

Telekommunikationsnetze Praktika 3

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Hintergrund

- Aufbauend auf die Erfahrungen von Versuch 1 & 2 ist ein komplexerer Aufbau mit Routern zu konfigurieren. Es kommt das Routingprotokoll RIPv2 zum Einsatz.

Inhalt des Praktikums

- Grundlegende Konfiguration von Router, Switches und PCs
- Konfiguration und Fehlersuche im Routing
- CLI: Abarbeiten von mehreren eingefügten Befehlen

Vorbereitung

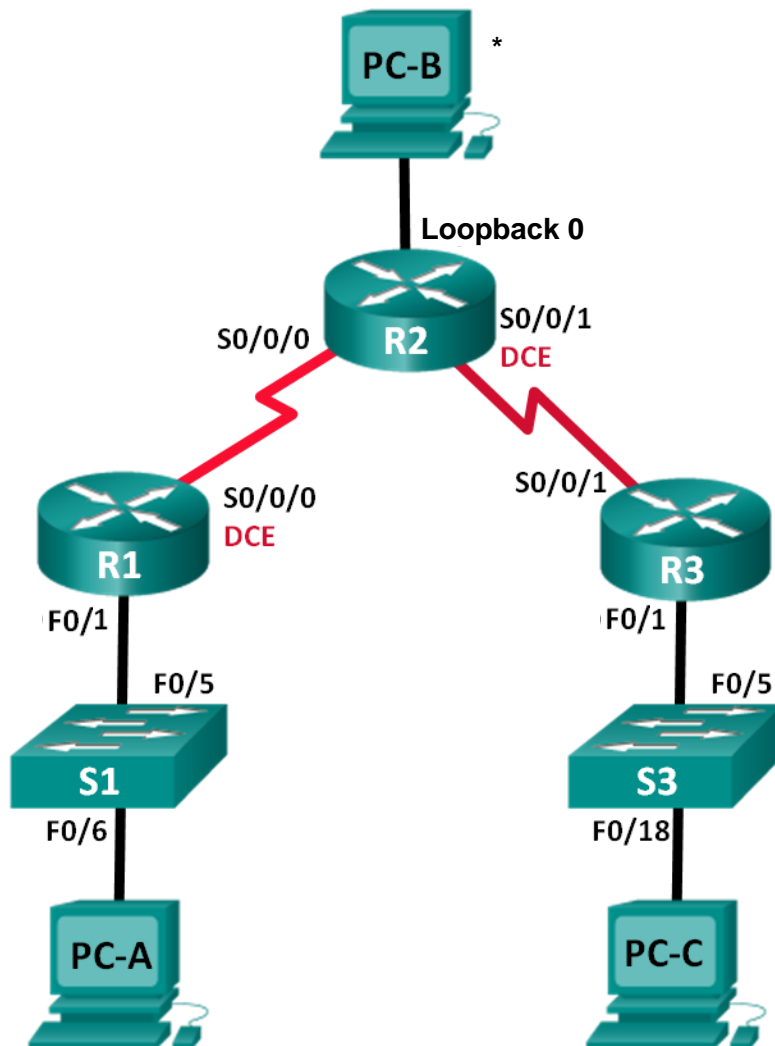
- Fassen Sie Befehle aus Praktika 2 zusammen (Konfiguration und Informationsausgabe)
- Passen Sie die Befehle für die in diesem Versuch genutzten Geräte an
- bringen sie diese Befehle z.B. als Text Datei auf einem USB Stick mit:
 - o Befehle, die Informationen über die Konfiguration ausgeben
 - o Befehle, zur Einstellung von
 - Sicherheit (Passworte aktivieren, motd, ...)
 - Konfiguration (Hostname, IP Adressen, ...)
- Mit dem CiscoPacketTracer kann das Praktikum geübt und vorbereitet werden

Führen Sie das Praktikum entsprechend der Anleitung (7.3.2.4 – modifiziert gegenüber original Cisco Dokument) auf den folgenden Seiten durch.

- Prüfen sie ob alle Geräte zueinander über einen PING Befehl erreichbar sind und antworten.
- Führen Sie ggf. eine Fehlersuche durch.

Lab – Configuring Basic RIPv2 and RIPvng

Topology



*) see note on

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	F0/1	172.30.10.1	255.255.255.0	N/A
	S0/0/0 (DCE)	10.1.1.1	255.255.255.252	N/A
R2	Loopback 0	209.165.201.1	255.255.255.0	N/A
	S0/0/0	10.1.1.2	255.255.255.252	N/A
	S0/0/1 (DCE)	10.2.2.2	255.255.255.252	N/A
R3	F0/1	172.30.30.1	255.255.255.0	N/A
	S0/0/1	10.2.2.1	255.255.255.252	N/A
S1	N/A	VLAN 1	N/A	N/A
S3	N/A	VLAN 1	N/A	N/A
PC-A	NIC	172.30.10.3	255.255.255.0	172.30.10.1
PC-B*	NIC	209.165.201.2	255.255.255.0	209.165.201.1
PC-C	NIC	172.30.30.3	255.255.255.0	172.30.30.1

*) PC-B is in the lab not available, in real world it is the connection to the uplink of the network. Here you use a virtual Loopback Interface. Its status will go up and it is possible to send and receive a ping to this address while a unconnected Ethernet port will not do so.

Objectives

Part 1: Build the Network and Configure Basic Device Settings

Part 2: Configure and Verify RIPv2 Routing

- Configure and verify RIPv2 is running on routers.
- Configure a passive interface.
- Examine routing tables.
- Disable automatic summarization.
- Configure a default route.
- Verify end-to-end connectivity.

Removed Part 3: Configure IPv6 on Devices & Part 4: Configure and Verify RIPv6 Routing

Background / Scenario

RIP version 2 (RIPv2) is used for routing of IPv4 addresses in small networks. RIPv2 is a classless, distance-vector routing protocol, as defined by RFC 1723. Because RIPv2 is a classless routing protocol, subnet masks are included in the routing updates. By default, RIPv2 automatically summarizes networks at major network boundaries. When automatic summarization has been disabled, RIPv2 no longer summarizes networks to their classful address at boundary routers.

RIPv6 (RIP Next Generation) is a distance-vector routing protocol for routing IPv6 addresses, as defined by RFC 2080. RIPv6 is based on RIPv2 and has the same administrative distance and 15-hop limitation.

Lab – Configuring Basic RIPv2 and RIPv6

In this lab, you will configure the network topology with RIPv2 routing, disable automatic summarization, propagate a default route, and use CLI commands to display and verify RIPv2 routing information. *You will then configure the network topology with IPv6 addresses, configure RIPv6, propagate a default route, and use CLI commands to display and verify RIPv6 routing information.*

Note: The routers used with CCNA hands-on labs are Cisco 1841 Integrated Services Routers (ISRs). The switches used are Cisco Catalyst 2960s. Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of the lab for the correct interface identifiers.

Note: Make sure that the routers and switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

Required Resources

- 3 Routers (Cisco 1841)
- 2 Switches (Cisco 2960)
- 2 PCs with Linux (\$ `screen /dev/ttyUSB0`), Windows (terminal emulation: Tera Term, PuTTY)
 - 3rd PC, PC-B is not available in Lab, in real word it stands for connection to the network uplink
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet and Serial cables as shown in the topology

Part 1: Build the Network and Configure Basic Device Settings

In Part 1, you will set up the network topology and configure basic settings.

Step 1: Cable the network as shown in the topology.

Step 2: Initialize and reload the router and switch.

- a. erase/delete the startup-config and vlan.dat, reload

Step 3: Configure basic settings for each router and switch.

- a. Disable DNS lookup.
- b. Configure device names as shown in the topology.
- c. Configure password encryption.
- d. Assign **class** as the privileged EXEC password.
- e. Assign **cisco** as the console and vty passwords.
- f. Configure a MOTD banner to warn users that unauthorized access is prohibited.
- g. Configure **logging synchronous** for the console line.
- h. Configure the IP address listed in the Addressing Table for all interfaces.
 - 1) For Loopback interface use the same commands as for ports:

```
R2(config)# interface Loopback 0
R2(config-if)# ip address ...
```
 - 2) For serial ports use the commands according to:

```
R1(config)# interface Serial10/0/0
R1(config-if)# ip address 10.3.2.1 255.255.255.252
```

- 3) On the DCE (*data carrier equipment*) side of the connection set the clock rate:
R1(config-if)# **clock rate 2000000**

- i. Configure a description to each interface with an IP address.
- j. Copy the running-configuration to the startup-configuration.

Step 4: Configure PC hosts.

Refer to the Addressing Table for PC host address information.

Step 5: Test connectivity.

At this point, the PCs are unable to ping each other.

- a. Each workstation should be able to ping the attached router. Verify and troubleshoot if necessary.
- b. The routers should be able to ping one another. Verify and troubleshoot if necessary.

Part 2: Configure and Verify RIPv2 Routing

In Part 2, you will configure RIPv2 routing on all routers in the network and then verify that routing tables are updated correctly. After RIPv2 has been verified, you will disable automatic summarization, configure a default route, and verify end-to-end connectivity.

Step 1: Configure RIPv2 routing.

- a. On R1, configure RIPv2 as the routing protocol and advertise the appropriate networks.

```
R1# config t
R1(config)# router rip
R1(config-router)# version 2
R1(config-router)# passive-interface f0/1
R1(config-router)# network 172.30.0.0
R1(config-router)# network 10.0.0.0
```

The **passive-interface** command stops routing updates out the specified interface. This process prevents unnecessary routing traffic on the LAN. However, the network that the specified interface belongs to is still advertised in routing updates that are sent out across other interfaces.

- b. Configure RIPv2 on R3 and use the **network** statement to add appropriate networks and prevent routing updates on the LAN interface.
- c. Configure RIPv2 on R2. Do not advertise the 209.165.201.0 network.

Note: It is not necessary to make the F0/0 interface passive on R2 because the network associated with this interface is not being advertised.

Step 2: Examine current state of network.

- a. The status of the two serial links can quickly be verified using the **show ip interface brief** command on R2.

```
R2# show ip interface brief
```

Interface	IP-Address	OK?	Method	Status	Protocol
Embedded-Service-Engine0/0	unassigned	YES	unset	administratively down	down
GigabitEthernet0/0	209.165.201.1	YES	manual	up	up
GigabitEthernet0/1	unassigned	YES	unset	administratively down	down
Serial0/0/0	10.1.1.2	YES	manual	up	up

Lab – Configuring Basic RIPv2 and RIPv2

```
Serial0/0/1          10.2.2.2          YES manual up          up
```

- b. Check connectivity between PCs.

From PC-A, is it possible to ping PC-B*? _____ Why? _____

From PC-A, is it possible to ping PC-C? _____ Why? _____

From PC-C, is it possible to ping PC-B*? _____ Why? _____

From PC-C, is it possible to ping PC-A? _____ Why? _____

*) Use IP address of loopback-interface on R2

- c. Verify that RIPv2 is running on the routers.

You can use the **debug ip rip**, **show ip protocols**, and **show run** commands to confirm that RIPv2 is running. The **show ip protocols** command output for R1 is shown below.

```
R1# show ip protocols
Routing Protocol is "rip"
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Sending updates every 30 seconds, next due in 7 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Redistributing: rip
Default version control: send version 2, receive version 2
  Interface          Send Recv  Triggered RIP  Key-chain
  Serial0/0/0        2        2
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
  10.0.0.0
  172.30.0.0
Passive Interface(s):
  GigabitEthernet0/1
Routing Information Sources:
  Gateway            Distance    Last Update
  10.1.1.2           120
Distance: (default is 120)
```

When issuing the **debug ip rip** command on R2, what information is provided that confirms RIPv2 is running?

When you are finished observing the debugging outputs, issue the **undebug all** command at the privileged EXEC prompt.

When issuing the **show run** command on R3, what information is provided that confirms RIPv2 is running?

-
- d. Examine the automatic summarization of routes.

The LANs connected to R1 and R3 are composed of discontinuous networks. R2 displays two equal-cost paths to the 172.30.0.0/16 network in the routing table. R2 displays only the major classful network address of 172.30.0.0 and does not display any of the subnets for this network.

```
R2# show ip route
<Output omitted>
  10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C    10.1.1.0/30 is directly connected, Serial0/0/0
C    10.2.2.0/30 is directly connected, Serial0/0/1
R    172.30.0.0/16 [120/1] via 10.2.2.1, 00:00:23, Serial0/0/1
    [120/1] via 10.1.1.1, 00:00:09, Serial0/0/0
  209.165.201.0/24 is variably subnetted, 2 subnets, 2 masks
C    209.165.201.0/24 is directly connected, GigabitEthernet0/0
L    209.165.201.1/32 is directly connected, GigabitEthernet0/0
```

R1 displays only its own subnets for the 172.30.0.0 network. R1 does not have any routes for the 172.30.0.0 subnets on R3.

```
R1# show ip route
<Output omitted>
  10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C    10.1.1.0/30 is directly connected, Serial0/0/0
R    10.2.2.0/30 [120/1] via 10.1.1.2, 00:00:21, Serial0/0/0
  172.30.0.0/16 is variably subnetted, 2 subnets, 2 masks
C    172.30.10.0/24 is directly connected, GigabitEthernet0/1
```

R3 only displays its own subnets for the 172.30.0.0 network. R3 does not have any routes for the 172.30.0.0 subnets on R1.

```
R3# show ip route
<Output omitted>
  10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C    10.2.2.0/30 is directly connected, Serial0/0/1
R    10.1.1.0/30 [120/1] via 10.2.2.2, 00:00:23, Serial0/0/1
  172.30.0.0/16 is variably subnetted, 2 subnets, 2 masks
C    172.30.30.0/24 is directly connected, GigabitEthernet0/1
```

Use the **debug ip rip** command on R2 to determine the routes received in the RIP updates from R3 and list them here.

R3 is not sending any of the 172.30.0.0 subnets, only the summarized route of 172.30.0.0/16, including the subnet mask. Therefore, the routing tables on R1 and R2 do not display the 172.30.0.0 subnets on R3.

Step 3: Disable automatic summarization.

- The **no auto-summary** command is used to turn off automatic summarization in RIPv2. Disable auto summarization on all routers. The routers will no longer summarize routes at major classful network boundaries. R1 is shown here as an example.

```
R1(config)# router rip
R1(config-router)# no auto-summary
```

- Issue the **clear ip route *** command to clear the routing table.

```
R1(config-router)# end
R1# clear ip route *
```

Lab – Configuring Basic RIPv2 and RIPv3

- c. Examine the routing tables. Remember will it take some time to converge the routing tables after clearing them.

The LAN subnets connected to R1 and R3 should now be included in all three routing tables.

```
R2# show ip route
```

```
<Output omitted>
```

```
Gateway of last resort is not set
```

```

    10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C       10.1.1.0/30 is directly connected, Serial0/0/0
C       10.2.2.0/30 is directly connected, Serial0/0/1
       172.30.0.0/16 is variably subnetted, 3 subnets, 2 masks
R       172.30.0.0/16 [120/1] via 10.2.2.1, 00:01:01, Serial0/0/1
       [120/1] via 10.1.1.1, 00:01:15, Serial0/0/0
R       172.30.10.0/24 [120/1] via 10.1.1.1, 00:00:21, Serial0/0/0
R       172.30.30.0/24 [120/1] via 10.2.2.1, 00:00:04, Serial0/0/1
    209.165.201.0/24 is variably subnetted, 2 subnets, 2 masks
C       209.165.201.0/24 is directly connected, GigabitEthernet0/0
```

```
R1# show ip route
```

```
<Output omitted>
```

```
Gateway of last resort is not set
```

```

    10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       10.1.1.0/30 is directly connected, Serial0/0/0
R       10.2.2.0/30 [120/1] via 10.1.1.2, 00:00:12, Serial0/0/0
       172.30.0.0/16 is variably subnetted, 3 subnets, 2 masks
C       172.30.10.0/24 is directly connected, GigabitEthernet0/1
R       172.30.30.0/24 [120/2] via 10.1.1.2, 00:00:12, Serial0/0/0
```

```
R3# show ip route
```

```
<Output omitted>
```

```

    10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       10.2.2.0/30 is directly connected, Serial0/0/1
R       10.1.1.0/30 [120/1] via 10.2.2.2, 00:00:23, Serial0/0/1
       172.30.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       172.30.30.0/24 is directly connected, GigabitEthernet0/1
R       172.30.10.0 [120/2] via 10.2.2.2, 00:00:16, Serial0/0/1
```

- d. Use the **debug ip rip** command on R2 to exam the RIP updates.

```
R2# debug ip rip
```

After 60 seconds, issue the **no debug ip rip** command.

What routes are in the RIP updates that are received from R3?

Are the subnet masks now included in the routing updates? _____

Step 4: Configure and redistribute a default route for Internet access.

- a. From R2, create a static route to network 0.0.0.0/0, using the **ip route** command. This forwards any unknown destination address traffic to the R2 toward PC-B, simulating the Internet by setting a Gateway of Last Resort on the R2 router. Here you have no PC-B hence this command triggers an error.

```
R2(config)# ip route 0.0.0.0 0.0.0.0 209.165.201.2
```

- b. R2 will advertise a route to the other routers if the **default-information originate** command is added to its RIP configuration.

```
R2(config)# router rip
R2(config-router)# default-information originate
```

Step 5: Verify the routing configuration.

- a. View the routing table on R1.

```
R1# show ip route
<Output omitted>
Gateway of last resort is 10.1.1.2 to network 0.0.0.0

R* 0.0.0.0/0 [120/1] via 10.1.1.2, 00:00:13, Serial0/0/0
   10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C    10.1.1.0/30 is directly connected, Serial0/0/0
R    10.2.2.0/30 [120/1] via 10.1.1.2, 00:00:13, Serial0/0/0
   172.30.0.0/16 is variably subnetted, 3 subnets, 2 masks
C    172.30.10.0/24 is directly connected, GigabitEthernet0/1
R    172.30.30.0/24 [120/2] via 10.1.1.2, 00:00:13, Serial0/0/0
```

How can you tell from the routing table that the subnetted network shared by R1 and R3 has a pathway for Internet traffic?

- b. View the routing table on R2.

How is the pathway for Internet traffic provided in its routing table?

Step 6: Verify connectivity.

- a. Simulate sending traffic to the Internet by pinging from PC-A and PC-C to 209.165.201.2.

Were the pings successful? _____

- b. Verify that hosts within the subnetted network can reach each other by pinging between PC-A and PC-C.

Were the pings successful? _____

Note: It may be necessary to disable the PCs firewall.

Reflection

1. Why would you turn off automatic summarization for RIPv2?

2. In both scenarios, how did R1 and R3 learn the pathway to the Internet?
