



# Reading XML

Jeffrey Leek  
Johns Hopkins Bloomberg School of Public Health

# XML

- Extensible markup language
- Frequently used to store structured data
- Particularly widely used in internet applications
- Extracting XML is the basis for most web scraping
- Components
  - Markup - labels that give the text structure
  - Content - the actual text of the document

<http://en.wikipedia.org/wiki/XML>

# Tags, elements and attributes

- Tags correspond to general labels
  - Start tags `<section>`
  - End tags `</section>`
  - Empty tags `<line-break />`
- Elements are specific examples of tags
  - `<Greeting> Hello, world </Greeting>`
- Attributes are components of the label
  - ``
  - `<step number="3"> Connect A to B. </step>`

<http://en.wikipedia.org/wiki/XML>

# Example XML file



This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
<!-- Edited by XMLSpy® -->
▼<breakfast_menu>
  ▼<food>
    <name>Belgian Waffles</name>
    <price>$5.95</price>
    ▼<description>
      Two of our famous Belgian Waffles with plenty of real maple syrup
    </description>
    <calories>650</calories>
  </food>
  ▼<food>
    <name>Strawberry Belgian Waffles</name>
    <price>$7.95</price>
    ▼<description>
      Light Belgian waffles covered with strawberries and whipped cream
    </description>
    <calories>900</calories>
  </food>
  ▼<food>
    <name>Berry-Berry Belgian Waffles</name>
    <price>$8.95</price>
    ▼<description>
      Light Belgian waffles covered with an assortment of fresh berries and whipped cream
    </description>
    <calories>900</calories>
  </food>
  ▼<food>
    <name>French Toast</name>
    <price>$4.50</price>
    ▼<description>
      Thick slices made from our homemade sourdough bread
    </description>
    <calories>600</calories>
  </food>
  ▼<food>
    <name>Homestyle Breakfast</name>
    <price>$6.95</price>
    ▼<description>
      Two eggs, bacon or sausage, toast, and our ever-popular hash browns
    </description>
    <calories>950</calories>
```

<http://www.w3schools.com/xml/simple.xml>

# Read the file into R

```
library(XML)
fileUrl <- "http://www.w3schools.com/xml/simple.xml"
doc <- xmlTreeParse(fileUrl,useInternal=TRUE)
rootNode <- xmlRoot(doc)
xmlName(rootNode)
```

```
[1] "breakfast_menu"
```

```
names(rootNode)
```

```
food food food food food
"food" "food" "food" "food" "food"
```

# Directly access parts of the XML document

```
rootNode[[1]]
```

```
<food>  
  <name>Belgian Waffles</name>  
  <price>$5.95</price>  
  <description>Two of our famous Belgian Waffles with plenty of real maple syrup</description>  
  <calories>650</calories>  
</food>
```

```
rootNode[[1]][[1]]
```

```
<name>Belgian Waffles</name>
```

# Programmatically extract parts of the file

```
xmlSApply(rootNode,xmlValue)
```

```
"Belgian Waffles$5.95Two of our famous Belgian Waffles with plenty of rea
```

```
"Strawberry Belgian Waffles$7.95Light Belgian waffles covered with strawberries and
```

```
"Berry-Berry Belgian Waffles$8.95Light Belgian waffles covered with an assortment of fresh berries and
```

```
"French Toast$4.50Thick slices made from our homemade so
```

```
"Homestyle Breakfast$6.95Two eggs, bacon or sausage, toast, and our ever-popula
```

# Programmatically extract parts of the file

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xmlSApply(rootNode,xmlValue)
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```

```
"French Toast$4.50Thick slices made from our homemade so
```

```
"Homestyle Breakfast$6.95Two eggs, bacon or sausage, toast, and our ever-popula
```



# XPath

- */node* Top level node
- *//node* Node at any level
- *node[@attr-name]* Node with an attribute name
- *node[@attr-name='bob']* Node with attribute name attr-name='bob'

Information from: <http://www.stat.berkeley.edu/~statcur/Workshop2/Presentations/XML.pdf>

# Get the items on the menu and prices

```
xpathSApply(rootNode,"//name",xmlValue)
```

```
[1] "Belgian Waffles"          "Strawberry Belgian Waffles" "Berry-Berry Belgian Waffles"  
[4] "French Toast"            "Homestyle Breakfast"
```

```
xpathSApply(rootNode,"//price",xmlValue)
```

```
[1] "$5.95" "$7.95" "$8.95" "$4.50" "$6.95"
```

# Another example

The screenshot shows the ESPN website for the Baltimore Ravens. The browser address bar displays [http://espn.go.com/nfl/team/\\_/name/bal/baltimore-ravens](http://espn.go.com/nfl/team/_/name/bal/baltimore-ravens). The page features a navigation bar with links: Clubhouse, Stats, Schedule, Roster, Splits, Depth Chart, Transactions, Rankings, Photos, Stadium, and Blog. The main content area is divided into several sections:

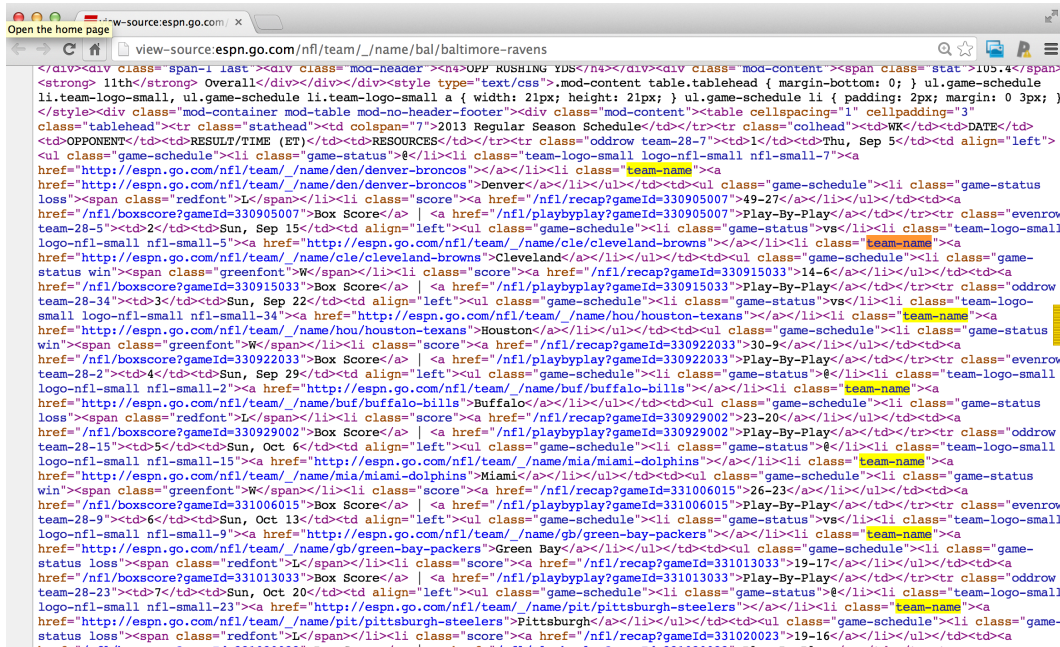
- Recent Game:** A final score of 34-17 against the Cincinnati Bengals at Paul Brown Stadium. Key stats include Dalton (281 yds pass), Green-Ellis (66 yds rush), and Hawkins (74 yds rec).
- 2013 Season Record:** Overall 8-8, 3-3 vs AFC North, and 6-6 vs AFC.
- Team Leaders:** Joe Flacco (3912.0 yds pass), Rice (660.0 yds rush), and Smith (1128.0 yds rec).
- 2013 Overall NFL Rankings:** Passing YDS (18th), Rushing YDS (30th), Opp Passing YDS (12th), and Opp Rushing YDS (11th).
- 2013 Regular Season Schedule:** A table listing games from September to October.
- NFL Nation Buzz:** A video player featuring reporter Jamison Hensley.
- 2013 Team Leaders:** A table showing Joe Flacco's performance across various categories.

WK	DATE	OPPONENT	RESULT/TIME (ET)	RESOURCES
1	Thu, Sep 5	@ Denver	L 49-27	Box Score   Play-By-Play
2	Sun, Sep 15	vs Cleveland	W 14-6	Box Score   Play-By-Play
3	Sun, Sep 22	vs Houston	W 30-9	Box Score   Play-By-Play
4	Sun, Sep 29	@ Buffalo	L 23-20	Box Score   Play-By-Play
5	Sun, Oct 6	@ Miami	W 26-23	Box Score   Play-By-Play
6	Sun, Oct 13	vs Green Bay	L 19-17	Box Score   Play-By-Play

PASSING	ATT	COMP	YDS	TD
Joe Flacco	614	362	3912	19

[http://espn.go.com/nfl/team/\\_/name/bal/baltimore-ravens](http://espn.go.com/nfl/team/_/name/bal/baltimore-ravens)

# Viewing the source



```
</div><div class="span-1 last"><div class="mod-header"><h2>OFF RUSHING YDS</h2></div><div class="mod-content"><span class="stat">105.4</span>
<strong> 11th</strong> Overall</div></div><div><div style="text/css">.mod-content table.tablehead { margin-bottom: 0; } ul.game-schedule
li.team-logo-small, ul.game-schedule li.team-logo-small a { width: 21px; height: 21px; } ul.game-schedule li { padding: 2px; margin: 0 3px; }
</style><div class="mod-container mod-table mod-no-header-footer"><div class="mod-content"><table cellpadding="1" cellspacing="3"
class="tablehead"><tr class="thead"><td colspan="7">2013 Regular Season Schedule</td></tr><tr class="colhead"><td>WK</td><td>DATE</td>
<td>OPPONENT</td><td>RESULT</td><td>TIME (ET)</td><td>RESOURCES</td><td></tr><tr class="odddrow"><td colspan="7">team-28-7</td></tr><td>1</td><td>Thu, Sep 5</td>
<td></td><td></td><td></td><td></td></tr><tr class="evendrow"><td colspan="7">team-schedule</td></tr><tr class="game-status"><td colspan="7">
<div class="team-logo-small logo-nfl-small"><a href="http://espn.go.com/nfl/team/_/name/den/denver-broncos"></a></li><li><div class="team-name"><a
href="http://espn.go.com/nfl/team/_/name/den/denver-broncos">Denver</a></li></ul></td><td><div class="game-schedule"><li class="game-status
loss"><span class="redfont"><div class="span-1"><div class="score"><a href="/nfl/recap?gameId=330905007">49-27</a></div></li></ul></td><td><a
href="/nfl/boxscore?gameId=330905007">Box Score</a> | <a href="/nfl/playbyplay?gameId=330905007">Play-By-Play</a></td></tr><tr class="evendrow">
team-28-5</td><td>2</td><td>Sun, Sep 15</td><td></td><td></td><td></td><td></td></tr><tr class="game-status"><td colspan="7">
logo-nfl-small nfl-small-5</td></tr><tr class="game-schedule"><li class="game-status">vs</li><li><div class="team-name"><a
href="http://espn.go.com/nfl/team/_/name/cle/cleveland-browns">Cleveland</a></li></ul></td><td><div class="game-schedule"><li class="game-
status win"><span class="greenfont"><div class="span-1"><div class="score"><a href="/nfl/recap?gameId=330915033">14-6</a></div></li></ul></td><td><a
href="/nfl/boxscore?gameId=330915033">Box Score</a> | <a href="/nfl/playbyplay?gameId=330915033">Play-By-Play</a></td></tr><tr class="odddrow">
team-28-34</td><td>3</td><td>Sun, Sep 22</td><td></td><td></td><td></td><td></td></tr><tr class="game-status"><td colspan="7">
logo-nfl-small logo-nfl-small-34</td></tr><tr class="game-schedule"><li class="game-status">vs</li><li><div class="team-name"><a
href="http://espn.go.com/nfl/team/_/name/hou/houston-texans">Houston</a></li></ul></td><td><div class="game-schedule"><li class="game-status
win"><span class="greenfont"><div class="span-1"><div class="score"><a href="/nfl/recap?gameId=330922033">30-9</a></div></li></ul></td><td><a
href="/nfl/boxscore?gameId=330922033">Box Score</a> | <a href="/nfl/playbyplay?gameId=330922033">Play-By-Play</a></td></tr><tr class="evendrow">
team-28-2</td><td>4</td><td>Wed, Sep 29</td><td></td><td></td><td></td><td></td></tr><tr class="game-schedule"><li class="game-status"><div class="team-logo-small
logo-nfl-small nfl-small-2"><a href="http://espn.go.com/nfl/team/_/name/buf/buffalo-bills">Buffalo</a></li></ul></td><td><div class="game-schedule"><li class="game-status
loss"><span class="redfont"><div class="span-1"><div class="score"><a href="/nfl/recap?gameId=330929002">23-20</a></div></li></ul></td><td><a
href="/nfl/boxscore?gameId=330929002">Box Score</a> | <a href="/nfl/playbyplay?gameId=330929002">Play-By-Play</a></td></tr><tr class="odddrow">
team-28-15</td><td>5</td><td>Sat, Oct 6</td><td></td><td></td><td></td><td></td></tr><tr class="game-status"><td colspan="7">
logo-nfl-small nfl-small-15</td></tr><tr class="game-schedule"><li class="game-status"><div class="team-name"><a href="http://espn.go.com/nfl/team/_/name/mia/miami-dolphins">Miami</a></li></ul></td><td><div class="game-schedule"><li class="game-status
win"><span class="greenfont"><div class="span-1"><div class="score"><a href="/nfl/recap?gameId=331006015">26-23</a></div></li></ul></td><td><a
href="/nfl/boxscore?gameId=331006015">Box Score</a> | <a href="/nfl/playbyplay?gameId=331006015">Play-By-Play</a></td></tr><tr class="evendrow">
team-28-9</td><td>6</td><td>Wed, Oct 13</td><td></td><td></td><td></td><td></td></tr><tr class="game-schedule"><li class="game-status">vs</li><li><div class="team-name"><a
href="http://espn.go.com/nfl/team/_/name/gb/green-bay-packers">Green Bay</a></li></ul></td><td><div class="game-schedule"><li class="game-status
loss"><span class="redfont"><div class="span-1"><div class="score"><a href="/nfl/recap?gameId=331013033">19-17</a></div></li></ul></td><td><a
href="/nfl/boxscore?gameId=331013033">Box Score</a> | <a href="/nfl/playbyplay?gameId=331013033">Play-By-Play</a></td></tr><tr class="odddrow">
team-28-23</td><td>7</td><td>Wed, Oct 20</td><td></td><td></td><td></td><td></td></tr><tr class="game-status"><td colspan="7">
logo-nfl-small nfl-small-23</td></tr><tr class="game-schedule"><li class="game-status"><div class="team-name"><a href="http://espn.go.com/nfl/team/_/name/pit/pittsburgh-steelers">Pittsburgh</a></li></ul></td><td><div class="game-schedule"><li class="game-
status loss"><span class="redfont"><div class="span-1"><div class="score"><a href="/nfl/recap?gameId=331020023">19-16</a></div></li></ul></td><td><a
```

[http://espn.go.com/nfl/team/\\_/name/bal/baltimore-ravens](http://espn.go.com/nfl/team/_/name/bal/baltimore-ravens)

# Extract content by attributes

```
fileUrl <- "http://espn.go.com/nfl/team/_/name/bal/baltimore-ravens"
doc <- htmlTreeParse(fileUrl,useInternal=TRUE)
scores <- xpathSApply(doc,"//li[@class='score']",xmlValue)
teams <- xpathSApply(doc,"//li[@class='team-name']",xmlValue)
scores
```

```
[1] "49-27"    "14-6"     "30-9"     "23-20"    "26-23"    "19-17"    "19-16"    "24-18"
[9] "20-17 OT" "23-20 OT" "19-3"     "22-20"    "29-26"    "18-16"    "41-7"     "34-17"
```

teams

```
[1] "Denver"      "Cleveland"  "Houston"    "Buffalo"    "Miami"      "Green Bay"
[7] "Pittsburgh"  "Cleveland"  "Cincinnati" "Chicago"    "New York"   "Pittsburgh"
[13] "Minnesota"   "Detroit"    "New England" "Cincinnati"
```

# Notes and further resources

- Official XML tutorials [short](#), [long](#)
- [An outstanding guide to the XML package](#)