Big Data –
Managing Location in a Smart City

Geospatial World Forum 2014

Hans Viehmann
Product Manager EMEA
Location Information in Smart Cities
Everyone uses and shares Location Data

Where is ... How do I get to ...

Find me the nearest ... When is the bus coming?

I have checked in at ... on Foursquare.

Today I’m at GWF 2014

N 53° 35.469, E 10° 01.261 ... ...
N 53° 35.473, E 10° 01.263 ... ...
N 53° 35.477...
Two major challenges

Manage incoming data

Use location data in context
Characteristics of Incoming Data
Specific to location information

- Continuous streams of sensor data
  - Large number of sensors, massive amounts of data
  - Location transmitted explicitly – GPS, phone network, ...

- Implicit location information
  - Address: Needs to be interpreted
  - Unstructured information: Requires semantic analysis

- Needs to be analyzed for proximity, spatial interaction
- Needs to be evaluated in context
  - Environment, Road network, Public transport routes
Manage incoming location data

Cascading architecture: devices → gateways → servers

- High-speed, real-time data capture
- Event processing capabilities on data streams
- Location analysis for tracking, geo-fencing, ...
- Geospatial analysis in the back-end
- Proven in telematics and RFID/IoT use cases

(Spatial Stream Processing)

Edge devices
Gateway devices
Data center
Two major challenges

Manage incoming data

Use location data in context
Using Location Data in Context

Smart City needs to provide Geospatial information

- Conventionally using location data on a map
- Two-dimensional data usually not sufficient, need 3D
  - Location within buildings - shopping malls, airports, ...
  - Lots of use cases for city modelling (see next slide)
- Value-add through integration with other data
  - spatial or non-spatial information combined in open platform
  - use of standards (ISO, OGC) is prerequisite
- 3D data acquisition is Big Data topic in itself
  - but well-understood and routinely possible
Example: City of Berlin – 3D City Model
Implemented by TU Berlin

- 550,000 buildings, reconstructed from 2D cadastre and LIDAR data
- Textures extracted from oblique aerial photography
- Combined with various data sets
- Based on CityGML standard
Smart Cities need a Spatial Data Infrastructure

Requirements

- Database functionality such as
  - Spatial queries
  - Semantic queries
  - Versioning/Long Transactions

Use existing open standards
- Interoperability
- Protect the Investment
SDIs are ideal for a Cloud Infrastructure

<table>
<thead>
<tr>
<th>Deployment Model</th>
<th>Service Model</th>
<th>Operating Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>Applications</td>
<td>Customer Owns</td>
</tr>
<tr>
<td></td>
<td>(SaaS)</td>
<td>Customer Operates</td>
</tr>
<tr>
<td>Public</td>
<td>Platform</td>
<td>Customer Owns</td>
</tr>
<tr>
<td></td>
<td>(PaaS)</td>
<td>Provider Operates</td>
</tr>
<tr>
<td>Hybrid</td>
<td>Infrastructure</td>
<td>Provider Owns</td>
</tr>
<tr>
<td></td>
<td>(IaaS)</td>
<td>Provider Operates</td>
</tr>
</tbody>
</table>
SDI is fundamental part of Smart City Platform

- Collaboration
- Harmonization
- Modernization

City Service

City Operation

City Infrastructure

Citizen Empowerment

Business Productivity

Sustainable City

Social Media

Entrepreneurs

Sensors

Copyright © 2014, Oracle and/or its affiliates. All rights reserved.
SDI is fundamental part of Smart City Platform
Hardware and Software
Engineered to Work Together