XPath

References

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

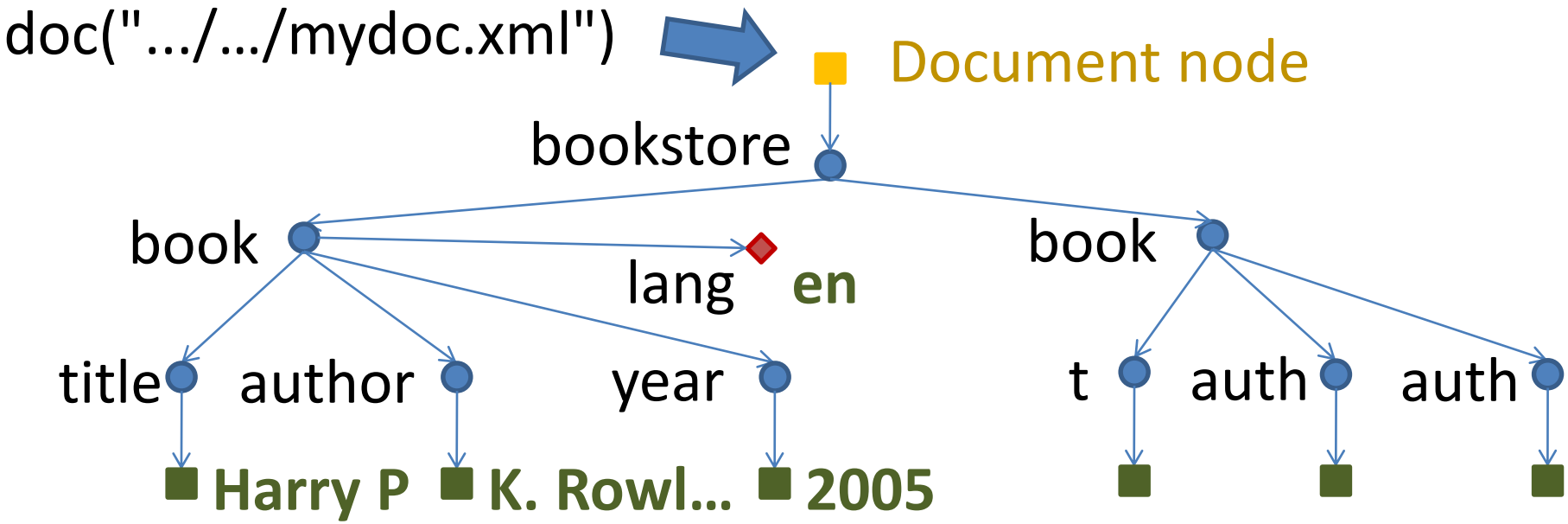
Values

- XQuery and XPath manipulate ordered sequences of *items*; an *item* is either a node or an atomic value
- Nodes as those of XDM

XPath

- <bookstore>
  <book lang=en>
  <title>Harry Potter</title>
  <author>J K. Rowling</author>
  <year>2005</year>
  <price>29.99</price>
  </book>
  </bookstore>

The tree



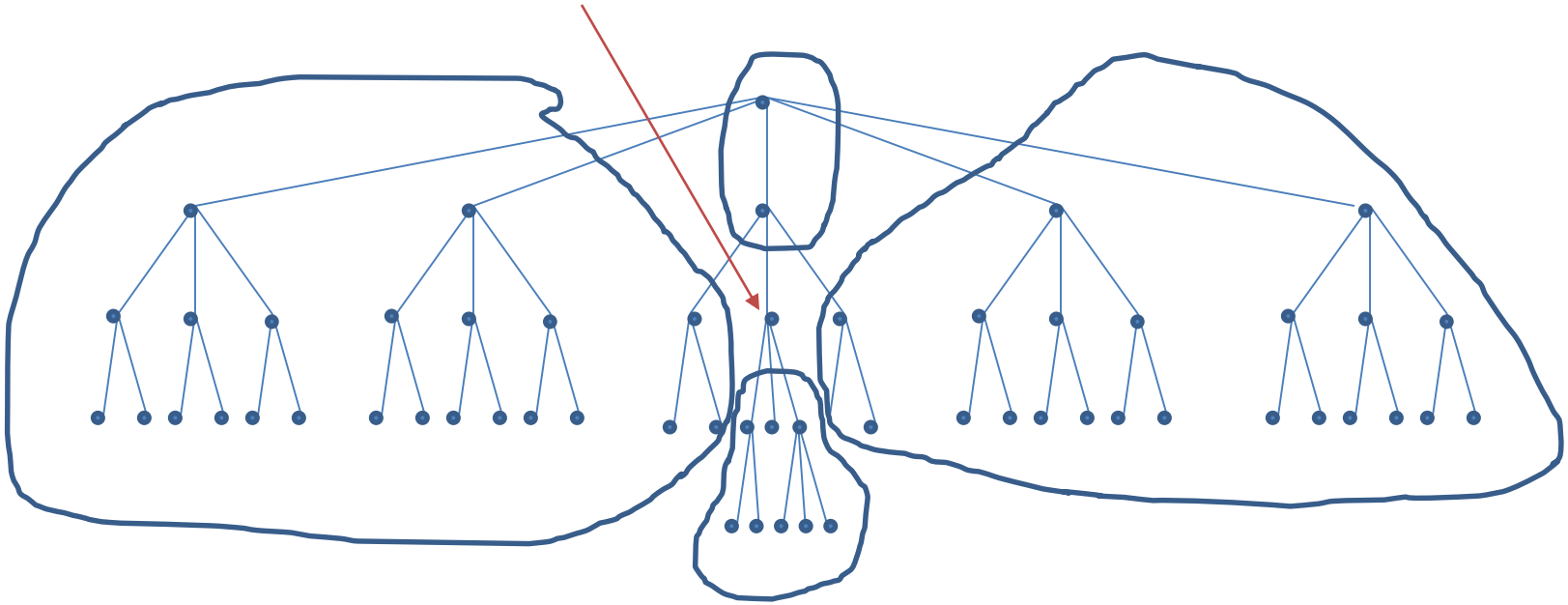

```
$doc /child::element(bookstore)/child::element(book)
$doc /bookstore/book
$doc /descendant::element(author)/child::text()
$doc //author/text()
$doc //book[./author/text() = "K. Rowling"]/title/text()
```

Abbreviations

- Omitted axis: child::
  - book = child::book
- @ = attribute::
  - book/@lang = child::book/attribute::lang
- // = /descendant-or-self::*/
  - $doc//book = $doc/d-o-s::*/child::book
- .. = parent::node()
  - $doc//book/@lang/../author/text()
  - $doc//book[./@lang]/author/text()

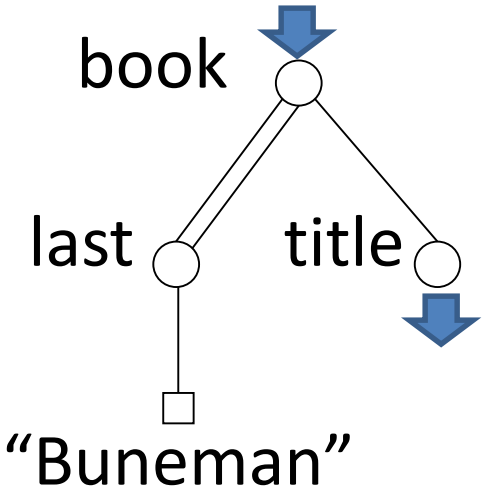
Other axes

- self
- parent
- child: only elements, no attribute
- attribute: the attributes
- namespace
- ancestor, ancestor-or-self
- descendant, descendant-or-self
- following: follow but are not descendants
- following-sibling
- preceding: precede but are not ancestors
- preceding-sibling



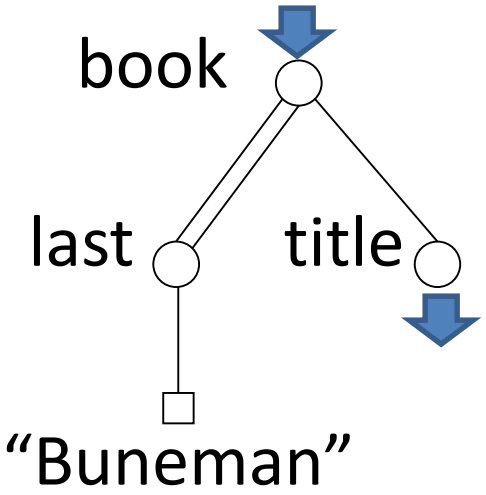
Tree patterns

- Trees with simple “son” edges and double “descendant” edges
- Nodes can be labeled with a kind (“element” “text” “attribute”), a name, a value
- A starting node and a destination node



Tree patterns

- They express Xpath queries:
  - book[//last/text() = 'Buneman']/title
  - book//last/text()/../ancestor::element(book)/title
- They express in a canonical way a set of equivalent XPath queries



Boolean and numerical predicates

- Comparison:
  - descendant::book[@lang = "en"]
- Quantification:
  - .//book[@lang]
  - .//bool[@lang = ("en", "ita")]
- Evaluating path / step: if [[path]] is L=N1,…,Nn, we evaluate step n-times, once for each context (L,Ni)
- Numerical predicates:
  - ./bookstore/book/author[1] => ./bookstore/book/author[position()=1]
  - (./bookstore/book/author)[1]

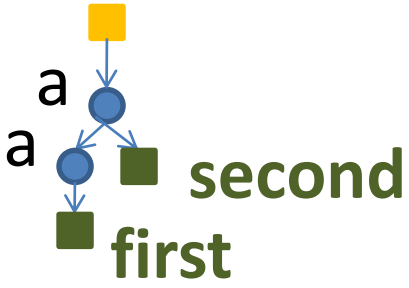
Quantification: the effective boolean value of a sequence

- Empty: false
- The first element is a node: true [./author]
- First is not a node, and length >1: fail
- First is not a node, and length = 1 (singleton):
  - Is a string or untyped: true if not empty
  - Is numeric: true if not zero
  - Is a boolean: true if is true
  - Otherwise: fail

The order of the result

- Document order: the root, the first child and all of its desendants, the second child…
- XPath: every expression that returns nodes, returns them with no duplicates and in document order
  - //a[1]//text() -> “first”, “second”
  - //a[2]//text() -> “first”
  - //a//text()

    -> reorder(“first”, “second”,” first”)
    = (“first”, “second”)



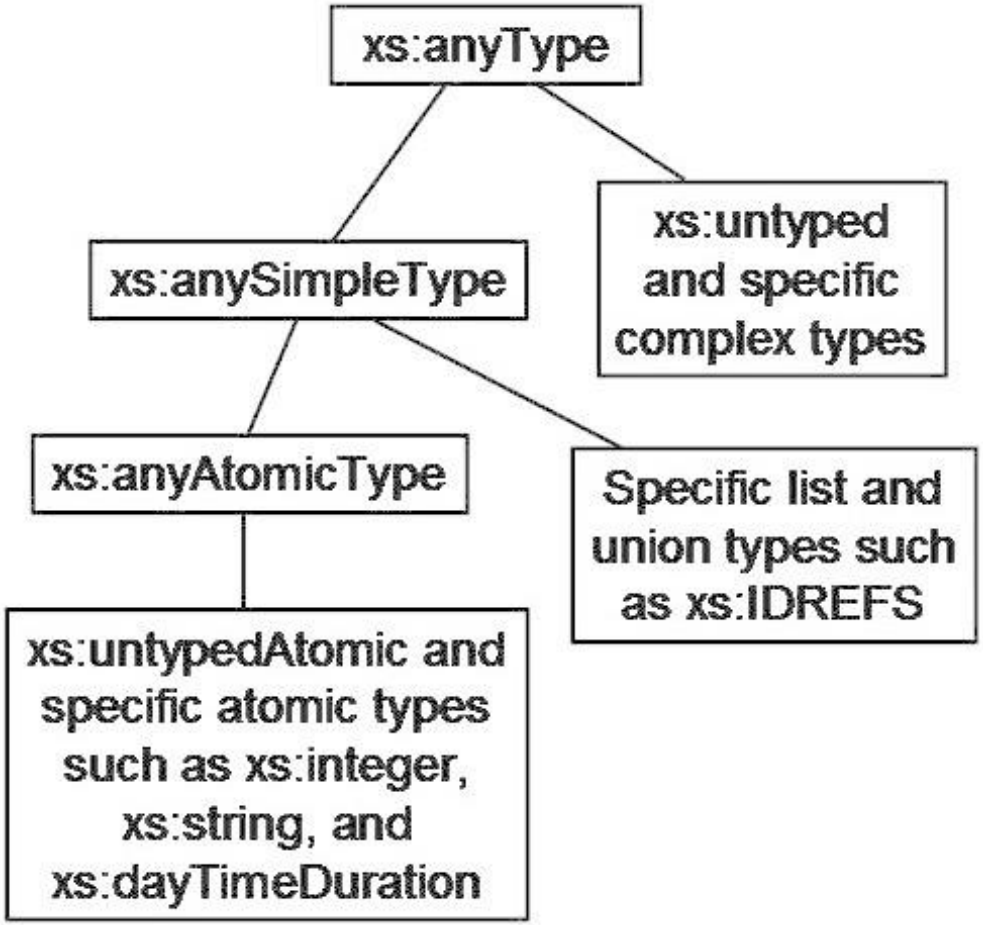
Atomization

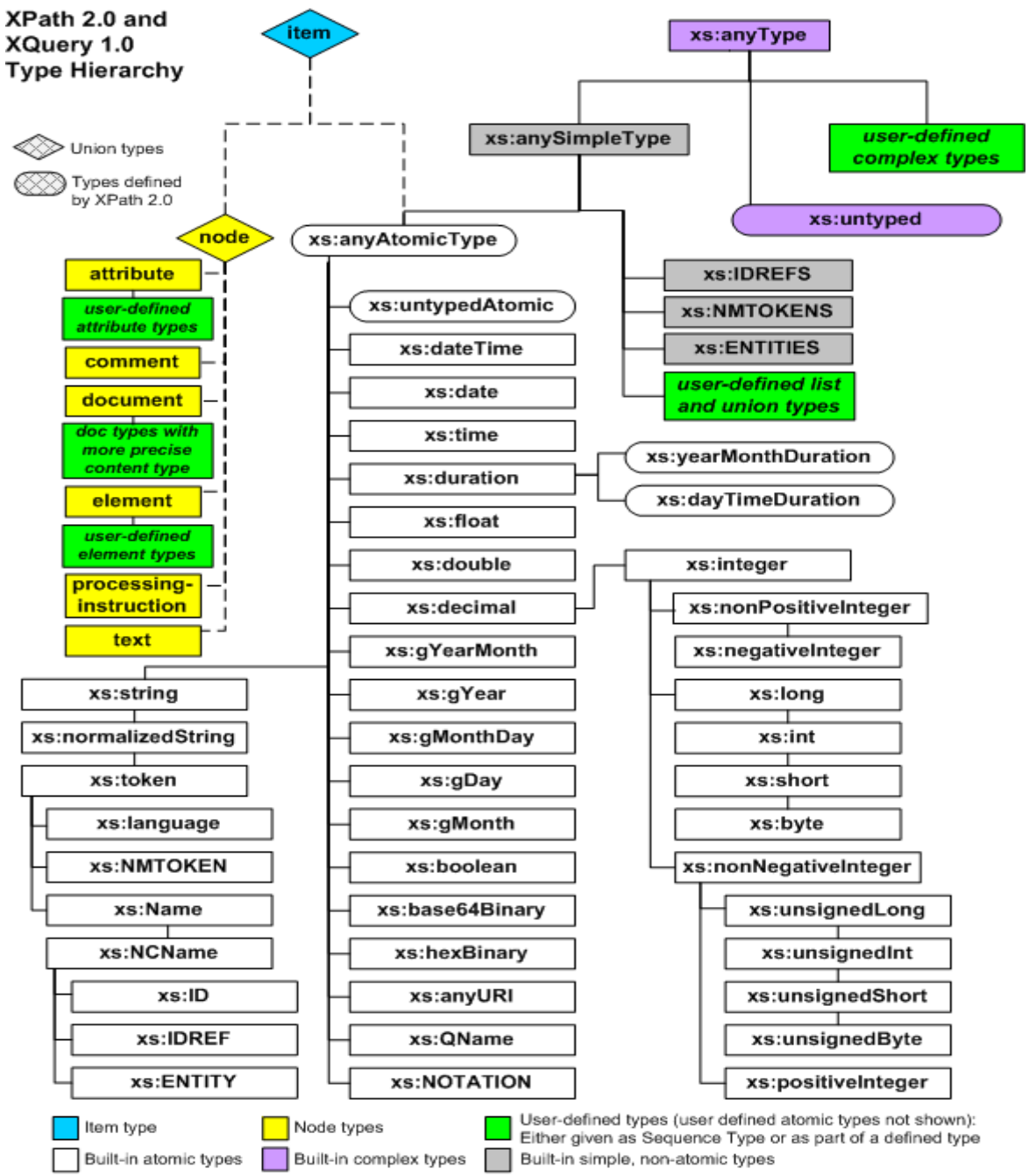
- $john/weight+ 1 ?
- <weight>5</weight> + 1 ?
  - 6, if *weight* is declared numeric
  - *Error* otherwise
- Every function that expects an atomic value (+, = …) triggers atomization
- Atomization:
  - Identity over atomic values
  - The typed value for nodes
- $doc //book[./author = "K. Rowling"]/title/text()

String value e typed value

- String value of a document/element: all the strings of the text leaves, read in document order
- Typed value:
  - Untyped element or typed element with mixed content: the string value
  - Simple content-type element: the string value converted according the content-type
  - Element with element-only content: error

XDM types


xs:anyType
xs:anySimpleType
xs:untyped and specific complex types
xs:anyAtomicType
Specific list and union types such as xs:IDREFS
xs:untypedAtomic and specific atomic types such as xs:integer, xs:string, and xs:dayTimeDuration


XPath 2.0 and
XQuery 1.0
Type Hierarchy
Union types
Types defined by XPath 2.0
item
node
attribute
user-defined attribute types
comment
document
doc types with more precise content type
element
user-defined element types
processing-instruction
text
xs:anyType
xs:anySimpleType
user-defined complex types
xs:untyped
xs:anyAtomicType
xs:IDREFS
xs:NMTOKENS
xs:ENTITIES
user-defined list and union types
xs:untypedAtomic
xs:dateTime
xs:date
xs:time
xs:duration
xs:yearMonthDuration
xs:dayTimeDuration
xs:float
xs:double
xs:decimal
xs:integer
xs:nonPositiveInteger
xs:negativeInteger
xs:long
xs:int
xs:short
xs:byte
xs:nonNegativeInteger
xs:unsignedLong
xs:unsignedInt
xs:unsignedShort
xs:unsignedByte
xs:positiveInteger
xs:gYearMonth
xs:gYear
xs:gMonthDay
xs:gDay
xs:gMonth
xs:boolean
xs:base64Binary
xs:hexBinary
xs:anyURI
xs:QName
xs:NOTATION
xs:string
xs:normalizedString
xs:token
xs:language
xs:NMTOKEN
xs:Name
xs:NCName
xs:ID
xs:IDREF
xs:ENTITY
Item type
Built-in atomic types
Node types
Built-in complex types
User-defined types (user defined atomic types not shown): Either given as Sequence Type or as part of a defined type
Built-in simple, non-atomic types

fn:id

- Let us assume an *IdRefAuth* attribute of type *IDREF* in *books*, and an attribute *Id* of type *ID* in *authors*
- fn:id(E): finds, in the current document, the nodes whose ID appears in the string sequence E:
  - $doc//book[year=2010]/@IdRefAuth:
    - The idrefs of the authors of 2010 books
  - $doc/fn:id($doc//book[year=2010]/@IdRefAuth)
    - The element nodes of those authors
    - Same as:
      - $doc/fn:root()//*[@Id= (…)]
  - $doc/fn:id($doc//book[year=2010]/@IdRefAuth)/name
    - The names of those authors