Suitability of MANET Protocols for Heterogeneous Mobile Devices Communication in Gaming and Multimedia

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Abstract

The improvement and development of MANET protocols has been widely researched in order to bring about new technology with the rapidly developing field. More emphasis has been placed on development of protocols with some improvements focused on one issue in MANETs (ECMANSI, MANSI, ZRP, DVMRP) than working on all round MANET that would significantly tackle most if not all issues with MANET protocols so far (FLIP). However, there has also been more emphasis on development of non demanding applications that are not included multiplayer gaming and real-time multimedia content rich streaming applications. This paper looks at the use of mobile devices in gaming and multimedia rich applications. It proposes a protocol, which is in development that offers better efficiency, reliability, robustness and adaptability of wireless communication.

Keywords

MANET, Steiner Trees, Network Protocol, Heterogeneous devices, Multiplayer games

1 Introduction

As time goes on there are many new forms of communication being integrated into young people's lives? These include mobile phones, video mp3 players, mini laptops (ASUS) etc. These devices are capable of performing different functions and mostly they are now merged into one complete device. This has thus enabled the development of more powerful mobile devices which are ultra-mobile but at the same time can cater for a whole host of tasks like playing videos, music, and games at a less computational costs compared to the PC's. There are also indications that these devices are now being brought into classrooms slowly but surely by students thus in the near future they will form a part of their education. These devices however do have some inferiority. Due to their size, there are restrictions in hardware capabilities which rendered constrain on the software capabilities as well **[1]**. These can be seen in different devices having different hardware specifications and also communication specifications. Thus to be able to relay an application across a plethora of different devices, there must be an accommodation for these devices to help relay information between heterogeneous devices as the application is in operation.

The standard for communication among mobile devices is varied with some devices choosing to use Bluetooth rather than WIFI while some employ both communication techniques. These are the two main modes of wireless communication including GPRS. The nature of

communication between these devices and their uniqueness has prompted the birth of MANET communication protocols **[1]**. These protocols have the ability to be mobile and versatile in connecting different devices on the move and with varying capabilities. However, there are different routes when it comes to MANET protocols with some using uni-casting methods and others using multicasting methods for data distribution and route establishment.

The operating systems on all these different mobile devices vary as well from windows mobile, Symbian, linux, blackberry, J2ME **[2]**. These are the main platforms on the market being used but with Symbian taking the lead in Europe terms of percentage of users due to its feature rich system and ease of use **[2]**. The development engines used to make gaming and advanced content rich multimedia applications include J2ME, Flashlite, Brew, JAMDAT **[10]**. The use of game engines for mobile devices has still not been exhausted and is thus a ripe area of research. There are a few engines such as OPENGL ES, M3GE (Mobile 3D Game Engine), EDGELIB, Mobiola 3D being used to create challenging games on mobile devices. This has led to a mini revolution as far as the quality of graphics and game play available on mobile devices. These engines have given rise to more FSP's being developed for mobile devices enabling mobile device owners to enjoy more challenging game play that could only be found on dedicated gaming equipment or PC's **[10]**.

2 Mobile Devices Gaming and Communication

Mobile devices have become part and parcel of young people's everyday tools **[2]** that make them to be used in the class rooms as a helper rather than a hindrance. The mobile device has and is being trialled in different ways for different applications including classroom usage, gaming and simulations, context aware computing, flexible mobile content delivery and many more **[2]**. Thus mobile device gaming as far as types are concerned can be seen as equivalent to PCs or Platform games for designated gaming hardware like Playstation and Xbox **[10]**. Some of game genres include MMOG, FPS, Strategy games, Pervasive games, educational games, Racing games, sports games, Virtual reality games etc **[10]** have already been designed for these game consoles. These games are now being shaped into multiplayer games on heterogeneous devices but with some difficulties because of the problems associated with the portability, device mobility, latency, reliability of networks.

The utilisation of MANET protocols in the Dispersal and Mobile communication in gaming takes place in the wireless networking but with some constraints including mobile device limitations, overheads, platform limitations, packet loss, speeds, and overcrowding of the bandwidth. The number of players that could be involved at any given time in multiplayer instances could also have an impact on the network performance **[2]**. However, these limitations can be manipulated and their influence reduced or even eradicated in order to boost the communication level between heterogeneous mobile devices. The mobility and number of participating devices have necessitated the need for a protocol that can actually encompass all this and more to reduce the amount of communication restriction between mobile heterogeneous. One such protocol known as FLIP **[5]** is already in

development which addresses a wide spectrum of devices and can be used as an inter-connector between heterogeneous devices. It is well structured in enabling different devices to interlock into mobile communication clouds. This protocol can also handle the distribution of small data packets across a wireless network between different types of devices. However it does not address the specific needs of multimedia intensive applications.

In MANET'S there is a dynamic number of nodes which need to be connected together in order for communication to take place thus the similarities in the Steiner tree problem of trying to join a set number of points and thus at the same time producing a minimum tree set which would show joining of these points in an interconnected fashion thus enabling cost reduction communication wise (transmission energy, time). There are a few Multicast MANETS that have used the Steiner tree to account for cost effective shortest paths **[9, 10]** and in other areas used to effectively lower energy consumption in transmissions **[7]**.

The Steiner tree which is a combinatorial optimization problem has been used in mobile device networks to formulate heuristic algorithms taking polynomial time **[9]**. It conforms to an optimization where there is possible set of feasible solutions which can be reduced down to a single one. Therefore the objective in using this technique is to find the most robust solution for the network paths between nodes from sender going to the receiver **[9]**. The Steiner tree has unique features which allows for adding more vertices into the network as needed **[8]**.

3 Network Protocol Design Principles

The network protocol that supports heterogeneous devices for distributing game states and multimedia streaming should be able to:

- minimise the latency levels in communication between different devices
- ensure efficiency and flexibility when communicating with other data link and transport layer protocols
- provide a seamless communication route between heterogeneous devices thus the efficient distribution of multimedia rich content/game states

The overhead and complexity of a protocol is directly related to the functionality of the protocol provides that the flexibility of the protocol would only use in widening the types of devices it could handle **[3]**. The flexibility of the protocol that fits into different layers is shown in Figure 1. The protocol can take over the functionality of any layer between the transport and data link segments. At the same time the protocol can be used underneath the existing protocols to satisfy the Network layer - Data link layer protocols.

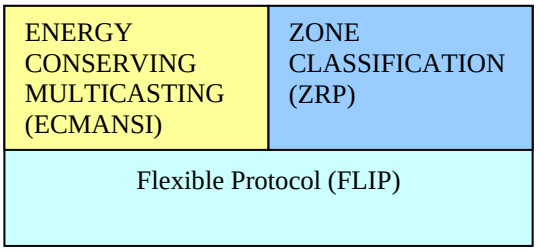

Figure.1 Protocol Bock Diagram

The protocol normally carries out data communication in a three phase process namely identify and tag as a

node and relay. The process of identification can be done in different ways. The easiest way is the random multicast identity clarification messages which sent out message to the network to see if there are any new nodes that have yet to join the network, if yes then they reply with a message that contains information about the device. This information is then kept in as a set of tables across the main network nodes which then deduce how routes can be formed when needed.

Although the main aim of the protocol is to cater for heterogeneous mobile devices communication for multiplayer gaming and multimedia content rich applications. The protocol should also be intelligently adaptable to the lower end needs of other applications to enable a wider frontal for usability. The first step of the protocol design would be its structure and how it recruits nodes and utilises the nodes according to their abilities i.e. its power levels, processing power, medium of wireless communication (Bluetooth, WIFI, infra red, Edge). The actual protocol would need to be like water when it pours into any container, it would take the shape of that container (adaptability). The issues that need to be taken into account will be movement, latency, and scalability. Within movement there are questions involving reliability which is a mainstay concern in MANET protocols. How does the protocol tackle the movement issue and reliability at the same time? Latency a measure of time taken to traverse a system from point A to point B is also an important factor. The minimisation of this tends to reduce transmission times thus aiding in better communication. Scalability measures how many devices can actually use that protocol until such time it starts to waiver in its robustness and thus its performance becomes compromised. The more scalable the protocol can be the better it is. Thus the proposed protocol is in the process of development and encompasses the use of three different protocols explained as shown in Figure 1.

The proposed protocol encompasses three different protocols with one as a base that actually at its level can be used as a basic communication protocol on its own. The other protocol used is ECMANSI [7], which is mainly concerned with reliability and energy consumption during transfer of data packets to introduce a dynamic way of cost effective route usage. The other protocol ZRP [13], which utilises the division of nodes into zones dependant on distances in hop counts between nodes, can be used to reduce packet loss. If ZRP protocol combines with ECMANSI, a more robust MANET multicast protocol that would answer most if not all the issues mentioned in Section 2.

4 Conclusions

This paper presents issues that affect MANETS when it is used in multiplayer gaming or multimedia intensive purposes namely latency, reliability, robustness. These are some of the key cornerstones that make up all round protocol. The proposed protocol would seem best suited to tackle these issues and lay down a more standard base to which protocols would try to aspire in becoming. This protocol would be able to tackle all if not most of the main wireless protocol issues that are related to wireless communication. This will be achieved by using different principles from different communication protocols that have so far come short to offer a good solution to address the use of mobile devices in gaming and multimedia rich applications.

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