Nmap: Scanning the Internet

by Fyodor

Black Hat Briefings USA – August 6, 2008; 10AM
Defcon 16 – August 8, 2008; 4PM

Abstract

The Nmap Security Scanner was built to efficiently scan large networks, but Nmap's author Fyodor has taken this to a new level by scanning millions of Internet hosts as part of the Worldscan project. He will present the most interesting findings and empirical statistics from these scans, along with practical advice for improving your own scan performance. Additional topics include detecting and subverting firewall and intrusion detection systems, dealing with quirky network configurations, and advanced host discovery and port scanning techniques. A quick overview of new Nmap features will also be provided.

Old Slide Disclaimer

These slides were due in June, when I was still running scans and at least a month away from finishing analasys. So while the topic isn't changing, the final slides will differ materially from these.

These slides are from the inaugural Black Hat Webcast with Jeff Moss on June 26, 2008. The webcast gives a good overview of the talk and describes some valuable early results of the scanning. The video is scheduled to be posted at http://blackhat.com in early July.

Planning the Big Scan

- Determining IP addresses to scan
- P2P Scanning?
- Legal Issues
- Firewalls
- Performance

Scan Results

- Scans are still running
- Some tentative results already available, and can improve scan performance.

Best TCP Ports for Host Discovery

- Echo request, and even Nmap default discovery scans are insufficient for Internet scanning.
- Adding more TCP SYN and ACK probes can help, but which ports work the best?

Top 10 TCP Host Discovery Port Table

- 80/http
- 25/smtp
- 22/ssh
- 443/https
- 21/ftp
- 113/auth
- 23/telnet
- 53/domain
- 554/rtsp
- 3389/ms-term-server

Default Host Discovery Effectiveness

```
# nmap -n -sL -iR 50000 -oN - | grep "not scanned" |
awk '{print $2}' | sort -n > 50K_IPs

# nmap -sP -T4 -iL 50K_IPs
Starting Nmap ( http://nmap.org )
Host dialup-4.177.9.75.Dial1.SanDiego1.Level3.net
(4.177.9.75) appears to be up.
Host dialup-4.181.100.97.Dial1.SanJose1.Level3.net
(4.181.100.97) appears to be up.
Host firewall2.baymountain.com (8.7.97.2) appears to
be up.
[thousands of lines cut]
Host 222.91.121.22 appears to be up.
Host 105.237.91.222.broad.ak.sn.dynamic.
163data.com.cn (222.91.237.105) appears to be up.
Nmap done: 50000 IP addresses (3348 hosts up) scanned
in 1598.067 seconds
```

Enhanced Host Discovery Effectiveness

```
# nmap -sP -PE -PP -PS21,22,23,25,80,113,31339
-PA80,113,443,10042 --source-port 53 -T4 -iL 50K_IPs
Starting Nmap 4.65 ( http://nmap.org ) at 2008-06-22
19:07 PDT
Host sim7124.agni.lindenlab.com (8.10.144.126)
appears to be up.
Host firewall2.baymountain.com (8.7.97.2) appears to
be up.
Host 12.1.6.201 appears to be up.
Host psor.inshealth.com (12.130.143.43) appears to be
up.
[thousands of hosts cut]
Host ZM088019.ppp.dion.ne.jp (222.8.88.19) appears to
be up.
Host 105.237.91.222.broad.ak.sn.dynamic.
163data.com.cn (222.91.237.105) appears to be up.
Host 222.92.136.102 appears to be up.
Nmap done: 50000 IP addresses (4473 hosts up) scanned
in 4259.281 seconds
```

Enhanced Discovery Results

- Enhanced discovery:
  - took 71 minutes vs. 27 (up 167%)
  - Found 1,125 more live hosts (up 34%)

Top Open TCP & UDP Ports

- Will be available by Black Hat USA
- Substantial reduction of current default 1703 TCP ports, 1480 UDP
- --top-ports feature available now, but no data to use it.

Nmap News!

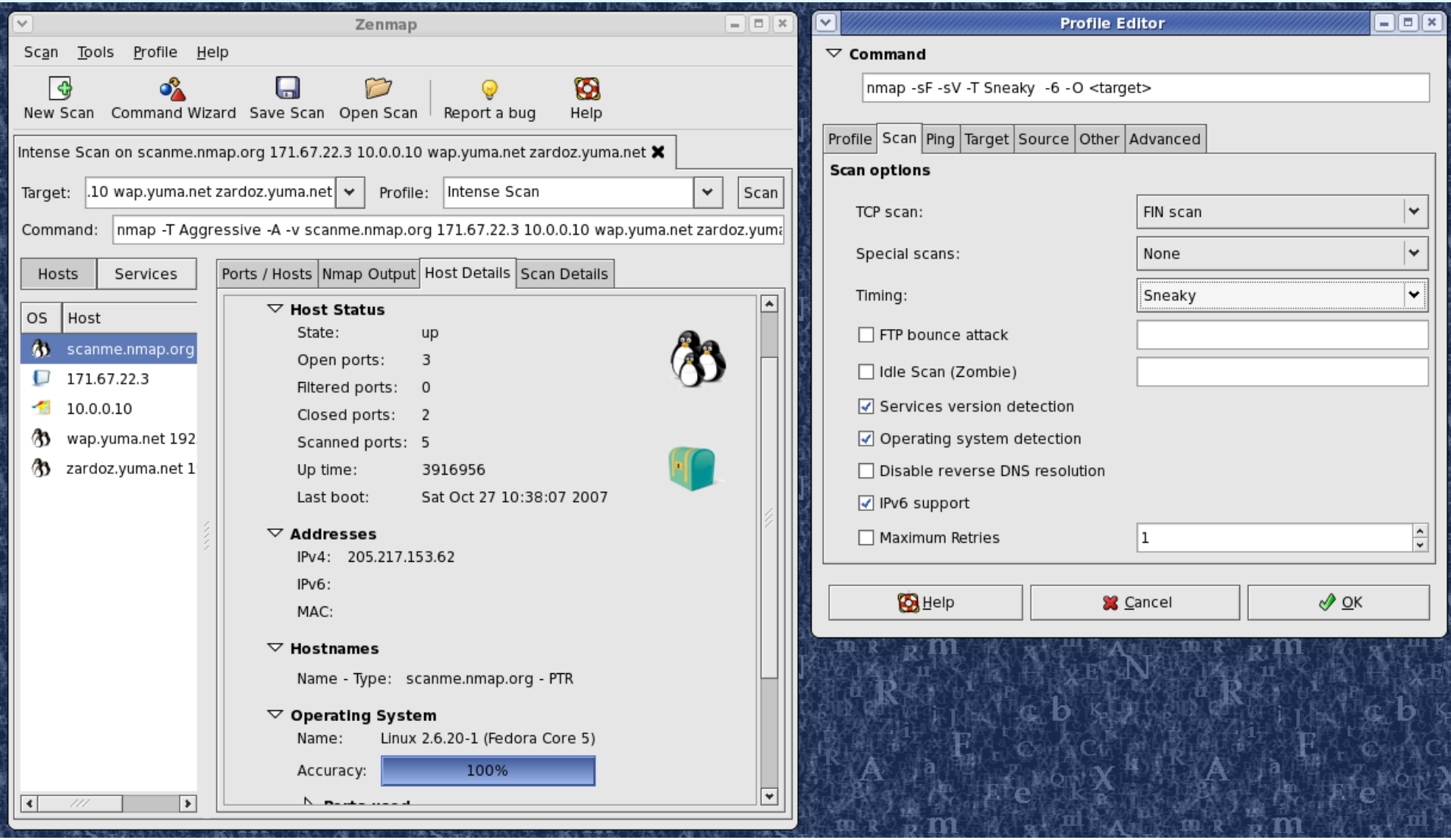
Nmap Scripting Engine (NSE)

```
# nmap -A -T4 scanme.nmap.org
Starting Nmap ( http://nmap.org )
Interesting ports on scanme.nmap.org (64.13.134.52):
Not shown: 1709 filtered ports
PORT    STATE  SERVICE VERSION
22/tcp  open   ssh     OpenSSH 4.3 (protocol 2.0)
25/tcp  closed smtp
53/tcp  open   domain  ISC BIND 9.3.4
70/tcp  closed gopher
80/tcp  open   http    Apache httpd 2.2.2 ((Fedora))
|_ HTML title: Site doesn't have a title.
113/tcp closed auth
Device type: general purpose
Running: Linux 2.6.X
OS details: Linux 2.6.20-1 (Fedora Core 5)
Uptime: 40.425 days (since Tue May 13 12:46:59 2008)
Nmap done: 1 IP address scanned in 30.567 seconds
Raw packets sent: 3464 (154KB) | Rcvd: 60 (3KB)
```

Fixed-rate packet sending

```
nmap –min-rate 500 scanme.nmap.org
```

Zenmap GUI


Zenmap
Scan Tools Profile Help
New Scan
Command Wizard
Save Scan
Open Scan
Report a bug
Help
Intense Scan on scanme.nmap.org 171.67.22.3 10.0.0.10 wap.yuma.net zardoz.yuma.net
Target: .10 wap.yuma.net zardoz.yuma.net
Profile: Intense Scan
Scan
Command: nmap -T Aggressive -A -v scanme.nmap.org 171.67.22.3 10.0.0.10 wap.yuma.net zardoz.yuma
Hosts
Services
OS
Host
scanme.nmap.org
171.67.22.3
10.0.0.10
wap.yuma.net 192
zardoz.yuma.net 1
Ports / Hosts
Nmap Output
Host Details
Scan Details
Host Status
State: up
Open ports: 3
Filtered ports: 0
Closed ports: 2
Scanned ports: 5
Up time: 3916956
Last boot: Sat Oct 27 10:38:07 2007
Addresses
IPv4: 205.217.153.62
IPv6:
MAC:
Hostnames
Name - Type: scanme.nmap.org - PTR
Operating System
Name: Linux 2.6.20-1 (Fedora Core 5)
Accuracy: 100%
Profile Editor
Command
nmap -sF -sV -T Sneaky -6 -O <target>
Profile
Scan
Ping
Target
Source
Other
Advanced
Scan options
TCP scan: FIN scan
Special scans: None
Timing: Sneaky
FTP bounce attack
Idle Scan (Zombie)
Services version detection
Operating system detection
Disable reverse DNS resolution
IPv6 support
Maximum Retries
1
Help
Cancel
OK

2nd Generation OS Detection

```
# nmap -A -T4 scanme.nmap.org
[...]
Device type: general purpose
Running: Linux 2.6.X
OS details: Linux 2.6.20-1 (Fedora Core 5)
```

More info: http://nmap.org/book/osdetect.html

Version Detection

```
# nmap -A -T4 scanme.nmap.org
Starting Nmap ( http://nmap.org )
Interesting ports on scanme.nmap.org (64.13.134.52):
Not shown: 1709 filtered ports
PORT    STATE  SERVICE VERSION
22/tcp  open   ssh     OpenSSH 4.3 (protocol 2.0)
25/tcp  closed smtp
53/tcp  open   domain  ISC BIND 9.3.4
70/tcp  closed gopher
80/tcp  open   http    Apache httpd 2.2.2 ((Fedora))
|_ HTML title: Site doesn't have a title.
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Raw packets sent: 3464 (154KB) | Rcvd: 60 (3KB)
```

--reason

```
# nmap --reason -T4 scanme.nmap.org
[...]
Interesting ports on scanme.nmap.org
(205.217.153.62):
Not shown: 1709 filtered ports
Reason: 1709 no-responses
PORT    STATE  SERVICE REASON
22/tcp  open   ssh     syn-ack
25/tcp  closed smtp    reset
53/tcp  open   domain  syn-ack
70/tcp  closed gopher  reset
80/tcp  open   http    syn-ack
113/tcp closed auth    reset
```

Advanced Traceroute

```
# nmap –traceroute scanme.nmap.org
[...]
TRACEROUTE (using port 22/tcp)
HOP RTT   ADDRESS
1   0.60  wap.nmap-int.org (192.168.0.6)
[...]
6   9.74  151.164.251.42
7   10.89 so-1-0-0.mpr1.sjc2.us.above.net
(64.125.30.174)
8   10.52 so-4-2-0.mpr3.pao1.us.above.net
(64.125.28.142)
9   14.25 metro0.sv.svcolo.com
(208.185.168.173)
10  12.80 scanme.nmap.org (64.13.134.52)
```

Performance and Accuracy

```
# nmap -T4 --max_rtt_timeout 200
--initial_rtt_timeout 150 --
min_hostgroup 512 –max_retries 0
-n -P0 -p80 -oG pb3.gnmap
216.163.128.0/20
Starting Nmap
[...]
Nmap run completed -- 4096 IP
addresses (4096 hosts up) scanned
in 46.052 seconds
```

TCP and IP Header Options

```
# nmap  -vv -n -sS -P0 -p 445 --
ip-options "L 10.4.2.1" 10.5.2.1
```

Learn More

- Download Nmap from http://nmap.org
- Download these slides from: http://insecure.org/presentations/BHDC08/