Security part

13.2. Vulnerabilities and attacks

Vulnerabilities

- Vulnerabilities appear everywhere in the stack
  - Modern systems are very large and complex
  - Impossible to test all possible use cases in advance
- Long history of
  - Network protocol vulnerabilities
  - OS vulnerabilities
  - Application vulnerabilities
    - Browsers, web servers, database mgmt systems, mail programs
    - Web apps (see OWASP Top 10)
    - Mobile apps
- Also non-technical vulnerabilities”
  - Social engineering
  - Illness, loss of personnel
  - Power failure, comms problems, fire, flood, earthquake, …

Human vulnerabilities (Social Engineering)

- Social engineering is the practice of manipulating legitimate users
- Users are tricked into providing passwords or other secrets or allowing the attacker to bypass security
- Can be very effective
  - Typically tried in bulk on a large number of users in the hope that a few users will fall for it
  - Sometimes very subtle

- Best defence is security awareness training
  - See SANS ”Securing the Human” project:
  - http://securingthehuman.sans.org/

Malware: risks from insecure programs

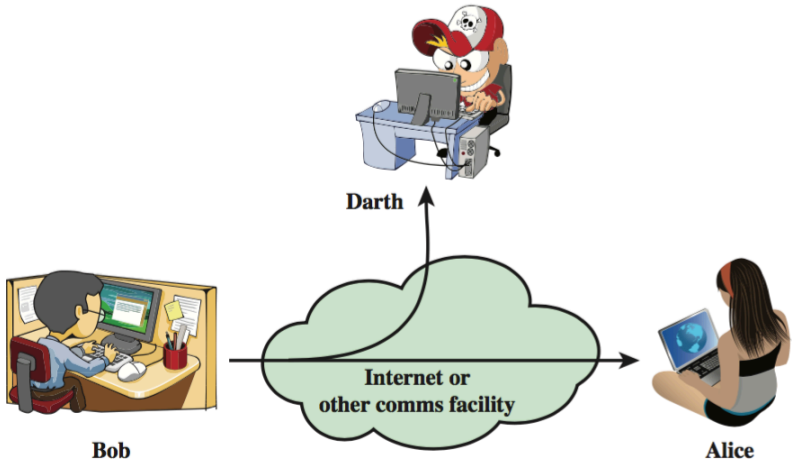
- Anything that can be executed on a machine may have all the rights and privileges of the user who is (directly or indirectly) executing it
- This may include
  - Read/write/modify/create/delete files or data
  - Reading from input devices (e.g. keyboard)
  - Writing to output devices
  - Interacting with the user
  - Administrative tasks like creating user accounts, opening/closing ports, launching other programs
  - Connection to other networked machines, file transfer, send emails, etc

Types of Attackers

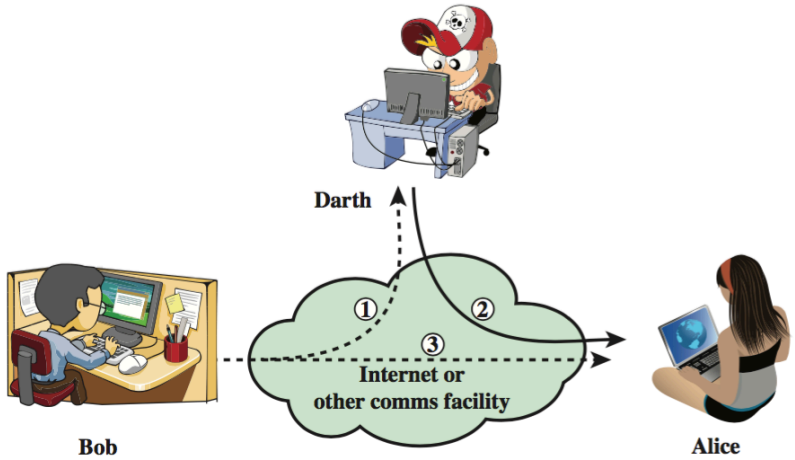
- Opportunists
  - Typically scan wide range of addresses looking for system to exploit
  - For fun; to vandalise; to store pirated movies, music, etc
- Professionals
  - Industrial espionage; Fraud; Spam
- Activists
  - Political or social motivation
- Disgruntled current and former employees and contractors
  - May be able to bypass security measures – via legitimate accounts, accounts left open, back doors, etc
- Worms and automated agents
  - Malicious software

Classification of Attacks

- Passive Attack
  - Eavesdropping or monitoring to:
    - Obtain message contents, or
    - Monitor traffic flows



- Active Attack
  - Modification of data stream to:
    - Masquerade as someone else
    - Replay previous messages
    - Modify messages in transit
    - Denial of service
  - Break into system



Passive attack: Sniffing

- Sniffing on a network
  - Easy to do on broadcast LAN if attacker can get physical access to network point
  - Wireless LANs often have no encryption or broken encryption (e.g. WEP)
  - WAN security varies

- Keystroke logging
  - Keystroke logging software may be installed by virus or directly by attacker.
  - Alternatively, can insert small piece of hardware between keyboard and computer

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Stages of an active attack – the five Ps

- Probe
- Penetrate
- Persist
- Propagate
- Paralyse

Stages of an attack – Probe

- Reconnaisance
  - Public information – Whois, DNS, target company website, search engines
  - Maltego
  - “Google hacking”
  - Social engineering

- Sniffing & scanning
  - Listen on broadcast (W)LANs; NetStumbler, Wireshark
  - Key logging
  - Network mapping
  - Port scanning; Nmap
  - Software version mapping
  - Vulnerability scanning

Stages of an attack – Penetrate

- Finding secrets
  - Password guessing & grinding (brute force cracking)
  - Malware (virus, Trojan, rootkit, etc)
- Spoofing
  - IP address / MAC address
- Session hijacking
- DNS cache poisoning
- Malformed input
  - Buffer overflows, format string attacks, …
- Web app attacks
  - SQLi, XSS, CSRF, …
- All of the above; Metasploit framework

Stages of an attack – Persist

- Having gone to the trouble of breaking in, the attacker wants to get back in easily
- Back door for remote control
  - Install small service listening on port and providing access (e.g a shell)
  - or else a small client that “dials out”
- Trojan horse
  - Malicious software often disguised as something innocuous
- Rootkit
  - Trojan suite that hides itself by suppressing logging and monitoring tools
- Covert channels
- Steganography

Stages of an attack – Propagate

- Use newly compromised system as the source of further attacks – more sniffing and scanning (see “Probe”)
- Map internal network from compromised machine.
- Often internal resources are configured to trust each other, making it easier to attack.

Stages of an attack – Paralyse

- The attacker does some damage – stealing or destroying data, bringing systems down, etc.
- Access confidential data
  - By sniffing, malformed input, web app attacks, etc (see “Probe”, “Penetrate”)
- Integrity breach
  - Modify/corrupt data
- Denial of Service (DoS)
  - where one user takes up so much of a shared resource that little or none of the resource is left for others.
  - These resources can be CPU time, disk space, OS processes, network bandwidth, or even someone’s time.
  - Examples: Amplifier attacks, Distributed DoS