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# The Perfect Storm for Enterprise-Class Clouds

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White Paper

Many data centers have leveraged the benefits of the commoditization in the computer industry, so what makes cloud computing so remarkable? This paper describes three key characteristics of cloud computing: elasticity (provisioning and deprovisioning resources in real time to meet workload demands), utility (providing resources on a “pay-as-you-go” basis), and ubiquity (providing services available from the worldwide web).

This paper also focuses on the key attributes required for enterprise computing and explains how the Unisys Secure Cloud can deliver these through enterprise-class cloud computing.

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## Introduction

Cloud computing is not an overnight sensation. The weather conditions have forecasted its arrival over the last two decades. Early pioneers, such as e-Bay and Amazon took the “e-Commerce” model and applied a massively scalable architecture in their data centers. Creating this type of scalable architecture was only possible because of the rapid commoditization of computing resources over the last decade.

Computing began as a few coveted mainframes, which were superseded by minicomputers and then microcomputers and now devices that hardly look or feel like computers at all, such as PDAs and smart cell phones. In addition, the cost for storage has plummeted along with the ramping up of network capacities and speeds. Many data centers have leveraged the benefits of this commoditization, so what makes cloud computing remarkable?

Although it has different meanings to different people, this paper assumes that cloud computing is a very broad approach to computing that has three key attributes:

- **Elasticity** – resources can be provisioned and de-provisioned in real time to meet workload demands
- **Utility** – resource usage is provided on a “pay-as-you-go” basis, as opposed to the traditional approach of incurring the upfront capital expenses and ongoing operational expenses, even if the resources are underutilized
- **Ubiquity** – services from the cloud are available from the worldwide web, enabling user interfaces that go beyond traditional workstations and include cell phones and other appliances

This paper explains the “perfect storm” that has created the ideal atmosphere for cloud computing and also describes how this can be applied to enterprise-class environments.

## Clouds at Your Service

The description of ubiquity given as one of the three key attributes contains a key word in it – service. The cloud provides an abstract platform that responds to requests for services. Indeed, the “killer apps” for cloud computing have been Software as a Service (SaaS) applications. The expectation is that, without installing a “fat” application, the user can access the service immediately through any device that supports a ubiquitous web browser. So, simply stated, the cloud is basically a processing plant for services that can be consumed worldwide by other software or end users.

There is no control over the time and place for these service requests. Observing and predicting the rate of requests for services is not unlike predicting weather storms. Although there is a concept of “typical” weather, sudden changes in conditions can cause storms to arise. Similarly, the rate of requests for service can suddenly and unexpectedly “spike”. This spike is where the attributes of elasticity and utility are important. The infrastructure must be capable of expanding when service requests increase and of ramping down when they subside. Many savvy CIOs realize that, to support this level of elasticity, requires a capital investment into resources that, for too much of the time, would remain dormant in their data centers. Therefore, the requirement for a utility-based business model is quite appealing.

The infrastructure that supports the cloud must be capable of responding in real time to the sudden change in requests. You can refer to this capability as a real-time infrastructure (RTI). An RTI supports a real-time enterprise (RTE) which can respond in real time to changing business conditions, for example a sudden request for service because of a new marketing campaign that is required to combat a competitor’s new offerings.

Two additional Unisys white papers “An Intelligent Infrastructure for a Real-Time Enterprise” and “Building the Road to a Real-Time Infrastructure” describe the motivation and technologies behind an RTI. The capabilities that are necessary to provide an RTI are relatively new and have caused this “perfect storm” of technological development in the last ten years so that clouds could appear. Whether the development of RTIs caused the formation of clouds – or the other way around – is a debate for another day. But there is no doubt that the “perfect storm” includes the emergence of some key technologies: server virtualization, extreme automation and service-oriented architectures.

Server virtualization is a technology that, more than the others, has been transformational in nature. When it emerged in the commodity market, it immediately provided value in the areas of test and development, as well as server consolidation. Now, it is a centerpiece of the cloud computing platform. We cannot predict all of the ways that server virtualization will impact computing in the future.

Extreme automation is a level of automation that goes beyond simple scripts. The recent emergence of “run book automation” provides a mechanism that can link together events and actions throughout the data center. For example, when a new server is provisioned in the cloud, much more is involved than turning it on. In a properly managed data center, a number of processes are involved, including:

- Incident Management
- Change Management
- Configuration Management

Each of these processes involves system management software that must be updated and possibly human intervention to authorize the change. Once the change begins, the server must be brought into its proper domain. It requires access to storage and the network, as well as joining a cluster of other servers to provide the services that are required. All of these processes are automated through run book automation. Extreme automation provides a sort of “exo-operating system” that manages servers, software and human processes in a manner similar to an operating system managing its own resources.

Service-oriented architectures include service-oriented applications, executing on a service-oriented infrastructure. The key is that the infrastructure is architected to deliver and manage services, which is at the heart of software as a service. Because the infrastructure’s elasticity is driven by the need to provide quality of service, services need to be identified, monitored and governed. Emerging technologies are starting to appear that manage the “product” being delivered by clouds – services.

## Enterprise-Class Cloud Computing

Cloud computing has its roots in commodity, mass-market computing. It leverages commodity-priced hardware and software. Its original appeal was to small- and medium-sized businesses that wanted to establish their own web-based commerce but were not able to sustain the capital expenses or the cost for data center expertise.

One of the surprising twists in cloud computing is that it also appeals to large businesses. This appeal is because of the three attributes previously presented. But enterprises are hesitant because of very real concerns. For example, “How can I trust that my data will be secured from other enterprises using the cloud and how can I ensure that security will be managed with the industries’ best practices?”

There are concerns regarding the workloads that are moved to the cloud, such as

- Do I have to rewrite my workload to cater to the cloud’s infrastructure and APIs?
- What if those APIs lock me into a cloud so that I cannot have the flexibility of moving the workload to another cloud or back to my datacenter?
- How do I know that the cloud provider can provide the level of support that I need for my mission-critical application?

For enterprises that rely on computing as a strategic advantage, these questions are not trivial.

Today, most of cloud computing providers are focused on the commodity market, which precludes a number of key attributes that are required for enterprise computing. These qualities are needed to address today’s concerns regarding cloud computing:

- Security and isolation of information within the boundaries of the data center
- Transformation services that address unique workloads that do not fit the commodity computing profile
- Proven and verifiable processes and procedures
- Global reach for service and support, as well as local compliance issues

The Unisys Secure Cloud delivers these key qualities to a new set of data centers – the set that demand enterprise-class cloud computing. The following sections offer information about these qualities.

## Security Based on Stealth

One of the key motivations for companies to develop and provide cloud platforms is that they can set up a multitenant environment where multiple customers share resources. This sharing of resources enables them to take optimal advantage of the resources and therefore lowers their capital and operating costs. This sharing is an important factor in their cost model. But a multitenant approach immediately brings up a warning flag for IT professionals who understand the security risk of this approach.

Unisys rises above the commodity market in three areas of security. The first two are powered by our Stealth technology. For data-in-motion (data that is transmitted through the cloud network), Stealth not only provides a higher level of encryption than the standard approach (which is called Secure Socket Layer or SSL), but it also breaks apart the information into multiple streams. In this way, if another user of the cloud was monitoring the communication, that user would not only have to decrypt the stream but would also have to find the other streams that are part of the original message. The term "Stealth" refers to the fact that, once a customer is "Stealthed" within its own community of interest, the actual existence of the communication path cannot be discovered by observers outside that community of interest.

For data-at-rest, such as data stored on disk, the same techniques apply. The data is split into multiple stripes, and each stripe is encrypted. For both data-in-motion and data-at-rest, Stealth provides a new level of security and isolation that does not require changes to the application or hardware. Its simplified approach to isolation ensures that other communities of interest cannot detect that the data path exists, thus mitigating many of the requirements for network-based isolation through virtual LANs and other current techniques.

The third area of security is not software, but a repeatable set of proven processes. These processes minimize the risk of human error. This area of security is also built on a wealth of experience that Unisys has developed, along with best practices that are used by enterprise-class data centers. Unisys has been recognized as a leader in secure computing. We have received the ISO 27001 2005 certification for best practices in Information Security Management for all of our data centers and managed service centers. The award-winning processes coupled with Stealth provide a new level of achievement for Unisys and security for our clients.

## Transformation Services for Unique Workloads

Unisys has, through experience and innovation, developed services that focus on transformation and modernization. That experience now extends into a variety of cloud assessment and cloud advisory services as well as cloud application design and implementation services. These services utilize tools, techniques and processes that are invaluable when considering the migration of a nontrivial workload to a cloud.

The services start with an assessment where the target data center is evaluated to discover workloads that could benefit from cloud computing. Once they are discovered, the software and storage requirements are evaluated regarding a shift into the cloud. Unisys does not require that applications be re-factored or rewritten. The assessment services produce deliverables that lay out a low-risk plan to transform from the current state to a future state where the workload can take advantage of the key cloud attributes. Because no changes are required to the workload, there are no unique APIs to lock in the workload. With the Unisys Secure Cloud, you can receive customized services where your unique requirements and computing approach are retained.

Figure 1 shows a model of maturity regarding the readiness of a workload to participate in an RTI as well as a cloud environment. Some enterprises are at the beginning of this maturity model, with current projects focused on virtualization and consolidation. Others are still rationalizing their infrastructure and are consolidating the hardware and software. The transformation services mentioned previously address enterprises and workloads at any of the stages of maturity. These services provide the structure and foundation so that the workload can be cloud-enabled when the customer chooses to do so.

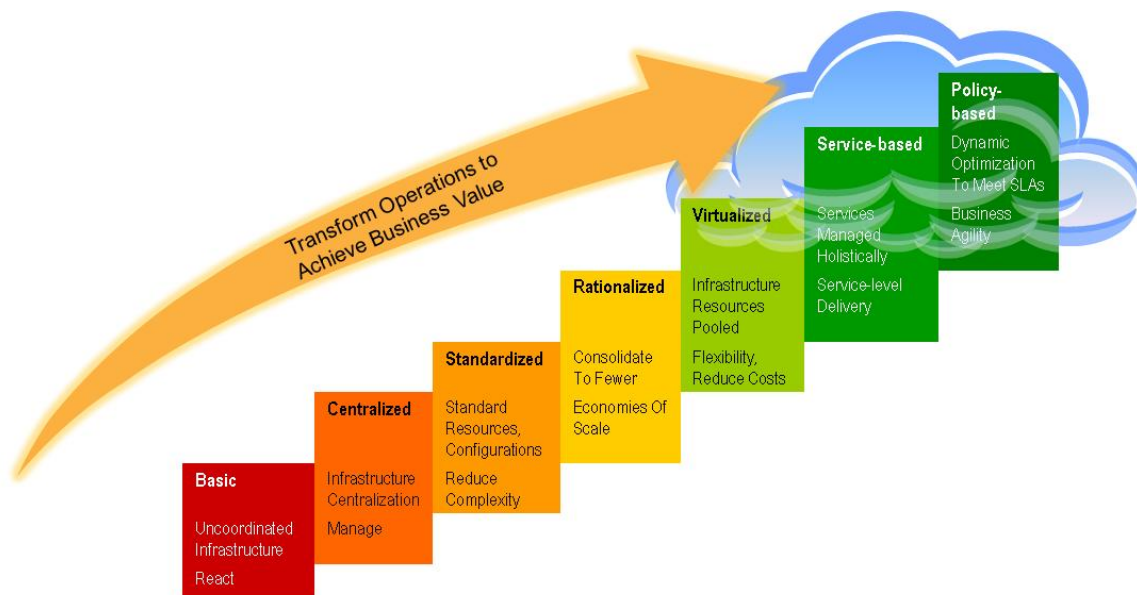


Figure 1. Infrastructure Maturity Model

## Proven and Verifiable Process and Procedures

Unisys has received awards and certifications as a result of its deep knowledge and execution of best practices. As mentioned in the previous security section, enterprise computing is not just about hardware and software. It requires well-developed processes and procedures that are the best in the industry and that are executed flawlessly. Unisys has been in the forefront of ensuring availability and security since the dawn of computing.

Our certifications include:

- All major Unisys Data Centers and Managed Service Centers achieved ISO 27001:2005, a global standard for best practices in Information Security Management.
- Unisys is the only company to hold global ISO-9001 certification for multivendor parts delivery, product distribution, and network integration operations.
- Desktop services, portal and electronic interfaces, service request management, service supply chain, and maintenance/T&M billing are compliant with ISO9001:2000 and TickIT standards.
- Maintenance, installation, and project management services are ISO-9002 certified for operations in Australia, Canada, Europe, Hong Kong, Latin America, Singapore, Taiwan, and the U.S.
- Unisys centers in Bangalore and Shanghai are certified to CMMI level 5.

All service locations meet all FDIC, FFIEC, OCC, NIST and HIPAA requirements.

## Global Service and Support

Unisys is one of the few companies today that maintains a significant presence throughout the world. Not only is service and support 24x7 in nature, but Unisys today utilizes physical data centers positioned around the globe. There are 25 centers within North America, 8 centers in Latin America, 14 centers in Europe/Middle East/Africa and 26 centers throughout the Asia Pacific region.

As customers throughout the world start transforming into the Unisys cloud, many of these data centers will be enhanced to become regional and global clouds, depending on their location and available facilities. This means that Unisys can create clouds that are local to enterprise clients. This capability is useful in two ways. First of all, the latency time to access data can cause performance degradation if the distance is over 1000 miles. Local data centers provide compute power with relative low latency. Secondly, many governments impose restriction regarding the movement of data outside the country's borders. Again, Unisys can address this restriction through the many data centers that are available near commercial centers around the world.

Support is not an issue – over 1.6 million seats are supported with our Desktop Outsourcing Services. Unisys handles over 7.5 million service events per year.

Finally, our relentless focus on precision of execution has won awards and certifications for Unisys. For example, Unisys received the prestigious Black Book of Outsourcing award.

- #4 Ranking: 2008 50 Best Managed Global Outsourcing Vendors
- 2007 Green 50: Top Honor Roll
- #2 Ranking: 2007 Top 10 Infrastructure: Infrastructure Help Desk

## The Unisys Vision

Over the last 60 years Unisys has had the vision to develop and utilize new technologies and services for the benefit of the industry and our customers. Our mainframe systems have been using virtualization and automation technologies for over 20 years. We have taken the deep engineering capabilities in delivering highly available, high transaction systems with complex workloads and applied them to the evolving and consolidating marketplace. Our ability to deliver RTEs and RTIs whether in-sourced or outsourced helps us provide the perfect platform for the emerging “cloud computing” environment.

Our mission is to provide customers with the most open, cost effective and secure IT service environment by helping them understand, plan, implement and manage their IT infrastructure their way. Unisys is uniquely positioned to provide cloud computing that is secure enough and scalable enough for enterprise-class computing.

## About the Author

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Dr. Salsburg has published and presented over 60 papers internationally in the fields of infrastructure and business service modeling, management and optimization. His current focus within Unisys is the realization of real-time infrastructure management.

He has been awarded two international patents for optimization and modeling algorithms. He received his Ph.D. in Mathematics from Drexel University in 1992 in the field of Probability and Statistics.

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For more information, please contact [securecloud@unisys.com](mailto:securecloud@unisys.com) or visit [www.unisys.com](http://www.unisys.com).

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