

There's something on my ARM

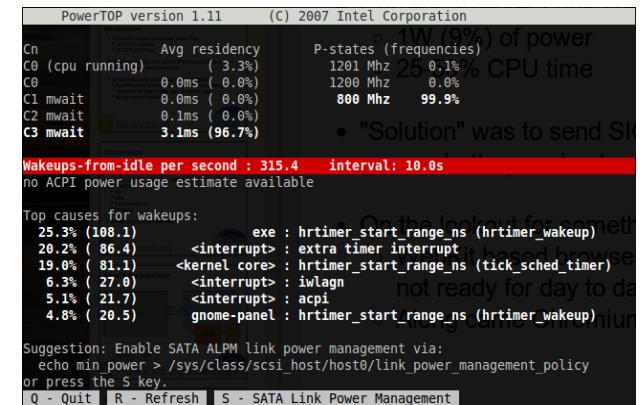
Chromium on the Beagleboard



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Motivation

- Current browser consumes when "idle"
 - 1W (9%) of power
 - 25-50% CPU time



- "Solution" was to send SIGSTOP to browser whenever I was on battery and not using it
- On the lookout for something that will do better
 - WebKit based browsers looked promising, but were not ready for day to date use 10 months ago.
 - Along came Chromium...

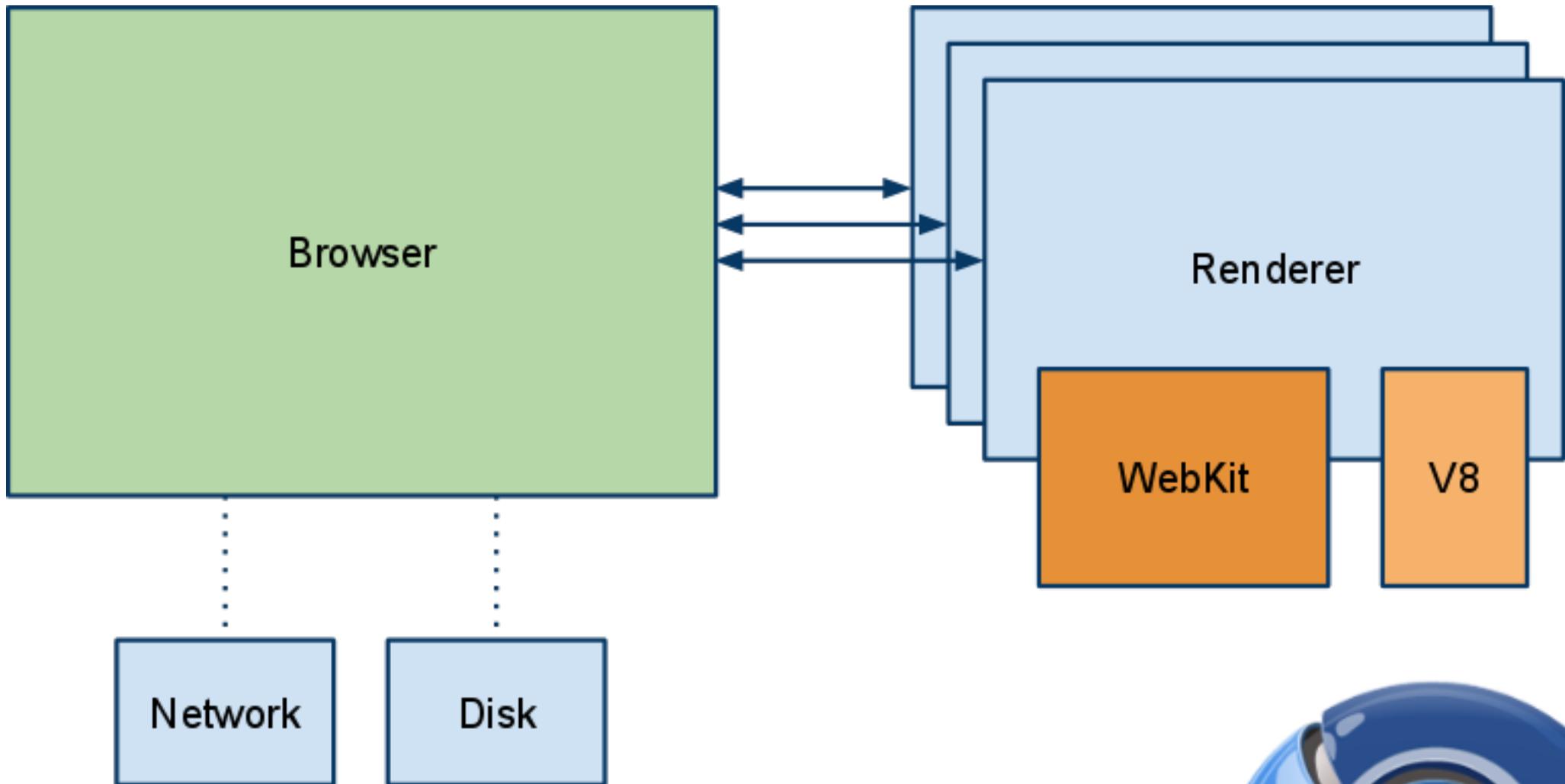


Chromium

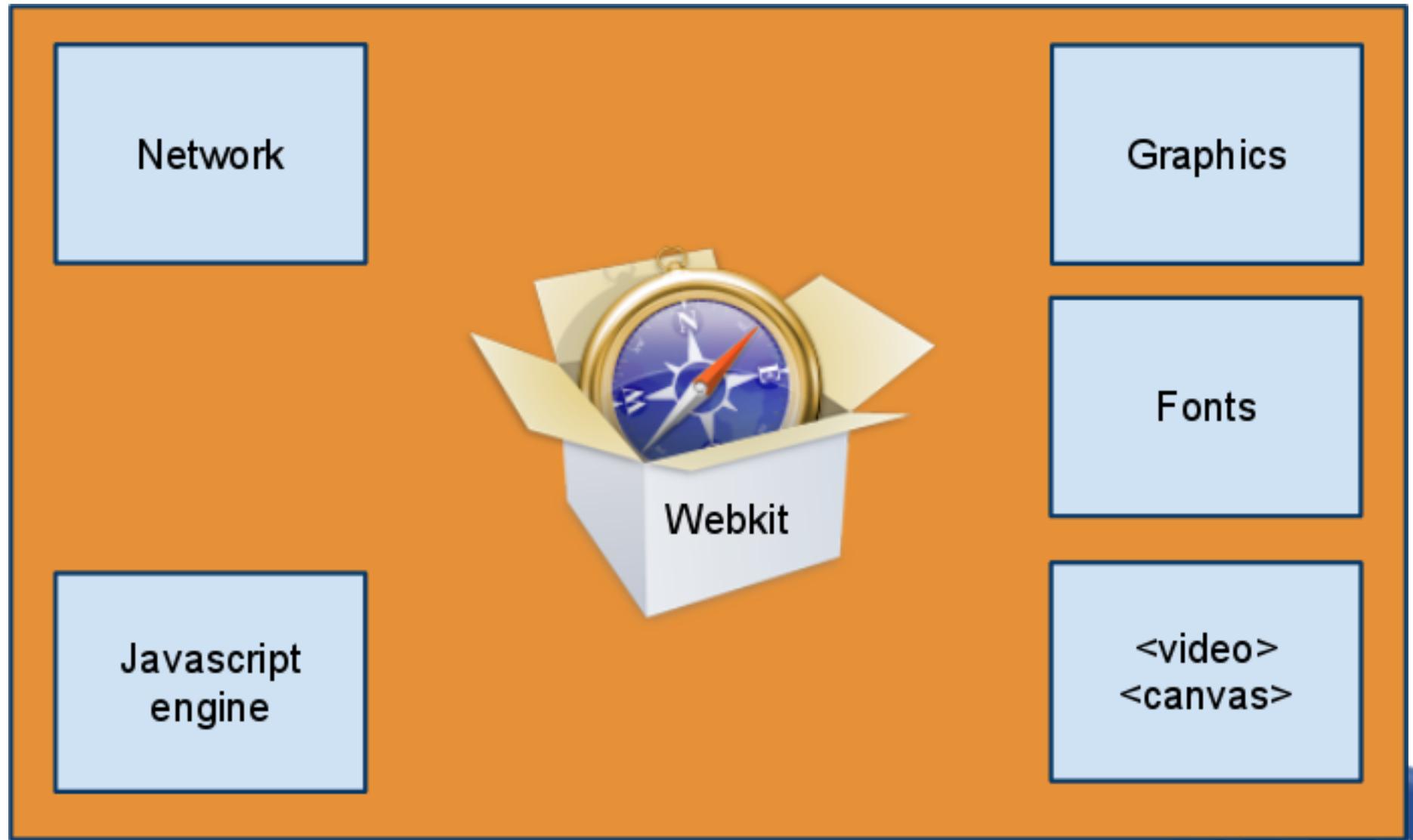
- Open source browser started by Google
 - Now over 200 members, 56 non-Googlers have submitted patches
- Built on other open source software
 - WebKit
 - V8
 - Skia
 - Network library
 - FFmpeg
- Multi process, multi threaded



How it fits together



How it fits together



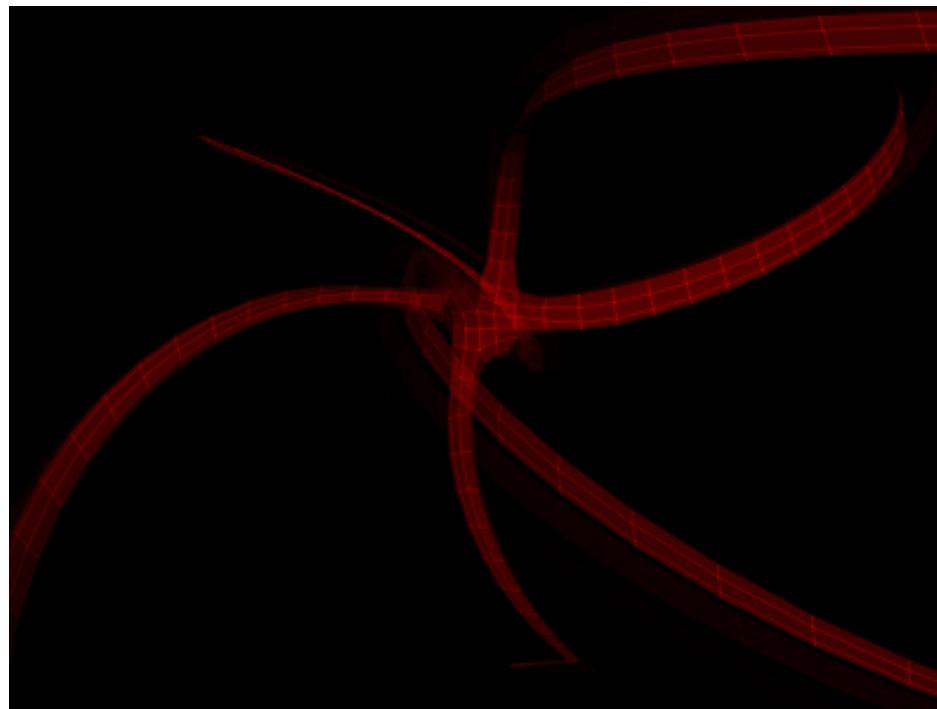
Cool stuff

- Browser
 - Starts faster than gnome-calculator
 - Process isolation
 - Downside is high RAM usage
 - Upside memory is freed when tab is closed
 - Sandboxes are interesting
 - Read LWN
 - Zygotes
 - For stability at update time



Cool stuff

- V8
 - fast startup
 - at build time, core js libs loaded, take snapshot of stack, used to speed start up
 - *fast* at run time
 - Allows javascript 3D rendering engines: [pre3d](#)



Cool stuff

- Rendering
 - Bitmaps stored in X, accelerated scrolling
 - Linux port is on equal or better footing than win, mac

"My three laptops have relatively comparable hardware and run Chrome on Windows, Mac, and Linux respectively. The Linux version of Chrome feels ridiculously faster than Windows and Mac."

- Chromium Developer



Summer of Code

- "Forging a better Cr on Linux"
- Dean, my mentor, was great
 - Code reviews
 - Technical discussions
- Patches
 - Scaling number of X bitmaps based on system memory
 - Re-wrote v8 build scripts to enable ARM port
 - Fixed time conversion code for 64 bit `time_t` on amd64 to help enable 64-bit port
 - Task manager backend for Linux
- Successful in Summer of code
- Now have commit access



Scale the Backing Store

```
// Returns the size of the backing store cache.  
-// TODO(iyengar) Make this dynamic, i.e. based on the available resources  
-// on the machine.  
static int GetBackingStoreCacheSize() {  
- const int kMaxSize = 5;  
- return kMaxSize;  
+ // This uses a similar approach to GetMaxRendererProcessCount. The goal  
+ // is to reduce memory pressure and swapping on low-resource machines.  
+ static const int kMaxDibCountByRamTier[] = {  
+ 2, // less than 256MB  
+ 3, // 256MB  
+ 4, // 512MB  
+ 5 // 768MB and above  
+ };  
+  
+ static int max_size = kMaxDibCountByRamTier[  
+     std::max(base::SysInfo::AmountOfPhysicalMemoryMB() / 256,  
+             static_cast<int>(arraysize(kMaxDibCountByRamTier)) - 1)];  
+ return max_size;  
}
```



Task manager

Page	Private Memory	CPU	Network	Goats Teleported
Browser	172,996K	14	0	14
Tab: Tips for Using the Payment Card - Google Summ	13,172K	0	0	2
Tab: The Colin Walls Blog	19,008K	0	0	8
git Tab: martine's webkit-who at master - GitHub	16,260K	0	0	7
W Tab: Anarcho-syndicalism - Wikipedia, the free encyc	18,564K	0	0	3
Tab: triple j Unearthed - Artist	13,484K	0	0	9
Tab: Texas Instruments leads adoption of IEEE 1149.	16,852K	0	0	8
W Tab: Mobile phones on aircraft - Wikipedia, the free	14,844K	0	0	12
Tab: Business Models for Open Source Hardware De	11,540K	0	0	14
Tab: Digi-Key - 296-23428-ND (Manufacturer - BEAG	13,300K	0	0	10

[Stats for nerds](#) [End process](#)

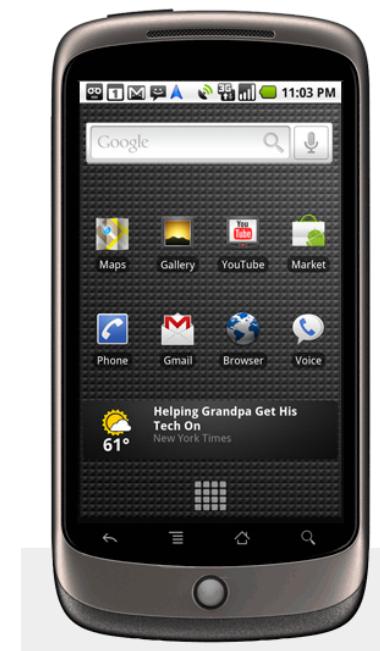


ARM processors

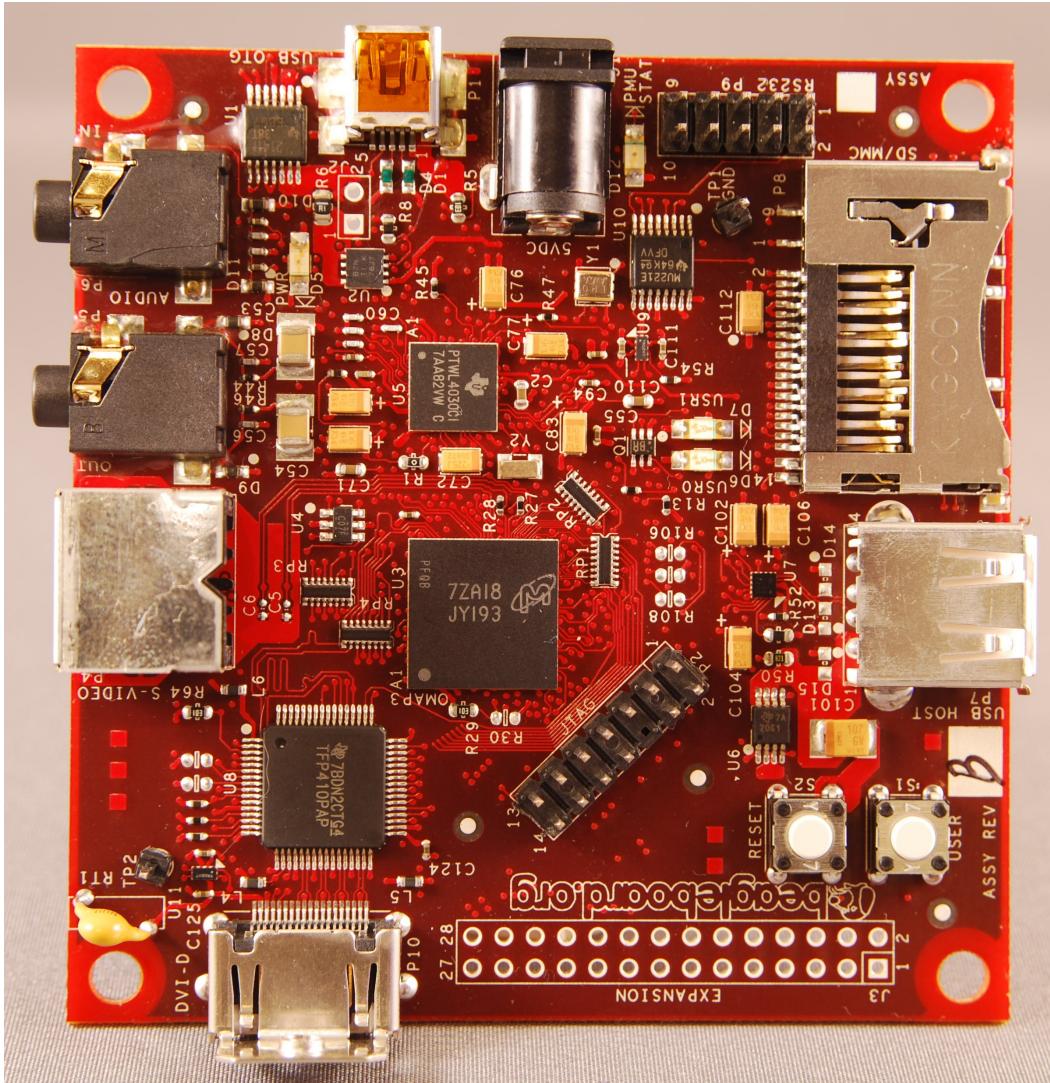
Family	ISA	System on Chip	Products
ARM7	ARMv4		Nintendo DS Gameboy Advance
ARM9	ARMv4, ARMv5	TI OMAP1	Nintendo DS Freerunner (Openmoko) Chumby
ARM11	ARMv6	TI OMAP2 Freescale i.MX31 Qualcomm MSM7200	Nokia N800 HTC Dream
Cortex	ARMv7	TI OMAP3 Freescale I.MX51 Qualcomm Snapdragon	iPhone 3G S Nexus One



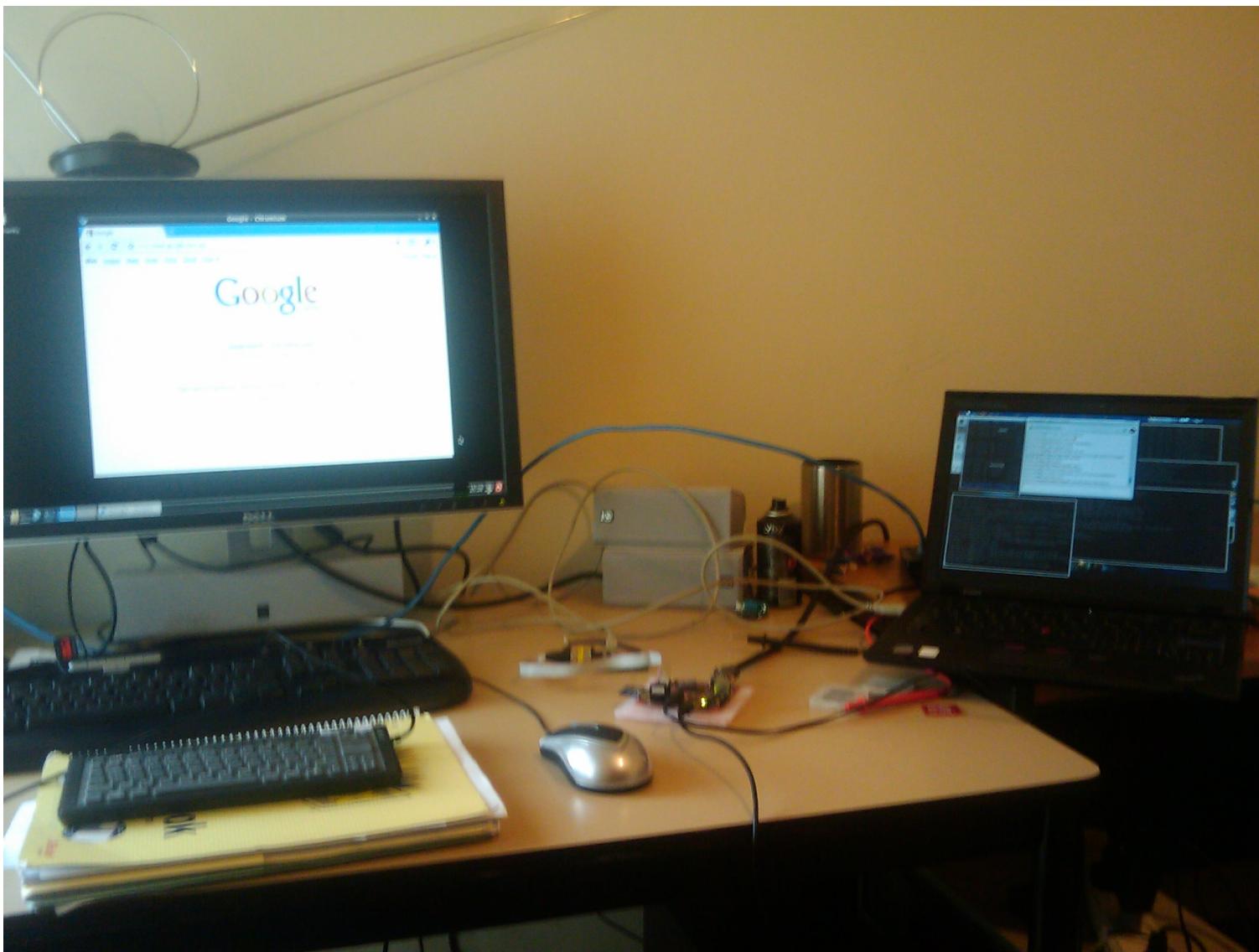
ARM processors



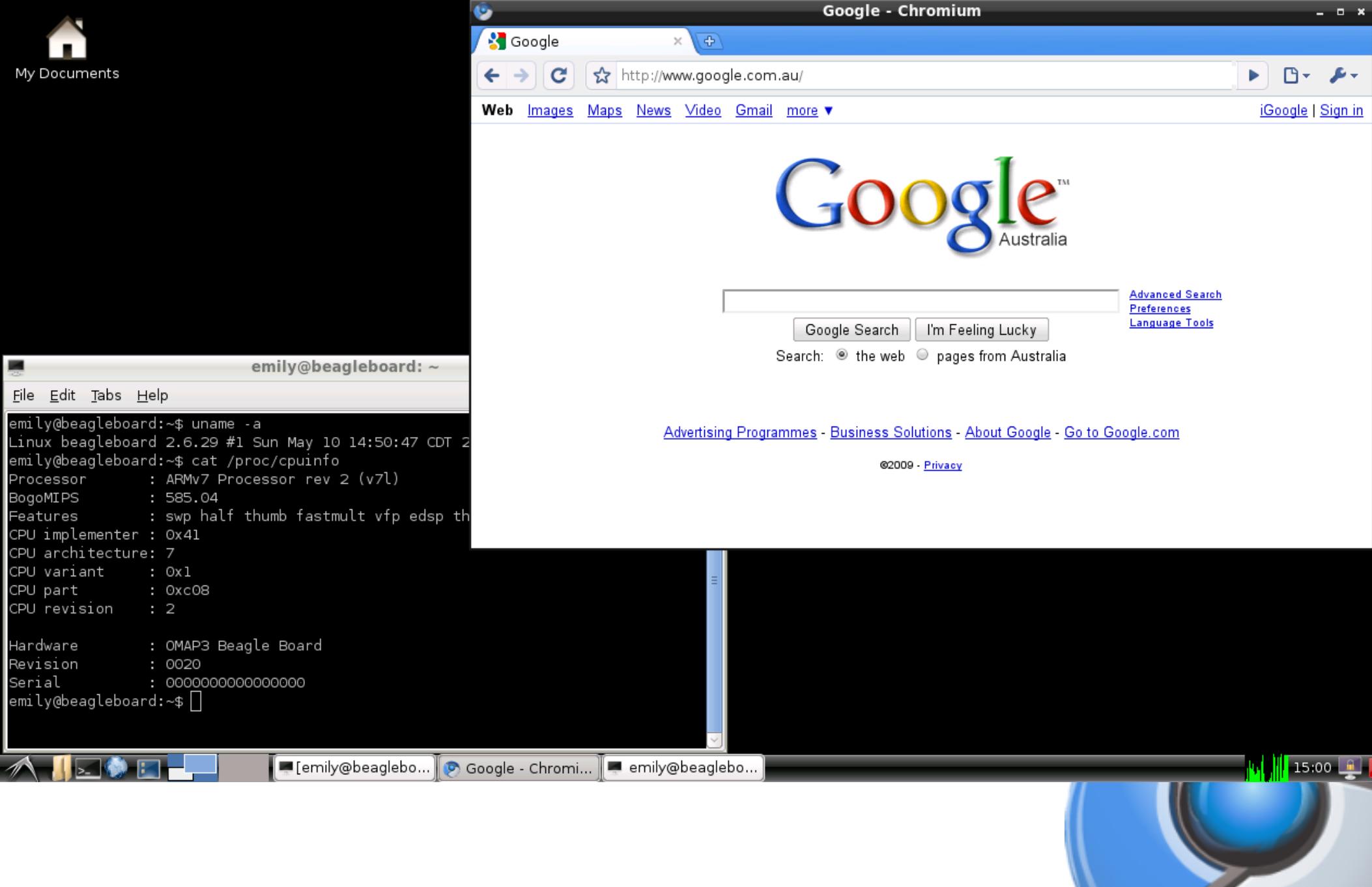
The BeagleBoard



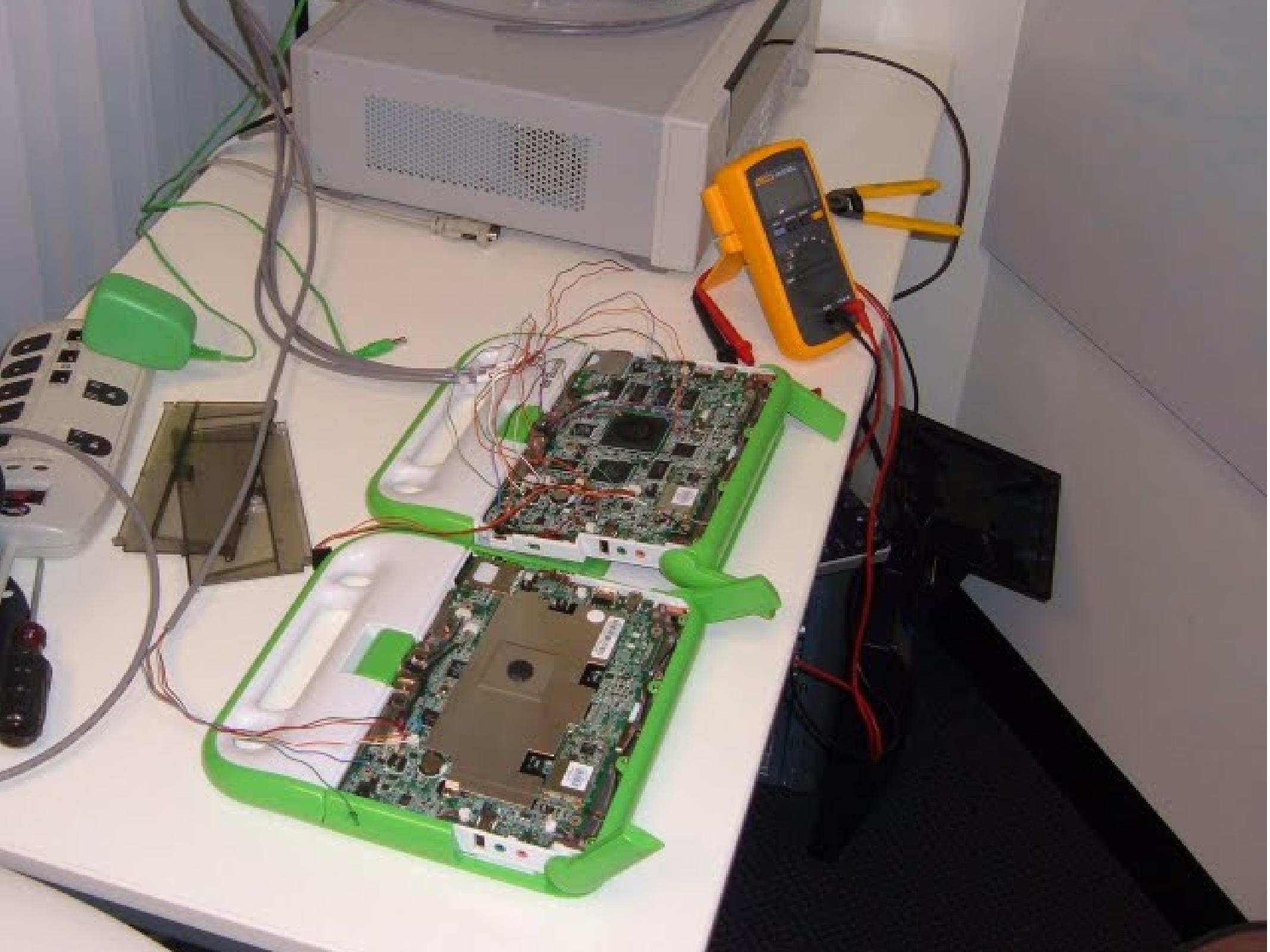
Chromium on the BeagleBoard



Chromium on the BeagleBoard



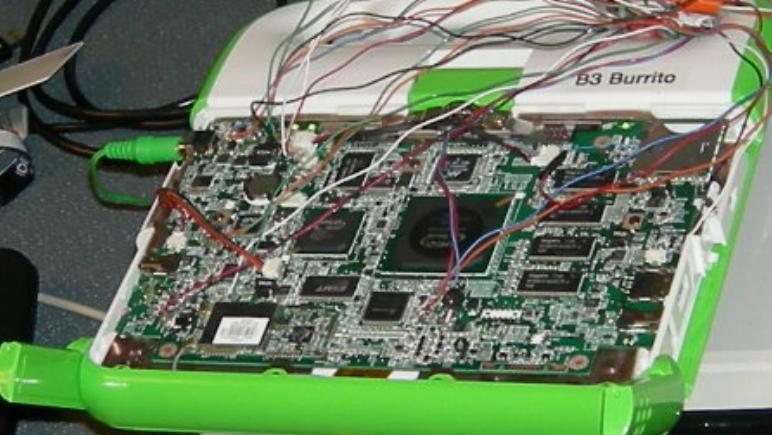




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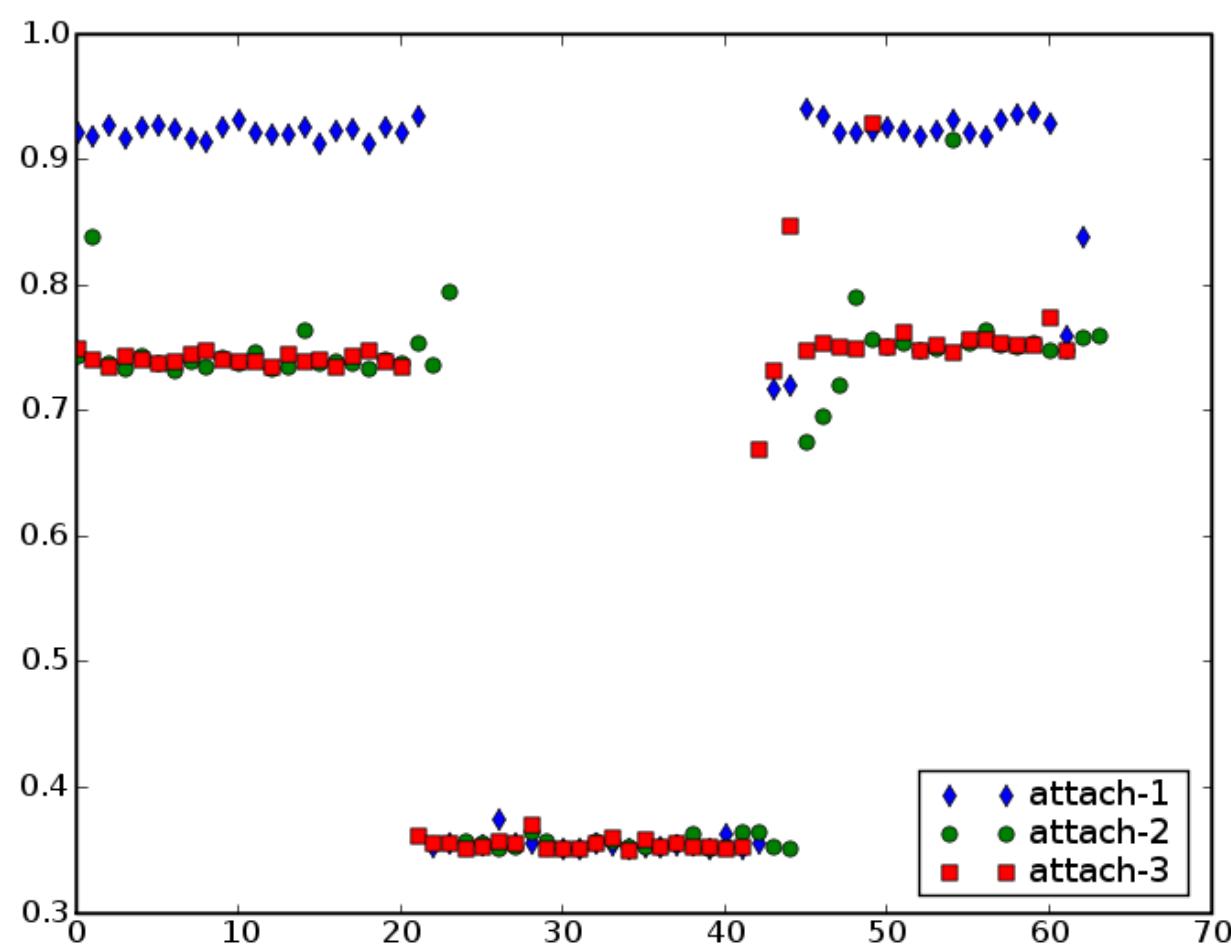
XO Power Measurements

preB3 "Burrito" Q2C17 build 515

Mains: attached

Battery: not present

4:VIN	8:VIN1	3:EC	14:SUS3.3	1:VCORE	15:VMEM	6:WLAN3.3	12:3VPCU	2:LCD1.8	10:LEDPWR	13:LCD	5:DCON2.5	16:DCON1.8	9:CAMERA	17:ACODEC	18:AAMP	19:CAFE2.8	20:CAFE1.2	21:CAFE3.3	23:VCOM	24:3.3	25:+5	26:3M	27:2.5M	28:VCO
6.301488	0.300996	0.049536	0.011780	1.626554	0.000515	0.340741	0.137236	0.021573	0.847980	0.216446	0.191961	0.096771	0.000100	0.171951	0.000101	0.000014	0.051690	0.017764	0.006328	1.119441	0.016126	1.666039	0.729713	2.36609
6.303713	0.305113	0.049603	0.011386	1.626764	0.002222	0.340658	0.137004	0.021798	0.847549	0.217327	0.191670	0.096595	0.000154	0.172148	0.000051	0.000154	0.051695	0.017614	0.006328	1.119157	0.016466	1.666210	0.729762	2.36657
6.304743	0.302851	0.049502	0.011914	1.626689	0.002326	0.340741	0.137572	0.021708	0.847836	0.217176	0.191658	0.096553	0.000234	0.171951	0.000177	0.000043	0.051905	0.017601	0.006495	1.119541	0.017937	1.665721	0.729419	2.36654
6.298856	0.304972	0.049603	0.011921	1.626469	0.003550	0.340800	0.138072	0.021748	0.848265	0.216751	0.192227	0.096580	0.000117	0.172031	0.000101	0.000099	0.051660	0.017547	0.006428	1.118756	0.016353	1.665337	0.729084	2.36626
6.301883	0.303005	0.049586	0.011654	1.626578	0.003677	0.340774	0.136854	0.021635	0.84															
6.295061	0.307870	0.049636	0.011927	1.626857	0.009840	0.340674	0.137906	0.022015	0.84															
6.298127	0.307511	0.049452	0.011907	1.626712	0.009893	0.340808	0.137672	0.021637	0.84															
6.298566	0.303712	0.049619	0.011453	1.626784	0.009461	0.340774	0.136904	0.021617	0.84															
6.302056	0.307037	0.049536	0.011854	1.625716	0.009756	0.340758	0.137705	0.021794	0.84															





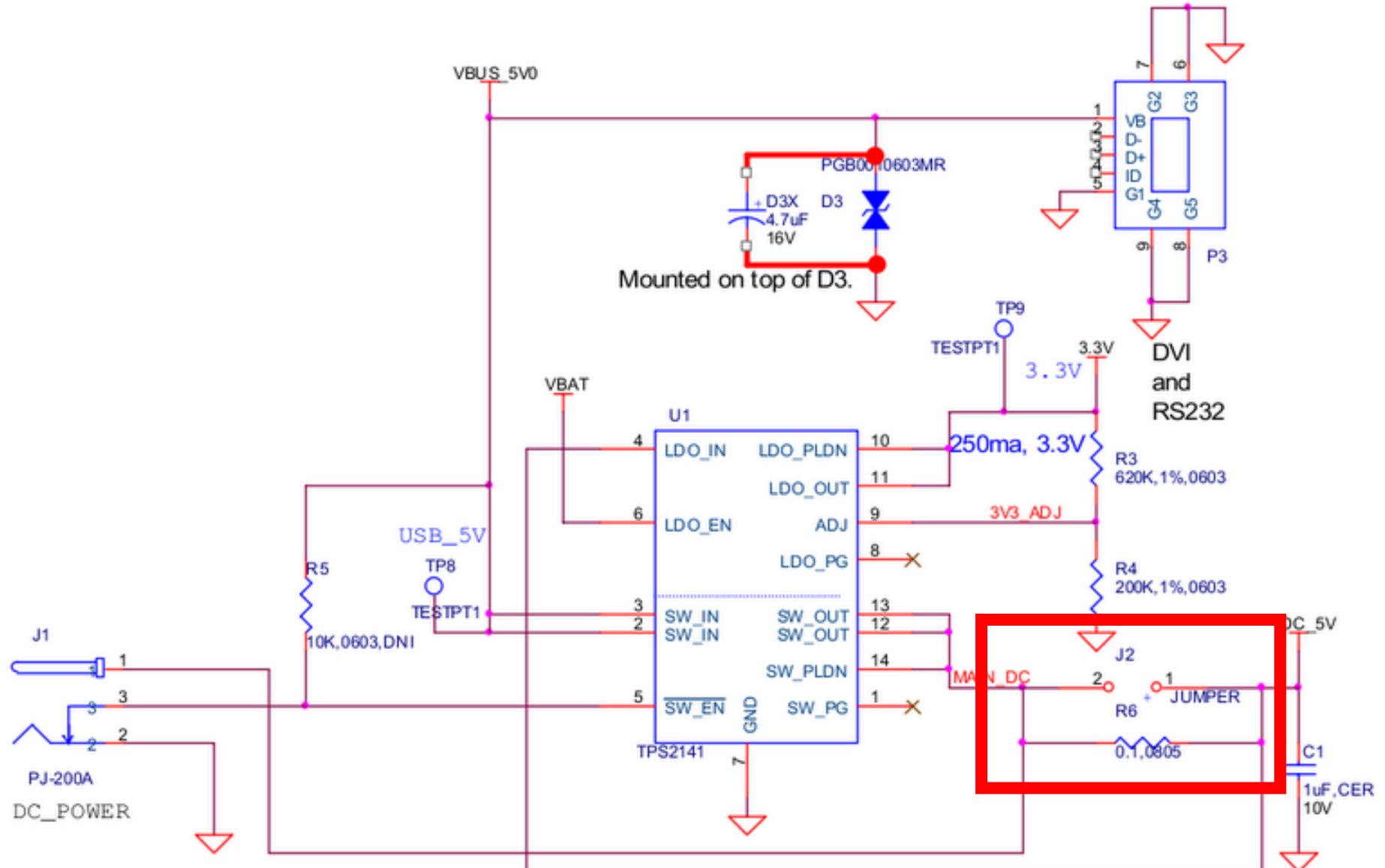
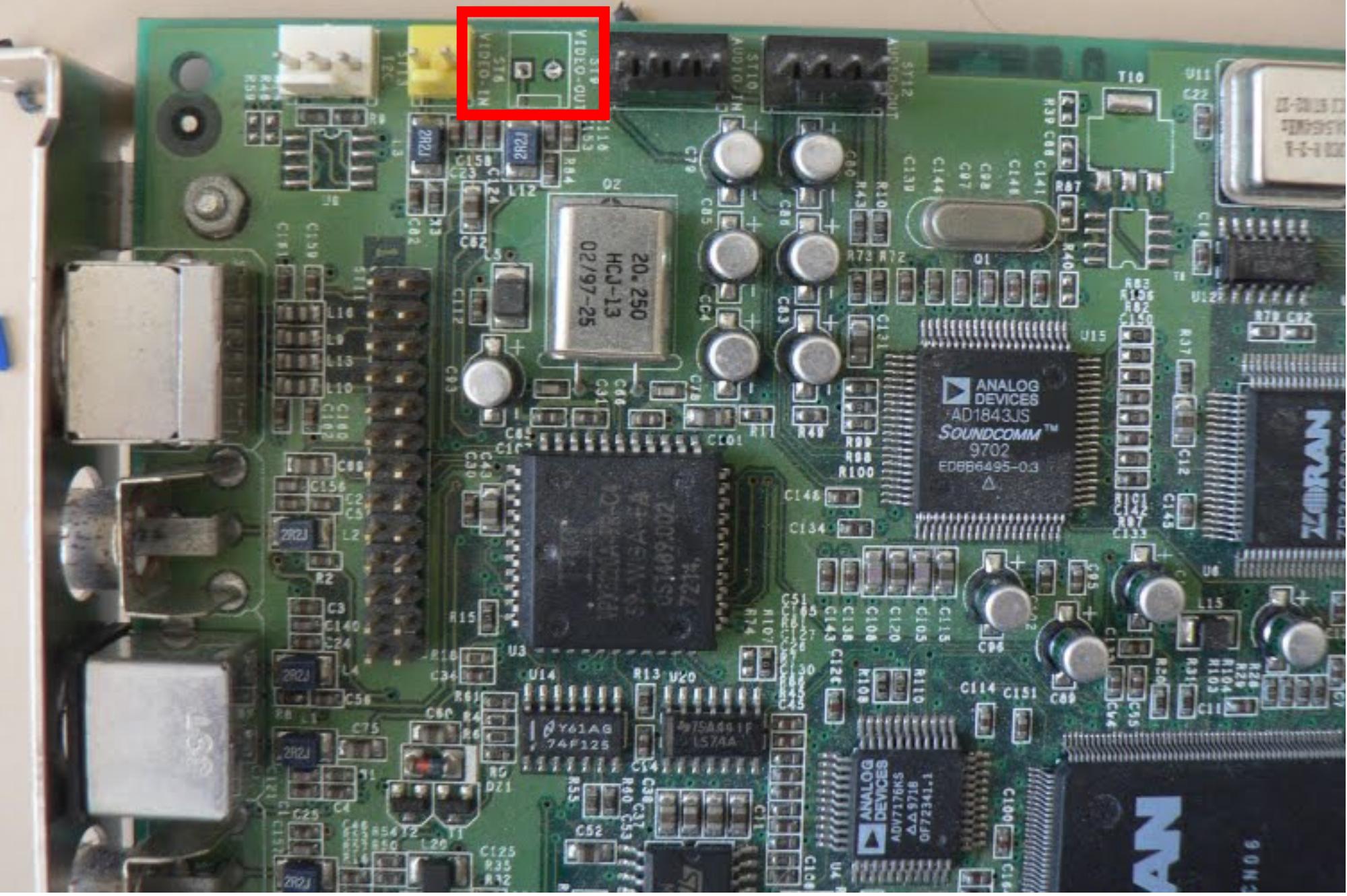
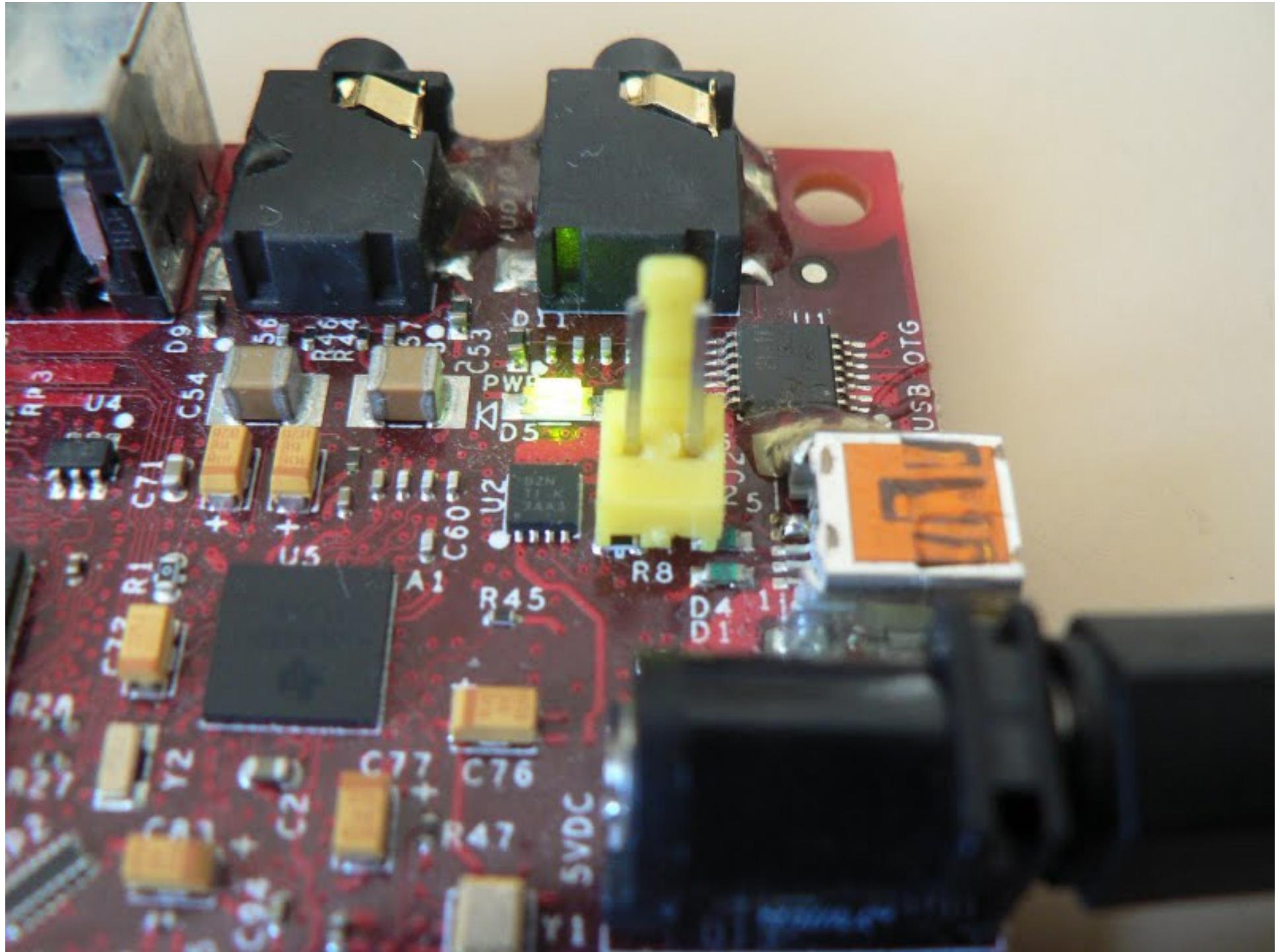
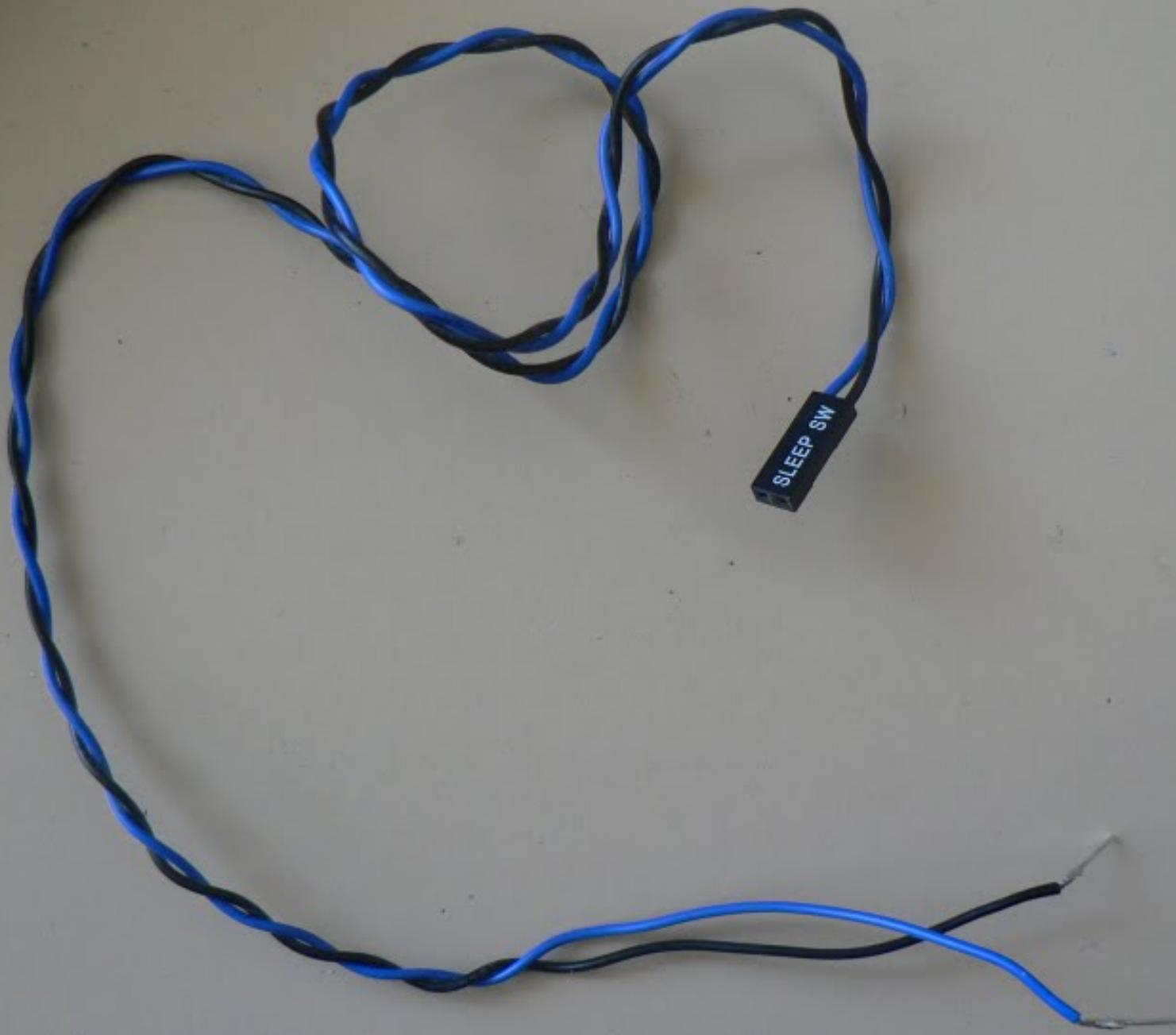
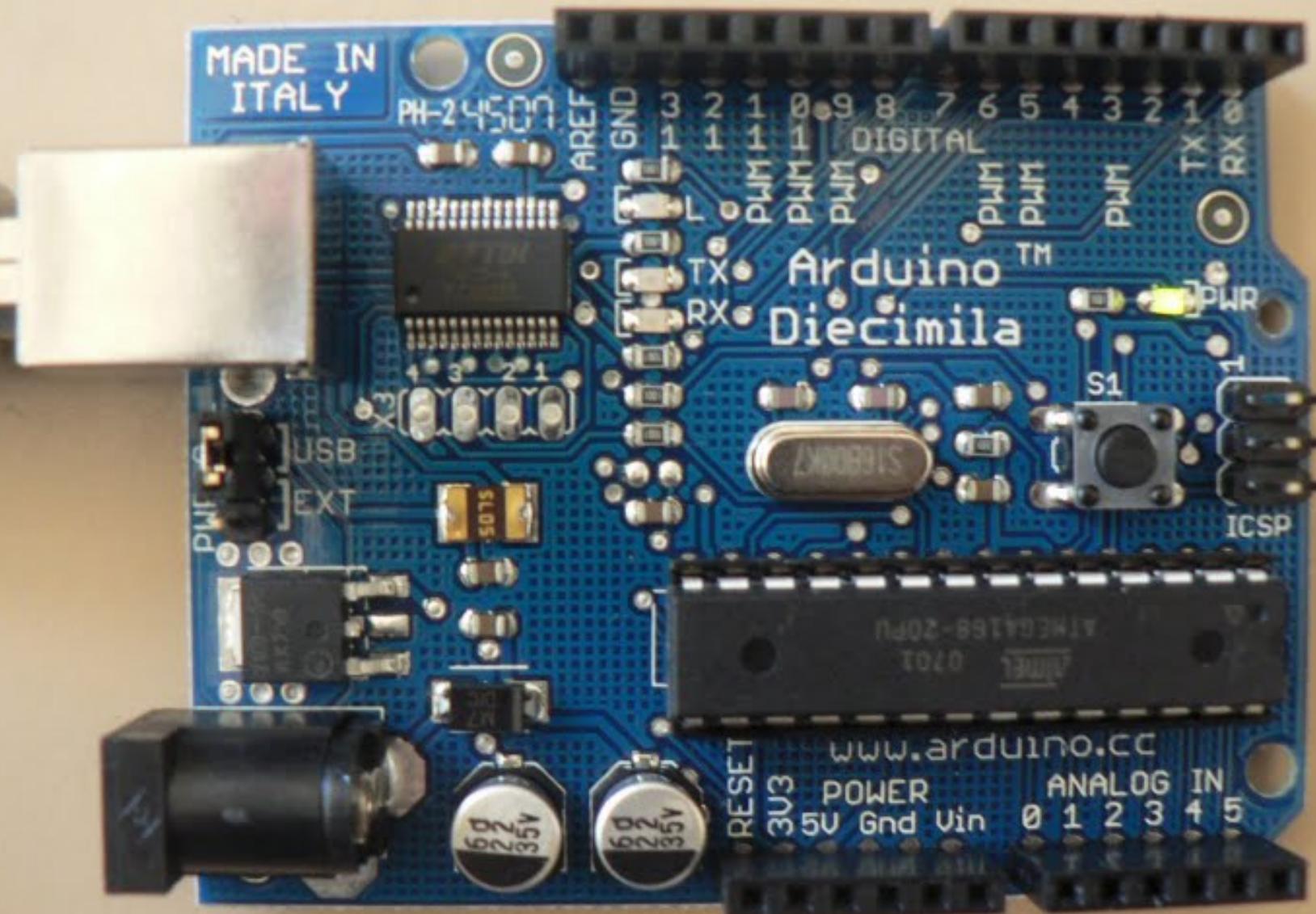


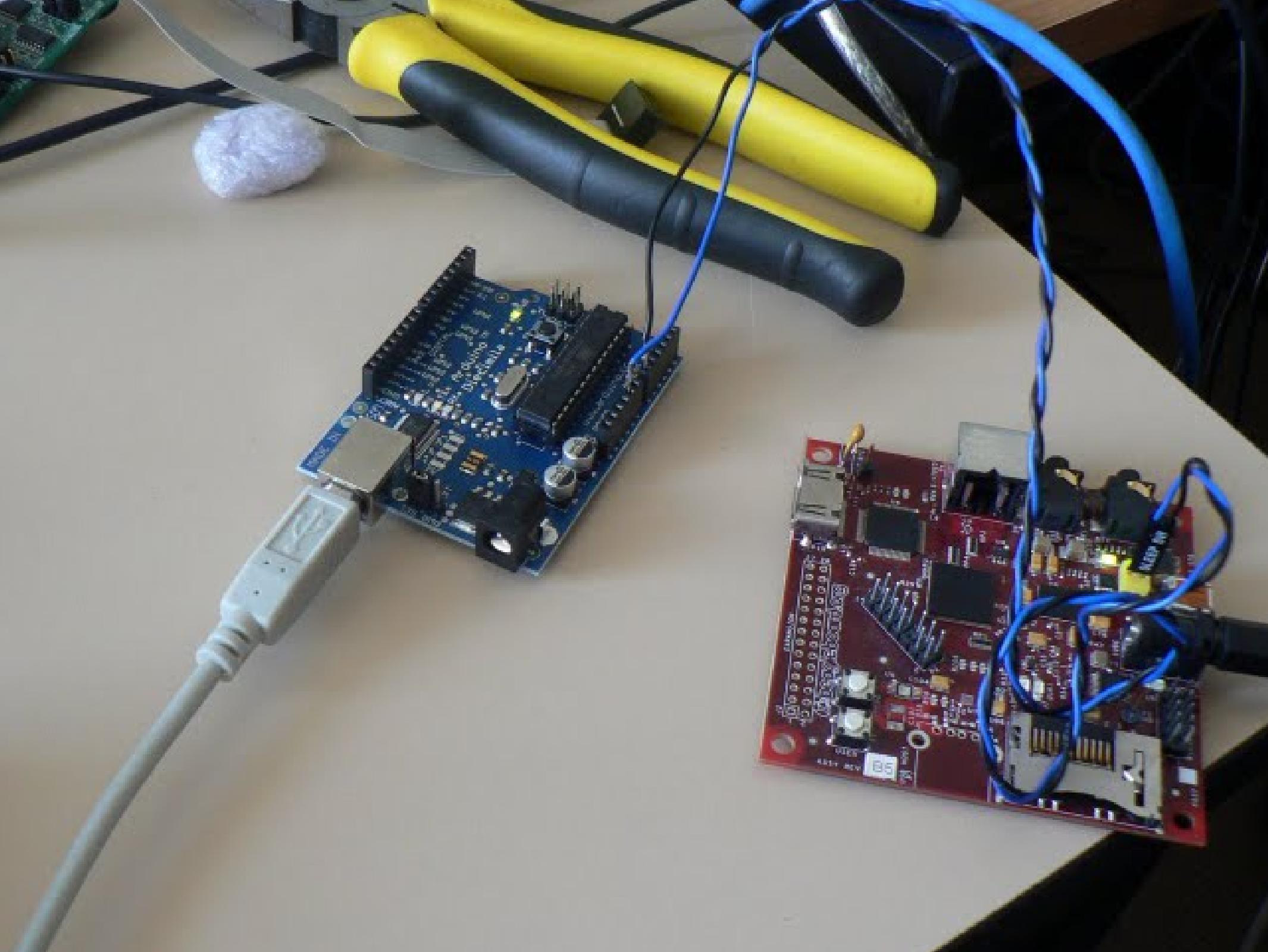
Figure 19. Input Power Section











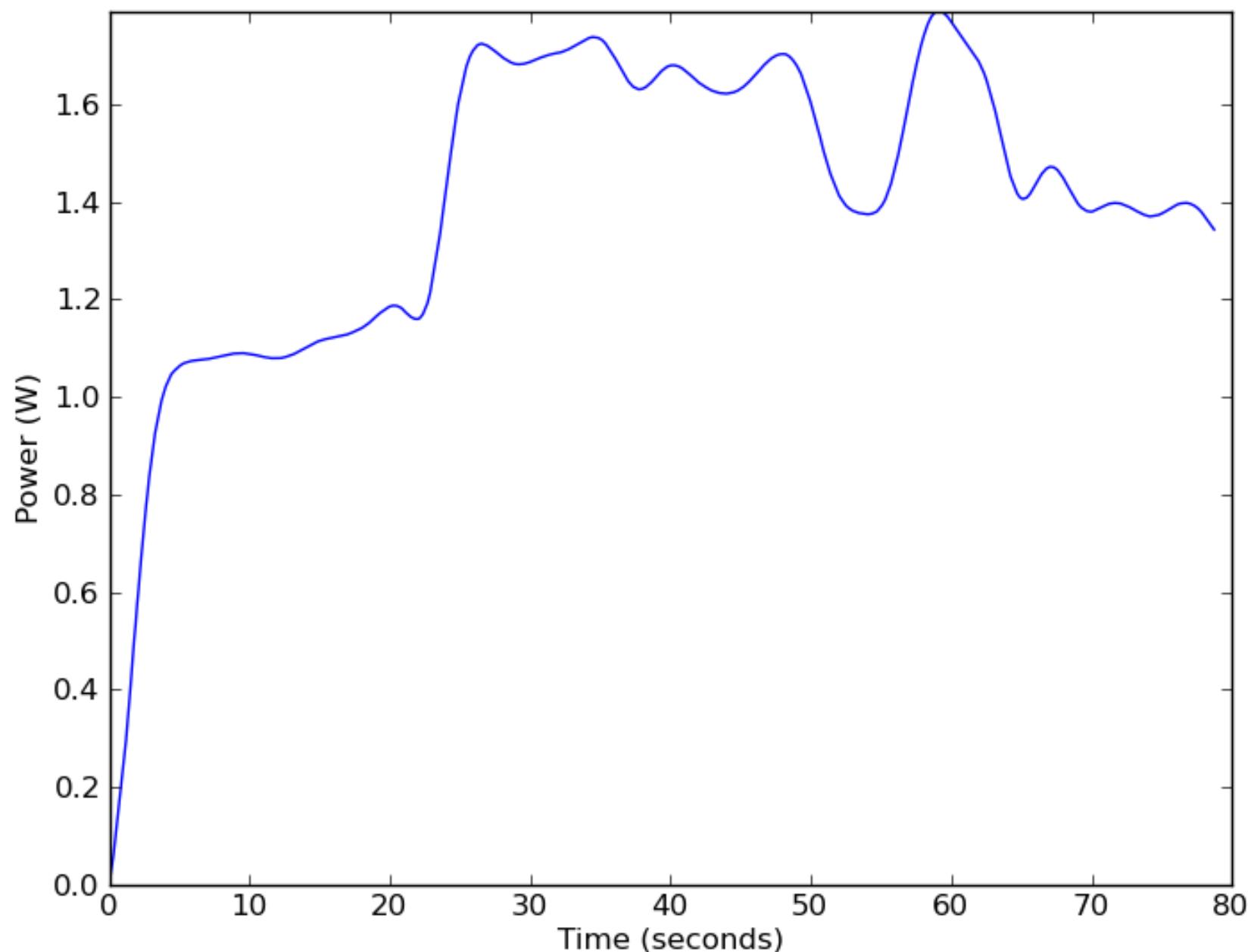
The screenshot shows the Arduino IDE interface with the following details:

- Menu Bar:** File, Edit, Sketch, Tools, Help.
- Toolbar:** Includes icons for play, stop, upload, download, and other common functions.
- Title Bar:** Displays "AnalogInSerial §".
- Code Editor:** Contains the following C++ code for the "AnalogInSerial" sketch:

```
void setup() {
  Serial.begin(9600);
  analogReference(INTERNAL);
}

void loop() {
  // read the analog input into a variable:
  int analogValue = analogRead(0);
  // print the result:
  Serial.println(analogValue);
  // wait 10 milliseconds for the analog-to-digital converter
  // to settle after the last reading:
  delay(10);
}
```
- Serial Monitor:** A window at the bottom showing a black screen with a small blue header bar.
- Page Number:** The number 15 is visible at the bottom left corner of the IDE window.

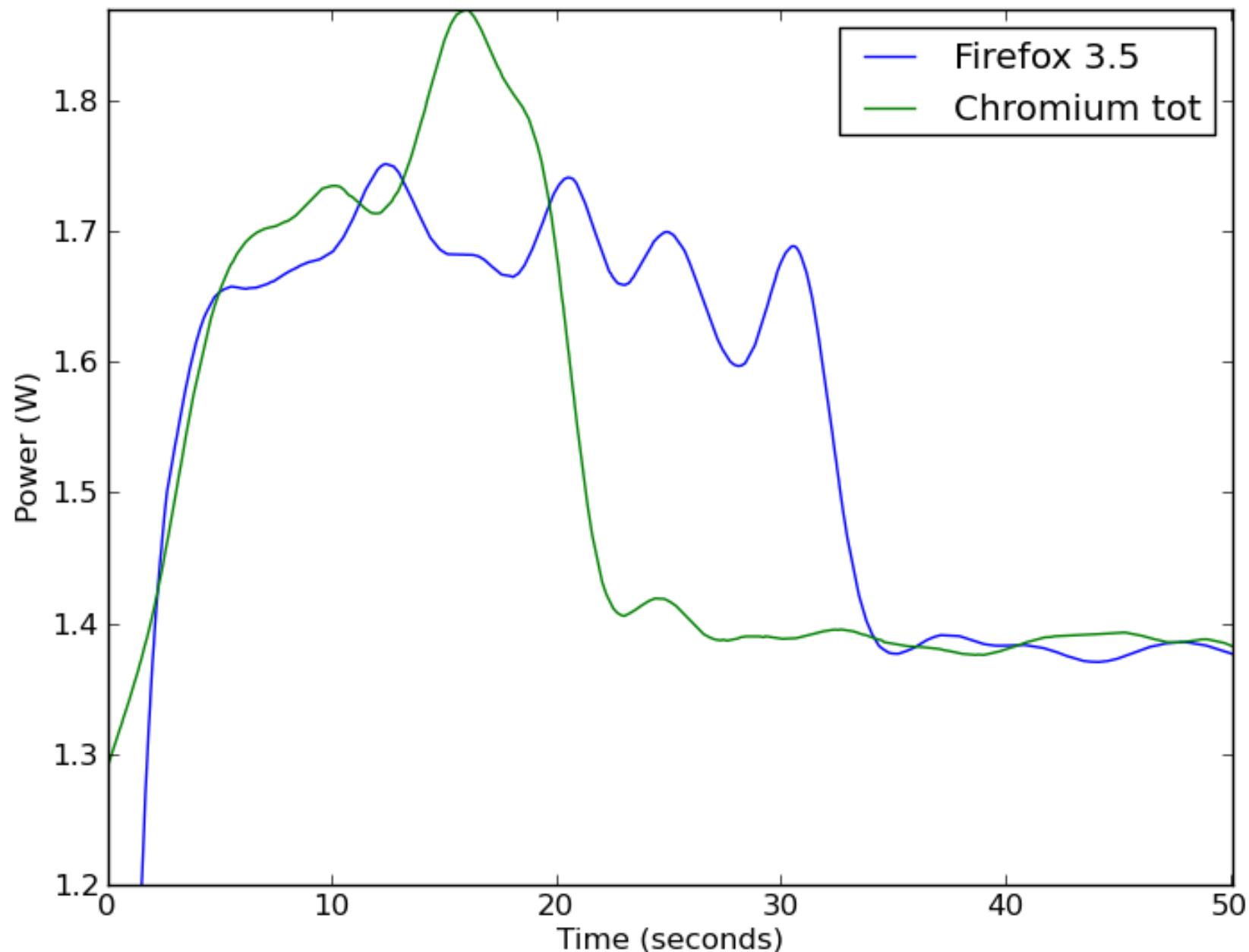
System power consumption: cold boot to idle desktop



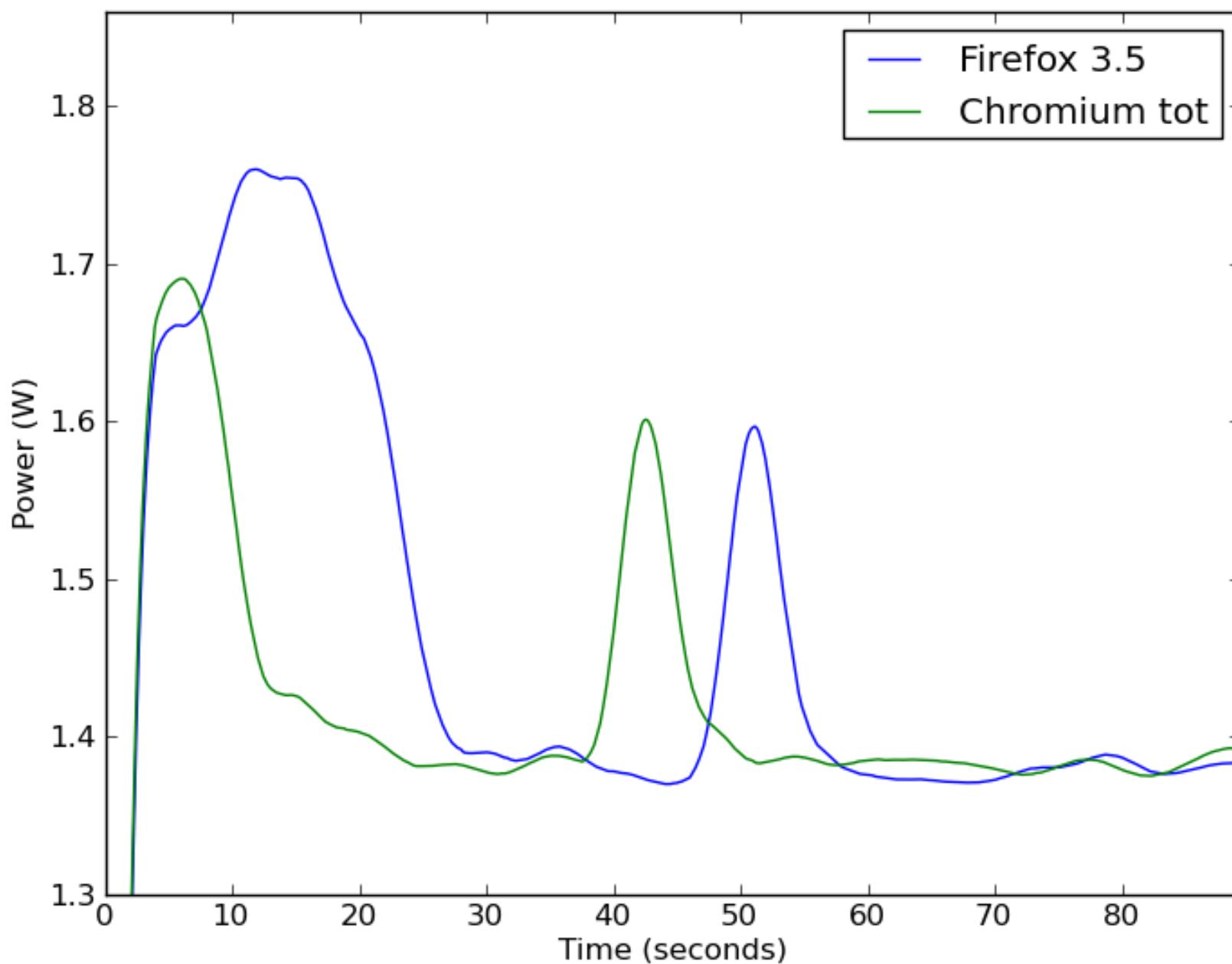
Browser power consumption

- Firefox 3.5 (Ubuntu Karmic, -march=armv7)
- Chromium top-of-tree (-march=armv7-a -mthumb)
- USB hub with network, keyboard, mouse
- DVI monitor, 1280x1024 @ 60Hz, 16-bit

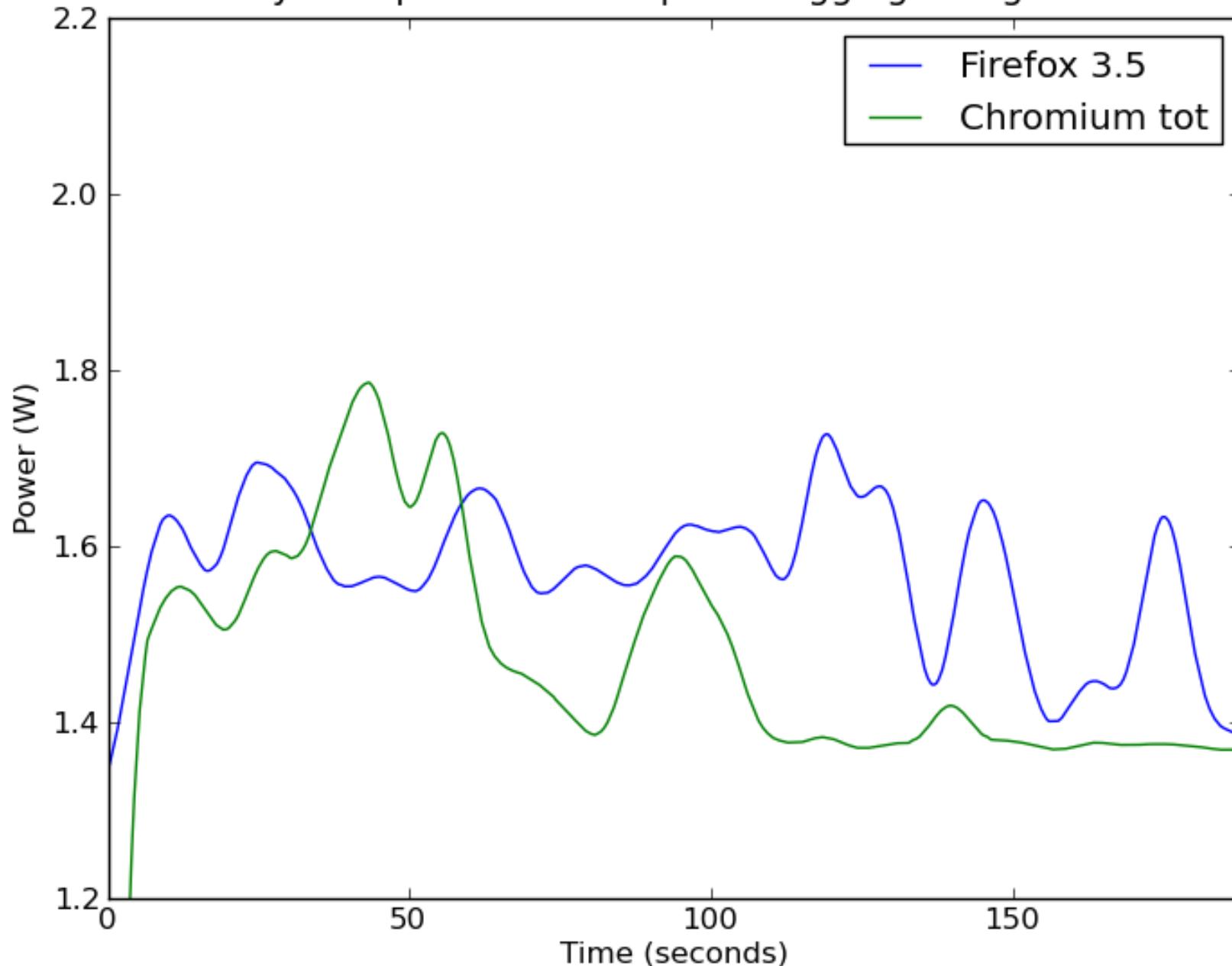
System power consumption: browser cold start



System power consumption: browser warm start

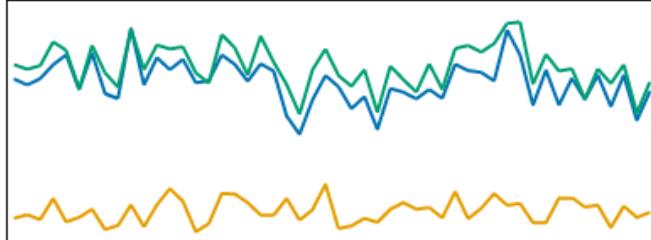


System power consumption: logging into gmail





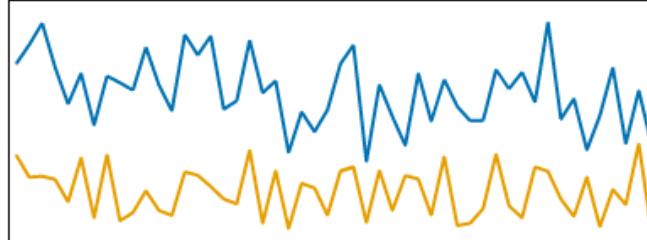
Page Cycler Moz



Legend: t, t_ref, t_extcs1

move mouse over graph Shift-click to place baseline

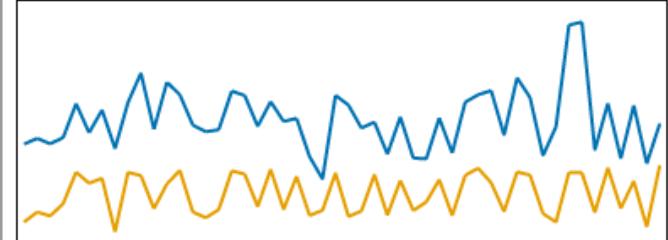
Page Cycler Intl1



Legend: t, t_ref

move mouse over graph Shift-click to place baseline

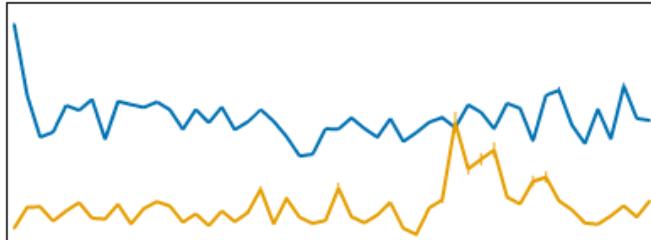
Page Cycler Intl2



Legend: t, t_ref

move mouse over graph Shift-click to place baseline

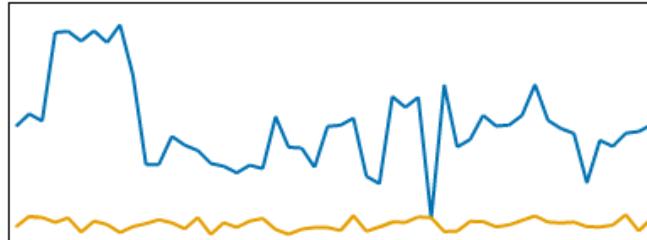
Page Cycler Moz - HTTP



Legend: t, t_ref

move mouse over graph Shift-click to place baseline

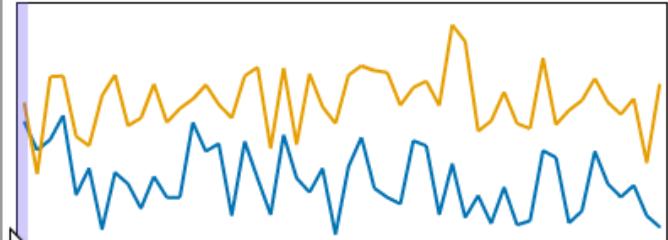
Bloat - HTTP



Legend: t, t_ref

move mouse over graph Shift-click to place baseline

Page Cycler DHTML



Legend: t, t_ref

r32899: 7012.00 ms +/- 10.14 Shift-click to place

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