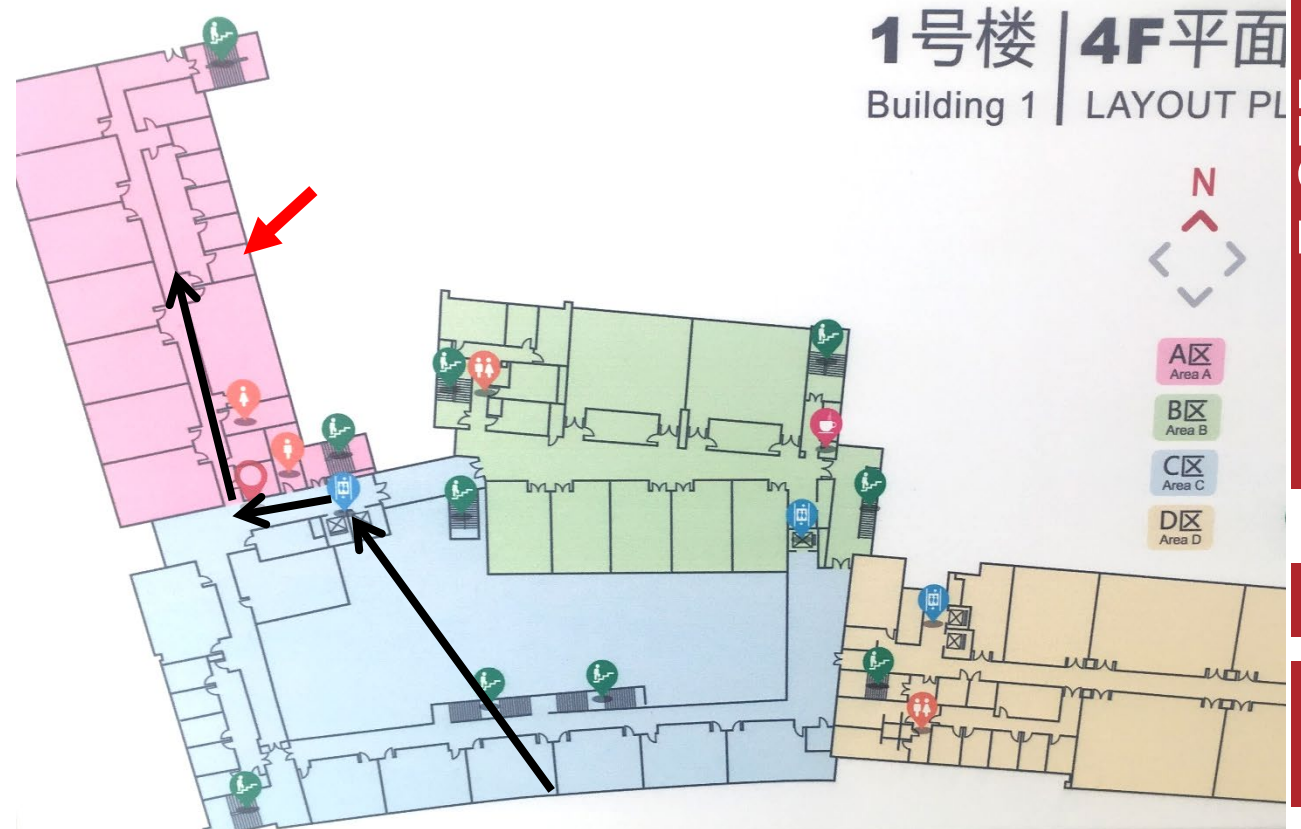# CS120: Computer Networks

Lecture 1. Course Introduction 1

Zhice Yang

General Information

- Instructor:
  - Zhice Yang (杨智策), www.yangzhice.com

  - Office hours:
    - Tuesday 2:30 p.m. – 4:30 p.m.
    - yangzhc@shanghaitech.edu.cn
    - 2068 5362
    - Office 1A-404E

General Information (cont.)

- TAs:
  - Fengxu Yang (杨丰旭)
    - yangfx@shanghaitech.edu.cn
  - Si Liao (廖思)
    - liaosi@shanghaitech.edu.cn
  - Yuelin Liu (刘越麟)
    - liuyl5@shanghaitech.edu.cn
- Wechat
  - Q&A
  - Urgent Notifications
- Blackboard (互动教学平台)
  - Notifications
  - Course Materials
  - Homework Submission

General Information (cont.)

- Textbook
  - Computer Networks: A System Approach 5th
    - by Larry Peterson, Bruce Davie
    - http://product.dangdang.com/22722782.html (English Version)
- References
  - Computer Networking: A Top-Down Approach 7th
    - by James Kurose, Keith Ross
    - https://item.jd.com/12392810.html

Grading

- No Cheating !
  - Once confirmed. Fail the course

- 20% Homework
  - Four Homework Assignments (5% each)

- 35% Final Exam
  - No Midterm

- 45% Course Project
  - Group: <= 2 students
    - email TA (liaosi@shanghaitech.edu.cn) your group members before Sep. 16
  - 40% for four subprojects (about 10% each)
    - Submit your project (code) to Blackboard
    - Ask TAs to check and grade your project before submitting your code
  - 5% if you finish all the four subprojects
    - "finish" means: obtain at least 60% points of the compulsory part of every subproject
  - Reference code of project 1 and 2 is provided after the due
  - Programming language: No restrictions (Java is suggested)
  - Estimated coding overhead (3000 lines)
  - You can use any open-source code (should be explicitly acknowledged with reference link)
  - Project checking is scheduled in weekend
  - Can only use the provided the sound cards

- Up to 25% Bonus Score
  - For finishing optional parts of Course Project

- 5% Attendance

- Delayed Submissions
  - -10 % * N, N is the delayed time in unit of day (N<=10)
  - -5% for the first 0 – 12 Hours
  - -10 % for the first 12 – 24 Hours

START PROJECT EARLY

Week	Time		Time	
1	Sep. 5	Course Introduction 1	Sep. 7	Course Introduction 2
2	~~Sep. 12~~		Sep. 14	Physical Layer
3	Sep. 19	Discussion: Audio Interface	Sep. 21	Framing & Error Detection
4	Sep. 26	Reliable Transmission	Sep. 28	Multiple Access 1
5	~~Oct. 3~~Oct. 8	Multiple Access 2	~~Oct. 5~~	
6	Oct. 10	Switching	Oct. 12	IP address
7	Oct. 17	RIP and OSPF	Oct. 19	BGP
8	Oct. 24	NAT and Router Design	Oct. 26	SDN
9	Oct. 31	Discussion: Network Simulator	Nov. 2	Mobile Routing
10	Nov. 7	TCP 1	Nov. 9	TCP 2
11	Nov. 14	Congestion Control 1	Nov. 16	Congestion Control 2
12	Nov. 21	Other Topics in TCP	Nov. 23	Data Presentation & Compression
13	Nov. 28	DNS	Nov. 30	HTTP & SMTP
14	Dec. 5	FTP & P2P	Dec. 7	Network Security 1
15	Dec. 12	Network Security 2	Dec. 14	Summary
16	Dec. 19		Dec. 21	
18	Jan. 2		Jan. 4	

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proj0 release

proj1 release

proj0 due

proj1 due

proj2 release

proj2 due

proj3 release

proj3 due

proj4 release

proj4 due

Withdraw Policy

- According to University's Policies

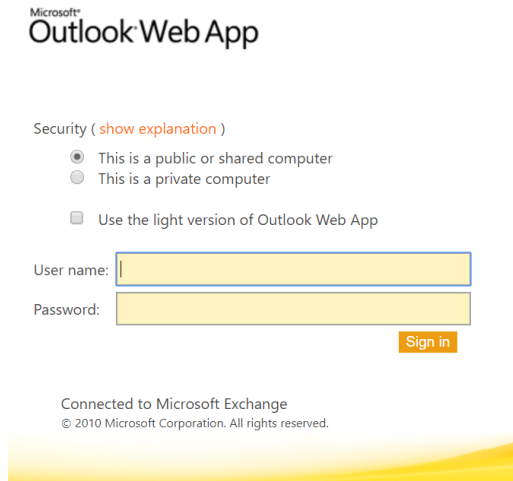# What is a Computer Network

Internet

Information Sharing

Email

USB Type-C

Device to Device Connections

Wireless Connections

The Goal of This Course is

- NOT
  - Writing network apps
  - Configuring network devices

The Goal of This Course is

to Build a Computer Network

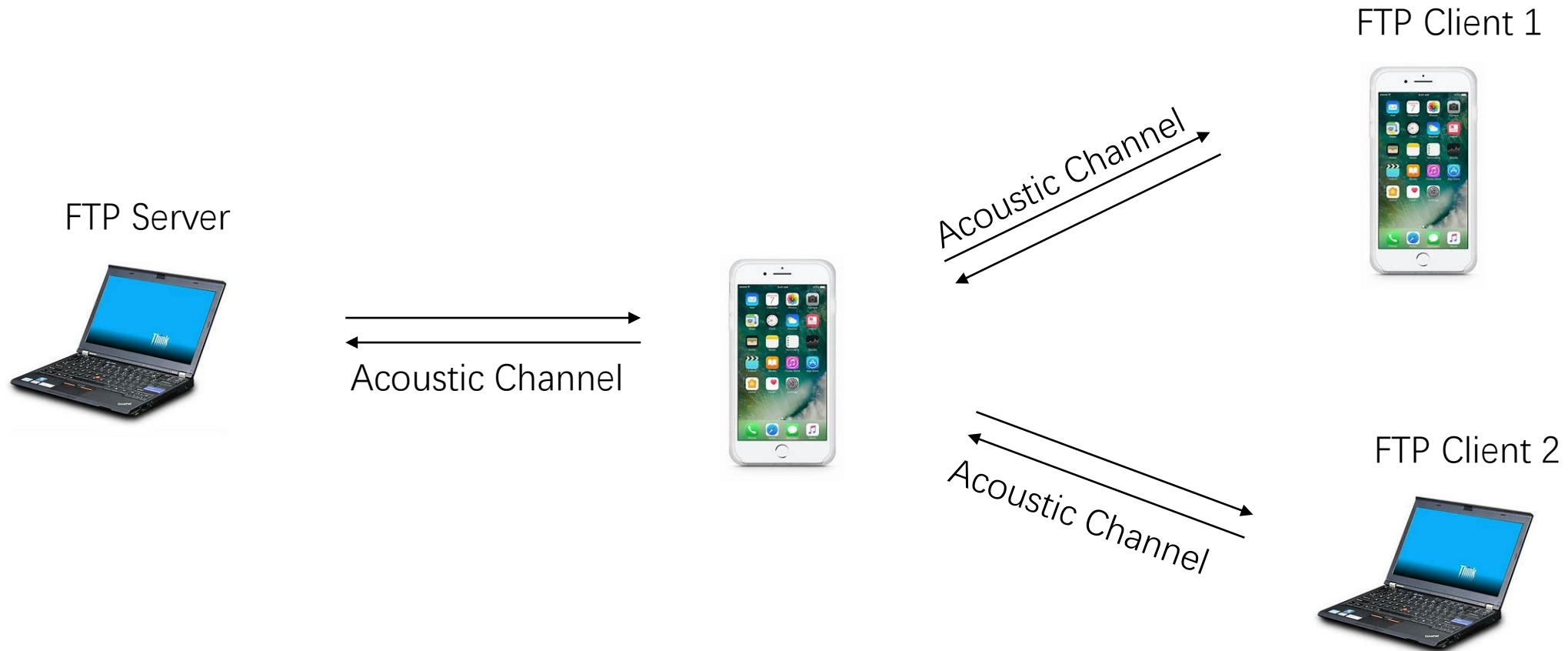to understand how real computer networks work

Top-Down

Bottom-Up

Build a HTTP Service from Ground up ?

- A Real Network Like Internet is too Complicated
  - Implement an http server (Apache, Nginx…)
  - Implement an http browser (Chrome, IE…)
  - Implement a TCP/IP stack (net/core, socket…)
  - Implement a link layer driver (ath9k, e1000…)
  - Implement a modem chip (ar9285, Intel i210…)

Too Much…

About our Project

- Acoustic Network (Athernet)

FTP Client 1

FTP Server

Acoustic Channel

Acoustic Channel

Acoustic Channel

Acoustic Channel

FTP Client 2

Subproject 1

- Acoustic Connection
  - Node to node connection through speakers and microphones

Acoustic Channel

Subproject 2

- Multiple Access
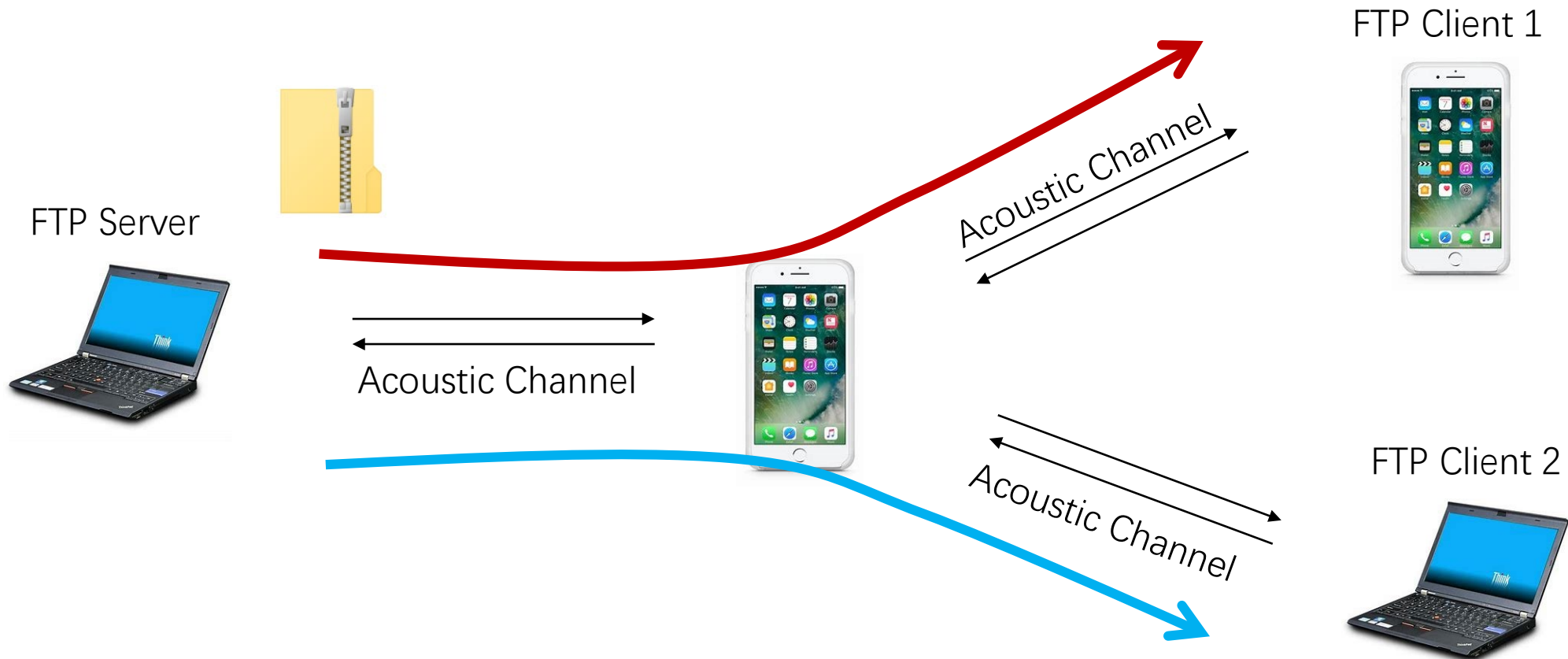 - Efficiently handle the access of multiple nodes

Acoustic Channel
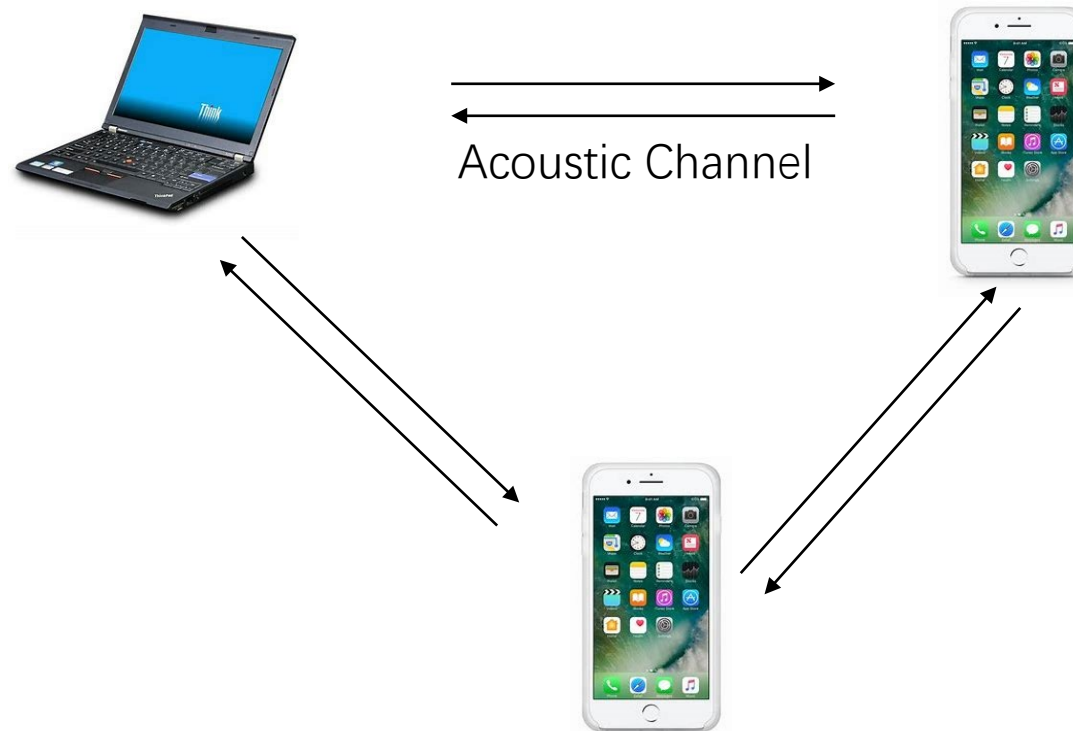
Subproject 3

- NAT
  - Implement a network gateway
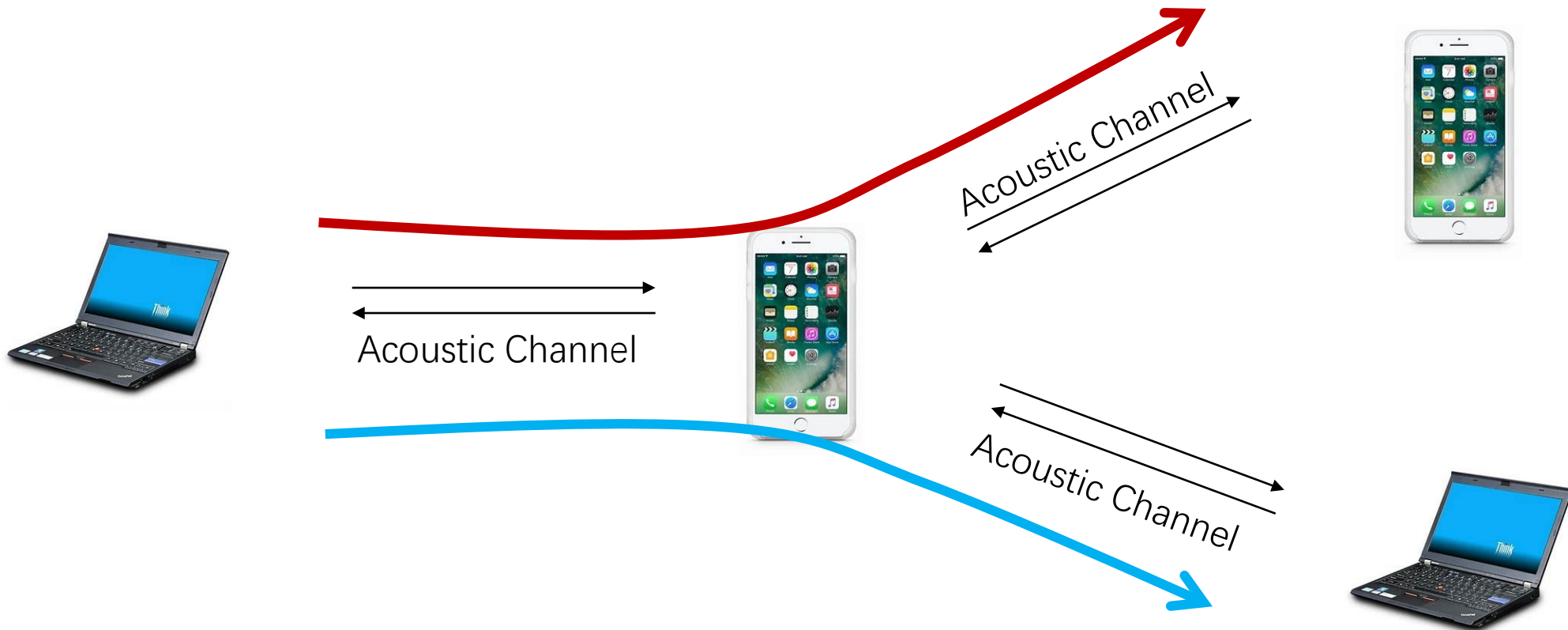
Subproject 4

- Reliable Delivery and Network Application
  - e.g.: FTP

FTP Client 1

Acoustic Channel

FTP Server

Acoustic Channel

Acoustic Channel

FTP Client 2

About the Project

- Building the Acoustic Network
  - Basic Communication
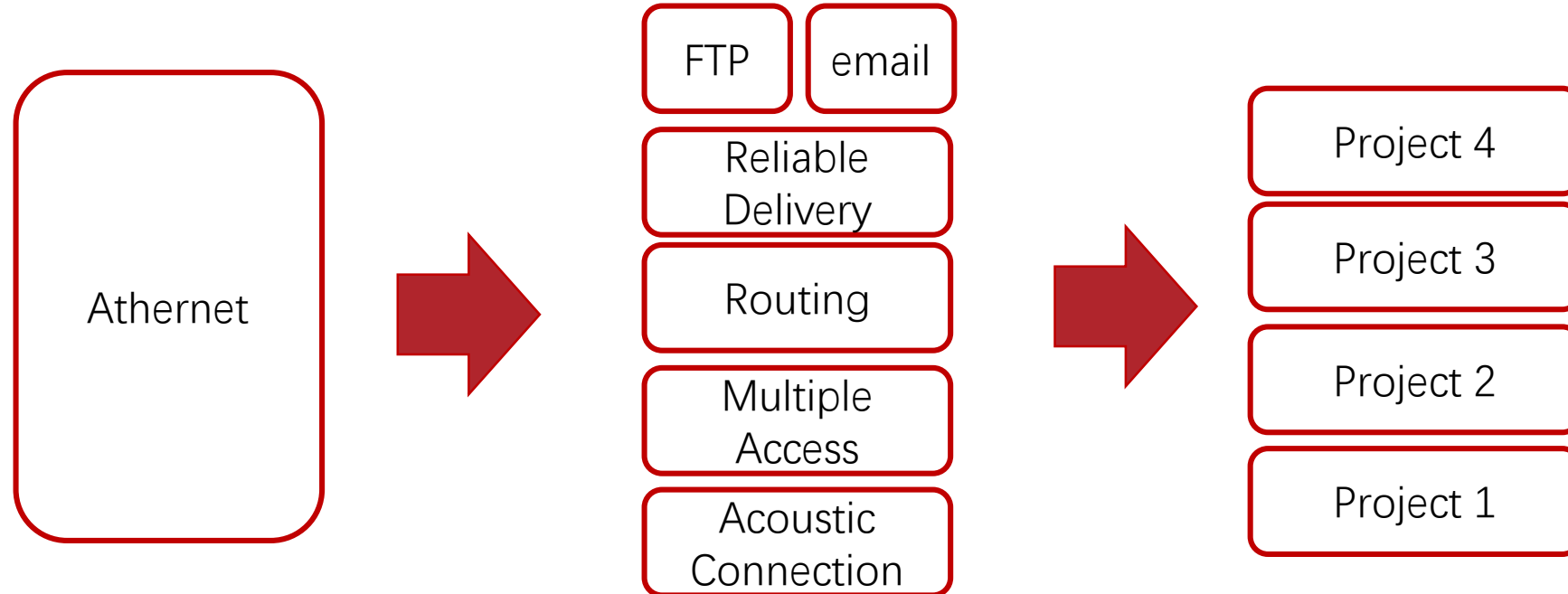 - Reliability
  - Resource Sharing
  - Scalability
  - etc.

Still Very Challenging …

Shoulders of Giants

- We introduce and borrow existing designs from state-of-the-art network technologies (especially the Internet)

Project:

Athernet

Lectures:
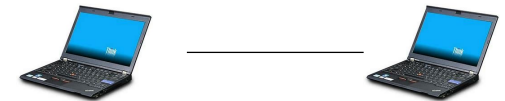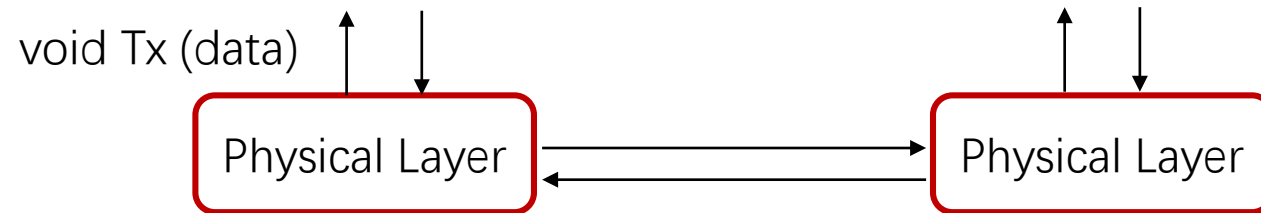
Conceptual Part:
Basic Algorithms,
Models and Protocols

Demo Part:
Real examples from Internet traffic,
operating systems

Existing Designs:

CSMA   Sliding Window
TCP
CRC   Coding
Framing
IP
OSPF   DNS
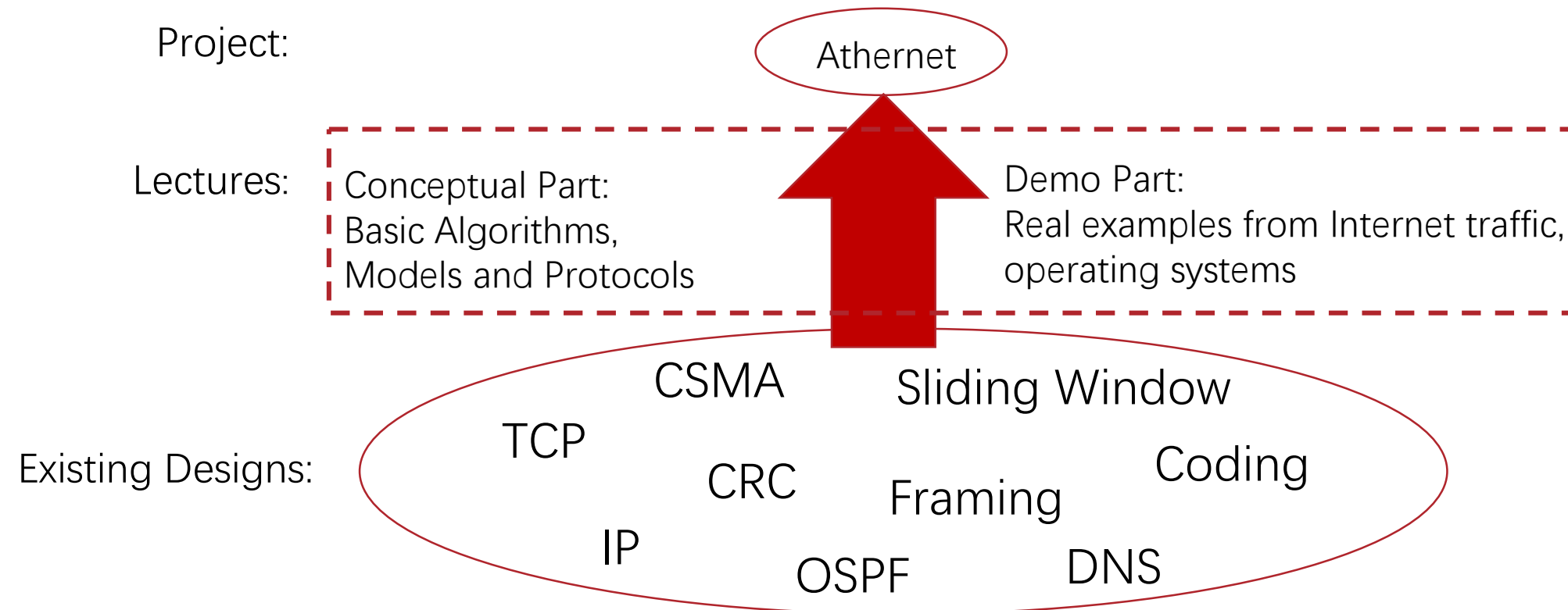
The Concept of Network Layering
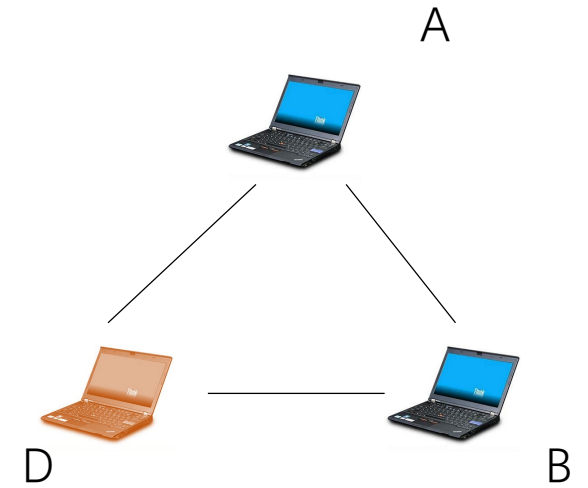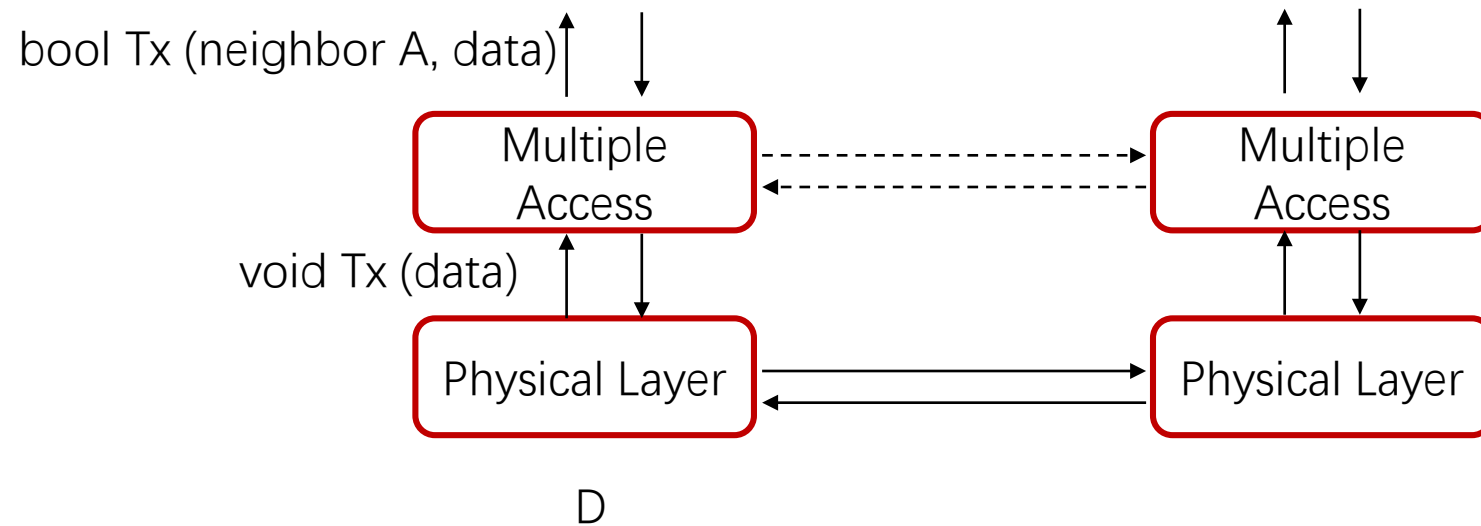
- Benefit
  - Modular Design

How Laying Works ?

- Protocols
  - One or more protocols implement the functionality of a certain layer
  - A protocol defines a communication service
    - Service Interface (for upper layer)
    - Peer to peer Interface (for the same layer)
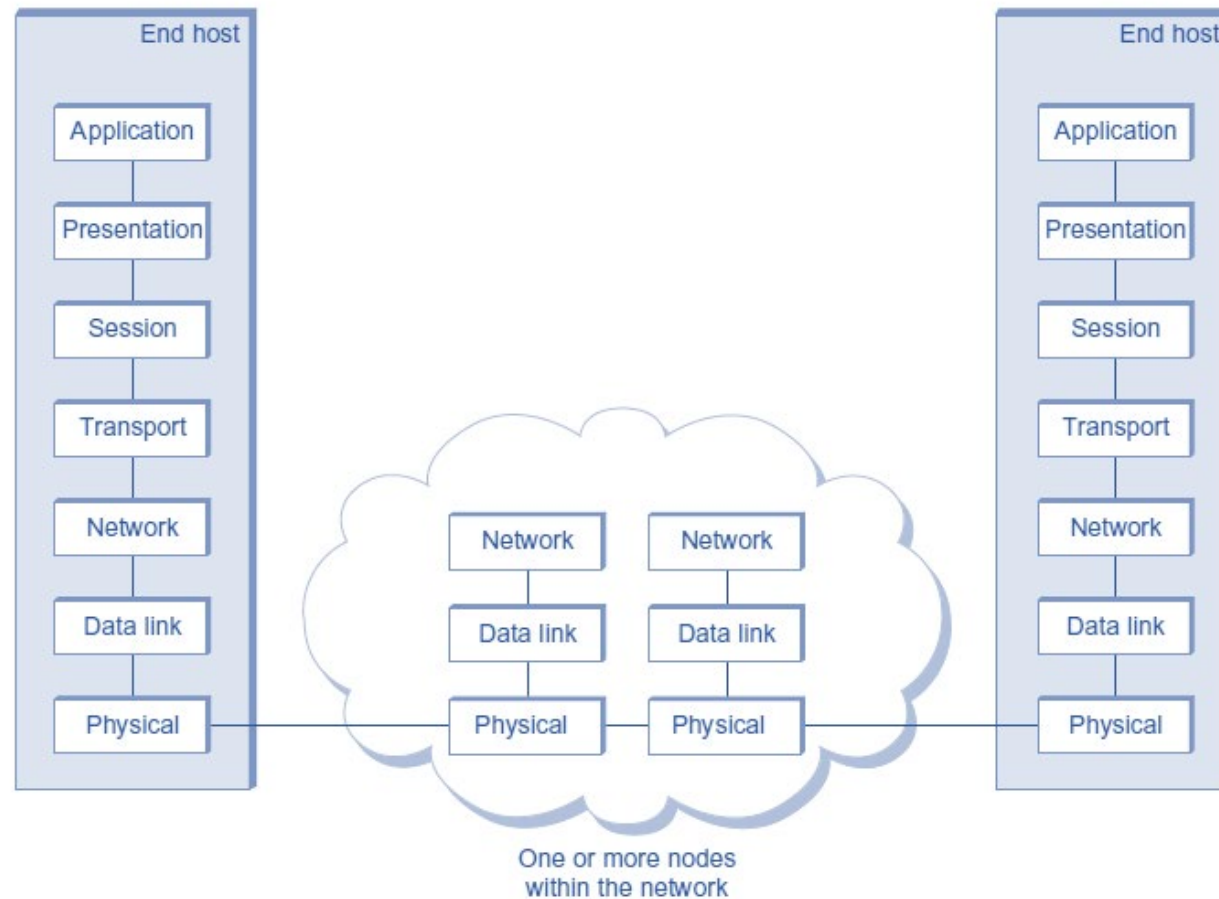
How Laying Works ?

void Tx (data)

Physical Layer

Physical Layer

How Laying Works ?

bool Tx (neighbor A, data)

| Multiple Access | | Multiple Access |

void Tx (data)

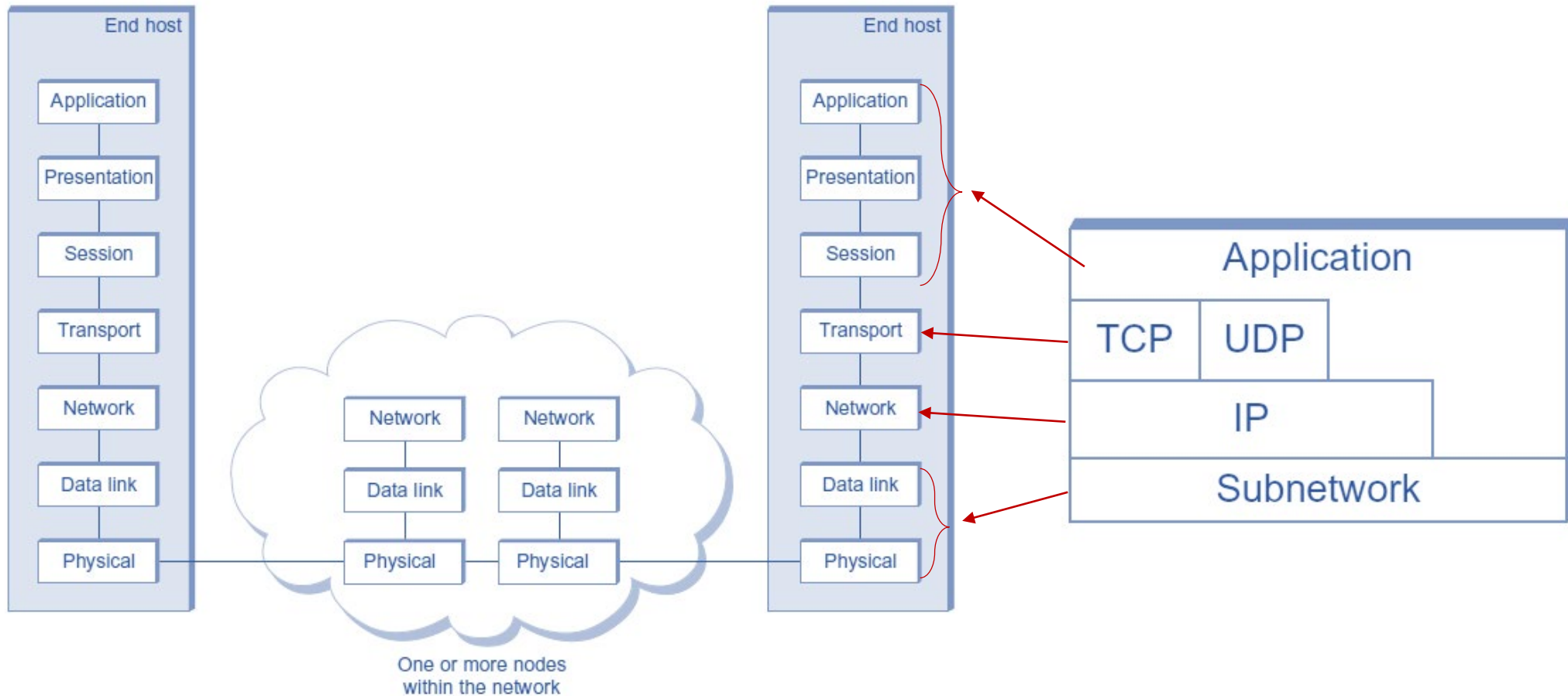| Physical Layer | | Physical Layer |

D

A

D   B

Canonical Layer Model

- OSI 7 Layer Model

Layering of the Real Internet

Layering of the Real Internet