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"From bits to information"

Intrusion Detection Systems

Outline

- Attack Patterns.
- SNORT.
- IDS Types

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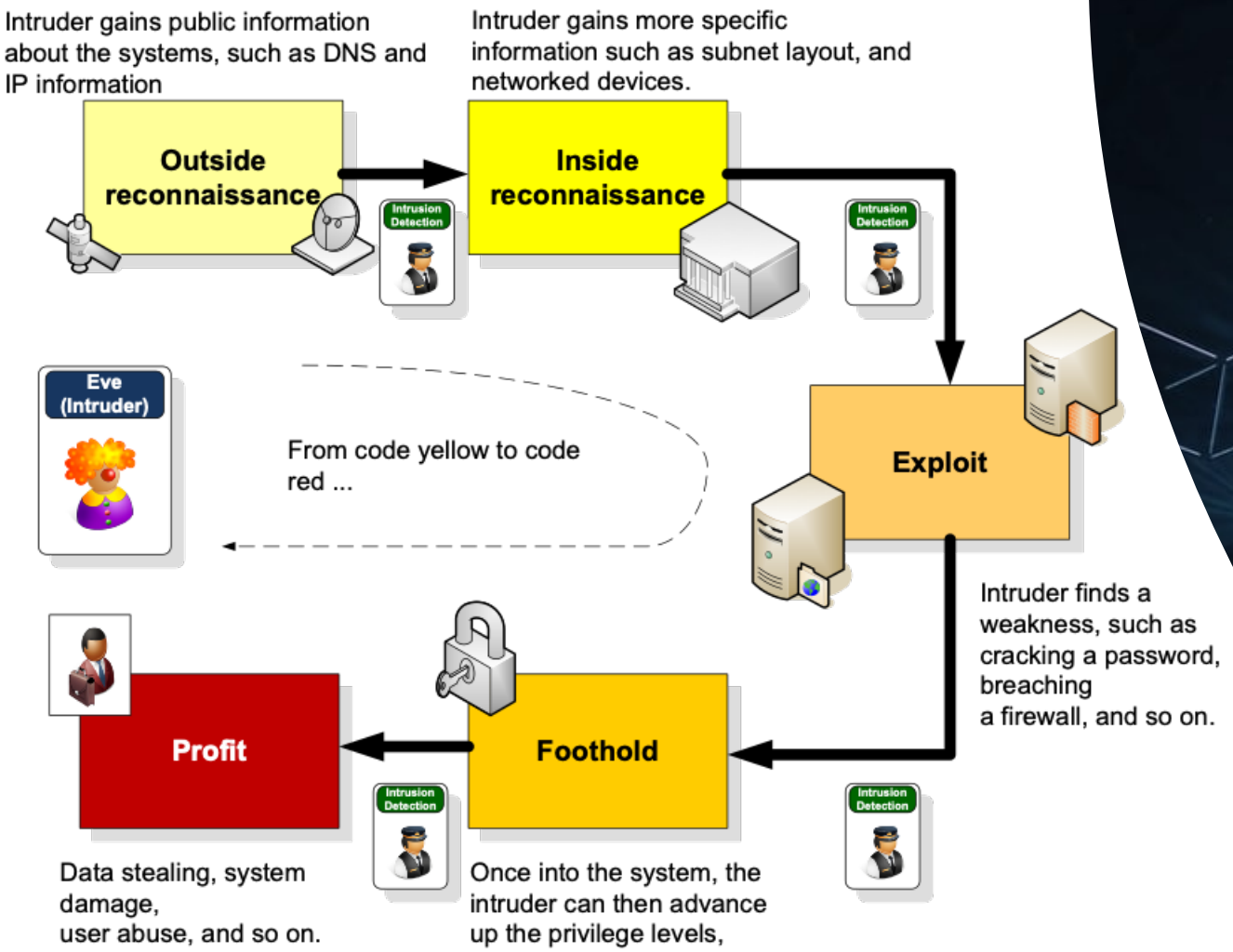
Attack Patterns

Intrusion Patterns



Kill Chain graphic: https://en.wikipedia.org/wiki/Kill_chain

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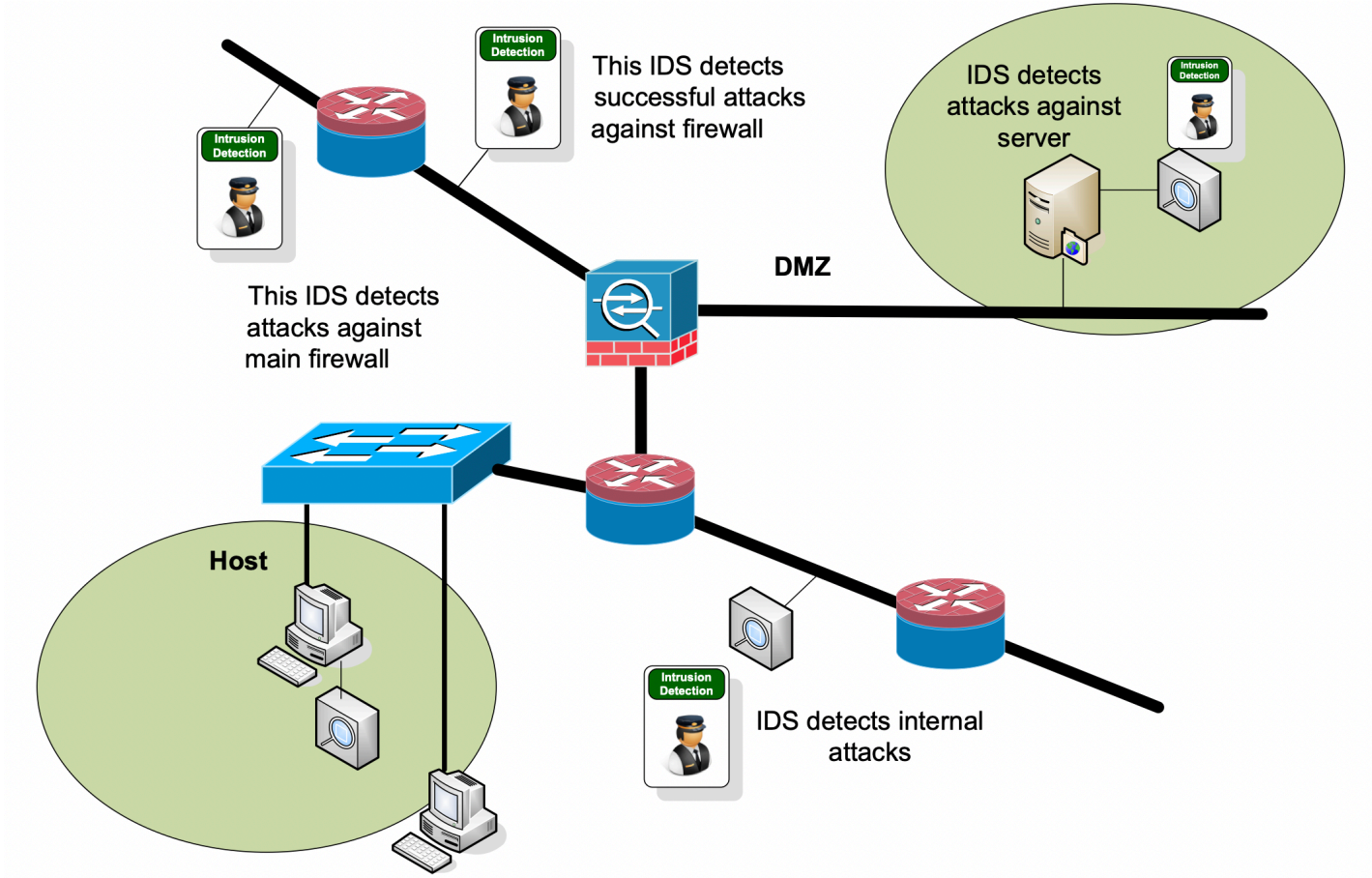
Intrusion Patterns

Phases of the Intrusion Kill Chain

Reconnaissance	Research, identification, and selection of targets
Weaponization	Pairing remote access malware with exploit into a deliverable payload (e.g. Adobe PDF and Microsoft Office files)
Delivery	Transmission of weapon to target (e.g. via email attachments, websites, or USB drives)
Exploitation	Once delivered, the weapon's code is triggered, exploiting vulnerable applications or systems
Installation	The weapon installs a backdoor on a target's system allowing persistent access
Command & Control	Outside server communicates with the weapons providing "hands on keyboard access" inside the target's network.
Actions on Objective	The attacker works to achieve the objective of the intrusion, which can include exfiltration or destruction of data, or intrusion of another target

Kill Chain graphic: https://en.wikipedia.org/wiki/Kill_chain

Host-based or Network-based



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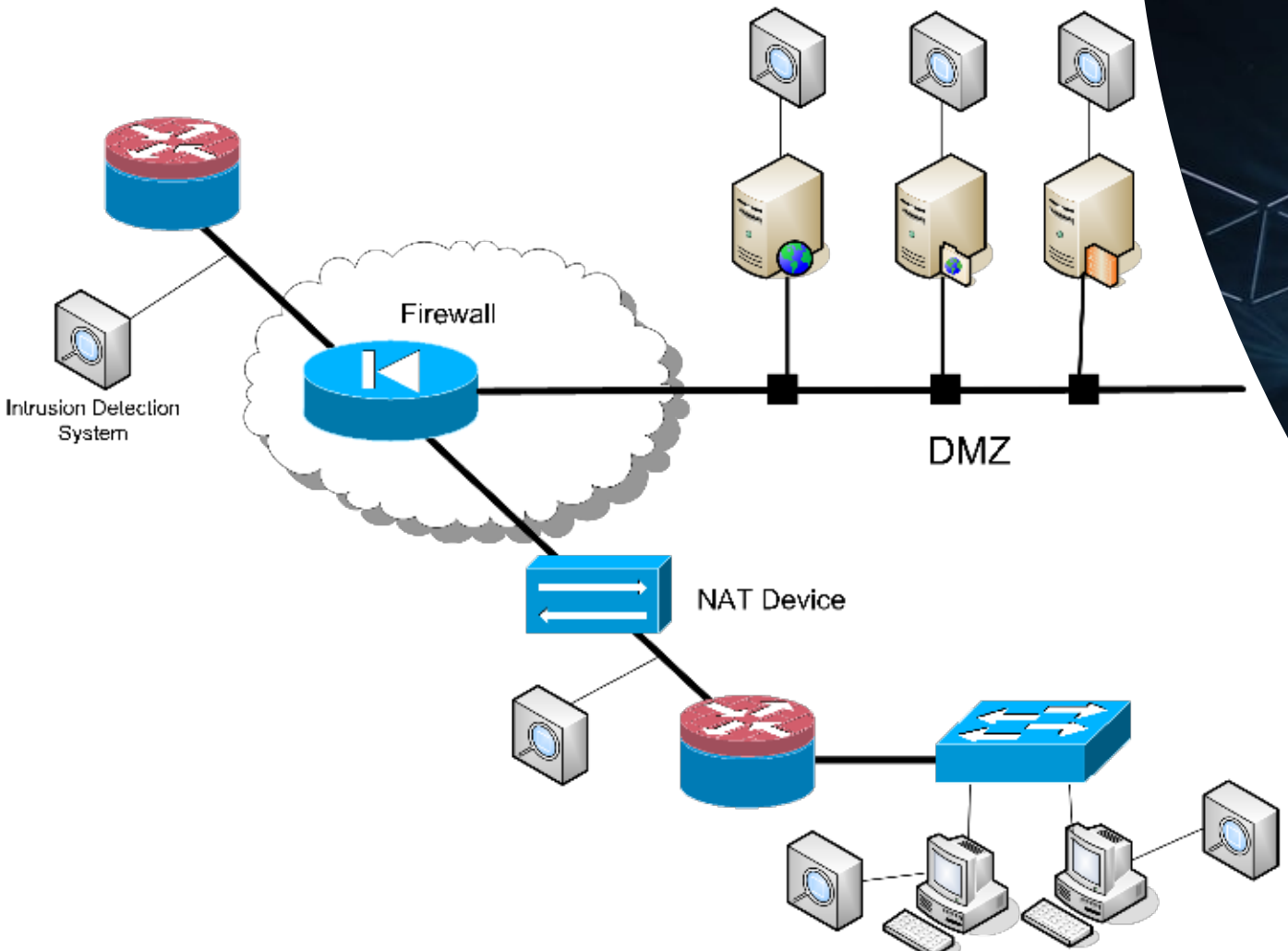
IDS Placement



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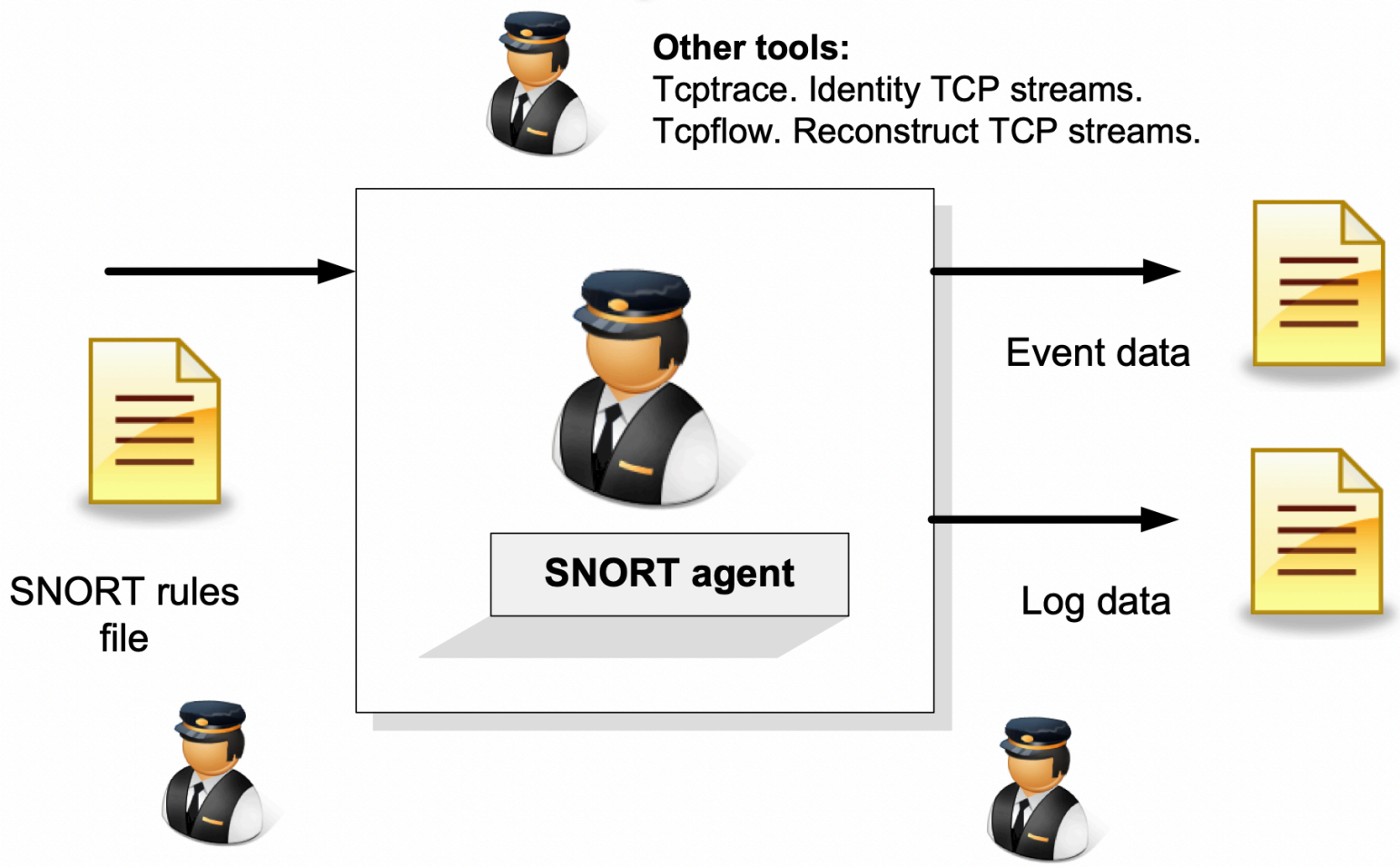
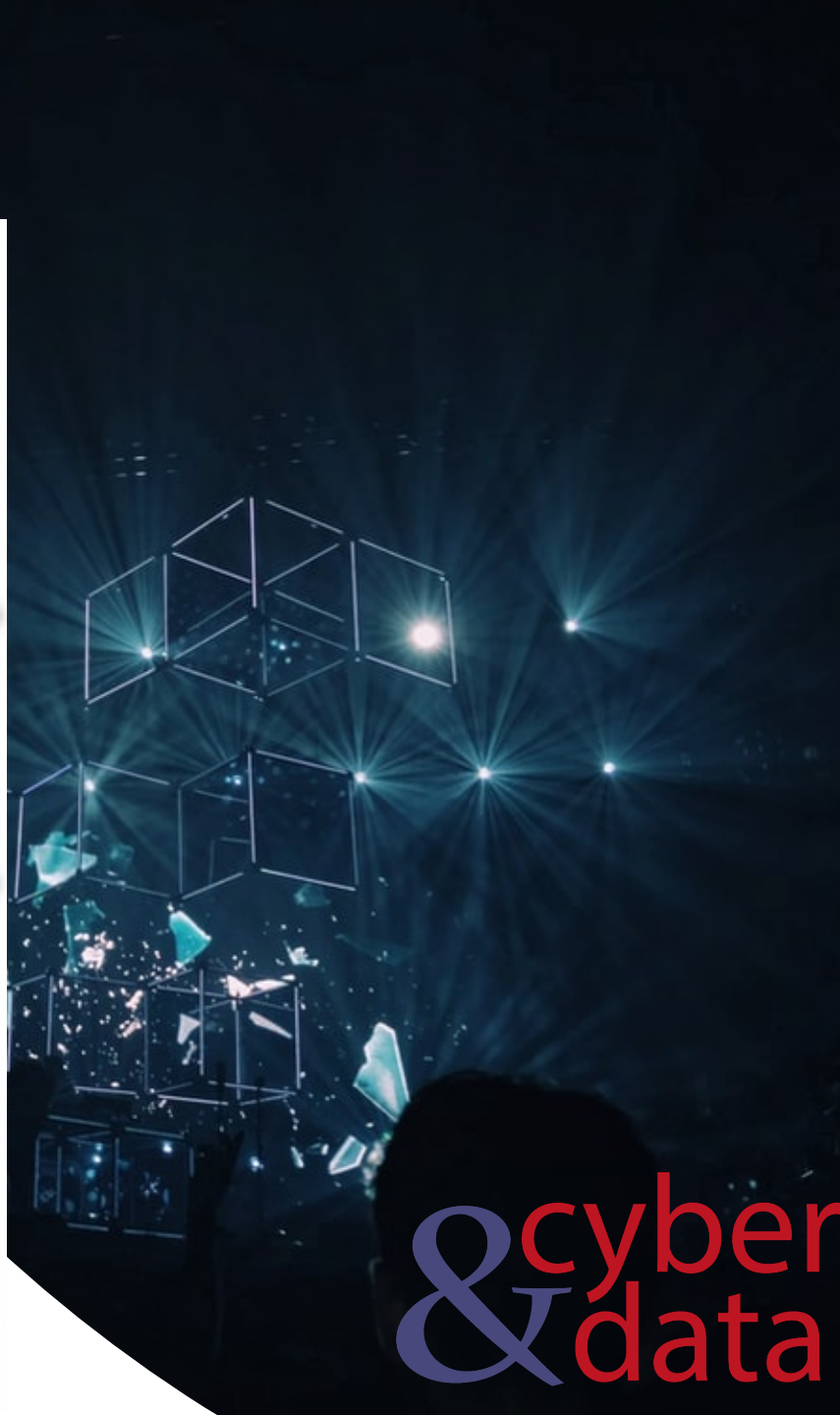
Snort

Snort


Other tools:
Tcptrace. Identity TCP streams.
Tcpflow. Reconstruct TCP streams.
Event data
SNORT agent
SNORT rules file
Log data
Signature detection.
Identify well-known patterns of attack.
Anomaly detection.
Statistical anomalies, such as user logins, changes to files, and so on.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Example of Snort Rule

```
alert tcp any any -> 192.168.1.0/24 111 (content:"|00 01 86 a5|"; msg:"mountd access";)
```

Source IP

Source port
(any,
or m:n for m to n)

Destination IP

Destination port
(any,
or m:n for m to n)

Example Snort Rule

```
alert tcp any any -> 192.168.1.0/24 111 (content:"|00 01 86 a5|"; msg:"mountd access";)
```

Payload detection:

Hex sequence `"|00 01 86 a5|"`

Text sequence `"USER root"`

Modifiers:
rawbytes
offset
distance
within
uricontent
bytejump

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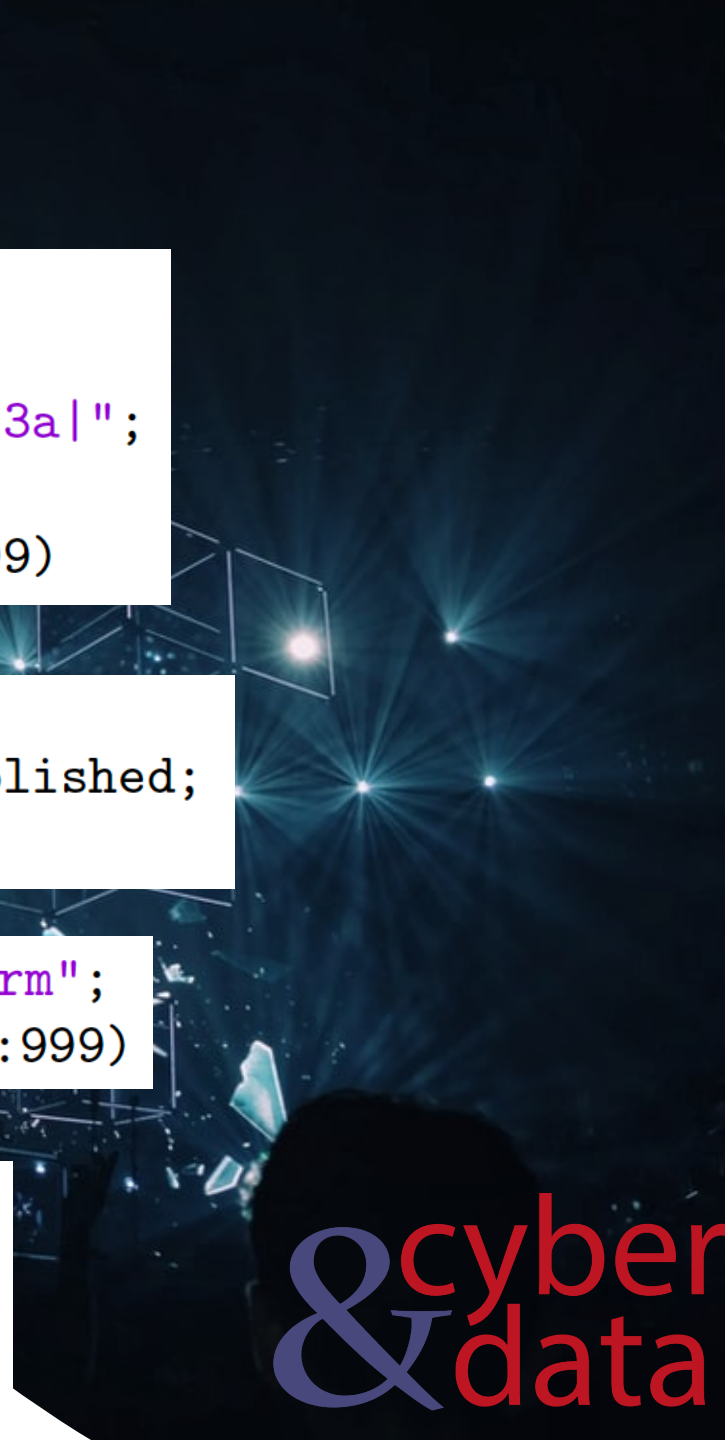
Example Snort Rule

```
alert tcp $SMTP_SERVERS any -> $EXTERNAL_NET 25
  (msg:"VIRUS OUTBOUND .vbs file attachment";
  flow:to_server,established; content:"Content-Disposition|3a|";
      content:"filename=|22|"; distance:0; within:30;
  content:".vbs|22|"; distance:0; within:30; nocase; sid:999)
```

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 21
  (msg:"FTP passwd retrieval attempt"; flow:to_server,established;
  content:"RETR"; nocase; content:"passwd"; sid:999)
```

```
alert tcp any any -> any 139 (msg:"Virus - Possible QAZ Worm";
  flags:A; content: "|71 61 7a 77 73 78 2e 68 73 71|"; sid:999)
```

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 21
  (msg:"FTP CWD ~root attempt"; flow:to_server,established;
  content:"CWD"; nocase; content:"~root"; nocase;
  distance:1; sid:999)
```



Example Snort Rule

```
sfportscan: proto { all } memcap { 10000000 } sense_level { low }
```

```
preprocessor flow: stats_interval 0 hash 2
preprocessor sfportscan: proto { all } scan_type { all }
             sense_level { low } logfile { portscan.log }
```

```
C:\> snort -c scan.rule -dev -i 3 -p -l c:\\bill -K ascii
Initializing Preprocessors!
Initializing Plug-ins!
Parsing Rules file scan.rule
,----------[Flow Config]----------------------
| Stats Interval: 0
| Hash Method:    2
| Memcap:         10485760
| Rows :          4096
| Overhead Bytes: 16388(%0.16)
`-----------------------------------------------
Portscan Detection Config:
    Detect Protocols: TCP UDP ICMP IP
    Detect Scan Type: portscan portsweep decoy_portscan
        distributed_portscan
    Sensitivity Level: Low
    Memcap (in bytes): 1048576
    Number of Nodes: 3869
    Logfile:         c:\\bill/portscan.log

Tagged Packet Limit: 256
```

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A Simple Rule

Snort Rule

Snort Rule

Snort Rule

Snort Rule

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A Few Intrusions

An example

Rules

Rules

Rules

Rules

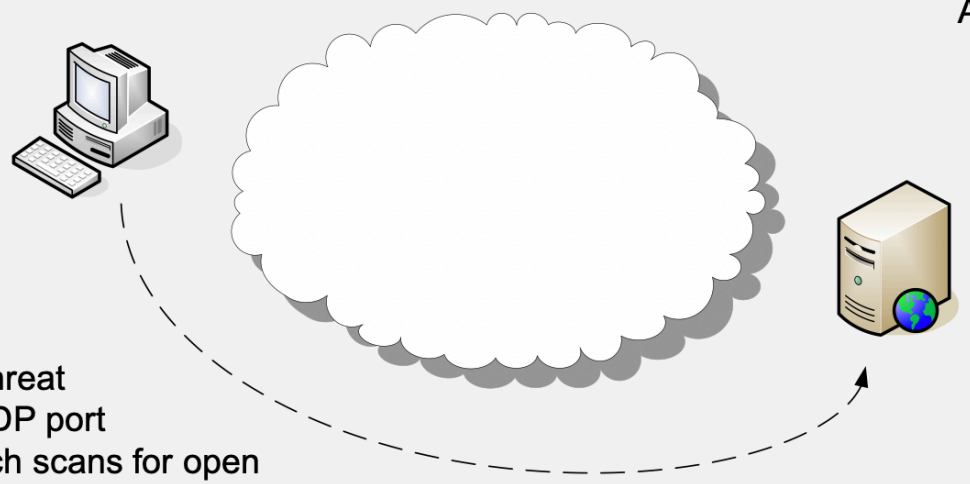
Rules

Rules

PCAP

Port sweep

Open port 10?
Open port 11?
..
Open port 8888?



Typical scans:
Ping sweeps.
TCP scans.
UDP scans.
OS identification scans.
Account scans.

A particular threat is the TCP/UDP port scanner, which scans for open ports on a host.

If an intruder finds one, it may try and connect to it.

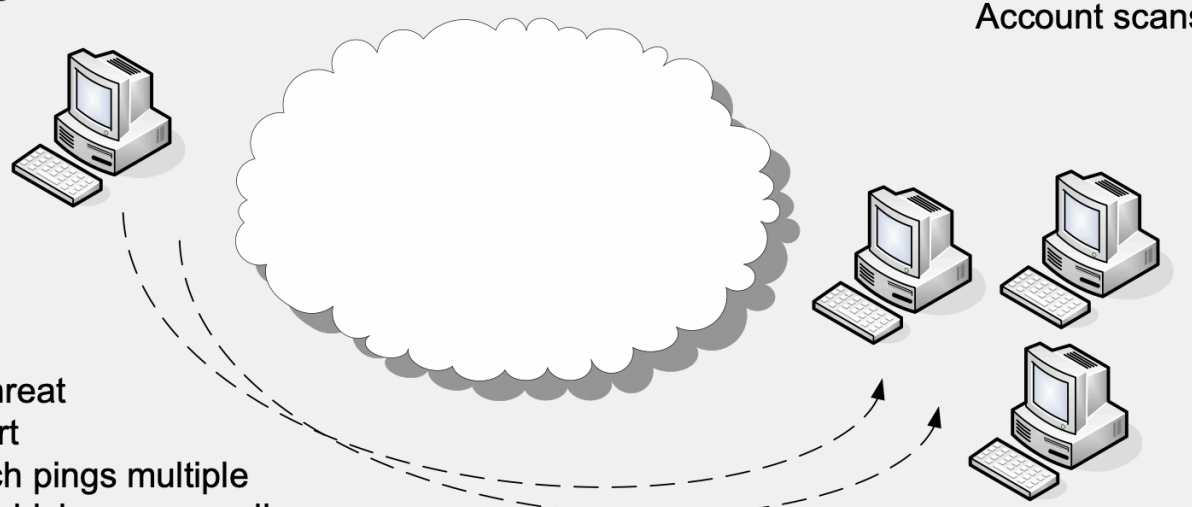
An open port is in the LISTEN state.

```
C:\log>netstat -a
Active Connections
Proto  Local Address          Foreign Address        State
TCP    bills:epmap            bills:0                LISTENING
TCP    bills:microsoft-ds     bills:0                LISTENING
TCP    bills:1035             bills:0                LISTENING
TCP    bills:3389             bills:0                LISTENING
```

Ping sweep

Ping 192.168.0.1?
Ping 192.168.0.1?
..
Ping 192.168.0.253?
Ping 192.168.0.254?

Typical scans:
Ping sweeps.
TCP scans.
UDP scans.
OS identification scans.
Account scans.

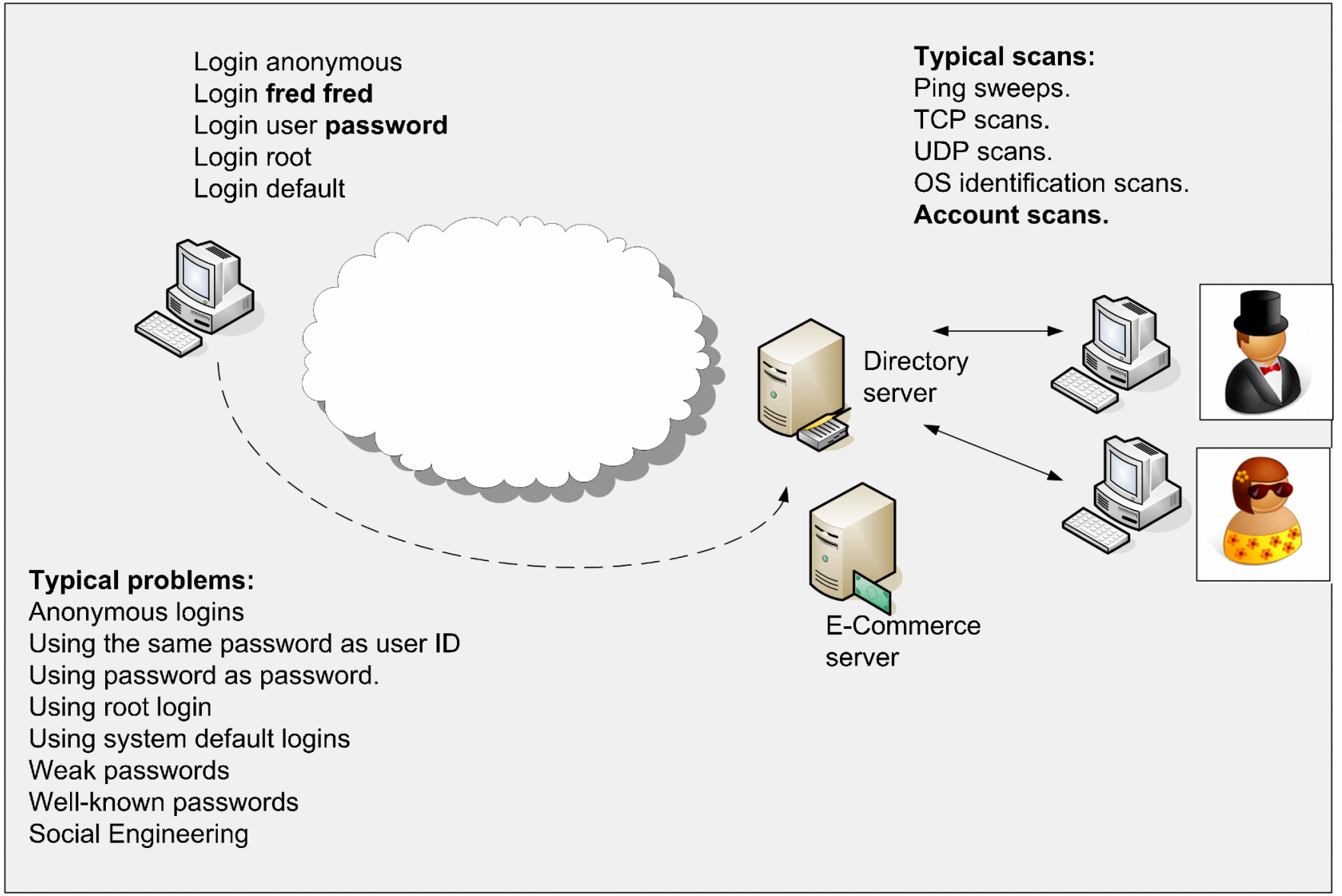


A particular threat is the ping port scanner, which pings multiple hosts to see which ones are alive

If an intruder finds one, they may try and connect to it.

Often ping (ICMP) is blocked on the gateway of the network.

Login sweep


Login anonymous
Login **fred fred**
Login user **password**
Login root
Login default
Typical scans:
Ping sweeps.
TCP scans.
UDP scans.
OS identification scans.
Account scans.
Directory server
E-Commerce server
Typical problems:
Anonymous logins
Using the same password as user ID
Using password as password.
Using root login
Using system default logins
Weak passwords
Well-known passwords
Social Engineering

Login sweep

PCAP

Login sweep

PCAP

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Examples

FTP Detection

FTP

Add your rules here:

```
# Signature Detection
alert tcp any any -> any 21 ( msg:"FTP";sid:10000)
```

Determine

Trace name: /log/ftp2.zip

Snort Output

Click here for the Pcap file. The Snort output is:

```
alert.ids:
[**] [1:10000:0] FTP [**]
[Priority: 0]
08/31-20:24:40.417691 192.168.47.1:49430 -> 192.168.47.134:21
TCP TTL:128 TOS:0x0 ID:16588 IpLen:20 DgmLen:52 DF
******S* Seq: 0x4372316F  Ack: 0x0  Win: 0x2000  TcpLen: 32
TCP Options (6) => MSS: 1460 NOP WS: 2 NOP NOP SackOK
```

Web

FTP Detection

FTP

Add your rules here:

```
alert tcp any any -> any 21 (flags:S;msg:"FTP Connection";sid:9000005;rev:1;)
alert tcp any 21 -> any any (msg:"FTP Bad login"; content:"530 User "; nocase; flow:from_server,established; sid:491;
rev:5;)
```

Determine

Trace name: /log/ftp2.zip

Snort Output

Click here for the Pcap file. The Snort output is:

```
alert.ids:
[**] [1:9000005:1] FTP Connection [**]
[Priority: 0]
08/31-20:24:40.417691 192.168.47.1:49430 -> 192.168.47.134:21
TCP TTL:128 TOS:0x0 ID:16588 IpLen:20 DgmLen:52 DF
******S* Seq: 0x4372316F  Ack: 0x0  Win: 0x2000  TcpLen: 32
TCP Options (6) => MSS: 1460 NOP WS: 2 NOP NOP SackOK
```

Web

Telnet Detection

Hydra Telnet

Add your rules here:

```
alert tcp any any <> any 23 (flags:S; msg:"Telnet Login";sid:9000005;rev:1;)
```

Determine

Trace name: /log/hydra_telnet.zip

Snort Output

Click here for the Pcap file. The Snort output is:

```
alert.ids:
[**] [1:9000005:1] Telnet Login [**]
[Priority: 0]
01/12-11:48:04.333781 192.168.47.171:7104 -> 192.168.47.200:23
TCP TTL:128 TOS:0x0 ID:31573 IpLen:20 DgmLen:48 DF
******S* Seq: 0xB3747913  Ack: 0x0  Win: 0xFFFF  TcpLen: 28
TCP Options (4) => MSS: 1460 NOP NOP SackOK
```

Web

File type Detection

Email with GIF

Add your rules here:

```
alert tcp any any -> any any (content:"GIF89a"; msg:"GIF";sid:10000)
alert tcp any any -> any any (content:"%PDF"; msg:"PDF";sid:10001)
alert tcp any any -> any any (content:"|89 50 4E 47|"; msg:"PNG";sid:10002)
alert tcp any any -> any any (content:"|50 4B 03 04|"; msg:"ZIP";sid:10003)
alert tcp any any -> any any (content:"|FF D8|"; msg:"JPEG";sid:10004)
alert tcp any any -> any any (content:"|49 44 33|"; msg:"MP3";sid:10005)
alert tcp any any -> any any (content:"|52 49 46 46|"; msg:"AVI";sid:10006)
alert tcp any any -> any any (content:"|46 57 53|"; msg:"Flash SWF";sid:10007)
alert tcp any any -> any any (content:"|46 4C 56|"; msg:"Flash Video";sid:10008)
alert tcp any any -> any any (content:"|1F 8B 08|"; msg:"GZip";sid:10009)
alert tcp any any -> any any (content:"|52 61 72 21 1A 07 00|"; msg:"RAR";sid:10010)
alert tcp any any -> any any (content:"|D0 CF 11 E0 A1 B1 1A E1|"; msg:"Office 2010";sid:10011)
```

Determine

Trace name: /log/with_gif.zip

Snort Output

Click here for the Pcap file. The Snort output is:

```
alert.ids:
[**] [1:10000:0] GIF [**]
[Priority: 0]
01/05-19:38:04.190265 77.72.118.168:80 -> 192.168.47.171:2641
TCP TTL:128 TOS:0x0 ID:61162 IpLen:20 DgmLen:83
```

Web

Credit Card Detection

Email with credit card details

Add your rules here:

```
# Detecting credit card details
alert tcp any any <> any any (pcre:"/5\d{3}(\s|-)?\d{4}(\s|-)?\d{4}(\s|-)?\d{4}/"; \
        msg:"MasterCard number detected in clear text";content:"number";nocase;sid:9000003;rev:1;)

alert tcp any any <> any any (pcre:"/3\d{3}(\s|-)?\d{6}(\s|-)?\d{5}/"; \
        msg:"American Express number detected in clear text";content:"number";nocase;sid:9000004;rev:1;)

alert tcp any any <> any any (pcre:"/4\d{3}(\s|-)?\d{4}(\s|-)?\d{4}(\s|-)?\d{4}/"; \
        msg:"Visa number detected in clear text";content:"number";nocase;sid:9000005;rev:1;)
```

Determine

Trace name: /log/email_cc2.zip

Snort Output

Click here for the Pcap file. The Snort output is:

```
alert.ids:
[**] [1:9000005:1] Visa number detected in clear text [**]
[Priority: 0]
01/06-21:20:26.755456 192.168.47.171:1061 -> 192.168.47.134:25
TCP TTL:128 TOS:0x0 ID:628 IpLen:20 DgmLen:1500 DF
***A**** Seq: 0xCA178C7B  Ack: 0x91870925  Win: 0xFEF9  TcpLen: 20
```

Web

ICMP Detection

Ping sweep

Add your rules here:

```
alert icmp any any -> any any (msg:"ICMP Packet found";sid:9000000;)
alert icmp any any -> any any (itype: 0; msg: "ICMP Echo Reply";sid:9000001;)
alert icmp any any -> any any (itype: 3; msg: "ICMP Destination Unreachable";sid:9000002;)
alert icmp any any -> any any (itype: 4; msg: "ICMP Source Quench Message received";sid:9000003;)
alert icmp any any -> any any (itype: 5; msg: "ICMP Redirect message";sid:9000004;)
alert icmp any any -> any any (itype: 8; msg: "ICMP Echo Request";sid:9000005;)
alert icmp any any -> any any (itype: 11; msg: "ICMP Time Exceeded";sid:9000006;)
```

Determine

Trace name: /log/ping_sweep.zip

Snort Output

Click here for the Pcap file. The Snort output is:

```
alert.ids:
[**] [1:9000005:0] ICMP Echo Request [**]
[Priority: 0]
08/25-15:48:52.876833 192.168.47.1 -> 192.168.47.2
ICMP TTL:59 TOS:0x0 ID:57989 IpLen:20 DgmLen:28
Type:8  Code:0  ID:12928   Seq:0  ECHO
```

Web

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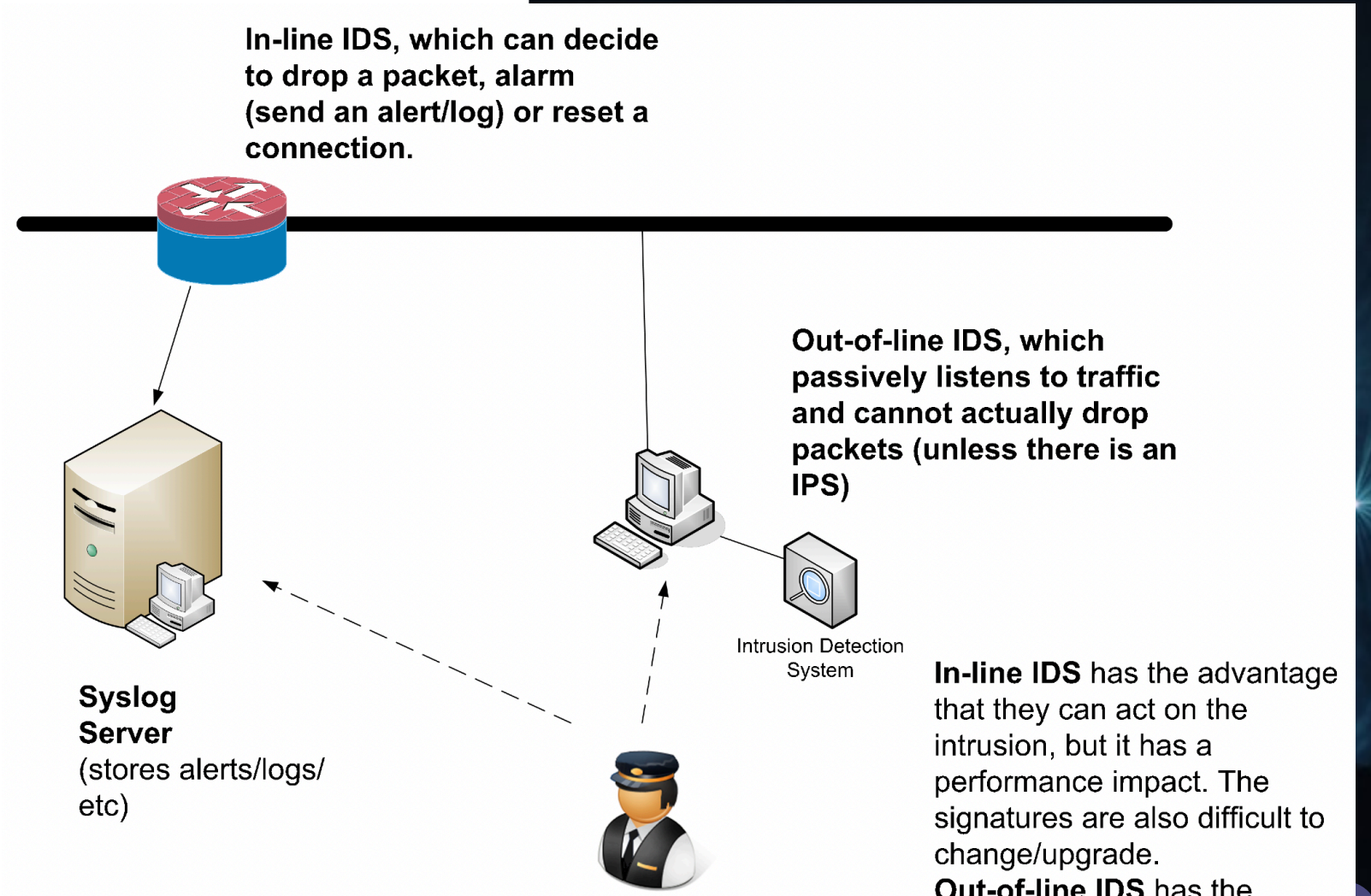
Intrusion Detection Systems

Port scanning

In-line/out-of-line



In-line IDS has the advantage that they can act on the intrusion, but it has a performance impact. The signatures are also difficult to change/upgrade.
Out-of-line IDS has the advantage of being able to more easily craft an IDS rule, but cannot take actions, directly.

Honeypot

Honeypot

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Intrusion Detection Systems