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Investigating Cloud ERP Providers Selection for SMES in A Multi-Tenant Environment

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ABSTRACT: Enterprise Resource Planning (ERP) systems provided as a service in the cloud is offering immense assistance for the Small and Medium sized Enterprises (SMEs) with respect to cost effectiveness and affordability, to be able to compete favorably and fairly with their Large Enterprises (LE) counterparts who have the financial wherewithal to adopt the rather expensive traditional or on-premise ERP Systems. However, to be able to achieve such numerous benefits such as economies of scale, improved flexibility, reduced capital cost, improved accessibility, and so on, many service subscribers (tenants) often share the same remote physical infrastructure put in place by the cloud service providers (CSPs). This multi-tenancy concept however introduces a high level of security and privacy risks unique to cloud services, such as attacks from other consumers, who may be competitors or simply hackers, sharing the same infrastructure. Hence, it becomes a challenge for the SMEs to select a suitable CSP whose security and privacy mechanisms most meet the security requirements of the organizations. We critically appraise some selected frameworks for the selection of cloud computing and, more specifically cloud ERP providers in order to be able to identify dimensions and measure of selection. We compare the frameworks based on their components, criteria for selection in the approaches and the suitability for the SMEs. We discovered that there is a link between frameworks of evaluation, ranking and selection of cloud providers. In our review, we found out that current selection methods are complementary one to another in the sense that they select providers based on different criteria and can be worked upon to suit requirements of the SMEs.

Keywords: Cloud ERP, CSP, Multi-tenancy, Privacy and Security, Selection, SMEs.

1. INTRODUCTION

Traditional Enterprise Resource Planning (ERP) systems have been around for over two decades in which case organizational data reside within the premise of the organizations [1]. However, with the emergence of cloud computing which is a paradigm concept of accessing a network of remote servers via the Internet for the purpose of managing, processing and storing data, many enterprises have seized the opportunity based on its many advantages over the traditional model, such as scalability, flexibility, cost effectiveness, reliability, broad network access, etc to move their businesses to the cloud [2]. Therefore, Cloud ERP is just a name coined from the combination of Enterprise Resource Planning (ERP) Systems and Cloud Computing. In spite of these numerous benefits of cloud computing, many organizations, most especially, large enterprises, are hesitant and afraid to migrate their precious organizational data to the cloud apparently on the ground of insecurity.

Security concern remains a viable stumbling block to a widespread adoption of this paradigm technology yet by many organizations [3], [4], [5]. In a research survey conducted by IDG Enterprise in 2012 to 2013 on companies' view of cloud adoption, two-thirds (67%) of the respondents chose security as the top three concerns over the cloud while a whopping 56% of the companies say they can't adopt cloud fully until they are sure the cloud is safe and capable of managing the security of their data [6].

However, research, as well as observation, has proved that adoption of cloud computing was found to be higher in Small and Medium Enterprises (SME's) than in Large organizations. This has been found to be so apparently due to two major reasons namely, the reduced and affordable capital expenditure to access a pool of incredible computing resources at pay-per-use [7] and the fact that the SMEs have not as much assets to lose as the large enterprises in case of any possible eventual breach of data migrated to the cloud [8]. Also, the financial capability of the Large Enterprises (LEs) to implement the conventional traditional technologies has been found to be another reason why cloud adoption rate is greater in the SME's than in the LE's.

As identified by Musson [9], most security problems in Cloud Computing stem from three areas:

loss of control,
lack of trust (mechanisms) and
multi-tenancy

Security issues in Cloud Computing is a broad topic, this survey focuses only on the security issues that stem from the multi-tenant feature of Cloud Computing as it is expected to provide a more detailed analysis and deeper level of understanding of this domain. he remaining part of this review article is divided into four sections, making five in all. Section II gives a comprehensive description of the research methodology adopted in collecting and analyzing the articles reviewed. Section III provides a general overview of the present study status of each major theme constituting the research topic. Critical evaluation of existing models and frameworks for selecting cloud service providers, including a few obvious trends are provided in Section IV. Section V ends the paper with findings, conclusion and future work.

II. Research Methodology

The methodology employed in this study is the review of literature searched out with certain keywords as key for search. Such keywords include Cloud Computing, ERP, service provider, selection, multi-tenancy, SME's, security and privacy. The review focuses on articles published in major scholarly journals and proceedings of conferences spreading over a period of 6 years (2008 – 2014), owing to the fact that though ERP has been around for over two decades [1], cloud computing is a relatively new paradigm concept of computing which emerged in late 2000's. The review does not include unpublished papers. A couple of scientific databases were searched in a bid to obtain recent and relevant papers on the topic under review. These include: Science Direct, ACM Digital Library, IEEE Computer Society Digital Library, Web of Science, IEEE Xplore Digital Library, SpringerLink and Scopus. Table I shows the list of publications identified from Computer and IS journals as well as conference proceedings and the corresponding number found/collected during the search. Relevant articles from other scientific publications which we found during the search and collection process were also considered.

Table I : Analysis Of The Results Of The Searching Phase

	Databases	No of Papers Collected	No of Papers Relevant	No of Papers used after filtering (due to duplication)
1.	Science Direct	25	13	5
2.	ACM Digital Library	23	16	11
3.	Web of Science	3	1	1
4.	IEEE Xplore Digital Library	29	24	19
5.	SpringerLink	33	16	5
6.	Scopus	34	10	7
7.	Emerald	41	21	15
	TOTAL	**188**	**101**	**63**

Table 2: Iisub Topic Searched And Corresponding Usable Publications

	Topic Searched	**Papers**
1.	Enterprise Resource Planning Systems	[1], [2], [10], [11], [20]
2.	ERP and Cloud Computing	[2], [3], [7], [13], [14], [15], [16], [17], [18], [19], [21]
3.	Cloud ERP Privacy and Security	[4], [5], [6], [9], [22], [36], [43]
4.	SME's and (Cloud) ERP	[7], [8], [12], [23], [24], [25], [26], [27], [28], [29], [30], [31], [32], [33], [34, [35], [49], [52], [60]
5.	Security and Multi-tenancy	[36], [37], [38], [39], [40], [42], [44], [45], [46], [47]
6.	Cloud ERP Provider selection for SME	[48], [50], [51], [52], [53], [54], [55], [56], [57], [58]

III. Present Study

III.1 ERP Systems

Enterprise Resource Planning (ERP) is a software for business management which integrates internal and external management of information across an entire organization-embracing finance/accounting, manufacturing, sales and service, human resource, customer relationship management, etc. [10], [11], ERP systems automate this activity with an integrated software application. The purpose of ERP is to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders. Historically, ERP systems in its early emergence focused on big enterprises but of late, adoption has been found to be on the increase with small and medium scale enterprises [12], [13].

III.2 Cloud Computing

Ever since its phenomenal emergence in 2008[5], there are myriads of definitions for Cloud Computing (CC) as proposed by IT practitioners and various previous researchers. However, this research adopts the definitions by the National Institute of Standards and Technology (NIST) [14] and Armbrust et al [15]. NIST defines Cloud Computing as "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" [14]. While Armbrust et al [15] put their definition of Cloud computing as being "both the applications delivered as services over the Internet, and the hardware and system software in the data centers that provide those services". The researchers adopt these definitions based on their comprehensive detailed summary nature of the new concept in computing trend. Fundamentally, there are three models by which cloud computing services are delivered. These are: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS), [16], with four deployment models: Private cloud, Public cloud, Community cloud and Hybrid cloud. It is made up of five essential characteristic features: On-demand self-service, Broad network access, Resource pooling, Rapid elasticity and Measured service [14], [17]. These 3 dimensions (delivery, deployment and essential characteristics) are shown in fig 1 below. Other note-worthy characteristics are: Location independence, Sustainability, Reliability [18]. Based on the essential features of Cloud Computing which fundamentally offers cheap capital investment, the SMEs seize this opportunity to save investment on IT infrastructure and have more money in terms of budgetary allocations on their core and direct business operations such as business development and marketing.

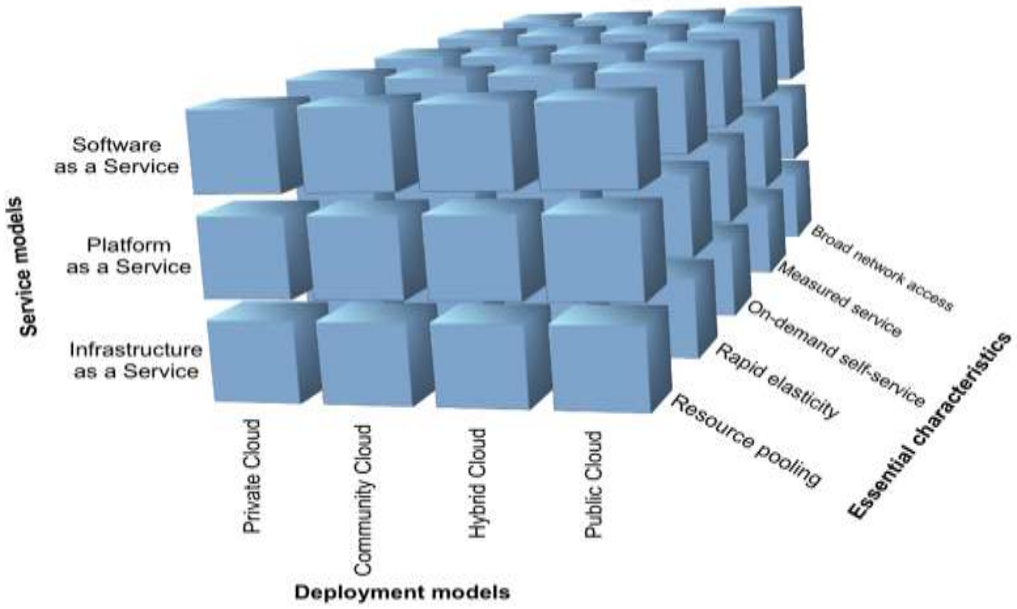

Fig 1: The 3 dimensions of Cloud Computing (Peter and Tim, 2011)

AJAX (Asynchronous JavaScript And XML), Multi-tenancy and Virtualization are the three technologies considered to be instrumental to the emergence and development of cloud computing [19]. While AJAX enables the client to communicate

with the server dynamically; multi-tenancy describes shared use of single software by multiple clients through their private and individual data space whereas virtualization allows for sharing of physical resources.

III.3 Cloud ERP

Basically, ERP is designed to integrate data from across all the business functions within an organization and also to integrate data as it concerns supply, production, distribution and product delivery to customers [20]. In traditional ERP, software or solutions are installed locally in computers and data are stored in servers in-house. Platforms and infrastructure are under the control of the organization. Moreover, management of data including its security, maintaining the server and cost of general maintenance of infrastructure and space occupied as well as disaster recovery provision are all a responsibility of the enterprise [21].

However, with the emergence of cloud computing which is a paradigm concept of accessing a network of remote servers via the Internet for the purpose of managing, processing and storing data, many enterprises have seized the opportunity based on its many advantages over the traditional model, such as scalability, flexibility, cost effectiveness, reliability, broad network access, etc to move their businesses to the cloud. Therefore, Cloud ERP is just a name coined from the combination of Enterprise Resource Planning (ERP) Systems and Cloud Computing. Cloud-based ERP systems are basically provided using the Software-as-a-Service (SaaS) architecture, under a situation where users rent the software and use, rather than buy it [22].

III.4 SMEs and (Cloud) ERP Systems

The Small and Medium-sized Enterprises (SMEs) have been said to be the "lifeblood of any vibrant economy" and have been known to be the silent driver in a thriving and agile nation's economy [23]. Based on a report by Industry Canada, as of December 2011, a whopping 98.1% of all employer businesses in Canada are small-sized businesses (Employer Businesses are those which maintain a payroll of at least one person), and 1.7% of businesses are medium-sized businesses. That leaves the large businesses with the responsibility for only 0.2% of employer businesses [24]. In a similar veil, according to a research work published by Sledgianowski et al [25] in 2008, it reported that 90 percent of all businesses in the USA are both Small and Medium Enterprises (SMEs). As a matter of fact, globally, SMEs have been said to be employers of an estimated 85% of persons in the manufacturing sector while contributing around 70% of Gross Domestic Product in the global socio-economic development [26]. An increase in the SMEs has also been observed to be in an exponential rise in the United Kingdom of late largely due to the self employment drive resulting from the current economic recession [27]. The significance of SMEs to the Malaysian economy was factually indicated by its contribution in all sectors and reportedly amounting to a worth of RM4.3 billion ($1.35 billion) or 20% of Malaysian Gross Domestic Product (GDP) in 1990; this was equally projected to have increased to RM120 billion ($36.5 billion) or 50% by year 2020 [28].

While large enterprises encounter a lot of challenges in implementation of online services obviously because of their complex functionalities and data security concerns, it is noted that such services are better suited for small industries [29] apparently because of their size and lesser concern about security than the large enterprises [30]. In a research report by Haddara [31], he discovered that despite the aggressive desire of the SMEs to adopt ERP which is expected to assist them in efficiently managing their businesses, high software and license fees, and implementation complexity has created some resistance for traditional ERP packages [31], [27]. However, in today's technology-driven economy, the fact remains undeniable that ERP system is crucial to the success and sustainability of any SMEs [29], [32].

In a world of increasing competition on daily basis, the SMEs have been forced to compete with their large enterprise counterparts in an environment rather unfriendly to them but obviously favorable to the large enterprises. The SMEs have restricted access to Government funding. The high costs with which latest technologies come make them not easily affordable for the SMEs [33], [34]. However, with the advent of Cloud Computing and its numerous benefits, Cloud ERP systems are now offered at a lower cost, which is financially convenient for the SMEs to adopt [15] thereby affording them a platform of fairness and favorable competition with their large enterprise counterparts as far as ERP systems adoption is concerned [34], [35].

III.5 Multi-tenancy and Cloud Security

The idea of multi-tenancy is fundamental to cloud computing. Multi-tenancy is a term that defines the use or sharing of the same application or resources by two or more (multiple) consumers that may come from the same or different

organizations. This is a situation where the organization's operating systems and applications are run on virtual machines (VM) hosted in parallel configuration with the VM of other organization on shared physical devices [36], [37]. According to [38], "Information Security or Security refers to protecting information and information systems from unauthorized access, use, disclosure, disruption, modification, inspection, recording or destruction". In a multitenant environment, where multiple independent users or consumers share the same physical infrastructure, and in a scenario where the tenants which may have opposing goals share a pool of resources, securing the multiple tenants' sensitive data and information becomes a challenge. Also, conflict of interest may result. So, how does multi-tenancy deal with conflict of interest? Can tenants get along together and 'play nicely'? If they can't, can they be isolated? How to provide separation between two or more tenants? Thus an attacker can legitimately be in the same physical machine as the target [9].

Multi-tenancy is known to be the root cause of concerns for many users [39]. Nevertheless, the fact remains undeniable that it enables optimal server utilization, thus lowering costs of infrastructure. However, the threats posed by multi-tenancy feature of cloud differ as we move from one cloud delivery model to another [40].

According to a report released by Gartner, 60% of virtualized servers will be less secure than the physical servers which they replace [41]. Currently, as identified by [42], multi-tenant cloud is faced with two major sources of threats: virtualized infrastructure which can be attacked by the exploitation of possible security vulnerabilities in the massive and complex virtualized pile of software; also, attacks from unauthorized accesses to sensitive and precious data from cloud operators. Hence, in multi-tenancy, residual data can be visible to a co-tenant while trace of operations by a co-tenant is also very possible. These have been found to constitute a challenge to the security and privacy of data in cloud environments [43].

A couple of researchers have worked in the area of ensuring security in the multitenant domain: [44] (Isolation and customization); [45] (Suggests removal of virtualization layer); [46] (Incorporation of Active Protection System); [42] (use of Nested Virtualization); [47] (Constructing a Virtual Machine Monitor in form of a new Micro-Kernel), and many others. However, research is still ongoing as more and more vulnerabilities, threats, risks and security challenges emerge with time.

IV. Cloud Service Providers Selection – Related Works

Although there have been ample challenges for organizations to select suitable cloud service providers for themselves as interest in adoption of Cloud services is noticeably on exponential increase by the SMEs in recent times [48], consistent and concerted efforts both by researchers and Information Technology practitioners toward addressing these challenges have produced a handful research reports. One of the most common evaluation and selection criteria when it comes to Cloud Service Providers (CSP's) is the Quality of Service (QoS) criteria, such as usability, performance, agility, reliability, availability, accessibility, trust etc., while some other include several methods based on security and privacy requirements and other quality parameters.

In a research conducted by Iffatt and Bruce [49] in 2011 on Cloud Computing and SMEs in the UK, which involves 93 different SMEs respondents across the United Kingdom (UK), when asked to identify the most important criteria for selecting a vendor from a list which consists of Terms & condition of supply, Data protection clauses, Data retention policy, Jurisdiction clauses, Other data security clauses, Termination of contract, Technology deployed, Information and/or IT security standards implemented by supplier, Right to audit a supplier, observation concluded that 'Data Retention Policy' and 'Terms & Conditions of Supply' are of priority concern as a whopping 69% chose the two as the most important criteria in the process of seeking cloud service vendor for their organization [49].

Ouedraogo and Mouratidis's work [50] presented key foundations of the security assurance in cloud services which they describe as C.A.RE approach. This approach helps to determine the adequacy of a Cloud Service Provider's (CSP) security mechanism put in place by way of assessing its completeness in addressing most, if not all, risks to which a service may be exposed; the potential of that security to be adapted upon the identification of a security vulnerability during an audit, and how transparently such information is shared with the concerned CSC. Works in 3 phases: (1.) The "COMPLETE" phase – gathers necessary evidence possible alignment. Involves 3 levels of granularity ("None", "Partial", "All") (2.) The "AUDITABLE" phase – a complement to the Completeness metric and contains 5 levels of assurance. (3.) The "REPORTABLE" phase – a timely conveyance of the report of any issue uncovered in the actual probing which involves two capability levels, No information and Security related information shared with the CSC at the end of the whole process [50].

A framework which is a systematic comparator of the performance and cost of cloud providers was proposed by [51]. This framework measures the elastic computing, persistent storage, and networking services offered by a cloud along metrics

that directly reflect their impact on the performance of customer applications. Measurement methodology includes three processes namely: Providers selection (Amazon AWS, Microsoft Azure, Google AppEngine and Rackspace CloudServers), Identification of common services (the common core set of functionality) and, Choosing performance metrics. Though this research was in-depth, it considered limited parameters.

A PEST Benefit/Threat Analysis framework meant to analyze factors that should be addressed by the SME before selecting ERP in Cloud environment was proposed by Tripti, 2013 [52]. Findings of the research indicate that the main benefit areas for an organization are Economical & Technological while threats are more in the Political & Social factors. In conclusion, the work proposed some threat mitigation approach where threats were identified [52]. One weakness of this work is that the four factors considered may be too general and may not be suitable to analyze more specific factors.

Punam et al, 2012 [53] proposed a framework for selecting trustworthy cloud service provider based on the recommendations provided by their trustworthy acquaintances. This framework which is an advancement over the work of Punam et al in 2007 [54] primarily combines two types of agents – user agent which submits user application with specified requirements, and service provider agent which presents corresponding resource information on behalf of the service provider before recommendations are made. The framework handles the challenge of uncertainties in the recommendations present in previous Puman et al's work through the use of Fuzzy Inference System (FIS).

In another work by Mouratidisa et al, 2013 [55] the researchers engaged in preliminary identification of security and privacy issues, such as Data integrity, Data segregation, Data availability, Backup strategy, Provider's transparency, Data protection and Legal compliance and afterwards proposed a framework that incorporates a modeling language and provides a structured process that supports elicitation of security and privacy requirements and the selection of a cloud provider based on the satisfiability of the service provider to the relevant security and privacy requirements via three processes namely Security & Privacy Cataloguing, Security & Privacy Analysis, and then Selection Analysis.

Wang et al [56] proposed a cloud service selection approach that is based on Quality of Service (QoS) awareness. This approach which they presented as being able to provide reliable and efficient optimal service selection for users work in two stages. A cloud model that computes the QoS uncertainty performs pruning of redundant services and selection of reliable ones using Backward Cloud Generator (BCG) algorithm. In the second stage, a Mixed Integer Programming (MIP) is employed to accomplish the task of actual selection of optimal services for users [56]. To overcome the challenges and difficulties encountered in modeling some QoS attributes, Lin et al, 2012 [57] proposed a QoS-contest aware model which extracts QoS context factors by analyzing them and comparing them with QoS attributes to determine correlation.

In a similar work by Garg et al, 2011 [58], a framework and a mechanism was put forward which measures the quality of Cloud services as well as prioritize them based on 12 Service Measurement Index Key Performance Indicators (SMI KPI's) namely, Service response time, Sustainability, Suitability, Accuracy, Transparency, Interoperability, Availability, Reliability, Stability, Cost, Adaptability, Elasticity and Usability. Involves 3 phases: 1. Hierarchy structure for cloud services on SMI KPIs, 2. Computation of relative weights of each QoS and Service, 3. Relative value-based weights for ranking Cloud services.

In their paper titled "A Service Selection Approach in Cloud Manufacturing for SMEs", Haijiang et al, 2014 [59] presented an approach (CMfg-SME) for selecting cloud manufacturing resource and providing service according to the specific demands of the SMEs. Though the paper focuses on manufacturing, yet, SMEs are the majority of the manufacturing enterprises [60]. The proposed model makes use of service selection algorithms called Single Service Selection (SSS) algorithm and Genetic Algorithm (GA) in which some query conditions are used to detect most matching services and then arranging them in order based on the feedback score and finally returning the service with the highest score to the requester SME organization.

Ke et al [61] considered multi-tenancy security-based as well as other factors in their proposed selection approach to cloud service, however, the scope of their work only covered the Service Level Agreement (SLA) utility function between the service providers and tenants using a modified version of ELECTRE (Elimination Et Choice Translating Reality) method which is one of the early techniques used in Multicriteria Decision Analysis (MCDA) [62][63].

A framework for selection of best CSP proposed by Baranwal and Vidyarthi [64] uses Ranked Voting Method which involves application of a particular standard measurement framework referred to as Service Measurement Index (SMI) which measures based on seven essential characteristics, with each characteristic in turn having at least three attributes as proposed by a professional body called Cloud Services Measurement Initiative Consortium (CSMIC) [65]. However, the

work of [64] takes the SMI framework further in that it proposed additional QoS attributes which tend to make selection more accurate and flexible.
Summarily, as shown in the table III below, in most of the various frameworks and models designed for selection of cloud service provider, it is observed that it principally involves 3 phases or stages which are:

- Gathering of relevant information on the concerned parameters of interest from both the service providers and the client organization in form of requirements
- Comparison or matching of several providers' available security apparatus or mechanisms with the client's security and privacy requirements to determine suitability of a provider for a client organization.
- Ultimate recommendation and selection of the best suitable providers based on ability to meet most if not all the security and privacy requirements and needs of the client organizations.

Table III: Early Frameworks and Approaches to the Selection of Cloud (Erp) Service Providers

Selection Approach	Components/Process	Characteristics	Author(s)
C.A.RE approach	- The "COMPLETE" phase; - The "AUDITABLE" phase; - The 'REPORTABLE" phase	Determines the adequacy of a Cloud Service Provider's (CSP) security mechanism provided by way of assessing its completeness in addressing most, if not all, of the risks to which a particular service may be exposed.	Ouedraogo and Mouratidis, 2013
PEST Benefit/Threat Analysis framework for selection of Cloud ERP for SMEs	- The Political evaluation criteria - The Economical criteria - The Social evaluation criteria - The Technological criteria	Analyzes factors that should be addressed by the SME before selecting ERP in Cloud environment	Tripti, 2013
CloudCmp - Systematic comparator of the performance and cost of cloud providers	TPC-W (web server and database performance benchmark) Test Blasting (for DNA alignment)	Measures the elastic computing, persistent storage as well as networking services provided by CSP along metrics that directly reflect their impact on the customer applications performance.	Li et al, 2010
Framework for selecting trustworthy cloud service provider based on the recommendations provided by their trustworthy acquaintances	Works with the use of Fuzzy Inference System (FIS).	Uses multi-agent system – User agent and Service provider agent. Generates query from the user's requirements, generates recommendations for the user and updates trust level on trustworthy acquaintances.	Puman et al, 2010
Cloud provider selection framework based on Security and Privacy requirements	- Security and privacy cataloguing - Security and privacy analysis - Selection analysis	Incorporates a modeling language and provides a structured process that supports elicitation of security and privacy requirements and the selection of a cloud provider based on the satisfiability of the service provider to the relevant security and privacy requirements via three processes.	Mouratidis et al, 2013
QoS-Aware Service Selection approach	- Cloud Model (Backward Cloud Generator Algorithm) - Mixed Integer Programming (MIP)	Computes the uncertainty of QoS and uses MIP to identify and select the best combination and the most suitable cloud services.	Wang et al, 2011

SMICloud: A Framework for Comparing and Ranking Cloud Services	- Analytical Hierarchical Process (AHP)	Measures the quality and prioritize Cloud services.	Garg et al, 2011
A Service Selection Approach in Cloud Manufacturing for SMEs (CMfg-SME)	- Single Service Selection (SSS) algorithm - Genetic Algorithm (GA)	Analyses Characteristics of CMfg-SME to build a service selection model. Introduces constraints on service selection.	Haijiang et al, 2014
An optimal selection approach for a multi-tenant service based on a SLA utility	- SLA formalization - Utility function of SLA -Modified ELECTRE – Discover reasonable multi-tenancy service	Formalizes tenants' customized personal requirements in a multi-tenancy service configuration before passing through a 9 step process of extracting relative strengths among candidate solutions to get a selection order.	Ke et al, 2012
Framework for selection of best Cloud Service Provider using Ranked Voting Method	- Service Measure Index (SMI)	Voter ranks alternatives in order of preference. Has a catalogue of metrics with each metric acting as a voter while the Cloud Service Providers are their candidates.	Baranwal and Vidyarthi, 2014

V. Findings, Conclusion and Future Work

This review paper presented an overview of the research papers associated with the selection of a Cloud Service Provider for the SME's. The major objective of this study has been to examine the current state and use of several Cloud ERP Service Providers selection methods based on evidences available in the literature, with eventual focus on the security and privacy criteria of service selection. We aimed to identify gaps in current research as far as Cloud ERP provider selection methods are concerned in a bid to be able to suggest areas for further investigation and provide more in-depth research direction as well as contributing useful knowledge to the Information Systems Body of Knowledge.

For future work, firstly, we seek to identify the selection target, clear selection goal and clear solution for the problem of selection of cloud SaaS provider. Secondly, propose a Multi-Tenant Security Assurance framework for SMEs in decision making on Cloud ERP Provision selection. Thirdly, we seek to develop a prototype based on the proposed framework, capable of addressing the problem of choosing suitable Cloud ERP providers for the SMEs based on the security and privacy apparatus provided by the providers in a multi-tenant environment. This framework is expected to be validated via tangible evidence which includes real case studies and expert reviews, to afford it more applicability when it comes to the industrial environments.

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