

XML Query Forms (XQForms): Declarative Specification of XML Query Interfaces

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Overview

Motives

- An increasing amount of sources export XML views of themselves
 - View = XML Schema + data
- XML Query will allow querying these views
- XQForms generates query forms and reports for querying these XML views

XQForm - Microsoft Internet Explorer

File Edit View Favorites Tools Help

← → ↻ 🔍 🏠 📄 📧 🗨️ 👤

Links >>

Proximity Sensors ⚙️

General

Manufacturer:

Supply Voltage: to

Additional Attributes ▾

Part Number:

Mechanical

Body Type:

Dimensions: Dia Length

mm

Sorting & Options

Results/page:

Supply Voltage Min: DESC:

DESC-Manufacturer: up +

DESC-Output Type: dn -

Reset **Execute**

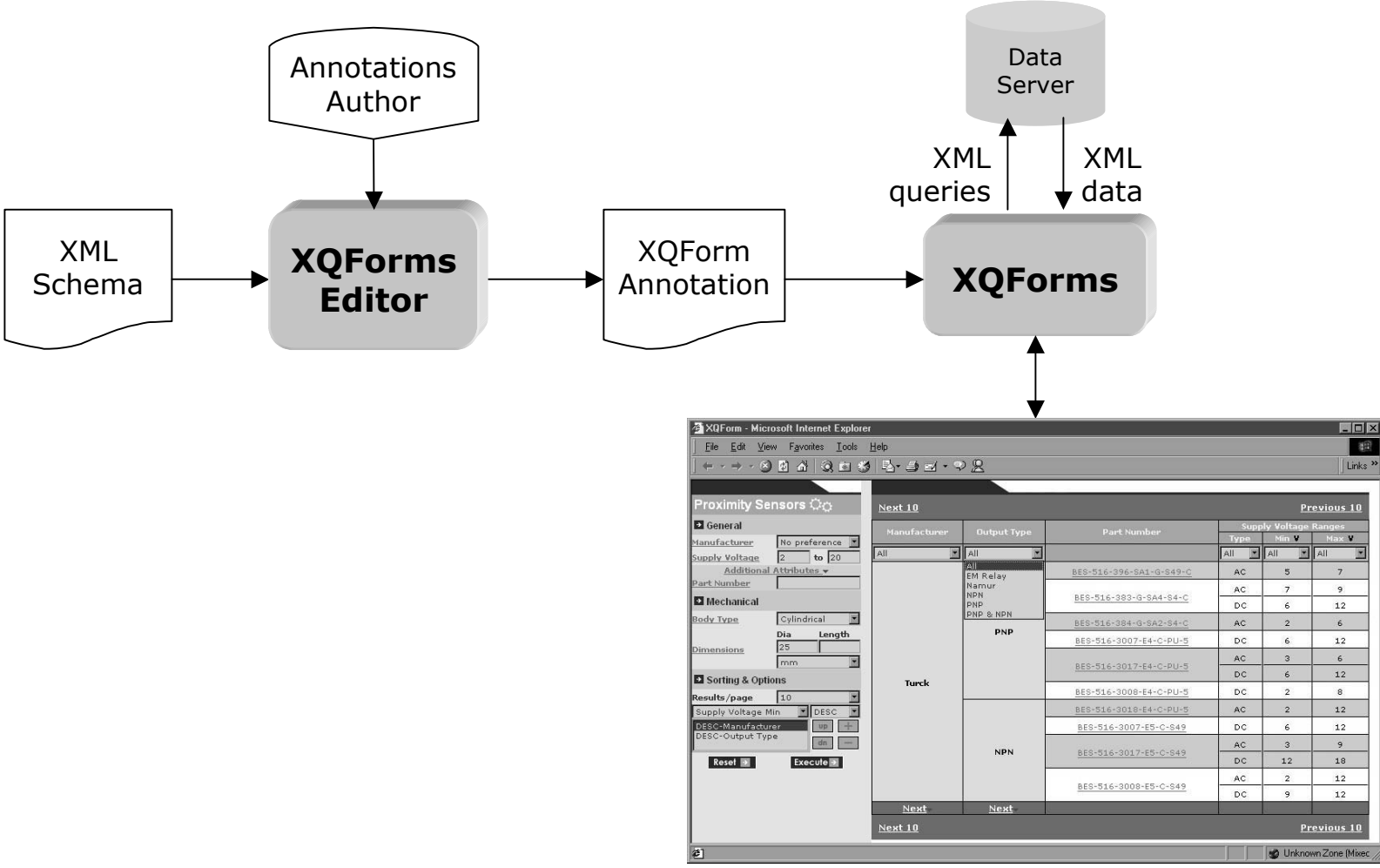
Next 10
Previous 10

Manufacturer	Output Type	Part Number	Supply Voltage Ranges		
			Type	Min ▼	Max ▼
All	All		All	All	All
Turck	All	BES-516-396-SA1-G-S49-C	AC	5	7
	EM Relay	BES-516-383-G-SA4-S4-C	AC	7	9
			DC	6	12
	PNP	BES-516-384-G-SA2-S4-C	AC	2	6
			DC	6	12
	PNP & NPN	BES-516-3007-E4-C-PU-5	AC	3	6
			DC	6	12
	NPN	BES-516-3017-E4-C-PU-5	AC	2	12
			DC	2	8
	NPN	BES-516-3008-E4-C-PU-5	AC	2	12
			DC	6	12
	NPN	BES-516-3007-E5-C-S49	AC	3	9
			DC	12	18
	NPN	BES-516-3017-E5-C-S49	AC	2	12
DC			9	12	
BES-516-3008-E5-C-S49					

Next
Next

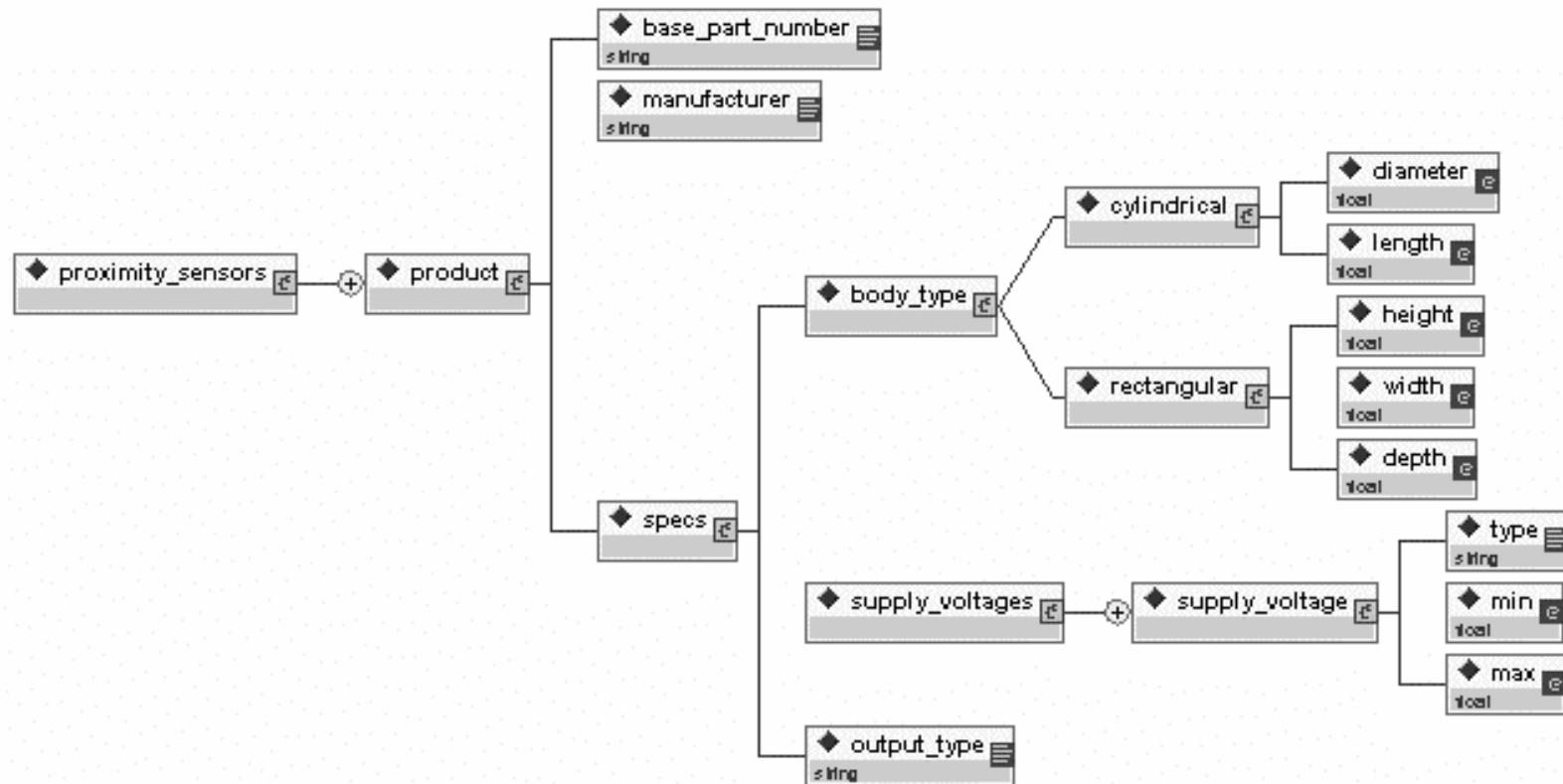
Next 10
Previous 10

Basic Architecture



Basic Architecture

Example XML Schema



XQForms Builder

File Edit Action Deploy Help

proximity_sensors

- product+
 - SEQ
 - base_part_number
 - manufacturer
 - catalog_version
 - family
 - description
 - marketing_blurb?
 - image_filename?
 - pdf_filename?
 - dimensional_drawing_filename?
 - specifications
 - specification+
 - SEQ
 - cpn_pattern?
 - sensing_technology
 - sensing_distance
 - body_type
 - mounting_type
 - sensing_direction
 - connection_type
 - housing
 - protection_ratings
 - approvals
 - operating_temp
 - number_of_wires
 - supply_voltage
 - switching_mode
 - switching_frequency
 - power_led
 - output_led
 - field_bus_capability
 - intrinsically_safe
 - weld_field_immune
 - other_attributes
 - cpn_specifications?

XAnnotate: 5 annotations found

Name	Path
manufacturer	/proximity_sensors/product/manufacturer
max_distance	/proximity_sensors/product/specifications/spec...
sensing_technology	/proximity_sensors/product/specifications/spec...
operating_temp	/proximity_sensors/product/specifications/spec...
supply_voltage	/proximity_sensors/product/specifications/spec...

Control Properties: Select

Query Characteristics

Label: Manufacturer

Values:

Label	Data Value	Binding Path	D	P
No preference	any		<input checked="" type="radio"/>	=
Balluff		proximity_sensors/product/manufacturer	<input type="radio"/>	=
Baumer		proximity_sensors/product/manufacturer	<input type="radio"/>	=
Turck		proximity_sensors/product/manufacturer	<input type="radio"/>	=

Multiple: Dependencies: Annotation Name

Size: 3

Unit: [Dropdown]

Precision: 0

Presentation Characteristics

Categories: Sensors, General

Attached Info: [Text Area]

Initially Hidden:

Cancel OK

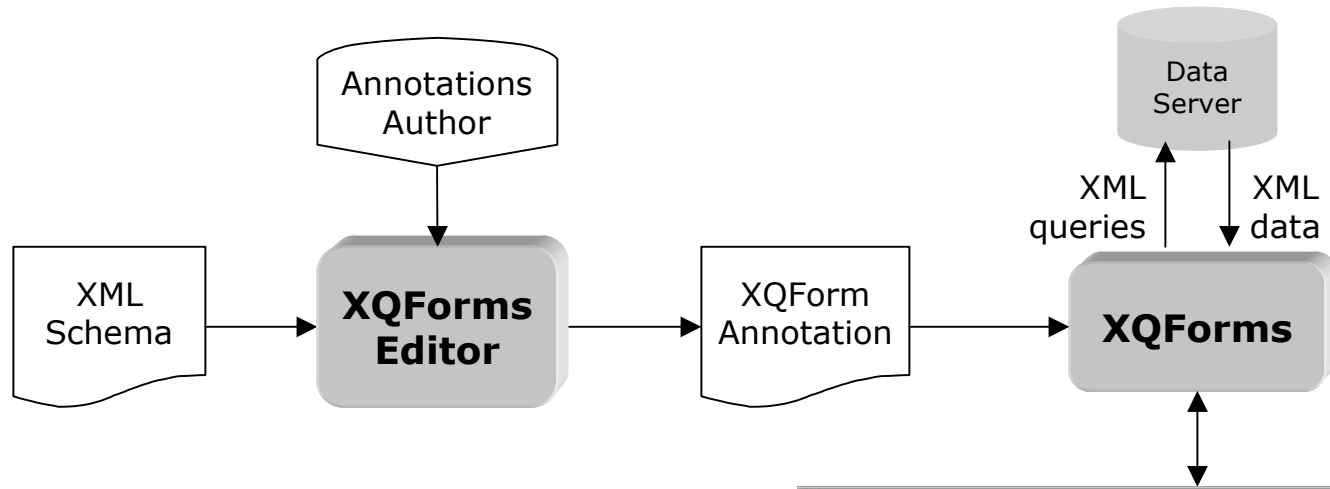
Schema: E:\XSDesign\Projects\schemastGS_SensorsProximity.xsd
 Annotation: E:\XSDesign\Projects\simple\simple.xqf

Basic Architecture

Query Control Annotation

```
<select>
  <label>Manufacturer</label>
  <values>
    <value default="true">
      <label>No preference</label>
      <data_value>any</data_value>
      <binding_path></binding_path>
      <condition>EQ</condition>
    </value>
    ...
    <value>
      <label>Turck</label>
      <binding_path>
        proximity_sensors/product/manufacturer
      </binding_path>
      <condition>EQ</condition>
    </value>
  </values>
  <multiple>>false</multiple>
</select>
```

Basic Architecture



Screenshot of the XQForm application in Microsoft Internet Explorer. The application displays a search interface for Proximity Sensors and a results table.

Proximity Sensors

General

Manufacturer: No preference
 Supply Voltage: 2 to 20
 Part Number: [Additional Attributes]

Mechanical

Body Type: Cylindrical
 Dimensions: Dia 25, Length [mm]

Sorting & Options

Results/page: 10
 Supply Voltage Min: DESC
 DESC-Output Type

Results Table:

Manufacturer	Output Type	Part Number	Supply Voltage Ranges		
			Type	Min V	Max V
Turck	PNP	BES-516-396-SA1-G-S49-C	AC	5	7
		BES-516-389-G-SA4-S4-C	AC	7	9
		BES-516-384-G-SA2-S4-C	DC	6	12
		BES-516-3007-E4-C-PU-5	AC	2	6
		BES-516-3017-E4-C-PU-5	DC	3	6
		BES-516-3008-E4-C-PU-5	DC	6	12
	NPN	BES-516-3018-E4-C-PU-5	AC	2	12
		BES-516-3007-E5-C-S49	DC	6	12
		BES-516-3017-E5-C-S49	AC	3	9
		BES-516-3017-E5-C-S49	DC	12	18
		BES-516-3008-E5-C-S49	AC	2	12
		BES-516-3008-E5-C-S49	DC	9	12

Detailed Architecture

Steps in a Query Control lifecycle

XML Schema



XMAS Query

```
1 WHERE  
2 proxSource proximity_sensors.product $P  
3 AND $P manufacturer._ $M  
4 AND $M = "Turck"
```

Annotation

```
1 <select>  
2   <label>Manufacturer</label>  
3   ...  
4   <value>  
5     <label>Turck</label>  
6     <binding_path>  
7       proximity_sensors/product/manufacturer  
8     </binding_path>  
9     <condition>EQ</condition>  
10  </value>  
11  ...  
12 </select>
```

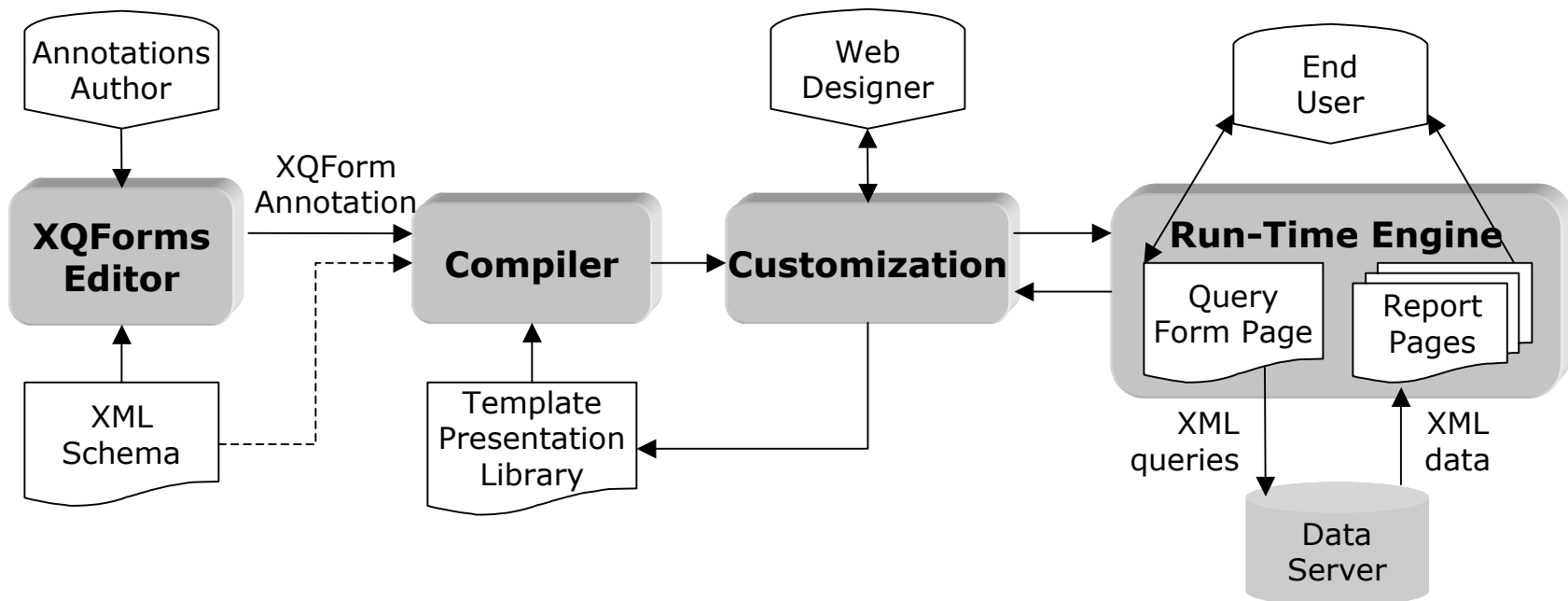
Form Elements

Manufacturer

No preference
No preference
Balluff
Baumer
Turck

Detailed Architecture

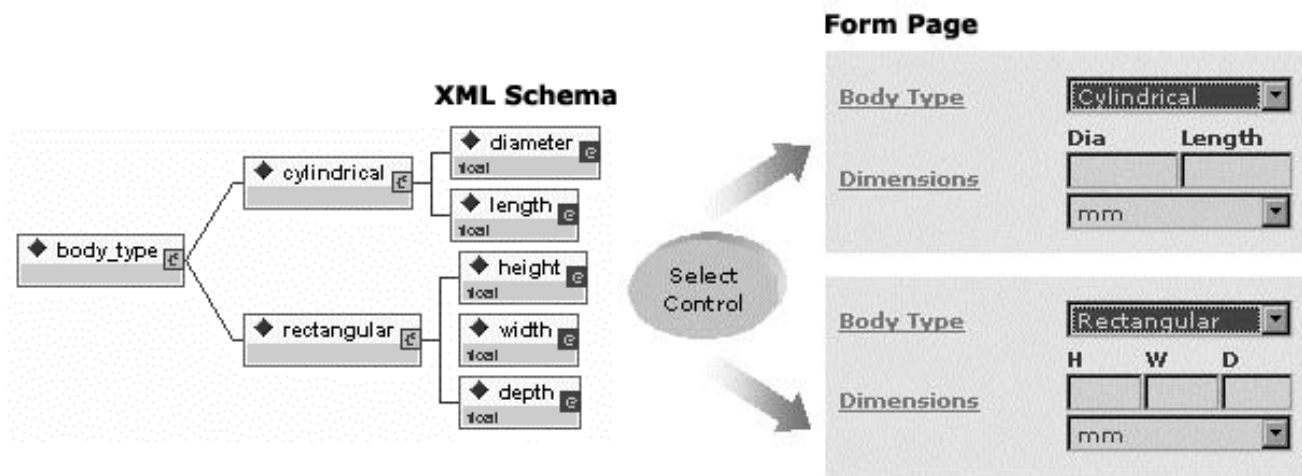
Steps in an XQForm lifecycle



- Separation of content, query semantics and presentation

Detailed Architecture

Dependencies among Query Controls



- Ability to express CASE statements
- Different query controls contribute in querying
- The corresponding form elements are shown on the query form page

Reports

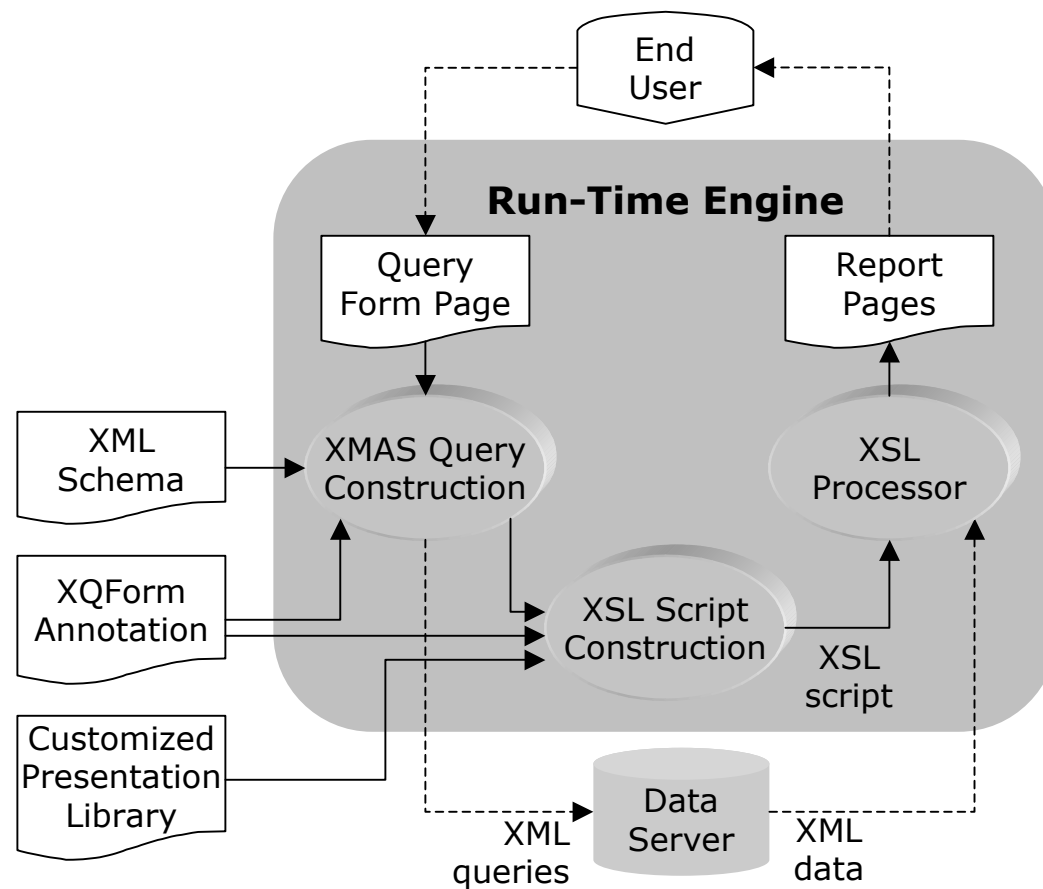
Annotation

```
<report>
  <main_result_unit>
    <binding_path>
      proximity_sensors/product
    </binding_path>
  </main_result_unit>
  <result>
    <label>Manufacturer</label>
    <binding_path>manufacturer</binding_path>
    <pattern>concat(., ' Manufacturer')</pattern>
    <summarize order="ASC">true</summarize>
  </result>
  <result>
    <label>Part Number</label>
    <binding_path>base_part_number</binding_path>
    <template>base_part_number.xsl</template>
    <summarize>>false</summarize>
  </result>
  ...
</report>
```

- Specifies the data that appear on the report page
- Mechanism for easy customization of the report page
- The complexity of the XSL script for rendering the XML data is hidden

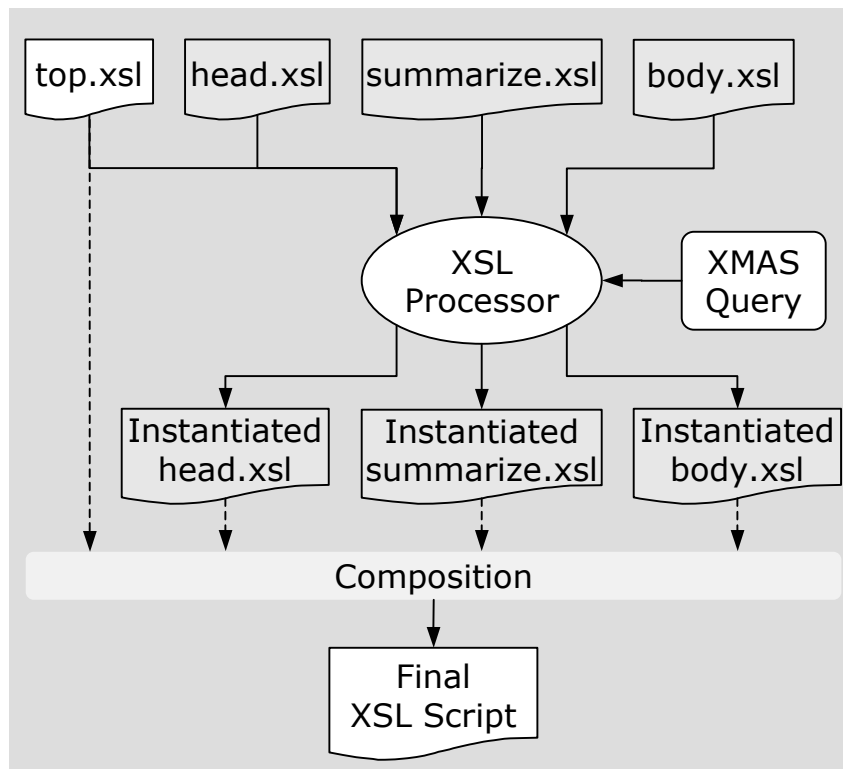
Reports

Architecture



Reports

Composition



- Engine applies system XSL scripts, called *metaXSL* scripts
- *metaXSL* scripts follow the structure of the XML query and construct the visual structure of the report page
- *metaXSL* scripts attach XSL templates to the simple and complex elements

XQForm - Microsoft Internet Explorer

File Edit View Favorites Tools Help

← → ↻ 🏠 🔍 📄 📧 🗨️ 👤

Links »

Proximity Sensors ⚙️

➔ **General**

Manufacturer:

Supply Voltage: to

Additional Attributes ▾

Part Number:

➔ **Mechanical**

Body Type:

Dimensions: Dia Length

mm

➔ **Sorting & Options**

Results/page:

Supply Voltage Min: DESC:

DESC-Manufacturer: up +

DESC-Output Type: dn -

Reset ➔ **Execute** ➔

Next 10
Previous 10

Manufacturer	Output Type	Part Number	Supply Voltage Ranges			
			Type	Min ▼	Max ▼	
All ▾	All ▾		All ▾	All ▾	All ▾	
Turck	All	BES-516-396-SA1-G-S49-C	AC	5	7	
	EM Relay	BES-516-383-G-SA4-S4-C	AC	7	9	
	Namur		DC	6	12	
	NPN	BES-516-384-G-SA2-S4-C	AC	2	6	
	PNP	BES-516-3007-E4-C-PU-5	DC	6	12	
	PNP & NPN		AC	3	6	
	PNP	BES-516-3017-E4-C-PU-5	DC	6	12	
			AC	2	12	
		BES-516-3008-E4-C-PU-5	DC	2	8	
			AC	2	12	
		NPN	BES-516-3007-E5-C-S49	DC	6	12
				AC	3	9
			BES-516-3017-E5-C-S49	DC	12	18
				AC	2	12
BES-516-3008-E5-C-S49	DC	9	12			
Next	Next					

Next 10
Previous 10

Unknown Zone (Mixec)

Conclusions

Functionality Provided to Developers

- Declarative definition and generation of powerful query form and report pages for XML data modeled by XML Schemas
- Automated query construction and report formatting
- Separation of querying functionality and presentation
- High degree of customizability

Conclusions

Functionality Provided to End Users

- Ability to express arbitrary selection and projection conditions on the query form page
- Ability to express arbitrary sorting conditions
- Control on the number of elements that are returned from the data server
- Advanced navigation capabilities in the returned reports
- Ability to dynamically summarize and filter the query results on the reports pages
- On Line Demo:
<http://www10.enosysmarkets.com>

Related Work

- XForms
 - Based on XML Schemas
 - Focus on end user interaction and XML instance creation
- Strudel
 - Graph model
 - Site graph
 - Functions on edges/links
- Commercial systems
 - Visual InterDev
 - Relational databases

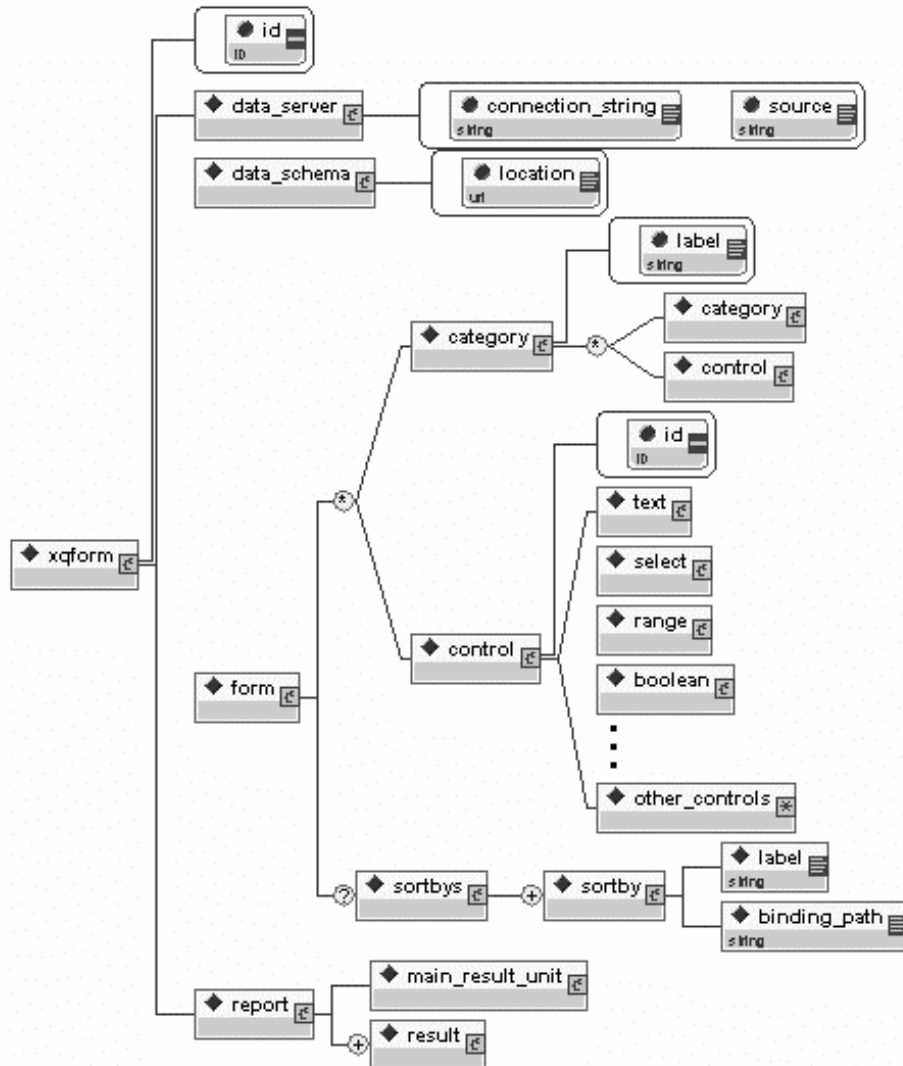
Future Directions

- Expanded XML schema
 - Disjunction of repeatable elements
- Decision trees
 - Multi-step forms
 - More powerful dependencies
- Comparison reports
- Report customization
- Updates

Outline

- Overview
- Basic Architecture
- Detailed Architecture
 - The four steps of the XQForms' lifecycle
- Reports
 - Automatic report construction
- Summary
 - Functionality provided
- Related work
- Future directions

Annotation Scheme



- Captures the general attributes of an XQForm
- Expresses the structure and the semantics of the query form page
- Specifies the syntax of an easily extensible collection of query controls
- Specifies which data elements will appear on the report page

Overview

XQForms Editor

The screenshot displays the XQForms Editor interface. On the left is a tree view of the XQuery schema, showing elements like `proximity_sensors`, `product+`, `SEQ`, `base_part_number`, `manufacturer`, `specs`, `body_type`, `OR`, `cylindrical`, `rectangular`, `supply_voltages`, `supply_voltage+`, `type`, `min`, `max`, and `output_type`.

The central pane shows "6 annotations found" in a table:

Name	Path
manufacturer	/proximity_sensors/product/manu...
supply_voltage	/proximity_sensors/product/specs...
base_part_number	/proximity_sensors/product/base...
body_type	/proximity_sensors/product/specs...
rectangular	/proximity_sensors/product/specs...
cylindrical	/proximity_sensors/product/specs...

Below the annotations table is the "Control Properties: Select" panel, which includes:

- Query Characteristics:** A table for defining query results.
- Presentation Characteristics:** Fields for categories and attached info.

On the right side, there are two configuration panels:

- Main Result Unit:** Shows a "Binding Path" of `proximity_sensors/product`.
- Sort By Options:** A table for defining sort order.
- Query Result Options:** A table for defining query result options.
- Properties:** Fields for "Summarize" (set to None), "Unit", "XSL Pattern", and "Precision".

At the bottom of the window, the schema and annotation paths are displayed:

Schema: C:\GS_SensorsProximity.xsd
Annotation: C:\Projects\prox.xqf