

COMPUTER NETWORKS - LABORATORY 037

Subject:

Configure Cisco routers - Serial interfaces.

Task A: Configuring Cisco router Serial interfaces

1. Prepare two Cisco routers having serial interfaces (Modules Cisco WIC 1T, 2T Cisco WIC, Cisco NM Serial 8A / S, Cisco PA 4T or 4T Cisco NM Serial socket SmartSerial or DB60).
Connect the devices as below:



2. In each of the routers a serial select the interface to configure. The name of interface is dependent on device's installed expansion cards and base interfaces present. These are, for example: serial 0/0 or s 0/0:

```
Router (config) #interface serial 0/0
Router (config-if) #
```

First select a type of encapsulation used in the serial link: PPP (Point-to-Point Protocol) or - HDLC (High Level Data Link Control). Encapsulation type must be compatible in both interfaces (discrepancy will result in continuous on and off link protocol switching - so-called "flapping" of the interface):

```
Router (config-if) #encapsulation ppp
or
Router (config-if) #encapsulation hdlc
```

Then define the IP addresses of the both interfaces involved:

```
Router (config-if)#ip address 200.200.200.1 255.255.255.0
Router (config-if)#no shutdown
```

3. In the case of a router having a serial interface to determine DCE clock speed links, e.g. ..:

```
Router (config-if)#clock rate 250000
```

Naturally IP addressing for all used interfaces must be developed independently and meet the generally known rules.

4. Check the link settings:

```
Router # show ip int serial 0 / 0
Router show run
Router # show controllers serial 0/0
```

and check (ping between routers) the ability to transmit IP datagrams over the link serial.

Warning: communication between the PC will not yet be possible (it would be necessary configuring IP routing processes on both routers)

5. Change the mode of framing in both the opposite interfaces (PPP or HDLC) and re-test the functioning of the connection

Task B: PAP (Password Authentication Protocol) for PPP Serial links

1. The installation of the previous task, you must enter the remote identification system router-based authentication PAP.
Note ! PAP and CHAP works only over PPP (it does not work on HDLC, so even proper commands won't be available)

The principle of operation PAP: router logs on the opposite side of the link with the user names and passwords defined there.

2. The router, which will accept the serial connection and requires authorization, define a user's password (the data on the two sides may be different). These will be the local user data, which must be used at the remote side authentication PAP:
Router1 (config) #username cisco priv 15 password cisco

Then enter the router serial interface configuration forcing the PAP login:

Router1(Config) #int serial 0/ 0

Router1(Config-if) #PPP authentication PAP

In the opposite router (Interface Configuration) define a rule requiring logging in the remote site using the specified credentials:

Router2(Config) #int serial 0/ 0

Router2(Config-if) #PPP PAP sent-username cisco password cisco

Login information for both parties must comply.

3. Connect and turn on PAP authentication tracking:
Router # debug PPP authentication
Disable track after login test:
Router # no debug PPP authentication
4. Switch the interface off and then on again, observing serial link re-authorization process (switching on and off will force it):
Router (config-if) #sh
Router (config-if) #no sh
5. Add authentication "in the opposite direction" ("a server" router will also be authorized). Test (debug) the link operation as before.

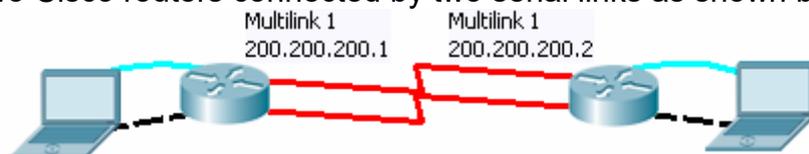
Task C: CHAP (Challenge Handshake Authentication Protocol) for PPP Serial links

1. The installation of the task A system should be introduced to identify the remote router based on CHAP authentication (excluding pre-PAP). Principle of operation CHAP: routers identify themselves by exchanging tokens in challenge mode - response. These tokens are generated (MD5) based on a commonly held (so this time converging!) User passwords. The names of users with the same password is also the name of router (hostname) on opposite sides of the communication.
2. The routers on both sides of the link, define a unique name for hostname:
Router 1 (config) #hostname R1
R1(Config) #
Router2 (config) #hostname R2
R2(Config) #
3. The routers on both sides of the serial link, define the user name that is the name that the hostname has the opposite router. In addition - both user accounts must have the same password:
R1(Config) #username R2 password pass
R2(Config) #username R1 password pass
 Note: The values are case-sensitive.
4. The serial interfaces on both sides of the router configuration, enter the login forcing challenge handshake on the remote router when the serial connection (remember to remove any configuration tasks from the previous PAP): R1 (config)
#int serial 0
R1(Config-if) #PPP authentication CHAP
R2(Config) #int serial 0
R2(Config-if) #PPP authentication CHAP
5. Turn on tracing and connect CHAP:
 Router # debug PPP authentication
 Disable track after login test:
 Router # debug no PPP authentication

Task D: Multilink PPP

If you have multiple parallel serial links between routers it is possible to aggregate these links into logical one (similar to EtherChannel / LAG Ethernet technology).

1. Prepare two Cisco routers connected by two serial links as shown below



2. In both routers, configure a virtual multilink interface giving him a number. Specify multilink interface IP addresses (so that they were in the same IP network):

```
R1(Config) #interface multilink 1
R1(Config-if) #ip address 200.200.205.1 255.255.255.0
```

```
R2(Config) #interface multilink 1
```

R2(Config-if) #ip address 200.200.205.2 255.255.255.0

3. In the next step, configure and assign to the multilink (of previously selected number) some physical serial interfaces (including it in a PPP multilink connection). Note that there are no defined serial interface IP addresses any more (interfaces will now multilink interface components):

```
Router (config) #int serial 0/3/0
Router (config-if) #encapsulation ppp
Router (config-if) #ppp multilink
Router (config-if) #ppp multilink group 1
Router (config-if) #clock rate 1000000
Router (config-if) #no shut
```

4. Check the status of PPP multilink:
`router #show ppp multilink`
`router #debug ppp multilink events`

Check (ping) the communication between routers in a multilink PPP. Notice that link still works after one of the cables was disconnected.

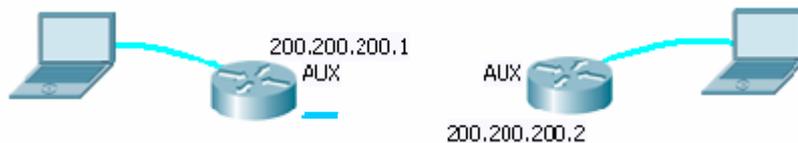
5. Prove the existence of PPP multilink fragmentation. For this purpose switch diagnostic mode on router R1 (watching packets through the interface multilink):
R1#debug ppp multilink fragments
Then send the router R2 to the router R1 to ping one datagram ICMP extended length

R2(config) #ping 200.200.205.1 rep 1 size 40000

In the resulting report, check the size and number of datagrams transmitted.

Task E: Serial ports hardware extensions

1. You can overbuild an IP interface over a simple async link (like Cisco console or AUX line). So if you have a spare AUX line socket in two routers (RS-232 async) it is possible to use it as communication link between. Connect two AUX sockets in routers with Cisco Console Rollover cable.



In routers, configure the lines:

```
Router (config) #line aux 0
Router (config-line) #mode InOut
Router (config-line) #transport input all
Router (config-line) #flowcontrol hardware
```

Check the number of newly defined async interface:

```
Router # show line
```

Then configure that Async interface (using this particular number):

```
Router (config) #interface Async 65
Router (config-if) #ip address 200.200.200.1 255.255.255.0
Router (config-if) #encapsulation ppp
Router (config-if) #async default routing
Router (config-if) #async mode dedicated
```

where 65 is the example number assigned to Async interface by the system. IP address must be configured according to the general principles (RS-232 is now an IP network segment).

Async default routing command activates the IP routing on Async interface, and *async mode* determines RS-232 as dedicated line (the default interface for IP traffic over this hardware is async).

After configuring the serial interface check the communication (ping).

2. HSSI (High Speed Serial Interface) link in Cisco routers:

If you have a NM HSSI card on your Cisco routers - connect Cisco HSSI cable. Configure the interfaces on both sides according to the pattern:

```
Router1 (config) #int HSSI 1/0
Router1 (config-if) # HSSI internal-clock
Router1 (config-if) #ip address 200.200.200.1 255.255.255.0
Router 1 (config-if) #no sh
```

```
Router2 (config) #int HSSI 1/0
Router2 (config-if) # HSSI internal-clock
Router2 (config-if) #ip address 200.200.200.2 255.255.255.0
Router2 (config-if) #no sh
```

where again - interfaces addressing should be defined in accordance with the general rules. After you configured the link - check (ping) the communication. When DCE mode is enabled in HSSI, is possible to modify the clock speed (in HSSI it is possible to modify clock speeds for both sides independently, so DCE mode can be activated in both routers simultaneously):

```
Router 1 (config-if) #hssi DCE
Router 1 (config-if) #clock rate 5000
```

```
Router2 (config-if) #hssi DCE
Router2 (config-if) #clock rate 50000
```

Check effect of such modifications:

```
Router1 # ping 200.200.200.2 repeat 10000
```