

Low consumption and high performance Intel, AMD and ARM based Mini PCs

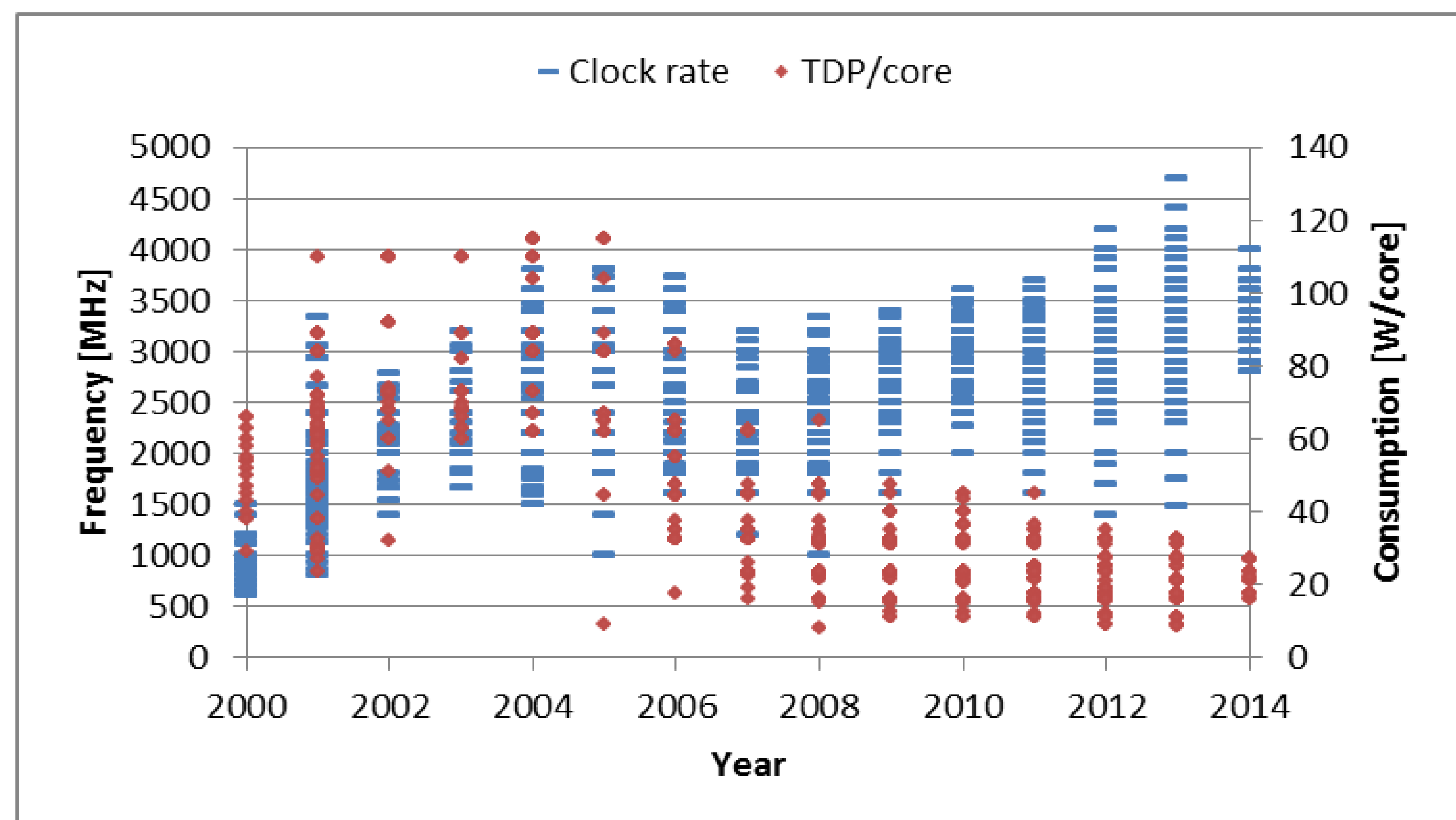
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In the early 2010s, the interest on Mini PC market shifted towards the ARM architecture. The first cheap hackable, Linux-friendly ARM-based Mini PC, the MeLE A1000 was introduced in 2012. We tested the use of this ARM-based Mini PC as thin client and the speed of Linux system based on this architecture and the test results were published by us. During our research, we found that although the computing performance of MeLE A1000 is similar to an Intel Pentium III processor, there is a significant difference in consumption, which today is an important aspect regarding the continuous increase in the number of electronic devices and the energy consumption growth in households.



Many Android media players based on Amlogic S802 Meson8 platform with quad core **ARM Cortex A9r4** processor, which is the set-top box version of the M802 SoC, first were launched in Q1 2014. The clock speed of the processor is 2 GHz. The GPU is octa-core ARM Mali-450 MP6 running with 600 MHz speed. The CPU supports maximum 4 GBDDR3/3L, LPDDR2/3, USB 2.0 and OTG but no USB 3.0. The Tronsmart Vega S89 Elite fan-less media player has this SoC with 2 GB DDR3/3L system memory and 8 GB NAND flash. The media player includes Google's Android 4.4 Kitkat operating system. I/O ports: 2 x USB 2.0 host ports, micro USB OTG port, micro SD card slot, 10/100 Ethernet, WiFi 802.11a/b/g/n, Bluetooth 4.0, HDMI 1.4b, AV, optical S/PDIF and a built in IR sensor for remote control support.



Tronsmart Vega S89

The increase of the degree of integration is contributed significantly to the appearance and spread of Mini-ITX standard. Of course, with the integration levels, more and more heat is generated in a smaller place, so its dissipation has become a challenge for hardware manufacturers. With the appearance and spread of SoC solutions, this problem was more and more significant. **The development of manufacturing technologies and architectures established the base of lower power consumption at higher clock rates.** The solutions are new energy efficient architectures and increased parallel processing.



ZOTAC AQ01

ZOTAC announced at the end of 2013 the ZBOX nano series AQ01 Mini PC with quad-core **AMD A4-5000** APU (non-fanless) but without onboard memory and storage. I/O ports: 1 x SATA 6.0 Gbit/s, 2 x USB 3.0, 5 x USB 2.0, Gigabit Ethernet, Analog out, Microphone input, optical S/PDIF, WiFi 802.11ac, Bluetooth 4.0, HDMI, DisplayPort, Card reader, integrated IR receiver.

The new ZOTAC ZBOX C-series nano Mini PCs combine new fan-less chassis with high-performance processors. The ZBOX CI320 nano has an **Intel N2930** CPU inside, but there is not a memory and storage. I/O ports: 1 x SATA 6.0 Gbit/s, 1 x eSATA, 4 x USB 3.0, 2 x USB 2.0, Gigabit Ethernet, Analog out, Microphone input, optical S/PDIF, WiFi 802.11ac, Bluetooth 4.0, HDMI, DisplayPort, Card reader, integrated IR receiver.



ZOTAC CI320

Conclusion

The purpose of our research was to analyze some CPUs with the lowest possible power consumption to determine the strength of the current Mini PC market conditions. The selected processors had similar parameters, but different processor architecture.

In the area of consumption, the ARM architecture based processors are preferred, although performance is slightly lower than the x86/64 rivals. This is mainly due to the fact that they are primarily intended to run general-purpose applications on them, so tasks that require floating point calculations are less recommended. The only limitation of the world-wide spread is the low-level software support.

In case of the x86/64 architecture processors, Intel clearly leads the ranking in consumption, but the computing power of AMD is nearly in the same position. The results of our measurements show that AMD is also primarily focused on running general applications, while Intel is slightly stronger in the floating point calculations.

		Single-core	Multi-core
ZOTAC CI320 (max. TDP ~7.5W)	Sum	842	2714
	Integer	892	3371
	Floating	740	2924
	Memory	949	980
ZOTAC AQ01 (max. TDP ~15W)	Sum	866	2785
	Integer	962	3668
	Floating	712	2800
	Memory	982	990
Tronsmart Vega S89 (max. TDP ~7W)	Sum	787	2325
	Integer	990	3291
	Floating	646	2192
	Memory	667	602