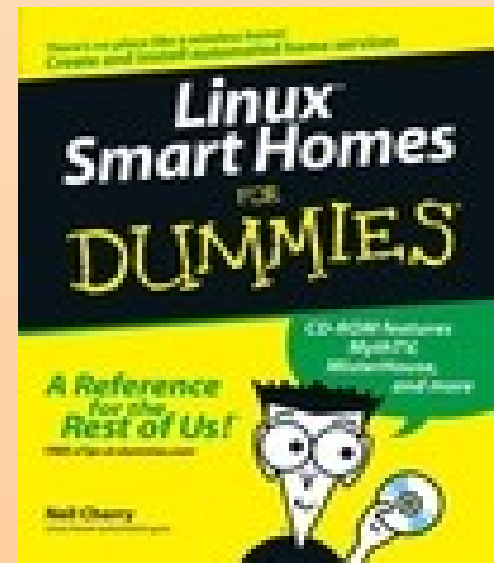


Presenting Home Automation *with Misterhouse*

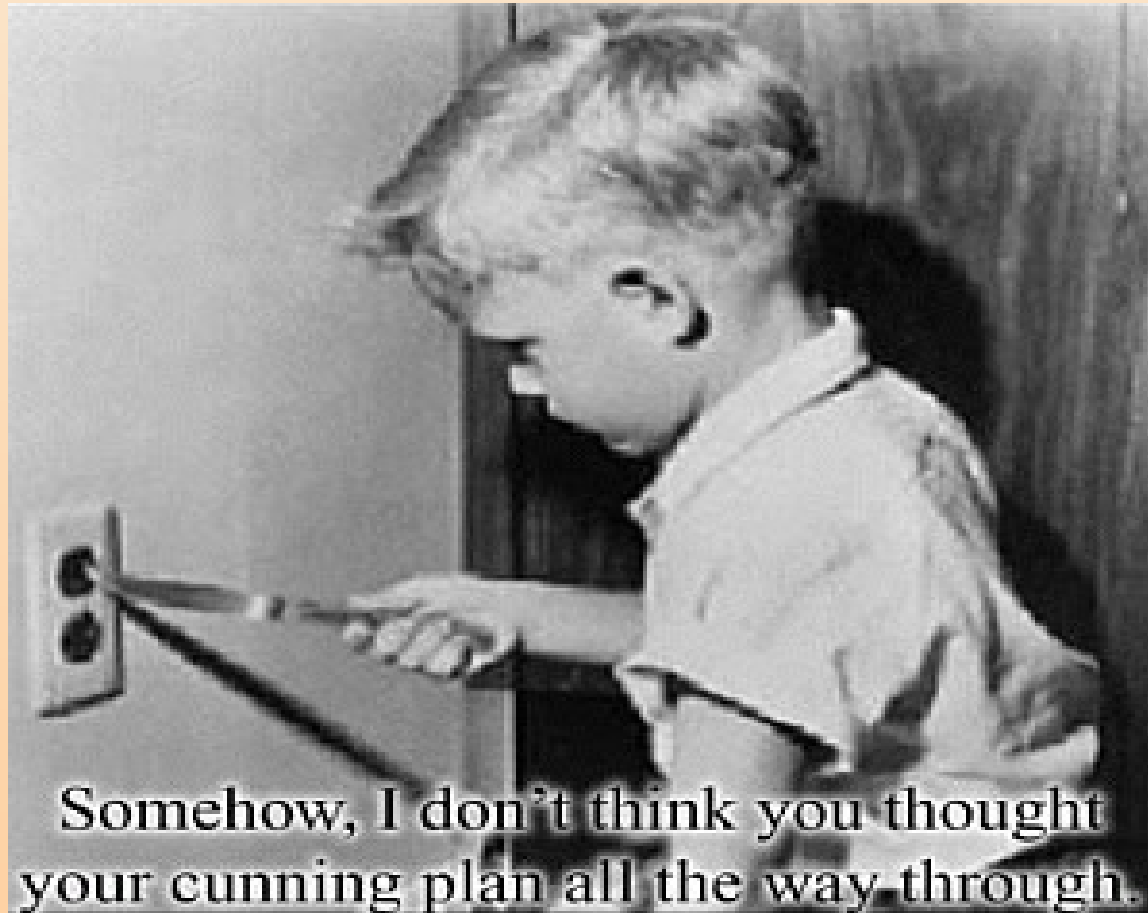




Pinky : Gee, Brain what do you want to do tonight?

Brain : The same thing we do every night Pinky.
Try to ~~take over~~ *automate* the world!

Safety & Disclaimer



Somehow, I don't think you thought your cunning plan all the way through.

My Introduction

- Neil Cherry (ncherry@linuxha.com)
- my web site: <http://www.linuxha.com/>
- Home Automation has been my hobby/passion/obsession since 1978
- Author: Linux Smart Homes For Dummies (2006)
- My background is networking, electronics, embedded systems and programming
- This presentation can be found @:
<http://ushomeautomation.com/Presentations/>
(TCF2011)

What is home automation (HA)?

- Home Automation (or Domotics) is automation specific to the requirements of private residences. It applies techniques for the comfort, security, entertainment and communications needs of it's residents.
- In simplest terms it is control and monitoring of devices and information.
 - Lighting and appliance control
 - Heating, ventilation and air conditioning (HVAC)
 - Energy/Resource management

What is HA? (cont'd)

- Security and access control (SAC)
 - Doors and windows control and monitoring
 - fire alarm (FA), fire, life, and safety (FLS)
 - CO alarm
 - Flood/Water Alarm
- Communications (voice and data)
- Entertainment control
- Information processing (things like resource management)
 - Thunderstorm/Tornado/Tsunami/Earthquake/
Weather warning

What is HA? (cont'd)

- It is all these things integrated into a single package and is quickly including things outside the home.
- Because of this HA is now becoming a misnomer!
- ... perhaps a better name would be Smart Home Information Technology ... ;-)
- ... for now I'll stick with HA.

What can you do with HA?

- With HA you control and monitor devices and information
 - Sprinkler system (device)
 - monitor your email (information)
- trigger things based on time, temperature, email or something else. (information)
- Security
 - monitoring doors and windows
 - fire, smoke, water & CO

HA (continued)

- Entertainment
 - music
 - Streaming/Juke box
 - Internet Radio
 - Podcasting
 - TV
 - live
 - recorded (VCR, DVR)
 - Streaming video
 - video casting (YouTube)
 - Radio

HA (continued)

- Weather
 - prediction
 - recorded history
 - current temperature, humidity, wind, barometric pressure, rain fall, sunshine.
 - phase of the moon
 - tides
 - Internet
 - Thunderstorm/Tornado/Tsunami/Earthquake warning

Home Automation Introduction

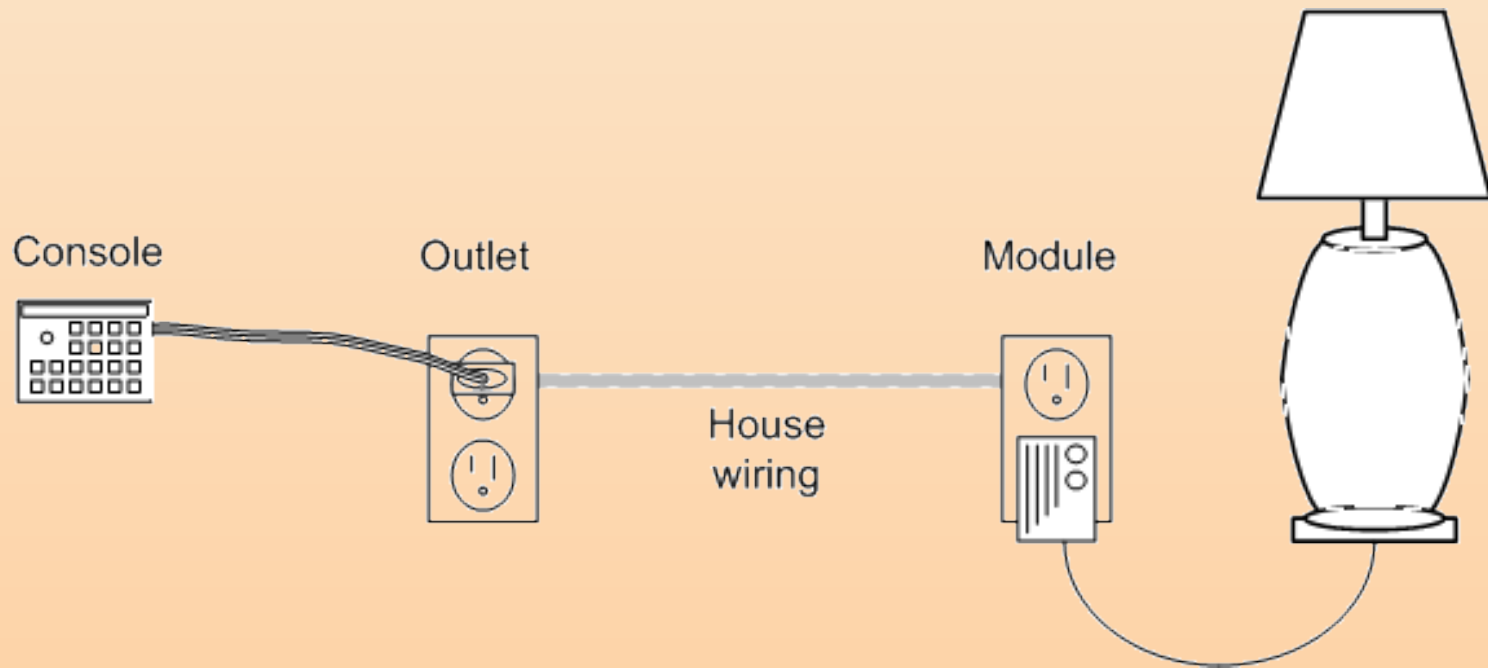
- Home automation, It often starts with holiday lights
- You don't need a computer for this
- A simple timer or a remote and some modules will do ...
- *... but where's the fun in that?! :-)*



HA Introduction

- Typical hardware you'll start with:
 - Lamps modules
 - Computer interfaces
 - A desktop control is not a bad idea also
- You expand to control other appliances typically lights
- Has a very high 'Geek factor'
- Wild ideas begin to fill your head
- Reality sets in when gremlins strike
- SAF is **very** important!

Simple X10 Setup (cont'd)



2011, the year of convergence

- Disruptive technologies
 - Open Source/FOSS community
 - Linux / GNU utilities
 - X10 patents expiring
 - Touchscreen technology (resistive/capacitive)
 - ARM processors & cell phone usage
 - Apple iPod/iPhone
 - Android
 - The App Store

2011, the year of convergence

- Disruptive technologies (cont'd)
 - The flood of Insteon, Z-Wave, ZigBee and others
 - Plug computers
 - Energy usage awareness
 - Cloud computing
 - M2M

Technology

- PLC – Power line carrier or communications
 - X10
 - Insteon
 - UPB
- Z-Wave & ZigBee (900 MHz/2.4GHz) both are wireless mesh
- Direct IO (Digital and Analog)
- Networked (IP, RS485, IButton, SPI, wireless)
- PC Interface (USB, serial, PCI board)

What can you do with it?

- Lights and appliances (direct, power line or wireless)
- TV, VCR, DVD, Tivo (IP network/IR)
- Monitor weather
- Temperature
- Thermostats
- Internet Information
- Monitor Energy

Computer Interfaces

- Lots of different vendors, interface types and communication protocols
- Serial, USB, and IP
- Some are plug like some a USB stick like (Z-Wave for example)



Modules



- Lamp module
- Appliance module
- Digital/Analog I/O module (Sprinklers)
- Universal module (digital input)
- Wireless module

Wall Switches

- Some control loads
- Some only transmit a command
- some do both
- They do come in different colors and styles



KeypadLincs



- Some only send commands
- some can control one load (appliance control)
- the ones with a load can receive commands

KeypadLinc w/Dim

- Controls an electrical load
- Sends commands
- can send group commands.
- on/off
- dim/bright



Wall Outlets



- Insteon OutletLinc
- on/off
- X10 Super Socket – I don't recommend this product

Z-Wave Lock sets



Wireless Thermostats

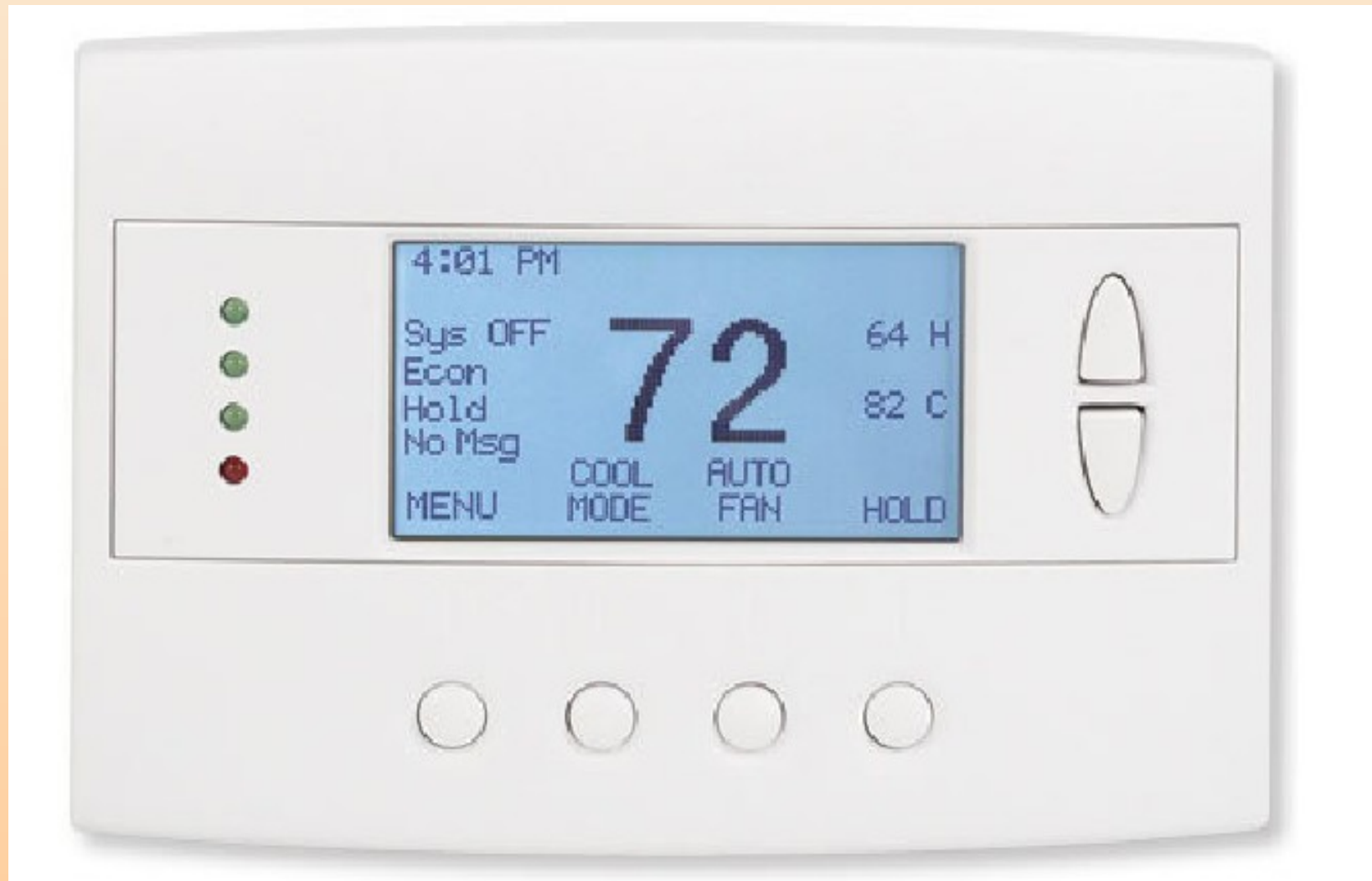


Table top controllers



- Ugly but useful
- Smarthome has a lot of useful features
- Mini console – 4 buttons (useful for testing)
- Maxi Console - 16 buttons

Insteon Remote



Misterhouse (MH)



<http://www.misterhouse.net/>

Misterhouse (MH)

- MH is written entirely in Perl.
- It has a rather strange Object Oriented method of coding because MH writes some of it's Perl code at startup
- Very flexible because it's able to take advantage of the existing library of Perl Modules.
- Starting out is not terrible complex but some knowledge of Perl is required.
- Plenty of examples exist
- Mail lists are very friendly and supportive.

Plug Computer



- ARM (v5) processor
- 1G Hz
- 512M RAM
- 512M Flash/ SD slot
- No math coprocessor
- No fan
- 4 Watts of power
- Linux based

Misterhouse (MH)

- Control & Interface
 - X10
 - Insteon
 - Z-Wave
 - UPB
 - KNX/EIB
 - Direct I/O
 - 1-wire/IButton
 - IP (TCP, UDP, HTTP, ...)

Misterhouse (MH)

- IR
 - transmit
 - receive
- Wireless remotes (non X10/Insteon)
- Macros
- Triggers
- Tables (.mht ->.mhp)

Misterhouse (MH)

- Speech – TTS
- Listen – STT
- Weather
- News
- On this day, fortune etc.
- Comics
- TV Guide
- Home Layout – Floor Plan

Misterhouse (MH)

- Grocery list
- Organizer/Calendar
- Stocks
- email
- Home Security
- custom Perl code
- custom web pages

Web Interface & Demo

The screenshot shows a Mozilla Firefox browser window displaying the MrHouse web interface. The browser's address bar shows the URL <http://www.mh.uucp:8080/ia5/>. The browser's menu bar includes File, Edit, View, History, Bookmarks, Tools, and Help. The browser's toolbar includes navigation buttons (Back, Forward, Home, Stop, Reload), a search bar with the Google logo, and a status bar at the bottom showing system information.

The MrHouse web interface features a large logo at the top left and a grid of navigation buttons. The buttons are arranged in two rows of three, with a fifth button (Admin) positioned to the right of the top row. The buttons are:

- Back
- My MH
- Menu
- Search
- Admin
- MrHouse Home
- Mail Headlines News
- MrHouse Modes
- Lights Appliances
- HVAC Weather
- Security Cameras
- Phone Calls VoiceMail Msgs
- TV/Radio Guide MP3 Music
- Speech
- Comics Pictures
- Events Calendar Clock
- Statistics Logged Data

At the bottom of the page, there is a status bar with the following text: "When all else is lost, the future still remains. 21:37:35 up 24 days, 9:55, 9 users, load average: 0.00, 0.00, 0.00 Page Views: 556".

The browser's status bar at the bottom shows the following information: "Rise 7:13 AM Set 6:12 PM tv_time (%) 71.4°F (87.8) 100% no wind Fri, Oct 19 9:37 PM". The browser's download bar shows "Downloads" with files "electronics_tes..." and "DigitalHome.pdf". The browser's address bar shows "Done" and "Clear" buttons.

Floor Plan

The screenshot displays the MrHouse web interface in a Mozilla Firefox browser window. The browser's address bar shows the URL <http://www.mh.uucp.9080/ia5/>. The page features a navigation menu with buttons for Back, My MH, Menus, Search, and Admin. The main content area is titled "Property" and contains a floor plan diagram with various rooms and control buttons. The rooms shown are: Patio, DiningRoom, Kitchen, BA1, BR1, Gar, L1, LivingRoom, Hall, BR3, BR2, Porch, Box, BA2, WR, CR, FY, F2, and Study. Each room contains a light bulb icon, indicating that the lights in that room can be controlled. On the left side of the floor plan, there is a vertical list of control buttons: Control by Floorplan, Control Lights, Control Appliances, Browse Lights, Browse Appliances, and Floorplan View. Below this list, there is a link for "Floorplan SVG". The bottom of the browser window shows a system tray with the following information: Rise 6:47 AM, Set 7:19 PM, daytime (%), 40.6°F 71%, no wind, and Tue, Mar 29 11:52 AM.

MrHouse

Property

Control by Floorplan

Control Lights

Control Appliances

Control Appliances

Browse Lights

Browse Appliances

Floorplan View

Floorplan SVG

Floorplan View

Patio

DiningRoom

Kitchen

BA1

BR1

Gar

L1

LivingRoom

Hall

BR3

BR2

Porch

Box

BA2

WR

CR

FY

F2

Study

Rise 6:47 AM Set 7:19 PM daytime (%) 40.6°F 71% no wind Tue, Mar 29 11:52 AM

Custom Web page

MisterHouse

Back My MH Menus Search Admin

Weather forecast for the Trenton, NJ area

Weather Conditions at 10:53 AM EDT on 29 Mar 2011 for Trenton, NJ.
Temp(F) Humidity(%) Wind(mph) Pressure(in) Weather

41 33% NORTH at 10 30.13 Clear

Forecast for Trenton, NJ
1148 am EDT Tue Mar 29 2011

☀ This afternoon	Sunny. Highs in the upper 40s. Northwest winds around 15 mph.
Tonight	Mostly clear. Lows in the upper 20s. Northwest winds 10 to 15 mph...diminishing to around 5 mph after midnight.
☀ Wednesday	Partly sunny. A chance of rain in the afternoon. Highs in the upper 40s. Northwest winds around 5 mph...becoming southwest around 5 mph in the afternoon. Chance of rain 30 percent.
Wednesday night	Mostly cloudy with a 30 percent chance of rain. Lows in the lower 30s. Southwest winds around 5 mph... becoming northwest around 5 mph after midnight.
☀ Thursday	Mostly cloudy. A chance of rain in the afternoon. Highs around 50. Northeast winds 5 to 10 mph. Chance of rain 30 percent.
Thursday night	Rain likely. Lows in the mid 30s. Chance of rain 60 percent.
☀ Friday	Rain likely. Highs around 50. Chance of rain 70 percent.

[Refresh Recently Spoken Text](#)

- 03/28/11 07:46:00 PM daytime: Task notice for bruce, test task.hi again
- 03/27/11 07:46:00 PM daytime: Task notice for bruce, test task.hi again
- 03/26/11 07:46:00 PM daytime: Task notice for bruce, test task.hi again
- 03/25/11 07:46:00 PM daytime: Task notice for bruce, test task.hi again
- 03/24/11 07:46:00 PM tv. time: Task notice for bruce, test task.hi again

Rise 6:47 AM Set 7:19 PM **daytime (%)** 40.6°F 71% no wind Tue, Mar 29 11:53 AM

http://www.mh.uucp:9080/mv mh/news ii.pl?TTN

MH .mht file

#	Type	Address	Name	Groups
#				
X10A,	01,	Holiday_Lights,	Holiday O,	
X10A,	01,	x01,	Holiday Test O,	
X10A,	01,	Backup_Lights,	Holiday O,	
X10A,	02,	x02,	Holiday Test O,	
X10A,	03,	x03,	Holiday Test O,	
X10A,	04,	x04,	Holiday Test O,	
X10A,	05,	x05,	Holiday Test O,	

MH .mhp file

- MH generates this code from the .mht file:

```
$Holiday_Lights = new X10_Appliance('01', );  
$Holiday        = new Group;  
$Holiday        -> add($Holiday_Lights);  
$0              = new Group;  
$0              -> add($Holiday_Lights);
```

User code

```
# Need to add Christmas time here
# Actually any Holiday.

if(state_now $Holiday_LightsOn) { # 0100n was just sent
    # Holiday lights

                                set $x01 ON;

    Timer->new->set(1, sub {      set $x02 ON; });
    Timer->new->set(2, sub {      set $x03 ON; });
    Timer->new->set(3, sub {      set $x04 ON; });
    Timer->new->set(4, sub {      set $x05 ON; });

    run_after_delay 2, "print_log 'Ending delay test 1'";
}
```

More user code

```
if(state_now $Holiday_LightsOff) { # 010Iff was just sent
    # Holiday lights
    set $x01 OFF;
    Timer->new->set(1, sub { set $x02 OFF; });
    Timer->new->set(2, sub { set $x03 OFF; });
    Timer->new->set(3, sub { set $x04 OFF; });
    Timer->new->set(4, sub { set $x05 OFF; });
    run_after_delay 5, "print_log 'Ending delay test 1'";
}
```

Macro code (Perl)

```
# LRicon is actually a LampLinc V2
# manually turned on - sends out E4EON ($LR_ON)
# manually turned off - sends out E4EOFF
# ($LR_OFF)
if(state_now $LR_ON) {
    Timer->new->set(1, sub{ $LRiLamp->set(ON)});
    Timer->new->set(1, sub{ $LRicon->set(ON)});
}
if(state_now $LR_OFF) {
    Timer->new->set(1, sub{ $LRiLamp->set(OFF)});
    Timer->new->set(1, sub{ $LRicon->set(OFF)});
}
```

Questions & Answers

- ? Anyone? Anyone?

Books & Podcasts

- Linux Smart Homes For Dummies
 - <http://linuxha.com/FD/book/>
- Smart Home Hacks
 - <http://gordon.typepad.com/>
- Hardware Hacking Projects for Geeks
- Podcast presentation on HA
 - <http://laugks.org/news/2007/07/19/laug-podcast-0607-home-automation/>
- My Linux Link Tech Show visit
 - <http://www.tlits.org/dl.php?episode=162>

References

- <http://www.linuxha.com/>
- <http://www.linuxha.com/FD/book/>
- <http://www.misterhouse.net/>
- <http://www.weedtech.com/>
- <http://www.planetchristmas.com/>
- <http://computerchristmas.com/>
- <http://www.smarthome.com/>
- <http://www.smarthomeusa.com/>
- <http://www.x10.com/>
- <http://home-automation.org/>

Reference (cont.)

- <http://www.linuxha.com/athome/index.html#Documents>
- <http://home.comcast.net/~ncherry/>
- My web site: <http://www.linuxha.com/>
- My other web site:
<http://ushomeautomation.com/>
- My blog: <http://linuxha.blogspot.com/>
- My email: ncherry@linuxha.com

Extra material

The material that follows was not meant to be presented during this presentation. It is meant as extra (bonus ;-) material to give you something to think about.

If you have any questions they can be directed to me at: ncherry@linuxha.com. I'll answer them as I get time.

Thank you

The dream since 1985!



Automating the Coffee Maker

- RFC2324 – HTCPCP
- RFC2325
- Simply task
- We turn on the coffee maker every morning at 5:30 AM
- ... or do we?



When we make coffee ...

- we fill the maker with water
- we add a new filter
- we fill it with coffee
- we turn it on
- we let it brew
- Sometimes we set it up the night before with the timer so it goes off before we get up.

Simple automation

- We can just add an appliance module and program the computer to turn on the coffee maker
- but we still have to setup the machine and make sure it's on
- this is no easier than setting the timer

What we'd like it to do ...

- Fill the coffee maker with water
- turn on the machine
- brew the coffee
- turn off when there is no coffee

- *It would really be nice if it refilled water, coffee and filter as necessary.*
- *Reading my mind would be a good idea too! ;-)*

What we have to do ...

- Safely brew a pot of coffee
 - make sure the pot is on the burner
 - check the status of the pot (empty? full?)
 - Check the machine for water, fill as needed but not if there's a pot brewing
 - don't overfill the machine
 - turn off when empty or there's no pot (for n amount of time).

What if devices could communicate?



What if devices could communicate?

- If we had one standard device communications protocol it would be easier
- Do you set your coffee pot and alarm clock for about the same time?
- If devices could communicate we could set our alarm in one place
- and have the coffee ready in another

What if devices could communicate?

- and a little code:

```
if(time_now($Wake_Up - 0:20) &&  
  $Alarm_OK) {
```

```
  $CoffeePot->set(ON);
```

```
}
```

```
if(time_now($Wake_Up) && $Alarm_OK) {
```

```
  $AlarmClock->ramp(GENTLE);
```

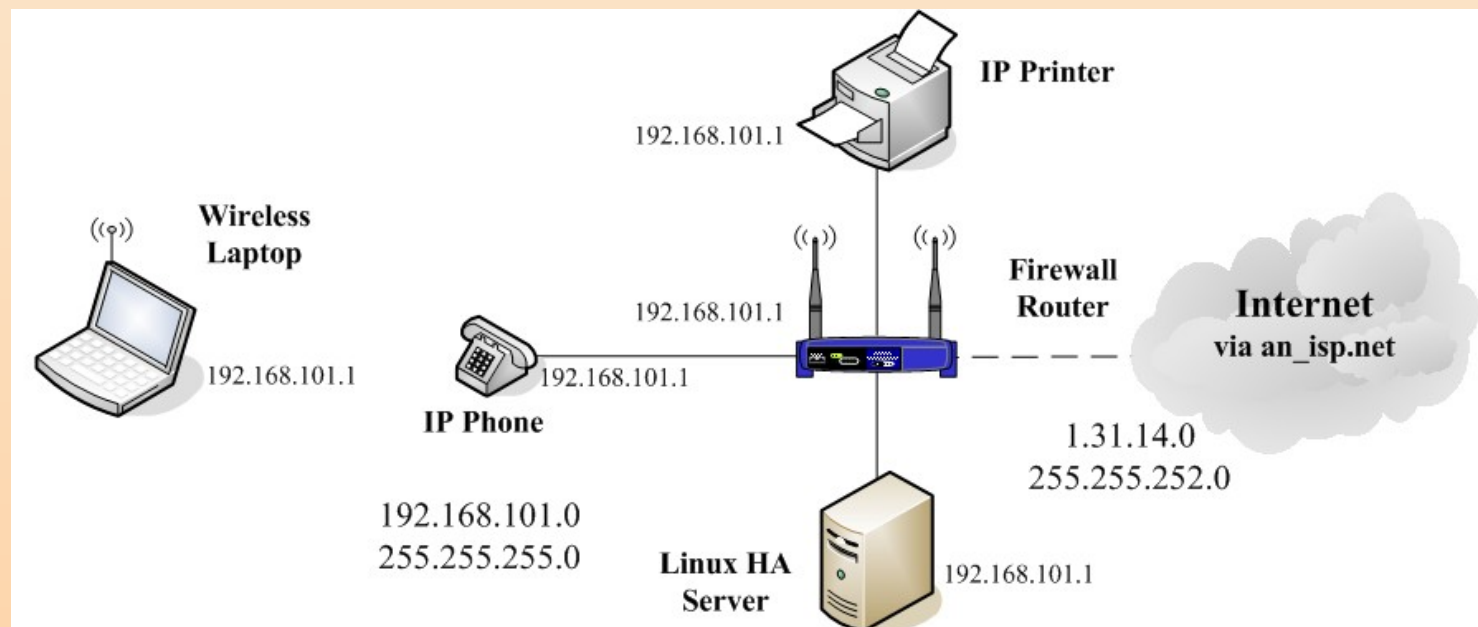
```
  $AlarmClock->set(ON);
```

```
}
```

Resource Management

- Record usage history
 - unusual patterns usual indicate waste
- Find out what's using power
 - with a history you can predict when an appliance could break down
- Tailor resource better to make usage patterns
- Use of AI (Intelligent software, not a thinking machine) for better results.

Networking



Future Homes



- IP on Everything!
- 'nano-controllers' (not x86 devices) with network support for lamps (4-8 pin 8 bit controllers)
- pico-controllers (maybe x86 but more likely ARM (16/32 bit) size devices) for larger appliances
- pico-ITX (32/64 bit x86/ARM) like devices for TV, Stereo
- Companies will offer home system monitoring like today's security offerings

Future Homes

- You may have less direct control over your home. More of it will be under the control of the Service company (Good/Bad ? Depends on the service)
- You'll get reports that you can determine what's going on.
- You may be able to determine when it's cost effective to buy-up
- Question of centralized control (the cloud) or distributed intelligence (home/cloud).

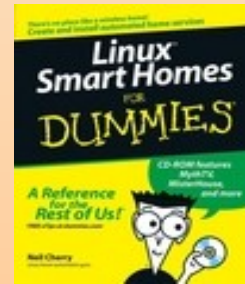
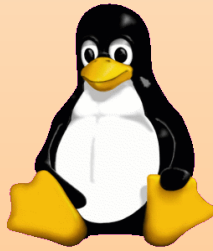
Where we're going

- Control (actually we're here)
- Monitoring
- Services (Cloud Computing)
- Telehealth

Reliability or things that make you go hmm ...

- X10 has been said to work 90% of the time
- Insteon works better (99% of the time?)
- 90% of 364 is 36.4 days failed
- 99% of 364 is 3.6 days failed
- 99.9% - .364 days (~8.7 hours)
- 99.999% - .00364 days (5.2 mins)

Presenting Home Automation *with Misterhouse*



1

Over the years I've created various slide shows/presentations on the subject of home automation. This presentation is being done for the Trenton Computer Festival on April 2nd, 2011 at the College of NJ in Ewing, NJ.



Pinky : Gee, Brain what do you want to do tonight?

Brain : The same thing we do every night Pinky. Try to ~~take over~~ *automate* the world!

Safety & Disclaimer



3

Because much of the home automation material involves working with electrical appliances and devices caution must be exercised. Batteries as small as 9v have enough current to kill a person under the right circumstances. Household AC (120, 208 or 220) can kill very easily under most circumstances. If you are not qualified to work with electricity I recommend you use a qualified electrician. While he may cost you extra money he may save your life and property.

None of the information or opinions expressed in this presentation are paid for. They are strictly my own and may not represent an endorsement of someone's project, product or service (unless otherwise stated so).

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7

Smart Home Information Technology – That's a joke son (look at the acronym) :-)

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 - Sprinkler system (device)
 - monitor your email (information)
- trigger things based on time, temperature, email or something else. (information)
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 - Streaming/Juke box
 - Internet Radio
 - Podcasting
 - TV
 - live
 - recorded (VCR, DVR)
 - Streaming video
 - video casting (YouTube)
 - Radio

HA (continued)

- Weather
 - prediction
 - recorded history
 - current temperature, humidity, wind, barometric pressure, rain fall, sunshine.
 - phase of the moon
 - tides
 - Internet
 - Thunderstorm/Tornado/Tsunami/Earthquake warning

Home Automation Introduction

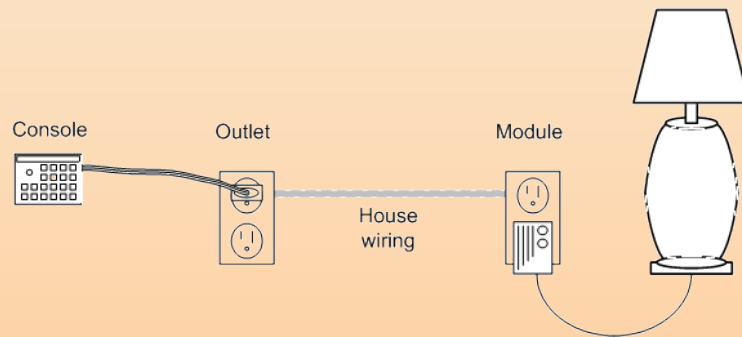
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- Disruptive technologies (cont'd)
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 - Plug computers
 - Energy usage awareness
 - Cloud computing
 - M2M

15

· 2011 has been an interesting year! The year started with a large number of HA vendors showing off Plug based products that would interface with their products and things like Z-Wave (very popular), ZigBee and Insteon. The end of 2010 saw the US government standardizing on ZigBee for it's energy initiatives. With tablet style devices becoming more common place we've seen a lot of Apps for home automation.

· Currently Z-Wave has a nice lead on ZigBee and I'd say that it's become the standard of the day for home automation. Z-Wave appears to be one of the first to bring out a product line that measures energy usage in the device modules. ZigBee also has such features but it lags Z-Wave's availability. Insteon also appears to be getting into this part of the market but is late to market.

· Of course they would love if we had a house full of their products but I don't see that happening for a while so to monitor the home's power you can get devices like kill-a-watt, TED or my favorite: the Brultech ECM-1240 which can monitor the mains and 5 circuits.

· The plug computer seems to made the biggest difference as it's small, quiet, low powered and can basically be ignored and hidden away. I'll speak more about this later.

· We're seeing more and more applications being moved into the cloud. We're already familiar with email (Gmail, Yahoo, etc), shared documents (file sharing, Google Docs, Flickr) and of course storage but now processing power (databases) and software services (SOAP, REST and Web Services) can be purchased via the cloud. This leads to more being done in the cloud. One such service is image processing from cheap home IP cameras. The service processes the images from the cameras and provides motion detection and security services to the customer. All handled in the cloud.

· M2M, think OnStar for your home except you don't hit the Blue button. Things like your appliances communicate with services for your benefit. If you have a Nook then you've experienced M2M which is tightly tied to Cloud Services.

Technology

- PLC – Power line carrier or communications
 - X10
 - Insteon
 - UPB
- Z-Wave & ZigBee (900 MHz/2.4GHz) both are wireless mesh
- Direct IO (Digital and Analog)
- Networked (IP, RS485, IButton, SPI, wireless)
- PC Interface (USB, serial, PCI board)

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- TV, VCR, DVD, Tivo (IP network/IR)
- Monitor weather
- Temperature
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- Monitor Energy

Computer Interfaces

- Lots of different vendors, interface types and communication protocols
- Serial, USB, and IP
- Some are plug like some a USB stick like (Z-Wave for example)



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- Lamp module
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- They do come in different colors and styles



KeypadLincs



- Some only send commands
- some can control one load (appliance control)
- the ones with a load can receive commands

KeypadLinc w/Dim

- Controls an electrical load
- Sends commands
- can send group commands.
- on/off
- dim/bright



Wall Outlets



- Insteon OutletLinc
- on/off
- X10 Super Socket – I don't recommend this product

Z-Wave Lock sets



Wireless Thermostats

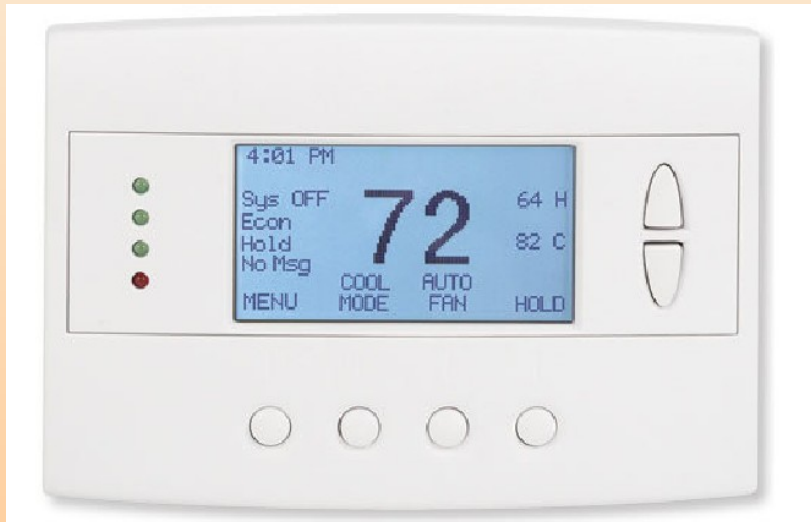


Table top controllers



- Ugly but useful
- Smarthome has a lot of useful features
- Mini console – 4 buttons (useful for testing)
- Maxi Console - 16 buttons

Insteon Remote



Misterhouse (MH)



<http://www.misterhouse.net/>

Misterhouse (MH)

- MH is written entirely in Perl.
- It has a rather strange Object Oriented method of coding because MH writes some of it's Perl code at startup
- Very flexible because it's able to take advantage of the existing library of Perl Modules.
- Starting out is not terrible complex but some knowledge of Perl is required.
- Plenty of examples exist
- Mail lists are very friendly and supportive.

Plug Computer



- ARM (v5) processor
- 1G Hz
- 512M RAM
- 512M Flash/ SD slot
- No math coprocessor
- No fan
- 4 Watts of power
- Linux based

Misterhouse (MH)

- Control & Interface
 - X10
 - Insteon
 - Z-Wave
 - UPB
 - KNX/EIB
 - Direct I/O
 - 1-wire/IButton
 - IP (TCP, UDP, HTTP, ...)

Misterhouse (MH)

- IR
 - transmit
 - receive
- Wireless remotes (non X10/Insteon)
- Macros
- Triggers
- Tables (.mht ->.mhp)

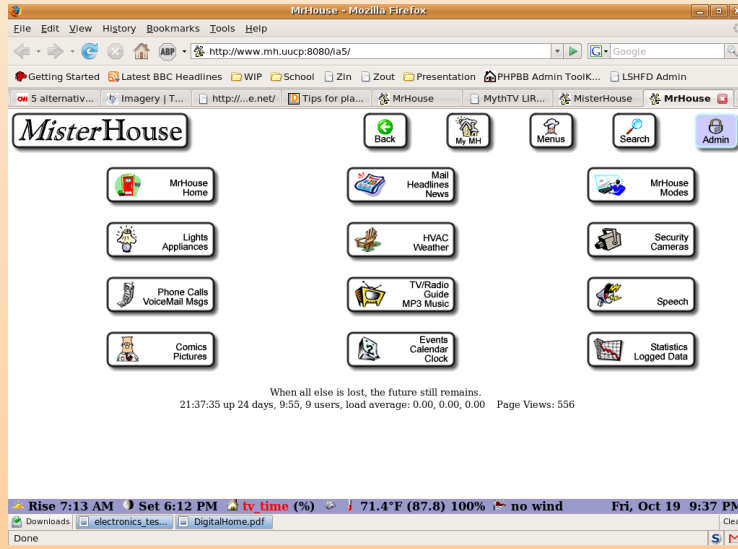
Misterhouse (MH)

- Speech – TTS
- Listen – STT
- Weather
- News
- On this day, fortune etc.
- Comics
- TV Guide
- Home Layout – Floor Plan

Misterhouse (MH)

- Grocery list
- Organizer/Calendar
- Stocks
- email
- Home Security
- custom Perl code
- custom web pages

Web Interface & Demo



Floor Plan

The screenshot displays the MisterHouse web interface in a Mozilla Firefox browser window. The browser's address bar shows the URL <http://www.mh.uucp-9080/ta5/>. The interface features a navigation bar with the "MisterHouse" logo and buttons for "Back", "My MH", "Menus", "Search", and "Admin".

On the left side, there is a vertical menu of control options:

- Control by Floorplan
- Control Lights
- Control Appliances
- Control Appliances
- Browse Lights
- Browse Appliances
- Floorplan View
- Floorplan SVG
- Floorplan View

The main area shows a floor plan with the following rooms and areas:

- Property
- Ratio
- DiningRoom
- Kitchen
- BA1
- BR1
- Gar
- LivingRoom
- Hall
- BR2
- BR3
- Porch
- Box
- BA2
- WR
- CR
- FY
- F2
- Study
- L1

At the bottom of the browser window, the system status bar displays: Rise 6:47 AM, Set 7:19 PM, daytime (%), 40.6°F 71%, no wind, Tue, Mar 29 11:52 AM.

Custom Web page

The screenshot shows a web browser window displaying the 'MisterHouse' website. The page features a navigation menu on the left with buttons for 'HowTo', 'My Menu1', 'My Menu2', 'NJ_Heather', 'NJ_Heather', 'I-net Access', 'Shopping list', 'Shopping list II', and 'Security'. The main content area is titled 'Weather forecast for the Trenton, NJ area' and displays current weather conditions and a multi-day forecast.

Weather forecast for the Trenton, NJ area

Weather Conditions at 10:53 AM EDT on 29 Mar 2011 for Trenton, NJ.
Temp(F) Humidity(%) Wind(mph) Pressure(in) Weather

41 33% NORTH at 10 30.13 Clear
Forecast for Trenton, NJ
1148 am EDT Tue Mar 29 2011

● This afternoon	Sunny. Highs in the upper 40s. Northwest winds around 15 mph.
Tonight	Mostly clear. Lows in the upper 20s. Northwest winds 10 to 15 mph...diminishing to around 5 mph after midnight.
● Wednesday	Partly sunny. A chance of rain in the afternoon. Highs in the upper 40s. Northwest winds around 5 mph...becoming southwest around 5 mph in the afternoon. Chance of rain 30 percent.
Wednesday night	Mostly cloudy with a 30 percent chance of rain. Lows in the lower 30s. Southwest winds around 5 mph... becoming northwest around 5 mph after midnight.
● Thursday	Mostly cloudy. A chance of rain in the afternoon. Highs around 50. Northeast winds 5 to 10 mph. Chance of rain 30 percent.
Thursday night	Rain likely. Lows in the mid 30s. Chance of rain 60 percent.
● Friday	Rain likely. Highs around 50. Chance of rain 70 percent.

[Refresh Recently Spoken Text](#)

- 03/28/11 07:46:00 PM daytime: Task notice for bruce, test task.hi again
- 03/27/11 07:46:00 PM daytime: Task notice for bruce, test task.hi again
- 03/26/11 07:46:00 PM daytime: Task notice for bruce, test task.hi again
- 03/25/11 07:46:00 PM daytime: Task notice for bruce, test task.hi again
- 03/24/11 07:46:00 PM daytime: Task notice for bruce, test task.hi again

● Rise 6:47 AM ● Set 7:19 PM ● daytime (%) ● 40.6°F 71% ● no wind Tue, Mar 29 11:53 AM

http://www.mh.uccp-9080/mv mh/mhw ii.g7TTN

MH .mht file

#	Type	Address	Name	Groups
#				
X10A,	01,	Holiday_Lights,		Holiday O,
X10A,	01,	x01,		Holiday Test O,
X10A,	01,	Backup_Lights,		Holiday O,
X10A,	02,	x02,		Holiday Test O,
X10A,	03,	x03,		Holiday Test O,
X10A,	04,	x04,		Holiday Test O,
X10A,	05,	x05,		Holiday Test O,

MH .mhp file

- MH generates this code from the .mht file:

```
$Holiday_Lights = new X10_Appliance('01', );  
$Holiday       = new Group;  
$Holiday       -> add($Holiday_Lights);  
$O             = new Group;  
$O             -> add($Holiday_Lights);
```

User code

```
# Need to add Christmas time here
# Actually any Holiday.

if(state_now $Holiday_LightsOn) { # 0100n was just sent
  # Holiday lights

                                set $x01 ON;

  Timer->new->set(1, sub { set $x02 ON; });
  Timer->new->set(2, sub { set $x03 ON; });
  Timer->new->set(3, sub { set $x04 ON; });
  Timer->new->set(4, sub { set $x05 ON; });

  run_after_delay 2, "print_log 'Ending delay test 1'"; 40
}
```

More user code

```
if(state_now $Holiday_LightsOff) { # 010Iff was just sent
  # Holiday lights
  set $x01 OFF;
  Timer->new->set(1, sub { set $x02 OFF; });
  Timer->new->set(2, sub { set $x03 OFF; });
  Timer->new->set(3, sub { set $x04 OFF; });
  Timer->new->set(4, sub { set $x05 OFF; });
  run_after_delay 5, "print_log 'Ending delay test 1'";
}
```

Macro code (Perl)

```
# LRicon is actually a LampLinc V2
# manually turned on - sends out E4EON ($LR_ON)
# manually turned off - sends out E4EOFF
# ($LR_OFF)
if(state_now $LR_ON) {
    Timer->new->set(1, sub{ $LRiLamp->set(ON)});
    Timer->new->set(1, sub{ $LRicon->set(ON)});
}
if(state_now $LR_OFF) {
    Timer->new->set(1, sub{ $LRiLamp->set(OFF)});
    Timer->new->set(1, sub{ $LRicon->set(OFF)});
}
```

Questions & Answers

- ? Anyone? Anyone?

Books & Podcasts

- Linux Smart Homes For Dummies
 - <http://linuxha.com/FD/book/>
- Smart Home Hacks
 - <http://gordon.typepad.com/>
- Hardware Hacking Projects for Geeks
- Podcast presentation on HA
 - <http://laugks.org/news/2007/07/19/laug-podcast-0607-home-automation/>
- My Linux Link Tech Show visit
 - <http://www.tllts.org/dl.php?episode=162>

References

- <http://www.linuxha.com/>
- <http://www.linuxha.com/FD/book/>
- <http://www.misterhouse.net/>
- <http://www.weedtech.com/>
- <http://www.planetchristmas.com/>
- <http://computerchristmas.com/>
- <http://www.smarthome.com/>
- <http://www.smarthomeusa.com/>
- <http://www.x10.com/>
- <http://home-automation.org/>

Reference (cont.)

- <http://www.linuxha.com/athome/index.html#Documents>
- <http://home.comcast.net/~ncherry/>
- My web site: <http://www.linuxha.com/>
- My other web site:
<http://ushomeautomation.com/>
- My blog: <http://linuxha.blogspot.com/>
- My email: ncherry@linuxha.com

Extra material

The material that follows was not meant to be presented during this presentation. It is meant as extra (bonus ;-) material to give you something to think about.

If you have any questions they can be directed to me at: ncherry@linuxha.com. I'll answer them as I get time.

Thank you

The dream since 1985!



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Seems I'm not the only one to be dream of home automation. This picture is from an Italian computer magazine from 1985.

Automating the Coffee Maker

- RFC2324 – HTCPCP
- RFC2325
- Simply task
- We turn on the coffee maker every morning at 5:30 AM
- ... or do we?



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While the RFCs are meant as a joke I'm afraid I've taken them too seriously! ;-) But we should consider what goes into doing something as simple as making our morning coffee before we attempt to automate the task. Often when we consider what needs to be done it turns out that it's actually easier to not automate the task and to deal with it ourselves.

When we make coffee ...

- we fill the maker with water
- we add a new filter
- we fill it with coffee
- we turn it on
- we let it brew
- Sometimes we set it up the night before with the timer so it goes off before we get up.

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Much of the safety system is dependent on human intervention. Why would you turn on a coffee pot if there was no water in the pot? If you wanted coffee you'd first make sure that you have the machine setup for what you want before turning it on (or possibly using a timer to make sure it goes on after you've set it up). That little bit of setup can be very hard, expensive and difficult to do correctly.

Even something as simple as filling the pot with the correct amount of water requires smaller steps. Oh and if you are explaining this to your spouse may I recommend that you don't use the toilet float to explain how the pot fills with water. The analogy doesn't work well. ;-)

Simple automation

- We can just add an appliance module and program the computer to turn on the coffee maker
- but we still have to setup the machine and make sure it's on
- this is no easier than setting the timer

What we'd like it to do ...

- Fill the coffee maker with water
- turn on the machine
- brew the coffee
- turn off when there is no coffee

- *It would really be nice if it refilled water, coffee and filter as necessary.*
- *Reading my mind would be a good idea too! ;-)*

What we have to do ...

- Safely brew a pot of coffee
 - make sure the pot is on the burner
 - check the status of the pot (empty? full?)
 - Check the machine for water, fill as needed but not if there's a pot brewing
 - don't overfill the machine
 - turn off when empty or there's no pot (for n amount of time).

What if devices could communicate?



What if devices could communicate?

- If we had one standard device communications protocol it would be easier
- Do you set your coffee pot and alarm clock for about the same time?
- If devices could communicate we could set our alarm in one place
- and have the coffee ready in another

What if devices could communicate?

- and a little code:

```
if(time_now($Wake_Up - 0:20) &&
  $Alarm_OK) {
  $CoffeePot->set(ON);
}
if(time_now($Wake_Up) && $Alarm_OK) {
  $AlarmClock->ramp(GENTLE);
  $AlarmClock->set(ON);
}
```

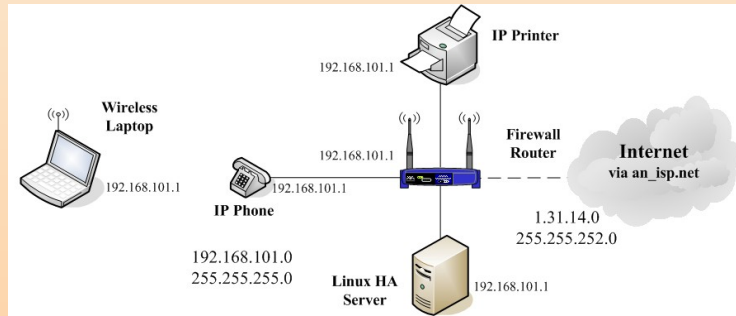
56

Some simple Perl code that could be used by Misterhouse. Of course this assumes that the correct modules have been written before hand. Such as the Mr. Coffee module and Alarm Clock modules. Once this has been written then making use of these modules is much easier.

Resource Management

- Record usage history
 - unusual patterns usual indicate waste
- Find out what's using power
 - with a history you can predict when an appliance could break down
- Tailor resource better to make usage patterns
- Use of AI (Intelligent software, not a thinking machine) for better results.

Networking



Future Homes



- IP on Everything!
- 'nano-controllers' (not x86 devices) with network support for lamps (4-8 pin 8 bit controllers)
- pico-controllers (maybe x86 but more likely ARM (16/32 bit) size devices) for larger appliances
- pico-ITX (32/64 bit x86/ARM) like devices for TV, Stereo
- Companies will offer home system monitoring like today's security offerings

Future Homes

- You may have less direct control over your home. More of it will be under the control of the Service company (Good/Bad ? Depends on the service)
- You'll get reports that you can determine what's going on.
- You may be able to determine when it's cost effective to buy-up
- Question of centralized control (the cloud) or distributed intelligence (home/cloud).

Where we're going

- Control (actually we're here)
- Monitoring
- Services (Cloud Computing)
- Telehealth

Reliability or things that make you go hmm ...

- X10 has been said to work 90% of the time
- Insteon works better (99% of the time?)
- 90% of 364 is 36.4 days failed
- 99% of 364 is 3.6 days failed
- 99.9% - .364 days (~8.7 hours)
- 99.999% - .00364 days (5.2 mins)

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While not strictly part of home automation, a rather important point to take into consideration when dealing with reliability. Some folks say that X10 works 9 out of 10 times. While I agree with the 90% number I don't agree with the 9 out of 10 times. I tend to see X10 and my other HA product work in long spurts with short bursts of failure.