

Adrian Costinas.2024047

by Adrian Costinas

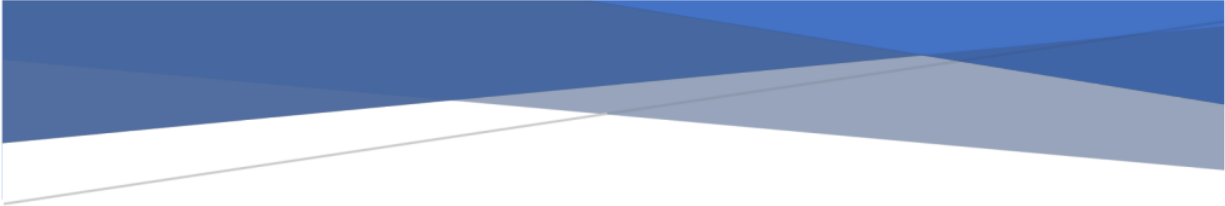
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OWN COMPUTER SYSTEM INVESTIGATION AND HTPC PROPOSAL

Abstract

This report is split in three main parts and the objective is to hold an inquiry into my own system hardware and network characteristics. The last part focuses on delivering an HTPC system build.

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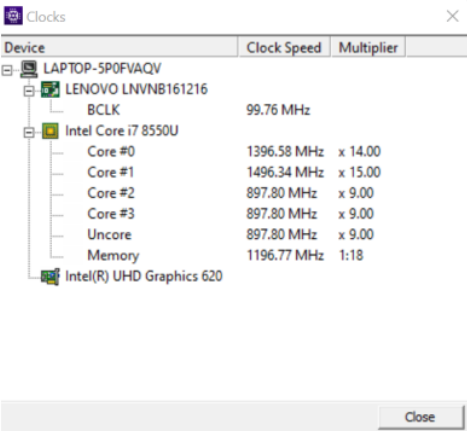


Figure 2. CPU Clocks

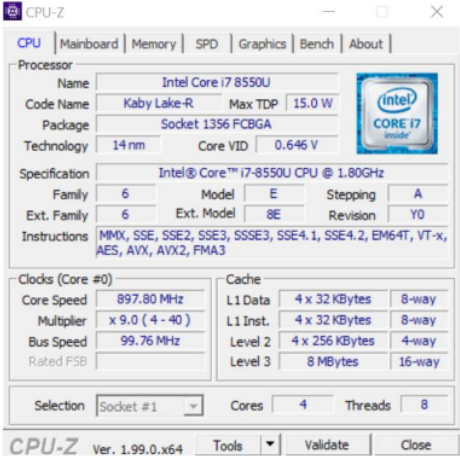


Figure 1. CPU

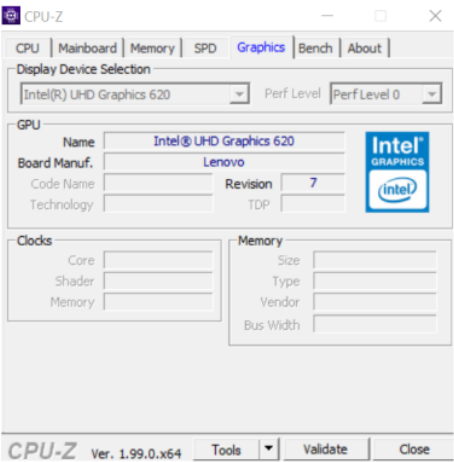


Figure 5. CPU Graphics

Item	Value
Description	Disk drive
Manufacturer	(Standard disk drives)
Model	UTEON CV3-DE256
Bytes/Sector	512
Media Loaded	Yes
Media Type	Fixed hard disk
Partitions	4
SCSI Bus	0
SCSI Logical Unit	0
SCSI Port	0

Figure 6. Storage

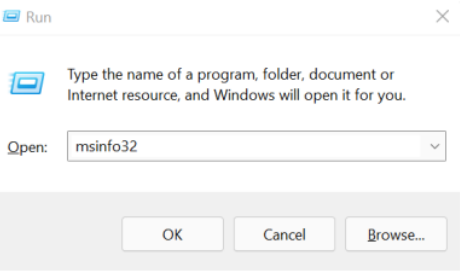


Figure 4. msinfo32 cmd

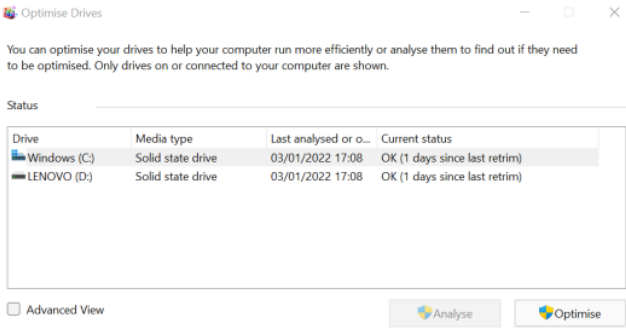


Figure 3. SSD Partitions

Item	Value
OS Name	Microsoft Windows 11 Home
Version	10.0.22000 Build 22000
Other OS Description	Not Available
OS Manufacturer	Microsoft Corporation
System Name	LAPTOP-SP0FVAQV
System Manufacturer	LENOVO
System Model	81BN
System Type	x64-based PC
System SKU	LENOVO_MT_81BN_BU_idea_FM_ideapad 320S-14IKB
Processor	Intel(R) Core(TM) i7-8550U CPU @ 1.80GHz, 2001 Mhz, 4 Core(s), 8 Logical Pro...
BIOS Version/Date	LENOVO 4QCN37WW(V2.03), 07/09/2017
SMBIOS Version	3.0
Embedded Controller Version	2.37
BIOS Mode	UEFI
BaseBoard Manufacturer	LENOVO
BaseBoard Product	LNVNB161216
BaseBoard Version	SDK0J40709 WIN
Platform Role	Mobile

Figure 8. System Info



Figure 7. Lenovo Ideapad 320S

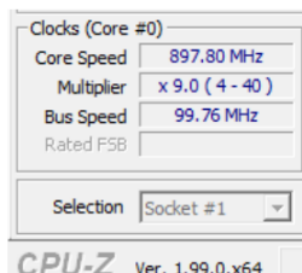


Figure 10. Core Multiplier

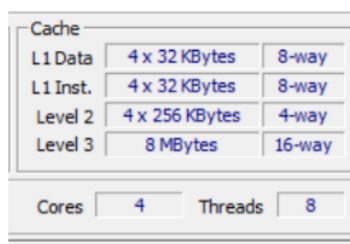


Figure 9. Cache

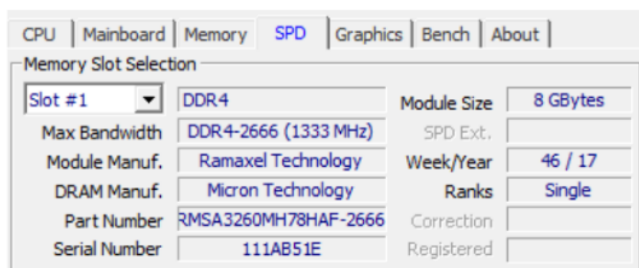


Figure 11. RAM

```

Wireless LAN adapter Wi-Fi:
Connection-specific DNS Suffix . : 
Description . . . . . : Qualcomm Atheros QCA9377 Wireless Network Adapter
Physical Address. . . . . : E8-2A-44-FD-07-90
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
IPv6 Address. . . . . : 2a02:a58:84a3:4800:2569:4c63:e997:60b0(Preferred)
Temporary IPv6 Address. . . . . : 2a02:a58:84a3:4800:214e:fdde:e87a:d782(Deprecated)
Link-local IPv6 Address . . . . . : fe80::2569:4c63:e997:60b0%18(Preferred)
IPv4 Address. . . . . : 192.168.100.16(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained. . . . . : 05 January 2022 14:45:50
Lease Expires . . . . . : 09 January 2022 17:30:47
Default Gateway . . . . . : fe80::1%18
DHCP Server . . . . . : 192.168.100.1
DHCPv6 IAID . . . . . : 484977220
DHCPv6 Client DUID. . . . . : 00-01-00-01-29-4A-8D-32-E8-2A-44-FD-07-90
DNS Servers . . . . . : fe80::1%18
NetBIOS over Tcpip. . . . . : Enabled

Ethernet adapter Bluetooth Network Connection:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : 
Description . . . . . : Bluetooth Device (Personal Area Network)
Physical Address. . . . . : E8-2A-44-FD-07-9E
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes

C:\Users\adria>

```

Figure 15. ipconfig /all

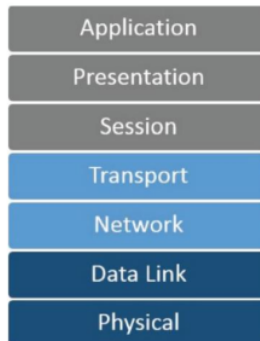


Figure 14. OSI Model

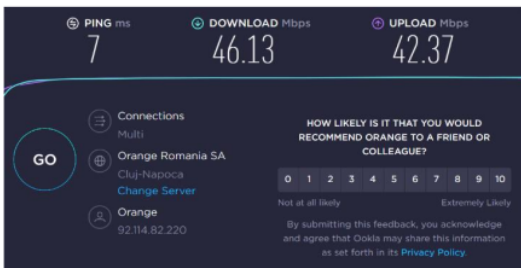


Figure 13. Internet Speed

```

C:\Users\adria>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet 2:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : 

Wireless LAN adapter Local Area Connection* 11:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : 

Wireless LAN adapter Local Area Connection* 12:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : 

Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . : 
IPv6 Address. . . . . : 2a02:a58:84a3:4800:2569:4c63:e997:60b0
Temporary IPv6 Address. . . . . : 2a02:a58:84a3:4800:214e:fdde:e87a:d782
Link-local IPv6 Address . . . . . : fe80::2569:4c63:e997:60b0%18
IPv4 Address. . . . . : 192.168.100.16
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : fe80::1%18

Ethernet adapter Bluetooth Network Connection:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : 

C:\Users\adria>

```

Figure 12. Default Gateway

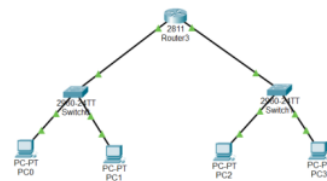


Figure 16. Network Infrastructure

```

Command Prompt
IP Address.....: 0.0.0.0
Subnet Mask.....: 0.0.0.0
Default Gateway...: 0.0.0.0

C:\>ipconfig

Wireless0 Connection:(default port)

Connection-specific DNS Suffix...:
Link-local IPv6 Address.....: FE80::205:5EFF:FE14:6EB9
IPv6 Address.....: ::
IPv4 Address.....: 10.44.3.101
Subnet Mask.....: 255.255.255.0
Default Gateway.....: 10.44.3.1

Bluetooth Connection:

Connection-specific DNS Suffix...:
Link-local IPv6 Address.....: ::
IPv6 Address.....: ::
IPv4 Address.....: 0.0.0.0
Subnet Mask.....: 0.0.0.0
Default Gateway.....: ::

C:\>
  
```

Figure 17. ipconfig Packet Tracer



Figure 18. WPA2

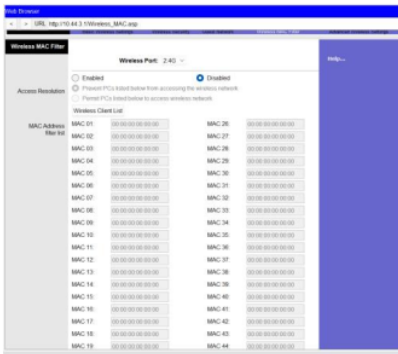


Figure 19. MAC Filters



Figure 20. AV Amplifier Connections

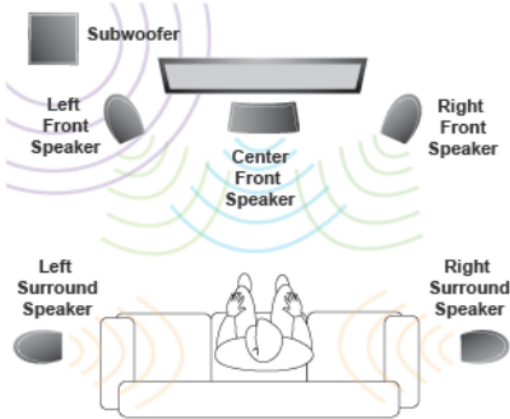


Figure 21. Surround System Diagram

List of Tables

AMD Ryzen 5 5600G		£229
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B450M MORTAR MAX	 https://www.google.com/url?sa=i&url=http 1	£85
SilverStone SST-GD06B	 https://www.google.com/imgres?imgurl=htt 1	£85
Corsair CMK16GX4M2D3000C16 Vengeance LPX 16 GB	 https://www.amazon.co.uk/Corsair-CMK16GX 1	£52
Samsung 980 500 GB PCIe 3.0	 https://www.amazon.co.uk/Samsung-3-100-l 1	£44
3x Seagate BarraCuda 2TB Internal Hard Drive HDD	 Roll over image to zoom in	3x £48

Corsair SF Series SF450 SFF 450 W Fully Modular 80 Plus Gold Power Supply Unit	 https://www.amazon.co.uk/Corsair-SF450-F 1	£82
Total		£721

Part 1: Own System Inquiry

Initially I was excited to work on this assignment because gave me the chance to talk about a nice system built by myself but unfortunately the video card is malfunctioning at the moment, so I have to settle for my backup system, a Lenovo Ideapad 320S-14IKB (Type 81BN)([Figure 7](#)). A low powered 14 inch laptop bought it in 2017, discontinued at this point but it did good to me for all this years.

At this point I'm running Windows 11, there was a slight performance lost upgrading from Windows 10 but still works well for general office work, research and browsing.

CPU

I'll start the hardware inquire with them most vital part of a system, the central processing unit (CPU), or microprocessor which is the brain of any computer or any IoT device [1].

I used the software CPU-Z to find out the make, model, and properties of my CPU but there are different ways to find out without using an installable software, one method showing in [Figure 4](#) is running the "msinfo32" in the run command window to access the "System Information" window [2]. Can be seen in [Figure 1](#) that CPU-Z shows allot of information about the CPU, I'll explain them one by one.

This CPU's name is Intel Core i7 8550U. Intel represents the maker of the CPU that dictates the kind of motherboard compatible and the type of socket. Core i7 8550 represents the model name and the

generation. The “U” at the end signifies that this CPU is low voltage used for laptops [3].

Cropped out [Figure 10](#) shows the current core speed and the core multiplier. The base core speed is 1.80GHz, a total number of 4 cores and 8 threads ([Figure 1](#)). All CPU's run at a multiplier of the bus speed, the bus speed is usually 100MHz. Back in the day when computers were evolving the engineers noticed that the CPU did most of the work and it didn't make sense to increase the speed for other components, they could just redirect the work from the CPU on multiple bus lanes [4]. In my case the maximum multiplier is x40 because the max turbo boost speed of the CPU is 4.0GHz, that can be activated in the Bios.

Cache is a special type of RAM called SRAM which is much faster than the normal ram and its duty is to help the CPU to access the most used data much faster. Cache is structured in three layers. Layer 1 is the fastest and the first place where the CPU looks, if the data is not found it looks further in layer 2 which is slower, if can't find it in layer 2 goes for the last layer, layer 3 which is the slowest. [Figure 9](#) shows the structure and sizes of cache.

This CPU is having Hyper-Threading Technology this means that it can run more than one thread on each core simultaneously [5].

The last property that I'm going to present for this CPU is the Integrated Graphics Processing Unit, that basically means that this CPU fulfills the video processing function that is usually achieved by the Graphic Processing Unit (GPU) [4].

RAM

Random Access Memory (RAM) is a volatile memory meaning that every time the system loses power the RAM data is lost. Main purpose of RAM is to give a space to run the most used applications at that moment to be accessed quickly by the CPU. The mainstream generation is DDR4 with DDR3, DDR2, DDR SDRAM used in older legacy systems. [Figure 11](#) shows my ram configuration, I'm running one DDR4 stick with 8GBytes size and the speed of 1333 MHZ. Also, I've got an extra empty slot that I plan to fill with another 8GBytes stick in the future.

When upgrading RAM there are some important things that have to be taken in consideration. First is the generation, a motherboard that supports DDR4 will not fit a DDR3 RAM. To not hinder performance when adding another stick into a second empty slot the ram speeds and

sizes need to be the same [4]. Lastly, laptops and PC use different formats of RAM, figure shows the format difference between a PC ram and a laptop RAM which are called SO-DIMMs.

Storage

When it comes to storage, with the help of System information in [Figure 8](#) we can clearly see that the total amount of storage space is 238.47GB. The curious thing is that at the media type it says that is a Fixed Hard Disk, but I know that this laptop has an SSD. After some inspection of this system [Figure 3](#) shows that indeed it is an SSD. I've looked online and different forums said that was because the system doesn't recognise the difference because they use the same connectors. Hard disk drives have moving components, platters with magnetic material that are paired with magnetic head that read and write data on the plates [6]. On the other hand, solid-state drives have an integrated circuit typically us flash memory to store data. SSDs are faster than HDDs especially the NVMe M.2 SSD's [7] because they plug straight into the bus.

This is a small, very portable type of laptop, and this kind usually don't have to many ports because of the small format. This is a list with the available ports.

- 2 x USB 3.0 with 4.8 Gbit/s
- USB-C with up to 10Gbps speed
- HDMI
- Headset port
- SD slot

Part 2: Network Addressing

To better understand the roles IP and MAC addresses play in transfer of data I prefer to introduce the Open Systems Interconnection (OSI) reference model and analyse it for a bit.

The OSI Model

The OSI model was created by the International Organization for Standardization (ISO) to standardize network connectivity between applications, devices, and protocols [8]. The [Figure 12](#) shows the reference model structured on 7 distinct layers, each with different functions and troubleshooting methods. Every time when network

protocols and connectivity options are changed the application doesn't suffer any change, in my opinion this is the biggest advantage of using the OSI reference model.

Brief introduction of each layer [9]:

- Application Layer – provides the user interface.
- Presentation Layer – presents data for the application or the network.
- Session Layer – responsible for setup, management, and teardown of session between two computers.
- Transport Layer – coordinates the data transfer between end systems and hosts.
- Network Layer – packet forwarding and routing through different routers
- Data Link Layer – node-to-node data transfer
- Physical Layer – the electrical and physical representation of a system.

Physical and Logical Addressing

The MAC address is the physical address operating at the Layer 2 and facilitates the local delivery of frames within the same network. The MAC address is unique and preprogrammed into the network cards of every computer or in network interfaces (network devices) [8]. The switches are the main connectivity devices found at layer 2 that use MAC addresses to forward frames within the network.

The IP address is a logical address operating at layer 3 and facilitates the routing process. Routing represents the moving of packets over multiple networks with the help of a routing table made from different IP addresses. The IP address is made of two parts: a logical network and a logical host section [8]. The router is the main device located at layer 3 and performs the decision making based on the routing tables that can be statically entered by the network engineers or dynamically via routing protocols.

Windows Command Prompt

The main way to find out the physical and logical address for a computer is to run the command "ipconfig /all" in the Command Prompt, which can be searched in the search bar in Windows. The [Figure 13](#) shows the information that I got running the "ipconfig/all" command. I've sniped only the information for the Wireless adapter because I'm connected to wireless at this point. The MAC address can be found highlighted in yellow, six groups of two hexadecimal digits, separated by hyphens E8-

2A-44-FD-07-9D. Every computer takes its IP address from the DHCP server and in this situation my router fulfills this function. The IP is reserved by the router and assigned to my computer for a period of time. The figure shows my IP highlighted in blue 192.168.100.16, the router assigns this IP based on the default gateway and the subnet mask.

Using the website www.speedtest.net to check my internet speed, [Figure 14](#) is showing that I've got a Symmetrical Connection meaning that the download and upload speeds are roughly equal with 46.13 Mbps on download and 42.37 Mbps on upload with a latency of 7 ms.

Logical Addressing Process

There are two ways to assign an IP to the members of the network, static and dynamic. The static IP is assigned by the network administrator and is usually used for printers attached to the network because we need its IP to remain the same.

Most computers get their IP by the DHCP server for a short period of time. The DHCP server allows the reservation of an IP address for a period of time looking for the MAC address of the device [8]. For home networks the router plays the role of the DHCP server

Router Configuration

To access the Router interface we need to access the Default Gateway of the router that can be found running "ipconfig" in Command Prompt, highlighted with blue in [Figure 15](#). Next the default gateway needs to be run in browser and a login page will appear in like in figure. The login credentials can be found on the back of every home router. Unfortunately, at the moment I'm making this report I'm traveling back to my home town in Romania and apparently my family doesn't have the login credential anymore, this is an example of bad practice when it comes to securing your own network.

I'm going to finish this last part on Packet Tracer. Packet Tracer is a simulation tool designed by the Cisco Systems and used in teaching network topologies. The simulated environment is similar in configuration with Cisco routers and switches.

First, as can be seen in [Figure 16](#), I'm creating a basic network made of four computers, two switches and one router. I'm setting a DHCP server to get IP addresses across the network. Next I'm running a 'ipconfig' in the command prompt of one of the computers ([Figure 17](#)).

I'm taking the default gateway and run it in web browser, it be introducing the credentials and I'm logged in the router settings.

There are a couple of ways to secure your network. First and the most important is to select the most secured protocol available for the router, in this we can see that WPA2 protocol is available ([Figure 18](#)) and paired with AES encryption and a good password the network is considerable harder to hack. To avoid giving your password to anyone wanting to connect to your network we can create a separate guest network giving another layer of protection against bad agents.

Another security method based on access control is MAC filtering ([Figure 19](#)). Mac filtering works two ways, first blocking any system with a specific MAC address and second giving access to the network a specific number of systems based on their MAC addresses. This is a great way to eliminate traffic on a certain network.

Part 3: Home Theatre PC Build

A Home Theatre PC is a computer that can store, play, and show music and movies, as well as images. Could be called a living room PC and connects to a TV and in most of the cases to a stereo or home theatre system [10].

First let's argue a bit about the necessity of a system like this, at this moment there are numerous smart TV's that connect to the internet and stream from the mainstream platforms like Netflix, Amazon Video or different gadgets like Google Chrome, and Amazon Fire TV that plug into TV's and gives them the possibility to stream.

First is about control, what I'm going to build later is a Windows machine that can be used in other situations and run all kind of useful apps. Second is about the storage, for my system I'm going to chose a considerable amount of storage to back up own movies and music from media disks or online resources to combat the buffering in case of slow internet connection. The biggest advantage with a HTPC is the lack of limitation when it comes to the resources, you can stream or download from a lesser-known vendors.

The main focus of my build will be the stealth and quietness of the system considering that this system will be primarily used to watch

movies, any hum or led lights will affect the best experience that can offer.

The first component I must decide on is the CPU. When it comes to minimizing noise the CPU in my opinion plays the biggest role. In concordance with my goal, the fans are the loudest components in a PC build. Generally, less power we use less heat we going to get fewer fans in the system following this train of thought I've decided to use a CPU with integrated graphics processing unit and a Thermal Design Power (TDP) less than 65W [11] to take advantage of passive colling when the CPU uses fewer resources. I'm choosing an integrated processing unit because at this point the technology behind this kind of processors is good enough to play 4K without any frame drops or stuttering.

After careful consideration [12] I've decided to go with AMD, specifically AMD Ryzen 5 5600G. Is a 4.4 GHz Max Boost, with 6 cores and 12 threads with 19MB a total amount of cache and 7 Graphic Compute Units drowning 65W TDP. I will not use the stock cooler because has a small heat sink and a small vent, the small vents are the loudest instead I' going with beQuiet Pure Rock 2 with one 120mm fan and a massive heat sink.

For the Motherboard I'm going with an mATX form factor for the general low profile of the system. The one that I'm using is the B450M MORTAR MAX because support the AMD processors and has four SATA ports for the hard drive disks an m2 port and two PCIe X16 for extra expansion cards. Continuing with this form factor I'm choosing the SilverStone SST-GD06B - Grandia HTPC Micro ATX for a compact and stylish HTPC case that fits perfectly on any TV stand.

For memory I'm going with 16 GB of RAM, knowing that this system will be used mainly for playing Videos 16 GB will be plentiful. 8 GB could be enough but in the later years the RAM prices are low and will not make much difference when it comes to the final price.

This system could be used as a backup for a Blu-ray collection and with 50GB pe disk, that could add up to a great amount. In this case for the main storage will be using three 2 TB HDD and a secondary 500 GB NVMe M.2 Solid State Drive to run Windows from for a faster boot and updates. Also, will be including a Blue-Ray write/red drive.

This system will draw at most 250W of power, considering that for power supply I'm going for a 450W from Corsair hoping that the fan will

not switch on to often. Another option was to go for a much bigger power supply to make sure that the system will not reach the certain load to switch on the fans.

Hi-Fi AV Amplifier and Speakers

For the AV amplifier and speakers package I've chose the Sony STRDH790.CEK 7.2, this is a 7.2 amp, but [Figure 20](#) shows highlighted the ports for a 5.1 speaker system. For the Speakers and Subwoofer Jamo Studio 8 for 5 high quality speaker and Kanto, a 200W subwoofer. The [Figure 21](#) shows a diagram with the placement of every speaker, the surround speakers on the sides, left and right on stand facing the listener, the front speakers on each side of the TV, the centre speaker on the middle on the stand and the Subwoofer a side close to the ground.

The cable connections can be seen in [Figure 20](#), the main front speakers ports are highlighted with green and are connected via a 3.5 mm jack audio connection. The surround speakers will be connected to the ports highlighted in blue, these are wire connectors. The centre speaker connects to wires and can be seen highlighted with red. The subwoofer out connection is for the subwoofer speaker. The TV will be connected to the TV/ARC connection highlighted with yellow and the HTPC will be connected to the HDMI connection highlighted with orange.

References

- [1] "The Computer System," [Online]. Available: <https://peda.net/kenya/ass/subjects2/computer-studies/form-1/the-computer-system>.
- [2] L. Heddings, "How to Open the System Information Panel on Windows," November 2017. [Online]. Available: <https://www.howtogeek.com/196893/how-to-open-the-system-information-panel-on-windows-8/#~:text=Hit%20Windows%2BR%20to%20open,shortcut%20for%20even%20easier%20access..> [Accessed 2022].
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- [12] "8 Best CPUs With Integrated Graphics in 2022 (Not Only For Gamers)," [Online]. Available: <https://techtreatbox.com/best-cpus-with-integrated-graphics/>.
]

FINAL GRADE

GENERAL COMMENTS

Instructor

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GRADING FORM: GJ_2019

ADRIAN COSTINAS**380****ENGAGEMENT WITH LITERATURE**

Very good, targeted references used. Could have been even more extensive in parts (such as the HTPC aspect) though.

70**KNOWLEDGE AND UNDERSTANDING**

Exceptional level of K&U demonstrated.

85**COGNITIVE AND INTELLECTUAL**

Most areas very well reasoned and explained

80**PRACTICAL APPLICATION**

Good use of tools to obtain the system information and sensible components for the HTPC

80

TRANSFERABLE SKILLS



Generally well laid out and presented, although: All the images dumped at the start of the assignment isn't good - could have been formatted better and put into the appropriate areas of the report. Should try not to use the "I" first person style of writing.

65