International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 4, June 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

A Real Time Multimedia Streaming in Mobile Ad Hoc Networks Utilizing Multicast Tree Structure

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ABSTRACT
Multicast transmission is a more productive instrument when contrasted with unicasting in supporting ongoing media applications, and consequently there is a significant angle expected to upgrade network advancements. Versatile impromptu organizations have been the subject of dynamic examination for various years. This study researches the attainability of involving such organizations for communicating interactive media streams. This study concentrated on currently accessible conventions, for example, Serial MDTMR and Parallel MNTMR and proposed another system involving Multicast-Tree Structure Protocol for MANETS. The review carries out the MCT (Multicast-Tree) structure for MANETS and assesses the exhibition with both Serial MDTMR and Parallel MNTMR.

How to cite this paper: Gh Nabi Malla "A Real Time Multimedia Streaming in Mobile Ad Hoc Networks Utilizing Multicast Tree Structure" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-4, June 2020, pp.1854-1857, URL: www.ijtsrd.com/papers/ijtsrd31642.pdf

IJTSRD31642

INTRODUCTION

Media streaming is typically sent from pre-recorded video and audio files, but it can also be distributed as part of a live transmission "feed." In a live transmission, the video signal is converted into a packed computerised signal and communicated from an exceptional server that can do multicast, sending the same record to multiple clients at the same time. The data is handled and played as it is received via remote channels, i.e., downloaded, and the substance is discarded. As a result, even if you have downloaded a file, it will not and cannot be saved to your hard drive. Ad hoc Networks with Flexibility (MANETs) Mohapatra et al. (2004) refer to a type of remote organisation that can be formed quickly and haphazardly without the need for infrastructure. As indicated by hub portability and changing organisational geographies, such organisations can also adjust and reconfigure themselves on the fly. Because of the strategic climate's inherent uniqueness, these characteristics are especially appealing to the military client. MANET innovation has its roots in security, having originated from military research endeavours.

A MANET system is a network of wireless nodes that communicate via bandwidth-constrained wireless links. Each interconnected wireless node can serve as a sender, receiver, or router. When the node is a sender, it can send messages via some route to any specified destination node. It can receive messages from other nodes as a receiver. When the node acts as a router, it can forward the packet to the destination or the next router along the path. Each node can buffer packets awaiting transmission if necessary.

MOBILE AD HOC NETWORKS (MANET'S):

A wireless mobile ad hoc network is made up of mobile devices linked together by wireless multi-hop communication paths. These ad hoc wireless networks self-create, self-organize, and self-manage. Figure 1 shows an example of a mobile ad hoc network. These mobile ad hoc networks provide distinct advantages and versatility in specific environments and applications. They can be intrinsically fault-resilient because they do not operate within the constraints of a fixed topology and do not require fixed infrastructure or base stations. Because all nodes are allowed to move, the topology of such networks is bound to change over time. Node addition and deletion are only possible through interactions with other nodes. Thus, where wired-line networks are not feasible, these types of networks offer numerous advantages. Such advantages piqued the interest of military, police, and rescue agencies, particularly in disorganised or hostile environments such as isolated scenes of natural disaster and armed conflict. Other major areas of application have recently emerged as home or small-office networking and collaborative computing with laptop computers in a small area (e.g., a conference classroom, single building, convention centre, etc.). Furthermore, people have recognised from the start that ad hoc networking has a clear, potential use in all of the traditional areas of interest for mobile computing. The concept of mobile ad hoc networking arose as an attempt to extend the services offered by the traditional internet to the wireless mobile environment. All current works, as well as our research, regard the ad hoc network as a wireless extension of the internet, based on the ubiquitous IP networking mechanisms and protocols.

Today's internet operates on an essentially static infrastructure in which network elements are interconnected via traditional wire-line technology and do not move, particularly those that provide routing or switching functions. By definition, all network elements in a mobile ad hoc network move. As a result, numerous more difficult challenges must be overcome before the practical benefits of ad hoc networking can be realised. Furthermore, node mobility limits their power capacity and, as a result, their transmission range. These nodes must frequently adhere to strict weight constraints in order to be portable. Furthermore, these mobile elements are no longer just end systems; they must also relay packets generated by other nodes, so each node must be capable of acting as a router. As nodes move in and out of range with respect to one another, including routers, the resulting topology must be communicated to all other nodes as needed to maintain connectivity information. The limited bandwidth of wireless channels, as well as their generally hostile transmission characteristics, impose additional constraints on how much administrative and control information may be exchanged and how frequently. One of the most difficult challenges for ad hoc networking is ensuring effective routing. As these mobile ad hoc networks become more popular for increasingly complex applications, the various Quality of Service (QOS) attributes for these applications must also be met as a set of pre-determined service requirements. Furthermore, due to the increasing use of ad hoc networks for military/police use, as well as the increasing commercial applications that are envisioned to be supported on these types of networks, various security issues had to be addressed.

MANET CHARACTERISTICS:

A MANET has several distinguishing features. For starters, there is no centralised infrastructure. It differs from traditional mobile wireless networks in that base stations, access points, and servers must all be installed before the networks can be used. The ad hoc network is decentralised, with all mobile nodes serving as routers and all wireless devices interconnected. This implies that the MANET is also a self-configuring network in which network activities such as topology discovery and message delivery are carried out by the nodes themselves. The second distinguishing feature of a MANET is its dynamic topology. Because nodes are free to move at will, the network topology changes rapidly and unpredictably over time. Alternative paths are automatically found, and data packets are forwarded across the network's multi-hop paths. Finally, a MANET uses variable-capacity links with limited bandwidth. Wireless links have far less capacity than hard-wired links. As a result, a MANET has links with relatively low bandwidth, high bit error rates, and unstable and asymmetric links. In contrast, wired networks are distinguished by high bandwidth links, low bit error rates, and stable and symmetric links. Congestion is often the norm rather than the exception as a result of having a low link capacity. Fourth, a MANET is frequently constrained by energy-constrained operations. This is due to the fact that its nodes are frequently battery-powered hand-held devices. Because mobile nodes rely on these finite energy sources, power conservation is critical in MANET system design. Finally, Wei and Zakhor provide only limited physical security (2007) When compared to fixed-cable networks, mobile wireless networks are more vulnerable to physical security threats such as eavesdropping, interception, denial-of-service, and routing attacks. As a result, security techniques must be used to mitigate these threats. Nodes prefer to emit as little power as possible while transmitting as infrequently as possible. This reduces the likelihood of detection and interception. Furthermore, as opposed to centralised networks, the decentralised nature of network control will add robustness against failure.

PROPOSED SYSTEM

We used a multi-way structure called Multicast-Tree Structure to achieve good connectivity and distributedness in a Mobile Ad Hoc environment. Because of its balancing nodes, the path used to send a packet from source to destination provides better video streaming with less delay and a lower number of lost packets. The main advantages of a Multicast-Tree Structure are that it follows a balanced structure, which allows all nodes to be distributed easily and without data loss. A Multicast-Tree Structure (Luo et al., 2007) may have multiple root nodes. This feature is more useful when transferring large amounts of data from one location to another. In a Mobile Ad Hoc network environment, there can be a large number of servers transmitting data to all remaining nodes/systems. This data structure may offer good performance when streaming a video. Because of their lower height, all nodes are always connected with a shorter distance, allowing every system to easily transmit a packet. The distributed environment in a Multicast-Tree will be used in Wireless Ad Hoc Networks to use more nodes. When compared to existing systems such as Serial MNTMR and Parallel MDTMR, Multicast-Trees have a mobility structure that includes inserting and deleting nodes while data is being transmitted. So, when a new packet arrives from a source or any server and the bandwidth is insufficient for any node, it has the ability to restructure its environments due to its mobility by using insertion/add and deletion methods. The data structure Multicast-Tree is distributed (Padmanabhanet al., 2002) because it has a lower tree height and can use more than one root from the source side. If the density is low while transmitting a video, it may be impossible to maintain packet forwarding from one node to another. However, because of the mobility and distributed nature of the Multicast-Tree, there is a lower rate of packet loss. When a node wants to acquire a packet or transmit a packet, operations like inserting and deleting a node are performed in a Multicast-Tree.

MULTICAST-TREE GENERATION

A virtual Minimum Spanning Tree connects all members of a session multicast tree. The session controller performs the minimum spanning tree calculation, and the results are communicated to all members in the form of a (parent, children) list. Link costs are an example of an application-specific performance metric that is computed in a distributed fashion by members and reported to the controller on a regular basis. The video packets are distributed to the child nodes via Multicast-Tree. This data structure is useful when a root node (server) attempts to send data to leaf nodes over wireless links with a capacity of 100 mbps. Assume that all of the nodes are mobile devices with wireless channels such as Bluetooth and Wi-Fi. When a root node is overburdened due to heavy traffic or a lack of power or mobility, the node (root) will clone some servers in the next level. Because of system link failures, all nodes at the destination nodes will not receive data at the same time. When a data packet is sent from the root node with a bandwidth of 100 mbps, the node will attempt to send the file to the nodes present. The nodes communicate with root via wireless channels such as Bluetooth or Wi-Fi. If a node is overburdened due to a lack of power or mobility, servers are moved to the next leave node, and so on. The nodes in a MANET are distributed and mobile using Multicast-Tree techniques. All of the nodes are linked to one another, and the information is stored in a database. The bandwidth of a cable will be divided into 25 mbps per link, distributing the bandwidth until the lower lever. Because of the low bandwidth at the lower lever, the video quality suffers, resulting in delays, packet loss, and an increase in bad periods. Lower level nodes have less bandwidth and communicate with fewer nodes than upper level nodes. For a good video quality, operations such as searching, insertion, and deletion will be performed..

The performance factors are:
- Rearranging the nodes
- Throughput
- Signal (wireless) strength
- Communication at levels

Rearranging the nodes: If a node is unable to obtain data from its successor while data is being sent from the root to the next level nodes, it may borrow from a subsequent node. The deletion and insertion operations will be useful in this case. However, before proceeding with insertion and deletion, the nodes should search for the node that contains the available data. All of the system's nodes and structures will be rearranged and balanced here.

Throughput: In a wireless networks the throughput will be measures in terms of "data packets per second" or "data packets per time slot". All nodes will have some throughput while streaming using a 2-3-4 tree. The root node will have 100% throughput. And it will decrease for the following levels.

Signal strength: The signal strength will be measured by the nodes as they communicate with the other nodes in the premises. The signal strength will be high when two systems are close together and low when two systems are far apart. Because of its distributed nature, the signal strength of a Multicast-Tree will be good.

Communication at levels: When a root system provides links to multiple nodes, it indicates that the communication level will be high. As a result, the number of packets transferred per second will increase. Simultaneously, the delay will be reduced up to those level systems. A tree will have an n-number of levels. Performance will be reduced for each level. However, in Multicast-Tree, the height of a tree is reduced. As a result, it improves performance.

IMPLEMENTATION

The implementation is carried out in the NS-2 (Zhu and Kunz, 2004) Network Simulator, and the results are compared with MDTR and MNTR for various performance metrics, as illustrated by the graphs below. Implementation of Modules:

- Node plotting
- Route finding
- Packet splitting
- Sending Packets
- On-line and Off-line Techniques
- Calculation of Metrics
- Plotting the Metrics graphically

Node plotting: This is the first module in the system that has been proposed. In this module, all users, such as laptops and mobile phones, are source systems, and among these nodes, any one node can act as a server, and depending on the size of the file, several systems may be used to act as servers. We can use an n-number of nodes on the source side in this module. Before transmitting any data from the node, set the location and size of the node. These specific nodes plotting module for sending files, giving the actual resemblance of a Mobile Ad Hoc Networks and so on to work on the network. The nodes are created statically here. During the runtime, the nodes function as a Mobile Ad Hoc Network for the active transmission of video streams, giving the appearance of a packet moving from source to destination.

Route finding: The second module of the proposed system, in which we can obtain input as source and destination. Then we database, so once the source and destination are selected, this module searches the database for the available path, and thus the obtained paths are considered, and these different paths are taken for the packets to be transmitted from source to destination. So, once the paths are obtained, packets are routed through them to their destination.

Packet splitting: Figure 6 depicts the third module of the proposed system. Files are divided into packets in this module based on specific criteria. It will first determine the shortest path from source to destination. The file length will then be divided by the total number of paths. Each path has an equal number of packets. Because streaming media cannot be done as a single packet, the video is split and taken as packets, which are then sent from source to destination via various paths using scalable coding techniques. The split packets are given different numbers in order to determine which is to be played first. On the other side, packets are received, and optimization techniques are applied and displayed to the user.

Packet transmission: Another module of the proposed system that sends packets from source to destination without packet loss is the packet transmission from one node to another in the network. Each packet will choose its own path for packet transmission and will send a packet between the source and destination. The packets sent here take different paths to reach the destination, so they arrive not in a sequential manner but in an unusual manner, but the packets are played accordingly during playback.

On-line and off-line techniques: In this module, we develop techniques for pre-fetching split packets arriving at the destination from different nodes, as shown in Fig. 8, so that the video viewed is optimised. Online and offline techniques may include packet encoding and decoding, as well as packet distribution via a relay server. Here, we use different techniques for pre-fetching, both off-line and online, to compare which algorithms provide better optimization, and the results are used to draw different metrics.

RESULTS

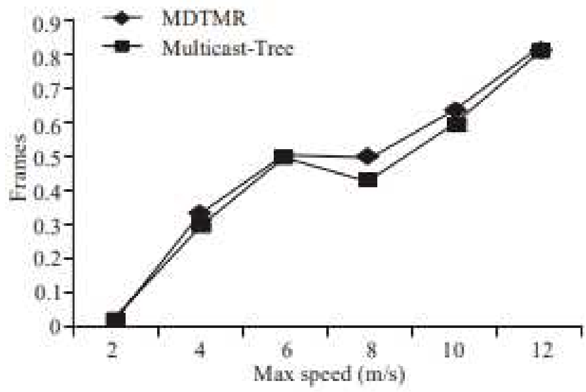

Figure 1: Graph for the ratio of bad frames in MDC

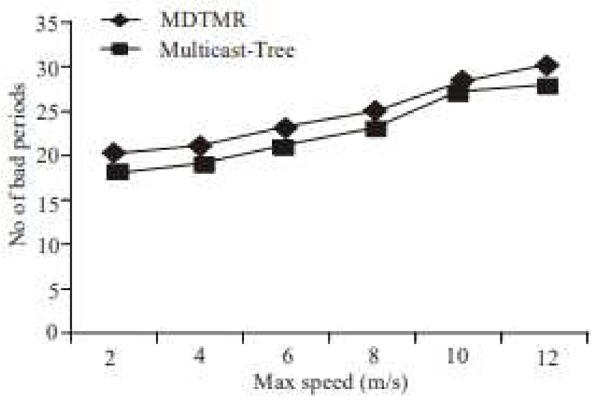

Figure 2: Graph for the ratio of bad periods

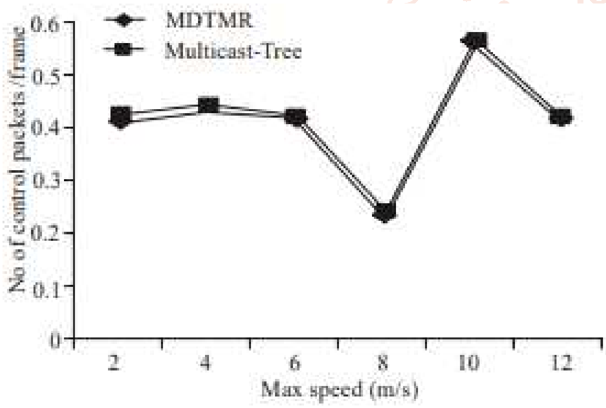

Figure 3: Graph for normalized control packets

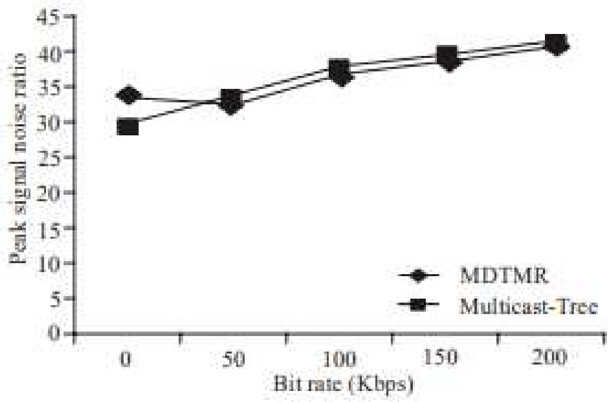

Figure 4: Graph for distortion

CONCLUSION

The Mobile Ad Hoc Network's streaming system has been successfully implemented. This proposed system significantly improves on the existing system in the field of Media Streaming. The proposed system considers metrics such as packet loss, the ratio of bad frames to bad periods, delay, distortion, forward efficiency, and so on. So, after transferring the video from source to destination, the metrics mentioned above are calculated and graphs are plotted. As a result, it provides better performance across all metrics when streaming a video in a Mobile Ad Hoc Network. The current system accepts several nodes in general, but in the future, an organisation must be able to choose the number of nodes or peers it will use. The database currently stores all of the paths for packets to take from source to destination, but in general, these paths should be calculated by the system itself, laying the groundwork for future work. Finally, the video can be viewed only after the entire transmission has been completed, and this is to be corrected so that the video can be viewed during the transfer.

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