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K1833503

DESIGNING A PHYSICAL NETWORK

CI5220 Networking and Operating Systems Coursework

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Introduction: *"a description of my interpretation"*

This **Coursework** aims to design an Intranet (a private network accessible only to an organization's staff) for the Dotheboys College. The College consists of three campuses: a larger one in Leeds and two smaller ones in Hull and Sheffield, each composed of multiple subnets and workgroups, connected to each other through different types of wired technologies. The task is to create an effective model that correctly and hierarchically describes the interconnections between the various workgroups.

- In general, a **workgroup** is a *"physically grouped set of users sharing local resources such as database, web and file servers and printers interconnected by some LAN technology e.g. switch"*.[1]

- A **switch** is a device with a table that associates its Ethernet ports with the MAC addresses of a workgroup's computers: for each incoming frame the switch has the task of finding out if the source MAC address is in its table (if not, add it by associating it with the port from which the frame arrived) and if the destination MAC address is in its table (if not, broadcast the frame to every other port) and of transmitting the frame. A set of workgroups connected by switches form a LAN (**L**ocal **A**rea **N**etwork).

- Workgroups can also be linked by **routers**, *"devices that prevent broadcast of local traffic, understand frame types and how to route"*.[1] Routers use the IP address in each incoming packet to decide how to forward it. When connecting two workgroups with a switch they form a single subnet, alternatively connecting them with a router they form two different subnets. Routers will often be used in the design: in the case of WAN routers their function is to allow the connection to the Internet while the internal routers are used to subdivide the College into subnets and to improve the speed and reliability of the connection.

- Furthermore, workgroups can be connected to each other using a **Backbone Network**, to which the connection is made possible by routers. Unlike switches, routers can connect networks that use different types of technologies: for example, in the College design a Gigabit Ethernet backbone, an ATM backbone and an FDDI backbone will be linked together through routers.

- In the event that the backbones are at great distances from each other (> 10 km), as for the Dotheboys College, it is necessary to use leased point-to-point connections from a **WAN** (**W**ide **A**rea **N**etwork) provider.

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1 Source: [Mini-Lecture: Intranet Technology](#)

Dotheboys College: *Intranet Design*

1 - Leeds Campus

1.1 - Department

➢ *"Each **department** building has three 100baseT Ethernet subnets serving the staff, student and admin user-groups."*
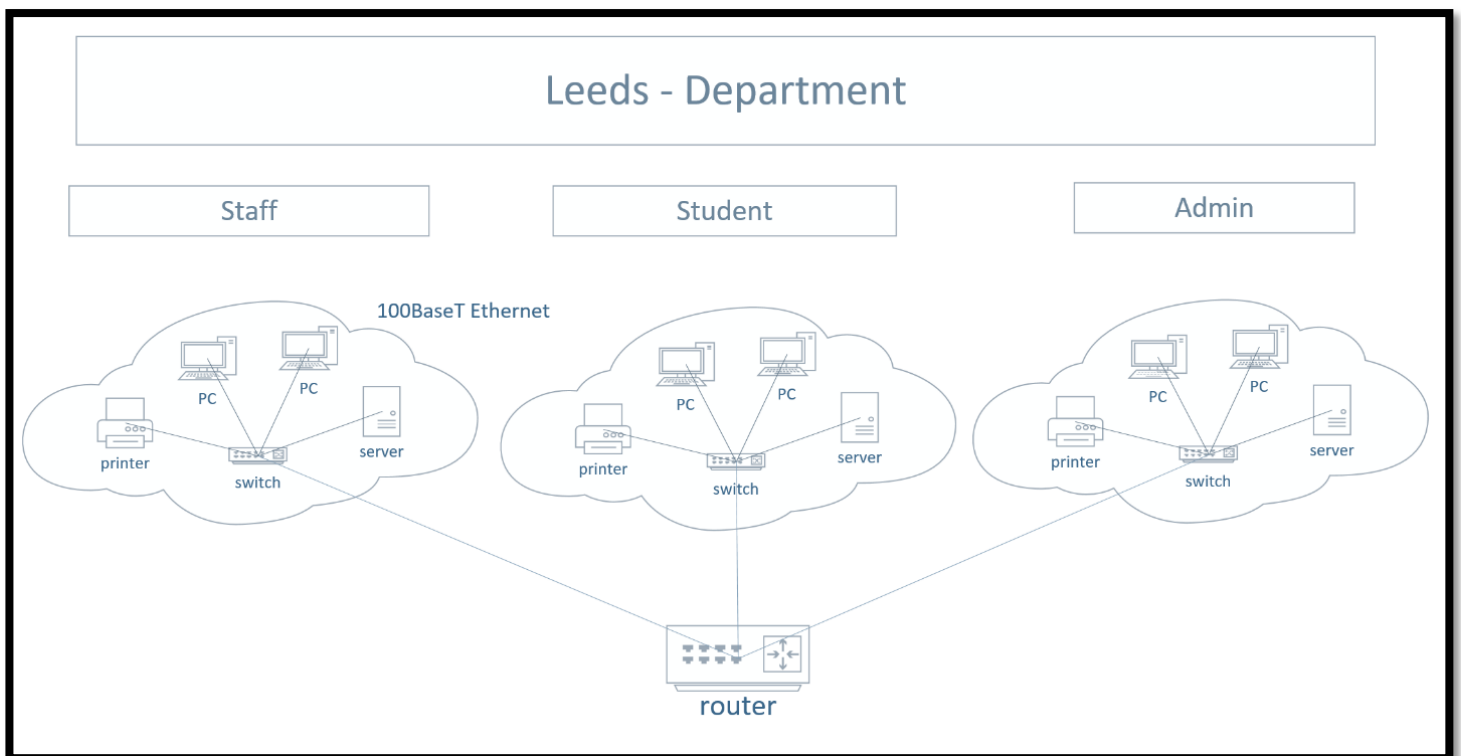

Figure 1

The project starts with the design of a Leeds campus department, Figure 1 represents three different subnets connected via a router (to subdivide into subnets and to improve the speed and reliability of the connection).

Each subnet has connections via 100baseT Ethernet cables (**Base**: the signal is placed onto the wire without modulation; **U**nshielded **T**wisted **P**air cable; **Full duplex**: data can be transmitted simultaneously in both directions; Data rate: 100 Mbit/s; maximum distance: 100m).

1.2 - Service Building

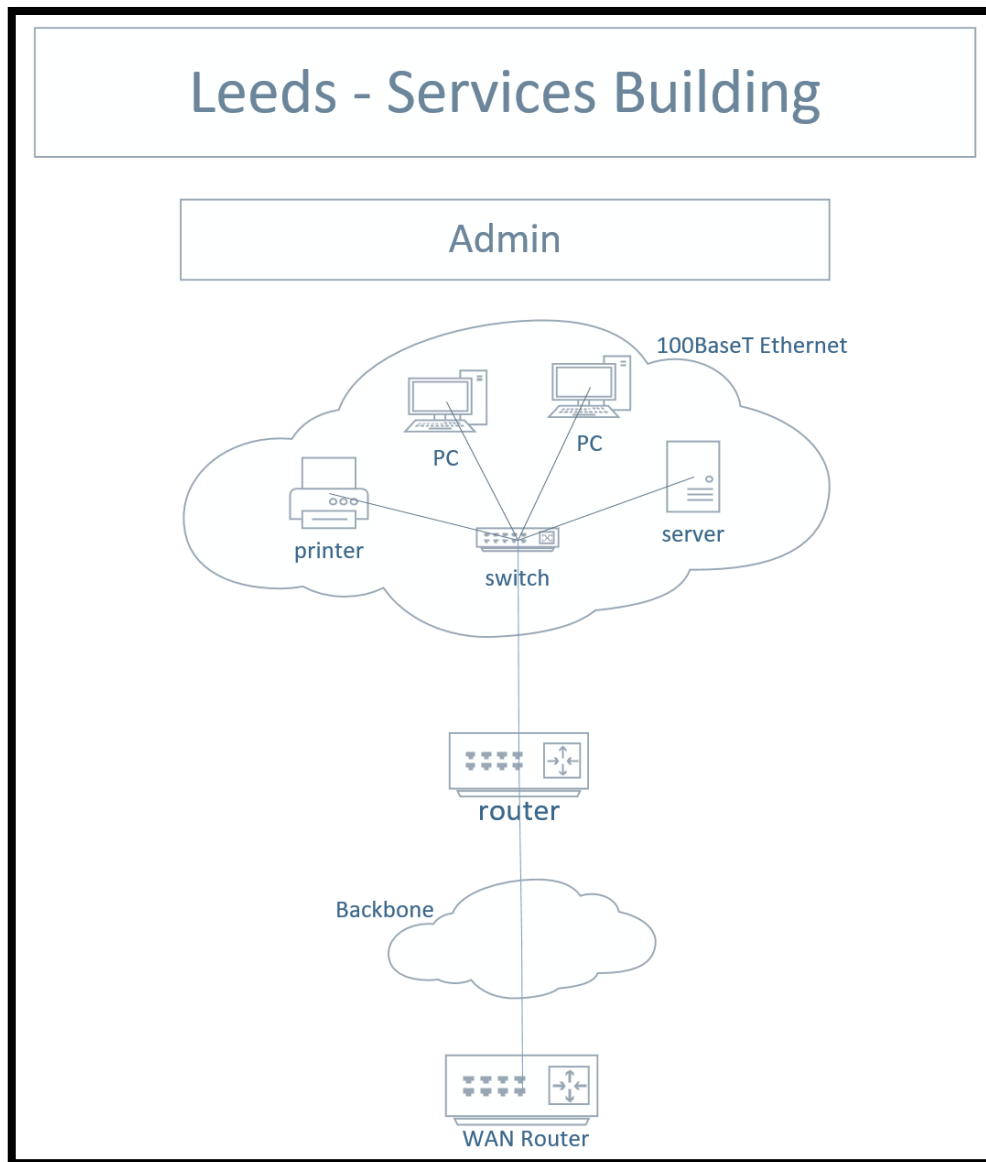> ➢ *"The **Services building** houses the WAN router as well as a 100baseT admin network."*

Figure 2

As per specification, Figure 2 represents the Services Building with an admin workgroup with 100baseT cable connection linked to a router (to subdivide into subnets and to improve the speed and reliability of the connection).

Also the WAN router has been inserted inside the building located hierarchically under the Gigabit Ethernet backbone.

1.3 - Leeds Campus

➢ *"The **Leeds site** has three department buildings (Technology, Law and Business) and an additional Services building, all linked together by a Gigabit Ethernet backbone with a switch in each building."*

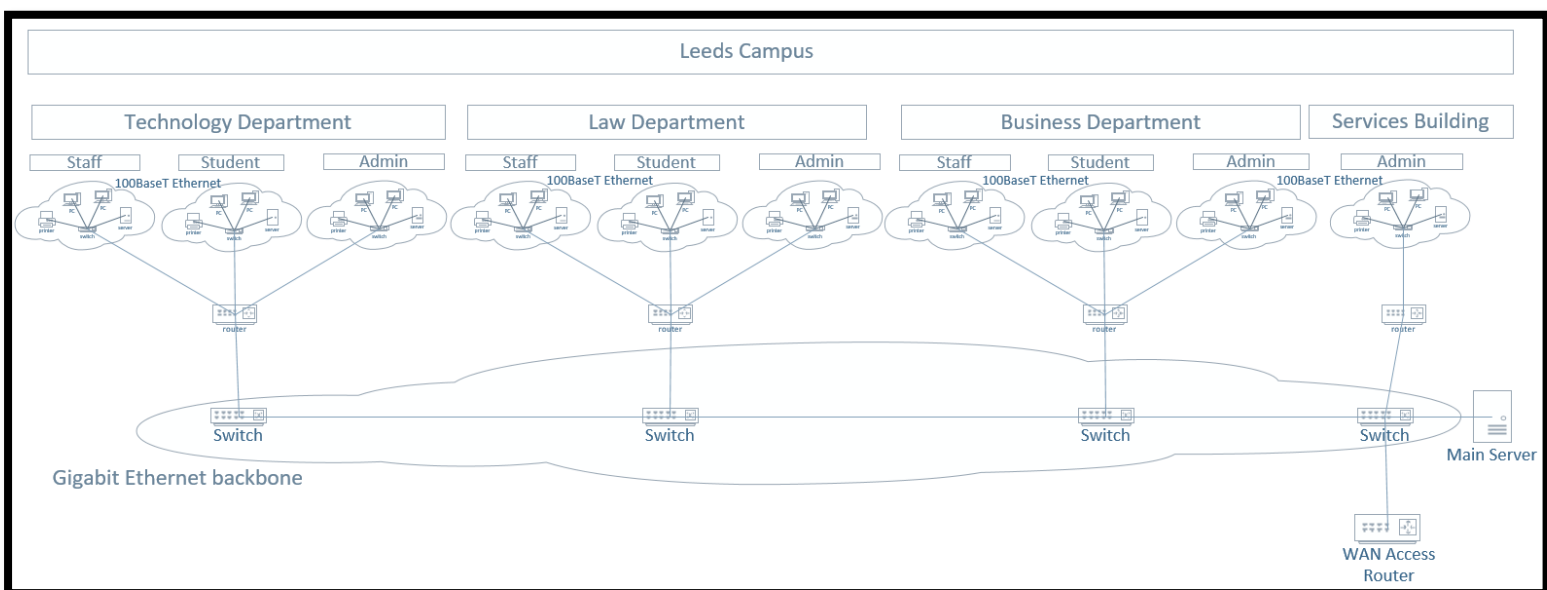➢ *"The main student information and authentication server is also housed on this site."*

Figure 3

Finally Figure 3 shows the three departments and the Services building connected through a Gigabit Ethernet backbone (in which a switch for each building is explicitly placed in order to remain as close as possible to the specification), to which the main server is also connected, assuming it has an Ethernet port.

2 - Hull Campus

> ➤ *"The **Hull site** comprises a single large building with an ATM backbone linking four laboratory workgroups."*
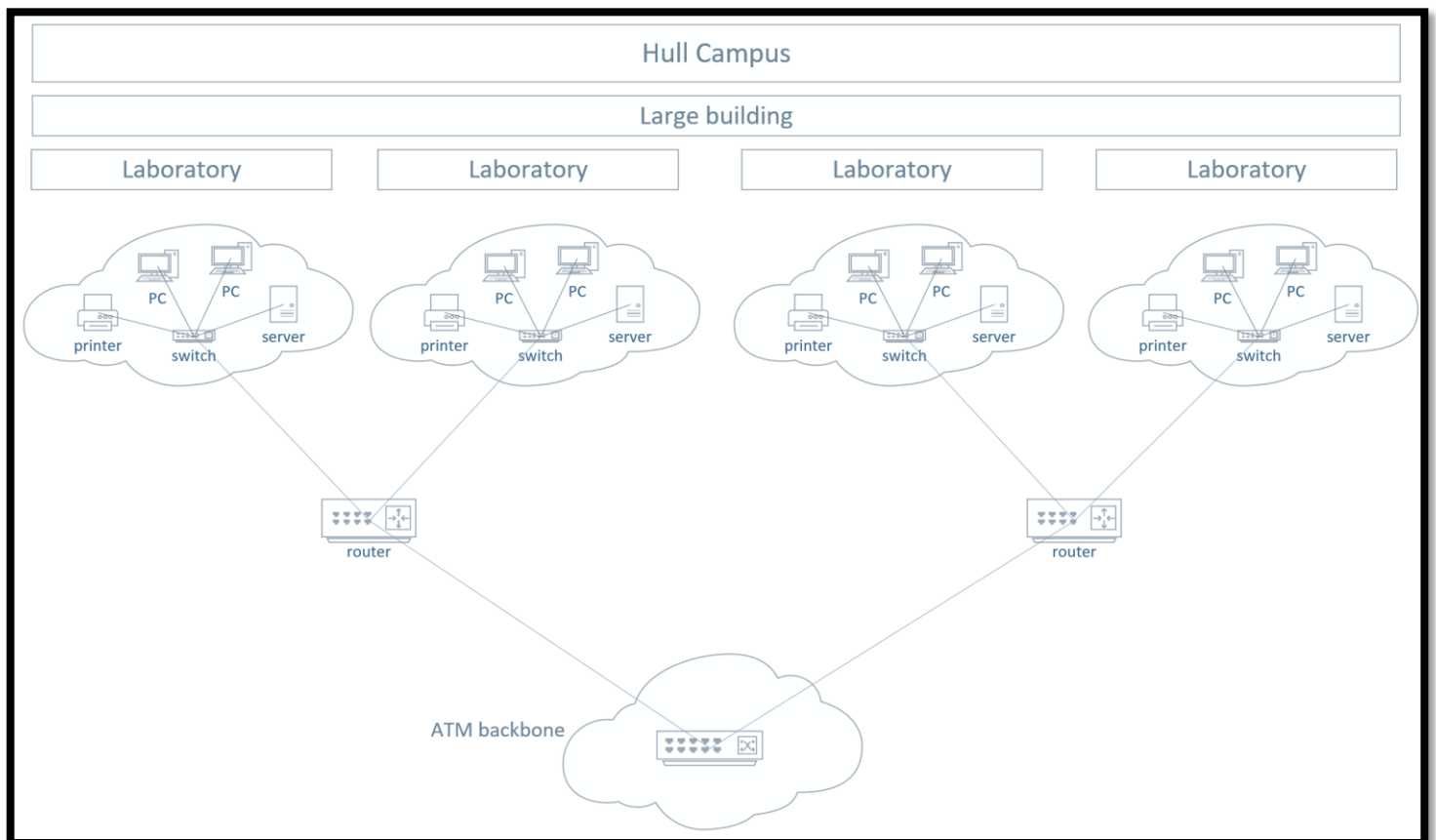

Figure 4

Figure 4 represents each laboratory with a different workgroup.

Then, assuming that the "large building" is really very large, two routers are used (to subdivide into subnets and to improve the speed and reliability of the connection) to avoid long cables running through the entire building.

Finally everything is connected with an ATM backbone (**ATM** = Asynchronous Transfer Mode, it is one of the Asynchronous WAN Technologies: unlike the Synchronous there are not permanently assigned time slots, data is simply sent when they are ready and there is a free slot).

3 - Sheffield Campus

3.1 - Building

> *"Each (**building**) with two workgroup subnets of 30 workstations each and an additional small staff workgroup."*
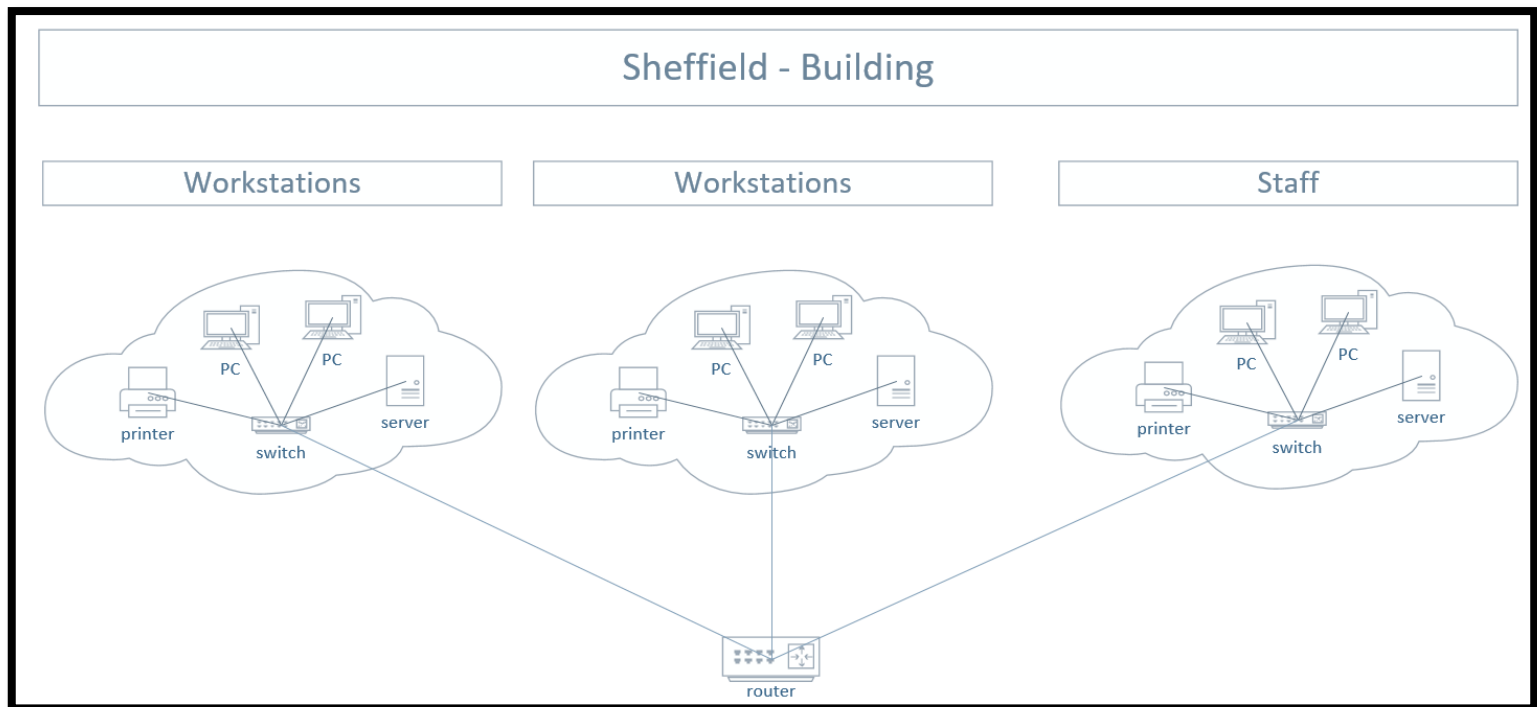

Figure 5

According to specification, Figure 5 simply shows three workgroups (two for the workstations and one for the staff) connected via a router (to subdivide into subnets and to improve the speed and reliability of the connection).

3.2 - Sheffield Campus

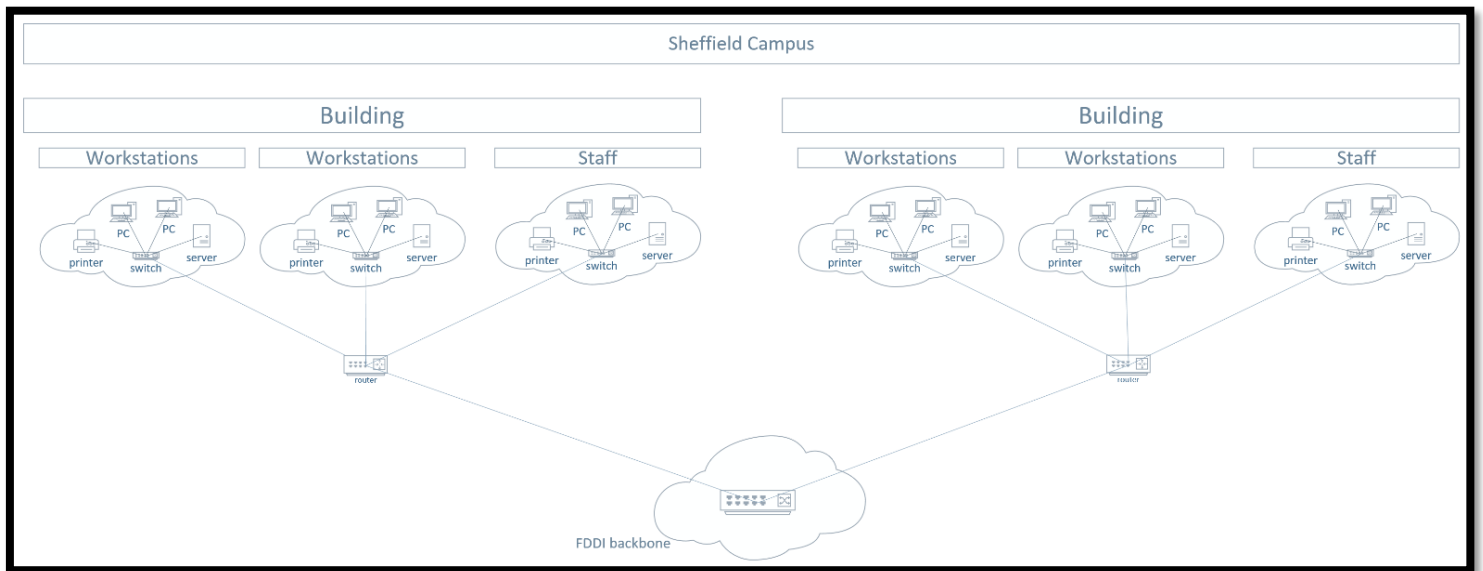➢ *"The **Sheffield campus** has two buildings connected by an FDDI backbone"*

Figure 6

Figure 6 represents two buildings connected via an FDDI backbone (**FDDI** = Fibre Distributed Data Interface; Data rate: 100Mbit/s; Fibre optic; based on the Token Ring protocol).

4 - Dotheboys College

> *"**Dotheboys College** (principal Dr. Wackford Squeers) has campuses located in Leeds, Hull and Sheffield. Each site has its own network infrastructure and is connected to the other two sites via WAN links."*
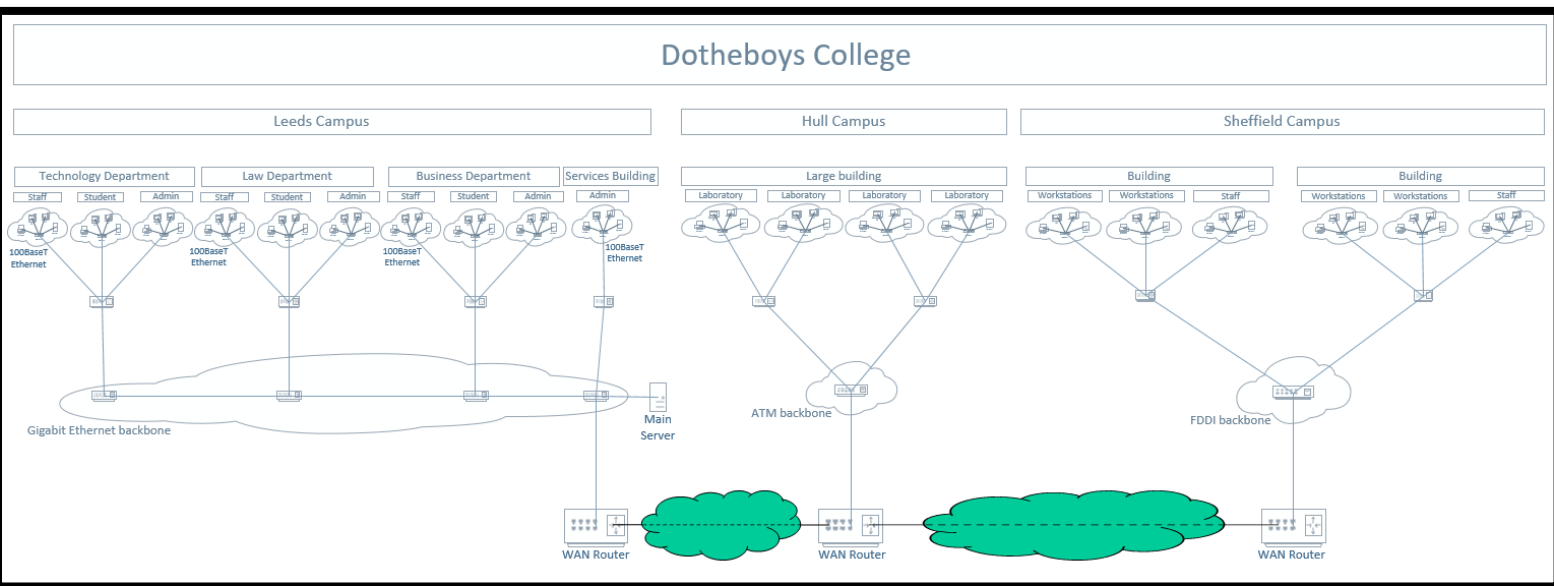

Figure 7

To conclude the design of the College, Figure 7 represents the three campuses connected together with WAN links which, unlike the rest of the campuses, are not owned by the College but must be leased by a Network Service Provider.
WAN routers are used to connect the College with the rest of the Internet.