

Web Services Interfaces

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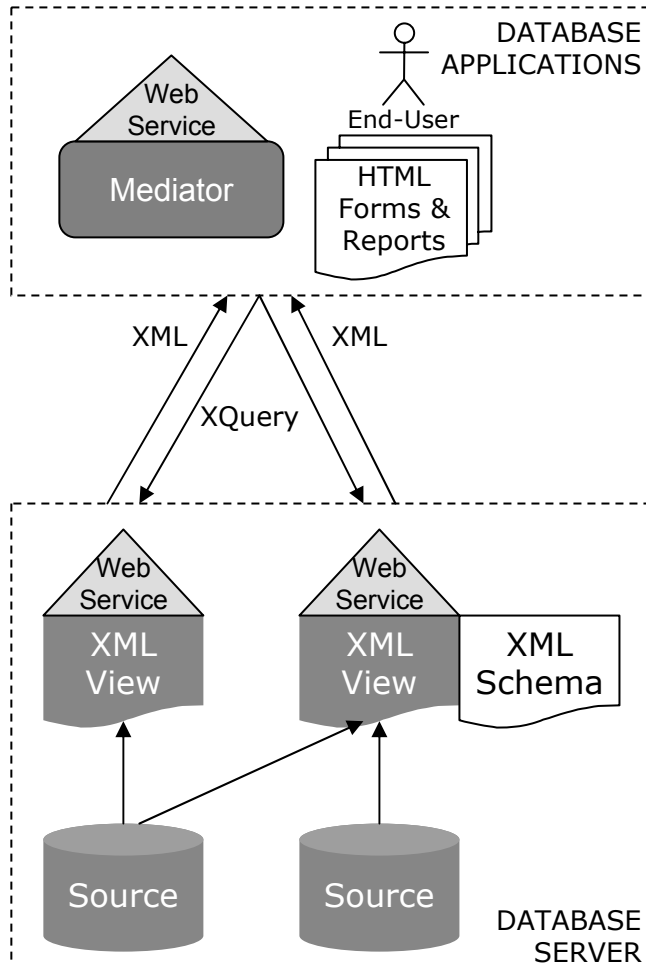
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Exporting DBMSs on the Web



- Exporting Query Capabilities on the Web
 - Web Services (Function Signatures)
- Integrating Web Applications
 - Use Web Services
 - Export Query Capabilities Themselves
- HTML Web Interfaces (Forms & Reports)

Overview

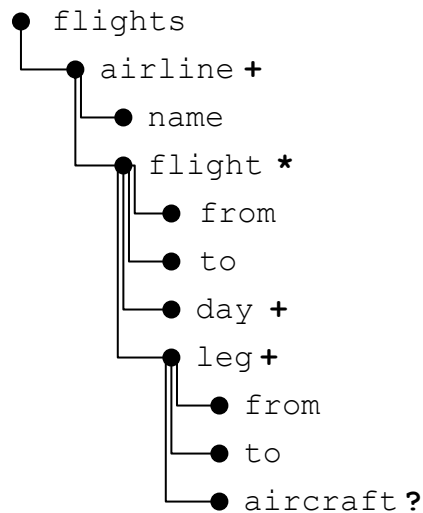
- Query Set Specification Language (QSSL)
 - Describes Parameterized Tree Pattern (TP) Queries
- Data Services
 - Web Services for Query Capabilities
- Forms & Reports for Semistructured Data
 - The QURSED system
- Authoring Interfaces

Motivation for QSSL

- Web Services published as function signatures:
 - Fixed number of input and output parameters
 - Do not capture the functionality of databases
 - Large number of web services needed
 - One function signature for every parameterized query
 - Do not capture the semantic connections the available functions have with each other and with the underlying databases
- JDBC Interfaces
 - All possible queries
 - Difficult to export schema information

Query Set Specification Language

Goals

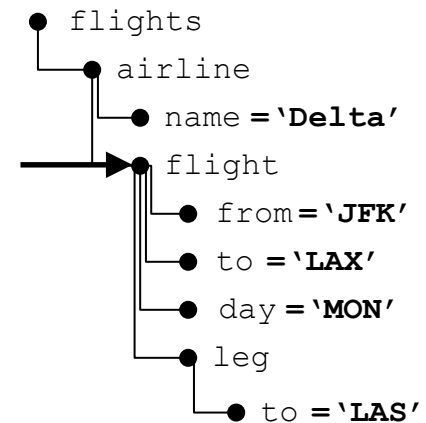


- Any combination of the following conditions on:
 - the name of the airline company
 - the origin and destination of one or more flights (optional)
 - a day of the week
 - the origin of zero or more legs (optional)
 - the destination of zero or more legs (optional)
 - the aircraft used for zero or more legs (optional)
- The queries may return “airline” or “flight” elements

Query Set Specification Language

Query Language

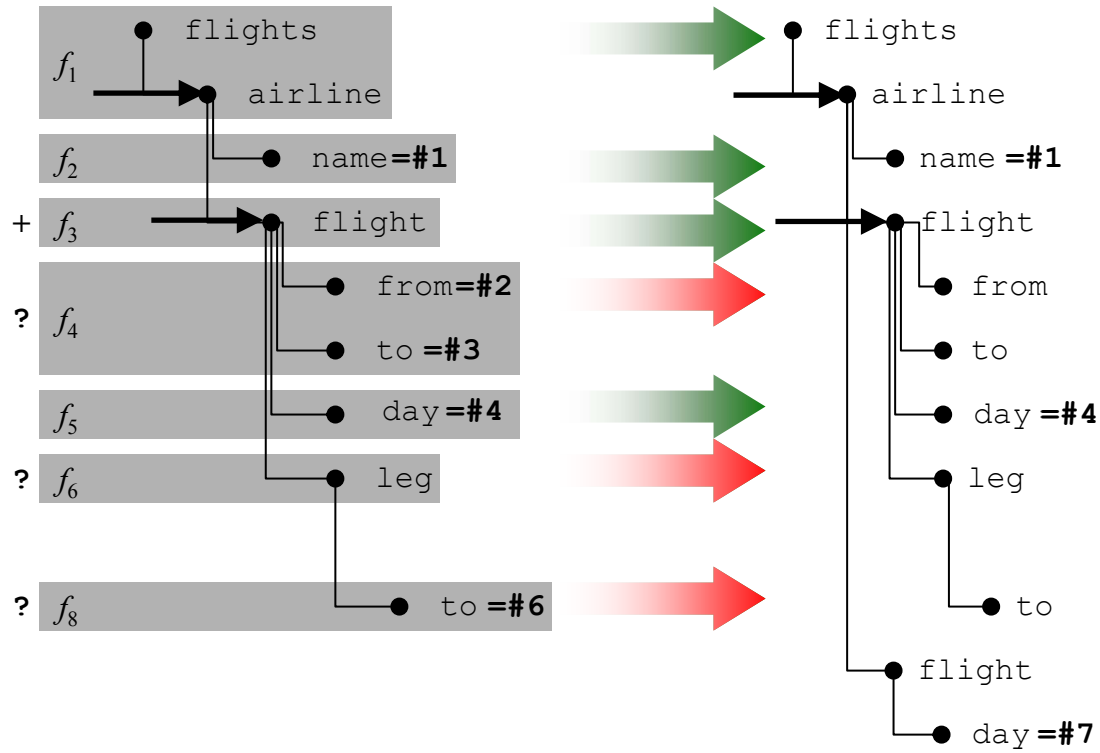
- Tree Pattern Queries:
 - Acyclic XPath expressions consisting of:
 - node tests
 - child axis '/'
 - descendant axis '//'
 - predicates '['']
 - Widely used in current applications
 - Building blocks of XQuery
 - Excellent visual paradigm for GUIs



```
flights/airline[name='Delta']/flight[from='JFK'][to='LAX'][day='MON'][leg[to='LAS']]
```

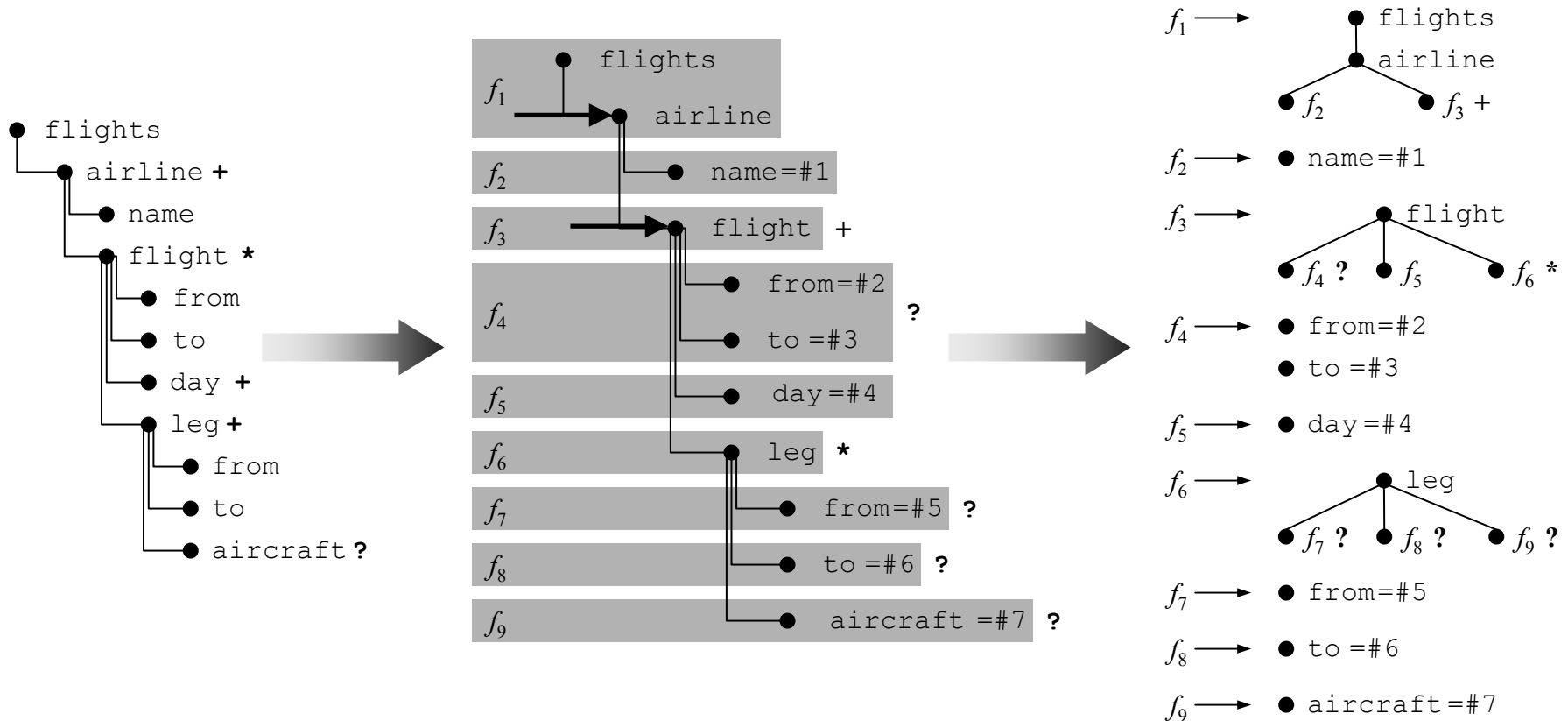
Query Set Specification Language

Query Set Specification



Query Set Specification Language

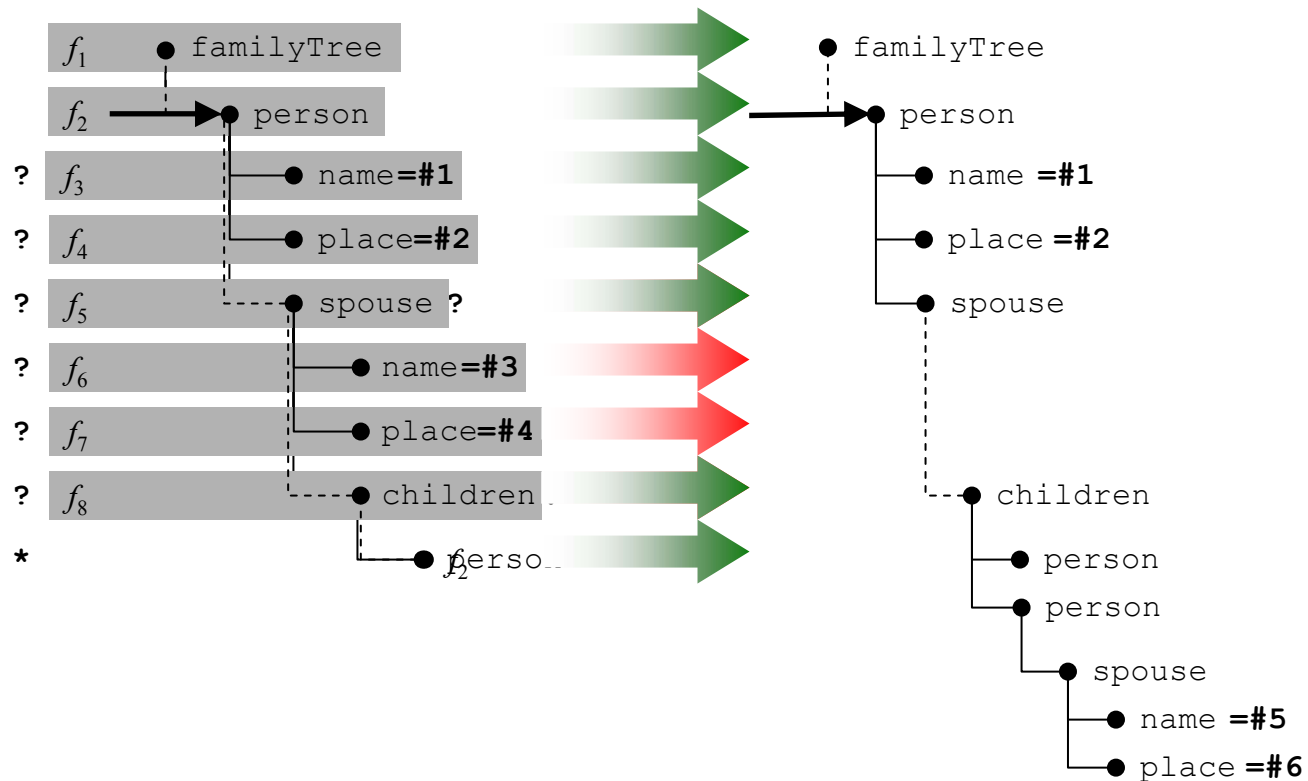
Query Set Specification



- Similar to extended context-free grammars

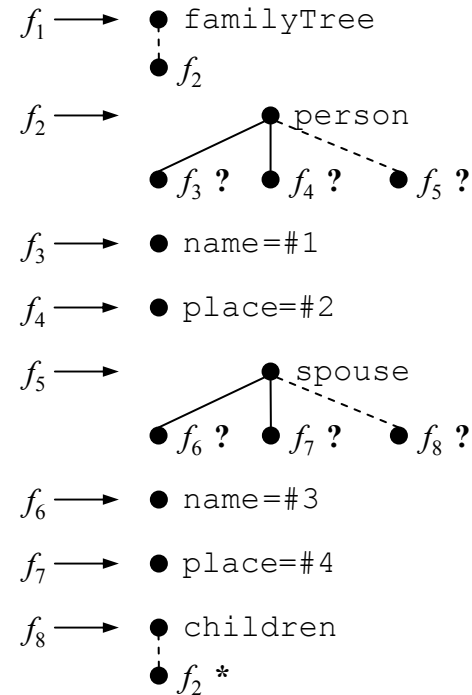
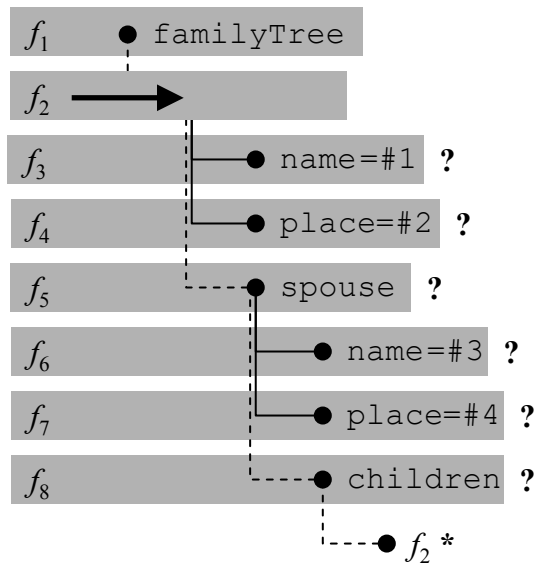
Query Set Specification Language

Recursive XML Schemas



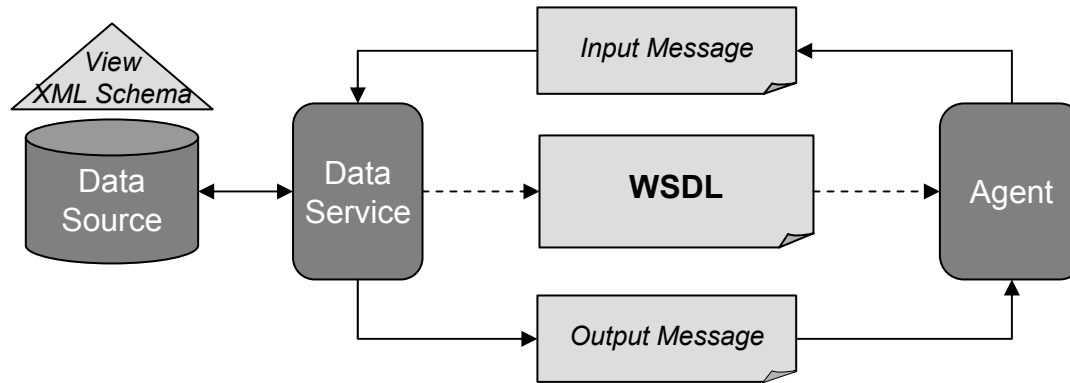
Query Set Specification Language

Recursive XML Schemas



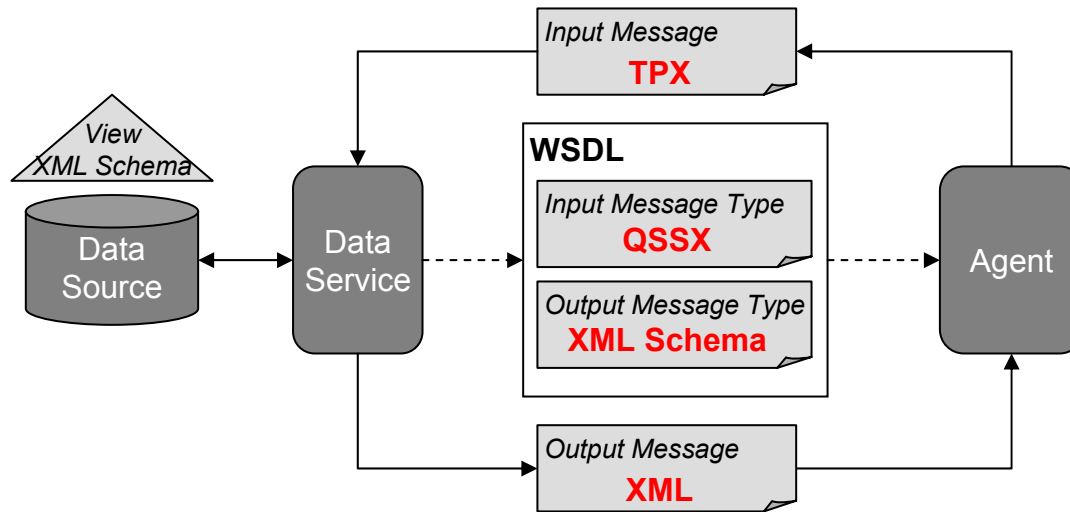
- QSS of fixed size

Data Services



- **Data Service** = WSDL + QSS
- A QSS deployed as a web service
- Exports the XML Schema of an XML view
- Connects the WSDL calls with the underlying database
- Receives queries that are encoded by QSS
- Explicit relationship between input and output

Data Services



- QSS is translated to XML Schema (QSSX)
- TP queries that are encoded as XML (TPX)
- Query result is described by an XML Schema

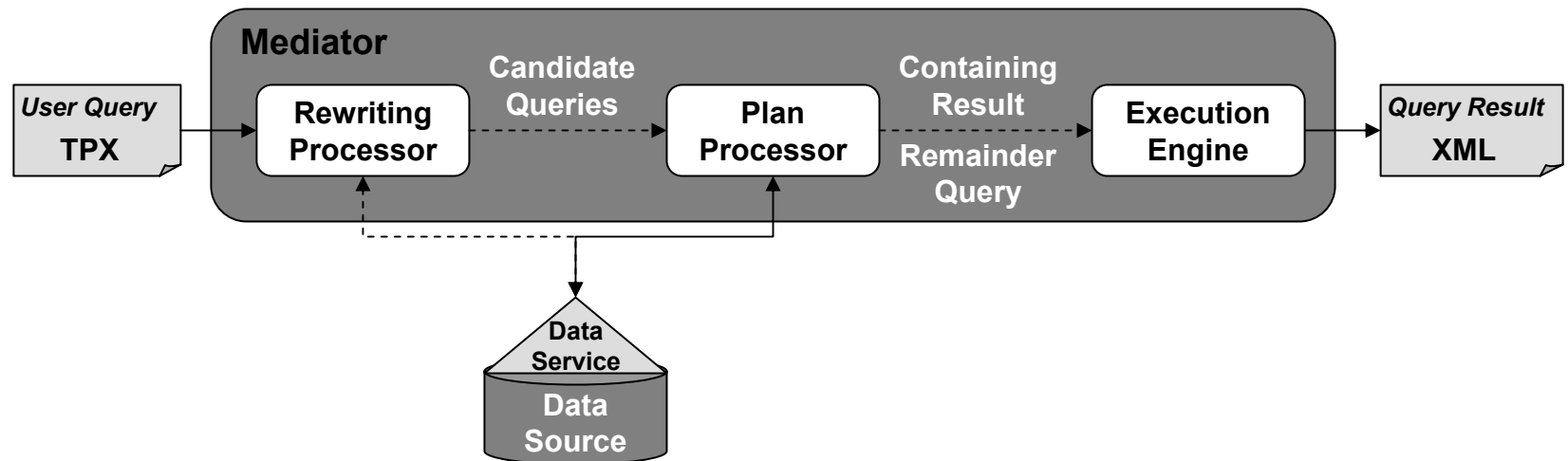
Data Services

Reasoning

1. Membership of a query in a data service
 2. Subsumption of data services
 3. Totality of a data service
 4. Overlap of data services
- These problems (except 1) are undecidable for context-free grammars
 - QSS can be translated to an equivalent top-down nondeterministic unranked tree automaton
 - Problems become decidable

Future Work

Capability-Based Rewriting



- Capability-based rewriting problem
 - Partial rewritings

Data Services

Authoring Interface

The screenshot shows the QSSX Editor interface for editing a flight data service. The main window displays a tree view of the EST Root structure. The 'airline' element is selected, and its children are visible: 'name = #0', 'flight', and 'leg'. The 'flight' element is further expanded to show 'to = #1', 'from = #2', 'day = #3', and 'leg'. The 'leg' element is expanded to show 'to = #4', 'from = #5', and 'aircraft = #6'. The 'airline' and 'flight' elements are highlighted in yellow, while 'leg' is highlighted in pink. The 'aircraft = #6' element is highlighted in green.

Selected Element Information:

Name:
Occ:
Type:

Fragments:

Name	Multiplicity	Fragment Color
f1	1	Yellow
f2	1	Light Blue
f3	+	Light Green
f4	?	Pink
f5	1	Yellow
f6	*	Magenta
f7	?	Light Blue
f8	?	Light Green

Fragment Elements:

Name	Operator	Value
aircraft	=	#6

Query Forms and Reports

Requirements

- Handle semistructureness
 - Powerful query forms and reports
- Be declarative
 - Separate logic from presentation
- Visual interface for the developer
 - Programming should NOT be a requirement

Query Forms and Reports

Query Form and Report Pages - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Sensors

General

Manufacturer:

Sensing Distance:

Protection Rating 1:

Protection Rating 2:

Operating Temperature: to

Mechanical

Body Type:






Dimension X:

Dimension Y:

Results

Results/page:

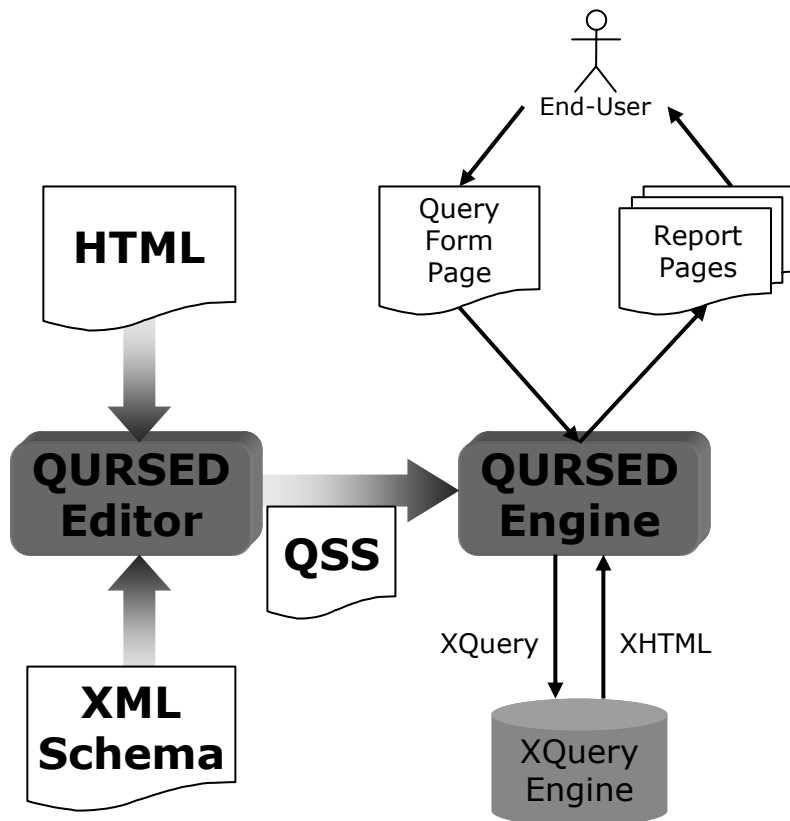
Sort By Options: Sensing Distance

Next 10				Previous 10	
Image	Manufacturer	Part Number	Protection Ratings	Sensing Distance mm	Body Type
	<input type="text" value="All"/>		<input type="text" value="All"/>	<input type="text" value="All"/>	
	<input type="text" value="All"/> <input type="text" value="Balluff"/> <input type="text" value="Turck"/>	BC 3-M12-AN6X	NEMA1 NEMA3 NEMA4	6.0	Cylindrical Diameter mm Barrel Style 15 Smooth
	Turck	BC 3-M12-AP6X	NEMA3	6.0	Cylindrical Diameter mm Barrel Style 19 Smooth
	Turck	BC 5-Q08-AN6X2	NEMA3 NEMA4	7.0	Rectangular Height mm Width mm 14 9
	Turck	BC 5-Q08-AP6X2	NEMA3 NEMA6 NEMA11	7.5	Rectangular Height mm Width mm 10 35
	Turck	BC 5-S18-AN4X		10.0	Rectangular Height mm Width mm 15 10
	Turck	BC 5-S18-AP4X	NEMA1 NEMA3	10.6	Rectangular Height mm Width mm

My Computer

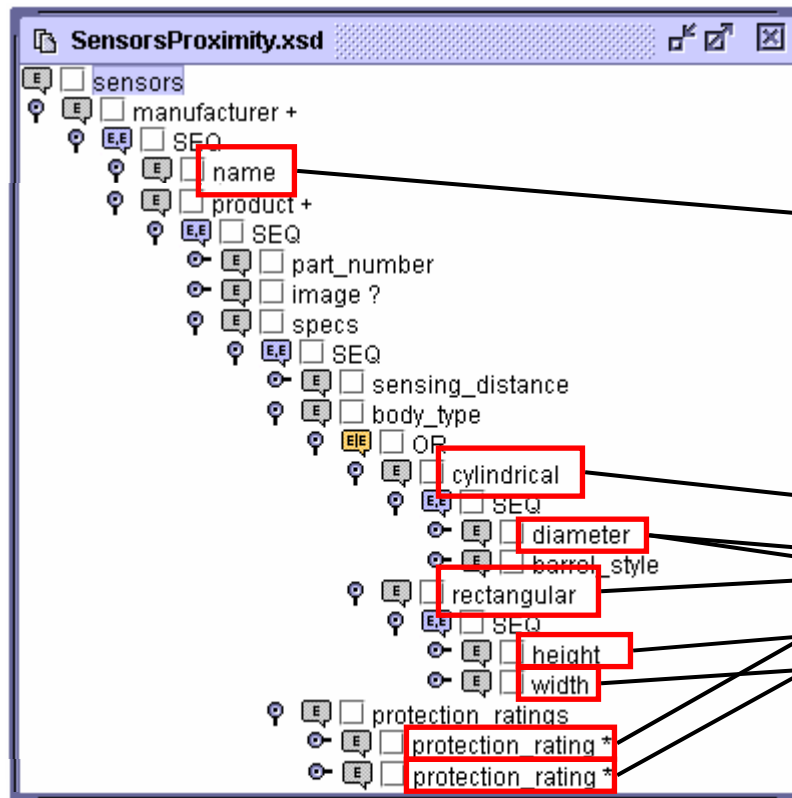
Query Forms and Reports

QURSED Approach



- XML Schema-driven
- Declarative!
 - Separation of content & presentation
- Editor
 - Visual actions to declarative specifications
 - Automatic construction of report pages
- Query Set Specification (QSS)
 - Large set of parameterized queries
 - Compact representation
- Engine
 - Automatic query formulation
 - Direct result construction

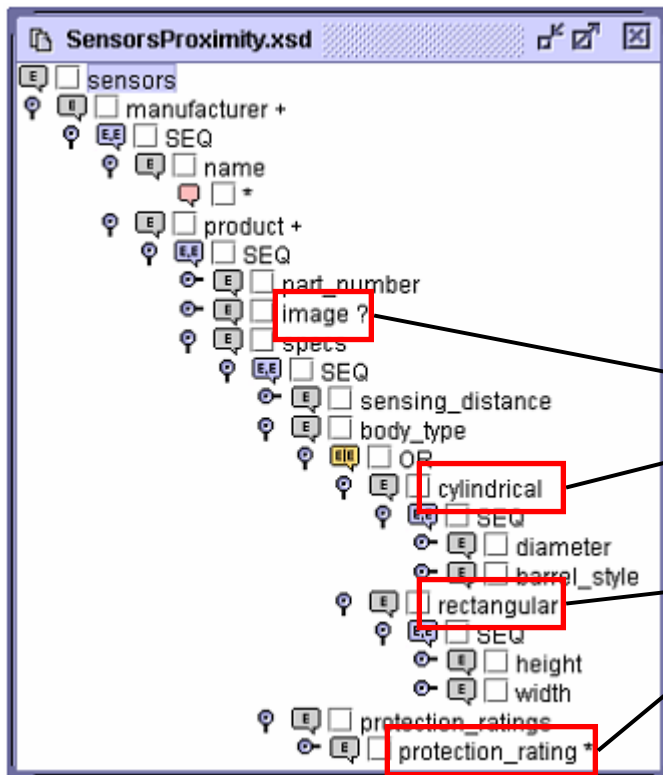
Developing Query Forms from the XML Schema



The screenshot shows a web application titled "Query Form and Report Pages". The form is for "Sensors" and is divided into several sections:

- General**:
 - Manufacturer: A dropdown menu with options "No preference", "Balluff", "Baumer", and "Turck". "Turck" is selected and highlighted with a red box.
 - Sensing Distance: A text input field containing "6" and a dropdown menu with "mm".
 - Protection Rating: A dropdown menu with "No preference" selected and highlighted with a red box.
 - Protection Rating: A second dropdown menu with "No preference" selected and highlighted with a red box.
 - Operating Temperature: A dropdown menu with "°C" selected.
- Mechanical**:
 - Body Type: A dropdown menu with "Rectangular" selected and highlighted with a red box.
 - Height: A text input field and a dropdown menu with "mm".
 - Width: A text input field and a dropdown menu with "mm".
- Results**:
 - Results/page: A dropdown menu with "10" selected.
 - Sort By Options: A dropdown menu with "Sensing Distance" selected and a "DESC" button.
 - DESC-Manufacturer: A dropdown menu with "up" and "dn" buttons.
 - Buttons: "Reset" and "Execute" buttons.






Developing Reports from the XML Schema



C:\Documents and Settings\Administrator.ALEXANDROS\Desktop\example\Results3.htm - Micr...

File Edit View Favorites Tools Help

Next 10 Previous 10

Image	Manufacturer	Part Number	Protection Ratings	Sensing Distance mm	Body Type
	Turck	BC 3-M12-AN6X	NEMA1 NEMA3 NEMA4	6.0	Cylindrical Diameter mm Barrel Style 15 Smooth
	Turck	BC 3-M12-AP6X	NEMA3	6.0	Cylindrical Diameter mm Barrel Style 19 Smooth
	Turck	BC 5-Q08-AN6X2	NEMA3 NEMA4	7.0	Rectangular Height mm Width mm 14 9
	Turck	BC 5-Q08-AP6X2	NEMA3 NEMA6 NEMA11	7.5	Rectangular Height mm Width mm 10 35
	Turck	BC 5-S18-AN4X		10.0	Rectangular Height mm Width mm 15 10

My Computer

QURSED Editor

Building Query/Visual Association

The screenshot displays the QURSED Editor interface with several key components and annotations:

- Editor Window:** Contains a menu bar (File, View, Action, Deploy, Help) and toolbars for New, Open, Save, Build Report, and Deploy.
- Data Source(s):** Shows a tree structure for `SensorsProximity.xsd` with nodes like `sensors`, `manufacturer`, `name`, `product`, `part_number`, `image?`, `specs`, `sensing_distance`, `body_type`, `protection_ratings`, `protection_rating*`, and `operating_temp`. A blue arrow labeled **Data Path** points to the `name` node under `manufacturer`.
- Condition Fragments List:** A table listing condition fragments:

ID
manufacturer_name
protection_rating_1
protection_rating_2

A blue arrow labeled **Condition Fragment List** points to the `manufacturer_name` row.
- Form Control:** A tree structure on the right side, including `html`, `body`, `form`, `select`, and various options like `name`, `man_name_select`, `Baumer`, `Turck`, `prot_rating_1_select`, `NEMA3`, `prot_rating_2_select`, and `NEMA1`. A blue arrow labeled **Form Control** points to the `man_name_select` control.
- Expression Editor:** Located at the bottom, it has tabs for Arithmetic, Comparison, Boolean, Constant, and Custom. The `Comparison` tab is active, showing an expression: `sensors/manufacturer/name/* = man_name_select`. A blue arrow labeled **Predicate** points to the `=` operator.

QURSED Editor

Building Reports

The screenshot displays the QURSED Editor interface, which is used for building reports from XML data. The interface is divided into several panes:

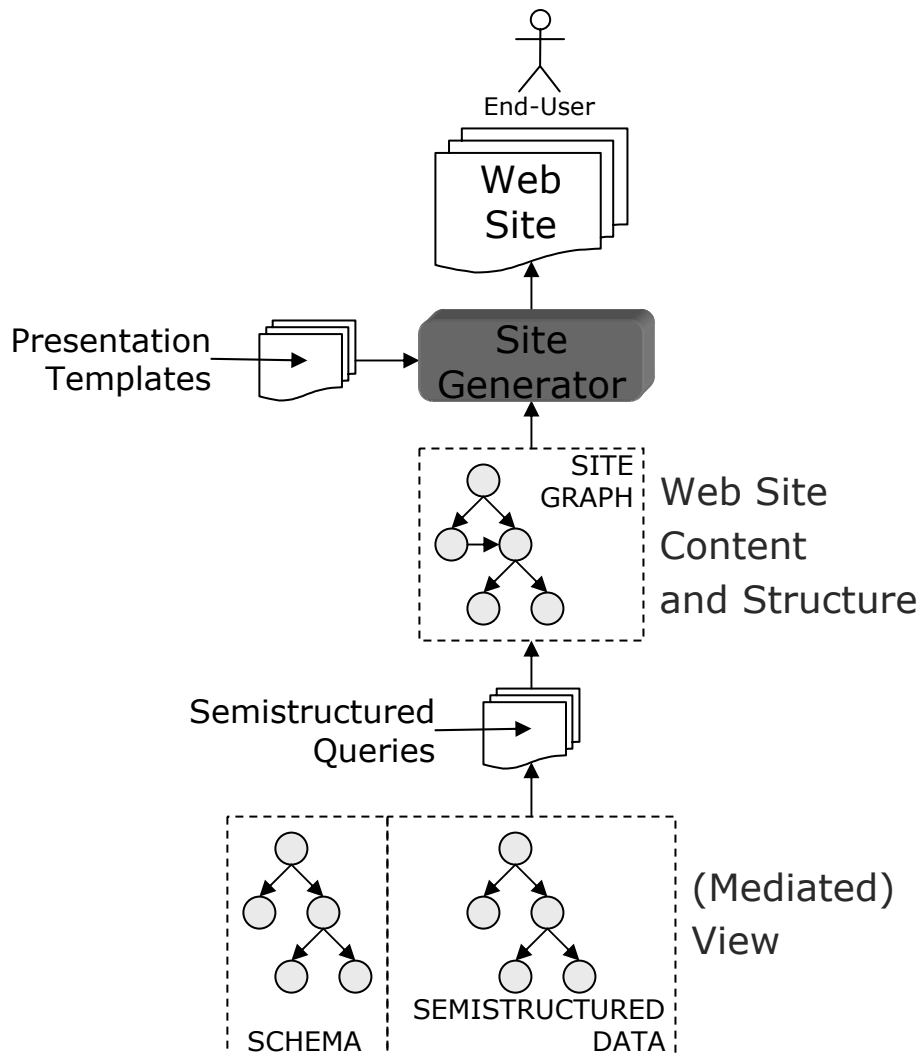
- Data Source(s):** Shows the XML structure of the data source, `SensorsProximity.xsd`. The tree includes elements like `sensors`, `manufacturer`, `product`, `part_number`, `image`, `specs`, `sensing_distance`, `body_type`, `cylindrical`, `diameter`, `barrel_style`, and `rectangular`. A blue box labeled "Elements to Appear on Report" points to the `manufacturer`, `product`, and `body_type` elements.
- Element Mappings:** A table showing the mapping of source elements to target report elements. A blue box labeled "Group By Mapping" points to the mapping of `/manufacturer/name` to `table_cell_1`. A blue box labeled "Element Mapping" points to the mapping of `/product/image` to `img_1`.
- GroupBy Mappings:** A table showing the mapping of source elements to target report elements, grouped by. The mappings are:

Source	Target
<code>sensors/manufacturer</code>	<code>table_row_1</code>
<code>.../manufacturer/prod...</code>	<code>table_row_2</code>
<code>.../product/image</code>	<code>img_1</code>
<code>.../body_type/cylindrical</code>	<code>table_row_3</code>
<code>/body_type/rectangu</code>	<code>table_row_4</code>
- SortBy Mappings:** A table showing the mapping of source elements to target report elements, sorted by. The table is currently empty.
- Query Form Page / Template Report Page:** Shows the resulting report structure, including `html`, `body`, `table`, `tr`, `td`, and `table_cell` elements. The structure is a table with rows and cells, where the content is populated from the data source.

More Features

- Structural disjunction
- Dependencies
- Sort-by options
- Template-driven construction of report pages
- Report customization
- Dynamic projection
- Online demo:
<http://www.db.ucsd.edu/qursed/>

Related work



- Data intensive Web site generators
 - Strudel
 - Forms as functions on edges/links
 - Araneus
 - Autoweb
- Declarative
- Separation of content, structure and presentation

Related work

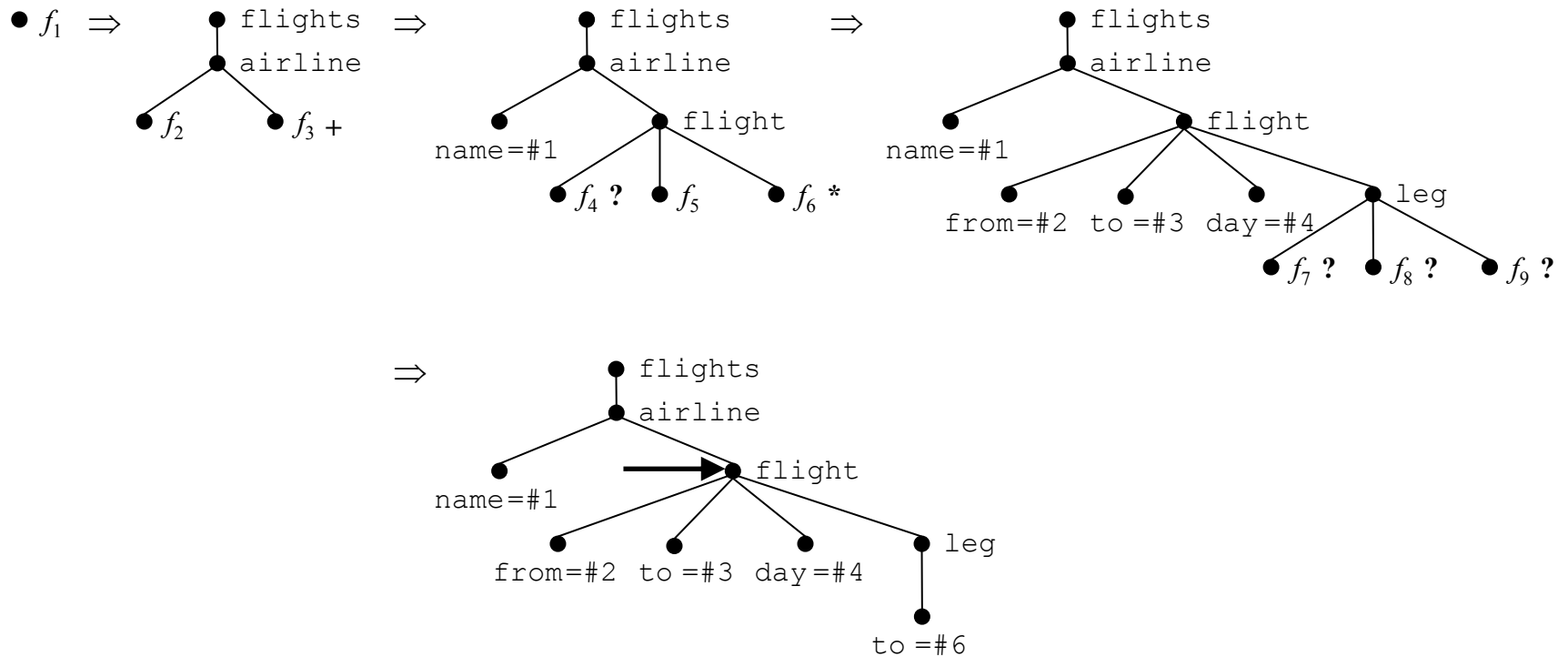
- Web-based Form and Report Generators
 - Macromedia Ultradev, Coldfusion, Microsoft Visual InterDev
 - Excellent for flat uniform relational tables
 - Visual query formulation paradigm allows the specification of projections, sort-bys, simple conditions
 - However, the development of form and report pages for semistructured data requires substantial programming effort
- Visual Querying Interfaces
 - EquiX, BBQ, VQBD, Lorel's DataGuide-driven GUI, PESTO
 - Excellent visual paradigm for the formulation of fairly complex queries
 - The goal is the development of a query or a query template
 - User needs to be familiar with database models and schemas

Questions and Answers

?

Query Set Specification Language

Example Derivation



Related Work

Capability-Based Rewriting

- Capabilities described as binding patterns
 - Adornments on view attributes
 - Negative approach
- Expansions of Datalog programs
 - Recursive programs → Infinite queries
 - Positive approach
- Capability-based rewriting problem
 - Total rewritings only

QURSED System Architecture

