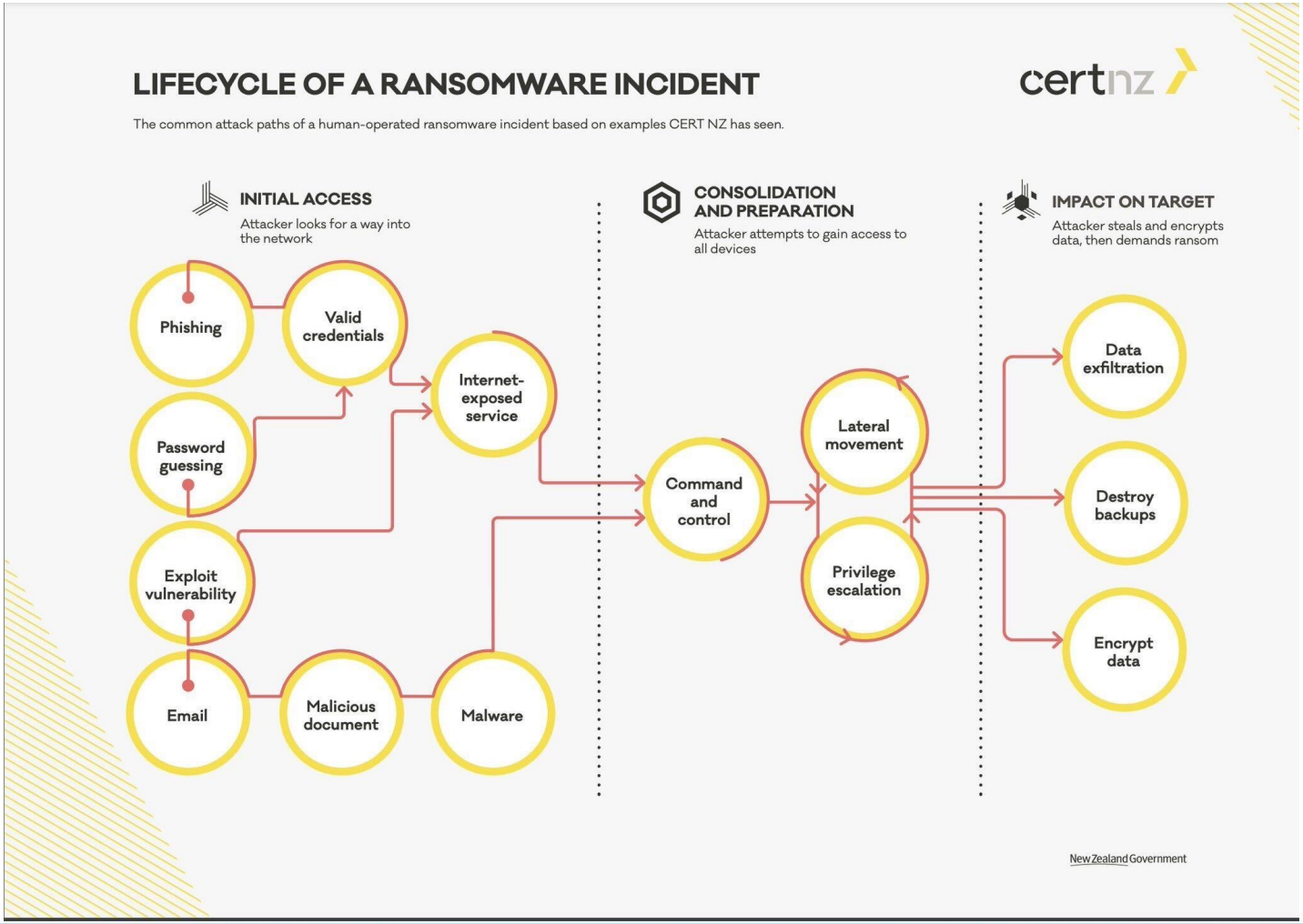
Windows Forensics Introduction

Typical Attack Path



The Windows Operating System

- Currently the most common for caseload, with OSX / MacOS becoming more and more frequent.
- Big, complex behemoth of an OS.
- Does a lot of things under the hood.
- Does a lot for compatibility and “experience”.

Windows Forensics Core

- Most time spent in Windows forensics understanding live artifacts if possible (running processes, network connections, etc.).
- If volatile data is not available – spending a lot of time digging into the operating system itself (typically in the registry) and available logs.

Executing Code on Windows

- Sounds straightforward. Isn't.
- Portable executables (.exe), DLLs (.dll)
- Execute directly on the command line or through other binaries.
- Common paths to run malware as a .dll / library to decrease detection rates.
- Executable scripting languages (Jscript, VBScript, Powershell).
- Other stuff (HTA files, SCR files, etc.).
- Powershell.

Credentials on Windows

- NTLM and Kerberos are primary mechanisms.
- SSO Single Sign On credentials are cached by authentication providers on the system.
- Leads to pass-the-hash/credential attacks.
- Stored locally in the SAM Security Account Manager file
  - HKLM\SAM
  - HKLM\SYSTEM

Windows Persistence

- Many ways to perform this but the most frequent areas are referred to as “autoruns”.
- Windows registry is the most common place to find autoruns:
  - HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Run
  - HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\RunOnce
  - HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Run
  - HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\RunOnce
- Installing / modifying a Windows Service is also a popular persistence mechanism.

Process / Command-line Logging

- Windows doesn't have default process or command-line logging.
- Command-line logging may be configured locally
  - AKA Event 4688
  - AKA "Command line process auditing"
- Most often configured in:
  - Endpoint Detection and Response (EDR) tools
  - Microsoft's SYSMON

Powershell Logging

- Since Windows 7 – primarily Powershell v5
- Default logging (mostly) disabled, however, logging for anything that the Antimalware Scan Interface (AMSI) determines to be “suspicious”.
- Events Logged as a 4104 event – level “Warning”
- Better logging in Powershell is configured through a Group Policy Object (GPO)
  - (Administrative Templates -> Windows Components -> Windows PowerShell)
  - Can configure module, script block and transcription logging

Powershell Logging

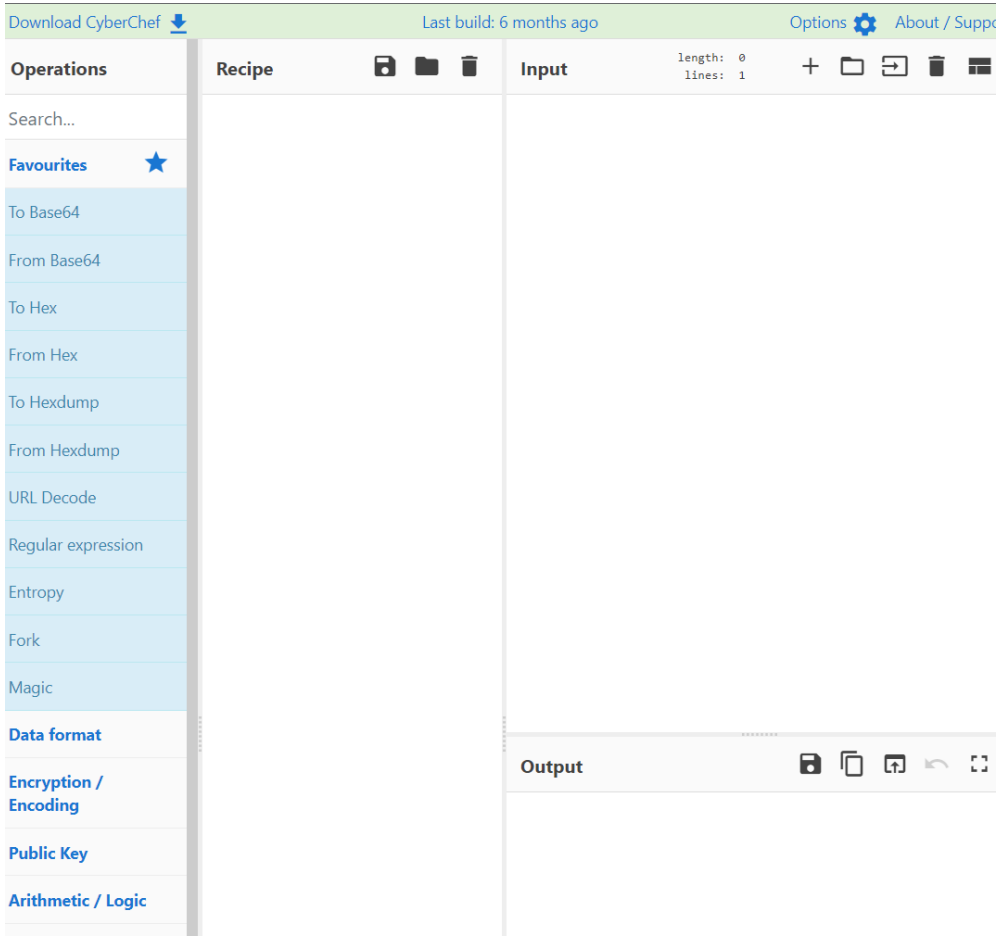
- Module Logging
  - EID 4103
  - Captures portions / snippets
  - Does not reliably capture commands executed
- Script Block Logging
  - EID 4104
  - Show all commands and / or source for any PowerShell run on the system, user, and path to the script
- Transcription Logs
  - Keystroke / over-the-shoulder logging of a PowerShell session

Powershell Logging

- Powershell Tricks…
  - There are actually a lot of methods for obfuscating and executing commands in PowerShell and we see them often in incident response and forensics.
- All of these are the same:
  - Fully spelled out:
    - powershell.exe –EncodedCommand ZQBjAGgAbwAgACIARABvAHIAbwB0AGgAeQAiAA==
  - Truncated with alternate capitalization:
    - powershell.exe –eNco ZQBjAGgAbwAgACIAVwBpAHoAYQByAGQAIgA=
  - Using caret escape-character injection to break-up the string:
    - powershell.exe –^e^C^ ZQBjAGgAbwAgACIAVwBpAHQAYwBoACIA

CyberChef

- At some point we have to discuss CyberChef – we'll start here and then discuss further in network forensics.
- CyberChef:
  - Can host locally or access online - https://gchq.github.io/CyberChef/
  - Data swiss army knife
  - We're going to use for encoded PS> commands



Emotet (malware) sample

- POwersheLL -windowstyle hidden -ENCOD
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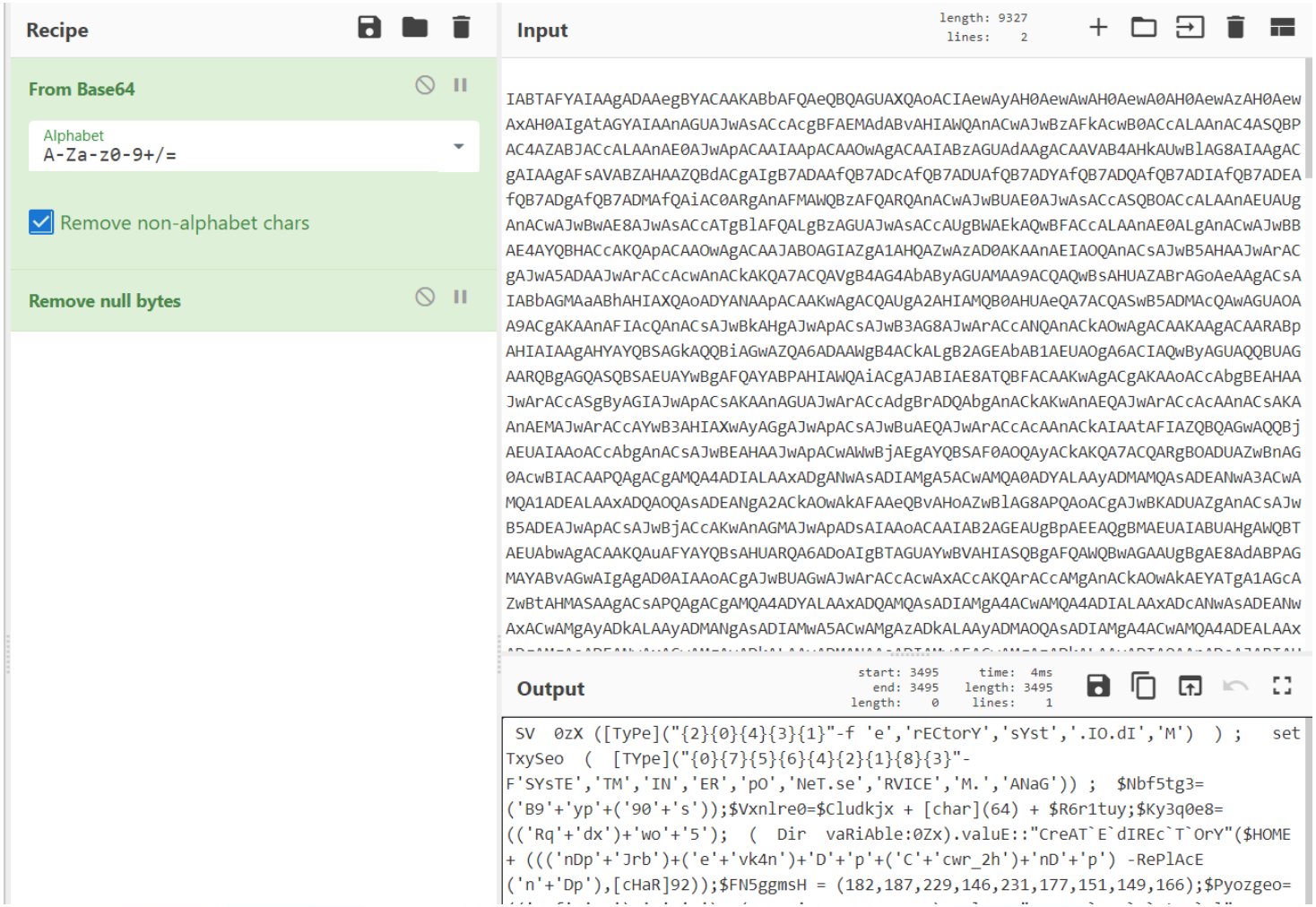
Into the CyberChef!



Windows Registry Forensics

Registry Refresher

- Basically a filesystem into and of itself.
- Hierarchical database that primarily stores information as a key->value pair.
- Core store for compatibility and ease-of-use / preferences features in Windows, also used by installed software.
- Registry can be obtained via disk capture OR memory capture.

Registry Hierarchy

- HKEY_CURRENT_USER (HKCU)
  - Configuration information for currently user (associated with their profile)
- HKEY_USERS (HKU)
  - Local profiles on the system.
- HKEY_LOCAL_MACHINE (HKLM)
  - System-level configuration information
- HKEY_CURRENT_CONFIG
  - Contains information about the hardware profile of the system

Registry Key Forensic Features

- This section will be a review / survey of key locations in registry that store forensically interesting and important information.
- This typically involves when the subject of an investigation takes actions to:
  - Add registry keys (e.g., persistence).
  - Modify registry keys (running an executable)

SHIMCACHE

SHIMCACHE

- Application Compatibility Database
- WinXP+
- \SYSTEM\CurrentControlSet\Control\Session Manager\ AppCompatCache
- Entry for every application executed:
  - Full path information.
  - Last modification time.
  - File size.
  - Execution flag.
- Notes
  - Sequential (typically in order of execution)
  - Has a max # of entries (usually 1,024)

USERASSIST

Windows Explorer UserAssist

- Application Compatibility Database
- WinXP+
  - NTUSER.DAT\Software\Microsoft\Windows\Currentversion\Explorer\UserAssist\{GUID}\Count
  - Tracks GUI executables, shortcuts execution
- Notes
  - All values encoded
  - Uses GUIDs
    - CEBFF5CD – Executable file
    - F4E57C4B – LNK / Shortcut
  - Good for seeing what happened in a user session.

OpenSave MRU

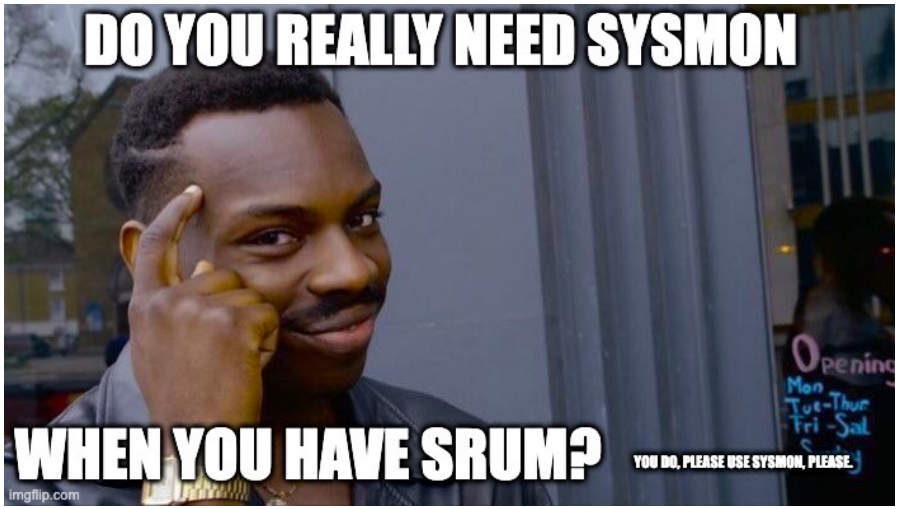
OpenSave – User / Session Feature

- Registry key
- WinXP+
  - NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Explorer\ComDlg32\OpenSavePIDlMRU
  - Tracks files that have been opened / saved through the Windows Explorer shell dialog box
  - Organized into 2 subkeys "*" and the file extension subkeys
- Entry includes:
  - File Name
  - Full Path
  - MRU order (order in which file was opened/saved by user)
- Notes
  - Good for seeing what happened in a GUI user session.
  - Not super helpful for malware investigations.

SRUM

System Resource Usage Monitor (SRUM)

- Records programs and network activity
- Win8+
- Entry includes:
  - Timestamp
  - EXE path
  - SID
  - BytesRecieved / BytesSent
- Notes
  - Writes once and hour and at shutdown.
  - Can grab from disk at C:\Windows\System32\sru\SRUDB.dat



BAM!

Windows Explorer UserAssist

- Background Activity Moderator (BAM)
- Win10 1709+
  - HKLM\SYSTEM\CurrentControlSet\Services\bam\UserSettings\{SID}
- Entry includes:
  - Last execution timestamp
  - EXE path
- Notes
  - Only exists in recent Win10

Recent Office Files

Recent Office Files

- The Office apps trace recently executed / edited files
- Office 2010+
  - NTUSER.DAT\Software\Microsoft\Office\<Version>15
  - NTUSER.DAT\Software\Microsoft\Officce\VERSION\UserMRU\LiveID_####\FileMRU
  - Software\Microsoft\Windows\CurrentVersion\Explorer\RecentDocs\
- Notes
  - Variety of values here
  - For RecentDocs – will need to do some decoding (hex)
  - Organized by file extension