Invisible Monitoring

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Motivation

Why is challenging?

Description I

- Two main sections:
  1. Central control system
     - ✓ Easy to extend
     - ✓ Rules based
     - ✓ Modifiable
     - ✓ Not restricted to this project

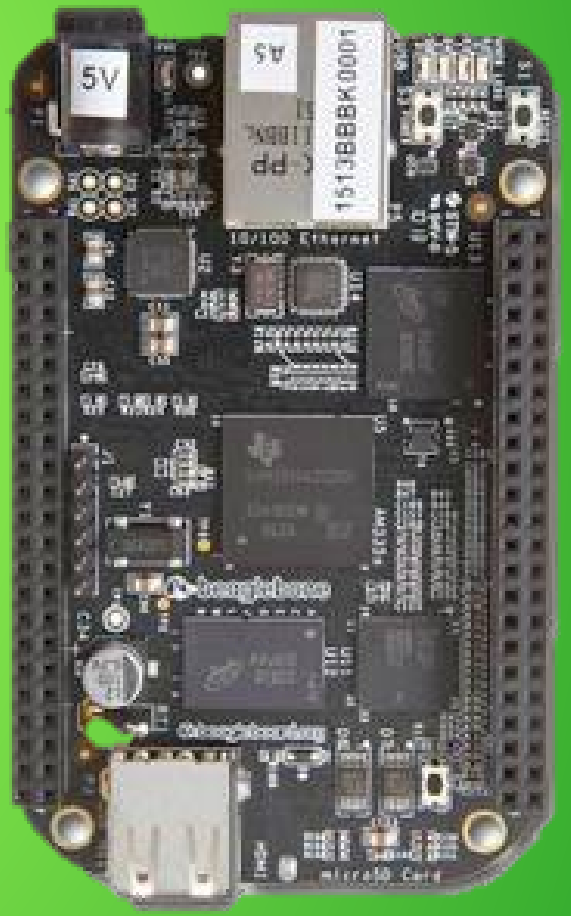
Description II

- Invisible monitoring
  - ✓Low cost
  - ✓Non intrusive
  - ✓Real time access to information (position)

Central Unit
BeagleBone Black

- BBB:
  - ARM Cortex-A8 Processor
  - USB, Ethernet, microSD, HDMI ports
  - Debian, Android, Angostrom

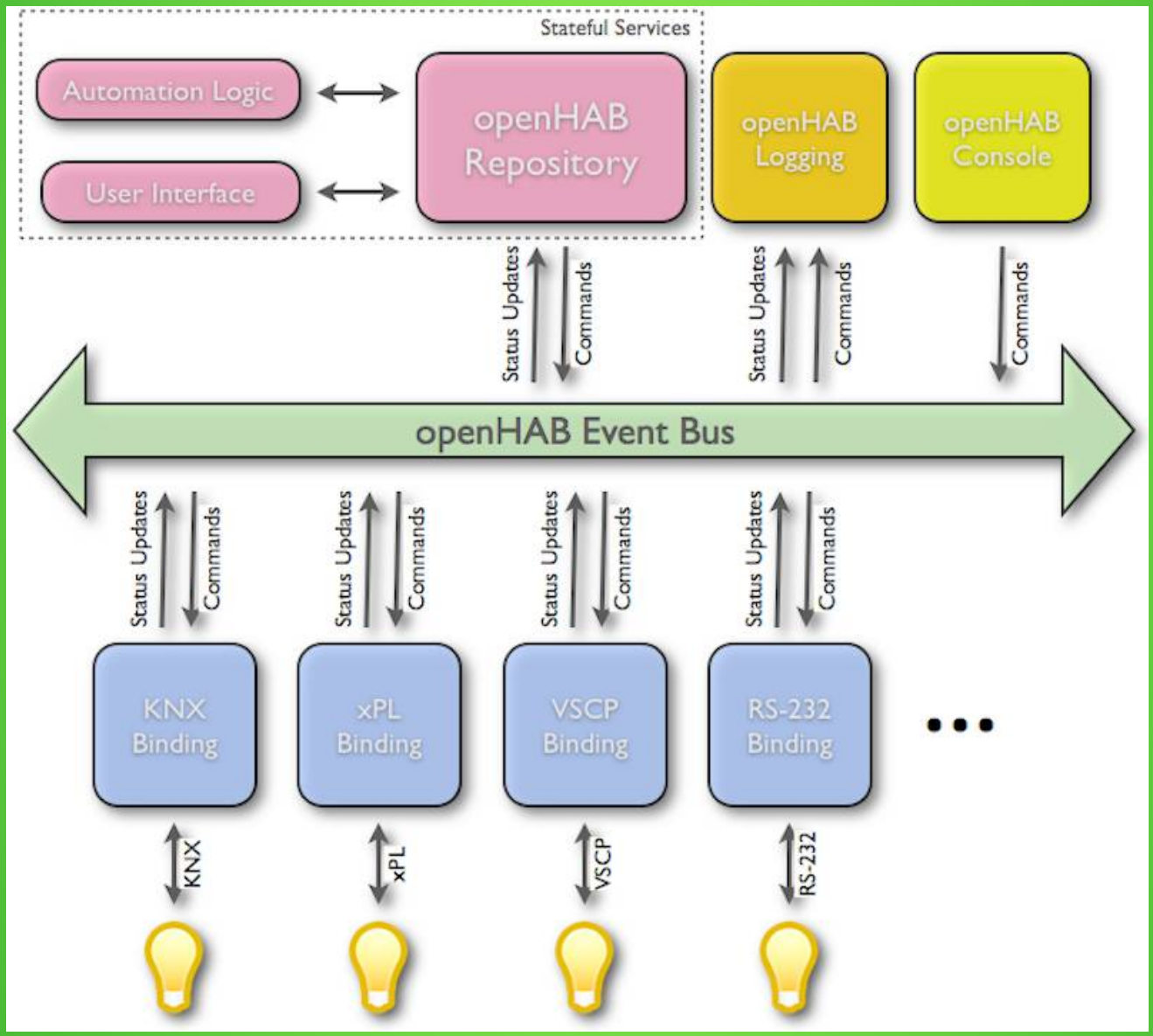
Performance is only a constraint
Not the resources BBB has



- Based on Java
- Open-Source
- Integration Platform for Smart Homes
- Support over 80 Technologies
- Two Parts
  - Runtime
  - Designer

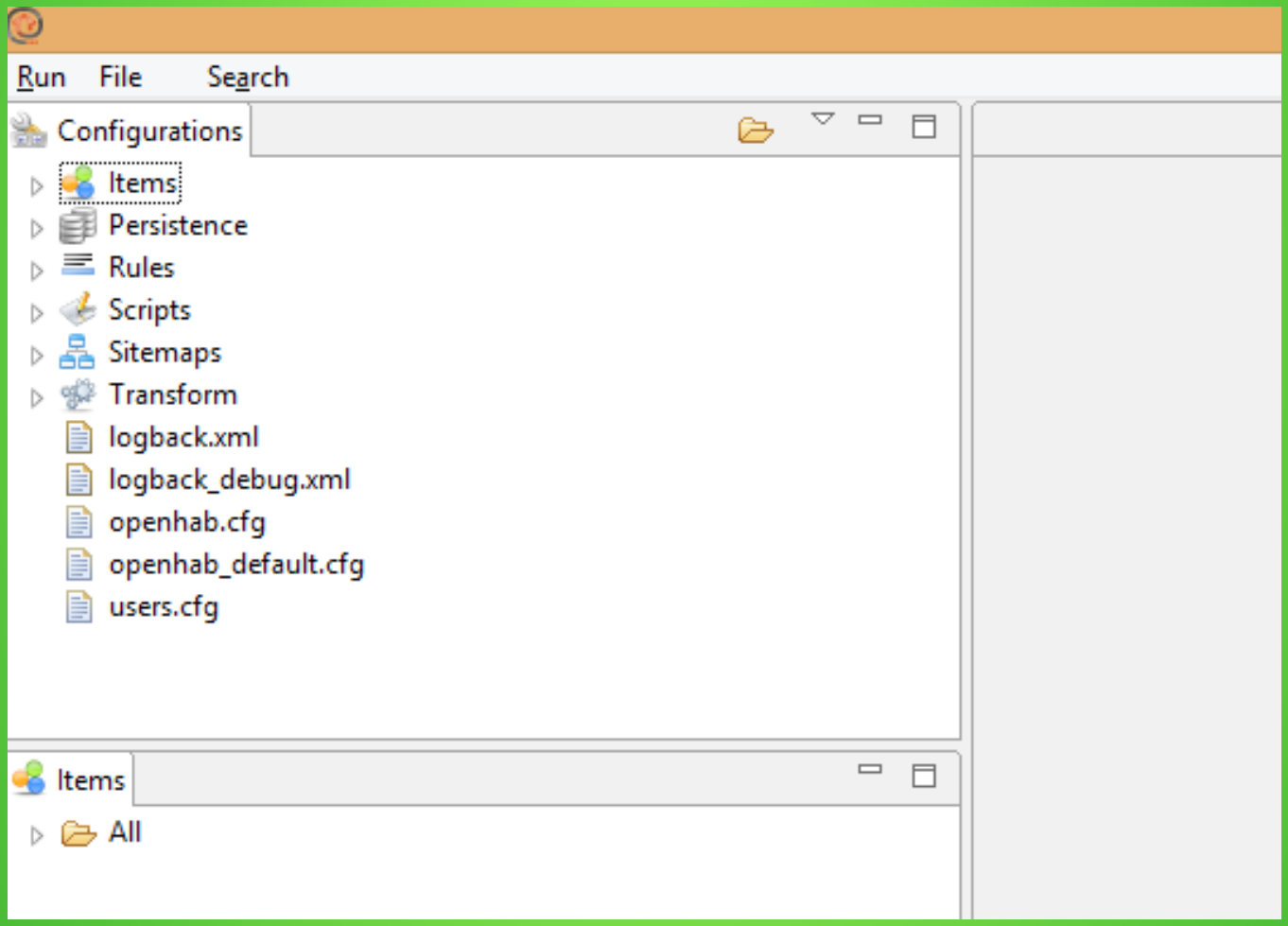
- Plug-ins:
  - HABDoird
  - HABmin

OpenHAB Runtime Architecture



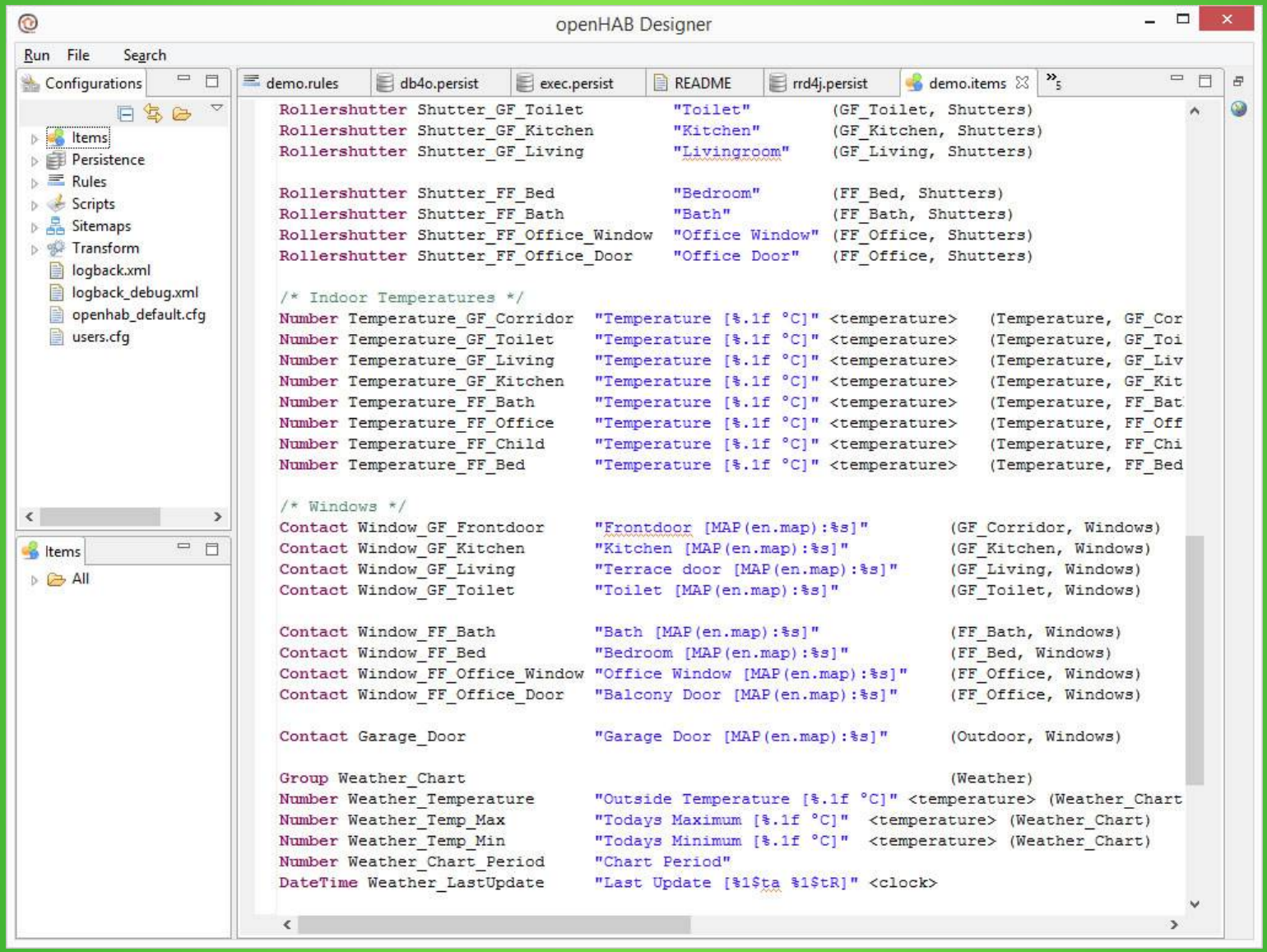
openHAB

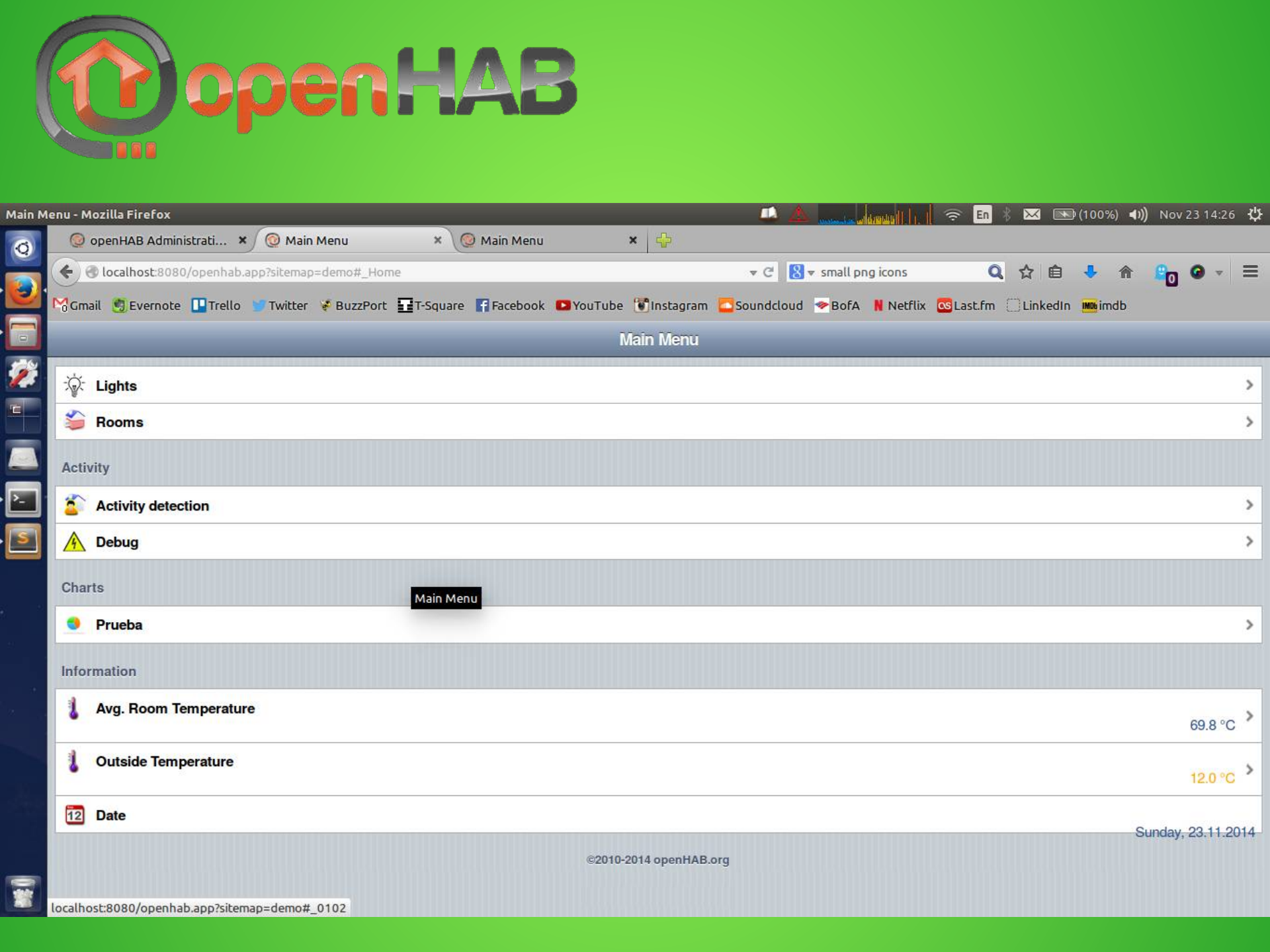
Designer



openHAB

Designer




openHAB
Main Menu - Mozilla Firefox
Nov 23 14:26
openHAB Administrati...
Main Menu
Main Menu
localhost:8080/openhab.app?sitemap=demo#_Home
small png icons
Gmail
Evernote
Trello
Twitter
BuzzPort
T-Square
Facebook
YouTube
Instagram
Soundcloud
BofA
Netflix
Last.fm
LinkedIn
imdb
Main Menu
Lights
Rooms
Activity
Activity detection
Debug
Charts
Main Menu
Prueba
Information
Avg. Room Temperature
69.8 °C
Outside Temperature
12.0 °C
Date
Sunday, 23.11.2014
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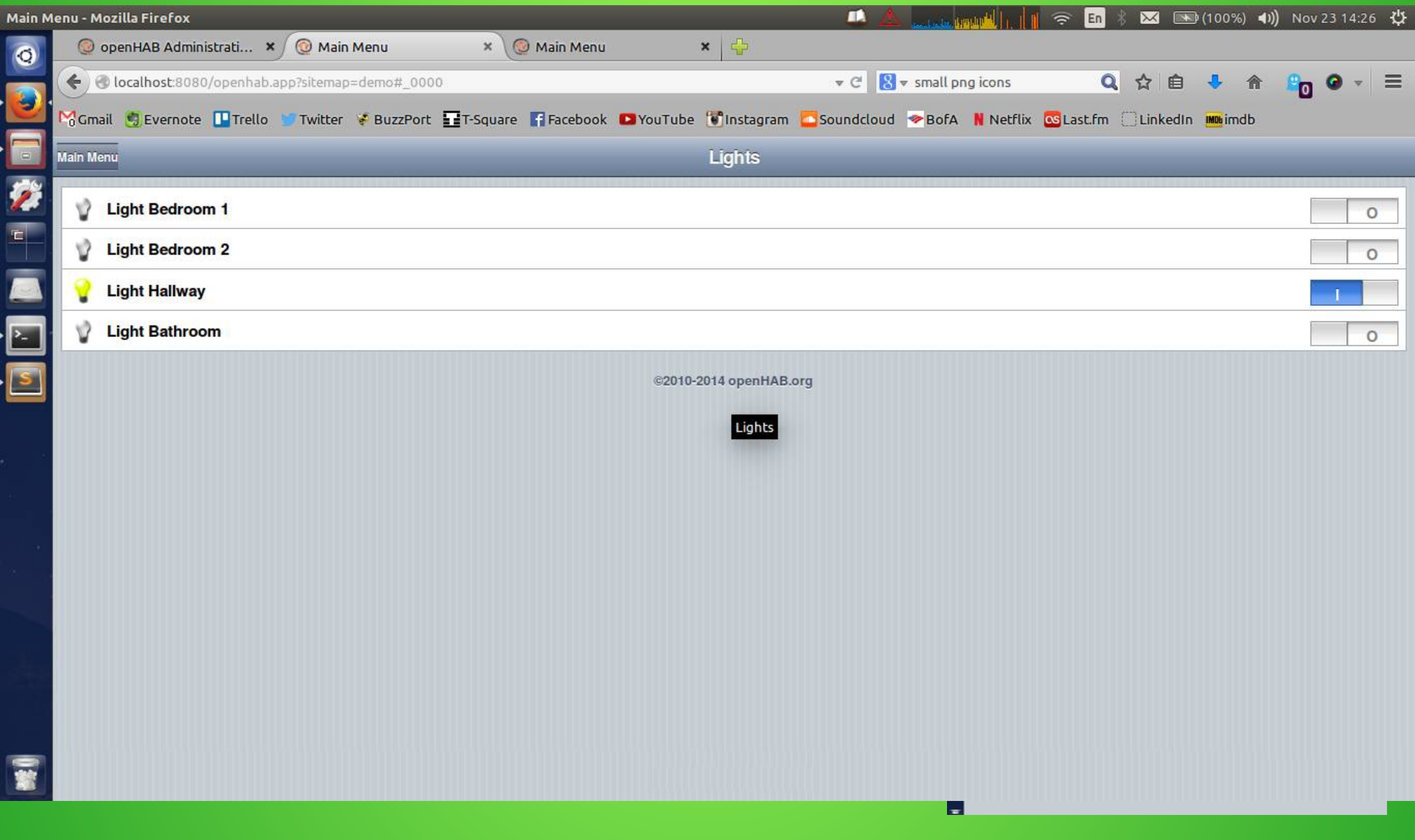
localhost:8080/openhab.app?sitemap=demo#_0102


Main Menu - Mozilla Firefox
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Main Menu
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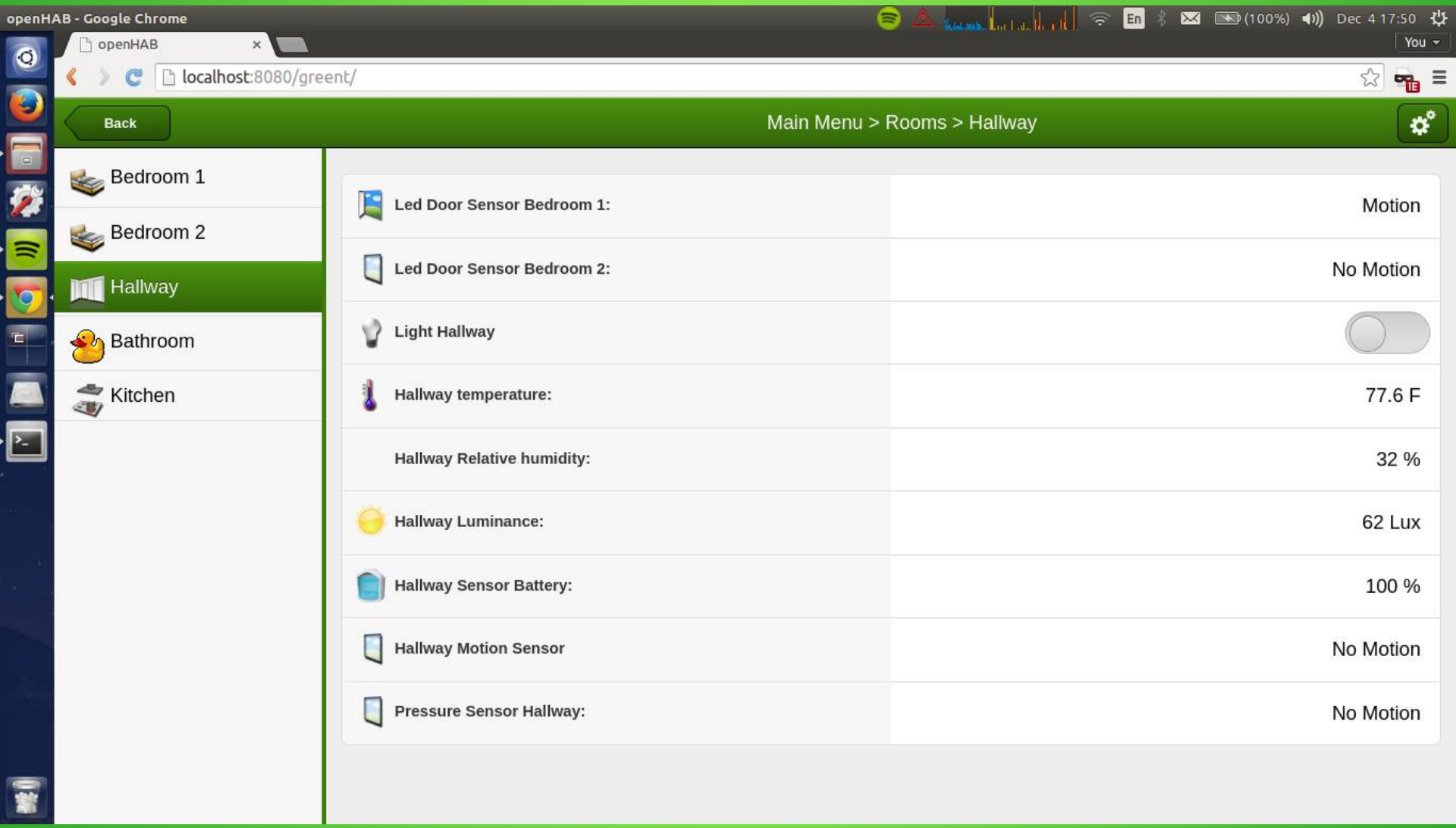
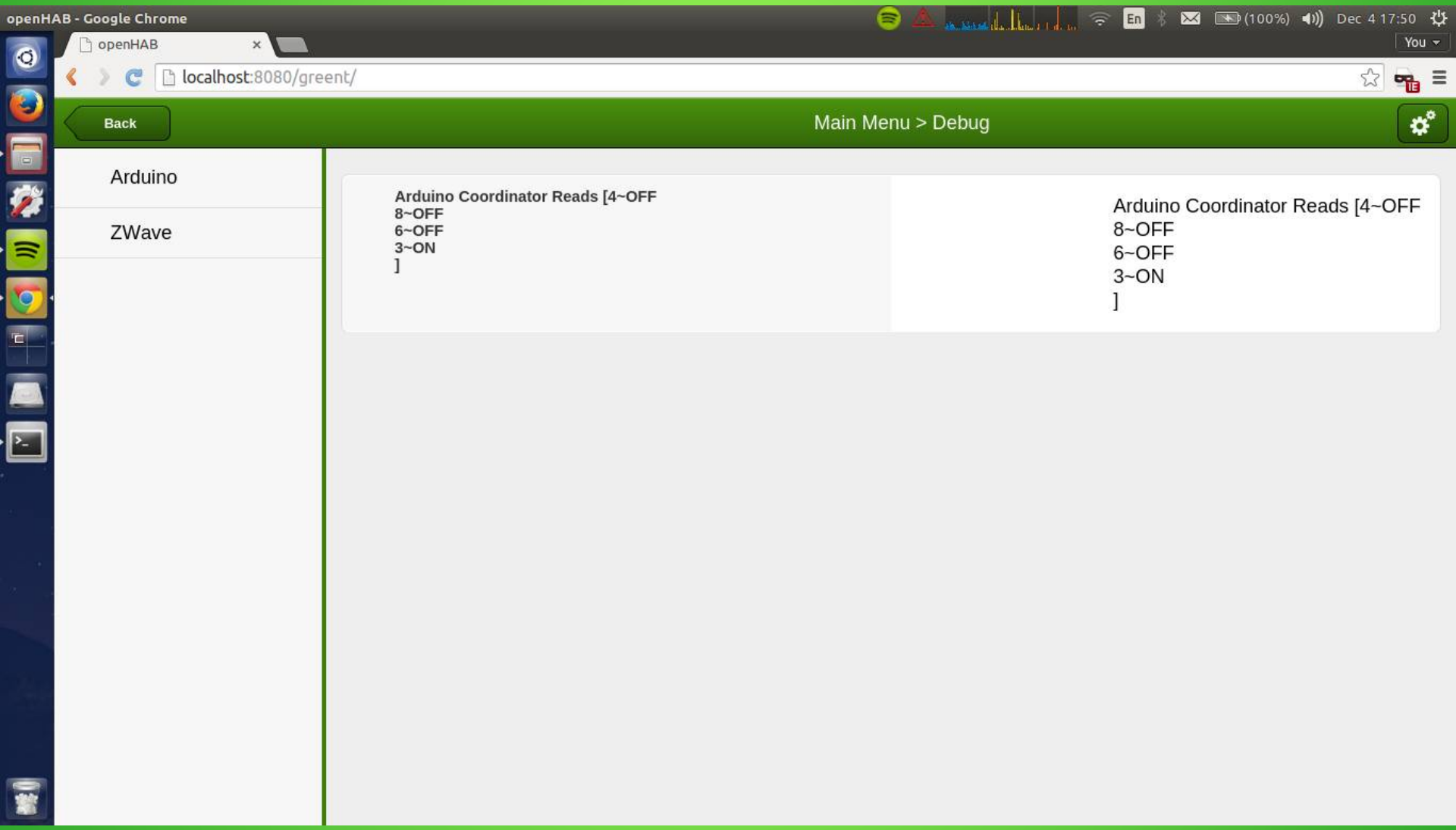
localhost:8080/openhab.app?sitemap=demo#_0000
small png icons
Gmail
Evernote
Trello
Twitter
BuzzPort
T-Square
Facebook
YouTube
Instagram
Soundcloud
BofA
Netflix
Last.fm
LinkedIn
imdb
Main Menu
Lights
Light Bedroom 1
Light Bedroom 2
Light Hallway
Light Bathroom
©2010-2014 openHAB.org
Lights


openHAB - Google Chrome
openHAB
localhost:8080/greent/
Back
Main Menu > Rooms > Hallway
Bedroom 1
Bedroom 2
Hallway
Bathroom
Kitchen
Led Door Sensor Bedroom 1:
Motion
Led Door Sensor Bedroom 2:
No Motion
Light Hallway
Hallway temperature:
77.6 F
Hallway Relative humidity:
32 %
Hallway Luminance:
62 Lux
Hallway Sensor Battery:
100 %
Hallway Motion Sensor
No Motion
Pressure Sensor Hallway:
No Motion

Our Debug on Web interface

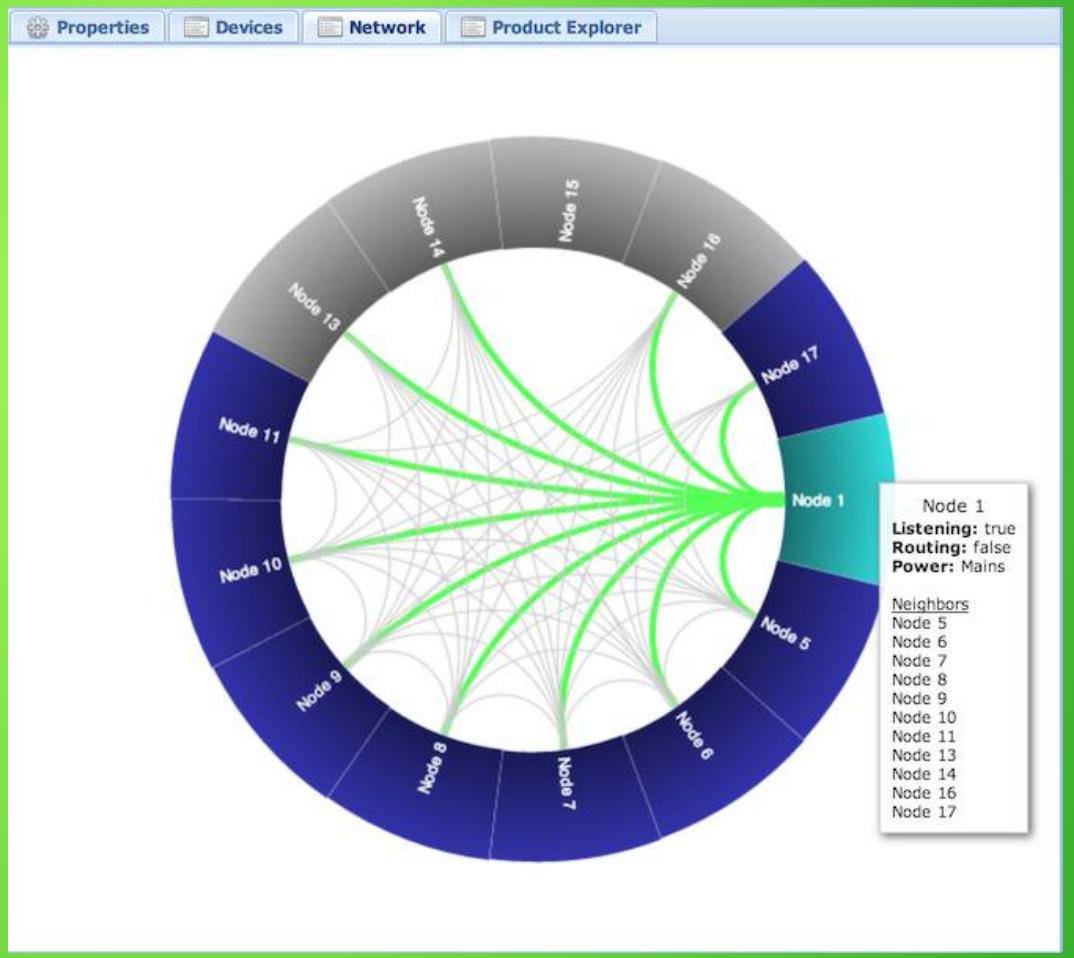


HABDroid

Mobile App for interface (both iOS and Android)

HABmin

- Web administration console for openHAB
- Easy to configure
- devices
- Example
  - Z-wave Network:



Z-wave

- Z-wave Stick

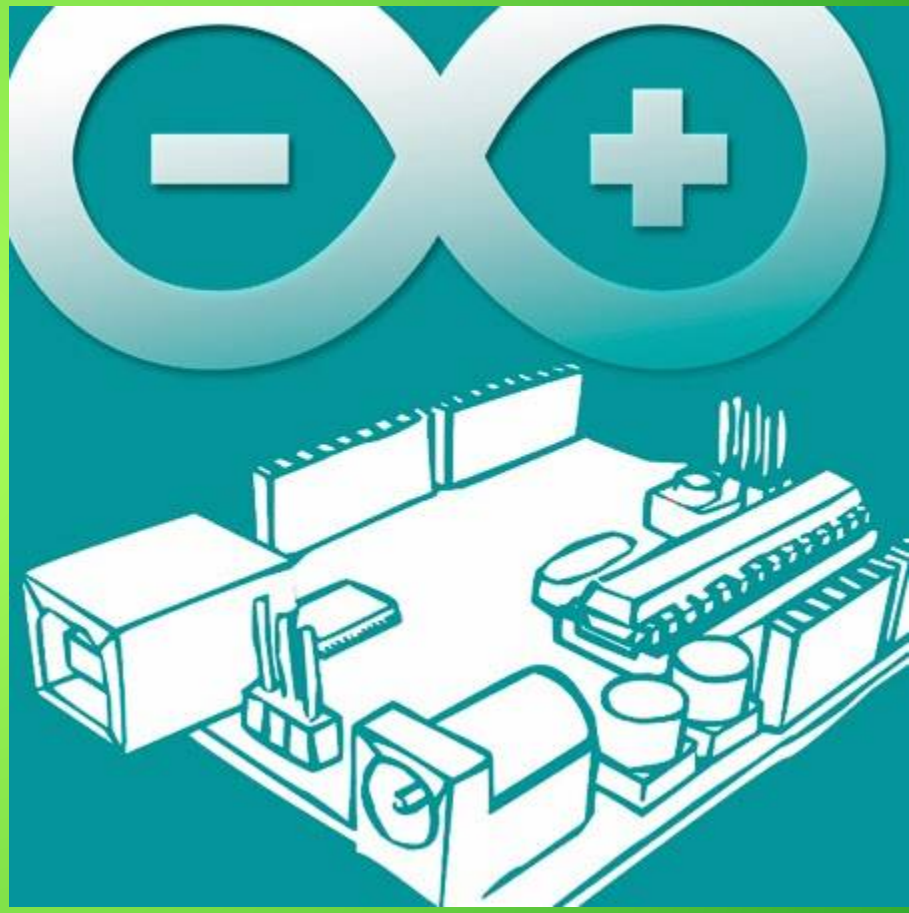
- 4in1 Multi-Sensor
- Motion ,Temperature ,Humidity
  - Luminance

- Lamp Module as an Actuator
  - Also a mesh booster

Z-wave

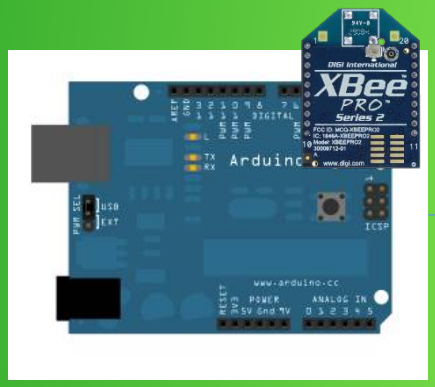
Lamp Module and 4in1 Motion sensor

Zigbee + Arduinos + Sensors

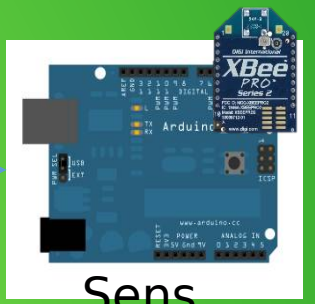


API Mode

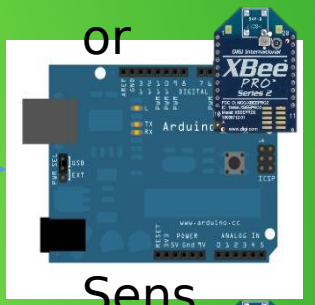
One to many connection



Coordinator



Sensor



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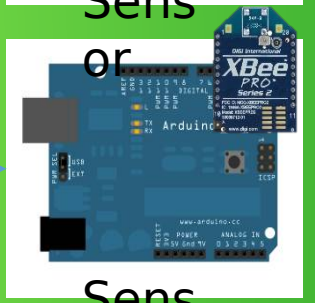
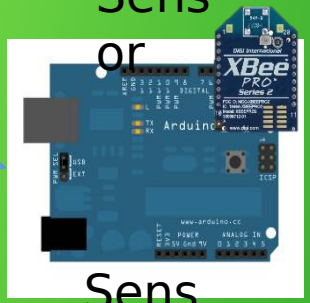


Sensor



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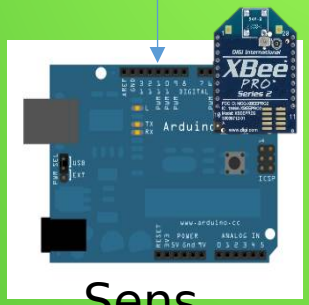
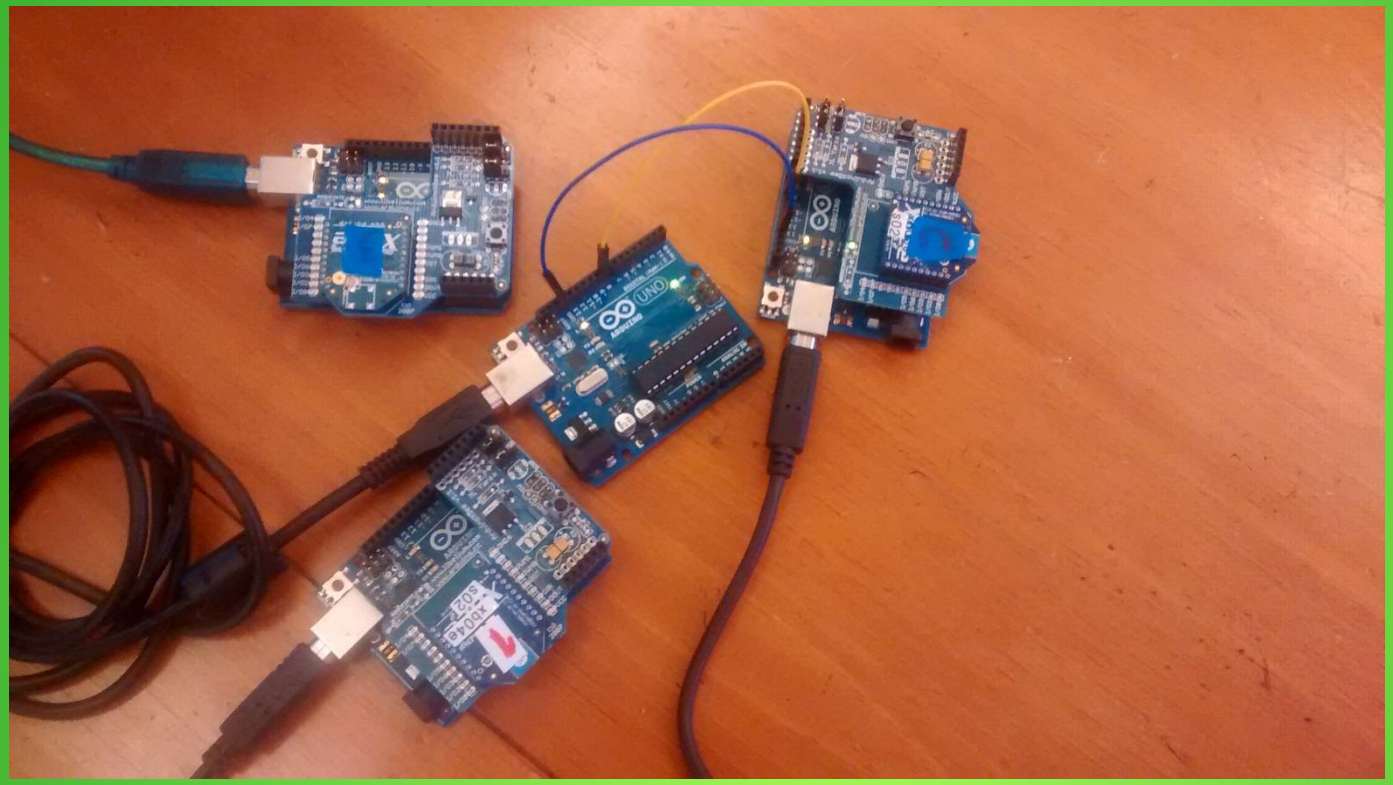


Sensor

Sensor



The coordinator and some slaves

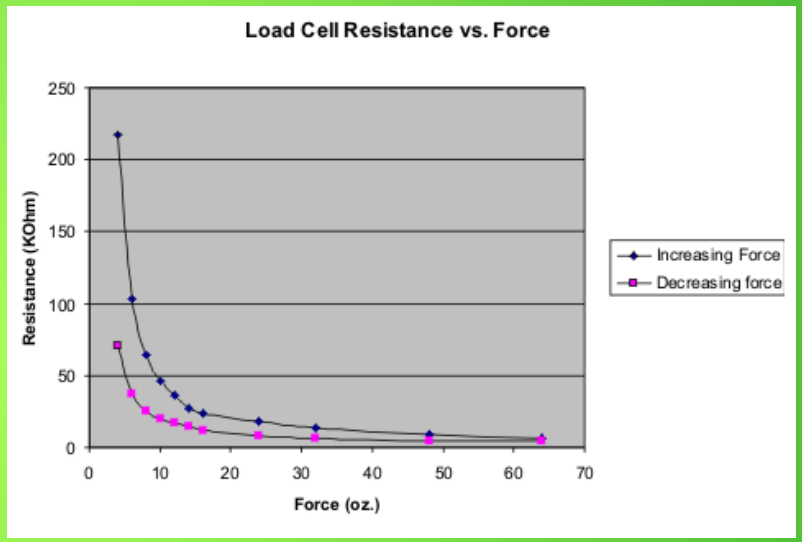
The coordinator and many slaves

message structure

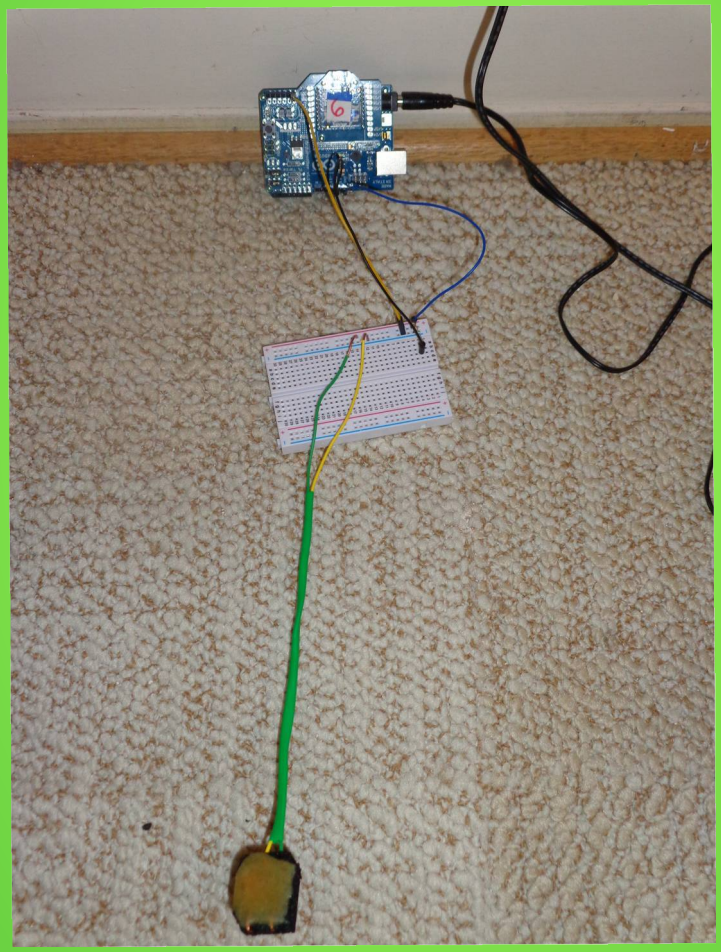
- 2 Byte Packages
- **Why?**
- 10-bits resolution from the ADC in the Arduino
- Other bits are used for node identification
- |□6 bits node identification □| |□ 10 bits data information□|

What kind of sensors?

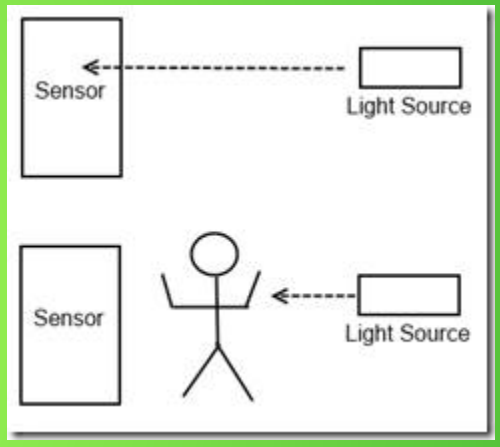
Force sensors (Pressure)



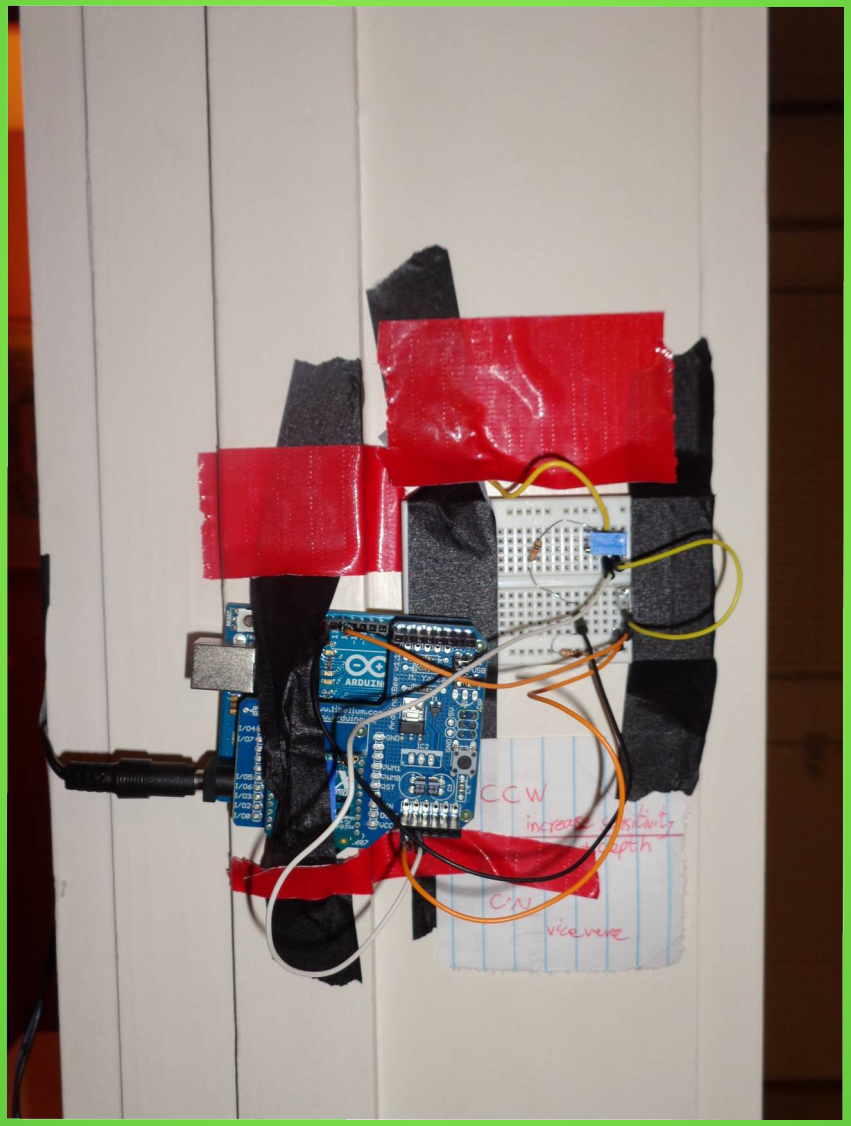
Our Motion Sensor

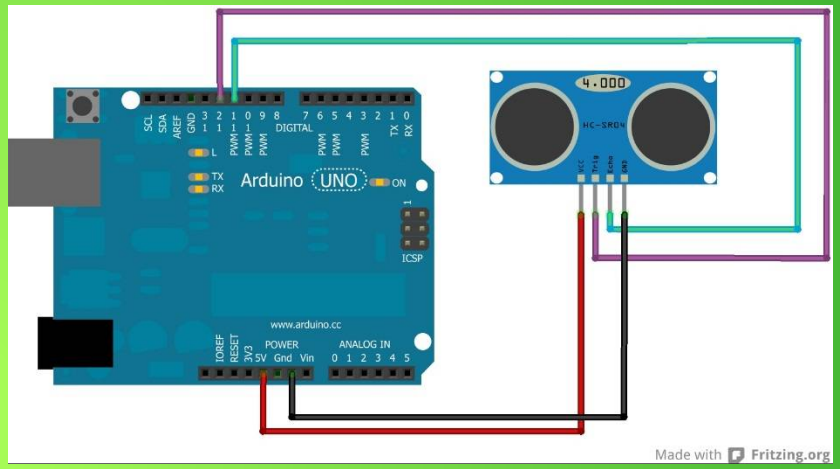


A infrared barrier



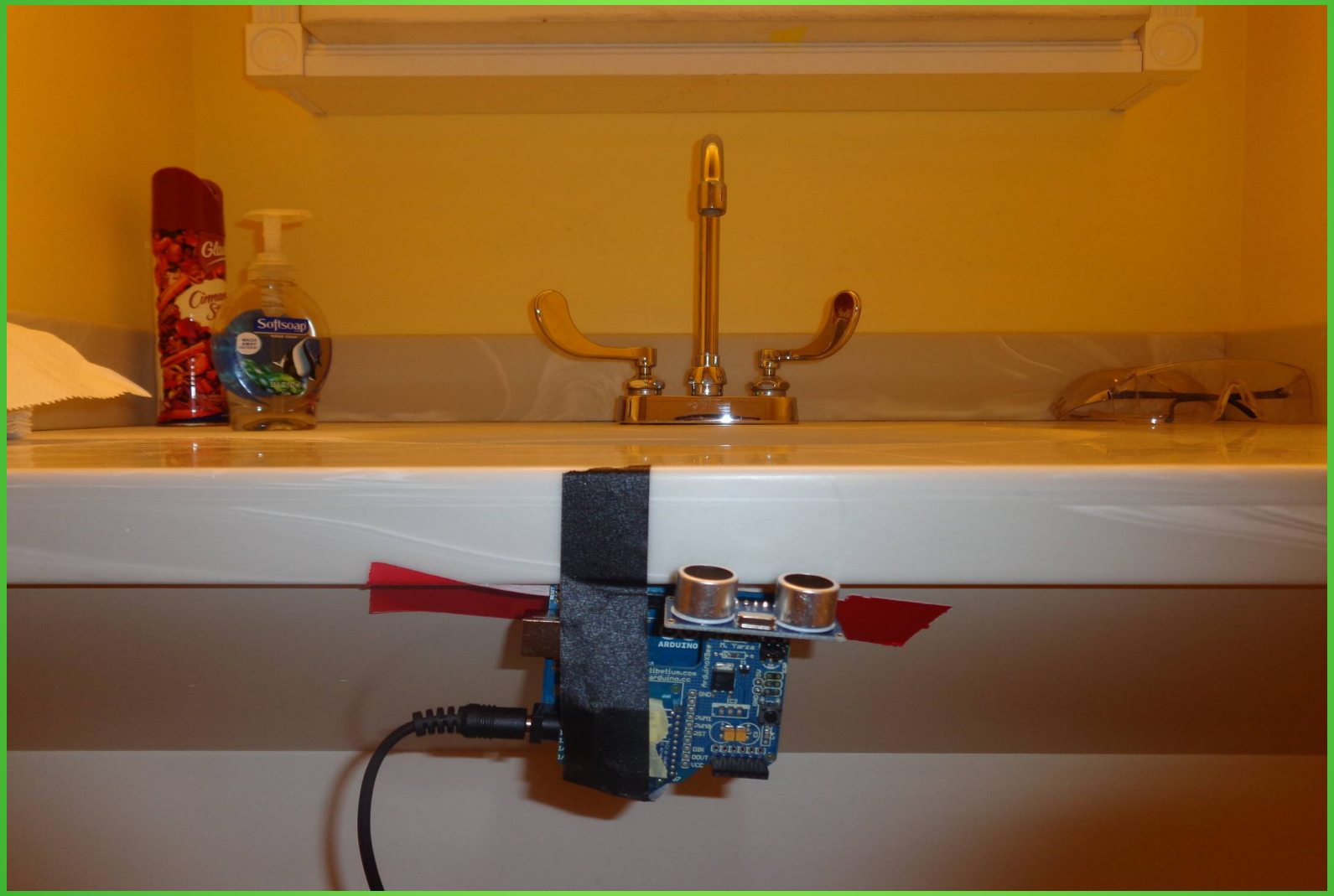
Our Infrared Barrier





Ultrasonic sensor

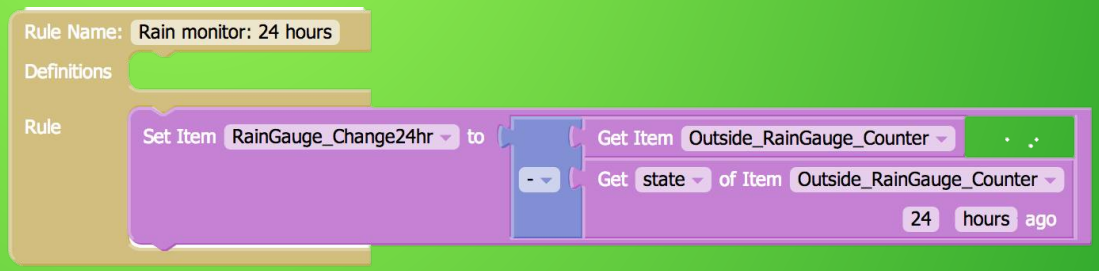
Ultrasonic sensor



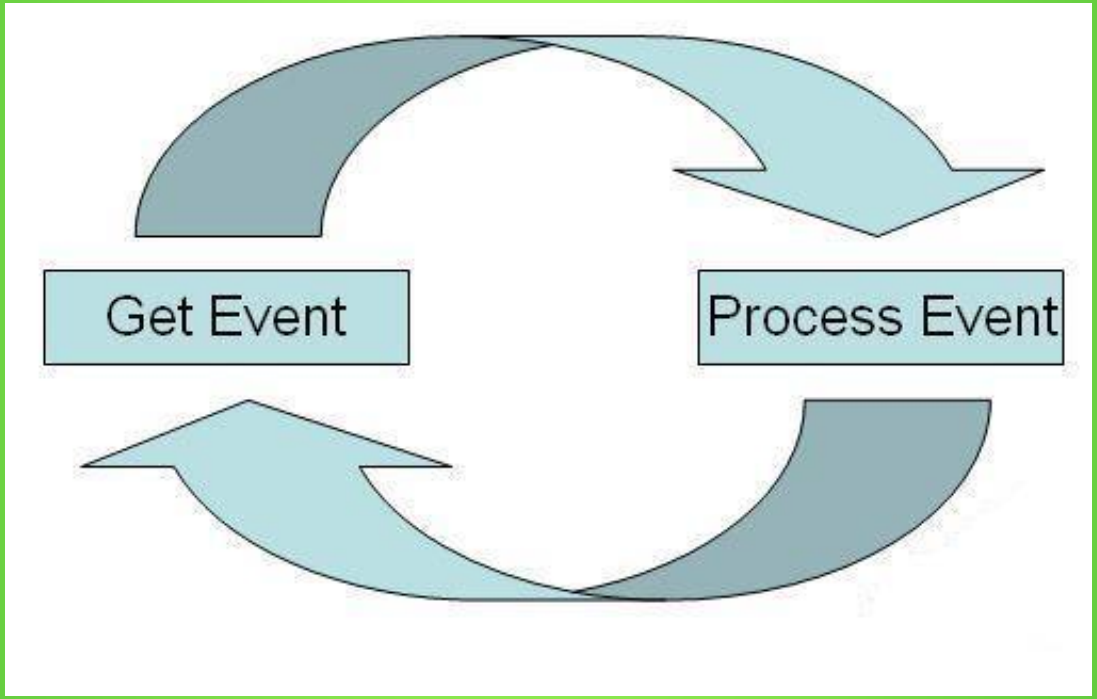
Event-Driven Programming

Rules based programming

- Item(-Event)-based triggers: They react on events, i.e. commands and status updates for items
- Time-based triggers: They react at special times, e.g. at midnight, every hour, etc.
- System-based triggers: They react on certain system statuses.



How to know if there is activity?



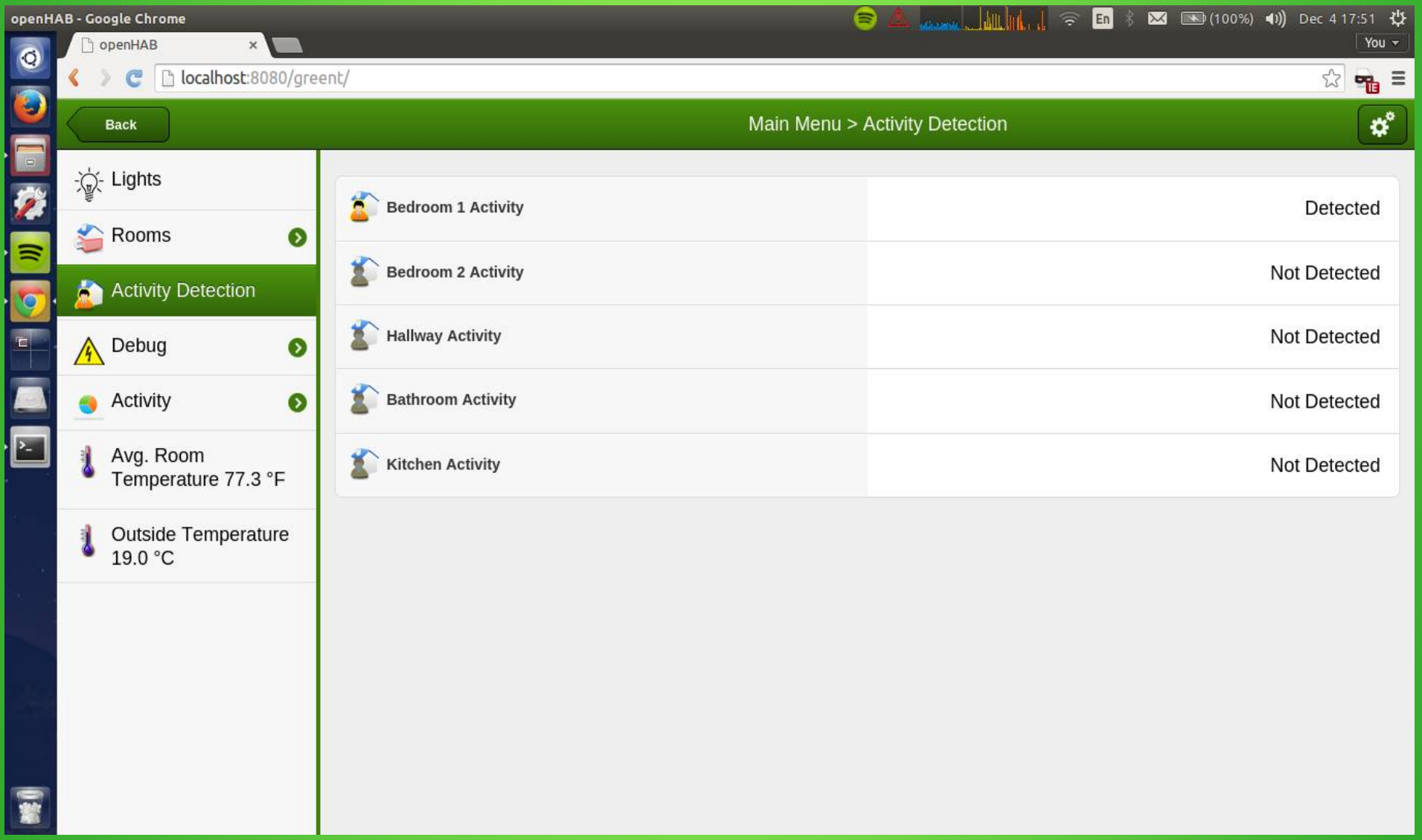
How to know if there is activity?

- What information the infrared barrier give us?
- That the person is near that door
- For us is not important to know exactly in which room
  - We activate both rooms.
- It’s better for coherence and multiple persons

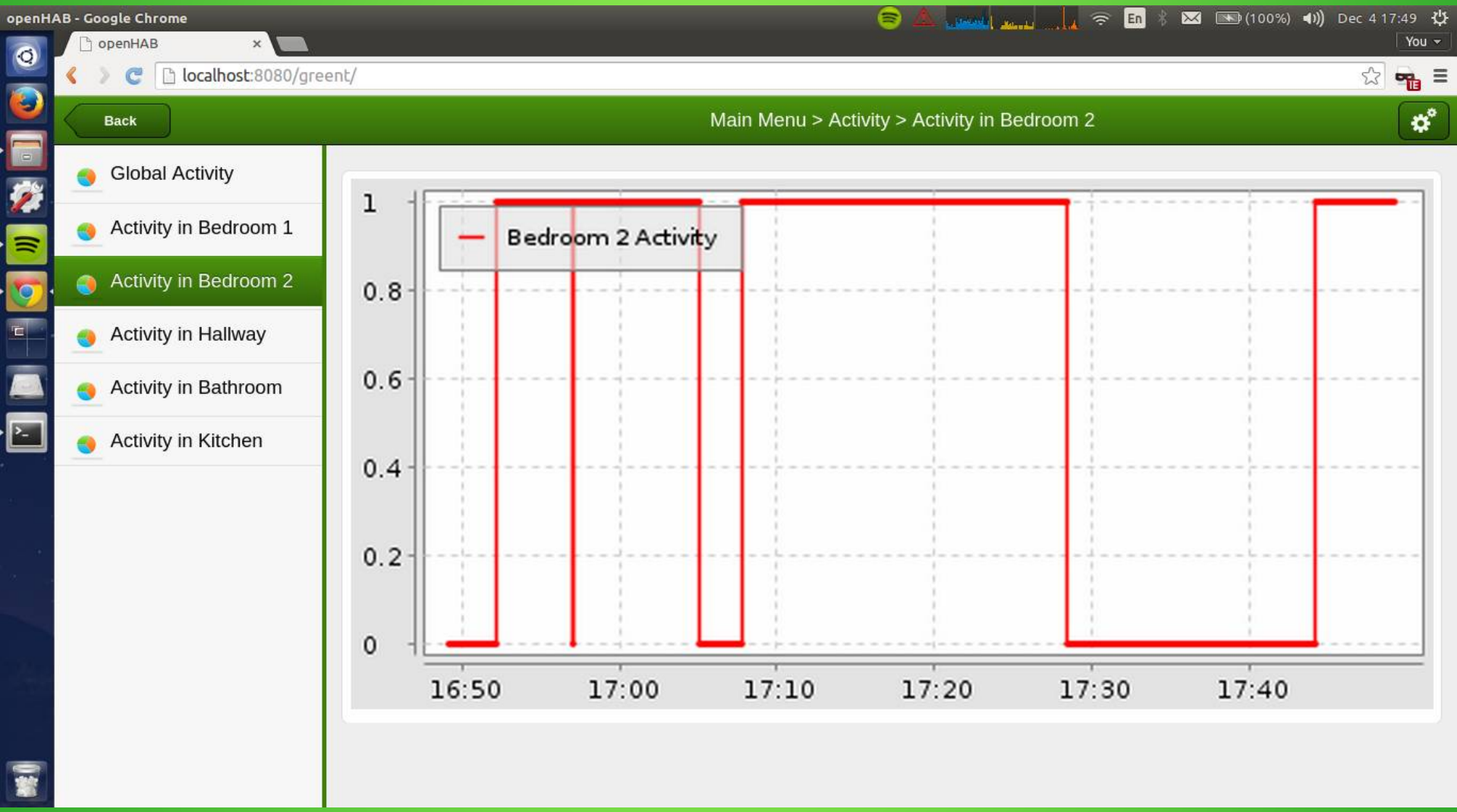
How to know if there is activity?

- Each action has a latency for which the activity is still valid as a indicator of activity.

Activity interface



Database and Graphs



Database and Graphs

Summary

- Low cost monitoring system
- Testbed for future projects in AwareHome
- Less intrusive position detection system.