

Cloud Services: Do Risks Outweigh Benefits?

Peter Géczy¹, Noriaki Izumi¹ and Kôiti Hasida¹

¹ National Institute of Advanced Industrial Science and Technology (AIST), Tokyo, Japan

Abstract. Adoption of cloud service models by organizations has been met with significant reluctance. Cloud-based services refer to networked delivery of services within organization or from external providers. The services range from data storage, throughout communication and collaboration support tools, to complex service packages supporting business processes within organizations. The primary reluctance is toward employing services of external providers and accessing them over internet. The external provider or other entities may compromise organizational data and services, thus posing significant security risks. Transfer of data and services to external providers results in substantial loss of control over timely management and retention. Cloud adoption and utilization by organizations requires considerable assessments. We elucidate pertinent risks and benefits associated with cloud services and provide actionable knowledge for managers and information technology professionals.

Keywords: cloud adoption, cloud-based services, cloud computing, web services, providers, information technology management, knowledge management, actionable knowledge.

1. Introduction

Knowledge-intensive organizations utilize a broad spectrum of information technologies in their operations [1]. The information technologies provide important tools and services indispensable for organizations' operations. They span from computing and networking infrastructures to software platforms and tools. Significant financial and human resources are dedicated to maintenance, management and innovation of organizational information systems and infrastructures. Knowledge workers extensively rely on information technologies for their work [2].

Information technologies are regarded as mission critical for knowledge intensive organizations [3]. Organizations have been lacking coordinated strategy in earlier-day adoptions of information systems [4]. Various divisions within the organization have been installing systems suiting their specific needs. This has led to a number of implementations with overlapping functionalities and missing interoperability. The need to economize distributed information technology resources has surfaced. Organizational portals have provided a viable solution [5]. The portals enable single-point access to distributed resources. The enabling technology bringing together multiplicity of localized implementations and unified front-end has been the service-oriented architecture and design [6]. The service-oriented architectures and designs have allowed re-use of existing organizational information technology resources and their accessibility over networks—both internal and external.

Accessibility of distributed resources over networks has set the ground for so-called cloud computing [7]. In cloud computing, information technology services are accessible over intranet, internet, or mobile networks and may be provided on-demand. This delivery model underlines more economical and efficient utilization of information technology resources [8]. However, benefits of cloud-based services are generally over-emphasized by the external providers, while risks are downplayed. Cloud-based services present numerous risks and challenges—particularly the externally provided ones.

2. Cloud-Based Models and Services

The cloud-based models aim at providing on-demand information technology services over networks [9]. The essential principles of cloud environment models are illustrated in Figure 1. Users access services over networks that are provided by the third party providers or by their own organizations. Interactions with services are facilitated via web-based interfaces. Services may be accessible both internally (over organizational intranets) and externally (over internet and mobile networks).

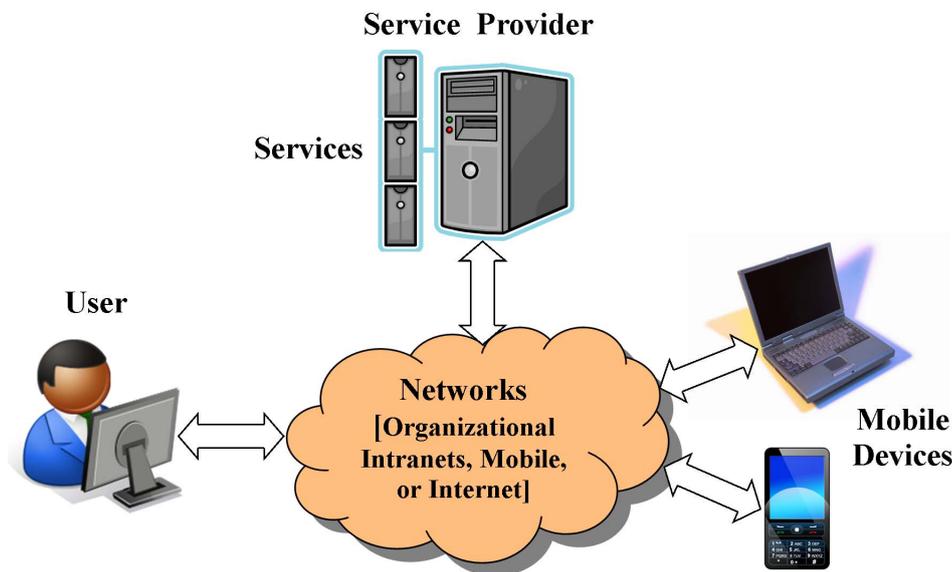


Fig1. Depiction of the essential characteristics of cloud-based models

There are three essential models of cloud environments:

Private: Organization that utilizes the cloud computing services owns them. Hence, all the infrastructure and services are hosted in-house. Services may be accessible only within the organization, or from outside. This is the most secure, but also the most costly model.

Public: External providers provide cloud computing services over internet or mobile operator networks. All the infrastructure and services are outside of the organization that utilizes them. This is the most insecure, but the cheapest model.

Hybrid: Critical cloud computing services are hosted and provided in-house, while non-critical services are hosted and provided by external providers. Security and costs can be balanced in this model.

Cloud-based services are wide ranging. They span from hardware infrastructures, throughout software, to development platforms. Three most notable categories of cloud-based services are commonly denoted as: infrastructure as a service, software as a service, and platform as a service.

Infrastructure as a Service (IaaS): Computing infrastructures and related constituents are provided as services. They include provisions of the complete computing hardware (e.g. servers), or specific elements such as Central Processing Unit (CPU) time (i.e. computing power), storage (i.e. allocated capacity for storing data), bandwidth, etc. The infrastructure may be in-house or rented from outside providers.

Software as a Service (SaaS): Software functionalities are provided as on-demand services. There is a spectrum of software functionalities and services; for instance: e-mail services, customer relation management systems, office productivity suites, collaboration suits, social networking services, etc. SaaS provides advantages of centralized management and maintenance of software.

Platform as a Service (PaaS): Computing platforms and solutions are delivered as services. The offerings include tools and facilities for application design and development, versioning and testing, integration, web service marshalling, etc. PaaS providers offer various services to support the application development lifecycle.

3. Risks and Benefits Associated with Cloud-Based Services

There are numerous considerable issues with cloud-based services. Public clouds, particularly, are posing the most concerns. Managers should carefully take into account at least the following problems with cloud-based services [10].

- **Security:** Placing organizations' valuable data on servers of external providers poses important security risks. Data and services may be compromised by the provider or other entities.
- **Loss of Control:** When putting your data and services to servers of outside providers, you lose substantial control. On the other hand, the external provider achieves control.
- **Performance:** Accessing services over networks, principally internet, notably affects performance. Slow network connectivity may substantially degrade performance.
- **Availability:** Cloud-based services are accessed via networks. If the network is inaccessible, or services/servers are down, users are unable to access critical services and data.
- **Transfer:** Transferring large amounts of data to incompatible environment may be costly. Assess compatibility issues regarding your data formats and management practices.
- **Customization:** Most of the outside services offer limited or no customization of services. Hence, there are notable re-training and adjustment costs.
- **In-House Relocation:** Bringing back in-house data/services from external providers is often made troublesome and costly by the providers, since they want to retain customers.
- **Liability:** The providers legally distance themselves from liabilities; especially in important cases such as data loss/damage, security and compromise.
- **Legislations:** Cloud-based services are often distributed world-wide. Organizations' valuable data may be placed on servers in geographical locations with insufficient legal protection and inadequate security.

There are benefits associated with cloud-based services. Presently, the major benefits are mostly related with the private clouds. The private clouds have also strong potential to avoid the most significant dangers associated with security, control and compromise of data and services.

- **Outsourcing Similarity:** Cloud-based service adoption is relatively comparable to outsourcing. Information technology managers with outsourcing experience are able to appropriately weight problems and benefits associated with adoption of cloud-based services. Hence, the adoption may be faster and more efficient.
- **Ease of Deployment:** Deployment of new cloud-based services from external providers may be relatively easy. External providers specialize in cloud-based services. The services are usually readily available for immediate use. However, this holds in cases of adopting previously unused services. Transfer of existing organizational services is typically complex.
- **Cost Savings:** Adopting third party cloud-based services may bring short-term cost reductions. Reduced costs can be due to decrease of maintenance and management costs, and also costs related to internal hardware and software infrastructures. It is important to note, that public clouds are economical only for a short term—generally 1-2 years.
- **Payments:** While private cloud-based services are considered the most cost effective in the long run, they require greater initial investment. If an organization lacks sufficient funds, pay-for-use option may be beneficial. Also, payments may be segmented into several instalments (e.g. payments monthly, quarterly, or semi-annually). This may also benefit short-term planning, since the future-term costs can be estimated more accurately.
- **Up-to-Datedness:** Software, hardware and related infrastructures are professionally managed and maintained. Users are provided with up-to-date environments and do not need to be concerned with upgrade and update issues.

4. Conclusions

Cloud-based models do not present a new technological paradigm, but rather a different service delivery. They are seen as a blend of readily-available technologies and enablers. Cloud-based services and technologies have both benefits and risks. Information technology managers should carefully weight advantages and disadvantages prior to adopting cloud-based services.

The primary risks are security, loss of control, availability, performance and legislative aspects. Security risks relate to compromization of valuable organizational data by external entities. Loss of control refers to inability to completely control data and services outside of organization. Availability underlines undisrupted access to services and data. Performance is affected by connectivity speed between the access point and the service location. Present-day internet is significantly less reliable and secure than organizational intranets. Legislative aspects relate to data protection, privacy, and liabilities of providers. Benefits of cloud-based services include relative ease of deployment, potential cost savings, and various payment options.

Considering the risks and benefits of cloud-based services, the most beneficial are the private clouds. They feature the highest security, the greatest control and availability. Hybrid clouds represent the compromise between risks and benefits. Risks could be minimized by maintaining the core data and services in-house—in private clouds, while reducing costs by outsourcing residual data and services to public clouds. The public clouds are currently the most unfavorable. They present the highest security risks, the lowest control, and the greatest liability and legislative gaps.

5. Acknowledgements

The authors would like to thank the members of the Social Intelligence Technologies Research Laboratory at the National Institute of Advanced Industrial Science and Technology (AIST) for their valuable discussions and comments.

6. References

- [1] M. Alvesson. Knowledge Work and Knowledge-Intensive Firms. Oxford University Press, Oxford, 2004.
- [2] T. H. Davenport. *Thinking for a Living - How to Get Better Performance and Results from Knowledge Workers*. Harvard Business School Press, Boston, 2005.
- [3] C. Ringel-Bickelmaier, M. Ringel. Knowledge Management in International Organisations. *Journal of Knowledge Management*, 2010, **14**(4), 524-539.
- [4] T. Butler, C. Murphy. Understanding the Design of Information Technologies for Knowledge Management in Organizations: A Pragmatic Perspective. *Information Systems Journal*, 2007, **17**(2), 143-163.
- [5] D. Sullivan. *Proven Portals: Best Practices for Planning, Designing, and Developing Enterprise Portal*. Addison-Wesley, Boston, 2004.
- [6] M. Rosen, B. Lublinsky, K. T. Smith, M. J. Balcer. *Applied SOA: Service-Oriented Architecture and Design Strategies*. Wiley, New York, 2008.
- [7] D. S. Linthicum. *Cloud Computing and SOA Convergence in Your Enterprise*. Addison-Wesley Professional, New York, 2009.
- [8] G. Morton, T. Alford. The Economics of Cloud Computing Analyzed. October 26, 2009. <http://govcloud.ulitzer.com/node/1147473>
- [9] A. Haeberlen. A Case for the Accountable Cloud. *ACM SIGOPS Operating Systems Review*, 2010, **44**(2), 52-57.
- [10] K. Julisch, M. Hall. Security and Control in the Cloud. *Information Security Journal*, 2010, **19**(6), 299-309.