WORKING WITH WEB DATA IN R

JSON

Charlotte Wickham
Instructor

JSON (JavaScript Object Notation)

http://www.json.org/

- Plain text format
- Two structures:
  - objects: {"title" : "A New Hope", "year" : "1977"}
  - arrays: [1977, 1980]
- Values: "string", 3, true, false, null, or another object or array

An example JSON data set

```
[
  {
    "title" : "A New Hope",
    "year" : 1977
  },
  {
    "title" : "The Empire Strikes Back",
    "year" : 1980
  }
]
```

Indentifying a JSON response

```
> library(httr)
> url <- "http://httpbin.org/get"
> r <- GET(url)
```

- You know API returns JSON. E.g. from https://httpbin.org/ *"All endpoint responses are JSON-encoded"*
- Check the type returned based on the header:

```
> http_type(r)
[1] "application/json"
```

Indentifying a JSON response

- View the contents as "text"

```
> writeLines(content(r, as = "text"))
No encoding supplied: defaulting to UTF-8.
{
"args": {},
"headers": {
  "Accept": "application/json, text/xml, application/xml, */*",
  "Accept-Encoding": "gzip, deflate",
  "Connection": "close",
  "Host": "httpbin.org",
  "User-Agent": "libcurl/7.54.0 r-curl/2.8.1 httr/1.2.1"
},
"origin": "98.232.182.170",
"url": "http://httpbin.org/get"
}
```

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Let's practice!

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Manipulating JSON

Oliver Keyes
Instructor

Movies example

```
[
  {
    "title" : "A New Hope",
    "year" : 1977
  },
  {
    "title" : "The Empire Strikes Back",
    "year" : 1980
  }
]
```

Movies example

```
> movies_json <- '
+ [
+   {
+     "title" : "A New Hope",
+     "year" : 1977
+   },
+   {
+     "title" : "The Empire Strikes Back",
+     "year" : 1980
+   }
+ ]'
```

Movies example

```
> fromJSON(movies_json, simplifyVector = FALSE)
[[1]]
[[1]]$title
[1] "A New Hope"

[[1]]$year
[1] 1977



[[2]]
[[2]]$title
[1] "The Empire Strikes Back"

[[2]]$year
[1] 1980
```

Simplifying the output

- simplifyVector = TRUE - arrays of primitives become vectors
- simplifyDataFrame = TRUE - arrays of objects become data frames

```
> fromJSON(movies_json, simplifyDataFrame = TRUE)
                        title year
1               A New Hope 1977
2 The Empire Strikes Back 1980
```

Extracting data from JSON

- Rely on fromJSON() to simplify

```
> fromJSON(movies_json, simplifyDataFrame = TRUE)$title
[1] "A New Hope"              "The Empire Strikes Back"
```

- Or iterate over list: rlist, base or tidyverse

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XML structure

Charlotte Wickham
Instructor

Movies in XML

```
<?xml version="1.0" encoding="UTF-8"?>
<movies>
  <movie>
    <title>A New Hope</title>
    <year>1977</year>
  </movie>
  <movie>
    <title>The Empire Strikes Back</title>
    <year>1980</year>
  </movie>
</movies>
```

- Tags: <tagname>... </tagname>.
- E.g. <movies>, <movie>, <title>, <year>

Tags can have attributes

```
<?xml version="1.0" encoding="UTF-8"?>
<movies>
  <movie>
    <title year = "1977">A New Hope</title>
  </movie>
  <movie>
    <title year = "1980">The Empire Strikes Back</title>
  </movie>
</movies>
```

The hierarchy of XML elements

```
<?xml version="1.0" encoding="UTF-8"?>
<movies>
  <movie>
    <title>A New Hope</title>
    <year>1977</year>
  </movie>
  <movie>
    <title>The Empire Strikes Back</title>
    <year>1980</year>
  </movie>
</movies>
```

The hierarchy of XML elements

```
<?xml version="1.0" encoding="UTF-8"?>
<movies>
  <movie>
    <title>A New Hope</title>
    <year>1977</year>
  </movie>
  <movie>
    <title>The Empire Strikes Back</title>
    <year>1980</year>
  </movie>
</movies>
```

movie element

The hierarchy of XML elements

```
<?xml version="1.0" encoding="UTF-8"?>
<movies>
  <movie>
    <title>A New Hope</title>
    <year>1977</year>
  </movie>
  <movie>
    <title>The Empire Strikes Back</title>
    <year>1980</year>
  </movie>
</movies>
```

title element

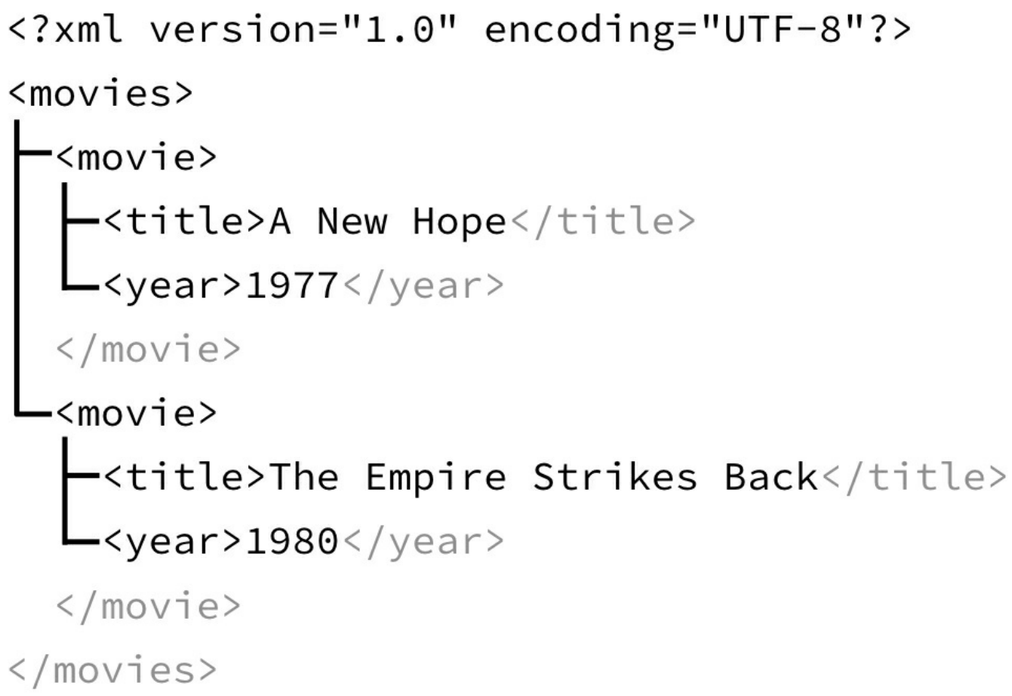
year element

The hierarchy of XML elements

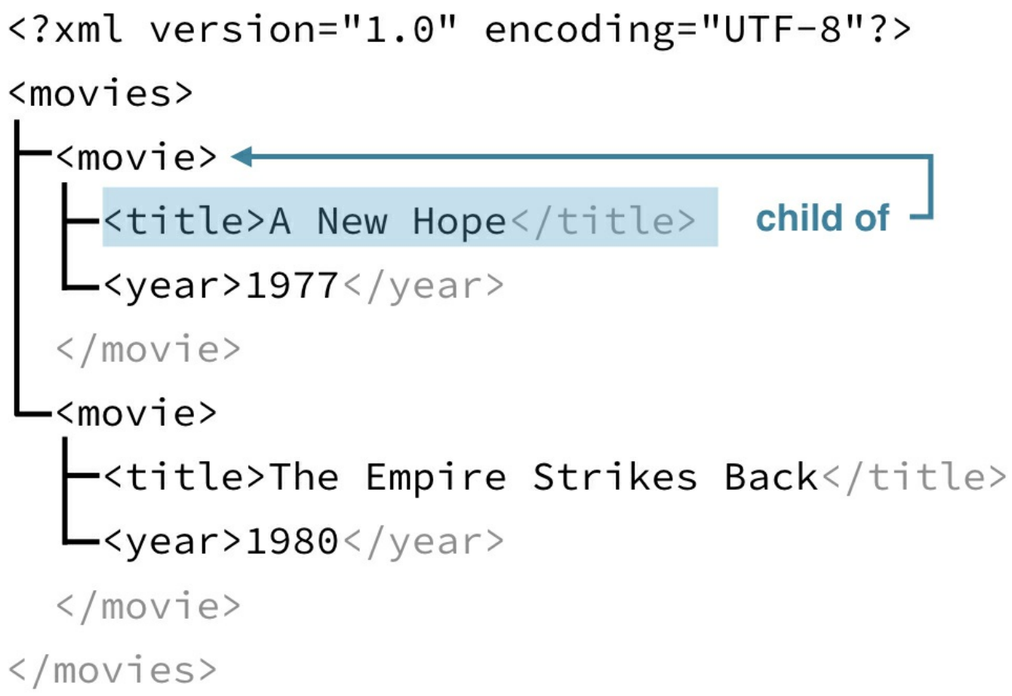
```
<?xml version="1.0" encoding="UTF-8"?>
<movies>
  <movie>
    <title>A New Hope</title>
    <year>1977</year>
  </movie>
  <movie>
    <title>The Empire Strikes Back</title>
    <year>1980</year>
  </movie>
</movies>
```

text

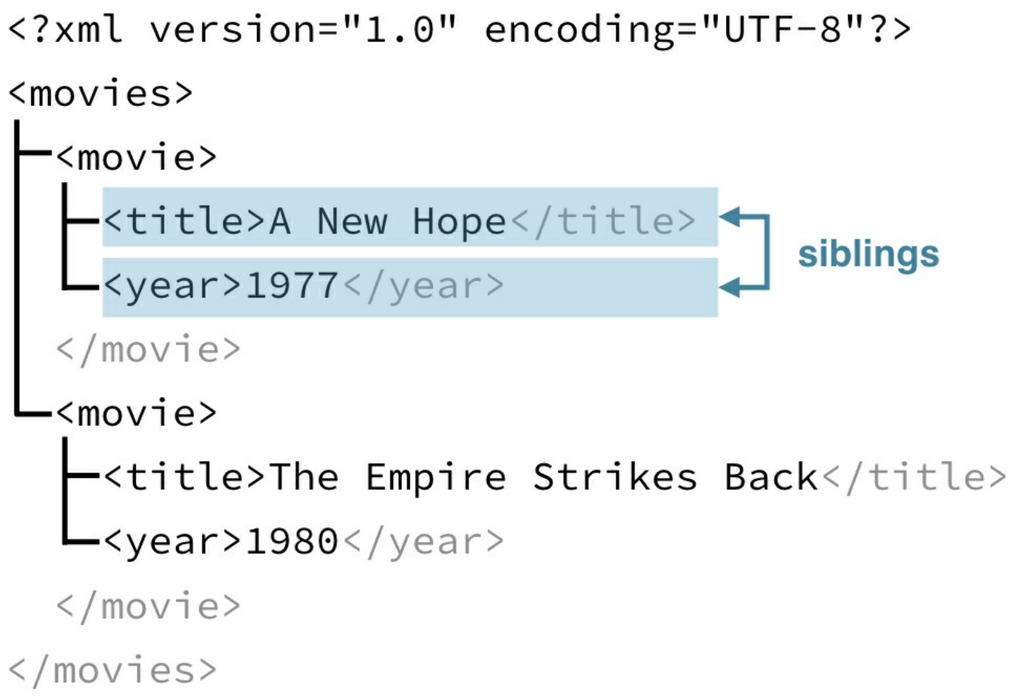
Understanding XML as a tree



Understanding XML as a tree



Understanding XML as a tree



Understanding XML as a tree

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XPATHS

Oliver Keyes
Instructor

Movies example

```
<?xml version="1.0" encoding="UTF-8"?>
<movies>
  <title>"Star Wars"</title>
  <movie episode = "IV">
    <title>A New Hope</title>
    <year>1977</year>
  </movie>
  <movie episode = "V">
    <title>The Empire Strikes Back</title>
    <year>1980</year>
  </movie>
</movies>
```

Movies example

```
movies_xml <- read_xml('
<?xml version="1.0" encoding="UTF-8"?>
<movies>
  <title>"Star Wars"</title>
  <movie episode = "IV">
    <title>A New Hope</title>
    <year>1977</year>
  </movie>
  <movie episode = "V">
    <title>The Empire Strikes Back</title>
    <year>1980</year>
  </movie>
</movies>')
```

XPATHS

- Specify locations of nodes, a bit like file paths: /movies/movie/title
- xml_find_all(x = ____, xpath = ___)

XPATHS

- Specify locations of nodes, a bit like file paths: /movies/movie/title

- xml_find_all(x = ____, xpath = ___)

```
> xml_find_all(movies_xml, xpath = "/movies/movie/title")
{xml_nodeset (2)}
[1] <title>A New Hope</title>
[2] <title>The Empire Strikes Back</title>
```

XPATHS

- Specify locations of nodes, a bit like file paths: /movies/movie/title

- xml_find_all(x = ____, xpath = ___)

```
> xml_find_all(movies_xml, xpath = "/movies/movie/title")
{xml_nodeset (2)}
[1] <title>A New Hope</title>
[2] <title>The Empire Strikes Back</title>

# Store the title nodeset
> title_nodes <- xml_find_all(movies_xml,
+     xpath = "/movies/movie/title")

# Extract contents with xml_text()
> xml_text(title_nodes)
[1] "A New Hope"              "The Empire Strikes Back"
```

Other XPATH Syntax

- // - a node at any level below
- //title

```
> xml_find_all(movies_xml, "//title")
{xml_nodeset (3)}
[1] <title>"Star Wars"</title>
[2] <title>A New Hope</title>
[3] <title>The Empire Strikes Back</title>
```

- @ - to extract attributes
- //movie/@episode

```
> xml_find_all(movies_xml, "//movie/@episode")
{xml_nodeset (2)}
[1]  episode="IV"
[2]  episode="V"
```

Wrap Up

XPATH	Meaning
/node	Elements with tag node at this level
//node	Elements with tag node anywhere at or below this level
@attr	Attribute with name attr

- Get nodes with xml_find_all()
- Extract contents with xml_double(), xml_integer() or as_list().

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