Building a "Smart House" and You Want to Do It Yourself? a.k.a. - my IOT experiments and some random thoughts...

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My new IOT lab that looks pretty much like a house ③



Smart house? IOT?

- If you would like to build a "smart" house or "IOT enabled", then you have two options:
 - You outsource it, vaguely describe what your wishes are, pay a lot of money and voila – you have some smarts in your house, but it works the way the vendor envisioned it.
 - Or you decide that your technical and experimental skills are up to the task, you start learning and experimenting and build the whole system by yourself.

Home brewing the IOT

- I decided to build it myself.
- It's much more fun and you learn a lot.
- Also consumes a lot of your time while you learn and experiment. Be aware of that.
- IOT world is a Wild West. It takes time before you start distinguishing what is what there.

Easy and non-private or not easy and private?

- First thing that I had to decide was the architecture of a system that I'm building:
 - Buy cheap sensors and actuators that connects over Internet to unknown cloud intelligence somewhere in the world and let my home environment be controlled and measured by random folx from the Internet?
 - Or design sensors and actuators around home gateway that doesn't talk to the cloud, but uses local intelligence and keeps control and data in my home environment?

Home gateway dilemma...

- I decided for home gateway.
- Next question: Some home gateways are not very smart and uses remote intelligence in the cloud to control your home environment.
 Should I use them?
 - YES
 - -NO

Home gateway dilemma...

- The answer was NO. Obviously.
- I really like my home environment private and not controlled by random people from around the planet.
- What to use then?
 - Raspberry PI or any Linux system with open source home automation control system software
 - Some vendors boxes that supposedly don't talk to the cloud

Home gateway dilemma...

- Decision was to use something Linux based.
- For first experiments I used Raspberry PI with Z-wave and Zigbee USB controllers
- For "production" use DeskMini PC with i5 processor, two disks in mirror, 16GB ram and Ubuntu Linux.





Automation software dilemma...

- What exactly do we expect from this IOT stuff?
- What are we going to do with it?
- How are we going to program the rules and intelligence?
- What kind of interface do we expect?
- Are we doing it just because it's cool and other people have it?
- Test couple of known solutions and then decide!

Automation software dilemma...

- Before testing the software decide on sensors and actuators and what protocols you are going to use.
- I tested Z-wave, Zigbee and MQTT
- Without some test sensors and controllers you'll not be able to test automation software
 as by default it does nothing and is pretty useless without any sensors to read/control.

Test "thingies"...



Automation software dilemma...

- I tested over 10 of them, including:
 - Domoticz
 - OpenHAB
 - Mozilla WebThings gateway
 - Home assistant
 - MisterHouse
 - OpenMotics
 - ioBroker
 - OpenNetHome
 - SeerHome (not open source, not free)

Automation software dilemma...

- Which one to choose?
- It depends on what you are looking for, but after you'll install and test all of them – you'll get a pretty good idea of what you need ^(C)
- I was torn between OpenHAB and Domoticz, but then decided for Domoticz
- Better rules creation engine and programming, but a bit older user interface.
- Can't have it all, apparently 🙂

Domoticz with Machinon skin



Domoticz with Machinon skin



Domoticz – rules – Blockly way



Now what?

• Well testing, testing and more testing.

- ...until you are happy with your decision and you get enough experience to properly understand what you need and expect from your system.
- Reading about it doesn't bring you any experience.

Experience and stories...

- Z-Wave sensors can store settings, scenes and things that you would not imagine.
- Z-Wave sensors/actuators that are not directly reachable by controller tend to be slower to respond due to not very optimal mesh network
- Zigbee sensors are not so complicated to setup and read/control

Experience and stories...

- Z-Wave sensors are much more expensive than Zigbee (Z-Wave protocol is licensed)
- If you are using Z-Wave DIN Light Dimmers make sure you get your electrical wiring correctly ^(C)



Experience and stories...

- Start creating rules and scenes and you'll learn how the whole thing works during the process. For a start you can use Blockly to easily put rules together, later you may switch to Python or LUA for more complex rules.
- Every rules engine has its own ways of interpreting commands, so – test, test test.

3-phase electricity ("uplink")





3-phase current measurement

- I looked for a cheap and IPv6 enabled 3-phase passive current metering system (with split coil transformers for passive reading), but couldn't find one.
- Raspberry PI seems like a good and cheap platform to run a system like this.
- Found very cheap 1-phase current meters that you can talk to them over USB (3 of them)
- And it works ^(c) Currently I'm busy assembling it, but testing in the lab was successful.

3-phase current measurement



3-phase current measurement

- Python module to talk to measurement devices over USB (MODBUS RT)
- Reading values from python script through crontab
- Storing values in RRD (for now) and to Domoticz gateway through HTTPS API calls
- Now I'll know how much current our house is drawing at any point in time through main 3phase power connection
- Domotizc rules to react if current is too high on any of 3 phases! Price? Less than 100EUR ^(C)

Battery powered motion sensor?

- Property of wireless sensors is that they drain battery. This is not a very comfortable property when you have many of them.
- We have PoE available. We have UTP cables everywhere. Why not using PoE for powering all this sensors?
- Couldn't find any motion/temp/humidity/light sensor that would be powered over PoE, communicate over Ethernet and MQTT or WOT and support IPv6(-only) environment.

Motion sensor – home brewed

So we decided to develop and build our own POE powered IPv6 sensor ⁽²⁾

• CPU: <u>STM32F030CC</u>

– Enough ram (32kB) for so cheap MCU

• ETH: <u>ENC424J600</u>

Factory pre-set MAC, SPI connection for cheaper MCU

• POE: <u>Si3404</u>

- Most integrated solution, less possibility for mistakes

Motion sensor – home brewed



Motion sensor – home brewed

- After couple of versions first boards are now showing the sign of life ☺
- Magic smoke tends to escape from electronic devices proven fact.
- Just put magic smoke back in and try again.
- We'll keep you posted on progress and development (if you want)
- IPv6-only, POE powered and with MQTT/WOT? Lot's of work ahead.

IOT and AI

- Rules creators and LUA/Python programming works when you have small amount of rules and actions on your home gateway.
- Rules start interfering with each other rather quickly when number of rules grows.
- I wish that I would have a smart and intelligent box that would login to my home gateway as myself, observe the environment through sensors and learn when a manual action is done (like switching the light on or off) and then slowly start executing actions...

Thoughts...

- Because of simplicity people tend to connect whatever they can buy cheaply and allow this devices to talk to the Internet.
- Who has control of data on the other side?
- What is this data being used for?
- Who has taken the control of our environments away from you? Do we want this? Connected front door locks? Come on...

Thoughts...

- If we can unlock our front door through "the cloud" then anyone that gains access to that cloud can unlock your door. Scary.
- Local AI learning about your everyday life?
- IOT world is a Wild Wild West. Huge number of vendors selling products of various quality – who can tell you what is what? How secure it is? Will it breach our privacy?
- Don't just read about IOT stuff buy one or two examples of various things that you would consider using and test test test test. That's the way you'll learn.

Questions? Suggestions?

	Floorplan	Switches Scenes	Temperature	e Weather Uti	lity Custo	om Setup	
2019-05-09 16:50:02 🛎 ▲ 05:3	38 ▼20:21					Room:	All
Light/Switch Device	es:						
#4_kuhinja_LED-Level	Off	#4_kuhinja_LED-RGBW	34 %	Smrekica-switch	Off	#2_MS_dnevna-Motion	On
•		<u>ه</u> —		Off Always	On Timer .	8	
Harmony-SiolBOX+LCI	D Off	alarm-vlomljeno-ackno	wledge Off	#3_PowerPlug-Switch	On	#5_MS_TV-Motion	On
						8	
PowerSwitch-override	Off	GeoFence-Jan	On	Geofence-app-test	Off	Spalnica-Temperature	21.5° C
		8					
Kuhinja-Temperature	21.7° C	<7	orz@i	soc org>			