

Intelligent Information and Communication Processing for Cyber-Physical Data

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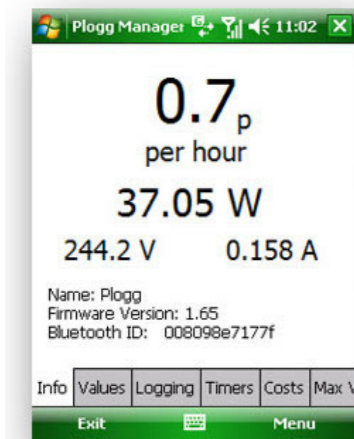


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Agenda

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

Sensors and Cyber-Physical Systems



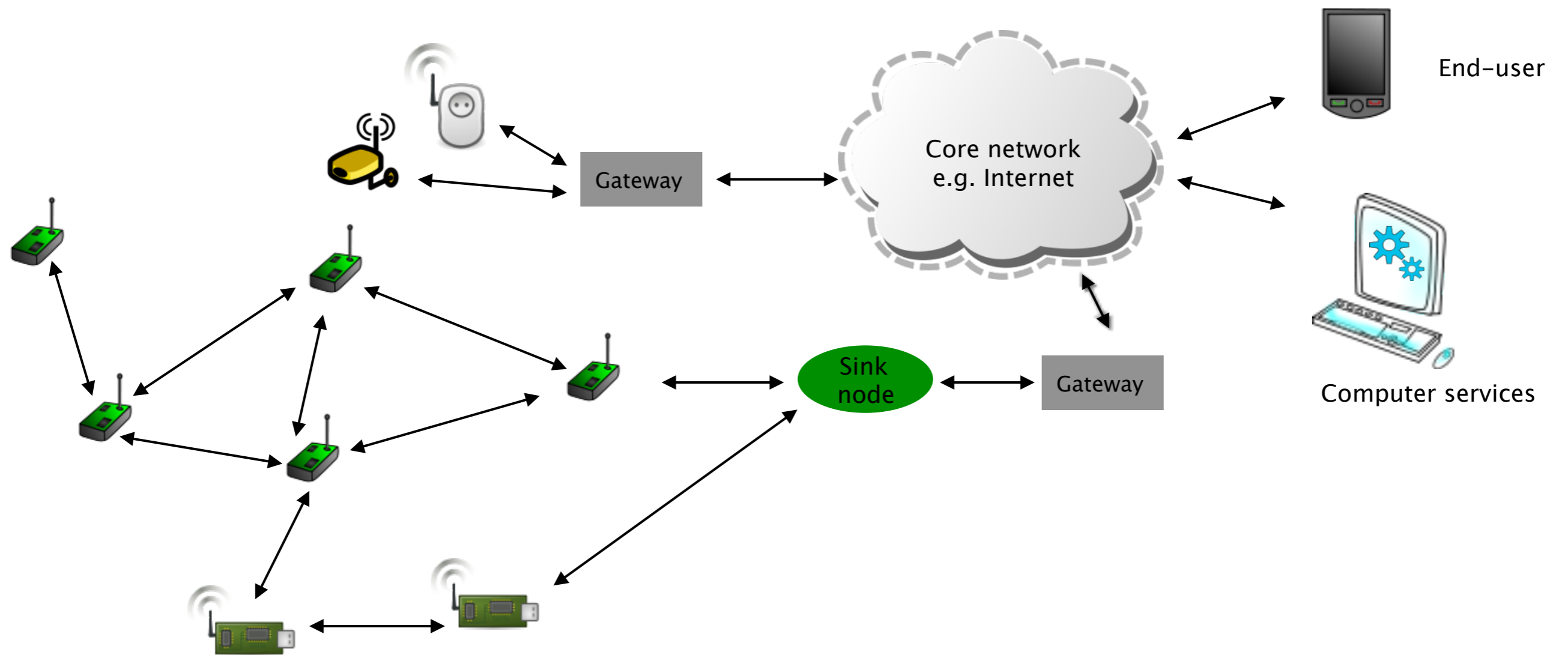
Linker Intel Group



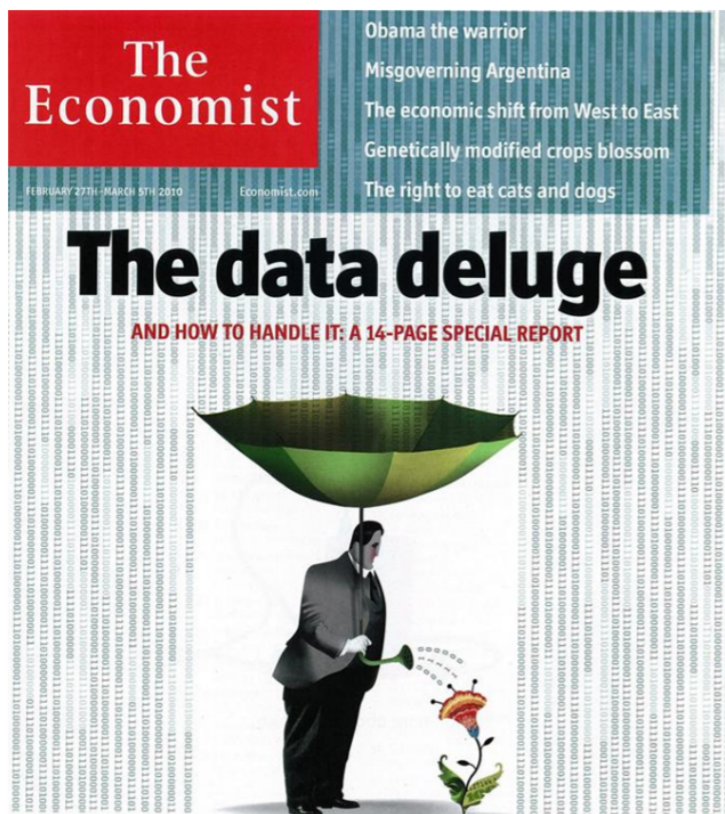
Image Sensor Device



Sensor Networks

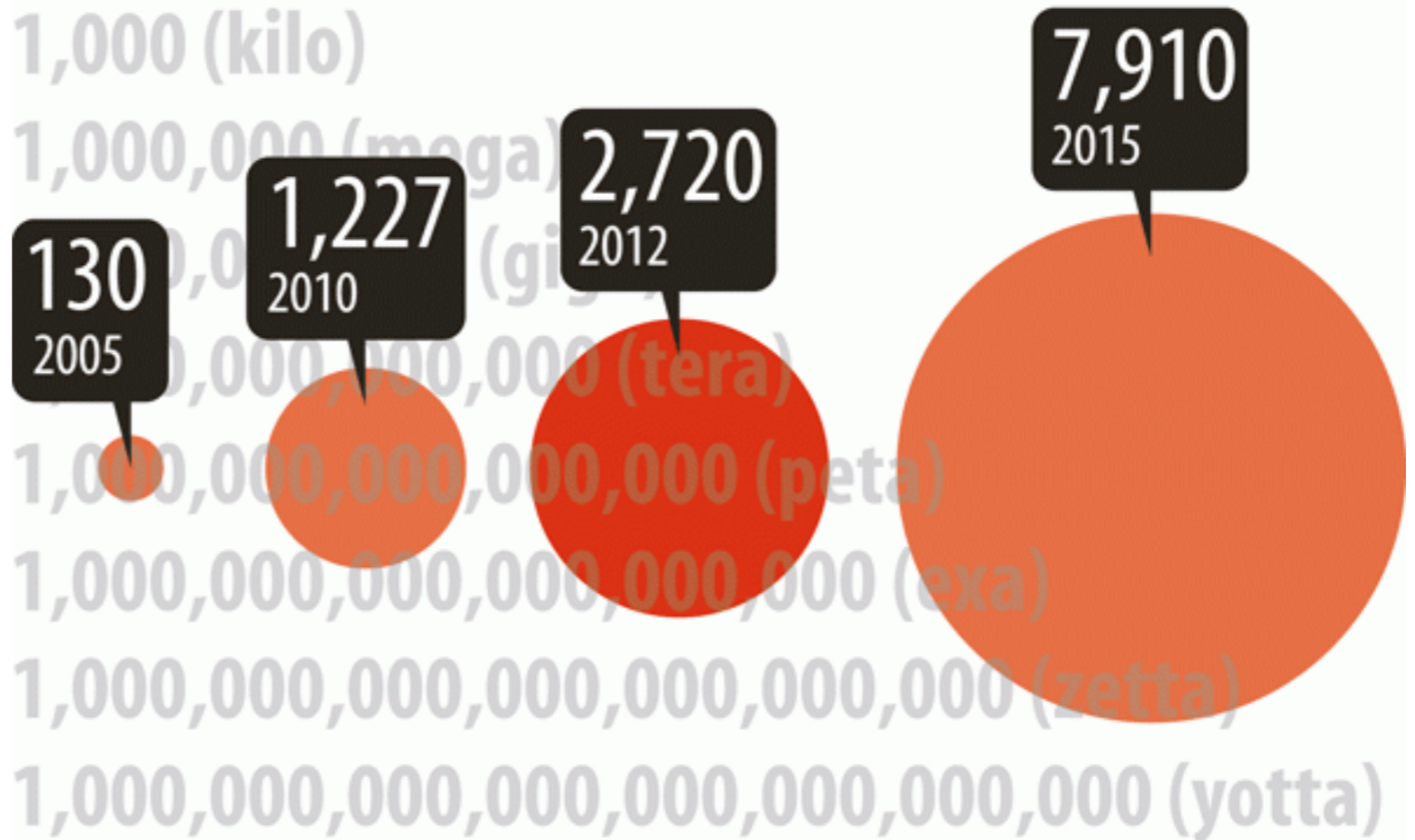


The data deluge



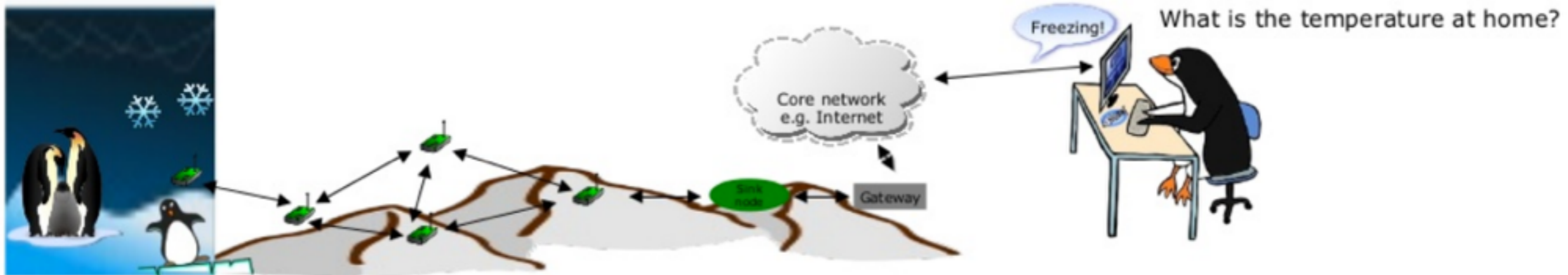
Exponential

Quantity of global digital data, exabytes

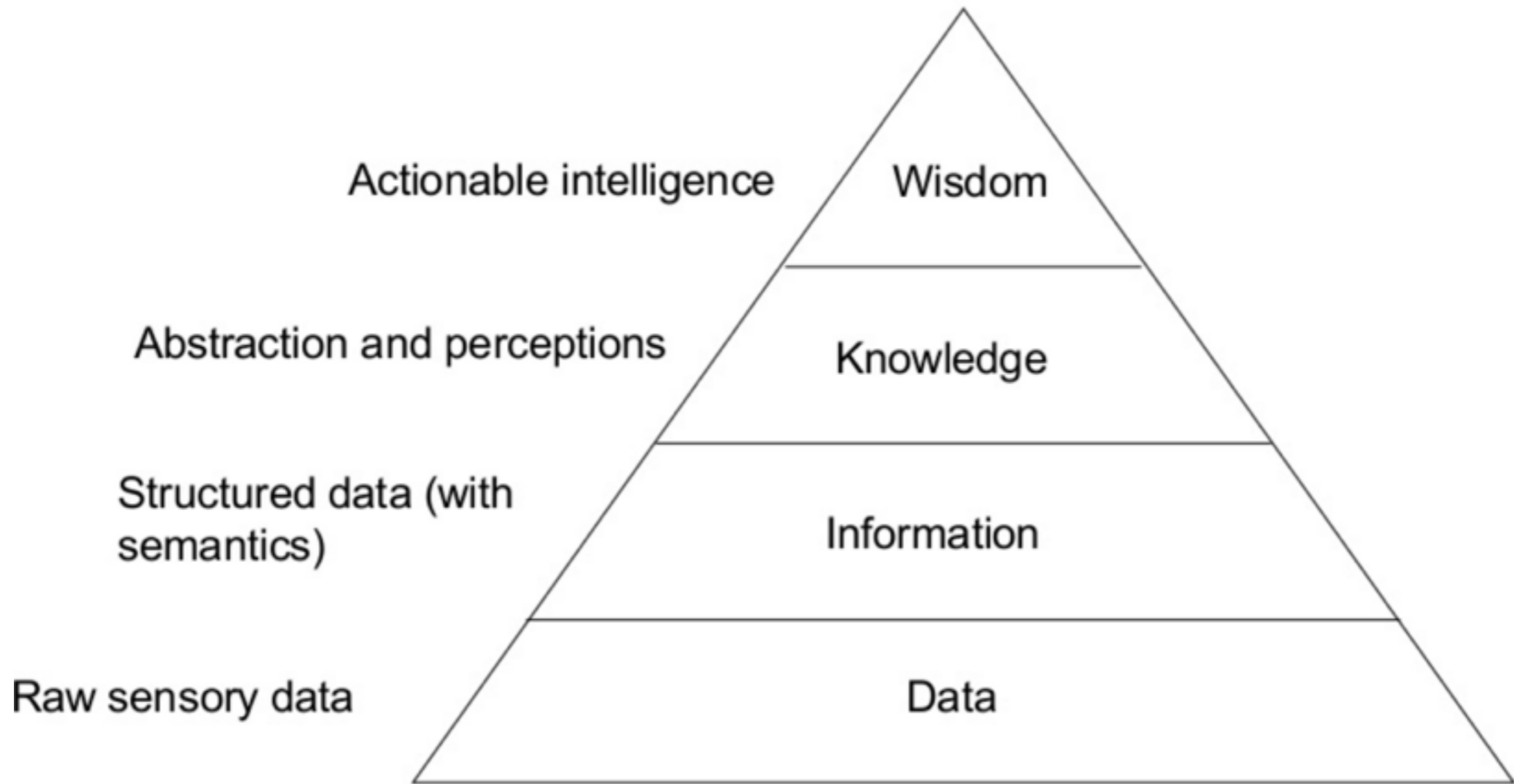


Source: EMC/IDC Digital Universe Study, 2011

Image courtesy: the Economist



Do we need this data?



Traditional Data Modeling

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

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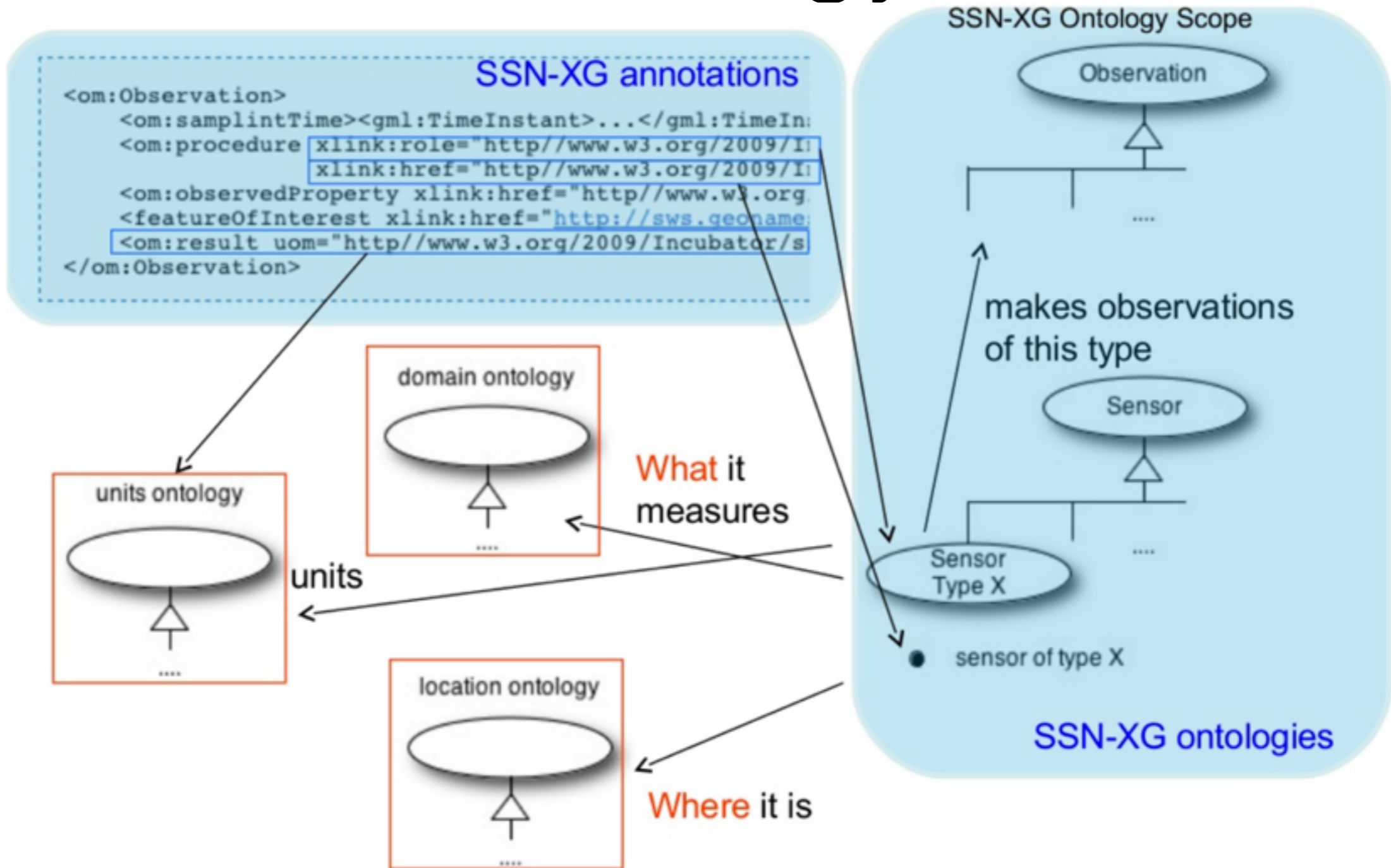

Data alone is not enough!

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

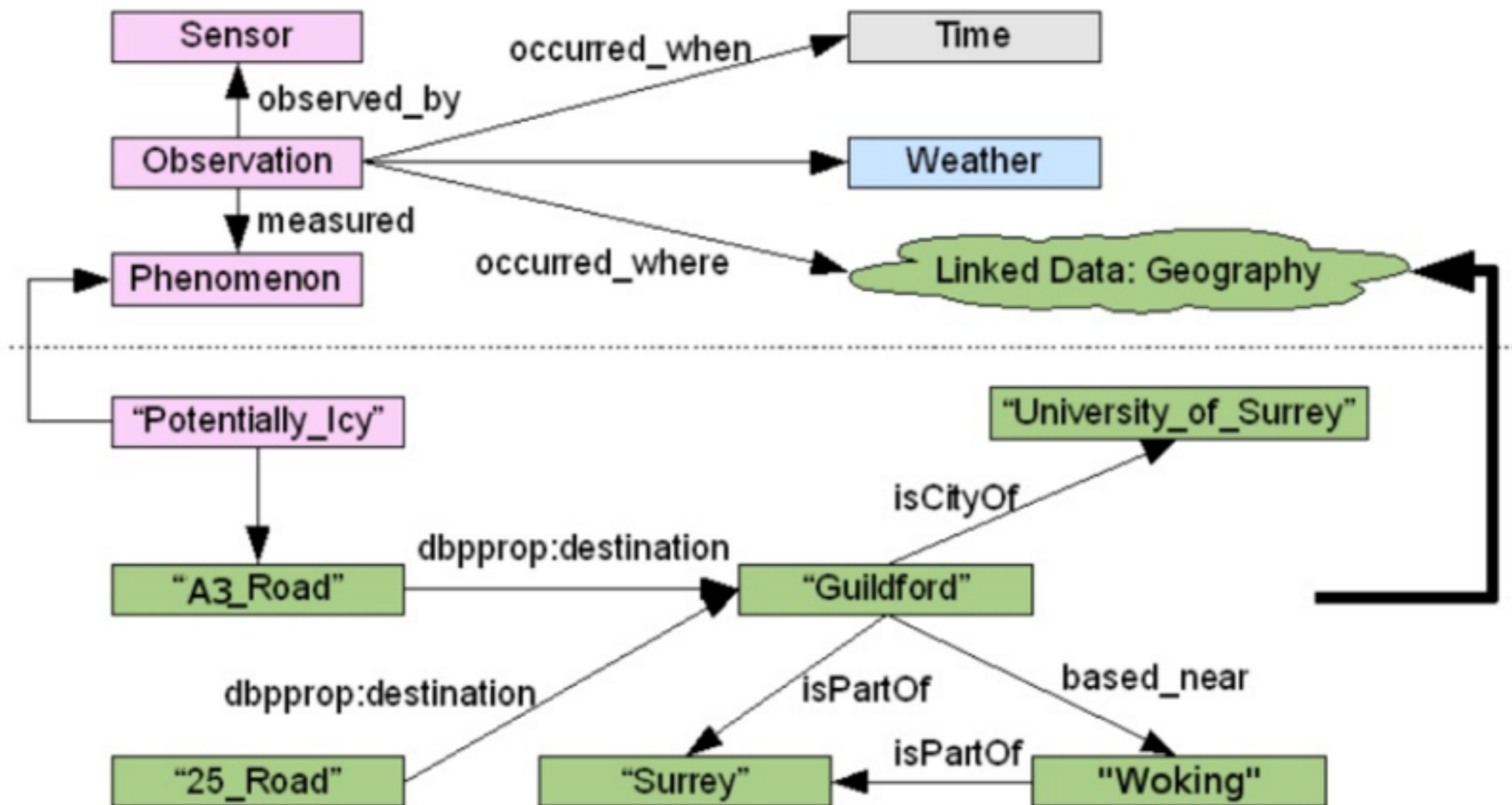
Semantic Modeling

- 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

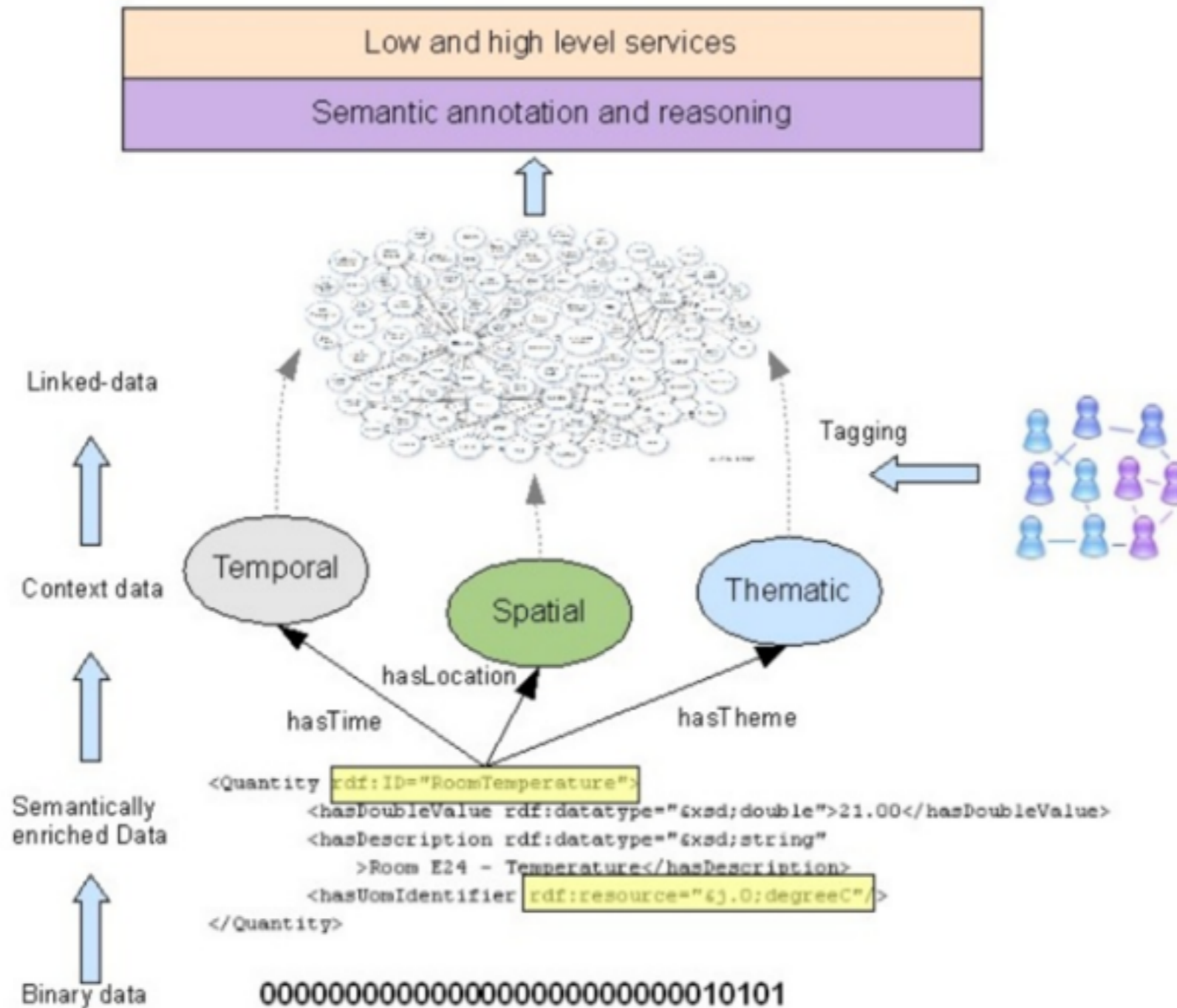
Semantic Sensor Network Ontology



An Example



Using Semantic Models



Sense2Web: Annotate Sensor Data

The screenshot displays two browser windows. The left window, titled 'Sense2Web - Mozilla Firefox', shows the 'Sensor Registration Page'. The right window, titled 'Google Maps API Sample - Mozilla Firefox', shows a map with a sensor overlay information popup.

Sense2Web - Mozilla Firefox

Sense to Web

Sensor Registration Page

Sensor Name:

Sensor ID:

Sensor Type:
 Temperature sensor@en | <http://dt>

Sensor Location:
 CCSR | <http://www.ee.surrey.ac.uk/>

Sensor Location from Linked-data:
 Guildford@en | <http://dbpedia.org/>
 Guildford@de | <http://dbpedia.org/>
 Guildford@es | <http://dbpedia.org/>
 Guildford@fr | <http://dbpedia.org/>
 Guildford (Surrey) railway station@en | <http://dbpedia.org/>
 Guildford@it | <http://dbpedia.org/>
 Compton, Guildford@en | <http://dbpedia.org/>
 Guildford@nn | <http://dbpedia.org/>
 Old Guildford, New South Wales@en | <http://dbpedia.org/>

SOS link:

Sensor description file (RDF/OWL):

Google Maps API Sample - Mozilla Firefox

Sense to Web

Demo

Sensor Map Overlay Information :

Sensor description URI: <http://ee.surrey.ac.uk/ccsr/sensei/simple/sensor#3223e-86bca-0123-e123>

Sensor type: http://dbpedia.org/resource/Temperature_sensor

Location URI (local ontology): http://www.ee.surrey.ac.uk/ccsr/sensei/LocationOntology.owl#Building_BB

Linked-data location URI: http://dbpedia.org/resource/University_of_Surrey

Linked-data tag: <http://www.ontologyportal.org/Worflint#WNO0-10334635>

Get resource description in

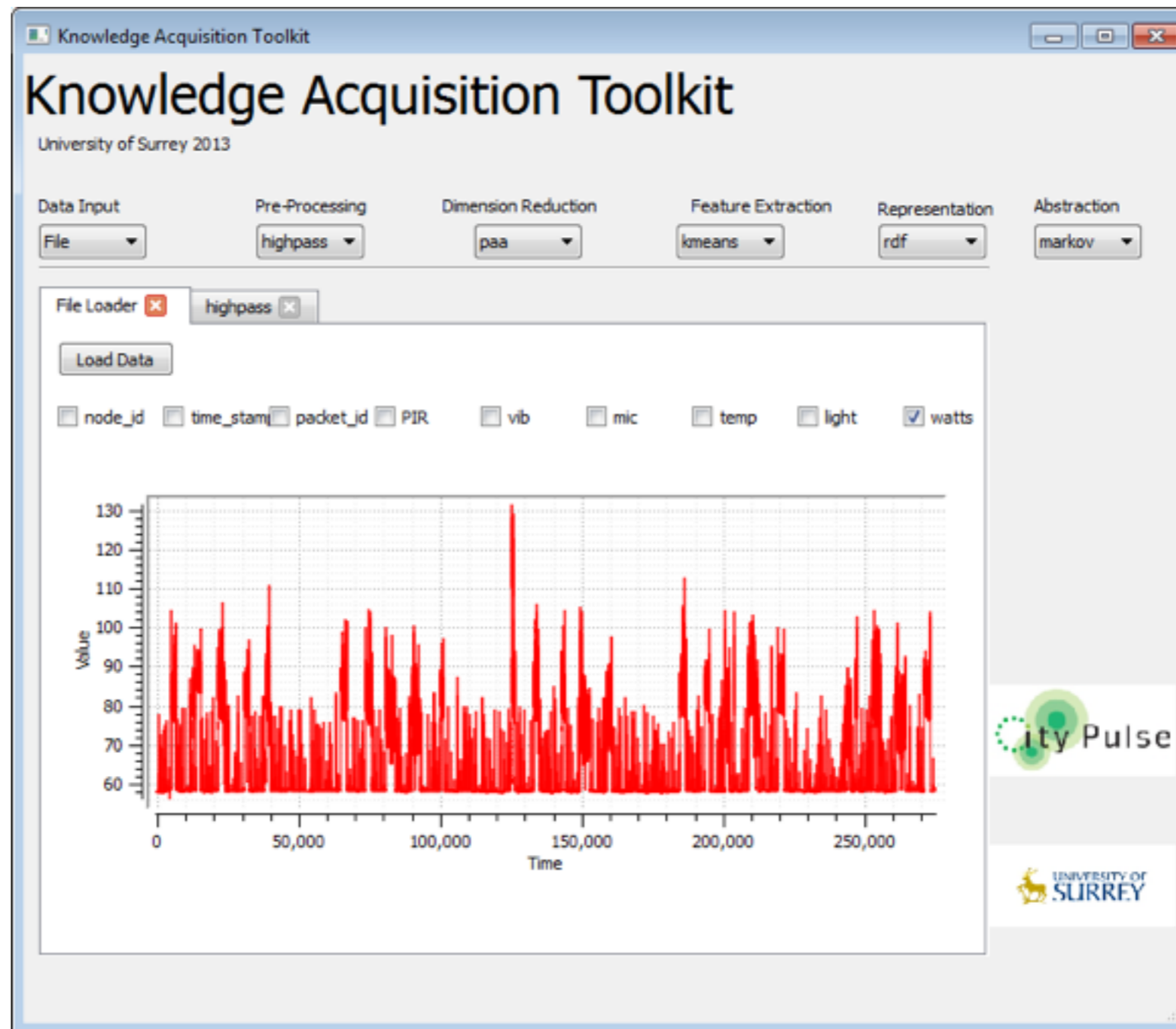
Sensor status is:

HumanSensor
 Sensor#123
 FX-GD-67
 PMB-123
 sdtsd56765
 ABC-test-SD61
 TeloSBSensorTS1

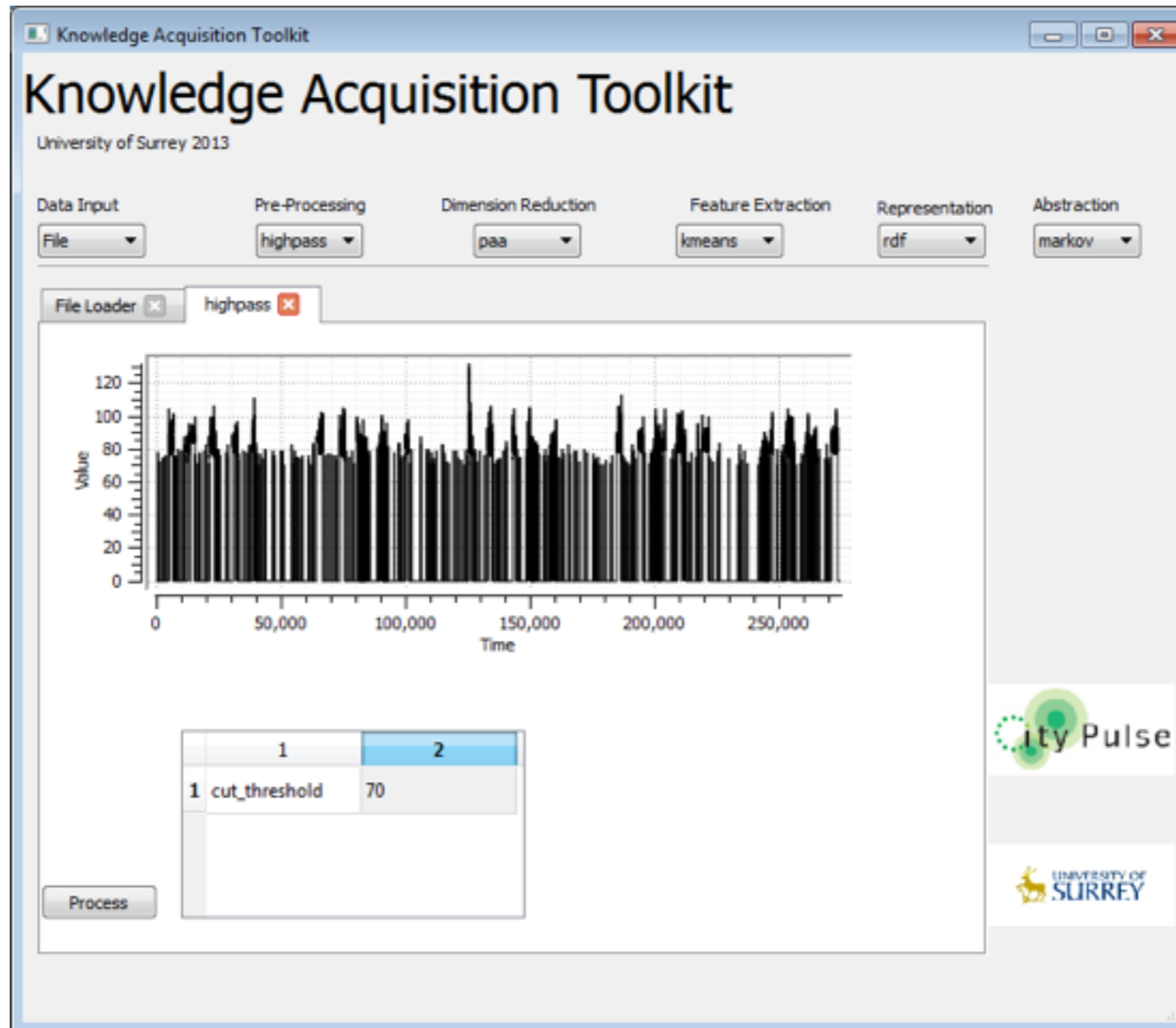
Connecting Data

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

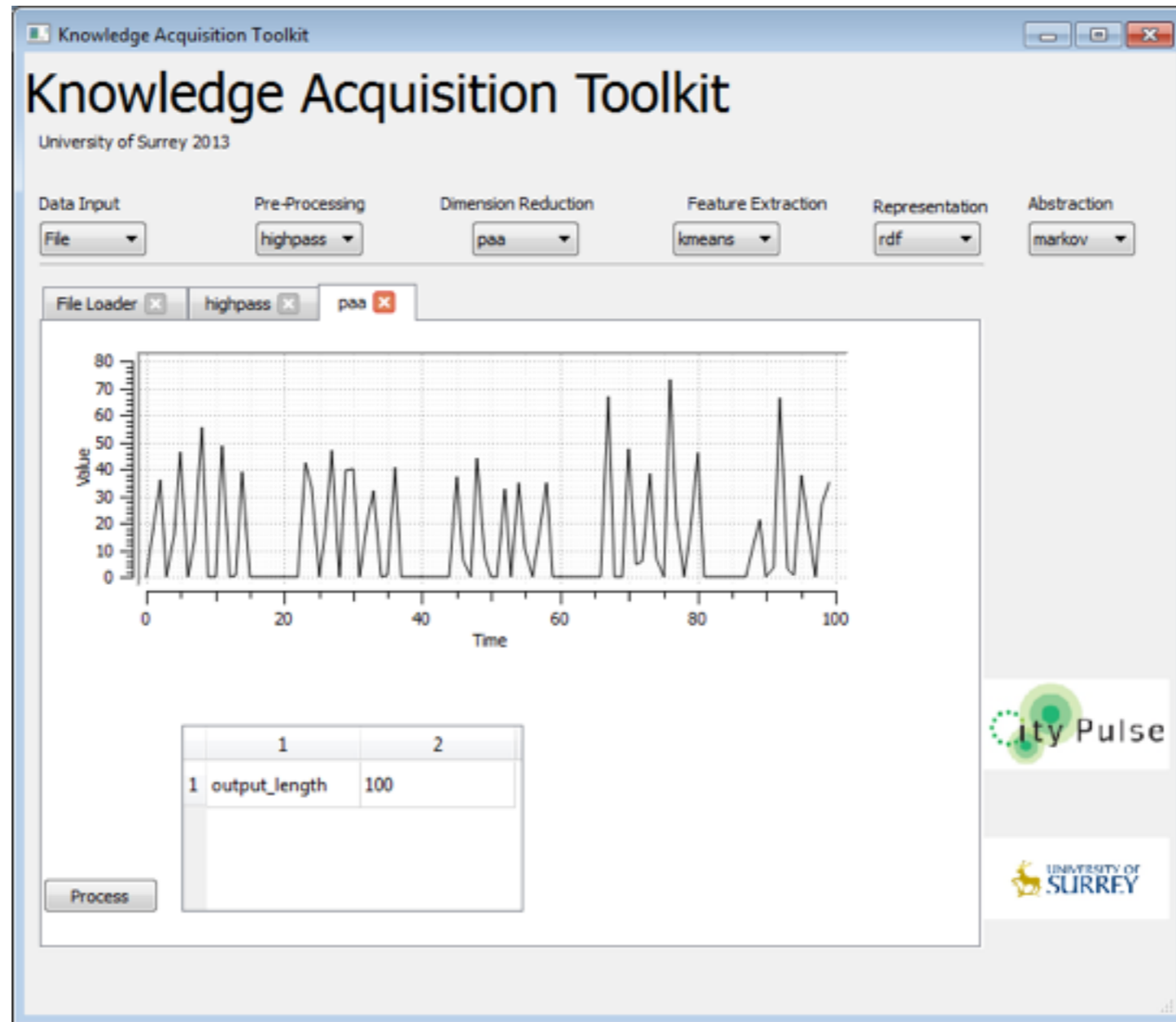
KAT: the Knowledge Acquisition Toolkit



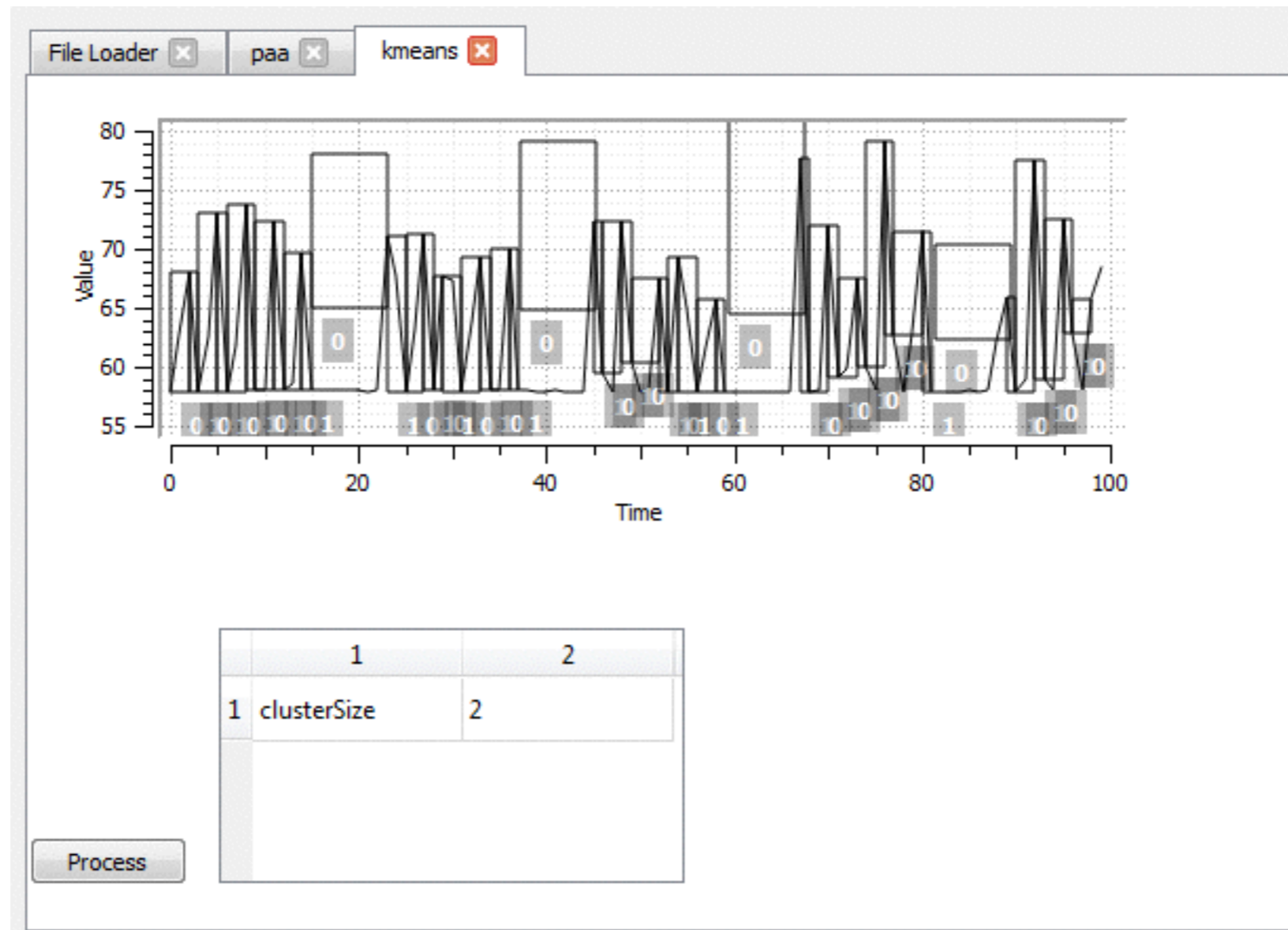
KAT: the Knowledge Acquisition Toolkit



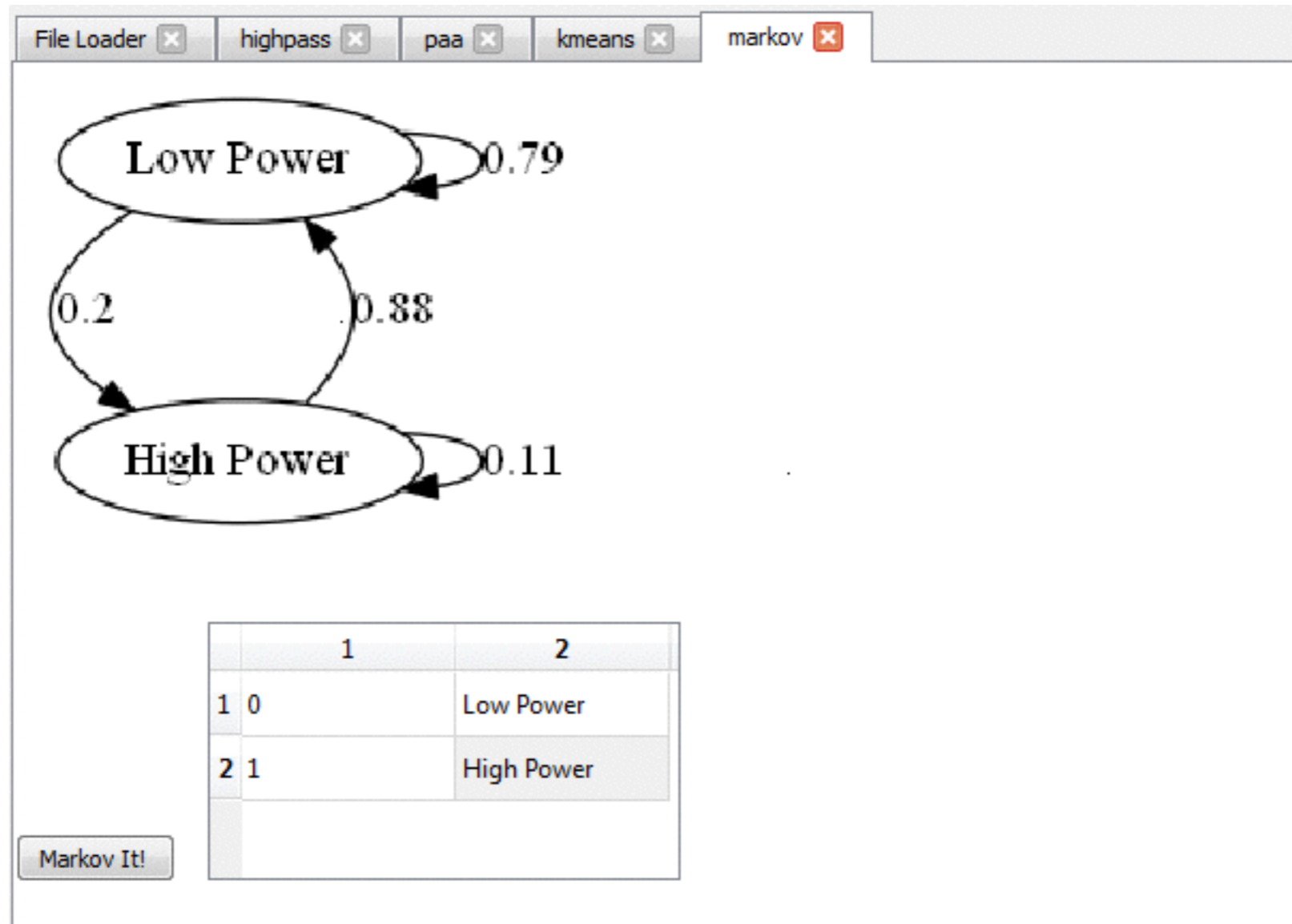
KAT: the Knowledge Acquisition Toolkit



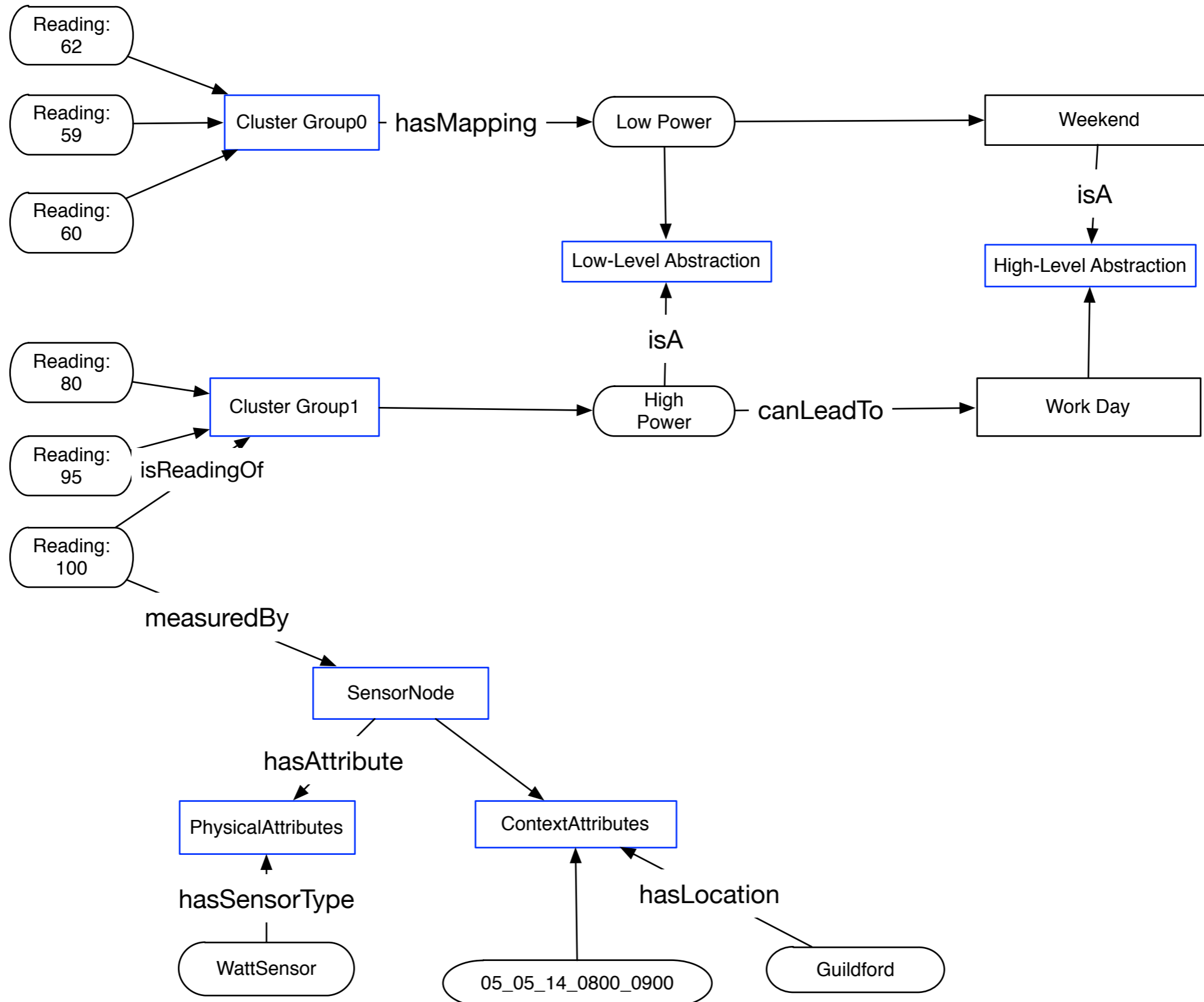
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KAT: Knowledge Acquisition Toolkit



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?