CPS 470
Data Communication Fall 2010

Course Overview and Introduction

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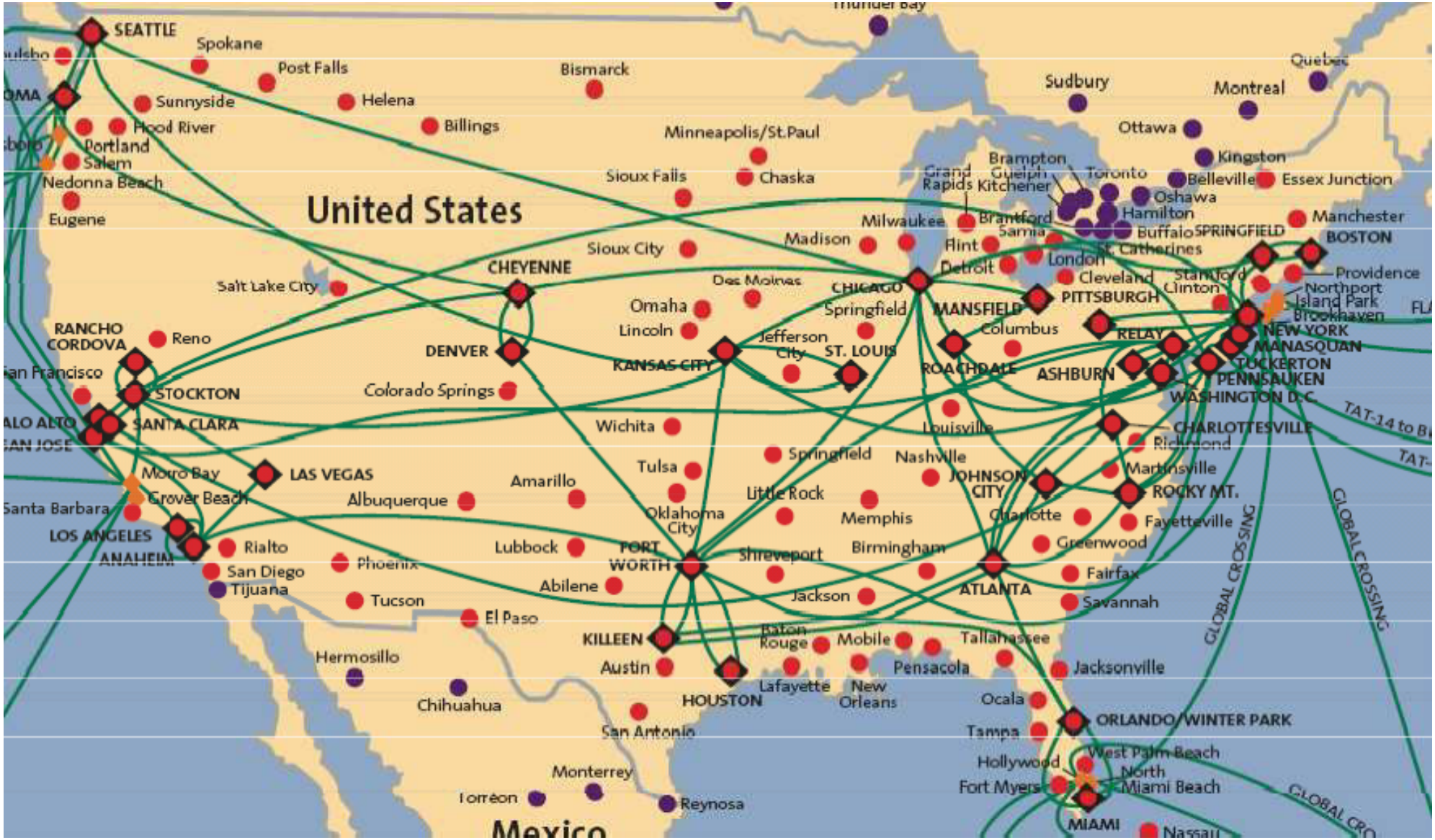
Efrei

9-20-2016

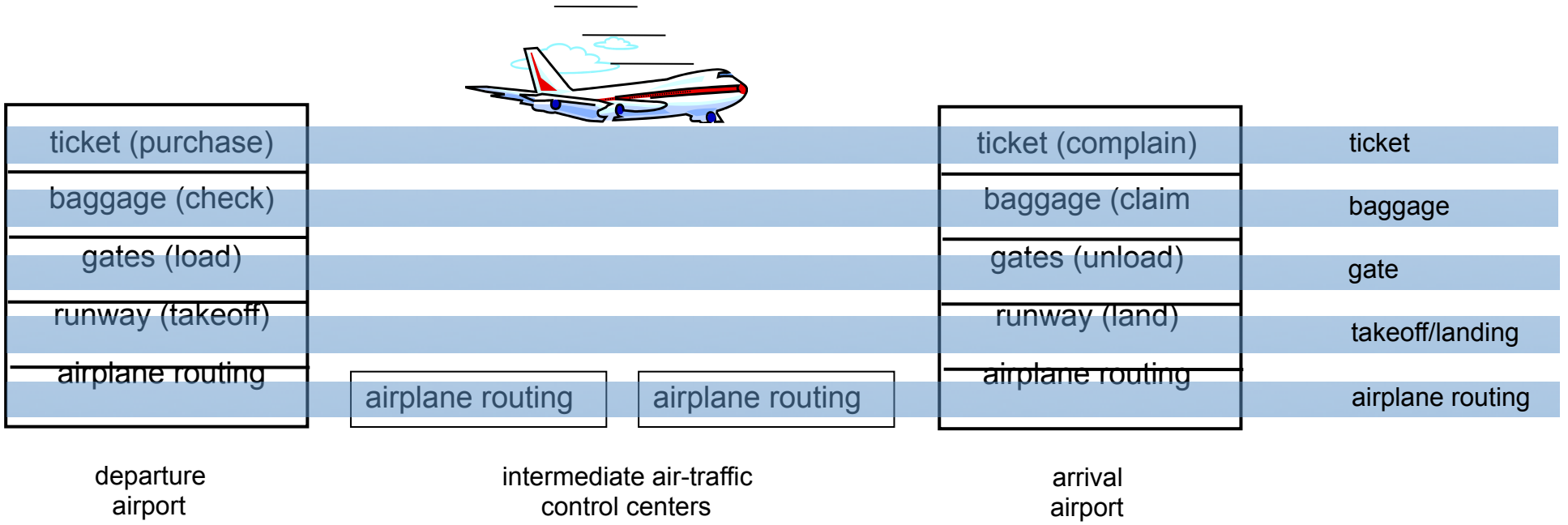
Agenda

- Overview
- Syllabus
- Academic integrity
- Homework expectations
- Introduction to computer networking
- Questions

The Internet



Layering of Airline Functionality

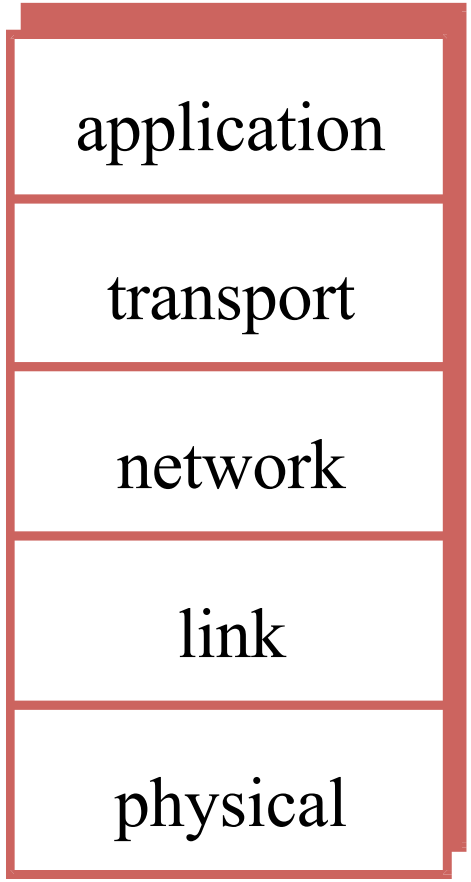


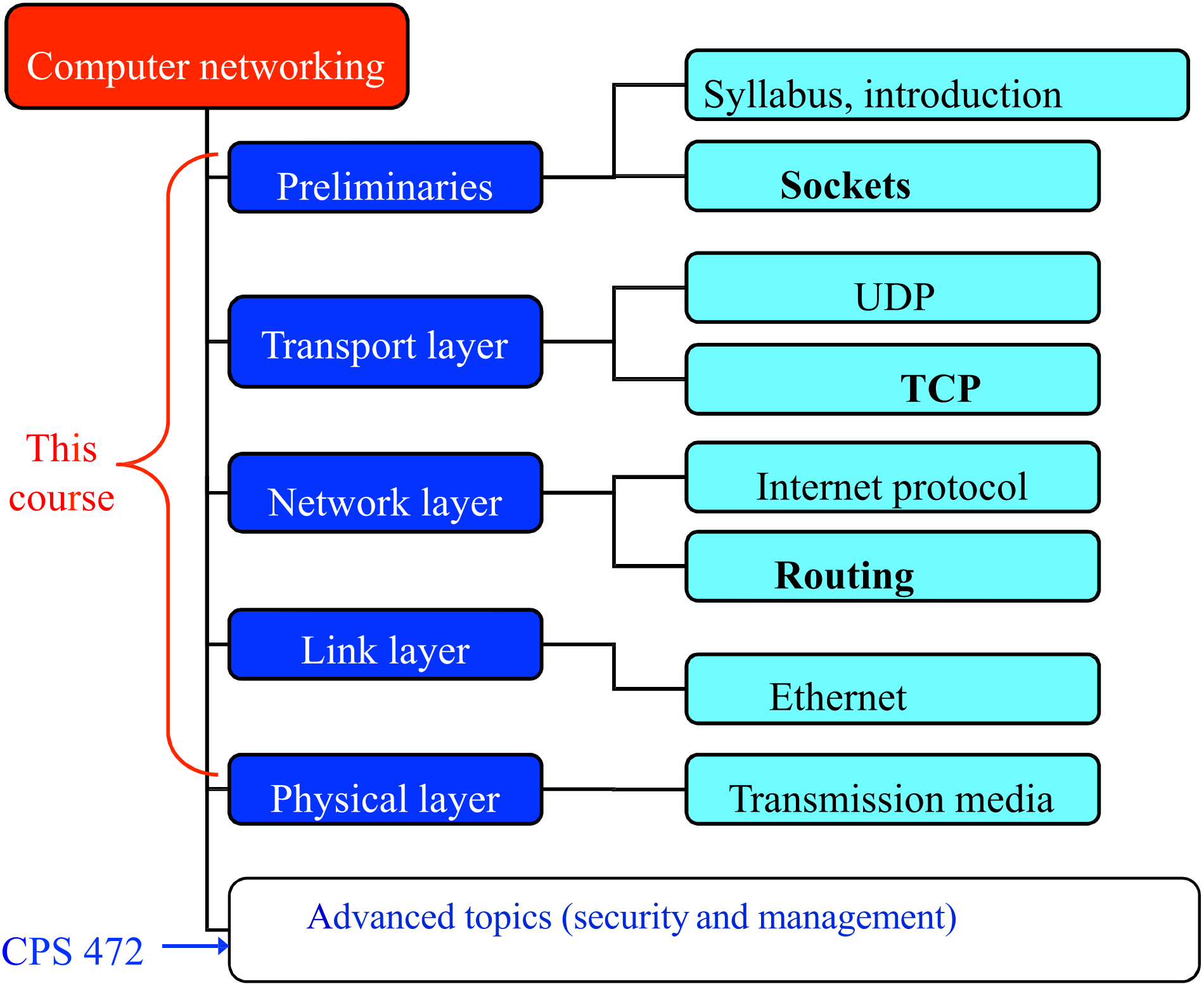
Layers: each layer implements a service

- Via its own internal-layer actions
- Relying on services provided by layer below

Internet Protocol Stack

- Application: supporting network applications
  - FTP, SMTP, HTTP
- Transport: process-process data transfer
  - TCP, UDP
- Network: routing of datagrams from source to destination
  - IP, routing protocols
- Link: data transfer between neighboring network elements
  - PPP, Ethernet
- Physical: bits "on the wire"




Computer networking
Syllabus, introduction
Preliminaries
Sockets
UDP
Transport layer
TCP
This course
Internet protocol
Network layer
Routing
Link layer
Ethernet
Physical layer
Transmission media
Advanced topics (security and management)
CPS 472

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Syllabus

- Theoretical Part
  - Instructor: **Dario VIEIRA**
    - Office: 4th floor of the building A
    - Email: dario.vieira@efrei.fr
- Practical Work (Travaux Pratiques – TP)
  - Instructor: **Maxime MARION**
    - Two groups of TP
      - English group
      - French group
- Final project
  - The same groups of TP
  - Team of 2 students
  - "Soutenance" (questions about code; questions about the whole project, etc.)

Syllabus

- DE: **15 December**

- Textbook
  - J.F. Kurose and K.W. Ross, "Computer Networking: A Top-Down Approach," Addison-Wesley, 5th edition, 2009 (4th edition OK too)

- Course website
  - All materials will be available at Campus Moodle
  - The Course Materials are mainly the slides given in class

Syllabus 2

- Course goals
  - Get “feel” and terminology
  - Understand principles behind network services
  - Conceptual, implementation aspects of network protocols
- Approach
  - Use Internet as example
  - Instantiation and implementation in the Internet

- This is not a Course about
  - Advanced Computer Network
  - Advanced Routing Protocol (BGP, OSPF, RIP…)
  - Advanced Security

Syllabus 3

- Prerequisites
  - Knowledge about Oriented Object Programming and C++/Java
  - Willing to work hard
- Desirable prerequisites
  - Integrated Development Environment (IDE)
    - Netbeans
    - Eclipse
    - Others

Syllabus 4

- Final Grade

1. Exams
   - Material covered in class and homework
     - Material: Slides available at Moodle Campus

2. Project
   - 1 programming assignment (30% of final grade)
   - Some homework

3. Practical Work (TP)

Syllabus 5

- Final grade distribution
  - A: 90~100%
  - B: 80~89%
  - C: 70~79%
  - D: 60~69%
  - F: 0~59%
- Feel free to ask for help!
  - Programming assignments may be time-consuming
  - Ask questions during class, office hours, appointments, or via email
  - Zhongmei: zyao@udayton.edu

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Academic Integrity

- No teamwork is allowed
  - General discussion is acceptable, but your solutions must be your own work
- Academic rules
  - See the Academic Honor Code at Campus Moodle
  - See Academic Dishonesty at Campus Moodle
  - Appropriately cite the source (including code!)
  - Do not copy someone else's work
- Any occurrence of dishonesty: a zero grade for the assignment for all students involved

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Homework Expectations

- Handwritten submission is to be avoided
  - Write in word or LaTex (download MikTex and WinEdt)
- Homework is due at the beginning of class
  - Delays due to circumstances beyond your control must be requested well in advance
  - For late submission, 20% penalty per day (zero point after 5 days)
- Provide a detailed report on each programming assignment
  - Explain how your code fulfills the required functionality
  - Describe interesting parts of your implementation
  - Answer questions in the problem statement
  - Sample runs: capture screenshots of what your code does on test input data
  - Demonstrate in your report that you truly understood the material

Homework Expectations 2

- Homework submission requirements:
  - ZIP file named <your last name>-as#.zip
    - E.g., sirot-as1.zip, sicard-as6.zip
- Projet submission requirements:
  - ZIP file named <last name1>-<last name2>.zip
    - E.g., sirot-bouchon.zip
  - All cpp and h files must start with a commented section with your name and a brief description of the purpose or functions
  - The ZIP file must contain a README file providing detailed instructions on compilation and execution of your code
- Submit the ZIP at Campus Moodle
- Submit hard copy of report in class

Homework Expectations 3

- isidore.udayton.edu
  - Use your UD Novell username and password to log in
  - View your course site by going to *My Workspace* and then *Worksite setup*
  - Find your grades at isidore
- Quick start guide
  - http://learn.udayton.edu/manuals/Isidore_Student_Guide.pdf
- Frequently asked questions
  - http://learn.udayton.edu/isidore/

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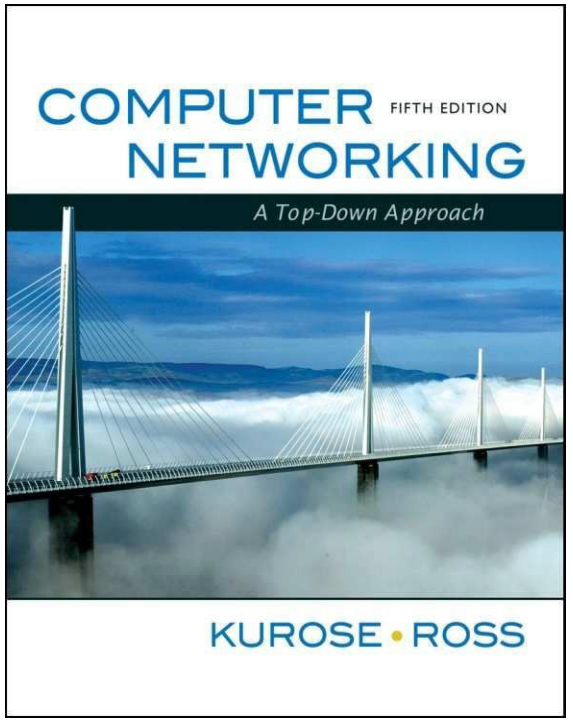


Uses of Computer Networks

Computer networks are collections of autonomous computers, e.g., the Internet

They have many uses:

- Business Applications »
- Home Applications »
- Mobile Users »

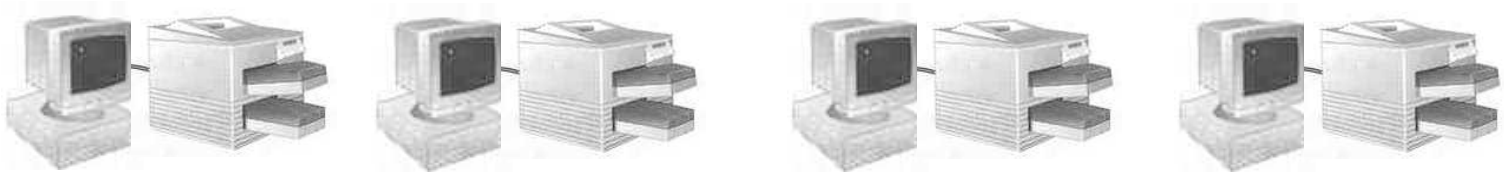
These uses raise:

- Social Issues »

This text covers networks for all of these uses

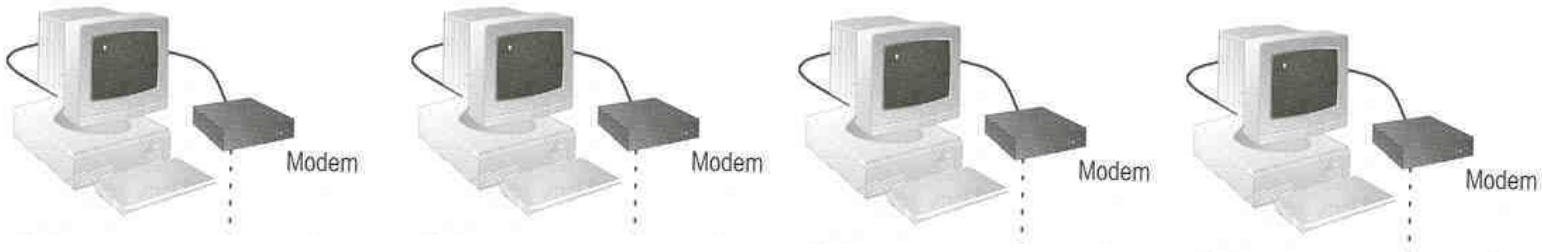
- Sharing hardware or software

  - **E.g. print document**



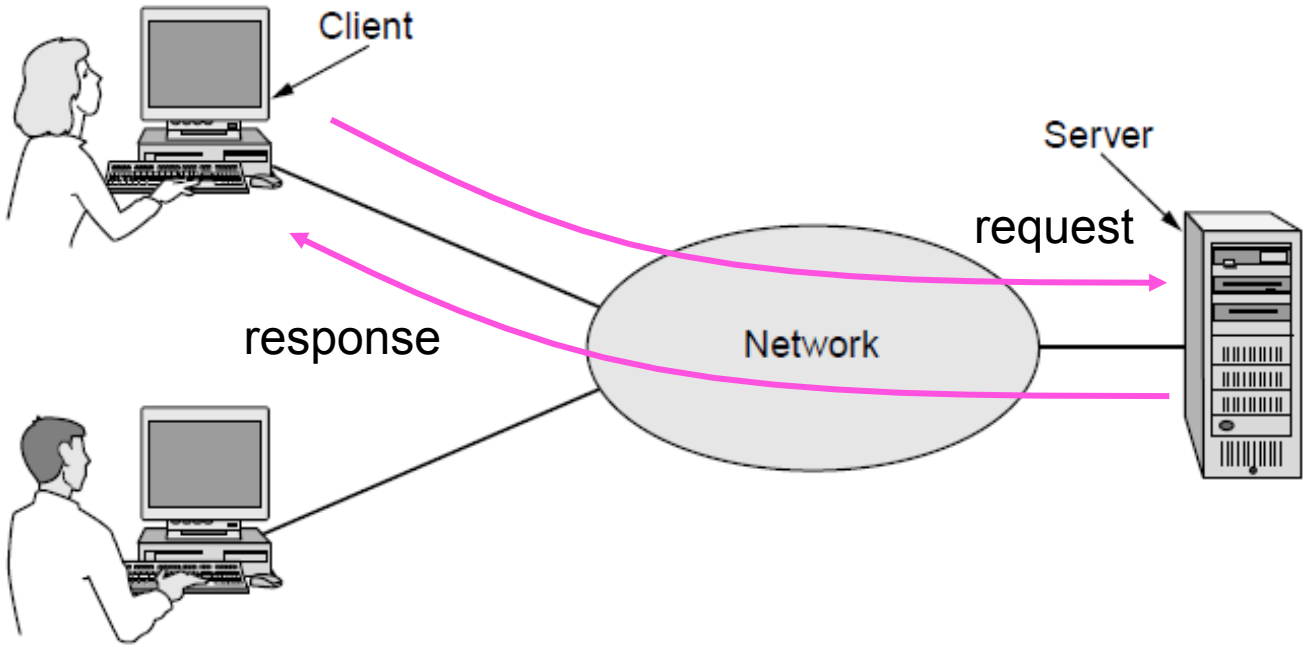
- **Centralize administration and support**

  - E.g. Internet-based, so everyone can access the same administrative or support application from their PCs



Business Applications

Companies use networks and computers for resource sharing with the client-server model:



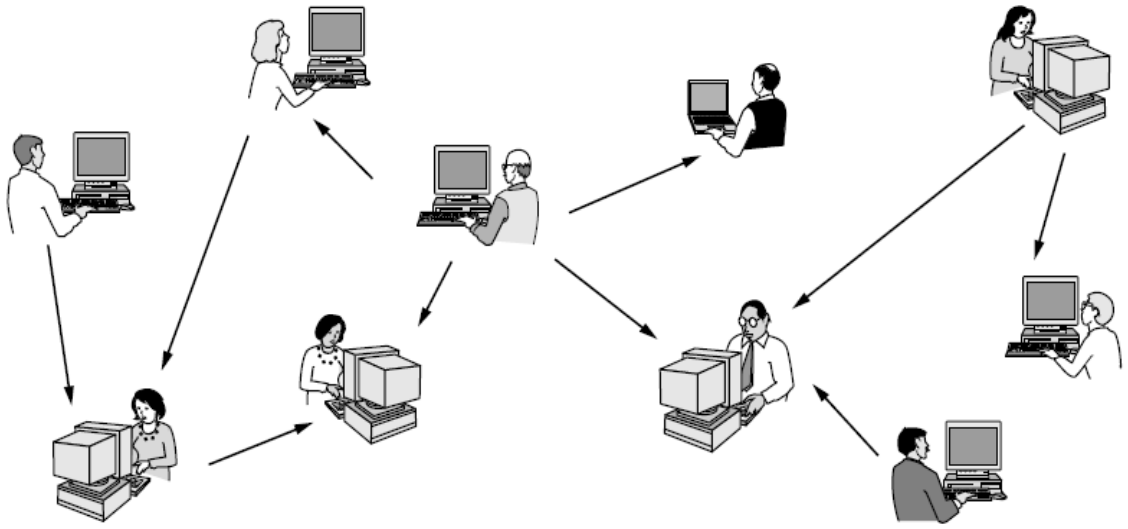
Other popular uses are communication, e.g., email, VoIP, and e-commerce

Home Applications

Homes contain many networked devices, e.g., computers, TVs, connected to the Internet by cable, DSL, wireless, etc.

Home users communicate, e.g., social networks, consume content, e.g., video, and transact, e.g., auctions

Some application use the peer-to-peer model in which there are no fixed clients and servers:



Mobile Users

Tablets, laptops, and smart phones are popular devices; WiFi hotspots and 3G cellular provide wireless connectivity.

Mobile users communicate, e.g., voice and texts, consume content, e.g., video and Web, and use sensors, e.g., GPS.

Wireless and mobile are related but different:

Wireless	Mobile	Typical applications
No	No	Desktop computers in offices
No	Yes	A notebook computer used in a hotel room
Yes	No	Networks in unwired buildings
Yes	Yes	Store inventory with a handheld computer

Social Issues

Network neutrality – no network restrictions

Content ownership, e.g., DMCA takedowns

Anonymity and censorship

Privacy, e.g., Web tracking and profiling

Theft, e.g., botnets and phishing

How many kinds of Networks?

- Depending on one's perspective, we can classify networks in different ways
  - Based on transmission media: Wired (UTP, coaxial cables, fiber-optic cables) and Wireless
  - Based on network size: LAN and WAN (and MAN)
  - Based on management method: Peer-to-peer and Client/Server
  - Based on topology (connectivity): Bus, Star, Ring …

    :

    :

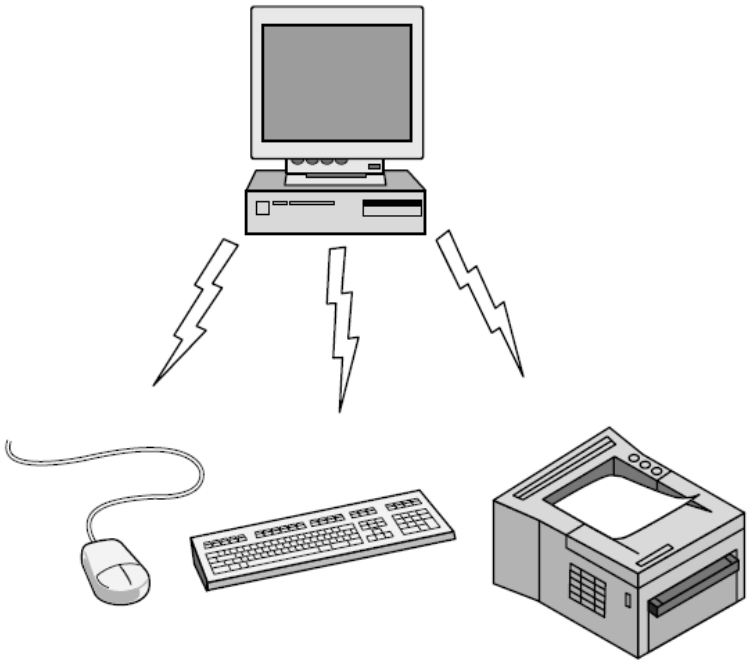
Network Hardware

Networks can be classified by their scale:

Scale	Type
Vicinity	*PAN (Personal Area Network)* »
Building	*LAN (Local Area Network)* »
City	*MAN (Metropolitan Area Network)* »
Country	*WAN (Wide Area Network)* »
Planet	*The Internet (network of all networks)*

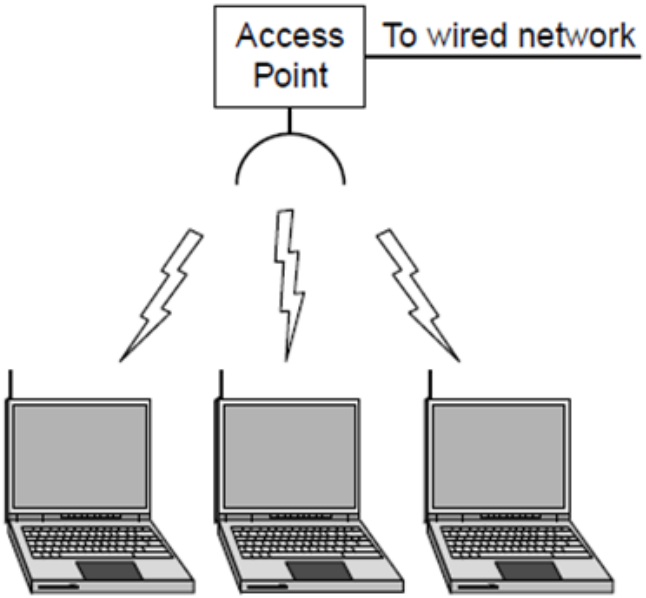
Personal Area Network

Connect devices over the range of a person
Example of a Bluetooth (wireless) PAN:

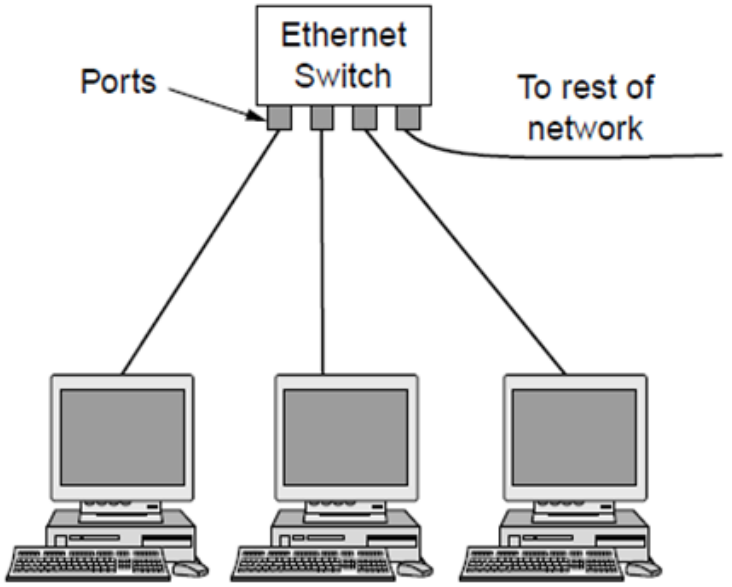


Local Area Networks

Connect devices in a home or office building
Called enterprise network in a company



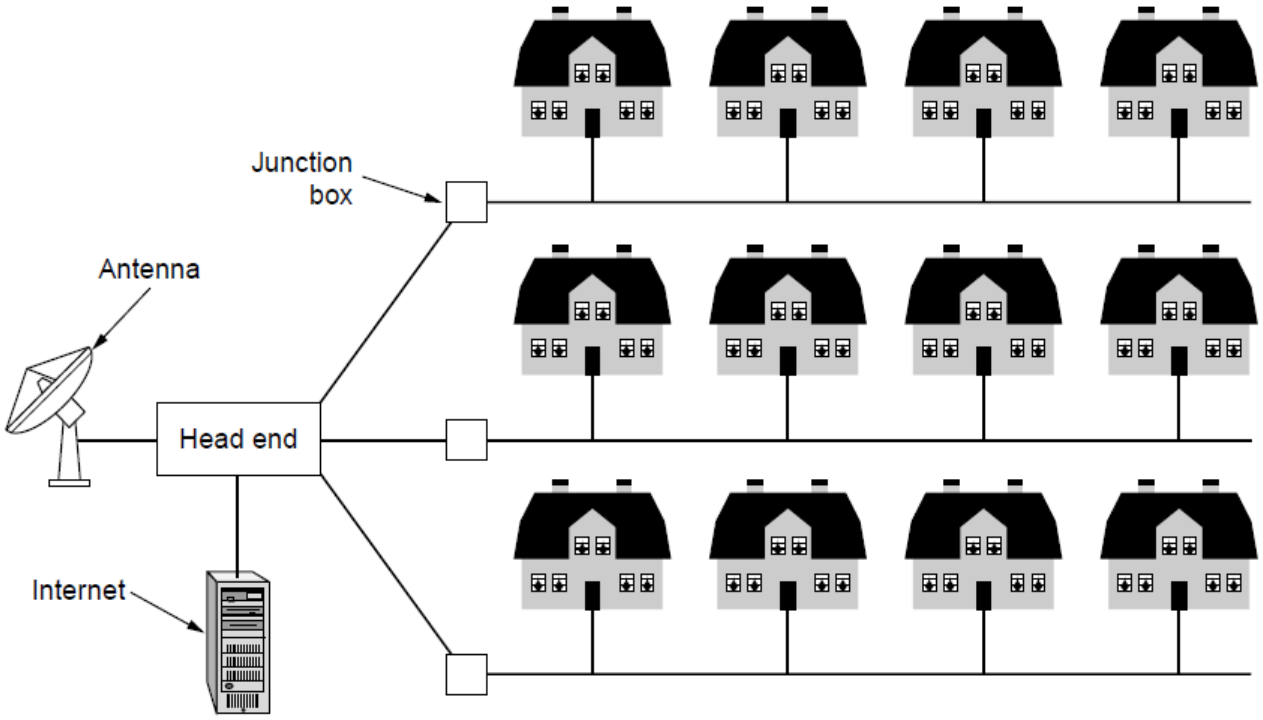
Wireless LAN with 802.11



Wired LAN with switched Ethernet

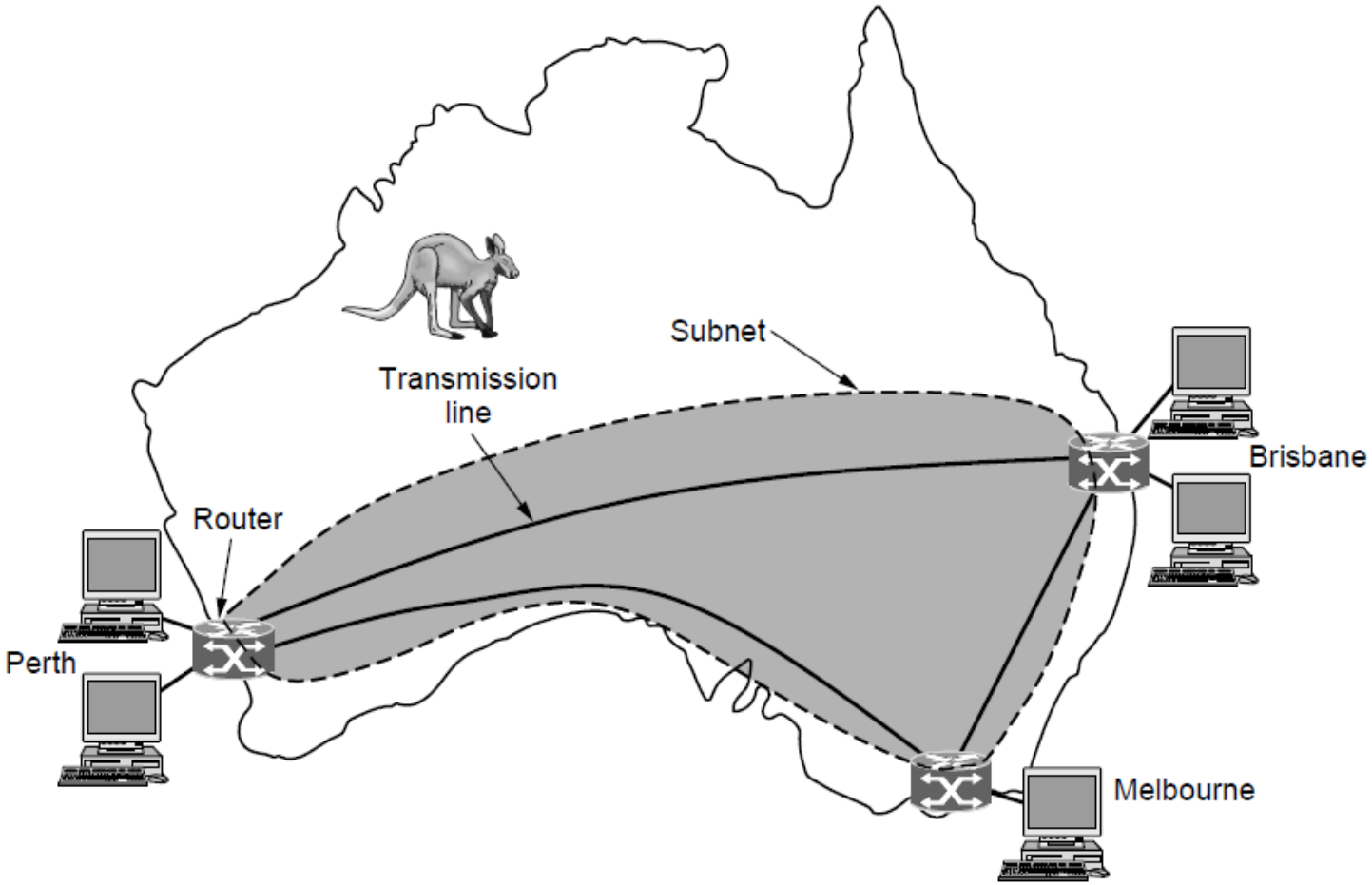
Metropolitan Area Networks

Connect devices over a metropolitan area
Example MAN based on cable TV:



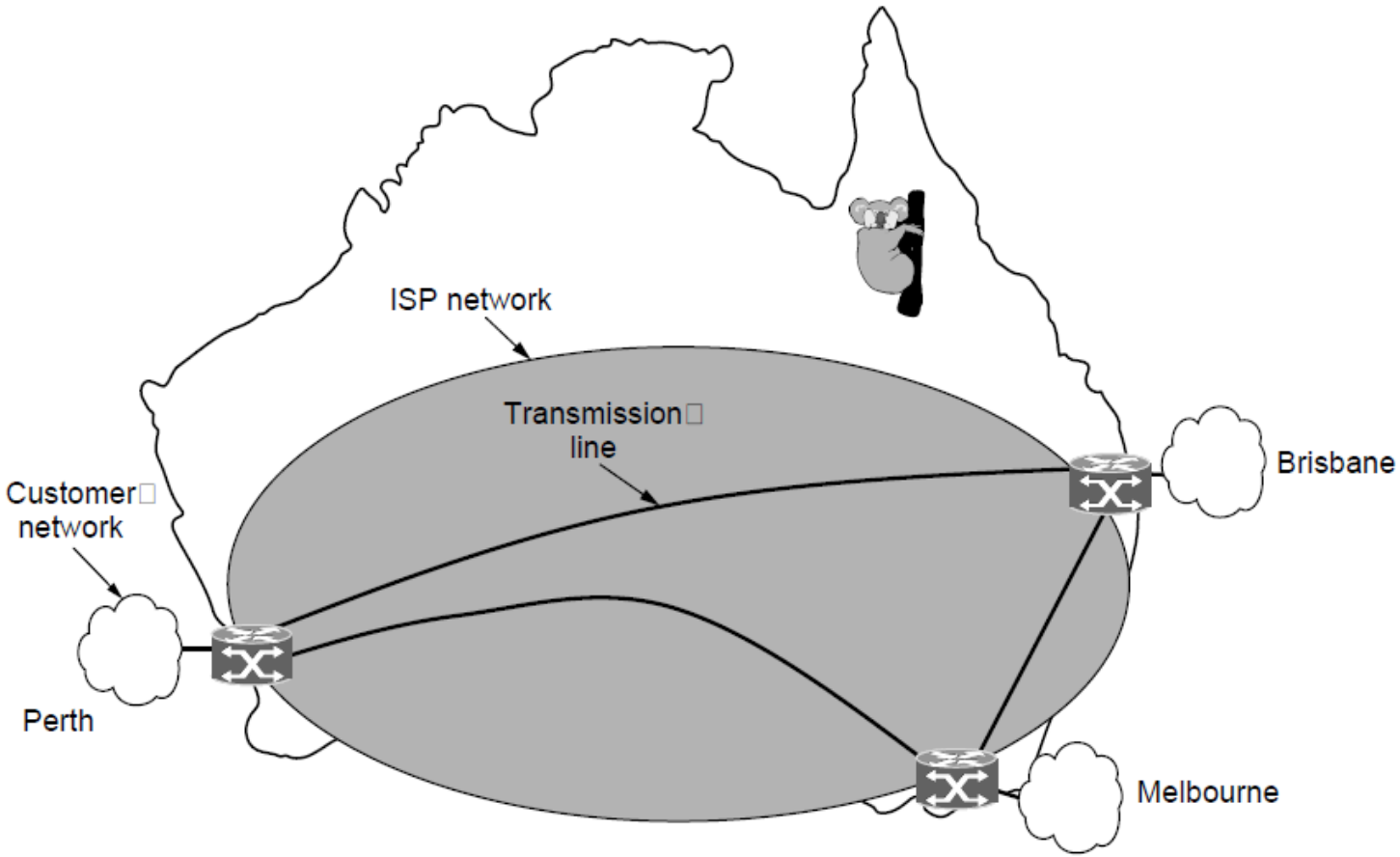
Wide Area Networks (1)

Connect devices over a country
Example WAN connecting three branch offices:



Wide Area Networks (2)

An ISP (Internet Service Provider) network is also a WAN. Customers buy connectivity from the ISP to use it.



Wide Area Networks (3)

A VPN (Virtual Private Network) is a WAN built from virtual links that run on top of the Internet.

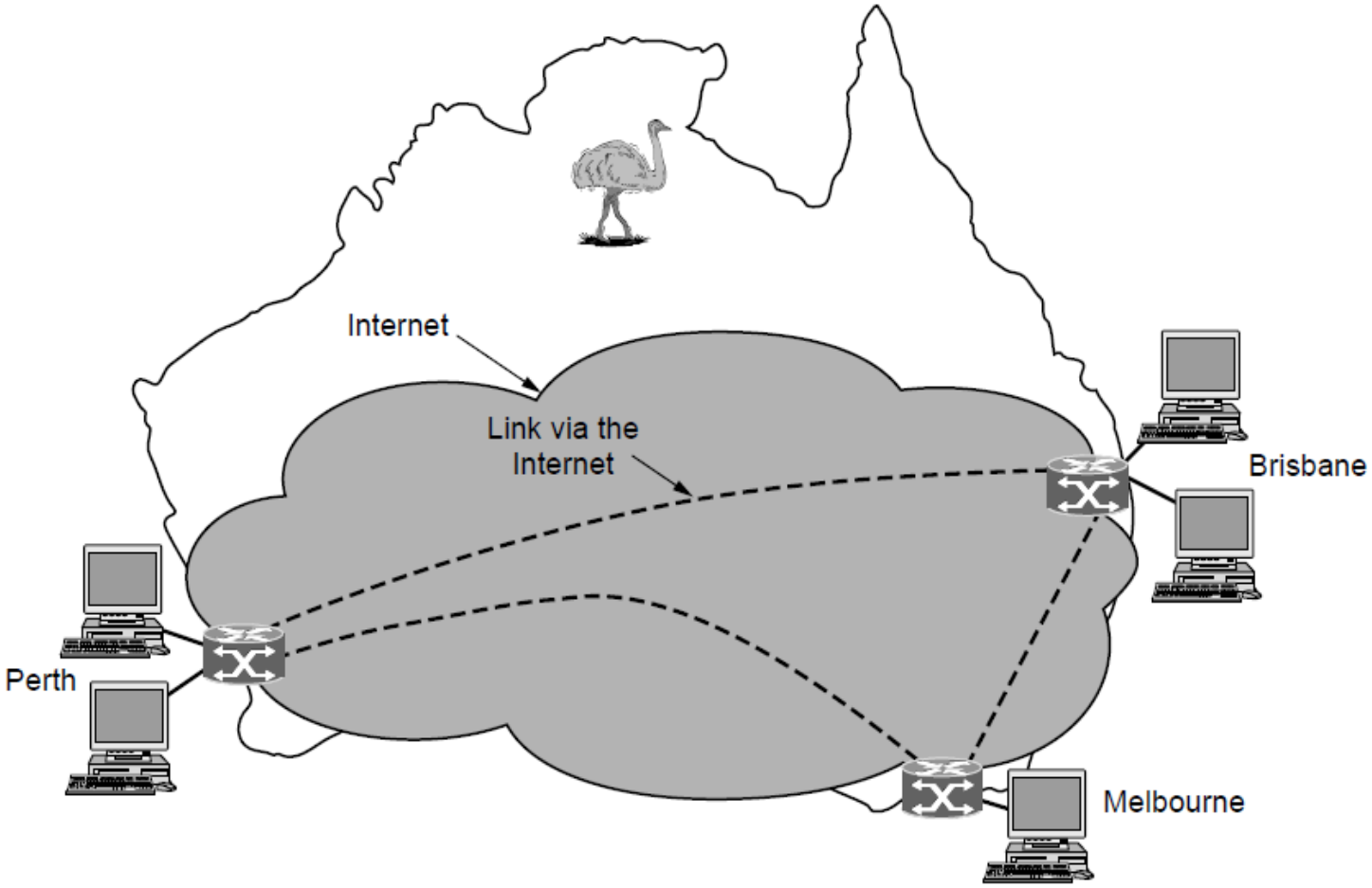
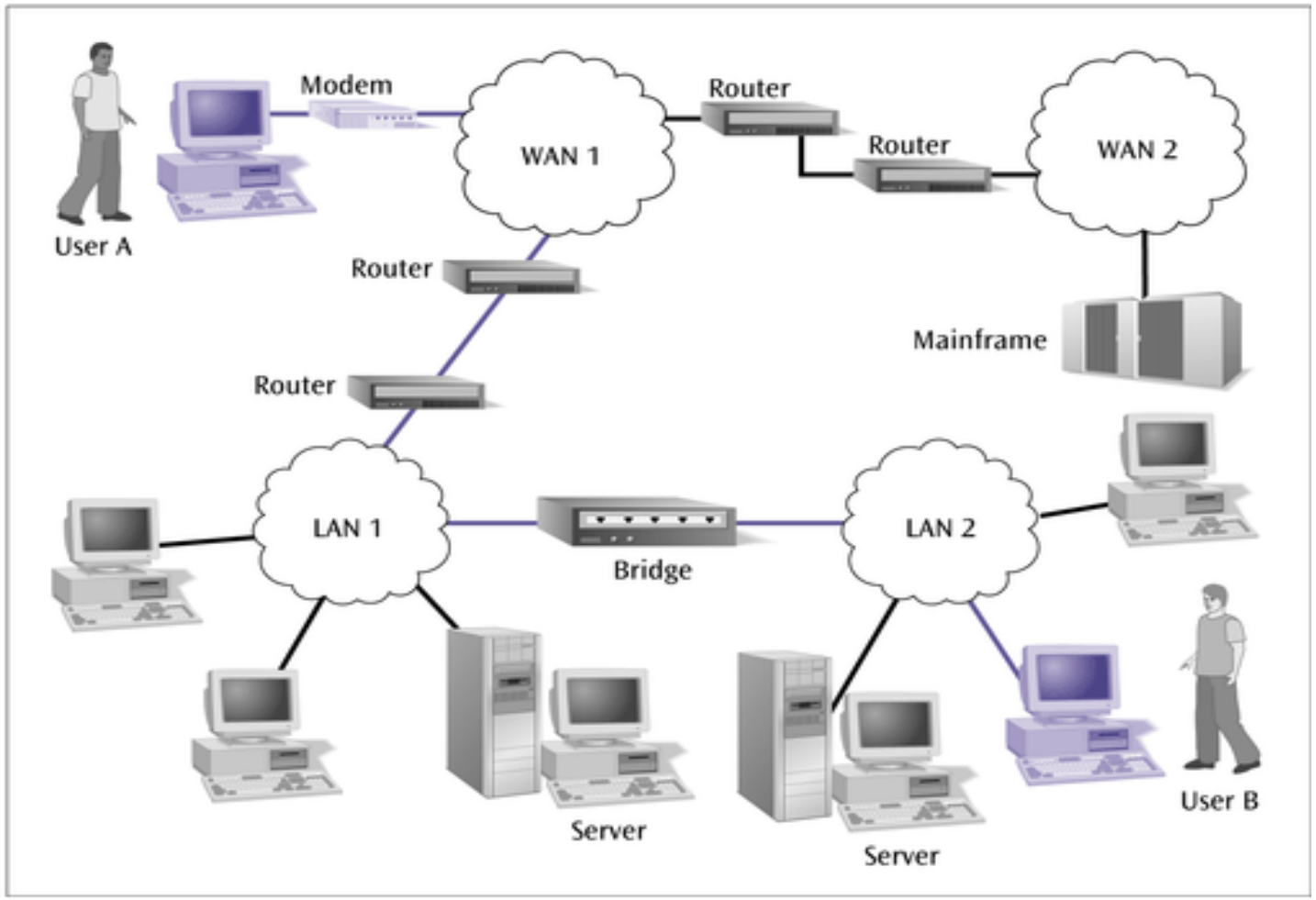


Figure 1-1
An overall view of the interconnection between local area networks and wide area networks



Chapter 1 Introduction: Roadmap

1. What *is* the Internet?
2. Network edge
   - End systems, access networks, links
3. Network core
   - Circuit switching, packet switching, network structure
4. Delay, loss, and throughput in packet-switched networks
5. Protocol layers, service models
6. Networks under attack: security
7. History

The Internet: "Nuts and Bolts" View


PC


server


wireless laptop


cellular handheld

- Millions of connected computing devices:
  - Hosts = end systems
  - Running *network apps*

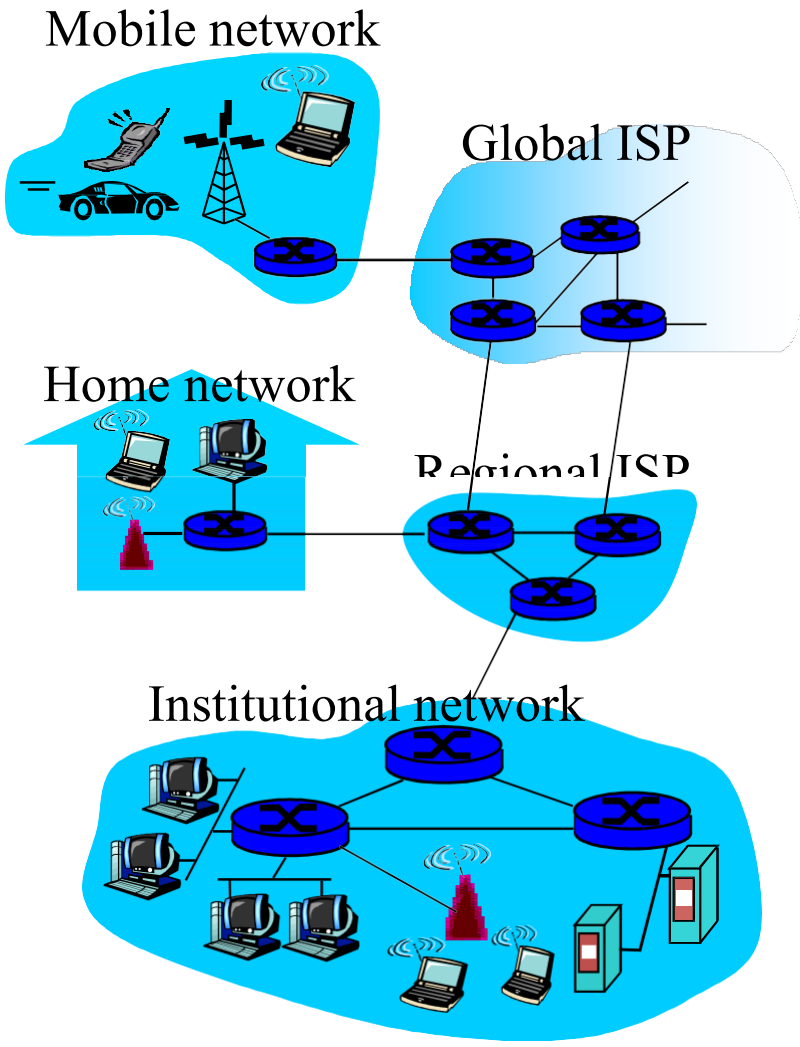

access points

wired links

- Communication links
  - Fiber, copper, radio, satellite
  - Transmission rate = bandwidth

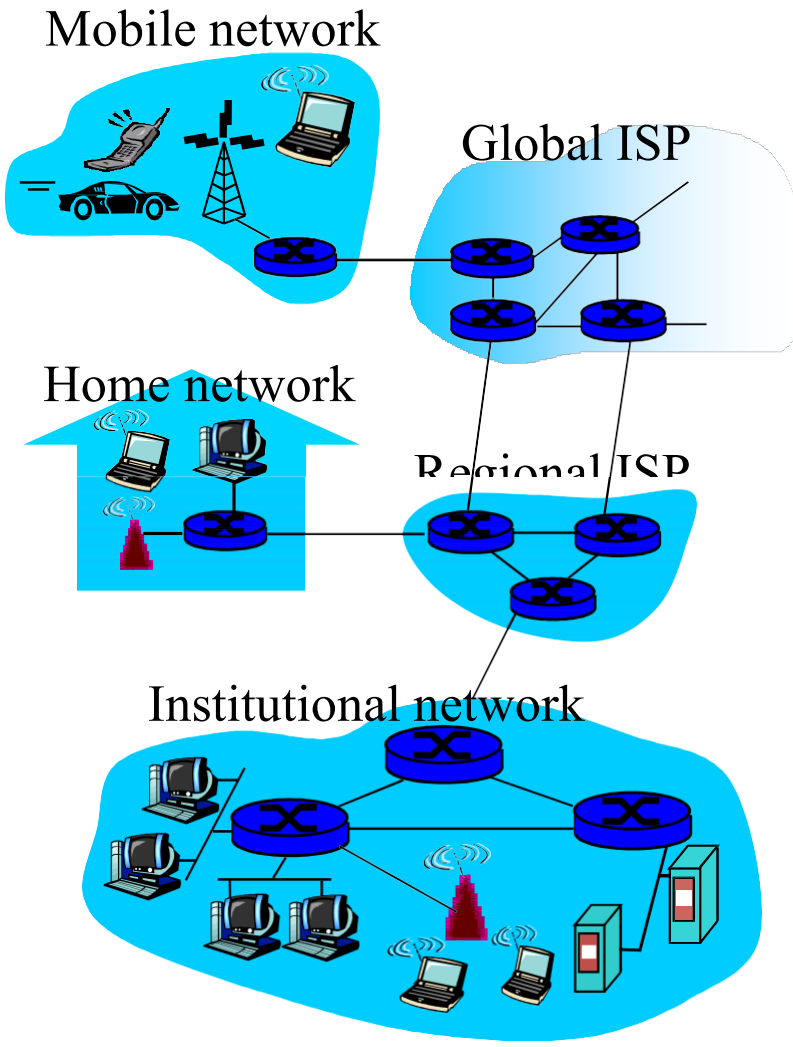

router

- Routers
  - Forward packets (chunks of data)



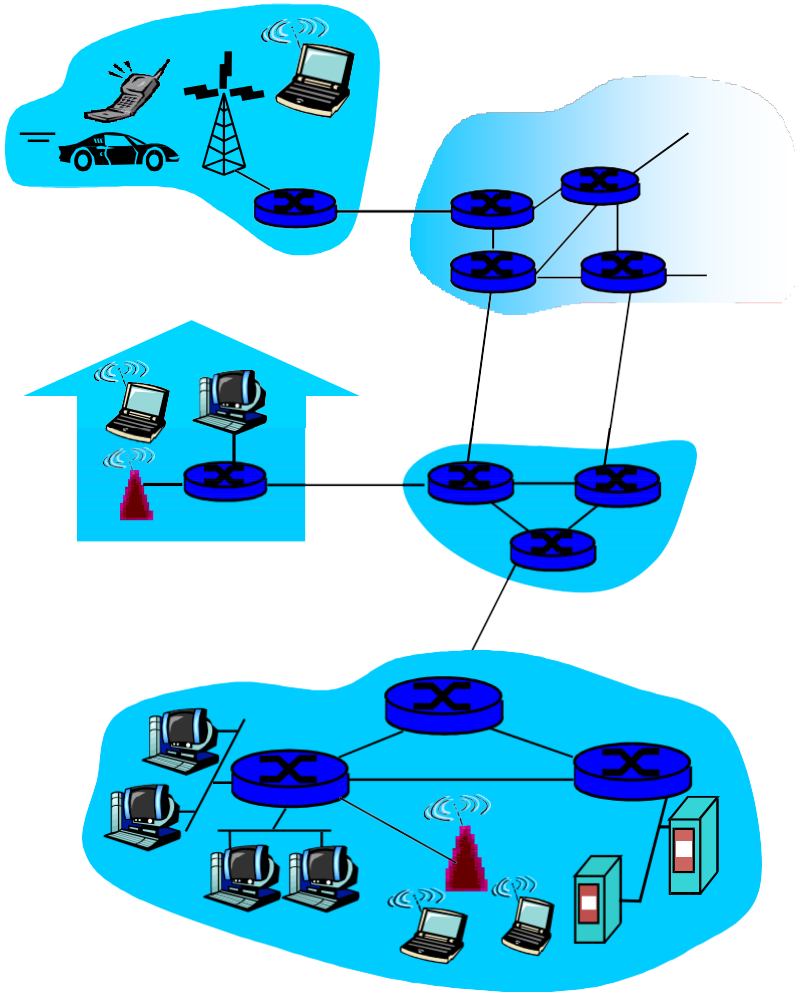
The Internet: "Nuts and Bolts" View

- Protocols control sending, receiving of msgs
  - E.g., TCP, IP, HTTP, Skype, Ethernet
- Internet: "network of networks"
  - Loosely hierarchical
  - Public Internet versus private intranet
- Internet standards
  - RFC: Request for comments
  - IETF: Internet Engineering Task Force



What's the Internet: A Service View

- Communication infrastructure
  - It enables distributed applications:
  - Web, VoIP, email, games, e-commerce, file sharing
- Communication services provided to apps:
  - Reliable data delivery from source to destination
  - "Best effort" (unreliable) data delivery



What's a Protocol?

Human protocols:

- "What's the time?"
- "I have a question"
- Introductions

… specific msgs sent

… specific actions taken when msgs received, or other events

Network protocols:

- Machines rather than humans
- All communication activity in Internet governed by protocols

protocols define format, order of msgs sent and received among network entities, and actions taken on msg transmission, receipt

What's a Protocol?

A human protocol and a computer network protocol: