UNIVERSITI PUTRA MALAYSIA

COLLECT AND DISSEMINATE LAYER PROTOCOL FOR SEARCHING CLOUD SERVICES

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FSKTM 2014 18

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UNIVERSITI PUTRA MALAYSIA

2014

COLLECT AND DISSEMINATE LAYER PROTOCOL FOR SEARCHING CLOUD SERVICES

By

THAMILVAANI A/P ARVAREE @ ALVAR

Thesis Submitted to the School of Graduate Studies, University Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

November 2014

Abstract of thesis presented to the Senate of University Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

COLLECT AND DISSEMINATE LAYER PROTOCOL FOR SEARCHING CLOUD SERVICES

By

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November 2014

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Cloud computing is one contemporary technology in which the research community has recently embarked. This paradigm shifts the location of the infrastructure to the network to reduce the costs associated with the management of hardware and software resources.In recent years, the number of cloud service providers is increasing.

Lack of common cloud standards or protocol delays the interoperability across service providers. Moreover, in capabilities of the search engine to match queries with exact result from service provider is the common issue among cloud users. Thus, lead the cloud customers to face challenges and problems in selecting the right service provider who meets their needs.

The objective of this research is to model an approach tha ist able to meet the user's searches for services in cloud environment whereby the search queries entered by the users can be mapped with accurate cloud services. In meeting this objective, there are two prominent activities proposed by this research. The introduction of the search protocol named Collect Desseminate Layer (CDL) to perform the query matching with high accuracy of search results. The proposed protocol evaluate by developing and implementing a search engine named Cloud Keyword Search Engine (CSSE). Experiments will be designed and conducted to ensure that the protocol meets the specification of matching the search results.

The methodology used to enable smooth execution of proposed model going through phases namely preliminary experiments, design activities involving protocol design and tool design and identification of metrics for evaluation and performance analysis experiments.

The proposed protocol design is mainly on construction of service searching layer andevaluation and performance analysis experiments for which design to prove the performance of the proposed protocol and search engine. Response time, success rate and similarity ranking are three measurement metrics to be used in this research. Dimensional consistency testing and boundary adequacy testing are two testing strategiesadopted to prove the performance of the proposed protocol and search engine.

Results obtained from the analysis of this research show the mapping of an accurate search results as per the user search query using CDL are increasing. The use of proposed protocol and search engine in service searching reduce the time taken to perform the searching. It also recorded that the success rate and similarity ranking of the search results are increased. Results for performance analysis experiments show the performance of protocol is maintained where the computation time remained at constant level even if the number of users are increased. The computation cost is also reduced. The increases of number of users using the search engine at one time is not affecting the Cloud Keyword Search Engine (CSSE) as compared to normal search engine which increases the computation time. Therefore, the proposed model and protocol has able to outperform common search engine process in common protocol in terms of response time, success rate and similarity ranking. It is able to produce a standard protocol and search engine to perform the service searching in cloud computing with high accurate search results to users.

Abstraktesis yang dikemukakankepadaSenatUniversiti Putra Malaysia
SebagaimemenuhikeperluanuntukijazahDoktorFalsafah

LAPISAN PENGUTIPAN DAN PENYEBARAN PROTOKOL UNTUK CARIAN PERKHIDMATAN PENGKOMPUTERAAN AWAN.

Oleh

THAMILVAANI A/P ARVAREE @ ALVAR

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Pengkomputeranawanadalah salah satuteknologikontemporaridi manakomuniti penyelidikandimulakan baru – baru ini . Paradigmaini memindahkanlokasiinfrastruktur ke rangkaian untukmengurangkan kos yang berkaitandengan pengurusanperkakasandan perisiansumber.Sejak tahunkebelakangan ini,bilanganpembekal perkhidmatan awansemakin meningkat.Walau bagaimanapun, pada masa ini banyak kajianmemberi tumpuan kepadaenjin carian danportalweb untukpengkomputeranawankepada pengguna yangingin mencariperkhidmatan awan.

Kekurangan standardawanbiasaatau protokol sekaligus melengahkan operasi seluruhpembekal perkhidmatan.Selain itu, dalamkeupayaanenjincarian untukpertanyaansepadandengan keputusanyang tepatdaripada pembekal perkhidmatanadalah isu yangbiasa di kalanganpenggunaawan.Justeru itu,pelangganawanmenghadapicabaran dan masalahdalam memilihpembekalperkhidmatan yang tepatdan memenuhikeperluan mereka.

Objektifkajian ini adalah untukmemodelkansatu pendekatan yangdapat memenuhicarianpenggunabagi perkhidmatandalam persekitaranawandi manapertanyaancarianyang dimasukkan olehpengguna bolehdipetakan dengan tepat.Dalam memenuhi objektif ini, terdapat duaaktivitiutamayang dicadangkan olehkajian ini.Pengenalanprotokolcarianyang dinamakanLapisanPengutipan dan Penyebaran (CDL) untuk melaksanakan pertanyaanyang hampir samadengan ketepatan yang tinggihasil carian.Protokolyang dicadangkandisahkandengan membangun dan melaksanakanenjincariandinamakanAwanKata KunciEngine Carian

(CSSE). Eksperimen direka bentukuntuk memastikanbahawa protokol yangmemenuhispesifikasiyang sepadan denganhasil carian.

Metodologi yangdigunakan untuk membolehkanpelaksanaanlancar dalam model yang dicadangkanmelalui beberapa fasa iaituujikajiawal,aktiviti reka bentukyang melibatkan reka bentukprotokol danreka bentuk alat, pembinaan perkhidmatanmencarialgoritmadan pengesahandan pengesahanujikajiyang manareka bentukuntuk membuktikanprestasiprotokolyang dicadangkan danenjin carian.Masa tindak balas, kadar kejayaan danrankingpersamaantigametrikpengukuranyang akan digunakandalam kajian ini.Ujiankonsistendimensidan ujiankecukupansempadandua strategiujianyang diguna pakaiuntuk membuktikanprestasiprotokolyang dicadangkan danenjin carian.

Keputusan yang diperolehi daripadaanalisiskajian ini menunjukkanpemetaansatukeputusan carianyang tepatsepertipertanyaancarianmenggunakanCDLsemakin meningkat.Penggunaancadanganprotokol danenjin carian dalammencariperkhidmatanmengurangkan masa yang diambiluntuk melaksanakanmencari.Ia jugamencatatkan bahawakadar kejayaandanrankingpersamaanhasil carianmeningkat. Keputusanuntuk eksperimenpengesahanmenunjukkanprestasiprotokoldikekalkandi mana masapengiraankekal padatahapyang berterusanwalaupunbilangan penggunaditingkatkan.Kospengiraanjuga dikurangkan. Kenaikanbilangan penggunamenggunakan enjin carianpada satu-satumasatidak menjejaskan prestasi AwanKata KunciEnjin Carian (CSSE) berbanding dengan enjin carianbiasa yangmeningkatkan masapengiraan. Oleh itu, model dan protokolyang dicadangkandapatmengatasi isu prosesenjin carianbiasa dalamprotokolbiasadari segi masatindak balas,kadar kejayaandan persamaankedudukan.Ia mampuuntuk menghasilkanprotokol standarddan enjin carianuntuk melaksanakan perkhidmatanmencaridalam perkomputeran awandenganhasilcariantinggi yang tepatkepada pengguna.

ACKNOWLEDGEMENT

I wish to take this opportunity to thank the many people whose collaboration made this work a success.

First, I thank God for the grace that is always sufficient and the mercies that are always new every morning, for He has seen me through many challenging situations.

Next, I wish to acknowledge the good work and guidance accorded by my Supervisor Associate Professor Dr.RodziahAtan who gave me a lot of good intellectual help and challenges at all stages of my PhD study. I also wish to acknowledge the other members of my Supervisory Committee, Dr Sa'adah Hassan and Dr.Yusmadi Yah Yusoh for their many contributions towards the shaping of my research form the ground up.

I also wish to thank my family members for their endless support. Finally, I wish to thank all my friends for the many fruitful discussions that we shared together.

I certify that a Thesis Examination Committee has met on 13 November 2014 to conduct the final examination of Thamilvaani A/P Arvaree @Alvar on her thesis entitled "Collect And Disseminate Layer Protocol For Searching Cloud Services" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the University Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

Members of the Thesis Examination Committee were as follows:

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This thesis was submitted to the Senate of University Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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Declaration by graduate student

I hereby confirm that:
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This is to confirm that:
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LIST OF ABBREVIATIONS

CDL	Collect Disseminate Layer
CSSE	Cloud Service search Engine
SaaS	Software As A Service
PaaS	Platform As A Service
IaaS	Infrastructure As A Service
SLA	Service Level Agreement
CBIR	Content Based Image Retrieval

CHAPTER 1

INTRODUCTION

1.1 Overview

Cloud computing is one contemporary technology in which the research community has recently embarked. This paradigm shifts the location of the infrastructure to the network to reduce the costs associated with the management of hardware and software resources. Developers with innovative ideas for new Internet services no longer require the large capital outlays in hardware to deploy their service or the human expense to operate it. The problem though lies in the riskiness of this new technology. In this research our main focus is to discuss the specified risks and issues concerning cloud services searches. This chapter also elaborates on the research objectives, scope, and contribution made by this thesis, followed by an outline of the remaining chapters of the thesis.

1.2 Background

Cloud computing is a paradigm for large-scale distributed computing that makes use of the existing technologies such as virtualization, service-orientation, and grid computing. It offers different ways to acquire and manage IT resources on a larger scale.

Even though, cloud computing provides numerous benefits to the users, still there are many risks involved in this technology. Users may benefit from cloud computing, in areas such as enhanced service accessibility, other technical advantages, and reduced operational costs.

Cloud computing is a particular form of outsourcing, characterized by the increase in the extent to which resource management is delegated. This is beneficial in that it enables both parties to focus on their special competencies. On the other hand, the greater opacity is when things go wrong. Cloud computing, therefore, exacerbates many of the risks arising from the outsourcing, and creates some new ones. Data owners will hesitate to adopt cloud technologies if there are risks of data to the cloud service provider or a third party. Some of the common risks associated with cloud computing are in terms of choice of contractor, terms of contract, monitoring, effective actions for problems solving and constructive relationship of different parties involved. Among the common sub category of operational risks are availability, reliability, integrity, fit and maintainability (Rellermeyer, 2009). Most of the issues raised reflect to how services are been searched.

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1.3 Problem Statement

Searching cloud services over in Internet from service provider are becoming difficult to end users due to variety of services and resources offered in the clouds. Philip (2009) in his statement has mentioned about inexistence of standards, open protocols and search mechanisms for discovering different kinds of clouds in detail. Philip (2009) in his research has mentioned that at present, since there are only a few large companies which can afford the costs of Cloud computing infrastructure, customers had to search those clouds manually. With advances of hardware and software, more and more medium and small companies may introduce their clouds aiming at a specific area to the Cloud computing community. At that time, manual search will not be an appropriate approach for service discovery. Users will find difficulties in searching the accurate services and selecting the accurate service providers without a proper standards, procedures or protocol. Lack of common cloud standards delayed the interoperability across providers. Thus, lead the cloud customer to face challenges and problems in selecting the right service provider that meets their needs (Jrad, 2012).

Preliminary study of this research identified the most prominent problems faced by users in retrieving the accurate services. The most common problem faced by users is the refinement of the search query. 39% of users found that searching need to refine many time. 37% of the users found difficulties to know the relevancy of the search results obtained from the search query entered. The main underlying reason of prominent problems occurs is because of inexistence of proper or well defined set of protocol or standard to perform searching over in Cloud. On the other hand, users found the above mentioned problems also due to generic search engine design.

Even though there are many existing generic search engines that consumers can use for finding cloud services, these engines may return URLs containing not relevant web pages to meet the original service. Intuitively, visiting all the web page can be time consuming. Generic search engines (e.g., Google, MSN, etc) are very effective tools for searching URLs for generic user queries. Generic search engines designs are inappropriate to determining most suitable cloud services (Han, 2010). The design is lack to cater specifically for Cloud services searches. Users need a Cloud service search engine to enhance the chance of discovering appropriate Cloud services.

In recent years, the number of cloud service providers has increased. In cloud environment, providers can publish various cloud services through cloud environment, and consumers can access these services provided by the cloud application layer through web portals (Kang, 2010). However, currently very few studies that focuses on search engine and web portal for cloud computing system (Kang, 2011).

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Therefore, this research should be answering questions of:-

1. How to formulate a search protocol that produces accurate search results of Cloud services?
2. What will be the best method to enable the protocol to produce the accurate list of search results?

1.4 Research Objectives

Two main objectives formulated for this research are as follows:

1. To propose search protocol for searching the cloud services over cloud environment.
2. To construct a Collect Disseminate Layer that complement the proposed protocol for accurate cloud service search results.

The two research objectives are formulated to enhance the environment by having a search protocol that can ease users who are seeking for Cloud services. Besides that, the two research objectives enable the users to obtain most accurate search results.

1.5 Research Scope

The main focus of this research is on designing a search protocol for Cloud environment. The existing search protocol in Cloud environment was designed for private searching, whereas, this research focuses on open cloud environment which is more on accuracy of search result with search query by a specifically design search engine for Cloud services.

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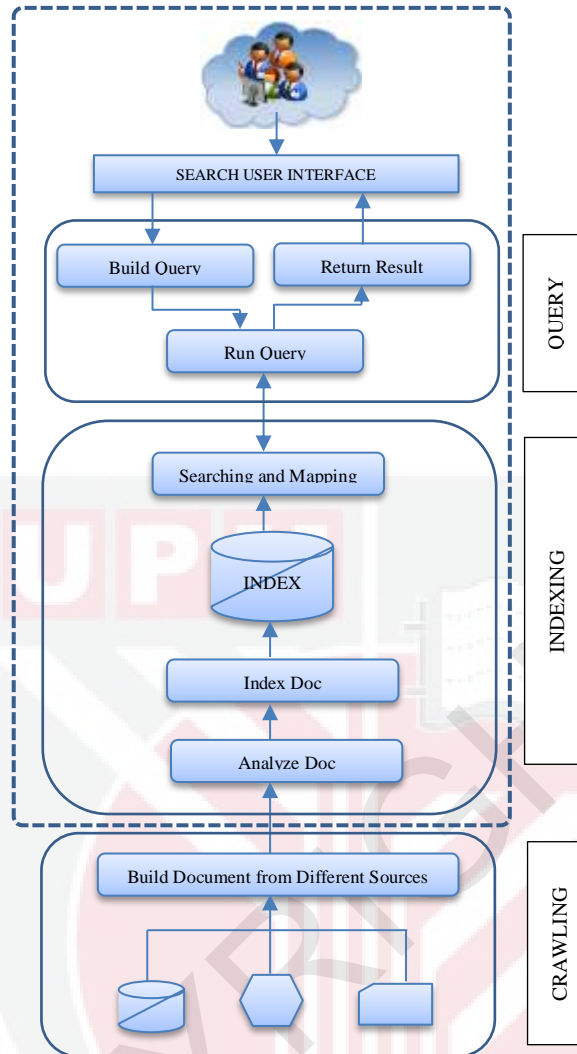
Figure 1.1 Research Scope

Figure 1.1 shows the complete steps of searching process and key components of search engine. The key components of search engine are query, indexing and crawling. Search query is a request for information made using a search engine. Every time a user types a keyword (a string of characters) in a search field and presses "Enter", a search query is made. Indexing is the process of collecting, parsing and storing data for use by search engine. It provides results for search queries. Without an index, search engine will take a large amount of time to process any query. Crawling is the process of discovering and retrieving content to be indexed. Without search engine crawlers, search engine results or uploaded data pages will be empty and would never be found.

This research focuses on query and index components of search engine and scoped at searching and mapping process. Searching and mapping is the first process of index component. Searching for entered keyword by user from first component query will proceed by mapping with index database which stores the collection of indexed documents after analysis from various sources.

Searching in cloud may vary according to the types of services required by users. There are mainly three different types of services offered by cloud namely Software As a Service (SaaS), Platform As a Service (PaaS) and Infrastructure As a Service (IaaS). This research concentrated on Software As a Service type. Development of the proposed search engine focus on Software As a Service type of services as a search result.

The evaluation of proposed protocol is scoped to be carried out in a cloud setup and in a control laboratory environment for testing purpose due to cost of real Cloud environment setup.

1.6 Research Contributions

This thesis has made the following contributions:

a. Introducing Collect Disseminate Layer (CDL) protocol for service searching over cloud environment.
b. Reducing number of iteration cycle to retrieve services from the cloud service provider.
c. Implementing a search tool called Cloud Service Search Engine (CSSE), to list out accurate search results which accurately mapped with the search query input by the users
d. Improving the respond time for matching queries and displays the results which sequentially reduce the computation time and cost even though the number of users are increasing.

1.7 Organization of Thesis

This thesis is divided into eight chapters. The first chapter is the introduction of the thesis. It describes the problem background and statement, research objectives, scope, and research contributions of the thesis.

The detailed study of cloud computing definitions, components of cloud computing, layers, technology comparison, benefits of cloud computing, risks, cloud framework, keyword searching and searching algorithms by other researches and existing published materials accessible is presented in chapter two of this document.

Methodology is a general overview of the research methods and materials used to carry out the analysis, proposed protocol design, tool design, and identification of metrics, evaluation strategy and performance analysis strategy. More specific details of how each objective was accomplished are presented in the respective chapters.

Chapter detailed out on preliminary study. Different phases of experiments and setup described detailed. Each experiments result have clearly documented and explained accordingly.

The fifth chapter describes proposes a detail design of Collect Disseminate Layer (CDL) protocol with the detailed steps involved at each layer of the protocol. This chapter also discuss the details of the proposed search engine and how it rank and arranges the search results to user view with a detail formula, algorithms, metrics, and experiments.

Implementation of the proposed solution is mainly discussed on an experiment setup and procedure. It describes the different experiment carried in this research with its aim. Key measurement which includes during the experiment clearly discussed with experiment variables. The detailed test environment and architecture were explained with diagrams.

Result analysis and recommendation computed from this research is discussed in chapter five. Results obtained from the experiment were discussed and the detailed analysis drawn. Sample results of data tables were used to draw the analysis. Besides, it does also discuss on how this research meet up with the research objective.

Conclusion and future work chapter gives a general conclusion of the research presented in this thesis and also proposes some research directions that can be investigated as future work.

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