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To Q: or not to Q: That is the Question

App-V: VFS or MNT install

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To Q: or not to Q: That is the Question

... at least that is *one* question that often is discussed in an App-V environment.

While monitoring an application setup with the App-V Sequencer, you will have to decide if you install the application to the C: drive (the installer's default location) or to the Q: drive. Microsoft strongly recommends to always install to the Q: drive (an "MNT install"). However, many applications proved to work fine after they were installed to C: (a "VFS install"). This article discusses some of the myths and facts around that "C: vs. Q:" or "VFS vs. MNT" installations.

1 What's up with the Q drive?

Microsoft App-V is the only application virtualization solution I know that incorporates the concept of a virtual drive letter. On the client, the App-V Client software creates a new (virtual) drive that can be considered as the "mount point" for all virtual applications. Whenever a virtual application requests a file from the package, it will get this file finally from Q - even if the app requested the file from C.

Depending on the environment, sometimes another drive letter (sometimes the B: drive) is used by the App-V clients. This can be configured during the Client installation. If the preconfigured drive letter already is occupied (by Fixed Drives, Removable Drives but also by Network Drives), the App-V client will use another drive letter (starting close to "Q" in the alphabet). In order to reflect potentially different drive letters on the client, App-V applications can use the variable %SFT_MNT%. This variable always point to the current virtual drive letter. Hence it can be used within virtual packages to be more flexible. If you try to resolve %SFT_MNT% on your App-V Client you have to enter a Virtual Environment: SFT_MNT is only visible there and points to "Q:" or whatever the actual drive letter is.

While "SFT_MNT" or "Virtual Drive Letter" would be the more general term, I'll stick to "Q:" here – simply because it's shorter.

Users may see the Q: drive on their clients (within Explorer) but it easily can be hidden by Group Policy. Neither users nor admins or the operating system (and other applications) do have access to Q: Only Virtual Applications (and tools that have been launched from within Virtual Environments) can read from Q:.

Each Virtual Package (like the OpenOffice Suite, certain Tools or Line-of-Business-Suites) has its own, dedicated "Primary Directory" that is located directly under Q:. Each of these folders is individual per-package: two packages cannot share the same Primary Directory. The App-V Clients throws an error if two different packages try that. In the "ancient days" (actually before SP1 for App-V 4.6)) this Primary Directory had to follow the "8+3" naming convention, but that's another story..

2 Install Directory and Primary Directory

During Sequencing, one or the other Sequencing Wizard Screen will ask you for the "*Primary Directory*". This is where the Sequencer will collect all files that have been added or modified during Sequencing, also it will use this directory for its own, internal files (like osguard.cp) and folders (like SoftgridUserSettings).

Depending on the Sequencer version, the Screen in question will prompt for "The primary directory the application was/will be installed to" before or after the actual monitoring.

The *Primary Directory* has to be on the Q: drive. There is no discussion about that.

The *Install Directory*, as referred to by this article, is the folder where you actually install the application to during Sequencing. You may be prompted by the application's MSI or Setup.exe or you may manually copy files to the Install Directory. Whether or not this will be a folder on the Q: or C: drive - this is what we're discussing here. If you install an application to C:, every file later on will be copied into the "VFS" (Virtual File System) folder under the Primary Directory. This sometimes is called a "VFS install". If you install the application to a folder within the Primary Directory, this is going to be a "MNT install", because the app is installed into the "Mount Point" (actually the Q: drive).

3 MNT vs. VFS: An Overview

Unlike I normally do, I'll start with the "overview" here and explain the details later on.

Let's start with a given statement: Microsoft *strongly* recommends installing applications to the Q: drive (hence perform an MNT install).

	MNT install (Q:)	VFS install (C:)
Official Statement	Recommended by Microsoft	Proven to be possible. Supported (but not liked) by Microsoft
Sequencing Performance	May allow faster Sequencing	May slow down Sequencing
Execution Performance	May run faster on Client machines	May result in slower applications
Installer Compatibility	Not possible with every installer	Possible with every installer
General Execution Compatibility	Medium: Some applications may not allow to be run from a drive different to C:	High: Most application allow to run from C: A very few applications will refuse to launch
Platform Compatibility (x86/x64)	High	Medium / High (uncertain)

Application Update Compatibility	High	High
Package Branching Support	Weak	High
DSC Conflict Prevention	High	Medium

4 VFS vs. MNT – Some Details

4.1 Official Statement

Microsoft (even more penetrative than Softricity) is pushing Sequencing Engineers to always install the application to Q:. In the 4.6 SP1 release of the Sequencer, a Balloon Message even states one "has to install the application into the Primary Directory" that is located on the Q: drive. The only real reason MS gives is "performance" (during sequencing and execution). However, MS "allows" to install applications to C: as well, namely if they can't be installed to another drive.

4.2 Sequencing Performance

If files are copied to the C: drive during installation, the Sequencer will create a copy of them in the Q: drive's VFS directory. If an installer created a lot of and/or large files on C:, the Sequencer will collect all of these files and copy it to another location (the Q: drive's VFS folder) afterwards. This additional copying is time consuming. This is especially true if the disk sub system is quite slow (sometimes for VMs) and if Anti-Virus software scans every written file.

If files are created on the Q: drive from the beginning, this additional copy will not occur. The Sequencing process is faster for an MNT install.

4.3 Execution Performance

An application that has been installed to C: is likely to request its file resources from C: as well. Registry values and INI files may point to C: and if the application was launched from (a virtualized) C: most of the files will be expected there (in the same folder or in relative sub folders). On an App-V Client, these files do not really exist on C: - they only appear to the application as if they were on C:. When an application requests a file from C:, the App-V Client will serve it from the client's Q:\PrimaryDirectory\VFS folder instead. This means, that for every file activity on C: the Client first has to determine if this file is part of the Virtual Environment (because is also may be part of the local file system) and then it has to "map" or "re-route" the request to Q:.

If the application was configured to run from Q:, these mappings are not required. The application requests files from Q: and immediately will receive them.

It sounds clear and there is no doubt about it: VFS-ed application will be impacted by slower file access activities. However, there are no public available benchmarks so far. Sometimes community members (and leaders) perform some tests, but the answers are like: Yes, there is an impact but it is so small that it still could be within the measuring inaccuracy or Yes, there is an impact but this doesn't influence the user perceived performance. But even if the impact on an individual PC is not significant (because current Disk I/O systems are quite fast), the effect may be more dramatic in Server Based Computing environments (Terminal Server, RDS Server with or without Citrix XenApp), where multiple users share the same OS instance. Also, in Virtual Desktop environments (VDI), where multiple virtual OS instances run on the same Virtual Machine host, the impact could become significant – esp. since in VDI the "disks" usually are located on the SAN with limited I/Os.

While writing this article, Project Virtual Reality Check is about to release their whitepaper "Phase IV – Application Virtualization Impact on VDI". Project VRC compares 3 major AppVirt solutions here, but unfortunately they didn't make any test to compare App-V's VFS vs. MNT impact. In ProjectVRC, the applications were sequenced to the Q: drive (following Microsoft's recommendation). Watch the project's web site: http://www.projectvrc.com/.

So, while there should be a decreased Execution Performance for VFS installs, it is actually not clear how deep the impact is for different execution platforms like physical PCs, Terminal Servers or VDI.

4.4 Installer Compatibility

When installing an application, most installers right now require to specify the installation target. For an MNT install, it is important that the installer allows to specify the target directory. If that's not given, you can't install the application to Q:. You'll find yourself in situations where:

- The installer just doesn't ask you for a target location (and installs to C:\ApplicationName, C:\Program Files\ApplicationName or even %Appdata%\ApplicationName)
- The installer only allows you to select a folder on the C: drive
- Even though the installer allows to specify a target on Q:, lots of files are created/modified on C:

These kinds of installers simply don't allow you to perform an intended MNT install: They are not compatible with that approach. But even if the installer allows to select the SFT_MNT drive, some files almost always will go into the VFS.

Of course you can virtualize applications that install to C: anyway. Then all files go to C: during installation, and are copied to Q: afterwards by the sequencer – a VFS install.

Also, it seems that the 4.6 SP1 Sequencer struggles with some activities during installation by not hiding the Symbolic Link to the installer (instead the Symbolic Link's target is resolved and visible in the Registry). I translated an article describing that at KirxBlog (http://bit.ly/keJDqx). There are several workarounds for that, one would be to perform a VFS install.

If your organization already has a lot of Unattended Installers prepared (like Custom Made MSIs, Answer Files, Transforms...) that all point to C: and that you just want to "convert" into an App-V Package, you probably may start with a VFS install. Thus, you don't have to adjust the – sometimes complicated and sophisticated – Setups.

Most Installers will work with a VFS install. For an MNT install most Installers require at least minor adjustment – if they ever work.

4.5 Execution Compatibility

Regardless of the location the application was installed to, some apps will struggle to launch:

- Some applications cannot be started from a drive different to C:, although the installer allowed to adjust the location: These applications are not compatible with the MNT install (luckily, they are very rare)
- Some applications determine, that they have been installed to C: but are launched from Q:\PrimaryDirectory\VFS (however they do notice that). These applications are not compatible with a VFS install (luckily, also these applications are very rare)

Actually, once you were able to sequence the application to C: or Q:, chances are very high that they also execute from that drive – except some exceptions :-)

4.6 Platform Compatibility

Sometimes issues were reported, if an application was installed to C:\Program Files on a 32-bit Sequencer and then got executed on a 64-bit Client.

Then, often a "Directory not found" App-V error message is displayed.

Actually, there are two MS Best Practices void here: The Application was not installed to Q:, and the Sequencing and Execution Platform do not match. However, it is a Common Sense that sequencing on a "lower" OS should allow the app to run on a "higher" OS as well.

It looks like the issue comes from different mappings on x86 and x64 systems.

Some applications seem to have difficulties with a VFS install if they have been sequenced on a 32-bit Sequencer but are executed on a 64-bit Client. While this seems to be an App-V "internal" issue (by not mapping "CSIDL_PROGRAM_FILES" to the "right" (x86) folder on a client, that behavior causes some applications to be incompatible with a VFS install.

During Sequencing on the 32-bit Sequencer, C:\Program Files becomes CSIDL_PROGRAM_FILES. On a 32-bit Client, CSIDL_PROGRAM_FILES perfectly is mapped back to C:\Program Files (or even D:\Program Files). On a 64-bit Client (and Sequencer), CSDIL_PROGRAM_FILES also refers to C:\Program Files. But on a x64 Client, this is the "x64-applications Program Files". But because it is a 32-bit application, its resources should be mapped to C:\Program Files(x86). Basically the same does not only occur for the CSIDL items but to environment variables like %PROGRAMFILES% as we...

If that 32-bit application would have been sequenced on an x64 Sequencer, the variable would be CSIDL_PROGRAM_FILESX86. On an x64-Client, this would map back to the right

location. It seems like this could be the issue. Also "strange" Short Name effects might be a reason. Also, some applications fail while accessing System32 vs. SysWOW64.

(By the way: CSIDL items are not an invention by Softricity. Microsoft maintains a list of them, though they are more relevant for developers than for admins: http://msdn.microsoft.com/en-us/library/bb762494.aspx)

Potential Workarounds:

- Install the application to Q:\ (MNT install)
- Configure the application to point to Q:\Primary Directory\VFS\CSIDL_PROGRAM_FILES (instead of "C:\Program Files") or similar locations
- Create two Sequences, one with an x86 and one with an x64 Sequencer. Use the "OS VALUE" tag to control the deployment

A MNT install would avoid such cross-platform conflicts.

4.7 Application Update Compatibility

Actually, if the original application installer could deal with either C: or Q:, chances are high that also updates and newer versions of that application can be installed and run from the same target. There should be no difference between a VFS or MNT install. In fact it might be that newer versions are more "relaxed" and allow you to change the Sequencing approach – but in that case you should sequence the application again from scratch.

4.8 Package Branching Support

One of App-V's feature is to create a "Branch Package": You open an existing Package on the Sequencer, navigate to [Menu] / Save as… and select the "Save as new Package" option. There, you specify a new Package Name and a new Primary Directory.

The result is a "new" package that can be used independent (or side-by-side) from the original one.

Before 4.6, the App-V Sequencer did parse the virtual Registry and replaced the values containing the old Primary Directory with the new one.

Starting with 4.6, replacing the Primary Directory does not work any longer (at least if you use the Sequencer's GUI – if using the command line Sequencer, it could work).

Anyway this replacement never was performed with files (like INI files).

If you branch an application that was installed to the Q: you may run into trouble, because there might be some registry values and/or entries in INI files or other configuration files in the new package that still point to the old, original location – these applications probably will fail on the client.

This issue does not occur for a VFS install: Within the virtual Registry and configuration files, only references to the C: drive are stored and the App-V Client always maps them to the "current" Primary Directory's VFS folder, also for branched application.

4.9 DSC Conflict Prevention

One of the downsides of Dynamic Suite Composition is that the joint virtual environment again may introduce application conflicts.

One of the resources that discusses this issue is http://blog.stealthpuppy.com/virtualisation/dynamic-suite-composition-and-short-names/

It is very unlikely, but you may imagine the following: You have two components, that you want to link into the target package. Both components include a Java Virtual Machine and have been sequenced by two different Sequencing Engineers (or there was a long time in between).

For Component A, you sequenced the JRE to C:\Program Files\Java. You did the same for Component B in the separate package.

Now you link them together with a target application by creating two DEPENDENCIES to Component A and B. Obviously, you will create an application conflict here, because one of the components will overly the other. Because Dynamic Suiting sometimes shows odd results, the target application may fail.

This only happens for a VFS install. If at least one of the components has been installed to Q:\Primary Directory, such a conflict would not occur, because both JREs have been installed into different locations intentionally.

5 Summary and Recommendations

As you can see, there is no easy answer to the question whether an application should be installed to the C: or the Q: drive during Sequencing. At the end, you will be required to try-end-error for some applications.

The recommendation is

- If you intent to "branch" an application a lot, sequence it to C:
- Sequence Dynamic Suite Composition Components to Q:
- Sequence all other applications to Q, except if
  - They cant's be installed/run from Q:
  - You have lots of "sophisticated" Unattended Installations that point to C: (then Sequencing it might be much easier and faster)