Building SCaLE’s OpenWrt Conference WiFi

Yes...The very network you’re connected to right now

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@sarcasticadmin
July 2022
Tech Team
Conference attendees need WiFi
• Jan 2017 - "Does anyone know how to build OpenWrt?"
History

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- March 2017 - SCaLE 15x
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- July 2022 - SCaLE 19x
## Hardware

~120 consumer "routers"

<table>
<thead>
<tr>
<th>Model</th>
<th>WiFi Chipsets</th>
<th>2.4 GHz</th>
<th>5 GHz</th>
<th>RAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netgear 3700v2</td>
<td>Ath AR9220 + AR9223</td>
<td>b/g/n</td>
<td>a/n</td>
<td>64MB</td>
</tr>
<tr>
<td>Netgear 3800[CH]</td>
<td>Ath AR9220 + AR9223</td>
<td>b/g/n</td>
<td>a/n</td>
<td>64MB</td>
</tr>
</tbody>
</table>
https://github.com/socallinuxexpo/scale-network
SCaLE’s OpenWrt image

16MB max

Kernel: Linux 5.10.89 2022 mips GNU/Linux
Pkgs: Bash, Python, OpenSSH, lldp, tcpdump, rsyslog, apinger, zabbix
Files: Openwrt Configs, ssh keys, etc.

Removed: luci, dropbear, dnsmasq, logd
OpenWrt Flash
Traditional OpenWrt Flash
Solo OpenWrt Flash
Mass OpenWrt Flash
Flash
Flash

Autoflash  OpenWrt Flash
SCaLE’s OpenWrt management

- Custom DHCP options: WiFi Channels and Network Config
- Re-flash APs for any major system updates
- SSH
- Rsyslog and zabbix for observability
Golden Tests

gen_templates $TMPLOC

diff -u -r "golden/$TARGET" $TMPLOC/
Weekly Image Build
## Automated Testing

### Weekly Image Build

This workflow has a `workflow_dispatch` event trigger.

<table>
<thead>
<tr>
<th>Workflow Run</th>
<th>Event</th>
<th>Status</th>
<th>Branch</th>
<th>Actor</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>openwrt-build</code> #64</td>
<td>4 days ago</td>
<td>2h 6m 10s</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td><code>openwrt-build</code> #63</td>
<td>11 days ago</td>
<td>1h 32m 4s</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td><code>openwrt-build</code> #62</td>
<td>18 days ago</td>
<td>1h 50m 9s</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td><code>openwrt-build</code> #61</td>
<td>25 days ago</td>
<td>1h 29m 8s</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td><code>openwrt-build</code> #60</td>
<td>last month</td>
<td>1h 50m 8s</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td><code>openwrt-build</code> #79</td>
<td>last month</td>
<td>1h 31m 3s</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td><code>openwrt-build</code> #78</td>
<td>2 months ago</td>
<td>1h 28m 27s</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td><code>openwrt-build</code> #77</td>
<td>2 months ago</td>
<td>1h 50m 11s</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td><code>openwrt-build</code> #76</td>
<td>2 months ago</td>
<td>1h 50m 10s</td>
<td></td>
<td>...</td>
</tr>
</tbody>
</table>
Automated Testing

Weekly Image Build

openwrt-build openwrt-build #84

Summary

Jobs

- Building openwrt img (ar71xx)
- Building openwrt img (ipq806x)

Triggered via schedule 4 days ago

<table>
<thead>
<tr>
<th>Status</th>
<th>Total duration</th>
<th>Artifacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success</td>
<td>2h 0m 10s</td>
<td>4</td>
</tr>
</tbody>
</table>

openwrt-build.yml

on: schedule

Matrix: Building openwrt img

- 2 jobs completed

Show all jobs

Artifacts

Produced during runtime

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>ar71xx-openwrt-build-artifacts</td>
<td>102 MB</td>
</tr>
<tr>
<td>ar71xx-openwrt-buildlog</td>
<td>45.6 MB</td>
</tr>
<tr>
<td>ipq806x-openwrt-build-artifacts</td>
<td>37.9 MB</td>
</tr>
<tr>
<td>ipq806x-openwrt-buildlog</td>
<td>47.4 MB</td>
</tr>
</tbody>
</table>
Automated Testing

Serverspec

describe file (’/etc/config/network’) do
  it { should exist }  
  it { should be_symlink } 
  it { should be_owned_by ’root’ }  
  it { should be_grouped_into ’root’ } 
end
Automated Testing

Autoflash
Automated Testing

Autoflash

Configuration

Hardware: Raspberry Pi 4, Relay, USB Ethernet Adapter, AP Board
Software: FreeBSD 13, GitLab runner, magic wormhole, and expect
Automated Testing
Automated Testing
Automated Testing
Radio Testing

1. iperf
2. Dogfooding
3. Surveying
Impact

- Stable platform for the conference
- Saves an entire day during show prep
- Autoflash decreased feedback loops from 20+ min to 5 min per test
- 52 serverspec tests being checked on all images
- Enables expanding AP hardware to support more than 1 model with limited overhead
- WiFi radios remaining up if initial boot had no connectivity
- DHCP reservations mismatches and range overlap
- DNS ACL assumptions for Pasadena Convention Center
- Belkin RT3200: WiFi 6
- DAWN: https://github.com/berlin-open-wireless-lab/DAWN
- Automated client WiFi testing in CI
- Advanced surveying process
https://github.com/socallinuxexpo/scale-network
This talk

https://github.com/sarcasticadmin/talks
Thank you