transform.xq for dummies

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Wish me good luck

- New computer
- New OS version (Ubuntu 15.04)
- New oXygen version (17)
- New presentation format (George Bina's DITA CSS)
- New topics (XQuery, higher-order functions)

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topic title

Data-Driven Programming in XQuery

Introduction

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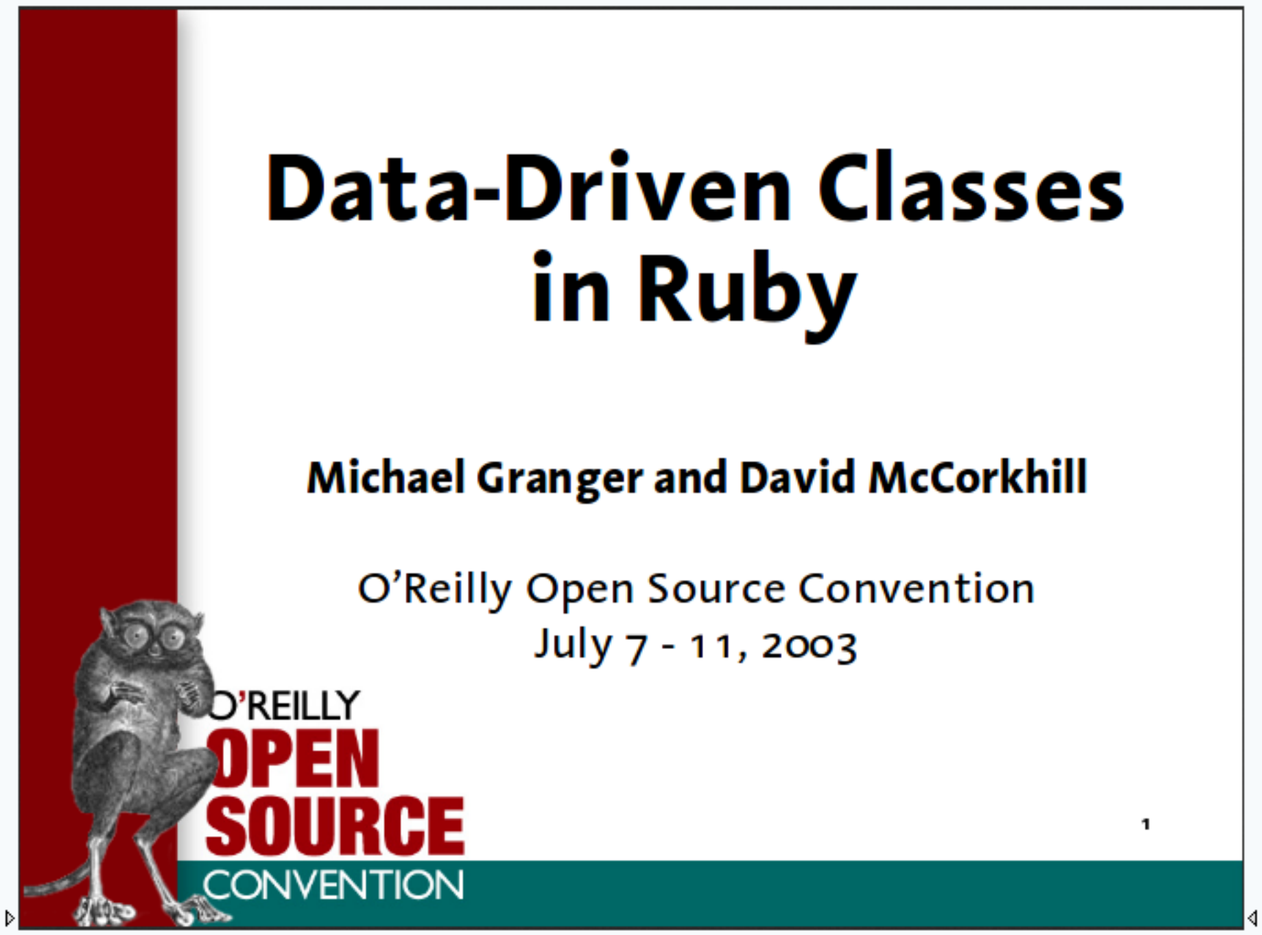
Introduction

A looong time ago



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topic topic title
Data-Driven Programming in XQuery
Introduction
Eureka
• Data-driven techniques minimize the impact of new or changing data structures and APIs
• Expressing functionality with data allows for run-time changes
• Allows code to be managed in parceled chunks
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Introduction

A source of inspiration

- XML Driven Classes in Python (OSCON 2004)
- TreeBind (XTech 2006 and XML 2006)

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Introduction

What are “data-driven” classes?

- All classes are data-driven in some sense.
- Data-driven classes are classes defined by dynamic information.
  - Classes which modify or create their behavior based on state (data).
  - Classes not (completely) defined by source or object code

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Introduction

What is Data-Driven programming?

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Introduction

What is Data-Driven programming?

Wikipedia

> "In computer programming, data-driven programming is a programming paradigm in which the program statements describe the data to be matched and the processing required rather than defining a sequence of steps to be taken.[1] Standard examples of data-driven languages are the text-processing languages sed and AWK,[1] where the data is a sequence of lines in an input stream – these are thus also known as line-oriented languages – and pattern matching is primarily done via regular expressions or line numbers."

-- Wikipedia

Introduction

What is Data-Driven programming?

c2.com

> "Data Driven Programs are programs which process data files whose contents cause the program to do something different. The extreme case is an interpreter and the interpretable program files. "

-- c2.com

Introduction

What is Data-Driven programming?

Data-oriented Design

> "If the ultimate result of an application is data, and all input can be represented by data, and it is recognised that all data transforms are not performed in a vacuum, then a software development methodology can be founded on these principles, the principles of understanding the data, and how to transform it given some knowledge of how a machine will do what it needs to do with data of this quantity, frequency, and it's statistical qualities. Given this basis, we can build up a set of founding statements about what makes a methodology data-oriented. "

-- Data-oriented Design

Introduction

Examples

Introduction

Examples

Hello world

```
public class HelloWorld {
    public static void main(String[] args) {
        System.out.println("Hello, World");
    }
}
```

- This hello world is 0% data-driven.
- The JVM that runs this program is 100% data-driven.

Introduction

Examples

A backup utility

```
<backups>
 <task name="apache-norm">
  <postgres name="test" user="apache" dump="dbtestdump.sql"/>
  <mysql name="wikixmlfr" user="wikixmlfr" password="XXXX"
   dump="/home/apache/wikixmlfrdump.sql"/>
  <user name="apache" host="gwnormandy.dyomedea.com">
   <exclude>xmlfr/</exclude>
   <exclude>vdv/albums/</exclude>
  </user>
 </task>

 <!-- ... -->

</backups>
```

backup.xml

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Introduction

Examples

A mailing list manager

- Used by the XML Guild
- Powered by TreeBind
- XML elements are mapped to classes and methods that wrap IMAP and SMTP actions.
- See mailing-list.xml.

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```
<?xml version="1.0" encoding="UTF-8"?>
<listManager>
   <server>localhost</server>
   <storeType>imap</storeType>
   <user>...</user>
   <password>...</password>
   <port>143</port>
   <folderManager>
      <folder>INBOX</folder>
      <messageHandler>
         <ifEither>
            <ifIsRecipient>info@xmlguild.org</ifIsRecipient>
            <ifIsRecipient>info@thexmlguild.org</ifIsRecipient>
            <ifIsRecipient>info@xmlguild.info</ifIsRecipient>
            <ifIsRecipient>info@xml-guild.org</ifIsRecipient>
            <ifIsRecipient>info@xml-guild.com</ifIsRecipient>
         </ifEither>
         <sendToList>
            <subjectPrefix>[the XML Guild]</subjectPrefix>
            <footer><![CDATA[
--
The XML Guild
   where you find established XML experts . . .
       http://xmlguild.org/
       info@xmlguild.org
]]></footer>
            <recipient>vdv@dyomedea.com</recipient>
            <recipient>...</recipient>
            <recipient><!-- other recipients removed --></recipient>
            <envelopeFrom>info-bounce@xmlguild.org</envelopeFrom>
            <header name="Precedence">List</header>
            <header name="List-Id">&lt;info.xmlguild.org&gt;</header>
            <header name="List-Post">&lt;mailto:info@xmlguild.org&gt;</header>
            <server>localhost</server>
            <user>...</user>
            <archive>archive</archive>
         </sendToList>
         <moveTo>done</moveTo>
      </messageHandler>
      <messageHandler>
         <moveTo>unparsed</moveTo>
      </messageHandler>
```

Introduction

XSLT

- Like sed and awk mentioned by wikipedia, XSLT is data-driven by design.
- <xsl:template match=""> natively binds data to XSLT instructions

Introduction

Functional programming

- Data-Driven programming in functional worlds have not been widely explored yet.
- Functional programming considers functions as data, does that help?
- How can we bind data to functions?
- That's the topic of this talk!

Introduction

Conclusion

- It's a paradigm
- Programming languages features and libraries can facilitate data-driven programming
- Data binding libraries are helpful to do data-driven programming in object oriented worlds
- XSLT is data-driven by design
- What about functional programming?

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topic

Functional XQuery

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Functional XQuery

Hangman

- Rules borrowed from Wikipedia.
- State persisted in XML (hangman.xml).

```
<hangman status="in-progress" misses="Z">
   <word>
      <letter guessed="true">H</letter>
      <letter guessed="true">A</letter>
      <letter guessed="true">N</letter>
      <letter guessed="false">G</letter>
      <letter guessed="true">M</letter>
      <letter guessed="true">A</letter>
      <letter guessed="true">N</letter>
   </word>
   <display>
      <head shown="true"/>
      <body shown="true"/>
      <right_arm shown="true"/>
      <left_arm shown="true"/>
      <right_leg shown="false"/>
      <left_leg shown="false"/>
   </display>
</hangman>
```

Functional XQuery

In Python

Reference implementation in Python using the XML-Driven classes presented at OSCON 2004.

```
# Class Letter: individual letters to be guessed
class Letter(XmlObject.XmlObjectElement):

    def addGuess(self, guess):
        if self._value() == guess:
            self.guessed._set('true')
            return True
        else:
            return False

    def isGuessed(self):
        return self.guessed._value() == 'true'

XmlObject.XmlObjectElement_letter = Letter
```

Functional XQuery

In XSLT

hangman.xsl

```
<xsl:template match="letter[.=$guess]/@guessed">
   <xsl:attribute name="guessed">true</xsl:attribute>
</xsl:template>
```

Functional XQuery

transform.xq

Functional XQuery

XQuery with transform.xq

hangman-txq.xq using transform.xq.

```
(: Guesses :)
tfm:rule('letter/@guessed', function($mode, $node) {
   attribute {xs:QName(name($node))} {
      if ($node/.. = $guess)
      then 'true'
      else $node
   }
}),
```

Doesn't work on Saxon for whatever reason.

Functional XQuery

XQuery with transform.xq and annotations

hangman-txq2.xq using transform.xq

```
declare %tfm:rule("default","letter/@guessed",2)
function f:guessed-att($mode, $node){
   f:copy($node,
      if ($node/.. = $guess)
         then 'true'
         else $node
   )
};
```

Relies on a MarkLogic extension function.

Functional XQuery

What transform.xq brings us

- A parser for a subset of XSLT match patterns (converted to XQuery functions).
- A way to bind XQuery functions (playing the role of XSLT templates) to match patterns.
- *What could we do without this outstanding library?*

Functional XQuery

Classical XQuery

hangman-recurs.xq

```
...
    else if ($node instance of attribute(guessed)) then
        f:copy($node,
            if ($node/.. = $guess)
                then 'true'
                else $node
        )
...
```

Could be much worse!

Functional XQuery

With higher-order functions

hangman-hof.xq

```
...
    (: @guessed attributes :)
    f:rule(
    function($node as node()) as xs:boolean {
        $node instance of attribute(guessed)
    }, function($node as node(), $transform as function(*)) as node() {
        f:copy($node, if ($node/.. = $guess)
              then 'true'
              else $node)

    }),
...
```

Similar to transform.xq without match patterns.

Functional XQuery

Missing maps in XQuery 3.0

Dirty hack used by hangman-hof.xq to simulate maps:

```
(: borrowed from transform.xq :)
declare function f:rule(
    $predicate as (function(node()) as xs:boolean),
    $action as (function(node(), function(*)) as node()?))
    as function(*) {

    function($k as xs:string) {
       switch($k)
          case 'predicate' return $predicate
          case 'action' return $action
          default return ()
    }
};
```

Functional XQuery

The magic of higher-order functions

The f:transform() function in hangman-hof.xq:

```
(: Some high order functions magic :)
declare function f:transform($rules as function(*)*) as function(*) {
   function($node as node(), $transform as function(*)) as node()? {
      if (head($rules)('predicate')($node))
         then head($rules)('action')($node, $transform)
      else if (exists(tail($rules)))
         then f:transform(tail($rules))($node, $transform)
         else ()
   }
};
```

Functional XQuery

Conclusion

- Higher-order functions do facilitate data-driven programming in XQuery.
- Maps are missed in XQuery 3.0 but can be simulated.
- transform.xq gives you all you need but you can also easily write your own mechanism.
- Good old if/then/else and recursion isn't that awful after all!

Functional XQuery

Acknowledgments

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- Tony Graham, Patrick Durusau and my three anonymous reviewers for their reviews, comments, corrections, questions and suggestions.
- John Snelson for his very inspiring transform.xq.
- George Bina for pushing me into dita.
- XML London for this gathering.

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Data-Driven Programming in XQuery

Functional XQuery

Questions

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