Computer Networks

IP Address

What is an IP (Internet Protocol) Address?

- A number which identifies a device on a network.
- Configured in software “IP Host” , and can be changed
- MAC Address “burned” onto the hardware and cannot be changed

What is the purpose of an IP Address?

- Enables hosts to communicate across networks
- IP Address is required to use TCP/IP

IPv4 & IPv6

- **IPv4**
  - Internet protocol
  - Approximately 4.3 billion IP addresses
  - Nearly exhausted
- **IPv6**
  - Newer version of IP to succeed version 4
  - How many? 2^128
  - 2^128 = 340,282,366,920,938,463,463,374,607,431,768,211,456 Addresses

IP Address basics – bits & bytes

- Bit is either a 1 or a 0 (zero)
- Byte = 8 bits “Octet”
- IP Address is made up of 32 bits = 4 bytes “Octets”

Decimal & Binary

- Can write an IP address in two ways
- Binary
- 00001010000001010000010100000001
- Decimal
- 10.10.10.1

- Use dotted-decimal notation
- Octet value range: 0 – 255

IP Addresses & Network Classes

- 172.16.0.0
- Not all network are the same size
- Three classes of networks were created

Class A Network

- Very large networks
- Network portion is just the first octet
- Host portion is octets 2, 3, and 4
- 10.0.0.0

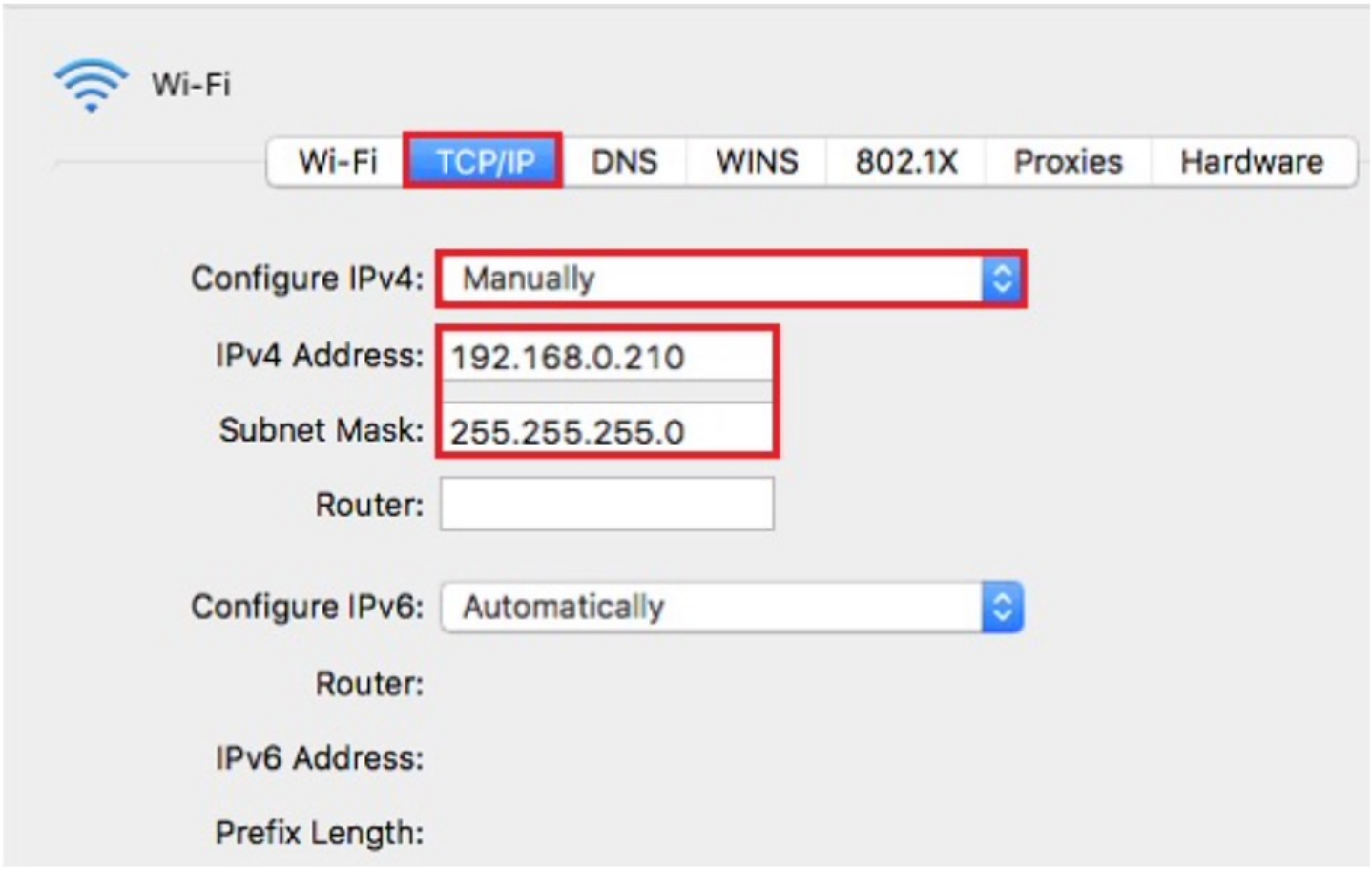
Class B Network

- Medium sized networks
- Network portion = first 2 octets
- Host portion = octets 3 and 4
- 172.16.0.0

Class C Network

- Small networks
- Network portion = octets 1,2, and 3
- Host portion = 4th octet
- 192.168.1.0

Network Setting



Values of First Octet in IP Addresses of Different Classes

- Class A: 00000000. 00000000. 00000000. 00000000
- Class B: 10000000. 00000000. 00000000. 00000000
- Class C: 11000000. 00000000. 00000000. 00000000
- Class D: 11100000. 00000000. 00000000. 00000000
- Class E: 11110000. 00000000. 00000000. 00000000
- **Total Range**
- Class A: 0 (00000000) – 127 (01111111)
- Class B: 128 (10000000) – 191 (10111111)
- Class C: 192 (11000000) – 223 (11011111)

Loopback address

- **Loopback address : 127.0.0.0**
- The loopback address allows for a reliable method of testing the functionality of **an Ethernet card** and its **drivers** and **software** without a physical network.

- It also allows information technology professionals to test **IP software** without worrying about broken or corrupted drivers or hardware.

Range of Address Classes

Address Class	RANGE	Default Subnet Mask
A	1.0.0.0 to 126.255.255.255	255.0.0.0
B	128.0.0.0 to 191.255.255.255	255.255.0.0
C	192.0.0.0 to 223.255.255.255	255.255.255.0
D	224.0.0.0 to 239.255.255.255	Reserved for Multicasting
E	240.0.0.0 to 254.255.255.255	Experimental
Note: Class A addresses 127.0.0.0 to 127.255.255.255 cannot be used and is reserved for loopback testing.		

Network classes Range

Classes	1st Octet Range	Network Numbers
Class A	1 to 126	1.0.0.0 to 126.0.0.0
Class B	128 to 191	128.0.0.0 to 191.255.0.0
Class C	192 to 223	192.0.0.0 to 223.255.255.0

Network classes Range

Classes	Total # of Networks	Total # of Hosts per Network
Class A	$2^7 - 2 = 126$	$2^{24} - 2 = 16{,}777{,}214$
Class B	$2^{14} = 16{,}384$	$2^{16} - 2 = 65{,}534$
Class C	$2^{21} = 2{,}097{,}152$	$2^8 - 2 = 254$

Private & Public IP Addresses

- **Public IPs**
- Assigned by ICANN (The Internet Corporation for Assigned Names and Numbers)
- Routable over the Internet

- **Private IPs**
- Not assigned by ICANN
- Not routable over the Internet
- Used on private networks

Private IP Network

- Class A 10.0.0.0
- 10.0.0.0 through 10.255.255.255

- Class B 172.16.0.0
- 172.16.0.0 through 172.16.31.255

- Class C 192.168.0.0
- 192.168.0.0 through 192.168.255.255

Network Address Translation

- The use of private IPs helps to conserve the public IPs
- IP Address and NAT (Network Address Translation)
- NAT helps for communication between:
- Public IP Address and Private IP Address

Network & Broadcast Address

- **Network address:**

  is **first address** in the network and it is used for **identification network segment**.

- **Broadcast address:**

  is the **last address** in the network, and it is used for **addressing all the nodes in the network** at the same time.

IP Address Example

Addresses	Values
IP Address	192 . 186 . 64 . 7
Mask Address	255 . 255 . 255 . 0
Network Address	192 . 186 . 64 . 0
First Host Address	192 . 186 . 64 . 1
Last Host Address	192 . 186 . 64 . 254
Broadcast Address	192 . 186 . 64 . 255

Network & Broadcast Address (CLASS C)

Addresses	Values
IPv4 address	192.168.10.117
Class C subnet mask	255.255.255.0
Network Address	192.168.10.0
First Host Address	192.168.10.1
Last Host Address	192.168.10.254
Broadcast Address	192.168.10.255

Network & Broadcast Address (CLASS B)

Addresses	Values
IPv4 address	172.22.18.201
Class B subnet mask	255.255.0.0
Network Address	172.22.0.0
First Host Address	172.22.0.1
Last Host Address	172.22.255.254
Broadcast Address	172.22.255.255

Network & Broadcast Address (CLASS A)

Addresses	Values
IPv4 address	10.2.122.17
Class A subnet mask	255.0.0.0
Network Address	10.0.0.0
First Host Address	10.0.0.1
Last Host Address	10.255.255.254
Broadcast Address	10.255.255.255