

# Campus Network Design and Implementation

## Computer Network-1 Course Project

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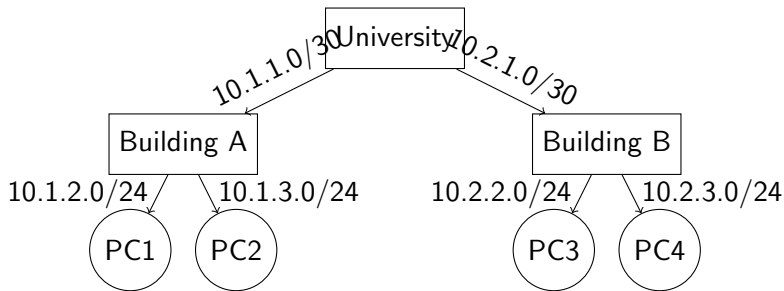
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# Network Diagram



# Network Configuration

- ▶ MikroTik RouterOS is used for routers.
- ▶ Each router uses a unique identity and interface addressing.
- ▶ PCs have static IP addresses and default gateways.
- ▶ Subnetting: 10.1.x.x for Building A, 10.2.x.x for Building B.

# Router Configuration: University Router (R1)

```
1 system identity set name="university"  
2 ip address add address=10.1.1.1/30 interface=ether1  
3 ip address add address=10.2.1.1/30 interface=ether2
```

- ▶ Connects to Building A and B routers.
- ▶ /30 subnets for point-to-point links.

## Router Configuration: Building A Router (R2)

```
1 system identity set name="Building_A"  
2 ip address add address=10.1.1.2/30 interface=ether1  
3 ip address add address=10.1.2.1/24 interface=ether2  
4 ip address add address=10.1.3.1/24 interface=ether3
```

- ▶ ether1: Uplink to University Router
- ▶ ether2: First LAN subnet for PC1
- ▶ ether3: Second LAN subnet for PC2

## Router Configuration: Building B Router (R3)

```
1 system identity set name="Building_B"  
2 ip address add address=10.2.1.2/30 interface=ether1  
3 ip address add address=10.2.2.1/24 interface=ether2  
4 ip address add address=10.2.3.1/24 interface=ether3
```

- ▶ ether1: Uplink to University Router
- ▶ ether2: First LAN subnet for PC3
- ▶ ether3: Second LAN subnet for PC4

# PC Configuration: Building A

```
1 # PC1
2 PC1> ip 10.1.2.2/24 10.1.2.1
3 # PC2
4 PC2> ip 10.1.3.2/24 10.1.3.1
```

- ▶ Each PC has a static IP and gateway.
- ▶ Test: ping 10.1.2.1 or ping 10.1.3.1



# PC Configuration: Building B

```
1 # PC3
2 PC3> ip 10.2.2.2/24 10.2.2.1
3 # PC4
4 PC4> ip 10.2.3.2/24 10.2.3.1
```

- ▶ Each PC has a static IP and gateway.
- ▶ Test: ping 10.2.2.1 or ping 10.2.3.1

# RIP Configuration: University Router

```
1 # Enable RIP on relevant interfaces
2 routing rip interface add interface=ether1 send=v2 receive
   =v2
3 routing rip interface add interface=ether2 send=v2 receive
   =v2
4 # Tell RIP about directly connected subnets
5 routing rip network add network=10.1.1.0/30
6 routing rip network add network=10.2.1.0/30
7 # Set RIP settings
8 routing rip set redistribute-connected=yes
9 routing rip set update-timer=15s
10 routing rip set timeout-timer=30s
11 routing rip set garbage-timer=30s
```

# RIP Configuration: Building A Router

```
1 routing rip interface add interface=ether1 send=v2 receive  
   =v2  
2 routing rip interface add interface=ether2 send=v2 receive  
   =v2  
3 routing rip interface add interface=ether3 send=v2 receive  
   =v2  
4 routing rip network add network=10.1.1.0/30  
5 routing rip network add network=10.1.2.0/24  
6 routing rip network add network=10.1.3.0/24  
7 routing rip set redistribute-connected=yes  
8 routing rip set update-timer=15s  
9 routing rip set timeout-timer=30s  
10 routing rip set garbage-timer=30s
```

# RIP Configuration: Building B Router

```
1 routing rip interface add interface=ether1 send=v2 receive  
   =v2  
2 routing rip interface add interface=ether2 send=v2 receive  
   =v2  
3 routing rip interface add interface=ether3 send=v2 receive  
   =v2  
4 routing rip network add network=10.2.1.0/30  
5 routing rip network add network=10.2.2.0/24  
6 routing rip network add network=10.2.3.0/24  
7 routing rip set redistribute-connected=yes  
8 routing rip set update-timer=15s  
9 routing rip set timeout-timer=30s  
10 routing rip set garbage-timer=30s
```

## RIP Command Explanations

- ▶ `routing rip interface add interface=etherX send=v2 receive=v2`: Enables RIP version 2 on the router's interface. Only interfaces used to connect other routers should run RIP.
- ▶ `routing rip network add network=10.X.X.0/YY`: Informs RIP which directly-connected networks to advertise to neighbors.
- ▶ `routing rip set redistribute-connected=yes`: Ensures directly-connected networks are included in RIP updates.
- ▶ `routing rip set update-timer=15s`: How often RIP sends updates (default = 30s; lower for lab/small network).
- ▶ `routing rip set timeout-timer=30s`: If no update is received in 30s, the route is considered invalid.
- ▶ `routing rip set garbage-timer=30s`: A route is removed 30s after being marked invalid.

# Verification: End-to-End Connectivity with RIP

## Ping from PC3 to PC2 (Building B to Building A):

```
1 PC3> ping 10.1.3.2
2
3 84 bytes from 10.1.3.2 icmp_seq=1 ttl=61 time=1.491 ms
4 84 bytes from 10.1.3.2 icmp_seq=2 ttl=61 time=1.291 ms
5 84 bytes from 10.1.3.2 icmp_seq=3 ttl=61 time=2.439 ms
```

## Ping from PC1 to PC4 (Building A to Building B):

```
1 PC1> ping 10.2.3.2
2
3 84 bytes from 10.2.3.2 icmp_seq=1 ttl=61 time=1.831 ms
4 84 bytes from 10.2.3.2 icmp_seq=2 ttl=61 time=1.235 ms
5 84 bytes from 10.2.3.2 icmp_seq=3 ttl=61 time=2.860 ms
```

*Successful replies indicate full network reachability via dynamic routing.*

# DHCP: University Router

```
1 ip pool add name=pool1 ranges=10.1.1.2-10.1.1.2
2 ip pool add name=pool2 ranges=10.2.1.2-10.2.1.2
3
4 ip dhcp-server add interface=ether1 address-pool=pool1 \
5     lease-time=24h name=dhcp1 disabled=no
6 ip dhcp-server add interface=ether2 address-pool=pool2 \
7     lease-time=24h name=dhcp2 disabled=no
8
9 ip dhcp-server network add address=10.1.1.0/30 \
10     dns-server=8.8.8.8,8.8.4.4 gateway=10.1.1.1
11 ip dhcp-server network add address=10.2.1.0/30 \
12     dns-server=8.8.8.8,8.8.4.4 gateway=10.2.1.1
13
14 ip dhcp-server enable 0
15 ip dhcp-server enable 1
```

# DHCP University Router: Command Explanations (1/2)

- ▶ `ip pool add ...`  
Creates a pool (range) of IP addresses that the DHCP server can assign to clients, excluding addresses statically set on routers.
- ▶ `ip dhcp-server add ...`  
Enables a DHCP server on a specific interface, using the defined pool. `lease-time=24h` means each client keeps its IP for 24 hours.
- ▶ `name=dhcpX`  
Used to identify different DHCP servers per interface (e.g., `dhcp1` for `ether1`, `dhcp2` for `ether2`).



## DHCP University Router: Command Explanations (2/2)

- ▶ `ip dhcp-server network add ...`  
Specifies the subnet, default gateway, and DNS servers (here, Google DNS) to inform clients.
- ▶ `ip dhcp-server enable X`  
Activates the DHCP server instance (replace X with the correct number).
- ▶ `ip dhcp-server print`  
Shows the current DHCP servers configured on the router.
- ▶ `ip dhcp-server lease print`  
Displays the list of IPs assigned to clients.

# DHCP: Building A Router

```
1 ip address add address=10.1.2.1/24 interface=ether2
2 ip address add address=10.1.3.1/24 interface=ether3
3
4 ip pool add name=pool-buildingA1 ranges
   =10.1.2.100-10.1.2.200
5 ip pool add name=dhcp-pool-buildingA2 ranges
   =10.1.3.100-10.1.3.200
6
7 ip dhcp-server network add address=10.1.2.0/24 \
8   gateway=10.1.2.1 dns-server=8.8.8.8
9 ip dhcp-server network add address=10.1.3.0/24 \
10  gateway=10.1.3.1 dns-server=8.8.8.8
11
12 ip dhcp-server add interface=ether2 name=dhcp-buildingA1 \
13   address-pool=pool-buildingA1
14 ip dhcp-server add interface=ether3 name=dhcp-buildingA2 \
15   address-pool=dhcp-pool-buildingA2
16 ip dhcp-server enable dhcp-buildingA1
17 ip dhcp-server enable dhcp-buildingA2
```

## DHCP: Building B Router

```
1 ip address add address=10.2.2.1/24 interface=ether2
2 ip address add address=10.2.3.1/24 interface=ether3
3
4 ip pool add name=pool-buildingB1 ranges
   =10.2.2.100-10.2.2.200
5 ip pool add name=dhcp-pool-buildingB2 ranges
   =10.2.3.100-10.2.3.200
6
7 ip dhcp-server network add address=10.2.2.0/24 \
8   gateway=10.2.2.1 dns-server=8.8.8.8
9 ip dhcp-server network add address=10.2.3.0/24 \
10  gateway=10.2.3.1 dns-server=8.8.8.8
11
12 ip dhcp-server add interface=ether2 name=dhcp-buildingB1 \
13   address-pool=pool-buildingB1
14 ip dhcp-server add interface=ether3 name=dhcp-buildingB2 \
15   address-pool=dhcp-pool-buildingB2
16 ip dhcp-server enable dhcp-buildingB1
17 ip dhcp-server enable dhcp-buildingB2
```

# DHCP Test: PC Example

```
1 # On PC in Building A, subnet 10.1.3.0/24:  
2 PC2> ip dhcp  
3 # Expected: IP 10.1.3.x/24, GW 10.1.3.1  
4  
5 # On PC in Building B, subnet 10.2.2.0/24:  
6 PC3> ip dhcp  
7 # Expected: IP 10.2.2.x/24, GW 10.2.2.1
```

# VLAN Configuration

This section will be added later.

# Network Testing

This section will be added later.

# Conclusion

- ▶ **Current Progress:**

- ▶ Network design completed
- ▶ Basic configuration implemented
- ▶ Local and routed connectivity established
- ▶ DHCP configuration added

- ▶ **Next Steps:**

- ▶ Add VLAN configuration
- ▶ Document and test full connectivity