WES 7/8 and Windows Embedded 8.x Industry Device Driver Integration Techniques

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Getting the device drivers working in the OS image is one of the first steps to Windows Embedded development. Once the device drivers are in place, the rest of the project can proceed. This paper looks a couple of techniques that can assist with driver integration and reducing image size.

Capturing Drivers

Capturing device drivers and placing them in the Distribution Share or in a Module is a critical part in automating the operating system installation process. It is also time consuming to track down every driver. There are two options to getting the drivers needed for the system. The first is to get it from the board vendor. The drivers can be extracted and placed in the Out-of-Box folder (WES7) or into a module (WE8S). The second option is to enable Windows Update on the target. Windows update can pull down the drivers from Microsoft, which will be placed in the driver store. Once in the driver store, "C:\Windows\System32\DriverStore\FileRepository", you can then copy the drivers and place them in the Distribution Share or Module. The second option can be a little faster:

1. Install the OS on the target system, but don't have it connected to the Internet. For WES7 install Windows 7 or WES7 from IBW. For WE8S, install Windows 8 or WE8S from IBW. For WEI 8.x, just install WEI.
2. On the target system, open File Explorer
3. Go to the C:\Windows\System32\DriverStore\FileRepository and sort the files by date with the latest at the top of the list.
4. Note the date and time of the top most file.
5. Connect the computer to the Internet.
6. In Control Panel, enable Windows Update and do an update.
7. Windows Update will find the latest updates that will include device drivers. Select all drivers including those that are optional.

☑ Security Update for Windows 8.1 (KB2962140)	1.6 MB	
☑ Update for Microsoft Camera Codec Pack for Windows 8.1 (KB2899189)	6.9 MB	
☑ Update for Windows 8.1 (KB2894853)	3.6 MB	
☑ Update for Windows 8.1 (KB2933809)	1.8 MB	
☑ Update for Windows 8.1 (KB2939087)	900 KB	
☐ Windows 8.1 Update (KB2919355)	74.0 MB	
☑ Windows Malicious Software Removal Tool for Windows 8 and Windows 8.1 - April 2014 (KB890830)	24.7 MB	
Windows 8.1 Drivers (6)		
☑ Broadcom Corporation driver update for Dell Wireless 380 Bluetooth 4.0 Module	1.1 MB	
☑ DELL INC - Other hardware - Airplane Mode Switch	26 KB	
☑ Intel - Other hardware - Intel(R) Active Management Technology - SOL	22 KB	
☑ Intel - Other hardware - Intel(R) Management Engine Interface	69 KB	
☑ Intel Corporation - Graphics Adapter WDDM1.1, Graphics Adapter WDDM1.2, Graphics Adapter WDDM1.3 - I...	53.6 MB	
☑ Intel driver update for Intel(R) Centrino(R) Ultimate-N 6300 AGN	2.2 MB	

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Select the updates you want to install

	☑ Name	Size
Important (16)	Windows 8.1 Drivers (1)	
Optional (1)	☑ Intel - LAN - Intel(R) 82579LM Gigabit Network Connection	235 KB
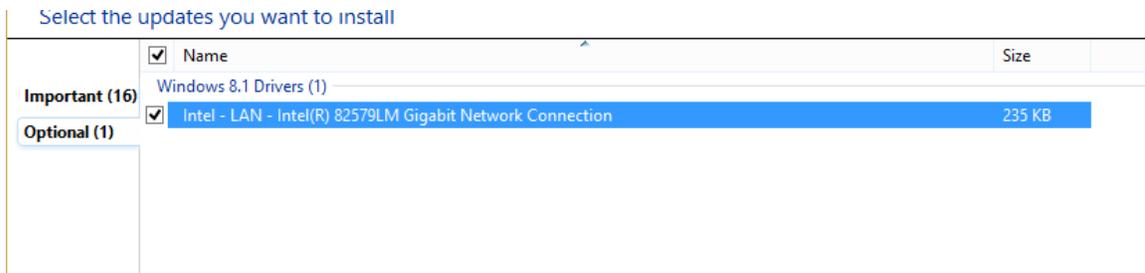
8. Install the driver updates.
9. Reboot the system when asked.
10. On the target system, open File Explorer.
11. Go to the C:\Windows\System32\DriverStore\FileRepository and sort the files by date with the latest at the top of the list.

Name	Date modified	Type
netwen00.inf_x86_690add4d0096ba21	5/5/2014 1:48 PM	File folder
heci.inf_x86_88551c2afe06d607	5/5/2014 1:48 PM	File folder
e1c6332.inf_x86_b879e7b0936a5090	5/5/2014 1:48 PM	File folder
intelaud.inf_x86_02a23bd7f2a91025	5/5/2014 1:48 PM	File folder
iwdbus.inf_x86_9f799646119a1ac5	5/5/2014 1:48 PM	File folder
igdlh.inf_x86_cfce9b2e51f88ad5	5/5/2014 1:48 PM	File folder
bcbtums-win8x86-brcm.inf_x86_be808c92ab9ba9b7	5/5/2014 1:47 PM	File folder
bth.inf_x86_71d7c12bd50d5232	5/5/2014 1:47 PM	File folder
bthleenum.inf_x86_6e2db489ce72164e	5/5/2014 1:47 PM	File folder
bthpan.inf_x86_021f5ac2bdfd0ff4	5/5/2014 1:47 PM	File folder
tdibth.inf_x86_915b458c54135a57	5/5/2014 1:47 PM	File folder
dellrbtn.inf_x86_0f6ef9155758a779	5/5/2014 1:47 PM	File folder
input.inf_x86_a1d66c261a93ef6c	5/5/2014 1:47 PM	File folder
mesrl.inf_x86_ac0930781d75d118	5/5/2014 1:47 PM	File folder
wpdfs.inf_x86_d67a8256c1147128	5/5/2014 1:45 PM	File folder
monitor.inf_x86_009a4a79b658e2d7	5/5/2014 1:43 PM	File folder
nvstusb.inf_x86_4062adbc825e3c5c	5/5/2014 1:25 PM	File folder
nvhda.inf_x86_54caabafe3d65327	5/5/2014 1:25 PM	File folder
nettun.inf_x86_0568b6bd639e2e28	5/5/2014 12:30 PM	File folder
netvwifimp.inf_x86_5521d0bcf2c99b72	5/5/2014 12:29 PM	File folder
wdmaudio.inf_x86_e7ccd91d9274a785	5/5/2014 12:26 PM	File folder
display.inf_x86_60e3b5d4c6737a57	5/5/2014 12:26 PM	File folder
hdaudio.inf_x86_9e8e7d1d7cd54532	5/5/2014 12:26 PM	File folder

12. Using the previous the date noted in 4 above, copy all folders that come after that date and place them on a USB flash disk. You can now add them to the distribution share or module.

It is important to note that these might not be the latest drivers from their respective manufacturers, but you can track the latest drivers now that you have a working set of drivers.

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Driver File Reduction

What if you decided to go with option 1 and get the latest drivers from the manufacturer? This is the choice that is typically made, but there is one thing to look out for. Even though disk drives get bigger and cheaper, there are still embedded products with frugal hardware budgets that require going with smaller cheaper drives. Starting with WES7 (and especially 64-bit builds), the OS image sizes are much bigger than the images produced with Windows XP Embedded. Every opportunity to save space is important. One technique is to reduce the number of device drivers in the DriverStore.

WES and WEI make it very easy to add device drivers to the image. Without knowing it, you could be adding to the image size. The following example will use a RealTek audio driver as an example. The driver comes with several INF files so Windows can automatically install the driver. In this case, there are 33 different INFs.

New folder

alcrmv.exe	Alcxau18.inf	RtkPgExt.dll
Alcxau.inf	Alcxau19.inf	RTKVAC.sys
Alcxau0.inf	Alcxau20.inf	RtlCPAPI.dll
Alcxau1.inf	Alcxau21.inf	RTLCPL.exe
Alcxau2.inf	Alcxau22.inf	SoundMan.exe
Alcxau3.inf	Alcxau23.inf	
Alcxau4.inf	Alcxau24.inf	
Alcxau5.inf	Alcxau25.inf	
Alcxau6.inf	Alcxau26.inf	
Alcxau7.inf	Alcxau27.inf	
Alcxau8.inf	Alcxau28.inf	
Alcxau9.inf	Alcxau29.inf	
Alcxau10.inf	Alcxau30.inf	
Alcxau11.inf	Alcxau31.inf	
Alcxau12.inf	Alcxwdm.cat	
Alcxau13.inf	Alcxwdm0.cat	
Alcxau14.inf	ALSndMgr.cpl	
Alcxau15.inf	ALSNDMGR.WAV	
Alcxau16.inf	ChCfg.exe	
Alcxau17.inf	RtkAPO.dll	

During installation of the operating system, each instance of the INF will be placed in the driver store c:\Windows\System32\DriverStore\FileRepository. Just looking at the driver store size, the result is 1.17GB.
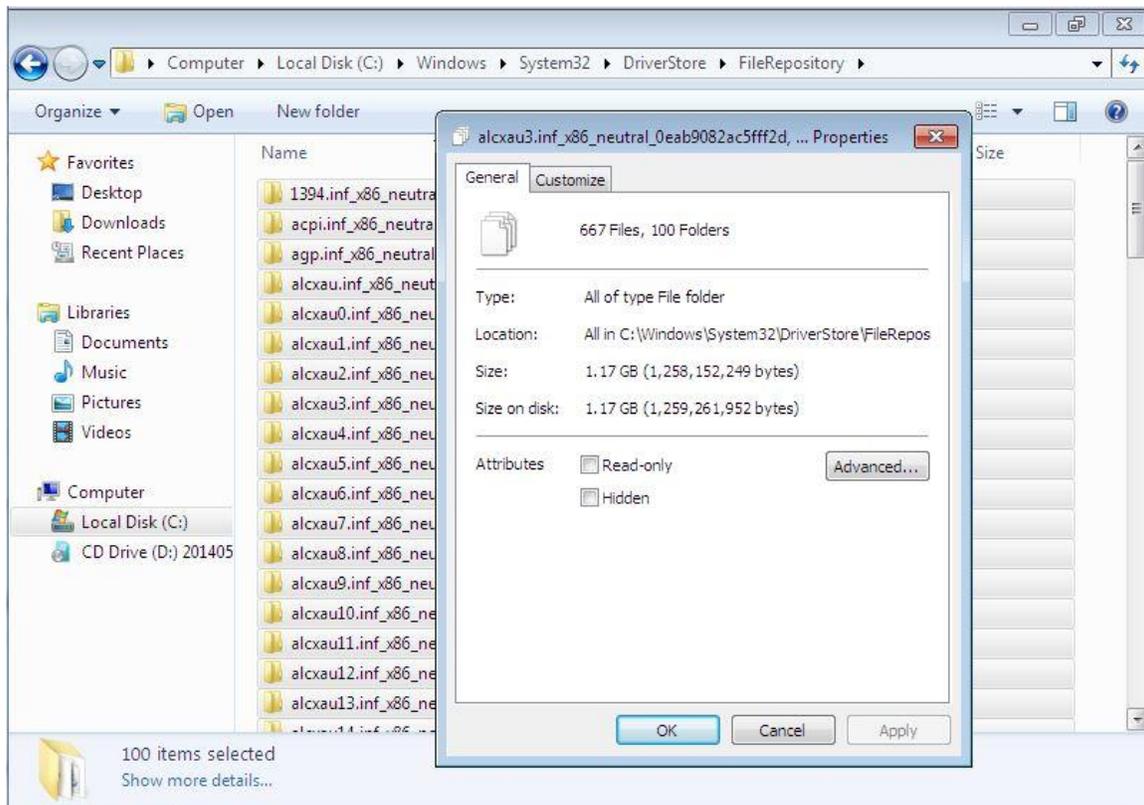
Next, looking at the 33 instances of the audio driver, the size they contribute is 1.15GB, which is very large amount.
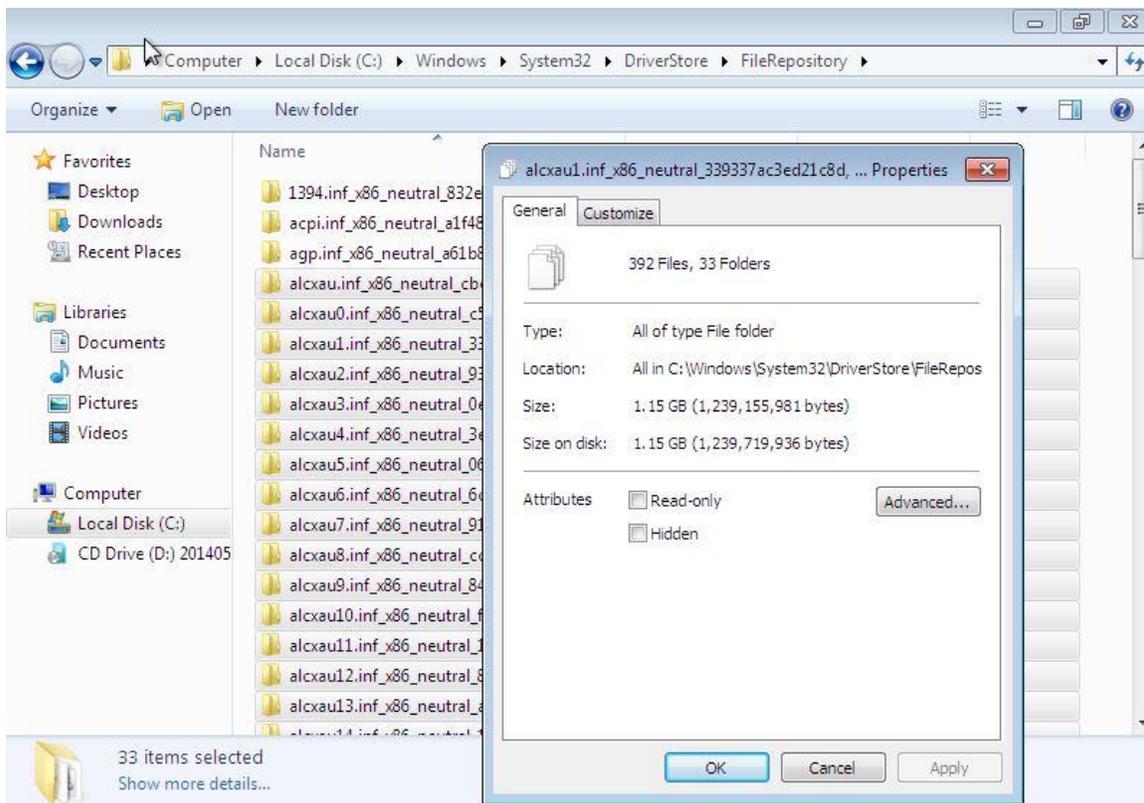
Each audio folder contains 1 INF and a copy of the driver files, which adds up 36.7 MB. Multiply 36.7 MB times 33 and you will get the 1.15GB.
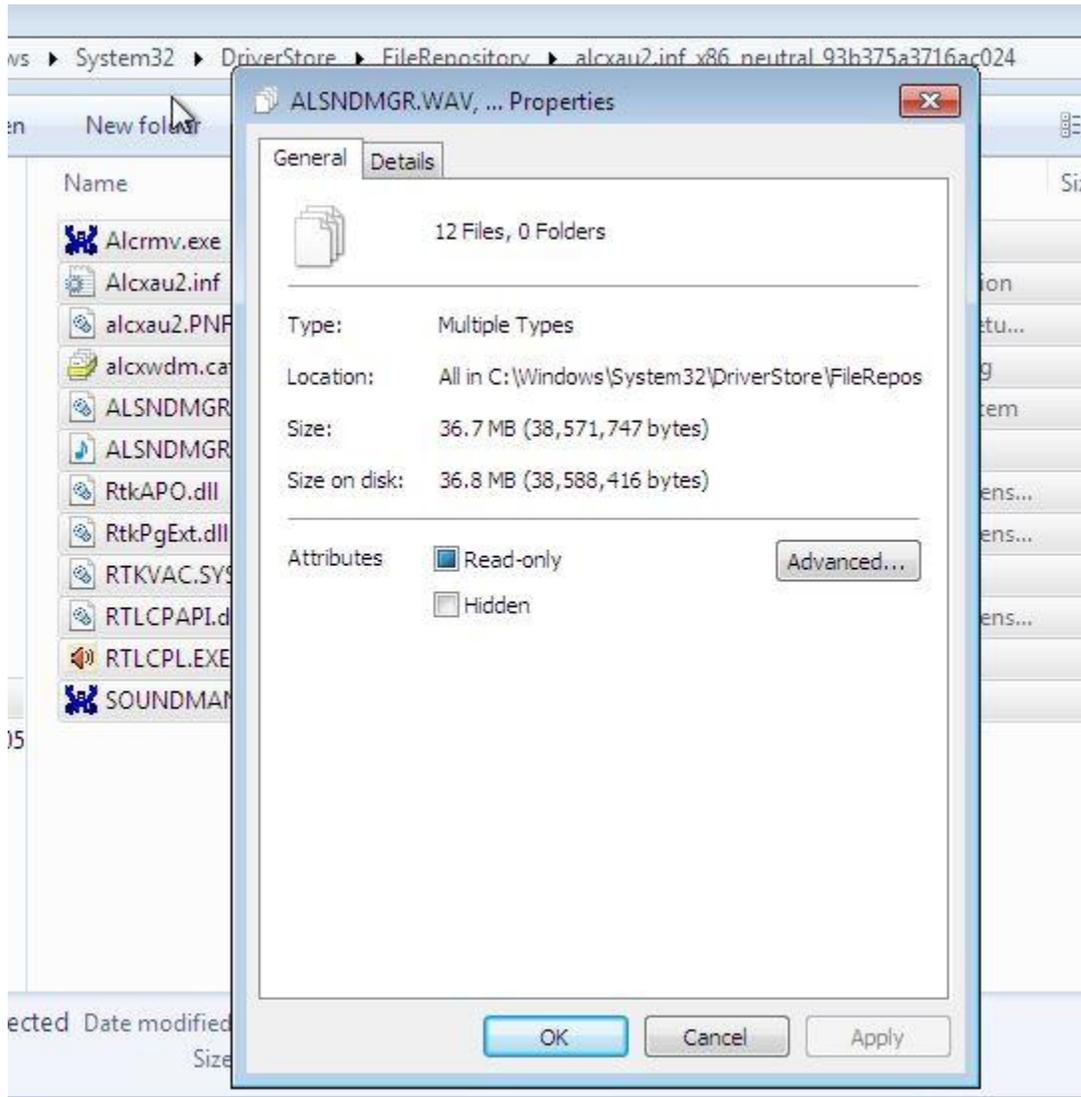
Is 33 copies really necessary for an embedded system or even a desktop? Unless, you are attempting so support different platforms, the answer is no. The multiple INF files contain different PnP IDs to match different chip PnP IDs. You can reduce the footprint by focusing on only the single PnP ID for your system. Using Device Manager, you can look at the device driver that gets installed and determine the PnP ID for the chip in your system.
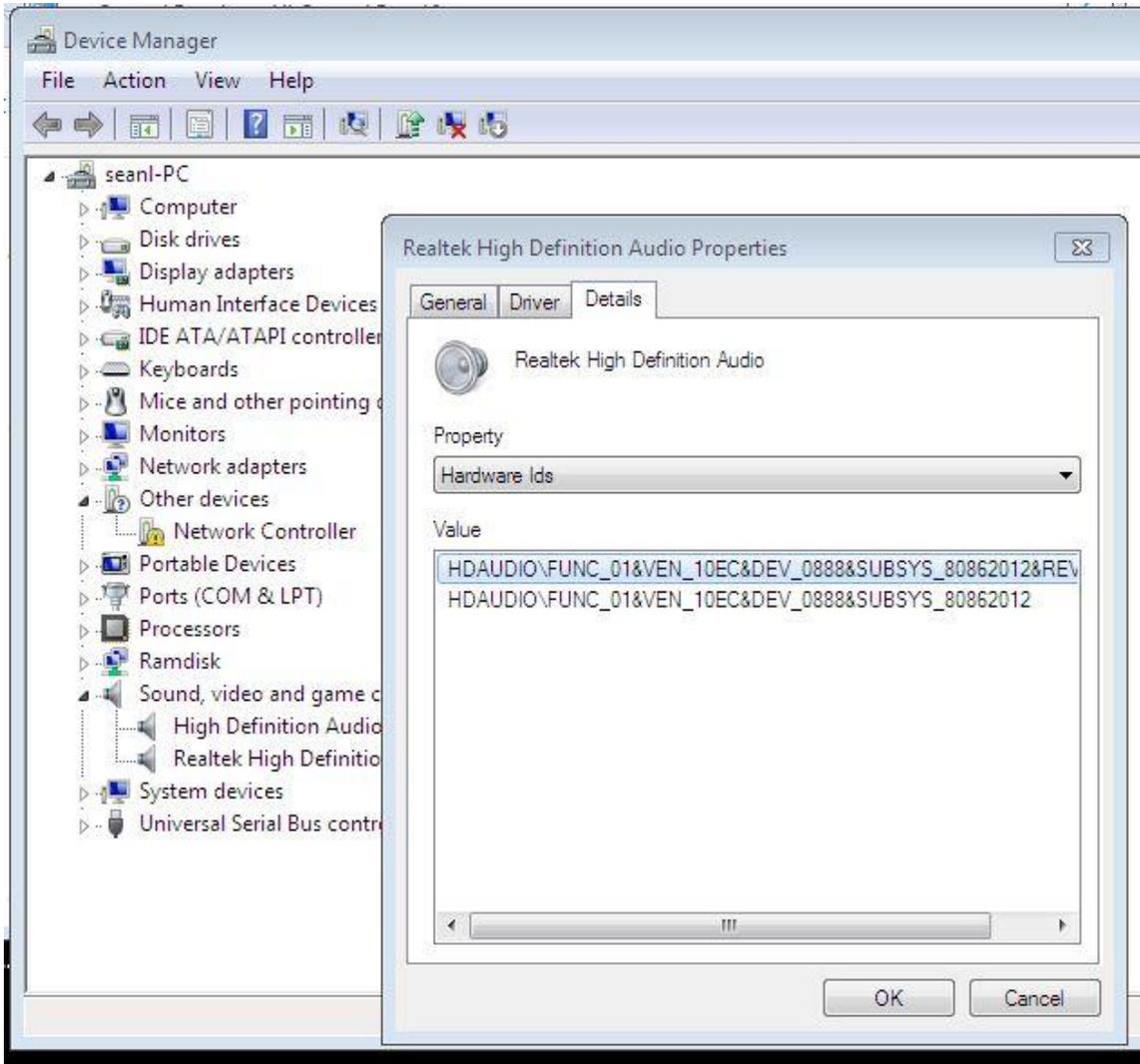
Using this information, search for the PnP ID in the INFs using "find in file" in File Explorer. In general, only look for a PnP ID based on PCI\VEN_####&DEV_###. For this specific case, look for only HDAUDIO\FUNC_01&VEN_####&DEV_####. The SUBSYS numbers can be ignored.
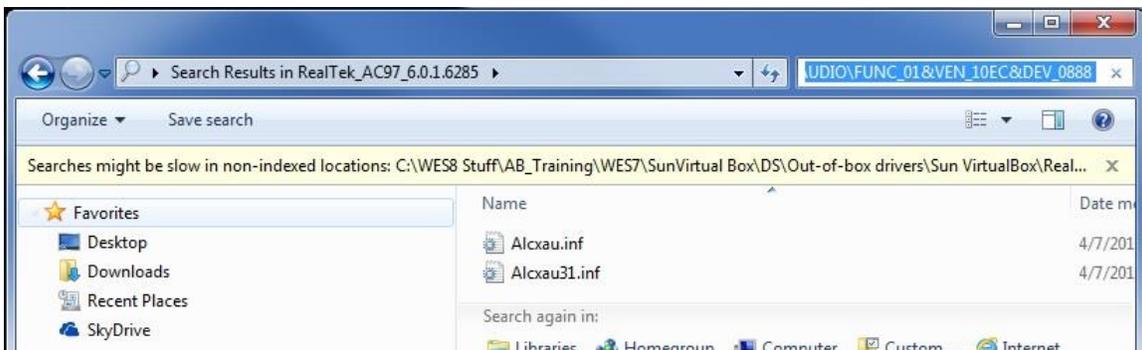
Once you find an INF file containing the PnP ID, you can delete the rest of the INF files.
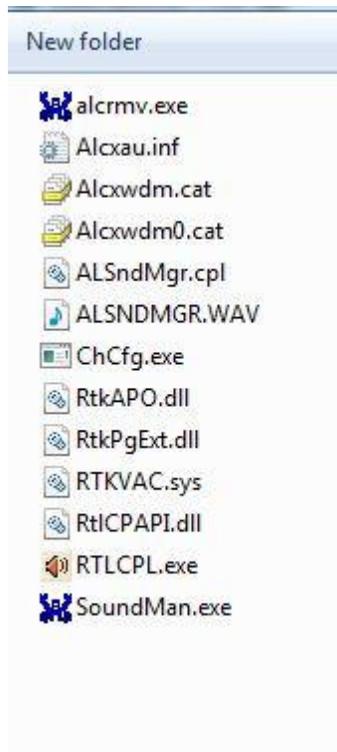
The resulting driver store will have only once instance of the driver, and the correct INF for the platform. In this example, the resulting space is 1GB less than before.
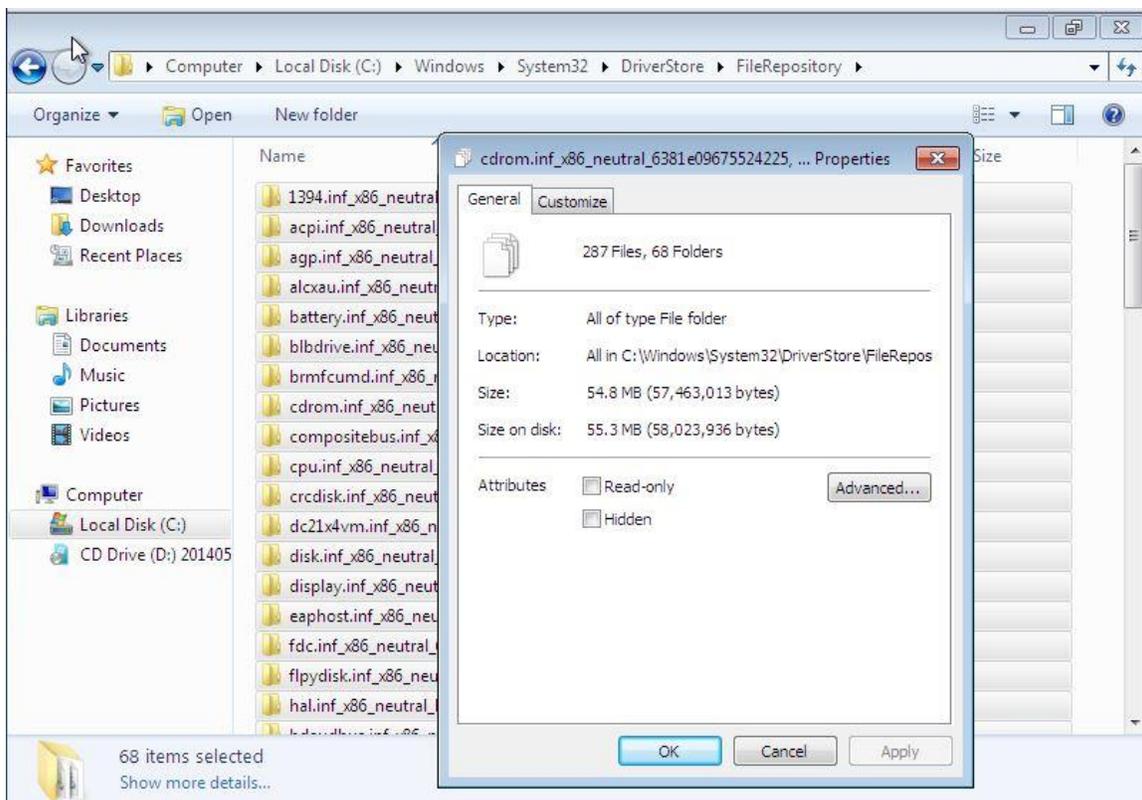
This was for only one device driver. Take into account other drivers like video and Ethernet; and using this technique, you can save yourself some space.