

# *Dynamic Host Configuration Protocol*

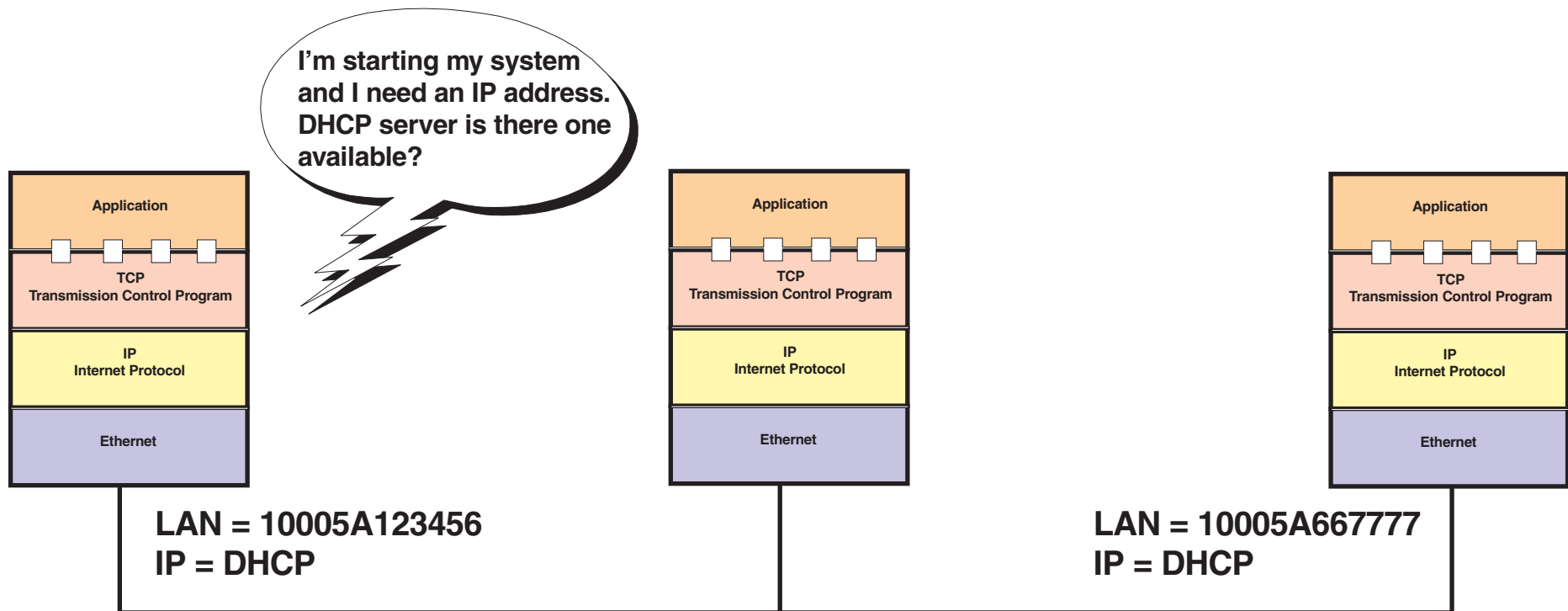
## *DHCP*



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# Dynamic TCP/IP Configuration



**DHCP (Dynamic Host Configuration Protocol) uses a server that contains a list of available IP addresses**

**Instead of configuring an IP address in the workstation, you ask for an address when needed**

**Resolves issues of moving between subnets and reconfiguring workstations**

# IP Addressing Background

IP address is 32 bits long

Each device/host has unique address

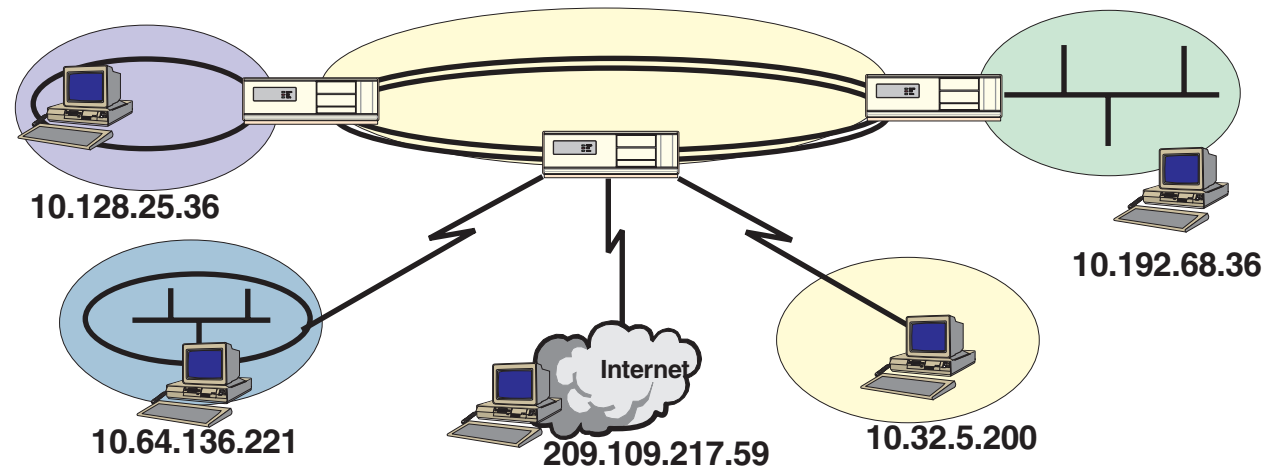
Expressed as 4 decimal numbers

Format: 10.128.25.36

Divided into two parts

Network address

Host address

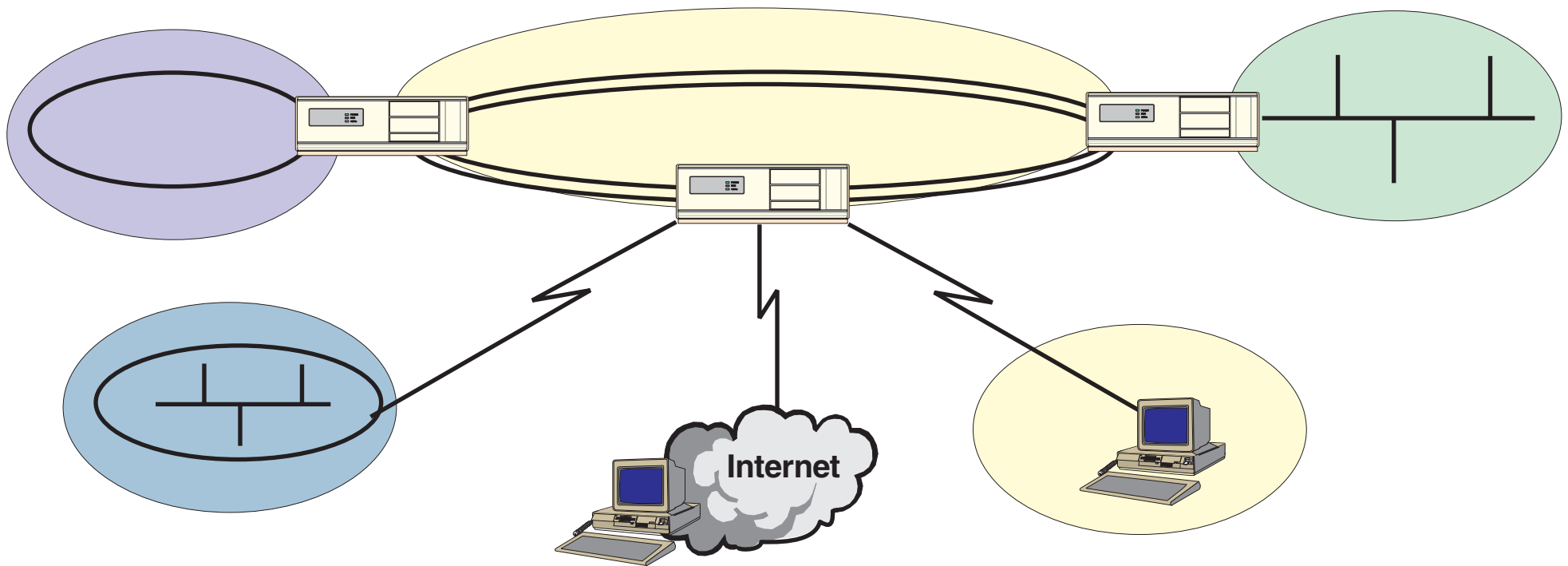


Host addresses locally administered

Network addresses assigned by Internet Service Provider

- as of 1/1/1998 you pay for addresses

# *Solutions to IP Address Distribution*



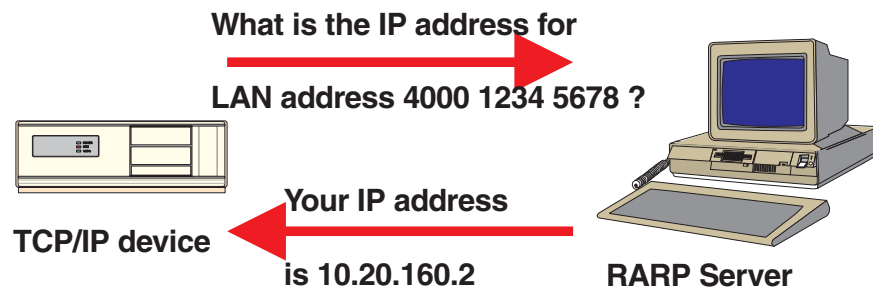
**Reverse Address Resolution Protocol (RARP) (RFC 903)**

**Bootstrap Protocol (BOOTP) (RFC 951)**

**Dynamic Host Configuration Protocol (DHCP) (RFC 1541)**

# RARP and BOOTP

## Reverse Address Resolution Protocol

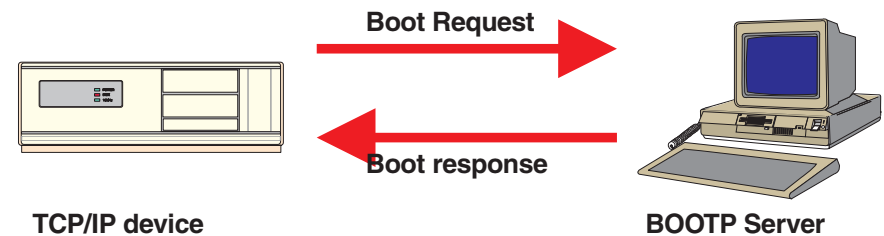


Oldest technology  
Not able to pass through routers  
Efficient for diskless workstations

### Disadvantages

Cannot give other information  
subnetwork mask  
gateway address  
Domain Name Server

## BOOT Protocol



### Advantages

Configuration information  
Permanent IP address  
File to load and execute  
Remote configuration  
Relieve configuration at workstation

### Disadvantages

Permanent association of IP address  
Inefficient use of address space  
Not suitable for mobile users  
Impedes dynamic network topology  
IP addresses still pre-assigned  
Tables can get rather large

# Dynamic Host Configuration Protocol

**DHCP is an extension to BOOTP**

**Enables IP hosts to automatically receive an available IP address**

**Enables IP hosts to dynamically configure themselves**

**Mechanism for address assignment**

**Many systems still need 'static' (non-changing) IP addresses**

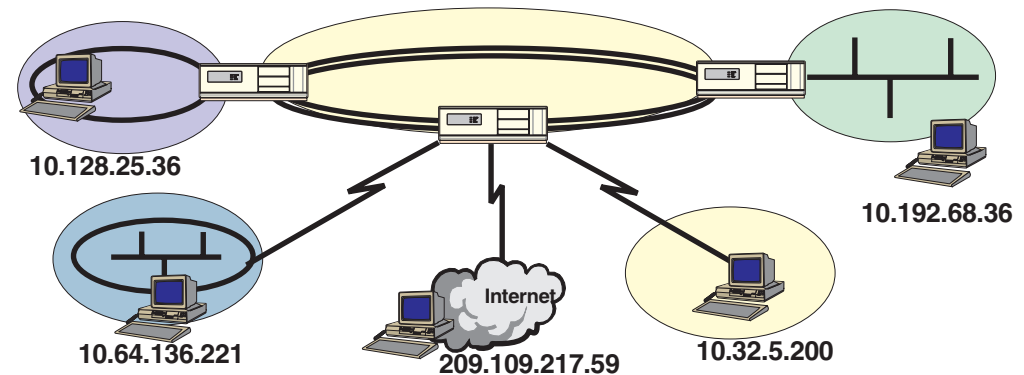
**Servers**

**SNA host systems**

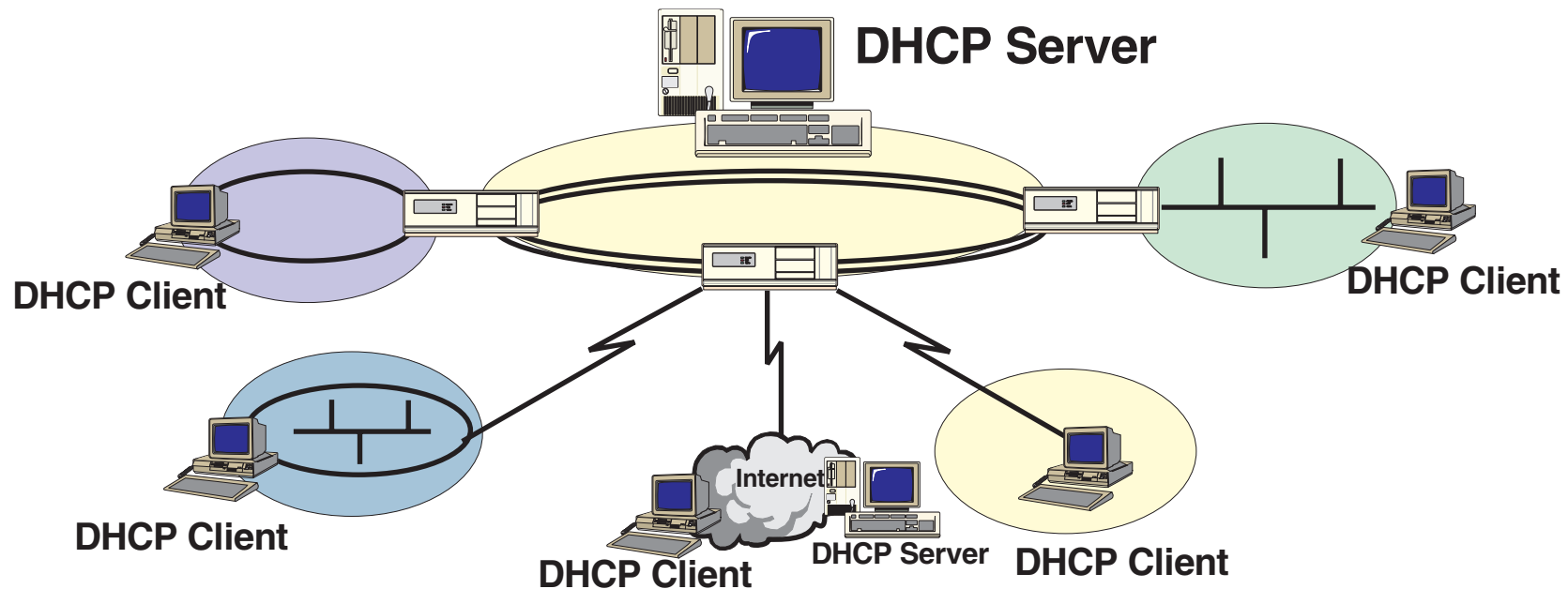
**Routers**

**Gateways**

...



# DHCP Terminology



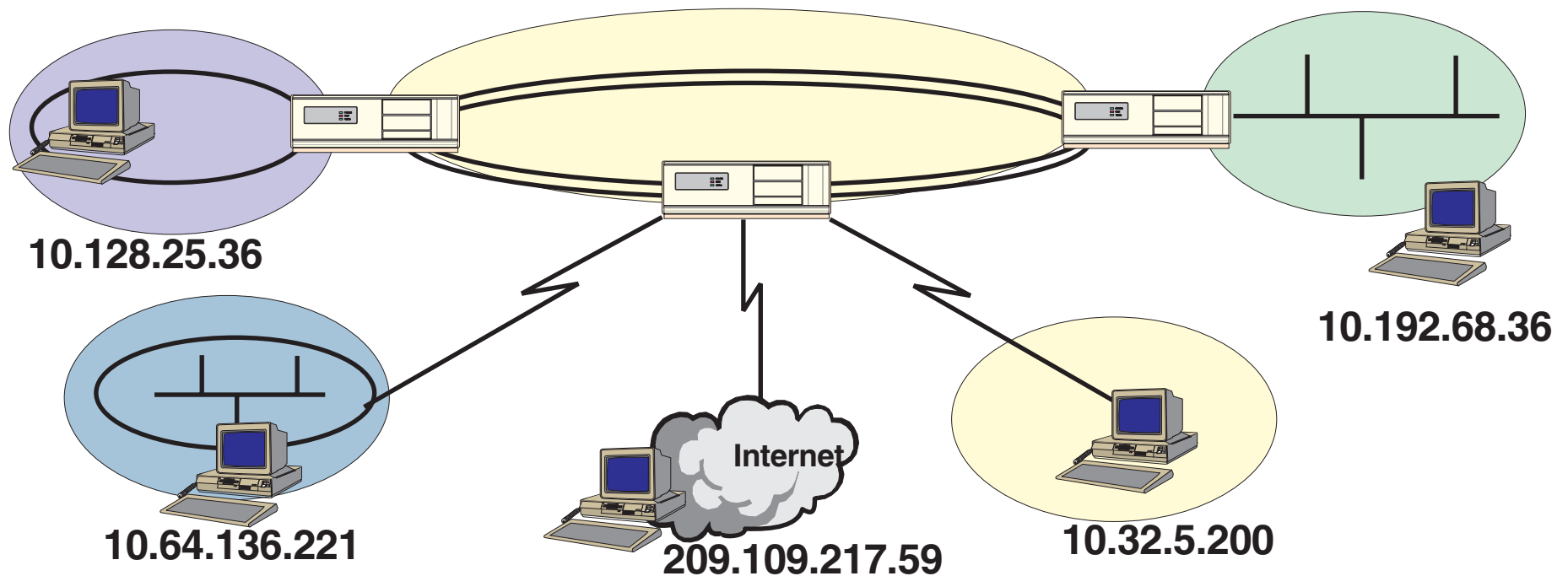
**DHCP client:** IP host obtaining configuration via DHCP

**DHCP server:** IP host that returns configuration to DHCP clients

**BOOTP Relay Agent:** router that passes DHCP messages across networks

**Binding:** collection of configuration parameters associated with a client

# DHCP Methods

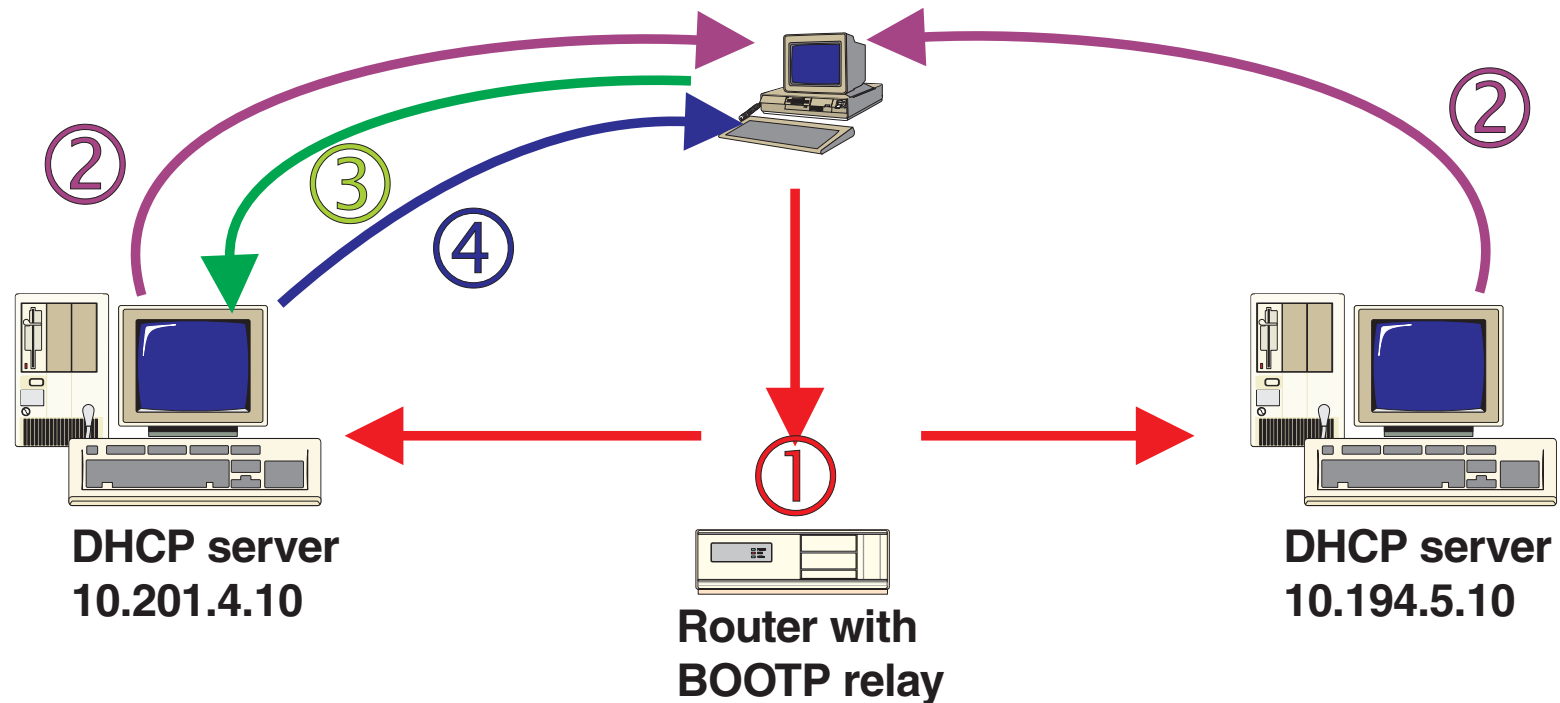


**Manual** - like BOOTP

**Automatic** - addresses allocated from a pool and associated with a MAC address until manual intervention

**Dynamic** - addresses allocated from a pool for a specified length of time (lease period)

# DHCP Operations



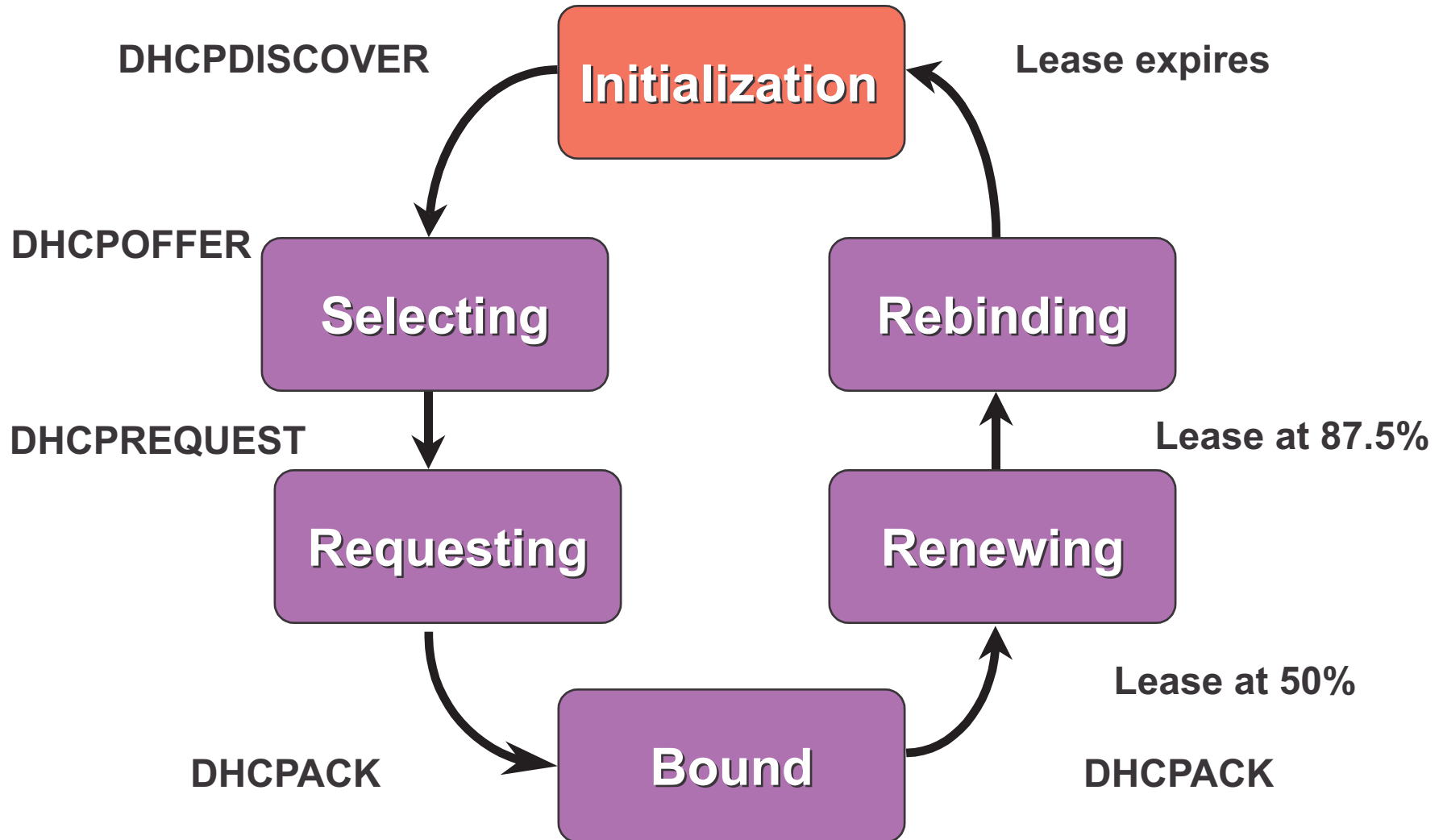
**Workstation submits a DHCP request IP address discover message**

**More than one server may respond**

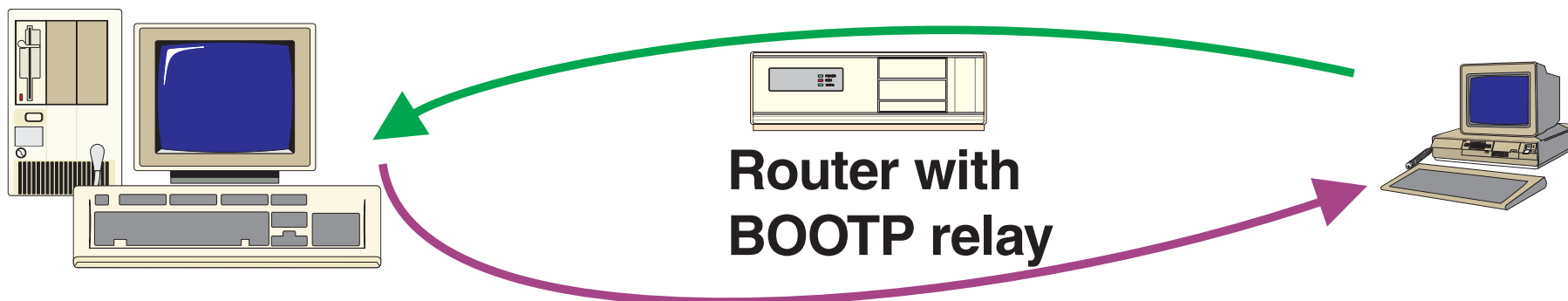
**Workstation selects one address and replies to server**

**The server commits the address and responds**

# DHCP Flows



# *DHCP Addresses Distributed*



**DHCP server  
10.201.4.10**

**DHCP server provides more than device address**

**IP Address  
Subnet mask  
Router (gateway) addresses  
DNS (Domain Name Server) addresses  
Domain name**

# DHCP Renewal Sequence

## IP lease renewal

### DHCPREQUEST

Source IP address = 10.107.8.13  
Dest. IP address = 10.201.4.10  
Requested IP address = 10.107.8.13  
Hardware address = 08004....

Initial  
renewal interval

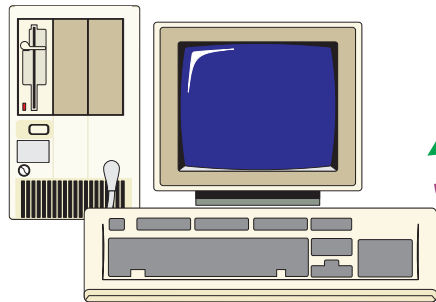


$\frac{1}{2}$  TTL

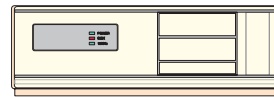
Subsequent  
renewal interval



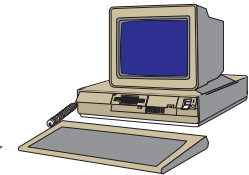
$\frac{7}{8}$  TTL



**DHCP server**  
**10.201.4.10**



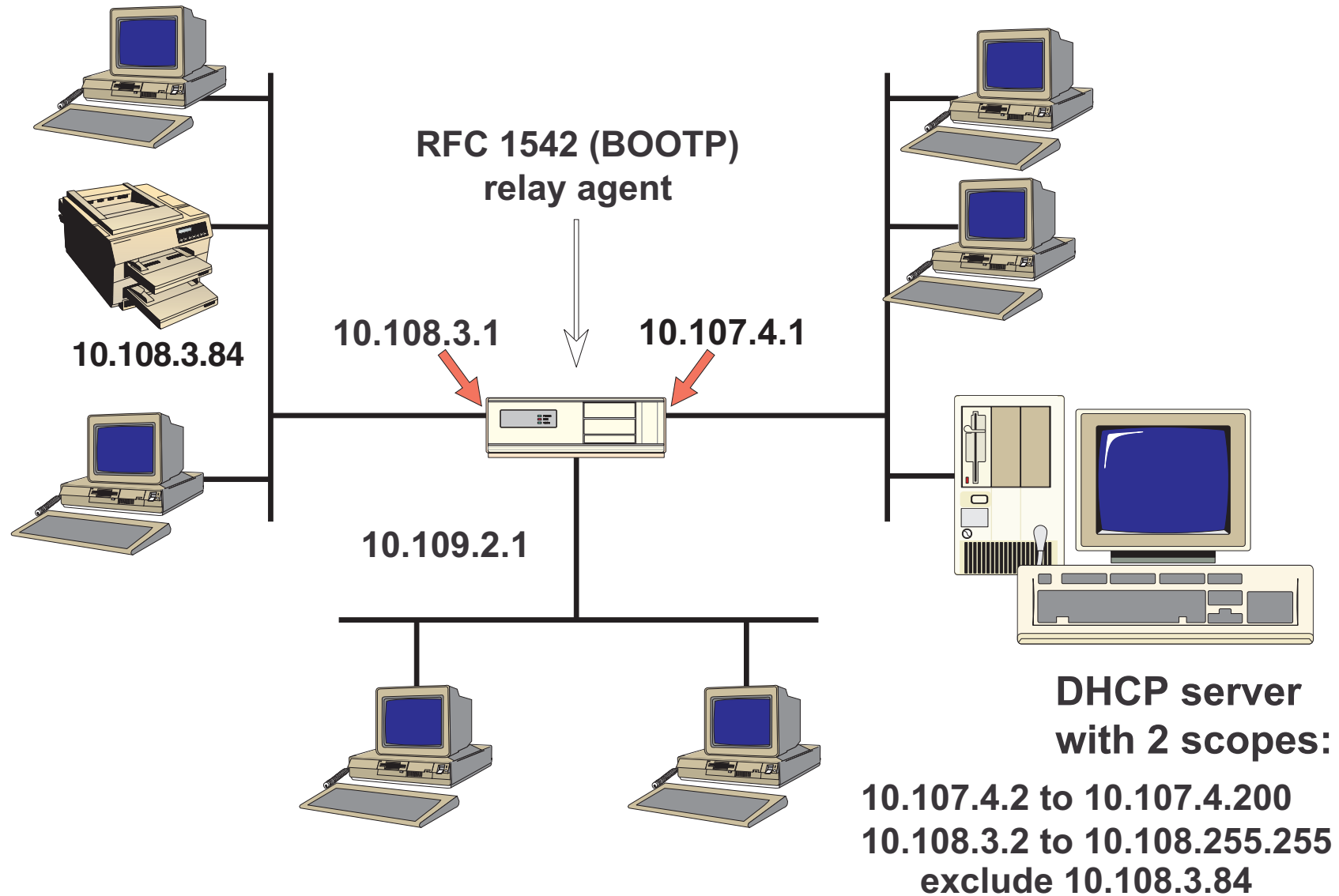
**Router with  
BOOTP relay**



### DHCPACK

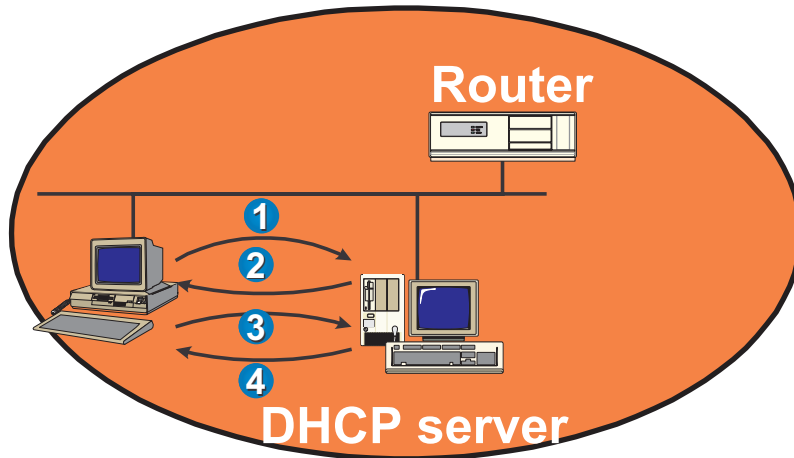
Source IP address = 10.201.4.10  
Dest. IP address = 10.107.8.13  
Offered IP address = 10.107.8.13  
Client hardware address = 08004....  
Subnet mask = 255.255.255.0  
Length of lease = 72 hours  
Server identifier = 10.107.3.24  
DHCP option: router = 10.107.8.1

# DHCP Scope

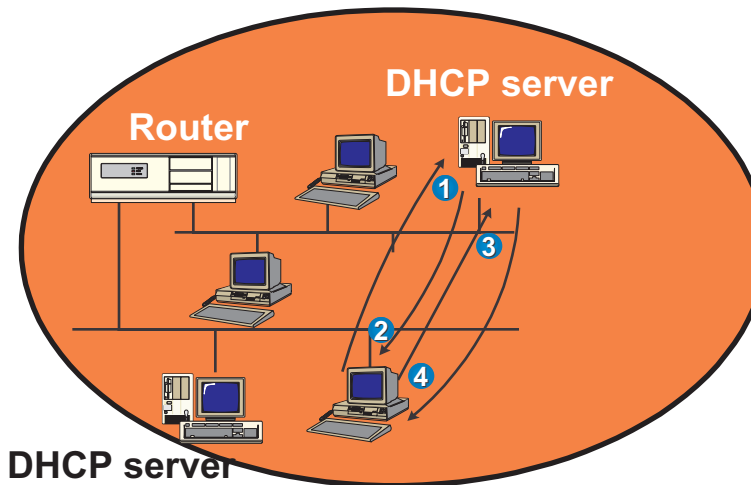
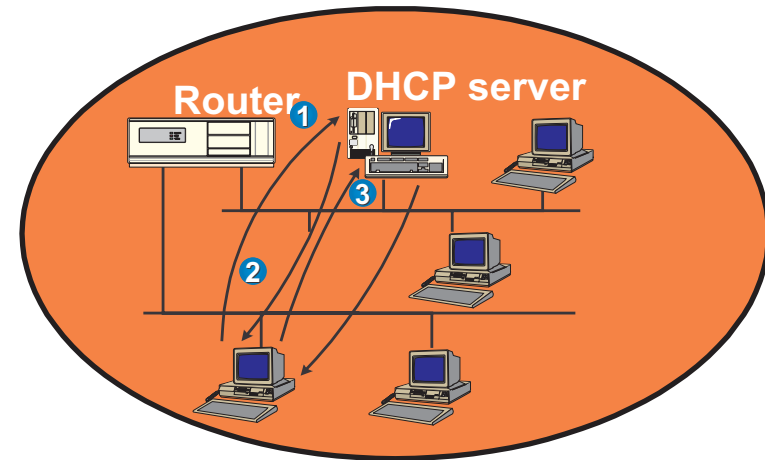


# DHCP Design

## Option 1



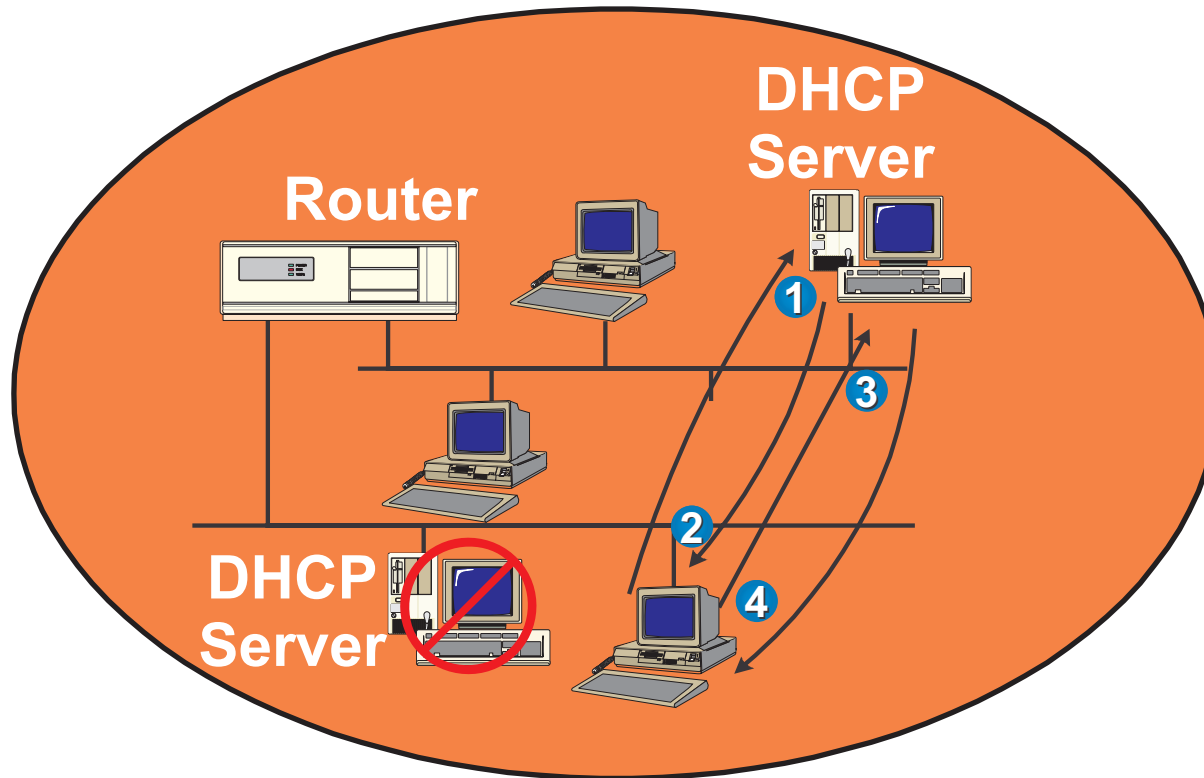
## Option 2



## Option 3

- 1 DHCP discover
- 2 DHCP offer
- 3 DHCP request
- 4 DHCP acknowledge

# DHCP Redundancy



**No replication protocol between servers**

**If all servers down**

**Clients will still boot provided their lease is still valid**

**Clients with expired lease will fail**

**New or moved clients will fail**

# ***DHCP Redundancy Options***

## **Short leases**

**Increased traffic**

**Increased need for redundancy**

## **Long leases**

**Less traffic**

**More time for recovery**

**Less IP address turnover**

## **None**

**Use long lease time**

**Backup server offline**

**Backup scope activated manually**

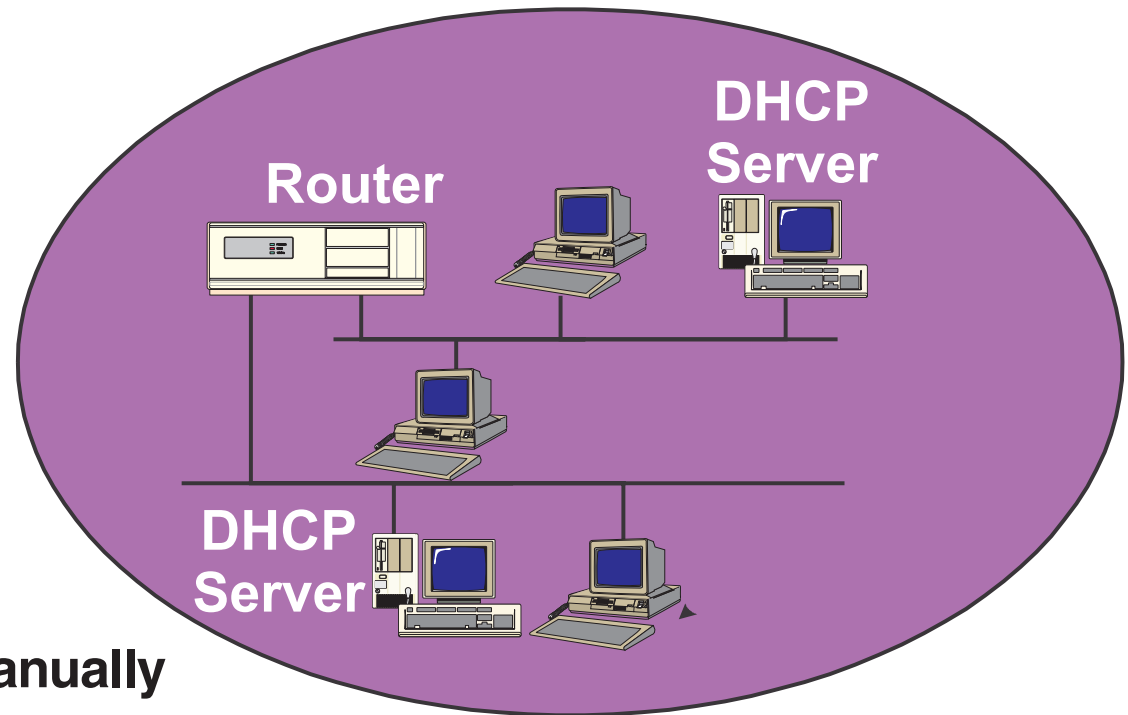
**Periodic backups**

**Copy directory often**

**Realtime server backup**

**Split address space**

**No priority of requests**



# DHCP Server Options

**Automatic database backup**

**Automatic restore of corrupted database**

**Superscopes**

**Collection of scopes**

**Duplicate address detection**

**DHCP pings address before assignment**

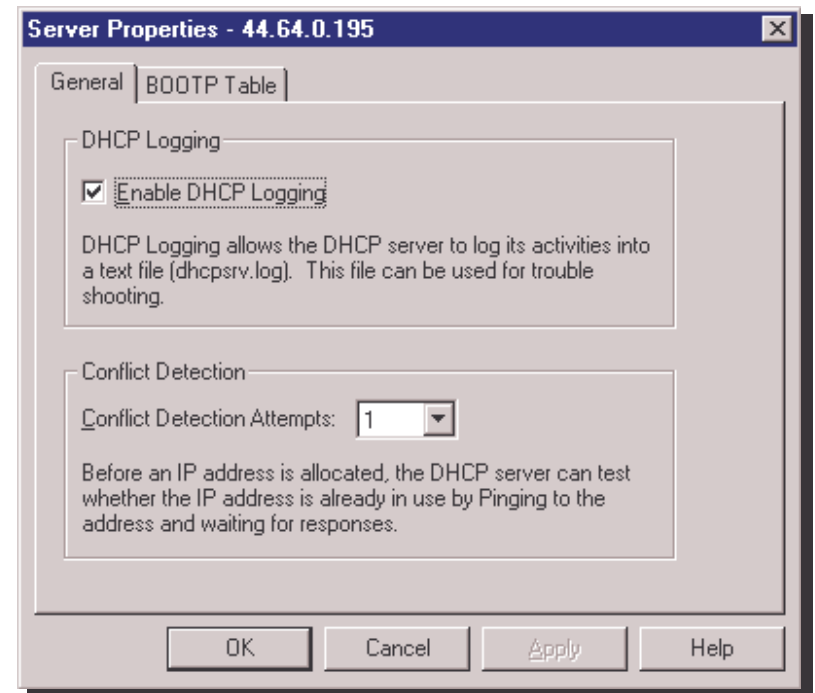
**Can lower performance**

**Cannot detect duplicates on renewal**

**Automatic scavenging**

**Overall cleanup of database and releasing of addresses**

**IP switch support**



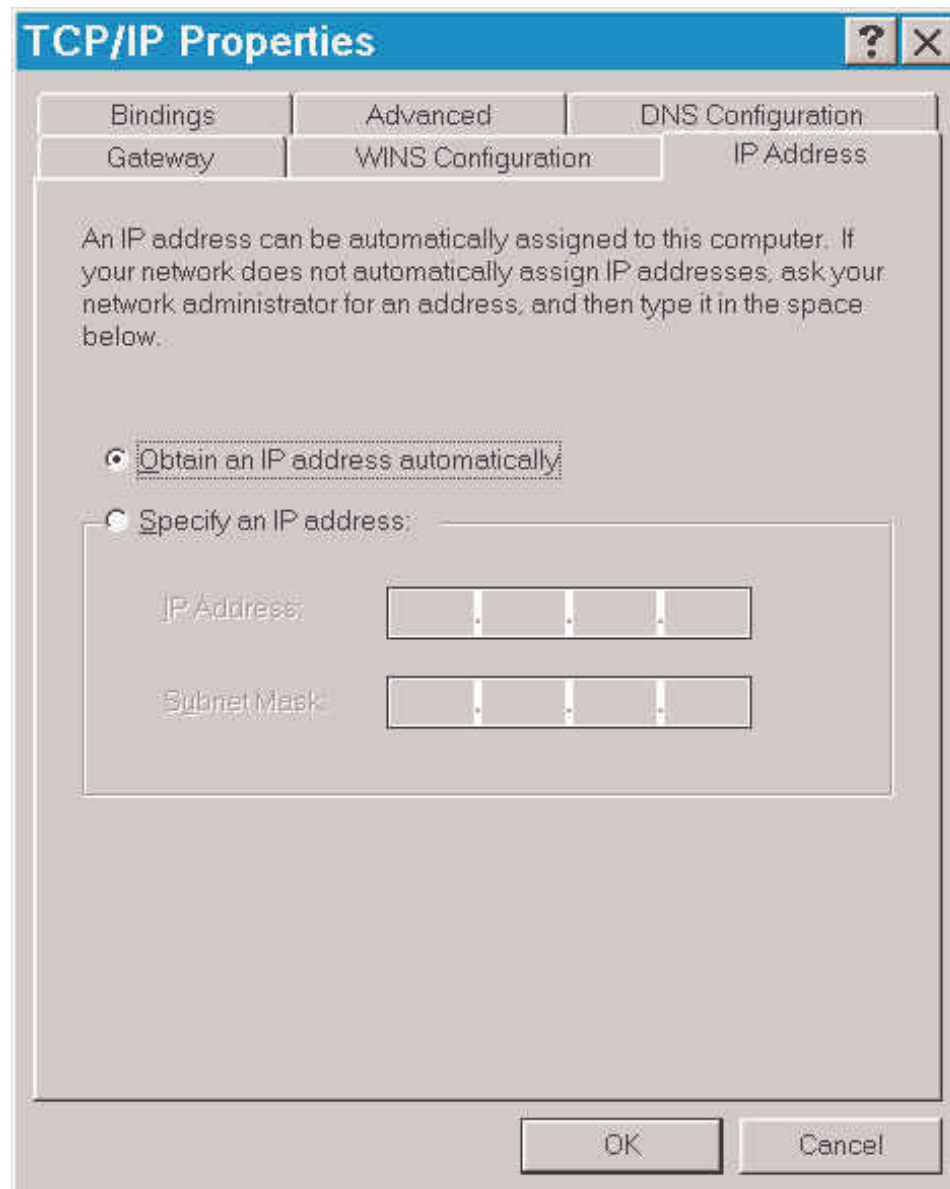
# *DHCP Server Audit Logs*

**ID Date,Time,Description,IP Address,Host Name,MAC Address**

```
15,12/18/98,21:07:21,NAck,157.60.109.236,NN2Z-LAP,00805FA40E9A
10,12/18/98,21:07:22,Assign,44.64.0.191,NN2Z-LAP,00805FA40E9A
11,12/18/98,22:12:58,Renew,44.64.0.191,NN2Z-LAP,00805FA40E9A
11,12/19/98,13:04:44,Renew,44.64.0.191,NN2Z-LAP,00805FA40E9A
12,12/19/98,17:37:40,Release,44.64.0.198,nn2z-95,0020AF3457F5
```

**Many servers now have additional information to help with debugging and security audits**

# DHCP and Windows 95 and Windows 98



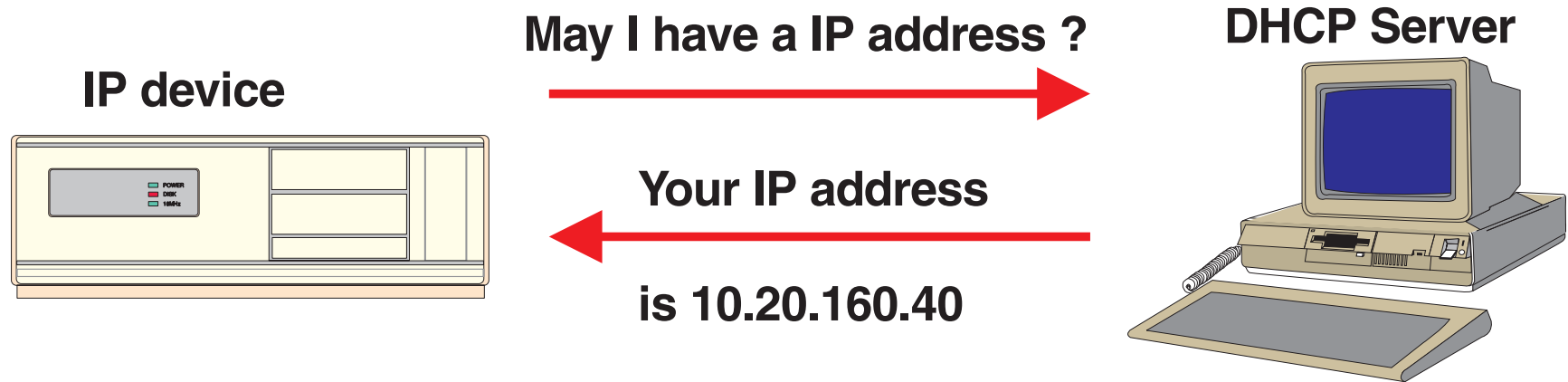
**Windows 95/98 configuration defaults to use DHCP**

**WINS is similar to DHCP, but used to resolve NetBIOS names to IP address**

**Essential for explosive Internet access**

**Type 'winipcfg' from a DOS command line to see what your assigned IP address is and other assigned IP information**

# Top Concerns with DHCP



**Backup with Server-Server communications**

**Security requires major development work**

**Client access lists**

**Naming DHCP servers**

**DHCP and DNS integration**  
**Proprietary implementations exist**  
**IETF working on standard**

**Linking DHCP and LDAP (Lightweight Directory Access Protocol)**  
**Replication**  
**Data sharing**  
**Linkage to security server**