

A Comparative Study on Recent Mobile Phone Processors

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Abstract: Now a days mobile phones have developed into sophisticated gadgets offering numerous prospects. They are more or like computer systems. The processor is the brain of the mobile operations. Multitasking processors are needed to handle multiple applications. A processor reads and executes the instructions provided by the users. In this paper we focus our study on 4 mainly used mobile processors namely NvidiaTegra , Samsung Exynos , Qualcomm Snapdragon and Intel Atom. The features , advantages and disadvantages of each of these are compared and discussed .

Keywords: Mobile phone Processors, Qualcomm Snapdragon, NvidiaTegra , Samsung Exynos, Apple A9, Mediatek ,Intel Atom

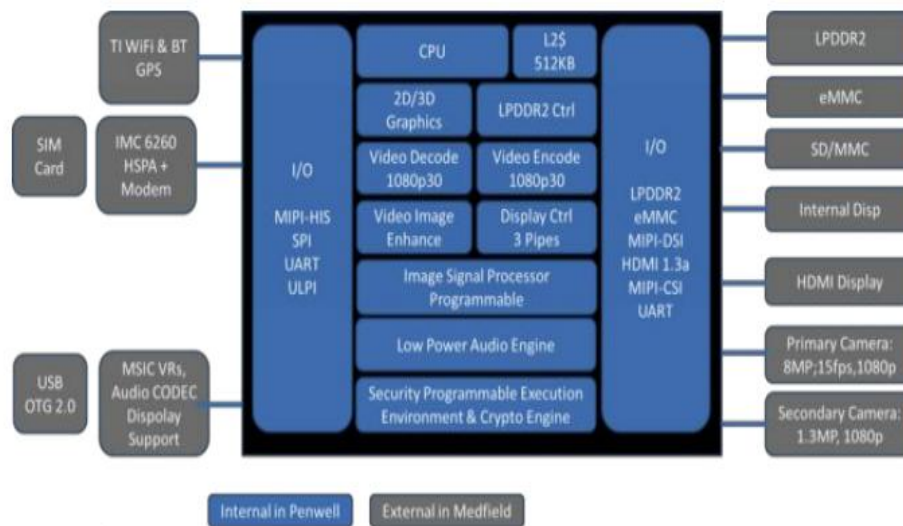
I. Introduction

The processor is the "brain" of every devices. The Processor handles the instructions of the software applications. All mobile phones have a processor of some kind which may be integrated into the main cell phone chip, or be a separate computer chip. A faster processor allows applications to run faster. The speed of raw processor is measured in MHz or GHz. However some processors are more powerful than other processors, so even if two different processors both run at a speed of 1 GHz, if one processor is more powerful, it may run software applications much faster. Other factors often affect the perceived speed of a mobile phone , For example, the wireless radio and network determine how fast the data gets downloaded. Also, phones may have a separate graphics processor that determines the speed of visual elements, especially with games and other areas with complex animations.

A mobile processor^[1] is a system on a chip designed to support applications that are running in a mobile phone's operating system. A mobile processor provides a self contained operating environment that provides all system capabilities required to support a mobile applications, including memory management, graphics processing and multimedia. Mobile processors may be independent from other specialized processors in the same device, such as a phone's baseband processor. Some vendors manufacture their own mobile application processors. Other vendors purchase their mobile application processors, using them as original equipment manufacturer components. For example, the Qualcomm Snapdragon mobile phone application processor is contained in many smart phones that use Qualcomm Snapdragon to run the Android mobile phone operating system and Android mobile applications.

A wide variety of mobile devices contain mobile processors, including feature mobile phones, smart phones, tablets, eReaders, netbooks, automotive navigation devices and gaming consoles.

II. Mobile Phone Processor Architecture



III. Different Mobile Phone Processors

The mobile processor has become more and more important on the latest smartphone hardware's specification sheets. To appreciate the importance of mobile processors, it's not really necessary to know the workings of each one. This year we have seen several next generation mobile phone processors introduced, mainly from Nvidia, Qualcomm, Apple, and Samsung.

In this paper, we would like to present some important information's about these chips in the mobile phones and tablets. They are currently powering and those which will be appearing soon-to the best of our knowledge.

3.1 Qualcomm Snapdragon

3.1.1 Qualcomm Snapdragon 600 And 800

Qualcomm dominates mobile processors, and these two Snapdragon processors will likely be in many of the Smartphone released during the year 2013.

The quad-core Snapdragon 600 resides in both mid range and high-end smart phones and tablets, can run up to a speeds of 1.9GHz and is equipped with an Adreno 320 graphics chip. Think of it like a turbo-boosted Snapdragon S4, which was found in the Samsung Galaxy S3 and most other phones that came out in late 2012.

The quad-core Snapdragon 800 never made its debut until the end of this year, but it was worth the wait. Its features include Ultra HD resolution video recording and streaming to Ultra HD external displays, cameras with up to 55 megapixels and a clock speed up to 2.3GHz.

It also supports 3G and 4G, plus the latest graphics chip that is the Adreno 330 graphics chip. Qualcomm says it's 75% faster than the fastest Qualcomm's Snapdragon S4.

Qualcomm's Snapdragon^{[2][3]} 600 seen in: While it's seen as the lesser alternative to the Qualcomm's Snapdragon 800, Qualcomm's Snapdragon 600 is still found in most of the smart phones in sale. For example: The Samsung i9505 Galaxy S4 and the HTC One, and the recently announced HTC One Max. Other devices with the processor includes the ZTE Grand Memo, the LG G Pad 8.3 tablet and LG Optimus G Pro.

Snapdragon 800 seen in: The majority of high-end and big screen smartphones released recently uses the Snapdragon 800. Sony utilizes the mobile phone processor in the Xperia Z1 and the Z1 Ultra, while Samsung has stuffed it along with 3GB of RAM inside the Galaxy Note 3. LG uses it in their LG G2, Nokia using it in their Lumia 1520 and Lumia 2520 tablet, and Asus slotted it into the updated Padfone Infinity 2.

3.1.2 Qualcomm Snapdragon 200 And 400

Unlike their more powerful chips, the Qualcomm's Snapdragon^{[2][3]} 600 and 800, the Snapdragon 200 and 400 live in more standard devices. The dual-core Snapdragon 400 can run at a speed of 1.7GHz and has 4G connectivity, and an Adreno 305 graphics chip, while the Snapdragon 200 can reach only upto 1.4GHz and has a basic Adreno 203 graphics processor.

The Snapdragon 200 has been used in low-end mobile phones such as the HTC Desire 500 and the Samsung Galaxy Win, while the Snapdragon 400 powers the HTC Desire 601 and the HTC First.

3.2 Nvidia Tegra 4 And Tegra 4i

The Nvidia Tegra^[4] 4 is defined as the world's fastest mobile phone processor and it modifies the super advanced ARM Cortex A15 cores to produce speed up to 1.9GHz. Like the Nvidia Tegra 3, the Nvidia Tegra 4 also has a companion core to take care of the easier tasks, that results in less energy consumption and longer battery life. It's capable of supporting Ultra HD (4K) video by using the HDMI port, 4GB of RAM, and a screen resolution up to 3200 x 2000 pixels.

Nvidia's second Tegra chip, the Nvidia Tegra 4i, is based on the ARM Cortex A9 architecture, but still it offers some stonking specifications such as 2GB of RAM, 1080p resolution and a maximize the speed upto 2.3GHz. It also has Nvidia's new i500 4G LTE modem built-in, which is very slim and more power efficient.

We're excited about both Nvidia's new processors, but it has only very recently they have begun appearing in hardware we can actually buy. ZTE was the first to come up with a smartphone powered by the Tegra 4, but it is only available in China. However, Nvidia's chip has fared better in case of tablets, with Microsoft adopting it for the refreshed surface range. Naturally, Nvidia's own Android-based Shield portable gaming machine also uses a the Nvidia Tegra 4.

As for the Tegra 4i, it's still coming soon, and is expected to arrive in an unknown hardware before the end of the year, which could be based on a Nvidia reference design phone.

Tegra 4 seen in: some months ago, the Nvidia Tegra 4 was nowhere to be seen. ZTE has since announced the Geek smartphone, making good on its promise to be the first to produce a Nvidia Tegra 4 device, while Microsoft has used it inside the Surface 2 tablet. Elsewhere, the Nvidia Tegra 4 is taking care of business in the Asus Transformer Pad TF701T, the Kobo Arc 10HD, and the upcoming HP Slate 7 Extreme.

Tegra 4i coming soon in: Nvidia's Phoenix reference phone, equipped with an 8mm chassis and a 1080p, 5-inch display, which is apparently available for manufacturers to purchase outright. The Phoenix could be joined by another reference phone, with a smaller 4.8-inch screen, an 8-megapixel camera, and 4G LTE.

3.3 Samsung Exynos 5 Octa (Eight Core)

The Samsung's Exynos^[5] 4 Quad is a processor driving many of the Samsung's high-end phones and tablets outside the U.S., including the Galaxy S3 and the Galaxy Note 8.0. Its eight-core sister chip, the Exynos 5 Octa, is expected this year.

The eight-core Samsung's Exynos 5 Octa powers the i9500 version of the Galaxy S4 and the N9500 Galaxy Note 3, versions which are sold only in a limited area around the world. Initially it was believed to be an issue related to 4G LTE connectivity, the production volumes are to be blamed for its lack of international availability.

While it's called an eight-core chip, the Samsung's Exynos 5 Octa is effectively two quad-core chips nailed together using the concept of ARM's Big Little. Without being too technical, here's how this works: When demand on the processor is low, everything is handled by the "Small" 1.2GHz quad-core chip, but when demands get more stressful, a "Big" 1.8GHz quad-core chip based on the same ARM Cortex A15 architecture as the Nvidia Tegra 4 takes over. The benefits are same as that of Tegra 3's little companion core, as it results in lower energy consumption when the phone is performing basic tasks.

At first, the Samsung Exynos 5 Octa could only use four cores at a time, but an updated version uses a new technique to enable all eight to work together.

Samsung Exynos 5 Octa seen in: The i9500 Samsung Galaxy S4, and the N9500 Galaxy Note 3.

3.4. APPLE A9

The Apple A9^[6] is a 64-bit ARM based system on chip designed by Apple. It first introduced in the iPhone 6S and iPhone 6S Plus. Apple states that it has 70% more CPU performance and 90% more graphics performance compared to that of its predecessor, i.e. the Apple A8.

The A9 features an Apple-designed 64-bit 1.85 GHz ARMv8-A dual-core CPU called Twister. The A9 in the iPhone 6S has 2 GB of RAM included in the package. It has a per-core L1 cache of 64 KB for data and 64

KB for instructions, an L2 cache of 3 MB shared by both CPU cores, and an 8 MB L3 cache that services the entire system on chip.

The Apple A9 is packed with a new image processor, a feature which was introduced in the Apple A5, that have an advantage of better temporal and spatial noise reduction as well as improved local tone mapping. The Apple A9 directly integrates an embedded M9 motion coprocessor, a feature that was originally introduced with the Apple A7 as a separate chip. In addition to servicing the gyroscope, accelerometer, compass, and barometer, it can recognize Siri voice commands.

3.5. Mediatek Mt6592

MediaTek^[7] isn't a very well known processor in the U.S. or Europe, but its cheap, low-power MT6589 quad-core processor can only be found in various smartphones that are sold in China. Following this success, it has moved onto developing an eight-core processor, named it as MT6592. Based on ARM's Big Little technology, it will also be able to run all eight cores simultaneously. A recent rumor that has linked the MT6592 with a Sony smartphone and tablet hybrid codename Tianchi, possibly due for release in November.

3.6. Intel Atom

3.6.1 Intel Atom Z2580 Clover Trail+

Intel Atom^[8] Z2580 Clover Trail+ is Intel's follow-up to the Medfield chip seen in mobile phones such as the Motorola Razr i and the ZTE Grand X IN. The Clover Trail+ adds an extra core to make this a dual-core processor and it can run up to a speed of 2.0GHz. It has an enhanced PowerVR graphics, tripling the 3D ability of the Medfield.

Intel's Z2580 seen in: The Lenovo K900, a 5.5-inch, 1080p smartphone or tablet hybrid was released at CES 2013. However, the device that has yet to make out its way out of China. Following a deal with ZTE, the Chinese firm put the Z2580 into the ZTE Geek, but then exchanged it out for the Nvidia Tegra 4 several months later. To make up, ZTE subsequently announced the Grand X2 in May.

3.6.2 Intel Atom Z2420 Lexington

It has been announced at CES 2013, the Z2420 Lexington is destined for modestly specified hardware. The chip has already been adopted by Acer, which is included inside Liquid C1, an Android 4.0 phone with a 4.3-inch screen and an 8-megapixel camera. Since then, it has shown up in the Asus Fonepad tablet and HTC Desire 601.

IV. Conclusion

The recent developments in mobile communication technology show the importance of mobile phone processors in the handsets. We are very much aware of the existence and capabilities of normal and extended CPU in a system; but unfortunately most of us don't have much idea regarding the mobile phone processors. We couldn't carry out a strict comparison of the recent mobile phone processors in our article; but we have tried our best to bring out some features and capabilities of the four mobile phone processors; which may be of use to those who study about the processor technology. The upcoming releases Qualcomm Snapdragon 830, Kirin 940, MediaTek MT8173, Intel Atom X5 and X7 of the processors will surely make drastic changes in the future.

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