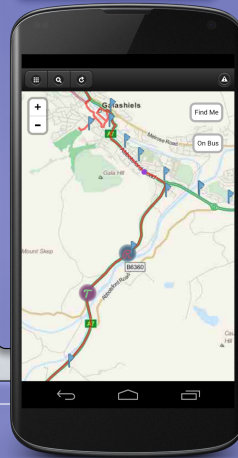# GetThere: A Rural Passenger Information System Utilising Linked Data & Citizen Sensing

Problem

A commonly given reason for not using public transport in rural areas is lack of convenience, which includes inadequate passenger information. Real-time passenger information (RTPI) systems use a variety of information sources to provide passengers with information such as estimated vehicle arrival times and notifications of delays or cancellations. Few RTPI systems exist in non-urban areas, for a variety of reasons, including lack of infrastructure for obtaining and providing real time information.
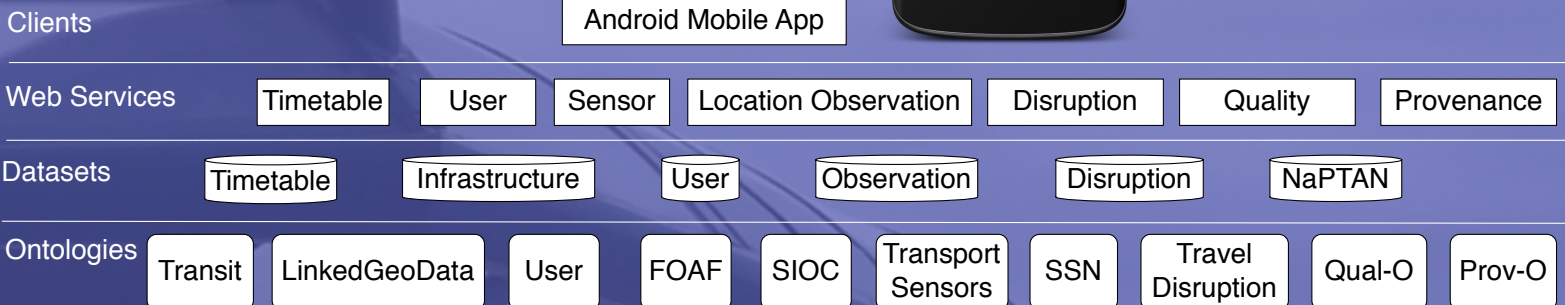
GetThere

In the Informed Rural Passenger Project we are developing *GetThere*, a RTPI system for rural areas. GetThere uses data from multiple sources (including observations such as vehicle location and occupancy level crowd sourced from users), and delivers information via multiple channels (smartphone app, SMS).
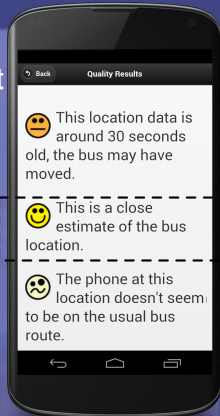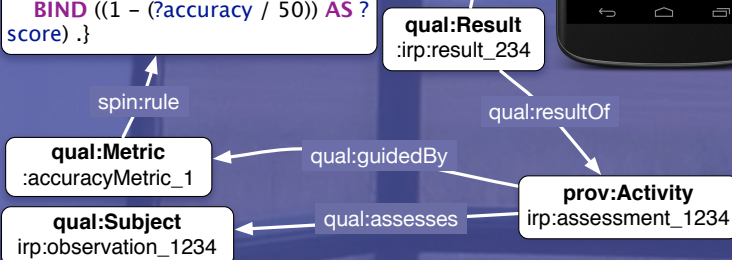
Architecture

Clients	Android Mobile App

Web Services	Timetable	User	Sensor	Location Observation	Disruption	Quality	Provenance

Datasets	Timetable	Infrastructure	User	Observation	Disruption	NaPTAN

| Ontologies	Transit	LinkedGeoData	User	FOAF	SIOC	Transport Sensors	SSN	Travel Disruption	Qual-O	Prov-O

Data Quality

Given the open nature of the data, issues around quality and trust naturally arise. We have developed a quality assessment model and associated reasoning service to evaluate data used by the system.

```
CONSTRUCT {
  _:b0 a qual:Result .
  _:b0 qual:hasScore ?score .
} WHERE {
  ?obs ssn:observationResult ?ov .
  ?ov sensors:accuracy ?accuracy .
  BIND ((1 – (?accuracy / 50)) AS ?
score) .}
```

This location data is around 30 seconds old, the bus may have moved.

This is a close estimate of the bus location.

The phone at this location doesn't seem to be on the usual bus route.

qual:Result
:irp:result_234

spin:rule

qual:resultOf

qual:Metric
:accuracyMetric_1

qual:guidedBy

prov:Activity
irp:assessment_1234

qual:Subject
irp:observation_1234

qual:assesses

Disruptions

Users can report travel disruption, such as road closures and roadworks. These are described using the travel disruption ontology and linked to the infrastructure dataset. This allows, for example, the quality assessment service to consider any disruption that may affect a particular bus route and the location observations associated with it.

lgd:Way
:a7w464

dis:onWay

dis:Disruption
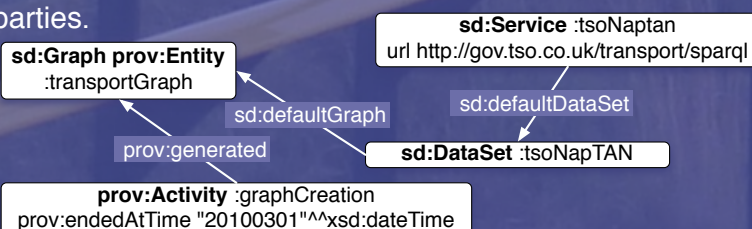:roadClosed

irp:travelsAlong

trn:Route :x95
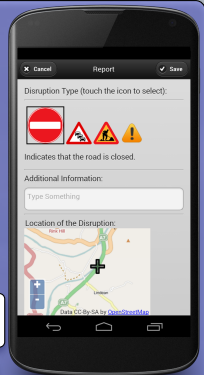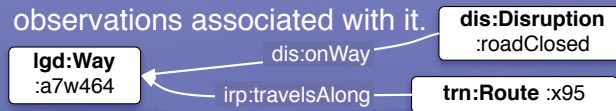
Deployment

Working with various stakeholders in the Scottish Borders, UK, we are conducting an extended study, deploying the *GetThere* system on eight First Group routes, investigating changes in travel behaviour as a result of using the system. User feedback gathered through interviews and focus groups will be used to guide future development of the system.

Provenance

Provenance provides a record of the entities, activities, and agents involved in the creation and manipulation of data. Uses of provenance within the ecosystem include inferring provenance for user observations, and maintaining provenance records for data hosted by third parties.

sd:Service :tsoNaptan
url http://gov.tso.co.uk/transport/sparql

sd:Graph prov:Entity
:transportGraph

sd:defaultGraph

sd:defaultDataSet

prov:generated

sd:DataSet :tsoNapTAN

prov:Activity :graphCreation
prov:endedAtTime "20100301"^^xsd:dateTime

Discussion

We use open datasets to provide domain data where possible. This has presented various challenges including dealing with information that may be out-of-date, and integrating heterogeneous data sources. Provenance and quality assessment are used to address the former, while linked data is used to address the latter. Although this has required converting some existing datasets, it has brought benefits in terms of simplified integration and maintenance

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