ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 11, November 2015

Energy-Efficient Fault –Tolerance in Mobile Cloud: Survey

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ABSTRACT: The advances in hardware for hand-held portable devices, resource-intensive application still remain off bounds since they require significant computation and storage capabilities. These issues are addressed by employing remote servers, such as clouds and peer mobile devices. However, for mobile devices deployed in dynamic networks challenges of reliability and energy efficiency remain largely unaddressed. These challenges are addressed by an approach called as k-out-of-n computing. This paper provides the survey on the compressive issues on energy consumption and fault tolerance in mobile devices. As long as k-out-of-n remote servers are accessible, mobile devices successfully retrieve or process data, in the most energy-efficient way. The paradigm of cloud computing are used to manipulate and access the data to be stored and processed reliably on cloud.

KEYWORDS: Mobile computing, Cloud computing, Mobile Cloud, k-out-of-n computing.

I. INTRODUCTION

Clouds are large-scaled distributed computing systems built around core concepts such as computing as utility, virtualization of resources, on demand access to computing resources, and outsourcing computing services.Personal mobile devices have gained enormous popularity in recent years. Due to their limited resources (e.g., computation, memory, energy), however, executing sophisticated applications (e.g., video and image storage and processing, or map-reduce type) on mobile devices remains challenging. As a result, many applications rely on offloading all or part of their works to "remote servers" such as clouds and peer mobile devices. Mobile devices derive the energy required for their operation from batteries. In the case of many consumer electronics devices, especially mobile phones, battery capacity is severely restricted due to constraints on size and weight of the device. This implies that energy efficiency of these devices is very important to their usability.

Cloud computing is a new paradigm in which computing resources such as processing, memory, and storage are not physically present at the user's location. Instead, a service provider owns and manages these resources, and users access them via the Internet. For example, Amazon Web Services lets users store personal data via its Simple Storage Service (S3) and perform computations on stored data using the Elastic Compute Cloud (EC2).

Mobile applications have become an indispensable part of everyday life. Truly portable mobile devices, such as smart phones and tablets, are increasingly capable devices with processing and storage capabilities that make significant step improvements with every generation. While power in mobile devices will continue to be constrained relative to tethered devices, advances in battery and power management technology will enable mobile devices to manage longer-lived computations with fewer burdens on available power.

Cloud computing is the delivery of computing services over the Internet. Cloud services allow individuals and businesses to use software and hardware that are managed by third parties at remote locations. Examples of cloud services include online file storage, social networking sites, webmail, and online business applications. The cloud computing model allows access to information and computer resources from anywhere that a network connection is available. Cloud computing provides a shared pool of resources, including data storage space, networks, computer processing power, and specialized corporate and user applications.

1. Characteristics of Cloud

The characteristics of cloud computing include on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service.

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i. On-demand self-service means that customers can request and manage their own computing resources.
ii. Broad network access allows services to be offered over the Internet or private networks.
iii. Pooled resources means that customers draw from a pool of computing resources, usually in remote data centers.
iv. Services can be scaled larger or smaller; and use of a service is measured and customers are billed accordingly.

The cloud computing service models are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS).

i. In a Software as a Service model, a pre-made application, along with any required software, operating system, hardware, and network are provided.
ii. In PaaS, an operating system, hardware, and network are provided, and the customer installs or develops its own software and applications.
iii. The IaaS model provides just the hardware and network; the customer installs or develops its own operating systems, software and applications.

Deployment of cloud services are the Cloud services are typically made available via a private cloud, community cloud, public cloud or hybrid cloud as shown in figure1. Generally speaking, services provided by a public cloud are offered over the Internet and are owned and operated by a cloud provider. Some examples include services aimed at the general public, such as online photo storage services, e-mail services, or social networking sites. However, services for enterprises can also be offered in a public cloud. In a private cloud, the cloud infrastructure is operated solely for a specific organization, and is managed by the organization or a third party. In a community cloud, the service is shared by several organizations and made available only to those groups. The infrastructure may be owned and operated by the organizations or by a cloud service provider. A hybrid cloud is a combination of different methods of resource pooling (for example, combining public and community clouds). Cloud services are popular because they can reduce the cost and complexity of owning and operating computers and networks. Since cloud users do not have to invest in information technology infrastructure, purchase hardware, or buy software licenses, the benefits are low up-front costs, rapid return on investment, rapid deployment, customization, flexible use, and solutions that can make use of new innovations. In addition, cloud providers that have specialized in a particular area (such as e-mail) can bring advanced services that a single company might not be able to afford or develop. Some other benefits to users include scalability, reliability, and efficiency. Scalability means that cloud computing offers unlimited processing and storage capacity. The cloud is reliable in that it enables access to applications and documents anywhere in the world via the Internet. Cloud computing is often considered efficient because it allows organizations to free up resources to focus on innovation and product development.

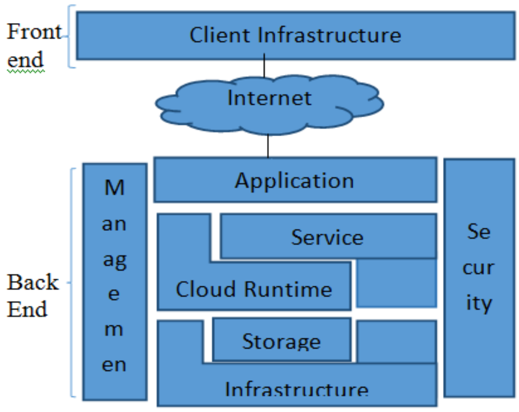

Figure1: Cloud Computing Architecture

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ISSN (Print): 2320-9798

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II. RELATED WORK

M. Satyanarayanan [1], Small scale network in Cloud computing has gained attention recently. A resource-rich cluster that is Cloudlet is well connected to the Internet and is available for use by nearby mobile devices; it can apply synthesis recursively to generate a family of overlays. Launching VM would involve pipelined application of these overlays, with intermediate results cached for reuse. Earlier stages of the pipeline tend to involve larger overlays that are more widely used across applications and are hence more likely to be found in a persistent cache. Conceptually, it seek a "wavelet"-like decomposition of VM state into a sequence of overlays that decrease in size but increase in specificity. A trade-off is that each overlay introduces some delay in pre-use infrastructure customization. The cost of generating overlays isn't a factor because it occurs offline. Another deployment challenge relates to the assumption that a relatively small set of base VMs will suffice for a large range of applications. A mobile device with an overlay generated from a base VM that's too old might not be able to find a compatible cloudlet. This problem could be intensified by the common practice of releasing security patches for old OS releases. Although the patch's effect could be incorporated into the overlay, it would increase overlay size. A different approach would be to trigger generation of new overlays when security patches are released, which mobile devices would then have to download.

Byung-Gon Chun [2]A small Virtual Machine (VM) overlay is delivered to mobile devices to a cloudlet infrastructure and lets it take over the computation is presented. Similar works that use VM migration are also done in CloneCloud. The system overcomes design and implementation challenges to achieve basic augmented execution of mobile applications on the cloud, representing the whole-sale transfer of control from the device to the clone and back. They combine partitioning, migration with merging, and on-demand instantiation of partitioning to address these challenges. The prototype delivers up to 20x speedup and 20x energy reduction for the simple applications they tested, without programmer involvement, demonstrating feasibility for the approach, and opening up a path for a rich research agenda in hybrid mobile-cloud systems.

Sokol Kosta [3] ThinkAir, framework for offloading mobile computation to the cloud is presented. A mobile device delivers a small Virtual Machine (VM) overlay to a cloudlet infrastructure and lets it take over the computation. Similar works that use VM migration are also done in ThinkAir. Using Think Air requires only simple modifications to an application's source code coupled with use of the ThinkAir tool-chain. Experiments and evaluations with micro benchmarks and computation intensive applications demonstrate the benefits of ThinkAir for profiling and code offloading, as well as accommodating changing computational requirements with the ability of on-demand VM resource scaling and exploiting parallelism. Key components of ThinkAir are, theyhave ported Android to Xen allowing it to be run on commercial cloud infrastructure, and continue to work on improving programmer support for parallelizable applications.

Cong Shi presents [4] Based on CPU usages a MAUI determines which processes to be offloaded to remote servers. Serendipity considers using remote computational resource from other mobile devices. This paper have developed and evaluated the Serendipity system that enables a mobile device to remotely access computational resources on other mobile devices it may encounter. The main challenge addressed is how to model computational tasks and how to perform task allocation under varying assumptions about the connectivity environment. Through an emulation of the Serendipity system have explored how such a system has the potential to improve computation speed as well as save energy for the initiating mobile device also reported on a preliminary.

Chien-An Chen [5], Despite the advances in hardware for hand-held mobile devices, resource-intensive applications (e.g., video and image storage and processing or map-reduce type) still remain off bounds since they require large computation and storage capabilities. Recent research has attempted to address these issues by employing remote servers, such as clouds and peer mobile devices. For mobile devices deployed in dynamic networks (i.e., with frequent topology changes because of node failure/unavailability and mobility as in a mobile cloud), however, challenges of reliability and energy efficiency remain largely unaddressed. The challenges are addressed in an integrated manner for both data storage and processing in mobile cloud, an approach called k-out-of-n computing. In solution, mobile devices successfully retrieve or process data, in the most energy-efficient way, as long as k out of n remote servers are accessible. Through a real system implementation they have proved the feasibility of the approach. Extensive simulations demonstrate the fault tolerance and energy efficiency performance of our framework in larger scale networks. Presented the first k-out-of-n framework that jointly addresses the energy-efficiency and fault-tolerance challenges. It assigns data fragments to nodes such that other nodes retrieve data reliably with minimal energy consumption. It also allows nodes to process distributed data such that the energy consumption for processing the data

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International Journal of Innovative Research in Computer and Communication Engineering

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is minimized. Through system implementation, the feasibility of our solution on real hardware was validated. Extensive simulations in larger scale networks proved the effectiveness of our solution. The paper propose an efficient k-out-of-n task scheduling algorithm that reduces the job completion time and minimizes the energy wasted in executing duplicated tasks on multiple processor nodes.

Dimakis et al. [6] For maintaining a distributed storage system in a dynamic network they have proposed several erasure coding algorithms. The results about the problem of reducing repair traffic in distributed storage systems based on erasure coding. Three versions of the repair problems are considered: exact repair, functional repair and exact repair of systematic parts. In the exact repair model, the lost content is exactly regenerated; in the functional repair model, only the same MDS-code property is maintained before and after repairing; in the exact repair of systematic parts, the systematic part is exactly reconstructed but the non-systematic part follows a functional repair model. Finally small finite-field constructions require further investigation. While many of the constructions presented require a large finite-field size, practical storage systems would benefit from efficient binary operations. Recently Zhang et al. suggested a scheme for repairing Even odd code, which are binary codes with n = k+2. The proposed scheme does not match the cut-set bound it improves on the naive repairing method of reconstructing all the data blocks. Constructing regenerating codes for small finite fields or designing repair algorithms for existing codes will be of significant practical interest.

Aguilera et al. [7]For better reliability a protocol to efficiently adopt erasure code was proposed. Erasure codes are powerful alternatives to replication for storage; they provide better space efficiency and control over the redundancy level. However, they create complications due to complexity and cohesion of data, especially with concurrent updates and failures. The new protocol addresses the complications that have features to make it broadly applicable, and its efficiency is reasonable as demonstrated by experiments. The protocol allows the use of highly-efficient erasure codes with large n and k, and small n - k.

Chen [12] and [13], distribute data and process the distributed data in a dynamic network. Both the distributed data and processing tasks are allocated in an energy-efficient and reliable manner, but how to optimally schedule the task to further reduce energy and job makespan is not considered. Furthermore, the tradeoffs between the system reliability and the overhead, in terms of more storage space and redundant tasks, is analysed.

III. Proposed Work

From the above discussed survey we choose the effective way of k-out-of-n computing terminology for which we can proceed for energy consumption and fault tolerance that assigns data fragments to nodes such that other nodes retrieve data reliably.

Some of the main challenges of mobile devices is energy consumption that is utilized by the media content but using the cloud involves data reliability, network availability, load imbalance and data latency/synchronization in case of multiple media streams from different clouds. The ultimate aim is to enable a systematic approach to improving power management of mobile devices.

IV. Conclusion and Future Work

In this paper, the problems in limited resource of mobile devices and how to execute sophisticated application on mobile devices are studied. The k-out-of-n computing is used for energy consumption assigned data fragments to nodes that leads for energy consumption in storing reliable data and retrieving the data reliably. This survey has provided us a crystal clear idea about the wide dimensions of energy consumption for retrieving and processing the distributed data and to support the fault-tolerant under the dynamic network topology.

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