Successes and Challenges of Computer Security Research

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What do we mean when we say "security"?

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Technological change = new dangers and new fears

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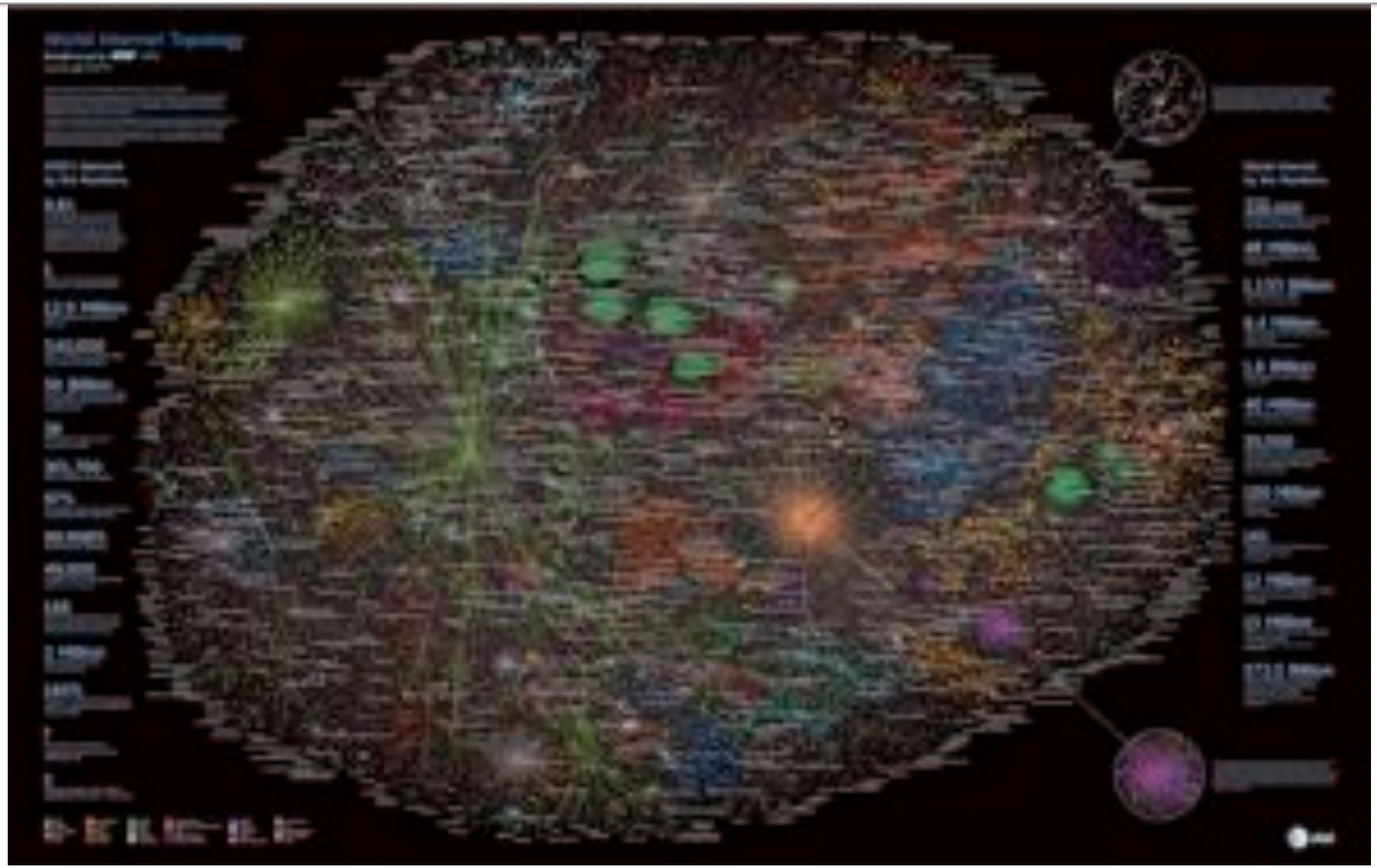
The big change: global connectivity



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Managing risk

Example: e-commerce

What made this possible?

- Public-key cryptography
- Efficient private-key cryptography
- Key-exchange protocols
- Certificate authorities and trust hierarchies

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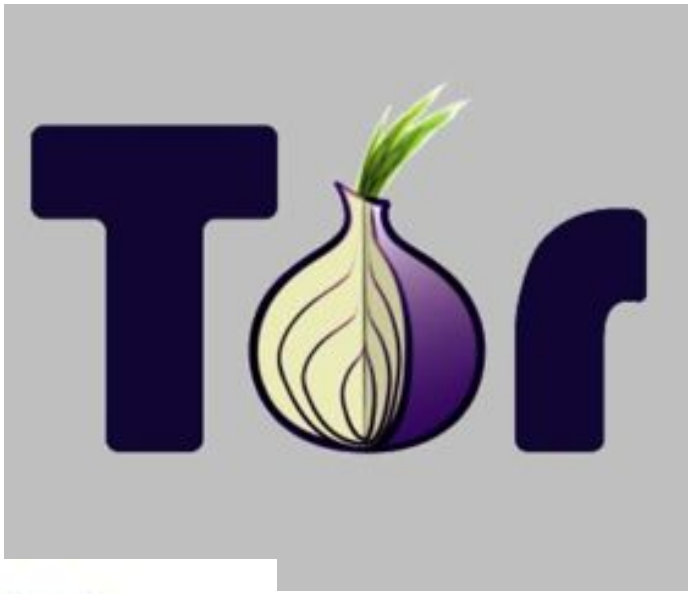
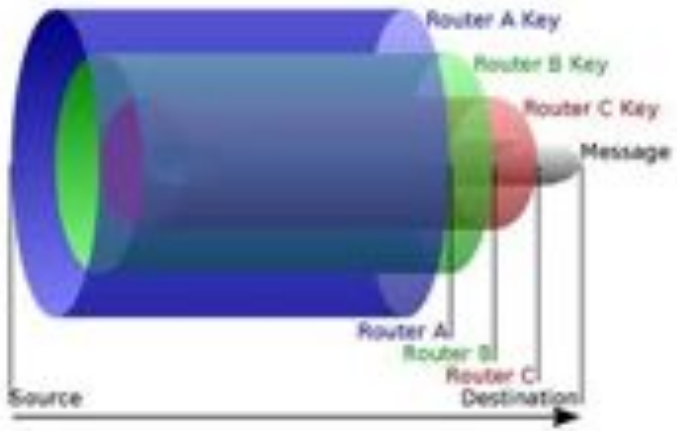
Example: anti-censorship





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NITRD efforts underlie most of today's defensive technologies

- Virtual private networks
- Network defenses
  - Firewalls, intrusion detection, data leakage protection
- Two-factor authentication
- Anti-malware
- Exploit mitigation (ASLR, DEP, stack cookies)
- Vulnerability finding tools, safe languages
- Virtual machine isolation

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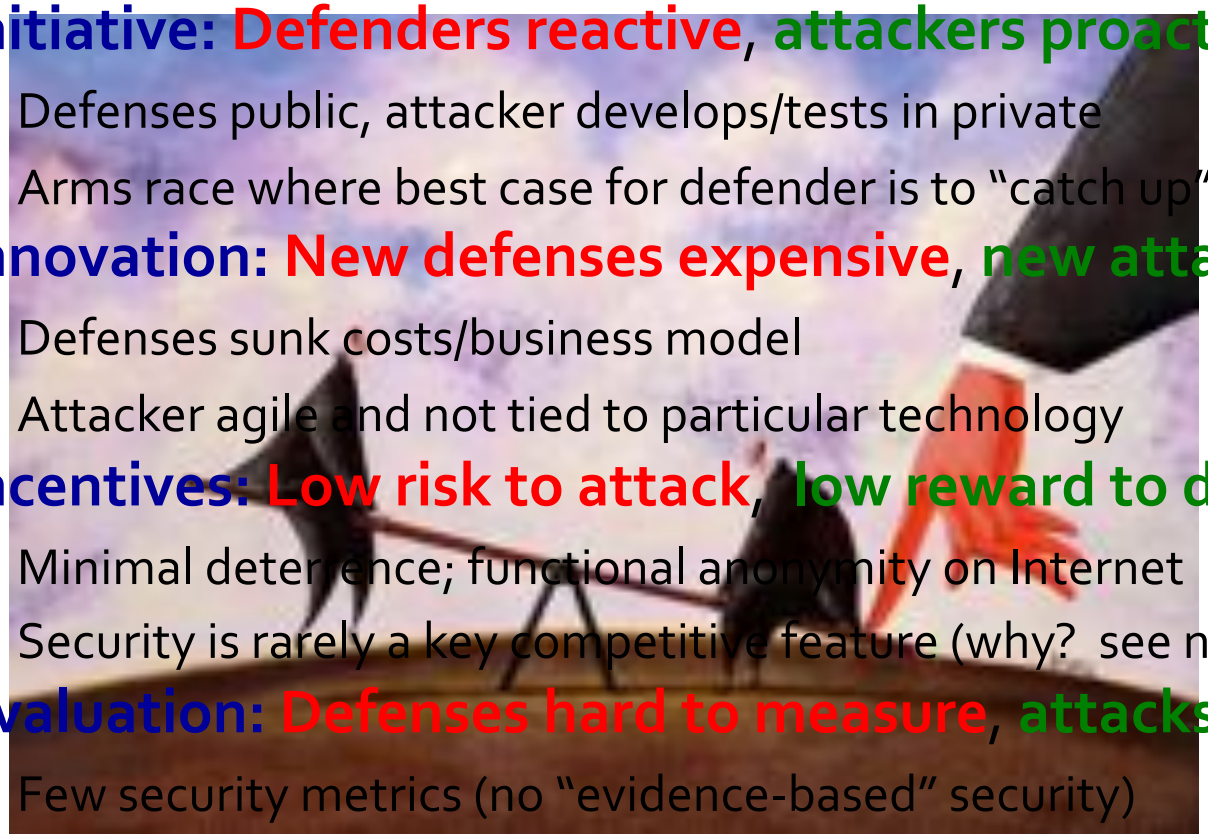
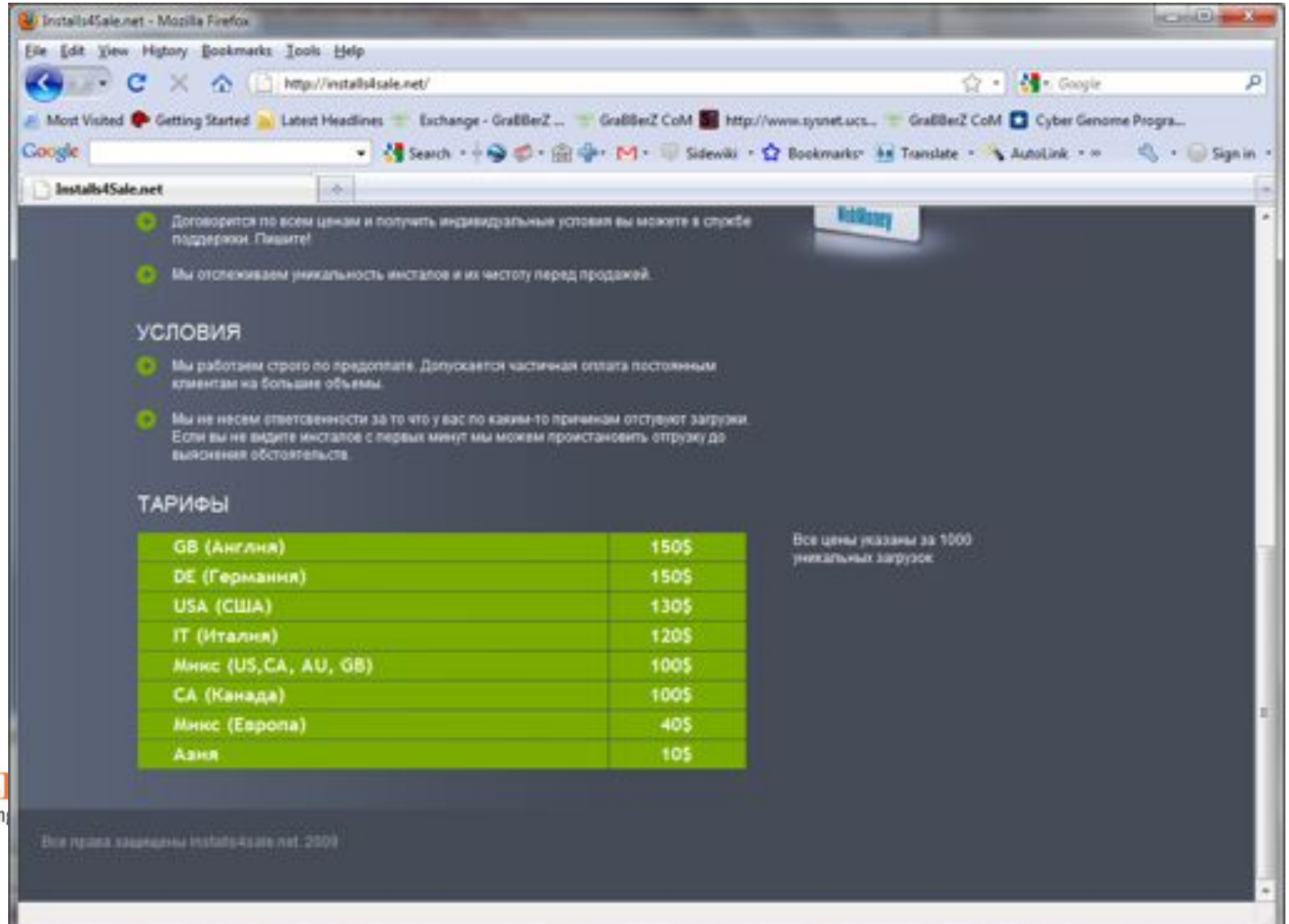
Challenge: structural asymmetries



- **Initiative: Defenders reactive, attackers proactive**
  - Defenses public, attacker develops/tests in private
  - Arms race where best case for defender is to "catch up"
- **Innovation: New defenses expensive, new attacks cheap**
  - Defenses sunk costs/business model
  - Attacker agile and not tied to particular technology
- **Incentives: Low risk to attack, low reward to defend**
  - Minimal deterrence; functional anonymity on Internet
  - Security is rarely a key competitive feature (why? see next)
- **Evaluation: Defenses hard to measure, attacks easy**
  - Few security metrics (no "evidence-based" security)
  - Attackers measure success/monetization which drives attack quality

Challenges: new adversaries

- E-crime as a business



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Challenges: new adversaries

- E-crime as a business

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Challenges: new adversaries

- Mass action/hacktivism

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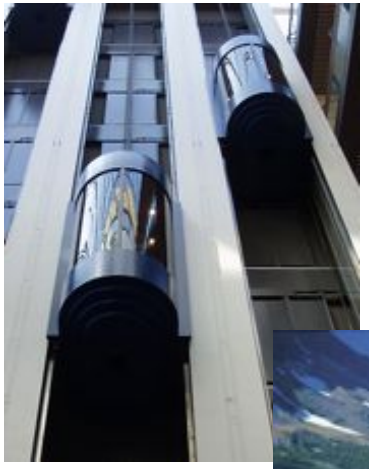
Challenges: new adversaries

- State-motivated/sponsored actors

Challenges: the Internet of things



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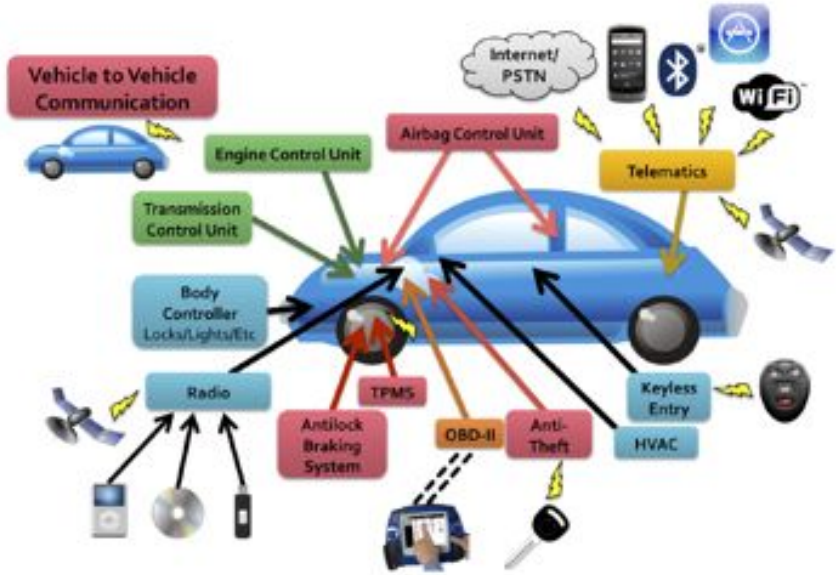
Computer security meets the real world



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The value of security research

- Security is a game of innovation
- Keeping up, staying ahead; readiness

…down the road, the cyberthreat, which cuts across all [FBI] programs, will be the number one threat to the country."

-- Robert Mueller, Jan 31, 2012

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Thank you

- Questions?