Home Automation With openHAB

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Topics

- Definition of Home Automation
- Examples of Home Automation
- Motivation for choosing openHAB
- Configuring openHAB

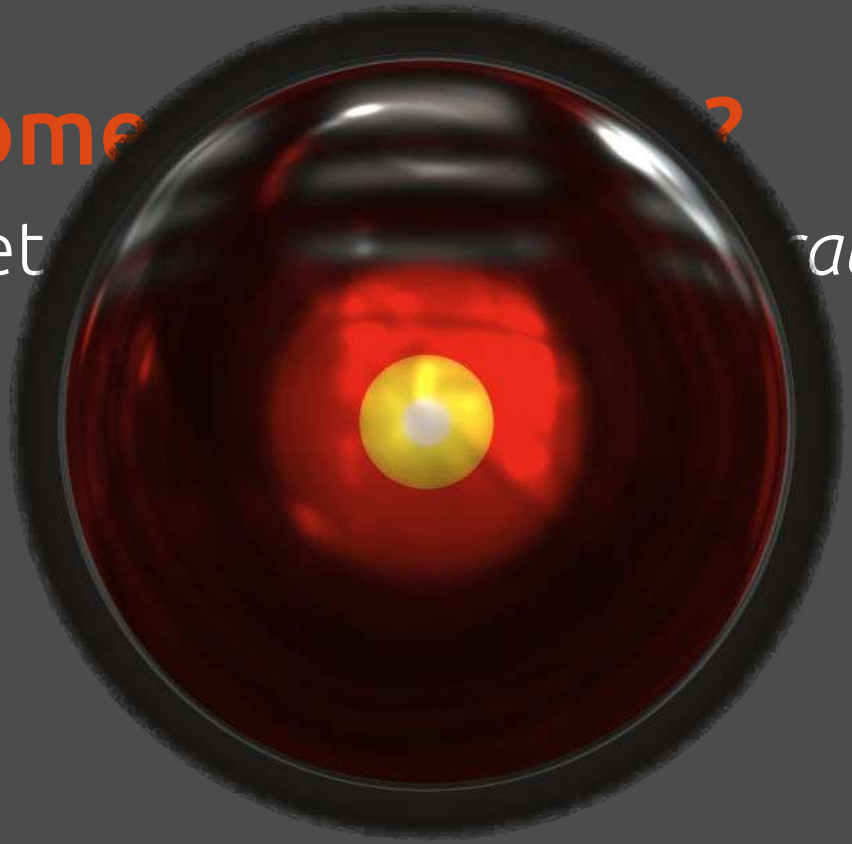
Definition of Home Automation

What is a Connected Home?

- Ability to set and receive device state
  - Thermostats
  - Lights
  - Sensors
  - Blinds
  - Cameras

What is Home[illegible]?

- Ability to set [illegible]*ally*



Examples of Home Automation

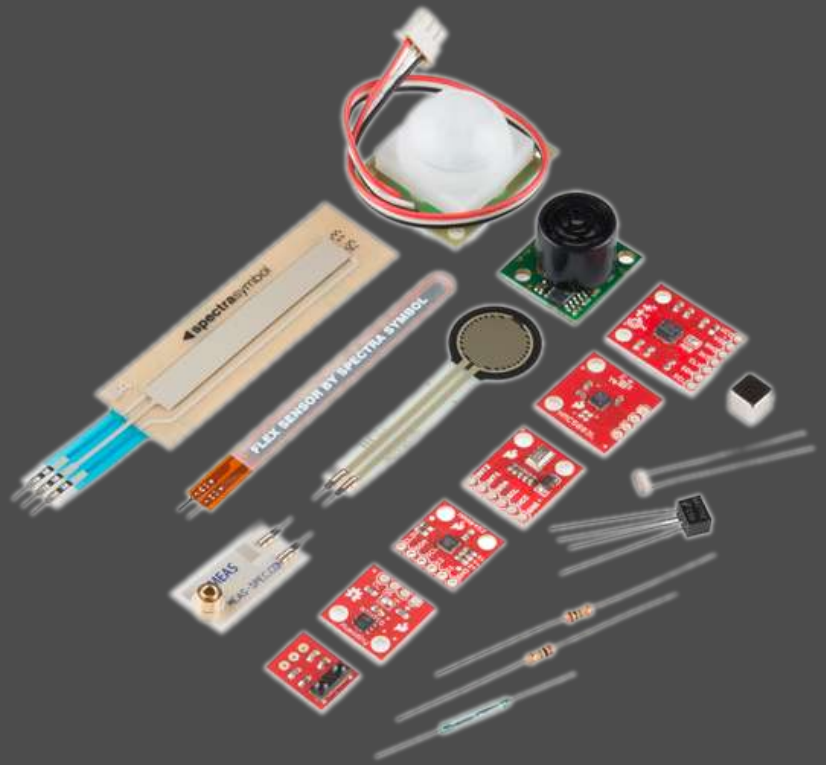
HA: Examples

- Thermostats
  - Default to a different program when its zone is unoccupied
  - Automatically transition between seasonal preferences
  - Enforce a temperature range instead of a fixed amount

HA: Examples

- Lights
  - Day-of-year changes
    - when "night" begins
  - Time-of-day changes
    - color temperature
    - max brightness
  - Enforce max time on
  - Presence-based triggers

HA: Examples



- Sensors
  - Detect presence
    - BT, distance; IR motion sensor; post-processed video
  - Detect temperature
    - operate HVAC
  - Detect CO
    - trigger alerts

HA: Examples

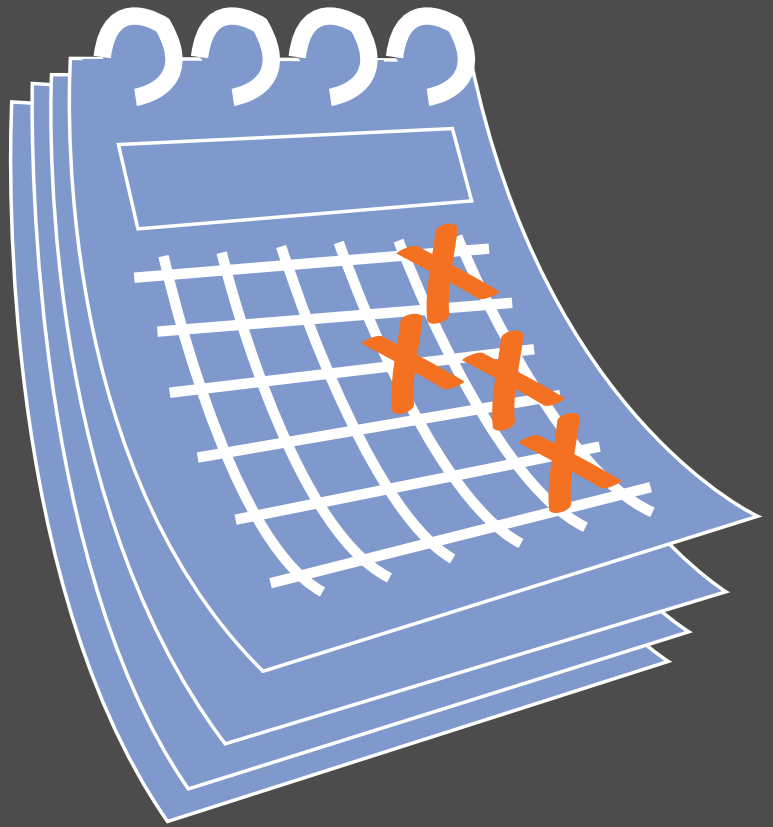
- Blinds
  - Day-of-year / time-of-day changes
    - Lower automatically to block summer sun
    - Raise automatically to let in winter sun

HA: Examples

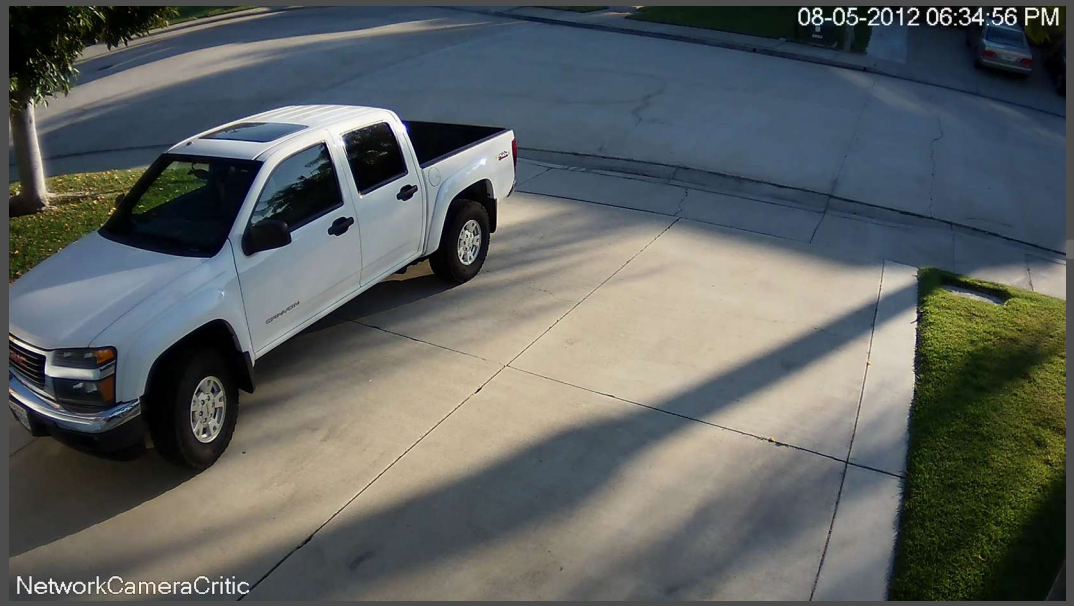
- Cameras
  - See who rang the doorbell
    - Watch the video message they left
  - Detect a vehicle in your driveway
    - Use license plate analysis to build a DB of who it is

HA: Integrated Theoretical Example

- Trigger: family vacation (calendar)
- Event: turn on away mode
  - Enable security
  - Increase sensitivity of internal motion detection
  - Pseudo-randomly play out lighting scenarios
  - Minimal HVAC operation



HA: Integrated Theoretical Example



- Trigger: Skippy's car detected in the driveway
- Event: On the next doorbell press
  - Play "Skippy is here" over house speakers
  - Send an SMS to your cell phone

Motivation for choosing openHAB

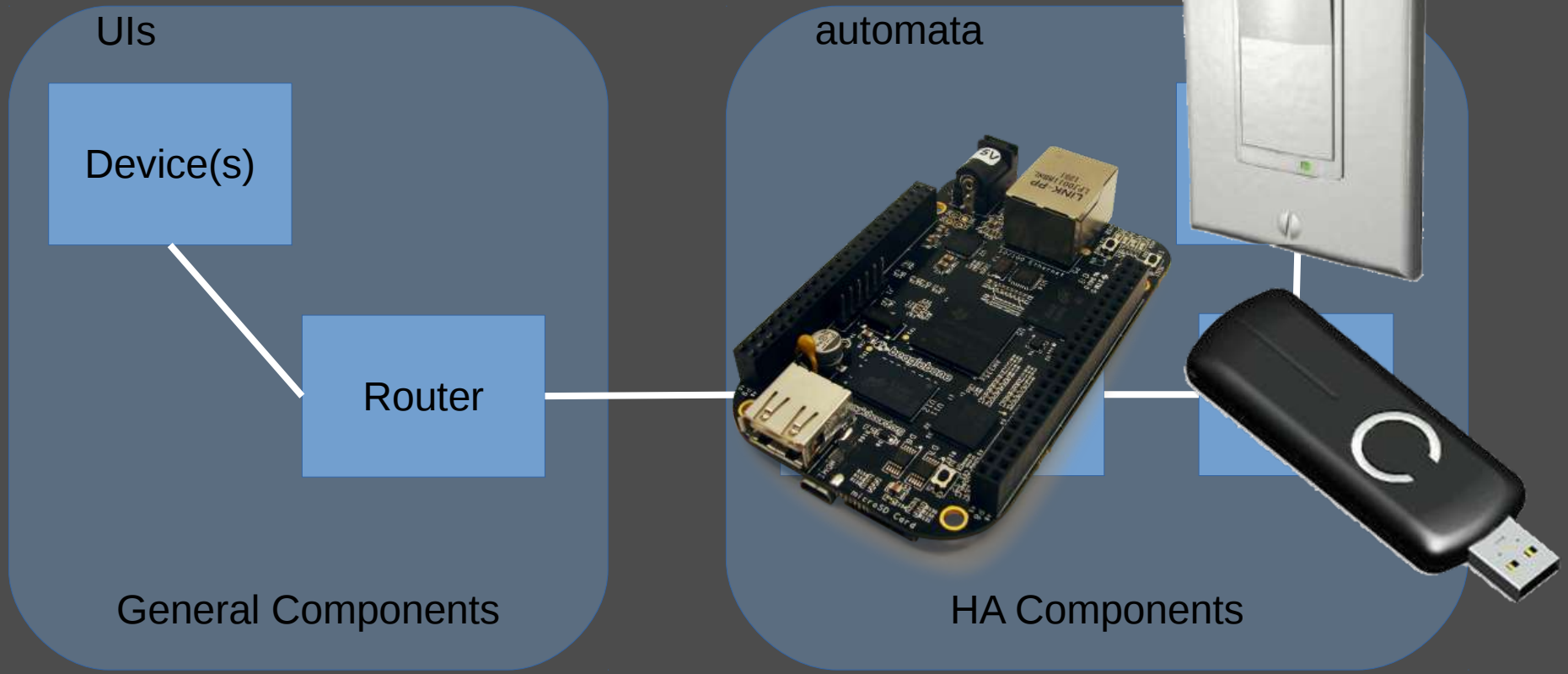
Why openHAB?

- Mix and match Insteon, Z Wave, X10, Hue, Asterisk, Bluetooth, DIY, etc.
- Add the next cool technology in 10 years
- Open Source GUIs (browser, Android, iOS, HTTP)
- General controller hardware (mostly)
  - Any Java-supporting OS
- Change your controller hardware and keep your rules
- Doesn't rely on The Cloud™ for processing or control
- No fees
- Huge, active community

Why not Proprietary?

- http://www.theverge.com/2014/10/24/7061557/nest-acquires-revolv-in-a-bid-to-control-your-entire-smart-home
  - "it's immediately discontinuing Revolv's product"

Basic Network Diagram: LAN Control



Supported Technologies ("binding"s)

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

Supported Technologies (2)

Epson Projector	Device	video, projector	Production	epsonprojector	1.3.0
Exec	Protocol	cli	Production	exec	0.6.0
FreeSWITCH	PBX	telephony, sip	Preview	freeswitch	1.5.0
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

Supported Technologies (3)

IHC / ELKO	Wired	lighting, heating, shades, security, metering	Production	ihc	1.1.0
Insteon	Powerline	lighting, shades, security	Production	insteonhub	1.4.0
IRTrans	Wireless	infrared, climate, audio, video	Preview	irtrans	1.5.0
KNX	Wired	lighting, heating, shades, security, metering, ventilation, climate	Production	knx	0.1.0
Koubachi	Wireless	plants	Production	koubachi	1.2.0
MAX!Cube	Wireless	lighting, heating, shades, security, metering, ventilation, climate	Production	maxcube	1.4.0
Leviton/HAI Omnilink	Protocol	home automation, security, lights, thermostats, audio, video	Preview	omnilink	1.5.0
Milight	Wireless	lighting	Production	milight	1.3.0
Modbus	Wired	lighting, heating, metering, ventilation, climate, industrial	Production	modbus	1.1.0
Mpd	Protocol	audio, music	Production	mpd	0.8.0

Supported Technologies (4)

MQTT	Protocol	message, bus	Production	mqtt	1.3.0
MQTTitude	Protocol	location	Production	mqttitude	1.4.0
Netatmo	Device	weather, climate	Production	netatmo	1.4.0
Network Health	Protocol	network, ping	Production	nh	0.6.0
Nibe Heat Pump	Device	heating, heatpump	Production	nibeheatpump	1.3.0
Nikobus	Wired	lighting, shades, security	Production	nikobus	1.3.0
Novelan/Luxtronic	Device	heating, heatpump	Production	novelanheatpump	1.0.0
NTP	Protocol	date, time	Production	ntp	0.8.0
One Wire	Wired	lighting, heating, climate	Production	onewire	0.6.0
Onkyo AV Receiver	Device	audio, video	Production	onkyo	1.3.0
Open Energy Monitor	Device	energy	Production	openenergymonitor	1.4.0

Supported Technologies (5)

Open Sprinkler	Device	plants	Production	openSprinkler	1.3.0
Philips Hue	Wireless	lighting	Production	hue	1.2.0
Piface	Device		Production	piface	1.3.0
Pioneer AV Receiver	Device	audio, video	Production	pioneeravr	1.4.0
Plugwise	Wireless	lighting, metering	Production	plugwise	1.1.0
PLC Bus	Powerline		Production	plcbus	1.1.0
Pulseaudio Server	Device	audio, music	Production	pulseaudio	1.2.0
Pushover	Cloud	social, messaging	Preview	-	1.5.0
Prowl	Cloud	social, messaging	Preview	-	0.6.0
RFXCOM	Wireless	lighting, heating, security	Production	rfxcom	1.2.0
Samsung TV	Device	tv, video	Production	samsungtv	1.2.0

Supported Technologies (6)

Sen.se	Cloud	data, graphs	Production	sense	1.3.0
Serial	Protocol	serial	Production	serial	0.6.0
SNMP	Protocol	network	Production	snmp	0.9.0
Squeezebox	Device	audio, music	Production	squeeze	1.3.0
System Info	Device	system, network	Production	systeminfo	1.3.0
Somfy URTSI	Device	shades	Production	urtsi	1.3.0
Sonos	Device	audio, music	Production	sonos	1.1.0
Swegon	Device	climate, ventilation	Production	swegon	1.1.0
TCP/UDP	Protocol	network	Production	tcp	1.1.0
Tellstick	Wireless	lighting, sockets, devices	Preview	tellstick	1.5.0
Tinkerforge	Device	io, diy	Production	tinkerforge	1.3.0
Tivo	Device	video, multimedia	Production	tivo	1.4.0
Twitter	Cloud	social	Production	twitter	1.2.0

Supported Technologies (7)

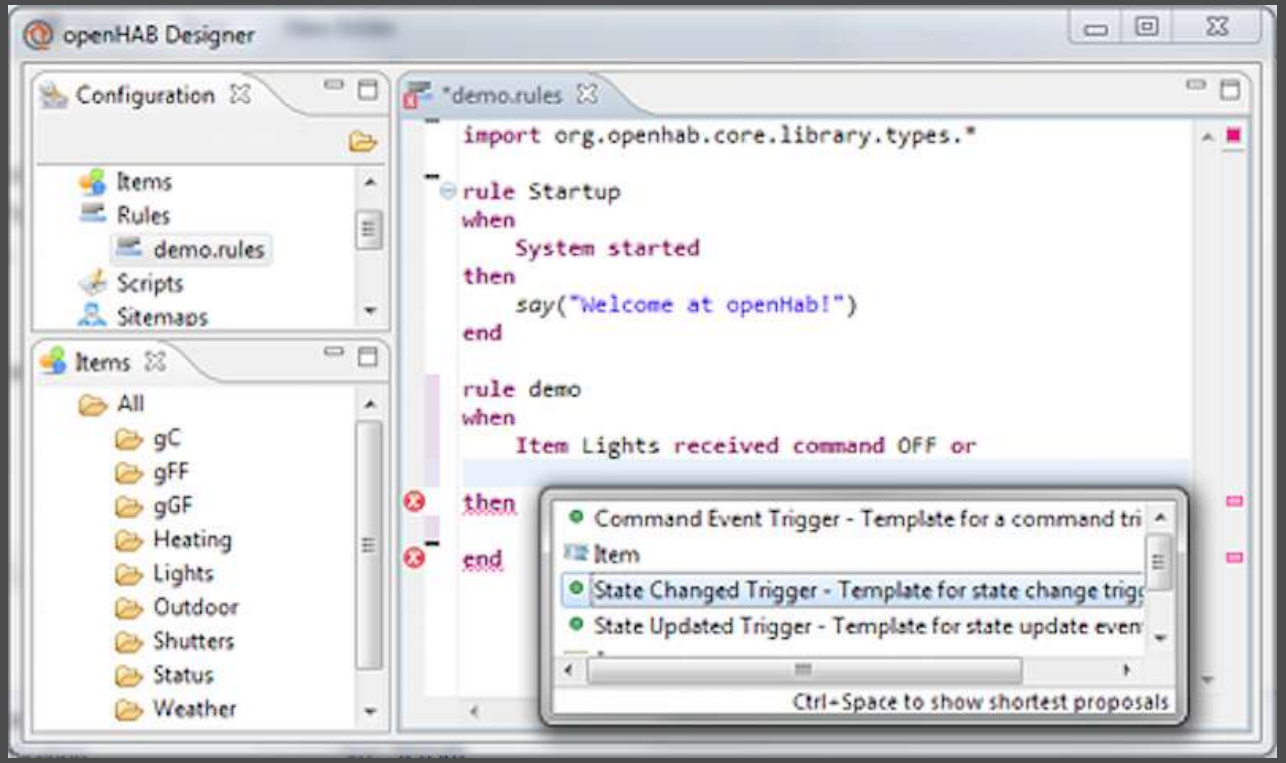
VDR	Device	video, tv	Production	vdr	0.9.0
XBMC	MediaCenter	audio, video, pictures	Preview	xbmc	1.5.0
Wake on LAN	Protocol	network	Production	wol	0.6.0
Withings	Device	fitness, quantified self	Preview	withings	1.5.0
Xively	Cloud	data, graphs	Production	xively	1.3.0
xPL	Protocol	homeautomation	Preview	xPL	1.5.0
Z-Wave	Wireless	lighting, heating, shades, security, metering, locks	Production	zwave	1.3.0

Configuring openHAB

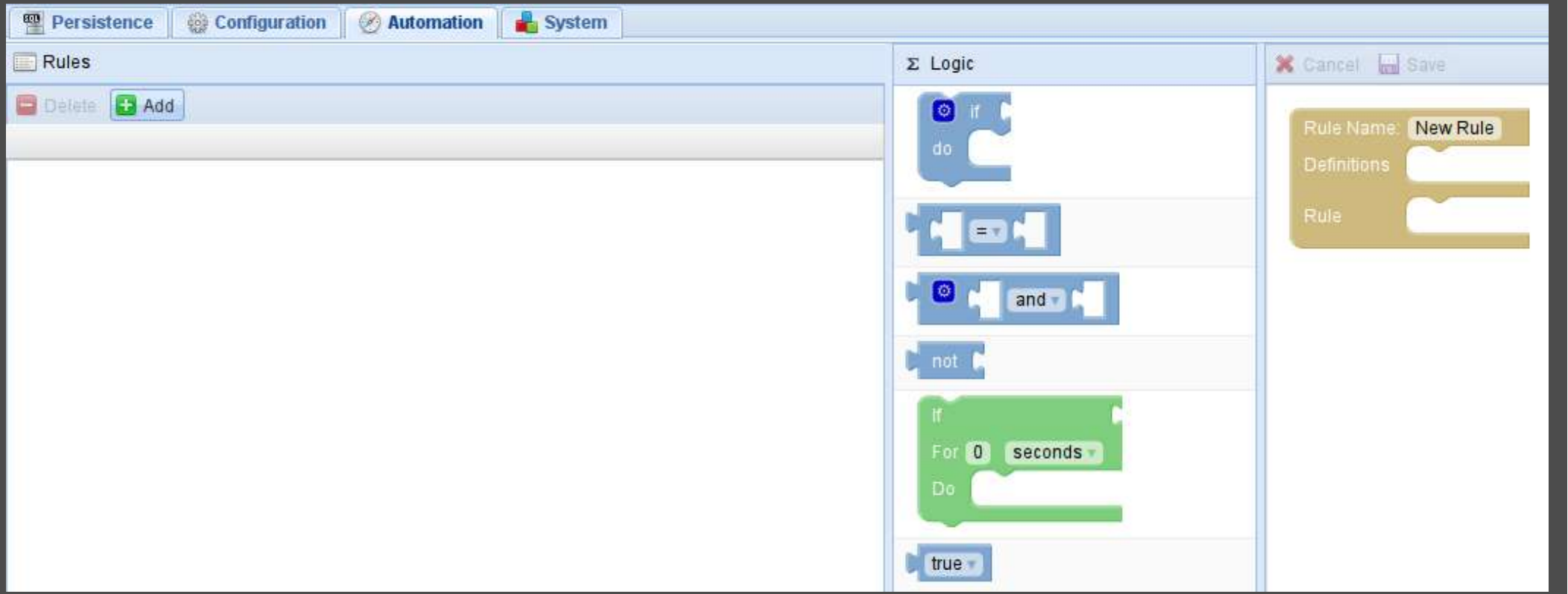
Configuration

- Demo files simulate a real setup
- Key parts of the `configurations` directory:
  - `openhab.cfg`
  - **`sitemaps`**
  - **`items`**
  - **`rules`**
  - **`scripts`**
  - **`transform`**
  - **`persistence`**

Configuration: GUI: openHAB Designer



Configuration: GUI: HABmin



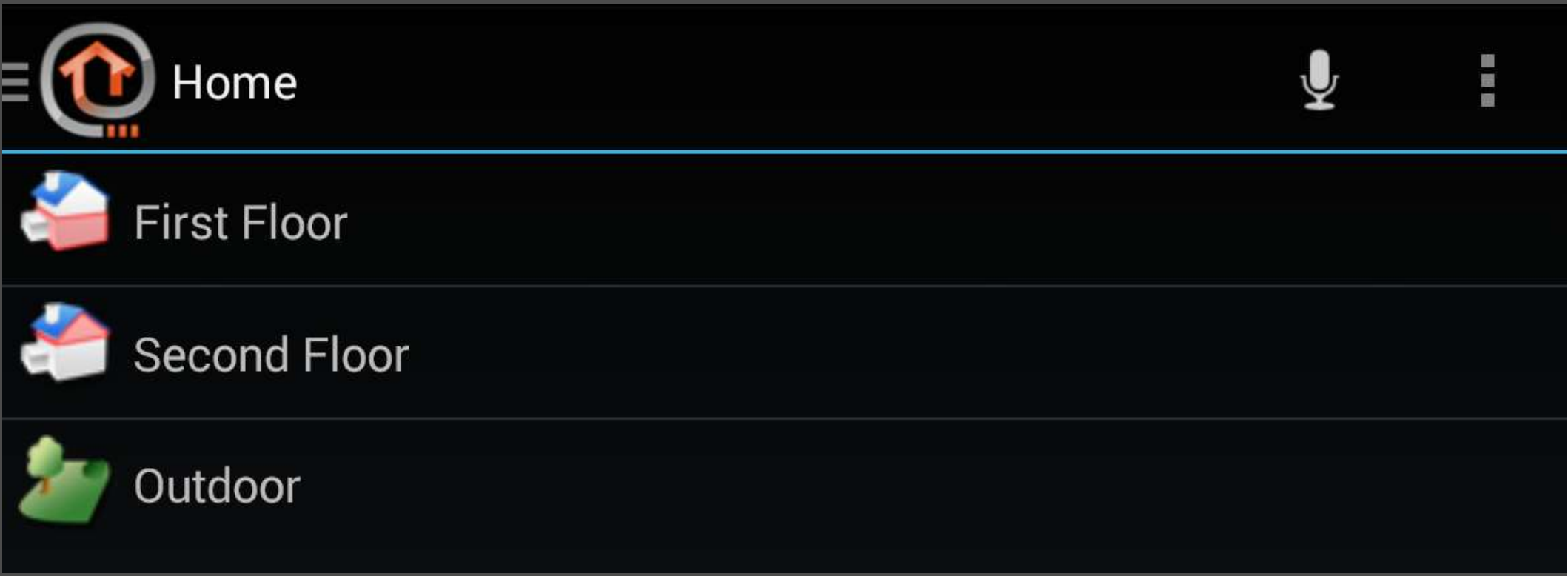
Configuration: openhab.cfg

- General openHAB configuration
- Technology-specific configuration
  - `zwave:port = /dev/ttyUSB0`
  - `hue:secret=openHABRuntime`

Configuration: sitemap

- Each one defines a hierarchy of *groups* and *items* for GUIs
- openHAB's GUIs operate on one sitemap at a time
  - Having >1 means support for multiple user types
    - `kid.sitemap`, `guestroom.sitemap`, `visitor.sitemap`, `testing.sitemap`, etc.
  - Password protect, or not

Configuration: full.sitemap



Configuration: full.sitemap

```
sitemap full label="Home" {
  Frame {
    Group item=gFF label="First Floor"
    icon="groundfloor"
    Group item=gSF label="Second Floor"
    icon="firstfloor"
    Group item=Outdoor label="Outdoor"
    icon="garden"
  }
}
```

Configuration: items

- All devices (and device groups) that openHAB knows about
  - Accessible to all sitemaps
  - Physical and virtual devices

Configuration: igo.items

```
Group All
Group gFF    (All)
Group gSF    (All)
Group Outdoor  (All)

Group SF_Child    "kid's Room"   <bedroom> (gSF)
Group SF_Master_Bedroom  "Master Bedroom"  <bedroom> (gSF)

Group:Switch:OR(ON, OFF)    Lights    "All Lights [(%d)]" (All)
Group:Switch:OR(ON, OFF)    Fans "All Fans [(%d)]"   (All)
```

Configuration: igo.items

```
Switch Light_FF_Pantry_Ceiling     "Pantry Ceiling"     (gFF, Lights)
{zwave="6:command=switch_binary"}

Switch Light_SF_Bedside     "Master Bedroom"     (SF_Master_Bedroom,
Lights){zwave="3:command=switch_binary"}

Switch Fan_SF_kid        "kid's Fan"      (SF_Child, Fans)
{zwave="4:command=switch_binary"}

Dimmer Light_SF_kid         "kid's Ceiling Light [%d %%]"
(SF_Child, Lights)
{zwave="8:restore_last_value=true:refresh_interval=5"}

Switch Button_FF_Doorbell       "Doorbell"    (Outdoor)
```

DIY device integration

- "smart" doorbell: https://github.com/Human/smart-doorbell
- Push state to openhab via HTTP API
  - `wget http://bbb1:8080/CMD?Button_FF_Doorbell=ON`
  - `wget http://bbb1:8080/CMD?Button_FF_Doorbell=OFF`
- Could also use REST API

Configuration: rules

- React to input conditions
  - Time, device state, system events
- Induce output conditions
  - TTS, device state, scripts, etc.

Configuration: igo.rules: kid's bedtime

```
rule "Turn on Ceiling Light at Bedtime"
when
    //          s m h
    Time cron "0 0 0 * * ?" // UTC time (8PM) daily
then
    logInfo("kid light", "turning kid's overhead light to
    100%")
    sendCommand(Light_SF_kid, 100)
end
```

Configuration: igo.rules: pantry timer

```
var Timer timer = null
rule "Pantry Light Timer"
when
    Item Light_FF_Pantry_Ceiling changed
then
    if (Light_FF_Pantry_Ceiling.state == ON) {
        logInfo("pantry", "turned ON")
        if (timer == null) { // first ON command, so create a timer to turn the light off again
                timer = createTimer(now.plusSeconds(1800)) [|sendCommand(Light_FF_Pantry_Ceiling, OFF)]
        } else { // subsequent ON command, so reschedule the existing timer
                timer.reschedule(now.plusSeconds(1800))
        }
     } else if (Light_FF_Pantry_Ceiling.state == OFF) {
            logInfo("pantry", "turned OFF")
            if(timer != null) { // remove any previously scheduled timer
                    timer.cancel
                    timer = null
            }
     }
end
```

Configuration: igo.rules: dim the light

```
var Boolean Light_SF_kid_updated = false
var Boolean Light_SF_kid_update_lock = false
rule "Slowly Dim Ceiling Light"
when
   //         s m h
   Time cron "0 * 1,2,3 * * ?" // each min betw 9-11PM EST
then
   if (Light_SF_kid_update_lock == false) {
      Light_SF_kid_update_lock = true
      logInfo("dimming", "waiting for polled state")

      // push a change after 2 consecutive updates
      for (i: 1..2) {
         Light_SF_kid_updated = false
         while (Light_SF_kid_updated == false) {
            logInfo("dimming", "waiting for poll " + i)
            Thread::sleep(1000)
         }
      }
      var Number brightness = 0
      var Number new_brightness = 0

      if (Light_SF_kid.state instanceof DecimalType) {
            brightness = Light_SF_kid.state as DecimalType
      }

      new_brightness = brightness - 1

      if (new_brightness >= 0) {
            logInfo("dimming", "to " + new_brightness)
            sendCommand(Light_SF_kid, new_brightness)
            postUpdate(Light_SF_kid, new_brightness)
      }

      Light_SF_kid_update_lock = false

   } // lock in place; don't dim

end
```

Configration: rules vs scripts

- Rule actions and scripts are written in Xtend
- You can call scripts from rules
  - I do not recommend this

Configuration: transform

- Pick desired content out of XML

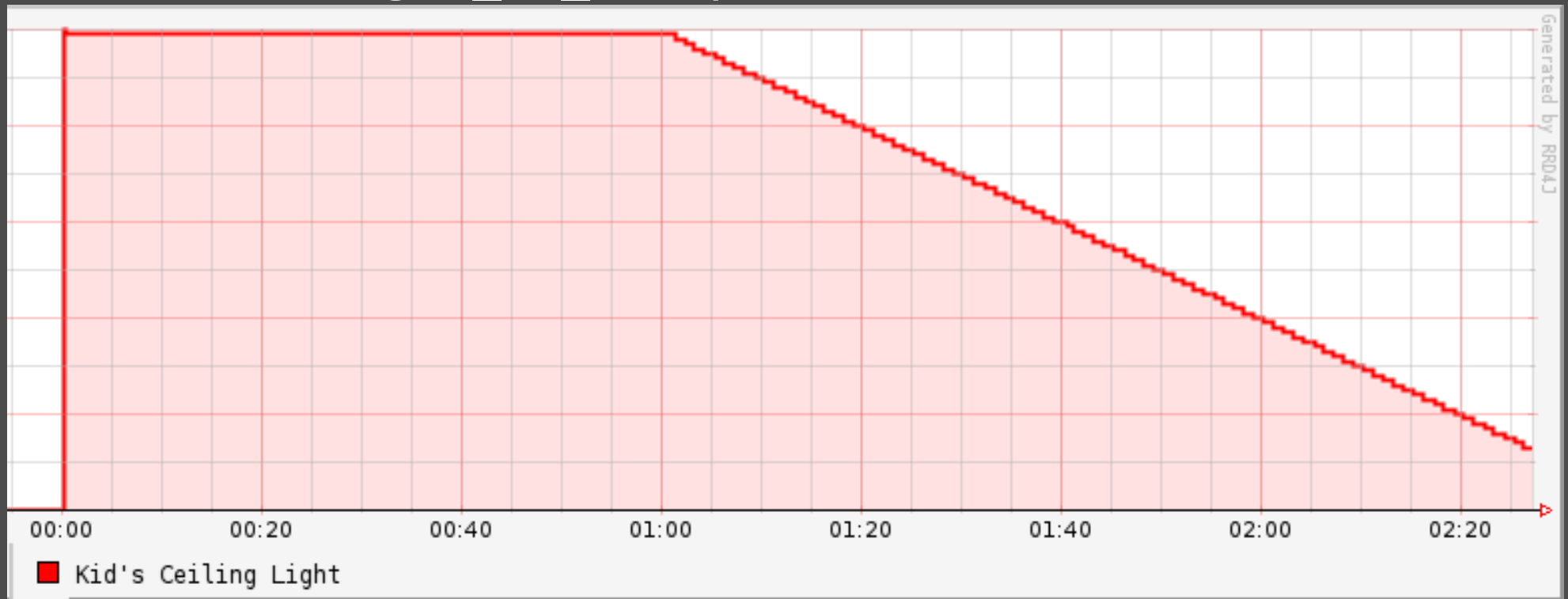
Configuration: persistence

- Store historic device state
- Charts!
  - items and/or groups*

*not groups of groups

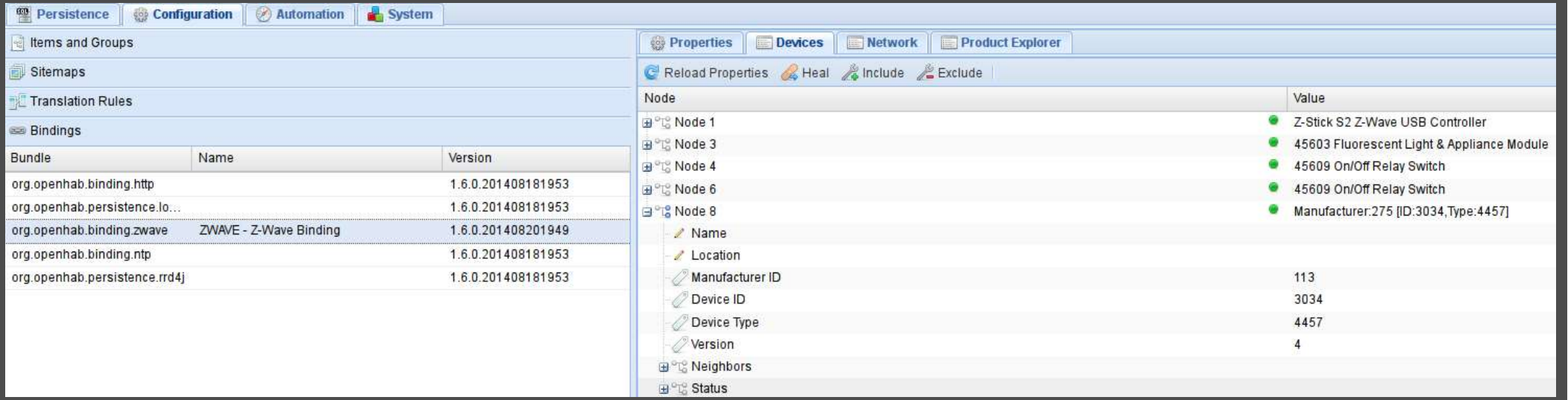
Configuration: persitence: charts

- http://bbb1:8080/rrdchart.png?items=Light_SF_Kid&period=4h&w=1200

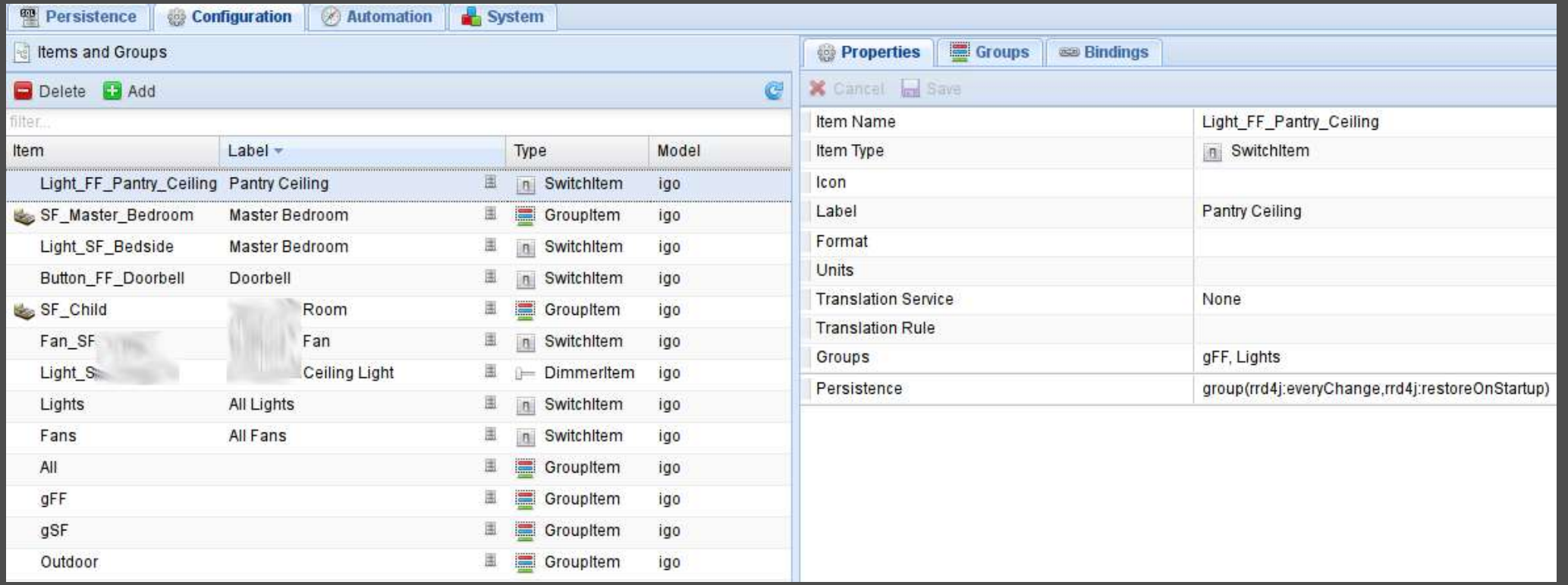


Habmin

- adminster openHAB in your browser
- http://bbb1:8080/habmin/index.html



Habmin


Persistence
Configuration
Automation
System
Items and Groups
Delete
Add
filter...
Item
Label
Type
Model
Light_FF_Pantry_Ceiling
Pantry Ceiling
SwitchItem
igo
SF_Master_Bedroom
Master Bedroom
GroupItem
igo
Light_SF_Bedside
Master Bedroom
SwitchItem
igo
Button_FF_Doorbell
Doorbell
SwitchItem
igo
SF_Child
Room
GroupItem
igo
Fan_SF
Fan
SwitchItem
igo
Light_S
Ceiling Light
DimmerItem
igo
Lights
All Lights
SwitchItem
igo
Fans
All Fans
SwitchItem
igo
All
GroupItem
igo
gFF
GroupItem
igo
gSF
GroupItem
igo
Outdoor
GroupItem
igo
Properties
Groups
Bindings
Cancel
Save
Item Name
Light_FF_Pantry_Ceiling
Item Type
SwitchItem
Icon
Label
Pantry Ceiling
Format
Units
Translation Service
None
Translation Rule
Groups
gFF, Lights
Persistence
group(rrd4j:everyChange,rrd4j:restoreOnStartup)

Images Used

- http://www.openhab.org/images/openhab-logo-square.png
- http://stockfresh.com/image/1984505/3d-house-symbol-in-a-gear-wheel
- http://depositphotos.com/25147683/stock-photo-house-gears-metal-meter-tool.html
- http://4vector.com/free-vector/hardware-tools-workshop-screwdriver-wrench-clip-art-116055
- http://www.highfidelityreview.com/genostv-cyclops-remote-control.html
- http://readwrite.com/2013/01/15/why-write-your-own-book-when-an-algorithm-can-do-it-for-you
- http://designapplause.com/wp-content/xG58hlz9/2012/10/led-bulb1.png
- https://www.sparkfun.com/products/12797
- http://www.usmotions.com/retractable-screen-motors.html
- http://www.cctvforum.com/viewtopic.php?f=5&t=32137
- http://upload.wikimedia.org/wikipedia/commons/9/9c/Blue_calendar_icon_with_dates_crossed_out.svg
- http://www.networkcameracritic.com/?p=764
- http://memegenerator.net/instance/55684579
- http://www.openhab.org/features-rules.html
- http://zeroturnaround.com/rebellabs/the-adventurous-developers-guide-to-jvm-languages-xtend/
- http://www.smartthingsnz.co.nz/store/wp-content/uploads/2013/12/aeon-labs-z-stick.png
- http://www.asihome.com/images/act-zrw103.png
- http://elinux.org/images/1/18/BBB-400.png

Resources

- Sitemaps
  - https://github.com/openhab/openhab/wiki/Explanation-of-Sitemaps
- Items
  - https://github.com/openhab/openhab/wiki/Explanation-of-items
- Rules
  - https://github.com/openhab/openhab/wiki/Rules
  - https://code.google.com/p/openhab-samples/wiki/Rules
  - Xtend
    - http://www.eclipse.org/xtend/documentation.html#Xtend_Expressions

Resources

- Scripts
  - https://github.com/openhab/openhab/wiki/Scripts
  - https://github.com/openhab/openhab/wiki/Samples-Scripts
- Transform
  - https://github.com/openhab/openhab/wiki/Transformations
  - https://github.com/openhab/openhab/wiki/Samples-XSLT-Transformations
- Persistence
  - https://github.com/openhab/openhab/wiki/Charts
  - http://hypoaktiv-openhab-wiki.googlecode.com/hg/Charts.wiki
  - https://github.com/openhab/openhab/wiki/Persistence

Resources

- HABmin
  - https://github.com/cdjackson/HABmin
- HTTP API
  - https://code.google.com/p/openhab-samples/wiki/Tricks#Use_URL_to_manipulate_items
- REST API
  - https://github.com/openhab/openhab/wiki/REST-API

Resources

- https://github.com/openhab/openhab/wiki
- http://www.openhab.org
- https://code.google.com/p/openhab-samples/wiki/Tricks
- https://github.com/openhab/openhab/wiki/Samples-Tricks
- https://code.google.com/p/openhab-samples/wiki/integration
- http://jpmens.net/2014/01/14/a-story-of-home-automation/