ENTERPRISE COMPUTING

CHOOSING THE BEST PATH TO SERVER CONSOLIDATION

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Government IT departments are tasked with managing increased processing demands across disparate organizations. As a result of funding rules requiring separate infrastructures for each project and agency procurement habits, system administrators are now burdened with servers that are difficult to manage, underutilized, underperforming and sprawled across facilities. For the agency, server sprawl and disparity have resulted in higher IT costs, staffing and space requirements and greater management complexities.

This paper describes the considerations for selecting the best server consolidation solution approach to help agencies streamline their server infrastructure, eliminate unnecessary costs and maximize return on investment in the data center.

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BUSINESS CHALLENGES

LEGACY SERVER MANAGEMENT COMPLEXITY

In many government organizations, program-driven funding has meant dedicated servers and applications for each and every project. In x86-based environments, this "silo" effect has prevented the efficient use of hardware resources (for example, typical server utilization rates run around 5–10 percent of CPU capacity). More recently, UNIX and mainframe server environments, with disparate hardware and operating systems of varying ages and performance capabilities, are tasked with heavy workloads, further increasing server management challenges.

Adding yet another layer of complexity are situations where system ownership is assigned to IT managers on an individual basis. This assignment often causes resistance to consolidation due to a perceived loss of asset control—a mindset that has both hampered consolidation efforts and slowed the attainment of their business value.

SHARED SERVICES AND SLAs

Nearly every IT executive in the government understands that shared services and operations play a significant role in supporting the strategic goals of their organization. Consolidation across the IT organization, typically starting with servers, is often one of the first and most common approaches to implementing shared services. As agencies consolidate their IT functions into the shared-services model, there is a greater need for an integrated, holistic view of operations supported by metrics such as Service Level Agreements (SLAs). In an SLA, the IT department and customer agree on the services and performance levels that will be provided, and how success or failure will be measured. Server consolidation can help IT departments achieve SLAs across organizations.

GOVERNMENT-WIDE INITIATIVES

At the federal level, numerous initiatives and directives are also moving agencies to evaluate ways to improve their IT efficiency such as through consolidation projects. These include the OMB Line of Business and Shared Service Center initiatives and GAO requirements to deliver value earlier in the life of a project.

CONTINUITY OF OPERATIONS

According to Gartner, server consolidation also helps agencies support a business continuity plan. Following server consolidation, agencies can create a highly available environment so that when one server suffers a failure, another can seamlessly run in its place. However, to address an entire site failure, remote data centers are needed. "Complementary data centers provide the capacity to keep governments online and connected in times of crisis," says Gartner. "As a result, such 'public value' factors must be highlighted, in addition to cost savings." For jurisdictions that are not large enough to have two data centers that are sufficiently separated, Gartner suggests partnering with another government agency for space. Building out consolidated server environments for remote data centers is frequently the most efficient and least costly approach to extending an agency's environment to this level of functionality.

MAKING THE CASE

One of the primary considerations for most consolidation projects is cost. In standard federal funding cycles, it can be tough to secure additional funding for consolidation projects without an accurate return on investment (ROI) assessment. The value to be gained must be proven with strong financial models that justify investments in new technology, staff development and training and accompanying enterprise management solutions. The following benefits are among the most significant ones that can be assessed and documented for server consolidation projects.

Reduced Total Cost of Ownership

Fewer servers require fewer resources to maintain, resulting in lower total cost of ownership (TCO) for equipment, hardware and software maintenance; administration; and infrastructure such as space, power, cooling, network connectivity and storage. A smaller footprint in the data center also frees up space for future expansion. Having fewer physical tasks to perform also has the effect of reducing demand on front-line support staff. As a result, consolidation can facilitate the redeployment of some staff functions to critical areas such as certification and accreditation of systems.

Simplified and Optimized IT Environment

While TCO savings are often the primary driver, many organizations will derive their greatest server consolidation benefits from centralizing and upgrading their system and lifecycle management tools such as configuration management, capacity management, performance management, asset management and imaging applications. Such applications not only deliver quick ROI, but also enable ongoing cost benefits as IT organizations take advantage of increasingly sophisticated capabilities. Centralized management provides greater control over and visibility into the infrastructure, enabling IT organizations to establish, monitor and troubleshoot SLAs and other customer metrics. It also helps integrate business processes across the enterprise, in turn improving the agency's level of service to its constituents.

Improved Reliability and Performance

Many agency servers are underutilized and/or inefficient to manage. However, the ability of consolidation to compress IT resources can substantially increase resource utilization. As a result, the systems in the data center can become more modular and portable, and can be dynamically provisioned and de-provisioned. This ability to balance workload in step with fluctuating demand gives IT resources greater agility to respond to changing business requirements.

In addition, newer server architectures offer additional capability to improve reliability and availability. For example, high availability technologies, such as clustering and rapid provisioning, enable continuity of operations, while hot-swappable devices allow administrators to replace failed components without bringing down entire systems. These features make it much easier for IT departments to commit to and ensure consistently high levels of service.

CHOOSING THE BEST PATH TO CONSOLIDATION

While an effective server consolidation solution should help agencies identify TCO savings, integrate disparate systems, enhance reliability and improve efficiency, it should also enable service delivery that is more efficient and predictable.

To achieve these goals, a comprehensive server consolidation solution should encompass not just system, software and infrastructure components, but also project management, a solid implementation approach and financial planning for each step. Taking a best-of-breed approach to this effort will ensure the most appropriate combination of components, tools and services are employed in creating the best fit with the agency's environment. Formulation of this solution should also factor in such considerations as workload requirements capacity, the current operating environment, supported services and applications, power/cooling and space constraints and IT skill sets.

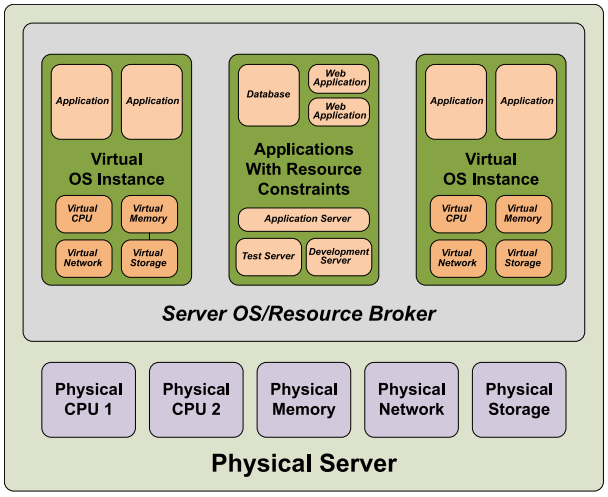
Server consolidation supports the growing trend of utility computing by offering the flexibility to locate different services on the same hardware at the same time, and size applications to allow more than one service per server.

A consolidation solution should also enable partitioning and virtualization. These technologies allow organizations to run multiple applications or jobs on the same server by taking advantage of the fact that some processes are idle while others are busy. As a result, numerous servers can be consolidated onto a single easier-to-manage machine. In addition, grid computing can be more readily supported by uniting computers in formerly separate domains. Although different vendors have different partitioning approaches, physical servers function as multiple virtual servers.

UNIX Environments

Legacy UNIX environments tend to reflect a "one service per box" model. Typically, agencies are managing multiple UNIX devices of varying age, with insufficient resources to keep up. Often, older machines run into maintenance issues, or fall off of maintenance contracts. In addition, performance levels of older machines are significantly lower, resulting in unacceptable price/performance ratios. These disparate machines also run varying versions of operating systems, and some cannot support new applications. The dual demands of reducing this overhead and increasing its application resource efficiency continue to drive consolidation of multiple applications onto larger UNIX servers, then partitioning those machines into multiple virtual machines.

Different UNIX servers can be partitioned to run multiple tasks using a hardware-based method, and in some cases with software-based capability. Hardware-based partitioning divides hardware into independent sections, while software-based partitioning creates higher-level software partitions that can share the same hardware. Ideally, partitions can be created on the fly or their resource space changed to accommodate fluctuating workload demands.



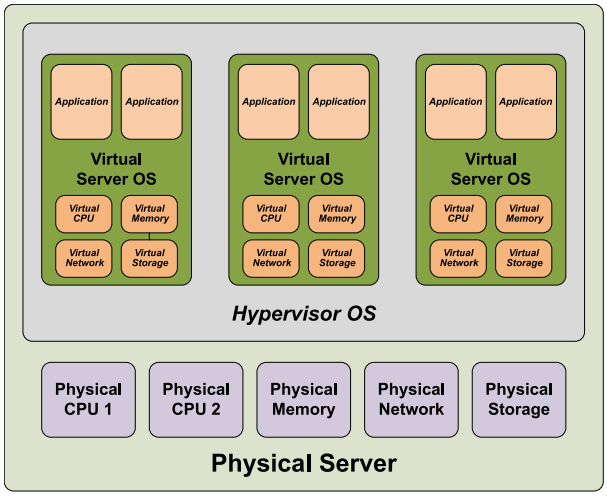
Workload Management

The primary objective in a UNIX environment is improved performance—even where utilization already is high. In addition to performance improvements, organizations can reduce maintenance costs by supporting fewer operating systems, thereby reducing workload. For many projects, the maintenance savings alone can recoup this investment. Consolidation can also help optimize staff resources by providing a common structure for evaluating needs, making good decisions and maximizing performance.

In addition, consolidation creates the flexibility to allocate resources based on fluctuating demands (for example, accommodating different services such as quarterly financials, back up and restore, ERP or accounting, which peak at different times of the year). Some organizations with dual configurations run one service all day, and then run another all night. This increased flexibility drives even higher utilization of the system.

x86-Based Environments

Many agencies have hundreds of smaller x86-based servers running various operating systems and versions. The hardware platforms are usually heterogeneous (such as HP, Dell, IBM, etc.). In addition, due to application conflicts and funding models, a "one server, one application" legacy has caused server sprawl. Server capacity in these situations is significantly underutilized (5–10 percent of capacity). Moreover, each disparate server requires its own set of patches, hotfixes and hardware upgrades. This disparity makes the server environment extremely complex to manage. Server consolidation can help IT organizations significantly streamline this management and maintenance picture.



Virtualization

The prevailing method for consolidation is virtualization. Virtualization allows the operating system and the environment to be disconnected from the hardware platform.

In Windows and Linux environments, solutions commonly use x86 processor platform servers with virtual machine software, to give organizations the assurance that their applications will port from the legacy server to the destination server in the consolidated environment.

(Note: The concept of combining Windows/UNIX operating systems on the same server, while intriguing, offers additional management challenges and requires special care.)

SIZING AND PLATFORM SELECTION

Agencies planning for consolidation must decide which applications and servers they want to consolidate and then determine how much new hardware to purchase. Major hardware, software, benchmarks and other tools are used in the sizing and capacity planning process. Sizing tools are widely available to help guide agency decisions based on the performance data of existing hardware.

When selecting a platform, agencies also need to determine the appropriate destination hardware that will support their current and future requirements. Factors that must be evaluated in making these decisions include:

- The organization's data center environmental situation (power, cooling and space requirements).

- The organization's IT skill sets.
- The volume of servers to be purchased (factoring in economic thresholds for server sizes and quantities).

EXPERTISE AND ACTION PLANS ARE CRITICAL

In order to navigate these complex choices, qualified and seasoned professional resources should be involved in solution development at all phases. These experts should hold certifications by leading systems vendors in the system planned to be implemented, such as APC, Cisco, HP, IBM, Sun and VMware/EMC.

A proven solution delivery method should be followed that encompasses all phases of server consolidation, from infrastructure assessment and solution design to deployment, test, integration and management. The specific activities for each phase should include:

Plan

In this phase, agency requirements should be verified to ensure the server consolidation solution's features and functionality will achieve the desired results. This may require assessing workload requirements and capacity, supported services and applications, power, cooling and space constraints and IT skill sets. Agency readiness must also be assessed.

Design

Based on the assessments completed in the planning phase, engineers design the device-specific configurations. They also produce detailed plans for staging, implementing, migrating and escalating the solution, as well as a System Test & Acceptance Checklist.

Implement

Prior to installation, engineers confirm with the agency that all out- standing requirements for readiness are resolved, and that each site is ready to proceed. Engineers then configure the devices and stage the equipment either at the customer site or at the integration facility. All equipment is rack-mounted, cabled, powered on and tested according to a detailed implementation plan. A migration plan is used to transition users gradually to the new architecture. System performance is validated using the System Test & Acceptance Checklist. Finally, training is tailored for administrators or users to ensure a successful transition.

Operate

Immediately following installation, engineers monitor system performance. Any abnormal conditions and suboptimal performance are identified, documented and remedied.

CORE TECHNOLOGY COMPONENTS

All server consolidation solutions share three basic technical building blocks: systems, software and management tools.

Systems

Because distinct classes of servers have evolved to satisfy different workload requirements and application environments, a server consolidation solution should be sufficiently scalable to accommodate each class. Once the most appropriate hardware and processor choice is determined for the agency, these servers are then architected for desired levels of reliability, availability and serviceability. Mid-range and high-end servers are most often selected to support UNIX workloads, and rack-mount and blade server options are commonly chosen for Windows and Linux environments.

High-End Servers. Designed for high performance and robust workloads such as databases, application services, data warehouses and decision support systems, these servers can scale to greater than 140 processor cores in a single chassis.

Mid-Range Servers. Systems with architectures that generally parallel those of high-end servers, these servers are effective target architectures for consolidating large numbers of smaller, less-critical UNIX workloads and workloads such as application services and smaller databases.

Rack-Mount Servers. A platform for applications that need lower processing capacities than mid-range servers can support, these servers typically scale to between 4 and 32 processing cores.

Blade Servers. Designed to offer shared resources and data center-class performance, these servers are used heavily to achieve environmental savings in virtual server environments. They can often be more cost efficient and use significantly less floor space than traditional box-based servers. These servers are composed of server blades, which each have their own software and operating systems, but share connectivity, power and cooling and management resources.

Hardware Partitions. When organizations have a strong need to isolate applications during consolidation, some server designs can maintain electrically controlled hardware partitions. While hardware partitions yield the highest degree of isolation, they are often not as flexible as virtualization software or resource partitioning techniques.

Software

Server consolidation solutions include both operating and application software to enable systems administrators to more effectively manage their server infrastructure.

Server Virtualization. Administrators are allowed to create virtual machines with one or more processors. Each virtual machine is independent of the other. By placing a layer of abstraction between the physical hardware resources and the operating systems, many different instances and versions of operating systems can often run on a single physical server. As a result, significant cost savings can be achieved by reducing the server footprint and the associated power, cooling, space and cabling requirements.

Shared-OS Workload Management. Many applications and operating systems can be run across large systems with access to large amounts of memory. This varies slightly from server virtualization, as it provides access to a broad range of system resources from a single application or operating system instance.

Management Tools

Capacity Management. Continual monitoring of available capacity in the server environment ensures that SLAs and other user requirements are met. Proactive capacity management is a core component of assessing the existing environment to determine where server consolidation may be a good fit. Some examples of metrics that can be captured for real-time analysis and trending are:

- CPU utilization
- Memory utilization

• Page file utilization

• Disk I/O

• Network I/O

Capacity management systems enable visual trending and analysis of server performance metrics.

Performance Management. A defined list of system resources is continually monitored to ensure that SLAs are being met. Examples of resources tracked include SLA attainment, application performance, application health and the overall system utilization and health when compared to SLAs.

Configuration Management. A centralized view of overall system resources and configurations is essential. With a consolidated configuration management database (CMDB), IT organizations can manage and track the lifecycle of a significantly larger number of servers than ever before, while still maintaining compliance with security requirements and SLAs.

Asset Management. Report generation and other tasks to manage user SLAs are provided. In virtualized environments, asset management tools are also effective in helping to ensure customers that their workloads are separated, and they are receiving the full promised value of the consolidated infrastructure. This data can also be used for compliance, asset tracking and security reporting.

System Imaging. Systems can be imaged and redeployed into both stand-alone servers and virtual server environments. Tools manipulate system drivers and other foundational elements of the operating system to enable portability throughout the consolidated server environment for both the operating systems and their associated applications.

Service Desk. Systems with web-based tools give administrators an interface point for reporting on the status of pre-defined metrics and SLAs. Service desk systems also allow users of consolidated server resources to view their systems and obtain personalized reporting information on the attainment of their agreed-upon SLAs.

Infrastructure

Data centers are often difficult to scale in support of new applications and high-density consolidated server environments. Server consolidation solutions must address the complex requirements behind concentrated power and cooling, dense computing and system backup functions. These functions require a best-of-breed infrastructure for:

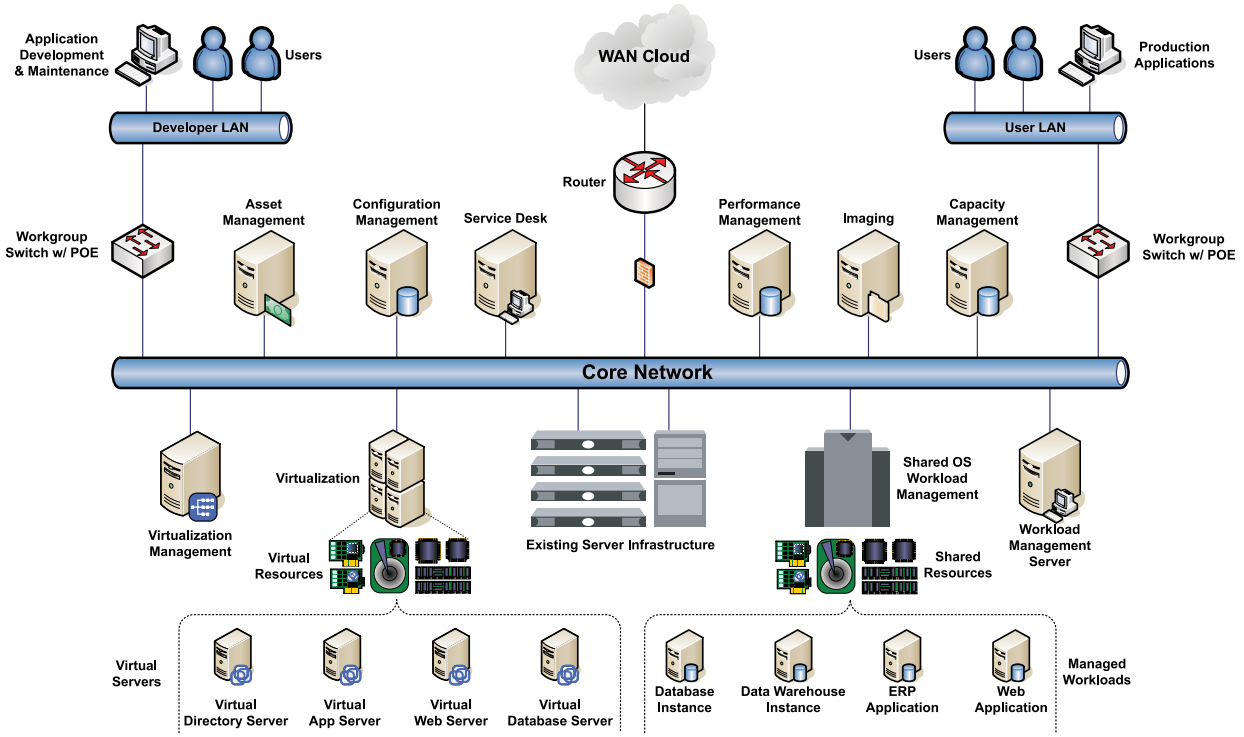
Networking. Core network connectivity components enable significant scalability in performance and throughput within the network infrastructure. They include:

- *Core Network Switches.* These switches provide highly consolidated connectivity for better performance and manageability in consolidated server environments.
- *Core Storage Switches.* These switches provide large director-class storage connectivity due to the extremely dense and manageable port count, often necessary to achieve maximum value in consolidated server environments.

Storage. Key elements of this critical solution component include:

- *Data Storage.* Systems from mid-range to high-end, in either modular or monolithic designs, accommodate any consolidated server infrastructure. By centralizing the data on a shared storage device, physical ties between the functionality of the server and the storing of the data are removed. This allows for changes in the server architecture without posing a risk to the associated data. Once the applications have been consolidated onto the chosen architecture, the data can be centrally managed, enabling replication for disaster recovery and continuity of operations.

SERVER CONSOLIDATION TECHNICAL ARCHITECTURE



- *Storage Management Software.* Daily management of storage helps to reduce staffing requirements, with the net effect that fewer people are needed to manage more storage. Realizing this efficiency has become especially important to agencies as the growth rate of their storage has overtaken the growth rate of skilled people who can manage that storage. In turn, this disparity has increased the need for quality management software that can automate tasks and produce usable reports for such metrics as trend analysis, available disk space and performance utilization. Some typical examples of management software include applications for storage resource management (SRM) and software to centralize the logging of alert messages.

- *Storage Networking.* Traditional network attached storage (NAS) as well as storage area networks (SANs) allow for the centralization of both file-level and block-level data.

Combining these two architectural designs decreases the amount of file servers and enables application servers to be managed in a unified manner. NAS systems are designed to handle file-level data in the most efficient manner. Most NAS devices will perform much better than standard servers in serving data out to the network. This can eliminate the need for file servers on the network. By contrast, SANs are designed to handle block-level applications such as databases. The technology advances in both of these areas have resulted in the development of storage architectures that will allow for the central management of both types of data, helping to reduce the cost of maintaining data and the risk of losing that data.

Power and Cooling. High-density computing environments with servers such as blade servers and high-end servers require significantly greater power and cooling in a much more focused and concentrated manner. Typical power and cooling considerations can include:

- *Next-Generation Power.* Distribution and battery backup capabilities must be able to scale from a single rack to hundreds of racks to support diverse workloads and computing environments. While power distribution in consolidated server environments is often significantly more dense than in other environments, and can therefore be more efficient, it must be accounted for in the design process.
- *Cooling Technologies.* Hot-aisle containment, air removal and water-cooled racks are often necessary components in high-density consolidated server environments, to compensate for the aggregation of many systems into a smaller space.
- *Isolated and Scalable Cabling.* These are resources that must be present to assist with rapid solution deployment without disrupting other systems. While this is a comparatively mature technology, its powerful impact on other solution components makes it important not to overlook.

GTSI AND SERVER CONSOLIDATION

The GTSI approach to server consolidation addresses each of the key components, factors and considerations of this robust model. GTSI Server Consolidation solutions give agencies a thorough way to plan and implement an infrastructure that will increase server utilization rates, reduce server proliferation and simplify system management—reducing TCO and improving service reliability. By centralizing management control and integrating disparate systems, the GTSI solution helps shared-services IT environments perform with greater agility and predictability, to achieve SLAs and other customer requirements.

Best-of-Breed Approach

GTSI integrates server hardware, software and infrastructure across each performance class to meet customer-specific requirements. With an in-depth knowledge of leading server consolidation technologies and vendors, GTSI provides an objective assessment of the ideal combination of hardware, software and services for an agency's unique requirements. We also provide expert professional services to assist with any and all phases of server consolidation efforts.

Experience

GTSI is helping numerous government clients across federal civilian and defense agencies and state and local governments to achieve the benefits of server consolidation. Our engineers draw on years of real-world experience in designing and deploying enterprise computing solutions of all scales by providing agencies with realistic, actionable strategies and deliverables. We provide a rich spectrum of consulting and management services, and our PMI-certified project managers reduce risks and manage all project resources to successful execution in compliance with OMB Earned Value Management standards.

Technology Relationships

GTSI has deep relationships with the industry innovators and technology that best enable these consolidation benefits. Extensive government contracts can also be leveraged to accommodate the customer environment and protect existing investments. And with full certifications in leading vendor technologies, GTSI solutions will not only meet current requirements but also scale for future growth and changes.

From cost savings to management simplicity, the substantial benefits made possible by consolidating disparate servers are desirable to government agencies at all levels. GTSI offers a comprehensive solution for server consolidation that combines the best technology for the customer with GTSI domain expertise and proven methodologies to deliver on-target, on-budget results.

GTSI PROFESSIONAL, FINANCIAL AND LIFECYCLE MANAGEMENT SERVICES HELP YOU FOCUS ON YOUR AGENCY'S MISSION

TECHNOLOGY LIFECYCLE MANAGEMENT

Our unified methodology combines professional and financial services with strong COTS partnerships into a comprehensive framework for managing each phase of the infrastructure lifecycle, including assessment, acquisition, implementation, maintenance, refresh and disposal. By proactively planning for the requirements of each phase, we can align the funding and management of your programs with your benefits—helping you reduce TCO and risk.

GTSI FINANCIAL SERVICES

Our dedicated team of finance professionals can apply their deep understanding of government rules and regulations into creating financing and procurement strategies that help you gain faster access to the technology you need. We provide financing options for the entire lifecycle or specific phases, using your agency's more predictable, flexible operating budgets instead of its capital expenditures.

GTSI PROFESSIONAL SERVICES

Our seasoned engineering and PMI-certified project management resources carry extensive certifications in leading vendor technologies, and rigorously follow OMB Earned Value Management standards. These solutions architects and systems engineers support a wide range of integrated solutions in areas like enterprise software, advanced communications tools, mobility solutions, network infrastructure, data management, enterprise computing, asset tagging, asset disposal and security.

CUSTOMER ADVOCACY

GTSI is committed to providing you with the greatest value coupled with the most attentive customer care. To ensure your current needs are met and emerging goals accommodated, GTSI provides an executive-level Office of Customer Advocacy dedicated to ensuring your satisfaction with all aspects of our service.

CONTACT GTSI

To set up a personalized assessment of your server consolidation needs, call us today at 800-999-GTSI or visit us online at GTSI.com.

GTSI Corp.
3901 Stonecroft Blvd.
Chantilly, VA 20151-1010
800-999-GTSI
GTSI.com