Evoting – Basic installation and hardening

Version 1.8 Date 2025-02-14

Windows image documentation

Prerequisites

To create the image, the technician PC needs the following applications

AnyBurn	https://www.anyburn.com/download.php
Rufus	https://rufus.ie/de/
Windows ADK	https://learn.microsoft.com/en-us/windows-hardware/get-started/adk-install
HP Image Assistant	https://ftp.ext.hp.com/pub/caps-softpaq/cmit/HPIA.html
Lenovo Update Retriever	https://support.lenovo.com/ch/en/solutions/ht037099-download-thinkvantage-technologies-administrator-tools

Create packages

Software

7zip

64-Bit MSI from https://www.7-zip.org/download.html

GMP

This installer is provided by the customer

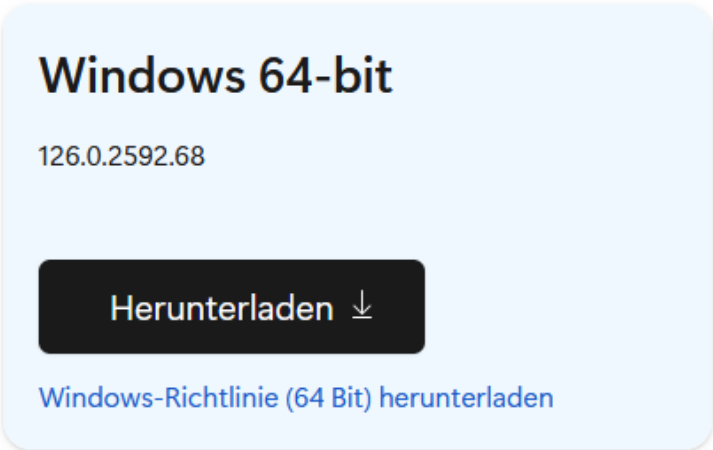
KeePass

Version 2.xx Setup from https://keepass.info/download.html

KeyStore Explorer

On https://keystore-explorer.org/downloads.html download the newest Windows setup (including JRE)

Edge



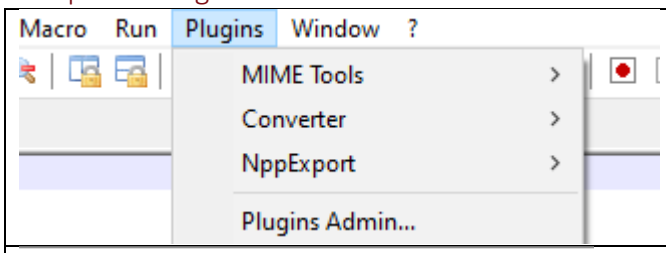
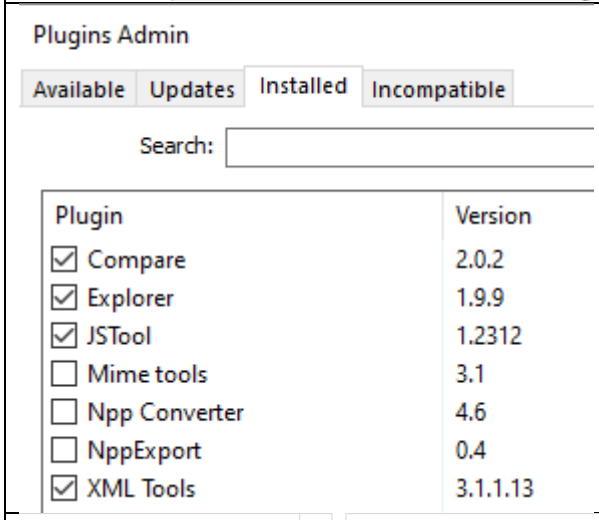
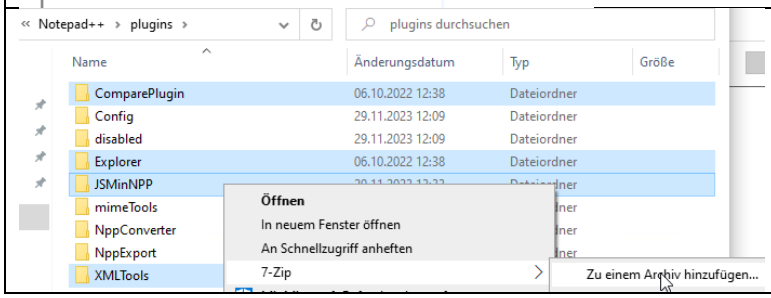
https://www.microsoft.com/de-de/edge/business/download

Download 64-bit package

Notepad++

Newest 64-Bit installer from https://notepad-plus-plus.org/downloads/

Notepad++ Plugins

	On a test computer, install Notepad++ and start Plugins Admin
	Install «Compare», «Explorer», «XML Tools» and «JSTool»
	Then package the four plugins as a self-extracting 7z archive

PowerShell 7

On https://learn.microsoft.com/en-us/powershell/scripting/install/installing-powershell-on-windows?view=powershell-7.4 download the current x64 PowerShell 7.x MSI

OpenSSL

On http://wiki.overbyte.eu/wiki/index.php/ICS_Download#Download_OpenSSL_Binaries_.28required_for_SSL-enabled_components.29 download the latest Win-64 3.x version

SDelete

Download from https://learn.microsoft.com/en-us/sysinternals/downloads/sdelete and extract the 32-Bit and 64-Bit executable

TotalCommander

Download 64-Bit Installer from https://www.ghisler.com/download.htm

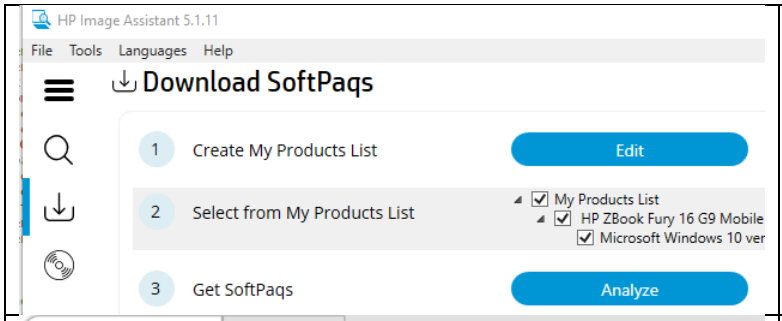
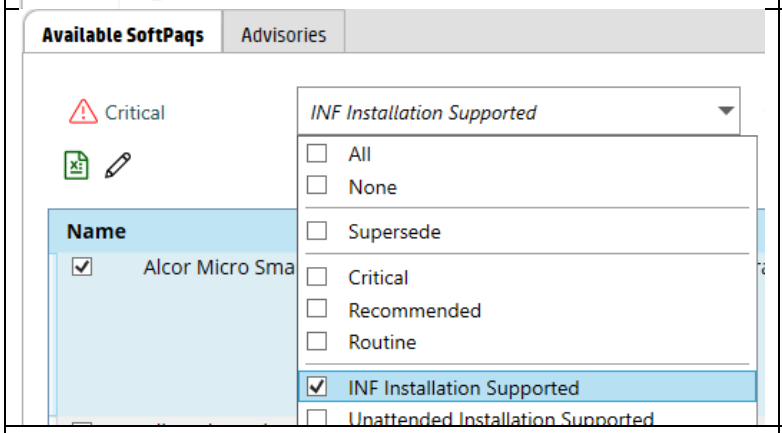
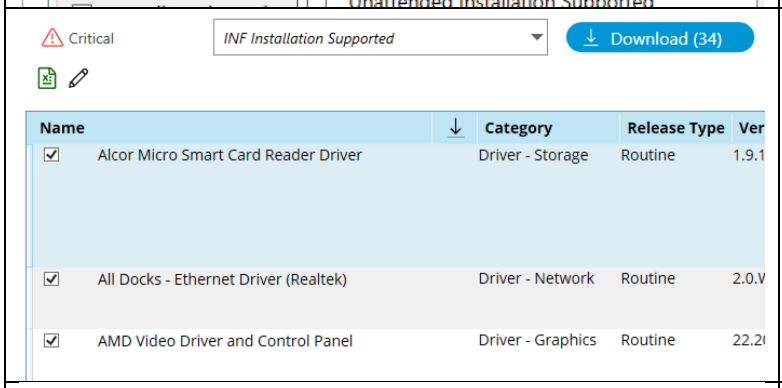
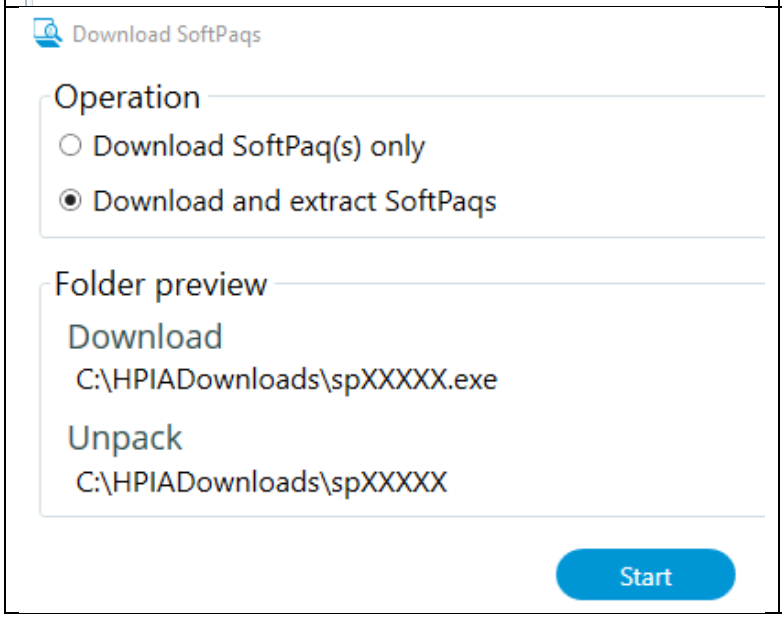
Drivers

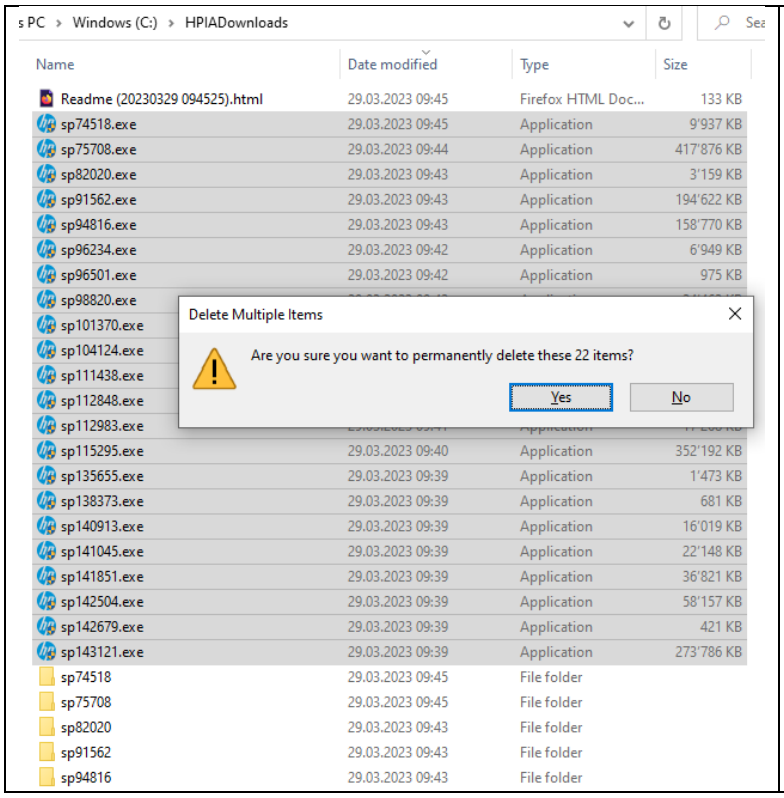
Supported models

The following laptop models have to be supported, and their drivers integrated into the image:

EliteBook 850 G5 (83B2), ThinkPad P52s (20LC), ZBook Fury 16 G9 (89C6), ZBook Fury 16 G10

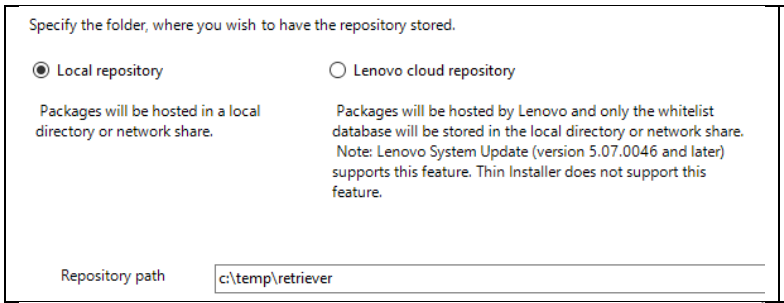
HP

	Start HP Image Assistant, click on the download icon on the left, then choose "Edit Product List", and add the computer model(s) we need drivers for, then click analyse
	Check "Inf Install supported" to filter for only drivers (not application or BIOS)
	Then click "Download"
	Choose "Download and Extract"

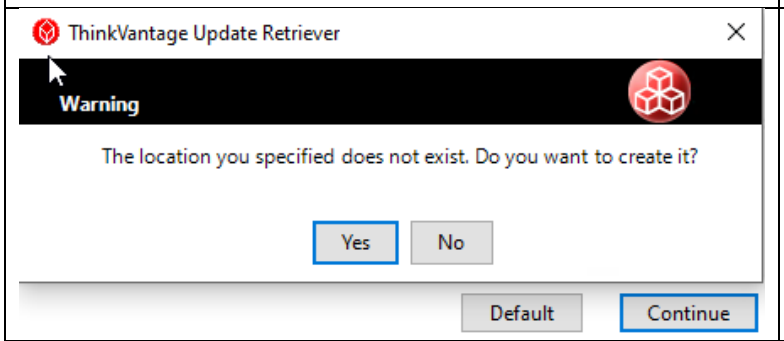


In the download directory, delete the driver packages, but keep the extracted directories and the readme file

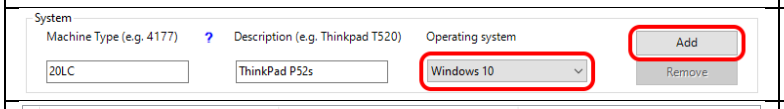
Lenovo



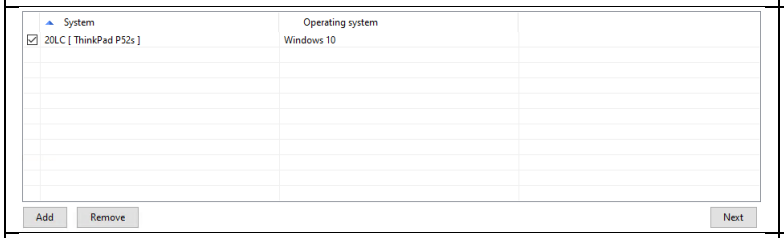
Start Lenovo Update Retriever, and configure the repository location to a local directory



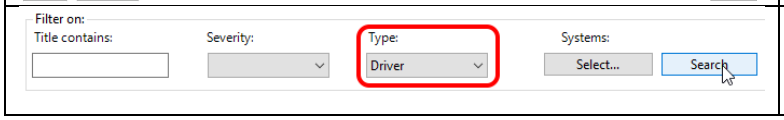
Press “Continue”, then “Yes”



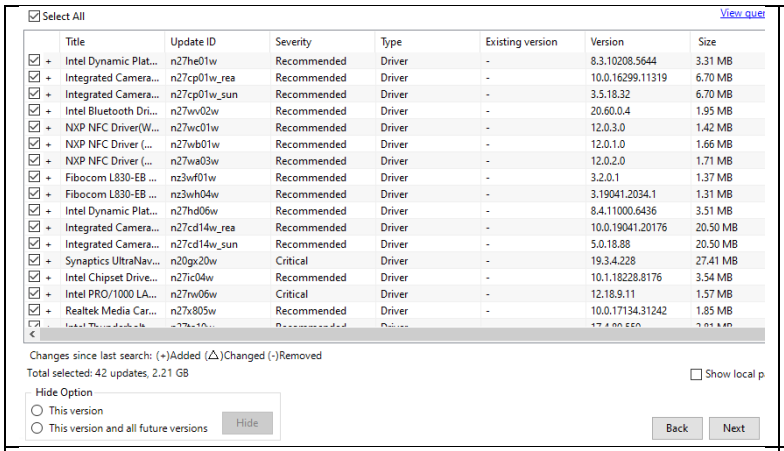
Add the laptop model you want to get drivers for



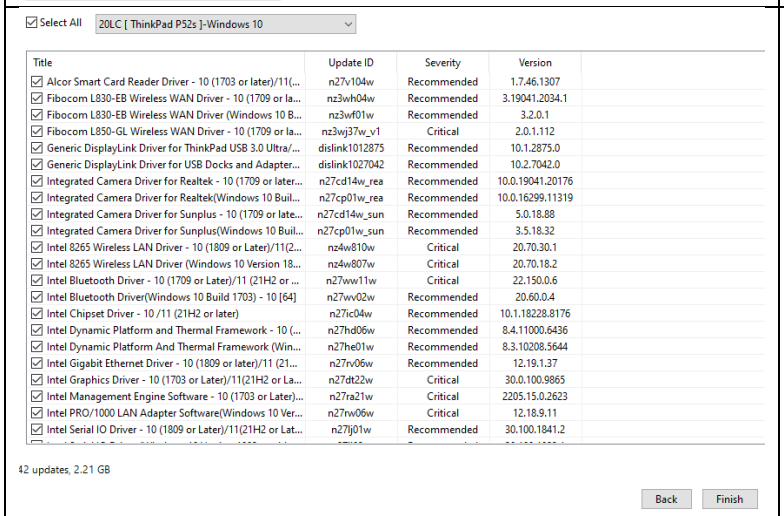
Then select it and press “Next”



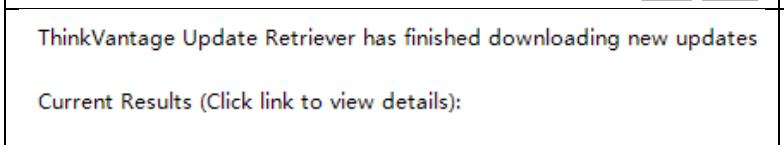
After the search has finished, choose “Type=Driver” and press “Search”



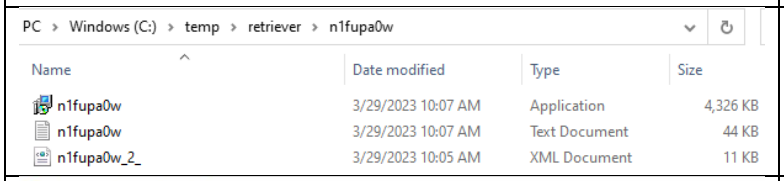
Select all drivers and press “Next”



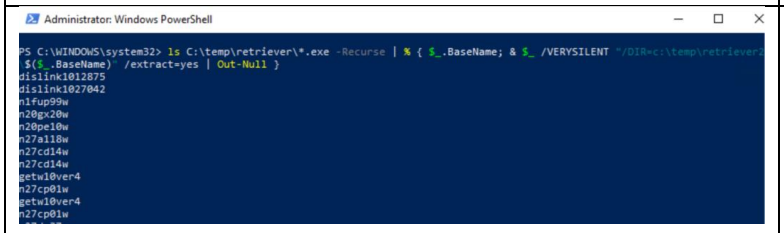
“Finish”



Wait for the downloads to finish

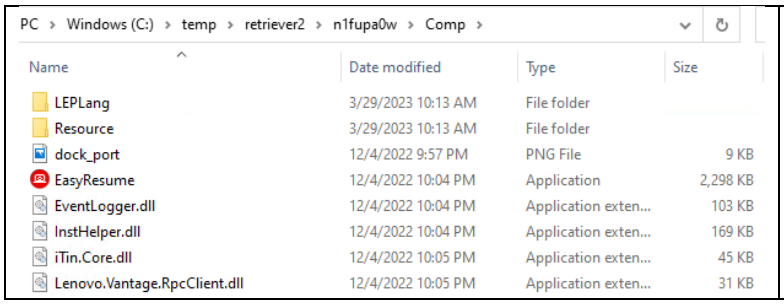


This will create a lot of directories with drivers inside executable archives



Use the following command in a window with admin rights to extract the packages:

```
ls C:\temp\retriever\*.exe -
Recurse | % { $_.BaseName; &
$_ /VERYSILENT
"/DIR=c:\temp\retriever2\$($_.
BaseName)" /extract=yes | Out-
Null }
```



This extracts the archive to usable file collections

Driver package adjustments

For some of the laptop models, not all drivers are needed, and some must be deleted before creating the packages.

HP 850 G5:

- Delete the driver for “Conexant HD Audio Driver” (currently SP140283)
- Delete the driver for “AMD Video Driver” (currently SP142415)

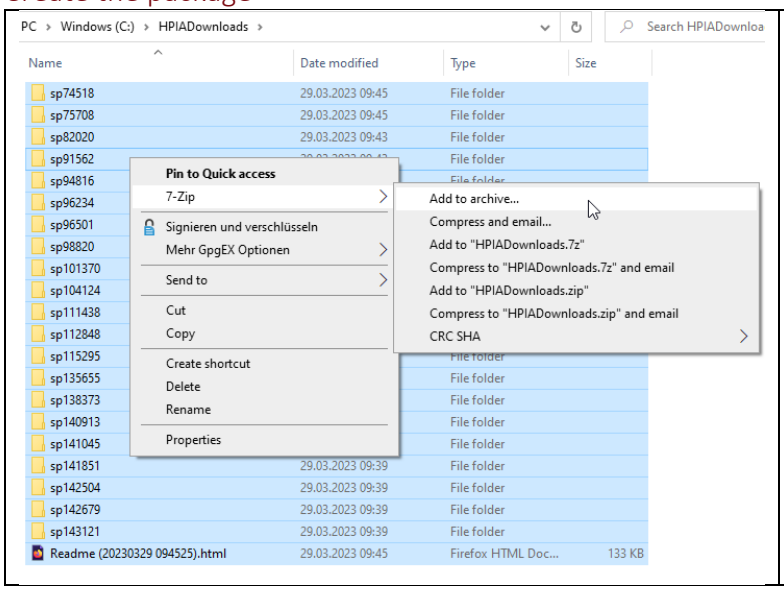
HP ZBook Fury 16 G9:

- Delete the driver for “AMD Video Driver” (currently SP156134)
- Delete the driver for “Realtek HD Audio” (currently SP156237)
- Delete the driver for “Intel XMM LTE” (currently SP145803)

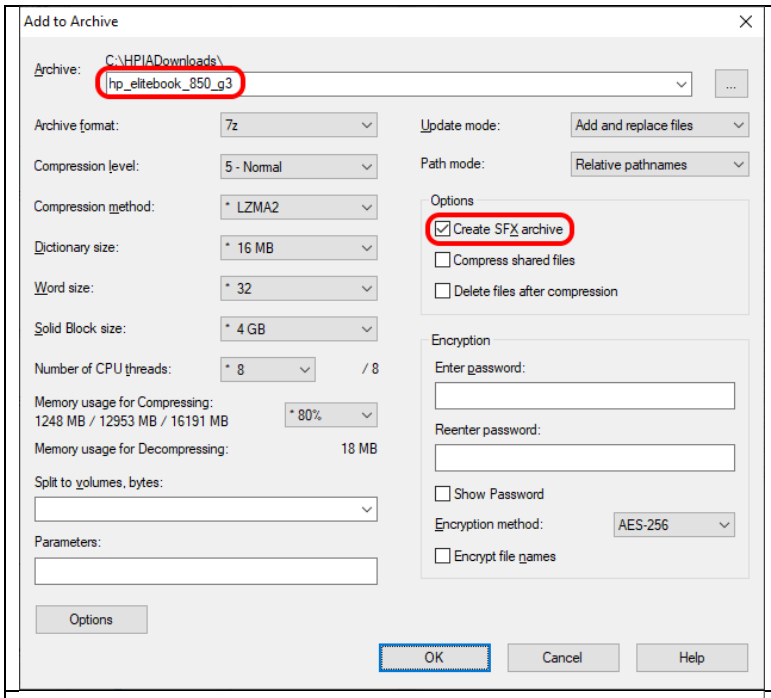
HP ZBook Fury 16 G10:

- Delete the driver for “Realtek HD Audio” (currently SP156212)
- Delete the driver for “Intel XMM” (currently SP155280)

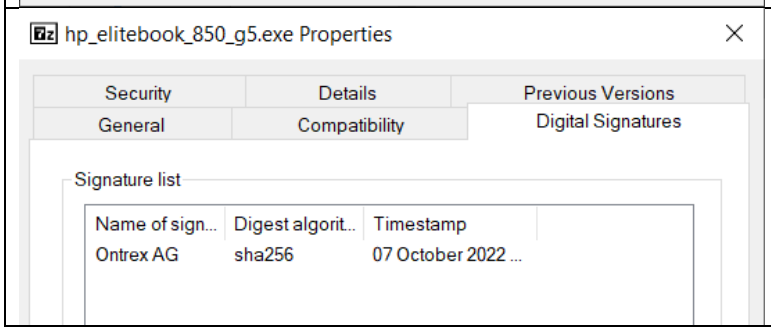
Create the package



Add the extracted folders to a 7zip archive



As self-extracting archive with the name of the laptop model



Sign the finished archive (with timestamp)

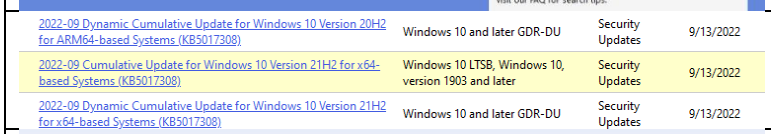
Updates

To identify which updates are needed, set up a computer with the last image version, enable networking on it, and let it automatically run Windows Update using Microsoft Update. Write down the KB numbers of any update it's installing, then download those updates separately and integrate them into the new image version.

Then, apply the image again, and repeat the above step until Windows Update reports that no updates need to be installed on a freshly applied image.

Windows

Go to https://catalog.update.microsoft.com/Home.aspx and search for the KB article numbers in the top right



2022-09 Dynamic Cumulative Update for Windows 10 Version 20H2 for ARM64-based Systems (KB5017308)	Windows 10 and later GDR-DU	Security Updates	9/13/2022
2022-09 Cumulative Update for Windows 10 Version 21H2 for x64-based Systems (KB5017308)	Windows 10 LTSB, Windows 10, version 1903 and later	Security Updates	9/13/2022
2022-09 Dynamic Cumulative Update for Windows 10 Version 21H2 for x64-based Systems (KB5017308)	Windows 10 and later GDR-DU	Security Updates	9/13/2022

For the monthly updates, download the regular cumulative update, not the dynamic one

For .NET only download the 4.8.1 package, not the 4.8

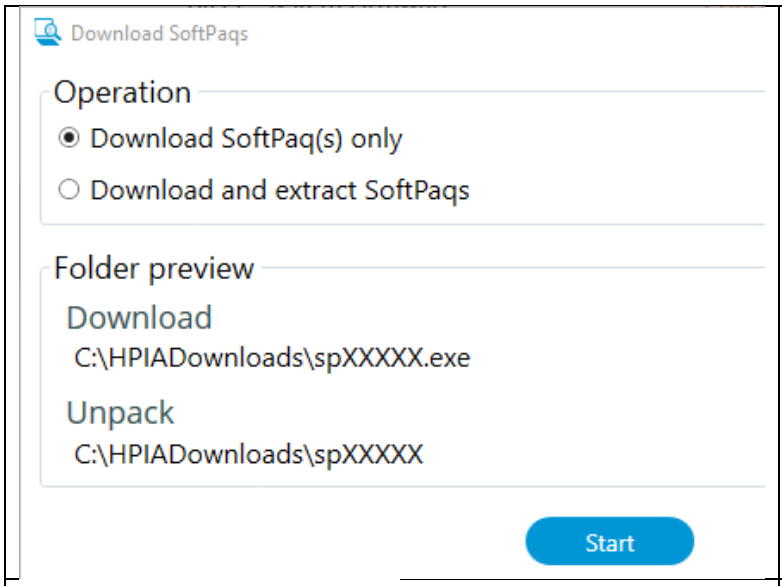
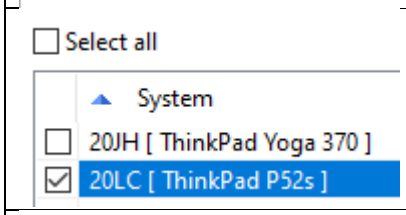
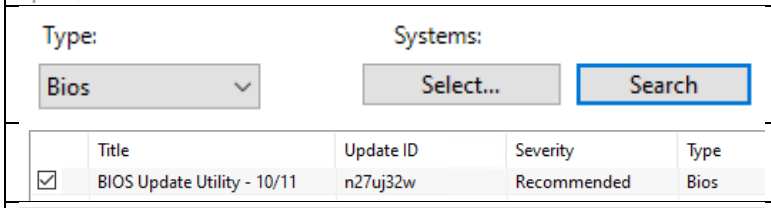
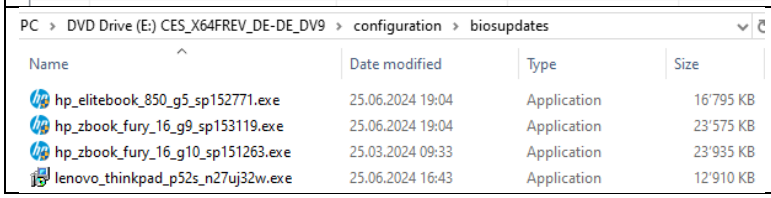
Windows Malicious Software Removal Tool - v5.106 (KB890830) — Windows 7, Windows Server 2008 — Update Rollups — 10/11/2022 Windows Malicious Software Removal Tool x64 - v5.106 (KB890830) — Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, Windows 10 LTSB, Windows Server 2016, Windows Server 2019, Windows 10, version 1903 and later, Windows Server, version 1903 and later, Windows 11 — Update Rollups — 10/11/2022 Windows Malicious Software Removal Tool - v5.106 (KB890830) — Windows 8.1, Windows 10, Windows 10 LTSB, Windows 10, version 1903 and later, Windows 11 — Update Rollups — 10/11/2022	For the malicious software removal tool, sort by date, then pick the newest package for Windows 10 64 bit
.NET Desktop Runtime 8.0.13 The .NET Desktop Runtime enables you to run existing Windows desktop applications. **This release includes the .NET Runtime; you don't need to install it separately.** OS: Windows — Installers: x64 | x86 | Arm64 | winget instructions — Binaries:	For .NET 8, go to https://dotnet.microsoft.com/en-us/download/dotnet/8.0 and download the newest "Desktop Runtime" for x64

Microsoft Defender

Antimalware solution — Definition version Microsoft Defender Antivirus for Windows 11, Windows 10, Windows 8.1, and Windows Server — 32-bit | 64-bit | ARM	On https://www.microsoft.com/en-us/wdsi/defenderupdates Download the 64-bit Version for the antivirus definitions
Update for Microsoft Defender Antivirus antimalware platform - KB4052623 (Version 4.18.2211.5) — Microsoft Defender Antivirus — Definition Updates — 12/8/2022	For the antimalware update, download the newest "Definition Updates" package
updateplatform.x86fre_85dfdcc7cc8df1062fc64ae81dbe0fc3b4e20e45.exe updateplatform.amd64fre_7f1e1eb218c67263a51f402fb080f1bbe311041b.exe updateplatform.arm64fre_9383ac7ca8917dc66023c6ff68d3679c8285f6bc.ex	Pick the one for "amd64fre"

BIOS

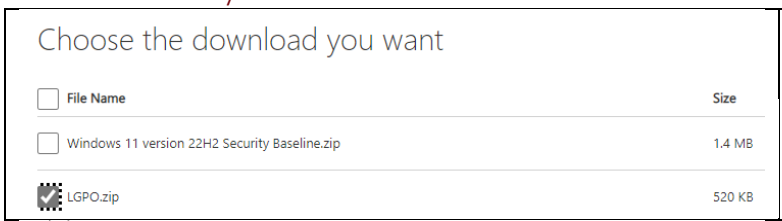
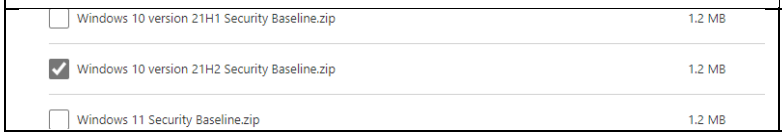
2 Select from My Products List My Products List HP ZBook Fury 16 G10 Mobile Workstation PC Microsoft Windows 10 version 21H2 (64-bit) HP ZBook Fury 16 G9 Mobile Workstation PC Microsoft Windows 10 version 21H2 (64-bit) HP EliteBook 850 G5 Notebook PC Microsoft Windows 10 version 21H2 (64-bit) 3 Get SoftPaqs — Analyze	For HP, select all models, then press Analyze
bios	Filter for the word "bios"
Critical — Select Components to Download/Apply — Download (3) Name — Category HP BIOS and System Firmware (U96) — BIOS - System Firm HP BIOS and System Firmware (V96) — BIOS - System Firm HP BIOS Config Utility (BCU) — Software - System HP Firmware Pack (Q78) — BIOS	Then check all the BIOS updates and click "Download"

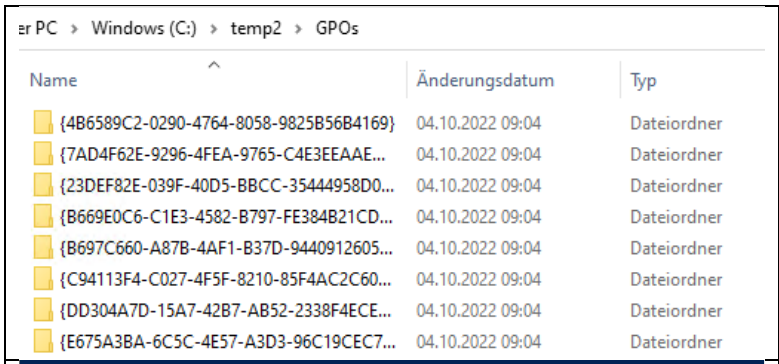
	Choose “Download only”
	For Lenovo, select the model in Update Retriever, then search for updates
	Filter for “Bios”
	Then download the BIOS update
	Rename them with their respective models, and copy them to the “biosupdates” directory under customization

Hardening

To harden the OS installation, we are using settings sets from both Microsoft, the Swiss Post, and the CIS benchmark, as well as some settings from ourselves.

Microsoft security baselines

	On https://www.microsoft.com/en-us/download/details.aspx?id=55319 download LGPO.exe
	And the baselines for 21H2



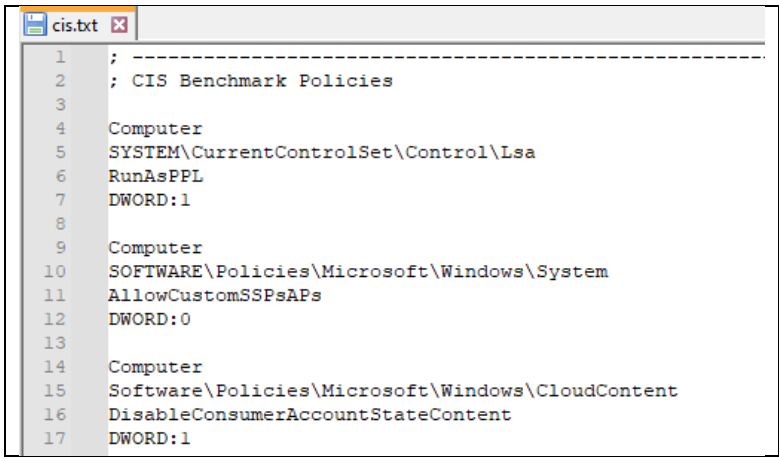
Extract the baseline zip file

Export the GPOs as text file using the script.

Swiss Post recommendations

The security settings from the Swiss Post have been implemented as PowerShell commands inside the customization.ps1

CIS Benchmark



The settings from the CIS benchmark have been implemented as LGPO exports in the file cis.txt

Custom settings

In addition to the predefined hardening rules taken from other sources, we have implemented a few security settings of our own. These mostly deal with cloud integration, privacy, and data leakage prevention.

Setting	Set to
Turn off the advertising ID	Enabled
Allow telemetry	Disabled
Do not show feedback notifications	Enabled
Do not allow web search	Enabled
Turn off Windows error reporting	Enabled
Disable changing Automatic Configuration settings	Enabled

There are also almost 100 privacy enhancing settings for the Edge browser that would be out of scope to document here in detail, but are listed in the text file “edge.txt” in the image.

Non-implemented security settings

The following security baseline settings recommended by either Microsoft or the Swiss Post haven't been implemented in the image. They are present in the configuration files but commented out and documented here with the respective reason why they weren't enabled.

Setting	Reason
Disable Windows + R	It's a usability decrease without a clear security benefit
Static DNS server	We didn't want to set a public DNS server like 8.8.8.8 due to privacy issues, and the security risk from a DNS based MitM attack seemed low considering we're using transport encryption
Configure Windows Defender SmartScreen: Block	Because the offline laptops don't have network connectivity, this would cause queries to SmartScreen to not work, and authorized E-Voting applications to be blocked
Deny write access to removable drives not protected by BitLocker	We need to save data to unencrypted USB drives during the e-voting process
Block untrusted and unsigned processes that run from USB	We need to be able to run executables from USB drives during the e-voting process
Script execution policy: All Signed	We need to be able to run unsigned scripts during the e-voting process

Autounattend-File

To allow the setup to proceed without user choices, we use an unattend file to automatically configure various settings and actions during Windows Setup. The unattend file is copied to the root file of the boot media under the name autounattend.xml.
Following are the settings that are implemented in the file, separated by the steps they are happening in.

WindowsPE

- OS Language is set to German
- User locale and system locale are set to Swiss German
- Keyboard layout is set to Swiss German
- Windows EULA is automatically accepted
- Registration organization of Windows is set to “Evoting”
- Disk is partitioned into 3 partitions:
    - 500 MB EFI partition for BitLocker
    - 16 MB MSR partition for disk metadata
    - Rest of the disk as a primary partition for the OS
- Partitions are formatted:
    - EFI partition as FAT32 and labelled “System”
    - OS partition as NTFS and labelled “Windows”
- The Windows installation is applied from the “Windows 10 Enterprise N LTSC” image

OOBESystem

- WLAN setup is skipped
- EULA is skipped
- Privacy settings are skipped
- Time zone is set to Western Europe Standard Time
- An administrator account is configured with a default password
- OS Language is set to German
- User locale and system locale are set to Swiss German
- Keyboard layout is set to Swiss German

Specialize

- Auto logon is configured for the administrator account
- Six PowerShell commands are started in sequence
    - PowerShell script execution policy is set to “RemoteSigned”
    - The drive letter of the boot media is retrieved from WMI
    - Drivers are installed
    - Applications are installed
    - Policies and other settings are applied
    - The updates are staged to the computer hard disk to later be installed

Checklist for image update

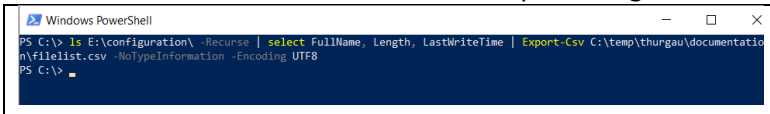
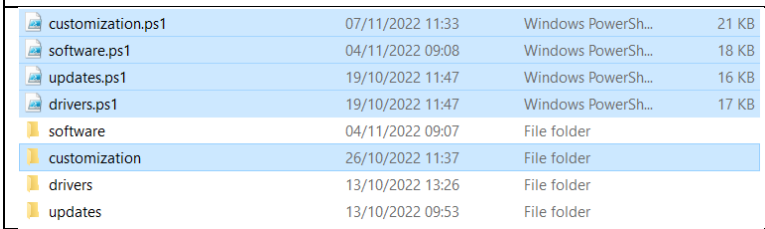
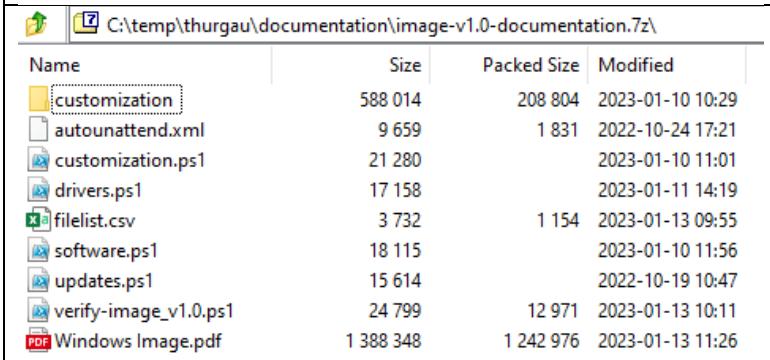
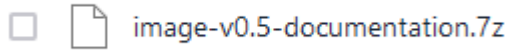
When a new version of the image is created, the following steps need to be executed:

- Check for every application whether a new version is available and replace those. For some of them, the customer might have to be contacted since the downloads aren’t public. For some applications, an update might not be allowed due to compatibility issues.
- Create a new driver package for each supported model. Make sure to exclude the drivers that have caused issues in the past.
- Download current BIOS update packages for every model, and update the script “check-biosupdatestatus.ps1” to the current versions
- Check with the customer if any security settings need to be adjusted.

- Set up a VM with the last image, then update it from the Microsoft servers, note the KB numbers of the updates that are being installed, and integrate them into the image.
- Check if any Notepad++ plugins have been updated by launching the application and looking at the update tab in Plugins Admin
- Create a Release Candidate ISO file, then modify the image verification script until it returns the correct results.
- Image a computer using the ISO file and doublecheck whether all Windows Updates are counted as installed.
- Sign the image verification script.
- Create a zip file with the documentation.
- Upload the iso file, the documentation, and the image verification script to the sharing platform
- Archive the image components onto the project network server

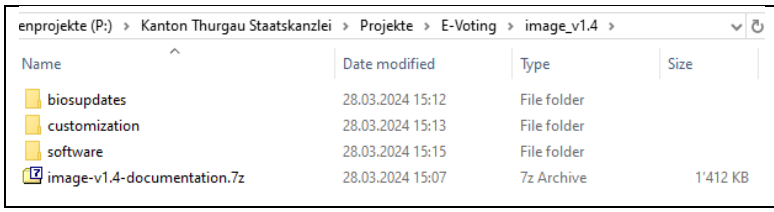
Create documentation to publish

We need to make available a collection of files to the public to document what we've done and allow some transparency to the voters. We create an archive of script and documentation files and provide that to the customer who takes care of the publishing itself.

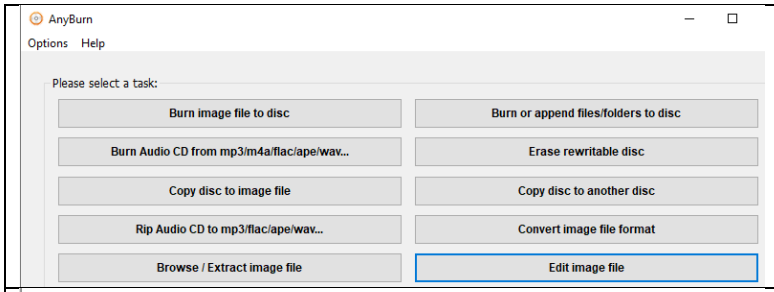
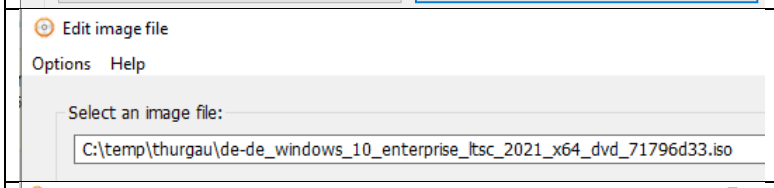
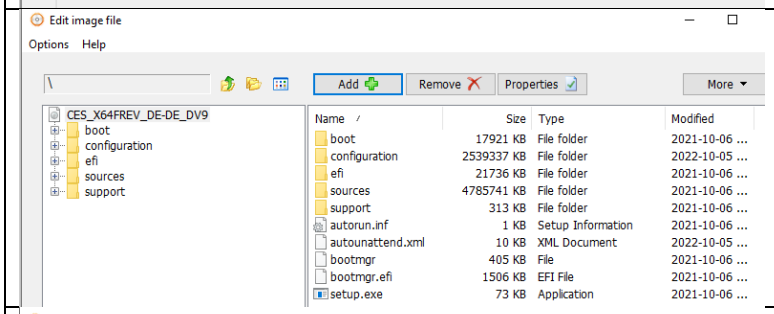
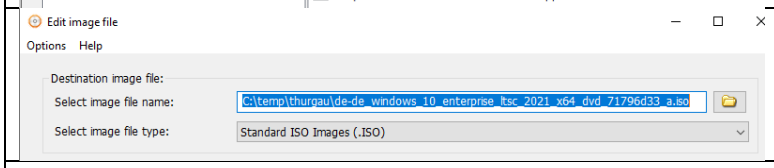
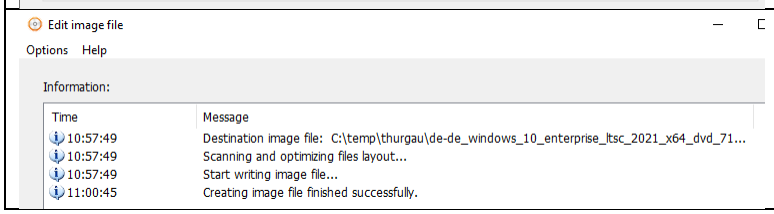
	Export a list of all the customized files to a CSV file using the command: `ls E:\configuration\ -Recurse | select FullName, Length, LastWriteTime | Export-Csv C:\data\thurgau\documentation\filelist.csv -NoTypeInformation -Encoding UTF8`
	Archive the four PowerShell files and the entire "customization" directory into a 7z file…
	…and add: • autounattend.xml • filelist.csv • the image verification script • image documentation Word file as a PDF
	Upload the resulting file

Archival

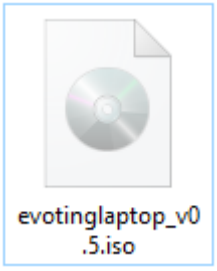
While we don't archive the full ISO files due to space issues, we want to archive the most important files for future reference.

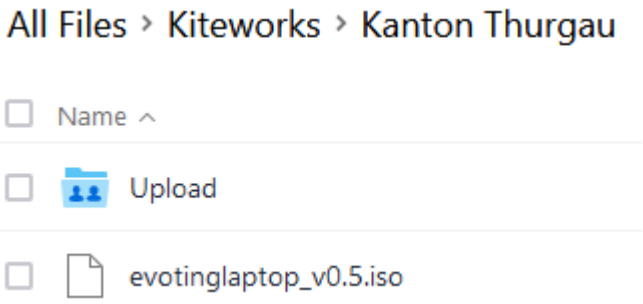
	Create a subdirectory for the current image version, and copy the documentation 7z, as well as the directories: *customization*, *software* and *biosupdates*

Create the bootable ISO

	Start Anyburn, then choose "Edit Image"
	Open a bootable ISO file
	Add the “autounattend.xml” and the “configuration” directory
	Save under a different name
	Wait until it’s finished

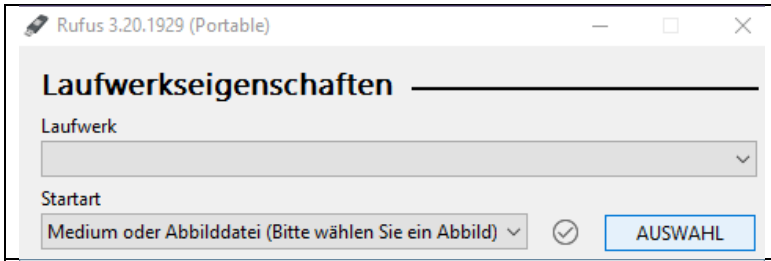
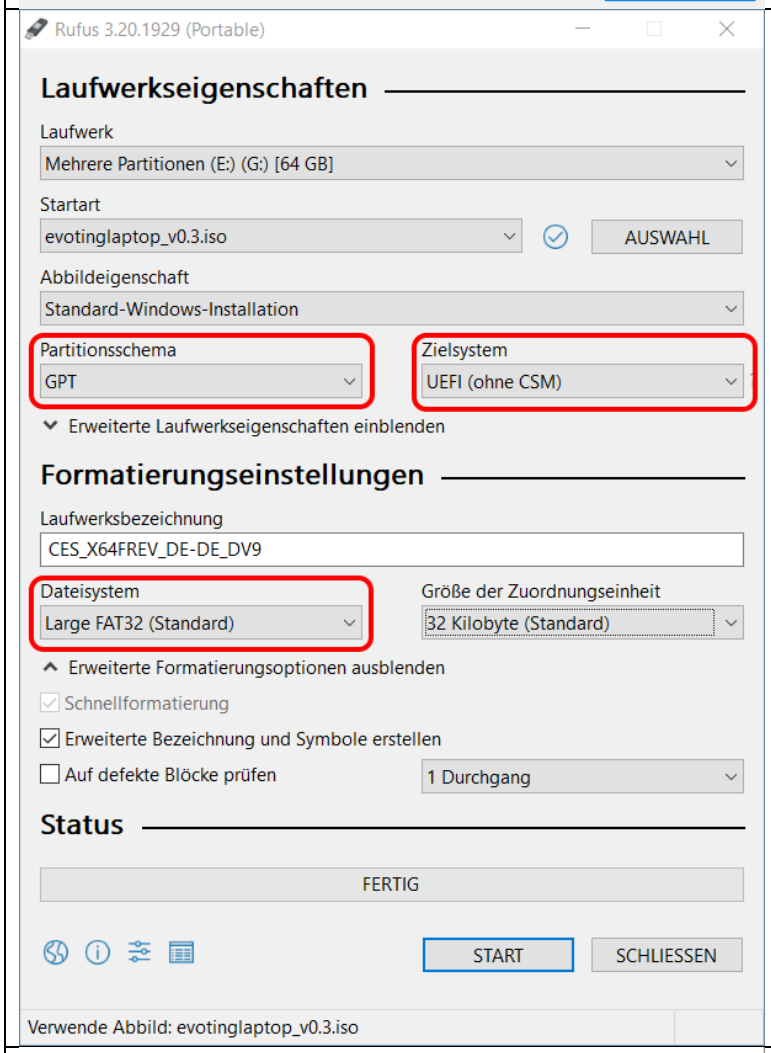
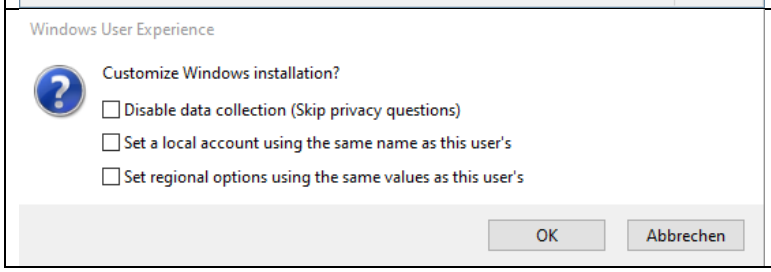
Upload the image

	Rename the resulting image to evotinglaptop_vx.y.iso

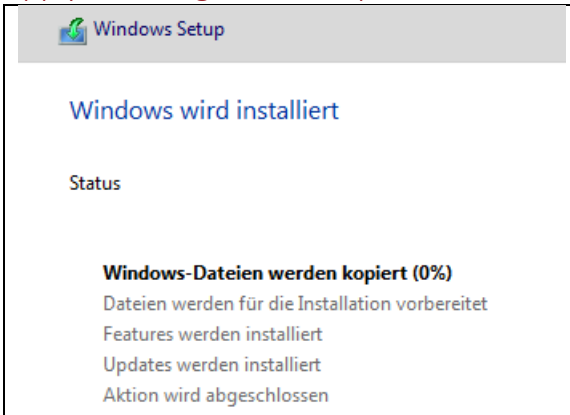
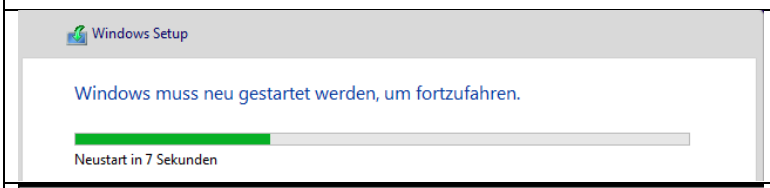
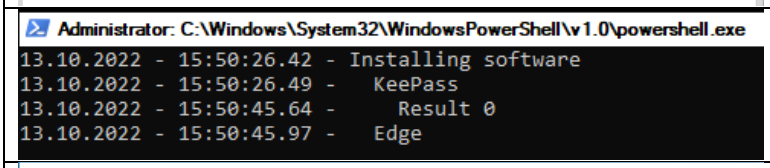
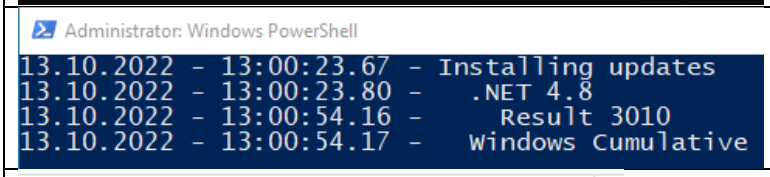
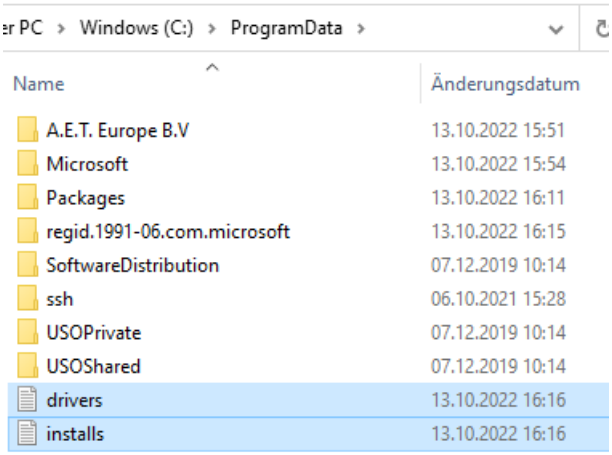
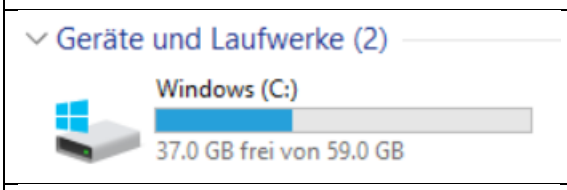
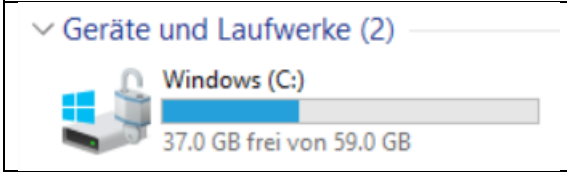
	And upload it to the Kiteworks share https://kiteworks.ontrex.ch/#/folder/8666a49b-a3d7-4831-9d02-45666f755d19

User Guide

Extract the ISO to a USB Stick

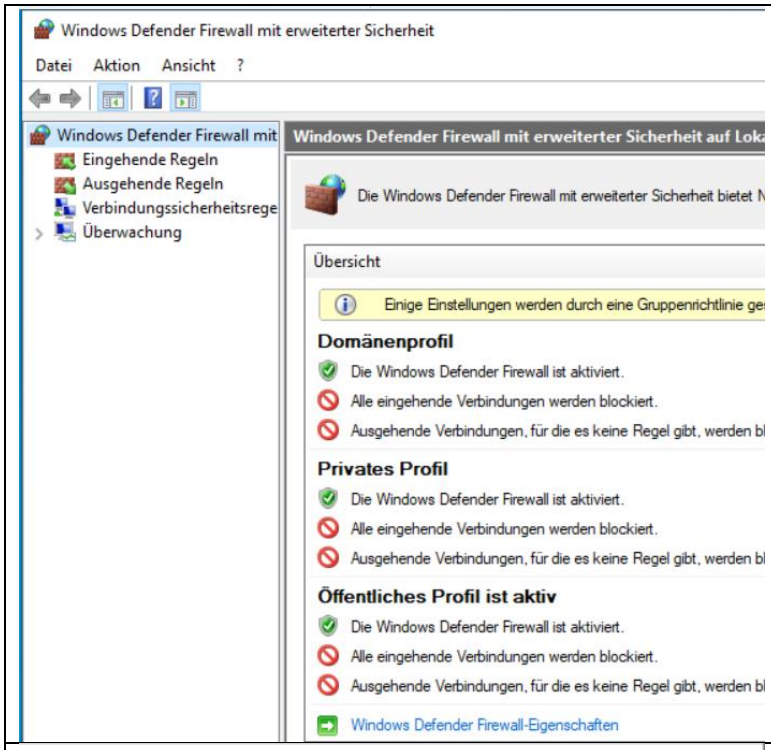
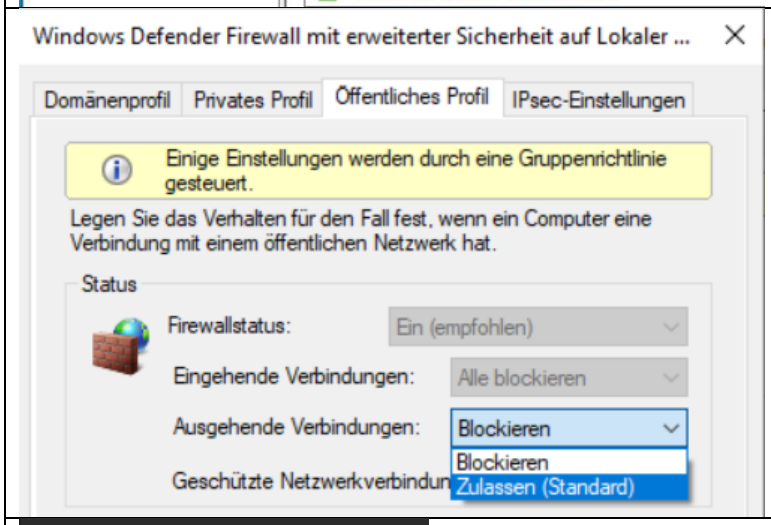
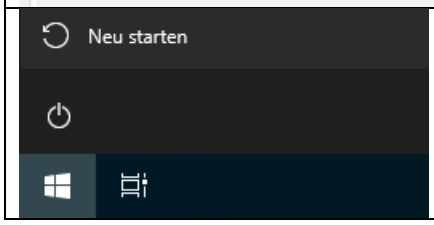
	Start Rufus and select the ISO file
	Use GPT, UEFI (without CSM) and Large FAT32 as options Do not modify the drive name, it has to stay on the default value
	Do not let Rufus do any adjustments to the Windows installation

Apply the image to a computer

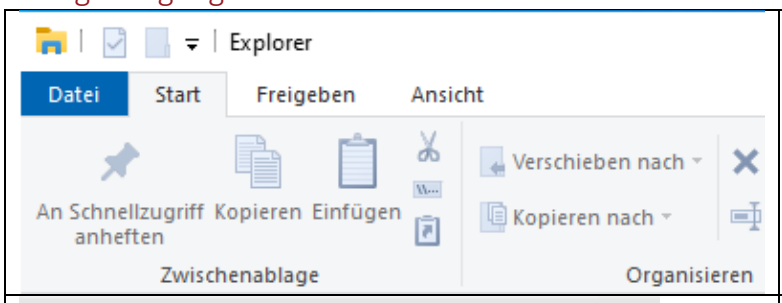
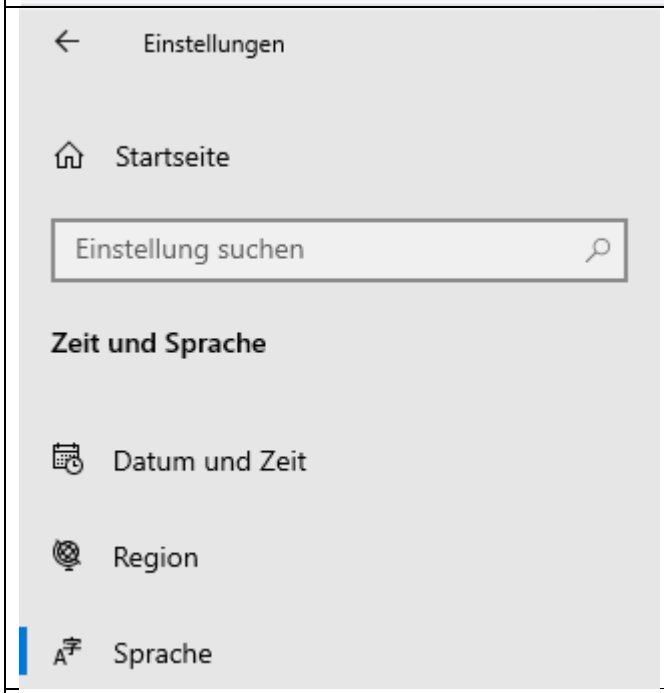
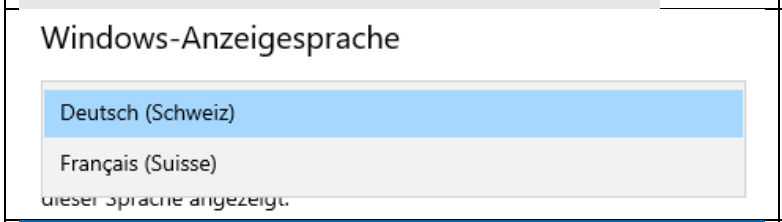
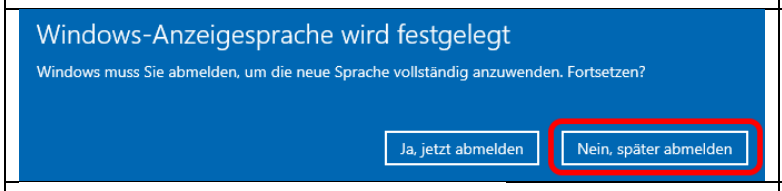
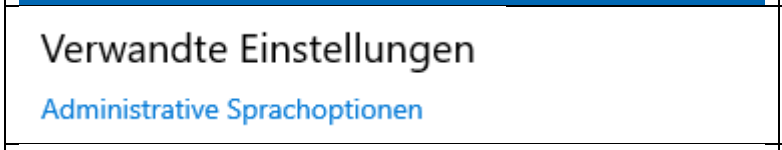
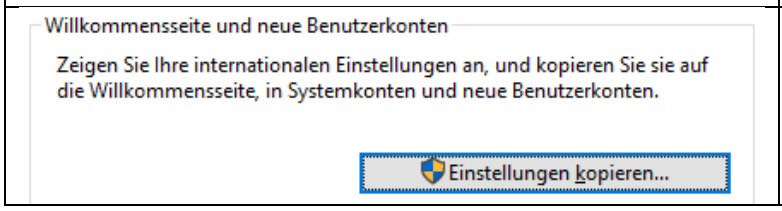
	Boot the laptop from the USB stick by pressing either F9 for HP, F12 for Lenovo, or Esc for Panasonic early in the boot process. The Windows Setup will then automatically start
	After a while it'll reboot…
	…and continue by installing drivers, applications etc
	When the computer is installing updates, the USB stick can be removed
	Log files about the setup are created in the directory c:\programdata
	The hard drive will not be immediately encrypted
	After a few reboots however it'll be encrypted (if the laptop is connected to a power supply)

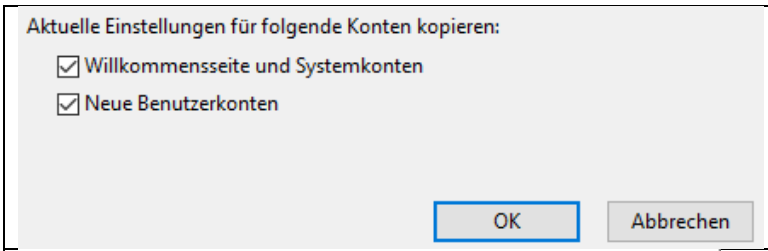
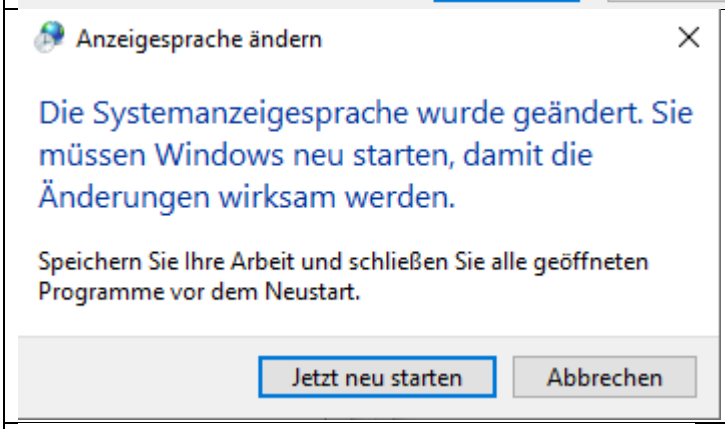
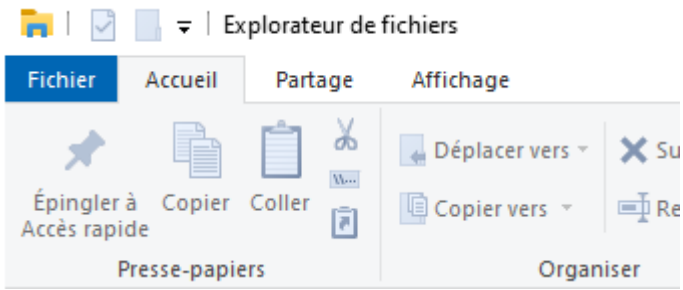
Enable network connectivity

By default, both incoming and outgoing network connections are blocked. If the specific laptop that is being set up needs to have Internet connectivity, outgoing connections have to be manually enabled.

	With the administrator account, open the Windows Firewall settings
	Set outbound connections to “Allowed” under the public profile
	Then restart the computer

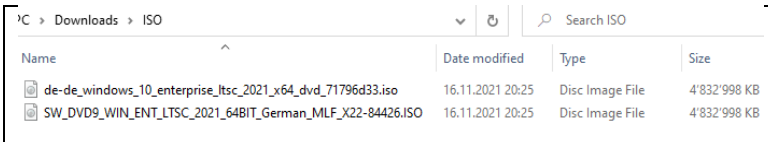
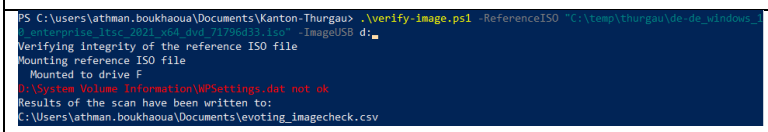
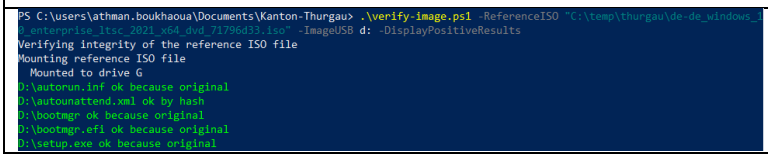
Change language

	By default, the UI language is in German. If the PC is required to be in French…
	…then open Settings and go to “Time and Language”, then “Language”
	Change the display language to French
	Do *not* log off when prompted
	Scroll down and click “Administrative language options”
	Click “Copy Settings”

	Set the checkboxes on the login page and the new user accounts, then press OK
	Confirm the restart
	After that, Windows is in French

Verify image authenticity

To verify that a USB stick hasn't been tampered with and contains only either official Microsoft files or files that have been put there as part of the image customization, the script "verify-image.ps1" can be used.

	Download the German Windows LTSC 2021 ISO from an official Microsoft source, like the VLSC, the partner download portal or Visual Studio Downloads.
	Run the script with the parameter -ReferenceISO pointing to the above ISO file, and -ImageUSB set to the USB drive that should be checked
	Optionally, the parameter "-DisplayPositiveResults" can be used to show correctly checked files in green

	A	B	C	D	E	F	G	H
1	Info	Reason	Result	FileName				
2	3378723CI	original	ok	D:\autorun.inf				
3	E803F131A	hash	ok	D:\autounattend.xml				
4	4EEAC11B	original	ok	D:\bootmgr				
5	96B7EE39A	original	ok	D:\bootmgr.efi				
6	30043368(	original	ok	D:\setup.exe				
7	A6FB0A49	hash	failed	D:\System Volume Information\WPSettings.dat				
8	16327144	original	ok	D:\boot\bcd				
9	CD2C00CE	original	ok	D:\boot\boot.sdi				
10	2F9C2428	original	ok	D:\boot\bootfix.bin				
11	55A47316A	original	ok	D:\boot\bootsect.exe				
12	F425E135A	original	ok	D:\boot\etfsboot.com				
13	BF8A9CC6	original	ok	D:\boot\memtest.exe				
14	C89CDA7E	original	ok	D:\boot\de-de\bootsect.exe.mui				

The script will output a detailed report in the “Documents” directory that shows check results for all files

Version History

v0.1

- Initial Version
- Includes 8 applications, drivers for 4 models and initial hardening rules from both Swiss Post and Microsoft
- Includes updates for October 2022

v0.2

- Add 7-Zip application
- Add Total Commander configuration, license, and shortcut in Start Menu
- Enable display of hidden files and file extensions in Explorer
- Remove camera driver from 850 G3 driver package
- Fix driver install logic for both 850 G3 and 850 G5
- Downgrade Smart Screen policy in Explorer from Block to Warn

v0.3

- UAC is now set to highest level
- PowerShell execution policy set to allow unsigned scripts
- Changed username for admin login to “EvotingAdmin”

v0.4

- Blocking all outgoing ICMP packets
- Blocking all outgoing network connections by default
- Blocking cameras and audio devices in with device installation restrictions
- Update Total Commander to version 10.52
- Installing Total Commander to c:\totalcmd
- Installing OpenSSL to c:\openssl

v0.5

- Updated OpenSSL to 1.1.1s
- Enabled the hardening rule “Disable new DMA devices when the PC is locked”

v1.0

- Disabled all Bluetooth devices
- Disabled automatic Windows Updates
- Disabled 31 Windows services for additional hardening
- Added support for laptop model HP ZBook Fury 16 G9
- Added almost 100 privacy hardening rules for Edge Browser
- Updates to Windows for December 2022
- Updates to applications: Notepad++ 8.4.8, STunnel 5.67

v1.1

- Added .NET 6 Runtime
- Disabled Sleep Mode
- Added a barcode and OCR font
- Increased local account password expiration to 120 days
- Split setup logs into two files to make them more readable
- Updates to Windows for March 2023
- Updates to applications: KeePass 2.53.1, Notepad++ 8.5.1, OpenSSL 1.1.1t, STunnel 5.69

v1.1.1

- Removed SafeSign
- Installed GMP to c:\vmgj
- Updates to applications: KeePass 2.54, Notepad++ 8.5.3, OpenSSL 3.1.1

v1.2

- Added 63 new hardening rules from CIS benchmarks
- Disabled Hibernate Mode
- Assigned text files to open with Notepad++
- Customized task bar
- Removed support for HP EliteBook 850 G3
- Updates to Windows and drivers for July 2023
- Updates to applications: 7-Zip 23.01, Notepad++ 8.5.4, STunnel 5.70

v1.3

- Uninstalled Windows Experience Pack
- Allowed standard users to change the system time
- Added the font “Roboto Mono”
- Added the Notepad++ Plugin “JSTool”
- Updates to Windows and drivers for November 2023
- Updates to applications: KeePass 2.55, Notepad++ 8.6, OpenSSL 3.2.0, SDelete 2.05, STunnel 5.71, TotalCommander 11.02

v1.3.1

- Added support for laptop model HP ZBook Fury 16 G10

v1.4

- Disabled Windows Recovery Partition
- Added two applications: PowerShell 7 and KeyStore Explorer 5.5.3
- Added BIOS updates to the image for every supported model
- Added a script that notifies if the installed BIOS version is too old
- Updates to Windows and drivers for March 2024
- Updates to applications: KeePass 2.56, Notepad++ 8.6.4, OpenSSL 3.2.1, STunnel 5.72, TotalCommander 11.03

v1.5

- Removed an application: STunnel
- Updates to BIOS, Windows and drivers for June 2024
- Updates to applications: KeePass 2.57, Notepad++ 8.6.8, OpenSSL 3.3.1, 7-Zip 24.07, PowerShell 7.4.3

v1.6

- Added French language pack
- Updates to BIOS, Windows and drivers for September 2024
- Updates to applications: Notepad++ 8.6.9, OpenSSL 3.3.2, 7-Zip 24.08, PowerShell 7.4.5

v1.7

- Updates to BIOS, Windows and drivers for November 2024
- Updates to applications: KeePass 2.57.1, Notepad++ 8.7.1, OpenSSL 3.4.0, PowerShell 7.4.6

v1.8

- Replaced .NET 6 Runtime with .NET 8 Runtime
- Updates to BIOS, Windows and drivers for February 2025
- Updates to applications: 7-Zip 24.09, Notepad++ 8.7.7, PowerShell 7.4.7, TotalCommander 11.5

Image Authenticity

The authenticity of files in the image is guaranteed through a few different ways:

- Microsoft files are either signed by Microsoft or contained in an ISO file that has a well-known hash published on the official Microsoft website as well as third party websites.

- Driver files from hardware manufacturers are signed by the manufacturers. Windows would display a warning popup when a driver installation with an invalid signature is attempted, so any unsigned driver would be visible during imaging.
- Application executables are signed by their respective developers.
- Application add-ins that we deploy for Notepad++ or Total Commander are not signed. However, they are downloaded from inside their signed parent executable over an HTTPS connection.
- Ontrex custom developed files are either signed by Ontrex, or a hash of the file is stored in a signed script.

This reduces the risk that any malicious files are present in the image, at least to a degree that we can trust the respective developers.

Lessons learned

1. Windows updates cannot be installed during the "specialize" step. Probably due to provisioning mode. They instead need to be installed in a RunOnce key.
2. Scheduled tasks also cannot be added during Windows Setup because the task service isn't running yet.
3. BitLocker encryption cannot start if there is a DVD inserted in the optical drive, or the laptop is not connected to a power supply.
4. There is no way to block USB network adapters only. If using the DenyDeviceClasses GPO, it blocks every network adapter including internal ones.
5. You cannot define power settings by registry keys. You need to use the powercfg.exe commands.

Scripts

export-gpos.cmd

```
lgpo /parse /m ".\{23DEF82E-039F-40D5-BBCC-
35444958D065}\DomainSysvol\GPO\Machine\registry.pol" /q > ie_computer.txt
lgpo /parse /m ".\{4B6589C2-0290-4764-8058-
9825B56B4169}\DomainSysvol\GPO\User\registry.pol" /q > user.txt
lgpo /parse /m ".\{7AD4F62E-9296-4FEA-9765-
C4E3EEAAECC1}\DomainSysvol\GPO\Machine\registry.pol" /q > credentialguard.txt
lgpo /parse /m ".\{B669E0C6-C1E3-4582-B797-
FE384B21CDD1}\DomainSysvol\GPO\Machine\registry.pol" /q > defender.txt
lgpo /parse /m ".\{B697C660-A87B-4AF1-B37D-
9440912605E7}\DomainSysvol\GPO\Machine\registry.pol" /q > bitlocker.txt
lgpo /parse /m ".\{C94113F4-C027-4F5F-8210-
85F4AC2C6082}\DomainSysvol\GPO\User\registry.pol" /q > ie_user.txt
lgpo /parse /m ".\{DD304A7D-15A7-42B7-AB52-
2338F4ECE2C7}\DomainSysvol\GPO\Machine\registry.pol" /q > computer.txt
```

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