

...experience the commitment™

## Addressing the challenges of cloud order orchestration and provisioning

## TABLE OF CONTENTS

<b>1</b>	<b>Introduction .....</b>	<b>3</b>
<b>2</b>	<b>Provisioning in the cloud .....</b>	<b>4</b>
2.1	Infrastructure as a Service .....	4
2.2	Platform as a Service .....	5
2.3	Software as a Service .....	5
2.3.1	Single cloud .....	5
2.3.2	Multi-cloud.....	6
2.4	Other SaaS aspects .....	6
<b>3</b>	<b>Cloud and telecom provisioning parallels.....</b>	<b>7</b>
<b>4</b>	<b>Possible way forward.....</b>	<b>8</b>
<b>5</b>	<b>Conclusion .....</b>	<b>9</b>
	<b>About CGI.....</b>	<b>10</b>

### 1 Introduction

By now, the many benefits of cloud computing are widely known. It's affordable and flexible, with a broad range of features that include on-demand, self-service, measured service, elasticity and multi-tenancy capabilities. Choosing such a model sounds simple enough. However, the cloud's complexity lies beneath the covers, especially when it comes to the critical task of cloud provisioning.

Cloud provisioning is akin to traveling through a tunnel with a series of steel doors ahead. As an enterprise or government entity moves into the cloud, various challenges must be faced and decisions made, regardless of whether private, public or hybrid cloud offerings have been chosen.

Today, the journey to the cloud has only just begun. At CGI, we forecast that the complexity of cloud computing will continue to grow before it levels off, as many more cloud offerings and providers enter the marketplace with additional intra- and inter-cloud provisioning services.

More immediate complications center on the cloud's promise of a utility-like model. The cloud's promise of "on demand" and "elastic" delivery in which products and services are provisioned accurately and in the right "volume" can be compared to the delivery of utility services. While this comparison may be valid in terms of volume, cloud services are significantly more heterogeneous than utilities, resulting in more provisioning complexity.

The exact nature of cloud provisioning depends not only on *what* cloud services are delivered but also on *how* they're delivered. For example, does the customer require high availability, disaster recovery and/or service level agreements. A cloud provider must take these additional service requirements into account, as the same cloud services may be provisioned differently based on them.

There is a variety of general service requirements that impact cloud provisioning, including the following:

- **Disaster recovery:** Disaster recovery involves the recovery time window within which a cloud service becomes operational should a disaster occur. Provisioning may involve remote resources or even an "active-active" setup in different data centers.
- **High availability:** This defines the percentage of time during which the cloud service must be available.
- **Service level agreements (SLAs):** Different customers and applications within the same environment may have different SLAs.
- **Other:** Other service requirements may involve network capacity, space and power.

A cloud provider will also need to consider various "flow down" requirements, as different Software as a Service (SaaS) modules have different Infrastructure as a Service (IaaS) requirements. A cloud provider will also have to factor in different end user patterns. For example, an occasional accounting user of enterprise resource planning (ERP) will have different needs than a heavy accounting user.

Finally, a cloud provider must consider convergent cloud provisioning where a user can subscribe to different functional modules within the same cloud or within multiple clouds and/or potentially cloud and non-cloud offerings. Such offerings could be provided within a cloud environment developed by the cloud

vendor or developed via partner installed products. Or, it could be an environment provided by cloud partners, i.e., outside the cloud vendor's own set of cloud offerings

## 2 Provisioning in the cloud

Moving past those “steel doors” to realize the cloud's many promises—fast time to market, on-demand provisioning and lower costs—requires maximizing automation in cloud provisioning and order orchestration. This reality is true whether a cloud provider taps individual cloud computing partners or networks of software and hardware partners. Whatever the route chosen, the complexity and competition surrounding cloud computing offerings will only increase.

The key to addressing this complexity is automation. Figure 1 below illustrates a simple “complex” scenario: two separate clouds on the left and in the middle, and an IT supported stack on the right. Such stacks can be deployed separately by different providers or provided by a cloud aggregator (a system integrator or a communication service provider):

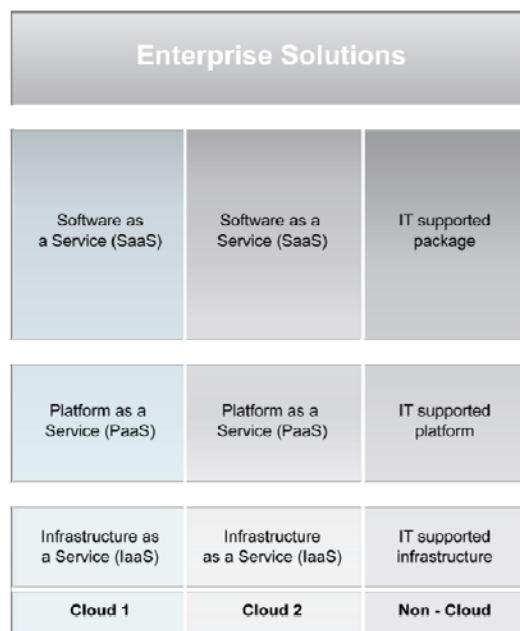


Figure 1 – Hybrid enterprise cloud

### 2.1 Infrastructure as a Service

Infrastructure as a Service (IaaS) can range from a simple offering (e.g., remote, automated backup, provisioned per user) to a complex maze of different infrastructure software and hardware assets, such as the following:

- **CPUs and virtual machines:** A cloud provider must provision these dynamically in line with customer requirements. Where SaaS is provided, infrastructure presents a “flow down” and

needs to be changed dynamically.

- **Operating system:** Different applications run on different operating systems, and operating systems vary by cost. The customer needs to select the best fit based on system variations.
- **Storage (direct access storage device):** A provider must ensure that different storage capacities (including mirroring) are provisioned, as well as the availability of different types of storage that reflect different price points based on client criteria.
- **Other resources:** Other examples include network capacity, space and power.

### 2.2 Platform as a Service

Platform as a Service (PaaS) includes software frameworks and the necessary hardware in which to develop and deliver business solutions. Similar to IaaS solutions, PaaS solutions impact different hardware and software assets, such as the following:

- **Hardware architectures:** These involve different server sizes—from small, Intel-based servers to mid- or top-range servers and mainframes—that utilize different chips.
- **Software operating systems:** Examples include Windows, Linux, MAC OS, Solaris and z/OS.
- **Development and application frameworks:** Examples include Java and .Net.
- **Solution stacks:** Examples include LAMP, MAMP, and WINS.

### 2.3 Software as a Service

Software as a Service (SaaS) may be delivered as a single or multi-cloud offering. An example of a single cloud offering is unified communications, which consists of different modules. Examples of a multi-cloud offering include unified communications and enterprise resource planning clouds. With a multi-cloud offering, the cloud provider must deploy and provision all third-party software and hardware products necessary to run such offerings in the cloud.

#### 2.3.1 Single cloud

A single cloud, “one module” offering can be provided as an IaaS, PaaS or SaaS. As an SaaS—for example, voice over IP (VoIP) within unified communications—a cloud offering can be provisioned at different levels within an enterprise, including the following:

- **First-time deployment:** In the case of an advanced multi-tenant solution, this typically means the business logic is customized for the enterprise in the initial deployment to maximize competitive advantage and services.
- **Corresponding third-party dependent solutions:** These are necessary for the cloud offering to run as installed and configured (e.g., a relational database management system).
- **Authorized “volumetrics”:** An example includes the number of users.

- **Infrastructure aligned with authorized “volumetrics” and SLAs:** These can vary by enterprise.
- **Dynamic provisioning:** Up and down based on user operational characteristics.

A single cloud, “multiple module” offering may contain a selection of functional modules that an enterprise may use. Unified communications examples include VoIP, telepresence, conferencing, contact center and messaging.

The cloud provider must accommodate each of the module’s hardware and software dependencies, both on its premises and potentially also on the customer’s premises, such as items related to the network infrastructure. Provisioned “units” may vary in nature in different modules. For example, network capacity provisioned in VoIP per user varies from network capacity per user for a telepresence solution.

### 2.3.2 Multi-cloud

Multiple cloud (i.e., “cloud aggregator”) offerings involve the delivery of disparate solutions (e.g., unified communications and enterprise resource planning) by an aggregator out of the cloud. Each solution may have multiple application modules with multiple “flow down” and operational criteria that affect SaaS and IaaS. They may also have multiple dependencies on different third parties within the cloud provider’s data centers, as well as on outside cloud partners delivering cloud services out of their data centers.

## 2.4 Other SaaS aspects

SaaS provisioning may consist of different activities:

1. **Flow down:** SaaS is supported by computing infrastructure assets, such as servers, direct access storage devices, networking and operating systems. Automated provisioning of such assets must be supported when SaaS is provisioned. Different SaaS modules need different IaaS solutions.

Further, different enterprise customers may need different IaaS per the same SaaS module. As an example, the network capacity required for a messaging module within unified communications will vary from the network capacity required for telepresence. An expert enterprise resource planning (ERP) user from an accounting department, for example, will face a different need than a user who uses ERP for weekly timesheets and occasional expense reports.

2. **Client-specific business logic:** Creating client-specific business logic for the first time varies based on the individual SaaS scenario. For systems that see business logic separated through a layered architecture, different enterprises may face different business logic for the same release of the SaaS offering. In such cases, an enterprise subject matter expert or SaaS provider may need to create the business logic through a business process outsourcing model.
3. **Evolving business logic:** Adapting SaaS to new business demands requires an enterprise to deploy a new release of the business logic.
4. **Additional resources:** Provisioning must distinguish between adding already authorized resources within agreed limits versus reaching a “ceiling” and needing to expand capacity. In the latter case, a cloud provider must invoke a client authorization process. If a client hits the “usage

ceiling” defined, for example, by authorized cost in a particular month, and the enterprise hasn’t authorized a higher ceiling, the provider will need to deactivate the service.

5. **“Licensing”:** Even though the cloud’s usage-based model does not (by definition) include licenses, cloud providers need to offer an intermediate alternative for partners who still provide licenses. Such licenses could offer dynamic features, such as unnamed user and short-term usage capabilities. In this case, the cloud provisioning cycle must check the availability of licenses per application module and the relevant embedded technology in a license inventory, and automatically procure more licenses once the inventory is depleted.

To ensure cloud convergence and maximize control and automation, a cloud provider must take a 360-degree view of cloud provisioning. The same solution that provides SaaS for the enterprise business user must support the provisioning of the corresponding IaaS and flow down provisioning. In short, it’s critical that a cloud provider has a single order orchestration and provisioning solution for IaaS, PaaS and SaaS, as well as its own cloud offerings. It also needs to combine or white-label the solutions of its partners. The question is how to accomplish this.

### 3 Cloud and telecom provisioning parallels

Cloud and telecommunications providers face parallel challenges. In both cases, convergent order orchestration and provisioning remain an unresolved issue. The complexity increases with multiple networks and partners, quadruple play offerings, and an avalanche of applications, resulting in high order fallout, long order to cash timeframes and high costs. Other parallels include the following:

- **Competition:** Telecom, cable and new providers compete for a market share of “next gen” products and services in telecom. Communication service providers, system integrators and product vendors compete with the same vigor for cloud market share.
- **Convergence:** With the transition to Internet protocol networks, communication service providers and new entrants now compete in the application space, as everything involves an application. Telecom customers choose convergent bundles of different products based on an avalanche of telecom applications from different providers. Similarly, the transition from the traditional license/annual maintenance to the cloud is fueling new horizontally and vertically convergent cloud offerings from cloud providers.
- **Time to market and cost:** With voice over Internet protocol (VoIP) and the fall of the “walled garden,” time to market and costs now serve as key differentiators for communication service providers. Similarly, cloud providers with the ability to minimize time to market and costs will position themselves well in cloud computing.
- **Partnerships:** With hundreds of thousands of applications available—for example, applications for wireless devices—no communication service provider can go it alone in the telecom space. Partnerships are essential. Similarly, just as no single enterprise product vendor or systems integrator “owns” the enterprise market, no single cloud supplier will likely own it either. As with telecom providers, no single cloud provider can provide everything. Thus, the success of enterprise cloud offerings also rests on partnerships, which in turn must be supported by seamless cloud provisioning.

- **Silos:** Communication service providers began to develop telecom offerings in silos, but then had to demolish them to support quadruple play offerings. This latter step is no easy task and the process is still ongoing. Similarly, different cloud providers are introducing new offerings in silos, as they compete for market share.
- **Complexity:** Complexity is the root cause of order fallout in telecom. OSS/BSS system maps cover communication service providers' walls with multiple customer care, service activation, billing and provisioning systems. This complexity grows as the existing OSS/BSS migrates to the next generation IP-based system. It's further increased by competition, convergence, time to market, cost and silos.

Enterprise cloud provisioning is no less complex, as cloud providers must shepherd complex cloud offerings through different modules within the same cloud and different clouds (horizontally), as well as support flow down (vertical cloud convergence).

In addition, each enterprise customer may require different high availability, service level agreements and disaster recovery and expects seamless cloud provisioning of complex enterprise services. A cloud provider must also take specific cloud requirements into account, such as the following:

- **Multi-tenancy:** The cloud provider must provision the enterprise user to the right "instance" of the cloud provider software.
- **Data location:** Enterprises have preference about data location. European Union (EU) countries ask providers to host enterprise data in their respective countries, or at a minimum within another EU country. Similarly, U.S. and Canadian customers require the same of providers.

## 4 Possible way forward

To address cloud provisioning complexity and ensure fast time to market through cloud provisioning automation, imagine a decision network where dynamic business logic, driven by state changes in the enterprise systems, helps execute or bypass decision nodes. Examples include up and down, directly ordered, or derived volumes of cloud products and services and stated changes in cloud provisioning systems. Such a solution must fulfill the following requirements:

- **SME-driven.** A solution must be driven by a subject matter expert (SME). SMEs, rather than programmers, create business logic. This focus ensures fast time to market and puts the creativity where it belongs, i.e., in the cloud provider's SME hands. However, this focus also creates a greater implementation challenge; the system not only needs to handle an unprecedented level of complexity, but provide an easy way for an SME to handle it.
- **Data-driven.** Cloud provisioning data is not static and, as a result, a variety of service configurations may ensue. The cloud provisioning system must react to data changes initiated by customers or interfacing systems.
- **Data validation.** A cloud provider must validate data continuously. If that data is not valid at the start of the provisioning business logic execution, it must either be automatically corrected or rejected. Because the associated data may change, the validation should continue throughout the



cloud provisioning process.

- **Non-linear approach.** A cloud provider must support a cloud provisioning approach that's non-linear, given that the problem to solve is non-linear also.
- **Automated correction.** Increases in volume and complexity make this feature essential. The cloud provisioning system must monitor all cloud provisioning requests and automatically perform corrective action. In the event a corrective action requires a manual intervention, the system monitors these through cascading alarms. This feature may assign a task to an individual or a group. If either does not complete the task during the required period, an alarm cascades to a different individual or group. The combination of automated error correction and cascading alarms ensures all orders are met.
- **Drill down dashboards and reports.** A significant number of provisioning requests flow through the system. Many of them are convergent and contain multiple decision nodes. The cloud provisioning system must support drill down dashboards and reports that are easy to understand. Such dashboards and reports must identify issues, such as the root problem, and report on automatic corrections. Even if an issue is automatically corrected, the cloud provider has the visibility into root causes and can then decide whether to tolerate, fix or upgrade the systems causing the issue.
- **State aware.** The system must be state aware. This ensures efficient use of resources and swift recovery.
- **Open system.** The system must be open, supporting web services and service-oriented architecture. However, because the system must typically handle both legacy and modern systems, it must have an open access layer through which to easily interface older solutions that do not comply with modern standards.

## 5 Conclusion

Cloud provisioning is an often overlooked challenge. It must automate highly complex tasks, as well as provide up and down provisioning. Only then can the promise of “on demand” convergent cloud provisioning be realized, alongside a robust “flow down” cloud provisioning structure.

In the meantime, cloud providers are at a crossroads. They can implement silo offerings and suffer the same consequences that the telecom industry has already experienced, or they can adopt a new approach. The providers who understand and learn from the telecom parallels will be in the best position to compete in this dynamic new market.

To paraphrase Charles Darwin: “It is not the strongest of the cloud providers who will survive, nor the most intelligent, but the ones who are most adaptable to change.”



## About CGI

At CGI, we're in the business of satisfying clients by helping them win and grow. For more than 35 years, we've operated upon the principles of sharing in clients' challenges and delivering quality services to address them.

As a leading IT and business process services provider, CGI has a strong base of 31,000 professionals operating in more than 125 offices worldwide, giving us the competitive advantage of close proximity to our clients. Through these offices, we offer local partnerships and a balanced blend of global delivery options to ensure clients receive the optimal combination of value and expertise required for their success.

We define success by helping our clients achieve superior performance and gain competitive advantage. To learn more, visit [www.cgi.com](http://www.cgi.com).