

Green-Mobile-Cloud-Computing Motivated Middleware for Next Technology

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Abstract: In this paper three computing techniques are inte-grated via a Middleware software agent. Mobile computing involves mobile interaction, mobile hardware, and mobile software, where as cloud computing re-lies on sharing of resources to meet coherence and economies of scale over a network. Green comput-ing is slimier to cloud computing but it is more re-lated to selecting energy-efficient networking technolo-gies and products, and minimizing resource use when-ever/wherever possible. A novel approach is proposed where Middleware is coordinating between mobile and cloud computing techniques to achieve green computing for next generation where people are mostly talk about global worming.

Keywords: MANET, Green Computing, Mobile Com-puting, Cloud Computing

1. INTRODUCTION AND RELATED WORK

Mobile Computing is a information management platform without a pre-defined location and/or connec-tion to a network to publish and/or subscribe to informa-tion [6]. This freedom allows users to access and pro-cess desired information from anywhere in the space, hence the state of the user, static or mobile, does not af-fect the information management capability of the mo-bile environment. Mobile computers normally rely on battery power with compact size of many mobile de-vices, hence usually expensive batteries are be used to obtain more battery life. MANET is a Mobile Adhoc Network called as infrastructureless network where net-work’s topology changes over a period.

I. RELATED WORK

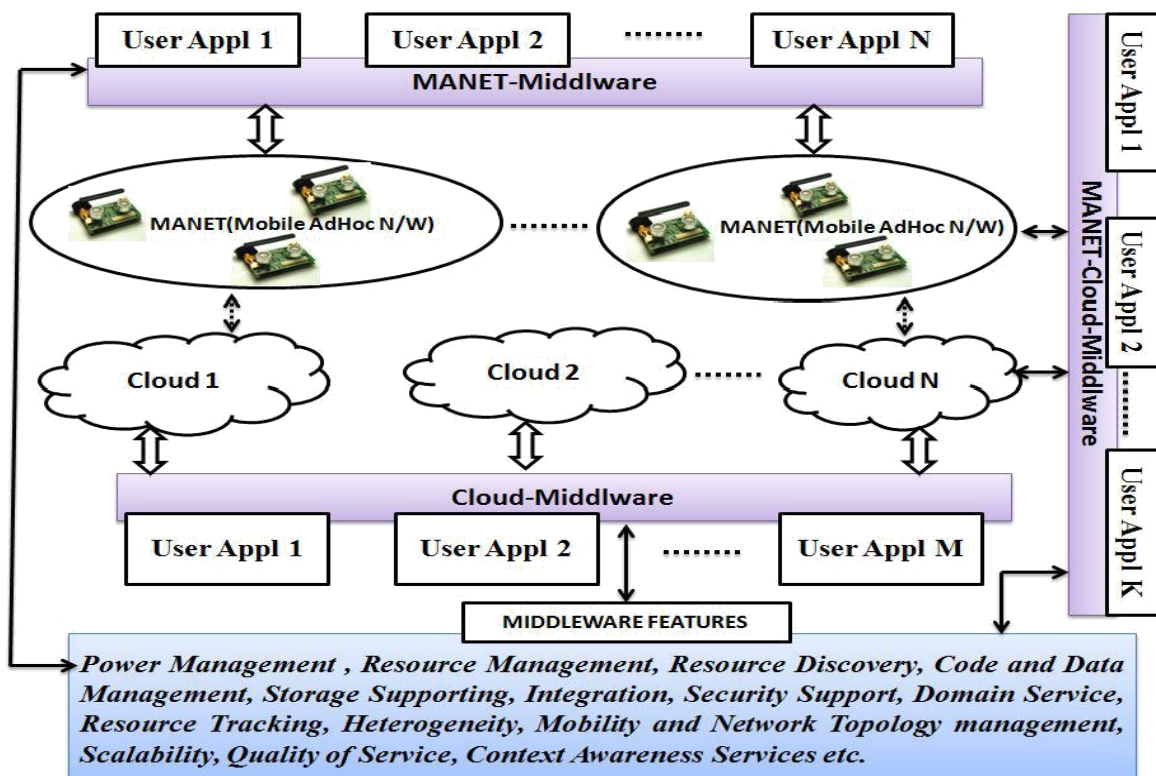


Figure 1. Overview of Mobile-Cloud Computing based Middleware Arch

Cloud computing is a network computing technology that uses the internet and remote servers to maintain information and multipurpose applications, it provides a platform for heterogeneous applications and other services over the internet along with scalability and virtualisation. Cloud Computing provides on demand or dynamic solutions by accessing a shared pool of configurable computing resources (e.g., servers, applications, storage, networks and services) that can be quickly provisioned and released with minimal management effort or service contributor communication. Cloud computing has many possible delivery modes, few of them are, Platform as a Service (PaaS), Software as a Service (SaaS) and Infrastructure as a Service (IaaS). In SaaS, software is hosted on a cloud server and that can be accessed by users over the internet. PaaS is a pay as you use service for utilising hardware, storage and network services over the internet. IaaS is an infrastructure as service which allows developers to build applications on the infrastructure provided by the cloud service provider.

Cloud Computing helps in energy saving by consolidating local network software, pictures, videos, emails and documents on remote servers than keeping them on personal computers [2].

Green Computing (Green Chemistry) is responsibility of designing, manufacturing, using, and disposing of computers, servers, and its hardware like monitors, printers, storage devices, and networking and communications systems in order to consume efficiently and effectively with minimal or no impact on the environment [4][5]. Intention of Green Computing is to minimize the use of hazardous materials, use energy efficiency product to increase its lifetime, and support the recyclability or biodegradability of defunct materials and factory waste. Needs to use low carbon footprints and mitigate carbon emissions.

Green Networking would include, using products which is having more Energy Stars like 6 star, implementing virtualization, server consolidation, upgrading older equipment for newer, choosing more energy-efficient products like energy-efficient central processing units (CPUs), incorporating systems management to increase efficiency, applying telecommuting, remote administration, working from home, videoconferencing, proper disposal of electronic waste (e-waste) etc.

A Green Data Centre is a repository with advanced technologies and strategies for the data management, storage, and dissemination of data in which the mechanical, lighting, electrical and computer systems are designed to achieve maximum energy efficiency and minimum environmental impact. Some of the examples include, recycling products, hybrid/electrical equipments, etc.

Middleware is a software infrastructure that binds together the applications, operating systems, network hardware, and network stacks. Its main services include standardized system services to diverse applications. It provides a runtime environment that can support and coordinate multiple applications. However the main important mechanism of middleware is to achieve adaptive and efficient utilization of heterogeneous resources. A middleware layer act as a broker between applications and/or user, translating application requirements into configuration parameters etc. Due to the dynamism of mobile environments, applications should have some degree of power awareness to best reach their network lifetime requirements. The middleware should supply mechanisms that allow the application to monitor the network state through a high level interface [1].

2. Proposed Architecture

Green Computing is the study and practice of designing, manufacturing, using, and disposing of computer related devices with energy efficient. Before designing any such environment, we should study about Green Computing Architecture w.r.t power saving and its goals, impact, matrices, solutions etc.

The major approaches of the Green Computing is, Product longevity, Software and deployment optimization, Power management, Materials recycling, Telecommuting and Low performance computing.

The major task of middleware is Code Management, Resource Management, Resource Discovery, Database Data Management, Storage Supporting, Integration, Security Support, Domain Service, Resource Tracking, Heterogeneity, Mobility and Network1 Topology management, Scalability, Quality of Service, Context Awareness Services etc.

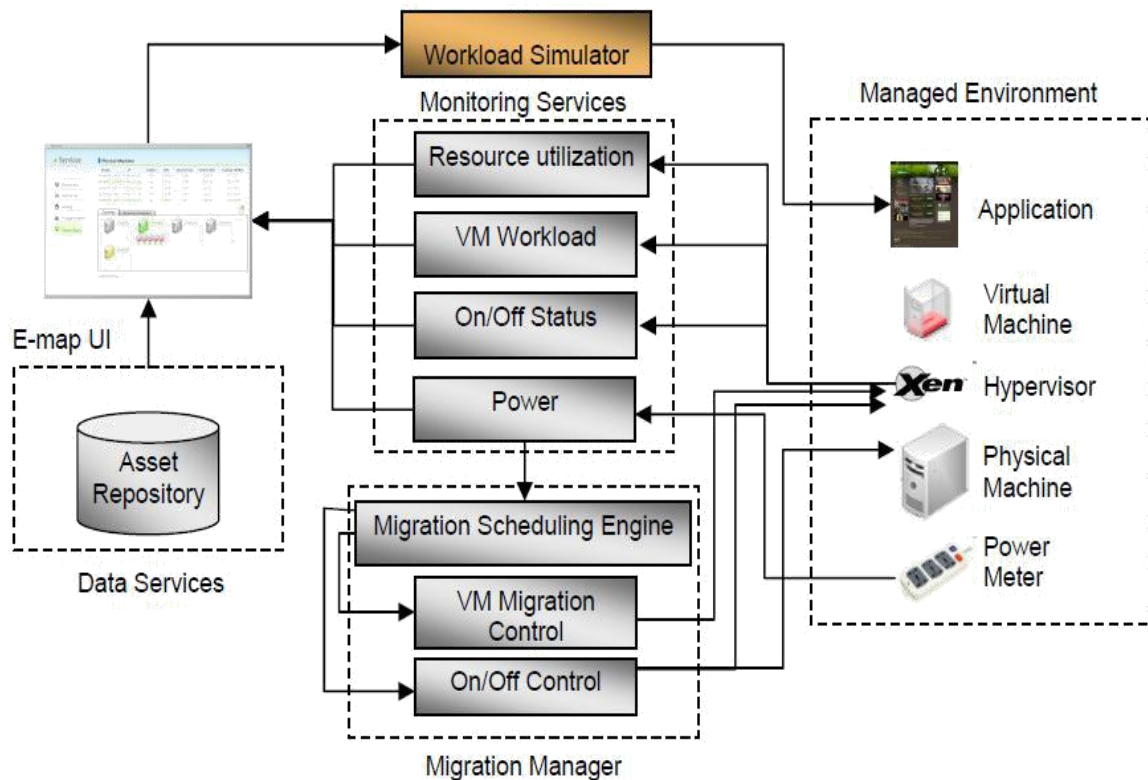


Figure 2. Green Cloud Architecture

In this proposed architecture, the middleware is de-signed to evaluate Data center power, Operating system support, Power supply, Storage, Video card, and Dis-play.

Figure 1 shows the architecture of Mobile-Cloud Computing based Middleware for Green Computing. MANET is a set of wireless nodes, the data gathered by these nodes can be delegated on to Cloud or Middle-ware of Cloud based on the requirement and applications. There could be applications based on MANETs data processed by middleware. There are few combinations of computing and middleware techniques,

- a) MANET Middleware
 Here, heterogeneous data types of different mobile de-vices can be handled and constructing User Interface data.
- b) Cloud Middleware
 Here, heterogeneous complex data of different cloud systems can be handled and constructing User Interface data.
- c) MANET-Cloud Middleware
 This middleware handles heterogeneous cloud computing data and MANET computing data and constructing User Interface data.
- d) Green Computing Middleware
 It uses collaborative methods and autonomic computing techniques for energy management, configuration, performance, safety, availability, scalability of solution, accuracy, etc

In the above middleware services, managing power saving is primary concern and resource sharing is common agenda.

Figure 2 shows Green Cloud Architecture [3] with the functions of components and their relations, this enables enterprises to consolidate computing resources, reduce management complexity and speed the response to business dynamics. Also it enables to improve the re-source utilization and reduce power consumption. This architecture monitors a variety of system factors and performance measures including application workload, resource utilization and energy

consumption, hence the system is able to dynamically choose workload and re-source utilization. Green Cloud Computing System Architecture Technologies consist of five core technologies:

- a. Scalable Network Architecture
- b. Energy-efficient Cooling and Power Efficient System
- c. Modular Cloud Computing System
- d. Scalable Virtual Internet Appliance and
- e. Flash Memory Based Cloud Storage System.
- f. Each design of these subsystems should be integrated

so that the whole architecture can be seamlessly synchronized. The overall summary of this architecture is to reduce the unnecessary power consumption in a cloud computing environment. In this architecture, E-Map is a web-based service with Flash front-end which is connected to the Workload Simulator which gives a user interface to show the real-time view of present and past system on/off status, workload status, resource consumption, temperature and energy consumption in the system at multiple scales, from high-level overview down to individual IT devices and other equipment. Workload Simulator receives a user instructions to adapt workload, e.g. workloads, CPU utilisation etc. Managed Environment contains virtual machines (VM) and/or commands on it, resources, physical machines, devices, and applications with adaptive workload, etc. Monitoring Service observes and collects comprehensive factors such as application work-load, resource utilization and power consumption, etc. Migration Manager triggers live conversion and makes decision on the placement of virtual machines on physical servers based on the knowledge or information provided by the Monitoring Service.

3. Conclusions

In the future software computing technology, Mobile computing, Cloud computing and Green computing makes a big positive difference in terms of global warming, costing, lifetime etc. A middleware will fill the heterogeneity gap among these three computing techniques. Hence better resource management and energy management can be achieved. A novel approach is proposed where middleware is coordinating between mobile and cloud computing techniques to achieve green computing for future networking. Green computing is basically study and practice of using computing resources efficiently, the primary objective is to account for the triple bottom line viz "People, Planet, Profit".

References

- [1] N. Chandrakant, H. Deshpande, J. Tejas, P. D. Shenoy, K. R. Venugopal, and L. M. Patnaik. "emid: Maximizing lifetime of wireless sensor network by using energy efficient middleware service". In *International Journal of Innovative Technology and Creative Engineering*, volume 1, pages 20–24, Mar 2011.
- [2] U. Irfan and Climate Wire. Cloud computing saves energy. In <http://www.scientificamerican.com/article.cfm?id=cloud-computing-saves-energy>, June 2013.
- [3] Liang Liu, Hao Wang, Xue Liu, Xing Jin, WenBo He, QingBo Wang, Ying Chen. Greencloud: A new architecture for green data center. In *ICAC-INDST*, pages 29–38, June 2009.
- [4] Margaret Rouse. Green networking.
- [5] Wikipedia. Green computing. In http://en.wikipedia.org/wiki/Green_computing.
- [6] Wikipedia. Mobile computing. In http://en.wikipedia.org/wiki/Mobile_computing.