Introduction to Economics of Information Security

Murat Kantarcioglu
Incentive Issues in Information Security

- Misaligned incentives could be a significant problem in Information Security.
  - Software bugs vs. Software companies’ incentives
  - UK Banks ATM Security vs United States ATM security
  - Paying for virus detection software
  - Incentive issues in P2P sharing networks

- In many cases understanding/solving security problems require designing carefully aligned incentives.
Interdependent Security

- Network Externalities are important in many fields.
  - If more people have cell phones, than texting becomes more valuable.
- Externalities may be important in security
  - Weakest Link
    - Program Security may depend on the weakest programmer
  - Sum of efforts
    - Program testing may depend on all of the programmers’ efforts
  - Strongest Link
    - Efforts of whistleblower?
Lemon Market

- Cost of asymmetric information
- Lemon markets could be used to analyze economic costs of dishonesty
- Applicable for understanding why people do not pay for extra privacy or security protection in many cases.
Example: Used Car Market

• **Question:** why the new car’s price differs substantially with a one year old car?

• For modeling purposes, assume you have four different types of cars:
  – Good, Bad, Used and New

• Assume that buyers cannot distinguish between good and bad cars than
  – Sellers of used cars now has a better knowledge than buyers
  – Good and bad cars will be priced the same. (why ?)
  – Used car value < New Car (otherwise, trade bad used cars)
  – Owner of good machine must be locked in (why ?)
  – Result: Bad drives out the good (why ?)
Example: Insurance

- **Question:** Why does not the price of providing medical insurance over 65 rise to match the risk?
  - At high price levels, only the ones who will be certain that they need insurance will buy it.
  - Such adverse selection could increase with genetic testing?
Example: The Cost of Dishonesty

- Similar to lemon markets
  - Dishonest dealings may drive out, honest dealings
  - The cost of dishonesty now includes the cost of loss due to cheating plus loss incurred due to prevention of honest dealings.
Counteracting Institutions

- Warranties and guarantees
  - Sellers try to send signals about the quality of the goods.
- Brand Names / Trusted Vendors
- Chains
  - How many of you chosen a restaurant chain during business trips?
- Certification
  - Licensing of doctors and lawyers
  - Degrees (e.g., PhD in CS signals your expected quality.)
Implications of Lemon Markets for Data Privacy

• Unless customers could differentiate between good data privacy versus bad data privacy than “bad” companies will drive out “good” ones.

• More transparency is needed.
Implications of Lemon Markets for Information Security

• Develop approaches to measure software security
  – Vulnerability markets
    • Open markets for trading vulnerability information?
      – You may gain more by selling to bad guys.
  • Two contracts for software payment
    – First contract for if there is no vulnerability found in some certain time period
    – Second contract for if there is some vulnerability found
    – Trade such contracts in the market
  – Insurance
    • Hard to apply in information security due to large scale interdependencies.
Digital Rights Management and Incentives

• DRM helps the system vendors more than the music industry
  – Apple is the dominant force for DRM and music industry
Other Market Failures

- Certificates for Security can cause adverse selection problems
  - According to one study, %3 of regular web sites and %8 of certified web sites are malicious.
Economics of Privacy*

• In many cases, users do not have any incentive in privacy technologies due to
  – lemon market effect.
  – Cost of privacy lost is very little in many domains.
    • Using credit card reveals all your purchase history.

• Only exception could be health care where cost of privacy violation could be significant
  – Revealing the fact that a patient is HIV positive??

*: These are my thoughts. 😊