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(Hydroplane)

https://github.com/cdhop/nmap101

URUG

UtahSec

UPHPU

SLLUG

BsidesSLC

OpenWest

DC801

RubyHack

UtahSaint

HackWest

801Labs

SaintCON

UTOS

What is NMAP?

A security scanner originally written by Gordon Lyon (Fyodor Vaskovich) used to discover hosts and services on a computer network, thus creating a "map" of the network.

— Wikipedia

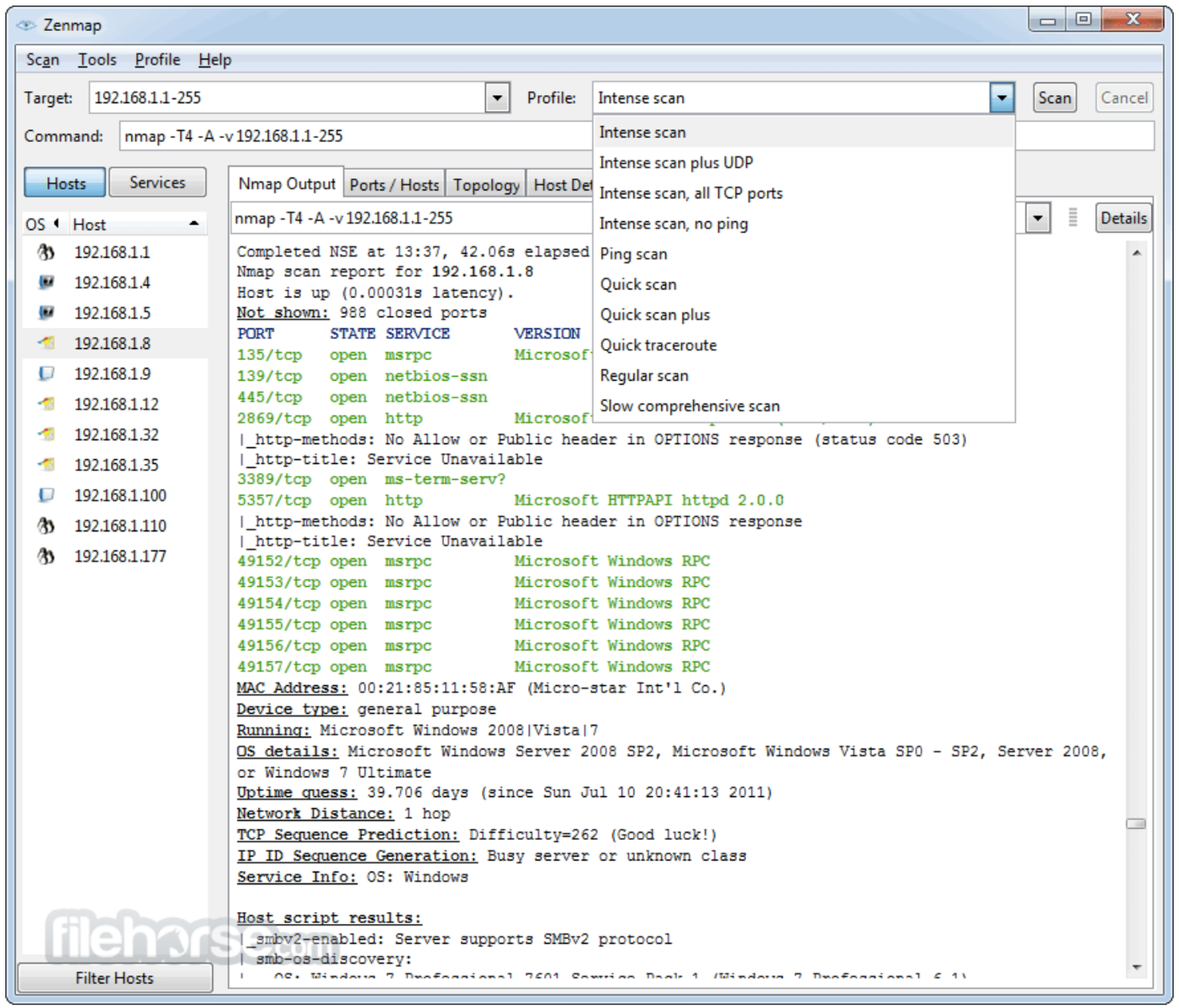
What can it do?

- Host Discovery
- Port Scanner
- Version/OS Detection
- Additional functionality through NMAP Scripting Engine (NSE)

- I am not a lawyer
- I am definitely not your lawyer
- To be safe, only scan your own systems, or systems that you have explicit authorization to scan.
- Test Host: **scanme.nmap.org**

- Package Management
- Binaries (Windows/Macintosh)
- Source Code

GUI (Zenmap)


Zenmap
Scan Tools Profile Help
Target: 192.168.1.1-255
Profile: Intense scan
Scan
Cancel
Command: nmap -T4 -A -v 192.168.1.1-255
Hosts
Services
OS
Host
192.168.1.1
192.168.1.4
192.168.1.5
192.168.1.8
192.168.1.9
192.168.1.12
192.168.1.32
192.168.1.35
192.168.1.100
192.168.1.110
192.168.1.177
Filter Hosts
Nmap Output
Ports / Hosts
Topology
nmap -T4 -A -v 192.168.1.1-255
Details
Intense scan
Intense scan plus UDP
Intense scan, all TCP ports
Intense scan, no ping
Ping scan
Quick scan
Quick scan plus
Quick traceroute
Regular scan
Slow comprehensive scan
Completed NSE at 13:37, 42.06s elapsed
Nmap scan report for 192.168.1.8
Host is up (0.00031s latency).
Not shown: 988 closed ports
PORT STATE SERVICE VERSION
135/tcp open msrpc
139/tcp open netbios-ssn
445/tcp open netbios-ssn
2869/tcp open http
|_http-methods: No Allow or Public header in OPTIONS response (status code 503)
|_http-title: Service Unavailable
3389/tcp open ms-term-serv?
5357/tcp open http Microsoft HTTPAPI httpd 2.0.0
|_http-methods: No Allow or Public header in OPTIONS response
|_http-title: Service Unavailable
49152/tcp open msrpc Microsoft Windows RPC
49153/tcp open msrpc Microsoft Windows RPC
49154/tcp open msrpc Microsoft Windows RPC
49155/tcp open msrpc Microsoft Windows RPC
49156/tcp open msrpc Microsoft Windows RPC
49157/tcp open msrpc Microsoft Windows RPC
MAC Address: 00:21:85:11:58:AF (Micro-star Int'l Co.)
Device type: general purpose
Running: Microsoft Windows 2008|Vista|7
OS details: Microsoft Windows Server 2008 SP2, Microsoft Windows Vista SP0 - SP2, Server 2008, or Windows 7 Ultimate
Uptime guess: 39.706 days (since Sun Jul 10 20:41:13 2011)
Network Distance: 1 hop
TCP Sequence Prediction: Difficulty=262 (Good luck!)
IP ID Sequence Generation: Busy server or unknown class
Service Info: OS: Windows
Host script results:
|_smbv2-enabled: Server supports SMBv2 protocol
| smb-os-discovery:

A port is an end point/interface for communication on a system/host available over a network.

Specific port numbers are often used to identify specific services (for example: 80 http, 22 ssh, 443 https, etc)

Ports 1-1024 are considered ‘well-known’ and usually require root/administrator privileges.

There are 65536 (0-65535/16 bits) possible ports.

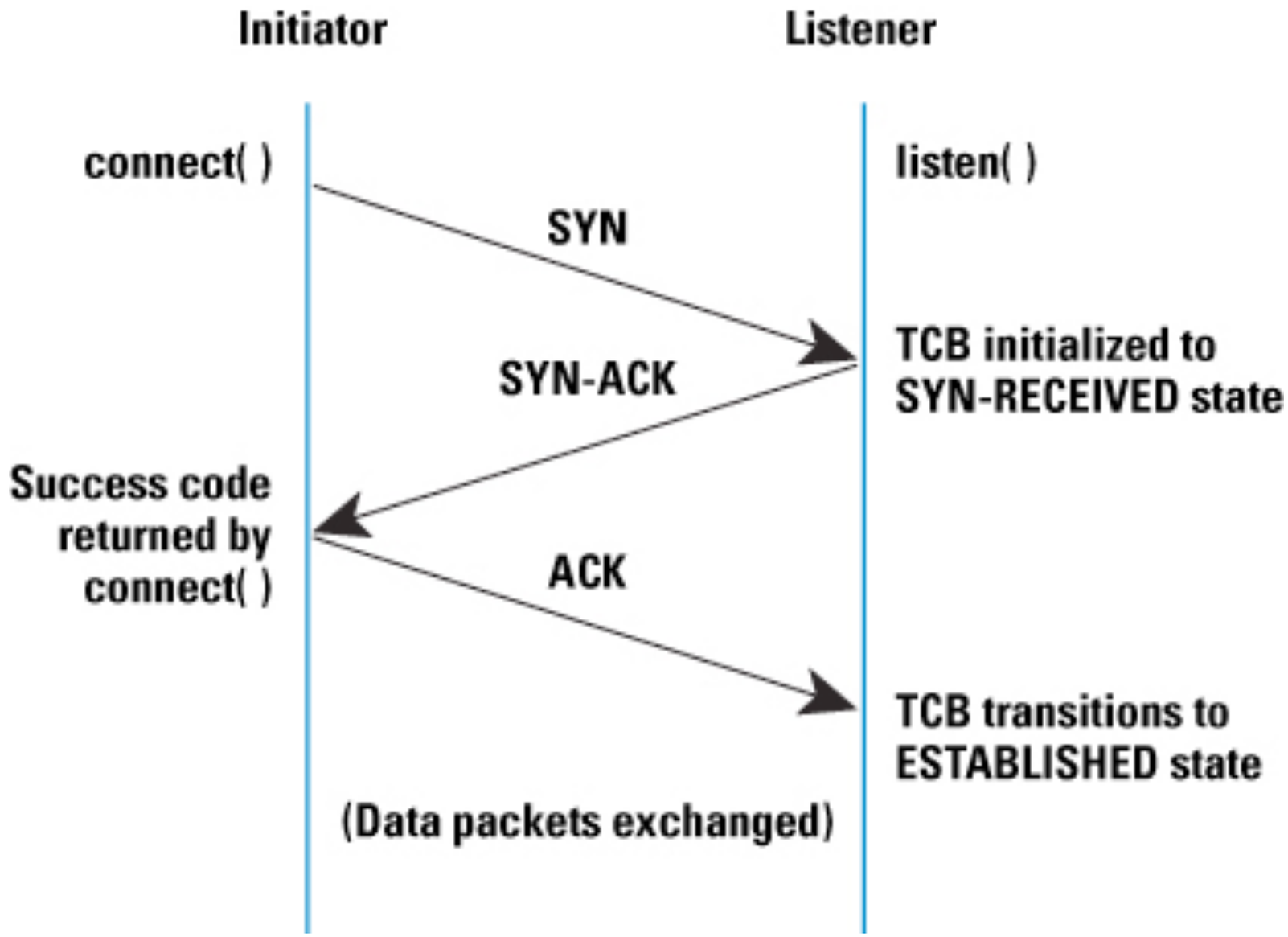
A port that accepts connections is considered to be ‘OPEN’. Conversely, a port that does not accept connections is considered to be ‘CLOSED’.

It may be difficult to conclusively determine the status of a port.

- **Transmission Control Protocol (TCP)**
  ‘guarantees’ delivery of data/packets
  (Examples: http, ssh, smtp).

- **User Datagram Protocol (UDP)**
  provides ‘best effort’ delivery of data/packets
  (Examples: dns, snmp, ntp).

TCP Three Way Handshake



Scan Phases

1. Target Enumeration
2. Host Discovery
3. Reverse DNS Resolution
4. Port Scanning
5. Version Detection
6. OS Detection
7. Traceroute
8. Script Scanning
9. Output

-sn find hosts that respond to ICMP, http, and/or https (No port scan)

-Pn skips Nmap discovery stage altogether (No ping)

-PR low-level local network host discovery (ARP scan)

Host Discovery

```
# nmap -sn 172.28.128.0/24

Starting Nmap 7.40 ( https://nmap.org ) at 2017-07-09 14:55 EDT
Nmap scan report for 172.28.128.1
Host is up (0.00067s latency).
MAC Address: 0A:00:27:00:00:00 (Unknown)
Nmap scan report for 172.28.128.2
Host is up (0.00055s latency).
MAC Address: 08:00:27:32:B4:9C (Oracle VirtualBox virtual NIC)
Nmap scan report for 172.28.128.3
Host is up (0.00075s latency).
MAC Address: 08:00:27:24:AF:0A (Oracle VirtualBox virtual NIC)
Nmap scan report for 172.28.128.4
Host is up.
Nmap done: 256 IP addresses (4 hosts up) scanned in 2.04 seconds
```

- Parameter: **-sT**
- Can be used by an unprivileged user
- Completes the TCP Three Way Handshake
- Example: **nmap -sT scanme.nmap.org**

TCP Connect Scan

```
# nmap -sT 172.28.128.3

Starting Nmap 7.40 ( https://nmap.org ) at 2017-07-09 15:02 EDT
Nmap scan report for 172.28.128.3
Host is up (0.0010s latency).
Not shown: 977 closed ports
PORT     STATE SERVICE
21/tcp   open  ftp
22/tcp   open  ssh
23/tcp   open  telnet
MAC Address: 08:00:27:24:AF:0A (Oracle VirtualBox virtual NIC)

Nmap done: 1 IP address (1 host up) scanned in 0.21 seconds
```

- Parameter: **-sS**
- Must be a privileged user
- Sends the SYN packet, then waits for the SYN/ACK
- Faster than Connect Scan
- Example: **nmap -sS scanme.nmap.org**

TCP SYN Scan

```
# nmap -sS 172.28.128.3

Starting Nmap 7.40 ( https://nmap.org ) at 2017-07-09 15:04 EDT
Host is up (0.00035s latency).
Not shown: 977 closed ports
PORT     STATE SERVICE
21/tcp   open  ftp
22/tcp   open  ssh
23/tcp   open  telnet
MAC Address: 08:00:27:24:AF:0A (Oracle VirtualBox virtual NIC)

Nmap done: 1 IP address (1 host up) scanned in 0.23 seconds
```

- Parameter: **-sU**
- Must be a privileged user
- Only way to scan UDP Ports
- Recommend using **-sUV** in order to get more valuable results
- Example: **nmap -sUV scanme.nmap.org**

```
# nmap -sU 172.28.128.3

Starting Nmap 7.40 ( https://nmap.org ) at 2017-07-09 15:07 EDT
Host is up (0.00041s latency).
Not shown: 993 closed ports
PORT     STATE         SERVICE
53/udp   open          domain
68/udp   open|filtered dhcpc
69/udp   open|filtered tftp
111/udp  open          rpcbind
137/udp  open          netbios-ns
138/udp  open|filtered netbios-dgm
2049/udp open          nfs
MAC Address: 08:00:27:24:AF:0A (Oracle VirtualBox virtual NIC)

Nmap done: 1 IP address (1 host up) scanned in 1070.89 seconds
```

Xmas / Null Scans

- Parameters: **-sX** | **-sN**
- Must be a privileged user
- Exploits standards/RFCs
- Usually doesn't work against Windows
- Examples: **nmap -sX scanme.nmap.org**

Xmas Scan

```
# nmap -sX 172.28.128.3

Starting Nmap 7.40 ( https://nmap.org ) at 2017-07-09 16:32 EDT
Nmap scan report for 172.28.128.3
Host is up (0.00014s latency).
Not shown: 977 closed ports
PORT     STATE         SERVICE
21/tcp   open|filtered ftp
22/tcp   open|filtered ssh
23/tcp   open|filtered telnet
MAC Address: 08:00:27:24:AF:0A (Oracle VirtualBox virtual NIC)

Nmap done: 1 IP address (1 host up) scanned in 1.56 seconds
```

Null Scan

```
# nmap -sN 172.28.128.3

Starting Nmap 7.40 ( https://nmap.org ) at 2017-07-09 16:34 EDT
Nmap scan report for 172.28.128.3
Host is up (0.00017s latency).
Not shown: 977 closed ports
PORT     STATE         SERVICE
21/tcp   open|filtered ftp
22/tcp   open|filtered ssh
23/tcp   open|filtered telnet
MAC Address: 08:00:27:24:AF:0A (Oracle VirtualBox virtual NIC)

Nmap done: 1 IP address (1 host up) scanned in 1.56 seconds
```

- Parameter: **-sI**
- To the target it appears that the idle host is performing the port scan
- Stealth Scan
- Recommend disabling host discovery
- Example: **nmap -Pn -sI patsy.host target.host**

- Parameter: **-sV**
- Grabs and displays the service banners
- Increases the confidence in the identification of services
- Example: **nmap -sV scanme.nmap.org**

```
# nmap -sV 172.28.128.3

Starting Nmap 7.40 ( https://nmap.org ) at 2017-07-09 16:35 EDT
Nmap scan report for 172.28.128.3
Host is up (0.00066s latency).
Not shown: 977 closed ports
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
MAC Address: 08:00:27:24:AF:0A (Oracle VirtualBox virtual NIC)
Service Info: Hosts:  metasploitable.localdomain, localhost, irc.Metasploitable.LAN;
OSs: Unix, Linux; CPE: cpe:/o:linux:linux_kernel

Service detection performed. Please report any incorrect results at https://
nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 12.00 seconds
```

- Parameter: **-O**
- Scans the target and attempts to detect the OS by comparing it to Nmap's OS fingerprint profiles
- Example: **nmap -O scanme.nmap.org**

OS Detection

```
# nmap -O 172.28.128.3

Starting Nmap 7.40 ( https://nmap.org ) at 2017-07-09 16:38 EDT
Nmap scan report for 172.28.128.3
Host is up (0.00033s latency).
Not shown: 977 closed ports
…
MAC Address: 08:00:27:24:AF:0A (Oracle VirtualBox virtual NIC)
Device type: general purpose
Running: Linux 2.6.X
OS CPE: cpe:/o:linux:linux_kernel:2.6
OS details: Linux 2.6.9 - 2.6.33
Network Distance: 1 hop

OS detection performed. Please report any incorrect results at https://nmap.org/
submit/ .
Nmap done: 1 IP address (1 host up) scanned in 2.05 seconds
```

- Parameter: **-T(1-5)**
- Increase/Decrease scan speeds
- Faster scans may be unreliable
- Default speed is 3
- Might try slow scan speeds to ‘hide’ a port scan
- Example: **nmap -T4 scanme.nmap.org**

Optimization: Timeouts

- Parameter: **--host-timeout 1m**
- Helpful with coping with latency
- Example: **nmap scanme.nmap.org --host-timeout 1m**

- Parameters: **-oN** | **-oX** | **-oS** | **-oG** | **-oA**
- Available Formats: Normal, XML, Script Kiddie, Grepable
- Can be used to feed other tools
- Example: **nmap -oN target.nmap target.host**

- An arbitrary scripting framework that allows users to trigger additional checks/actions based on certain open ports or services

- Added to NMAP through a Google Summer of Code in 2006

- There are over 500+ scripts included

- Example: **nmap -p443 --script=ssl-enum-ciphers scanme.nmap.org**

```
#  nmap -p443 --script=ssl-enum-ciphers cryptopartyutah.org

Starting Nmap 7.12 ( https://nmap.org ) at 2017-07-10 18:04 MDT
Nmap scan report for cryptopartyutah.org (107.170.219.231)
Host is up (0.047s latency).
PORT    STATE SERVICE
443/tcp open  https
| ssl-enum-ciphers:
|   TLSv1.2:
|     ciphers:
|       TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 (secp384r1) - A
|       TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (secp384r1) - A
|       TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384 (secp384r1) - A
|       TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256 (secp384r1) - A
|     compressors:
|       NULL
|     cipher preference: server
|_  least strength: A

Nmap done: 1 IP address (1 host up) scanned in 3.04 seconds
```

NSE: Categories

- NSE scripts define a list of categories they belong to.
- Currently defined categories are **auth**, **broadcast**, **brute**, **default**, **discovery**, **dos**, **exploit**, **external**, **fuzzer**, **intrusive**, **malware**, **safe**, **version**, and **vuln**.
- Scripts can/usually belong to more that one category

- Scripts are written in LUA
- Generally have three sections: **head**, **rule**, **action**
- Using the -d option flag can be useful when writing/debuging scripts
- Over 120 standard libraries available

```
description = [[ A simple example NSE script ]]

---
--@output
-- 22/tcp  open  ssh
-- l_simple-example: Open!

author = "hydroplane"
license = "Same as Nmap--See http://nmap.org./book/man-legal.html"
categories = {'safe'}

portrule = function(host, port)
  return port.state == 'open'
end

action = function(host, port)
  return 'Open!'
end
```

Practical Examples

- Homepage: **https://nmap.org**

- **Nmap Network Scanning**: The Official Nmap Project Guide to Network Discovery and Security Scanning (ISBN: 978-0979958717)

- **Nmap Essentials** (ISBN: 978-1783554065)

- **SANS Nmap Cheat Sheet**: https://blogs.sans.org/pen-testing/files/2013/10/NmapCheatSheetv1.0.pdf

Questions?

Trinity Uses NMAP