Foundations of Computer Security

Lecture 71: Availability

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Aspects of Computer Security

Recall that historically computer security has been defined to encompass:

Confidentiality: (also called secrecy/privacy) who can *read* information;

Integrity: who can *write* or modify information;

Availability: are resources available when needed.

Availability Attacks

Attacks on availability are called *denial of service* or DoS attacks. An attacker prevents a user from accessing or utilizing available system resources.

A particular class of DoS attacks are labeled *Distributed Denial of Service* or DDoS attacks. These typically involve co-opting the services of many other machines to participate in the attack, a *botnet*.

Gresty's Framework

David Gresty at Liverpool John Moore's University classifies DoS attacks into two groups:

1. **the consumer problem**: (also called "man-in-the-middle" attack) the attacker gets logically between the client and service and somehow disrupts the communication.
2. **the producer problem**: the attacker produces, offers or requests so many services that the server is overwhelmed.

Typical Scenarios

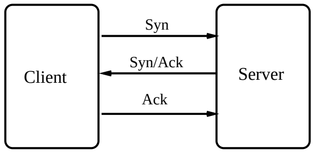
In a typical producer attack:

- the volume of requests may overwhelm the server.
- the transaction may involve some handshake (protocol); the attacker does not respond and the server ties up resources waiting for a response.

A classic example of the second is so-called *syn flooding*.

TCP Handshake

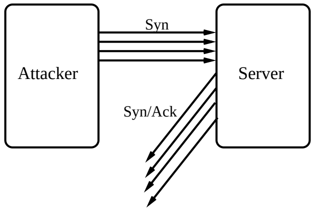
Via this three-way handshake a client establishes a TCP connection with a server.



Server receives the SYN packet, allocates space in an internal table and sends SYN/ACK back to the caller. The connection remains "half-open" until the ACK is received by the server or the connection times out.

SYN Flooding Attack

A *SYN Flooding* attack happens when an attacker forges the return address on a number of SYN packets. The server fills its table with these half-open connections.



All legitimate accesses are denied until the connections time-out.

SYN Flooding Solutions

Is the SYN flooding problem inherent in the way TCP connections are established? How could you close the vulnerability?

1. *Increase the server's queue size:* typically only 8 connections are allowed; could consume considerable resources.
2. *Shorten the time-out period:* might disallow connections by slower clients.
3. *Filter suspicious packets:* if the return address does not match the apparent source, discard the packet. May be hard to determine.
4. *Change the algorithm:* instead of storing the record in the queue, send the information encrypted along with the SYN/ACK. A legitimate client will send it back with the ACK.

Lessons

- Availability attacks are called "denial of service" attacks.
- An attacker can either block traffic from clients (the consumer problem) or flood the server (the producer problem).
- Syn flooding is a classic DoS attack.

Next lecture: Availability II