NANOTECHNOLOGY: A REVOLUTION IN THE MOBILE WORLD

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Abstract-- Nanotechnology is the engineering which is based on the fabrication of chips or ICs measuring less than 100 nm. Physicist Richard Feynman is known as the father of nanotechnology. Earlier days where processing was so slow that we had to wait for hours even sometime days but after the enhancement in tech world and introduction of nanotechnology computation and speed has increased 100 times. This change has brought many positive effects and the chips that made possible are listed below.

Key Words: **Nanotechnology, Software Engineering, Mobile Platform Development**

I. INTRODUCTION

➢ Processors:

While designing a processor we always care about reducing its size and make it smaller as possible as we can. Smaller transistors will make use of more complex and sophisticated features to be put into the products which allow for computers to run faster and safer from a browsing as well searching experience to business applications.[1] Thus smaller, faster and lighter computers will be the potential result of the nanotechnology impact on computer technology.[2] Today's pocket-sized smartphone has more computing power than the huge computers.[3] Nanoelectronics uses very thin wires and molecule sized transistors. Such kind of devices have more memory and calculating ability in smaller area or space. The power consumed would be less. They are really tiny, that is billionths of a meter, or about 1/500th the width of a human hair.[4] Qualcomm is the largest manufacturer of processors fir Android mobiles and tablets.

➢ The Qualcomm Snapdragon S Series:

The first processor created by qualcomm was the Snapdragon S based on 65 nm architecture featuring a Scorpion CPU core, an Adreno 200 GPU and GSM/UMTS radio.[5]

Feature:

- Clock Rate-1000 MHz
- Number of Cores / Threads-1 / 1
- Manufacturing Technology-65 nm
- Capabilities- Embedded 600MHz DSP (GSM, GPRS, EDGE, UMTS/WCDMA, HSDPA, HSUPA, MBMS baseband), Embedded Seventh-generation gpsOne GPS module, gpsOneXTRA Assistance
- GPU-Qualcomm Adreno 200
- 64 Bit -no 64 Bit support
- Announcement Date 09/01/2008

Know issues: In-efficient due to 65 nm architecture and no 64 bit support.

➢ The Qualcomm Snapdragon 200 Series:

The next processor created by qualcomm was the Snapdragon 200 Series but this time 45 nm architecture featuring quad core Cortex-A5 with a dedicated GPU for enhanced graphics performance.[6]

Features:

- Series-Qualcomm Snapdragon
- Codename-Cortex-A5
- Series-Snapdragon Cortex-A5
- Clock Rate-1400 MHz
- Number of CPU Cores and Threads- 4 & 4 respectively
- Technology-45 nm
- Extended Features-USB 2.0, Bluetooth 4.
- 0,802.11n WLAN
- GPU-Qualcomm Adreno 203
- Announcement Date-09/26/2012

Know issues: In-efficient due to 45 nm architecture and single threaded performance is however much lower.[7]

➢ The Qualcomm Snapdragon 400 Series:

The Qualcomm Snapdragon 400 is an entry level ARM-SoC(System On Chip) for Android smartphones as well as for tablets.[8] It offers four Cortex A7 cores clocked up to 1.6 GHz (Quad-Core) as well as an Adreno 305 graphics card. Also, a HSPA+/LTE radio is integrated in the SoC, which is manufactured in a 28-nanometer LP process.

It was a big revolution as it was the first processor to come with 28 nm architecture which came out to be really efficient.

Features:

Series - Qualcomm Snapdragon(SD400)
Codename :- ARM-v7
Series: Snapdragon ARM-v7
Clock Rate-1600 MHz
Number of Cores & Threads: 4 & 4 resp.
Underlaying technology-28 nm
Features- Adreno 305, LPDDR2/LPDDR3 Memory Controller, GSM/UMTS/WCDMA/LTE
GPU : Qualcomm Adreno-305
Announcement Date -07/01/2013
Known Issues: Low GPU performance.
Exception: Snapdragon 450 :
The Snapdragon 450 was launched on 28 June 2017.

- it's the first 14nm FinFET chip in its tier, delivering improved power efficiency
- the chip integrates the octacore ARM Cortex-A53 CPU clocked at 1.8Ghz
- the integrated GPU solution features the Adreno 506, which boosts performance by 25% compared to the previous 435 chip

The Qualcomm Snapdragon 625/626 Chipsets:

The Qualcomm Snapdragon 625 is a mid-range octa-core SoC with 8 ARM Cortex-A53 CPU cores at up to 2 GHz, an Adreno 506 GPU, a DDR3L-1866 memory controller and a X9 LTE (Cat 7, 4G+, 300 Mbps down, 150 Mbps up) modem. Furthermore, the chips supports 802.11ac WiFi and Bluetooth 4.1/4.2 respectively. [9]They are manufactured in 14nm FinFet. Due to the modern manufacturing process, power consumption and throttling should be better with the Snapdragon 625/626.[10] They dissipate less heat due to there 14 nm structure and hence consumes less power.

Feature:

Series Qualcomm Snapdragon
Codename Cortex-A53
Series: Snapdragon Cortex-A53
Clock Rate:2.0 GHz
Number of Cores & Threads : 8 & 8 Respectively
Fabrication Technology : 14 nm
Features : Adreno-506 GPU, 802.11ac WLAN, Bluetooth 4.1, LTE Cat. 7, Dual-Channel LPDDR3-1866 Memory Controller
GPU : Qualcomm Adreno-506
64 Bit : Yes 64 Bit support.
Announcement Date - 02/11/2016

Performance and user experience enhanced after the arrival of these chipsets. They are fast, accurate and most efficient in their segment. They save around 75% of space and overall output is also magnificent.

➢ The Qualcomm Snapdragon 835 Chipsets:

The Qualcomm Snapdragon 835 is a high-end SoC for smartphones (mostly Android based) that was released early 2017.[11] Its one of the first processors that is manufactured in 10 nm (LPE FinFET at Samsung). The SD835 is the successor to the Snapdragon 821.It integrates 4x Kryo 280 at 2.45 GHz (max) for performance and 4x Kryo 280 at 1.9 GHz (max) for efficiency. Furthermore offers an X16 LTE modem, 802.11a/b/g/n/ac/ad WiFi, a dual-channel 32-Bit 1866 MHz LPDDR4x memory controller.

Features :
Series:Qualcomm Snapdragon(SD 800 Series)
Codenamed as - Kryo 280
Clock Rate – 2.45 GHz
Number of Cores & Threads :8 & 8 respectively
Transistor Count >3000 Million
Fabrication Technology : 10 nm
Features - X16 LTE Modem, Adreno 540 GPU, Hexagon DSP, Spectra 180 Camera, Aqstic Audio, IZat Location, Haven Security
Graphics - Qualcomm Adreno-540 (- 710 MHz)
64 Bit support : YES
Announcement Date - 03/22/2017

It is one of the fastest and most efficient processors among all in their segment. 10 nm architecture provides less power consumption and high graphics processing. [12]

This is it of the microprocessors from Qualcomm but it's not the end.[13] Soon, there will be a launch

of 7nm processor namely Snapdragon 845 which is said to be a processor we won't see for ages.[14]

We just can't ignore the ultimate processor which is so young and created unbeatable records just after the launch. It is the A11 chipset by APPLE Inc.

- **The APPLE A11 Bionic:**

A11 bionic is a real powerhouse if we compare it with other processors present till date in competition.[15] The A11 is manufactured by TSMC on a 10 nm FinFET process and contains 4.3 billion transistors on a die 87.66 mm2 in size, 41% smaller than the A10. It is manufactured in a package on package or PoP (an integrated circuit packaging method that is used to combine vertically discrete logic and memory ball grid array) together with 2 GB of LPDDR4X memory in the iPhone 8 and 3 GB of LPDDR4X memory in the iPhone 8 Plus and iPhone X.[16] It is blazingly fast and scored a mindboggling score of 4118 on geekbench(multicore test).[17]

Features :
Series - Apple
Codename - Monsoon / Mistral
Number of Cores / Threads - 6 / 6
Transistor Count - 4300 Million
Manufacturing Technology - 10 nm
Extended Features - ARMv8 Instruction Set
64 Bit support
Announcement Date - 09/12/2017

II. CAMERA SENSORS:

Sony Exmor Sensors:

The cameras which are applied upon mobile devices rely on nano-transistors for each pixel, thus least the size of transistors in a micro-processor amazing the performance of the camera.[18] Miniaturization or making it at a nano level allows more silicon transistors which in turn generates more pixels and an improves image definition.

Sensors such as IMX298,IMX230,IMX318 etc. are based upon nano structure of microprocessor.[19]

SCREEN

We all hear about different types of displays but we miss their underlying principle of their manufacturing. [20]We know sAMOLED displays are the best we have until now.[21] Transistors underpin microprocessors, they also play a vital role in controlling the intensity of light generated or given off by pixels.[22] The mixture of gases are used to form these transistors which makes high-definition screens possible.[23]

III. CONCLUSION

What we have in our pocket right now is the gift of nanotechnology. We all use these magnificently faster, accurate and slim devices. They had made our lives simpler and much hassle free. Day by day we are proceeding a step further in advancement of technology. Today we have 10 nm processor but soon there is going to be a 7 nm(SD845). Breakthroughs are making technologies ever compact and ever more robust day by day, from microprocessors, computing memory to flat panel displays and PV cells. This is opening up of gates of limitless new possibilities and opportunities in the field of computing.

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