A live Link from GIS to the Internet of Things

Dustin Demuth

52north
exploring horizons

Geoinformatik 2013 - 13.03.

question

how to integrate live data from a sensor platform into GIS, without using third party services?

question

how to integrate data of sensor platforms into GIS, without using third party services?

answer

connect the sensor platform to the internet and turn it into a feature service!

internet of things

concept

- unique identification of things
- physical attributes have virtual representations
- internet protocols are used to transport the information

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summary

IoT is network of physical things and their virtual representations which use the internet protocols as transport mechanisms [1].

web of things

adds an application layer to the iot

- extends the IoT [2]
- each thing is a resource with an URI [3]
- HTTP [4] and REST [5]

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summary

WoT builds an application layer on top of the IoT and makes accessing things more simple, by using lightweight web standards.

concept

turn each measurement into a resource

- apply WoT paradigm to sensor platforms
  - each sensor is a resource, represented as a layer
  - each measurement is a resource, represented as a feature
- use methods which already fit into the GIS domain

http, rest

concept

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`example.org/sensorlayer`

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```
example.org/sensorlayer/measurementfeature
```

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OGC compliance

requirements

for implementing the concept

- affordable, open, customizable hardware
- capable of reading various sensors
- storage
- sufficient processing power

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- lightweight data format & interfaces → JSON & REST
- standardized interface → esri / OGC GeoServices REST API [6]

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GeoServices REST API

provides interface definitions for:

- Map Service
- Geocode Service
- Geometry Service
- Geoprocessing Service
- Image Service
- Feature Service

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GeoServices REST API

Request examples

/ `example.org/geoservices/`
service description and array of available layers

/<id>/ `example.org/geoservices/1/`
detailed information on the layer which is identified by 1

/<id>/query `example.org/geoservices/1/query`
list of features within a layer

/<id>/<oid> `example.org/geoservices/1/15328`
single feature of layer 1, identified by object id 15328

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RESTful GeoService API

Request examples: filtering

/<id>/query? `example.org/geoservices/1/query?geometryType=GeometryPoint&geometry=7,52`
features of layer 1 which are on point (7 , 52)

/<id>/query? `example.org/geoservices/1/query?f=json`
features of layer 1 encoded in json-format (standard)

& parameters `where`, `returnGeometry`, `inSR`, `outSR`, `spatialRel`,`relationParam`, `objectIds`, `outFields`, `returnIdsOnly`

RESTful GeoService API

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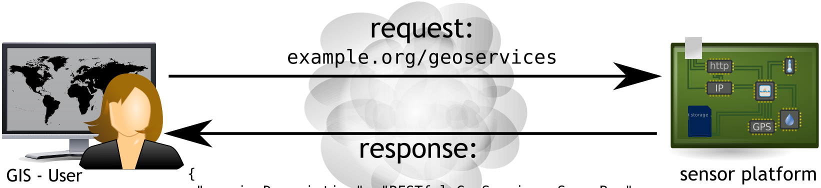
& parameters `where`, `returnGeometry`, `inSR`, `outSR`, `spatialRel`,`relationParam`, `objectIds`, `outFields`, `returnIdsOnly`

but:
due to processing and memory constraints filtering is not implemented in our approach

workflow



request:
example.org/geoservices

response:

```
{
 "serviceDescription": "RESTful GeoServices SenseBox",
 "layers": [
  {
    "id": "1",
    "name": "temperature"
   }
  ]
}
```

RESTful GeoService API

..and some responses

/

```
{
  "serviceDescription": "RESTful GeoServices SenseBox",
  "layers": [
    {
    "id": "1",
    "name": "temperature"
    }
  ]
}
```

RESTful GeoService API

..and some responses

/<id>/

```
{
  "id": "1",
  "type": "Feature Layer",
  "displayField": "value",
  "capabilities": "Query",
  "geometryType": "GeometryPoint",
  "minScale": 0,
  "maxScale": 0,
  "spatialReference": {
      "wkid": 4326
  },
  "objectIdField": "objectid",
  "fields": [
    {
      "name": "objectid",
      "type": "FieldTypeOID",
      "alias": "Object ID"
    },
    <...>
  ]
}
```

RESTful GeoService API

..and some responses

/<id>/query

```
{
  "objectIdFieldName": "objectid",
  "geometryType": "GeometryPoint",
  "spatialReference": {
    "wkid": 4326
  },
  "fields": [
    {
      "name": "objectid",
      "type": "FieldTypeOID",
      "alias": "Object ID"
    },
    <...>
  ],
```

RESTful GeoService API

..and some responses

```
"features": [
{
  "geometry": {
    "point": {
      "x": 7.652118,
      "y": 51.934969
    },
    "spatialReference":
        {
      "wkid": 4326
    }
  },
```

```
  "attributes": {
    "ObjectID": "15328",
    "Time": "2013-01-08
        T14:36:03Z",
    "Value": "15"
  }
},
<...>
}]}
```

evaluation

+ low power consumption
+ simple integration of sensors into gis
+ easy customization by the users
- limited in speed
- limited in memory
- missing multithreading
o currently limited choice of clients

what comes next?

build clients

more powerful hardware

thank you

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appendix

images

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acknowledgements

This work has been partially supported by the project *Flexible and Efficient Integration of Sensors and Sensor Web Services* funded by the ERDF program for NRW (contract number N 114/2008), proceeding research was done during a Google Summer of Code 2012 project