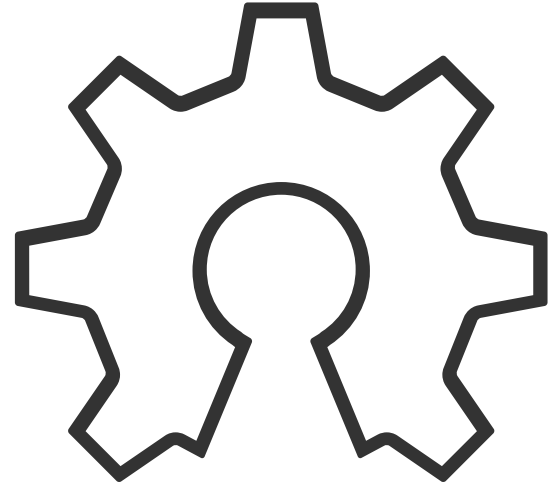
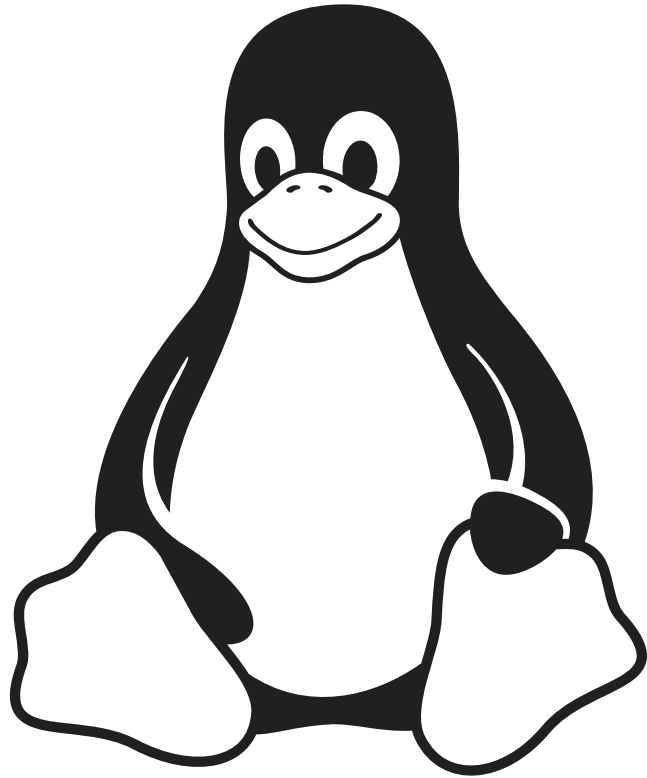


# **The Road to Fully Open Hardware Mobile Computing**



**Keynote by Lukas F. Hartmann  
MNT Research GmbH — <https://mntre.com>  
FSIC2023, Paris**



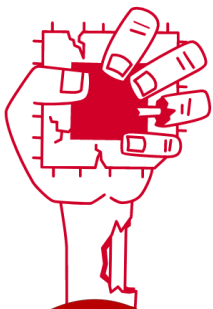
**open source  
hardware**

In September 2017, Google security researcher Cfir Cohen reported a vulnerability to AMD of a PSP subsystem that could allow an attacker access to passwords, certificates, and other sensitive information; a patch was made available to vendors in December 2017.<sup>[10][11]</sup>

In March 2018, an Israeli firm related to the PSP in AMD's that could allow malware to firmware updates to handle upheld by independent security claimed by CTS Labs were the purpose of stock manipulation.

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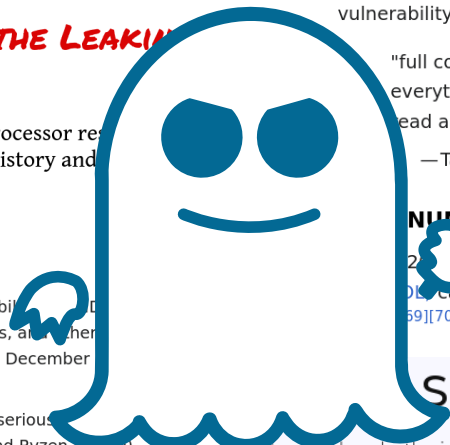
In March 2018, an Israeli security company reported a handful of allegedly serious vulnerabilities related to the PSP in AMD's architecture CPUs (EPYC, Ryzen, Ryzen Pro, and Ryzen Mobile) that could allow malware to run and gain access to sensitive information.<sup>[12]</sup> AMD announced firmware updates to handle these flaws.<sup>[13][14]</sup> Their validity from a technical standpoint was upheld by independent security claimed by CTS Labs were the purpose of stock manipulation.



## ZOMBIELOAD ATTACK

RETURN OF THE LEAKING  
DEAD

Watch out! Your processor reveals  
private browsing-history and  
data.



## THUNDERCLAP

Modern computers are vulnerable  
to malicious peripheral devices

### SA-00075 (a.k.a. Silent Bob is Silent) [\[edit\]](#)

In May 2017, Intel confirmed that many computers with AMT have had an unpatched critical privilege escalation vulnerability (CVE-2017-5689).<sup>[38][51][36][52][53]</sup> The vulnerability, which was nicknamed "Silent Bob is Silent" by the researchers, affects numerous laptops, desktops and servers (Hewlett Packard Enterprise and HP Inc.), Intel, IBM, and Microsoft breaks a fundamental isolation between user applications and the operating system.<sup>[58][59][60]</sup> Those researchers claimed that the vulnerability allowed a program to access the memory, and other reports claimed the bug also affects the BIOS. The vulnerability was described as giving remote attackers "full control of affected machines, including the ability to install persistent malware (rootkits) in firmware and read and modify any data."

—Tatu Ylonen, *ssh.com*<sup>[54]</sup>

### NUMA [\[edit\]](#)

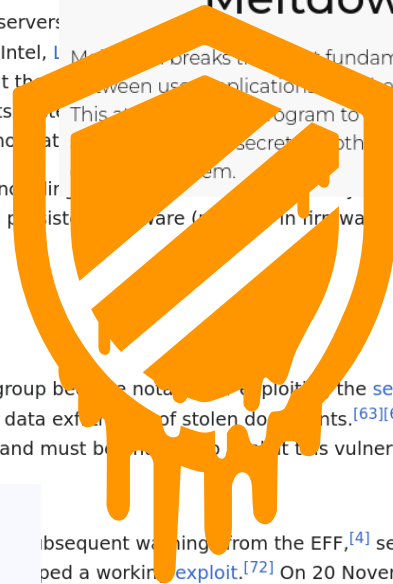
In 2017, the PLATINUM cybercrime group became notable for exploiting the serial over IP capabilities of AMT to perform data exfiltration of stolen documents.<sup>[63][64][65][66]</sup> SOL is disabled by default, and must be manually enabled to exploit this vulnerability.<sup>[71]</sup>

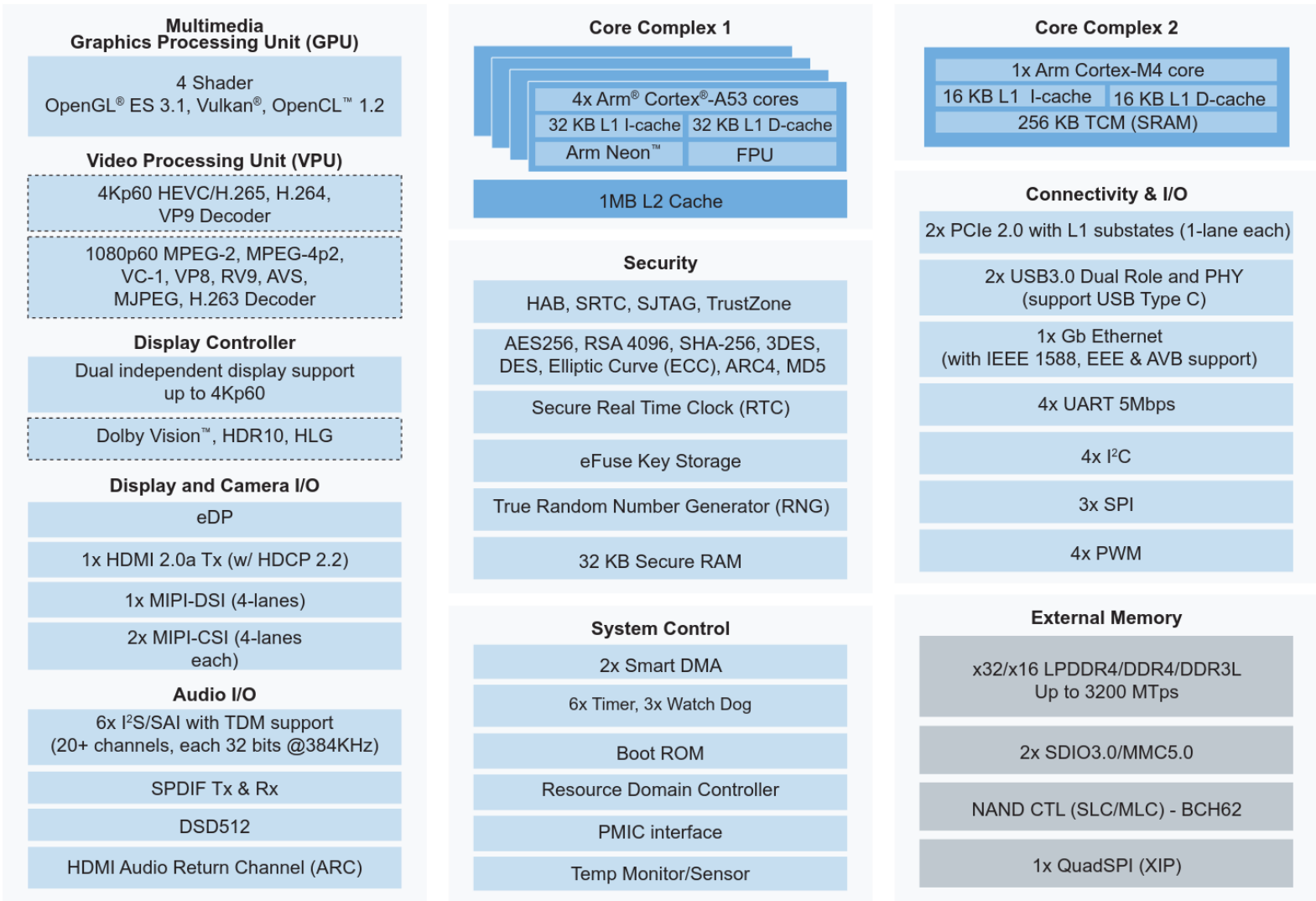
### Spectre

Spectre breaks the isolation between different applications. It allows an attacker to trick error-free programs, which follow best practices, into leaking their secrets. In fact, the safety checks of said best practices actually increase the attack surface and may make applications more susceptible to Spectre

exploitation were not entirely known.<sup>[14]</sup> It is not possible to patch the problems from the operating system, and a firmware (UEFI, BIOS) update to the motherboard is required, which was anticipated to take quite some time for the many individual manufacturers to accomplish, if it ever would be for many systems.<sup>[42]</sup>

### Meltdown





Optional Capability



### 9.4.3 Memory Map and Register Definition

This section includes the DDRC PHY module memory map and detailed descriptions of all registers.

#### NOTE

Synopsys **Proprietary**. Used with permission.

### 13.3.3 Usage Mode

The GPU should be programmed through the NXP provided driver. NXP does not provide support for software that directly programs the GPU registers. APIs for programming the GPU through the software driver are described in separate driver documentation.



**Panfrost** 

Group ID: 1345 

FOSS driver for Mali Txxx and Gxx GPUs

## Nouveau: Accelerated Open Source driver for nVidia cards

The **nouveau** project aims to build high-quality, free/libre software drivers for [nVidia cards](#). “Nouveau” [nuvo] is the French word for “new”. Nouveau is composed of a Linux kernel KMS driver (nouveau), Gallium3D drivers in Mesa, and the Xorg DDX (xf86-video-nouveau). The kernel components have also been ported to [NetBSD](#).

Project Etnaviv is an open source user-space driver for the Vivante GCxxx series of embedded GPUs.

**This repository contains reverse-engineering and debugging tools, and `rnndb` register documentation. It is not necessary to use this repository when building the driver.**

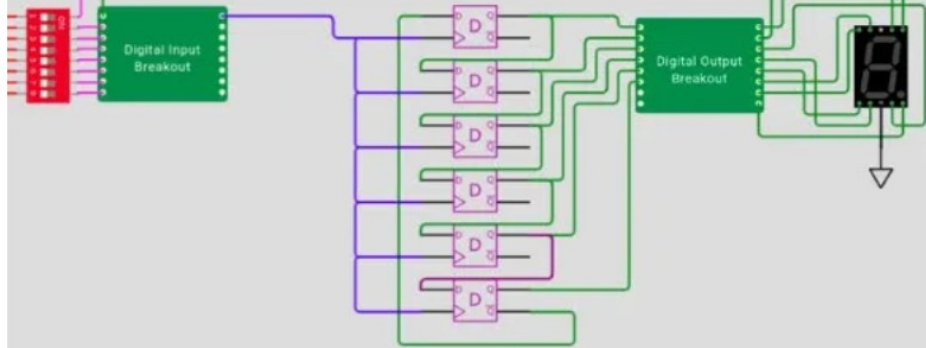
```

433 if (counter_x >= vga_h_max) begin
434     counter_x <= 0;
435     if (counter_y >= vga_v_max) begin
436         counter_y <= 0;
437         sprite_px <= 0;
438         sprite_py <= 0;
439     end else begin
440         counter_y <= counter_y + 1'b1;
441     end
442 end else begin
443     counter_x <= counter_x + 1'b1;
444 end
445
446 if (counter_x==vga_h_rez) begin
447     if (counter_y<vga_v_rez-1'b1)
448         need_line_fetch <= counter_y + 1'b1;
449     else
450         need_line_fetch <= 0;
451 end
452
453 // signal synchronization point to fetch process
454 if (counter_x<8 && counter_y==vga_v_sync_start)
455     need_frame_sync <= 1;
456 else
457     need_frame_sync <= 0;
458
459 // rasterline interrupt:
460 // - first time on vblank start (1 pixel long)
461 // - second time on report_y (1 pixel long)
462 if (counter_y == vga_v_sync_start || (vga_report_y != 0 && (counter_y == vga_report_y - 1'b1))) begin
463     // i tested the position of the interrupt relative to vdma_init,
464     // there's a wide window where a buffer switch is ok, and

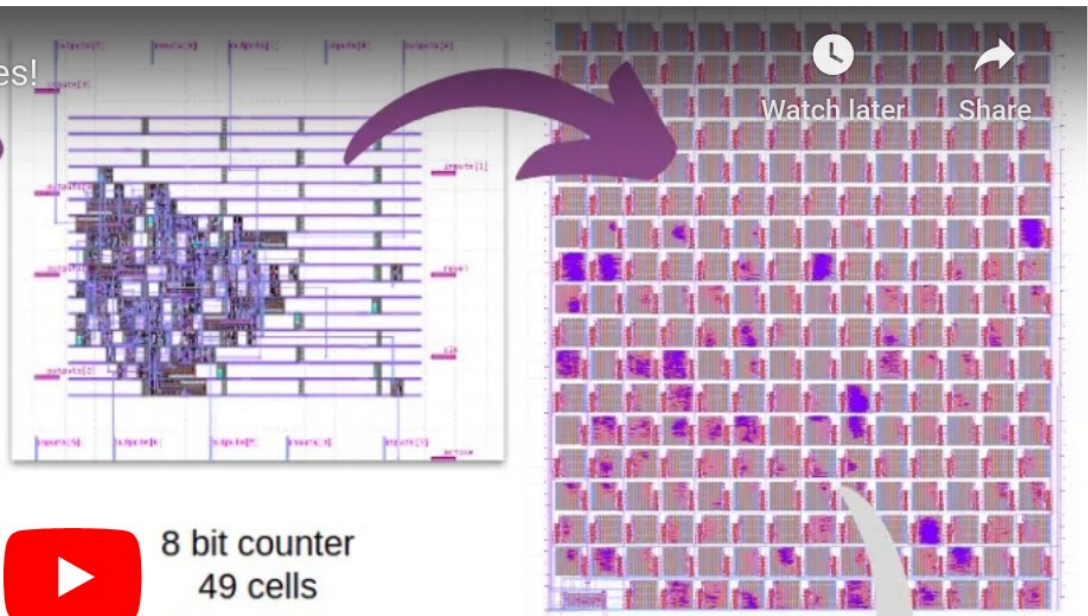
```



Tiny Tapeout 4 - From idea to chip design in minutes!




8 bit counter  
49 cells



# Tiny Tapeout 4

From idea to chip design  
in minutes!

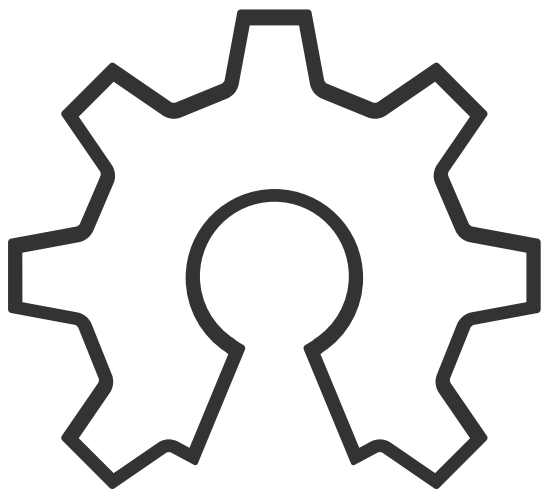
Watch on  YouTube





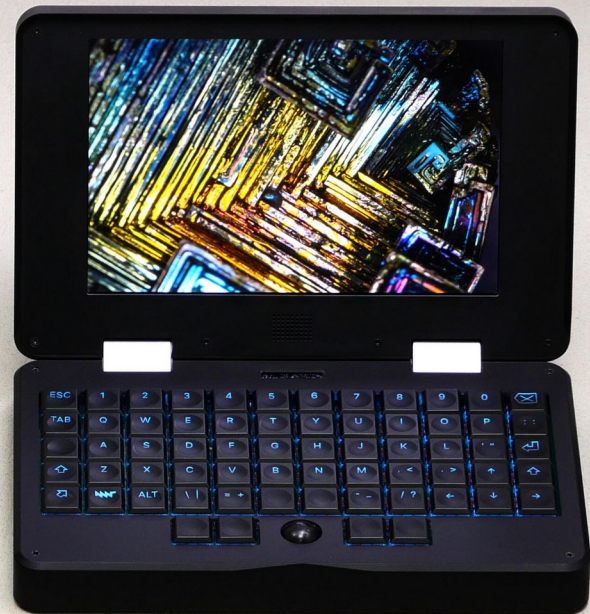
# Introducing the GF180 Open MPW Shuttle





**open source  
hardware**













# I'm building my own reform!

■ MNT Reform



**jacqueline**

1  Feb '22

Hey all!

I got a bit carried away, and now I'm building my own Reform. You might have seen pictures on twitter, but people have been telling me that you fine folks here might like to have some updates as well!

It's no fun to just straight up build the perfectly good, well-designed thing, so I have added my own take on things 😊

First up, I've replaced the barrel jack input with a USB-C port, and am going to be relying on USB-PD for external power. I'm happy with my schematic and layout for this, and am now just waiting for PCBs from my fab to come back so I can see if it actually works. Here is a rendering of my gay pcb:

Feb 2022

1 / 6

Feb 2022

Feb 2022
























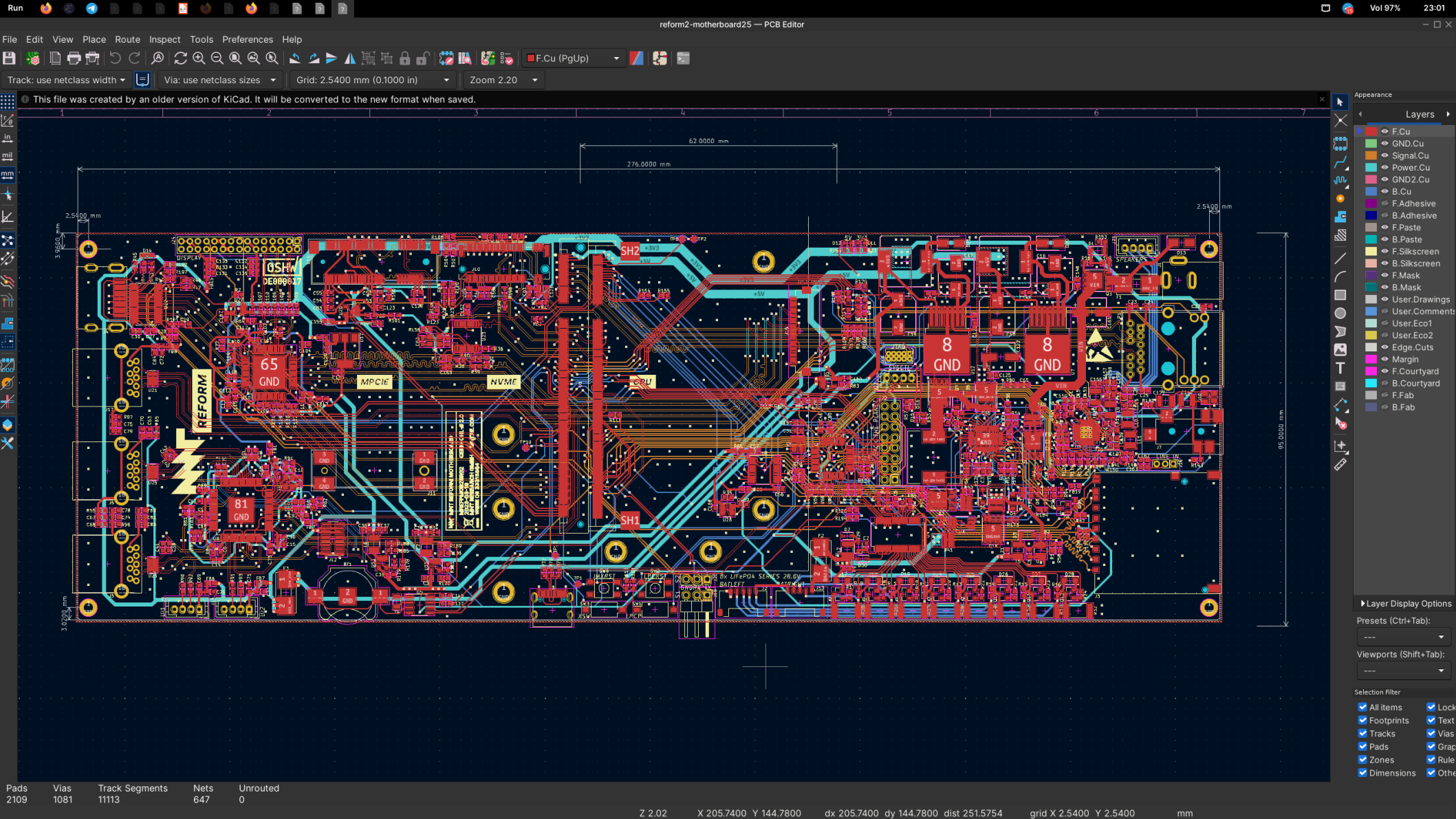


	F1 On	F2 Wake	F3	F4 Off	F5 Reset	F6	F7 DFU	F8	F9 RGB	F10 	F11 	F12 	
		1	2	3	4	5	6	7	8	9	0	Del	
	Tab	Q 7 <	W 8 \$	F 9 >	P [	G _	J [	L _	U ]	Y ]	; : _	Bksp _	
	- 	A 4 (	R 5 "	S 6 )	T #	D #	H %	N {	E =	I }	O 	' '	
	Esc 0	Z 1 :	X 2 *	C 3 +	V +	B +	K &	M ^	, ! ~	. @ ~	/ ? ~	Enter ~	
Click	Shift	Super	Alt	Ctrl	Num 	Shift	Symb 	Nav 	←	↓	↑	→	

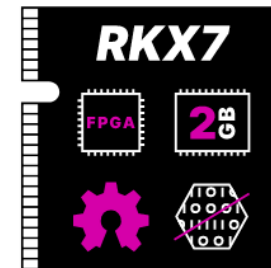
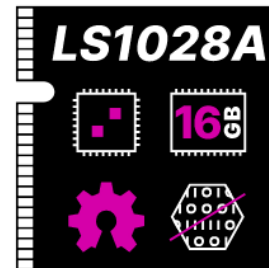
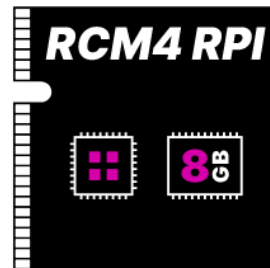
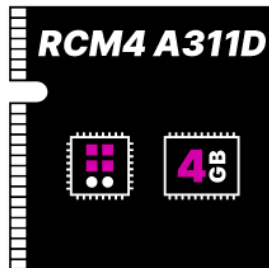
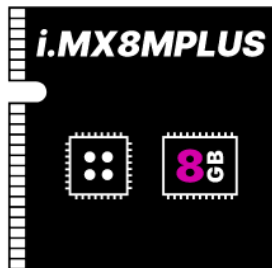
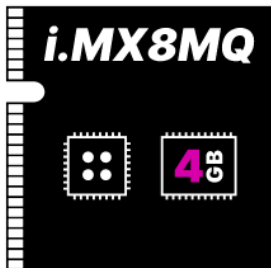




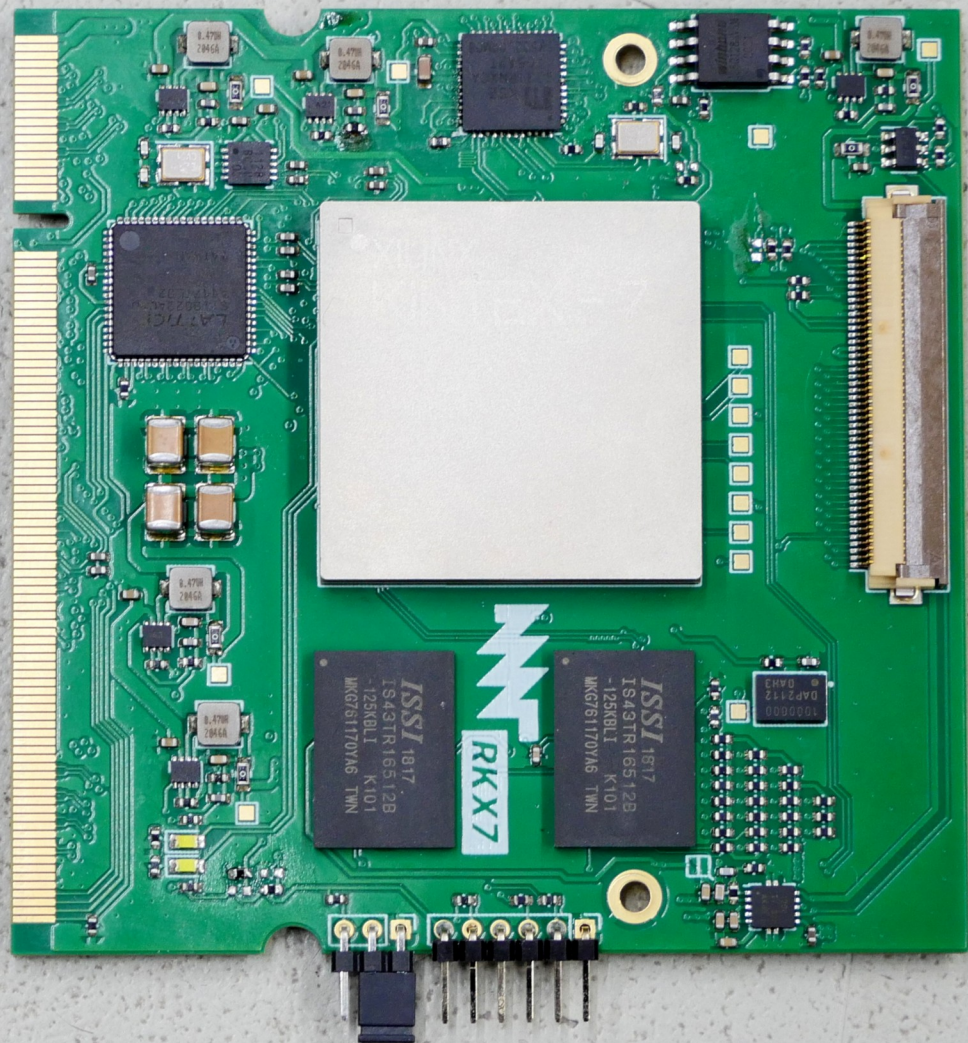
 reform2-keyboard-fw	release version 2023-07-03	Jul 3, 2023, 9:13 PM
 reform2-keyboard-lettering/visicut	keyboard-lettering: add v6 qwertz	Nov 1, 2022, 5:44 PM
 reform2-keyboard-pcb	keyboard: add WIP R-2D version, atmega RC notes	Jul 21, 2022, 12:17 PM
 reform2-keyboard3-pcb	keyboard3 rc snapshot	May 16, 2023, 6:28 PM
 reform2-lpc-driver	replace delay with sleep per kernel doc recomendations	Jun 24, 2022, 4:17 PM
 reform2-lpc-fw	release version 2023-07-03	Jul 3, 2023, 9:13 PM
 reform2-motherboard-pcb	reform2: update PCBs incl. badges to production revs, a...	Jun 10, 2021, 1:20 PM
 reform2-motherboard25-pcb	actual MB2.5 snapshot WIP	May 16, 2023, 6:27 PM
 reform2-oled-pcb	reform2: update PCBs incl. badges to production revs, a...	Jun 10, 2021, 1:20 PM
 reform2-protected-batterypack-pcb	reform2-protected-batterypack production update	May 16, 2023, 6:29 PM
 reform2-safety	reform2: update PCBs incl. badges to production revs, a...	Jun 10, 2021, 1:20 PM
 reform2-speakers	speakers: updated design for better fit	May 20, 2020, 2:01 PM
 reform2-trackball-fw	trackball: dont force send report	Oct 5, 2022, 6:01 PM
 reform2-trackball-pcb	reform2: update PCBs incl. badges to production revs, a...	Jun 10, 2021, 1:20 PM
 reform2-trackball-sensor-pcb	reform2: update PCBs incl. badges to production revs, a...	Jun 10, 2021, 1:20 PM
 reform2-trackball2-fw	trackball2 flash tool: make interactive loop	May 16, 2023, 6:22 PM
 reform2-trackball2-pcb	trackball pcb: add v2 with rp2040 mcu	Aug 22, 2022, 3:40 PM

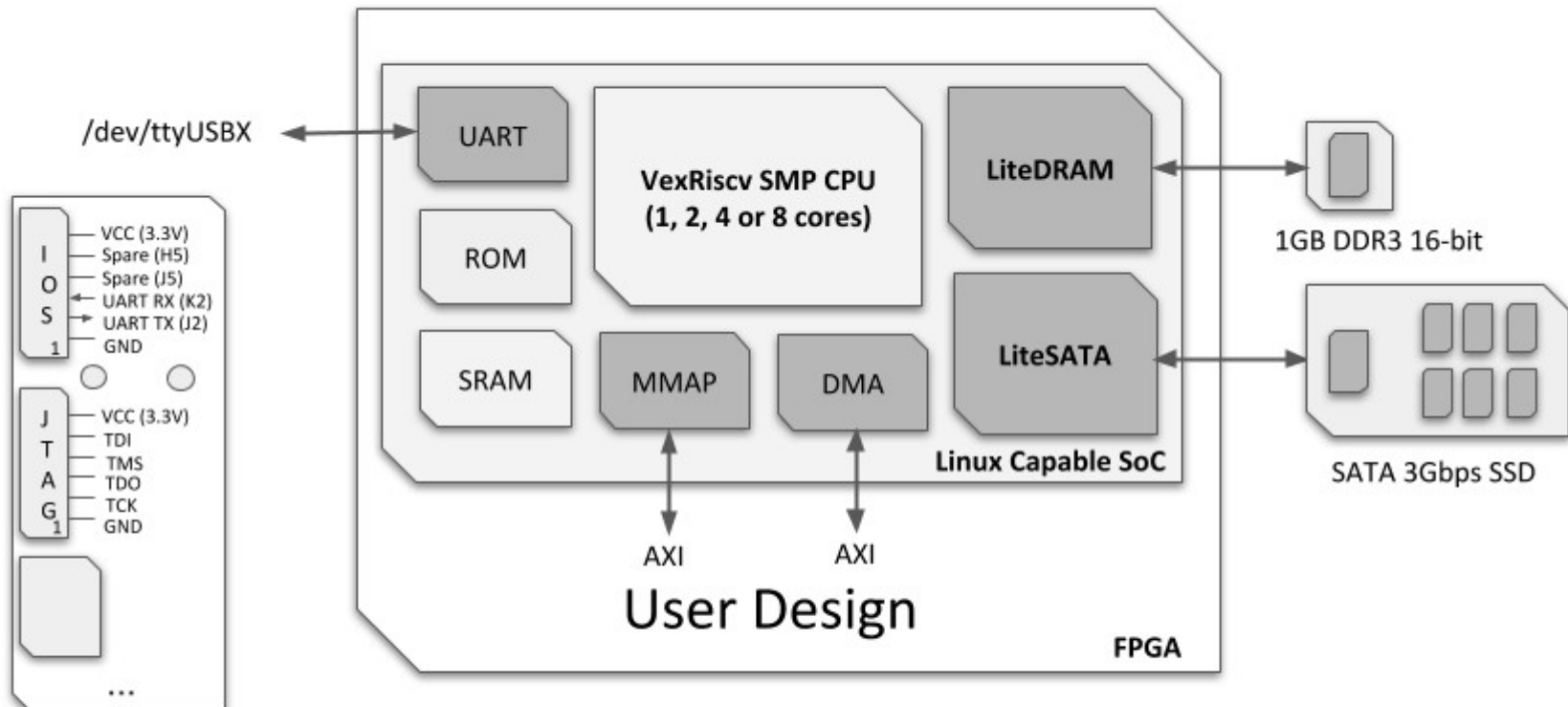






<b>CPU</b>	4× 1.5GHz Cortex-A53	4× 1.8GHz Cortex-A53 (2GHz overclocked)	4× 2.2 GHz Cortex-A73 + 2× 1.8 GHz Cortex-A53	4× 1.5 GHz Cortex-A72 (2 GHz overclocked)	2× 1.5 GHz Cortex-A72	Kintex-7 FPGA (i.e. VexRiscV/LiteX)
<b>GPU</b>	Vivante GC7000L (OpenGL/ES 2.1 with Etnaviv)	Vivante GC7000UL (OpenGL/ES 2.1 with Etnaviv)	ARM Mali G52 MP4 (OpenGL/ES 3.1 with Panfrost)	VideoCore 4 (OpenGL/ES 3.1, Vulkan 1.0)	Vivante GC7000UL (OpenGL/ES 2.1 with Etnaviv)	User defined
<b>RAM</b>	4 GB LPDDR4	8 GB LPDDR4	4 GB LPDDR4	8GB LPDDR4	16 GB DDR4	2 GB DDR3
<b>Wi-Fi</b>	via mPCIe card	Integrated QCA9377 (WiFi 5)	Integrated RTL8822CS (WiFi 5)	Integrated BCM43455 (WiFi 5)	via mPCIe card	No
<b>Bluetooth</b>	No	Integrated QCA9377 (BT 5.0)	Integrated RTL8822CS (BT 5.0)	Integrated BCM43455 (BT 5.0)	No	No
<b>Ethernet</b>	1 Gbit/s	1 Gbit/s	1 Gbit/s	1 Gbit/s	1 Gbit/s	1 Gbit/s
<b>PCIe</b>	2 Slots	1 Slot	1 Slot	1 Slot	1 Slot + 1 external + 1 SATA-III	2 Slots
<b>Dual Display</b>	Yes	Yes	No (either internal or HDMI display at a time)	Yes	No (external GPU possible)	Yes
<b>Open Source Firmware</b>	DDR4C and HDMI (optional) have closed source firmware.	DDR4C and WiFi/BT have closed source firmware.	Part of boot/TF-A and Wi-Fi firmware is closed source.	Closed boot blob.	eDP has closed source firmware (required only in laptop).	Yes
<b>Open Source Drivers</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>PDF Schematics</b>	Yes, full	Yes, full	Yes, partial	Yes, partial	Yes	Yes
<b>KiCAD Sources</b>	No	Adapter only	Adapter only	Adapter only	Yes, full	Yes, full
<b>USB</b>	USB 3.0	USB 3.0	USB 2.0	USB 2.0	USB 3.0	USB 1.0 (user defined)
<b>HDMI</b>	HDMI 2.0a	HDMI 2.0a	HDMI 2.1	HDMI 2.0	No (external PCIe for eGPU)	HDMI 1.4





Pico-EZmate connectors

## Multi-Core Linux SoC on Acorn CLE215+

Enjoy Digital  
CDA

Built with





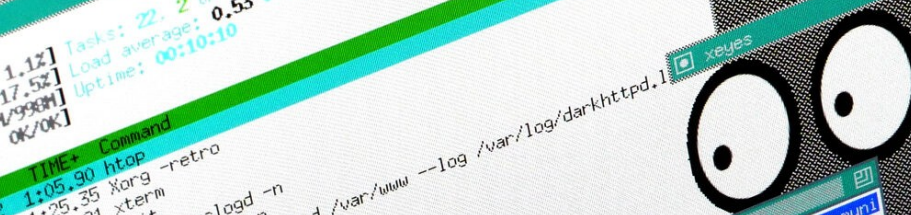




```
dev
etc
evtest
root@reformat:~#
```

1.12] Tasks: 22, 2 thr, 35 kthr: 1 running  
17.52] Load average: 0.53 0.44 0.23  
84.94/99.94] Uptime: 00:10:10  
OK/OK]

PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	MEM%	TIME+	Command
109	root	20	0	30420	10372	4856	S	1.1	0.2	1:05.90	htop
101	root	20	0	7612	4804	4076	S	1.1	0.0	1:25.35	Xorg -retro
104	root	20	0	2800	356	252	S	0.0	0.0	0:10.21	xterm
54	root	20	0	2800	284	248	S	0.0	0.0	0:06.25	init
58	root	20	0	2800	280	160	S	0.0	0.0	0:01.04	/sbin/syslogd -n
83	nobody	20	0	1884	188	1364	S	0.0	0.0	0:01.18	/usr/sbin/darkhttpd /var/www --log /var/log/darkhttpd.1
84	root	20	0	2796	1440	1264	S	0.0	0.0	0:00.04	/bin/sh -sh
94	root	20	0	2652	1344	228	S	0.0	0.1	0:02.57	-i
100	root	20	0	2656	264	2796	S	0.0	0.0	0:01.18	/bin/sh ./x.sh
105	root	20	0	4556	3668	4856	S	0.0	0.0	0:00.05	tum
106	root	20	0	30420	10372	228	S	0.0	0.4	0:04.21	Xorg -retro
107	root	20	0	2656	4964	1696	S	0.0	0.0	0:00.22	sh
111	root	20	0	7456	1808	2980	S	0.0	0.0	0:00.15	sh
112	root	20	0	2656	5608	4212	S	0.0	0.0	0:01.56	xterm
114	root	20	0	8000	4868	228	S	0.0	0.5	0:00.16	sh
116	root	20	0	7456	264	3124	S	0.0	0.0	0:00.08	cwebber
117	root	20	0	2656	3472	4052	S	0.0	0.0	0:00.08	dodo
118	root	20	0	7456	4708	1648	S	0.0	0.0	0:00.08	dustfinger
120	root	20	0	2656	76	3576	S	0.0	0.0	0:00.08	eery
121	root	20	0	16124	4344	3576	S	0.0	0.0	0:00.08	eschaton
133	root	20	0	16124	4344	3576	S	0.0	0.0	0:00.08	ex-parrot
141	root	20	0	16124	4344	3576	S	0.0	0.0	0:00.08	klima



```
Source: https://mntre.com/reform-logs Source: https://source.mnt.re Community and CoC: https://community.mnt.re  
Topic set by mntre ["mntre@softboy.mntmn.com"] [Wed May 19 22:18:24 2021]
```

Users	[E	[_nrb_	[ajr	[aphistic	[arminweig	[Aristotelis	[Asmadeus	[austriancoder	[bkeys	[blast007	[bleb	[buckket	[c-keen[m]	[chartreuse	[chomwit	[conky	[Irsi	[Channel	[Irsi	[de-riscv	[hellol
	[joe	[jomo	[josch	[jryans	[kfx	[kklimonda	[Kooda	[kuno	[lastebil	[leonardo	[lexik	[marlun	[minute	[minute-riscv	[mjw	[mlarkin	[natalie	[nicks	[Total of	[Total of	[Total of
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```
Help F2Setup F3Search F4Filter F5Tree F6Sort  
F7Help F8Setup F9Search F10Filter F11Tree F12Sort  
F13Help F14Setup F15Search F16Filter F17Tree F18Sort  
F19Help F20Setup F21Search F22Filter F23Tree F24Sort  
F25Help F26Setup F27Search F28Filter F29Tree F30Sort  
F31Help F32Setup F33Search F34Filter F35Tree F36Sort  
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[illegible]

# Skybox: Open-Source Graphic Rendering on Programmable RISC-V GPUs

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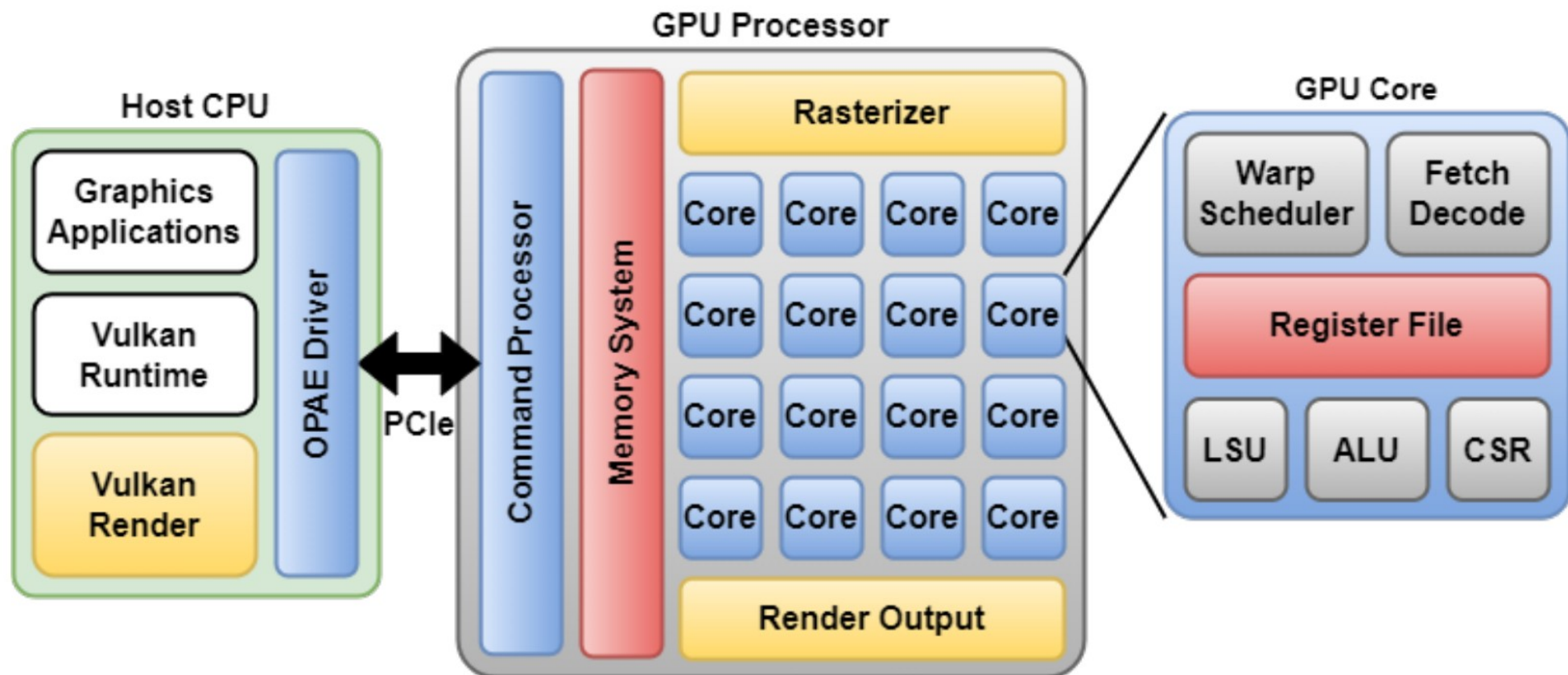


Figure 1: Skybox framework overview.



# Celerity: An Open Source 511-core RISC-V Tiered Accelerator Fabric

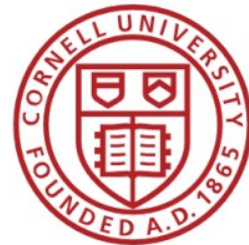
*Prof. Michael Taylor  
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<http://www.opencelerity.org>



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**W** UNIVERSITY of  
WASHINGTON

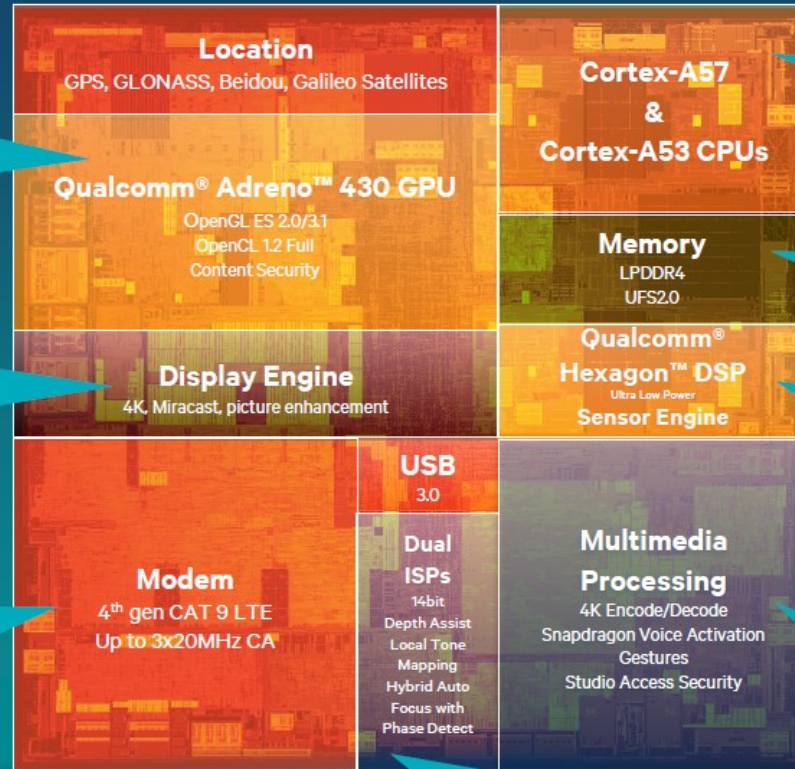


# Introducing the Snapdragon 810 Processor

Advanced Graphics & Compute with the Adreno 430 – the best GPU Qualcomm Technologies' has ever made

4K primary & external display support with ecoPix and TruPalette and 3:1 pixel compression

Mobile industry's FIRST announced multi-channel 4G LTE SoC supporting Category 9 Carrier Aggregation



Not drawn to scale.

FIRST Announced ARM®v8-A/64-bit using Cortex®-A57+ Cortex®-A53

Mobile industry's FIRST announced dual channel 1600 MHz LPDDR4 memory

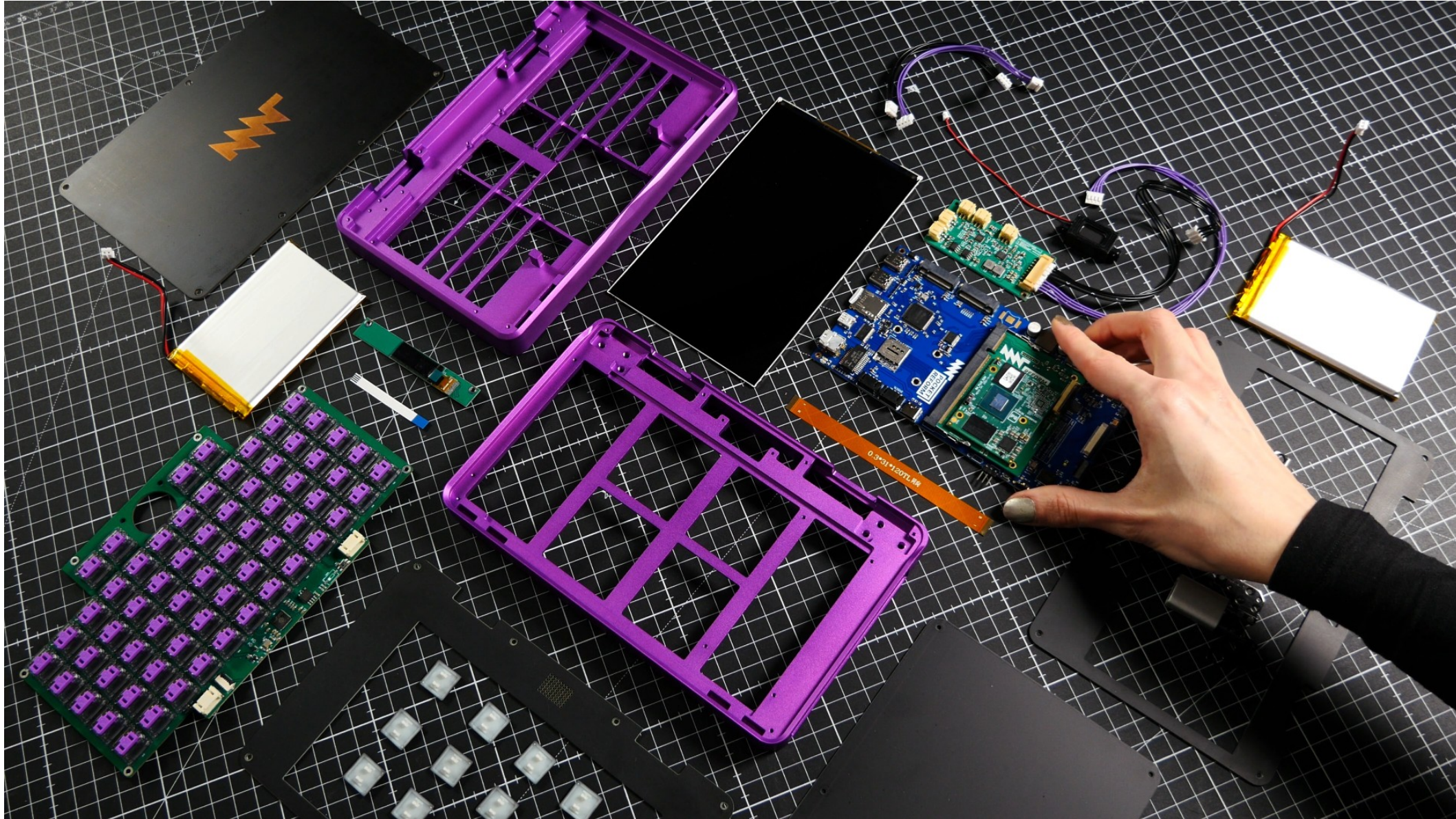
Qualcomm Technologies' FIRST UFS 2.0 Support

Greatly improved power management for DSP/Sensor Engine, Low Power Snapdragon Voice Activation (SVA), 12-channel surround sound decode

Qualcomm Technologies' FIRST hardware implementation of 4K HEVC/ H.265 video encode. HEVC designed to deliver up to 50% better video compression

Qualcomm Technologies' FIRST 14-bit Dual ISP for highest quality, depth enabled photography. Up to 21MP for main camera with depth assist, phase detect, for sharper dual camera user experiences





**Thank You!**

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FSIC2023, Paris**

