

MASHERY

Streaming XML

Rob Richards

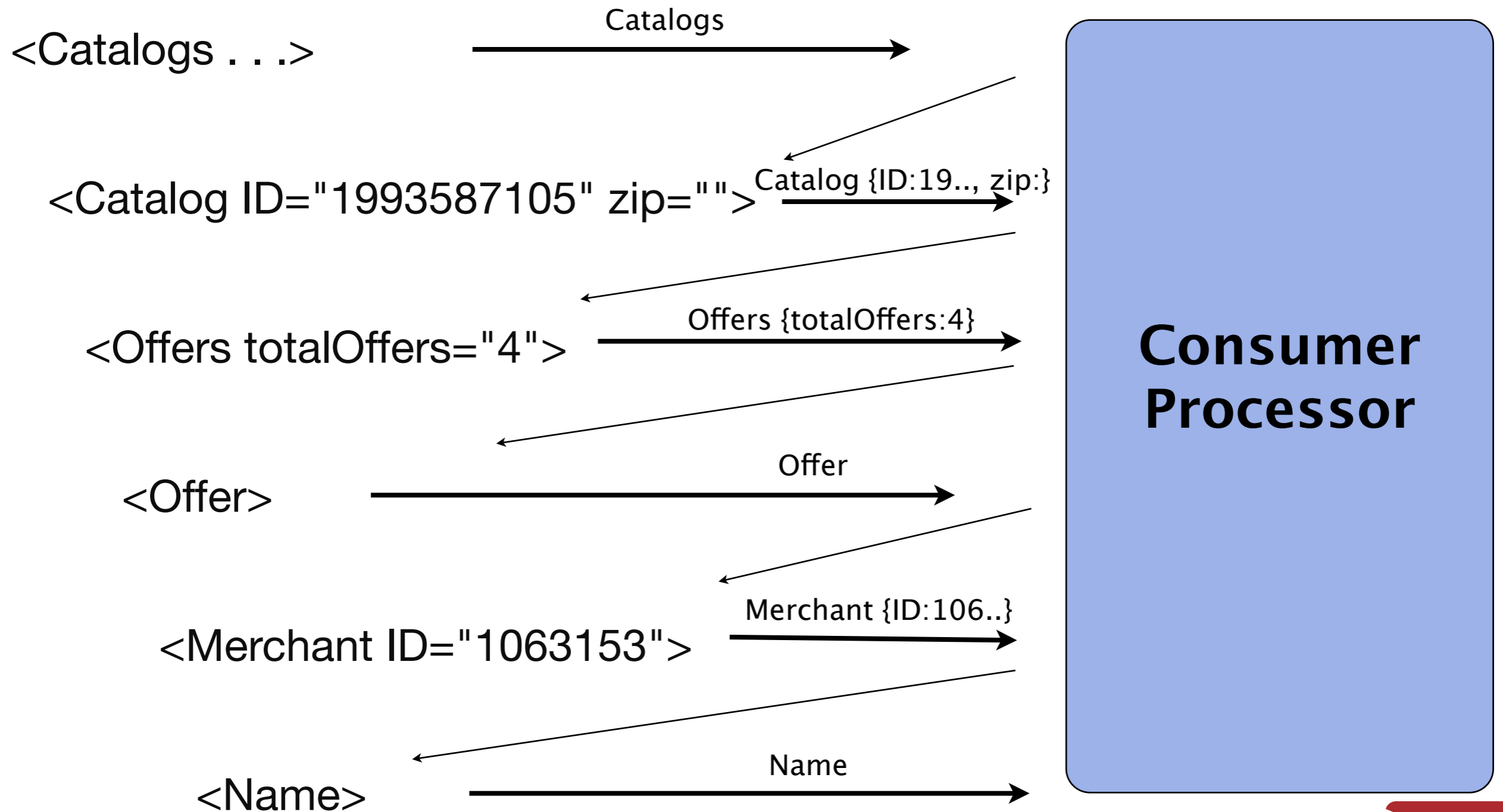
May 22, 2008

<http://xri.net/=rob.richards>

Parsing XML

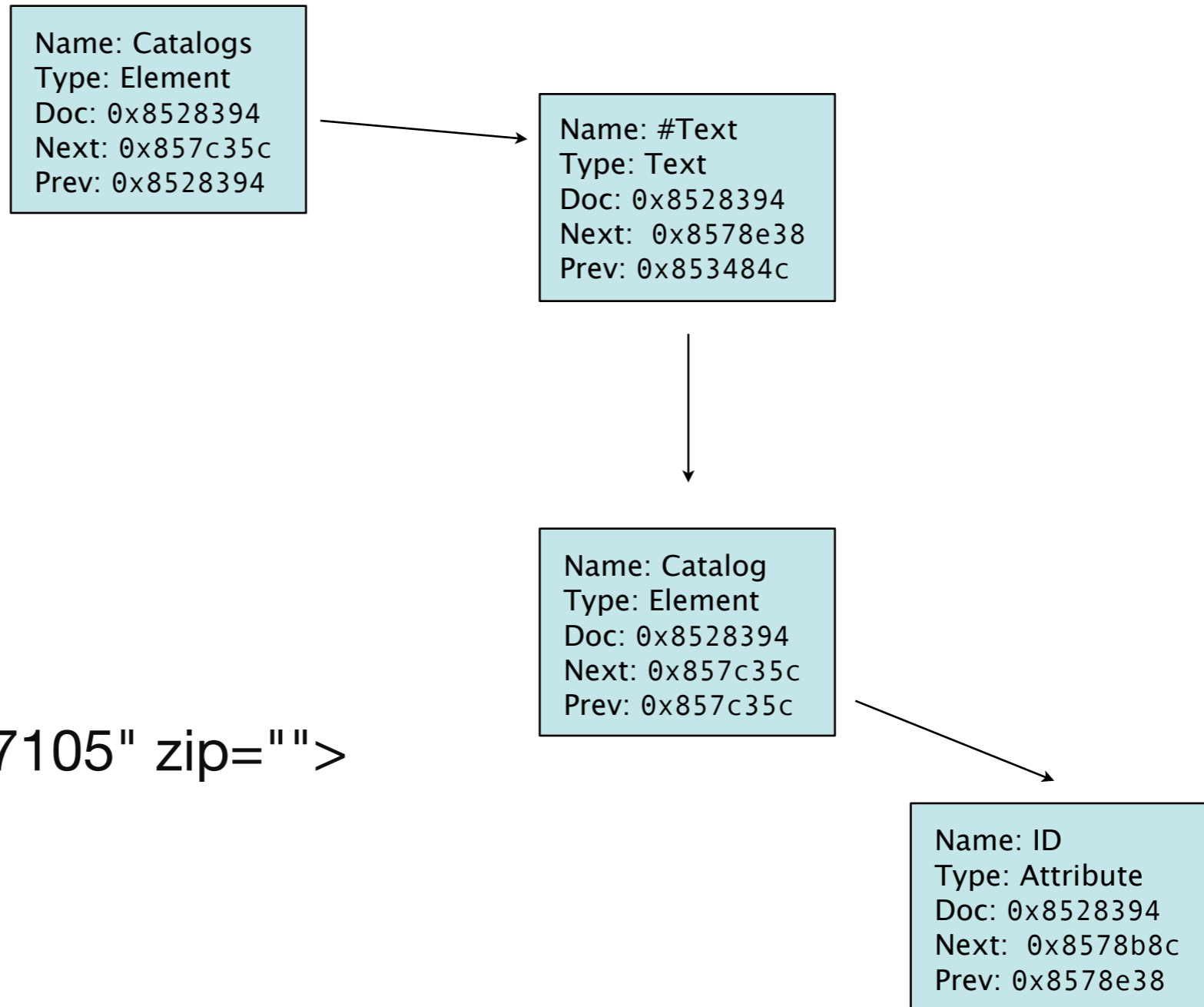
- Push Parser
 - Parser scans document and emits events to execute caller's callbacks
- Tree Parser
 - XML is read into memory and converted into a Tree
- Pull Parser
 - XML data is processed as needed and determined by the caller

Push Parser



Tree Parser

<Catalogs . . .>



<Catalog ID="1993587105" zip="">

SAX (ext/xml)

- Event based push parser
- Low memory usage
- Works using function callbacks
- Read-only
- Forward only
- No validation support

ext/xml Example

```
function startElement($parser, $name, $attrs) {  
    // start element handler logic  
}
```

```
function endElement($parser, $name) {  
    // end element handler logic  
}
```

```
$xml_parser = xml_parser_create();  
xml_set_element_handler($xml_parser, "startElement", "endElement");
```

```
while ($data = fread($fp, 4096)) {  
    if (!xml_parse($xml_parser, $data, feof($fp)))  
        echo "ERROR!";  
}
```

```
xml_parser_free($xml_parser);
```

DOM

- Tree based parser
- Allows for creation and editing of XML documents
- Provides XPath and XInclude Support
- Provides validation support
 - DTD
 - XML Schemas
 - RelaxNG
- Ability to work with HTML documents
- Zero copy interoperability with SimpleXML

DOM Example

```
$dom = new DOMDocument();
$dom->load(<URI>);

$root = $dom->documentElement;
foreach ($root->childNodes AS $node) {
    if ($node->nodeType == XML_ELEMENT_NODE) {
        echo $node->nodeName;
    }
}

$child = $root->firstChild;
$parent = $child->parentNode;
```


SimpleXML

- Tree based parser
- Provides simple access to XML documents
- Operates only on elements and attributes
- Contains XPath support
- Allows for modifications to the XML
- Zero copy interoperability with DOM

SimpleXML Example

```
$sxe = simplexml_load_string('<root/>');  
$sxe->child = '';  
$sxe->child->nodea = 'A';  
$sxe->child->nodeb = 'B';  
$nodea = $sxe->child->nodea;  
  
$nodes = $nodea->xpath('/root/child');  
  
$childnode = $nodes[0];  
  
echo $childnode->nodea;  
  
$node = dim_import_simplexml($childnode);  
echo $node->nodeName;
```

XMLReader

- It is a Pull parser
- Forward moving stream based parser
- Based on the C# XmlTextReader API
- Advantages
 - Low memory footprint
 - Simple API
 - Faster Processing
 - Namespace support
 - Validation support
 - Advanced Feature Set

Simple XML Document

<root>

<child cattr="123">my content</child>

<?php echo 'hello world';?>

<![CDATA[random data]]>

</root>

Simple Parsing

```
$reader = new XMLReader();  
$reader->XML($xml);  
while ($reader->read())  
{  
    echo "Name: " . $reader->name . "\t";  
    echo "Value: " . $reader->value . "\n";  
}  
$reader->close();
```

Simple Parsing Results

Name: root Value:

Name: #text Value:

Name: child Value:

Name: #text Value: my content

Name: child Value:

Name: #text Value:

Name: php Value: echo 'hello world';

Name: #text Value:

Name: #cdata-section Value: random data

Name: #text Value:

Name: root Value:

Reading Data

- `XML($stringInput [, $encoding [, $options]])`
 - Reads and XML document loaded within a string
- `open($URI [, $encoding [, $options]])`
 - Reads an XML document at location specified by URI
 - Uses PHP streams to read the data

Streams To The Rescue

```
$url = 'http://developer.ebay.com/webservices/latest/eBaySvc.wsdl';  
  
$begin = microtime(true);  
$sxe = simplexml_load_file($url);  
$end = microtime(true);  
echo "Root node: " . $sxe->getName() . "\n";  
$total = $end - $begin;  
echo "Elapsed time: " . $total . "\n";
```


Streams To The Rescue

Root node: definitions

Elapsed time: 20.740789175

Streams To The Rescue

```
$url = 'http://developer.ebay.com/webservices/latest/eBaySvc.wsdl';
$begin = microtime(true);

$reader = new XMLReader();
$reader->open($url);
while ($reader->read()) {
    if ($reader->nodeType == XMLReader::ELEMENT) {
        echo "Root node: " . $reader->localName . "\n";
        break;
    }
}
$reader->close();
$end = microtime(true);
$total = $end - $begin;
echo "Elapsed time: " . $total . "\n";
```

Streams To The Rescue

Root node: definitions

Elapsed time: 0.236433029175

100X Faster!

Memory Impact

```
echo "Memory used: " . memory_get_usage()."\n";
```

SimpleXML Example

Memory used: 64000

XMLReader Example

Memory used: 65448

Real Memory Impact

```
echo "Memory used: " . memory_get_usage()."\n";  
Debug build of libxml2 used to capture its maximum memory usage
```

SimpleXML Example

Memory used: 64000

libxml2 memory usage: 12980964 (**13 MB**)

XMLReader Example

Memory used: 65448

libxml2 memory usage: 28098 (**28 KB**)

Node Types

XMLReader::ELEMENT	Element opening tag
XMLReader::END_ELEMENT	Element closing tag
XMLReader::ATTRIBUTE	Attribute
XMLReader::TEXT	Text node
XMLReader::CDATA	CDATA node
XMLReader::PI	Processing Instruction
XMLReader::COMMENT	Comment Node
XMLReader::WHITESPACE	Whitespace
XMLReader::NONE	No Data: BOF or EOF

Node Types

```
while ($reader->read()) {  
    switch ($reader->nodeType) {  
        case XMLReader::ELEMENT:  
            echo '<' . $reader->localName . '>';  
            break;  
        case XMLReader::END_ELEMENT:  
            echo '</' . $reader->localName . '>';  
            break;  
        case XMLReader::TEXT:  
        case XMLReader::SIGNIFICANT_WHITESPACE:  
            echo $reader->value;  
    }  
}
```

Attributes

```
<root>  
  <child attr1="abc" attr2="def" />  
  <child xmlns:pref="urn::pref" pref:attr1="123" />  
</root>
```

```
/* Position cursor at first child element */  
while ($reader->read()) {  
  if ($reader->localName == 'child') {  
    /* insert code here */  
    break;  
  }  
}
```


Attributes

```
<root>  
  <child attr1="abc" attr2="def" />  
  <child xmlns:px="urn::px" px:attr1="123" />  
</root>
```

```
echo 'Attr1: ' . $reader->getAttribute("attr1") . "\n";           // Attr1: abc  
echo 'Attr2: ' . $reader->getAttribute("attr2") . "\n";           // Attr2: def  
  
$reader->next('child');  
echo 'Attr1: ' . $reader->getAttribute("attr1") . "\n";           // Attr1:  
echo 'Attr1: ' . $reader->getAttributeNS("attr1",  
                                         "urn::px") . "\n";       // Attr1: 123  
  
echo 'Attr1: ' . $reader->getAttributeNo(1) . "\n";               // Attr1: 123  
echo 'Attr1: ' . $reader->getAttributeNo(0) . "\n";               // Attr1: urn::px
```

Attributes

```
<root>
  <child attr1="abc" attr2="def" />
  <child xmlns:px="urn::px" px:attr1="123" />
</root>
```

```
$reader->moveToFirstAttribute();
echo $reader->name . ': ' . $reader->value . "\n";           // attr1: abc
while ($reader->moveToNextAttribute()) {
    echo $reader->name . ': ' . $reader->value . "\n";       // attr2: def
}
```

```
$reader->moveToElement();
$reader->next('child');
$reader->moveToAttributeNo(0);
echo $reader->name . ': ' . $reader->value . "\n";           // xmlns:px: urn::px
```

XMLReader Properties

- name
- localName
- nodeType
- hasValue
- value
- hasAttributes
- attributeCount
- depth
- prefix
- namespaceURI
- baseURI
- isDefault
- isEmptyElement
- xmlLang

Basic Parser Configuration

- XMLReader::LOADDTD
- XMLReader::DEFAULTATTRS
- XMLReader::VALIDATE
- XMLReader::SUBST_ENTITIES

```
$reader = newXMLReader();
```

```
$reader->open($file);
```

```
$reader->setParserProperty(XMLReader::LOADDTD, TRUE);
```

```
$reader->setParserProperty(XMLReader::VALIDATE, TRUE);
```

```
var_dump($reader->getParserProperty(XMLReader::VALIDATE));
```

Advanced Parser Configuration

- Leverages ext/libxml parser constants
- Provides advanced parsing capabilities to XMLReader

```
$reader = new XMLReader();  
$reader->XML($xml, NULL,  
            LIBXML_NOCDATA | LIBXML_DTDVALID | LIBXML_XINCLUDE);  
  
echo $reader->nodeType."\n";  
while ($reader->read()) {  
    echo $reader->name."\n";  
}
```

DTD Validation

```
<!DOCTYPE chapter [  
  <!ELEMENT chapter (title, para)>  
  <!ELEMENT title (#PCDATA)>  
  <!ELEMENT para (#PCDATA)>  

```

```
$reader->XML($xml, NULL, LIBXML_DTDVALID | LIBXML_NOERROR);  
while ($reader->read()) {  
    echo $reader->name . ': ' . $reader->value . "\n";  
    if (! $reader->isValid()) {  
        echo libxml_get_last_error()->message;  

```

chapter:

**Element chapter content does not follow the DTD,
expecting (title , para), got (title)**

RelaxNG Validation

XML Source

```
<chapter>  
  <title>XMLReader</title>  
  <test/>  
</chapter>
```

RelaxNG Source

```
<element name="chapter" xmlns="http://relaxng.org/ns/structure/1.0">  
  <element name="title"><text/></element>  
  <element name="para"><text/></element>  
</element>
```

RelaxNG Validation

```
$reader = new XMLReader();  
libxml_use_internal_errors(true);  
$reader->XML($xml);  
$reader->setRelaxNGSchemaSource($rng);  
  
while ($reader->read()) {  
    if (! $reader->isValid()) {  
        echo $reader->name . ': ' . $reader->value . "\n";  
        echo libxml_get_last_error()->message;  
        break;  
    }  
}
```

test:

Did not expect element test there

XML Schema Validation

```
<chapter>
```

```
  <title>XMLReader</title>
```

```
  <test/>
```

```
</chapter>
```

```
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
```

```
  <xsd:element name="chapter">
```

```
    <xsd:complexType>
```

```
      <xsd:sequence>
```

```
        <xsd:element name="title" minOccurs="1">
```

```
          <xsd:complexType>    <xsd:sequence>
```

```
            <xsd:element name="title" minOccurs="1" type="xsd:string"/>
```

```
            <xsd:element name="para" minOccurs="1" type="xsd:string"/>
```

```
          </xsd:sequence>    </xsd:complexType>
```

```
        </xsd:element>
```

```
      </xsd:sequence>
```

```
    </xsd:complexType>
```

```
  </xsd:element>
```

```
</xsd:schema>
```

XML Schema Validation

```
$reader = new XMLReader();  
libxml_use_internal_errors(true);  
$reader->XML($xml);  
$reader->setSchema('schema.xsd');  
  
while ($reader->read()) {  
    if (! $reader->isValid()) {  
        echo $reader->name . ': ' . $reader->value . "\n";  
        echo libxml_get_last_error()->message;  
        break;  
    }  
}
```

chapter:

Element 'test': This element is not expected.

Exporting Nodes

```
<movie>
  <title>PHP: Behind the Parser</title>
  <character>
    <name>Ms. Coder</name>
  </character>
</movie>
```

```
while($reader->read()) {
    if ($reader->name == 'title') {
        $node = $reader->expand();
        $dom = new DOMDocument();
        $node = $dom->importNode($node, true);
        print $dom->saveXML($node);
        break;
    }
}
```

<title>PHP: Behind the Parser</title>

XMLWriter

- Lightweight, forward-only API for generating well formed XML
 - Automatically escapes data
 - Writes to memory or directly to streams
 - Ability to control indenting
 - Enforces wellformedness by automatically closing open tags

Creating The Document

```
$writer = new XMLWriter();
```

```
$writer->openMemory();
```

```
$writer->setIndent(true);
```

```
$writer->setIndentString("\t");
```

```
$writer->startDocument('1.0', 'UTF-8');
```

```
$writer->startElement('results');
```

```
echo $writer->flush(false);
```

```
<?xml version="1.0" encoding="UTF-8"?>
```

```
<results
```

Writing Content

```
$writer->startElement('result');  
$writer->writeAttribute("id", "123");  
$writer->writeElement('name', 'John & Jane');  
$writer->startElement('lastName');  
$writer->text('Doe');  
$writer->endElement();
```

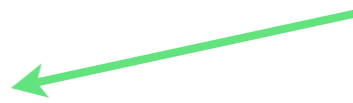
```
echo $writer->flush()
```

```
<?xml version="1.0" encoding="UTF-8"?>  
<results>  
  <result id="123">  
    <name>John & Jane</name>  
    <lastName>Doe</lastName>
```

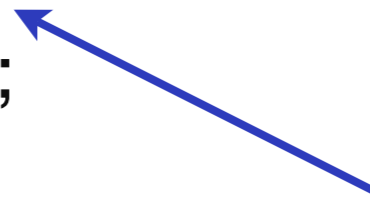
Completing The Document

```
$writer->endElement();  
$writer->startElement('result');  
$writer->writeAttribute("id", "456");  
$writer->startElement('name');  
$writer->writeRaw('Joe & Mary');  
$writer->endElement();  
$writer->writeElement('lastName', 'Smith');  
$writer->endDocument();  
echo $writer->flush()."\n";
```

Add raw content



Close off all open tags



</result>

<result id="456">

<name>Joe & Mary</name>

<lastName>Smith</lastName>

</result>

</results>

Writing To Streams

- Requires less resources when outputting XML
 - Faster web service response time
 - Less server load
 - Write directly to `php://output`
 - Write to custom stream wrappers
 - Automatic buffer flushing as needed

Writing To Streams

```
$data = array(array('name' => 'Dick & Jane', 'number' =>123),  
array('name' => 'John & Mary', 'number' => 456));
```

```
$writer = new XMLWriter();  
$writer->openURI('php://output');  
$writer->setIndent(true);
```

```
$writer->startElement('results');  
foreach ($data AS $record) {  
    $writer->startElement('result');  
    foreach ($record AS $key => $value) {  
        $writer->writeElement($key, $value);  
    }  
    $writer->endElement();  
    $writer->flush();  
}
```

```
$writer->endDocument();  
unset($writer);
```

Writing To Streams

```
<results>  
  <result>  
    <name>Dick & Jane</name>  
    <number>123</number>  
  </result>  
  <result>  
    <name>John & Mary</name>  
    <number>456</number>  
  </result>  
</results>
```

Namespaces: Brute Force

```
$writer = new XMLWriter();  
$writer->openMemory();  
$writer->setIndent(true);  
  
$writer->startElement('pfx:root');  
$writer->writeAttribute('xmlns:pfx', 'urn::mypfx');  
$writer->writeElement('pfx:child', 'mydata');  
  
$writer->endDocument();  
echo $writer->flush();
```

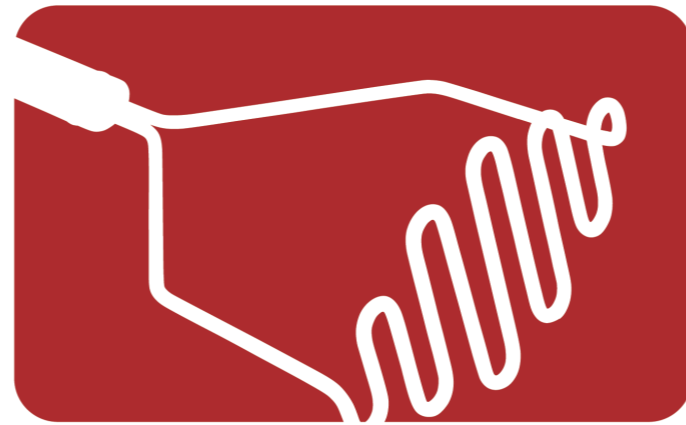
```
<pfx:root xmlns:pfx="urn::mypfx">  
  <pfx:child>mydata</pfx:child>  
</pfx:root>
```

Namespaces

```
$writer = new XMLWriter();  
$writer->openMemory();  
$writer->setIndent(true);  
  
$writer->startElementNS('pfx', 'root', 'urn:mypfx');  
$writer->writeElementNS('pfx', 'child', 'urn:mypfx', 'mydata');  
  
$writer->endDocument();  
echo $writer->flush();
```

```
<pfx:root xmlns:pfx="urn:mypfx">  
  <pfx:child xmlns:pfx="urn:mypfx">mydata</pfx:child>  
</pfx:root>
```

Namespace Declaration
Is Repeated



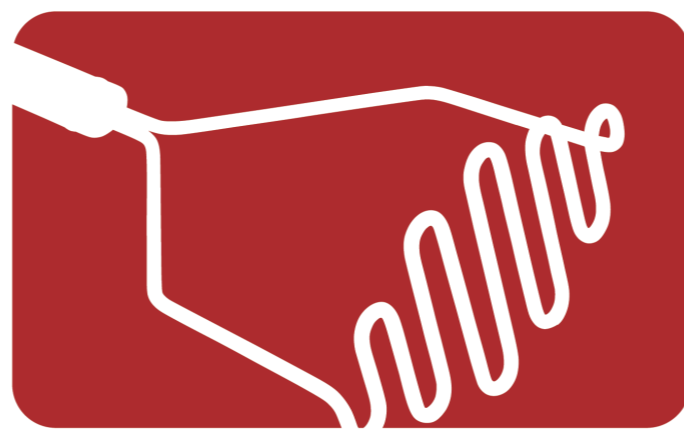
MASHERY

Streaming XML

Rob Richards

<http://www.cdatazone.org>

<http://xri.net/=rob.richards>



MASHERY

We Are Hiring PHP & AJAX Developers

Contact us: jobs@mashery.com

OPEN TO ALL

**We want to meet you! Please join us for complimentary pizza
and beer (or your drink of choice)**

**Sheraton Gateway Suites O'Hare
11th floor**

**Thursday, May 22nd
5:30 - 7:30pm**