CHAPTER 1 : INTRODUCTION AND OVERVIEW

1.0 WHAT IS CLOUD COMPUTING?

Cloud Computing is a way of using business applications over the Internet (Gill, R..,2011), just like using online banking or Gmail. No more expensive, capital-intensive hardware and infrastructure and no more expensive, time-consuming, staff-intensive upgrades. Its pay-as-you-go feature would enable your finance, human resources, sales, or service applications through a Web browser. According to IDC, this software delivery model is experiencing dramatic growth, and the market for cloud-based solutions is set to grow six times faster than the overall software market.

Katzan, H.. (2010) defines *Cloud computing* is a model for providing on-demand access to *computing* service via the Internet. The Internet is the transport mechanism between the client and the server located somewhere in cyberspace, as compared to having computer applications residing on an "on premises" computer. *Adoption* of *cloud computing* practically eliminates two ongoing problems in IT service provisioning:

i. the upfront costs of acquiring computational resources and;

ii. the time delay of building and deploying software applications.

The technology does not exist without a downside, which in this case is the privacy of business and personal information is assumed at stake.

Cloud Computing could be revolutionary rather than evolution of IT Services since its inception in 2002. Although it is still sometimes taken as to be the newest label of the

previously available services, the Application Service Provider (ASP) model. But now, it is far more understood and acceptable to describe it as cloud computing.

Gartner's managing vice president Daryl Plummer said in one of his talks that cloud heralds a new era in the relationship between end user and software provider as users focus on the service they actually need rather than what a particular platform can provide. A customer-centric approach, rather than technology-centric.

In one of the Cloud Computing workshops, The Open Group has conducted one in July 2009 which purpose was to gather customer views on the motivations for, and key requirements of, the use of Cloud Computing technologies. The pain points that customers experience through not using Cloud Computing is categorised in nine (9) categories, ranked in priority orders :

i. Timeliness/ agility
ii. Resource optimisation
iii. Cost
iv. Need to remove obstacles to innovation
v. Security
vi. Risk Management
vii. Compliance
viii. Need to improve quality of IT support
ix. Business Continuity

The other perspective is to look the IT-infrastructure from an enterprise's point of view itself, i.e. which infrastructure is required or built based on the enterprises' business requirements, which include :

i. Data Center Management

ii. Architecture Transformation and Evolution

iii. Policy-based Management of IT Platforms

Previous IT services pain-points could easily be addressed by the cloud computing technology and services. Example including the challenges for organisations in managing its own data centers, its facilities including the network management, hardware acquisition and currency, energy efficiency, scalability with business demands which are all costly to be implemented in a way that could easily expands and contracts as demand changes.

As businesses aggregates and collaborate in global context, the Data Center scalability is again constrained by cost, to efficiently manage the environments, satisfy the regulatory requirement within the geographic limitations. Under this circumstances that there is need to transform the ways that the data center is managed. Cloud solutions then brings in agility, elacticity and economic viability to the forefront.

People seem to have their own opinion on what cloud computing means. The definition ranges from the ability to rent a virtual server, load software on it, upgrade resources to meet sudden demand or release it as and when not requiring it. For Sun, cloud computing means 'services that are encapsulated, have an API, and are available over the network (Carolan and Gaede, 2009).

Smith, 2009 defines cloud computing as a means of renting computers, storage and network capacity on an hourly basis from some company that has these resources in its own data center and can make them available to you and your customers via the Internet.

Gartner defines cloud computing as a style of computing where massively scalable IT-related capabilities are provided as a service across the Internet to multiple external customer.

UC Berkeley defines it as the illusion of infinite computing resources available on demand, the elimination of top-front commitments by cloud users, and the ability to pay for use of computing resources on a short-term basis as needed.

This study scopes cloud computing into ’the availability of the computing resources or applications by subscription model that can replace their CAPEX investment to utilize the same for the companies’ own business requirements or processes needs’. Purely riding on the generic feature on Cloud, which is flexible and pay per use model, the study is to test on the factors that influence the adoption of Cloud Computing services.

1.1 THE EMERGENCE OF CLOUD COMPUTING

The ecosystem1 of Cloud Computing is illustrated in a 3 x 3 grid as below :

	Public	Hosted	Private
Applications	Software as a service	Hosted applications	On Premise applications
Platforms	Platform as a service	Hosted Platforms	On Premise Platforms
Infrastructure	Infrastructure as a service	Hosted Infrastructure	Private Infrastructure

Figure 1-1 : Cloud Layers[i]

Cloud layers most referenced in the market are application layer, platform layer and infrastructure layer.

Application layer contains applications used by end-users, administrators, and managers. Platforms are the middleware that sits underneath the applications, often including things like security, management tools, databases, messaging, and servers. Infrastructure includes things such as core computing and storage resources and infrastructure management.

Commonly, there are three (3) types of clouds, “Public”, “Hosted”, and “Private” which in public, applications, platforms, and infrastructure have been highly abstracted from hardware as they are offered as a service over the public internet and are designed as “multi-tenant” services (one core code base under all users). Public cloud often is publicly accessible and has publicly accessible APIs, metered usage and is often designed in a way that lets users provision themselves instantly and leave when they want (one-demand). Some very well-known examples are Salesforce.com,

[1] http://www.cloudtweaks.com/2010/02/bcs-cloud-computing-ecosystem-a-comprehensive-list/

Google's web-based Google Apps, Force.com (the development platform), Google's App Engine (a deployment platform), and of course Amazon Web Services, the Rackspace Cloud, and Microsoft Azure.

In the Hosted column, there are "On-Demand" applications from the big vendors. Often these are applications hosted by vendor with both a perpetual license fee and a separate hosting fee. In the Private column include those vendors who are building anything that would fit in the "Private cloud" category.

There are also Hybrid type of cloud services which is a combination of public cloud and private cloud. This starts with the term referred by service providers. Most common in service providers that the private cloud term conflicts where service providers usually refers the term as to a cloud services that is provisioned via a private network. Thus, the hybrid cloud is a platform by the service provider that supports the provisioning of the public as well as private cloud.

1.2 PURPOSE AND SIGNIFICANT OF STUDY

The proposed research will contribute to a new knowledge, especially in identifying the relationship between factors that determine ones decision in adopting cloud computing among Malaysian internet users.

This underlying research on Cloud Computing adoption in Malaysia will provide the basis for other future technological as well as market researches in determining different packages, service features as well as support infrastructure that comes with the services offered.

Particularly for users or potential users of Cloud Computing, the knowledge emerges from this study may be used to make better choice of the various cloud offerings from various service provider.

Nevertheless, for the services providers, the knowledge from this study could be essential in designing the right feature of the services targeting a particular market and verticals.

For Malaysia as a country, the study is hoped to become the basis for further positioning of Malaysia in becoming the content, halal businesses, applications, education and in promoting medical hubs and tourism by aggregating and providing the Cloud-technology-based applications, infrastructure and platforms required by these businesses and segments.

Initiatives like below could possibly be achieved by :

- Having special tax incentives for individual, SOHO, SME and Enterprises to gauge the adoption of cloud services especially from local providers, in supporting the national content and application hub. Very recently is the Blue Lane initiative by the government parked under the PEMANDU NKEA.
- Encourage Malaysian or local solution integrators (SI) to collaborate together in providing cloud services to serve a higher level organizations, individuals whether it is organic (local) or inorganic (off-shore) leveraging on the availability of the public network.
- Realizing the objective of Malaysia to be an internet hub in the region.

1.3 RESEARCH QUESTIONS AND OBJECTIVE OF THE STUDY

1.3.1 Research Objectives

The objective of this study is to find if there is relationship between main behavioral factors (independent variables) with the intention to adopt (dependent variables) the emerging and revolutionary cloud computing services by internet-users individual in Malaysia.

Little academic or market research has been done on individual or organizational adoption to cloud computing in Malaysia despite widespread and accelerating adoption of Private Cloud and usage in developed countries like in the United States (Anonymous, 2010) [ii] showed in a survey sponsored by Novell. The findings include :

i. Current cloud computing adoption is much higher that previously thought
ii. Cloud computing will complement, not replace, enterprise data centers
iii. Security is a top concern for the public cloud
iv. Private clouds mitigate security concerns
v. Private clouds offer compelling benefits
vi. Private cloud computing is emerging as the consensus choice for enterprises

The results of a new Harris Interactive survey of more than 200 IT leaders at large enterprise organizations were announced in October. The survey, sponsored by Novell, reveals much broader adoption of cloud computing than has been suggested by previous research, and shows accelerating momentum behind developing private cloud infrastructures. The research strongly suggests cloud computing - both public and private - will be an increasing part of the mix of resources deployed by enterprise

IT organizations, and that companies are particularly interested in simplifying management across their integrated physical, virtual and cloud environments.

1.3.2 A Mixed Approach

Cloud adoption is a focus for many enterprise organizations - but the question remains, what is the best way to leverage the power of cloud computing, maximizing efficiency gains and cost savings while minimizing risk? According to the Harris Interactive survey, focused primarily on IT director-level and above at large enterprises organizations (2,500-20,000+ employees), 77 percent report using some form of cloud computing today, much higher than previously reported.

Other key findings tied to cloud adoption include:

* Private clouds are the next logical step for organizations already implementing virtualization, according to 89 percent of the respondents

* 34 percent of survey respondents are using a mixed approach of private and public cloud computing, with 43 percent planning to increase their use of the combined approach

* 87 percent of respondents believe public cloud computing adoption will occur alongside of, instead of replacing, company-owned data centers, with 92 percent indicating an increase in public cloud use as current IT platforms are replaced

* 3 1 percent of respondents find that a key benefit to private cloud computing is the ability to manage a heterogeneous infrastructure.

1.3.3 Security Remains a Top Concern

The Harris Interactive study also revealed security as a leading barrier to cloud computing adoption, with 83 percent of survey respondents feeling private cloud computing offers most of the advantages of public cloud computing (freedom from maintaining hardware, lower cost upkeep, resource scalability, lower initial costs) without the security and compliance issues of the public cloud.

This research is targeted to determine the correlation of five (5) behavioral factors of individual's intention to adopt or fail to adopt cloud computing. Correlation test is done to determine the items below :

i. Direction of relationship
ii. Strength of relationship
iii. Coefficient of determination

The correlation test done in here is to find out the Coefficient of determination R^2, used in the context of statistical models which main purpose is the prediction of future outcomes on the basis of other related information. It provides a measure of how well future outcomes are likely to be predicted by the model.

By referring to the Technology Acceptance Model (TAM) and the Innovation Diffusion Theory (IDT), this study is to identify the correlation, in the essence of finding the coefficient of determination between the behavioral factors for individuals in adopting cloud computing. This study is to test Cloud Technology adoption among Malaysian internet users.

1.4 STATEMENT OF PROBLEM

While there are market research that studied about the pain-points that could be addressed by the Cloud Computing, this study is to find out what exactly the factors that motivates the adoption of Cloud Computing.

Especially for Malaysia, there is currently very few of academic research done based on theories of adoption in determining the possible factors influencing Cloud Computing adoption. Nevertheless, there are market researches conducted by particular organizations like TM and MIMOS on cloud computing, particularly in Malaysia. MIMOS is in the research and Development segment, while TM is looking at a service provider point of view. Just recently that USM offered a grant for doing Master and PhD degree in the Cloud Computing area.

Technology vendors (HP, Oracle, Dell, Novell, etc.) tend to write about the wonders of Cloud Computing with the intention to boost their hardware and equipment sales. Write-ups and articles from technology vendors like IBM, HP, Oracle and Novell have proposed that cloud computing will contribute significantly to business value and suggested that cloud computing have great potential for organizations as well as individuals. These technological articles are mostly descriptive. Thus, this empirical study attempts to answer the factors influencing adoption of cloud computing in Malaysia.

1.5 ORGANISATION OF THE STUDY

This study is organized as such that it follows a certain methodology from its problem statement, data collection, statistical analysis, fulfillment of ethics during its data collection, reporting as well as presentation.

This document comprises of five (5) chapters and organized as follows :

Chapter 1 presented on the introduction to Cloud Computing and the statement of the problem.

Chapter 2 reviews the Cloud Computing literature in order to understand the nature and potential adoption of Cloud Computing services by individuals. Literature based on theories of adoption is also reviewed, which includes the Technology Acceptance Model (TAM) and Innovation Diffusion Theory (IDT).

Chapter 3 further presents the Research Methodology used from data collection methodology techniques to testing of the hypotheses and its testable hypothesis based on these two theories and the approach from the past research by Udoh, E (2010) and Hebron (2008).

Chapter 4, the results of testing of the hypotheses from the framework is presented and discussed.

Chapters 5 presents the discussion on the limitations, implications of the research for academics and practitioners and future research directions.

1.6 CHAPTER SUMMARY

Chapter 1 is where the introduction to this study is presented. This chapter introduces what Cloud Computing is all about including the definition and the theories involved in this study. Finally, this chapter suggested the organization of the chapters which involved the introduction to the conclusion and recommendation.