

**Internet
Controlled**

**Christmas
Lights**

www.itwinkle.org

Tom Hammond
tominohio@gmail.com



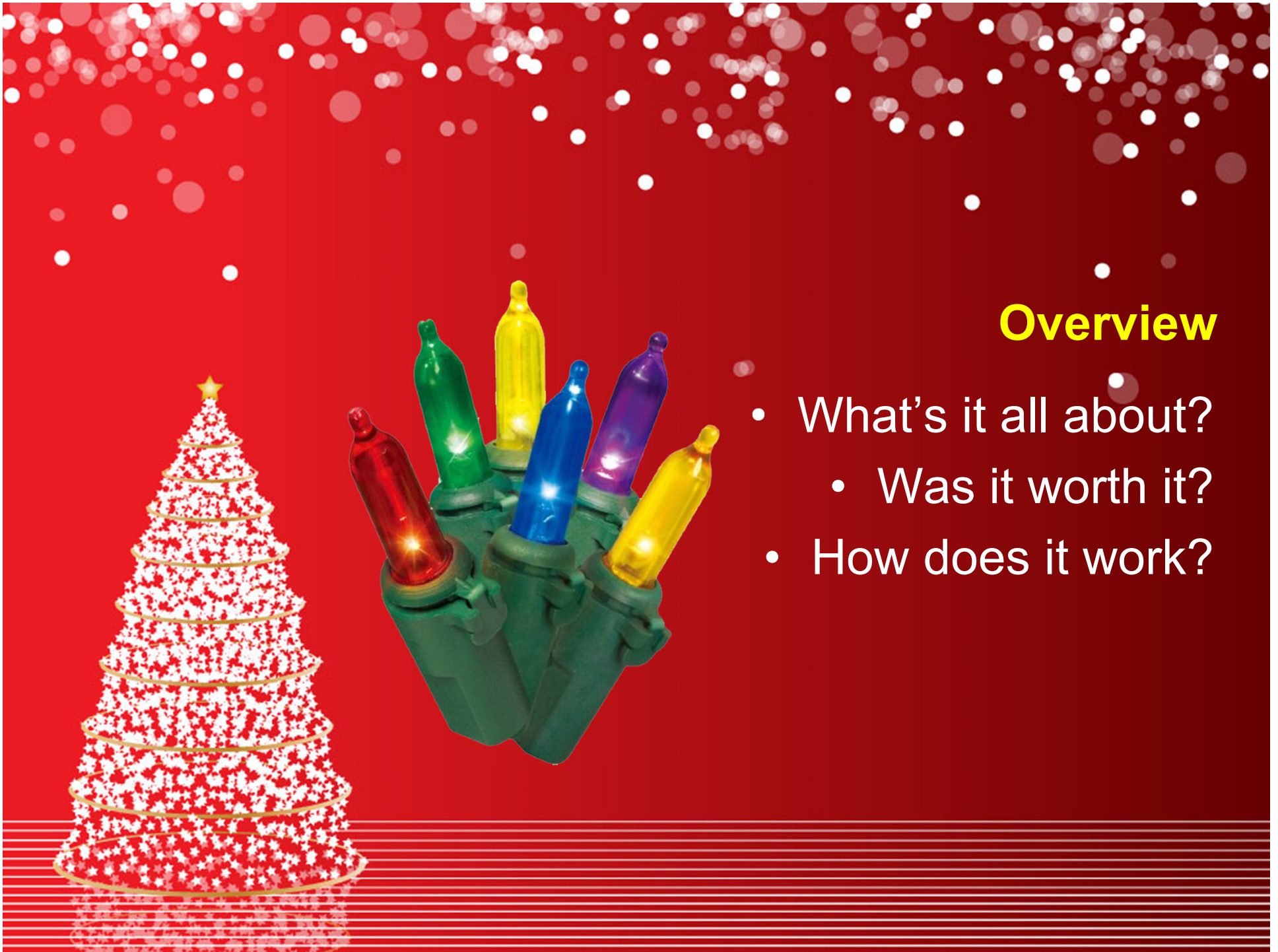
Topics

- Overview
- xLights Animations
- Falcon Player
- Streaming Webcam
- Router and DDNS Settings
- Visitor Website
- Low-cost Light Controllers
- Summary and Q&A



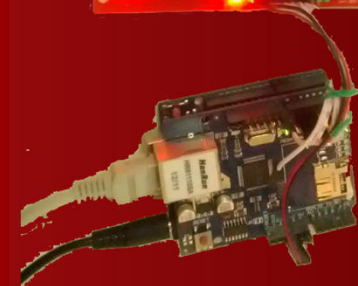
Overview

- What's it all about?
 - Was it worth it?
- How does it work?



What's it all about?

- Do not live on a busy street, wanted more people to enjoy the lights
- Did not want to sacrifice original “show” that plays to my neighborhood
- Internet users choose brief animations from a website, all lights play that animation
- Streaming webcam allows Internet users to view lights



Was it worth it?

- Started with one article in local newspaper
- Has grown to 3 live television interviews (including Good Morning America), 2 live radio interviews, and 64 newspaper, television, radio, and website articles
- Internet users from all over the world
- Control requests every five seconds, overloaded camera, updated website to allow users to take turns



How does it work?



User clicks link



Arrives at home network



Port forwarding



Arrives Falcon Player



runEventScript



Start sequence



30-second show



Regular show

xLights Animations

- “Regular” sequences for neighbors
 - Sequences for Internet control



“Regular” sequences for neighbours

- Long, fancy sequence created in xLights that is intended for neighbors to watch
- Internet users can watch lights through streaming webcam
- When sequence finishes, Falcon Player repeats it indefinitely



Sequences for Internet control

- Much shorter sequences created in xLights, only 30 seconds long
- Numerous sequences to support different animations that Internet users can choose from
- Playlist setup in Falcon Player that plays short sequence once, then loops the “regular” playlist after that



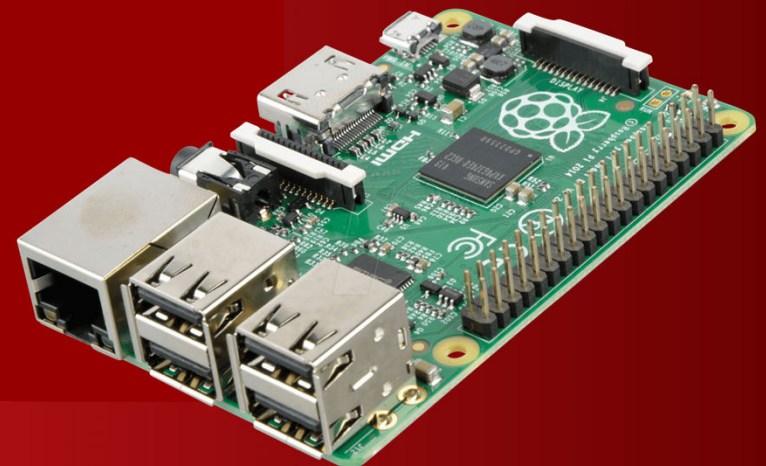
Falcon Player

- Installing FP onto Raspberry Pi
- Uploading sequences & playlists
 - Securing FP from hackers



Installing FP onto Raspberry Pi

- Need
 - Raspberry Pi 2 or 3
 - 8-16G memory card (or larger for large shows)
 - 2A DC micro USB power adapter
- Image that installs Raspberry Pi OS and Falcon Player v1.8 in one step: fpp.bc2va.org/images
- Assign a static IP address
- Falcon Player configuration tips on iTwinkle.org website (under Build It > Internet Control)



Uploading sequences & playlists

1. Use Falcon Player's "Content Setup > File Manager > Sequences" menu to upload sequences (.fseq files)
 - These are found in xLights' "show" directory
 - Upload regular and Internet control animations (pressing [F9] reveals this folder)
2. Create playlist for each sequence that plays Internet control sequence once, then loops regular sequence after that
3. Create bash scripts for each playlist, upload to "Content Setup > File Manager > Scripts" in FP



Securing Falcon Player from hackers

1. Set password for Falcon Player web interface
 - via “Status/Control > Set UI password” menu
2. Set password for Raspberry Pi OS
 - Via “Help > SSH Shell” menu
 - Login as user “fpp/falcon” and execute “sudo passwd fpp” command
3. Disable “root” login for Rpi OS
 - Via www.itwinkle.org website (under “Build It > Internet Control > How to Build It > Configure Falcon Player” menu)
4. Configure FP to receive Internet commands
 - Via www.itwinkle.org website (under same menu as above)
 - Allows RunEventScript.php to run despite FP WI password



Streaming Webcam

- The hardware
- The software



The hardware

- Need
 - Raspberry Pi 2 or 3
 - RPi camera module (do not buy “No IR” version)
 - Male USB connector, long two-wire and Ethernet cables
 - 5.25V USB power adapter
 - Dummy security camera enclosure
- Assembly
 - 3D printed camera adapter and body extender
 - Power RPi through power and ground pins
 - Mount RPi onto plate, attach to battery compartment upside down



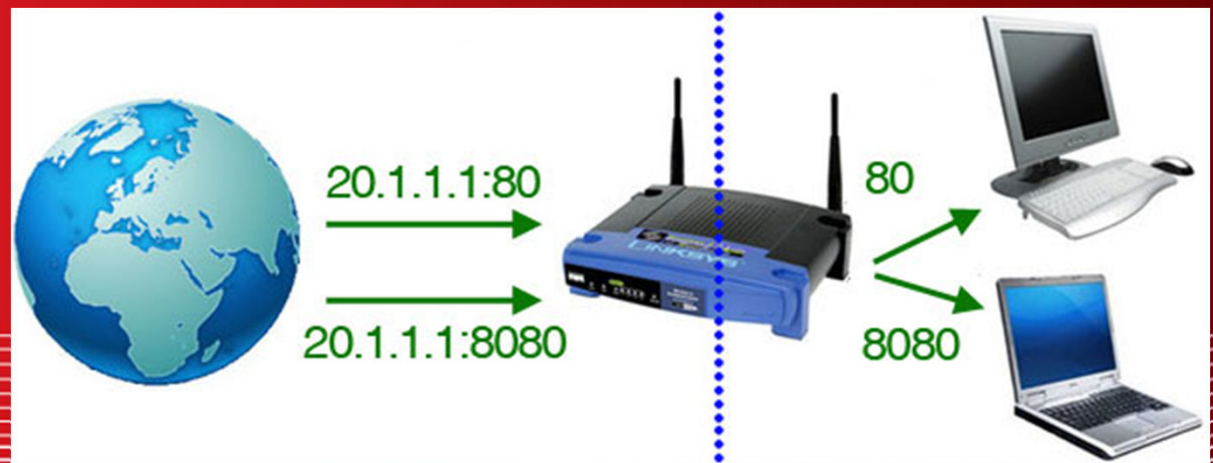
The software

- MotionEyeOS
 - Free streaming and security camera software
 - from <https://github.com/ccrisan/motioneyeos/releases>
 - Save image to microSD with “Win32 Disk Imager”
- Software configuration
 - Set static IP address (not DHCP from router)
 - Set Streaming Port to 8080 (avoid conflict with Fal. Player)
 - Set resolution & frame rate (640x480, 15 FPS allows eight video streams on a 4Mbps Internet upload speed)
 - Set “stream_limit” to stop video stream after x minutes, prevents users from watching video all day



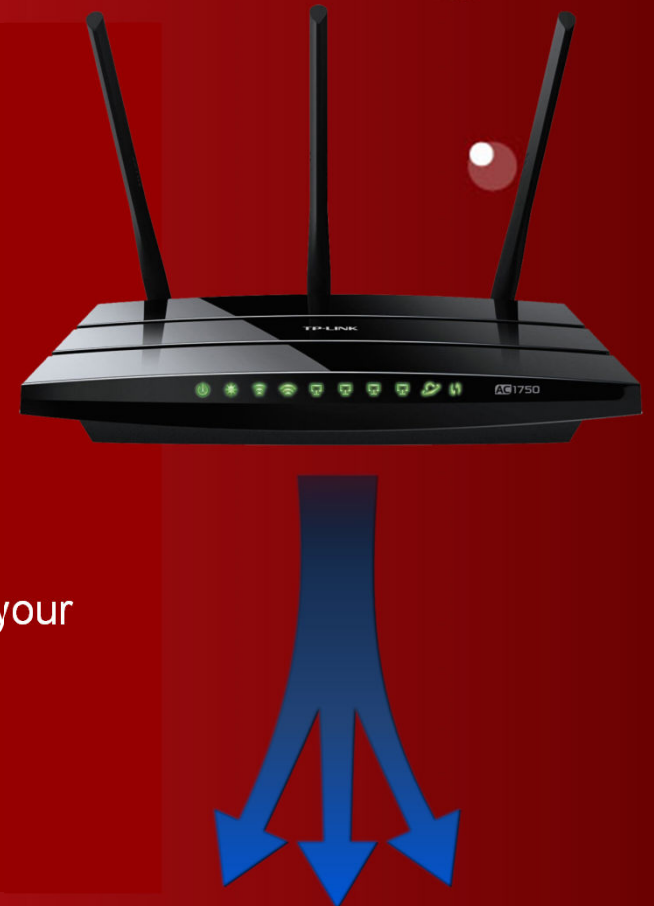
Router and DDNS Settings

- Configuring your Internet router
 - Setting up Dynamic Domain Name Service



Configuring your Internet router

- Falcon Player and webcam are both web servers
- Incoming requests need directed to either device
- Use “port forwarding” feature in your router
 - Access router configuration page via IP address of your computer with a “1” as the fourth number (x.x.x.1)
 - Direct port 80 to the IP address of Falcon Player
 - Direct port 8080 to the IP address of webcam



Setting up Dynamic Domain Name Service

- Internet provider assigns IP address to your house
 - Address changes from time to time
- DDNS assigns a domain name to the IP address so that users can always find your house network
- www.noip.com is a free DDNS service, there are others
 - Install program on your computer to update domain name when IP address changes
 - Must “verify” your account once a month
 - itwinkle.ddns.net goes to Falcon Player
 - itwinkle.ddns.net:8080 goes to webcam



no-ip
The DNS Service Provider

Visitor Website

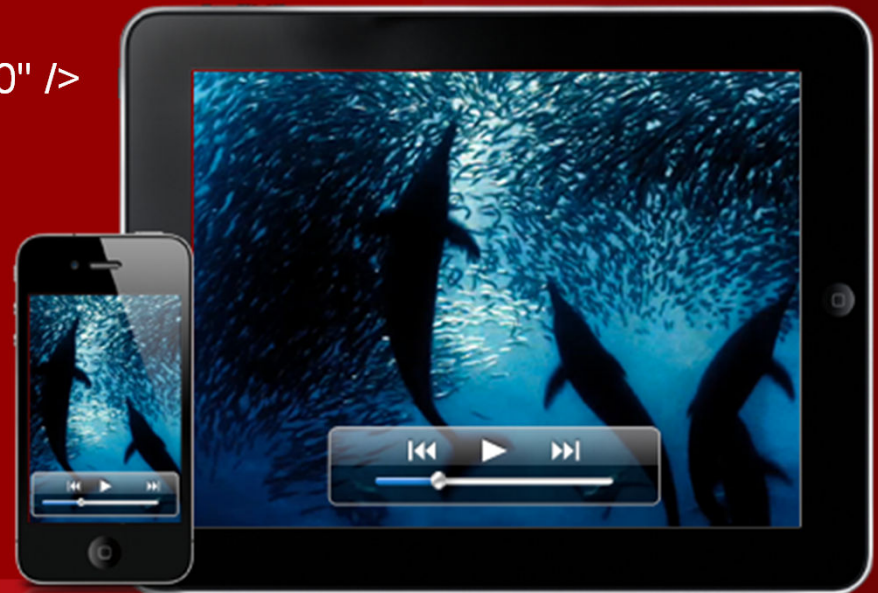
- Webcam streaming video
- Controlling lights from webpage
 - Website traffic problems



iTwinkle.org
CHRISTMAS IS IN THE AIR

Website streaming video

- Create file called index.php, add these lines:
 - `<!DOCTYPE html>`
`<html>`
`<body>`
``
`</body>`
`</html>`
- That's it!



Controlling lights from webpage

- Create bash script on Falcon Player
 - `/opt/fpp/bin.pi/fpp -c stop`
`/opt/fpp/bin.pi/fpp -p "butterfly"`
- Create PHP script on website
 - ```
<?php
$url = "http://itwinkle.ddns.net/runEventScript.php
?scriptName=butterfly.sh";
$headers = @get_headers($url);
?>
```
- Create website link to run PHP script
  - ```
<iframe style="display:none;" name="target"></iframe>
<a href="/butterfly.php" target="target">Butterfly</a>
```



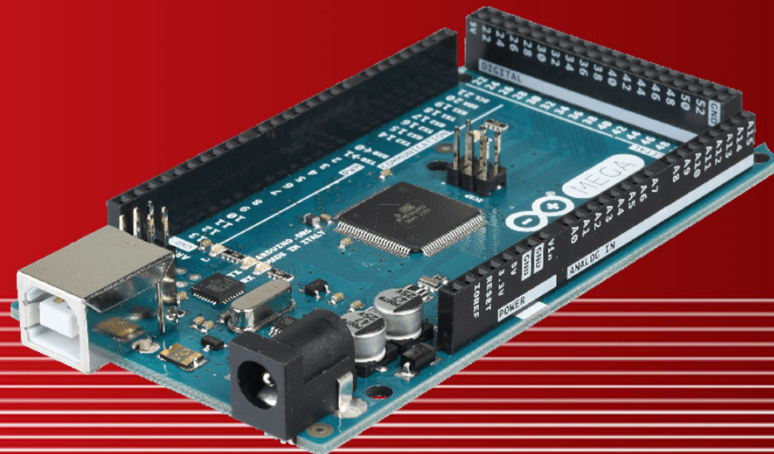
Website traffic problems

- Webcam
 - Fast Internet upload speed, lower streaming resolution
 - Set “stream_limit” to stop video stream after x minutes
- Internet control of lights
 - Website displays log of current location controlling the lights
 - When animation is chosen, choices are disabled for 30 seconds, allows chosen animation to play fully.
 - Future plans: implement queuing system



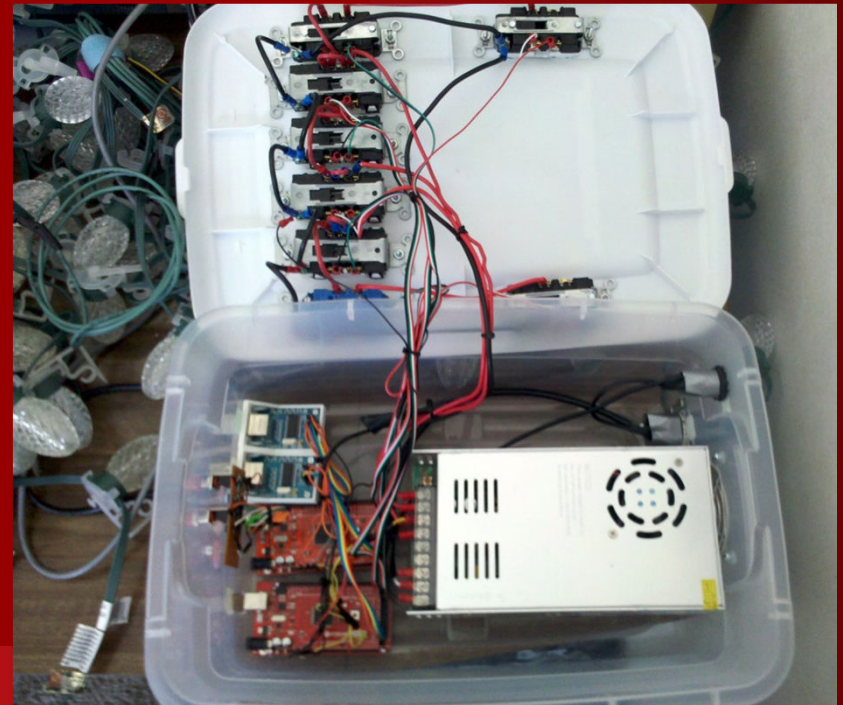
Low-Cost Light Controllers

- Arduino for G.E. Color Effects
- Arduino for WS2811 & “dumb” RGB
- BeagleBone Black for WS2811



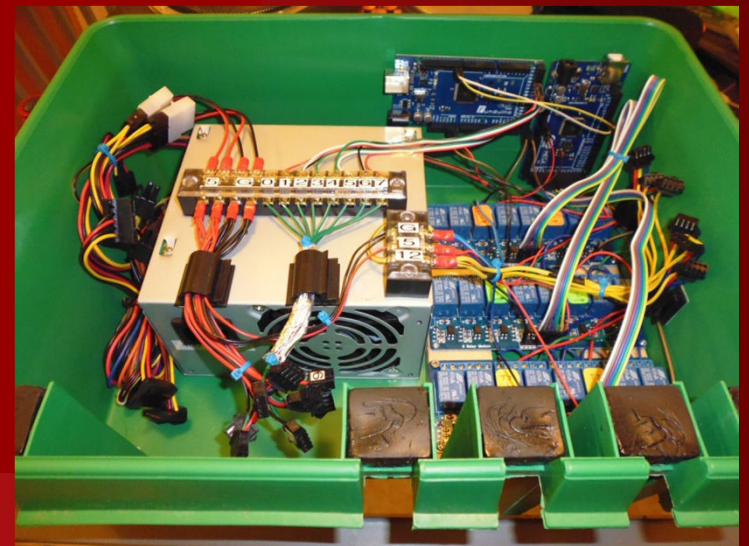
Arduino for G.E. Color Effects

- One Arduino can drive 8 strings of G.E. Color Effects lights (50 lights per)
- Arduino Mega 2560 with Ethernet add-on board
- “Rate Manager” added to Falcon Player to reduce Ethernet data going Arduino



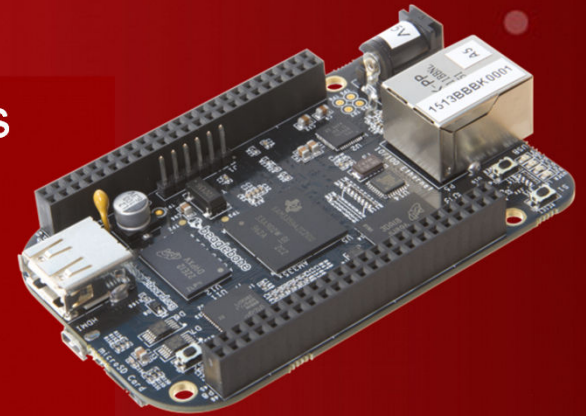
Arduino for WS2811 & “dumb” RGB

- One Arduino can drive 8 strings of WS2811 lights (50 lights per) and 8 strings of dumb RGB lights
- Arduino Mega 2560 with Ethernet add-on board
 - Drives both kinds of strings from one Arduino
- Dumb RGB lights require three relays per string
- “Rate Manager” added to Falcon Player to reduce Ethernet data going Arduino



BeagleBone Black for WS2811

- One BBB can drive 48 strings of WS2811 lights (600 lights per), total of 28,800 lights
- Uses “PixelBone 48” cape
 - <http://tinyurl.com/pixelbone48>
- Falcon Player runs on BBB
- Work-in-progress, building 17-foot “flat” tree with 16 WS2811 strips (2,400 lights)





Summary and Q&A

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