Network and System Administration

ICA Part 2

Introduction

In this ICA, I will be looking at a problem proposed by Barclays bank for one of their branches in Manchester. The branch needs new hardware and a full review of their layout to meet modern demands. I will be investigating this problem as a network solution provider and suggesting a plan for their branch to adopt, meeting demands now and providing a good level of service for at least 5 years.

Network Analysis:

From the information that is available in the ICA brief, I can come to a comfortable conclusion on the requirements needed to implement a solution.

As stated in the brief, the new network must be able to support 80 officers, 10 support staff and 5 members of the management team. I am going to assume that these all need an end machine each as part of the network. In addition to this the requirements state that 20 printers need to be used within the building and they also need to house 5 different servers used for their own purpose. This creates a total of 120 end devices over 6 floors, which I am seeing as a minimum requirement for the network to handle. I will look to leave some room for expansion within this number when planning the network. I will have to set up the number of nodes available for each switch when designing the network IP address for each switch.

The standard of the hardware needs to be upgraded as the server is currently only running windows vista which is a version of windows released in 2007. Using an old OS like this could come with some security risks, and this is one of the areas I will be looking to improve. The brief also explains that they are currently using some old layer 2 switches, which could also pose some security risk if has old firmware. I will have to investigate new layer 2 switches for the network as well as a possibility of including some layer 3 switches if necessary.

High performance and availability were the two main requirements that Barclays are looking for in the new system, and I believe that the ISND connection that is currently in place is not efficient for the requirements needed. BT have recently said that they will discontinue ISND lines from 2025 as more and more businesses are switching to newer technologies. This calls for a change to the internet connection within the branch. Gigabit internet speed are very common now where fibre optic cables are installed, and this only results in faster and more reliable connectivity. This would boost the performance of the greatly compared to keeping ISDN for the internet.

As well as an overhaul of the switches in the system being positive for the overall network, new hardware with the latest firmware will also make the network more secure. This along with the upgrade made to a new OS will also increase the security that the network has, without getting any extra software.

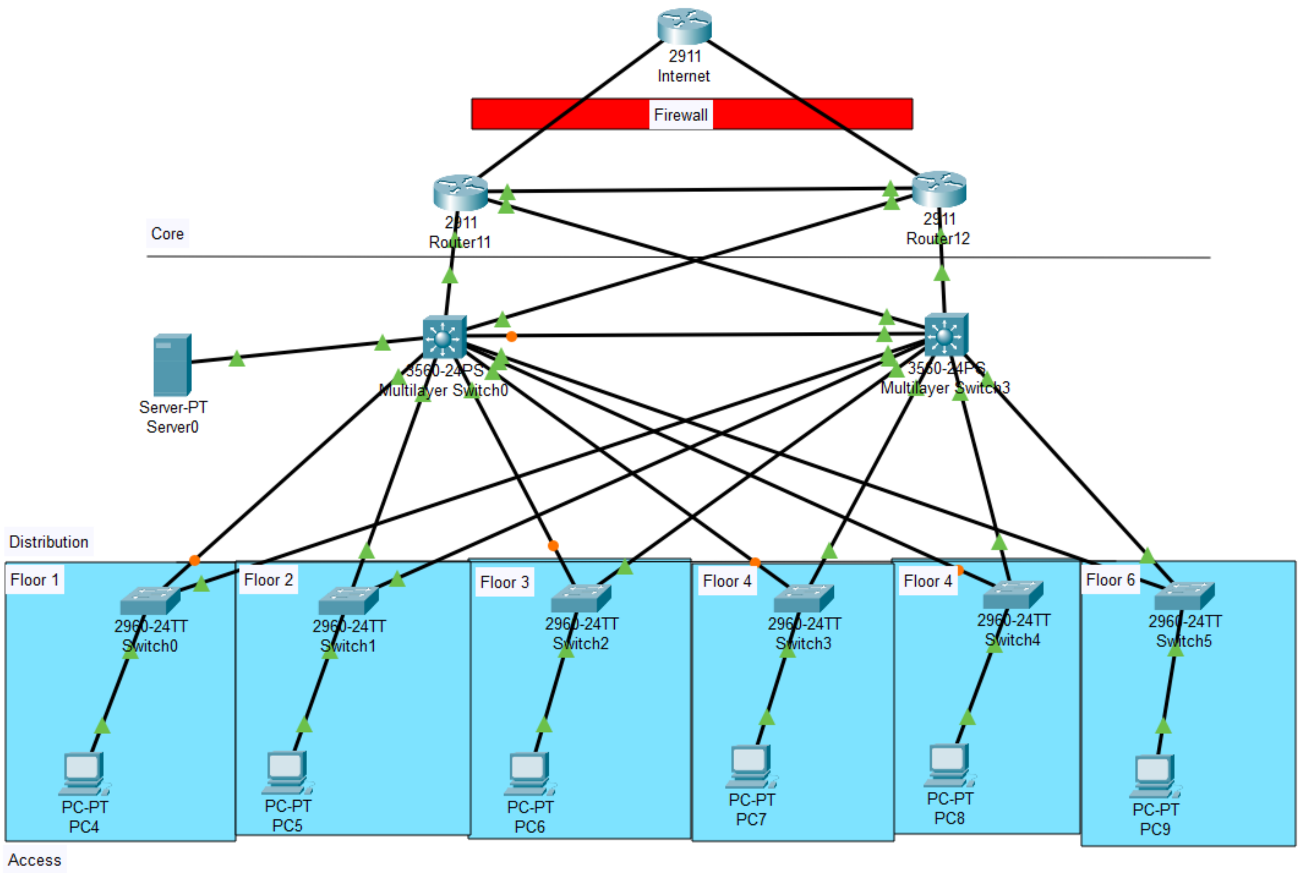
Network Design:

B	C	D	E	F	G	H	I	J	K	L	M
NET 0	Network	192.168.10.0	/27	**NET 6:0**	Network	192.168.10.192	/30	**NET 7:0**	Network	192.168.10.224	/30
(Floor 1)	First	192.168.10.1	/27		First	192.168.10.193	/30		First	192.168.10.225	/30
	Last	192.168.10.30	/27		Last	192.168.10.194	/30		Last	192.168.10.226	/30
	Broadcast	192.168.10.31	/27		Broadcast	192.168.10.195	/30		Broadcast	192.168.10.227	/30
NET 1	Network	192.168.10.32	/27	**NET 6:1**	Network	192.168.10.196	/30	**NET 7:1**	Network	192.168.10.228	/30
(Floor 2)	First	192.168.10.33	/27		First	192.168.10.197	/30		First	192.168.10.229	/30
	Last	192.168.10.62	/27		Last	192.168.10.198	/30		Last	192.168.10.230	/30
	Broadcast	192.168.10.63	/27		Broadcast	192.168.10.199	/30		Broadcast	192.168.10.231	/30
NET 2	Network	192.168.10.64	/27	**NET 6:2**	Network	192.168.10.200	/30	**NET 7:2**	Network	192.168.10.232	/30
(Floor 3)	First	192.168.10.65	/27		First	192.168.10.201	/30		First	192.168.10.233	/30
	Last	192.168.10.94	/27		Last	192.168.10.202	/30		Last	192.168.10.234	/30
	Broadcast	192.168.10.95	/27		Broadcast	192.168.10.203	/30		Broadcast	192.168.10.235	/30
NET 3	Network	192.168.10.96	/27	**NET 6:3**	Network	192.168.10.204	/30	**NET 7:3**	Network	192.168.10.236	/30
(Floor 4)	First	192.168.10.97	/27		First	192.168.10.205	/30		First	192.168.10.237	/30
	Last	192.168.10.126	/27		Last	192.168.10.206	/30		Last	192.168.10.238	/30
	Broadcast	192.168.10.127	/27		Broadcast	192.168.10.207	/30		Broadcast	192.168.10.239	/30
NET 4	Network	192.168.10.128	/27	**NET 6:4**	Network	192.168.10.208	/30	**NET 7:4**	Network	192.168.10.240	/30
(Floor 5)	First	192.168.10.129	/27		First	192.168.10.209	/30		First	192.168.10.241	/30
	Last	192.168.10.158	/27		Last	192.168.10.210	/30		Last	192.168.10.242	/30
	Broadcast	192.168.10.159	/27		Broadcast	192.168.10.211	/30		Broadcast	192.168.10.243	/30
NET 5	Network	192.168.10.160	/27	**NET 6:5**	Network	192.168.10.212	/30	**NET 7:5**	Network	192.168.10.244	/30
(Floor 6)	First	192.168.10.161	/27		First	192.168.10.213	/30		First	192.168.10.245	/30
	Last	192.168.10.190	/27		Last	192.168.10.214	/30		Last	192.168.10.246	/30
	Broadcast	192.168.10.191	/27		Broadcast	192.168.10.215	/30		Broadcast	192.168.10.247	/30
				NET 6:6	Network	192.168.10.216	/30	**NET 7:6**	Network	192.168.10.248	/30
					First	192.168.10.217	/30		First	192.168.10.249	/30
					Last	192.168.10.218	/30		Last	192.168.10.250	/30
					Broadcast	192.168.10.219	/30		Broadcast	192.168.10.251	/30
				NET 6:7	Network	192.168.10.220	/30	**NET 7:7**	Network	192.168.10.252	/30
					First	192.168.10.221	/30		First	192.168.10.253	/30
					Last	192.168.10.222	/30		Last	192.168.10.254	/30
					Broadcast	192.168.10.223	/30		Broadcast	192.168.10.255	/30

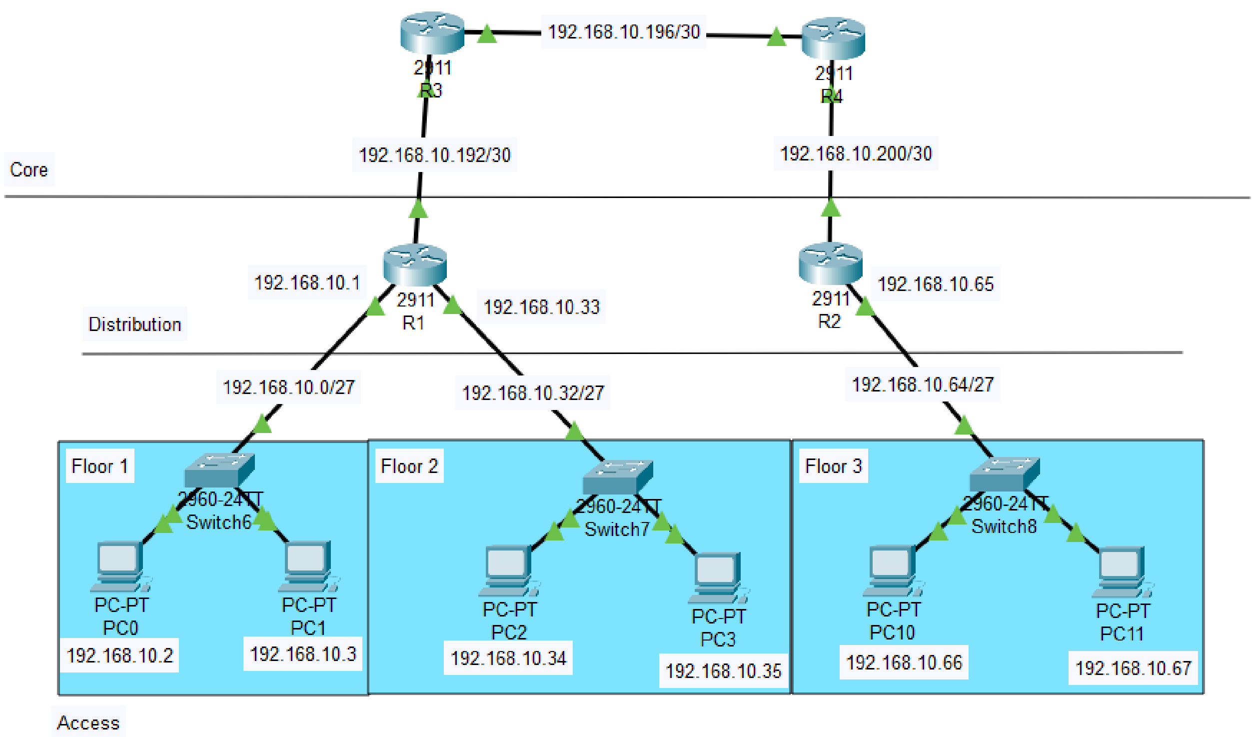
The above image is my addressing table for the network I am proposing. I have decided to subnet the network into floors for the bank, as each floor can be used as a different section of work. This will improve speed within the network and help the devices on each floor communicate more effectively. As part of the ICA, I was only allowed to start with a class c address for my solution, however after I created my topology, I decided that I needed more subnets to fully partition the network.

Therefore, I used VLSM to divide my last 2 subnets that were unused in the floors into smaller subnets with only 2 host addresses. This net size is perfect for connections between routers etc because they only need 2 hosts per subnet.

The size of the subnets for each floor was determined by information I was given in the ICA brief. With a total of 120 end devices needed (including servers, printers, and end devices for all the staff) over 6 floors, this averaged out to 20 devices required per floor. The /27 subnet I use for the floors allows 30 hosts, which meets these requirements and gives room to expand the number of devices on each floor.



Network Implementation:

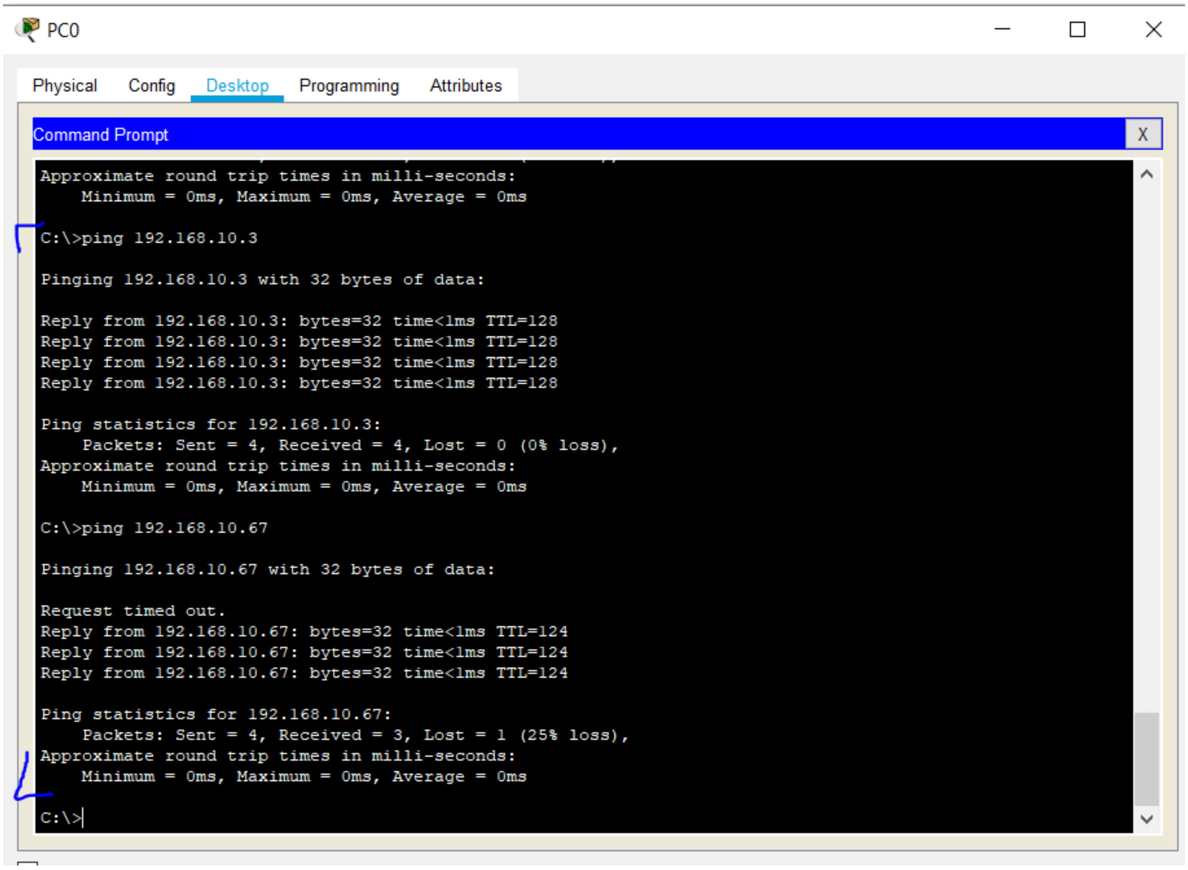


For the implementation of my design, I have only demonstrated the premise with 3 floors. This can still give a good example as to how the network will be laid out within the building. Firstly, each pc resembles many end devices that can be hooked up to a switch on each floor and used on each floor. As you can see from the image, I used the subnet table from before on these 'floors' to make sure that there was enough space on each of these subnets to host enough devices. using these on the same subnet makes communication between the devices faster within the network.

When implementing, I decided against the limitation of same floor communication, as I think than different departments within a bank would benefit greatly if they could all communicate with each other; however, by separating these floors into subnets they will still have some benefits of being separated, like the faster connection time between other end device on their own subnet. I also used the VLSM shown in the subnetting table to subnet the connections between routers. This makes a very effective way of subnetting as there were 0 wasted connections between these subnets.

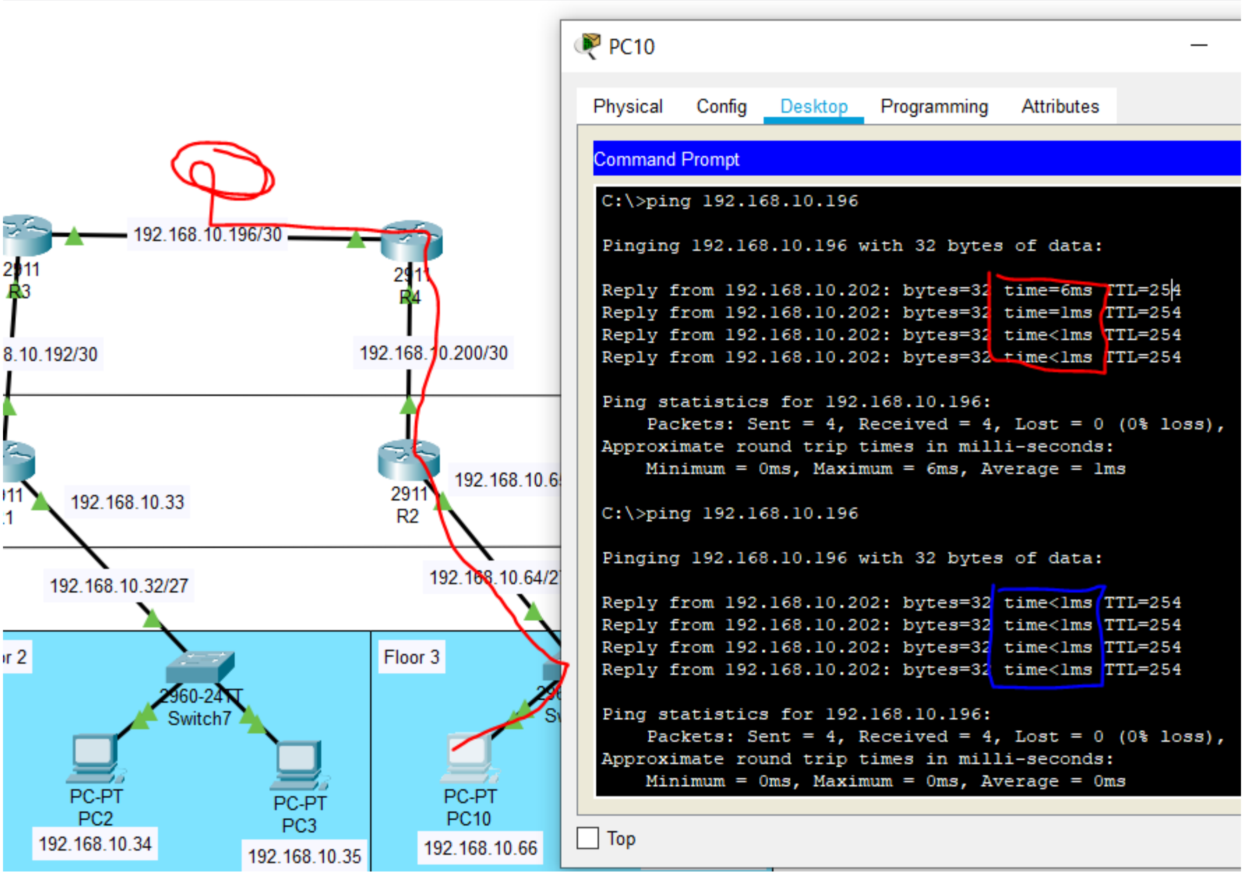
Because I did this I still needed to communicate across different floors, which means pinging across different subnets. I set up some RIP routing to do this from each router. This is also why I decided to use routers in the distribution layer as they are much easier to configure and I can simply set up some RIP routing and communication is much more effective. This means that any future changes to the network can also mean that the routing is already set up, which will make it easier to futureproof.

By dividing the floors into subnets and using these as structure for the network I decided that VLAN's were not necessarily required to fit the needs of the scope. As explained before, I think that having easy communication between floors will be beneficial for the business.

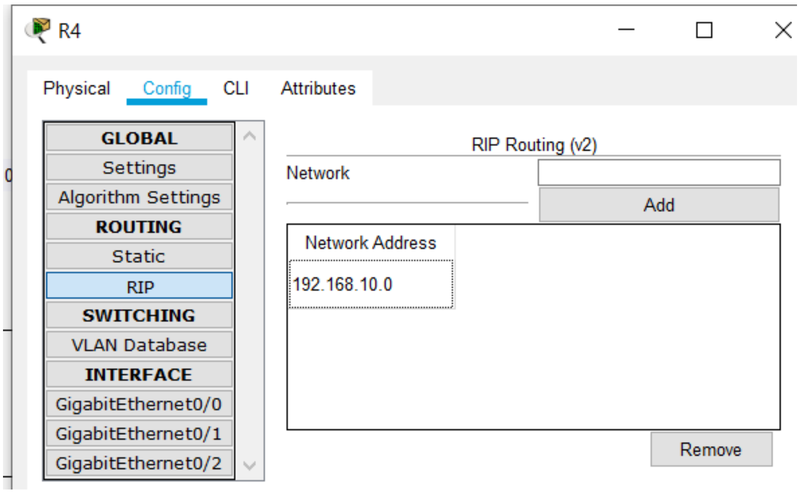


From the first ping test that I completed, pinging PC0 to PC1 was almost instant, sending 32 bytes of data 4 times successfully in less than 1ms. This is within the suggested time given in the brief which is a positive. In the second test I sent packets from the first PC to a Pc on the other side of the network, and only 75% of the packets were received. This could be down to the route not being used and, in the future, I would expect 100% of the packets to arrive. However, regarding the packets that did make it, all of them were delivered in less than 1ms which shows that the network does not have a speed issue.

Even regarding the fact that different subnets are used throughout the network and RIP routing could slow down some packets, all data got sent very quickly and I am not concerned about this with my solution.



From this next ping test I show how I set up the rip routing so that the subnets that are set up can be used without blocking access across the network. As I pinged the network between the core routers from a PC the time improves. This happens as the pcs learn the most effective way of communicating across the network. the PC can only do this because I set up routing between the routers which allows the PC to know what subnets they can communicate across.



All the routers are set up like this, and I used version 2 of RIP routing because this works with variable length subnet masks, which allowed me to use the same network address and still tell the router where to route can go from using the subnets.

Costing table

For the costing, I am going to assume that assume that they have all the end devices, as well as any backup hardware that I have not included in my implementation but is included in my design. This leaves some fresh new layer 2 switches, which were obviously need upgrading from the old system. The whole distribution and core layer of the network also will need replacing.

Hardware costing table for ICA Part 2

Layer 2 Switches			
Name	Price per unit	Amount required	Total price
S5860-24XB-U, 24-Port Multi-Gigabit Ethernet L3 Managed Convergence Switch, 24 x 10G BASE-T, 4 x 10Gb SFP+, with 4 x 25Gb SFP28 Uplinks, Stackable Switch, Broadcom Chip	£2,572.00	6	£15,432.00

Layer 3 Switches			
Name	Price per unit	Amount required	Total price
N5860-48SC, 48-Port L3 Data Centre Leaf Switch, 48 x 10Gb SFP+, with 8 x 100Gb QSFP28 Uplinks, Stackable, Broadcom Chip, Software Installed	£2,813.00	2	£5,626.00

Routers			
Name	Price per unit	Amount required	Total price
Cisco Systems Cisco2911/K9 Cisco 2911 integrated Ethernet connection Cable router	£ 291.94	2	£583.88

L2 Switch total Price	£15,432.00
L2 Switch total Price	£5,626.00
Router total price	£583.88
Grand total Price	**£21,641.88**

Policies:

Backup – I would suggest that the building will follow a differential backup policy, making a full back up once a week and following up the rest of the week with incremental backups every day. This is a very efficient way of backing data up, but still ensures that once a week a full backup is completed, making it a very safe option for a bank.

Disaster Recovery – In the disaster recovery policy, it is very important that the data comes first, and everything should be done to keep the integrity of the data as good as possible. Due to the backup policy previously stated, in the event of any loss or corruption of systems, a last backup should be restores using the last full backup and then every increment up until the most recent possible. This should be done to reset the network and to keep the data stored as integral as possible.