2015 SPRING
CNCE461: COMMUNICATION NETWORKS
통신네트워크

(0. Overview & Introduction)

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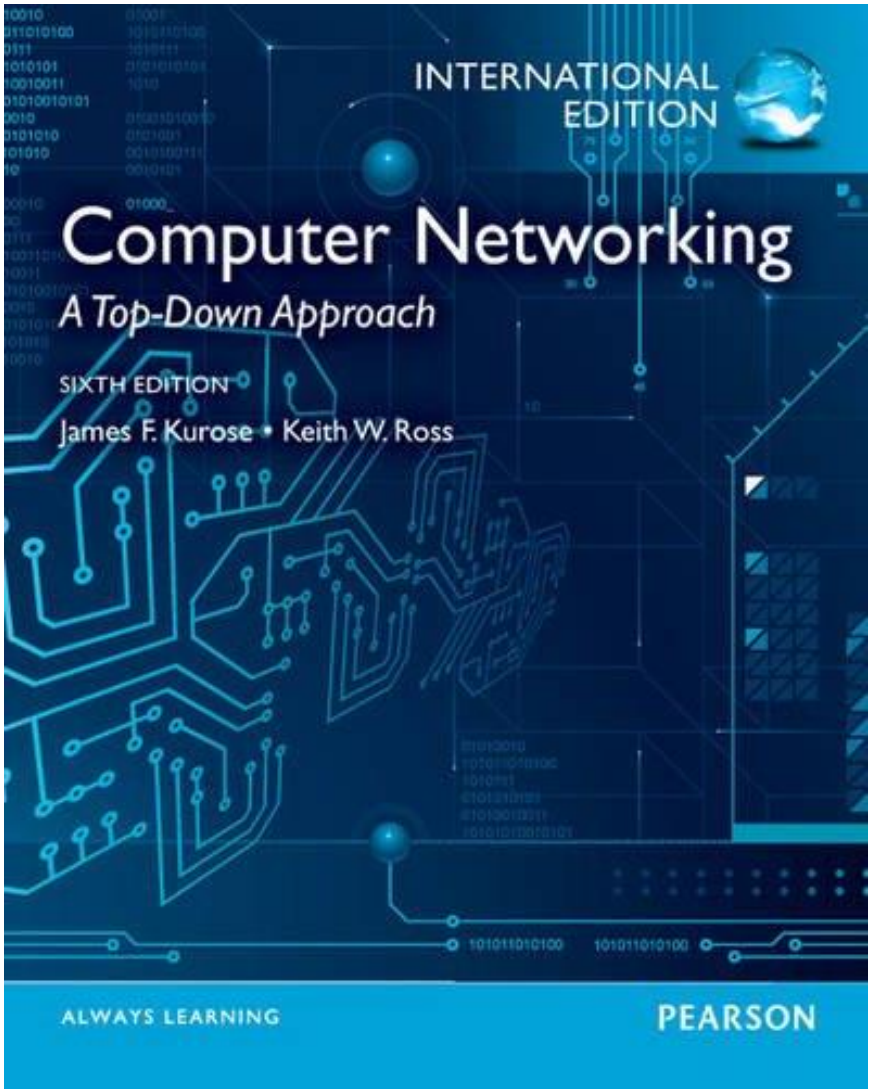
- International edition



Important Announcements

- Students must submit **all** the programming project reports with source codes. Otherwise you will get the lowest grade (i.e., F)
- **Not taking the final exam means** an F for the final course grade
- No change on the final grade once it is given
- **Any kinds of negotiation (for graduation, getting a job, whatever) will never be allowed, as before!**

Goals for Today's Class

- Quick overview (for those who've newly joined my class!)
  - Goals of the course
  - Structure of the course
  - Learning the material
  - Programming assignments
  - Course grading
  - Academic policies

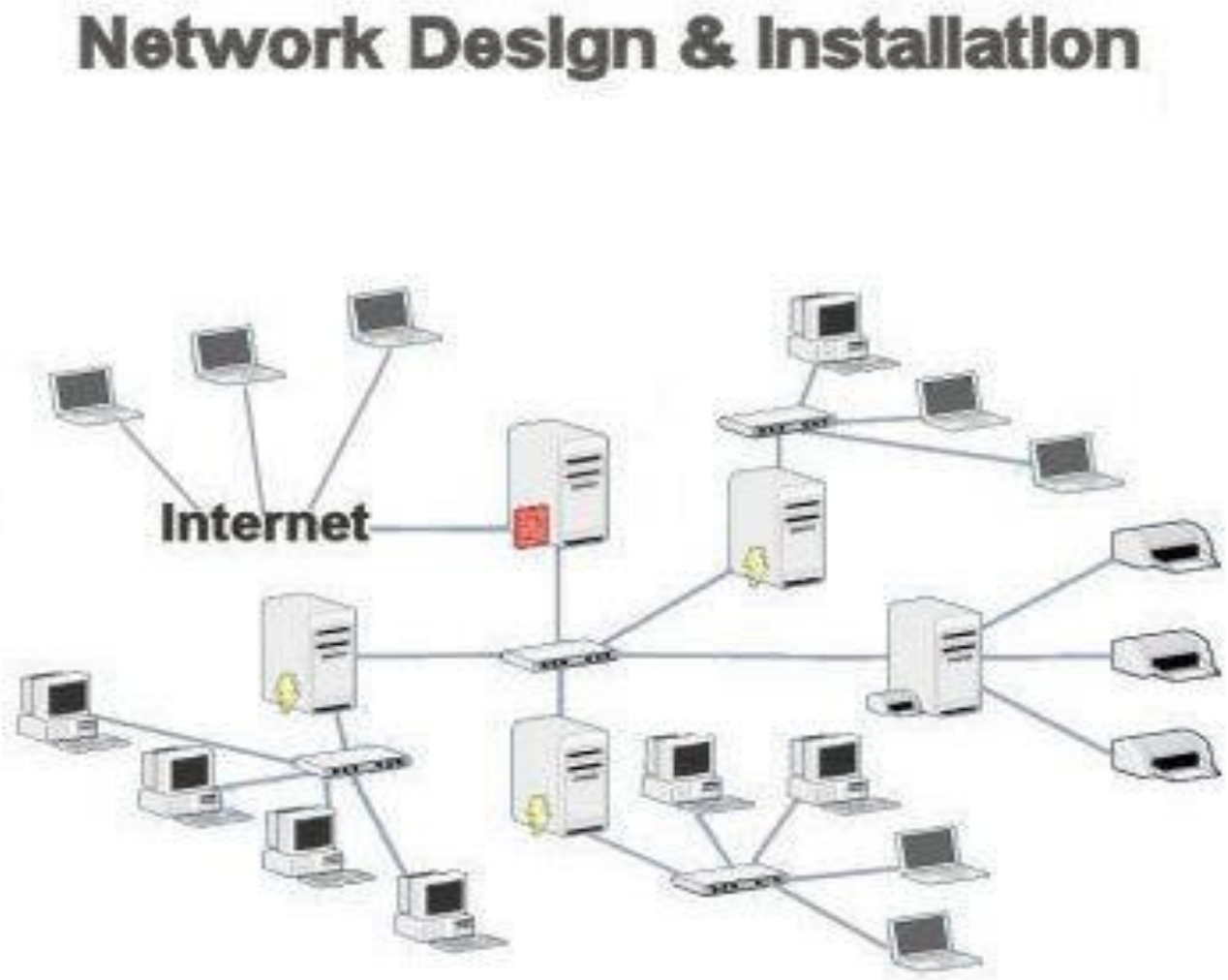
- Key concepts in data networking
  - Protocols
  - Layering
  - Resource allocation

What is a Network?

- In this course, the following topics are covered:
  - Fundamental design principles of **computer networks**
  - Standard protocols for (un)reliable data communication in **computer networks**
  - Performance evaluation techniques for various **network** technologies

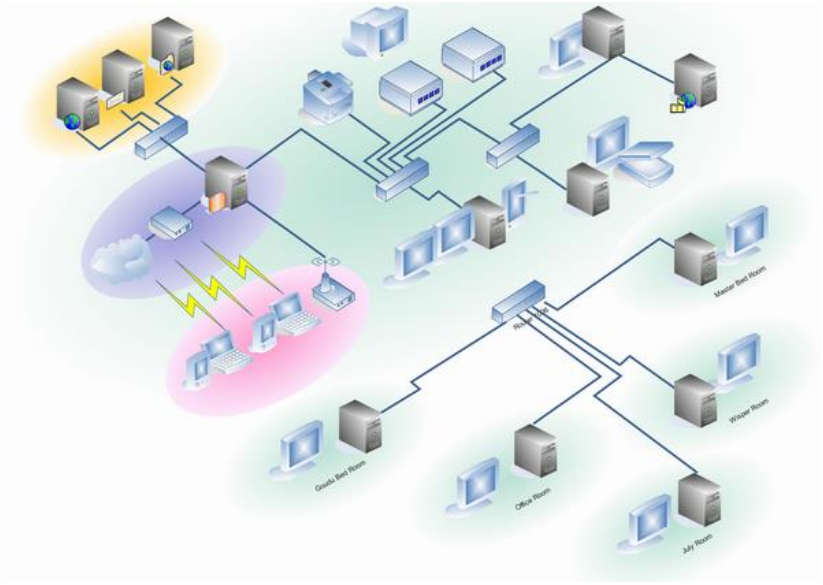
- ***Then, what is a network?***

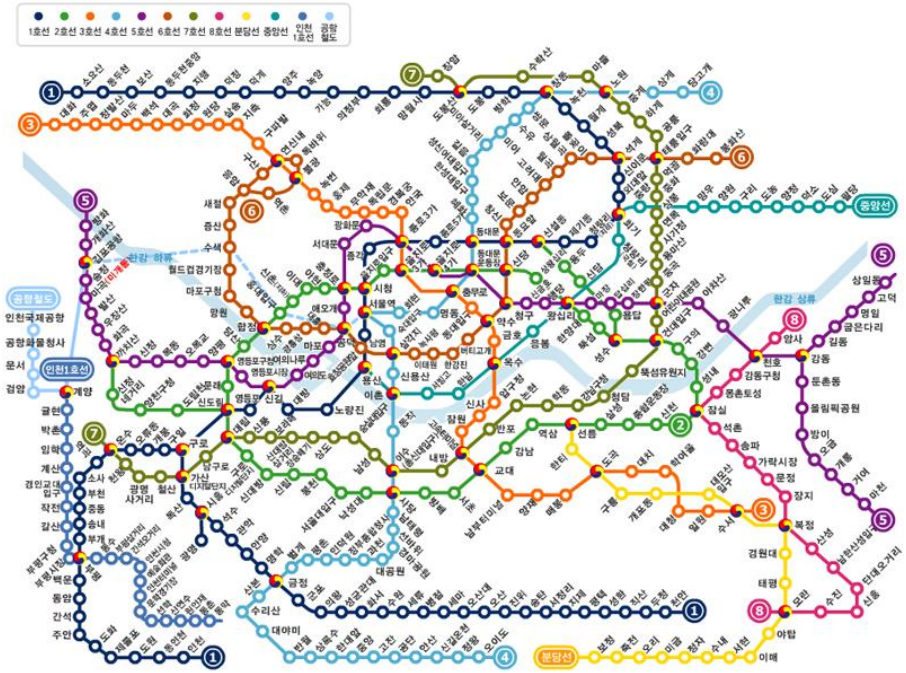
What is a Network?



What is a Network?

- **Network**
  - **A system that carries a commodity between 2 or more entities**
    - *e.g.,* Transportation network, electric grid, postal, water, telephone
- **Computer Network**
  - Collection of general-purpose computers interconnected by communications channels in which information moves
    - Sometimes, a unspecified set of networks is called as a **cloud**






넷기어 속성
일반
고급
연결에 사용할 장치:
Intel 21140-Based PCI Fast Ethernet Adapter (Generic)
구성(C)...
이 연결에 다음 항목을 사용(O):
Microsoft 네트워크용 클라이언트
Microsoft 네트워크용 파일 및 프린터 공유
QoS 패킷 스케줄러
인터넷 프로토콜(TCP/IP)
설치(N)...
제거(U)
속성(R)
설명
전송 컨트롤 프로토콜/인터넷 프로토콜. 기본적인 광역 네트워크 프로토콜로, 다양하게 연결된 네트워크상에서 통신을 제공합니다.
연결되면 알림 영역에 아이콘 표시(W)
확인
취소

TCP/IP protocol stack

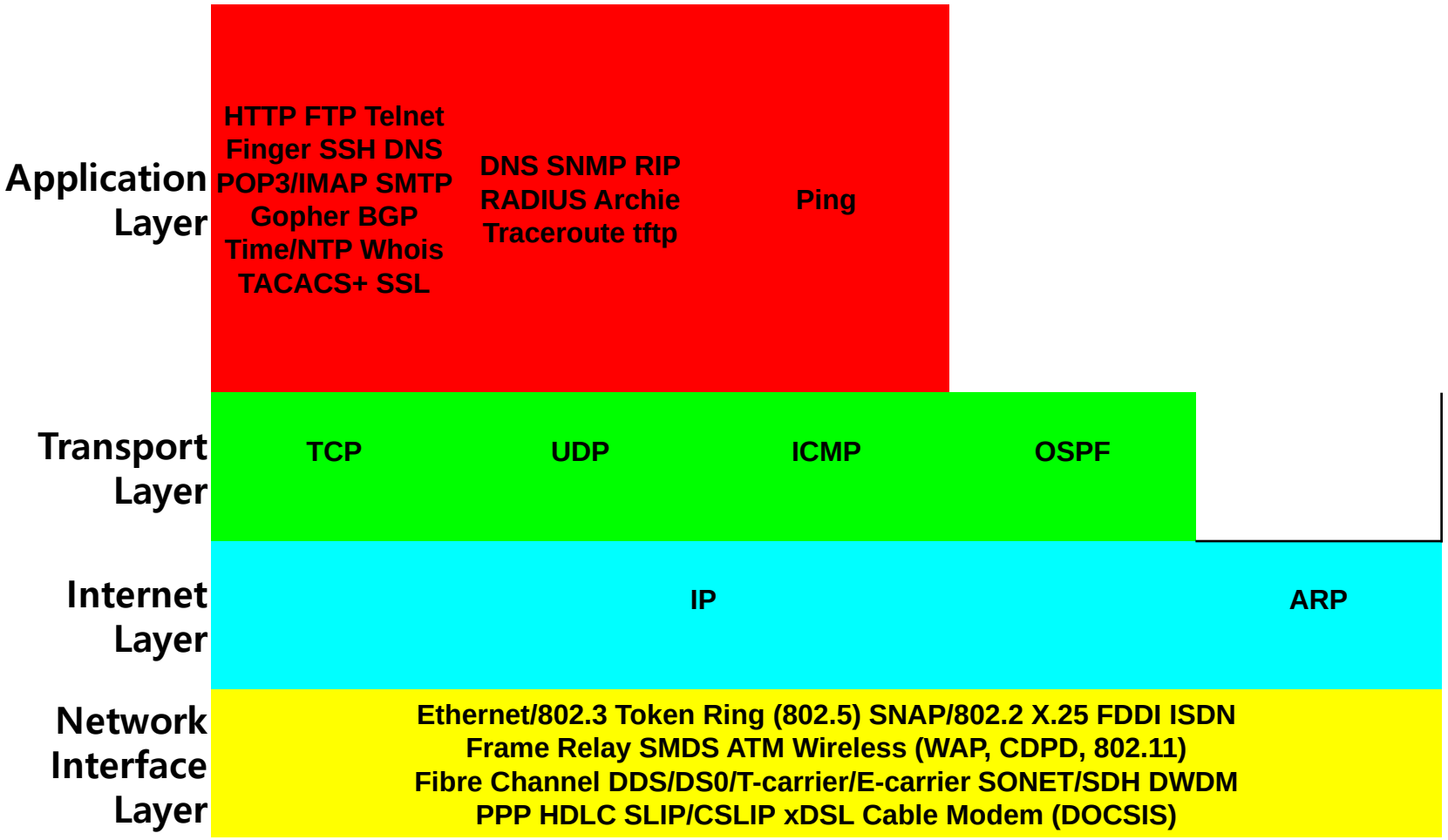


FIGURE. Abbreviated TCP/IP protocol stack.

Requirements for Computer Networking

- Definition of a computer network:
  - A *shared* platform through which a *large* number of users and applications *communicate* with each other.
- Connectivity: *who and how to connect?*
- Scalability: *how many to connect?*
- Resource sharing: *how to utilize the connectivity?*
  - Packet switching in datacom
  - Circuit switching in telecom

Node: Host or Intermediary

- Host
  - Mainframe, workstation, desktop, hand-held, set-top-box, etc.
  - Act as client or server, or both
- Intermediary
  - Hub, switch, router, gateway, etc.
  - Wire-speed processing is a goal
  - Embedded system with special ICs for speedup or cost reduction

Link: Point-to-Point or Broadcast

- **Access type**
  - **Point-to-Point**
    - Simplex, half-duplex, full-duplex
    - Usually WANs
  - **Broadcast**
    - Multiple access: contend to transmit
    - Usually LANs (exception: satellite-based ALOHA)
- **Media type**
  - **Wired**
    - Twisted pair, coaxial cable, fiber optics
  - **Wireless**
    - Radio(10^4~10^8 Hz), microwave (10^8~10^{11} Hz), infrared (10^{11}~10^{14} Hz)

Popular Wired and Wireless Link Technologies

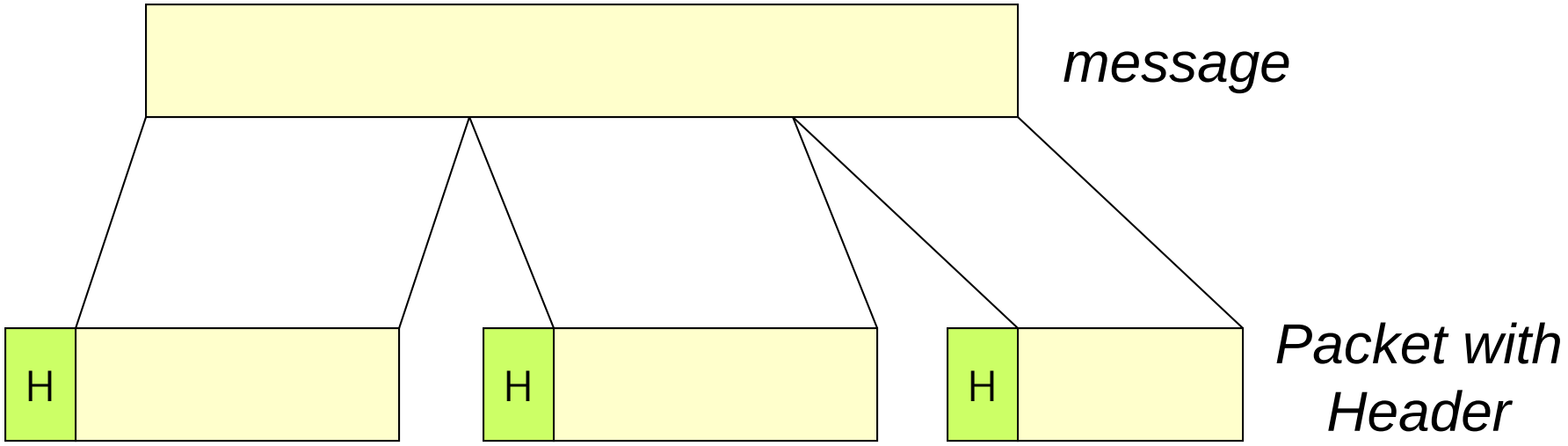
	Wired	Wireless
Local	Cat-5 twisted-pair Ethernet (10 Mbps ~ 1 Gbps)	2.4 GHz band WLAN (2 ~ 54 Mbps ~ 600 Mbps)
Last-mile	POTS (28.8 ~ 56 kbps) ISDN (64 ~ 128 kbps) ADSL (16 kbps ~ 55.2Mbps) CATV (30 Mbps) FTTB (10 Mbps ~)	GPRS (128 kbps) 3G (384 kbps ~ several Mbps) WiMAX (40 Mbps)
Leased-line	T1 (1.544 Mbps) T3 (44.736 Mbps) OC-1 (51.840 Mbps) OC-3 (155.250 Mbps) OC-12 (622.080 Mbps) OC-24 (1.244160 Gbps) OC-48 (2.488320 Gbps) OC-192 (9.953280 Gbps) OC-768 (39.813120 Gbps)	

Transmission Time and "Length" of a Bit

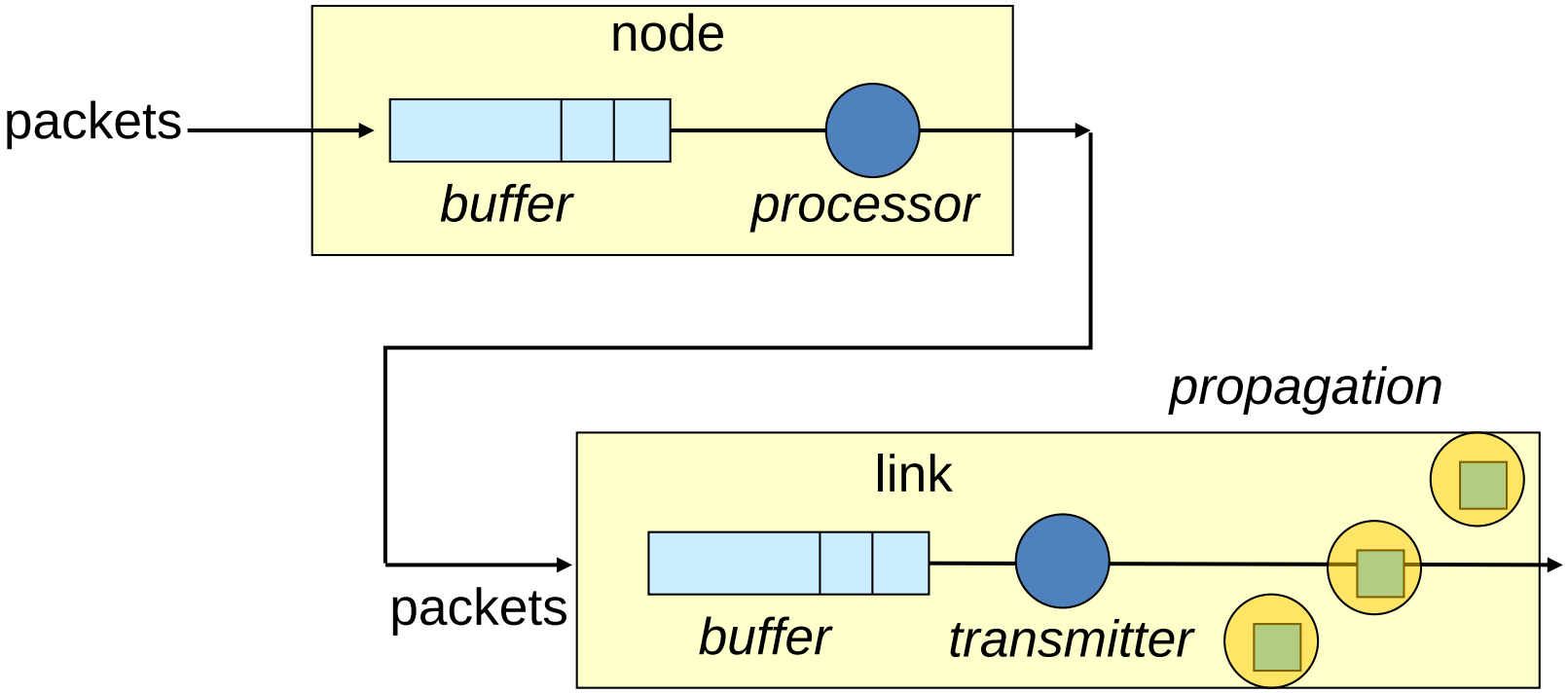
- Bandwidth
  - The maximum amount of data that can be handled by a system in a second
  - The number of bits transmitted and *contained* in the distance *propagated* by the signal in one second

Packetization a Message

Decomposing a message into packets with added header



Queuing at a Node and a Link



Key Concepts in Networking

- Protocols
  - Speaking the same language
  - Syntax and semantics
- Layering
  - Standing on the shoulders of giants
  - A key to managing complexity
- Resource allocation
  - Dividing scare resources among competing parties
  - Memory, link bandwidth, wireless spectrum, paths, …
  - Distributed vs. centralized algorithms
- Naming
  - What to call computers, services, protocols, …