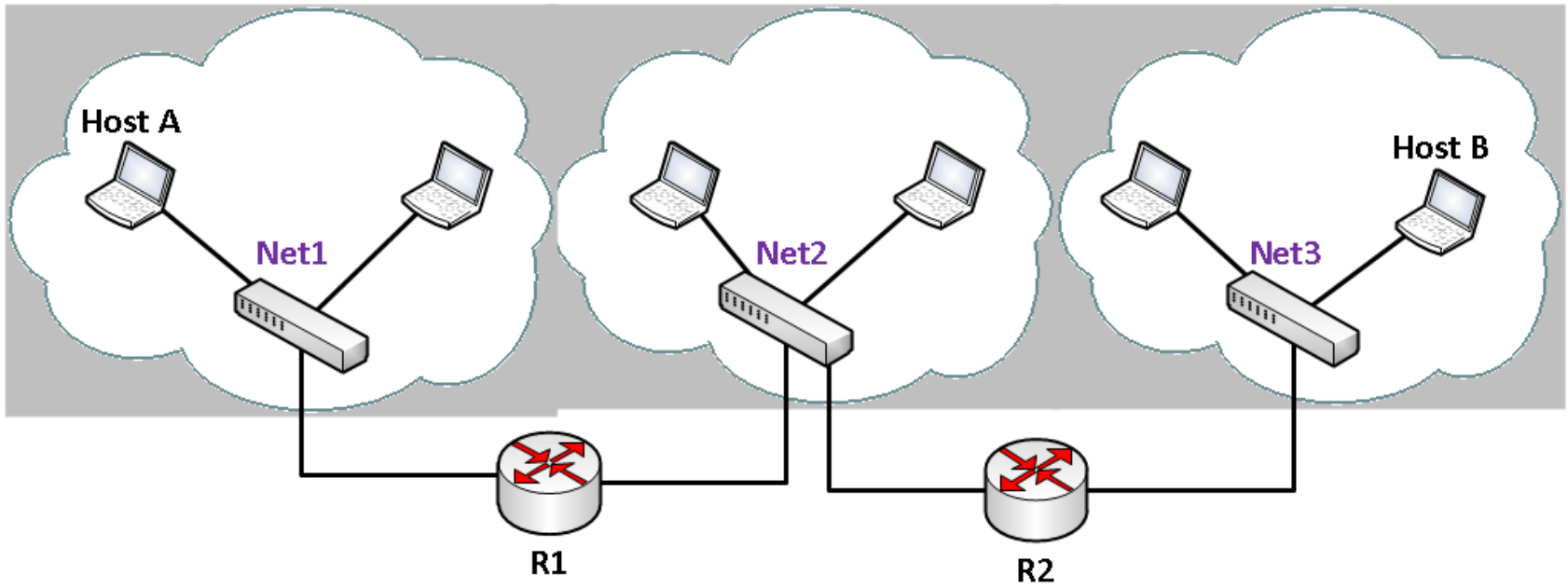
COMP30040
Forwarding techniques, routing tables, DHCP

Cristian Olariu

Conceptual forwarding techniques

- Next-hop method
- Network-specific method
- Host-specific method
- Default method

Next-hop forwarding method



Host A routing table

Destination	Next Hop
Host B	R1

Router R1 routing table

Destination	Next Hop
Host B	R2

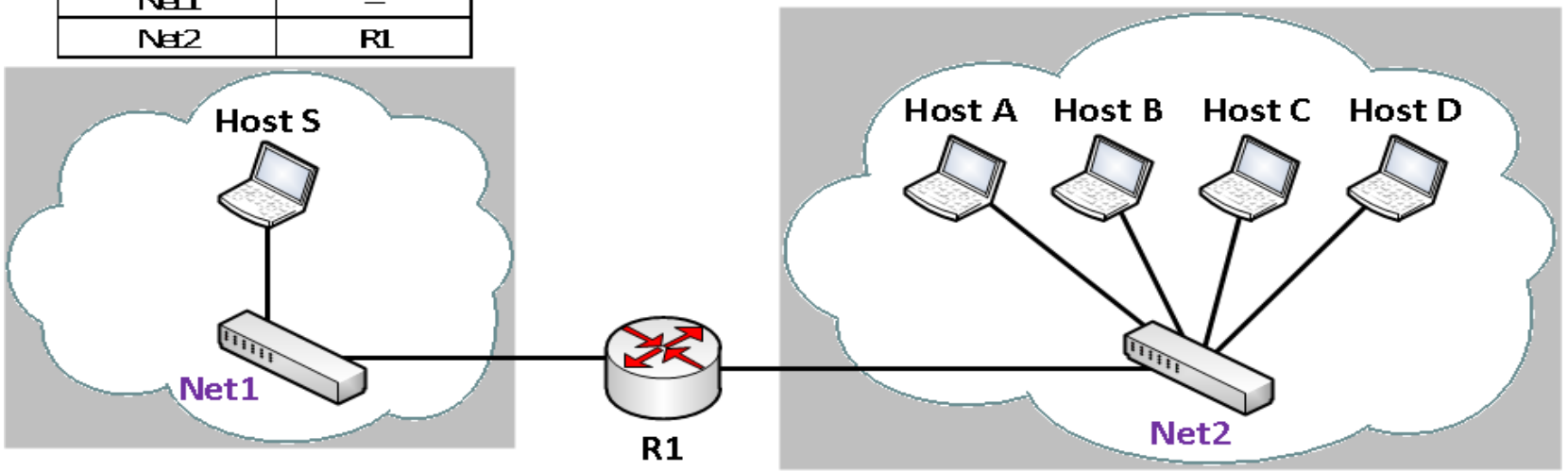
Router R2 routing table

Destination	Next Hop
Host B	–

Network- **or** host-specific forwarding method

Network-specific routing table for Host S

Destination	Next Hop
Net1	–
Net2	R1



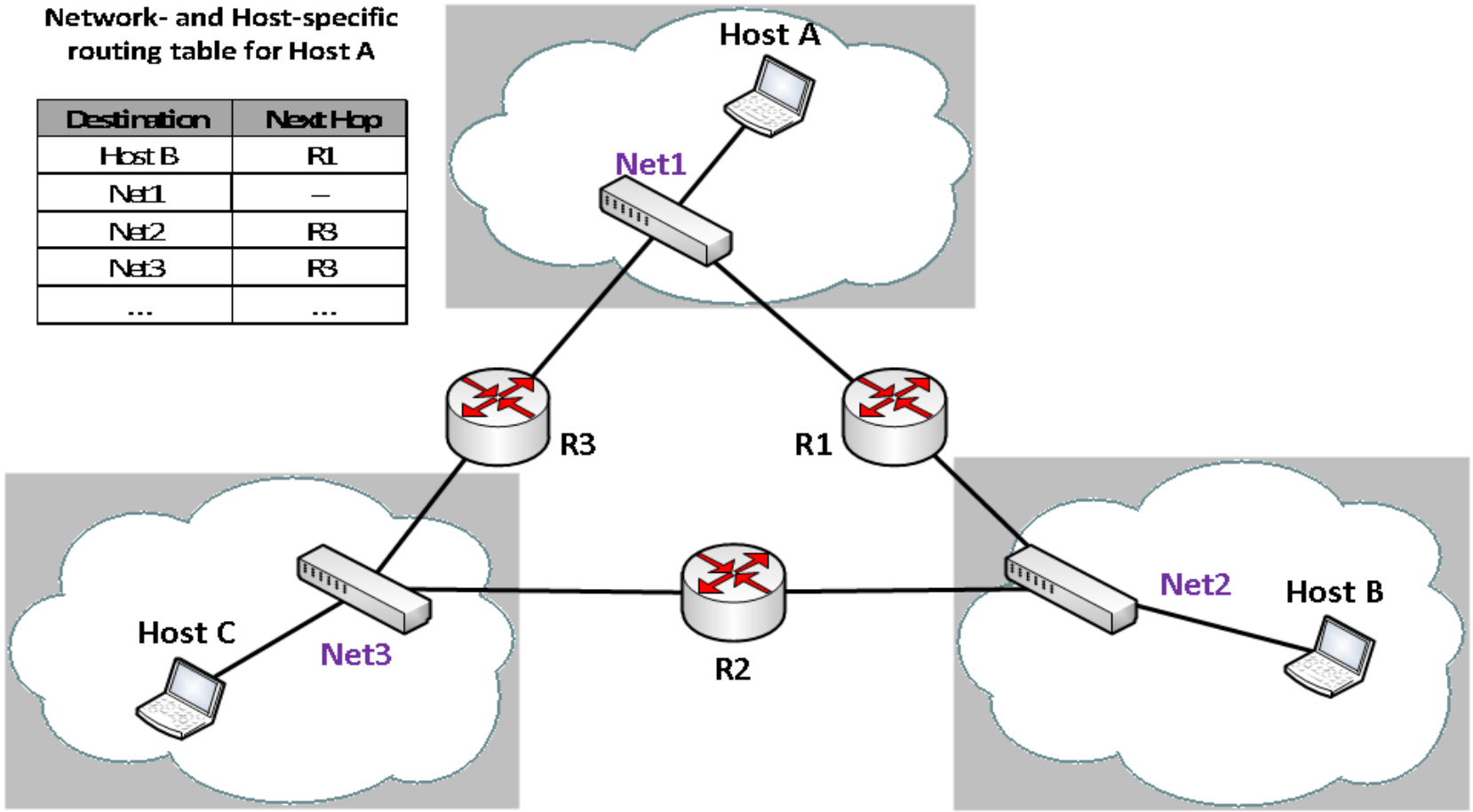
Host-specific routing table for Host S

Destination	Next Hop
Host A	R1
Host B	R1
Host C	R1
Host D	R1

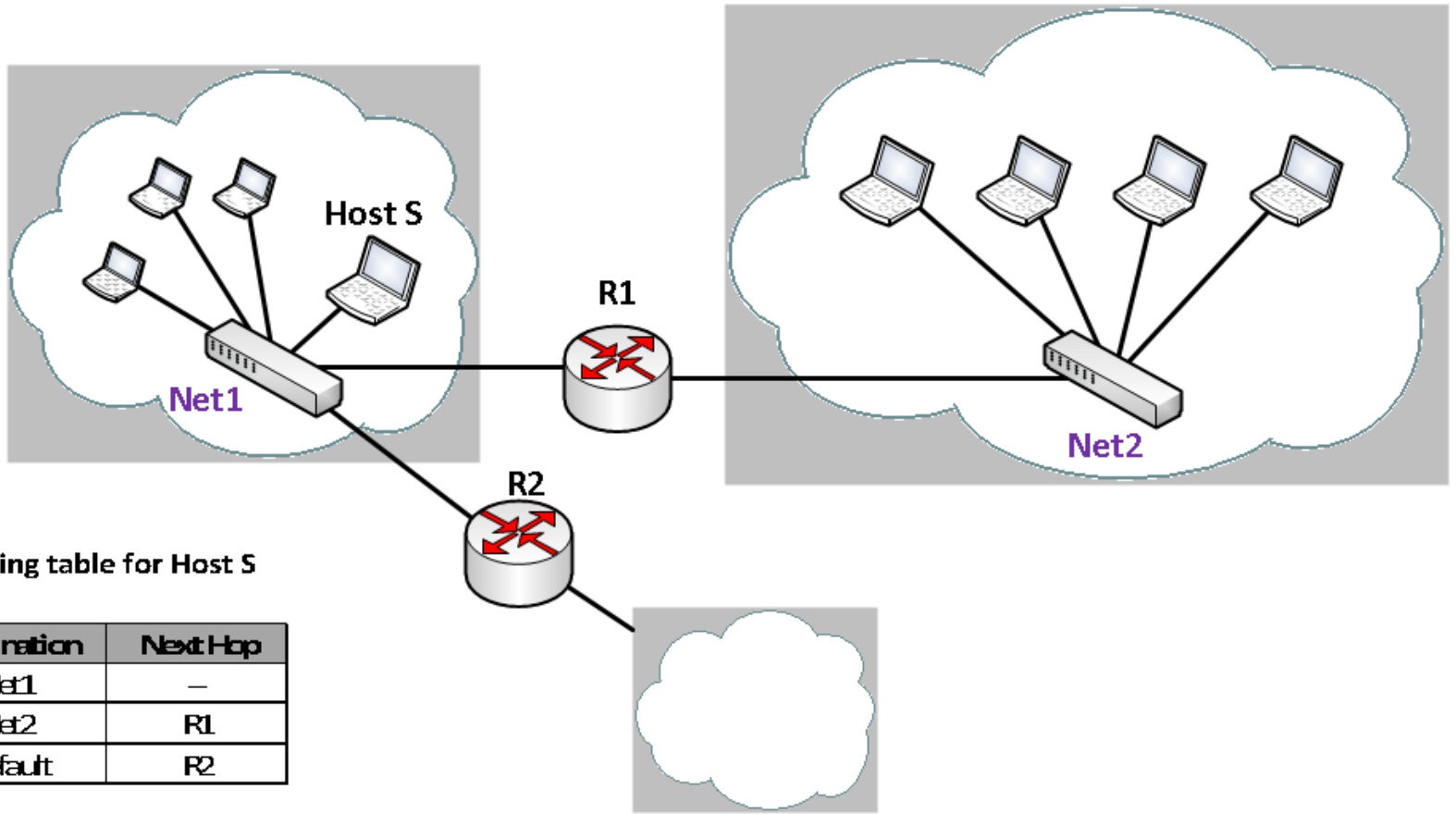
Network- **and** host-specific routing

Network- and Host-specific routing table for Host A

Destination	Next Hop
Host B	R1
Net1	–
Net2	R3
Net3	R3
…	…



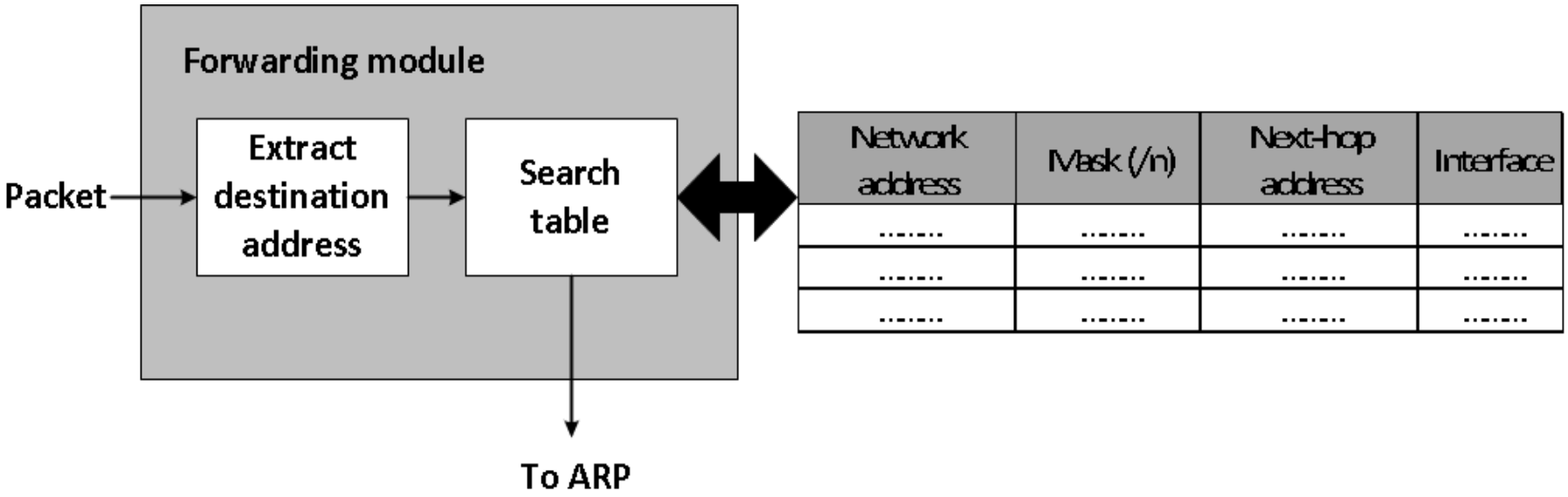
Default routing



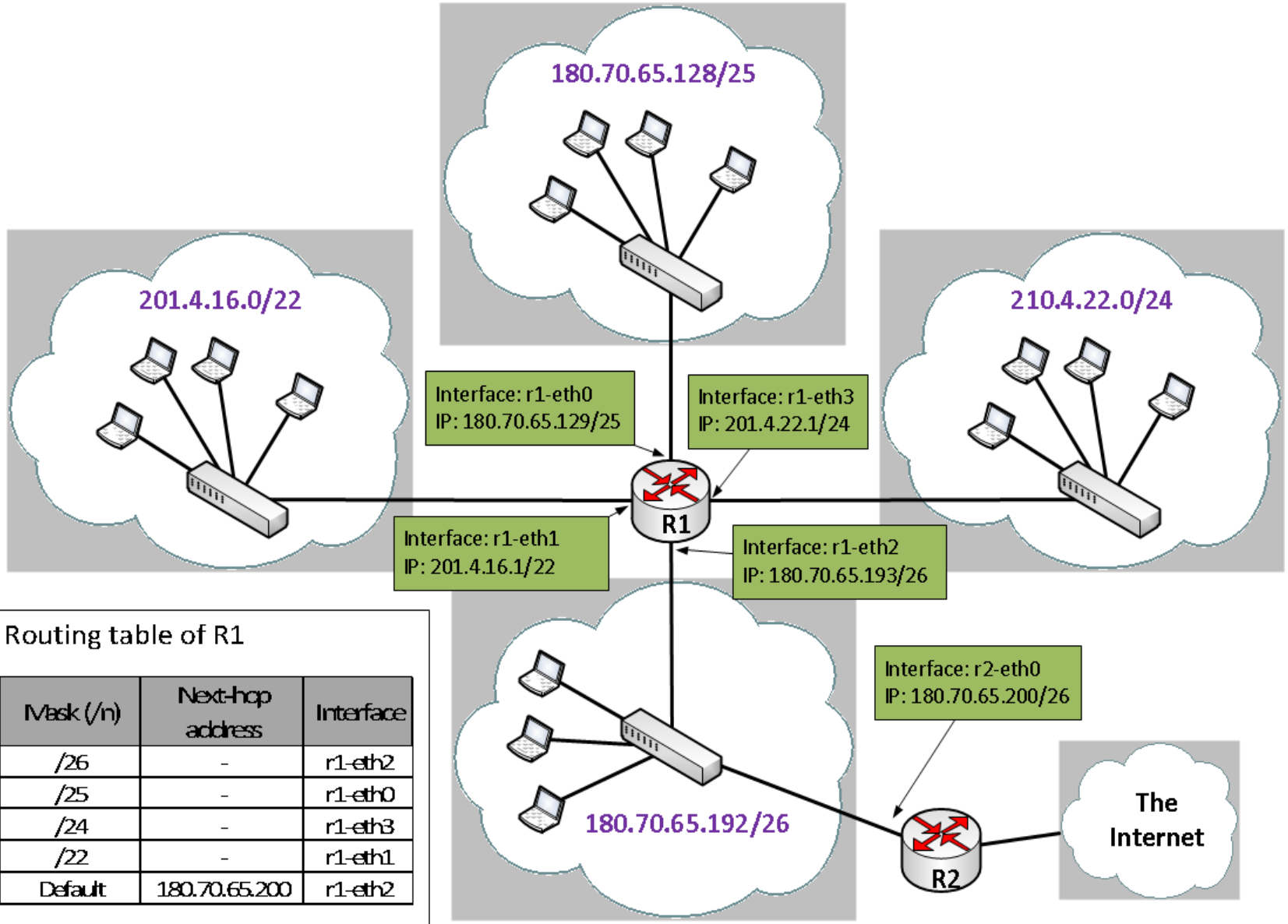
Routing table for Host S

Destination	Next Hop
Net1	–
Net2	R1
Default	R2

Forwarding with Classless Addressing



Example



Routing table of R1

Network address	Mask (/n)	Next-hop address	Interface
180.70.65.192	/26	-	r1-eth2
180.70.65.128	/25	-	r1-eth0
210.4.22.0	/24	-	r1-eth3
201.4.16.0	/22	-	r1-eth1
Default	Default	180.70.65.200	r1-eth2

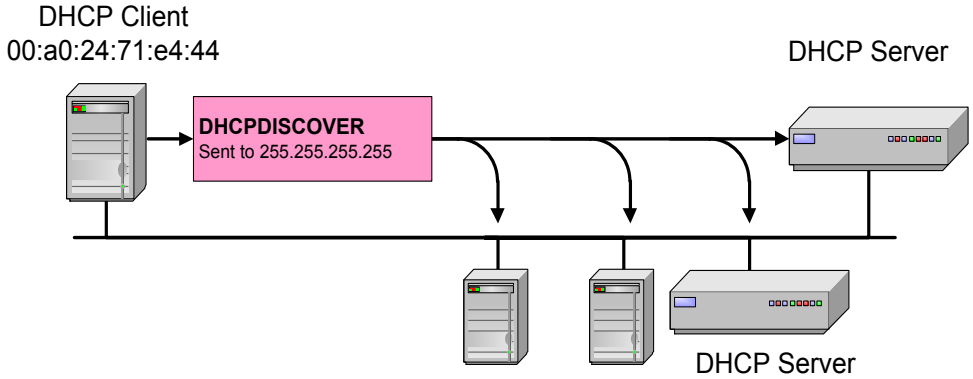
DHCP

What is DHCP

- “Dynamic Host Configuration Protocol” (RFC 2131)
- Automatically assigns IP addresses to devices (I.e. hosts) on your network
  - Prevents having to manually enter IP configuration commands
  - Prevents typos that can cause connectivity problems or disrupt the network (e.g., exchanging IP address and gateway address)

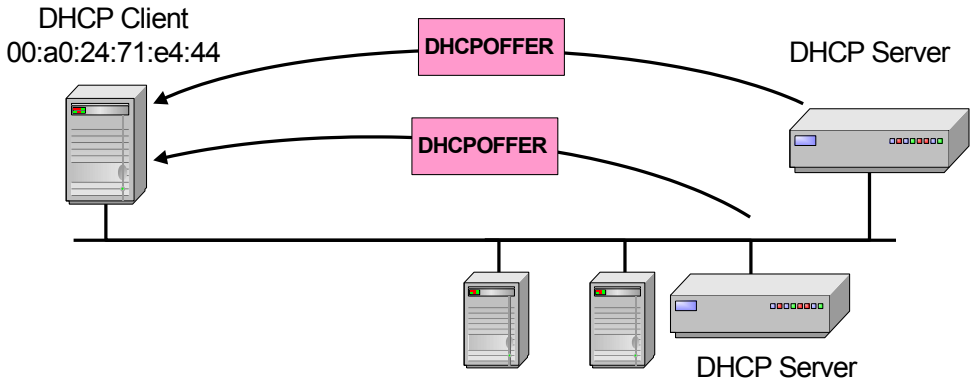
DHCP Operation is a **four step process** between clients (UDP port 68) and servers (UDP port 67):

Step 1: Client sends *Discover:* "Someone, please send me an address I could use."(broadcast)



DHCP Discover

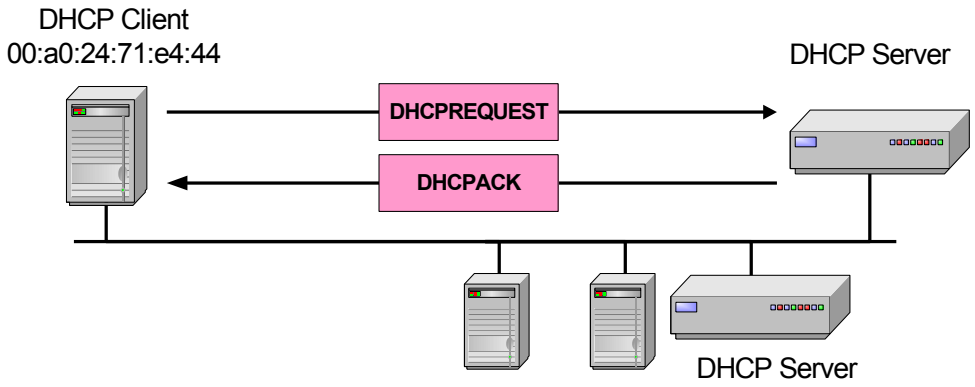
Step 2: Servers *Offer:* "Use this a.b.c.d address".



DHCP Offer

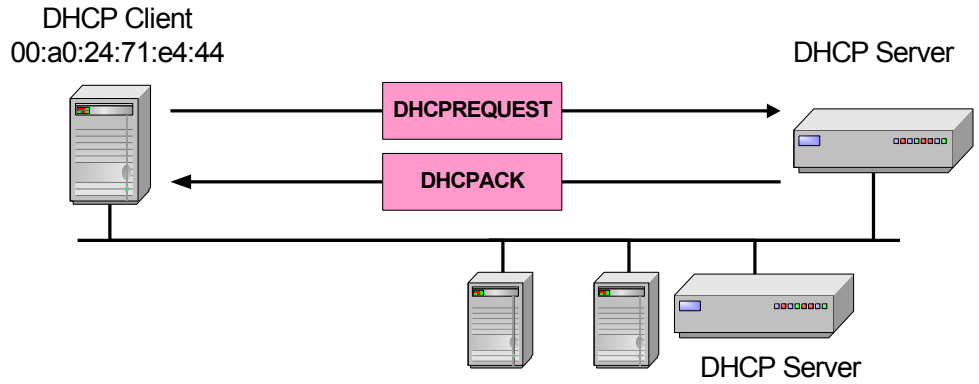
DHCP Operation

Step 3: Client *Requests:* “I’ m using this a.b.c.d address”. (broadcast)



DCHP REQUEST

Step 4: Servers *Acknowledge* “OK or No Way!” (ACK/NAK)



Renewing a Lease (sent when 50% of lease time has expired). If DHCP server sends DHCPNACK, then address is released.

DHCP Results

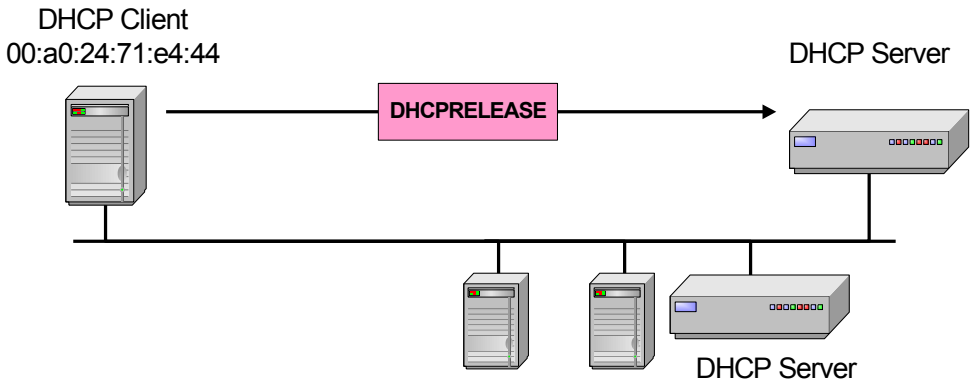
- Servers should provide IP address, netmask, DNS servers, domain, and gateway, etc.

- Client will be allowed to use the address for a period of time called a *Lease*
  - Normal campus addresses: 2 day lease
  - Roaming addresses: 42 minutes

Lease Renewal

- Halfway through lease period, client asks its current DHCP server to grant extension on usage of the same IP address.
  - Client sends *Request* (unicast).
  - Server sends *Acknowledge.*
- If current server is not available, client will broadcast request. This may cause it to change servers.
- If lease expires, client must stop using the address and start the process from scratch.

DHCP Operation: releasing the IP address



DCHP RELEASE

At this time, the DHCP client has released the IP address

Useful commands

- **ipcalc 192.168.1.13/27**
  - *calculate a subnet's parameters*
  - *If ipcalc is not installed in your Linux VM, install it with: sudo apt-get install ipcalc*

```
➜  ~  ipcalc 192.168.1.13/27
Address:   192.168.1.13          11000000.10101000.00000001.000 01101
Netmask:   255.255.255.224 = 27  11111111.11111111.11111111.111 00000
Wildcard:  0.0.0.31              00000000.00000000.00000000.000 11111
=>
Network:   192.168.1.0/27        11000000.10101000.00000001.000 00000
HostMin:   192.168.1.1           11000000.10101000.00000001.000 00001
HostMax:   192.168.1.30          11000000.10101000.00000001.000 11110
Broadcast: 192.168.1.31          11000000.10101000.00000001.000 11111
Hosts/Net: 30                     Class C, Private Internet
```

- **ip route add 10.1.1.0/24 via 192.168.1.1 dev eth0**
  - *add a route on the host this command is run, for subnet 10.1.1.0/24 by specifying the IP address of the next hop, i.e. 192.168.1.1, and this route should use the eth0 interface*
- **ip route add default via 192.168.1.1 dev eth0**
  - *add a route on the host this command is run, for any subnet that is not already in my routing table by specifying the IP address of the next hop, i.e. 192.168.1.1, and this route should use the eth0 interface*
- **ip route show**
  – show the current routing table of a host
- **dhclient eth0**
  - requests the settings for eth0 using the DHCP protocol