

Web Services Interfaces

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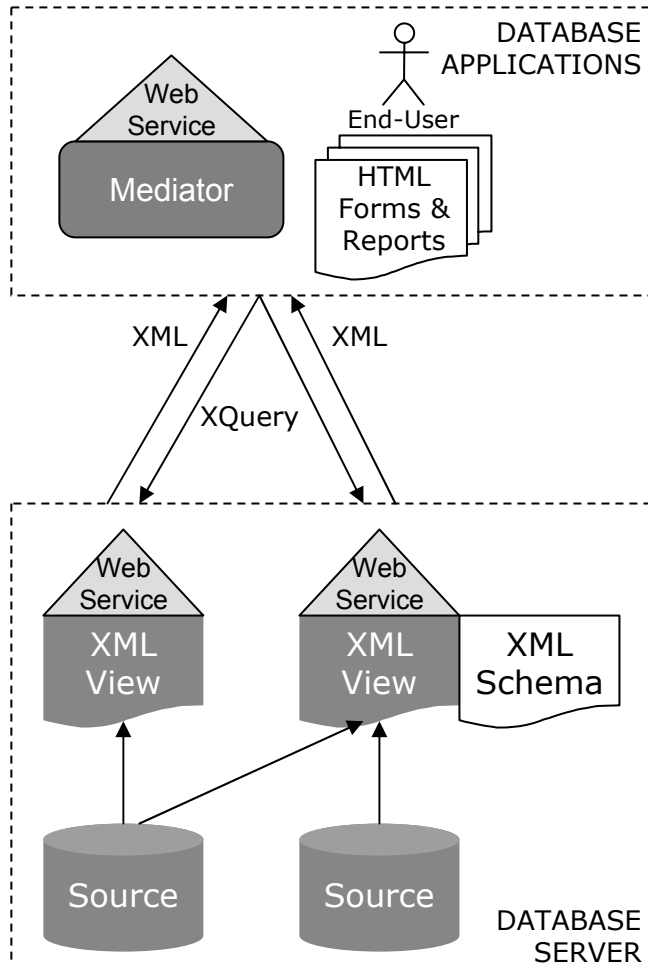
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Exporting DBMSs on the Web



- 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

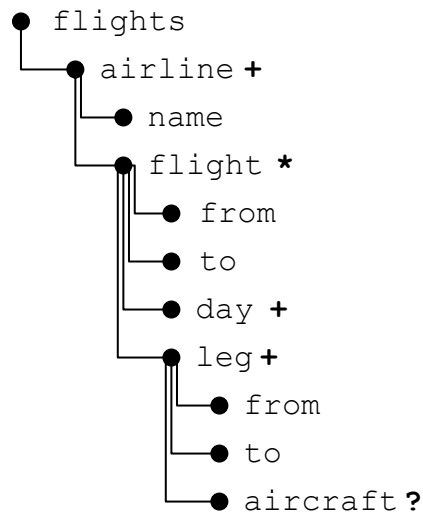
- Query Set Specification Language (QSSL)
 - Describes Parameterized Tree Pattern (TP) Queries
- Data Services
 - Web Services for Query Capabilities
- Forms & Reports for Semistructured Data
 - The QURSED system
- Authoring Interfaces

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

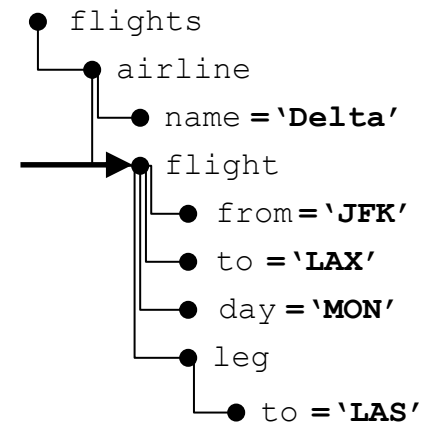


- Any combination of the following conditions on:
 - the name of the airline company
 - the origin and destination of one or more flights (optional)
 - a day of the week
 - the origin of zero or more legs (optional)
 - the destination of zero or more legs (optional)
 - the aircraft used for zero or more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

Query Set Specification Language

Query Language

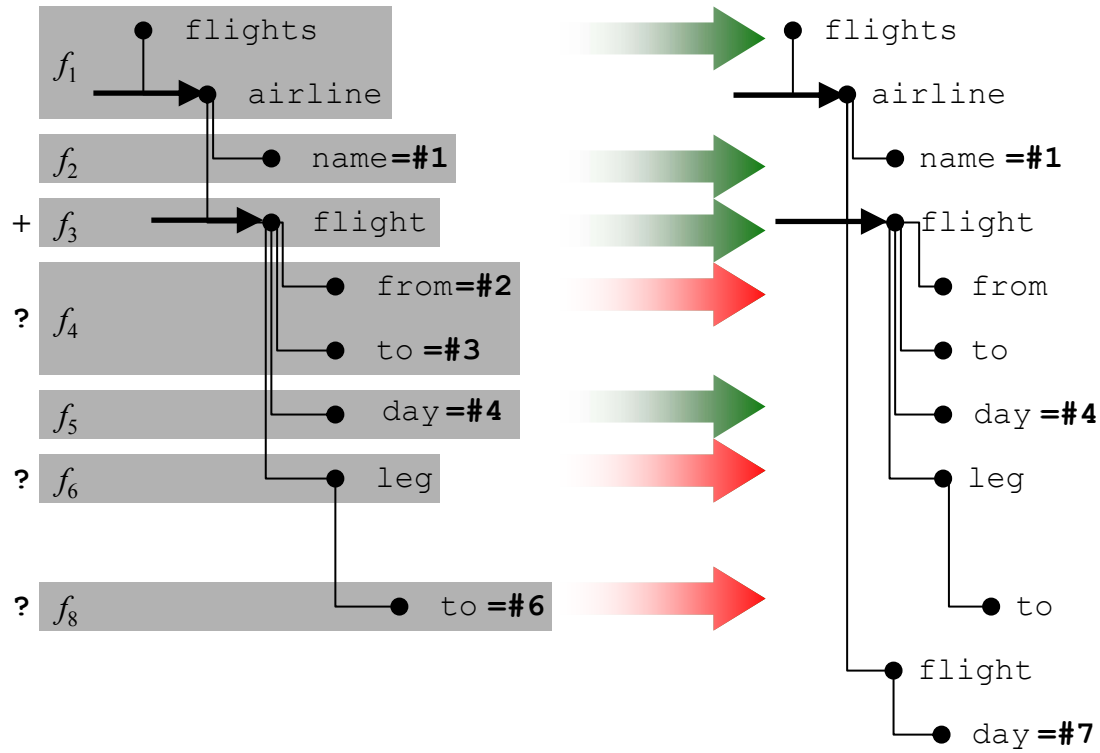
- Tree Pattern Queries:
 - Acyclic XPath expressions consisting of:
 - node tests
 - child axis '/'
 - descendant axis '//'
 - predicates '['']
 - Widely used in current applications
 - Building blocks of XQuery
 - Excellent visual paradigm for GUIs



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

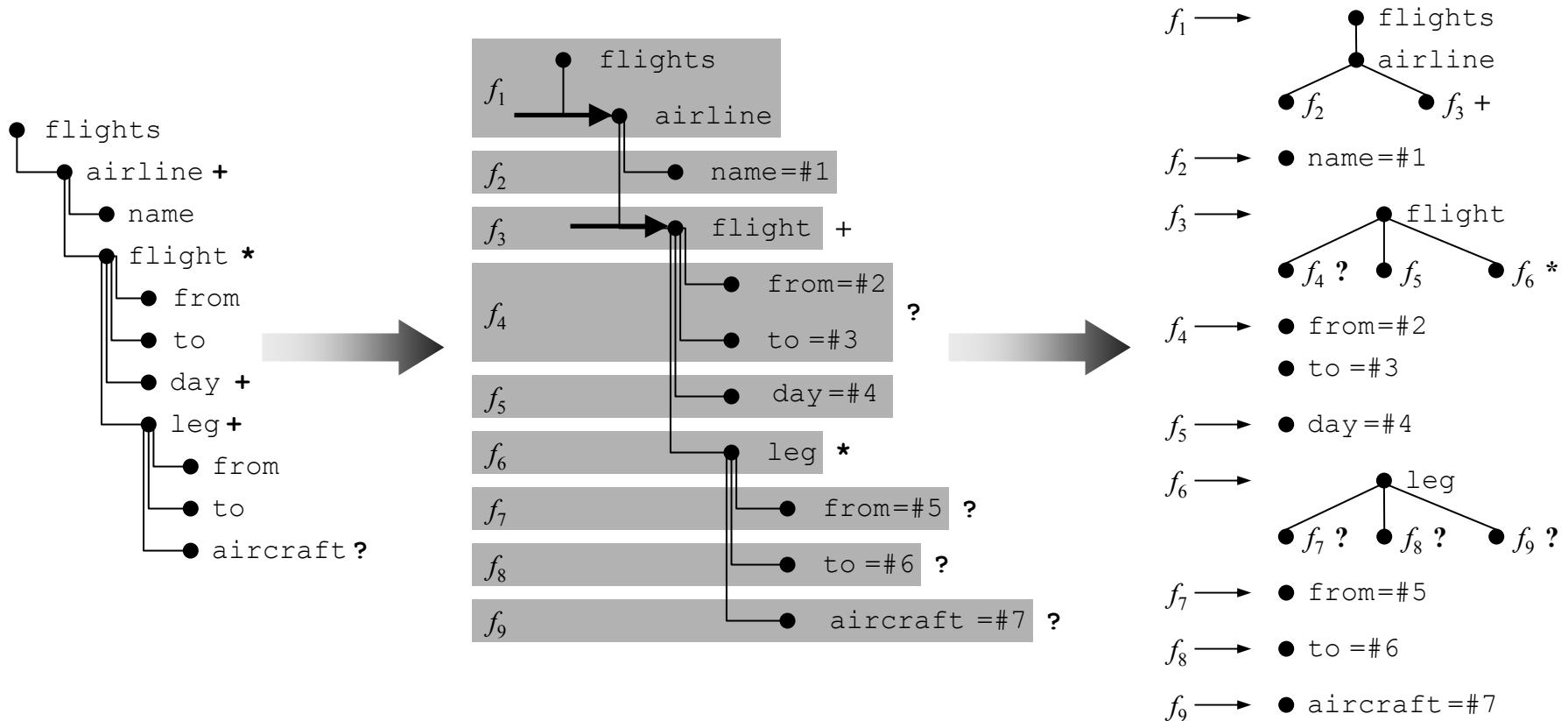
Query Set Specification Language

Query Set Specification



Query Set Specification Language

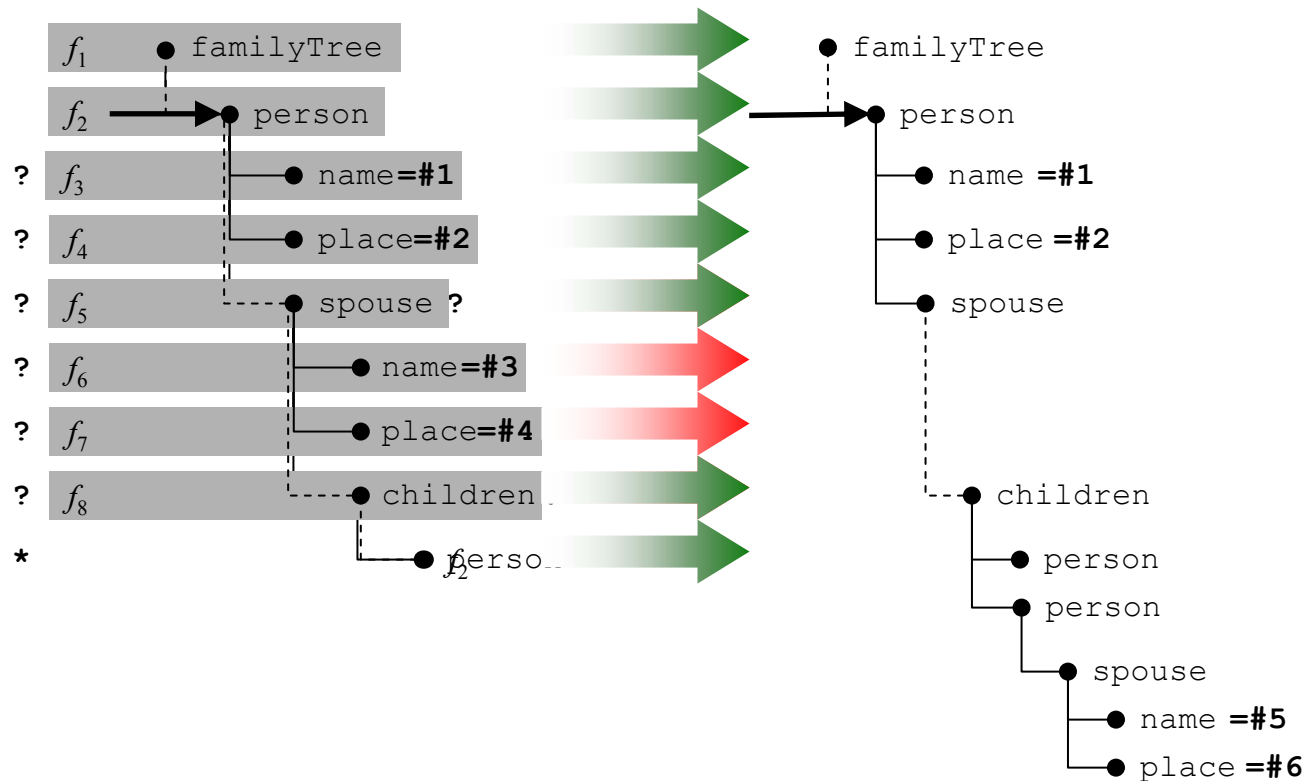
Query Set Specification



- Similar to extended context-free grammars

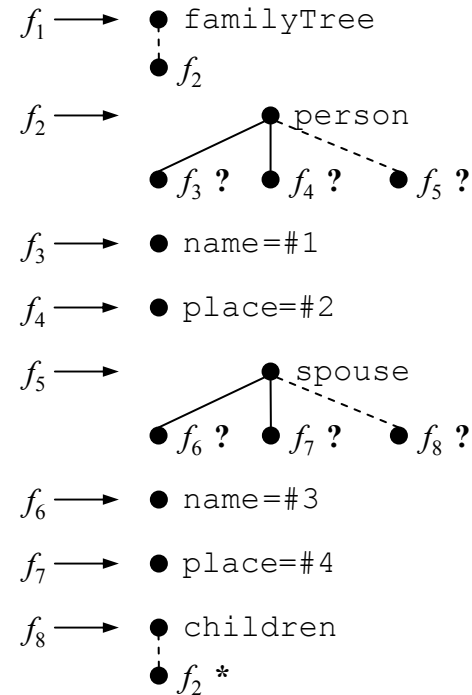
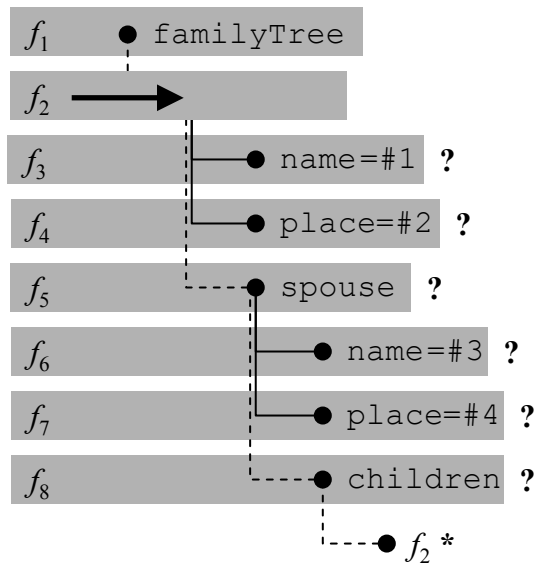
Query Set Specification Language

Recursive XML Schemas



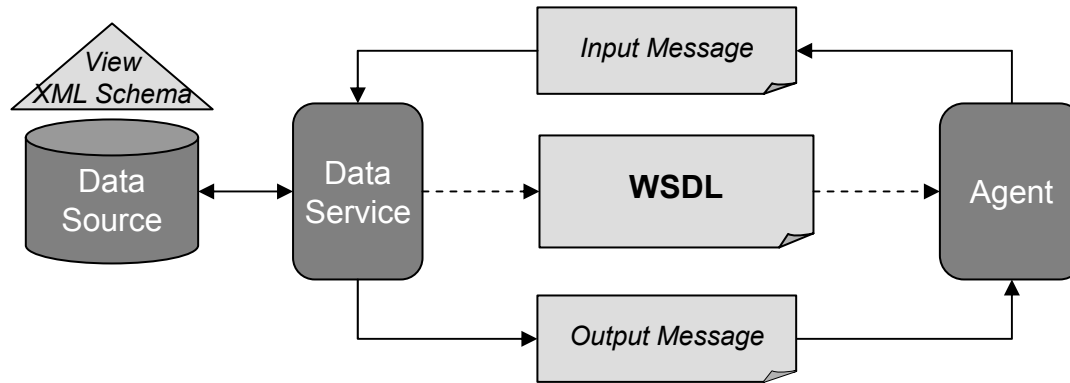
Query Set Specification Language

Recursive XML Schemas



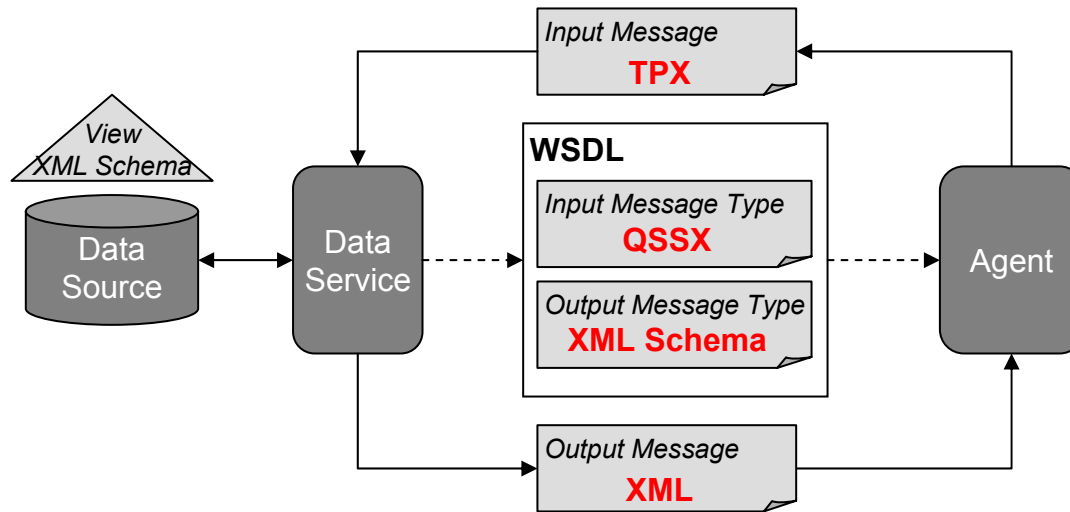
- QSS of fixed size

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

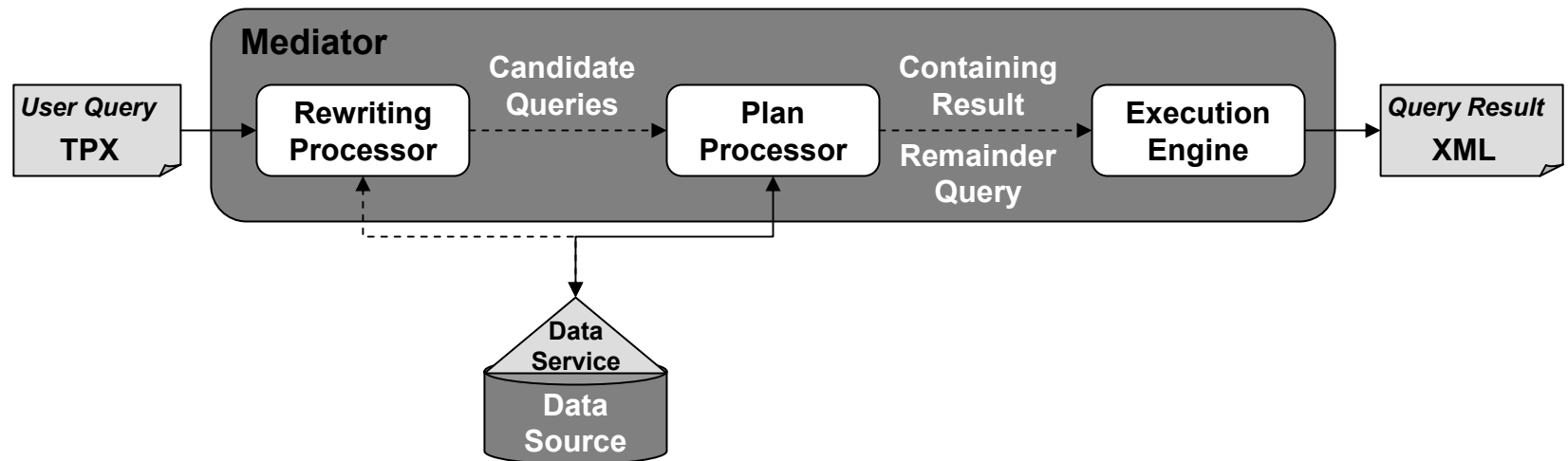
Data Services

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 flight data. The main window displays a tree view of the data structure, with the 'airline' element selected. The 'Selected Element Information' panel on the right provides details for the selected element and lists available fragments.

QSSX Editor - (flights.qxl)

File Action

Tree View:

- EST Root
 - flights
 - airline
 - name = #0
 - flight
 - to = #1
 - from = #2
 - day = #3
 - leg
 - to = #4
 - from = #5
 - aircraft = #6

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	?	Cyan
f8	?	Light Green

Buttons: New Fragment, Edit Fragment, Delete Fragment

Fragment Elements:

Name	Operator	Value
aircraft	=	#6

Buttons: Bind Value to Element, Delete Fragment Element

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:

- Balluff
- Baumer
- Turck

Sensing Distance:

Protection Rating 1:

Protection Rating 2:

Operating Temperature: to °C

Mechanical

Body Type:

Dimension X:

Dimension Y:







Results

Results/page:

Sort By Options: Sensing Distance

- DESC-Manufacturer
-

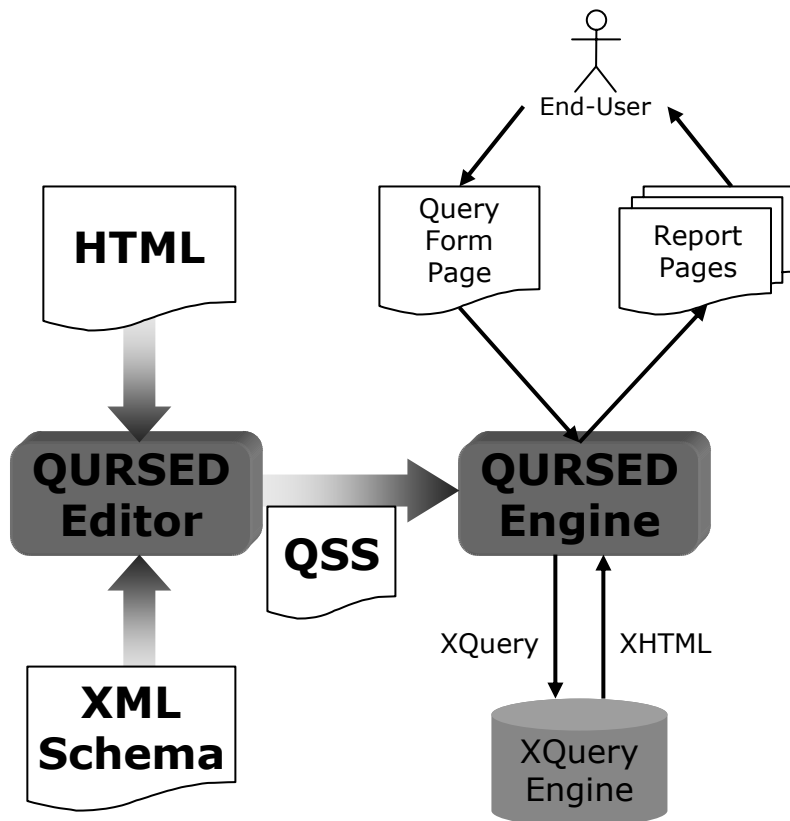
Next 10
Previous 10

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

My Computer

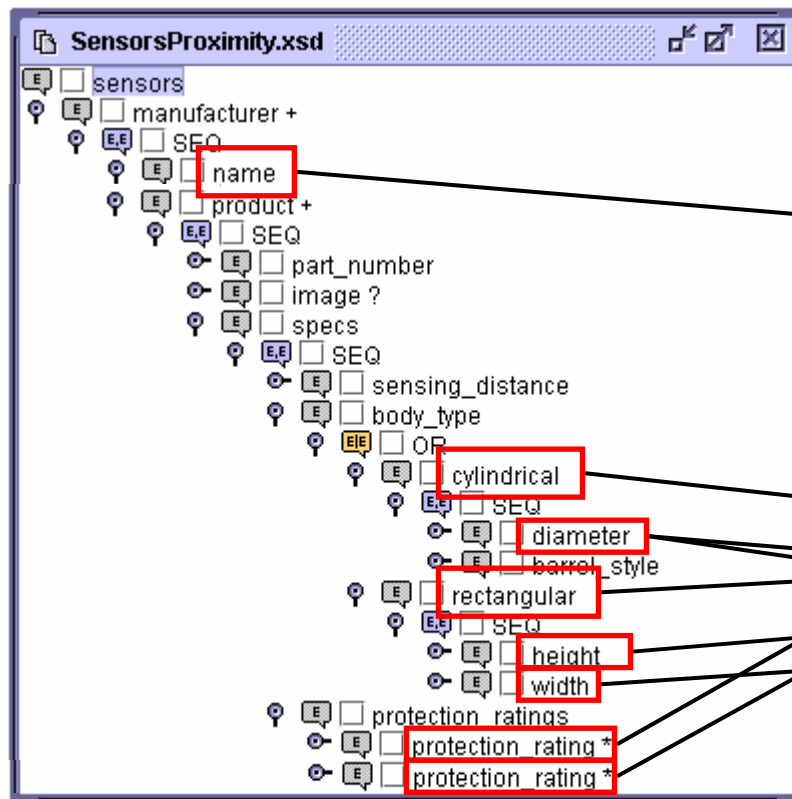
Query Forms and Reports

QURSED Approach



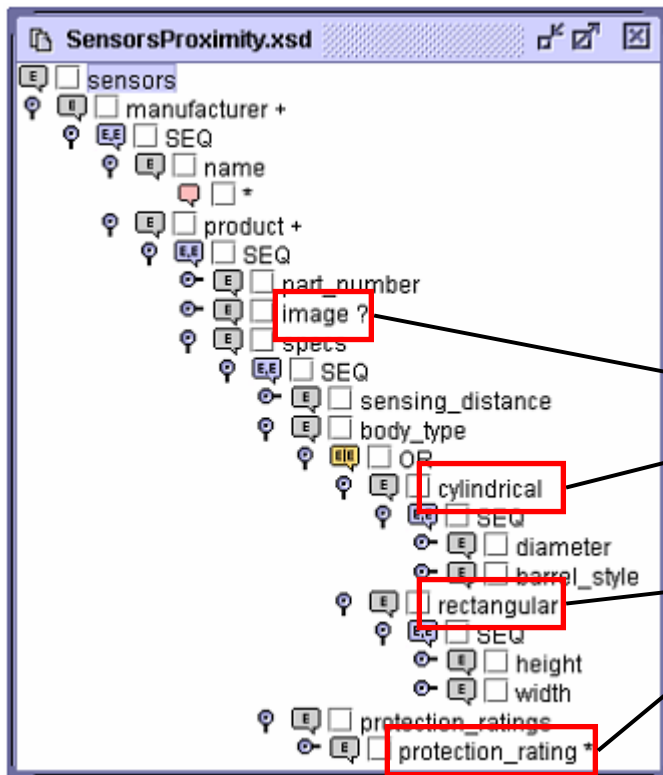
- XML Schema-driven
- Declarative!
 - Separation of content & presentation
- Editor
 - Visual actions to declarative specifications
 - Automatic construction of report pages
- Query Set Specification (QSS)
 - Large set of parameterized queries
 - Compact representation
- Engine
 - Automatic query formulation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

Developing Query Forms from the XML Schema



The screenshot shows a web application window titled "Query Form and Report Pages - ...". The application has a menu bar with "File", "Edit", "View", "Favorites", and "Tool". The main content area is titled "Sensors" and contains a "General" section with the following fields: "Manufacturer" (a dropdown menu with "No preference", "Balluff", "Baumer", and "Turck" selected), "Sensing Distance" (a text input with "6" and a "mm" dropdown), "Protection Rating" (a dropdown menu with "No preference" selected), and "Protection Rating" (another dropdown menu with "No preference" selected). Below these is an "Operating Temperature" section with a "to" label and a "°C" dropdown. The "Mechanical" section contains "Body Type" (a dropdown menu with "Rectangular" selected), "Height" (a text input with "mm" dropdown), and "Width" (a text input with "mm" dropdown). The "Results" section contains "Results/page" (a dropdown menu with "10" selected), "Sort By Options" (a dropdown menu with "Sensing Distance" selected and "DESC" dropdown), and "DESC-Manufacturer" (a dropdown menu with "up" and "dn" buttons). At the bottom are "Reset" and "Execute" buttons. The Windows taskbar at the bottom shows "My Computer".






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	
	Turck	BC 3-M12-AP6X	NEMA3	6.0	Diameter mm	Barrel Style
					15	Smooth
	Turck	BC 5-Q08-AN6X2	NEMA3 NEMA4	7.0	Cylindrical	
					Diameter mm	Barrel Style
					19	Smooth
	Turck	BC 5-Q08-AP6X2	NEMA3 NEMA6 NEMA11	7.5	Rectangular	
					Height mm	Width mm
					14	9
	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:

- Condition Fragment List:** A blue callout box points to the 'Condition Fragments' table in the central pane. The table lists fragments: ID, manufacturer_name, protection_rating_1, and protection_rating_2.
- Data Path:** A blue callout box points to the 'SensorsProximity.xsd' data source tree on the left, specifically to the 'manufacturer' node.
- Form Control:** A blue callout box points to the 'man_name_select' control within the 'select' form in the 'Query Form Page' on the right.
- Predicate:** A blue callout box points to the 'Expression Editor' at the bottom, which shows the predicate: `sensors/manufacturer/name/* = man_name_select`.

The interface includes a menu bar (File, View, Action, Deploy, Help) and a toolbar with icons for New, Open, Save, Build Report, and Deploy. The 'Expression Editor' has tabs for Arithmetic, Comparison, Boolean, Constant, and Custom, with the 'Comparison' tab selected.

QURSED Editor

Building Reports

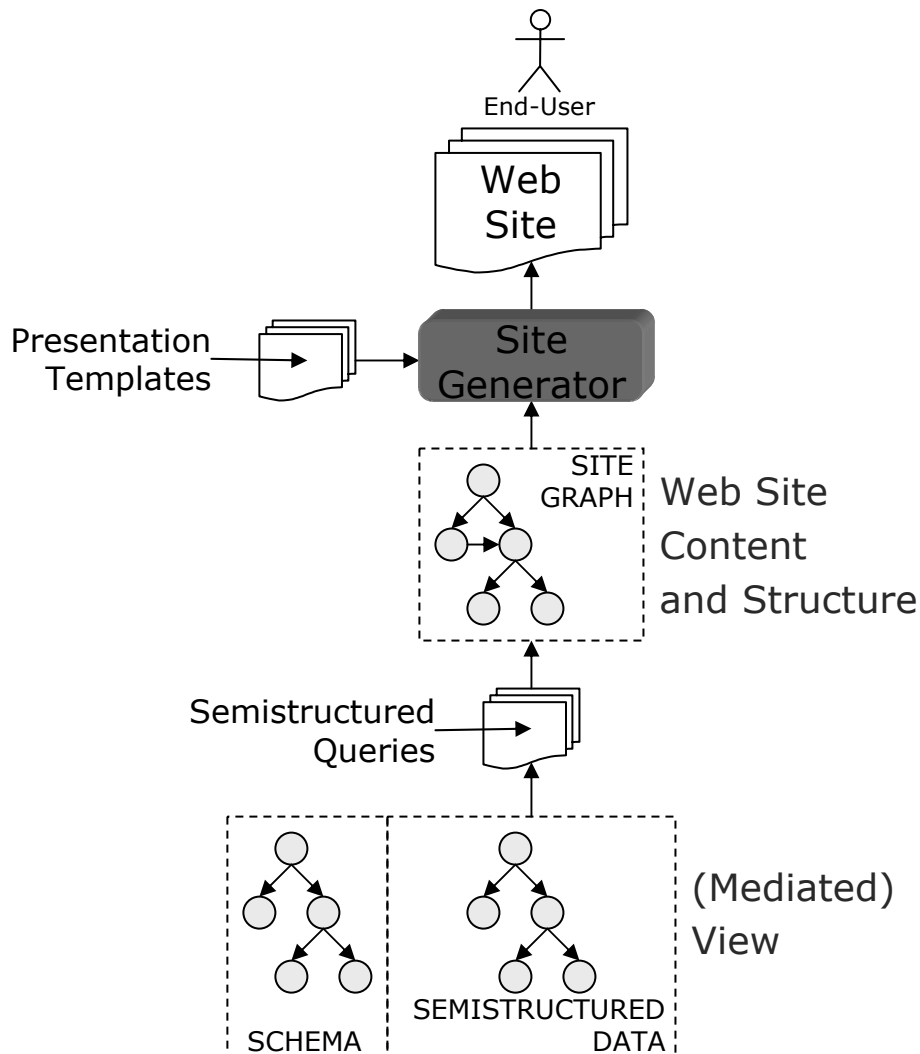
The screenshot displays the QURSED Editor interface, which is used for building reports from data sources. The interface is divided into several panes:

- 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.
- Query Form:** Contains three mapping tables:
 - Element Mappings:** Maps source elements to target report elements. For example, `/manufacturer/name*` maps to `table_cell_1`, `.../part_number*` maps to `table_cell_2`, `.../product/image*` maps to `img_1`, `.../sensing_distance*` maps to `table_cell_3`, and `/diameter*` maps to `table_cell_4`.
 - GroupBy Mappings:** Maps source elements to target report elements. For example, `sensors/manufacturer` maps to `table_row_1`, `.../manufacturer/prod...` maps to `table_row_2`, `.../product/image*` maps to `img_1`, `.../body_type/cylindrical` maps to `table_row_3`, and `/body_type/rectangu` maps to `table_row_4`.
 - SortBy Mappings:** Currently empty.
- Report:** Shows the resulting report structure, including `html`, `body`, `table`, `tr`, `td`, and `table_cell` elements. A blue box labeled "Group By Mapping" points to the `tr` element, and another blue box labeled "Element Mapping" points to the `td` element.

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

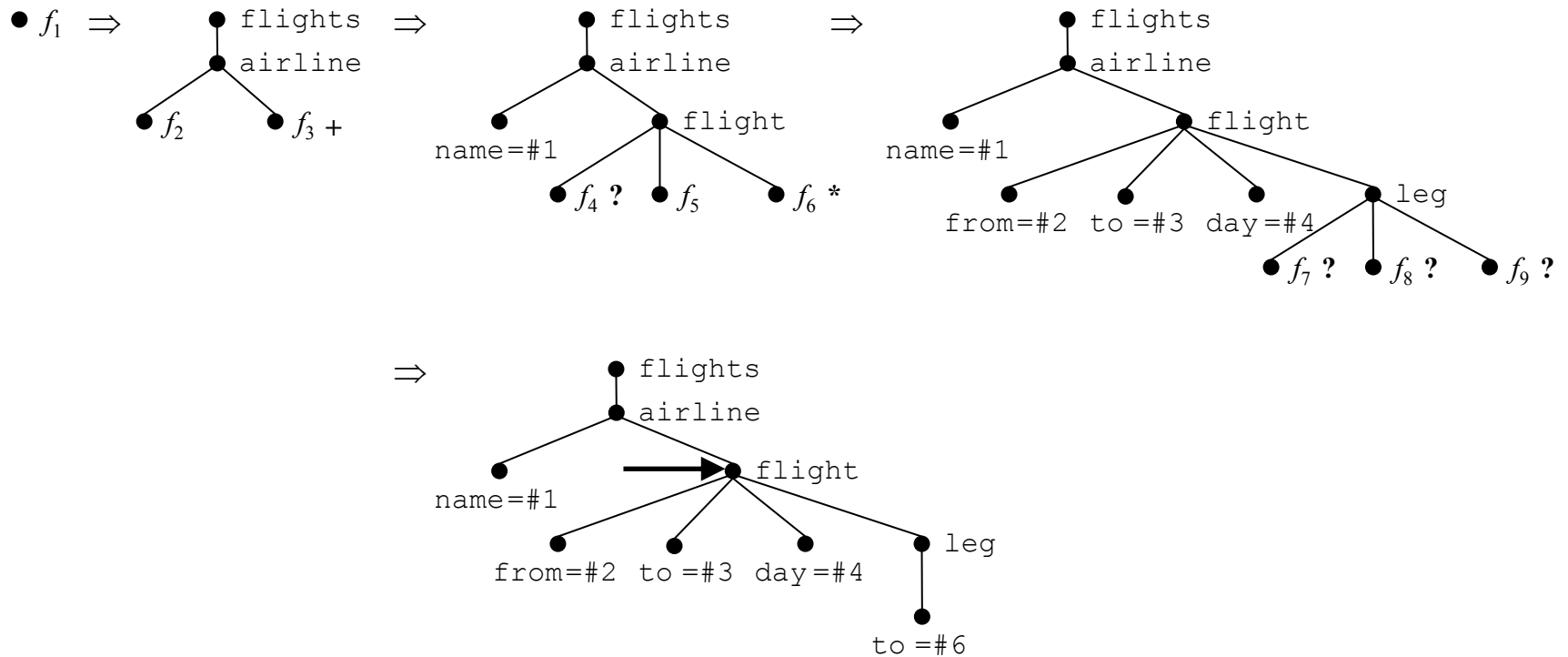
- Web-based Form and Report Generators
 - Macromedia Ultradev, Coldfusion, Microsoft Visual InterDev
 - Excellent for flat uniform relational tables
 - Visual query formulation paradigm allows the specification of projections, sort-bys, simple conditions
 - However, the development of form and report 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

