Network Attacks

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9:07 AM

Vectors

- Network protocol issues or features
- Bugs in server programs
- Bugs in client programs
- Bugs in websites or web programs (but not the actual web server)

Network Protocols

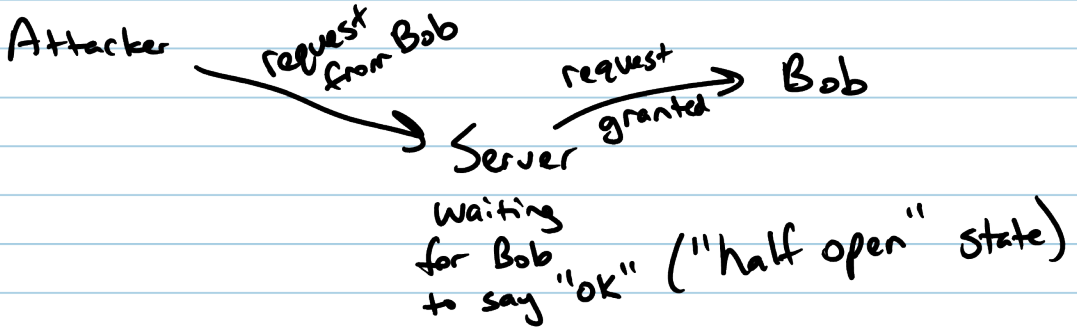
70s/80s were trusting times in computing, so TCP/IP has very few security features built in

Examples:

- No default encryption - packet sniffing attacks
- No verification of addresses - "spoof" addresses
- No verification of infrastructure servers - forge responses

Common attacks

- Flood an Ethernet switch with random source MAC addresses
  - confuses the switching algorithm so it starts broadcasting all data
  - enables packet sniffing
  - fix: don't allow one cable to have multiple MACs
- Reflected Distributed Denial of Service Attack
  - Attacker generates a packet with forged source IP address that requests a connection
  - may use many machines to generate packets



Server runs out of slots for half-open connections
Can't process ANY connections

fix: SYN cookies eliminates need for half-open state by sending a cryptographic "cookie" w/ that info

ARP Cache Poisoning
ARP is used to translate IP address ⇔ MAC addrs
Trick into using malicious MAC address for an IP addr

DNS Cache Poisoning
Same idea, but for domain names & IP addrs
fix - DNSSEC allows digital certificates for domain name ⇔ IP address lookups

Operational Security Protections Against Protocol Attacks
1) Keep up to date w/ systems
2) Firewalls
Watch for spoofed addresses, bad flag combos, etc.
Disable access for computer that appears to be doing common network protocol attacks
3) Protocol-based intrusion detection systems

Best practice is to use all three (as much as feasible) to have layers of defense ("defense in depth")

Bugs in Programs
Three Main Types
Mistake in program code/logic
Exploitable feature of program
Malicious code (intentional)
Mistakes in code/logic
Very common issue w/ programs
Some languages have syntactic features which are visually similar, but logically different
C/C++/Java example:
if (x = y) vs if (x == y)

set x to be same value as y
is x equal to y?
Accidentally use wrong logical operator
&& AND of two items & bitwise AND

Accidentally use wrong logical operator
- && AND of two items
- & bitwise AND
- || OR of two items
- | bitwise OR

Don't sanitize user input
- no limits on number of letters typed
- no checks on values typed

Feature gets used "unexpectedly"
- no logic error, but didn't foresee what users will do

Malicious code
- not much to do except be careful where you get programs

Classic examples:
- Brain virus - late 1980s
  - floppy disk virus
    - infects boot sector of disk
    - gets run when disk put into reader
  - puts itself into RAM on vulnerable system
    - copies itself to new floppies when disk is put into reader

- Morris Worm - Nov 2, 1988
  - self-replicating code using bug in email servers
  - Robert T. Morris Jr created it as a grad student
    - convicted in 1990
  - also tried common usernames & passwords
  - caused at least 10% of systems to crash or go offline

  - caused development of CERT & several security groups

- Code Red Worm - mid 2001
  - buffer overflow in web page distributed by default with Microsoft web servers
  - allowed any code after buffer to be run as user running Microsoft web server (often Administrator)

bug had been patched one month before 1st worm, but few had applied patch

Lessons: Patching is not done as often as it should
Web servers shouldn't run as Admin
Even poorly coded worms can spread quickly

Zeus Virus / Trojan - within last 5 years
web bug - caught from visiting website with malicious code or clicking email attachments
targetted at banking credentials
use mix of key logging, browser-in-the-middle, & session hijacking
evades anti-virus & malware detection software

Lessons: Malware writers are tricky, can't count on antivirus software & patches alone

How Can We Protect Ourselves?
1) Keep up to date on patches for ALL software
2) Have anti-virus & malware detection software and keep it up to date too
3) Be careful what software you install & where you get it
4) Consider having a dedicated system for secure transactions or a "throw-away" virtual machine for random web browsing

"Botnets"
These are compromised machines w/ backdoors on them that respond to command & control networks
Used in generic Distributed Denial of Service attacks told to go to a site