

Task: A large university has recently purchased a new building that consists of a ten storey office block in the centre of town. Each level is to be turned into teaching and administrative space, housing up to 100 computers per floor. Each floor is to have its own network that may be isolated from the other floors, but all interconnected via a suitable backbone. Each user is to have a nominal data rate of 10Mbps.

Produce a reasonably detailed design in which the individual LANs may be implemented. You should specify the technology to be used and the main components (e.g. hubs, routers, etc.).

Answer:

Creating a Design.

Given the scenario presented, here follows a design of one of the floors of the University building showing the architectural floor plan and the LAN design utilizing the Extended Star as the LAN topology.

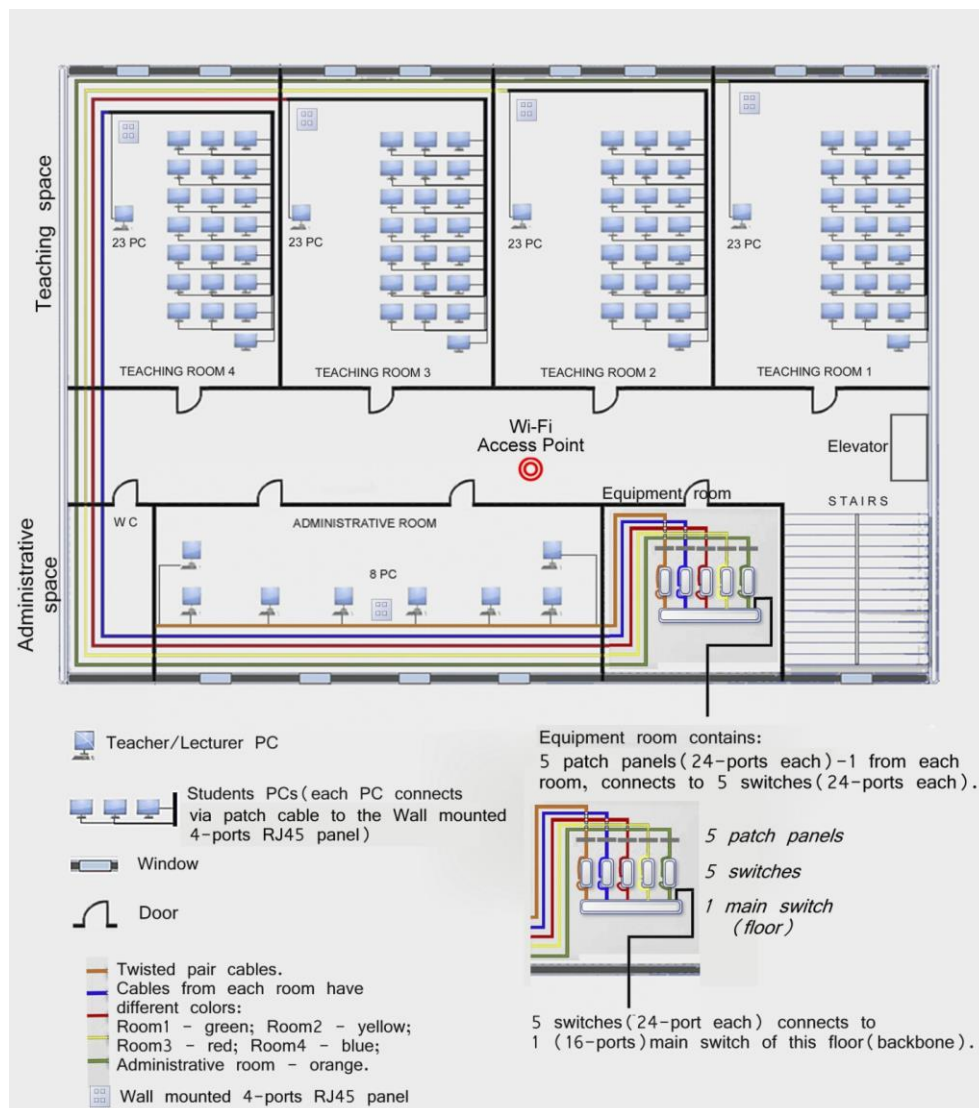


Figure 1. An example of the University floors from 1 to 4 and from 6 to 10

An explanation of the design in here follows:

Floors 1-10 will contain all the University Operating floors, whereas the fifth floor will also house the Server. Figure 1 presents an example of the University floors from 1 to 4 and from 6 to 10; whereas Figure 2 below presents the 5th floor depicting the Server within this floor's Equipment room.

On a floor there are 4 Teaching rooms (with 23 PCs per room), 1 Administrative office (with 8 PCs), 1 Equipment room, a Wi-Fi Access Point, a WC, stairs, and an elevator access.

Each Teaching room contains 23 computers (22 for students and 1 for teacher/lecturer), 5 wall-mounted 4-ports RJ45 panels and 1 wall-mounted 3-ports RJ45 panel (23 ports in total for 23 PCs). Each PC is connected through patch cable to a wall panel. Each wall panel is connected through twisted pair cable to the 24-ports patch panel, which is located in the Equipment room.

The Administrative office contains 8 computers, 5 wall-mounted 4-ports RJ45 panels and 1 wall-mounted 3-ports RJ45 panels (23 ports in total for 23 PCs). Each PC is connected through patch cable to a wall panel. Each wall panel is connected through twisted pair cable to the 24-ports patch panel, which is located in the Equipment room. Despite the fact that the Administrative office is currently using only 8 PCs (8 ports) - all the wall panels for 23 PCs are implemented into the wall. This is necessary if, for example, the Administration will need to connect printer, new computers, or auditors need to connect their laptop to the network, and so on.

Each room has a different color of the cable. It is necessary for high-quality cabling design, as well as in the case of rapid troubleshooting cable. Cables are passed from the wall panels located at the bottom of the walls, up to the ceiling from the room number 4, via room number 3, 2, 1, Administrative office; and are passed in the Equipment room and each connected to its own port in the 24-ports Patch panel.

The Equipment room contains: 5 Patch panels with 24-ports each (1 Patch panel per room), 5 Switches with 24-ports each (1 Switch per room), 1 Main 16-ports Switch per floor, and an additional cable as spare.

Each room on the same floor is connected from each wall panel via twisted pair cable to its own 24-ports Patch panel (each of the 23 PCs in 23 ports), which is located in the Equipment room.

The 24th port of the Patch panel is empty.

All 23 patch cables from the Patch panel connect to the 24-ports Switch from port 1 to 23. The 24th port is connected through the Patch cable to the 1st port of 16-ports Main Switch per floor.

In the Main 16-ports Switch, only 5 ports are utilized (5 rooms) and the 6th port connects through the crossover cable of this floor with the other 9 floors in the Backbone.

Figure 2 below presents the design of the 5th floor.

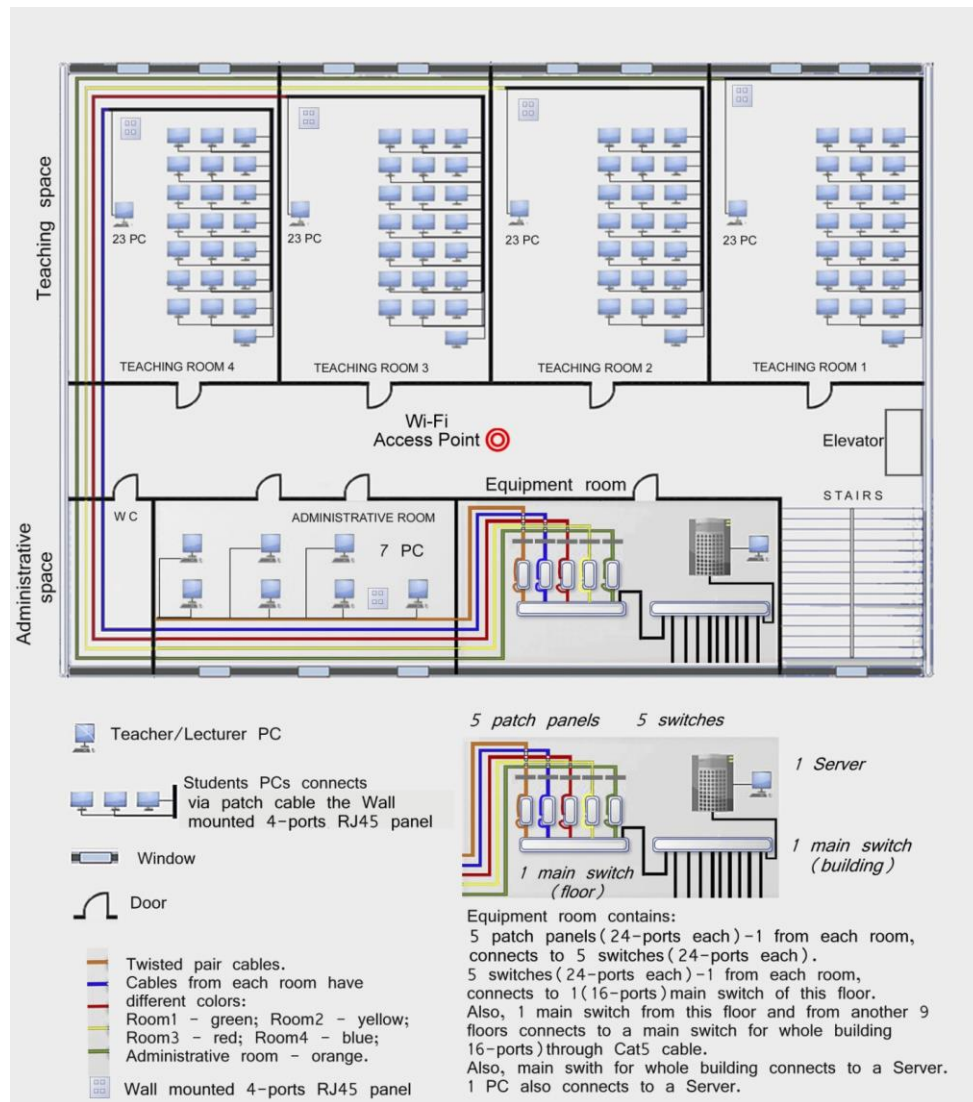


Figure 2. An example of the University's 5th floor depicting the Server.

The Server was placed on the 5th floor of the building for several reasons.

Firstly, for security purposes.

Secondly, elevated from the ground floor for protection from natural disasters, such as flooding.

Thirdly, for the cable weight. There is a significant difference in cable weight if the cable has to be pulled down from the 10th all the way to the 1st floor, then from the 5th floor spanning only 5 floors up and down.

On the 5th floor there are 4 Teaching rooms (with 23 PCs), 1 Administrative office (with 7 PCs), 1 Equipment room, a Wi-Fi Access Point, a WC, stairs, and an elevator access.

The Teaching room are identical to those of the other floors as detailed above.

The Administrative office contains 7 computers, 5 wall-mounted 4-ports RJ45 panels and 1 wall-mounted 3-ports RJ45 panel (23 ports in total for 23 PCs). Each PC is connected through patch cable to a wall panel. Each wall panel is connected through twisted pair cable to the 24-ports patch panel, which is located in the Equipment room. Despite the fact that the Administrative office is currently using only 7 PCs (7 ports) - all the wall panels for 23 PCs are implemented into the wall.

It is necessary, for example, if the Administration will need to connect printer, new computers, or auditors need to connect their laptop to the network, and so on.)

The Equipment room is located on the 5th floor of the building and contains: 5 Patch panels 24-ports each (1 Patch panel per room), 5 Switches with 24-ports each (1 Switch per room), 1 Main 16-ports Switch per floor, 1 Main 16-ports Switch per building, Server with PC, optional cable.

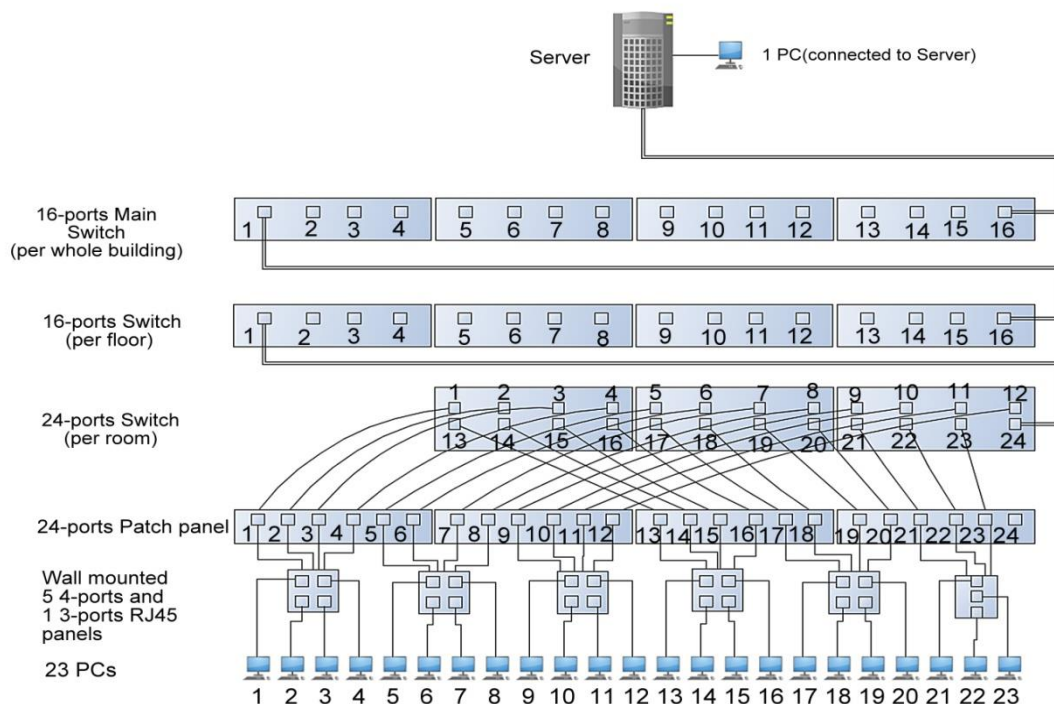


Figure 3. An example of cables connections.

Each room on the same floor is connected from each wall panel via twisted pair cable to its own 24-ports Patch panel (each of the 23 PCs in 23 ports), which is located in the Equipment room.

24th port of Patch panel is empty.

All 23 patch cables from Patch panel connect to the 24-ports Switch from port 1 to 23.

The 24th port is connected through Patch cable to the 1st port of 16-ports Main Switch per floor.

In the Main 16-ports Switch per floor, only 5 ports (from 1 to 5) are utilised (5 rooms), and the 16th port connects through cable to the 1st port of the Main 16-ports Switch for whole building.

In the Main 16-ports Switch per floor only 5 ports (from 1 to 5) are utilised (5 rooms) and the 16th port connects through crossover cable to the 1st port of the Main 16-ports Switch for whole building.

In the Main 16-ports Main Switch for whole building only 10 ports are utilized and the 16th port connects to the Server.

This LAN design consists of the following components:

- A network interface card (NIC) in each computer
- Computers
- Wall-mounted ports with RJ-45
- Ethernet cable Cat5 unshielded twisted-pair UTP
- 24-ports Patch panels
- 24/16-ports Switches
- Server
- Access point
- Power supply
- Networking software.