



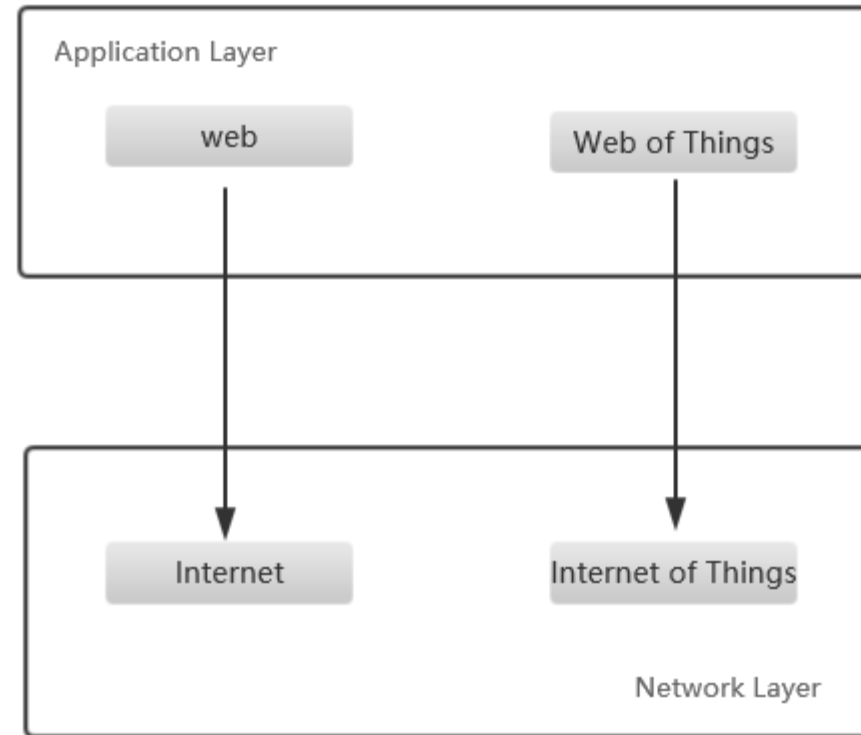
A Semantic Annotation System for Web of Things

Du Sicong
BUPT number : 2013213144
QM number : 130801256
Project No. : RC_3144



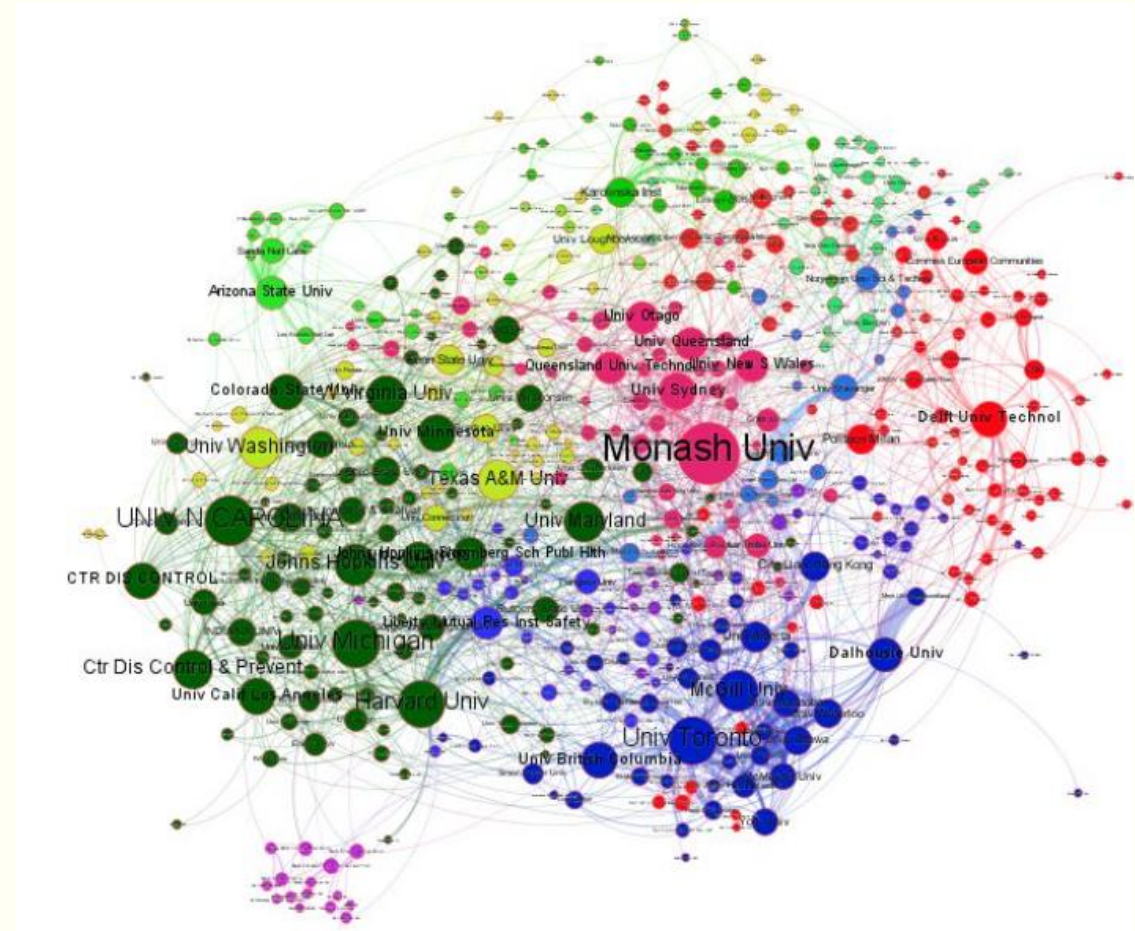
Web of Things

- Reuse web pattern and protocols
- Simplify the application creation
- Make things part of WWW



Semantic annotation

- Metadata
- Construct a knowledge graph
- Machine understandable



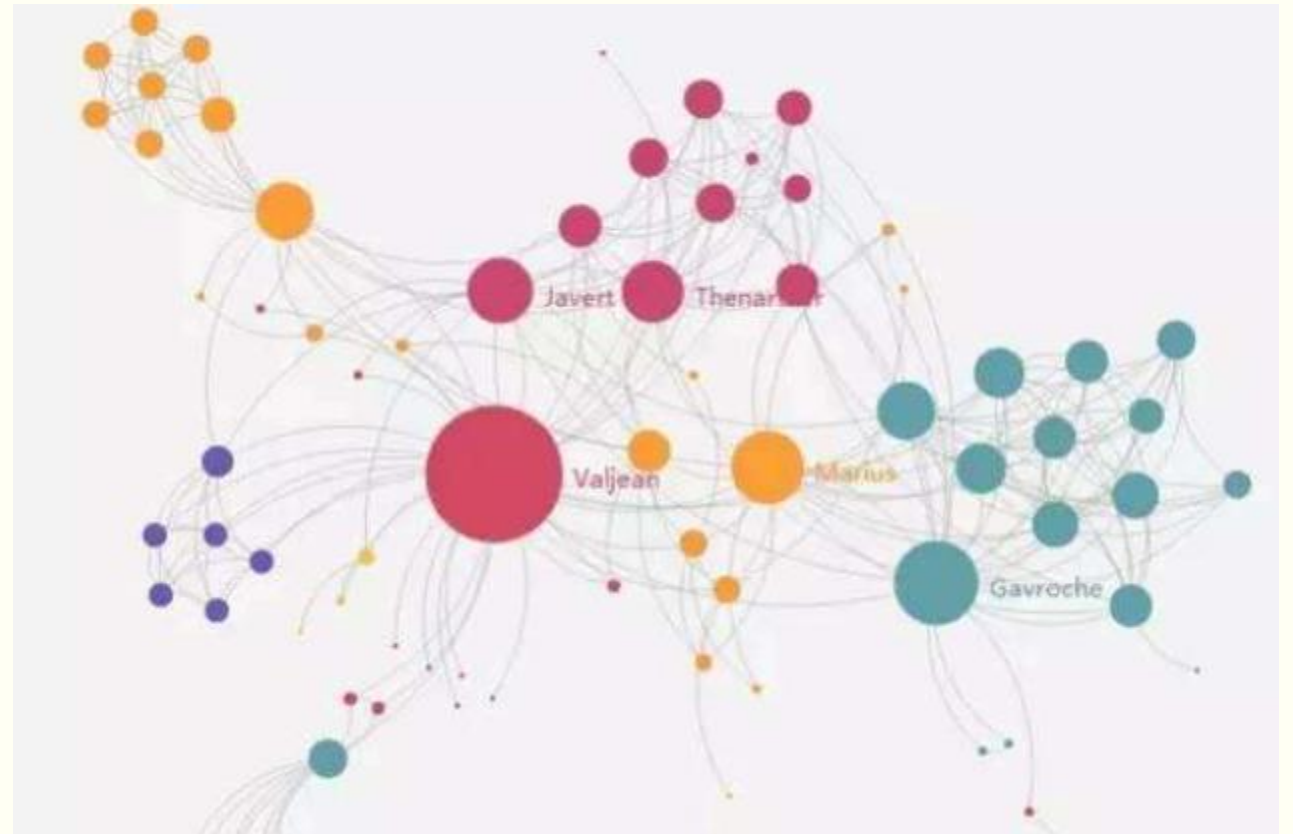
Present status

- Domain specific knowledge base
- Isolation among WoT application

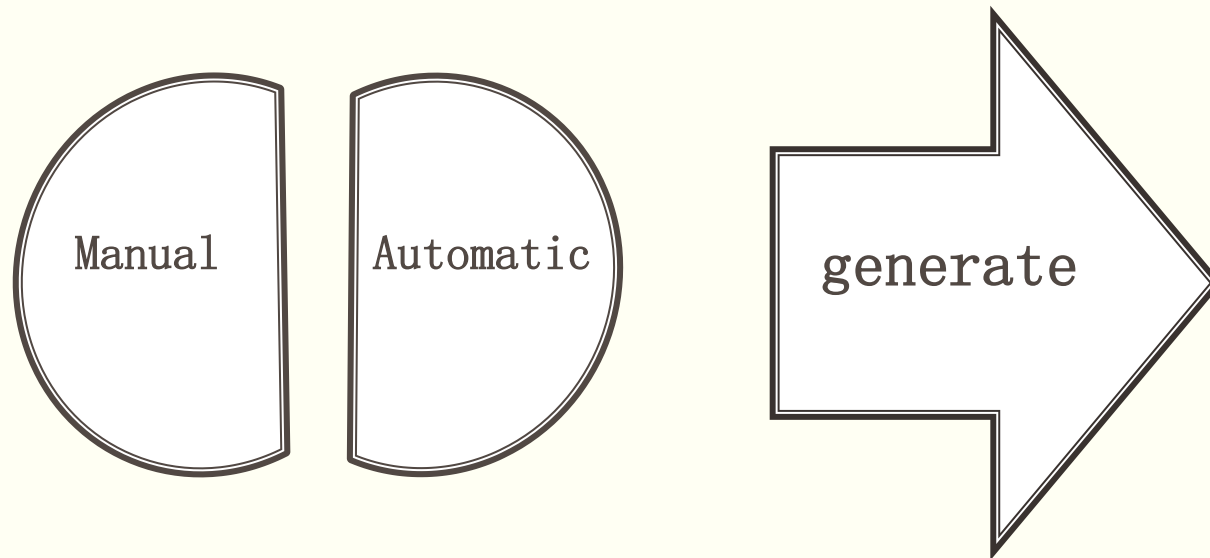


Motivation

- Connect them together
- Growing body
- Ambiguity : different definition but the same meaning
- Take a global domain independent knowledge base as medium



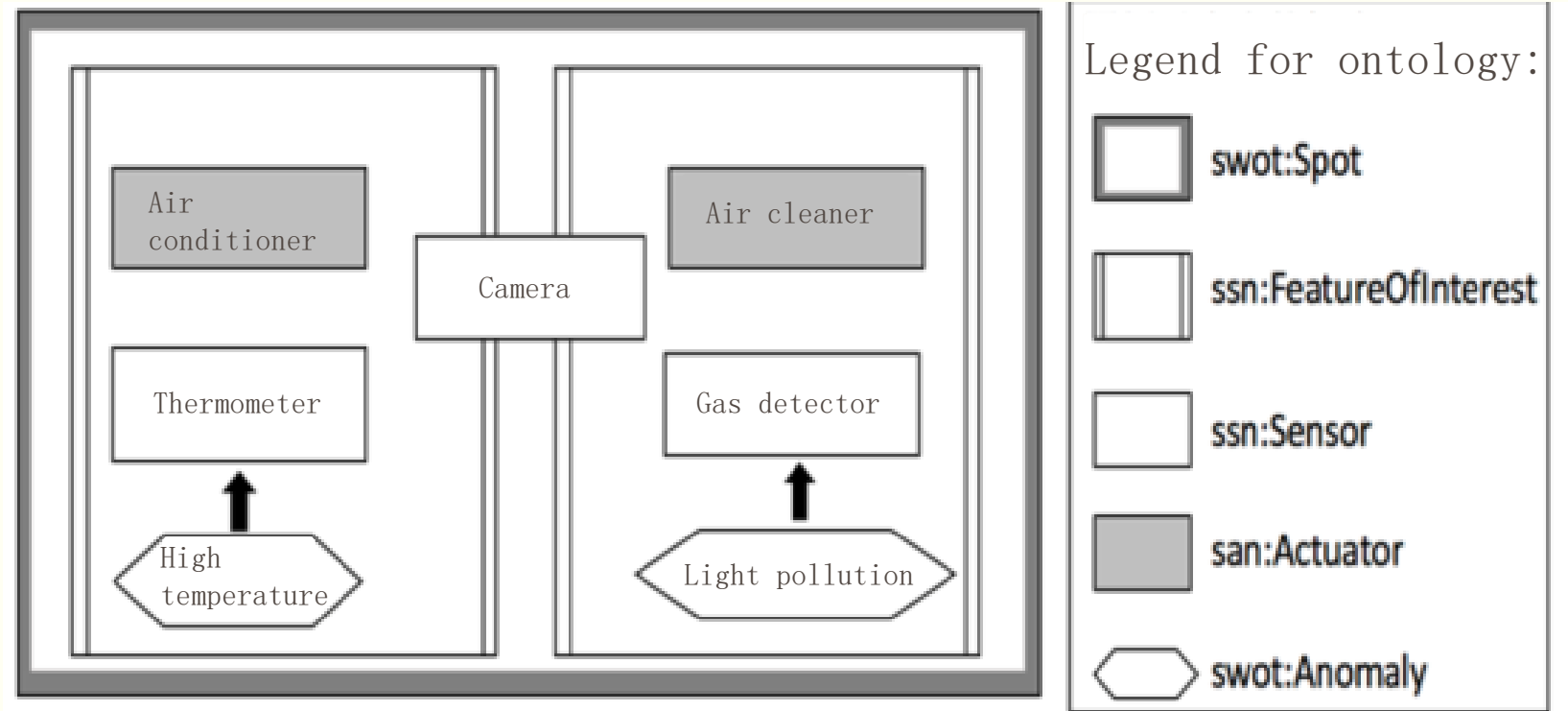
Semantic annotation system



Networked knowledge infrastructure

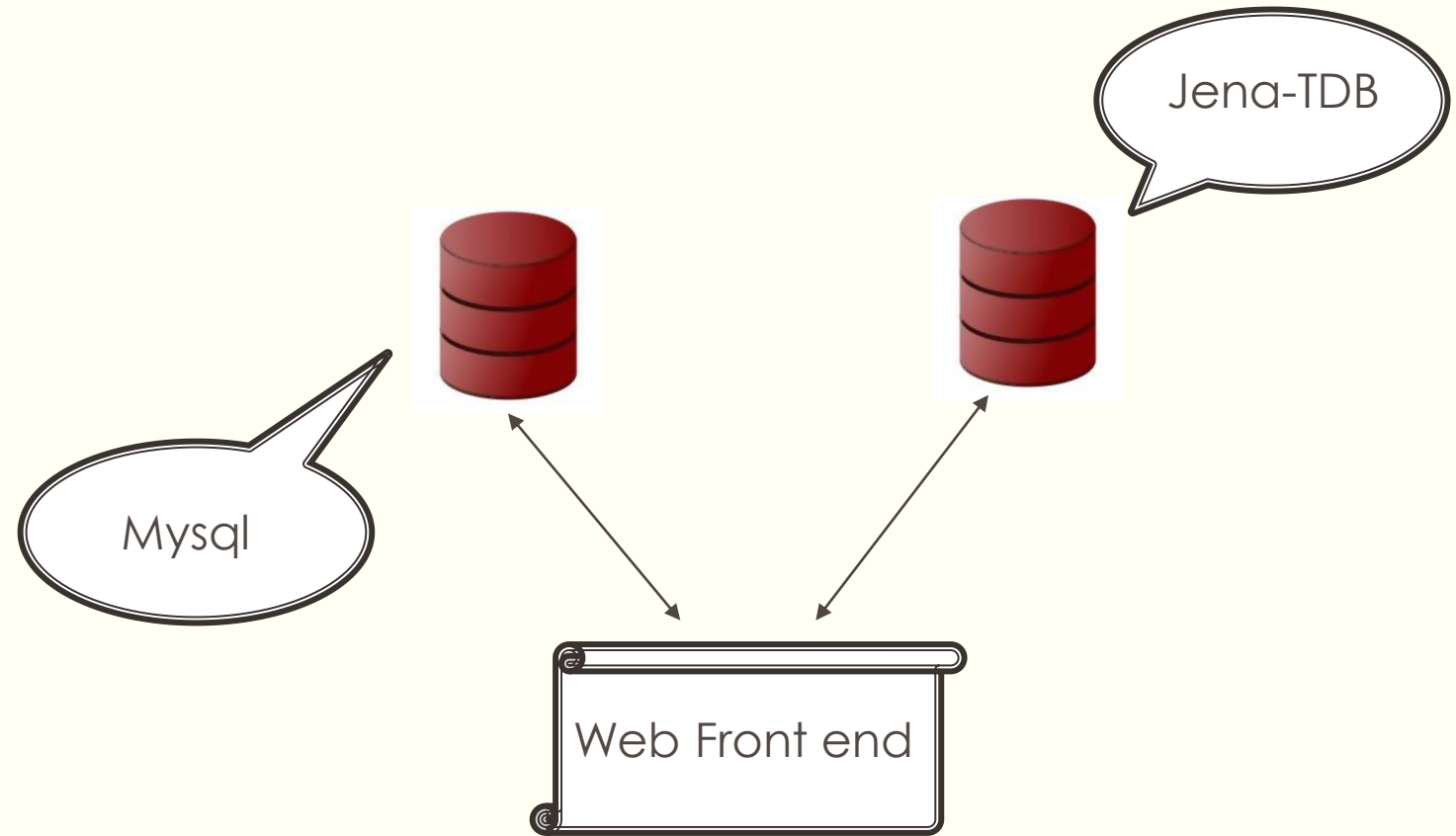
Manual annotation tool

Ontology design



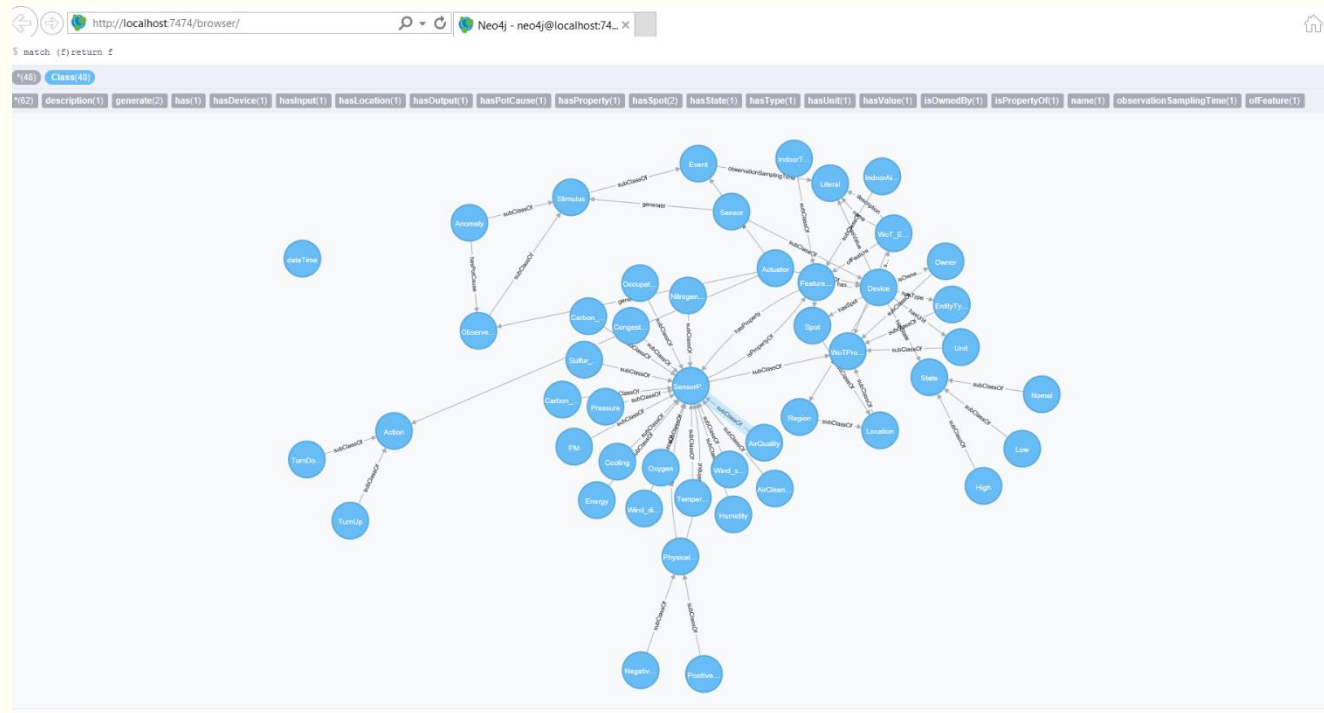
Manual annotation tool

Proof-of-concept Implementation



Manual annotation tool

Initial local knowledge base



Manual annotation tool

Input UI

Device Annotation System

HomeDevice's Anomaly QueryDevice Automatically controllingtype ▾

Device Management ▾Business Management ▾Quit

New Device

Select a device class

Sensor ▾

Device Name

Device Description

Device Type

Property

▾

Unit

Owner

Region

Spot

Save device

Help

Device Properties Settings

• device Name: Give a unique name to your device.

• Description: Describe your device briefly.

• Device Type: Describe of which concrete type your device is.

• Property: Describe what type of value your device detects e.g. Temperature

• Unit: Describe the unit of the value which is detected by your device. e.g.kg, g, m

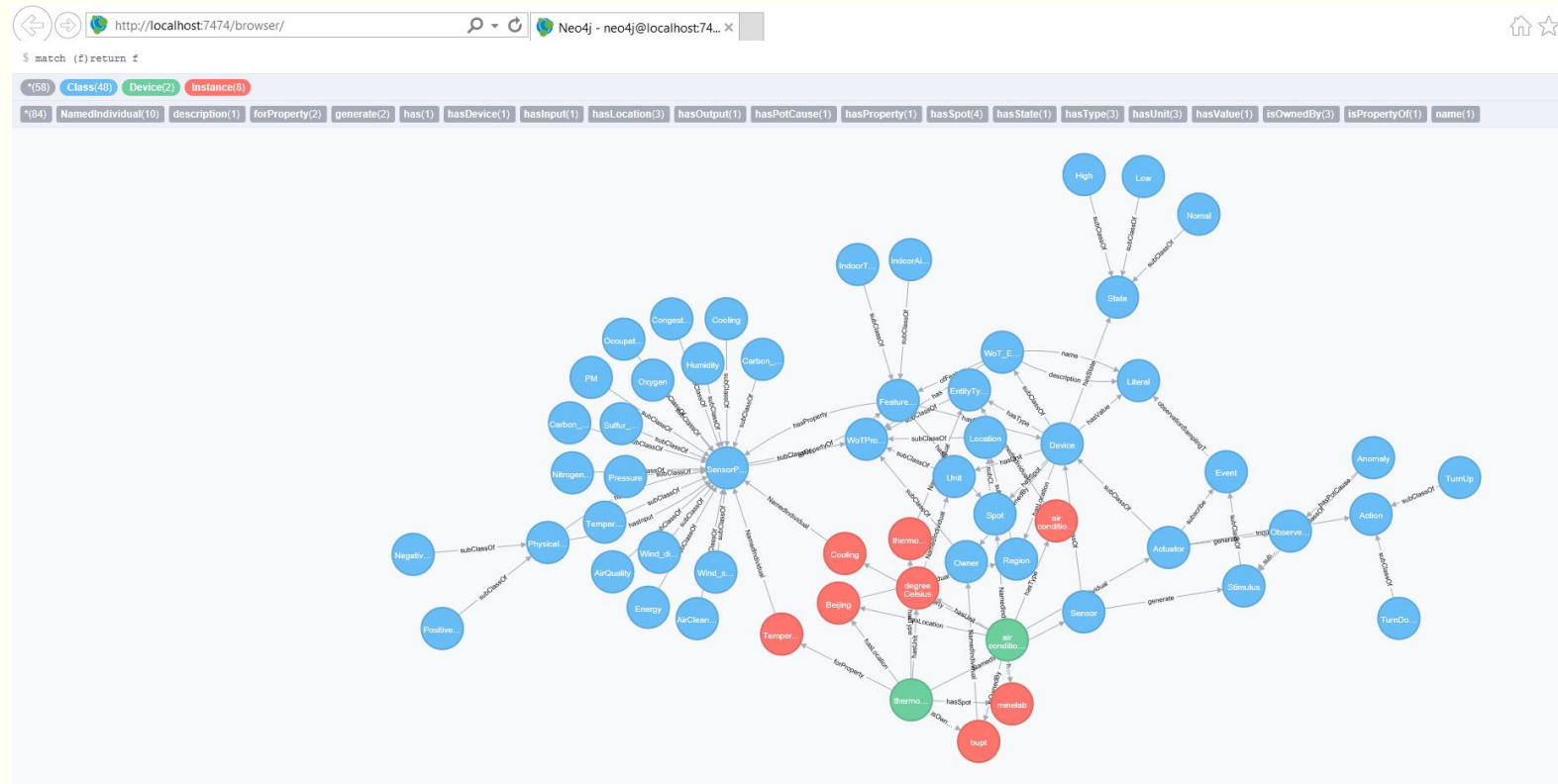
• Owner: The company or institution to which your device belongs.

• Region: The city and district your device locates in.

• Spot: Describe the concrete scene in which your device is deployed.

Manual annotation tool

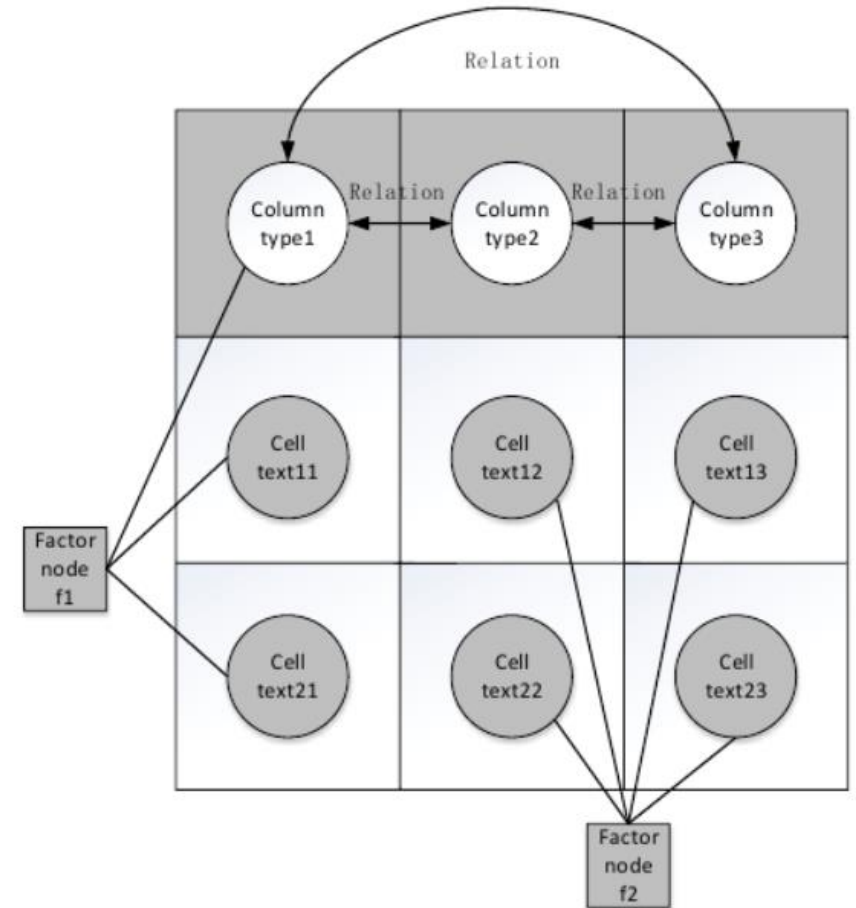
Local knowledge base after manual annotation



Automatic annotation tool

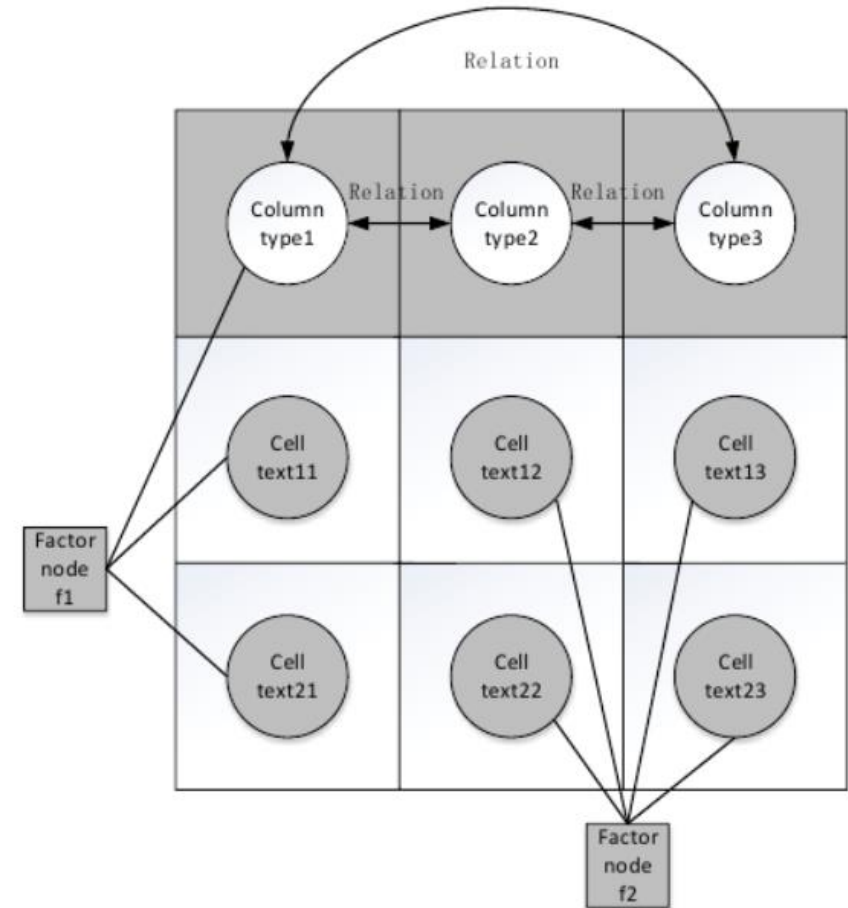
Factor graph model

<i>City</i>	<i>State</i>	<i>Mayor</i>	<i>Population</i>
Baltimore	MD	S.Rawlings-Blake	640,000
Philadelphia	PA	M.Nutter	1,500,000
New York	NY	M.Bloomberg	8,400,000
Boston	MA	T.Menino	610,000



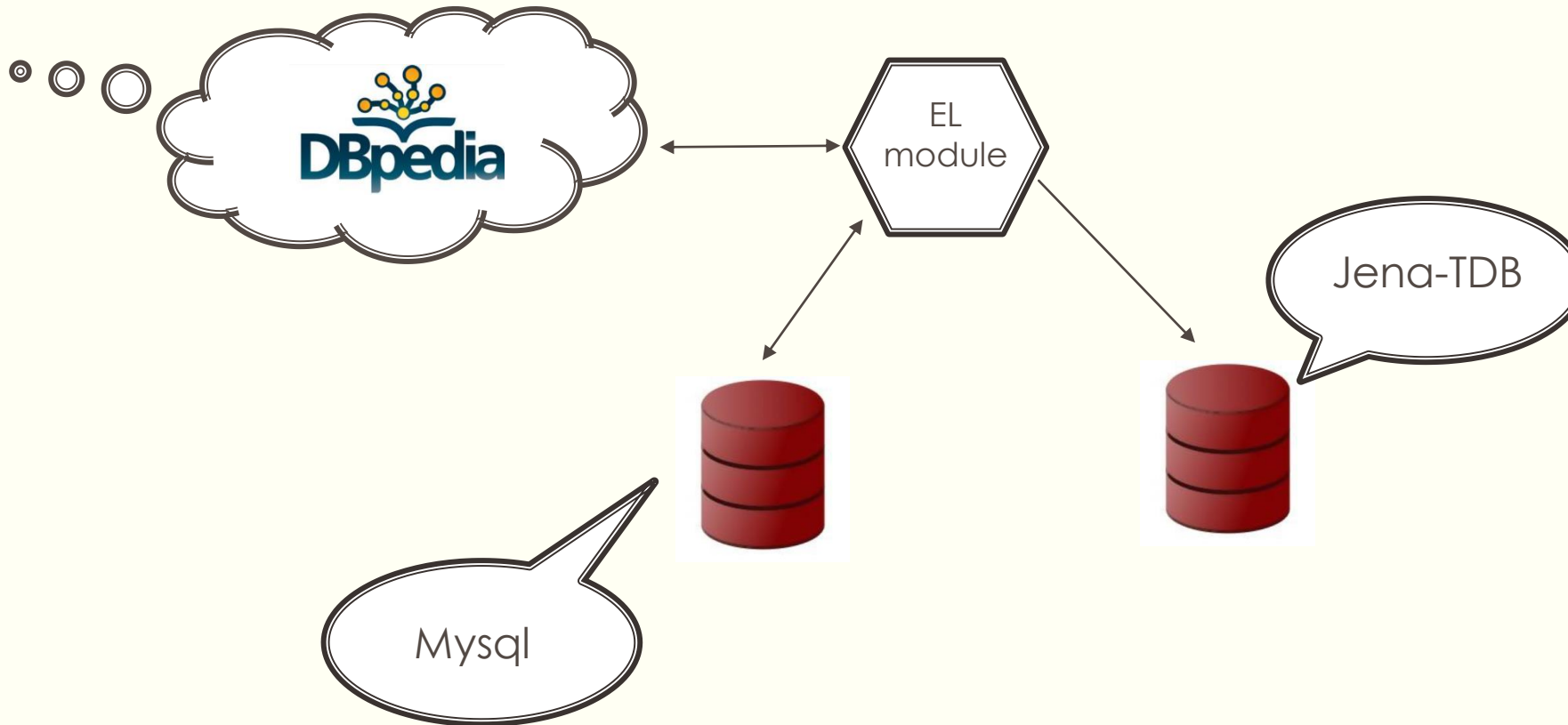
Automatic annotation tool

- Message passing
- Iterative
- Entity linking



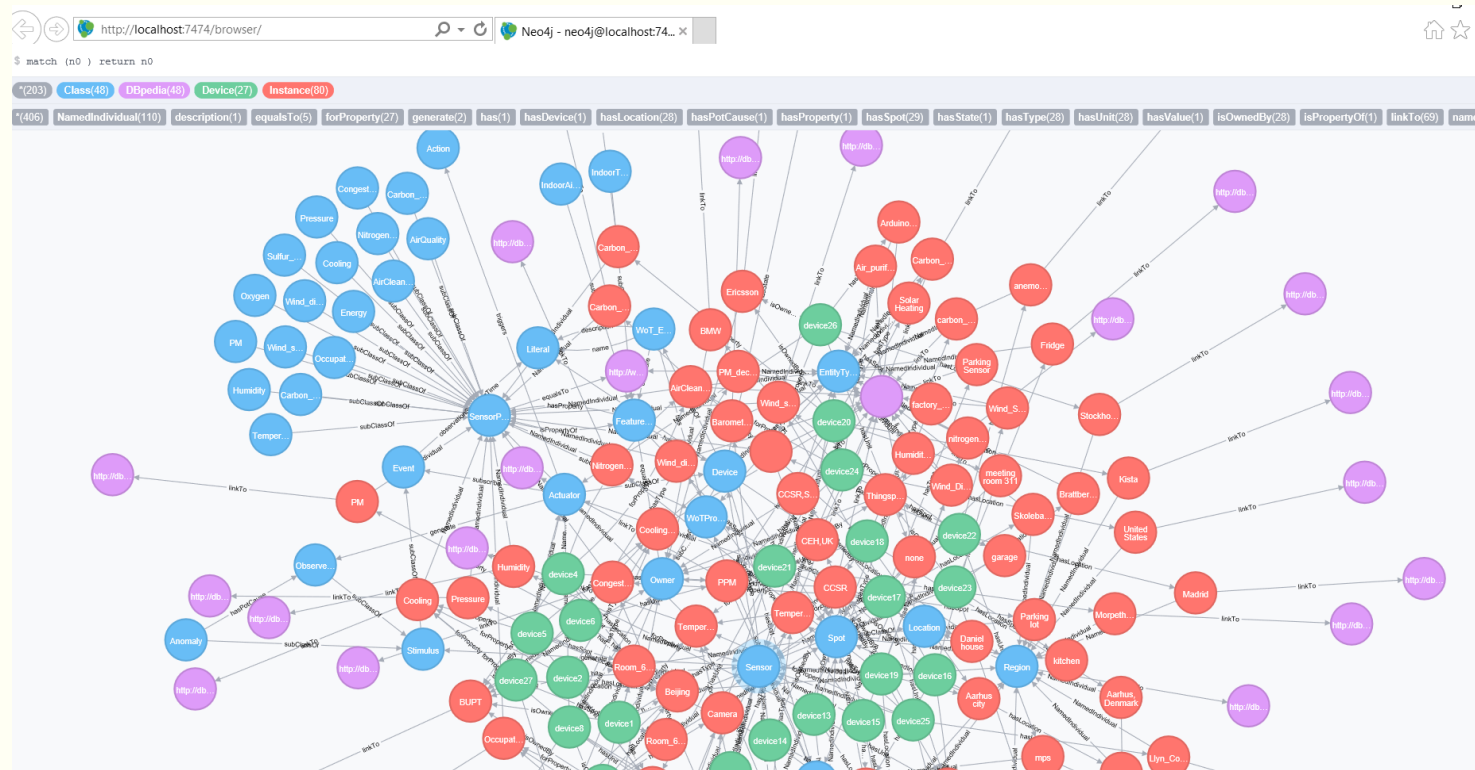
Automatic annotation tool

Proof-of-concept Implementation



Automatic annotation tool

Local knowledge base after automatic annotation



Usage of the knowledge graph

- Anomaly diagnosis
- Automatic controlling
- Semantic searching

Device Annotation System Home Device's Anomaly Query Device Automatically controlling type -

Anomaly list

temp_high_65	2017-01-18 16:16:43.636
--------------	-------------------------

Anomaly causes

device2_Cause	device5_Cause	device3_Cause
---------------	---------------	---------------

device15
device16
device17
device18
device19
device2
device20
device21
device22
device23
device24
device25
device26
device27
device2_Cause
device3
device3_Cause
device4
device5
device5_action_up

Description: device5 Property assertions: device5

Types +
● Actuator ? @ x o

Same Individual As +

Different Individuals +

Object property assertions +

- triggers device5_action_up
- isOwnedBy BUPT
- hasUnit degree
- hasSpot Room_612
- hasType CoolingAC
- generate device5_Cause
- 'for property' Room_612_IndoorTemperature_Cooling
- hasState high
- hasLocation Beijing
- subscribe temp_high_65

Data property assertions +

- hasValue 31.0f
- deviceID "82"

```
SELECT DISTINCT ?deviceID
WHERE {
  ?device swot:deviceID ?deviceID.
  ?device dul:hasLocation ?loc_local.
  ?loc_local swot:linkTo ?loc_el.
  BIND(URI(?loc_el) as ?loc_el_uri).
  ?loc_local a swot:Region.
  SERVICE <http://dbpedia.org/sparql> {
    ?loc_el_uri ?rel ?loc_db.
    FILTER regex(str(?loc_db),"China")
  }
}
```

Search For
Device

With Option

China in Region
University in Owner

查询结果:

地区(Region)	场景(Spot)	机构(Organization)	名称(name)
Beijing	Room_612	BUPT	device1
Beijing	Room_612	BUPT	device2



THANK YOU!