

1811357 - Patrick Atkinson - ACCD4001 - Assignment

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Computer systems and components specification

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Abstract

In this report, the author is given two scenarios for users requiring new computer systems and is tasked with specifying appropriate components. The author will establish the key points for each scenario (such as budget and expected usage) and design the systems to suit. A summary is given for each component, along with the reasoning behind the choice. A costed list of components is also given for each system. The author summarises their findings at the end of the report.

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1. Introduction

The author has been tasked with recommending computer specifications for two scenarios. A costed list of components will be produced for each specification, with justifications for the choices made.

2. Scenario 1

2.1. Scenario outline

This system is for an elderly user who would like a low-cost, small form factor desktop PC with a full-sized keyboard and mouse and a 'decent' sized monitor due to their poor eyesight. Their usage of the system will consist of:

- Word-processing functions
- Web browsing and email usage
- Viewing video content online (e.g. YouTube)
- Performing video calls with family members abroad.

The user does not specify whether they already have peripherals so the author will include them in the specification. The author will be aiming for a total system price (including base unit, monitor, keyboard, mouse, webcam, speakers and operating system) under £550 including VAT.

2.2. Specification

This section outlines the components chosen and the reasoning behind the choices. There is also an itemised price list of the components with a total price at the end.

2.2.1. Components

2.2.1.1. Central Processing Unit (CPU)

The author believes a low-cost CPU with integrated graphics is the most appropriate choice for this system and recommends the AMD Ryzen 3 3200G. It is a quad core processor based on AMD's Zen+ architecture with Radeon Vega 8 graphics [1][2]. AMD class this as an Accelerated Processing Unit (APU) [1][2]. Competitor CPUs at the same price point either lack integrated graphics (e.g. Intel Core i3-9100F [3]) or were outperformed by the previous

generation of APU (e.g. Intel Pentium Gold G5420) [4]. A cooler is also included with the APU.

2.2.1.2. Motherboard

The CPU choice requires a motherboard with an AM4 socket. It needs video outputs to account for the CPU's integrated graphics and sufficient ports for the chosen peripherals. The requirements call for a small form factor system, therefore the author recommends a microATX (mATX) based system. Whilst smaller form factors (such as Mini-ITX) are available, these motherboards are less readily available at low prices (the cheapest Mini-ITX AM4 motherboard the author could find online was £72.90 [5]). The author recommends the MSI A320M-A PRO MAX mATX motherboard. It is based on the A320 chipset which supports up to 6 USB 2.0 ports, 2 USB 3.0 (now called USB 3.1 Gen 1 [6]) ports and 1 USB 3.1 (now called USB 3.1 Gen 2 [6]) port. The motherboard itself has 4 rear USB 3.1 Gen 1 Type A ports and 2 rear USB 2.0 ports, with support for additional ports through headers on the motherboard [7]. It has an M.2 slot and 4 SATA 3 ports for non-volatile storage, a DVI-D port and a HDMI port for video outputs, and line-in, audio out and headphone jacks for audio connectivity [7]. This provides ample connectivity for the recommended peripherals, with room for expansion in the future.



Figure 1: Rear connectivity for the chosen motherboard [8].

2.2.1.3. Random Access Memory (RAM)

The consensus is that at least 4 gigabytes (GB) of RAM is required for web browsing and basic productivity tasks [9][10], [11]. The motherboard specified requires Double Data Rate 4 (DDR4) memory [7] up to 2993MHz (limited by the CPU [12]). The author recommends 8GB of DDR4-2666 in a single DIMM configuration from Crucial to account for the memory used by the integrated graphics on the APU. Crucial are a respected memory manufacturer, and offer a 10 year warranty on this product [13].

2.2.1.4. Non-volatile storage

As the chosen motherboard has an M.2 slot, the author is recommending a Solid State Drive (SSD) in this form factor rather than as a 2.5-inch drive, in this case the Western Digital 250GB 3D NAND M.2 2280 SSD. This drive uses the SATA standard over the M.2 interface, meaning the drive is limited to SATA speeds (550MB/s sequential read and 525MB/s sequential write [14]). M.2 drives do not require additional cabling due to the drive slotting directly into the motherboard. This increases the simplicity of installation as a 2.5-inch drive would require data and power cables to be routed, and the drive to be mounted somewhere else in the case. There is also a 5 year warranty on this product [14].

2.2.1.5. Graphics Processing Unit (GPU)

Due to the nature of the system's use case, the author believes a discrete GPU is unnecessary and that a GPU integrated into the CPU is sufficient [15].

2.2.1.6. Case and Power Supply Unit (PSU)

Due to the requirement for the system to be compact, the author recommends the CiT S506 Micro ATX case. It is very compact (99mm wide, 339mm high and 364mm deep) but still offers a reasonable maximum PSU length of 190mm, and a maximum CPU cooler height of 81mm (the chosen CPU's cooler height is 54mm [16]) [17].

The author's recommendation for PSU is the Corsair VS450. This is a 450-watt power supply with 80 PLUS certification [18] (achieved by having greater than 80% efficiency at 20%, 50% and 100% loads on the power supply [19]).

2.2.1.7. Monitor

Due to the user's poor eyesight, the author recommends a relatively large monitor with a relatively low resolution for the size. This will result in a lower pixel density, measured in Pixels Per Inch (PPI) [20]. The standard PPI for the Windows desktop environment is 96PPI, and many monitors have pixel densities in this range. By choosing a display with a lower pixel density, images and text on the screen will appear bigger [21]. Whilst this can also be achieved on displays with higher pixel densities by using scaling, higher pixel density displays are often more expensive and some applications may not scale properly [21]. The author has specified the Xenta XE27FHD monitor, a 27 inch display with a resolution of 1920x1080, resulting in a pixel density of approximately 82PPI [20]. Whilst the author could not find reviews by

publications, customer reviews from eBuyer.com give it an average of 8.1 out of 10 across 62 reviews [22].

2.2.1.8. Peripherals

The author recommends Microsoft's Wired Desktop 600 as the keyboard and mouse set and the Logitech C270 as the webcam. Based on their personal experience, these are good quality peripherals at a reasonable price. The webcam has a built-in microphone [23] so an additional microphone is not required. The author also recommends Logitech Z120 speakers. These are basic speakers but have a 4.4 out of 5 rating on Amazon across 8058 customer reviews as of 25/04/2020 [24].

2.2.2. Costings

Below are the costings of the system. These prices were correct as of 15th April 2020.

Image	Description	Retailer	Price
	AMD Ryzen 3 3200G (CPU)	eBuyer	£77.99
	MSI A320M-A PRO MAX (Motherboard)	eBuyer	£42.98
	Crucial 8GB DDR4-2666 (RAM)	eBuyer	£29.91
	Western Digital Blue 250GB 3D NAND M.2 (Non-volatile storage)	eBuyer	£44.22
	Corsair VS450 (PSU)	eBuyer	£39.99
	CiT S506 MATX (Case)	eBuyer	£26.98
	Microsoft Wired Desktop 600 (Keyboard/mouse)	eBuyer	£19.98
	Logitech C270 (Webcam)	Amazon	£24.57
	Logitech Z120 (Speakers)	Logitech	£14.99

	Xenta XE27FHD (Monitor)	eBuyer	£99.98
	Windows 10 Home 64-bit OEM (OS)	eBuyer	£98.32
	Shipping	eBuyer	£6.19
	Shipping	Logitech	£1.68
Total			£527.78

3. Scenario 2

3.1. Scenario outline

A recent graduate has the requirement for a system that will be used for editing 4K video content. They will use using video-editing software capable of GPU acceleration. The budget for the system is approximately £2500 (within £150 either way) including VAT, covering the base unit and monitor. There needs to be provision for ingesting the footage from a variety of different memory cards at high speeds, and the system needs to have analogue surround sound and SPDIF outputs.

The graduate also has an additional requirement for external storage in the form of a Network Attached Storage (NAS) device. This should have 8 terabytes (TB) of storage initially, with scope to be expanded up to 56TB with 8TB drives in the future. There should be redundancy to protect the data. A budget is not specified for the NAS device, but the solution needs to be cost-effective.

3.2. Specification

This section outlines the components chosen and the reasoning behind the choices. There is also an itemised price list of the components with a total price at the end.

3.2.1. System components

3.2.1.1. Central Processing Unit (CPU)

Video editing software benefits from a high-performance CPU, with software such as Adobe Premiere Pro being impacted more by CPU performance than GPU performance [25]. The author recommends the AMD Ryzen 9 3900X. It performs slightly better than the Intel Core-

i9 10920X which has the same core count despite costing roughly £200 less than the Intel CPU (see Appendix A) [26].

3.2.1.2. CPU cooler

The author recommends the Arctic Liquid Freezer II 280 all-in-one liquid cooler. It outperforms other well regarded CPU coolers (such as the Noctua NH-D15) at a similar price point, with better thermal performance at slightly lower noise levels [27].

3.2.1.3. Motherboard

The CPU choice requires a motherboard with an AM4 socket. The author recommends the MSI X570-A PRO. It is an ATX motherboard based on the X570 chipset. A key feature of this chipset is PCIe 4.0 support, allowing the use of PCIe 4.0-based NVMe SSDs. The chosen motherboard has one M.2 slot supporting PCIe 4.0, with a second slot supporting PCIe 3.0 [28]. The motherboard also has the required audio outputs for the user. All rear USB ports are USB 3.2 Gen 1 (4 Type A ports) or USB 3.2 Gen 2 (one Type A and one Type C) [28].



Figure 2: Rear connectivity for the chosen motherboard [28].

3.2.1.4. Random Access Memory (RAM)

It is recommended that a system has 64GB of RAM for 4K editing in Adobe Premiere Pro [25]. Benchmarks suggest there is a benefit to quicker memory for AMD systems in Adobe Premiere Pro and After Effects with diminishing returns for the highest speed memory [29]. To get a balance between memory capacity and speed within the budget, the author recommends Corsair Vengeance LPX 64GB DDR4-3200 RAM. This meets the capacity requirements and is relatively high-speed.

3.2.1.5. Non-volatile storage

Multiple drives are suggested for video editing software for best performance [30]. The author recommends a two-drive configuration; one drive for the operating system (OS) and software, and one for scratch files and project files. They recommend the Samsung 970 EVO Plus V-

NAND 500GB M.2 NVMe SSD for the first drive. This is ample capacity for the OS and software, and the PCIe 3.0 interface allows high transfer speeds (3500MB/s sequential read and 3200MB/s sequential write [31]). The recommendation for the second drive is the Corsair Force series Gen. 4 PCIe MP600 2TB M.2 NVMe SSD. This drive has a PCIe 4.0 interface, providing very high transfer speeds (4950MB/s sequential read and 4250MB/s sequential write [32]) without the need for a Redundant Array Independent Disks (RAID) configuration. This drive can be partitioned for project and scratch files as necessary.

3.2.1.6. Graphics Processing Unit (GPU)

Despite supporting GPU acceleration, the performance of many of the popular video editing programs is more dependent on the CPU than the GPU. However, there are some programs (such as DaVinci Resolve) that have performance heavily reliant on the GPU [33]. The user has not specified which video editing software they will be using; therefore, the author recommends the Gigabyte RTX 2070 Windforce 2X GPU. It is a relatively high-end GPU that should perform well in software such as DaVinci Resolve without being so expensive that the budget for the CPU is affected to the detriment of performance in CPU-bound video editing software [34][25].

3.2.1.7. Case and Power Supply Unit (PSU)

The author used an online power supply calculator [35] to get a basis for the system's power usage. The result (see Appendix B) was a recommendation for a 750W power supply based on a power usage of 491W. The author recommends a Corsair RM750 750-watt PSU. It is 80 PLUS Gold certified [36] and fully modular, meaning only the required cables for a particular system configuration need to be connected to the PSU.

The case requires ATX compatibility and mounts for the CPU cooler radiator. The author recommends the Fractal Design Define S. This is a sound dampened case with provision for mounting a variety of differently sized water-cooling radiators [37]. The sound dampening will ensure the system is quiet to prevent the user being disturbed. The case has numerous cable management features which, along with the fully modular PSU, allow for neat cable routing.

3.2.1.8. Monitor

The author recommends a 4K monitor with a wide colour gamut to provide more colour detail. It should also be colour accurate to ensure accurate colour grading can be carried out. The author's recommended monitor is the BenQ EW3270U 4K monitor. It supports 10-bit colour

with 95% and 100% coverage of the DCI-P3 and Rec. 709 colour spaces respectively [38], with both being used for video production [39]. It also has good colour accuracy from the factory [38].

3.2.1.9. Peripherals

The author recommends the Kingston FCR-HS4 USB 3.0 card reader for ingesting footage at high speeds. It supports various types of memory cards including CompactFlash (CF Type I & II) and Secure Digital (SD/SDHC/SDXC UHS I-II) [40].

3.2.2. System costings

Below are the costings of the system. These prices were correct as of 26th April 2020.

Image	Description	Retailer	Price
	AMD Ryzen 9 3900X (CPU)	eBuyer	£439.97
	MSI X570-A PRO (Motherboard)	Scan	£164.99
	Corsair Vengeance LPX 64GB DDR4-3200 (RAM)	Overclockers UK	£289.99
	Arctic Liquid Freezer II 280 AIO (CPU cooler)	Scan	£79.99
	Samsung 970 EVO Plus M.2 500GB (Non-volatile storage)	eBuyer	£111.18
	Corsair Force series MP600 M.2 2TB (Non-volatile storage)	eBuyer	£399.98
	Fractal Design Define S (Case)	eBuyer	£68.99

	Corsair RM750 (PSU)	eBuyer	£105.99
	Gigabyte GeForce RTX 2070 Windforce X2 (GPU)	Overclockers UK	£398.98
	BenQ EW3270U 32" 4K (Monitor)	Amazon	£399.99
	Windows 10 Home 64-bit OEM (OS)	eBuyer	£98.32
	Kingston FCR-HS4 USB 3.0 (Card reader)	MyMemory	£17.95
	Shipping	Overclockers UK	£10.50
	Shipping	Scan	£11.50
	Shipping	eBuyer	£11.05
	Shipping	MyMemory	£0.00
Total			£2609.38

3.2.3. NAS components

3.2.3.1. Network Attached Storage (NAS) device

The requirement for having scope for 56TB using 8TB drives means an 8-bay NAS device is required. The author recommends the Synology DS1819+ NAS device. The author believes the choice of RAID should be Synology Hybrid RAID (SHR), a feature unique to Synology devices. This is a hybrid of RAID 1 and RAID 5 that can be configured for 1 or 2 drive redundancy (requiring a minimum of two drives or four drives respectively) [41][42]. When configured for 1 drive redundancy, this allows for the user to start with a smaller array than they would be able to with RAID 5 which requires a minimum of three drives [42]. It also allows drives of mixed capacity to be used but does not limit the available capacity of each drive to that of the smallest drive in the array [41][43].

This NAS device has four Gigabit Ethernet ports for network connectivity [44]. Link aggregation can be used to aggregate the ports for additional bandwidth or fault tolerance [45]. The author suggests that this is configured for fault tolerance, as the transfer speeds between the computer and NAS device will be limited by the speed of the computer's Gigabit Ethernet. This means aggregating the NAS device's ports for additional bandwidth would not see a performance benefit. Assuming the network infrastructure between the computer and NAS device allow it, the two will be connected at Gigabit speeds (1000 Megabits per second, or 125 Megabytes per seconds).

3.2.3.2. Non-volatile storage

NAS specific drives are recommended for use in NAS devices, with the author's choice being two Seagate IronWolf 8TB NAS drives. These drives are designed to operate continuously, with higher workload ratings (measured in terabytes per year). A typical hard drive would be rated at around 55TB per year [46], whereas the chosen drives are rated at 180TB per year [47]. The drives are also designed to handle the vibration caused by having multiple drives close together in an enclosure, with rotational vibration (RV) sensors designed to sense and reduce vibrations [46][47]. The author has chosen to have two drives so the user will have 1 drive of redundancy using the chosen RAID configuration. The drives each have a transfer rate of up to 210MB per second [48] which, combined with the striping of the RAID configuration, should saturate the Gigabit connection.

3.2.4. NAS costings

Below are the costings of the NAS device. These prices were correct as of 2nd May 2020.

Image	Description	Retailer	Price
	Synology DS1819+ 8 Bay Desktop NAS	eBuyer	£874.68
	Seagate IronWolf 8TB NAS Hard Drive	eBuyer	£237.99
	Seagate IronWolf 8TB NAS Hard Drive	eBuyer	£237.99
	Shipping	eBuyer	£3.49
	Shipping	MyMemory	£0.00
Total			£1354.14

4. Conclusion

The author believes the system specifications they have set out for the two scenarios meet the requirements of each based on the information given. In an ideal world, the author would have had discussions with the users to better understand their preferences to ensure the specified systems are more tailored to their needs. For example, an open source operating system such as Linux could be used in the case of scenario 1 to bring the cost of the system down by approximately 18%, but the user would have to be comfortable with this decision. Another example would be establishing the video editing software being used for scenario 2 and biasing the system to suit that software.

5. Glossary

Acronym	Term
AIO	All-In-One
APU	Accelerated Processing Unit
CPU	Central Processing Unit
DDR	Double Date Rate
GB	Gigabyte
Gb	Gigabit
GPU	Graphics Processing Unit
MB	Megabyte
Mb	Megabit
NAS	Network Attached Storage
NVMe	Non-Volatile Memory Express
OS	Operating System
PSU	Power Supply Unit
RAID	Redundant Array of Independent Disks
RAM	Random Access Memory
RV	Rotational Vibrations
SHR	Synology Hybrid RAID
SSD	Solid State Drive
TB	Terabyte

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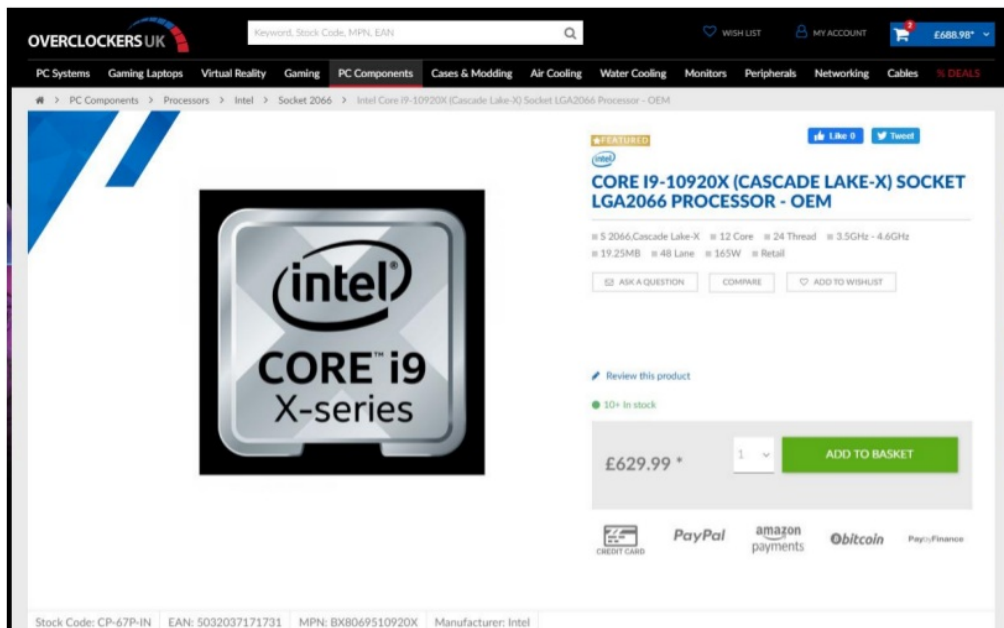
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7. Appendices

7.1. Appendix A

7.1.1. Intel Core i9-10920X pricing versus AMD Ryzen 9 3900X pricing as of 26/04/2020



The screenshot shows the product page for the Intel Core i9-10920X (Cascade Lake-X) Socket LGA2066 Processor on the Overclockers UK website. The page features a large image of the processor, its specifications, and pricing information.

Product Details:

- Processor: Intel Core i9-10920X (Cascade Lake-X) Socket LGA2066 Processor - OEM
- Specifications: 5 2066 Cascade Lake-X, 12 Core, 24 Thread, 3.5GHz - 4.6GHz, 19.25MB, 48 Lane, 165W, Retail
- Price: £629.99*
- Availability: 10+ In stock
- Payment Options: Credit Card, PayPal, Amazon payments, Bitcoin, Pay/Finance

Navigation and Search:

- Search bar: Keyword, Stock Code, MPN, EAN
- Navigation menu: PC Systems, Gaming Laptops, Virtual Reality, Gaming, PC Components, Cases & Modding, Air Cooling, Water Cooling, Monitors, Peripherals, Networking, Cables, DEALS
- Breadcrumb: PC Components > Processors > Intel > Socket 2066 > Intel Core i9-10920X (Cascade Lake-X) Socket LGA2066 Processor - OEM

Footer Information:

- Stock Code: CP-67P-IN
- EAN: 5032037171731
- MPN: BX8069510920X
- Manufacturer: Intel



The screenshot shows the product page for the AMD Ryzen 9 3900X AM4 CPU/Processor with Wraith Prism RGB Cooler on the ebuyer.com website. The page features a large image of the processor box, its specifications, and pricing information.

Product Details:

- Processor: AMD Ryzen 9 3900X AM4 CPU/Processor with Wraith Prism RGB Cooler
- Specifications: Ryzen 9 3900X, 12 Cores, 24 Threads, Boost Clock 4.8GHz
- Price: £439.97 (inc. VAT)
- Availability: In stock
- Payment Options: PayPal, Check out

Navigation and Search:

- Search bar: Search for products...
- Navigation menu: Computing, Peripherals, Components, Network & Storage, TV & Audio, Gadget & Gifts, Gaming, Home & Outdoors, Office Furniture, Business, Clearance
- Breadcrumb: Components > Processors AMD > AMD AM4 Ryzen 9 > AMD Ryzen 9 3900X AM4 CPU/Processor with Wraith Prism RGB Cooler

Footer Information:

- QuickFind: 585782 - Mfr part code: 100-10000003280X
- Rating: 4.5 stars (based on 1 review)
- Auth. reseller

7.2. Appendix B

7.2.1. Power supply calculator results

Results:

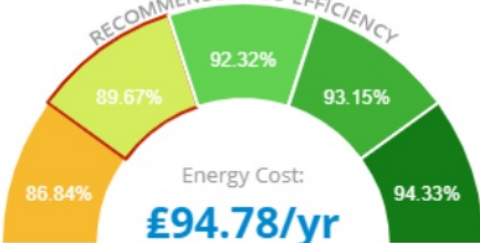
<https://outervision.com/b/vuwH3w>  [bb]  T

Load Wattage: **441 W**
Recommended UPS rating: **850 VA**
Recommended PSU Wattage: **491 W**

Amperage (combined)

+3.3V	+5V	+12V
10.2 A	12.8 A	28.6 A
98 W		343 W

RECOMMENDED PSU EFFICIENCY



Energy Cost:
£94.78/yr

PSU Price: **£88.70** Payback Period: **11.23 years**

kWh Cost  **£0.11**

Recommended Power Supply:

 Corsair CX750M 750W 80+ Bronze Power Supply - Available at Amazon

CALCULATE **RESET**

1811357 - Patrick Atkinson - ACCD4001 - Assignment

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

87/100

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GRADING FORM: GJ_2019

PATRICK ATKINSON

433

ENGAGEMENT WITH LITERATURE



Superb level of targeted, relevant background reading and research sources.

88

KNOWLEDGE AND UNDERSTANDING



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

90

COGNITIVE AND INTELLECTUAL



Choices backed up with excellent justification as well as reliable research sources.

90

PRACTICAL APPLICATION



Extremely appropriate systems specified.

90

TRANSFERABLE SKILLS



Generally well laid out and presented. Good use of formatting and breaking the report down into sensible nested numbered sections that follow the numbering convention detailed in class. Good writing style. Reads well with a good 'flow'.

75