

Reimagine technology to accelerate your business



# A Cloud Computing Handbook for Business

## Abstract

Business demands for more flexible and cost effective ways to access computing services have driven the creation and adoption of cloud services. Organizations want to avoid upfront infrastructure investment, reach business goals and serve customers more quickly.

This white paper describes cloud computing from a technology perspective and highlights key attributes and features. It also addresses deployment models, fundamentals for a cloud computing strategy and a cloud computing migration methodology that is focused on bringing value to organizations.



## Introduction

Because it can be complex, the entire topic of cloud computing has many considerations. In this white paper we will provide a reference for businesses migrating to the cloud. This paper will:

- Define cloud computing
- Review enablers
- Review key characteristics
- Discuss fundamental concepts
- Identify evaluation points
- Introduce a Cloud Computing Migration Model

Based on our research and experience with cloud computing, Ciber is well-equipped to be a valued partner in guiding clients through the process of accessing computing services via the cloud.

With more than 35 years of experience as a system integrator, Ciber understands how technology can impact business as well as the opportunity to help businesses get results more quickly.

## The business appeal of cloud computing

Organizations with computing intensive or cyclical demand problems see appealing features in cloud computing solutions. Indeed, numerous news articles chronicle cases where cloud computing lowered the bar for entry into a resource (storage and compute) intensive problem. These range from challenging research and development problems on to major commercial applications. Almost any organization employing a computing solution will find an appealing proposition for cloud computing:

- Leveling the 'playing field' - an individual or business entity of any size can quickly leverage a tremendous supply of computing resources while paying only for those resources they actually use.
- Cloud computing makes it easier for companies to get started without large capital expenses (CapEx) [2].

- Reducing operational expenditures (OpEx) for computing solutions - cloud computing service providers handle most of the 'heavy lifting' in keeping solutions deployed on their systems operational [2].
- Employee effort can be focused on the specific computing problem of the organization rather than infrastructural issues.
- Cloud computing solutions can automatically scale to meet sudden surges in demand.

Listing these propositions shouldn't be understood as an easy-going substitute for a proper business case analysis or reasonable business/IT alignment. Rather than making assumptions, the real added value for each enterprise or parts of an enterprise should be evaluated carefully. Even in an enterprise looking for the best value/cost ratio, depending on one's role in the enterprise, the focus on these propositions will be different.

- CIO – optimizing the time-to-market cycle and guaranteeing the availability and reliability of the systems in the cloud
- CFO – controlling and managing the costs for systems in the cloud
- COO – improving the efficiency of operation and increasing client satisfaction

Finding the best balance for an enterprise is a challenging task for a cloud computing environment. Clients can draw on Ciber's expertise in developing business requirements and implementing a solution.

## Definition of cloud computing

Cloud computing can be understood as an umbrella term that spans at least two conceptual uses. At times it is employed to refer to software delivered as a service. At other times it refers to the behind-the-scenes machinery and systems software that makes software delivered as a service possible. The National Institute of Standards and Technology (NIST) provides the following definition of Cloud Computing [1]:

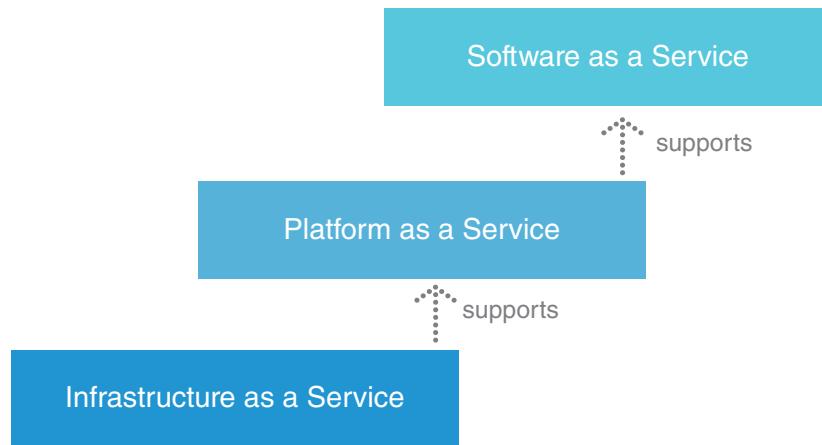


Figure 1

“Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” (Badger, Grance, Patt-Corner, & Voas, 2011)

Ciber adopted this definition for its research activities and to build a complete set of business focused solutions for our clients. Based on this definition, services from cloud belong to one of the following categories:

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)

Usually these categories are depicted as a pyramid or a layered model. These representations imply that it is necessary to have an IaaS and a PaaS before someone can provide SaaS. Therefore, we rather prefer a slightly different diagram to visualize the supportive character of each layer.

As we discuss later in this article, this is an aspect of the maturity of a concrete cloud computing implementation. But it is possible to provide a fully mature SaaS without having a fully mature cloud computing environment for IaaS or PaaS.

## Deployment models

However, now it is time to answer the question about how many types of clouds exist. Depending on the chosen criteria, different vendors will come to slightly different numbers and types of models. Because of controversial discussion about security in the cloud, Ciber identified the level of control as one of the most important criteria to classify a cloud computing model.

Therefore, we follow a very simple classification of cloud computing models that is well accepted in the community. This model is based on three different fundamental types that allow one to derive any cloud model.

- Private cloud – describes when an organization chooses to create its own cloud computing solution on its own premises or in a dedicated environment from a solution provider.
- Public cloud – describes when a cloud computing solution provider creates a data center which sells computing services to the public.
- Hybrid cloud – describes a cloud computing solution that leverages aspects of both private and public cloud models.

In the technology community this is known as the cloud deployment model. The deployment model dictates where computing resources are physically located and how to address the resulting issues.



Looking at the deployment model helps to understand how to structure cloud implementation. But this doesn't answer the question about what is different from a well known internal or external data center. For this it is necessary to understand the underlying concepts of cloud.

## Characteristics of cloud computing

- Cloud computing is an evolving mix of existing software and hardware disciplines and technologies. It is often difficult to quantify whether a particular design or commercial service is indeed a cloud computing solution or just a superficial lookalike.
- The "NIST Cloud Computing Synopsis" provides a set of key characteristics which can help to identify true cloud computing solutions (Badger, Grance, Patt-Corner, & Voas, 2011):
- On-demand self-service – a consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.
- Broad network access – capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (for example, mobile phones, laptops and personal digital assistants (PDAs)).
- Resource pooling – the provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the subscriber generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (for example, country, state, or datacenter). Examples of resources include storage, processing, memory, network bandwidth and virtual machines.
- Rapid elasticity – capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.

- Measured service – cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled and reported providing transparency for both the provider and consumer of the utilized service.

However, incorporating the best aspects of existing computing system design and implementation practices is not the whole story of cloud computing. Recent technological developments have acted to enable cloud computing in the following ways:

- Increasingly inexpensive and ubiquitous access to the Internet at broadband speeds
- Ongoing construction of massive internet-connected data centers that provide stunning quantities of computing and data storage at very low cost due to economies of scale
- Availability of low-cost or open-source software to automatically manage and maintain computing resources

Similar to other complex concepts, cloud computing is not just a yes or no. There is usually no big bang solution to get cloud up and running. It's rather an evolutionary process to develop a fully enabled cloud computing environment. To have a measurement to validate the maturity and therefore the capability of a current cloud computing environment, Ciber provides a reference architecture and maturity model for cloud computing.

## Fundamentals for a cloud computing strategy

The cloud computing maturity model and reference architecture is an aggregation of already existing maturity models and reference architectures on a more abstract level. To develop the right migration strategy for a company there is a set of concepts which can be seen as fundamental to a cloud strategy.

Hardware virtualization is an aspect of IT that has become mature in the past few years without getting the same attention as grid computing or SOA. However, the efficiency and flexibility of current data center wouldn't be possible without the concept and products of hardware

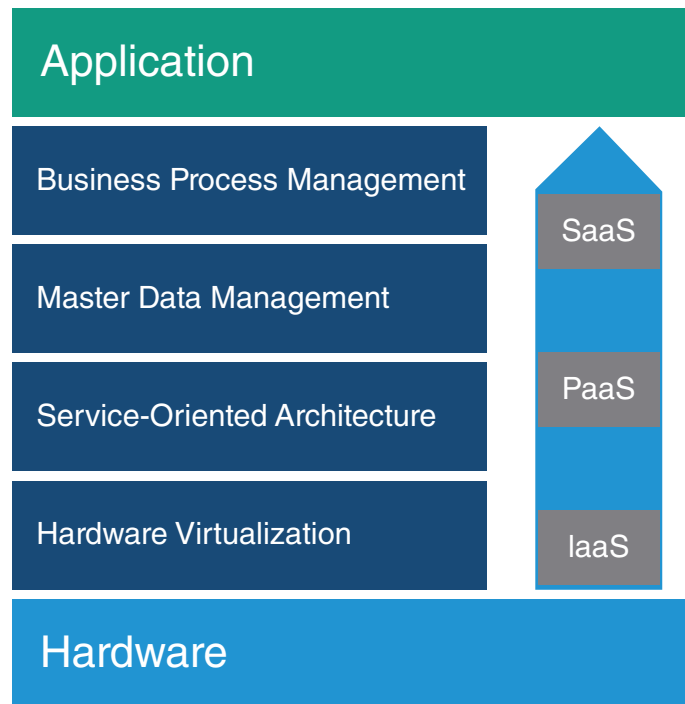


Figure 2

virtualization. A data center needs a new dedicated server? Use a virtual machine. You need additional CPU's or memory? Just plug a new blade into the data center rack.

Grid computing may be simply defined as the pooling of multiple computational resources over a network to achieve a common goal. In order for cloud computing to successfully pool computing resources, software must be created that provides a framework for coordination and control of the individual grid participants. This software, known as grid middleware, may be as simple as a message-passing framework. However, in many cases it has evolved to provide advanced services such as automatically handling hardware or communications failures, and automatically provisioning additional computing resources as needed.

Service oriented architecture (SOA) is itself an evolution of the most successful aspects of enterprise architecture/integration. Core aspects for a successful enterprise SOA are standardization, governance for design time and runtime, and providing an environment to utilize services. Through years of industry experience and refinement SOA is a proven core concept of IT.

Master data management (MDM) is an organizational and technological discipline centered on ensuring that an organization's key reference data is managed in a well-defined and consistent manner. The key goal of MDM is ensuring that the origin of all critical organizational information can be traced to a single trusted source.

Even though most of the parts for cloud computing are already well known and understood, bringing them together means facing an additional level of complexity. In Ciber's cloud computing reference architecture and maturity model, these relationships and dependencies are shown.

### Evaluation points for cloud computing solutions

Cloud computing services are not infallible and introduce new considerations not found in traditional computing solutions. Ciber recognizes that many practical considerations must be taken into account before implementation of a cloud computing solution. A particular organization's needs may or may not prove to have a specific cloud computing solution.

Ciber has created a list of criteria for evaluating the suitability of cloud computing according to an organization's particular needs. A summary of these criteria is as follows:

- Application criticality – if the solution becomes unavailable, what is the impact to the organization? What is the scope of the impact and what recovery plans can be devised?
- Scalability – does the solution have varying computing or data storage needs?
- Data privacy and intellectual property concerns – does your application contain proprietary data or algorithms that are of critical value and whose exposure or loss would result in irreparable damage? Is your application subject to regulatory requirements over its data?
- Pre-packaged cloud solutions – could a pre-packaged cloud solution address the need without creating custom software?
- Cost and accounting structure – is the migration of costs from a capital expenditure-centric model to an operational-centric model desirable? Would the “pay only for what is used” model represent an advantage over another approach?
- Support and maintenance – does the organization have the staff needed to support development, deployment and maintenance of the solution?
- Integration of existing assets – are there existing code or database assets that may or must be reused? How compatible are such assets with various cloud computing service providers?
- Vendor lock-in – the current absence of standards in the challenging new aspects of cloud computing can lead to the situation that a vendor provides an optimized solution for its environment that is not easy to migrate to another cloud vendor.

## Cloud computing migration model

Cloud computing methodologies provide a comprehensive blueprint for implementing cloud computing solutions. Ciber has developed a cloud computing methodology for guidance in implementing cloud computing solutions. This

framework is used to guide clients on a safe path from establishing their cloud strategy through implementing a specific cloud computing solution. Ciber's methodology provides processes, best practices and defined work products.

In Figure 3, Ciber's cloud methodology guides clients through cloud evolution is depicted. Our methodology follows a proven approach for a successful implementation of a cloud environment.

Ciber's cloud methodology follows a classical phase model in five phases. Starting with support for the client to establish and communicate the enterprise cloud initiative (phase 1) by real world client references. Phase 2, 3 and 4 provides clients with information about their current state and an optimized roadmap to migrate into the new cloud environment. The last phase (5) represents the implementation of the cloud roadmap.

To support each phase of Ciber's methodology, we develop and maintain a set of reference documents which gives guidance through the process.

- Cloud reference architecture – provides a sample working solution so designers may reuse existing proven design components for their solution and ensure that all needed aspects of a successful design have been considered.
- Cloud maturity model – provides a set of criteria to evaluate a cloud computing solution and a path to evolve cloud computing solutions over time.
- Cloud migration strategies – provides descriptions of typical migration scenarios to migrate traditional computing solutions to cloud computing based solutions.
- Best practices – provides examples and descriptions of solutions which have been used in other cloud implementations from other clients.

As cloud computing technologies grow and evolve, Ciber continuously refines reusable methodologies, strategies and architectural approaches based on the nature of the business demand.

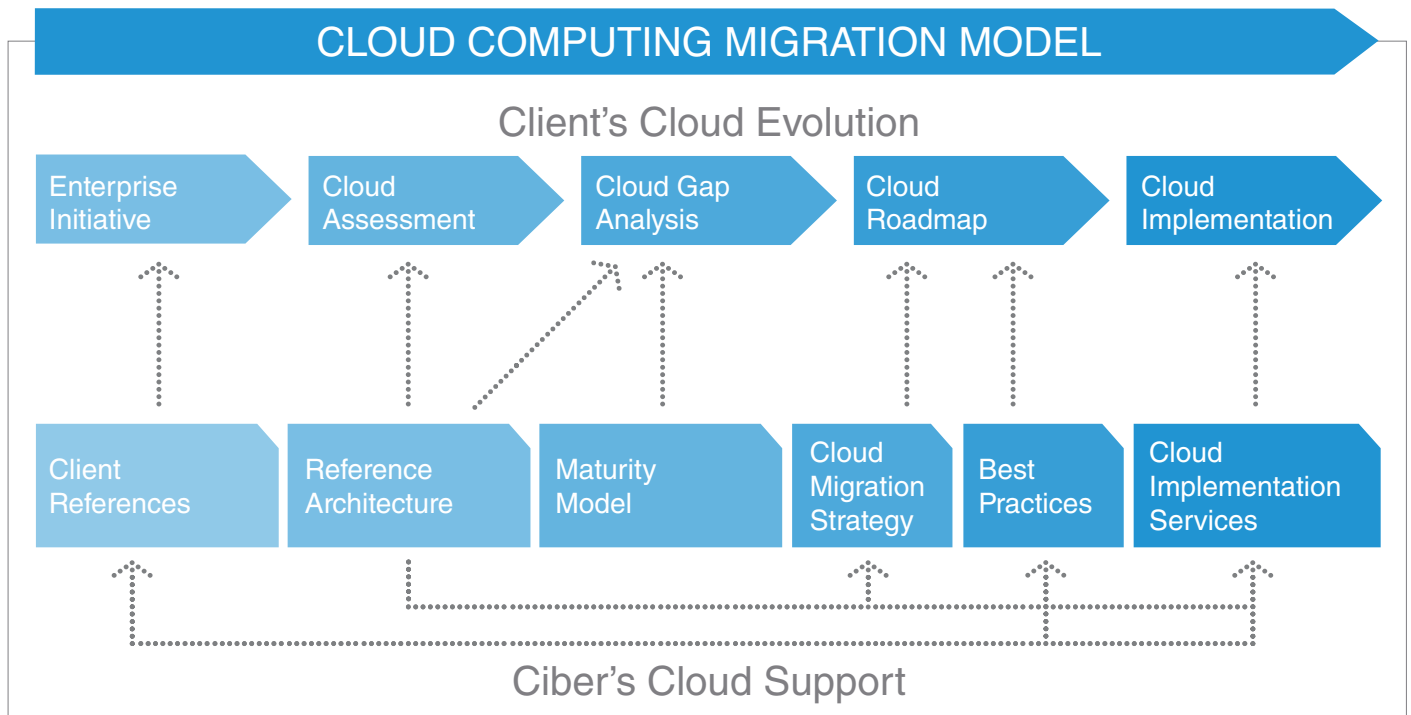


Figure 3

## Summary

This white paper has introduced cloud computing – exploring its origins, enablers, key characteristics and abilities. Cloud computing promises to revolutionize how computing solutions apply to a wide range of business demands. It will prove a valuable tool in the effort to manage costs and maximize organizational efficiency.

Cloud computing combines multiple business relevant and proven management approaches, enterprise integration strategies and technologies to a new and unique solution for companies in a fast paced business world. It's about cost efficiency and transparency of IT, but equally important about agility and sustainability for business.

Cloud computing based on a mature IT and business strategy enables enterprises to adapt IT resources quickly and efficiently. At the same time, enterprises can reduce the risk of change for their IT systems, by minimizing the upfront costs (CapEX) and on demand scaling.

## Bibliography

- [1] Badger, L., Grance, T., Patt-Corner, R., & Voas, J. (2011). DRAFT Cloud Computing Synopsis and Recommendations. Gaithersburg: NIST.
- [2] Ciber Whitepaper 'The Value of Cloud: Building the Case for Adoption and Transformation' 2011



### About Ciber

Ciber is a consulting, outsourcing and business solutions integration provider with offices across North America and India. For more than 45 years, Ciber has served clients by delivering expertise, IT services, and solutions that transform organizations and provide tangible business value. Ciber's strength is now enhanced by its parent company, HTC Global, a growing technology innovation and execution leader. HTC Global helps clients reimagine technology to accelerate their business.

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