Implementing a Sensor Observation Service for Wi-Fi tracking data

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by

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Preface

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1 Introduction

This report describes the process and results of the assignment for the GEO1007 course in the MSc Geomatics programme. For this assignment, the authors chose one of seven topics. The chosen topic focusses on implementing a Sensor Observation Service to publish the tracking data derived from the geomatics synthesis project on a server and test it in a SOS client, such as the 52 North application.

A Sensor Observation Service (SOS) is a service standardized by the Open Geospatial Consortium (OGC). The standard defines a web service interface for the discovery and retrieval of real time or archived data produced by all kinds of sensors like mobile or stationary as well as in-situ or remote sensors (OGC, 2016). A sensor can measure multiple things, e.g. a meteorological sensor can observe properties such as temperature, wind speed, humidity. The SOS standard focusses mainly on the observations of these sensors.
In this project, the focus lies on the Wi-Fi network of the TU Delft campus. The wireless access points (AP) used in the Wi-Fi network can be seen as sensors, and the devices registered by the APs can be seen as the measurement. Each devices can be identified by its unique mac address, but also other properties can be measured, i.e. the received signal strength and the signal to noise ratio (SNR). These are all observations that can be retrieved using a SOS. In the next sections the research question, objectives, methods and tools will be discussed.

1.1. Problem description

During this project, the research will be guided by the following question:
How can the 52North webapplication be used to publish and visualize the WiFi tracking data from the TU Delft eduroam network?

This research question can be divided into the following subjects which need to be addressed:

- Research the 52North database model for a SOS
- Setting up the SOS server
- Testing the SOS client

These questions can be answerd once the goals and objectives have been established.

1.2. Objectives

To answer the research question and subquestions, the purpose of the research has to be clearly defined. The purpose of the research is captured into two main objectives:

- To provide a method for publishing WiFi-based tracking data through an SOS service and visualize the data in a client. The user can view and subset the data in the client and eventually download it. This allows a quick, preliminary data filtering which speeds up the data analysis workflow.
- To set up a SES service which pushes newly added tracking data to the client/user.

MUST	SHOULD
Automatically transform the raw WiFi-logs from the PostgreSQL database to an SOS-compliant data model. Time series tracking data (subset WiFi-logs with time range) in the client	Functionality to download raw WiFi-logs or trajectories.
COULD	**WONT**
	Push notification to the user when new data is available Push new data to the user. When subscribing, the user can decide to either receive the raw WiFi-logs or the trajectories.

Table 1.1: MoSCoW Rules

To dive deeper into the steps that need to be taken to answer the research question, the objectives can be divided into sub-goals:

- Automatically transform the raw WiFi-logs from the PostgreSQL database to an SOS-compliant data model.
- Functionality to download raw WiFi-logs or trajectories.
- Time series tracking data (subset WiFi-logs with time range) in the client

Finally, to structure the objectives and goals and to define the scope of the project, the objectives are grouped using the MoSCoW rules (see Table 1.1). To achieve these goals, implementation of the SOS Core Profile is necessary, comprising the mandatory operations: GetCapabilities, DescribeSensor, GetObservation.

1.3. Methods

1.3.1. Tools

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Methodology

2.1. 52North application

2.1.1. Database model

2.1.2. Client

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Implementation

3.1. Preprocessing (of the wifilog data)

3.2. Filling the tables

3.2.1. 'Simple' tables

codespace

FeatureOfInterest::codeSpace is the codespace attribute for the identifier (*gml:identifier*) of the access points. As the GML 3.2. schema defines the *gml:identifier* is a "special identifier is assigned to an object by the maintaining authority with the intention that it is used in references to the object." Furthermore, the attribute *codeSpace* is of type *anyURI*. In the present case the Technical University Delft is the maintaining authority of the campus WLAN and with it the access points. Because there is no official repository that contains the identifiers of the access points, we defined the codespace as *tudelft-wlan*.

name and codespacename

Codespacename refers to the codespace for the *name* of the *featureOfInterest*. *FeatureOfInterest:name* refers to *gml:name* in the GML 3.2 schema. In the case of the TU Delft WLAN the access point names equal to the access point identifiers, thus they have the same codespace as well.

hibernatediscriminator

According to the SensorObservationService documentation provided by 52North's wiki page, four tables require the attribute 'hibernatediscriminator'. The wiki page describes this attribute as 'only needed for internal purposes', but this is rather unclear. Because there is no clear description on the value of this attribute, the value 'F' is chosen, as indicator for a 'False' value.

3.2.2. FeatureOfInterest

3.2.3. Series

3.2.4. Observation

3.2.5. ComplexValue

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Results

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Conclusions and recommendations