Atoms, Bits, and Networks

An Engineering Approach to Computer Networking
Introduction

■ Today’s economy
  ◆ manufacturing, distributing, and retailing *atoms*
  ◆ but also
    ✦ publishing
    ✦ banking
    ✦ film making….
  ◆ main ‘product’ is creation and dissemination of information
  ◆ *part of the ‘information economy’*

■ Future economy likely to be dominated by information
  ◆ e.g. smart shoes and wireless tags on groceries
Information

- A representation of knowledge
  - Knowledge of a song vs. representation

- Can represent in two ways
  - analog (atoms)
  - digital (bits)

- Digital is better
  - computers manipulate digital information
  - infinitely replicable
  - networks can move bits efficiently
Information as atoms

- Common
  - books
  - bills
  - CDs
  - ...

- We can do better if we represent information as bits

- The is the heart of the Digital Revolution
  - convert information as atoms to information as bits
  - use networks to move bits around instead of atoms
  - let bits be bits!

- (What industries are affected?)
What do we need?

- Ways to represent all types of information as bits
- Ways to move lots of bits everywhere, cheaply, and with quality of service
  - need to engineer computer networks to meet these objectives
Common network technologies

- Two successful computer networks
  - telephone network
  - Internet
- What comes next?
  - something like an ATM network
  - ideas have influenced thinking on “next-generation” Internet
- We will study all three technologies
Concepts and techniques

- Protocols and protocol layering
- System design
  - rules of thumb
- Multiple access
  - how to share a wire
- Switching
- Scheduling
- Naming, addressing and routing
- Error control
- Flow control
- Traffic management
Engineering computer networks

- Common protocols
- Protocol implementation techniques