Source Capabilities

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Source capabilities [YGMU99]

Limited interface

- sources (or source wrappers) support only limited query patterns
- mediators defined using views
- full query evaluation at the mediator level

Issues

- describing source (wrapper) capabilities
- describing mediator capabilities
- capability-based query rewriting

Templates

- template $\equiv$ a vector of attribute adornments
- sources export sets of templates
- view templates depend on mediator properties:
  - basic evaluation
  - postprocessing
  - passing bindings between join arguments
- a query has to match some view template to be answerable
Adornments

Attribute adornments

1. f: the attribute may or may not be specified in the query (free)
2. u: the attribute cannot be specified in the query (unspecifiable)
3. b: the attribute must be specified in the query (bound)
4. c[S]: the attribute must be specified and its value must be among the elements of the set S (constant)
5. o[S]: the attribute may or may not be specified in the query but, if it is specified, its value must be among the elements of the set S (optional)

Matching

<table>
<thead>
<tr>
<th></th>
<th>f</th>
<th>o[S]</th>
<th>b</th>
<th>c[S]</th>
<th>u</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant a variable</td>
<td>+</td>
<td>a ∈ S</td>
<td>+</td>
<td>a ∈ S</td>
<td>-</td>
</tr>
<tr>
<td>variable</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>
Union views

Deriving view templates

• composing base-view templates attribute-wise
• all combinations are considered but some may yield no result
• repeat if more than two views (composition is commutative and associative)

Composition of adornments

<table>
<thead>
<tr>
<th></th>
<th>f</th>
<th>o[S₂]</th>
<th>b</th>
<th>c[S₂]</th>
<th>u</th>
</tr>
</thead>
<tbody>
<tr>
<td>f</td>
<td>f</td>
<td>o[S₂]</td>
<td>b</td>
<td>c[S₂]</td>
<td>u</td>
</tr>
<tr>
<td>o[S₁]</td>
<td>f</td>
<td>o[S₂]</td>
<td>b</td>
<td>c[S₂]</td>
<td>u</td>
</tr>
<tr>
<td>b</td>
<td>o[S₁]</td>
<td>o[S₁∪S₂]</td>
<td>b</td>
<td>c[S₁]</td>
<td></td>
</tr>
<tr>
<td>c[S₁]</td>
<td>b</td>
<td>c[S₂]</td>
<td>b</td>
<td>c[S₁]</td>
<td></td>
</tr>
<tr>
<td>u</td>
<td>c[S₁]</td>
<td>c[S₁]</td>
<td>c[S₁]</td>
<td>u</td>
<td></td>
</tr>
</tbody>
</table>


Other operations

Join

- join attributes: as for union
- non-join attributes: copy base-view adornments

Selection

- copy base-view adornments

Projection

- copy base-view adornments
- hidden attributes have to have f, o, or u adornments
Postprocessing for union

Filtering

- adding a filter operation
- converting \( u \) and \( o \) to \( f \)

Composition of adornments with filtering

<table>
<thead>
<tr>
<th></th>
<th>( f )</th>
<th>( o[S_2] )</th>
<th>( b )</th>
<th>( c[S_2] )</th>
<th>( u )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f )</td>
<td>( f )</td>
<td>( f )</td>
<td>( b )</td>
<td>( c[S_2] )</td>
<td>( f )</td>
</tr>
<tr>
<td>( o[S_1] )</td>
<td>( f )</td>
<td>( f )</td>
<td>( b )</td>
<td>( c[S_2] )</td>
<td>( f )</td>
</tr>
<tr>
<td>( b )</td>
<td>( b )</td>
<td>( b )</td>
<td>( b )</td>
<td>( c[S_2] )</td>
<td>( f )</td>
</tr>
<tr>
<td>( c[S_1] )</td>
<td>( c[S_1] )</td>
<td>( c[S_1] )</td>
<td>( c[S_1] )</td>
<td>( c[S_1 \cap S_2] )</td>
<td>( c[S_1] )</td>
</tr>
<tr>
<td>( u )</td>
<td>( f )</td>
<td>( f )</td>
<td>( b )</td>
<td>( c[S_2] )</td>
<td>( f )</td>
</tr>
</tbody>
</table>
Postprocessing for join

Join

- pass the bindings from the first argument of the join to the second argument
- converting \( b \) in the second argument to \( f \)

Composition of adornments with passing bindings

\[
\begin{array}{cccccc}
 & \text{f} & \text{o}[S_2] & \text{b} & \text{c}[S_2] & \text{u} \\
\text{f} & \text{f} & \text{f} & \text{f} & \text{c}[S_2] & \text{f} \\
\text{o}[S_1] & \text{f} & \text{f} & \text{f} & \text{c}[S_2] & \text{f} \\
\text{b} & \text{b} & \text{b} & \text{b} & \text{c}[S_2] & \text{b} \\
\text{c}[S_1] & \text{c}[S_1] & \text{c}[S_1] & \text{c}[S_1 \cap S_2] & \text{c}[S_2] & \text{f} \\
\text{u} & \text{f} & \text{f} & \text{c}[S_2] & \text{f} & \text{f} \\
\end{array}
\]
Postprocessing for selection

Selection

- converting $u$ and $o$ to $f$ through filtering
- converting $b$ to $f$ if the value of the attribute can be inferred from the selection condition
- converting $c[S]$ to $f$ if some element of $S$ can be inferred from the selection condition
A query may be \textit{answerable} in a given database state even if it does not match any of the view templates.

\textbf{Liberal and conservative templates}

- \textit{liberal}: convert \texttt{c} (in the second argument) to \texttt{f} for joins
- \textit{conservative}: as before

\textbf{Query–template matching}

- query \textit{answerable} if it matches at least one conservative template
- query \textit{not answerable} if it does not match any of the liberal templates
- query \textit{may be answerable} otherwise: \textit{dynamic} execution