University of Washington
Department of Computer Science & Engineering

Managing XML and Semistructured Data

Lecture 6: XPath

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In this lecture

- Review of the XPath specification
  - data model
  - examples
  - syntax

Resources:

A formal semantics of patterns in XSLT by Phil Wadler.

XML Path Language (XPath) www.w3.org/TR/xpath

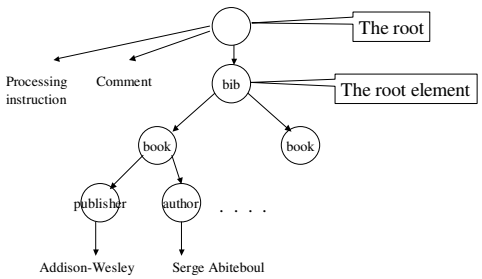
XPath

- http://www.w3.org/TR/xpath (11/99)
- Building block for other W3C standards:
  - XSL Transformations (XSLT)
  - XML Link (XLink)
  - XML Pointer (XPointer)
  - XML Query
- Was originally part of XSL

Example for XPath Queries

```
<bib>
    <book>  <publisher> Addison-Wesley </publisher>
            <author> Serge Abiteboul </author>
            <author> <first-name> Rick </first-name>
                     <last-name> Hull </last-name>
            </author>
            <author> Victor Vianu </author>
            <title> Foundations of Databases </title>
            <year> 1995 </year>
    </book>
    <book price="55">
            <publisher> Freeman </publisher>
            <author> Jeffrey D. Ullman </author>
            <title> Principles of Database and Knowledge Base Systems </title>
            <year> 1998 </year>
    </book>
</bib>
```

Data Model for XPath



Much like the Xquery data model

XPath: Simple Expressions

/bib/book/year

Result: <year> 1995 </year>
<year> 1998 </year>

/bib/paper/year

Result: empty (there were no papers)

XPath: Restricted Kleene Closure

//author

Result: <author> Serge Abiteboul </author>
<author> <first-name> Rick </first-name>
<last-name> Hull </last-name>
</author>
<author> Victor Vianu </author>
<author> Jeffrey D. Ullman </author>

/bib//first-name
Result: <first-name> Rick </first-name>

Xpath: Functions

/bib/book/author/text()

Result: Serge Abiteboul
Jeffrey D. Ullman

Rick Hull doesn't appear because he has firstname, lastname

Functions in XPath:
- text() = matches the text value
- node() = matches any node (= * or @* or text())
- name() = returns the name of the current tag

Xpath: Wildcard

//author/*

Result: <first-name> Rick </first-name>
<last-name> Hull </last-name>

* Matches any element

Xpath: Attribute Nodes

/bib/book/@price

Result: "55"

@price means that price is has to be an attribute

Xpath: Qualifiers

/bib/book/author[firstname]

Result: <author> <first-name> Rick </first-name>
<last-name> Hull </last-name>
</author>

Xpath: More Qualifiers

/bib/book/author[firstname][address[//zip][city]]/lastname

Result: <lastname> … </lastname>
<lastname> … </lastname>

Xpath: More Qualifiers

/bib/book[@price < “60”]

/bib/book[author/@age < “25”]

/bib/book[author/text()]

Xpath: Summary

bib	matches a bib element
*	matches any element
/	matches the root element
/bib	matches a bib element under root
bib/paper	matches a paper in bib
bib//paper	matches a paper in bib, at any depth
//paper	matches a paper at any depth
paper|book	matches a paper or a book
@price	matches a price attribute
bib/book/@price	matches price attribute in book, in bib

bib/book/[@price<“55”]/author/lastname matches…

Xpath: More Details

- An Xpath expression, p, establishes a relation between:
  - A *context node*, and
  - A node in the *answer set*
- In other words, p denotes a function:
  - S[p] : Nodes -> {Nodes}
- Examples:
  - author/firstname
  - . = self
  - .. = parent
  - part/*/*/subpart/../name = part/*/*[subpart]/name

The Root and the Root

- <bib> <paper> 1 </paper> <paper> 2 </paper> </bib>
- bib is the “***document element***”
- The “***root***” is above bib

- /bib = returns the document element
- / = returns the root

- Why ? Because we may have comments before and after <bib>; they become siblings of <bib>

- This is advanced xmlogy

Xpath: More Details

- We can navigate along 13 axes:
  - ancestor
  - ancestor-or-self
  - attribute
  - child
  - descendant

  We’ve only seen these, so far.
  - descendant-or-self
  - following
  - following-sibling
  - namespace
  - parent
  - preceding
  - preceding-sibling
  - self

Xpath: More Details

- Examples:
  - child::author/child:lastname = author/lastname
  - child::author/descendant::zip = author//zip
  - child::author/parent::* = author/..
  - child::author/attribute::age = author/@age
- What does this mean ?
  - paper/publisher/parent::*/author
  - /bib//address[ancestor::book]
  - /bib//author/ancestor::*//zip

Xpath: Even More Details

- name() = the name of the current node
  - /bib//*[name()=book] same as /bib//book
- What does this mean ?
  /bib//*[ancestor::*[name()!=book]]
  - In a different notation bib.[^book]*._
- Navigation axis gives us strictly more power !