# The R4X package
## Convenient XML Manipulation for R

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data analysis that delivers

# Outline

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## References

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# E4X
Ecmascript (Javascript) for XML. Example from Wikipedia:
http://en.wikipedia.org/wiki/E4X

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```
var sales = <sales vendor="John">
   <item type="peas" price="4" quantity="6"/>
   <item type="carrot" price="3" quantity="10"/>
   <item type="chips" price="5" quantity="3"/>
</sales>;

alert( sales.item.(@type == "carrot").@quantity );
alert( sales.@vendor );
for each( var price in sales..@price )
  alert( price );
```

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# The XML Package
from the $\hat{\Omega}$ project. http://www.omegahat.org/RSXML/

This package provides facilities for the S language to

- parse XML files, URLs and strings, using either the DOM (Document Object Model)/tree-based approach, or the event-driven SAX (Simple API for XML) mechanism;
- parse HTML documents,
- perform XPath queries on a document,
- generate XML content to buffers, files, URLs, and internal XML trees;
- read DTDs as S objects.

# The XML Package in 3 slides
Creating XML content

```
> x <- xmlNode( "test",
    xmlNode( "bar", attrs = c( fruit = "mango") ),
    xmlNode( "bar", attrs = c( fruit = "apple" )),
  attrs = c(type="foo"))
> x

<test type="foo">
 <bar fruit="mango"/>
 <bar fruit="apple"/>
</test>

> class(x)

[1] "XMLNode"
```

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# The XML package in 3 slides
Append content to an XML structure, the addChildren function

```
> x

<test type="foo">
 <bar fruit="mango"/>
 <bar fruit="apple"/>
</test>

> addChildren( x,
     xmlNode( "bar", attrs =
       c( fruit = "pineapple" ) ) )

<test type="foo">
 <bar fruit="mango"/>
 <bar fruit="apple"/>
 <bar fruit="pineapple"/>
</test>
```

# The XML package in 3 slides
Query content of an XML structure

```
> # The "fruit" attribute of the first child of x
> xmlAttrs( xmlChildren(x)[[1]], "fruit" )

  fruit
"mango"

> # The "fruit" attribute of each child of x
> xmlApply( x, xmlAttrs, "fruit" )

$bar
  fruit
"mango"

$bar
  fruit
"apple"
```

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# Create XML objects

# The `xml` generic function

The default method tries to convert strings into XML nodes, including nested nodes. Remember: Strings can be multiline in R.

```
> y <- xml( '<test><foo blah="1"/><bar/></test>')
> y <- xml( '
    <test>
        <foo blah="1"/>
        <bar/>
    </test>
  ')
> y

<test>
 <foo blah="1"/>
 <bar/>
</test>

> class( y )

[1] "XMLNode"
```

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# Dynamic content with brew

The `brew` package provides a jsp-like templating framework for R. The `<%=` operator is used by R4X to add dynamic content without having to use `paste` or `sprintf`.

```
> f <- c("mango", "apple", "strawberry" )
> x <- xml( '
    <fruits>
      <fruit><%= f[1] %></fruit>
      <fruit><%= f[2] %></fruit>
      <fruit><%= f[3] %></fruit>
    </fruits>
  ')
> x <- xml( '
    <fruits>
      <%for( i in f) {%>
        <fruit><%= i %></fruit>
      <%}%>
    </fruits>
  ')
```

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# For stronger taste, distill rather than brew
The distill function generates brew templates giving a syntax closer to E4X than pure brew code.

```
> x <- xml( txt <- '
    <fruits>
      <fruit>{f[1]}</fruit>
      <fruit>{f[2]}</fruit>
      <fruit>{f[3]}</fruit>
    </fruits>
  ')
> x <- xml( txt <- '
    <fruits>
      <@fruit~f>
        <fruit>{ fruit }</fruit>
      </@>
    </fruits>
  ')
```

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# loop generators

Loop generators are special xml tags starting with @ that are used to generate for loop code.

| Distilling Tag | Corresponding brew code |
|----------------|-------------------------|
| <@i|n> | <% for( i in 1:n){ %> |
| <@i~x> | <% for( i in x){ %> |
| <@i?y> | <% for( i in seq(along=y) ){ %> |
| </@> | <%}%> |

```
> cat( txt )
  <fruits>
    <@fruit~f>
      <fruit>{ fruit }</fruit>
    </@>
  </fruits>
> cat( distill( txt ) )
  <fruits>
    <% for( fruit in f){%>
      <fruit><%= fruit %></fruit>
    <%}%>
  </fruits>
```

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# Adding content to a node
The + and %+=% operators (see package operators for details on %+=%)

```
> (y <- x + "<fruit>blueberry</fruit>")

<fruits>
 <fruit>mango</fruit>
 <fruit>apple</fruit>
 <fruit>strawberry</fruit>
 <fruit>blueberry</fruit>
</fruits>

> a <- "raspberry"
> y %+=% "<fruit>{a}</fruit>"
> y

<fruits>
 <fruit>mango</fruit>
 <fruit>apple</fruit>
 <fruit>strawberry</fruit>
 <fruit>blueberry</fruit>
 <fruit>raspberry</fruit>
</fruits>
```

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# Example 1:

## Generating a tag cloud in xHTML

# Tag cloud

Generating a simple tag cloud. See the operators package for details. Generated with the following script from the words used in all descriptions of R packages.

```r
> all <- casefold( readLines( "descriptions.txt" ) )
> all <- all %s~% "/[^\\w\\s]//pg" %/~% "\\s+"
> all <- all %without% commonWords
> tab <- rev( sort( table( all ) ) )[1:250]
> words <- names(tab)
> for( word in words ){
  if( ( plural <- sprintf("%ss", word) ) %in% words ) {
    tab[word] <- tab[word] + tab[plural]
    tab[plural] <- 0
  }
}
> tab <- tab[ tab != 0 ]
> tab <- tab[ sort(names(tab)) ]
> ncuts <- 8
> sizes <- as.numeric( cut ( tab, ncuts ) )
> refs <- round( seq( 10,24, length=ncuts) )
> words <- names(tab)
```

# Tag cloud
Generating a simple tag cloud. R4X code to write the html page.

```
> tags <- xml( '
    <html>
      <head>
      <style type="text/css">
      <@i|ncuts>
            .cl{i}{
                font-size:{refs[i]}pt;
            }
      </@>
      </style>
      </head>
      <body>
        <@i|length(tab)>
          <span class="cl{sizes[i]}">{words[i]}</span>
        </@>
      </body>
    </html>' )
>   tags %>% "tags.html"
```

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# Manipulate XML objects

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# Example XML Structure

We will use this simple XML structure to demonstrate the slicing of objects of class `XMLNode`.

```
<root>
 <child id="1">
  <subchild id="sub1">foo</subchild>
  <subchild id="sub2">bar</subchild>
 </child>
 <child id="2">
  <subchild id="a">blah</subchild>
  <subchild id="b">bob</subchild>
  <something id="c"/>
 </child>
 <fruits>
  <fruit>banana</fruit>
  <fruit>mango</fruit>
 </fruits>
</root>
```

# XPATH-like syntax

R4X defines an XPATH-like syntax to manipulate XML structures with the usual R extractors [ and [[

| path expression | [ | [[ |
|---|---|---|
| "child" | list | XMLNode |
| "child/subchild" | list | XMLNode |
| "child/subchild/#" | vector | vector |
| "child/subchild/#n" | numeric vector | numeric vector |
| "child/@id" | vector | vector |
| "child//@id" | vector | vector |
| "child/~sub.*" | list | XMLNode |
| "fruits" | XMLNode | XMLNode |

Table: Classes of result for various path expressions.

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# slicing with [

The *single* square bracket [ gives an XMLNode or a list of XMLNode if the path matches more than one node

```
> x[ "child" ]

$child
<child id="1">
 <subchild id="sub1">foo</subchild>
 <subchild id="sub2">bar</subchild>
</child>

$child
<child id="2">
 <subchild id="a">blah</subchild>
 <subchild id="b">bob</subchild>
 <something id="c"/>
</child>

> x[ "child/subchild[1]/@id" ]

 child  child
"sub1"    "a"
```

# Appending content with [<-.XMLNode

The [ extractor also works to add content to an XML structure using the XPath-like expressions.

```
> ( y <- xml( '<test/>' ) )

<test/>

> type <- "foo-bar"
> y[ "foo/bar/test" ] <- '<test type="{type}" />'
> y

<test>
 <foo>
  <bar>
   <test type="foo-bar"/>
  </bar>
 </foo>
</test>
```

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# Example 2:
## Fetch information from RSS feeds

# RSS: Example
Example RSS feed from http://www.w3schools.com/rss.

```xml
<?xml version="1.0" encoding="ISO-8859-1" ?>
<rss version="2.0">
<channel>
  <title>W3Schools Home Page</title>
  <link>http://www.w3schools.com</link>
  <description>
      Free web building tutorials
  </description>
  <item>
    <title>RSS Tutorial</title>
    <link>http://www.w3schools.com/rss</link>
    <description>
        New RSS tutorial on W3Schools
    </description>
  </item>
</channel>
</rss>
```

# Update on the Olympics
Fetching data from the BBC Olympics RSS feed.

```
> sport <- xml( url(
    "http://newsrss.bbc.co.uk/[...]/olympics/rss.xml") )

> titles <- sport[ "channel/item/title/#" ]

> cat( titles, sep = "\n" )

Live - Olympics
Sprinter Thanou barred from Ga [..]
Phelps claims first Beijing go [..]
China defend women's diving ti [..]
Cooke grabs first GB gold meda [..]
Ronaldinho shines in Brazil wi [..]
Rice sees off Hoff for shock g [..]
Park secures 400m freestyle go [..]
South Korea clinch archery gol [..]
Blake dodges showers to progre [..]
```

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# References

XML references from W3C:

- ▶ E4X: `http://www.w3schools.com/e4x/default.asp`
- ▶ RSS: `http://www.w3schools.com/rss/default.asp`

R References

- ▶ XML ($\hat{\Omega}$). `http://www.omegahat.org/RSXML/`
- ▶ brew: `http://www.rforge.net/brew/`
- ▶ operators:
  `http://r-forge.r-project.org/projects/operators`

Pictures

- ▶ `http://www.flickr.com/photos/gamin/383003317/`
- ▶ `http://www.flickr.com/photos/27812866@N04/2748511595/`

# Questions ?

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