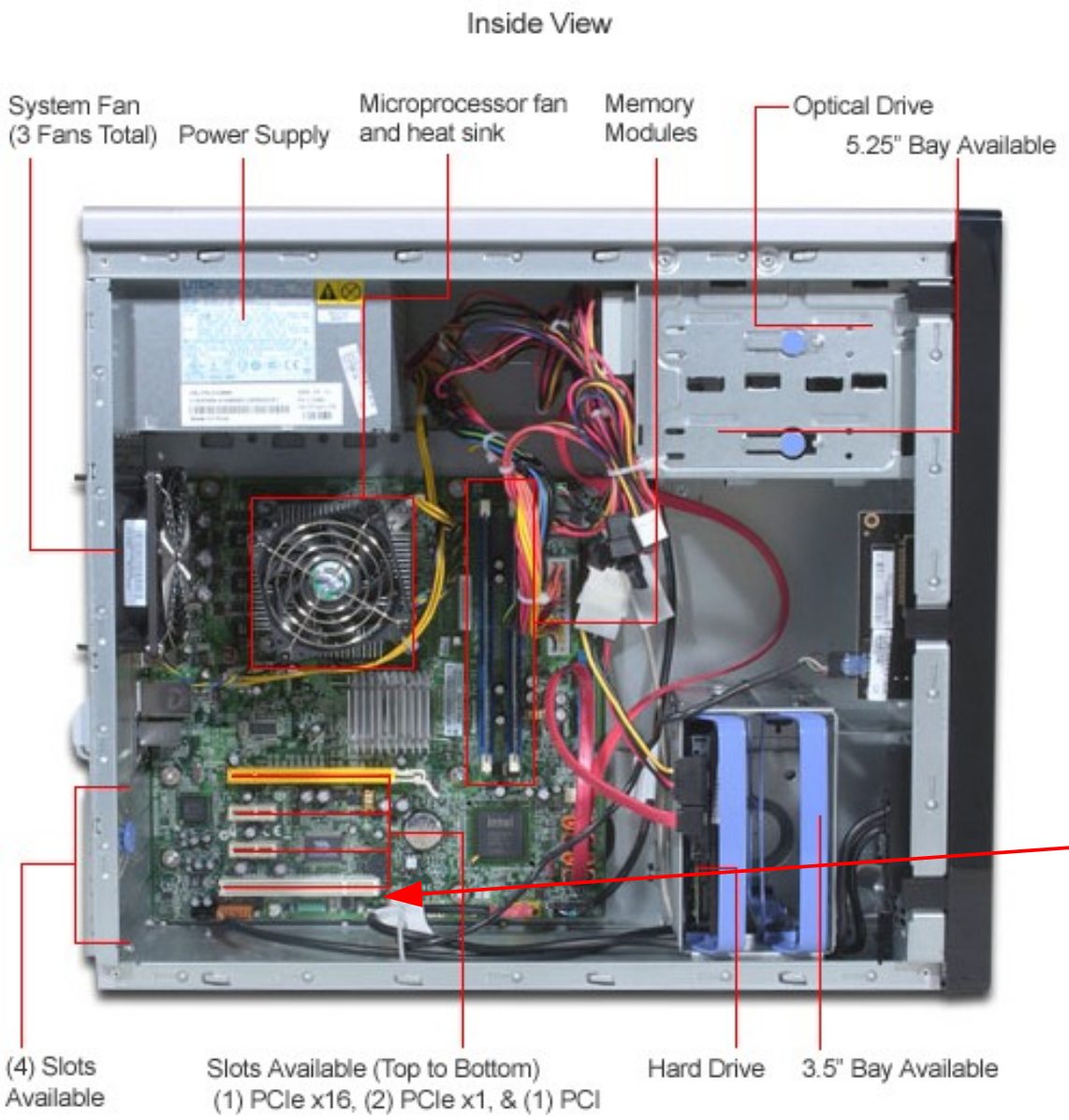
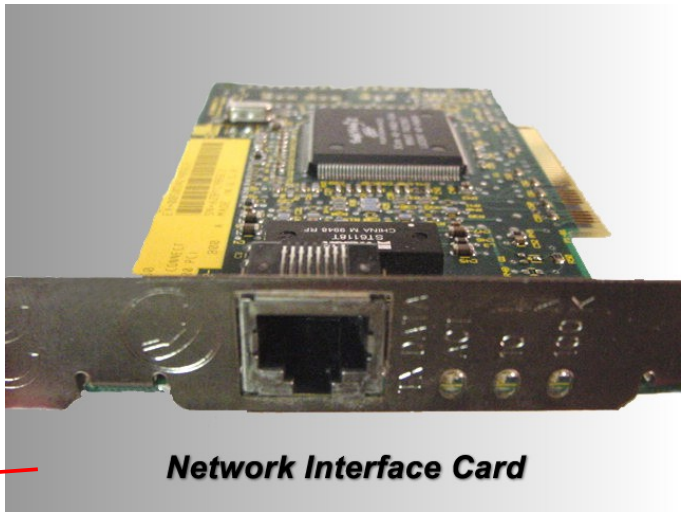
CS378: Computer Networks Lab

Topic 01: Overview

Slides borrowed from:
Kameswari Chebrolu
Department of CSE, IIT Bombay

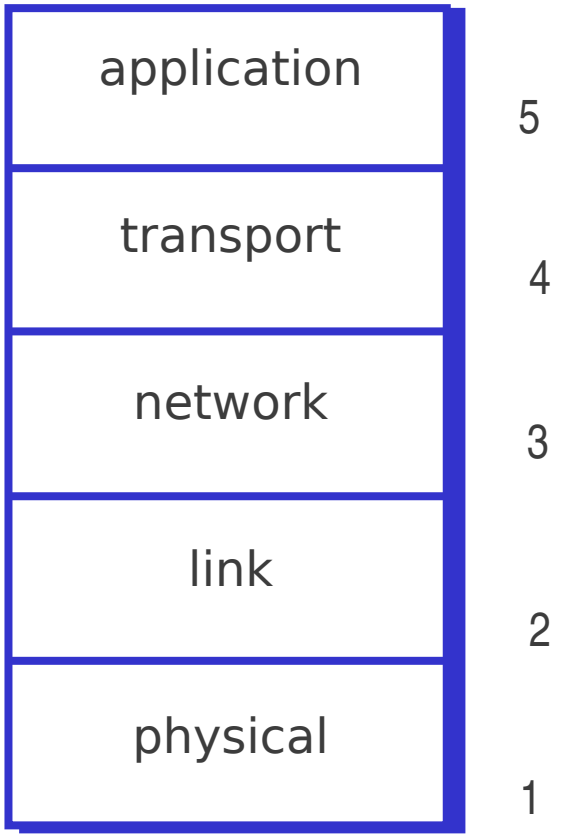
Inside Computer





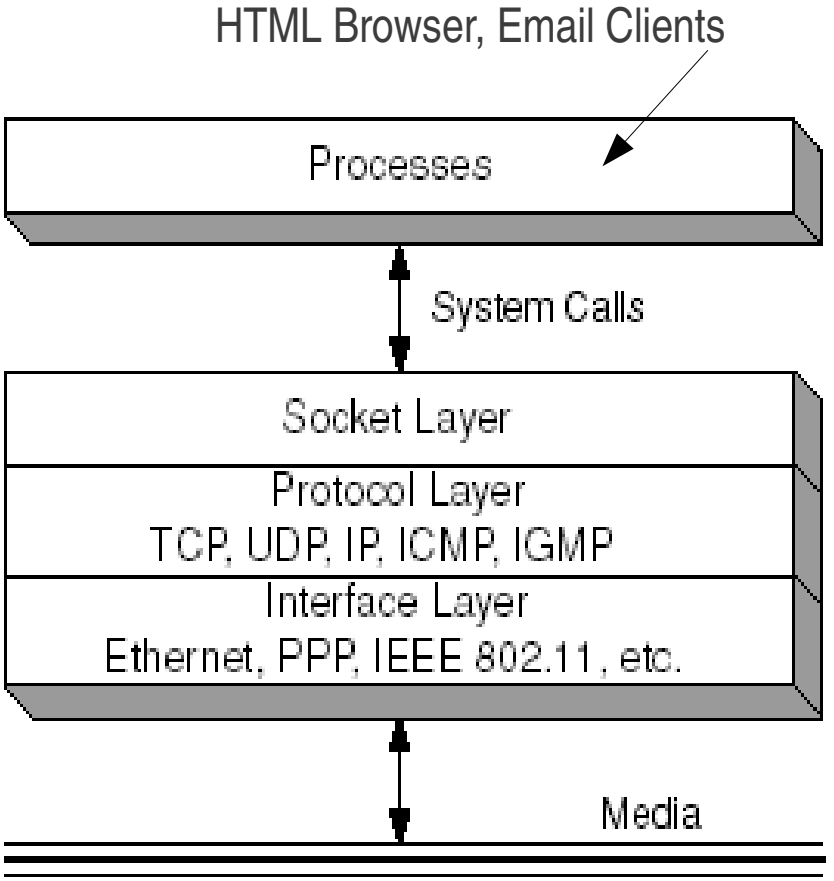
Internet protocol stack

- Application: supporting network applications
  - FTP, SMTP, HTTP
- Transport: process-process data transfer
  - TCP, UDP
- Network: routing of datagrams from source to destination
  - IP, routing protocols
- Link: data transfer between neighboring network elements
  - PPP, Ethernet
- Physical: bits “on the wire”



Networking Code Organization

- Most applications are implemented as *user space* processes.
- Protocols are implemented in the system kernel
  - Socket layer
  - Protocol layer
  - Interface layer

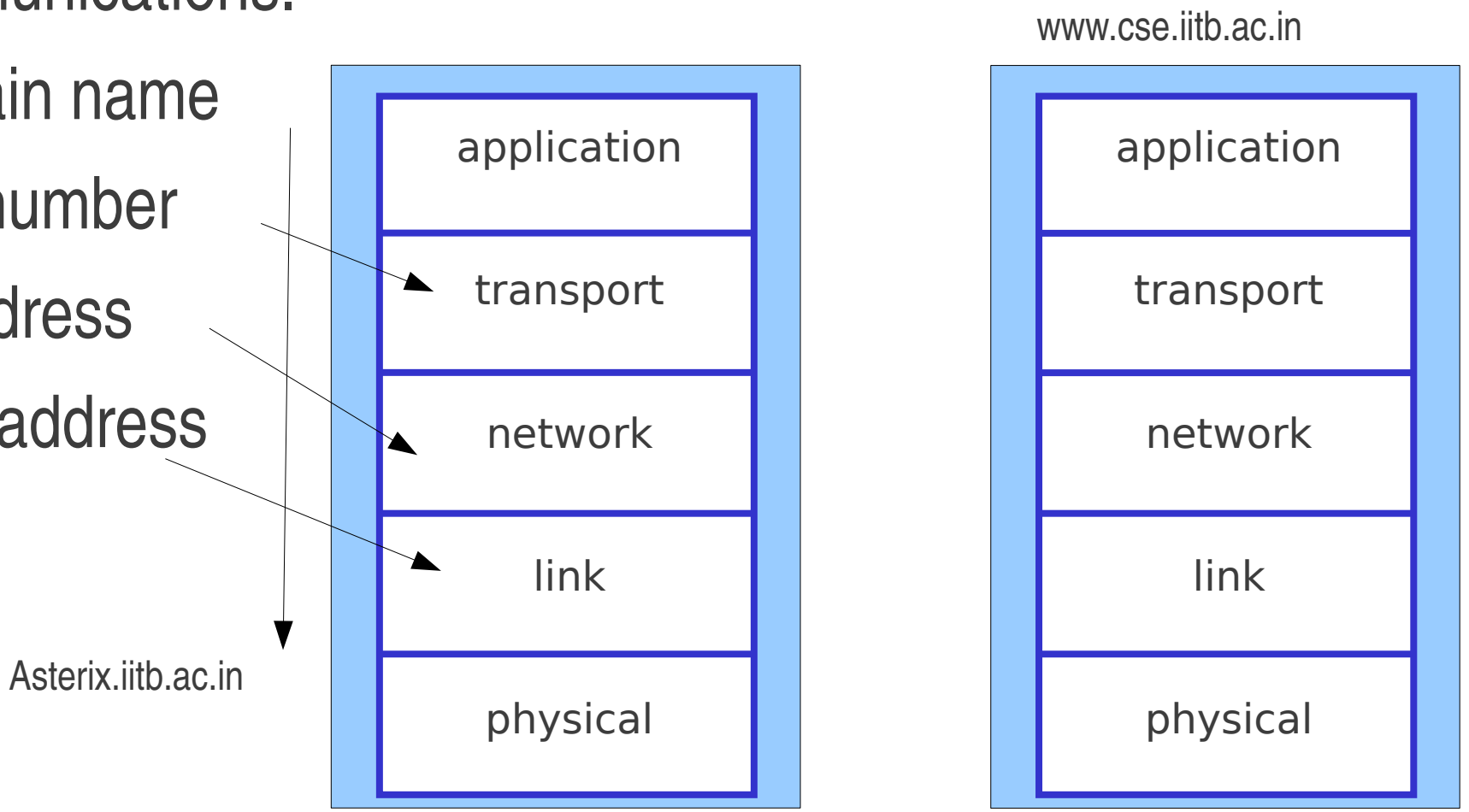


Network Configurations Files

- When a host is configured to boot locally, network configuration parameters are stored in files.
- When the system boots up, parameters are read from the files and used to configure the daemons and the network interface.
- A parameter may be changed by editing the corresponding configuration file.
- Examples:
  - /etc/hosts
  - /etc/services
  - /etc/network/interfaces

Naming and Addressing

- Uniquely identify processes in different computers for communications.
- Domain name
- Port number
- IP address
- MAC address



How to figure out the addresses of the corresponding host?

Domain Name

- A user friendly name to identify a host
- Domain Name System (DNS): resolves a domain name to the corresponding IP address.
- Example:
  - www.cse.iitb.ac.in → 59.162.23.130 (outside world)
  - www.cse.iitb.ac.in → 10.105.1.3 (inside IITB)
- A host first contacts its local DNS server to get the mapping
  - host needs to know the local DNS server address (specified in configuration file)

IP Address

- Each interface in a host is assigned an IP address.
- IPv4, 32 bits, dotted-decimal notation

128.238.42.112 means

10000000	in 1st Byte
11101110	in 2nd Byte
00101010	in 3rd Byte
01110000	in 4th Byte

- IPv6, 128-bit address

Media Access Control Address

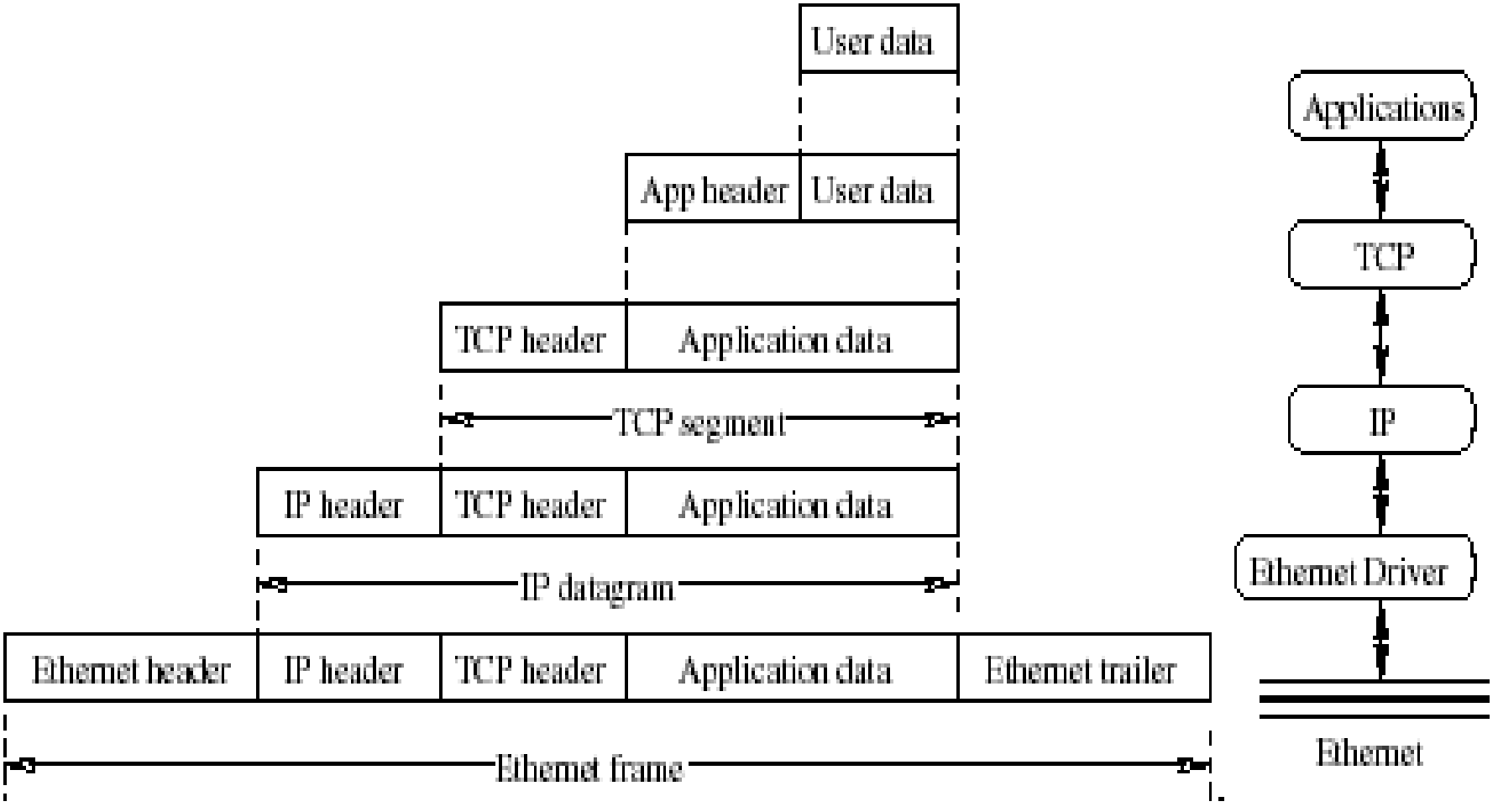
- Apart from IP address, each interface in a host also has a hardware address (MAC address)
- Ethernet MAC address is 48 bits long
  - E.g 00:18:F3:96:C2:A7
- ARP protocol is used to translate an IP address to MAC address

Port Numbers

- Address for the application layer user process.
- Port Number field specified in TCP or UDP header.
- Well-known port numbers
  - 1 to 255: Internet wide services
  - 256 to 1023: preserved for Unix specific services
  - 1024 and up: ephemeral port numbers
  - Port 80 is associated with http (web server)
  - Port 25 is associated with email

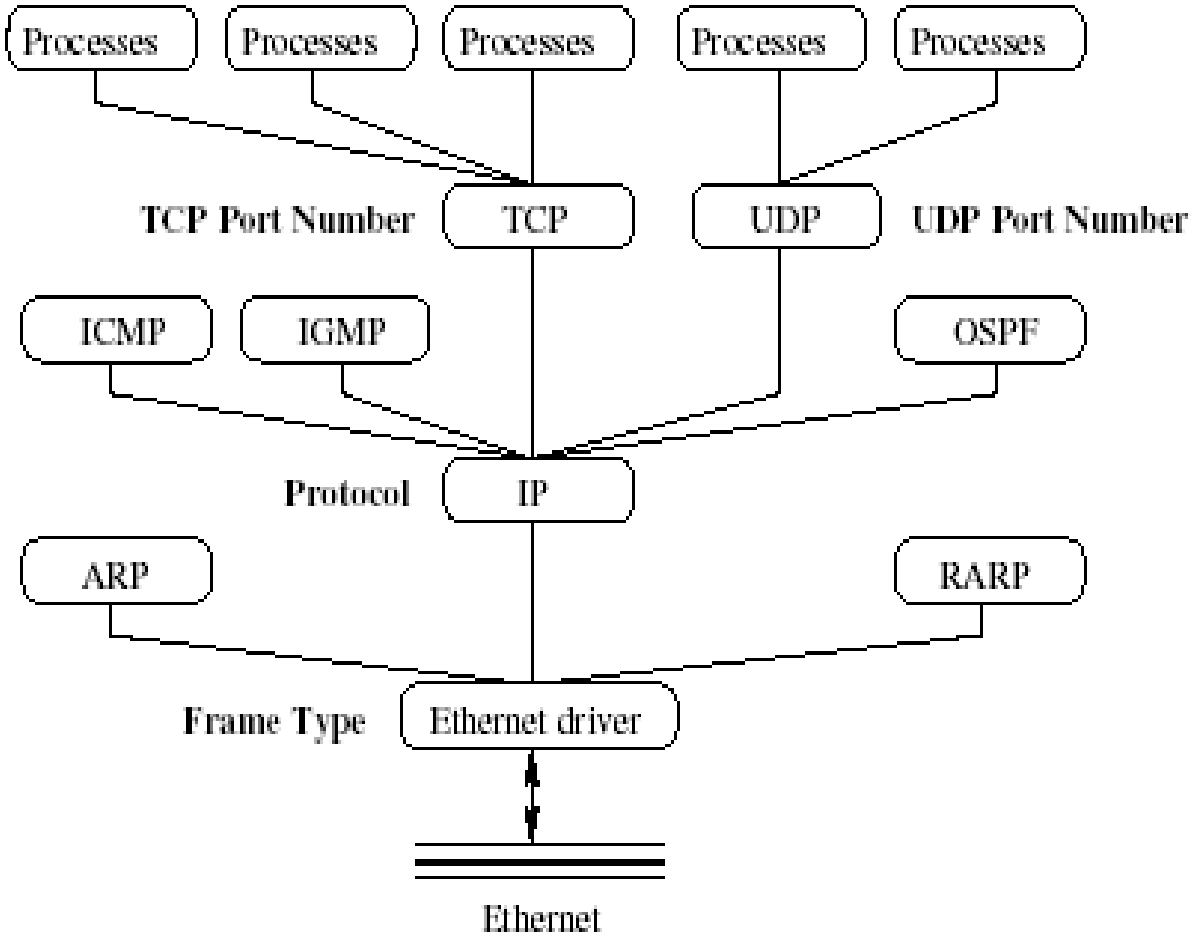
Encapsulation

- The application data is sent down
- Each layer adds a header to the data (PDU) from its higher layer.



Multiplexing and Demultiplexing

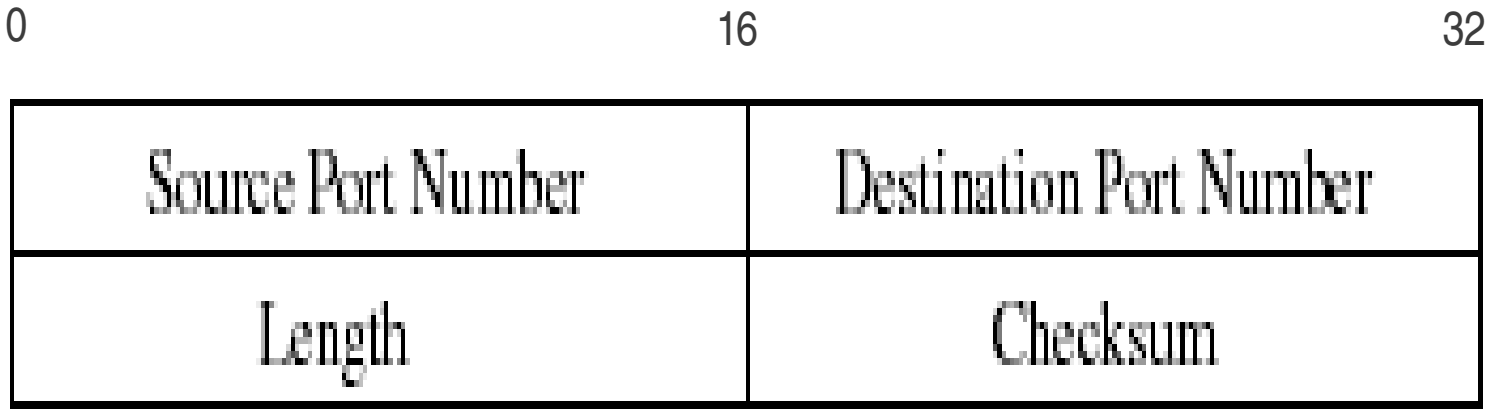
- Different higher layer protocols can use the service by the same lower layer protocol.



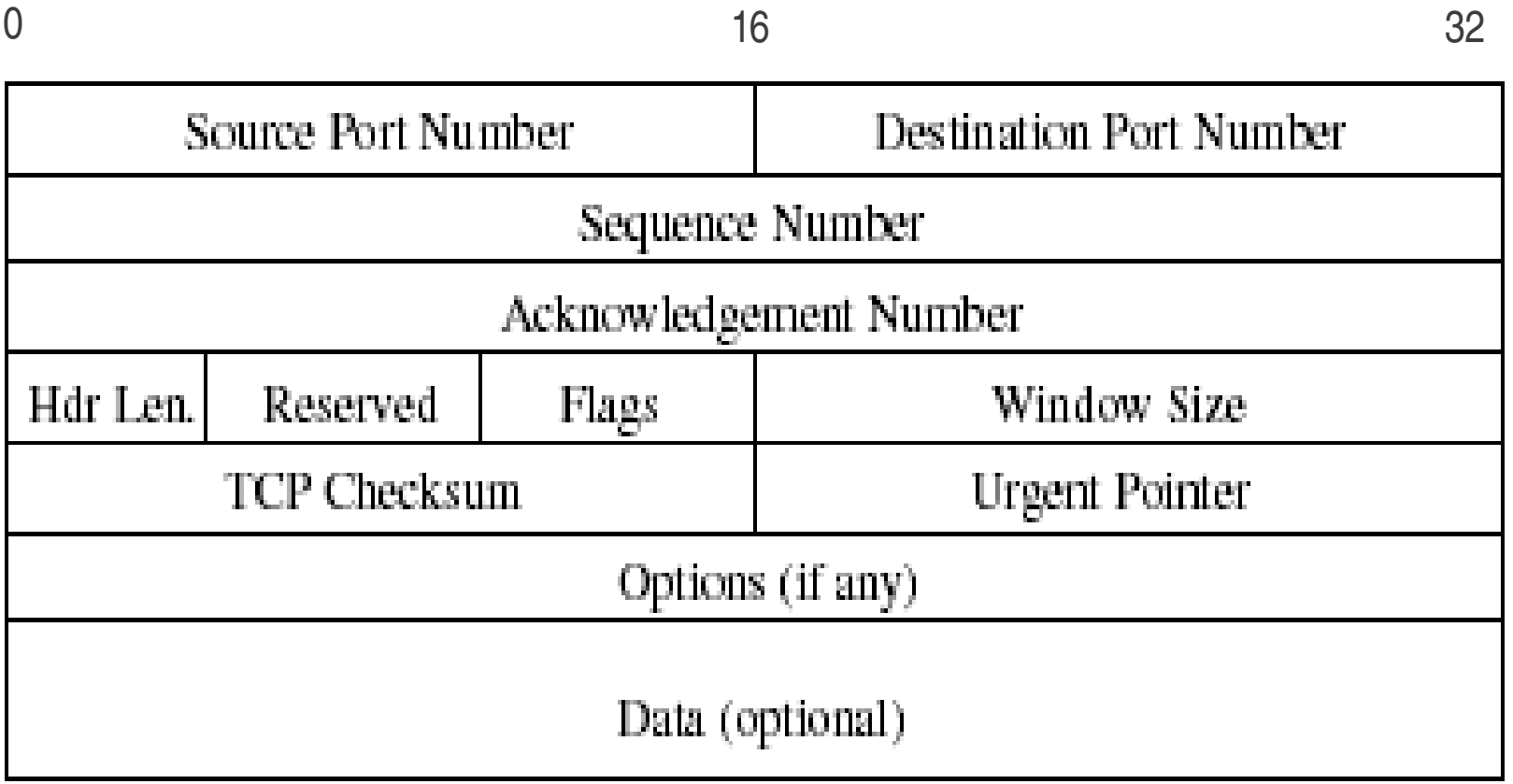
Application Header

- Example: Show Email Header

UDP Header Format

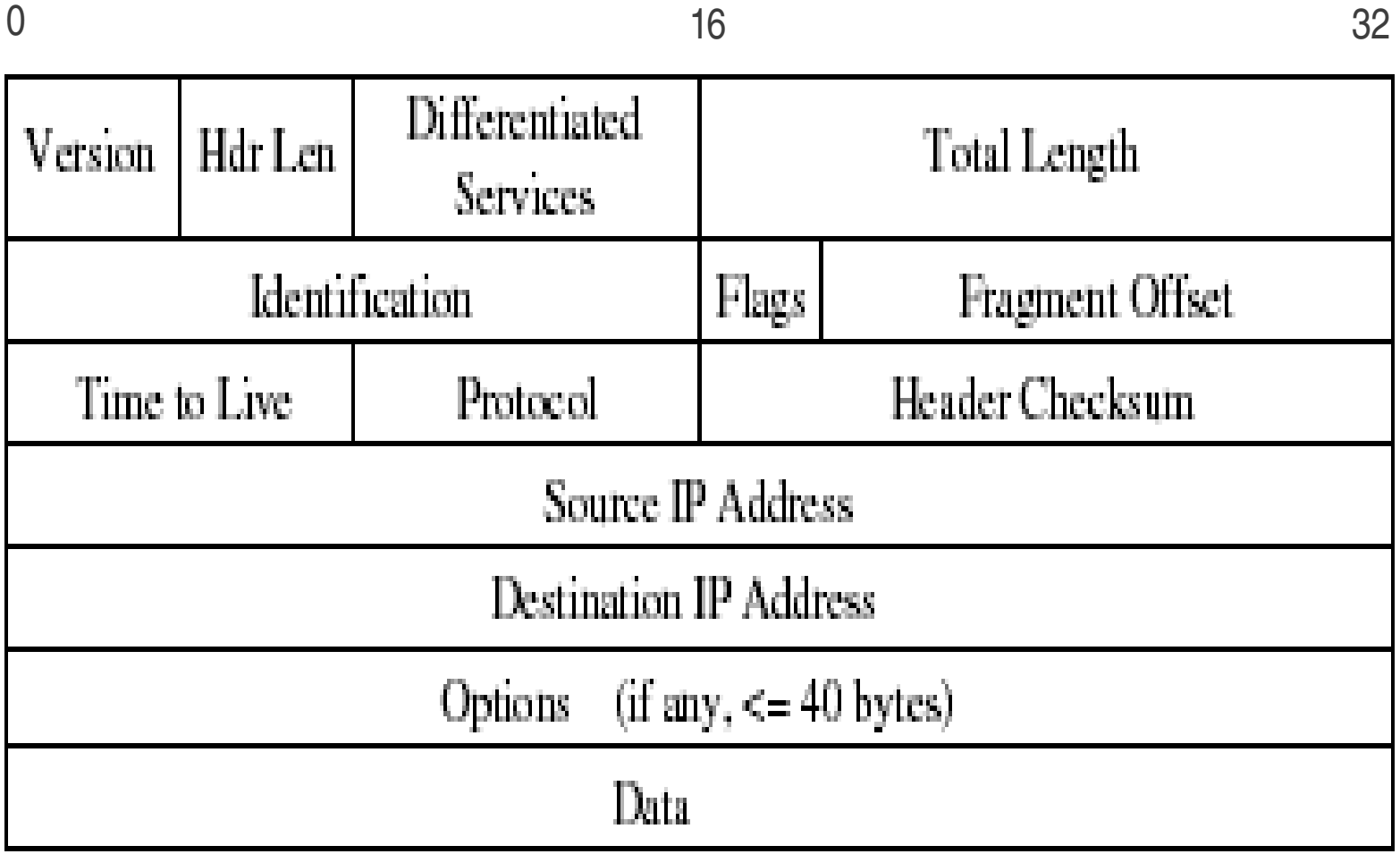


TCP Header Format



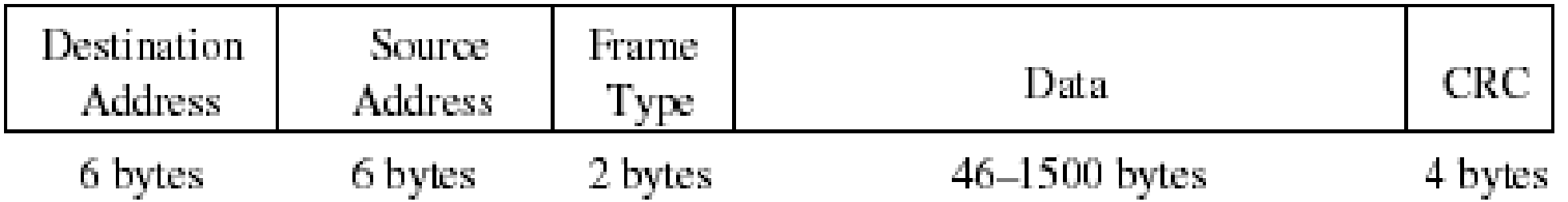
IP Header Format

- Size: 20 bytes without options.



Ethernet Frame Format

- Source Ethernet (MAC) Address
- Destination Ethernet Address
- Frame Type: used to identify the payload
- CRC: used for error control



Packet Sniffer

- Sniffs messages being sent/received from/by your computer
- Store and display the contents of the various protocol fields in the messages
- Passive program
  - never sends packets itself
  - no packets addressed to it
  - receives a copy of all packets (sent/received)

Packet Sniffer Structure

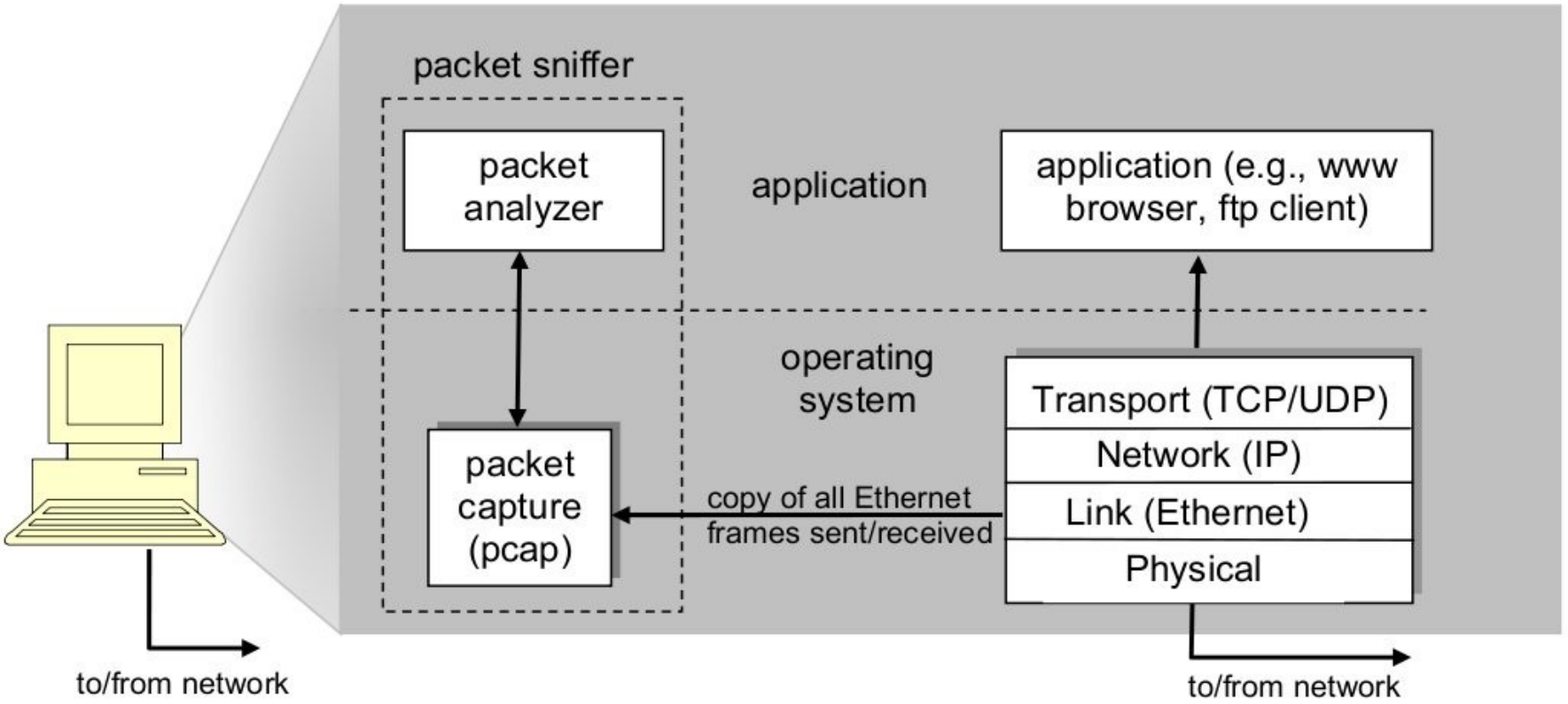


Figure 1: Packet sniffer structure

Diagnostic Tools

- Tcpdump
  - E.g tcpdump -enx host 10.129.41.2 -w exe3.out
- Wireshark
  - wireshark -r exe3.out

http://openmaniak.com/tcpdump.php

http://openmaniak.com/tcpdump.php

Screen Shot

command memo

listing of captured packets

details of selected packet header

packet **content** in hexadecimal and ASCII

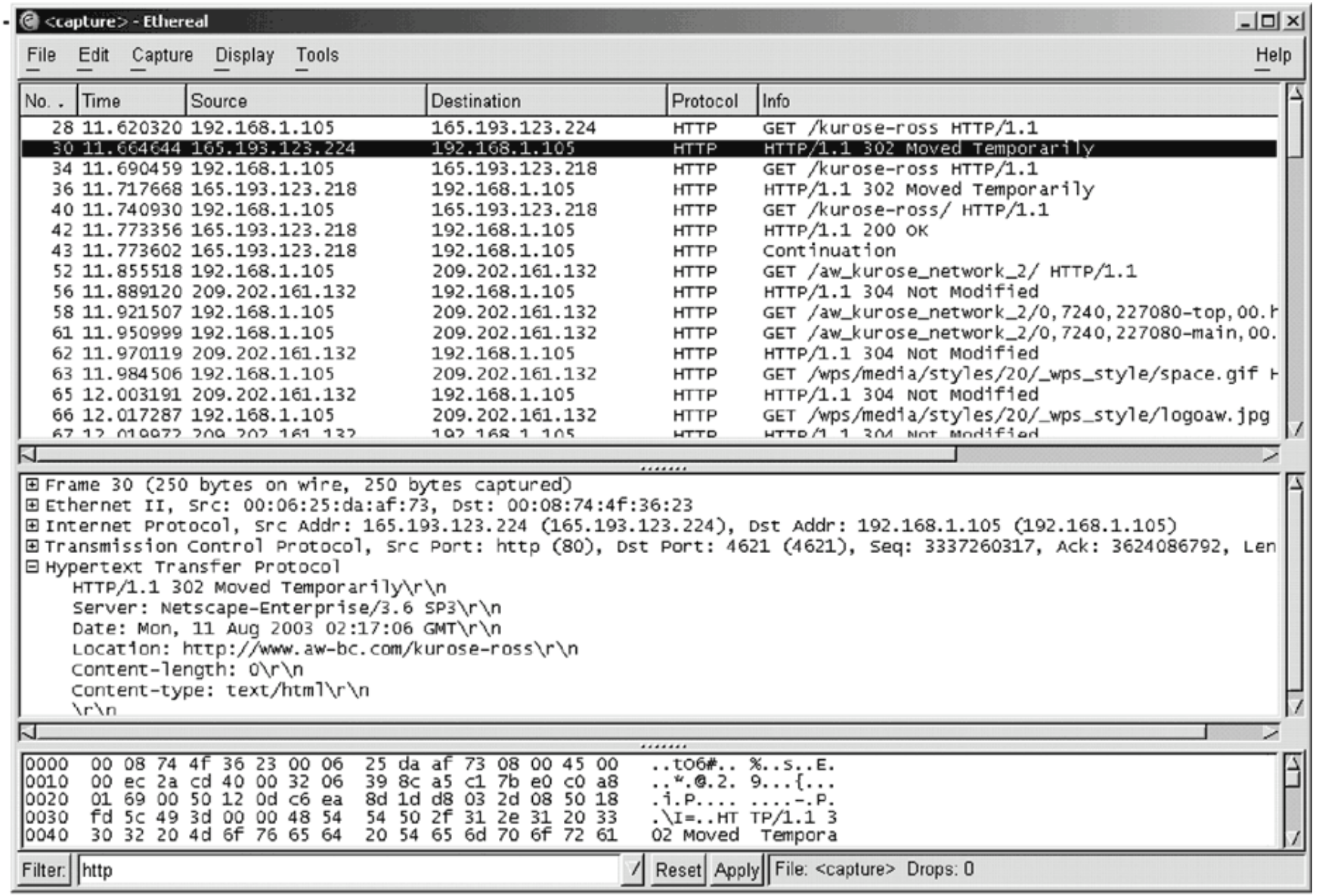


Figure 1.22 ♦ An Ethereal screen shot

Miscellaneous Stuff

- Time is tight: Don't loiter, get on with the task asap
- Discuss with partner to ensure both understand what is being done
- Take turns (both need to learn what is happening)
- Each student reports “self” and “partner's” contribution to the lab
  - Reality check via exam
  - Total marks weighed accordingly