SGI® VizServer® Systems with NICE Software for Remote Visualization Access via Private Clouds and Data Centers

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Abstract

With engineering and scientific support staff caught between the desire for high-performance anywhere computing and shrinking IT budgets, IT managers and senior architects at large companies are witnessing a radical shift in the way they are being asked to provide IT services to an increasingly demanding technical user base.

The explosive growth of simulation models and technical data is leading to major consolidation trends in storage and computing resources. More data needs to move from the data center to the engineers' workstations, but IT professionals also need to serve an increasingly distributed workforce. This makes it difficult to efficiently deploy workstations everywhere they're needed. Moreover, the complexity of this infrastructure requires training and procedures that affect user productivity and time-to-results. Finally, security concerns often require IT managers to provide onerous "need to know" access to technical data and applications.

How can IT professionals reduce costs and provide secure, efficient services to their distributed, diverse user base? Is there a way to leverage mobile technology to foster better collaboration for end users?

Many companies are turning to technical cloud software to address these challenges. These solutions help IT professionals reduce infrastructure costs and increase IT agility by leveraging cloud computing technologies to deliver consolidated and secure high-performance computing and 3D visualization services. Now technical staff can focus on solving difficult engineering challenges.

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1.0 High-Performance Computing and Visualization Trends

The concept of remote visualization has been around for years in high performance computing environments but remote visualization over long distances was a challenge and an expensive solution. In some situations the internal networks were slow to the user desktop, slow over remote sites or the visualization server was under powered. Some remote visualization solutions were not practical and were not supported since they lacked a tightly coupled front-end solution with user security, job/resource management and ease of use features. With the right combination of SGI hardware and NICE software many of these past challenges are addressed with SGI's remote visualization solution.

Providing both high-performance computing (HPC) and visualization tools is becoming more difficult than ever. The rising cost of workstation management, larger file sizes, more remote workers, and the resulting need for collaboration are requiring IT professionals to reexamine how they deliver services.

The first trend is the increase in cost to manage workstations coupled with stagnant IT budgets. In the oil and gas market, for example, hardware and software costs can reach $11,000 – for just one workstation.[1] Yet according to research from Gartner, IT budgets generally remained flat in 2012.[2] This trend is expected to continue and requires IT executives to choose between funding strategic projects or upgrading workstations and software.

Workstation and software upgrades are necessary, however, since digital models and simulations are becoming more detailed and require higher-resolution graphics. It comes at a high cost: files that reach 50GB and are growing annually.[3] Technical staff uses these optimized models to improve the accuracy and precision of the final product, but IT executives struggle both to manage large amounts of data and ensure the data can be delivered securely and quickly.

Outsourcing complex work to Asia to reduce labor costs and find readily available talent is another trend, particularly as designs become more intricate.[4] However, outsourcing requires software that can be accessed from remote locations and can sync models and designs across multiple user locations.

Meanwhile, even companies that don't outsource are seeing an uptick in mobile computing, which only adds to these challenges. As more technical staff adopts powerful mobile devices, they will demand access to both HPC and visualization applications outside of the office. This means IT managers need to provide software with full HPC capabilities that renders graphics quickly and easily on laptops.

To be successful in the future, IT professionals need to be able to provide HPC and visualization tools in more of an anytime, anywhere fashion.

The SGI® VizServer® system with NICE software solution provides an excellent remote visualization user experience allowing the user to incorporate the solution into their daily workloads using a web portal to manage batch scheduler jobs, system resources, and to initiate one or many visualization sessions while using the same GPU device as an accelerator for computing.

Following is an example of an enterprise solution deployed supporting a corporate secured internal network where users from remote locations or internal locations can access the web portal to launch a visualization session between the user's desktop and the SGI VizServer systems.

1 Bryant, S. (March 7, 2012). CAD/ucation. CAD training – "a worthwhile investment?"
2 Howlett, D. (January 18, 2012). ZDNet. "CIO IT budgets flat in 2012" say Gartner but….
3 Jackson, M. (June 5, 2012). Datanami. "Optimizing visualization workloads."
4 Gartner, Inc. (December 21, 2010). Gartner Says "India Still No. 1 Destination for Offshore Services."
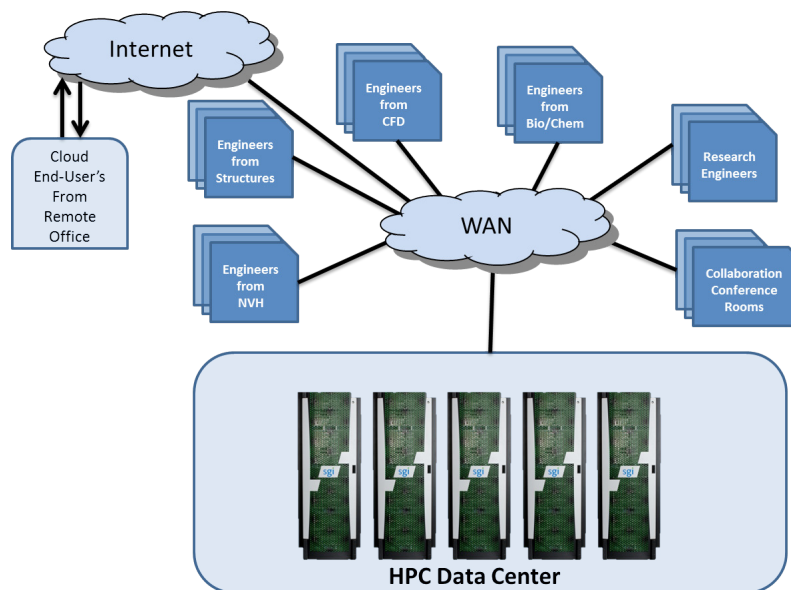
2.0 Six Headaches Caused by Technical Software Limitations

Managers and senior architects face six primary challenges with traditional design and engineering software, ranging from slow data transfer and loading times to security concerns.

2.1 Slow Data Transfer and Loading Times

A long software load time, large models that require more memory, and congested networks reduces engineer productivity. This means fewer resources to pursue projects due to inefficiency and time lost waiting for software and models to load.

2.2 High Cost of Upgrading Desk-Side IT Infrastructure

Upgrading network cabling and workstations requires a significant capital investment due to the high cost of labor for cabling, core network upgrades, and new or upgraded workstations. Most existing network speeds can only accommodate a 100Mbps connection, which can cause significant delays for higher-end applications.

With IT budgets not expected to increase, infrastructure upgrades may come at the expense of other projects—a situation that often negatively impacts revenue and profitability. Add to this the need for frequent service packs and updates of design and engineering software on all workstations, and constraining the total cost of ownership can become a formidable challenge. Fortunately, solutions like SGI VizServer compute servers are available that leverage existing infrastructure to allow the IT department to focus its budget on strategic projects rather than upgrades.

2.3 Human Error and Inefficient Resource Usage

In HPC environments, multiple engineers use clusters of multiprocessors to run more detailed simulations. The more complicated the job, the greater the risk that command line parameters may be entered incorrectly. Inexperienced users make mistakes, leading to repeated job submissions, lost productivity, and wasted computing resources that could have been allocated to other jobs. Fortunately, SGI provides tools that minimize the probability of user errors.

2.4 Remote Collaboration Difficulties

Remote collaboration often requires groups of engineers to access the exact same version of the file and application. If the file has been modified locally and not synced with the server, collaborators may not be looking at the same data. Reconsolidating the data is complicated, and work groups can lose track of who has the latest version of the file. Decisions could be made based on the wrong version of the models. Fortunately, hardware and software solutions from SGI and NICE exist that allow for all models to be kept in sync and readily available to all collaborators.

2.5 Poor Mobile Application Performance

Laptops lack the graphics cards and memory required for traditional 3D modeling or HPC software, leading to lost productivity on the road and at remote locations. Slow, disjointed rendering causes lost productivity and makes it impossible for engineering staff to respond to emergencies or check jobs remotely. As a result, companies often experience significant project delays until engineers can return to the office. SGI VizServer with NICE software allow responsive mobile access to 3D modeling and HPC applications, regardless of the terminal device performance.

2.6 Security Breaches and Data Theft

Downloading full models to workstations exposes companies to data theft. Users can easily copy the models to a USB drive and create derivative works that could cost the company millions. However, deploying robust desktop security often results in lost productivity and requires substantial investments.

3.0 SGI VizServer Compute Servers with NICE Desktop Cloud Visualization™ (DCV) Software

SGI VizServer systems with NICE DCV software give technical users remote 3D modeling tools through a web-based portal, allowing for GPU and resource sharing and secure data storage.

In a typical 3D visualization scenario, a software application uses local resources (CPU, memory, etc.) and sends a stream of graphics commands to a graphics adapter (GPU) installed on the workstation. The GPU renders the data into pixels and outputs them to the local display as a video signal.

Using SGI VizServer systems with NICE DCV software, all OpenGL® applications run natively on remote SGI servers with NVIDIA® Graphics cards, which may also be consolidated and virtualized. The native GPU driver renders the scene geometry and graphics state on the remote physical GPU, and pixels are compressed and sent over the network to the local display. The resulting pixel stream can be encrypted and distributed to multiple clients, to ensure secure real-time collaboration, and the compression ratio can be dynamically adapted to get the best experience on any network speed. See example below.
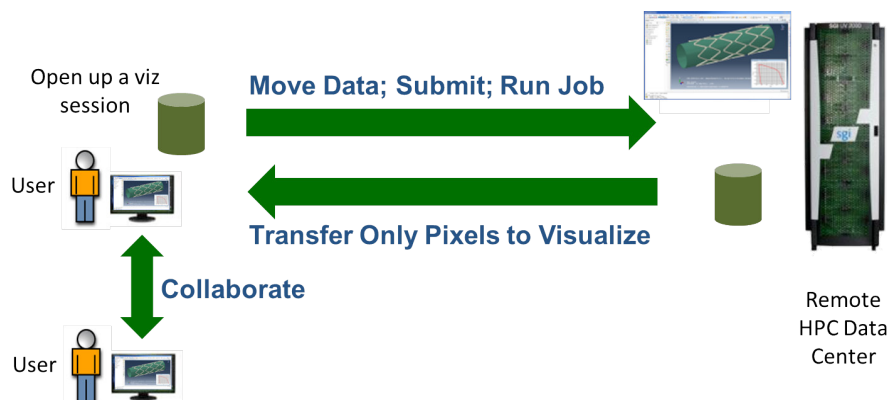
SGI VizServer systems with NICE DCV software can provide visualization capabilities through a software-as-a-service (SaaS) built in the company's private network. The software is accessed through an easy-to-use web interface, resulting in simplicity for the end user. This solution provides intuitive help and guidance to ensure that less-experienced users can maximize productivity without being hindered by complex IT processes.

3.1 SGI VizServer Compute Servers with NICE Software Components

- **Engineer-friendly self-service portal:** The self-service portal enables engineers and scientists to access the applications and data in a web browser–based setting. It also provides security, monitoring, and management to ensure that users cannot leak company data and that IT managers can track usage. Engineers and scientists access applications and data directly from their web browsers, with no need for a separate software installation on their local client.

- **Resource control and abstraction layer:** The resource control and abstraction layer lies underneath the portal, not visible to end users. It handles job scheduling, remote visualization, resource provisioning, interactive workloads, and distributed data management without detracting from the user experience. This layer translates the user request from the browser and facilitates the delivery of resources needed to complete the visualization or HPC tasks. This layer has a scalable architecture to work on a single cluster or shared memory server, as well as a multi-site WAN implementation.

- **Computational and storage resources:** The SGI VizServer system with NICE DCV software takes advantage of the company's existing or newly purchased SGI industry-standard resources, such as servers, HPC schedulers, memory, graphical processing units (GPUs), and visualization servers, as well as the required storage to host application binaries, models and intermediate results. These are all accessed through the web-based portal via the resource control and abstraction layer and are provisioned according to the end user's needs by the middle layer.

The NICE DCV and EnginFrame™ portal software are built on common technology standards. The software adapts to network infrastructures so that an enterprise can create its own secure engineering cloud without major network upgrades. The software also secures data, removing the need to transfer it and stage it on the workstation, since both technical applications and data stay in the private cloud or data center. These solutions feature the best characteristics of cloud computing—simple, self-service, dynamic, and scalable, while still being powerful enough to provide 3D visualization as well as HPC capabilities to end users, regardless of their location.

3.1.1 Deployment Models

HPC Portal

This model is ideal for computational-intensive, and parallel job submission, control, and monitoring. Users access applications and data through a web browser.

Behind HPC portals, IT managers and architects configure one or more SGI Linux operating system based clusters or shared memory systems. Optional stand-alone graphics servers can provide post-processing and simulation steering that run visualization programs on demand. The graphics server connects to the computing clusters with very high speed networks and contains GPUs that can be shared across multiple users, large memory, and powerful processors to speed up rendering of large models.

This model also uses one or more web servers, where the HPC portal of the technical cloud software resides. The server is a gateway based on HTTPS and simple object access protocol (SOAP) architecture and provides end users with browser-based access to the visualization servers for 3D-enabled sessions and abstracts underlying HPC schedulers for batch jobs. This model may offer command line interface access and the ability to automate or integrate the HPC services with Python, Microsoft .NET, or Java tools, such as statistical optimization tools and product data management (PDM) tools, among others.

Remote 3D "Virtual Workstations"

This model is ideal for 3D visualization and connecting remote users to OpenGL applications that run in a data center. User's access full desktops - like in common VDI (Virtual Desktop Infrastructure) - or individual applications and data through a web browser, but the 3D performance is significantly better than a traditional VDI.

The "Virtual Workstation" model primarily provides visualization capabilities. It includes SGI servers equipped with one or more NVIDIA® GPUs that may or may not be shared among users. These NVIDIA® GPUs provide OpenGL application acceleration required by technical applications that can be installed and run in the private cloud or data center without modifications. The end user works from a thin client, such as a laptop equipped with a web browser, that is only used to show pixels and requires no data or application logic locally. Therefore, even tablets can be used to work or collaborate. Data and applications are kept in the data center, but remote desktop access allows engineers and scientists to use them and be productive from remote locations.

Installation, Workflow and Support Services

SGI VizServer compute servers with NICE software can be designed and installed by in-house IT staff; however, SGI Professional Services can provide a range of support options including factory installation and testing, onsite configuration and knowledge transfer services. Thus managers and architects can focus on delivering the required HPC and visualization capabilities while minimizing disruption to business operations.

SGI Services personnel bring expertise and experience to help turn powerful technology into business solutions. To do this, SGI turns to the deep experience base of its service professionals, honed over decades. SGI has played a formative role in pioneering graphics technology since the mid-1980's, and no other company can provide the depth of Subject Matter Expertise, combined with tried and true experience in visualization technology.

| Service	Customer Value Proposition
Proof of Concept	Allows customers to evaluate new approach to visualization with low initial investment.
Quickstart	Prodives fast ramp to productivity using the new software. More complete employment of software due to increased understanding. Better use of SGI resources Better return on technology investment
Site Workflow / Tuning Services	Tunes the software for the customer's workflow, and optimizes software for their environment. • When users are located in the same site, or when the users are in different locations.

3.1.2 SGI VizServer Systems with NICE Software Benefits

SGI VizServer servers with NICE DCV offer many benefits to managers and end users alike, including:

- Utilizing large network pipes in the datacenter, it accelerates data and application loading times, allowing for the creation, modeling, modification, simulation, and storage of data in the cloud much faster than on a remote workstation.

- Enhances application performance by provisioning resources based on actual user needs.

- Enables mobile access by utilizing a web interface environment and optimizing visual performance based on available bandwidth to provide HPC and visualization capabilities regardless of connectivity.

- Reduces infrastructure upgrade costs by removing the need to upgrade workstations or peripheral network components.

- Minimizes resource waste and user error by providing guided workflows and parameter checking prior to workload submission.

- Enables collaboration with far-flung colleagues, each having instantaneous access to the most recent model and real-time view of its representation.

- Prevents data theft and security breaches with customizable, restricted access to data and applications, and moving pixels instead of data.

3.2 SGI VizServer with NICE Software Solution at a Glance
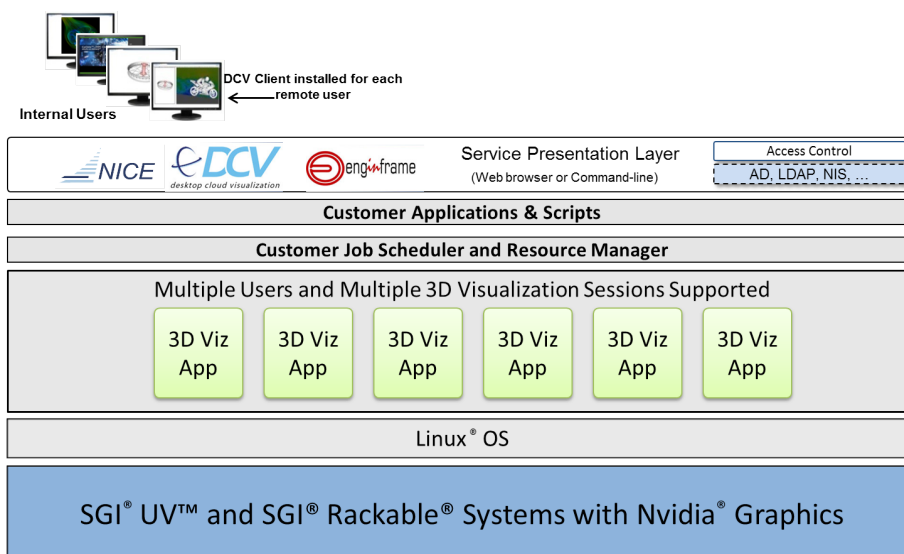
4.0 About SGI Hardware and Graphics Card support

4.1 SGI® Rackable® Standard Depth Platform

SGI Rackable servers, model number C2108-RP2, support up to 256GB of memory per node in a dense architecture with up to 16 cores per 2U with support for Linux®, FDR and QDR Infiniband® solutions, eight-core processors, GPU's and DDR3 memory. NVIDIA® Graphics cards supported are: Quadro® K2000D (supports 1-2 users); Quadro® K5000 (supports 3-5 users) and the Quadro® K6000 (supports 6-8 users).


SGI Rackable 2U Sever, model number CH-C2108-RP2.

4.2 SGI® UV™ 2000 Servers

SGI UV 2000 servers scale up to 256 sockets (2,048 cores, 4096 threads) with architectural support for up to 262,144 cores (32,768 sockets). Support for up to 64TB of global shared memory in a single system image enables CAE workflows, for example, to be accelerated for overall time to solution by running pre/post-processing, solvers and visualization on one machine without moving data. Flexibility of sizing memory allocated to a job independently from the core allocation in a multi-user, heterogeneous workload environment prevents jobs requiring a large amount of memory from being starved for cores.

Typical CAE Workflow Using UV
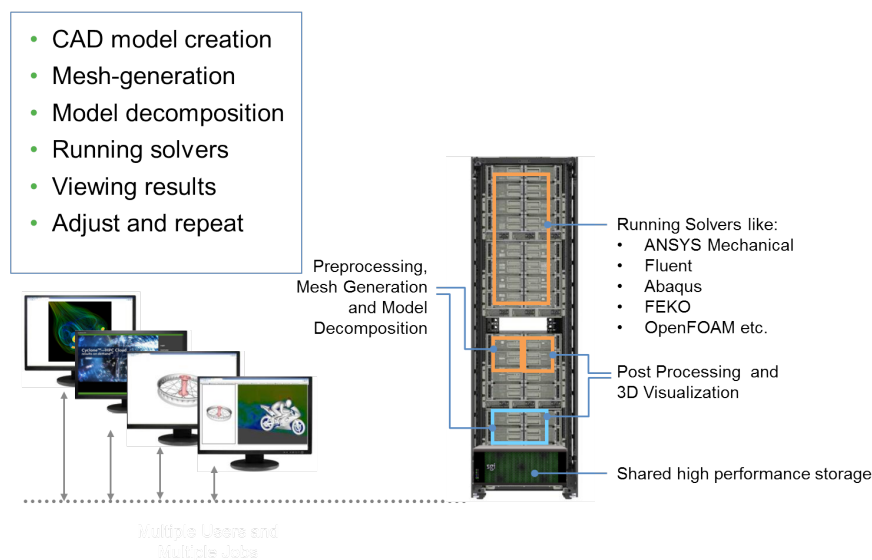
NVIDIA® Graphics cards supported on the SGI® UV™ platform are: Quadro K2000D (supports 1-2 users) and Quadro K5000 (supports 3-5 users).

5.0 About NICE Software

5.1 NICE EnginFrame™

NICE EnginFrame, NICE's HPC portal offering, is an advanced, commercially supported grid portal that provides access to grid-enabled infrastructures, HPC clusters, data, licenses, and interactive applications. It can be accessed by any authorized user with a standard web browser. EnginFrame deftly handles computational-intensive and - parallel job submission, control, and monitoring. EnginFrame is based on standard protocols that facilitate the deployment of engineer-friendly portals to create, discover, and explore more efficiently. It provides for encrypted access and file transfers, protecting intellectual property and infrastructures.

5.2 NICE Desktop Cloud Visualization™ (DCV) software

NICE DCV, NICE's remote 3D "virtual workstation" offering, is an advanced remote 3D access technology that allows technical end users to access robust 3D modeling tools through a web-based portal. IT professionals can share GPUs and memory across multiple user sessions. Data resides securely in the data center, reducing load time and offering IT professionals the option of granting data and application access based on the user's needs.

EnginFrame and DCV applications work together to deliver the best attributes of cloud computing and technical software. IT professionals are provided with an intuitive yet powerful solution that increases user productivity while eliminating expensive upgrades. EnginFrame software provides HPC capabilities to run large solver calculations, while the DCV solution provides the 3D modeling tools needed for remote viewing of complex, detailed models. Used together, they deftly meet the computing needs for technical end users while delivering services in an intuitive, user-friendly interface.

6.0 About SGI

SGI is focused on helping customers solve their most demanding business and technology challenges by delivering technical computing, Big Data, and cloud computing solutions that accelerate time to discovery, innovation, and profitability. The company develops markets and sells a broad line of low-cost, mid-range and high-end scale-out and scale-up servers and data storage solutions, as well as differentiating software. SGI sells infrastructure products designed-to-order for large-scale data center deployments. In addition, it provides global customer support and professional services related to its products. SGI enables enterprises to meet their computing and storage requirements at a lower total cost of ownership and provides them greater deployment flexibility and scalability.

SGI products and services are used by the scientific, technical and business communities to solve challenging data-intensive computing, data management and visualization problems. These technical computing applications typically require large amounts of compute power along with fast and efficient data movement both within the computing system and to and from large-scale data storage installations. SGI systems accesses, analyze, transform, manage, visualize and store very large amounts of data in real or near real time.

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