Mastering the Nmap Scripting Engine
by Fyodor and David Fifield

http://insecure.org/presentations/BHDC10/

Black Hat Briefings Las Vegas
July 28; 4:45 PM; Augustus 5+6

Defcon 18
July 30; 5:00 PM; Track One
Outline

• NSE Intro & Usage
• Large-scale Scan #1: SMB/MSRPC
• Large-scale Scan #2: Favicon
• Writing NSE Scripts
• Live Script Writing Demo
• Nmap News
• Final Notes & Q/A
Nmap Scripting Engine

```bash
# nmap -A -T4 scanme.nmap.org

Starting Nmap 5.35DC18 ( http://nmap.org )
Nmap scan report for scanme.nmap.org (64.13.134.52)
Host is up (0.0018s latency).
Not shown: 995 filtered ports
PORT      STATE  SERVICE VERSION
22/tcp    open   ssh     OpenSSH 4.3 (protocol 2.0)
| ssh-hostkey: 1024
53/tcp    open   domain
80/tcp    open   http    Apache httpd 2.2.3 ((CentOS))
|_html-title: Go ahead and ScanMe!
| http-methods: Potentially risky methods: TRACE
|_See http://nmap.org/nsedoc/scripts/http-methods.html
113/tcp   closed auth
31337/tcp closed Elite
OS details: Linux 2.6.13 - 2.6.31, Linux 2.6.18
Nmap done: 1 IP address (1 host up) scanned in 23.32 seconds
```
Pre-written Scripts and the NSEDoc Portal

http://nmap.org/nsedoc/

<table>
<thead>
<tr>
<th>Scripts</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>afp-brute</td>
<td>Performs password guessing against Apple Filing Protocol (AFP)</td>
</tr>
<tr>
<td>afp-path-vuln</td>
<td>Detects the Mac OS X AFP directory traversal vulnerability, CVE-2010-0533.</td>
</tr>
<tr>
<td>afp-serverinfo</td>
<td>Shows AFP server information. This information includes the server's hostname, IPv4 and IPv6 addresses, and hardware type (for example Macmini or MacBookPro).</td>
</tr>
<tr>
<td>afp-showmount</td>
<td>Shows AFP shares and ACLs.</td>
</tr>
<tr>
<td>asn-query</td>
<td>Maps IP addresses to autonomous system (AS) numbers.</td>
</tr>
</tbody>
</table>
Large Scale Scan #1: SMB/MSRPMC Scripts

Ron Bowes spent months researching SMB/MSRPMC protocols and wrote a suite of 13 scripts.

**Informational**: smb-os-discovery, smb-server-stats, smb-system-info, smb-security-mode

**Detailed Enumeration**: smb-enum-users, smb-enum-domains, smb-enum-groups, smb-enum-processes, smb-enum-sessions, smb-enum-shares

**More intrusive**: smb-brute, smb-check-vulns, smb-psexec
Who to test them out on?
MS Scan Details

- **Step 1:** Find target IP addresses. 1,004,632 located in ARIN DB.

- **Step 2:** Start broad version detection scan (nmap -T4 --top-ports 50 -sV -O --osscan-limit --osscan-guess --min-hostgroup 128 --host-timeout 10m -oA ms-vscan -iL ms.ips.lst)
  - Found 74,293 hosts up out of 1M IPs in 26 hours

- **Step 3:** Examine results
MS SMB Scan Results

- Vast majority of MS networks block Windows ports such as 135 and 445 at their gateways.
- ... but not all!
- Results
Humble Beginnings:
The Story of http-favicon.nse

A simple idea: fingerprint web applications by retrieving the favicon. Vlatko Kosturjak wrote a script to do it. (http://seclists.org/nmap-dev/2008/q4/397)

However, the database was small and of unknown quality. If only we had a tool to do large Internet scans... and a way to write scripts for it... (http://seclists.org/nmap-dev/2009/q3/462)

The favicon-survey.nse script (not part of the Nmap package) downloads favicons and stores them in the filesystem.
Results of the Favicon Survey

Scanned the external links of

- dmoz.org: 5,042,341
- en.wikipedia.org: 3,218,826
- de.wikipedia.org: 832,521
- fr.wikipedia.org: 652,040
- es.wikipedia.org: 532,951

Omitting duplicates, around 8 million domains.

- 995,152 unique icons
- 799,924 image files
- 195,228 non-image files (HTML error pages)

“Indeed, I have been scanning ;-)”

Favicon Visualization

A secondary survey: The Alexa top one million sites. Pack the icons tightly, with the size of each one proportional to its “reach.”

http://nmap.org/favicon/
Writing NSE Scripts
Introduction to Lua & Why We Chose It

• Lightweight embeddable scripting language
  – Easy to learn
  – Tiny to embed: “Complete distribution (source code, manual, plus binaries for some platforms) fits comfortably on a floppy disk”.

• Widely used, known, and debugged
  – Created in Brazil in 1993, still actively developed
  – Best known for its use in the game industry: World of Warcraft, Crysis, etc.
  – Security tools: Nmap, Wireshark, Snort 3.0
Why We Chose Lua (Continued)

- Extensible
  - Hooked to Nmap's fast parallel networking libraries
- Safe & Secure
  - No buffer overflows, format string vulns, etc.
- Portable
  - Windows, Linux, Mac, *BSD, etc.
- Interpreted
Capabilities Added by Nmap

- Protocol/helper libraries
  - 45, including DNS, HTTP, MSRPC, Packet, SNMP, unpwdb, etc.
- Protocol brute forcers
- Easy SSL
- Dependencies
Script Example #1: rpcinfo
Script Example #2: smb-enum-users
Live Script Demonstration

Problem: Find my webcam on a dynamic IP address.

The webcam uses thttpd to serve /cam.jpg, so use a script to check those two things.
Make it a Production Script

To turn http-brute into distribution-ready script, I would next

- expand the portrule to match more HTTP services,
- add script arguments to control the path retrieved and the method used,
- add NSEDoc @usage and @output examples, and
- let it cache credentials for other scripts to use.
What's Coming in NSE?

- Prerules & Postrules
- Target Acquisition Scripts
- Lots more scripts! Current queue:
  - Vnc-info (Patrik Karlsson)
  - Vnc-brute (Patrik Karlsson)
  - Svn-brute (Patrik Karlsson)
  - Hostmap (Ange Gutek)
  - Http-xst (Eduardo Garcia Melia)
  - Rmi-dumpregistry (Martin Swende)
Zenmap NSE Integration

Profile Editor

Scan options

Targets (optional):
TCP scan: None
Non-TCP scans: None
Timing template: Aggressive (-T4)

Enable all advanced/aggressive options (-A)
Operating system detection (-O)
Version detection (-sV)
Idle Scan (Zombie) (-sl)
FTP bounce attack (-b)
Disable reverse DNS resolution (-n)
IPv6 support (-6)

Target: scanme.nmap.org
Profile: Intense scan
Command: nmap -T4 -A -v scanme.nmap.org

Host Status
State: up
Open ports: 3
Filtered ports: 993
Closed ports: 4
Scanned ports: 1000
Up time: 2636588
Last boot: Thu Jul 31 22:13:52 2010

Addresses
IPv4: 64.13.134.52
IPv6: Not available
MAC: Not available

Hostnames
Name - Type: scanme.nmap.org - user
Name - Type: scanme.nmap.org - PTR

Operating System
Name: Linux 2.6.15 - 2.6.26
Accuracy: 100%

Nmap Output | Ports / Hosts | Topology | Host Details | Scans

Filter Hosts
Ndiff

# ndiff facebook-072410.xml facebook-072510.xml

69.63.176.68:

<table>
<thead>
<tr>
<th>PORT</th>
<th>STATE</th>
<th>SERVICE</th>
<th>VERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>-80/tcp</td>
<td>open</td>
<td>http</td>
<td>lighttpd 1.5.0</td>
</tr>
<tr>
<td>+80/tcp</td>
<td>open</td>
<td>http</td>
<td>nginx</td>
</tr>
</tbody>
</table>

video-ssl-03-06-ash1.fbcdns.net (69.63.186.53):

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<th>PORT</th>
<th>STATE</th>
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<th>VERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>-443/tcp</td>
<td>open</td>
<td>ssl/http</td>
<td>lighttpd 1.5.0</td>
</tr>
<tr>
<td>+443/tcp</td>
<td>open</td>
<td>ssl/http</td>
<td>nginx</td>
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</tbody>
</table>

legacymail.thefacebook.com (66.220.144.49):

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<tbody>
<tr>
<td>443/tcp</td>
<td>open</td>
<td>ssl/http</td>
<td>Microsoft IIS httpd 6.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>Did not follow redirect to <a href="https://mail.thefacebook.com/exchange">https://mail.thefacebook.com/exchange</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>Did not follow redirect to <a href="https://mail.thefacebook.com/exchange/">https://mail.thefacebook.com/exchange/</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
#!/bin/sh

date=`date "+%s"`

cd /hack/facebook/scripts/

nmap -T4 -F -sV -O --osscan-limit --osscan-guess -oA facebook-${date} [netblocks] > /dev/null

ndiff facebook-old.xml facebook-${date}.xml > facebook-diff-${date}

cp facebook-${date}.xml facebook-old.xml

printf "\n********** NDIFF RESULTS **********\n"
cat facebook-vscan-diff-${date}

printf "\n********** SCAN RESULTS **********\n"
cat facebook-vscan-${date}.nmap
Ncat

http://nmap.org/ncat/
Modern Networking Features

SSL encryption support (client or server)
Proxy (act as proxy server, or client chaining through multiple proxies)
Portability
TCP/UDP port redirection
IPv6
Fine-grained access control
Connection brokering
Missing feature
Ncat Chat

A slight hack to broker mode enables a very rudimentary chat server.

Official chat server for this presentation: `ncat --ssl -v chat.nmap.org`

Server was started with command: `ncat -l --ssl --chat chat.nmap.org`
Rainmap: An Online Scanning Service

Nmap Security Scanner
- Intro
- Ref Guide
- Install Guide
- Download
- Changelog
- Book
- Docs

Security Lists
- Nmap Hackers
- Nmap Dev
- Bugtraq
- Full Disclosure
- Pen Test
- Basics
- More

Security Tools
- Pass crackers
- Sniffers
- Vuln Scanners
- Web scanners
- Wireless
- Exploitation
- Packet crafters
- More

Site News
Advertising
About/Contact

Create a new scan profile:

Profile name

Security conferences

Target(s)

www.blackhat.com
www.defcon.org
www.securitybsides.com
www.cansecwest.com

Here's what Nmap will do for each target:

+ Check responsiveness

+ Look for open ports

Detect the Operating System

Detect remote services/versions

Scan with the default scripts
Nmap Script Authors

Aaron Leininger
Andrew Orr
Ange Gutek
Arturo Busleiman
Bernd Stroessenreuther
Brandon Enright
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Diman Todorov
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Marek Majkowski
Martin Swende
Matthew Boyle
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Michael Schierl
Patrik Karlsson
Philip Pickering
Richard Sammet
Rob Nicholls
Ron Bowes
Sven Klemm
Thomas Buchanan
Tom Sellers
Vladz
Vlatko Kosturjak
Final Notes

• Ron Bowes at Black Hat Arsenal
  – Thursday, Station 5, 8:00 AM – 12:30 PM
• Slides to be posted Friday (and video as soon as we get it) to:
  http://insecure.org/presentations/
• Download Nmap from: http://nmap.org
• NSEDoc portal: http://nmap.org/nsedoc/
• NSE system docs: http://nmap.org/book/nse.html