

# Building web applications using XML technologies

**XML, XQuery, XForms, XHTML – A uniform technology stack**

*Markup Forum, Stuttgart, Nov 22 2013*

Dr. Christian Grün, Dr. Alexander Holupirek

BaseX.org - The Open Source XML Database and XQuery processor

BaseX GmbH - Professional XML Data Services

Database and Information System Group, U Konstanz

# Who we are and where we come from ...



Christian Grün

Alex Holupirek

Prof. Dr. Marc H. Scholl



since 2005

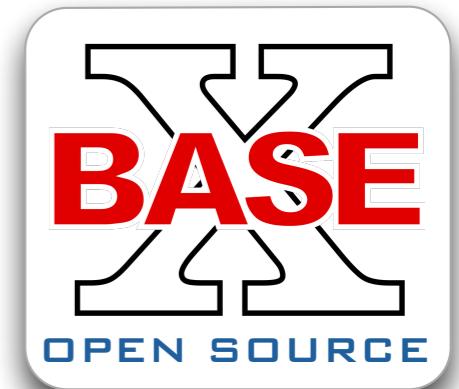
Database and Information System (DBIS) Group, U Konstanz

👉 BaseX was born here and is still used in active research projects

# 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



since 2007

BaseX  
BaseXdb

worldwide  
<http://basex.org>  
Joined on Feb 16, 2011

5 public repos 0 private repos 14 members

**baseX**  
BaseX Main Repository.  
Last updated 4 hours ago

**baseX-tests**  
BaseX Extended Tests  
Last updated 3 days ago

**baseX-api**  
BaseX API Implementations  
Last updated 6 days ago

**baseX-examples**  
BaseX Example Code  
Last updated 10 days ago

## Community

- Join our mailinglists:  
**baseX-talk**, **baseX-announce**, **baseX-commits**
- Fork us on [github.com/BaseXdb/baseX.git](https://github.com/BaseXdb/baseX.git)
- Check documentation [docs.basex.org](http://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



since 2011

## Software Development

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

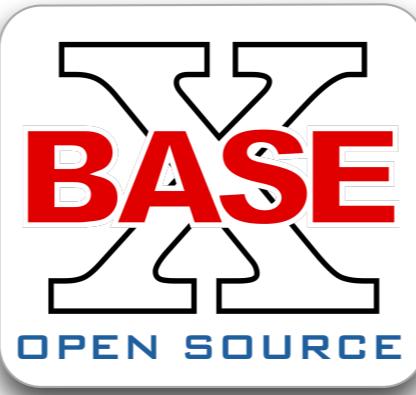
## Legal entity to foster the Open Source project

- Currently 3 full-time employees and 6 part-time workers

# 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

HOME BASEX SERVICES CUSTOMERS OPEN SOURCE ABOUT US CONTACT

Welcome to BaseX  
the XML database of your choice.

**About BaseX**  
BaseX is a fast and powerful, yet light-weight and platform independent XML database system and XPath/XQuery processor.  
  
We offer professional support, individual solutions for your business, and trainings on XML, XQuery and BaseX.  
BaseX is completely Open Source (BSD licensed), freely available for use in your projects, and very easy to handle.  
[Download BaseX 6.5](#)

**Latest News**  
[Release of BaseX 6.5](#)  
17.01.2011 We are excited to announce the release [\[more\]](#)

[Homepage Relaunch, Commercial Offerings](#)  
17.01.2011 We are pleased to announce the relaunch [\[more\]](#)

[Integrating BaseX in olygen](#)  
17.11.2010 We have added a simple tutorial how to [\[more\]](#)

[News archive](#)

**Screenshots**  **Introductory Video**  **XQuery Live Demo** 

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Imprint | Donate  

# XML Database and XQuery processor

## What is XQuery 3.0?

- (more than a) **query** language for XML data
- (more than a) counterpart to SQL
- is 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
- **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

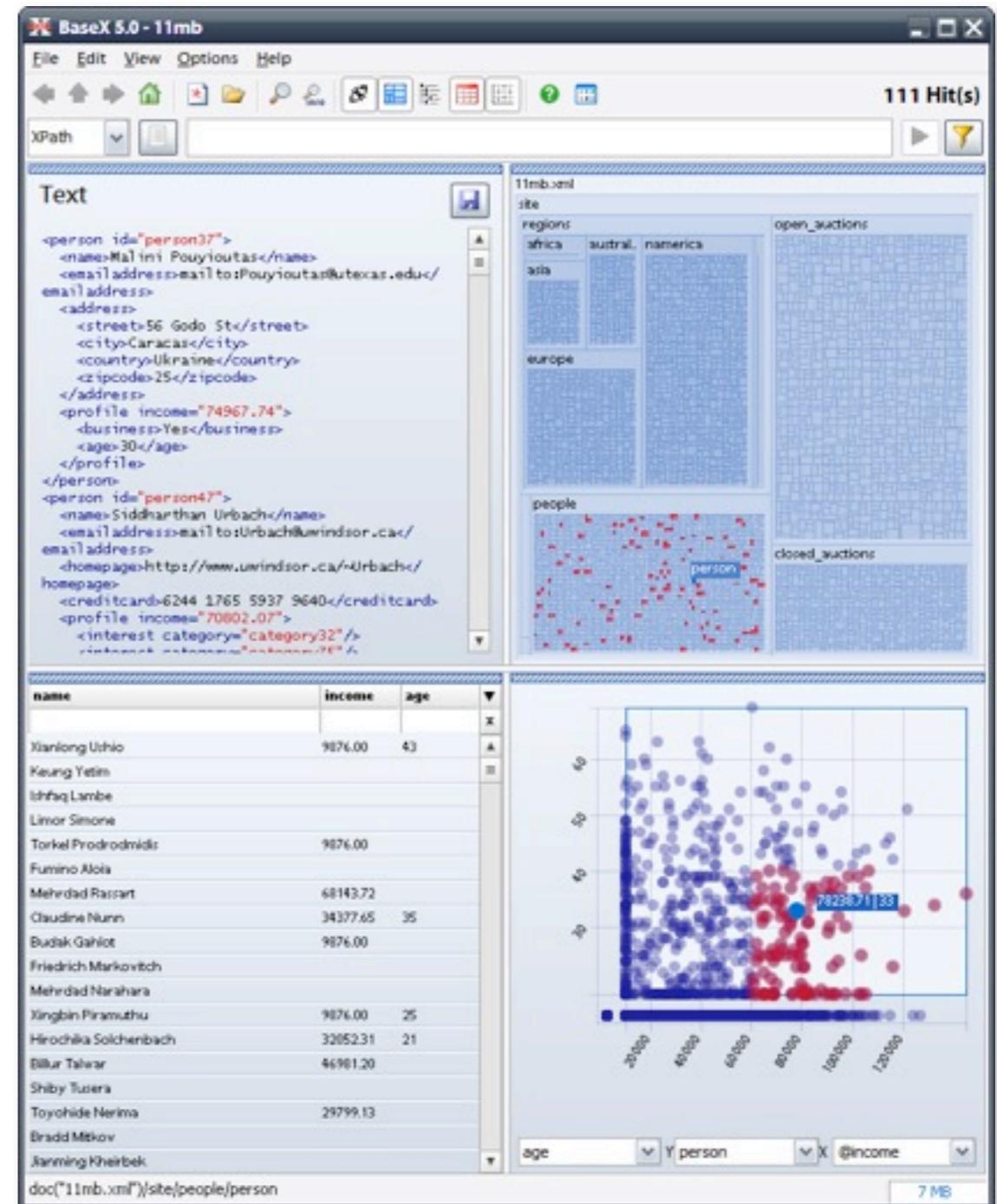
# XML : the data / XQuery : the tool

## The BaseX GUI

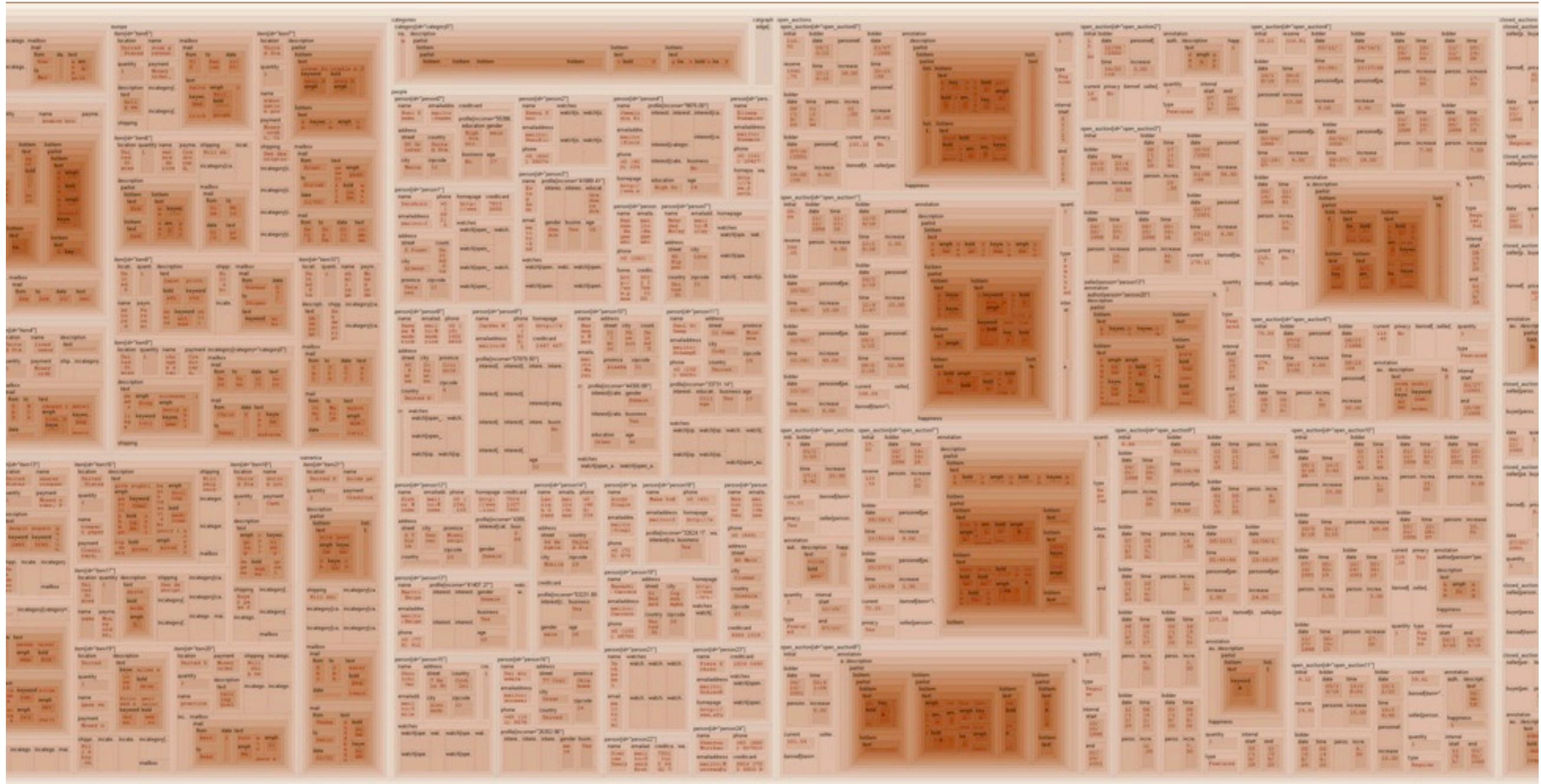
- focus: ease of use
- **interactive** visualizations
- keyword search
- **real-time** querying and filtering
- integrated XQuery editor

## 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 – factbook

18 Hit(s)

XQuery – Query.xq

```
for $city in doc('factbook')//city/name/text()  
where starts-with($city, 'Mu')  
order by $city  
return $city
```

OK 1 : 1

Query Info

Total Time: 328.48 ms

Query: for \$city in doc('factbook')//city/name/text()

Compiling:

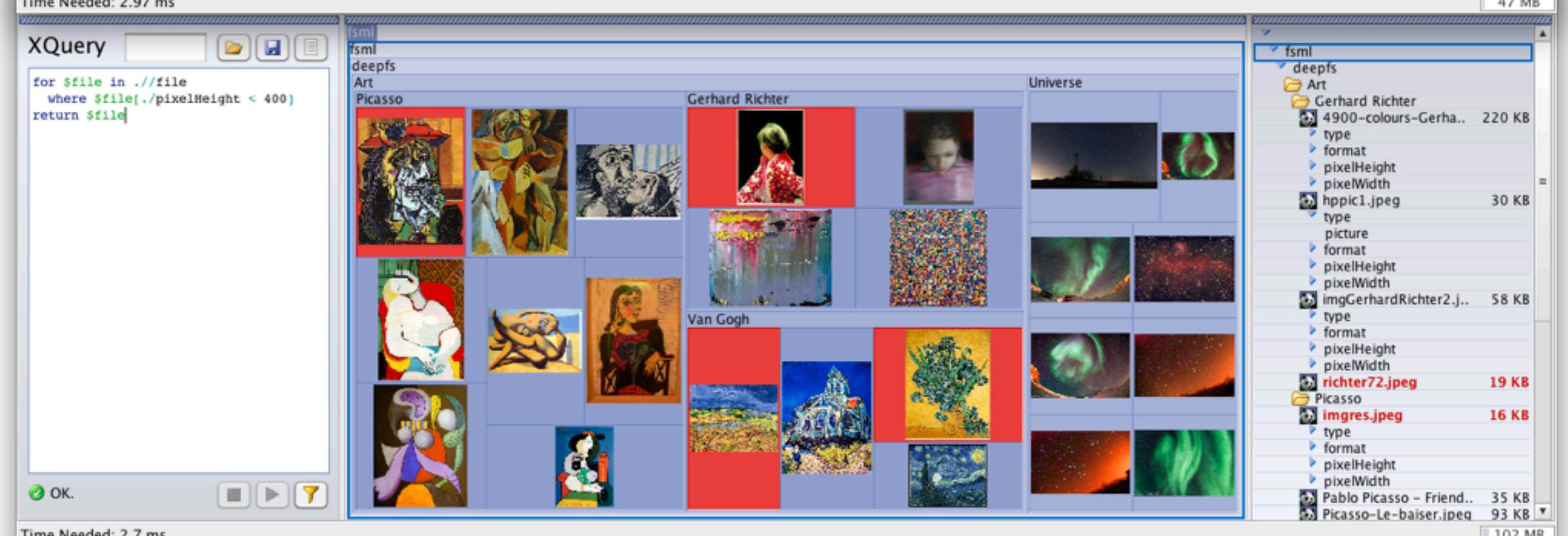
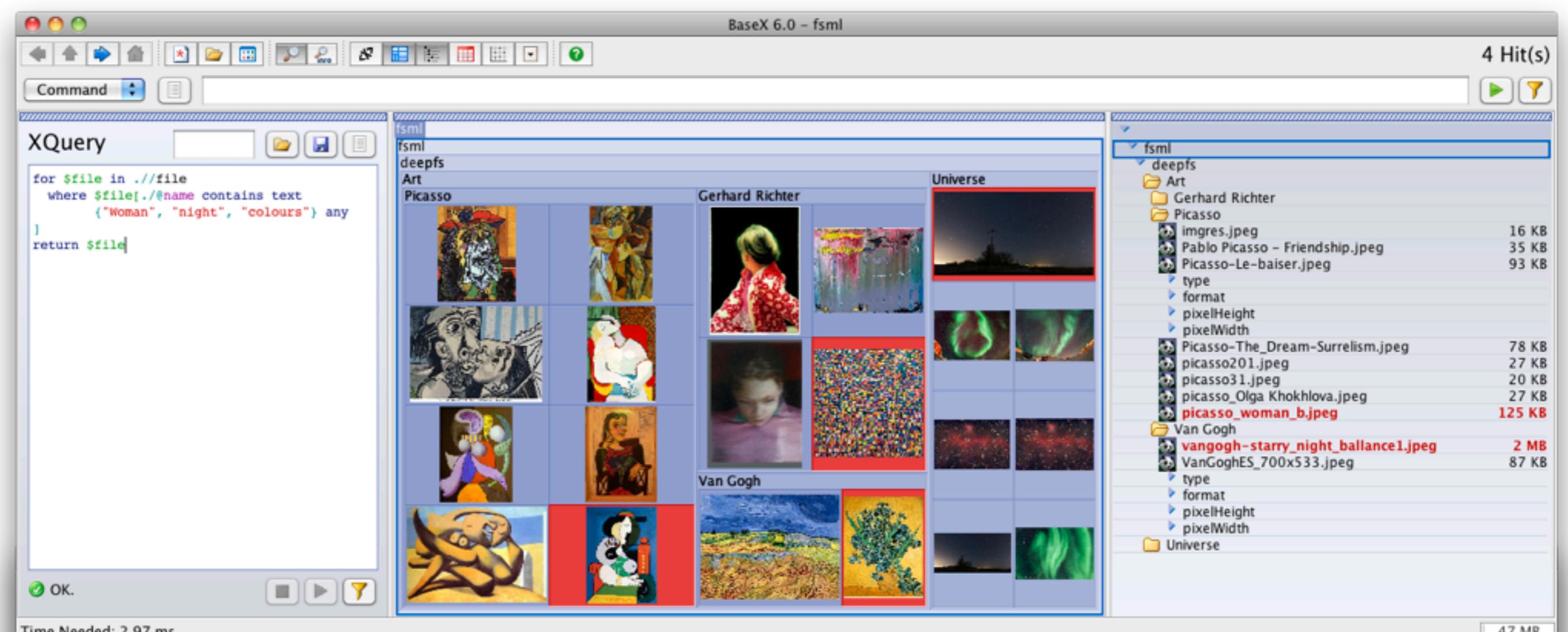
- rewriting where clause to predicate(s)
- pre-evaluating doc("factbook")
- optimizing descendant-or-self step(s)

factbook.xml

mondial

doc("factbook.xml")/mondial/country/province

17 MB



File Edit View Options DeepFS Help

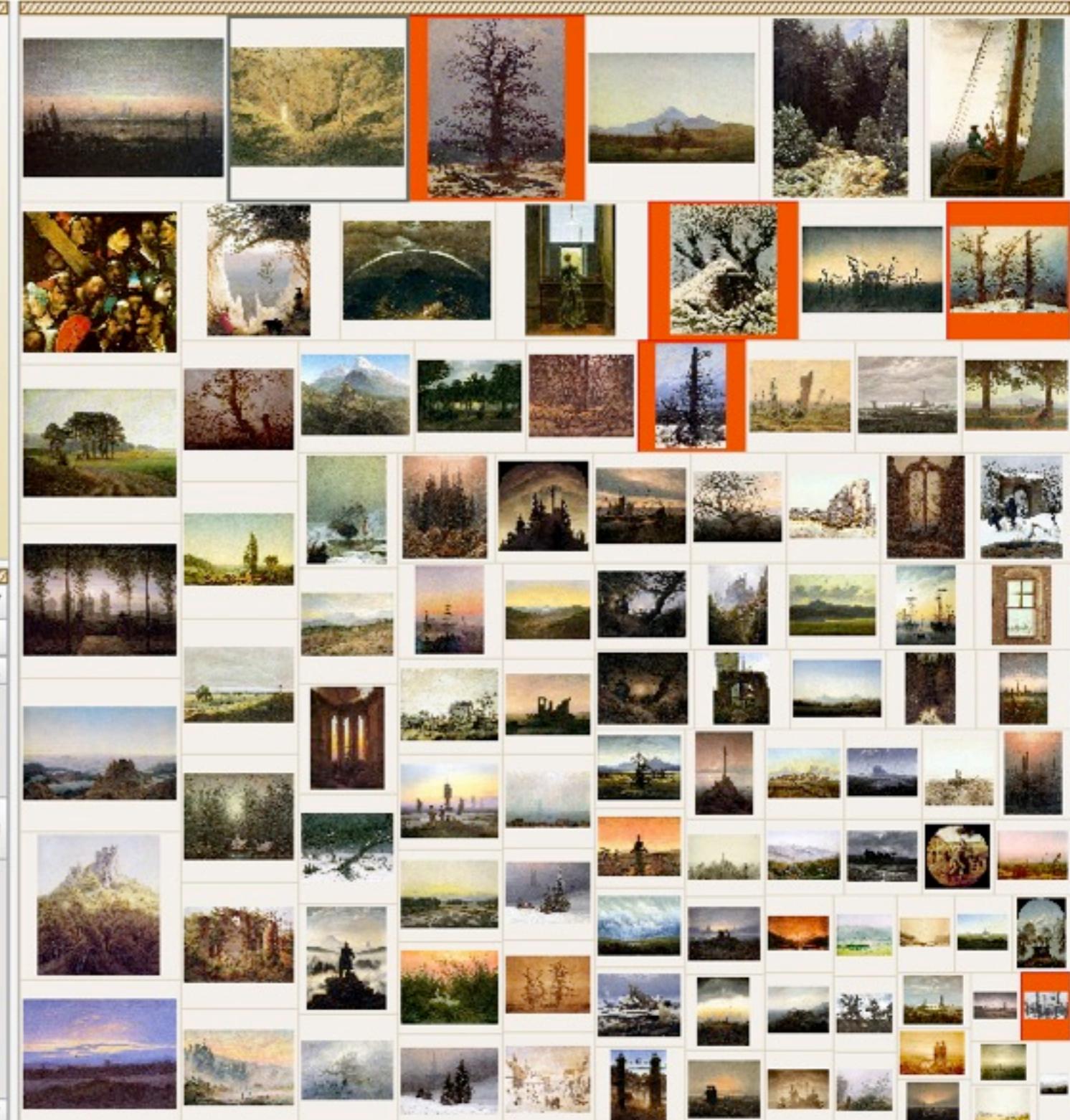


5 Hit(s)

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 Riesengetirge [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

---

# **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
- Widgets 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>
```



## 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:	<b>Like A Rolling Stone</b>
Artist set to:	<b>Bob Dylan</b>
Date of Recording:	<b>21.06.1965</b>
Selected genre:	<b>Folk</b>

### Input forms

Change title to:	<input type="text" value="Like A Rolling Stone"/>
Change artist to:	<input type="text" value="Bob Dylan"/>
Change recording date:	<input type="text" value="21.06.1965"/> ...
Genre:	<input type="text" value="Folk"/>

B MP3 XForms Demo +

file:///Users/holu/Desktop/MarkupForum/mp3demo/mp3-demo.xml W Wikipedia (en)

Webapps based on pure XML Technologies :: MP3 XForms Demo :: starring fabulous XSLTForms

## 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: **06/21/1965**

Selected genre: **Folk**

### Input forms

Change title to:

Change artist to:

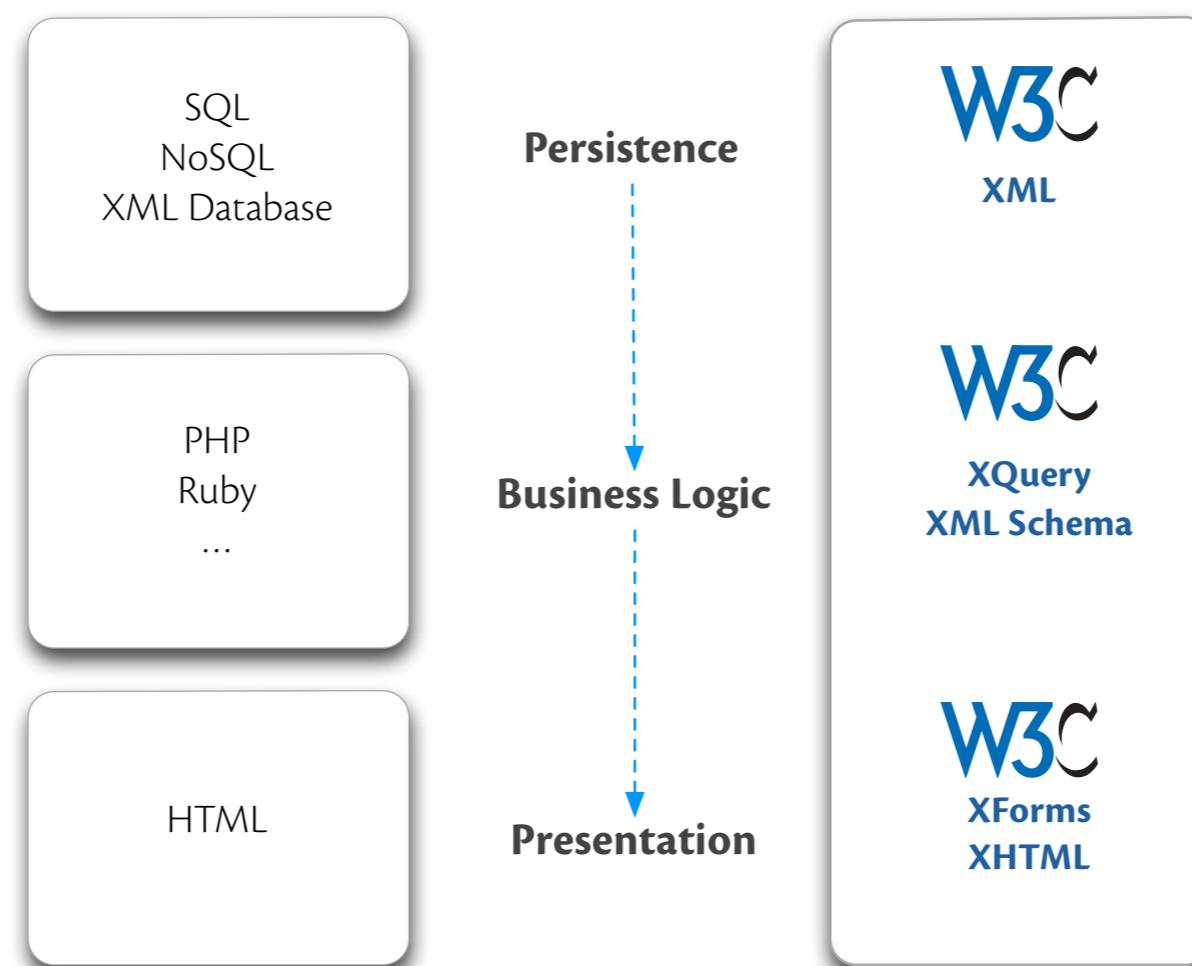
Change recording date:  ...

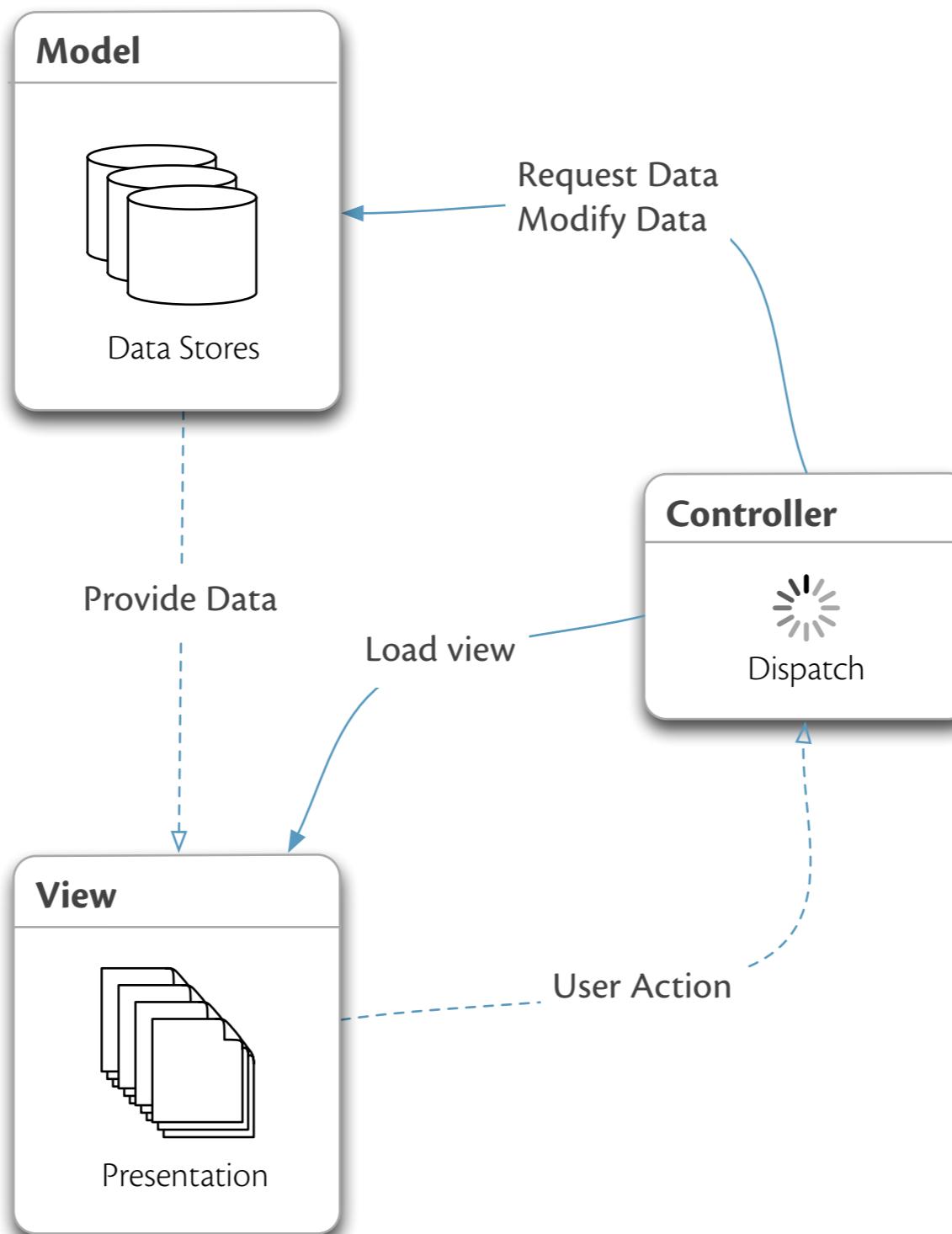
Genre:

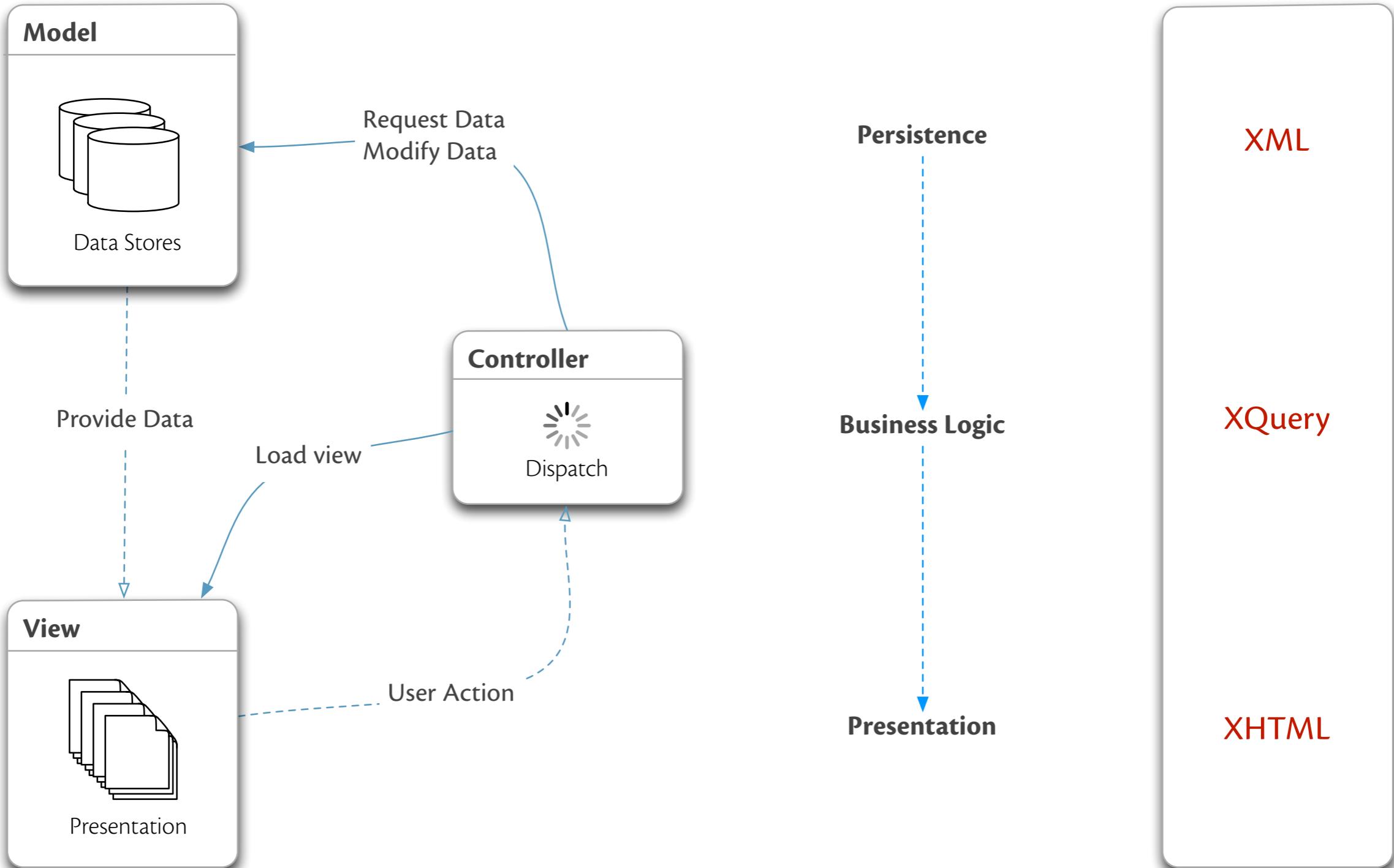
**Reload from MP3**

# General Solution Strategy

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







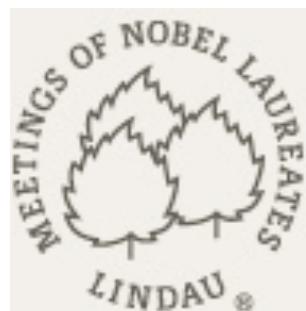
---

# Real Life Application

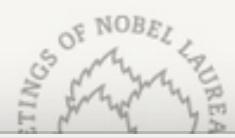
# Lindau Nobel Laureate

---

- Nobelpreisträgertagung Lindau Bodensee
- Alumni-Portal powered by **XQuery**
- ... supported by **XForms**
- Web Application implemented with XML Technologies



**The Lindau Nobel Laureate Meetings**  
Educating, Inspiring, Connecting Scientific Generations since 1951



BETA



Login



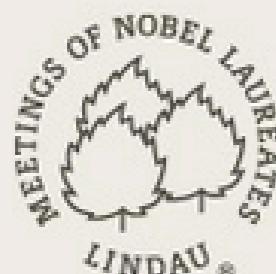
alumni.lindau-nobel.org/restxq/login?r=/restxq/nobel/select



H



Alumni Directory



**The Lindau Nobel Laureate Meetings**  
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BETA

## Please Login

Name

Sekretariat

Password

\*\*\*\*\*

[Login](#)

[Alumni Directory Lindau Nobel Laureate Meeting](#)



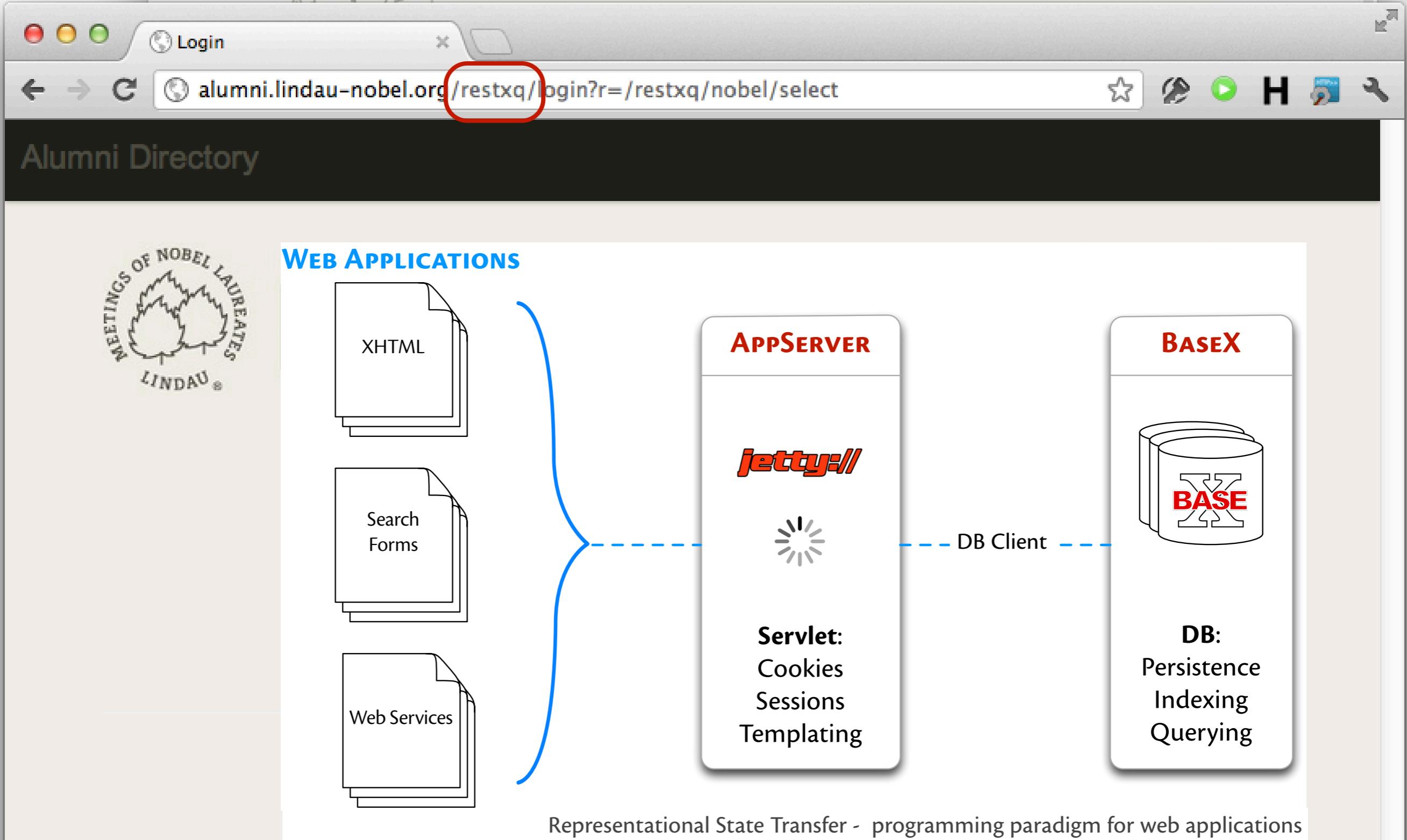
Dr.rer.nat

CiC nanoGUNE



Ph.D.

University Hospital  
Jena



Dr.rer.nat

CiC nanoGUNE



Ph.D.

University Hospital  
Jena



# The Lindau Nobel Laureate Meetings

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BETA



MEETING: 2012 Physics NATIONALITY: DE

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FULLTEXT SEARCH

Fulltext



SEARCH BY NAME

A B C D E F G H I J K L M  
N O P Q R S T U V W X Y  
Z



SEARCH BY MEETING

Meeting



SEARCH BY COUNTRY

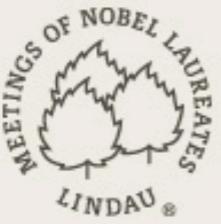
Nationality

- Albania
- Algeria
- Argentina
- Armenia
- Australia
- Austria
- Azerbaijan
- Bangladesh
- Belarus
- Bolivia

website  
generated  
with

W3C  
XQuery

completely



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• Back

Alumni Profile



Marta Bello

PhD, University of Valencia

Postdoctoral Researcher

W3C

XQuery

W3C

XForms

Output  
Forms

• Back

Alumni Directory Lindau Nobel Laureate Meeting



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● Back

**Edit Profile**



Change

2012 Physics

**W3C**  
**XQuery**

**W3C**  
**XForms**

**Input  
Forms**

Title

PhD

Looking for

Research Interest

Applying and engineering novel bioanalytical tools to provide fundamental understanding to complex biological responses with special focus on the physics of processes taking place at the cell surface

Motivation for Science

My fascination for scientific research stems in the first place from my own curiosity and from the intellectual challenge of understanding and describing natural phenomena. I enjoy constantly tackling new unanswered questions. While, so far, a major part of my research was

Institution

Chalmers University of Technolog

Institution Country

Nationality

Switzerland ▾

Date of Birth \*

11/1/1981 ▾

④ November ▾

S M T W T F S

1 2 3 4 5 6 7

8 9 10 11 12 13 14

15 16 17 18 19 20 21

22 23 24 25 26 27 28

29 30 1 2 3 4 5

6 7 8 9 10 11 12

1980 1981

1982

---

# Interactive Search

---

# Discography Database

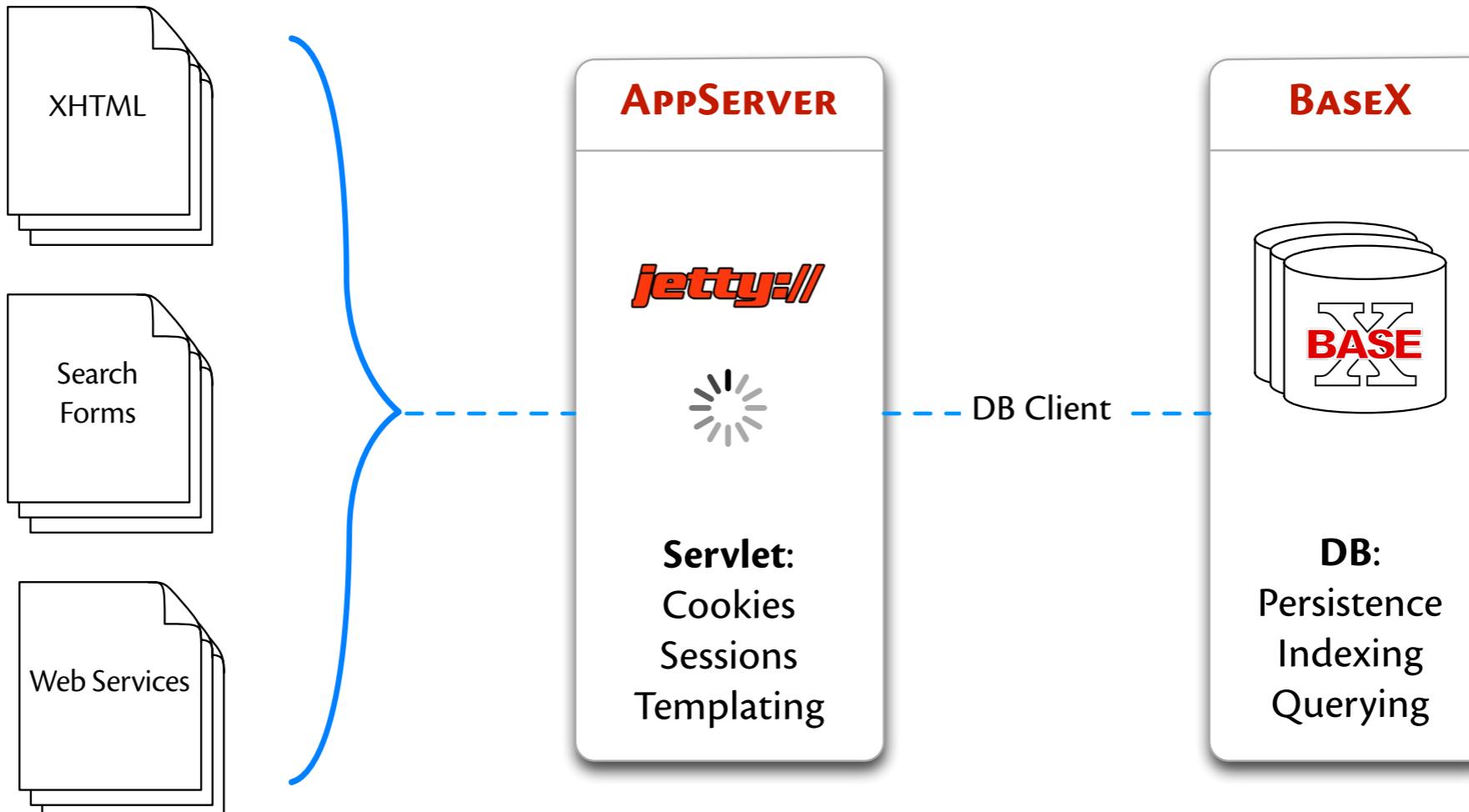
**Data:** 4,297,128 releases, 14 GB of XML input

**Source:** <http://discogs.com/data/>

Artist: Alfred Schnittke 10 Results  Similar Results

Title: Symphony

## WEB APPLICATIONS



Representational State Transfer - programming paradigm for web applications

# Discography Database

Data: 4,297,128 releases, 14 GB of XML input

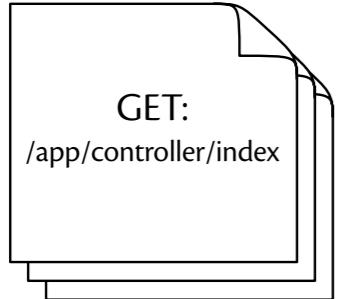
Source: <http://discogs.com/data/>

Artist: Alfred Schnittke 10 Results  Similar Results

Title: Symphony

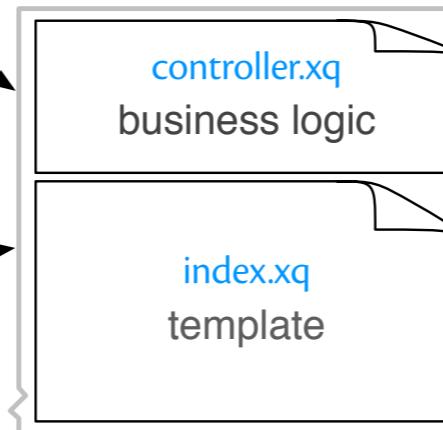
**CLIENT**

GET or POST Request

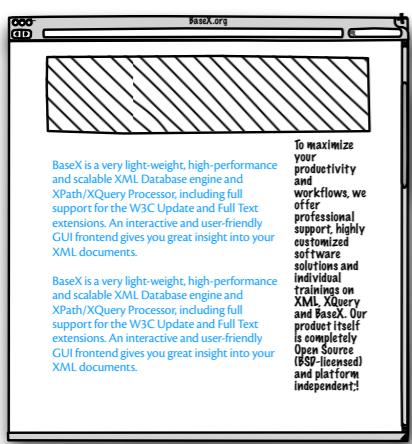
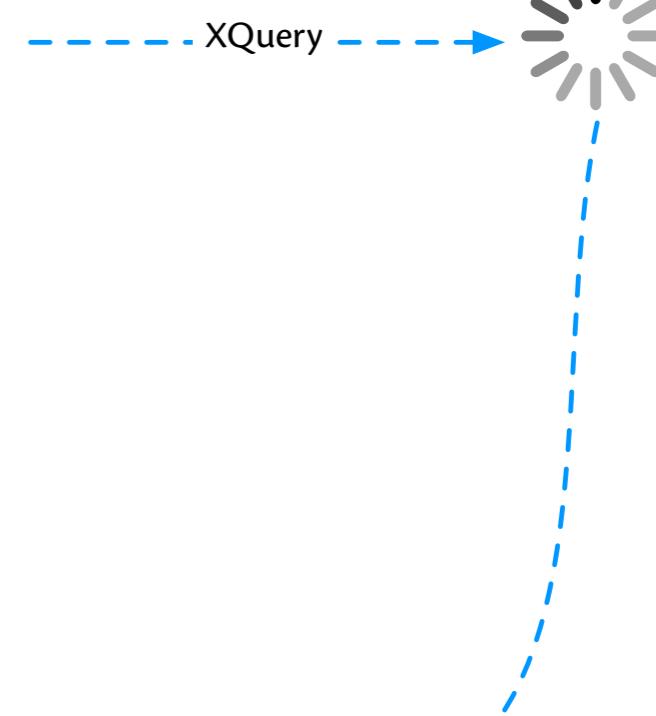


**APP SERVER**

Servlet

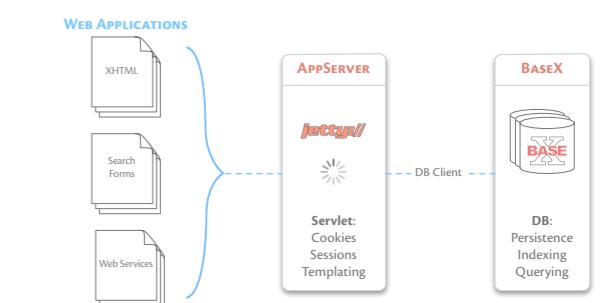
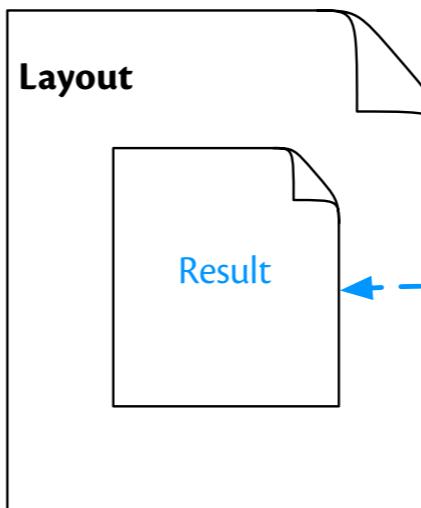


**BASEX**



response Object

Body  
Cookies



# Discography Database

Data: 4,297,128 releases, 14 GB of XML input

Source: <http://discogs.com/data/>

Artist: Alfred Schnittke

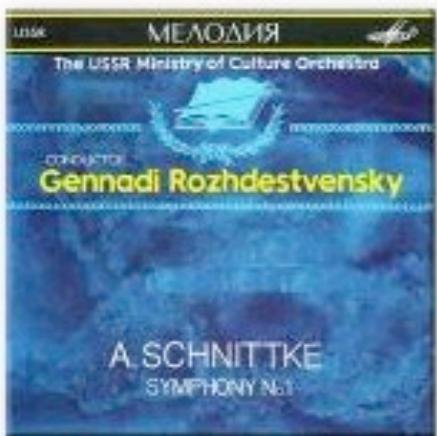
10 Results ▾

Title: Symphony

Similar Results



Found: 127 results for "Alfred Schnittke" and 14,501 results for "Symphony".



## Alfred Schnittke: Symphony # 1

**Label:** Gramzapis Company GCD 00062  
**Released:** 1987  
**Country:** Russia  
**Genre:** Classical  
**Style:** Post-Modern  
**Tracklist:**

1.1	Senza Tempo. Moderato
1.2	Allegretto
1.3	Lento
1.4	Lento. Allegro



## Alfred Schnittke: Symphony No. 6 · Symphony No. 7

**Label:** BIS BIS-CD-747  
**Released:** 1996-02-00  
**Country:** Sweden  
**Genre:** Classical  
**Style:** Post-Modern  
**Tracklist:**

<a href="#">Symphony No. 6</a>	
1	Allegro Moderato
2	Presto
3	Adagio - Attacca -
4	Allegro Vivace
<a href="#">Symphony No. 7</a>	
5	Andante - Attacca -

# Thank You !

## Building web applications using XML technologies

**XML, XQuery, XForms, XHTML – A uniform technology stack**

*Markup Forum, Stuttgart, Nov 22 2013*

Dr. Christian Grün, Dr. Alexander Holupirek

BaseX.org - The Open Source XML Database and XQuery processor

BaseX GmbH - Professional XML Data Services

Database and Information System Group, U Konstanz

