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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 and 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.

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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.

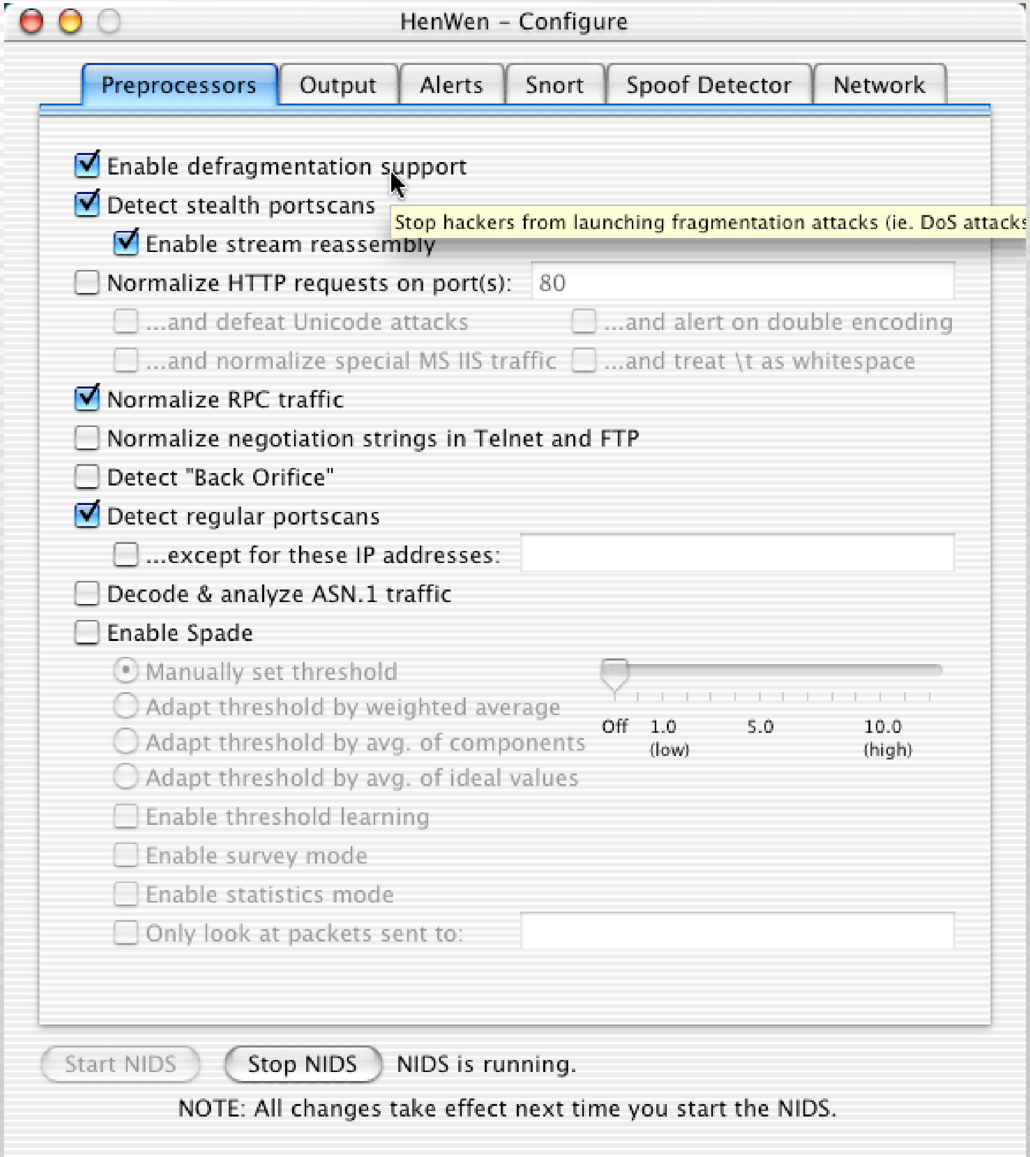
Host Based

- 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.

HenWen



☑ Enable defragmentation support

Stop hackers from launching fragmentation attacks (ie. DoS attacks

☑ Detect stealth portscans

☑ Enable stream reassembly

☐ Normalize HTTP requests on port(s): 80

☐ ...and defeat Unicode attacks ☐ ...and alert on double encoding

☐ ...and normalize special MS IIS traffic ☐ ...and treat \t as whitespace

☑ Normalize RPC traffic

☐ Normalize negotiation strings in Telnet and FTP

☐ Detect "Back Orifice"

☑ Detect regular portscans

☐ ...except for these IP addresses:

☐ Decode & analyze ASN.1 traffic

☐ Enable Spade

● Manually set threshold

○ Adapt threshold by weighted average

○ Adapt threshold by avg. of components

○ Adapt threshold by avg. of ideal values

☐ Enable threshold learning

☐ Enable survey mode

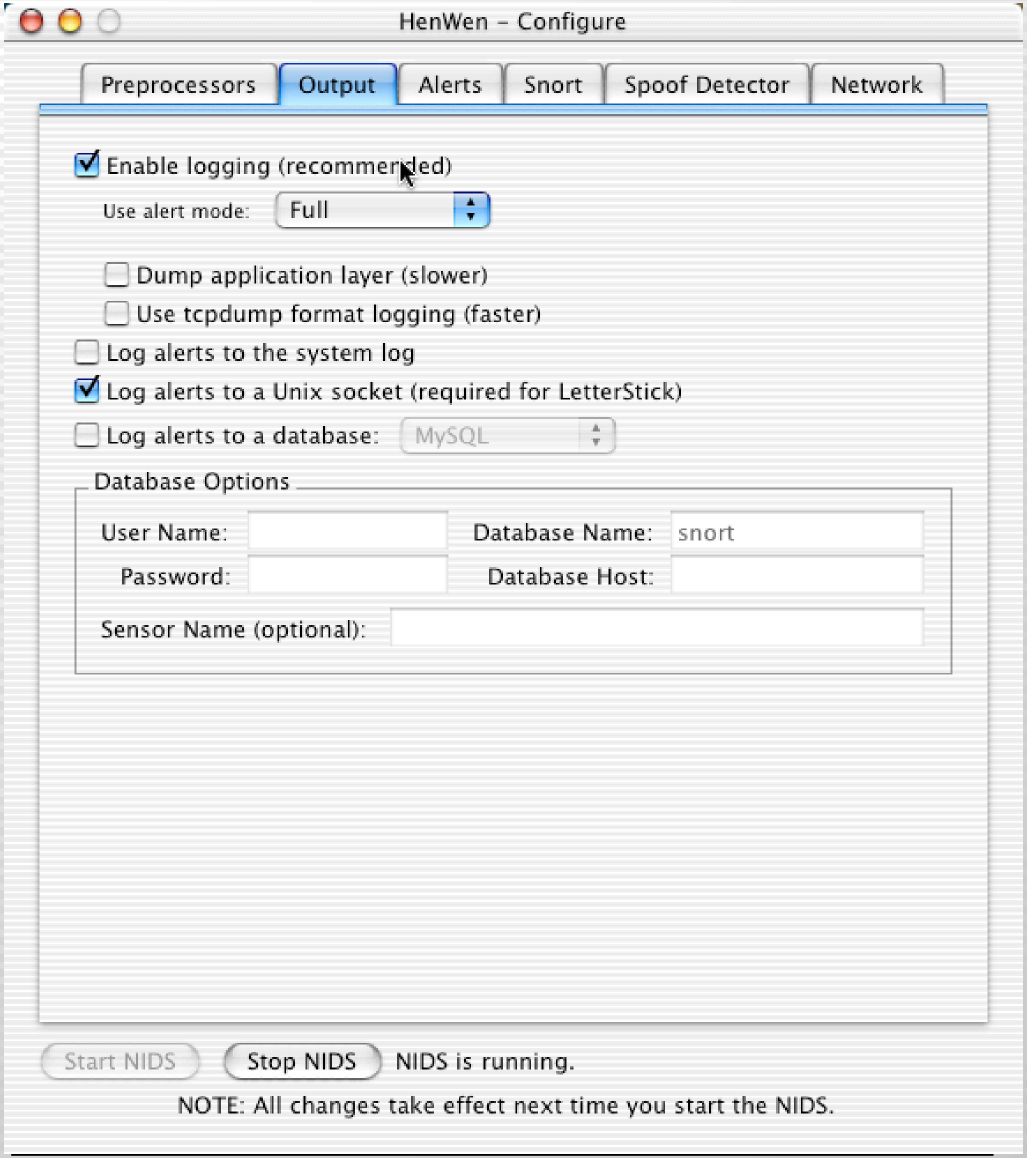
☐ Enable statistics mode

☐ Only look at packets sent to:

NIDS is running.

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

HenWen



☑ 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:

Database Name: snort

Password:

Database Host:

Sensor Name (optional):

NIDS is running.

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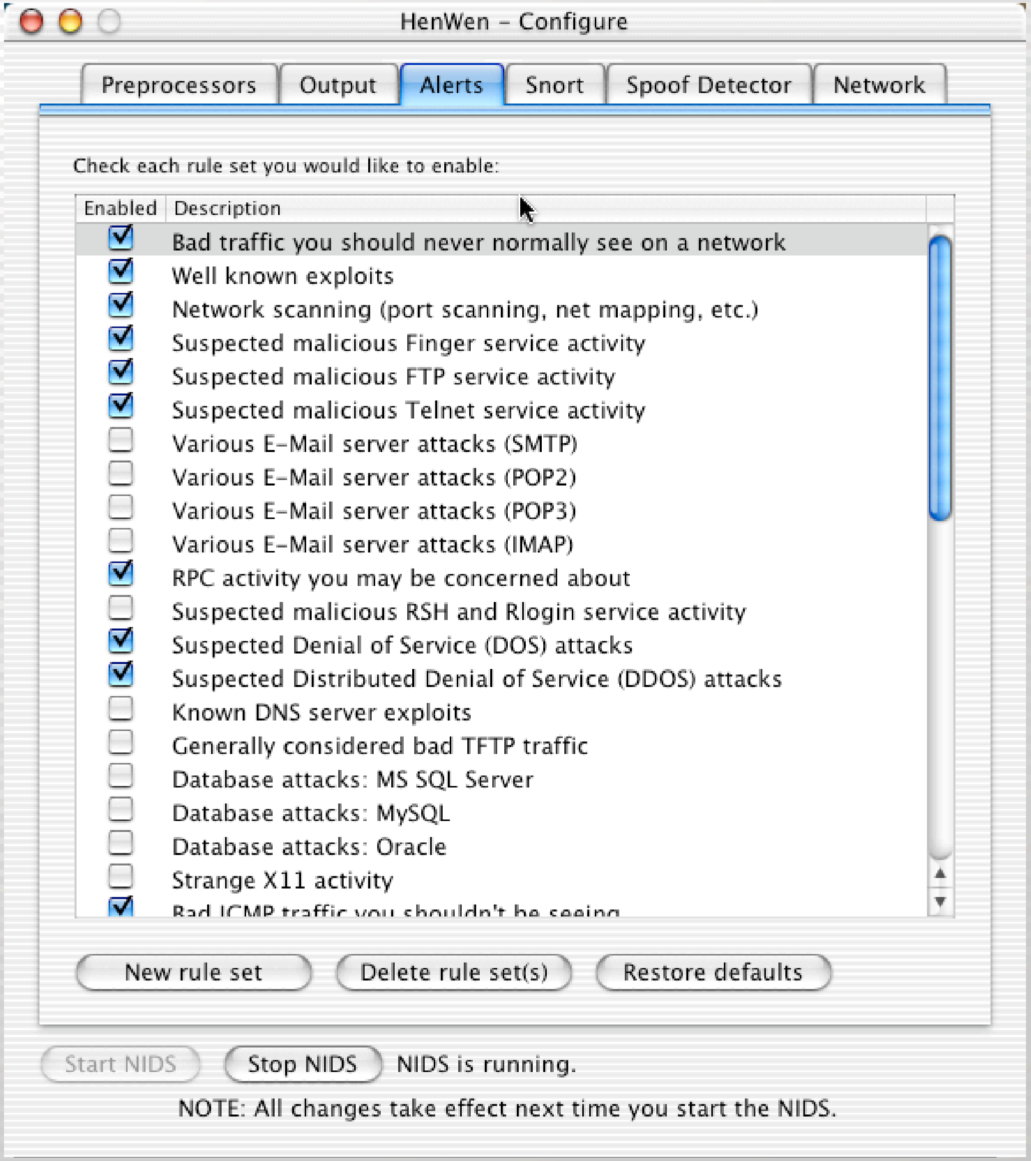
HenWen



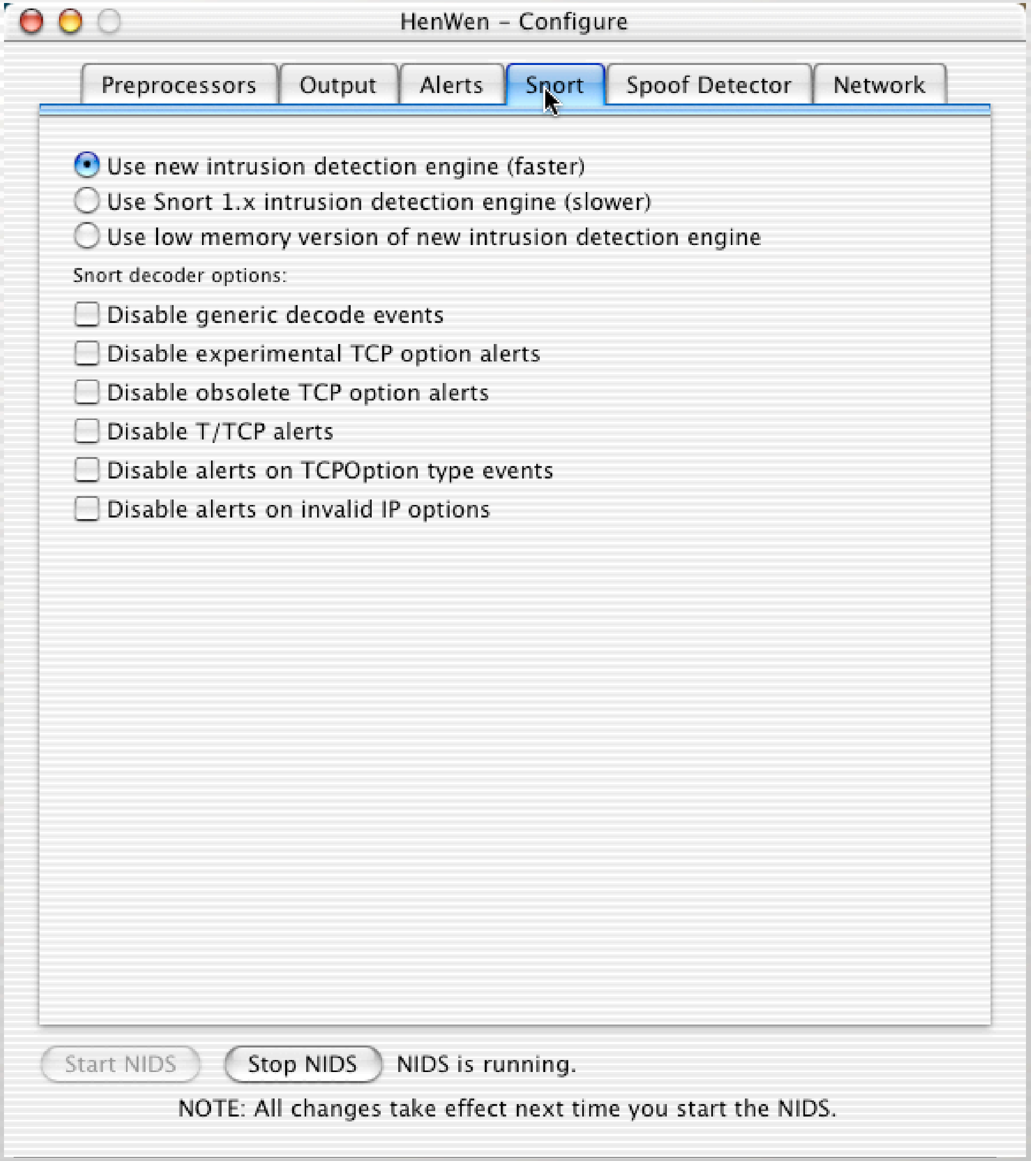
Check each rule set you would like to enable:

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

NIDS is running.

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

HenWen



● Use new intrusion detection engine (faster)
○ Use Snort 1.x intrusion detection engine (slower)
○ Use low memory version of new intrusion detection engine

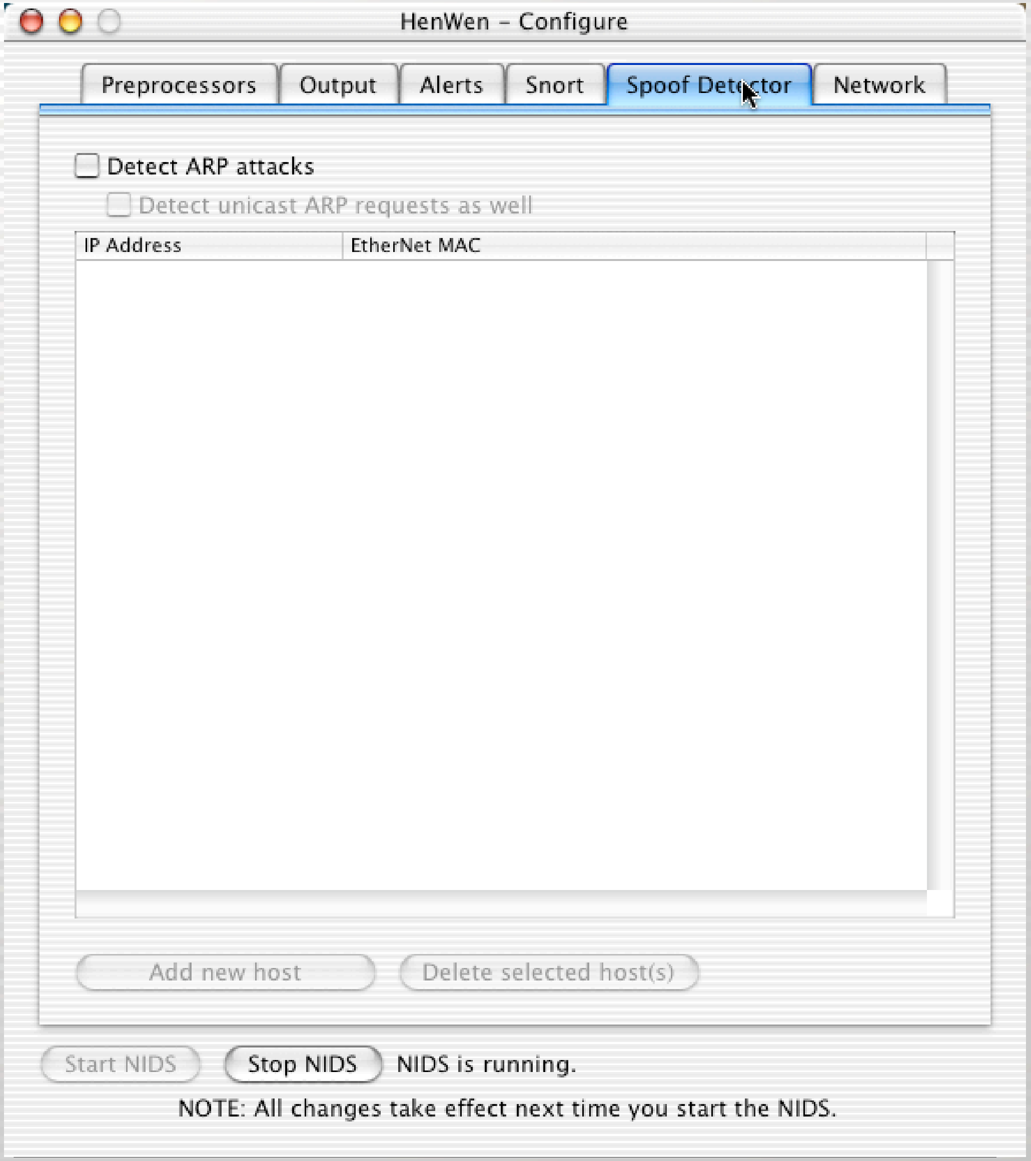
Snort decoder options:

- □ 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

NIDS is running.

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

HenWen



HenWen – Configure

□ Detect ARP attacks

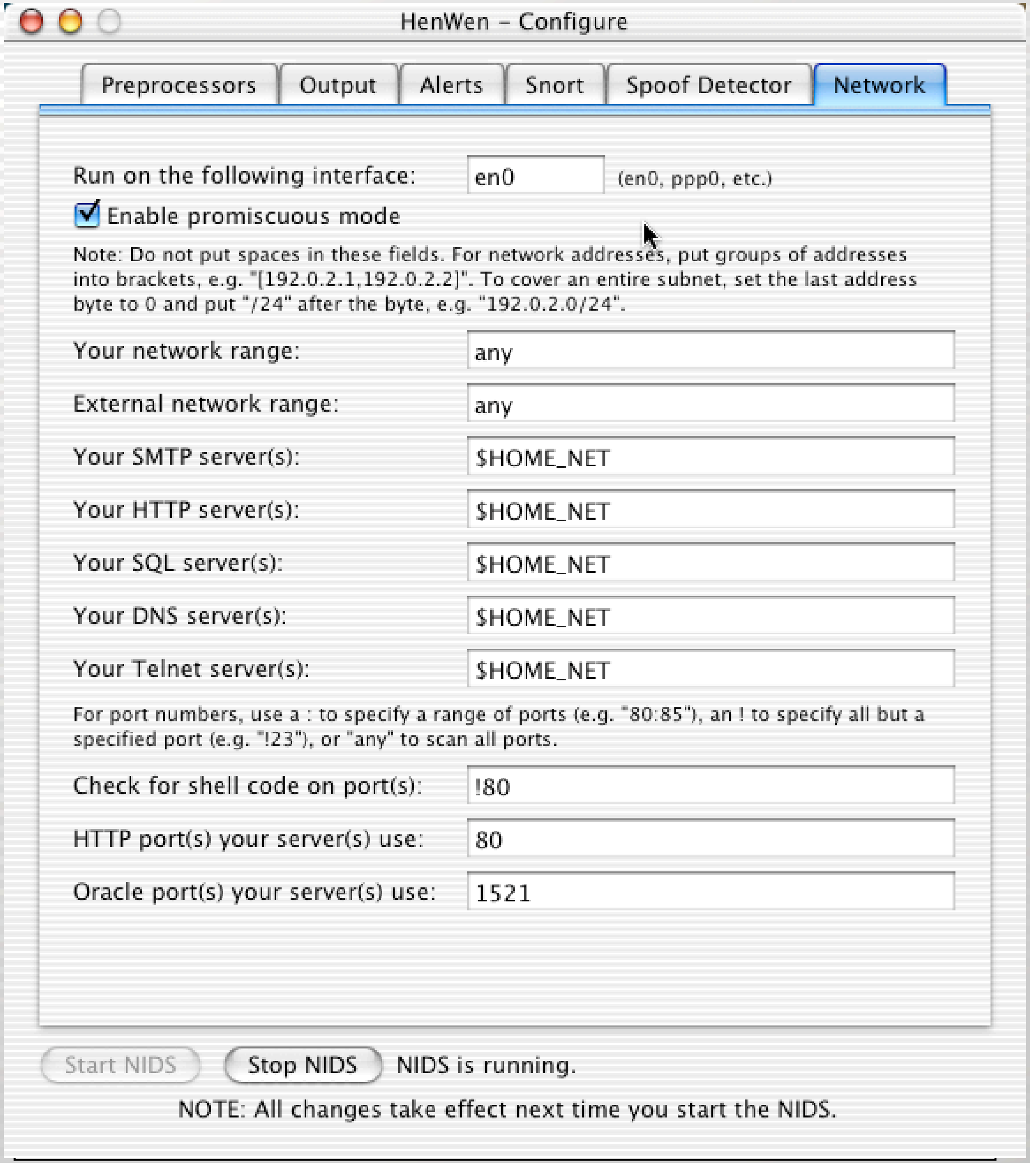
□ Detect unicast ARP requests as well

IP Address	EtherNet MAC

NIDS is running.

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

HenWen



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".

Your network range: any

External network range: any

Your SMTP server(s): $HOME_NET

Your HTTP server(s): $HOME_NET

Your SQL server(s): $HOME_NET

Your DNS server(s): $HOME_NET

Your Telnet server(s): $HOME_NET

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. "!23"), 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

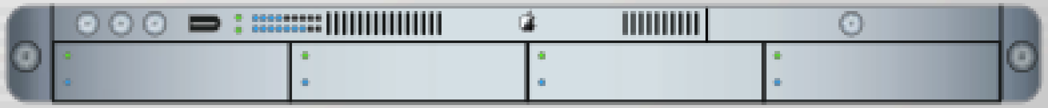
NIDS is running.

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
```

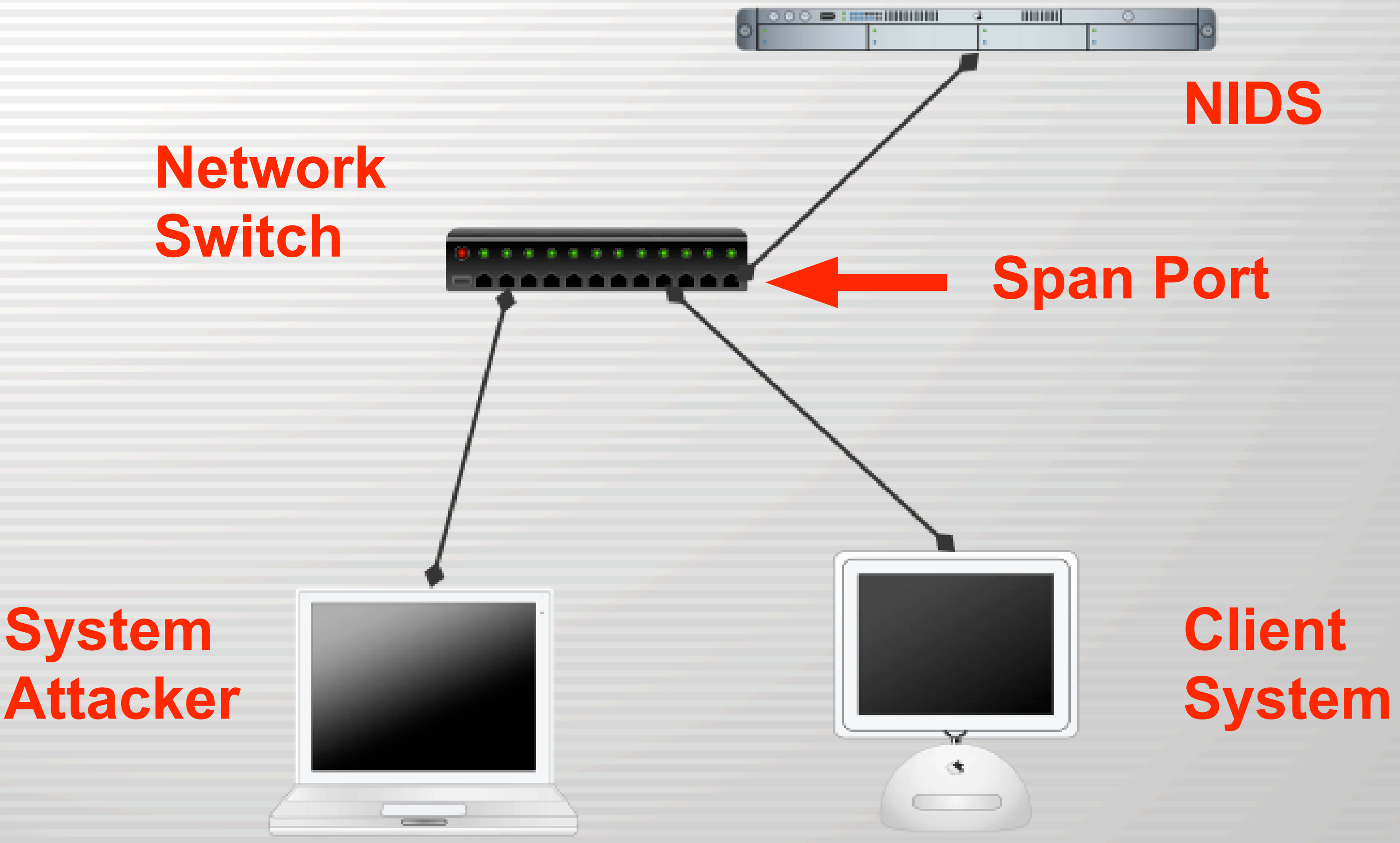
Demonstration



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



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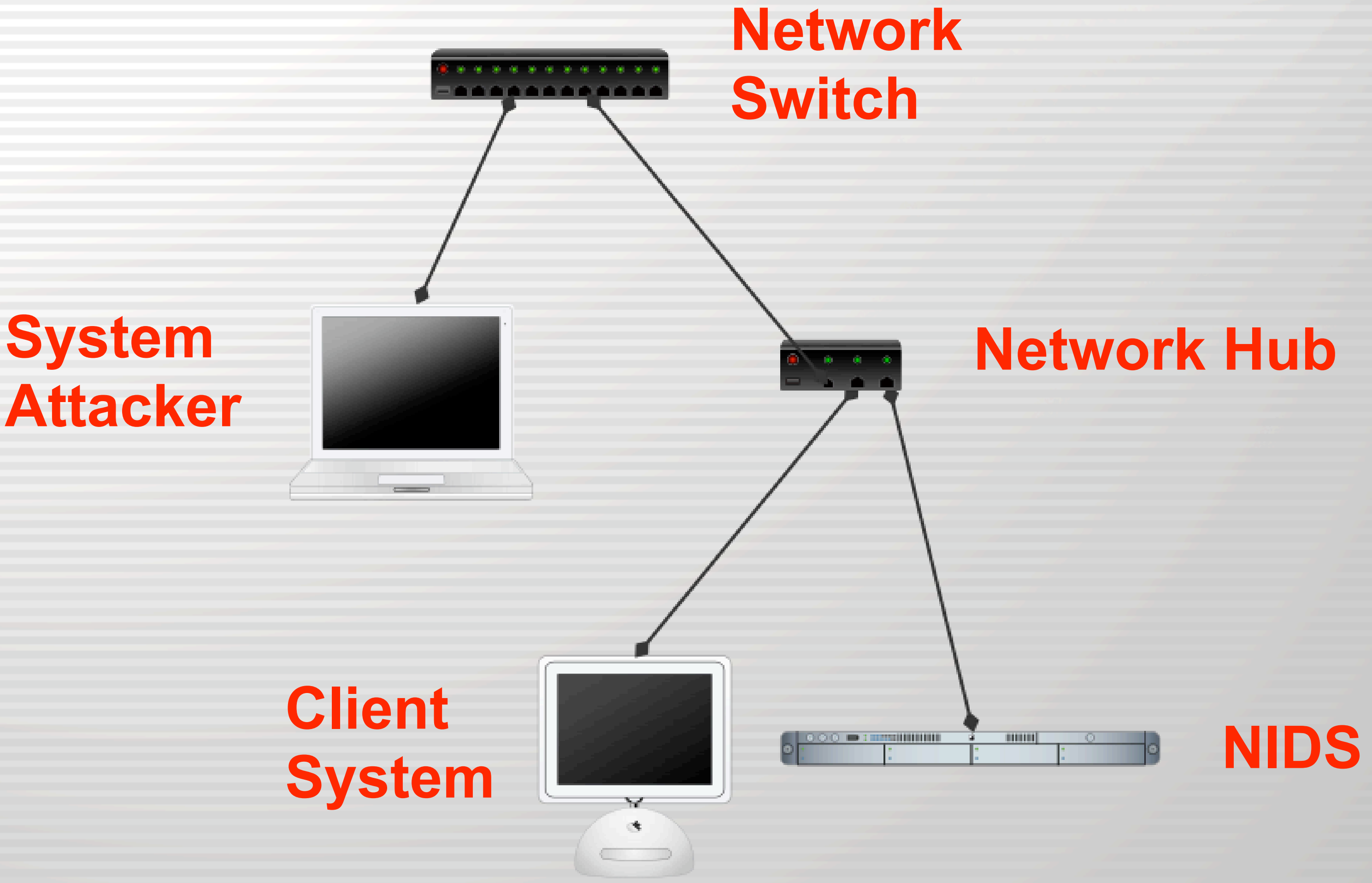
Using a Hub



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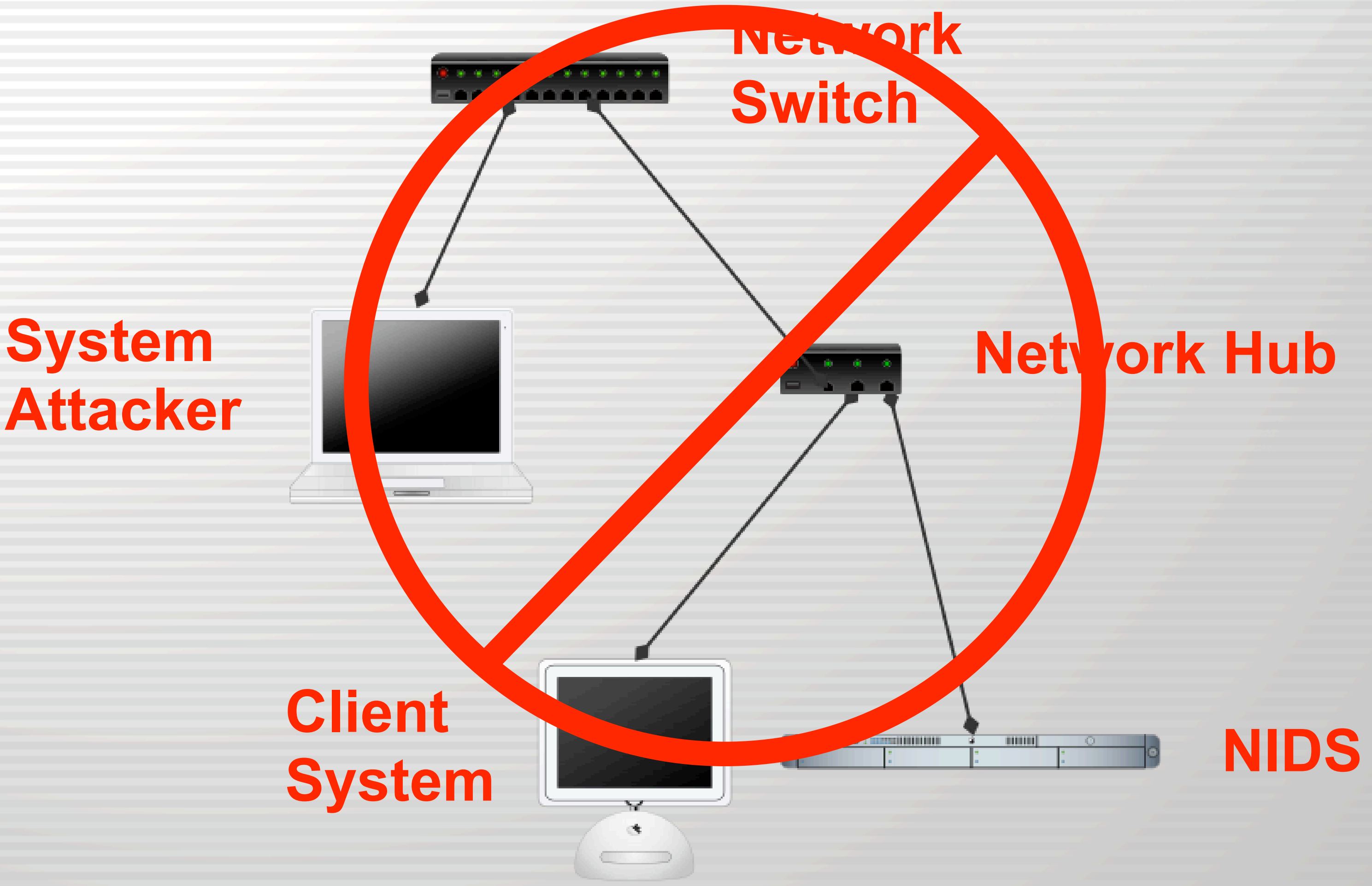
Using a Hub



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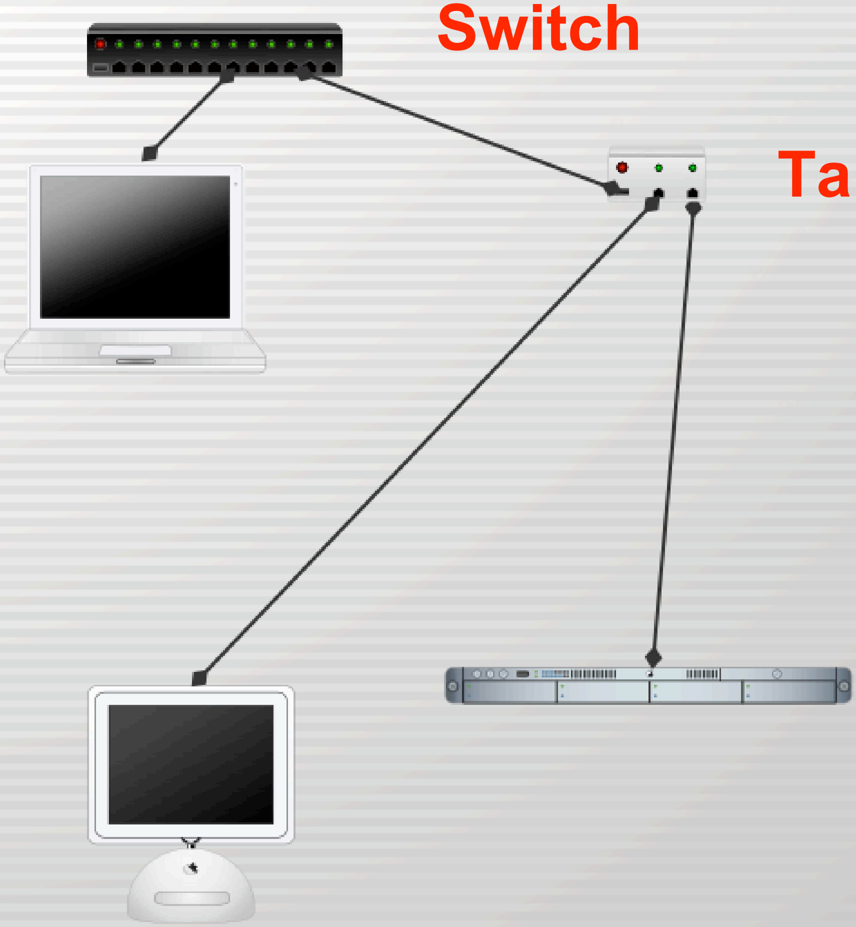
Network Taps



Network Switch

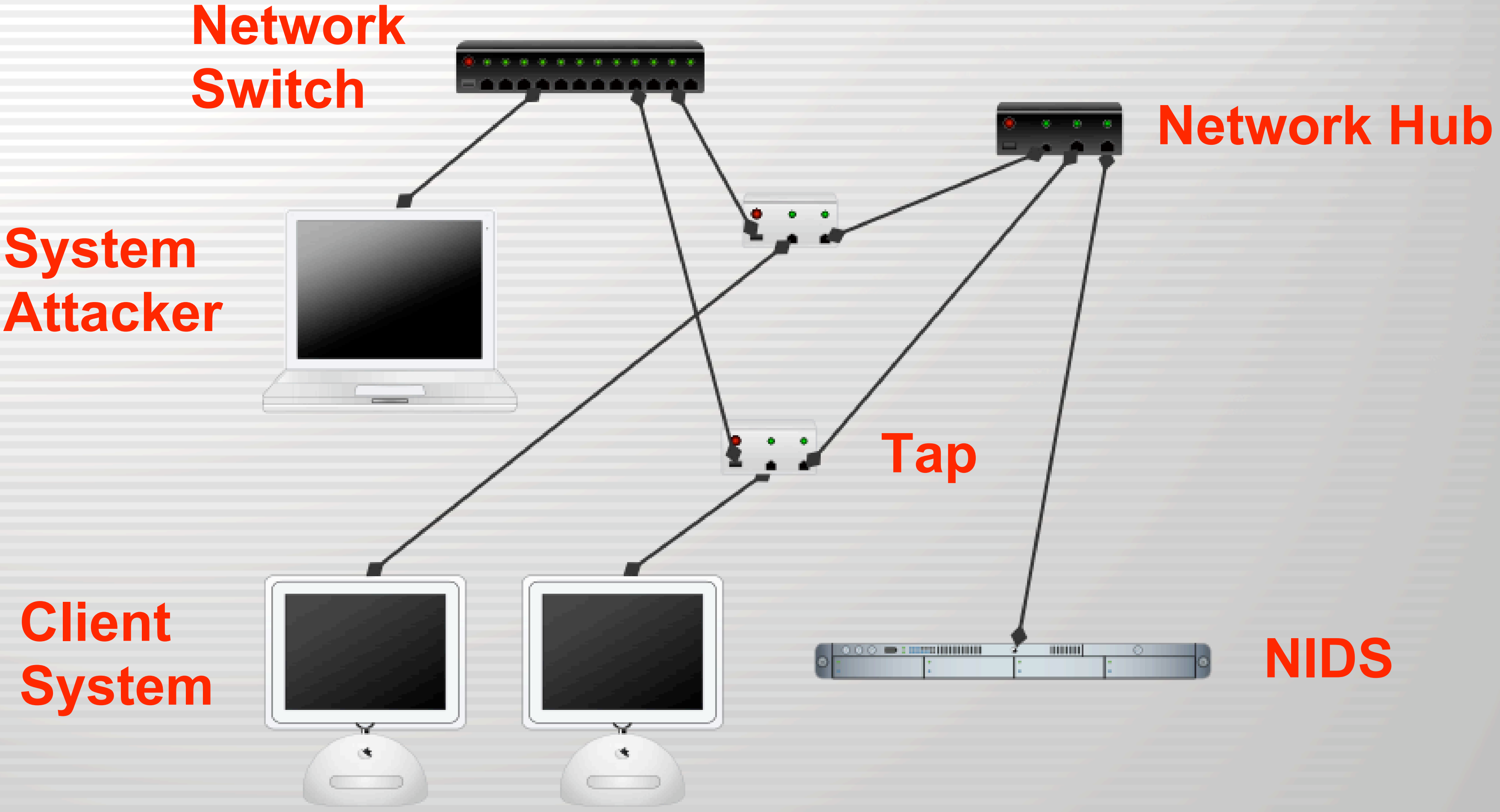
System Attacker

Tap

NIDS

Client System

Multiple Network Taps



Network Switch

Network Hub

System Attacker

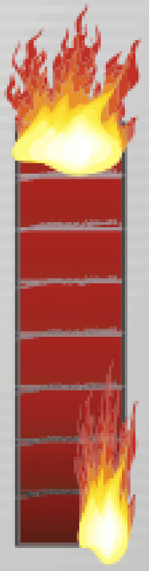
Tap

Client System

NIDS

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
  - http://www.insecure.org/tools.html

Resources

- Systrace
  - http://www.citi.umich.edu/u/provos/systrace

Questions and Answers

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