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

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Funded by

Gefördert von MA23 Wirtschaft, Arbeit Statistik StaDt+Wien

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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)

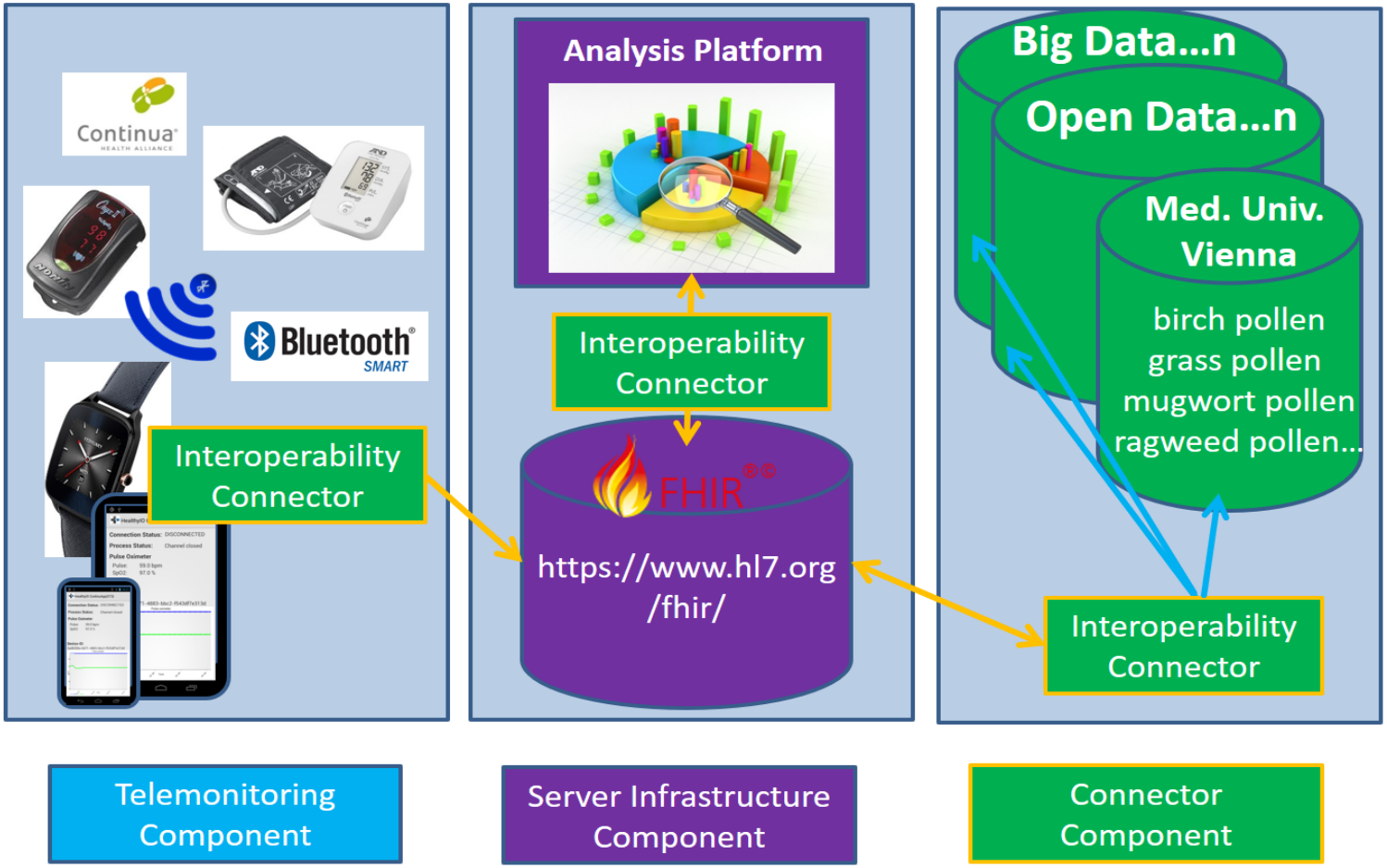
- **Prototypes** where **developed**
- Hardware used in the setup was:
  - Nonin Onyx Vantage 9590 **Finger-Puls Oximeter** (Continua Certified/ IEEE 11073 standards family based)
  - A&D Medical **Blood Pressure Monitor** UA-651ble (Continua Certified/ Bluetooth Low Energy)
  - Android 6.0 (Marshmallow) 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

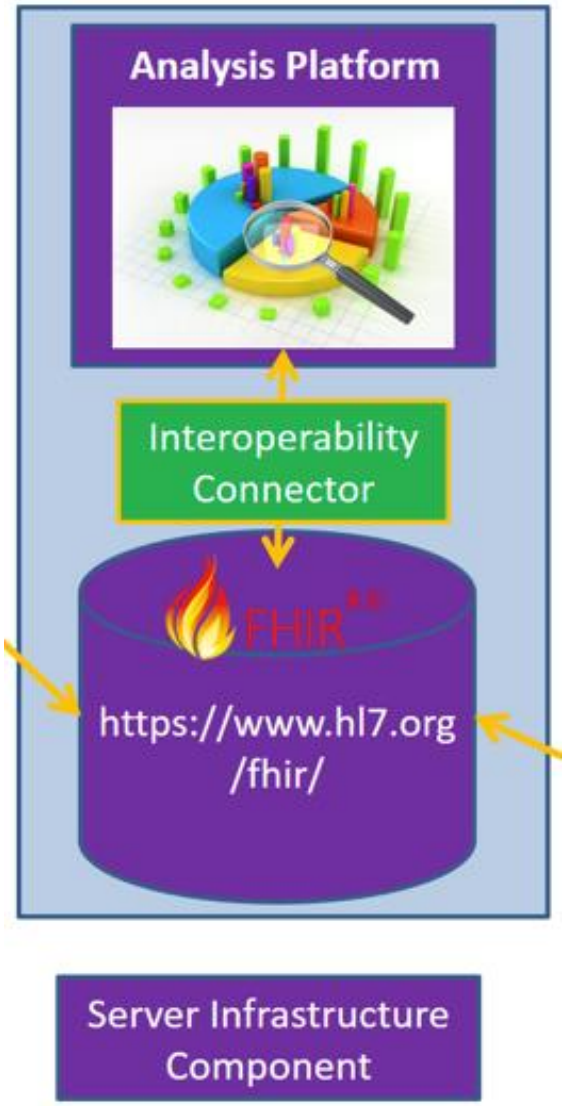


Results (3/5)

- 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)

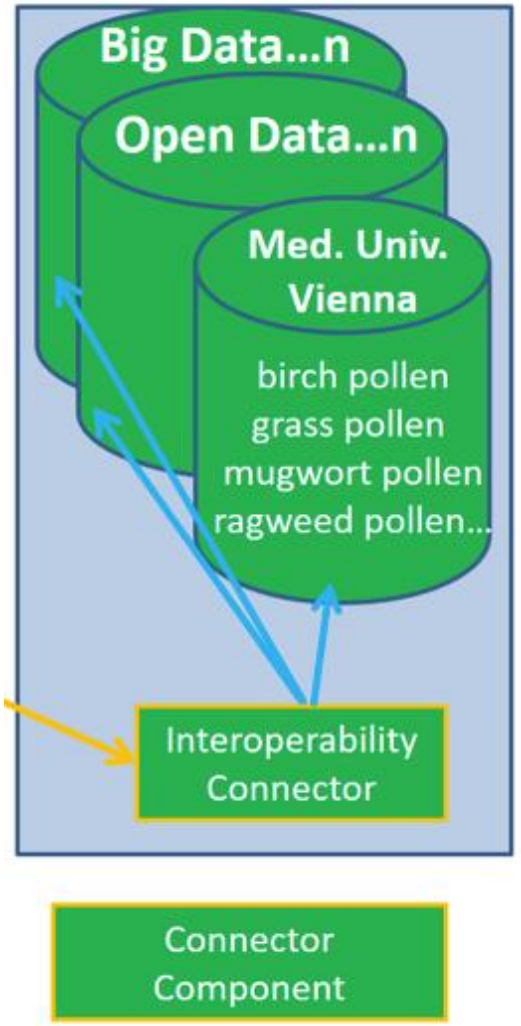
- Server Infrastructure Component
  - Uses Open Source Server (FHIRbase)
  - Extended to meet requirements regarding extensions
  - Analysis Platform for data visualization
  - Uses Connector Component



Results (5/5)

- Connector Component
  - Platform independent library
  - Responsible for mapping
  - Based on HAPI FHIR library
- Snippet of the FHIR Resource:

```
<extention url="http://fhtw.at/fhir/StructureDefinition/pollen-info">
  <extention url="obsType">
    <!-- alternative could be historicalData -->
    <valueCode value="forecastData">
  <extention/>
  <extention url="generationTime">
    <!-- date and time when the data was generated -->
    <valueDateTime value="2017-03-14T10:57:34+01:00">
  <extention/>
<extention/>
<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

[1] European Commission, “eHealth Action Plan 2012-2020,” 2012.

[2] European Commission, “eHealth - CEF Digital -Sector Specific DSI,” 2016. [Online]. Available: https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/eHealth. [Accessed: 30-Jan-2017].

[3] D. D. Maeng, A. E. Starr, J. F. Tomcavage, J. Sciandra, D. Salek, and D. Griffith, “Can Telemonitoring Reduce Hospitalization and Cost of Care? A Health Plan’s Experience in Managing Patients with Heart Failure.,” Popul. Health Manag., vol. 0, no. 0, pp. 1–5, 2014

[4] P. Urbauer, M. Frohner, M. Forjan, B. Pohn, S. Sauermann, and A. Mense, “A Closer Look on Standards Based Personal Health Device Communication: A Résumé over Four Years Implementing Telemonitoring Solutions,” Eur. J. Biomed. Informatics, vol. 8, no. 3, pp. 65–70, 2012.

[5] P. Urbauer, S. Sauermann, M. Frohner, M. Forjan, B. Pohn, and A. Mense, “Applicability of IHE/Continua components for PHR systems: Learning from experiences,” Comput. Biol. Med., vol. 59, pp. 186–193, Apr. 2015.

Thank you for your attention!

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