LAB SESSION WEEK 5 – TUTORIAL NOTES

GENERAL INFORMATION

1. Discussion Boards Opened → The more you participate the more examples will be posted

   VLSM

   ARP, Inter-VLAN and Intra-VLAN comms

2. Group Lab Activity 1 Today

   Form your groups and send me a private message with the team members (only one of you)

   Anyone NOT in a group, I will place you in one.

   Activity sheet now available in Canvas → Lab sessions page, Week 5 tab.

   You have one week to submit the completed Activity Sheet in Canvas

   I will create the Canvas groups –> only one team member needs to submit.

REVISION

1. Basic configuration → Disable DNS lookup, hostname, SSH (user/pwd), **logging sync**, MOTD, shut unused ports
2. Logging sync → Configured in the **line console 0**. This command syncs the console input/output buffer
3. The VLAN database → VLAN IDs, VLAN names and VLAN Membership (also need to know how to remove VLANs)
4. 802.1q → Frame tagging, trunk interfaces
5. DTP →
6. When using layer 2 switches alone, only hosts within the same VLAN and same IP Network can talk to each-other
7. Also, only a host in VLAN 99 will be able to ping the IP address on interface VLAN 99 (again, if they belong to the same IP Network)
8. This is because the switch only can make forwarding decisions based on MAC addresses
9. An interface VLAN will be in the protocol “down” state if there are no active (up) ports for that VLAN or the VLAN is not created
10. For hosts in different VLANs – i.e. in different IP networks – to communicate with each other, we need to have a routing device.
11. Some sh commands:

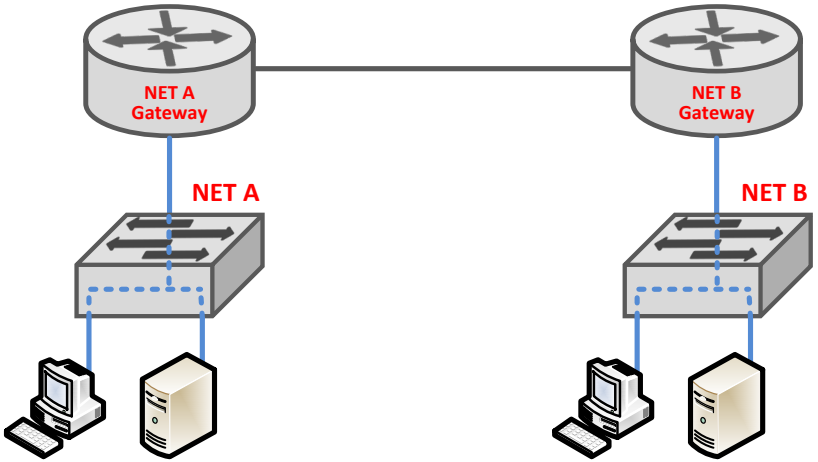
    sh vlan brief

    sh vlan id <x>

    sh interface trunk
12. Answer to connectivity scenarios in Lab-SU4a → go to lab handout.
13. What happen with the VAN connection after enabling port-security?

TUTORIAL

Intra-VLAN vs Inter VLAN communication



The Default Gateway

1. If hosts are not connected to the same shared media, they can't just exchange messages over the media
2. If the final destination is outside their Network, they need the aid of an intermediary device

   A communication device (typically a router) able to send messages between 2 IP Networks
3. Hosts must know the IP of their **Default Gateway** in order to communicate outside their Network
4. Today you are going to be asked to configure a default gateway, but we don't really have one in the network

ARP Process

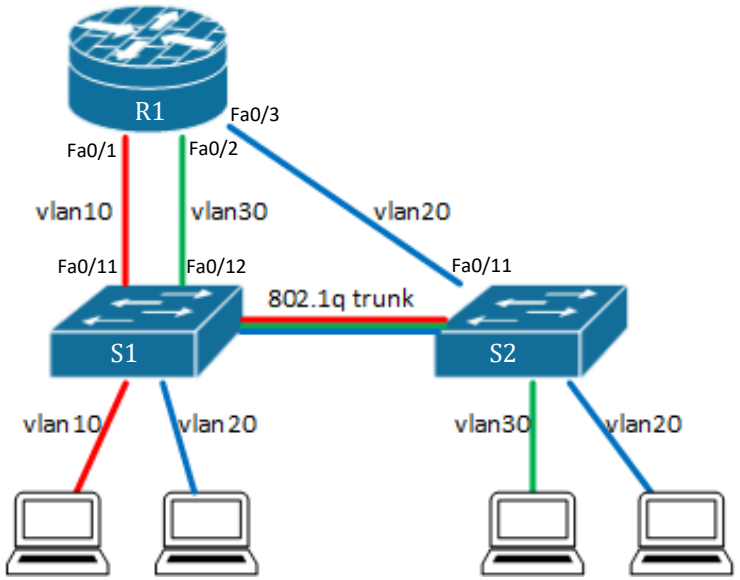
1. Packets need to be encapsulated in a L2 frame for transmission
2. Hosts then need to know the dest. MAC address to be used for a particular dest. IP address
3. How do they know? The ARP (Address Resolution Protocol) process

4. When first need to send a message to a particular IP address:
    - If in the same Network → L2 broadcast ARP request: who is 'destination IP address'
    - If NOT → L2 broadcast ARP request: who is 'default GW address'

Inter-VLAN routing configuration:

1. Per-interface inter-VLAN routing (Lab 5a)
2. Router-on-a-stick (Lab 5B)
3. Layer 3 switching (not covered in this Unit)

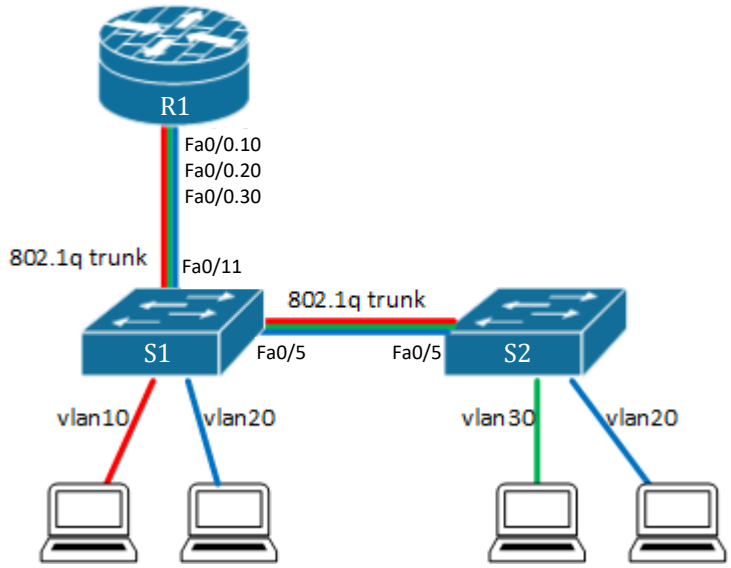
Per-Interface Routing



1. One router Interface per VLAN → This router interface will hold the default gateway address for that VLAN

2. When needing to communicate outside their network → hosts find a way through the switched network up to their default gateway
3. The Default Gateway (i.e. the router) will use the routing table to find the exit interface for the destination host
4. Configure an 802.1q trunk on inter-switch link (as we learned in lab 4)
5. How do we configure Fa0/11 on S1? → access for VLAN 10
6. How do we configure Fa0/12 on S1? → access for VLAN 20
7. How do we configure Fa0/11 on S2? → access for VLAN 30
8. How do we configure Fa0/1, Fa0/2 and Fa0/3 on R1? → default gateway IP address/mask for VLAN 10, 30 and 30
9. Routers have limited (usually a few) interfaces → restricts the number of VLANs to only a few.
10. Do you see a problem with this approach?

Router-on-a-stick



1. Only ONE interface between one of the switches and the router → this link will carry **ALL** VLANs
2. Configure an 802.1q trunk on inter-switch link (as we learned in lab 4)

   Fa0/5 on S1 and Fa0/5 on S2 configured as switchport mode trunk
3. Configure the switchport connecting to router as an 802.1q trunk

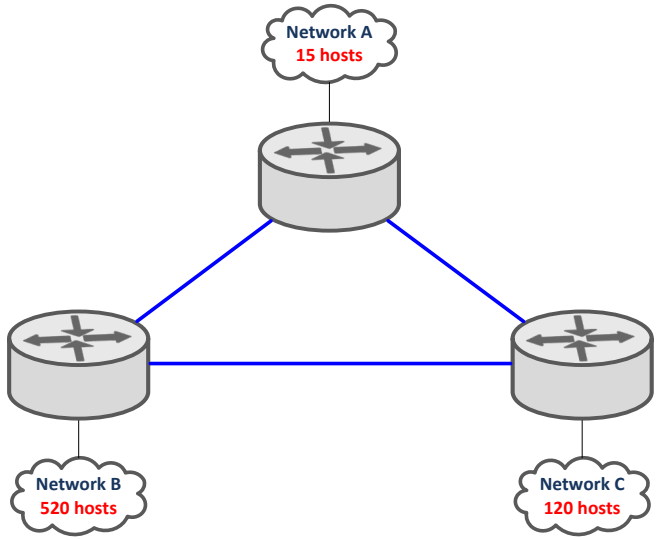
   Fa0/5 on S1 and Fa0/5 on S2 configured as switchport mode trunk
4. Configure sub-interfaces on the router with the corresponding 802.1q encapsulation for each VLAN

   We need at least 3 sub-interfaces (1 more if we are configuring a switch management VLAN)
5. Each sub-interface will be configured with the default gateway address for the corresponding VLAN
6. When needing to communicate outside their network → hosts find a way through the switched network up to their default gateway
7. The Default Gateway (i.e. the router) use the routing table to find the exit sub-interface for the destination host
8. Efficient use of router interfaces without restricting the number of VLANs to the number of available router interfaces.

VLSM exercise

Major Network: 172.16.0.0/16

Refer to diagram for Network and Host requirements



Solution:

- How many networks do we need? 6
- Arrange the Networks by size:
    - Network B
    - Network C
    - Network A
    - Link 1
    - Link 2
    - Link 3

Network B (520 hosts):

- How many usable IP addresses? → 1024 – 2 = 1022
- How many host bits? → 1024 = 2^10 → 10 host bits
- How many network bits? → 32 bits – 10 host bits → 22 network bits
- Subnet mask? → /22
- Subnet mask in dotted decimal notation? → 255.255.252.0

11111111	.	**11111111**	.	**11111100**	.	**00000000**
255	.	255	.	128+64+32 +16+8+4	.	0
255	.	255	.	252	.	0

- Network address → 172.16.0.0/22

172	.	16		**0000000**	.	**0000000**
172	.	16		0	.	0

- Broadcast Address → 172.16.3.255/22

172	.	16		**0000011**	.	**11111111**
172	.	16		3	.	255

Network C (120 hosts):

- How many usable IP addresses? → 128 – 2 = 126
- How many host bits? → 128 = 2^7 → 7 host bits
- How many network bits? → 32 bits – 7 host bits → 25 network bits
- Subnet mask? → /25
- Subnet mask in dotted decimal notation? → 255.255.255.128

11111111 . 11111111 . 11111111 . 10000000

255 . 255 . 255 . 128

- Network address → 172.16.4.0 /25

172 . 16 . **0000100** . **00000000**

172 . 16 . 4 . 0

- Broadcast Address → 172.16.4.127 /25

172 . 16 . **00000100** . **01111111**

172 . 16 . 4 . 64+32+16+8+4+2+1

172 . 16 . 4 . 127

Network A:

- How many usable IP addresses? → 32 – 2 = 30
- How many host bits? → 32 = 2^5 → 5 host bits
- How many network bits? → 32 bits – 5 host bits → 27 network bits
- Subnet mask? → /27
- Subnet mask in dotted decimal notation? → 255.255.255.224

11111111	.	**11111111**	.	**11111111**	.	**11100000**	
255	.	255	.	255		128+64+32	
255	.	255	.	255	.	224	

- Network address → 172.16.4.128 /27

172	.	16	.	**0000100**	.	**10000000**	
172	.	16	.	4	.	128	

- Broadcast Address → 172.16.4.159 /27

172	.	16	.	**00000100**	.	**10011111**	
172	.	16	.	4	.	128+16+8+4+2+1	
172	.	16	.	4	.	159	

Link 1:

- How many usable IP addresses? → 4 – 2 = 2
- How many host bits? → 4 = 2^2 → 2 host bits
- How many network bits? → 32 bits – 2 host bits → 30 network bits
- Subnet mask? → /30
- Subnet mask in dotted decimal notation? → 255.255.255.252

11111111	.	**11111111**	.	**11111111**	.	**11111100**	
255	.	255	.	255		128+64+32+16+8+4	
255	.	255	.	255	.	252	

- Network address → 172.16.4.160

172	.	16	.	**0000100**	.	**10100000**	
172	.	16	.	4	.	128+32	
172	.	16	.	4	.	160	

- Broadcast Address → 172.16.4.163

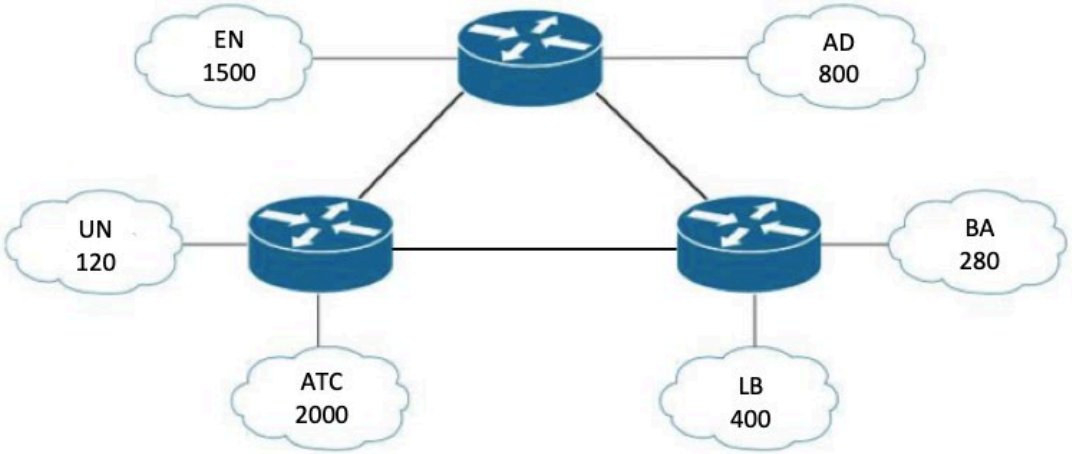
172	.	16	.	**0000100**	.	**10100011**	
172	.	16	.	4	.	128+32+ 2+1	
172	.	16	.	4	.	163	

Calculate Link 2 and Link 3's Networks.

VLSM Exercise 2

Note: For students to complete in their own time.

Major Network: 136.186.224.0/19



Network Name	Network Address	Subnet Mask	Broadcast Address