CSE 303
Concepts and Tools for Software Development

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Winter 2007 - Lecture 13
Societal Implications of Computing
Impact of Computer Engineering Solutions

Midterm Logistics

- Next Friday, February 9th, in class

- Closed books, closed laptops
- Bring 1 piece of paper (letter size) with notes
  – You can write on both sides

- Practice midterms
  – Are posted on the class website
  – Sample midterm 1: skip question 5b

Content for Our Midterm

- Lectures 1 through 14 (this Monday)

- Overall, midterm will be similar in style to the practice midterms
  - But specific questions may be of a different style

- Expect questions on linux commands, shell scripts, utilities, regular expressions, and C

Societal Implications of Computing

- Why are we studying this?

- Educated computer scientists must think about broader implications of what they do

    - Because it affects other people's lives
    - Because it affects their lives

Three High-Level Topics

- Impact of computer engineering solutions
  - Gain broad education necessary to understand the impact of computer engineering solutions in global, economic, environmental and societal contexts

- Ethics
  - Identify ehtical issues
  - Discuss possible courses of action

- Knowledge of contemporary issues
  - Discuss various contemporary issues related to the societal implications of computing

Evaluation

- We wll have 4 in-class discussions

- 10% of your grade: 3-page paper

  – There will be three questions

  – One question per high-level topic

  – Please write between 0.5 and 1 page for each question (10 pt font, single-spaced, 1" margings)

Today's Topic: RFID

Radio Frequency IDentification (RFID)

Using radio frequency (RF) signals

To identify (ID) objects

Does not require line-of-sight

(Some materials courtesy of Prof. Gaetano Borriello)

RFID Basics

RFID systems comprise tags and readers

- Tags are placed on objects

- Readers placed in the environment interrogate tags

Tags can be active or passive

- Active tags: longer read-range (up to 300 feet)

    – Battery powered, expanded capability, expensive

- Passive tags: shorter read-range (1 foot to a few meters)

    – Receive power from RF field, limited capability, cheap

- Each tag has a unique ID (typically 64 to 128 bits)

- Tags can include other information besides ID (< 2KB)

RFID Components

RFID Reader   RFID Antennas
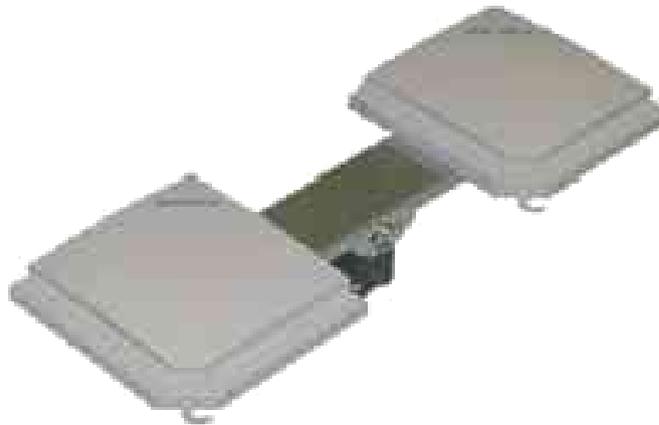
Active Tag

Passive Tag

A Wide Variety of Tags

Communication Between Reader and Tag

Example of RFID Deployment

RFID Reader

RFID Antenna

Missed Reading

RFID Reader

RFID Antenna
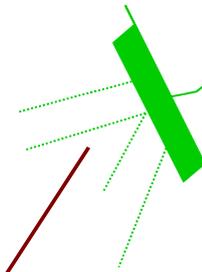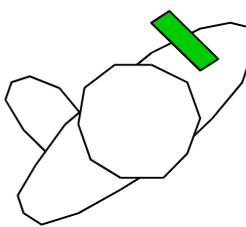
Duplicate Readings
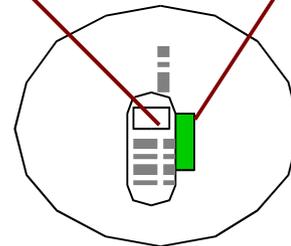
RFID Tag
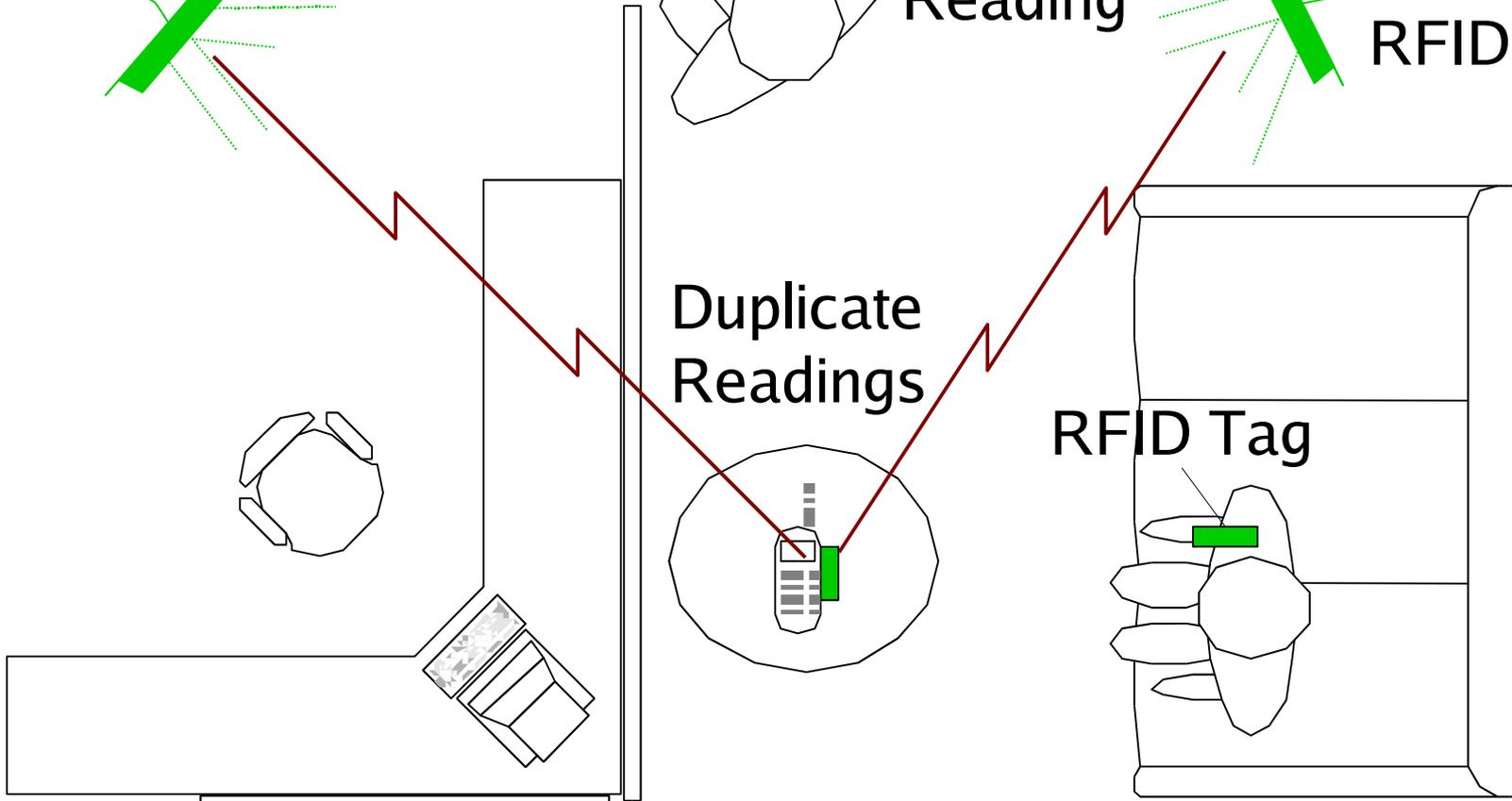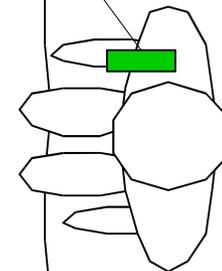
Elements of an RFID System

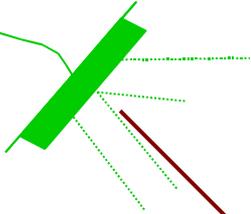- **Tags:** carry unique identifiers
- **Readers:** detect tags in their vicinity
- **Networking infrastructure**
  - Reader is connected to a network and communicates tag IDs to interested parties
- **Databases**
  - Collect the "read events" and log them with time/place
- **Applications and their user interfaces**
  - Use the data in various ways

Existing RFID Applications

- Supply-chain management
- Package tracking
- Airline tickets, luggage
- Pharmaceuticals
- Medical: patient id
- Asset tagging, archiving
- Identifying pets
- Tracking library books
- Anti-counterfeiting
- RFID tags inside passports
- Toll collection (highways)

Market-Driven Technology

- 6 of top 7 retailers worldwide support RFID
  - \> $1 trillion revenue
- 100s of manufacturers and retailers

Other Useful Applications?

- Elder care (UW & Intel Seattle)
  - What objects people use is a good indicator of what they are doing
- Study human social dynamics (UW & Intel Seattle)
  - How social groups form and evolve with time
- Woodland Park Zoo: track visitors
- Speed pass at gas stations (Exxon Mobile)
- Help people monitor their outdoor workout
  - iPod with reader
  - Nike shoes with active RFID tags

Implications of RFID

- As previous examples show, RFID enables many apps that can make our lives better

- But, there are serious security problems

  - Possible to intercept communication between reader and tag (need cryptography)

- There are very serious privacy problems

  - Opportunities for mining and surveillance

  - Example: Nike+iPod story

- There are also great reliability problems

  - What are the implications of wrong information?

Many Privacy Challenges

Other Implications of RFID

- Health considerations
  - Must stay at least 9" away from an RFID antenna
- What are the implications
  - For technology, business and society
  - Of having a "number on everything"?
- RFID Enables

  - Merging physical and virtual worlds
  - Every object is an index into a world-wide database
  - Every object has its own history
  - Tracking objects over their entire lifetime
  - Analyzing trends in user habits

Extra Information

- Google for: RFID
- RFID Ecosystem project: http://rfid.cs.washington.edu/
- **Security Analysis of a Cryptographically-Enabled RFID Device.** S. Bono, M. Green, A. Stubblefield, A. Juels, A. Rubin, and M. Szydlo. Usenix Security. 2005
- iPod + Nike security analysis project http://www.cs.washington.edu/homes/yoshi/papers/
- EPCGlobal http://www.epcglobalinc.org/home
- RFID ConsortiUm for Security and Privacy http://www.rfid-cusp.org/