System Security Group | Lancaster University

Economics of Security

Aims

- Provide a new tool set to understand security issues
- Help us to understand broader ranges of risks to security outside of the technical

Why Are We Not More Secure?

- We know how to build secure systems!
- Wrong incentives
    - Guards don't suffer
    - Security shift liability
- The Internet, millions of independent principles interacting
    - Reasonable global outcomes from selfish local actions
- Incentives drive security design and policy

Is Network insecurity the Same as Air Pollution?

- Insecure machines connected to the Internet have costs for all
    - Who should bear al the cost?
        - Individuals, vendors, regulators, authorities?
- Security Economics can be used to help understand
    - Security issues: Privacy, Spam, Phishing etc
    - System Dependability: optimum ratio of dev to test
    - Analysis of Policy Problems: DRM

Public Good

- Same quantity of good regardless of desire
  - Air Quality
- Properties:
  - Non-rivalrous: my use does not deplete yours
  - Non-excludable: inefficient to stop people from using them, lighthouse
- Public good supply
  - Directly from governments: national defence
  - Patents and Copyright: temporary monopoly

Security and Public Good

- Many aspects of security are public goods
  - Air defence is not an individual action
- Strong externalities
  - Cost borne by others
  - One insecure system connected to the Internet affects all
    - Air pollution, toxic dumping
- Is IT security air defence or air pollution
  - Spam used to be a large number of small groups
  - Spam now a small group of powerful teams
  - Is it a national defence issue?

The Price of a Good

- Jerons and Menger: the price of a good in equilibrium is the marginal cost of production
- A good cost £10 to produce, not every producer sells at £10, only marginal ones
    - Those producers just stay in business
    - If price goes down marginal producers close
    - If price goes up marginal producers open

The Price of Information

- In a competitive market price should be its marginal cost
  - Information has high fixed costs
  - Information re-production is free
  - Reason for so much free info, zero is a fair price
- If you can produce at 0 cost then the incentive is to cut without limit to undercut competitors
- Encyclopaedias
  - Britannica $1600, Encarta $49.95, Wikipedia $0

Business Models

- Linux is free, support is not
- Snort is free, rules are not
- Open source devs contribute for free, but gain CV experience
- Information Goods and Services Characteristics
    - High fixed costs, low production = service or advertising model
    - Dominated by network effects
    - Technical lock in
    - Tend to lead to dominate firms and monopolies

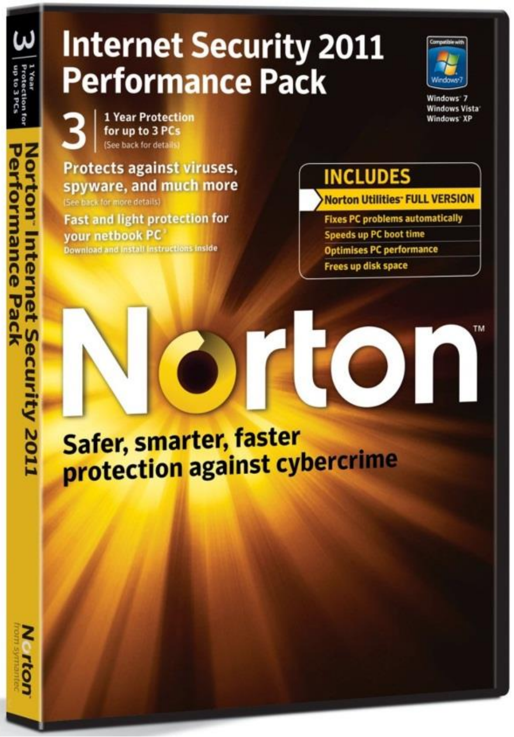
The Value of Lock In

- Shapiro and Varian: The value of a company is the total lock in cost
- Consider a company with 100 staff with Office @ £500 a pop
  - Company switch to Open Office save £50000
  - If costs of change were less, they would switch
  - If they were more MS would put up price
- Consider Apple and Itunes

Information Asymmetry

- George Akerlof - “Market for Lemons” – 1970
  - Some know more than others
- Example
  - 100 used cars, 50 good £2000, 50 bad £1000
  - Sellers know which is which, buyers don’t
  - What is the market price of the used car?
  - At £1500 no good cars will be offered, so price will be closer to £1000.

Can You Decide?


Internet Security 2011
Performance Pack
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Protects against viruses, spyware, and much more
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Fixes PC problems automatically
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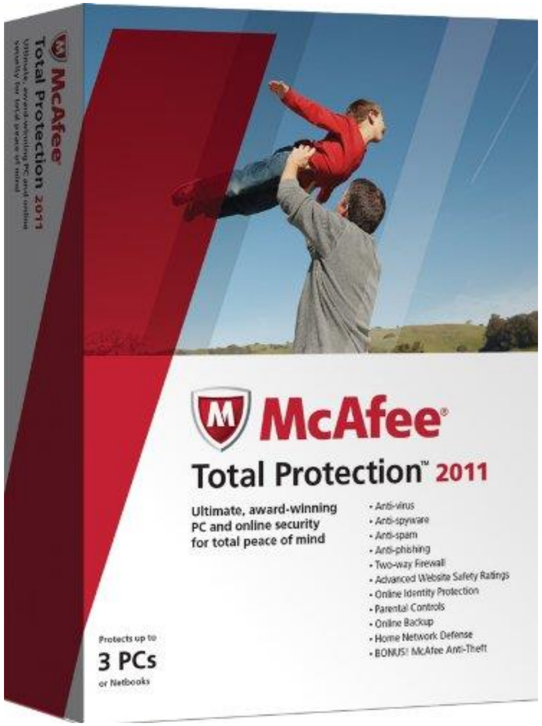


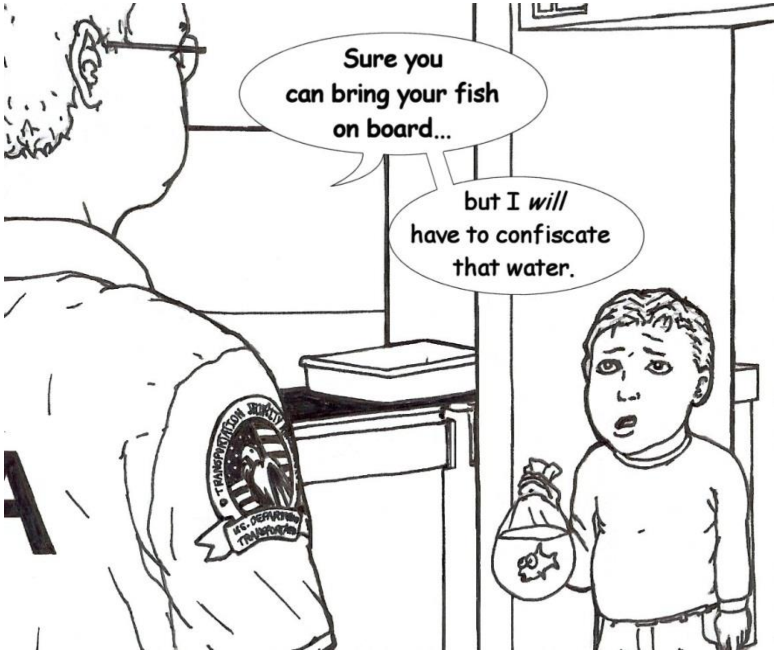
- Poor security products dominate when users can’t tell the difference
  - Race to the bottom on price

What about you? Why do you get insurance?

- Hidden information – adverse selection
- Hidden action – moral hazard
- Volvos are safe cars but have higher accident rates
  - Do bad drivers buy them? – AS
  - Do you drive badly because you think you are safer? – MH
- Consider AV products?
  - Do they make you feel safer – act riskier
  - Get the best AV because you are risky
- What about in private browsing?

Why does security fail?

- Those guarding have no incentives to protect what we think is important.
  - Guards don't suffer a point of failure
  - Risks are dumped on others
- Security is a power relationship
  - Principles control security meaning to advance power


Sure you can bring your fish on board...
but I *will* have to confiscate that water.
TRANSPORTATION SECURITY
U.S. DEPARTMENT OF TRANSPORTATION

What is the best Strategy?

- Jack Hirshleifer founded conflict theory
- Consider the country of Anarchia
  - Flood defence managed by everyone on the coast
    - As good as the weakest link
    - The more defenders the greater the number of weaknesses
  - Missile defence is based on best shot
    - Best effort

System Reliability and Freeriding

- Hal Varian work applying previous theory to effort applied in securing systems.
- **Total effort.** Reliability depends on the sum of the efforts exerted by the individuals.
- **Weakest link.** Reliability depends on the minimum effort.
- **Best shot.** Reliability depends on the maximum effort.

How should you structure your dev team?

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- Program correctness can depend on minimum effort
  - Most careless programmer
- Software vulnerability testing may depend on sum of all testers efforts
- Security depends on best effort
  - Actions taken by individual champion, architect/designer
- More agents
  - Less reliability in min. effort case
  - More reliability in total effort case

Whys is Windows insecure?

- Why are there still so many bugs when Windows is so dominant?
- Why no comparable effort in commodity platforms compared to defence or healthcare?
- Technically we know how to build good systems, so why don’t we?
- Product insecure at first then improve, why?
  - Symbian, IBM
  - Win95->Win98->WinXP->Vista->Win7->Win10

What is the software market like?

- Low marginal but high fixed costs
- Network effects
- Technical lock-in
- Race to dominate, the dominant firm gets all the money
- MS 1990’s philosophy *“ship it Tuesday and get it right by V3”* is rational
- You must appeal to complementers
  - Security gets in the way
  - Add security later, but make sure it helps lock in

DRM, is it a good thing?

- Varian, DRM is about tying, bundling and price discrimination
- Transfer of control from owner of contain to owner of file
  - Potential for lock in increases
  - Amazon Kindle 1984, Itunes DRM
- Oberholzer & Strumpf showed music shared was not bad backed up by Canadian government
  - Varian in early 2005 showed DRM helps system manufacturers not music industry
  - End of the year publishers protesting against Apple

Questions?