Intelligent Information and Communication Processing for Cyber-Physical Data

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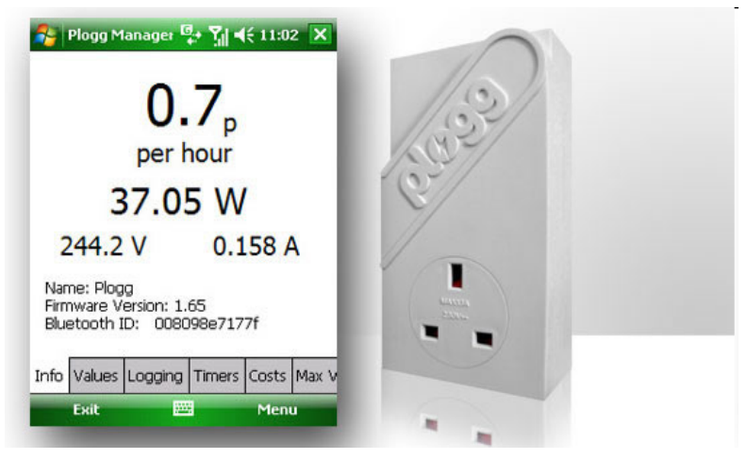
Agenda

- Background
- Semantic Modeling
- Tools for Modeling and Knowledge Acquisition
- Future Work

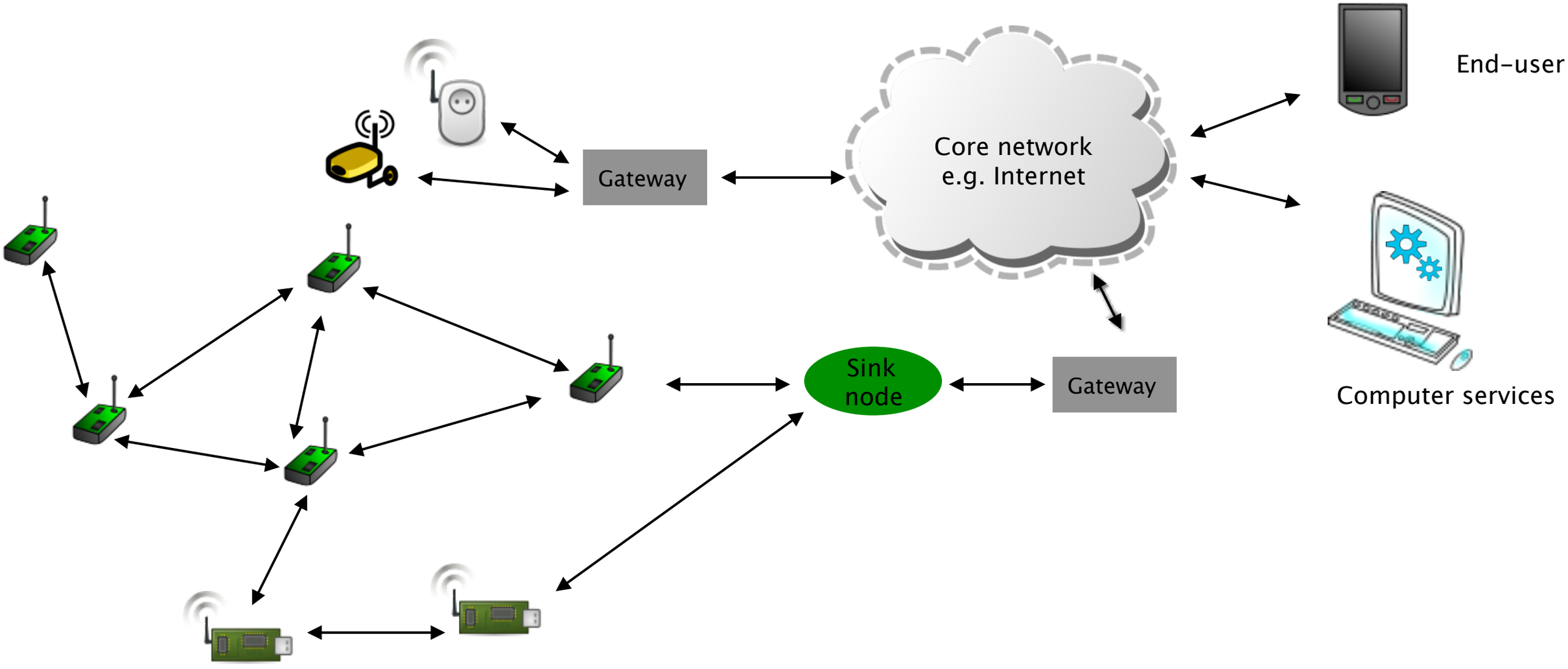
Sensors and Cyber-Physical Systems



Linker Intel Group

Image Sensor Device

Sensor Networks



The data deluge

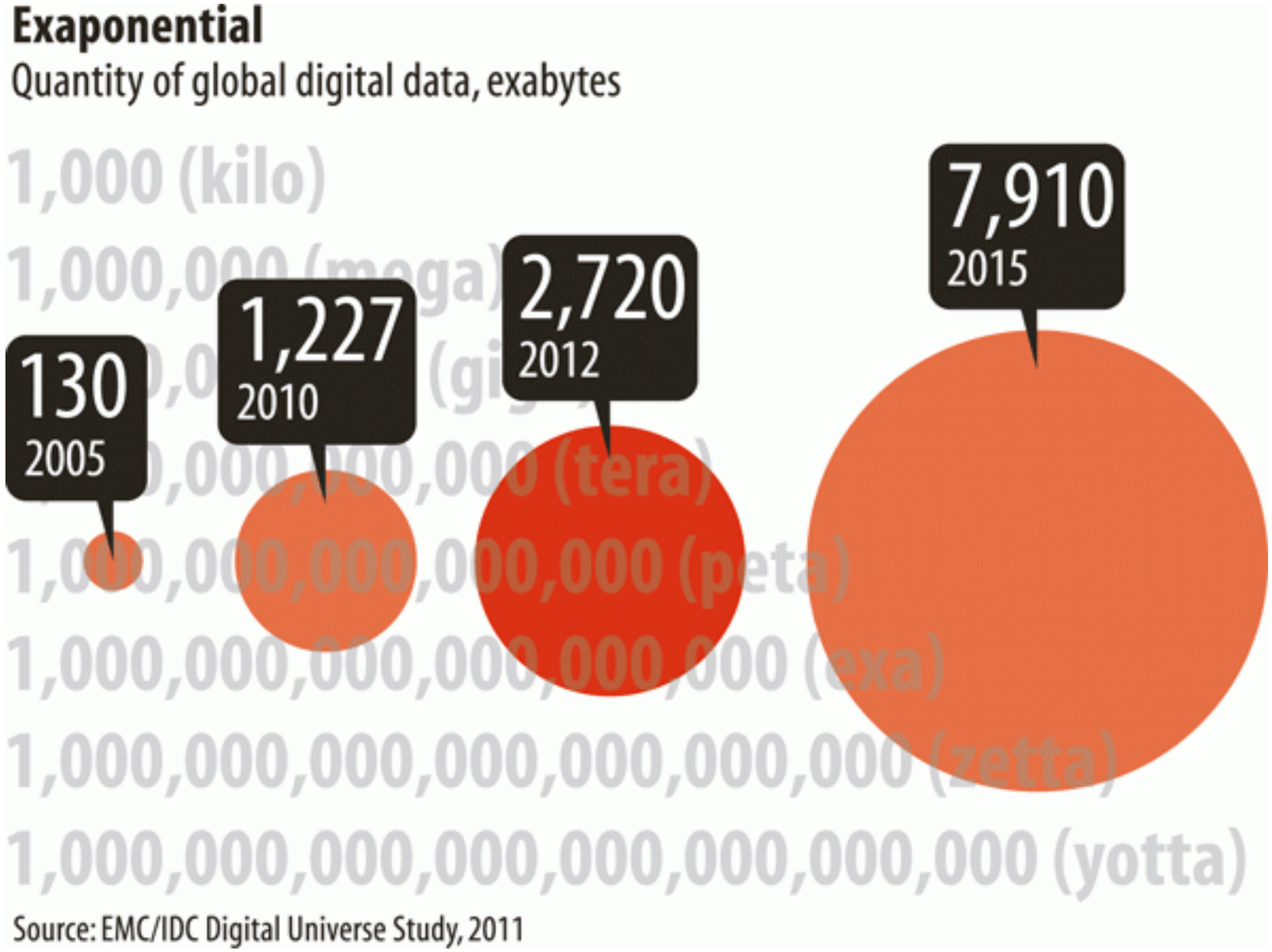
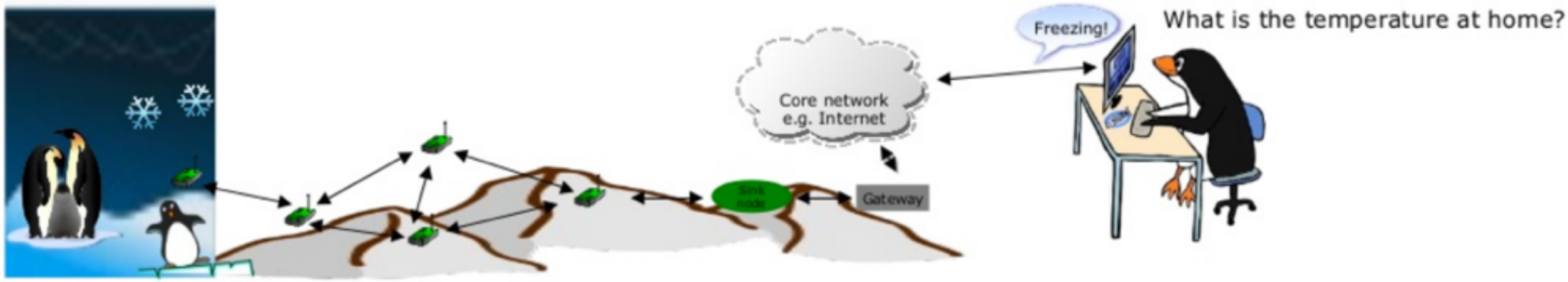
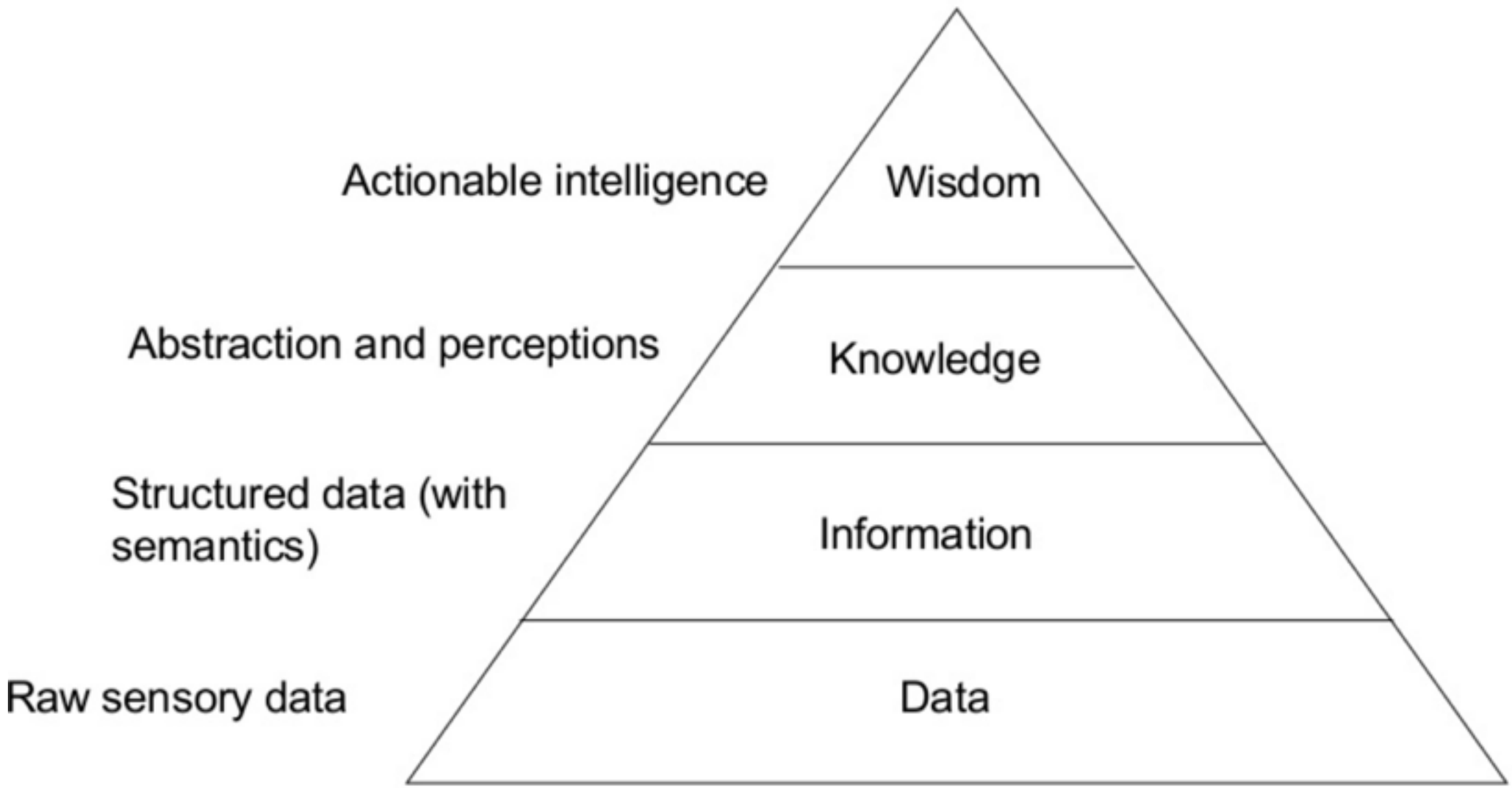


Image courtesy: the Economist


What is the temperature at home?
Freezing!
Core network
e.g. Internet
Sink
node
Gateway

Do we need this data?



Traditional Data Modeling

- Standards such as Sensor Web Enablement (SensorML) are widely adopted.

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    </swe:field>
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        </swe:Quantity>
    </swe:field>
```

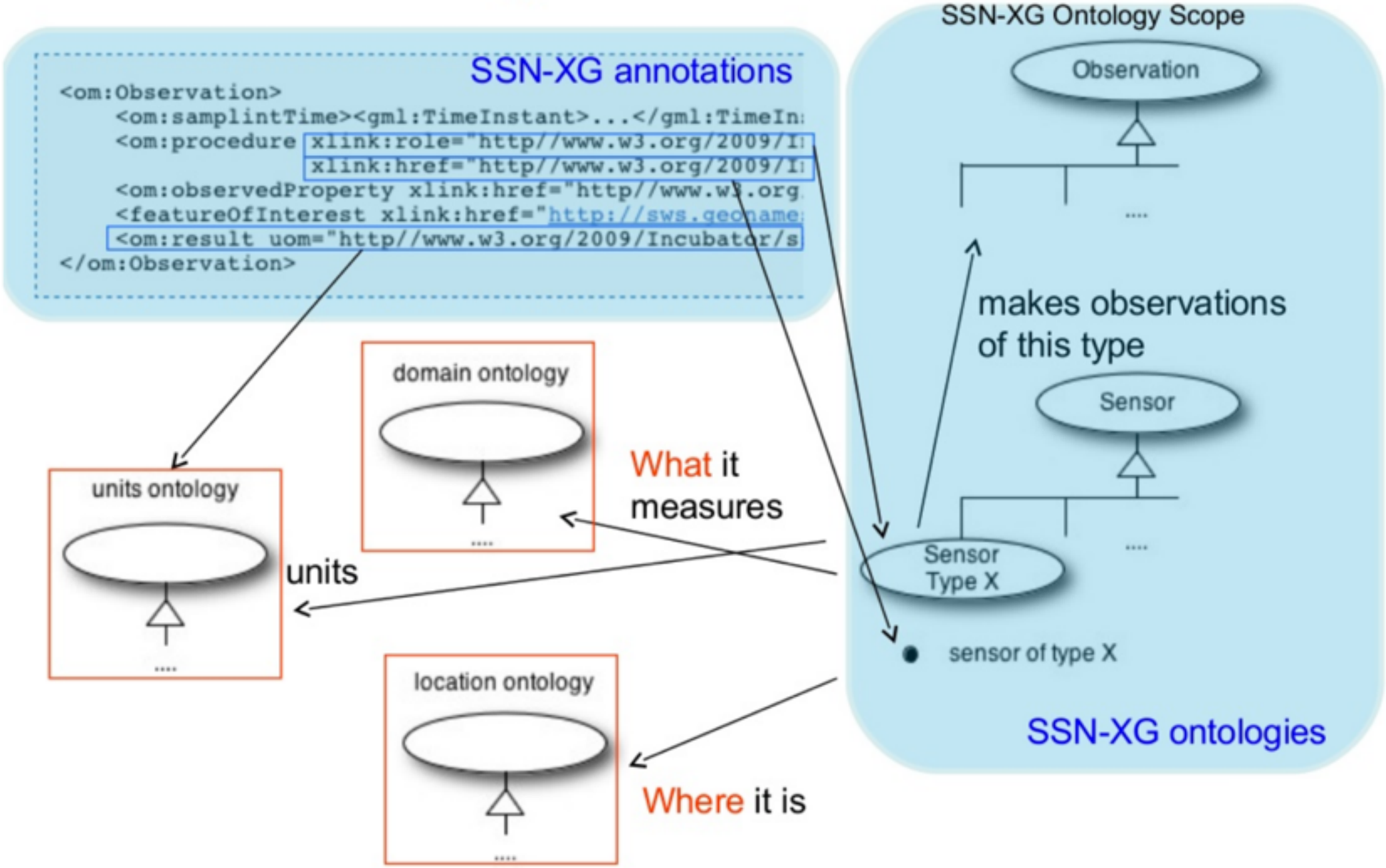
Data alone is not enough!

- Data with the right semantics
- Provenance, Quality of Information
- Interpretable formats
- Links and interconnections
- Background Knowledge, domain Information
- Hypotheses, expert Knowledge

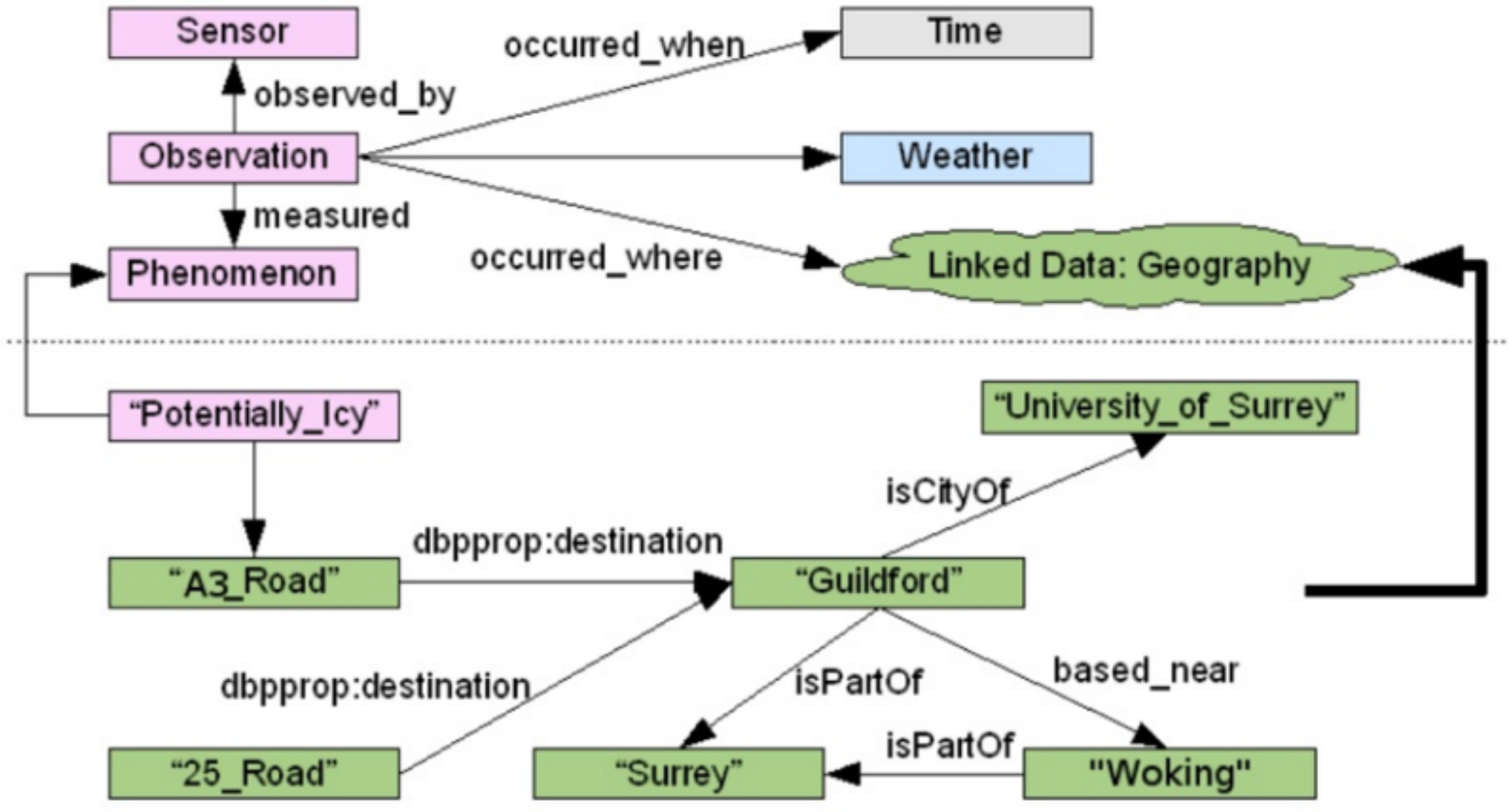
Semantic Modeling

- Defining raw data models is not enough
- Domain knowledge and context has to be modeled too
- Semantic models allow the connection between different aspects of cyber-physical systems, their environment and contextual information

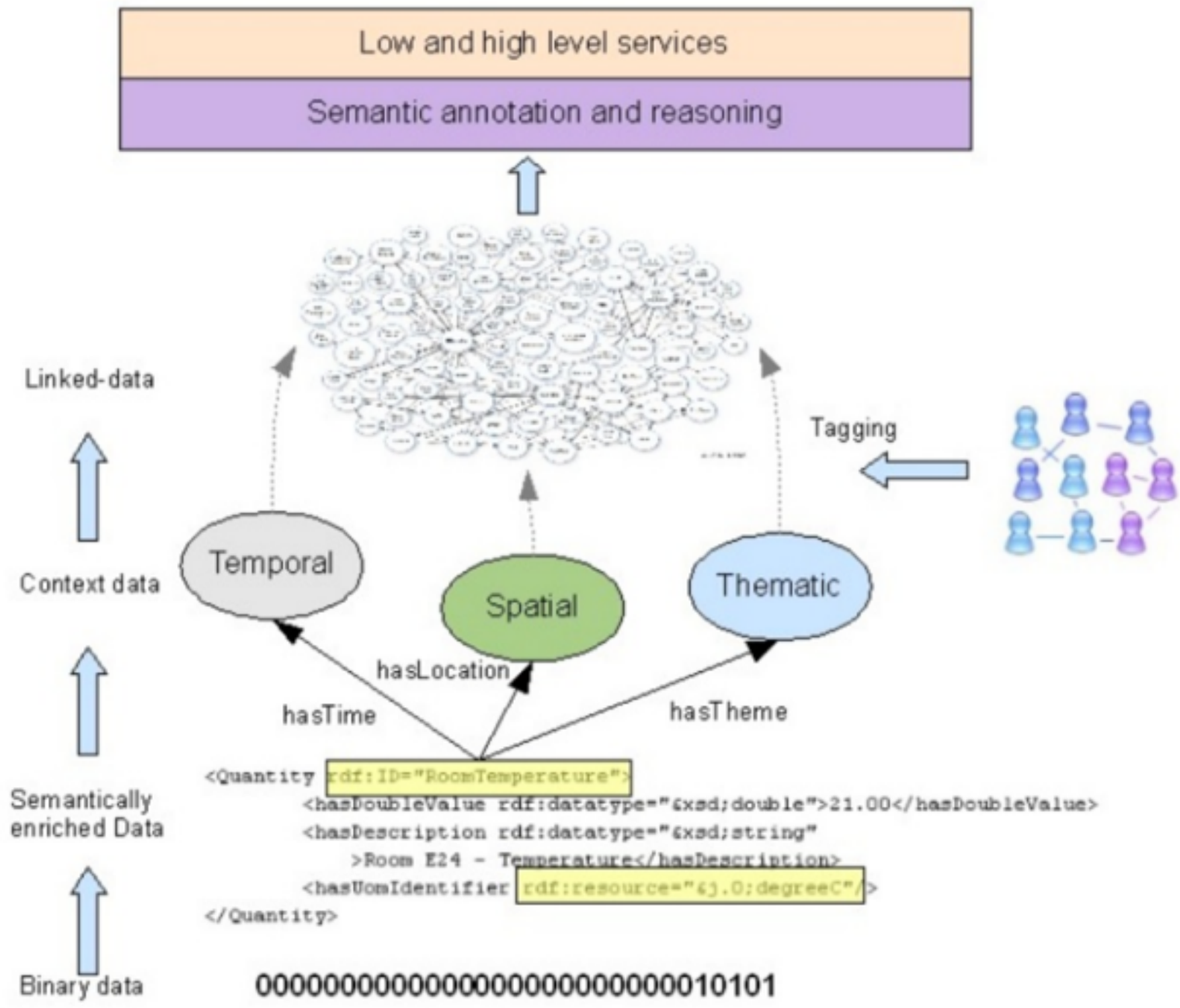
Semantic Sensor Network Ontology



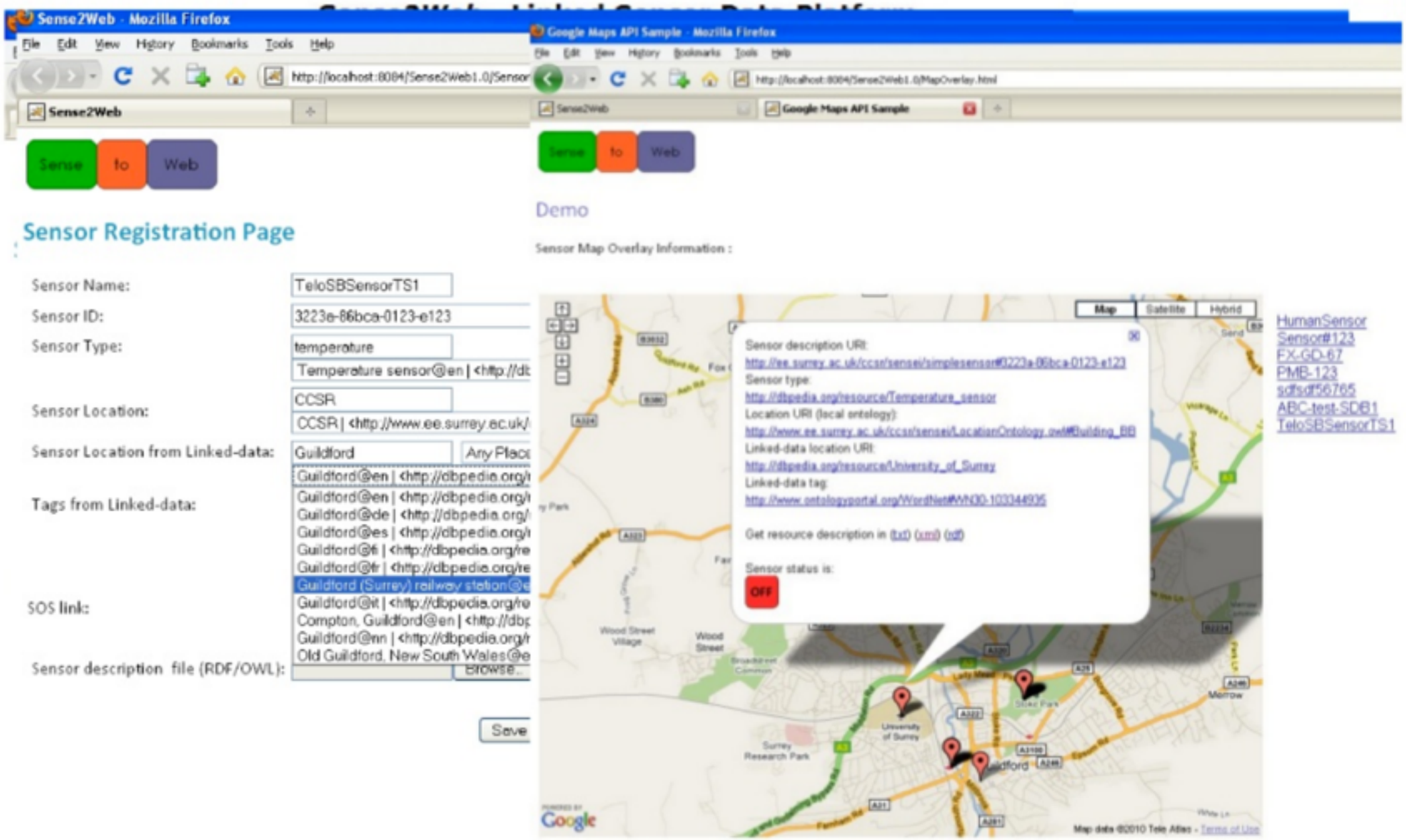
An Example


Sensor
observed_by
Observation
measured
Phenomenon
occurred_when
Time
Weather
occurred_where
Linked Data: Geography
"Potentially_Icy"
"University_of_Surrey"
isCityOf
dbpprop:destination
"A3_Road"
"Guildford"
dbpprop:destination
isPartOf
based_near
isPartOf
"25_Road"
"Surrey"
"Woking"

Using Semantic Models



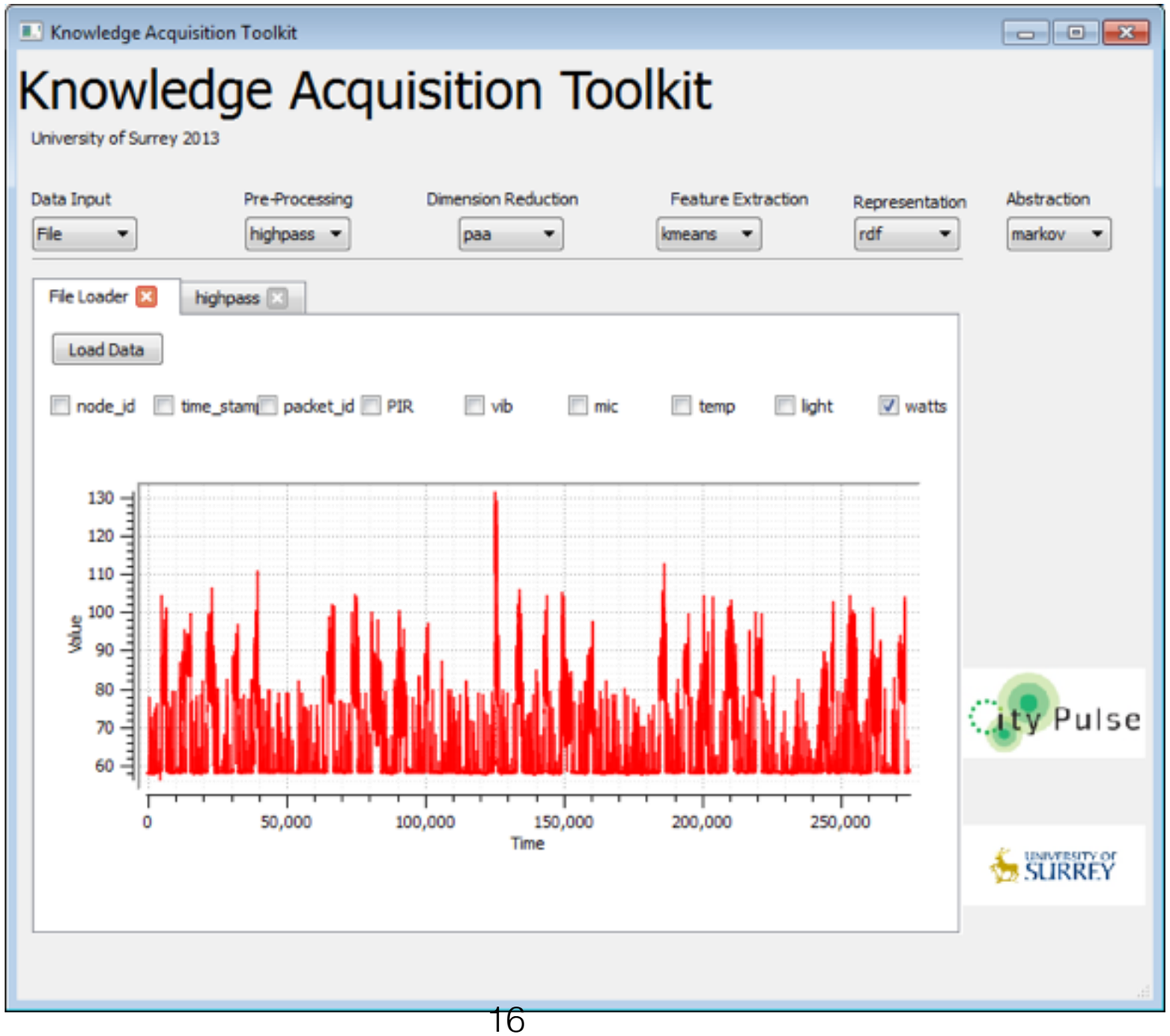
Sense2Web: Annotate Sensor Data



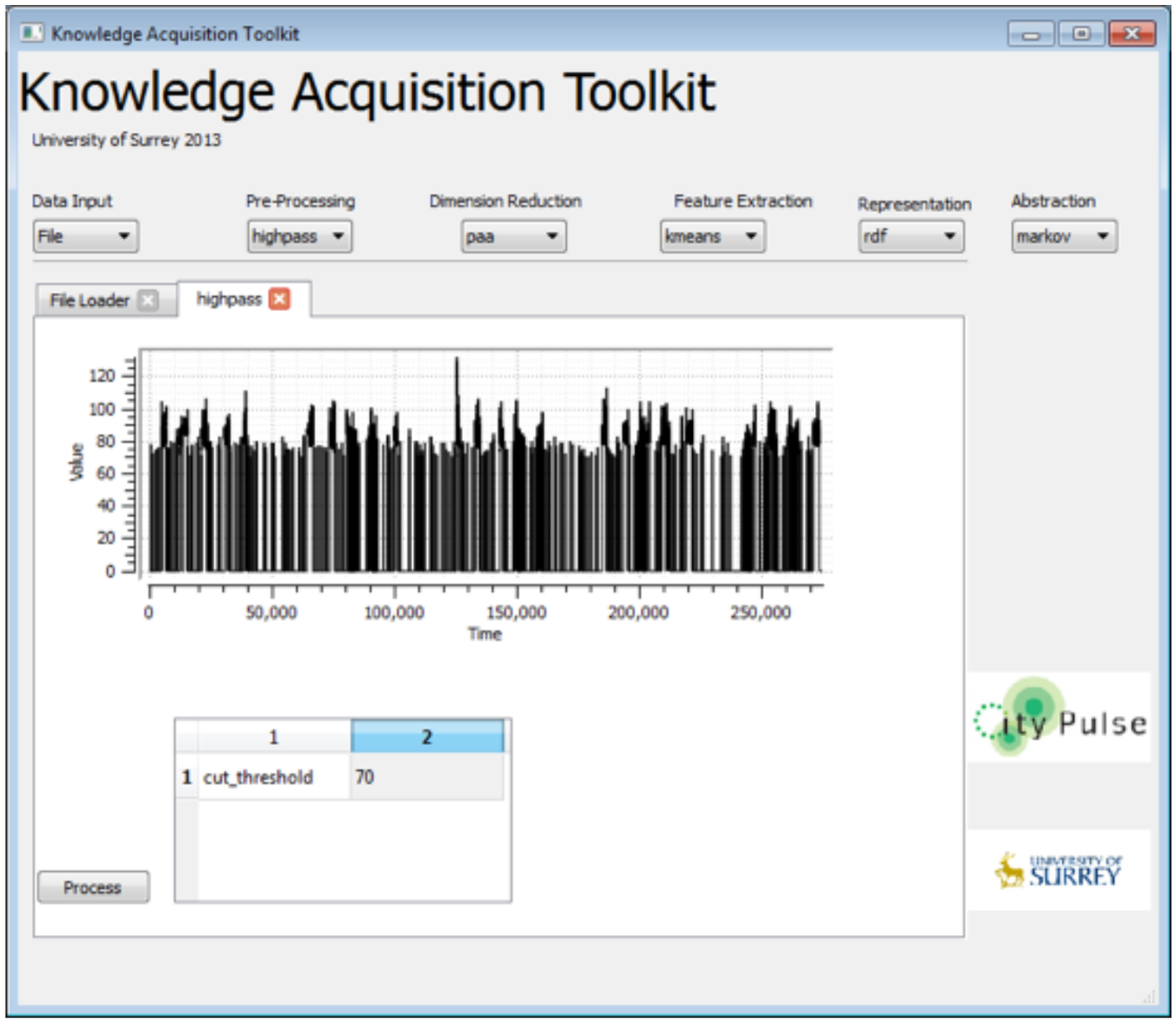
Connecting Data

- Sense2Web allows the modeling of static information (structure, location, meta information)
- How to model phenomena and their occurrence in the model?

KAT: the Knowledge Acquisition Toolkit



KAT: the Knowledge Acquisition Toolkit



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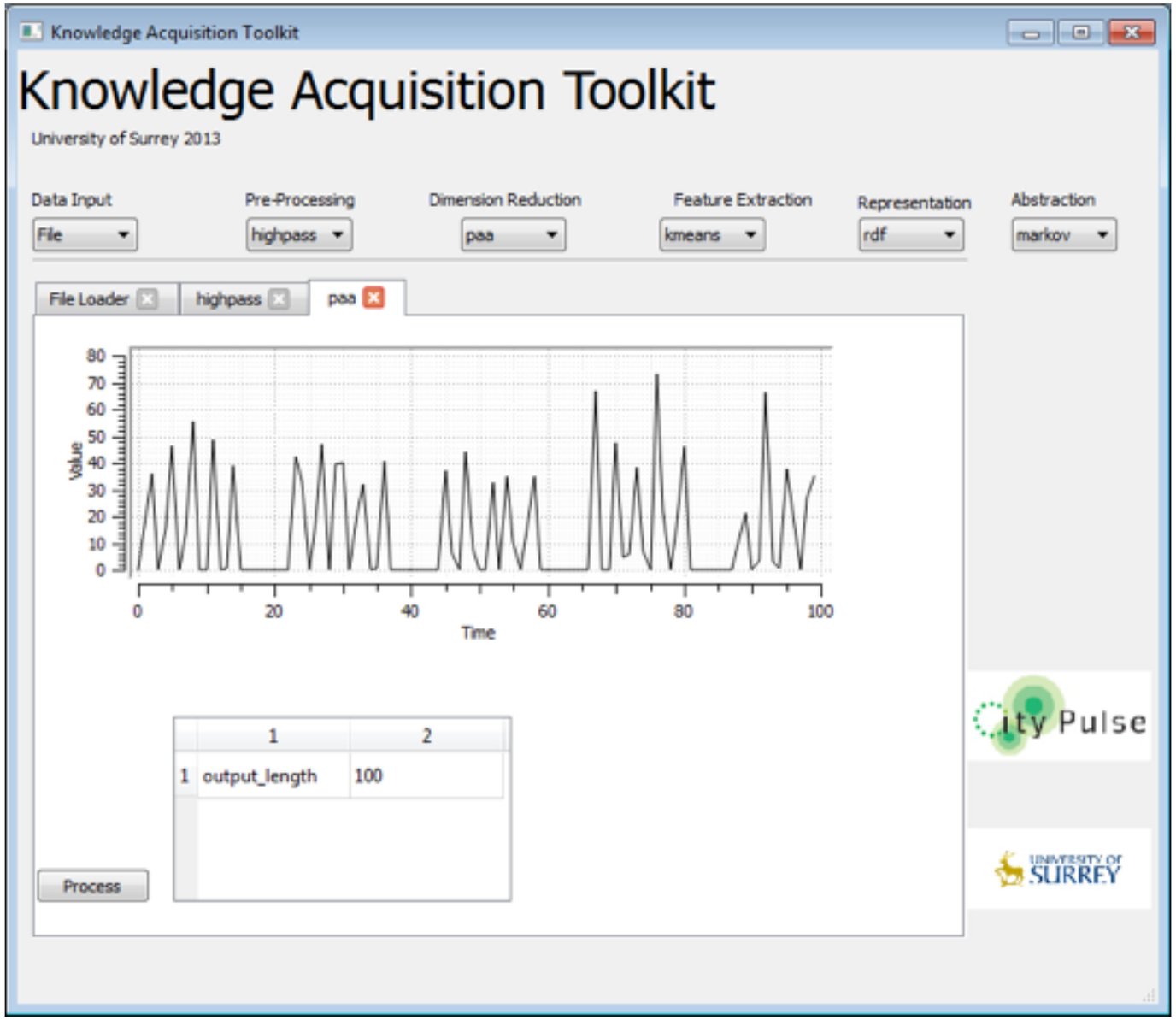

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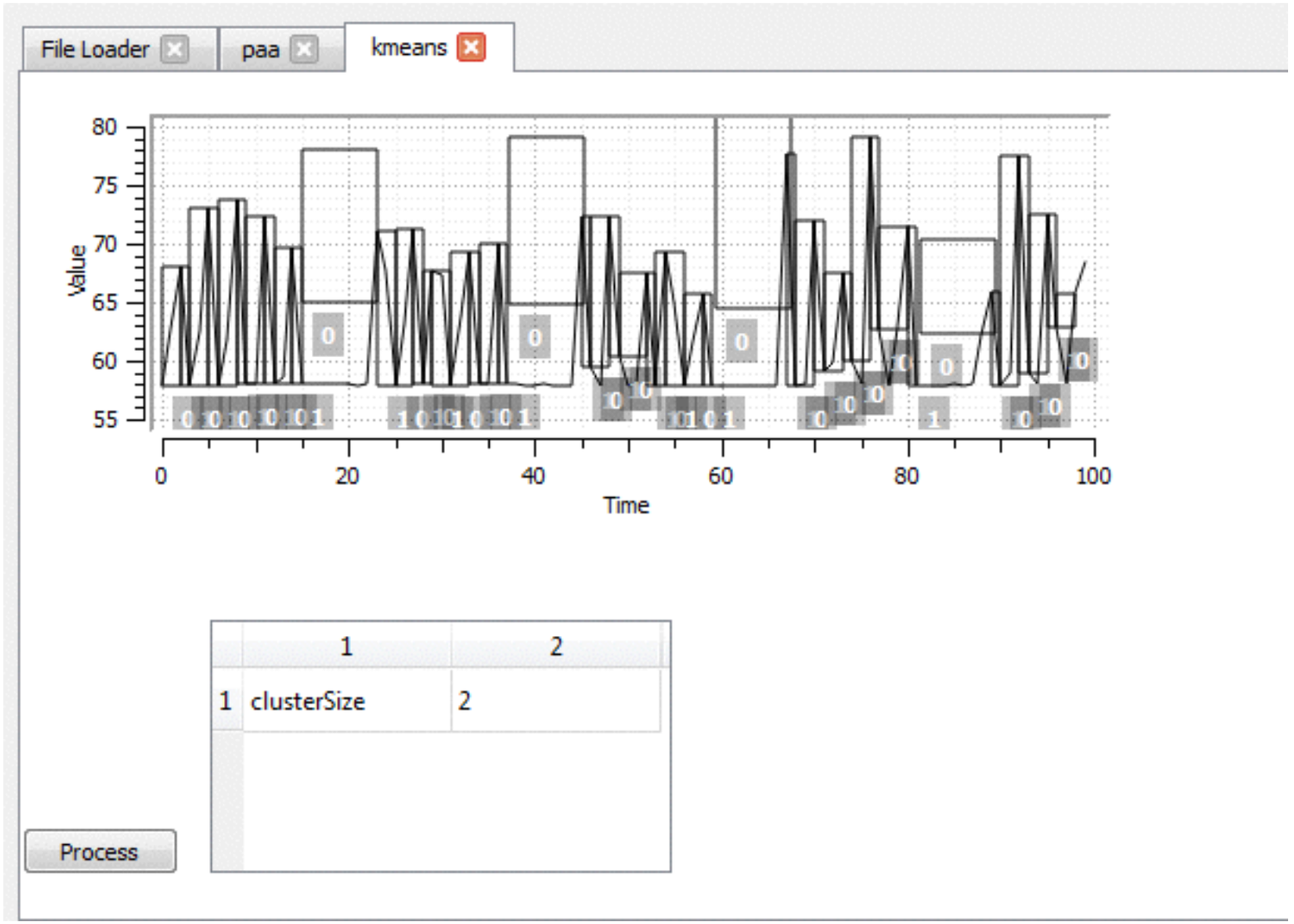

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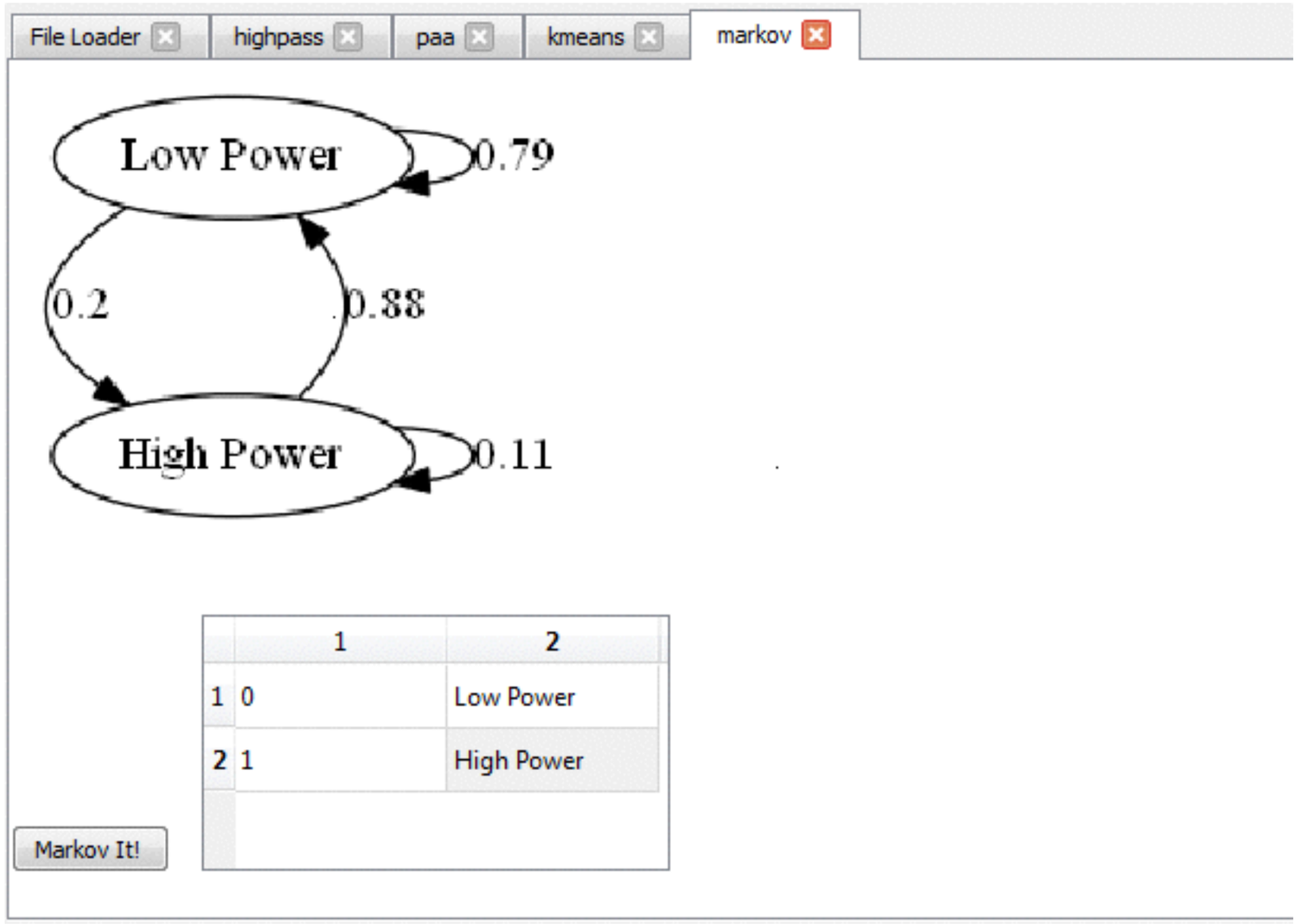

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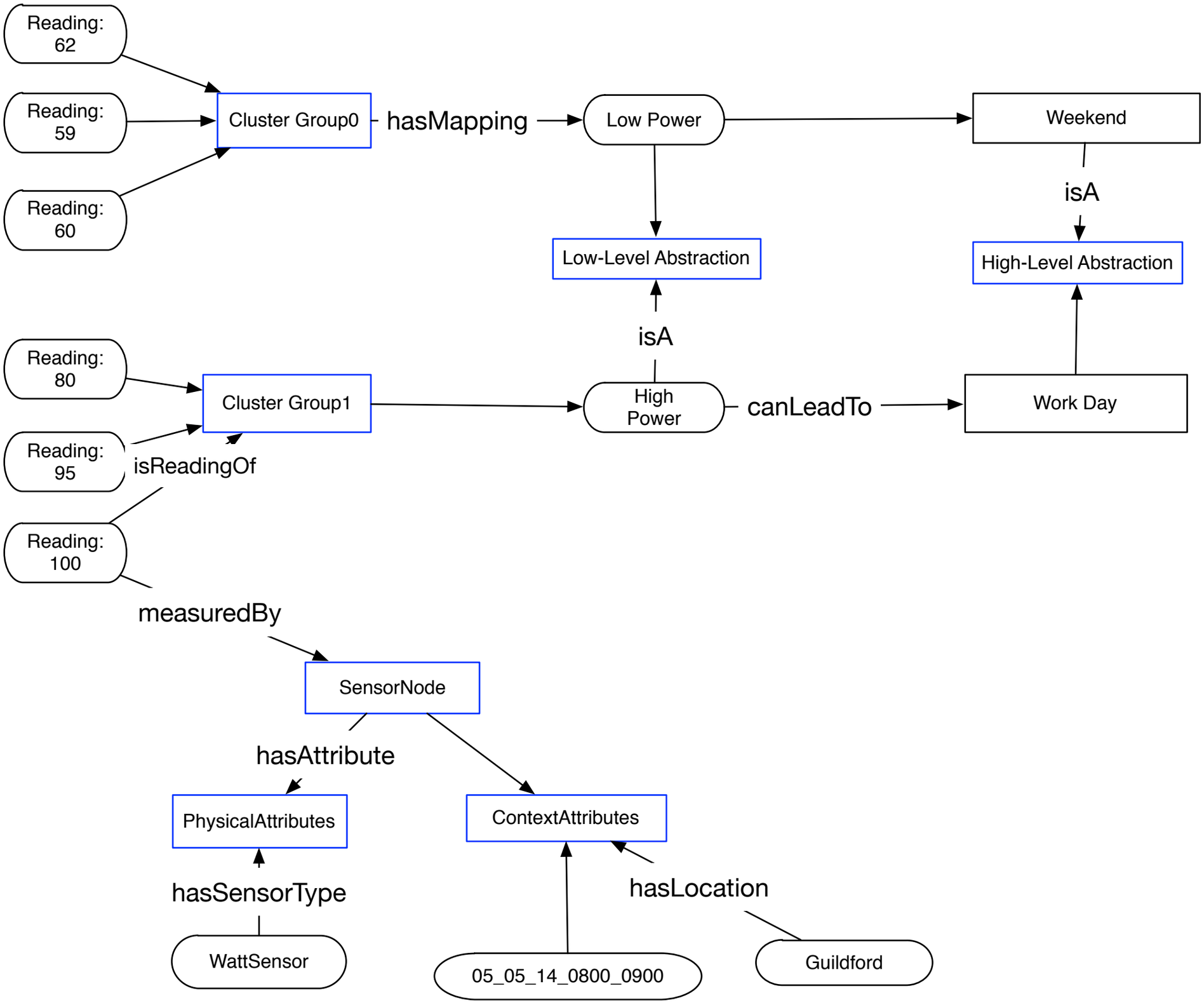

Current and Future Work

- Automation of the knowledge acquisition steps
- Context Adaption to changes in the environment
- Integration with real world scenarios (CityPulse Project)

Thanks! Questions?