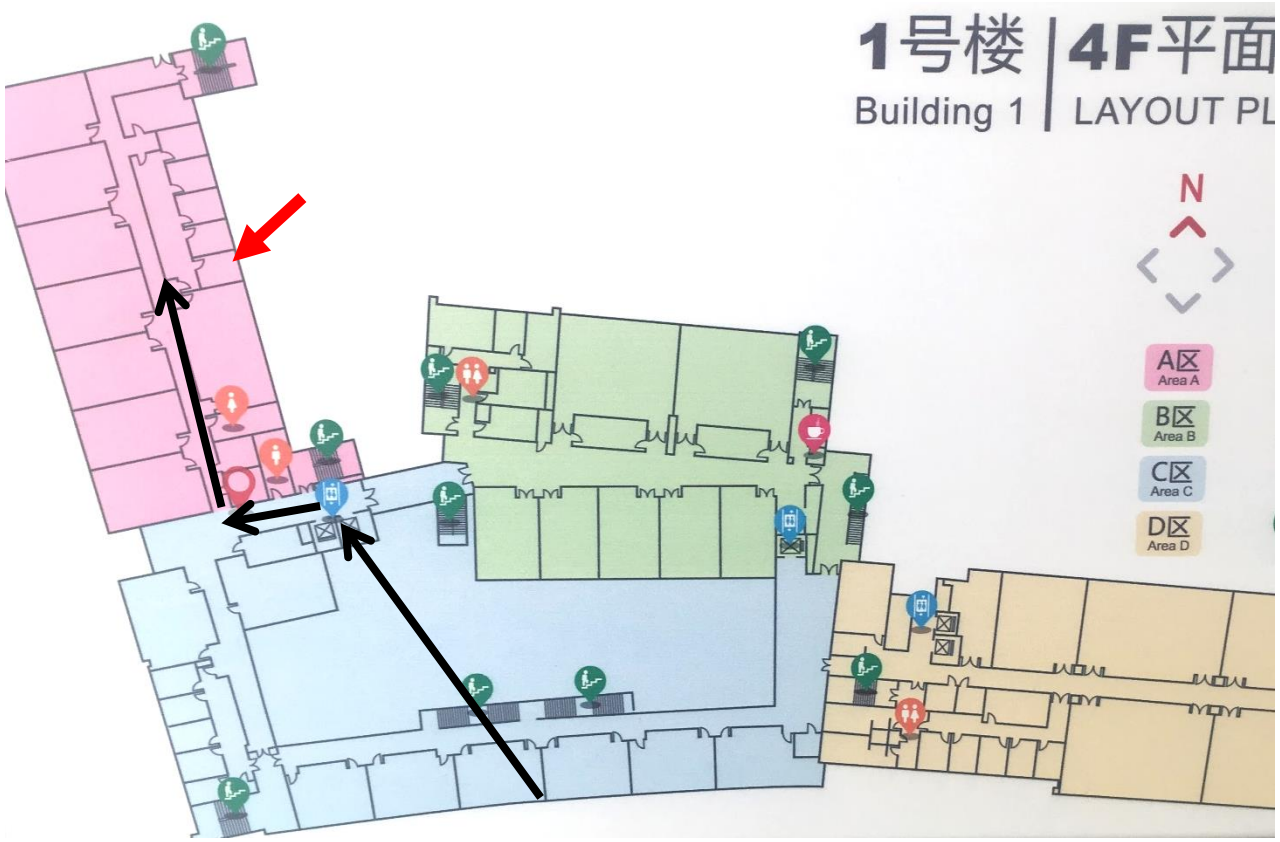
CS120: Computer Networks

Lecture 1. Course Introduction

Zhice Yang

General Information

- Week 1-16
  - Zhice Yang (杨智策)
    - yangzhc@shanghaitech.edu.cn
    - Office hours:
      - Tuesday 10:30 a.m. – 11:30 a.m.
      - Office 1A-404E



General Information (cont.)

- TAs:
  - Yihui Yan (严亦晖)
    - yanyh@shanghaitech.edu.cn
  - Hao Li (李昊)
    - lihao2023@shanghaitech.edu.cn
- WeChat Group
  - Q&A
  - Urgent Notifications
- Blackboard (互动教学平台)
  - Email Notifications
  - Course Materials
  - Homework Submission
- GitHub
  - https://github.com/sist-cs120/project-wiki
  - https://sist-cs120.github.io/project-doc/
  - Project Documentation and Discussion

该二维码7天内(10月7日前)有效，重新

General Information (cont.)

- Textbook
  - Computer Networks: A System Approach 5th
    - by Larry Peterson, Bruce Davie
  - Computer Networks: A System Approach 6th
    - by Larry Peterson, Bruce Davie
    - https://item.jd.com/13015993.html
    - Open access version: https://book.systemsapproach.org/
- Reference Textbook
  - Computer Networking: A Top-Down Approach 8th
    - by James Kurose, Keith Ross
    - https://item.jd.com/13464817.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 (lihao2023@shanghaitech.edu.cn) your group members no later than Oct. 8
  - 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 a minimum score of 60% of the compulsory parts 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 links)
  - Project checking is scheduled on weekends
  - Can only use the provided sound cards
- Up to 25% Bonus Score
  - For finishing Course Project optional parts
- Up to 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. 16~~		Sep. 18	Course Introduction
2	Sep. 23	Bandwidth and Latency	Sep. 25	Physical Layer
3	Sep. 30	Discussion: Audio Interface	~~Oct. 2~~	
4	~~Oct. 7~~Oct. 12	ACK	Oct. 9	Framing & Error Detection
5	Oct. 14	Medium Access Control (Ethernet)	Oct. 16	Medium Access Control (Wi-Fi)
6	Oct. 21	Switching	Oct. 23	IP Address
7	Oct. 28	Intradomain Routing (RIP and OSPF)	Oct. 30	NAT and Router Design
8	Nov. 4	Discussion: Network Simulator	Nov. 6	Mobile Routing
9	Nov. 11	SDN	Nov. 13	Interdomain Routing (BGP)
10	Nov. 18	TCP 1	Nov. 20	TCP 2
11	Nov. 25	Congestion Control 1	Nov. 27	Congestion Control 2
12	Dec. 2	Other Topics in TCP	Dec. 4	Data Compression
13	Dec. 9	DNS	Dec. 11	HTTP & SMTP
14	Dec. 16	FTP & P2P	Dec. 18	Network Security 1
15	Dec. 23	Network Security 2	Dec. 25	Summary
16	Dec. 30		Jan. 1	Final Exam
18	Jan. 13		Jan. 15	Final Project Due

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18	Jan. 6		Jan. 8	Final Project Due

proj0 release

proj1 release

proj0 due

proj1 due

proj2 release

proj2 due

proj3 release

proj3 due

proj4 release

proj4 due

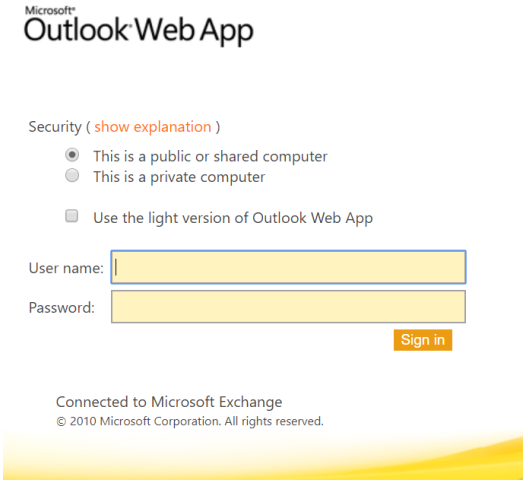
Withdraw Policy

- According to University's Policies

What is a Computer Network

Internet

Information Sharing



Email

Device to Device Connections

Wireless Connections

This Course is about…

- NOT
  - Coding networked apps
  - Configuring network devices

App Store

Google play

This Course is about…

How to design and implement computer networks

In this way

to understand how real computer networks work

Top-Down

Bottom-Up

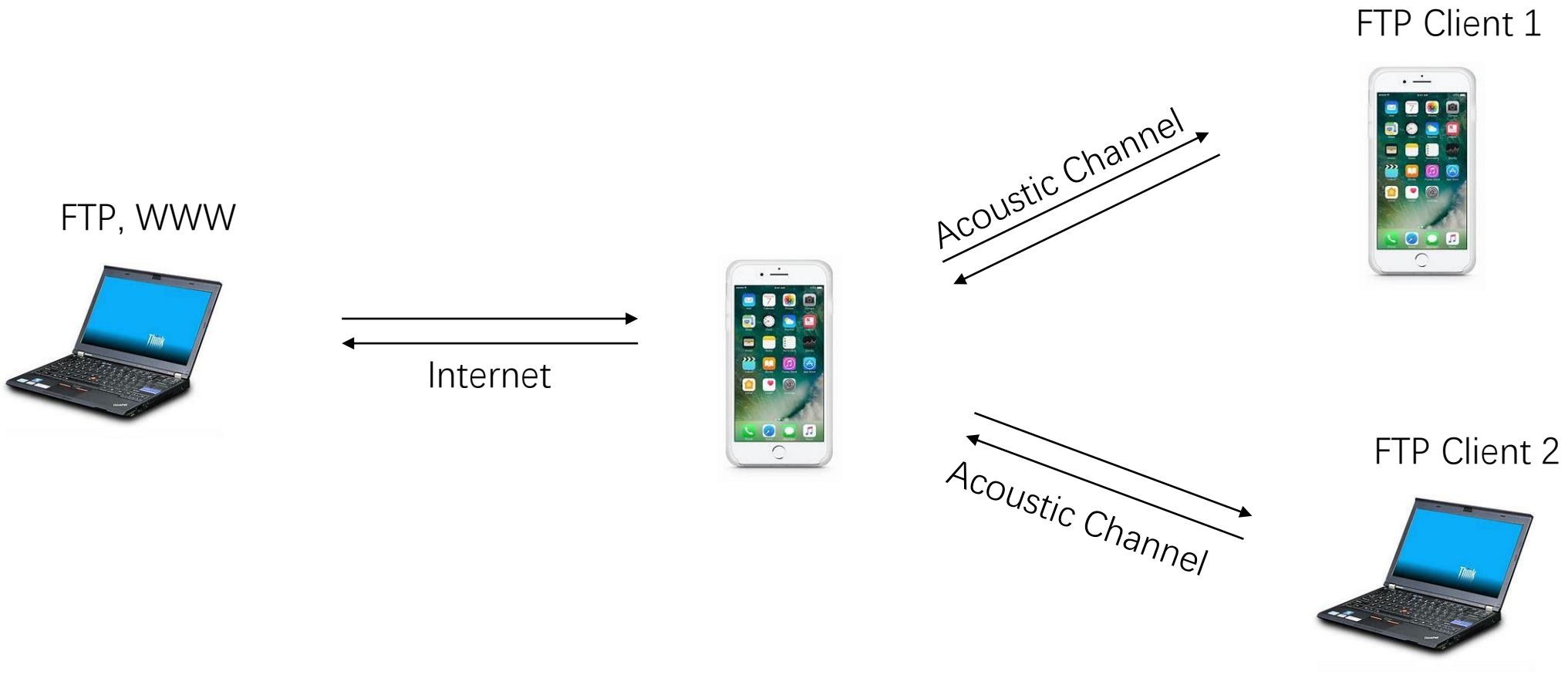
Build a HTTP Service from Ground up ?

- 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…

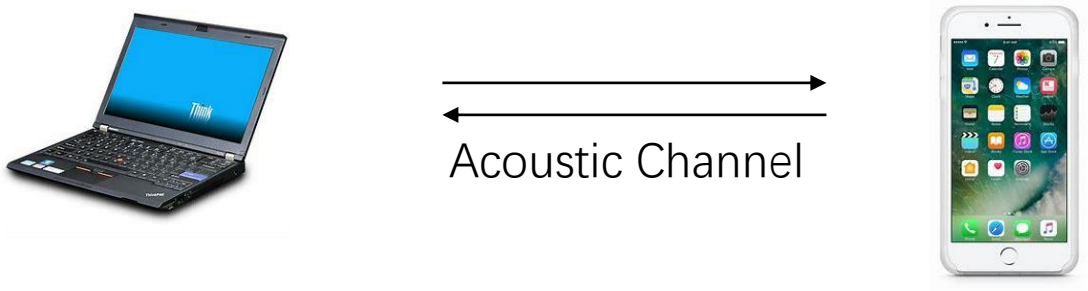
About the Course Project

- A Toy Network over Acoustic Channel



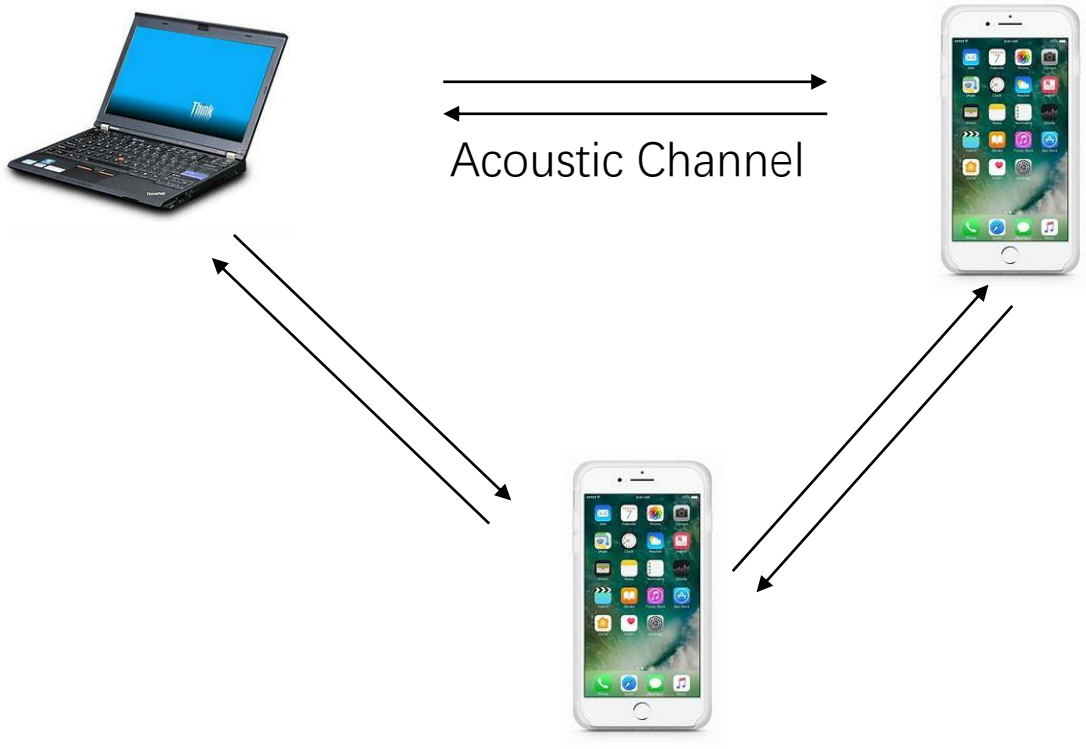
Subproject 1

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



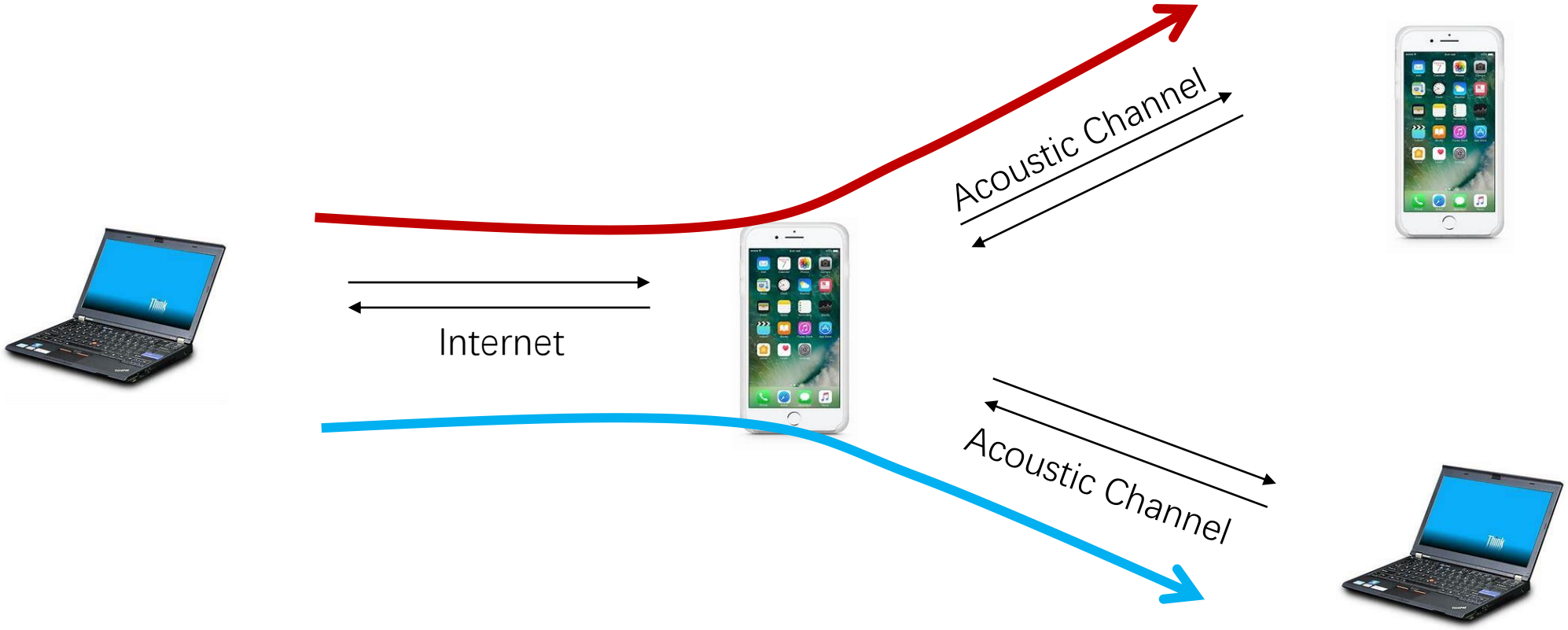
Subproject 2

- Multiple Access
  - Efficiently handle the access of multiple nodes



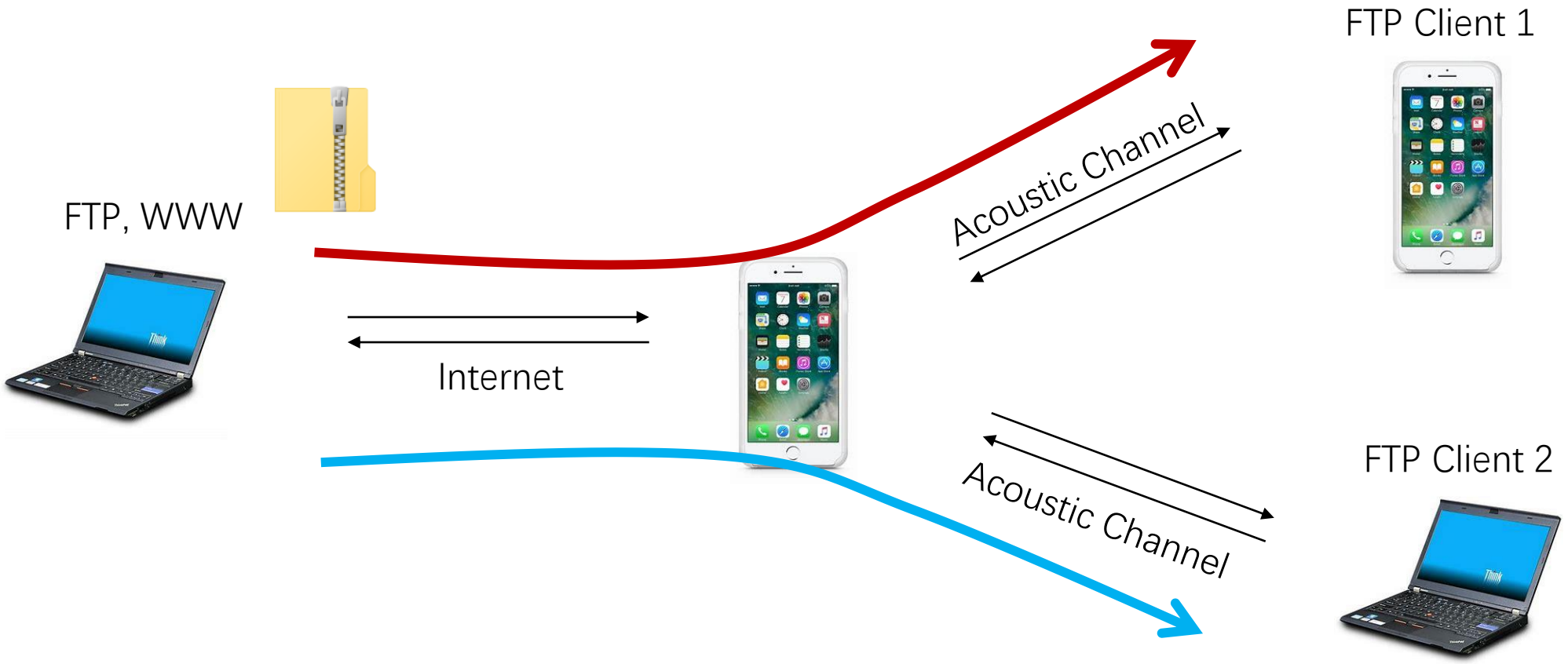
Subproject 3

- NAT
  - Implement a gateway to connect the network to the Internet



Subproject 4

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



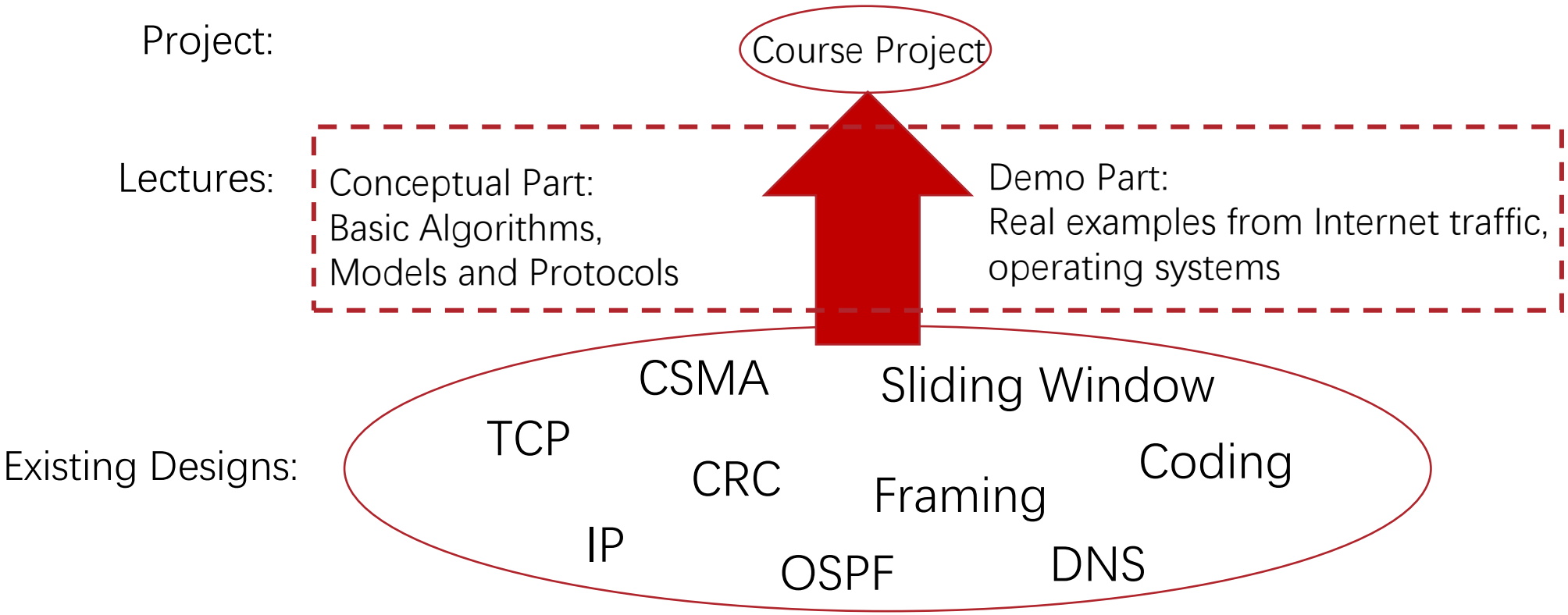
About the Project

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

Still Very Challenging …

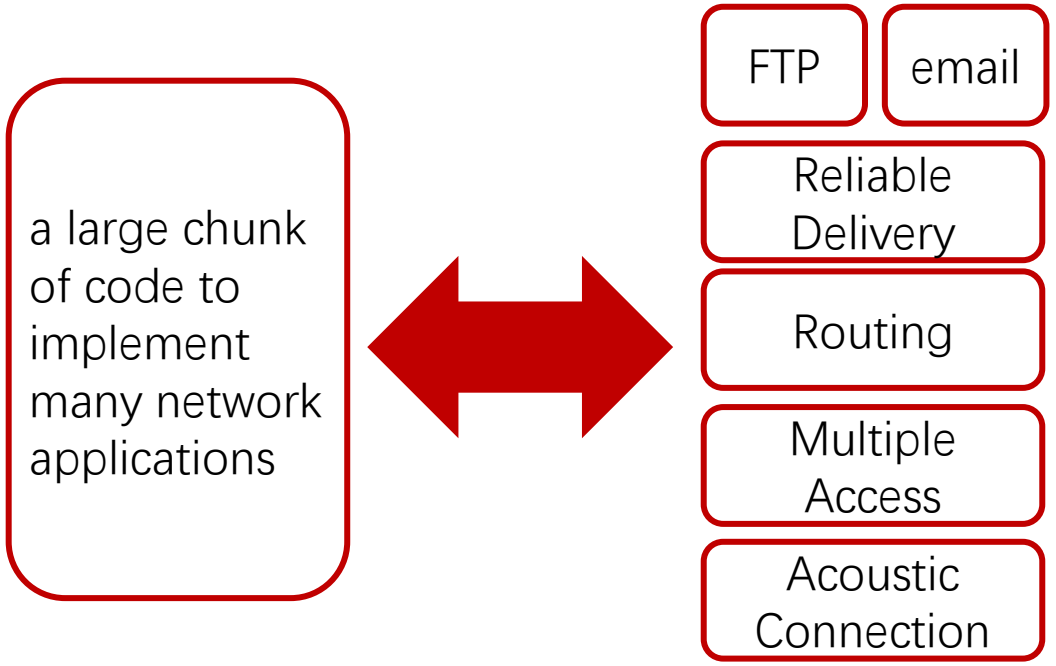
Shoulders of Giants

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



The Concept of Network Layering

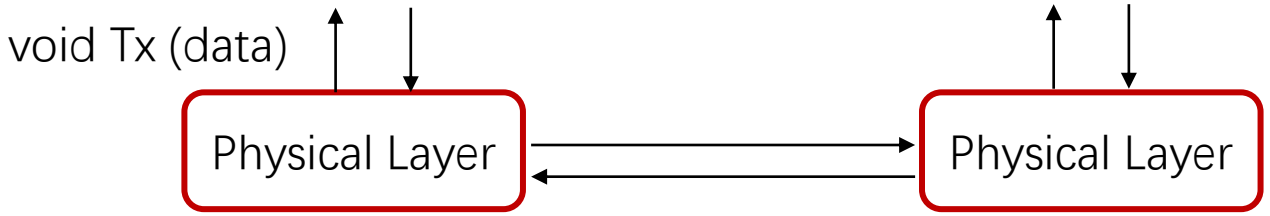
- Benefit
  - Modular Design



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 ?



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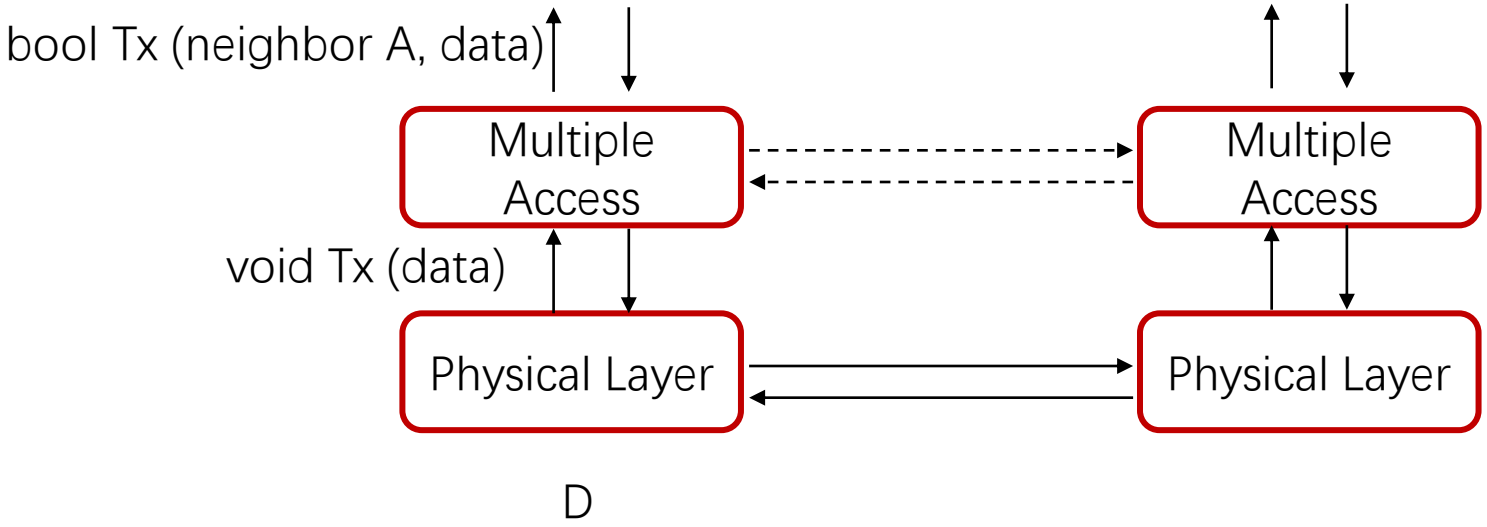
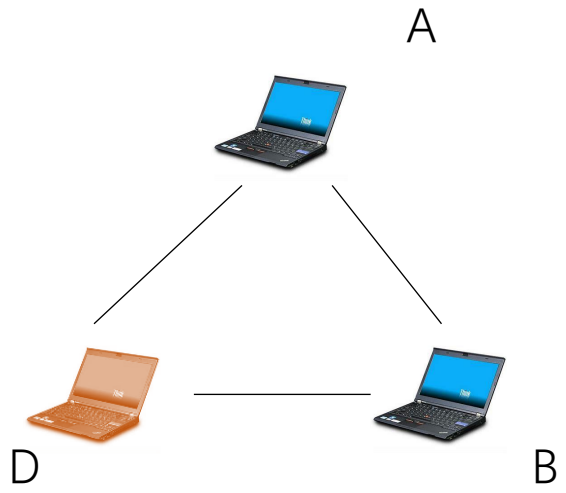
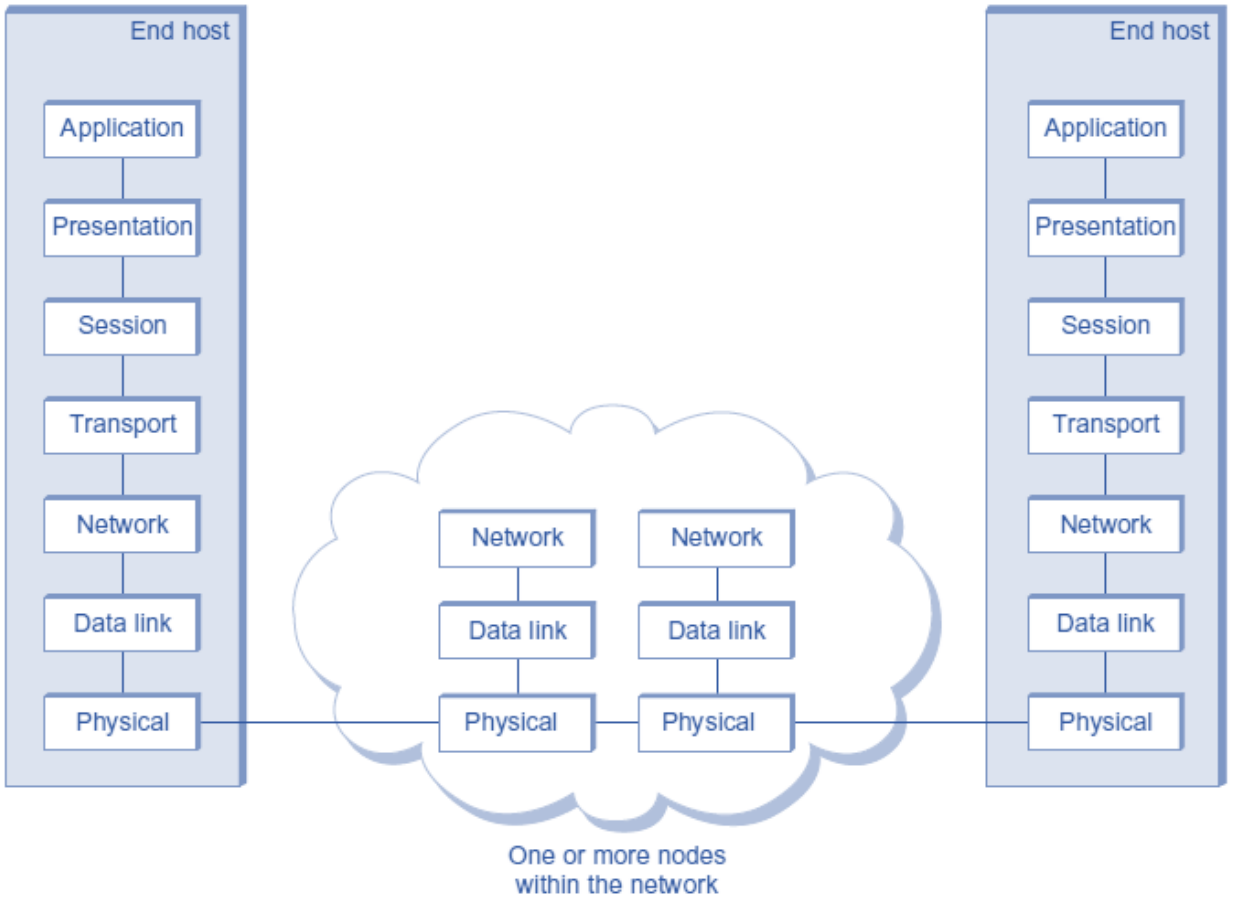


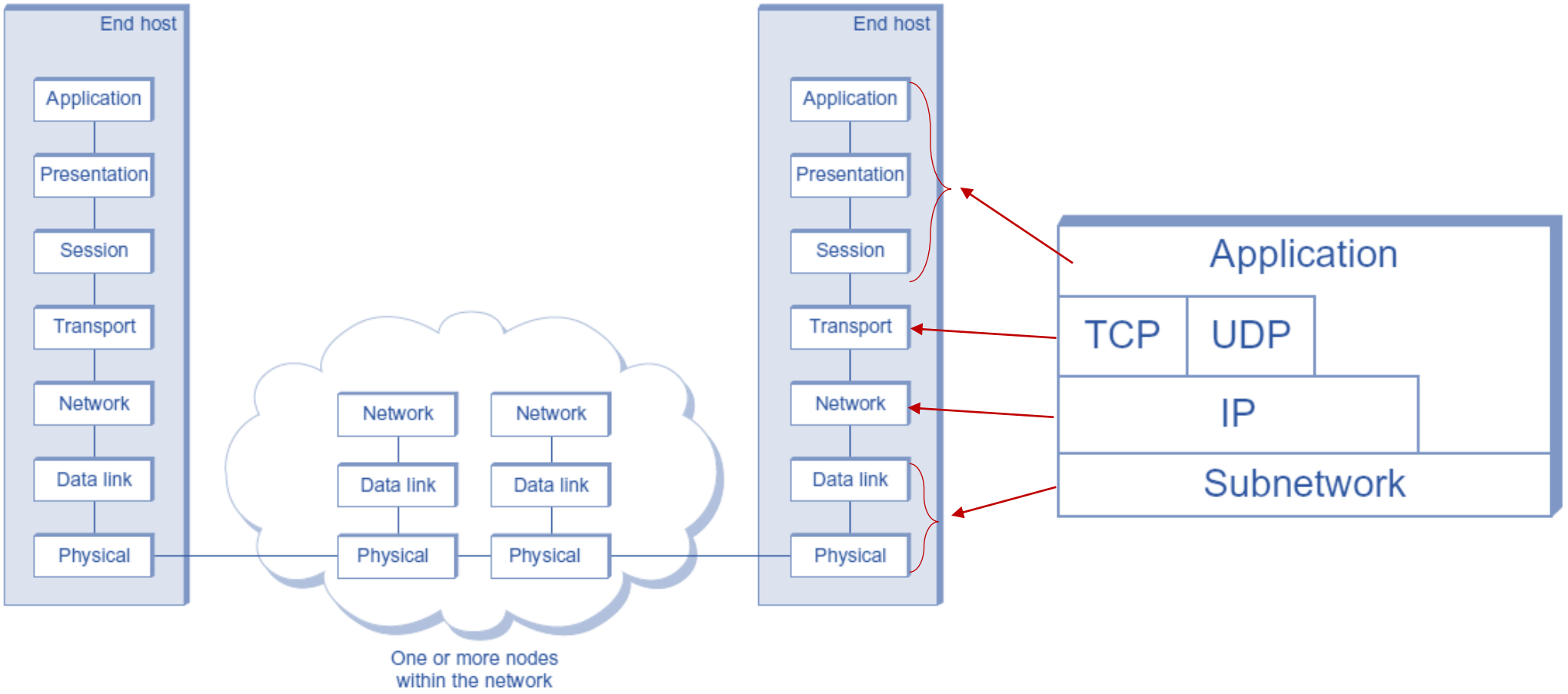


Canonical Layer Model

- OSI 7 Layer Model



Layering of the Real Internet



Layering of the Real Internet