DISM + FFU Capture and Restore an Image
By Sean D. Liming and John R. Malin

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Windows 10 Enterprise 2019 (Build 1809 Ver 17763)

Moving from the Past to the Future
Cloning a master image for mass production is an important step for Windows Embedded Standard and Windows Embedded Industry. First, the image must be rolled back to create the master, which is accomplished using Sysprep. Here is an example command:

Sysprep /generalize /oobe /shutdown /unattend:c:\myunattend.xml

The XML unattend file is a small answer file that handles several of the Out-of-Box Experience (OOBE) screens, as well as, accounts, run–time key, computer names, etc. The unattend answer file is created using the System Image Manager (SIM) tool from the Windows ADK. There are those that say you don't need Sysprep, but failure to run Sysprep and just copying the image can run into technical consequences. In short, one must run Sysprep to duplicate the image.

Once the image has been rolled back, the next step is to capture the master image for deployment to other systems. Our books have covered creating the unattend file and running Sysprep, but what is not covered is an actual full disk capture utility. There are several hardware disk duplication solutions for hard drives and compact flash cards. International Microsystems Inc. and Logicube are two companies that offer hardware duplication products. There are also software solutions. Some of the most popular are Acronis True Image, Norton Ghost, and Clonezilla. Since Microsoft only had a solution to capture a partition to a WIM file, which proved to be complicated when trying to capture a whole disk with all the UEFI partitions, we wrote an article covering CloneZilla to help those who wanted a free software full disk image capture solution. The problem with Clonezilla is that it is a Linux-based, two-USB flash drive solution. One drive is for the Clonezilla software and the other for the captured image. With the recent release of Windows 10 1809, Microsoft has introduced a solution to capture a full disk image to an FFU file, which only requires 1 USB flash disk. In this document, we will look at how to set up and use this new free solution.

Create the WinPE Image on Your Development Machine
The first step is to create a WinPE 1809 image. WinPE features used to come with the ADK, but with Windows 10 1809, the WinPE tools are a separate downloadable add-on for the ADK. Here is the link to the Windows ADK for Windows 10, version 1809 and Windows PE add-on for the ADK

https://docs.microsoft.com/en-us/windows-hardware/get-started/adk-install

First, install the ADK on your development machine, and then install the WinPE add-on. If you have already installed the ADK on your development machine, just install the WinPE add-on.

1. With both the ADK and WinPE add-on installed, from the start menu, go to Windows Kits and open Deployment and Imaging Tool Environment.
2. Run the following command to create a WinPE image and workspace:

   Copype amd64 c:\WinPE64

```
Deployment and Imaging Tools Environment                                    —    □    ×

pt\bootmgr.efi.mui
C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Windows Preinstallation Environment\amd64\Media\ro-
ro\bootmgr.efi.mui
C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Windows Preinstallation Environment\amd64\Media\ru-
ru\bootmgr.efi.mui
C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Windows Preinstallation Environment\amd64\Media\sk-
sk\bootmgr.efi.mui
C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Windows Preinstallation Environment\amd64\Media\sl-
si\bootmgr.efi.mui
C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Windows Preinstallation Environment\amd64\Media\sr-
latn-rs\bootmgr.efi.mui
C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Windows Preinstallation Environment\amd64\Media\sv-
se\bootmgr.efi.mui
C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Windows Preinstallation Environment\amd64\Media\tr-
tr\bootmgr.efi.mui
C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Windows Preinstallation Environment\amd64\Media\uk-
ua\bootmgr.efi.mui
C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Windows Preinstallation Environment\amd64\Media\zh-
cn\bootmgr.efi.mui
C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Windows Preinstallation Environment\amd64\Media\zh-
tw\bootmgr.efi.mui
153 File(s) copied
        1 file(s) copied.
        1 file(s) copied.
        1 file(s) copied.

Success


C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Deployment Tools>
```

The workspace gets created, and the WinPE image is placed in the c:\WinPE64\media directory. The image, as is, will boot to a command prompt. Some people like to create a shell for their WinPE and have a more user-friendly interface. Features such as .NET 4.5 are available to be added to the WinPE image. You could mount the c:\WinPE64\media\sources\boot.wim file to the c:\WinPE64\mount folder and add additional features and files. This link discusses the WinPE add-on features:

https://docs.microsoft.com/en-us/windows-hardware/manufacture/desktop/winpe-add-packages--optional-components-reference

To launch an app on startup:

https://docs.microsoft.com/en-us/windows-hardware/manufacture/desktop/winpeshlini-reference-launching-an-app-when-winpe-starts

3. For this exercise, we will stick with booting to the command shell. Create the following two batch files and place these files in c:\WinPE64\media

Capture.bat:

```
Dism /Capture-Ffu /ImageFile:d:\My-WIN10-MM-DD-YY.ffu
/CaptureDrive:\\.\PhysicalDrive0 /Name:MYOS /Compress:default
```

Apply.bat:

```
dism.exe /apply-ffu /imagefile:d:\My-WIN10-MM-DD-YY.ffu
/ApplyDrive:\\.\PhysicalDrive0
```

Note: Each batch file is a single line. You may have to change the file path to match the root of the USB flash disk. You can use notepad.exe to make any required changes.

With the WinPE image created, the next step is to create a bootable USB flash disk. There are a couple of ways to create a bootable USB flash disk. Here are two options:

Option 1: Create the Bootable USB Flash Disk Using Rufus
Most PC systems have 64-bit UEFI firmware and boot support. The Rufus utility has the ability to create a UEFI bootable USB flash disk.

1. You will need to download and install Rufus: https://rufus.ie/
2. With Rufus installed, plug in a blank USB flash disk (32GB or higher)
3. Run Rufus
4. Set the Boot selection to UEFI:NTFS (Note: you may have to expand the drive properties or show the advanced format option to get this Boot selection option)
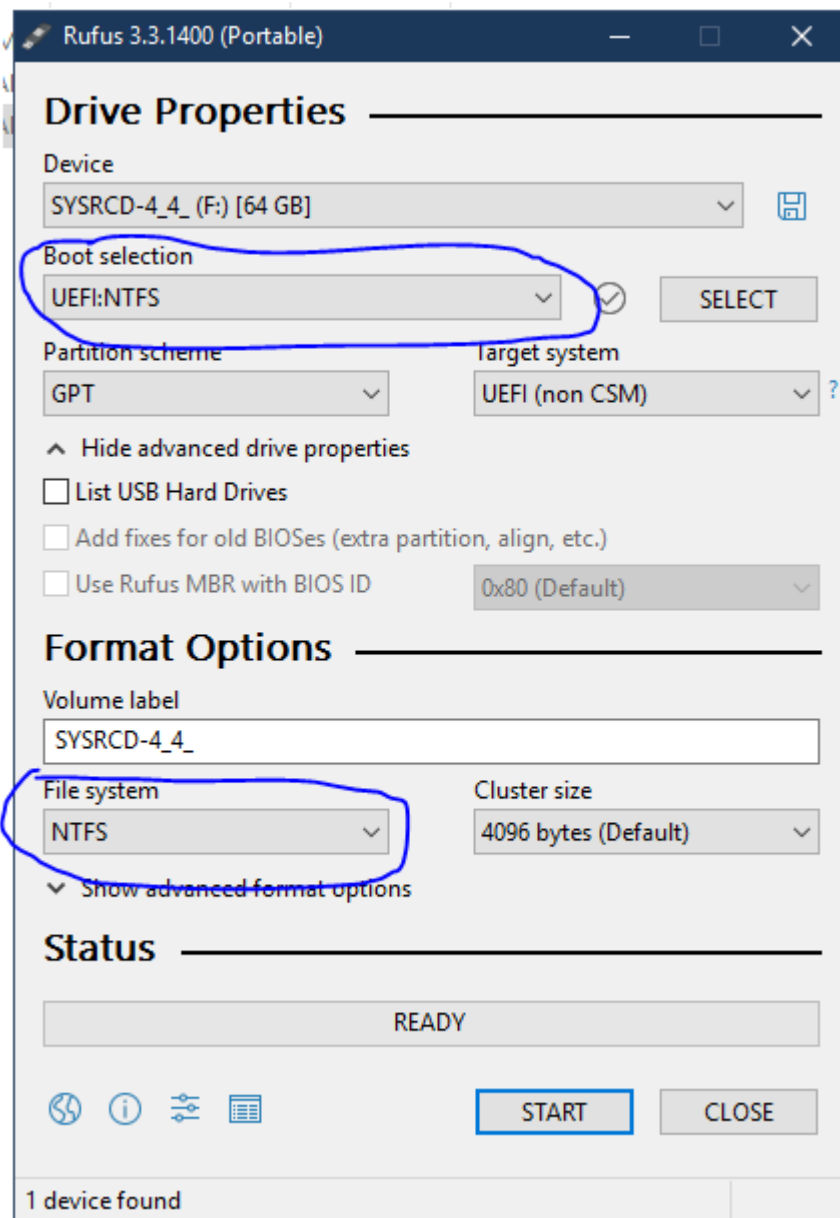
5. The File system should be set to NTFS.

6.   Optional: change the volume name to your liking
7.   Click start – The USB flash disk will be split into two partitions.
8.   When the formatting has completed, copy the contents of the c:\WinPE64\media to the larger partition. The USB flash disk is now ready to be used for capture and restore.

Option 2: Create the Bootable USB Flash Disk Using Diskpart

In this option, we will use the built-in Diskpart utility to create a bootable USB flash disk.

1.   Plug in the USB flash disk (32GB or higher)
2.   Open a Command Windows with elevated privileges.
3.   Run Diskpart, and then perform he flowing commands:

    List disk
    Select disk <use USB disk number from list disk>
    Clean
    Create part pri
    Select part 1
    active
    format quick fs=**FAT32**
    assign
    exit

Note: You may have to use exFAT instead of FAT32 for larger capacity drives.

4.   Copy the contents of the c:\WinPE64\media to the USB flash disk. The USB flash disk is now ready to be used for capture and restore.

Perform the Capture

Here are the steps to capture the FFU image:

1.   Safely eject the formatted USB flash disk from the development machine.
2.   Plug the USB flash disk into the target system that has been Sysprep'd.
3.   Power on the system, and hit the DEL key to get into BIOS settings screen.
4.   Select the Save & Exit, and go down to the boot override section (or change the boot order to boot to the USB flash disk).
5.   Select the UEFI USB flash disk.
6.   The system will boot to a command prompt. Change directory to drive D – this should be the root of the USB flash disk. If the root of the USB flash disk is a different drive letter, the capture.bat file will have to be edited to change the path to the .FFU file. Notepad is available in WinPE to make this edit.
7.   Run the capture.bat file. This will capture the image to the USB flash disk.
8.   When finished, run the following to shut down the system:

    wpeutil shutdown

Perform the Apply

Here are the steps to apply the FFU image:

1.   Plug the USB flash disk into the target system.
2.   Power on the system, and hit the DEL key to get into BIOS settings screen.
3.   Select the Save & Exit and go down to the boot override section (or change the boot order to boot to the USB flash disk).
4.   Select the UEFI USB flash disk.
5.   The system will boot to a command prompt. Change directory to drive D – this should be the root of the USB flash disk. If the root of the USB flash disk is a different drive

        letter, the apply.bat file will have to be edited to change the path to the .FFU file. Notepad is available in WinPE to make this edit.

6.   Run the apply.bat file. This will apply the image to the target system disk.

7.   When finished, run the following to shut down the system:

wpeutil shutdown

8.   Reboot the system and Windows should boot and go through a mini-setup.

The new DISM + .FFU support is a convenient and free solution to capture and deploy images.

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