# Network and Internet Defences

## Computer Security Lecture 13


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# Outline

Firewalls

Attack detection

Attack attraction

Building in security

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- Firewalls
- Attack detection
- Attack attraction
- Building in security

# Firewall varieties

Protect vulnerable machines; compensate for *impossibility* of securing internal networks.

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4. **Circuit relays**, e.g., SOCKS. Generic circuit-passing for TCP connections. Middle ground between 1 and 3. Drawbacks: poor for outgoing traffic (can even tunnel IP).

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  - Don’t prevent attacks at higher level. Circuit relay won’t prevent SMTP attacks. Application gateway may scan emails for viruses, but either accepts or rejects too much.
  - Clearly can’t prevent inside attacks, or protect apps that must be exposed (web servers). Growth of web-services: “Internet interprets censorship as damage and routes around it.”

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- Forensics: the art of reading other less obvious, incidental trails. E.g., shell, editor, application history/lock files; secret key files; outgoing mail drops, firewall and web cache logs; ultimately file system block level or hard-drive data recovery.

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- Issues: difficult problem; Internet is noisy medium; too few attacks so more false alarms than real ones; maintaining library of attack signatures; encryption can conceal signatures.

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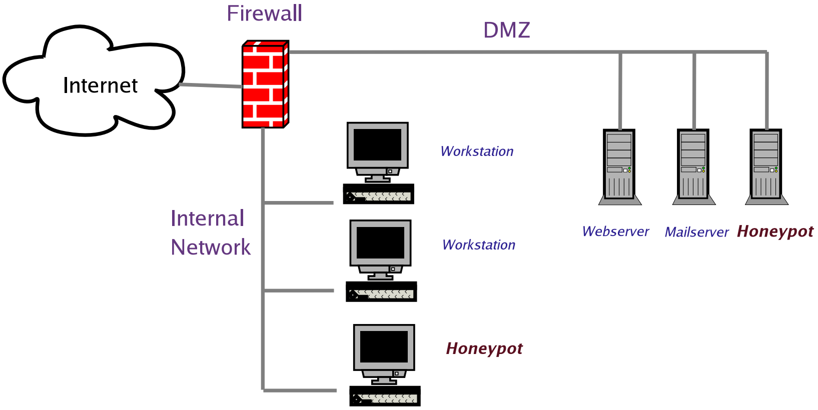
  - **research honeypots**

# Production Honeypot Deployment




- Production honeypots configured identically to corresponding machines. No DNS entries.

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- Nonetheless want to offer a high level of interaction to attackers as possible, and appear convincing (e.g. assign a domain name, fabricate a list of users, simulate network activity).
- Advanced attackers (as opposed to script kiddies) may still be difficult to detect/attract.

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- CDROM *Roo*, boots into a Linux-based Honeynet gateway, or "Honeywall". Target systems placed behind the gateway; the gateway performs all Data Capture (i.e., logging) and Data Control (i.e., containment; firewalling).

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  - E.g., for the Internet, **IPsec**.

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  - Examples include **ssh** for remote login, **SSL/TLS** designed for secure web transactions, and **S/MIME** or **PGP** for secured email.

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  - Uses Diffie-Hellman (i.e., key agreement of fresh shared key without authentication).

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- Security association meaningful for destination end only: peer-to-peer security requires two SAs.
- SAs are usually negotiated dynamically using IKE, although other protocols possible.
- IKE is rather complicated (allows for extending SAs, deleting SAs, detecting dead peers), which has raised interoperability problems. A Kerberos-based protocol and simplified version, IKEv2 (2005), may replace it.

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- Similarly, to use ESP with an IPv6/IPsec datagram, the sender:
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  - calculates the encryption and/or authentication
- There is much flexibility over where IPsec is placed: encryption may occur at hosts or routers; packets may be sent in a *transport* or *tunneled* mode.

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- ESP in transport mode similar, except a trailer is added to user data (including encryption padding) before encrypting. Encryption applies to TCP header, user data, and trailer. Authentication field is added at the end. Minor difference: no authentication of IP header.

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- Authentication doesn’t apply to mutable fields of new IP header.
- ESP in tunnel mode encrypts the original IP header, TCP header, user data, and the ESP trailer (padding). An extra authentication field is appended. Again, authentication of the new IP header is omitted with ESP.

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- Many further issues (caching, insecure compatibility, etc).

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- Flexible choice of ciphers. Implementations for various platforms, including free OpenSSH.
- Disadvantages: need to carry private key around; still vulnerable to DoS attacks (connection terminations) by injected IP packets.

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- Security by encapsulation in the network level, using e.g. IPsec, L2TPv3+IPsec, SSL/TLS.

# Other defences, mechanisms and tools

- **Kerberos**: secure authentication system for networks: *tickets* with short lifetimes, reduces password traffic on network. Applications have to be adapted to use Kerberos libraries. Improves security inside network perimeters (compared with host-based trust on network services).

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- SSL/TLS-enhanced protocols e.g., **SSLtelnet**, **SSLftp**, **stunnel**.

# References


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**Recommended Reading**

Part II of Cheswick (1st edition available online).