

Eclipse DemoCamps

November 2013

Grenoble

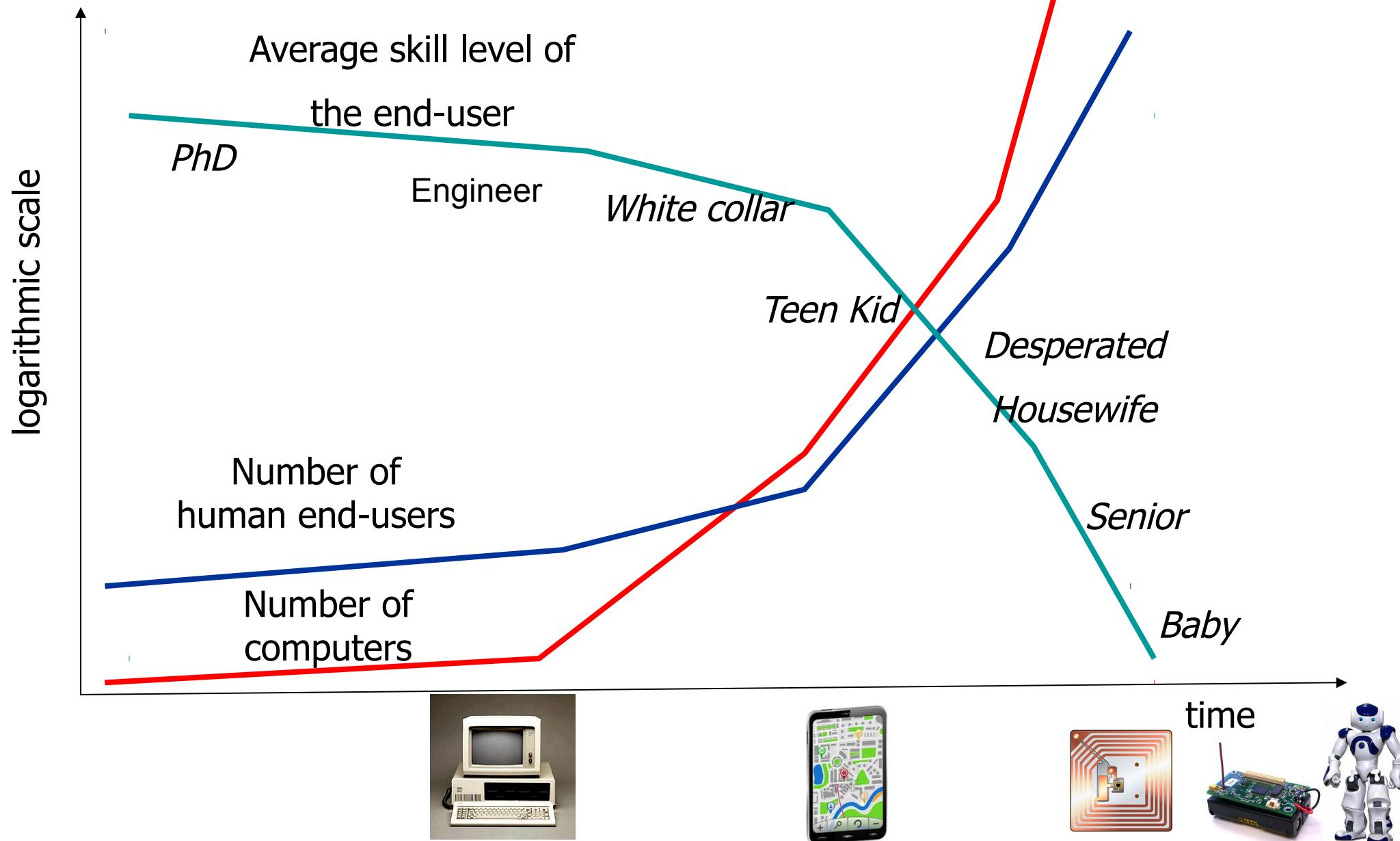


Projets Eclipse
pour l'IoT, le M2M et le SOHO

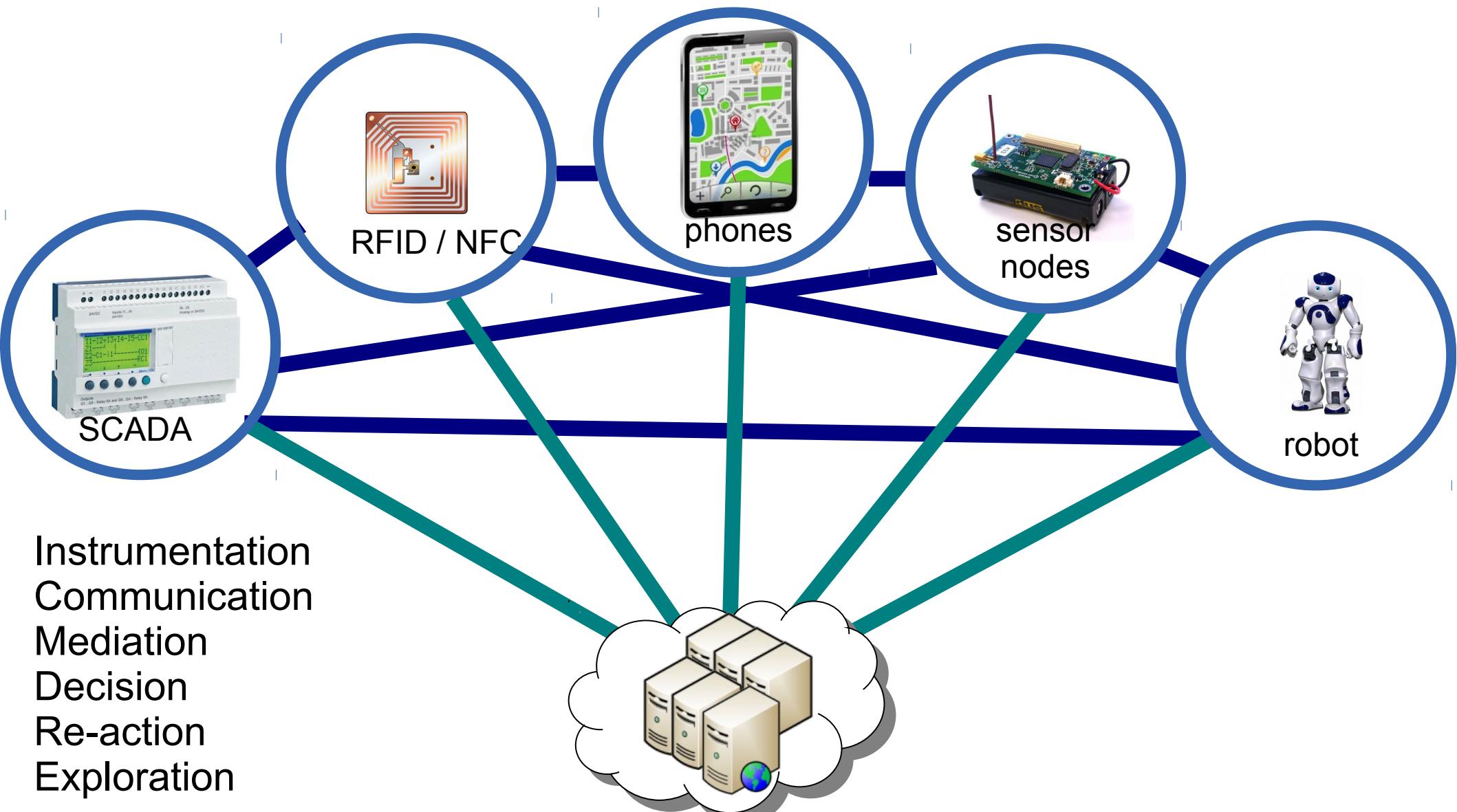
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**Qui connaît
les acronymes
IoT, M2M et SOHO
?**

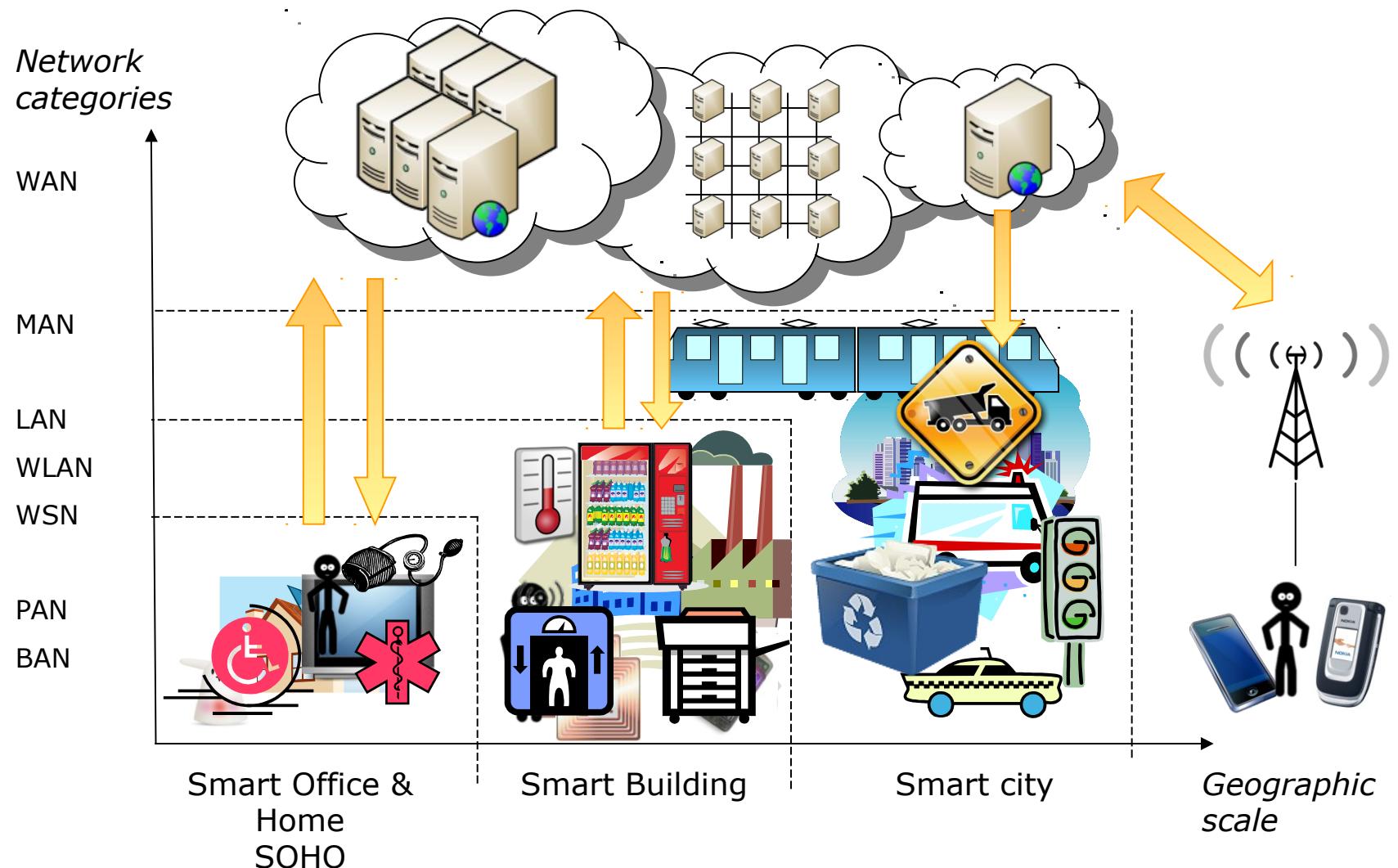
Remember



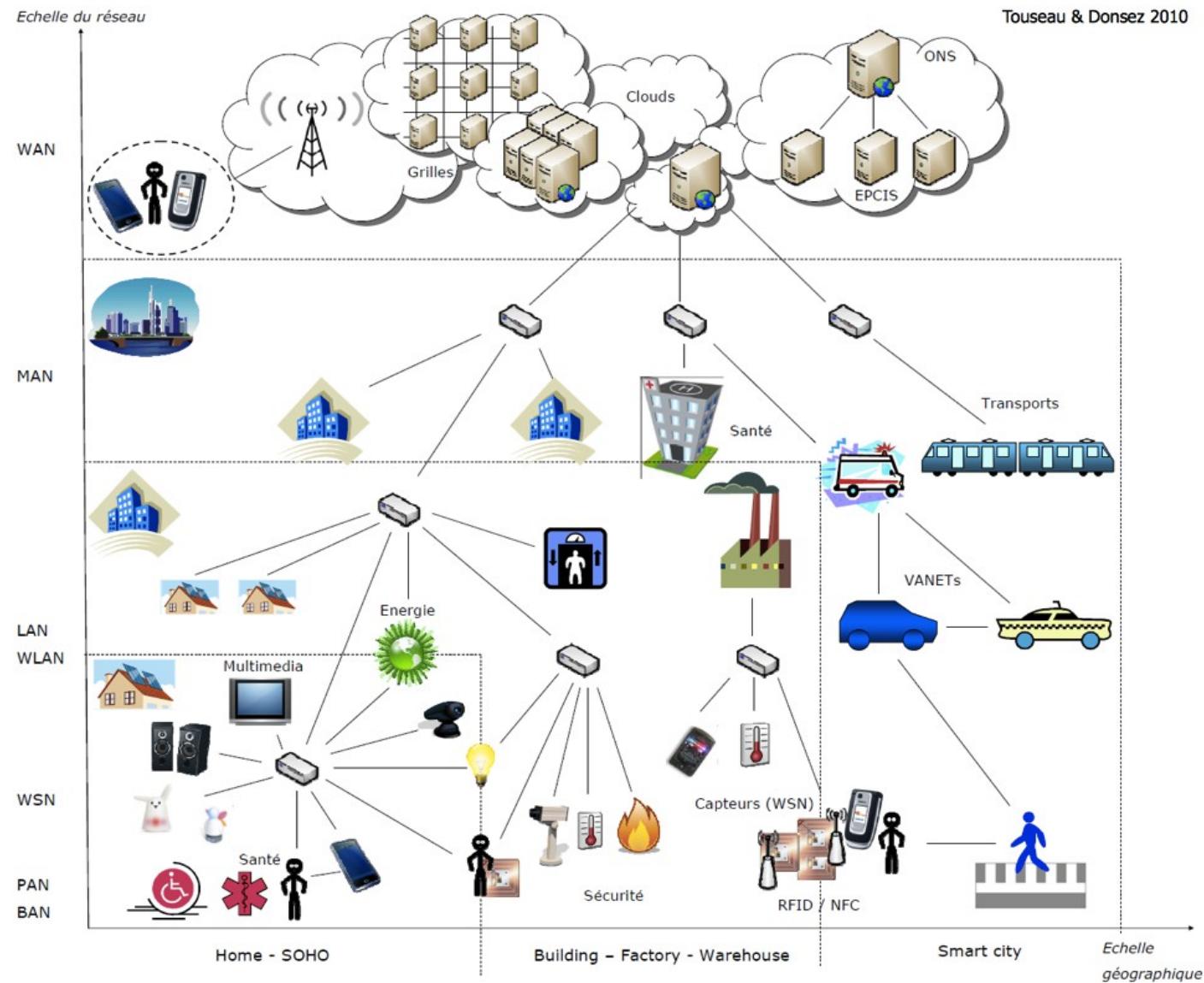
The Internet of (chatty) Things (IoT)



Big Picture of IoT Applications

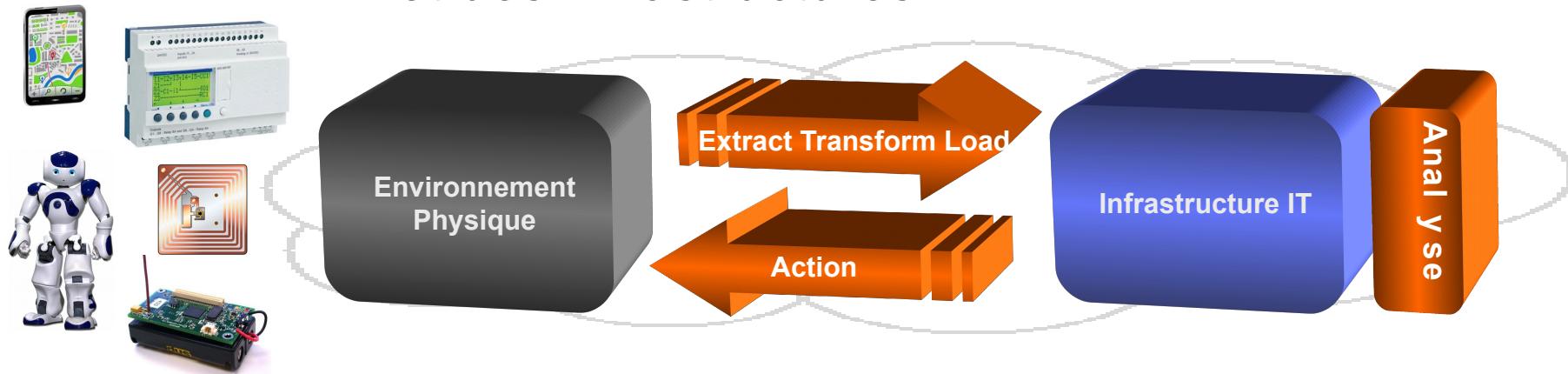


Big Picture of IoT Applications



Les Services Machine-à-Machine (M2M): Nouvelle vague du "e-business" :

- Services à valeur ajoutée basés sur les dispositifs enfouis
- Intégration sécurisée et résiliente
des environnements physiques / opérationnels
et des infrastructures IT



- Support "temps réel" (*just-in-time*) à la prise de décision
- Intégration avec les applications IT
- Crédit de nouveaux services à valeur ajoutée
- Crédit de nouveaux modèles économiques

Présent : Solutions M2M ad-hoc

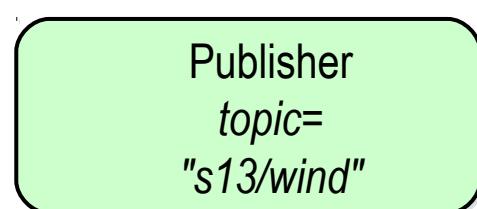
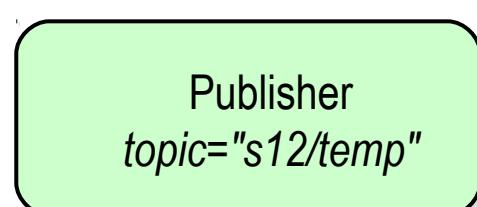
- Centré Domaine
 - Dédié (voir « fermé ») à un secteur d'activité
 - Un équipement → Un usage
 - Faible mutualisation des infrastructures matérielles et logicielles
 - Solutions multi-acteurs/opérateurs difficiles
 - Perte d'opportunités inter-secteurs
- Intergiciels, Méthodes Logicielles, ... communes (indépendant de domaines)

Patrons d'architecture IoT

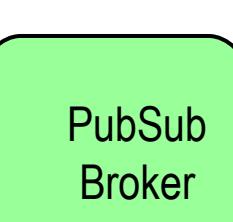
- Evénementiel
 - Publish – Subscribe
 - QoS (determinist, reliable, elastic, ...)
- Médiation
 - ECA (Event Condition Action)
 - CEP (Complex Event Processing)
 - EST (Event Stream Processing)
- ETL (Extract – Transform - Load)

Publish-Subscribe Pattern

Event/Data
Producers



Event/Data
Consumers



E6

E4

E1

E2

E3

E4

E2

E1

E4

E3

E1

E4

E2

E1

E4

E3

E1

Market of PubSub Brokers

Into the JVM

- OSGi Event Admin
- OSGi Wire Admin
- OSGi Monitor Admin

Distributed

- CORBA Data Distribution Service (DDS)
- JMS
- AMPQ
- MQTT
- STOMP
- XMPP
- ROS (Robot Operating System)
- UPnP GENA
- PubNub (PaaS)
- PubSubHubbub
- Siena
- ...

MQ Telemetry Transport (MQTT)

<http://mqtt.org/>

- Protocole léger de type Publish-Subscribe pour M2M et IoT
 - Hiérarchie de « topics » : /buildingF/sensors/s11/#
- Support de connectivité (TPC/IP) intermittente ou couteuse
 - Satellite, WSN, ...
- Faible overhead par paquet (2 octets)
- 3 niveaux de QoS pour livraison (fire-and-forget, fire-and-confirm)
- Sécurité par certificat (SSL/TLS)
- Nombreuses implémentations de clients et de serveurs concises
 - C, C++, **Arduino**, Java, Python, JS (Node.JS), Lua, ...
 - 80 KB pour l'implémentation de référence (IBM)
- Proposé à la standardisation OASIS
- Projets : Mosquitto, Eclipse Paho (m2m.eclipse.org), Cloud providers of MQTT ...

Eclipse Projects



- Fondation Eclipse
 - Projets open-source
 - IDE (JDT, PDE, **CDT**)
 - RCP
 - Equinox
 - P2
 - Marketplace (2^{11} plugins)

Eclipse Projects

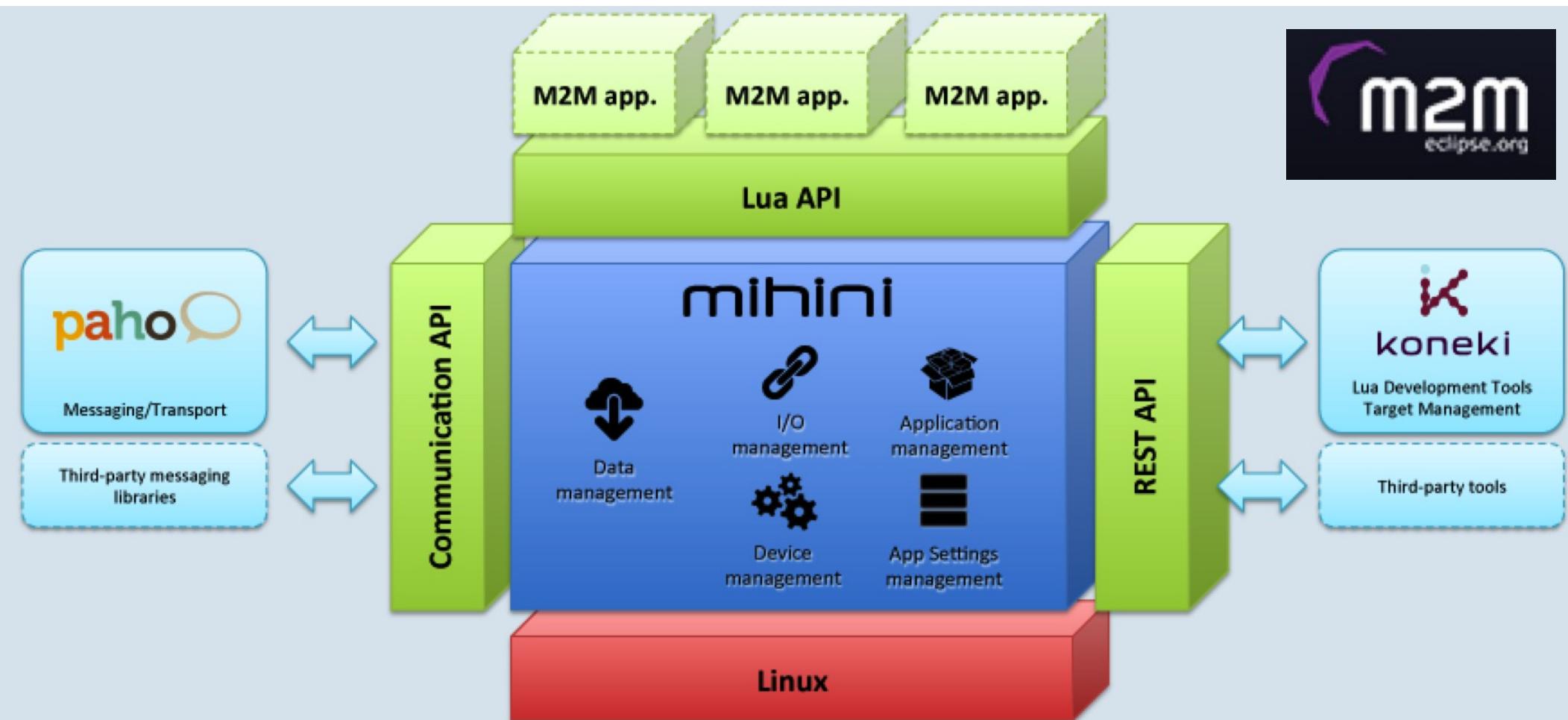


- 4 Projets et Working Group
 - Eclipse M2M (*Benjamin Cabé*)
 - Paho (mqtt clients) , soon *Mosquitto* (mqtt servers),
 - Minihi (platform), Koneki (IDE for LUA)
 - Eclipse Kura
 - Low-level bundles for M2M gateways
 - for Admin, Configuration and Deployment
 - Equinox Concierge (*Jan Rellemeyer*)
 - OSGi R5 platform
 - small-footprint and optimized for embedded devices and CDC 1.1 JVM
 - Eclipse Smart Home (2014)
 - **OpenHAB** (*Kai Kreuzer*)

Eclipse Working Group M2M

m2m.eclipse.org

Technologies : MQTT, M3DA, OMA DM, REST, OSGi, ...



OpenHAB



<https://code.google.com/p/openhab>

- open Home Automation Bus (openHAB)
- Universal integration platform for home automation things
- Based on OSGi Java (Equinox OSGi)
- Event bus (OSGi Event Admin)
- DSL for ECA Rules and HCI
 - Using Eclipse Xtext and Xtend
- Bindings with many SOHO protocols (enOcean, ZigBee, Hue ...)
- Now part of Eclipse Smart Home project
 - EPL licence

OpenHAB Demo

<http://demo.openhab.org:8080/greent>

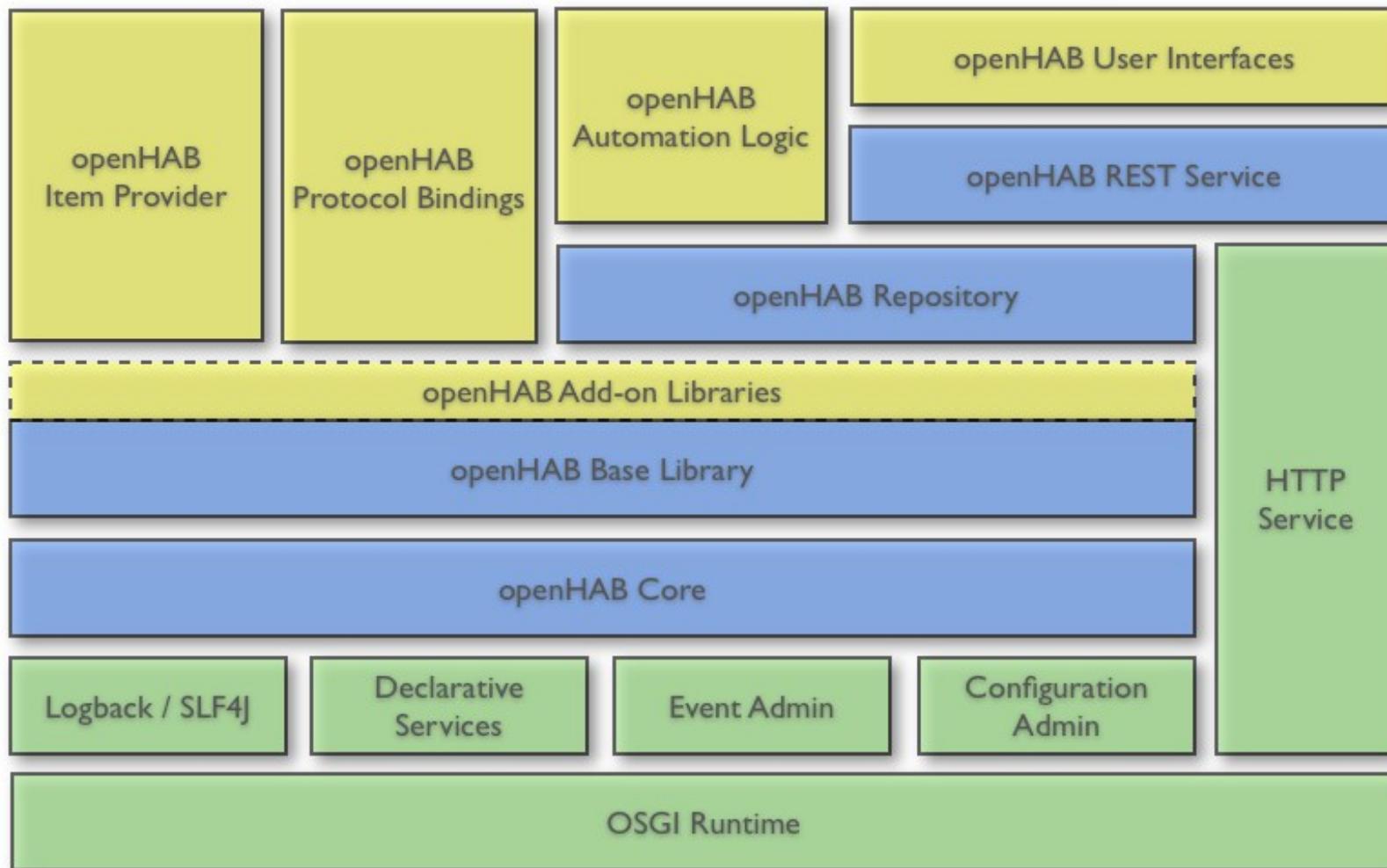
Main Menu > Ground Floor > Kitchen

Back 

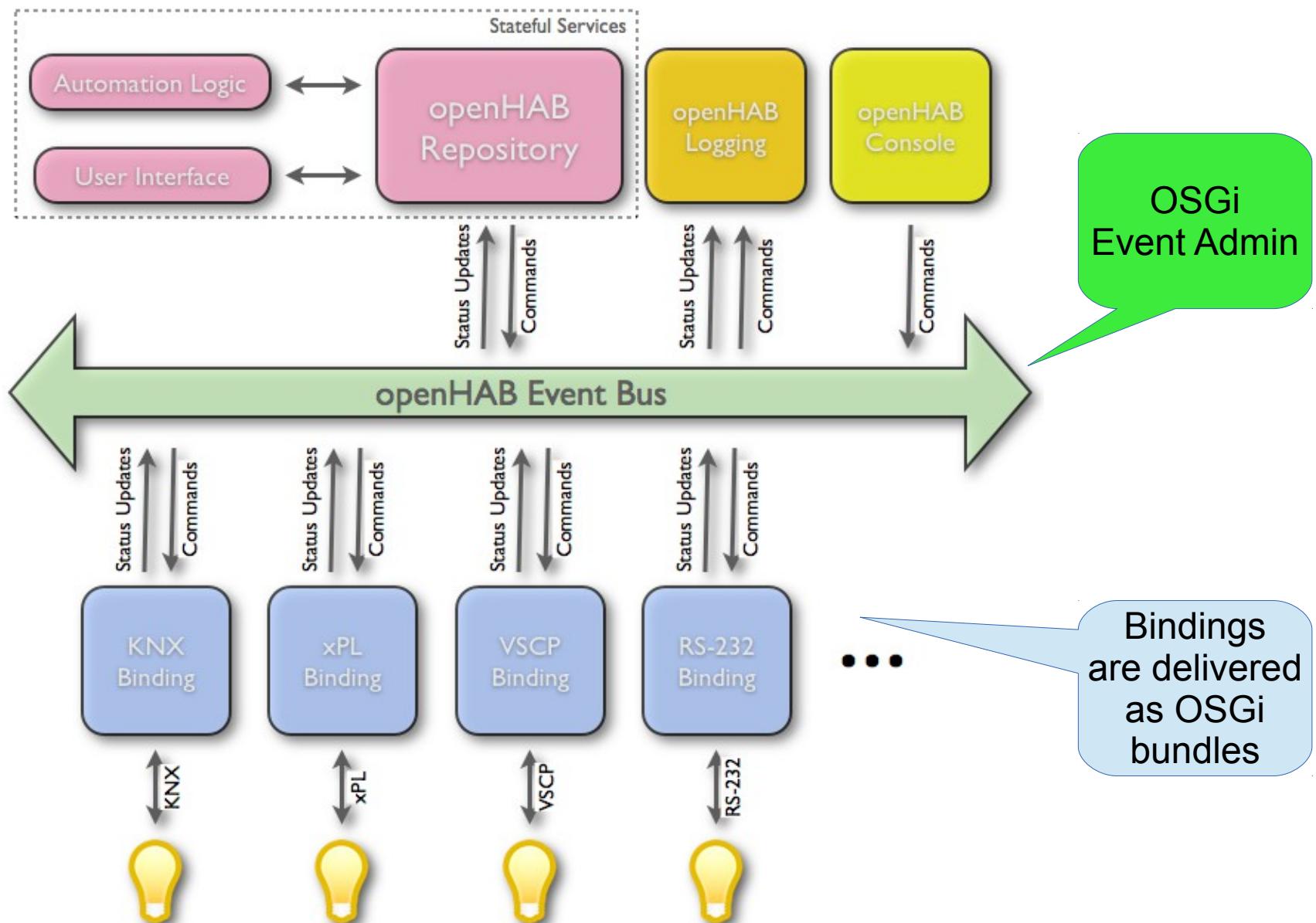
 Living Room	 Ceiling	<input type="button" value=""/>
 Kitchen	 Table	<input type="button" value=""/>
 Toilet	 Kitchen	<input checked="" type="button" value=""/>
 Corridor	 Kitchen	<input type="button" value=""/>  <input type="button" value=""/>
	 Temperature	21.4 °C
	 Kitchen	open

openHAB Architecture Overview

■ openHAB Add-ons
■ openHAB Core Components
■ OSGi Framework



OpenHAB Event Bus



OpenHAB IDE

The screenshot shows the openHAB Designer interface. The left sidebar contains a tree view of configurations:

- Configurations
 - Items
 - demo.items
 - greent.items
 - Persistence
 - Rules
 - demo.rules
 - Scripts
 - Sitemaps
 - demo.sitemap
- Transform
- logback.xml
- logback_debug.xml
- openhab_default.cfg

The "Items" tab is selected in the bottom-left panel.

The main editor area is titled "openHAB Designer" and displays the content of the "demo.items" configuration file. The file defines a sitemap for a "Smart Doll House" with various frames and groups:

```
// wiki https://code.google.com/p/openhab/wiki/Sitemaps
sitemap ExperimentalBMS label="Smart Doll House"
{
    Frame label="Maison" {
        Group item=gFF label="1er Etage" icon="firstfloor"
        Group item=gGF label="Rez de Chausée" icon="groundfloor"
        Group item=gC label="Cave" icon="cellar"
        Group item=Outdoor label="Jardin" icon="garden"
        Group item=gPerson label="Occupants" icon="boy1"

        Text label="Vue d'ensemble" icon="gear" {
            Frame label="Général" {
                Switch item=Lights mappings=[OFF="All Off"]
                Group item=gEnergy label="Energies" icon="electricity"
                Group item=Heating
                Group item=Windows
                Group item=Weather label="Météo" icon="weather"
                Group item=gRobot label="Robots" icon="cleaner"
                Group item=gArduinoOutdoor label="AgriStation" icon="garde"
                Text item=Temperature
                Text item=GeigerCounter icon="radioactive"
                Group item=gAdmin label="Administration" icon="gear"
                Group item=gPreference label="Préférences Utilisateur" icon="user"
            }
            Frame label="Debug" {
                // ...
            }
        }
    }
}
```

Model : Items and Groups

- Items
 - Are SOHO-specific sensors & actuators
 - *Switch, Dimmer, RollerShutter, Color, Contact, Number, Text*
 - Sensors emit « state » events
 - Actuators receive « command » events
 - Bound to protocols (*enOcean, Serial, Hue, ModBus, MQTT ...*)
- Groups
 - of Items
 - of Group
 - Logical, Physical, Device class, ...
 - can be active (command and state)

DSL for Items and Groups

```
Group All
Group gGF
Group gFF
...
Group GF_Living      "Living Room"   <video>        (gGF)
Group GF_Kitchen     "Kitchen"       <kitchen>      (gGF)
Group FF_Office      "Office"        <office>       (gFF)
Group FF_Child       "Child's Room"  <boy>          (gFF)
...
Group Shutters
Group Lights
...
Group:Switch:OR(ON, OFF)    Lights      "All Lights [%d]"    (All)
Group:Number:AVG           Temperature "Avg. Room Temperature [%.1f °C]" <temperature> (Status)
...
Dimmer Light_GF_Living_Table      "Table"                (GF_Living, Lights)
Switch Light_GF_Kitchen_Table    "Table"                (GF_Kitchen, Lights)
Switch Heating_GF_Corridor       "GF Corridor"        <heating>      (GF_Corridor, Heating)
Switch Shutter_all
Rollershutter Shutter_GF_Kitchen "Kitchen"             (GF_Kitchen, Shutters)
Number Temperature_GF_Corridor   "Temperature [%.1f °C]" <temperature> (Temperature, GF_Corridor)
Contact Window_GF_Frontdoor     "Frontdoor [MAP(en.map):%s]" (GF_Corridor, Windows)

Switch Button_Up
Number Temp_FF_Office
Color PhilipsHueBulb
{enocean="{id=00:00:00:00, eep=F6:02:01, channel=B, parameter=I}"}
{onewire="26.AF9C32000000#temperature"}
{hue="1"}
```

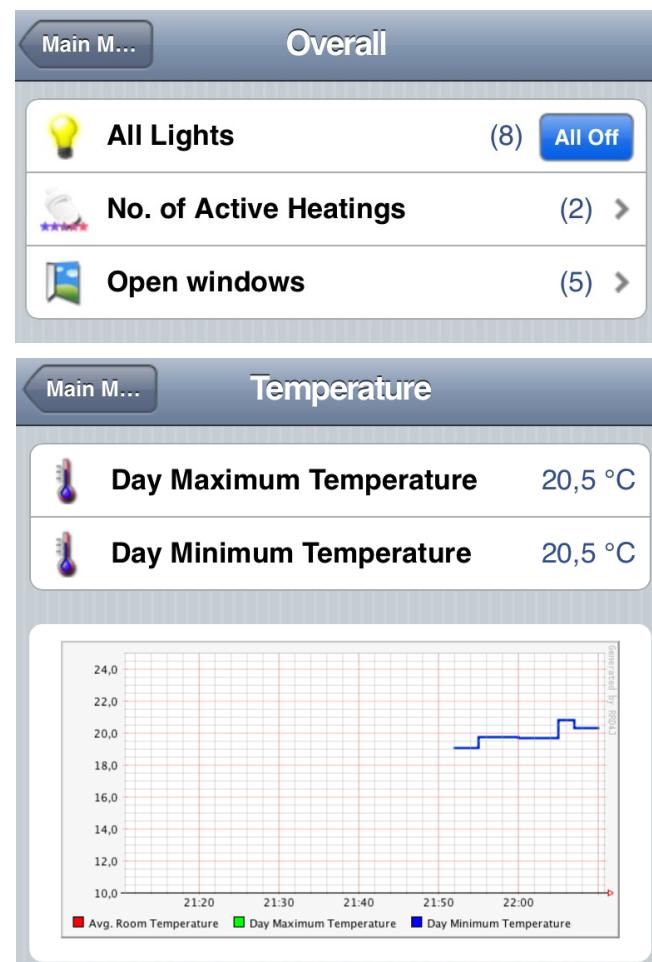
Main Menu



DSL for HCI

```
sitemap demoCamp label="Main Menu" {
    Frame {
        Group item=gFF label="First Floor" icon="firstfloor"
        Group item=gGF label="Ground Floor" icon="groundfloor"
        Text label="Overall" icon="settings" {
            Switch item=Lights mappings=[OFF="All Off"]
            Group item=Heating
            Group item=Windows
        }
    }
    Frame label="Chart" {
        Text item=Temperature label="Temperature" {
            Frame {
                Text item=Temp_Max
                Text item=Temp_Min
            }
            Frame {
                Chart item=Temp_Chart period=h refresh=10000
            }
        }
    }
}
```

DSL for HCI



```
sitemap demoCamp label="Main Menu" {
    Frame {
        Group item=gFF label="First Floor" icon="firstfloor"
        Group item=gGF label="Ground Floor" icon="groundfloor"
        Text label="Overall" icon="settings" {
            Switch item=Lights mappings=[OFF="All Off"]
            Group item=Heating
            Group item=Windows
        }
    }
    Frame label="Chart" {
        Text item=Temperature label="Temperature" {
            Frame {
                Text item=Temp_Max
                Text item=Temp_Min
            }
            Frame {
                Chart item=Temp_Chart period=h refresh=10000
            }
        }
    }
}
```

DSL for ECA Rules

```
var Timer timer = null

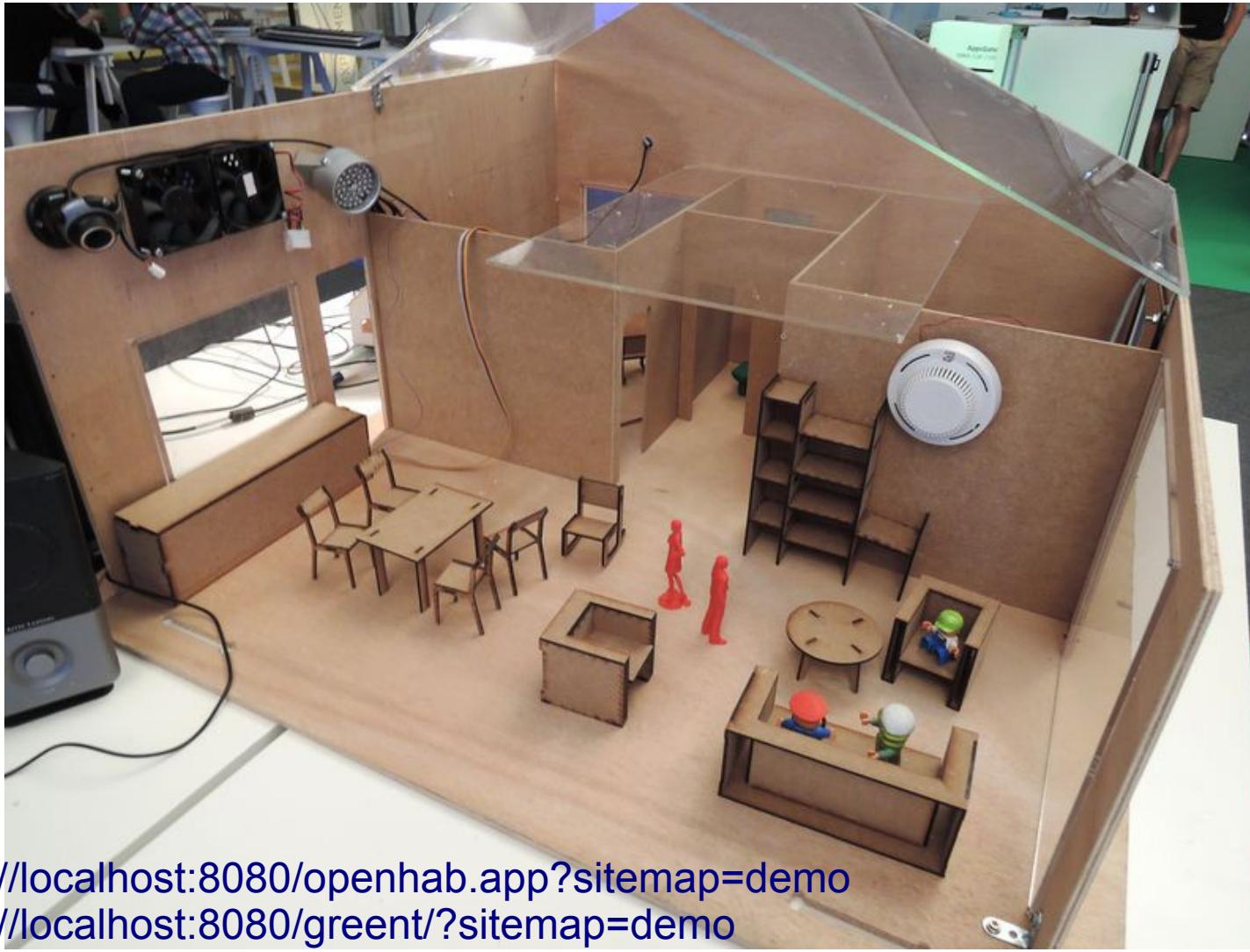
rule "Update max and min temperatures"
when
    Item Temperature changed or
    Time cron "0 0 0 * * ?" or
    System started
then
    postUpdate(Temp_Max, Temperature.maximumSince(now.toDateMidnight).state)
    postUpdate(Temp_Min, Temperature.minimumSince(now.toDateMidnight).state)
end

rule "Set random room temperatures"
    when
        System started or
        Time cron "0 0/5 * * * ?"
    then
        Temperature?.members.ForEach(temperature|
            postUpdate(temperature, 20.0
                + (25.0 - (Math::random * 50.0).intValue) / 10.0)
        )
    end
```

Condition

Xtend

Demo Smart Doll House OpenHAB + Arduino + MQTT

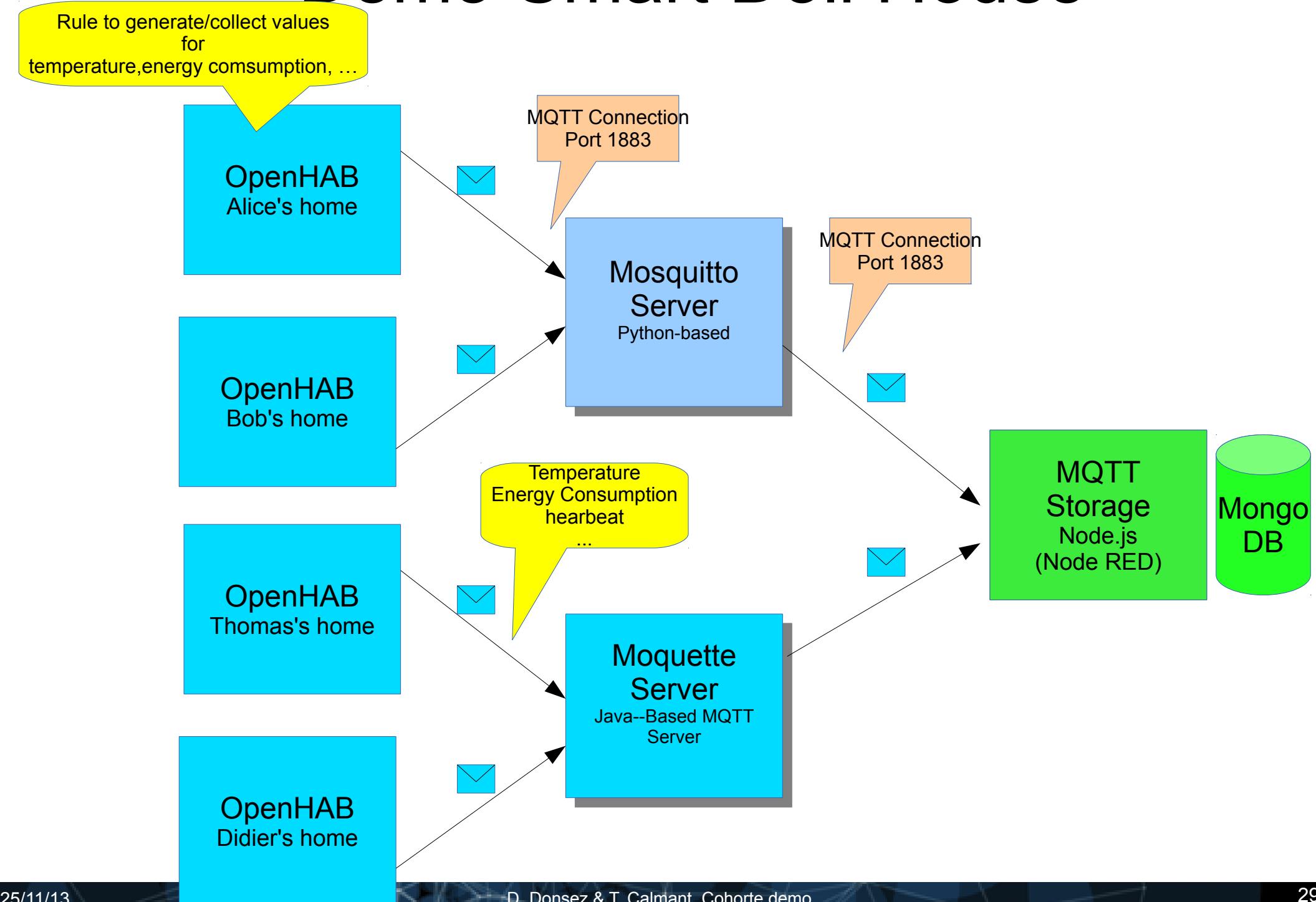


<http://localhost:8080/openhab.app?sitemap=demo>

<http://localhost:8080/greent/?sitemap=demo>

<http://air.imag.fr/index.php/SDH>

Demo Smart Doll House



Node RED Mashup for IoT stream processing

Node-RED

Deploy

info debug

/openHAB/1234/out/Temp_Max/state
20.40000000

25 Nov 2013 13:50:00.448 [5b091701.1505]
/openHAB/1234/out/Temp_Min/state
20.13750000

25 Nov 2013 13:50:00.474 [5b091701.1505]
/openHAB/1234/out/Temp_Max/state
20.13750000

25 Nov 2013 13:50:00.496 [5b091701.1505]
/openHAB/1234/out/Temp_Min/state
20.10000000

25 Nov 2013 13:50:00.541 [5b091701.1505]
/openHAB/1234/out/Temp_Max/state
20.10000000

25 Nov 2013 13:50:00.563 [5b091701.1505]
/openHAB/1234/out/Temp_Min/state
20.10000000

25 Nov 2013 13:50:00.586 [5b091701.1505]
/openHAB/1234/out/Temp_Max/state
20.10000000

25 Nov 2013 13:50:00.608 [5b091701.1505]
/openHAB/1234/out/Temp_Min/state
20.10000000

http://localhost:1880

```
graph LR; mqtt1[test.mosquitto.org] --> f1[nop]; mqtt2[m2m.eclipse.org] --> f1; mqtt3[local mqtt broker] --> f1; mqtt4[RabbitMQ Dev] --> f1; mqtt5[q.m2m.io] --> sw[Switch on content]; f1 --> sw; sw --> f2[nop]; sw --> add[add timestamp to payload]; add --> mongo[mongodb]; mongo --> debug[debug]; mongo --> log[Log File]
```

Q & A

Bonus Track

