Module Title: Software-Defined Networking and Wireless Network Security

Assignment number: 2

Assignment Topic: WLAN design and planning with security

Submission deadline: 19th December 2025

Total marks: 100

Weightage: 15%

Objective:

- To familiarise with Wireless Local Area Network Design and Planning.
- To design a WLAN as part of the LAN.
- To create multiple WLANs with different SSIDs and VLANs.
- To select an appropriate security protocol or technique.

Part 1: (40 Marks)

Describe the planning and design of a wireless local area network (WLAN). If you are given a chance to deploy a WLAN for a company. How will you complete that task, and what things should you consider for WLAN planning, design, and security? Describe, but also provide a diagram of your network.

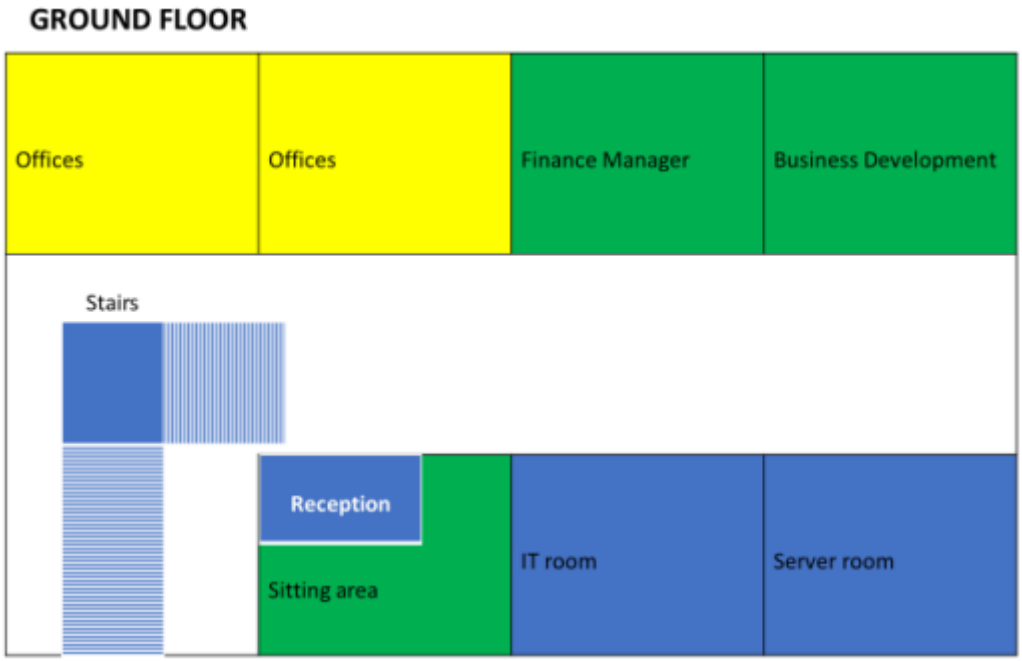
Write a brief report with important points. The following points are just an example for you to think.

- Number of departments (eg, 3 departments)
- Number of IP addresses (eg, 3 employees per department)
    - IP subnets for each SSID
    - DHCP scopes or static assignments
- VLANs
- Access points (which AP models) and their placements **
    - Number, type, and estimated locations of access points
    - Floor plan considerations and coverage zones
    - Channel planning (2.4 GHz & 5 GHz), interference avoidance, and signal overlap design
- Use of wireless LAN controller
- WLAN topology and architecture
    - Type of WLAN architecture (centralised, distributed, controller-based, cloud-managed, etc.)
    - Network requirements (coverage, capacity, mobility, security)
- SSIDs and network segmentation
- DHCP strategy
- Which encryption technique should be used and why?
- Firewall connectivity to protect wireless networks
- Security techniques, attacks, and vulnerabilities
- Cost

- Security and compliance planning
    - Authentication methods (RADIUS, certificates)
    - Wireless intrusion prevention (WIPS/WIDS)
    - Guest network isolation
- Hardware and software requirements

Planning mainly includes initially the plan on the network design. List of important aspects, like placement of wireless access points in a diagram, and black spots. Spectrum mapping and coverage. Number of APs and switches required, where they will be placed. What will be the topology? Where will servers be? Secondly, how many subnets will you require? How many SSIDs will you require? How will you stop an employee from connecting to a wireless network of a different department? The choice of AP model, protocols, security considerations, antenna, PHY layer and MAC layer techniques. Servers and their placement, if any. Antenna height,

As an example, I am providing you with a rough ground floor diagram. Assume there is only one floor. Assume each room is 30x30 m^2 and the corridor is 120x2 m^2. Entrance is again 30x30.



Deliverable:

A report of 1000 – 1500 words.

You need to provide details on planning a wireless local area network and provide details on what you will consider. If you have selected a topology, what are the reasons? If you are deploying two Access Points in one location, explain the reasons. How many WLAN networks will you suggest and deploy, and why? How many IP addresses will you allocate and allow? Provide some details on the security side, like which threats/attacks and vulnerabilities you can avoid by your choice of network design. This is just an example.

Marks distribution:

- WLAN Architecture, diagrams, and justifications: 10 marks
- Access point placement and planning: 10 marks
- SSID, segmentation, IP addressing, DHCP: 10 marks
- Security planning and HW/SW requirements: 10 marks

Part 2: (60 Marks)

You need to design and implement a WLAN for a company. Their requirements are mentioned below.

- A wireless access to connect to the Internet for their employees.
- A separate VLAN for each of the 3 department employees. Separate subnet for each department.
- A VLAN for a Local area network as a separate subnet.
- Central configuration and management of Access points using a wireless LAN controller.
- Separate SSID for each department. (One can be shown at least)
- Using DHCP is up to you, how you want to implement it (separately or within an ML (multi-layer) switch)
- You might need a router or ML switch to connect different VLAN traffic.
- You need to think about the proper encryption and authentication technique to be used, but you need to give a reason why you want to choose, for example, WEP, WPA, WPA2, PSK, EAP, etc.

For the first part of the Internet, you can also configure a separate web server, but it should be accessible by all the subnets.

To make it more secure, you might need to add a DMZ, put a web server within the DMZ and provide access using a firewall device.

The LAN and WLAN subnets should be connected, which means they must be able to ping each other.

Deliverables:

- A report discussing the design and the implementation. Use a screenshot of each step and show it's working. (Max 1500 words)
- Show the output of working in the report. The ping command is used between each WLAN-related VLAN and LAN-related VLAN. Web access from each VLAN to the Web server.
- Provide packet tracer file. Mandatory

Marking:

- Network design and implementation covering all parts: 40 marks
- Description and step-by-step explanation of each task: 20 marks
- **Reasoning on choices like the security techniques used is mandatory.**