Windows Environments

Thomas & Chris

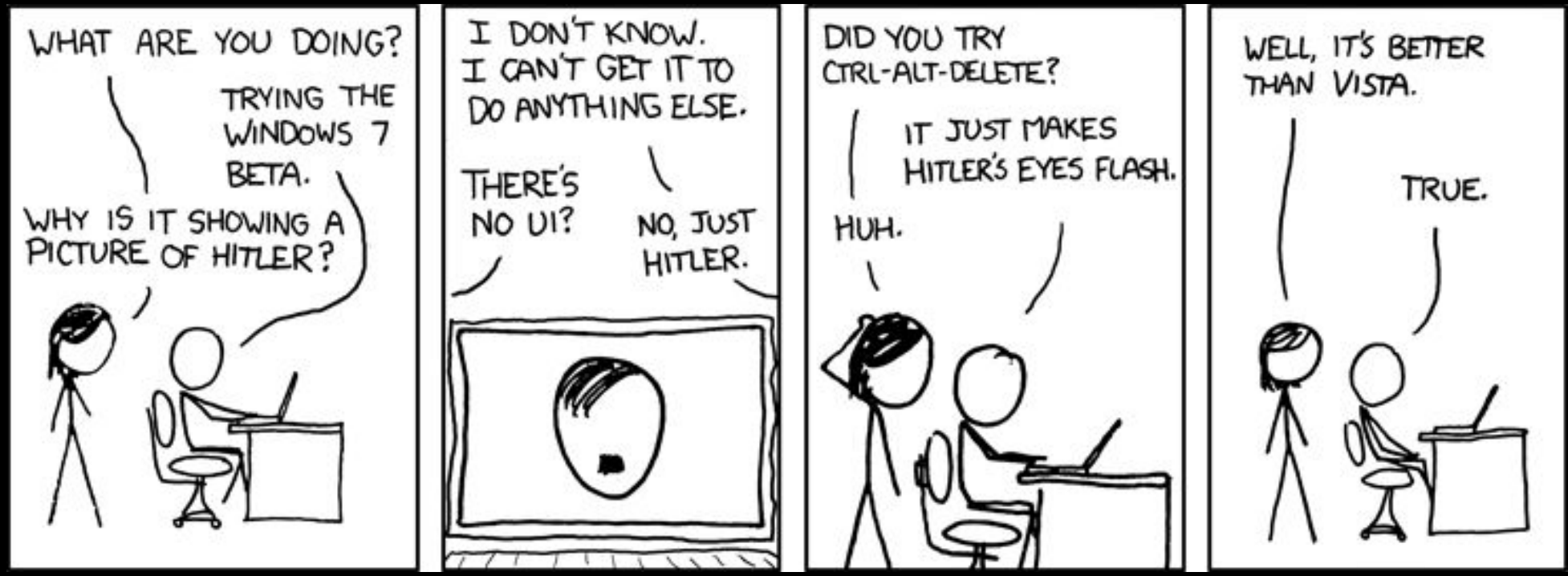
Announcements

- TracerFIRE, next weekend!

- Spray Paint Social: First week of April

- Cyphercon! (Late April, Tickets on sale now I think…)
  - We will get sponsorship money

sigpwny{ctrl_alt_delete}



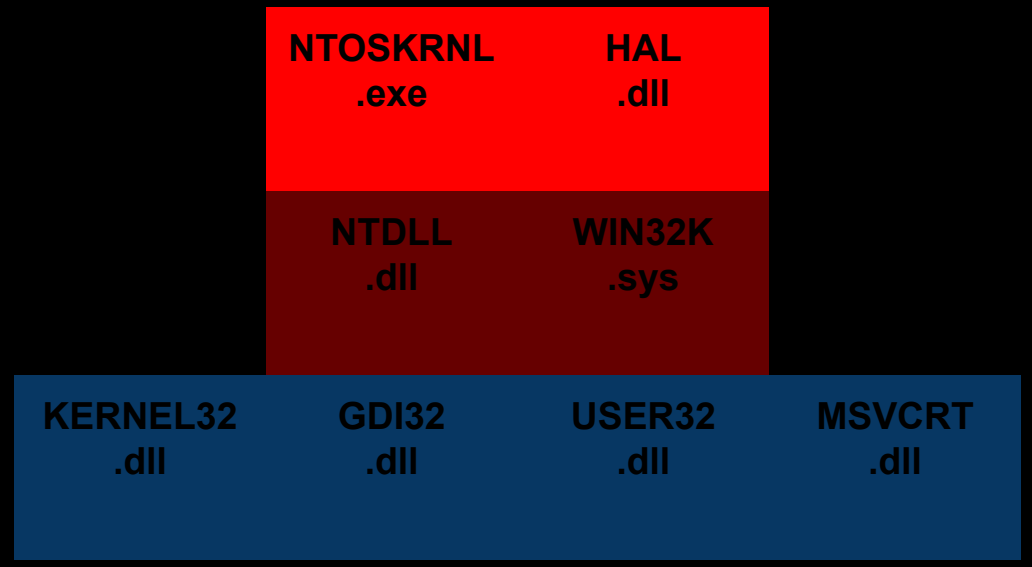
Core OS Basics

System Architecture

- NTOSKRNL - Core kernel
- HAL - Hardware abstraction layer

- NTDLL - Syscalls and runtime library
- WIN32K - Graphics & UI

- kernel32 - System API
- gdi32 - Drawing API
- user32 - UI API
- MSVCRT - C API (stdlib)



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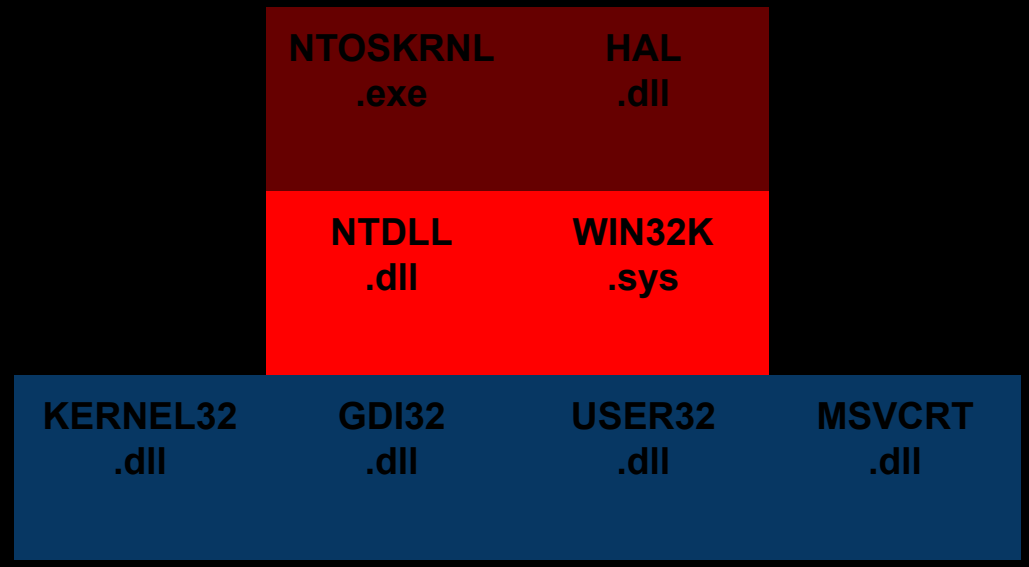

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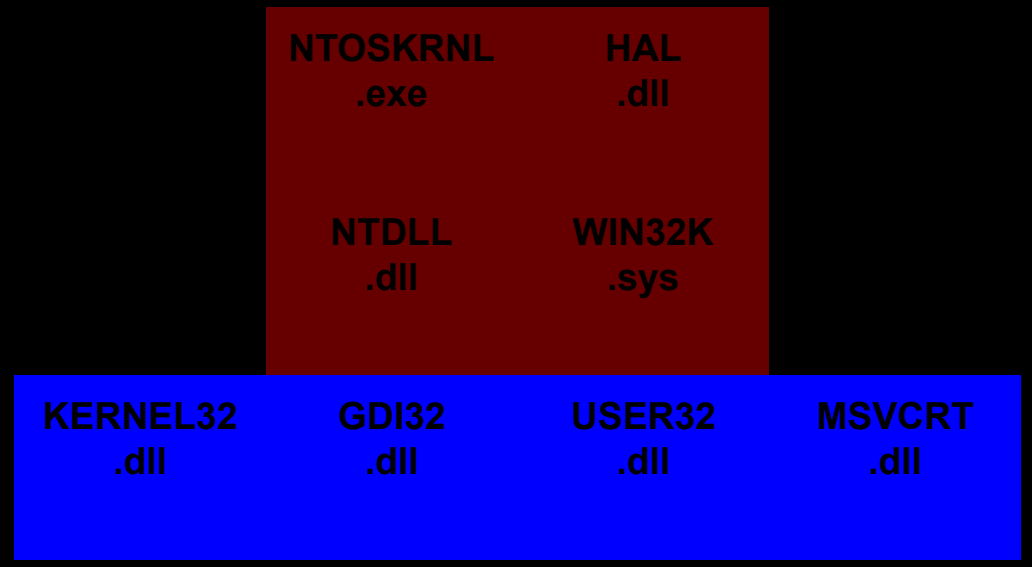


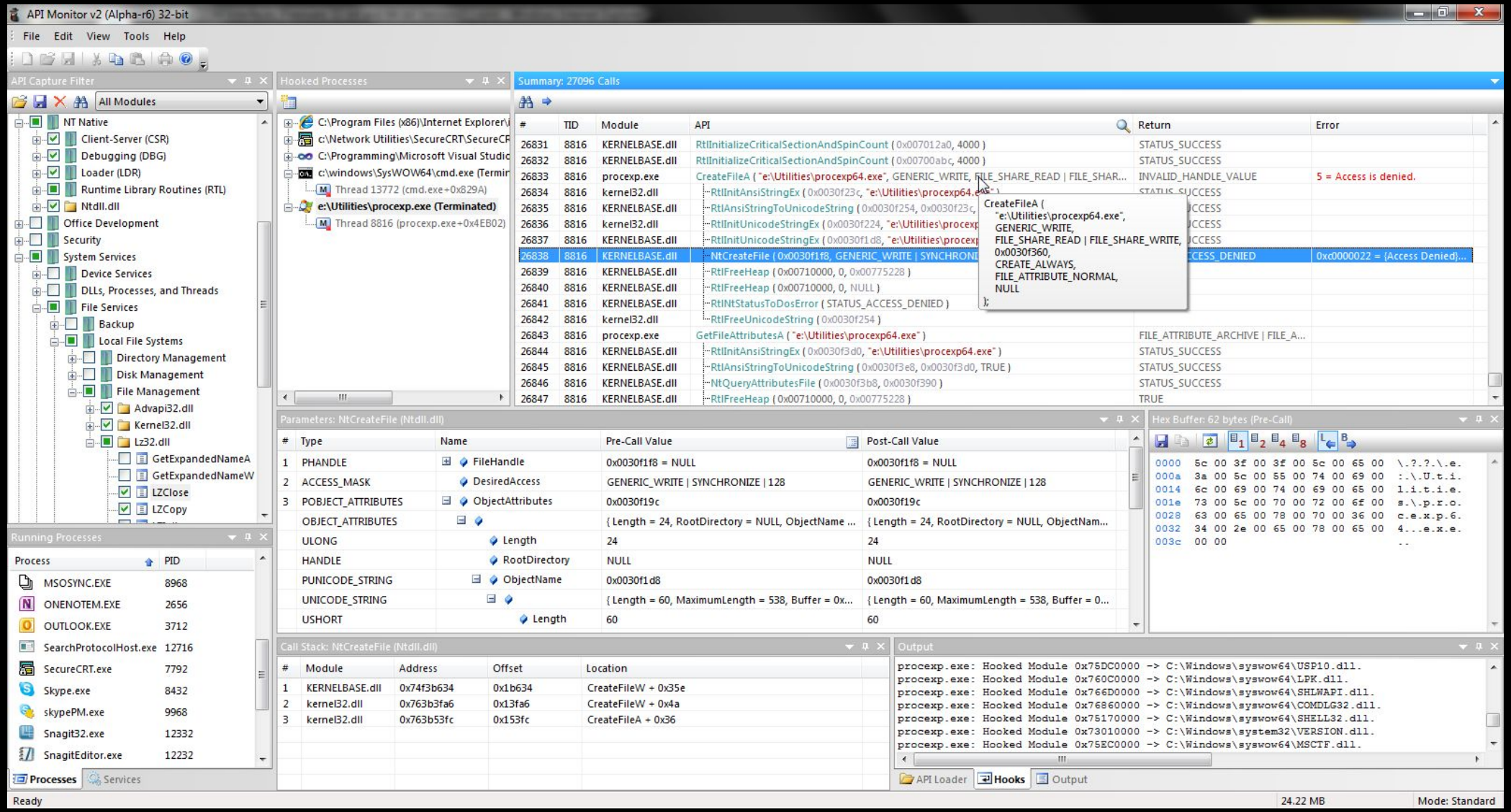
WINAPI

Core way that any program interacts with Windows

Includes interfaces for files, devices, windows, threads, etc.

Monitoring a program's WINAPI calls is extremely powerful!

Here's A Cool Tool To Do It


API Monitor v2 (Alpha-r6) 32-bit
File Edit View Tools Help
API Capture Filter
All Modules
NT Native
Client-Server (CSR)
Debugging (DBG)
Loader (LDR)
Runtime Library Routines (RTL)
Ntdll.dll
Office Development
Security
System Services
Device Services
DLLs, Processes, and Threads
File Services
Backup
Local File Systems
Directory Management
Disk Management
File Management
Advapi32.dll
Kernel32.dll
Lz32.dll
GetExpandedNameA
GetExpandedNameW
LZClose
LZCopy
Hooked Processes
C:\Program Files (x86)\Internet Explorer\
c:\Network Utilities\SecureCRT\SecureCR
C:\Programming\Microsoft Visual Studio
c:\windows\SysWOW64\cmd.exe (Termin
Thread 13772 (cmd.exe+0x829A)
e:\Utilities\procexp.exe (Terminated)
Thread 8816 (procexp.exe+0x4EB02)
Summary: 27096 Calls
TID Module API Return Error
26831 8816 KERNELBASE.dll RtlInitializeCriticalSectionAndSpinCount (0x007012a0, 4000) STATUS_SUCCESS
26832 8816 KERNELBASE.dll RtlInitializeCriticalSectionAndSpinCount (0x00700abc, 4000) STATUS_SUCCESS
26833 8816 procexp.exe CreateFileA ("e:\Utilities\procexp64.exe", GENERIC_WRITE, FILE_SHARE_READ | FILE_SHAR... INVALID_HANDLE_VALUE 5 = Access is denied.
26834 8816 kernel32.dll RtlInitAnsiStringEx (0x0030f23c, "e:\Utilities\procexp64.exe")
26835 8816 KERNELBASE.dll RtlAnsiStringToUnicodeString (0x0030f254, 0x0030f23c,
26836 8816 kernel32.dll RtlInitUnicodeStringEx (0x0030f224, "e:\Utilities\procexp
26837 8816 KERNELBASE.dll RtlInitUnicodeStringEx (0x0030f1d8, "e:\Utilities\procexp
26838 8816 KERNELBASE.dll NtCreateFile (0x0030f1f8, GENERIC_WRITE | SYNCHRONI... CESS_DENIED 0xc0000022 = {Access Denied}...
26839 8816 KERNELBASE.dll RtlFreeHeap (0x00710000, 0, 0x00775228)
26840 8816 KERNELBASE.dll RtlFreeHeap (0x00710000, 0, NULL)
26841 8816 KERNELBASE.dll RtlNtStatusToDosError (STATUS_ACCESS_DENIED)
26842 8816 kernel32.dll RtlFreeUnicodeString (0x0030f254)
26843 8816 procexp.exe GetFileAttributesA ("e:\Utilities\procexp64.exe") FILE_ATTRIBUTE_ARCHIVE | FILE_A...
26844 8816 KERNELBASE.dll RtlInitAnsiStringEx (0x0030f3d0, "e:\Utilities\procexp64.exe") STATUS_SUCCESS
26845 8816 KERNELBASE.dll RtlAnsiStringToUnicodeString (0x0030f3e8, 0x0030f3d0, TRUE) STATUS_SUCCESS
26846 8816 KERNELBASE.dll NtQueryAttributesFile (0x0030f3b8, 0x0030f390) STATUS_SUCCESS
26847 8816 KERNELBASE.dll RtlFreeHeap (0x00710000, 0, 0x00775228) TRUE
CreateFileA (
"e:\Utilities\procexp64.exe",
GENERIC_WRITE,
FILE_SHARE_READ | FILE_SHARE_WRITE,
0x0030f360,
CREATE_ALWAYS,
FILE_ATTRIBUTE_NORMAL,
NULL
);
Parameters: NtCreateFile (Ntdll.dll)
Type Name Pre-Call Value Post-Call Value
1 PHANDLE FileHandle 0x0030f1f8 = NULL 0x0030f1f8 = NULL
2 ACCESS_MASK DesiredAccess GENERIC_WRITE | SYNCHRONIZE | 128 GENERIC_WRITE | SYNCHRONIZE | 128
3 POBJECT_ATTRIBUTES ObjectAttributes 0x0030f19c 0x0030f19c
OBJECT_ATTRIBUTES { Length = 24, RootDirectory = NULL, ObjectName ... { Length = 24, RootDirectory = NULL, ObjectNam...
ULONG Length 24 24
HANDLE RootDirectory NULL NULL
PUNICODE_STRING ObjectName 0x0030f1d8 0x0030f1d8
UNICODE_STRING { Length = 60, MaximumLength = 538, Buffer = 0x... { Length = 60, MaximumLength = 538, Buffer = 0...
USHORT Length 60 60
Hex Buffer: 62 bytes (Pre-Call)
0000 5c 00 3f 00 3f 00 5c 00 65 00 \.?.?.\.e.
000a 3a 00 5c 00 55 00 74 00 69 00 :.\.U.t.i.
0014 6c 00 69 00 74 00 69 00 65 00 l.i.t.i.e.
001e 73 00 5c 00 70 00 72 00 6f 00 s.\.p.r.o.
0028 63 00 65 00 78 00 70 00 36 00 c.e.x.p.6.
0032 34 00 2e 00 65 00 78 00 65 00 4...e.x.e.
003c 00 00 ..
Running Processes
Process PID
MSOSYNC.EXE 8968
ONENOTEM.EXE 2656
OUTLOOK.EXE 3712
SearchProtocolHost.exe 12716
SecureCRT.exe 7792
Skype.exe 8432
skypePM.exe 9968
Snagit32.exe 12332
SnagitEditor.exe 12232
Processes Services
Call Stack: NtCreateFile (Ntdll.dll)
Module Address Offset Location
1 KERNELBASE.dll 0x74f3b634 0x1b634 CreateFileW + 0x35e
2 kernel32.dll 0x763b3fa6 0x13fa6 CreateFileW + 0x4a
3 kernel32.dll 0x763b53fc 0x153fc CreateFileA + 0x36
Output
procexp.exe: Hooked Module 0x75DC0000 -> C:\Windows\syswow64\USP10.dll.
procexp.exe: Hooked Module 0x760C0000 -> C:\Windows\syswow64\LPK.dll.
procexp.exe: Hooked Module 0x766D0000 -> C:\Windows\syswow64\SHLWAPI.dll.
procexp.exe: Hooked Module 0x76860000 -> C:\Windows\syswow64\COMDLG32.dll.
procexp.exe: Hooked Module 0x75170000 -> C:\Windows\syswow64\SHELL32.dll.
procexp.exe: Hooked Module 0x73010000 -> C:\Windows\system32\VERSION.dll.
procexp.exe: Hooked Module 0x75EC0000 -> C:\Windows\syswow64\MSCTF.dll.
API Loader Hooks Output
Ready
24.22 MB
Mode: Standard

Handles & Data Types

- Windows has weird names for types
- Uses Hungarian notation
  - Variable prefixed with abbreviation of its data type
  - ex. LPVOID = long pointer void = void*

- Kernel maintains a list of objects it is responsible for
  - Each is given unique address in this global list called a HANDLE
  - HINSTANCE - Handle to a process
  - HMODULE - Handle to a module (DLL)

Dynamic Link Libraries (DLLs)

Code fragments to be compiled into a standalone library

Linked statically & dynamically against multiple programs

Dynamically loading DLLs common practice in malware & game hacking 👀

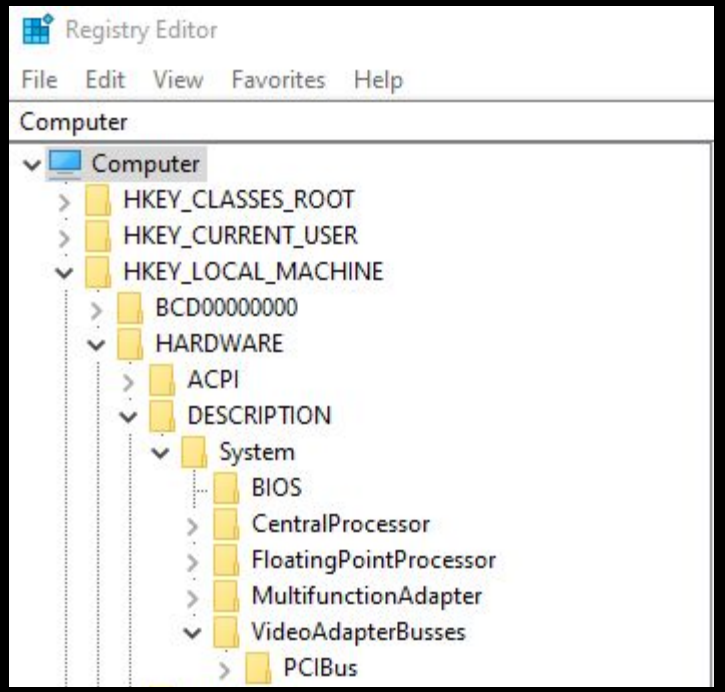
```
BOOL APIENTRY DllMain( HMODULE hModule,
DWORD  ul_reason_for_call, LPVOID lpReserved) {
  switch (ul_reason_for_call)
  {
  case DLL_PROCESS_ATTACH:
  case DLL_THREAD_ATTACH:
  case DLL_THREAD_DETACH:
  case DLL_PROCESS_DETACH:
    break;
  }
  return TRUE;
}
```

Registry

Hierarchical central database

Stores keys in tree format

Keys can be saved and queried with WINAPI



Enterprise Windows

(We will run longer mtg on this, here are basics)

There are no chals for this, start on chals if you want

Domains

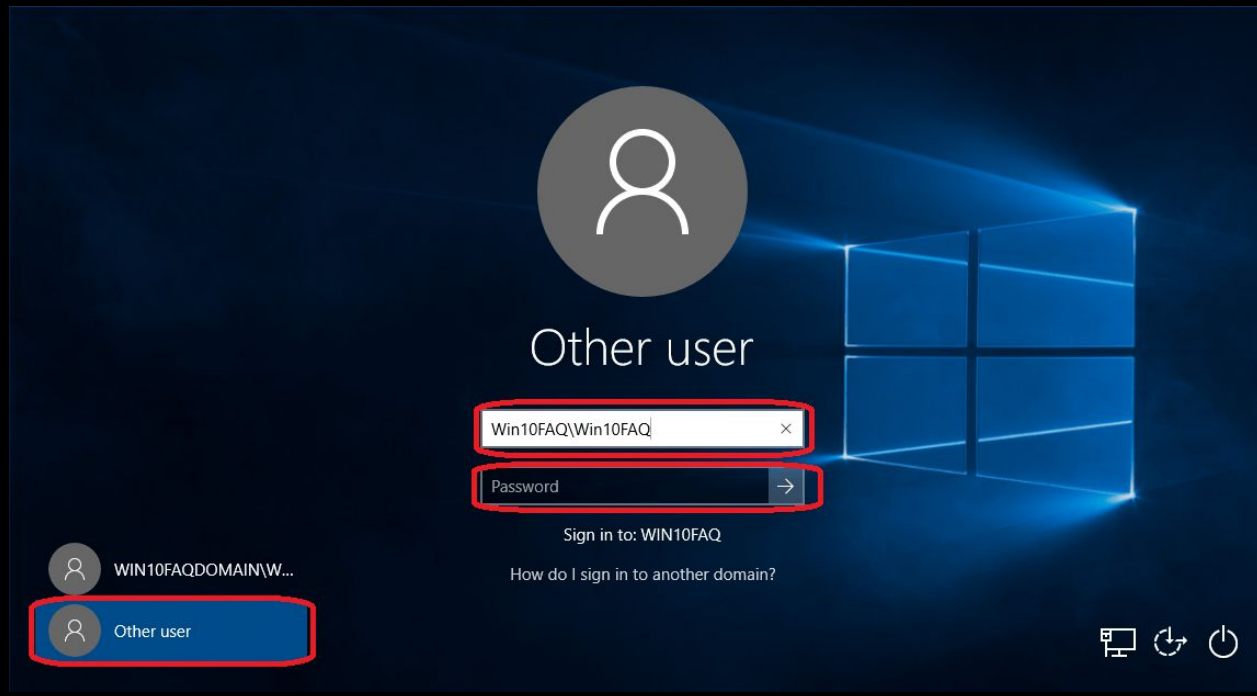
Domains are a network of **user accounts**, computers, devices (printers), and other **security protocols.**

- Users are often of the form *user@domain.tld* (or domain\user) (tquig2@illinois.edu, illinois.edu\tquig2)

Users have different levels of access split into **Groups**

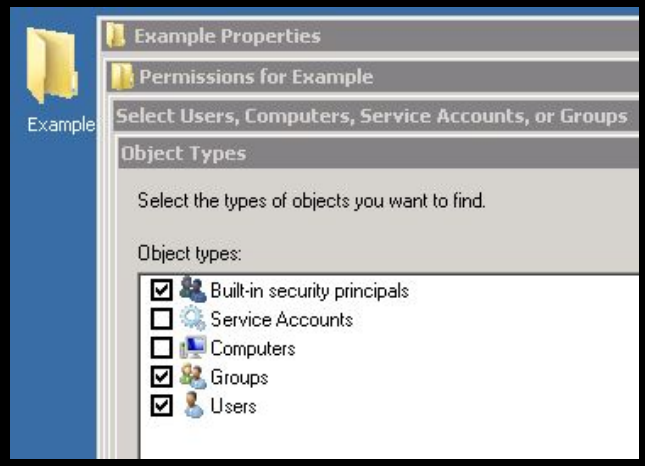
- Domain Admins

Controlled by a **domain controller**

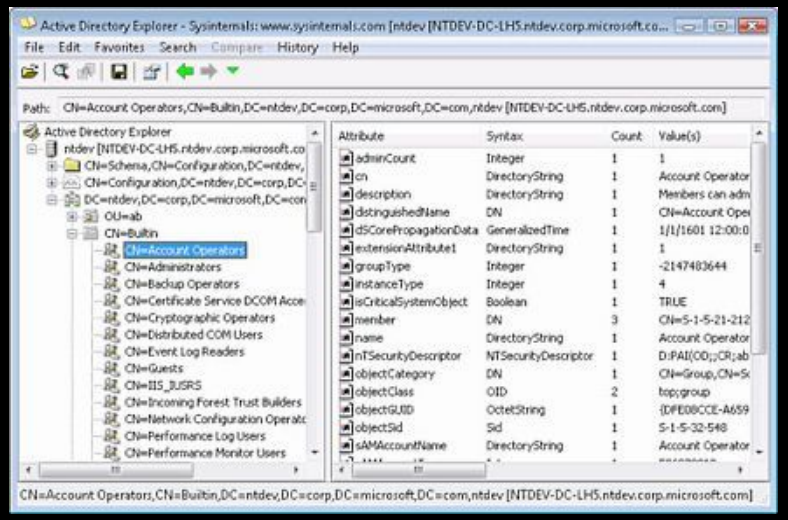


Active Directory

We could teach a semester long class on Active Directory



Active Directory (AD) is the underlying framework that allows identity on Windows Domains to exist.

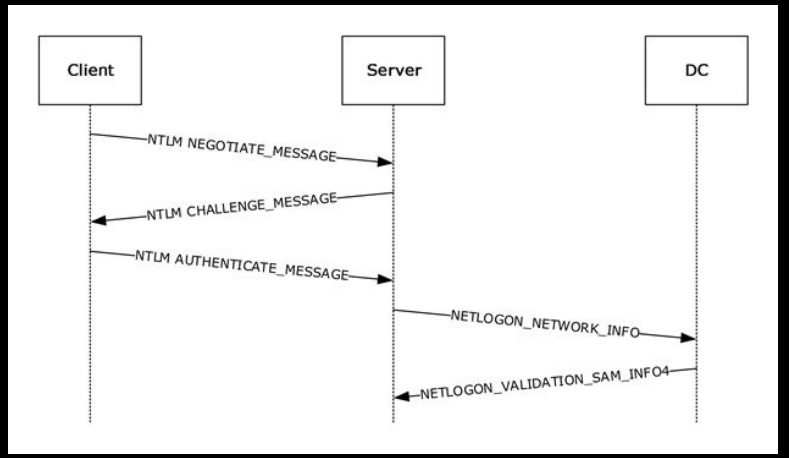


Most often run off of **Windows Server** (usually an outdated version)

Authentication Methods

NTLM

- Windows New Technology LAN Manager
- Challenge / Response method
- Allows for security Selection
- NTLMv1 is vulnerable, NTLMv2 is a bit better



Kerberos

- Strong ticket-based authentication method
- Vulnerable to “Kerberoasting”

Next Meetings

Sunday Seminar: Crypto Math w Nebu

- Explain the underlying math of crypto (RSA, AES, earlier crypto)
- Stop Crypto Paralysis!

Next Thursday: (??? Pentesting Fundamentals ???)

- We aren’t sure yet what it will be
- Problably pentesting fundamentals
- might be something else :)