Web Services Interfaces

Michalis Petropoulos
Alin Deutsch
**Yannis Papakonstantinou**
Vasilis Vassalos
Scott Mitchell
UNIVERSITY OF CALIFORNIA, SAN DIEGO

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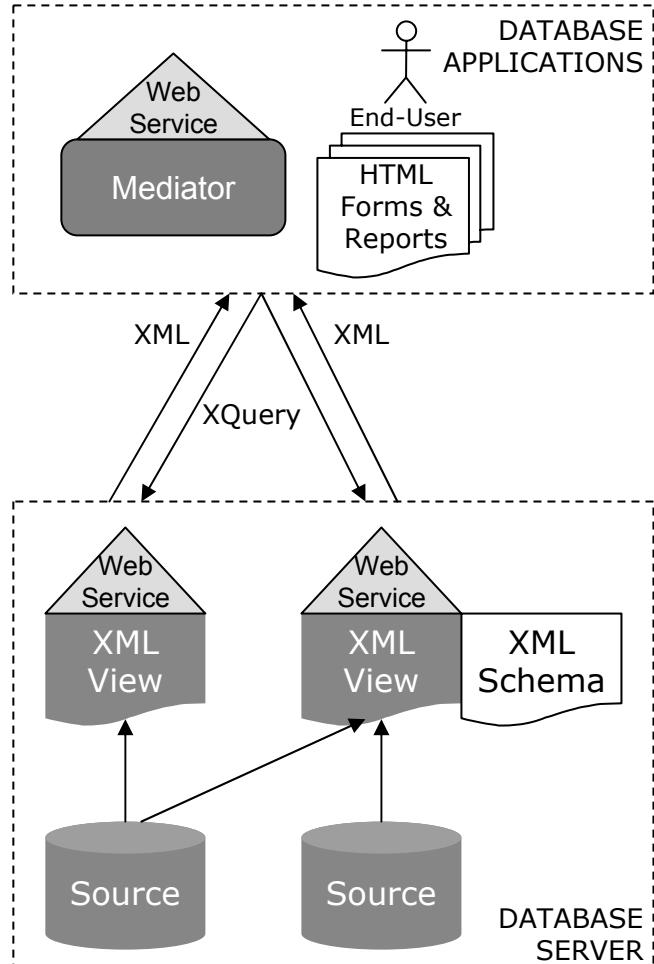
- Exporting Query Capabilities on the Web
  - Web Services (Function Signatures)
- Integrating Web Applications
  - Use Web Services
  - Export Query Capabilities Themselves
- HTML Web Interfaces (Forms & Reports)

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

```
●  flights
    ●  airline +
        ●  name
        ●  flight *
            ●  from
            ●  to
            ●  day +
            ●  leg +
                ●  from
                ●  to
                ●  aircraft ?
```
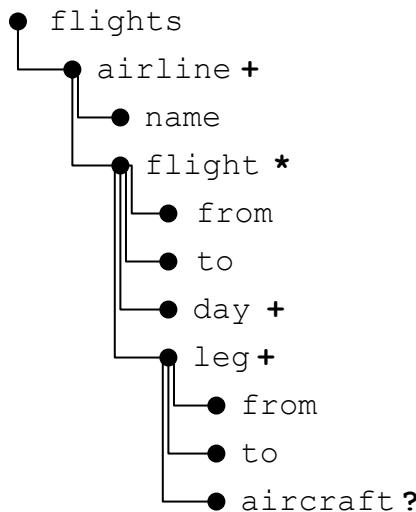
- Any combination of the following conditions on:
  - the name of the airline company
  - the origin and destination of one or more flights (optional)
  - a day of the week
  - the origin of zero or more legs (optional)
  - the destination of zero or more legs (optional)
  - the aircraft used for zero 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'
```
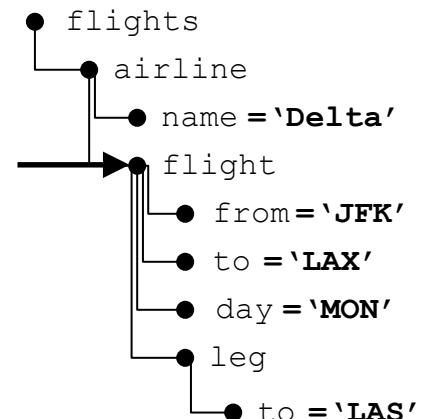
flights/airline[name='Delta']/flight[from='JFK'][to='LAX'][day='MON'][leg[to='LAS']]

Query Set Specification Language

Query Set Specification

Query Set Specification
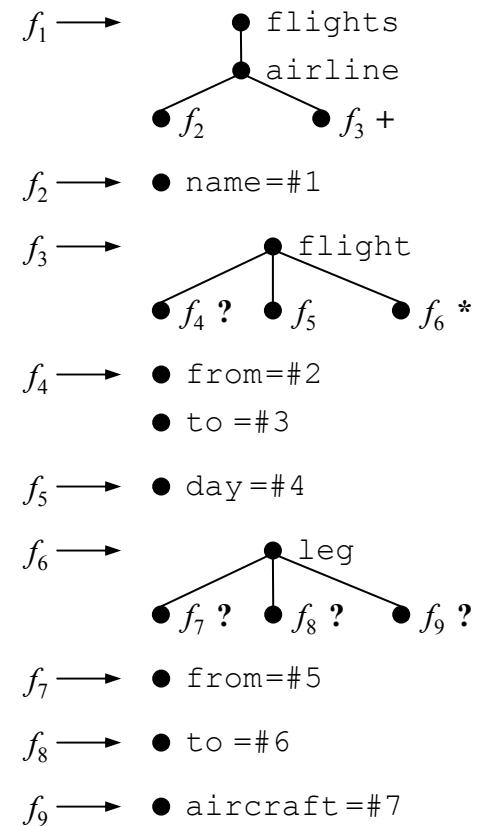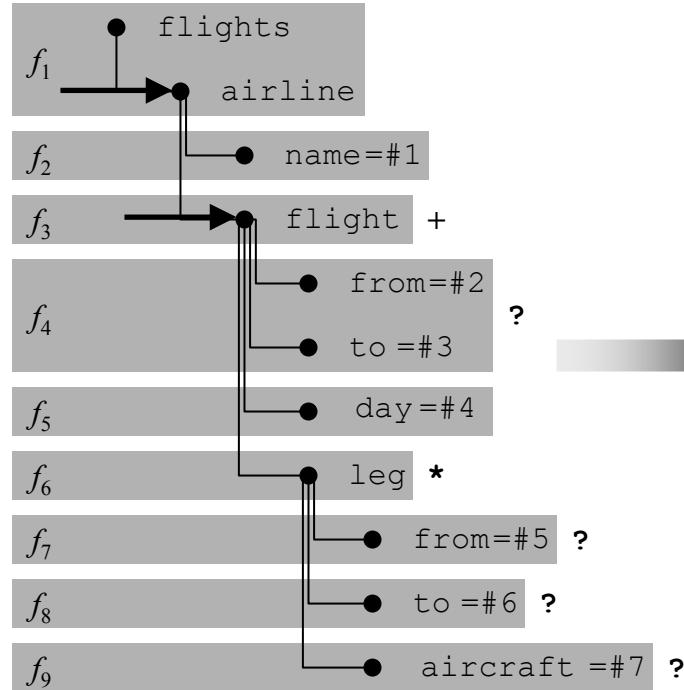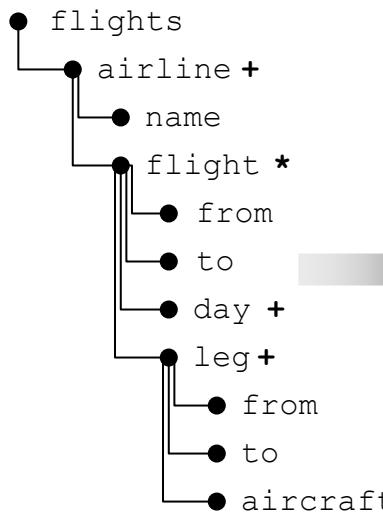
- Similar to extended context-free grammars

Query Set Specification Language

Recursive XML Schemas
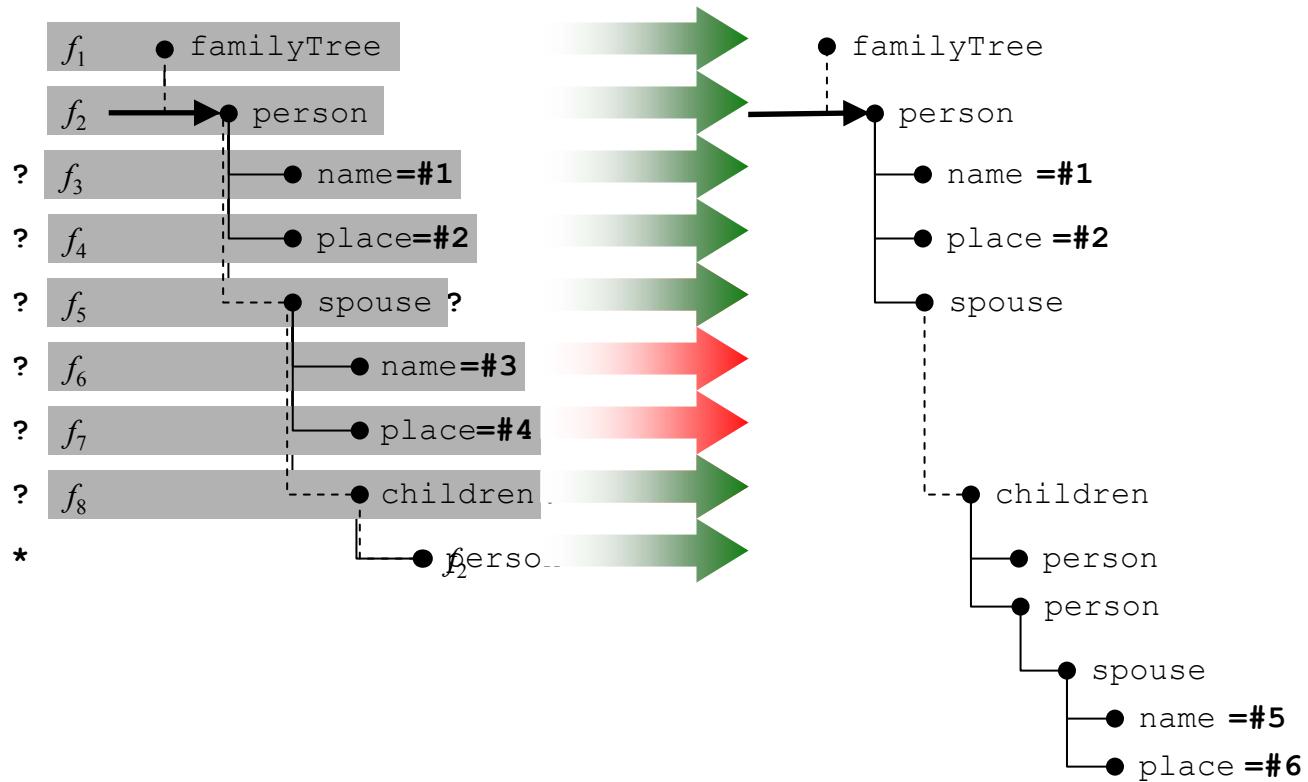
Query Set Specification Language

Recursive XML Schemas
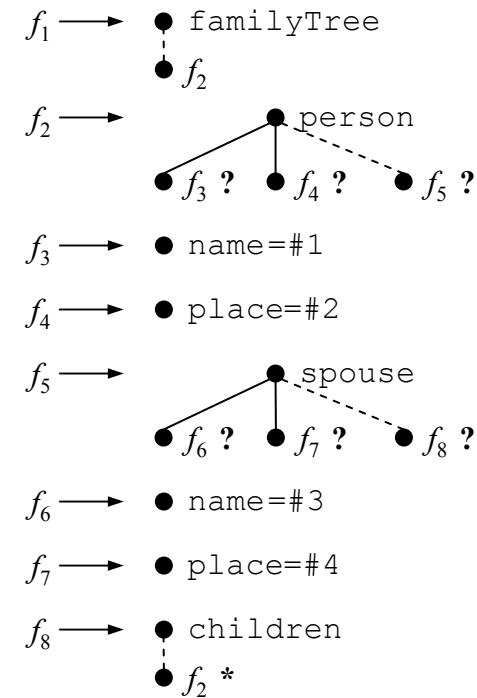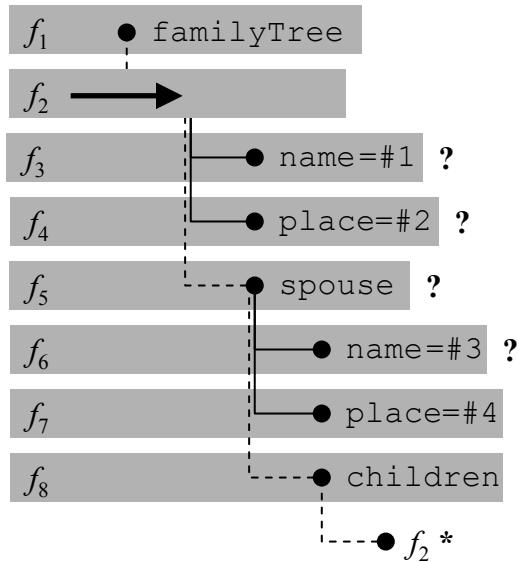
- QSS of fixed size

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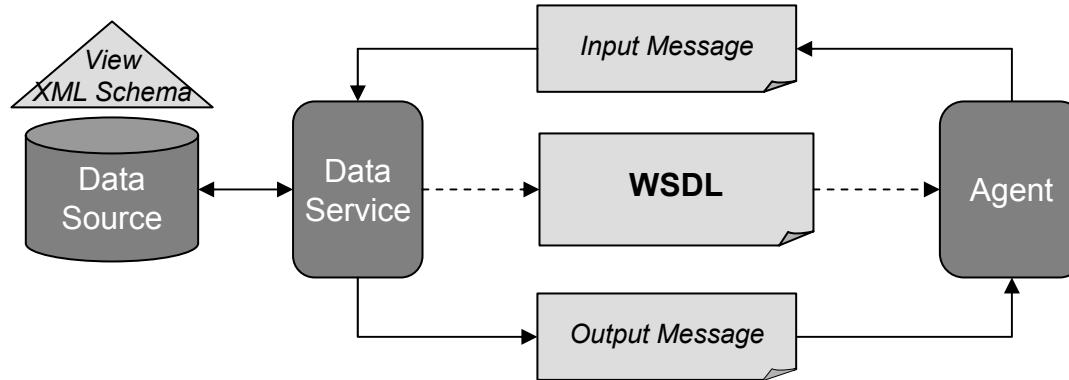
- **Data Service** = WSDL + QSS
- A QSS deployed as a web service
- Exports the XML Schema of an XML view
- Connects the WSDL calls with the underlying database
- Receives queries that are encoded by QSS
- Explicit relationship between input and output

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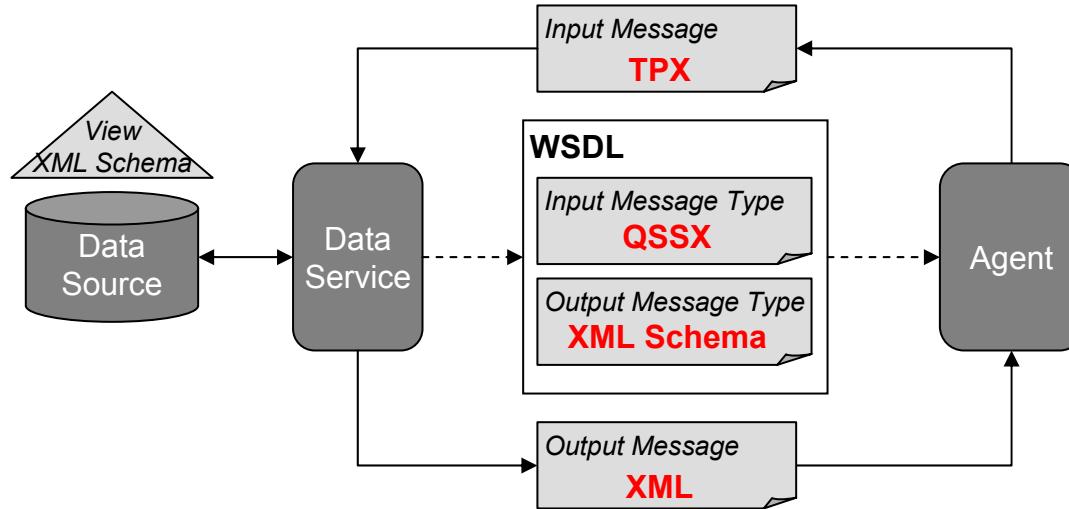
- QSS is translated to XML Schema (QSSX)
- TP queries that are encoded as XML (TPX)
- Query result is described by an XML Schema

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
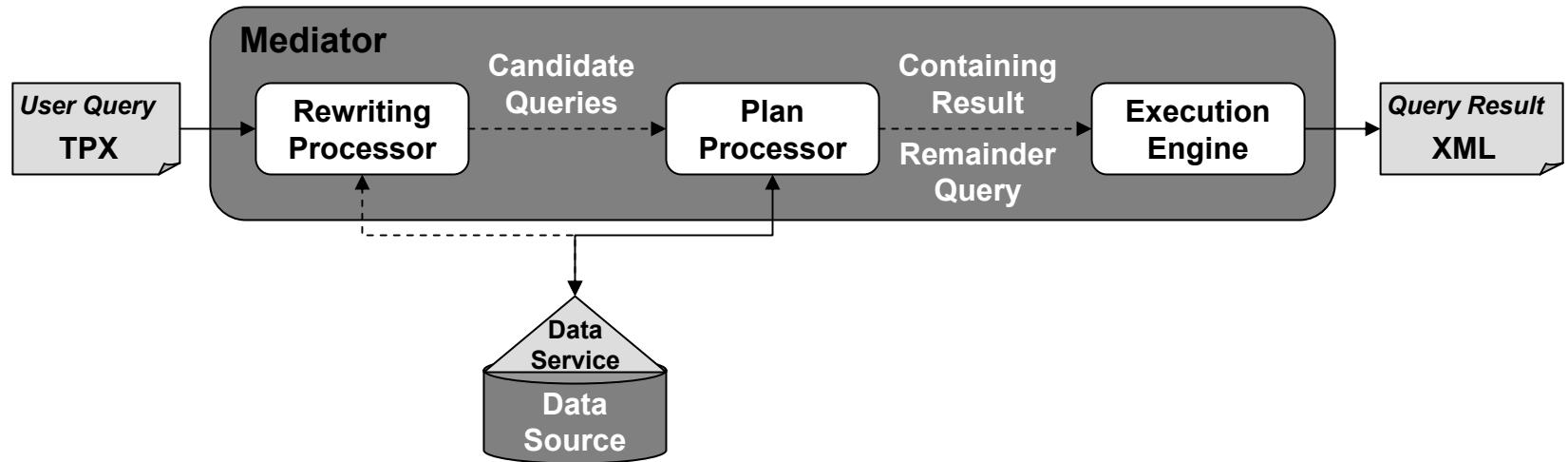
- Capability-based rewriting problem
  - Partial rewritings

Data Services

Authoring Interface

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 Forms and Reports

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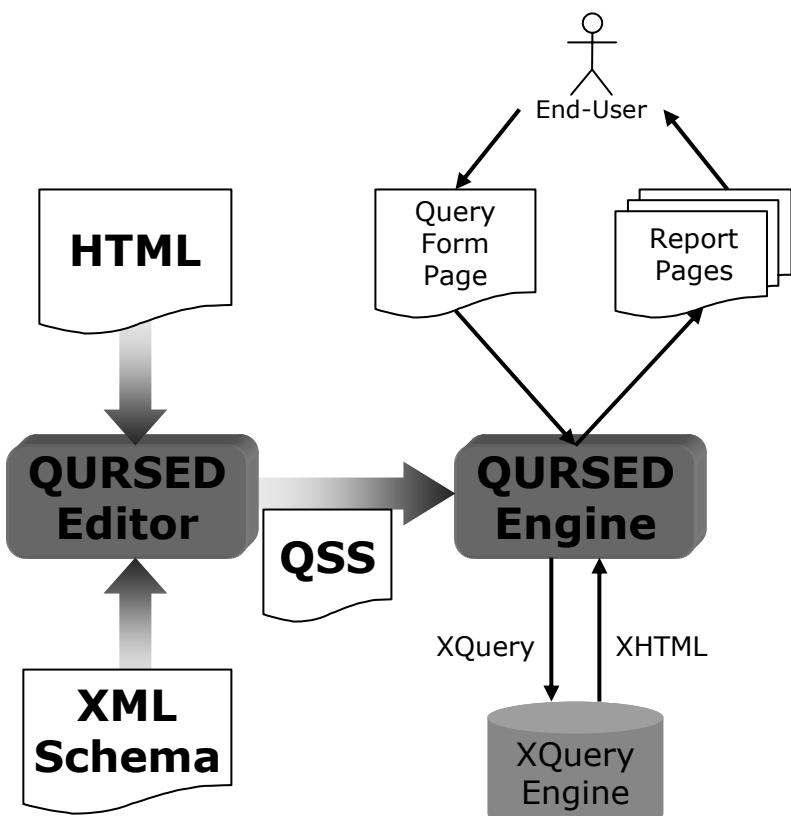
- XML Schema-driven
- Declarative!
  - Separation of content & presentation
- Editor
  - Visual actions to declarative specifications
  - Automatic construction of report pages
- Query Set Specification (QSS)
  - Large set of parameterized queries
  - Compact representation
- Engine
  - Automatic query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

Developing Query Forms from the XML Schema
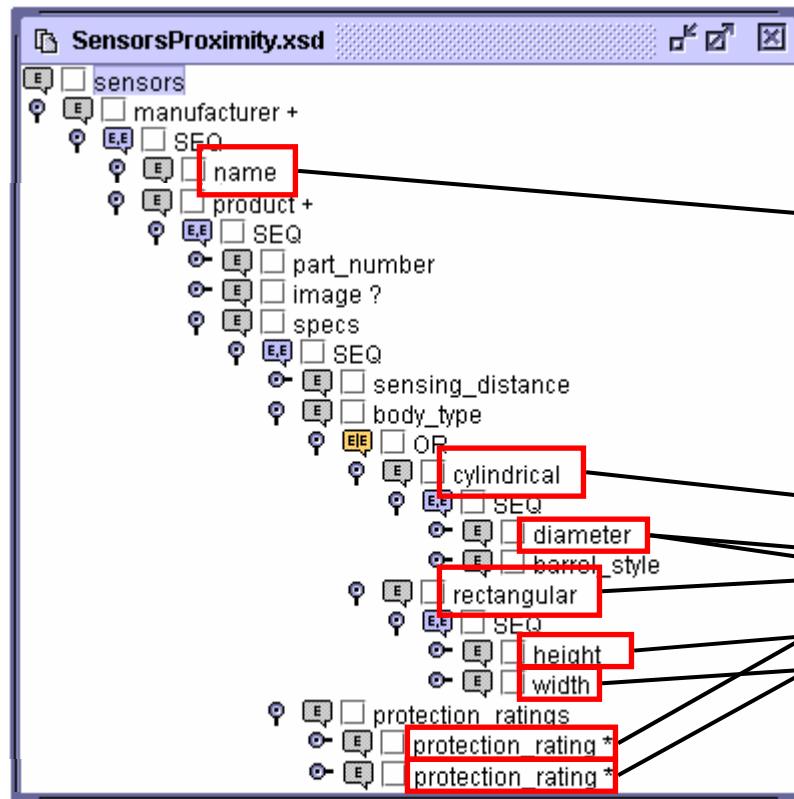
Developing Reports from the XML Schema

QURSED Editor

Building Query/Visual Association
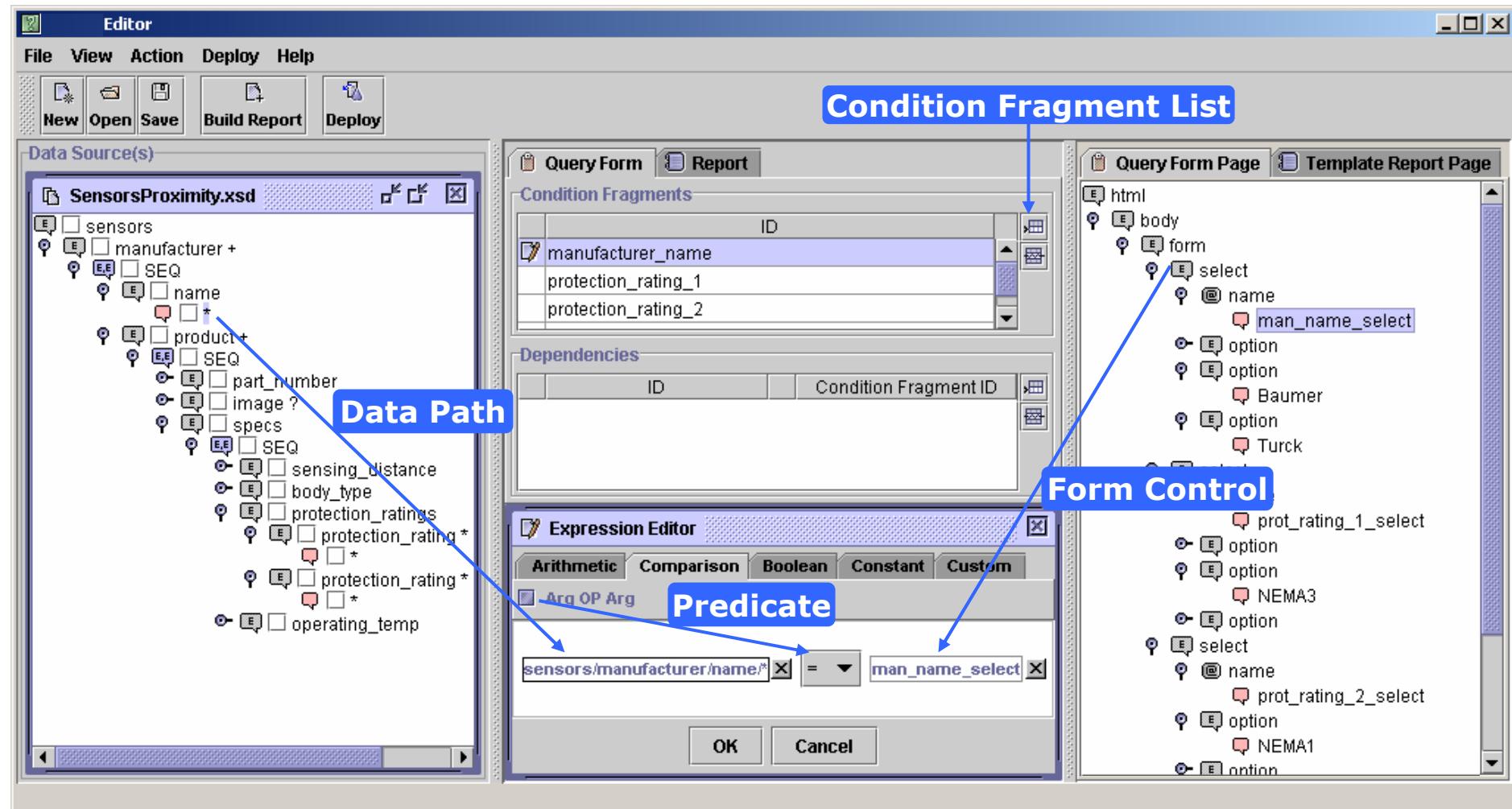
QURSED Editor

Building Reports

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

End-User

Web Site

Presentation Templates

Site Generator

SITE GRAPH — Web Site Content and Structure

Semistructured Queries

(Mediated) View

SCHEMA

SEMISTRUCTURED DATA
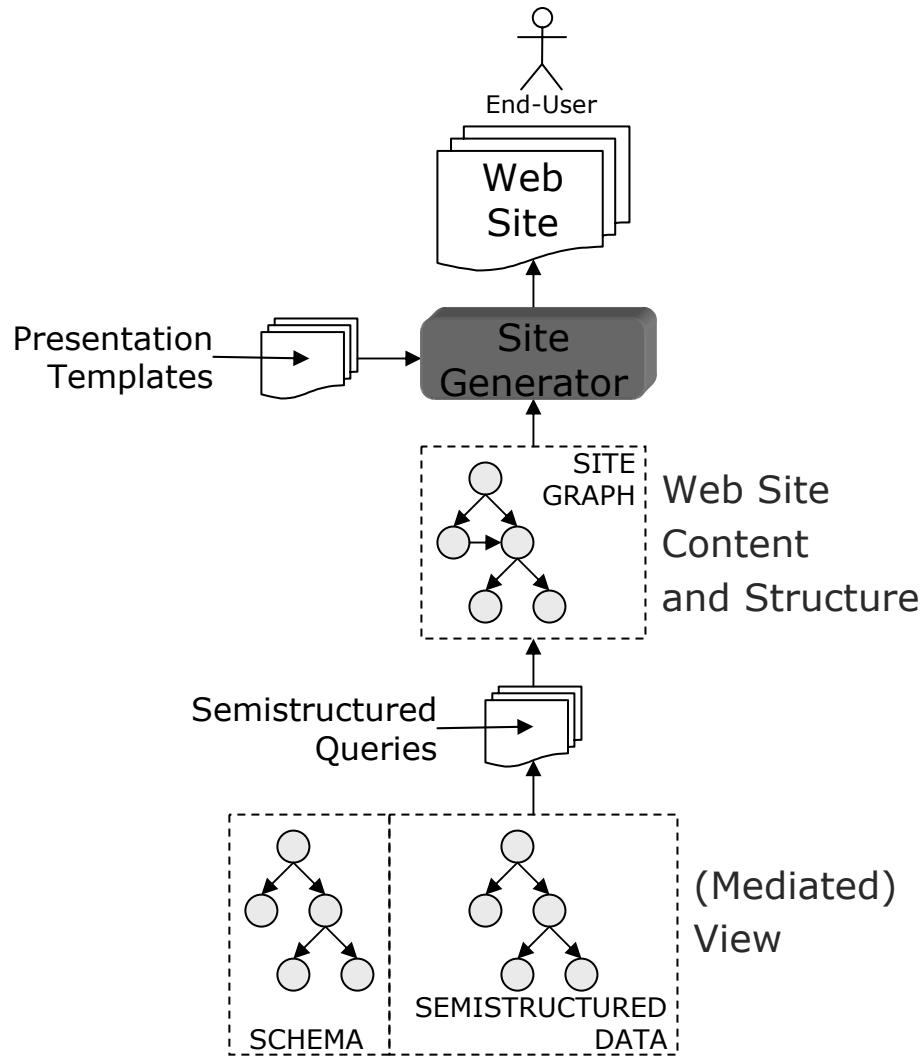
- Data intensive Web site generators
  - Strudel
    - Forms as functions on edges/links
  - Araneus
  - Autoweb

- 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
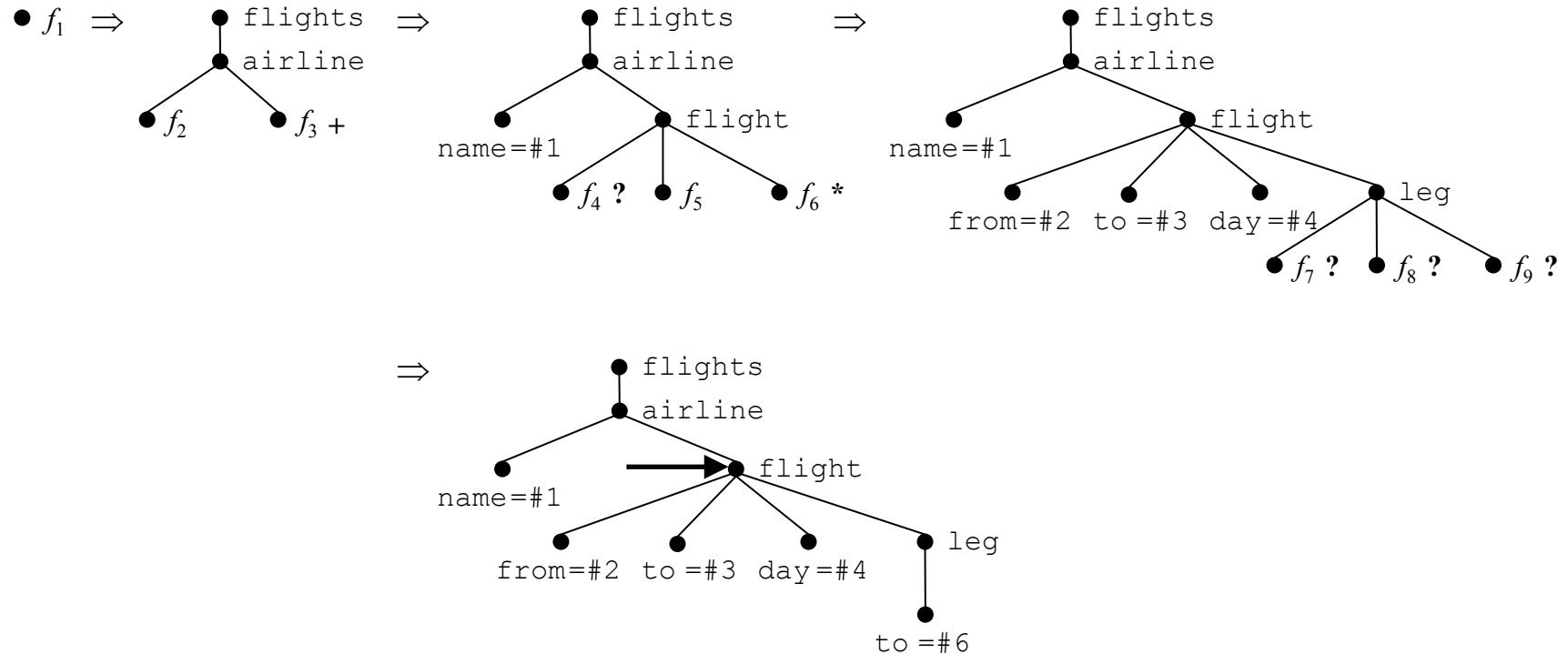
Related Work

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