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RECENT STUDY IN MICROSOFT SURFACE BOOK AND ITSSIMILARITIES, DIFFERENCES BETWEEN VON-NEUMANN ARCHITECTURE

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ABSTRACT

In this research, authors had investigated and analysed a hybrid laptop produced by Microsoft, the Microsoft Surface Book. Throughout this research, we will be talking about the technology and concept used by the company to produce this computer, which included the specification and architecture. The CPU specification, general architecture, instruction set, registers, memory architecture, implementation issues, I/O specifications and similarity as well as differences with the general computer architecture. We had also analysed the special feature of this computer which made it one of the people's favourite laptop now. At the end of this paper authors discussed about the future of mobile computers.

Keywords: Microsoft Surface Book, technology, general computer architecture, feature, future

I. INTRODUCTION

In this paper, we are required to do researches about a specific model of mobile computer. This allows us to have a detailed knowledge about the technology used in the mobile computer. Using the knowledge that we can obtain from this research, we can further improve the technologies used. We can also see that there are still a lot of potential for the improvement ofmobile computers. On October 26, 2015, Microsoft released the Surface Book, a 2-in-1 hybrid pc. This computer is described as the ultimate laptop by the Microsoft Company itself. This computer is highly recognised for its full-sized, detachable keyboard. This laptop is a hybrid device, in which it can be a laptop or a tablet by just removing the keyboard, making it one of the most user friendly product by Microsoft, as this can suits the user's needs in various ways. We chose this device as our researching device as we think it is going to be the start of a new generation of mobile devices. We wanted to explore more about this device so that we can have further understanding about the current system architecture as well as the potential that it has.

1.1 Selected Mobile Device - Microsoft Surface Book

1.1.1. Cpu Specifications, Features And General Architecture

Surface book comes with two CPU options; both are Intel Skylake dual-core processor, i5-6300U and i7-6600U

Intel i5-6300U processor [1]

➢Dual-core

➢Base frequency is 2.4 GHz; Max Turbo frequency is 3GHz.

➢ On-chip L2 + L3 cache 3584 KB

➢Max TDP 15W

➢Support 64 bit

➢ Memory types DDR4-2133, LPDDR3-1866, DDR3L-1600

➢ CPU socket type is BGA1356

Intel i7-6600U processor [2]

➢Dual-core

➢Base frequency is 2.6 GHz; Max Turbo frequency is 3.4GHz.

➢ On-chip L2 + L3 cache 4608 KB

➢Max TDP 15W

➢Support 64 bit

➢ Memory types DDR4-2133, LPDDR3-1866, DDR3L-1600

➢CPU socket type is BGA1356

Core i7-6600U is more powerful than i5-6300U in terms of speed. Core i7-6600U having higher operating frequency to help user to achieve better performance in all programs. However the official price of i7-6600U is higher than i5-6300U shown in Fig.1.

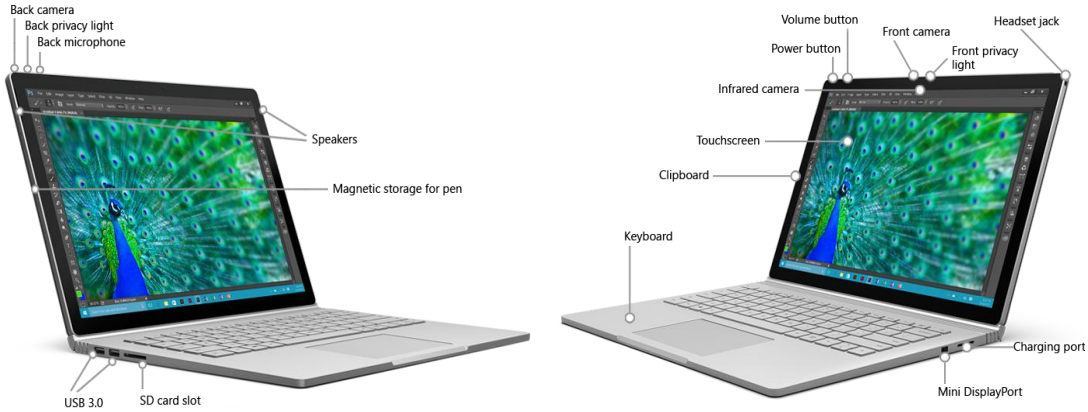

Fig.1 Image: Microsoft surface book

There are several features in the Surface book that makes it a very unique computer. The first one that we are going to talk about here is the latch. The latch that attaches the tablet and the keyboard had a very special design that overcame a problem that has been faced by previous detachable-hybrid tablets. On previous tablets like this, the weight on the tablet itself due to the motherboard, the battery cells and the screen causes the laptop to be top-heavy, causing problems like tipping over. By using a set of parallel hinges to open the screen and putting most of the weight at the keyboard part, the problem can be handled effectively. With its Muscle Wire Lock, the tablet part is securely fastened on the keyboard until it is time to undock. [3]. The second feature of this laptop is Windows 10. Surface book is designed to be compatible with all the major new functions of Windows 10, in which a lot of them requires touch screen, particularly in the start screen. With the latest version of Windows

pre-installed, the user can instantly enjoy the latest operating system developed by Microsoft without much trouble.

The next best feature for Surface Book is its battery life. Based on a battery life test, the laptop can last for over 12 hours on a constant video playback under optimum settings. This enables the laptop to be used for a very long time before having to be charged again. This provides a very big convenience to those who have to use the computer for a very long time while moving around such as salesman. It is also very beneficial for casual users as they do not have to bring the adapter along and look for power supply when they are using it for hours.

The detachable discrete GPU option is a very good feature for the computer. The user can order an optional NVIDIA GeForce GPU along with the Surface Book, which sits in the keyboard part of the computer. So when the user needs a heavy support on graphics such as playing video games and doing multimedia tasks, they can simply dock the tablet onto the keyboard part to get the support from the GPU. When the support is not needed, the user can undock the tablet for portability.Surface Pen is one of the biggest selling point of the Microsoft Surface series is well. Surface Pen is basically a stylus that provides a variety of support to the user while using the computer. There are utilities like buttons, magnetic surfaces and replaceable tips that are compatible with the Surface Book. For example, user can click on the button at the end of the pen to call up the OneNote for quick note taking. The button can also be used as erasers so that erasing can be much faster than changing the tools in the system itself.Last, but not least, the design of the Surface Book is one of the best in the market. It has a shiny chrome Windows logo on the top lid. The all-metal body, the super-bright PixelSense screen, the book like hinge and the surface pen that is attached to the computer just adds a huge credit to its appearance. With a weight of 1.5kg, the 13.5" laptop is considerably light, taking the specs it has into account. [4]

1.1.2 Instruction Set And Registers

Microsoft Surface Book has 2 available processors, which are 6^{th} Gen 2.6-GHz Intel Core i7-6600U processor and 6^{th} Gen 2.4-GHz Intel Core i5-6300U processor respectively. Both of these processors are using a 64-bit instruction set. [3] With the 64-bit instruction set, the processor can handle datapathwidths, integer size and memory address widths of 64 bits. The ability to store 2^{64} (over 18 quintillion) different values allows it to handle more variations of data, such as colors and sound. With a longer instruction and larger combination of values, the instruction can now be more complex and detailed. An instruction can be divided into a few parts, which are shown in Fig.2.

- Opcode : Specifies the operations to be performed
- Source Operand : The source address of operand where the Opcode is executing on
- Result Operand : The destination address of the operand where the Opcode has executed on

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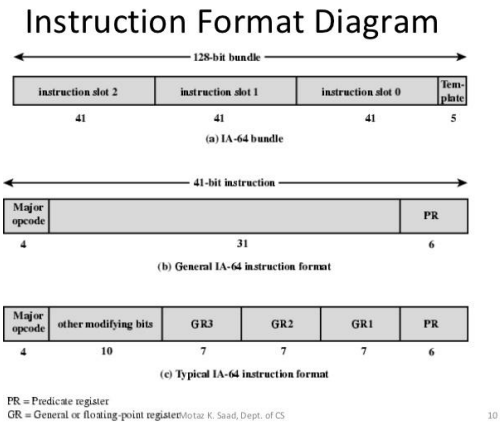

Fig.2 Instruction Format

Besides, it also allows the system to have a higher Random Access Memory (RAM), compared to a 32-bit instruction set which can only handle up to about 4GB RAM. Registersare small storage locations that are quickly accessible by the CPU that are used to store data, addresses or instructions. However, registers used in a computer must be large enough for the instruction sets in the computer. So, surface book uses 64-bit registers so that it can handle the 64-bit instructions used by the processor. There are several kinds of registers, each serving different purposes that are required by the surface book to operate.First, there are General Purpose Registers. These registers are required to carry out algorithms and calculations. They are used to store intermediate results or data values. The registers under this category are:

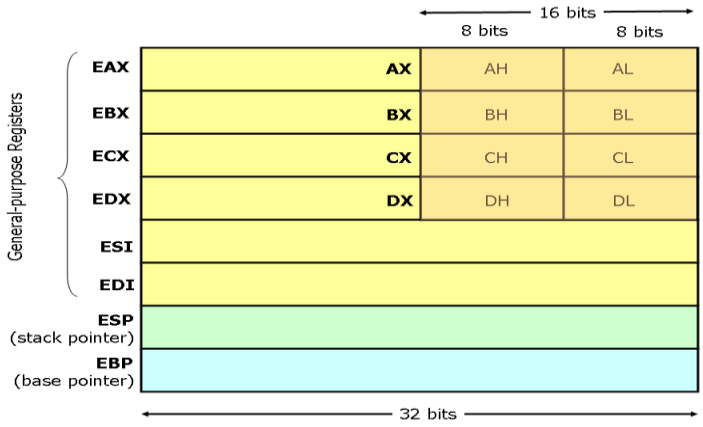

Fig.3 Registers

1.1.3 Memory Architecture/ Model[5]

Microsoft Surface Book shown in Fig.4 comes with Solid-State Drive (SSD) and PC Memory. SSD is a non-volatile storage device which stores persistent data on solid-state flash memory. For this model, it is using aluminium based SSD tray. Based on the information found, it used SamsungPM 951 SSD, a non-mechanical design of Samsung K9CHGY8S5C NAND flash mounted on a circuit board and has a shock resistant up to 1500g/0.5ms. It has options of 128GB, 256GB (retail version),512GB and up to 1TB.

Fig.4Samsung PM 951 SSD

Computer Memory is physical device which has the capability of storing information temporary or permanently. The PC memory is referring to Random-Access Memory (RAM). RAM is a volatile memory and it is a primary storage. When a computer has a higher RAM, the response will be faster. For a more specific detail, Microsoft Surface Book is using Samsung K4E4E324EE DRAM. There are 2 options which are 8GB and 16GB. The most popular combination for Microsoft Surface book is PC memory 8GB and 512GB SSD. The RAM is soldered to the motherboard.Microsoft Surface Book does not used HDDs (Hard Disk Drive) or hybrid drives. It has a full-sized SD slot.

II. IMPLEMENTATION ISSUES

2.1 Graphics Coprocessor

The graphical coprocessor perform rendering functions and all the 2D and 3D geometry, it will offloading the main CPU to performing such tasks.

Fig.5Example of graphic coprocessor

Surface book NVIDIA GeForce graphic (GPU)

- 384 pipelines
- 40 GB/s bus width
- 64 bit bus
- 954 Mhz core clock
- 5010 Mhz Memory Data Rate

With a dedicated GPU, it able to support wide-ranging 3D games even at full resolution. With the NVIDIA graphics, users even can edit their photo without effort and have a browser of more than 9tabs and streaming video also. By using Microsoft Surface Book, user could able to perform multitasking without worries.

2.2 GRAPHICS PIPELINE

Graphics pipeline is the process of turning a 3D model into computer display, Once a 3D model has been created in any 3D computer animations the stages required to transform a 3 Dimensional object into a 2 Dimensional screen. The stages are in charge of preparing data at first gave pretty much as properties toward the end focuses (vertices) or control purposes of the geometric primitives used to depict what is to be rendered. The run of the mill primitives in 3D illustrations are lines and triangles. The sort of properties gave per vertex incorporate x-y-z organizes, RGB values, translucency, composition, reflectivity and different attributes. So with graphics pipeline process Surface Book able to display 3D graphics in 2D display. Nowadays, the most common usage of this is for gaming purpose and also shown in Fig.6.

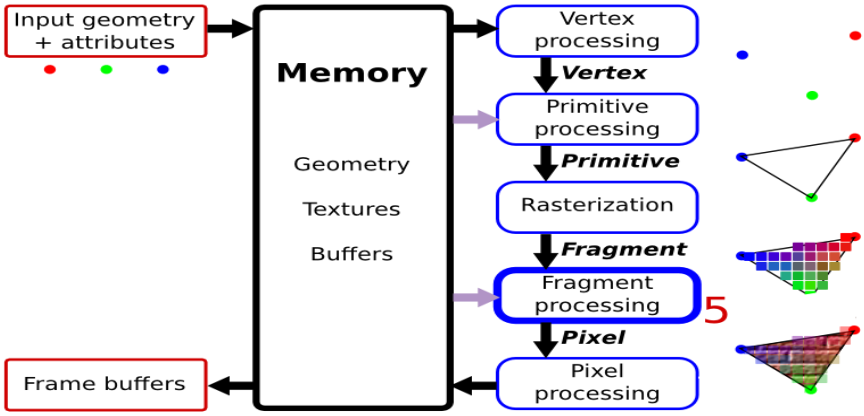

Fig.6 Graphic Pipeline

III. I/O SPECIFICATIONS

Input and output specifications are one of the main concern of mobile device users nowadays. It can highly enhance the user experience on the mobile device, no matter the user is a casual user or a heavy user.First, let us talk about input components and devices. Input devices are devices that allows the user to enter data into the computer, in the form of text, image, sound or even pressure. The specifications of the input technologies are as below:

3.1 Keyboard

- Detachable from the clipboard shown in Fig.7.
- Included a 5-point multi-touch touchpad with two buttons and a QWERTY keyboard without a numpad
- Provides multiple quick and useful functions with gestures on the touchpad and key combinations on the keyboard
- Uses mechanical fraction to be attached to the clipboard

Fig.7 Detachable Keyboard

3.2 Surface Pen[6]

- A stylus that is fully compatible with the Microsoft Surface series shown in Fig.8.
- Included a top button, LED, clip, magnetic surface, right-click button and a cap
- The magnetic surface can be used to attach the pen to the device itself
- The LED acts as indicator when the battery is low as well as pairing mode
- The top button is a clicking mechanism which leads to multiple quick functions. It can also be used as an eraser to erase the note. Uses bluetooth technology to link with the Surface Book.
- The tip of the pen can be replaced with other tips that are suitable to get the job done
- It has 1024 levels of pressure sensitivity

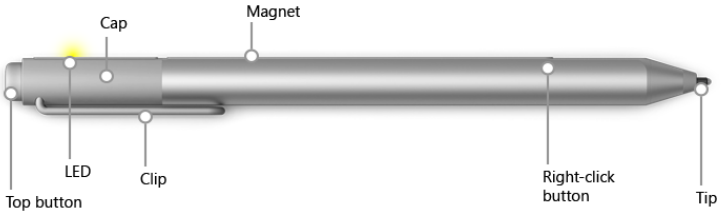

Fig.8 Surface Pen

3.3 Camera

- 5-megapixel front facing camera
- 8-megapixel rear facing camera with autofocus. Capable of filming 1080p videos
- Windows Hello[5] face authenticating camera (front facing) shown in Fig.9.

Fig.9Rear Camera

3.4 Ports

- Two USB 3.0 port shown in Fig.10.
- MicroSD card reader

Fig.10 Ports

Output devices are devices that returns the output to the user, in the form of visual and audio. A good output technology can enhance the user's experience with the device and keep the user from harm by the output device shown in Fig.11.

3.5 Display

- 13.5 inch PixelSense display
- 3000 * 2000 (267 PPI) Resolution
- 3:2 aspect ratio

Fig.11 Screen

IV. SIMILARITIES AND DIFFERENCES BETWEEN ARCHITECTURE OF COMPUTERS

Microsoft Surface Book has a different computer architecture compares to the general computer. Microsoft Surface Book is using Maxwell Architecture while the general computer applied Von Neumann Architecture. Below are two different tables with the analysis of both similarities and difference of the computer architecture:

Similarities	
• Microarchitecture is used ➢ a computer organization ➢ to define the data paths, data processing	
Differences	
Von Neumann Architecture (General Computer)	Maxwell Architecture (Microsoft Surface Book)
• Standard intel HD Graphics • Comprised with: • Arithmetic Logic Unit (ALU) ➢ performs basic calculation: add, subtract, multiple, divide ➢ comparison function: 'greater than', 'less than', 'equal to' • Control Unit (CU) ➢ manage the process of transferring program and data into and out of memory ➢ executes program instructions • Memory Unit (MU) ➢ hold data and program that process data • Input/Output ➢ interaction with machine • Bus ➢ allows flowing of information between parts of computer	• NVIDA GeForce GPU (Graphic Processing Unit) • World most advanced GPU - power the best graphics cards in the world • Have a new frontier in visual computing with the new VXGI (Voxel Global Illumination) technology • Support the exclusive MFFA (Multi-Frame Sampled Anti-Aliasing) technology - high resolution and FBS • dual GPU setup • High speed GDDR5 memory • Streaming Multiprocessor (SM) - improves energy efficiency • twinned with a gigabyte of video memory • 3D processing power

V. FUTURE OF MOBILE COMPUTING

From the research that we had done on Surface Book, we had obtained a lot of information about mobile computers nowadays. We think that there are still changes and improvement that can be made to make Surface Book and other mobile computers better. We also think that a few concepts used by Surface Book are very good ideas and can be used as reference for future mobile computer development.First of all, the detachable keyboard feature by the Surface Book is a very good idea. It allows the user to alter it between tablet and laptop form based on the user's needs. This can avoid extra burden like the keyboard when it is not needed during occasions

like meeting, presentations or using the device while walking around. During these times, only simple note taking or navigating is needed and the keyboard can be a nuisance to carry around. So, we definitely think that detachable parts is a good idea for future computing as it fulfils one of the most important part of the mobile computers: mobility.The concept of detachable processor is also a very good idea and should be used more frequently in the world of mobile computing. Just like Surface Book, mobile computers should have detachable processors in which the computer can still work without a problem without it. This can increase its portability because unnecessary weight can be left out when the user are not in need of the processor. This can also be a choice for the customers whether to order the processor when buying the computer as well. This can make the computer more affordable more a wider range of customers.

VI. CONCLUSION

This paper explained about the Microsoft Surface Book with various perspectives like architecture, similarities, implementation issues were discussed in detail. From this paper we believe in future the life style of people will have major changes in all over the world.

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REFERENCES

[1] Intel® ARK (Product Specs). (2016). Intel® Core™ i5-6300U Processor (3M Cache, up to 3.00 GHz) Specifications. [online] Available at: http://ark.intel.com/products/88190/Intel-Core-i5-6300U-Processor-3M-Cache-up-to-3_00-GHz [Accessed 4 Apr. 2016].

[2] Intel® ARK (Product Specs). (2016). Intel® Core™ i7-6600U Processor (4M Cache, up to 3.40 GHz) Specifications. [online] Available at: http://ark.intel.com/products/88192/Intel-Core-i7-6600U-Processor-4M-Cache-up-to-3_40-GHz [Accessed 4 Apr. 2016].

[3] Cpu-world.com. (2016). Intel Core i5-6300U vs i7-6600U. [online] Available at: http://www.cpu-world.com/Compare/856/Intel_Core_i5_Mobile_i5-6300U_vs_Intel_Core_i7_Mobile_i7-6600U.html [Accessed 4 Apr. 2016].

[4] iFixit. (2016). Microsoft Surface Book Teardown. [online] Available at: https://www.ifixit.com/Teardown/Microsoft+Surface+Book+Teardown/51972 [Accessed 4 Apr. 2016].

[5] Domingo, J. (2015). 6 Cool Microsoft Surface Book Features. [online] PCMag Asia. Available at: http://asia.pcmag.com/microsoft-surface-pro-3/6977/feature/6-cool-microsoft-surface-book-features [Accessed 4 Apr. 2016].

[6] Microsoft Surface. (2016). Microsoft Surface laptops. [online] Available at: https://www.microsoft.com/surface/en-us/devices/surface-book#techspec-block [Accessed 4 Apr. 2016].