



# T Level Technical Qualification in Digital Support Services

Occupational specialism assessment (OSA)

## Digital Infrastructure

Assignment 1 - Workbook - Pass

Guide standard exemplification materials

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## Guide standard exemplification materials

Assignment 1

Workbook - Pass

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# About this assignment

## Introduction

All evidence should be placed in this workbook.

Save your document regularly as you work through the assignment. It is recommended you save after inserting each piece of evidence.

You can use multiple copies of the floor plan as required - copy a blank version from the appendix and paste where required. It is recommended that you use a new copy of each floor plan for task 1 and task 3.

Submit this workbook in .pdf format at the end of the assignment using the file naming convention.

Surname\_Initial\_student number\_Workbook1

For example: Smith\_J\_123456789\_Workbook1.pdf

## Evidence

Print screens of websites should be captioned with the following information:

- article title
- website address
- date accessed
- publisher

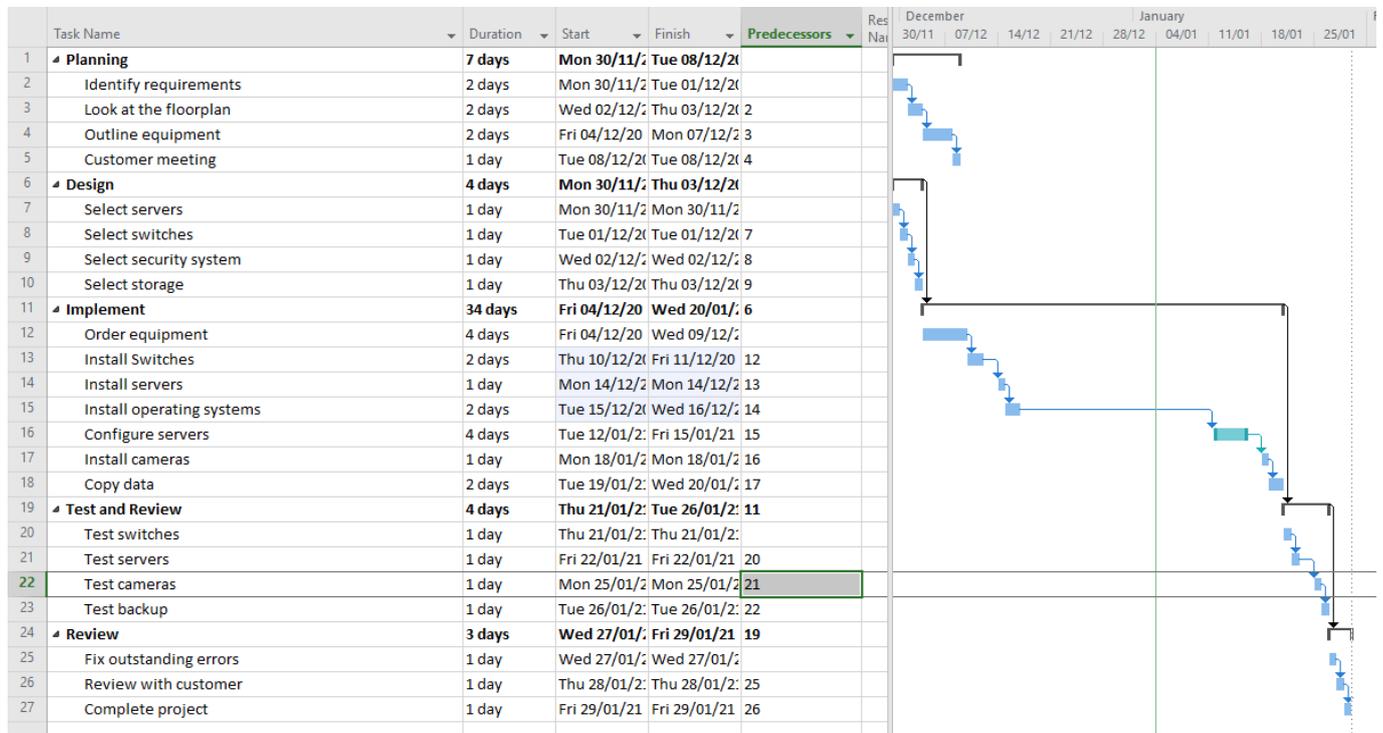
All print screens should be numbered and linked to the task.

For example, task 1, evidence 2 would be shortened to 1.2.

Ensure each print screen is labelled with a brief description of what is being shown.

# Task 1: planning

## Project plan and Gantt chart



## Legal Requirements and data security

- health and safety – this will ensure that people use good manual handling and also work in a tidy manner. Also to avoid slips trips and falls when working with equipment, ensuring you work tidy
- Computer Misuse Act – make sure you do not damage equipment with malicious intent, or to use data inappropriately
- GDPR – to ensure that data is handled correctly, is not transmitted outside of the country, deleted when no longer needed
- backing-up – the systems need to be backed up so that if migration fails or some upgrade fails, the system can be rolled back to a previous good state
- antistatic precautions – even though new equipment is being purchased and installed, components might still need to be handled that could be considered static sensitive

## Physical threats and security countermeasures

### Fire:

- the first risk to the building is fire, this can cause major disruption to the business whilst the building is repaired, and equipment replaced. Installing sprinklers and other fire suppression systems will reduce the risk of equipment being damaged in a fire

Theft:

- theft of equipment will not only cost the business money to replace the hardware, but it is the loss of the data stored on them
- I would recommend use of locks to reduce the risk of someone just walking away with a laptop that is left unattended
- use of software like Intune would allow you to lock a computer or phone that is stolen remotely
- the building should also implement CCTV cameras throughout to act as a deterrent for potential thieves. If a computer is stolen you will be able to identify the thief

Electrical and heating:

- a UPS will help reduce the risk of electrical damage to equipment by providing a constant quality of electricity free of surges and drops
- keeping the server in an air conditioned space will keep equipment cool and prevent overheating

**Digital threats and security countermeasures**

Equipment failure:

- an additional server and switch will be purchased so that if either a server or a switch fails, then another could be swapping in. Locating the backup server in a different location will protect data in event of a fire

Malware:

- virus checkers will be installed on all computers and the machines will also have the latest updates applied. The virus checker should be part of an Endpoint Security system to centrally manage updates and force computers to be up to date at all times

Hacking:

- wireless access will require authentication with active directory to ensure that all users have valid accounts. A firewall should be installed on the network to prevent an intruder accessing the network from the internet. Users should be blocked from installing software on their own computer

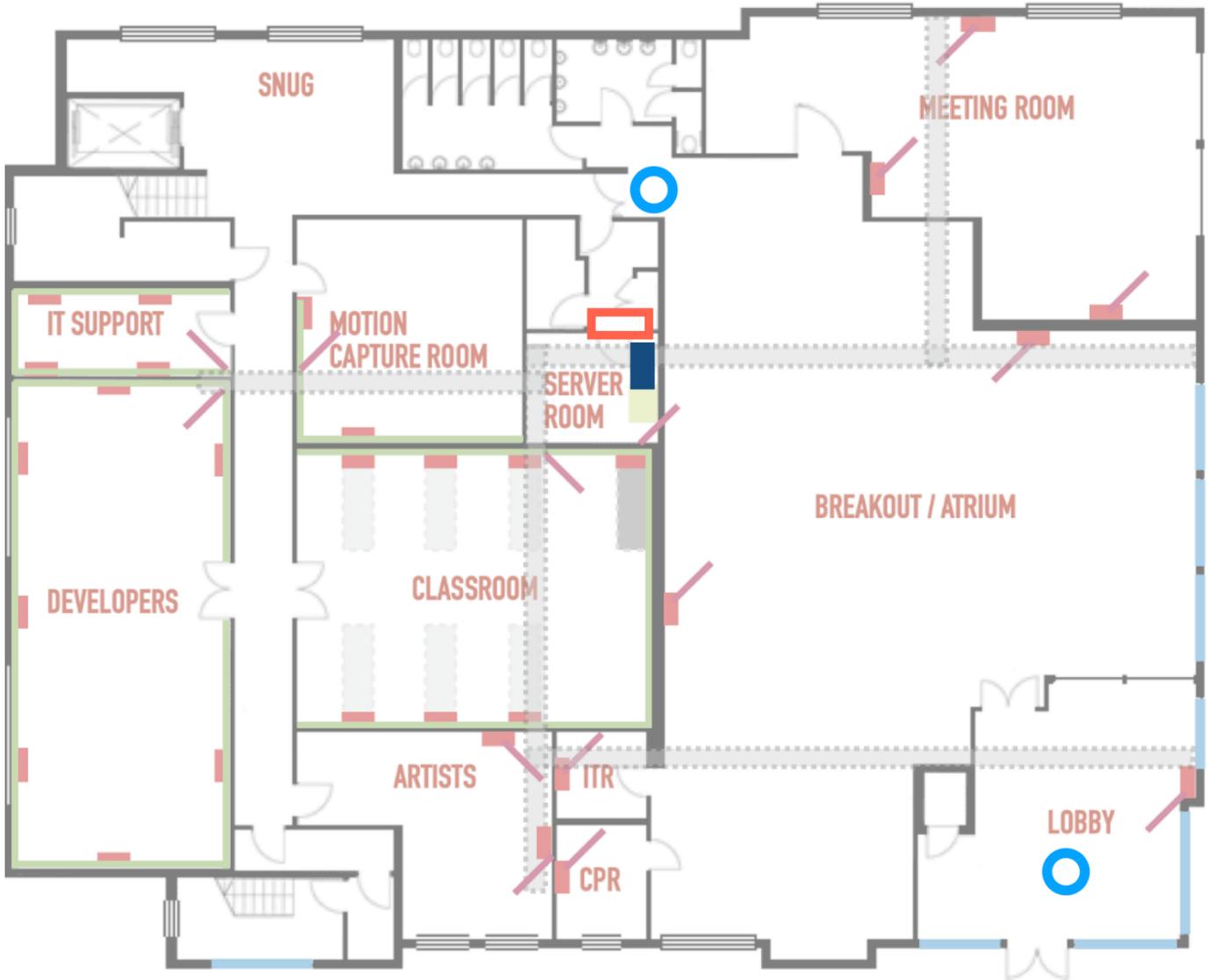
Remote access:

- remote access into the business will not be provided to ensure the network is as secure as possible. However, some items will be stored in the cloud to make it easier for people to work together

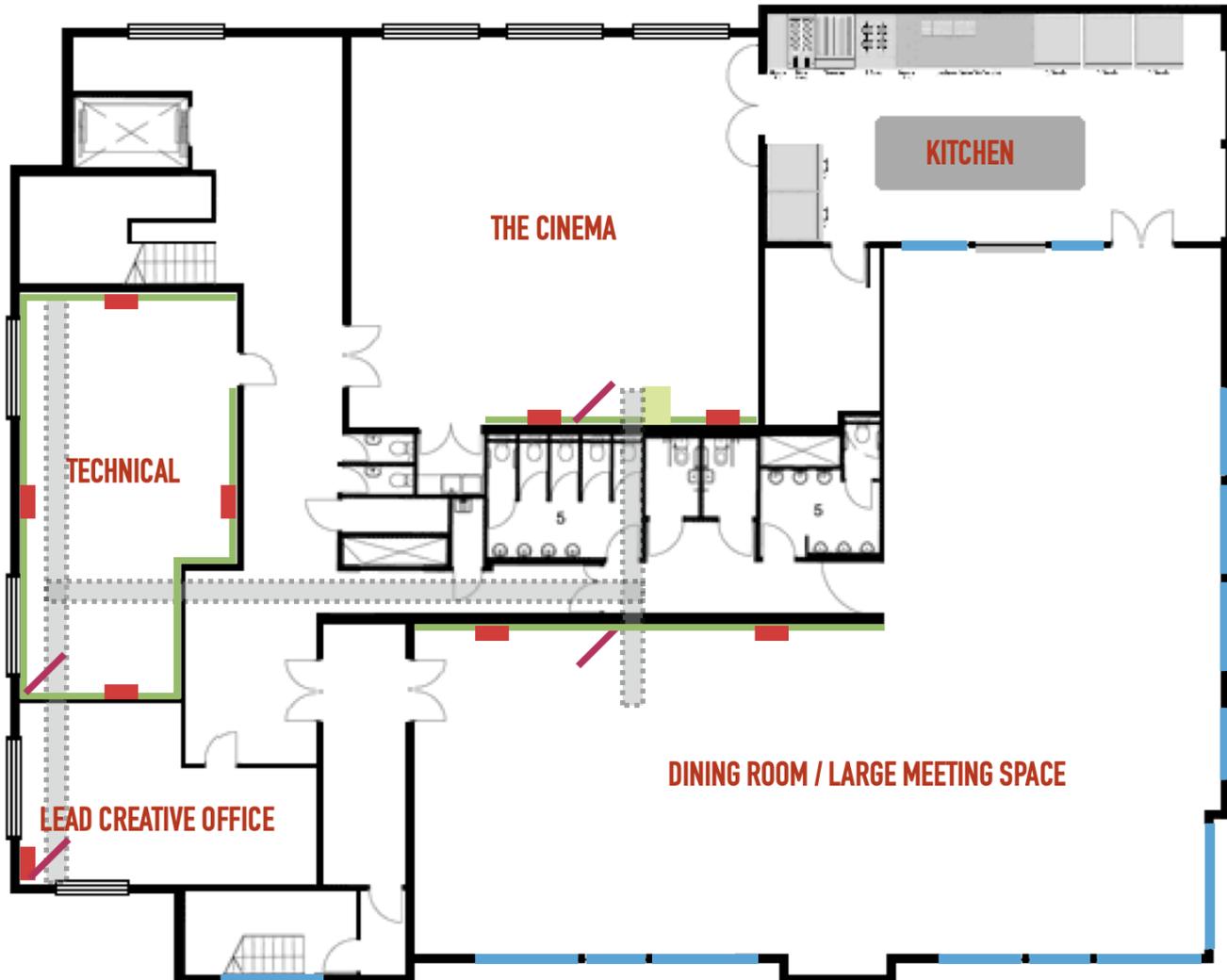
Annotated floor plans

	IP camera	These will be used to guard against any theft of equipment or other malicious activity. One camera will identify any intruder accessing the building through the lobby and the other will allow us to capture any intruder accessing staff areas that shouldn't.
	UPS battery backup	In the event of a power loss they would be able to sustain the servers until the power resumed or provide enough time to power down the servers.
	Swipe card door entry	The external door will have a swipe card access to prevent unauthorised access to the server room.

## Floor plan: ground floor



## Floor plan: first floor



## Task 2: design - servers and storage

### Server approach

Willow Technology is a company that specialises in creative industries. In their field they will need to their network to have plenty of storage capacity, ability to host a web server and database to host customer website

This means they will require a large amount of file storage, a directory server and a web server. This means it will need three physical servers to cover this off. It makes it easier to organise as each server will just be doing a fixed task(s).

One of the benefits of this approach is that the servers can be purchased with just enough capability to achieve the required task. The approach to the hardware provides better utilisation (for example, CPU and memory rather than buying over the top machines).

The following table shows the various roles that will need to be installed as part of the initial build of the network

Server 01		Web server	Support
DNS		Database	File server
DHCP		Web server	
Active directory			
Remote access service (RAS)			

### Server roles

This server will effectively ‘govern the network’ providing authentication to all users logging in and applying policies to lock down individual computers. The roles allocated will be:

DNS – domain name service will be required on the network to allow the mapping of device names to IP addresses.

DHCP – dynamic host control protocol, this will ensure that both wired and wireless devices are allocated an IP address that will allow them to connect to the network

Directory service (active directory) – the directory service will provide the address book of all the users and computers available on the network as well as providing the policies that will lock down computers to limit the way that end users can use them to company policies.

RAS – allows remote users to connect via VPN to access work resources.

### Application roles

Webserver (IIS) – this is where websites will be stored and created for customers to test. Internet information services is built into Windows and can be used to host customers’ websites.

Database (SQL server) – this will provide the website data required to make the websites. SQL needs to be installed on the server so that websites can access the database to save customer data.

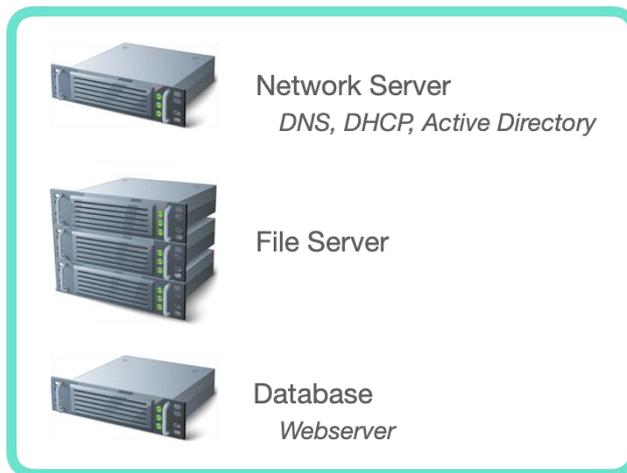
File and storage services – this will provide centralised storage, backup and control of the files. Installing this role will allow all files and data to be accessed by any user on any computer. It will also allow us to apply polices to

make sure that only authorised users can actually see and access files they are allowed to. File and storage services will allow us to run backups easily to make sure that our data is protected.

The following table breaks down how the various roles and applications will be split over the machines.

<p><b>Network server – Server01</b></p> <p>This server will govern the network and have the following roles.</p>	<p>DNS</p> <p>DHCP</p> <p>Directory service (active directory)</p> <p>Remote access service (RAS)</p>
<p><b>Web server</b></p> <p>This server will hold customer websites and the databases with customer data.</p>	<p>Database, web server</p>
<p><b>File server</b></p> <p>This server will be used to hold company data.</p> <p>This server will need to be backed up daily to prevent loss of data in event of system failure.</p>	<p>File and storage services</p>

### Technical documentation



Network server and database (Server01 and web server)

I recommend that we purchase two of these servers and use one for each of the servers named above.



	<p>HyperServe RMXE-2U8</p> <p>X11SCM-F with Dual Intel Gigabit LAN &amp; Dedicated LAN for IPMI &amp; Remote KVM Management</p> <p>Intel Xeon E-2224, 4 Core, 3.4GHz, 8MB Cache, 71Watts.</p> <p>4 x 16GB DDR4 2666MHz ECC UDIMM Module</p>
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The main server has been selected based on a number of reasons:

- Novatech is a good local company that have a good reputation and the system represents a good price
- the HyperServe RMXE-2U8 server offers 1x Intel Xeon E-2224, 4 Core physical and 4 virtual cores running at 3.4GHz, 8MB Cache means that this is easily powerful enough to carry out the three roles that are not that demanding all for the price of £1359.98
- the memory has been set at 6 x 16Gb (64Gb) filling all four available slots. In the future this memory could be replaced with 32GB DDR4 2666MHz ECC UDIMM Module giving a total of 128Gb of memory
- the main storage will reside on the file server, but 4x Intel S4510 480GB 2.5" SATA3 6Gb/s Data Centre SSD drives have been added to the base specification. This gives a large amount of space on the server and SSD's are very fast to respond so this should make the machine easily powerful enough to handle DHCP, DNS and Active Directory as well as the webserver database role

This server is sufficiently powerfully enough to powerful to run the server roles: active directory/DNS/DHCP on Server01, and IIS/SQL on the web server.

By using two of these servers we will have great performance, and by using two different servers we both separate the workload without overloading either server. Backups will allow us to recover the servers quickly in event of a server failure.

Both these servers will run Windows Server 2019 as an operating system (more details below) but this OS is capable of providing all the roles we need as long as we install SQL Server onto the web server as well.

The Server being used as Server01 is more than powerful enough to support 50 clients connecting to it as well as allowing remote access VPN connection via RAS.

### File server



	<p>HyperServe AFX-2U24</p> <p>2U Rack Chassis 24x 2.5" U.2 Bays 1600Watt Redundant PSUs</p> <p>Gigabyte MR91-FS0 Motherboard</p> <p>Intel Xeon Bronze 3204, 6 Core, 1.90GHz, 8.25MB Cache, 85Watts</p> <p>2 x 16GB DDR4 2666MHz ECC Registered DIMM Module</p> <p>10 x Seagate Exos 10E2400 12TB 2.5" SAS 12Gb/s 10,000RPM Enterprise HDD</p> <p>1+1 1600W Platinum Redundant Power Supply rail kit included</p>
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As this machine is a file server it requires storage capability over processing, it has the ability to take 24 2.5" drives that can be added to the storage server that makes this a very useful server that can grow with the business.

The specification I have selected has 10 drive bays filled giving a total storage of 120 terabytes of storage, if another 14 of the same hard disks are purchased then this would give 288 terabytes of storage. This would allow all the files and media to be centrally stored for Willow.

### Operating system

Each of the servers will be Windows Server 2019, this powerful and well used operating system is used extensively in industry and works with the desktop operating systems. The OS is the latest server release from Microsoft and should support for business for the next few years. Windows Server 2019 is able to support all of the server roles listed above as long as we install SQL server onto the webserver as well.

Another benefit of the OS is that it has a rich and successful history and numerous sources of product support and training.

### Redundancy and reliability

All the servers selected support RAID which can be implemented effectively to provide redundancy in event of hard drive failure. When configured RAID is designed to keep running when a hard drive fails with data being copied onto multiple hard drives. The broken hard Drive can be replaced and the data will automatically copy itself back onto the replacement.

It is also a good idea to purchase duplicates of all the servers. If we do this we can configure the duplicates as failover servers so that if one goes down it is able to take over keeping the overall system running.

## Print screens of online sources used and written evaluation of sources

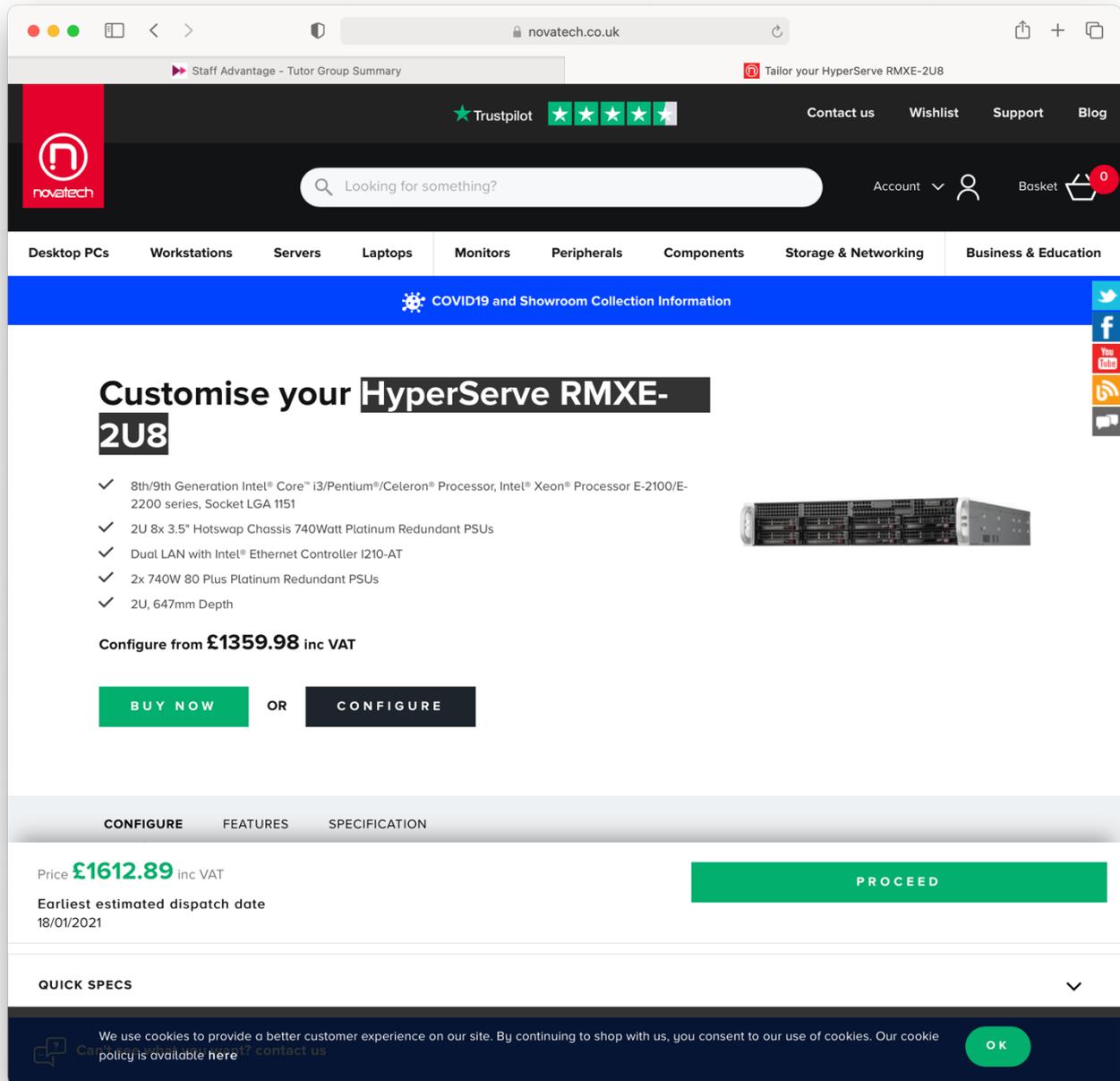


Figure 1 - <https://www.novatech.co.uk/newmodserver.html?s=SR-0246>

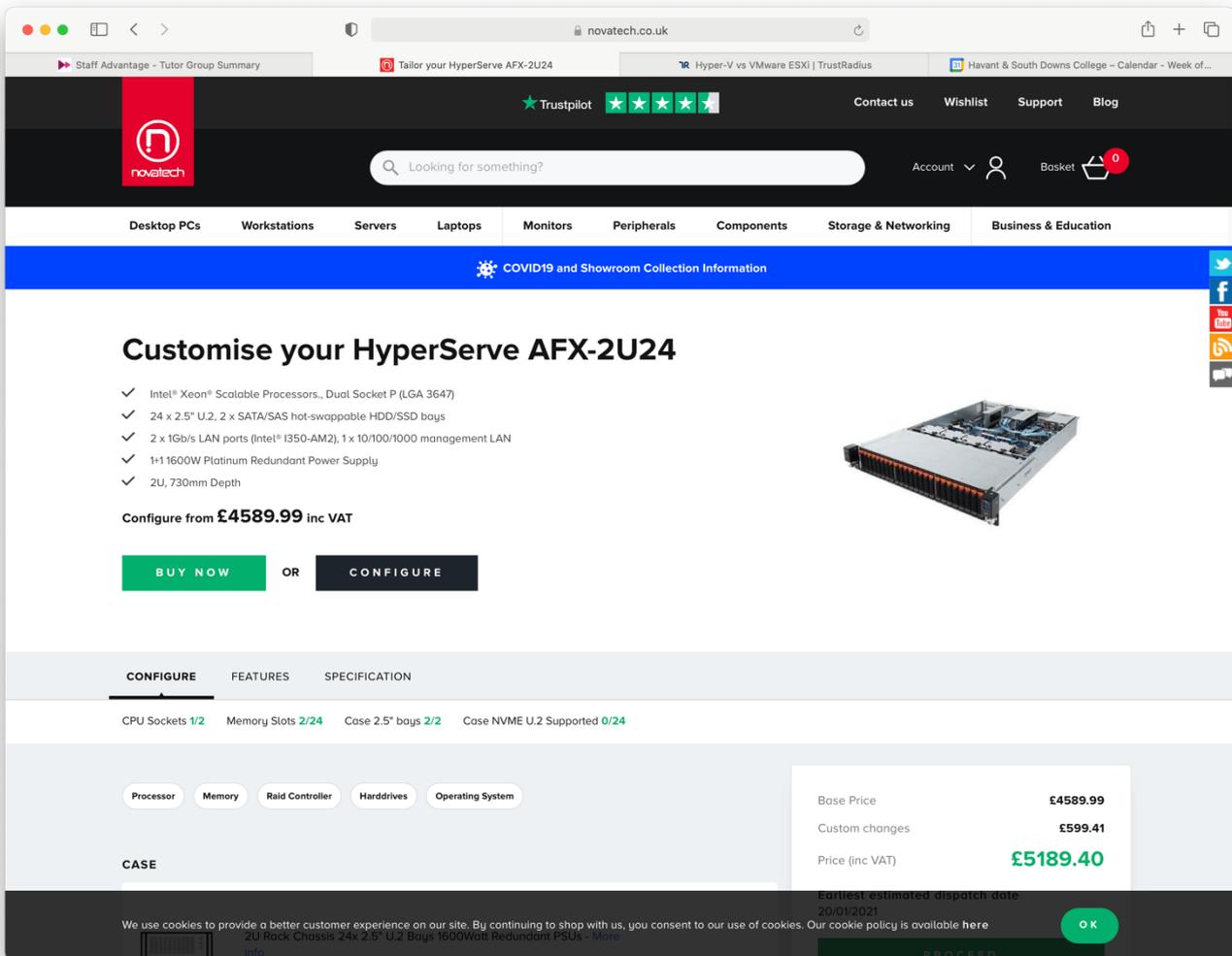


Figure 2 - <https://www.novatech.co.uk/newmodserver.html?s=SR-0216>

I used the Novatech website to select the two servers, as you will see later, they are a highly rated company. On the website they give you features of the various servers and also the technical specifications that you can configure them to meet your needs. On the website they allow you to select servers and file servers and this was useful when picking a server. This was a good source of information and helped when selecting storage and servers.

I was able to select a server that was powerful enough to meet all the technical specifications – support (30 wired / 20 wireless devices and 15 remote access connections), 60TB shared storage with capacity to double over three years, Reliability and redundancy through RAID.

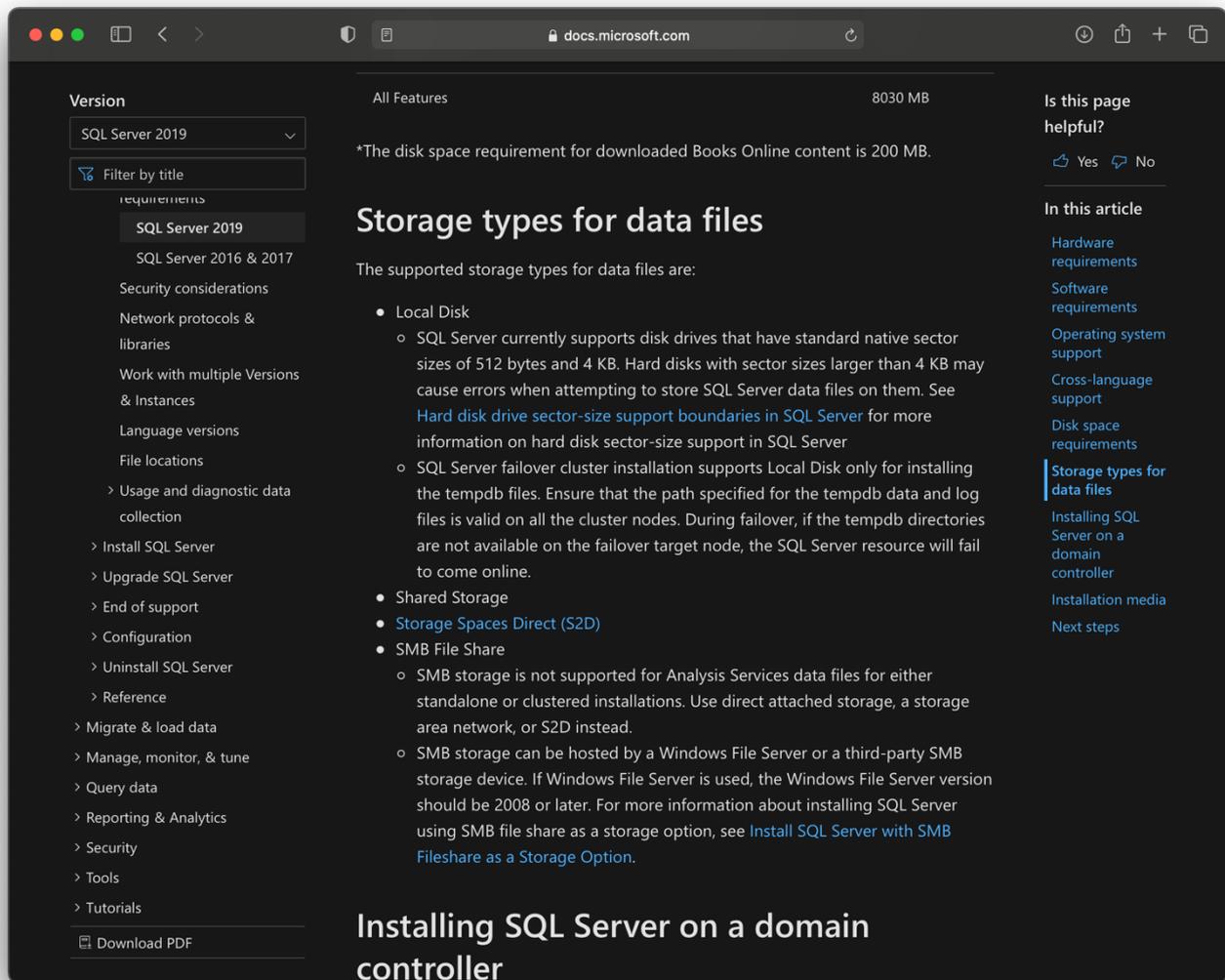


Figure 3 - <https://docs.microsoft.com/en-us/sql/sql-server/install/hardware-and-software-requirements-for-installing-sql-server-ver15?view=sql-server-ver15>

Microsoft is a trusted source and I needed to confirm information about the latest version of Server 2019. SQL server is needed to be installed on the web server, and I have confirmed that this Windows version supports SQL.

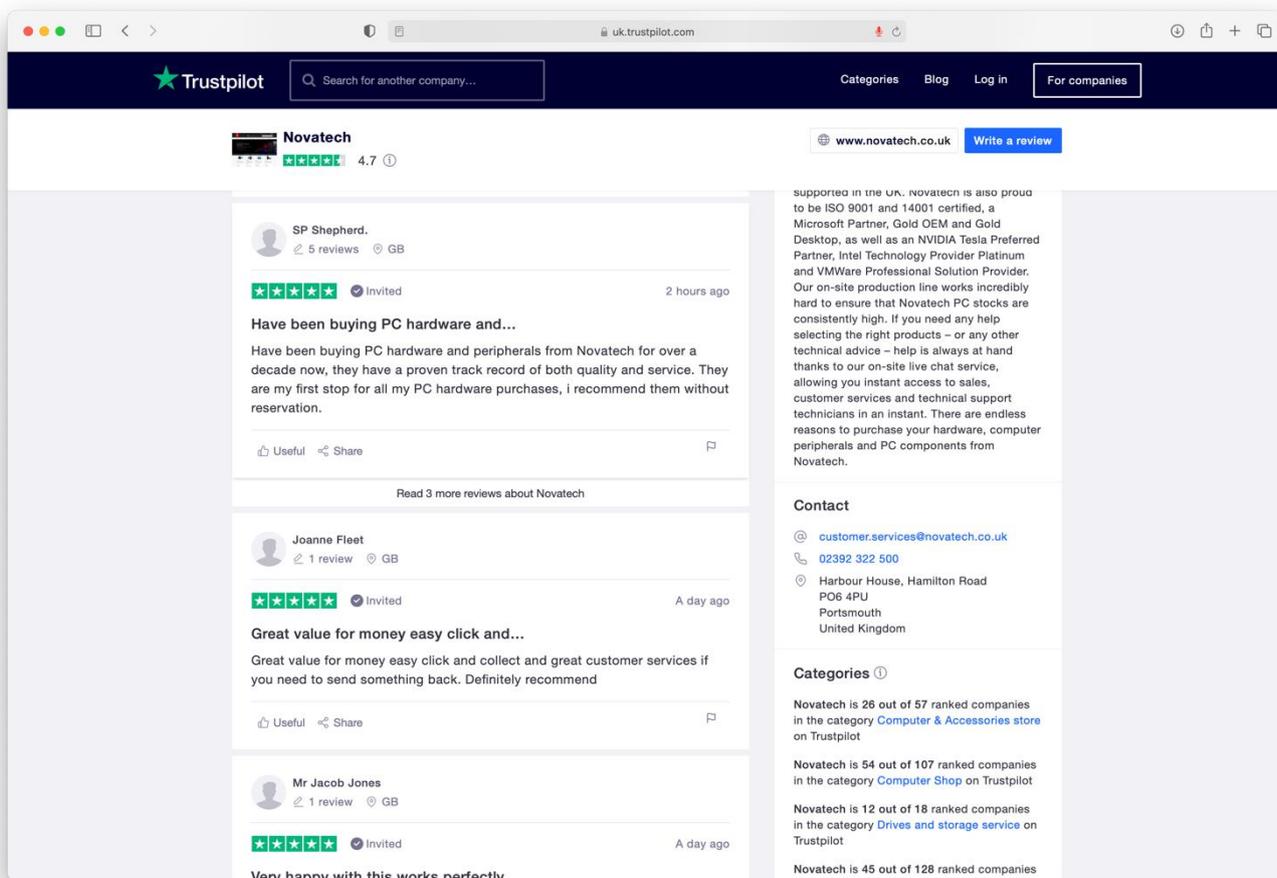


Figure 4 - <https://uk.trustpilot.com/review/www.novatech.co.uk>

The following source gave me confidence in the information on the Novatech website, they were rated as 4.7 out of 5 on Trustpilot. This means that you can rely on the feedback and information on the website.

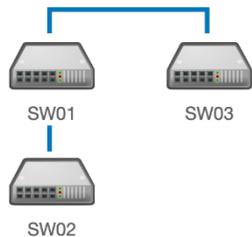
## Task 3: design - communication equipment

### Technical documentation

#### Switches

The approach taken is to implement three switches in the building, one will be placed upstairs and the other two will be located in the server room and connected together. These will be managed switches that way they can be configured and secured a little more than the unmanaged ones.

Having three of the same switches will provide easy configuration and installation. It also provides additional ports for spare capacity.

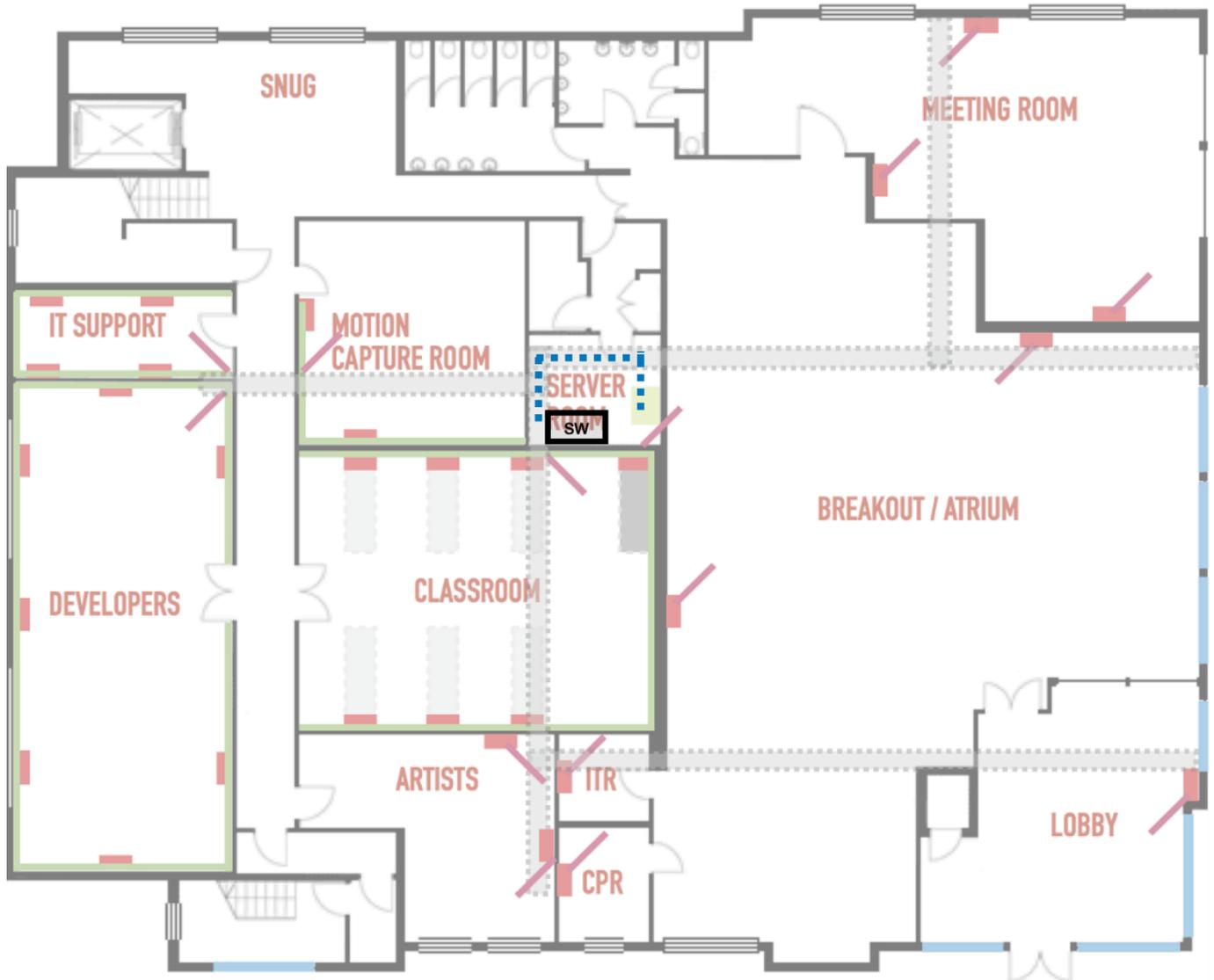


Switch	Location	Coverage	Summary
SW01	Server room	Lobby (2), Breakout (4), Meeting Room (6), Motion Capture (4), Artists (4), ITR (2), CPR (2), Servers (4), Access Points	Each of the switches will have 48 network ports and 6 high speed fibre connections. This means that all the switches can be easily connect with fibre connections and also connect to the servers if they have fibre ports.
SW02		IT Support (8), Developers (14) Classroom (14)	
SW03	The cinema	Cinema (4), Dining Room (4), Lead Creative (2), Technical (8) – 18 Ports	This will also mean that there are sufficient extra ports should there be a reason to expand the network in future.

 A photograph of a Netgear ProSafe GS752TS Manageable Ethernet Switch. It is a rack-mountable device with a silver and black front panel. The front panel features 46 RJ-45 ports arranged in two rows of 23. To the right of the ports are six SFP (Small Form-factor Pluggable) slots and two expansion slots. The device is shown from a front-facing perspective.	<p>Netgear ProSafe GS752TS Manageable Ethernet Switch 46 x Network (RJ-45) Ports - 6 x Expansion Slots 10/100/1000Base-T – Shared SFP Slot – 6 2 Layer Supported</p>
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As you can see on the floorplan below, the server room will have the two switches installed in the rack as outlined earlier. The 2 switches though not shown will have a fibre connection between them and another fibre going through the void to the switch directly above. This reduces the amount of cable running back to the centralised switch and separating out the 2 floors. On the map, only one switch is demonstrated in the server room as they will both be installed in the same cabinet and therefore will be physically stacked together (SW01 and SW02).

All of the network ports up and downstairs will need to be cabled back to the switches. This will require quite a lot of cable. But since the cable is cheaper than buying extra switches this was felt to be a good option.





Despite the size of the upstairs, only 18 network ports have been positioned on the floor plan. The switch will be connected back via a fibre cable to the core switch in the server room. The ceiling already has the cable tray installed so the challenge of running the cable back to the single switch is relatively simple to overcome.

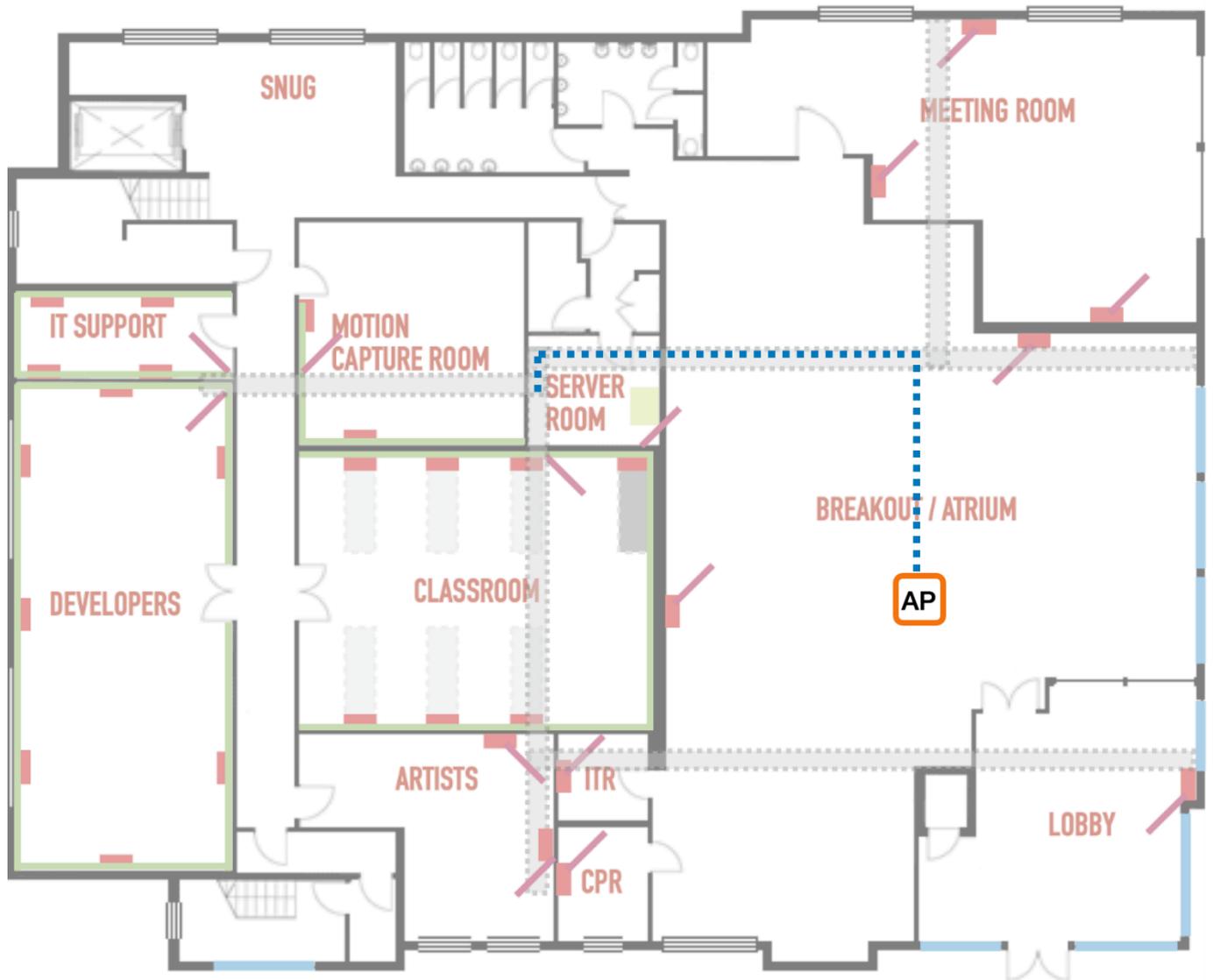
### Wireless infrastructure

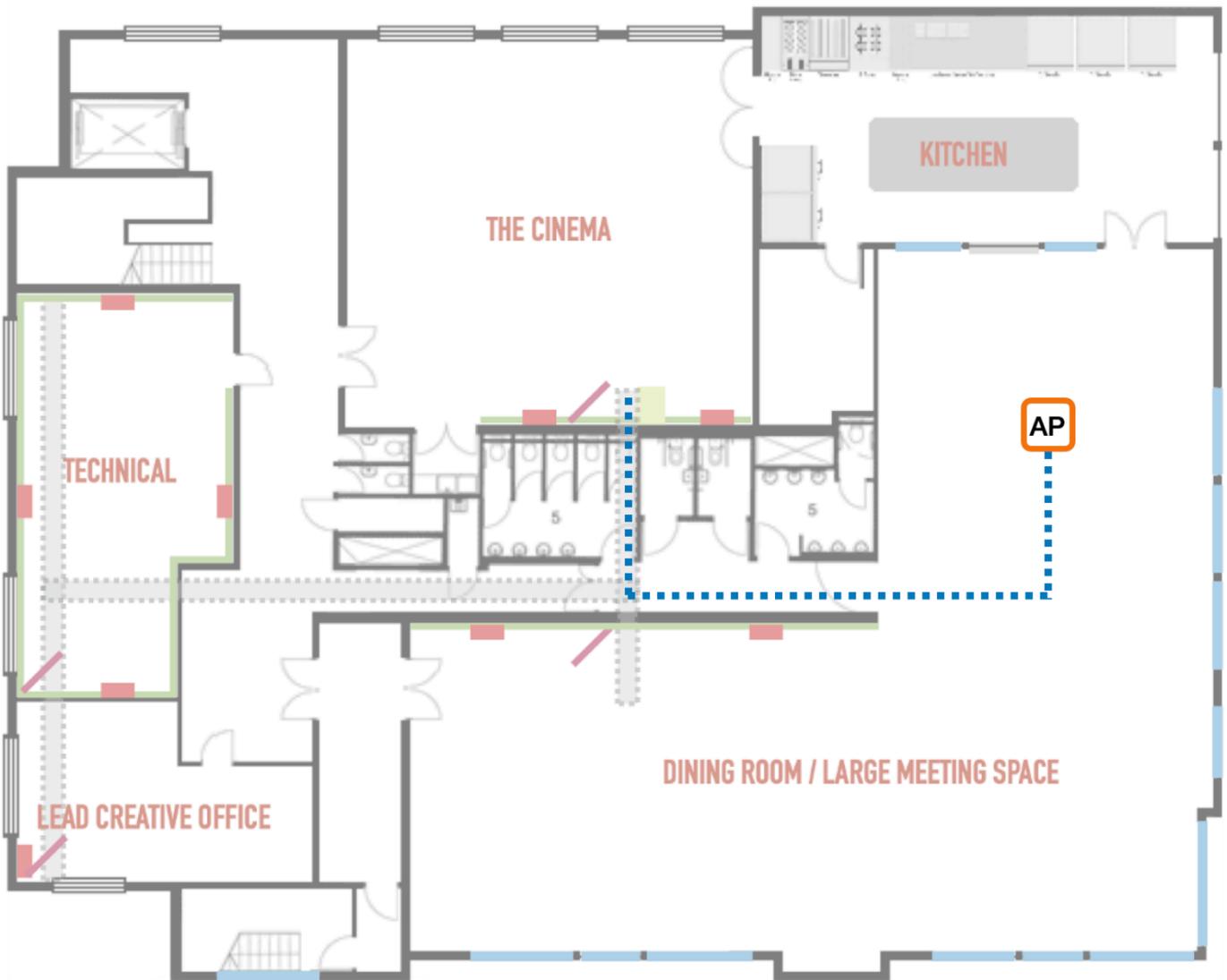
The two access points have been placed in high traffic areas with the majority of the customers will gather. This is why the dining room and the atrium have been covered. The built in security on the device will help secure the network as the WIFI password can be given to guests as the arrive at the building.

 A white, cylindrical wireless access point with a TP-LINK logo on the front. It has a green LED indicator light at the bottom.	<p>TP-LINK EAP225 V3</p> <p>IEEE 802.11ac</p> <p>1.17 Gbit/s Wireless Access Point</p> <p>5 GHz, 2.40 GHz</p> <p>1 x Network (RJ-45)</p>
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The TP-Link supports the latest mainstream speed of 802.11ac and this is a good speed that customers and staff will appreciate. The AP connects to the central switch via an ethernet cable.

In the upstairs spaces an AP has been installed in the dining room, again this is another public space and should a useful addition to the building. This is also connected back to the main switch using ethernet cable.

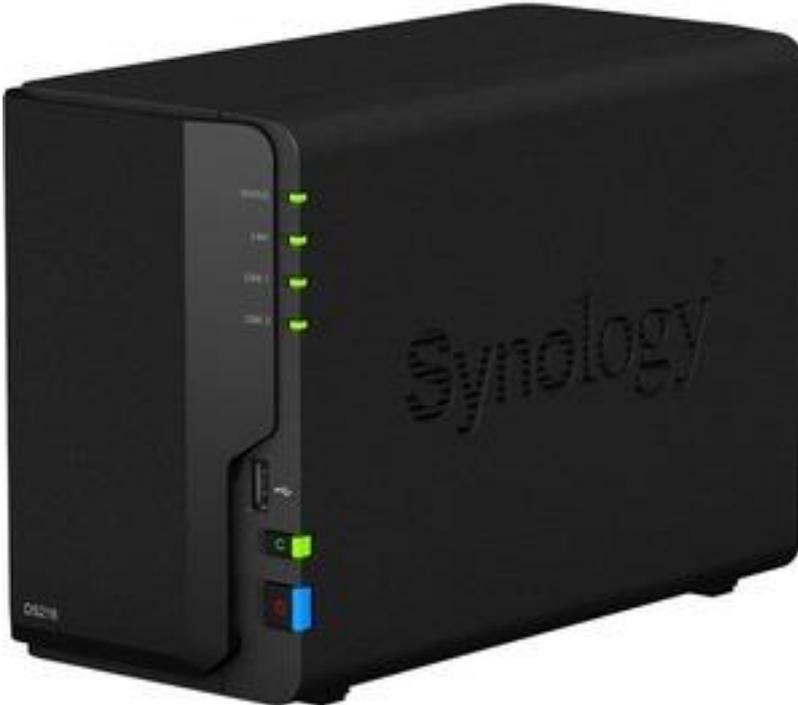




### CCTV solution

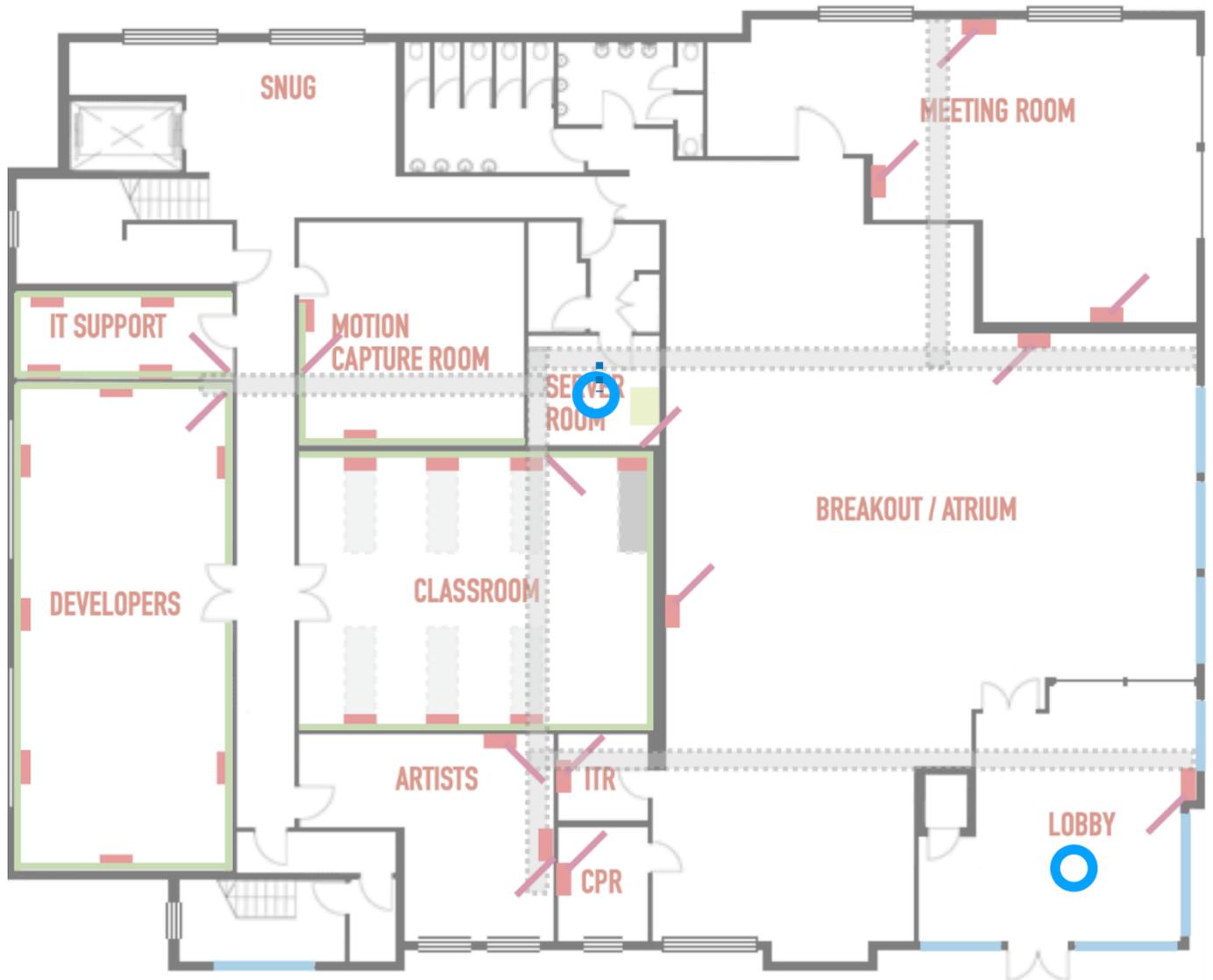
The placement of the CCTV equipment has been identified in the brief from the customer, they required a camera in the dining room, covering the server room and in the main entrance. It also stressed in the customers' requirements that they required a 360° degree camera. The D-Link cameras have been selected for a number of reasons including the price and the wireless capability.

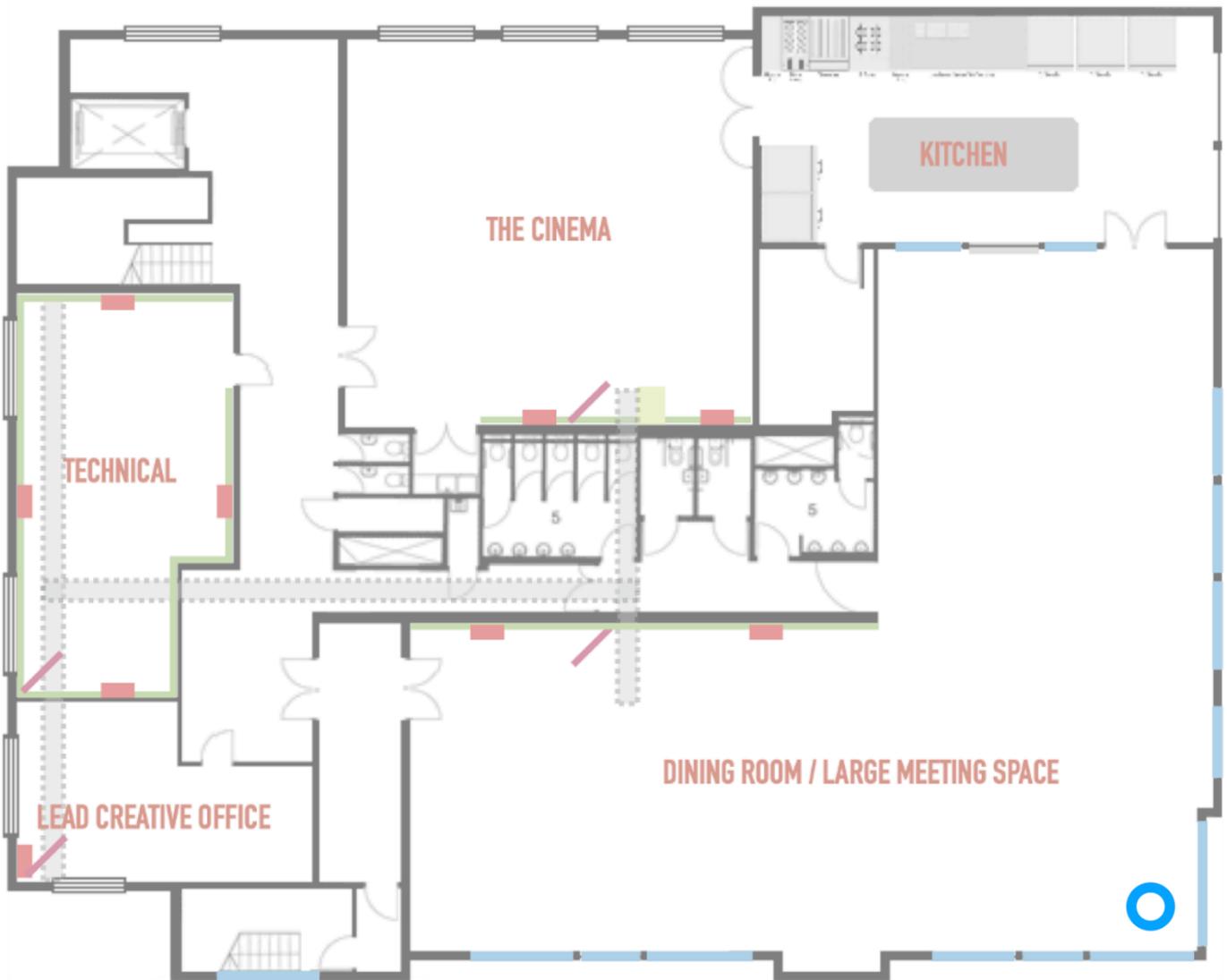
The NAS solution is the cheapest one available from Synology and will cover off the requirements of the task. It will however need two hard disks added to ensure it delivers on the brief.

 A black Synology DiskStation DS218 network-attached storage (NAS) device. It is a compact, rectangular unit with a front panel featuring the Synology logo, a power button, and several status LEDs. The top of the device has a drive bay cover.	<p>Synology DiskStation DS218</p> <ul style="list-style-type: none"><li>2 x Total Bays SAN/NAS Storage System</li><li>Realtek RTD1296 Quad-core (4 Core) 1.40 GHz</li><li>2 x HDD Supported - 24 TB Supported HDD Capacity</li><li>2 x SSD Supported</li><li>2 GB RAM DDR4 SDRAM</li></ul>
 A white D-Link DCS-5020L network camera. It has a dome-shaped top with a lens and several small LEDs. The base is cylindrical and features a Wi-Fi antenna on the side and the D-Link logo at the bottom.	<p>D-Link DCS-5020L</p> <ul style="list-style-type: none"><li>Network Camera - Colour - 640 x 480 CMOS</li><li>Cable - Fast Ethernet</li><li>Wireless - Wi-Fi</li></ul>

Only three cameras and the locations have been specified by the customer as shown on the two floorplans. Each of the cameras will connect via wireless, this will save the need to wire them in, only needing to worry about the power for them. As they will be on the WiFi network only relevant users with the camera log in details will be able to access both the NAS drive and the camera feed.

The NAS drive also features a complete operating system that would work independently of internet access, it is also very flexible and allows for other rich additional applications to be added to the NAS drive to add functionality. It is noted on the manufacturers website that additional CCTV licenses will be required to be purchased to support every camera.





## Print screens of online sources used and written evaluation of sources

The Novatech site provided useful information about ProSafe switch, the price seemed reasonable and the technical specification would be good for what was needed.

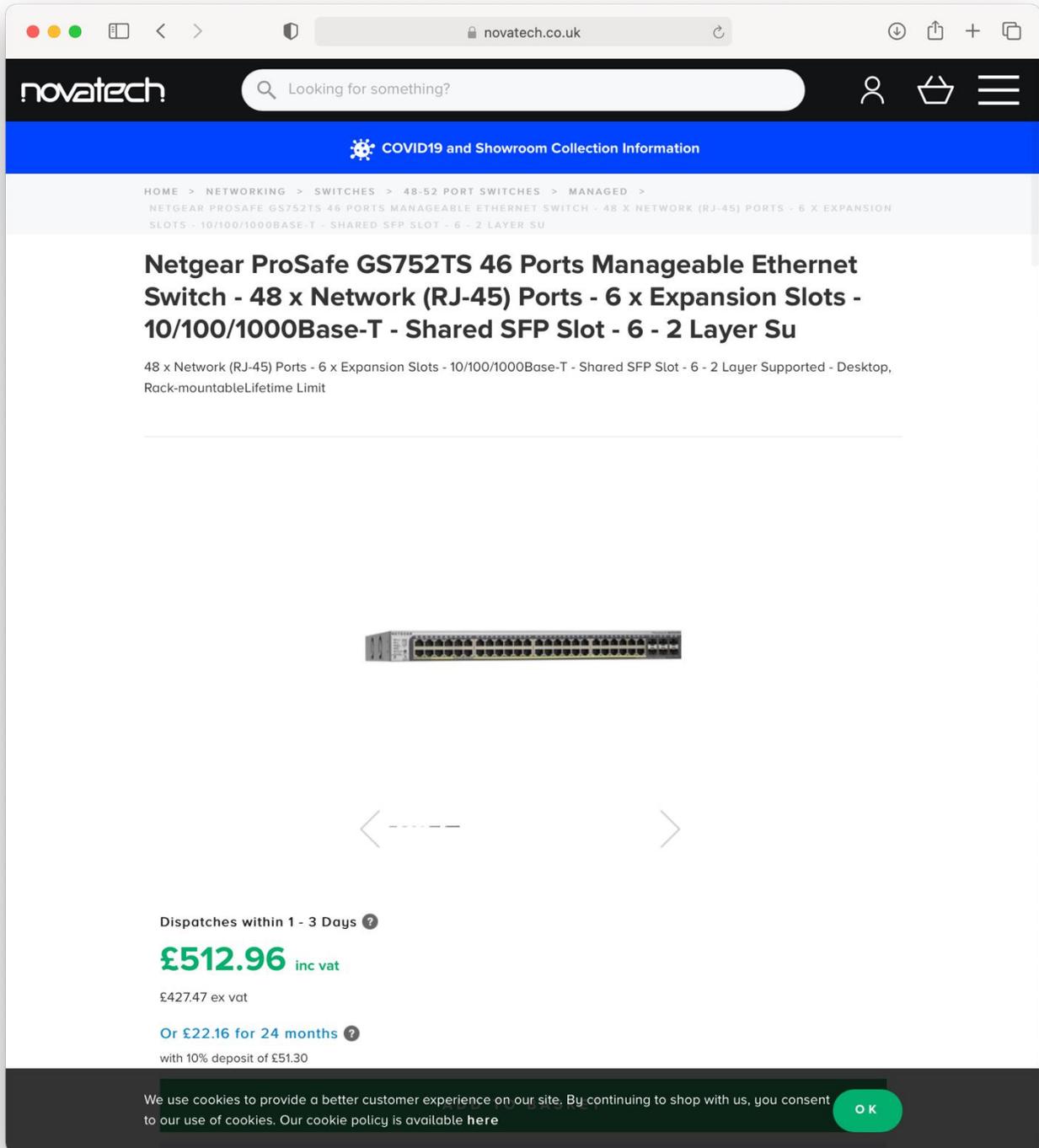


Figure 5 - <https://www.novatech.co.uk/products/netgear-prosafe-gs752ts-46-ports-manageable-ethernet-switch-48-x-network-rj-45-ports-6-x-expansion-slots-101001000base-t-shared-sfp-slot-6-2-layer-su/gs752tsb-100eus.html>

The Novatech website provided technical information about the various NAS drives available and the technical specification. Little detail was provided regarding its application but this should achieve the task assuming all the information came from Synology in the first place.

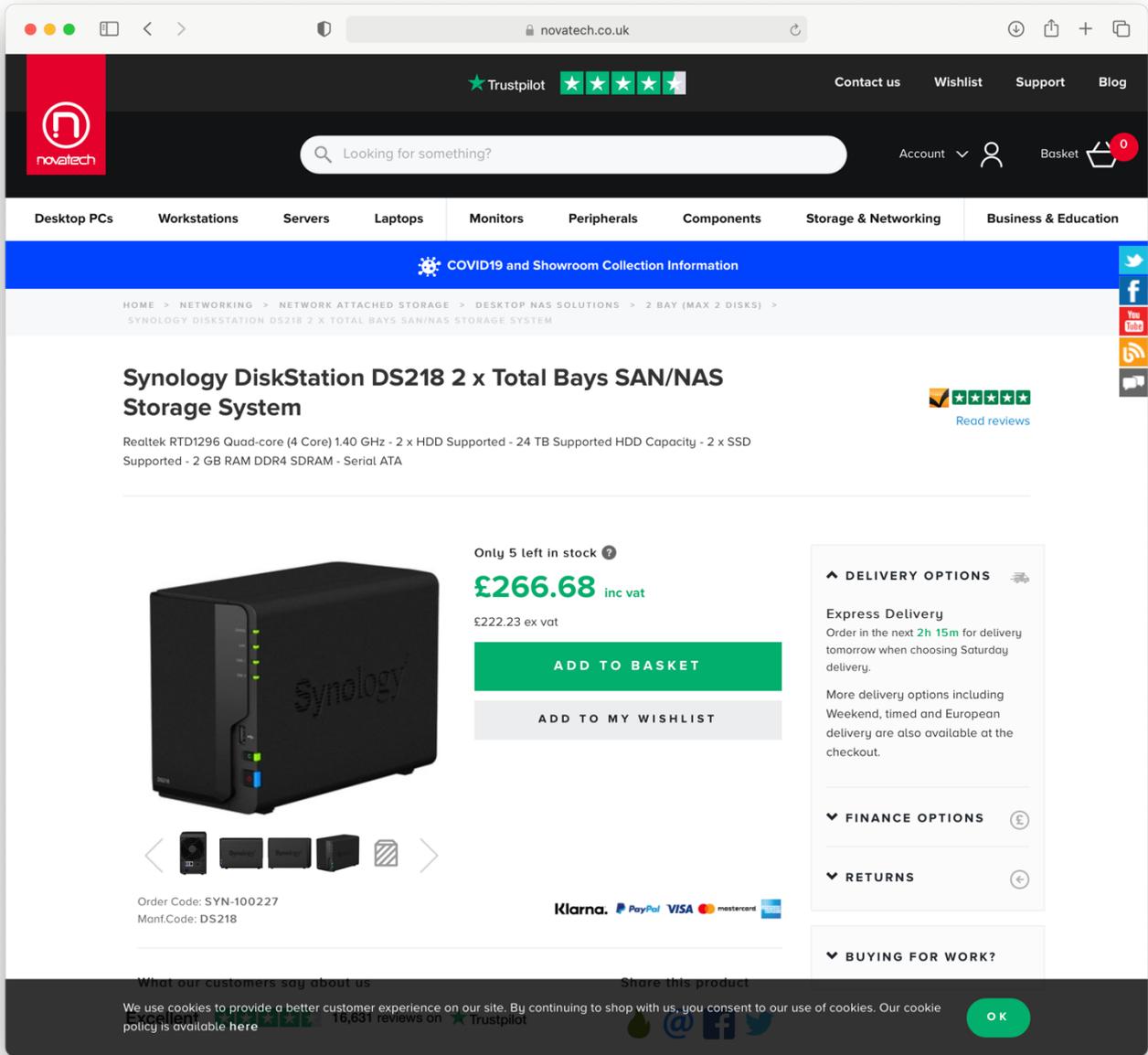


Figure 6 – <https://www.novatech.co.uk/products/synology-diskstation-ds218-2-x-total-bays-sannas-storage-system/ds218.html>

The following page and subsequent pages just showed the features and other technical information regarding the camera. The information seemed accurate as it was on the resellers page but is has not been cross checked.

The screenshot shows a web browser window displaying the product page for a D-Link DCS-5020L Network Camera on the Novatech website. The page features a navigation menu with categories like Desktop PCs, Workstations, Servers, Laptops, Monitors, Peripherals, Components, Storage & Networking, and Business & Education. A search bar is present with the text "Looking for something?". The product title is "D-Link DCS-5020L Network Camera - Colour - 640 x 480 - CMOS - Cable, Wireless - Wi-Fi - Fast Ethernet". The price is listed as £101.26 inc vat, with a note "Ordered Upon Request" and "£84.38 ex vat". A pink box states "This product is only available to buy when in stock". The page also includes sections for "DELIVERY OPTIONS", "FINANCE OPTIONS", "RETURNS", and "BUYING FOR WORK?". The footer contains a Trustpilot rating of 4.5 stars based on 16,631 reviews and a cookie policy notice.

Figure 7 - <https://www.novatech.co.uk/products/d-link-dcs-5020l-network-camera-colour-640-x-480-cmos-cable-wireless-wi-fi-fast-ethernet/dcs-5020le.html>

The TP-Link camera is a good value for money access point that will provide suitable coverage with its 802.11ac connection. TP-Link, is a good brand as I have used a similar access point at home and had very good results. The access point also has a secure log on to access the wireless making is a wise choice for the problem.

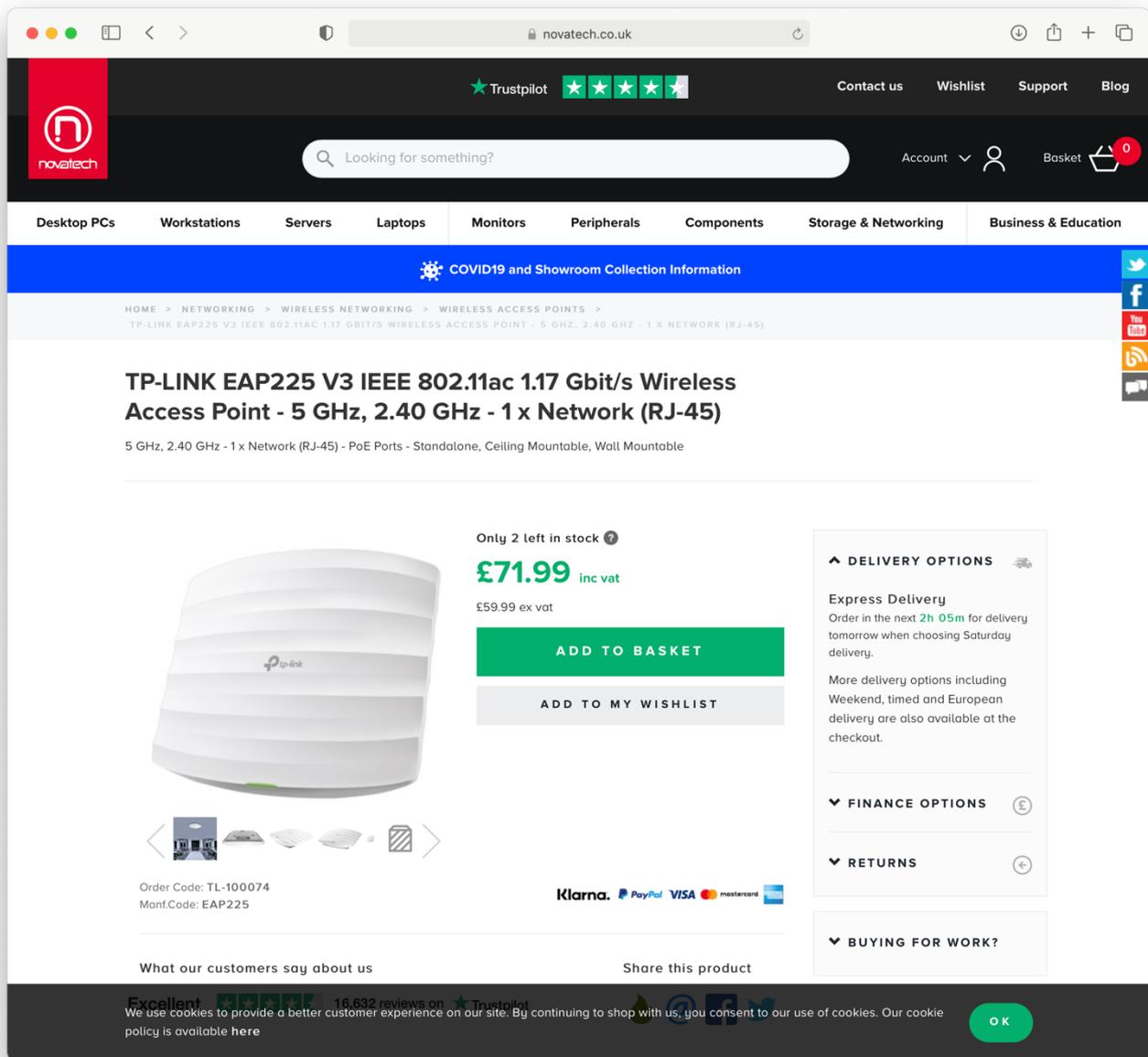


Figure 8 - <https://www.novatech.co.uk/products/tp-link-eap225-v3-ieee-802-11ac-1-17-gbits-wireless-access-point-5-ghz-2-40-ghz-1-x-network-rj-45/eap225.html>

## Review and submit

You have now reached the end of the assignment. It is recommended that you review all the evidence required for the assignment to ensure all print screens and annotations have been provided.

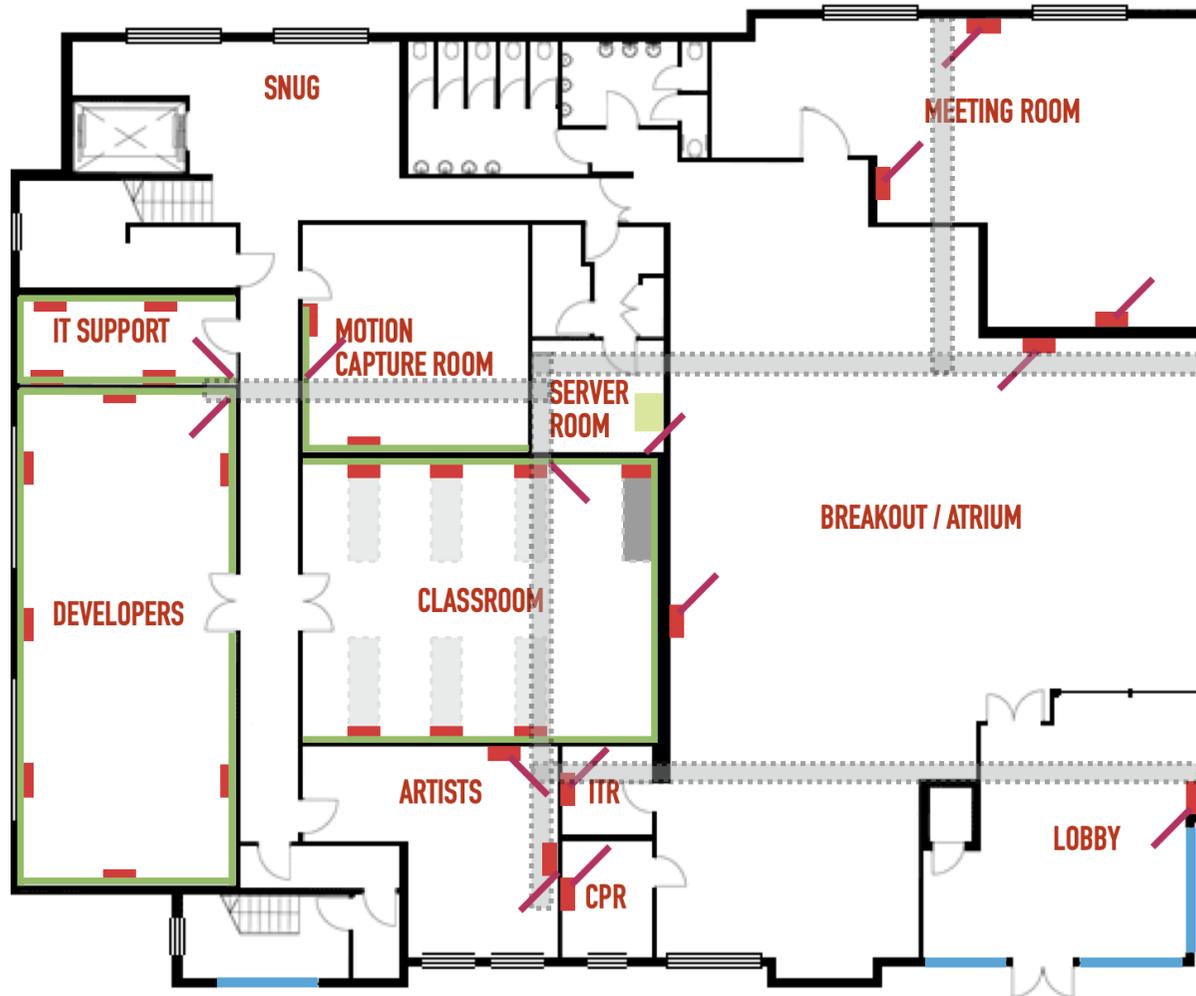
Save this document and convert into a .pdf for submission using the file naming convention.

Surname\_Initial\_student number\_Workbook1

For example: Smith\_J\_123456789\_Workbook1.pdf

## Floor plan: ground floor

To be copied as required.



## Floor plan: first floor

To be copied as required.



## Document information

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Owner: Head of Assessment Design

## Change History Record

Version	Description of change	Approval	Date of Issue
v1.0	Published final version		May 2021
v1.1	NCFE rebrand.		January 2023