BoF: Challenges of Low Spec Embedded Linux

Embedded Linux Conference, Europe 2019
Goal of this BoF

● Establish a shared mindset amongst participants on what a “Low Spec Linux Device” is in 2019
● Explore various dimensions of “Low Spec Linux” and pinpoint Hotspots that could deserve attention in 2019/20
● Discuss potential Agenda, Topics and Actions for ongoing Linux Low Spec efforts
What is Low Spec Linux in Year 2019?
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- Idea: everything that cannot run a traditional linux desktop distribution could be low spec
- Idea: You wouldn’t be able to use glibc
  - Idea: C++ is not very suitable for low spec
- Idea: Low spec devices are typically build with resources constrained to the level that you need for a specific purpose
- Idea: limited bandwidth from storage to CPU
What are Hotspots of Low Spec Challenges in 2019?

Linux Components (Footprint)

Distributions (Footprint+Velocity)

Other (Development and Mindset)
Component Hotspots

**Bootloader**
- U-Boot

**Init System**
- systemd, sysvinit, proc.d, pantavisor, ...

**Kernel**
- Linux

**Middleware**
- Bus, Bluetooth, Graphics?, Networking?, ...

**libc**
- MUSL, GLIBC, ...

**Container Engines**
- docker, lxc, pantavisor, systemd
Component Hotspots

- graphics
- systemd
- networking
## Linux Distribution Hotspots

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw: Busybox</td>
<td>&lt; 1MB</td>
</tr>
<tr>
<td>OpenWRT</td>
<td>&gt; 2MB</td>
</tr>
<tr>
<td>Alpine</td>
<td>&gt; 2MB</td>
</tr>
<tr>
<td>Yocto</td>
<td>&gt; 3MB (poky-tiny)</td>
</tr>
<tr>
<td>Buildroot</td>
<td>&gt; 700KB</td>
</tr>
<tr>
<td>Debian</td>
<td>&gt; 20MB</td>
</tr>
</tbody>
</table>
Linux Distribution Hotspots

- buildroot
- busybox
- Yocto not so much
- Alpine interesting binary option while still smallish
- Debian not low spec suitable
Development and Mindset Hotspots

**Cross Development**
Toolchains, Build Systems

**Frameworks**
Boost, Qt

**Snapd**
Is this Embedded?

**Higher Level Languages**
Python, Javascript, Rust, ...

**Upstreaming**
no-upstreaming

**Docker**
Cloud is good for Embedded?
Results: Actions & Findings

- What is low spec linux: Low spec devices are those that have lowest BoM cost (which these days is roughly 64M mem & 16M of flash)
- Linux Kernel meets these days requirements for such devices
- Main Focus should be on unbloating Middleware as well as having good tools for keeping low spec devices updated and secured