Installing Windows 10X 195xx (emulator image) on real hardware

Here's some quick notes on installing Windows 10X on real hardware. For this example, we're assuming a system with *no* other critical disks installed, and a helpful host system being around to set up the initial image.

Prerequisites

Host

- Windows 10 Manganese build (195xx).
- Utility USB flash drive of ~32GB+.

Target

- CPU with Hyper-V support for VAIL.
- Graphics card with DCHU drivers available.
- UEFI system firmware with the ability to **disable Secure Boot**.
- Boot drive larger than 128 GiB. An 128 GB SSD usually isn't.
- Preferred: 4Kn boot drive. We'll provide steps a bit later for converting the image.

Host work

Fetch and mount the emulator image

Make sure you have a *clean* `Flash.vhdx` from the W10X emulator. Copy it someplace, and preferably keep another backup as well.

Mount it using PowerShell (as administrator):

```
Mount-VHD "X:\WCOS\Flash.vhdx"
```

Check if the emulator image is mounted correctly:

```
Get-StoragePool -FriendlyName OSPool
```

This should look like the following:

```
FriendlyName OperationalStatus HealthStatus IsPrimordial IsReadOnly     Size AllocatedSize
------------ ----------------- ------------ ------------ ----------     ---- -------------
OSPool       OK                Healthy      False        False      127.9 GB      21.81 GB
```

Gather UpdateApp and verify it works

Start `diskpart` so you can mount MainOS:

```
list volume
# select the volume called MainOS
select volume 42
# assuming M: is free
assign letter=m
exit
```

From the MainOS partition, go and hunt down the following files and drop them in a standalone folder (for example, `X:\WCOS\Tools`):

\Windows\Servicing

- UpdateApp.exe
- CbsApi.dll
- CbsMsg.dll

\Windows\System32

- CbsCore.dll
- DrvServicing.dll

- IUSpaces.dll
- IUSpaces_vb.dll (copy and rename IUSpaces.dll)
- UpdateAPI.dll
- cimfs.dll
- cmiadapter.dll
- cmiaisupport.dll
- cmintegrator.dll
- dpx.dll
- drvstore.dll
- msdelta.dll
- mspatcha.dll
- mspatchc.dll
- turbostack.dll
- wcp.dll
- wdscore.dll

Run `cmd.exe` as administrator, go to the tool directory, and try getting the installed packages on the image:

```
cd /d X:\WCOS\Tools
updateapp getinstalledpackages
```

The result should look a lot like the following:

```
UpdateApp - Update Application for Windows Mobile
[00:00:00] Loaded servicing stack from X:\wcos\tools with session name IUPackageInfoSession_EFIESP
[00:00:00] External storage staging directory is: (null)
[00:00:00] Closing session IUPackageInfoSession_EFIESP
[00:00:00] Loaded servicing stack from X:\wcos\tools with session name IUPackageInfoSession_MainOS
[00:00:00] External storage staging directory is: (null)
[00:00:01] Closing session IUPackageInfoSession_MainOS
164 packages:
Microsoft-OneCore-HyperV-Guest-UpdateOS-Package~31bf3856ad364e35~amd64~en-US~10.0.19563.1000, UpdateOS
Microsoft-OneCore-HyperV-Guest-UpdateOS-Package~31bf3856ad364e35~amd6410.0.19563.1000, UpdateOS
Microsoft-OneCore-ServicingStack-UpdateOS-Package~31bf3856ad364e35~amd6410.0.19563.1000, updateos
Microsoft-OneCore-ServicingStack-UpdateOS-UX-Package~31bf3856ad364e35~amd6410.0.19563.1000, updateos
Microsoft-OneCoreUpdateOS-Product-Package~31bf3856ad364e35~amd64~en-US~10.0.19563.1000, updateos
Microsoft-OneCoreUpdateOS-Product-Package~31bf3856ad364e35~amd6410.0.19563.1000, updateos
Microsoft-Windows-OneCoreUpdateOS-ImageCustomization-Package~31bf3856ad364e35~amd64
10.0.19563.1000, updateos
```

```
Microsoft-Composable-ModernPC-BootEnvironment-Core-CodeIntegrity-Sbcp-Package~31bf3856ad364e35~amd6410.0.19563.1000, EFIESP
Microsoft-OneCore-BcdBootoption-Package~31bf3856ad364e35~amd64~~10.0.19563.1000, EFIESP

    [...]

getinstalledpackages completed successfully
command took 7 seconds
```

If it does, congratulations! You can move on to the next step.

Inject graphics and network drivers

For this example we'll show the Intel HD Graphics driver, but you might need to add more INFs depending on your hardware. If you can't find the right INFs, why are you even doing this?

Place extracted Intel drivers in a directory, so that you have e.g. `X:\WCOS\DHCUDrivers\Graphics\iigd_dch.inf`. Open `iigd_dch.inf`, and note down the values for 'Provider' and 'DriverVer'. For me, those were:

```
Provider=%Intel%
DriverVer=08/23/2019,26.20.100.7158
```

The provider name is an indirected variable here, so we go and find what `%Intel%` meant as well. A bit below in the INF, we find the following:

```
Intel        = "Intel Corporation"
```

Good! Now, invoke `updateapp` with the data we've just discovered to install the INF to the BSP partition in your WCOS image:

```
updateapp install "DriverPackage|X:\WCOS\DHCUDrivers\Graphics\iigd_dch.inf|Intel_Corporation-iigd_dch.inf~amd64~26.20.100.7158~bsp|0"
```

Note the recurrence of `Intel_Corporation` and `26.20.100.7518`. The installation process will complain with an error code of `c0880005` if you get the 'keyform' wrong.

The general rule for inf file names and provider names in the 'keyform' is the following:

- Any space in the inf name or the provider name must get replaced by an underscore '_'
- Any dash in the inf name or the provider name must get replaced by an underscore '_'

After you've installed your favorite driver packages, we can prepare the utility flash drive.

Make a utility flash drive

Gather the following assets into a directory we'll label `X:\WCOS\UtilityDrive\Boot`:

- From an ISO of Windows 10 19559 AMD64 (or higher - see UUPDump or similar for generating these):
  - boot\
  - EFI\
  - sources\boot.wim
  - bootmgr.efi
- For later servicing, your WCOS\Tools folder. **Use a hex editor to replace any mention of the Unicode string `X:\Windows` in UpdateAPI.dll and UpdateApp.exe with something like `X:\Wbndows`, or expect any servicing tasks to fail.**
- An x64 EFI shell. **Rename EFI\boot\bootx64.efi to EFI\boot\winx64.efi, and name the shell as EFI\boot\bootx64.efi.** You'll **need** the shell in order to ***ever*** boot regular Windows again (including PE).
- A file called `startup.nsh` in the root:

  ```
  dmpstore -d SecureBootPlatformID
  fs0:\efi\boot\winx64.efi
  fs1:\efi\boot\winx64.efi
  fs2:\efi\boot\winx64.efi
  fs3:\efi\boot\winx64.efi
  fs4:\efi\boot\winx64.efi
  fs5:\efi\boot\winx64.efi
  fs6:\efi\boot\winx64.efi
  fs7:\efi\boot\winx64.efi
  fs8:\efi\boot\winx64.efi
  fs9:\efi\boot\winx64.efi
  fsA:\efi\boot\winx64.efi
  ```

  If you are having troubles getting back to Windows PE/Windows Desktop, you may also try the following extra commands in startup.nsh: (**Warning**: these will kill every variables you have saved on your system)

  ```
  dmpstore -d -guid BA57E015-65B3-4C3C-B274-659192F699E3
  dmpstore -d -guid 77FA9ABD-0359-4D32-BD60-28F4E78F784B
  ```

```
dmpstore -d -guid EAEC226F-C9A3-477A-A826-DDC716CDC0E3
```

- gdisk64.exe from GPT fdisk.
- ddrelease64.exe.

Partitioning

1. Connect your UFD.
2. Open `diskpart`.
3. `list disk`, `select disk` the **right disk, or you'll lose all data on it and will have to do a long partition scan to have any hopes of retrieving your data**, and `clean` + `convert gpt`.
4. `create partition primary size=5000`, `format fs=fat32 quick`, `assign letter=y` to make a bootable FAT32 partition.
5. `create partition primary`, `format fs=exfat quick`, `assign letter=z` to make an exFAT partition to house the VHDX.

Putting things in place

Place your boot drive directory on the drive you called `Y:`. `Dismount-VHD "X:\WCOS\Flash.vhdx` in your PowerShell to unmount the VHDX, and copy the VHDX to `Z:`. You should now have a tree structure similar to:

```
Y:\
    Boot\
    EFI\
    Sources\
    Tools\
    startup.nsh
Z:


Flash.vhdx
```

Eject and unplug the UFD.

Target work

Use your throwaway laptop or other modern enough system with *larger-than-128GB* system drive. **Make sure Secure Boot is off.**

Boot Windows PE

Boot it on the target. Really. Once you get into Setup, press `Shift-F10` to open a command prompt. Go back and open another, for good measure. Alt-Tab works for switching here.

Copy the VHD (destructive!)

Find out where your USB flash drive is mounted. This will involve doing a lot of the following:

```
C:
dir
D:
dir
E:
dir
F:
dir
```

Here, we'll assume the *boot* volume is D: and the volume with Flash.vhdx is E:.

Open `diskpart`, and attach the VHD:

```
select vdisk file=E:\flash.vhdx
attach vdisk readonly
# wait a minute or so
list disk
# if MainOS etc. show up as online, good!
```

Note down the ID of a 2048 MB disk with a 2048 MB free space, and subtract 1 from it.

```
  # note: there's no 16
  Disk 17   Online        2048 MB  2048 MB
```

The ID to note down, therefore, is 16. Also, note down the ID of the target disk (3 in this case).

Wipe it. Yes. That's data loss for you. **Make sure you've got backups of anything important on there.**

```
select disk 3
clean
convert mbr
```

```
exit
```

(replacing `3`)

Copy the VHDX's content to your disk:

```
E:\Tools\ddrelease64 if=\\.\physicaldrive16 of=\\.\physicaldrive3 bs=8M --progress
```

(replacing `16` and `3`)

... and go have a hot beverage while waiting for this to hit 131072M.

Rebuild the GPT (for 512-byte disks only)

You probably have a 512-byte disk, so you're going to have to rebuild the GPT. Yay!

Run commands along the following:

```
> E:\tools\gdisk64 -l \\.\physicaldrive16
[..]
Number  Start (sector)    End (sector)  Size       Code  Name
   1             512            8703   32.0 MiB    EF00  BS_EFIESP
   2            8704       33554426   128.0 GiB   4202  OSPool
```

Remember the numbers (start, end, code and name) for each partition. Multiply the numbers by 8 (since 4K/512 = 8) - so you get 4096, 69624, etc.

Now, we'll create a new GPT for the target disk:

```
E:\tools\gdisk64 \\.\physicaldrive3
# accept any warning
x
z
E:\tools\gdisk64 \.\physicaldrive3


# accept the warning
```

n
1
4096
69631
EF00

n
2
69632
268435415
4202

c
1
BS_EFIESP

c
2
OSPool

p

check if it makes sense - matches the above but with different sector numbers

w

Exit all open windows, and your system should reboot.

Boot Windows PE, again

Boot into Windows PE again - not the internal disk you just overwrote. Verify in `diskpart` if you can `list volume` and it'll show MainOS etc. without you having attached the VHD.

Remove WCOS Security

In Windows PE, open `diskpart` and do `select volume`. Find the volume named `ÈFIESP` we will assume here its volume id is 6, yours may be different. Then we run `select volume 6` and `assign`. Do `list volume` again to find the drive letter of EFIESP, in our case it's `E:`, yours may be different.

Delete the following file: `del E:\efi\Microsoft\Boot\SecureBootPolicy.p7b`

You may additionally replace `winsipolicy.p7b` with the one from a desktop sku (the file is located in the same folder).

Boot W10X

OK, now you can boot your internal disk. If you haven't followed the Remove WCOS Security instructions, this will set a Secure Boot policy value, however, so you'll have to boot your utility flash drive again if you want to boot any other Windows media (or otherwise execute the `dmpstore` command).

If everything's right, you should be booting into Windows 10X, and your graphics adapter might even be working.

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