

Addressing with IPv4 (1/7)

1

Problem: How does a data packet find its way through the Internet to its goal ?

Standardized addressing is necessary:

- IP protocol software allocates a **unique address** to every host (exactly: to any network interface)
- IP standard (**IPv4**) assigns each host a 32 bit binary number for the entire communication in the Internet, the
→ **IP address** (*Internet Protocol Address*)
- Each data packet sent in the Internet contains the IP address of the sender and the receiver

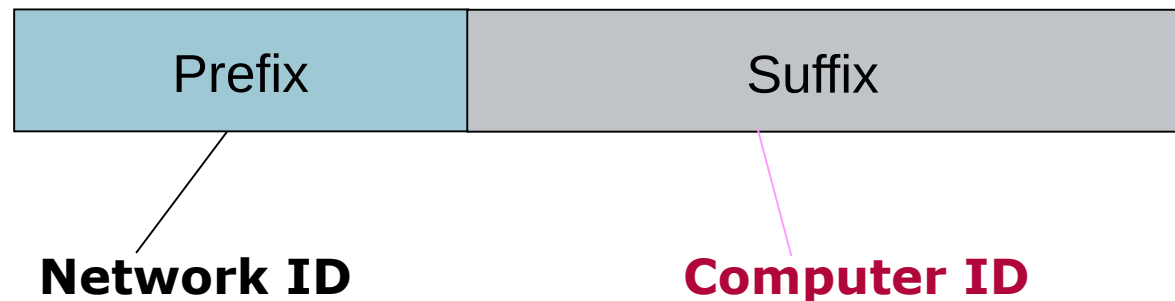
Addressing with IPv4 (2/7)

2

IPv4 address (32 bits) consists of a:

- **Prefix** – identifies the physical network
- **Suffix** – identifies a specific computer in the network concerned

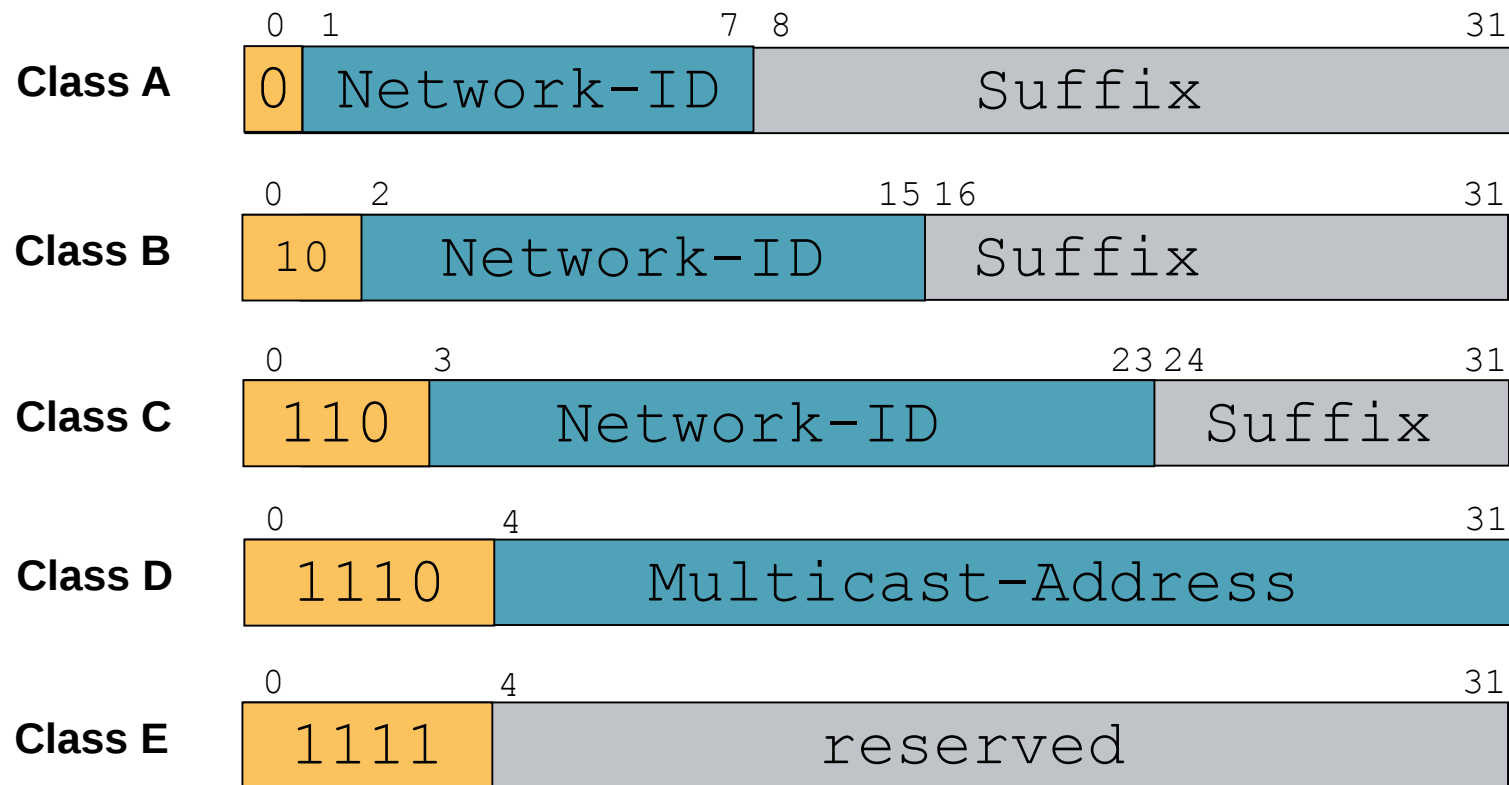
IP address does not identify a specific computer, but rather
a link from a computer to a network



Addressing with IPv4 (3/7)

3

Classful Addressing (historically)



Addressing with IPv4 (4/7)

4

IPv4 addresses have the following notation:

xx.xx.xx.xx

Each of the xx's can be a number in the range of 0...255
(8bits * 4 = 32bits)

Some Examples:

Loop-Back addresses (local host):

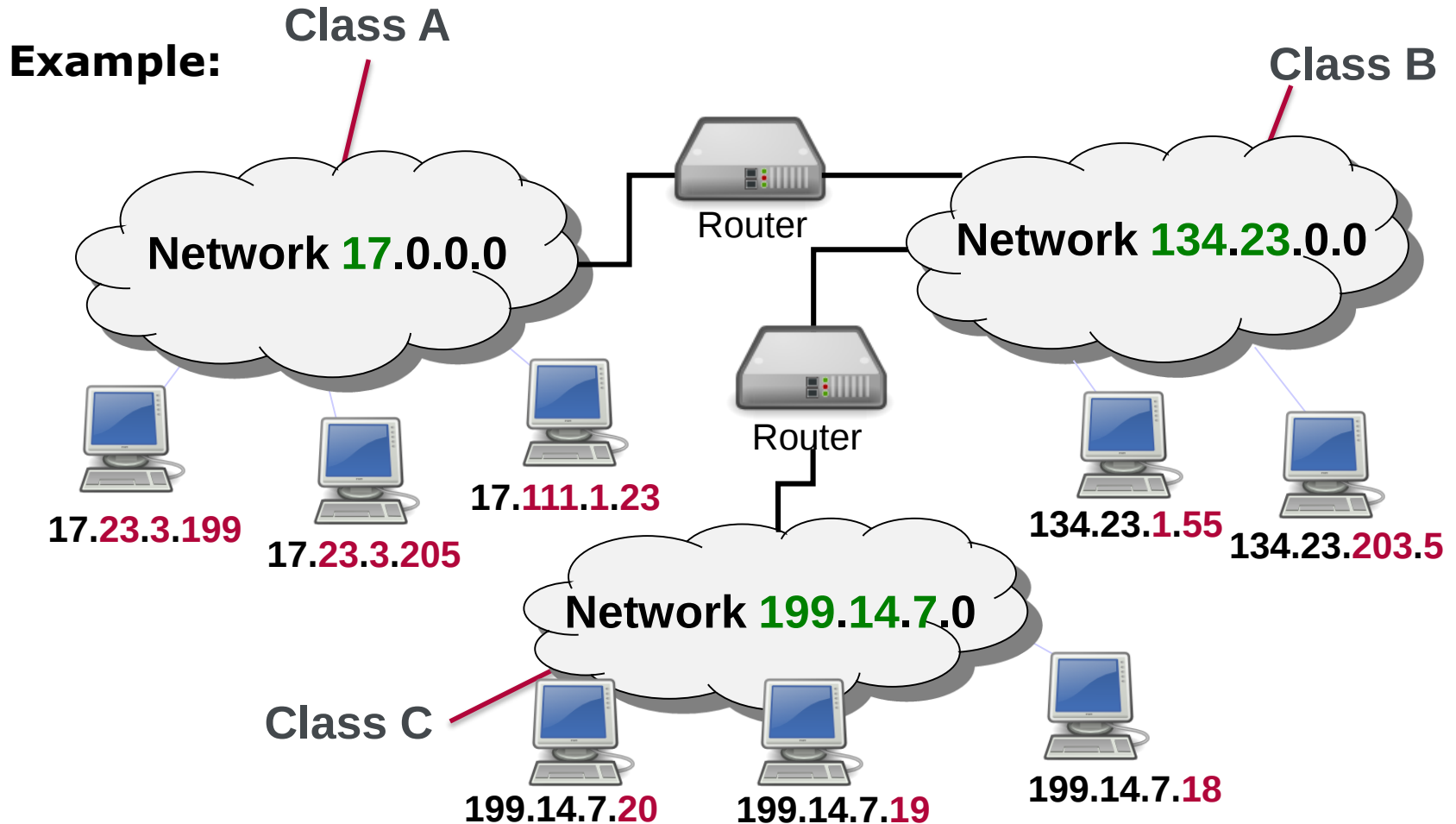
- Network ID = 127
- Host ID = 1 (convention)

Private addresses (RFC1597)

- 10.x.x.x, 172.16.0.0 – 172.31.254.254,
192.168.0.0 – 192.168.254.254

Addressing with IPv4 (5/7)

5

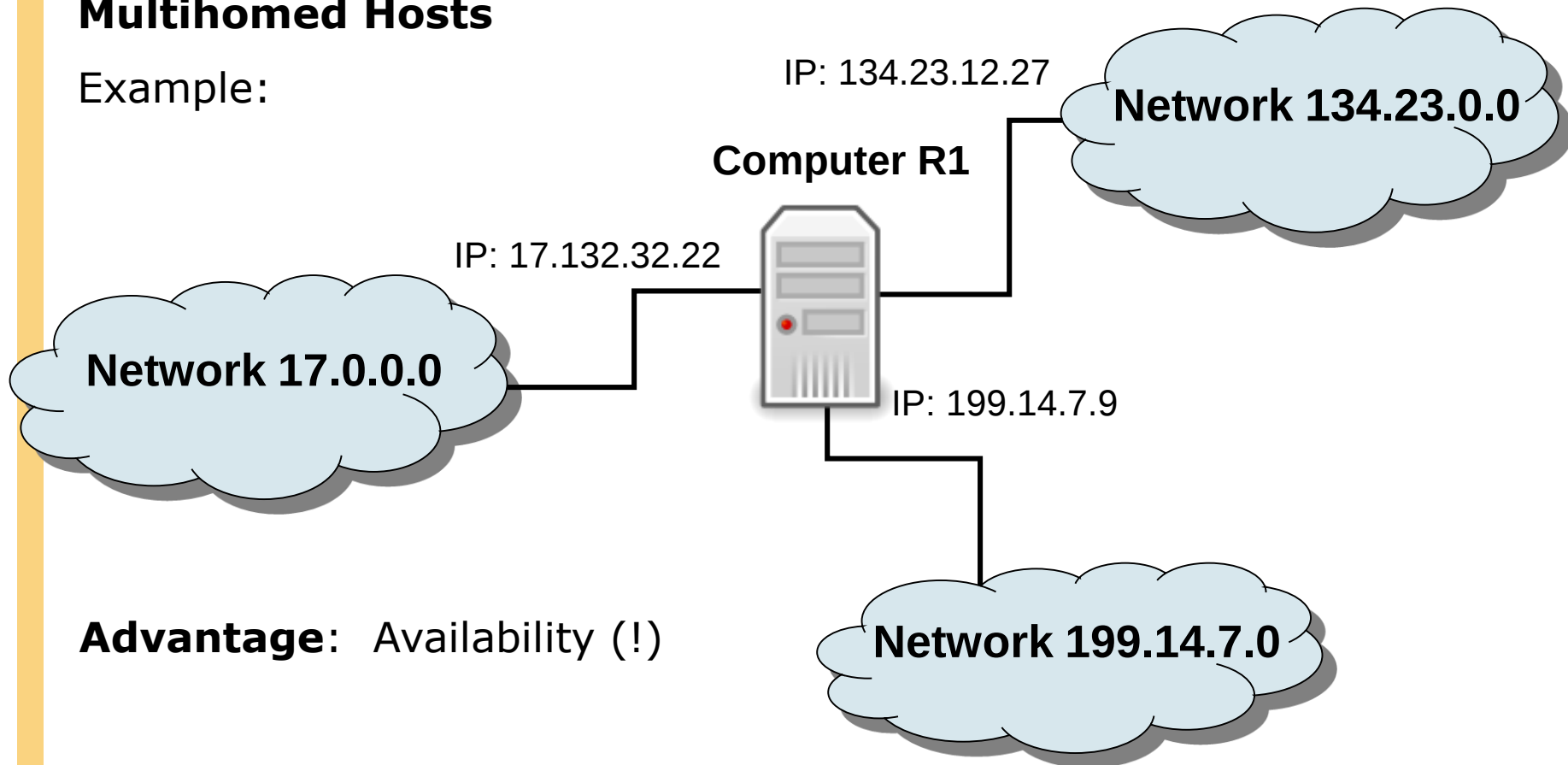


Addressing with IPv4 (6/7)

6

Multihomed Hosts

Example:



Advantage: Availability (!)

Addressing with IPv4 (7/7)

7

Address Space – Theory and Practice ...

Problem:

What to do when network grows beyond the number of computers allowed?

- Additional network of the same address class? or
- Request a network of the next higher address class?
 - ➔ Class C network (254 hosts) usually too small,
Class B network (65.534 hosts) usually too big!

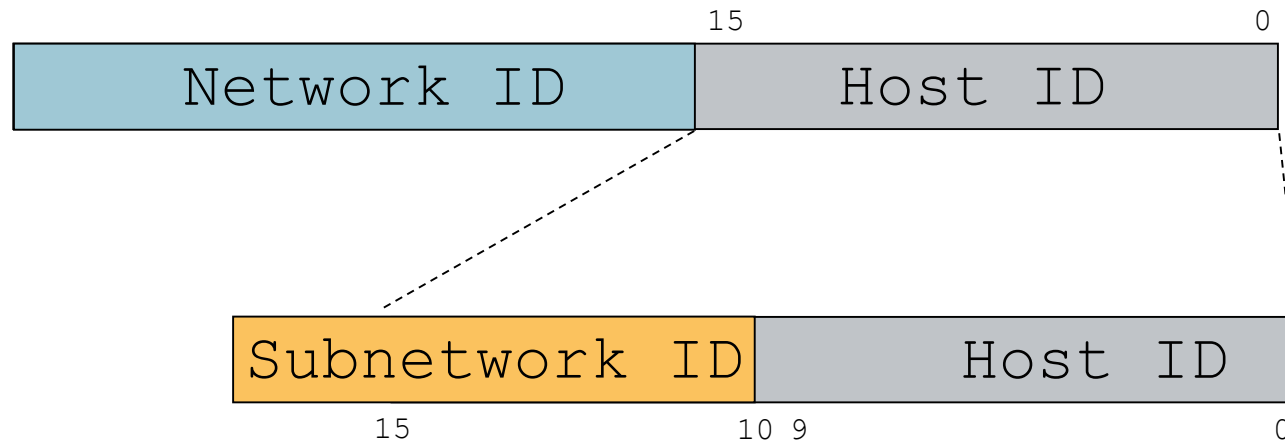
Solutions:

- **Subnetwork addressing**
- **Classless addressing** (supernetting)
and Classless Inter-Domain Routing (CIDR)
- **Network Address Translation (NAT)**

Subnetting and Classless Addressing (1/4)

8

Subnetting: Logically a network is divided into separate, physically independent subnetworks (originally: subdividing “classful” addressed networks into several smaller networks)



Subnetwork ID with 6 bits → 62 subnetworks

Host ID with 10 bits → 1022 hosts



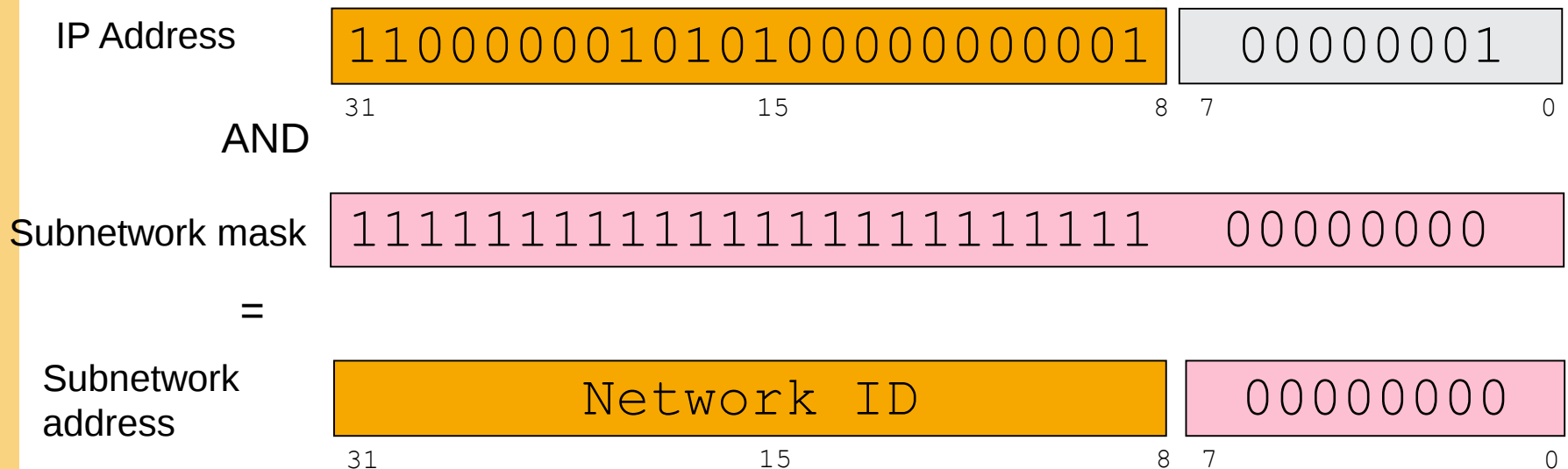
How to differentiate between subnetwork ID ↔ host ID?

Subnetting and Classless Addressing (2/4)

9

Today: Elimination of address classes and the distinction between network and host ID by means of **subnetwork masks** of variable lengths (VLSM, Variable Length Subnet Mask)

192.168.1.1/24



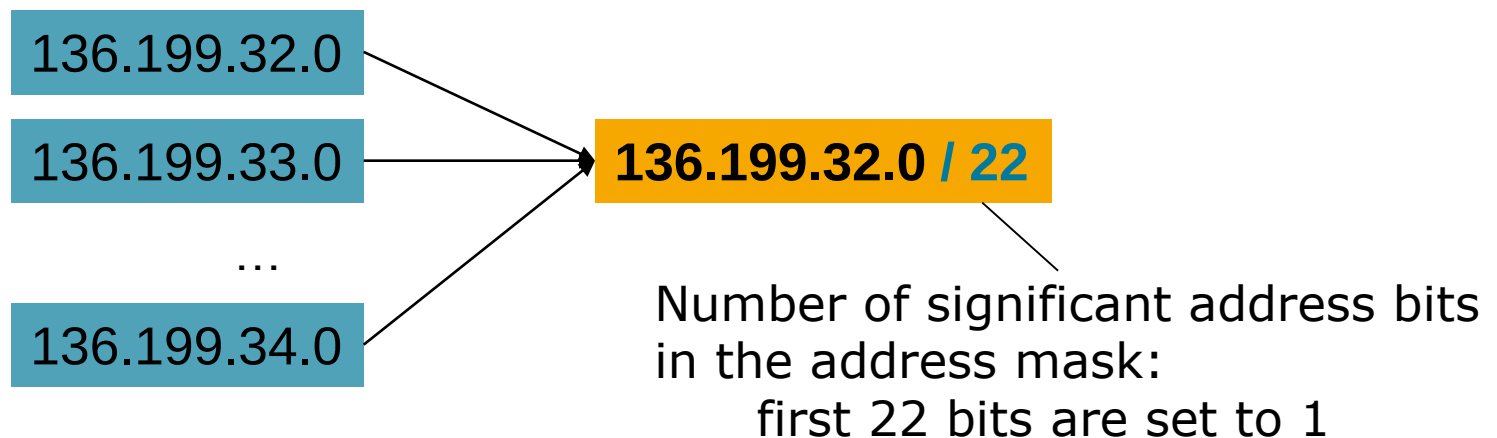
Router identifies a subnet via an associated **subnetwork mask**:

- **IP address AND subnetwork mask = (sub)network ID**
- **IP address AND subnetwork mask⁻¹ = host ID**
(subnetwork mask⁻¹ := bitwise inversion of the subnetwork mask)

Notation for network masks

- **Dotted-decimal notation:**
192.168.1.0/255.255.255.0
- **CIDR notation:**
192.168.1.0/24
→ /24 indicates the number of 1-bits in the subnetwork mask
(from most significant bit)

- **Supernetting** is a complementary approach to subnetting
- Individual networks are combined to a “super network” to reduce routing table entries
- Use of contiguous address blocks (CIDR blocks)
- Classless Interdomain Routing (RFC 1519):
Entry (139.199.32.0,3) specifies the three network classes



NAT – Network Address Translation

- Use of “**private**” **IP address space**
- Private IP addresses may only be used **internally**
- NAT router translates internal/external addresses
- Uses **TCP source/destination port** for unique identification

