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