Propose of Standards based IT Architecture to enrich the Value of Allergy Data by Telemonitoring Data

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Introduction (1/2)

- **European eHealth Action Plan** [1] & Funding project/framework **Connecting Europe Facility (CEF)** [2], state the **importance of eHealth services** and related infrastructures

- **Multilevel Interoperability** plays a **key role**
  - e.g. ELGA or epSOS

- **Telemonitoring** projects are **emerging** in diverse forms and shapes

- Telemonitoring systems **increase efficiency and decrease costs** [3]
Introduction (2/2)

- Project „INNOVATE“, aims to:
  - Investigate interoperability standards
  - Design and implement „development kits“

- **Focus** is the integration and exchange of data from eHealth/mHealth applications with open data applications

- The actual work based on previous projects [4],[5]

- Past approaches concerned with Personal Health Devices (Telemonitoring) and EHR Systems
Objectives

- This work is a **feasibility study**
- **Investigates the applicability of a standard based IT-Architecture** integrating PHD-Data and open data sources
- **Proof of concept use case:**
  - **pollen forecast data** from the Medical University of Vienna
  - combined with **Personal Health Device data**
Methods (1/2)

- First a **literature based research** was conducted
- Selection criteria was:
  - Actuality and significance
  - Actuality and amount of practical application of standards referenced
- **Experts review** was conducted to investigate selected sources
- As a **result standards were selected** and **IT-Architecture was proposed**
Methods (2/2)

- **Prototypes where developed**

- Hardware used in the setup was:
  - Nonin Onyx Vantage 9590 **Finger-Puls Oximeter** (Continua Certified/IEEE 11073 standards family based)
  - A&D Medical **Blood Pressure Monitor** UA-651ble (Continua Certified/Bluetooth Low Energy)
  - Android 6.0 (Marshmallow) on a OnePlus 3 **Smartphone**
  - Asus Zen Watch 2 (**Smart Watch** Bluetooth v4.1 BLE)
  - Open Source HAPI **FHIR** for the Interfaces and the **Server** [13], [14]

- **Feasibility was tested by performing interoperability tests**

- **Possible correlation of data should be investigated**
Results (1/5)

- Literature research focused on eHealth systems and other domains, like Smart Cities in general
- Common approaches could be identified
- Popular approach
  - Registry/repository-model (e.g. IHE XDS Profile)
- Actual approaches used Light weight communication protocols
Results (2/5)

Standards Based System Architecture

Analysis Platform

Interoperability Connector

https://www.hl7.org/fhir/

Big Data...n
Open Data...n

Med. Univ. Vienna

birch pollen
grass pollen
mugwort pollen
ragweed pollen...

Interoperability Connector

Connector Component

Server Infrastructure Component

Telemonitoring Component
Results (3/5)

- **Telemonitoring Component**
  - Based on the Continua Health Alliance Guidelines
  - Applies two ways: common X73 based as well as BLE based
  - Smartphone as well as Smartwatch App’s
  - Puls Oximeter & BP-Device
  - Integrates the Connector Component for further transmission
Results (4/5)

- Server Infrastructure Component
  - Uses Open Source Server (FHIRbase)
  - Extended to meet requirements regarding extensions
  - Analysis Platform for data visualization
  - Uses Connector Component
Results (5/5)

- Connector Component
  - Platform independent library
  - Responsible for mapping
  - Based on HAPI FHIR library

Snippet of the FHIR Resource:

```xml
<extension url="http://fhtw.at/fhir/StructureDefinition/pollen-info">
  <extension url="obsType">
    <!-- alternative could be historicalData -->
    <valueCode value="forecastData"/>
  </extension/>
  <extension url="generationTime">
    <!-- date and time when the data was generated -->
    <valueDateTime value="2017-03-14T10:57:34+01:00"/>
  </extension/>
</extension/>
<status value="final"/>
<code>
  <coding>
    <system value="1.2.40.0.29.99.1"/>
    <code value="Pollen_Forecast"/>
    <display value="Pollen_Forecast"/>
  </coding>
</code>
```
Discussion

- **Interoperability tests** (using Continua Test Tools and IHE Gazelle) successfully
- **Completely based on medical IT-Standards** (platform independent connectors)
- Non-standardized sources => integrated with minimal effort
- However the **workload** should **not be underestimated**
- **Increased complexity** by combination of **data** with a **completely other nature** than health related data
- **Data correlation** could **not be investigated** meaningful, due to **bad weather situation**
Outlook

- **In-depth interoperability tests** of the FHIR-Interfaces

- **Integration of non-medical data**, e.g. different domains, with a focus on open source data sources

- **Stronger consideration and integration of security aspects** and requirements

- **System extension towards layperson decision support** in Smart Cities
References


Thank you for your attention!

www.healthy-interoperability.at/