Internet and Security: A Closer Look

JAN 16, 2015
- Key Ideas of the Internet
- Internet Security
- Mobile Security
Key Ideas of the Internet

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Where did the Internet come from?

- Government sponsored project in the 1960s
  - Cold war

- Defense department
  - What if parts of the phone network are destroyed?
(Old) Phone Network

- Phone connection
  - Dedicated circuit between two parties
    - “Circuit Switching”
  - If a segment of the circuit in the network is destroyed
    - The two parties cannot communicate
A More Resilient Communication Network

- How to design a communication network
  - that can survive
  - when parts of the network are destroyed?
Key Idea 1: Packet Switching

- Multiple routes between two parties via a network
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- Multiple routes between two parties via a network
- A message is broken up into “packets” at the sender
- Each packet can be transmitted via a different route
- The message is composed from packets at the receiver
What if part of the network is destroyed?

- Some packets will be lost
- Lost packets are re-sent via other routes
- “Protocol” between sender and receiver
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  - Detects duplicate packets at the receiver
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- Lost packets are re-sent via other routes
- “Protocol” between sender and receiver
  - Detects lost packets
  - Detects out-of-order packets at the receiver
  - Detects duplicate packets at the receiver
  - Detects corrupted packets at the receiver
Different Types of Computers in a Network

- Consider 3 different types of computers: A, B, C
  - 3 different pairs of computer types
    - A-B, B-C, A-C
    - 3 different “protocols”
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- Consider 3 different types of computers: A, B, C
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    - A-B, B-C, A-C
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- N types of computers
  - $N(N-1)/2$ different protocols
  - Lots of work
Key Idea 2: Interface Message Processors (IMPs)

- Computers don’t directly connect to each other
- Each computer connects to an IMP
  - IMPs connect to each other
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  - IMPs connect to each other

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  - 3 different protocols: A-IMP, B-IMP, C-IMP

- N types of computers
  - N protocols, instead of N(N-1)/2
Multiple Networks

- APRANET, NSFNET, USENET, CSNET, UUNET, ...

- Computers on one network couldn’t talk to those on another network.
Key Idea 3: Internet Protocol

- Networks are connected to each other via Gateways
  - “inter” network => Internet

- Internet Protocol (IP) (1970s)
  - If a computer /network understands IP
    - It can communicate with another on a different network
More Familiar Networks

- **Local Area Networks (LANs)**
  - Ethernet
  - Wifi

- These networks are connected to the Internet via routers/ISP/gateways/...
Software/Hardware Complexity

- Designing “apps” could be complex
  - Involving many ideas
Key Idea 4: Abstraction Levels

- Like an onion
  - Many layers/levels
  - Working at one level without knowing the details of the lower levels
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- Like an onion
  - Many layers/levels
  - Working at one level without knowing the details of the lower levels

- Send email, search via google, ...
  - Without knowing any details about Internet Protocol, Gateways, IP addresses....

- Easier to build “apps” quickly
Beyond Communication

• Phone system
  ○ 911 service
  ○ 411 service
  ○ 800 toll-free to businesses
Key Idea 5: Resource Sharing

- Internet is not just for communication
  - Allow sharing of resources
    - World Wide Web (1990s)
      - Sharing of scientific information/data/articles
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    - Fast forward to now
      - Banking, shopping, entertainment, education, ....
Key Idea 5: Resource Sharing

- Internet is not just for communication
  - Allow sharing of resources
    - World Wide Web (1990s)
      - Sharing of scientific information/data/articles
      - “hyperlinks” that link related resources
      - URL: Uniform Resource Locator
    - Fast forward to now
      - Banking, shopping, entertainment, education, ...
  - Future
    - ???
      - Up to our imagination
      - Whatever that can be digitized can be transmitted and shared
Government and Free Enterprise

- The US government decided not to restrict internet technology
- No one single authority controls the Internet
  - Each network/gateway is controlled by its owner (in some cases governments)
    - Lots of cooperation
- Free to innovate and commercialize
Summary of Key Ideas

1. Packet switching
2. Interface Message Processors
3. Internet Protocol
4. Abstraction Levels
5. Resource Sharing
More Outreach Efforts

- cs.fit.edu/~pkc/cs4hs
  - District-wide tic-tac-toe tournament
    - Organized by Edgewood in April/May
    - Your player against others
  - Summer Camps
    - July