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REVIEW OF LITERATURE THE QUALITY OF SERVICE OF MULTICAST ROUTING IN AD HOC WIRELESS NETWORKS

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Abstract: Frequent interactions among the group members of distributed wireless network environment may be facilitated with the help of Mobile Ad Hoc NETworks (MANETs). Some of the group-oriented applications include disaster management, battlefields, audio/video conferencing, e-commerce, e-education, etc. Group communication demands dynamic construction of efficient and reliable multicast routes under user mobility and varying channel conditions. Multicast routing mechanisms in MANETs have been consistently improved by researchers considering various performance measures such as energy efficient route establishment, packet delivery ratio, quicker and faster proactive route recovery, network life time, reliability, Quality of Service (QoS) based on bandwidth, delays, jitters, and security. The paper focuses on most recent reliable and QoS based multicast routing mechanisms that helps in multimedia communication over MANETs. The mechanisms are considered under different topological routing categories such as mesh, tree, zone and hybrid. We provide an overview of existing multicast routing mechanisms based on routing categories and point to directions for future research and development.
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Introduction:

Mobile Ad hoc Networks (MANETs) are a class of wireless communication networks without a fixed infra-structure. The MANET concept has basically evolved to tackle the disaster situations like tsunami, earthquake, terrorist activities, battlefields, landslides, etc. Later, the concept has been extended to include applications such as online education, gaming, business, etc. Several applications in MANETs need group communication to manage the situations. The MANET nodes do not provide reliable services and QoS (Quality of Service) guarantees as compared to other wireless networks such as WiFi, WiMAX, GSM and CDMA. The main sources of unreliability in MANETs are due to limited battery capacity, limited memory and processing power, varying channel conditions, less stability under unpredictable and high mobility of nodes. The QoS parameters to be guaranteed for multimedia group communication are bandwidth, delay, packet loss, jitters and bandwidth-delay product.

The measure of unreliability increases when we need to communicate real-time multimedia traffic where a stringent Quality of Service (QoS) parameters are to be satisfied. QoS is one of the significant components to evaluate MANET performance since QoS restricts the bounds on bandwidth, delay, bandwidth delay product, jitter and packet loss. The violation of these parameters degrades the overall performance of an application. Reliable multicast routing include the mechanisms such as error detection, signaling of error messages to source and destination and retransmission method of lost packets (Petitt, 1997, Kunz, 2003).

Some of the parameters that can be considered for reliable communication are node stability, link stability, route stability, survivability, mobility, etc. *Node stability* in MANET depends on parameters such as mobility, battery life, memory, data transmission rate and number of interfaces currently being used. A node becomes less stable and looses its connectivity with higher mobility. Longer battery life provides more stability to the node under higher data transmission rates since energy is spent for every packet transmitted. A node will be overloaded with increase in number of neighbors since the node is connected to each neighbor through an interface that drains more energy, consumes buffer space and requires higher processing capability.

Link stability depends on wireless link characteristics such as link failures, packet loss rate, channel sensing rate, channel fading rate, bit error rate, bandwidth fluctuations, environmental effects, etc. Fluctuating wireless channel triggers packet loss resulting into link failures and degrades link reliability. The failure in channel sensing and channel fading increase bit errors that triggers large variation in available bandwidth. Imperfect channel sensing degrades the system performance. Existing communication systems use checksum and sequence numbering for error control and some form of negative or missing positive acknowledgement with packet retransmission for error recovery. If checksum formation and verification is not performed properly, it can affect system performance drastically. *Route stability* relies on the performance of source, destination and intermediate nodes and the wireless channel connecting end-to-end route. If the lifetime of a route decreases, the reliability of end-to-end delivery may be enhanced with alternate routes between source and destination. To enhance the route stability, there is a necessity of mesh based and multipath routing techniques. *Network survivability* reflects the ability of a network to continue to functioning during and after failures. Network survivability may be perceived as a composite measure consisting of both network failure duration and failure impact on the network. Now let us define the various QoS parameters such as bandwidth, delay, jitter, bandwidth delay product and synchronization.

Bandwidth is defined as data transmission rate, i.e., the amount of data to be transferred every second. For example, consider bits required for a sequence of pictures in a movie which have to be transferred from source to a destination in a distributed system environment. Real time applications require guaranteed bandwidth for better quality and continuous presentation.

Delay incurred between multimedia data generation at a source and its presentation at a destination is subjected to have stringent bounds. These bounds are expressed by the transfer delays. End-to-end delay may be split into at least four contributing delays: (1) source compression and packetization delay, (2) transmission delay, (3) end system queueing and synchronization delay and (4) sink decompression, depacketization and output delay. Among these delays, the second one is random delay and remaining are assumed to be fixed delays.

Bandwidth delay product is an important parameter in MANETs since it provides a measure of end-to-end network pipe in multi-hop networks. Bandwidth delay product is well understood concept in wire-line systems. It helps in defining enough number of in-flight packets to fill the network pipe. However, the wireless connectivity instigates fluctuating end-to-end network pipe, wherein it becomes difficult to maintain end-to-end connectivity for bandwidth delay product bounded multimedia applications.

Jitter is defined as the difference between the inter-arrival times and inter-generation times of adjacent packets. Jitters are introduced due to random network delays incurred by the sequence of packets of a continuous multimedia stream. Jitters can be reduced in the end systems by the use of buffers. However, these buffers are very large and they require huge memory resources. Thus it is better to have the jitter already controlled by the network itself. During data transmission, we may come across two types of jitters, namely, negative and positive jitters. Negative jitter indicates the inter-arrival time of the packet gradually reducing whereas the positive jitter indicates the inter-arrival time of a packet gradually increasing. A sequence of negative jitter may result in downstream node congestion and consecutive packet loss. On the other hand, a sequence of positive jitter may result in significant delays. A large sequence of negative and positive delays have significant effects on performance of QoS for multimedia.

Synchronization and resynchronization of multimedia streams is a crucial task to be solved throughout running of a multimedia application for a smooth and efficient playout. It is necessary to address synchronization problem to facilitate better quality of presentation to the users. Multimedia applications require two types of synchronization techniques: intra-stream and inter-stream synchronization. Synchronization of media streams in MANETs is most complicated issue because of the nature of connectivity and unpredictable and random mobility of nodes.

As different applications have different requirements, their level of QoS and associated QoS parameters also differ from application to application. For example, in multimedia applications, the bandwidth and delay are the key parameters, whereas military applications have additional requirement of security and reliability. For defense applications, finding trustworthy intermediate hosts and routing through them can be a QoS parameter. For applications such as emergency search and rescue operations, availability is the key QoS parameter.

Group communication in MANETs poses many challenges and issues such as resource management, routing management, synchronization, power management, etc. The members of a group communicate by means of multicast routing mechanisms that discover and maintain multicast routes. Providing reliable and QoS supported multicast communication among group members becomes

necessary for real time and non-real time applications. Researchers have proposed a variety of multicast routing techniques to improve multicast routing performance in MANETs (Junhai et al., 2009, Bheemarjuna Reddy et al., 2006, Badarneh and Kadoch, 2009, Papavassiliou and An, 2002, Liu and Kaiser, 2005, Ali et al., 2007). In this paper, we present a review of several multicast routing mechanisms in MANETs that motivate the scientific and research community to work towards improvement in the existing mechanisms.

LITERATURE REVIEW

There is various protocol for wireless network, ad-hoc networks etc. This section presents the previous work around the world based on protocol and their performance for network capacity enhancement.

Chen et al., [1] Due to significant advances in wireless modulation technologies, some MAC standards such as 802.11a, 802.11b, and 802.11g can operate with multiple data rates for QoS-constrained multimedia communication to utilize the limited resources of MANETs more efficiently. In this work, by means of measuring the busy/idle ratio of the shared radio channel, a method for estimating one-hop delay is first suggested. Then, by constructing a multicast tree, a delaysensitive multicast protocol for real-time applications in multidate MANETs is proposed. In order to increase the network capacity, the proposed multicast protocol intends to minimize the sum of the total transmission time of the forwarders and the total blocking time of the blocked hosts, by taking the neighbouring information of the forwarders into account and properly adjusting the data rates of the forwarders. Simulation results show that the proposed delay estimation method is more accurate, as compared with previous works. Besides, the proposed multicast protocol can induce higher network capacity, while satisfying the delay requirement.

E. H. Wu et al., [2] Network coding is a promising technology proven to improve the performance of wireless networks. To successfully design a quality-of-service (QoS)- satisfied routing protocol with network coding, the bandwidth consumption of a coding host should be determined. Furthermore, coding opportunities should be increased to improve network capacity. Nevertheless, it is challenging to determine whether a host can be a coding host and to determine the bandwidth consumption of a coding host in a mobile ad hoc network (MANET). In this work, it is first present and define the coding conditions to identify a coding host. The bandwidth consumption of a coding host is then estimated under the contention-based wireless networks with a random-access mechanism. Finally, it is proposing a bandwidth-satisfied and coding-aware multicast routing protocol (BCMRP). By taking into account the residual bandwidth of the carrier-sense neighbours of the forwarders, the proposed protocol can satisfy the bandwidth requirements of the requested flow and other ongoing flows. As a consequence of considering coding opportunities in multicast tree construction, the proposed multicast protocol can reduce the total bandwidth consumption. The simulation results show that BCMRP outperforms the prior multicast routing protocols in receiving ratio, admission ratio, and total bandwidth consumption.

P. R. Satav et al., [3] The research in MANET has been carried out for the development of various techniques which will increase the competency of the network only. A plenty number of proposed routing protocols are magnificent in terms of efficiency. However, proposed protocols were generally fulfilling the set of trusted network and not considered for adversarial network setting, hence there is no security mechanism has been considered. MANET is widely used in sensitive fields like battlefield, police rescue operation and many more in such type of sensitive field an attacker may try to gather information about the conversation starting from the origin node to the terminal node. Secure route selection approach for route selection in adverse environment is discussed in this article. The results shows that proposed algorithm, will resolve the single & collaborative attack by increasing the computational & storage overhead and by improving the significant PDR, achieves a noticeable enhancement in the end to end delay.

J. Kniess et al., [4] The search for service providers (e.g., ambulance, fire truck, etc.) after a disaster, must take place within a short time. Therefore, service discovery protocol which looks for providers that can attend victims, respecting time constraints, is crucial. In such a situation, a commonly solution for ensuring network connectivity between victims and providers is ad hoc networks (MANET), composed by batteryoperated mobile nodes of persons (victims or not). However, an efficient service discovery protocol must care about energy consumption of mobile nodes and also prevent useless movement of providers. These are the aims of the Resource Reservation Protocol (ΔRRP), presented in this paper. Applying both Gauss-Markov [1] and Mission Critical Mobility [2] models to characterize human mobility, performance evaluation results on the Network Simulator NS2 confirm the effectiveness of ΔRRP protocol when compared to other protocols.

M. Maragatharajan et al., [5] A Multicast routing protocols for Mobile Ad hoc remote system assumes an essential part in the typical applications of ad hoc wireless networks, namely, emergency &

rescue operations, Distributed & Collaborative computing, Wireless mesh networks and etc. Multicasting is nothing but send information not to all members but for a group of members. It is the most favoured technique for group communication because it decreases overhead and improves transmission capacity use. Multicasting in a mobile and multi hop wireless network is considerably more complex than in wired networks due to node mobility, Security, Energy management, Routing, Addressing and deployment considerations. This work discusses some state-of-the-art multicast routing for mobile ad hoc network. Protocol comparison table can also be given.

P. Nekrasov et al., [6] In this work it is present Local Group Connected Dominating Set (LG-CDS) algorithm which can be used in conjunction with SMF protocol for multicasting in MANETs. LG-CDS performs distributed election of relays for connecting members of locally located groups using only twohop neighborhood information. It is worth noting that the algorithm can be tuned to elect redundant relays to improve fault tolerance. Using simulation in ns-3 it is evaluate the performance of LG-CDS and show that our approach provides high network capacity while being stable to topology changes.

M. A. Gawas et al., [7] To support QoS for a multimedia traffic, IEEE 802.11e standard Enhanced distributed channel access (EDCA) has been proposed. However, the EDCA is more focused on providing quality of service(QoS) solution at the MAC layer, which is necessary, but perhaps not sufficient as the layered TCP stack architecture does not satisfy the QoS demands in ad hoc network. This is due to the fact that routing protocol is responsible for the successful packet delivery and QoS Support. The conventional single scalar routing protocols are not suitable for high traffic QoS sensitive multimedia traffic load on Mobile ad Hoc Networks (MANETs). The work proposes a Cross layer Multimetric link disjoint Multipath Routing (CMMR) protocol based on distinct QoS constraints. The work uses cross-layer communications to consider multiple layer metrics like MAC queue utilization, node density degree, and mobility factor to achieve channel state awareness and keep the up to date status of the route in terms of QOS proficiency at each intermediate node. The proposed algorithm is validated with an extensive simulation with high real time traffic using NS3. The results show significant improvement of CMMR in terms of packet delivery, and end-to-end delay.

J. Maxa et al., [8] UAV Ad hoc NETworks (UAANETs) can be defined as a new form of ad hoc networks in which nodes are Unmanned Aerial Vehicles (UAVs) and Ground Control Station (GCS). Compared to the usual Mobile Ad hoc NETwork (MANET), this new network paradigm has some unique features and brings specific challenges such as node mobility degree, network connectivity patterns, delay-sensitive applications and network security. Indeed, from routing point of view, none of the several UAANET routing protocols proposed in the literature have been designed with security in mind. This lack of consideration can make the certification of UAANETs difficult to obtain. In this work, it is present our vision of such a challenge and the research that it is are conducting. The aim is to propose an original secure routing protocol for UAANETs using a Model Driven Development (MDD) approach which will ease the certification of final UAV products. The first preliminary results concerning our securerouting protocol design will be presented. This work describes our ongoing research which will provide secure communications for UAV ad hoc networks at the end of the SUANET (Secure Uav Ad-hoc NETwork) project.

P. Novotny et al., [9] it is are concerned with reliably harvesting data used to monitor a service-based system hosted in a mobile ad hoc network (MANET) environment. These data are time-bounded, time-sensitive time-series data recorded by individual hosts in the network. Harvesting is used to gather the data for global time-series analyses, such as fault localization. The MANET environment challenges data harvesting, due to the inherently unstable and unpredictable connectivity and the resource limitations of wireless devices. it is present an epidemic, delay tolerant method to improve the availability of time-series monitoring data in the presence of network instabilities, asymmetries, and partitions. The method establishes a network-wide synchronization overlay to incrementally and efficiently move data to intermediate nodes. it is have implemented the algorithm in Java EE and evaluated it in the CORE and EMANE MANET emulation environments.

B. S. Bhati et al., [10] Data privacy is one among the challenging issues in Mobile Ad hoc NETworks (MANETs), which are deployed in hostile environments to transfer sensitive data through multi-hop routing. The undesired disclosure of data can result in breach of data privacy, and can be used in launching several attacks. Many of the works achieved data privacy by using approaches such as data transformation, data perturbation, etc. But, these approaches introduce high computational overheads and delays in a MANET. To minimize the computations in preserving data privacy, it is have proposed a computational intelligence based data privacy scheme. In the scheme it is use data anonymization approach, where rough set theory is used to determine the data attributes to be anonymized. Dynamically changing multiple routes are established

between a sender and a receiver, by selecting more than one trusted 1-hop neighbour nodes for data transfer in each routing step. Anonymity of the receiver is also discussed. The work has been simulated in different network sizes with several data transfers. The results are quite encouraging.

S. Jelassi et al., [11] Mobile Ad-hoc Networks (MANET) have been initially proposed for short-session exchanges of small data chunks in emergency and tactical missions, where network' infrastructure is inexistent or temporally broken. The quick rise of processing and communication capabilities of mobile devices allows moving toward offering user-friendly and delay-sensitive multimedia services over a MANET. The integration of multimedia services needs a good understanding of the effects of MANETs on the applications running contexts. This work aims at exploring network delay processes of packet voice communications on mobile ad-hoc networks. To do that, a wide range of representative scenarios has been defined and simulated. The gathered traces have been inspected from qualitative and quantitative perspectives in order to discover (1) dependency between up/down path lifetime and delay variation processes, and (2) features of network delay variation at transport-layer.

C. Lal et al., [12] In this work, it is present an adaptive delayaware multipath routing (ADAMR) framework for reliable transmission of delay-sensitive applications over mobile ad-hoc networks (MANETs). The proposed method uses cross-layer design to abstract the Quality-of-Service (QoS) constraints of requesting applications in terms of end-to-end delay. To ensure that each admitted data session packet gets the required delay, it is use an adaptive flow admission control technique. The proposed admission control procedure admits only those data sessions for which our multipath routing protocol is able to find a delay-aware route. Proposed multipath routing protocol not only discovers routes that satisfy the given delay constraints, but also makes sure that the discovered routes are node-disjoint. When a link break is detected on an active route, it is use backup route to bypass another overhead generating route discovery process. Extensive simulations prove the effectiveness of the proposed approach under various network scenarios. it is use H.264/SVC encoded video traces to model the video source nodes in the network. The proposed method provides required QoS guarantees and perform congestion control based on the current network load levels. It is also observed from simulation results that ADAMR performs accurate admission control and discovers stable multiple node-disjoint routes with minimal routing overhead.

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