Network Startup Resource Center

Campus Network Design and Deployment Security

Security Cookbook

Tools and Topics

Topic Areas

- Access control
- Antivirus
- Authentication
- Detection
- Encryption
- Planning

Tools

Critical to understand:

- There are *many, many* tools
- Both Open Source and commercial
- Neither is superior or inferior to the other

Before you secure, have a plan

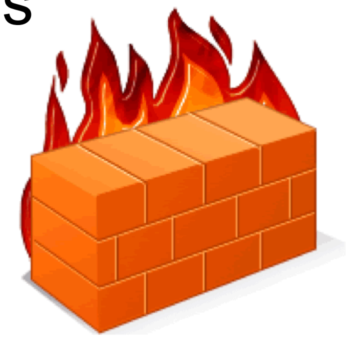
- What are you trying to do?
- Do you have approval?
- Obtain the resources
- Create a phased roll-out plan
- Be open and honest
- Provide solutions to your users

Access Control

Firewalls: Where to place them?

- Between VLANs and VRFs (Virtual Firewalls)
  - 3COM, Cisco, Juniper, etc. have solutions
- On individual servers
- On some clients
- Near the border? This is hard. Why?
  - Consider minimal key ACLs (NetBIOS, antispoofing, RFC 1918 leakage or ingress, etc.)

– Do you need firewalls on all servers?



Access Control

Firewalls:

A few Open Source software-based options

- **IPTables** (iptables): Linux
- **IPFW**: FreeBSD
- **IPF**: FreeBSD, NetBSD, OpenBSD, SunOS, HP/UX, and Solaris
- **PF** (with ALTQ for QoS): FreeBSD and OpenBSD

Some Open Source hardware-based solutions

– IPCop:	http://ipcop.org/
– *m0n0wall:*	http://m0n0.ch/wall/
– *pfSense:*	http://www.pfsense.org/
– Smoothwall:	http://www.smoothwall.org.

Access Control

Firewalls:

Under Windows

- **Windows Firewall**: XP and above
- ZoneAlarm Pro, Comodo Firewall Pro, Outpost Firewall Free, PC Tools Firewall Plus, Privatefirewall, Tall Emu's Online-Armor, Ashampoo, Jetico, Lavasoft, Look'n'Stop, Net, Preventon, Sphinx [Software], Sunbelt, Bullguard, Computer Associates, F-Secure, Kaspersky, McAfee, MicroWorld, Norton, Panda & Trend Micro, Webroot.

And, there’s always what comes on your wireless router...

Access Control

BCP38: *Best Current Practices 38*, or “Ingress Filtering” as defined by RFC 2827:

http://tools.ietf.org/html/bcp38

Egress Filtering: *Don’t let your compromised clients harm others!* Keep Your organization off blacklists.

http://en.wikipedia.org/wiki/Egress_filtering

Access control: management VLANs

- Create management subnets with VLANs
- Provide access to resources (routers, switches, APs, etc.) from these subnets.
- Use ACLs to do this…
  - Similar to firewall rules concept
  - ACL = Access Control List
  - Typically placed on routers
  - In English ACL sounds like "*ahkul*"

Access Control

Egress Filtering

- Watch for viruses (part of Network Scanning)
- Block outgoing SMTP from unauthorized IPs
- Look for typical attack signatures and block
- What else?

Other Types of Access

- Rate limit users if necessary (PF w/ALT-Q or in HW)
- Transparent Proxies (Cisco's WCCP [Web Cache Control Protocol] and, possibly, the use of Squid)

Access Control

Provide multiple user IDs and access domains to assign blame! ☺

Big topic. Possible solutions include:

- Radius
- Kerberos
- LDAP
- Activive Directory

Detection

Detect bad stuff on your network using Network Intrusion Detection Systems (NIDS)

Open Source

- SNORT: http://www.snort.org/
  - ✓ sguil: http://sguil.sourceforge.net/

Commercial

- Cisco Intrusion Detection in hardware: http://www.cisco.com/warp/public/cc/pd/sqsw/sqidsz
- VCC/Tripwire, F5, Big Iron, Juniper, etc.

Detection

Detect unexpected changes on servers:

Open Source

- Tripwire: http://sourceforge.net/projects/tripwire/
- Samhain: http://www.la-samhna.de/samhain/
- fcheck: `apt-get install fcheck …`

Scan Servers for Vulnerabilities

- Nessus: http://www.nessus.org/
- nmap: http://nmap.org/
- Nikto: http://cirt.net/nikto2

```
# nmap -A -T4 –F <HOST>
```

Detection

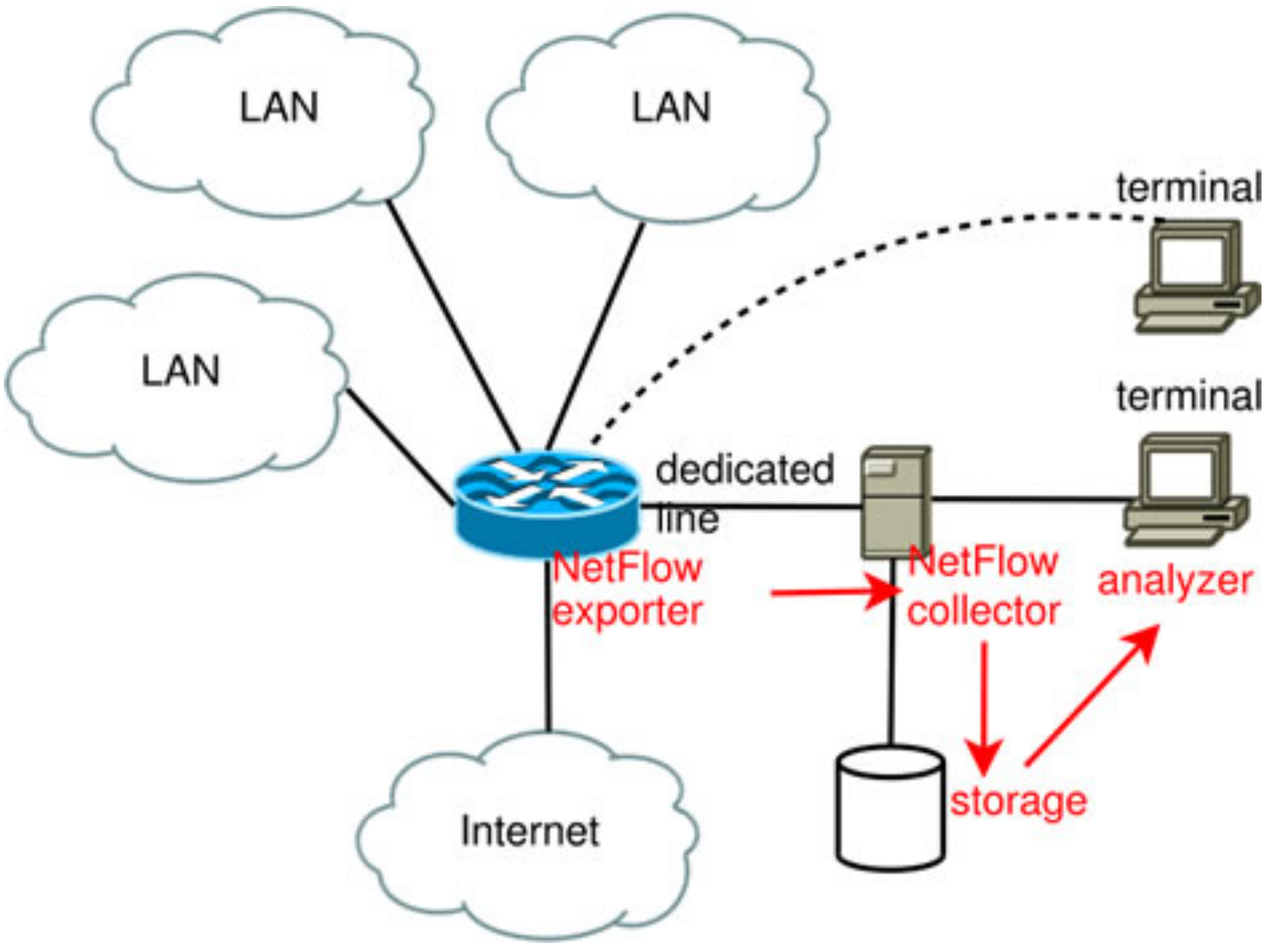
The NetFlow standard is available on Cisco, Juniper, HP, etc. hardware.

Use tools to view flows to detect DDoS attacks and common other network attacks:

Tools

- **nfdump** (collector): http://nfdump.sourceforge.net/
- **NfSen** (GUI): http://nfsen.sourceforge.net/
- **pmacct** (collector): http://www.pmacct.net/
- **pmGraph** (GUI): http://www.aptivate.org/pmgraph

Detection: Netflow



Antivirus

From the server side. Scanning incoming and outgoing emails for viruses:

Open Source Tools

- Amavis Next Generation: http://sourceforge.net/projects/amavis/
- Clam Antivirus: http://www.clamav.net/l
- exiscan (for Exim): http://www.exim.org/
- Mailscanner: http://www.mailscanner.info/
- Sanitizer: http://mailtools.anomy.net/

Graphing and Baselining

A core Network Monitoring and Management concept.

- Start to monitor your network
- Gain insight in to what is “normal” activity
- Graph this information

Now you will more easily detect abnormal conditions and be able to present this graphically. Netflow is critical to this.

Access/Authentication with encryption

SSH - Perhaps the single most important system administration tool that exists.

Let’s say that again…

SSH - Perhaps the single most important system administration tool that exists.

SSH: Routers, Switches, Servers, APs

Enable SSH on:

- routers
- switches
- servers (where possible)
- access points
- anything else that offers it as an option

Disable Telnet on most everything

Again – disable telnet on your routers, switches, servers and APs.

SSH: Key concepts

Keys vs. Passwords

- Public/Private key pairs (use them)
- Disable passwords when possible
- Understand the basics:
  - Ciphers
  - Checksums
  - Certificates

The power of SSH next…

The power of SSH

You can do a *lot* with SSH:

- Disable passwords to avoid compromised machines.
- Log in to multiple machines with one password that never expires (or no password if you want)
- Execute commands securely and remotely
- Securely copy files/data between two machines
- Gain root access to remote servers by exchaning your public key – not a password.

Backup, backup, backup…

Backup routers

Backup switches

Backup access points

Use **RANCID**:

- *Really Awesome New Conflg Differ* (really)
- http://www.shrubbery.net/rancid/

Without backups you are much more vulnerable to attack.

Forensics: Logging

- Send logs from devices to a logging server
- Consider your logging system (syslog, syslog-ng, rsyslog, etc.)
- Use regex to look for unusual events (swatch, tenshi, grep…)
- Longer-term problems, immediate problems and post-attack forensics require that you log as much as possible.

Logging: router msgs to log server

How hard is it to send router messages to a central logging server?

```
router# configure terminal
router(config)# logging IPADDRESS
router(config)# logging facility local5
router(config)# logging userinfo
router(config)# exit
router# write memory
routerX# exit
```

A few references

- *Enterprise MPLS VPN – Howto*
  http://brokenpipes.blogspot.com/2006_06_01_archive.html
- *FreeBSD Security*
  http://www.freebsd.org/doc/handbook/security.html
- *Real Security For a Virtual Network*
  http://3comsblog.wordpress.com/tag/vrf/
- *Securing Debian Manual*
  http://www.debian.org/doc/manuals/securing-debian-howto/ch-sec-tools.en.html
- *Top 100 Security Tools* (2006)
  http://sectools.org/
- *Ubuntu Security Forums*
  http://ubuntuforums.org/showthread.php?t=510812

Questions?

?

Optional bits and pieces

Some more detailed discussion of authentication mechanisms and encryption methods.

Authentication

How to verify you are who you say you are…

- **OPIE:** *One time Passwords In Everything,* implements a one-time password (OTP) scheme based on S/key, which will require a secret passphrase (not echoed) to generate a password for the current session, or a list of passwords you can print and carry on your person.

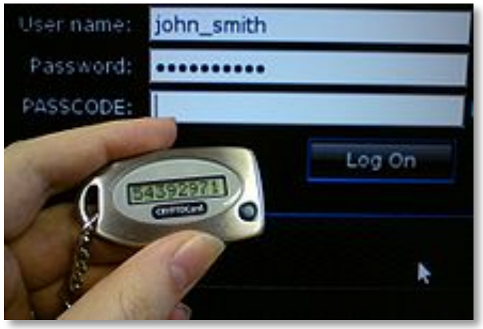
- **RADIUS:** *Remote Authentication Dial In User Service,* is a networking protocol that provides centralized Authentication, Authorization, and Accounting (AAA) management for computers to connect and use a network service.

freeRADIUS The world's most popular RADIUS Server.

Authentication

How to verify you are who you say you are…

- **token based authentication:** one-time id per session to offer additional layer of security. Similar to OPIE. Many products and variations:
  http://en.wikipedia.org/wiki/Security_token



User name: john_smith

Password: ●●●●●●●●●●●

PASSCODE:

Encryption

TLS: *Transport Layer Security*:

How TLS Works*

A TLS client and server negotiate a stateful connection by using a handshaking procedure:

1. The handshake begins when a client connects to a TLS-enabled server requesting a secure connection and presents a list of supported CipherSuites (ciphers and hash functions).
2. From this list, the server picks the strongest cipher and hash function that it also supports and notifies the client of the decision.
3. The server sends back its identification in the form of a digital certificate. The certificate usually contains the server name, the trusted certificate authority (CA) and the server's public encryption key.
4. The client may contact the server that issued the certificate (the trusted CA as above) and confirm that the certificate is valid before proceeding.
5. In order to generate the session keys used for the secure connection, the client encrypts a random number with the server's public key and sends the result to the server. Only the server should be able to decrypt it, with its private key.
6. From the random number, both parties generate key material for encryption and decryption.

*http://en.wikipedia.org/wiki/Transport_Layer_Security

Encryption

IPSec: Internet Protocol Security is a protocol suite for securing Internet Protocol (IP) communications by authenticating and encrypting each IP packet of a communication session.

- Protects any application traffic across an IP network.
- An end-to-end security scheme operating in the Internet Layer of the Internet Protocol Suite.
- Uses SHA1 for integrity protection and authenticity and 3DES or AES for confidentiality.
- Available for most operating systems built in to the kernel stack:
  - ✓ Linux, AIX, OpenBSD, FreeBSD, Mac OS X
  - ✓ Windows (since 2000)
  - ✓ Cisco IOS
  - ✓ Android, z/OS, Solaris
  - ✓ Many more…

Encryption

- **PSK**: Pre-Shared Key. Used with deprecated Wi-Fi protection scheme known as WPA or “Home Mode”. Key is created on the AP and passphrase is used on the client to regnerate the key. Excellent details availabe here:

  http://en.wikipedia.org/wiki/Wi-Fi_Protected_Access

- **PEAP**: The **Protected Extensible Authentication Protocol**, also known as **Protected EAP** or simply **PEAP**, is a protocol that encapsulates the Extensible Authentication Protocol (EAP) within an encrypted and authenticated Transport Layer Security (TLS) tunnel.
  - **EAP:** http://en.wikipedia.org/wiki/Extensible_Authentication_Protocol
  - **EAP-TLS:** http://en.wikipedia.org/wiki/EAP-TLS#EAP-TL
  - **PEAP-TLS**: http://en.wikipedia.org/wiki/Protected_Extensible_Authentication_Protocol

Access Control

Gaining proper access to resources:

- **WPA-2 (802.11i): Wi-Fi Protected Access** (**WPA**) and **Wi-Fi Protected Access II (**WPA2**)** are the names of security protocols and security certification programs developed by the Wi-Fi Alliance to secure wireless computer networks. WPA using TKIP is largely deprecated
- **WEP: Wired Equivalent Privacy** (deprecated) security algorithm for IEEE 802.11 wireless networks. Is susceptible to eavesdropping. A WEP connection can be cracked with readily available software within minutes.

A nice primer on TLS, Wi-Fi and the use of the Extensible Authentication Protocol, or EAP:

http://etutorials.org/Networking/802.11+security.+wi-fi+protected+access+and+802.11i/Part+II+The+Design+of+Wi-Fi+Security/Chapter+9.+Upper-Layer+Authentication/Transport+Layer+Security+TLS/