CCNA   **SRWE Lab 1**

                               Names:
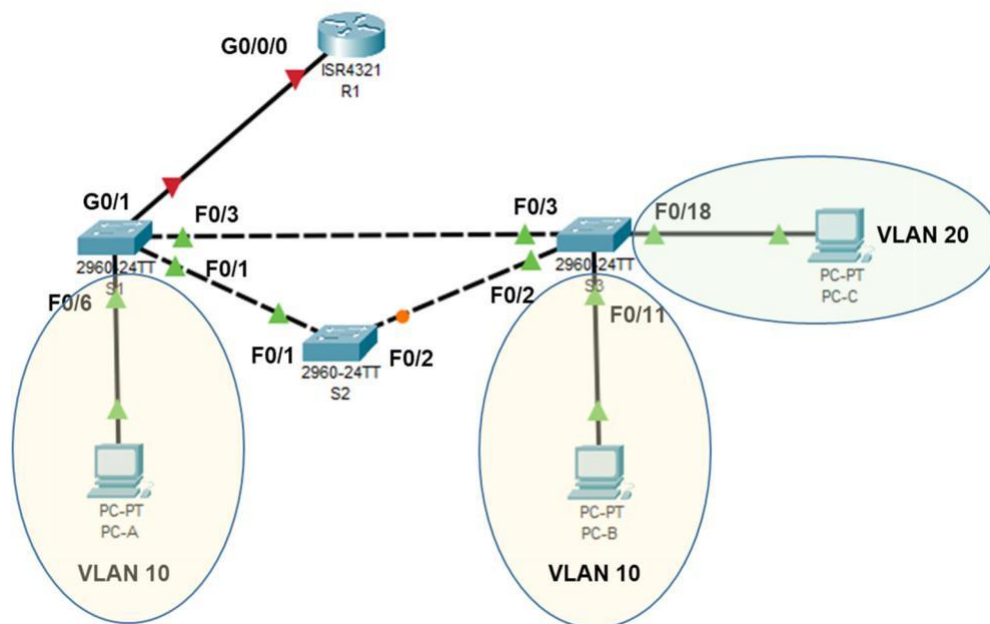
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VLANs and 802.1Q Trunks

Inter-VLAN-Routing

Lab Preparations

SRWE Assessments: Modules 1 - 4:

                             Switching Concepts, VLANs, and Inter-VLAN Routing Exam

NP Course: NP Chapter 8

Cisco IOS Commands

Lab Instructions

Task 1 - VLAN Database and Switch Access Ports

Task 2 - IEEE 802.1Q Trunks Task 3 -

Inter-VLAN-Routing

Deliverables and List of Due Dates

Write your answers in **red color**. You may use the comment capabilities of the free Adobe reader.

Part 1:   Cisco IOS Basic Configuration Commands

a. Read the **Lab Instructions** of this Lab, and read NP chapters 8

b. Check the **IOS Command List**, provided for the Labs and Review already used and new configurationcommands.

Part 2:   Recall Basic Configuration Commands

a. Basic router interface commands

-   Configure router interface g0/1 with description "Link to LAN-A", IP address 172.16.10.1/29 and activate it

R1(config)# interface g0/1
R1(config-if)# description Link to LAN-A
R1(config-if)# ip address 172.16.0.1 255.255.255.248
R1(config-if)# no shutdown

-   Display the status of all **interfaces** in brief.   **R1(config)# exit**

    R1# show ip interface brief or sh ip int br

-   Display the status of all **interfaces** in brief.
    R1# show ip interface brief or sh ip int br

-   Display the **detailed status** of the interface g0/1
    R1# show ip interface g0/1

-   Display the **routing table**.
    R1# show ip route

-   Display the **running configuration**.
    R1# show running-config or sh run

Part 3:   Cisco IOS Switch VLAN / Trunk Commands

a)   Basic VLAN switch configurations

-   Create **VLAN 57** with name "students" on switch S1
    S1(config)# vlan 57
    S1(config-vlan)# name students

-   Configure S1 switch port f0/23 to be **access port** for VLAN 57

    S1(config)# interface f0/23
    S1(config-if)# switchport mode access
    S1(config-if)# switchport access vlan 57

-   Display the **VLAN database** in brief
    S1# show vlan brief

b) Basic Trunk switch configurations

- Configure the interface f0/5 as trunk port with native VLAN 99, VLAN allowed 57, 58, 59, 99

    S1(config)# **interface f0/5**

    S1(config-if)# **switchport mode trunk**

    S1(config-if)# **switchport trunk native vlan 99**

    S1(config-if)# **switchport trunk allowed vlan 57,58,59,99**

c) Display the status of **trunk interface** f0/5

    S1# **show interface trunk f0/5**

d) Basic SVI switch configurations

- Create management VLAN 100 (Name Management)

    S1(config)# **vlan 100**
    S1(config-vlan)# **name Management**

- Create the interface, configure IP address 192.168.100.11/24 for the management VLAN 100

    S1(config)# **interface vlan 100**
    S1(config-if)# **ip address 192.168.100.11 255.255.255.0**
    S1(config-if)# **no shutdown**

- Set switch port f0/1 to be access port for VLAN 100.

    S1(config)# **interface f0/1**
    S1(config-if)# **switchport mode access**
    S1(config-if)# **switchport access vlan 100**

- Configure an IP default gateway with IP address 192.168.100.1 on switch S1.

    S1(config)# **ip default-gateway 192.168.100.1**

Part 4: Cisco IOS Inter-VLAN-Routing Commands

a) Switch Trunk to Router configurations

Configure the interface f0/5 of switch S1 as trunk port with native VLAN 100, VLAN allowed 10,20,100

S1(config)# **interface f0/5**
S1(config-if)# **switchport mode trunk**
S1(config-if)# **switchport trunk native vlan 100**
S1(config-if)# **switchport trunk allowed vlan 10,20,100**
S1(config-if)# **exit**

b) Router sub-interface and physical interface

- Create a sub-interface for VLAN 10 at router R1 interface g0/0 with description "VLAN 10 interface", IEEE 802.1q encapsulation and IP address 10.0.0.1 / 24.

  R1(config)# interface g0/0.10

  R1(config-subif)# description VLAN 10 interface

  R1(config-subif)# encapsulation dot1Q 10

  R1(config-subif)# ip address 10.0.0.1 255.255.255.0

  further-
  R1(config-subif)# exit

  R1(config-if)# no shutdown (switching-on)

- Configure router R1 interface g0/0 as native trunk interface for VLAN 100 with description "VLAN 100 interface", IP address 192.168.100.1 / 24 and switch-on this physical interface.
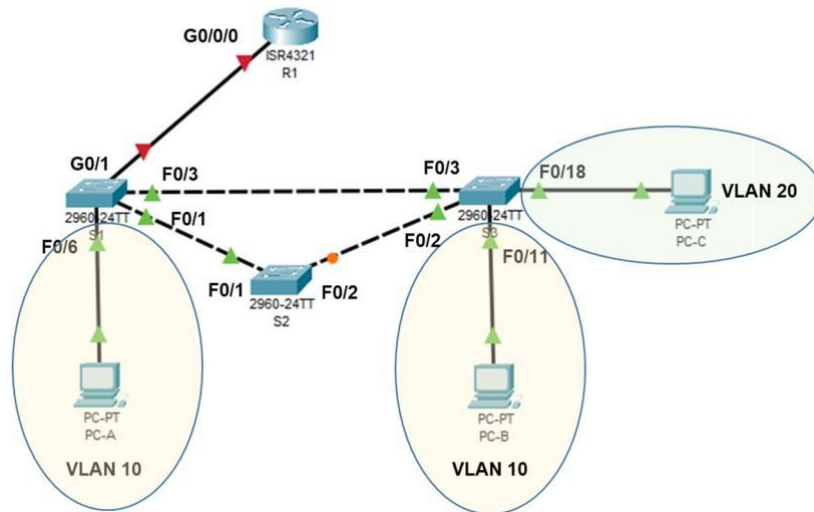
  R1(config)# interface g0/0.100

  R1(config-if)# description VLAN 100 interface

  R1(config-if)# ip address 192.168.100.1 255.255.255.0

  R1(config-if)# exit

Task 1 – VLAN Database and Switch Access Ports

Packet Tracer Topology

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0/0	192.168.99.1	255.255.255.0	N/A
	G0/0/0.10	192.168.10.1	255.255.255.0	N/A
	G0/0/0.20	192.168.20.1	255.255.255.0	N/A
S1	VLAN 99	192.168.99.11	255.255.255.0	192.168.99.1
S2	VLAN 99	192.168.99.12	255.255.255.0	192.168.99.1
S3	VLAN 99	192.168.99.13	255.255.255.0	192.168.99.1
PC-A	NIC	192.168.10.10	255.255.255.0	192.168.10.1
PC-B	NIC	192.168.10.11	255.255.255.0	192.168.10.1
PC-C	NIC	192.168.20.20	255.255.255.0	192.168.20.1

Part 1:   Set Up Network Topology and Initialize Devices

Step 1:   Build topology in Packet Tracer.

COVID-19 Version: Build topology in **Packet Tracer**. Use and re-label the following devices:

a.   Build the network with ISR4321 router, 2960 switches, and PCs in Packet Tracer. Rename the devices.

b.   Cable the network according to the topology with straight-through TP cables ⬜ and cross-over cables ⬜.

c.   We will use the CLI window of the network devices directly for configurations.

d.   Configure IP address, net mask and default gateway for PC-A, PC-B, and PC-C.

Step 2: Configure some basic settings for switches S1 and S2.

Double-click network devices and use the CLI window. When network device is booting up, skip any automatic configuration.

For Switch S1, S2, and S3, perform the following tasks:

a. Disable DNS lookup.

b. Configure device name

c. Assign **class** as the privileged EXEC encrypted password.

a) Assign **cisco** as the console password, enable login, configure **logging synchronous** to prevent console messages from interrupting.

d. Configure password encryption

e. Save your running configuration in the startup configuration.

Step 3: Verify the S1 switch management interface (Switched Virtual Interface (SVI))

a. **Switch Management Interface**: Cisco switches can be configured with a special IP address known as **Switched Virtual Interface (SVI)**. The SVI or management address can be used for remote access to the switch to display or configure settings. If the VLAN 1 SVI is assigned an IP address, by default, all ports in VLAN 1 have access to the SVI management IP address. The SVI may be moved to any VLAN number.

Only the switch's **Switched Virtual Interface (SVI)** may be accessed by IP connectivity. The SVI will need a MAC address in the local subnet and broadcast domain.

Record the MAC address of the **SVI** for VLAN 1 (**show interface vlan1**): **0001.c961.bd34**

Examine the IP properties of the SVI VLAN 1 (**show ip interface vlan1**), and record the status of line and protocol:

S1#sh ip int vlan1

Vlan1 is administratively down, line protocol is downInternet protocol processing disabled

b. Examine the default properties of the FastEthernet interface (**show interface f0/6**) used by

PC-A. Did the switch need the IOS command **no shutdown** for switched interfaces to be up?

No. (already connected as--FastEthernet0/6 is up, line protocol is up (connected))

Record speed and duplex setting of the interface:
Full-duplex, 100Mb/s

c. Examine the initial VLAN settings of the switch (IOS command **show vlan**

brief). What is the default name of VLAN 1? **Default**

Which switch ports are in VLAN 1?
all ports from Fa0/0 to Fa0/24 with Gig0/1,Gig0/2

Part 2: Create VLANs and Assign Switch Ports

VLAN Assignment Specifications

Switch	Assignment
S1	VLAN 10, VLAN 20, VLAN 99
S2	VLAN 10, VLAN 20, VLAN 99
S3	VLAN 10, VLAN 20, VLAN 99

VLAN	Name
VLAN 10	Student
VLAN 20	Faculty
VLAN 99	Management

Step 1: Create VLANs on the switches

a. Create all VLANs 10, 20, and 99 on S1 according to the VLAN assignment list. Example configuration for VLAN10:

```
S1(config)# vlan 10
S1(config-vlan)# name Student
. . .
```

b. List your VLAN database on **S1** (**show vlan brief**).

Which VLANs are available on switch S1?

```
10    student                         active
20    Faculty                         active
99    Management                      active
10    student                         active
1002  fddi-default                    active
1003  token-ring-default              active
1004  fddinet-default                 active
1005  trnet-default                   active
```

c. Create **all VLANs (10,20,99)** on all switches **S2** and **S3** and ensure, all VLANs are created.

```
10    student                         active
20    Faculty                         active
99    Management                      active
```

Step 2: Assign VLANs to Switch Access Ports

a. To assign a switch port to a VLAN, the following example commands are required:

```
S1(config)# int f0/6
S1(config-if)# switchport mode access
S1(config-if)# switchport access vlan
10
. . .
```

b. Assign the **Student VLAN 10** to the correct interfaces on **S1 and S3**.

c. Assign the **Faculty VLAN 20** to the correct interface on **S3**.

d. Generate a switch IP address for the **Management VLAN 99** (virtual interface VLAN 99) on all switches S1, S2, and S3 according to the Addressing Table

Note: Notice that the **VLAN 99 protocol** is in the down state even though you entered the **no shutdown** command. The interface is down because no switch ports are assigned to VLAN 99.

e. Check your interfaces (IOS command **show ip interface brief)** on switch **S3**.

Record the status of VLAN 99:

```
Vlan99                   192.168.99.13   YES manual up
down
```

f. Configure the **default gateway** for each switch S1, S2, and S3 according to the Addressing Table.
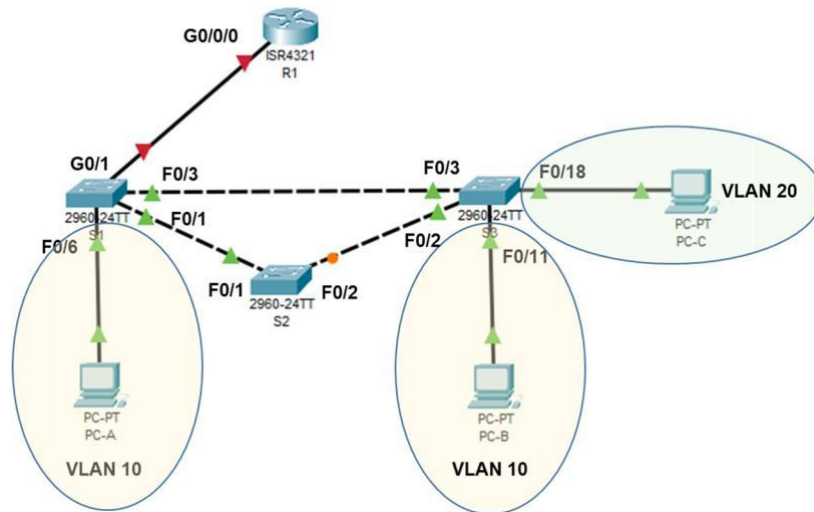

Step 3:   Test Connectivity

From switch S1 can you ping switch S3 (y/n)? **no**

From switch S1 can you ping switch S2 (y/n)? **no**

Task 2 – IEEE 802.1Q Trunks

Packet Tracer Topology

Continue with the topology and Addressing Table of Task 1.

Part 1: Configure 802.1Q Trunks

Step 1: 802.1Q Trunks between switches S1, S2, and S3

The **Dynamic Trunking Protocol (DTP)** is active by default on a 2960 switch. DTP might be a security leak and should not be used. For that reason, the **switchport mode trunk** command is used to manually configure a port as a trunk with encapsulation 802.1q.

a) For switch S1, change the switch port mode on interface f0/3 to force trunking on both switches S1, and S3.

```
S1#sh int trunk
Port        Mode         Encapsulation  Status      Native vlan
Fa0/3       on           802.1q         trunking    1

Port        Vlans allowed on trunk
Fa0/3       1-1005

Port        Vlans allowed and active in management domain
Fa0/3       1,10,20,99

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/3       1,10,20,99
```

b) Issue the **show interfaces trunk** command to view the trunk mode on S3.
   Which Encapsulation is used on the trunk links? **802.1q**
   Which VLANs are allowed on the trunk? **1-1005 (1,10,20,99)**
   What is the native VLAN on your trunk? **native vlan 1**
   Note: By default, all VLANs known in a switch are allowed on a trunk

Step 2: Test Connectivity again

a) From switch S1 can you ping switch S3(y/n)? **YES**

   Explain, why this does not work: **Actually it did work!**

Step 3: 802.1Q Trunks between switches S1, S2, and S3

Cisco uses a proprietary protocol known as the **Dynamic Trunking Protocol (DTP)** on its switches. Some ports automatically negotiate to trunking.

A good practice is to configure either access ports or trunk ports, to change the native VLAN and to switch-off all unused ports.

We assign the native VLAN to VLAN 99, which will be transmitted over trunks by un-tagged Ethernet frames.

a. For switch S1, change the switch port mode on interface f0/1 and f0/3 to enforce trunking. Example code:

```
S1(config)# interface f0/1
S1(config-if)# switchport mode trunk
S1(config-if)# switchport trunk native vlan 99
S1(config-if)# switchport trunk allowed vlan
10,20,99
```

Perform these steps on **both switches S1 and S2**.

b.   Issue the **show interfaces trunk** command to view the trunk mode on S2.

Which Encapsulation is used on the trunk link S1-S2?
 802.1q

Which VLANs are allowed on the trunk S1-S2?
vlan 10,20,99

What is the native VLAN on your trunk S1-S2? **native vlan 99**

c. Change the switch port mode on all other trunk ports as well (switch S1 port F0/3, switch S2 F0/2, and switch S3 port F0/2 and F0/3) to enforce trunking.

Step 4: Test Connectivity

a. Check connectivity (ping) from S3 IP address to S2 IP address. Connectivity (y/n)? **yes**

b. Check connectivity (ping) from S3 IP address to S1 IP address. Connectivity (y/n)? **yes**

c. Check connectivity (ping) from PC-A to PC-B, both connected to VLAN 10. Connectivity

(y/n)? **yes** **Note**: Remove errors, if a. – c-. are not working.

d. Check connectivity (ping) from PC-A (VLAN 10) to PC-C (VLAN 20), Connectivity

(y/n)? **no**

Explain, why PC-A cannot ping PC-C.

We can observe that PC-A and PC-C are staying on separate subnets with different IP addresses. They are also connected to non-similar VLANs. If trunk ports are added to all switches, then trunk can carry VLANs on those switches. Then, routing will be possible along those trunk ports. Because of non-configuration of VLAN on switch and default gateway, PC-A cannot ping PC-C.

Task 3 – Inter-VLAN-Routing

Packet Tracer Topology
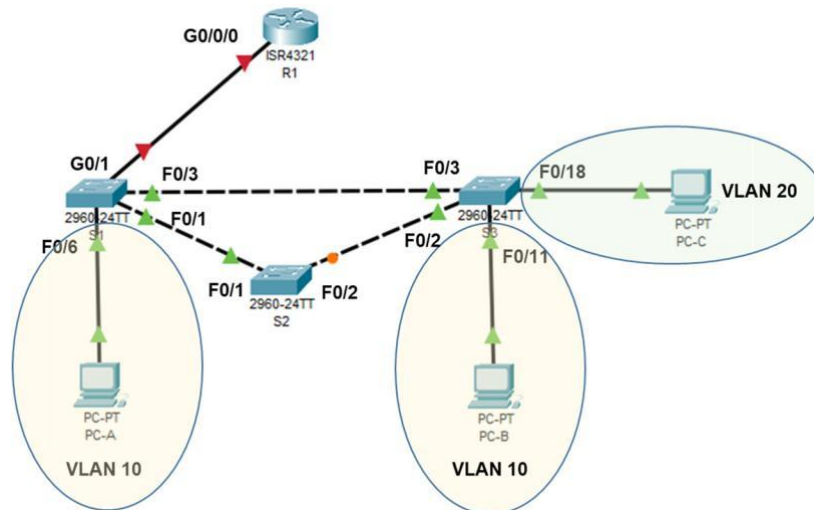
We continue with the Topology and Addressing Table of Task 1.

Part 2:   Basic Configuration of Router R1

Step 1:   Configure basic settings of Router R1.

a. Disable DNS lookup.

b. Configure the device name as shown in the topology.

c. Assign **class** as the privileged EXEC encrypted password.

d. Assign **cisco** as the console password, enable login

e. Configure **logging synchronous** to prevent console messages from interrupting.

f. Configure password encryption

g. Copy the running configuration to the startup configuration.

Part 3:   Configure 802.1Q Trunk-Based Inter-VLAN Routing

Step 1:   802.1Q Trunk from Switch S1 to Router R1

Interface G0/1 of switch S1 will be used as trunk port to router R1, with VLAN 99 as the native VLAN.

a. Create a trunk on interface G0/1 of switch S1 with native VLAN 99, and allow all VLANs 10,20, and 99 to be transmitted over the trunk.

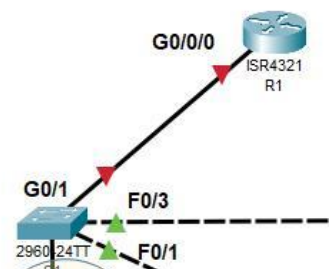b. Issue the **show interfaces trunk** command to view the trunk mode on S1.

Which Encapsulation is used on the trunk link at interface G0/1?
802.1q
Which VLANs are allowed on the trunk?
10,20,99

What is the native VLAN on your trunk? **vlan 99**

Step 2: **Router Interfaces for all VLANs.**

a. Configure the <u>native</u> VLAN 99 gateway IP address, which will be assigned to the interface G0/0/0 directly.

b. For each non-native VLAN, create a sub-interface on R1 G0/0/0.ID, using the VLAN number as the sub-interface ID.

Example code:
```
R1(config)# interface g0/0/0.10 R1(config-subif)#
encapsulation dot1Q 10 R1(config-subif)# ip address
192.168.10.1 255.255.255.0
. . .
```

c. Finally, switch on the physical interface G0/0/0. **done**

Step 3: **Display Device Information**

Use the **show ip route** command on the router to answer the following questions.

a. Record the subnets, which are routed at R1.
192.168.10.0, 192.168.20.0, 192.168.99.0

```
      192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.10.0/24 is directly connected,
GigabitEthernet0/0/0.10
L        192.168.10.1/32 is directly connected,
GigabitEthernet0/0/0.10
      192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.20.0/24 is directly connected,
GigabitEthernet0/0/0.20
L        192.168.20.1/32 is directly connected,
GigabitEthernet0/0/0.20
      192.168.99.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.99.0/24 is directly connected, GigabitEthernet0/0/0
L        192.168.99.1/32 is directly connected, GigabitEthernet0/0/0
```

b. What code is used in the routing table to indicate a directly connected network?
by C- CONNECTED and L-LOCAL (locally)

c. How many networks are directly connected to router R1? **THREE**

d. How many static routing paths are assigned by the administrator? **none**

Step 4: **Test Connectivity between VLANs**

a. Can switch S1 ping its default gateway? **yes**

b. Can switch S2 ping its default gateway? **yes**

c. Can switch S3 ping its default gateway? **yes**

d. Can PC-A ping its default gateway? **yes**

e. Can PC-A ping switch S3? **yes**

f. Can PC-A ping PC-C? **yes**

Note: Remove errors, if a. – f-. are not working.

Reflection

a. What are the advantages of trunk-based or router-on-a-stick inter-VLAN routing?

Router-on-a-stick or inter-VLAN method is used with one router connected to one switch through a single cable. This permits us to route packets to networks occupied with VLANs attached to a router trunk. By using router VLAN trunking configuration, it gives the router a logical interface connected to each VLAN by having one port per VLAN. Trunk based routing helps a routing process within our network among multiple VLANs.

b. Which advantages are given by VLANs for Broadcast Domains

VLANs usually splits up broadcast domains to confine them. As a result, they reduce excess traffic in broadcast domains and increase more broadcast domains. VLANs accelerates performance and security too in the network by controlling broadcast propagation.

c. Which security advances do you gain by using VLANs?

VLANs provides us with a logical grouping of several network devices, by this, they can reduce broadcast traffic and permit more control over implementing security plans.

Deliverables

Lab Teams

This lab may be solved in teams of max. 3 students. All teams have to upload their deliverables in time.

Module Group Exams

Each team member must solve the requested **Module Group Exams** before delivery date.

Deliverables

Each teams uploads the following files:

- Create a PDF file **SRWE-Lab1-Result.pdf** with the completed and answered **Lab Preparations and Lab Instructions**.
  All tasks must be worked on and all questions must be answered.
  Write your answers in **red color**. You may use the comment capabilities of the free Adobe reader.

- Save your final Packet Tracer file **SRWE-Lab1-PT.pkt**

- Record the running configuration of switch S1 and router R1 (show run) in one text file **SRWE-Lab1-S1-R1.txt**

Due Dates

Group 1	Teams 1-9	Due Date
	Module Group Exams 1-4	13.12. – EOB
	Upload Deliverables	13.12. – EOB
	CCNA ZOOM Presentation	15.12. - 16:45 ff.

Group 2	Teams 1-9	Due Date
	Module Group Exams 1-4	10.01. - EOB
	Upload Deliverables	10.01. - EOB
	CCNA ZOOM Presentation	12.01. - 16:45 ff.

- Per team you load one solution in Ilias in time.
- Per team you book one timeslot for acceptance.