Arm Cortex-A8 and Intel core i7 920

By:

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The research paper will investigate two distinguished computer processors that provide a wide range of specialized functions. Both versions have been tailored to offer high-performance user-friendly interface to meet the needs of all users. It is necessary to have broad knowledge and understanding of computer specifications before purchasing one in order to choose the machine that best fits one's preferences.

The ARM Cortex has been in use since 2005. It was introduced as a processor supporting the ARMv-A. The Cortex-A8 is supported by optimized IP target at mid-range solutions, which enables to be efficient and easily integrated. The MAIL 400 also provides a mid-range processing option, and it is compatible with all Mali hinge end, display and video processors. This processor has specific structures that make it perfect in high-performance end products. It has a symmetric superscalar pipeline that enables it to simultaneously issue any two instructions that sequentially occur. It also has an advanced branch prediction unit with over 95% accuracy, an integrated L2 cache that provides optimal performance in demanding systems. This processor has the advantage of using accelerating multimedia and DSP processes, because it supports the NEON technology. The Cortex-A8 processor can also speed from 600MHz to more than 1GHz, thus meeting the requirements for power optimized mobile devices needing the operation in less than 300mW and performance-optimized consumer applications (Gu, 2010).

On the other hand, the Intel Core i7-920 processor is fully equipped with enhancements for its best performance. It boasts the clock speed of 2.66 GHz, and it can achieve a turbo boosted clock of 2.93 GHz. Besides, an added boost of over-clocking is also possible with this processor. This processor has four cores and eight threads, and memory capacity of 8 MB in the smart cache. The overall memory capacity is 24GB, which provides a bandwidth of 25.6GB available from three channels. The Intel Core i7-920 has a maximum TDP of 130 watts, and the instruction set runs on a 64-bit system. Enhancement features in this processor include Intel 64, turbo boost technology, and idle states and an execute-disable bit. This processor also has upgraded enhancements that include Intel hyper-threading technology, Intel VT-x with extended page tables, and VT-x Virtualization Technology (Portillo et al., 2001)

The instruction set architecture serves as a boundary between hardware and software. This set of instructions is grouped into five categories that include the operant storage found in the CPU, explicitly named operant, operant locations as well as type and size of operant and operations. The common types of instruction set architectures are the accumulator, stack, and general purpose register.

Using a memory management unit in application gives the benefit of virtual memory that permits many processes to run using address protection and flexible memory mapping. The memory pages are organized according to access privileges, mapping, and size. The features of the memory management unit are translation look-aside buffers, protected memory spaces, variable page size, and easy and fast management of translation look-aside buffers exceptions. The role of this hardware is to convert virtual addresses required by the CPU to physical addresses. It is also used to protect the processes from each other by operating systems. The memory management unit uses translation buffers to accelerate the process of converting from virtual to physical. Translation buffers can be separate, depending on the devise used for instructions and data, or unified. The ARM Cortex A-8 has a two-level memory system, all four way set associative, while Intel Core i7-920 has one-leveled associative (Oshana and Kraeling, 2013).

As Damien (2011) explains, the level one cache is found in the CPU and it is used for the temporary storage of instructions and data. This primary cache is the fastest form of storage. It is limited in size, because it is built with a zero wait state interface to the processor's execution unit. The level 1 cache undergoes implementation by the use of static RAM that was 16KB. All designs with cache level 1 keeps the most frequently used data and the code, and updates the external memory. The ARM Cortex has a level 1 cache of 3KB, while the Intel has 8MB.

Level 2 cache supplies stored information to the processor without delaying. It is used when the cache has been missed to make sure that the CPU does not search for information elsewhere. The information stored in cache one is also stored in cache level 2

Cortex-A8 supports a control diagram that enables it to produce high-quality prediction results in fewer replays and lower power. The dynamic branch consists of 512-entry 2-way BTB, 4k-entry GHB indexed by branch history, and 8-entry return stack. All the branches are resolved in a single stage, and speculative and non-speculative versions of branch history are maintained (Portillo et al, 2011)

All computers are powered by a central processing unit (CPU), and from 1990s microprocessor CPUs have been used, because they are much faster than their previous counterparts and for a long time have been used as a standard for computing. Technology companies are currently designing CPUs that are meant to be faster, advanced, and cheaper, and in the process they are adding more cores making them more powerful. This paper seeks to explain how CPUs work and why it is necessary to have a computer with multiple cores. Advantages and disadvantages of both will also be explained (Oshana and Kraeling, 2013).

How CPU Works

The central processing unit serves as the brain of the computer as it takes all instructions from the user. The user, in this case, enters raw data, which is unorganized or unsorted, for processing. It processes the data through the use of logic and arithmetic codes, and finally executes to different computer parts to display the final information output.

Single-Core CPU

A single-core central processing unit uses only one core inside of the processor of a computer. It has been widely used from 1990s, but today its usage has dropped as these processors can only be found in smartphones, laptops, and netbooks.

Advantages:

- Single-core uses less power as compared to multi-cores.
- Machines using single-core have no problem of overheating, because they use less energy than multi-cores.
- Having a single-core processor is suitable, because it is compatible with most of the software.

Disadvantages:

- Computers using single-core processors are much slower, because they have less computing power as compared to multi-core processors.
- Computers using single-core processors have a problem of freezing, a situation where the computer "hangs" and fails to respond to new programs run by the user.

Multi-Core CPU

A multi-core processor has two cores integrated into a single unit and used to execute tasks (Slater, 1989).

Advantages:

- Multi-core processors perform functions faster than the single-core processor, because it has multiple cores integrated into one.

Disadvantages:

- Due to the excessive usage of electricity, multi-core computers waste much power.
- Due to high power usage, multi-core computers are prone to overheating.

A memory module is a circuit board containing DRAM integrated circuits installed on a computer's motherboard. In other words, a memory module is a type of board that is normally used for RAM in desktop computers depending on the processor. Both processors use dual-channel plan that requires a dual-channel motherboard and each of the two common memory modules, namely SIMM (single in-line memory module) and DIMM (dual in-line memory module). SIMM is relatively old and uses a 30-pin connector. Most computers allow for installation of multiple SIMM modules, for example, one would install two 8-megabyte modules. Most computers allow for installation of multiple SIMM modules, for example, one would install two 8-megabyte modules to achieve capacity of a 16-megabyte module. Later, SIMM were modeled to have an increased bandwidth and also had up to 256 MB of RAM (Oshana and Kraeling 2013).

After the development of multi-core processors that had high speed and bandwidth capability, the technology industry had to devise a new module called DIMM (dual in-line memory module). Designed to have as large as a 184-pin connector, the DIMM module has the capacity of 8MB to 1GB and can be installed in a single module instead of being installed in pairs.

Both ARM Cortex-A8 and Intel Core i7-920 support dynamic branch prediction even though the aspect is more developed in Intel Core i7-920 than its competitor. The 14-stage pipeline system allows the dynamic aspect to work with multiple instructions per clock cycle. It operates as a static in-order pipeline, in that instructions issue, execute, and commit in order. According to Gu (2010), the overall pipeline consists of three sections of instruction fetch, instruction decode, and execute.

In conclusion, the Intel Core i7-920 seems to be a better model, especially for persons interested in high-performance machines. It is of great necessity to have a machine that can run a substantial number of tasks simultaneously without delays or hanging. By managing instances of overheating from the processor, one stands to accomplish numerous tasks in a short period. My opinion is that efficacy is the most important attribute one can place on a computer, especially in the generation that experiences information overload.

References

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