

Computer Architecture

by Shaun Fox

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Assignment Title: Computer systems and components specification

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Introduction

In this task, it is required to plan a computer system build for two very different scenarios, one for an elderly relative who wants very basic use and must be low cost, while the second is for a recent graduate who needs superb performance, and will be using the system for work/business needs. ~

Both of these scenarios will require vastly different considerations when choosing what components should be used as the performance required differs greatly. The considerations made will be to CPU, GPU, Case, RAM, Storage, Motherboard, PSU and peripherals.

Justifications of these choices will be made according to the requirements of the scenario in questions, relating to the hardware requirements of the software that will most likely be used in the given application of the scenario. Once the requirements for each specification will be made, a 'shopping list' with current costs will be made to prove validity of the choices made can be made within budget.

Scenario One

The first scenario is to develop a specification for an elderly relative, who is stated to only require the functions of basic use, including word processing, email, web browsing. Additionally, they also

require the ability to stream online videos and to be able to perform VoIP video calls to other family members. It is stated that the build should be low cost.

Required Software

The minimum requirements for the above scenario will be taken from the most used software for the functions listed above.

Operating System

For the operating system for the elderly relative given in this scenario, Windows would be the most suitable choice for user friendliness. Even though Linux has several distributions that aim to have a user friendly interface, and would save costs by being free and open source, including software suite Open Office, which would handle all basic productivity applications and is mostly compatible with Microsoft Office documents, Windows is by far the most popular OS [1] so would be the most suitable choice for a general user. Windows has the required applications all available from the Microsoft store: Office 365 (Word and other applications), Outlook, Microsoft Edge, and Skype.

The minimum required specifications for Windows 10 are listed below.

Processor: 1 GHz or faster compatible processor
RAM: 1 GB for 32-bit or 2 GB for 64-bit
Hard drive size: 32GB or larger hard disk
Graphics card: Compatible with DirectX 9 or later with WDDM 1.0 driver
Display: 800x600

CPU

Taking into account that the applications required to run in this scenario are basic, the lowest costing components will be chosen for this, as any basic modern components will be able to handle basic use for much time to come.

For this reason, the chosen processor and motherboard combination will be the AMD 7th Gen A6-9500 APU Processor [2] and Biostar A320MH AM4 DDR4 mATX Motherboard.

The speed of the CPU is 3.5GHz, exceeding the minimum requirement of Windows 10. The processor itself has 8 cores, 2 for general processing, and 6 for graphical processing. This processor which has both general processing, and graphical processing units on the same chip, is called an APU (Accelerated Processing Unit). It has benefits over an integrated graphics on a motherboard by offering faster speeds and lower power consumption. [3]

Motherboard

The motherboard is the correct socket for the processor, AM4. It is also a mATX factor, which can fit in a smaller case than regular ATX machines, so will suit the requirement of the case being of a small

form factor for the elderly person. The motherboard supports up to 32GB RAM through two slots (DIMM), which far exceeds requirements but will future proof if need be. The board also supports HDMI connection, which will ensure that a wide range of monitors and even televisions can be used. It also supports USB 3.1, which will ensure that any USB device can be supported in the long term. The on board graphics also support Direct X12, which again exceeds Microsoft Windows 10 requirements.

I/O Ports

The I/O requirements for this system are minimal. 3.5mm stereo out/microphone in, at least 3 USB ports for mouse, keyboard, and webcam, LAN (at least 10/100) and VGA or HDMI. The chosen motherboard has all of these.

RAM

For this system, the minimum required amount of RAM would be 2GB, as listed by the specifications required for Windows 10 above. However, for DDR4 as supported by the motherboard, the memory modules are not made in any smaller capacities, so for this reason 4GB at 2400MHz has been chosen. As memory is one of the least expensive components, it is not a primary concern when looking to keep within budget.

Storage

For the basic user, there is no need to look at performance drives, such as SSD SATA Drives, Hybrid SSHD or m.2 NVMe storage solutions, which would far exceed a budget system and offer wasted performance.

For the storage, the most suitable would be a Seagate BarraCuda 500GB. The prices for such a vast amount of storage, relevant to a basic user, are very reasonably priced. This choice will allow ample storage, considering Windows 10 only requires 32GB. This (and many other brands of) hard drive comes with a 2 year warranty.

Case

The chosen case is a AvP Hyperion EV33B Black Cube case. It is mATX form factor, so it is small and will fit the specification required by the elderly person in the scenario. It has an I/O panel on front for USB3 and USB2, so makes for easy access for USB peripherals which will be used temporarily (USB storage etc). This case has the required space for an ATX form factor PSU, so it has a wider choice available.

PSU

The PSU chosen should be able to safely provide power to all the components listed. Especially considering that a graphics card will not be used, power consumption for this unit will be very low. A Be Quiet SFX Power 2 300W Fully Wired 80+ Bronze Power Supply will more than provide enough power to the unit.

The ratings below show how much each component should draw, to show that the total draw will be

supported by the power supply. The ratings are taken from the product specifications listed by the manufacturer or an average figure where the specific value is not available. [4]

Component	Model	Power Rating
CPU	AMD A6-9500	65 W
Motherboard	Biostar A320MH	25W
RAM	Kingston 4GB DDR4 2400MHz	3W
HDD	Seagate BarraCuda 500GB 7200RPM SATA	7.5W
Total	-	100.5W

Monitor

Given the requirements stated in the brief, the user will be elderly and may have poor vision, so a suitably sized monitor should be chosen. There are built in accessibility tools within Windows that help with poor vision (Magnifying Glass, Screen Reader), but for convenience sake it would be better for the user to already have a larger than average.

The average computer monitor size is between 21 and 30 inches. [5] The chosen monitor is 24 inches, Lenovo D24-10 23.6" Full HD Monitor. It offers a higher than average size for easier viewing, and it supports FHD resolution, as well as being able to support a HDMI connection.

Peripherals

The peripherals for this specification are quite basic, USB keyboard & mouse, and a USB Webcam, because it was specified that Skype-like video calling would need to be a function. Basic speakers have been provided to save on costs.

Cost

All of the costs have been sourced from www.ebuyer.co.uk and www.argos.co.uk. And are shown below.

Component	Model	Cost
CPU	AMD 7th Gen A6-9500 APU Processor	32.99
Motherboard	Biostar A320MH AM4 DDR4 mATX Motherboard	37.97
RAM	Kingston 4GB DDR4 2400MHz	19.06
HDD	Seagate BarraCuda 500GB	35.09
Case	AvP Hyperion EV33B	22.79
PSU	Be Quiet SFX Power 2 300W	49.17

Monitor	Lenovo D24-10 23.6"	89.99
Mouse & Keyboard	Xenta Wired Keyboard & Mouse Desk Set	7.97
Webcam	Trust Exis 17003 Webcam with Microphone	9.99
Misc	Xenta HDMI 5M 4K High Speed Black Cable	1.65
Misc	Xenta Kettle Cable 1m	1.19
Speakers	Trust Mila 2.0 Speaker Set	8.99
Total		316.85

Link
https://www.ebuyer.com/807863-amd-7th-gen-a6-9500-apu-processor-ad9500agabbox
https://www.ebuyer.com/864690-biostar-a320mh-am4-ddr4-matx-motherboard-a320mh
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https://www.ebuyer.com/753876-seagate-barracuda-500gb-3-5-hard-drive-at-ebuyer-com-st500dm009
https://www.ebuyer.com/724862-avp-hyperion-ev33b-black-cube-case-cas-107
https://www.ebuyer.com/620499-be-quiet-sfx-power-2-300w-fully-wired-80-bronze-power-supply-bn226
https://www.ebuyer.com/960880-lenovo-d24-10-23-6-full-hd-monitor-62a0kat1uk
https://www.ebuyer.com/840020-xenta-wired-keyboard-mouse-desk-set-km-340376
https://www.argos.co.uk/product/6006204
https://www.ebuyer.com/193824-xenta-hdmi-5m-4k-high-speed-black-cable-plex-v1-45m
https://www.ebuyer.com/875240-xenta-kettle-cable-1m-xkc

Scenario 2

The second scenario is for a recent graduate who wants to become self-employed working in producing and editing 4K video. These are much more demanding requirements than the first with far more consideration needing to be taken. There is a specific budget of approximately £2,500.

Required Software

As with the above scenario, Windows 10 will be used as the operating system. The specification of this system will far exceed the previous as this will be a high-performance video editing system. There will be additional software required for the editing of 4K video, so a well-known package will be chosen to provide a benchmark for the level of performance required by this machine. Taking from a curated list of various software packages for 4K Video Editing [6], the package that came out on top as best rated was Adobe Premier Pro CC. Below is a table of the recommended specifications for running the software.

As well as the basic requirements listed below, Adobe also mention that for Hardware acceleration to be supported for both HEVC & H.264 encoding/decoding, a 7th Gen or later Intel Core processor or equivalent.

System requirements for Premiere Pro

Windows

	Recommended specifications
Processor	Intel® 7 th Gen or newer CPU – or AMD equivalent
Operating system	Microsoft Windows 10 (64-bit) version 1809 or later
RAM	• 16 GB of RAM for HD media • 32 GB for 4K media or higher
GPU	4 GB of GPU VRAM For a list of recommended graphic cards, see Recommended graphics cards for Adobe Premiere Pro .

Hard disk space	• Fast internal SSD for app installation and cache • Additional high-speed drive(s) for media
Monitor resolution	1920 x 1080 or greater
Sound card	ASIO compatible or Microsoft Windows Driver Model
Network storage connection	10 Gigabit ethernet for 4K shared network workflow
Internet	Internet connection and registration are necessary for required software activation, validation of subscriptions, and access to online services.*
More system requirements	• VR system requirements • Hardware acceleration system requirements • Recommended graphics cards for Adobe Premiere Pro

[7]

CPU

As stated in the requirements for Adobe, which will be the most resource intensive application used on the system, an Intel 7th Gen or higher - or equivalent, needs to be used. In this choice, an article was looked at which looked at several CPU choices for selected budgets. [8] The CPU chosen was the Intel 9th Gen Core i9-9900k. It has 8 cores, which are well suited to video editing, and will allow for hardware acceleration for encoding/decoding as mentioned above. This CPU supports up to 128GB DDR-2666 RAM. With 32GB being the recommended for Adobe, this extra support allows for future proofing as requirements increase over time.

Motherboard

For the motherboard, more consideration than scenario one's choice needs to be taken. The reason for this is the required storage connectivity. The motherboard chosen is Gigabyte Z390 AORUS ELITE LGA 1151 ATX. This motherboard has two PCI-E slots for m.2 NVMe storage options. NVMe SSD solutions are solid state hard drives that connect via a pci-e interface. Where SATA has at current, a 500-600MB/s typical read/write speed, m.2 solutions can reach speeds of up to 5GB/s. It is important to have m.2 storage for a machine that will be used for video editing as it is a resource intensive task for storage speeds as well as processing power. The chosen motherboard also

supports up to 64GB of RAM. With the adobe recommended 32GB, this will allow plenty of room for expansion later if required.

RAM

The memory chosen is HyperX Predator 64GB 4x16 3GHz DDR4. This will ensure excellent performance and that the memory will not bottleneck any of the other components.

Storage

As mentioned previously, an NVMe storage solution will be essential when video editing due to the faster transfer speeds. NVMe solutions are faster as they communicate directly with the CPU, and do not have to go through another controller like SATA does. As stated in the Adobe requirements, at least 2 drives are recommended, an m.2 drive for the installation of Adobe and for cache. 8GB of storage is required as a minimum for Adobe.

NVMe m.2

For the m.2 solution, the Seagate 500GB BarraCuda 510 M.2 NVMe SSD has been chosen. It has ample storage for app installation and for any media that needs to be stored there. This model of m.2 SSD can read/write up to 3.4/2.4GB/s, far exceeding conventional SATA or SSD drives.

SSD

For the slower storage, which would be used for data which is not speed sensitive, a regular SSD can be used. For this budget, it is possible to implement a RAID drive system. For a regular consumer this would not be such an issue, however given the scenario is for a person who is looking to use this for work purposes, having protection against drive failures can mean saving against actual financial loss.

4 WD Blue 500GB 3D NAND SSD drives will be able to provide RAID 1+0, which will offer mirroring as well as striping. This will offer redundancy if one fails drives, and will also potentially double speeds of the drives, which are rated at Read/Write 560/530MB/s.

Case

The consideration to take with this scenario is that the case needs to be large enough to allow heat to gather and to allow enough space for cooling fans to push out this hot air. A standard ATX case will provide enough space for both to occur. Corsair Obsidian 750d Full Tower ATX Case has been chosen as it will allow for installation of many case fans, and allows for full size GPUs.

Sound Card

To allow for the surround sound monitoring system and supplied audio to be used, a sound card must be provided as the onboard audio options for motherboards often do not come with 7.1 surround options & SPDIF. There are more expensive options however for this purpose, a basic sound card will suffice, and allow for more budget towards the essential components such as the CPU & GPU. StarTech 7.1 Channel Sound Card has been chosen for lowest cost and meeting the specifications.

Monitor

As mentioned in the specification, the nature of video editing will be 4k. So, a 4K monitor with HDMI connection has been chosen. LG 34WL500-B 34" Ultrawide HD LED IPS Monitor has been chosen as it fits the criteria and is also ultrawide, offering more screen space for work.

GPU

Onto one of the most critical components of the build, the graphics card. The graphics card chosen is NVIDIA GeForce RTX 2070. It is on the list of recommended GPUs from Adobe for running Adobe Premier. The chosen model has 8GB of GDDR6, which is twice the recommended for running the software, and has 3 fans on the GPU to make sure that it stays cool during high workloads.

PSU

Given that the components listed are all high performance, the power consumption on this unit will be far above scenario 1.

The power consumption is listed in the table below, either taken from the manufacturer's website or from average consumption dependent on the type of component.

Component	Model	
CPU	Intel Core i9 9900K 3.6 GHz	95
Mobo	Gigabyte Z390 AORUS ELITE LGA 1151	80
GPU	Gigabyte GeForce RTX 2060 SUPER 8GB	210
Memory	HyperX Predator 64GB 4x16 3GHz DDR4	10
m.2	Seagate 500GB BarraCuda 510 M.2 NVMe SSD	10
SSD	WD Blue 500GB 3D NAND SSD *4	10
Sound Card	StarTech 7.1 Channel Sound Card	1
Total		416

It is always best to allow plenty of headroom when choosing a PSU, as they are never 100% stable, and getting a higher wattage PSU now can save changing it later if expansion is needed later. For this reason, the Be Quiet! 650W Modular PSU.

Card Reader

An external high-speed card reader has been added, which supports all major memory card formats and supports USB 3.0 for high-speed transfer rates.

NAS

The NAS bay enclosure, to fit in with the required specification, must have 8 bays and support up to

56TB. Infortrend EonStor GSe Pro 108 8 Bay Desktop NAS Enclosure can support up to this amount and comes without storage drives. The Seagate IronWolf 8TB NAS Hard Drive 3.5" provides 8TB of storage and is suited to NAS bays.

Cost

Component	Model	Cost
CPU	Intel Core i9 9900K 3.6 GHz	£ 499.98
Mobo	Gigabyte Z390 AORUS ELITE LGA 1151	£ 181.73
GPU	Gigabyte GeForce RTX 2060 SUPER 8GB	£ 419.98
Memory	HyperX Predator 64GB 4x16 3GHz DDR4	£ 332.00
Case	Corsair Obsidian 750d Full Tower Atx Case	£ 141.22
m.2	Seagate 500GB BarraCuda 510 M.2 NVMe SSD	£ 90.12
SSD	WD Blue 500GB 3D NAND SSD *4	£ 239.96
PSU	Be Quiet! 650W Modular PSU	£ 171.50
Monitor	LG 34WL500-B 34" Ultrawide HD LED IPS Monitor	£ 319.97
Sound Card	StarTech 7.1 Channel Sound Card	£ 52.98
Card Reader	StarTech Multi Media Flash Memory Card Reader	£ 21.48
Total		£ 2,470.92

NAS		
Bay	Infortrend EonStor GSe Pro 108 8 Bay	£ 791.99
Drive	Seagate IronWolf 8TB NAS Hard Drive 3.5"	£ 237.98
Total		£ 1,029.97

Links

https://www.ebuyer.com/859394-intel-core-i9-9900k-3-6-ghz-processor-bx80684i99900k
https://www.ebuyer.com/861440-gigabyte-z390-aorus-elite-lga-1151-atx-motherboard-z390-aorus-elite
https://www.ebuyer.com/958079-gigabyte-geforce-rtx-2060-super-8gb-gaming-oc-white-v2-graphics-card-gv-n206sgamingoc-white-8gd-v2
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- [7] Adobe, "Premiere Pro System requirements," [Online]. Available: <https://helpx.adobe.com/premiere-pro/system-requirements.html>. [Accessed 4 5 2020].

[8] 3dInsider.com, 24 3 2020. [Online]. Available: <https://3dinsider.com/cpu-video-editing/>.
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Computer Architecture

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

70/100

Instructor

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GRADING FORM: GJ_2019

ENGAGEMENT WITH LITERATURE



Excellent targeted, relevant background reading and research sources - although this could have been even more extensive and even more explicit citations to the various (correct!) statements made in the report could have been included to obtain higher marks.

65

KNOWLEDGE AND UNDERSTANDING



Extremely competent demonstration of knowledge of the underlying concepts and technologies used.

78

COGNITIVE AND INTELLECTUAL



Choices backed up with good justification. Despite the outcomes being sensible, Could have done even more in looking at the alternative solutions, and providing solid justification as to why your chosen components are the most suitable compared to others.

69

PRACTICAL APPLICATION



Extremely appropriate systems specified.

76

TRANSFERABLE SKILLS



Good writing style. Reads well with a good 'flow'.
Would have benefited from a more formalised layout,
such as breaking down the assignment into more
detailed numbered sections that follow the 1. 1.1 1.2
2. Style Would have benefited in having more
images of some of the components included to give
context and interest.

63