

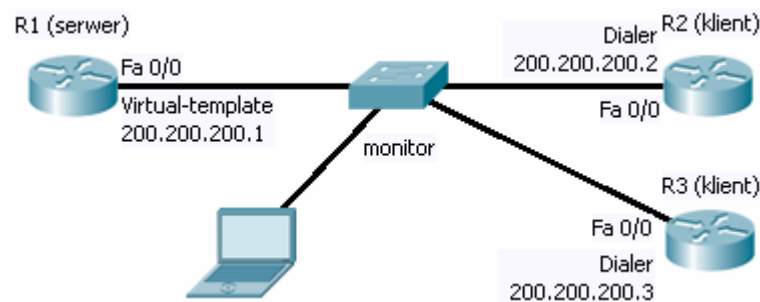
# COMPUTER NETWORKS - LABORATORY 045

Subject:

Cisco IOS. Setting up Point-to-Point over Ethernet (PPPoE) links.

## Task A: Configuring PPP over Ethernet PPPoE

1. You the topology as shown below (Ethernet switch connects three Cisco routers with Ethernet interface each time):



2. Configure the SPAN (Switched Port Analyzer) monitoring session in the Ethernet switch:

```
Switch (config) #monitor session 1 source interface Fa0 / 1 both
Switch (config) #monitor session destination interface Fa0 1/4
```

where the *Fa0/1* port is connected to future PPPoE server, *Fa0/4* is connected to the computer with network traffic analyzer enabled (Wireshark app). The switch will now copy all the datagrams passing through the port *Fa0/1* to port *Fa0/4*

Start the Ethernet interface monitoring in Wireshark.

3. Preparation of two simultaneous PPPoE connections between R1 and R2 and between R1 and R3:

On PPPoE server (R1):

- create a user account that will be used in the process of PPP PAP authentication:
 

```
R1 (config) #AAA new-model
R1 (config) #username network password network
```
- create a BBA (BroadBand Aggregation Group) which bonds a Virtual-Template interface:
 

```
R1 (config) # bba-group pppoe global
R1 (config-bba-group) virtual-template 1
```

where the a 'global' keyword defines a default (you can also create your own named PPPoE options here)

- configure the Ethernet interface allowing the PPP encapsulation, based on the BBA group. There are no IP addresses to define in this interface:  
*R1 (config) #interface Fa 0/0*  
*R1 (config-if) #no shut*  
*R1 (config-if) #pppoe enable global group*
- create a pool of IP addresses for PPP clients:  
*R1 (config) #ip local pool p1 200.200.200.3 200.200.200.10*
- to support PPP interface Virtual-Template is set with a selected BBA group. The IP address for *Virtual-Template* is set outside pool but in the same IP network. PPP authentication with PAP is required for new clients:  
*R1 (config) #interface Virtual-Template 1*  
*R1 (config-if) #ip address 200.200.200.1, 255.255.255.0*  
*R1 (config-if) #ppp authentication pap*  
*R1 (config-if) #peer default IP address pool p1*
- due to the fact that the PPP datagram defines additional 8 bytes in the header it is necessary to reduce the MTU provided by a link layer PPPoE – from standard value of 1500 (that's Ethernet) bytes to 1492  
*R1 (config) #interface Virtual-Template 1*  
*R1 (config-if) #mtu 1492*

The client (configuration for example R2):

- configure the Ethernet interface, setting PPP encapsulation and dialing-into pool 1 behavior (dial-number-pool 1):  
 There is no IP address define in this interface:  
*R2 (config) #interface Fa 0/0*  
*R2 (config-if) #no shut*  
*R2 (config-if) #PPPoE-client dial-number-pool 1*
- create a dialer interface compatible with a dialer pool number, define PPP encapsulation and PPP PAP authenticating (sending login information after connect). Adjust the MTU as well:  
*R2 (config) #interface Dialer 1*  
*R2 (config-if) #ip address negotiated*  
*R2 (config-if) #mtu 1492*  
*R2 (config-if) #dialer pool 1*  
*R2 (config-if) #encapsulation ppp*  
*R2 (config-if) #ppp pap sent username-password user sieci*

R3 router configuration is (second PPPoE client) is identical to R2

#### Complete PPPoE server configuration

```

aaa new-model
username Network password Network

bba-group pppoe global
virtual-template 1
exit

interface fa 0/0
pppoe enable global group
no sh
exit

ip local pool pool 200.200.200.2
200.200.200.10

Virtual-Interface Template 1
ip address 200.200.200.1 255.255.255.0
ppp authentication pap
peer default ip address pool pool
mtu 1492
exit

```

#### Complete configuration of any PPPoE client

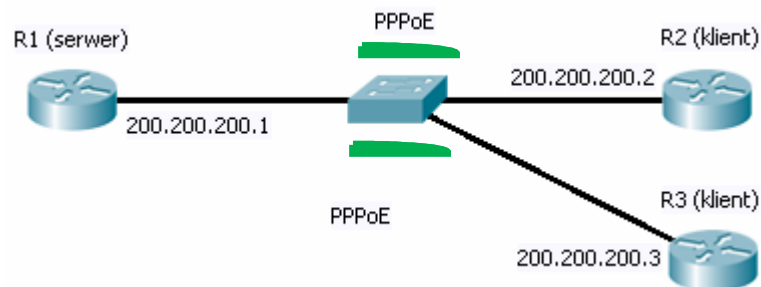
```

interface dialer1
ip address negotiated
encapsulation ppp
dialer pool 1
ppp pap sent-username Network password
Network
exit

interface fa 0/0
no ip address
PPPoE-client dial-number-pool 1
no sh
exit

```

4. After starting the interfaces check communication between routers R, R2, R3 with ping command using IP addresses assigned to PPPoE clients. Watch the traffic (using the Wireshark) during tests



Note: Due to the lack of direct PPP link between two PPPoE clients (these are routers R2 and R3) there should be no connectivity between these PPPoE clients now (it's a point-to-multipoint network).

PPP server must mediate in IP communications between these clients (acts as a hub-and-spoke device). Therefore, the client routing reconfiguration is needed to redirect traffic to that server, instead direct connectivity:

*R2 (config) #ip route 200.200.200.3 255.255.255.255 200.200.200.1*

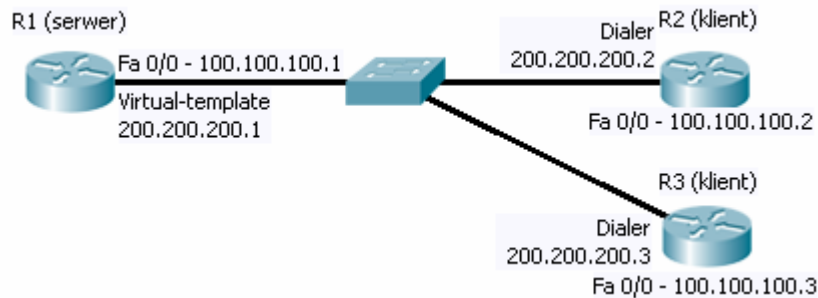
*R3 (config) #ip route 200.200.200.2 255.255.255.255 200.200.200.1*

Check IP communication again after applying these changes.

5. IP addresses of physical Ethernet interfaces have not been configured (addresses are used only by Dialer and Virtual-Access interfaces). PPP was overbuild on Ethernet, so it works within it's own addressing space. However, it does not mean we have to resign from ordinary IP frames encapsulated in Ethernet directly.

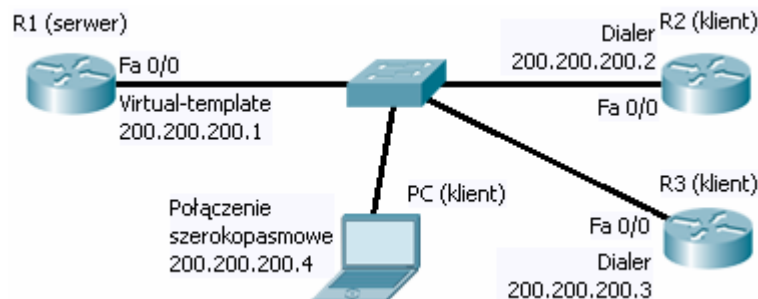
Add some addresses to Ethernet now, not removing the PPPoE setup between routers R1, R2, R3:

```
R1 (config) #interface fa 0/0
R1 (config-if) #ip address 100.100.100.1 255.255.255.0
R2 (config) #interface fa 0/0
R2 (config-if) #ip address 100.100.100.2 255.255.255.0
R3 (config) #interface fa 0/0
R3 (config-if) #ip address 100.100.100.3 255.255.255.0
```



Now we have both 100,100,100/0 and 200.200.200/0 networks available, Inspect simultaneous traffic (ping) in these networks (Wireshark) checking encapsulation used for communication in both cases.

6. Connect additional computer to an Ethernet switch the - but this time designated to run PPPoE client, not a network monitoring (choose a thin client terminal PC for it). Use some different port on switch, avoiding monitor-session destination port previously configured.



Now another (third) PPPoE connection will be created – this time from a computer, not router. In Windows operating system create a new network connection (in the "Network Connections" panel), choose:

*New call* -> Connect to the Internet -> Configure connection manually -> Connect using a broadband connection that requires a user and password. Set any name of "ISP".

Enter your user name and password for PPPoE authentication in accordance with the PPP authentication credentials configured in router R1.

Make sure that the authentication mode for PPPoE is PAP.

Then activate the connection ("Connect"). After a successful connection check IP address assigned to the computer and the ability to communicate with the router R1 (ping). Check the status of PPPoE sessions in the router R1

```
R1 # show PPPoE session
R1 # show statistics pppoe
R1 # show PPPoE summary
```