CS-435
spring semester 2025

Network Technology & Programming Laboratory

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Computer Science Department

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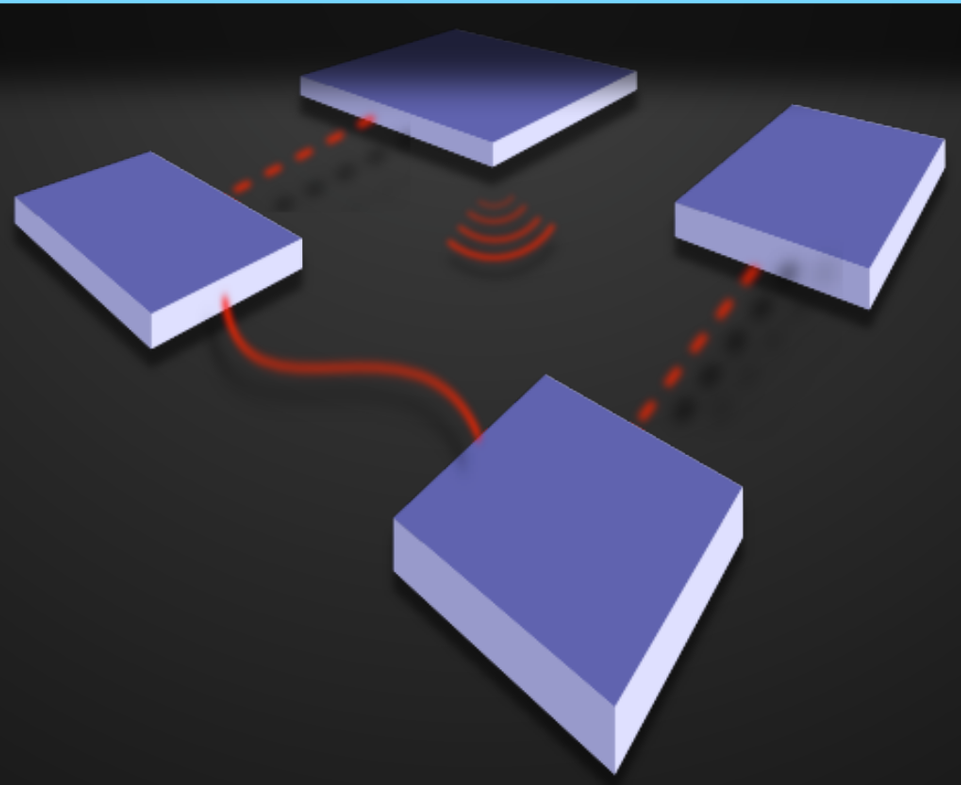
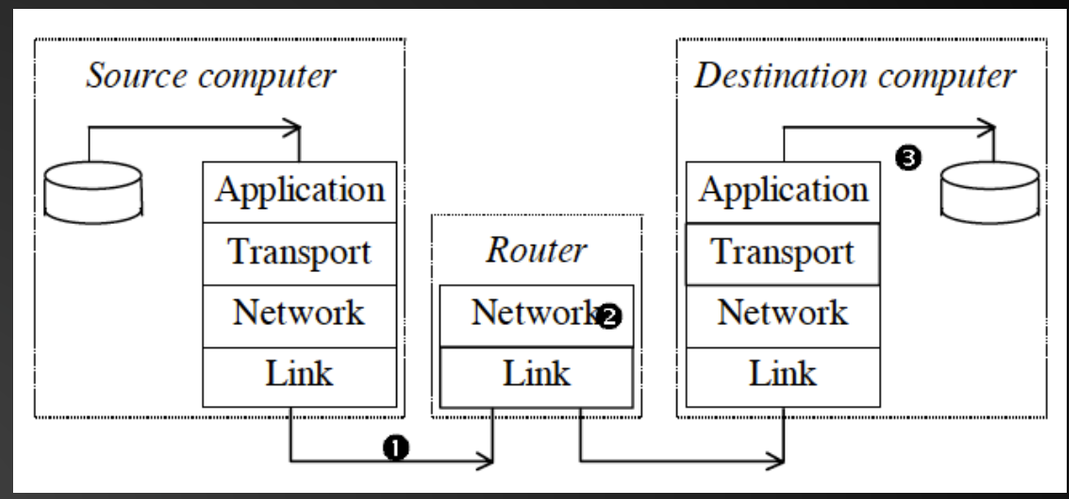


CS-435

Lecture #3 preview:

- The “e2e argument” argument.
  - Pros & Cons
- IP v4
  - Header
  - Addressing

The end to end argument



- Sets of design principles
- Helps in proper placement of functions
  - Placing functions at higher levels in a layered design
  - Suggest to be closer to the application

The end to end argument

- Which functions belong at which Layer?
- reliability
- routing
- encryption
- compression

The end to end argument

The Careful File-Transfer

- Possible threats to FT (independent of network communications)
  - Storage disk error / hardware fault
  - Buffer errors in FTP client
  - Soft error
  - Bit change (in packet transmission)
- FTP Client should have built-in reliability

The end to end argument

Pros:

- Provided guidance in system design
- Suggests proper placement of functions
- Some (which?) of the arguments are convincing

Cons:

- Different application requirements
- Exponential growth of the Internet
- Does not take into account technological advances

End to end & some lost causes

- Security
- Routing
- Congestion Control

Security

- What does the military example mean in the paper by Moors*?

**A critical review of "End-to-end arguments in system design"*

Routing

- Source vs. Per-hop (transparent) routing

Congestion Control

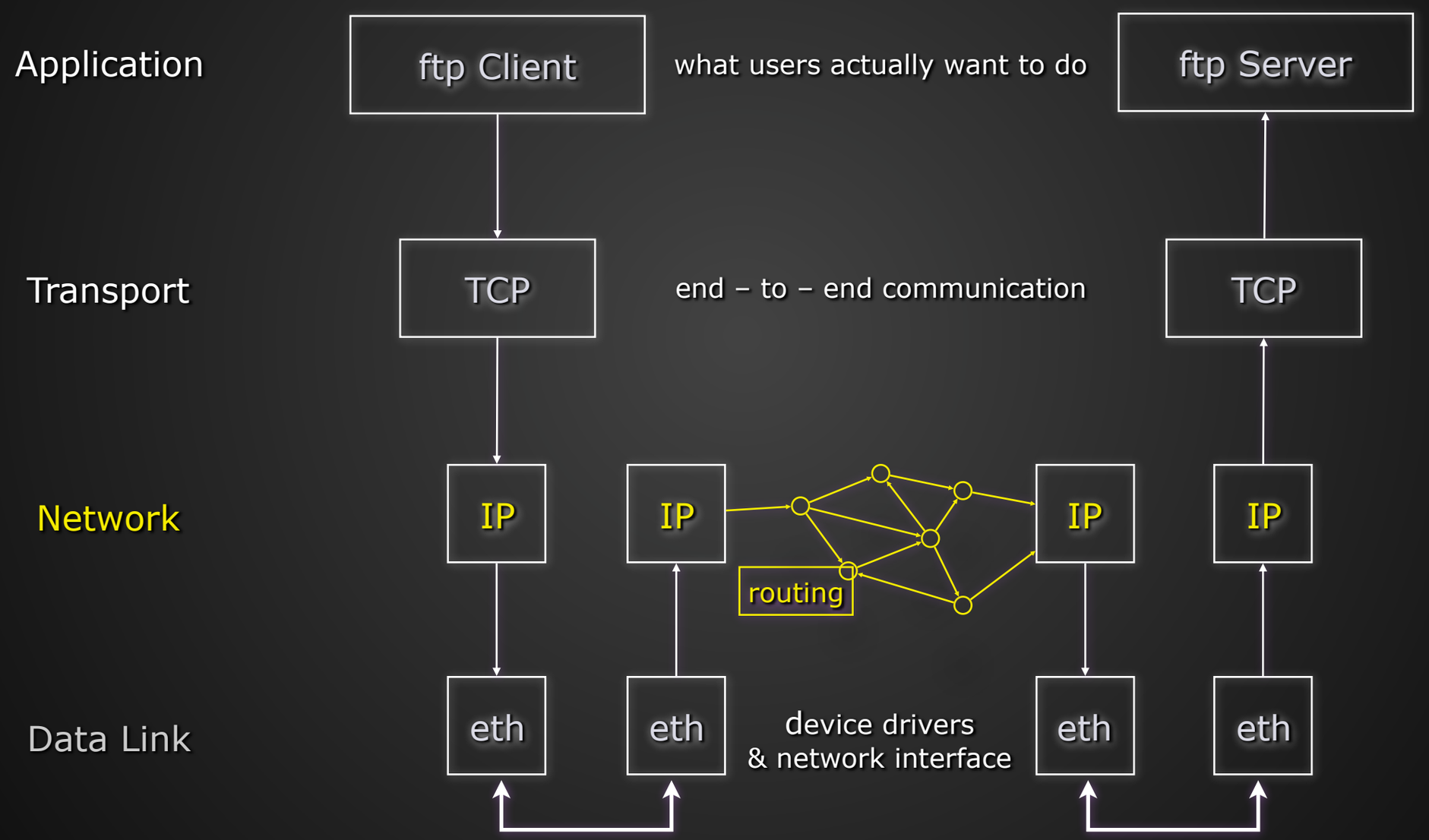
- the network should be **responsible** for controlling congestion (as in the routing argument)

- Can **it** (’s owner) **trust** that endpoints will cooperate well in controlling congestion?

- inappropriate for certain networks
  - (The famous TCP vs. Wi-Fi case)

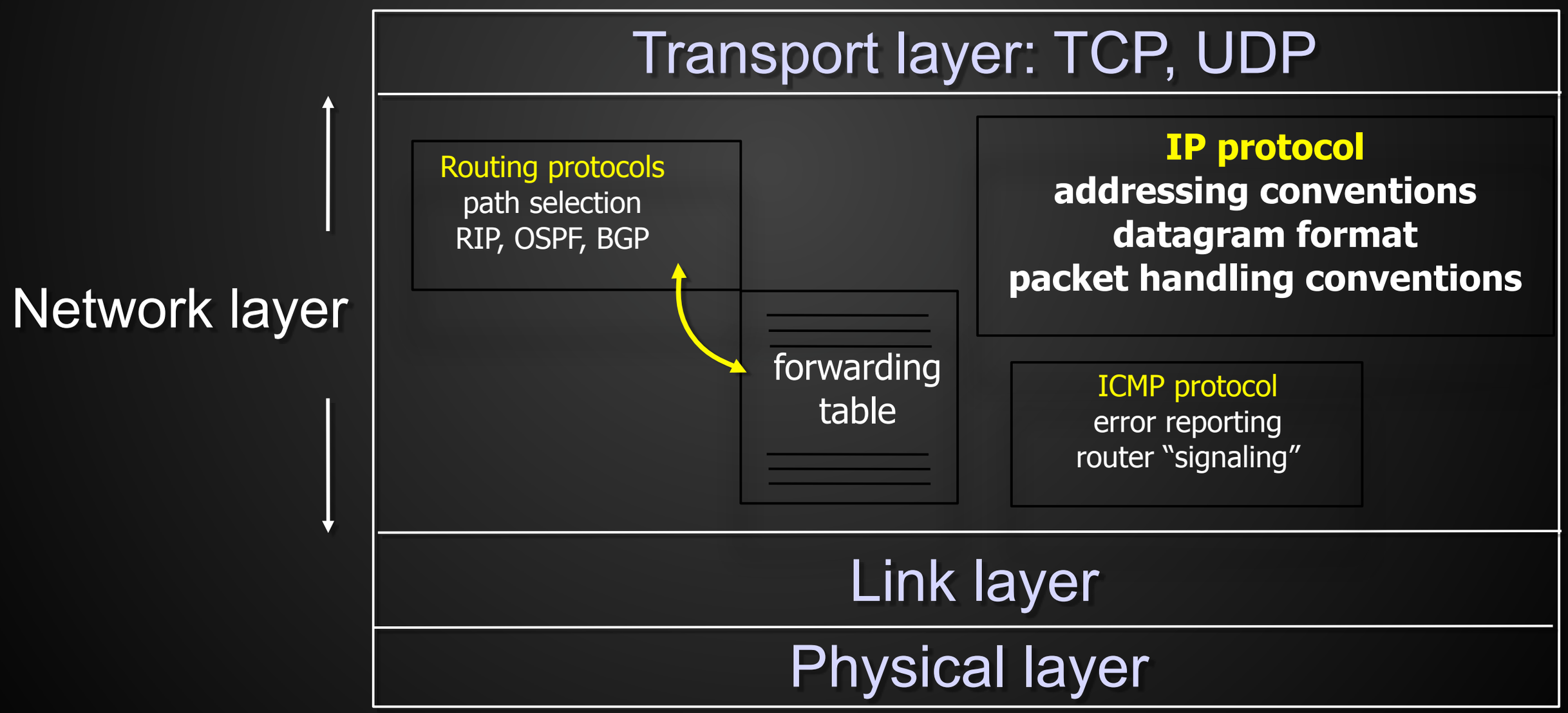
The Network Layer

The Network Layer

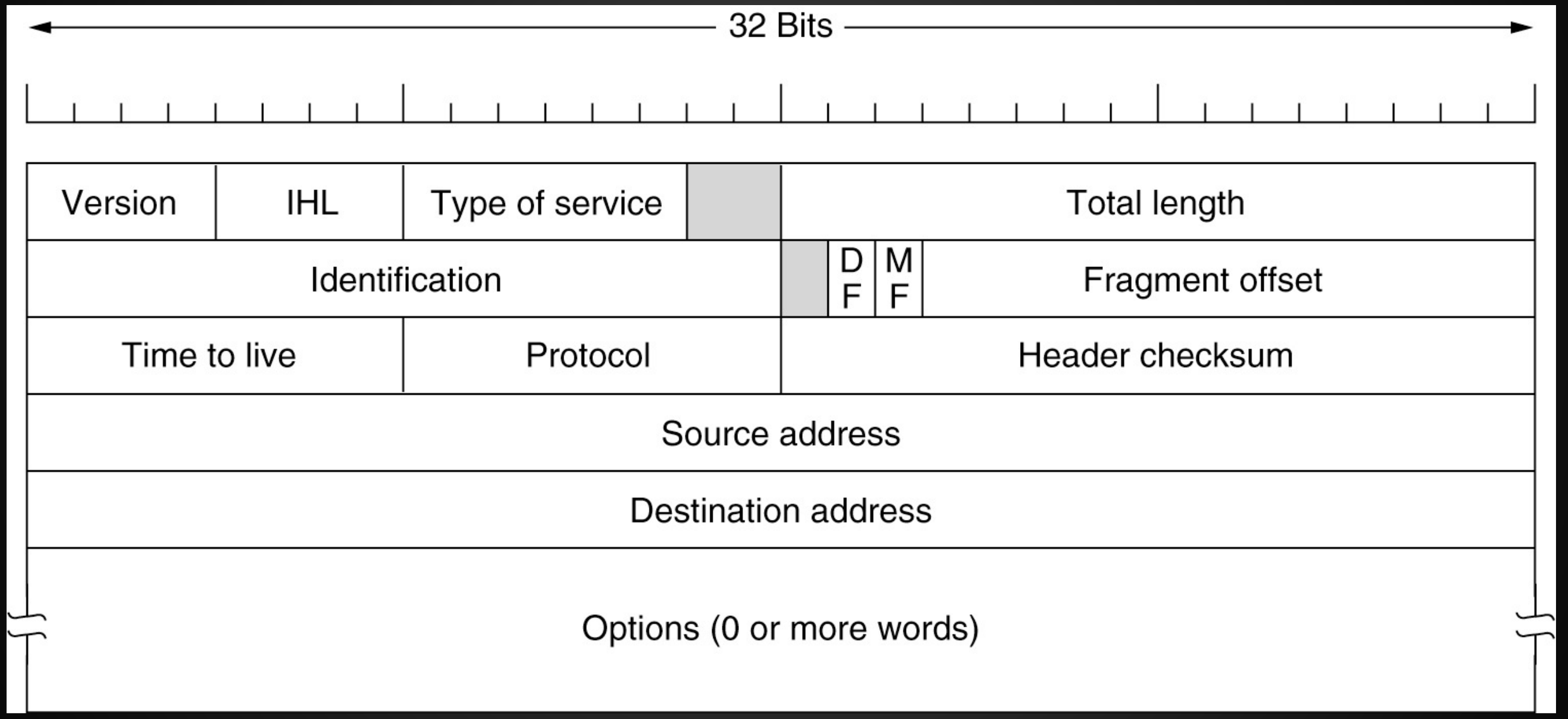


The network layer inside the TCP/IP

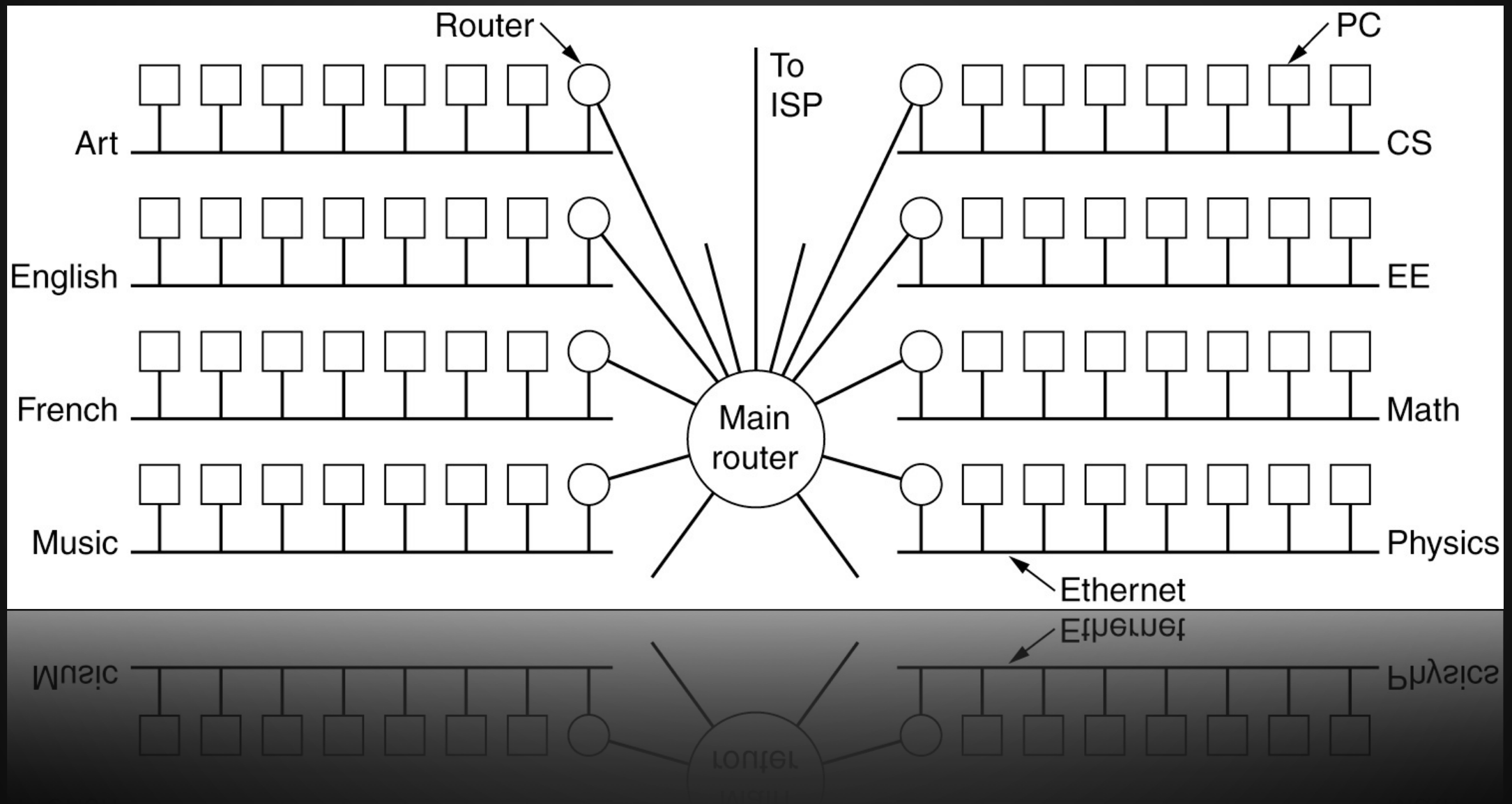
- Host & router network layer functions:



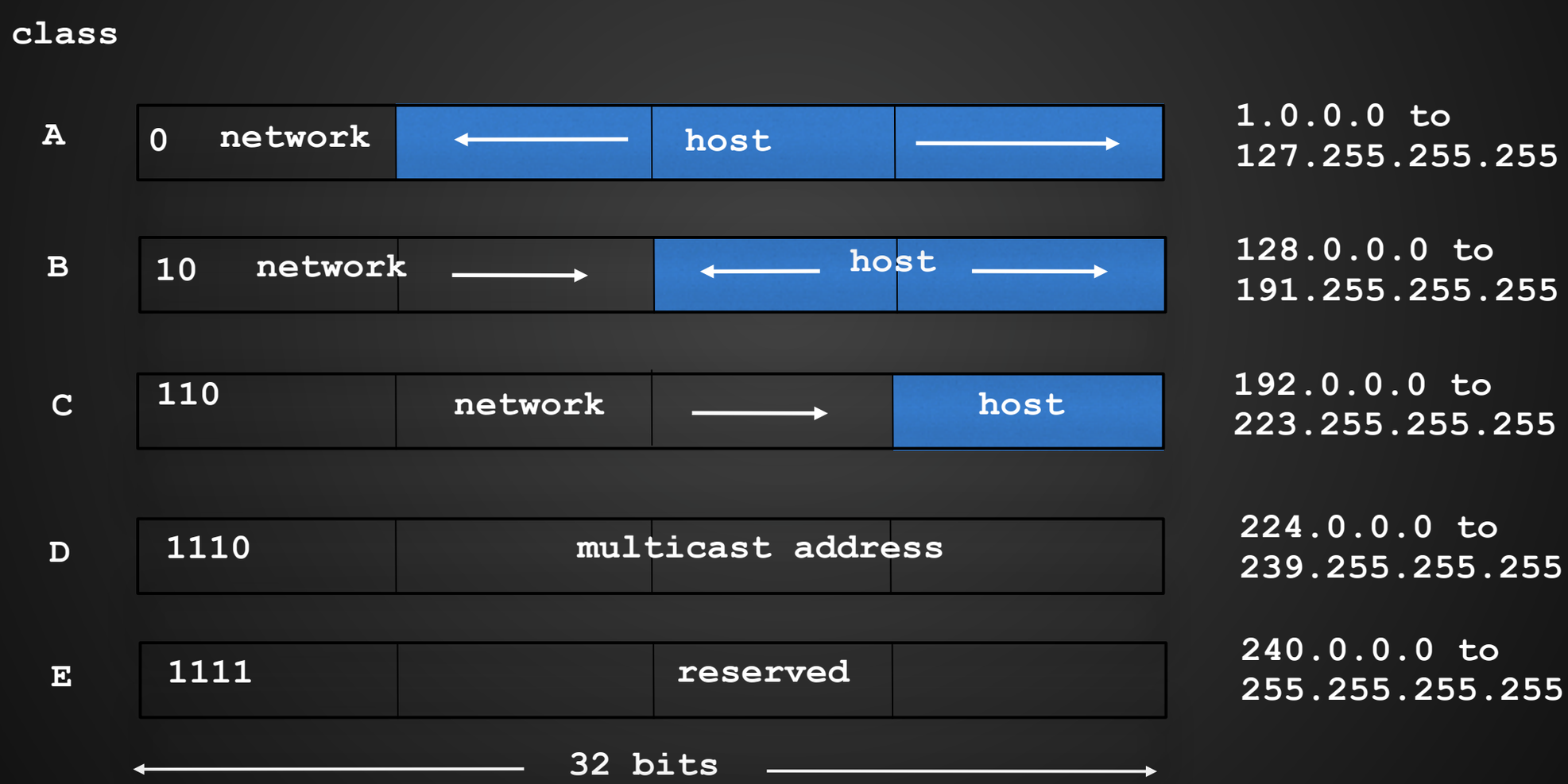
The IP v4 header



IP v4 subnets



IP v4 address



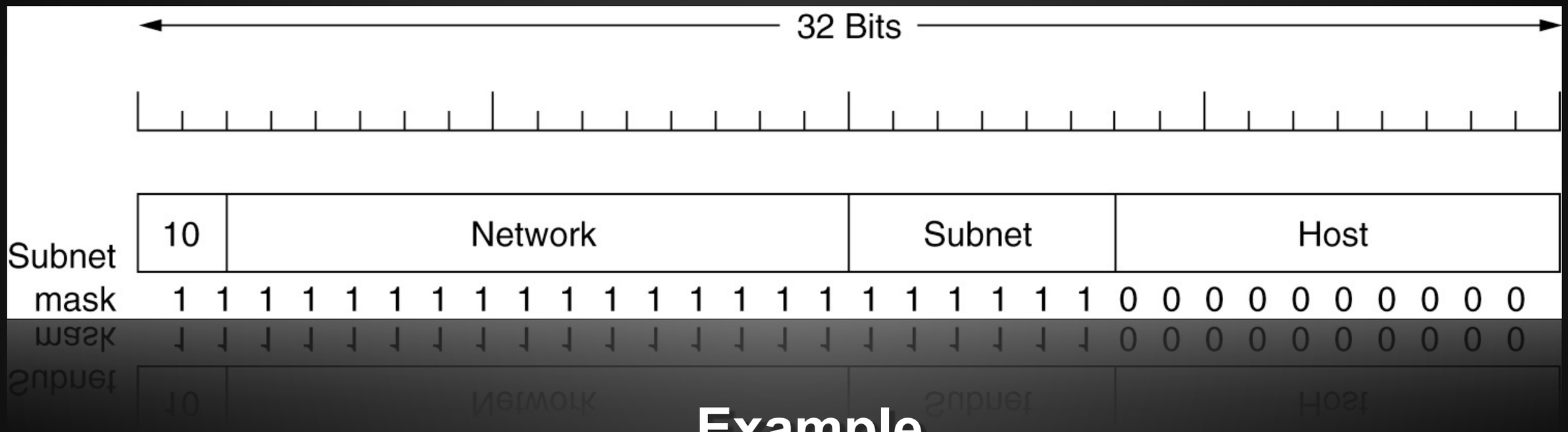
IP v4 CIDR

Classless Inter-Domain Routing

- the most significant bits represent the network address which identifies a whole network or subnet
- the least significant bits represent the host identifier

- variable-length subnet masking (VLSM)
- 147.52.0.0/16
- network id: smallest address (ex. 147.52.0.0)
- broadcast address: largest address (ex.147.52.255.255)
- supernetting: 147.52.0.0/24 ... 147.52.255.0/24

IP v4 address



Example

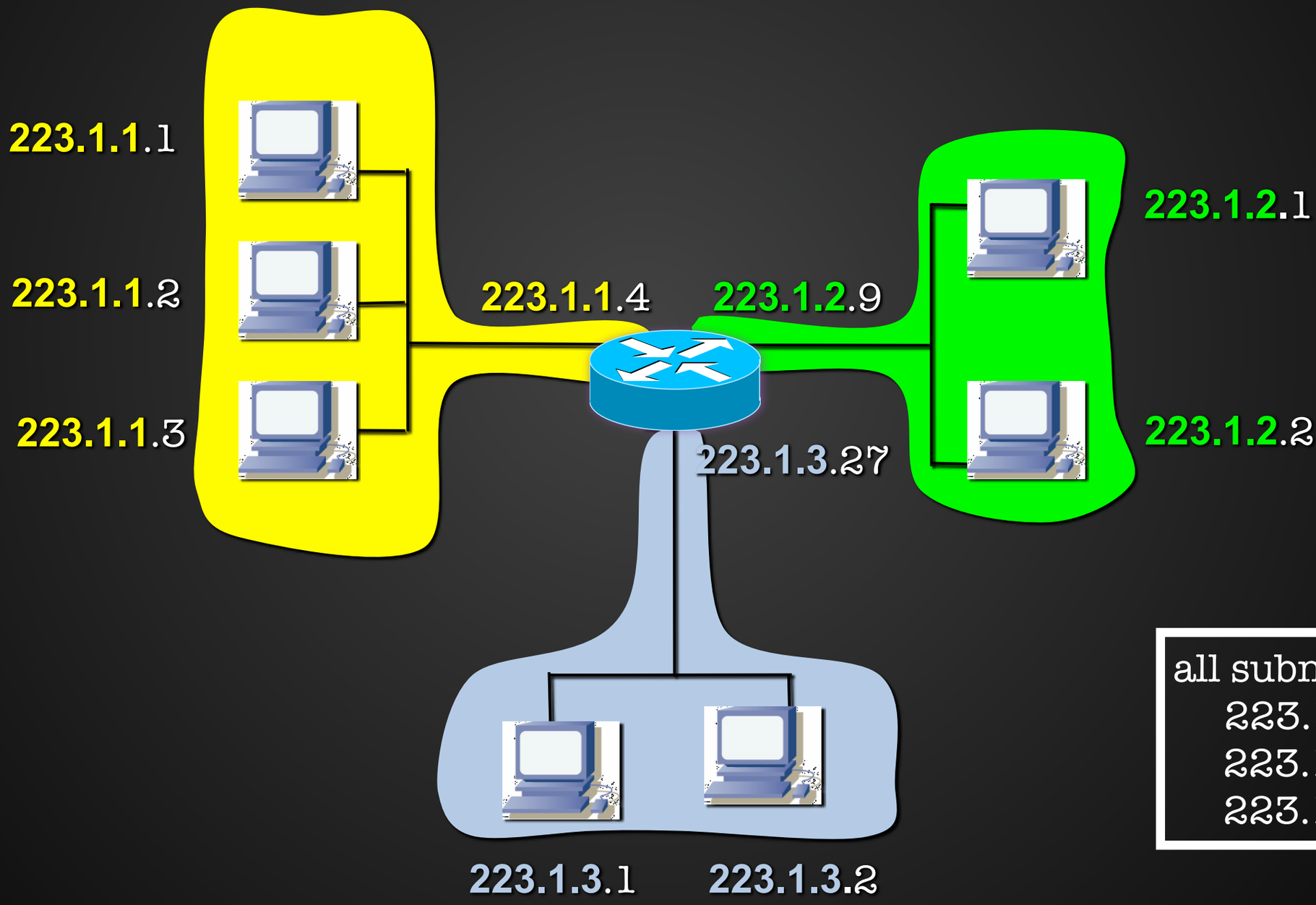
UoC: 147.52.0.0/16

octets	binary	
147.52.0.0	10010011.00110100.00000000.00000000	network id - address
255.255.0.0	11111111.11111111.00000000.00000000	subnet mask
147.52.255.255	10010011.00110100.11111111.11111111	broadcast address

IP v4 reserved address blocks

CIDR address block	Description
0.0.0.0/8	Current network (only valid as source address)
10.0.0.0/8	Private network
14.0.0.0/8	Public data networks (eof 2008-02-10)
127.0.0.0/8	Loopback
128.0.0.0/16	Reserved (IANA)
169.254.0.0/16	Link-Local
172.16.0.0/12	Private network
191.255.0.0/16	Reserved (IANA)
192.0.0.0/24	Reserved (IANA)
192.0.2.0/24	TEST-NET-1, Documentation and example code
192.88.99.0/24	IPv6 to IPv4 relay
192.168.0.0/16	Private network
198.18.0.0/15	Network benchmark tests
198.51.100.0/24	TEST-NET-2, Documentation and examples
203.0.113.0/24	TEST-NET-3, Documentation and examples
223.255.255.0/24	Reserved (IANA)
224.0.0.0/4	Multicasts (former Class D network)
240.0.0.0/4	Reserved (former Class E network)
255.255.255.255	Broadcast

IP v4 address



all subnets /24
223.1.1.0
223.1.2.0
223.1.3.0