Group Report

Introduction

The focus of this report will be to demonstrate the understanding that we have gained in network analysis and how this has come to be of use when putting together a plan for what Pompfest should do in the festival. This plan will be a combination of a logical and physical design spec that could be used by Pompfest to put into action during the festival preparation. The logical design will be covering how in theory everything is going to be connected together along with a more general connection model. The physical design is going to be covering how to put the logical design into practice with a more detailed overview.

Assumptions Made

One of the assumptions made was where the stages were going to be put because this would affect our decision on cable runs as we are going to assume that the routers and all the other network hardware will be put behind the stage next to the audio and lighting equipment for that stage as those will be off limits and not in a very public space.

Secondly, we have made the assumption that the wireless access points have a 100m radius range because although they will have a larger radius we want to be able to overlap some WAPs and because of the size of the festival by having a smaller radius this will balance the load on the WAPs due to phone connecting to the closest one and then being handed off if they end up moving. Therefore we are also assuming that the WAPs can be meshed.

Another assumption we have considered is that the routers will have built in firewalls, although we have put them in our designs, they will be built into the routers this will save costs by combining the two for such a short term event. However this will put some extra strain on the router due to having to filter the packets as they come in.
Furthermore, we assumed that local vendors and merchants would either come equipped with a POS system that was compatible with ours such as they had a wireless dongle or a NIC on their computers. Also that the wireless access points would be powered by power over ethernet standard IEEE 802.3af, of which its cost will be factored into the price of the AP.

Smaller technical assumptions that we made include: the routers are connected and are communicable through the internet/telecommunications cabinet connections, the two large food outlets in section G have three payment points, the first aid tent does not require a connection other than the wireless network access, and the network has access to a cloud based database server as a backup should both of the local databases fail.

Issues Influencing Design

Firstly, the cost of hardware was one of the issues that we needed to consider when creating our design. We did not work with a strict budget in mind as we prioritised functionality above all else. Despite this we did make sure everything served a purpose and that we were not wasteful with our design. Evidence of this can be seen in our wristband database servers, we used two servers so that in the event of the main database server failing we would have a backup for failover and there would be no downtime, causing no delays to festival-goers, but did not exceed this as the chances of two of our servers failing would be miniscule, and it would evidently be wasteful to exceed this number.

Another issue we needed to consider were the restrictions imposed on us by the specification. For instance the location of the telecommunication cabinets influenced where we wanted to place our routers. It was also necessary to ensure that the requirements of the specification had been met, for example that all POS devices and stage areas had wired and wireless internet access.

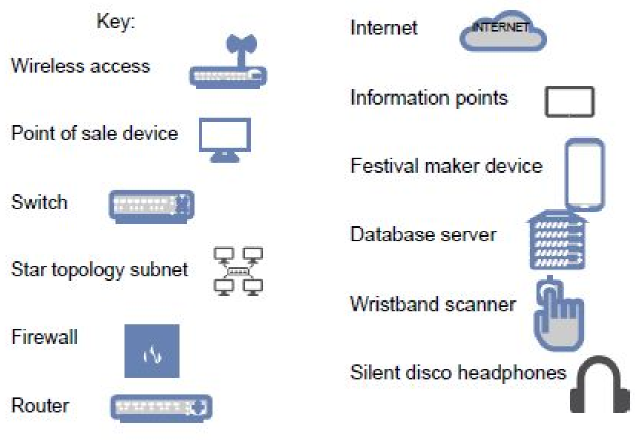
The impact of geography was another consideration that needed to be accounted for, we had to ensure that all hardware was appropriately placed. For example the placement and quantity of the wireless access points were determined by the range of the connection and size of the geographical area, to make sure that the entire festival area had wifi access.

We also needed to consider the temporary nature of the network. This meant that all of the network hardware that would be installed must also be easily removed. We achieved this through ensuring that none of the equipment we used required a large amount of time to install/uninstall.

Logical Design

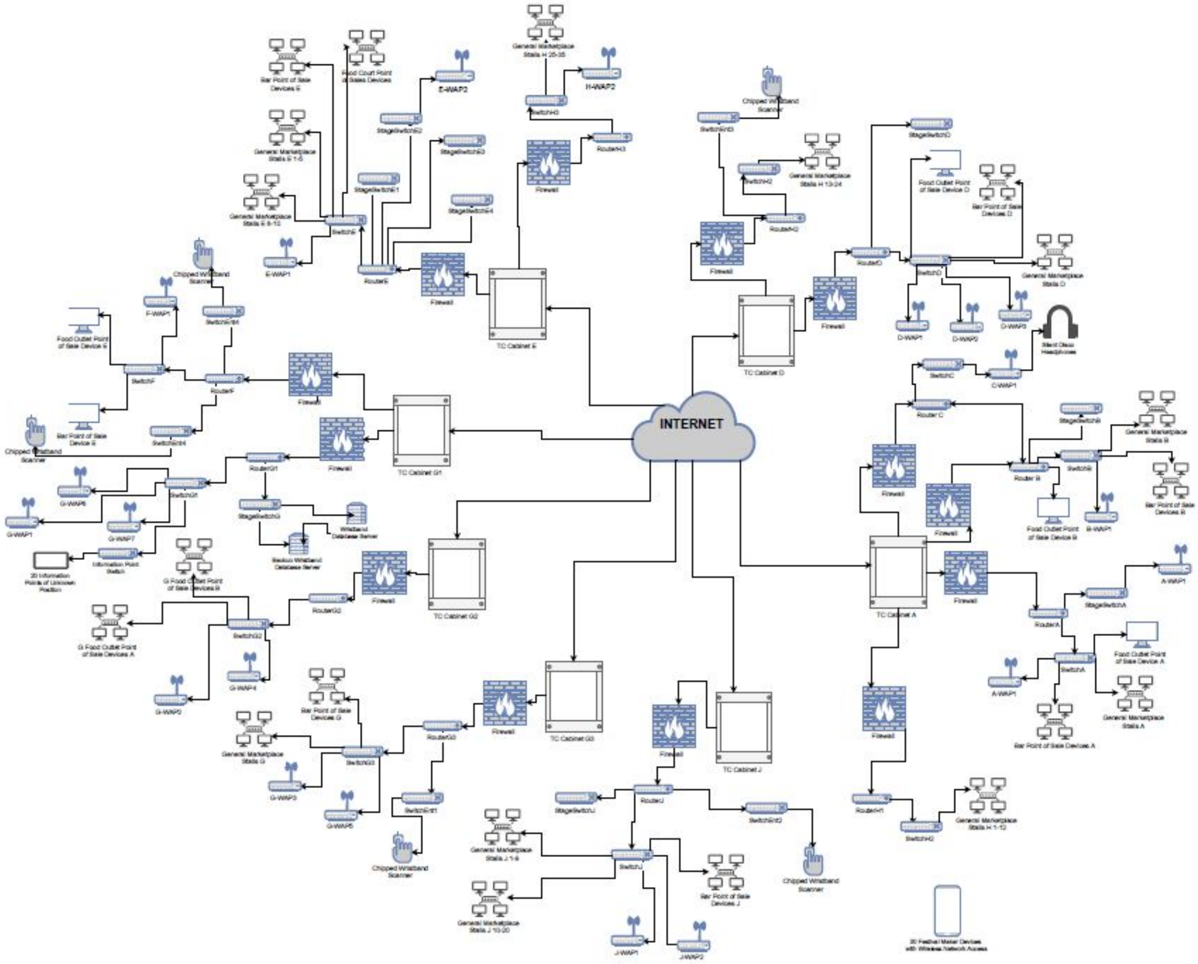
The logical design needed to illustrate the topologies and and general structure that we would use to develop our physical network design. We needed to consider the requirements of the brief such that we could cater to the all of the devices and systems that the network needs to support. The logical design was presented in a simplistic format such that it is easy to comprehend and so that it became a useful resource when we started completing our physical network designs.

The largest factor that led to the fundamental structure of our design came from our decision to use all of the available telecommunication cabinets (TCCs) available, to support the festival network. This decision helped to distribute the top level points of failure that were in our control. This meant that if one of the TCCs were to fail, only a fraction of the network would be disrupted. As the logical design stands, the only single point of failure for the entire network lies with the ISP. This can be overcome by having a secondary ISP on standby however this is not something that can be represented on the logical design.

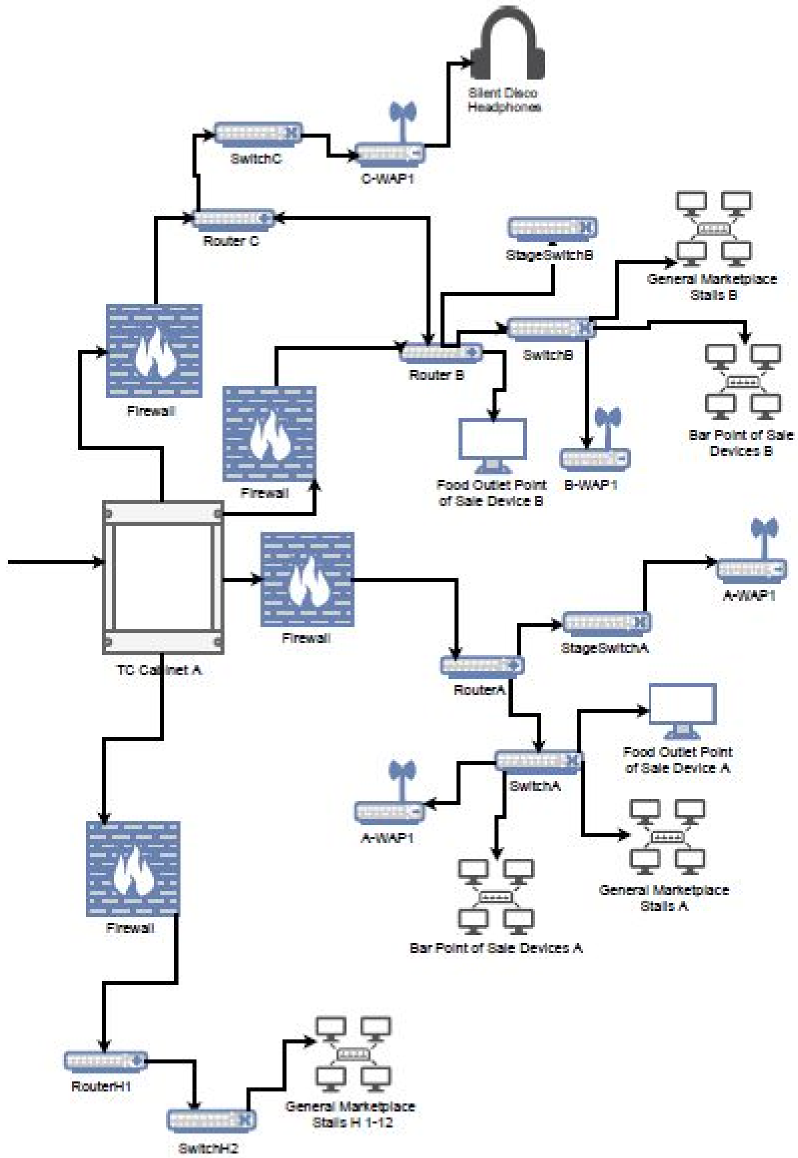


Logical Design Overview

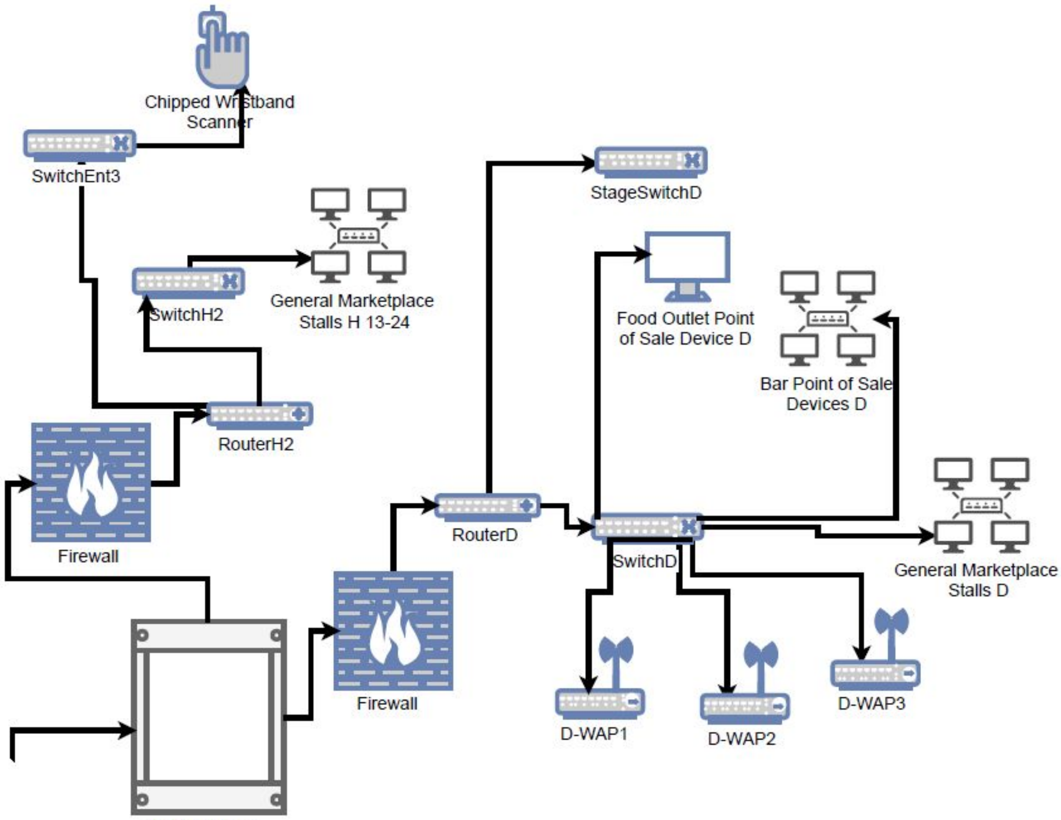
Our logical design follows an expanded star topology in order to satisfy the network requirements. While it was considered to use a bus topology for sub-networks where we would expect there to be long stretches of physically connected machines in order to save on the quantity of cabling required, ultimately we came to the decision that using star topologies for all of the subnets would ensure a greater reliability and would provide a reduction in the number of machines affected by a damaged cable. This corroborates with our intention to design a network that prioritises functionality rather than cost minimalism. What follows is the logical network design broken up into sections corresponding to the telecommunication cabinet it is connected to.


INTERNET

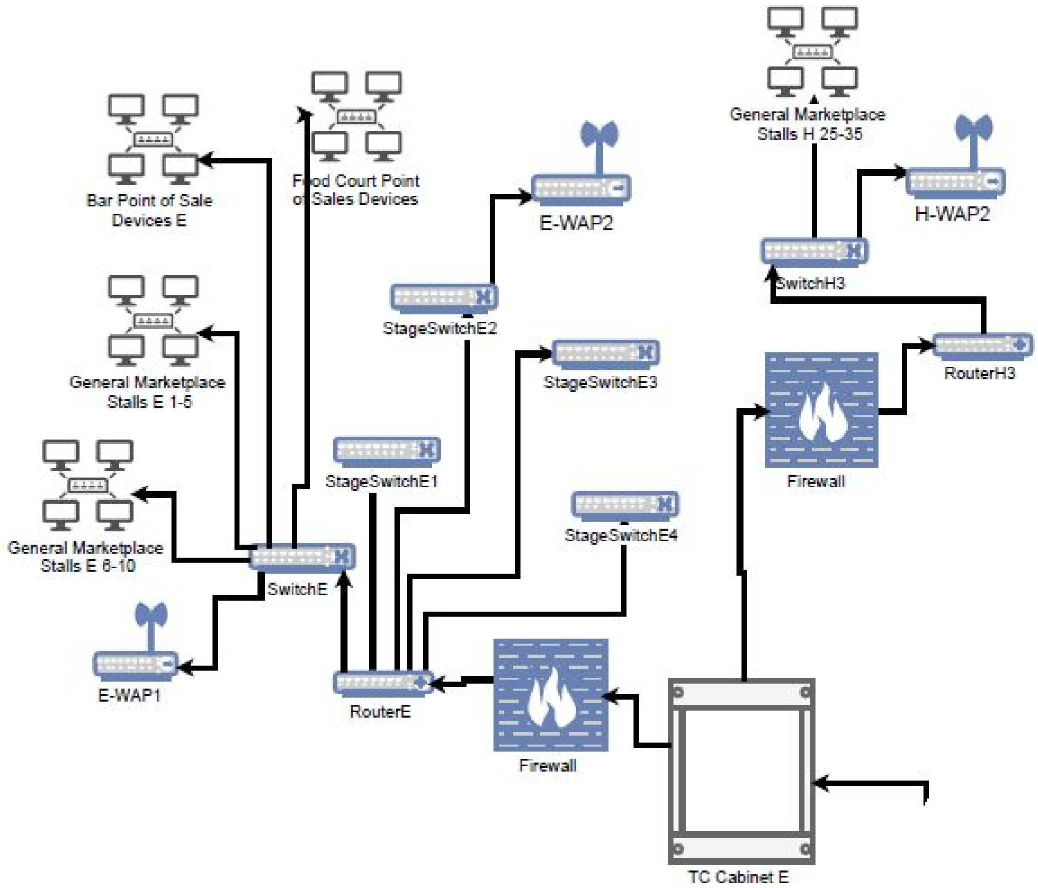
Branching from TC Cabinet A



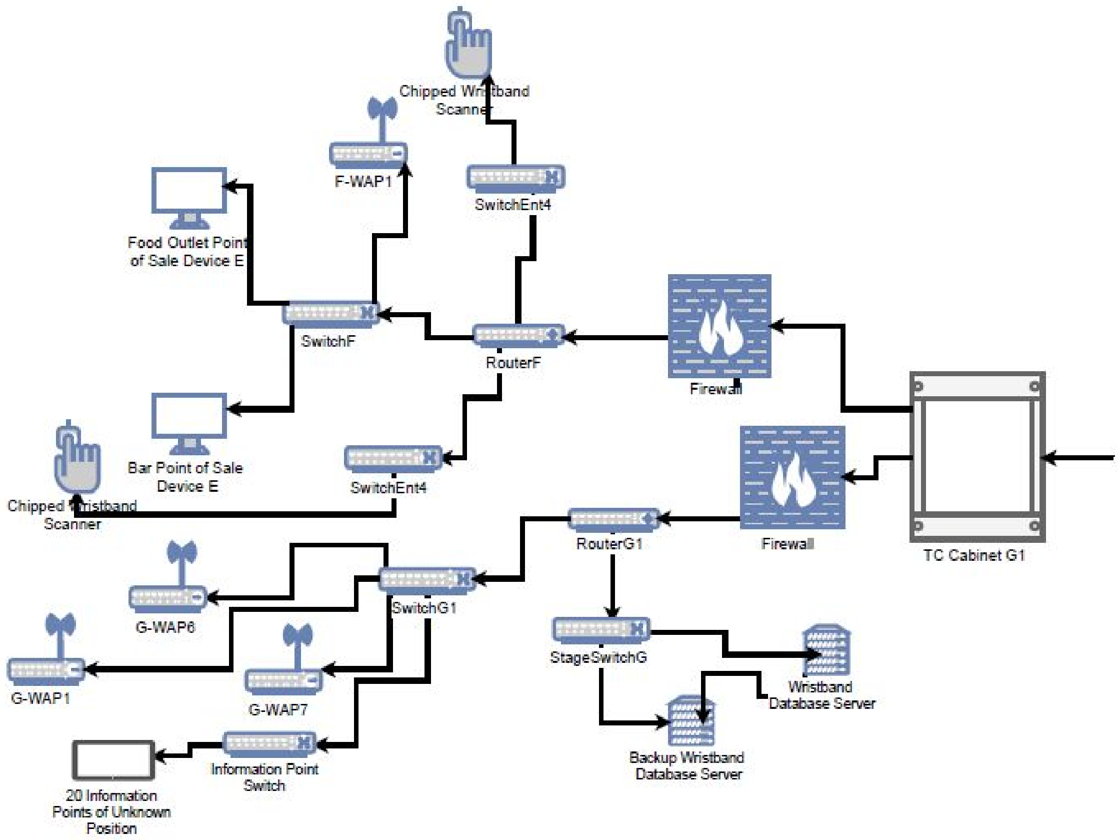
Branching from TC Cabinet D



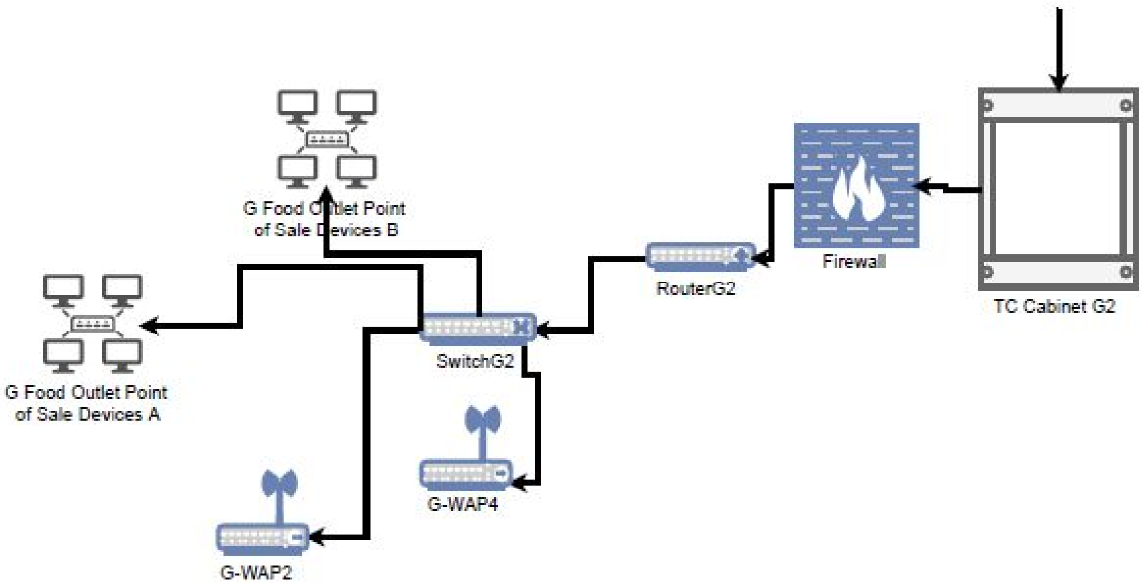
Branching from TC Cabinet E



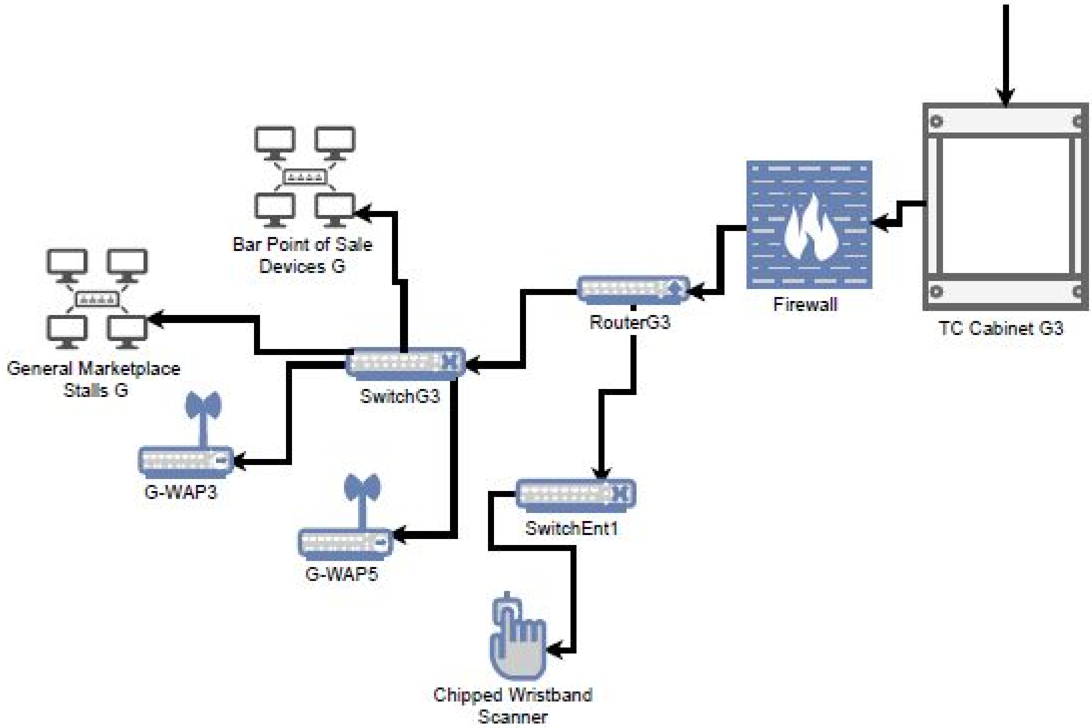
Branching from TC Cabinet G1



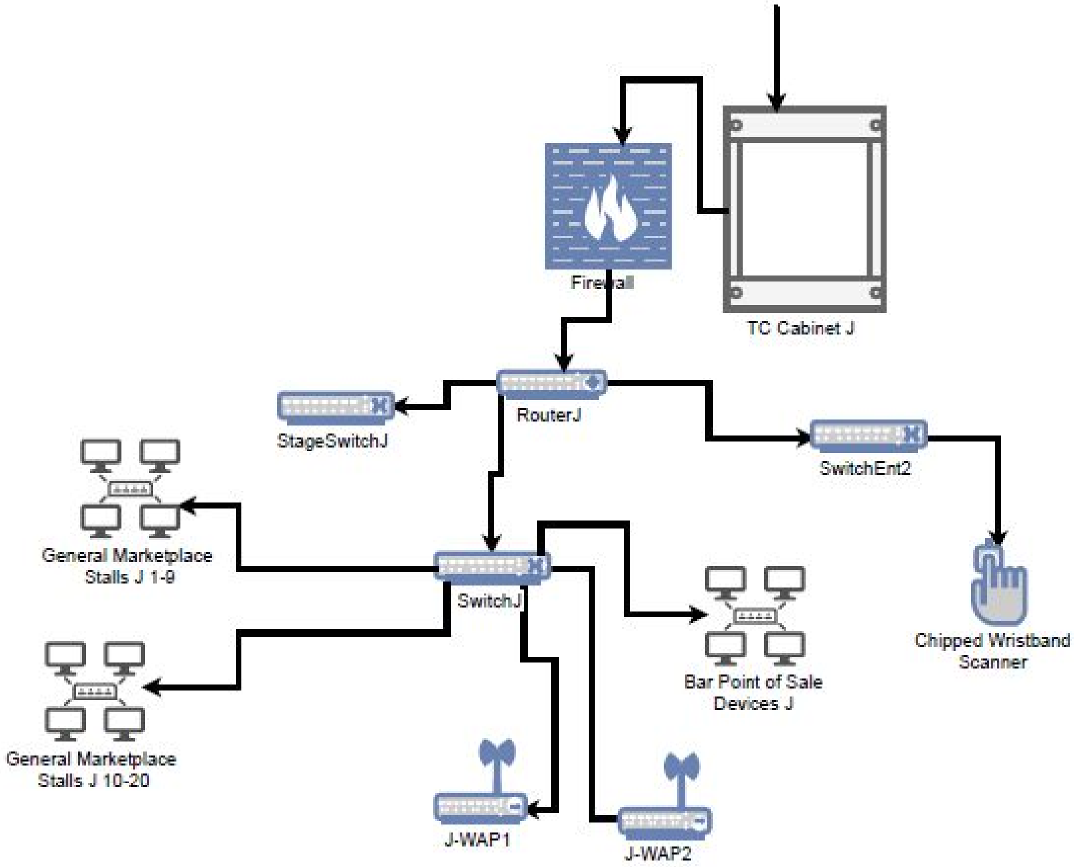
Branching from TC Cabinet G2



Branching from TC Cabinet G3



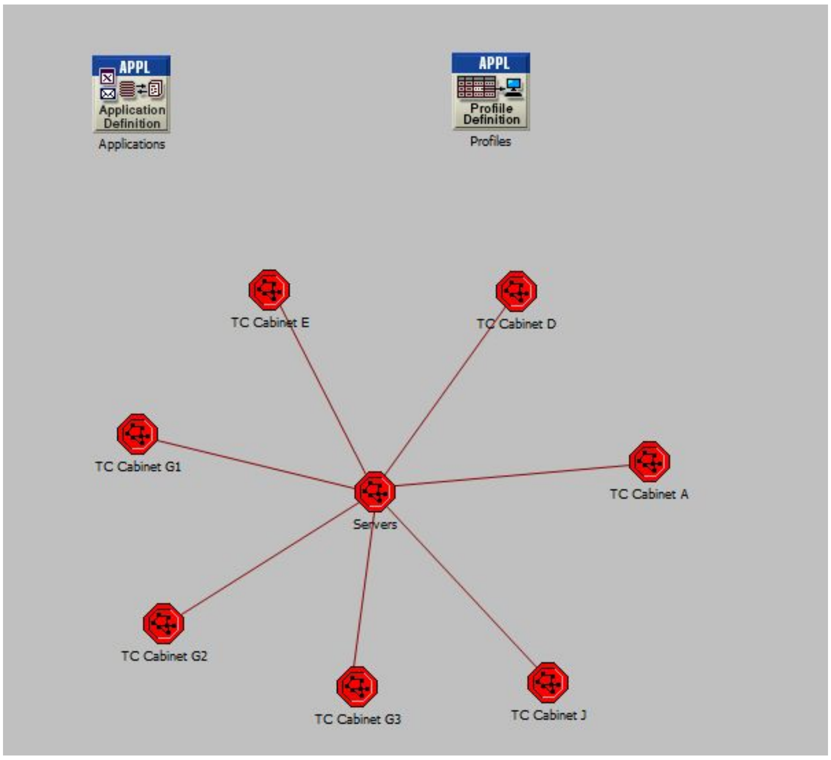
Branching from TC Cabinet J



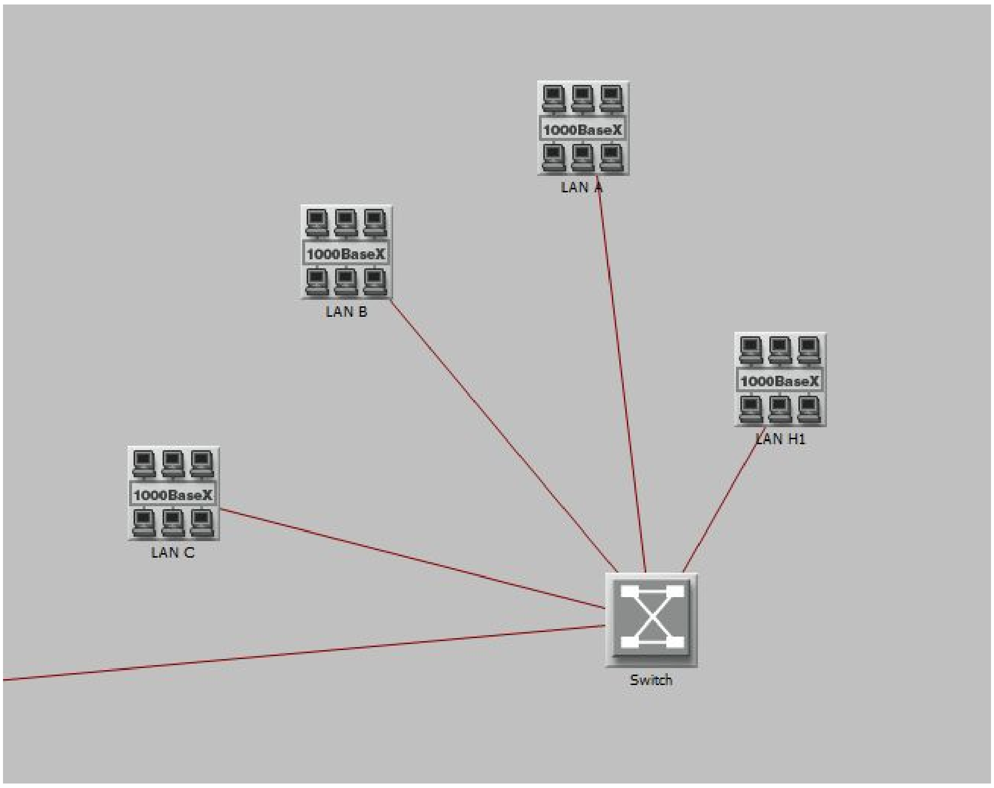
Simulation of Logical Design

Through the simulation of our logical design we can demonstrate that our network does not have a bottlenecked flow of data. We estimated that from the available profiles, ‘E-commerce Customer’ would be the most accurate representation of the majority of the users within the network, assumed that each of the LANs generate a similar amount of network traffic and assumed that there would be 30% background network utilisation.

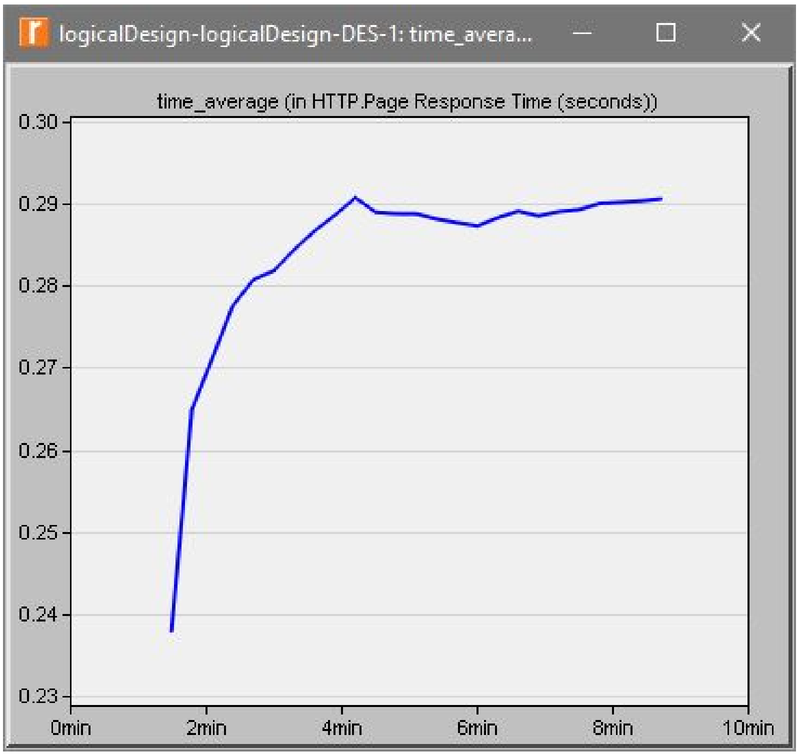
This simulation effectively demonstrates that our network would not experience bottlenecking as page response time and ethernet delay maintain at lower figures. One consideration is that due to the large amount of nodes within the network, it is possible for a high level of packet loss. This is illustrated in the graph comparing packets packets sent vs packets received as the time average for packets sent exceeds the time average for packets received. This can be resolved through the use of CSMA/CD to ensure that all packets are successfully sent to their destination.



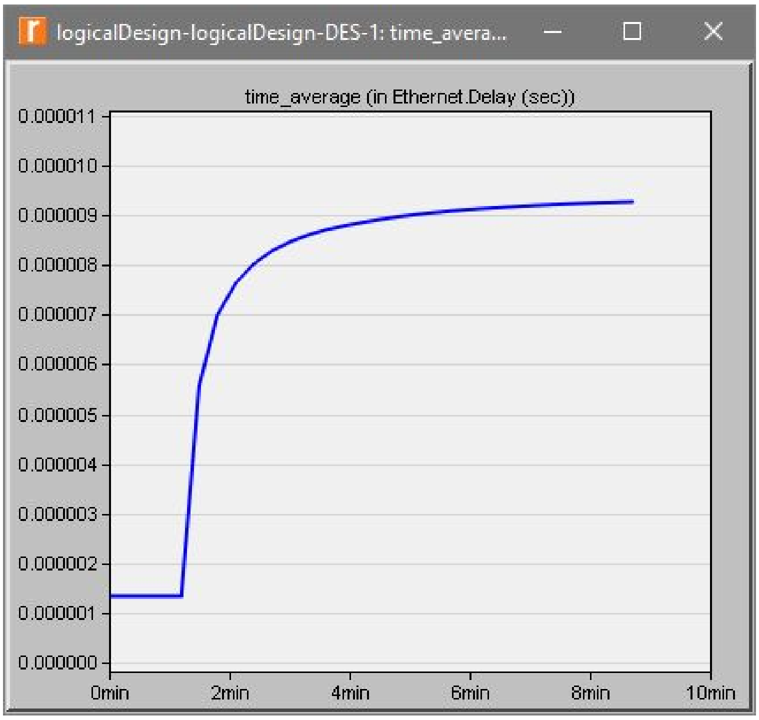
Congruent with the logical design overview.



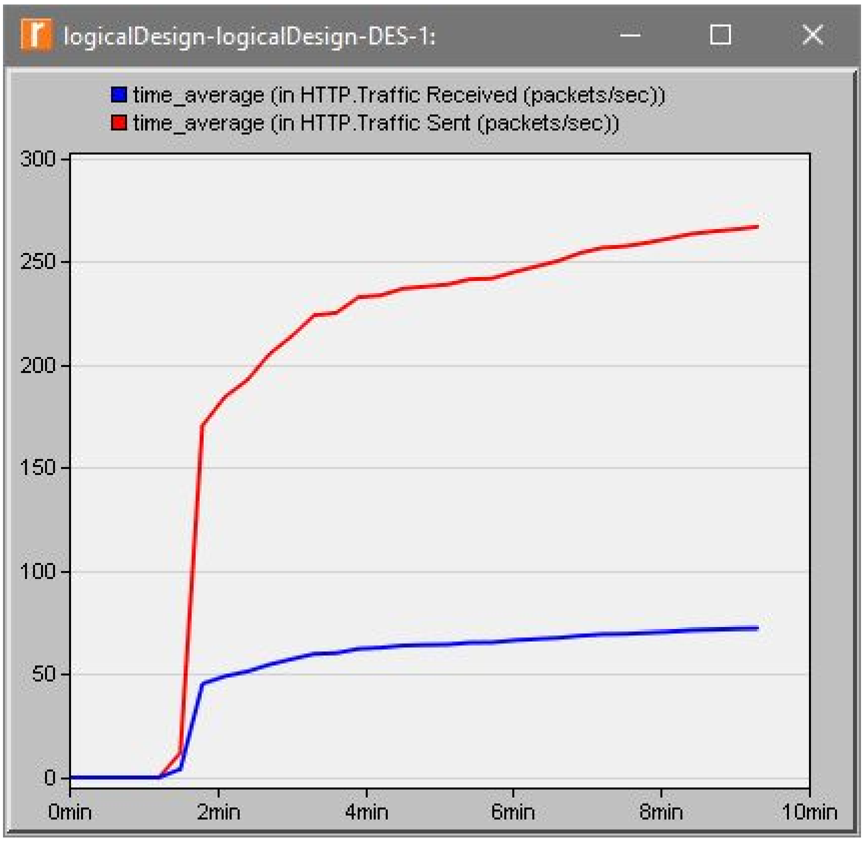
Congruent with the ‘Branching from TC Cabinet A’ diagram.



Graph of the time average for HTTP page response time over time.



Graph of the time average of the ethernet delay within the network over time.



Graph of the HTTP traffic received and sent within the network over time.

Physical Design

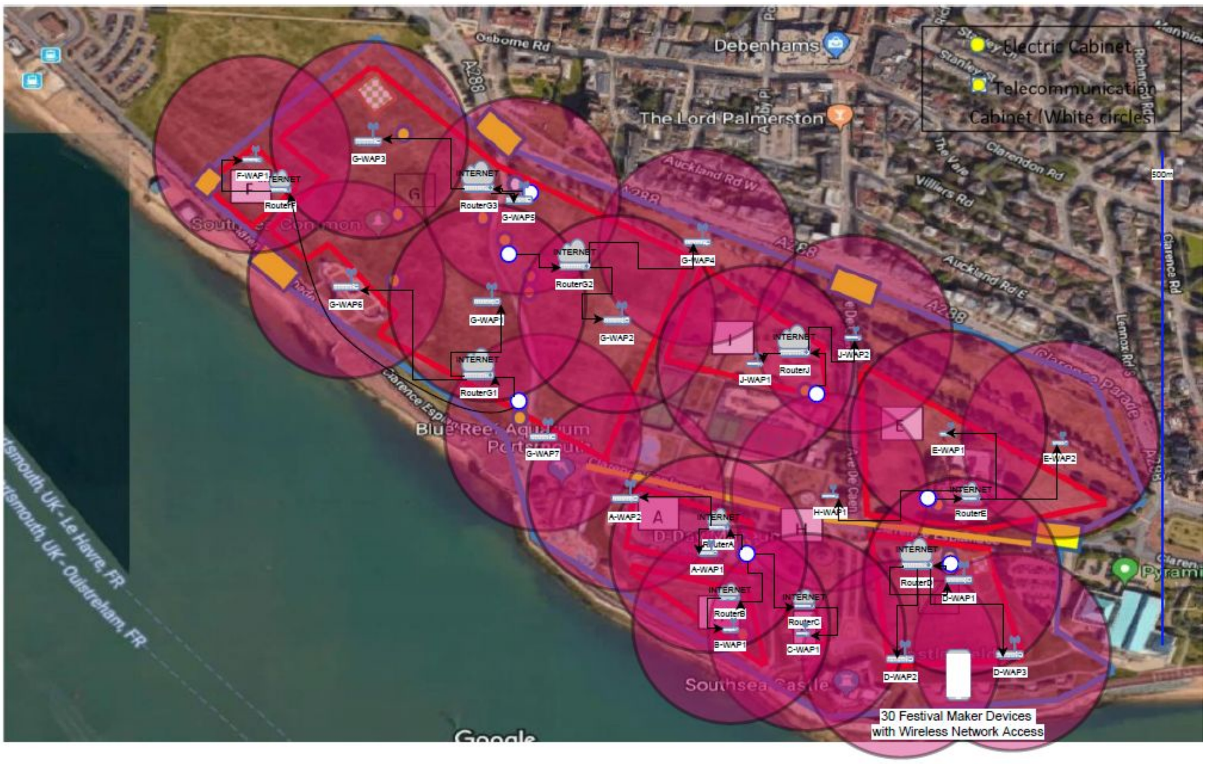
The physical design looks at the implementation of our logical design. Therefore it describes the physical location and connection of all of the devices we plan to use to the extent that if the design were to be given to a contractor, they would be able to easily implement the design. While the physical design is primarily based upon the logical design we created, during the process of physical design we encountered situations in which the logical design could not cater the the demands of the networks physical situation. Therefore we returned to the logical design and reevaluated the way in which it could be structured in order to better suit the network's practical environment.

Connections between hardware of distances greater than 100m utilised fibre optic cable and connections of distances less than 100m utilised category 6 ethernet cables. This ensures that the quality and integrity of the signals carried over cables will be maintained such that a constant connection can be maintained.

One extra consideration is that the Festival Maker devices are not regarded in the detailed physical designs as it is assumed that their location will be changing throughout the duration of the festival. They are, however, represented in the Coverage Overview to demonstrate that they are accessing the network over a wireless connection.

Coverage Overview

The overage overview demonstrates the fact that we successfully planned a method for complete wireless access across the grounds of the festival. By having 100m radii around each of the wireless access points, we were able to visualise the extent at which we had effectively provided wireless coverage. This diagram, however, is not a complete physical design. It is important to note in the Coverage Overview that the connections between the routers and the WAPs are not representative of the complete physical connection between the router and the WAPs. This is described in the detailed physical diagrams that follow.



Physical Network Design Wireless Access Coverage Overview.

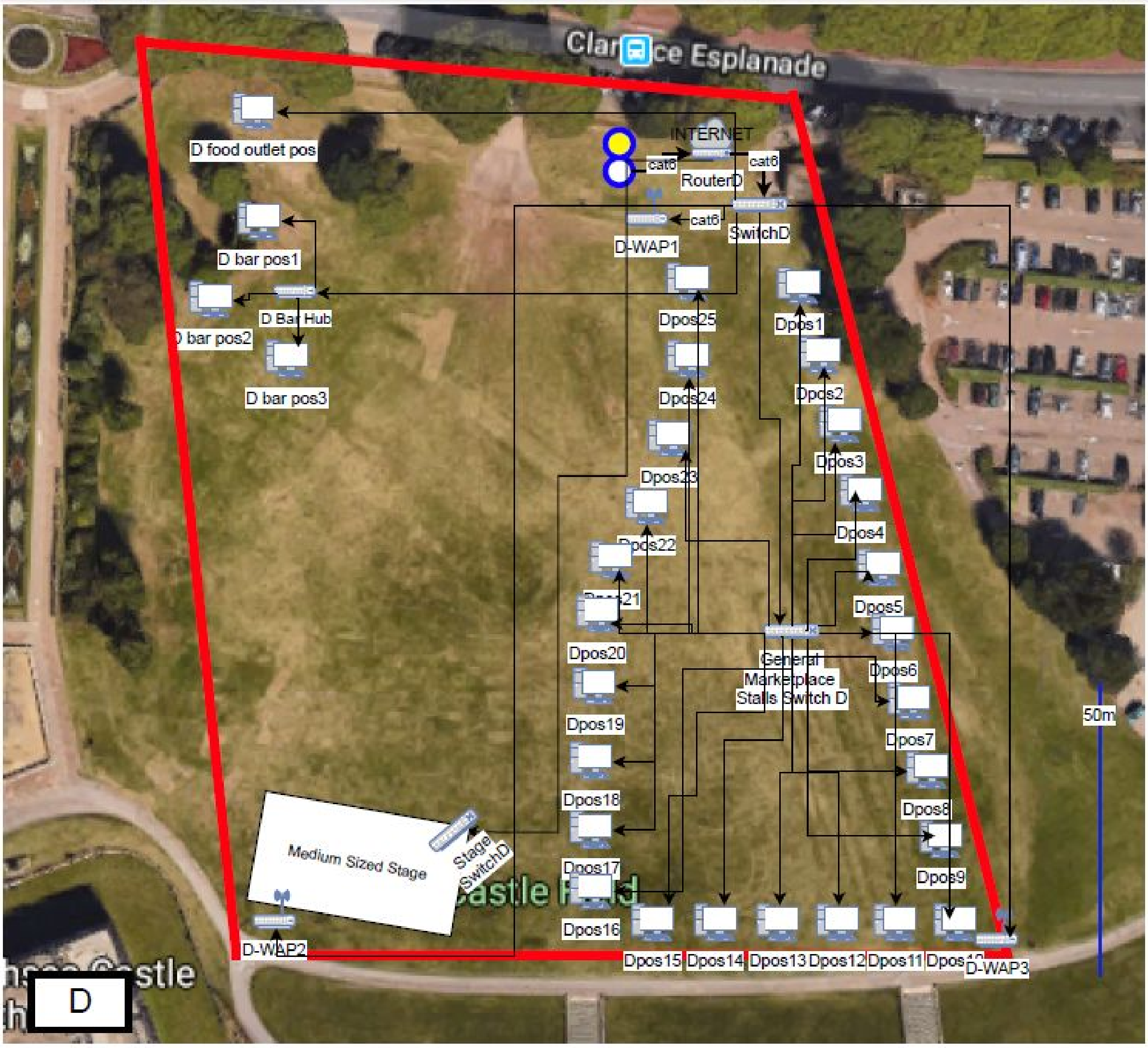
Section A

Clarence Esplanade
Clarence Esplanade
D-Day Museum
Ave De Caen
50m
A-WAP2
Apos1
Apos2
Apos3
Apos4
Apos5
Apos6
Apos7
Apos8
Apos9
Apos10
Apos11
Apos12
Apos13
Apos14
Apos15
Apos16
Apos17
Apos18
Apos19
Apos20
General Marketplace
Stalls Switch A
INTERNET
RouterA
cat6
Small Stage
Stage SwitchA
A food outlet pos
A bar pos3
A Bar Hub
A bar pos2
A bar pos1
A-WAP1
SwitchA
A

Section B and C

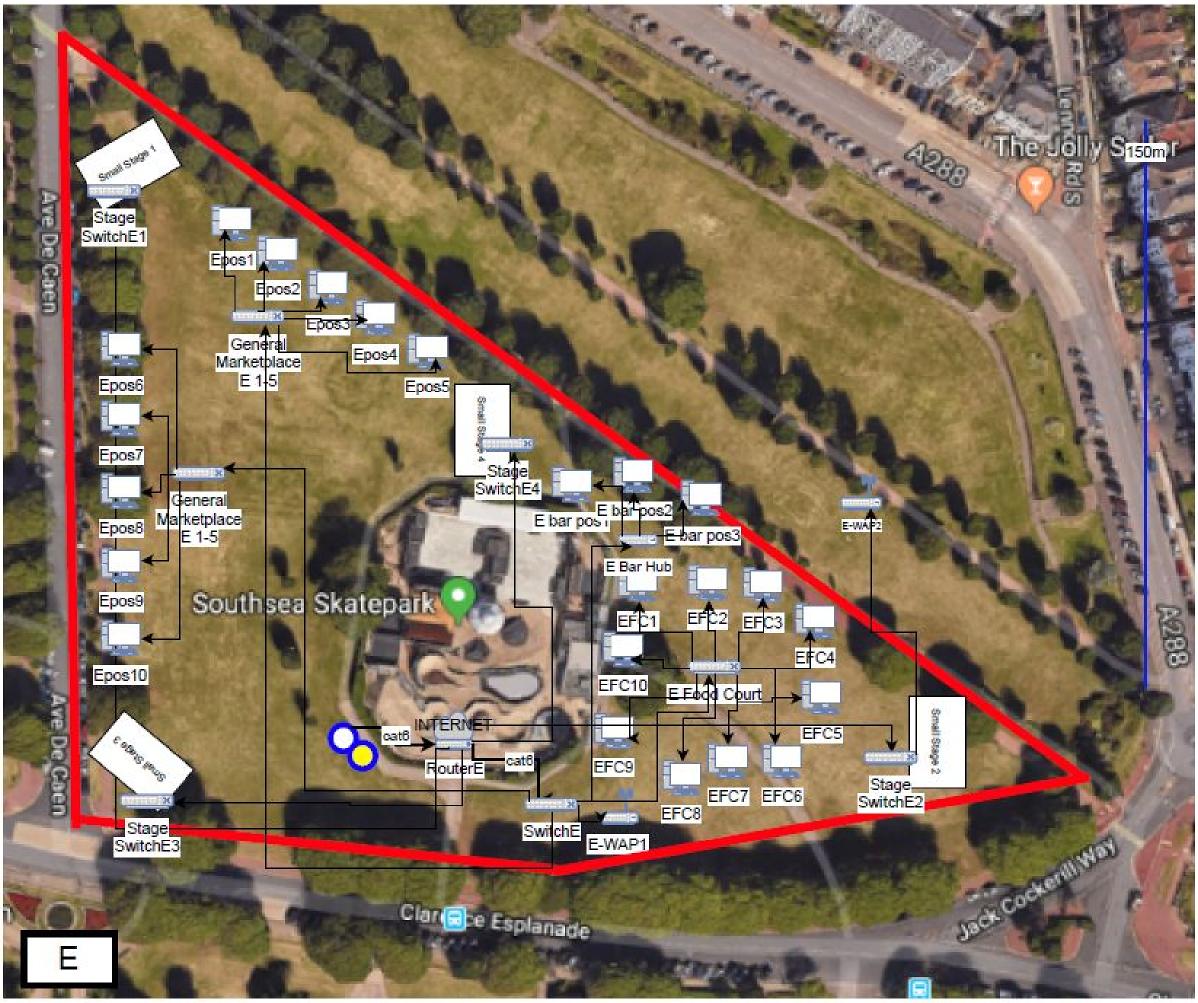
Routers B and C are connected here by a fibre optic cable to provide failover.

Section D



Clarence Esplanade
INTERNET
cat6
RouterD
cat6
SwitchD
cat6
D-WAP1
D food outlet pos
D bar pos1
D Bar Hub
D bar pos2
D bar pos3
Dpos25
Dpos1
Dpos24
Dpos2
Dpos23
Dpos3
Dpos22
Dpos4
Dpos5
Dpos20
General Marketplace Stalls Switch D
Dpos6
Dpos19
Dpos7
Dpos18
Dpos8
Dpos9
Dpos17
Medium Sized Stage
Stage SwitchD
Castle Road
Dpos16
D-WAP2
Dpos15
Dpos14
Dpos13
Dpos12
Dpos11
D-WAP3
50m
Castle
D

Section E


Small Stage 1
Stage SwitchE1
Epos1
Epos2
Epos3
Epos4
Epos5
General Marketplace E 1-5
Epos6
Epos7
Epos8
Epos9
Epos10
General Marketplace E 1-5
Small Stage 4
Stage SwitchE4
E bar pos1
E bar pos2
E bar pos3
E Bar Hub
E-WAP2
EFC1
EFC2
EFC3
EFC4
EFC5
EFC6
EFC7
EFC8
EFC9
EFC10
E Food Court
Southsea Skatepark
INTERNET
cat6
RouterE
cat6
SwitchE
E-WAP1
Small Stage 3
Stage SwitchE3
Small Stage 2
Stage SwitchE2
Ave De Caen
A288
The Jolly S
150m
Clarence Esplanade
Jack Cockerill Way
E

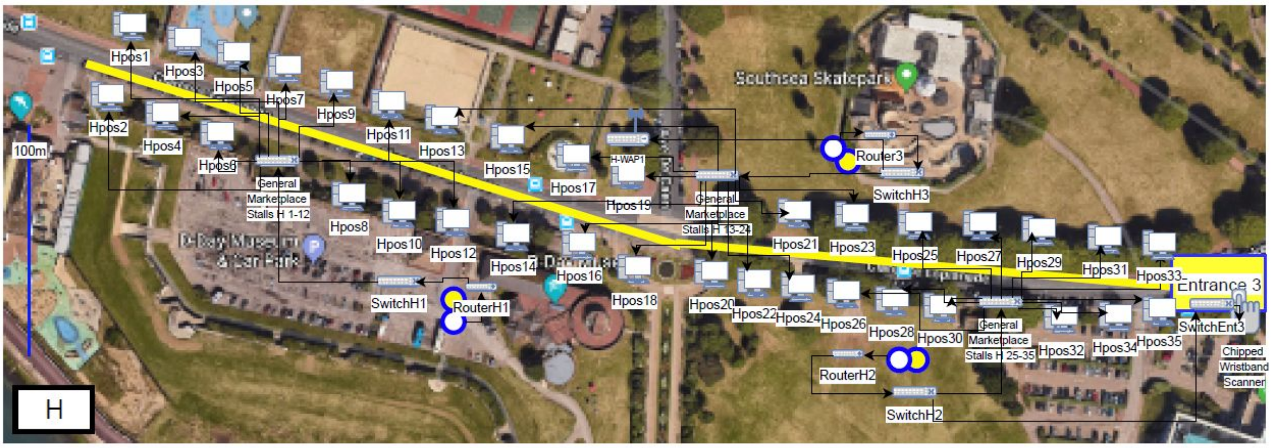
Section F

Router F is connected to TC cabinet G1. See the section G detailed physical design and the ‘Branching from TC Cabinet G1’ logical design for further clarification.

Section G

Key:
Gpos - Section **G** Point Of **S**ale device
GFOA - G Food outlet A

Section H



Key:
Hpos - Section **H**
Point Of **S**ale device

Section J

0Components and Costing List

Item	Quantity	Price	Total Price	Justification
WAP - Cisco Meraki MR74	20	£933	£18,660	Outdoor enterprise AP, it can accomodate a high user count and can be configured remotely from one computer and will be powered from PoE
Switch - UniFi Switch 48 (750W)	15	£1,025	£15,375	Allows PoE which will make routing for the APs easier. Also allows management and overview from a webpage. Also had 4 SFP ports for fibre connections
Switch - UniFi Switch 24 (500W)	25	£545	£13,625	Same as the 48 port version, also both version can be rack mounted for ease of use in a small, shallow rack cabinets.
Router - UniFi Switch 16 XG	10+10	£599+£299	£7,990	Allows up to 10 Gigabit Fibre to be used and also has 16 SFP ports for fibre. Is also

+ UniFi Security Gateway Pro				bundled with a security gateway part of the UniFi package.
1000m Fibre Optic spool	2	£200	£400	For use with cable runs of over 100m
305m Cat 6 Ethernet	6	£95	£570	For use with cable runs less than 100m and APs
100x Cat 6 RJ45 connections	15	£8	£120	For terminating the ends of the Cat 6 cable.
PowerEdge R740xd Rack Server	2	£4,055	£8,110	High-powered database server with 2 drives for redundancy and nvme drives for speed.
Total			£64,850	

References