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A Survey on Resource Allocation policies in Mobile ad-hoc Computational Network

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Abstract:

In this paper computability of distinctive resource allocation policies in different dimensions are expressed for mobile ad-hoc computational network. Resource scheduling is a complicated task in mobile computing since there are many different alternatives with varying capacities. Resource allocation task is mainly scheduled for the Process which gives the available user preference and resources The idea of the mobile ad hoc computational Grid is motivated by recent advancement in mobile computing which now make it feasible to design and develop the next generation of applications through sharing of computing resources in mobile ad hoc environments. There should be a provision that all resources are made available to complete intensive task in efficient manner to satisfy their need without compromising on the performance of the system. The process of optimizing the resources being allocated is the main challenge in mobile computing network. Hence, the main aim of this paper is to identify open challenges associated with efficient resource allocation. In this regard, we study, first, outlines the problem and available for this purpose. Furthermore, available techniques already presented in the literature are summarized. The advantages and disadvantages of the existing techniques are comprehensively analyzed.

Keywords: Mobile computing, Ad-hoc network, Computational grid, Resource allocation.

1. Introduction:

In recent years, with mobile computing and communication technologies growth, Mobile ad hoc computational networks are emerging as a new computing paradigm, which enabling innovative applications through sharing of computing resources among mobile devices without any pre-existing network infrastructure. A computational network is a software infrastructure that allows distributed computing devices to share computing resources to run computationally intensive applications. A mobile ad hoc network means wireless network of mobile devices that communicate with each other without any preexisting network infrastructure. For example, a group of mobile robots deployed in an urban environment can collaborate with each other to do an automated video surveillance or a group of soldiers can use their wearable computing devices and range of sensor nodes to form a network in order to form a 3D map and to identify and monitor stationary and moving objects within a map. Resource allocation is a most important task in any parallel and distributed computing system. Compared to traditional infrastructure-based distributed systems such as Grids and Clusters, mobile ad hoc computational network are characterized by shared and unreliable communication medium, low bandwidth, higher latency, restricted battery power, node mobility and infrastructure-less network environment. So that, resource allocation schemes proposed for traditional distributed systems cannot be applicable for mobile ad hoc computational Grids.

2. Need of Efficient Resource allocation:

In Mobile ad-hoc computational network, Resource Allocation (RA) is the process of assigning available resources like processing power, memory, bandwidth, battery power to different tasks for any intensive application. Communication in mobile ad hoc networks is always expensive and unreliable. There are many factors that contribute to communication cost. Unreliable and short-term connectivity between nodes can increase communication cost due to frequent failure and activation of links, and inappropriate resource allocation can increase communication cost due to multi-hop communication between dependent tasks. To reduce communication cost, an efficient and effective resource

allocation scheme is required that allocates interdependent tasks to nodes within a mobile ad hoc computational network.

3. Related Work:

Most of the work on resource allocation in computational Network is focused towards infrastructure based powerful computing systems connected through high performance communication networks. However, due to recent advancements in mobile computing and communication technologies, there is a significant shift towards mobile Grids research. The research in mobile Grids can be divided into two categories. In the first category, mobile devices are allowed to access fixed Grid resources, while in the second category, they can be used as a computing resource within a Grid. The second category is further divided into two subcategories. In the first subcategory, mobile devices are integrated with infrastructure-based computing systems and in the second subcategory, they can collaborate with one another without any pre-existing network infrastructure. The research on resource allocation in mobile ad hoc computational network is still in a preliminary phase and a very few schemes based on decentralized architecture have address issues such as node mobility, energy management, task failure, constrained communication environments, limited battery power, task dependencies, and lack of pre-existing network infrastructure.

The surveys on scheduling strategies, techniques, methods have been done and a lot of task/job scheduling algorithms are introduced. The resource scheduling is been a tough job especially as it is the one which decides which resource will be allocated to which task and for how much time. There are also resource allocation strategies that take into consideration different parameters. While making a strategy the allocation methods should keep into consideration resource contention, task types, resource capabilites, dependencies between task.

The different resource allocation methods review like An Energy-Efficient Resource Allocation Scheme (EERA**),** Network Aware Rank-based Resource Allocation Scheme, Two Phase Node Selection and Assignment Algorithm, Distance based resource allocation, scheme, Distributed resource allocation scheme, Transmission Power-based Allocation Scheme, A Network Aware and Power-based Resource Allocation.

4. Algorithms/Techniques Introduced with Domains:

4.1 An Energy-Efficient Resource Allocation Scheme (EERA)

EERA aims to reduce energy consumed in transmission of data between dependent tasks. It takes into account dependencies and task type, and allocates interdependent tasks to nodes which are accessible to one another at minimum transmission power. Before task allocation, all tasks are sorted and are assigned to different levels depending on precedence and parallel execution dependencies. The lower most level consists of tasks with no predecessors and the higher most level consists of tasks with no successors. Tasks with parallel execution dependencies are assigned to same level. At each level, tasks are assigned a priority according to task type. The remote communication-bound tasks have highest priority followed by local-communication-bound and computation-bound tasks. Allocation starts from the lowest level and at each level, tasks are considered by priority. Only tasks with no predecessors whose predecessors have completed execution are considered for allocation. The EERA is different from existing work because it takes into account dependencies between tasks and is based on hybrid architecture which results into effective allocation decisions and also reduces processing burden from a single node[2].

4.2 Network Aware Rank-based Resource Allocation Scheme

In this scheme, the nodes maintain connection quality information of their kNN. Based on connection quality, they calculate their rank and send that to resource allocation service. The decision making is divided into two levels: at first level resource allocation service selects a node with highest rank while at second level node selected at level-1 allocates tasks to its kNN based on connection quality. Since network environment is dynamic, each node calculates its rank at regular intervals. If new calculated rank is greater than threshold value then it sends to resource allocation service. It has also been observed that sometime connection quality changes for a short time and then becomes stable. Calculation of rank based on short term information may be misleading. To avoid this problem connection quality is monitored for time interval *x* and then is compared against a threshold value to decide whether to send it or not[2].

4.3 Two Phase Node Selection and Assignment Algorithm

The two phase node selection and assignment algorithm ensures that nodes with a minimum communication

distance are selected for allocation of interdependent tasks. It is slightly flexible in a sense that if other nodes are also available with a minor distance difference, which doesn't affect communication cost, then among those a better suited node is selected depending on a task type. This improves a utilization of nodes while maintaining a minimum distance among. communicating tasks. The tasks with low processing requirements such as local and remote communication-bound tasks are allocated to low processing nodes making high processing nodes available for computation-bound tasks[5].

4.4 Distance based resource allocation scheme

Centralized distance based resource allocation scheme for interdependent tasks in mobile ad hoc computational Grids. The scheme selects nodes based on distance information to reduce communication cost and application completion time. It is based on a group mobility model and is adaptive to task failure due to node mobility and low battery power.

4.5 Distributed resource allocation scheme

Distributed resource allocation scheme based on first come first serve strategy that allows each mobile node to perform a mapping based on job's requirements. It employs a proactive and reactive fault tolerance mechanism and supports redundant execution of tasks to deal with task failure[6].

4.6 Min-Min algorithm

Min-Min algorithm is for mobile grid scheduling, which concerns with the resource reliability. The main idea of Min-Min algorithm is to classify the tasks of intensive application and use different ways to calculate the resource reliability on the basis of different parameters and then select the most reliable resource to process the task[3].

4.7 *Transmission Power-based Allocation Scheme*

In this method, the idea is to allocate interdependent tasks to nodes that accessible at minimum transmission power. To allocate an interdependent task set, the resource allocation service first sends the m to grid members, where m is the number of tasks in a set. Each grid member runs the kNN search algorithm, where k >= m, calculates the weight and sends the weight to the resource allocation service. The resource allocation service then selects the node with the highest weight. The decision to allocate tasks within a set is made by the selected node, which then allocates the tasks to its kNN according to task type[2].

4.8 A Network Aware and Power-based Resource Allocation

In this approach, author combines the transmission power-based algorithm and connection quality-based algorithm to calculate node's grade. Power-based interdependent tasks to nodes based on transmission power control mechanism while rank-based allocation scheme considers connection quality in order to make allocation decisions. Using transmission power-based algorithm they calculates weights of the nodes and using quality-based algorithm they calculated rank of nodes. By using weights and ranks of every node they calculate their grade. Using that grade allocations are done[2].

5. Results and Analysis:

The following table summarizes scheduling strategies on scheduling method, parameters, and other factors. The different algorithms are working on same parameters at some cases. Each algorithm focuses on improving different parts of cloud environment. The differences are shown in Table 1.

Table 1: Different Allocation Strategies/Methods

Sr. No.	Resource allocation Strategies /Method	Allocation Parameters	Impacts
1	An Energy-Efficient Resource Allocation Scheme (EERA)	Energy Consumption	Reduce energy consumed in transmission of data between dependent tasks.
2	Network Aware Rank-based Resource Allocation Scheme	Network Characteristics	Nodes maintain connection quality information helps for dynamic decisions
3	Two Phase Node Selection and Assignment Algorithm	Task type, Task dependencies	Nodes with a minimum communication distance selected. task type , dependencies considered for better

			allocations
4	Distance based resource allocation scheme	Distance between nodes	Selects nodes based on distance information to reduce communication cost and application completion time
5	Distributed resource allocation scheme	Fault tolerance	first come first serve strategy
6	Transmission Power-based Allocation Scheme	Energy consumption	Allocate interdependent tasks to nodes that accessible at minimum transmission power
7	A Network Aware and Power-based Resource Allocation	Network quality, Energy consumption	They combines the transmission power-based algorithm and connection quality-based algorithm

6. Advantages and Limitations:

Advantages:

1) In Mobile ad-hoc computational network there is no any pre-existing network infrastructure so easy to build at anywhere, anytime.

2) Because it is wireless network infrastructure so set up cost gets low.

3) Resource allocation scheme helps to gain throughput.

Limitations:

1) As we consider Mobile ad-hoc computational network there is wireless communication so bandwidth limitations are there.

2) Migration problem occurs, when any nodes goes out of range area then need to migrate task to other node. It is not easy to transfer huge data from one node to the other.

3) Because we use mobile nodes as our resource there is limited battery power is biggest limitation for task completion.

4) There is security constrain for Mobile ad-hoc computational networks.

7. Conclusion

Resource allocation is one of the most important task in mobile ad-hoc computational network environment. In this paper we have analyzed various allocation algorithms and tabulated various parameters.. Existing resource allocation algorithm gives high throughput and cost effective but they do not consider reliability and fault tolerance. So we need to concentrate on algorithms that improve reliability and fault tolerance in mobile computing environment.

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