Network and Internet Vulnerabilities

Computer Security Lecture 8

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Outline

Internet attacks and defences

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- The last step happens in the most serious cases, especially where security flaws may be exploited to attack other, well-managed sites.
- Internet security is a **distributed community-wide responsibility**. Black-listing is a socioeconomic countermeasure. Black lists may be useful for crackers as well as good guys (they list hosts which may have security holes), so systems which are not repaired find themselves being attacked and isolated from the rest of the network.

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- A protocol implementation fix called **SYNcookie**, is for Bob to send out Y as encrypted version of X, so he doesn't need to keep state. This is implemented in Linux and some other systems.

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- SYN flooding attacks usually have forged source addresses. The ACK is either impossible (address not reachable) or targets another machine, sending meaningless ACK packets.
- The SYNcookie fix doesn’t prevent flooding. As a countermeasure to assist tracing, network providers should implement **ingress filtering** on edge routers (RFC 2267). This ensures packets entering the Internet have source addresses within their origin network fragment, restricting forged packets.

Smurfing (directed broadcast)

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- A **fraggle**: similar attack with UDP packets (port 7, or other ports). Also attacks using TCP.

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- 16th Feb 2003: 46k broken networks; 10 in UK.
- 3rd Feb 2005: 2k broken networks reported.
- 29th Jan 2007: `www.powertech.no/smurf/` replaces `netscan.org`, only 231 broken
- 31st Jan 2008: 124 broken (2448867 scanned)

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  - Have routers add extra *ICMP traceback messages* with a low probability, e.g., 1 in 20,000. Then sysadmins can trace large-scale attacks back to responsible machines (even if IP spoofing is used).

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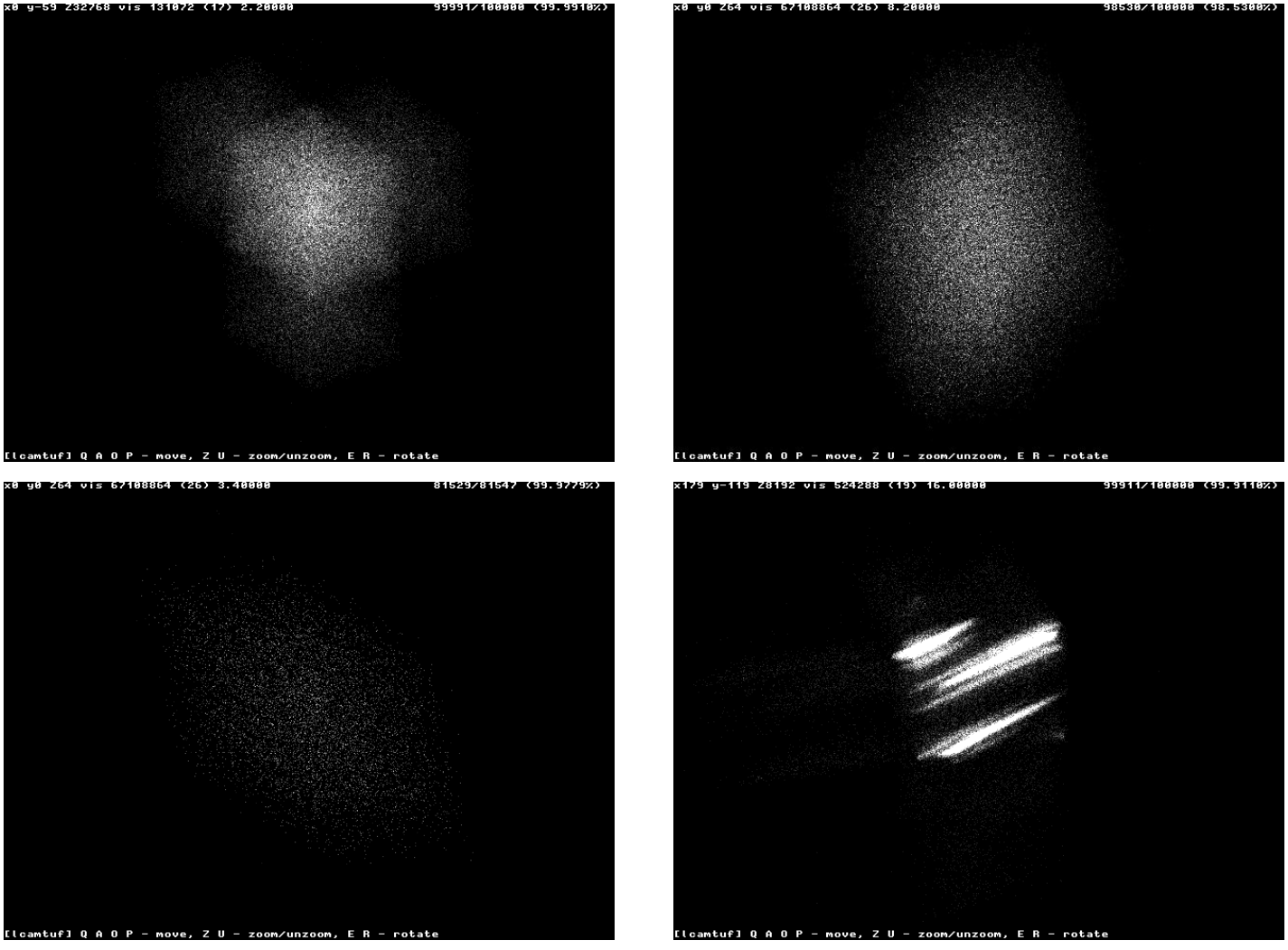
- A complex attack, but can be scripted.

ISN Predicability



- Plots in 2002 for WinXP (tl), Linux (tr), OS/400 (bl), UNICOS (br).
- See `http://lcamtuf.coredump.cx/newtcp`

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- TCP includes **source routing**, for bypassing network outages. Source-routed packets escape the (weak) authentication of the return address. Forged ICMP **redirect messages** can have similar effect.

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- The attack called **DNS cache poisoning** is based on feeding false information into locally cached DNS tables. It means that, within some network portion, a web site can be redirected elsewhere, for example, completely outwith the web-site server’s control.

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- Can also prevent Alice noticing, by sending synchronized empty packets instead of disconnecting, and letting her reconnect to server afterward.

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  If any of these authentication mechanisms are broken by an attacker, he can attach a malicious application to the server.

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- NFS and NIS have had numerous additional security problems. NFS file-handles can be guessed. NIS may serve up password files, and NIS server responses can be faked. Newer replacements are recommended.

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- Many reported flaws in particular implementations (libraries, specific network devices).

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  - Voice traffic on another transport, e.g. RTP over UDP

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- Various vulnerabilities reported by CERT/CC, UK NISCC, University of Oulou's PROTOS tool. Including DoS and worse.

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- **Software bug attacks** exploit bugs in particular network server (or client) program versions. Most incidents raised by CERT/CC are because of program bugs.

References

Surveys of (older) network attacks and defences are in the Wily Hacker book and Anderson's book. For more recent and practical information, look on the Internet, e.g., articles in the hacker magazine Phrack, `http://www.phrack.org`.

Ross Anderson. *Security Engineering: A Comprehensive Guide to Building Dependable Distributed Systems*.
Wiley & Sons, 2001.

William R Cheswick, Steven M Bellovin, and Aviel D Rubin. *Firewalls and Internet Security Second Edition: Repelling the Wily Hacker*.
Addison-Wesley, 2003.

Recommended Reading

Chapter 18 of Anderson.