NVIDIA GRID vGPU PROFILE SIZING FOR WINDOWS 10

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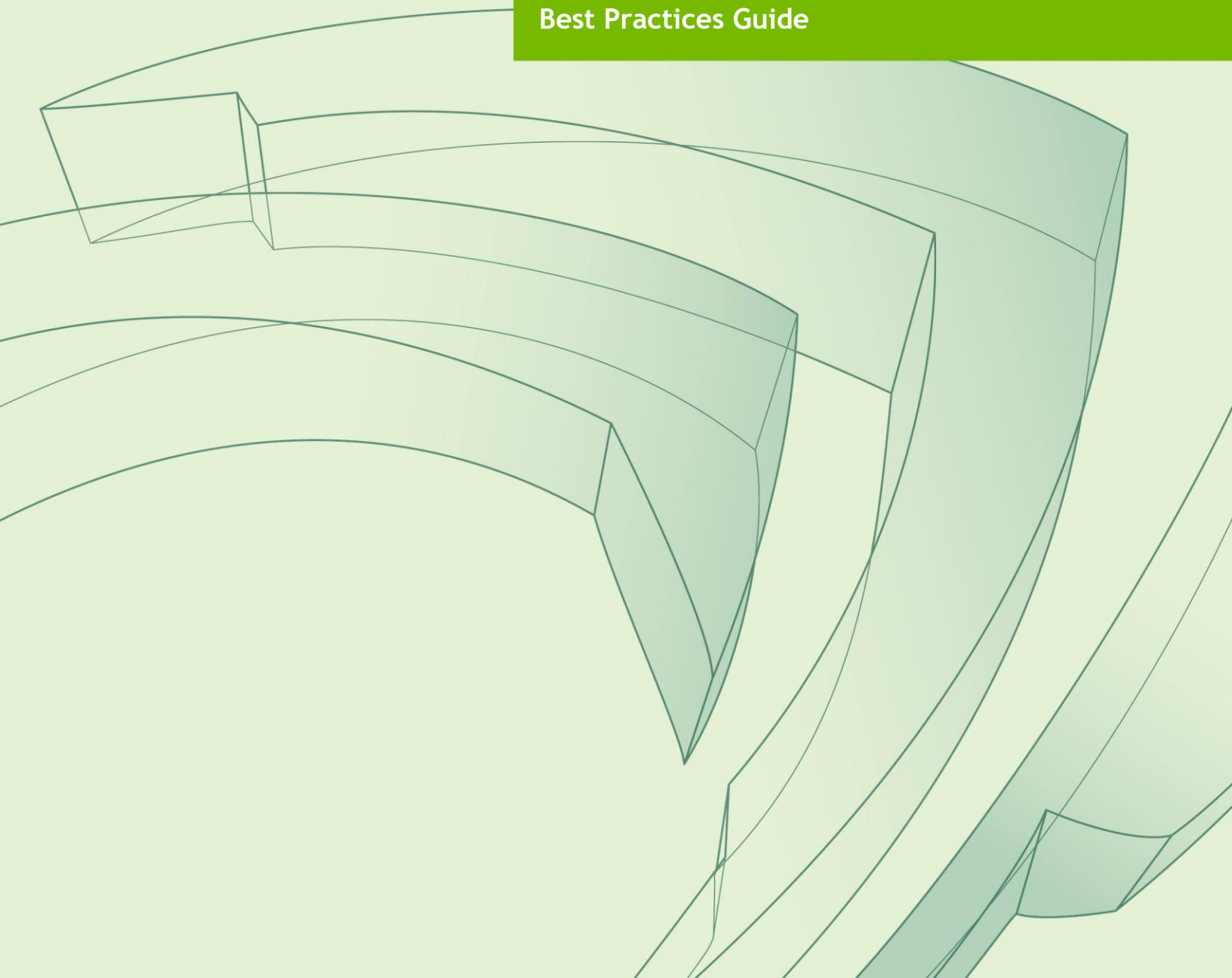
NVIDIA Performance Engineering

Best Practices Guide



HOW TO CHOOSE THE CORRECT NVIDIA GRID vGPU PROFILE FOR WINDOWS 10

NVIDIA GRID vGPU AND MICROSOFT WINDOWS 10

To provide the right level of user experience for your users, it's important to provide them with the right amount of resources based on their workloads. There are many factors to consider when sizing a virtual desktop environment including CPU, RAM, storage, network, and more. The purpose of this guide is to provide guidance on how to assign the appropriate amount of frame buffer for Windows 10 knowledge worker use cases in NVIDIA GRID™ environments.

The latest operating system from Microsoft, Windows 10, was designed to deliver improved user experience on both PCs and mobile devices. While Windows 10 has a great look and feel, it also introduces more frequent OS updates. This higher frequency of updates is driving many organizations to rethink how they manage their PC refreshes. Desktop virtualization allows IT departments to more easily manage and deploy these new upgrades, but new considerations must be made to accommodate the user experience requirements. Graphics will become even more important when Windows 10 is deployed in virtual environments to ensure that users get full functionality and application compatibility.

SIZING GUIDANCE FOR WINDOWS 10

Windows 10 is proving to be the most graphics-intensive operating system that Microsoft has ever released. As you move from a Windows 7 or 8 environment it's important to reevaluate the requirements of your virtual desktops as you transition. Frame buffer, or graphics memory, is a dedicated resource in NVIDIA GRID deployments and can help you determine the overall density of your environment.

Knowledge worker workloads will vary per user depending on many factors, including:

- Number of applications
- The types of applications
- File sizes
- Number of Monitors and their resolution

To size your vGPU profile correctly, all of these factors must be considered.

To understand the impact of some of these factors on frame buffer usage, the NVIDIA GRID Performance Engineering team conducted a number of tests using Windows 10 with the NVIDIA Tesla™ M10 GPU. Based on these tests, NVIDIA recommends that users that have any of the following characteristics should be assigned a vPC 1 GB profile to deliver optimal experience:

- Heavy application use; including WebGL, video streaming, and flash applications
- 2560×1600 resolution or higher
- 2 or more monitors

As with any workload, your results will vary. Therefore, NVIDIA recommends that you conduct real user testing to get specific scalability numbers for your environment.

CHOOSING A vGPU PROFILE

To deliver optimal performance to your users, it's important to look at several factors to determine the correct vGPU profile. The guidance in the following sections is based on testing by the NVIDIA GRID Performance Engineering team of different factors and their effect on frame buffer usage. The suggested steps for testing within your own environment are provided to help you get the most accurate results.

Frame Buffer Usage per VM

Testing was conducted on two different VMs, both of which were configured with 2 vCPUs, 4 GB of vRAM, and NVIDIA GRID 4.1 software. The first VM had a Virtual PC (vPC) license and 512 MB of frame buffer on a Tesla M10 (M10-0B profile).The second VM also had a vPC license but the frame buffer was increased to 1 GB on the Tesla M10 (M10-1B profile).

Workload	Resolution	Monitors	Frame buffer usage
M10-0B Profile			
Windows 7 idle	1920x1080 (full HD)	1	168 MB
Windows 10 idle	1920x1080 (full HD)	1	229 MB
Windows 10 idle	2560x1600	1	287 MB
LoginVSI Win10 Knowledge Worker	1920x1080 (full HD)	1	411 MB
M10-1B Profile			
Windows 10 idle	1920x1080 (full HD)	2	283 MB
LoginVSI Win10 Knowledge Worker	1920x1080 (full HD)	2	664 MB

Application Workload

A user's application workload will always be the most important factor in determining which profile will deliver optimal performance. Office workers today use many applications simultaneously, often with multiple applications interacting with one another. Based on a study with Lakeside Software, the number of applications that use OpenGL or DirectX, and, therefore leverage graphics acceleration, has doubled in the last 5 years. Today, almost 60% of users have at least one application that is graphics accelerated.

To simulate application workloads in the testing, the LoginVSI Windows 10 Knowledge Worker (medium) workload was used. Like any benchmark, this synthetic workload can be used to simulate real user behavior but should not take the place of real user testing.

To understand if users can use the Virtual PC edition with 512 MB of frame buffer (M10-0B profile), it's important to monitor frame buffer usage with a monitoring tool that exposes GPU resources on their physical PCs or on their VMs. If usage exceeds 512 MB of frame buffer, you should move to 1 GB of frame buffer (M10-1B profile).

A number of existing monitoring vendors have GPU metrics already built into their platforms. If you do not currently use a monitoring solution, you can use free solutions such as Microsoft Performance Monitor (PerfMon), NVIDIA System Management Interface (nvidia-smi), GPUProfiler, and others.

Monitor Resolution

As monitor resolutions continue to increase, more pixels are being delivered to the screen. As a result, the frame buffer usage in a virtual environment increases. Today, most users have full HD (1920×1080) resolution or above, which uses a minimum of 229 MB of frame buffer when Windows 10 is idle.

While full HD is currently the most common resolution, an increasing number of devices are being released with higher resolution screens. On a 2560×1600 monitor, Windows 10 uses 287 MB of frame buffer when idle, about 60 MB more than on a 1920×1080 monitor.

To provide enough frame buffer to support the application workload, NVIDIA recommends using Virtual PC with 1 GB of frame buffer (M10-1B profile) when using 2560×1600 resolution for office workloads. To deliver higher resolutions, up to 4K (4096×2160), you should use Virtual Workstation (vWS) with a minimum of 1 GB of frame buffer (M10-1Q profile).

Number of Monitors

The number of monitors to which the VM is being delivered also affects frame buffer usage. Today it is very common to see office workers with at least 2 monitors, which will increase the frame buffer requirements.

Testing showed that 2 full HD monitors running an idle Windows 10 VM used 283 MB of frame buffer. When a workload was added on the two full HD monitors, frame buffer usage reached 611 MB, which exceeds the 512 MB of the M10-0B profile.

When you are supporting a knowledge worker environment that has two or more monitors, NVIDIA requires that you use Virtual PC with 1 GB of frame buffer (M10-1B profile). Depending on your overall workload, 3-4 monitors may require using Virtual Workstation with 2 GB of frame buffer (M10-2Q) to deliver optimal performance.

TESTING YOUR NVIDIA GRID ENVIRONMENT

As with all scalability testing, user workloads and environment must be taken into account for scalability analysis. In order to test NVIDIA GRID in your environment you can choose to get started with a certified NVIDIA partner or start a proof of concept (POC) with a certified server and the 90-day NVIDIA GRID evaluation license.

Important things to remember during your POC

1. **Define “acceptable” user experience**.

   Defining user experience (UX) requires careful examination of user and application interaction.

   A definition of acceptable user experience can be obvious, such as the rendering time for an image to appear, or the ability to smoothly pan across that image. It can also

be less obvious, such as the ability to smoothly scroll down a page or the "snappy" reaction for a menu to appear after a right click.

To avoid generic feedback, ask users to report metrics, and to judge specific activities or functions using finite scales (for example, 1-5, 5 being best).

2. **Compare real-world workloads.**

   In virtual environments, time-slicing of resources allows users to get the same level of performance even when sharing resources.

   Time-slicing results from users' thinking time, which includes any pause in their interaction with the application, any period when they are not using the application, or even sitting at their desks.

   By adding up all the time away from the application (for example, meetings, lunch, and periods out of office) you could expect to get even more benefits from shared resources. These benefits equate to more resources for each user's session and typically a more responsive application.

   A realistic estimate of user interaction with an application results in a better-perceived experience by the end user than benchmarks based on peak workloads with inhuman work that is unrepresentative of real users' interactions with an application.

3. **Test with real users**.

   It's important to actually look at the application running to be sure that the experience is enjoyable for users.

   While idle systems or benchmarks can be used as a starting point, real user workflows may require more or less graphics resources. Because the number of monitors and their resolution will impact graphics requirements, users bringing their own devices or logging in from different locations may impact the overall user experience.

   When you also consider the effect of real-world workloads, you can see why real users are the most accurate means of testing.

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