HEXUP

An XQuery Update Implementation

Per Andersson
Lukas Niessen

Frontiers of Programming Language Technology '07/'08

XML/XPath

- XML: eXtensible Markup Language

```
<recipe>
<ingredient unit='cups'>Flour</ingredient>
</recipe>
```

- XPath: Language to select nodes from an XML document
  → XML document is viewed as a tree

```
/recipe
```

XML/XPath

- XML: eXtensible Markup Language

```
<recipe>
<ingredient unit='cups'>Flour</ingredient>
</recipe>
```

- XPath: Language to select nodes from an XML document
  → XML document is viewed as a tree

```
/recipe/ingredient
```

XML/XPath

- XML: eXtensible Markup Language

```
<recipe>
<ingredient unit='cups'>Flour</ingredient>
</recipe>
```

- XPath: Language to select nodes from an XML document
  → XML document is viewed as a tree

```
/recipe/ingredient[@unit='cups']
```

XML/XPath

- XML: eXtensible Markup Language

```
<recipe>
<ingredient unit='cups'>Flour</ingredient>
</recipe>
```

- XPath: Language to select nodes from an XML document
  → XML document is viewed as a tree

```
/recipe/ingredient[@unit='cups']
//ingredient
```

XQuery

- XQuery: Query language for XML
- Basic component of XQuery: FLWOR-expressions

```
for $s in /recipes/recipe/ingredient
let $t := /recipes/recipe/title
where $s[@amount > 3]
order by $s
return <res> $t $s </res>
```

- Cp. `SELECT ... FROM ... WHERE ... ORDER BY` in SQL

XQuery Update

- Extension (superset of XQuery)
- Important elements
  - Insert: `insert nodes ... as first into ...`
  - Delete: `delete nodes ...`
  - Replace: `replace node ... with ...`
- Compare SQL's insert, delete, update

HEXUP Tools

- Haskell
  - Functional programming language
- Parsec
  - Monadic parsing library for parsing XQuery grammar
- Haskell XML Toolbox
  - Framework for dealing with XML documents in Haskell

Parsec

- Monadic parser combinator for Haskell
  - Alternative to bottom-up parser generators (Happy)
  - Combinator, infix higher order functions
  - Designed from scratch as an industrial strength parser library
  - Well documented in literature, but Parsec is the first complete implementation meant to be used in bigger projects

Example Grammar

From XQuery Grammar:

```
LetClause ::= "let" "$" VarName TypeDeclaration? ":="
              ExprSingle ("," "$" VarName
              TypeDeclaration?   ":=" ExprSingle)*
```

Parsec Grammar

```
letClause :: Parser FLWORExpr
letClause = do
    string "let"
    whiteSpace
    char '$'
    id <- identifier
    whiteSpace
    string ":="
    whiteSpace
    xp <- parens expressions
    whiteSpace
    return (LetClause id xp)
```

HXT

- Haskell XML Toolbox: Collection of tools for processing XML with Haskell
- Includes
  - Generic data model, including DTD subset
  - Document parsing and validation
  - XPath support
- Drawback: data model doesn't conform to the W3C data model for XPath/XQuery

Examples/Live Demo

```
<?xml version="1.0" standalone="yes"?>
<recipes>
<recipe name="bread" prep_time="5 mins" cook_time="3 hours">
 <title> Basic bread </title>
   <ingredient amount="3" unit="cups">Flour</ingredient>
   <ingredient amount="0.5" unit="ounce">Yeast</ingredient>
   <ingredient amount="2" unit="cups" state="hot">Water</ingredient>
   <ingredient amount="1" unit="teaspoon">Salt</ingredient>
   <instructions>
     <step>Mix all ingredients together.</step>
     <step>Knead thoroughly.</step>
     <step>Cover with a cloth, and leave for 1h in warm room.</step>
     <step>Knead again.</step>
     <step>Place in a bread baking tin.</step>
     <step>Cover with a cloth, and leave for 1h in warm room.</step>
     <step>Bake in the oven at 350(degrees)F for 30 minutes.</step>
   </instructions>
 </recipe>
</recipes>
```

Examples/Live Demo

```
<?xml version="1.0" standalone="yes"?>
<recipes>
<recipe name="bread" prep_time="5 mins" cook_time="3 hours">
 <title> Basic bread </title>
   <ingredient amount="3" unit="cups">Flour</ingredient>
   <ingredient amount="0.5" unit="ounce">Yeast</ingredient>
   <ingredient amount="2" unit="cups" state="hot">Water</ingredient>
   <ingredient amount="1" unit="teaspoon">Salt</ingredient>
   <instructions>
     <ingredient amount="1" unit="teaspoon">Salt</ingredient>
     <step>Mix all ingredients together.</step>
     <step>Knead thoroughly.</step>
     <step>Cover with a cloth, and leave for 1h in warm room.</step>
     <step>Knead again.</step>
     <step>Place in a bread baking tin.</step>
     <step>Cover with a cloth, and leave for 1h in warm room.</step>
     <step>Bake in the oven at 350(degrees)F for 30 minutes.</step>
   </instructions>
 </recipe>
</recipes>
```