Current Journal of Applied Science and Technology

39(34): 82-97, 2020; Article no.CJAST.62378
ISSN: 2457-1024
(Past name: British Journal of Applied Science & Technology, Past ISSN: 2231-0843, NLM ID: 101664541)

Unified Ontology Implementation of Cloud Computing for Distributed Systems

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Authors' contributions

This work was carried out in collaboration among all authors. Author ZSA prepared the detailed review of previous works related to cloud computing and distributed systems and wrote the first draft of the manuscript. Authors RKI and MAMS managed the analyses and discussion parts of the study. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/CJAST/2020/v39i3431039
Editor(s):
(1) Prof. Samir Kumar Bandyopadhyay, University of Calcutta, India.
Reviewers:
(1) Sirisha Potluri, ICFAI Foundation for Higher Education, India.
(2) M. Muthu, Indian Institute of Technology Madras, India.
Complete Peer review History: http://www.sdiarticle4.com/review-history/62378

Review Article

Received 10 August 2020
Accepted 15 October 2020
Published 11 November 2020

ABSTRACT

The ability to provide massive data storage, applications, platforms plus many other services leads to make the number of clouds services providers been increased. Providing different types of services and resources by various providers implies to get a high level of complexity. This complexity leads to face many challenges related to security, reliability, discovery, service selection, and interoperability. In this review, we focus on the use of many technologies and methods for utilizing the semantic web and ontology in cloud computing and distributed system as a solution for these challenges. Cloud computing does not have an own search engine to satisfy the needs of the providers of the cloud service. Using ontology enhances the cloud computing self-motivated via an intelligent framework of SaaS and consolidating the security by providing resources access control. The use RDF and OWL semantic technologies in the modeling of a multi-agent system are very effective in increases coordination the interoperability. One of the most efficient proposed frameworks is building cloud computing marketplace that collects the consumer's requirements of cloud services provider and managing these needs and resources to provide quick and reliable services.

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Keywords: Computing; ontology; cloud providers; cloud services; distributed systems.

1. INTRODUCTION

The cloud computing based on use of technology of computer and development too, whereby dynamically many things as a service are virtualized scalable and provided resources over the Internet [1,2]. Cloud computing will move all the data and programs to the cloud including the info provided by the third part plus computing such as storage and computation [3–5]. The services will be published by the providers over the internet and access to all these services by the application layer of cloud through the portal of the web [6]. It can be defined as converting data besides procedures, where computation is done also how it is done, it is a transforming information technology and investigated in many fields [7,8]. It is also gradually changed the working environment of IT professional and cracks various troubles for conservative calculation containing treatment highest works, fixing bring up-to-date of software besides by means of extra calculating series [9,10]. The procedure of searching different kinds of clouds till now has no mechanism for discovery. The consumers of clouds generally have to search for the exact services of cloud manually [11,12].

The term "Ontology" comes from Greek, it was used for the first time by the German theologian and philosopher Johannes Clauberg. The first part "On" means "to be" and "ta" means "being" [13]. It refers to the knowledge which consists of a set of concepts in a certain domain, these concepts are related to each other via a set of relationships. The most important use of ontology is to design and define the structure of the information and knowledge representation of a domain [14,15]. Additionally, ontology is also used in the modeling design for different requirements of many information systems aspects. The modeling process of the requirements is planned and executed based on the adopting the cloud computing environment as a solution environment [16,17]. In fact, the most effective property of ontology is the ability to represent an explicit knowledge for a conceptual domain through the logical realities expressed by a semantic web language such as OWL [18]. As well as many researchers focuses on the designing of models for machine behavior by converting the working scenarios to behavioral model. The state of all machines can be expressed by a set of messages [19].

The cloud ontology invested and discovered by the cloud service to help the cloud users to search for their appropriate services because of generic web browsers such as Google and Yahoo may provide irrelevant web-pages [20]. Soon, the solution could be found to matches needs by designing a semantically based web browser for all organizations deals with cloud computing that receives our request and retrieve the exact need without providing all websites that contain the entered need keywords [21].

The Cisco Inter-cloud architecture consists of the following layers, which shown in Fig. 1:

- Cloud platform and underlying infrastructure
- Cloud services and value-added products
- Application enablement platform as a service
- Cloud OSS
- Cloud BSS
- Marketplace

Each layer has dependencies and services available to the layer below and above it. This chapter will explore these layers and describe the Inter-cloud abstraction and interfaces [22].

Depending on the previous introduction, the main objective of this research is oriented towards focusing on effects of Ontology on cloud computation processing. Reviewing the use of ontology in different proposed cloud computing systems will be shown in this paper. The rule of the ontology in cloud computing is very effective in converting the user problems into requirements ontology to be processed in the semantic web. In addition, the cloud computing is lacked to provide a semantic environment and this problem can be solved by using the ontology in cloud computing demand representations.

2. THE UTILIZATION OF ONTOLOGY IN CLOUD COMPUTING

Recently, the cloud computing can defined as the new way of computing which is widely scalable to provide a different service, resources, and data storing. Unfortunately, with all of these advantages, cloud computing has a lack in providing reliable services for many applications. Many methods and techniques are used to solve these lacked sides of cloud computing.

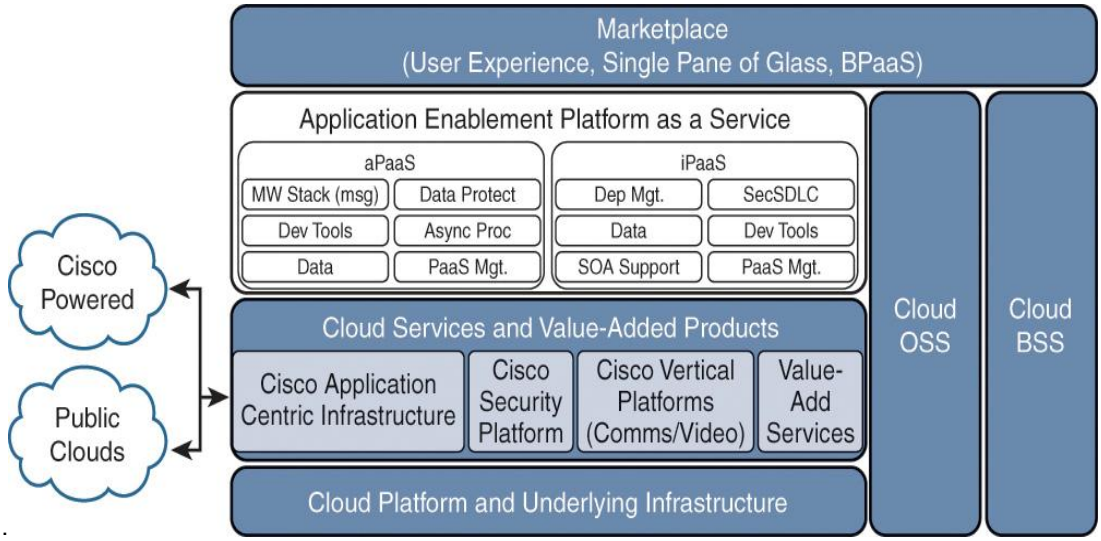

Fig. 1. Cisco Inter-cloud architecture [22]

2.1 Representation of Requirements in Cloud Computing Using Ontology

Richard Greenwell et al. [2] thinks that the requirements of the cloud users can be expressed as a semantic intelligent demand. These demands can be addressed and delivered as a cloud service based on a predefined and developed cloud-based ontology.

This mechanism is executed by designing a structured framework based on ontologies, the function of this framework is creating a model for all concepts within the domain as well as expressing the relationships among these concepts. The use of ontology in this framework is described as the solver of requirements' problem. The framework includes partitioning the user requirements ontology to a set of knowledge parts that describe the nature of each requirement to be processed by the ontology modeling tools.

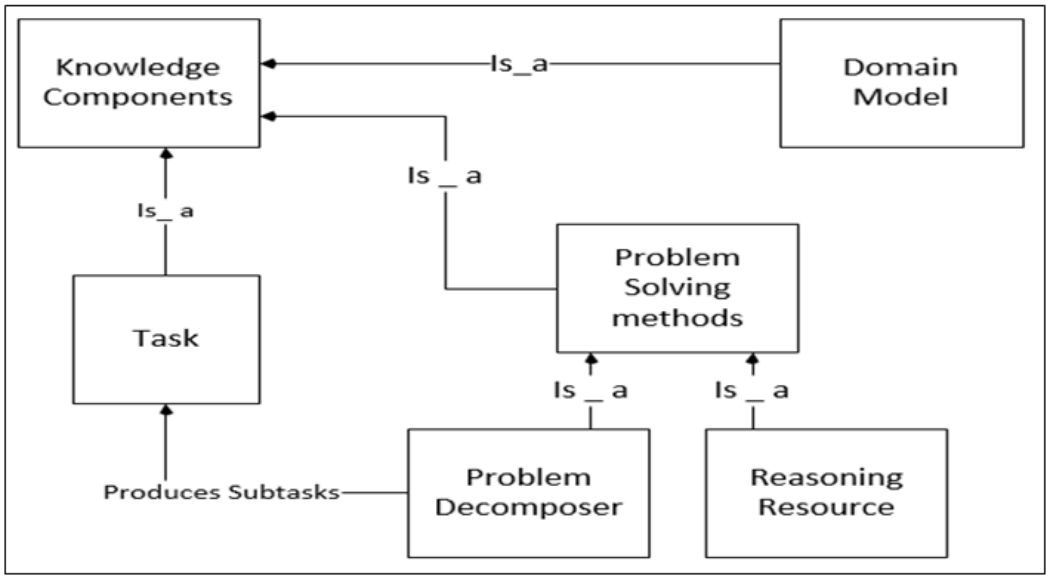

Fig. 2(a). Requirements of ontology implementation [16]

Therefore, the ontology components will receive the same characteristics of knowledge component. Problem-solving methods (PSMs) and domain models could be used by the requirements engineers to create an effective inheritance and set operations. Fig. 2(a) shows the mechanism of requirements modeling, the cloud user requirements are provided with a checklist of its needs presented by the ontology as well as representing the requirements elements. All requirements are represented as a semantic form while rich semantic is used to represent the concepts, these capabilities of representation enable the requirements' engineers to implement fuzzy searches and to produce some new knowledge through the use of ontology management tools.

The structure of ontology consists of many layers as shown below in Fig. 2(b), each layer performs a certain task. The upper layer treats with problem-solving for cloud user tasks. The next layer is brokerage layer, it is responsible for representing elements as ontology, many tasks related to cost and QoS are implemented in this layer. The lower layer is assigned for some operational requirements such as UPML ontology, pricing, description of resources, and cloud interface adapters and bridges.

The requirements in the problem-solving layer are related to the user requirements domain or process. The brokerage fragments receive the upper layer's processed requirements; therefore, the requirements ontology focuses on brokerage and lower layers aspects. Discovery is supposed to be an example for the brokerage fragment; it looks for resources for the upper layer requirements. The function of the discovery consists of two sub-functions, the first is looking for the model of cloud resources in order to build a list of resources, the second subfunction is querying string in the list to find the appropriate resource [16].

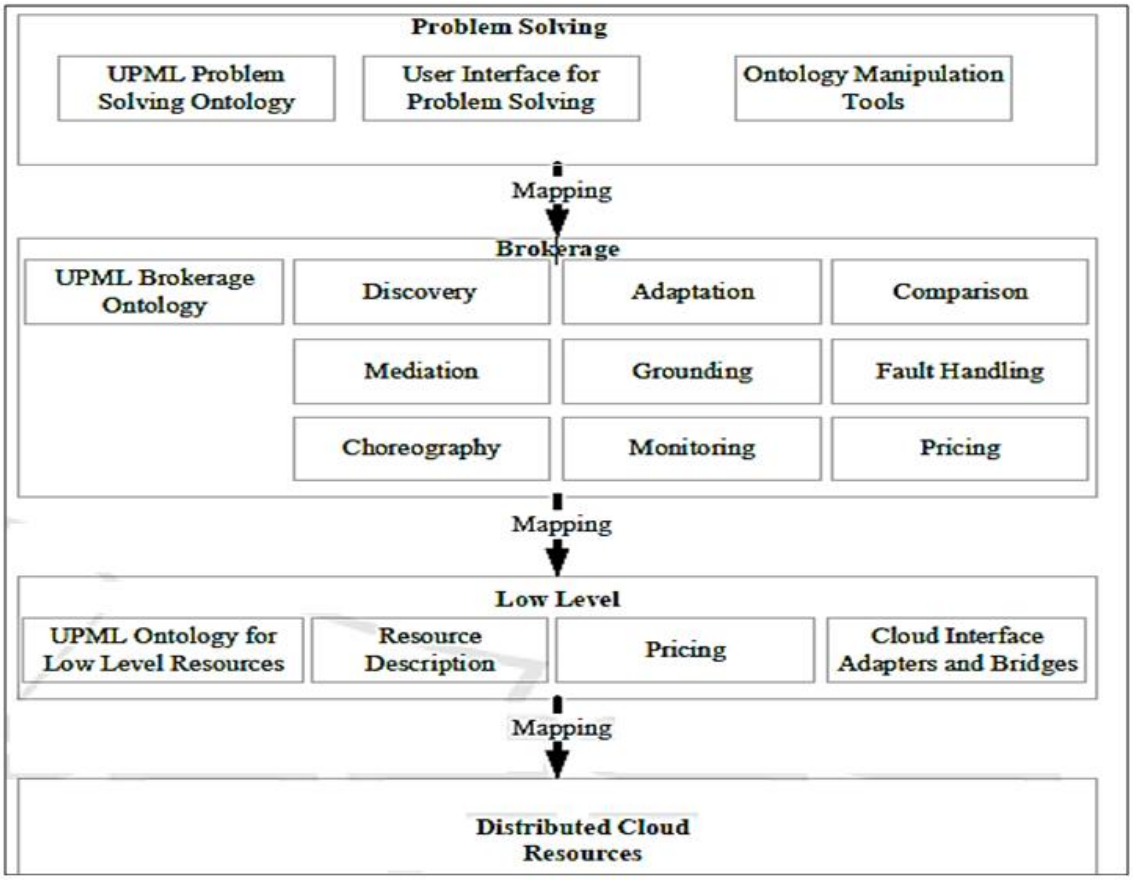

Fig. 2(b). The Architecture of ontology's layers [16]

2.2 Ontology on Cloud Computing

The use of the ontology in cloud computing helps to perform a cloud dissection to address the relationship and dependency in previous computing technologies in order to be able for creating an effective model based on a wide comprehension of the technology [23]. Automating the environment is a task performed by the ontology to enable software agents to find and use the services. The cloud instances should be able to listen to each other to prepare its ready state. This state enables to accept interoperability transformation. The transportation and using of semantic web techniques is possible by using XMPP as inter cloud protocol [24]. The first components of Inter-cloud topology are the Inter-cloud root, the function of this component is similar to that of DNS, and it consists of many services like naming and trusting of Authority plus many other services. The second component is an intercloud gateway that presents the function of supporting the entire profile for internet protocols. The third component is Intercloud exchange which provides a cooperation among clouds to begin the negotiation process. The last component is resource catalog, it is responsible for providing a summary view of all computing resources within different cloud platforms [25]. The providers of software in cloud publish the software online to be used by multiple clouds users, this can be achieved by utilizing a software delivery model constructed by SaaS with multi-tenancy architecture (MTA) [26]. This architecture consists of four layers:

- Data layer: Defining different types of data ontology system cause heterogeneity, this can be solved by developing an ontology integration. This can be done by creating a high level of comprehensive ontology depending on the current ontology system. As the ontology could be represented as a tree, then the value "1" will be given to all keywords that have the same meaning. In order to produce a knowledge, the conceptual homogeneity is calculated.
- Service layer: The service could be simple service which performs many fundamentals operations or could be composite service that is a number of simple services, performing the complicated operations. Each service refers to ability under some circumstances and all the complex task is executed by the ontology.
- Business process layer: In this layer, the complicated business task and workflows are executed by organizing the services and participants. The cloud user could search a workflow warehouse by entering the keywords and getting their interest.
- User interface layer (UI): A UI ontology helps to create concepts, relationships, and searching for UI elements. The ontology should have the information about the collecting, presenting, monitoring of data.
- Cross-layer relationship: This relationship is present firstly between the data layer and service layer, secondly between UI layer and the rest three layers, and finally between service layer and workflow layer. There are three kinds of relationships in this multi-layered model. The first is Feeding data between service and data layer, the second is compositing and the third is interaction [27].

2.3 Distributed Multi-Agent System Based on Ontology

Khaoula ADDAKIRI et al. [28] believed that a Multi-Agent Systems (MAS) have a disadvantage related to the lacks to establish a reliable interconnection with semantic web standards. However, MAS is considered to be a powerful technology due to its various advantages in complicated and distributed environments. In order to consolidate the cooperation and interoperability among the components of MAS, a new method is suggested that use the semantic web technology (RDF and OWL).

Belief Desire Intention (BDI) is an example of intelligent systems that are supported by developing the architectures of many agents. The aim is to study the exterior agents and communication between other agents and with the environments. Such model is necessary to overcome the needs of knowledge management. Each organization that applies this kind of models, there are many activities appears such as receiving and sending e-mails and opening saved documents or creating a new one. In knowledge model, the agents are saved by using OWL that utilizes three software to maintain the agents' data [19]. The first software is Java Expert System Shell defined as (JESS), it is an engine with efficient tools prepared by java language that enables to develop an effective system with intelligent capabilities which leads to building a knowledge as facts and rules. The

second software is JENA which is an open source Semantic Web framework for Java, it presents an Application Programming Interface (API) that uses RDF and OWL to create some applications for semantic web as well as providing the ability to read and write in RDF/XML. The third software is Protégé which is free open source editor for ontology, the function of this software is to open, store, and edit RDF and OWL ontology.

Many methodologies have been developed to enhance the performance of the Multi-Agent Systems. Most of these methodologies are based on the three basic concepts, they are the software development of object-oriented, engineering knowledge, and knowledge based systems development and specifications of software. One of the most important applications of that methodology is MAS-Common KADs which utilizes the object-oriented tools. This methodology deals with agent systems by using Meta concepts such as the agent model, the task model, the organization model, the expertise model, the coordination model, and model of communication. To perform the process of knowledge modeling, the model of agent will be so important, task model and organization model for creating the application [29]. The proposed system's design depends on three basic UML diagram as in the programming of object-oriented, they are: the diagram of use case, the diagram of sequence, and diagram of class as shown in Fig. 3(a), 3(b) and 3(c).

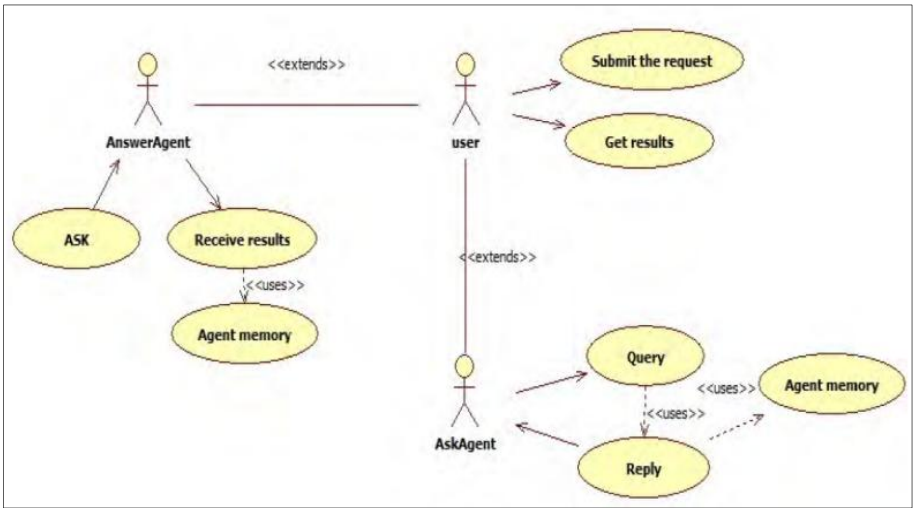

Fig. 3(a). Agents use case diagram [28]

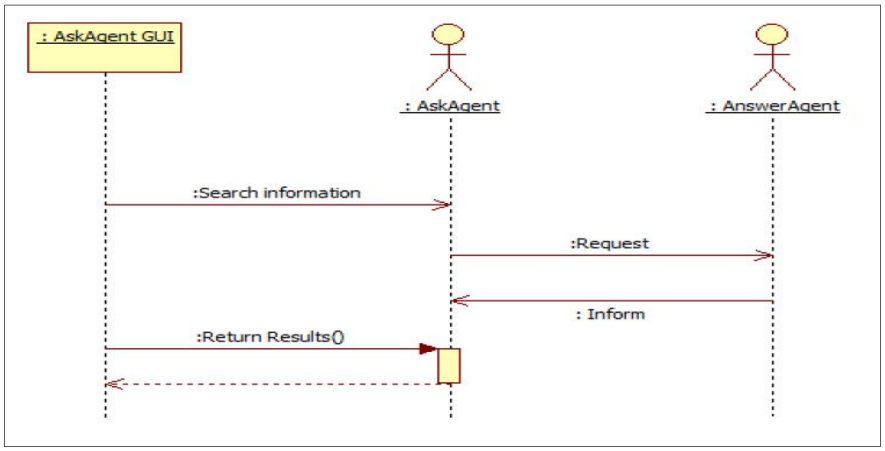

Fig. 3(b). Agent sequence diagram [28]

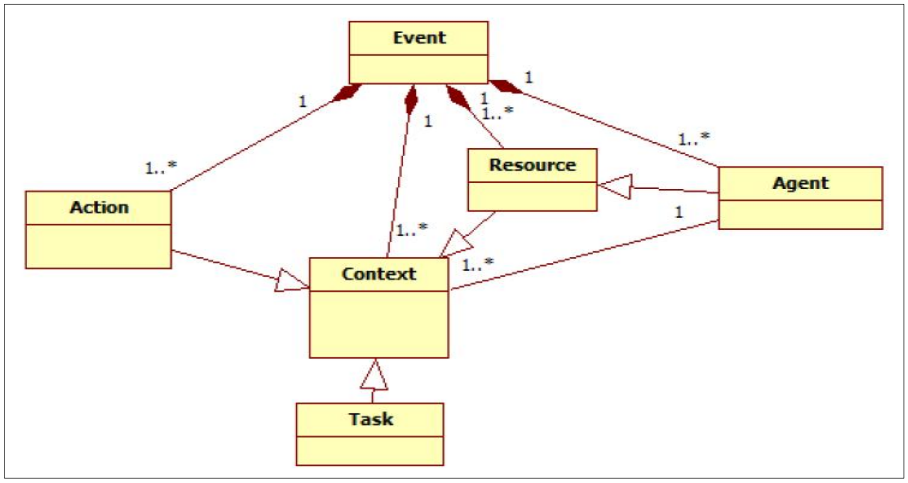

Fig. 3(c). Agent class diagram [28]

3. LITERATURE REVIEW

In 2017, Parhi et al. [29] discussed the art of approaches which concerned with the services of the cloud discovery and selection also their limitation is highlighted. Then, the structure of the proposed frame work was presents followed by the algorithm of semantic matchmaking. In this work the services of cloud are selected and discovered in which the service of functional and nonfunctional was described by the ontology semantically. The system here is developed using JADE and Apache Jena API. Beside that developing a perfect service of semantic technique which considers the preferences of customer for computing similarity relating grade headed for significance of both clouding service's metaphors. Identically contrivance goals aim at determining then choosing the appropriate benefactor of any server trendy plentiful advanced achievement aptitude though preserving lower reply period.

In 2017, Hasan and Kumari [21] presented a cloud marketplace a generic distrusted framework to confirm the following: Discover the service's cloud automation, removing barriers between consumers and the providers, and process's selecting. Plus that, adopting two different algorithms applied of matching by implementing two generic framework's instances. The algorithms are: Recursive and dominant attribute. These algorithms based on ontology of unified cloud service. The unified cloud services presented in this work plus cloud service's real life depending on the proposed work on ontology. This work build a marketplace of cloud service whereas utilities of the consumers and providers can trends the services of cloud. There result reduced the time of executions.

In 2017, Simona et al. [31] proposed ontology by mapping from the recommendations the knowledge needed. According to the overlapping of ontology, the granularity has been chosen and selected for this process. The ontology's similarities and integrity was very simple to be identified and detect. By inferior stage of subparts which attached throughout this procedure, as a header current model serves for cloud security standardization ontology. There are three classes which the material consumes remained prearranged towards suitable for these classes. The modules are: supremacy, computer-generated besides action. The first class then the third class lean towards to cover the IT domain and have generic approach. These classes are actually similarly for computing of cloud. The foundation of current ontology grounded of Safety of Cloud Association Safekeeping Direction aimed at Perilous Zones Emphasis hip calculating of cloud. Many requirements from different view of the proposed ontology this analysis is enable it.

In 2018, Arena et al. [32] presented the results towards the development of a tool of the evaluation of data training by paving the way of an extension, that associates what named Preparation Assessment collection for many Ontology-kinds by model of Preparation analyzed on behalf of trainee's expertise level assessment. To compute all employees' presentation plus aggregate the data, SPARQL queries are used.

After that, enhancing the proposed framework SWRL with capabilities of wealthier implication depended for assuming apprentice's know-how stage task, finally, coherent was depended toward categorization. Ultimately, outcomes gotten through current effort must be protracted for employee expertise – already available on the SFO –to analyze association working out actions then presentation outcomes for dexterity obligatory through company.

In 2018, Castañé et al. [33] an architecture was proposed on behalf of subsidiary energetic combination routes for physical fast-tracks for resources of clouding material, plus management of ontology which grounded on resources. This construction obtainable for scheme of Cloud Lightning for demonstration in what way Ontology of cloud lightning which applied for management of autonomous resource. Current task named through primary phase growth also this work depended originally for demonstration semantic efficiency for Ontology grounded supply organization of the process of judgment creation.

In 2018, Verginadis et al. [24] discussed the design of scheme of Metadata which enables the awareness of computing of multi-cloud. The main objective was to aid the management of data, the control access, and the application of info-conscious location to spread with insecurely joined applications of multiple cloud. Through presenting vocabulary then vocabulary features of meaning descriptions resolve addressed by these objective which mostly depended with spreading applicable area precise dialectal. The recognizing of Cloud computing by way of greatest projecting holding means besides transporting amenities ended Internet. Overabundance cloud facility contributions presently accessible besides existence accepted through SMEs, nonetheless similarly via bigger organizations proceeding-grounded several dominances for models of outdated calculating. Conversely, and because of processing this big data, the requirements of computing of the contemporary cloud submission consumes remained rapidly enlarged.

In 2019, Al-Sayed et al. [34] extracting the common properties by analyzing the existing cloud ontologies. Then during the constructions there was some rules been considered of the ontologies of cloud or assessment contingent. After applying all this steps, they found and suggesting five rules to evaluate the ontologies of cloud. The ontology build to enhance the retrieving services that match the demands of customer was unique foremost structure chunks for facility detection procedure. Their job well-thought-out as important phase aimed at emerging official agenda towards auto-assessing the clouding-ontology.

In 2019, Maroc and Zhang [35] proposed an ontology which by it can assess the services security posture for cloud facilities safety-based evaluation towards sustenance cloud investors for both enhancement besides selecting service. The proposed ontology area conceptions consumes stood constructed grounded on manufacturing morals then finest performs, in addition its considering the external factors, the context, considerations, setting, actions and consequences. Comparing to the availabilities security ontologies assessment for the cloud facilities, seems extra inclusive for conceptions and possessions. The development of the ontology is never fully complete since it repetitive besides continuous procedure.

In 2019, Djemaa et al. [36] proposed a semantic priority measure depending on the syntactic and semantic similarity and present an approach of the service of cloud ranking and matching based on the ontology of WordNet and TF-IDF tenure allowance near overawed semantics' nonexistence communication amongst positions of this model. The measure of similarity presented built for LDA prototypical for recognizing the categories of cloud facility automatically arranged towards Web. For enhancing performance of the planned work, they presented likeness ration of semantic priority grounded for semantic check through likeness of the topical check. Global F-check for planned crawler displays upsurge about fifty three point five percentage equated through CSSE, also twenty eight point seven percentage for Multiple processes one.

In 2019, Modi and Garg [37] to perform the service of cloud matchmaking, composition and selections to fulfil the user's requirements. The proposed used the semantics web and quality service (QoS) model. Researchers progressed cloud ontologies in the Semantic Web for providing description of semantic to the service provider and requester. They considers the parameters of QoS, such as time response, throughput, the availability also charge, related with value pledge besides improved operator gratification to automate the tasks of the cloud service. Researchers, emphases towards cloud facility lifespan sequence stages method.

Table 1. The techniques that use the ontology in cloud computing

Author(s)	Problem	Technique	Procedure	Machine Properties and tools	Result
Parhi et al. [29]	Parameter like time slot and price as a QoS parameters slot of cloud.	The contents of the framework is archive named Semantic Cloud facility Source providers of facility.	Proposing a cloud ontology which describes the services of functional and non-functional parameters by a multi agent based on framework for cloud services. Applying similarity model of Tversky.	The framework of Java Agent Development JADE plus Apache Jena API was been used. the contents of Jena framework such as RDF API support the SPARQL query language The type of processor: Intel Core i3 2.00 GHz with 4.0 GB RAM, The type of framework which used was built using Java Agent Development Framework, MySQL, ProtegeOWL API and Jena API in Eclipse IDE.	The result of the proposed approach and after performing several rounds of experiments using JADE shoed that the Response Time perform better and the measures of accuracy like F measure, Precision and Recall give better results. The proposed multi-agent framework has been analyzed and compared with the existing approaches11111.
Hasan and Kumari [21]	Lacking of classic engine and barriers between the providers of service and consumers.	Providing the service of cloud based on ontology by building a marketplace adding	Apply matching process between the score of operator demand with cloud facility. Finding regular entire percentage expanse likeness.	The parameters used are: Vcpu=4 Ram=10GB Storage=75GB Obtainability =Nnty	Execution time reduced with a rate Twenty percentage.

Author(s)	Problem	Technique	Procedure	Machine Properties and tools	Result
		to executing 2plaforms.	Judgement prepared grounded on 4 strictures: identical facilities, performance period, middling tally, recall with precision.	nine percentage Charge = Thirty Dollars for each 30 days, Position = India Operating.	
Simona et al. [31]	The Virtualization issues of cloud-specific	Providing a semantic cloud depending on the ontology which composed, the knowledge related to the new cloud depended with security to be orientation prototypical investigation.	Enables dynamic changes through depending o orientation ontologies prototypes giving to condition. Hence, permitting the extreme certainty security valuation.	Depending ontologies for EA orientation prototypes. And using OWL semantic distinct great flat operational description despite W3C endorsement identifying RDF/XML for normal composition	Observing the semantic inconsistency matters for ontology conversions.
Arena et al. [32]	Training Analytics Model.	Factual manufacturing information presentation of viability with heftiness suggested explanation.	Awarding besides increasing TDET.	Association permitting skills of Web Facts, like widespread – open – ideals fixed depressed via W3C, SFO industrialized agenda for EU.	The results obtained cover approach near placement for TEO, TAM.
Castañé et al. [33]	The enhancement cooperating working subjects trendy intercloud and multicloud surroundings then	A Service Oriented Architecture (SOA) architecture. Creating the CL-Ontology	The Selection of Resource module practices set of conceivable applications then checks CL_Ontology near hypothesis semantic- established supply plan, manipulating semantic.	The URDs stowage comprises explanation altogether possessions for substructure portion,	Generating dominant awareness storehouse that communal sympathetic material be joint then enhanced.

Author(s)	Problem	Technique	Procedure	Machine Properties and tools	Result
	equivalents occur amongst exertions.			SOSM system, CL-Plug and Play, A Telemetry.	
Verginad et al. [24]	skirmish toward opportunely achievement overabundance for cloud facility	The Diagram involves Presentation Location, Large Data besides CAS prototypes	Usefulness purpose might contain 4 separate portions (for example: positioning/reconfiguration cost vs. RAM usage vs. consignment dispensation amount vs. reply period	The CAMEL language with model-driven engineering (MDE), CPU logical processors are from eight to thirty two, RAM from four to eight GB.	Information about data description Diagram introduced about info-conscious multiple cloud computing. The diagram encompasses Submission Assignment.
Al-Sayed et al. [34]	The difficulties toward assess cloud ontologies for illustrative/non-illustrative of recitation structures of cloud facilities.	SOCCA consumes stayed planned towards accomplish multiple clouds besides near permit application execution in excess of different clouds.	consider following suggested evaluation rules: S.FFs ⇔ RT.NFFs O.FFs ⇔ DT.NFFs R ∝ O A ∝ 1/O S.R ∝ 1/O	Plane classification may be appropriate, while utmost mutual groupings placed primary.	Developing cloud ontology which with any luck resolve reflecting proposed instructions
Maroc and Zhang [35]	The susceptibilities security problem present in system besides recognized intimidations	CSCASEOnto Service Model and Deployment Model	Essential ideas assembled into 5 universal groups, specifically: context, assumptions, external factors, activities, and outcomes	CCM prearranged through sixteen regulator provinces, then additional separated into sub-provinces: KAC Policy, CBFR, CHM, and MAP.	Increased confidence in assurance level of assessment outcomes withConceivable assessment procedure mechanization.
Djemaa et al. [36]	The absence of semantic	Based on WordNet ontology and TF-IDF	The model of LDA subject depended like technique for investigating huge	MS-Win seven by Java seven JRE in	The technique recovers presentation of crawlers

Author(s)	Problem	Technique	Procedure	Machine Properties and tools	Result
	communication amongst relations of TF-IDF prototypical	Proposed a semantic priority measure adding to CSOnt for representing keywords.	groups of manuscript booklets.	EKSR version two. Also, CSOnto created consuming Protégé 4.3, microcomputer with 6.00 GB of Random Access Memory.	with outdoes CSSE and the Multiple-threaded crawler. F-Measure for anticipated crawler demonstrates growth more than fifty three percentage and more than twenty eight percentage.
Modi and Garg [37]	perform matchmaking of cloud facility, collection with configuration, near achieve final operator requests	Cloud-based healthcare decision-making system	Model separated to 3 chief portions: user, cloud broker and infrastructure	CloudSim-Java-based device aimed at pretending significant cloud calculating substructures for solitary host was used	Availability: reachable facilities. Response time: period mandatory for achieve the procedure. Throughput: Aimed at facility operators.

4. DISCUSSION

In this review many works was compared, below a discussion of each work. Two instances of generic framework were implemented by Samer and Valli [21]. There a contribution in their work which was collecting the advertisements of cloud service from the website provider after that modeling them according to the unified of ontology.

The system was developed using JADE and Apache Jena API [30]. Beside that developing a perfect service of semantic technique which considers the preferences of customer for computing similarity relating grade headed for significance of both clouding service's metaphors. Identically contrivance goals aim at determining then choosing the appropriate benefactor of any server trendy plentiful advanced achievement aptitude though preserving lower reply period. At many stage the request was processed by the agents of the framework according to their pre-defined role until the most appropriate service is recommended to the user based on the user-specified functional as well as non-functional requirements. The new approach performs better in: response time and accuracy measures such as Precision, Recall and F-Measure. [21] Considered a first try for building a marketplace of cloud service and can used as utilities between providers and consumers. Two instances implemented here, the first one depend on the dominant and recessive attribute approach while the other based on similarity approach of the ontological semantic.

Depending on the following parameters a comparisons between both approaches is done: no. of matching services, time of execution, average score, and recall. The time of execution minimized by 20% plus maintained the same value for all other parameters as SimQ [31]. There goals was to aim covering all of the areas of security by proposed an ontology based on systematic analysis and mapping of the relevant documentation of cloud computing security. They proposed ontology by mapping from the recommendations the knowledge needed. According to the overlapping of ontology, the granularity has been chosen and selected for this process [32]. They presented the results towards the development of a tool of the evaluation of data training by paving the way of an extension, that associates what named Preparation Assessment collection for many Ontology-kinds by model of Preparation analyzed on behalf of trainee's expertise level assessment. Ultimately, outcomes gotten through current effort must be protracted for employee expertise – already available on the SFO –to analyze association working out actions then presentation outcomes for dexterity obligatory through company. Integration tests of the technologies which used have been carried out using real industrial data showing the feasibility and robustness of the proposed solution [33]. An architecture was proposed on behalf of subsidiary energetic combination routes for physical fast-tracks for resources of clouding material, plus management of ontology which grounded on resources. This work described the attempts to exploit many parallels, depended originally for demonstration semantic efficiency for Ontology grounded supply organization of the process of judgment creation. The internal architecture of the Cloud Lightning system is redesigned and presented to show the feasibility of incorporating a semantic engine to alleviate interoperability issues to facilitate the incorporation of HPC in Cloud.

The Metadata Schema's details introduced for data-aware multi-cloud computing depending on which components will the software dedicated be able to interpret requirements [24], It corresponds to a vocabulary, constraints and offerings' characteristics in order to properly manage big data, the placement of their processing jobs was optimized and control all accessing requests in multi-cloud environments. The main objective was to aid the management of data, the control access, and the application of info-conscious location to spread with insecurely joined applications of multiple cloud. Through presenting vocabulary then vocabulary features of meaning descriptions resolve addressed by these objective which mostly depended with spreading applicable area precise dialectal [34]. They have noticed that there is not a framework or a benchmark to evaluate the cloud ontologies. A set of observations was analyzed and identified that represent their strengths and weaknesses. The ontology build to enhance the retrieving services that match the demands of customer was unique foremost structure chunks for facility detection procedure. Their job well-thought-out as important phase aimed at emerging official agenda towards auto-assessing the clouding-ontology. The result of this work can be the main and basic step developing a formal framework to automatically evaluate cloud ontologies.

While [35] proposed an ontology which by it can assess the services security posture for cloud facilities safety-based evaluation towards sustenance cloud investors for both enhancement besides selecting service. The development of the ontology is never fully complete since it repetitive besides continuous procedure [36]. The measure of similarity presented built for LDA prototypical for recognizing the categories of cloud facility automatically arranged towards Web. For enhancing performance of the planned work, they presented likeness ration of semantic priority grounded for semantic check through likeness of the topical check. Global F-check for planned crawler displays upsurge about fifty three point five percentage equated through CSSE, also twenty eight point seven percentage for Multiple processes one [37]. The proposed used the semantics web and quality service (QoS) model just to perform the service of cloud matchmaking, composition and selections to fulfil the user's requirements. And QoS such as: time response, cost plus throughput as part of the SLA. A framework presented to show the relationship among these tasks. They conclude that the matchmaking of cloud service, selection and composition with the use of nonfunctional characteristics could perform very well and in addition that the end user plays an important role in the development of an efficient composition solution by cloud service providers.

5. RECOMMENDATION

This paper has been built to focus on getting well knowledge about Ontology implementation of cloud computing for distributed systems, and explaining the main requirements of performing best ontology. Adding to that, considering the main targets of speeding up the computation process, well ascertaining achievement, beside more reliable outcomes. Hence, we recommend to depend these requirements that could be considered as the bases on building semantic ontology for distributed systems taking in account principles of cloud computing.

6. CONCLUSION

The quintessence of using ontology in cloud computing consists of reduced time, quick discovery action, and arriving at accurate results. Regarding the review we have performed of the literature above, we found that Parhi et al. put forward that the analysis and comparison of multi-agent framework was performed with already existing approaches by means of utilizing several experimental rounds of JADE. The experiments all together demonstrate that the approaches that are proposed are significantly better regarding measures of time and accuracy such as F-measure, recall, precision. Al-Sayed et al. With their ontologies of cloud being analyzed to have their common properties extracted because it is so difficult to assess representative ontologies or non-representative for the purpose of describing features of service without a set of conditions of agreed evaluation that is predefined. It is worth mentioning that these rules have been confirmed to see if they are appropriate for evaluating cloud ontologies.

As a consequence, a five rule set evaluating cloud ontologies had been put forward and applied on the existing cloud ontologies. The essential part of the service discovery process is to establish suitable cloud ontology to enhance the process of retrieving services that match the demands of costumers. Current paper can be regarded as a good initiative for developing a framework that is formal which automatizes the evaluation of cloud ontologies. Maroc and Zhang solved the problem of security by means of proposed ontology for the evaluation of cloud security's services based on evaluation with information that can be used to provide support for cloud stakeholders in both improvement and service selection. Djemaa et al. A semantic measure of two level of similarity based on both TF-IDF and LDA models are important and efficient for focused crawlers. The advantages of the performance of the approach that is proposed by using a large number of text content demonstrates its validity in dealing with issues related to analyzing a large number of information that is available on the Web. The efficiency of the suggested approach is evaluated in relation to five metrics of performance: Retrieval Time, Recall, Fallout Rate, F-Measure, and Precision.

As a future work, we suggest to take in consideration the recommendation illustrated in this research, and build practical steps towards utilizing the abilities of Ontology and Semantic Web for enhancing the approaches of cloud computing.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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