Home Automation with F/LOSS

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5 October 2015

Outline

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Who is this guy?

- David Lachut
- PhD Candidate in Computer Science
  - *Holistic Home Energy Management: From Sensing to Data Analytics*
- B.S. Physics, 2009, University of Arkansas–Fayetteville
- Linux and Open Source Enthusiast

Home Automation is HUGE!

- "By 2017, 90% of all Samsung products will be IoT devices — and that includes all our televisions and mobile devices. And [by 2020], every single piece of Samsung hardware will be an IoT device, whether it is an air purifier or an oven." - BK Yoon, President & CEO of Samsung
- Google: Brillo, Nest
- Apple: HomeKit
- Xfinity Home

My dissertation research uses home automation tools
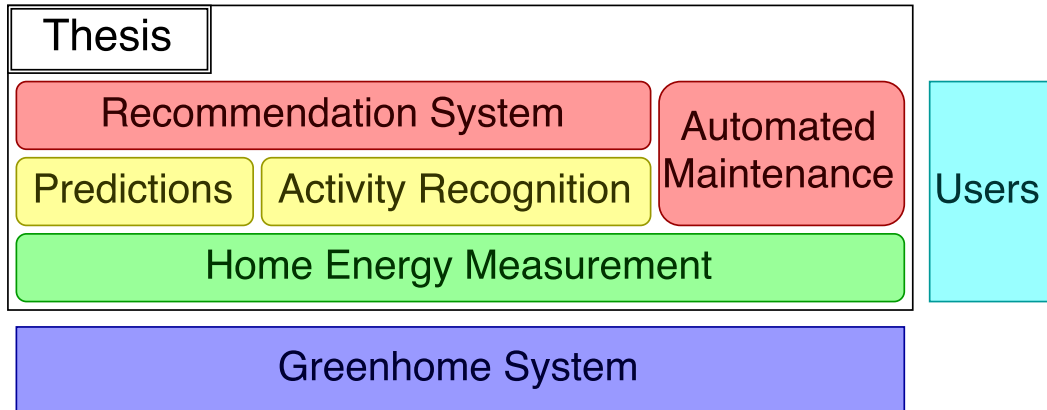
Home Automation needs Open Source

- The only thing more personal than your home is your own body
  - Code must be trustworthy
  - Code must be under our control
  - If you don't own the code running your home, you don't own your home
- We need an "Internet of Things that do what we tell them" (Cory Doctorow, *Solid Conference 2015*)

There are very many home automation standards
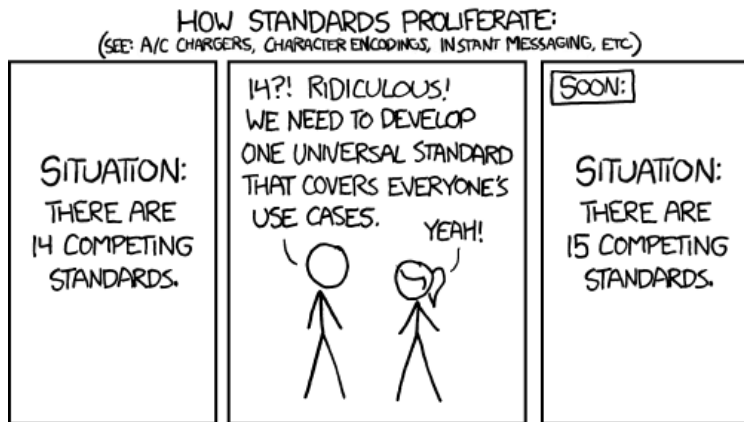
X10 is more than a decade older than I am

Frequency	Powerline or 310MHz
Open Software	???
Topology	flat
Encryption	n/a
Bandwidth	very low
Range	Powerline or short
NumDevices	256
Applications	HA Only
Compelling Feature	First to market
Disadvantage	Slow, limited, unreliable

Insteon extended X10

Frequency	Powerline or 900MHz
Open Software	???
Topology	p2p and mesh
Encryption	n/a
Bandwidth	0.18 to 13 Kbps
Range	Powerline or 45m
NumDevices	Thousands
Applications	HA Only
Compelling Feature	Backwards compatible with X10
Disadvantage	Low-bandwidth

INSTEON®

ZigBee is good but. . .

Frequency	2.4GHz
Open Software	Certified OSS Stack available
Topology	Tree, Star, Mesh with Coordinator
Encryption	128bit AES, key from coord
Bandwidth	20-250Kbps
Range	10-100m (spec)
	10-20m (useful)
NumDevices	5-20 (normal)
	>400 (experimental)
	>6000 (spec)
Applications	Most IoT Domains
Compelling Feature	Most deployment scenarios
Disadvantage	Mostly not IPv6

EnOcean is very low-power

Frequency	315MHz or 900MHz
Open Software	fhem, ago-control
Topology	Star
Encryption	128bit AES (maybe)
Bandwidth	125Kbps
Range	30-300m
NumDevices	maxInt32
Applications	Switches
Compelling Feature	Energy Harvesting
Disadvantage	Too low power, little support

Bluetooth is getting Smarter

Frequency	2.4Ghz
Open Software	Bluez
Topology	Scatternet (Mesh in development)
Encryption	128bit AES
Bandwidth	270Kbps
Range	<100m
NumDevices	up to 7x fanout
Applications	Health, Sport, Proximity, Alerts, Media
Compelling Feature	Ubiquitous
Disadvantage	Scatternet

Google *Weaves* a Nest with *Thread*

Frequency	2.4GHz
Open Software	???
Topology	Mesh
Encryption	AES
Bandwidth	20-250Kbps
Range	10-20m
NumDevices	250ish
Applications	Limited HA
Compelling Feature	Purpose-built for Home Automation, IPv6
Disadvantage	Few available devices

Z-Wave leads the US market

Frequency	900MHz
Open Software	reversed OSS Stack available
Topology	Mesh w/ controller
Encryption	128bit AES (locks and all Gen5)
Bandwidth	100Kbps (to 350k Gen5)
Range	30m (to 45m Gen5)
NumDevices	232
Applications	HA Only
Compelling Feature	Most available consumer devices
Disadvantage	Closed standard, Bottlenecked supply

Vera is a hackable starter hub

License	Proprietary on top of Linux
Site	http://getvera.com/
Target Market	Consumer
Dev Status	Released
Functionality	Z-Wave, Insteon, X10
Architecture	Proprietary Hub

Smartthings is popular, but not as hackable

License	Proprietary
Site	http://www.smartthings.com/
Target Market	Consumer
Dev Status	Released
Functionality	WiFi, ZWave, Zigbee
Architecture	Proprietary Hub

Apple do their own thing with HomeKit

License	Proprietary
Site	`https://developer.apple.com/`
Target Market	Consumer
Dev Status	Released
Functionality	MFi (BTLE, WiFi)
Architecture	Proprietary Mobile+Cloud

I've used HomeOS/Lab of Things for research
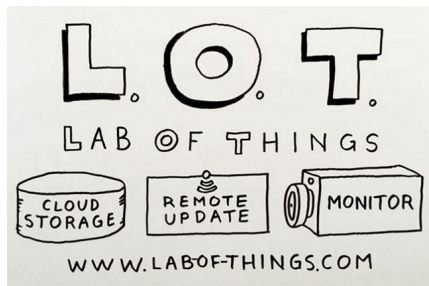
License	MSR-LA
Site	http://www.lab-of-things.com/
Target Market	Home Automation Research
Dev Status	Beta
Functionality	Z-Wave, Custom
Architecture	Hub+Cloud

IFTTT is a neat tool beyond home automation

License	Proprietary
Site	`https://ifttt.com`
Target Market	Consumer
Dev Status	Released
Functionality	Web API
Architecture	Web-based rules engine

OpenHAB is also Eclipse Smarthome

License	EPL
Site	`http://www.openhab.org/,`
	`http://www.eclipse.org/`
Target Market	Enthusiast
Dev Status	Released, v2 in Beta
Functionality	Z-Wave, Serial, Insteon,
	and Many More
Architecture	Event-bus-based Hub

OpenHAB supports very many interfaces

Bindings and Bundles

Every technology or device, social network or cloud platform integrated into openHAB is supported by a specific bundle. Those bundles are optional and pluggable, they can be added to your openHAB as soon as you need them.

Bindings provide integration with different home automation technologies and devices while there are quite a lot of other bundles providing integration and communication with social networks, instant messaging, cloud IoT platforms and much more.

Technology/ Device	Type	Tags	Status	Bundle	Since
Asterisk	PBX	telephony, sip	Production	asterisk	0.9.0
Astro	System	astronomical time	Preview	astro	1.5.0
Bluetooth	Wireless	presence, wearables	Production	bluetooth	0.3.0
ComfoAir Zehnder	Device	ventilation, climate	Production	comfoair	1.3.0
CUPS	Device	printer	Production	cups	1.1.0
digitalSTROM	Powerline	lighting, metering, shades	Production	digitalstrom	1.3.0
Daikin	Device	climate	Preview	daikin	1.5.0
DMX	Wired	lighting	Production	dmx	1.2.0
Dropbox	Cloud	storage	Production	dropbox	1.3.0
eKey	Device	fingerprint, security, access control	Preview	-	1.5.0
EnOcean	Wireless	lighting, heating, metering	Production	enocean	1.3.0
Epson Projector	Device	video, projector	Production	epsonprojector	1.3.0
Exec	Protocol	cli	Production	exec	0.6.0
FreeSWITCH	PBX	telephony, sip	Preview	freeswitch	1.3.0
Fritz Box	PBX	telephony, sip	Production	fritzbox	0.7.0
Fritz AHA	Wireless Powerline	lighting, metering	Production	fritzaha	1.3.0
Google Calendar	Cloud	automation, scheduling	Production	gcal	1.1.0
GPIO	Device	system, gpio	Preview	gpio	1.5.0
HDAnywhere	Device	audio, video	Production	hdanywhere	1.4.0
Heatmiser	Wired	heating	Production	heatmiser	1.4.0
HomeMatic	Wireless	lighting, heating, shades, security, metering	Production	homematic	1.2.0
HTTP	Protocol	http	Production	http	0.6.0
iHC / ELKO	Wired	lighting, heating, shades, security, metering	Production	ihc	1.1.0
Insteon	Powerline	lighting, shades, security	Production	insteonhub	1.4.0

openHAB Architecture Overview