Improving the Efficiency of Government with Graphics Virtualization
Why high-performance virtualization matters more than ever in government

Government must serve citizens efficiently and support missions ranging from disease control and managing entitlement programs to defense and intelligence. To do this, IT must be able to secure sensitive information in the data center and deliver it securely to knowledge workers, analysts, engineers, and data scientists wherever they are located. IT must also support math-intensive computations such as those needed to work with large 3D models, images, simulations, and productivity software.

These functions and others occur in the virtual desktop environments (VDIs) of many agencies. Effective graphics virtualization has become critical to VDIs that work well and will become increasingly important as the market transitions to Windows 10.

Agency CIOs, CTOs, executive directors of IT, and IT program managers will find this white paper a helpful review of graphics virtualization in government.

Challenges and trends in government

These eight data points offer an overview of the context in which governments operate now and for the foreseeable future:

- Data security for an increasingly mobile workforce is a primary concern
- 90% of federal CIOs have cited an increase in cyber attacks
- Data breaches account for an estimated US$637 million annually across federal IT systems
- Government agencies are transitioning desktops to the data center, with some migrating to Windows 10 to protect against cyber threats
- Agencies must simultaneously confront budget constraints, evolving regulations, and the need for better network performance
- Some consolidation initiatives—such as the Federal Data Center Consolidation Initiative (FDCCI)—require IT to reduce its footprint
- Many IT departments must migrate from legacy hardware, manage multiple devices, and support a variety of use cases
- Government agencies are moving to virtual desktop infrastructure (VDI)—which may experience performance issues—to increase security, reduce cost, and enable mobility

1 DelPrete, George (2015 Jun 9) 4 Top Challenges for Federal CIOs
2 Guerry, Pem (2017 Jul 18) The 3 Big IT Challenges Facing Federal Agencies
3 Pellerin, Cheryl (2016 Mar 8) DoD-Wide Windows 10 Rapid Deployment to Boost Cybersecurity
Virtualization in government

A focus on reducing costs per user, protecting intellectual property, and reducing IT’s footprint has driven adoption of VDI in government. However, many older, thin-client VDI solutions haven’t virtualized the graphics processing units (GPUs) that make 3D modeling and other math- and graphically intense applications possible. In addition, as adoption of Windows 10 becomes more widespread, office productivity applications require more powerful graphics processing.

As some readers of this white paper are aware, application and desktop virtualization solutions have been around for a long time, but their primary point of failure tends to be user experience. The reason is very simple.

When many applications and desktops were first virtualized, GPUs were not a part of the mix. This means that all the capture, encode, and rendering traditionally done on a GPU in a physical device was handled by the CPU in the host. That worked for some of the more basic applications, but it never truly met users’ native experience and performance requirements.

In 2013, NVIDIA, a leader in graphics processing, released a virtual GPU solution that allowed users to virtualize GPUs housed in the data center and share them on virtual machines throughout a government agency. Of particular interest to IT and programs managers was a virtualized GPU’s ability to support multiple users simultaneously with no degradation in performance. This capability not only improved performance for existing application and desktop environments but also made use cases such as simulation and virtual training possible.

The Cisco–NVIDIA GPU solution for government

Cisco and NVIDIA have partnered in a virtualization solution for government that brings together the Cisco Unified Computing System™ (Cisco UCS®)–or Cisco HyperFlex™–plus NVIDIA GPUs and vGPU software. (See Figure 1.) This solution allows IT to securely deliver general purpose productivity applications as well as design and engineering, video surveillance, and geospatial analysis files to government employees and contractors wherever they are located.

Cisco UCS overcomes key IT challenges—lack of visibility and control, rigid infrastructure, and security vulnerabilities. It offers a wide range of platforms designed to address the demands of government workloads while simplifying IT operations, driving a policy-defined architecture, and offering options for growth. Users can allocate a pool of resources with NVIDIA GPU acceleration, on a just-in-time basis. In addition, the Cisco HyperFlex Platform delivers hyperconverged infrastructure (HCI) anytime, anywhere. Built on Cisco UCS, Cisco HyperFlex offers scalability, pay-as-you-grow economics, and multisite, distributed computing at scale.

Figure 1  The Cisco and NVIDIA solution for government

NVIDIA GPU virtualization

NVIDIA GPU virtualization brings graphics acceleration and a high-quality user experience to any device. GPU virtualization also helps government cost-effectively scale VDI. This is critical, given the increasing graphical requirements of Windows 10 and modern office productivity applications used by many government employees, the heavy use of computation- and video-intensive processes in some government operations, the push toward IT consolidation, and growing concerns over security.
How the NVIDIA virtual GPU works

In a VDI environment powered by NVIDIA data center GPUs, IT installs a driver set at the hypervisor layer that enables it to recognize the NVIDIA GPUs. During the creation of a Windows 10 virtual machine, IT adds a PCI device with a specific NVIDIA Quadro virtual Data Center Workstation (Quadro vDWS) or NVIDIA GRID Virtual PC (GRID PC) profile that allows the desktop operating system to use physical GPU device capabilities defined by that profile. Once the virtual machine is operational, IT installs an NVIDIA device driver so that the Windows OS recognizes the virtual GPU as a Quadro or NVIDIA graphics-capable device. A significant number of graphics, design, and engineering applications are written to recognize Quadro capabilities. (See Figure 2.)

Solution benefits

As part of the joint solution, Cisco UCS delivers these benefits to government customers:

- Reduce CapEx/OpEx by virtualizing graphical and math-intensive applications, offering better IT services, and enabling public servants to work on mobile devices
- Accelerate the performance of graphics- and math-intensive office productivity applications
- Increase security by storing files in the data center and reducing data movement
- Take advantage of increased memory with servers that offer up to 3 TB of memory
- Virtualize desktops/applications and reduce cost and complexity through centralized Cisco Intersight™ management

Primary use cases in government

Use cases in government include:

- Common office productivity applications, such as Webex® Meetings and online training, in general-purpose Windows 10 VDI environments
- Virtual workstations applications such as managing predictive maintenance schedules, accessing and manipulating personnel data, and modeling a range of critical military and non-military outcomes
Government agencies that choose Cisco HyperFlex to support hyperconverged infrastructure can also meet a broad range of critical needs:

• Increase speed and efficiency by combining compute, storage, and networking in a single system
• Achieve agility for distributed environments with centralized data management and ease of use
• Improve the security of sensitive information, with role-based data security
• Scale to meet application needs with NVIDIA GPUs and increased Cisco compute-only nodes, logical availability zones, and high-capacity, large-form-factor disk drives
• Differentiate through integrated network fabric and the ability to independently scale compute and storage

NVIDIA GRID vPC/vApps and NVIDIA data center GPUs increase the productivity of knowledge workers through applications such as Microsoft Office and streaming video. NVIDIA Quadro Virtual Data Center Workstation software and NVIDIA data center GPUs virtualize visual- and computation-based files so designers, engineers, analysts, and data scientists can quickly access them. With Cisco UCS and Cisco HyperFlex, they make it possible to scale VDI across an organization without the performance limitations of traditional, thin-client VDI solutions.

Conclusion

Digital transformation in government has driven adoption of VDI, despite the limitations of older technologies. Now, the Cisco-NVIDIA solution expands the benefits of advanced networking and graphics acceleration across government operations to deliver the following benefits:

• Increases the productivity of government professionals by delivering graphics performance on virtual desktops that is similar to that on dedicated workstations
• Enables these professionals to work remotely—from a home office, for example—or on the go by providing access to virtual workstations from any device
• Secures intellectual property security by locating critical files in the data center and using desktop broker policy to prevent them from being copied or downloaded
• Drives data quality and consistency by housing design files, video, images, and other intellectual property in the data center for better version control and improved quality
• Allows IT personnel to quickly and easily update or replicate systems across an agency—previously a time-consuming task—through superior scalability

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