

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

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# Overview

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## 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**

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### 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** ➔

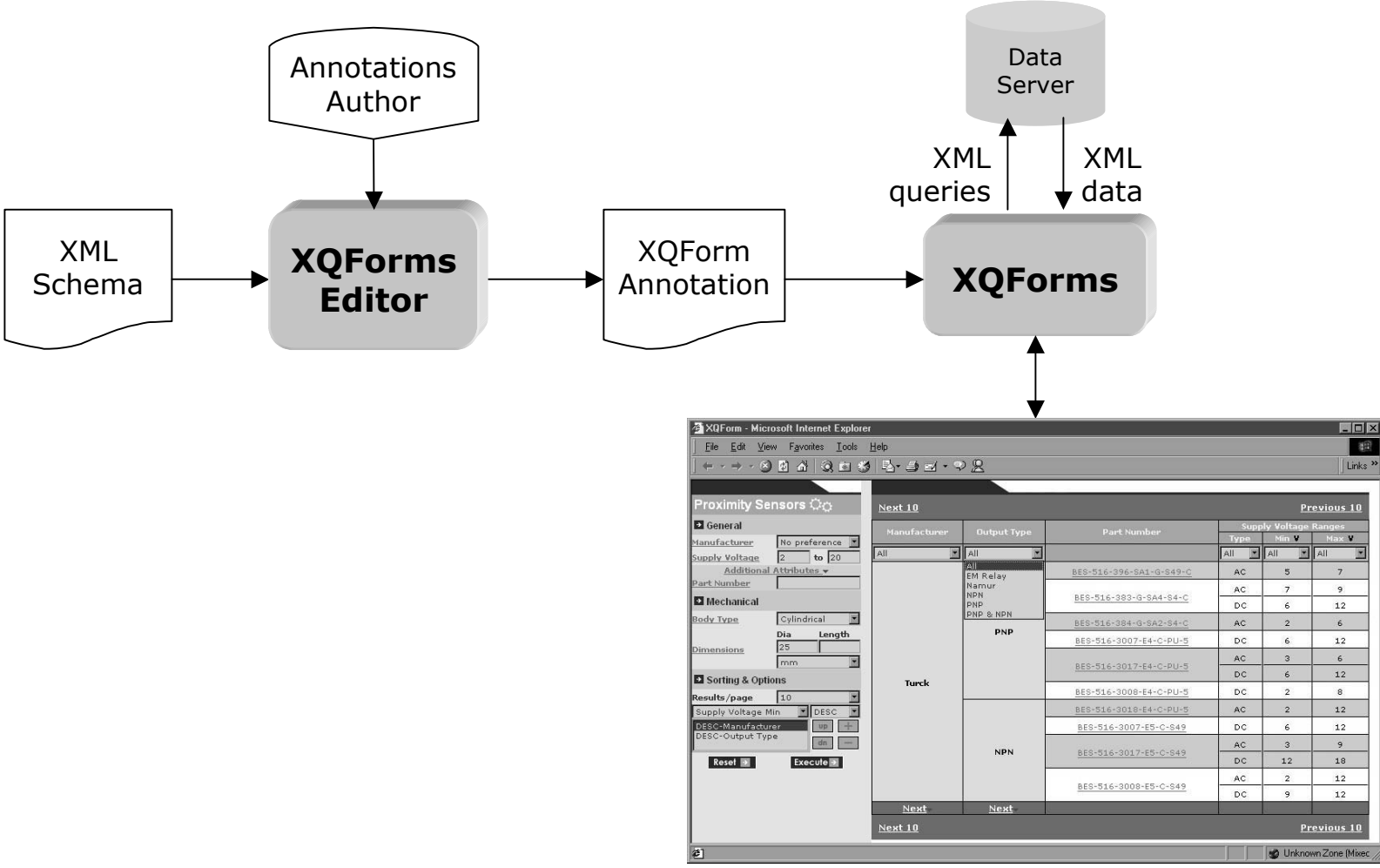
Next 10
Previous 10

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

Next 10
Previous 10

Unknown Zone (Mixec)

# Basic Architecture



XQForm - Microsoft Internet Explorer

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 Manufacturer

DESC Output Type

Reset Execute

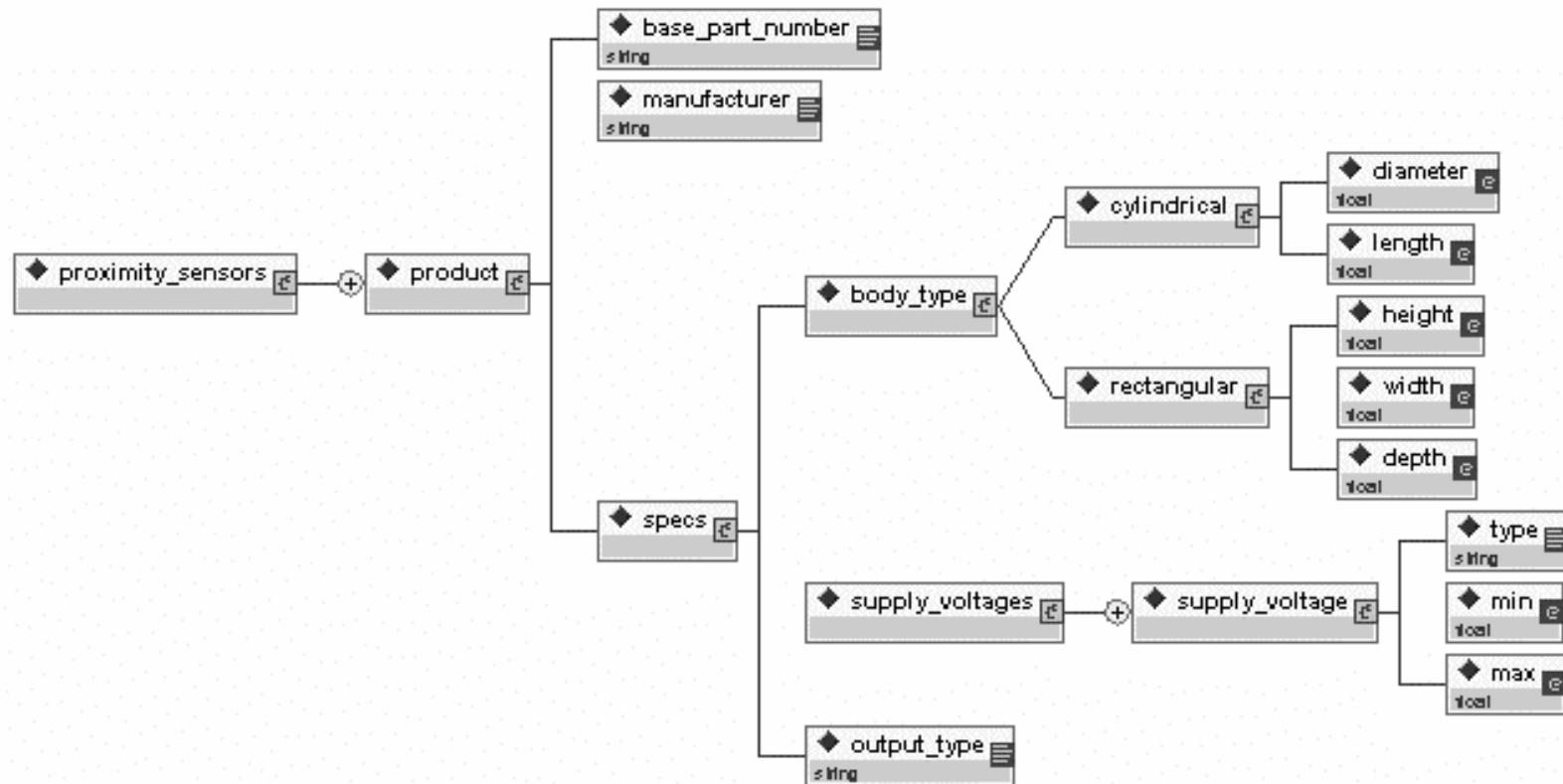
Manufacturer	Output Type	Part Number	Supply Voltage Ranges		
			Type	Min	Max
Turck	PNP	BES-516-396-SA1-G-S49-C	AC	5	7
		BES-516-389-G-SA4-S4-C	AC	7	9
		BES-516-384-G-SA2-S4-C	DC	6	12
		BES-516-384-G-SA2-S4-C	AC	2	6
		BES-516-3007-E4-C-PU-5	DC	6	12
		BES-516-3017-E4-C-PU-5	DC	3	6
		BES-516-3008-E4-C-PU-5	DC	6	12
		BES-516-3008-E4-C-PU-5	DC	2	8
		BES-516-3018-E4-C-PU-5	AC	2	12
		BES-516-3007-E5-C-S49	DC	6	12
NPN	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

Next 10 Previous 10

Unknown Zone (Msec)

# 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:

Precision: 0

Presentation Characteristics

Categories: Sensors, General

Attached Info:

Initially Hidden:

Cancel OK

Schema: E:\XSDesign\Projects\schemast\GS\_SensorsProximity.xsd  
 Annotation: E:\XSDesign\Projects\simple\simple.xqf

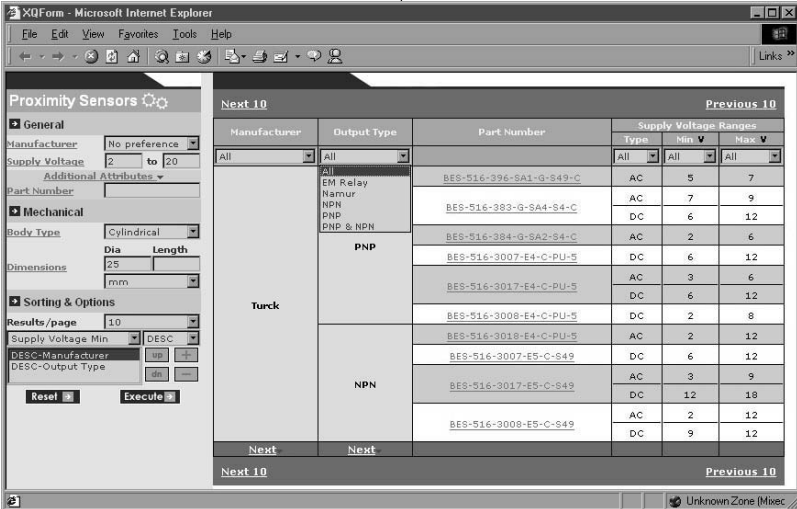
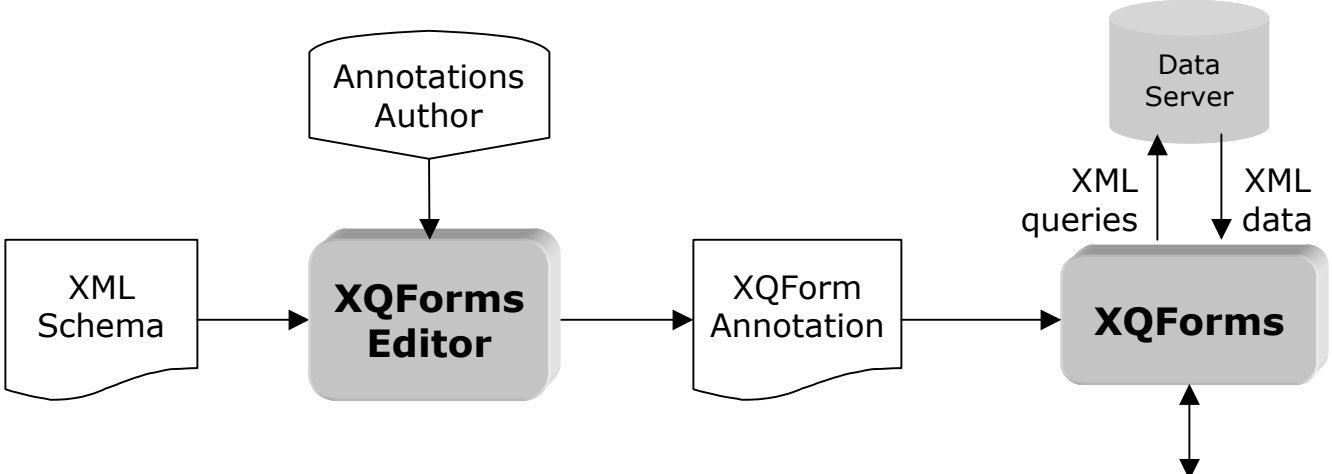
# Basic Architecture

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## 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





# 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>
```

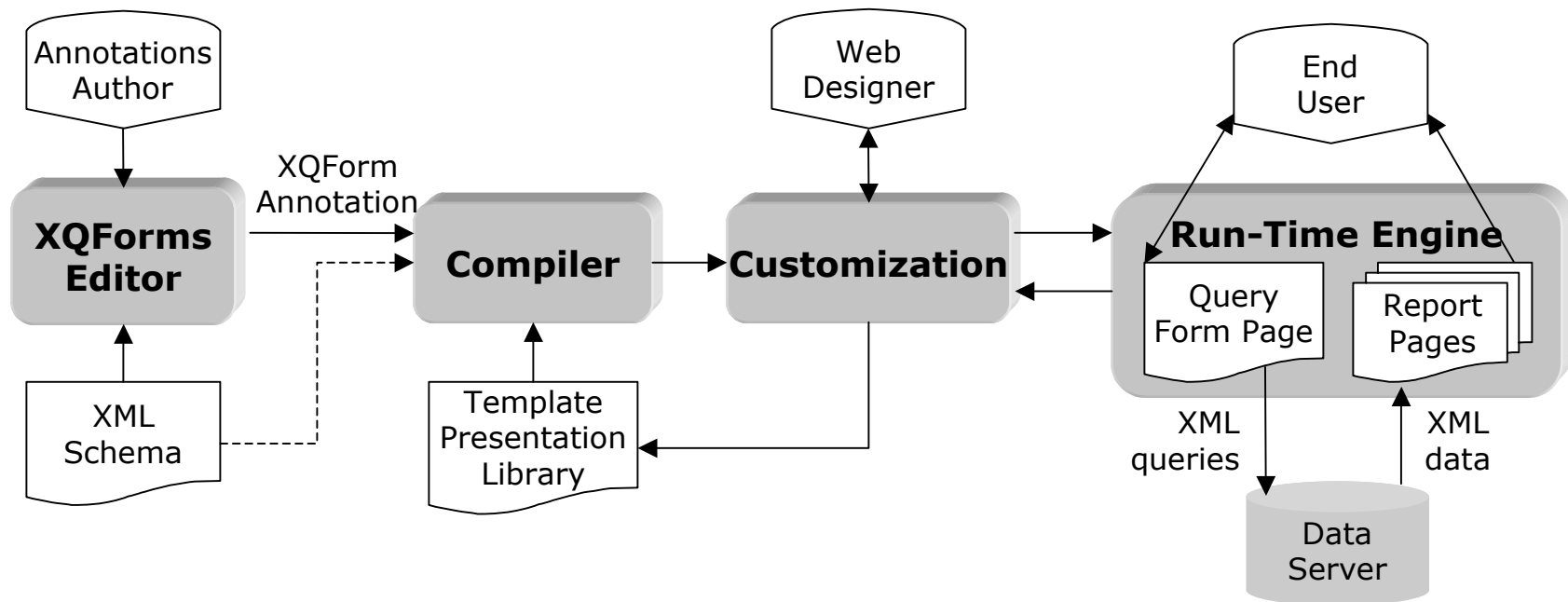
### Form Elements

Manufacturer

No preference
No preference
Balluff
Baumer
Turck

# Detailed Architecture

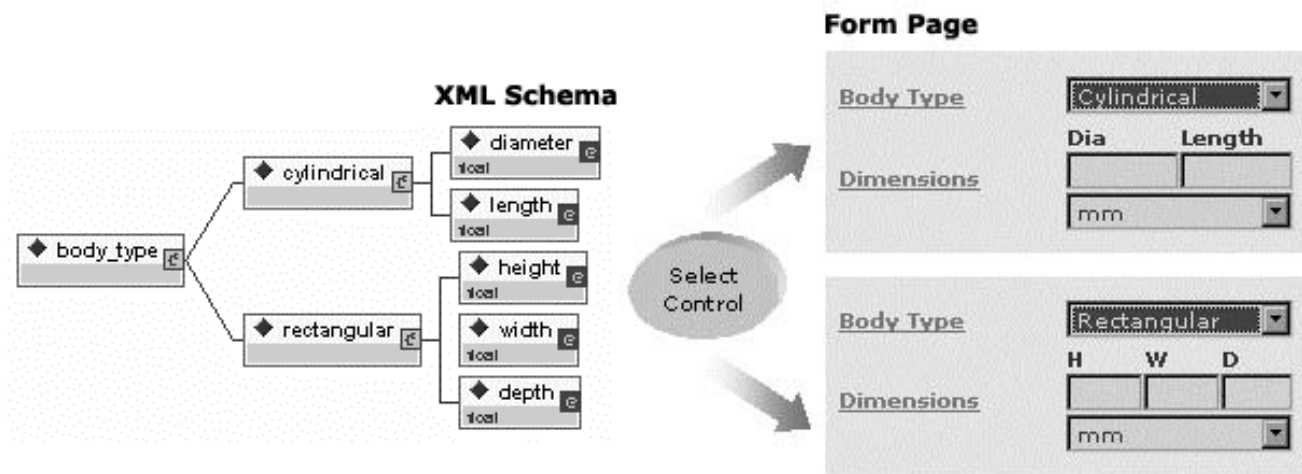
## Steps in an XQForm lifecycle



- 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

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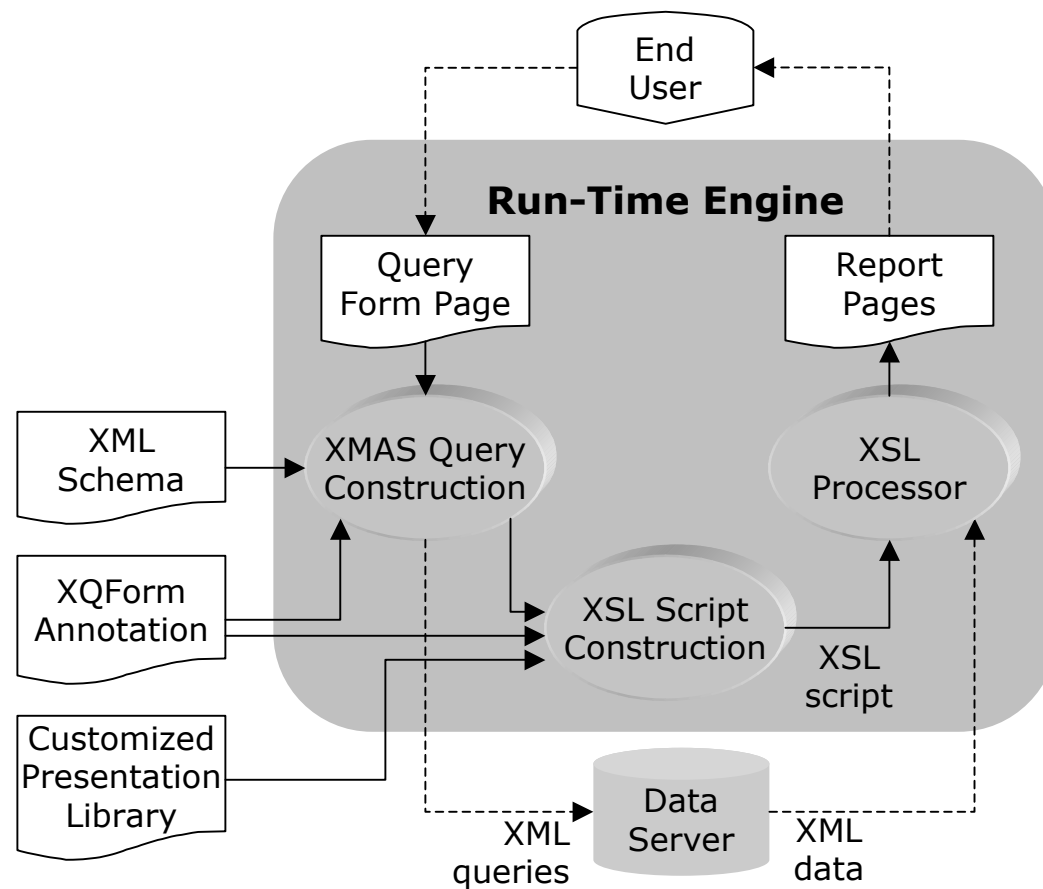
## Annotation

```
<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

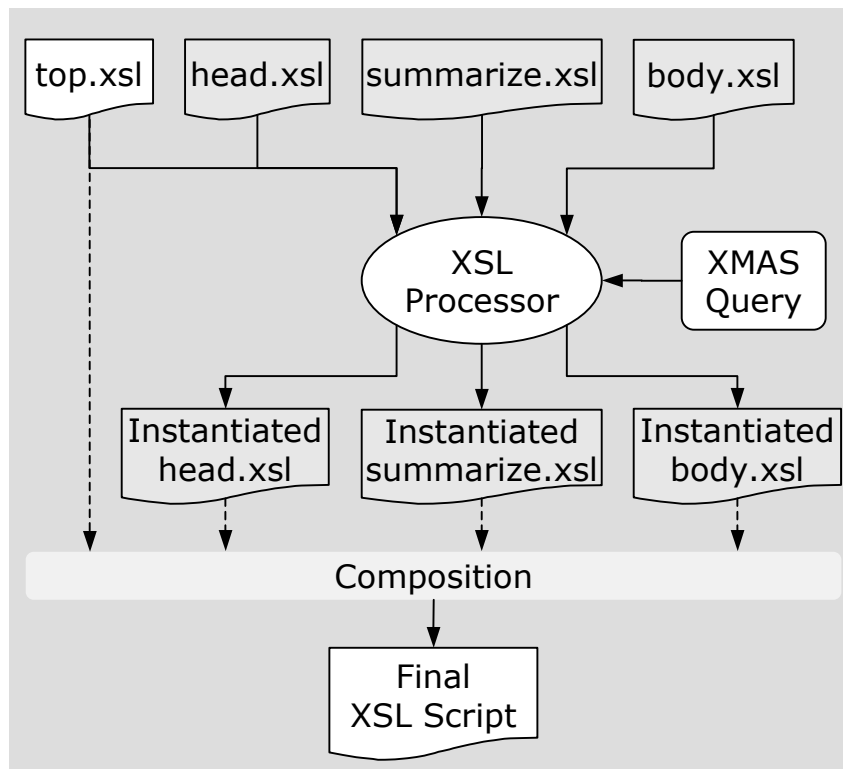
# Reports

## 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

### 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-Manufacturer:

DESC-Output Type:

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

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# Conclusions

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## 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

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## 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

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- 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

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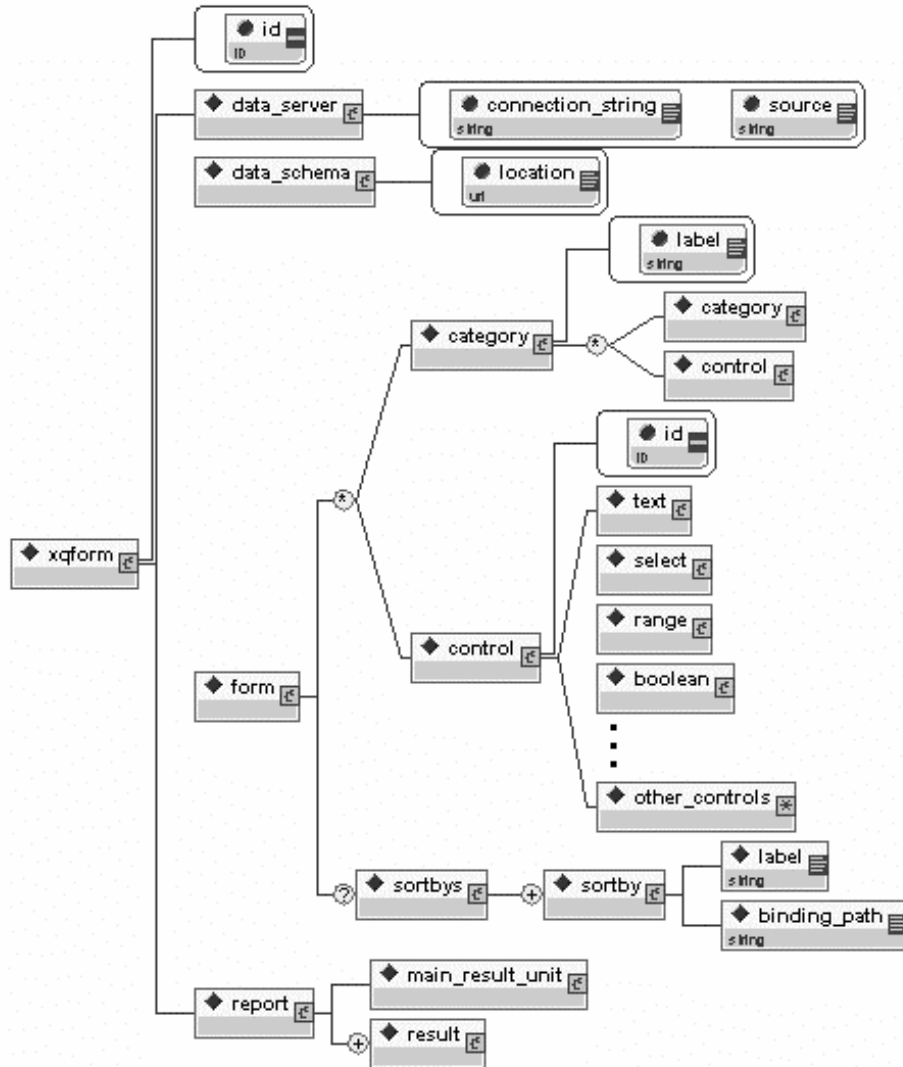
- Expanded XML schema
  - Disjunction of repeatable elements
- Decision trees
  - Multi-step forms
  - More powerful dependencies
- Comparison reports
- Report customization
- Updates

# Outline

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- 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', 'diameter', 'length', 'rectangular', 'height', 'width', 'depth', 'supply\_voltages', 'supply\_voltage+', 'type', 'min', 'max', and 'output\_type'. The main area 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 table is the 'Control Properties: Select' dialog for the 'Manufacturer' field. It includes 'Query Characteristics' with a table of values:

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

The dialog also has sections for 'Presentation Characteristics' (Categories: Proximity ..., General) and 'Properties' (Summarize: None, Unit: [dropdown], XSL Pattern: [text], Precision: [text]). At the bottom, it shows 'Schema: C:\GS\_SensorsProximity.xsd' and 'Annotation: C:\Projects\prox.xqf'.