



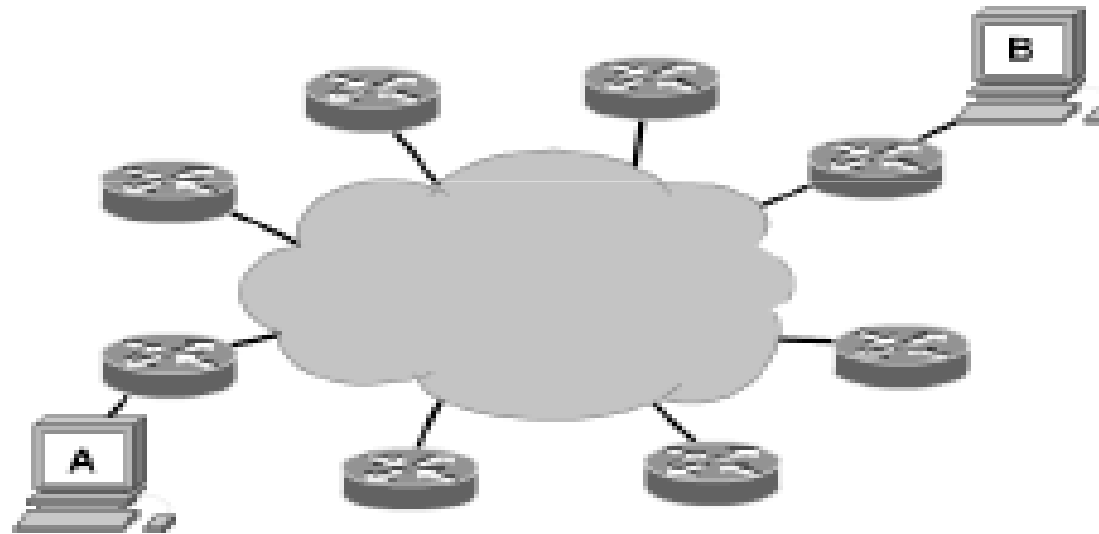
IP Addressing and Numbering systems

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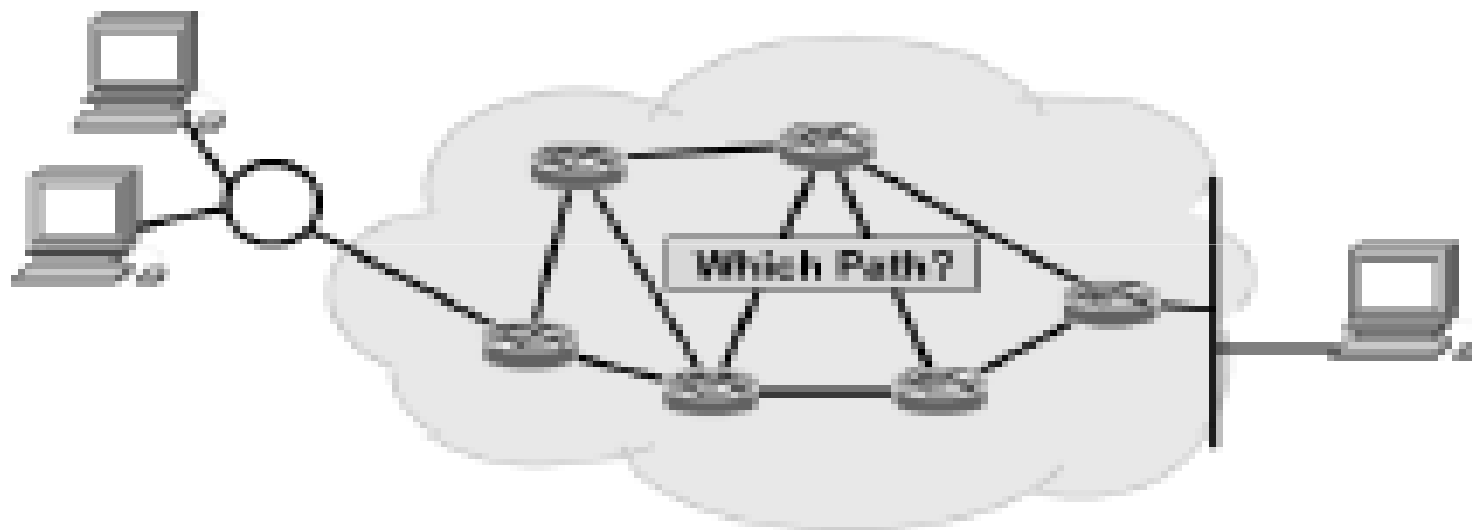
Identify Network Users



Computer Mobility

- **Layer 2 / MAC address**
 - **Physically burned into the NIC**
 - **Doesn't change**
 - **The devices real identity**
- **Layer 3 / Protocol address**
 - **Set with software**
 - **The devices "mailing" address**
 - **Needs to change when device is moved**

Path Determination



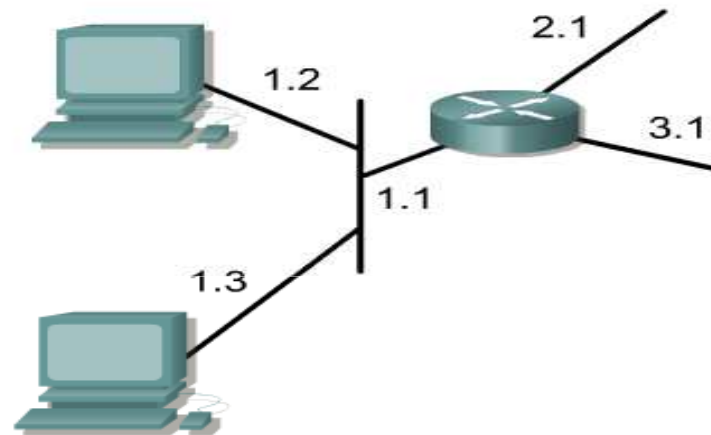
**Path determination is determined by
Routing Protocols.**

Addressing: Network and Host

Network address:

- **Helps to identify route through the network cloud**
- **Divided into two parts:**
 - **Network**
 - **Host (node)**
- **Each protocol has its own method of dividing the network address into network and host portions**

Addressing: Network and Hosts



Network	Host
1	1 2 3
2	1
3	1

Addressing: Network and Host

- **Phone numbers are similar to network addresses**
 - **Area code / Phone Number**
 - **035 / 16 74 17**
 - **035 -> Network Portion**
 - **16 74 17 -> Host Portion**
 - **035 -> Halmstad**
 - **16 74 17 -> Halmstad University**

Logical Addresses Examples

- **AppleTalk address** **400:22**
 - Network 400, host 22
- **IPX (Novell)** **4b39.00c0.4f31.03d2**
 - Network 4b39, host 00c0.4f31.03d2
- **IP (Internet)** **207.81.104.15**
 - Network 207.81.104, host 15

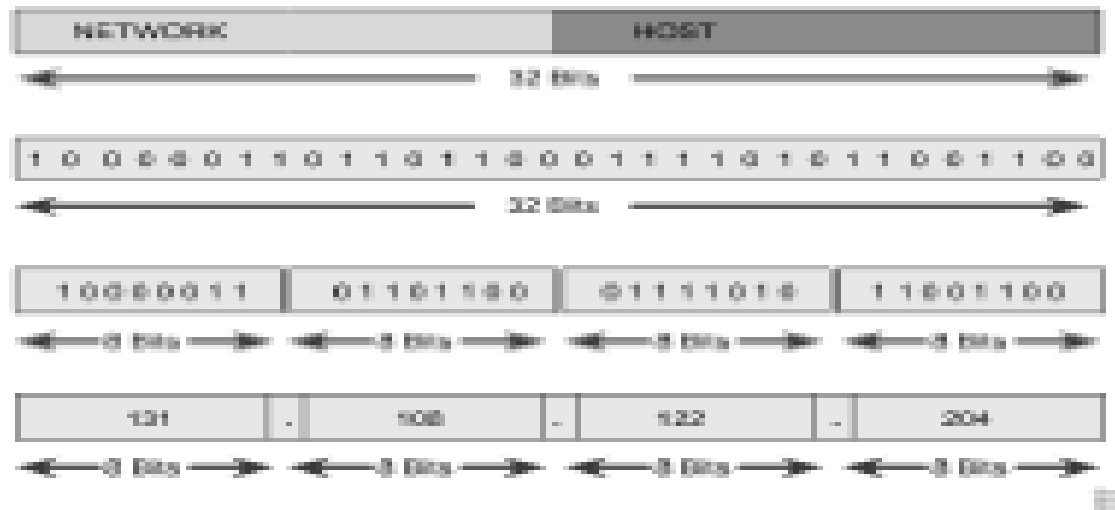
IP Address

- **IP addresses are made up of 32 bits**
 - **10101001110001110100010110001001**
- **Dotted notation to represent the decimal value of each byte (octet)**
 - **10101001.11000111.01000101.10001001**
 - **169.199.69.137**

IP Address



- **IP addresses has two parts**
 - **Network number**
 - **Host number**



IP Address



- **Which bits refer to the network number?**
- **Which bits refer to the host number?**

Classful IP Addressing

- **5 classes of IP addresses**
 - **Class A**
 - **Class B**
 - **Class C**
 - **Class D**
 - **Class E**

Address Classes

Class A	Used for Internet hosts
Class B	Used for Internet hosts
Class C	Used for Internet hosts
Class D	Used for Internet multicasts
Class E	Unused (used "experimentally")

Computers on the Internet can only be addressed using Class A, B, or C addresses.

Determining Address Class

Class A	First octet is between 0 – 127	0xxxxxxx
Class B	First octet is between 128 - 191	10xxxxxx
Class C	First octet is between 192 - 223	110xxxxx
Class D	First octet is between 224 - 239	1110xxxx
Class E	First octet is between 240 - 255	11110xxx

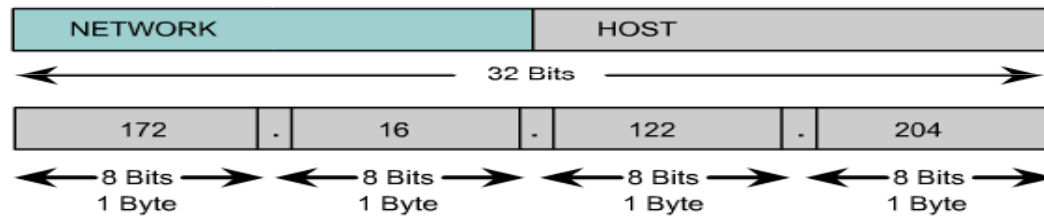
Computers on the Internet can only be addressed using Class A, B, or C addresses.

Private IP Addresses

Class	RFC 1918 internal address range
A	10.0.0.0 to 10.255.255.255
B	172.16.0.0 to 172.31.255.255
C	192.168.0.0 to 192.168.255.255

Only for internal use

Address Class



An IP address will always be divided into a network and host portion. In a classful addressing scheme, these divisions take place at the octet boundaries.

Address Class

Class A	Network	Host		
Octet	1	2	3	4

Class B	Network		Host	
Octet	1	2	3	4

Class C	Network			Host
Octet	1	2	3	4

Class D	Host			
Octet	1	2	3	4

Class D addresses are used for multicast groups. There is no need to allocate octets or bits to separate network and host addresses. Class E addresses are reserved for research use only.

- **Network number assigned by ARIN (American registry for Internet Numbers)**
- **Host number assigned by administrator**

Which part is network?

199.46.36.5

111.211.11.1

7.141.30.89

222.8.56.107

192.168.16.2

163.100.5.1

199.46.36.5

111.211.11.1

7.141.30.89

222.8.56.107

192.168.16.2

163.100.5.1

IP Addressing

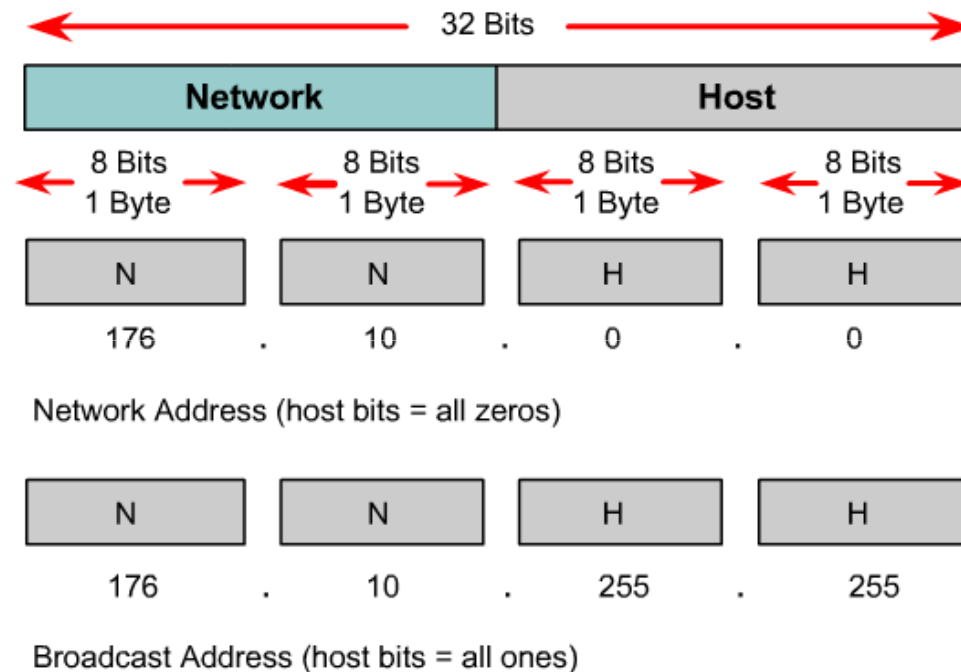
- **Network ID**
 - **All zeros in the host portion of the address**
 - **Network IDs cannot be used as an address for any device that is attached to the network**
 - **Host on a network can only communicate directly with devices if they have the same network ID**
 - **Routers use the network ID when it forwards data on the Internet**

IP Addressing



- **Broadcast Address**
 - **All ones in the host portion of the address**
 - **Broadcast addresses cannot be used as an address for any device that is attached to the network**
 - **Used to send data to all devices on the network**
 - **All devices pay attention to a broadcast**

Network and Broadcast address



This Class B address is the broadcast address for this network.
When packets are received with this destination address, the data is processed by every computer.

Network Maths

- **Three numbering systems are of most interest in networking**
 - **Decimal (base 10)**
 - **0,1,2,3,4,5,6,7,8,9**
 - **Binary (base 2)**
 - **0,1**
 - **Hexadecimal (base 16)**
 - **0,1,2,3,4,5,6,7,8,9,a,b,c,d,e,f**

Binary presentation of data



- **Base 2**
 - **2 values in each position**
- **Electronic switches**
 - **1 = on**
 - **0 = off**