MIS Department

Abteilung für Wirtschaftsinformatik

Processing XML Documents with DOM Using BSF4ooRexx

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Overview

- Markup-Language
  - Basics
  - XML
- DOM
  - Principles
  - Exploiting DOM from ooRexx
  - Examples
- Roundup

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Terms, 1
(Markup Languages)

- Tag
  - Enables one to use tags to embrace regular text
    - Opening tag (a.k.a. start tag)

      `<some_tag_name>`
    - Closing tag (a.k.a. end tag)

      `</some_tag_name>`
  - Allows for analyzing text, by noticing which parts of a text are surrounded ("embraced") by which tags
  - "Element"
    - The sequence "opening tag", text, "closing tag"

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Terms, 2
(Markup Languages)

- Document Type Definition (DTD)
  - Defines the tags and their attributes, if any
    - Name (identifier) of the tag
    - Attributes for tags
    - "Content model"
      - Nesting of tags and the allowed sequence of tags
        - **Hierarchical structure !**
      - Allows to determine how many times an element may occur
  - "Instance" of a DTD
    - A document with text that got marked-up according to the rules defined in a DTD
    - A document that has been checked whether the DTD rules were applied correctly is named a "valid" document

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Terms, 3 (Markup Languages)

- HTML
  - A markup language for the WWW
    - HTML-Browser
      - Parses a document marked up according to HTML
      - Formats the text, depending on the used tags
  - DTD
    - Version 4.01: three variants defined
    - SGML-based, hence it is possible to
      - Use any case for the tags and attribute names
      - Some closing tags may be omitted if the end tags can be determined by the rules set forth in the DTD
      - It is possible to define exclusions

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Terms, 4 (Markup Languages)

- XML
  - A slightly simplified version of SGML
    - Allows the definition of DTDs for markup languages
      - Since 2002 an alternative got introduced in the form of "XML Schema": `http://www.w3c.org`
    - Tag and attribute names must be written in exact case
    - End tags must be always given
    - Attribute values can now be enclosed within apostrophes/single quotes (') in addition to double quotes (")
    - It is possible to explicitly denote empty elements

```
<some_tag_name/>
```


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Terms, 5 (Markup Languages)

- XML DTDs can be omitted
  - A matching DTD can be always inferred, if the document is "well formed":
    - All tags must be nested
    - Tags must not overlap
    - Start tags must have matching end tags
- Structure is always independent of the formatting!
  - Cascading Style Sheets (CSS)
    - Allows to define formatting (layout) rules for elements
    - It is possible to define specific formatting (layout) rules for elements with attributes that have specific values or depending on the sequence of the elements

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Terms (XHTML)

- Text, marked up in XHTML

```
<html>
  <head>
     <title>This is my HTML file</title>
  </head>
  <body>
     <h1>Important Heading</h1>
     <p>This <span class="verb">is</span> the
        first paragraph.</p>
     <h1>Another Important Heading</h1>
     <p id="xyz1">Another paragraph.</p>
     <p id="a9876">This <span class="verb">is</span> it.</p>
  </body>
</html>
```


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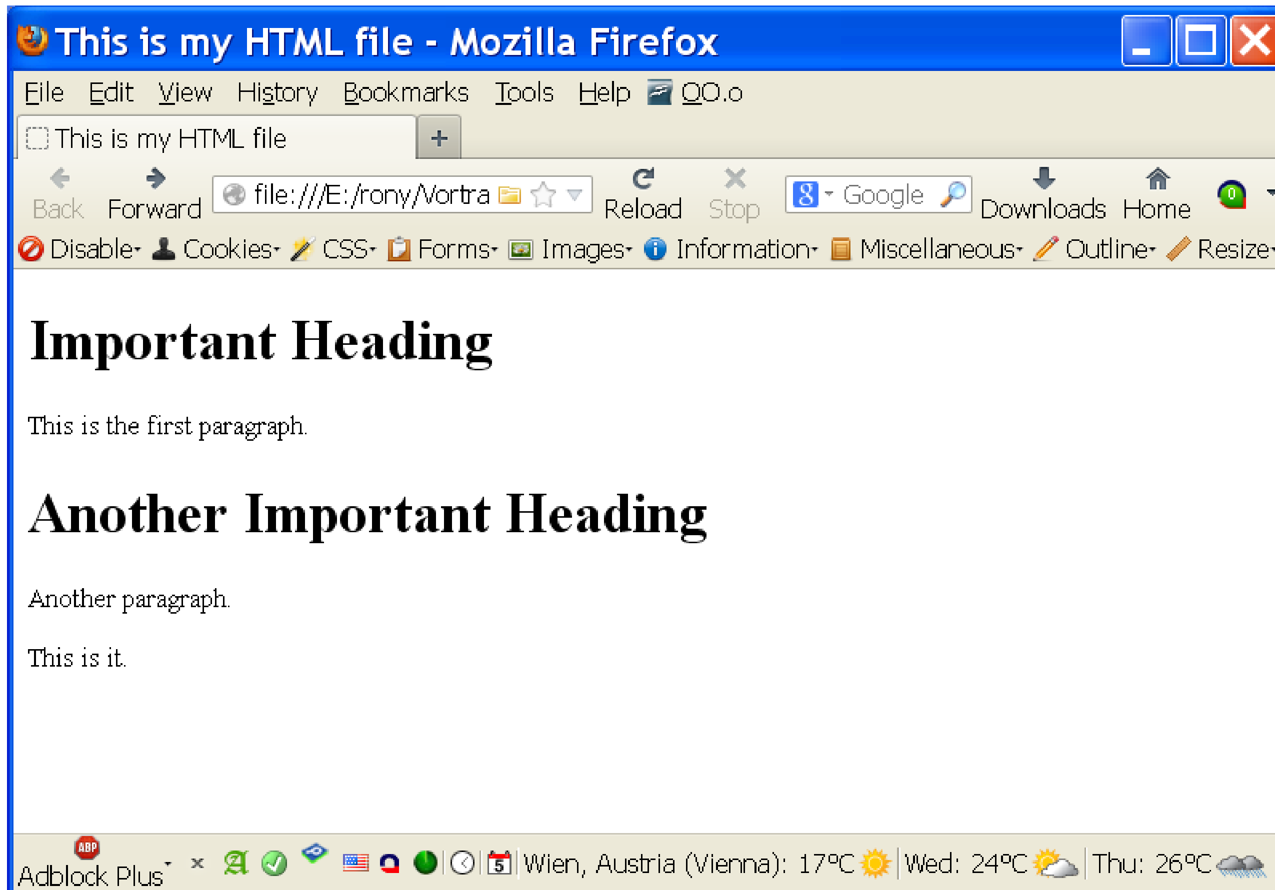
XHTML Text Rendered in Firefox



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Example: Linking a Cascading Style Sheet (CSS)

- Text, marked up in XHTML

```
<html>
  <head>
     <title>This is my HTML file</title>
     <link rel="stylesheet" type="text/css" href="example2.css"/>
  </head>
  <body>
     <h1>Important Heading</h1>
     <p>This <span class="verb">is</span> the
        first paragraph.</p>
     <h1>Another Important Heading</h1>
     <p id="xyz1">Another paragraph.</p>
     <p id="a9876">This <span class="verb">is</span> it.</p>
  </body>
</html>
```


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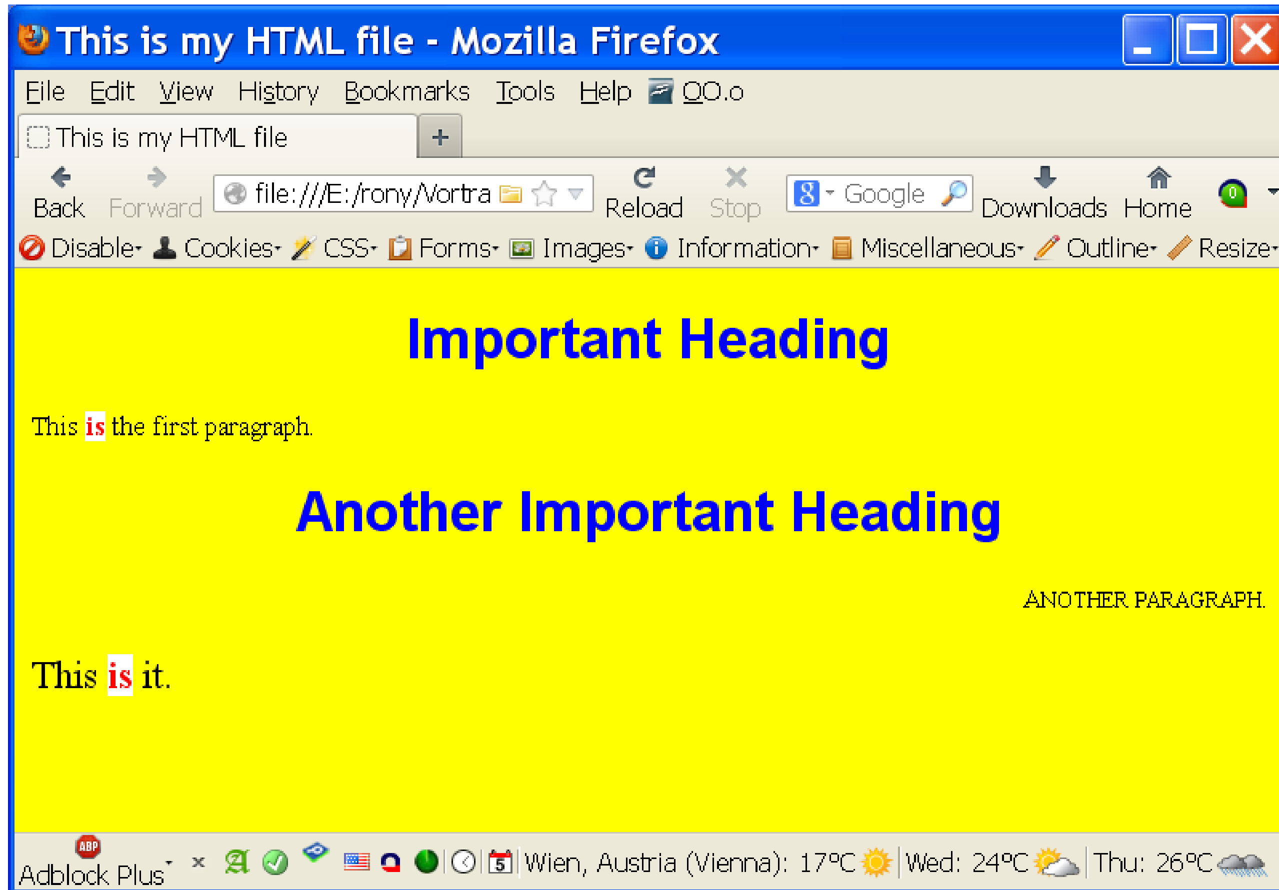
XHTML Text Rendered in Firefox with CSS



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Example of a Cascading Style Sheets (CSS)

Tag → h1
Tag → body
"class" Attribut → .verb
"id" Attribut → #xyz1
"id" Attribut → #a9876

```
h1        { color: blue;
            text-align: center;
            font-family: Arial,sans-serif;
            font-size: 200%; }

body      { background-color: yellow;
            font-family: Times, Avantgarde;
            font-size: small; }

.verb     { background-color: white;
            color: red;
            font-weight: 900; }

#xyz1     { font-variant: small-caps;
            text-align: right; }

#a9876    { font-size: large; }
```


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Document Object Model (DOM), 1

- Parsing of a HTML/XML file
  - Creates a parse tree in which the elements are nodes
    - Each HTML browser needs to do this with each HTML file!
- Application Programming Interfaces (API) for
  - Creating, querying, changing and deleting nodes from the tree
    - This includes the manipulation of attributes as well!
    - Intercepting events, while the user is working with the parse tree
    - User generated events as a result of using the mouse or the keyboard
    - Application generated events like "document loaded"

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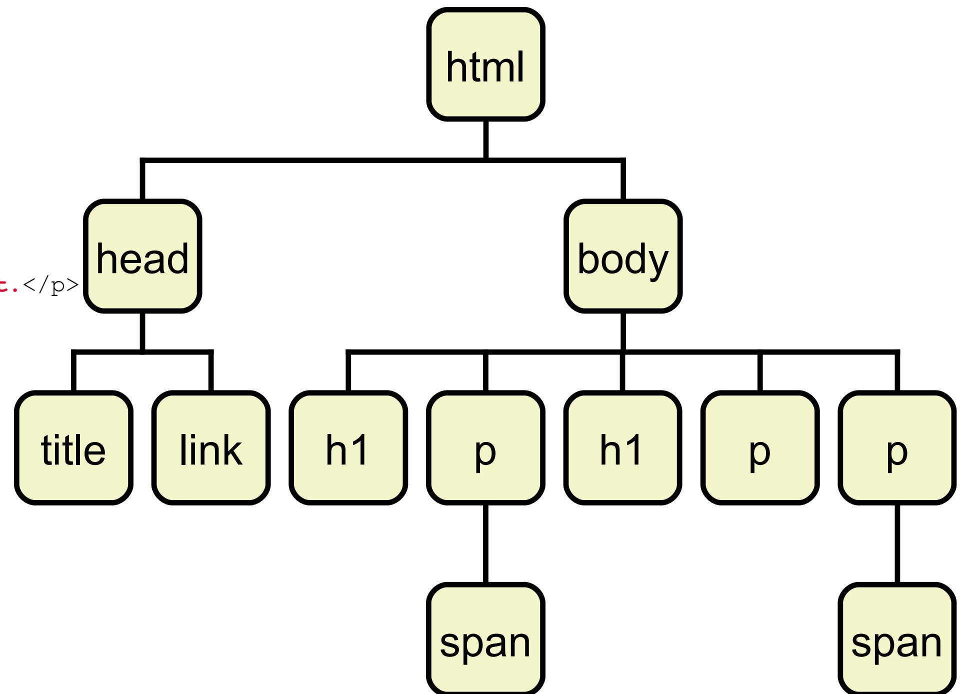
Document Object Model (DOM), 2 Example

```
<!-- example2.html -->
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "DTD/xhtml1-transitional.dtd">
<html>
  <head>
     <title>This is my HTML file</title>
     <link rel="stylesheet" type="text/css" href="example2.css"/>
  </head>
  <body>
     <h1>Important Heading</h1>
     <p>This <span class="verb">is</span> the
        first paragraph.</p>
     <h1>Another Important Heading</h1>
     <p id="xyz1">Another paragraph.</p>
     <p id="a9876">This <span class="verb">is</span> it.</p>
  </body>
</html>
```



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DOM (Document Object Model), 3
Java DOM Parsers

- A Java DOM parser processes the entire document
  - "Factory" pattern, which allows different implementations of DOM parsers to be deployed via Java
- The DOM parser creates a parse tree where each node is one of type (cf. Java documentation of org.w3c.dom.Node)
  - Attr (attribute), CDATASection (character data section), Comment, Document, DocumentFragment, DocumentType, Element, Entity, EntityReference, Notation, ProcessingInstruction, Text
- The interface definitions for nodes (cf. org.w3c.dom.Node) also include a set of methods to manipulate the parse tree

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DOM (Document Object Model), 4

- The interface org.xml.sax.ErrorHandler defines the methods a SAX/DOM error listener must implement
  - error(SAXParseException exception)
  - fatalError(SAXParseException exception)
  - warning(SAXParseException exception)
- org.xml.sax.SAXParseException has the following methods
  - getCause() returns a Throwable Java object representing the cause
  - getException() returns an embedded exception, if any
  - getMessage() returns a string with the detailed error message
  - toString() returns a string representation of the SAXParseException

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DOM-parsing in ooRexx

- Create an ooRexx listener class for handling errors/warnings
- Create an ooRexx listener object from it
- Create a Java object that embeds the ooRexx listener object
  - BSFCreateRexxProxy(rexxListenerObject,[slotArg],interfaceName[,...])
  - interfaceName denotes the Java interface name which methods the Rexx listener object handles
    - It is possible to denote more than one Java interface, if the Rexx listener object is able to handle all methods defined by them!
- Let the Java DOM parser parse the document
- Process the resulting parse tree with Rexx routines node by node

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"code01.rxj ": Extract Text from any XHTML Document The ooRexx Program (Main Program), 1

```
/* purpose: demonstrate how to extract the text from a xml file using DOM */
parse arg xmlFileName

   /* create an instance of the JAXP DocumentBuilderFactory    */
factory=bsf.loadClass("javax.xml.parsers.DocumentBuilderFactory")~newInstance
factory~setNamespaceAware(.true)     -- set desired parser to namespace aware
parser=factory~newDocumentBuilder    -- create the parser from the factory

eh=.errorHandler~new        -- create an error handler Rexx object
   -- wrap up the Rexx error handler as a Java object
javaEH=BsfCreateRexxProxy(eh, , "org.xml.sax.ErrorHandler")
parser~setErrorHandler(javaEH)    -- set the error handler for this parser

rootNode=parser~parse(xmlFileName)  -- parse the file, returns root node

   /* make important constants available via .local            */
clzDomNode=bsf.loadClass("org.w3c.dom.Node") -- load the Java interface class
.local~CDATA_SECTION_NODE=clzDomNode~CDATA_SECTION_NODE  -- save field value
.local~TEXT_NODE         =clzDomNode~TEXT_NODE           -- save field value

   /* now collect all text and CDATA nodes and display them    */
call followNode rootNode

::requires BSF.CLS      /* get the Java support */

... cut ...
```


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"code01.rxj ": Extract Text from any XHTML Document The ooRexx Program (the ooRexx Classes), 2

```
... cut ...
::requires BSF.CLS        /* get the Java support */

::routine followNode     /* walks the document tree recursively */
  use arg node
  call processNode node               -- process received node
  if node~hasChildNodes then
  do
     children=node~getChildNodes      -- get NodeList
     loop i=0 to children~length-1    -- 0-based indexes!
        call followNode children~item(i)   -- recurse
     end
  end

::routine processNode    /* processes each node                 */
  use arg node
  nodeType=node~getNodeType       -- get type of node
  if nodeType=.text_node | nodeType=.cdata_section_node then
     say pp(node~nodeValue)

::class ErrorHandler     -- a Rexx error handler ("org.xml.sax.ErrorHandler")

::method unknown         /* handles "warning", "error" and "fatalError" events */
  use arg methName, argArray  -- arguments from the Java SAX parser
  exception=argArray[1] -- retrieve SAXException argument
  .error~say(methName":" -
            "line="exception~getLineNumber",col="exception~getColumnNumber":" -
            pp(exception~getMessage))
```


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"code01.rxj ": Extract Text from any XHTML Document Running the ooRexx Program, 3

```
f:\>rexx code01_text.rxj example2.html
[
  ]
[
      ]
[This is my HTML file]
[
      ]
[
  ]
[
  ]
[
      ]
[Important Heading]
[
      ]
[This ]
[is]
[ the
         first paragraph.]
[
      ]
[Another Important Heading]
[
      ]
[Another paragraph.]
[
      ]
[This ]
[is]
[ it.]
[
  ]
[
]
```

```
<!-- example2.html -->
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
                      "DTD/xhtml1-transitional.dtd">
<html>
  <head>
     <title>This is my HTML file</title>
     <link rel="stylesheet" type="text/css" href="example2.css"/>
  </head>
  <body>
     <h1>Important Heading</h1>
     <p>This <span class="verb">is</span> the
        first paragraph.</p>
     <h1>Another Important Heading</h1>
     <p id="xyz1">Another paragraph.</p>
     <p id="a9876">This <span class="verb">is</span> it.</p>
  </body>
</html>
```


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"code01.rxj ": Extract Text from any XHTML Document Some Remarks, 4

- Some remarks
  - Text can be encoded as
    - Plain text (node type TEXT_NODE) or
    - CDATA sections (node type CDATA_SECTION_NODE)
      - **<[!CDATA[**...character-data...**]]>**
  - Ignorable whitespace is not ignored, but treated like any whitespace
    - A node of type TEXT_NODE will be created for it
  - The node types used in the Java DOM parser are retrievable via the Java interface class org.w3c.dom.Node
    - To make it easy to refer to these values from ooRexx, the types TEXT_NODE and CDATA_SECTION_NODE are retrieved and made available to all parts of the Rexx program by storing them in .local

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"code02.rxj": List Elements in Document Order The ooRexx Program (Main Program), 1

```
/* purpose: demonstrate how to extract the text from a xml file using DOM */
parse arg xmlFileName

   /* create an instance of the JAXP DocumentBuilderFactory    */
factory=bsf.loadClass("javax.xml.parsers.DocumentBuilderFactory")~newInstance
factory~setNamespaceAware(.true)     -- set desired parser to namespace aware
parser=factory~newDocumentBuilder    -- create the parser from the factory

eh=.errorHandler~new        -- create an error handler Rexx object
   -- wrap up the Rexx error handler as a Java object
javaEH=BsfCreateRexxProxy(eh, , "org.xml.sax.ErrorHandler")
parser~setErrorHandler(javaEH)    -- set the error handler for this parser

rootNode=parser~parse(xmlFileName)  -- parse the file, returns root node

   /* make important constants available via .local            */
clzDomNode=bsf.loadClass("org.w3c.dom.Node") -- load the Java interface class
.local~ELEMENT_NODE      =clzDomNode~ELEMENT_NODE   -- save field value

   /* now collect all text and CDATA nodes and display them    */
call followNode rootNode

::requires BSF.CLS      /* get the Java support */

... cut ...
```


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"code02.rxj": List Elements in Document Order The ooRexx Program (the ooRexx Classes), 2

```
... cut ...
::requires BSF.CLS      /* get the Java support */

::routine followNode    /* walks the document tree recursively */
  use arg node
  call processNode node               -- process received node
  if node~hasChildNodes then
  do
     children=node~getChildNodes      -- get NodeList
     loop i=0 to children~length-1    -- 0-based indexes!
        call followNode children~item(i)   -- recurse
     end
  end

::routine processNode   /* processes each node                  */
  use arg node
  nodeType=node~getNodeType        -- get type of node
  if nodeType=.element_node then
     say pp(node~nodeName)

::class ErrorHandler    -- a Rexx error handler ("org.xml.sax.ErrorHandler")

::method unknown        /* handles "warning", "error" and "fatalError" events */
  use arg methName, argArray  -- arguments from the Java SAX parser
  exception=argArray[1] -- retrieve SAXException argument
  .error~say(methName":" -
           "line="exception~getLineNumber",col="exception~getColumnNumber":" -
           pp(exception~getMessage))
```


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"code02.rxj": List Elements in Document Order Running the ooRexx Program, 3

```
f:\>rexx code02_text.rxj example2.html
[html]
[head]
[title]
[link]
[body]
[h1]
[p]
[span]
[h1]
[p]
[p]
[span]
```

```
<!-- example2.html -->
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
                      "DTD/xhtml1-transitional.dtd">
<html>
  <head>
     <title>This is my HTML file</title>
     <link rel="stylesheet" type="text/css" href="example2.css"/>
  </head>
  <body>
     <h1>Important Heading</h1>
     <p>This <span class="verb">is</span> the
        first paragraph.</p>
     <h1>Another Important Heading</h1>
     <p id="xyz1">Another paragraph.</p>
     <p id="a9876">This <span class="verb">is</span> it.</p>
  </body>
</html>
```


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"code02.rxj": List Elements in Document Order Some Remarks, 4

- A few remarks
  - The DOM parse tree has more nodes than shown in the output!
  - This particular program processes nodes of type ELEMENT_NODE only
  - The node types used in the Java DOM parser are retrievable via the Java interface class org.w3c.dom.Node
    - To make it easy to refer to these values from ooRexx, the type ELEMENT_NODE is retrieved and made available to all parts of the Rexx program by storing it in .local
- One could also use the Java infrastructure to filter only those node types one is interested in

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"code03.rxj" : List Elements in Document Order #2 The ooRexx Program (Main Program), 1

```
/* purpose: demonstrate how to extract the text from a xml file using DOM */
parse arg xmlFileName

   /* create an instance of the JAXP DocumentBuilderFactory    */
factory=bsf.loadClass("javax.xml.parsers.DocumentBuilderFactory")~newInstance
factory~setNamespaceAware(.true)     -- set desired parser to namespace aware
parser=factory~newDocumentBuilder    -- create the parser from the factory

eh=.errorHandler~new        -- create an error handler Rexx object
   -- wrap up the Rexx error handler as a Java object
javaEH=BsfCreateRexxProxy(eh, , "org.xml.sax.ErrorHandler")
parser~setErrorHandler(javaEH)    -- set the error handler for this parser

rootNode=parser~parse(xmlFileName)  -- parse the file, returns root node

   /* make important constants available via .local            */
clzDomNode=bsf.loadClass("org.w3c.dom.Node") -- load the Java interface class
.local~ELEMENT_NODE      =clzDomNode~ELEMENT_NODE  -- save field value

   /* now collect all text and CDATA nodes and display them    */
call followNode rootNode, 0

::requires BSF.CLS      /* get the Java support */

... cut ...
```


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"code03.rxj" : List Elements in Document Order #2 The ooRexx Program (the ooRexx Classes), 2

```
... cut ...
::requires BSF.CLS       /* get the Java support */

::routine followNode     /* walks the document tree recursively */
  use arg node, level
  call processNode node, level        -- process received node
  if node~hasChildNodes then
  do
     children=node~getChildNodes     -- get NodeList
     loop i=0 to children~length-1   -- 0-based indexes!
        call followNode children~item(i), level+1  -- recurse
     end
  end

::routine processNode    /* processes each node                 */
  use arg node, level
  nodeType=node~getNodeType       -- get type of node
  if nodeType=.element_Node then
     say "    "~copies(level) || pp(node~nodeName)

::class ErrorHandler     -- a Rexx error handler ("org.xml.sax.ErrorHandler")

::method unknown         /* handles "warning", "error" and "fatalError" events */
  use arg methName, argArray  -- arguments from the Java SAX parser
  exception=argArray[1] -- retrieve SAXException argument
  .error~say(methName":" -
           "line="exception~getLineNumber",col="exception~getColumnNumber":" -
           pp(exception~getMessage))
```


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"code03.rxj" : List Elements in Document Order #2 Running the ooRexx Program, 3

```
f:\>rexx code03_text.rxj example2.html
    [html]
        [head]
            [title]
            [link]
        [body]
            [h1]
            [p]
                [span]
            [h1]
            [p]
            [p]
                [span]
```

```
<!-- example2.html -->
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
                      "DTD/xhtml1-transitional.dtd">
<html>
  <head>
     <title>This is my HTML file</title>
     <link rel="stylesheet" type="text/css" href="example2.css"/>
  </head>
  <body>
     <h1>Important Heading</h1>
     <p>This <span class="verb">is</span> the
        first paragraph.</p>
     <h1>Another Important Heading</h1>
     <p id="xyz1">Another paragraph.</p>
     <p id="a9876">This <span class="verb">is</span> it.</p>
  </body>
</html>
```


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"code03.rxj" : List Elements in Document Order #2 Some Remarks, 4

- A few remarks
  - The DOM parse tree has more nodes than shown in the output!
    - Note whitespace before first shown element
  - This particular program processes nodes of type ELEMENT_NODE only
  - The node types used in the Java DOM parser are retrievable via the Java interface class org.w3c.dom.Node
    - To make it easy to refer to these values from ooRexx, the type ELEMENT_NODE is retrieved and made available to all parts of the Rexx program by storing it in .local
- One could also use the Java infrastructure to filter only those node types one is interested in

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"code04.rxj" : List Elements with Text
The ooRexx Program (Main Program), 1

```
/* purpose: demonstrate how to extract the text from a xml file using DOM */
parse arg xmlFileName

   /* create an instance of the JAXP DocumentBuilderFactory    */
factory=bsf.loadClass("javax.xml.parsers.DocumentBuilderFactory")~newInstance
factory~setNamespaceAware(.true)     -- set desired parser to namespace aware
parser=factory~newDocumentBuilder    -- create the parser from the factory

eh=.errorHandler~new       -- create an error handler Rexx object
   -- wrap up the Rexx error handler as a Java object
javaEH=BsfCreateRexxProxy(eh, , "org.xml.sax.ErrorHandler")
parser~setErrorHandler(javaEH)    -- set the error handler for this parser

rootNode=parser~parse(xmlFileName)  -- parse the file, returns root node

   /* make important constants available via .local            */
clzDomNode=bsf.loadClass("org.w3c.dom.Node") -- load the Java interface class
.local~CDATA_SECTION_NODE=clzDomNode~CDATA_SECTION_NODE  -- save field value
.local~TEXT_NODE         =clzDomNode~TEXT_NODE           -- save field value
.local~ELEMENT_NODE      =clzDomNode~ELEMENT_NODE   -- save field value

   /* now collect all text and CDATA nodes and display them    */
call followNode rootNode, 0

::requires BSF.CLS      /* get the Java support */

... cut ...
```


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"code04.rxj" : List Elements with Text
The ooRexx Program (the ooRexx Classes), 2

```
... cut ...
::requires BSF.CLS       /* get the Java support */

::routine followNode     /* walks the document tree recursively */
  use arg node, level
  call processNode node, level       -- process received node
  if node~hasChildNodes then
  do
     children=node~getChildNodes     -- get NodeList
     loop i=0 to children~length-1   -- 0-based indexes!
        call followNode children~item(i), level+1   -- recurse
     end
  end

::routine processNode    /* processes each node                  */
  use arg node, level
  nodeType=node~getNodeType       -- get type of node
  if nodeType=.text_node | nodeType=.cdata_section_node then
     say "   "~copies(level) || "-->" pp(node~getNodeValue)    -- instead of getData()
  else if nodeType=.element_node then
     say "   "~copies(level) || pp(node~getNodeName)

::class ErrorHandler     -- a Rexx error handler ("org.xml.sax.ErrorHandler")

::method unknown         /* handles "warning", "error" and "fatalError" events */
  use arg methName, argArray  -- arguments from the Java SAX parser
  exception=argArray[1] -- retrieve SAXException argument
  .error~say(methName":" -
           "line="exception~getLineNumber",col="exception~getColumnNumber":" -
           pp(exception~getMessage))
```


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"code04.rxj" : List Elements with Text Running the ooRexx Program, 3

```
f:\>rexx code04_text.rxj example2.html
 [html]
      --> [
  ]
      [head]
         --> [
     ]
         [title]
            --> [This is my HTML file]
         --> [
     ]
         [link]
         --> [
  ]
      --> [
  ]
      [body]
         --> [
     ]
         [h1]
            --> [Important Heading]
         --> [
     ]
         [p]
            --> [This ]
            [span]
               --> [is]
            --> [ the
        first paragraph.]
         --> [
     ]
         [h1]
            --> [Another Important Heading]
         --> [
     ]
         [p]
            --> [Another paragraph.]
         --> [
     ]
         [p]
            --> [This ]
            [span]
               --> [is]
            --> [ it.]
         --> [
  ]
      --> [
]
```

```
<!-- example2.html -->
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
                      "DTD/xhtml1-transitional.dtd">
<html>
  <head>
     <title>This is my HTML file</title>
     <link rel="stylesheet" type="text/css" href="example2.css"/>
  </head>
  <body>
     <h1>Important Heading</h1>
     <p>This <span class="verb">is</span> the
        first paragraph.</p>
     <h1>Another Important Heading</h1>
     <p id="xyz1">Another paragraph.</p>
     <p id="a9876">This <span class="verb">is</span> it.</p>
  </body>
</html>
```


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"code04.rxj" : List Elements with Text Some Remarks, 4

- A few remarks
  - The DOM parse tree has more nodes than shown in the output!
    - Note whitespace before first shown element
  - This particular program processes nodes of type TEXT_NODE, CDATA_SECTION_NODE and ELEMENT_NODE only
  - The node types used in the Java DOM parser are retrievable via the Java interface class org.w3c.dom.Node
    - To make it easy to refer to these values from ooRexx, the types TEXT_NODE, CDATA_SECTION_NODE and ELEMENT_NODE are retrieved and made available to all parts of the Rexx program by storing them in .local
  - One could also use the Java infrastructure to filter only those node types one is interested in

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More Available with Java DOM Parsing Than Documented by Java!

- The default DOM parser coming with Java (Apache's Xerces2) is capable of more than what is documented in Oracle's JavaDocs!
  - The W3C interface org.w3c.dom.traversal.DocumentTraversal, cf. documentation at *http://www.w3.org/2003/01/dom2-javadoc/org/w3c/dom/traversal/DocumentTraversal.html*
    - Method createNodeIterator(...) filters nodes and returns the result as a list with the methods defined in the interface org.w3c.dom.traversal.NodeIterator for its traversal
    - Method createTreeWalker(...) filters nodes and returns the result as a tree with the methods defined in the interface org.w3c.dom.traversal.TreeWalker for its traversal

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Using A NodeIterator to Iterate over Elements

- Get the Java constant field value for showing (filtering) elements using the Java interface class org.w3c.dom.traversal.NodeFilter and the constant field named SHOW_ELEMENT
- Create a NodeIterator from the DOM parse tree and use its methods to iterate over the filtered nodes
- Hint
  - Compare the following code "code05.rxj" with "code02.rxj" above

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"code05.rxj": List Elements in Document Order The ooRexx Program (Main Program), 1

```
/* purpose: demonstrate how to list the element names in document order */
parse arg xmlFileName
   /* create an instance of the JAXP DocumentBuilderFactory    */
factory=bsf.loadClass("javax.xml.parsers.DocumentBuilderFactory")~newInstance
factory~setNamespaceAware(.true)     -- set desired parser to namespace aware
parser=factory~newDocumentBuilder    -- create the parser from the factory

eh=.errorHandler~new        -- create an error handler Rexx object
   -- wrap up the Rexx error handler as a Java object
javaEH=BsfCreateRexxProxy(eh, , "org.xml.sax.ErrorHandler")
parser~setErrorHandler(javaEH)    -- set the error handler for this parser

rootNode=parser~parse(xmlFileName)  -- parse the file, returns root node

   /* get constant value to determine node types to filter     */
whatToShow=bsf.getConstant("org.w3c.dom.traversal.NodeFilter", "SHOW_ELEMENT")
   /* create a NodeIterator with only Element nodes            */
iterator=rootNode~createNodeIterator(rootNode, whatToShow, .nil, .true)
   /* process list of Element nodes                            */
node=iterator~nextNode  /* get first node                      */
loop while node<>.nil
   say pp(node~getNodeName)
   node=iterator~nextNode  /* get next node                    */
end

::requires BSF.CLS       /* get the Java support */
::class ErrorHandler     -- a Rexx error handler ("org.xml.sax.ErrorHandler")
... as depicted above ...
```


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"code05.rxj": List Elements in Document Order Running the ooRexx Program, 2

```
f:\>rexx code05_text.rxj example2.html
[html]
[head]
[title]
[link]
[body]
[h1]
[p]
[span]
[h1]
[p]
[p]
[span]
```

```
<!-- example2.html -->
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
                      "DTD/xhtml1-transitional.dtd">
<html>
  <head>
     <title>This is my HTML file</title>
     <link rel="stylesheet" type="text/css" href="example2.css"/>
  </head>
  <body>
     <h1>Important Heading</h1>
     <p>This <span class="verb">is</span> the
        first paragraph.</p>
     <h1>Another Important Heading</h1>
     <p id="xyz1">Another paragraph.</p>
     <p id="a9876">This <span class="verb">is</span> it.</p>
  </body>
</html>
```


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Using A TreeWalker to Iterate over Elements

- Get the Java constant field value for showing (filtering) elements using the Java interface class org.w3c.dom.traversal.NodeFilter and the constant field named SHOW_ELEMENT
- Create a TreeWalker from the DOM parse tree and use its methods to iterate over the filtered nodes
- Note
  - The createTreeWalker() method will filter element related nodes as well (e.g. text nodes included in an element)
- Hint
  - Compare the following code "code06.rxj" with "code03.rxj" above

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"code06.rxj": List Elements in Document Order The ooRexx Program (Main Program), 1

```
/* purpose: demonstrate how to list the element names in document order */

parse arg xmlFileName

   /* create an instance of the JAXP DocumentBuilderFactory    */
factory=bsf.loadClass("javax.xml.parsers.DocumentBuilderFactory")~newInstance
factory~setNamespaceAware(.true)     -- set desired parser to namespace aware
parser=factory~newDocumentBuilder    -- create the parser from the factory

eh=.errorHandler~new        -- create an error handler Rexx object
   -- wrap up the Rexx error handler as a Java object
javaEH=BsfCreateRexxProxy(eh, , "org.xml.sax.ErrorHandler")
parser~setErrorHandler(javaEH)    -- set the error handler for this parser

rootNode=parser~parse(xmlFileName)  -- parse the file, returns root node

   /* get constant value to determine node types to filter     */
.local~show_element=bsf.getConstant("org.w3c.dom.traversal.NodeFilter", "SHOW_ELEMENT")
whatToShow=.show_element

   /* create a TreeWalker with only Element nodes              */
walker=rootNode~createTreeWalker(rootNode, whatToShow, .nil, .true)

   /* process list of Element nodes                            */
call walkTheTree walker~firstChild, 0

::requires BSF.CLS      /* get the Java support */

... cut here ...
```


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"code06.rxj": List Elements in Document Order The ooRexx Program, 2

```
... cut here ...

   /* process list of Element nodes                              */
call walkTheTree walker~firstChild, 0

::requires BSF.CLS      /* get the Java support */

::routine walkTheTree   /* walk the tree recursively                  */
  use arg node, level

  say "   "~copies(level) || pp(node~getNodeName)  -- show element name indented

  child=node~firstChild        -- depth first
  do while child<>.nil
     -- there may be other node types coming with elements in a TreeWalker
    if child~getNodeType=.show_element then -- make sure only element nodes
       call walkTheTree child, level+1      -- recurse, increase level

    child=child~nextSibling  -- breadth next
  end


::class ErrorHandler    -- a Rexx error handler ("org.xml.sax.ErrorHandler")

... as depicted above ...
```


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"code05.rxj": List Elements in Document Order Running the ooRexx Program, 2

```
f:\>rexx code06_text.rxj example2.html
[html]
    [head]
        [title]
        [link]
    [body]
        [h1]
        [p]
            [span]
        [h1]
        [p]
        [p]
            [span]
```

```
<!-- example2.html -->
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
                      "DTD/xhtml1-transitional.dtd">
<html>
  <head>
     <title>This is my HTML file</title>
     <link rel="stylesheet" type="text/css" href="example2.css"/>
  </head>
  <body>
     <h1>Important Heading</h1>
     <p>This <span class="verb">is</span> the
        first paragraph.</p>
     <h1>Another Important Heading</h1>
     <p id="xyz1">Another paragraph.</p>
     <p id="a9876">This <span class="verb">is</span> it.</p>
  </body>
</html>
```


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Roundup

- Parsing any XML encoded document possible
  - Using BSF4ooRexx
  - Exploiting Java's functionality for parsing XML documents
- DOM parsing
  - DOM parser first creates parse tree
  - One may directly walk the DOM parse tree or use the traversal methods to filter the DOM parse tree into a NodeIterator or TreeWalker
- Rather easy, needs enough memory for the parse tree
- Easy to exploit from ooRexx !

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Further Information

- World Wide Web Consortium ("W3C")
  http://www.w3c.org
  http://www.w3c.org/Style/CSS/
  http://www.w3c.org/DOM/
  http://www.w3c.org/MarkUp/ (HTML, XHTML2)
  http://www.w3.org/QA/2002/04/valid-dtd-list.html (Doctype links)
- DOM specific URLs (as of 2013-05-01)
  http://www.saxproject.org/ (current project home)
  http://www.cafeconleche.org/books/xmljava/chapters/index.html (book)
  http://docs.oracle.com/javase/7/docs/api/org/w3c/dom/package-summary.html (Java 7 docs)
  W3C: http://www.w3.org/2003/01/dom2-javadoc/org/w3c/dom/traversal/DocumentTraversal.html
  Apache Xerces2: http://xerces.apache.org/xerces2-j/javadocs/api/org/w3c/dom/traversal/DocumentTraversal.html
- Sample files installed with BSF4ooRexx
  - bsf4oorexx/samples/DOM

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