Network-Based Denial of Service Attacks

Trends, Descriptions, and How to Protect Your Network

Craig A. Huegen <chuegen@cisco.com>

Cisco Systems, Inc.

SANS ‘98 Conference - Monterey, CA

CISCO SYSTEMS

980209_dos.ppt

Trends

- **Significant increase in network-based DoS attacks over the last year**

  Attackers’ growing accessibility to networks

  Growing number of organizations connected to networks

- **Vulnerability**

  Most networks have not implemented spoof prevention filters

  Very little protection currently implemented against attacks

Profiles of Participants

- **Tools of the Trade**
  - Anonymity
  - Internet Relay Chat
  - Cracked super-user account on well-connected enterprise network
  - Super-user account on university residence hall network
  - “Throw-away” PPP dial-up accounts
- **Typical Victims**
  - IRC Users, Operators, and Servers
  - Providers who eliminate troublesome users’ accounts

Goals of Attacks

- **Prevent another user from using network connection**

  “Smurf” and “Fraggle” attacks, “pepsi” (UDP floods), ping floods

- **Disable a host or service**

  “Land”, “Teardrop”, “NewTear”, “Bonk”, “Boink”, SYN flooding, “Ping of death”

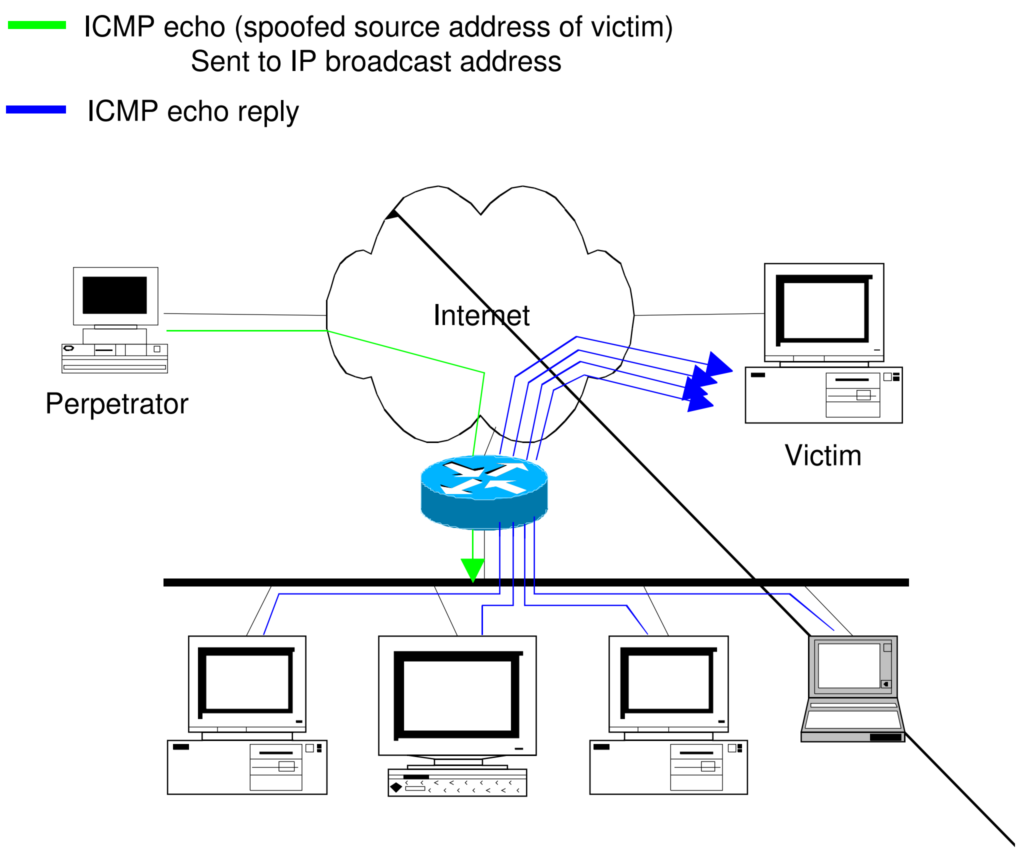
- **Traffic monitoring**

  Sniffing

“Smurf” and “Fraggle”

- **Very dangerous attacks**
  - Network-based, fills access pipes
  - Uses ICMP echo/reply (smurf) or UDP echo (fraggle) packets with broadcast networks to multiply traffic
  - Requires the ability to send spoofed packets
- **Abuses “bounce-sites” to attack victims**
  - Traffic multiplied by a factor of 50 to 200
  - Low-bandwidth source can kill high-bandwidth connections
- **Similar to ping flooding, UDP flooding but more dangerous due to traffic multiplication**

“Smurf” (cont’d)



ICMP echo (spoofed source address of victim)
Sent to IP broadcast address
ICMP echo reply
Internet
Perpetrator
Victim

“Smurf” and “Fraggle” trend

- Smurf attacks are still “in style” for attackers - Fraggle released March ‘98
- Significant advances made in reducing the effects

    Education campaigns through the use of white paper and other education by NOCs has reduced the average “smurf” or “fraggle” attack from 80 Mbits/sec to less than 5 Mbits/sec

- Most attacks can still inundate a T1 link

"Land"

- Goal is to severely impair or disable a host or its IP stack
- Connects address and port pair to itself
- Requires the ability to spoof packet source addresses
- Requires the victim's network to be unprotected against packets coming from outside with own IP addresses

Craig A. Huegen <chuegen@cisco.com>

“Teardrop”, “NewTear”, “Bonk”, “Boink”, “Ping of Death”

- Goal is to severely impair or disable a host or its IP stack
- Use packet fragmentation and reassembly vulnerabilities
- Require that a host IP stack be able to receive a packet from an attacker

SYN flooding

- Goal is to deny access to a TCP service running on a host
- Creates a number of half-open TCP connections which fill up a host's listen queue; host stops accepting connections
- Requires the TCP service be open to connections from the victim

Sniffing

- Goal is generally to obtain information
    - Account usernames, passwords
    - Source code, business critical information
- Usually a program placing an Ethernet adapter into promiscuous mode and saving information for retrieval later
- Hosts running the sniffer program is compromised using host attack methods

Prevention Techniques

- **How to prevent your network from being the source of the attack:**

  Apply filters to each customer network

    Allow only those packets with source addresses within the customer's assigned netblocks to enter your network

  Apply filters to your upstreams

    Allow only those packets with source addresses within your netblocks to exit your network, to protect others

    Deny those packets with source addresses within your netblocks from coming into your network, to protect your network

- **This removes the possibility of your network being used as an attack source for many attacks which rely on anonymity**

Prevention Techniques

- **How to prevent being a “bounce site” in a “Smurf” or “Fraggle” attack:**
  - **Turn off directed broadcasts to networks:**
    - **Cisco: Interface command “no ip directed-broadcast”**
    - **Proteon: IP protocol configuration “disable directed-broadcast”**
    - **Bay Networks: Set a false static ARP address for bcast address**
  - **Use access control lists (if necessary) to prevent ICMP echo requests from entering your network**
  - **Encourage vendors to turn off replies for ICMP echos to broadcast addresses**

Prevention Techniques

- Technical help tips for Cisco routers
- Unicast RPF checking
- Interprovider Cooperation

  Stories from the field

  Network Operations Centers should publish proper procedures for getting filters put in place and tracing started

References

- Detailed “Smurf” and “Fraggle” information
- Ingress filtering
- MCI’s DoSTracker tool
- Other DoS attacks

Author

Craig Huegen

<chuegen@cisco.com>

Questions?