UNIVERSITY OF
Southampton

Web Formats

COMP3220 Web Infrastructure

Dr Nicholas Gibbins – nmg@ecs.soton.ac.uk

Web Formats

HTML is the main Web format

- Many other formats in use on the Web
- Many other formats use Web standards

NOTE: This lecture goes into a lot of detail, but for illustrative purposes only. You should be broadly familiar with the range of formats, what they’re for and (roughly) how they work

eXtensible Markup Language

The eXtensible Markup Language

A **general purpose** markup language

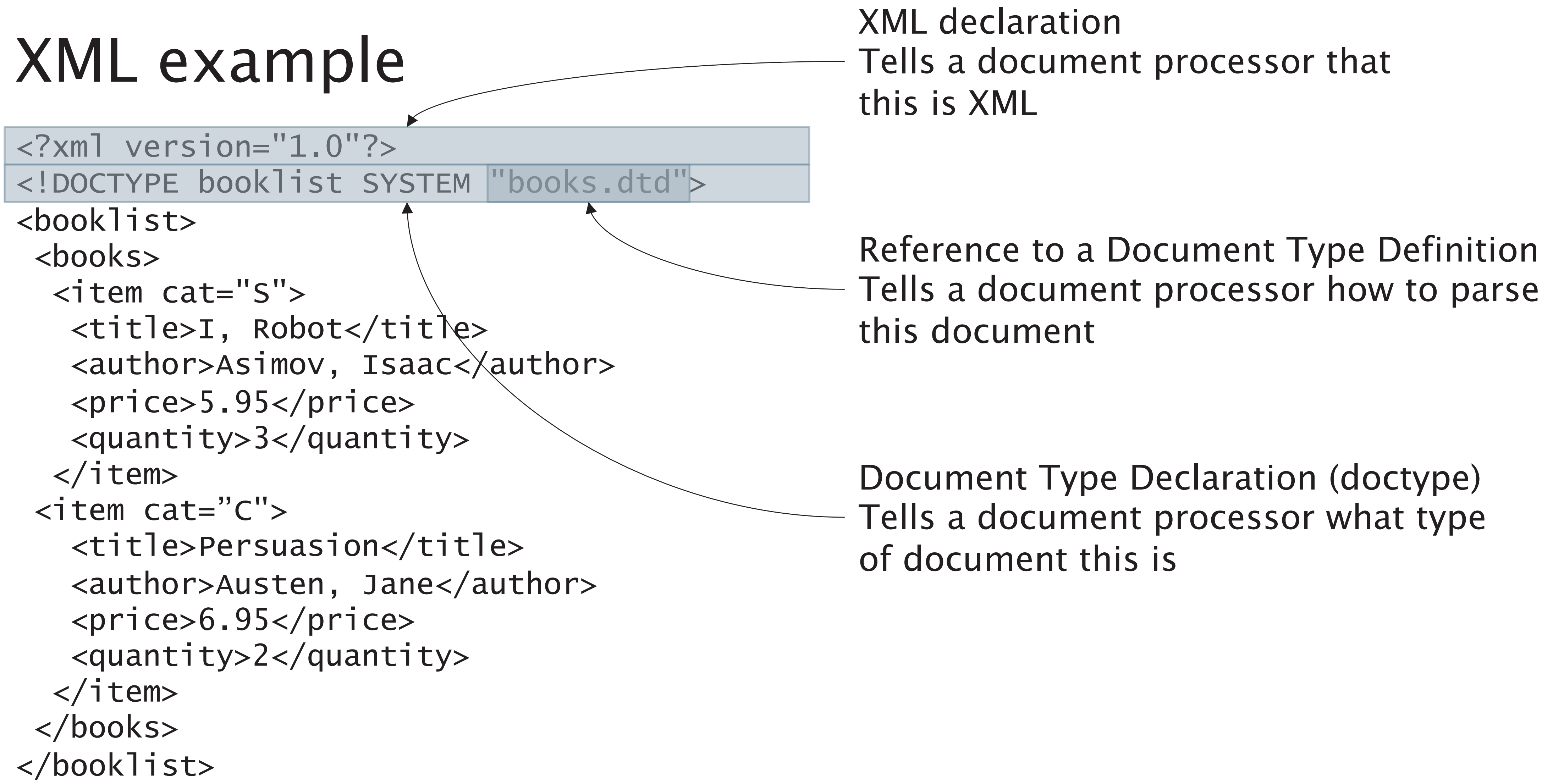
- A W3C-defined subset of the Standard Generalized Markup Language

A markup language for defining domain-specific markup languages

Used as the basis for a number of Web formats:

- Scalable Vector Graphics
- Resource Description Framework
- Synchronised Multimedia Integration Language
- Simple Object Access Protocol
- eXtensible Stylesheet Language Transformations
- (but not HTML5)

XML example



```
<?xml version="1.0"?>
<!DOCTYPE booklist SYSTEM "books.dtd">
<booklist>
 <books>
  <item cat="S">
   <title>I, Robot</title>
   <author>Asimov, Isaac</author>
   <price>5.95</price>
   <quantity>3</quantity>
  </item>
 <item cat=”C">
   <title>Persuasion</title>
   <author>Austen, Jane</author>
   <price>6.95</price>
   <quantity>2</quantity>
  </item>
 </books>
</booklist>
```

XML declaration
Tells a document processor that this is XML

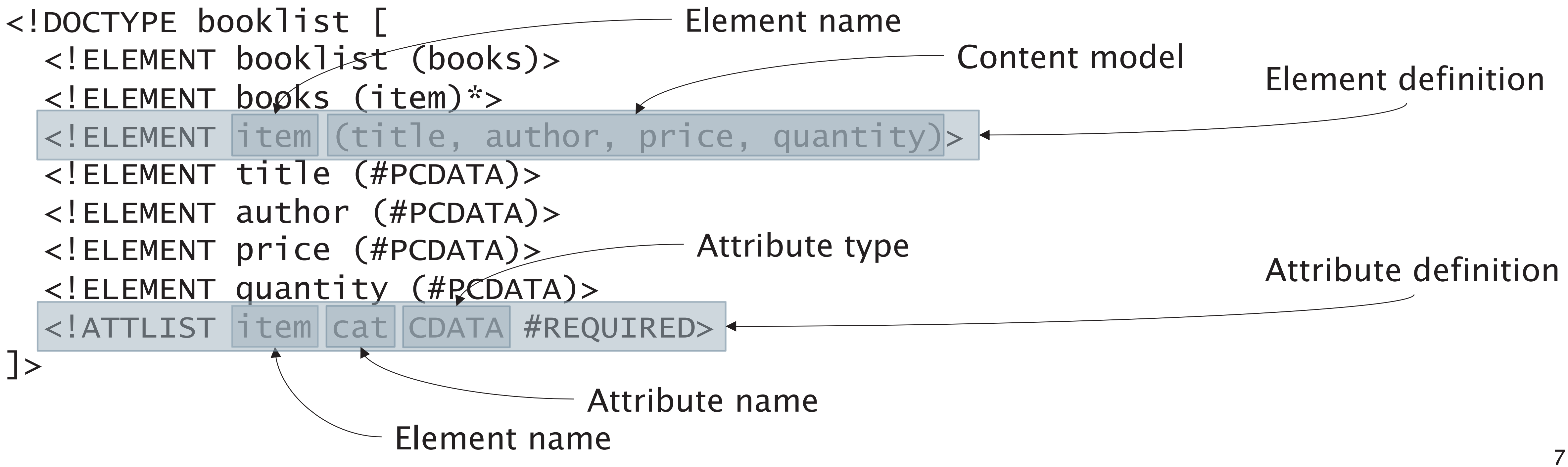
Reference to a Document Type Definition
Tells a document processor how to parse this document

Document Type Declaration (doctype)
Tells a document processor what type of document this is

Document Type Definition (DTD)

A formal definition of the grammar for an XML document type

- What elements and attributes exist
- What elements can exist inside other elements (the content model)
- Referenced by the document type declaration



```
<!DOCTYPE booklist [
  <!ELEMENT booklist (books)>
  <!ELEMENT books (item)*>
  <!ELEMENT item (title, author, price, quantity)>
  <!ELEMENT title (#PCDATA)>
  <!ELEMENT author (#PCDATA)>
  <!ELEMENT price (#PCDATA)>
  <!ELEMENT quantity (#PCDATA)>
  <!ATTLIST item cat CDATA #REQUIRED>
]>
```

Element name

Content model

Element definition

Attribute type

Attribute definition

Attribute name

Element name

Well-Formedness versus Validity

An XML document is *well-formed* if it obeys the syntax rules in the XML spec:

- Single root element
- Elements are correctly nested (no overlapping)
- Tag names contain only legal characters
- Start and end tag names have matching capitalisation
- (to name but a few of the rules)

Well-Formedness versus Validity

An XML document is *valid* if:

- It contains a reference to a DTD
- It only contains elements and attributes that are defined in that DTD
- Its use of those elements and attributes follows the grammar rules in the DTD

- All valid XML documents are well-formed
- Not all well-formed XML documents are valid

Other Schema Languages

Document Type Definitions have expressive limitations

- Cannot specify the range of values taken by attributes
- Cannot specify the range of non-markup element content

Two main competitors:

- XML Schema
- RELAX NG

Scalable Vector Graphics

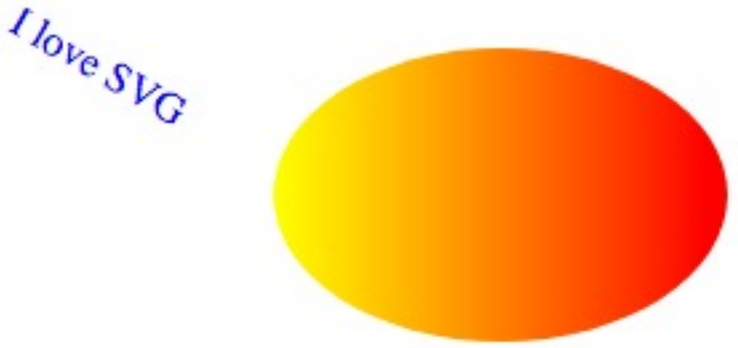
Scalable Vector Graphics

XML-based language for describing 2D graphics

- Resolution independent
- Support for Javascript event handlers
- Support for manipulation via the Document Object Model (DOM)
- Uses CSS for styling and animation
- Integrates with HTML5

SVG Example

```
<svg height="150" width="400" xmlns:xlink="http://www.w3.org/1999/xlink">
  <defs>
    <linearGradient id="grad1" x1="0%" y1="0%" x2="100%" y2="0%">
      <stop offset="0%" style="stop-color:rgb(255,255,0);stop-opacity:1" />
      <stop offset="100%" style="stop-color:rgb(255,0,0);stop-opacity:1" />
    </linearGradient>
  </defs>
  <ellipse cx="200" cy="70" rx="85" ry="55" fill="url(#grad1)" />
  <text x="0" y="15" fill="blue" transform="rotate(30 20,40)">I love
    <a xlink:href="http://www.w3.org/SVG/" target="_blank">SVG</a></text>
</svg>
```



MathML

MathML

XML-based language for expressing mathematical expressions

- Integrates with HTML5

Two sub-languages:

- Presentation-oriented (for display)
- Semantics-oriented

Presentational MathML

```
<math xmlns="http://www.w3.org/1998/Math/MathML">
  <mrow>
    <msup><mi>a</mi><mn>2</mn></msup>
    <mo>+</mo>
    <msup><mi>b</mi><mn>2</mn></msup>
    <mo>=</mo>
    <msup><mi>c</mi><mn>2</mn></msup>
  </mrow>
</math>
```

$$a^2 + b^2 = c^2$$

Semantic MathML

```
<math xmlns="http://www.w3.org/1998/Math/MathML”>
  <apply>
    <eq/>
    <apply>
      <plus/>
      <apply>
        <power/><ci>a</ci><cn>2</cn>
      </apply>
      <apply>
        <power/><ci>b</ci><cn>2</cn>
      </apply>
    </apply>
    <apply>
      <power/><ci>c</ci><cn>2</cn>
    </apply>
  </apply>
</math>
```

$$a^2 + b^2 = c^2$$

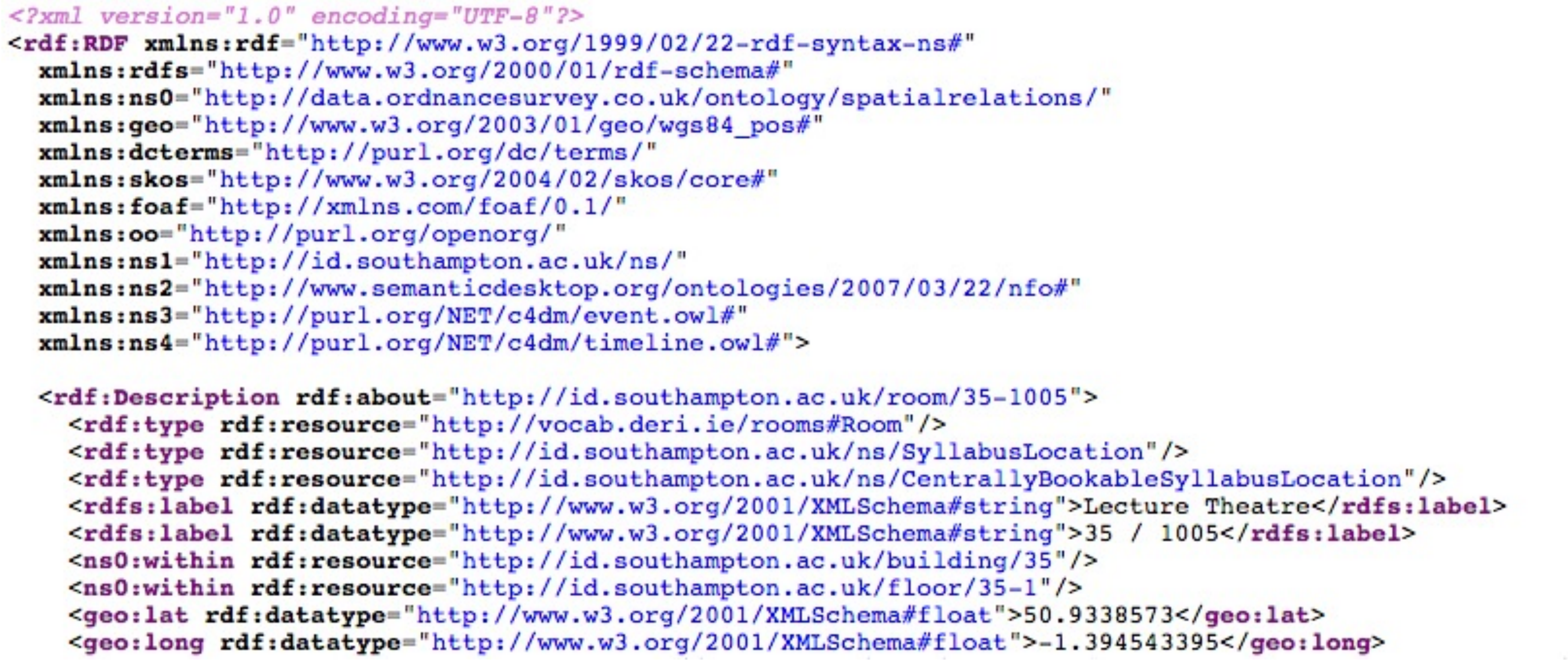
UNIVERSITY OF Southampton

Web Data

Structured and Linked Data on the Web

The Resource Description Framework

- Subject of a later lecture on this module
- Covered (in considerable depth) in COMP6215 Semantic Web Technologies next semester



```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:ns0="http://data.ordnancesurvey.co.uk/ontology/spatialrelations/"
  xmlns:geo="http://www.w3.org/2003/01/geo/wgs84_pos#"
  xmlns:dcterms="http://purl.org/dc/terms/"
  xmlns:skos="http://www.w3.org/2004/02/skos/core#"
  xmlns:foaf="http://xmlns.com/foaf/0.1/"
  xmlns:oo="http://purl.org/openorg/"
  xmlns:ns1="http://id.southampton.ac.uk/ns/"
  xmlns:ns2="http://www.semanticdesktop.org/ontologies/2007/03/22/nfo#"
  xmlns:ns3="http://purl.org/NET/c4dm/event.owl#"
  xmlns:ns4="http://purl.org/NET/c4dm/timeline.owl#">

  <rdf:Description rdf:about="http://id.southampton.ac.uk/room/35-1005">
    <rdf:type rdf:resource="http://vocab.deri.ie/rooms#Room"/>
    <rdf:type rdf:resource="http://id.southampton.ac.uk/ns/SyllabusLocation"/>
    <rdf:type rdf:resource="http://id.southampton.ac.uk/ns/CentrallyBookableSyllabusLocation"/>
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Lecture Theatre</rdfs:label>
    <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">35 / 1005</rdfs:label>
    <ns0:within rdf:resource="http://id.southampton.ac.uk/building/35"/>
    <ns0:within rdf:resource="http://id.southampton.ac.uk/floor/35-1"/>
    <geo:lat rdf:datatype="http://www.w3.org/2001/XMLSchema#float">50.9338573</geo:lat>
    <geo:long rdf:datatype="http://www.w3.org/2001/XMLSchema#float">-1.394543395</geo:long>
```

ePub

ePub Format

Open vendor-neutral standard for e-books defined by IDPF (now part of W3C)

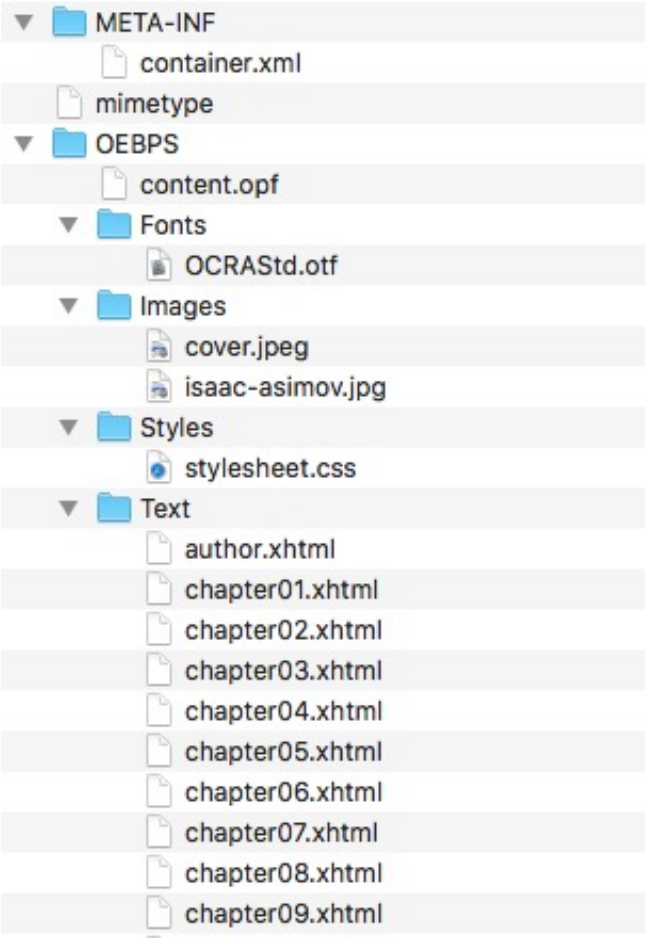
ZIP file of directory hierarchy containing XML and HTML files

- META-INF/container.xml
- OEBPS/content.opf

Use of HTML allows resizable and reflowable content – essential for adapting to a wide variety of readers

Other common ebook formats take similar approach (ZIP of XML/HTML files)

- Kindle (.azw), Mobipocket, Apple iBooks



```
▼ META-INF
    container.xml
  mimetype
▼ OEBPS
    content.opf
  ▼ Fonts
      OCRAStd.otf
  ▼ Images
      cover.jpeg
      isaac-asimov.jpg
  ▼ Styles
      stylesheet.css
  ▼ Text
      author.xhtml
      chapter01.xhtml
      chapter02.xhtml
      chapter03.xhtml
      chapter04.xhtml
      chapter05.xhtml
      chapter06.xhtml
      chapter07.xhtml
      chapter08.xhtml
      chapter09.xhtml
```

META-INF/container.xml

Points to OPF package which describes the other components of the document

```
<?xml version="1.0" encoding="UTF-8"?>
<container version="1.0”
  xmlns="urn:oasis:names:tc:opendocument:xmlns:container">
  <rootfiles>
    <rootfile full-path="OEBPS/content.opf"
              media-type="application/oebps-package+xml"/>
  </rootfiles>
</container>
```

OEBPS/content.opf

Three key components:

- Metadata about document

```
<metadata xmlns:dc="http://purl.org/dc/elements/1.1/"
          xmlns:dcterms="http://purl.org/dc/terms/"
          xmlns:opf="http://www.idpf.org/2007/opf"
          xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <dc:identifier id="uuid_id" opf:scheme="uuid">
    df3d24ec-aa53-4a72-9075-e97b5b7bc26f</dc:identifier>
  <dc:title>The Stars, Like Dust</dc:title>
  <dc:creator opf:file-as="Asimov, Isaac” opf:role="aut">Isaac Asimov</dc:creator>
  <dc:language>en</dc:language>
</metadata>
```

OEBPS/content.opf

Three key components:

- Metadata about document
- Manifest listing files that comprise document

```
<manifest>
  <item href="Images/cover.jpeg" id="cover"
        media-type="image/jpeg"/>
  <item href="Styles/stylesheet.css" id="css"
        media-type="text/css"/>
  <item href="Text/cover.xhtml" id="cover.xhtml"
        media-type="application/xhtml+xml"/>
  <item href="Text/chapter01.xhtml" id="chapter01.xhtml"
        media-type="application/xhtml+xml"/>
  ...
</manifest>
```

OEBPS/content.opf

Three key components:

- Metadata about document
- Manifest listing files that comprise document
- Spine listing table of contents

```
<spine toc="ncx">
  <itemref idref="cover.xhtml"/>
  <itemref idref="title.xhtml"/>
  <itemref idref="chapter01.xhtml"/>
  <itemref idref="chapter02.xhtml"/>
  <itemref idref="chapter03.xhtml"/>
  ...
</spine>
```

OEBPS/Text/chapter01.xhtml

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN”
"http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
  <head>
    <link href="../Styles/stylesheet.css" rel="stylesheet"
          type="text/css"/>
  </head>
  <body>
    <h1>ONE: The Bedroom Murmured</h1>
    <p>The bedroom murmured to itself gently. It was almost below the limits of hearing—
an irregular little sound, yet quite unmistakable, and quite deadly.</p>
    <p>But it wasn’t that which awakened Biron Farrill and dragged him out of a heavy,
unrefreshing slumber. He turned his head restlessly from side to side in a futile
struggle against the periodic burr-r-r on the end table.</p>
    <p>He put out a clumsy hand without opening his eyes and closed contact.</p>
    <p>“Hello,” he mumbled.</p>
```

UNIVERSITY OF Southampton

Office Open XML

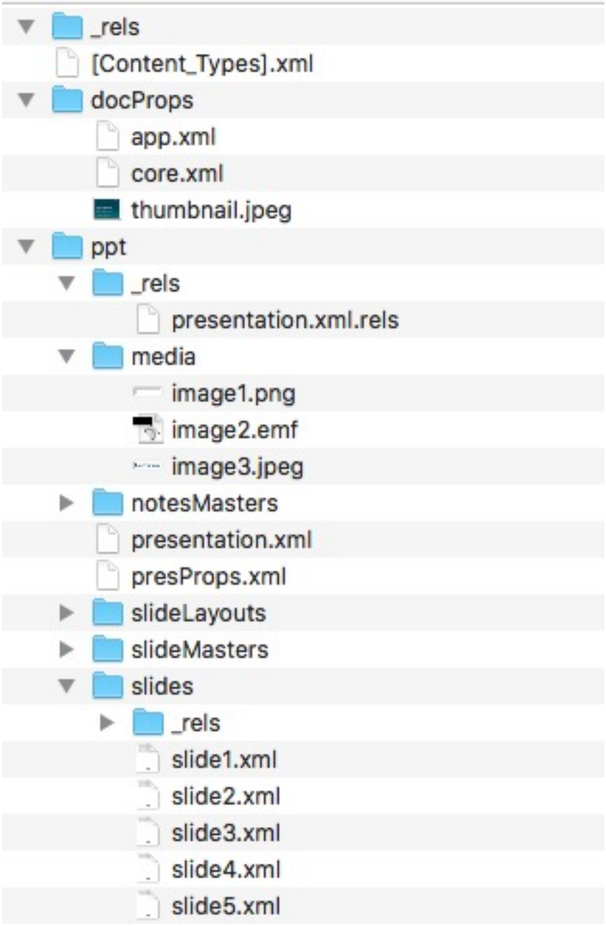
Open Office XML

Microsoft-originated XML-based format

- Standardised by Ecma and ISO/IEC
- Replaced pre-2007 proprietary format

ZIP file of directory hierarchy containing XML

- `docprops/` contains metadata
- `ppt/slides` contains slides
- `ppt/media` contains images
- `_rels` translates file names into XML attribute values



```
▼ _rels
  [Content_Types].xml
▼ docProps
    app.xml
    core.xml
    thumbnail.jpeg
▼ ppt
  ▼ _rels
      presentation.xml.rels
  ▼ media
      image1.png
      image2.emf
      image3.jpeg
  ▶ notesMasters
    presentation.xml
    presProps.xml
  ▶ slideLayouts
  ▶ slideMasters
  ▼ slides
    ▶ _rels
      slide1.xml
      slide2.xml
      slide3.xml
      slide4.xml
      slide5.xml
```

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<p:sld xmlns:a="http://schemas.openxmlformats.org/drawingml/2006/main"
        xmlns:r="http://schemas.openxmlformats.org/officeDocument/2006/relationships"
        xmlns:p="http://schemas.openxmlformats.org/presentationml/2006/main">
<p:cSld><p:spTree>
<p:nvGrpSpPr><p:cNvPr id="1" name=""/><p:cNvGrpSpPr/><p:nvPr/></p:nvGrpSpPr>
<p:grpSpPr><a:xfrm><a:off x="0" y="0"/><a:ext cx="0" cy="0"/><a:chOff x="0" y="0"/><a:chExt cx="0"
cy="0"/></a:xfrm></p:grpSpPr>
<p:sp><p:nvSpPr><p:cNvPr id="2" name="Title 1"/><p:cNvSpPr><a:spLocks noGrp="1"/></p:cNvSpPr>
<p:nvPr><p:ph type="ctrTitle"/></p:nvPr></p:nvSpPr><p:spPr/>
<p:txBody><a:bodyPr/><a:lstStyle/><a:p><a:r><a:rPr lang="en-GB" dirty="0"/><a:t>Web
Formats</a:t></a:r></a:p></p:txBody></p:sp><p:sp><p:nvSpPr><p:cNvPr id="3" name="Subtitle
2"/><p:cNvSpPr><a:spLocks noGrp="1"/></p:cNvSpPr><p:nvPr><p:ph type="subTitle"
idx="1"/></p:nvPr></p:nvSpPr><p:spPr/><p:txBody><a:bodyPr/><a:lstStyle/>
<a:p><a:r><a:rPr lang="en-GB" dirty="0"/><a:t>COMP3220 Web Infrastructure</a:t></a:r></a:p>
</p:txBody></p:sp><p:sp><p:nvSpPr><p:cNvPr id="4" name="Text Placeholder
3"/><p:cNvSpPr><a:spLocks noGrp="1"/></p:cNvSpPr><p:nvPr><p:ph type="body" sz="quarter"
idx="13"/></p:nvPr></p:nvSpPr><p:spPr/><p:txBody><a:bodyPr/><a:lstStyle/><a:p><a:r><a:rPr
lang="en-GB" dirty="0"/><a:t>Dr Nicholas Gibbins </a:t></a:r><a:r><a:rPr lang="mr-IN"
dirty="0"/><a:t>–</a:t></a:r><a:r><a:rPr lang="en-GB" dirty="0"/><a:t> </a:t></a:r><a:r><a:rPr
lang="en-GB" dirty="0" err="1"/><a:t>nmg@ecs.soton.ac.uk</a:t></a:r><a:endParaRPr lang="en-GB"
dirty="0"/></a:p></p:txBody></p:sp></p:spTree><p:extLst><p:ext uri="{BB962C8B-B14F-4D97-AF65-
F5344CB8AC3E}">
...
```

Portable Document Format

Portable Document Format

Not “of the Web”, but important for the Web

- 8.5bn HTML documents in Google
- 2.3bn PDF documents in Google

Structured for rendering of pre-formatted documents

- Set characters from fonts at position
- Draw lines (etc) at position
- No structure to text: no paragraphs, headings, lists, etc

Often used as official format of record

- Searchable – unlike scanned documents

PDF History

Derived from Adobe’s earlier PostScript language

- Subset of PostScript’s page description language (but not a programming language like PostScript)

Other features

- Font embedding in documents
- Structured object storage, with data compression
- Access control and DRM
- Extensible metadata
- Fillable forms, annotations
- Links!

Sample PDF

```
%PDF-1.0
1 0 obj
<<
/Type /Catalog
/Pages 3 0 R
/Outlines 2 0 R
>>
endobj
2 0 obj
<</Type /Outlines /Count 0>>
endobj
3 0 obj
<<
/Type /Pages
/Count 1
/Kids [4 0 R]
>>
endobj
```

Root Object

Outlines Object (TOC)

Page List

```
4 0 obj
<<
/Type /Page
/Parent 3 0 R
/Resources <<
/Font << /F1 7 0 R >>
/ProcSet 6 0 R >>
/MediaBox [0 0 612 792]
/Contents 5 0 R
>>
endobj
5 0 obj
<< /Length 44 >>
stream
BT /F1 24 Tf
100 100 Td (Hello World) Tj ET
endstream
endobj
```

First Page

Drawing commands for first page

BeginText, use font F1 at size 24, move to (100,100), draw the text “Hello World”, EndText

Sample PDF

```
6 0 obj
[/PDF /Text]
endobj
7 0 obj
<<
/Type /Font
/Subtype /Type1
/Name /F1
/BaseFont /Helvetica
>>
endobj
```

Definitions for first page

Fonts for first page

Number of objects, ID of root

```
xref
08
0000000000 65535 f
0000000009 00000 n
0000000074 00000 n
0000000120 00000 n
0000000179 00000 n
0000000322 00000 n
0000000415 00000 n
0000000445 00000 n
trailer
<<
/Size 8
/Root 1 0 R
>>
startxref 553
%%EOF
```

Index

UNIVERSITY OF Southampton

Next Lecture: Web APIs