XQuery Processing

A friendly Hello from the BaseX team

XUGS 5, Stuttgart, May 13 2013

Dr. Christian Grün, Dr. Alexander Holupirek

Database & Information Systems Group

University of Konstanz

BaseX.org

Who we are and were we come from …

BASE X RESEARCH

since 2005

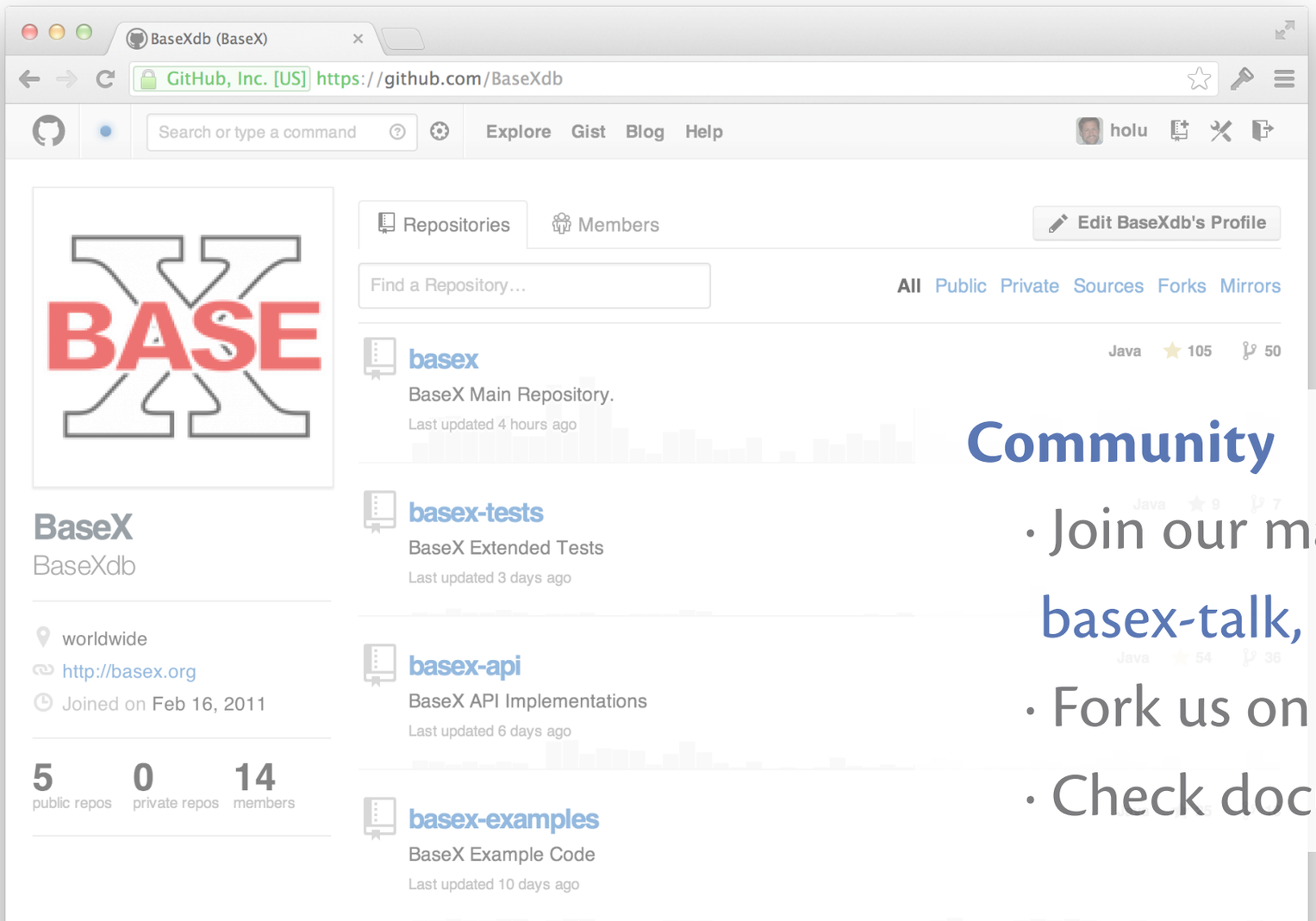
Database and Information System (DBIS) Group, U Konstanz

☞ **BaseX was born here and is still an active research system**

Who we are and what we are proud of ...

100% Open Source - BSD licensed XML DBMS

- database and source code is completely free
- small (~250 people), but steadily growing community
  - users help users
  - see how BaseX / XML is used in the wild



OPEN SOURCE

since 2007

Community

- Join our mailinglists:
  basex-talk, basex-announce, basex-commits
- Fork us on github.com/BaseXdb/basex.git
- Check documentation docs.basex.org

Who we are and how we earn a living …

Consultancy and Training

- We help to run BaseX in heterogeneous system architectures
- We provide trainings on XML, XQuery and BaseX itself

Software Development

- Web applications in a pure X* technology stack
- BaseX enhancements, *sponsored* features

Legal entity to foster the Open Source project

- Currently 3 full-time employees and 3 part-time workers

BASE X COMMERCIAL

since 2011

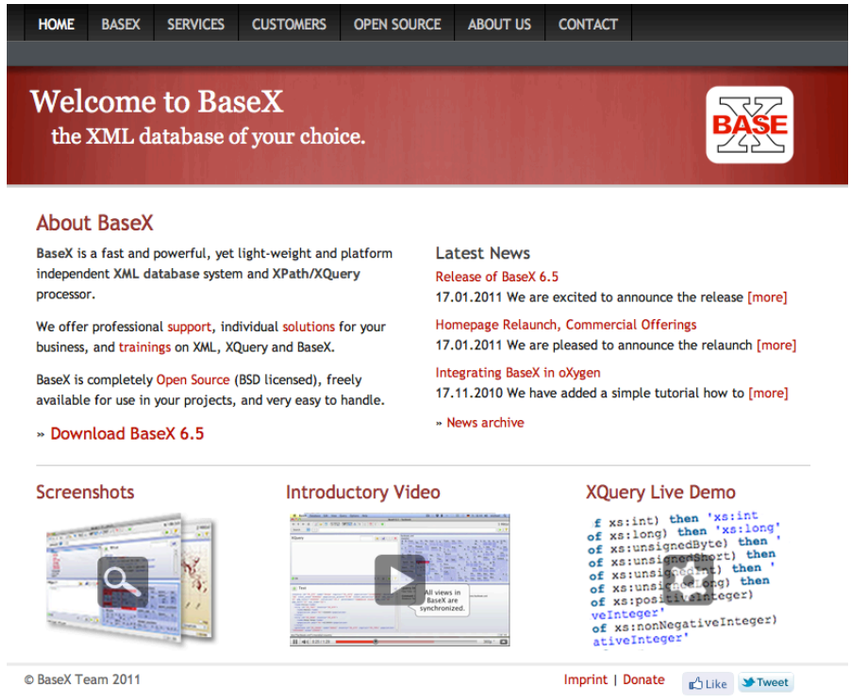
AIRBUS CIMPA PLM SERVICES · Deutscher Apotheker Verlag · Klett · MAX-PLANCK-GESELLSCHAFT · SBB · Studienstiftung des deutschen Volkes

The BaseX project

since 2005 | since 2007 | since 2011

Priorities

- High compliance rate to W3C standards
  - XPath / XQuery
  - Extensions: XQuery Update, XQuery Full-Text
- High usability and stability
- Performance, Performance, Performance



XQuery

What is XQuery 3.0?

- (more than a) query language for XML data
- (more than a) counterpart to SQL
- functional language
- extensible via user-defined functions and modules
- general purpose language?

Extensions

- Full Text
- Update Facility
- Scripting Extension

Alternatives

- XSLT: comparable features, but specialized on transformations
- SQL 2005:
  tries to combine SQL and XQuery

☞ Information Processing Language

XQuery …

… as a Functional Language

- prominent examples: Haskell, Scheme, OCAML, R
- based on the evaluation of functions: one input, one output
- no side effects (that would change the state of a program)
- higher-order functions: functions as arguments
- iteration ⇢ recursion

☞ XQuery 3.0 is a fully functional language

XQuery ...

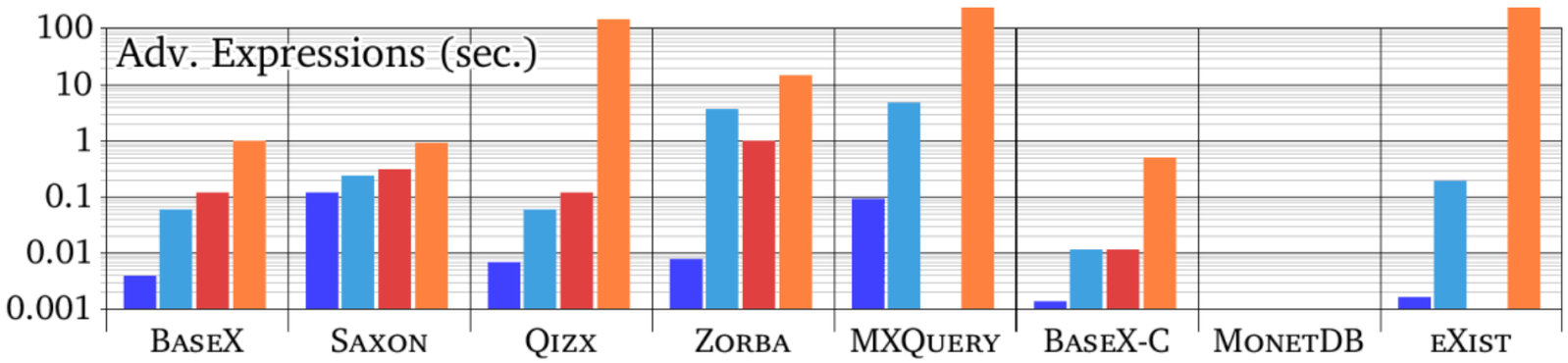
Examples

- Retrieve all item names:
  //item/name
- Retrieve item with id=0:
  /item[@id = "0"]
- Returns names of all items, ordered by their date

```
for $i in //item
order by $i/@date
return $i/name
```

- Nested query:

```
<hits>{
  for $num in 1 to 100
  let $name := concat("doc", $i, ".xml")
  let $doc := doc($file)
  for $i in $doc//item
  where $i/price > 1000
  group by $i/city
  return <hit>{ $i }</hit>
}</hits>
```



ID	Query

■ Hanoi	Computes the *Tower of Hanoi* problem ($n = 60$):
	`declare function local:hanoi($n) {`
	`  if($n = 1) then (1) else (2 * local:hanoi($n - 1) + 1)`
	`}; local:hanoi(60)`

■ Fibonacci	Calculates the *Fibonacci* number ($n = 20$):
	`declare function local:fib($n) {`
	`  if($n < 2) then ($n) else (local:fib($n - 1) + local:fib($n - 2))`
	`}; local:fib(20)`

■ Tour	Performs a Knight's Tour on a chessboard. Author: Michael Kay (11 kb)
■ Unicode	Returns a formatted list of all Unicode characters (1.5 kb)

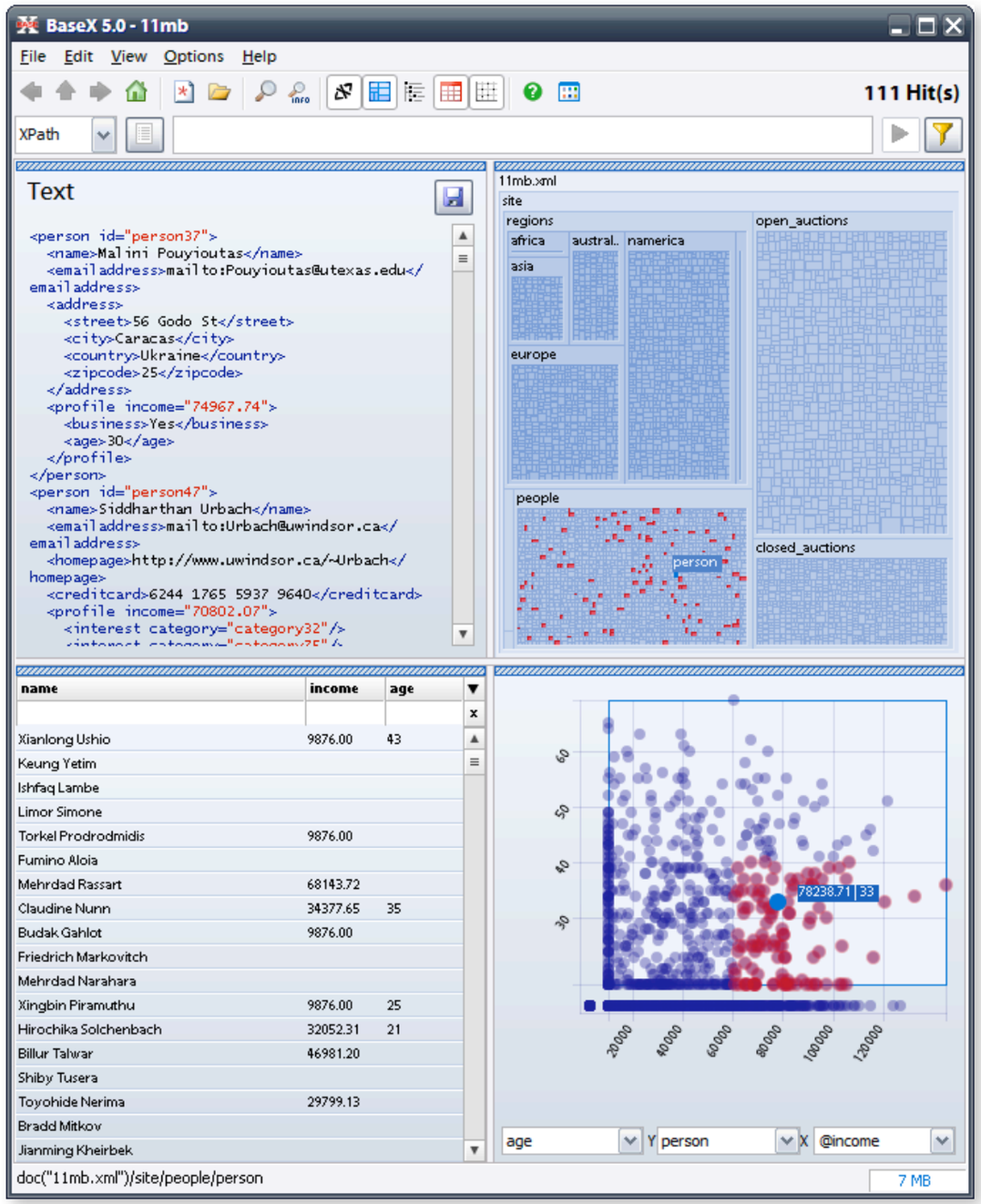
XML : the data / XQuery : the tool

The BaseX GUI

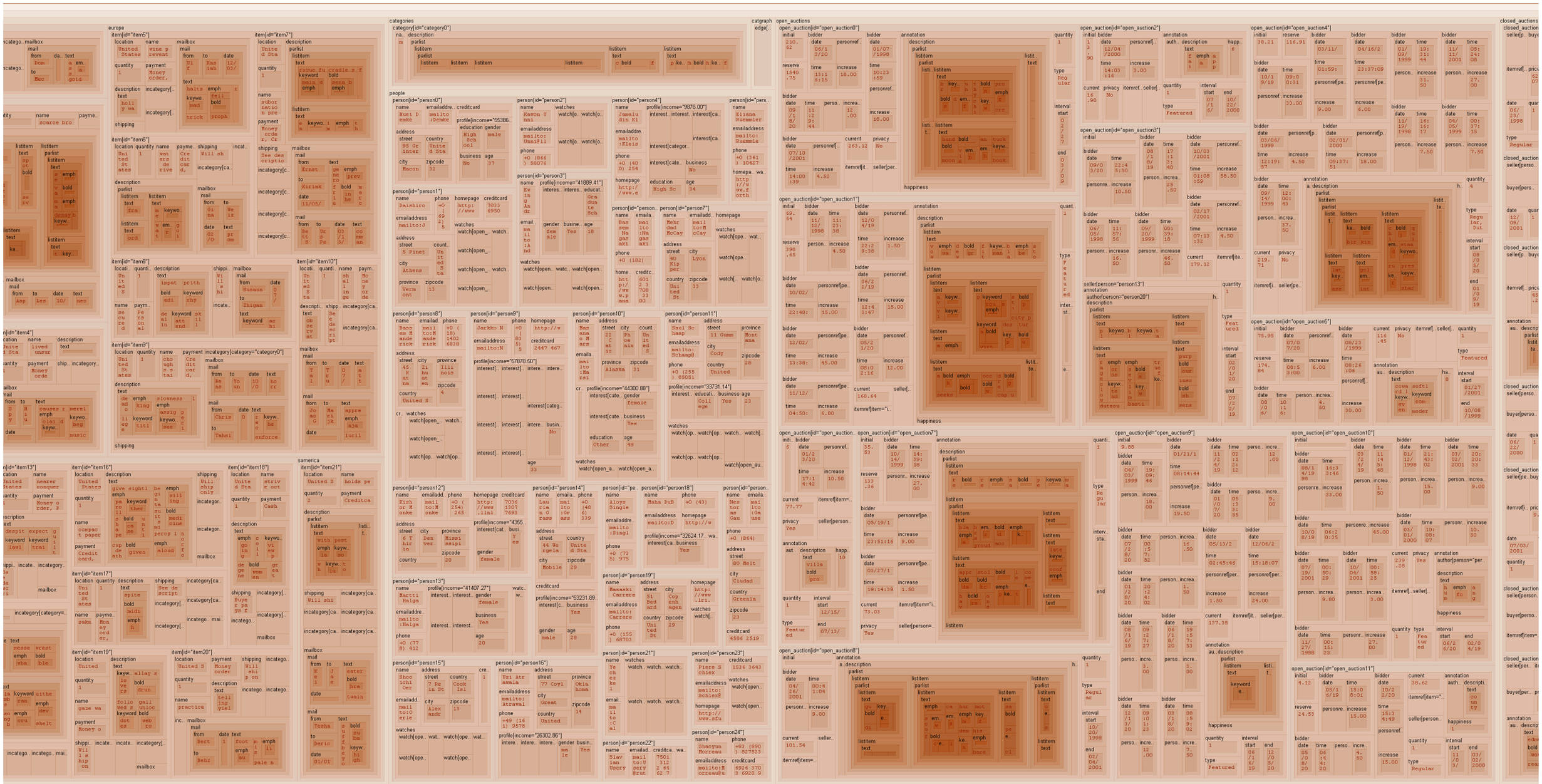
- focus: ease of use
- interactive visualizations
- keyword search
- real-time querying and filtering
- integrated XQuery editor

Visualizations

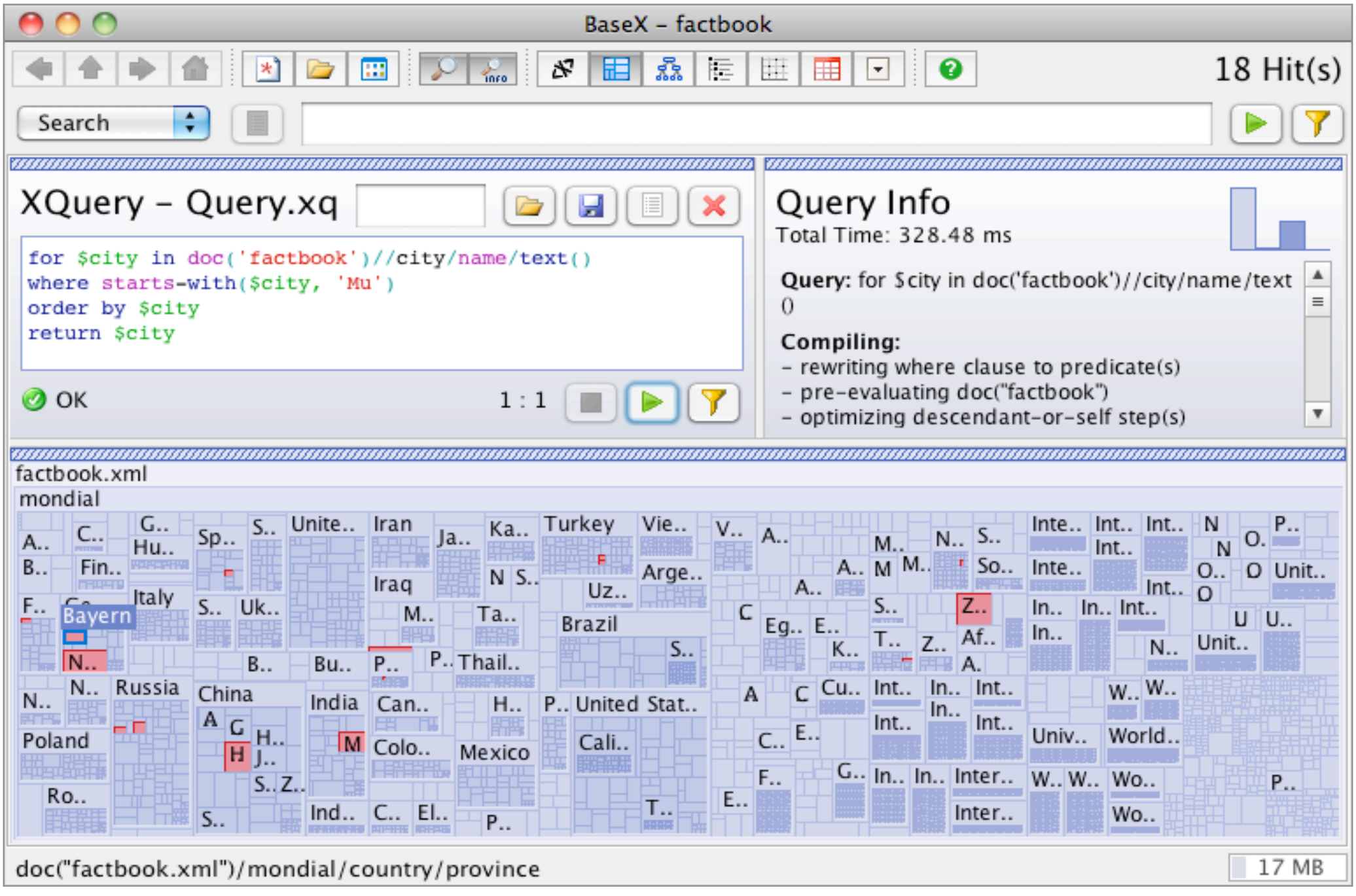
- give you better insight into your own data
- built on top of database
  (low main memory usage)



TreeView - XML Data Visualization



XQuery Editor: Query Your Data



BaseX 6.0 – fsml

4 Hit(s)

Command

XQuery

```
for $file in .//file
  where $file[./@name contains text
        {"Woman", "night", "colours"} any
]
return $file
```

OK.

fsml
fsml
deepfs
Art
Picasso
Gerhard Richter
Van Gogh
Universe

- fsml
  - deepfs
    - Art
      - Gerhard Richter
      - Picasso
        - imgres.jpeg 16 KB
        - Pablo Picasso – Friendship.jpeg 35 KB
        - Picasso-Le-baiser.jpeg 93 KB
          - type
          - format
          - pixelHeight
          - pixelWidth
        - Picasso-The_Dream-Surrelism.jpeg 78 KB
        - picasso201.jpeg 27 KB
        - picasso31.jpeg 20 KB
        - picasso_Olga Khokhlova.jpeg 27 KB
        - picasso_woman_b.jpeg 125 KB
      - Van Gogh
        - vangogh-starry_night_ballance1.jpeg 2 MB
        - VanGoghES_700x533.jpeg 87 KB
          - type
          - format
          - pixelHeight
          - pixelWidth
      - Universe

Time Needed: 2.97 ms

47 MB

XQuery

```
for $file in .//file
  where $file[./pixelHeight < 400]
return $file
```

OK.

fsml
fsml
deepfs
Art
Picasso
Gerhard Richter
Van Gogh
Universe

- fsml
  - deepfs
    - Art
      - Gerhard Richter
        - 4900-colours-Gerha.. 220 KB
          - type
          - format
          - pixelHeight
          - pixelWidth
        - hppic1.jpeg 30 KB
          - type
            - picture
          - format
          - pixelHeight
          - pixelWidth
        - imgGerhardRichter2.j.. 58 KB
          - type
          - format
          - pixelHeight
          - pixelWidth
        - richter72.jpeg 19 KB
      - Picasso
        - imgres.jpeg 16 KB
          - type
          - format
          - pixelHeight
          - pixelWidth
        - Pablo Picasso – Friend.. 35 KB
        - Picasso-Le-baiser.jpeg 93 KB

Time Needed: 2.7 ms

102 MB

BaseX 6.0 - Friedrich

File Edit View Options DeepFS Help

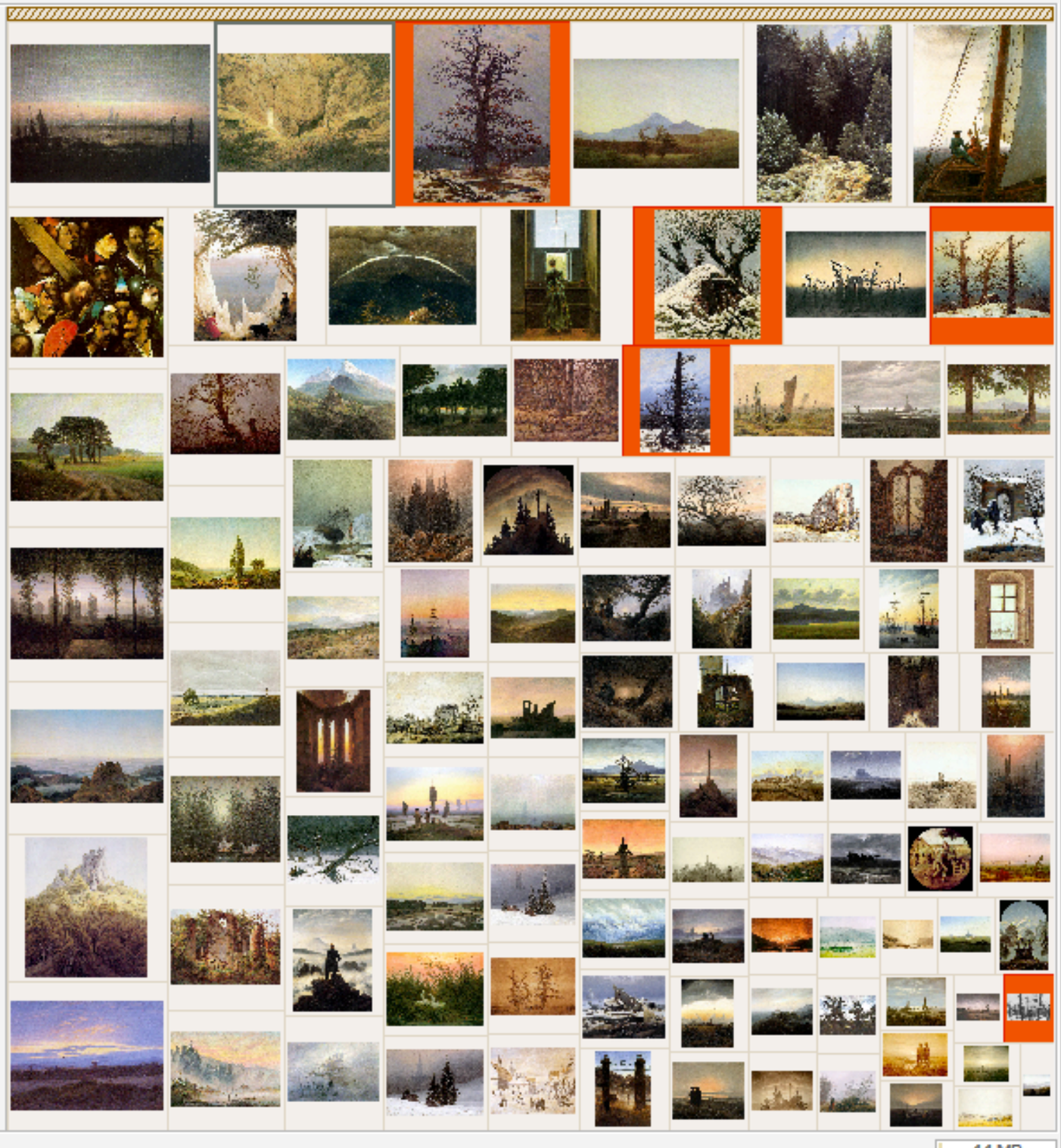
5 Hit(s)

Search Schnee

Text

```
<file name="Eichbaum im Schnee [1829, 71x48].jpg" size="193667"
 mode="33188" uid="0" gid="0" atime="1263149675531" ctime="
1263149675531" mtime="1155867478000" nlink="1" suffix="jpg"/>
<file name="Eiche im Schnee [1829, 44x35].jpg" size="520890"
mode="33188" uid="0" gid="0" atime="1263149675531" ctime="
1263149675531" mtime="1238830334009" nlink="1" suffix="jpg"/>
<file name="Huenengrab im Schnee [1807, 62x80].jpg" size="
261912" mode="33188" uid="0" gid="0" atime="1263149675562"
ctime="1263149675562" mtime="1155671173000" nlink="1" suffix="
jpg"/>
<file name="Klosterfriedhof im Schnee [1819, 121x170].jpg" size
="51988" mode="33188" uid="0" gid="0" atime="1263149675578"
ctime="1263149675578" mtime="1156932053000" nlink="1" suffix="
jpg"/>
<file name="Verschneite Huette (Huette im Schnee) [1827, 31x25]
.jpg" size="331897" mode="33188" uid="0" gid="0" atime="
1263149675609" ctime="1263149675609" mtime="1156703091000"
nlink="1" suffix="jpg"/>
```

suffix	name	size	mtime
jpg	Die Schwestern auf dem Balkon [1820, 74x52].jpg	99 KB	18.08.2006 04:16
jpg	Eichbaum im Schnee [1829, 71x48].jpg	189 KB	18.08.2006 04:17
jpg	Eiche im Schnee [1829, 44x35].jpg	509 KB	04.04.2009 09:32
jpg	Einsamer Baum [1821, 55x71].jpg	111 KB	18.08.2006 04:16
jpg	Elblandschaft [1823, 22x31].jpg	362 KB	04.04.2009 09:44
jpg	Erinnerung an des Riesengebirge [1835, 74x103].jpg	178 KB	27.08.2006 20:23
jpg	Felsenschlucht [1823, 91x72].jpg	126 KB	18.08.2006 04:17
jpg	Felsriff am Meeresufer [1824, 22x31].jpg	106 KB	18.08.2006 04:17
jpg	Flachlandschaft am Greifswalder Bodden [1834, 26x3..	186 KB	27.08.2006 20:24
jpg	Frau am Fenster [1822, 44x37].jpg	331 KB	04.04.2009 08:07
jpg	Frau am Meer [1818, 21x30].jpg	84 KB	13.08.2006 22:52
jpg	Frau vor der untergehenden Sonne [1820, 22x30].jpg	110 KB	27.08.2006 20:25
jpg	Fruehschnee [1828, 44x35].jpg	474 KB	04.04.2009 09:48
jpg	Gartenterrasse [1812, 54x70].jpg	184 KB	04.04.2009 20:36
jpg	Gebirgslandschaft mit Regenbogen [1810, 70x102].jpg	335 KB	04.04.2009 08:36



Time Needed: 6.45 ms

44 MB

Main Area of Activity

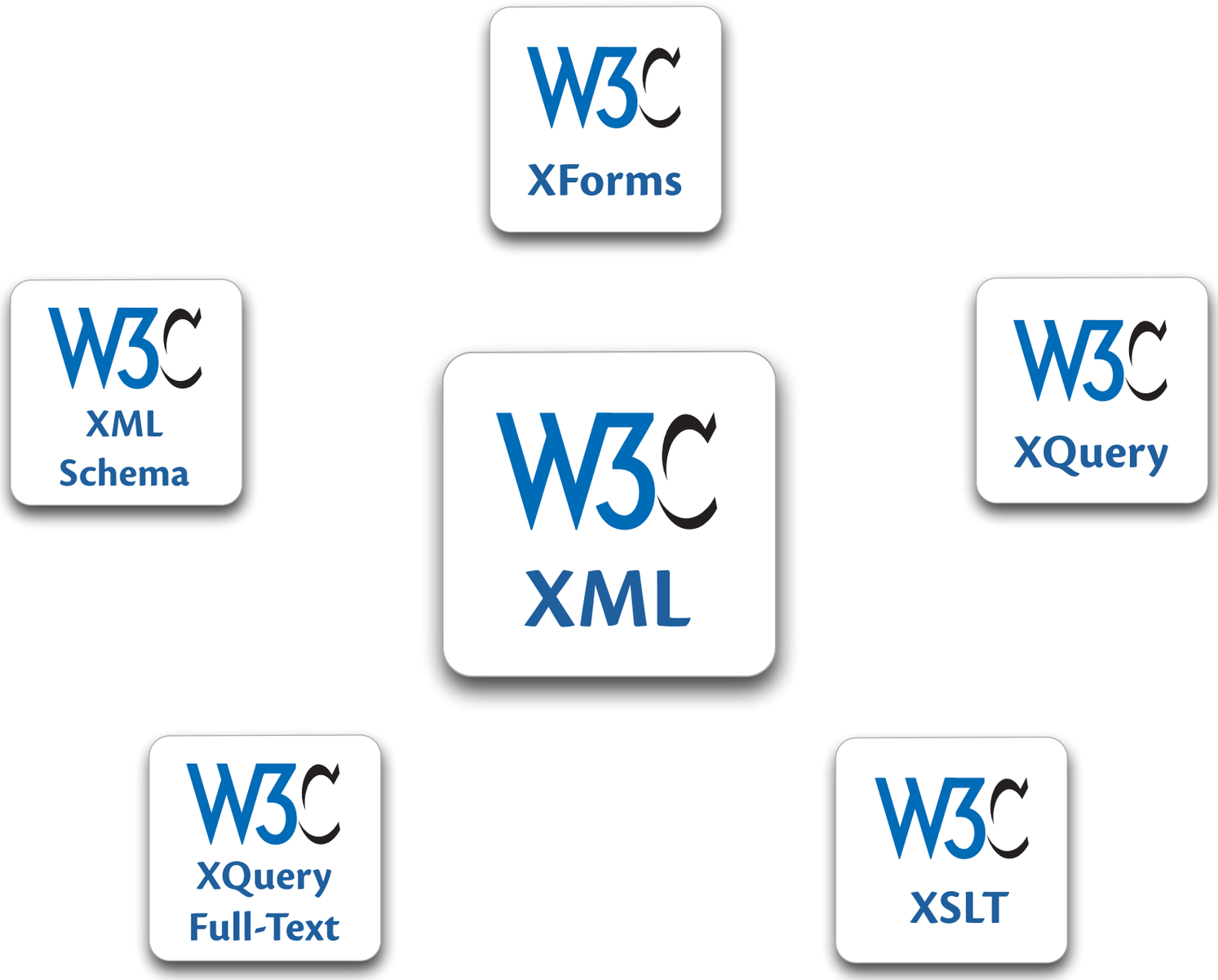
Web Application Development using XML Technologies

Starting situation

- Data is present as XML

```
<file name="05_Like_A_Rolling_Stone.mp3">
 <metadata>
  <title>Like A Rolling Stone</title>
  <artist>Bob Dylan</artist>
  <composer>Bob Dylan</composer>
  <album>Greatest Hits</album>
  <track>5/10</track>
  <recording_date>1965-06-21</recording_date>
  <genre>Folk</genre>
  <encodedby>iTunes 8.0.2</encodedby>
 </metadata>
</file>
```

XML Technologies



... use them!

Standard for the generation of electronic forms

- All form widgets are working
  - on the same XML data model
  - in a synchronized manner
- Widget are directly coupled to the data model

XML data model

```
<xf:model>
  <xf:instance>
    <data>
      <.... />
    </data>
  </xf:instance>
</xf:model>
```

```
<file name="05_Like_A_Rolling_Stone.mp3">
 <metadata>
  <title>Like A Rolling Stone</title>
  <artist>Bob Dylan</artist>
  <composer>Bob Dylan</composer>
  <album>Greatest Hits</album>
  <track>5/10</track>
  <recording_date>1965-06-21</recording_date>
  <genre>Folk</genre>
  <encodedby>iTunes 8.0.2</encodedby>
 </metadata>
</file>
```

XForms

XML data model

```
<xf:model>
 <xf:instance>
  <file name="05_Like_A_Rolling_Stone.mp3">
   <metadata>
    <title>Like A Rolling Stone</title>
    <artist>Bob Dylan</artist>
    <composer>Bob Dylan</composer>
    <album>Greatest Hits</album>
    <track>5/10</track>
    <recording_date>1965-06-21</recording_date>
    <genre>Folk</genre>
    <encodedby>iTunes 8.0.2</encodedby>
   </metadata>
  </file>
 </xf:instance>
</xf:model>
```

Output form

```
<xf:output ref="//title">
  <xf:label>Current title is: <xf:label>
</xf:output>
```

Input form

```
<xf:input ref="//title" incremental="true">
  <xf:label>Change title to: </xf:label>
</xf:input>
```

Output forms

Current title is: **Like A Rolling Stone**

Artist set to: **Bob Dylan**

Date of Recording: **21.06.1965**

Selected genre: **Folk**

Input forms

Change title to: Like A Rolling Stone

Change artist to: Bob Dylan

Change recording date: 21.06.1965 ...

Genre: Folk

MP3 XForms Demo

MP3 XForms Demo

file:///Users/holu/Documents/Defense/Code/mp3-demo.xml

Google

BaseX-Web :: Webapplications based on pure XML Technologies :: MP3 XForms Demo

XML Data Model - matches BaseX-FS' bi-directional transducer for mp3 files

```
<file name="05_Like_A_Rolling_Stone.mp3">
    <metadata>
        <title>Like A Rolling Stone</title>
        <artist>Bob Dylan</artist>
        <composer>Bob Dylan</composer>
        <album>Greatest Hits</album>
        <track>5/10</track>
        <recording_date>1965-06-21</recording_date>
        <genre>Folk</genre>
        <encodedby>iTunes 8.0.2</encodedby>
    </metadata>
</file>
```

XForm Widgets - coupled to and synchronized with XML Data Model

Output forms

Current title is: **Like A Rolling Stone**

Artist set to: **Bob Dylan**

Date of Recording: **21.06.1965**

Selected genre: **Folk**

Input forms

Change title to: Like A Rolling Stone

Change artist to: Bob Dylan

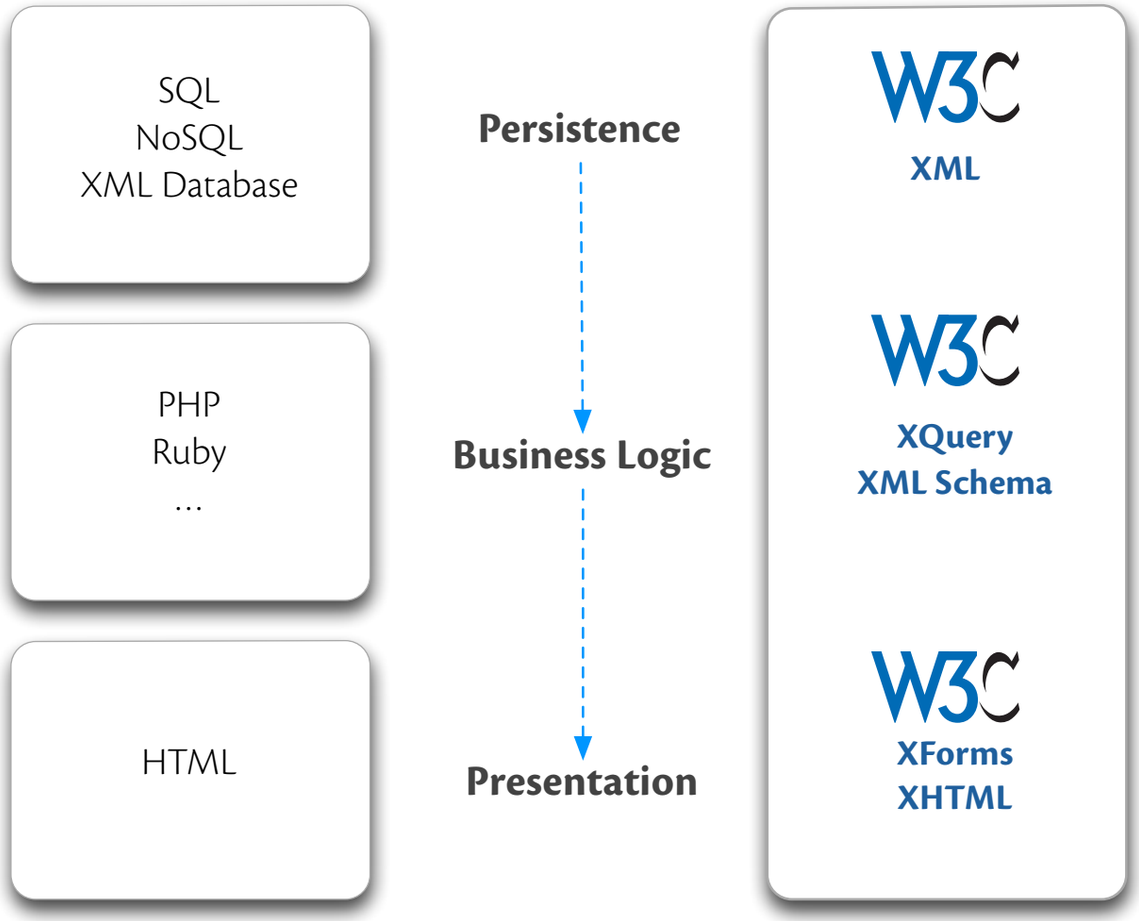
Change recording date: 21.06.1965 ...

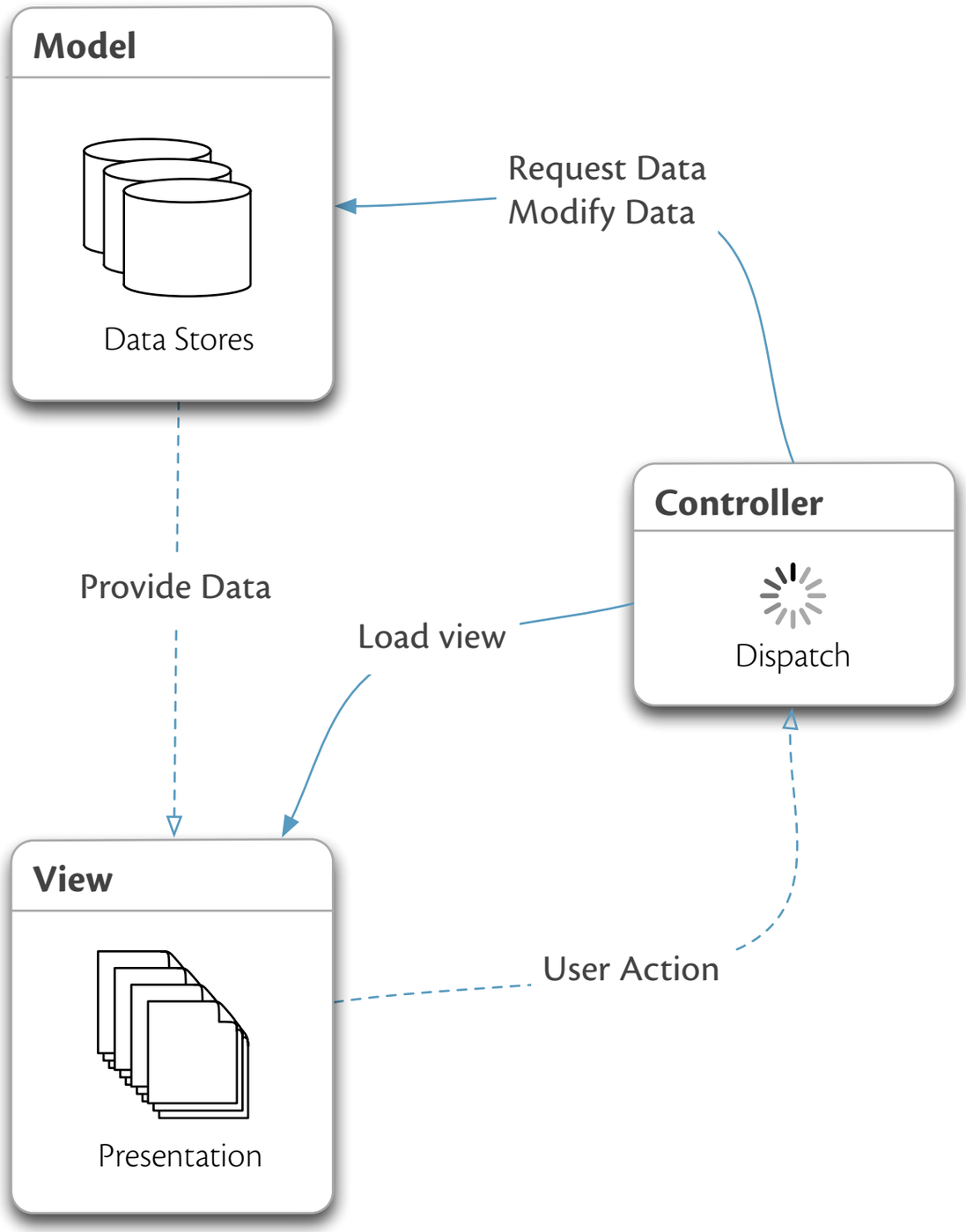
Genre: Folk

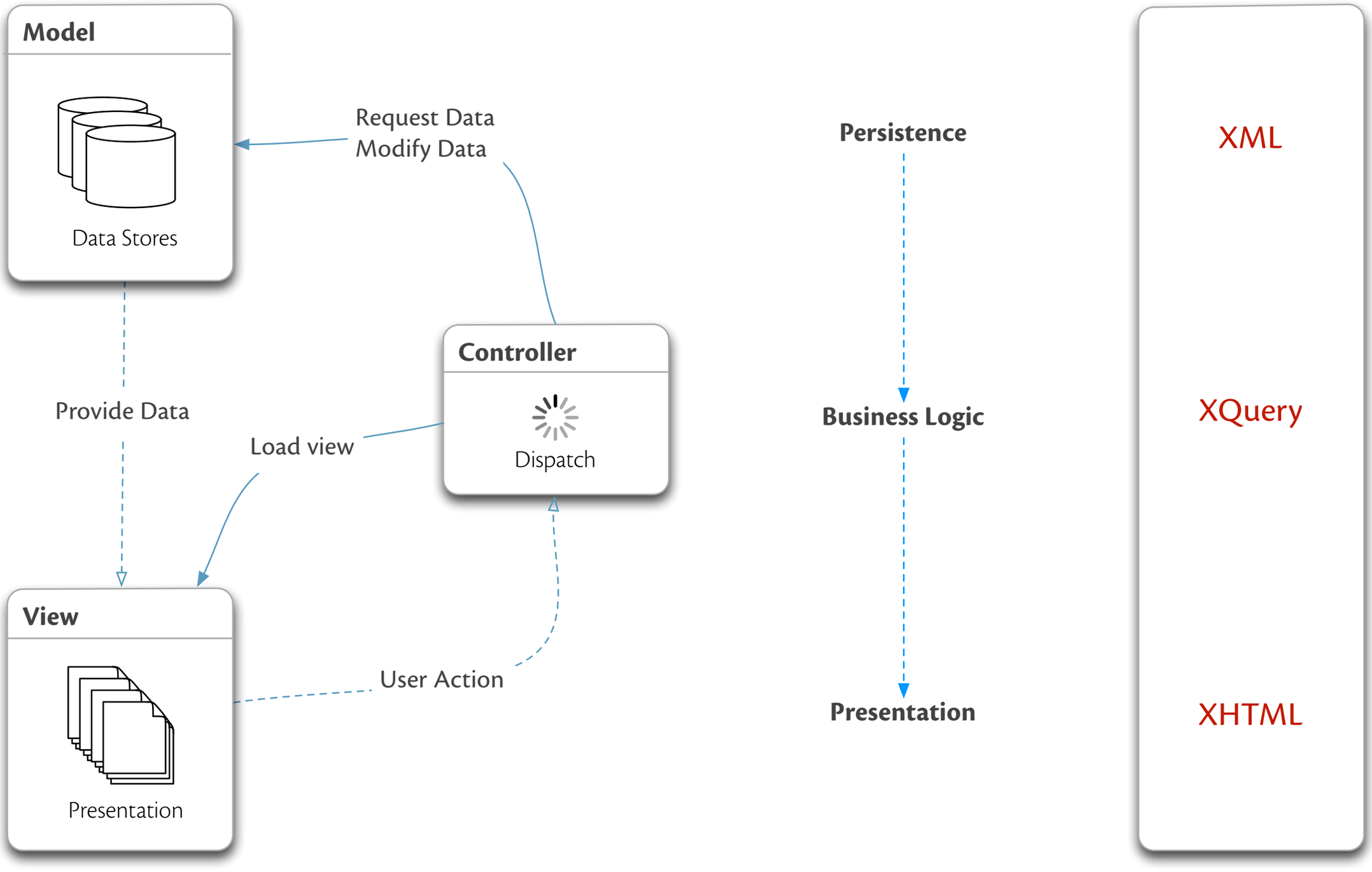
Reload from MP3

General Solution Strategy

- Use **established** industry **standards**
- Leverage consistent, **uniform technology stack**




Model
Data Stores
Request Data
Modify Data
Controller
Dispatch
Provide Data
Load view
View
Presentation
User Action


Model
Data Stores
Request Data
Modify Data
Provide Data
Load view
Controller
Dispatch
View
Presentation
User Action
Persistence
Business Logic
Presentation
XML
XQuery
XHTML

Interactive Search

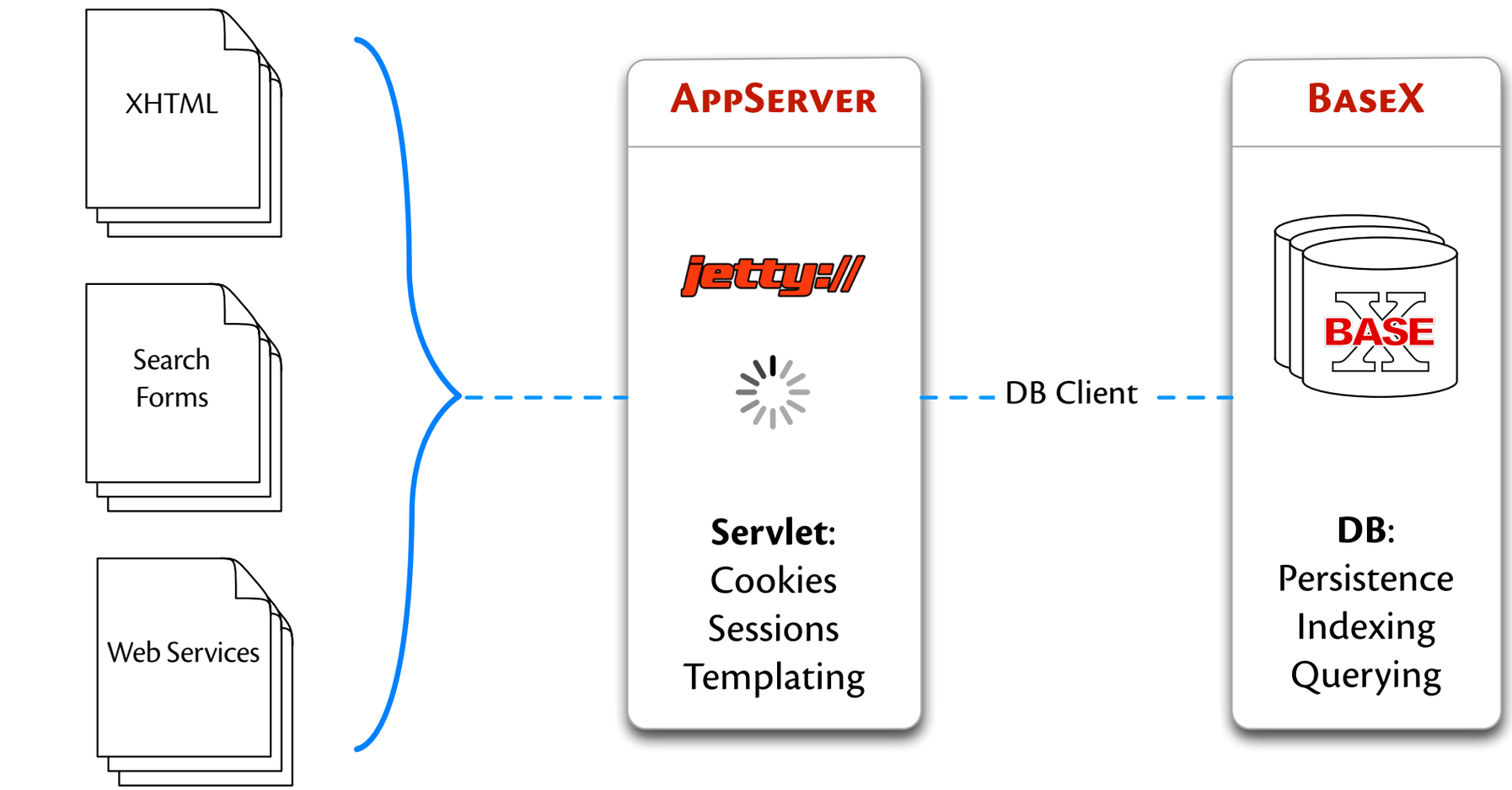
DaBi Datenbibliothek

gene -gott

10 Treffer

☑ Ähnliche Treffer

Web Applications



Representational State Transfer - programming paradigm for web applications

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10 Treffer

☑ Ähnliche Treffer

Client

AppServer

BaseX

GET or POST Request

Servlet

GET:
/app/controller/index

/app/controller/index

controller.xq
business logic

index.xq
template

XQuery

Result

Layout

Result

response Object

Body
Cookies

BaseX.org

BaseX is a very light-weight, high-performance and scalable XML Database engine and XPath/XQuery Processor, including full support for the W3C Update and Full Text extensions. An interactive and user-friendly GUI frontend gives you great insight into your XML documents.

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To maximize your productivity and workflows, we offer professional support, highly customized software solutions and individual trainings on XML, XQuery and BaseX. Our product itself is completely Open Source (BSD-licensed) and platform independent;!

Web Applications

XHTML

Search Forms

Web Services

AppServer

jetty

Servlet:
Cookies
Sessions
Templating

DB Client

BaseX

DB:
Persistence
Indexing
Querying

DaBi Datenbibliothek

gene -gott | 10 Treffer

☑ Ähnliche Treffer

1-10 Weiter

Titel	Auflagen	Autoren	Verlag	Jahr
Das "gläserne" Tier: Ein- und Ausblicke in Genome und Gene von Haustieren 	1	Brem, Gottfried	Wissenschaftliche Verlagsgesellschaft Stuttgart	2012
Anstecker "Ich berate gerne"	1		Deutscher Apotheker Verlag	2010
Verbandstoffe für die Kitteltasche 	1	Brandt, Hartmuth Kerkmann, René	Wissenschaftliche Verlagsgesellschaft Stuttgart	2010
Die Wiener rechtstheoretische Schule 	1	Kelsen, Hans Merkl, Adolf Verdross, Alfred Klecatsky, Hans R. Marcic, René Schambeck, Herbert	Franz Steiner Verlag	2010

Thank You !

XQuery Processing

A friendly Hello from the BaseX team

XUGS 5, Stuttgart, May 13 2013

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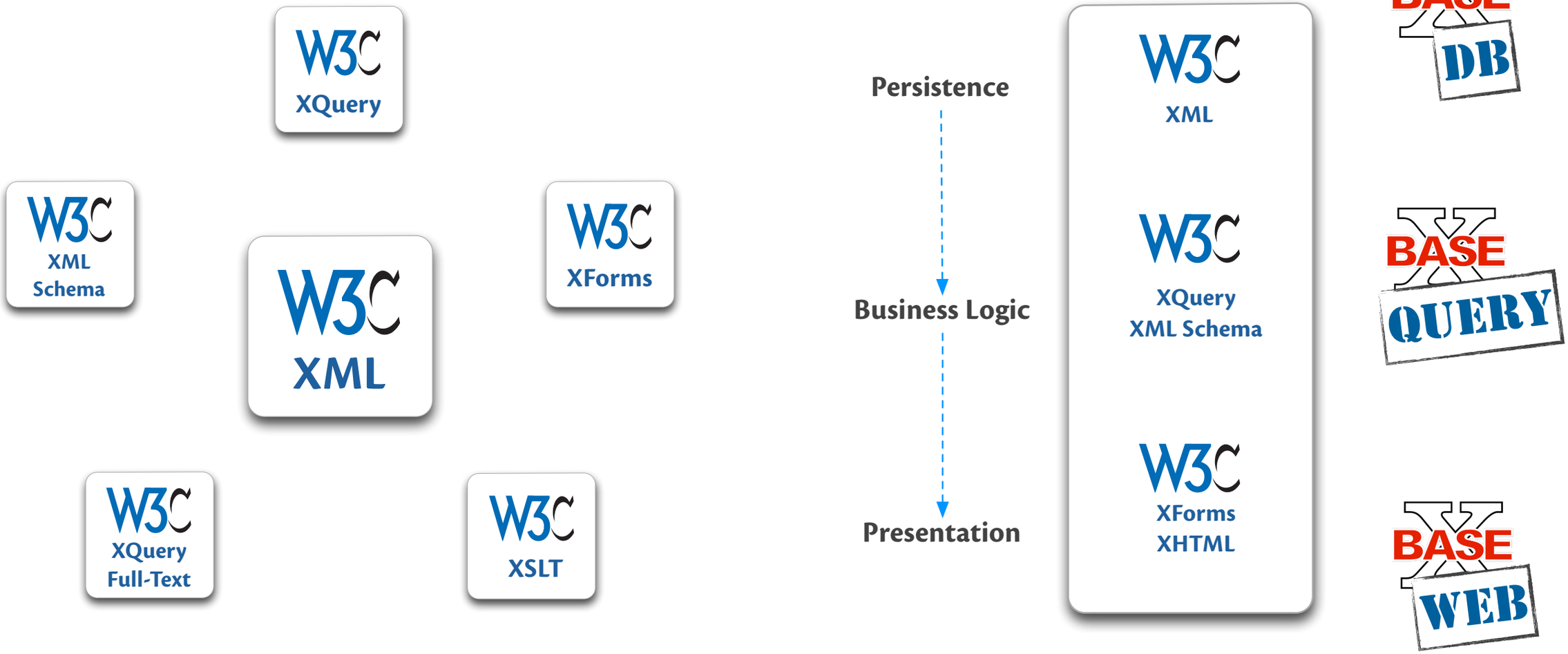
XQuery
XML Schema
XML
XForms
XQuery Full-Text
XSLT
Persistence
Business Logic
Presentation
XML
XQuery
XML Schema
XForms
XHTML
BASE X DB
BASE X QUERY
BASE X WEB