A FRAMEWORK AND ONTOLOGY FOR MOBILE SENSOR PLATFORMS IN HOME HEALTH MANAGEMENT

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PROBLEMS / OPPORTUNITIES

Problems

- Cost
- Complexity

Goals

- Interoperability framework
- Simplifying use of complex medical standards

Approach

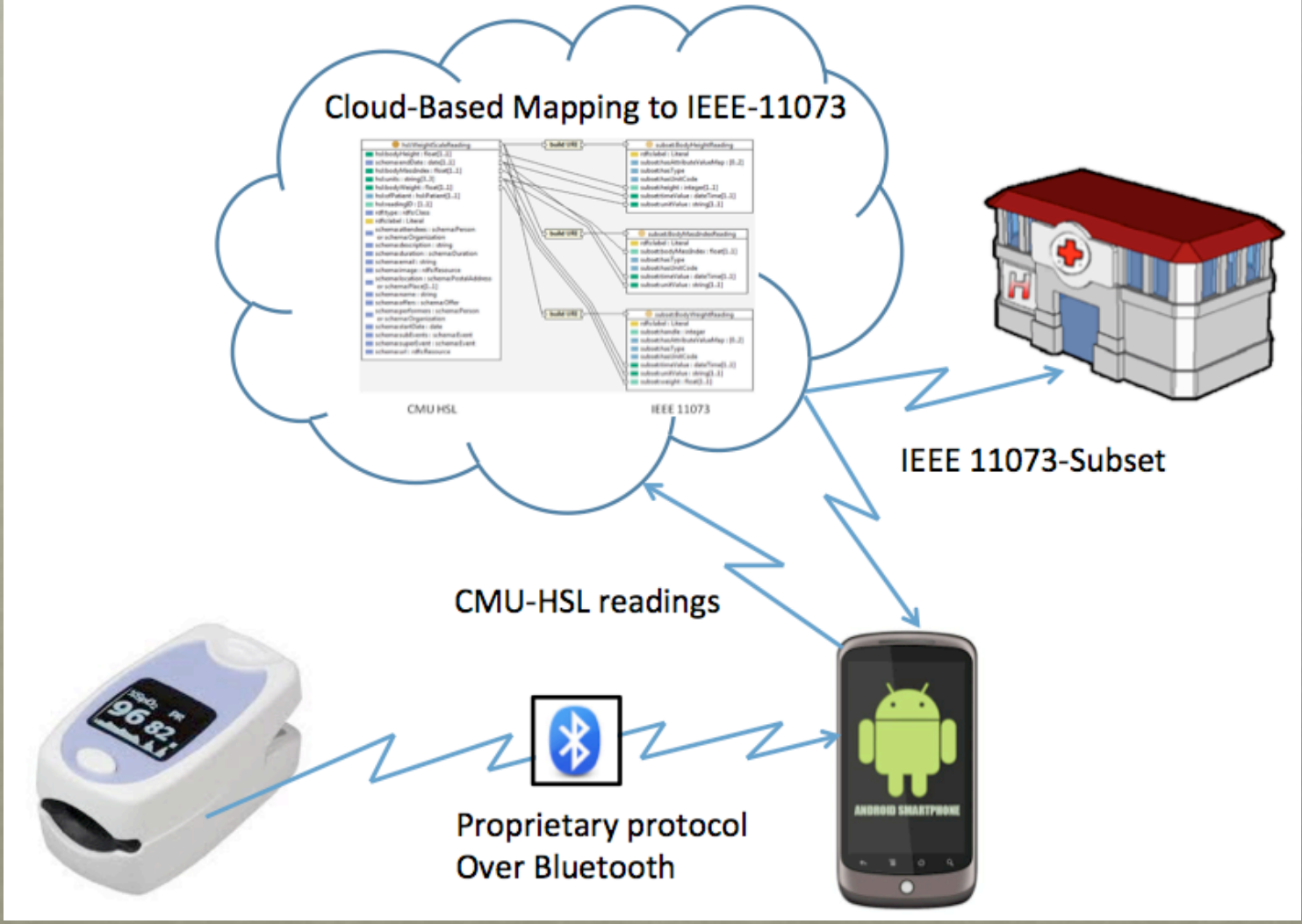
- Cloud based reasoning environment

RESEARCH OVERVIEW

Source: http://www.ercim.eu/publication/Ercim_News/enw60/husemann.html

- Ontologies to map sensor data to medical standards like IEEE 11073
- A cloud-based reasoning and mapping system built with RDF, OWL, SPARQL and SPIN

THE BIG PICTURE



EXISTING STANDARDS

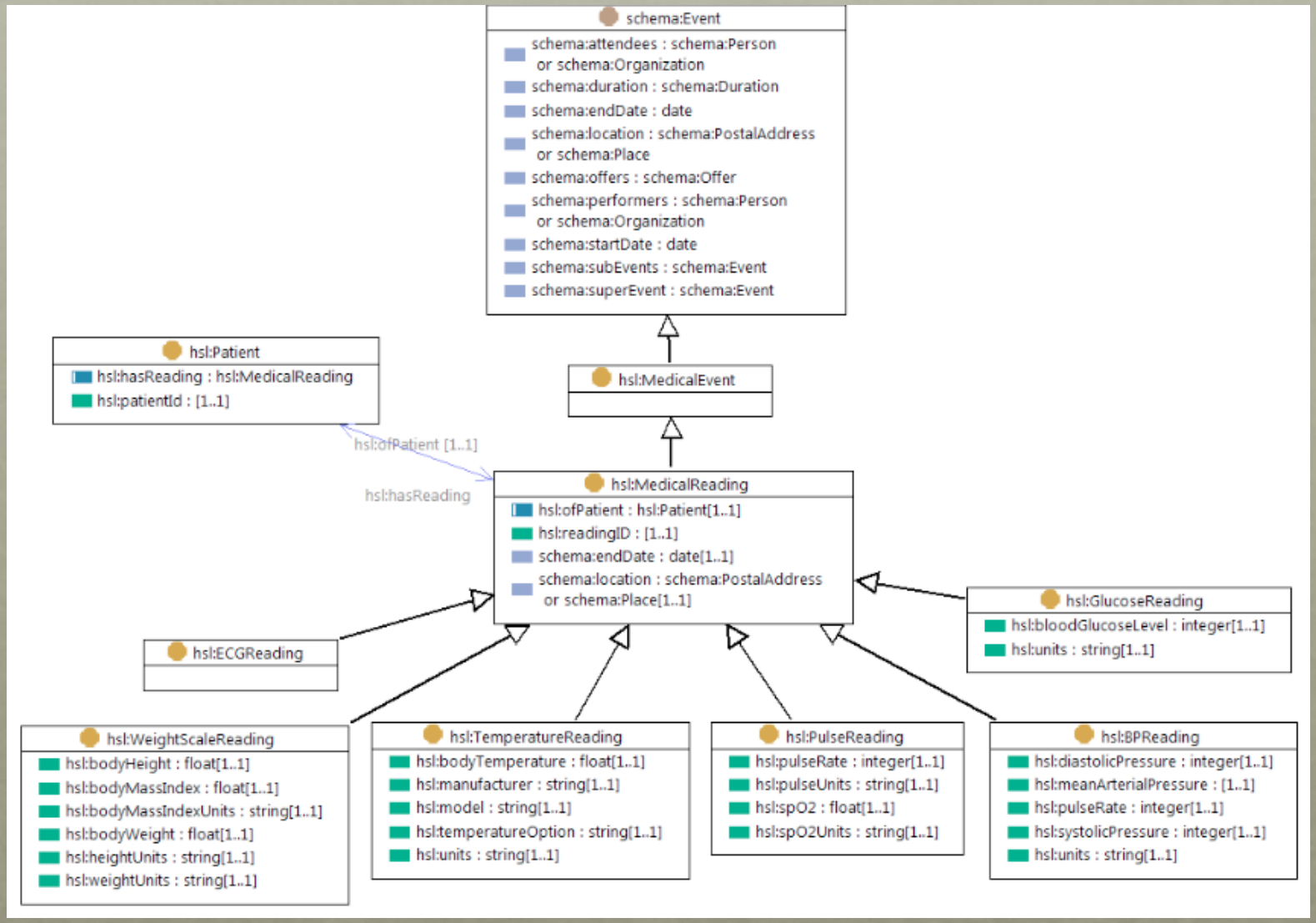
- **Health Level 7 (HL7)** - A global health standard that provides a framework for easy and transparent exchange of electronic health information.
- **IEEE 11073** – Family of standard for medical device information exchange.

HSL ONTOLOGY

The Healthcare Semantics Lite (HSL) ontology

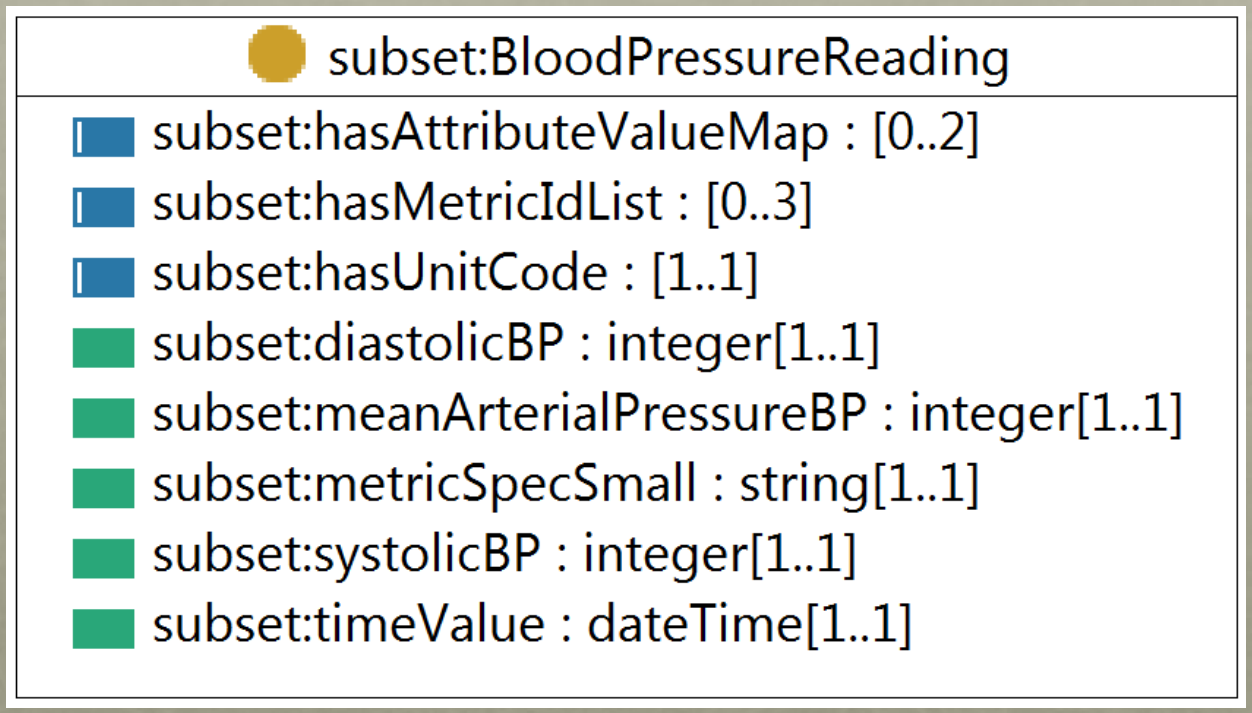
- Minimum set of data a medical reading
- Represents data for developers and public
- Inherits from Schema.org

HSL ONTOLOGY (PARTIAL)



IEEE 11073 SUBSET ONTOLOGY

Subset of the IEEE 11073 device-specific component standards



Class with mandatory IEEE 11073–10407 mandatory fields

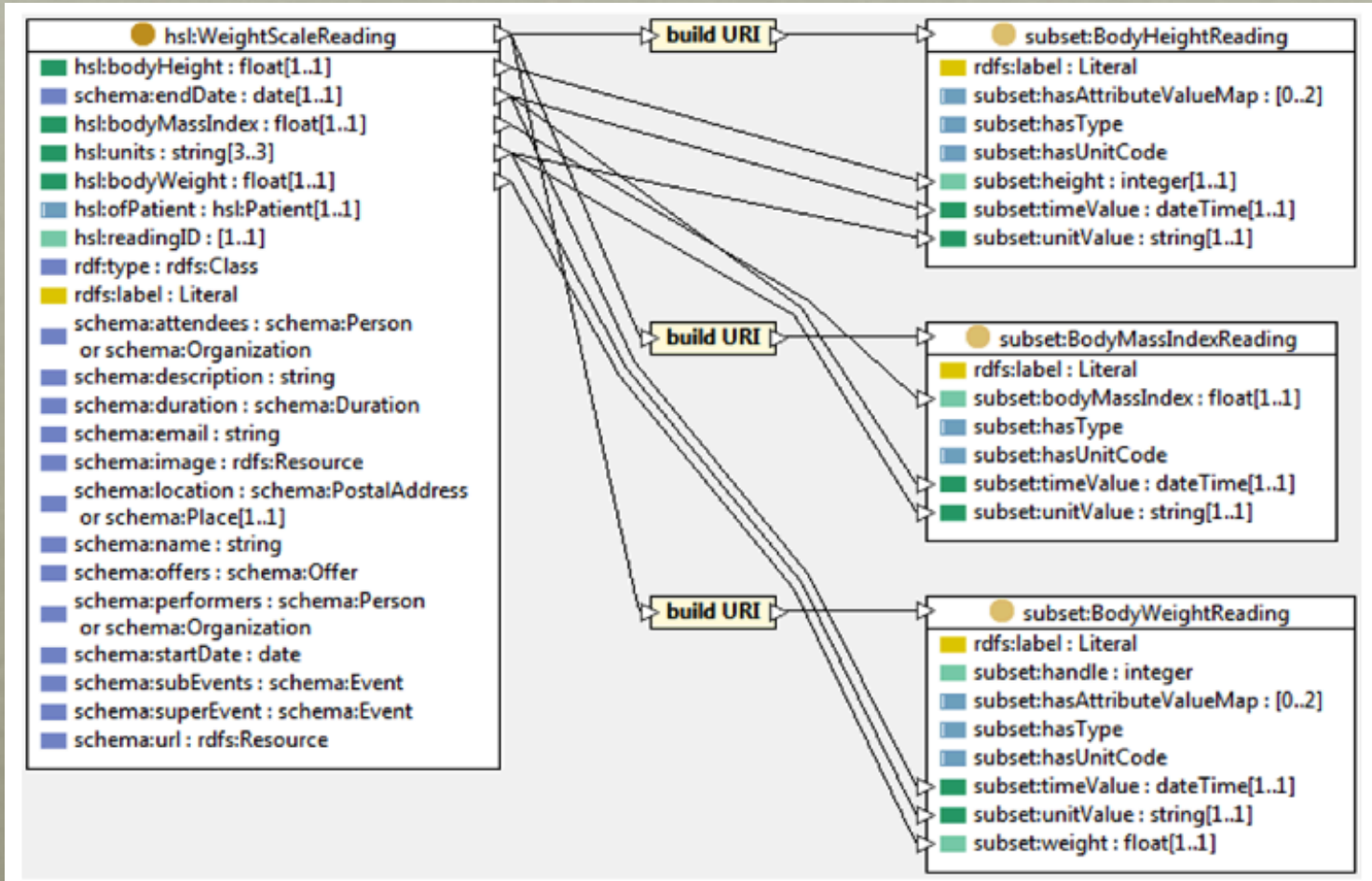
MAPPING HSL TO SUBSET

SPINMap used to define mappings

Example
Unit of measure for blood pressure
HSL: “mmhg” → Subset: “MDC_DIM_MMHG”

Other values mapped by default, e.g., manufacturer of the medical sensor.

HSL TO SUBSET DIAGRAM

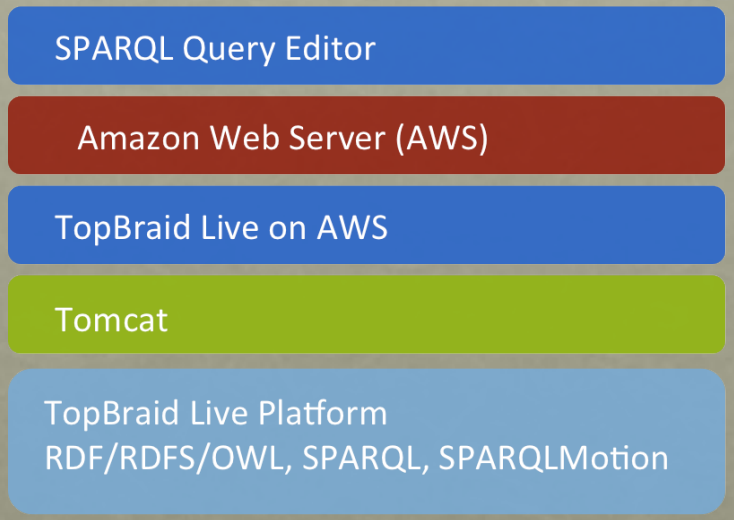


PROOF OF CONCEPT FRAMEWORK

- RDF
- Cloud-based OWL reasoner
- RESTful Endpoints

- SPARQL queries + SPIN rules
- Consumer context → Hospital context

Technology Stack



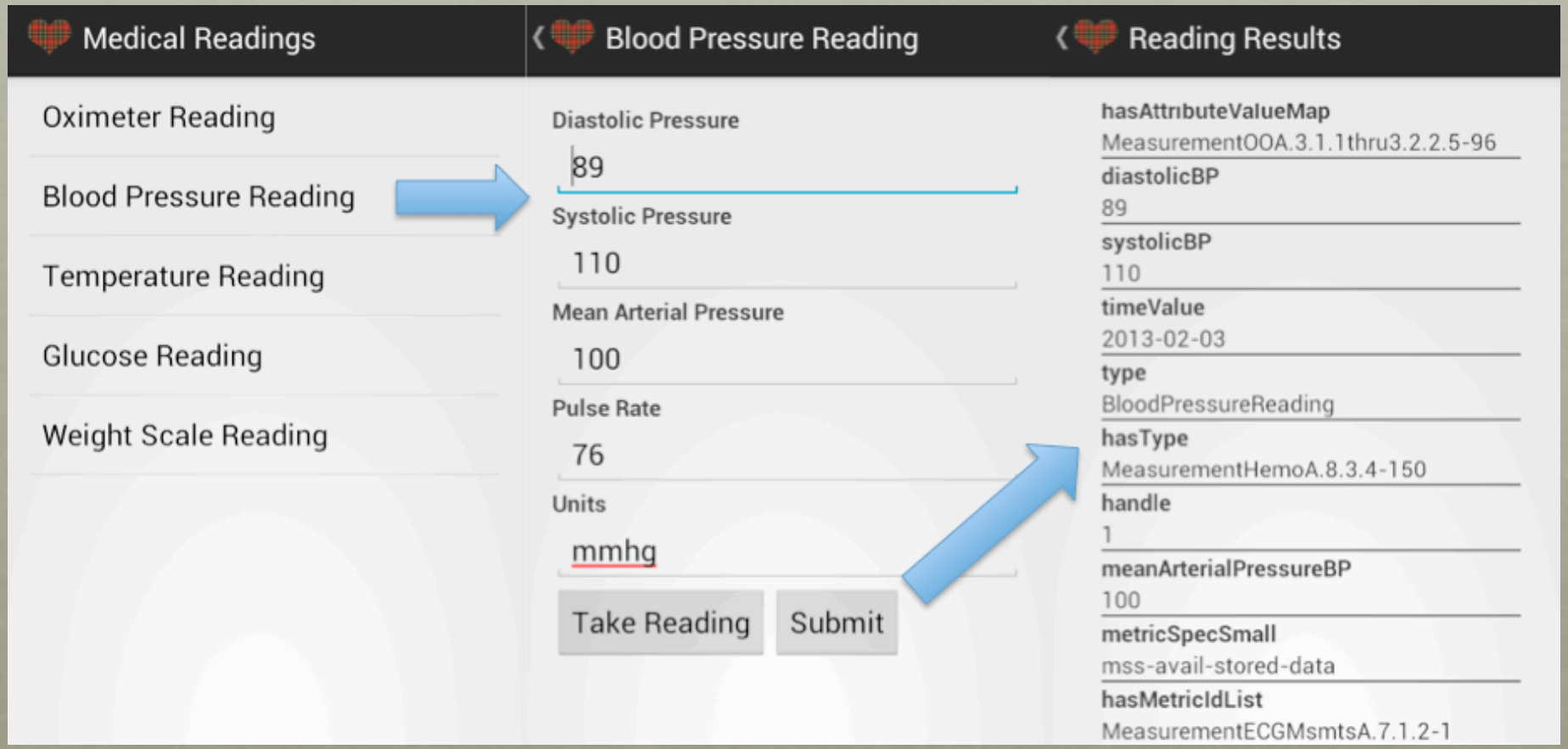
Pulse Reading SPARQL Construct Query

```
CONSTRUCT {
   ?newHslPatient a hsl:Patient .
   ?newHslPatient hsl:patientId ?patientId .
   ?newHslReading a hsl:PulseReading .
   ?newHslReading hsl:readingID ?readingId .
   ?newHslReading hsl:ofPatient ?newPatient .
   ?newHslReading hsl:pulseRate ?pulseRate .
   ?newHslReading hsl:spO2 ?spO2 .
   ?newHslReading schema:endDate ?timestamp .
}
WHERE {
   BIND ("http://cmusv/hsl#" AS ?hslUri) .
   BIND (spif:buildURI(fn:concat(?hslUri, ?patientId)) AS ?newHslPatient) .
   BIND (spif:buildURI(fn:concat(?hslUri, ?readingId)) AS ?newHslReading) .
}
```

MOBILE APP

- Interacts with medical sensors
  - Bluetooth Support
- Thin client
  - Interacts with cloud-based OWL reasoner
  - Renders JSON/XML data

APP SCREEN FLOW



- Easy to understand for patient and app developers

- IEEE 11073 compliant
- New data inferred

CONCLUSION

The biggest barriers to home healthcare are **cost** and **complexity**.

Smartphones

- Can replace many of the single-purpose medical devices
- Allow for home health monitoring
- Can provide important information to hospitals

Our extensible framework

- Opens world of home healthcare for mobile app developers
- Supports open interoperable information exchange
- Allows for sophisticated reasoning

QUESTIONS?

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