Intrusion Detection Systems

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Overview

- Intrusion Detection
  - What is it?
  - Why do I need it?
  - How do I do it?
- Intrusion Detection Software
  - Network based
  - Host based
- Intrusion Prevention
Disclaimer

- Please review your organizations policy on monitoring network traffic!
- Please review any security policies.
- In a public organization such as the University of Utah, there are potential issues if you monitor users activity.
- Possible Privacy Issues!
U of U Network Monitoring

• The U of U has an IT Policy
  - http://www.it.utah.edu/network_monitoring_policy_15Nov01.html

• Colleges and Departments may establish additional policies

• NIDS constitutes network monitoring

• Make sure you have both administrative and network management approval (Policy)
Definitions and Terms

- **False Positive**
  - A false positive is when your IDS indicates an event occurred when in fact it didn’t.
  - “The boy that cried wolf!”

- **False Negative**
  - Is when your IDS does not detect attacking activity.
  - “The wolf shows up and the boy is asleep.”
What is Intrusion Detection?

- An Intrusion Detection System (IDS) looks for specific events that indicate a potential attack on a system or network.
- An attack or intrusion is generally associated with events outside the organization.
- Misuse is associated with events within the organization.
IDS Approaches and Types

• There are several approaches
  – Pattern Matching Detection
  – Statistical Anomaly Detection

• There are several types
  – Host Based
  – Network Based
Pattern Matching Detection

- Looks for specific events
  - Like did my host log file record an attempt to log in as root?
  - Did my network IDS see mapping attempts occur?
  - If you match the pattern or sets of events, then indicate an attack.
  - Problem is there can be false positives.
Statistical Anomaly Detection

- Applies heuristics to the problem
  - Basically the system tries to determine “normal” activity and if something out of ordinary occurs then indicate an attack.
  - This is an attempt to minimize false positives.
  - This type still has issues like determining what is normal or not normal activity.
Host Based IDS

• Examine System Logs
  - syslog

• Examine Filesystem
  - File integrity or “Finger Printing”

• Examine System Process Execution
  - Watch Networking Stack
  - TCPWrappers
  - Process Accounting
Network Based IDS or NIDS

- Examine Network Traffic
  - Network “sniffing”
  - Pattern match network packets
  - Watch network flows
Do I Need Intrusion Detection?

- The simple answer is yes!
  - You will need to determine to what degree
- Threats will exist in any organization. Vulnerabilities will always exist and you need a way to determine if someone is examining your systems for potential weaknesses.
- Ignorance is not bliss
How Do I Detect Intrusions?

• What is effective?
  - Collection of Host and Network based
• Various collection of software packages both commercial and open source.
Host Based

- Will be covered in future meetings
  - File Integrity or “Finger Printing”
    - Tripwire
    - Radmind
  - Log file scanning
  - Network Port Watching
    - TCPWrappers
  - Other approaches
Network Based

• This meeting will focus on Snort using HenWen.
• HenWen is a Mac OS X GUI front end for Snort.
• Snort works on a pattern matching approach.
**Configure**

- **Enable defragmentation support**
- **Detect stealth portscans**
- **Normalize HTTP requests on port(s): 80**
- **Detect regular portscans**
- **Enable Spade**
  - Manually set threshold
  - Adapt threshold by weighted average
  - Adapt threshold by avg. of components
  - Adapt threshold by avg. of ideal values
- **Stop hackers from launching fragmentation attacks (i.e., DoS attacks)**
- **Enable stream reassembly**
- **Detect "Back Orifice"**
- **Decode & analyze ASN.1 traffic**
- **Only look at packets sent to:**

**Start NIDS**  **Stop NIDS**  **NIDS is running.**

NOTE: All changes take effect next time you start the NIDS.
Enable logging (recommended)
- Use alert mode: Full

- Dump application layer (slower)
- Use tcpdump format logging (faster)
- Log alerts to the system log
- Log alerts to a Unix socket (required for LetterStick)
- Log alerts to a database: MySQL

Database Options
- User Name: 
- Password: 
- Database Name: snort
- Database Host: 
- Sensor Name (optional): 

Start NIDS  Stop NIDS  NIDS is running.

NOTE: All changes take effect next time you start the NIDS.
## HenWen - Configure

### Check each rule set you would like to enable:

<table>
<thead>
<tr>
<th>Enabled</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️</td>
<td>Bad traffic you should never normally see on a network</td>
</tr>
<tr>
<td>✔️</td>
<td>Well known exploits</td>
</tr>
<tr>
<td>✔️</td>
<td>Network scanning (port scanning, net mapping, etc.)</td>
</tr>
<tr>
<td>✔️</td>
<td>Suspected malicious Finger service activity</td>
</tr>
<tr>
<td>✔️</td>
<td>Suspected malicious FTP service activity</td>
</tr>
<tr>
<td>✔️</td>
<td>Suspected malicious Telnet service activity</td>
</tr>
<tr>
<td>✔️</td>
<td>Various E-Mail server attacks (SMTP)</td>
</tr>
<tr>
<td>✔️</td>
<td>Various E-Mail server attacks (POP2)</td>
</tr>
<tr>
<td>✔️</td>
<td>Various E-Mail server attacks (POP3)</td>
</tr>
<tr>
<td>✔️</td>
<td>Various E-Mail server attacks (IMAP)</td>
</tr>
<tr>
<td>✔️</td>
<td>RPC activity you may be concerned about</td>
</tr>
<tr>
<td>✔️</td>
<td>Suspected malicious RSH and Rlogin service activity</td>
</tr>
<tr>
<td>✔️</td>
<td>Suspected Denial of Service (DOS) attacks</td>
</tr>
<tr>
<td>✔️</td>
<td>Suspected Distributed Denial of Service (DDOS) attacks</td>
</tr>
<tr>
<td>✔️</td>
<td>Known DNS server exploits</td>
</tr>
<tr>
<td>✔️</td>
<td>Generally considered bad TFTP traffic</td>
</tr>
<tr>
<td>✔️</td>
<td>Database attacks: MS SQL Server</td>
</tr>
<tr>
<td>✔️</td>
<td>Database attacks: MySQL</td>
</tr>
<tr>
<td>✔️</td>
<td>Database attacks: Oracle</td>
</tr>
<tr>
<td>✔️</td>
<td>Strange X11 activity</td>
</tr>
<tr>
<td>✔️</td>
<td>Bad ICMP traffic you shouldn’t be seeing</td>
</tr>
</tbody>
</table>

### Buttons:

- New rule set
- Delete rule set(s)
- Restore defaults

**NOTE:** All changes take effect next time you start the NIDS.
HenWen

Options:
- Use new intrusion detection engine (faster)
- Use Snort 1.x intrusion detection engine (slower)
- Use low memory version of new intrusion detection engine

Snort decoder options:
- Disable generic decode events
- Disable experimental TCP option alerts
- Disable obsolete TCP option alerts
- Disable T/TCP alerts
- Disable alerts on TCPOption type events
- Disable alerts on invalid IP options

Start NIDS  Stop NIDS
NIDS is running.
NOTE: All changes take effect next time you start the NIDS.
Detect ARP attacks
Detect unicast ARP requests as well

IP Address | EtherNet MAC
-------------|--------------

Add new host | Delete selected host(s)

Start NIDS | Stop NIDS

NIDS is running.

NOTE: All changes take effect next time you start the NIDS.
Run on the following interface: en0 (en0, ppp0, etc.)

**Enable promiscuous mode**

*Note: Do not put spaces in these fields. For network addresses, put groups of addresses into brackets, e.g. "[192.0.2.1,192.0.2.2]". To cover an entire subnet, set the last address byte to 0 and put "/24" after the byte, e.g. "192.0.2.0/24".*

<table>
<thead>
<tr>
<th>Your network range:</th>
<th>any</th>
</tr>
</thead>
<tbody>
<tr>
<td>External network range:</td>
<td>any</td>
</tr>
<tr>
<td>Your SMTP server(s):</td>
<td>$HOME_NET</td>
</tr>
<tr>
<td>Your HTTP server(s):</td>
<td>$HOME_NET</td>
</tr>
<tr>
<td>Your SQL server(s):</td>
<td>$HOME_NET</td>
</tr>
<tr>
<td>Your DNS server(s):</td>
<td>$HOME_NET</td>
</tr>
<tr>
<td>Your Telnet server(s):</td>
<td>$HOME_NET</td>
</tr>
</tbody>
</table>

*For port numbers, use a : to specify a range of ports (e.g. "80:85"), an ! to specify all but a specified port (e.g. "!123"), or "any" to scan all ports.*

| Check for shell code on port(s): | !80 |
| HTTP port(s) your server(s) use: | 80 |
| Oracle port(s) your server(s) use: | 1521 |

<table>
<thead>
<tr>
<th>Start NIDS</th>
<th>Stop NIDS</th>
</tr>
</thead>
</table>

**NOTE:** All changes take effect next time you start the NIDS.
/var/log/snort/alert

[**] [100:2:1] spp_portscan: portscan status from 218.73.229.61: 7 connections across 7 hosts: TCP(7), UDP(0) [**]
05/24-05:17:31.219371

[**] [100:3:1] spp_portscan: End of portscan from 218.73.229.61: TOTAL time(1s) hosts(7) TCP(7) UDP(0) [**]
05/24-06:03:36.543659

[**] [100:1:1] spp_portscan: PORTSCAN DETECTED from 172.198.99.217 (THRESHOLD 4 connections exceeded in 2 seconds) [**]
05/24-14:19:05.212321

[**] [100:2:1] spp_portscan: portscan status from 172.198.99.217: 6 connections across 6 hosts: TCP(6), UDP(0) [**]
05/24-14:35:48.829367

[**] [100:3:1] spp_portscan: End of portscan from 172.198.99.217: TOTAL time(2s) hosts(6) TCP(6) UDP(0) [**]
05/24-14:43:58.893324

[**] [100:1:1] spp_portscan: PORTSCAN DETECTED from 193.252.170.79 (THRESHOLD 4 connections exceeded in 2 seconds) [**]
05/26-12:07:43.622195

[**] [100:2:1] spp_portscan: portscan status from 193.252.170.79: 7 connections across 7 hosts: TCP(7), UDP(0) [**]
05/26-12:07:47.623947

[**] [100:2:1] spp_portscan: portscan status from 193.252.170.79: 1 connections across 1 hosts: TCP(1), UDP(0) [**]
05/26-12:54:20.594093

[**] [100:3:1] spp_portscan: End of portscan from 193.252.170.79: TOTAL time(6s) hosts(7) TCP(8) UDP(0) [**]
05/26-15:23:23.095528
Demonstration
NIDS in a Switched Network

- A Switched Network poses some technical hurdles that you must overcome.
- You need to put the NIDS in a location on your network where it can monitor the traffic you are concerned about.
Span Port

Network Switch

System Attacker

Client System

NIDS

Span Port
Using a Hub

Network Switch

Network Hub

System Attacker

Client System

NIDS
Using a Hub

Network Switch

System Attacker

Client System

Network Hub

NIDS

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Network Taps

System Attacker

Client System

Network Switch

Tap

NIDS
Multiple Network Taps

Network Switch

System Attacker

Client System

Tap

Network Hub

NIDS

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Intrusion Prevention

- Intrusion detection is generally separated from intrusion prevention.
- Intrusion Prevention includes
  - Firewalls
  - Network port security
  - Systrace (process jail)
  - Basically keeping attackers out
Honeypots

- Honeypots are systems that are made to look like real systems or network services but used to monitor attacker activity.
- Can be used as an advanced warning while you gather intelligence about the attacker to ward off an attack.
Common Questions

• Hopefully this will answer some of the common questions asked.
I have a firewall, why do I care?

• Just by keeping people out (Intrusion Prevention) does not mean you are not at risk.

• The attackers may already be inside.

• If you don’t know that attacks are being attempted, what do you do the day a new exploit is available and they compromise your machines?
Aren’t MAC addresses unique?

• What about using MAC address to trace an attacker?
  – MAC addresses get replaced by gateways, so you can only trace back to the gateway
  – Some gateways have extensive logging
  – Some systems like Linux allow administrators to change MAC addresses
Aren’t switched networks secure?

- More secure than non-switched networks, but still vulnerable.
  - ARP Spoofing
  - MAC Flooding
  - MAC Duplicating

- See SANS report on why your switched network isn’t secure
OK, my IDS gives me an alert!

• Now what?
  - Security policy and incident handling
    • SANS a good source of information
  - Record and retain log information
  - University of Utah
    • Contact Institutional Security Office (ISO)
    • http://iso.utah.edu/
Do I worry about mapping?

- When you install a NIDS you may see port scanning activity (mapping), do you worry about it?
- Well, if you saw someone walking through your neighborhood checking to see if doors are locked do you worry?
Can my NIDS keep up?

- In some networking environments you may have more network traffic (packets) than your NIDS can sort through.
- May need multiple NIDS to monitor groups of machines.
Things to Remember

- Attackers will most likely try and gain information about your network (mapping and reconnaissance)
- Your NIDS could be targeted or used to gather intelligence by attackers
  - Encrypt data whenever possible like between agent and monitor or if you remote syslog (use secure syslog).
More Things to Remember

- There are limitations to your IDS or NIDS, know them!
- Keep software current. Both for the systems you are trying to protect as well as your monitoring and server infrastructure.
Resources

• SANS Institute
  - http://www.sans.org/resources/idfaq

• Snort or HenWen
  - http://www.snort.org/
  - http://home.attbi.com/~dreamless/

• Top 75 Security Tools
Resources

• Systrace
  - http://www.citi.umich.edu/u/provos/systrace
Questions and Answers