Flexible Matching and Ranking of Web Service Advertisements

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Outline

- Problem statement
  - Current matchmakers' limitations
- Proposed solution
  - A flexible matchmaker
- Architecture
- Service request
- Matchmaking process
- Conclusion and future work

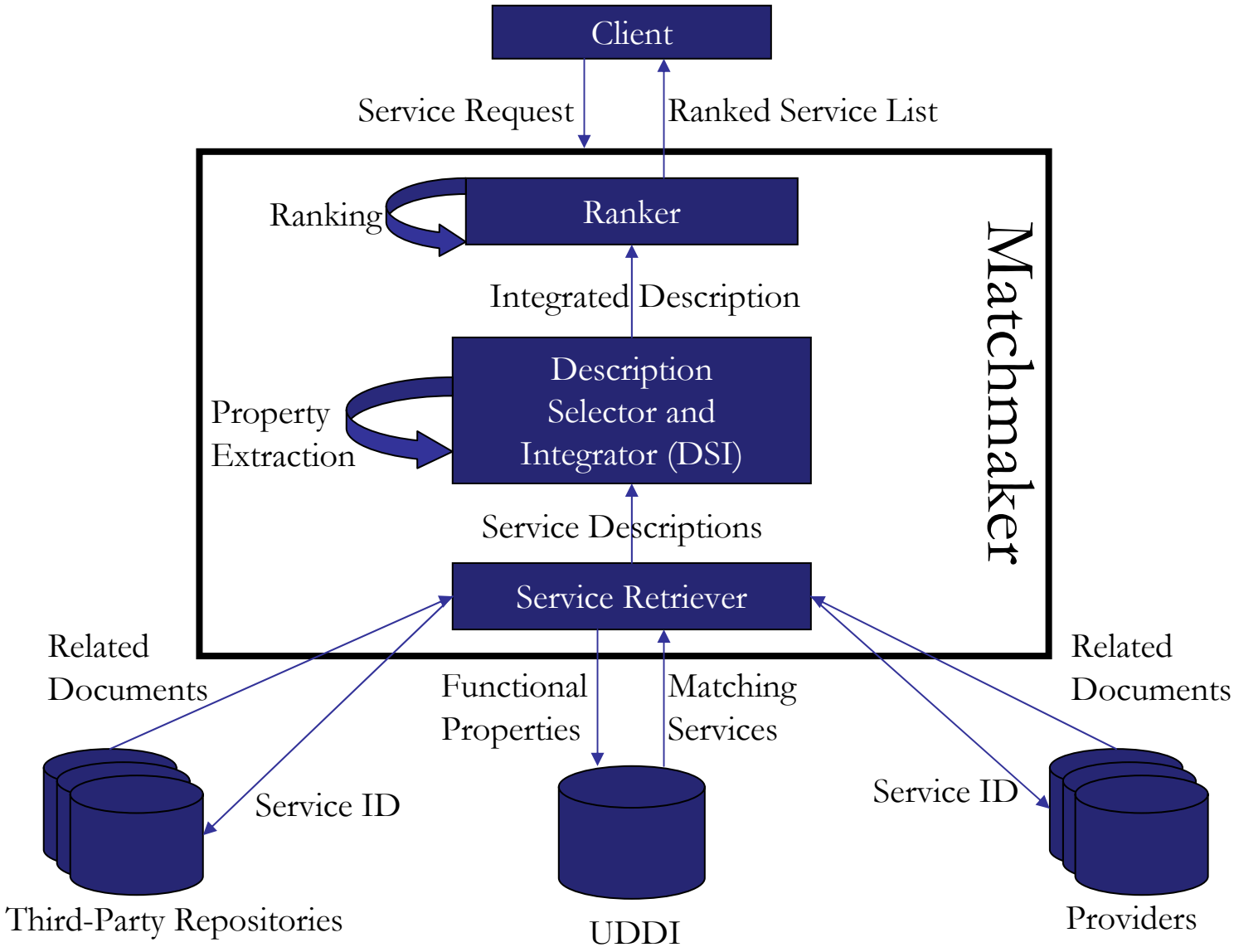
Problem

- Matchmakers' limitations
  - Specific service description languages
  - Bound to third-party repositories
  - Hard-coded ranking criteria
- Drawbacks
  - Service adaptation to matchmakers' languages
  - Static third-party repositories
  - Static ranking algorithm
  - Specific service publisher

Solution

- A Flexible Matchmaker!
  - Supporting current service description languages
  - Openness to emerging service description languages
  - User-defined third-party repositories
  - User-defined service ranking
  - Independence from service publisher

Architecture



Sample Use Case

- Looking for a restaurant recommendation service
- Functional properties
  - Input: area, type of cuisine, date
  - Output: name, concrete address
- Non-functional properties
  - reputation, availability, cost
- Quality of service description documents
  - Web Service Level Agreements (wsla)
  - WS-Agreement (wsaq)
- Third-party repositories
  - Reputation repository

Service Request

- Repositories
  - UDDI Repositories
  - Third-party repositories
- XPath extractors
- Selectors
- Utility function

Service Request
UDDI Repositories

```
<Repository BindingAddress= "http://registry.marketplace1.com/uddi/inquiry">
    <find_service xmlns="urn:uddi-org:api_v3">
        <findQualifiers>
            <findQualifier>
             uddi:uddi.org:findqualifier:sql99:like
            </findQualifier>
        </findQualifiers>
        <name>restaurant</name>
        <name>recommend</name>
        <name>cuisine</name>
        …
    </find_service>
</Repository>
```

Service Request
Third-Party Repositories

```
<Repository BindingAddress='http://www.repSite.com/rep'>
    <getReputation>
        <servicekey>
         $servicekey
        </servicekey>
    </getReputation>
</Repository>
```

Service Request XPath Extractors

- Locators for requested properties
- Each XPath extractor consists of:
  - XML namespace
    - Distinguish between different service description languages
  - XPath expression
    - The spot to find requested properties in the specified language

XPath Extractor Example

- Extractor for WSLA language

```
<Namespace>wsla</Namespace>
<XPathExpression>
/SLA/Obligations//SLAParameter[node()="$name"]/../Value[$condition]
</XPathExpression>
```

- Under /SLA/Obligations

```
<Predicate xsi:type="wsla:Less">
   <SLAParameter>Availability</SLAParameter>
   <Value>0.95</Value>
</Predicate>
```

- $name and $condition will be defined in **selectors**

Indirect XPath Extractors

- WS-Agreement XPath extractor

```
<Namespace>wsag</Namespace>
<XPathExpression>
//wsag:Variable[@name="$name"]/wsag:location[$condition]
</XPathExpression>
```

- Example WS-Agreement document

```
<wsag:Variable name="Availability" metric="...">
  <wsag:Location>
    //JobDescription/Resources/Availability/Exact
  </wsag:Location>
</wsag:Variable>
```

- Referring to the property value in another namespace

Dereferencing

- Enclosing the XPath expression in parentheses

```
(//wsag:Variable[@name="$name"]/wsag:location) [$condition]
```

- Indirect address

```
//JobDescription/Resources/Availability/Exact
```

- Dereferencing

```
<Availability>
<Exact>0.95</Exact>
</Availability>
```

Selectors

- Selectors determine requested service properties
- Each selector consists of
  - Selector (property) name
  - Assigned variable name
  - Namespace list
  - Selection condition
  - Default value

Selector Example

- Selector element

```
<Selector>
    <Name>availability</Name>
    <Variable>A</Variable>
    <Namespaces>
      <namespace>wsaq</namespace>
      <namespace>wsla</namespace>
    </Namespaces>
    <Condition>node()>=0.8</Condition>
    <Default>0.95</Default>
</Selector>
```

- Similar to SQL structure

```
Select Availability as A from wsaq, wsla where Availability>=0.8
```

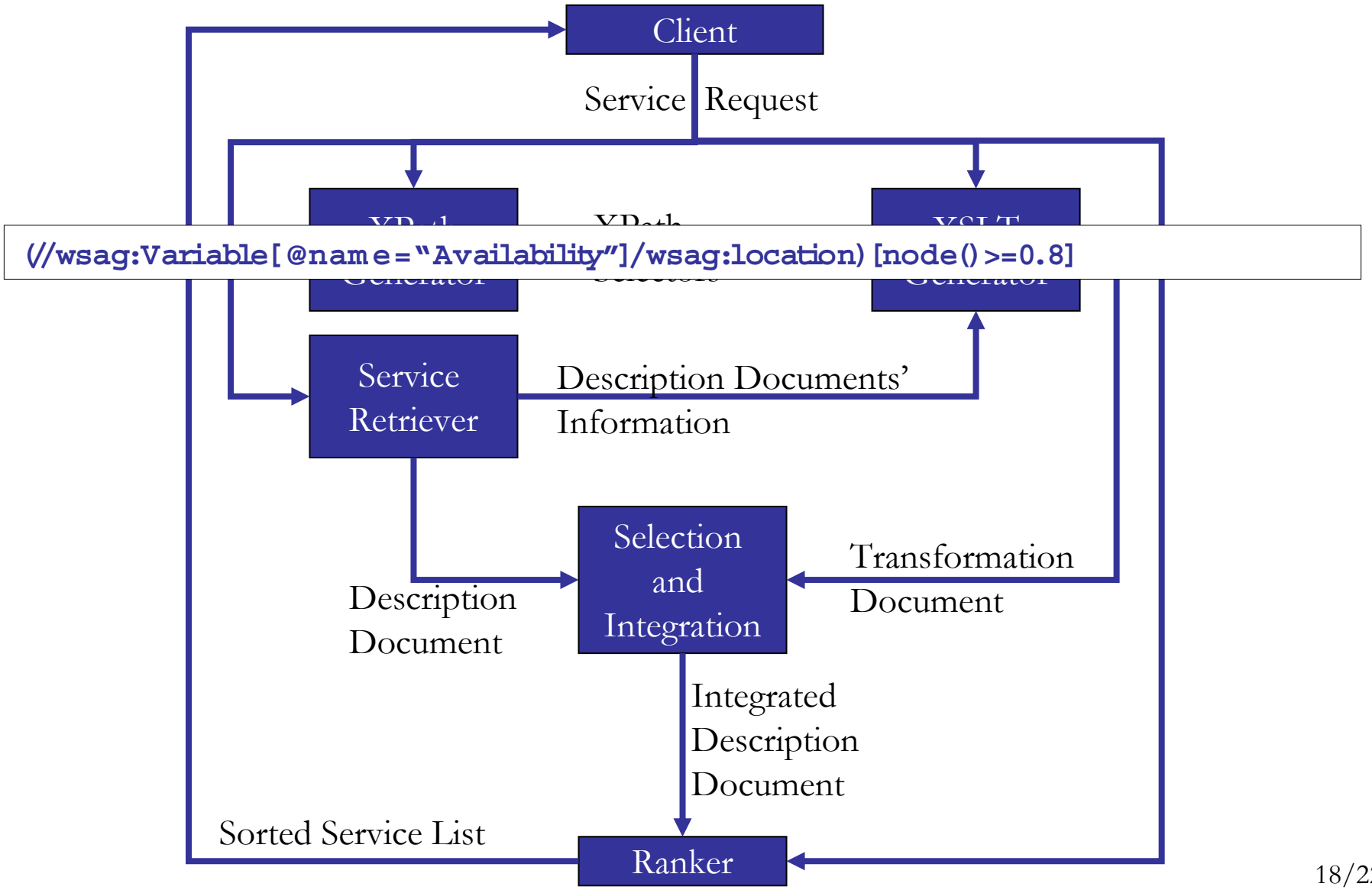
Selection Considerations

- Namespace list
  - Service description transparency to client
- Selection condition
  - Hard requirements
  - Service list filtration
  - Narrowing down the search
- Default value
  - Determining property necessity

Utility Function

- Utility function is a mathematical formula
  - Used for ranking the selected services
  - Variables: properties retrieved by Selectors
- Example
  - Variables
    - "Availability" as A, "Reputation" as R, "Cost" as C
  - Utility function
    - (A*R)/C
- Expressed by a mathematical markup language
  - MathML

Matchmaking Process



Deployment Strategies

- Matchmaker on UDDI server
  - Fully centralized
- Matchmaker on an external server
  - Possibly replicated service
- Matchmaker on client side
  - Fully distributed

Conclusion

- Summary
  - Problems with current matchmakers
  - A flexible matchmaker
    - Supporting description languages
    - User-defined third-party repositories
    - User-defined ranking
    - Independence from service publisher
- Future Work
  - Interleaving document fetching, selection and ranking
  - Dynamic negotiation for the best SLA