Affordable DIY Home Automation

From light switch robots to privacy concerned voice assistants

Calango Hackerclube,
Campus Party, Brasilia 2018
Ulrich Norbisrath (http://ulno.net)

whoami

- http://ulno.net, Ulrich Norbisrath
  email: replace http:// with ulno@

- **Adjunct Professor**
  - FH Upper Austria

- **Independent IoT Consultant/ Inventor**

- **PhD** from RWTH Aachen University: "Configuring eHome Systems"

- **Research:** Internet of Things, Story Driven Modeling, search support

- **Teaching:** H&B Automation, IoT, SE, Systems

- **International teaching and research experience:** USA, Germany, Austria, Estonia, Kazakhstan, Singapore, Indonesia
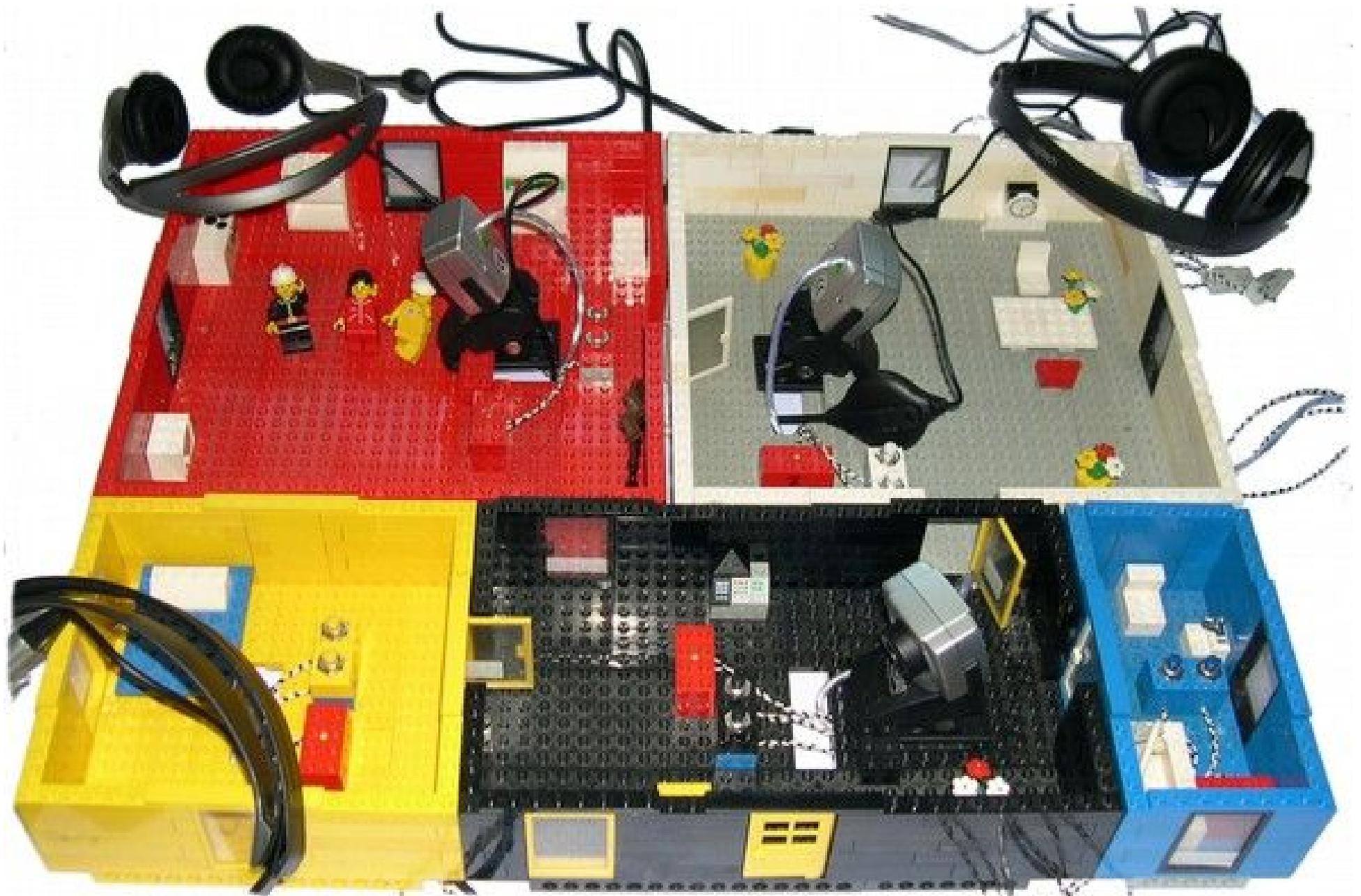
What about you?

- Who would think they are a Maker/Hacker?
- Who knows how to program (any language)?
- Who knows what an Arduino is?
- Who knows the ESP8266 (Amazon Dash)?
- Who has an idea about the Internet of Things (IoT)?

2002-2018
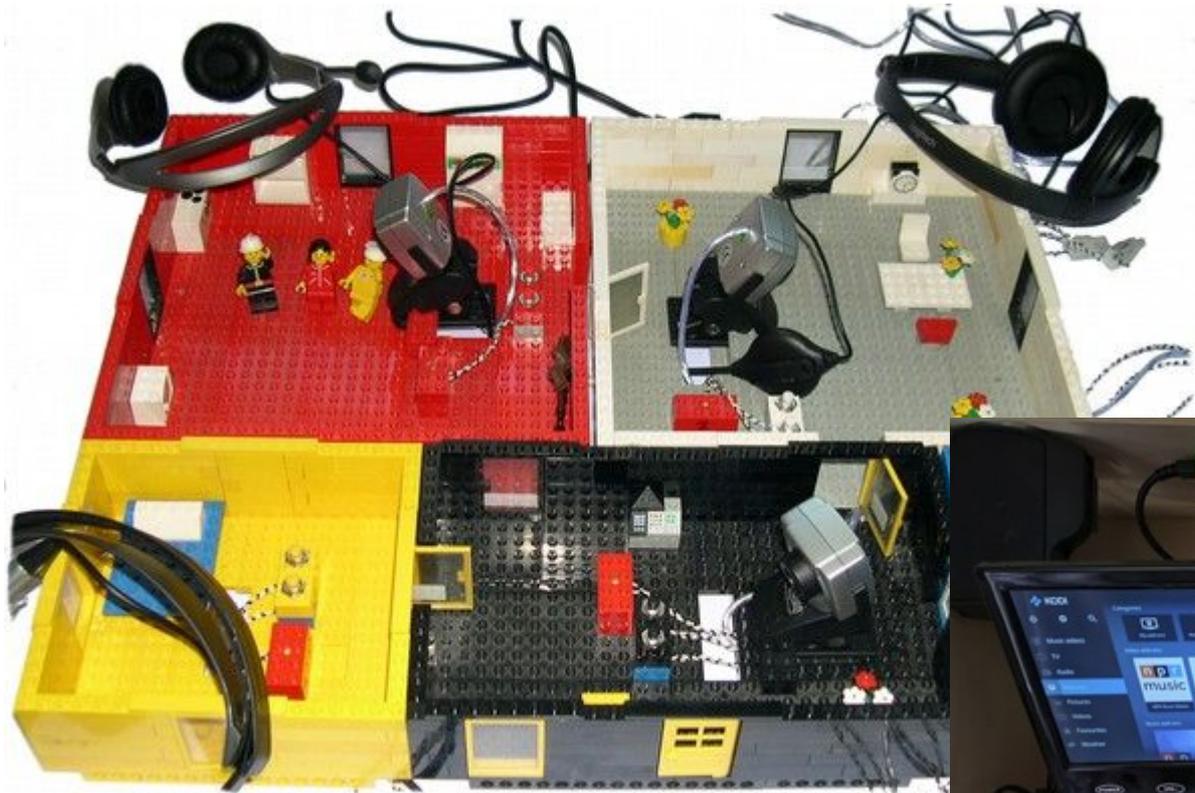
2004: eHomeDemonstrator v2

2017: eHomeDemonstrator v3

Your Friend's Home

ground floor plan

first floor plan

- 2 stories, 2.5 baths,
- 4 bedrooms, 2 garage stalls
- House+garage: 300 sqm
- Garden: 1000 sqm + pool

- How much would it cost to turn this into a smart home?

Student Results

Average: USD 40,000

Maximum: USD 120,000

Minimum: USD 5,000

without labor: USD 3,000

How is this possible?

1. DIY/Maker/Hacker

- Time, commitment, perseverance

- Stamina to endure failures

- Will to tinker and learn

- Access to workspace

- Access to community

2. Affordable IoT devices (ESP8266)

- Arduino on steroids for less
  - 160 MHz
  - GPIO ports
  - 0.5-16 MB
  - Ram 64k + 92k
  - Wifi on board
- Programmability
  - C/C++ with Arduino IDE
  - Lua
  - Javascript
  - Micropython
- Price: USD 1- USD 10
- You can also hack an Amazon Dash Button (USD 5)
- (Don't forget the new Raspberry Pi Zero W for USD 10 and other mini full computers)

Personal favorite: Wemos D1 Mini (USD 3)
(other popular option: nodemcu)

3. Software

- Influenced by 1+2

- Open source

- Facilitating and coordinating associated communities

Lighting

- Philips Hue: USD 15 per bulb (white)

- Or control existing light switch
  - 2 laser cut acrylic or wood pieces: < USD 10
  - 1 ESP8266: USD 3
  - 1 power adapter: available or USD 1
  - 1 small servo motor: USD 2.50
  - Screws, washers, and nuts: available

- Adapted from: http://www.instructables.com/id/Easy-Home-Automation-using-servo-switches/
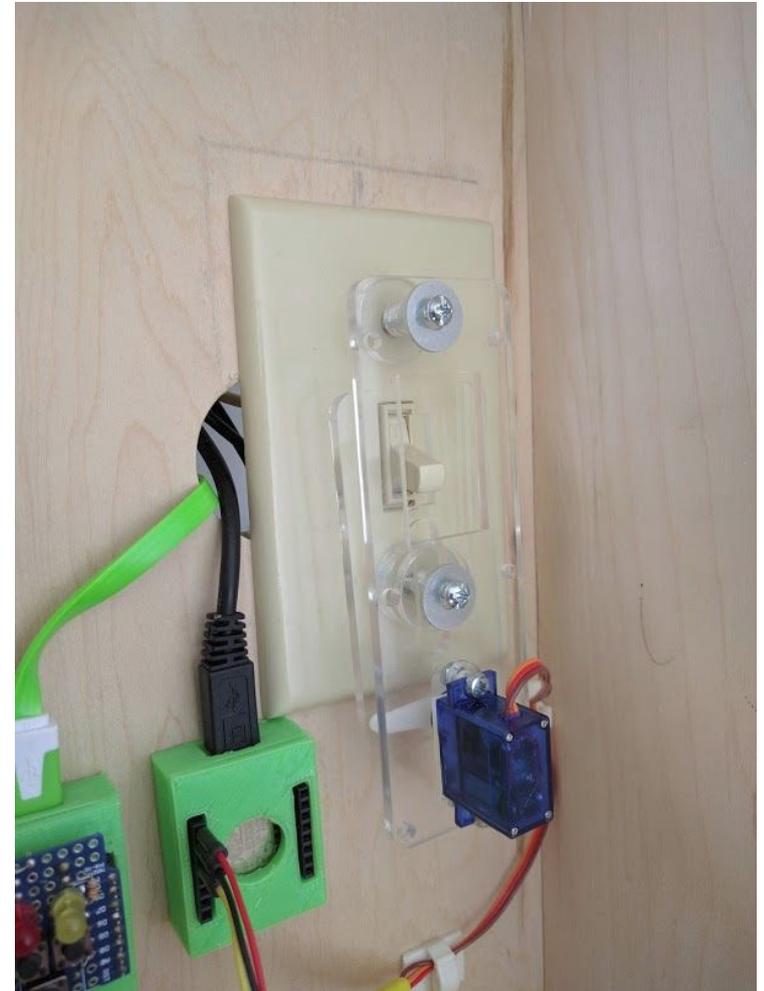
Lighting/Switching (Other Option)

- Relay(s) (USD 1)
  + Wemos D1 Mini
  (USD 3)
  + Power (USD 1)

- Sonoff (with UInoIoT or Tasmota firmware):
  < USD 8

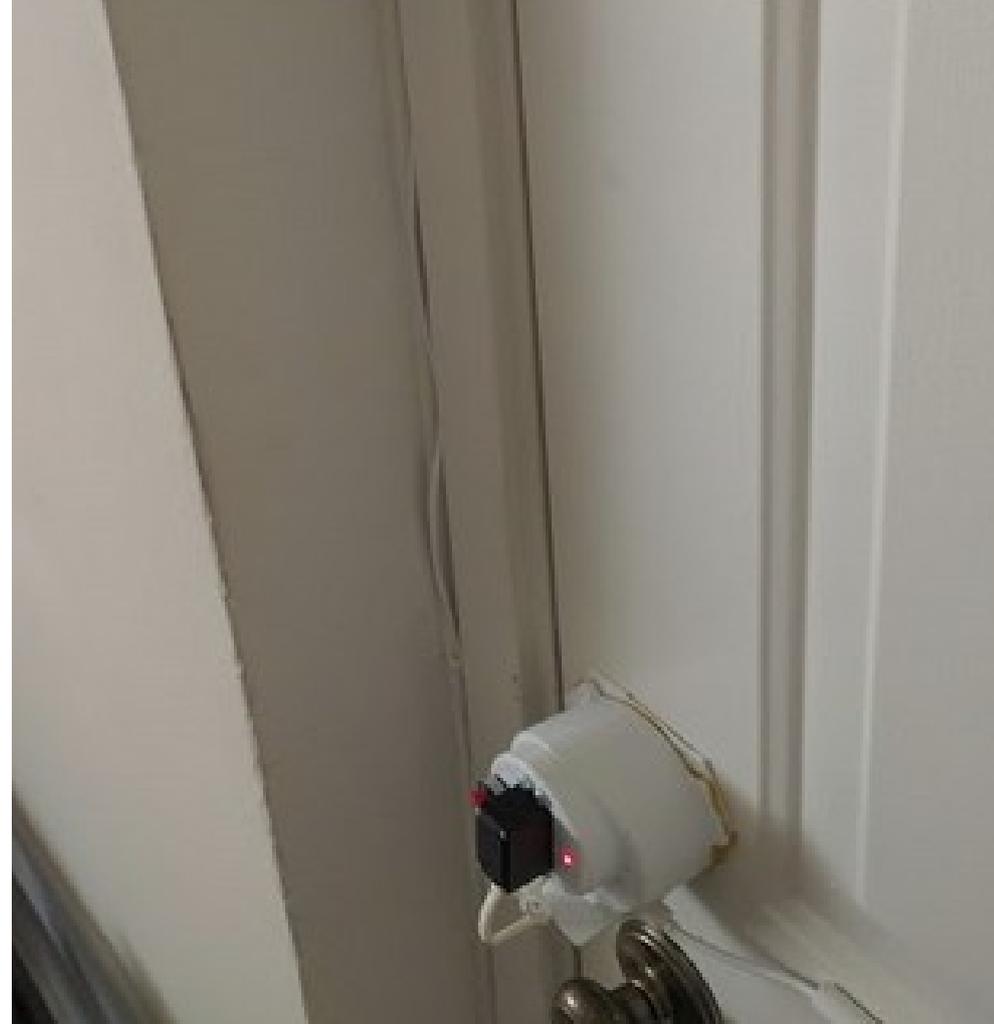Images from itead.cc and hackaday.com
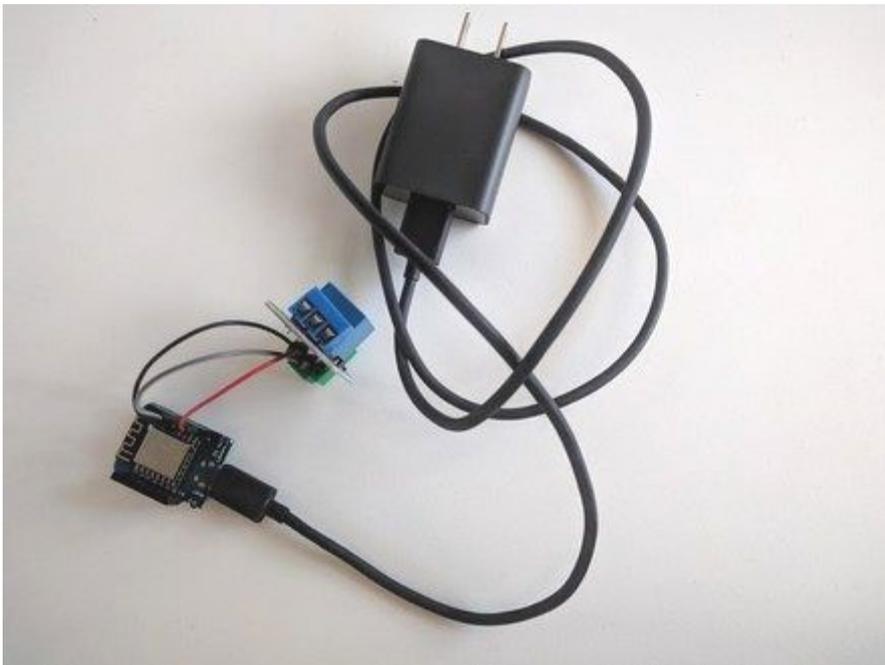
Wireless Buttons

- Wemos D1 Mini: USD 3
- Power Supply: USD 0-1
- Buttons: USD 1-2
- Wire: available
- Cardstock, felt, hot glue: insignificant

Smartlock

- 3D printed housing: < USD 2

- 1 button: USD 0.2

- 1 ESP8266: USD 3

- Strong torque servo motor: USD 5

- Power: 1 USD

Adapted from: https://www.youtube.com/watch?v=bAcK80fm1_0

Old Phone Dashboard

- Any old (Android) phone or tablet
- Full screen browser
- Daydream/Screensaver mode, touch to wake
- Home assistant or openhab dashboard
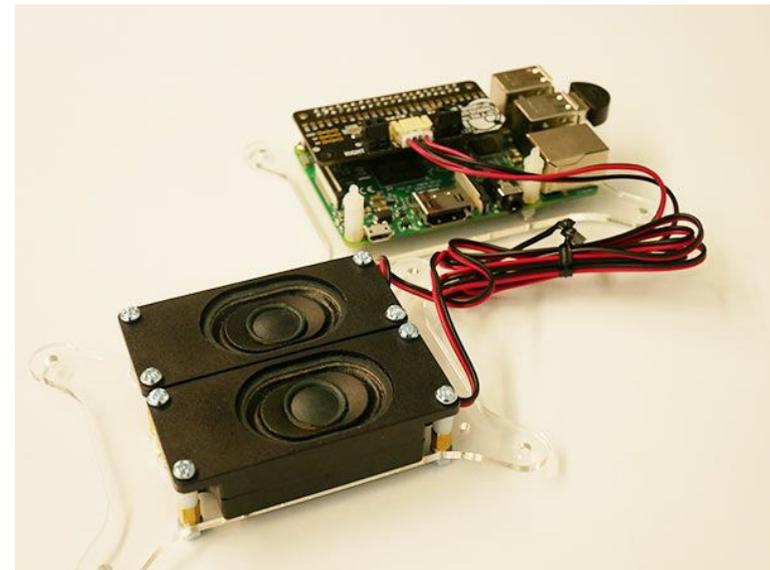- Glue to wall and power
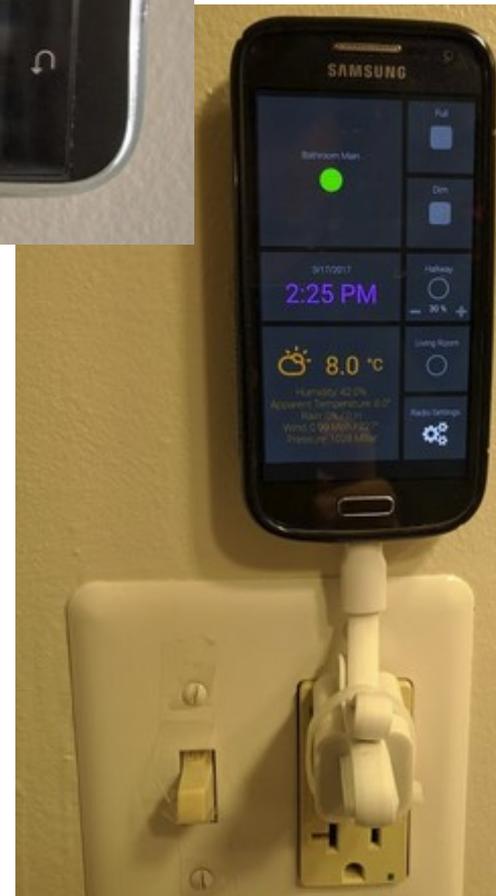
Multiroom Synchronous Audio

- Use Snapcast and several raspberry pis or pi zeros– really simple open source audio sync solution

- Android dashboards can be utilized
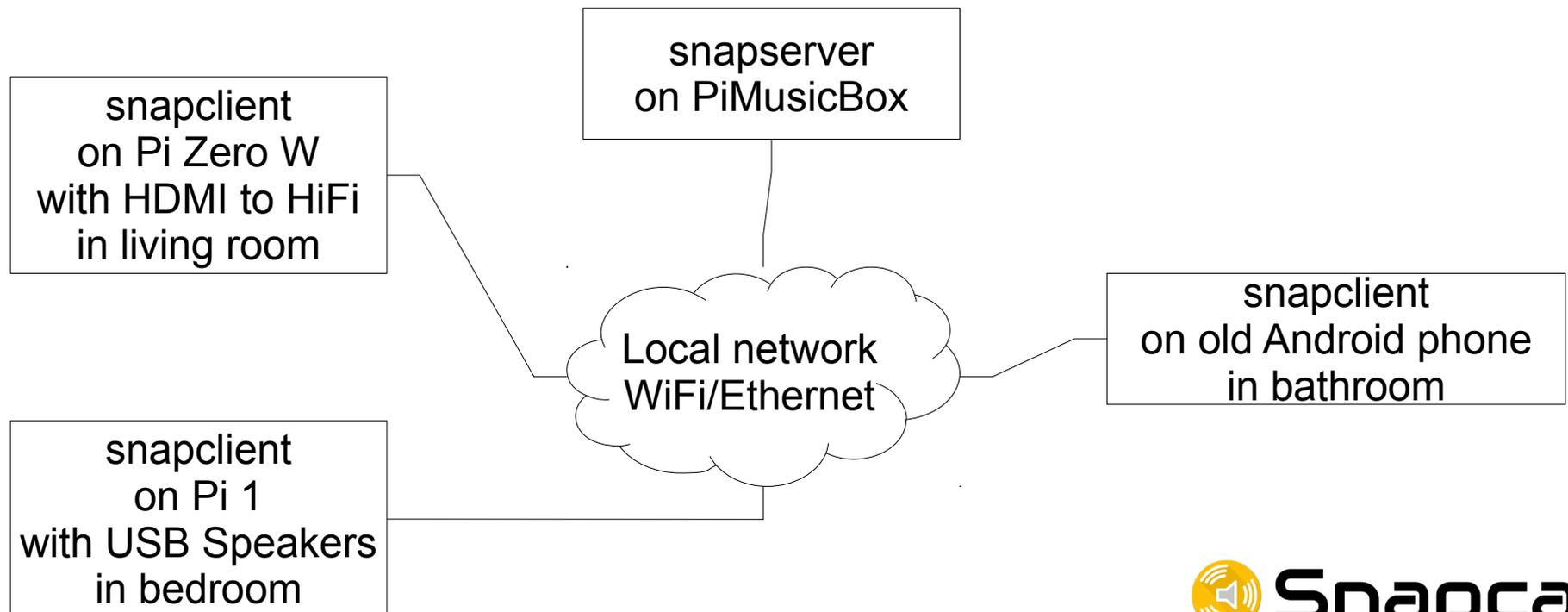
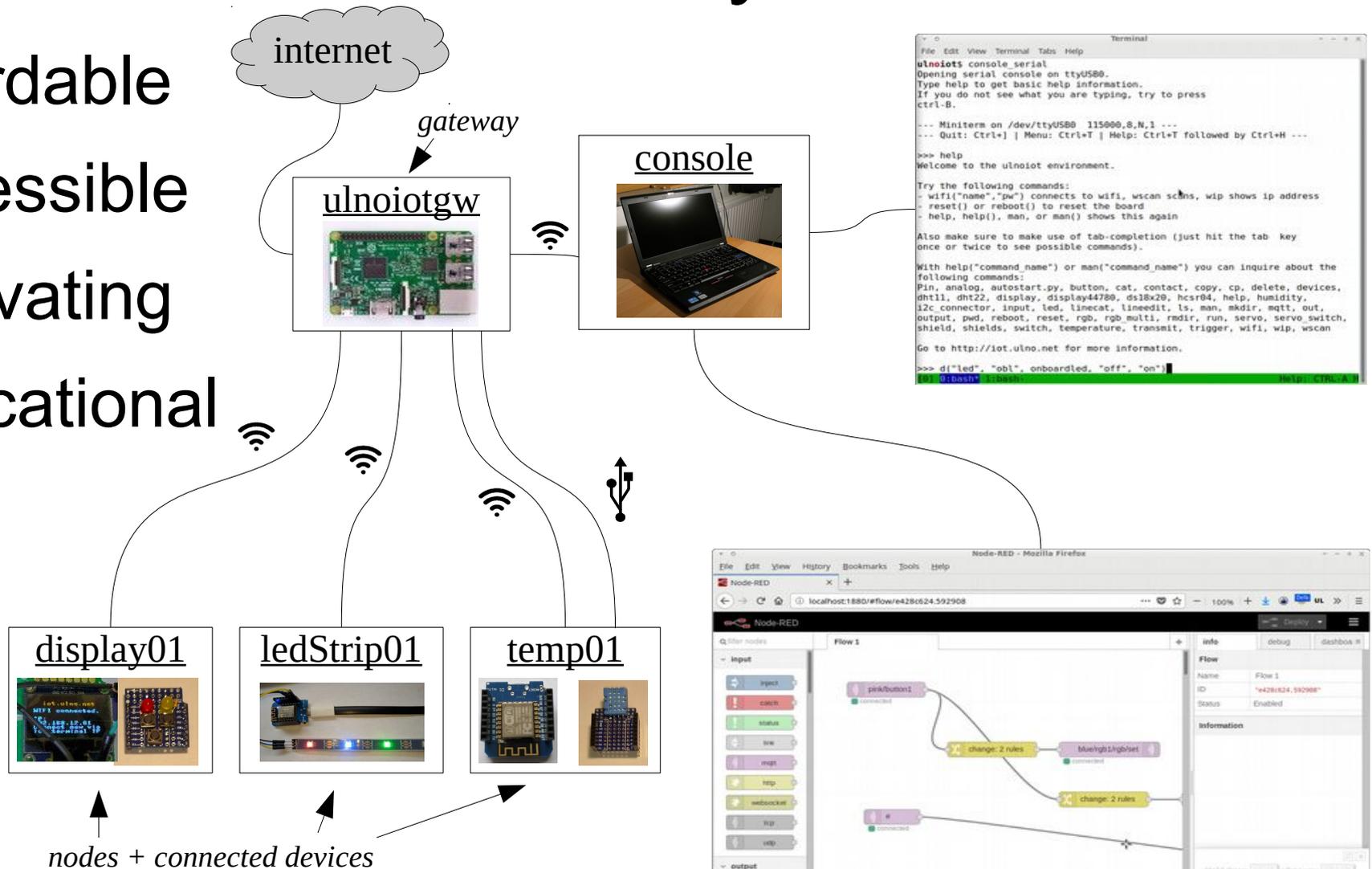# Privacy Concerned Voice Assistant

- Snowboy → hotword detection
- Mini PC like Raspberry Pi
- Microphone/ Google AI Kit
- optional: some Python → MQTT bridge code
- Plus: You know when it listens ← trust

- Other option: IFTTT with android phone or google home → Adafruit MQTT Dev-portal → Node-Red

taken from https://aws.amazon.com/blogs/machine-learning/build-a-voice-kit-with-amazon-lex-and-a-raspberry-pi/

UlnoIOT
Framework and Ecosystem for IoT

- Affordable
- Accessible
- Motivating
- Educational

internet

gateway

ulnoiotgw

console

display01

ledStrip01

temp01

nodes + connected devices

For more info:
- http://iot.ulno.net
- http://github.com/ulno/ulnoiot

Node-Red: http://nodered.org

Other Options

- For binding and integration:
    - Home Assistant (http://home-assistant.io)
    - openHAB (http://openhab.org)

- For Devices controlled by ESP8266:
    - Arduino-IDE: https://www.arduino.cc/en/Main/Software
    - Platform-IO: https://platformio.org/
    - Tasmota: https://github.com/arendst/Sonoff-Tasmota
    - Micropython:
      https://docs.micropython.org/en/latest/esp8266/index.html

Come, Visit, Learn, Share Your Ideas

Find me here or if you download these slides:
Campus Party, Brasilia, Dumont Hackerspace
(Calango Hackerclube)

Ulrich Norbisrath: http://ulno.net

UlnoIoT: http://github.com/ulno/ulnoiot

IoT Empire: http://iotempire.org

Coming soon:
UlnoIoT Introduction Workshop at CJT
Makerspace here in Brasilia.

Follow **instagram @ctjmakerspace** for
announcement