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FREME

OPEN FRAMEWORK OF E-SERVICES FOR MULTILINGUAL AND SEMANTIC ENRICHMENT OF DIGITAL CONTENT

FROM XML TO RDF STEP BY STEP: APPROACHES FOR LEVERAGING XML WORKFLOWS WITH LINKED DATA

XML PRAGUE | 12 FEBRUARY 2016

www.freme-project.eu

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On behalf of the FREME Consortium and Contributors

THE CO-AUTHORS OF THIS EFFORT AND PAPER

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MOTIVATION – THIS BREAKS XML PROCESSING!

<myData> <head>...</head> <body>

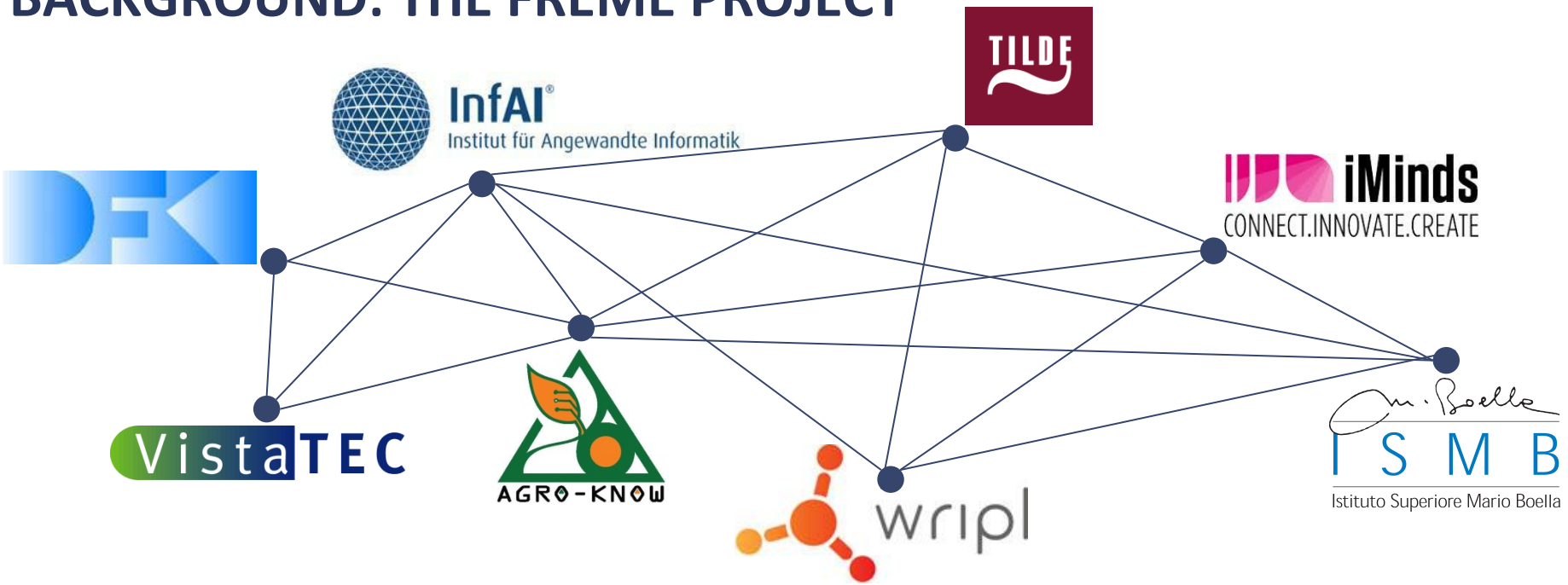
<linkedDataStorage>...</linkedDataStorage> ... </body> </myData>

- Validation
- Transformation
- Query
- ...
- Adaptation of schemas in real life scenarios often not possible

IS THIS RDF CHIMERA AGAIN?

- No: RDF Chimera is about relation between formats
  - XML, HTML RDF, JSON
- Our Issue here is about integration of formats
  - RDF in XML workflows for multilingual and semantic enrichment of content

BACKGROUND: THE FREME PROJECT



- Two year H2020 Innovation action; start February 2020
- Industry partners leading four business cases around digital content and (linked) data
- FREME = A framework for multilingual and semantic enrichment of digital content
- Is there a real need for this? Oh yes! See the following business cases

BUSINESS CASE "LINKED DATA IN PUBLISHING WORKFLOWS"

- Wolters Kluwer, Agroknow
- Enrichment of academic publication metadata

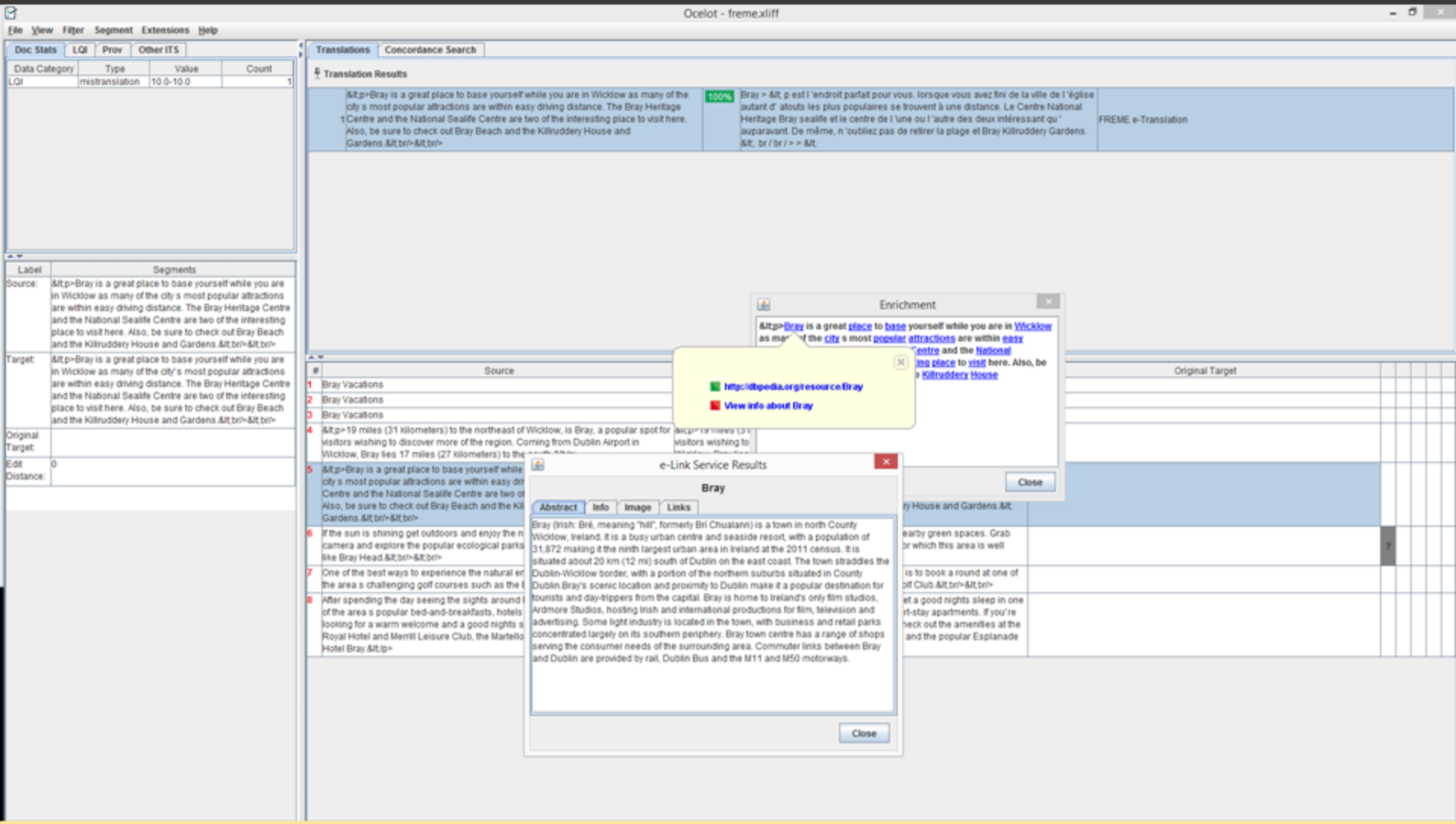
Before FREME	Result of deploying FREME
<dc:creator> <ags:creatorPersonal> Stoitsis, Giannis, Agroknow </ags:creatorPersonal> </dc:creator>	<dc:creator> <ags:creatorPersonal>Stoitsis, Giannis</ags:creatorPersonal> **<nameIdentifier schemeURI=** **"http://orcid.org/"** **nameIdentifierScheme=** **"ORCID">0000-0003-3347-8265** **</nameIdentifier>** **<affiliation>Agroknow</affiliation>** </dc:creator>
<dc:subject> <ags:subjectClassification scheme="ags:ASC"> <![CDATA[J10]]> </ags:subjectClassification> </dc:subject>	<dc:subject **freme-enrichment=** **"http://aims.fao.org/aos/agrovoc/c_426** **http://aims.fao.org/aos/agrovoc/c_24135** **http://aims.fao.org/aos/agrovoc/c_4644** **http://aims.fao.org/aos/agrovoc/c_7178">** <ags:subjectClassification scheme= "ags:ASC"><![CDATA[J10]]> </ags:subjectClassification> </dc:subject>

BUSINESS CASE
"LINKED DATA IN XML LOCALIZATION WORKFLOWS"

- Vistatec – workflows integrating localization XML formats XLIFF, ITS 2.0 and linked data, in the Ocelot editor for translation editing and review – see GUI screenshot next slide

Process Step	FREME e-service
Conversion of native document to Extensible Localization Interchange File Format	e-Internationalization
Translation	e-Terminology and e-Entity
Semantic enrichment	e-Link
Content publication	e-Pub

vistatec



SPARQL queries are executed to retrieve desired related information

BUSINESS CASE "LINKED DATA IN BOOK METADATA"

- iMinds – linked data in book metadata
- A potential approach for embedding linked data in ONIX

```
<Contributor>
 <NameIdentifier>
  <NameIDType>
   <IDTypeName>Meta4Books ContributorID</IDT
   <IDValue>65097</IDValue>
  </NameIDType>
 </NameIdentifier>
 <ContributorRole>A01</ContributorRole>
 <SequenceNumber>1</SequenceNumber>
 <NamesBeforeKey>Jonathan</NamesBeforeKey>
 <KeyNames>Franzen</KeyNames>
 <Entity>
  <URI>http://viaf.org/viaf/84489381/</URI>
 </Entity>
</Contributor>
```

APPROACHES FOR LINKED DATA INTEGRATION

1. Convert XML to linked data
2. Embed linked data into XML via structured markup
3. Anchor Linked data in XML attributes
4. Embed linked data in metadata sections of XML files
5. Anchor linked data via annotations in XML content

Try them out with DocBook or TEI content at
http://api-dev.freme-project.eu/doc/freme-showcase/xml-to-rdf.html

Implementation uses FREME, the Okapi framework and Saxon-CE, the Swiss army knife of XML in the browser processing

SCREENSHOT FROM DEMO

Call FREME e-Entity with XML content | Refresh output

Set the document type of the input: DocBook

Set the language of the input: English

Set the data set to be used for enrichment: DBpedia

Set the output type: 1. Convert XML to linked data

```
<article xmlns="http://docbook.org/ns/docbook"
xmlns:xlink="http://www.w3.org/1999/xlink" version="5.0">
<info>
<title>From XML to RDF step by step: Approaches for Leveraging XML
Workflows with Linked
Data</title>
</info>
<sect1 xml:id="s1">
<title>Introduction</title>
<para>We very much welcome you in the city of Prague, a home of
XML!</para>
</sect1>
</article>
```

1. CONVERT XML TO LINKED DATA

```
<article xmlns="http://docbook.org/ns/docbook"
xmlns:xlink="http://www.w3.org/1999/xlink" version="5.0">
<info>
<title>From XML to RDF step by step: Approaches for Leveraging XML
Workflows with Linked
Data</title>
</info>
<sect1 xml:id="s1">
<title>Introduction</title>
<para>We very much welcome you in the city of Prague, a home of
XML!</para>
</sect1>
</article>
```

1. CONVERT XML TO LINKED DATA

```
<http://freme-project.eu/#char=140,146>
        a                   nif:Phrase , nif:RFC5147String , nif:String , nif:Word ;
        nif:anchorOf        "Prague"^^xsd:string ;
        nif:beginIndex      "140"^^xsd:int ;
        nif:endIndex        "146"^^xsd:int ;
        nif:referenceContext  <http://freme-project.eu/#char=0,162> ;
        itsrdf:taClassRef     <http://dbpedia.org/ontology/City> ,
<http://dbpedia.org/ontology/Location> , <http://dbpedia.org/ontology
/Settlement> , <http://nerd.eurecom.fr/ontology#Location> ,
<http://dbpedia.org/ontology/PopulatedPlace> , <http://dbpedia.org/ontology
/Place> ;
        itsrdf:taConfidence   "0.9990763283024261"^^xsd:double ;
        itsrdf:taIdentRef     dbpedia:Prague .
```

1. CONVERT XML TO LINKED DATA

Benefits

- No need to change XML workflow
- Similar to RDF Chimera approach
- Difference: here focus on adding new (linked) information

Drawback

- New tool chain needed
- No useful representation of mixed content

2. EMBED LINKED DATA INTO XML VIA STRUCTURED MARKUP

```
<para>We very much welcome you in the city of <emphasis vocab="http://schema.org/" typeof="Place" property="name" resource="http://dbpedia.org/resource/Prague">Prague</emphasis>, a home of <emphasis vocab="http://schema.org/" typeof="Thing" property="name" resource="http://dbpedia.org/resource/XML">XML</emphasis>!</para>
```

2. EMBED LINKED DATA INTO XML VIA STRUCTURED MARKUP

Benefits

- Relying on hooks for data integration, e.g. RDFa 1.1 lite
- Common for search engine optimization, cf. schema.org
- May use other syntaxes like json-ld

Drawback

- May break XML validation
- May need at least adapted tool chains to understand RDFa / json-ld

3. ANCHOR LINKED DATA IN XML ATTRIBUTES

Example: Embedding anchors in XLIFF via ITS 2.0 text analytics markup

```
<source ...>
 <mrk ...its:taIdentRef="http://dbpedia.org/resource/Berlin">
  Berlin</mrk> is the capital of Germany!</source>
```

3. ANCHOR LINKED DATA IN XML ATTRIBUTES

Benefits

- Using existing XML attributes = no new markup is needed
- Toolchain can be kept as is

Drawback

- Actual data integration is just postponed
- Data integration does not leave a trace – missing provenance

4. EMBED LINKED DATA IN METADATA SECTIONS OF XML FILES

```
<article xmlns="http://docbook.org/ns/docbook" ...>
<info>
<title>From XML to RDF step by step: Approaches for Leveraging XML
Workflows with Linked
Data</title><annotation><programlisting>@prefix dbpedia-fr:
&lt;http://fr.dbpedia.org/resource/> .
...
&lt;http://freme-project.eu/#char=0,86>
        a                   nif:Phrase , nif:RFC5147String , nif:String ;
        nif:anchorOf        "From XML to RDF step by step: Approaches for
Leveraging XML Workflows with Linked Data"@en ;
        nif:beginIndex      "0"^^xsd:nonNegativeInteger ;
        nif:endIndex        "86"^^xsd:nonNegativeInteger ;
        nif:referenceContext  &lt;http://freme-project.eu/#char=0,162> ;
        &lt;http://purl.org/dc/elements/1.1/identifier>
```

4. EMBED LINKED DATA IN METADATA SECTIONS OF XML FILES

Benefits

- Metadata section does not influence size of main content
- Clear separation of concerns and processing

Drawback

- No per se relation to actual content
- Character offset pointers to content are fragile

5. ANCHOR LINKED DATA VIA ANNOTATIONS IN XML CONTENT – HERE USING W3C ANNOTATION MODEL

{ "id": "http://example.com/myannotations/a1", "type": "Annotation“...

"selector": { ...

"**/xlf:unit[1]/xlf:segment[1]/xlf:source/xlf:mrk[1]**"
"itsrdf:taIdentRef": "http://dbpedia.org/resource/Berlin",
"itsrdf:taClassRef": "http://schema.org/Place", ... } }

5. ANCHOR LINKED DATA VIA ANNOTATIONS IN XML CONTENT

Benefits

- Same as approach 4
- In addition, more robust anchoring via path expressions

Drawback

- Resolution of path expressions can be computationally expensive

APPROACHES FOR LINKED DATA INTEGRATION …

1. Convert XML to linked data
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3. Anchor Linked data in XML attributes
4. Embed linked data in metadata sections of XML files
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… Or: Routes to Bridge between RDF and XML

ROUTES TO BRIDGE BETWEEN RDF AND XML

- XSPARQL – W3C Member submission
- Compilation of SPARQL queries into XQuery

```
prefix foaf: <http://xmlns.com/foaf/0.1/>
prefix geo: <http://www.w3.org/2003/01/geo/wgs84_pos#>

<kml xmlns="http://www.opengis.net/kml/2.2">{
 for $name $long $lat from <http://nunolopes.org/foaf.rdf>
 where { $person a foaf:Person; foaf:name $name;
         foaf:based_near [ a geo:Point;
         geo:long $long;
         geo:lat $lat ] }
 return <Placemark>
  <name>{fn:concat("Location of ", $name)}</name>
   <Point>
    <coordinates>{fn:concat($long, ",", $lat, ",0")}</coordinates>
   </Point>
 </Placemark> }
</kml>
```

NEXT STEPS – WHAT DO YOU THINK?

- Conclusion with my co-authors:

"We believe that joint efforts in standardization bodies to bridge the gaps between RDF and XML in order to enable such transformations and integrated tooling in a standard way should be further pursued."

- What do you think – is it worth documenting this further
  - Have a W3C community group on the topic?
  - Document approaches and best practices?
  - Provide of-the-shelf tooling?

CONTACTS

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