

## Part 1; a:

Based on the requirements and budget provided, here is my recommendation for the new PCs and file server units:

### Designers PCs:

1. Processor: Intel Core i9-11900K - **£452**
  - Both processors have high clock speeds and multiple cores, making them suitable for AutoCAD and other design software.
2. RAM: 64GB DDR4 3200MHz RAM - **£144**
  - This will provide sufficient memory for large design files and multitasking.
3. Graphics Card: NVIDIA Quadro RTX 4000 - **£1,093**
  - These cards have 8GB of VRAM and are certified for AutoCAD, ensuring smooth performance and support for multiple displays.
4. Display: 3 or 4 monitors with a minimum resolution of 1920x1080, and a screen size of at least 24 inches - **£153**
  - These monitors have a resolution of 1920x1080, IPS panels for excellent color accuracy and wide viewing angles, and adjustable stands for ergonomics.
5. Storage: A fast SSD with a minimum of 1TB capacity to store large design files - **£169**
  - This will provide fast storage for the operating system and frequently used files.
6. Operating System: Windows 10 Pro 64-bit edition - **£128**
7. Network Card: Gigabit Ethernet network interface card (NIC) - **£29**
8. Ergonomic Accessories: Herman Miller Aeron Chair and Fully Jarvis Standing Desk - **£821**
  - These accessories will provide ergonomic support to the designers and promote health and safety in the workplace.

**Total cost per unit: £2,990**

**In terms of health, safety, and environmental issues**, all components are certified for safety and comply with RoHS (Restriction of Hazardous Substances) regulations.

**Security Features:**

1. Data Encryption: BitLocker Drive Encryption - included with Windows 10 and Windows Server 2019.
  - This will encrypt data on the hard drives to prevent unauthorized access.
2. Firewall: Windows Firewall - included with Windows 10 and Windows Server 2019.
  - This will block unauthorized access to the network.
3. Anti-Virus: Windows Defender Antivirus - included with Windows 10 and Windows Server 2019.
  - This will protect against malware and viruses.

**Environmental Considerations:**

- Energy Efficiency: All components selected have high energy efficiency ratings, helping to reduce the environmental impact and operating costs of the machines.
- Recyclability: Where possible, components with a high recyclability rate have been selected to reduce waste.

**Part 1; b:**

Based on the requirements stated in the question, the following are two file servers suitable for being the “**master**” and “**mirror**” animation frame stores:

**Master File Server:**

- Operating System: Windows Server 2019 Standard Edition (64-bit) - **£191**
- Processor: Intel Xeon E-2236 (6 cores, 12 threads, 3.4 GHz) - **£1,546**
- Memory: 32 GB DDR4 ECC RAM - **£124**
- Storage: 8 x 12 TB SAS HDDs in RAID 6 configuration (64 TB usable storage) - **£2,768**
- Network Interface: 2 x 10 Gigabit Ethernet ports - **£172**
- Redundant Power Supply: Yes - **£631**
- Backup Solution: Microsoft Azure Backup - **£45.17**

**Total cost per unit: £4,477.17**

#### **Justification:**

- Windows Server 2019 is a widely used and supported network operating system suitable for serving animation files to a large number of clients.
- The Intel Xeon E-2236 processor is a powerful server-grade processor suitable for handling large file transfer workloads.
- 32 GB of DDR4 ECC RAM is enough to handle the load of 55 animation machines (20 new and 35 existing).
- 8 x 12 TB SAS HDDs in RAID 6 configuration provide a total of 64 TB of usable storage, which is more than enough to store the animation files.
- 2 x 10 Gigabit Ethernet ports ensure fast file transfers between the master file server and the clients.
- A redundant power supply ensures that the server remains operational in the event of a power supply failure.
- Microsoft Azure Backup is a reliable and secure cloud backup solution that can be used to protect against data loss due to catastrophic failures.

#### **Mirror File Server:**

- Operating System: Windows Server 2019 Standard Edition (64-bit) - **£191**
- Processor: Intel Xeon 6226R (16 cores, 2.90 GHz) - **£1,546**
- Memory: 32 GB DDR4 ECC RAM - **£124**

- Storage: 8 x 12 TB SAS HDDs in RAID 6 configuration (64 TB usable storage) - **£2,568**
- Network Interface: 2 x 10 Gigabit Ethernet ports - **£171**
- Redundant Power Supply: Yes **£400**

**Total cost per unit: £5,000**

#### **Justification:**

- Using the same operating system and hardware configuration as the master file server ensures compatibility and consistency between the two servers.
- 8 x 12 TB SAS HDDs in RAID 6 configuration provide a total of 64 TB of usable storage, which is enough to store a mirror copy of the animation files.
- 2 x 10 Gigabit Ethernet ports ensure fast synchronization between the master and mirror servers.
- A redundant power supply ensures that the server remains operational in the event of a power supply failure.

#### **Environmental Considerations:**

- Energy Efficiency: All components selected have high energy efficiency ratings, helping to reduce the environmental impact and operating costs of the machines.
- Recyclability: Where possible, components with a high recyclability rate have been selected to reduce waste.

#### **Security Features:**

Both servers should have the following security features:

- Windows Defender Antivirus for protection against malware and viruses
- Windows Firewall for network security
- Role-based access control to restrict access to sensitive data

#### **Discussion and recommendations**

I recommend adopting a software-based mirroring solution, such as Windows Server's built-in Storage Spaces capability or third-party software, such as Acronis True Image, to mirror the servers. The software-based approach will enable real-time synchronization between the two servers, guaranteeing that any changes performed on one server are mirrored on the other. In the event that one server fails, this will guarantee that data is always accessible.

As a result, the two file servers that were previously suggested are suitable for use as the "master" and "mirror" animation frame storage. They have appropriate licensing requirements, network operating systems, and security features. The suggested software-based mirroring solution will guarantee that data is constantly accessible and that it may be rapidly retrieved in the event of a breakdown.

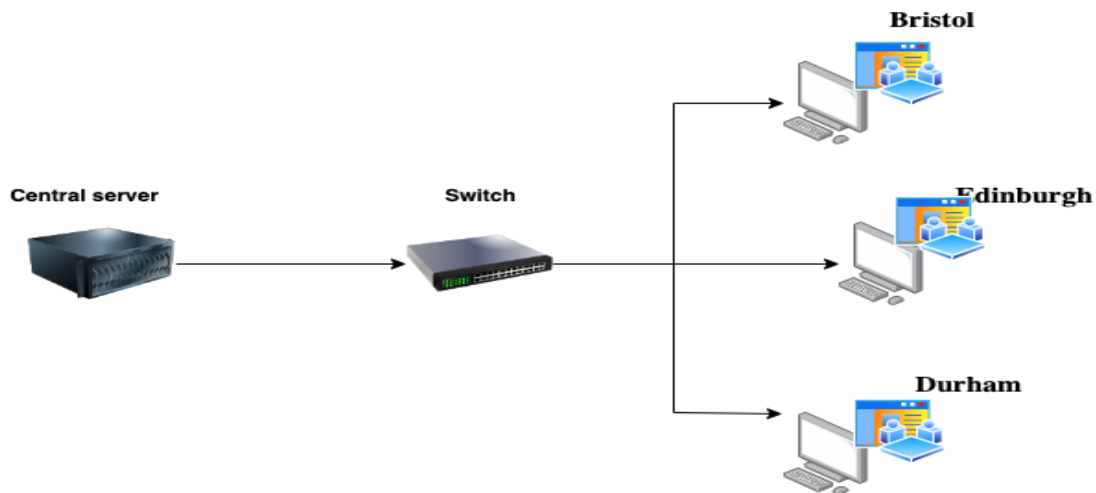
## **Part 2; a:**

Based on the requirement to secure data flowing between the Edinburgh, Bristol, and Durham sites, the following technologies can be recommended:

1. Virtual Private Network (VPN): VPN creates a secure, encrypted tunnel over the internet that can be used to connect remote sites together. By implementing VPN technology, data transmitted between sites can be encrypted and secure.
2. Secure Sockets Layer/Transport Layer Security (SSL/TLS): SSL/TLS are cryptographic protocols that provide secure communication over the internet. By using SSL/TLS, data can be encrypted and transmitted securely between sites.
3. Firewall: Firewall is a network security system that monitors and controls incoming and outgoing network traffic based on predefined security rules. By implementing a firewall, the company can control and monitor network traffic between sites, ensuring that only authorized traffic is allowed to pass.
4. Intrusion Detection and Prevention System (IDPS): IDPS monitors network traffic for signs of unauthorized access or malicious activities and takes action to

prevent them. By using IDPS, the company can detect and prevent potential security threats in real-time.

**Simple schematic diagram to illustrate these secure connections between the sites**



**IPv4:**

**Bristol Site:**

| Department/Group | Subnet Address | Subnet Mask         | IP Range      | Hosts |
|------------------|----------------|---------------------|---------------|-------|
| Management       | 192.168.1.0    | 255.255.255.22<br>4 | 192.168.1.1-4 | 4     |

|                    |              |                 |                 |    |
|--------------------|--------------|-----------------|-----------------|----|
| Boat Designers     | 192.168.1.32 | 255.255.255.240 | 192.168.1.5-20  | 15 |
| Aircraft Designers | 192.168.1.48 | 255.255.255.192 | 192.168.1.21-81 | 60 |

**Durham Site:**

| Department/Group | Subnet Address | Subnet Mask     | IP Range        | Hosts |
|------------------|----------------|-----------------|-----------------|-------|
| Management       | 192.168.2.0    | 255.255.255.224 | 192.168.2.1-7   | 7     |
| Car Designers    | 192.168.2.32   | 255.255.255.224 | 192.168.2.8-38  | 30    |
| Marketing        | 192.168.2.64   | 255.255.255.252 | 192.168.2.39-45 | 6     |

|                 |              |                     |                 |    |
|-----------------|--------------|---------------------|-----------------|----|
| Lorry Designers | 192.168.2.68 | 255.255.255.19<br>2 | 192.168.2.46-86 | 40 |
|-----------------|--------------|---------------------|-----------------|----|

## IPv6:

### Bristol Site:

| Department/Gro<br>up  | Subnet<br>Address  | Prefix<br>Length | IP Range                                              | Hosts              |
|-----------------------|--------------------|------------------|-------------------------------------------------------|--------------------|
| Management            | 2001:db8:1:1<br>:: | /64              | 2001:db8:1:1::1-2001:db8:1:1:<br>:ffff:ffff:ffff:fffe | 2 <sup>62</sup> -2 |
| Boat Designers        | 2001:db8:1:2<br>:: | /64              | 2001:db8:1:2::1-2001:db8:1:2:<br>:ffff:ffff:ffff:fffe | 2 <sup>62</sup> -2 |
| Aircraft<br>Designers | 2001:db8:1:3<br>:: | /64              | 2001:db8:1:3::1-2001:db8:1:3:<br>:ffff:ffff:ffff:fffe | 2 <sup>62</sup> -2 |

### Durham Site:



| Department/Group | Subnet Address | Prefix Length | IP Range                                          | Hosts      |
|------------------|----------------|---------------|---------------------------------------------------|------------|
| Management       | 2001:db8:2:1:: | /64           | 2001:db8:2:1::1-2001:db8:2:1::ffff:ffff:ffff:fffe | $2^{62}-2$ |
| Car Designers    | 2001:db8:2:2:: | /64           | 2001:db8:2:2::1-2001:db8:2:2::ffff:ffff:ffff:fffe | $2^{62}-2$ |
| Marketing        | 2001           |               |                                                   |            |

## Part 2 a:

To defend the company's local area networks within the sites, there are various methods that can be used from both physical site and network system perspectives. Here are some methods and their pros and cons:

### Physical Site Security Methods:

1. Access Control: Physical access control can be implemented to ensure only authorized personnel are allowed into the company premises. This can be done through measures such as security guards, CCTV cameras, biometric scanners, or smart card readers. This will limit the possibility of unauthorized personnel entering the premises and potentially accessing the network.

2. **Secure Facilities:** Company facilities such as server rooms should be locked and only accessible by authorized personnel. Servers and networking equipment should be kept in locked cabinets to prevent physical tampering.
3. **Power Supply:** Power supply to servers and network equipment should be backed up with an uninterruptible power supply (UPS) system, in case of power outages or surges. This will ensure that critical systems remain operational and data is not lost or corrupted.

### **Network Security Methods:**

1. **Firewalls:** Firewalls are used to monitor and control incoming and outgoing traffic from the network. They can be hardware or software-based, and are designed to block unauthorized access, malware, and other security threats. Firewalls can be used to restrict access to certain websites, ports, or services.
2. **Virtual Private Networks (VPN):** A VPN is a secure connection that allows remote access to the company network. This is particularly useful for employees who work from home or travel frequently. VPNs encrypt traffic between the remote device and the company network, making it harder for hackers to intercept sensitive data.
3. **Intrusion Detection and Prevention Systems (IDPS):** IDPS are software or hardware systems that monitor the network for potential threats such as malware or unauthorized access attempts. They can be configured to alert administrators when potential threats are detected, or to block the threat altogether.

Based on the above methods, the company should implement a combination of physical and network security measures to ensure the protection of their design files. Access control and secure facilities should be implemented to prevent physical tampering or unauthorized access to servers and networking equipment. Power supply should be backed up with a UPS system to ensure that critical systems remain operational in case of power outages or surges.

For network security, the company should implement firewalls to monitor and control incoming and outgoing traffic from the network. VPNs should be used to encrypt traffic between remote devices and the company network, making it harder for hackers to intercept sensitive data. IDPS should be implemented to monitor the network for potential threats and alert administrators when necessary.

Overall, a combination of physical and network security measures will help ensure the protection of the company's design files from potential threats such as hackers or competitors. The specific measures implemented should be based on the company's unique requirements and budget, and should be regularly reviewed and updated to ensure maximum effectiveness.

## Appendix

- PC- Processor

AMD Ryzen 9 5950X 16-core, 32-Thread Unlocked Desktop Processor  
[Visit the AMD Store](#)  
★★★★★ 3,264 ratings | 140 answered questions

**-41%** EUR **452**<sup>40</sup>  
List Price: EUR772.96 ⓘ

EUR 150.09 Shipping & Import Fees Deposit to Nigeria [Details](#) ✓  
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|                     |            |
|---------------------|------------|
| <b>Brand</b>        | AMD        |
| <b>CPU</b>          | AMD        |
| <b>Manufacturer</b> |            |
| <b>CPU Model</b>    | Ryzen 9    |
| <b>CPU Speed</b>    | 4.9 GHz    |
| <b>CPU Socket</b>   | Socket AM4 |

- PC- RAM

Crucial RAM 64GB Kit (2x32GB) DDR4 3200MHz CL22 (or 2933MHz or 2666MHz) Laptop Memory CT2K32G4SFD832A  
[Visit the Crucial Store](#)  
★★★★★ 23,410 ratings | 1000+ answered questions

**Amazon's Choice** for "64gb ddr4 3200mhz ram"

**-31%** EUR **144**<sup>58</sup>  
List Price: EUR209.92 ⓘ

- PC- Graphics Card

HP 5JV89AT Quadro RTX 4000 Graphic Card - 8 GB GDDR6  
[Visit the HP Store](#)  
★★★★★ 5 ratings

EUR **1,093**<sup>17</sup>

|                               |                    |
|-------------------------------|--------------------|
| <b>Graphics Coprocessor</b>   | NVIDIA Quadro 2000 |
| <b>Brand</b>                  | HP                 |
| <b>Graphics Ram Size</b>      | 8 GB               |
| <b>Video Output Interface</b> | DisplayPort        |
| <b>Chipset Brand</b>          | NVIDIA             |

- PC- Display

Dell S2421HS Full HD 1920 x 1080, 24-Inch 1080p LED, 75Hz, Desktop Monitor with Adjustable Stand, 4ms Grey-to-Grey Response Time, AMD FreeSync, IPS Technology, HDMI, DisplayPort, Silver

[Visit the Dell Store](#)

★★★★★ 590 ratings | 82 answered questions

Size: 24.0" FHD

24.0" FHD

27.0" FHD

See Sl

See All B

Deliver to Ni

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Dell DELL-MS/ Monitor,MSA2 Black

EUR 154.78

- PC- Storage

SAMSUNG 980 PRO SSD 2TB PCIe NVMe Gen 4 Gaming M.2 Internal Solid State Drive Memory Card, Maximum Speed, Thermal Control, MZ-V8P2T0B

[Visit the SAMSUNG Store](#)

★★★★★ 23,842 ratings | 983 answered questions

-55% EUR 164<sup>45</sup>

List Price: EUR 367.61

- PC- Operating System

Microsoft OEM System Builder | Windows 10 Home | 64-bit | Intended use for new systems | Upgradable to Windows 11 | Branded by Microsoft

[Brand: Microsoft](#)

Platform : Windows 10

★★★★★ 8,426 ratings

Price: EUR 125.75

Style: Home

Home EUR 125.75

Pro 3 options from EUR 163.49

- Network Card

10/100/1000Mbps Gigabit Ethernet Network Interface Card (NIC) Dual Copper RJ45 Ports, with Intel 82576 Chip, Equivalent to Intel E1G42ET, PCIE 2.0 X1, Support Windows/Windows Server/Linux/VMware ESX

[Visit the Alwong Store](#)

★★★★★ 20 ratings

EUR **29**<sup>87</sup>

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- **PC- Ergonomic Accessories**

FEZIBO Triple Motor L-Shaped Electric Standing Desk, 63 Inches Height Adjustable Stand up Corner Desk, Sit Stand Workstation with Splice Board, Black Frame/Rustic Brown Top

[Visit the FEZIBO Store](#)

★★★★★ 613 ratings

**-14%** EUR **580**<sup>44</sup>

List Price: EUR677.18 ⓘ

EUR 1,242.69 Shipping & Import Fees Deposit to Nigeria [Details](#)

- **server- Processor**

Intel Xeon 4210 Deca-core (10 Core) 2.20 GHz Processor - OEM Pack - 13.75 MB Cache - 3.20 GHz Overclocking Speed - 14 nm - Socket 3647 - 85 W

[Visit the Intel Store](#)

★★★★★ 3 ratings

**-17%** EUR **480**<sup>56</sup>

List Price: EUR579.48 ⓘ

[Eligible for Return, Refund or Replacement within 30 days of receipt](#) ▾

**Brand** Intel

**CPU Manufacturer** Intel

- **server- RAM**

v-Color 128GB(64GBx2) 3200MHz  
DDR4 ECC R-DIMM 4Gx4 2Rx4 ECC  
Registered DIMM Using hynix IC Dual  
Rank for Server/Workstation/Data  
Center Memory(TR464G32D422K)

[Visit the V-COLOR COLOR YOUR LIFE Store](#)

★★★★☆ 33 ratings | 14 answered questions

EUR **619**<sup>13</sup>

EUR 279.97 Shipping & Import Fees Deposit to Nigeria [Details](#) ▾

Size: **128GB (64GBx2)**

- **Server- Storage**

Western Digital 10TB WD Red Pro NAS Internal Hard  
Drive HDD - 7200 RPM, SATA 6 Gb/s, CMR, 256 MB Cache,  
3.5" - WD102KFBX

[Visit the Western Digital Store](#)

★★★★★ 3,521 ratings | 111 answered questions

**-31%** EUR **232**<sup>17</sup>

List Price: EUR 338.58 ⓘ

EUR 64.87 Shipping & Import Fees Deposit to Nigeria [Details](#) ▾

Available at a lower price from [other sellers](#) that may not offer free Prime shipping.

- **Server- Operating System**

MS Windows SVR 2019 Cal (5 User)  
GR

[Visit the Lenovo Store](#)

No reviews

EUR **191**<sup>49</sup>

[Join Prime to buy this item at EUR 172.34](#)

EUR 93.44 Shipping & Import Fees Deposit to Nigeria [Details](#) ▾

- Product Type: Computer Input Device
- Package Quantity: 1
- Package Dimensions: 0.5 cms (L) x 17.0 cms (W) x 25.0 cms

- **server- Rack Mount**

StarTech.com 12U 19" Open Frame  
Server Rack - 4 Post Adjustable  
Depth 22-40" Mobile - Free Standing  
Rolling Network/Computer  
Equipment Data Rack- Dell  
PowerEdge HP ProLiant ThinkServer  
(4POSTRACK12U)

[Visit the StarTech Store](#)

★★★★★ 1,512 ratings | 184 answered questions

Amazon's Choice for "12u server rack"

-25% EUR 231<sup>59</sup>

List Price: EUR 309.56

EUR 480.56 Shipping & Import Fees Deposit to Nigeria [Details](#)

Available at a lower price from [other sellers](#) that may not offer

- **Server storage:**



Seagate ST12000NM002G 12TB  
12Gb/s SAS HDD

[Visit the Seagate Store](#)

★★★★☆ 2 ratings

EUR 346<sup>04</sup>

EUR 83.06 Shipping & Import Fees Deposit to Nigeria [Details](#)

Available at a lower price from [other sellers](#) that may not offer  
free Prime shipping.

- **10 Gigabit Ethernet ports:**

TRENDnet 10 Gigabit PCIe Network Adapter, Converts A  
PCIe Slot Into A 10G Ethernet Port, Supports 802.1Q  
Vlan, Includes Standard & Low-Profile Brackets, PCIe 2.0,  
PCIe 3.0, Silver, TEG-10GECTX

[Visit the TRENDnet Store](#)

★★★★☆ 685 ratings | 70 answered questions

-5% EUR 86<sup>64</sup>

List Price: EUR 91.34

No Import Fees Deposit & EUR 18.49 Shipping to Nigeria [Details](#)

- **Redundant Power Supply**



Silverstone GM600 Silver Cybenetics Silver 600W Mini  
redundant Power Supply, SST-GM600-S (SST-  
MR0600FCSI-A)

[Visit the SilverStone Technology Store](#)

No reviews

EUR **631**<sup>31</sup>

EUR 169.76 Shipping & Import Fees Deposit to Nigeria [Details](#) ▾

Available at a lower price from [other sellers](#) that may not offer free Prime shipping.

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9 New from EUR 45.17

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★★★★☆ ▾ 28 ratings

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## Reference

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<https://ipwithease.com/ip-addressing-scheme-ipv4/>

<http://www.steves-internet-guide.com/ipv6-guide/>

[https://content.cisco.com/chapter.sjs?uri=/searchable/chapter/content/en/us/td/docs/ios-xml/ios/ipv6\\_basic/configuration/15-sy/ip6b-15-sy-book/ip6-add-basic-conn.html.xml](https://content.cisco.com/chapter.sjs?uri=/searchable/chapter/content/en/us/td/docs/ios-xml/ios/ipv6_basic/configuration/15-sy/ip6b-15-sy-book/ip6-add-basic-conn.html.xml)