# CIS 3210 DHCP



## In the beginning ...

- Hosts were assigned an IP address manually.
- Next came BOOTP.
- Now we have DHCP.

## BOOTP

- The <u>Bootstrap Protocol (BOOTP)</u>, defined in RFC 951, is the predecessor of DHCP.
- BOOTP provided a method for <u>diskless workstations</u> to download IP address configurations.
  - Diskless workstations are workstation or PCs without disk drives
  - E.g., Thin clients, cash register systems.

#### Both BOOTP and DHCP ...

- Both are client/server based.
  - The server has a static IP address and allocates, distributes, and manages IP configuration data allocation.
  - Each allocation (IP configuration data) is stored on the server in a data set called a <u>binding</u>.
- Both can assign IP configuration data.
  - IP address, subnet mask, default gateway, and DNS server address.
- Both use the same UDP ports known as BOOTP ports.
  - 67/UDPBootstrap Protocol (BOOTP) Server
  - 68/UDPBootstrap Protocol (BOOTP) Client

## Differences Between BOOTP and DHCP ...

• When a BOOTP client requests an IP address:

- The BOOTP server searches a predefined table for an entry that matches the MAC address for the client.
- If an entry exists, the corresponding IP address for that entry is returned to the client.
- This means that the binding between the MAC address and the IP address must have already been configured in the BOOTP server.
- Therefore, if a new host boots and is not in the BOOTP configuration file, the IP address cannot be assigned "dynamically"

## Differences Between BOOTP and DHCP ...

- DHCP allows for recovery and reallocation of network addresses through a finite leasing mechanism.
  - When the lease expires, the IP address can be assigned to another client later.
  - Clients may also renew leases and keep the same IP address.
- BOOTP does not use leases.
  - Clients have reserved IP address which cannot be assigned to any other host.

## Differences Between BOOTP and DHCP ...

- BOOTP provides a limited amount of information to a host.
- DHCP provides additional IP configuration parameters, such as WINS and domain name.

# Dynamic Host Configuration Protocol v4

#### Dynamic vs. Static IP Addressing Quiz

Desktop computer	Server	Router	Switch
Laptop	IP phone	Printer	RADIUS server
AP	PDA	iTouch	Fridge

#### **Static IP Address**



#### Dynamic (DHCP) IP Address



# Dynamic Host Configuration Protocol (DHCP)

- DHCP emerged as a standard protocol in October 1993 as defined in <u>RFC 1531</u>, succeeding the <u>BOOTP</u> protocol.
- DHCP allows a host to quickly and dynamically obtain configuration parameters from a DHCP Server.
  - In an Enterprise, DHCP is almost exclusively always configured on a dedicated server.

# Dynamic Host Configuration Protocol (DHCP)

- The client's configuration parameters can include:
  - IP Address
  - Subnet Mask
  - Default Gateway
  - DNS Server address
  - Domain Names
  - WINS Server address
  - •

## **3 DHCP Address Allocation Mechanisms**

#### Static (Manual) Allocation:

 The administrator statically assigns a pre-allocated IP address to the client and DHCP only communicates the IP address to the device.

#### • Dynamic Allocation:

- DHCP automatically assigns an IP address from a pool of addresses.
- The address is leased for a limited period of time configured on the server, or until the client no longer needs the address.

#### • Automatic Static Allocation:

- DHCP automatically assigns a static IP address permanently to a device, selecting it from a pool of available addresses.
- There is no lease and the address is permanently assigned to a device.

# DHCP Operation and Message Format

## How Does DHCP Work?

- A DHCP Server must be available.
  - Must have pre-configured range (scope) of addresses.

Scope Properties - (Local)	×
IP Address Pool	1
Set Barge	
End Address: 10 . 10 . 255	
Subnet Mas <u>k</u> : 255 . 255 . 255 . 0	
Exclusion Range:	
Start Address:	
End Address:	
Lease Duration	ך ר
O Unlimited	
Limited To: 3 → Day(s) 00 → Hour(s) 00 → Minutes	
Na <u>m</u> e:	1
Comment:	
OK Cancel <u>H</u> elp	

### **DHCP** Operation

- As clients come online they contact the DHCP server and request an address.
- The DHCP server chooses an address and allocates it to that host.
- DHCPv4 messages are encapsulated within the UDP transport protocol.
  - DHCPv4 messages from the client use UDP source port 68 and destination port 67.
  - DHCPv4 messages from the server to the client use UDP source port 67 and destination port 68.

#### **DHCP** Operation



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🖬 Address Resolution Protocol (request)	
Hardware type: Ethernet (0x0001) Protocol type: IP (0x0800) Hardware size: 6 Protocol size: 4 Opcode: request (0x0001) Sender MAC address: Cisco-Li_a0:d1:be (00:18:39:a0:d1:be) Sender IP address: 192.168.2.1 (192.168.2.1) Target IP address: 192.168.2.1 (192.168.2.1) Target IP address: 00:00:00_00:00:00 (00:00:00:00:00) Target IP address: 192.168.2.5 (192.168.2.5)	
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Address Resolution Protocol (arp), 28 bytes	P: 45 D: 45 M: 0 Drops: 0 .:

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⊕ Frame 3 (590 bytes on wire, 590 bytes captured)	
<ul> <li>Ethernet II, Src: Cisco-Li_a0:d1:be (00:18:39:a0:d1:be), Dst: Intel_9e:f7:15 (00:19:d2:9e:f7:15)</li> <li>Destination: Intel_9e:f7:15 (00:19:d2:9e:f7:15)</li> <li>Source: Cisco-Li_a0:d1:be (00:18:39:a0:d1:be) Type: IP (0x0800)</li> <li>Internet Protocol, Src: 192.168.2.1 (192.168.2.1), Dst: 192.168.2.5 (192.168.2.5)</li> <li>Version: 4 Header length: 20 bytes</li> <li>Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00) Total Length: 576 Identification: 0x0000 (0)</li> <li>Flags: 0x00 Fragment offset: 0 Time to live: 64 Protocol: UDP (0x11)</li> <li>Header checksum: 0xf356 [correct] Source: 192.168.2.1 (192.168.2.5)</li> <li>User Datagram Protocol, Src Port: bootpc (67), Dst Port: bootpc (68)</li> </ul>	
Source port: bootps (67) Destination port: bootpc (68) Length: 556	~
0000 00 19 d2 9e f7 15 00 18 39 a0 d1 be 08 00 45 009E. 0010 02 40 00 00 00 00 40 11 f3 56 c0 a8 02 01 c0 a8 .@@V 0020 02 05 00 43 00 44 02 2c 7e 7d 02 01 06 00 b3 e3C.D., ~} 0030 56 4c 00 00 00 00 00 00 00 c0 a8 02 05 00 00 VL 0040 00 00 00 00 00 00 00 19 d2 9e f7 15 00 00 00 00 0050 00 00 00 00 00 00 00 00 00 00 00 00	
File: "C:\DOCUME~1\bvachon\LOCALS~1\Temp\etherXXXXa02636" 6871 Bytes 00:00:13 P: 45 D: 45 M: 0 Drops: 0	

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6 1.810827 Intel_9e:f7:15 Broadcast ARP Gratuitous ARP for 192.168.2.5 (Request)		/
Image: Frame 4 (343 bytes on wire, 343 bytes captured) Image: Frame 4 (343 bytes on wire, 343 bytes captured) Image: Ethernet II, Src: Intel_9e:f7:15 (00:19:d2:9e:f7:15), Dst: Broadcast (ff:ff:ff:ff:ff:ff)		
Destination: Broadcast (ff:ff:ff:ff:ff)     Source: Intel_9e:f7:15 (00:19:d2:9e:f7:15)     Type: IP (0x0800)		
<ul> <li>Internet Protocol, Src: 0.0.0.0 (0.0.0.0), Dst: 255.255.255.255 (255.255.255.255)</li> <li>Version: 4         <ul> <li>Header length: 20 bytes</li> <li>Differentiated Services Field: 0x00 (DSCP 0x00: Default: ECN: 0x00)</li> </ul> </li> </ul>		
Total Length: 329 Identification: 0x543a (21562)		=
Fragment offset: 0 Time to live: 128		
Protocol: UDP (UXII) Header checksum: 0xe56a [correct] Source: 0.0.0.0 (0.0.0.0)		
Destination: 255.255.255.255.255 (255.255.255) User Datagram Protocol. Src Port: bootpc (68). Dst Port: bootps (67)		
Source port: bootpc (68)		-
Destination port: bootps (67) Length: 309		~
0000 ff ff ff ff ff ff 00 19 d2 9e f7 15 08 00 45 00E.	2	
$0020  \text{ff}  \text{ff}  00  44  00  43  01  35  66  \text{af}  01  00  00  00  03  e3  \dots \text{D.C.5}  k.\dots$	-	
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File: "C:\DOCUME~1\bvachon\LOCALS~1\Temp\etherXXXa02636" 6871 Bytes 00:00:13 P: 45 D: 45 M: 0 Drops: 0		

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## **DHCP** Message Format

• The DHCPv4 message format is used for all DHCPv4 transactions.

8	16	24	32							
OP Code (1)	Hardware Type (1)	Hardware Address Length (1)	Hops (1)							
Transaction Identifier										
Seconds - 2 bytes Flags - 2 bytes										
Client IP Address (CIADDR) - 4 bytes										
	Your IP Address (	YIADDR) - 4 bytes								
	Server IP Address	(SIADDR) - 4 bytes								
	Gateway IP Address	s (GIADDR) - 4 bytes								
(	lient Hardware Addres	ss (CHADDR) - 16 byte	is							
	Server Name (SNAME) - 64 bytes									
	Boot Filename - 128 bytes									
	DHCP Optic	ons - variable								

Wireshark capture

A DHCP-Wireshark.pcap [Wireshark 1.8.2 (SVN Rev 44520 from /trunk-1.8)]				
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Die Ene Den Do Ophraie Windhie Stangard Leichweit. Toop Tureurup Uch	OP Code (1)	Hardware Type (1)	Length (1)	Hops (1)
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	Seconds	- 2 bytes	Flags -	2 bytes
Filter: Expression Clear Apply 5		Client IP Address	(CIADDR) - 4 bytes	
		Your IP Address (	YIADDR) - 4 bytes	
No.  Time  Source  Destination  Protocol  Length  Info		Server IP Address	(SIADDR) - 4 bytes	
2 0 000000 0.0.0 255.255.255 DHCP 314 DHCP 1		Gateway IP Address	s (GIADDR) - 4 bytes	
2 0.000295 192.108.0.1 192.108.0.10 DHCP 342 DHCP (	(	Server Nerre (SI	ss (CHADDR) - 16 byte	IS
		Boot Filenan	NAME) - 04 Dytes	
4 0.070345 192.108.0.1 192.108.0.10 DHCF 542 DHCF 7		DHCP Optio	ons - variable	
4				
Frame 4: 342 bytes on wire (2736 bits). 342 bytes captured (2736 bits)				
Ethernet II. Src: DellComp_ad:f1:9b (00:08:74:ad:f1:9b). Dst: Grandstr_01:	fc:42 (00:0k	0:82:01:fc:4	2)	
■ Internet Protocol Version 4, Src: 192.168.0.1 (192.168.0.1), Dst: 192.168.	0.10 (192.10	58.0.10)		
User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68)				
🖻 Bootstrap Protocol			_	
Message type: Boot Reply (2)				
Hardware type: Ethernet Operation (OP) Code				
Hardware address length: 6	l type of m	essade		
Hops: 0		coouge.		
Transaction ID: 0x00003dle • A value of 1 Indicate	s a request	message		
seconds elapsed: 0 • A value of 2 is a repl	v messade			
Bootp flags: 0x0000 (Unicast)	Jineeeage			
Client IP address: 0.0.0.0 (0.0.0.0)				
Your (client) IP address: 192.168.0.10 (192.168.0.10)				
Next server IP address: 0.0.0.0 (0.0.0.0)				
Relay agent IP address: 0.0.0.0 (0.0.0.0)				
Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42)				
Client hardware address padding: 0000000000000000000				
Server host name not given				
Boot file name not given				
Magic cookie: DHCP				
⊕ Option: (53) DHCP Message Type     ↓				
Option: (58) Renewal Time Value				
Option: (59) Rebinding Time Value				
⊕ Option: (51) IP Address Lease Time				
0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00B tE.				
0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8 .H.F				
0020 00 0a 00 43 00 44 01 34 dt db 02 01 06 00 00 00C.D.4				
0040  00  00  00  00  00  00  00				
🛑 🌌   File: "C: \Users\Bob\_ACTIVE\CCNA 4 - CET 2345   Packets: 4 Displayed: 4 Mar   Profile: Default				

E       Edit View Go Capture Analyze Statistics Telephony Tools Internals Help       Image: Control of the statistics Telephony Tools Internals Help       Image: Control of the statistics Telephony Tools Internals Help         Filter:       Image: Control of the statistics Telephony Tools Internals Help       Image: Control of the statistics Telephony Tools Internals Help       Image: Control of the statistics Telephony Tools Internals Help         Filter:       Image: Control of the statistics Telephony Tools Internals Help       Image: Control of the statistics Telephony Tools Internals Help       Image: Control of the statistics Telephony Tools Internals Help         90       Control of the statistics Telephony Tools Internals Help       Image: Control of the statistics Telephony Tools Internals Help       Image: Control of the statistics Telephony Tools Internals Help       Image: Control of the statistics Internals Help	CHCP-Wireshark.pcap [Wireshark 1.8.2 (SVN Rev 44520 from /trunk-1.8)]				
B       B	File Edit View Go Capture Apalyze Statistics Telephony Tools Internals Help	8	16	24	32
Image: Source         Destination         Protocol         Length         Image: Type           30.070001         0.0.0.0         255,255,255,255         PHCP         314 DHCP         Destination         Burner PAdoms (SADDR) -4 byte           30.070011         0.0.0.0         255,255,255,255         DHCP         314 DHCP         Destination         Burner PAdoms (SADDR) -4 byte           40.070245         192,168,0.1         192,168,0.10         DHCP         314 DHCP         Burner PAdoms (SADDR) -4 byte           40.070245         192,168,0.10         DHCP         314 DHCP         Burner PAdoms (SADDR) -4 byte           40.070245         192,168,0.10         DHCP         314 DHCP         Burner PAdoms (SADDR) -4 byte           40.070245         192,168,0.10         DHCP         314 DHCP         Burner PAdoms (SADDR) -4 byte           40.070245         192,168,0.10         DHCP         312,0 EKCP         Burner PAdoms (SADDR) -4 byte           41         DHCP Dotool Version 4, Src: 192,168,0.010         DHCP 20,0 EKP         314 DHCP         Burner PAdoms (SADDR) -4 byte           42         DHCP Botool Version 4, Src: 192,168,0.010         DHCP 20,0 EKP         314 DHCP         Burner PAdoms (SADDR) -4 byte           43         Bootstrap Protocol Version 4, Src: 192,168,0.010         Internet Hadress: 0.0.0.0 (0.0.0.	The Fair Ten do Obhare Tripite Standard reichnout Toolo Strenung Teb	OP Code (1)	Hardware Type (1)	Length (1)	Hops (1)
Externet         Expression         Clear         Appy           0.000000         0.0.0.0         255.255.255.255.255.255.255.255.255.255	I 🗒 🕍 🎕 🕍 I 🗁 🔚 🗶 🎅 📇 I 🔍 🗢 🧼 🎝 ዥ 👱 I 🗐 📑 I 🗨 Q Q I		Transactio	on Identifier	
Filter         Expression         Clear         Appy         Dimt IP Admiss (MADR) - 4 byts           No.         Time         Source         Destination         Protocol         Length         Info           20.0002935         19221058.01         1022.165.05.10         DKCP         314 DMCP         Gamma         Sever IP Admiss (KADDR) - 4 byts           30.0.070031         0.0.0.0         255.255.255         DHCP         314 DMCP         Gamma         Sever IP Admiss (KADDR) - 4 byts           4         0.070345         1922.165.0.1         1922.165.0.10         DHCP         342 DHCP         Sever IP Admiss (KADDR) - 4 byts           6         Frame         192.165.0.1         1922.165.0.10         DHCP         342 DHCP         Sever IP Admiss (KADDR) - 4 byts           6         Hor         Sever IP Admiss (KADDR) - 4 byts         Sever IP Admiss (KADDR) - 4 byts         Sever IP Admiss (KADDR) - 4 byts           7         Sever Max (MAMCA)         Markas (MADDR) - 4 byts         Sever Markas (MADDR) - 4 byts         Sever Markas (MADDR) - 4 byts           8         Ethernet         192.165.0.10         DHCP         Sever Markas (MADDR) - 4 byts         Sever Markas (MADDR) - 4 byts           9         Ethernet         IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		Seconds	- 2 bytes	Flags -	2 bytes
Ime         Source         Destination         Protocol         Length         Info           10.000000         0.0.0.0         255.255.255.255         DHCP         314         DHCP         Gateway PAdress (GADOR) - 4 bytes           30.070031         0.0.0.0         255.255.255.255         DHCP         314         DHCP         Gateway PAdress (GADOR) - 4 bytes           40.070345         192.168.0.1         192.168.0.1         DHCP         314         DHCP         Gateway PAdress (GADOR) - 4 bytes           4         0.070345         192.168.0.1         DHCP         314         DHCP         Bade MCPDR         - Clere Hadress (MADOR) - 4 bytes           4         0.070345         192.168.0.1         DHCP         342         DHCP         Bade MCPDR         - Clere Hadress (MADOR) - 4 bytes           5         PFrame 4:         342         bytes         DHCP Optone - variable         - DHCP Optone - variable           11         Internet Protocol         Version 4, Src : 192.168.0.1         DHCP 10: List 2: 10: 10: 12: 168.0.10         - Clere Hadress: 12: 10: 10: 10: 12: 168.0.10           12         Internet type:         Ethernet + address: 10: 0.0.0         - List 2: 168.0.10         - Secont = address = address         - Address           13         Boott Frags: vaxoooo (unicas)         -	Filter:  Expression Clear Apply 5		Client IP Address	(CIADDR) - 4 bytes	
No.         Time         Source         Destination         Protocol         Length         Link         Source         Address (SLOD6) - 4 yeas           2         0.00000         0.0.0.0         255.255.255.255.255.255.255.255.255.255			Your IP Address (	(YIADDR) - 4 bytes	
1 0,000000       0,0,0,0       233,233,233       DHCP       314 DHCP       Cattery P Addres (GLODR) - A types         2 0,000205       192,168,0.1       192,168,0.1       DHCP       314 DHCP       Catter Hardware Address (GLADDR) - A types         3 0,07031       0.0,0.0       255,255,255       DHCP       314 DHCP       Beref Hardware (GLADDR) - A types         4 0,070345       192,168,0.1       192,168,0.10       DHCP       314 DHCP       Beref Hardwares (GLADDR) - A types         4 0,070345       192,168,0.1       192,168,0.10       DHCP       314 DHCP       Beref Hardwares (GLADDR) - A types         4 0,070345       192,168,0.1       092,168,0.10       DHCP       314 DHCP       Beref Hardwares (GLADDR) - A types         4 0,070345       192,168,0.1       092,168,0.10       DHCP       314 DHCP       Beref Hardwares (GLADDR) - A types         4 0,070345       192,168,0.1       092,168,0.1       DHCP       314 DHCP       DHCP Cybore - variable         4 0,070345       192,168,0.1       192,168,0.1       DHCP Cybore - variable       DHCP Cybore - variable         4 0,070345       192,168,0.1       192,168,0.1       DHCP Cybore - variable       DHCP Cybore - variable         4 0,070345       192,168,0.1       192,168,0.1       DHCP Cybore - variable       DHCP Cybore -	No.  Time  Source  Destination  Protocol  Length  Info		Server IP Address	(SIADDR) - 4 bytes	
2 0.000210       1227.005.01       1207.01	1 0.000000 0.0.0 255.255.255 DHCP 314 DHCP 1		Gateway IP Address	s (GIADDR) - 4 bytes	
3 0.070031       0.0.00       237.237.237.237.237.237.237.237.237.237.	2 0.000295 192.108.0.1 192.108.0.10 DHCP 342 DHCP (	(	Client Hardware Addres	ss (CHADDR) - 16 byte	35
4 0000343       192:108:0.10       DRCP       342 DRCP       DRCP Options - variable         0       E Frame 4: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits)       DRCP Options - variable       DRCP Options - variable         0       E thernet II, Src: DellComp_ad:f1:9b (00:08:74:ad:f1:9b), Dst: Grandsr.01:fc:42 (00:0b:82:01:fc:42)       DRCP Options - variable       DRCP Options - variable         0       User Datagram Protocol, Src: Port: bootps (67), Dst Port: bootpc (68)       Decomposition (192:168.0.10)       Ethernet II, Src: Port: Boot Reply (2)         Hardware type: Ethernet       Hardware type       • Identifies the type of hardware used in the network.       • 1 is Ethernet, 15 is Frame Relay, and 20 is a serial line.         Client IP address: 0.0.0.0 (0.0.0.0)       Your (client) IP address: 192.168.0.10 (192.168.0.10)       Next server IP address: 0.0.0.0 (0.0.0.0)         Relay agent IP address: 0.0.0.0 (0.0.0.0)       Relay agent IP address: conding: 000000000000000000000000000000000000	4 0 070245 102 168 0 1 102 168 0 10 DHCP 314 DHCP 1		Server Name (Si	NAME) - 64 bytes	
Image: Construct of the second sec	4 0.070343 192.108.0.1 192.108.0.10 DHCP 342 DHCP /		DHCP Ontic	ne - 120 bytes	
B Frame 4: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) B Ethernet II, Src: DellComp_ad:f1:9b (00:08:74:ad:f1:9b), Dst: Grandstr_01:fc:42 (00:0b:82:01:fc:42) Internet Protocol Version 4, Src: 192:168.0.10 (192:168.0.10 (192.168.0.10) B User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68) Bootstrap Protocol Message type: Boot Reply (2) Hardware type: Ethernet Hardware type: Ethernet Boot Piass: 0x0000 (unicast) Client IP address: 0.0.0.0 (0.0.0.0) Your (Client) IP address: 192.168.0.10 (192.168.0.10) Next server IP address: 192.168.0.10 (192.168.0.10) Next server IP address: 192.168.0.10 (192.168.0.10) Next server IP address: 0.0.0.0 (0.0.0.0) Client Mac address padding: 000000000000000000000000000000000000	4		Drior Optic	713 - 461161516	
<pre>Bitherine II, Sric DellComp_ad:f1:9b (00:08:74:ad:f1:9b), Dst: Grandstr_01:fc:42 (00:0b:82:01:fc:42)  Bitherine II, Sric DellComp_ad:f1:9b (00:08:74:ad:f1:9b), Dst: 192.168.0.10 (192.168.0.10)  Bitherine Protocol Version 4, Srcc 192.168.0.1 (192.168.0.1) Dst Port: 192.168.0.10 (192.168.0.10)  Bitherine Protocol, Src Port: bootps (67), Dst Port: bootpc (68)  Bootstrap Protocol Message type: Boot Reply (2) Hardware type: Ethernet Hardware address length: 6 Hops: 0 Transaction ID: 0x00003d1e Seconds elapsed: 0 Boot plags: 0x0000 (unicast) Client IP address: 0.0.0.0 (0.0.0.0) Your (client) IP address: 192.168.0.10 (192.168.0.10) Next Server IP address: 0.0.0.0 (0.0.0.0) Client MAC address padding: 000000000000000000000000000000000000</pre>	Frame 4: 342 bytes on wire (2736 bits), 342 bytes cantured (2736 bits)				
Thereffer Protocol Version 4, Src: 192.168.0.1 (192.168.0.1), Dt: 192.168.0.10 (192.168.0.10) # User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68) Bootstrap Protocol Message type: Boot Reply (2) Hardware type: Ethernet Hardware address length: 6 Hops: 0 Transaction ID: 0x00003dle Seconds elapsed: 0 Bootstrages: 0.0.0.0 (0.0.0.0) Your (client) IP address: 0.0.0.0 (0.0.0.0) Your (client) IP address: 0.0.0.0 (0.0.0.0) Relay agent IP address: 0.0.0.0 (0.0.0.0) Client Mac dadress padding: 000000000000000000000000000000000000	E Ethernet II. Src: DellComp ad:f1:9b (00:08:74:ad:f1:9b). Dst: Grandstr 01:	fc:42 (00:0)	0:82:01:fc:4	2)	
B User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68)           Bootstrap Protocol           Message type: Boot Reply (2)           Hardware type: Ethernet           Hardware type: Ethernet           Hardware address length: 6           Hops: 0           Transaction ID: 0x00003dle           Seconds elapsed: 0           Bootp flags: 0x0000 (Unicast)           Client IP address: 192.168.0.10 (192.168.0.10)           Next server IP address: 0.0.0.0 (0.0.0.0)           Your (client) TP address: 0.0.0.0 (0.0.0.0)           Relay agent IP address: Grandstr_Olifc:42 (00:0b:82:0lifc:42)           Client Mac address gradding: 000000000000000000000000000000000000	Thernet Protocol Version 4 Src: 192 168 0 1 (192 168 0 1) Dst: 192 168	0 10 (192 16	58 0 10)	2)	
Boots falled by the factor of	INCERNEE PROTOCOL STC Port: bootns (67) Dst Port: bootns (68)     INCERNEE PROTOCOL STC Port: bootns (67) Dst Port: bootns (68)	0.10 (152.1)			
Message type: Boot Reply (2)       Hardware Type         Hardware type: Ethernet       Identifies the type of hardware used in the network.         Transaction ID: 0x00003dle       Identifies the type of hardware used in the network.         Seconds elapsed: 0       Is Ethernet, 15 is Frame Relay, and 20 is a serial line.         Client IP address: 0.0.0.0 (0.0.0.0)       rour (client) IP address: 192.168.0.10 (192.168.0.10)         Next server IP address: 0.0.0.0 (0.0.0.0)       client hardware address gradbing: 000000000000000000000000000000000000	E Bootstrap Protocol			_	
<ul> <li>Hardware type: Ethernet</li> <li>Hardware type: Ethernet</li> <li>Hardware type: Ethernet</li> <li>Hardware address length: 6</li> <li>Hops: 0</li> <li>Transaction ID: 0x00003dle</li> <li>Seconds elapsed: 0</li> <li>Bootp flags: 0x0000 (unicast)</li> <li>Client IP address: 0.0.0 (0.0.0.0)</li> <li>Your (client) IP address: 192.168.0.10 (192.168.0.10)</li> <li>Next server IP address: 0.0.0.0 (0.0.0.0)</li> <li>Relay agent IP address: 0.0.0.0 (0.0.0.0)</li> <li>Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42)</li> <li>Client hardware address padding: 000000000000000000000000000000000000</li></ul>	Message type: Boot Reply (2)				
<ul> <li>Hardware address length: 6</li> <li>Hops: 0</li> <li>Transaction ID: 0x00003dle seconds elapsed: 0</li> <li>Bootp flags: 0x0000 (unicast)</li> <li>Client IP address: 10.0.0 (0.0.0.0)</li> <li>Your (client) IP address: 192.168.0.10 (192.168.0.10)</li> <li>Next server IP address: 0.0.0.0 (0.0.0.0)</li> <li>Relay agent IP address: 0.0.0.0 (0.0.0.0)</li> <li>Client MAC address: frandstr_01ifc:42 (00:0b:82:01:fc:42)</li> <li>Client hardware address padding: 000000000000000000000000000000000000</li></ul>	Hardware type: Ethernet				
<ul> <li>Habit of the field of</li></ul>	Hardware address length: 6	ardware us	sed in the		
Transaction ID: 0x00003d1e       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Seconds elapsed: 0       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Bootp flags: 0x0000 (Unicast)       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Client IP address: 0.0.0.0 (0.0.0.0)       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Your (client) IP address: 0.0.0.0 (0.0.0.0)       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Next server IP address: 0.0.0.0 (0.0.0.0)       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Relay agent IP address: 0.0.0.0 (0.0.0.0)       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Client Mark address: Grandstr_01:fc:42 (00:0b:82:01:fc:42)       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Client Mark address: Grandstr_01:fc:42 (00:0b:82:01:fc:42)       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Server host name not given       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Boot file name not given       • 1 is Ethernet, 15 is Frame Relay, and 20 is a         Magic cookie: DHCP       • 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Hops: 0				
<ul> <li>Seconds elapsed: 0</li> <li>Bootp flags: 0x0000 (Unicast)</li> <li>Client IP address: 0.0.0.0 (0.0.0.0)</li> <li>Your (client) IP address: 192.168.0.10 (192.168.0.10)</li> <li>Next server IP address: 0.0.0.0 (0.0.0.0)</li> <li>Relay agent IP address: 0.0.0.0 (0.0.0.0)</li> <li>Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42)</li> <li>Client hardware address padding: 000000000000000000000000000000000000</li></ul>	Transaction TD: 0x00003d1e				
■ Bootp flags: 0x0000 (unicast)       serial line.         Client IP address: 0.0.0.0 (0.0.0.0)       Your (client) IP address: 192.168.0.10 (192.168.0.10)         Next server IP address: 0.0.0.0 (0.0.0.0)       Relay agent IP address: 0.0.0.0 (0.0.0.0)         Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42)       Client hardware address padding: 000000000000000000000000000000000000	Seconds elapsed: 0	ame Relay,	and 20 is a	a	
Client IP address: 0.0.0.0 (0.0.0.0) Your (client) IP address: 192.168.0.10 (192.168.0.10) Next server IP address: 0.0.0 (0.0.0.0) Relay agent IP address: 0.0.0 (0.0.0.0) Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42) Client hardware address padding: 0000000000000000 Server host name not given Boot file name not given Magic cookie: DHCP					
Your (client) IP address: 192.168.0.10 (192.168.0.10) Next server IP address: 0.0.0.0 (0.0.0.0) Relay agent IP address: 0.0.0.0 (0.0.0.0) Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42) Client hardware address padding: 00000000000000000 Server host name not given Boot file name not given Magic cookie: DHCP	Client IP address: 0.0.0.0 (0.0.0.0)				
Next server IP address: 0.0.0.0 (0.0.0.0)         Relay agent IP address: 0.0.0.0 (0.0.0.0)         Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42)         Client hardware address padding: 000000000000000000         Server host name not given         Boot file name not given         Magic cookie: DHCP <ul> <li>Option: (53) DHCP Message Type</li> <li>Option: (53) Renewal Time Value</li> <li>Option: (51) IP Address Lease Time</li> </ul> <ul> <li>0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00B tE.</li> <li>0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8 .H.F</li> <li>0020 00 0a 00 43 00 44 01 34 df db 02 01 06 00 00 0c.D.4</li> <li>0030 3d 1e 00 00 00 00 00 00 00 00 a8 00 00 00</li></ul>	Your (client) IP address: 192.168.0.10 (192.168.0.10)				
Relay agent IP address: 0.0.0.0 (0.0.0.0)         Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42)         Client hardware address padding: 000000000000000000000000000000000000	Next server IP address: 0.0.0.0 (0.0.0.0)				
<pre>Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42) Client hardware address padding: 000000000000000000000000000000000000</pre>	Relay agent IP address: 0.0.0.0 (0.0.0.0)				
<pre>Client hardware address padding: 000000000000000000000000000000000000</pre>	Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42)				
Server host name not given         Boot file name not given         Magic cookie: DHCP <ul> <li>Option: (53) DHCP Message Type</li> <li>Option: (58) Renewal Time Value</li> <li>Option: (59) Rebinding Time Value</li> <li>Option: (51) IP Address Lease Time</li> </ul> <li> <ul> <li>O000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00B tE.</li> <li>O010 01 48 04 46 00 00 80 11 00 00 co a8 00 01 co a8 .H.F</li> <li>O020 00 04 30 044 01 34 df db 02 01 06 00 00 00C.D.4</li> <li>O030 3d 1e 00 00 00 00 00 00 00 00 co a8 00 0a 00 00 =</li> <li>B</li> <li>B</li></ul></li>	Client hardware address padding: 0000000000000000000				
Boot file name not given Magic cookie: DHCP Option: (53) DHCP Message Type Option: (58) Renewal Time Value Option: (59) Rebinding Time Value Option: (51) IP Address Lease Time 0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00B tE. 0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8 .H.F 0020 00 0a 00 43 00 44 01 34 df db 02 01 06 00 00 00C.D.4 0030 3d 1e 00 00 00 00 00 00 00 00 c0 a8 00 0a 00 00 = 0040 00 00 00 00 00 00 00 00 b 82 01 fc 42 00 00 00 00B tB	Server host name not given				
Magic cookie: DHCP            • Option: (53) DHCP Message Type         • Option: (58) Renewal Time Value         • Option: (59) Rebinding Time Value         • Option: (51) IP Address Lease Time         •         0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00B tE.         0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8 .H.F	Boot file name not given				
<pre></pre>	Magic cookie: DHCP				
<pre>     Option: (58) Renewal Time Value     Option: (59) Rebinding Time Value     Option: (51) IP Address Lease Time  0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00B tE. 0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8 .H.F 0020 00 0a 00 43 00 44 01 34 df db 02 01 06 00 00 00C.D.4 0030 3d 1e 00 00 00 00 00 00 00 c0 a8 00 0a 00 00 B </pre>	⊞ Option: (53) DHCP Message Type				
<pre>     Option: (59) Rebinding Time Value     Option: (51) IP Address Lease Time  0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00B tE. 0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8 .H.F 0020 00 0a 00 43 00 44 01 34 df db 02 01 06 00 00 00C.D.4 0030 3d 1e 00 00 00 00 00 00 00 00 c0 a8 00 0a 00 00 = 0040 00 00 00 00 00 00 00 b 82 01 fc 42 00 00 00 00B </pre>	⊕ Option: (58) Renewal Time Value				
<pre>     Option: (51) IP Address Lease Time  0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00    B tE. 0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8    B tE. 0020 00 0a 00 43 00 44 01 34 df db 02 01 06 00 00 00    C.D.4 0030 3d 1e 00 00 00 00 00 00 00 c0 a8 00 0a 00 00    B tB 0040 00 00 00 00 00 00 b 82 01 fc 42 00 00 00 00    B </pre>	🗉 Option: (59) Rebinding Time Value				
0000       00 0b 82 01 fc 42 00 08       74 ad f1 9b 08 00 45 00      B tE.         0010       01 48 04 46 00 00 80 11       00 00 c0 a8 00 01 c0 a8      B tE.         0020       00 0a 00 43 00 44 01 34       df db 02 01 06 00 00 00      C.D.4         0030       3d 1e 00 00 00 00 00 00 00 00       00 00 c0 a8 00 0a 00 00      B         0040       00 00 00 00 00 00 b       82 01 fc 42 00 00 00 00      B	⊕ Option: (51) IP Address Lease Time				
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0020 00 0a 00 43 00 44 01 34 df db 02 01 06 00 00 00c.D.4 0030 3d 1e 00 00 00 00 00 00 00 00 c0 a8 00 0a 00 00 = 0040 00 00 00 00 00 00 0b 82 01 fc 42 00 00 00 00	0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8 .H.F				-
0030 3d 1e 00 00 00 00 00 00 00 00 c0 a8 00 0a 00 00 = 0040 00 00 00 00 00 00 0b 82 01 fc 42 00 00 00 00	0020 00 0a 00 43 00 44 01 34 df db 02 01 06 00 00 00C.D.4				
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😝 💅 File: "C:\Users\Bob\_ACTIVE\CCNA 4 - CET 2345 Packets: 4 Displayed: 4 Mar Profile: Default	🔴 💅 File: "C:\Users\Bob\_ACTIVE\CCNA 4 - CET 2345   Packets: 4 Displayed: 4 Mar   Profile: Default				

DHCP-Wireshark.pcap [Wireshark 1.8.2 (SVN Rev 44520 from /trunk-1.8)]	
File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help	8 16 24 32
The first for the Theorem Carlos and the transmission for the	OP Code (1) Hardware Type (1) Hardware Address Hops (1) Length (1)
🛃 🗑 🎯 💓   🗁 🛄 💥 🔁 占   🔍 🗢 🌼 🌍 ዥ 🔽     🗉	J 🔄 🕀 🔍 Transaction Identifier
	Seconds - 2 bytes Flags - 2 bytes
Filter:  Expression.	. Clear Apply S Client IP Address (CIADDR) - 4 bytes
No Time Source Destination Protocol	Your IP Address (YIADDR) - 4 bytes
1.0.000000 0.0.0.0 255.255.255.255 DHCP	314 DHCP I Gateway IP Address (SIADDR) - 4 bytes
2 0.000295 192.168.0.1 192.168.0.10 DHCP	342 DHCP ( Client Hardware Address (CHADDR) - 16 bytes
3 0.070031 0.0.0.0 255.255.255.255 DHCP	314 DHCP I Server Name (SNAME) - 64 bytes
4 0.070345 192.168.0.1 192.168.0.10 DHCP	342 DHCP / Boot Filename - 128 bytes
	DHCP Options - variable
<ul> <li>Ethernet II, Src: DellComp_ad:f1:9b (00:08:74:ad:f1:9b), Dst</li> <li>Internet Protocol Version 4, Src: 192.168.0.1 (192.168.0.1),</li> <li>User Datagram Protocol, Src Port: bootps (67), Dst Port: boot</li> <li>Bootstrap Protocol</li> <li>Message type: Boot Reply (2)</li> <li>Hardware type: Ethernet</li> <li>Hardware address length: 6</li> <li>Hops: 0</li> <li>Transaction ID: 0x00003d1e</li> <li>Seconds elapsed: 0</li> <li>Bootp flags: 0x0000 (Unicast)</li> <li>Client IP address: 0.0.0.0 (0.0.0.0)</li> <li>Your (client) IP address: 192.168.0.10 (192.168.0.10)</li> <li>Next server IP address: 0.0.0.0 (0.0.0.0)</li> <li>Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42)</li> <li>Client hardware address padding: 000000000000000000</li> <li>Server host name not given</li> <li>Boot file name not given</li> <li>Magic cookie: DHCP</li> <li>Option: (53) DHCP Message Type</li> <li>Option: (59) Rebinding Time Value</li> <li>Option: (51) IP Address Lease Time</li> </ul>	<ul> <li>Grandstr_01:fc:42 (00:0b:82:01:fc:42)</li> <li>Dst: 192.168.0.10 (192.168.0.10)</li> <li>pc (68)</li> <li>Client IP Address <ul> <li>Used by a client during lease renewal when the address of the client is valid and usable.</li> <li>The client puts its own IPv4 address in this field if and only if it has a valid IPv4 address while in the bound state; otherwise, it sets the field to 0.</li> </ul> </li> </ul>
0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00e	tE.
0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8 .H.F	
0020 00 0a 00 43 00 44 01 34 df db 02 01 06 00 00 00c.E	.4
0030 S0 10 00 00 00 00 00 00 00 00 00 00 00 00	·········
📁 🌌   File: "C:\Users\Bob\_ACTIVE\CCNA 4 - CET 2345   Packets: 4 Displayed: 4 Mar   Profile: De	fault

A DHCP-Wireshark.pcap [Wireshark 1.8.2 (SVN Rev 44520 from /trunk-1.8)]									
File Edit View Go. Canture Analyze Statistics Telephony Tools Internals Help	8	16	24	32					
	OP Code (1)	Hardware Type (1)	Hardware Address Length (1)	Hops (1)					
🗒 🗑 🞯 🗑 🗑 🗁 🐻 🗶 22 📇    ⇔ ⇔ ⇔ 77 💆   目 📑   ⊙, Q		Transactio	on Identifier						
	Seconds -	- 2 bytes	Flags -	2 bytes					
Filter: Expression Clear Apply 5		Client IP Address	(CIADDR) - 4 bytes						
Na ITura Daskastina Daskastina		Your IP Address (	YIADDR) - 4 bytes						
		Server IP Address	(SIADDR) - 4 bytes						
2 0, 000295 192, 168, 0, 1 192, 168, 0, 10 DHCP 342 DHCP ( Oliver Marthuare Address (CHADDR) 48 total									
3 0 070031 0 0 0 0 255 255 255 DHCP 314 DHCP 1	G	Server Name (SI	SS (CHADDR) - 10 byte NAME) - 64 bytes	25					
4 0.070345 192.168.0.1 192.168.0.10 DHCP 342 DHCP		Boot Filenam	ne - 128 bytes						
		DHCP Optio	ons - variable						
<pre>Ethernet II, Src: DellComp_ad:f1:9b (00:08:74:ad:f1:9b), Dst: Grandstr_01:1 Internet Protocol Version 4, Src: 192.168.0.1 (192.168.0.1), Dst: 192.168.0 User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68) Bootstrap Protocol Message type: Boot Reply (2) Hardware type: Ethernet Hardware address length: 6 Hops: 0 Transaction ID: 0x00003d1e Seconds elapsed: 0</pre>	fc:42 (00:0b 0.10 (192.16	:82:01:fc:4 8.0.10)	2)						
<ul> <li>Bootp flags: 0x0000 (Unicast) Client IP address: 0.0.0.0 (0.0.0.0) Your (client) IP address: 192.168.0.10 (192.168.0.10)</li> <li>Next server IP address: 0.0.0.0 (0.0.0.0) Relay agent IP address: 0.0.0.0 (0.0.0.0)</li> </ul>	ng Client IP the server t	• Address to assign	an IPv4 ad	dress to					
Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42) Client hardware address padding: 0000000000000000000 Server host name not given Boot file name not given Magic cookie: DHCP									
<ul> <li>Option: (53) DHCP Message Type</li> <li>              Option: (58) Renewal Time Value      </li> <li>             Option: (59) Rebinding Time Value         </li> <li>             Option: (51) IP Address Lease Time         </li> </ul>									
0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00B tE.									
0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8 .H.F									
0020 00 0a 00 43 00 44 01 34 df db 02 01 06 00 00 00C.D.4									
0030 30 10 00 00 00 00 00 00 00 00 00 00 00 00									
🔴 🎽 File: "C: \Users \Bob \_ACTIVE \CCNA 4 - CET 2345 Packets: 4 Displayed: 4 Mar Profile: Default									

DHCP-Wireshark.pcap [Wireshark 1.8.2 (SVN Rev 44520 from /trunk-1.8)]					
File Edit View Go Capture Apalyze Statistics Telephony Tools Internals Help	8	16	24	32	
Die Ent Den Zo Ethne Sinkte Staten underwijf Tone Summe Ont	OP Code (1)	Hardware Type (1)	Length (1)	Hops (1)	
' 🗒 🗑 🎯 🕷 🕷   🖻 🐻 🗶 🥭 😓    ⇔ 🛸 💫 77 👱   🗏   ⊑   ⊑   Ѻ. Q		Transactio	on Identifier		
	Seconds	- 2 bytes	Flags -	2 bytes	
Filter: Expression Clear Apply 5		Client IP Address	(CIADDR) - 4 bytes		
No Time Source Destination Protocol Length Tafe		Your IP Address (	YIADDR) - 4 bytes		
1 0.00000 0.0.0 255.255.255 DHCP 314 DHCP 1		Catoway IP Address	(SIADDR) - 4 bytes		
2 0.000295 192.168.0.1 192.168.0.10 DHCP 342 DHCP (	(	Client Hardware Addres	s (GIADDIN) - 4 bytes	10	
3 0.070031 0.0.0.0 255.255.255 DHCP 314 DHCP I		Server Name (Sl	NAME) - 64 bytes	~	
4 0.070345 192.168.0.1 192.168.0.10 DHCP 342 DHCP /		Boot Filenam	ne - 128 bytes		
		DHCP Optic	ons - variable		
4					
⊞ Frame 4: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits)					
Ethernet II, Src: DellComp_ad:f1:9b (00:08:74:ad:f1:9b), Dst: Grandstr_01:1	fc:42 (00:0k	o:82:01:fc:4	2)		
■ Internet Protocol Version 4, Src: 192.168.0.1 (192.168.0.1), Dst: 192.168.0	0.10 (192.10	58.0.10)			
⊞ User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68)					
🗆 Bootstrap Protocol					
Message type: Boot Reply (2)					
Hardware type: Ethernet					
Hardware address length: 6					
Hops: O					
Transaction ID: 0x00003d1e					
Seconds elapsed: 0					
⊞ Bootp flags: 0x0000 (Unicast)					
Client IP address: 0.0.0.0 (0.0.0.0)	Client IP address: 0.0.0.0 (0.0.0.0)				
Your (client) IP address: 192.168.0.10 (192.168.0.10)					
Next server IP address: 0.0.0.0 (0.0.0.0)	dware Δd	dress			
Relay agent IP address: 0.0.0.0 (0.0.0.0)			<b>6</b> 41		
Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:fc:42) • Specifies	s the physi	cal layer of	r the client.		
Client hardware address padding: 0000000000000000000000					
Server host name not given					
Boot file name not given					
Magic cookie: DHCP					
⊕ Option: (53) DHCP Message Type     ↓					
Option: (58) Renewal Time Value					
Option: (59) Rebinding Time Value					
⊕ Option: (51) IP Address Lease Time					
0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00B tE.					
0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8 .H.F				Ĩ	
0020 00 0a 00 43 00 44 01 34 at ab 02 01 06 00 00 00C.D.4					
0040 00 00 00 00 00 00 00 00 00 00 00 00					
🥮 🌌   File: "C: \Users\Bob\_ACTIVE\CCNA 4 - CET 2345   Packets: 4 Displayed: 4 Mar   Profile: Default					

DHCP-Wireshark.pcap [Wireshark 1.8.2 (SVN Rev 44520 from /trunk-1.8)]					
File Edit View Go Capture Analyze Statistics Telephony Tools Internals	Help	0R Cada (1)	16	24	32
		OP Code (1)	Hardware Type (T)	Length (1)	Hops (1)
🗒 🗑 🎯 🕷 🕷 🗁 🗁 🐻 🗶 🔁 占 🔍 🔶 🌼 🌍 🏠		€ €	Transactio	on Identifier	
		Second	ls - 2 bytes	Flags - 2	bytes
Filter:	Expression Clear	Apply 5	Client IP Address	(CIADDR) - 4 bytes	
Na Tina Causa Dashashas	Destand Langth	Infe	Your IP Address (	(YIADDR) - 4 bytes	
No.   lime   Source   Destination	DHCP 31.		Server IP Address	(SIADDR) - 4 bytes	
2 0 000295 192 168 0 1 192 168 0 10	DHCP 34		Client Hardware Addres	s (GIADDR) - 4 bytes	
3 0. 070031 0. 0. 0 255. 255. 255	DHCP 31	4 DHCP I	Server Name (S	NAME) - 64 hytes	
4 0.070345 192.168.0.1 192.168.0.10	DHCP 34	2 DHCP	Boot Filenan	ne - 128 bytes	
	51121 51		DHCP Optic	ons - variable	
	tured (2736 bi	its)			
Ethernet II, Src: DellComp_ad:f1:9b (00:08:74:ad:f1:9	b), Dst: Grand	dstr_01:fc:42 (00:0	b:82:01:fc:4	2)	
Internet Protocol Version 4, Src: 192.168.0.1 (192.16	8.0.1), Dst: 1	192.168.0.10 (192.1	68.0.10)		
⊞ User Datagram Protocol, Src Port: bootps (67), Dst Po	rt: bootpc (68	8)			
🖻 Bootstrap Protocol					
Message type: Boot Reply (2)					
Hardware type: Ethernet					
Hardware address length: 6					
Hops: 0					
Transaction ID: 0x00003d1e					
Seconds elapsed: 0					
⊞ Bootp flags: 0x0000 (Unicast)		HCP Options			
Client IP address: 0.0.0.0 (0.0.0.0)		lood to identify th	a turna of D		+
Your (client) IP address: 192.168.0.10 (192.168.0.1	.0) (•(		e type of D	псе раске	L
Next server IP address: 0.0.0.0 (0.0.0.0)	(E	DHCP DISCOVEF	R, DHCPOF	FER,)	
Relay agent IP address: 0.0.0.0 (0.0.0.0)	•	HCP ontions car	also he us	ed to retriev	
Client MAC address: Grandstr_01:fc:42 (00:0b:82:01:	fc:42)				
Client hardware address padding: 000000000000000000	00 al	n IP address, a te	ext string, or	a hexadeci	mal
Server host name not given	n	umber from the se	erver		
Boot file name not given					
Magic cookie: DHCP	• F	-or example,			
⊞ Option: (53) DHCP Message Type		<ul> <li>DHCP optior</li> </ul>	n 66 and 150	are used by	
∃ Option: (58) Renewal Time Value		Cisco IP Pho	ones to identi	fv TFTP serve	ers.
🗄 Option: (59) Rebinding Time Value		Option 13 is		$\Delta N \Delta Ps$ to ide	ntify
⊞ Option: (51) IP Address Lease Time					illiy
0000 00 0b 82 01 fc 42 00 08 74 ad f1 9b 08 00 45 00		the WLC.			
0010 01 48 04 46 00 00 80 11 00 00 c0 a8 00 01 c0 a8	.H.F	This field is variab	le in length		
0020 00 0a 00 43 00 44 01 34 df db 02 01 06 00 00 00	C.D.	Roth client and so	rver mav u	so this field	
0030 3d 1e 00 00 00 00 00 00 00 00 c0 a8 00 0a 00 00	=		iver may us		
	····· \•	OHCP options are	listed in RI	FC 2132.	
😑 💅 File: "C:\Users\Bob\_ACTIVE\CCNA 4 - CET 2345 Packets: 4 Displayed: 4 Mar	Profile: Default	·			

# **Configuring DHCP**

#### **Router DHCP Roles**



## Why configure an IOS DHCP Server?

- In an enterprise, DHCP Services are usually provided by a Windows Server or a UNIX server platform.
  - They are relatively easy to manage and highly scalable.
- In smaller locations (SOHO, Branch) DHCP services can be provided by a Cisco router or Cisco switch.
  - Reduces DHCP deployment costs since a dedicated server is not warranted.
  - Cisco IOS leases IP addresses for 24 hours (default).
  - Newer Catalyst switches (2960) can also provide DHCP services.

#### **IOS DHCP Server**

• The DHCP service is enabled by default on newer IOS.

- To disable DHCP, in global config mode:
  - no service dhcp
- To re-enable:
  - service dhcp global

## Step 1: Exclude Addresses From the Pool

- Define a range of addresses that DHCP is not to allocate.
  - These are usually static addresses reserved for the router interfaces, SVIs, servers, and local network printers.



R1(config) **#ip dhcp excluded-address** *low-address* [high-address]

R1(config)# ip dhcp excluded-address 192.168.10.1 192.168.10.9
R1(config)# ip dhcp excluded-address 192.168.10.254

#### Step 2: Create the Address Pool

- Create the DHCP pool using the **ip dhcp pool** command.
  - Enters you into DHCP configuration mode



# Step 3: Configure the Specifics of the Pool

- Enter DHCP configuration mode and configure the specifics.
  - R1(dhcp-config)#

Tasks	Command
Define the address pool	<pre>network network-address [mask   /prefix-length]</pre>
Define the default gateway.	<b>default-router</b> address [address2address8]

Optional Tasks	Command		
Define a DNS server.	dns-server address [address2address8]		
Define the domain name.	domain-name domain		
Define the duration of the DHCP lease.	<pre>lease {days [hours] [minutes]   infinite}</pre>		
Define an option code	<pre>option code [instance number] {ascii string   hex string   ip-address} option 150 ip 192.168.1.254</pre>		

#### **DHCP Parameters and Options**

DHCP Option	Code	Description
Subnet Mask	1	<ul> <li>Specifies the subnet mask for the client to use (as per RFC 950)</li> </ul>
Router	3	<ul> <li>The list of routers the client can use (usually, in order of preference)</li> </ul>
Domain Name Server	6	<ul> <li>The list of DNS servers the client can use (usually, in order of preference)</li> </ul>
ARP Cache Timeout	35	<ul> <li>Specifies the timeout (seconds) for ARP cache entries</li> </ul>
IP Address Lease Time	51	<ul> <li>Specifies the period over which the IP address is leased (it must be renewed)</li> </ul>
Relay Agent Information	82	<ul> <li>Information about the port from which the DHCP request originates</li> </ul>
TFTP Server IP Address	150	<ul> <li>Typically used by devices such as IP Phones to download their configuration files</li> </ul>

## Step 3: Configure the Specifics of the Pool

R	1(dhcp-config)# ?						
D	HCP pool configuratio	n commands:					
	accounting	Send Accounting Start/Stop messages					
	bootfile	Boot file name					
	class	Specify a DHCP class					
	client-identifier	Client identifier					
	client-name	Client name					
	default-router	Default routers					
	dns-server	DNS servers					
	domain-name	Domain name					
	exit	Exit from DHCP pool configuration mode					
	hardware-address	Client hardware address					
	host	Client IP address and mask					
	import	Programatically importing DHCP option parameters					
	lease	Address lease time					
	netbios-name-server	NetBIOS (WINS) name servers					
	netbios-node-type	NetBIOS node type					
	network	Network number and mask					
	next-server	Next server in boot process					
	no	Negate a command or set its defaults					
	odap	Configure ODAP					
	option	Raw DHCP options					
	origin	Configure the origin of the pool					
	relay	Function as a DHCP relay					
	remember	Remember released bindings					
	renew	Configure renewal policy					
	server	Configure the server ID option value					
	subnet	Subnet allocation commands					
	update	-Dynamic updates					
	utilization	Configure various utilization parameters					
	vrf	Associate this pool with a VRF					

#### Verification Commands

R1# show ip	dhcp	?
binding	DHCP	address bindings
conflict	DHCP	address conflicts
database	DHCP	database agents
import	Show	Imported Parameters
pool	DHCP	pools information
relay	Misce	ellaneous DHCP relay information
server	Misce	ellaneous DHCP server information
snooping	DHCP	snooping

R1# show ip dhcp

Command	Description
show ip dhcp binding [address]	Displays a list of all bindings created on a specific DHCP server
show ip dhcp conflict [address]	Displays a list of all address conflicts recorded by a specific DHCP server.
show ip dhcp database [url]	Displays recent activity on the DHCP database. (Use this command in privileged EXEC mode.)
show ip dhcp server statistics	Displays count information about server statistics and messages sent and recieved.

#### show ip dhcp Commands

show ip dhcp server statistics

 Displays counts for <u>server statistics</u> and messages sent and received for an IOS-based DHCP server.

#### show ip dhcp binding

 Displays DHCP <u>binding</u> information for IP address assignment and subnet allocation.

#### show ip dhcp conflict

 Displays address <u>conflict</u>s found by a Cisco IOS DHCP server when addresses are offered to the client.

#### • show ip dhcp pool name

 Displays the subnets <u>pool</u> allocated and the current utilization level for the pool or all the pools if the name argument is not used.



```
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-10
R1(dhcp-config)# network 192.168.10.0 255.255.255.0
R1(dhcp-config)# default-router 192.168.10.1
R1(dhcp-config)# domain-name span.com
R1(dhcp-config)# end
```

#### Before PC1 Boots

R1# show ip dhcp binding								
Bindings from all pools not associated with VRF:								
IP address	Client-ID/	Lease expiration Type						
	Hardware address/							
	User name							
R1# show ip dhcp se	erver statistics							
Memory usage	23543							
Address pools	1							
Database agents	0							
Automatic bindings	0	A binding is a collection of						
Manual bindings	0	configuration parameters, including						
Expired bindings	0	at least an IP address associated						
Malformed messages	0	with or "bound to" a DHCP client.						
Secure arp entries	0							
		Pindings are managed by DHCD						
Message	Received	Diliulitys are managed by DHCF						
BOOTREQUEST	0	servers.						
DHCPDISCOVER	0							
DHCPREQUEST	0							
DHCPDECLINE	0							
DHCPRELEASE	0							
DHCPINFORM	0							
Message	Sent							
BOOTREPLY	0							
DHCPOFFER	0							
DHCPACK	0							
DHCPNAK	0							
R1#								

#### After PC1 Boots

	R1# show ip dhcp binding							
	Bindings from all po	ools not associated with	VRF:					
	IP address	Client-ID/	Lease expiration	Туре				
		Hardware address/						
		User name						
	192.168.10.10	0100.e018.5bdd.35	Oct 03 2007 05:05 PM	Automatic				
	R1# show ip dhcp ser	rver statistics						
	Memory usage	23786						
	Address pools	1						
	Database agents	0						
	Automatic bindings	1						
	Manual bindings	0						
	Expired bindings	0						
	Malformed messages	0						
	Secure arp entries	0						
	Message	Received						
	BOOTREQUEST	0						
	DHCPDISCOVER	6						
	DHCPREQUEST	1						
	DHCPDECLINE	0						
	DHCPRELEASE	0						
	DHCPINFORM	0						
	Message	Sent						
	BOOTREPLY	0						
	DHCPOFFER	1						
	DHCPACK	1						
	DHCPNAK	0						
1								

#### Verify PC1

#### C:\Documents and Settings\Bob> ipconfig /all

Windows IP Configuration

Ethernet adapter Local Area Connection:

Connection-specific DNS Suffix	:	span.com
Description	:	SiS 900 PCI Fast Ethernet Adapter
Physical Address	:	00-E0-18-5B-DD-35
Dhcp Enabled	:	Yes
Autoconfiguration Enabled	:	Yes
IP Address	:	192.168.10.10
Subnet Mask	:	255.255.255.0
Default Gateway	:	192.168.10.1
DHCP Server	:	192.168.10.1
Lease Obtained	:	Tuesday, October 02, 2008 1:06:22 PM
Lease Expires	:	Wednesday, October 03, 2008 1:06:22 Pl

C:\Documents and Settings\Bob>



```
R1(config)# ip dhcp excluded-address 192.168.11.1 192.168.10.9
R1(config)# ip dhcp excluded-address 192.168.11.254
R1(config)# ip dhcp pool LAN-POOL-11
R1(dhcp-config)# network 192.168.11.0 255.255.255.0
R1(dhcp-config)# default-router 192.168.11.1
R1(dhcp-config)# domain-name span.com
R1(dhcp-config)# end
```

#### After PC2 Boots

R1# show ip dhcp binding					
Bindings from all p	ools not associated with	h VRF:			
IP address	Client-ID/	Lease expiration	Туре		
	Hardware address/				
	User name				
192.168.10.10	0100.e018.5bdd.35	Oct 03 2007 06:14 PM	Automatic		
192.168.11.10	0100.b0d0.d817.e6	Oct 03 2007 06:18 PM	Automatic		
R1# show ip dhcp se	rver statistics				
Memory usage	25307				
Address pools	2				
Database agents	0				
Automatic bindings	2				
Manual bindings	0				
Expired bindings	0				
Malformed messages	0				
Secure arp entries	0				
Message	Received				
BOOTREQUEST	0				
DHCPDISCOVER	8				
DHCPREQUEST	3				
DHCPDECLINE	0				
DHCPRELEASE	0				
DHCPINFORM	0				
Message	Sent				
BOOTREPLY	0				
DHCPOFFER	3				
DHCPACK	3				
DHCPNAK	0				

#### After PC2 Boots

R1# show ip dhcp pool		
Pool LAN-POOL-10 :		
Utilization mark (high/low)	: 100 / 0	
Subnet size (first/next)	: 0 / 0	
Total addresses	: 254	
Leased addresses	: 1	
Pending event	: none	
1 subnet is currently in the pool :		
Current index IP addre	ess range	Leased addresses
192.168.10.11 192.168.	10.1 - 192.168.10.254	1
Pool LAN-POOL-11 :		
Utilization mark (high/low)	: 100 / 0	
Subnet size (first/next)	: 0 / 0	
Total addresses	: 254	
Leased addresses	: 1	
Pending event	: none	
1 subnet is currently in the	pool :	
Current index IP addre	ess range	Leased addresses
192.168.11.11         192.168.	11.1 - 192.168.11.254	1
R1#		

# **DHCP** Relay

#### **DHCP** Problems



#### **DHCP** Relay

C:\WINDOWS\system32\cmd.exe

C:\Documents and Settings\Administrator>ipconfig /release

- 🗆 🗙

Windows IP Configuration

Ethernet adapter Local Area Connection:

C:\Documents and Settings\Administrator>ipconfig /renew

Windows IP Configuration

An error occurred while renewing interface Local Area Connection : unable to contact your DHCP server. Request has timed out.

C:\Documents and Settings\Administrator>

- Remote clients may require DHCP services and send broadcasts to locate these servers.
- Routers, by default, will not forward client broadcasts beyond their subnet.
- Solution:
  - Place DHCP servers on all subnets
  - Use the Cisco IOS helper address feature.

- The IP helper address enables a router forward a UDP broadcast to a specific unicast IP address.
- Configured using the ip helper-address interface configuration command.
  - Command relays UDP broadcast requests.
  - Configured on the interface receiving the broadcast.

Router(config-if)#

#### ip helper-address address

 Enables forwarding and specifies destination address for main UDP broadcast packets

 Changes destination address from broadcast to unicast or directed broadcast address

Router(config)#

```
ip forward-protocol { udp [ port ] }
```

Specifies which protocols will be forwarded

#### **DHCP** Relay

R1# config t
R1(config)# interface Fa0/0
R1(config-if)# ip helper-address 192.168.11.5
R1(config-if)# end



## **DHCP** Relay

```
C:\WINDOWS\system32\cmd.exe
C:\Documents and Settings\Administrator> ipconfig /release
Windows IP Configuration
Ethernet adapter Local Area Connection:
      Connection-specific DNS Suffix . :
      Default Gateway . . . . . . . . . .
C:\Documents and Settings\Administrator> ipconfig /renew
Windows IP Configuration
Ethernet adapter Local Area Connection:
      Connection-specific DNS Suffix . :
      Default Gateway . . . . . . . . : 192.168.10.1
C:\Documents and Settings\Administrator>
```

- By default, the **ip helper-address** command forwards the following eight UDP services:
  - Port 37: Time
  - Port 49: TACACS
  - Port 53: DNS
  - Port 67: DHCP/BOOTP client
  - Port 68: DHCP/BOOTP server
  - Port 69: TFTP
  - Port 137: NetBIOS name service
  - Port 138: NetBIOS datagram service



Use the ip forward-protocol global configuration command to restrict or forward any UDP port in addition to the default eight.

#### Helper Addresses Example



RTA(config)# interface e0

RTA(config-if)# ip helper-address 172.16.1.2

RTA(config-if)# ip helper-address 172.24.1.9

RTA(config-if)# ip helper-address 172.24.1.255

The ip helper-address 172.24.1.255 is a directed broadcast and is more efficient than entering the address of each server.

#### ip directed-broadcast



To allow all the nodes in the server farm to receive directed broadcasts, configure interface e3 as follows:

RTA(config)#interface e3 RTA(config-if)#ip directed-broadcast

# Configuring a DHCP Client

# Configuring a DHCP Client

Router(config-if)#

ip address dhcp

Enables a Cisco IOS device to obtain an IP address dynamically from a DHCP server

- Sometimes, Cisco IOS routers in SOHO and branch sites have to be configured in a similar manner.
  - The method used depends on the ISP.
  - However, in its simplest configuration, the Ethernet interface is used to connect to a cable modem.
  - To configure an Ethernet interface as a DHCP client, the ip address dhcp command must be configured.

## Configuring a DHCP Client



Inbound access list is not set