

MIKROTIK ROUTEROS

ONLINE TRAINING CLASS – CHAPTER 7



BURMESE VERSION

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ROUTING FUNDAMENTALS

Static Routing

Dynamic Routing Protocols

Routing Information Base (RIB)

Routing Concepts

WHAT IS ROUTING ?

○ Routing

- Process of forwarding packets from one network to another network in an intermediate system (router).

○ Static routing

- Administrator configures the routing manually, by defining every destination network and gateway in every router along the path.

○ Dynamic routing

- Administrator needs to do a few configurations (activating dynamic routing protocol) in every router in day one and then the routers will automatically find the best path for every connected network.



DYNAMIC ROUTING PROTOCOLS

○ Distance Vector

- Routing Information Protocol (RIP)
 - RIPv2 for IPv4, RIPv6 for IPv6.
- Enhanced Interior Gateway Routing Protocol (EIGRP)
 - Previously Cisco proprietary, now open standard.
 - MikroTik does not support EIGRP.

○ Link-state

- Open Shortest Path First (OSPF)
 - OSPFv2 for IPv4, OSPFv3 for IPv6.
- Intermediate System to Intermediate System (IS-IS)
 - Defined as international standard ISO/IEC 10589:2002.
 - RouterOS does not support IS-IS.

○ Path Vector

- Border Gateway Protocol
 - The only one protocol that can carry internet routing table.



ROUTING INFORMATION BASE (RIB)

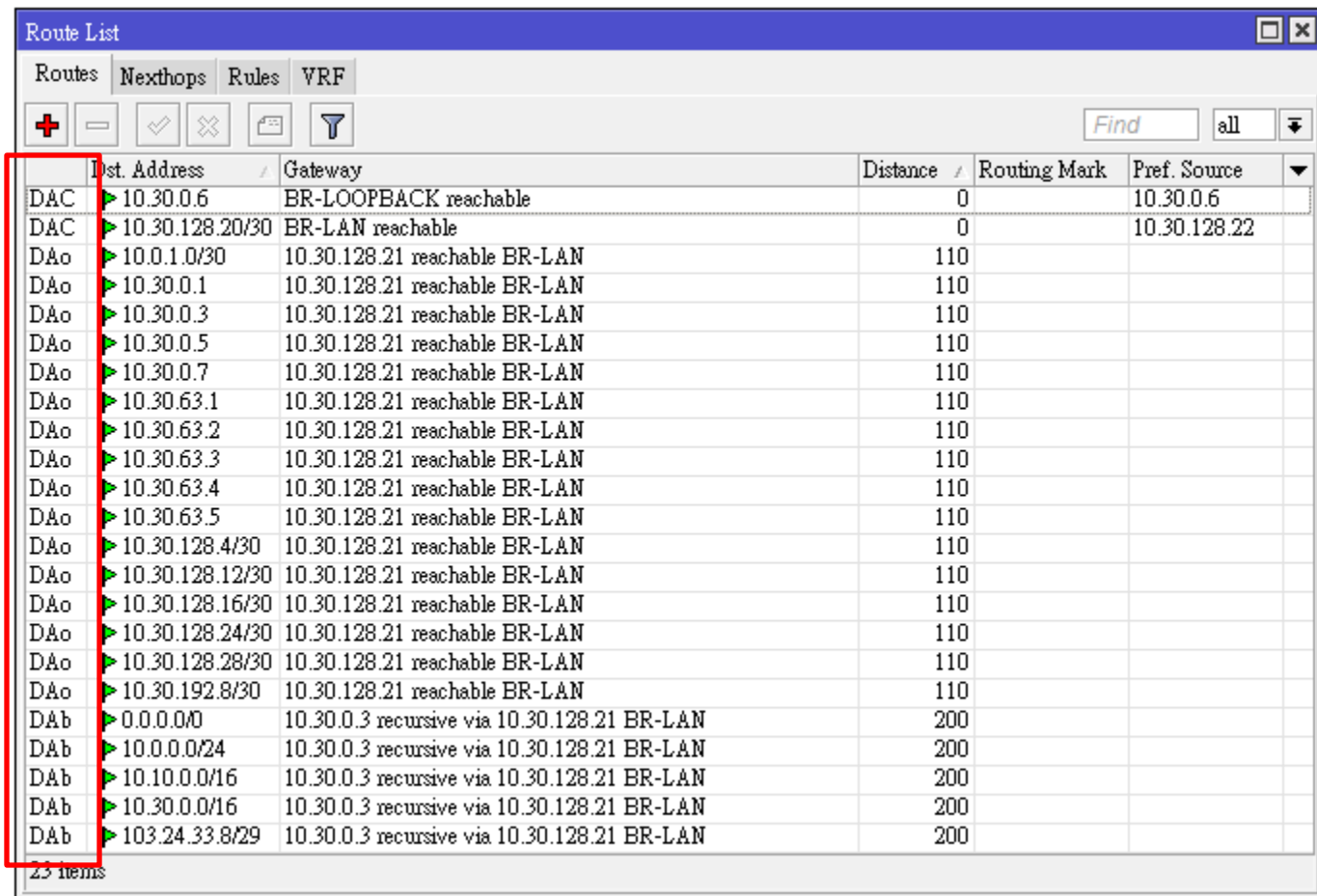
- A route is a record for the router to refer about which are the possible ways to reach a particular network.
- RIB is a table in router, which contains list of routes to certain destination networks.
 - All routes resulting from dynamic routing protocol calculation
 - Networks belong to active connected interfaces
 - Static routes that manually configured by administrator
- RIB also contains information about the metric (distance, cost, hop count...etc.) of every route.



ROUTER INFORMATION BASE (RIB) (CONT.)

- To view the RIB, go to **IP → Routes**.

**Routing
Flag**



	Dest. Address	Gateway	Distance	Routing Mark	Pref. Source
DAC	10.30.0.6	BR-LOOPBACK reachable	0		10.30.0.6
DAC	10.30.128.20/30	BR-LAN reachable	0		10.30.128.22
D Ao	10.0.1.0/30	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.0.1	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.0.3	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.0.5	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.0.7	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.63.1	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.63.2	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.63.3	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.63.4	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.63.5	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.128.4/30	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.128.12/30	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.128.16/30	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.128.24/30	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.128.28/30	10.30.128.21 reachable BR-LAN	110		
D Ao	10.30.192.8/30	10.30.128.21 reachable BR-LAN	110		
D Ab	0.0.0.0	10.30.0.3 recursive via 10.30.128.21 BR-LAN	200		
D Ab	10.0.0.0/24	10.30.0.3 recursive via 10.30.128.21 BR-LAN	200		
D Ab	10.10.0.0/16	10.30.0.3 recursive via 10.30.128.21 BR-LAN	200		
D Ab	10.30.0.0/16	10.30.0.3 recursive via 10.30.128.21 BR-LAN	200		
D Ab	103.24.33.8/29	10.30.0.3 recursive via 10.30.128.21 BR-LAN	200		

23 items

ROUTING FLAGS

- Routing flag is a set of codes that indicates type of route, source protocol, and current status of each route entry.
- Types of route
 - D = Dynamic, routes that fed in to RIB by dynamic routing protocol.
 - S = Static, routes that manually configured by administrator.
 - U = Unreachable, destination that we drop and send ICMP message.
 - B = Black hole, destination that we drop silently.
- Status
 - A = Active, indicates that the route is currently in use.
- Source protocol
 - C = Connected
 - b = BGP
 - o = OSPF
 - r = RIP

For example:

DAC = **D**ynamic, **A**ctive, **C**onnected

AS = **A**ctive, **S**tatic

DAb = **D**ynamic, **A**ctive, **B**GP

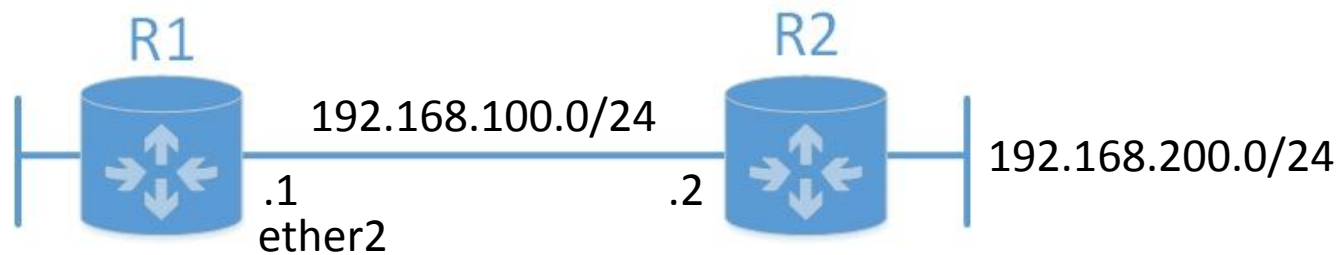


CONNECTED ROUTE

- Connected route is created automatically by the router when we add an IP address on an active interface.
- If there are two IP addresses that belong to the same subnet were assigned to the same interface, it will create only one connected route.
- If an IP address was assigned to two different interfaces, it will create only one connected route with two gateways, which will cause link instability when forwarding packets:
 - Router will do load balancing and cause packet loss when some packets are sent to wrong interface.
 - Point to point interfaces are exception.



CONNECTED ROUTE (CONT.)



Address List

Address: 192.168.100.1/24

Network: 192.168.100.0

Broadcast: 192.168.100.255

Interface: ether2

Forwarding Interface

Network Address

Network Prefix

Local Address

Route List

Route <192.168.100.0/24>

Destination: 192.168.100.0/24

Gateway Interface: ether2

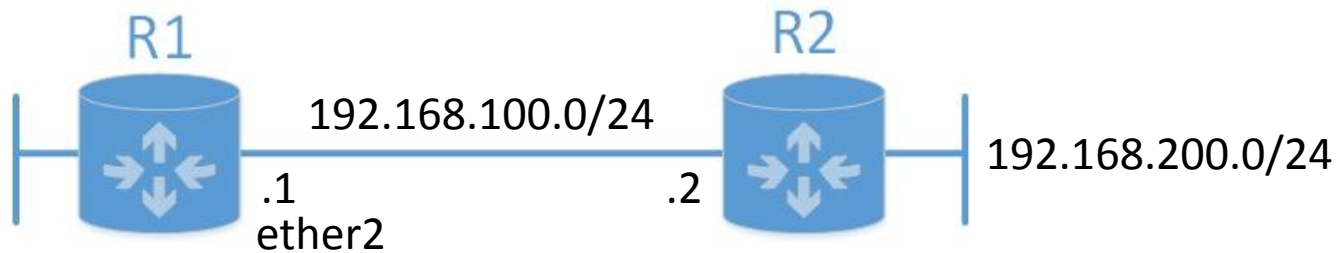
Pref. Source: 192.168.100.1

STATIC ROUTE

- Static route is created by adding route manually in routing table.
- Normally, in static route we only add destination network and the gateway.
- We can say that we define a route to which network, through which gateway.



STATIC ROUTE (CONT.)



The screenshot shows the MikroTik WinBox interface. The left sidebar contains a menu with the following items: Quick Set, Interfaces, Wireless, Bridge, PPP, Switch, Mesh, IP, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, MetaROUTER, Partition, Make Supout.tif, Manual, and Exit. The 'IP' menu item is circled in red. The main window displays the 'Route List' table, which has columns for Dst. Address, Gateway, Distance, and Routing Mark. A single entry is shown: DAC, 192.168.100.0/24, bridge-local reachable, 0. The 'New Route' dialog box is open, showing the 'General' tab. The 'Dst. Address' field is set to 192.168.200.0/24, and the 'Gateway' field is set to 192.168.100.2. The 'Check Gateway' dropdown is set to 'unicast'. The 'Distance' field is set to 30, and the 'Target Scope' field is set to 10. The 'Routing Mark' and 'Pref. Source' fields are empty. The 'OK' button is highlighted in red.

Dst. Address	Gateway	Distance	Routing Mark
DAC	192.168.100.0/24	bridge-local reachable	0

New Route dialog box fields:

- Dst. Address: 192.168.200.0/24
- Gateway: 192.168.100.2
- Check Gateway: unicast
- Distance: 30
- Target Scope: 10
- Routing Mark: (empty)
- Pref. Source: (empty)

ROUTE ATTRIBUTES

- Destination
 - Destination address and network mask (i.e.: 192.168.1.0/24).
 - 0.0.0.0/0 is default route, it means destination all networks.
- Gateway
 - IP address of gateway, should be IP address in the same subnet with one of the IP addresses that assigned on router interfaces.
 - Gateway can be an interface if it is point to point interface.
- Pref. Source
 - Source IP address of packets that originated by the router.
 - Must be one of the IP addressed assigned on the router.
- Distance / Administrative Distance
 - Reflect trust of a route's origin, used for best route selection when there are multiple routes to the same destination, lower is better.



BASIC ROUTING CONCEPTS

- Router will choose the best route based on
 - The route must be active
 - Gateway interface is up.
 - Gateway IP is reachable.
 - Most specific destination address
 - For example, if our destination is 192.168.0.130,
route 192.168.0.128/26 is more specific than 192.168.0.0/24,
because 192.168.0.128 contains only 64 IPs (.128 ~ .191),
but 192.168.0.0/24 contains 256 IPs (.0 ~ .255).
 - Smallest Administrative Distance.



EXERCISE

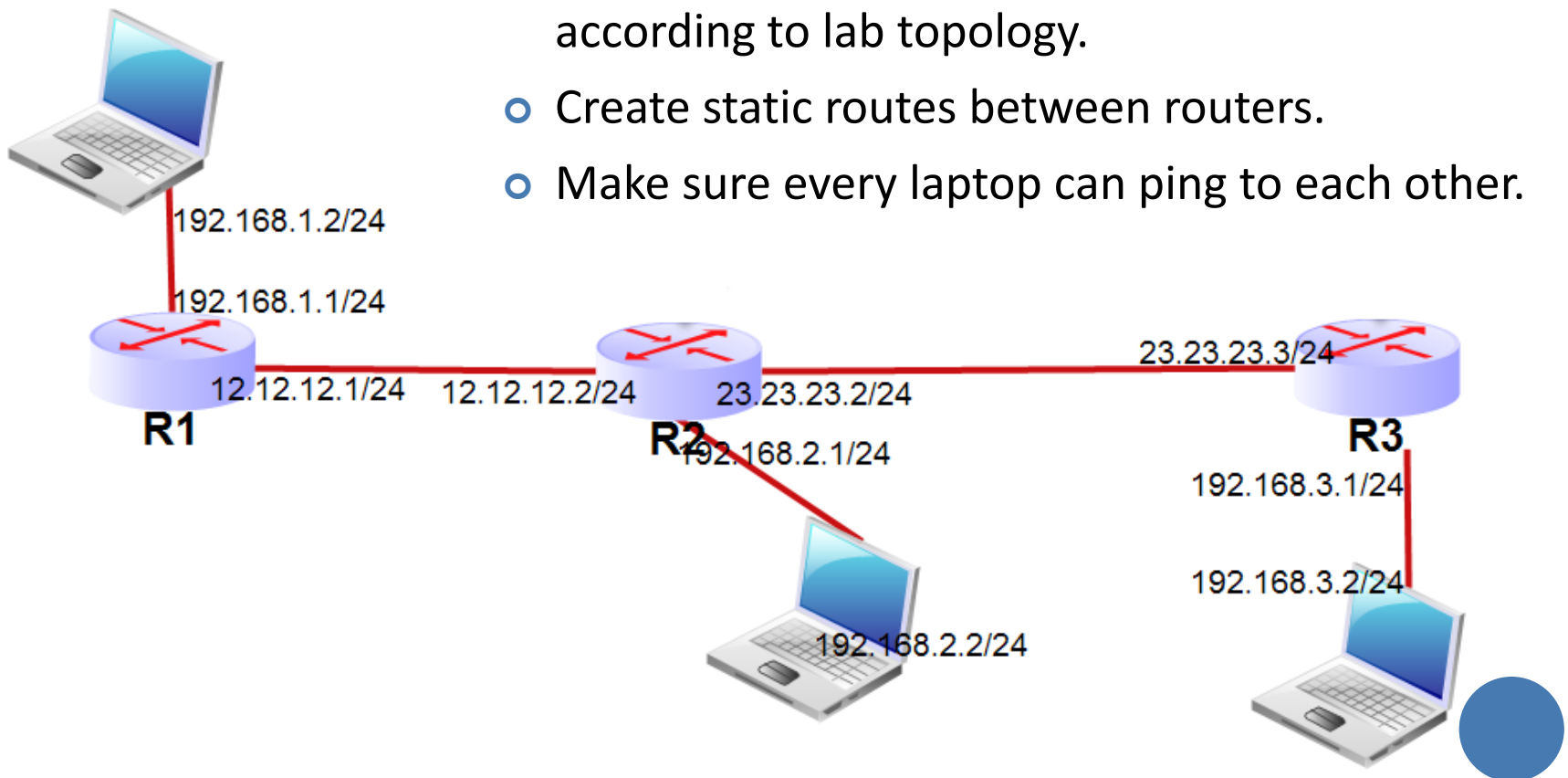
- For destination 192.168.10.1, which gateway will be chosen as best route?

Flag	Destination	Gateway	Distance
AS	192.168.10.0/28	192.168.1.1	1
AS	192.168.10.0/24	192.168.1.2	1
S	192.168.10.0/30	192.168.1.3	1
AS	192.168.10.0/29	192.168.1.4	5
AS	192.168.10.0/29	192.168.1.5	1



LAB: STATIC ROUTE

- Configure your laptop and router IPs according to lab topology.
- Create static routes between routers.
- Make sure every laptop can ping to each other.



LAB: STATIC ROUTE (CONT.)

○ R1

```
/ip route add dst-address=23.23.23.0/24 gateway=12.12.12.2  
/ip route add dst-address=192.168.2.0/24 gateway=12.12.12.2  
/ip route add dst-address=192.168.3.0/24 gateway=12.12.12.2
```

○ R2

```
/ip route add dst-address=192.168.1.0/24 gateway=12.12.12.1  
/ip route add dst-address=192.168.3.0/24 gateway=23.23.23.3
```

○ R3

```
/ip route add dst-address=12.12.12.0/24 gateway=23.23.23.2  
/ip route add dst-address=192.168.1.0/24 gateway=23.23.23.2  
/ip route add dst-address=192.168.2.0/24 gateway=23.23.23.2
```



LAB: STATIC ROUTE (CONT.)

- If there is no internet gateway in our network, we could also use default route (0.0.0.0/0) on R1 and R3.
- R1

```
/ip route add dst-address=0.0.0.0/0 gateway=12.12.12.2
```
- R2

```
/ip route add dst-address=192.168.1.0/24 gateway=12.12.12.1
```

```
/ip route add dst-address=192.168.3.0/24 gateway=23.23.23.3
```
- R3

```
/ip route add dst-address=0.0.0.0/0 gateway=23.23.23.2
```



ASK QUESTIONS?



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 - phyo@informationbeam.net





TO BE CONTINUED...

THANKS FOR YOUR ATTENTION!

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