Network Technologies (TCP/IP Suite)

Umar Kalim
Dept. of Communication Systems Engineering

umar.kalim@niit.edu.pk
http://www.niit.edu.pk/~umarkalim

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Agenda

- Logistics
- Introduction

Reading material

- Text books:
  - **Kurose and Ross** "Computer Networking: A Top-Down Approach Featuring the Internet", **3rd Edition**, 2004.
- Reference books:
  - TCP/IP Illustrated, Volume 1: The Protocols by W. Richard Stevens
  - W. Richard Stevens, Bill Fenner, and Andrew M. Rudoff, "UNIX Network Programming, Volume I: The Sockets Networking API", 3rd edition, 2003.
  - TCP/IP Protocol Suite by Behrouz A. Forouzan (3rd Edition)
  - Computer Networks by Andrew S. Tanenbaum
- Reference material
  - Selected publications and standards

Logistics & Pre-requisites

- Lectures & Handouts
  - Will be available online
- Office hours:
  - Thursday: 1:00 pm- 2:00 pm
- Computer Networks
  - course code ???
- Programming Experience
  - Java, C or C++
    - Code must be well commented
    - And properly indented
    - You will lose marks for poor written code
      - Code formatters available online

Grading policy

- Assignments
  5%
- Quizzes
  10%
- Survey report/Project
  15%
- OHT
  30%
- End-term
  40%

- Assignments
  - Individual
  - No late submission
- Quizzes
  - Mostly unannounced
  - Occasionally announced

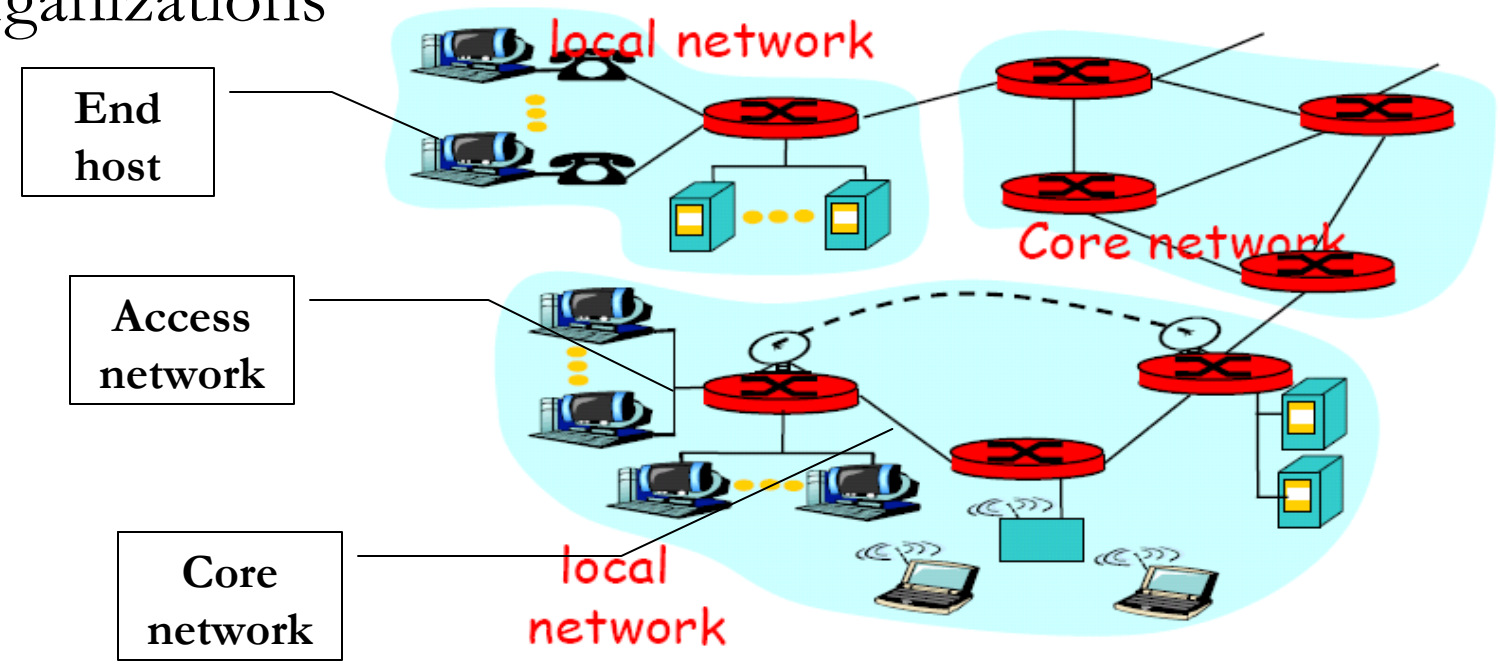
Objective of this course?

- Understand the
  - structure and components of computer networks,
  - packet switching,
  - TCP/IP,
  - window flow control,
  - network layer,
  - congestion control,
  - quality of service
  - Application Layer Programming

Lets begin!

Basic questions?

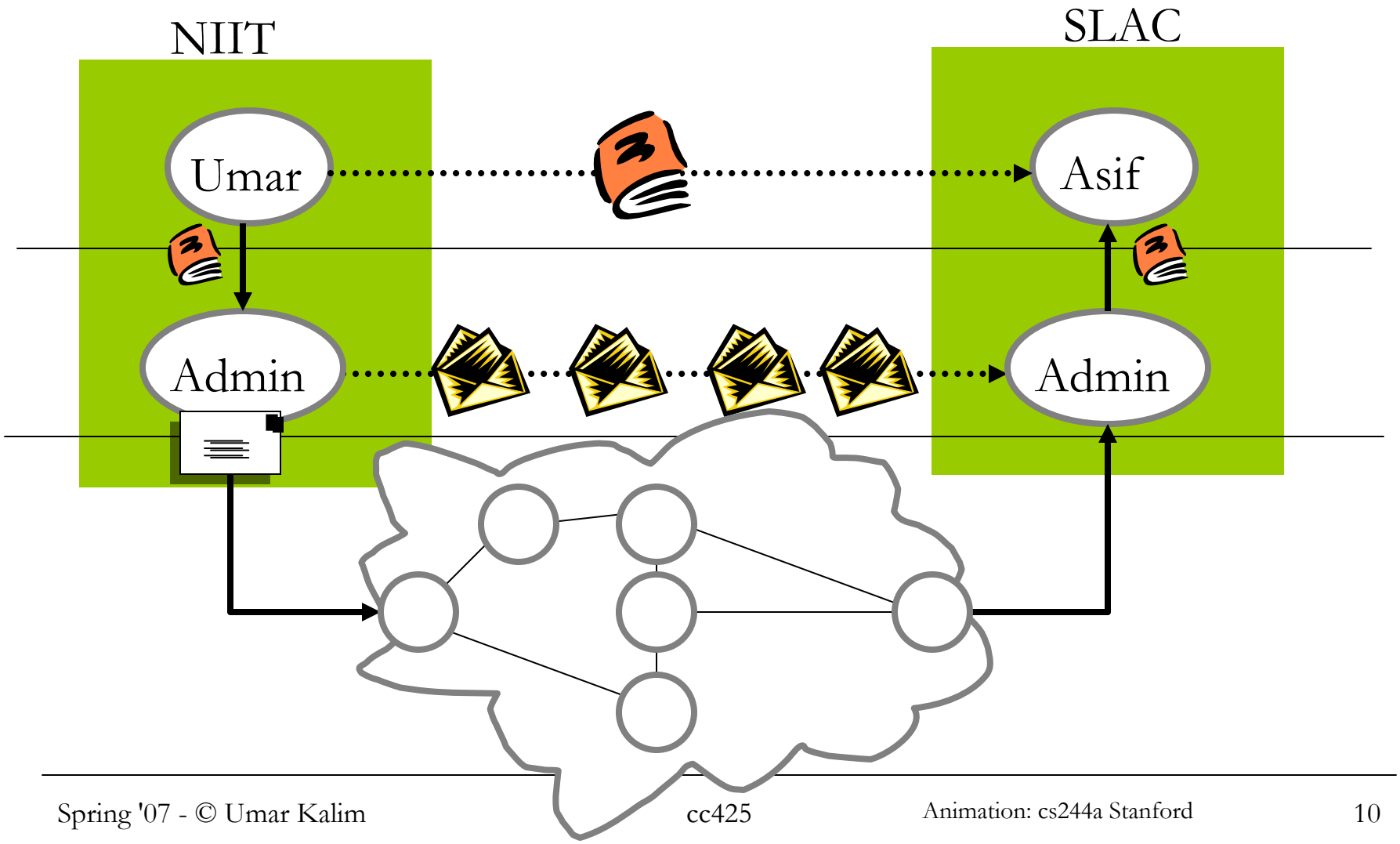
- What is the Internet?
  - Collection of networks, maintained by various organizations



Basic questions?

- What type of services run on the Internet?
  - Distributed applications
- What is a protocol?
  - Human analogy (message exchange)
  - A protocol defines the format and the order of messages exchanged between two or more communicating entities, as well as the actions taken on the transmission and/or receipt of a message.
- Why do we need protocols?
  - To provide common language
  - Avoid ambiguity

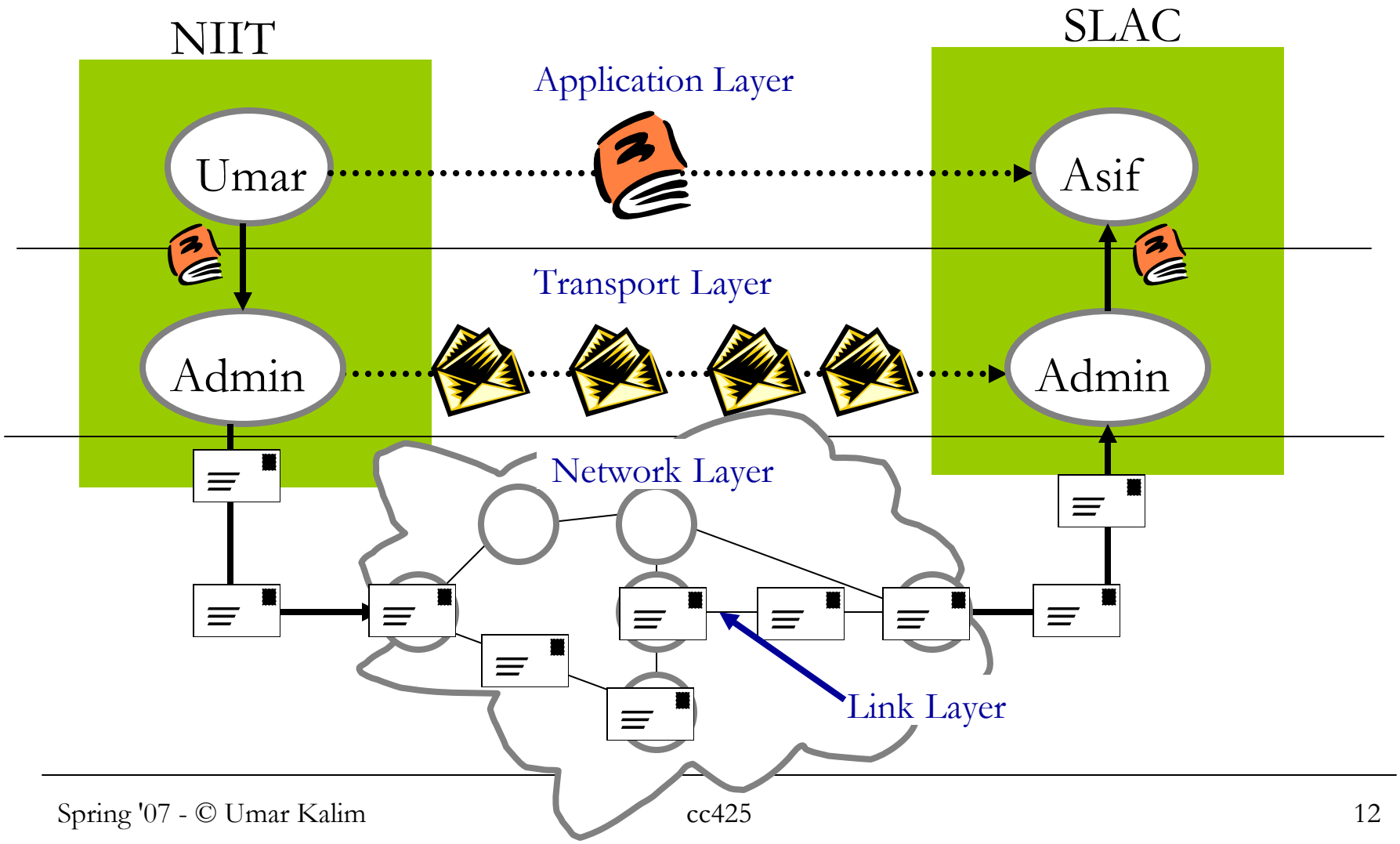
An Introduction to the mail system



Characteristics of the mail system

- Each envelope is individually routed.
- No time guarantee for delivery.
- No guarantee of delivery in sequence.
- No guarantee of delivery at all!
  - Things get lost
  - How can we acknowledge delivery?
  - Retransmission
    - How to determine when to retransmit? Timeout?
    - Need local copies of contents of each envelope.
    - How long to keep each copy.
    - What if an acknowledgement is lost?

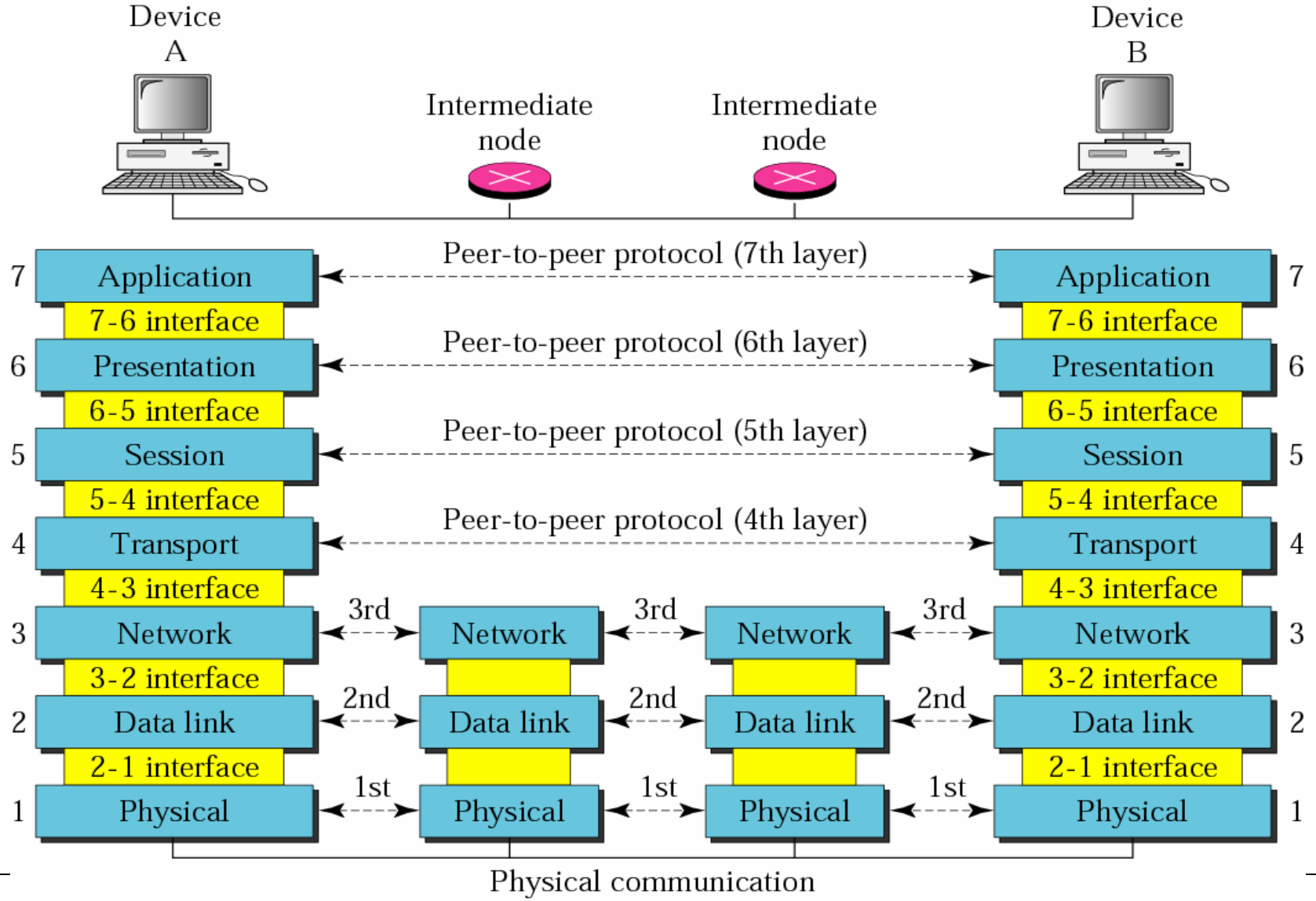
An Introduction to the mail system



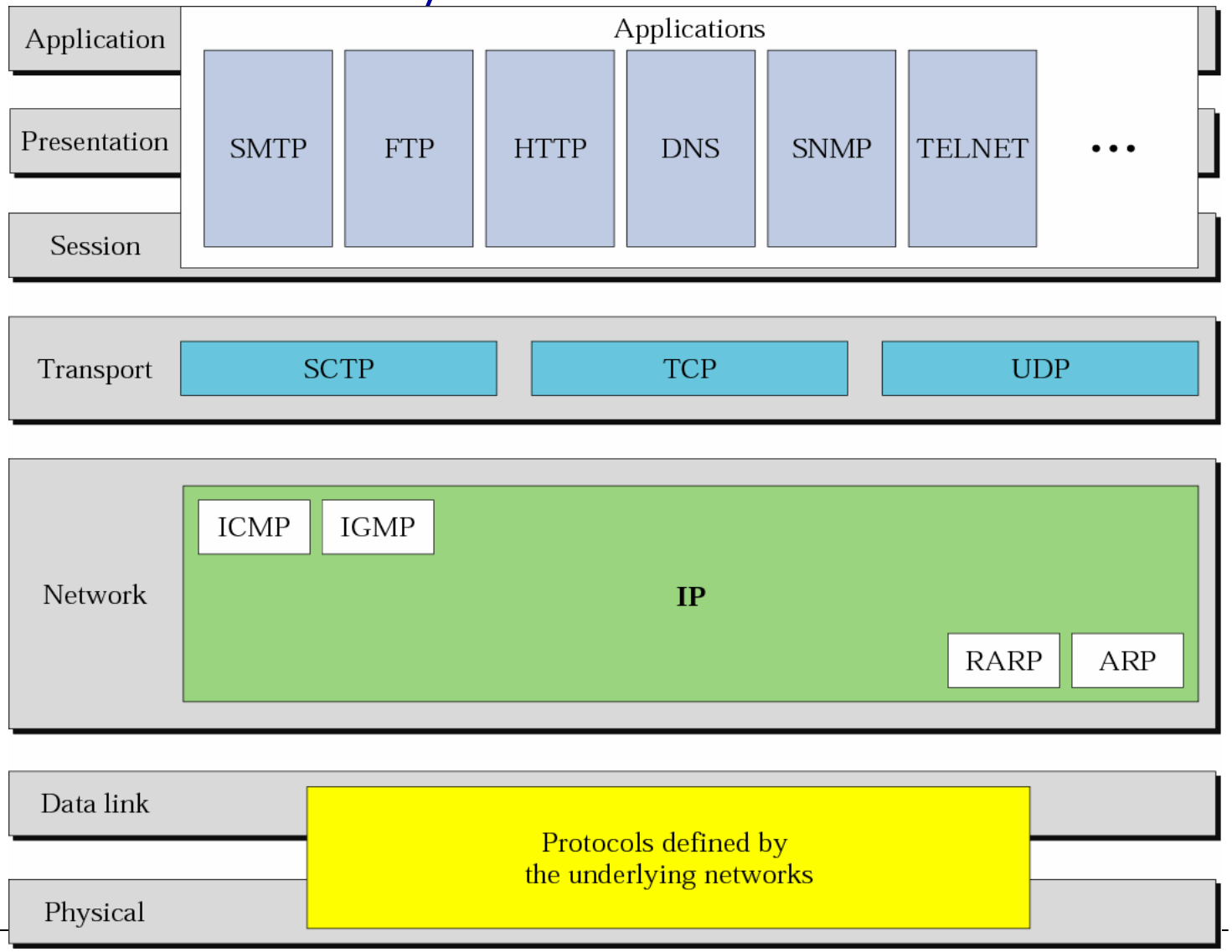
OSI Model

- An **open system** that allows two different systems to communicate irrespective of the underline architecture
- Open Systems Interconnection (OSI) Model
  - Proposed by International Standards Organization

OSI Model


Device A
Device B
Intermediate node
Intermediate node
Peer-to-peer protocol (7th layer)
Peer-to-peer protocol (6th layer)
Peer-to-peer protocol (5th layer)
Peer-to-peer protocol (4th layer)
7 Application
7-6 interface
6 Presentation
6-5 interface
5 Session
5-4 interface
4 Transport
4-3 interface
3 Network
3-2 interface
2 Data link
2-1 interface
1 Physical
3rd
2nd
1st
Physical communication

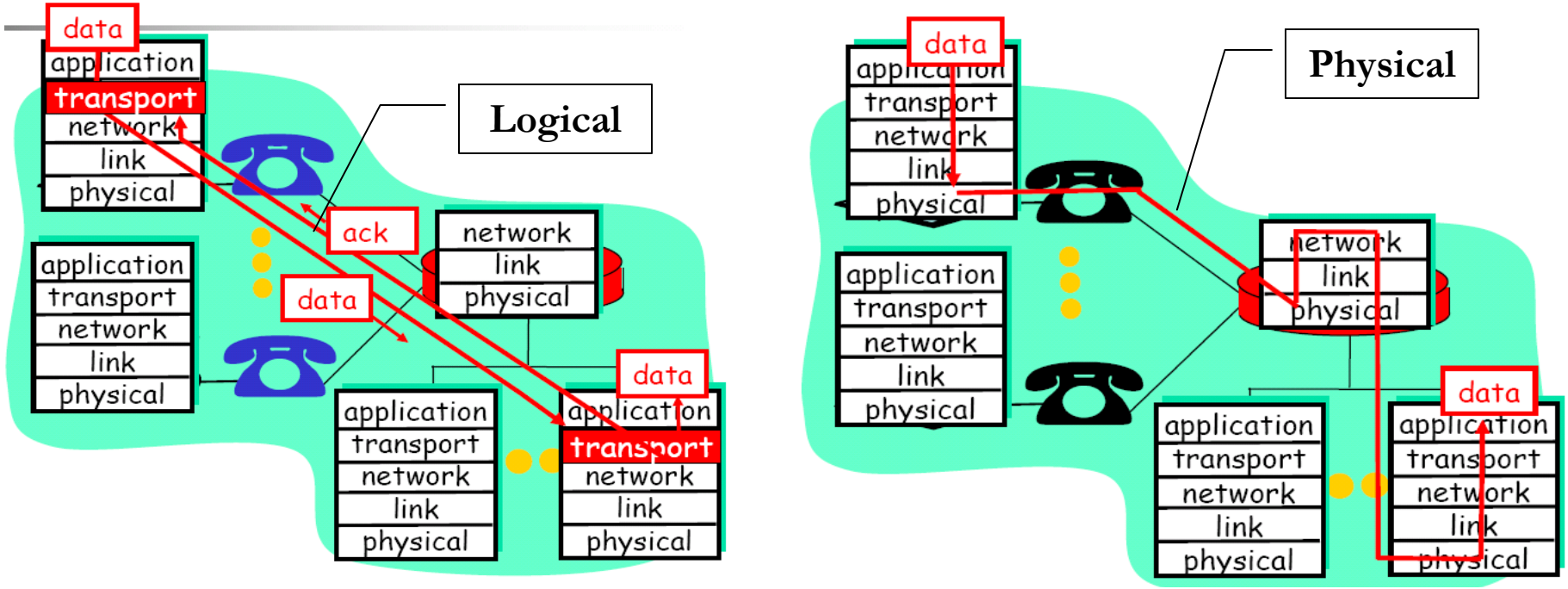
TCP/IP Suite



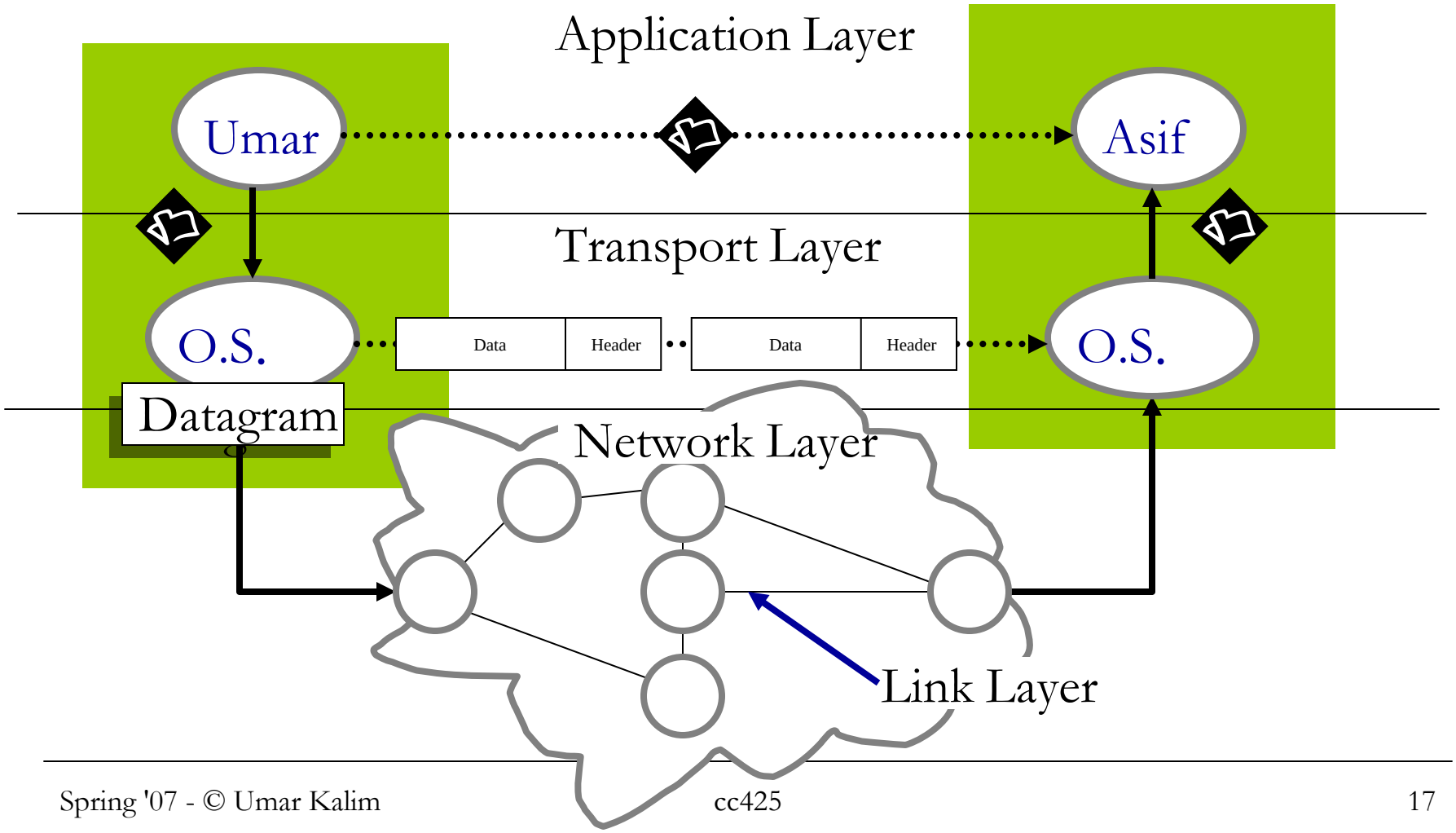
(TCP/IP does not define any protocol for the data-link and physical layer)

Layering??

- Based on functions of participating components
- Provides logical communication



An Introduction to the Internet



Characteristics of the Internet

- Each packet is individually routed.
- No time guarantee for delivery.
- No guarantee of delivery in sequence.
- No guarantee of delivery at all!
  - Things get lost
  - Acknowledgements
  - Retransmission
    - Need local copies of contents of each packet.
    - How to determine when to retransmit? Timeout?
    - How long to keep each copy?
    - What if an acknowledgement is lost?

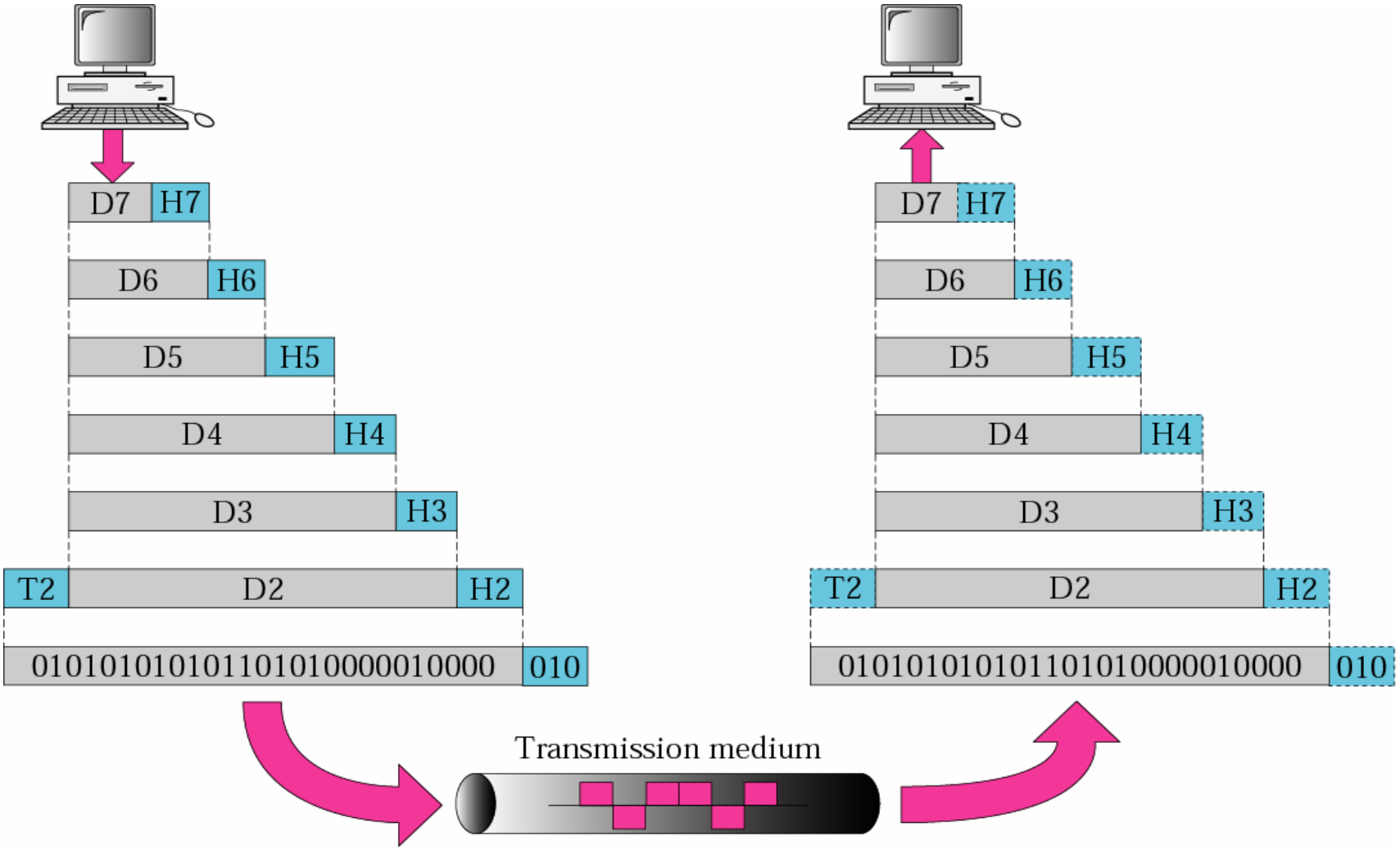
Characteristics of the Internet (2)

- No guarantee of integrity of data.
- Packets can be fragmented.
- Packets may be duplicated.

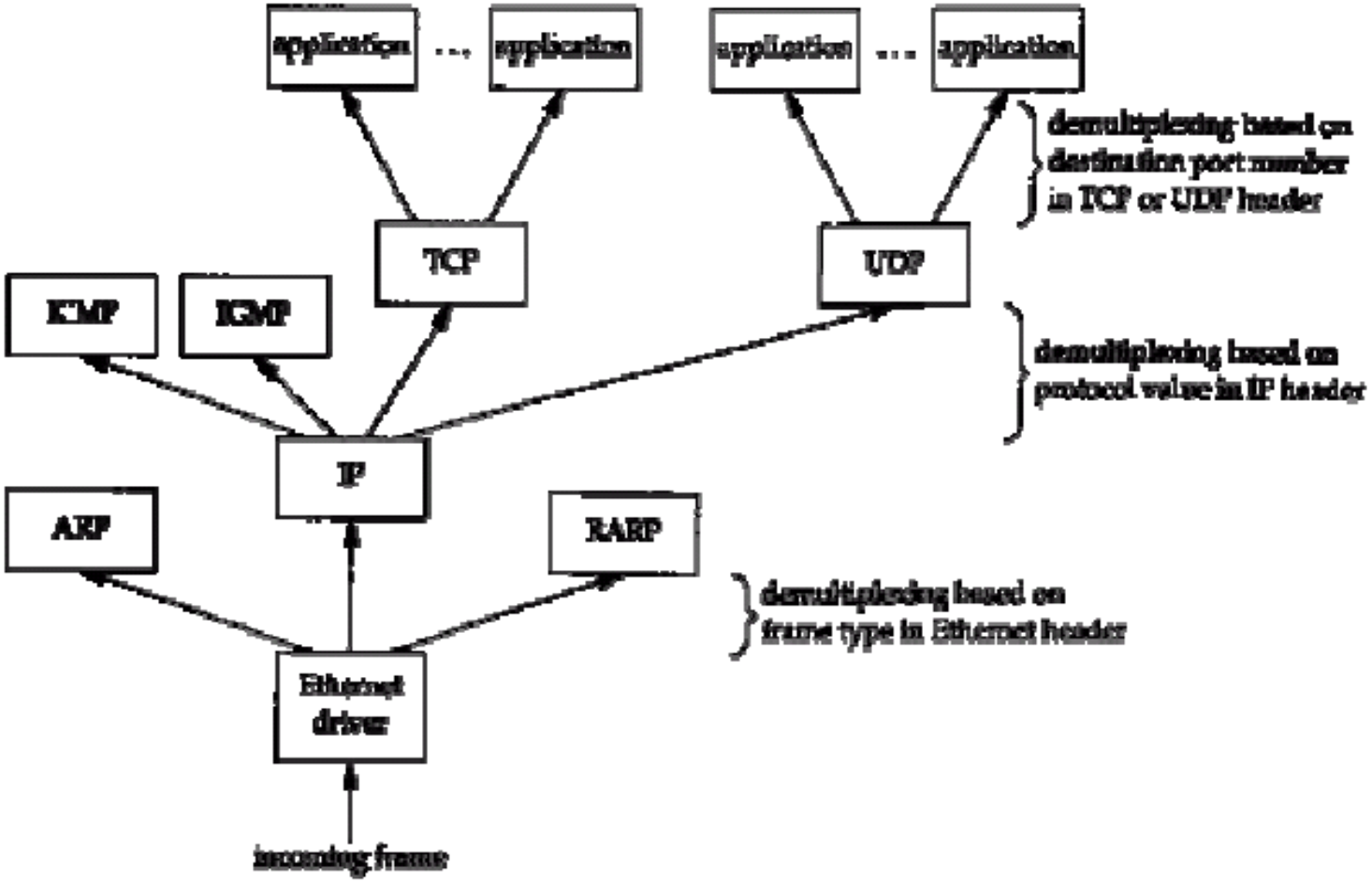
Layering in the Internet

- Transport Layer
  - Provides reliable, in-sequence delivery of data from end-to-end on behalf of application.
- Network Layer
  - Provides "best-effort", but unreliable, delivery of datagrams.
- Link Layer
  - Carries data over (usually) point-to-point links between hosts and routers; or between routers and routers.

Encapsulation



Demultiplexing



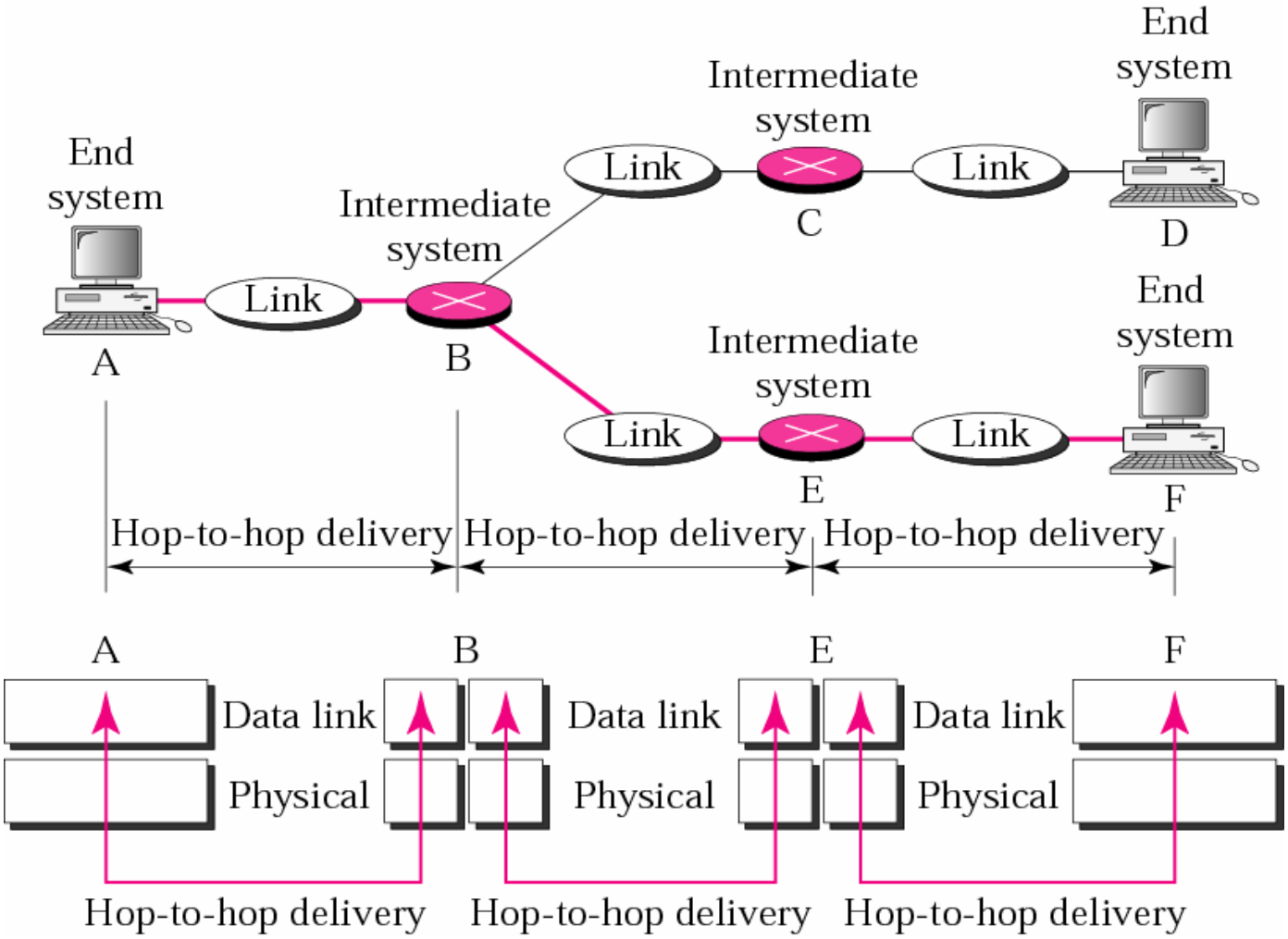
Some questions about the mail system

- How many sorting offices are needed and where should they be located?
- How much sorting capacity is needed?
  - Should we allocate for Eid?
- How can we guarantee timely delivery?
  - What prevents delay guarantees?
  - Or delay variation guarantees?
- How do we protect against fraudulent mail deliverers, or fraudulent senders?

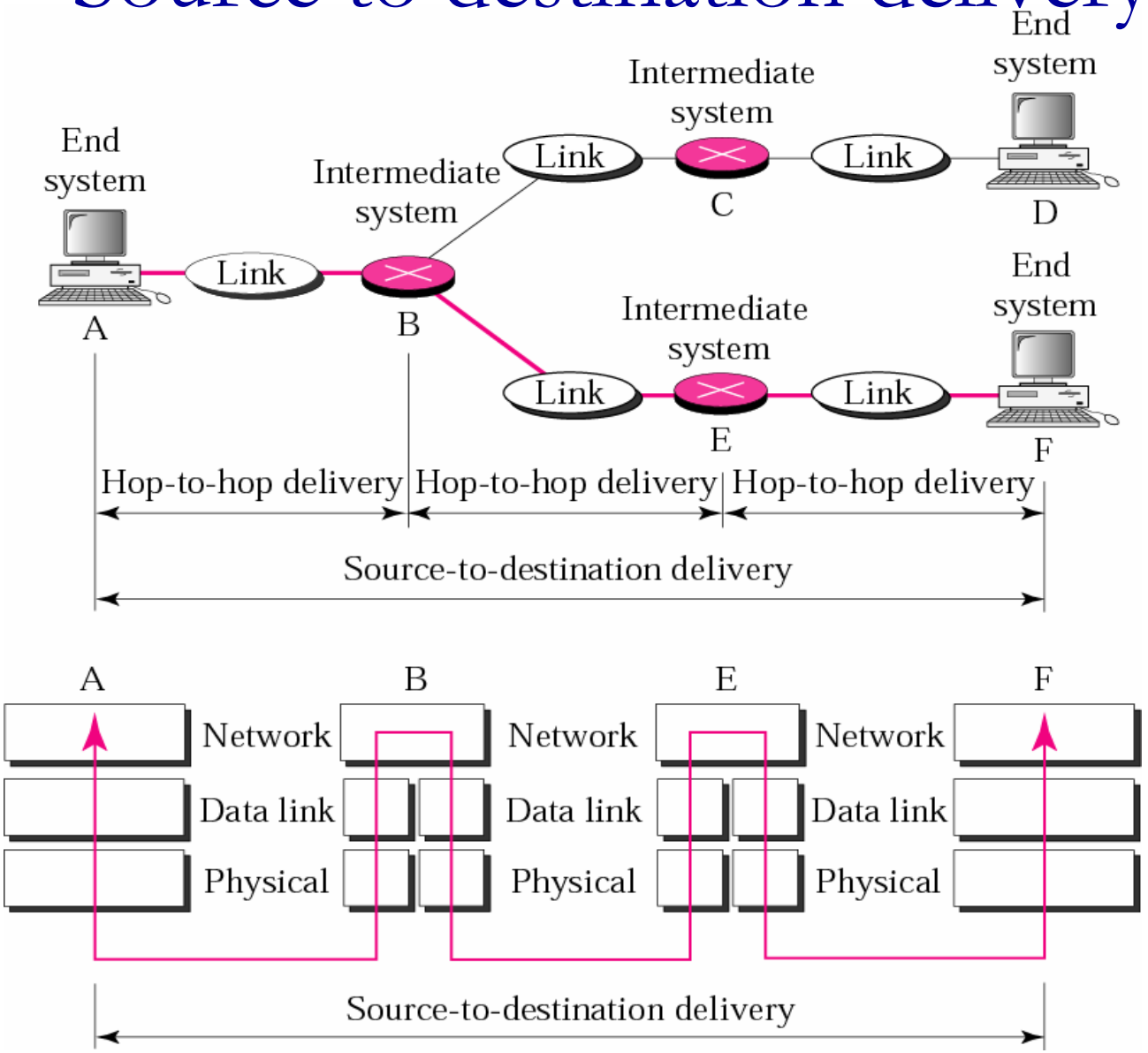
Questions?

That's all for today!

Hop-to-hop delivery



Source to destination delivery



Transport layer – Logical end2end delivery