Dotted decimal notation

12.34.56.78 ✓

00001100.00100010.00111000.01001110

123.456.789.100 ✗

01111011.11001000.11000101.01100100

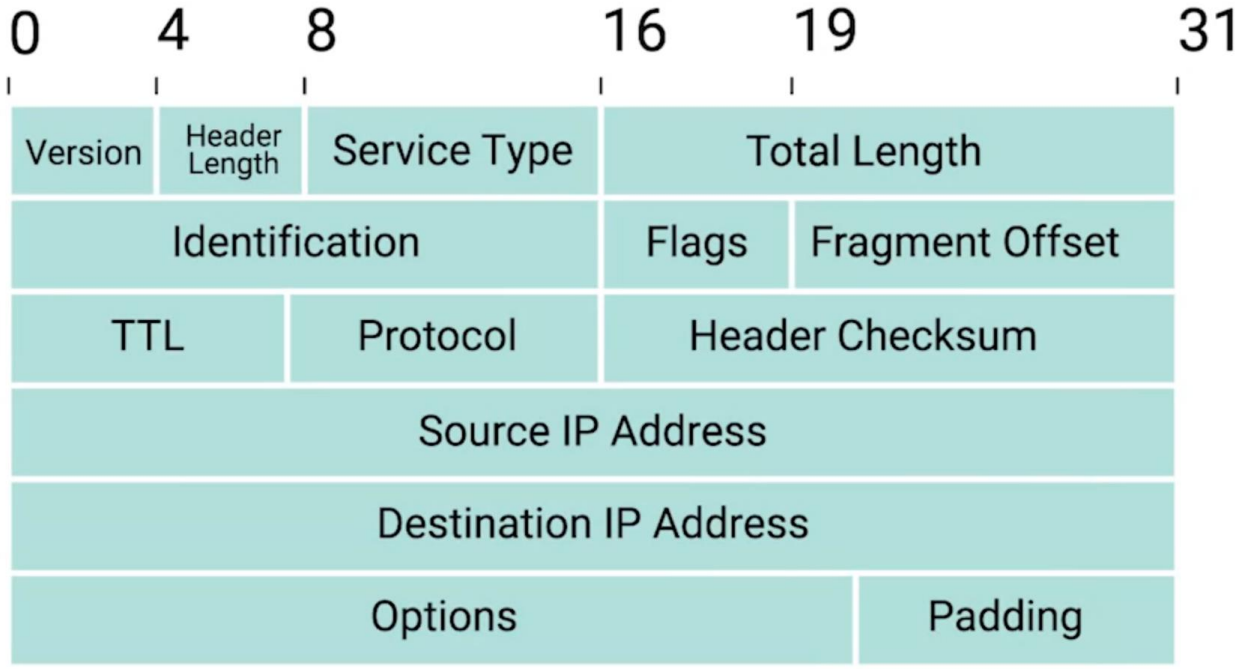
8 7 6 5 4 3 2 1. 9 8 7 6 5 4 3 2 1. 10 9 8 7 6 5 4 3 2 1. 8 7 6 5 4 3 2 1

IP addresses belong to networks, not to the devices attached to those networks.

Dynamic Host Configuration Protocol (DHCP)

In most cases, static IP addresses are reserved for servers and network devices, while dynamic IP addresses are reserved for clients.

IP Datagram Header



IP datagram

A highly structured series of fields that are strictly defined

The most common version of **IP** is version 4, or **IPv4**.

Total Length field

Indicates the total length of the IP datagram it's attached to

Service Type field

These 8 bits can be used to specify details about quality of service, or QoS, technologies

Header Length field

Almost always 20 bytes in length when dealing with IPv4

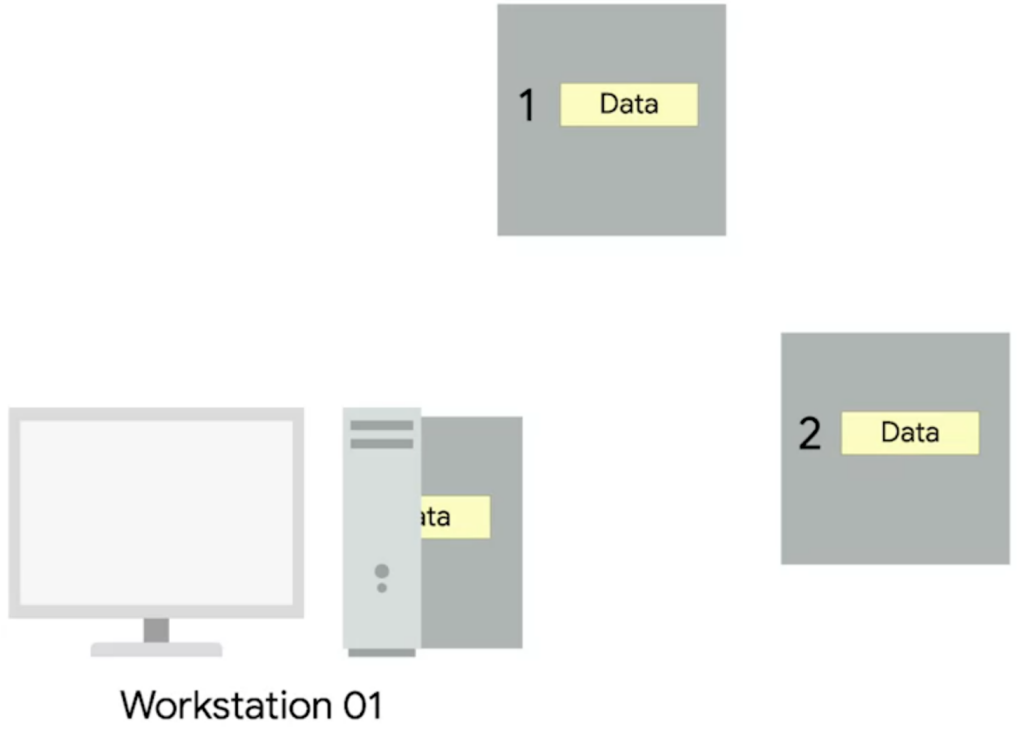
Identification field

A 16-bit number that's used to group messages together

The maximum size of a single datagram is the largest number you can represent with 16 bits.

65,535

If the total amount of data that needs to be sent is larger than what can fit in a single datagram, the IP layer needs to split this data up into many individual packets.



Fragmentation

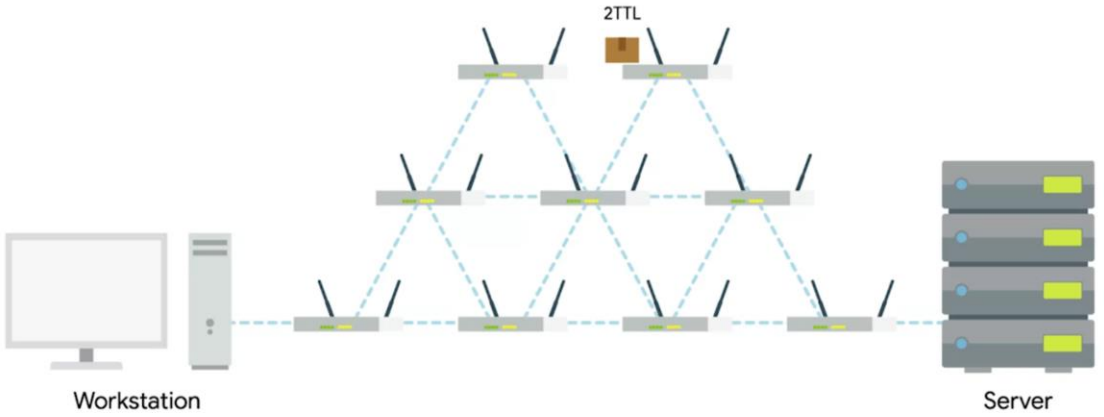
The process of taking a single IP datagram and splitting it up into several smaller datagrams

Flag field

Used to indicate if a datagram is allowed to be fragmented, or to indicate that the datagram has already been fragmented

Time to Live (TTL) field

An 8-bit field that indicates how many router hops a datagram can traverse before it's thrown away



IP options field

An optional field and is used to set special characteristics for datagrams primarily used for testing purposes

Header checksum field

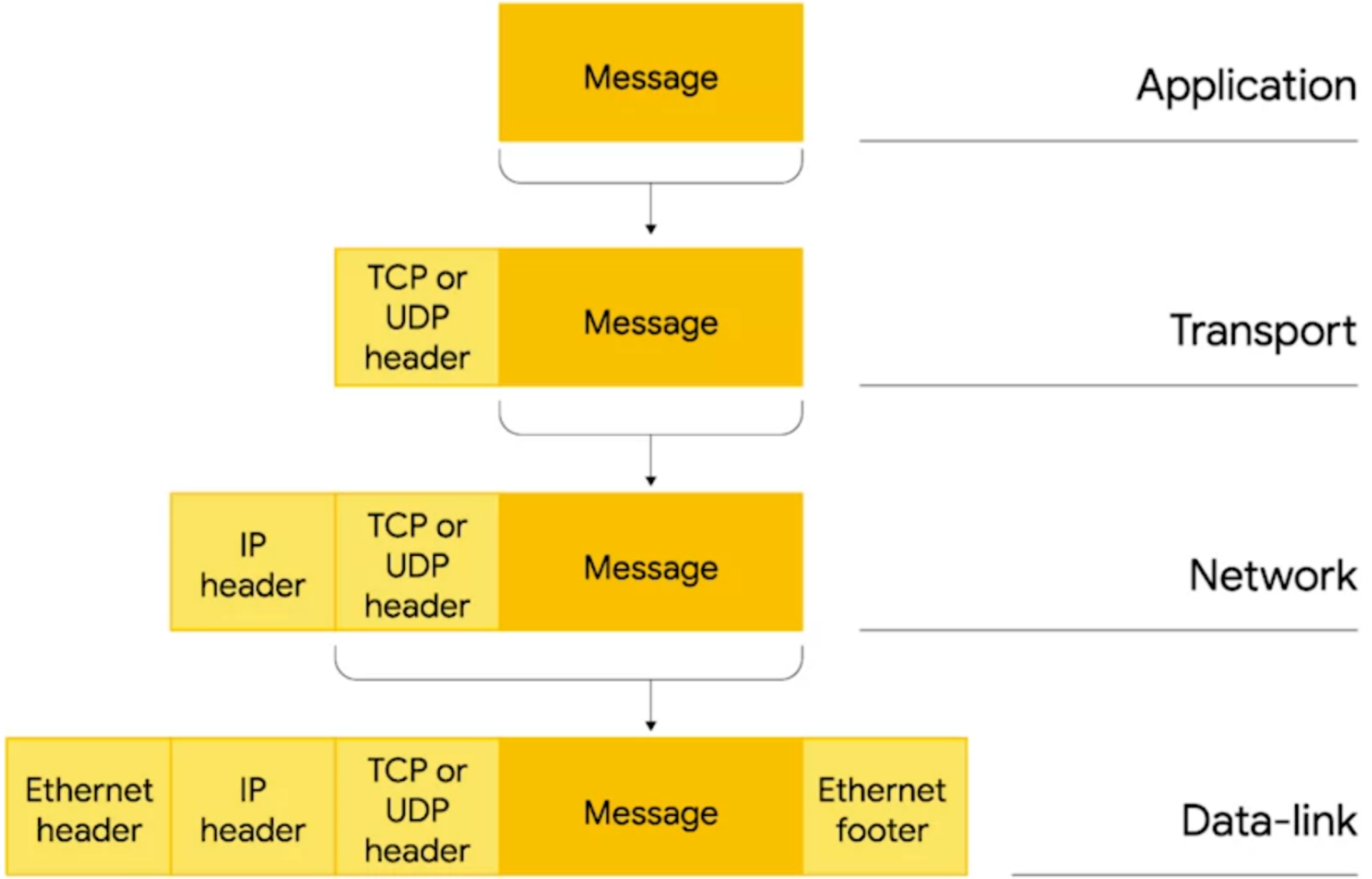
A checksum of the contents of the entire IP datagram header

Padding field

A series of zeros used to ensure the header is the correct total size

Protocol field

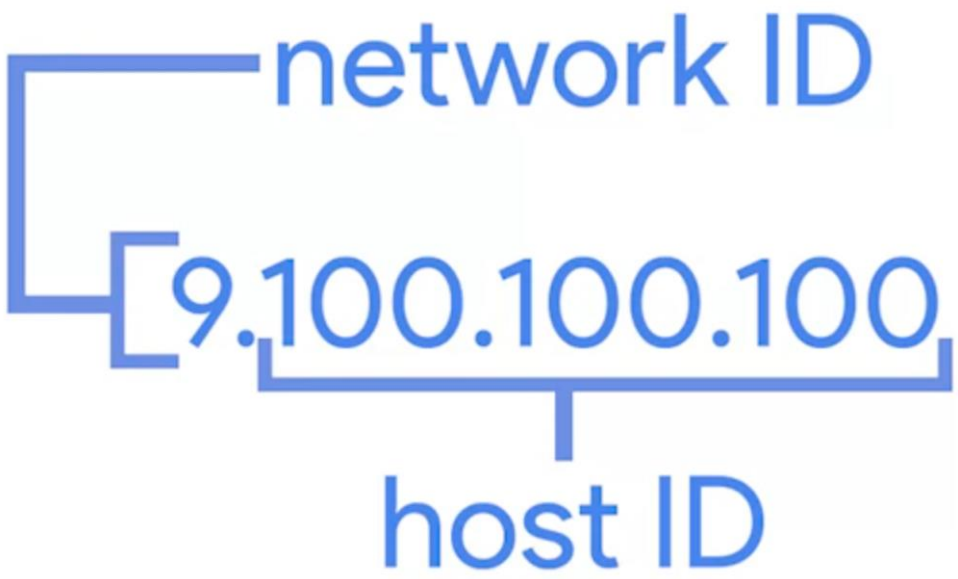
Another 8-bit field that contains data about what transport layer protocol is being used


Message
Application
TCP or UDP header
Message
Transport
IP header
TCP or UDP header
Message
Network
Ethernet header
IP header
TCP or UDP header
Message
Ethernet footer
Data-link

Address class system

A way of defining how the global IP address space is split up

IP addresses can be split into two sections: the **network ID** and the **host ID**.



Class A

123.456.780.00

host ID

Class B

123.456.780.00

host ID

Class C

123.456.780.00

host ID

Class	Left-most bit	Starting IP address	Last IP address
A	0xxx	0.0.0.0	127.255.255.255
B	10xx	128.0.0.0	191.255.255.255
C	110x	192.0.0.0	223.255.255.255
D	1110	224.0.0.0	239.255.255.255
E	1111	240.0.0.0	255.255.255.255

Address resolution protocol

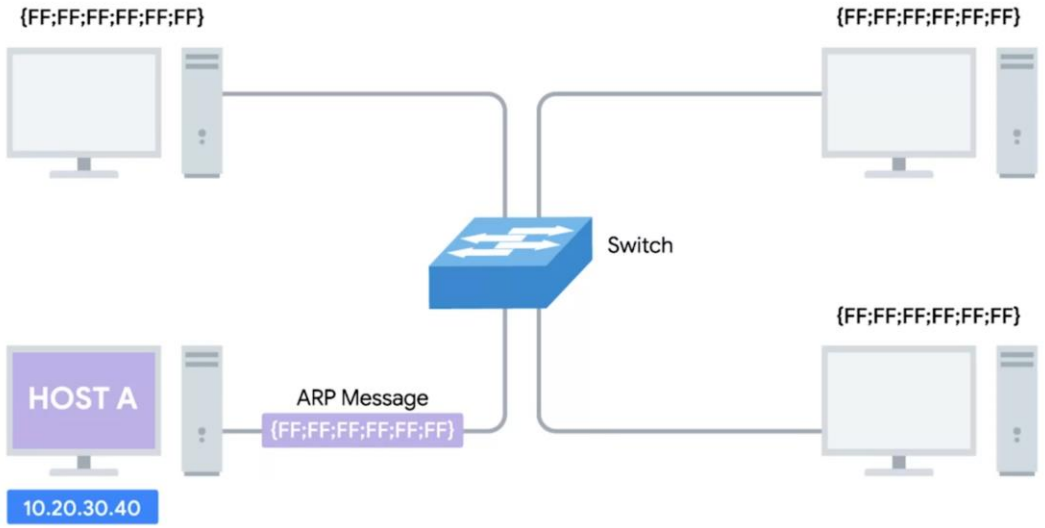
ARP

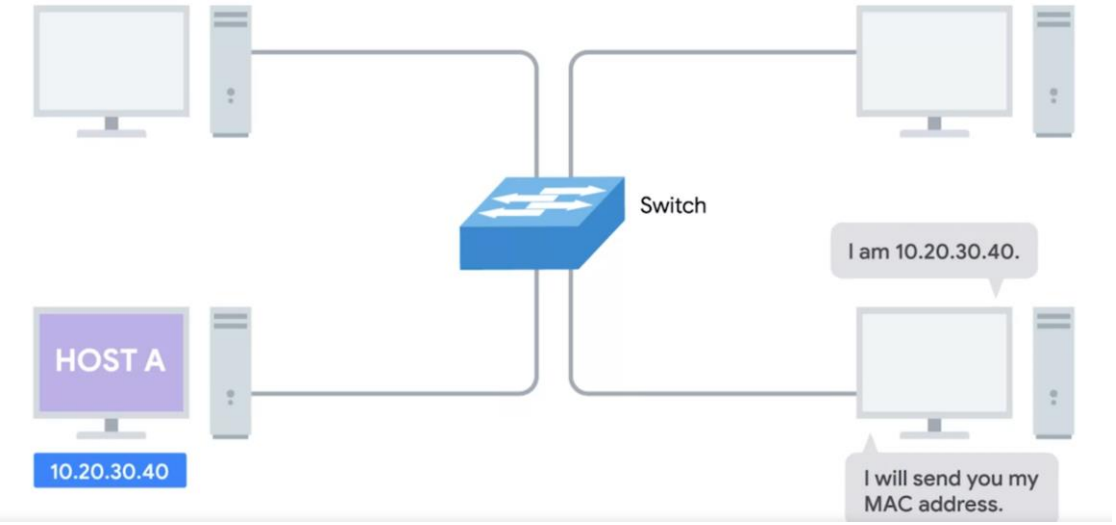
A protocol used to discover the hardware address of a node with a certain IP address

ARP table

A list of IP addresses and the MAC addresses associated with them

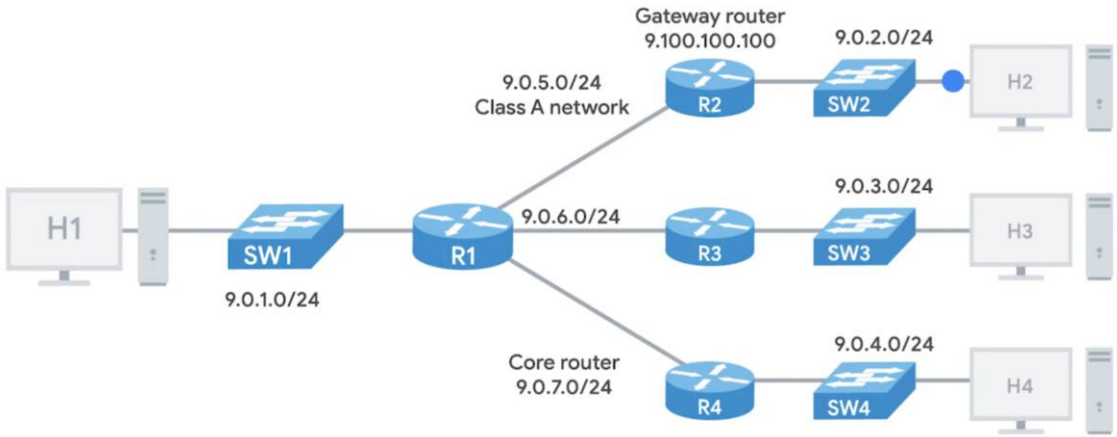
ARP table entries generally expire after a short amount of time to ensure changes in the network are accounted for.


{FF;FF;FF;FF;FF;FF}
{FF;FF;FF;FF;FF;FF}
Switch
{FF;FF;FF;FF;FF;FF}
HOST A
ARP Message
{FF;FF;FF;FF;FF;FF}
10.20.30.40

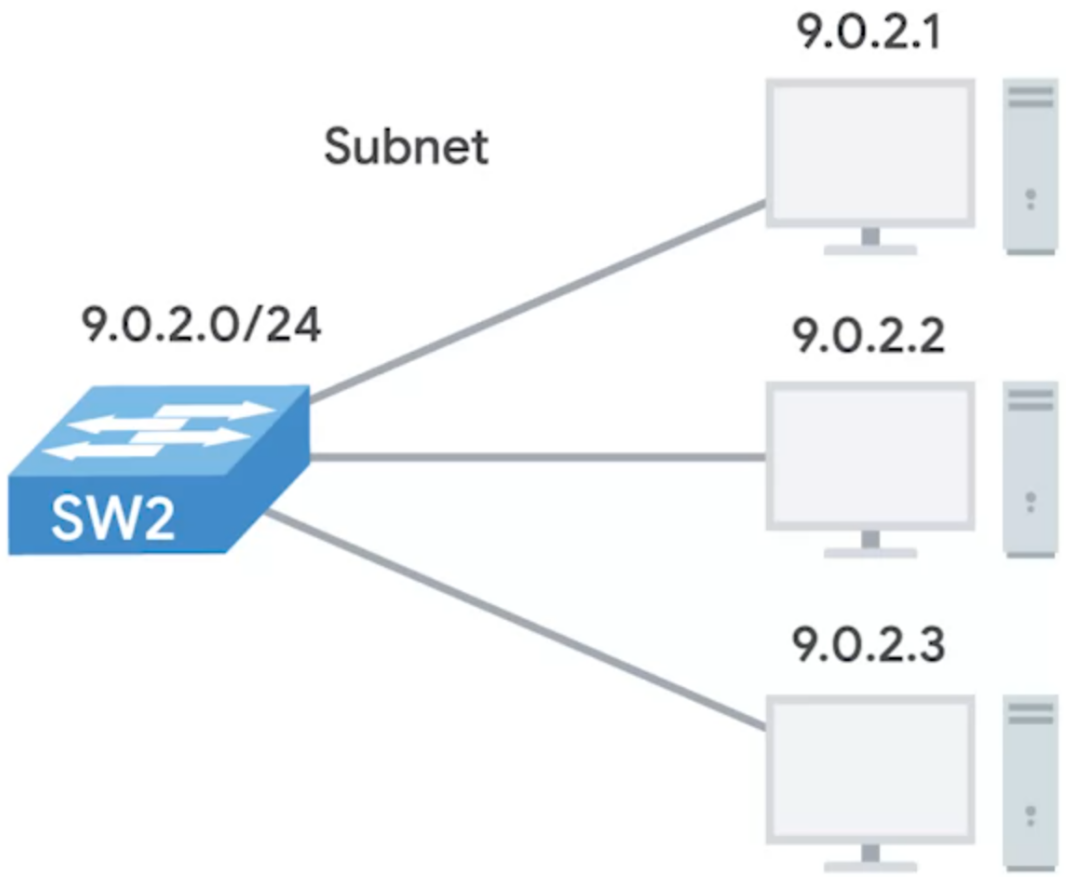

Switch
I am 10.20.30.40.
HOST A
10.20.30.40
I will send you my MAC address.

Subnetting

The process of taking a large network and splitting it up into many individual and smaller subnetworks, or subnets



Incorrect subnetting setups are a common problem you might run into as an IT Support Specialist, so it's important to have a strong understanding of how this works.



IP address classes

Class	Range	Max Hosts
A	0-126	16 Million
B	128-191	64,000
C	192-224	254
D	224-239	N/A
E	240-255	N/A

IP address	9	100	100	100
IP address *(in binary)*	0000 1001	0110 0100	0110 0100	0110 0100
Subnet mask *(in binary)*	1111 1111	1111 1111	1111 1111	0000 0000

Subnet masks

32-bit numbers that are normally written out as four octets in decimal

1 AND 1 = 1

1 AND 0 = 0

0 AND 0 = 0

X OR Y = Z

"If either X or Y is true, then Z is true; otherwise, it's false."

1 OR 0 = 1

0 OR 0 = 0

Subnet mask

A way for a computer to use **and operators** to determine if an IP address exists on the same network

IP address	9	100	100	100
	AND	AND	AND	AND
Subnet mask *(in binary)*	1111 1111	1111 1111	1111 1111	0000 0000

9.100.100

Classless Inter-Domain Routing

Subnet masks and IP address

Class		Mask short name	Max Hosts
A	255.0.0.0 11111111.00000000.00000000.00000000	/8	16,777,214
B	255.255.0.0 11111111.11111111.00000000.00000000	/16	65,534
C	255.255.255.0 11111111.11111111.11111111.00000000	/24	254
	255.255.240.0 11111111.11111111.11110000.00000000	/20	4,094
	255.255.255.224 11111111.11111111.11111111.11100000	/27	30
	255.255.255.252 11111111.11111111.11111111.11111100	/30	2

Network ID

8 bit Class A

16 bit Class B

24 bit Class C

CIDR notation

Demarcation point

To describe where one network or system ends and another one begins

/24 network is 8 host bits. 2^8 = 256

256 - 2 = 254

254 + 254 = 508

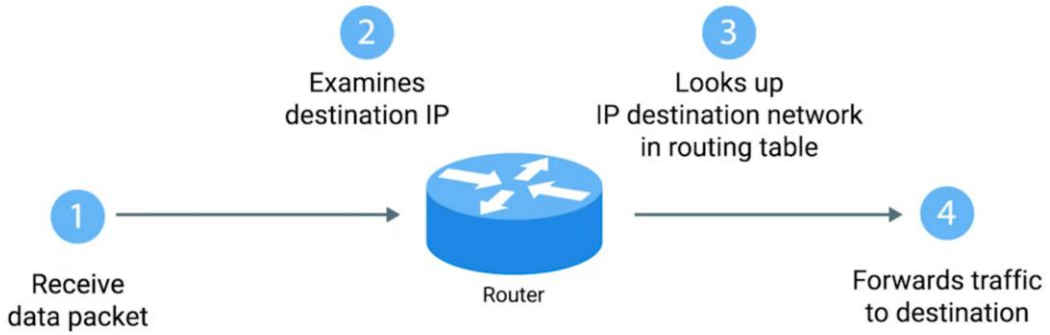
/23 network is 9 host bits. 2^9 = 512

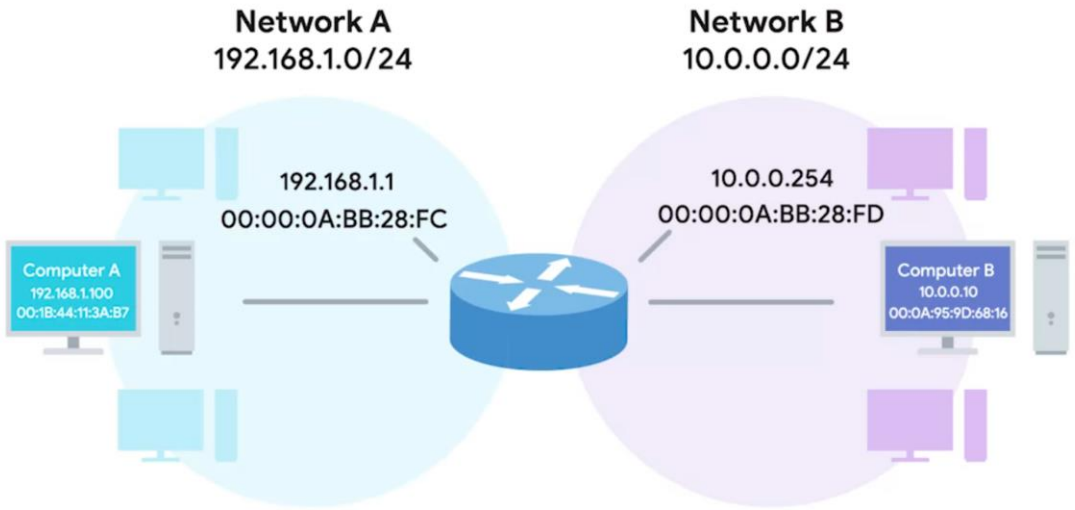
512 - 2 = 510

Router

A network device that forwards traffic depending on the destination address of that traffic

Basic routing:





IP: 192.168.1.1

Subnet Mask: 255.255.255.0

CIDR: 192.168.1.1/24

Interior gateway protocols are further split into two categories: **Link state routing protocols** and **distance-vector protocols.**

Routing protocols fall into two main categories: **interior gateway protocols** and **exterior gateway protocols.**

Autonomous system

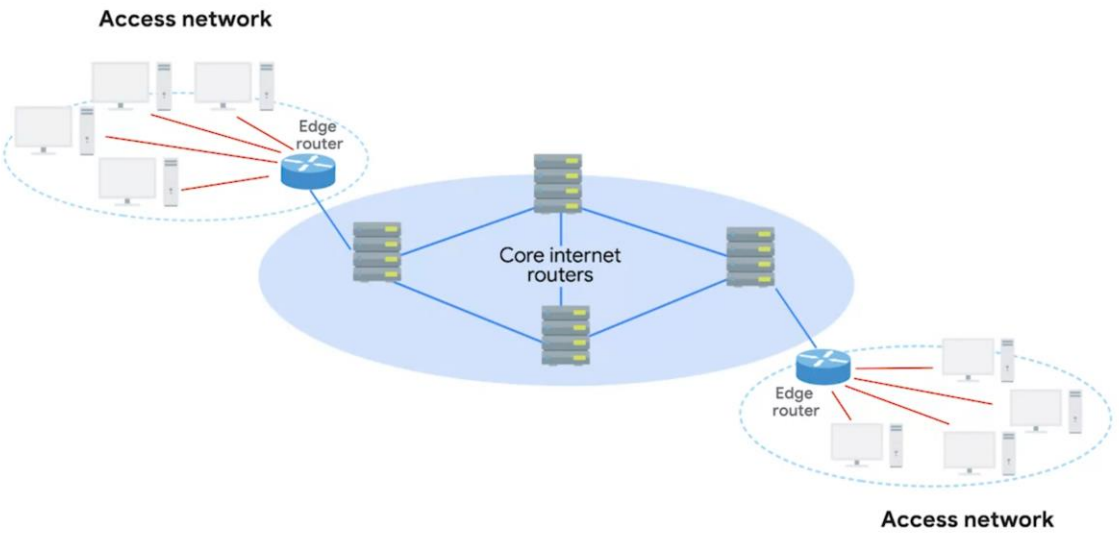
A collection of networks that all fall under the control of a single network operator

Interior gateway protocols

Used by routers to share information within a single autonomous system

Internet Assigned Numbers Authority (IANA)

A non-profit organization that helps manage things like IP address allocation



AS19604 = IBM

Along with managing IP address allocation, the **IANA** is also responsible for **ASN**, or **Autonomous System Number** allocation.

Autonomous System Number (ASN)

Numbers assigned to individual autonomous systems

Non-routable address space

- 10.0.0.0/8
- 172.16.0.0/12
- 192.168.0.0/16