Lab Exercise Sheet 3

Content: IEEE 802.1Q (VLAN)

Document and analyze your experimental procedures by using your Wireshark and terminal recordings. Note all relevant intermediate steps. Mark and explain all relevant information, such as protocol header fields, MAC addresses, IP addresses, port numbers. If you have little experience with Linux, you may need to do some research.

Group number:	
First name:	
Last name:	
Student number:	

This lab exercise uses a different logical network topology than in the first two exercise sheets. However, the physical topology (can) still remain the same. Instead of having a single network used by all four machines, you will create two networks with two different logical networks encapsulated in distinct VLANs. Hence, you will have to setup and configure a managed switch between the two networks and connect the hosts via VLAN tags to their distinct network. On layer 3 you can freely chose between IPv4 or IPv6.

In this lab, you will once again use Linux machines running the Debian operating system. All machines are equipped with network interface controller (NIC) capable of VLAN tagging. For connecting the hosts to the tagged network you can choose between **Port-based** and **Tagged VLAN**. The `ip` command is suitable for the configuration of tagged interfaces in Linux. For the configuration of Port-based VLAN you can use the provided **TP-Link TL-SG108E** Switching device.

For the lab exercise, you need to disable the Network Manager if it is not already disabled by default! Your configuration on the hosts needs to be done manually.

Furthermore, the experiments need to be conducted using the Command-Line Interface (CLI) and Wireshark.

Examination

For this Lab Exercise you need to prepare slides documenting your setup! The slides should contain your network configurations, steps performed and screenshots of relevant captures! Send your slides to your lecturer and present your results in the lecture!

1. **Premise**

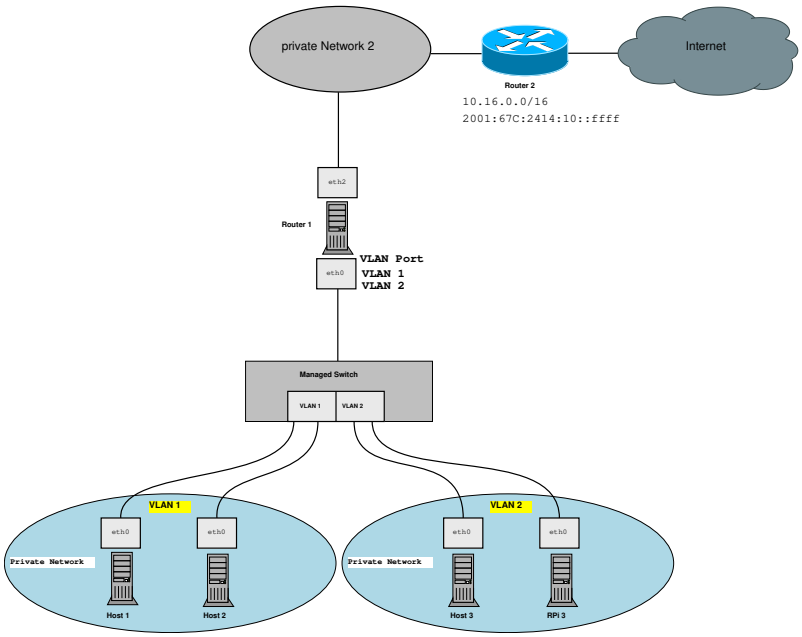

Figure 1: Network Topology of lab exercise 3

Figure 1 presents the object of the study. You are asked to configure the presented network topology and conduct experiments demonstrating the functionality of the network technology **802.1Q**. There are different ways of setting up a VLAN. You are free to choose the way you want to configure the VLANs.

Proposed Structure of the experiments

Please identify, investigate and document the following things:

(a) Object of study (what is studied?),

(b) Purpose (what is the intention?),

(c) Quality focus (which effect is studied?)

2. **Object of study**

Please identify what you want to study in your experiments and how you want to quantify the results of your experiments. For that you should identify the network topology that you are setting up. Afterwards you are asked to investigate the possibilities of setting up VLAN in this experiment. There are two possible ways:

- **Port-based VLAN**
- **Tagged VLAN**

Get familiar with the two possibilities and investigate the benefits and drawbacks of the two setups. Explain the difference between the two technologies. Document your findings and explanations!

Setup an experiment using one of the technologies and investigate the technologies using suitable tools (e.g Wireshark). You can choose **IPv4** or **IPv6** for your experiments!

3. **Purpose**

   Inspect the literature and make yourself familiar with VLAN in Linux. Sketch a diagram for the setup of your experiments and make a plan on the execution of your experiments!

   (a) Study the function of VLAN and how it works.

   (b) Study the packet analyser wireshark in detail.

   (c) Study the functions of `ip` and the managed switch in detail.

   (d) Study the function of VLAN tags on Layer-2 and how to set in a Linux Host.

   (e) Study what you can use to test your setup and how you can demonstrate your results.

   (f) Find suitable ways to demonstrate the benefits using your experimental setup!

   Please identify the purpose of the used technology and explain the benefit of using it in a practical use case.

4. **Quality focus**

   Focus on the following points in this experiment and find possible ways to show the following points:

   (a) How does VLAN work?

   - Explain the function of VLAN. Sketch a diagram illustrating the functionality of VLANs in the network stack and present the effects of VLAN on the **Broadcast Domain**!

   (b) How can a local network (LAN) be divided? (physically and logically)

   - Setup a network topology separating **Host 1** and **Host2** from **Host 3** and **RPi3** using VLANs!
   - Demonstrate the separation of the two resulting networks.

   (c) What are the benefits of using VLANs?

   - Explain the benefits of using VLANs compared to other networks protocols!
   - Demonstrate the benefits of using VLANs compared to other networks protocols! Use a suitable way for the practical demonstration (e.g. Wireshark)

   (d) What are the uses cases for VLAN?

   - Find practical use cases for the application of VLAN and explain the benefits of its use!

- Find alternative protocols, which offer the same functionality as VLAN!
- Find the limitations of VLAN and the purpose for its invention!

(e) Where is the use of VLAN suited?

- Make a critical assessment of VLAN and its purpose in practical applications!
- Make a recommendation for the applicability of VLAN in practical use cases!

Tests and Documentation

Document and present your findings!