

Cloud Computing Ontologies: A Systematic Review

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Abstract

The overarching goal of this research is to have a comprehensive understanding of Cloud Computing ontologies, as well as their uses and focal points. A study question, inclusion and exclusion criteria, and search technique are all part of the pre-defined research process that this systematic review used to identify primary papers. We have grouped the research that were chosen into four broad areas: cloud security, cloud interoperability, cloud resource and service description, and cloud service discovery and selection. In particular, the use of ontologies to enhance the interoperability and security of Cloud Computing services stands out as one of several difficulties and areas for further study that emerge from the evaluation of the included papers. A comprehensive review including cloud computing, ontologies, and cloud services.

I. INTRODUCTION

With the advent of cloud computing, a new standard for the offering a computer system, platform, or program as a function. Flexibility and pay-per-use are its key advantages. model and a considerable decrease in expenditure. Rhizoma [1] finds that, in terms of definition, the stated earlier is the one supplied by NIST. Cloud computing is a pay-as-you-go model, as stated in this description. make use of a paradigm that permits accessible, easy, on-demand connectivity to a communal pool of programmable computer resources assets (such as computer systems, data storage, apps, services) that may be quickly made available and made public via low level of involvement from service providers or management [1]. Cloud computing, in its most basic level, needs to include scalability, a utility model based on pay-per-use, and computer simulations [2]. Virtualization in the cloud is mostly a new model for doing business that allows for instantaneous access, pooling of resources, connection, flexibility, and pay-per-use decoupled system components [4]. Numerous Cloud Computing review articles may be found in the existing research; nevertheless, there has been no comprehensive evaluation of Cloud The book on

computing ontologies is out now. So, basically, Our study primarily focuses on the systematic selection and survey the literature and provide a cloud computing Computer ontologies, the many kinds of them, and the uses and emphasis on each. A number of research questions have been posed, including: primary emphasis and use cases for cloud computing scientific literature's coverage of ontologies? Can anyone tell me what the studies' effects on academic and industry group of people? The following is the outline of the paper. Section 2 is where we begin. please elaborate on the methodology used to compile this review. Chapter 3 includes summary information on the research that was considered. Section 4 offers a comprehensive analysis of pertinent evaluated articles and organized them into corresponding subjects into distinct groups. Next, in Section 5, a this comprehensive analysis. Based on our findings, provided in the previous section.

II. RESEARCH METHOD

In order to evaluate and understand all the research that is relevant to a particular research issue, our study use a systematic review approach [5]. In [5], we found several guidelines that try to solve some of the most unique issues in software engineering studies. The three primary steps of a systematic review are preparation, execution, and reporting. While making plans, we came up with a review methodology. Our paper's introduction lays forth the context and study issue. We only looked at fully-written English-language articles published in peer-reviewed journals and conferences between 2008 and 2011. Research not directly addressing ontology's role in cloud computing was not considered. Only the most comprehensive version of a research was considered when several versions of the same study were discovered. Information gathered mostly from Google Scholar as well as the following electronic scientific databases: ISI Web of Science, ScienceDirect, Current Contents, IEEE Xplore, and SpringerLink. We choose these databases since they have all the top Cloud Computing and ontology engineering articles and

conference papers. To discover papers that were relevant, the following search keyword was used: Cloud Computing AND ontology. Titles, abstracts, and keywords were used to filter irrelevant research, while full text reading was used to gather main articles. November 2011 was the month in which 463 publications were found via the search procedure. Once the publications list was narrowed down using titles, abstracts, and keywords, we examined the remaining papers in their entirety to make sure they were relevant to our study topic. The final tally for primary studies was 24. In order to do the data extraction and synthesis, we read each of the 24 papers in their entirety and copied pertinent information into Excel spreadsheets.

III. OVERVIEW DATA CONCERNING SELECTED STUDIES

Here we detail where the chosen papers were published and how often they were cited. Journal articles, book chapters, and conference proceedings comprised the bulk of these research' published works. The number of studies from each source type and their distribution are shown in Table I. Given the novelty of the paradigm shift to Cloud Computing, the expected distribution is consistent with the results. Google Scholar was used to

TABLE I. DISTRIBUTION PER PUBLICATION SOURCE TYPES

Source	Count
Conference proceedings	13
Book chapters	5
Journals	5
Workshops	1
Total	24

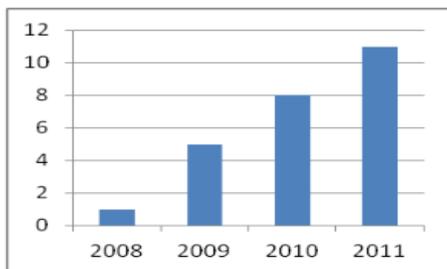


Figure 1. Number of studies by year of publication.

TABLE II. ACTIVE RESEARCH COMMUNITIES

Institution	Number of studies
Gwangju Institute of Science and Technology, South Korea	3
Wuhan Univ. of Technol., China	2
Victoria Univ. of Wellington, New Zealand	2

get the citation rates of the papers that were included. Many studies have very few citations, with the majority having less than ten. Since all the research that were originally chosen were published

between 2008 and 2011, and 75% of the papers that were added were published in the previous two years, this result is expected. Based on the data provided by Google Scholar, the papers that were chosen for this analysis had the highest number of citations [6] with 191 and [7] with 38. Figure 1 shows that there has been a rising trend in the number of relevant articles regarding Cloud Computing ontology when looking at the year of publication of the papers. To find research groups actively working on Cloud Computing ontologies, we additionally searched for authors' affiliation data in the chosen articles (Table II.).

IV. RESULTS

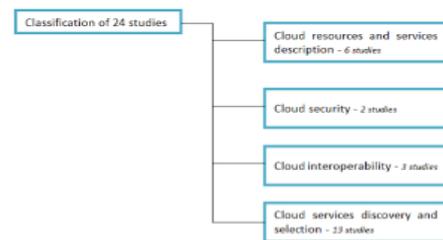


Figure 2. Classification of included studies.

Similarities in the primary emphasis and use of Cloud Computing ontologies guided our evaluation of the chosen research. Description of cloud resources and services, security in the cloud, interoperability in the cloud, and discovery and selection of cloud services were the four major groups we found. Figure 2 shows the distribution of these categories among research and also provides an illustration of them. The recognized groups parts that follow will provide further detail. Section A: Overview of Cloud-Based Services and Resources Research in this area describes existing Cloud resources and services, organizes existing Cloud services and pricing models, or defines new Cloud service types using Cloud ontologies. In [6], one of the first efforts was made to create a comprehensive Cloud ontology. An ontology that breaks down the Cloud into its five primary components—applications, software environments, software infrastructure, software kernel, and hardware—was presented in that study. Cloud services that have the same level of abstraction are considered to be part of the same layer, and each layer has one or more such services. In addition to outlining the benefits and drawbacks of each layer, the ontology writers in [6] addressed how each one relies on earlier ideas in computing. A Cloud business ontology model was suggested by Weinhardt et al.[7] to categorize existing Cloud services and pricing methods. Infrastructure, platform, and application as a service make up their ontology. Users and producers of cloud services may use it to create a map of current cloud services and establish pricing systems. Bohm et al. [8] proposed many Cloud Computing definitions, outlined its key players and value network in a methodical way, and provided several Cloud

Computing payment methods. They went over the models, terminologies, and ontologies that were already out there. Ontology as a service was first mentioned in the paper by [9]. With ontology as a service (OaaS), customers may have the source ontology customized to their needs by using the application and infrastructure provided by cloud suppliers. Ontology extraction and sub-ontology merging were described in detail by the study's authors in [9].

V. DISCUSSIONS

While there is a great deal of diversity in the language, context, and methods used in research articles on Cloud Computing ontologies, there is also a great deal of agreement on the topics covered, objectives, and applications. Similarities in the primary emphasis and use of Cloud Computing ontologies guided our evaluation of the chosen research. We classified them into four groups: describing cloud resources and services, security in the cloud, interoperability in the cloud, and finding and selecting cloud services. Using a research protocol to outline the study topic, inclusion and exclusion criteria, and search technique helped mitigate the greatest danger to the validity of the research—bias in the studies that were chosen to be included. The first author was responsible for creating the review process, which was then evaluated by the other two writers. We found that 80 percent of the relevant research dealt with user demands and the definition of Cloud resources and services when using Cloud Computing ontologies to find and choose the best service option. You may find a summary of the research on Cloud Computing ontologies and a foundation for finding ways to enhance both research and practice in the selected categories of topics. Table III details the primary findings, restrictions, and difficulties associated with these categories in the current body of research.

VI. CONCLUSION

The term "cloud computing" refers to a relatively new approach of providing various forms of IT infrastructure, platforms, and applications on demand. In this study, we provide a systematic review that aims to get a comprehensive understanding of Cloud Computing ontologies, their usage, and their focal points. By following the steps outlined in the systematic review protocol in [5], we were able to locate 24 original research. Cloud computing ontologies discussed in academic literature mostly pertain to the following topics and use cases: describing cloud resources and services, cloud security, cloud interoperability, and finding and selecting cloud services. The first group of research classifies existing services and pricing models in the Cloud, defines new kinds of Cloud services, or describes resources and services in the Cloud using Cloud ontologies. To better understand and implement ontologies for Cloud security, have

a look at the Cloud security category. Research into making various Cloud providers' services compatible with one another via the use of ontologies is what makes up the field of cloud interoperability. The last grouping consists of research that uses the previously established ontology to find and choose the optimal alternative Cloud service. Using ontologies to enhance the interoperability and security of Cloud Computing services is one of several problems and areas for future study that emerge from the evaluation of the chosen studies. Using an ontology-based method, researchers may overcome the fundamental difficulties of the Cloud Computing paradigm, which include provider lock-in and security/privacy problems. In light of the shortcomings of the present solutions, practitioners might use our work to locate existing methods or create new applications.

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