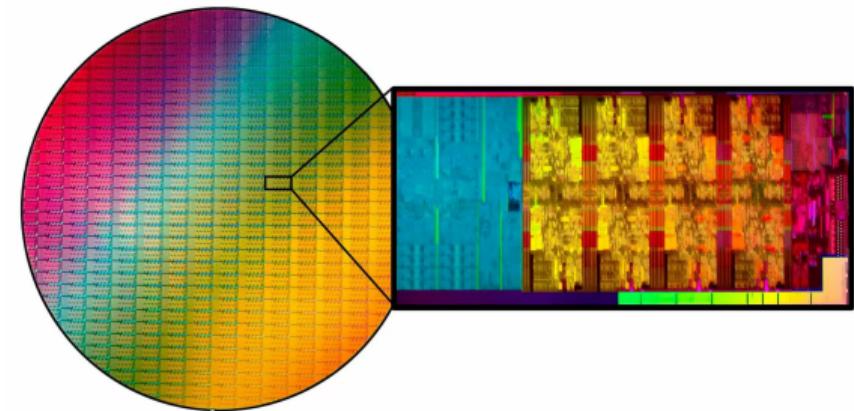


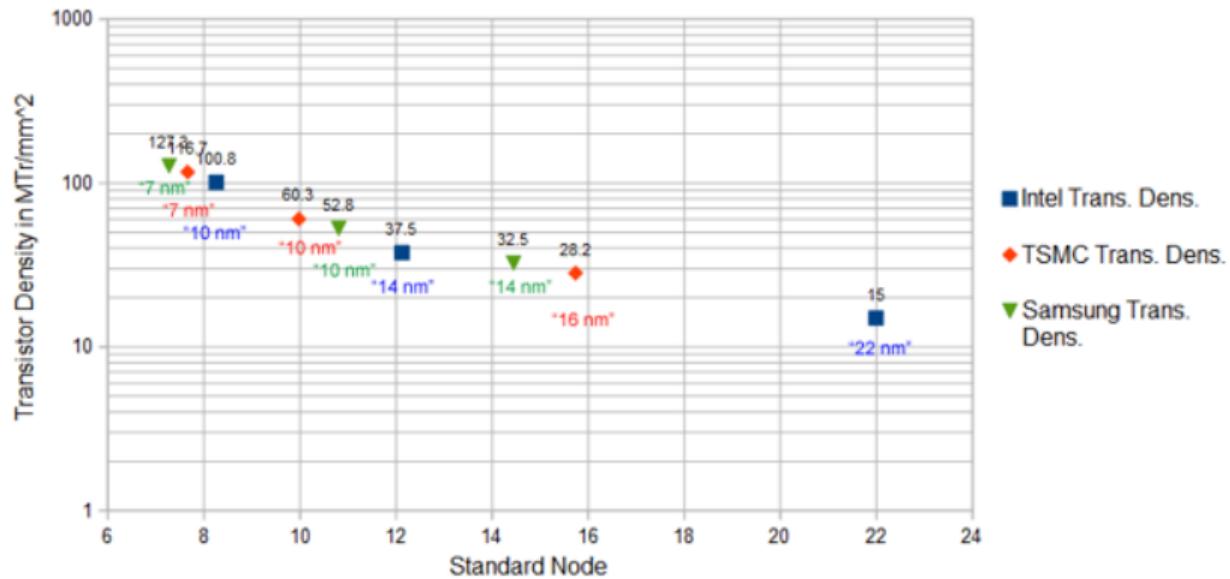
Procesory

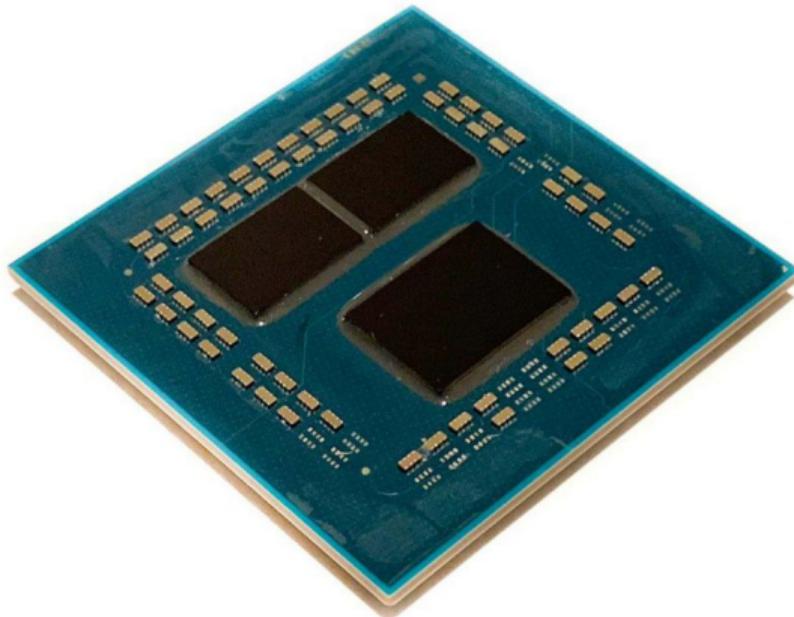
Grzegorz Koperwas Kamil Kowalczyk Kacper Nuckowski Weronika Chruszcz

3 lipca 2021



Transistor Density vs. Standard Node



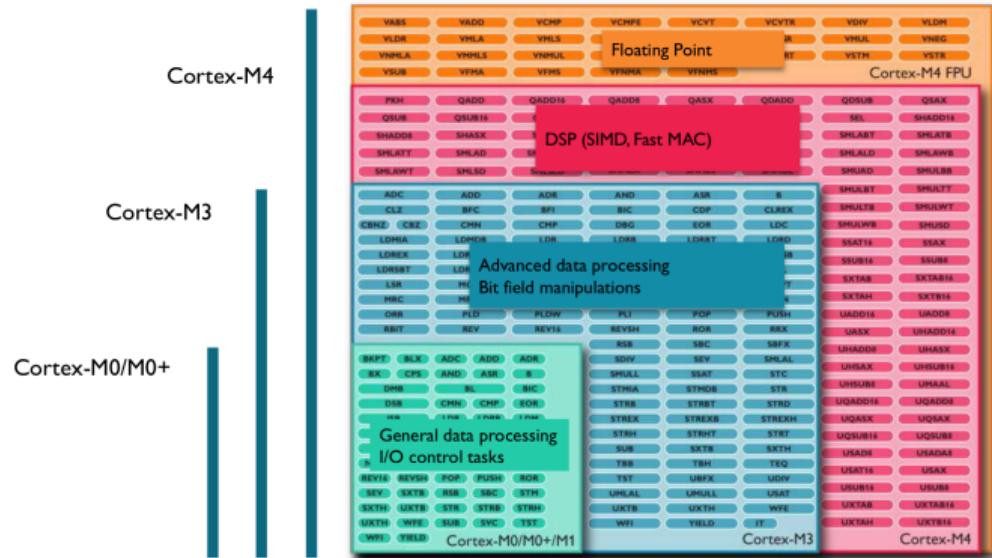


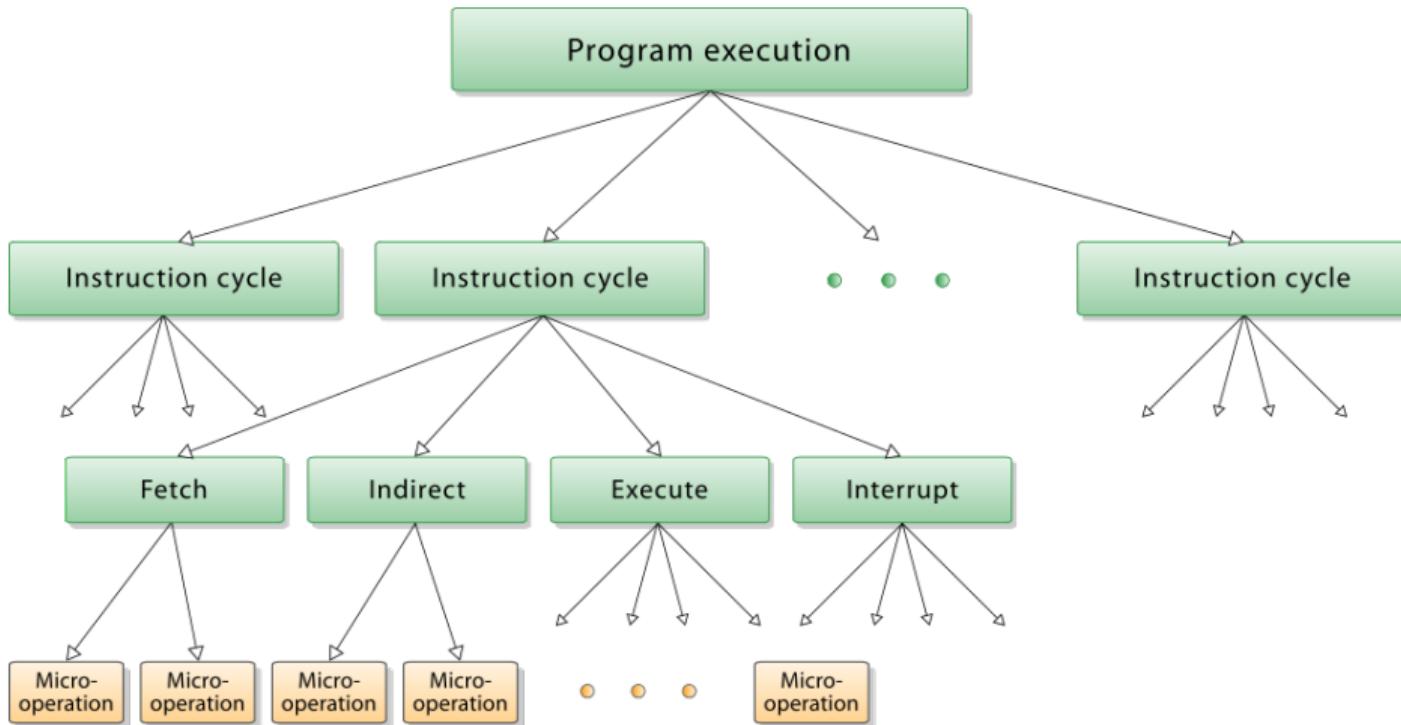
Procesor Ryzen 9 3900X ma 2 chipy z rdzeniami i jeden do obsługi i/o na starszym procesie.

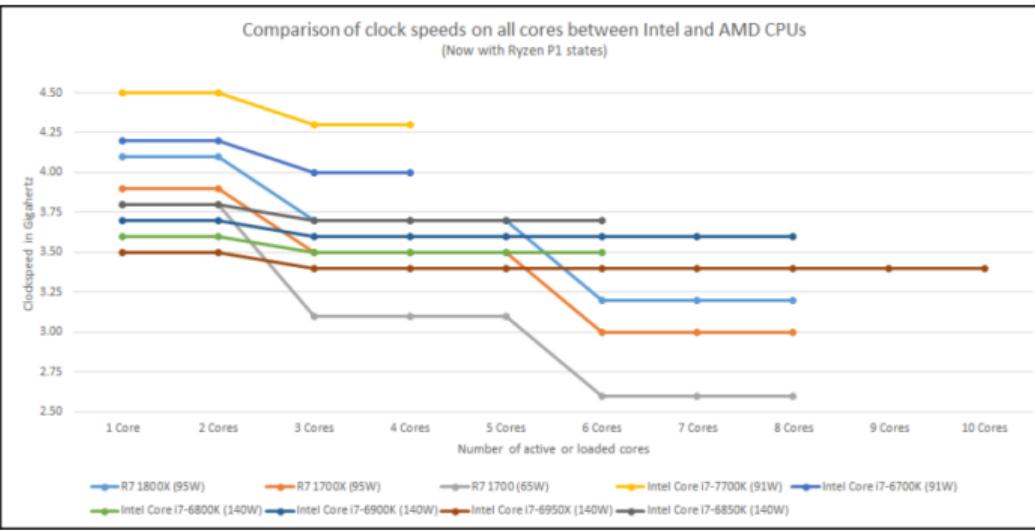
Content tree	
1	1.00 integer instructions
1.1	1.1.0 digital 40bit/50bit instruction
1.1.1	1.1.1.0 ADD with 32bit/32bit
1.1.1.1	1.1.1.1.0 ADD with 32bit/32bit
1.1.1.2	1.1.1.2.0 ADD with 32bit/40bit
1.1.1.3	1.1.1.3.0 ADD with 32bit/48bit
1.1.1.4	1.1.1.4.0 ADD with 32bit/56bit
1.1.1.5	1.1.1.5.0 ADD with 32bit/64bit
1.1.1.6	1.1.1.6.0 ADD with 32bit/80bit
1.1.1.7	1.1.1.7.0 ADD with 32bit/96bit
1.1.1.8	1.1.1.8.0 ADD with 32bit/128bit
1.1.1.9	1.1.1.9.0 ADD with 32bit/256bit
1.1.1.10	1.1.1.10.0 ADD with 32bit/512bit
1.1.1.11	1.1.1.11.0 ADD with 32bit/1024bit
1.1.1.12	1.1.1.12.0 ADD with 32bit/2048bit
1.1.1.13	1.1.1.13.0 ADD with 32bit/4096bit
1.1.1.14	1.1.1.14.0 ADD with 32bit/8192bit
1.1.1.15	1.1.1.15.0 ADD with 32bit/16384bit
1.1.1.16	1.1.1.16.0 ADD with 32bit/32768bit
1.1.1.17	1.1.1.17.0 ADD with 32bit/65536bit
1.1.1.18	1.1.1.18.0 ADD with 32bit/131072bit
1.1.1.19	1.1.1.19.0 ADD with 32bit/262144bit
1.1.1.20	1.1.1.20.0 ADD with 32bit/524288bit
1.1.1.21	1.1.1.21.0 ADD with 32bit/1048576bit
1.1.2.1	1.1.2.1.0 ADD with 64bit/64bit
1.1.2.2	1.1.2.2.0 ADD with 64bit/128bit
1.1.2.3	1.1.2.3.0 ADD with 64bit/256bit
1.1.2.4	1.1.2.4.0 ADD with 64bit/512bit
1.1.2.5	1.1.2.5.0 ADD with 64bit/1024bit
1.1.2.6	1.1.2.6.0 ADD with 64bit/2048bit
1.1.2.7	1.1.2.7.0 ADD with 64bit/4096bit
1.1.2.8	1.1.2.8.0 ADD with 64bit/8192bit
1.1.2.9	1.1.2.9.0 ADD with 64bit/16384bit
1.1.2.10	1.1.2.10.0 ADD with 64bit/32768bit
1.1.2.11	1.1.2.11.0 ADD with 64bit/65536bit
1.1.2.12	1.1.2.12.0 ADD with 64bit/131072bit
1.1.2.13	1.1.2.13.0 ADD with 64bit/262144bit
1.1.2.14	1.1.2.14.0 ADD with 64bit/524288bit
1.1.2.15	1.1.2.15.0 ADD with 64bit/1048576bit
1.1.2.16	1.1.2.16.0 ADD with 64bit/2097152bit
1.1.2.17	1.1.2.17.0 ADD with 64bit/4194304bit
1.1.2.18	1.1.2.18.0 ADD with 64bit/8388608bit
1.1.2.19	1.1.2.19.0 ADD with 64bit/16777216bit
1.1.2.20	1.1.2.20.0 ADD with 64bit/33554432bit
1.1.2.21	1.1.2.21.0 ADD with 64bit/67108864bit
1.1.3.1	1.1.3.1.0 ADD with 128bit/128bit
1.1.3.2	1.1.3.2.0 ADD with 128bit/256bit
1.1.3.3	1.1.3.3.0 ADD with 128bit/512bit
1.1.3.4	1.1.3.4.0 ADD with 128bit/1024bit
1.1.3.5	1.1.3.5.0 ADD with 128bit/2048bit
1.1.3.6	1.1.3.6.0 ADD with 128bit/4096bit
1.1.3.7	1.1.3.7.0 ADD with 128bit/8192bit
1.1.3.8	1.1.3.8.0 ADD with 128bit/16384bit
1.1.3.9	1.1.3.9.0 ADD with 128bit/32768bit
1.1.3.10	1.1.3.10.0 ADD with 128bit/65536bit
1.1.3.11	1.1.3.11.0 ADD with 128bit/131072bit
1.1.3.12	1.1.3.12.0 ADD with 128bit/262144bit
1.1.3.13	1.1.3.13.0 ADD with 128bit/524288bit
1.1.3.14	1.1.3.14.0 ADD with 128bit/1048576bit
1.1.3.15	1.1.3.15.0 ADD with 128bit/2097152bit
1.1.3.16	1.1.3.16.0 ADD with 128bit/4194304bit
1.1.3.17	1.1.3.17.0 ADD with 128bit/8388608bit
1.1.3.18	1.1.3.18.0 ADD with 128bit/16777216bit
1.1.3.19	1.1.3.19.0 ADD with 128bit/33554432bit
1.1.3.20	1.1.3.20.0 ADD with 128bit/67108864bit
1.1.4.1	1.1.4.1.0 ADD with 256bit/256bit
1.1.4.2	1.1.4.2.0 ADD with 256bit/512bit
1.1.4.3	1.1.4.3.0 ADD with 256bit/1024bit
1.1.4.4	1.1.4.4.0 ADD with 256bit/2048bit
1.1.4.5	1.1.4.5.0 ADD with 256bit/4096bit
1.1.4.6	1.1.4.6.0 ADD with 256bit/8192bit
1.1.4.7	1.1.4.7.0 ADD with 256bit/16384bit
1.1.4.8	1.1.4.8.0 ADD with 256bit/32768bit
1.1.4.9	1.1.4.9.0 ADD with 256bit/65536bit
1.1.4.10	1.1.4.10.0 ADD with 256bit/131072bit
1.1.4.11	1.1.4.11.0 ADD with 256bit/262144bit
1.1.4.12	1.1.4.12.0 ADD with 256bit/524288bit
1.1.4.13	1.1.4.13.0 ADD with 256bit/1048576bit
1.1.4.14	1.1.4.14.0 ADD with 256bit/2097152bit
1.1.4.15	1.1.4.15.0 ADD with 256bit/4194304bit
1.1.4.16	1.1.4.16.0 ADD with 256bit/8388608bit
1.1.4.17	1.1.4.17.0 ADD with 256bit/16777216bit
1.1.4.18	1.1.4.18.0 ADD with 256bit/33554432bit
1.1.4.19	1.1.4.19.0 ADD with 256bit/67108864bit
1.1.5.1	1.1.5.1.0 ADD with 512bit/512bit
1.1.5.2	1.1.5.2.0 ADD with 512bit/1024bit
1.1.5.3	1.1.5.3.0 ADD with 512bit/2048bit
1.1.5.4	1.1.5.4.0 ADD with 512bit/4096bit
1.1.5.5	1.1.5.5.0 ADD with 512bit/8192bit
1.1.5.6	1.1.5.6.0 ADD with 512bit/16384bit
1.1.5.7	1.1.5.7.0 ADD with 512bit/32768bit
1.1.5.8	1.1.5.8.0 ADD with 512bit/65536bit
1.1.5.9	1.1.5.9.0 ADD with 512bit/131072bit
1.1.5.10	1.1.5.10.0 ADD with 512bit/262144bit
1.1.5.11	1.1.5.11.0 ADD with 512bit/524288bit
1.1.5.12	1.1.5.12.0 ADD with 512bit/1048576bit
1.1.5.13	1.1.5.13.0 ADD with 512bit/2097152bit
1.1.5.14	1.1.5.14.0 ADD with 512bit/4194304bit
1.1.5.15	1.1.5.15.0 ADD with 512bit/8388608bit
1.1.5.16	1.1.5.16.0 ADD with 512bit/16777216bit
1.1.5.17	1.1.5.17.0 ADD with 512bit/33554432bit
1.1.5.18	1.1.5.18.0 ADD with 512bit/67108864bit
1.1.6.1	1.1.6.1.0 ADD with 1024bit/1024bit
1.1.6.2	1.1.6.2.0 ADD with 1024bit/2048bit
1.1.6.3	1.1.6.3.0 ADD with 1024bit/4096bit
1.1.6.4	1.1.6.4.0 ADD with 1024bit/8192bit
1.1.6.5	1.1.6.5.0 ADD with 1024bit/16384bit
1.1.6.6	1.1.6.6.0 ADD with 1024bit/32768bit
1.1.6.7	1.1.6.7.0 ADD with 1024bit/65536bit
1.1.6.8	1.1.6.8.0 ADD with 1024bit/131072bit
1.1.6.9	1.1.6.9.0 ADD with 1024bit/262144bit
1.1.6.10	1.1.6.10.0 ADD with 1024bit/524288bit
1.1.6.11	1.1.6.11.0 ADD with 1024bit/1048576bit
1.1.6.12	1.1.6.12.0 ADD with 1024bit/2097152bit
1.1.6.13	1.1.6.13.0 ADD with 1024bit/4194304bit
1.1.6.14	1.1.6.14.0 ADD with 1024bit/8388608bit
1.1.6.15	1.1.6.15.0 ADD with 1024bit/16777216bit
1.1.6.16	1.1.6.16.0 ADD with 1024bit/33554432bit
1.1.6.17	1.1.6.17.0 ADD with 1024bit/67108864bit
1.1.7.1	1.1.7.1.0 ADD with 2048bit/2048bit
1.1.7.2	1.1.7.2.0 ADD with 2048bit/4096bit
1.1.7.3	1.1.7.3.0 ADD with 2048bit/8192bit
1.1.7.4	1.1.7.4.0 ADD with 2048bit/16384bit
1.1.7.5	1.1.7.5.0 ADD with 2048bit/32768bit
1.1.7.6	1.1.7.6.0 ADD with 2048bit/65536bit
1.1.7.7	1.1.7.7.0 ADD with 2048bit/131072bit
1.1.7.8	1.1.7.8.0 ADD with 2048bit/262144bit
1.1.7.9	1.1.7.9.0 ADD with 2048bit/524288bit
1.1.7.10	1.1.7.10.0 ADD with 2048bit/1048576bit
1.1.7.11	1.1.7.11.0 ADD with 2048bit/2097152bit
1.1.7.12	1.1.7.12.0 ADD with 2048bit/4194304bit
1.1.7.13	1.1.7.13.0 ADD with 2048bit/8388608bit
1.1.7.14	1.1.7.14.0 ADD with 2048bit/16777216bit
1.1.7.15	1.1.7.15.0 ADD with 2048bit/33554432bit
1.1.7.16	1.1.7.16.0 ADD with 2048bit/67108864bit
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1.1.8.3	1.1.8.3.0 ADD with 4096bit/16384bit
1.1.8.4	1.1.8.4.0 ADD with 4096bit/32768bit
1.1.8.5	1.1.8.5.0 ADD with 4096bit/65536bit
1.1.8.6	1.1.8.6.0 ADD with 4096bit/131072bit
1.1.8.7	1.1.8.7.0 ADD with 4096bit/262144bit
1.1.8.8	1.1.8.8.0 ADD with 4096bit/524288bit
1.1.8.9	1.1.8.9.0 ADD with 4096bit/1048576bit
1.1.8.10	1.1.8.10.0 ADD with 4096bit/2097152bit
1.1.8.11	1.1.8.11.0 ADD with 4096bit/4194304bit
1.1.8.12	1.1.8.12.0 ADD with 4096bit/8388608bit
1.1.8.13	1.1.8.13.0 ADD with 4096bit/16777216bit
1.1.8.14	1.1.8.14.0 ADD with 4096bit/33554432bit
1.1.8.15	1.1.8.15.0 ADD with 4096bit/67108864bit
1.1.9.1	1.1.9.1.0 ADD with 8192bit/8192bit
1.1.9.2	1.1.9.2.0 ADD with 8192bit/16384bit
1.1.9.3	1.1.9.3.0 ADD with 8192bit/32768bit
1.1.9.4	1.1.9.4.0 ADD with 8192bit/65536bit
1.1.9.5	1.1.9.5.0 ADD with 8192bit/131072bit
1.1.9.6	1.1.9.6.0 ADD with 8192bit/262144bit
1.1.9.7	1.1.9.7.0 ADD with 8192bit/524288bit
1.1.9.8	1.1.9.8.0 ADD with 8192bit/1048576bit
1.1.9.9	1.1.9.9.0 ADD with 8192bit/2097152bit
1.1.9.10	1.1.9.10.0 ADD with 8192bit/4194304bit
1.1.9.11	1.1.9.11.0 ADD with 8192bit/8388608bit
1.1.9.12	1.1.9.12.0 ADD with 8192bit/16777216bit
1.1.9.13	1.1.9.13.0 ADD with 8192bit/33554432bit
1.1.9.14	1.1.9.14.0 ADD with 8192bit/67108864bit
1.1.10.1	1.1.10.1.0 ADD with 16384bit/16384bit
1.1.10.2	1.1.10.2.0 ADD with 16384bit/32768bit
1.1.10.3	1.1.10.3.0 ADD with 16384bit/65536bit
1.1.10.4	1.1.10.4.0 ADD with 16384bit/131072bit
1.1.10.5	1.1.10.5.0 ADD with 16384bit/262144bit
1.1.10.6	1.1.10.6.0 ADD with 16384bit/524288bit
1.1.10.7	1.1.10.7.0 ADD with 16384bit/1048576bit
1.1.10.8	1.1.10.8.0 ADD with 16384bit/2097152bit
1.1.10.9	1.1.10.9.0 ADD with 16384bit/4194304bit
1.1.10.10	1.1.10.10.0 ADD with 16384bit/8388608bit
1.1.10.11	1.1.10.11.0 ADD with 16384bit/16777216bit
1.1.10.12	1.1.10.12.0 ADD with 16384bit/33554432bit
1.1.10.13	1.1.10.13.0 ADD with 16384bit/67108864bit
1.1.11.1	1.1.11.1.0 ADD with 32768bit/32768bit
1.1.11.2	1.1.11.2.0 ADD with 32768bit/65536bit
1.1.11.3	1.1.11.3.0 ADD with 32768bit/131072bit
1.1.11.4	1.1.11.4.0 ADD with 32768bit/262144bit
1.1.11.5	1.1.11.5.0 ADD with 32768bit/524288bit
1.1.11.6	1.1.11.6.0 ADD with 32768bit/1048576bit
1.1.11.7	1.1.11.7.0 ADD with 32768bit/2097152bit
1.1.11.8	1.1.11.8.0 ADD with 32768bit/4194304bit
1.1.11.9	1.1.11.9.0 ADD with 32768bit/8388608bit
1.1.11.10	1.1.11.10.0 ADD with 32768bit/16777216bit
1.1.11.11	1.1.11.11.0 ADD with 32768bit/33554432bit
1.1.11.12	1.1.11.12.0 ADD with 32768bit/67108864bit
1.1.13.1	1.1.13.1.0 ADD with 65536bit/65536bit
1.1.13.2	1.1.13.2.0 ADD with 65536bit/131072bit
1.1.13.3	1.1.13.3.0 ADD with 65536bit/262144bit
1.1.13.4	1.1.13.4.0 ADD with 65536bit/524288bit
1.1.13.5	1.1.13.5.0 ADD with 65536bit/1048576bit
1.1.13.6	1.1.13.6.0 ADD with 65536bit/2097152bit
1.1.13.7	1.1.13.7.0 ADD with 65536bit/4194304bit
1.1.13.8	1.1.13.8.0 ADD with 65536bit/8388608bit
1.1.13.9	1.1.13.9.0 ADD with 65536bit/16777216bit
1.1.13.10	1.1.13.10.0 ADD with 65536bit/33554432bit
1.1.13.11	1.1.13.11.0 ADD with 65536bit/67108864bit
1.1.14.1	1.1.14.1.0 ADD with 131072bit/131072bit
1.1.14.2	1.1.14.2.0 ADD with 131072bit/262144bit
1.1.14.3	1.1.14.3.0 ADD with 131072bit/524288bit
1.1.14.4	1.1.14.4.0 ADD with 131072bit/1048576bit
1.1.14.5	1.1.14.5.0 ADD with 131072bit/2097152bit
1.1.14.6	1.1.14.6.0 ADD with 131072bit/4194304bit
1.1.14.7	1.1.14.7.0 ADD with 131072bit/8388608bit
1.1.14.8	1.1.14.8.0 ADD with 131072bit/16777216bit
1.1.14.9	1.1.14.9.0 ADD with 131072bit/33554432bit
1.1.14.10	1.1.14.10.0 ADD with 131072bit/67108864bit
1.1.15.1	1.1.15.1.0 ADD with 262144bit/262144bit
1.1.15.2	1.1.15.2.0 ADD with 262144bit/524288bit
1.1.15.3	1.1.15.3.0 ADD with 262144bit/1048576bit
1.1.15.4	1.1.15.4.0 ADD with 262144bit/2097152bit
1.1.15.5	1.1.15.5.0 ADD with 262144bit/4194304bit
1.1.15.6	1.1.15.6.0 ADD with 262144bit/8388608bit
1.1.15.7	1.1.15.7.0 ADD with 262144bit/16777216bit
1.1.15.8	1.1.15.8.0 ADD with 262144bit/33554432bit
1.1.15.9	1.1.15.9.0 ADD with 262144bit/67108864bit
1.1.16.1	1.1.16.1.0 ADD with 524288bit/524288bit
1.1.16.2	1.1.16.2.0 ADD with 524288bit/1048576bit
1.1.16.3	1.1.16.3.0 ADD with 524288bit/2097152bit
1.1.16.4	1.1.16.4.0 ADD with 524288bit/4194304bit
1.1.16.5	1.1.16.5.0 ADD with 524288bit/8388608bit
1.1.16.6	1.1.16.6.0 ADD with 524288bit/16777216bit
1.1.16.7	1.1.16.7.0 ADD with 524288bit/33554432bit
1.1.16.8	1.1.16.8.0 ADD with 524288bit/67108864bit
1.1.17.1	1.1.17.1.0 ADD with 1048576bit/1048576bit
1.1.17.2	1.1.17.2.0 ADD with 1048576bit/2097152bit
1.1.17.3	1.1.17.3.0 ADD with 1048576bit/4194304bit
1.1.17.4	1.1.17.4.0 ADD with 1048576bit/8388608bit
1.1.17.5	1.1.17.5.0 ADD with 1048576bit/16777216bit
1.1.17.6	1.1.17.6.0 ADD with 1048576bit/33554432bit
1.1.17.7	1.1.17.7.0 ADD with 1048576bit/67108864bit
1.1.18.1	1.1.18.1.0 ADD with 2097152bit/2097152bit
1.1.18.2	1.1.18.2.0 ADD with 2097152bit/4194304bit
1.1.18.3	1.1.18.3.0 ADD with 2097152bit/8388608bit
1.1.18.4	1.1.18.4.0 ADD with 2097152bit/16777216bit
1.1.18.5	1.1.18.5.0 ADD with 2097152bit/33554432bit
1.1.18.6	1.1.18.6.0 ADD with 2097152bit/67108864bit
1.1.19.1	1.1.19.1.0 ADD with 4194304bit/4194304bit
1.1.19.2	1.1.19.2.0 ADD with 4194304bit/8388608bit
1.1.19.3	1.1.19.3.0 ADD with 4194304bit/16777216bit
1.1.19.4	1.1.19.4.0 ADD with 4194304bit/33554432bit
1.1.19.5	1.1.19.5.0 ADD with 4194304bit/67108864bit
1.1.20.1	1.1.20.1.0 ADD with 8388608bit/8388608bit
1.1.20.2	1.1.20.2.0 ADD with 8388608bit/16777216bit
1.1.20.3	1.1.20.3.0 ADD with 8388608bit/33554432bit
1.1.20.4	1.1.20.4.0 ADD with 8388608bit/67108864bit
1.1.21.1	1.1.21.1.0 ADD with 16777216bit/16777216bit
1.1.21.2	1.1.21.2.0 ADD with



ARM Cortex-M Instruction Set Architecture

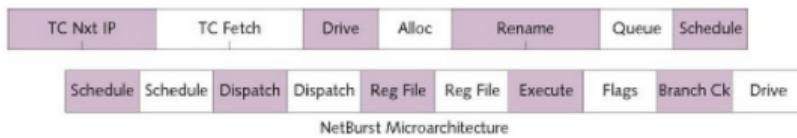




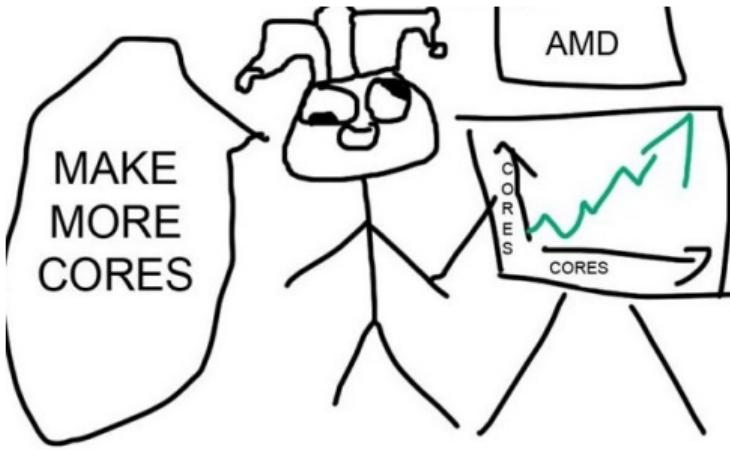


Częstotliwość zależy od:

- Dostępnego chłodzenia i mocy
- Danego zadania i instrukcji
- Czasu (W procesorach intel)

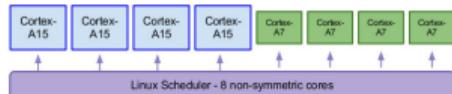


Dłuższy pipeline to wyższe zegary, ale długie pipeliny wymagają predykcji.

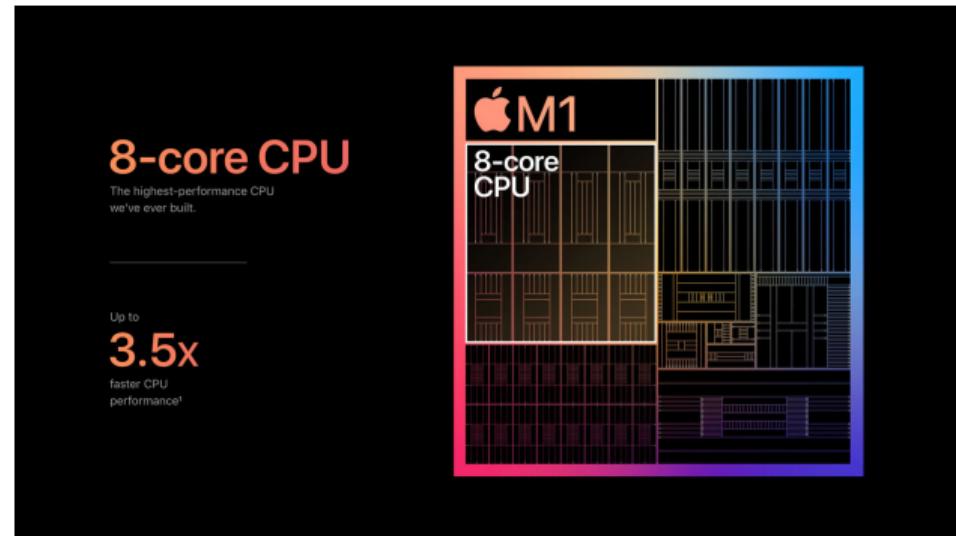


- Więcej rdzeni - większe chipy
- Programowanie aplikacji wielowątkowych jest trudne

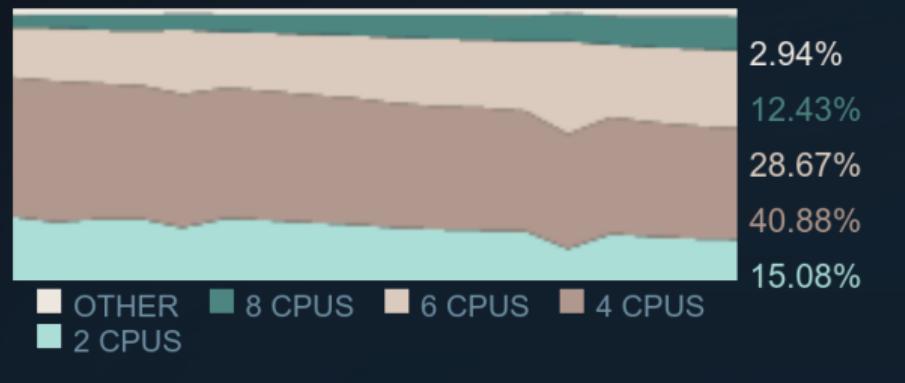
Czym jest big.LITTLE



4 duże rdzenie i 4 małe, zarządzane przez system.



NOVEMBER 2019 - APRIL 2021



Z danych Steam'a

- Zegary ustabilizowane na około 4,5Ghz
- Agresywny boost (nawet do 250W)
- Koniec dominacji 4 rdzeni.
- Duże ilości pamięci Cache

Dziękujemy za uwagę!