IJCSMS International Journal of Computer Science and Management Studies, Vol. 12, Issue 03, Sept 2012
ISSN (Online): 2231-5268
www.ijcsms.com

Wireless Grid Computing

Surbhi Sangwan

Department of CSE, UIET, MDU, Rohtak, India
surbhisangwan@gmail.com

Abstract

Grid computing is an important and developing computing initiative that involves the aggregation of network connected computers to form a large-scale, distributed system for coordinated problem solving and resource sharing. Wireless Grid is a new computing paradigm. This paper presents a review of wireless grid computing. In this paper various architectures and applications of wireless grids are discussed. Also various challenges related to wireless grids have been discussed.

Keywords*: Grid Computing, Resource Management, Wireless Grids, Architectures and Applications.*

1. Introduction

Wireless grids extend the capability of grid computing to wireless devices. The number of users using laptops, PDAs, cell phones, and other wireless devices is increasing leading to more networked wireless devices, and creating a vast collective potential of unexploited resources. Grid computing has attracted worldwide attention in a variety of applications ranging from physics, chemistry, environment, aerospace and healthcare systems [5], [4].

Grid computing [2], [3] is an important and developing computing initiative that involves the aggregation of network connected computers to form a large-scale, distributed system for coordinated problem solving and resource sharing. Generally wireless devices are characterized by reduced CPU performance, small secondary storage, heightened battery consumption sensitivity, and unreliable low-bandwidth communication. But these devices also may include such additions as cameras, microphones, bar code and RFID readers, GPS receivers and satellite receiver-transmitters as well as a wide variety of special purpose sensor.

Mobile Computing is a generic term describing the application of small, portable, and wireless computing and communication devices. This includes devices like Laptops with Wireless Local Area Networks technology, mobile phones, and Personal Digital Assistants (PDAs) with Bluetooth or Infrared Data Association (IrDA) interfaces. Mobile Grid enables both the mobility of the users requesting access to a fixed Grid and the resources that are themselves part of the Grid. Both cases have their own limitations and constraints that should be handled [6].

2. Characteristics of wireless grid

The main characteristics of Wireless Grid are:-

A. Consists of small, low powered devices.
B. New types of resources like cameras, GPS trackers and sensors can be shared among grid devices.
C. No centralized control.
D. Dynamic and unstable users / resources.
E. Geographically dispersed resources, with different management policies.
F. Includes heterogeneous resources, applications and interfaces.
G. Different security requirement and policies.

3. Types of Wireless Grid

Wireless Grid can be classified into following four categories:-

a) Fixed Wireless Grids
b) Dynamic Wireless Grids
c) Ad Hoc grids
d) Sensor Network Grids

Fixed Wireless grids: The devices are usually static. In wireless grids, wireless devices can act as real grid nodes where part of data processing and storage is taking place. In a special type of wireless grid, all wireless devices are considered pure access devices without processing or storage capabilities [1]; required resources are obtained from a wired, resource-rich backbone grid. Many technical concerns arise when integrating wireless devices into a grid. These include low bandwidth and high security risks, power consumption, and latency.

Dynamic Wireless Grids: As the processing power and other capabilities of mobile devices increases, researchers and commercial organizations are discovering new ways to use and share their resources. When the large numbers of available wireless devices is considered, the potential of

these dynamic ad hoc connections becomes vast In emergency situations, such as during natural disasters and on battle fields, wireless mobile devices might be the only available communication and computation services. Researchers have proposed various techniques for implementing the mobile grid vision, including centralized and P2P structure, intelligent mobile agents, mobile grid middleware

Ad Hoc Grids: These mobile devices range from relatively powerful computing systems carried by a vehicle, to very tiny, low-power sensors that can be implanted in the human body. Although they may know little about the identities and capabilities of each other, a group of mobile devices are able to organize a highly dynamic and infrastructure-less ad-hoc network, in which nodes can communicate in a hop-by-hop manner. Having been constructed from a group of mobile devices, an ad-hoc grid would allow the networked devices to accomplish a specific mission that maybe beyond an individuals computing or communication capacity. Applications of this grid can be wildfire fighting, and e-healthcare emergency, etc.

Sensor Network Grids: Sensor networks are composed of tiny devices that are generally dedicated to a single purpose. Wireless sensor networks integrate detection, processing and communication into the grid. Sensor networks are currently in use monitoring environmental factors such as temperature or humidity change, motion and light intensity. The developments in sensor networks is leading to advances in agriculture, physical building security, firefighting, warfare and a number of industrial areas. RFID technology to track products from manufacture through distribution and delivery and, potentially, to the consumers shopping cart leaving the store is developed.

4. Challenges of Resource Management in Wireless Grids

4.1 Resource Discovery and Selection

The dynamic environment of the wireless Grid makes necessary the use of sophisticated mechanisms for resource discovery and selection. The list of the authorized machines and resources that are available in the Grid infrastructure is continuously updated. The selection of those resources that are expected to meet the time or cost constraints imposed by the user has to be based not only on deterministic criteria but also on stochastic parameters, thus providing complex probabilistic models for the topology of the Grids and their capabilities. Some of the required parameters are resource accessibility, system workload, network performance, etc. A financial criterion of the resources used should be under consideration for the proper resource selection.

4.2 Information Security

Due to their wireless nature, devices in the grid communicate and pass information over standard radio frequencies that can be easily tapped. A number of encryption standards such as WEP have been devised to ensure data security and integrity over these otherwise insecure transmission frequencies.

4.3 Job Replication, Migration and Monitoring

In such context job migration and re-scheduling, as well as job replication and co-scheduling are both efficient ways to guarantee the completion of the jobs according to the restrictions set by the users. Job monitoring is difficult in dynamic environments. Especially job monitoring is responsible for detecting alert situations that could initiate a migration and alternatively identify if a job has been completed so as to suspend/stop/cancel the execution of the other replicas.

4.4 Job Scheduling

In a mobile Grid environment there are many more constraints that would make the job scheduling problem more complicated. The cost of resources is in that case a metric that is subject to context parameters. Imagine what can happen in a big conference room where the aggregated performance due to the many notebooks linked in wireless hotspots can result in a very cost effective solution for “instant” high performance computing. So the optimization criteria for a job scheduling mechanism should take under consideration not only the cost and the performance of each resource, but also the current availability of resources in the context.

4.5 Authentication and Authorization of device/user

The authentication of devices and users as they enter the grid presents additional complexities in wireless grids. To access any grid resources or services, each device and user has to be authorized.

4.6 Energy-efficient medium access

Energy consumption is crucial for the lifetime of battery-limited mobile devices as well as the whole system. To make Grid functionalities feasible in the network of mobile devices, energy efficiency should be the major concern for their implementation in each node.

5. Applications

Some important applications of the Wireless Grids are:-

Emergency Response System: Integrated wireless phone is based on emergency response system. It helps in detecting abnormal patterns in mobile call activity and its location. It initiates dynamic data driven simulations to predict the evolution of abnormality, and initiates higher resolution data collection in localities of interest.

Supply chain management: Using the sensor networks in supply chain management process helps in optimizing customer service for customized orders. It keeps track of expensive commodities. As the goods carrier is unloaded, each item can be sensed and easily located within the warehouse.

Natural Disaster management: The natural disasters like earthquake, flooding, volcanoes, Tsunami, wildfire fighting, etc. cause a serious destruction. As a preservation measure one can set up a sensor grid that consists of wireless sensors and wired sensors. The properly installed and maintained sensor grid can provide an advance warning of future disasters. The work considers both dynamic and static environmental conditions.

Entertainment: Wireless grid can be used for various entertainments like musical entertainment.

Automobile industry: Wireless grid technology is being applied to automobile industry. These projects share a common goal of developing a mobile wireless network implementation that allows automobiles to form peer-to-peer ad hoc connections in order to pass information on traffic and weather conditions, emergency situations, tracking of vehicles, the occurrence of traffic accidents or the location of nearby points of interest.

6. Conclusion

Wireless Grid is a new computing paradigm. This paper presents a review of wireless grid computing. In this paper various architectures and applications of wireless grids have been discussed. Also various challenges related to wireless grids have been discussed. Grid Computing will be the major area of focus in the future days. We may have Grid-net in the future as we have Internet today. Many research works have been done in wireless grid computing to address different issues, but still it has to reach its maturity level by implementing various commercial and industrial applications in different fields.

References

[1] Heba Kurdi, Maozhen Li, and Hamed Al-Raweshidy, A Classification of Emerging and Traditional Grid Systems, IEEE Distributed Systems Online, vol. 9, no. 3, 2008, art. no. 0803-3001.

[2] I. Foster, C. Kesselman, and S. Tuecke, The anatomy of the grid, enabling scalable virtual organization , International Journal on Supercomputer Applications, vol. 15, no. 3, 2001.

[3] I. Foster, C. Kesselman, J. M. Nick, and S. Tuecke, The physiology of the grid, an open grid services architecture for distributed systems integration.

[4] Lingfen Sun and Emmanuel C. Ifeachor, The impact of grid on healthcare.

[5] Pin Hu, Lingfen Sun and Emmanuel Ifeachor, An Approach to Structured Knowledge Representation of Service-oriented Grids.

[6] S. M. Park, Y.-B. Ko. and J. H. Kim, "Disconnected Operation Service in Mobile Grid Computing", International Conference on Service Oriented Computing (ICSOC' 2003), Trento, Italy, Dec 2003.