# FIT9137 Applied Week 6

**Topics:**

**Backbone Networks**

- Metropolitan Area Networks (MAN)
- Wide Area Networks (WAN) &
- Virtual Local Area Networks (VLANs)

**Covered Learning Outcomes:**

- Analyse and formulate the functions of communication architectures of local area networks, wide area networks and the Internet.
- Examine networks using the underlying fundamental theories, models, and protocols for data transmission.

**Instructions**

- One of the main purposes of an applied session is to build the learning community, create connections and include the learners. The other goal is to give and receive feedback from your peers and or your tutors.
- Form groups of 2 students (peers) to work through the exercises. If met a problem, try to solve it by asking direct questions to your peer. If the issue was not solved within peers, ask your tutor. If did not get a chance to solve the problem during your applied session with your peer or tutor, jump into one of many consultation hours and ask any of the tutors to help you. Please visit the "Teaching Team and Unit Resources" tile in the FIT9137 Moodle site.

## Backbone Networks

1. **What's a Metropolitan Area Network (MAN)?**

   A Metropolitan Area Network (MAN) is a computer network that connects computers within a metropolitan area, such as a single large CBD Central Business District such as Melbourne or Sydney, multiple cities/towns, or any large area with multiple buildings. A MAN is larger than a local area network (LAN) but smaller than a wide area network (WAN). Like WANs, a MAN is made up of interconnected LANs. Because MANs are smaller, they are usually more efficient than WANs, since data does not have to travel over greater distances. MANs may combine the networks of multiple organizations into one, or they can be managed by a single service provider.

   The size of MANs usually ranges from 5 km to 50 km. The purpose of MAN (Metropolitan Area Network) is to provide the link to the internet in the long run. A MAN (Metropolitan Area Network) usually incorporates several LANs to form a network. This large network MANs (Metropolitan Area Network) backbone comprises of an optical fiber set-up.

2. **What is a Wide Area Network (WAN)?**

In its simplest form, a wide-area network (WAN) is a collection of local-area networks (LANs) or other networks that communicate with one another. A wide area network is a large network of information that is not tied to a single location. WANs can facilitate communication, the sharing of information and much more between devices from around the world through a WAN provider such as International, Regional and Local Internet service providers. WANs can be vital for international businesses, but they are also essential for everyday use, as the internet is considered the largest WAN in the world. A WAN is essentially a network of networks, with the Internet the world's largest WAN. A wide area network (WAN) is any network that extends over a large geographic area, usually connecting millions of local area networks (LANs).

3. **Explain what are backbone networks and what type of technology is used in such networks??**

Backbone networks are High speed links between LANs and owned and operated by the same company. They enable communication between different LANs and provides connections to other backbones such as MANs in the CBD area and WANs in general and that connect to the public Internet.

A backbone or core network is a part of a computer network which interconnects pieces of various networks, providing a path for the exchange of information between different LANs or subnetworks. A backbone can tie together diverse networks in the same building, in different buildings in a campus environment, or over wide areas. Normally, the backbone's capacity is high speed links greater than the networks connected to it. They are High speed links between LANs, owned and operated by the company, enables communication between different LANs and provides connections to other backbones, MANs, WANs, and the Internet.

The technology used in such high-speed backbone networks are high-speed physical layer (often optical fibre), and implemented with core switches and/or core routers

A large corporation that has many locations may have a backbone network that ties all of the locations together, for example, if a server cluster needs to be accessed by different departments of a company that are located at different geographical locations. The pieces of the network connections (for example: Ethernet, wireless) that bring these departments together is often mentioned as network backbone. Network congestion is often taken into consideration while designing backbones.

One example of a largest backbone network is the Internet backbone.

4. **Define VLAN and how they are defined and configured?**

A virtual LAN (VLAN) is any broadcast domain that is partitioned and isolated in a computer network at the data link layer (OSI layer 2). LAN is the abbreviation for local area network and in this context virtual refers to a physical object recreated and altered by additional logic. A VLAN is a group of devices on one or more LANs that are configured to communicate as if they were attached to the same wired

network, when in fact they are located on several different LAN segments in different physical locations. Because VLANs are based on logical instead of physical connections, they are extremely flexible to manage.

**5. Can a VLAN span multiple switches?**

The answer is yes. While you can have more than one VLAN on a switch, they cannot communicate directly with one another on that switch. So for different VLAN's to communicate, the communication is only possible via routers. Hence VLAN to VLAN communications requires the use of a router. VLANs can span multiple switches as VLAN are identified based on switch port configuration, and so you can have more than one VLAN on each switch.

**6. List and briefly explain the VLANs advantages?**

- VLANs enable logical grouping of servers and computer stations that are physically dispersed on a network.
- VLANs enable users to keep the fixed assigned IP address, when people move office they can keep their IP addresses (just reconfigure the switch).
- VLANs reduce the need to have routers deployed on a network to contain broadcast traffic. Confinement of broadcast domains on a network significantly reduces traffic and limits it to the same subnet.
- VLAN's can organize the IP subnets by VLANs function.
- VLAN's are very Efficient as they are faster, cheaper, easier to configure than using routers to manage routing.

**7. How does VLAN work? and how VLAN is implemented?**

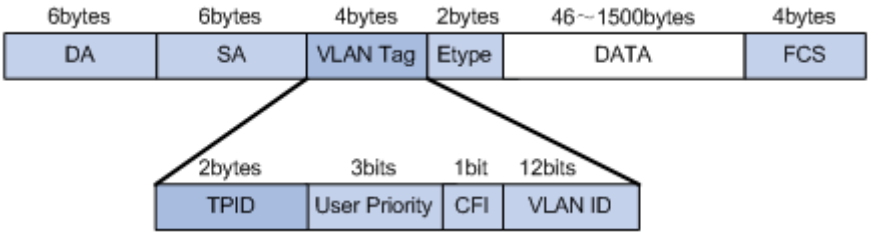
VLANs is implemented by network admin's who automatically define a VLAN group and configure a specified group of users by dividing workstations into different isolated LAN segments. These workstations can be in one physical location or different physical location, or the users move their workstations anywhere they will still be in the same VLAN, administrators don't need to reconfigure the network or change VLAN groups. Only configure the Switches that supports VLAN.

VLAN is implemented and configured on a VLAN supporting switch by placing or inserting 802.1Q tag to the frames to identify the frame into a single VLAN and make it into a single broadcast domain.

IEEE organization define the standard as IEEE 802.1Q, often referred to as Dot1Q, is the networking standard that supports virtual LANs (VLANs) on an IEEE 802.3 Ethernet network. This is performed by processing at datalink layer-2, when a frame enters the VLAN-aware portion of the network, a tag is added to represent the VLAN membership. Each frame must be distinguishable as being part of a VLAN.

The VLAN tag contains VLAN ID + priority code, The VLAN ID is 12 bits value that can identify 4096 VLANs. Switch configuration is done by network admin and they

define which VLANs span which switches, and how switches are connected (trunks).




- TPID - Tag Protocol Identifier (16 bits): set to a value of 0x8100 to identify the frame as an IEEE 802.1Q tagged frame.
- User Priority (3 bits): indicates the priority level (0 through 7) used for QoS.
- CFI - Canonical Format Indicator (1 bit): specifies if the MAC address is in noncanonical (1) or canonical (0) format.
- VID - VLAN Identifier (12 bits): uniquely identifies the VLAN which the frame belongs to.

802.1Q Tagging The 802.1Q standard adds this information to the Ethernet header, as shown in the figure below. The priority level values range from zero (best effort) to seven (highest). These values can be used to prioritize different classes of traffic. The VLAN ID tag specifies the VLAN to which the frame belongs.