



**Linaro
connect**
Vancouver 2018

Thermal Capping

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Main Idea

cpufreq cooling device can restrict the maximum frequency of a cpu to mitigate thermal events (passive response)

- Clipped max frequency implies clipped maximum possible capacity for a cpu.
- Thermal pressure - The delta between the maximum possible capacity of a cpu and maximum available capacity of a cpu due to thermal event
- Re-use the framework for tracking RT and DL utilization for tracking thermal pressure.
- Provide mechanism to update thermal pressure from thermal framework to scheduler.



Initial testing results

- hikey960 mainline kernel with debian file system.
- aobench (An occlusion renderer for benchmarking real-world floating point performance) (Phoronix Test Suite)

Result (secs)	Standard Error	Standard Deviation
Hikey 960 - no thermal pressure applied		
196.54	12.4	15.46%
Hikey 960 - thermal pressure applied		
162.54	20.61	31.06%



hikey960 Android 4.9 kernel - 5 runs of PCMark with 10 mins wait in between for the chip to cool down

	Result	Standard Deviation	Standard Deviation % of average
Hikey960 - no fan - no thermal pressure applied			
pcmark pcmark_DataManipulation	3296	1650	50.06%
pcmark pcmark_PhotoEditingV2	11821	5939	50.24%
pcmark pcmark_WebV2	7330	179	2.44%
pcmark pcmark_WritingV2	5795	2929	50.54%
Hikey960- no fan - with thermal pressure applied			
pcmark pcmark_DataManipulation	4413	204	4.62%
pcmark pcmark_PhotoEditingV2	13749	1738	12.64%
pcmark pcmark_WebV2	7424	245	3.30%
pcmark pcmark_WritingV2	7067	1848	26.15%
Hikey960 - with fan - no thermal pressure applied			
pcmark pcmark_DataManipulation	5045	55	1.09%
pcmark pcmark_PhotoEditingV2	17212	1771	10.29%
pcmark pcmark_WebV2	7362	114	1.55%
pcmark pcmark_WritingV2	8435	48	0.57%
Hikey960 - with fan - with thermal pressure applied			
pcmark pcmark_DataManipulation	5076	21	0.41%
pcmark pcmark_PhotoEditingV2	18133	81	0.45%
pcmark pcmark_WebV2	7412	142	1.92%
pcmark pcmark_WritingV2	8457	10	0.12%



Discussion

- Pelt signals – best way to track thermal utilization ?
- Who should call into thermal pressure tracking framework to update max capacity ?
 - Cpufreq driver?
 - Cooling device ?

