



WHITE PAPER: Computing Migrations

Computing Migration Strategies

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Executive Summary

This white paper describes various strategies for computing migrations. It provides a systematic approach for evaluating risk, using Smart Objects for more informative representation of hosts and their functions, planning considerations including backup strategies, as well as the advantages and disadvantages of the four major migration types.

The Savvis Transformation Methodology is examined as an effective approach for simple or complex migrations of all types. Finally, post-migration considerations are reviewed as part of overall migration planning strategies.

This paper includes the following sections:

- Introduction
- The Seven Deadly Layers
- Smart Objects
- Migration Types
- Savvis Transformation Methodology (STM)
- Post Migration: The Aftermath
- Summary
- How Savvis Can Help

Introduction

Computing migrations are very similar to composing and conducting a symphony. Many components are intertwined from passage to passage, and getting everyone to play their part, and play it well, can be a challenge. One wrong note amongst myriad complex arrangements is noticed, and one musician playing completely out of tune is a disaster.

Migrations are an important part of every organization, and concurrent multiple migration projects are common in the IT industry. Since technology continues to evolve at such a rapid pace, migrations of varying sorts can be found in most organizations. Migrations take on an additional level of complexity when key employees with critical knowledge are no longer with an organization. The IT department is left in the precarious position of trying to reverse-engineer the current state of applications and networks in their efforts to plan the migration. The purpose of this document is to describe some approaches to migration strategies. The scope and type of migration can dramatically impact timelines, requirements and outcomes; however, this white paper explores strategies that can be applied to migrations of nearly any type or complexity.

Migrations can be viewed from both a physical and a logical perspective. Applications can be literally lifted from one system and transplanted onto another. Others involve new hardware, new application versions, and data migration from one machine to another. We will talk more about these strategies later, but right now we will focus on risk avoidance and identifying pitfalls.

The Seven Deadly Layers

With any migration, it is important to identify as many potential risks as possible and determine how each layer of the OSI layer is impacted. It is important to fully understand the role that each of the layers plays to properly plan any type of migration. Most migration specialists will plan from bottom-to-top.

Physical Layer

The physical layer can have common mistakes, including miscalculating the total cable required, port density, improper testing of cable before going into production, and improper labeling or complete lack of labeling. If at all possible, budget should include a true structured cabling design, complete with MDF and IDFs. Savvis has designed numerous cable plant infrastructures supporting well in excess of several thousand hosts.

Datalink Layer

This layer is really made up of two sub layers: the Media Access Control sub-layer (MAC) and the Logical Link Control sub-layer (LLC). The LLC and MAC are fairly low-level functions. Areas that can cause problems at this level include clearing the ARP cache on switches; and routers, if IP address changes are required. Knowing whether hubs or switches are present in the migration is very important. Many times, the VLAN configurations of switches are overlooked, resulting in the inability of network segments to effectively speak or communicate.

Network Layer

Today, this layer is usually IP, and it is often where real configuration challenges come into play. Re-IPing is fairly common during migrations, but it can cause the biggest headaches because changing this layer usually impacts all of the layers above it. One of the notable effects of changing this layer are DNS issues. A common approach to migrating in situations where IP address renumbering is required is to reduce the Time To Live (TTL) settings for DNS zones. This forces updates to DNS servers around the globe to request more frequent updates on changes.

A good rule of thumb is to allow 72 hours for replication throughout the globe's DNS servers, even when the TTL is set very low. Savvis will usually set the TTL value to 5 minutes or 300 seconds.

This is also the point to consider any routing protocols that may be running (BGP, OSPF, EIGRP, RIP) and what effects re-IPing will have on them.

Also consider how your firewall appliance and other security-related devices will be impacted as a result of changing IP addresses. Keep in mind any Intrusion Detection or Intrusion Prevention devices on your network(s), and what configuration changes will be required to keep them operating while minimizing the number of false positives reported.

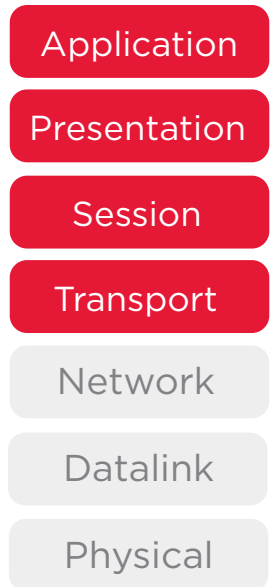


Figure 1
Typical Utility
Services
Infrastructure

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Transport Layer

When planning a TCP/IP migration, the transport layer generally accounts for TCP and UDP protocols. Remember that TCP/IP is not a single protocol, but a suite of protocols working together, similar to the Novell IPX/SPX stack. TCP is used for connection-oriented protocols, and UDP is used for connection-less protocols. It is important to know if applications are connection-oriented or rely on simply receiving packets that are broadcast out onto the network. Once again, security devices should be kept in mind when considering this layer.

Session Layer

The session layer deals with protocols that establish and maintain conversations across the network. Protocols like Remote Procedure Calls (RPC), NetBIOS, and Session Control Protocol (SCP) are examples of technologies that should be considered.

Presentation Layer

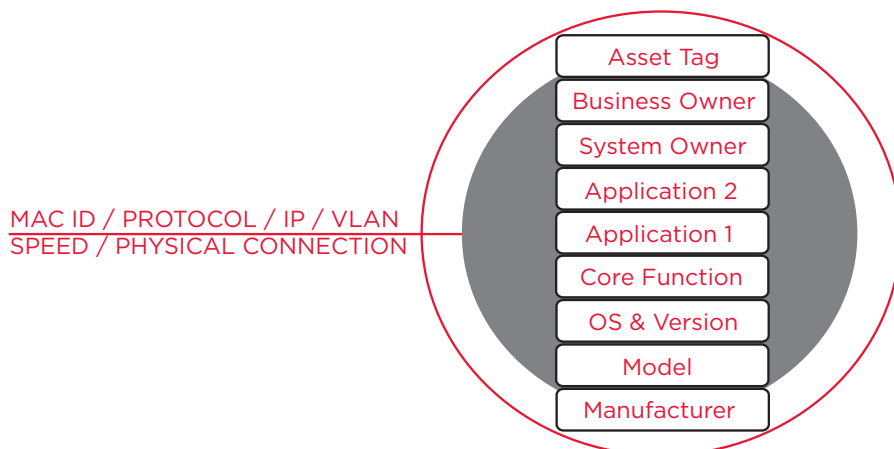
The presentation layer tends to be less troublesome when it comes to migrations. Common technologies at this layer include Apple's QuickTime, GIF, JPEG, TIFF, and MPEG for video compression. If you are moving from one standard to another within the presentation layer, there are many conversion tools available. Converting a site from using GIFs to JPEGs is a fairly easy task, and there are many products that have the conversion software conveniently built directly into them.

Application Layer

The application layer is the closest to the end user, and therefore can appear to have the greatest impact. Migrating from FTP to SCP, or from Telnet to SSH, requires end user training and budgets for both dollars and time should be included. Allow ample time for end user training, because it can impact other timelines for projects within an organization.

Smart Objects

A fundamental requirement for a successful migration includes an overall topology. Most IT organizations have outdated or simply inaccurate representations of both their physical and logical network configurations. At best, many topologies have simple diagrams that include fancy graphical representations of how each host actually looks. This, while aesthetically pleasing, wastes valuable real estate on topologies.



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Savvis has developed Smart Objects, which offers a more informative representation of hosts and their functions. By representing hosts in this fashion, it is possible to make a quick impact assessment of moving hosts from subnet to subnet, application from host A to host B, and a plethora of useful information. When combined into a larger view, the Smart Objects actually combine into a larger system that helps identify redundant systems and their dependencies, such as how application keep-alives are communicated, which is typically over either a dedicated serial connection, or over IP. By having a detailed overview on how systems interact, it is much easier to figure out how to take the system apart and rebuild it.

Other Considerations

Before beginning any migration, it is important to have a good full backup on hand. Depending on hardware available and backup technologies with which your staff or your IT outsourcing partner are comfortable, a mixed approach can turn a hard drive crash from a disaster to a blip on the migration journal. Savvis recommends that critical data have both a full system image stored on a SAN or NAS, as well as a copy on tape. This way you can have the convenience of restoring from a fast medium such as disk, with an additional safety net provided by the reference standard of tape.

Migration Types

There are four major types of migrations, each with distinct advantages and disadvantages. The complexity of the migration, budget and time considerations, and end-user impact, are just a few of the considerations to evaluate before determining whether a Forklift, Phased, Zero-Downtime, or Virtualized Systems migration is appropriate.

Forklift Migration

Arguably, a forklift migration is one of the easiest migrations to perform. From a physical perspective, shutting the machines down and moving them reduces complexity from a configuration standpoint.

Application forklifts to new hardware and a new platform can save a company considerable sums. Physical forklifts also reduce cost by having only one window and one time for any minor changes to occur. This is common in server consolidation or rationalization projects, because consolidating applications onto a smaller set of hardware makes it possible to retire older systems and associated maintenance fees.

Advantages

- Little to no configuration or architecture changes
- One window for downtime
- Least expensive

Disadvantages

- Greater opportunity for extended outage due to:
 - Hardware failure
 - Difficult back out plan
 - Extended downtime; longest of 3 types
 - No hardware refresh

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Phased Migration

The phased migration is one of the most popular migration strategies. A phased migration allows for compartmentalization of systems/applications, which in turn enables testing or migration of less critical elements in your environment without impacting the entire end user community.

With phased migrations, consider categorizing and moving systems in the following order:

1. Staging/Development/Testing, anything non-critical
2. Systems that can tolerate 12-24 hours of downtime with minimal impact on the user community
3. Systems/applications that can sustain 1-2 hours of downtime
4. Most downtime/mission-critical systems

There are two major benefits to following this plan. First, moving non-critical systems first gives you an opportunity to test the new infrastructure and work out any overlooked items or issues. Second, it gives the migration team a few practice runs for later, when mission-critical systems/applications are moved.

Advantages

- Move systems in a compartmentalized fashion allow for test migrations with non-critical systems (less impact to user community)

Disadvantages

- Typically more expensive than forklift-style migration

Zero-Downtime Migration

Zero-downtime moves are by far more complex, but they do offer the least possible impact to end users and can be very expensive. The two types of zero-downtime migrations both involve additional hardware, which can lead to increased cost.

1. Pooled Swing Gear

In this scenario, a pool of servers is allocated to act as swing gear. As applications or systems need to be moved, these servers are built, configured, tested, and have data ported over. They are then rebuilt as needed to support the next logical grouping of systems or applications to be ported over.

At the end of the migration, the pool of servers can either be returned if they were leased or rented, or the assets can be utilized for a staging or development environment.

2. New Hardware Deployment

This type of zero-downtime migration usually includes a hardware refresh. New systems and infrastructure is built, configured, tested, data is migrated, and end users are switched behind the scenes to the new systems. At the end of the migration, the legacy systems are written off and decommissioned. Generally, this is a capital intensive proposition.

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One option is to consider the Savvis utility platform, where Savvis deploys state-of-the-art hardware, with little to no capital expenditure. The Savvis utility platform provides a technology refresh without the financial burden of acquiring new assets and then depreciating them over time. By having two sets of hardware in operation, it provides for the most transparent type of migration.

This type of migration should be considered if your existing hardware is more than two- to three- years old. Most organizations depreciate their assets over 24-48 months. After 48 months, the technology often starts to exhibit signs of unreliability and is prone to “bumps in the night.”

Advantages

- Near-seamless to end users
- Opportunity for technology refresh
- Low risk

Disadvantages

- Can be expensive
- Can be complex

Virtualized Systems

First, it is important to clarify the term “virtualized systems.” It is used frequently in the industry, sometimes in close proximity with the term “utility computing.”

Utility Computing is a delivery mechanism, not necessarily a means of increased utilization of computing resources. Utility computing should be defined as a pay-as-you-go usage-based model, where computing resources including CPU, RAM, storage, load balancing, security services, network connectivity, and so on, are delivered, consumed, and billed according to user demand.

Virtualization, on the other hand, is a total-cost-of-ownership strategy that is achieved by having multiple virtualized servers utilizing a common set of hardware. Most systems today run, on average, between 10-35% utilization, which means that there is enough capacity to handle additional application load or user load. It is also common to find applications that require different supporting services that would conflict if they resided on the same OS.

Advantages

- Near-seamless to end users
- Low risk
- Opportunity for enormous cost savings

Disadvantages

- Can be expensive to transform to virtualized systems without a knowledgeable partner
- Potential for application conflicts

This is where increased utilization, additional flexibility and fewer support costs can be realized through system virtualization.

Another way to think of virtualization is a logical abstraction of software and hardware. Several IT professionals have been involved in server consolidation/rationalization projects where multiple applications can be consolidated onto a single set of hardware and common or host operating system. It is clear that virtualization will be one of the Top 10 technologies for 2006.

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Today, system virtualization follows two basic models: the Hypervisor model, and a model where n-number of guest operating systems are supported by a host operating system.

The Hypervisor model relies on a small piece of code of just 30-50k lines to interact with hardware resources. This considerably reduces the risk of an attack or compromise of a virtualized infrastructure because there is no host operating system that is supporting multiple guest operating systems.

The relatively small size of the Hypervisor code makes it easier to plug any holes in the code. This is in stark contrast to trying to find holes in an operating system with several million lines of code. Hypervisors are the newest iteration of virtualization technology, and are being developed by a number of companies including IBM, VMWare, Microsoft, and Xen.

When determining how your organization is going to implement virtualization, keep in mind that there is a balance to consider. While some organizations may find it possible to consolidate all of their discrete servers onto a single hardware platform, it may not be wise to do so. Two issues can result from the decision to consolidate:

Hypervisor

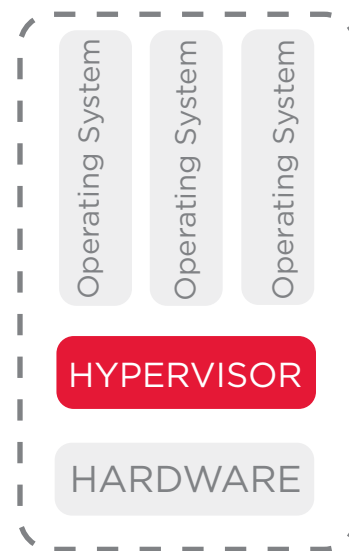
- Fewer lines of code (30k - 50k)
- Code interacts with hardware resources
- Reduced risk of compromising virtualized infrastructure
- Easy to find & plug holes in code
- Driver compatibility can be an issue

Hardware Failure

Many of today's environments have been overbuilt to eliminate the possibility of hardware failure having an impact on systems. The more that is consolidated, the higher the risk of a hardware failure impacting operationally-critical systems. Often, the best course of action in this case is to plan ahead to ensure that critical systems have robust internal components, and invest in as much data protection as you can afford.

Over-utilization

As mentioned earlier, most systems today run between 10-35% utilization. While this is low based on the hardware capabilities, it does not mean that utilization should be driven to 90-100%. A good rule of thumb is to plan 65% utilization for applications that can have spikes in system load, and 70-75% for systems with sustained usage requirements.



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Given these considerations, it is important to partner with a company that has not only performed traditional relocation-style migrations, but that has also developed a strategy for taking legacy system environments and transforming them to a more dynamic and flexible architecture.

Host OS

- Millions of lines of code
- Guest OS supported by Host OS
- Hard to find & plug holes in code

STM: Savvis Transformation Methodology

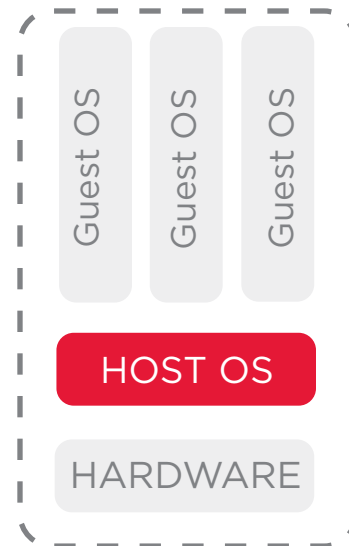
Savvis has created its transformation methodology based on the concept of ADIM: all the phases of a project, including migrations, where we Assess, Design, Implement, and Maintain infrastructure. The benefits of a formal methodology are particularly evident when planning complex migrations which are, in a way, transformations. This formal methodology aids in avoiding potential pitfalls due to either inexperienced staff or a lack of knowledge of existing systems. Savvis utilizes our Savvis Transformation Methodology (STM) whether we are performing a physical migration or logical migrations.

Most migrations have some level of change associated with them. For example, when migrating from one hosting provider to another, re-IPing hosts and devices are often required. In some cases, this is a trivial event; in others, where applications rely on a specific IP schema, this can become a critical milestone. A decision has to be made to either re-write the lines dependent on specific IPs to a more forgiving DNS name, or do a “find-and-replace” with the specific addresses. Having a formal method for transforming information technology can help you make an informed decision and set the proper direction.

During the Assess or due diligence phase, documentation of the existing infrastructure or systems is completed. Project plans are started, system inventories are completed, information exchange with other business units and their dependencies on specific applications are identified and documented.

Savvis then begins to Design the new systems and plan for the transformation from legacy systems to their new environment which, in some cases, is virtualized. Senior-level architects are engaged with capacity management resources begin to analyze past requirements and determine future scalability.

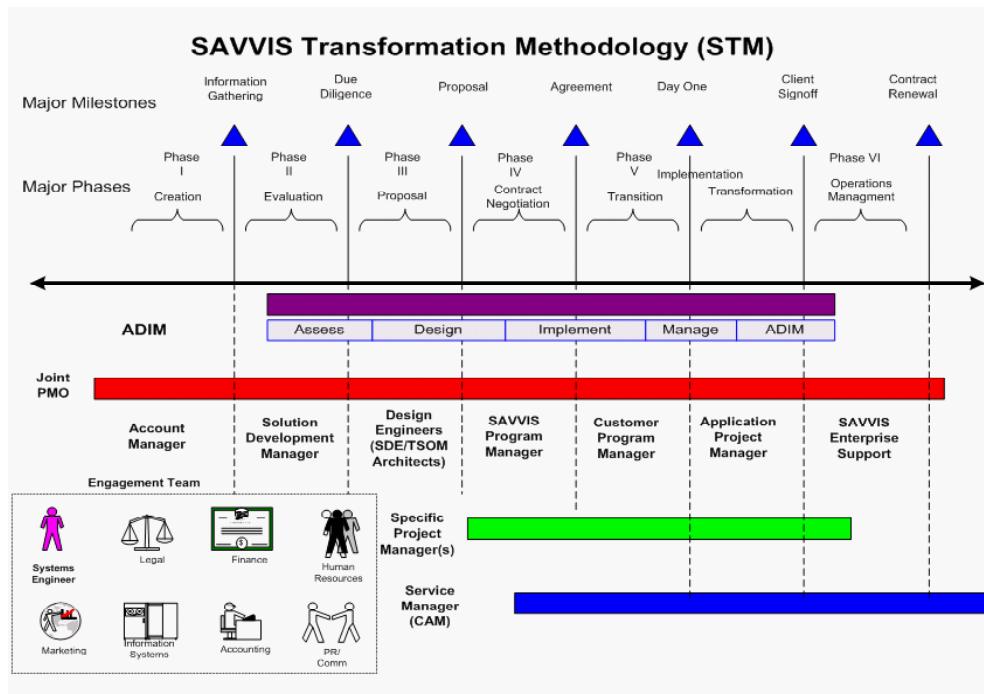
The Implement phase is where the actual work of application/system migrations takes place. System images are created, hardened and documented. Network devices and the security infrastructure allocated and deployed. At the end of the Implement phase, rigorous testing of the environment is performed to assure that a smooth transition from legacy to new is achieved.



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The Maintain phase moves the support of that infrastructure into an operational state. This includes any knowledge transfer from the build teams to the support organization. Savvis has a knowledge transfer framework that provides a means for consistent documentation from the Assess, Design, Implement and Design phases, which enables expedient transfer of knowledge from one phase to another. Typically most projects lead back into the Assess phase after a few months of stability in the Maintain phase. This ensures that we are always investigating new options to save our customers time, resources, and expenses.

We view the Savvis methodology as a roadmap to provide our customers with a framework for building and supporting their next generation infrastructure.



Post-Migration: The Aftermath

Post-migration activities are often not considered until after the migration is complete, which can lead to poor results in the Maintain or operate phase. Include what expectations you or your organization have for deliverables as part of the migration pre-planning. If you do not capture information during the Assess phase that is important for post-migration deliverables, it is more difficult to convince decision makers that it is required at all.

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Post Migration Planning & Deliverables

- Include post-migration expectations & deliverables during planning
- Detailed inventory where applicable
- Document topologies, system image information, hardening guidelines, other common elements
- System Run Book: detailed system information, startup/shutdown procedures, system interdependence organizational dependencies
- Document idiosyncrasies that materialize during migration to ease future migrations

When planning a physical, consolidation or rationalization, give serious consideration to a port-by-port, system-by-system inventory. This can save man hours when the move is occurring, as well as provide a means for troubleshooting mishaps that may occur post-migration. The inventory should be a living document within the supporting organizations, and should be secured with the common elements such as topologies, system image information, hardening guidelines, and so forth.

A system Run Book is another deliverable that should be planned for and expected. The Run Book should include specific requirements learned during the migration, such as detailed system information, startup/shutdown procedures, system interdependencies, organizational dependencies and so on. These typically tend to lend themselves helpful on systems that are in a very steady state, or systems that do not get touched very often. Document any idiosyncrasies that materialize during the migration so that future migrations or system troubleshooting will not require as much guesswork.

DEVICE INFORMATION				CURRENT INFORMATION AND LOCATION										DESTINATION INFORMATION AND LOCATION										NOTES			
Model	Server Name	Rack	Port	IP	VLAN	CARD	Switch	Blade	Cage/Room	Rack	VLAN	CARD	Switch	Blade	Application	Operating Syst	Asset Tag	3rd Party Component	Owner	Note							
SUN ULTRA 2	OPUS	1	1	YES	146.155.81.12	405	HMEVONE	CR302	710	DC3 Overflow Cage					CR312DC3-F0106	TedWat	DC2	EG-29	Solaris	846F2D0A	Oracle Forms	Burlow	Prode				
SUN E420R	POLECAT	1	1	YES		409	HMEVONE	CR302	514	DC3 Overflow Cage					CR312DC3-F0117	TedWat	DC2	EG-29	Solaris			Burlow	Active server				
SUN ULTRA 2	PANTHER	1	1	YES		409	HMEVONE	CR302	514	DC3 Overflow Cage					CR312DC3-F0116	TedWat	DC2	EG-29				Burlow					
SUN SPARC 5	VEASEL	1	2	YES	146.155.105.2	409	HMEVONE	CR302	514	DC3 Overflow Cage					CR312DC3-F0119	TedWat	DC2	EG-29	Solaris	5NF1903		Burlow	??				
SUN A5000	VALRUS	1	2	YES	146.155.85.65					To Value					N/A	TedWat	DC2	EG-29				Burlow	see cc				
SUN 420R	HEDGEHOG or ANTEL	1	2	YES	146.155.85.11	409	HMEVONE	CR302	515	DC3 Overflow Cage					CR312DC3-F0120	TedWat	DC2	EG-29				Burlow	TedWat				
SUN 3500	VALRUS OR IGLANA	1	2	YES		409	HMEVONE	CR302	5129	DC3 Overflow Cage					CR312DC3-F0121	TedWat	DC2	EG-29				Burlow	TedWat				
SUN E250	LIVY	1	3	YES	146.155.24.2	409	HMEVONE	CR302	517	DC3 Overflow Cage					CR312DC3-F0122	DNV	DC2	EG-29	Solaris	942H285		DNV team					
SUN E250	LIVY	1	3	YES		409	EXPI	CR302	5129	DC3 Overflow Cage					CR312DC3-F0117	DNV						DNV team					
SUN E250	BEAR	1	4	YES		409	HMEVONE	CR302	5129	DC3 Overflow Cage					CR312DC3-F0116		DC2	EG-29									
SUN E450	STINGRAY	1	4	YES		409	HMEVONE	CR302	5130	DC3 Overflow Cage					CR312DC3-F0119	DB Page Code Repository	DC2	EG-29					Lonkili				
COMP# 6400R	CW-APT-PPD-0801	1	6	YES	146.155.105.7	409	PQ1 4	CR302 DC2	5147	DC2 MIS Room					CR302 DC2 416		DC2	EG-29					Rickard				
COMP# 8500R	CW-APT-PPD-401	1	7	YES	10.76.11.30	MIS	TOP	CAT in Row	614	DC2 MIS Room							DC2	EG-29					Rickard				
COMP# 8500R	CW-APT-PPD-401	1	7	YES	146.155.181.14	405	BOTTOM	CR302	176	DC2 MIS Room					CR302 DC2 418	Access Pricing Tool								Mazdot			
SUN E450	CWGLOBALVIEW01	1	7	YES		405	HMEVONE	CR301	170	DC3 Overflow Cage					CR312DC3-F0106		DC2	EG-29						Dcor			

Summary

With the amount of change in our industry, one thing is common: Change. Migrations are an inevitable part of maintaining an organization's competitive edge when leveraging ever-changing technologies. Minimizing risk, controlling costs, and being cognizant of user impact are complicating factors that create myriad challenges to be planned for, monitored, measured and managed throughout the entire process.

Whether you are planning a physical migration or investigating a move towards consolidation or even virtualization, it makes sense to partner with someone who has experience. Savvis has performed thousands of migrations for our customers and can bring significant experience in server migrations, data center migrations, relocation services and utility computing.



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How Savvis Can Help

Migration Planning and Analysis Services. Savvis migration solutions utilize a comprehensive end-to-end methodology which includes assessment, design, implementation and management. This proven methodology serves as a roadmap for all types of data center relocations, as well as other migration requirements. The primary objective of our consultants is to achieve your migration goal with minimal service disruptions or downtime.

Data Center Migration Services. Savvis Data Center Migration Services are a comprehensive suite of service offerings that enable an organization to design, build, move, migrate or consolidate data centers. This complete solution supports each component of a data center move from high-level project planning through project execution.

Key data center services include design and construction of the target data center including structural, support, security, and capacity components of the data center, network infrastructure architecture, initial project estimation, high-level project development and detailed migration planning, technology selection and procurement of enabling hardware and software, data migration technologies, actual migration execution and project management.

Application/Platform Migration Service. Savvis' Platform/Application Migration Service provides customers with the confidence of knowing their application and or operating system transfer is being thoroughly managed by skilled consultants. Whether the migration is a change of physical location or a transition to an alternate platform, our team of application experts will focus on ensuring the correct system and application configurations and compatibility to provide a seamless integration.

Program Management Services. With Savvis' Program Management solution, our experienced professionals can help reduce the risk of project failure, effectively prioritize program initiatives, optimize internal resources, deliver on stakeholder expectations, and improve return on investment.

Savvis' Program Management solutions include integrations with Savvis, internal organizations and vendors; carefully planned milestones and stage-gate entry and exit criteria with clear deliverables; checklists, review cycles, and documents that are managed through workflows and monitored via alerts; program dashboards that provide quick, clear visibility of program status and performance information; resource allocation and management; risk assessment; and an issue resolution process with clearly-defined criteria and escalation paths.

Utility Platform Services. Our team of Utility Platform experts specializes in helping organizations plan for new technologies in cost effective ways while retaining existing investments whenever possible. We value-engineer growth plans to address our customer's goals and objectives, and provide real return on investment by propelling your business into the future by leveraging the Savvis Utility Platform.

The Savvis team will thoroughly evaluate your current hardware, software, security schema, data communications and network infrastructure and help you develop a road map that will allow you to migrate seamlessly to the Utility Platform.

**For more information
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