define respective relationships between different metadata standards, e.g. DC and
- *Classes* in RDF are defined by their relationships
- Properties are defined by their *Domain* and *Range*
- Classes can be sub-classes of other Classes

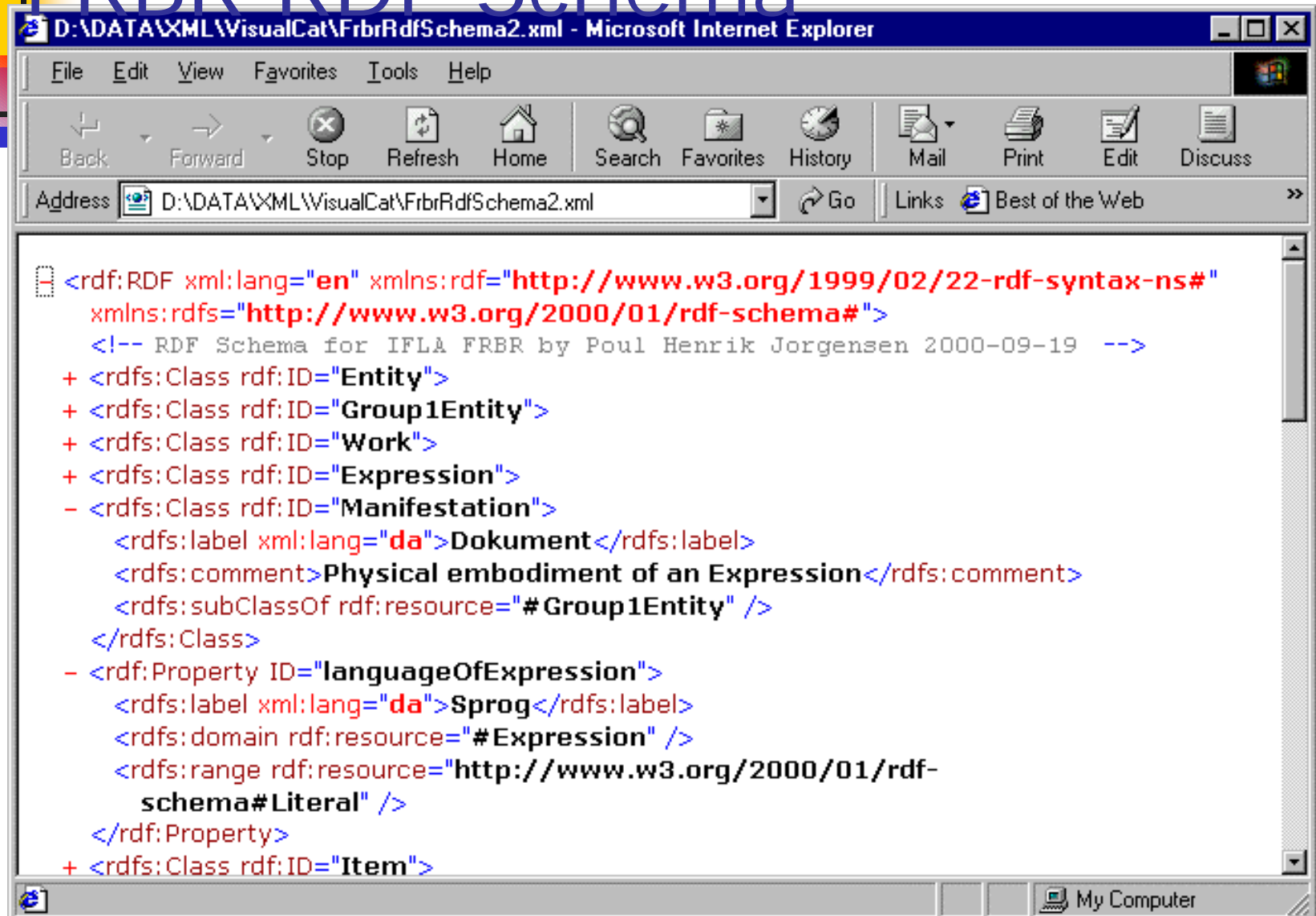
RDF Schema for Dublin Core



The screenshot shows a Microsoft Internet Explorer browser window displaying an XML schema for Dublin Core RDF. The address bar shows the URL: `http://www.portia.dk/pubs/RDF/RdfSerial20020321a.xsd`. The browser's menu bar includes File, Edit, View, Favorites, Tools, and Help. The toolbar contains Back, Forward, Stop, Refresh, Home, Search, and Favorites buttons. The address bar also includes a Go button and a Hyperlinks button. The main content area displays the XML schema code, which is partially expanded to show the following elements and their attributes:

```
- <xs:element name="RDF" abstract="false">
+ <xs:annotation>
+ <xs:complexType>
</xs:element>
- <xs:element name="Description" abstract="false">
- <xs:complexType mixed="true">
- <xs:choice>
  <xs:element ref="rdf:propertyElt" minOccurs="0"
    maxOccurs="unbounded" />
  <xs:element ref="rdf:Description" minOccurs="0" />
</xs:choice>
  <xs:attribute name="ID" type="xs:ID" use="optional" />
  <xs:attribute name="about" type="xs:anyURI" use="optional" />
</xs:complexType>
</xs:element>
<xs:element name="propertyElt" type="rdf:property" abstract="true" />
+ <xs:complexType name="container" abstract="true" mixed="true">
```

FRBR RDF Schema



```
<rdf:RDF xml:lang="en" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  <!-- RDF Schema for IFLA FRBR by Poul Henrik Jorgensen 2000-09-19 -->
  + <rdfs:Class rdf:ID="Entity">
  + <rdfs:Class rdf:ID="Group1Entity">
  + <rdfs:Class rdf:ID="Work">
  + <rdfs:Class rdf:ID="Expression">
  - <rdfs:Class rdf:ID="Manifestation">
    <rdfs:label xml:lang="da">Dokument</rdfs:label>
    <rdfs:comment>Physical embodiment of an Expression</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#Group1Entity" />
  </rdfs:Class>
  - <rdf:Property ID="languageOfExpression">
    <rdfs:label xml:lang="da">Sprog</rdfs:label>
    <rdfs:domain rdf:resource="#Expression" />
    <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-
      schema#Literal" />
  </rdf:Property>
  + <rdfs:Class rdf:ID="Item">
```



RDF MARC Application

- VisualCat is a cataloguing system, that utilize RDF:
- Relevant RDF structures are generated automatically from MARC records
- RDF data is used to link and navigate transparently among related MARC records
- RDF Resource URIs are used to fetch external resources



RDF FRBR Application

- RDF is a convenient method to represent IFLA FRBR information
- A new module to handle FRBR as RDF has been implemented
- The FRBR display formats are based on Library of Congress suggestions, that were prepared by Tom Delsey
- Interrelated FRBR RDF entities can be located, fetched and edited directly



RDF FRBR Work

```
<rdf:Description about="URI:FrWork1"/>
  <rdf:type resource="URI:FRBR/Work"/>
  <fr:titleOfWork>The English Patient</fr:titleOfWork>
  <fr:isCreatedBy>Ondaatje, Michael,
    1943?</fr:isCreatedBy>
  <fr:isRealizedThrough resource="URI:FrExp1"/>
  <fr:isRealizedThrough resource="URI:FrExp2"/>
  <fr:hasTransformation resource="URI:FrWork2"/>
  <fr:hasTransformation resource="URI:FrWork3"/>
</rdf:Description>
```

FRBR Work level 1

The screenshot shows a window titled "FRBR Editing" with a tree view of a work. The root node is "URI:FrWork1 (Work)", which is expanded to show its "Properties". A table lists two properties: "fr:titleOfWork" with the value "The English Patient" and "fr:isCreatedBy" with the value "Ondaatje, Michael, 1943?". Below the table, there are two more expanded nodes: "fr:isRealizedThrough (2)" and "fr:hasTransformation (2)". The first node contains "URI:FrExp1" and "URI:FrExp2". The second node contains "URI:FrWork2" and "URI:FrWork3".

Property	Value
fr:titleOfWork	The English Patient
fr:isCreatedBy	Ondaatje, Michael, 1943?

- URI:FrWork1 (Work)
 - Properties
 - fr:titleOfWork: The English Patient
 - fr:isCreatedBy: Ondaatje, Michael, 1943?
 - fr:isRealizedThrough (2)
 - URI:FrExp1
 - URI:FrExp2
 - fr:hasTransformation (2)
 - URI:FrWork2
 - URI:FrWork3

URI:FrWork1 (Work)

 Properties

FRBR Expression level 2

Property	Value
fr:titleOfWork	The English Patient
fr:isCreatedBy	Ondaatje, Michael, 1943?

 fr:isRealizedThrough (2)

 URI:FrExp1 (Expression)

 Properties

Property	Value
fr:formOfExpression	Text
fr:languageOfExpression	English

 fr:isEmbodiedIn (2)

 URI:FrMan1

 URI:FrMan2

 fr:isRealizationOf (1)

 URI:FrWork1

 URI:FrExp2 (Expression)

 fr:hasTransformation (2)

 URI:FrWork2

 URI:FrWork3

URI:FrExp1 (Expression)
 Properties

Property	Value
fr:formOfExpression	Text
fr:languageOfExpression	English

 fr:isEmbodiedIn (2)

 URI:FrMan1 (Manifestation)
 Properties

Property	Value
fr:titleOfManifestation	The English Patient
fr:isCreatedBy	Michael Ondaatje
fr:Publisher	Thorndike Press
fr:DateOfPublication	1997
fr:ManifestationIdentifier	ISBN: 0754010457 (U.K. hd.)

 fr:isEmbodimentOf (1)

 URI:FrExp1
 URI:FrMan2 (Manifestation)
 Properties

Property	Value
fr:titleOfManifestation	The English Patient : a novel
fr:isCreatedBy	Michael Ondaatje
fr:Publisher	Vintage Books



RDF Issues

- XML Schema for RDF Serialization
- Integration between XML- and RDF-Schemas
- Revised RDF Syntax definitions



FRBR Issues

- RDF Schema for FRBR
- XML Schema for FRBR
- Definitions of Works, Expressions & Manifestations
- Symmetrical FRBR relationships
- Identifiers for FRBR entities
- User Interface design
- Harvesting FRBR from MARC



Summary

- RDF is established W3C standard for metadata representation
- Classification systems can be specified and related by RDF Schemas
- Major bibliographic application of RDF is p.t. Dublin Core
- RDF is even more relevant for FRBR
- RDF is used in VisualCat and other operational bibliographical solutions