Xen Project Windows PV Drivers

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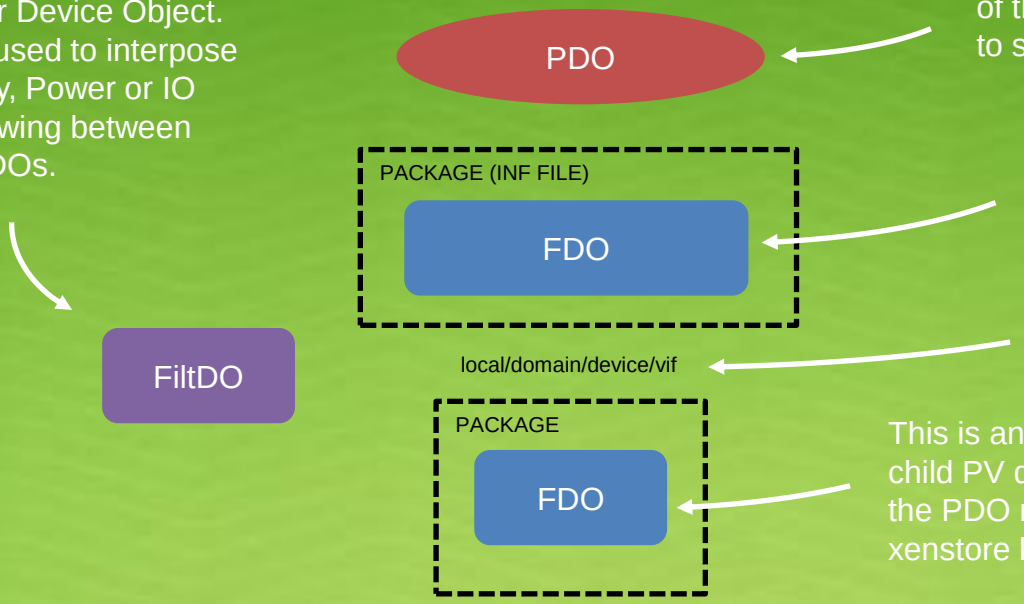
Agenda

- Background
  - Origin of the drivers
  - Legacy, Standard and XenProject drivers
- Driver interfaces
  - Discovery
  - Compatibility
- Building and Installing drivers
  - Tools

Terminology

This is a Filter Device Object. They can be used to interpose on Plug'n'Play, Power or IO messages flowing between PDOs and FDOs.



This is a Physical Device Object, created by a bus driver. The 'name' of this device is used by Windows to select a driver.

This is a Function Device Object, created when a driver binds to a Physical Device Object. The INF file states the 'names' it will bind to.

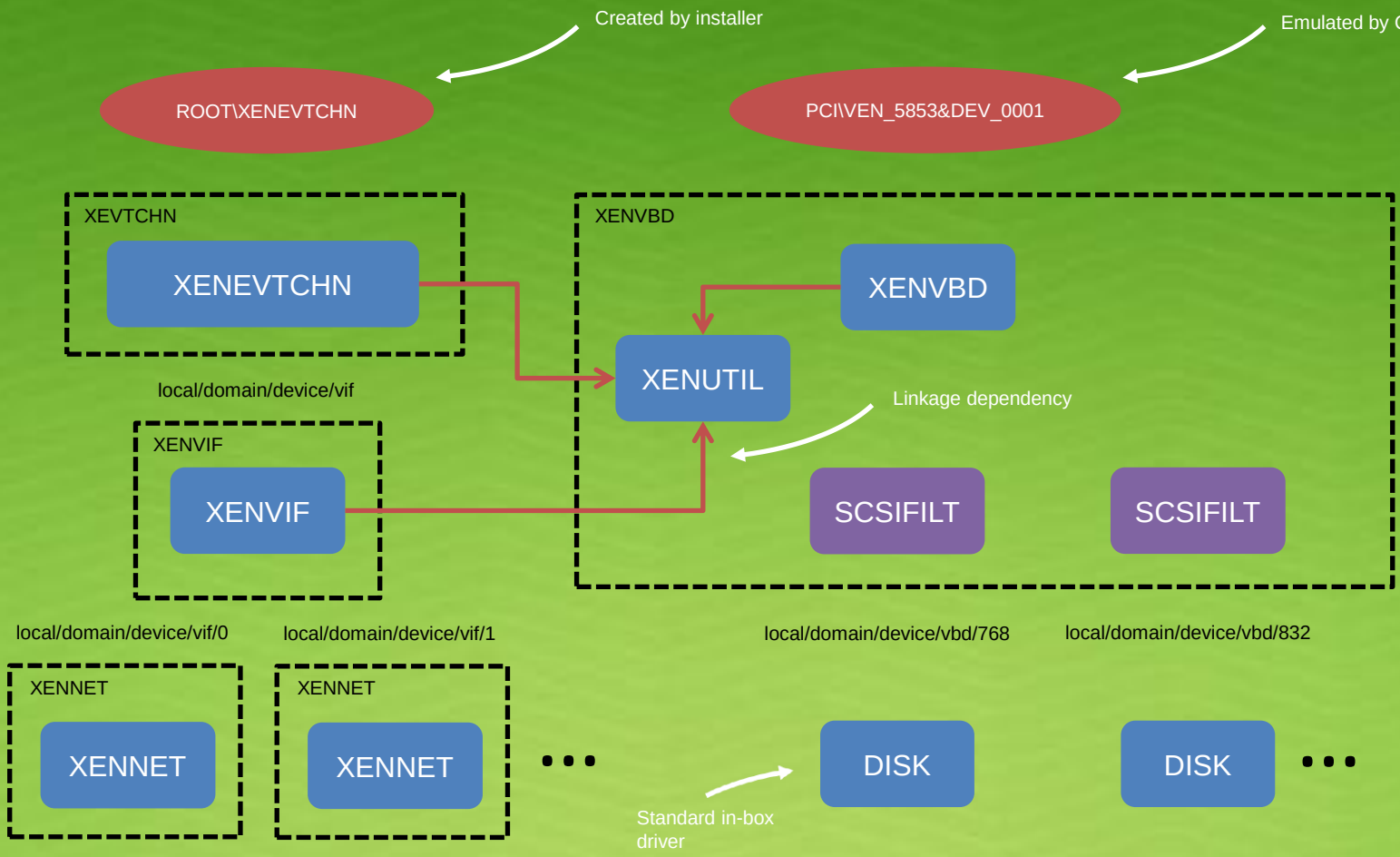
This is a xenstore key that is used by a PV bus driver to create a PDO.

This is an FDO created by a child PV driver that binds to the PDO representing the xenstore key.

Legacy Drivers

- Used for all versions of Windows in Citrix XenServer 6.0
- Used only for Windows XP and Server 2003 from XenServer 6.1
- Closed source
  - Code of unknown origin made open source difficult

Legacy Drivers



- XENIFACE omitted for simplicity

Legacy Drivers

Problems:

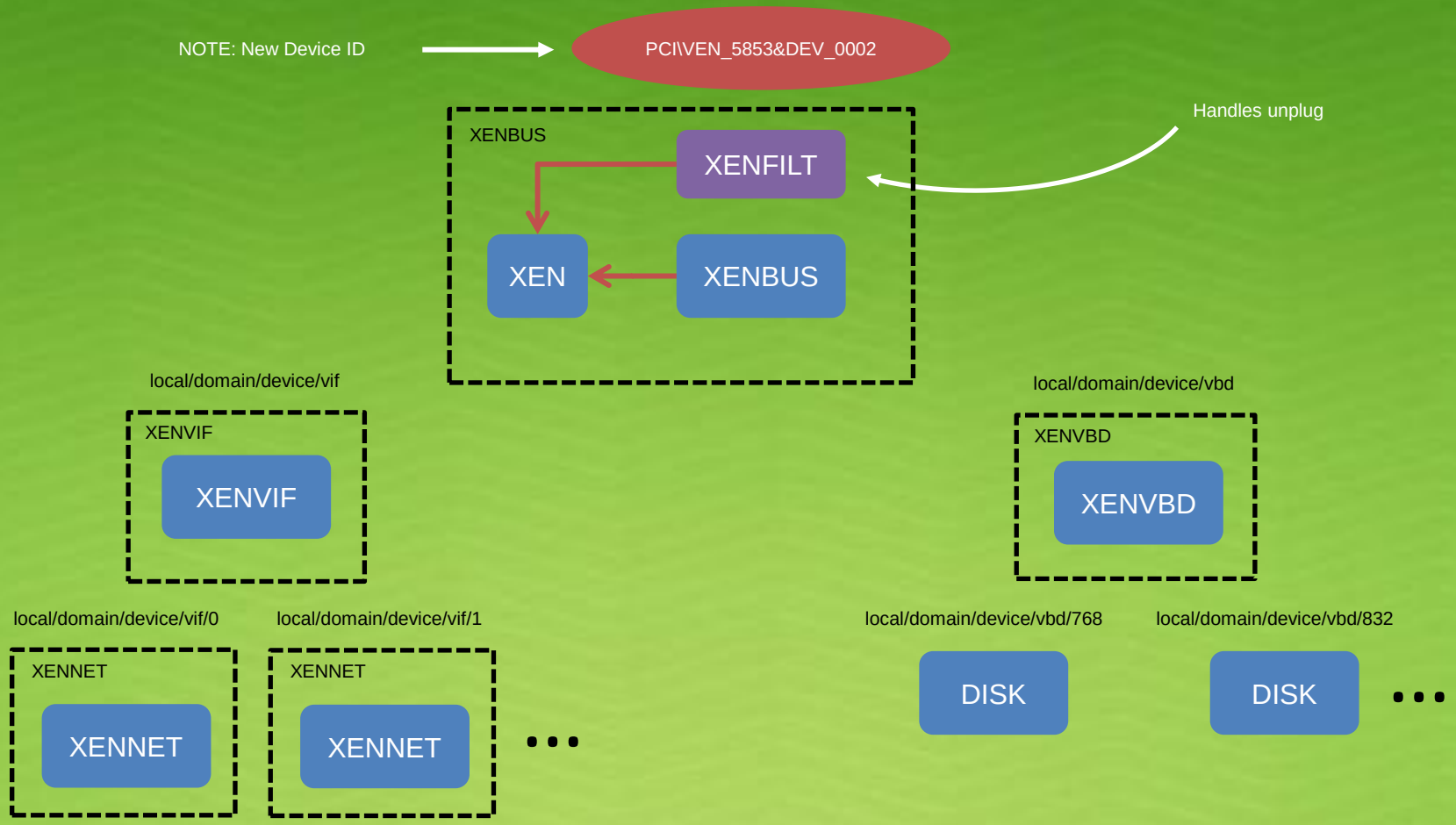
- SCSIFILT makes storage stack complicated
- Cross-package linkage dependencies make upgrade very tricky
  - Binary incompatibility can lead to hard-to-diagnose BSODs
- Two root nodes make load order unpredictable and initialization of PV interfaces very fragile
- Use of synthetic root node requires an installer
  - Windows Update cannot be used to deploy

"But Windows Update would be very useful for large installations or upgrades so that's a pain. What can we do?"

Standard Drivers

- Used for versions of Windows from Vista onwards from XenServer 6.1
- Built using Windows 8 WDK and Visual Studio 2012
  - Necessary for supporting Windows 8 onwards
- Anticipated to become open source
  - All code of unknown origin was removed

Standard Drivers



- XENIFACE omitted again for simplicity

Standard Drivers

Advantages:

- STORPORT instead of SCSIPORT
  - No need for SCSIFILT
- Independent packages
  - No binary compatibility issues
  - No installation ordering issues
- Just PCI root node
  - Windows Update now possible

Standard Drivers

Problems:

- New Device ID
  - Conceived to allow Windows Update deployment, but…
  - Caused big problems in XenServer 6.1
  - Not acceptable to upstream community (e.g. Amazon)
- Compatibility checks don’t behave well
  - Still an assumption that drivers will be installed or upgraded together

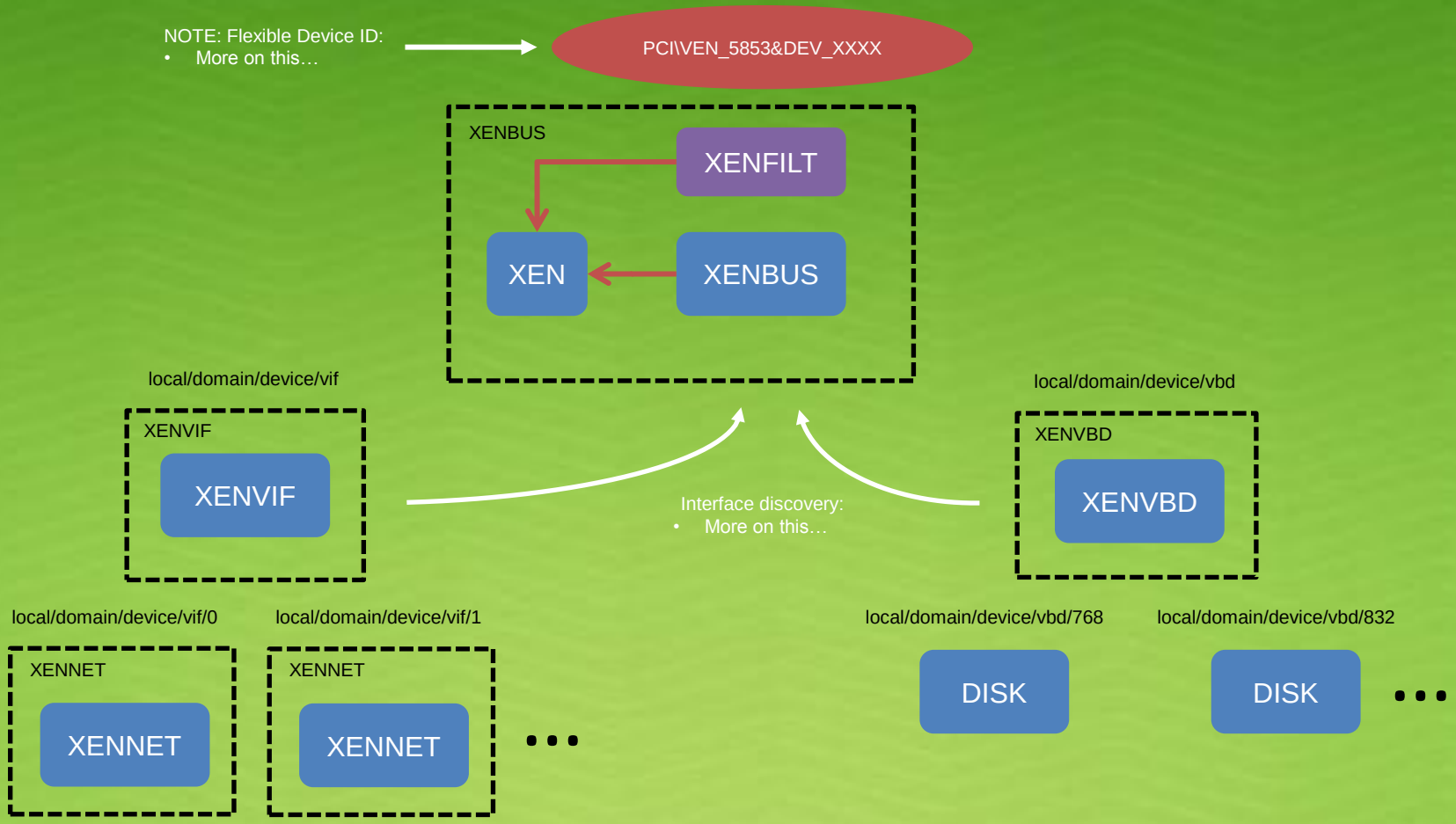
Xen Project Drivers

- XenServer went fully open source in 2013
- Desire for Windows PV drivers to become even more open
  - Drivers already functioning on most Xen installations
  - Amazon already building from source
- Windows PV Drivers sub-project ratified in June 2014
  - Front page accessible from http://www.xenproject.org
  - Source repositories at http://xenbits.xenproject.org
  - Project lead: Paul Durrant
  - Committers: Paul Durrant, Ben Chalmers and Owen Smith

Xen Project Drivers

- Plan to use for all versions of Windows from XenServer vNext
  - Windows 2003 goes out of support in May 2015
- Built using Windows 8 WDK and Visual Studio 2012
  - Cannot move to 8.1 WDK as Windows 7 is not supported
  - Source is buildable with 8.1 WDK and Visual Studio 2013
- Remaining problems from Standard Drivers addressed

Xen Project Drivers

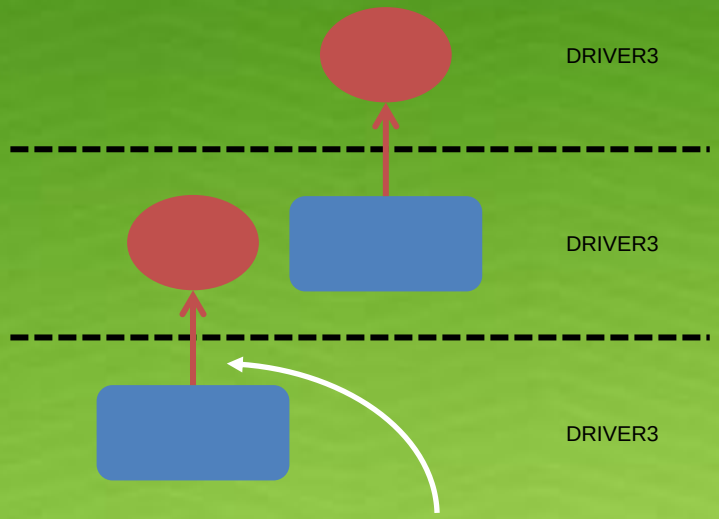


- XENIFACE still omitted for simplicity

Flexible Device ID

- XENBUS binds to any of these
- Co-installer selects ‘active’ device
  - Will only select if there’s no current selection
  - Only active device has children
    - Child PDO name carries device ID
- XenServer has reserved C000 for Windows Update

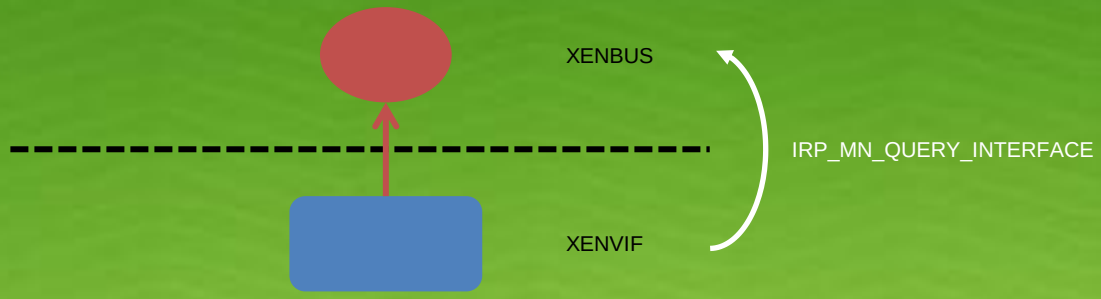
Interface Discovery



- `IRP_MN_QUERY_INTERFACE` message
  - Identifies interface by GUID
  - Gets back jump table and context

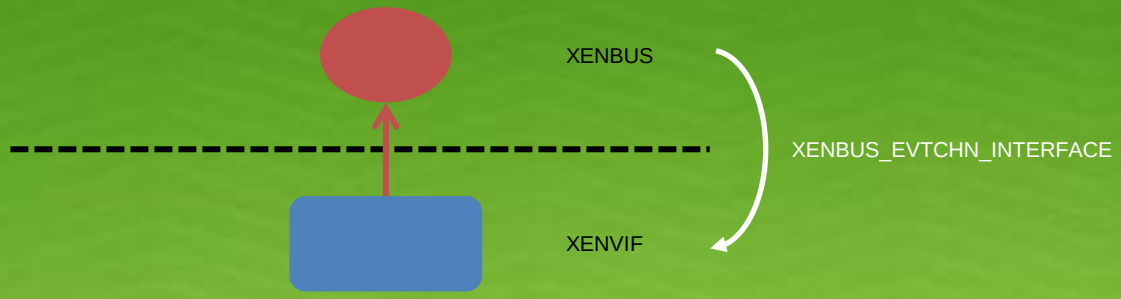
- Message may be forwarded to parent if interface not implemented
  - Client doesn't care where the interface is implemented
  - Allows interfaces to be exported by XENFILT
    - Unplug

Interface Discovery Example



- XENVIF codebase imports `evtchn_interface.h` from XENBUS
- XENVIF allocates a `XENBUS_EVTCHN_INTERFACE` structure and passes it to XENBUS in `IRP_MN_QUERY_INTERFACE` message
  - Always requests `XENBUS_EVTCHN_INTERFACE_VERSION_MAX`

Interface Discovery Example



- XENBUS fills in structure with requested interface version
- XENBUS completes IRP
- XENVIF calls `XENBUS_EVTCHN(Acquire, …)`
  - Acquisition not implicit in query
    - References must be dropped across S4 transition (Hibernate)
    - `IRP_MN_QUERY_INTERFACE` must be issued at `PASSIVE_LEVEL`

Interface Discovery Example

Compatibility:

- XENVIF binds to a particular PDO revision
  - Each PDO revision maps to a set of interface versions
- XENVIF **subscribes** to interface
  - Co-installer writes version to `HLKM/CurrentControlSet/Services/XENBUS/Interfaces/XENVIF/EVTCHN`

- XENBUS maintains compatibility
  - Change of interface version implies updated binding revision
    - Subscribers don't need to be concerned with older versions of providers
  - Co-installer checks subscribers and vetoes upgrade if interface versions are not implemented
    - Ensures subscribers are updated before providers

Available Interfaces

- XENFILT
  - UNPLUG
  - EMULATED
- XENBUS
  - DEBUG
  - SUSPEND
  - SHARED_INFO
  - EVTCHN
  - STORE
  - RANGE_SET
  - CACHE
  - GNTTAB
- XENVIF
  - VIF

Building

- BUILD.md should tell you want you need to know
- Pre-requistes
  - Visual Studio 2012 (**NOT** Express) or 2013 (Express OK)
  - Windows 8 or 8.1 WDK
    (See http://msdn.microsoft.com/en-us/windows/hardware/hh852365)
  - Python 3.x
- Set environment
  - KIT — Usually C:\Program Files\Windows Kits\8.0
  - SYMBOL_SERVER — I use C:\Symbols
- `build.py free|checked [nosdv]`
- Latest development builds available for download:
  (See http://www.xenproject.org/downloads/windows-pv-drivers/development-builds.html)

Installing

- INSTALL.md should tell you want you need to know
- Driver build results in directory and tarball
  - Copy to target (and unpack if necessary)
  - Navigate to x86 or x64
  - Either run `dpinst.exe` or use Device Manager
- Builds are test signed
  - Install .pfx file to avoid scary warning
  - Make sure testsigning is enabled on 64-bit systems

```
bcdedit /set testsigning on
```

Contributing

- See MAINTAINERS file
- Follow guidance at http://wiki.xen.org/wiki/Submitting_Xen_Patches
- Subscribe to mailing list win-pv-devel@lists.xenproject.org
  (See http://lists.xenproject.org/cgi-bin/mailman/listinfo/win-pv-devel)

Q & A