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 (other wise, 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. ☺