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COMPREHENSIVE COMPUTER SECURITY SERVICES

Easy and quick vulnerability hunting in Windows

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Who am I?

- CTO at IOActive Labs
  - Leading efforts to produce cutting edge research
- I have been working on security for +9 years
- I have found and helped to fix hundreds of vulnerabilities in software such as MS Windows, MS SQL Server, Oracle Database Server, IBM DB2, and more...
- +50 vulnerabilities found on MS products (+20 on Windows operating systems)
- I have researched and created novel attacks and exploitation techniques

Introduction

- With every application you install you are weakening your system security
- Sometimes you need to audit Windows applications
  - –Before installing them in hardened servers or in hundreds of desktops.
  - –For fun, etc.
- A quick and easy security audit can help to find out vulnerabilities
  - –Maybe you can convince your boss of not installing the application or to assume the risks.
  - –Make some $$$ by selling it, etc.

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Introduction

- Finding some kind of vulnerabilities is not difficult, you just need to know how and where to look for
  - –Hopefully today you will learn some how and where

The tools

- Sysinternals tools
  - –Process explorer, Process monitor
  - –TCPview, accesschk, WinObj, etc.
- Windows debugger
  - –WinDbg
- Windows tools
  - –Registry editor, Windows explorer, Component services, WMI Control, netstat , cacls, etc.
- Other
  - –Wireshark, DeviceTree, etc.

The process

- Always observe and ask yourself What, How, When and Why, be always curious
  - –What is that? What does that?
  - –How it does that?
  - –When it does that?
  - –Why it does that?
- Knowledge will get you free and also help you to find vulnerabilities

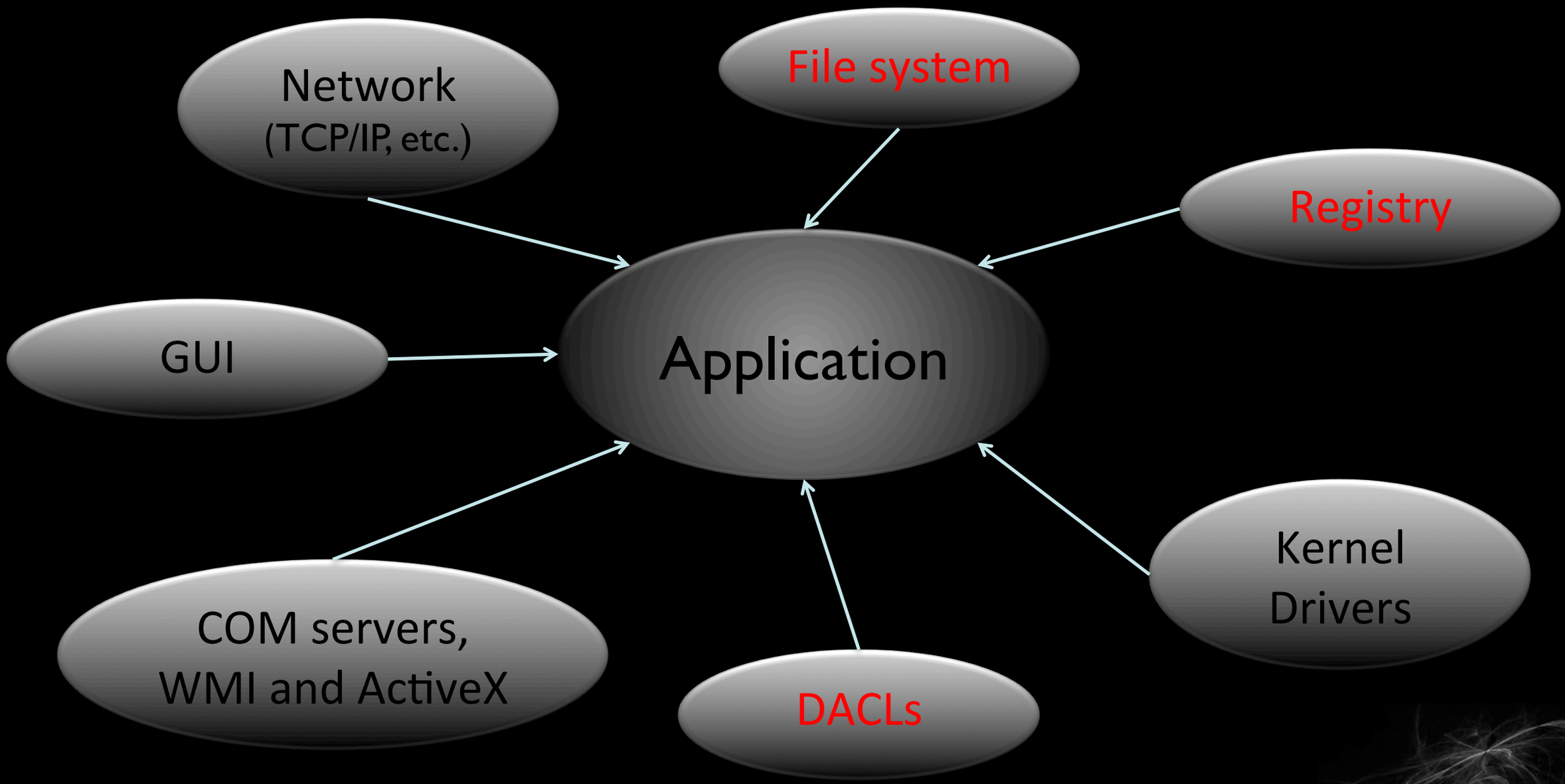
Targets

- Privileged applications
  - –Windows Services
    - Services processes run under privileged accounts
  - –Some non services processes run with higher privileges than regular ones
    - WMI processes
    - Windows Installer processes
    - Windows task processes
    - COM Servers, etc.
  - –Device drivers
  - –Vulnerabilities could allow to elevate privileges

Targets

- Regular applications
  - –ActiveX components
    - Can be accessed remotely by web sites from Internet or Intranet
    - Vulnerabilities could allow to execute code o perform dangerous actions
  - –Can save sensitive information on files or registry
  - –On Windows >= Vista there is privilege elevation by running with different Integrity Levels

Attack surface



Attack surface: GUI

- Unless the application is an interactive service (which is not common nowadays) there isn't much to look for here.
  - If it's an interactive service, GUI is protected on Windows >=Vista with new protection against shatter attacks
- If it's a web app then is just web app security related and not covered here
- So, we won't focus on the GUI

Attack surface: GUI

- Ask yourself
  - –Is an interactive service?
    - Can I manipulate the input in some way?

Attack surface: File System

- Applications save and read data from files
- Applications load binaries (.exe, .dll) read from files that are stored on folders
  - –Dll loading search order weaknesses
- Files and folders have DACL
  - –If DACL is weak then low privileged users can read, modify, delete, create, etc. files and folders.
    - This could allow elevation of privileges.
      - Reading a password (cleartext or hashed)
      - Modifying/creating a binary, configuration file, etc.

Attack surface: File System

- Ask yourself
  - –Have any application file or folder weak permissions?
    - Is the file used to save configuration data?
      - Does configuration data include security options?
    - Is the file used to save sensitive information?
    - Are Dlls or other binaries loaded from that folder?
  - –Does the application fail to load Dlls from regular folders?
    - There is any folder with weak permission in Path environment variable?

Attack surface: File System

- Accesschk.exe users c:\windows –wsu
  - –Searches for file and folder write permissions on all files and folder under c:\windows for users group.
- ProcMon can monitor for file writing, reading and Dll loading, etc.
- Windows Explorer allows to view files and folders, also to view and modify DACLs.
- Demo
  - –A couple of Windows 0days, one for NSA only and the other one for lazy people that doesn't patch often

Attack surface: Registry

- Applications save and read data from registry
- Registry keys have DACL
  - If DACL is weak then low privileged users can read, modify, delete, create, etc. values and keys.
    - This could allow elevation of privileges
      - » Changing a folder path or file name
      - » Changing some value that alters application execution
      - » Reading a password (cleartext or hashed)
      - » Etc.

Attack surface: Registry

- Ask yourself
  - –Have an application registry key weak permissions?
    - Is the key used to save configuration data?
      - Does configuration data include security options?
    - Is the key used to save sensitive information?
    - Is the key used to save files or folder paths?
      - Are those paths used by the application to access files and folders?

Attack surface: Registry

- Accesschk.exe users hklm –kwsu
  - –Searches for registry key write permissions on keys under HKEY LOCAL MACHINE for users group.
- ProcMon can monitor for registry writing, reading, modification, etc.
- Registry Editor allows to view and modify registry key and values, also to view and set DACLs
- Demo

Attack surface: DACLs

- Processes, Threads, Files, File Mappings, Pipes, Inter process synchronization objects, etc. are Kernel objects
  - –If they are securable they have a security descriptor then a DACL
  - –Named Kernel objects can be accesses from other processes
    - Some unnamed such as processes and threads can be accessed too

Attack surface: DACLs

- Windows services are securable objects
  - –Weak DACL means that low privileged users can change services permissions and elevate privileges

Attack surface: DACLs

- Ask yourself
  - –Can the Kernel object be accessed by other processes?
    - Has it a NULL DACL?
    - Has it a weak DACL?
  - –What kind of Kernel object is?
    - What are the known attack vectors for processes, threads, file mappings, pipes, etc.?
  - –Can a low privileged user change the service DACL or configuration?
  - –Demo

Attack surface: COM Servers, WMI and ActiveX

- Applications can install COM Servers, WMI providers and ActiveX controls
  - –COM Servers and WMI providers can run under high privileged accounts
    - New Windows versions enforce a strong ACL on COM Servers
      - Applications can modify ACL but with limits
    - If dangerous functionality is exposed to low privileged users it could be abused (most servers will impersonate the caller)
  - –ActiveX could be remotely accessed by web sites
    - This could allow abuse of functionality or exploitation of known or unknown vulnerabilities

Attack surface: COM Servers, WMI and ActiveX

- Ask yourself
  - –Are there COM Servers or WMI providers with weak DACLs?
    - Do they provide dangerous functionality?
  - –Does the COM Server or WMI provider run under a high privileged account and allow low privileged accounts to access them?
    - Can the functionality be abused in some way?
  - –Are there ActiveX components with non secure settings?
    - Have these ActiveX vulnerabilities or expose dangerous functionality?

Attack surface: COM Servers, WMI and ActiveX

- Component services tool displays COM Servers permissions and WMI Control tool displays WMI ones
- ActiveX safe for scripting and safe for initialization
  - Subkeys ***{7DD95801-9882-11CF-9FA9-00AA006C42C4}*** and ***{7DD95802-9882-11CF-9FA9-00AA006C42C4}*** under key ***HKCR\CLSID\{ActiveXGUID}\Implemented Categories***
  - Kill bit set if value named ***Compatibility Flags*** = 0x00000400 on ***HKLM\SOFTWARE\Microsoft\Internet Explorer\ActiveX Compatibility\ActiveXGUID***

Attack surface: COM Servers, WMI and ActiveX

- To detect COM objects (Servers, WMI and ActiveX) installed by an application monitor (ProcMon tool) key HKLM\SOFTWARE\Classes\CLSID
  - WMI providers are also listed on key HKLM\SOFTWARE\Microsoft\WBEM\CIMOM\SecuredHostProviders
- Demo

Attack surface: Network

- Services can be accessed locally or from the network, using TCP/IP or other protocols
  - –We need to identify what ports the application is listening on
    - netstat –anob
    - TCPView
- Services can make outbound connections
  - –netstat –anob
  - –TCPView
  - –Wireshark

Attack surface: Network

- Ask yourself
  - –Does the application listen in some ports ?
    - What ports?
    - Does it accept remote and/or local connections?
    - What protocols are used?
  - –Does the application make outbound connections?
    - What protocols are used?
    - Does it update itself?
      - Update is done in a secure way?

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Attack surface: Network

- Fuzz protocols on open ports
  - –Time consuming unless you do simple fuzzing
    - Simple fuzzing could be just changing bytes incrementally
      - Just capture a network packet and build a simple tool to change bytes in the packet and send it while target application is attached to a debugger
      - Could easily find some DOS if application is buggy
- Demo

Attack surface: Kernel drivers

- Some applications install device drivers
  - –Weak DACLs could allow abuse of functionality and elevation of privileges
    - WinObj and accessenum tools can be used to see DACLs
      - Accesschk.exe -wuo everyone \device
  - –They can have vulnerabilities allowing elevation of privileges
  - –Need to RE and debug to find out functionality and audit it
    - DeviceTree displays a lot of information about device drivers

Attack surface: Kernel drivers

- Ask yourself
  - –Does the application install device drivers?
    - Do they have a proper DACL?
    - What functionality do they provide?
      - Can the functionality be abused/exploited in some way?
- Demo

Conclusions

- Finding vulnerabilities is not difficult if you know how and where to look for.
- Be always aware and ask yourself What, How, When and Why

Fin

- Questions?
- Thanks

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