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## Active Tags: an XML System for Native XML Programming

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by Philippe Poulard

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Active Tags

# Active Tags

an XML System  
for Native XML Programming



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- A set of specifications (language/platform independant)
- A general-purpose framework
- Batch, Web applications, embedded in an application
- Looks like XSLT/XQuery/Jelly/ASP/PHP/JSP/JSTL/Ant...
- Use XML tags as actions to perform
- XPath-centric
- Can query various data sources (RDBMS, LDAP, XML native databases)
- Several libraries (modules) can be used

<http://disc.inria.fr/perso/philippe.poulard/xml/active-tags/>

Specifications :

Implementation :

<http://reflex.gforge.inria.fr>

The  
Active Tags  
engine, in Java

**Reflex**

Unix : everything is a file

OOP : everything is object

**Active Tags** : everything is XML

→ A powerful and complete system based upon XML technologies

Cohabitation of several tag libraries

Features are not overlapping each others

→ Chosen by INRIA

Used in production

→ Concise/powerful

Modular/extensible/maintenable

Easy to use (if you know XML/XPath ☺)

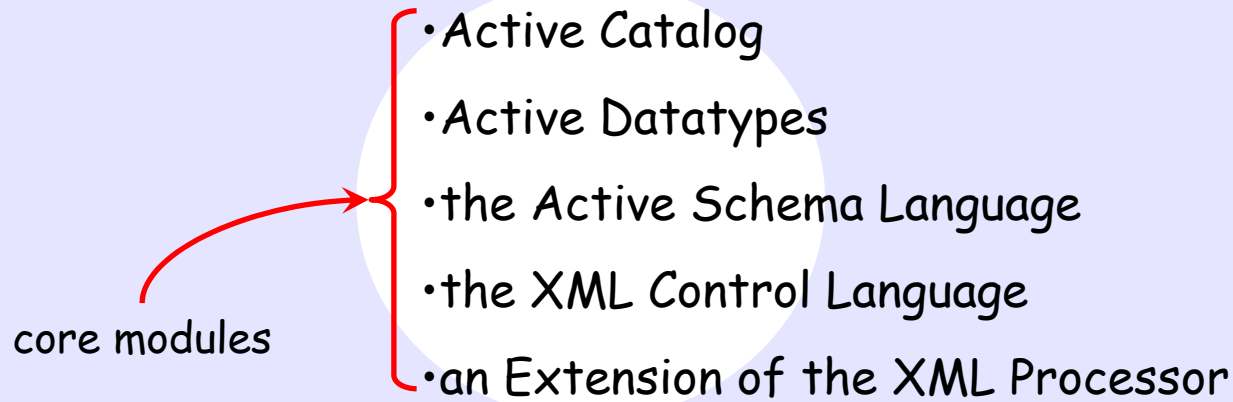
→ High-level API

General purpose

Mask details (DOM,SAX)

Connexions with the environment (SYSTEM, I/O, SQL, Web...)

master spec → Active Tags



- Active Sheet
- Active Document
- Active Material

**Standard modules**

- I/O module
- SYTEM module
- Web module
- RDBMS module

**Application**

- the XUnit framework

Some examples...

- A simple example → the basics
- Handling XML documents → mask DOM and SAX differences
- Pipelines → filtering a SAX stream with XPath patterns
- Combining modules → module cohabitation
- A Web application → introduction of X-Operable Objects
- Modularization → macro creation
- XUnit → testing XML

with XCL : the XML Contol Language

a convenient root

```

<?xml version="1.0" encoding="iso-8859-1"?>
<xcl:active-sheet
  xmlns:xcl="http://www.inria.fr/xml/active-tags/xcl">
  <xcl:parse name="myDoc"
    source="file:///path/to/document.xml"/>
  <xcl:parse-stylesheet name="myXslt"
    source="file:///path/to/stylesheet.xsl"/>
  <xcl:transform source="{ $myDoc }"
    stylesheet="{ $myXslt }"
    output="file:///path/to/output.html"/>
</xcl:active-sheet>

```

instruction that creates the property named « myDoc »

XPath expression

Like « AVT » in XSLT but :

- can occur in text content
- is not cast to string
- can refer to objects

### Shell-fashioned references

Comparison with Ant/Jelly/JSTL...

```

<document time="{ $now }">
  Welcome { $user.name } to Jelly!
</document>

```

Can't extend to path expressions ☹️ → { \$now/@year }

Can't compute expressions ☹️, can only refer to values

→ { \$price \* \$discount }

the engine "knows" which tag is an action and which tag is a literal  
 → an Active Catalog is plugged to the engine

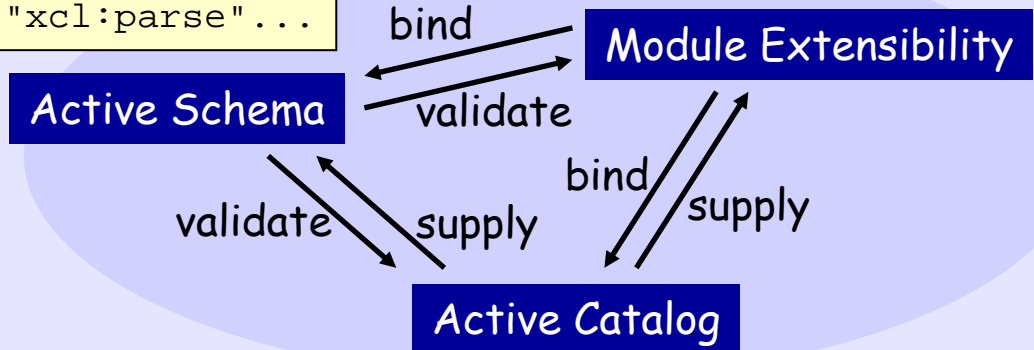
compatible ↪ XML catalog : map URI → URIs  
 Active Catalog : map URI + selector → resources  
 (URI, module, schema, catalog, active-sheet...)  
 resource management facilities (caching policy)

How is it resolved ?

Active tag → `<xcl:parse>`

```
<asl:schema target="xcl">
  <asl:element name="xcl:parse"...
```

```
<exp:module target="xcl">
  <exp:element name="xcl:parse"...
```



```
<cat:catalog>
<exp:module>
<asl:schema>
```

are resolved in the same manner

```
<cat:catalog>
  <cat:uri name="http://www.inria.fr..."
```



`<xcl:parse>` parse an XML document or fragment  
`<xcl:document>` create an XML document or fragment

} can be SAX or DOM

- SAX to DOM
- DOM to SAX

deferred processing

can be accessed with XPath

can be filtered with XPath patterns

```
<xcl:parse name="myDom" type="DOM" />
<xcl:document name="mySax" type="SAX">
  <wrapper>
    { $myDom }
  </wrapper>
</xcl:document>
```

```
<xcl:parse-stylesheet name="myXslt" source="file:///path/to/stylesheet.xsl"/>
<xcl:parse-filter name="xinclud" source="http://www.w3.org/2001/XInclude"/>
<xcl:parse name="myDoc" type="SAX" source="file:///path/to/document.xml"/>
<xcl:filter name="included" source="{ $myDoc }" filter="{ $xinclud }"/>
<xcl:transform source="{ $included }" stylesheet="{ $myXslt }"
  output="file:///path/to/output.html"/>
```

### Custom filters : XCL filters

- a subset of tags for XPath-based filters
- can process extra-large documents with SAX

```
<xcl:parse-filter>
<xcl:filter>
<xcl:rule> ← XPath pattern
<xcl:forward> ← can specify several "channels"
<xcl:apply-rules>
```

### Built-in filters

- XInclude filter
  - Line reader
  - Tokenizer
- text to XML {
- ↑  
regex

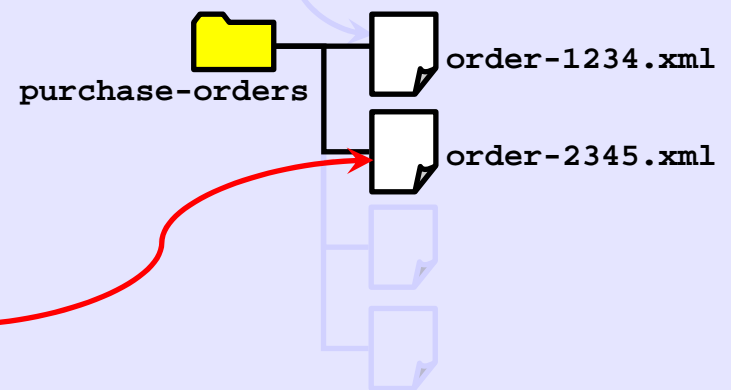
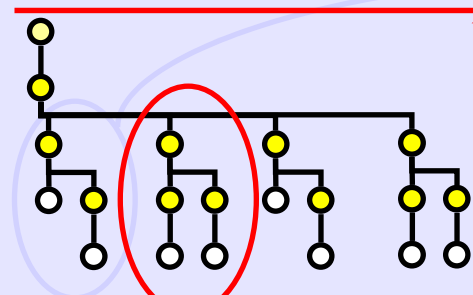
```

<xcl:parse name="allPo"
  source="file:///path/to/purchase-orders.xml" type="SAX"/>
<xcl:filter name="poSplitter" source="{ $allPo }">
  <xcl:rule pattern="/purchase-orders/order">
    <xcl:document name="order" type="SAX">
      <xcl:forward channel="order">
        <xcl:apply-rules/>
      </xcl:forward>
    </xcl:document>
    <xcl:transform
      output="file:///path/to/purchase-orders/order-{ @id }.xml"
      source="{ $order }"/>
  </xcl:rule>
</xcl:filter>
<xcl:transform output="{ $sys:null }" source="{ $poSplitter }"/>
  
```

inline definition

could also be DOM

SAX ("#main" channel)



("order" channel) SAX

serialize

modules URIs

literal

the engine "knows" which tag is active and which tag is a literal

AVT in content

```
<?xml version="1.0" encoding="iso-8859-1"?>
<xcl:active-sheet
  xmlns:sys="http://www.inria.fr/xml/active-tags/sys"
  xmlns:io="http://www.inria.fr/xml/active-tags/io"
  xmlns:xcl="http://www.inria.fr/xml/active-tags/xcl">
  <xcl:set name="dir"
    value="{ io:file('file:///path/to/dir/') }">
  <xcl:document name="mergeAll" type="SAX">
    <mergeAll>
      <xcl:for-each name="myFile"
        select="{ $dir/*[@io:is-file] }">
        <xcl:parse name="myDoc" type="SAX"
          source="{ $myFile }"/>
        { $myDoc }
      </xcl:for-each>
    </mergeAll>
  </xcl:document>
  <xcl:transform
    source="{ $mergeAll }"
    output="{ $sys:out }"/>
</xcl:active-sheet>
```

predefined property the « SYSTEM » module

No stylesheet = copy

Active tags : `<xcl:parse>`

XPath functions : `io:file()`

Predefined properties : `$sys:out`

Foreign attributes : `@xcl:version` ← directives

Data types : `io:x-file` ← x- for « XML friendly » objects

- Can apply XPath expressions
- Can be X-updated

```
$dir//*[@io:is-file]
```

```
$dir/*[@io:is-file][@io:extension='xml']
```



`io:x-file` type definition

In the documentation of the I/O module

<code>name()</code>	<code>xs:QName</code>	The name of the file
<code>parent::</code>	<code>io:x-file</code>	The parent directory of this file
<code>child::</code>	<code>adt:list of io:x-file</code>	The files contained in this directory
<code>@io:length</code>	<code>xs:integer</code>	The length of this file
<code>@io:is-file</code>	<code>xs:boolean</code>	Indicates whether or not this is a file.
<code>@io:last-modified</code>	<code>xs:date</code>	The last date when this file was modified

```
<xcl:update referent="{ $dir/@io:last-modified }"  
    operand="{ $newDate }" />
```

```
<xcl:update>  
<xcl:rename>  
<xcl:append>  
...etc
```

incoming URL : http://www.acme.com/index.xml

```

<?xml version="1.0" encoding="iso-8859-1"?>
<web:service
  xmlns:web="http://www.inria.fr/xml/active-tags/web"
  xmlns:xcl="http://www.inria.fr/xml/active-tags/xcl">
  <web:mapping match="^(.+)\.html$"
    mime-type="text/html">
    <xcl:parse name="myDoc" source="web:/// { $web:match/node()[1] }.xml"/>
    <xcl:transform
      source="{ $myDoc }"
      stylesheet="web:///WEB-INF/transform.xsl"
      output="{ value( $web:response/@web:output ) }"/>
  </web:mapping>
  <web:mapping match="...">
    <!--other web stuff-->
  </web:mapping>
</web:service>

```

regexp

captured group

type : io:output

XML view

```

<web:response
  web:output="[io:output@189c036]"
  web:mime-type="text/html"/>

```

type : web:x-response

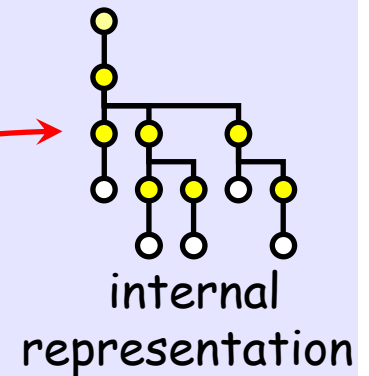
bound to an object

Objects type are identified by QNames like `web:x-response`,  
`io:x-file`, `io:output`, `io:input`,  
`xs:string`, `xs:integer`, `xml:document`, etc

```
<web:response
  web:output="[io:output@189c036]"
  web:mime-type="text/html">
  <Cache-Control>no-cache</Cache-Control>
  <Date>Tue, 15 Nov 1994 08:12:31 GMT</Date>
</web:response>
```

Not necessary represented with tags

Avoid  
round-trip



Objects are not necessary representable in XML :

- what would be the XML representation of an instance of `io:input` or `io:output` ?

(I'm not talking about the content, but about the container, as an object)

Big objects, binary object : high-cost for XML encoding/decoding

Incomplete objects : the content is computed only when it is accessed  
 (late binding)

incoming URL : http://www.acme.com/user.html?userName=Poulard

```

<?xml version="1.0" encoding="iso-8859-1"?>
<web:service
  xmlns:web="http://www.inria.fr/xml/active-tags/web"
  xmlns:xcl="http://www.inria.fr/xml/active-tags/xcl">
  <web:mapping match="^/user\.html$" >
    <xcl:set name="ldap"
      value="ldap://ldap.acme.org:9009/dc=acme,dc=org
        ??sub?(&(sn~={ $web:request/userName }))/>
    <xcl:parse name="dsml" source="{ $ldap }"/>
    <xcl:document name="userDoc"/>
    <user userName="{ $web:request/userName }">
      { $dsml }
    </user>
  </xcl:document>
  <xcl:transform
    source="{ $userDoc }"
    stylesheet="web:///WEB-INF/us
    output="{ value( $web:respons
  </web:mapping>
</web:service>

```

```

<xcl:set name="ldap"
  value="ldap://ldap.acme.org:9009/dc=acme,dc=org
    ??sub?(&(sn~={ $web:request/userName }))/>
<xcl:parse name="dsml" source="{ $ldap }"/>
<xcl:document name="userDoc"/>
<user userName="{ $web:request/userName }">
  { $dsml }
</user>
</xcl:document>

```

Batch script

```

<?xml version="1.0" encoding="iso-8859-1"?>
<xcl:active-sheet
  xmlns:sys="http://www.inria.fr/xml/active-tags/sys"
  xmlns:xcl="http://www.inria.fr/xml/active-tags/xcl">
  <xcl:set name="ldap"
    value="ldap://ldap.acme.org:9009/dc=acme,dc=org
      ??sub?(&(sn~={ $sys:env/userName }))/>
  <xcl:parse name="dsml" source="{ $ldap }"/>
  <xcl:document name="userDoc"/>
  <user userName="{ $sys:env/userName }">
    { $dsml }
  </user>
</xcl:document>
<xcl:transform source="{ $userDoc }"
  stylesheet="file:///path/to/userStylesheet.xsl"
  output="{ $sys:out }"/>
</xcl:active-sheet>

```

```

<xcl:set name="ldap"
  value="ldap://ldap.acme.org:9009/dc=acme,dc=org
    ??sub?(&(sn~={ $sys:env/userName }))/>
<xcl:parse name="dsml" source="{ $ldap }"/>
<xcl:document name="userDoc"/>
<user userName="{ $sys:env/userName }">
  { $dsml }
</user>
</xcl:document>

```

Active Tags

Web application

expose as a single tag (externalization inside a custom module)

### Use/define a custom module

```
<?xml version="1.0" encoding="iso-8859-1" ?>
<web:service
  xmlns:acme="http://tags.acme.org/usersInfo"
  xmlns:web="http://www.inria.fr/xml/active-tags/web"
  xmlns:xcl="http://www.inria.fr/xml/active-tags/xcl">
  <web:mapping match="^/user\.html$"
    <acme:user-info name="{ $web:request/userName }"/>
    <xcl:transform
      source="{ $acme:userInfo }"
      stylesheet="web:///WEB-INF/resources/userStylesheet.xsl"
      output="{ value( $web:response ) }"/>
  </web:mapping>
</web:service>
```

```
<?xml version="1.0" encoding="iso-8859-1" ?>
<xcl:active-sheet
  xmlns:acme="http://tags.acme.org/usersInfo"
  xmlns:sys="http://www.inria.fr/xml/active-tags/sys"
  xmlns:xcl="http://www.inria.fr/xml/active-tags/xcl">
  <acme:user-info name="{ $sys:env/userName }"/>
  <xcl:transform source="{ $acme:userInfo }"
    stylesheet="file:///path/to/userStylesheet.xsl"
    output="{ $sys:out }"/>
</xcl:active-sheet>
```

EXP : Extensible XML Processor

implementation of the tag  
(« macro tag »)

```
<?xml version="1.0" encoding="iso-8859-1" ?>
<exp:module target="acme"
  xmlns:acme="http://tags.acme.org/usersInfo"
  xmlns:exp="http://www.inria.fr/xml/active-tags/exp"
  xmlns:xcl="http://www.inria.fr/xml/active-tags/xcl">
  <exp:element name="acme:user-info">
    <xcl:set name="ldap"
      value="ldap://ldap.acme.org:9009/dc=acme,dc=org
        ??sub?(&(sn~={ $exp:params/@name } ) )"/>
    <xcl:parse name="dsml" source="{ $ldap }"/>
    <xcl:document name="userDoc" />
    <user userName="{ $exp:params/@name }"
      { $dsml }
    </user>
  </xcl:document>
  <exp:exports>
    <exp:export name="acme:userInfo" value="{userDoc}"/>
  </exp:exports>
</exp:element>
</exp:module>
```

exported property

XPath functions and predefined properties can also be defined with macros



A module made of active tags

```

<xunit:test-case> ← set the boundaries of a test
<xunit:assert-boolean-equals>
<xunit:assert-number-equals> } report assertions
<xunit:assert-node-equals>
<xunit:merge-reports> ← merge test-cases report
...etc
    
```

Test suites for :

- active sheets
  - individual XSLT templates
  - Java classes (that are dealing with XML datas)
- harness for tests suites

```

<xunit:test-case name="acme-test" label="Acme test">
  <!--stuff to test-->
  <acme:foo bar="do-it-like-this"/>
  <!--check the result-->
  <xcl:parse name="result" source="result.xml"/>
  <xcl:parse name="output-expected"
    source="file:///path/to/output-expected.xml"/>
  <!--check if they are equals-->
  <xunit:assert-node-equals result="{ $result }"
    expected="{ $output-expected/some[1]/result[2] }"/>
</xunit:test-case>
    
```

HTML report :

Acme test	Tests : 82	Errors : 1	Failures : 0
Node expected :	/some[1]/result[2]/foo[3]		
Result node :	/foo[3]		
Attribute existence :	Unexpected attribute bar="BAR"		

- A systemic consideration of XML technologies
  - each component focus on a well-defined problematic
  - component cooperation
- Allow to handle with ease XML datas
  - text to XML
  - SQL to XML
  - LDAP to XML
  - SAX, DOM, XCL filters and pipelines
- Extensible better than ever
  - Custom modules (macro tags, macro XPath functions)
- Viability
  - Lots of runnable examples and tips in RefleX
  - Already used in production at INRIA
  - Could be closer to XPath2/XQuery data model
  - Some features still experimental or incomplete

To go further :

- read carefully the slides !

<http://disc.inria.fr/perso/philippe.poulard/xml/active-tags.pdf>

- email-me

[Philippe.Poulard@sophia.inria.fr](mailto:Philippe.Poulard@sophia.inria.fr)

- discuss about Active Tags on the XML-dev list

- download the engine

<http://reflex.gforge.inria.fr>

- try the tutorials

- send me some money ☺

Questions ?