

## Kickstart Your Transition to the Cloud

With Cloud Computing Services from Sun

Effectively aligning IT resources to support global business demands is critical to survival in a global economy. The prevailing centralized, hierarchical business operational model is being swept aside by a rapid response, distributed model. This model empowers employees, partners, vendors and customers to address changes in global business conditions around the clock, and it is highly dependent on technology for communicating, collaborating, and transacting business. Traditional methods for planning, procuring, and deploying IT facilities and infrastructure are less effective, and the significant increase in demand for IT resources is outstripping available power, space, cooling capabilities, and budgets of many organizations.

### Moving to the cloud — a strategic commitment

When considering a move to the cloud, it is recommended that you implement a strategic analysis (Figure 1) to evaluate the readiness of the enterprise to migrate. As part of this analysis, you can identify the relevant opportunities created by transitioning to the cloud and define the requirements and architecture of the target deployment. In addition, this analysis allows you to identify the needed changes to IT operations, prepare a risk assessment, and prepare a financial impact assessment. These elements can then be combined to create a well-founded, compelling business justification for the required transformation.

### Highlights

- Leverage cloud computing to build computing environments with improved efficiency, security, and agility
- Provision resources on-demand, achieve operational efficiency, and optimize your datacenter with cloud computing
- Sun's comprehensive cloud value proposition, experience, and expertise makes it uniquely suitable to advise you on your cloud computing efforts
- Successfully plan and implement a cloud computing strategy with Sun Services through a structured methodology with minimal risk

**“Cloud computing is an operational model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction.”**

*National Institute of Standards and Technology, August, 2009*

A cloud computing strategy can provide a more flexible and responsive IT environment to support the rapidly changing needs of a distributed enterprise model. Sun Professional Services<sup>SM</sup> can help you plan, architect, implement, and support a cloud computing environment that aligns with your enterprise requirements.

A cloud computing strategy is implemented by identifying and distributing specific, suitable business tasks onto the public and private Internet, using attached compute, storage, and network resources to facilitate more cost effective and responsive services to users. A cloud computing environment helps enable a more open, flexible, and sharing IT environment that leverages technology to exact significant business advantage.

However, a cloud strategy can create significant stress on an enterprise shifting to such a dynamic, user driven IT environment. This stress can be identified and mitigated prior to the move by conducting a cross-functional evaluation of cloud opportunities and impact.

Sun Microsystems has been implementing cloud computing concepts for several years. Sun Professional Services can help you plan, architect, implement, and support a cloud computing model that aligns with your enterprise requirements.

### Challenges of enterprise IT

The evolution of the enterprise datacenter over the years has been driven by a wide range of often inconsistent organizational, operational, technical, and business considerations. Meanwhile, the different technologies that have come and gone have often left behind a residue of legacy infrastructure and applications. As a result, many enterprise datacenters maintain infrastructure and applications that are cumbersome, inefficient, difficult to manage, and expensive to maintain. More significantly, many of the enterprise datacenters evolved with little consideration for optimal use of power and cooling. As a result, today's challenges in power availability and cost, added to the increasingly demanding requirements to reduce carbon emissions, are creating severe difficulties for enterprise IT.

### Characteristics of cloud computing

Cloud computing does not represent a single, well defined technological implementation. Rather, it is a collection of operational models, architectures, and technologies optimized to enable you to efficiently provision and operate IT — networking, computing, storage, and software — as encapsulated services over the network. These encapsulated services are provided to applications as elastic, virtualized resources

- Industry best practices
- Application profile analysis
- IT infrastructure analysis
- Datacenter design and analysis
- IT strategy and governance policies
- IT operations analysis
- Security policies
- Audit requirements



- Architecture patterns
- Deployment patterns
- Service Level Agreements (SLAs)
- Metering and billing model
- Operational changes
- Policies
- Risks
- Financial justification

*Figure 1. The process of cloud strategic planning and analysis encompasses the full range of organizational considerations and results in technical and non-technical requirements and insights.*

that can scale on-demand. Resource usage can be measured and attributed to different applications, while multiple applications can securely share the underlying hardware and increase resource utilization.

Virtual machines and virtual appliances are the prevalent abstraction and unit of deployment on the cloud. Currently, new architectures are emerging that allow you to deploy virtual machines in a simple and elastic manner with virtually no scalability limits, achieving high capacity and economy of scale.

### Clouds types

Clouds can be categorized according to the service layer that they provide (Figure 2). These include:

- **Infrastructure as a service** — provides storage, networking, and computing resources on-demand

- **Platform as a service** — provides fully configured, virtualized servers on-demand
- **Software as a service** — provides fully functional applications or software infrastructure services on-demand

### Cloud traits

All cloud types share the following key traits:

- Services are available to all consumers
- Physical resources are abstracted and pooled regardless of their location
- Users can self-provision virtual resources
- High-resolution usage-tracking and service measurement are available
- Resources are elastic and rapidly provisioned
- The cloud is accessible and controlled by software
- Network access to the cloud is ubiquitous
- Multiple logically isolated users, or *tenants*, can be accommodated

#### Cloud categories

Clouds can be categorized as *public*, *private*, or *hybrid*:

- A **public cloud** provides a flexible, pay-per-use IT environment that helps the business to better match actual IT demand to expenditure, to decrease capital outlay for IT infrastructure, and to shift IT investment and risk to a third party. In addition, users typically realize access to greater IT functionality along with automatic, faster control over the deployment of IT resources to support their work.
- A **private cloud** operates within an enterprise datacenter or in an externally hosted datacenter for the sole benefit of a single enterprise. A private cloud is easier to align with security, compliance, and regulatory requirements, and provides more enterprise control over deployment and use.
- A **hybrid cloud** delivers IT through a mix of both public and private clouds.

#### The primary benefits of cloud computing

Cloud computing changes how applications are defined, developed, deployed, scaled, updated, maintained, and paid for, as well as the infrastructure on which they run. By decoupling application deployment from the physical infrastructure, applications can be rapidly deployed and scaled. As a result, once a business need is identified, the time-to-value of an application that is defined to support this need can be significantly reduced.

#### Challenges of transitioning enterprise computing to the cloud

While the benefits of cloud computing are compelling, the path to the cloud is not immediate, nor is it risk-free. To compute on the cloud you need to transition your organization and IT — applications, users, staff, and operations — to the cloud.

To minimize the exposure of the enterprise to the risks of cloud computing in general, and information mismanagement in particular, you need to implement an ongoing effort to educate users and track activities.

A few examples of the challenges facing the enterprise when implementing a cloud computing strategy are:

- Distributing data and sharing physical resources in multiple locations creates IT governance issues relating to regulatory compliance, security, and privacy.
- Many software vendors have not adapted their licensing models to cloud computing, making it difficult for the enterprise to ensure licensing compliance in a cloud environment.

- Because enterprise data can be distributed in many locations, it is difficult to achieve the inter-operability, scalability, and sufficient network bandwidth to support adequate service levels for computing on the cloud.
- Implementing high-resolution monitoring and metering of IT infrastructure and using the resulting data presents challenges at the technical, operational, and organizational levels.

#### Challenges unique to the public cloud

While public clouds are similar to private clouds from a technological perspective, they create unique challenges due to their nature as remote, shared entities. These include dependency on external suppliers for business-critical infrastructure — with an associated loss of control — and the use of a

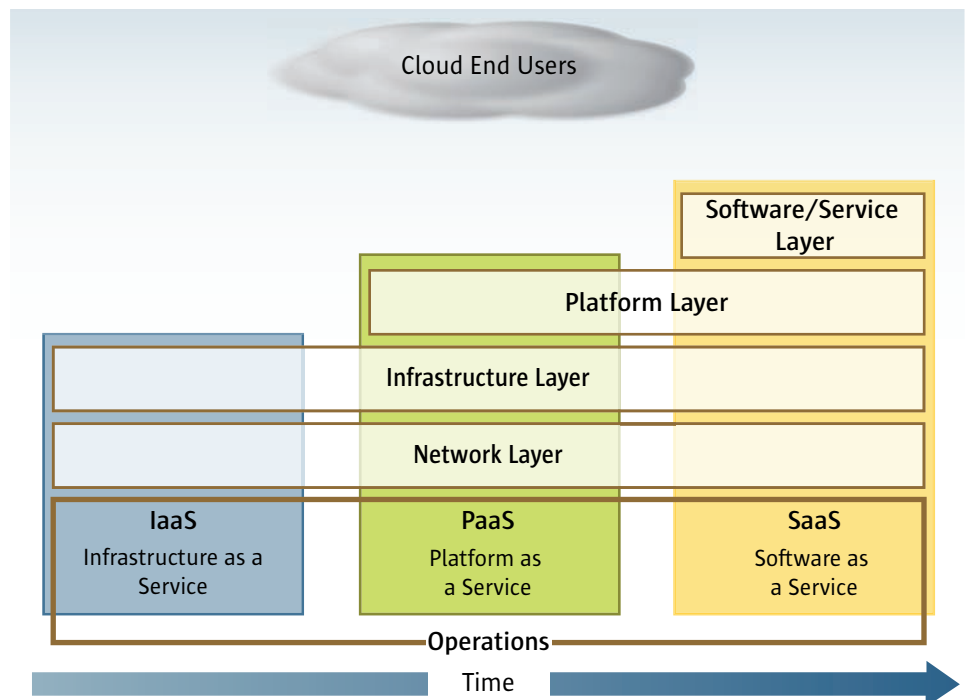


Figure 2. Different cloud types abstract different resources. Over time, organizations typically tend to adopt IaaS, followed by PaaS, and finally SaaS.

shared environment, which includes potential availability, latency, security, privacy, and regulatory issues.

### Legal issues in the public cloud

Data storage in the public cloud creates additional legal and regulatory challenges. For example, information stored on a cloud should be considered encapsulated and therefore immune from government access, unless appropriate court orders are obtained. Unfortunately, there is concern that the public cloud owner could grant government access to the information without the knowledge or consent of its owners.

In general, the legal issues of computing in the public cloud are still unclear and only time will tell if adequate solutions can be found to alleviate the issues without creating barriers to deployment.

### Industry-specific considerations

The justifications, issues, and benefits of transitioning to the cloud differ between industries and applications types. For example, in financial services, over-provisioning is the most common strategy used to deal with demand spikes, despite the high cost and inefficiency of this approach. If the enterprise uses cloud computing, it can service demand peaks by allocating datacenter capacity to handle them and, once the demand peak is over, the datacenter capacity can be applied to other, lower priority work loads, thus driving up average utilization.

Where large compute and storage farms are needed to support highly scalable, dynamic workloads such as those typical of HPC applications or publicly facing Web applications, the business justifications of the cloud are immediate. In fact, many of the technologies that underlie cloud computing were developed to service these types of applications.

The benefits of cloud computing are less pronounced where applications are constant in their resource demands, are not easy to partition for dynamic provisioning, or do not require a high level of scalability. In these environments, the risk and cost associated with transitioning to the cloud can be more difficult to justify.

The type of cloud that is most suitable for a given enterprise — public, private, or hybrid — and the service layers required — infrastructure, platform, or software — often depend on the types of applications the enterprise commonly uses.

### Applications that should move to the cloud

Applications should move to the cloud based on the cost/benefit considerations of the move. Typically, it is easy to justify moving applications that can benefit from rapid deployment, need a high level of elasticity, and can scale easily. Applications that are not standards based, or that are dependent on software that is not supported on the cloud, can be difficult to move. When transitioning to the cloud, you can choose to replace these difficult-to-transition applications or to maintain them in a traditional, non-cloud environment. In any case, storage, backup, or networking can still be provided by an IaaS cloud to applications that cannot transition to the cloud in full.

If considering a move to a multitenant cloud, whether public or private, applications that require security but cannot be secured, cannot be moved. For an expanded discussion of security on the cloud, see “Security on the cloud” on page 8.

### Cloud deployment models

In some cases, for technical, operational, or business reasons, a given application is concurrently deployed on traditional non-cloud infrastructure and on a cloud, or on a hybrid private/public cloud. Several general models for these types of deployment are recognized:

- **Test and development** — where the needs of development, testing, and early stage deployment benefit from low overhead, rapid provisioning, and the wide variety of software and hardware resources typically available on the cloud
- **Functional off-load** — where certain, well defined compute or storage functions are moved to the cloud, and other functions are retained in non-cloud environments
- **Augmentation** — where the public cloud is used to service peaks in demand in a private datacenter
- **Web services** — where a well defined service that is provided to many applications can benefit from the elastic nature of the cloud to service different levels of demand

### Route to the cloud

Whether the target deployment is to a public cloud, private cloud (in-house or hosted), or hybrid, moving an enterprise’s IT to the cloud is a complex task that requires fundamental changes to many IT related processes. To help ensure a successful transition, the route to the cloud typically consists of the following sequential stages, as illustrated in Figure 3.

When considering such a transition, it is important to remember that cloud computing is an evolution of current datacenter practices, architectures, and technologies. Over the last few years, your organization might have taken steps to rationalize your IT and make it more efficient, for example, by deploying your applications on virtualized servers. If this is the case, you have already

taken the first steps in your transition, which makes it much simpler to fully transition to the cloud.

### Analyzing the present state

Existing enterprise IT is often divided into several organizational and technological silos. The fact that business units are usually the owners of applications can result in an environment where there is minimal sharing of resources. This creates several issues and challenges:

- Widely diverging standards or proprietary interfaces — each business unit is free to select its own technological components
- Minimal interaction between different applications and minimal automatic information sharing — divergent development creates difficulties in application integration
- Poor utilization — business units tend to maintain their own, over-provisioned, spare capacity
- Diverse operations and processes — the needs of the business units differ and there is no entity within the enterprise that enforces common processes

The initial analysis identifies the extent of these challenges in the enterprise so that the following stages can focus on resolving the challenges in the course of the transition.

### Virtualizing, consolidating, and retiring equipment

On the cloud, virtual machines are the standard deployment object. Virtualization enables flexibility by abstracting the hardware. Software can be deployed without depending on any specific hardware resource. Once the applications are virtualized, the datacenter can be rationalized and consolidated at the infrastructure, platform, and application levels, and superfluous equipment can be retired.

### Optimizing operations

Decoupling applications from hardware helps enable facility and IT operations integration, infrastructure sharing, and improved automation. These in turn all contribute to optimizing resource usage and achieving SLA targets. The metering capabilities of cloud computing create extensive, high resolution usage data across all aspects of the datacenter operations. In addition to enabling pay-per-use, the data collected can be used to

track, manage, and plan datacenter capacity. The end result is that the datacenter as a whole can reach operational and architectural maturity.

### Transitioning to the cloud

Finally, the last step in evolving the datacenter to the cloud can begin by implementing the various components of the cloud infrastructure in phases, including:

- Physical resource virtualization
- Self provisioning
- Programmatic control
- Dynamic resource allocation
- Pay-per-use

External interfaces, often required to enable information and resource sharing between loosely coupled clouds, are implemented as part of the transition.

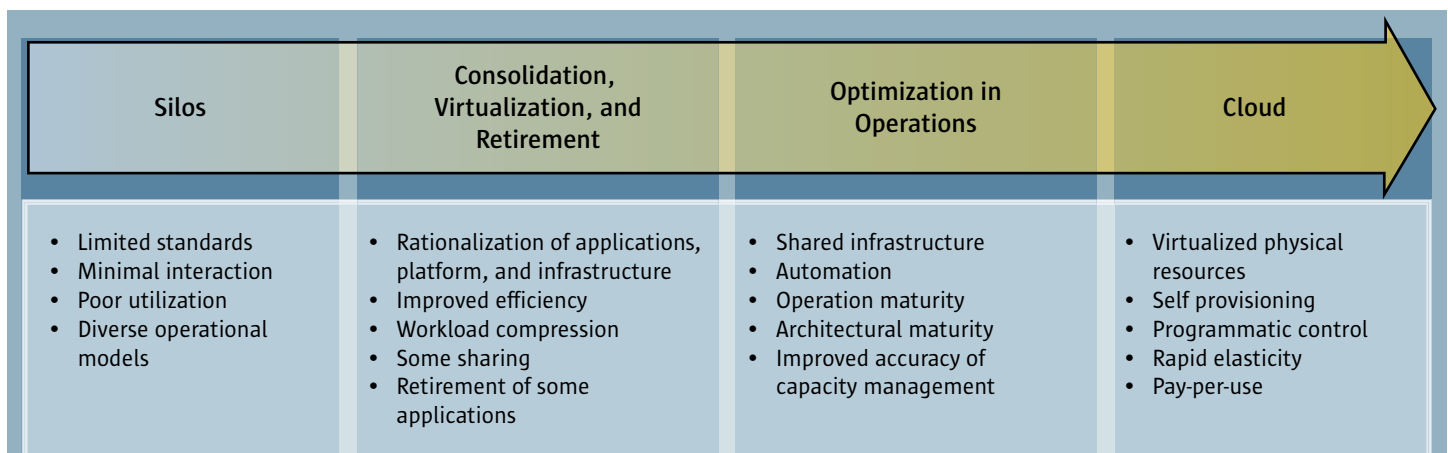


Figure 3. Organizations should evolve from a state of multiple, disjoint silos with their associated inefficiencies, through increasingly advanced operational models to the cloud.

### Strategic planning

While cloud computing focuses primarily on solving the issues associated with enterprise IT, it can deliver additional benefits by helping to create an agile, adaptive enterprise. The Sun Cloud Strategic Planning Service (Figure 4) helps you implement a strategic analysis and leverage the opportunities created by the move to the cloud. The strategic planning and analysis phase is the first stage of Sun's cloud services engagement. Sun cloud professionals apply a set of industry best practices and evaluation techniques to analyze the current enterprise environment and identify cloud computing opportunities. Each of the elements listed in the following sections are evaluated in the context of the needs and challenges of the enterprise, and the potential benefit to these elements that can be derived from cloud computing.

### Business alignment

- Key business drivers and performance indicators
- Enterprise economic environment and competitive landscape with a focus on the areas where cloud computing can be used for competitive advantage
- Opportunities to shift capital expenses to operational expenses
- Regulatory, governance, and decision support
- IT service levels, expenses, and risk

### Organizational considerations

- Ways to help ensure responsible cloud use
- Processes and tools to improve decision making
- Alignment between different business units
- Employee productivity, collaboration, and innovation

### IT technology and operations

- Service lifecycle management
- Alignment of IT with the needs of business units and users
- Optimized use of power, space, and cooling

- Enhanced business continuity and disaster recovery capabilities
- Efficiency of IT datacenter deployment
- Testing and handling of demand peaks
- Integration with other organizations when required by mergers and acquisitions

### Sun's cloud implementation methodology

To transition successfully to the cloud, you need to implement a structured, multistaged approach to plan, control, and reduce the risk of the transition. Sun's proven process (Figure 5) helps you transition to the cloud through the following stages:

- Discovery
- Synthesis
- Design
- Execute, realize
- Sustain

### Discovery

The discovery phase uses the insights gained in the strategic planning process to drill down into the enterprise IT. Initially, the

requirements are examined and validated and aspects of the current deployment that might inhibit progress are identified, together with aspects that are likely to support it. The set of validated requirements are assessed to identify critical success factors and perform a gap analysis.

### Synthesis

The synthesis phase maps the requirements and target deployment models to appropriate architectural options. This information is then used to design alternative solution options. The alternative solution options are then evaluated to help ensure they can meet the requirements and remedy the gaps, and the target solutions are defined. Finally, solution deployment programs plans are created and prepared for the design phase.

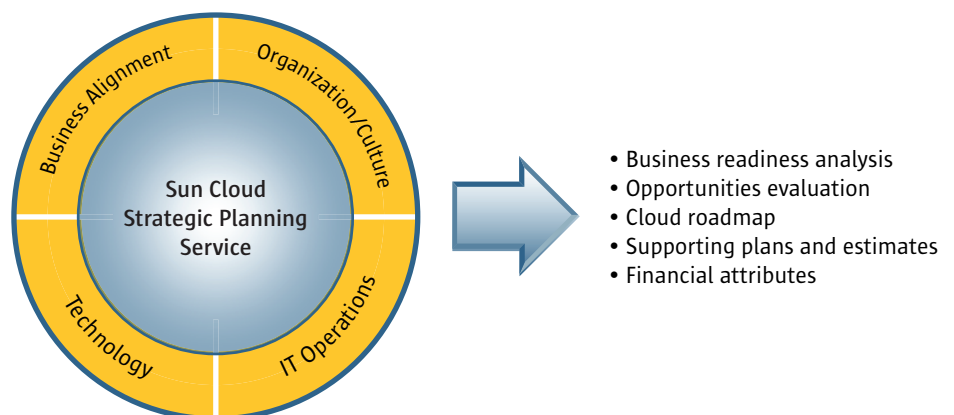


Figure 4. Cloud strategic planning integrates different aspects of the organization's strategy into a unified approach to cloud computing.

### Design

The detailed design phase creates the designs for the target architectures as derived from the synthesized program plans. Some of the assumptions and designs might require confirmation — by implementing proofs-of-concept, benchmarks, or pilot deployments — to finalize the design of the different elements and help ensure they match the requirements. The products of the design phase are concrete operational and engineering implementation plans.

### Execute, realize

The execution phase begins by validating the plans and reviewing the expectations of the different stakeholders regarding the implementation process. The transition is executed with Sun's standard project management methodologies, which maintain ongoing contact with stakeholders and deliver planned milestones. The physical systems are deployed in phases, with different applications transitioning to the cloud gradually to help ensure a smooth transition with minimal disruption. It is important to remember that the applications themselves can be adapted to the cloud and tested prior

to the actual transition, since the applications are normally backward compatible with traditional platforms. The deployment to the cloud is implemented after application changes are fully verified.

### Sustain

After successfully deploying the appropriate elements of enterprise IT to the cloud, the transition is complete and the organization moves its cloud operations into sustaining mode. In this stage, the enterprise implements the maintenance plans created in the design phase, including the operational support structure. Now you can monitor the performance of your IT operations and the key IT performance indicators, and validate the attainment of your operational objectives.

### Kickstart your transition to the cloud with Sun Services

Enterprise IT is facing increasing pressure to become more efficient. This pressure is driven by the difficult economic environment, increased competition, and regulatory pressure to control carbon emissions. The IT industry is responding to this challenge by developing new and innovative architectures,

technologies, and operational models that can help resolve the inefficiencies of enterprise IT. Cloud computing features — elasticity, resource virtualization, self provisioning, metering, multitenancy, and more — provide you with the tools you need to deploy IT services with unparalleled levels of efficiency. However, successfully adopting cloud computing requires that you transform your IT and implement fundamental organizational, technological, and operational changes.

Sun has been supporting the adoption of cloud computing in the enterprise, building cloud architectures, technologies for cloud computing, and providing public cloud services for several years. Sun Professional Services personnel have gained a wealth of experience in helping enterprises address the challenges of cloud computing. Sun's service offerings include strategic and tactical analysis, evaluating the current environment and cloud opportunities, planning the transition to the cloud, and managed services to support you in adopting and sustaining cloud computing.

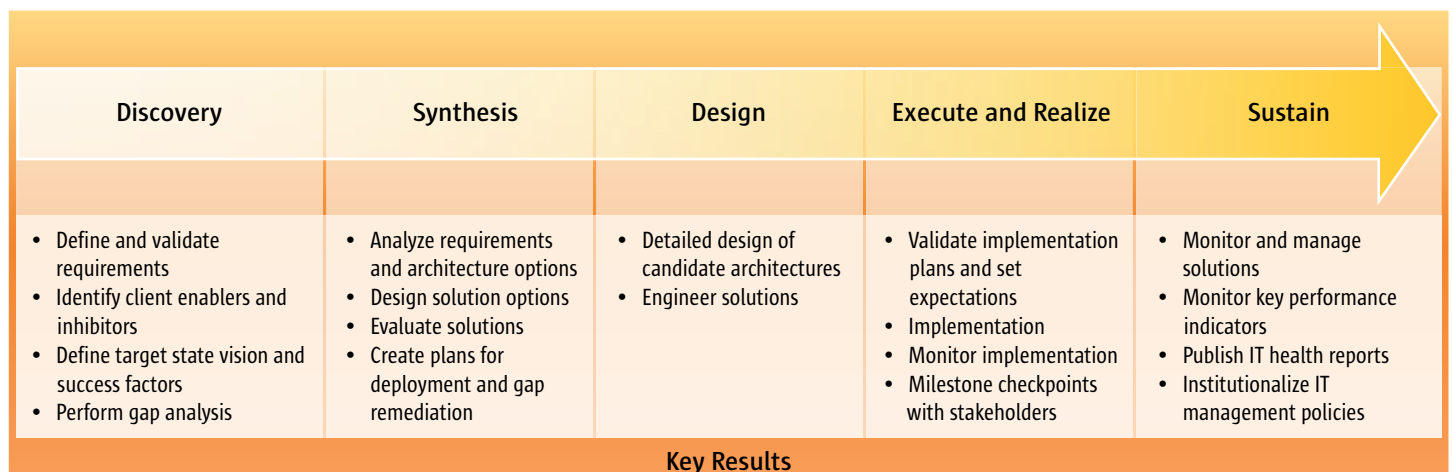


Figure 5. Sun's proven methodology helps you through the different stages of moving to the cloud.

### Security on the cloud

A cursory examination of security on the cloud can raise safety concerns for information that is processed and stored there. Sharing hardware resources, transporting sensitive data over public networks and storing it outside the enterprise's control, and entrusting core business processing to external organizations can all seem unsafe. However, closer examination reveals that while these concerns are valid, they can be resolved and the cloud can create opportunities for more secure computing environments.

When an enterprise encapsulates applications within virtual machine images to deploy on the cloud, security measures can be enforced and documented for all of these applications. Each virtual machine image can be secured and deployed any number of times on the cloud with an assured level of security. When the image needs updating, it is quickly redeployed, speeding up the integration of security fixes across the production environment.

Multiple tenancy in the public cloud creates real security concerns for the enterprise. A multitenancy environment requires application developers to more diligently protect against data leakage, resource exhaustion, and inappropriate administrative actions than in a private environment. While these risks exist in any environment, multitenancy combined with elasticity and self-provisioning amplify their potential impact. For example, auditing information must never be allowed to remain on temporary storage since a single physical system hosts any number of tenants over time. While these issues can be managed through policy,

process, and technology controls, a secure implementation is essential to protect against these and other security risks. A more drastic measure is to host sensitive applications in controlled areas that are physically and logically separated from other cloud tenants.

Another issue specific to the public cloud is data transfers. There is some data that normally does not leave the organization over public networks. If you transfer sensitive data to the public cloud and store it on shared resources, its vulnerability is increased. Strong encryption, and physical and logical containment techniques can be used to prevent disclosure. Alternatively, the application can be distributed and the components of the application that process the sensitive data can be deployed in the private datacenter.

The essence of security on the cloud is fundamentally similar to security in a traditional datacenter — whether shared or private. When the enterprise implements a comprehensive approach to security and governance, a secure IT ecosystem can be created that supports compliance objectives in traditional datacenters, private clouds, or public clouds.

Sun's immense expertise enables it to help you implement security on the cloud. Sun's identity management technologies, including identification, authentication, authorization, accountability, integrity, confidentiality, privacy, non-repudiation, and availability are all immediately applicable to the cloud — both public and private. Sun cloud computing professionals have the expertise to support you in securely deploying your IT to the cloud.

### Learn More

For more on cloud computing technologies and services from Sun visit <http://sun.com/service/cloud/>

Sun's comprehensive cloud value proposition, experience, and expertise makes it uniquely suitable to advise you on your cloud computing efforts. Sun can help you transition from your current enterprise datacenter and hosted services mix to the cloud with a structured methodology, helping you to minimize risk. By leveraging Sun's effective, unique, and proven tools, methodologies, best practices, and technologies, Sun Services can help you move to cloud computing — call us today.

**Leverage Sun's best practices and expertise to assess the benefits, define the strategy, and deploy to the cloud.**