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Cost Minimizing Dynamic Migration of Content Distribution Services into Hybrid Cloud

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ABSTRACT:

Cloud computing has become a highly demanded service or utility due to the advantages of high computing power, cheap cost of services, high performance, scalability, accessibility as well as availability. Cloud computing and storage solutions provide users and enterprises with various capabilities to store and process their data in third-party data centers. It relies on sharing of resources to achieve coherence and economy of scale, similar to a utility (like the electricity grid) over a network.

A growing number of content distribution applications are contemplating a switch to cloud based services. Two key tasks are involved for such a move: to migrate the contents to cloud storage, and to distribute the web service load to cloud-based web services. The main issue is to best utilize the cloud as well as the application provider's existing private cloud, to serve volatile requests with service response time guarantee at all times, while incurring the minimum operational cost. Employing Lyapunov optimization techniques, we design a dynamic control algorithm to optimally place contents and dispatch requests in a hybrid cloud infrastructure spanning geo-distributed data centers, which minimizes overall operational cost over time, subject to service response time constraints. Rigorous analysis shows that the algorithm nicely bounds the response times within the preset QoS target, and guarantees that the overall cost is within a small constant gap from the optimum achieved by a T-slot look ahead mechanism with known future information. We verify the performance of our dynamic algorithm with prototype-based evaluation.

INTRODUCTION

Cloud computing technologies have enabled rapid provi- sioning server utilities to users anywhere, anytime. To ex- ploit the diversity of electricity costs and to provide service proximity to users in different geographic regions, a cloud service often spans multiple data centers over the globe, e.g., Amazon CloudFront, Microsoft Azure. The elastic and on-demand nature of resource provisioning has made cloud computing attractive to providers of various applications. More and more new applications are being created on the cloud platform [1][2], while many existing applications are also considering the cloud-ward move [3][4], including content distribution applications [5][6].

As an important category of popular Internet services, content distribution applications, e.g., video streaming, web hosting and file sharing, feature large volumes of content and demands that are highly dynamic in the temporal domain.

A cloud platform with multiple, distributed data centers is ideal to host such a service, with substantial advantages over a traditional private or public content distribution network (CDN) based solution, in terms of more agility and significant cost reduction.

Two major components exist in a typical content distribution application, namely back-end storage for keeping the contents, and front-end web service to serve the requests. Both can be migrated to the cloud: contents can be stored in storage servers in the cloud, and requests can be distributed to cloud-based web services. Therefore, the key challenge for cloud-ward

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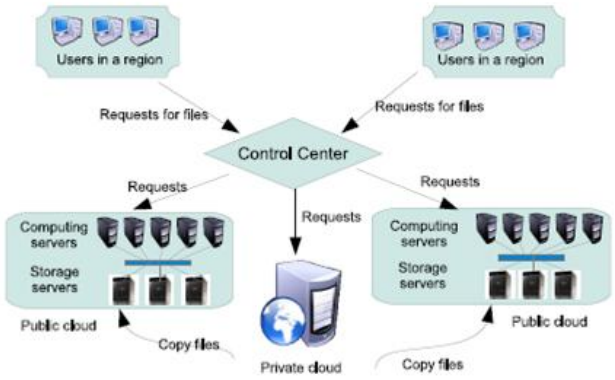
move of a content distribution application is how to efficiently replicate contents and dispatch requests across multiple cloud data centers and the provider's existing on-premise servers such that good service response time is guaranteed and only modest operational expenditure is incurred. Some existing work [3][4][5][6] have advocated to optimize application mi- gration into clouds, but none focuses on guaranteeing over- time cost minimization with a dynamic algorithm.

In this paper, we present a generic optimization framework for dynamic, cost-minimizing migration of content distribution services into a hybrid cloud (i.e., private and public clouds combined), and design a joint content placement and load distribution algorithm that minimizes overall operational cost over time, subject to service response time constraints. Our design is rooted in Lyapunov optimization theory [7][8], where cost minimization and response time guarantee are achieved simultaneously by efficient scheduling of content migration and request dispatching among data centers. Lyapunov op- timization provides a framework for designing algorithms with performance arbitrarily close to the optimal performance over a long run of the system, without the need for any future information. It has been extensively used in routing and channel allocation in wireless networks [7][9], and has only recently been introduced to address resource allocation problems in a few other types of networks [10][11]. We tailor Lyapunov optimization techniques in the setting of a hybrid cloud, to dynamically and jointly resolve the optimal content replication and load distribution problems. We demonstrate the optimality of our algorithm with rigorous theoretical analysis.

The algorithm nicely bounds the service response times within the preset QoS target in cases of arbitrary request arrivals, and guarantees that the overall cost is within a small constant gap from the optimum achieved by a T-slot lookahead mechanism with information into the future.

SYSTEM ARCHITECTURE:



EXISTING SYSTEM:

- Two major components exist in a typical content distribution application, namely back-end storage for keeping the contents, and front-end web services to serve the requests. Both can be migrated to the cloud: contents can be stored in storage servers in the cloud, and requests can be distributed to cloud-based web services.
- Hajjat et al. developed an optimization model for migrating enterprise IT applications onto a hybrid cloud. Their model takes into account enterprise-specific constraints, such as transaction delays and security policies.
- Zhang et al. propose an intelligent algorithm to factor workload and dynamically determine the service placement across the public cloud and the private cloud.
- Chen et al. propose to build CDNs in the cloud in order to minimize cost under the constraints of QoS requirement

DISADVANTAGES OF EXISTING SYSTEM:

- Onetime optimal service deployment is considered.
- They only propose greedy-strategy based heuristics without provable properties.
- It focuses on balancing the data access load, by considering social relationships and user access patterns in the data storage.

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PROPOSED SYSTEM:

In this paper, we present a generic optimization framework for dynamic, cost-minimizing migration of content distribution services into a hybrid cloud (i.e., private and public clouds combined), and design a joint content placement and load distribution algorithm that minimizes overall operational cost over time, subject to service response time constraints.

Our design is rooted in Lyapunov optimization theory, where cost minimization and response time guarantee are achieved simultaneously by efficient scheduling of content migration and request dispatching among data centers.

Lyapunov optimization provides a framework for designing algorithms with performance arbitrarily close to the optimal performance over a long run of the system, without the need for any future information.

We propose a generic optimization framework for dynamic, optimal migration of a content distribution service to a hybrid cloud consisting of a private cloud and public geo-distributed cloud services.

We design a joint content placement and load distribution algorithm for dynamic content distribution service deployment in the hybrid cloud. Providers of content distribution services can practically apply it to guide their service migration, with confidence in cost minimization and performance guarantee, regardless of the request arrival pattern.

ADVANTAGES OF PROPOSED SYSTEM:

- We tailor Lyapunov optimization techniques in the setting of a hybrid cloud, to dynamically and jointly resolve the optimal content replication and load distribution problems.
- We demonstrate optimality of our algorithm with rigorous theoretical analysis and prototype-based evaluation. The algorithm nicely bounds the response times (including queueing and round-trip delays) within the preset QoS target in cases of arbitrary request arrivals, and guarantees that the overall cost is within a small constant gap from the optimum achieved by a T-slot lookahead mechanism with information into the future.

Algorithm: Control Algorithm on the Control Center

Initialization:
Set up request queue $Q_j^{(m)}$, virtual queues G and $Z_j^{(m)}, \forall j \in \mathcal{N}, m \in \mathcal{M}$, and initialize their backlogs to 0;
In every time slot t:
1. Enqueue received requests to request queues ($Q_j^{(m)}$'s);
2. Solve optimization (14) to obtain optimal content placement and load distribution strategies $c_{ji}^{(m)}(t)$, $s_j^{(m)}(t)$, $y_i^{(m)}(t)$, $\forall j, i \in \mathcal{N}, m \in \mathcal{M}$;
3. Update content placement table with $y_i^{(m)}(t)$'s, and migrate files as follows:
for $i \in \mathcal{N}, m \in \mathcal{M}$ **do**
  if $y_j^{(m)}(t-1) = 0$ *and* $y_j^{(m)}(t) = 1$ **then**
    instruct on-premise server to upload file m to data center i;
  if $y_j^{(m)}(t-1) = 1$ *and* $y_j^{(m)}(t) = 0$ **then**
    signal data center i to remove file m;
4. Dispatch $s_j^{(m)}(t)$ requests from queue $Q_j^{(m)}$ to on-premise server, $c_{ji}^{(m)}(t)$ requests to data center i, $\forall j, i \in \mathcal{N}, m \in \mathcal{M}$;
5. Update virtual queue $Z_{ji}^{(m)}$ and G according to Eqn. (11) and (10);

CONCLUSIONS

In this review paper we are studied various techniques and algorithms are load balancing, job scheduling to utilization of resources in proper ways. Virtualization techniques is one of powerful feature of the cloud computing. Live migration is to improve performance and availability. In this paper optimal migration of a content distribution service to a hybrid cloud consisting of a private cloud and public cloud services. Using the Lyapunov optimization technique which can minimizes the operational cost of the application with Quality of service guarantees. Achieving efficient load balancing as well as provide high security

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