# Pentesting Lab

## Privilege Escalation - Windows

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17.03.2025

Summer 2025, www.isec.tugraz.at/ptl

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# Introduction

# What Is Privilege Escalation?

- ”Privilege Escalation consists of techniques that adversaries use to **gain higher-level permissions** on a system or network.” - MITRE ATT&CK
- ”Privilege Escalation is the act of exploiting a bug, a design flaw, or a configuration oversight in an operating system or software application to **gain elevated access** to resources that are normally protected from an application or user.” - Wikipedia
- ”Privilege Escalation is the process of **gaining** unauthorized access to **higher-level permissions** or privileges within a system or network.” - ChatGPT

# Why Do We Want to Escalate Privileges?

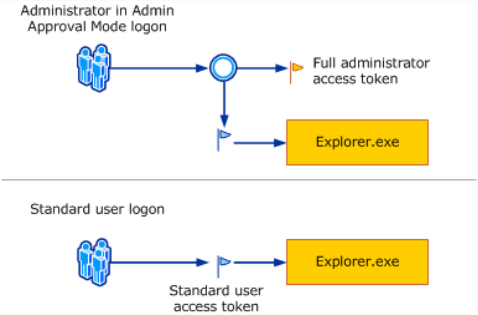
- Gaining persistence
- Credential dumping
- Lateral movement
- Prove impact

# Basics of the Windows Security Model

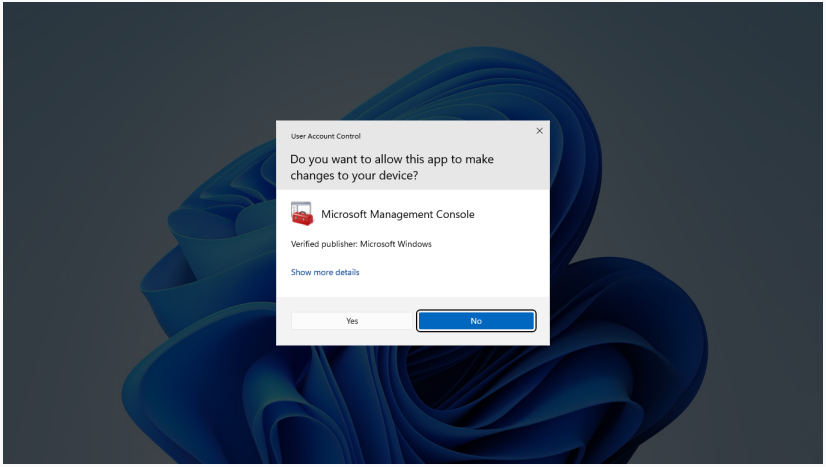
- Each user has an access token for their logon session
- Every process executed has copy of access token (of owner) in memory
- Token contains:
  - User
  - Groups
  - Privileges
  - SID (Security Identifier), identifies a logon session

- Administrators have **two** access tokens
  - One with User rights
  - One with Admin rights
- By default, processes are run with User rights
- When run as Administrator **UAC** will be prompted
- Can be abused in some cases

- Prompt Administrator to allow elevated activities
- UAC is configurable (different levels)
- Sometimes can be bypassed




https://learn.microsoft.com/en-us/windows/security/application-security/application-control/user-account-control/how-it-works

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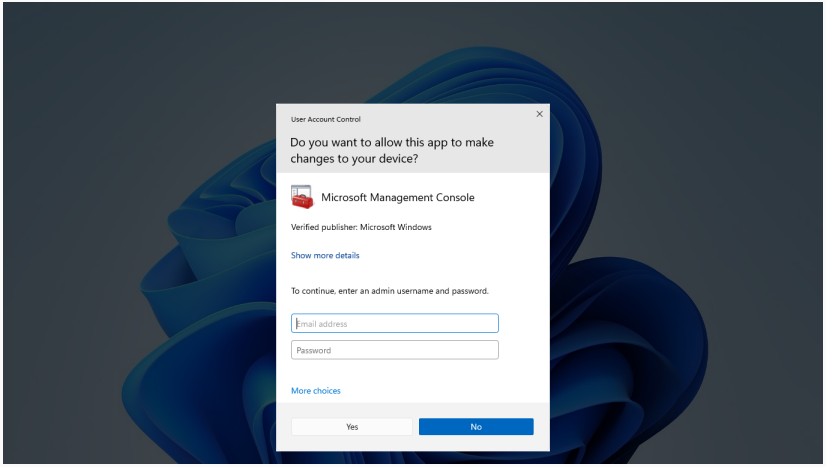
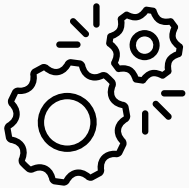
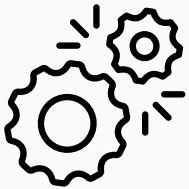



https://learn.microsoft.com/en-us/windows/security/application-security/application-control/user-account-control/how-it-works

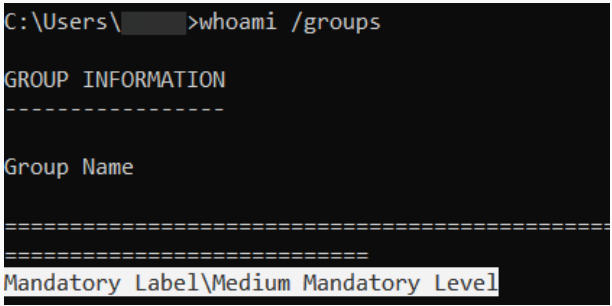
- `Administrator`
  - You can do **almost** everything
- `NT Authority\System`
  - Like root on Unix

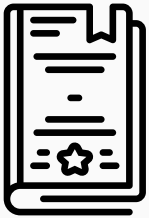


- Untrusted
  - For processes with anonymous logins
  - Highly restricted
- Low
  - Mainly for internet interactions
  - Processes face significant restrictions (no registry write access, ...)
- Medium
  - Default level for most activities
  - Assigned to standard users (even Administrators) and objects



- High
  - Reserved for Administrators
  - Allows modification of objects of lower/same integrity levels
- System
  - The highest operational level for the Windows kernel and core services
  - Out of reach even for administrators
  - Goal for privilege escalation
- Installer
  - Highest Integrity Level
  - Enables objects to uninstall any other object

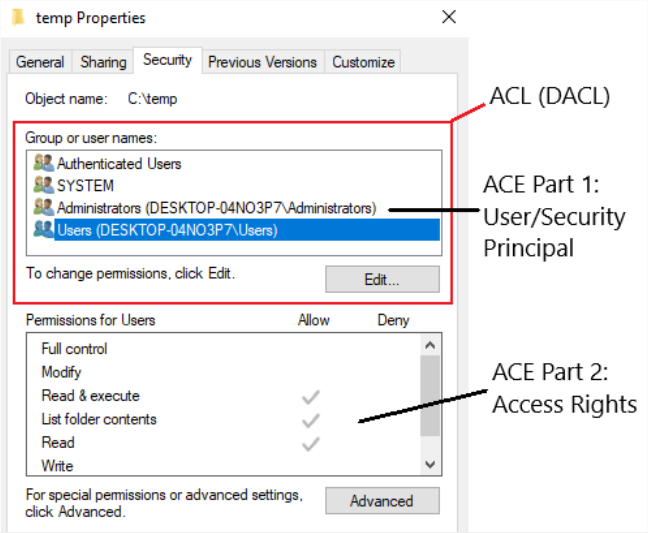

C:\Users\ >whoami /groups
GROUP INFORMATION
Group Name
Mandatory Label\Medium Mandatory Level



- List of ACE (Access Control Entities)
- ACE can be listed using icacls.exe
- Most important attributes:
  - (I) Inherited
  - (F) Full
  - (M) Modify
  - (D) Delete
  - (RWX) Read, Write, Execute

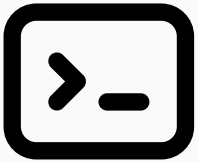
```
PS> icacls C:\Users\User\Desktop\file.txt
C:\Users\User\Desktop\file.txt BUILTIN\Administrators:(I)(F)
                              NT AUTHORITY\SYSTEM:(I)(F)
                              BUILTIN\Users:(I)(RX)
                              Mandatory Label\High Mandatory Level:(NW)
```

- DACL (Discretionary Access Control List)
  - Specifies which users and groups **have or do not have** access to an object
  - Contains ACEs that grant or deny access permissions
- SACL (System Access Control List)
  - Logging access attempts to an object
  - ACEs defines the type of access to be logged in the Security Event Log


temp Properties
General
Sharing
Security
Previous Versions
Customize
Object name: C:\temp
Group or user names:
Authenticated Users
SYSTEM
Administrators (DESKTOP-04NO3P7\Administrators)
Users (DESKTOP-04NO3P7\Users)
To change permissions, click Edit.
Edit...
Permissions for Users
Allow
Deny
Full control
Modify
Read & execute
List folder contents
Read
Write
For special permissions or advanced settings, click Advanced.
Advanced
ACL (DACL)
ACE Part 1: User/Security Principal
ACE Part 2: Access Rights

- SAM (Security Account Manager) & SYSTEM
  - Stores cashed hashed credentials on disk/registry
  - C:\Windows\System32\config\sam
  - HKEY_LOCAL_MACHINE\SAM
- LSA (Local Security Authority)
  - Stores credentials in memory
  - lsass.exe (Local Security Authority Subsystem Service)
- NTDS.dit
  - Database of Active Directory (will be covered in the AD lecture)
- LAPS (Local Administrator Password Solution)
  - Solution to manage local administrator password
  - Configurable for domain-joined computer

# DLL (Dynamically Linked Library)

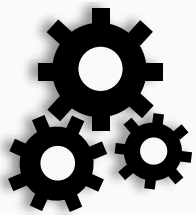


- Equivalent to Shared Libary (on Unix systems)
- Weak or Strong Reference?
  - Only defined by its filename
  - Normally used when it can be safely removed at some point
  - Windows attempts to find DLL through pre-defined order

# Common Vulnerabilities

When having access to credentials we shouldn't

- Plaintext credentials in the registry
- Saved credentials, e.g., passwords.txt
- Configuration files
- Readable SAM & SYSTEM database files
- PowerShell history
- unattend.xml

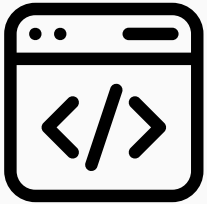


- If we can modify the service properties
- We can check our privileges using accesshck.exe (Part of Sysinternals)
- We can use sc.exe to query information about the service

```
C:\Users\pentestlab>accesschk.exe -uwcqv "pentestlab" * -accepteula
accesschk.exe -uwcqv "pentestlab" * -accepteula

Accesschk v6.10 - Reports effective permissions for securable objects
Copyright (C) 2006-2016 Mark Russinovich
Sysinternals - www.sysinternals.com

RW Apache
        SERVICE_ALL_ACCESS

C:\Users\pentestlab>
```

https://pentestlab.blog/2017/03/30/weak-service-permissions/

```
C:\Users\pentestlab>sc qc Apache
sc qc Apache
[SC] QueryServiceConfig SUCCESS

SERVICE_NAME: Apache
        TYPE               : 10  WIN32_OWN_PROCESS
        START_TYPE         : 2   AUTO_START
        ERROR_CONTROL      : 1   NORMAL
        BINARY_PATH_NAME   : "C:\xampp\apache\bin\httpd.exe" -k runservice
        LOAD_ORDER_GROUP   :
        TAG                : 0
        DISPLAY_NAME       : Apache
        DEPENDENCIES       : Tcpip
                           : Afd
        SERVICE_START_NAME : LocalSystem

C:\Users\pentestlab>sc config "Apache" binPath= "net localgroup administrators p
entestlab /add"
sc config "Apache" binPath= "net localgroup administrators pentestlab /add"
[SC] ChangeServiceConfig SUCCESS
```



- If we can modify the service binary
- We can use sc.exe to query information about the service
- We can use icalcs.exe to check our permissions for the specific file

```
C:\Users\pentestlab>sc qc Apache
sc qc Apache
[SC] QueryServiceConfig SUCCESS

SERVICE_NAME: Apache
        TYPE               : 10  WIN32_OWN_PROCESS
        START_TYPE         : 2   AUTO_START
        ERROR_CONTROL      : 1   NORMAL
        BINARY_PATH_NAME   : "C:\xampp\apache\bin\httpd.exe" -k runservice
        LOAD_ORDER_GROUP   :
        TAG                : 0
        DISPLAY_NAME       : Apache
        DEPENDENCIES       : Tcpip
                           : Afd
        SERVICE_START_NAME : LocalSystem
```

https://pentestlab.blog/2017/03/30/weak-service-permissions/

- If the services does not quote the path to the binary
- **And** the path contains spaces
  (e.g: C:\Program Files\Corp\service.exe)
  - C:\Program.exe
  - C:\Program Files\Corp.exe
  - C:\Program Files\Corp\service.exe
- Using PowerSploit we can automatically exploit this

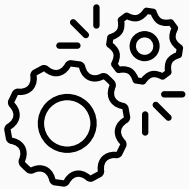
# Service - Unquoted Service Paths II

```
PS C:\Users\User> Get-ServiceUnquoted


ServiceName    : GDCAgent
Path           : C:\Program Files (x86)\Lenovo\GDCAgent.exe
ModifiablePath : @{Permissions=System.Object[]; ModifiablePath=C:\; IdentityReference=BUILTIN\Administrators}
StartName      : LocalSystem
AbuseFunction  : Write-ServiceBinary -Name 'GDCAgent' -Path <HijackPath>
CanRestart     : True

ServiceName    : GDCAgent
Path           : C:\Program Files (x86)\Lenovo\GDCAgent.exe
ModifiablePath : @{Permissions=System.Object[]; ModifiablePath=C:\; IdentityReference=BUILTIN\Users}
StartName      : LocalSystem
AbuseFunction  : Write-ServiceBinary -Name 'GDCAgent' -Path <HijackPath>
CanRestart     : True
```

https://pentestlab.blog/2017/03/09/unquoted-service-path/

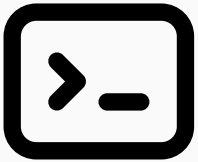
```
PS C:\Users\User> Write-ServiceBinary -Name 'GDCAgent' -Path "C:\GDCAgent.exe"

ServiceName                     Path                            Command
-----------                     ----                            -------
GDCAgent                        C:\GDCAgent.exe                 net user john Password123! /add && t...
```

https://pentestlab.blog/2017/03/09/unquoted-service-path/

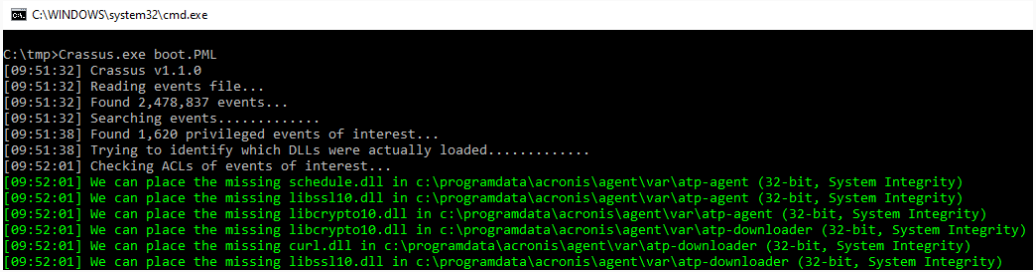


- Officially **signed** vulnerable drivers
- List of vulnerable drivers: `https://www.loldrivers.io`
- List currently installed drivers:

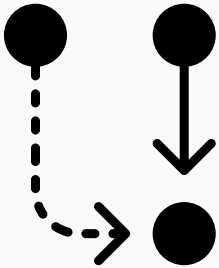
```
PS C:\Users\User> driverquery.exe /fo table /si
Module Name  Display Name           Driver Type   Link Date
============ ====================== ============ ======================
1394ohci     1394 OHCI Compliant Ho Kernel       12/10/2006 4:44:38 PM
3ware        3ware                  Kernel       5/18/2015 6:28:03 PM
ACPI         Microsoft ACPI Driver  Kernel       12/9/1975 6:17:08 AM
AcpiDev      ACPI Devices driver    Kernel       12/7/1993 6:22:19 AM
acpiex       Microsoft ACPIEx Drive Kernel       3/1/2087 8:53:50 AM
acpipagr     ACPI Processor Aggrega Kernel       1/24/2081 8:36:36 AM
<SNIP>
```



- If DLLs are missing or writeable, we can execute code
- Automatic enumeration: Crassus.exe (`https://github.com/vu-ls/Crassus`)



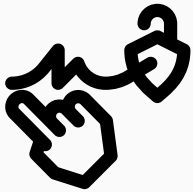

https://github.com/vu-ls/Crassus



- If you have root privileges in WSL, you have Administrator acccess on host
- If you don’t have root privileges –> Unix Privesc ;)

- SeImpersonatePrivilege allows impersonation (but **not** creation) of any token
- SeBackupPrivilege allows read access to entire filesystem
- SeRestorePrivilege allows write access to entire filesystem
- SeLoadDriverPrivilege allows loading drivers
- SeDebugPrivilege allows debugging other processes

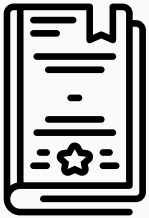
```
PS C:\Users\User> whoami /priv
```



- Custom software centers usually launch installers as admin
- Some installers allow to spawn explorer.exe or iexplorer.exe
- Running these as admin allows us to spawn a cmd.exe

When these 2 registers are enabled, any install (*.msi) runs as NT Authority\System

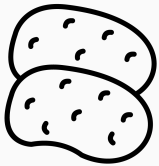
```
reg query HKCU\SOFTWARE\Policies\Microsoft\Windows\Installer /v
  AlwaysInstallElevated
reg query HKLM\SOFTWARE\Policies\Microsoft\Windows\Installer /v
  AlwaysInstallElevated
```



Check versions and look for public exploits

```
PS> Get-CurrentPatchInfo
```

Search identified kernel/software version on:
`https://www.exploit-db.com`



Series of privilege escalation techniques

- Abuses vulnerabilities in Windows authentication, tokens, and named pipes
- If in doubt, use Sweet Potato
- Summary: `https://jlajara.gitlab.io/Potatoes_Windows_Privesc`

# Enumeration

Search the system, look for something standing out

- User files (C:\Users\, %APPDATA%)
- Custom services and executables
- Version enumeration
- Scheduled tasks and services
- Processes running on the system

- WinPeas - Automated enumeration
  - `https://github.com/carlospolop/PEASS-ng`
- PowerUp - Automated enumeration + exploitation (no longer maintained)
- SharpUp - Automated enumeration (updated C# port of PowerUp)
  - `https://github.com/GhostPack/SharpUp`
- Seatbelt - Automated enumeration
  - `https://github.com/GhostPack/Seatbelt`
- LolBas - Helpful binaries, scripts and libraries
  - `https://lolbas-project.github.io`

- Checklists and information
  - `https://book.hacktricks.xyz/windows-hardening/windows-local-privilege-escalation`
  - `https://swisskyrepo.github.io/InternalAllTheThings/redteam/escalation/windows-privilege-escalation`

# Case Study

Showing WinPeas.log with a multitude of vulnerabilities.

PLAB{w1np3as_g0_brrr}

# Try it yourself

URL: `https://tryhackme.com/room/windows10privesc`

# Any Questions?