Videos on Demand for Mobile Users: a Study of Community Cloud Architecture with the use of Grid Virtualization

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*Abstract:*Mobile devices like cell phones and PDAs are being used by everyone in nowadays. But these mobile devices have limited storage. Reducing the storage constraint in mobile devices is a useful issue. Cloud computing has been the most prevalent technology and the advent of this with mobile devices can efficiently address the storage and processing constraints of mobile devices. Providing the required data on demand (when requested by user) from a cloud environment reduces the need to store the data in mobile devices. Community cloud architectures address this requirement. Community clouds are formed by sharing the infrastructure between different organizations having same business goals and requirements. This paper presents a community cloud architecture, making use of grid architectures for sharing the infrastructure and also provides its pros and cons along with the case study of videos on demand as a service.

Keywords: Community clouds, Cloud with Grid architectures, Mobile Clouds, On demand Services, cloud virtualization.

I. INTRODUCTION

This paper starts with the general introduction of Cloud Architecture, and then discusses the architecture for the community clouds with the use of grid virtualization among the organizations. The rest of the introduction follows the introduction of basic terminology of clod & grid.

A. Cloud Computing

It refers to accessing computing resources that are typically owned and operated by a third-party provider on a consolidated basis in one, or usually more, data centre locations [8].
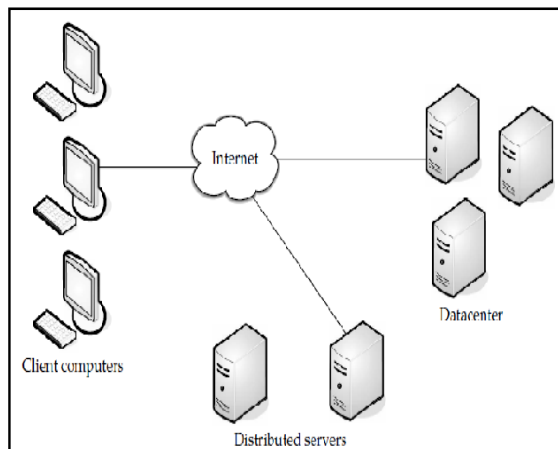

Figure1. Cloud computing architecture

As shown in Figure1 a client requests a service from a service provider through internet. The term cloud computing was given due to the fact that it uses internet for communication andgenerally internet is represented by the cloud symbols.

Data centres are the servers which contain the services to be provided by the service provider. These data centres are distributed among different servers to provide reliability [10].

Cloud computing incorporates infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS) as well as Web 2.0.

B. Grid Computing

A parallel processing architecture in which CPU resources are shared across a network, and all machines function as one large supercomputer [9].

In a grid computing environment as shown in figure different organizations having computing resources share their resources with each other so that all the shared resources virtually forms a super computer.
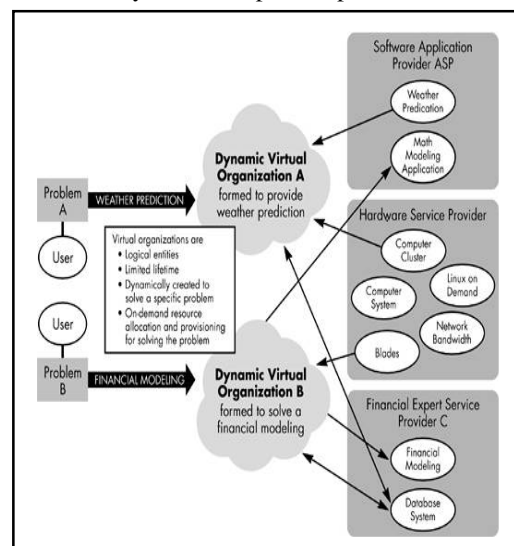

Figure2. Grid Computing Virtual Organization Architecture [7]

All the organizations that share resources form a virtual organization which is maintained by any one of the organizations or by a third party [7]. A client can request the virtual organization for the required service. The above diagram shows how the virtual organization provides different services like weather prediction & financial modelling to the end users from the participant organizations of virtual organization.

C. Difference between grid & cloud architectures

Both cloud and grid environments provide services to the end users but they differ to each other in some areas.

1. Grid computing services are provided by a virtual organization where as cloud computing services are provided by the service provider itself.
2. Cloud computing provides services to even thin clients (clients having no computing resources), but in a grid environment the client requesting a service should have minimum requirements in terms of both hardware and software.
3. Grid computing is where more than one computer coordinates to solve a problem together. Cloud computing is where an application doesn't access resources it requires directly; rather it accesses them through something like a service.

But similar thing for both environments is they provide scalability & virtualization to the end users.

II. MOTIVATION

As discussed, the motivation for this paper is to reduce the memory constraint of the mobile devices (Low Processing Units) such as cell phones and PDAs by providing the data on demand, so that no need of storing the data in limited memory contained by these devices [1].

A mobile device is a client in this scenario and the services required by it like documents, videos, audios and applications are provided by the service providers in grid architecture [2]. This paper considers providing videos on demand as an example because videos occupy more memory as compared to any other types of data or services.

But an identified problem with this is it is difficult to provide all the data (videos) to the client by the service providers as different users demand different types of videos and to store entire videos that are available in the world in the data centres of the provider is a hectic task. This is what exactly the reason for the emergence of community clouds.

A. Community Cloud

A group of organizations that identify themselves having common ideas or interests, and communicate and collaborate around these common ideas or interests forms Community clouds [2]. If the client requested video is not available with the gird provider organization, then that organization gets it from the other grid organizations in the community and provides it to the client. The client actually feels that he is getting from the grid organization he is subscribed to but actually it is from some other grid organization. Thus community clouds attain virtualization.

Establishing the cloud environment with the mobile devices is a challenging task as the mobile users are continuously moving from one cell region to another. Hence cloud environment can be established by Context awareness [1].

How to share the resources between different community organizations is an important issue because the client must be provided with virtualization from the original provider of the data or videos.

III. COMMUNITY CLOUD ARCHITECTURE

In order to share the resources between different organizations without failing the security of on organization with another there should be some SLAs between the organizations. This is possible with the Grid environment.

As shown in Figure above, A, B and C are three different organizations that provide videos to the mobile users on demand. These 3 organizations have the common business goal. So they can form a community cloud by sharing their resources (Data centres). As shown in figure a mobile client is requesting a video from organization 'A' over the internet. Upon receiving the request at 'A' first search is done if the requested video is available with it or not, if available that video is provided to the user, if not a search is done with the shared data centres of B & C and that video is presented to the mobile user. The end user thinks that he is getting video from A but actually the video is from the shared resources of B & C. Thus the virtual organization formed by the shared resources of organizations registered to a community provides virtualization to the end user.
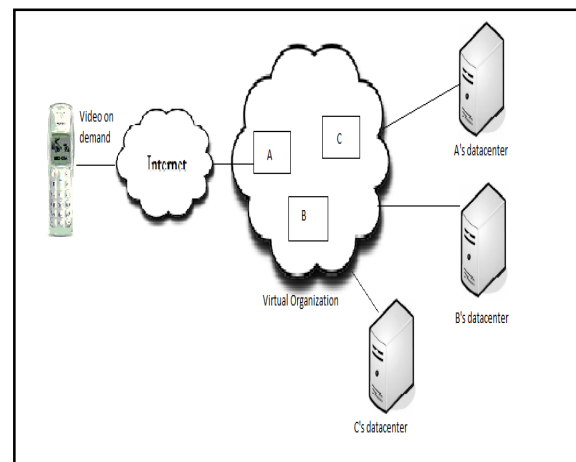

Figure3. Community cloud architecture formed with Grid virtual organization

[1].Cloud Federation

All the different organizations participated in the formation of Virtual Organization can be considered as different cloud providers. The process of migration of the request for a data from one cloud provider's data centre to another when the requested data (video) is not available can be named as Cloud Federation [15]. The following are some of the considerations in cloud federation.

A single sign on scheme would serve better for an enterprise user wishing to access community cloud services. Communication between the data centres within virtual organization can be done with Web Service architecture [3]. Several Web Services features like WS-Security, WS-Interoperability issues can be applied for efficient communication

IV. NEEDS OF COMMUNITY CLOUDS

In order to achieve the healthy working environment of a virtual organization for a community cloud, there is a requirement for the fallowing identified set of needs to be addressed.

1. Achieving interoperability between community members is the necessary issue. Shared well defined sets of standards should be followed by community members [14].
2. A flexible, hierarchal aggregation model is needed for new service providers to join the virtual organization formed by the community [14].
3. A proper network model should be opted for providing availability of data (videos) or services and scalability in terms of number of users.
4. Pricing models and Service Level Agreements(SLAs) should be proposed for efficient use of sharable resources of other participants in the community.

V. PROS AND CONS OF COMMUNITY CLOUDS

Community clouds have both advantages and disadvantages of their own.

Pros

1. On demand provision of the data or services to the end users.
2. Reduces the storage constraints of mobile devices.
3. As community clouds share resources between organizations the operational costs of organizations reduces as they can use each other's servers & resources [4].
4. End users need not to invest large amounts to have the client devices because a mobile device with internet connectivity is sufficient to do their operations.
5. As a virtual organization contains multiple data centres of different organizations, even one organization's server fails, but service can be delivered to end user from other organizations.
6. Offloading the computation related services from mobile devices to a cloud environment also save energy which is a key element for mobile devices [12].

Cons

1. The security between the different organizations, sharing the resources is a challenging issue.
2. Without proper SLAs between organizations, it is highly hectic task for the organizations about charging their peers depend on their usage of their resources [4].
3. Mobile devices cannot be in a fixed location. Devices like phones & PDAs are carried by the users where ever they go. Hence establishing cloud network is hectic task [1] [5].
4. Proper connectivity between client and the service provider which is not always possible can cause unnecessary delays and in-completion of the services.
5. To make the data (Videos) or services available to large number of end users requires huge series of hardware within a virtual organization [11].

VI. CONCLUSION

The community cloud architecture for providing on demand services to clients reduces the operational costs of both service providers as well as service consumers. But it is not suitable for all situations. Depends on the requirements of one should opt Community cloud environment for on demand services or data. As it has its own pros and cons as well users of on-demand service providing organizations have to choose community cloud architecture. In General, when the internet connectivity is fast, the probability losing connectivity between end user and the service provider is less and the service or data provided by the provider does not require much security constraints then the users can opt for the Community clouds with grid virtualization architecture. Decision Criteria also includes Licensing, Economies of Scale, Standardization, Privacy and Risk Management [14].

So many issues like Security and interoperability can be addressed with the use of web service architecture. These are future enhancements of the Community cloud architectures which are based on Grid Computing architecture. By addressing these issues will result in the acceptance of gird virtualized community cloud architectures in various industrial fields.

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