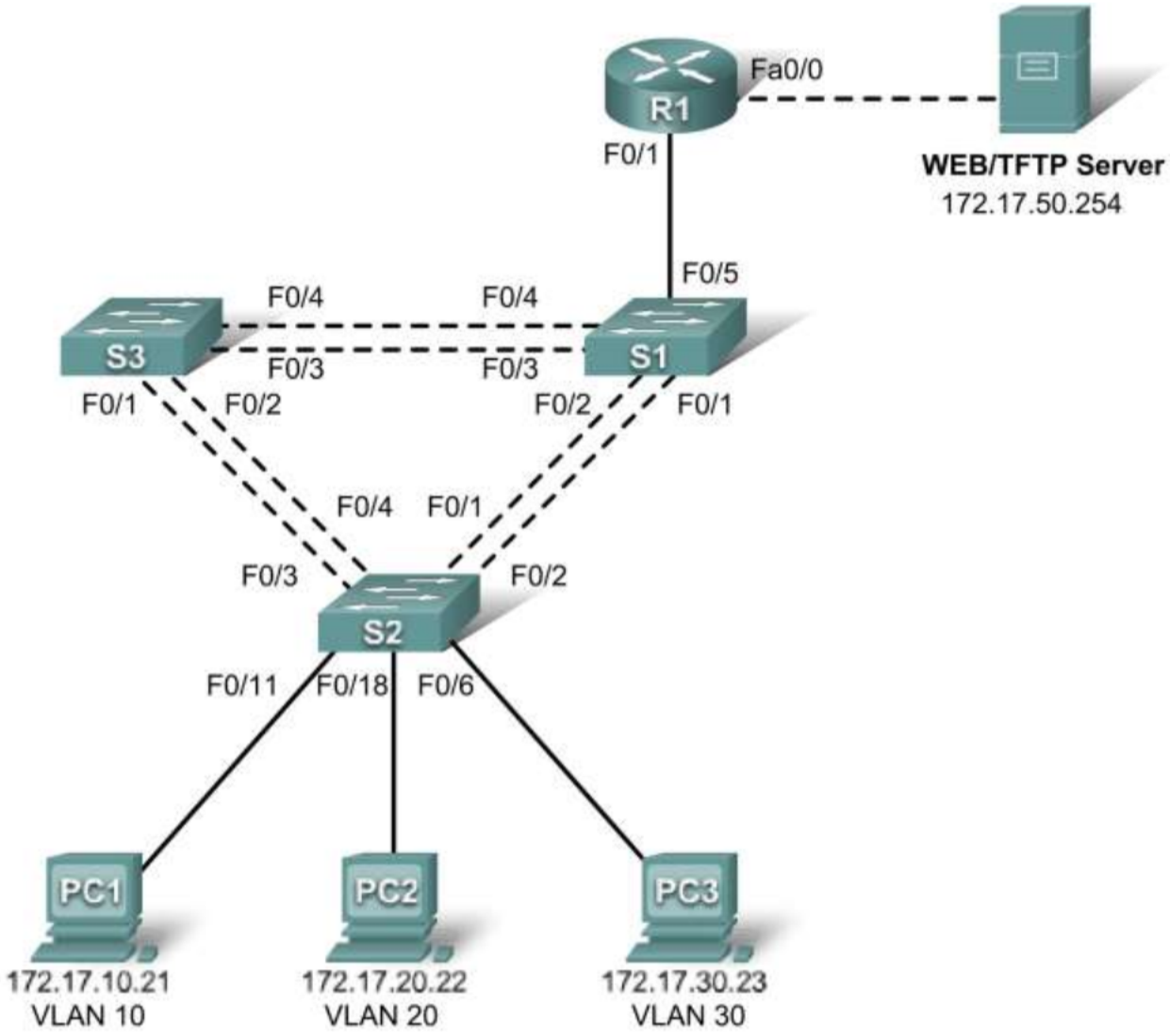
Lab 6.4.1: Basic Inter-VLAN Routing (Instructor Version)

Topology Diagram



Addressing Table

Device (Hostname)	Interface	IP Address	Subnet Mask	Default Gateway
S1	**VLAN 99**	172.17.99.11	255.255.255.0	172.17.99.1
S2	**VLAN 99**	172.17.99.12	255.255.255.0	172.17.99.1
S3	**VLAN 99**	172.17.99.13	255.255.255.0	172.17.99.1
R1	**Fa 0/0**	172.17.50.1	255.255.255.0	N/A
R1	**Fa 0/1**	See Interface Configuration Table		N/A
PC1	**NIC**	172.17.10.21	255.255.255.0	172.17.10.1
PC2	**NIC**	172.17.20.22	255.255.255.0	172.17.20.1
PC3	**NIC**	172.17.30.23	255.255.255.0	172.17.30.1
Server	**NIC**	172.17.50.254	255.255.255.0	172.17.50.1

Port Assignments – Switch 2

Ports	Assignment	Network
Fa0/1 – 0/5	802.1q Trunks (Native VLAN 99)	172.17.99.0 /24
Fa0/6 – 0/10	VLAN 30 – Guest (Default)	172.17.30.0 /24
Fa0/11 – 0/17	VLAN 10 – Faculty/Staff	172.17.10.0 /24
Fa0/18 – 0/24	VLAN 20 - Students	172.17.20.0 /24

Interface Configuration Table – Router 1

Interface	Assignment	IP Address
Fa0/1.1	VLAN1	172.17.1.1 /24
Fa0/1.10	VLAN 10	172.17.10.1 /24
Fa0/1.20	VLAN 20	172.17.20.1 /24
Fa0/1.30	VLAN 30	172.17.30.1 /24
Fa0/1.99	VLAN 99	172.17.99.1 /24

Learning Objectives

- Configuration of a switched LAN and router
- VLANs and VLAN Trunking Protocol (VTP)
- Router and 802.1q trunking on a Fast Ethernet interface
- Subinterfaces corresponding to the configured VLANs
- Inter-VLAN routing

Task 1: Prepare the Network

Step 1: Cable a network that is similar to the one in the topology diagram.

The output shown in this lab is based on 2960 switches and an 1841 router.

Ethernet (10Mb) LAN interfaces on routers do not support trunking, and Cisco IOS software earlier than version 12.3 may not support trunking on Fast Ethernet router interfaces.

Step 2: Clear existing configurations on the switches.

Clear NVRAM, delete the vlan.dat file, and reload the switches. After the reload is complete, use the **show vlan** command to confirm that only default VLANs exist and that all ports are assigned to VLAN 1.

```
Switch#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                Fa0/13, Fa0/14, Fa0/15,Fa0/16
                                                Fa0/17, Fa0/18, Fa0/19,Fa0/20
                                                Fa0/21, Fa0/22, Fa0/23,Fa0/24
                                                Gig0/1, Gig0/2
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

Step 3: Disable all ports using the shutdown command.

Use the **interface range** command. Repeat these commands on each switch in the topology.

Příkaz interface range chce v Packet Traceru mezery kolem pomlčky: **interface range fa 0/1 - 24**

```
Switch(config)#interface range fa0/1-24
Switch(config-if-range)#shutdown
Switch(config-if-range)#interface range gi0/1-2
Switch(config-if-range)#shutdown
```

Task 2: Perform Basic Switch Configurations

Step 1: Configure the S1, S2, and S3 switches.

Use the addressing table and the following guidelines:

- Configure the switch hostname.
- Disable DNS lookup.
- Configure an enable secret password of **class**.
- Configure a password of **cisco** for console connections.
- Configure a password of **cisco** for vty connections.
- Configure the default gateway on each switch

Output for S1 shown

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname S1
S1(config)#enable secret class
S1(config)#no ip domain-lookup
S1(config)#ip default-gateway 172.17.99.1
S1(config)#line console 0
S1(config-line)#password cisco
S1(config-line)#login
S1(config-line)#line vty 0 15
S1(config-line)#password cisco
S1(config-line)#login
S1(config-line)#end
%SYS-5-CONFIG_I: Configured from console by console
S1#copy running-config startup-config
Destination filename [startup-config]? [enter]
Building configuration...
```

Step 2: Re-enable the active user ports on S2 in access mode.

```
S2(config)#interface fa0/6
S2(config-if)#switchport mode access
S2(config-if)#no shutdown
S2(config-if)#interface fa0/11
S2(config-if)#switchport mode access
S2(config-if)#no shutdown
S2(config-if)#interface fa0/18
S2(config-if)#switchport mode access
S2(config-if)#no shutdown
```

Task 3: Configure the Ethernet Interfaces on the Host PCs

Configure the Ethernet interfaces of PC1, PC2, PC3 and the remote TFTP/Web Server with the IP addresses from the addressing table.

Task 4: Configure VTP on the Switches

Step 1: Configure VTP on the three switches using the following table. Remember that VTP domain names and passwords are case-sensitive.

Switch Name	VTP Operating Mode	VTP Domain	VTP Password
S1	Server	Lab6	cisco
S2	Client	Lab6	cisco
S3	Client	Lab6	cisco

S1:

```
S1(config)#vtp mode server
Device mode already VTP SERVER.
S1(config)#vtp domain Lab6
Changing VTP domain name from NULL to Lab6
S1(config)#vtp password cisco
Setting device VLAN database password to cisco
S1(config)#end
```

S2:

```
S2(config)#vtp mode client
..............................
```

S3:

```
S3(config)#vtp mode client
..............................
```

Step 2: Configure trunking ports and designate the native VLAN for the trunks.

Configure Fa0/1 through Fa0/5 as trunking ports, and designate VLAN 99 as the native VLAN for these trunks. Use the **interface range** command.

```
S1(config)#interface range fa0/1 - 5
S1(config-if-range)#switchport mode trunk
S1(config-if-range)#switchport trunk native vlan 99
S1(config-if-range)#no shutdown
S1(config-if-range)#end
```

```
S2(config)# interface range fa0/1 - 5
.....
```

```
S3(config)# interface range fa0/1 - 5
.....
```

Step 3: Configure VLANs on the VTP server.

Configure the following VLANS on the VTP server:

VLAN	VLAN Name
VLAN 99	management
VLAN 10	staff
VLAN 20	students
VLAN 30	guest


```
S1(config)#vlan 99
S1(config-vlan)#name management
S1(config-vlan)#exit
S1(config)#vlan 10
S1(config-vlan)#name staff
S1(config-vlan)#exit
S1(config)#vlan 20
S1(config-vlan)#name students
S1(config-vlan)#exit
S1(config)#vlan 30
S1(config-vlan)#name guest
S1(config-vlan)#end
```

Verify that the VLANs have been created on S1 with the **show vlan brief** command.

Step 4: Verify that the VLANs created on S1 have been distributed to S2 and S3.

Use the **show vlan brief** command on S2 and S3 to verify that the four VLANs have been distributed to the client switches.

```
S2#show vlan brief

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/1, Fa0/2, Fa0/4, Fa0/5
                                                 Fa0/6, Fa0/7, Fa0/8, Fa0/9
                                                 Fa0/10, Fa0/11, Fa0/12,Fa0/13
                                                 Fa0/14, Fa0/15, Fa0/16,Fa0/17
                                                 Fa0/18, Fa0/19, Fa0/20,Fa0/21
                                                 Fa0/22, Fa0/23, Fa0/24, Gi0/1
                                                 Gi0/2
10   staff                     active
20   students                          active
30   guest                             active
99   management                        active
```

Step 5: Configure the management interface address on all three switches.

```
S1(config)#interface vlan 99
S1(config-if)#ip address 172.17.99.11 255.255.255.0
S1(config-if)#end

S2(config)#interface vlan 99
S2(config-if)#ip address 172.17.99.12 255.255.255.0
S2(config-if)#end

S3(config)#interface vlan 99
S3(config-if)#ip address 172.17.99.13 255.255.255.0
S3(config-if)#end
```

Verify that the switches are correctly configured by pinging between them. From S1, ping the management interface on S2 and S3. From S2, ping the management interface on S3.

Were the pings successful? _____

All pings should be successful.

If not, troubleshoot the switch configurations and try again.

Step 6: Assign switch ports to VLANs on S2.

Refer to the port assignments table at the beginning of the lab to assign ports to VLANs on S2.

```
S2(config)#interface range fa0/6-10
S2(config-if-range)#switchport access vlan 30
S2(config-if-range)#interface range fa0/11-17
S2(config-if-range)#switchport access vlan 10
S2(config-if-range)#interface range fa0/18-24
S2(config-if-range)#switchport access vlan 20
S2(config-if-range)#end
S2#copy running-config startup-config
Destination filename [startup-config]? [enter]
Building configuration...
[OK]
```

Step 7: Check connectivity between VLANs.

Ping from PC1 (172.17.10.21) to PC2 (172.17.20.22). Ping from PC2 to PC3 (172.17.30.23).

Are the pings successful? _____

These pings are not successful.

If not, why do these pings fail?_____

_____

_____

Each host is in a different VLAN. Because each VLAN is in a separate Layer 3 domain, packets need to be routed at Layer 3 between VLANs. We have not yet configured the devices with L3 capability.

Task 5: Configure the Router and the Remote Server LAN

Step 1: Clear the configuration on the router and reload.

```
Router#erase nvram:
Erasing the nvram filesystem will remove all configuration files! Continue? [confirm]
Erase of nvram: complete
Router#reload
System configuration has been modified. Save? [yes/no]: no
```

Step 2: Create a basic configuration on the router.

- Configure the router with hostname R1.
- Disable DNS lookup.
- Configure an EXEC mode password of **cisco**.
- Configure a password of **cisco** for console connections.
- Configure a password of **cisco** for vty connections.

Step 3: Configure the trunking interface on R1.

- Enter subinterface configuration mode
- Establish trunking encapsulation
- Associate a VLAN with the subinterface
- Assign an IP address from the VLAN to the subinterface


```
R1(config)#interface fastethernet 0/1
R1(config-if)#no shutdown

R1(config-if)#interface fastethernet 0/1.1
R1(config-subif)#encapsulation dot1q 1
R1(config-subif)#ip address 172.17.1.1 255.255.255.0

R1(config-if)#interface fastethernet 0/1.10
R1(config-subif)#encapsulation dot1q 10
R1(config-subif)#ip address 172.17.10.1 255.255.255.0

R1(config-if)#interface fastethernet 0/1.20
R1(config-subif)#encapsulation dot1q 20
R1(config-subif)#ip address 172.17.20.1 255.255.255.0

R1(config-if)#interface fastethernet 0/1.30
R1(config-subif)#encapsulation dot1q 30
R1(config-subif)#ip address 172.17.30.1 255.255.255.0

R1(config-if)#interface fastethernet 0/1.99
R1(config-subif)#encapsulation dot1q 99 native
R1(config-subif)#ip address 172.17.99.1 255.255.255.0
```

- Router interfaces are down by default. The virtual interfaces are up by default. Proto musíme zadat příkaz no shutdown na 0/1 (fyzické rozhraní), a nemusíme na 0/1.xx (virtuální rozhraní).
- The subinterface can use any number, but it is good practice to assign the number of the VLAN as the interface number.
- The native VLAN is specified on the L3 (Layer 3) device (= router) so that it is consistent (v souladu) with the switches. Otherwise, na routeru VLAN 1 would be the native VLAN by default, and there would be no communication between the router and the management VLAN on the switches.

Confirm creation and status of the subinterfaces with the **show ip interface brief** command:

```
R1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        unassigned      YES unset  administratively down down
FastEthernet0/1        unassigned      YES unset  up                    up
FastEthernet0/1.1      172.17.1.1      YES manual up                    up
FastEthernet0/1.10     172.17.10.1     YES manual up                    up
FastEthernet0/1.20     172.17.20.1     YES manual up                    up
FastEthernet0/1.30     172.17.30.1     YES manual up                    up
FastEthernet0/1.99     172.17.99.1     YES manual up                    up
```

Step 4: Configure the server LAN interface on R1.

```
R1(config)# interface FastEthernet0/0
R1(config-if)#ip address 172.17.50.1 255.255.255.0
R1(config-if)#description server interface
R1(config-if)#no shutdown
R1(config-if)#end
```


There are now six networks configured. Verify that you can route packets to all six by checking the routing table on R1.

```
R1#show ip route
<output omitted>

Gateway of last resort is not set

     172.17.0.0/24 is subnetted, 6 subnets
C       172.17.50.0 is directly connected, FastEthernet0/0
C       172.17.30.0 is directly connected, FastEthernet0/1.30
C       172.17.20.0 is directly connected, FastEthernet0/1.20
C       172.17.10.0 is directly connected, FastEthernet0/1.10
C       172.17.1.0 is directly connected, FastEthernet0/1.1
C       172.17.99.0 is directly connected, FastEthernet0/1.99
```

If your routing table does not show all six networks, troubleshoot your configuration.

Step 5: Verify Inter-VLAN routing.

From PC1, verify that you can ping the remote server (172.17.50.254) and the other two hosts (172.17.20.22 and 172.17.30.23). **It may take a couple of pings** before the end-to-end path is established. Ze začátku se zdá, že síť není funkční, protože první pingy neprojdou.

Are the pings successful? _____

These pings should be successful.

If not, troubleshoot your configuration.

Task 6: Reflection

In Task 5, it was recommended that you configure VLAN 99 as the native VLAN in the router Fa0/0.99 interface configuration. Why would packets from the router or hosts fail when trying to reach the switch management interfaces if the native VLAN were left in default?

_____

_____

_____

_____

The native VLAN is untagged. If the VLAN 99 traffic to the router is untagged (as it would be because that is native on the switches), the router cannot interpret the data because there is no VLAN information in the header as expected. In turn, the router tags all VLAN 99 traffic outbound, and leaves VLAN 1 data untagged, so the switches are unable to correctly interpret either. VLAN traffic to the other VLANs should not be affected by the assignment of the native VLAN.

Jinými slovy: Přepínače používají jako native VLAN 99, zatímco router používá native VLAN 1 (default). Přepínače posílají rámce do VLAN 99 neoznačkované (protože je pro ně native), a proto jim router nerozumí. A obráceně: Router posílá neoznačkované rámce do VLAN 1, a těm zas nerozumí přepínače.

Final Configurations

Router 1

```
hostname R1
!
enable secret class
!
no ip domain lookup
!
interface FastEthernet0/0
 ip address 172.17.50.1 255.255.255.0
 no shutdown
!
interface FastEthernet0/1
 no shutdown
!
interface FastEthernet0/1.1
 encapsulation dot1Q 1
 ip address 172.17.1.1 255.255.255.0
!
interface FastEthernet0/1.10
 encapsulation dot1Q 10
 ip address 172.17.10.1 255.255.255.0
!
interface FastEthernet0/1.20
 encapsulation dot1Q 20
 ip address 172.17.20.1 255.255.255.0
!
interface FastEthernet0/1.30
 encapsulation dot1Q 30
 ip address 172.17.30.1 255.255.255.0
!
interface FastEthernet0/1.99
 encapsulation dot1Q 99 native
 ip address 172.17.99.1 255.255.255.0
!
<output omitted - serial interfaces not configured>
!
line con 0
line aux 0
line vty 0 4
 login
 password cisco
!
```

Switch 1

```
!
hostname S1
!
enable secret class
!
no ip domain lookup
!
interface FastEthernet0/1
 switchport trunk native vlan 99
 switchport mode trunk
!
interface FastEthernet0/2
 switchport trunk native vlan 99
```



```
 switchport mode trunk
!
interface FastEthernet0/3
 switchport trunk native vlan 99
 switchport mode trunk
!
interface FastEthernet0/4
 switchport trunk native vlan 99
 switchport mode trunk
!
interface FastEthernet0/5
 switchport trunk native vlan 99
 switchport mode trunk
!
<output omitted - all remaining ports in shutdown>
!
interface Vlan1
 no ip address
 no ip route-cache
!
interface Vlan99
 ip address 172.17.99.11 255.255.255.0
 no shutdown
!
ip default-gateway 172.17.99.1
ip http server
!
line con 0
 logging synchronous
line vty 0 4
 login
 password cisco
line vty 5 15
 login
 password cisco
```

Switch 2

```
!
hostname S2
!
enable secret class
!
no ip domain lookup
!
interface FastEthernet0/1
 switchport trunk native vlan 99
 switchport mode trunk
!
interface FastEthernet0/2
 switchport trunk native vlan 99
 switchport mode trunk
!
interface FastEthernet0/3
 switchport trunk native vlan 99
 switchport mode trunk
!
interface FastEthernet0/4
 switchport trunk native vlan 99
 switchport mode trunk
!
```



```
interface FastEthernet0/5
 switchport trunk native vlan 99
 switchport mode trunk
!
 interface FastEthernet0/6
 switchport access vlan 30
 switchport mode access
!
interface FastEthernet0/7
 switchport access vlan 30
!
interface FastEthernet0/8
 switchport access vlan 30
!
interface FastEthernet0/9
 switchport access vlan 30
!
interface FastEthernet0/10
 switchport access vlan 30
!
interface FastEthernet0/11
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/12
 switchport access vlan 10
!
interface FastEthernet0/13
 switchport access vlan 10
!
interface FastEthernet0/14
 switchport access vlan 10
!
interface FastEthernet0/15
 switchport access vlan 10
!
interface FastEthernet0/16
 switchport access vlan 10
!
interface FastEthernet0/17
 switchport access vlan 10
!
interface FastEthernet0/18
 switchport access vlan 20
!
interface FastEthernet0/19
 switchport access vlan 20
!
interface FastEthernet0/20
 switchport access vlan 20
!
interface FastEthernet0/21
 switchport access vlan 20
!
interface FastEthernet0/22
 switchport access vlan 20
!
interface FastEthernet0/23
 switchport access vlan 20
```



```
!
interface FastEthernet0/24
 switchport access vlan 20
!
interface Vlan1
 no ip address
 no ip route-cache
!
interface Vlan99
 ip address 172.17.99.12 255.255.255.0
 no shutdown
!
ip default-gateway 172.17.99.1
ip http server
!
line con 0
 password cisco
 logging synchronous
 login
line vty 0 4
 password cisco
 login
line vty 5 15
 password cisco
 login
!
end
```

Switch 3

```
!
hostname S3
!
enable secret class
!
no ip domain lookup
!
interface FastEthernet0/1
 switchport trunk native vlan 99
 switchport mode trunk
!
interface FastEthernet0/2
 switchport trunk native vlan 99
 switchport mode trunk
!
interface FastEthernet0/3
 switchport trunk native vlan 99
 switchport mode trunk
!
interface FastEthernet0/4
 switchport trunk native vlan 99
 switchport mode trunk
!
interface FastEthernet0/5
 switchport trunk native vlan 99
 switchport mode trunk
!
<output omitted - all remaining ports in shutdown>
!
```



```
interface Vlan99
 ip address 172.17.99.13 255.255.255.0
 no shutdown
!
ip default-gateway 172.17.99.1
ip http server
!
control-plane
!
line con 0
 password cisco
 login
line vty 0 4
 password cisco
 login
line vty 5 15
 password cisco
 login
!
end
```

