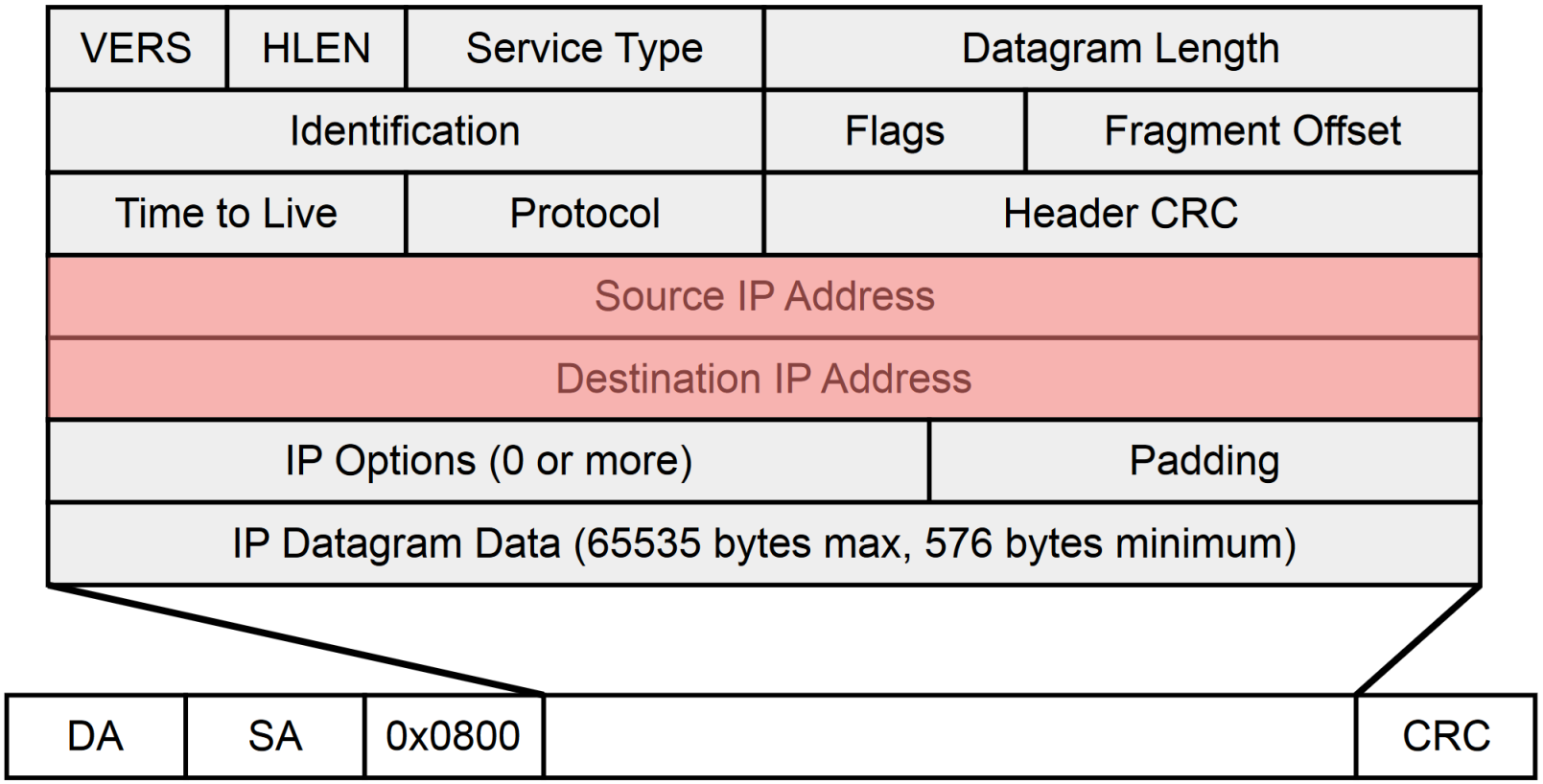
IT 609
Network and System Administration

IP Addresses

Tuesday October 14, 2021

IP Addresses

IP Packets


VERS
HLEN
Service Type
Datagram Length
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header CRC
Source IP Address
Destination IP Address
IP Options (0 or more)
Padding
IP Datagram Data (65535 bytes max, 576 bytes minimum)
DA
SA
0x0800
CRC

IP Addressing

4-byte address

Written in dotted decimal notation

132.177.80.57

69.63.184.142

74.125.67.100

etc

Each 1 byte value ranges from 0 to 255

IP Address - Two Meanings

Internet Protocol is intended to deliver to a "network" - a group of computers, not to a specific computer

IP Address contain 2 separate values

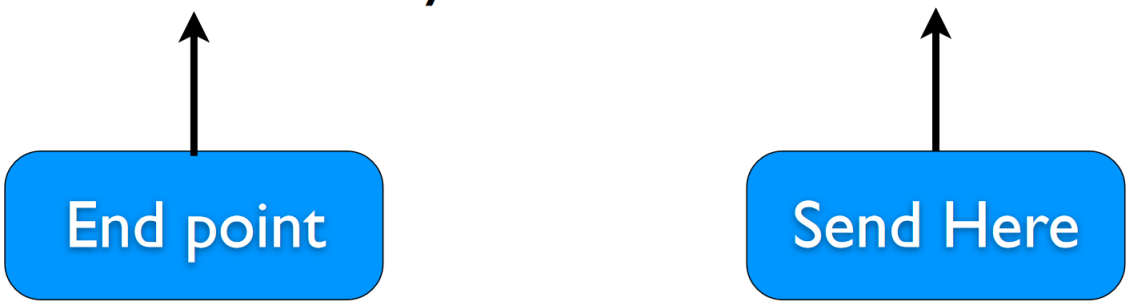
- Network address - what network
- Host address - what host on that network

IP and routers only care about the network part!!!

IP Addressing - Comparisons

Mailing Addresses

15 Academic Way, Durham, NH 03824



First, deliver to 03824 zip code, ignore the other parts

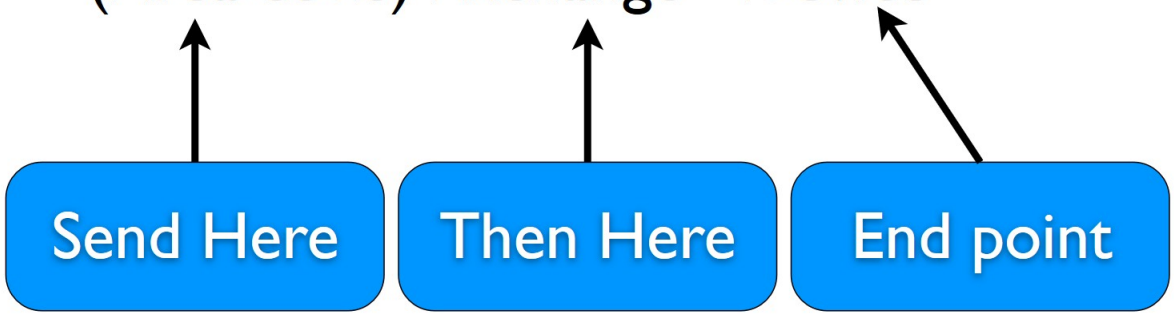
Local Post Office gets it to the specific street & number

IP Addressing - Comparisons

Telephone Numbers

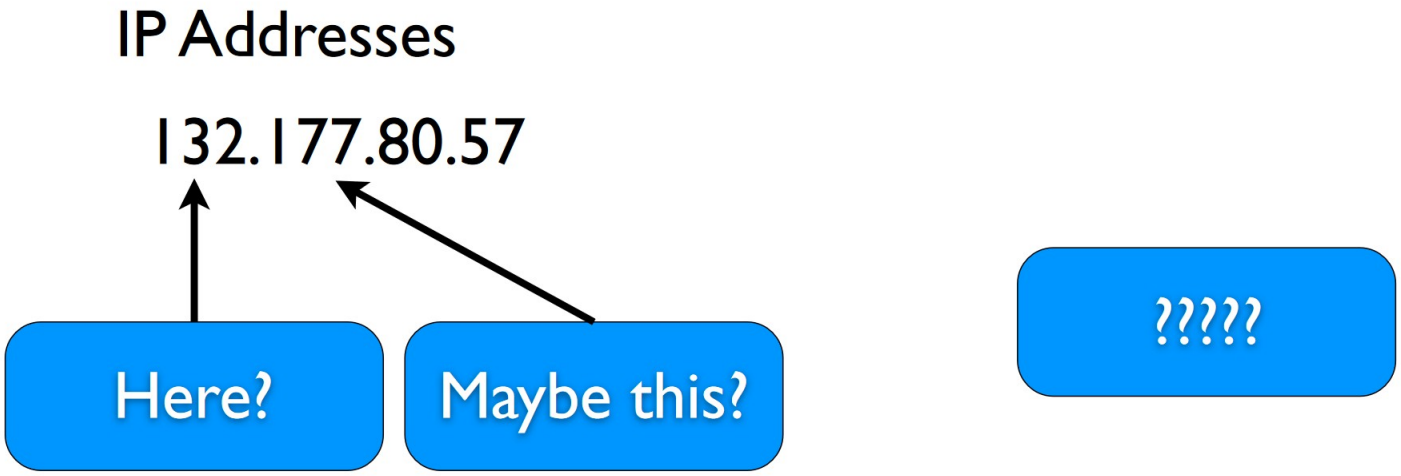
(603) 862 - 0213

(Area code) Exchange - Device



Calls get routed first to the area then the exchange and lastly the device

IP Addressing - Comparisons



First, deliver to the network

Then, the local network gets it to the device (see ARP)

- But which is which?

IP - Network & Host

IP Address contain 2 separate values

- Network address - what network
- Host address - what host on that network
- **IP and routers only care about the network part!!!**

The amount that is the network address is not always the same

A second piece of information is needed to tell how to split the address into the two parts

IP - Network & Host

Subnet Mask or Prefix

- How many bits of the address are for the network
- How many define the host

Older class-based IP address assignments conveniently split addresses at 1-byte boundaries

- Easy (for us)

Newer classless assignment can use most any number of bits for the network

- It might not be neat (for us)

Subnet Masks

A Subnet Mask determines how much of an IP address is the network and how much indicates the host

Standard Subnet Masks

- Class A - 255.0.0.0
- Class B - 255.255.0.0
- Class C - 255.255.255.0

Every IP host must have an IP address, gateway address, and subnet mask

Every entry in a routing table also has a subnet mask or prefix

IP - An Example (Fake)

A UNH computer - 132.177.86.57

Older class-based system this is class B

Class B - 2 bytes for network and 2 for host

Network = 132.177.0.0, Host = 86.57

In binary:

	10000100.10110001	.01010110.00111001
S. Mask=	11111111.11111111	.00000000.00000000
Network=	10000100.10110001	.00000000.00000000
Host=		01010110.00111001

Easy in decimal or binary - split at the boundaries!

Subnet mask = 255.255.0.0, Prefix = /16

IP - An Example (Real)

A UNH computer - 132.177.86.57

UNH : 22 bits for network and 10 for host

Prefix = /22 (e.g. 132.177.86.57/22)

Subnet mask = 255.255.252.0

Network = 132.177.84.0, Host = 2.57

In binary:

	10000100.10110001.01010110.00111001
S. Mask=	11111111.11111111.11111100.00000000
Network=	10000100.10110001.01010100.00000000
Host=	10.00111001

Easy only if you do it in binary!

Is It The Same Network?

For each computer using IP, the question to ask each time you contact a new IP address is whether or not that computer is on the same network as you are or a different one.

Keys to do so:

1) Your address

2) Destination address

3) Your subnet mask or prefix

Same Network

Your computer: 132.177.80.57

Destination: 132.177.81.16

Subnet mask - 255.255.0.0

```
132.177.080.057 = 10000100.10110001.01010000.00111001
255.255.000.000 = 11111111.11111111.00000000.00000000
-----------------------------------------------------
132.177.000.000 = 10000100.10110001.00000000.00000000

132.177.081.016 = 10000100.10110001.01010001.00010000
255.255.000.000 = 11111111.11111111.00000000.00000000
-----------------------------------------------------
132.177.000.000 = 10000100.10110001.00000000.00000000
```

Same Network

Your computer: 132.177.80.57

Destination: 132.177.137.2

Subnet mask - 255.255.0.0

```
132.177.080.057 = 10000100.10110001.01010000.00111001
255.255.000.000 = 11111111.11111111.00000000.00000000
-------------------------------------------------------
132.177.000.000 = 10000100.10110001.00000000.00000000

132.177.137.002 = 10000100.10110001.10001001.00000010
255.255.000.000 = 11111111.11111111.00000000.00000000
-------------------------------------------------------
132.177.000.000 = 10000100.10110001.00000000.00000000
```

Same Network

Your computer: 132.177.80.57

Destination: 132.177.81.16

Subnet mask - 255.255.252.0

```
132.177.080.057 = 10000100.10110001.01010000.00111001
255.255.252.000 = 11111111.11111111.11111100.00000000
-----------------------------------------------------
132.177.080.000 = 10000100.10110001.01010000.00000000

132.177.081.016 = 10000100.10110001.01010001.00010000
255.255.252.000 = 11111111.11111111.11111100.00000000
-----------------------------------------------------
132.177.080.000 = 10000100.10110001.01010000.00000000
```

Different Network - Must Route

Your computer: 132.177.80.57

Destination: 132.177.137.2

Subnet mask - 255.255.252.0

```
132.177.080.057 = 10000100.10110001.01010000.00111001
255.255.252.000 = 11111111.11111111.11111100.00000000
-----------------------------------------------------
132.177.080.000 = 10000100.10110001.01010000.00000000

132.177.137.002 = 10000100.10110001.10001001.00000010
255.255.252.000 = 11111111.11111111.11111100.00000000
-----------------------------------------------------
132.177.136.000 = 10000100.10110001.10001000.00000000
```