

Computer Networks

Fall 2018

Jiaqi Zheng (郑嘉琦)

Material with thanks to Mosharaf Chowdhury, Chen Tian and other colleagues.

Welcome Back !



Instructor: Jiaqi Zheng(郑嘉琦)

- Information

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- jzheng@nju.edu.cn

Research focus on using mathematical modeling as well as building systems to explore and understand the design of large-scale computer systems.

Textbook

- Kurose and Ross, [Computer Networking: A Top-Down Approach](#), 7th Edition, Pearson, 2017. ISBN 978-0133594140.



Prof. Jim Kurose



Prof. Keith W. Ross



陈鸣 教授

Schedule

日期/周	周二	周四	阅读材料
9.3-9.9 (一)	0-introduction	Exp1	
9.10-9.16 (二)	01-overview	02-protocol layer	1.1, 1.3, 1.4, 1.5
9.17-9.23 (三)	21-link layer	Exp2	6.1, 6.3, 6.4.2
9.24-9.30 (四)	22-switched LAN	23-wireless	6.4, 7.1, 7.2, 7.3
10.1-10.7 (五)	国庆放假	Exp3	
10.8-10.14 (六)	31-network layer	32-ip routers	4.1, 4.2, 4.3.1, 4.3.2, 4.3.5
10.15-10.21 (七)	33-routing basics	Exp4	5.1
10.22-10.28 (八)	34-routing algorithm	35-inter as routing	5.2, 5.3, 4.3.3
10.29-11.4 (九)	36-bgp	Exp4	5.4
11.5-11.11 (十)	41-transport layer	42- tcp basics	3.1, 3.2, 3.3, 3.4, 3.5
11.12-11.18 (十一)	43-flow & congestion control	Exp5	3.6, 3.7
11.19-11.25 (十二)	44-congestion control	51-http and web	2.2
11.26-12.2 (十三)	52-dns and cdn	Exp6	2.4
12.3-12.9 (十四)	53-video stream and cloud	61-security	2.6, 8.1, 8.6, 8.7
12.10-12.16 (十五)	62-Datacenter Networks	Exp6	6.6
12.17-12.23 (十六)	63-Network in datacenters	64-sdn	4.4, 5.5
12.24-12.30 (十七)	Review	Review	

Class workload

- Classroom
- Six experiments
 - 25%
- Home work
 - 15%
- Final exam
 - 60%
- Seminar (optional)

Communication protocol

- QQ group: 869992936
- TA: 博士研究生 何昕、高翼皋
- TA hours:
 - Every Monday
 - 20:00-22:00
- Experiments
 - 基础实验楼乙124机房
 - 单周
 - njunet18fall@163.com 交报告

Question

- What do you expect to learn from this course ?

Agenda

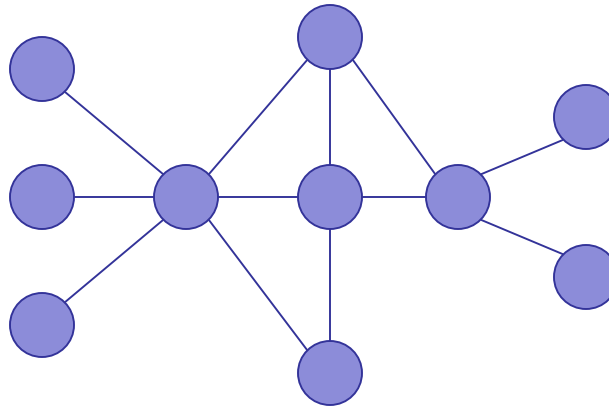
- Introductions
- What is (this course on) networking about?
- Why it is useful?
- How to proceed?
- Where are the resources?

What is missing?

- How do we access *most* services?
 - Examples include search engines, social networks, video streaming, etc.
- How do two machines communicate?
 - When they are directly connected
 - When they are not directly connected
- Using a network

What is a network?

- A system of “links” that interconnect “nodes” in order to move “information” between nodes



- Yes, this is very vague

There are many different types of networks

- Internet
- Telephone network
- Transportation networks
- Wireless networks
- Optical networks
- Datacenter networks

We will focus primarily on *the Internet*

The Internet is transforming everything

- The way we do business
 - E-commerce, advertising, cloud-computing
- The way we have relationships
 - Facebook friends, E-mail, IM, virtual worlds
- The way we learn
 - Wikipedia, MOOCs, search engines
- The way we govern and view law
 - E-voting, censorship, copyright, cyber-attacks

The Internet consists of many end-systems

● ● ● car navigator

● heart pacemaker

smartphone ●

end-system



iPad ●

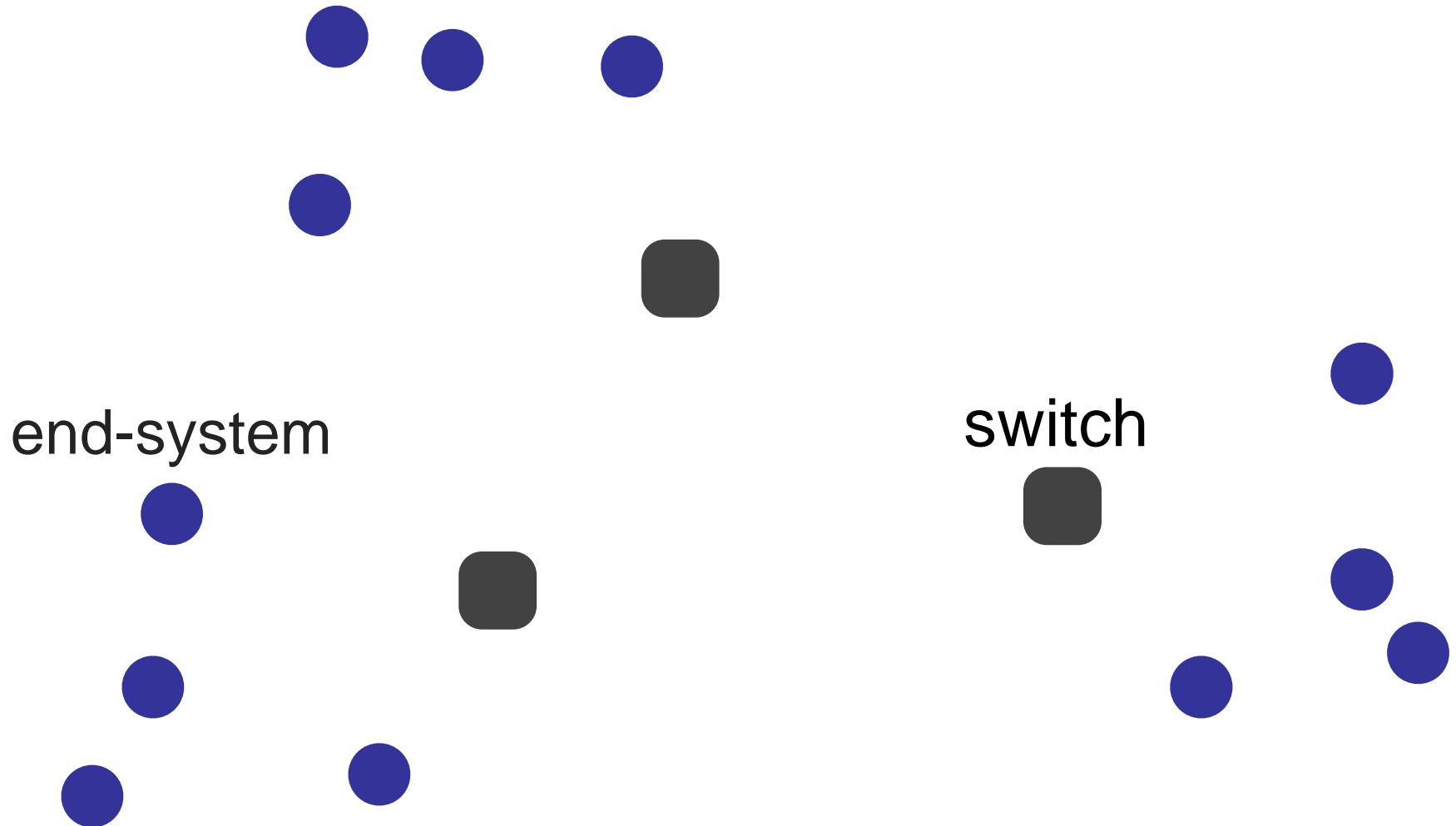
● Linux server

MAC laptop ●

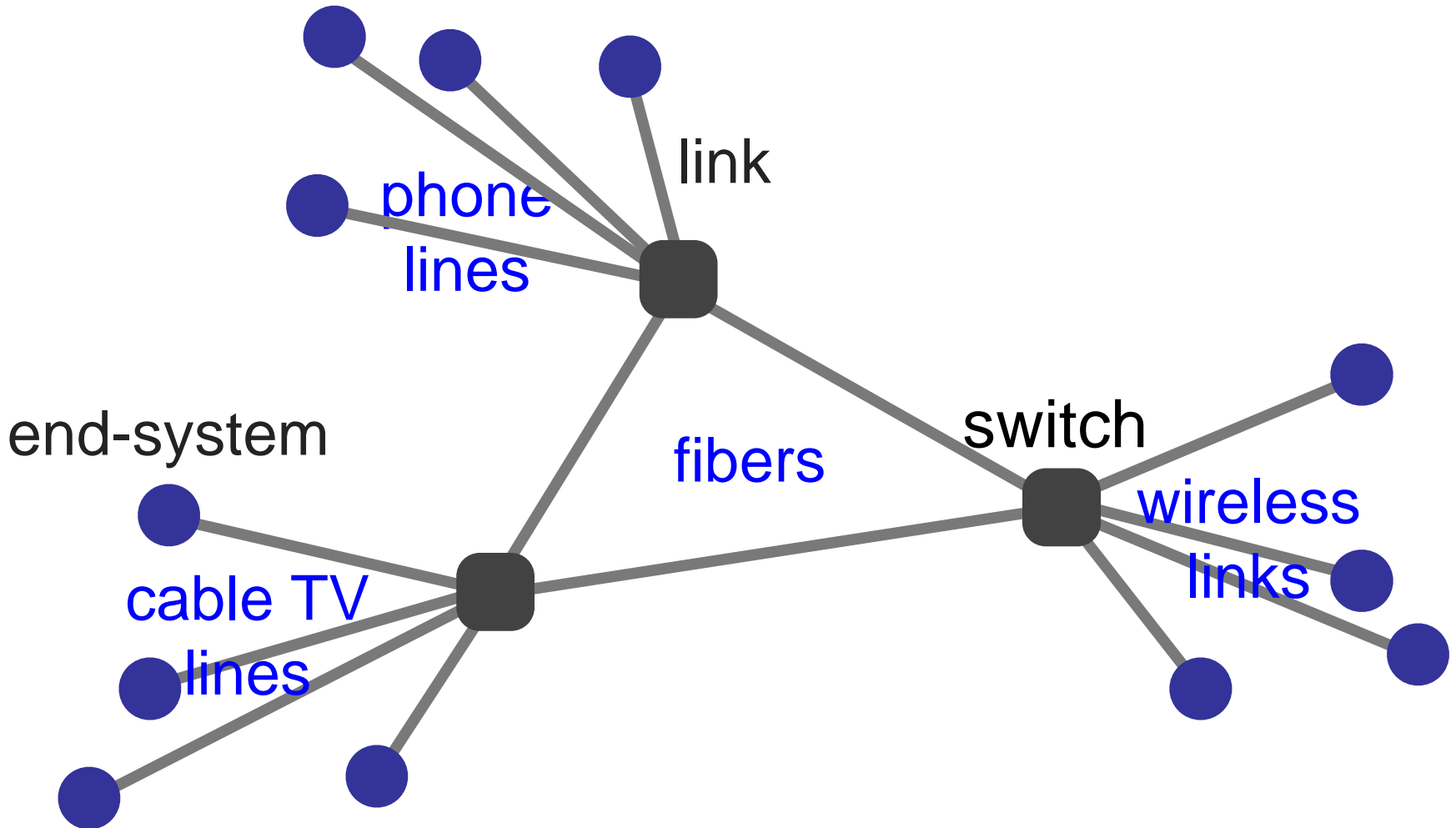


Windows PC

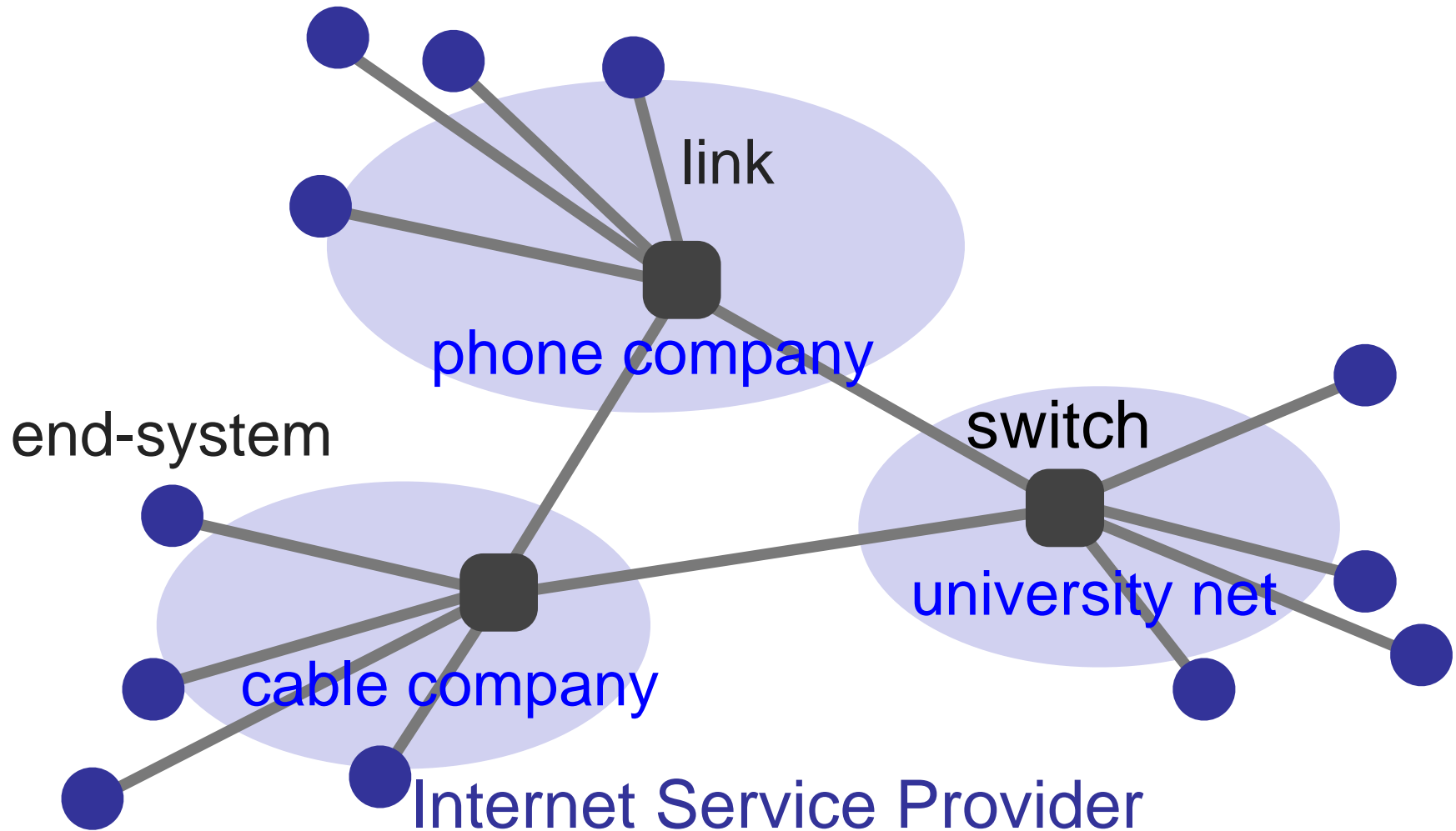
Connected by switches



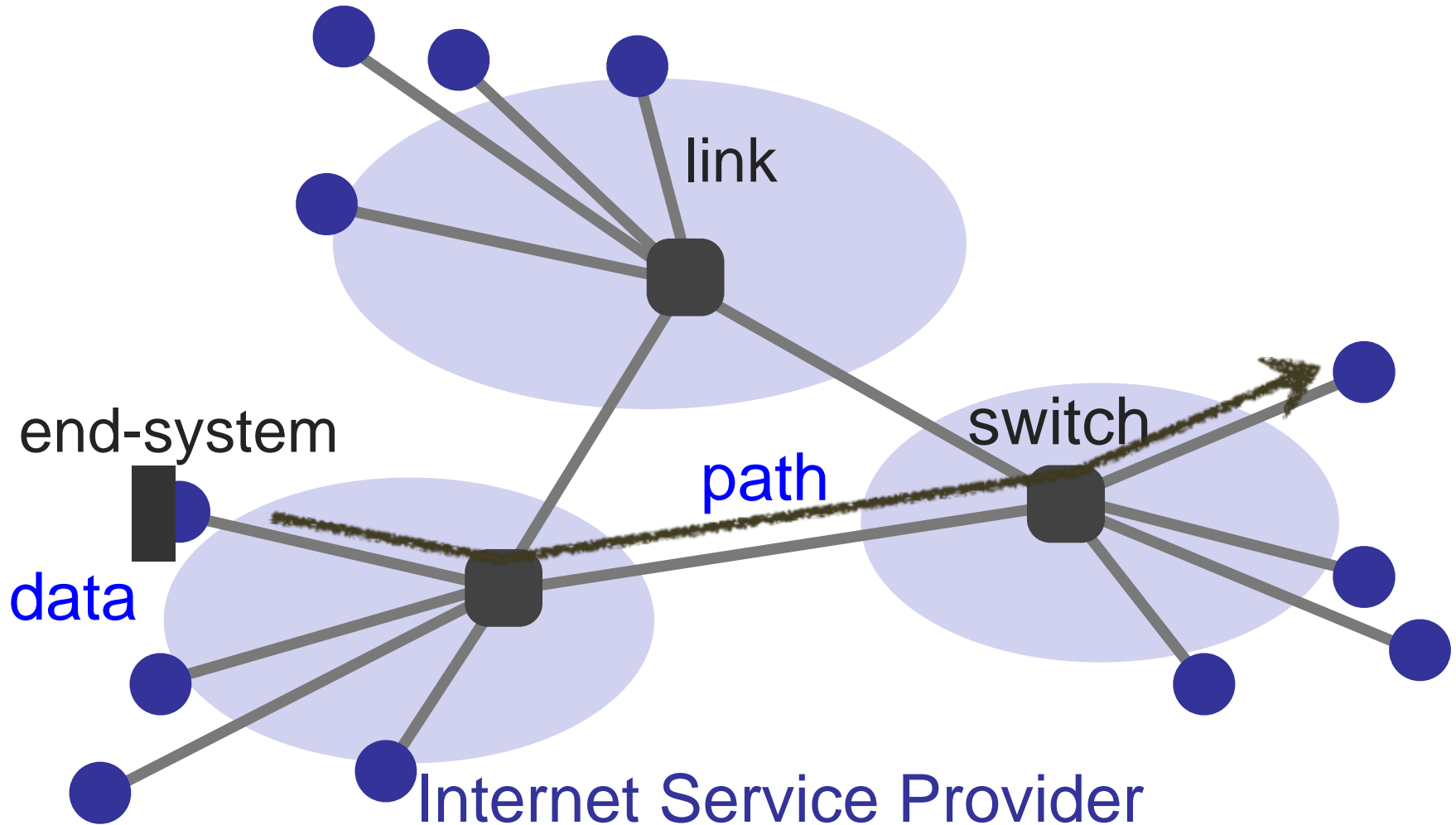
And links



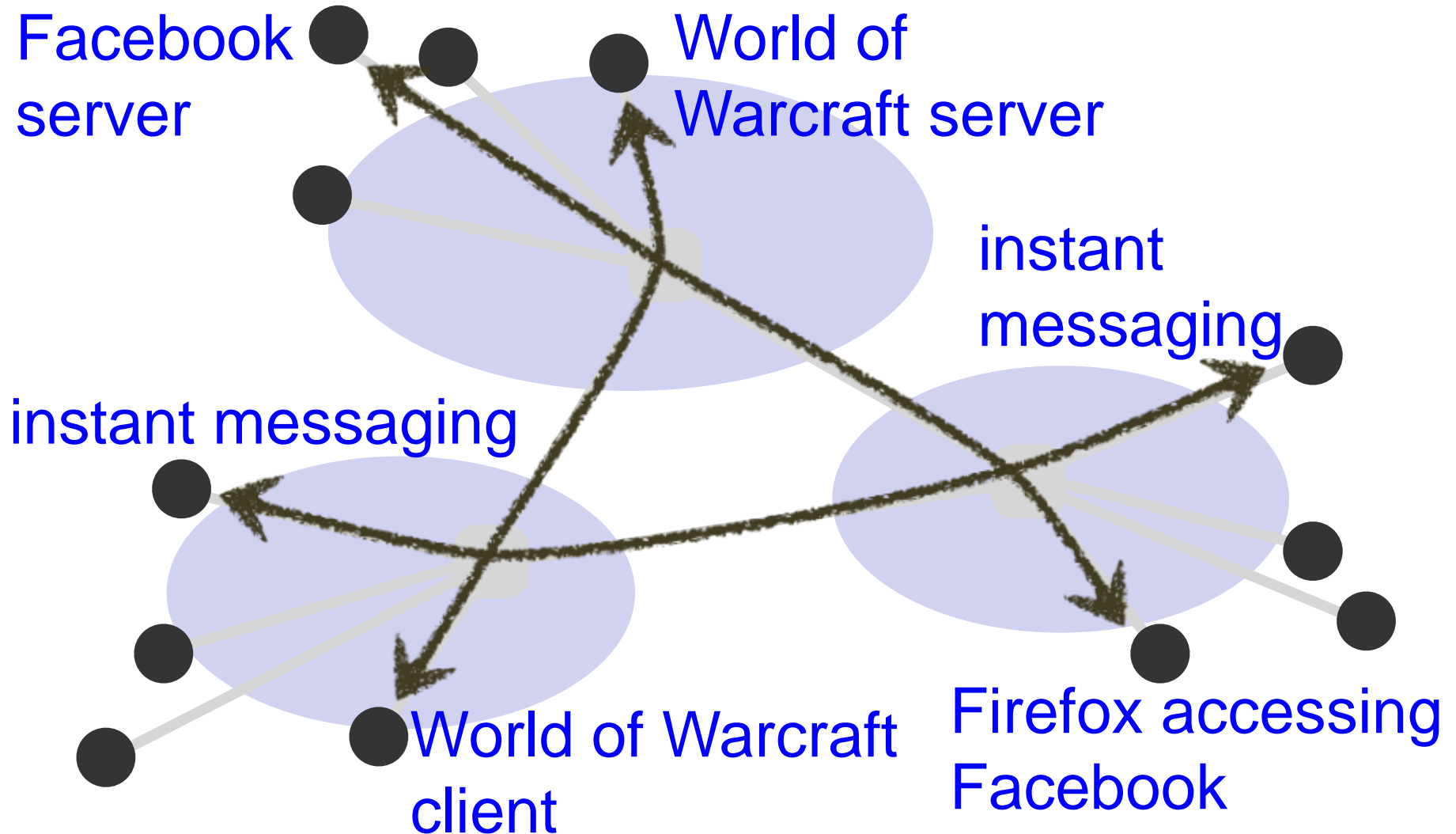
Managed by many parties



Transfers data

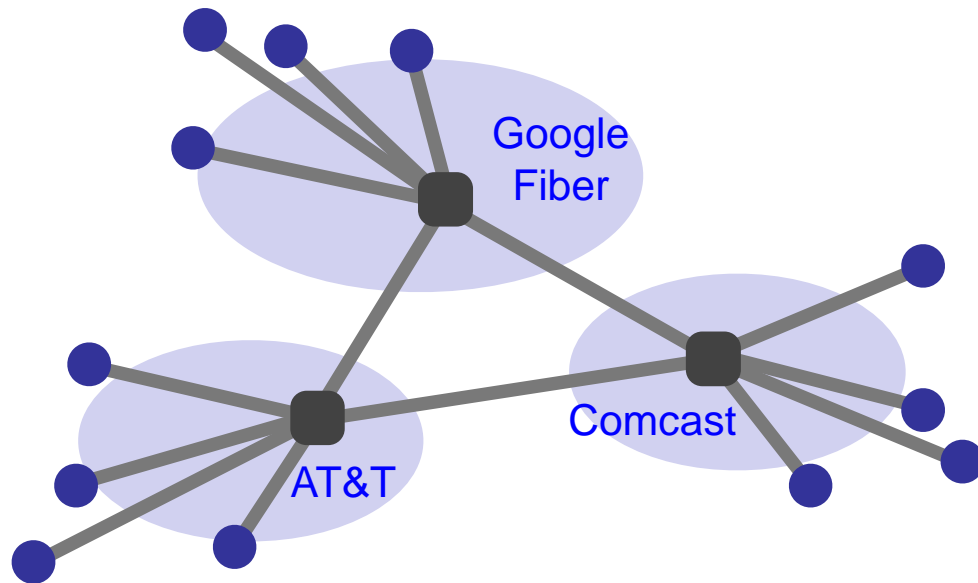


Shared among many services



A federated system

- The Internet ties together different networks **by the IP protocol**
 - *One interface to bind them all together*



Why a common interface?

- The Internet ties together different networks
 - >18,000 ISP networks
- Interoperability between users and networks as well as between different networks

MASSIVE Scale

- 3.5 Billion users (34% of world population)
- 1 Trillion websites
- 200 Billion emails sent per day
- 2 Billion smartphones
- 1.8 Billion Facebook users
- 4 Billion YouTube videos watched per day
- Routers that switch 10 Terabits/second
- Links that carry 100 Gigabits/second

Diversity in all dimensions

- Technology
 - Optical, wireless, satellite, copper
- Endpoint devices
 - From wearable devices and cell phones to datacenters and supercomputers
- Applications
 - Video streaming, social networking, file transfer, Skype, live TV, gaming, remote medicine, IM
- Users
 - Malicious, naïve, savvy, embarrassed, paranoid

The Internet is also

- Constantly evolving
- Decentralized
 - Many parties with (often conflicting) interests
- Failure-prone
 - Physical errors, logic errors, human errors, etc.
- Constrained by technology
 - Speed of the light is the limit (so far!)

Have we found the right solution?

- We don't really know
- What we do know
 - The early Internet pioneers came up with a solution that was successful beyond all imagining
 - Several enduring architectural principles and practices emerged from their work
- Still, it is just one design with many questions

The Internet is a lesson

- In how to reason through the design of a very complex system
 - What are our goals and constraints?
 - What's the right prioritization of goals?
 - How do we decompose a problem?
 - Who does what? How?
 - What are the interfaces between components?
 - What are the tradeoffs between design options?

Case study



What is this course about?

- To learn about (at a high level)
 - How the Internet works
 - Why it works the way it does
 - How to reason about complicated design problems
- What it's not about
 - How to write web services
 - How to design web pages
 - ...

Topics we will cover

- Basics
 - Packets, circuits, multiplexing, delay, loss, protocols
- Lower-level technologies
 - Ethernet, wireless
- What make networks tick
 - IP, routing protocols, BGP
- How do endpoints/applications use the network
 - DNS, CDN, HTTP, TCP
- Emerging/hot topics
 - Datacenters, management, security, SDN

Participation

- Ask and answer questions!!
 - It helps you understand and others too
 - It helps you stay awake
 - It helps me stay awake
- Sit toward the front

Summary

- Learning about the Internet and networking in general is
 - important and relevant
 - lots of fun – challenging real-world problems

