

# Chapter 7

## IPv4 Header

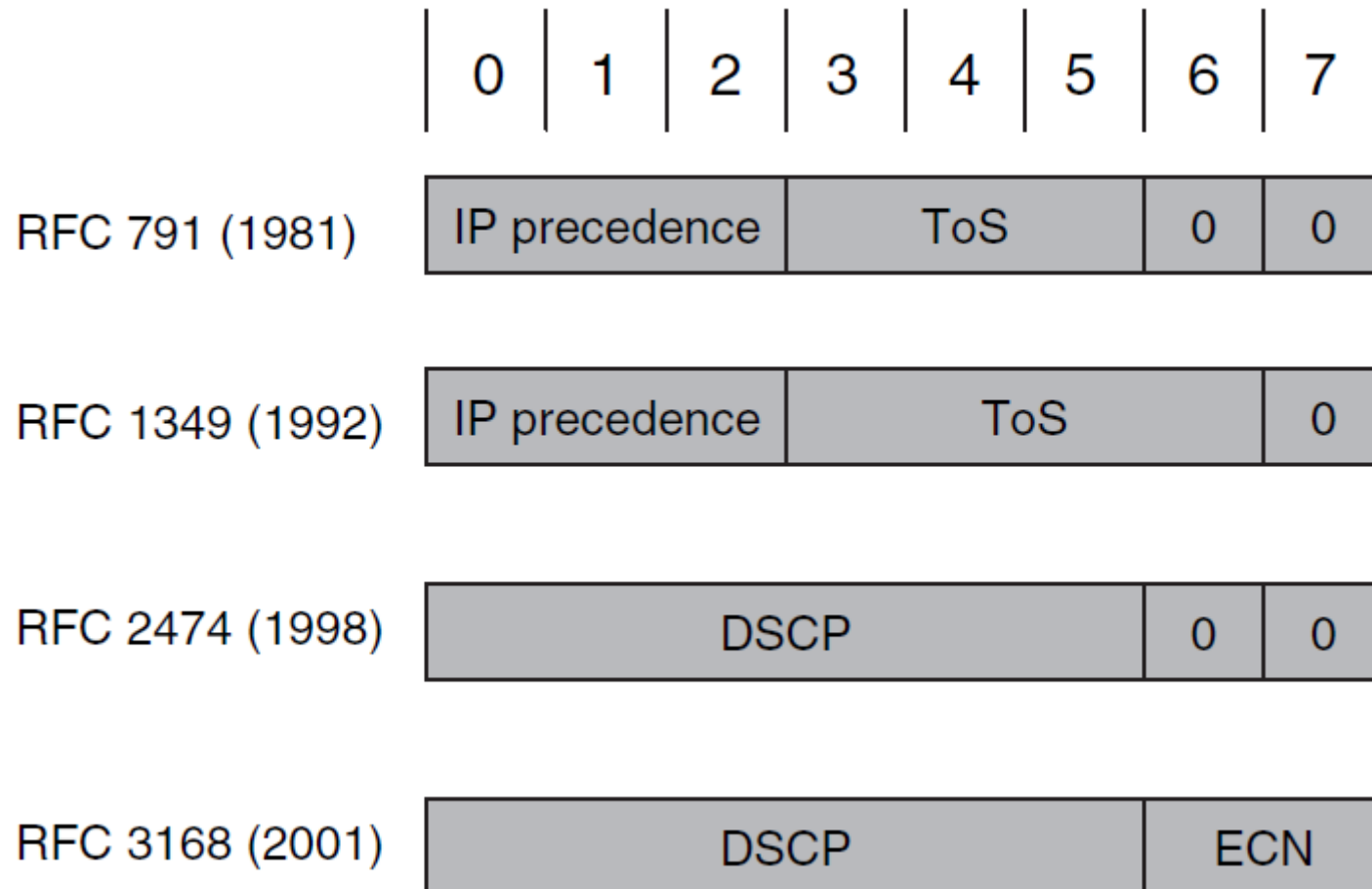
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1

Version		IHL		Type of Service				Total Length							
Identification						flags		Fragment Offset							
Time to Live				Protocol				Header Checksum							
Source Address															
Destination Address															
IP Options Field												Padding			

Protocol Number	Protocol
1	Internet Control Message Protocol (ICMP)
2	Internet Group Management Protocol (IGMP)
6	Transmission Control Protocol (TCP)
17	User Datagram Protocol (UDP)
88	Enhanced IGRP (EIGRP)
89	Open Shortest Path First (OSPF)
103	Protocol-Independent Multicast (PIM)

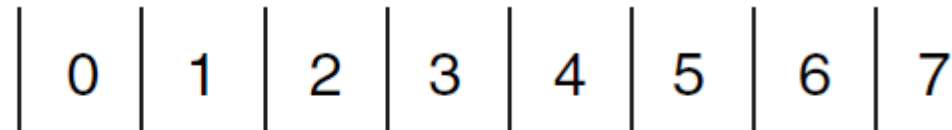
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## ToS



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## IP Precedence



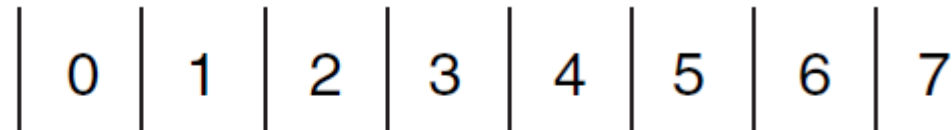
RFC 1349 (1992)

IP precedence	ToS	0
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Decimal	Binary	Description
0	000	Routine
1	001	Priority
2	010	Immediate
3	011	Flash
4	100	Flash override
5	101	Critical
6	110	Internetwork control
7	111	Network control

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## IP Precedence



RFC 1349 (1992)

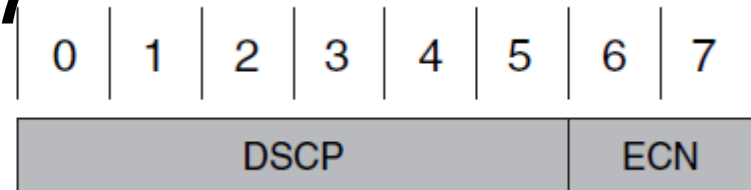
IP precedence	ToS	0
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ToS Bits 3 to 6	Description
0000	Normal service
1000	Minimize delay
0100	Maximize throughput
0010	Maximize reliability
0001	Minimize monetary cost

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## DSCP

RFC 3168 (2001)



IP Precedence			DSCP		
Service Type	Decimal	Binary	Class	Decimal	Binary
Routine	0	000	Best effort	0	000 to 000
Priority	1	001	Assured Forwarding (AF) Class 1	8	001 to 000
Immediate	2	010	AF Class 2	16	010 to 000
Flash	3	011	AF Class 3	24	011 to 000
Flash override	4	100	AF Class 4	32	100 to 000
Critical	5	101	Express Forwarding (EF)	40	101 to 000
Internetwork control	6	110	Control	48	110 to 000
Network control	7	111	Control	56	111 to 000

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## IPv4 Addressing

- Class A Addresses - 0 (00000000) to 127 (01111111)
- Class B Addresses - 128 (10000000) to 191 (10111111)
- Class C Addresses - 192 (11000000) to 223 (11011111)
- Class D Addresses - 224 (11100000) to 239 (11101111)
- Class E Addresses - 240 (11110000) to 254 (11111110)

Address Class	High-Order Bits*
A	0xxxxxx
B	10xxxxx
C	110xxxx
D	1110xxxx
E	1111xxxx

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## IPv4 Private Addresses

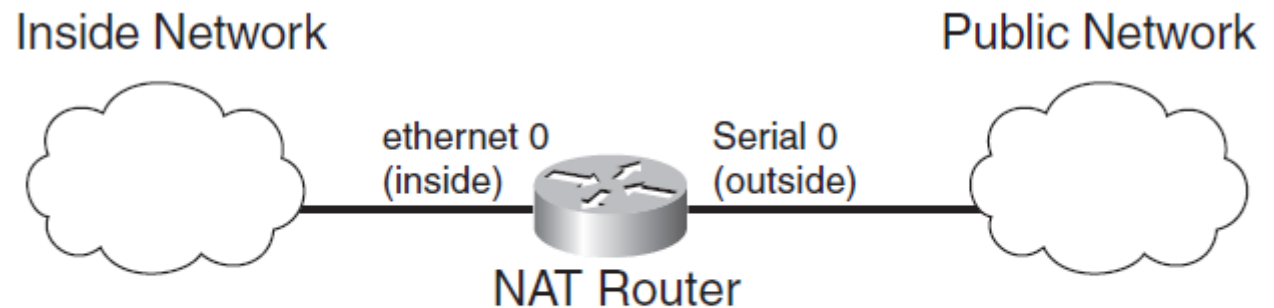
- ARIN (American Registry for Internet Numbers)
- RIPE NCC (Reseaux IP Europeens Network Control Center)
- APNIC (Asia Pacific Network Information Center)
- LACNIC (Latin America and Caribbean Network Information Center)
- AfrINIC (African Network Information Centre)

Class Type	Start Address	End Address
Class A	10.0.0.0	10.255.255.255
Class B	172.16.0.0	172.31.255.255
Class C	192.168.0.0	192.168.255.255

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## NAT

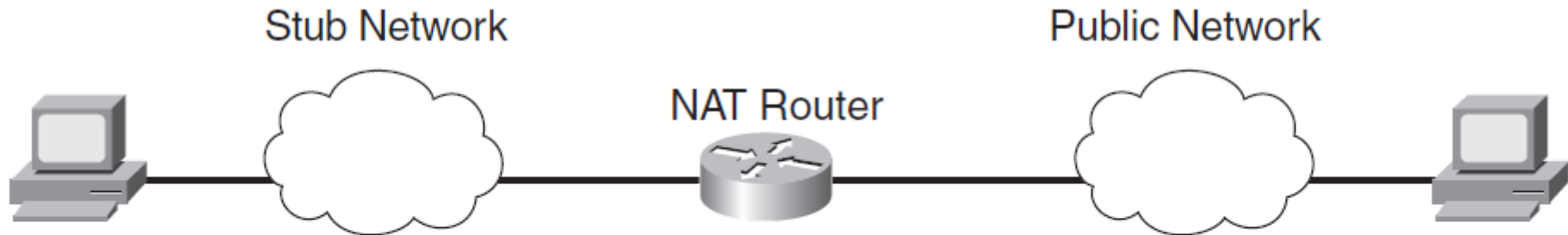
- Static NAT
- Dynamic NAT
  - Overloading
  - Overlapping



Inside local addresses: 192.168.10.0/24  
192.168.11.0/24

→

Inside global address pool: 200.100.100.1 to 200.100.100.254



Inside local addresses: 192.168.10.100 → Inside global address: 200.100.10.100

← Outside local addresses: 192.168.100.50 ← Outside global address: 30.100.2.50



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## IPv4 Address Subnets

Class	Binary Mask	Dotted-Decimal Mask		
			255.255.0.0	/16
			255.255.224.0	/19
			255.255.240.0	/20
			255.255.255.0	/24
A	11111111 00000000 00000000 00000000	255.0.0.0	255.255.255.128	/25
B	11111111 11111111 00000000 00000000	255.255.0.0	255.255.255.192	/26
C	11111111 11111111 11111111 00000000	255.255.255.0	255.255.255.224	/27
			255.255.255.240	/28
			255.255.255.248	/29
			255.255.255.252	/30
			255.255.255.255	/32

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## IP Address Subnet Design Example

- 195.10.1.0/24
- Deles i 6 subnets

LAN	Fourth Byte	Subnet Number	First Host	Broadcast Address
LAN 0	00000000	195.10.1.0	195.10.1.1	195.10.1.31
LAN 1	00100000	195.10.1.32	195.10.1.33	195.10.1.63
LAN 2	01000000	195.10.1.64	195.10.1.65	195.10.1.95
LAN 3	01100000	195.10.1.96	195.10.1.97	195.10.1.127
LAN 4	10000000	195.10.1.128	195.10.1.129	195.10.1.159
LAN 5	10100000	195.10.1.160	195.10.1.161	195.10.1.191
LAN 6	11000000	195.10.1.192	195.10.1.193	195.10.1.223
LAN 7	11100000	195.10.1.224	195.10.1.225	195.10.1.255

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## Point-to-Point link subnet example

•130.20.78.8/30

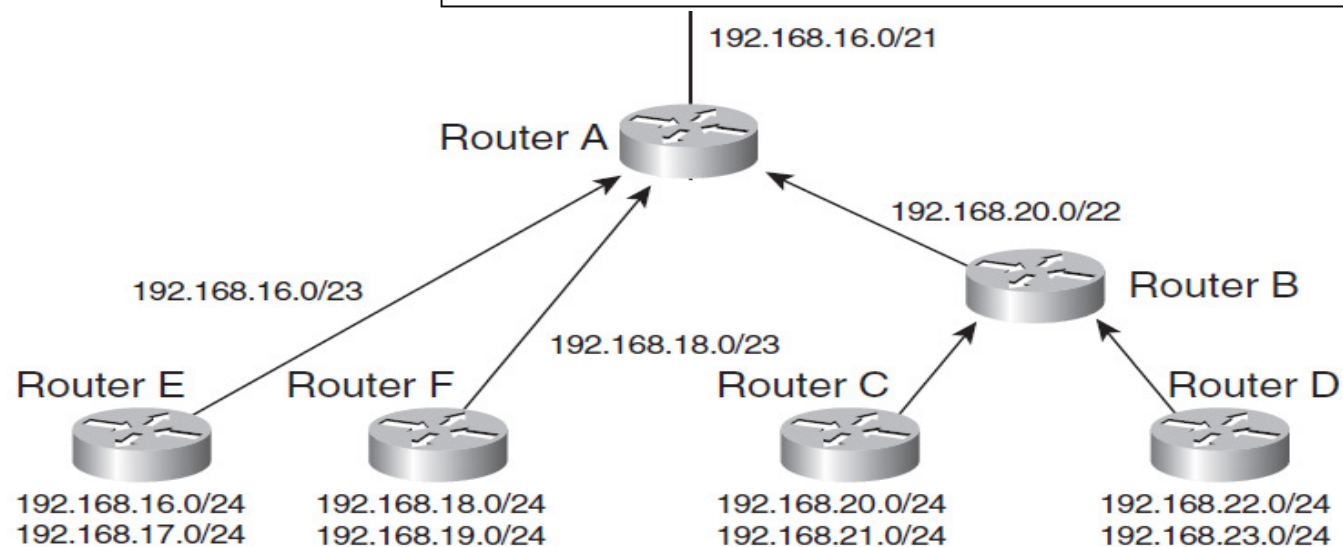
Binary Address	IP Address	Function
10000010 00010100 01001110 00001000	130.20.78.8	Subnetwork
10000010 00010100 01001110 00001001	130.20.78.9	IP address 1
10000010 00010100 01001110 00001010	130.20.78.10	IP address 2
10000010 00010100 01001110 00001011	130.20.78.11	Broadcast address

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## CIDR and Summarization

•130.20.78.8/30

Binary Address	IP Address
11001000 00000001 01100100 00000000	200.1.100.0
11001000 00000001 01100101 00000000	200.1.101.0
11001000 00000001 01100110 00000000	200.1.102.0
11001000 00000001 01100111 00000000	200.1.103.0

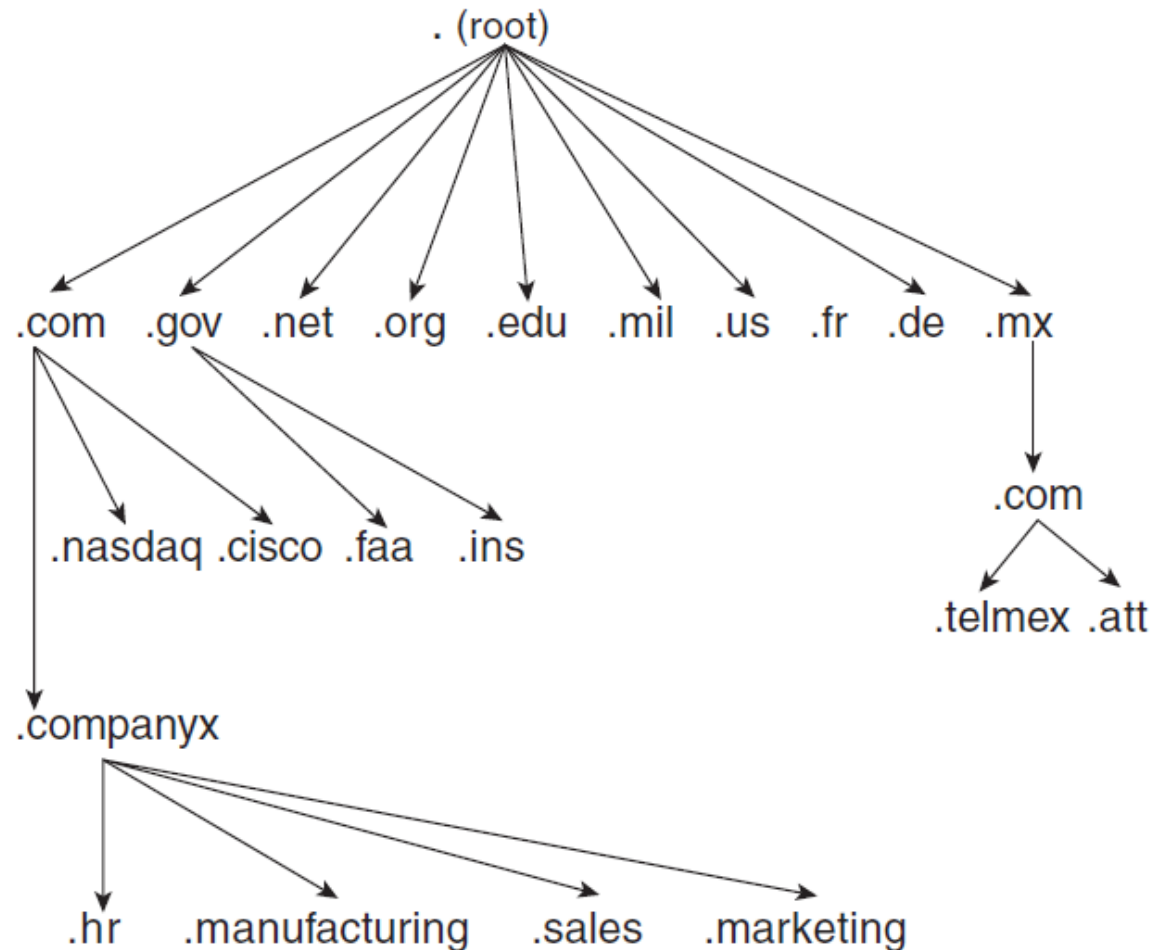




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## Address Assignment and Name Resolution

- BOOTP
- DHCP
- DNS
- ARP





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