Survey on Efficient Routing Techniques in Cloudlets

Madhavi Macharapu
Assistant Professor, DVR & Dr HS MIC College of Technology, Kanchikacherla, A.P. India
Email Id: madhavi.macharapu@gmail.com

Abstract: Cloud Computing is a technology which refers to configuring, manipulating and accessing the hardware and software resources on demand basis. It allows application software to be operated using internet enabled devices. The usage of cloud Technology in Mobile Communication has been drastically increasing for data transmission and exchange of data over mobile devices. One of the challenge for data delivery is cost and scalability .Day to Day the usage of mobile by users for data storage, transmission with cloud has been increasing the transmission of data through intermediate complex routers take more cost in terms of power consumption, scalability ,limitation of bandwidth so, we need efficient routing techniques that helps us to have optimized path for transmission of data over cloudlets so that the cost taken for transmission can be reduced and allows the data transmission for multiple users can be provided without any cumbersome .

Keywords: Cloud Technology, Mobile Communication, Routing Techniques, Optimized Path, Scalability

I. INTRODUCTION

Cloud Computing is a technology which refers to configuring, manipulating and accessing the hardware and software resources on demand basis. It allows application software to be operated using internet enabled devices. The services provided by cloud computing is categorized into three:

1. Saas (Software as a Service) is a software delivery method which provides access to software and its function remotely as a web based service to customers. This service is available to users anywhere in the world.

2. PaaS (Platform as a Service): It provides a platform and environment to allow developers to build applications and services, these services are constantly updated and new features added. It includes software support and management networking, deploying, testing.

3. Iaas (Infrastructures as a service) it provides access to computing resource in a virtualized environment like bandwidth, network connections, load balancers, IP address.

These services are provided to consumers for 24/7/365 days. Managing of resources, security, availability everything is provided by the service providers. The main advantages of using cloud computing are less cost, availability, easy access to information, backup/recovery.

The usage of mobiles became part of our life because of their useful capabilities. Users generally depend on mobile device for data transfer, making calls of audio and video, accessing internet. The scenario of combining mobile technology with cloud helps the users to maintain backup, provides resource availability, reduces the management cost, and allows resource sharing, because there are many limitations in mobile devices like limited battery life, limited processing capability and less storage capacity.

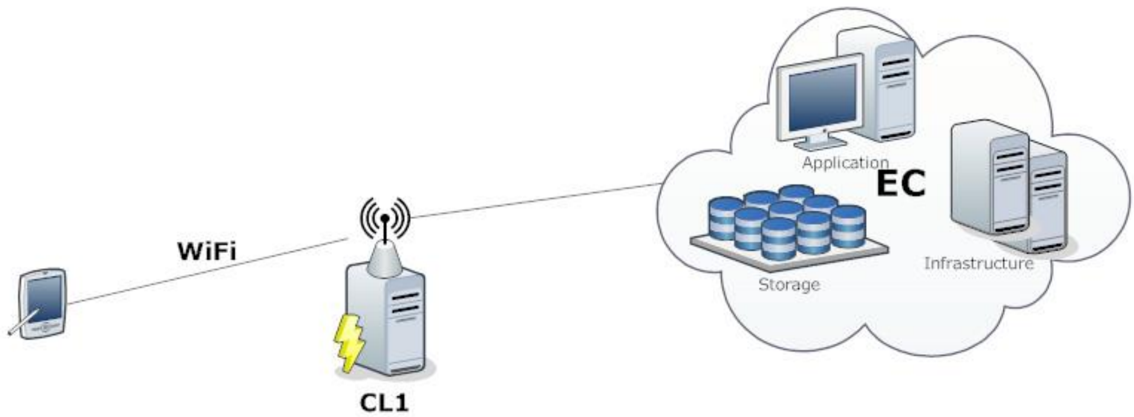
II. RELATED WORK

The lot of research work and effort are on the go, for improving the efficiency of routing in mobile cloud. These routing protocols are stranded on the application needs and the structure of the network.

However, there are some issues that must be taken into consideration while raising the routing protocols for mobile clouds. The most important and dazzling factor are the effectiveness and scalability that directly persuade the lifetime of the network. There are

Numerous surveys and Journals on routing protocols in cloud lets and an effort is done are presented below. The author [1] proposed a weight-based route selection algorithm which is a on- demand routing based on optimized route selection technique .In this model each base station holds a device named link manager which would communicate with mobile switching centre to measure and try to find various links for transmission between source and resource manager .link manager calculates the weight factor for different link subject to path cost and channel capacity .The link with greater weight factor is selected as the optimized route i.e. the shortest path is selected according to weight factor. The Resource Manager acts as a central database repository for all cloud nodes registered with it. The resource manager is responsible for updating the routing table. This algorithm reduces the time and energy through load balancing while routing mobile network transmission connected to a cloud environment.

The author [2] proposed MCC cloudlet-based model. These model is composed of a set of distributed and well-connected cloudlets within one location where most mobiles use cloud services. All of these cloudlets are connected to the Enterprise remote cloud. The mobile device directly communicates with the cloudlet which is connected to the Enterprise cloud. Even if the cloudlets are available Some Mobile cloudlets are not connected to enterprise model and in some cases device need to access a file stored in the Enterprise Cloud In another case, the mobile device will need to access services that are not available in the Cloudlet.



The Proposed Model works as follows:

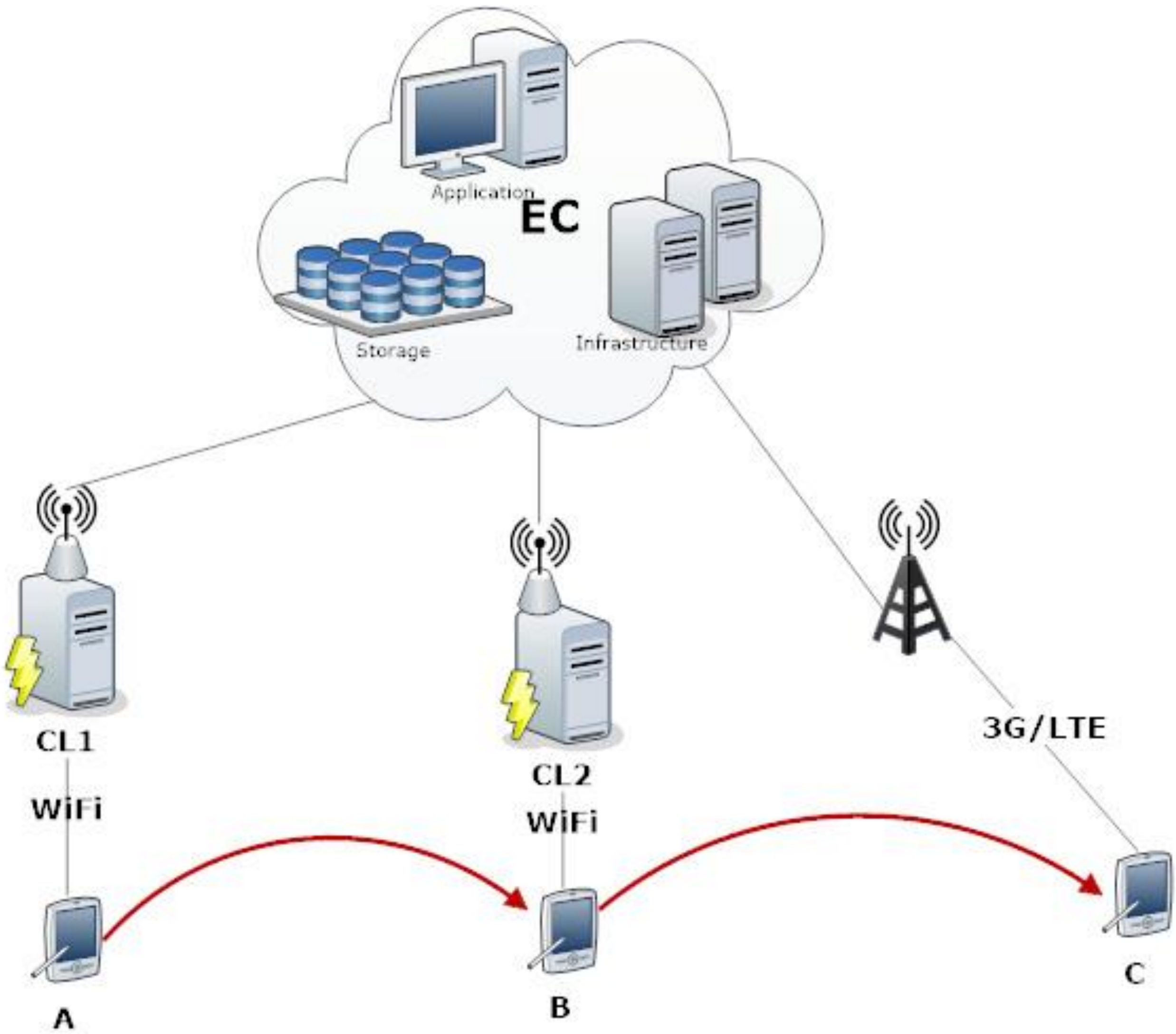
Mobile user in location A is connected to Cloudlet1 (CL1) using Wi-Fi connection while it is available in CL1 coverage area. Moving out of the coverage range of CL1 may result in moving to the coverage area of another cloudlet like moving to location B or moving to 3G\LTE coverage area like location C. CL1 and CL2 are also connected to the EC through wired connection. Consider the following mobility scenario:

a) Initial location is A and stay in A: In this situation, the mobile device accesses the EC through CL1 and remains in the coverage area of this CL until the requested job is completed.
b) Initial location is A and then moves to location B: In this situation, the mobile device accesses the EC through CL1, but before the completion of the requested job it changes its location to the coverage area of CL2 and outside the coverage area of CL1. In this case, the mobile device uses the

CL2 to perform new tasks or to complete the previous jobs, so that, if there are any data or processes remaining in the CL1, a request is sent to CL1 to send this information to CL2 to complete these jobs. This case is like moving from location B to any other location with CL coverage like moving back to A.

c) Initial location is B and then moves to location C: In this situation, the mobile device accesses the EC through CL2, but before the completion of the requested job, it changes its location to outside the coverage area of the host CL. Unfortunately, there is no available CL at location C. In this case, the mobile device should use the costly 3G/LTE connection to access the EC. Using this connection, mobile device can perform new tasks or complete the previous job, so that, if there are any data or processes remaining in the CL2, it will send a request to CL2 to send this information to EC in order to complete these jobs.

d) Initial location is C and then moves to location B: In this case, the mobile user is moving from 3G/LTE coverage area to CL coverage area. The mobile user data processing can be moved to the CL after that.



The author experimented this scenario in two approaches to manage this information.

i) Centralized approach

In this approach, the EC acts as a server is responsible for managing and tracking mobile device movement in the system. This management is done by storing the tracking information about the mobile device.

ii) De-centralized approach

In this approach, the mobile device acts as a cloudlet itself is responsible for managing its movement in the system. The mobile devices store a movement history along with the service that is currently running and the hosting CL to provide this information to new CL as needed

The author [3] the idea of the author is to reduce the number of packets to be transmitted over the network thus lead to reduce in energy and delay. So, they combined set of packets to process as single packet and named it as data collection. The objective of these Cloudlet-based data collection prototype is reduced packet transmission energy by using Wi-Fi comparing with cellular communication and Comparing with multiple transmissions in wireless sensor networks, sensor nodes in WBAN (Wireless Body Area Network) are designed for direct transmissions.

The author developed Cloudlet-based WBANs prototype system. These models one of the objective is to Support mobility of WBAN users. Proposed solution provides a holistic solution that can be deployed in different environments which are not limited in the health care systems. Examples of these applications are fire fighters, military, students in school or university or elders in elderly house, where the deployment of the cloudlets depends on the mobility and clustering the users in these applications

Therefore, in the implementation, a random way point mobility model is used to represent a WBAN user's mobility. At any given point in time and for a given area, the mobile user can be in one of following three regions: (1) Cloudlet Region (CR): in this region WiFi coverage is available, where a user can use the WiFi technology to transmit a data packet to the cloudlet. (2) Enterprise Region (ER): in this region only cellular coverage is available, where a user can use only cellular technology to transmit a data packet to the enterprise cloud. (3) Not-covered Region (NC), where neither WiFi nor cellular technology is available. In this case a user should buffer the packets until one of the above technologies is available, then to be able of transmitting the packet to the enterprise cloud. through random mobility a user can move from one region to another, therefore the transmission of the data packet depends on the region covered. The WBAN users are able also to receive a data that is transmitted either by the near cloudlet or the enterprise cloud. Such data could contain some controlling, queries or alarm messages for a specified WBAN user. Using these prototype system, they provided a scalable storage and processing infrastructure for large scale WBANs system.

The author [4] proposed a trusted model which mainly used for security and to minimize the average waiting time, to minimize the completion time and to maximize the utilization of the resources.

As a first step to investigate the problem about how to choose cloudlet nodes available for offloading independent tasks that dynamically arrive at the client nodes in mobile cloud computing environments. The author used the basis of both online scheduling and batch scheduling algorithms in multiprocessor systems, six heuristics were proposed and their performances with respect to both user-centric and system-centric metrics were evaluated in their experiments. In this Model client nodes and cloudlet nodes interconnect via ad hoc networks. All the nodes may move dynamically and establish connection with others. While they are moving, new tasks may occur in the client nodes and be processed either locally or be offloaded to cloudlet nodes. The previous proposed method or assumption is not suitable for highly dynamic mobile cloud computing environments, in which the nodes are mobile and the connectivity and the availability of resources always change dynamically. So, the author assumed the offloading decision is made totally based on the state of the computing environment when the decision is made and assume the state will maintain during the time period of interest. These assumptions, although unable to reflect exactly the intrinsic dynamical characteristics of mobile ad hoc cloud computing environments, which can be regarded as a solid basis for future researches to consider more complicated state, e.g., mobility prediction-based

Scheduling:

Here, At the decision-making moment, let the connected graph G = (V, E) represent

The mobile ad hoc cloud. The vertices, V, represent the client nodes and the cloudlet

Nodes that can communicate with others. The client nodes are responsible for generating tasks and submitting them to cloudlet nodes for offloading. The edges, E, represent the connection links between nodes. It is assumed that there is only at most one direct link between each pair of nodes. If there is no direct link between two nodes, they may establish an end-to-end route on the basis of certain MANET routing protocol [8] where the end-to-end bandwidth is very crucial for estimating the amount of time needed to transfer a given amount of data through multi-hop routes, by using the equation

if (HopNumber == 1) Bandwidth = MinBandwidth

else if (HopNumber == 2) Bandwidth = MinBandwidth/2

else if (HopNumber == 3) Bandwidth = MinBandwidth/3

else Bandwidth = MinBandwidth/4.

Besides the nodes, the tasks are another important component of the system. Tasks occur in client nodes according to certain process. Once occurred, they are submitted for offloading decision and thereafter allocated to certain cloudlet nodes for execution. For every task, it is described by a tuple {arrival time, computation amount, input Data, output data}. The items in the tuple individually represent the time when the task occurs, the amount of computation, the amount of data before execution and the amount of data after execution.

Based on the properties of the nodes and the tasks, when allocating a given task to some cloudlet node accessible, the expected communication cost, and the expected completion time can be figured out. Consequently, an offloading decision can be made according to certain criteria. The author in the proposed algorithm used three different tasks:

METComm: Based on the MET algorithm, the Minimum Execution Time with Communication heuristic assigns each task to the surrogate which can run the task in the least amount of total offloading time (i.e., tcomp i j + tcomm i j).

MCTComm: The Minimum Completion Time with Communication heuristic

assigns each task to the surrogate with the minimum expected completion time.

MinHop: The Minimum HOP heuristics assigns each task to the surrogate with which the number of hops from the client node is minimum. The author also implemented batch scheduling algorithm.

The Author [5] mainly focused on the security. They designed a trusted model in MANETs. The Author presented a method that is used for finding entity's trust. For minimizing the overhead in a resource-constrained. Environment as that of a MANET used only passive monitoring to evaluate the behaviours of a node. Subsequently,

The behaviours are translated to an estimate of trust, which the monitoring entity has on the monitored one [9]. The model approaches decentralized trust inference model to quantify the 'trust' for entities based on multi-dimensional trust attributes.

With some assumptions, before designing the trust inference framework: (1) To ensure the practicality of Trust model, we follow the tenet that the 'trust' should be defined and quantified locally. In other words, the trust value is Quantified only using the local information for scalability [14]. (2) the communications between two physical neighbours (one-hop) are considered more reliable than those of multi-hop communications. (3) For identifying misbehaving nodes, each monitoring node should be equipped with some local detection mechanism [12] (e.g., in this paper, the neighbour's behaviours can be monitored via using the promiscuous mode).; (4) The wireless link is symmetrical, while the 'trust' is not necessarily symmetric between two physical neighbourhood entities; (5) The cooperative action in the network interaction is encouraged, which is naturally required in such networks.

Basing on the above assumptions, a mobile ad hoc network with n nodes can be abstracted. Due to the mobile nodes join, leave, or fail over time, the number of n may be dynamically changing. In such networks, trust is a relationship between any two physical neighbour entities, which also can be described as an edge of a directed graph abstracted from the graph theory [10, 11]. Under permitting conditions, each node in the trust system is initially authenticated by an authentication method. In our trust model, every node maintains a trust value for each of its neighbours. This value is a measure of the credible degree of low and high, defined in a continuous range between 0 and 1 (i.e., $0 \leq TVij \leq 1$). Let vi and vj denote the monitoring node and the monitored node, respectively. To get accurate trust value between the normal nodes and the malicious nodes the author proposed an improved SCGM (1,1)-Markov chain prediction model to effectively forecast an interest node's trust. This not only provides a relative identification between the normal nodes and the malicious nodes, but also offers a prediction for a node's future behaviours. The ultimate goal of the mechanism is in response to the sudden or hidden malicious nodes in the routing path, in order to maintain the efficiency of routing.

The Disadvantages of the above methods for effective routing techniques are:

1.The first method suffers from complexity and cost

2. In the second method using of the two approaches is dependent on the simplicity and easiness of management required by the mobile side. In the first approach, the mobile device is not aware of the management process; as a result, everything is done by the EC.

3.In the Third Method Cloudlet system represents a fully cloud system capabilities but in small scale. It may vary from a workstation like system

to a more complex set of physical servers.

4.In the fourth method batch scheduling mode is used only for but only for the centralized or the hierarchical offloading architecture how to offload incoming applications to available cloudlets in such a mobile ad hoc cloud computing environment is still a challenge. This makes the computation offloading problem more complicated.

To overcome this problem, the proposed model uses evolutionary algorithms. These Evolutionary algorithms like genetic algorithms, Swarm Optimization provides efficient and optimized path for routing the packets among the cloudlets

Genetic Algorithms

Genetic Algorithms (GAs) are adaptive heuristic search algorithm based on the evolutionary ideas of natural selection and genetics. As such they represent an intelligent exploitation of a random search used to solve optimization problems. Although randomised, GAs is by no means random, instead they exploit historical information to direct the search into the region of better performance within the search space.

GAs simulate the survival of the fittest among individuals over consecutive generation for solving a problem. Each generation consists of a population of character strings that are analogous to the chromosome that we see in our DNA. Each individual represents a point in a search space and a possible solution. The individuals in the population are then made to go through a process of evolution.

GAs is based on an analogy with the genetic structure and behaviour of chromosomes within a population of individuals using the following foundations. Individuals in a population compete for resources and mates. Those individuals most successful in each 'competition' will produce more offspring than those individuals that perform poorly. Genes from `good' individuals propagate throughout the population so that two good parents will sometimes produce offspring that are better than either parent. Thus, each successive generation will become more suited to their environment.

Search Space

A population of individuals are being maintained within search space for a GA, each representing a possible solution to a given problem. Everyone is coded as a finite length vector of components, or variables, in terms of some alphabet, usually the binary alphabet {0,1}. To continue the genetic analogy these individuals are likened to chromosomes and the variables are analogous to genes. Thus, a chromosome (solution) is composed of several genes (variables). A fitness score is assigned to each solution representing the abilities of an individual to `compete'. The individual with the optimal (or generally near optimal) fitness score is sought. The GA aims to use selective `breeding' of the solutions to produce `offspring' better than the parents by combining information from the chromosomes.

III. CONCLUSION

For effective routing, we are going to use evolutionary algorithms which provides an optimized pat. Genetic Algorithms is better than conventional AI in that it is more robust. Unlike older AI systems, they do not break easily even if the inputs changed slightly, or in the presence of reasonable noise. Also, in searching a large state-space, multi-modal state-space, or n-dimensional surface, a genetic algorithm may offer significant benefits over more typical search of optimization techniques.

Conflict of interest: The authors declare that they have no conflict of interest.

Ethical statement: The authors declare that they have followed ethical responsibilities.

REFERENCES

[1]. Debabrata Sarddar, Rajesh Bose and Sudipta Sahana ”A novel approach on weight based optimized routing for mobile cloud computing”

[2]. Yaser Jararweha, Lo'ai Tawalbehb, Fadi Ababneha, Abdallah Khreishahc, Fahd Dosarib “Scalable Cloudlet-based Mobile Computing Model “.

[3]. Muhannad Quwaider , Yaser Jararweh “Cloudlet-based Efficient Data Collection in Wireless Body Area Networks”.

[4]. Bo Li,Yijian Pei1, Hao Wu1 · Bin Shen “Heuristics to allocate high-performance cloudlets for computation offloading in mobile ad hoc clouds”

[5]. Hui Xia, Jia Yu, Cheng-liang Tian, Zhen-kuan Pan, Edwin Sha Light-weight “Trust-enhanced On-demand Multipath Routing in Mobile Ad Hoc Networks”

[6]. Shires D, Henz B, Park S, Clarke J (2012)” Cloudlet seeding: spatial deployment for high performance tactical clouds”.

[7]. Satyanarayanan M, Lewis G, Morris E, Simanta S, Boleng J, Ha K (2013) “The role of cloudlets in hostile environments”. IEEE Pervasive Comput 12(4):40–49

[8]. Sarr C, Chaudet C, Chelius G, Lassous IG (2008)” Bandwidth estimation for IEEE 802.11-based adhoc networks”. IEEE Trans Mobile Comput 7(10):1228–1241

[9]. Xia, H.; Jia, Z.; Li, X.; Ju L. and Sha. E. (2013) “Impact of Trust Model on On-demand Multi-path Routing in Mobile Ad Hoc Networks”. Computer Communications, 36(9), 1078-1093.
[10]. Xia,H.; Jia, Z.; Li, X.; Ju, L. and Sha, E.. (2013) “Trust prediction and trust-based source routing in mobile ad hoc networks. Ad Hoc Networks”, 11(7), 2096-2114.
[11]. Rahimi, M.; Riazi, A. (2014) “On local entropy of fuzzy partitions. Fuzzy Sets and Systems”, 234, 97-108.
[12]. Balan R, Flinn J, Satyanarayanan M, Sinnamohideen S, Yang H-I (2002) “The case for cyber foraging”. In: Proceedings of the 10th workshop on ACM SIGOPS European workshop. ACM, pp 87–92
[13]. Mtibaa A, Snober MA, Carelli A, Beraldi R, Alnuweiri H (2014) “Collaborative mobile-to-mobile computation offloading”. In: 2014 international conference on collaborative computing: networking, applications and worksharing. IEEE, pp 460–465
[14]. Fahim A, Mtibaa A, Harras KA (2013) “Making the case for computational offloading in mobile device clouds. In: Proceedings of the 19th annual international conference on Mobile computing and Networking”. ACM, pp 203–205
[15]. Shires D, Henz B, Park S, Clarke J (2012)” Cloudlet seeding: spatial deployment for high performance tactical clouds”. In: The 2012 international conference on parallel and distributed processing techniques and applications. CSREA Press, pp 1–7
[16]. Saeid A, Zohreh S, AbdullahG(2012) “Mobile cloud computing: a review on smart phone augmentation approaches”. arXiv preprint
[17]. Abolfazli S, Sanaei Z, Ahmed E, Gani A, Buyya R (2014)” Cloud-based augmentation for mobile devices: motivation, taxonomies, and open challenges”. IEEE Commun Surveys Tutorials 16(1):337–368
[18]. Sharifi M, Kafaie S, Kashefi O (2012) “A survey and taxonomy of cyber foraging of mobile devices”. IEEE Communication Surveys Tutorials 14(4):1232–1243
[19]. Kristensen MD, Bouvin NO (2010) “Scheduling and development support in the scavenger cyber foraging System”. Pervasive Mobile Computing 6(6):677–692
[20]. Shi C, Lakafosis V, Ammar MH, Zegura EW (2012)” Serendipity: enabling remote computing among intermittently connected mobile devices”. In: Proceedings of the thirteenth ACM international symposium on mobile ad hoc networking and computing. ACM, pp 145–154
[21]. De Falco I, Scafuri U, Tarantino E (2014) “Two new fast heuristics for mapping parallel applications on cloud computing”. Future Generic Computing System 37:1–13
[22]. Gao B,HeL,Liu L, Li K, JarisSA(2012) “From mobiles to clouds: developing energy-aware offloading strategies for workflows”. In: Proceedings of the 2012 ACM/IEEE 13th international conference on grid computing. IEEE Computer Society, pp 139–146
[23]. Maheswaran M, Ali S, Siegal HJ, Hensgen D, Freund RF (1999)” Dynamic matching and scheduling of a class of independent tasks onto heterogeneous computing systems”. In: Eighth heterogeneous computing workshop. IEEE, pp 30–44.

