Basics

5 Phases to a penetration test

Reconnaissance
Scanning & Enumeration
Gaining Access
Maintaining Access
Covering Tracks

Attack Types

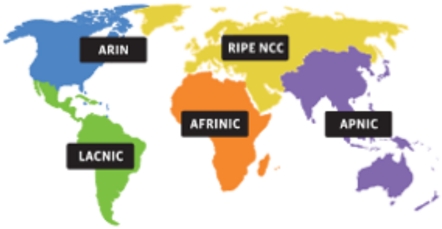
OS: Attacks targeting default OS settings
App level: Application code attacks
Shrink Wrap: off-the-shelf scripts and code
Misconfiguration: not configured well

Legal

18 U.S.C 1029 & 1030
RFC 1918 - Private IP Standard
RFC 3227 - Collecting and storing data
ISO 27002 - InfoSec Guidelines
CAN-SPAM - email marketing
SPY-Act - License Enforcement
DMCA - Intellectual Property
SOX - Corporate Finance Processes
GLBA - Personal Finance Data
FERPA - Education Records
FISMA - Gov Networks Security Std

CVSS - Common Vuln Scoring System
CVE - Common Vulns and Exposure

Regional Registry Coverage Map



Cryptography

Symmetric Encryption

Key pairs required =

Symmetric Algorithms

DES: 56bit key (8bit parity); fixed block
3DES: 168bit key; keys ≤ 3
AES: 128, 192, or 256; replaced DES
IDEA: 128 bit key
Twofish: Block cipher key size ≤ 256bit
Blowfish: Rep. by AES; 64bit block
RC: incl. RC2→RC6. 2,040key, RC6 (128bit block)

Asymmetric Encryption

Public Key = Encrypt, Private Key = Decrypt

Asymmetric Algorithms

Diffie-Hellman: **Key Exchange**, used in SSL/IPSec
ECC: Elliptical Curve. Low process power/Mobile
El Gamal: != Primes, *log* problems to encrypt/sign
RSA: 2 x Prime 4,096bit. Modern std.

Hash Algorithms

MD5: 128bit hash, expres as 32bit hex
SHA1: 160bit hash,rq 4 use in US apps
SHA2: 4 sep hash 224, 256, 384, 512

Trust Models

Web of trust: Entities sign certs for each other
Single Authority: CA at top. Trust based on CA itself
Hierarchical: CA at top. RA's under to manage certs
XMKS - XML PKI System

Cryptography Attacks

Known Plain-text: Search plaintext for repeatable sequences. Compare to t versions.
Ciphertext-only: Obtain several messages with same algorithm. Analyze to reveal repeating code.
Replay: Performed in MITM. Repeat exchange to fool system in setting up a comms channel.

Digital Certificate

Used to verify user identity = nonrepudiation
Version: Identifies format. Common = V1
Serial: Uniquely identify the certificate
Subject: Whoever/whatever being identified by cert
Algorithm ID: Algorithm used
Issuer: Entity that verifies authenticity of certificate
Valid from/to: Certificate good through dates
Key usage: Shows for what purpose cert was made
Subject's Public Key: self-explanatory
Optional fields: e.g., Issuer ID, Subject Alt Name...

Reconnaissance

Definition

Gathering information on targets, whereas foot-printing is mapping out at a high level. These are interchangeable in C|EH.

Google Hacking:

operator:keyword additional search items
site: Search only within domain
ext: File Extension
loc: Maps Location
intitle: keywords in title tag of page
allintitle: any keywords can be in title
inurl: keywords anywhere in url
allinurl: any of the keywords can be in url
incache: Search Google cache only

DNS

Port 53 nslookup (UDP), Zone xfer (TCP)

DNS record types

Service (SRV): hostname & port # of servers
Start of Authority (SOA): Primary name server
Pointer (PTR): IP to Hostname; for reverse DNS
Name Server (NS): NameServers with namespace
Mail Exchange (MX): E-mail servers
CNAME: Aliases in zone. List multi services in DNS
Address (A): IP to Hostname; for DNS lookup
DNS footprinting: whois, nslookup, dig

TCP Header Flags

URG: Indicates data being sent out of band
ACK: Ack to, and after SYN
PSH: Forces delivery without concern for buffering
RST: Forces comms termination in both directions
SYN: Initial comms. Parameters and sequence #'s
FIN: ordered close to communications

DHCP

Client —Discovers-> Server
Client <—Offers—- Server
Client —Requests—>Server
Client <—-Ack—- Server
IP is removed from pool.

Scanning & Enumeration

ICMP Message Types

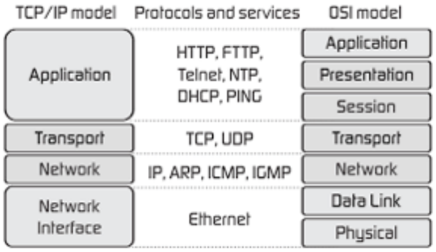
0: Echo Reply: Answer to Type 8 Echo Request
3: Destination Unreachable: No host/ network
Codes
0 – Destination network unreachable
1 – Destination host unreachable
6 – Network unknown
7 – Host unknown
9 – Network administratively prohibited
10 – Host administratively prohibited
13 – Communication administratively prohibited
4: Source Quench: Congestion control message
5: Redirect: 2+ gateways for sender to use or the best route not the configured default gateway
Codes
0 – Redirect datagram for the network
1 – Redirect datagram for the host
8: Echo Request: Ping message requesting echo
11: Time Exceeded: Packet too long to be routed

CIDR

Method of representing IP Addresses

IPv4 Notation

/30 = 4	.255.252
/28 = 16	.255.240
/26 = 64	.255.192
/24 = 256	.255.0
/22 = 1024	.248.0
/20 = 4096	.240.0



TCP/IP model	Protocols and services	OSI model
Application	HTTP, FTTP, Telnet, NTP, DHCP, PING	Application
		Presentation
		Session
Transport	TCP, UDP	Transport
Network	IP, ARP, ICMP, IGMP	Network
Network Interface	Ethernet	Data Link
		Physical

Port Numbers

0 – 1023: Well-known
1024 – 49151: Registered
49152 – 65535: Dynamic

Important Port Numbers

FTP: 20/21
SSH: 22
Telnet: 23
SMTP: 25
WINS: 42
TACACS: 49
DNS: 53
HTTP: 80 / 8080
Kerbers: 88
POP3: 110
Portmapper (Linux): 111
NNTP: 119
NTP: 123
RPC-DCOM: 135
NetBIOS/SMB: 137-139
IMAP: 143
SNMP: 161/162
LDAP: 389
HTTPS: 443
CIFS: 445
RADIUS: 1812
RDP: 3389
IRC: 6667
Printer: 515, 631, 9100

Tini: 7777
NetBus: 12345
Back Orifice: 27374
Sub7: 31337

HTTP Error Codes

200 Series - OK
400 Series - Could not provide req
500 Series - Could not process req

Nmap

Nmap is the de-facto tool for this pen-test phase

Nmap <scan options> <target>

-sA: ACK scan	-sF: FIN scan
-sS: SYN	-sT: TCP scan
-sI: IDLS scan	-sn: PING sweep
-sN: NULL	-sS: Stealth Scan
-sR: RPC scan	-Po: No ping
-sW: Window	-sX: XMAS tree scan
-PI: ICMP ping	-PS: SYN ping
-PT: TCP ping	-oN: Normal output
-oX: XML output	-A OS/Vers/Script
-T<0-4>: Slow - Fast	

Scan Types

TCP: 3 way handshake on all ports.
Open = SYN/ACK, Closed = RST/ACK
SYN: SYN packets to ports (incomplete handshake).
Open = SYN/ACK, Closed = RST/ACK
FIN: Packet with FIN flag set.
Open = no response, Closed = RST
XMAS: Multiple flags set (FIN, URG, and PSH) **Binary Header: 00101001**
Open = no response, Closed = RST
ACK: Used for Linux/Unix systems
Open = RST, Closed = no response
IDLE: Spoofed IP, SYN flag, designed for stealth.
Open = SYN/ACK, Closed = RST/ACK
NULL: No flags set. Responses vary by OS. NULL scans are designed for Linux/ Unix machines.

NetBIOS

nbstat
nbtstat -a COMPUTER190
nbtstat -A 192.168.10.12 remote table
nbtstat -n local name table
nbtstat -c local name cache
nbtstat -r -purge name cache
nbtstat -S 10 -display ses stats every 10 sec
1B == master browser for the subnet
1C == domain controller
1D == domain master browser

SNMP

Uses a community string for PW
SNMPv3 encrypts the community strings.

Sniffing and Evasion

IPv4 and IPv6

IPv4 == unicast, multicast, and broadcast
IPv6 == unicast, multicast, and anycast.
IPv6 unicast and multicast scope includes link local, site local, and global.

MAC Address

First half = 3 bytes (24bits) = Org UID
Second half = unique number

NAT (Network Address Translation)

Basic NAT is a one-to-one mapping where each internal IP == a unique public IP.
NAT Overload (PAT) == port address translation. Typically used as is the cheaper option.

Stateful Inspection

Concerned with the connections. Doesn't sniff ever packet, it just verifies if it’s a known connection, then passes along.

HTTP Tunnelling

Crafting of wrapped segments through a port rarely filtered by the Firewall (e.g., 80) to carry payloads that may otherwise be blocked.

Snort IDS

It has 3 modes:
Sniffer/Packet logger/Network IDS.
Config file: /etc/snort, or c:\snort\etc

```
#~ alert tcp !HOME_NET any -> $HOME_NET 31337 (msg : “BACKDOOR ATTEMPT-Back-orifice.”)
```

Any packet from any address != home network. Using any source port, intended for an address in home network on port 31337, send msg.
Span port: port mirroring
False Negative: IDS incorrectly reports stream clean

IDS Evasion Tactics

Slow down OR flood the network (and sneak through in the mix) OR fragmentation

TCPdump syntax

```
#~ tcpdump flag(s) interface
```

Attacking a System

C|EH rules for passwords

Must not contain user’s name. Min 8 chars. 3 of 4 complexity components. E.g., Special, Number, Uppercase, Lowercase

LM Hashing

7 spaces hashed: AAD3B435B51404EE

Attack types

Passive Online: Sniffing wire, intercept cleartext password / replay / MITM
Active Online: Password guessing.
Offline: Steal copy of Password i.e., SAM file. Cracking efforts on a separate system
Non-electronic: Social Engineering

Sidejacking

Steal cookies exchanged between systems and use to perform a replay-style attack.

Authentication Types

Type 1: Something you know
Type 2: Something you have
Type 3: Something you are

Session Hijacking

Refers to the active attempt to steal an entire established session from a target

1. Sniff traffic between client and server
2. Monitor traffic and predict sequence
3. Desynchronise session with client
4. Predict session token and take over session
5. Inject packets to the target server

Kerberos

Kerberos makes use of symmetric and asymmetric encryption technologies and involves:
KDC: Key Distribution Centre
AS: Authentication Service
TGS: Ticket Granting Service
TGT: Ticket Granting Ticket

Process

1. Client asks KDC (who has AS and TGS) for ticket to authenticate throughout the network. This request is in clear text.
2. Server responds with secret key, hashed by the password copy kept on AD server (TGT).
3. TGT sent back to server requesting TGS if user decrypts.
4. Server responds with ticket, and client can log on and access network resources.

SAM File

C:\Windows\system32\config

Registry

2 elements make a registry setting: a key (location pointer), and value (defines the key setting).
Root level keys are as follows:
HKEY_LOCAL_MACHINE – Info on Hard/software
HKEY_CLASSES_ROOT – Info on file associations and Object Linking and Embedding (OLE) classes
HKEY_CURRENT_USER – Profile info on current user
HKEY_USERS – User config info for all active users

HKEY_CURRENT_CONFIG – pointer to \hardware Profiles\.

HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion

\RunServicesOnce
\RunServices
\Run Once
\Run

Social Engineering

Human based attacks

Dumpster diving
Impersonation
Technical Support
Should Surfing
Tailgating / Piggybacking

Computer based attacks

Phishing - Email SCAM
Whaling - Targeting CEO's
Pharming - Evil Twin Website

Types of Social Engineers

Insider Associates: Limited Authorized Access

Insider Affiliates: Insiders by virtue of Affiliation that spoof the identity of the Insider

Outsider Affiliates: Non-trusted outsider that use an access point that was left open

Physical Security

3 major categories of Physical Security measures

Physical measures: Things you taste, touch, smell

Technical measures: smart cards, biometrics

Operational measures: policies and procedures

Web-based Hacking

CSRF - Cross Site Request Forgery

Dot-dot-slash Attack

Variant of Unicode or un-validated input attack

SQL Injection attack types

Union Query: Use the UNION command to return the union of target Db with a crafted Db

Tautology: Term used to describe behavior of a Db when deciding if a statement is true.

Blind SQL Injection: Trial and Error with no responses or prompts.

Error based SQL injection: Enumeration technique. Inject poorly constructed commands to have Db respond with table names and other information

Buffer Overflow

A condition that occurs when more data is written to a buffer than it has space to store and results in data corruption. Caused by insufficient bounds checking, a bug, or poor configuration in the program code.

Stack: Premise is all program calls are kept in a stack and performed in order. Try to change a function pointer or variable to allow code exe

Heap: Takes advantage of memory "on top of" the application (dynamically allocated). Use program to overwrite function pointers

NOP Sled: Takes advantage of instruction called "no-op". Sends a large # of NOP instructions into buffer. Most IDS protect from this attack.

Dangerous SQL functions

The following do not check size of destination buffers:

gets() strcpy() strcat() printf()

Wireless Network Hacking

Wireless Sniffing

Compatible wireless adapter with promiscuous mode is required, but otherwise pretty much the same as sniffing wired.

802.11 Specifications

WEP: RC4 with 24bit vector. Keys are 40 or 104bit

WPA: RC4 supports longer keys; 48bit IV

WPA/TKIP: Changes IV each frame and key mixing

WPA2: AES + TKIP features; 48bit IV

Spec	**Dist**	**Speed**	**Freq**
802.11a	30m	54Mbps	5GHz
802.11b	100m	11 Mbps	2.4GHz
802.11g	100m	54 Mbps	2.4GHz
802.11n	125m	100 Mbps+	2.4/5GHz

Bluetooth Attacks

Bluesmacking: DoS against a device

Bluejacking: Sending messages to/from devices

Bluesniffing: Sniffs for Bluetooth

Bluesnarfing: actual theft of data from a device

Trojans and Other Attacks

Virus Types

Boot: Moves boot sector to another location. Almost impossible to remove.

Camo: Disguise as legit files.

Cavity: Hides in empty areas in exe.

Macro: Written in MS Office Macro Language

Multipartite: Attempts to infect files and boot sector at same time.

Metamorphic virus: Rewrites itself when it infects a new file.

Network: Spreads via network shares.

Polymorphic Code virus: Encrypts itself using built-in polymorphic engine. Constantly changing signature makes it hard to detect.

Shell virus: Like boot sector but wrapped around application code, and run on application start.

Stealth: Hides in files, copies itself to deliver payload.

DOS Types

SYN Attack: Send thousands of SYN packets with a false IP address. Target will attempt SYN/ACK response. All machine resources will be engaged.

SYN Flood: Send thousands of SYN packets but never respond to any of the returned SYN/ACK packets. Target will run out of available connections.

ICMP Flood: Send ICMP Echo packets with a fake source address. Target attempts to respond but reaches a limit of packets sent per second.

Application level: Send "legitimate" traffic to a web application than it can handle.

Smurf: Send large number of pings to the broadcast address of the subnet with source IP spoofed to target. Subnet will send ping responses to target.

Fraggle Attack: Similar to Smurf but uses UDP.

Ping of Death: Attacker fragments ICMP message to send to target. When the fragments are reassembled, the resultant ICMP packet is larger than the max size and crashes the system

Viruses

Heartbleed: CVE-2014-0160

Founded by Neel Mehta, Heartbleed is a vulnerability with heartbeat in OpenSSL software Library. Allowed for MITM to steal information protected under normal conditions by SSL/TLS encryption.

POODLE: CVE-2014-3566

MITM exploit which took advantage of internet and software client fallback to SSL 3.0.

Shellshock: CVE-2014-6271

Exploits a vuln that executes codes inside the ' ' where the text should not be exe.

ILOVEYOU: A worm originating in the Philippines. Started in May 5, 2000, and was built on a VBS macro in Microsoft word/excel templates.

MELISSA: Email virus based on MS Word macro. Created in 1999 by David L. Smith.

Linux Commands

Linux File System

/	-Root
/var	-Variable Data / Log Files
/bin	-Binaries / User Commands
/sbin	-Sys Binaries / Admin Commands
/root	-Home dir for root user
/boot	-Stores kernel
/proc	-Direct access to kernel
/dev	-Hardware storage devices
/mnt	-Mount devices

Identifying Users and Processes

INIT process ID	1
Root UID, GID	0
Accounts of Services	1-999
All other users	Above 1000

Permissions

4 - Read
2 - Write
1 - Execute
User/Group/Others
764 - User>RWX, Grp>RW, Other>R

Snort

```
action protocol address port -> address port
   (option:value; option:value)
alert tcp 10.0.0.1 25 -> 10.0.0.2 25
   (msg:”Sample Alert”; sid:1000;)
```

Command Line Tools

NMap

```
nmap -sT -T5 -n -p 1-100 10.0.0.1
```

Netcat

```
nc -v -z -w 2 10.0.0.1
```

TCPdump

```
tcpdump -i eth0 -v -X ip proto 1
```

Snort

```
snort -vde -c my.rules 1
```

hping

```
hping3 -I -eth0 -c 10 -a 2.2.2.2 -t 100
   10.0.0.1
```

iptables

```
iptables -A FORWARD -j ACCEPT -p tcp
   —dport 80
```

Tools of the Trade

Vulnerability Research

- National Vuln Db
- Eccouncil.org
- Exploit-db

Foot-printing

Website Research Tools

- Netcraft
- Webmaster
- Archive

DNS and Whois Tools

- Nslookup
- Sam Spacde
- ARIN
- WhereisIP
- DNSstuff
- DNS-Digger

Website Mirroring

- Wget
- Archive
- GoogleCache

Scanning and Enumeration

Ping Sweep

- Angry IP Scanner
- MegaPing

Scanning Tools

- SuperScan
- NMap (Zenmap)
- NetScan Tools Pro
- Hping
- Netcat

War Dialing

- THC-Scan
- TeleSweep
- ToneLoc
- WarVox

Banner Grabbing

- Telnet
- ID Serve
- Netcraft
- Xprobe

Vulnerability Scanning

- Nessus
- SAINT
- Retina
- Core Impact
- Nikto

Network Mapping

- NetMapper
- LANState
- IPSonar

Proxy, Anonymizer, and Tunneling

- Tor
- ProxySwitcher
- ProxyChains
- SoftCab
- HTTP Tunnel
- Anonymouse

Enumeration

- SuperScan
- User2Sid/Sid2User
- LDAP Admin
- Xprobe
- Hyena

SNMP Enumeration

- SolarWinds
- SNMPUtil
- SNMPScanner

System Hacking Tools

Password Hacking

- Cain
- John the Ripper
- LCP
- THC-Hydra
- ElcomSoft
- Aircrack
- Rainbow Crack
- Brutus
- KerbCrack

Sniffing

- Wireshark
- Ace
- KerbSniff
- Ettercap

Keyloggers and Screen Capture

- KeyProwler
- Ultimate Keylogger
- All In One Keylogger
- Actual Spy
- Ghost
- Hidden Recorder
- Desktop Spy
- USB Grabber

Privilege Escalation

- Password Recovery Boot Disk
- Password Reset
- Password Recovery
- System Recovery

Executing Applications

- PDQ Deploy
- RemoteExec
- Dameware

Spyware

- Remote Desktop Spy
- Activity Monitor
- OSMonitor
- SSPro
- Spector Pro

Covering Tracks

- ELsave
- CCleaner
- EraserPro
- Evidence Eliminator

Packet Crafting/Spoofing

- Komodia
- Hping2
- PackEth
- Packet Generator
- Netscan
- Scapy
- Nemesis

Session Hijacking

- Paros Proxy
- Burp Suite
- Firesheep
- Hamster/Ferret
- Ettecap
- Hunt

Cryptography and Encryption

Encryption

- True Crypt
- BitLocker
- DriveCrpyt

Hash Tools

- MD5 Hash
- Hash Calc

Steganography

- XPTools
- ImageHide
- Merge Streams
- StegParty
- gifShuffle
- QuickStego
- InvisibleSecrets
- EZStego
- OmniHidePro

Cryptanalysis

- Cryptanalysis
- Cryptobench

Sniffing

Packet Capture

- Wireshark
- CACE
- tcpdump
- Capsa
- OmniPeek
- Windump
- dnsstuff
- EtherApe

Wireless

- Kismet
- Netstumbler

MAC Flooding/Spoofing

- Macof
- SMAC

ARP Poisoning

- Cain
- UfaSoft
- WinARP Attacker

Wireless

Discovery

- Kismet
- NetStumbler
- insider
- NetSurveyor

Packet Sniffing

- Cascade Pilot
- Omnipeek
- CommView
- Capsa

WEP/WPA Cracking

- Aircrack
- KisMac
- Wireless Security Auditor
- WepAttack
- WepCrack
- coWPatty

Bluetooth

BTBrowser

BH Bluejack

BTScanner

Bluesnarfer

Mobile Device Tracking

Wheres My Droid

Find My Phone

GadgetTrack

iHound

Trojans and Malware

Wrappers

Elite Wrap

Monitoring Tools

HiJackThis

CurrPorts

Fport

Attack Tools

Netcat

Nemesis

IDS

Snort

Evasion Tools

ADMutate

NIDSBench

IDSInformer

Inundator

Web Attacks

Wfetch

Httprecon

ID Serve

WebSleuth

Black Widow

CookieDigger

Nstalker

NetBrute

SQL Injection

BSQL Hacker

Marathon

SQL Injection Brute

SQL Brute

SQLNinja

SQLGET