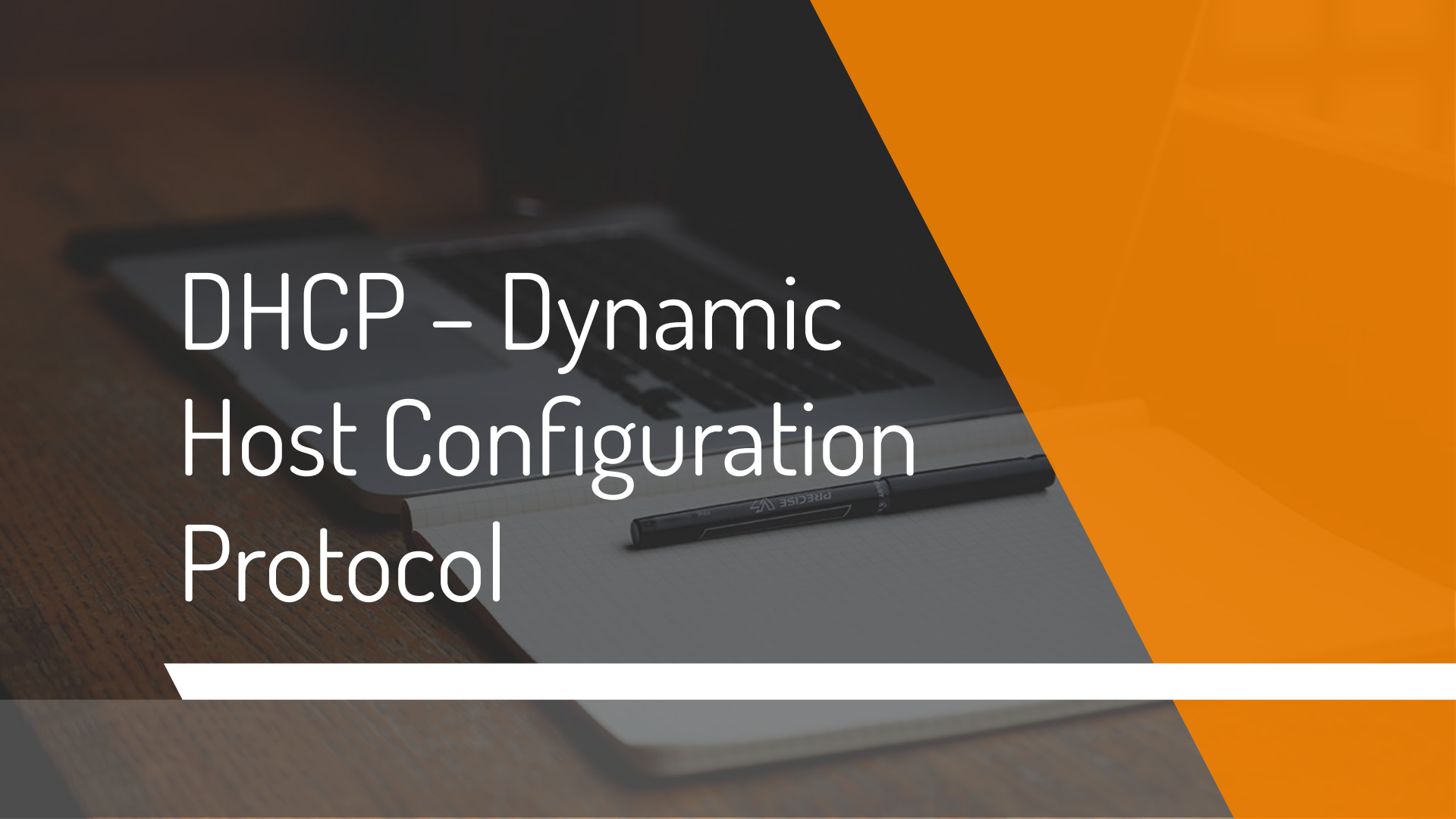
DHCP – Dynamic Host Configuration Protocol



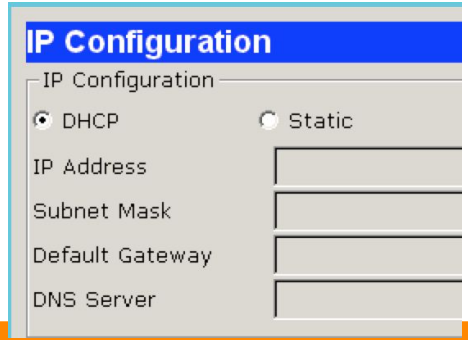
DHCP Terminology

- **DHCP pool**: group of IP addresses to be assigned dynamically
- **Default router**: default gateway
- **Lease time**: amount of time before a dynamically allocated IP expires and must be reassigned
- **Relay agent**: allows IP addresses to be dynamically allocated throughout multiple broadcast domains

DHCP Server

- Located on a router (for our purposes; can also be located on an external server)
- Assigns an IP address, a default gateway, and (optionally) a DNS server and domain name
- Interfaces can be assigned an IP with DHCP using the **ip address dhcp** command
- Use **do show dhcp binding** to view assigned IPs

DHCP on an end device in Packet Tracer



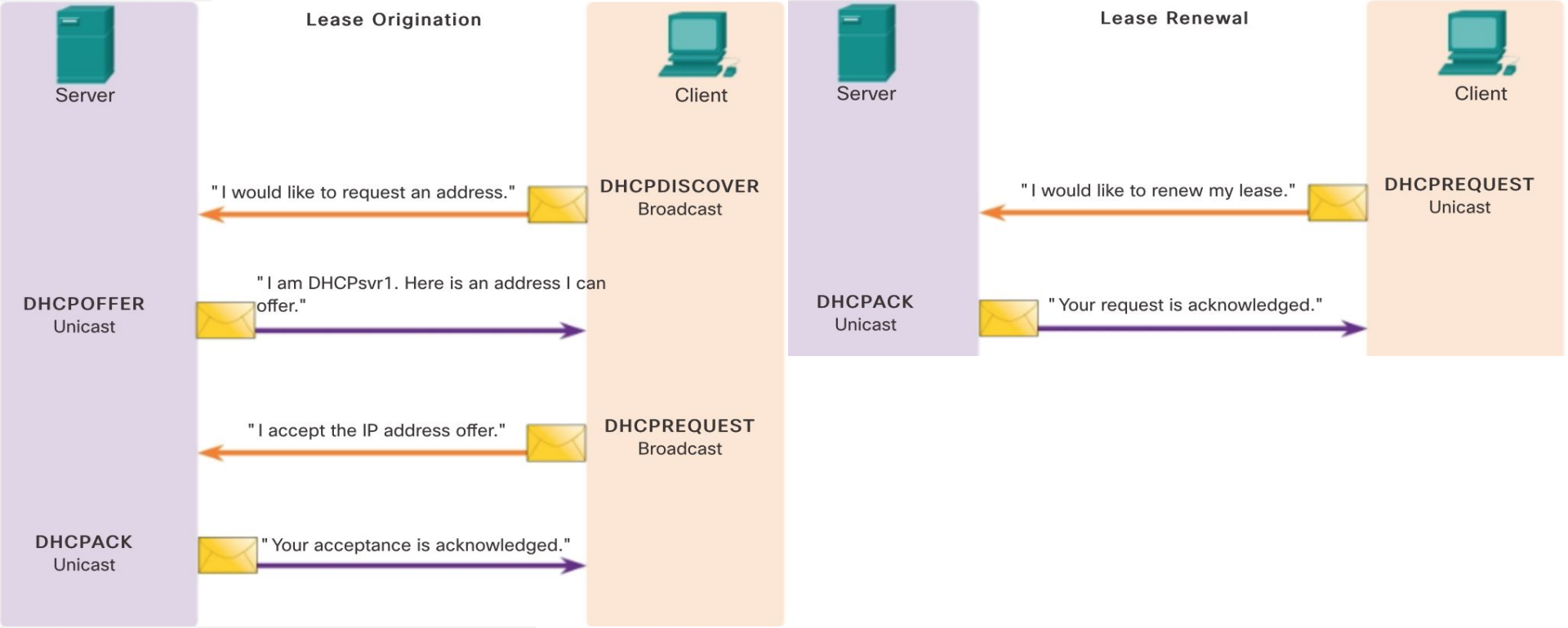
DHCP Allocation

- **Manual**: administrator assigns a pre-allocated IP address to client; DHCP communicates it to the device
- **Automatic**: DHCP automatically selects a static IP from a pool of available addresses and assigns it permanently to a device
- **Dynamic**: DHCP dynamically assigns an IP from a pool of addresses for a limited time or until address is no longer needed

DHCP Messages

- **DHCP discover (DHCPDISCOVER)** – broadcast message sent out with the client's MAC address to find a DHCP server
- **DHCP offer (DHCPOFFER)** – unicast message sent to client with an IP
- **DHCP request (DHCPREQUEST)** – broadcast message sent to all DHCP servers accepting the IP (unicast if renewing lease)
- **DHCP acknowledgment (DHCPACK)** – unicast message sent to client after IP is verified

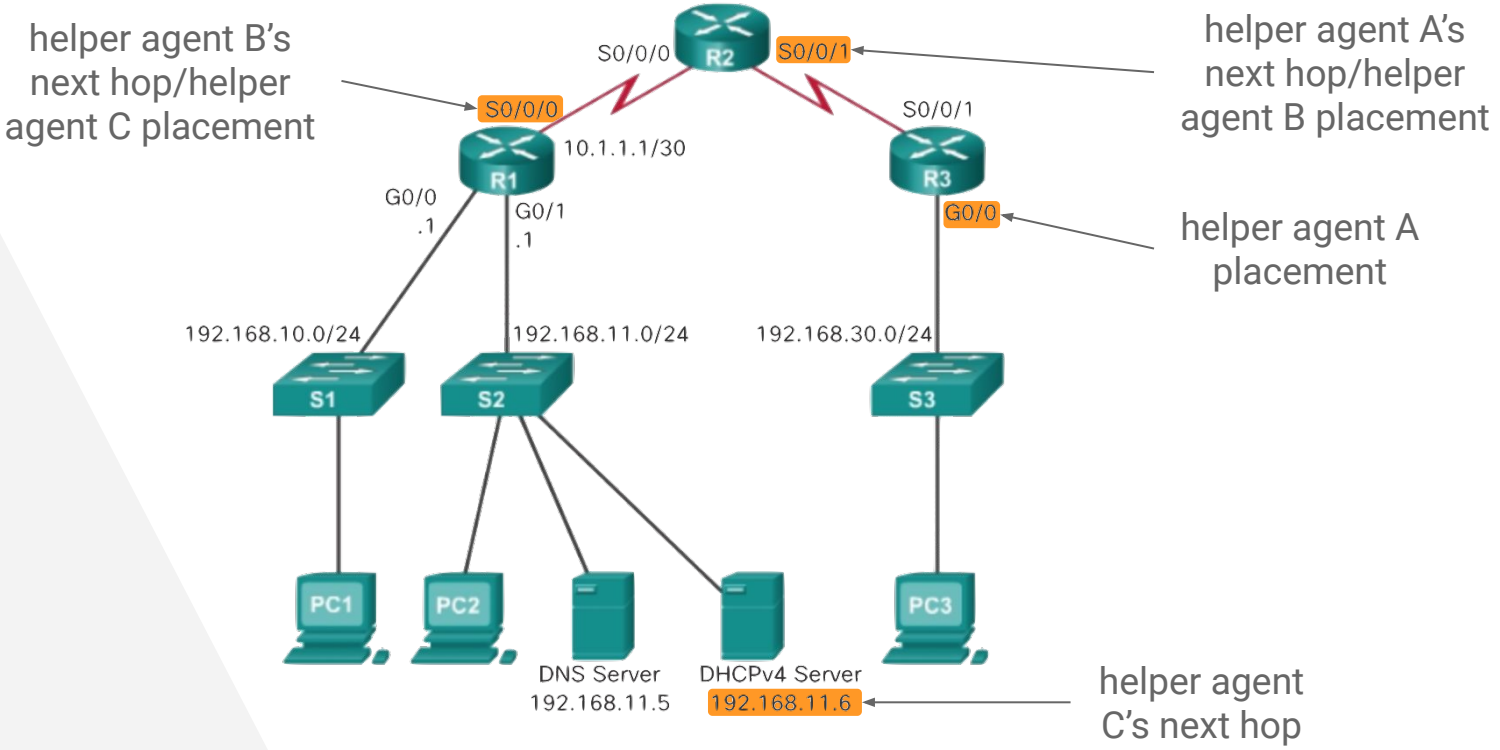
DHCP Messages



DHCP Relay

- Forwards DHCPDISCOVER messages outside the broadcast domain so they can be received by the DHCP server
- Used to avoid needing a DHCP server on every subnet
- **ip helper-address [ip address of next hop towards DHCP server]** is used on the router interface receiving a DHCP request to configure a relay agent
- The next hop is often the DHCP server itself; can also be the inbound interface of the nearest router between the relay agent and the DHCP server

DHCP Relay Placement Example: Allow PC3 to receive an IP from the DHCP server



DHCP Configuration

Step Description	Placement	Command	Category	Notes
enable dhcp	router config	service dhcp	requirement	enabled by default
create/configure a DHCP pool and enter DHCP config mode	router config	ip dhcp pool [pool name]	requirement	
define a range of available addresses	dhcp config	network [network address] [subnet mask]	requirement	overrides previous network command
add a default router	dhcp config	default-router [ip address of gateway]	requirement	may list up to 8 IPs
add a DNS server	dhcp config	dns-server [dns server ip address]	optional	
exclude preassigned IP addresses	router config	ip dhcp excluded-address [low ip address] [high ip address]	optional	
define a domain name	dhcp config	domain-name [domain name]	optional	
change the lease time	dhcp config	lease [days]	optional	default is 1 day add "[hours]" and/or "[minutes]" to the end of the command to further specify lease time use "lease infinite" to remove the lease time (not recommended)
configure a relay agent	router interface receiving a DHCP request	ip helper-address [ip address of next hop towards DHCP server]	optional	next hop is often the DHCP server itself; can also be the inbound interface of the nearest router between the relay agent and the DHCP server

DHCP Configuration Examples

```
R1(config)# ip dhcp excluded-address 192.168.10.1 192.168.10.9
R1(config)# ip dhcp excluded-address 192.168.10.254
R1(config)# ip dhcp pool LAN-POOL-1
R1(dhcp-config)# network 192.168.10.0 255.255.255.0
R1(dhcp-config)# default-router 192.168.10.1
R1(dhcp-config)# dns-server 192.168.11.5
R1(dhcp-config)# domain-name example.com
R1(dhcp-config)# end
R1#
```

```
R1(config)# interface g0/0
R1(config-if)# ip helper-address 192.168.11.6
R1(config-if)# end
R1# show ip interface g0/0
GigabitEthernet0/0 is up, line protocol is up
  Internet address is 192.168.10.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is 192.168.11.6
<output omitted>
```

Note: These screenshots came from two different example topologies. The helper address command will never be placed on the same router as the DHCP server.

Packet Tracer Labs

RSE 10.1.3.3
RSE 10.3.1.2

Credits

Special thanks to all the people who made and released these awesome resources for free:

- Presentation template by SlidesCarnival
- Photographs by Startupstockphotos