



User Defined DataTypes

An extension of XQuery



Introduction

- Rob Stapper
- Software-engineer
- Public sector, Netherlands



myProject

- Software re-engineering:
 - Input: code of any quality
 - Output: optimized code
 - Transparant
 - Maintainable
 - Semanticly correct
- Using Xquery/BaseX
 - XML
 - Functional
 - Qualitative good product and team
 - But missing datatypes: dataContainers & dataRecords



Why not use existing datatypes?

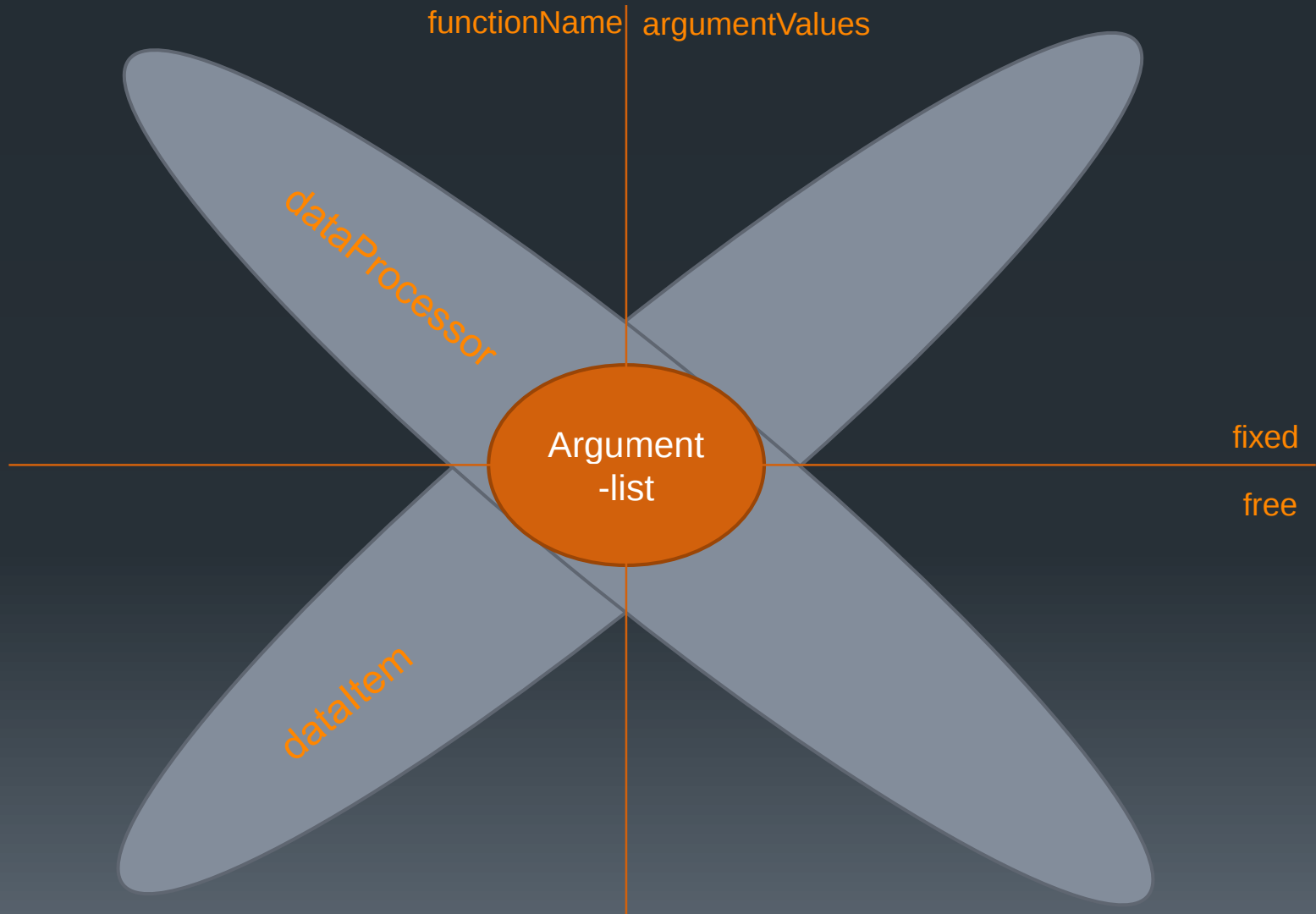
- Xquery's sequence?
- XML?
- Map/Array?
- Function?
- Is not a datatype.
- Intended for external data.
- Specific use.
- Yeeh, Functional Data Structures.



Aspect when introducing new datatypes

- Construction of the dataItems
 - <https://github.com/LeoWoerteler/xq-modules>
- Implementing within a Generic DataTyping Framework

Functional Data Structures



version_20151201

- inspect_functions_issue_1
- issues
- Praag 2016
 - 01a-pair-LW-org.xqm (1 KB)
 - 01b-pair-LW-org-demo.xq (306 Bytes)
 - 02a-pair-LW-annot.xqm (1 KB)
 - 02b-pair-LW-annot-demo.xq (308 Bytes)
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 - 06-typecheck-demo.xq (1 KB)
 - 99-demo_trace.xq (1 KB)
 - Basex 2016 Praag.pptx (56 KB)
- repo
- unitTests
 - .basex (704 Bytes)
 - .basexgui (10 KB)
 - .basexhome (0 Bytes)



01a-pair-LW-org.xqm

```
1 xquery version "3.0";
2
3 (:~
4 : A library for typed pairs of XQuery sequences.
5 :
6 : @author Leo Woerteler <leo@woerteler.de>;
7 : @version 0.1
8 : @license BSD 2-Clause License
9 :)
10 module namespace pair = "http://www.woerteler.de/xquery/modules/pair";
11
12 (:~
13 : Creates a pair from the given two values.
14 : @param $fst first partner
15 : @param $snd second partner
16 : @return the pair
17 :)
18 declare %public function pair:new(
19   $fst as item()*,
20   $snd as item()*)
21 as function(*) {
22   function($f) { $f($fst, $snd) }
23 };
24
```

OK

Editor

22 : 34



Result

Command Command...

L:/Projecten/BaseX-extension/version_20151201

*.xml, *.xq*

Find contents...

version_20151201

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01a-pair-LW-org.xqm 01b-pair-LW-org-demo.xq

```
1 import module namespace pair = "http://www.woerteler.de/xquery/modules/pair" at '01a-pair-LW-org.xqm';
2
3 let $p1 := pair:new( 1,2),
4     $p2 := pair:new( 3,4)
5
6 return( inspect:function( pair:new( 1,2))
7         , $p2( function( $_1, $_2) { $_1 + $_2 })
8         , $p1( function( $_1, $_2) { $_1 * $_2 })
9       )
10
```

OK

1:1

Result

```
<function>
  <argument type="item()" occurrence="*" />
  <return type="item()" occurrence="*" />
</function>
7
2
```

Time needed: 137.42 ms

11 MB

version_20151201 Postvak IN - r.stapp... Inspection Module - ... L:/Projecten/BaseX-... BaseX 2016 Praag - ...

NL < > 9:12

Database Editor View Visualization Options Help

Command Command...

L:/Projecten/BaseX-extension/version_20151201

*.xml, *.xqm

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```

1 xquery version "3.0";
2
3 (:~
4  : A library for typed pairs of XQuery sequences.
5  :
6  : @author Leo Woerteler <leo@woerteler.de>;
7  : @version 0.1
8  : @license BSD 2-Clause License
9  :)
10 module namespace pair = "http://www.woerteler.de/xquery/modules/pair";
11
12 declare namespace udt = 'system.GDF.userDefinedDataType' ;
13 (:~
14  : Creates a pair from the given two values.
15  : @param $fst first partner
16  : @param $snd second partner
17  : @return the pair
18  :)
19 declare %public function pair:new(
20   $fst as item(*),
21   $snd as item(*)
22 ) as function(*) {
23   udt:dateTime('pair') function($f) { $f($fst, $snd) }
24 };
25

```

Editor

OK

23 : 24



Result

```

<function>
  <argument type="item()" occurrence="*" />
  <return type="item()" occurrence="*" />
</function>
7
2

```

OK

51 MB

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 - 99-demo_trace.xq (1 KB)
 - Basex 2016 Praag.pptx (56 KB)
 - repo
 - unitTests
 - .basex (704 Bytes)
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```

1 import module namespace pair = "http://www.woerteler.de/xquery/modules/pair" at '02a-pair-LW-annot.xqm';
2
3 let $p1 := pair:new( 1,2),
4     $p2 := pair:new( 3,4)
5
6 return( inspect:function( pair:new( 1,2))
7         , $p2( function( $_1, $_2) { $_1 + $_2})
8         , $p1( function( $_1, $_2) { $_1 * $_2})
9         )
10

```

OK

1 : 1



```

<function>
  <argument type="item()" occurrence="*" />
  <annotation name="udt:dataType" uri="system.GDF.userDefinedDataType">
    <literal type="xs:string">pair</literal>
  </annotation>
  <return type="item()" occurrence="*" />
</function>
7
2

```

Command

Command...

.:Projecten/BaseX-projecten/_BaseX-extension/vers

*.xml, *.xq*

Find contents...

- version_20151201
 - inspect_functions_issue_1
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 - Praag 2016
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 - 03-pair-RS-demo.xq (417 Bytes)
 - 04-dataCollection-demo.xq (790 Bytes)
 - 05-dataRecord-demo.xq (315 Bytes)
 - 06-typecheck-demo.xq (1 KB)
 - 99-demo_trace.xq (1 KB)
 - BaseX 2016 Praag.pptx (1 MB)
 - ~\$BaseX 2016 Praag.pptx (165 Bytes)
- repo
 - logicOptimizer
 - system
 - unitTests
 - .baseX (755 Bytes)
 - .baseXgui (2 KB)
 - .baseXhome (0 Bytes)



01a-pair-LW-org.xqm 01b-pair-LW-org-demo.xq 02a-pair-LW-annot.xqm 02b-pair-LW-annot-demo.xq pair.xqm

```
1      module namespace pair      = "system.dataTypes.pair"      ;
2
3      (:=====:)
4      (: construction | )
5      (:=====:)
6
7      import module namespace dRec ='system.GDF.dataRecord' at '../GDF/dataRecord.xqm';
8      declare variable $pair:dataType := static-base-uri()      ;
9
10     declare %private function pair:constructor
11       ( $first as item()*
12       , $second as item()*
13       )
14     {
15       dRec:constructor( $pair:dataType, [ $first, $second ] )
16     } ;
17
18     (:=====:)
19     (: atomizers )
20     (:=====:)
21
22     declare function pair:atomizer( $pair )
23     {
24       dRec:dowith ( $pair, function( $first, $second )
25         { $first, $second } )
26     } ;
27
28     declare function pair:first ( $pair )
29     {
30       dRec:dowith ( $pair, function( $first, $second )
31         { $first } )
32     } ;
33
34     declare function pair:second ( $pair )
35     {
36       dRec:dowith ( $pair, function( $first, $second )
37         { $second } )
38     } ;
39
40     (:=====:)
41     (: interface )
42     (:=====:)
43
44     declare function pair:new ( $m, $n )
45     {
46       pair:constructor( $m, $n )
47     } ;
48
49
50
51
52
```

OK

4 : 50



Result

Parsing: 2824.12 ms

34 MB

L:/Projecten/BaseX-extension/version_20151201/Praag 2016/03-pair-RS-demo.xq - BaseX 8.4.2 beta 463843b

Database Editor View Visualization Options Help

Command Command...

L:/Projecten/BaseX-extension/version_20151201

*.xml, *.xq*

Find contents...

version_20151201

inspect_functions_issue_1

issues

Praag 2016

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repo

unitTests

.basex (704 Bytes)

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01a-pair-LW-org.xqm

01b-pair-LW-org-demo.xq

02a-pair-LW-annot.xqm

02b-pair-LW-annot-demo.xq

03-pair-RS-demo.xq

```
1 import module namespace pair = 'system.dataTypes.pair' at '../repo/system/dataTypes/pair.xqm' ;
2 import module namespace di = "system.GDF.dataItem" ;
3
4 di:deep-equal( map{ 1: pair:new( 1,2)
5                 , map{ 1: pair:new( 1,2)
6                 },
7 di:deep-equal( map{ 1: pair:new( 1,2)
8                 , map{ 1: pair:new( 1,3)
9                 )
```

OK

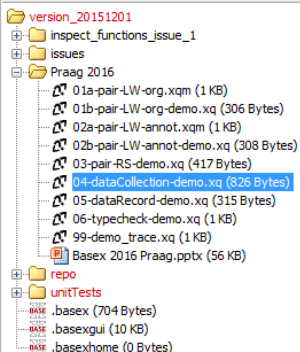
1 : 1

Result

true
false

Parsing: 2632.55 ms

53 MB



```

1 import module namespace seq = "system.dataTypes.seq" at 'L:/Projecten/BaseX-extension/version_20151201/repo/system/dataTypes/seq.xqm' ;
2 import module namespace di = "system.GDF.dataItem" at '../repo/system/GDF/dataItem.xqm' ;
3
4 let $seq := seq:new( ( seq:new(( 3, 1, 2))
5                       , 1
6                       , 2.0
7                       , 'c'
8                       , ( map{ 1: "one"
9                             , array{ 1, "ein"
10                                }
11                       , function( $f){ $f( 1, 2.0, 'c') }
12                       ) )
13 return ( di:serialize( $seq
14           , seq:itemContains( $seq, seq:new(( 1, 2, 3)))
15           , seq:itemContains( $seq, 'c')
16           , seq:itemContains( $seq, seq:new(( 3, 1, 2)))
17         )

```

OK

1 : 1



Result

```

( ( 3, 1, 2), 1, 2, c, { 1 : ( one)}, [ ( 1), ( ein)], <function><argument type="item()" occurrence="*" /><return type="item()" occurrence="*" /></function>
false
true
true

```

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```
1 import module namespace pair = 'system.dataTypes.pair' at '../repo/system/dataTypes/pair.xqm' ;
2 import module namespace di = 'system.GDF.dataItem' at '../repo/system/GDF/dataItem.xqm' ;
3
4 pair:new( 1, pair:new( 2, pair:new( 3, ( )))
5 ! di:serialize( . )
6
```

OK

1 : 1



Result

pair::[(1), (pair::[(2), (pair::[(3), ()])])]

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```
1 import module namespace pair      = 'system.dataTypes.pair'      at '../repo/system/dataTypes/pair.xqm'      ;
2 import module namespace set       = 'system.dataTypes.set'        at '../repo/system/dataTypes/set.xqm'        ;
3 import module namespace seq       = 'system.dataTypes.seq'        at '../repo/system/dataTypes/seq.xqm'        ;
4 import module namespace di        = "system.GDF.dataItem"         at '../repo/system/GDF/dataItem.xqm'         ;
5
6 declare function local:pair_(
7   ($fst as xs:integer
8   , $snd as function( function(*) ) as item()*)
9 )
10 {
11   let   $fst   := $fst
12   ,     $snd   := di:typeCheck( $snd, $set:dataType)
13
14   ,     $result := pair:new( $fst, $snd)
15
16   ,     $result := di:typeCheck( $result, $pair:dataType)
17   return $result
18 } ;
19
20 let $set := set:new(( 1, 2, 3))
21 let $seq := seq:new(( 1, 2, 3))
22
23 return ( local:pair_( 1, $set ) ! di:serialize( . )
24 ( :
25   , local:pair_( 1, $seq ) ! di:serialize( . )
26 :)
27 )
```

OK

12 : 61



pair::[(1), ((1, 2, 3))]

Result

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2 import module namespace set = 'system.dataTypes.set' at '../repo/system/dataTypes/set.xqm' ;
3 import module namespace seq = 'system.dataTypes.seq' at '../repo/system/dataTypes/seq.xqm' ;
4 import module namespace di = "system.GDF.dataItem" at '../repo/system/GDF/dataItem.xqm' ;
5
6 declare function local:pair_
7   ( $fst as xs:integer
8   , $snd as function( function(*) ) as item()*
9   )
10 {
11   let $fst := $fst
12   , $snd := di:typeCheck( $snd, $set:dataType)
13
14   , $result := pair:new( $fst, $snd)
15
16   , $result := di:typeCheck( $result, $pair:dataType)
17   return $result
18 } ;
19
20 let $set := set:new(( 1, 2, 3))
21 let $seq := seq:new(( 1, 2, 3))
22
23 return ( local:pair_( 1, $seq ) ! di:serialize( . )
24 (
25   , local:pair_( 1, $set ) ! di:serialize( . )
26 :)
27 )
```

Typecheck error. dataItem.dataType: seq, checked against dataType: set.

23 : 51



Result