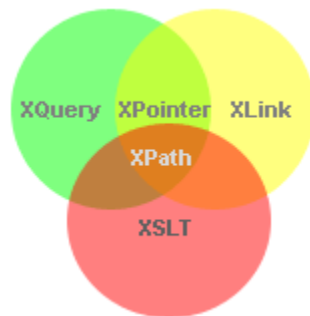


XML and XPath

What is XPath?

XPath is a major element in the XSLT standard.

XPath can be used to navigate through elements and attributes in an XML document.



- XPath is a syntax for defining parts of an XML document
- XPath uses path expressions to navigate in XML documents
- XPath contains a library of standard functions
- XPath is a major element in XSLT and in XQuery
- XPath is a W3C recommendation

XPath Path Expressions

XPath uses path expressions to select nodes or node-sets in an XML document. These path expressions look very much like the expressions you see when you work with a traditional computer file system.

XPath expressions can be used in JavaScript, Java, XML Schema, PHP, Python, C and C++, and lots of other languages.

XPath is Used in XSLT

XPath is a major element in the XSLT standard.

With XPath knowledge you will be able to take great advantage of XSL.

XPath Example

We will use the following XML document:

```
<?xml version="1.0" encoding="UTF-8"?>

<bookstore>

<book category="cooking">
  <title lang="en">Everyday Italian</title>
  <author>Giada De Laurentiis</author>
  <year>2005</year>
  <price>30.00</price>
</book>

<book category="children">
  <title lang="en">Harry Potter</title>
  <author>J K. Rowling</author>
  <year>2005</year>
  <price>29.99</price>
</book>

<book category="web">
  <title lang="en">XQuery Kick Start</title>
  <author>James McGovern</author>
  <author>Per Bothner</author>
  <author>Kurt Cagle</author>
  <author>James Linn</author>
  <author>Vaidyanathan Nagarajan</author>
  <year>2003</year>
  <price>49.99</price>
</book>

<book category="web">
  <title lang="en">Learning XML</title>
  <author>Erik T. Ray</author>
  <year>2003</year>
  <price>39.95</price>
```

</book>

</bookstore>

In the table below we have listed some XPath expressions and the result of the expressions:

| XPath Expression | Result |
|-------------------------------|--|
| /bookstore/book[1] | Selects the first book element that is the child of the bookstore element |
| /bookstore/book[last()] | Selects the last book element that is the child of the bookstore element |
| /bookstore/book[last()-1] | Selects the last but one book element that is the child of the bookstore element |
| /bookstore/book[position()<3] | Selects the first two book elements that are children of the bookstore element |
| //title[@lang] | Selects all the title elements that have an attribute named lang |
| //title[@lang='en'] | Selects all the title elements that have a "lang" attribute with a value of "en" |

/bookstore/book[price>35.00]

Selects all the book elements of the bookstore element that have a price element with a value greater than 35.00

/bookstore/book[price>35.00]/title

Selects all the title elements of the book elements of the bookstore element that have a price element with a value greater than 35.00

XML and XQuery

What is XQuery?

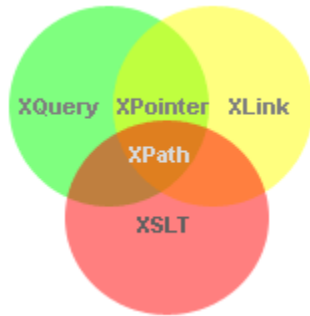
XQuery is to XML what SQL is to databases.

XQuery was designed to query XML data.

XQuery Example

```
for $x in doc("books.xml")/bookstore/book
where $x/price>30
order by $x/title
return $x/title
```

What is XQuery?



- XQuery is **the** language for querying XML data
- XQuery for XML is like SQL for databases
- XQuery is built on XPath expressions
- XQuery is supported by all major databases
- XQuery is a W3C Recommendation

XQuery is About Querying XML

XQuery is a language for finding and extracting elements and attributes from XML documents.

Here is an example of what XQuery could solve:

"Select all CD records with a price less than \$10 from the CD collection stored in cd_catalog.xml"

XQuery and XPath

XQuery 1.0 and XPath 2.0 share the same data model and support the same functions and operators. If you have already studied XPath you will have no problems with understanding XQuery.

XQuery - Examples of Use

XQuery can be used to:

- Extract information to use in a Web Service
- Generate summary reports

- Transform XML data to XHTML
- Search Web documents for relevant information

XQuery is a W3C Recommendation

XQuery is compatible with several W3C standards, such as XML, Namespaces, XSLT, XPath, and XML Schema.

XQuery 1.0 became a W3C Recommendation in 2007.

XQuery FLWOR Expressions

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What is FLWOR?

FLWOR (pronounced "flower") is an acronym for "For, Let, Where, Order by, Return".

- **For** - selects a sequence of nodes
- **Let** - binds a sequence to a variable
- **Where** - filters the nodes
- **Order by** - sorts the nodes
- **Return** - what to return (gets evaluated once for every node)

The XML Example Document

We will use the "books.xml" document in the examples below (same XML file as in the previous chapter).

[View the "books.xml" file in your browser.](#)

How to Select Nodes From "books.xml" With FLWOR

Look at the following path expression:

```
doc("books.xml")/bookstore/book[price>30]/title
```

The expression above will select all the title elements under the book elements that are under the bookstore element that have a price element with a value that is higher than 30.

The following FLWOR expression will select exactly the same as the path expression above:

```
for $x in doc("books.xml")/bookstore/book
where $x/price>30
return $x/title
```

The result will be:

```
<title lang="en">XQuery Kick Start</title>
<title lang="en">Learning XML</title>
```

With FLWOR you can sort the result:

```
for $x in doc("books.xml")/bookstore/book
where $x/price>30
order by $x/title
return $x/title
```

The **for** clause selects all book elements under the bookstore element into a variable called \$x.

The **where** clause selects only book elements with a price element with a value greater than 30.

The **order by** clause defines the sort-order. Will be sort by the title element.

The **return** clause specifies what should be returned. Here it returns the title elements.

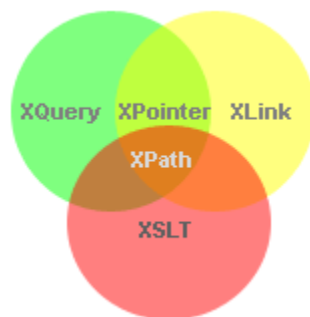
The result of the XQuery expression above will be:

```
<title lang="en">Learning XML</title>
<title lang="en">XQuery Kick Start</title>
```

XML, XLink and XPointer

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XLink is used to create hyperlinks in XML documents.



- XLink is used to create hyperlinks within XML documents
- Any element in an XML document can behave as a link
- With XLink, the links can be defined outside the linked files
- XLink is a W3C Recommendation

XLink Browser Support

There is no browser support for XLink in XML documents.

However, all major browsers support [XLinks in SVG](#).

XLink Syntax

In HTML, the `<a>` element defines a hyperlink. However, this is not how it works in XML. In XML documents, you can use whatever element names you want - therefore it is impossible for browsers to predict what link elements will be called in XML documents.

Below is a simple example of how to use XLink to create links in an XML document:


```
<?xml version="1.0" encoding="UTF-8"?>

<homepages xmlns:xlink="http://www.w3.org/1999/xlink">
  <homepage xlink:type="simple" xlink:href="https://www.w3schools.com">
    Visit W3Schools</homepage>
  <homepage xlink:type="simple" xlink:href="http://www.w3.org">Visit
W3C</homepage>
</homepages>
```

To get access to the XLink features we must declare the XLink namespace. The XLink namespace is: "http://www.w3.org/1999/xlink".

The xlink:type and the xlink:href attributes in the <homepage> elements come from the XLink namespace.

The xlink:type="simple" creates a simple "HTML-like" link (means "click here to go there").

The xlink:href attribute specifies the URL to link to.

XLink Example

The following XML document contains XLink features:

```
<?xml version="1.0" encoding="UTF-8"?>

<bookstore xmlns:xlink="http://www.w3.org/1999/xlink">

  <book title="Harry Potter">
    <description
      xlink:type="simple"
      xlink:href="/images/HPotter.gif"
      xlink:show="new">
      As his fifth year at Hogwarts School of Witchcraft and
      Wizardry approaches, 15-year-old Harry Potter is.....
    </description>
  </book>

  <book title="XQuery Kick Start">
    <description
      xlink:type="simple"
      xlink:href="/images/XQuery.gif">
```

```
xlink:show="new">
XQuery Kick Start delivers a concise introduction
to the XQuery standard.....
</description>
</book>

</bookstore>
```

Example explained:

- The XLink namespace is declared at the top of the document (xmlns:xlink="http://www.w3.org/1999/xlink")
- The xlink:type="simple" creates a simple "HTML-like" link
- The xlink:href attribute specifies the URL to link to (in this case - an image)
- The xlink:show="new" specifies that the link should open in a new window

XLink - Going Further

In the example above we have demonstrated simple XLinks. XLink is getting more interesting when accessing remote locations as resources, instead of standalone pages.

If we set the value of the xlink:show attribute to "embed", the linked resource should be processed inline within the page. When you consider that this could be another XML document you could, for example, build a hierarchy of XML documents.

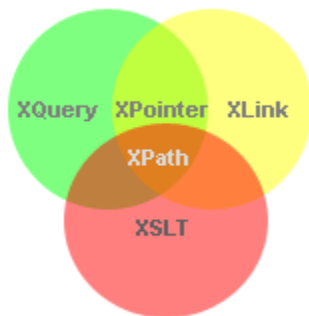
You can also specify WHEN the resource should appear, with the xlink:actuate attribute.

XLink Attribute Reference

| Attribute | Value | Description |
|---------------|---------------------|---|
| xlink:actuate | onLoad onRequest | Defines when the linked resource is read and shown: |

| | | |
|------------|---|---|
| | other none | <ul style="list-style-type: none"> onLoad - the resource should be loaded and shown when the link is loaded onRequest - the resource is not read or shown before the link is loaded |
| xlink:href | URL | Specifies the URL to link to |
| xlink:show | embed new replace other none | Specifies where to open the link. Default is "replace" |
| xlink:type | simple extended locator arc resource title none | Specifies the type of link |

XPointer



- XPointer allows links to point to specific parts of an XML document
- XPointer uses XPath expressions to navigate in the XML document
- XPointer is a W3C Recommendation

XPointer Browser Support

There is no browser support for XPointer. But XPointer is used in other XML languages.

XPointer Example

In this example, we will use XPointer in conjunction with XLink to point to a specific part of another document.

We will start by looking at the target XML document (the document we are linking to):

```
<?xml version="1.0" encoding="UTF-8"?>

<dogbreeds>

<dog breed="Rottweiler" id="Rottweiler">
  <picture url="https://dog.com/rottweiler.gif" />
  <history>The Rottweiler's ancestors were probably Roman
drover dogs.....</history>
  <temperament>Confident, bold, alert and imposing, the Rottweiler
is a popular choice for its ability to protect.....</temperament>
</dog>

<dog breed="FCRetriever" id="FCRetriever">
  <picture url="https://dog.com/fcretriever.gif" />
  <history>One of the earliest uses of retrieving dogs was to
help fishermen retrieve fish from the water.....</history>
  <temperament>The flat-coated retriever is a sweet, exuberant,
lively dog that loves to play and retrieve.....</temperament>
</dog>

</dogbreeds>
```

Note that the XML document above uses id attributes on each element!

So, instead of linking to the entire document (as with XLink), XPointer allows you to link to specific parts of the document. To link to a specific part of a page, add a number sign (#) and an XPointer expression after the URL in the xlink:href attribute, like this:

xlink:href="https://dog.com/dogbreeds.xml#xpointer(id('Rottweiler'))". The expression refers to the element in the target document, with the id value of "Rottweiler".

XPointer also allows a shorthand method for linking to an element with an id. You can use the value of the id directly, like this:

xlink:href="https://dog.com/dogbreeds.xml#Rottweiler".

The following XML document contains links to more information of the dog breed for each of my dogs:

```
<?xml version="1.0" encoding="UTF-8"?>

<mydogs xmlns:xlink="http://www.w3.org/1999/xlink">

  <mydog>
    <description>
      Anton is my favorite dog. He has won a lot of.....
    </description>
    <fact xlink:type="simple" xlink:href="https://dog.com/dogbreeds.xml#
Rottweiler">
      Fact about Rottweiler
    </fact>
  </mydog>

  <mydog>
    <description>
      Pluto is the sweetest dog on earth.....
    </description>
    <fact xlink:type="simple" xlink:href="https://dog.com/dogbreeds.xml#
FCRetriever">
      Fact about flat-coated Retriever
    </fact>
  </mydog>

</mydogs>
```