A Ontology for Public Transportation in IBK

Thomas Gress, Maximilian Hecht, Sabrina B. Neururer, Sascha Pudenz
Applied Ontology Engineering, 2010/11
Domain and Scope of the Ontology

- **Domain:**
  - Public Transportation in Innsbruck (Bus, Fiaker, Railway, Cable Car...)

- **Usage:**
  - To describe public transportation possibilities and their routes, times and costs within Innsbruck

- **Possible Users:**
  - Tourists, Locals, Tourist Centers, Info-Hotline, Websites...

- **Administration / Maintenance:**
  - Innsbruck Tourist Information Center, transport data should be supplied by the transportation owners (e.g. IKB, POST, Nordkettenbahnen...)

Competency Questions

- What is the fastest way from A to B?
  - duration

- Which transportation medium can I use to get from C to D?
  - transportation types

- Which is the nearest tramway stop
  - geographic

- How much does it cost to get from F to G using Horse-driven carriage (HDC = Fiaker)?
  - price
Usage Scenario: IBK-SightSpeeding

Idea: Many tourists, e.g. Chinese, have only one day to visit Innsbruck – however, they want to see as much as possible.

Scenario:

- Start the IBK-SightSpeeding App on Smartphone (Android, iPhone)
- Enter arrival time+place and departing time+place
- Prioritize places to visit, provided by other ontologies from Linked Open IBK (Sight seeing, Sports, Gastronomy...)
- IBK-SightSpeeding uses the Public Transport ontology to create an efficient route in respect to time and price

IBK-SightSpeeding

<table>
<thead>
<tr>
<th>Sights</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goldenes Dachl</td>
<td>3</td>
</tr>
<tr>
<td>Bergisel</td>
<td>1</td>
</tr>
<tr>
<td>Hungerburg</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sports</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wok Sliding @Igls</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gastronomy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Italian</td>
<td>2</td>
</tr>
<tr>
<td>Tyrolean</td>
<td>3</td>
</tr>
</tbody>
</table>

Generate Plan
Ontology Reuse

We found various ontologies when searching for „transport“

- http://www.pms.ifi.lmu.de/reverse-wga1/otn/OTN.owl

However:

- they had the wrong focus and ended with a class „transportation-device“ without subclasses
- they do only scratch the surface (i.e. listing transportation mediums as bus, taxi without routes, times or tickets)

Found a paper that covers the theory to build a transportation ontology:

- Junli Wang, Zhijun Ding, Changjun Jiang, "An Ontology-based Public Transport Query System" skg, pp.62, First International Conference on Semantics, Knowledge and Grid (SKG'05), 2005
The Public Transportation Ontology

- **Tool used:**
  - Protégé 4.x caused problems when renaming and restructuring
  - Protégé 3.4.4 + OWL
    - Better Usability
    - We tried to set up a collaborative database
    - Includes various tools for visualization (Jambalaya, OntoViz...)

- **Presentation of the Ontology (Live-Demo)**
Instances & Data Sources

Already created instances:

- 4 Bus lines (e.g. BusLine C)
- 15 Bus stops (e.g. Marktplatz)
- 15 Coordinates (e.g. MarktplatzKoordinaten)
- 1 Ticket (e.g. TicketStandard)
- 4 Schedules (e.g. CWorkday09AM)
- 17 TimeStops (e.g. Marktplatz10.14)
- 2 Bus types (e.g. Bus3080IBK)
Instances & Data Sources (contd.)

- Useful databases for the population of the Public Transport Ontology
  - Google earth database
    - Coordinates
  - IVB database
    - Bus line, tramway line
    - Bus stop, tramway stop
    - Ticket for bus and tramway
    - Schedule of bus and tramway Line
    - Transportation Medium
  - Tourist Information database
    - HDC lines
    - HDC stops
    - Tickets for HDC
    - Schedule of HDC
    - Transportation Medium
Instances & Data Sources (contd.)

- Useful databases for the population of the Public Transport Ontology (contd.)
  - ÖBB database
    - Train Line
    - Train Station
    - Ticket for Train
    - Schedule of Train
    - Transportation Medium
  - Database of Nordkettenbahnen
    - Tramway Line
    - Tramway Stop
    - Ticket for Tramway
    - Schedule of Tramway
    - Transportation Medium
### Instances & Data Sources (contd.)

<table>
<thead>
<tr>
<th>Domain &amp; Scope</th>
<th>Competency Questions</th>
<th>Usage Scenario</th>
<th>Reuse</th>
<th>Ontology Presentation</th>
<th>Instances &amp; Data Sources</th>
<th>Limitation &amp; Improvements</th>
<th>Conclusion</th>
</tr>
</thead>
</table>

- **How to keep the data up-to-date?**
  - Google
  - IVB
  - Tourist Information
  - ÖBB
  - Nordkettenbahnen

- **Who should host the ontology?**
  - Innsbruck Tourismus (Innsbruck Tourism)
Limitations and further Improvements

- The modeling of various transportation charges and different ticket types (e.g. Junior / Senior...) is not fully supported yet

- Approach how to integrate / link it with other ontologies (Linked Open Innsbruck) needs to be defined!

- The other ontologies in Linked Open Innsbruck need to provide coordinates for their entities to support the usage scenario (IBK-SightSpeeding)
Conclusion

- Ontology for public transport in Innsbruck covering
  - Times (Schedules, Arrival Times...)
  - Location (Stops, Coordinates...)
  - Transportation Medium Types (Bus, Tramway, HDC...)
  - Prices (Tickets...)

- General concept is the most important step → errors in the concept lead to redesign and rework effort

- Always possible to further extend the granularity / capability of the ontology → necessary to define the detail level

- Reuse of available ontologies problematic due to divergent scopes and application domains
Thank you for your attention!
Literature & Sources

- Junli Wang, Zhijun Ding, Changjun Jiang, "An Ontology-based Public Transport Query System" skg, pp.62, First International Conference on Semantics, Knowledge and Grid (SKG'05), 2005
- Innsbrucker Verkehrsbetriebe (IVB) [www.ivb.at](http://www.ivb.at)
- Swoogle [http://swoogle.umbc.edu/](http://swoogle.umbc.edu/)
- Vocamp [http://vocamp.org/wiki/Ontology_list](http://vocamp.org/wiki/Ontology_list)