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PRICE DEMAND MODEL FOR A CLOUD CACHE

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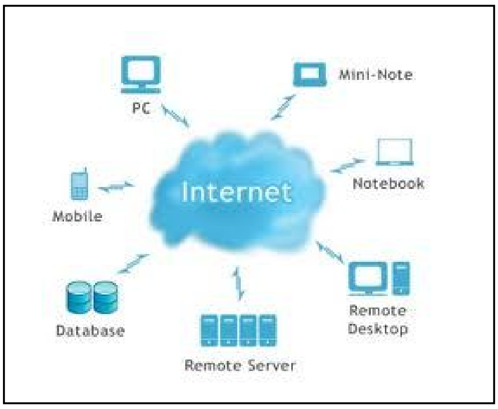
Abstract - Cloud applications that offer data management services are emerging. Such clouds support caching of data in order to provide quality query services. The users can query the cloud data, paying the price for the infrastructure they use. Cloud management necessitates an economy that manages the service of multiple users in an efficient, but also, resource economic way that allows for cloud profit. Naturally, the maximization of cloud profit given some guarantees for user satisfaction presumes an appropriate price-demand model that enables optimal pricing of query services. The model should be plausible in that it reflects the correlation of cache structures involved in the queries. Optimal pricing is achieved based on a dynamic pricing scheme that adapts to time changes. This paper proposes a novel price-demand model designed for a cloud cache and a dynamic pricing scheme for queries executed in the cloud cache. The pricing solution employs a novel method that estimates the correlations of the cache services in an time-efficient manner. The experimental study shows the efficiency of the solution.

***Keywords** : Computing, Optimal, Infrastructure, Centralizing, Adaptivity, Service.*

I.INTRODUCTION

The name cloud computing was inspired by the cloud symbol that's often used to represent the Internet in flowcharts and diagrams. Cloud computing is a technology that uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. This technology allows for much more efficient computing by centralizing storage, memory, processing and bandwidth.



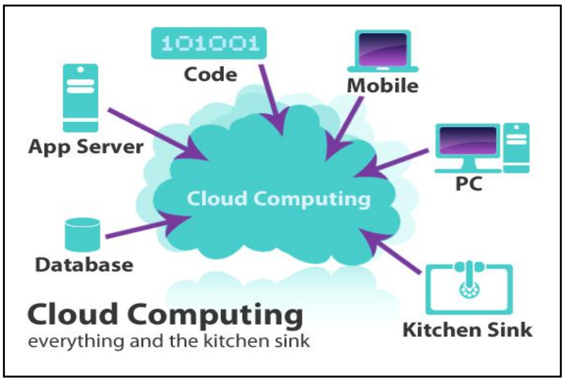
A simple example of cloud computing is Yahoo email or Gmail etc. You don't need software or a server to use them. All a consumer would need is just an internet connection and you can start sending emails. The server and email management software is all on the cloud (internet) and is totally managed by the cloud service provider Yahoo, Google etc. The consumer gets to use the software alone and enjoy the benefits. The analogy is, '***If you only need milk, would you buy a cow?***' All the users or consumers need is to get the benefits of using the software or hardware of the computer like sending emails etc. Just to get this benefit (milk) why should a consumer buy a (cow) software /hardware? For instance, without a cloud, you might run a web server that is a single computer. Maybe that computer is powerful enough to serve 1000 pages per minute. If your website suddenly becomes more popular, and the audience demands 2000 pages, it will take two minutes for all of them to get their pages displayed on their web browsers. If it gets even more popular, your server will slow to a crawl, and your audience might start losing interest. During other times, your server might only handle a few pages per minute, and the rest of the time it'll sit there waiting, instead of serving pages. If you moved your server to a cloud, however, you might rent computer power from a service_provider who might have thousands of servers, all connected together so they can share work between each other. You would share those servers with perhaps thousands of other websites, some big, some small, like an apartment building for websites. If your website suddenly becomes more popular, the cloud can automatically direct more individual computers to work to serve pages for your site, as you pay more rent for all the extra usage. If it spends months being unpopular, however, the rent you pay may dwindle down to a trickle. Meanwhile, some other, more popular site can use the computers that you are not using. In this way, computing power becomes more fluid.

A. How Does It Work?

Cloud computing provides the ability to store, access, manipulate, and share information without ever having to save the data to a local computer. Instead, the data rests on servers located off-site. There are three basic forms of cloud computing services, each offering the user a certain amount of control.

- Infrastructure as a Service (IaaS) **-** A service in which a client is provided with an entire infrastructure, including software and hardware, and pay a fee based upon usage. An example of this is Amazon’s S3.

- Platform as a Service (PaaS) - Services like Google App Engine allow a client to develop their own applications, but host them upon the proprietor’s infrastructure for a fee.
- Software as a Service (SaaS**)** - This is where a user is presented with the software only, sometimes for free or by subscription.



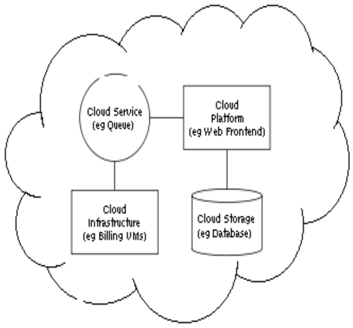
There was a time when Cloud Hosting was been used only by the governments but not it is making its way towards business, both large and small. As mentioned in Cloud Hosting “is dynamically scalable and provides virtualized resources as a service over the internet.” Think about the multitude of servers that are connected via networks to create a cloud where companies can store their data. Basically this cloud acts as an outsourcing agent for server and storage requirements. As we all know that cloud hosting has become a new buzzword, adoption may or may not be the good choice for your business or company. Just go through these advantages and disadvantages to learn more about your options with cloud computing.

III. ARCHITECTURE

Cloud architecture, the systems architecture of the software systems involved in the delivery of cloud computing, typically involves multiple *cloud components* communicating with each other over loose coupling mechanism such as messaging queue.

The two most significant components of cloud computing architecture are known as the front end and the back end. The front end is the part seen by the client, i.e., the computer user. This includes the client’s network (or computer) and the applications used to access the cloud via a user interface such as a web browser.

The back end of the cloud computing architecture is the *cloud* itself, comprising various computers, servers and data storage devices.



Layers

Once an Internet Protocol connection is established among several computers, it is possible to share services within any one of the following layers

Client
Application
Platform
Infrastructure
Server

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Provider

A *cloud provider* is the Company responsible for providing the cloud service.

Client:

cloud client consists of computer hardware and ccvc/or computer software that relies on cloud computing for application delivery, or that is specifically designed for delivery of cloud services and that, in either case, is in essence useless without it.

Examples include some computers, phones and other devices, operating systems, and browsers. Cloud Desktop as a Service or Hosted Desktop, is a term often used to refer to a container of a collection of virtual objects, software, hardware, configurations etc., residing on the cloud, used by a client to interact with remote services and perform computer related tasks.

Application

Cloud application services or "Software as a Service (SaaS)" deliver software as a service over the Internet, eliminating the need to install and run the application on the customer's own computers and simplifying maintenance and support. People tend to use the terms "SaaS" and "cloud" interchangeably, when in fact they are two different things.

Key characteristics include

- Network-based access to, and management of, commercially available (i.e., not custom) software
- Activities that are managed from central locations rather than at each customer's site, enabling customers to access applications remotely via the Web
- Application delivery that typically is closer to a one-to-many model (single instance, multi-tenant architecture) than to a one-to-one model, including architecture, pricing, partnering, and management characteristics

Centralized feature updating, which obviates the need for downloadable patches and upgrades

Platform

Cloud platform services, also known as Platform as a Service (PaaS), deliver a computing platform and/or solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications. It facilitates deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers.

Infrastructure

Cloud infrastructure services, also known as Infrastructure as a Service (IaaS), deliver computer infrastructure – typically a platform virtualization environment – as a service. Rather than purchasing servers, software, data-center space or network equipment, clients instead buy those resources as a fully outsourced service. Suppliers typically bill such services on a utility computing basis; the amount of resources consumed (and therefore the cost) will typically reflect the level of activity. IaaS evolved from virtual private server offerings.

Cloud infrastructure often takes the form of a tier 3 data center with many tier 4 attributes, assembled from hundreds of virtual machines.

Server

The servers layer consists of computer hardware and/or computer software products that are specifically designed for the delivery of cloud services, including multi-core processors, cloud-specific operating systems and combined offerings.

II. EXISTING SYSTEM

Existing clouds focus on the provision of web services targeted to developers, such as Amazon Elastic Compute Cloud (EC2), or the deployment of servers, such as Go Grid. There are two major challenges when trying to define an optimal pricing scheme for the cloud caching service. The first is to define a simplified enough model of the price demand dependency, to achieve a feasible pricing solution, but not oversimplified model that is not representative.

A static pricing scheme cannot be optimal if the demand for services has deterministic seasonal fluctuations. The second challenge is to define a pricing scheme that is adaptable to

(i) Modeling errors,

(ii) Time-dependent model changes.

(iii) Stochastic behavior of the application. The demand for services, for instance, may depend in a nonpredictable way on factors that are external to the cloud application, such as socioeconomic situations.

Static pricing cannot guarantee cloud profit maximization. In fact, as we show in our experimental study, static pricing results in an unpredictable and, therefore, uncontrollable behavior of profit. Closely related to cloud computing is research on accounting in wide-area networks that offer distributed services. Mariposa discusses an economy for querying in distributed databases. This economy is limited to offering budget options to the users, and does not propose any pricing scheme. Other solutions for similar frameworks focus on job scheduling and bid negotiation, issues orthogonal to optimal pricing.

III. OUR CONSTRUCTION

The cloud caching service can maximize its profit using an optimal pricing scheme. Optimal pricing necessitates an appropriately simplified price-demand model that incorporates the correlations of structures in the cache services. The pricing scheme should be adaptable to time changes.

Price adaptivity to time changes:

Profit maximization is pursued in a finite long-term horizon. The horizon includes sequential non-overlapping intervals that allow for scheduling structure availability. At the beginning of each interval, the cloud redefines availability by taking offline

Some of the currently available structures and taking online some of the unavailable ones. Pricing optimization proceeds in iterations on a sliding time-window that allows online corrections on the predicted demand, via re-injection of the real demand values at each sliding instant. Also, the iterative optimization allows for re-definition of the parameters in the price-demand model, if the demand deviates substantially from the predicted.

Modeling structure correlations:

Our approach models the correlation of cache structures as a dependency of the demand for each structure on the price of every available one. Pairs of structures are characterized as competitive, if they tend to exclude each other, or collaborating, if they coexist in query plans. Competitive pairs induce negative, whereas collaborating pairs induce positive correlation. Otherwise correlation is set to zero. The index-index, index column, and column-column correlations are estimated based on proposed measures that can estimate all three types of correlation. We propose a method for the efficient computation of structure correlation by extending a cache based query cost estimation module and a template-based workload compression technique.

Query Execution:

The cloud cache is a full-fledged DBMS along with a cache of data that reside permanently in back-end databases. The goal of the cloud cache is to offer cheap efficient multi-user querying on the back-end data, while keeping the cloud provider profitable. Service of queries is performed by executing them either in the cloud cache or in the back-end database. Query performance is measured in terms of execution time. The faster the execution, the more data structures it employs, and therefore, the more expensive the service. We assume that the cloud infrastructure provides sufficient amount of storage space for a large number of cache structures. Each cache structure has a building and a maintenance cost.

Optimal Pricing:

We assume that each structure is built from scratch in the cloud cache, as the cloud may not have administration rights on existing back-end structures. Nevertheless, cheap computing and parallelism on cloud infrastructure may benefit the performance of structure creation. For a column, the building cost is the cost of transferring it from the backend and combining it with the currently cached columns. This cost may contain the cost of nte grating the column in the existing cache table. For indexes, the building cost involves fetching the data across the Internet and then building the index in the cache.

Since sorting is the most important step in building an index, the cost of building an index is approximated to the cost of sorting the indexed columns. In case of multiple cloud databases, the cost of data movement is incorporated in the building cost. The maintenance cost of a column or an index is just the cost of using disk space in the cloud. Hence, building a column or an index in the cache has a one-time static cost, whereas their maintenance yields a storage cost that is linear with time.

IV. CONCLUSION

This work proposes a novel pricing scheme designed for a cloud cache that offers querying services and aims at the maximization of the cloud profit. We define an appropriate Price-demand model and we formulate the optimal pricing problem. The proposed solution allows: on one hand, long-term profit maximization, and, on the other, dynamic calibration to the actual behavior of the cloud application, while the optimization process is in progress. We discuss qualitative aspects of the solution and a variation of the problem that allows the consideration of user satisfaction together with profit maximization. The viability of the pricing solution is ensured with the proposal of a method that estimates the correlations of the cache services in an time-efficient manner.

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