XPath

Arantza Irastorza Goñi

eman ta zabal zazu

Informazioaren Kudeaketa Aurreratua

Gradua Ingeniaritza Informatikoan

Esp. Software Ingeniaritza

Lengoaiak eta Sistema Informatikoak saila

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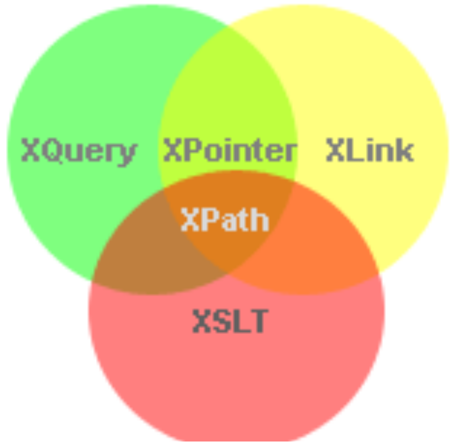
Contents

What is XPath?

- A language for addressing parts of an XML document

- A query language whose syntax uses path expressions on the document

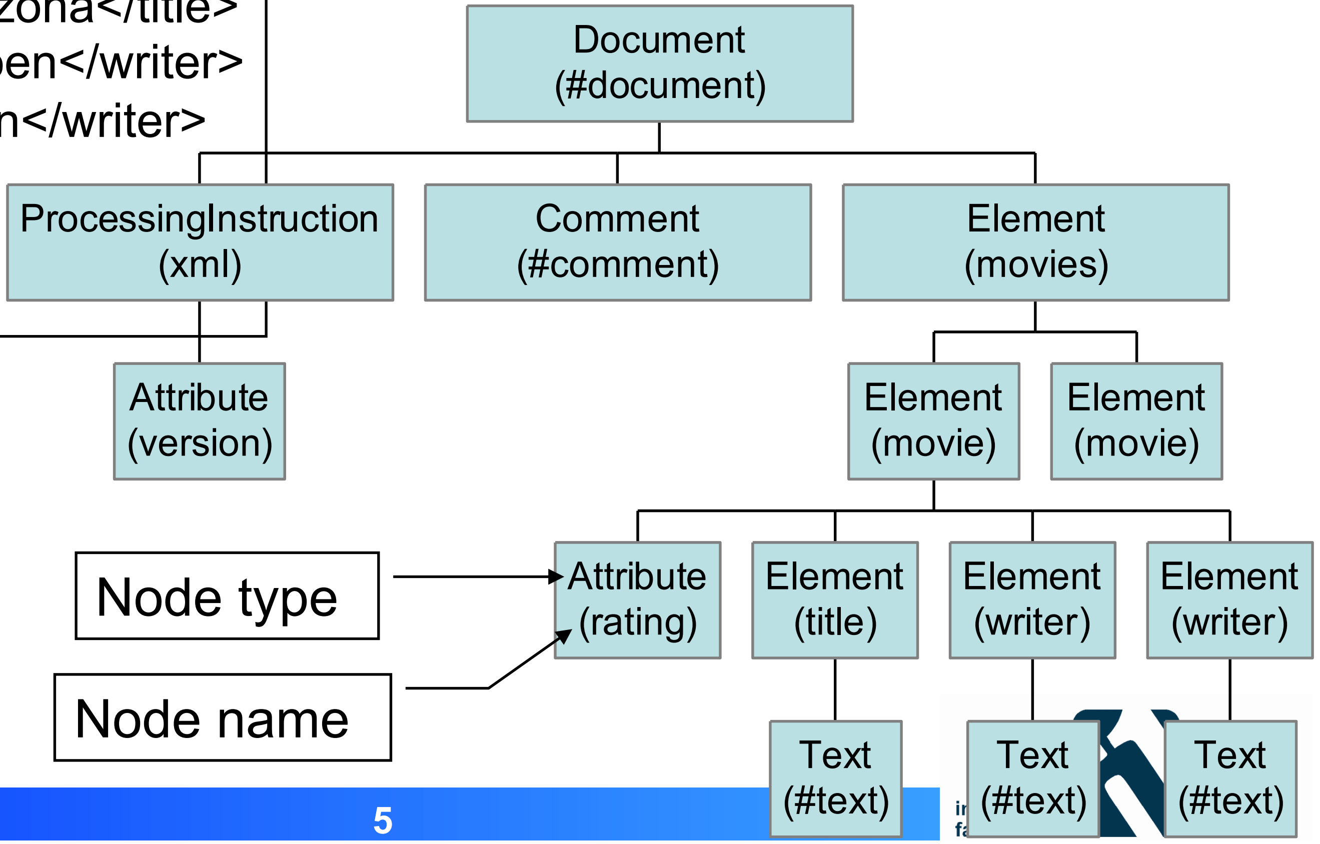
- XPath is used in other W3C specifications
  - *XSLT*
  - *XLink*
  - *XQuery*



XPath is a functional language: input: tree → output: node set

```
<?xml version="1.0" ?>
<!-- Nire pelikula gogozkoenak -->
<movies>
   <movie rating="PG-13" >
      <title>Raising Arizona</title>
      <writer>Ethan Coen</writer>
      <writer>Joel Coen</writer>
   </movie>
<movie> .... </movie>
</movies>
```

Relationship of nodes: parent, child, sibling, ancestor, descendant



XPath Expressions

- An XPath expression can be seen as function composition
  - Each location step is evaluated relative to the context node

- A function *(“location step”)*
  - *Input: context node → Output: node set*
  - E.g. *“child::movie”* is a function that returns a “movie” set

- Function composition (“/”)
  - E.g.: *child::movie/child:writer returns “writer”* nodes
  - It evaluates from left to right
    - The output of a function provides the context node to evaluate the next function
      - o the output of *child:movie* becomes the input of *child:writer*

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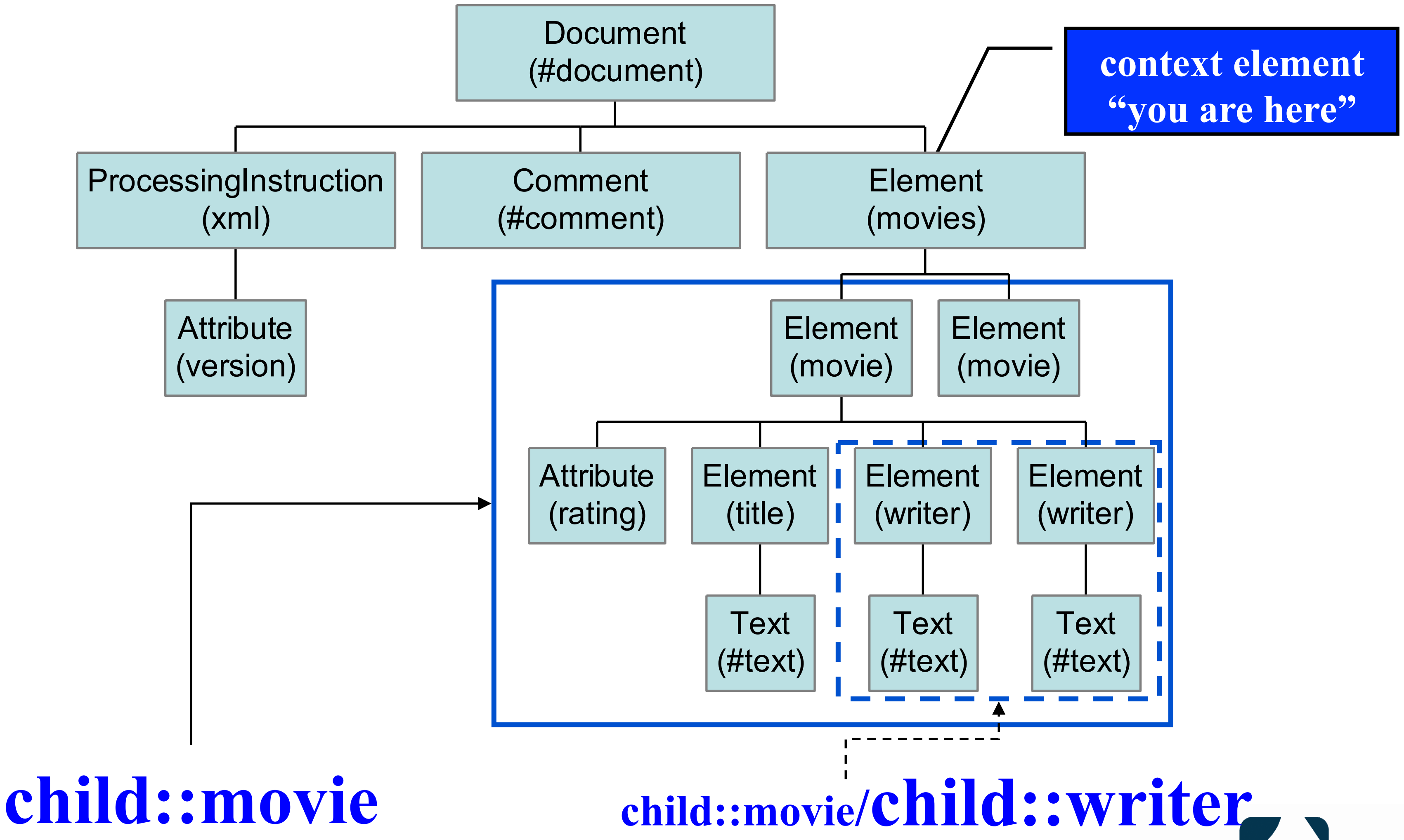
XPath Expressions. Example

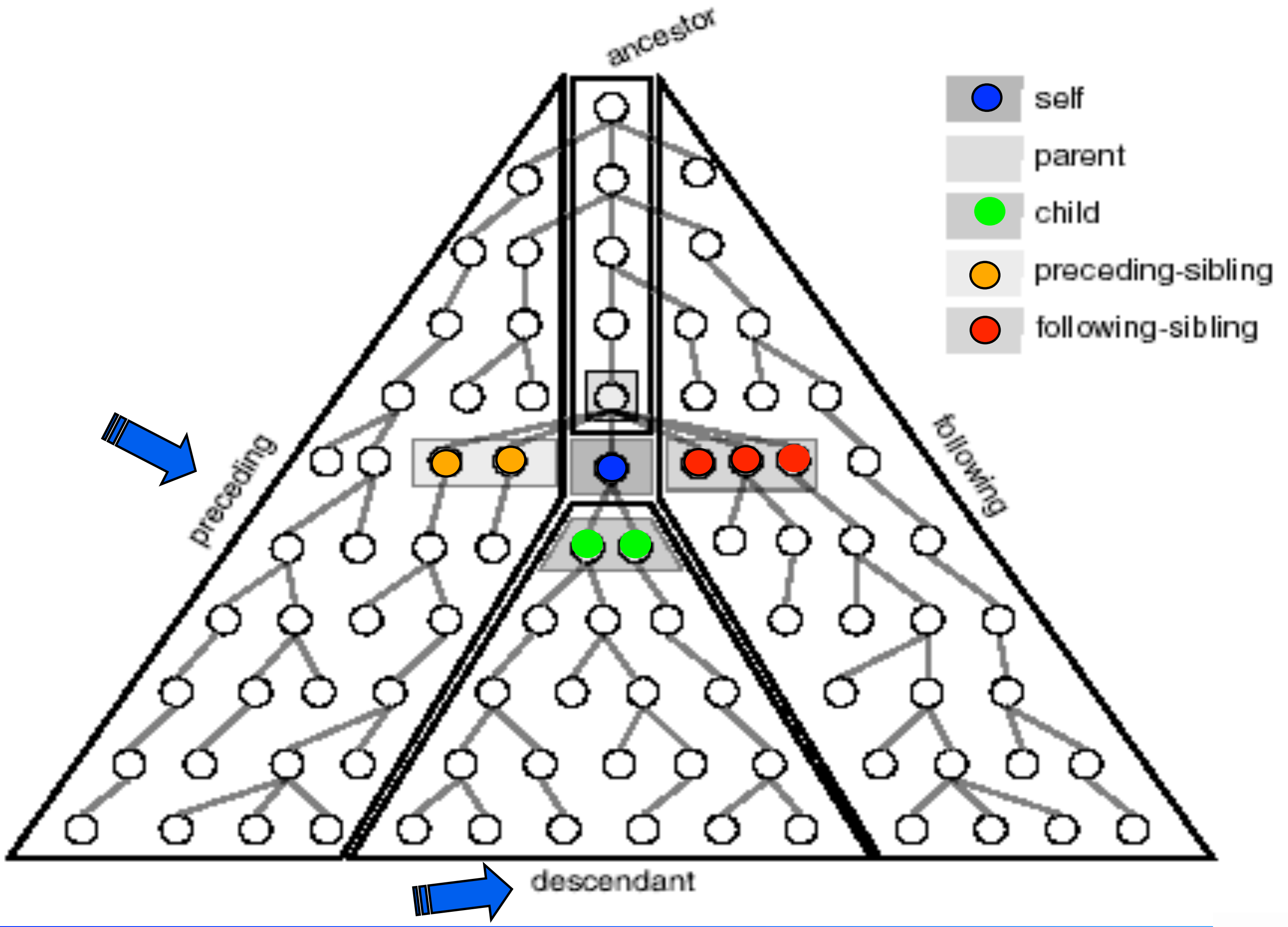


Location Path

- Consists of
  - axis
  - node test
  - predicates (optional)

- Syntax: **axis::nodeTest[predicate]**
  - E.g.: *child::movie[child::title='Raising Arizona']*

axis::nodeTest[predicate]



Axis types

- **parent**: selects the parent
- **ancestor**: selects all the ancestors
- **ancestor-or-self**: selects all the ancestors, including the current node

- **child**: selects all the child elements (DEFAULT AXIS)
- **descendant**: selects all the descendants
- **descendant-or-self**: selects all the descendants, including the current node

- **following**: selects all nodes that follow the current node, except ancestors, attribute nodes and namespace nodes
- **following-sibling**: selects the following siblings

- **preceding**: selects all nodes that appear before the current node, except ancestors, attribute nodes and namespace nodes
- **preceding-sibling**: select the preceding siblings

- **self**: selects the current node
- **attribute**: selects all the attributes

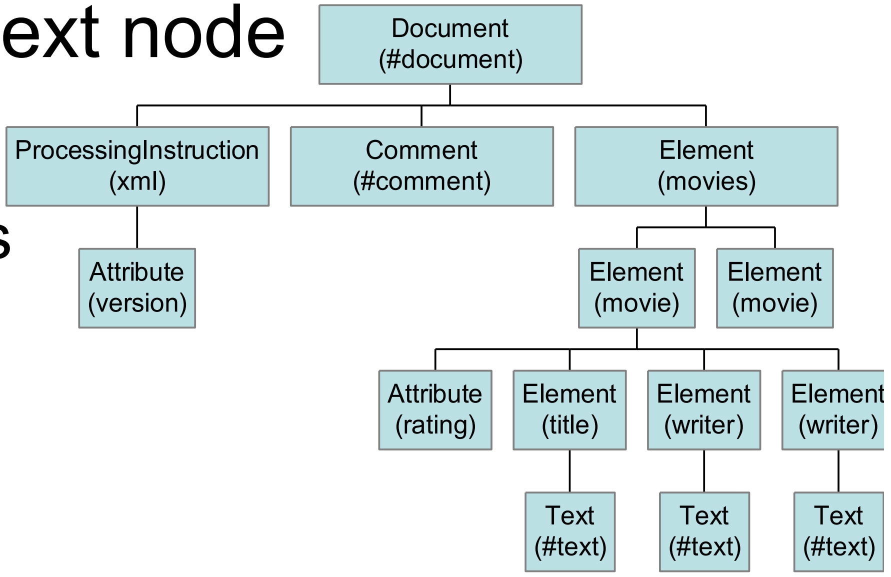
axis::nodeTest[predicate]

- An axis can potentially locate a lot of nodes

- The test is a predicate that is applied to each node of the axis and filters only nodes of a given type
  - If the test is fulfilled, the node is kept. Otherwise, it is discarded.

axis::nodeTest[predicate] Examples

Taking ‘*movies*’ as the context node



- *descendant::movie*
  - → retrieves the *movie* nodes
- *descendant::title*
  - → retrieves the *title* nodes
- *descendant::comment()*
  - → retrieves the comment nodes
- *descendant::movie/attribute::rating*
  - → retrieves the *rating* attribute of *movie* nodes

axis::nodeTest[predicate]

- The predicate acts as a filter: e[p]
  - for each element in the sequence e, if p is true, then propagate the element to the output, otherwise discard it

descendant::movie[child::title = “Airbag”]

- Existential semantics of predicates
  - [child::actor = “Barden”]   is true if at least one element returned by “actor” is string and equals to “Barden”
  - [child::actor = “Barden”] is false if “actor” returns the empty sequence or in the sequence there is no “Barden”
- The predicate may be a simple XPath
  - [actor] is true if “actor” returns a non-empty sequence

axis::nodeTest[predica
Examples

```xml
<?xml version="1.0" ?>
<movies>
  <movie rating="PG-13" type="mistery">
    <title>Raising Arizona</title>
    <writer>Ethan Coen</writer>
    <writer>Joel Coen</writer>
    <producer><name>Ethan</name>…</produ
    <director>Joel Coen</director>
  </movie>
  <movie type="comedy">
    <producer>Pete Smith</producer>
  </movie>
</movies>
```

- /child::movies/child::movie [child::producer/child::name]
- /child::movies/child::movie[child::producer/ child::name=‘Ethan’]
- /child::movies/ child::movie[attribute::type="mistery"]/ child::producer
- /child::movies/child::movie[child::producer/ child::name='Ethan']/child::director

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Path types

➢ Absolute

- evaluated from the root node
- start with /
- /child::movies/child::movie/child::title → would retrieve all the titles

➢ Relative

- evaluated from a context node
- start directly with the expression
- child::title → would select the title of the context node

Location path: abbreviated syntax

- The axis and the node test are combined
- Lets walk along the child, parent, self, attribute, and descendant-or-self axes

```
/child::movies/child::movie/attribute::rating
        /movies/movie/@rating

/child::movies/child::movie[contains(child::writer, ‘thom’)]
        /movies/movie[contains(writer, ‘thom’)]
```

Location steps

- **/** : the root element
- **comment()** : matches any comment node child of the context node
- **..** : indicates the parent of the current node
- **.** : indicates the context node
- **//** : selects from all descendants of the context node, as well as the context node itself
- ***@atrib*** : gets the value of the ‘*atrib*’ attribute
- **attribute()** : matches any attribute node child of the context node
- **@***: matches any attribute node child of the context node
- *****: matches any element node regardless of name
- **node()** : matches all node types: the element node and also the root node, text nodes, attribute nodes, comment nodes, …
- **text()** : matches any text node child of the context node
- **|** : matches any of the named elements

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Location steps. Examples

- child::movie/parent::.
  - movie/..
- child::movie/descendant::surname
  - movie//surname
- movie/director | movie/producer
- /movies/movie/node() <u>vs.</u> /movies/movie/*

Functions

- XPath provides more than 25 functions
- Functions with no argument operate on the context node
- Node Set Functions
  - **count()** – returns the number of nodes that the argument returns
- String Functions
  - **concat()** – returns the concatenation of its arguments
- Number Functions
  - **sum()** – returns the sum of the values of a node set
- Boolean Functions
  - **not()** – true if the argument is false, and vice versa
  - **contains(**string1, string2) – true if string1 contains string2
  - **starts-with(**string, pattern**)** – true if string starts with the pattern

http://www.w3.org/TR/xpath-functions/

Operators

- Boolean operators
  - *and, or, not*
- Arithmetic operators:
  - + - * *div mod*
- Relational operators:

<	>	=	>=	<=	<>	LIKE
&lt;	*&gt;*	=	*&gt;*=	*&lt;*=	!=	~=

Functions and Operators. Examples

- /movies/movie[title = “Airbag”]
- /movies/movie[count(actor) > 3]
- /movies/movie[contains(actor, ‘Marlon’)]
- /movies/movie[position() = 3]
- /movies/movie[(budget * 1,2) > 20000]/producer
- /movies/movie[budget < 1000 and matches(producer/name, "Coen“)]
- /movies/movie[@type != 'mistery']
- /movies/movie/producer[name   =   "Athen"]
- /movies/movie[matches(producer/name, "^Nico")]

Examples …

```
<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 Knowle
                <year> 1998 </year>
    </book>
</bib>
```

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/bib/book/year

Result: ????

/bib/paper/year

Result: ????

Examples …

```
<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 Knowlec
            <year> 1998 </year>
    </book>
</bib>
```

//author (*Restricted Kleene Closure*)

Result: ????

/bib//first-name

Result: ????????

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Examples ...

```
<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
            <year> 1998 </year>
    </book>
</bib>
```

/bib/book/author/text()

Result: ????

Examples…

```
<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
            <year> 1998 </year>
    </book>
</bib>
```

//author/*

Result: ????

//author/node()

Result: ????

Examples …

```
<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
            <year> 1998 </year>
    </book>
</bib>
```

/bib/book/@price

Result: ?

Examples …

```
<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
            <year> 1998 </year>
    </book>
</bib>
```

/bib/book/author[first-name]

Result: ???

/bib/book/author[first-name]/last-name

Result: ???

Examples …

```
<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 Knowledg
            <year> 1998 </year>
    </book>
</bib>
```

/bib/book[@price < "60"]

/bib/book[author/@age < "25"]/title

/bib/book[author/text()]