Multi Aided Delay Analysis In Cellular System

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Abstract*-Based on the common interest of mobile users (MUs) in a social group, the dissemination of content across the social group is studied as a powerful supplement to conventional cellular communication with the goal of improving the delay performance of the content dissemination process. The content popularity is modelled by a Zipf distribution in order to characterize the MUs' different interests in different contents. The Factor of Altruism (FA) terminology is introduced for quantifying the willingness of content owners to share their content. We model the dissemination process of a specific packet by a pure-birth based Markov chain and evaluate the statistical properties of both the network's dissemination delay as well as of the individual user-delay. Compared to the conventional base station (BS)-aided multicast, our scheme is capable of reducing the average dissemination delay by about 56.5%. Moreover, in contrast to the BS-aided multicast, increasing the number of MUs in the target social group is capable of reducing the average individual user delay by 44.1% relying on our scheme. Furthermore, our scheme is more suitable for disseminating a popular piece of content.*

Keywords*-*content dissemination, zipf distribution, pure birth markov chain.

I. INTRODUCTION

As a combination of social science and mobile networks, mobile social networks (MSNs) are attracting an increasing attention across the research community. In the context of MSNs, mobile users (MUs) may form a social group in order to cooperatively disseminate the content of common interest. There are substantial contributions to the performance analysis of epidemic forwarding in mobile ad hoc networks (MANETs).In the context of MANETs, a two-dimensional continuous time Markov chain (CTMC) was proposed for evaluating the performance of a heterogeneous MANETs. To a further advance, the authors derived a tight upper bound of the flooding time, which is defined as the number of time-steps required for broadcasting a message from a source node to all nodes. Furthermore, the end-to-end message delivery delay using an epidemic forwarding protocol was investigated theoretically in a composite twin-layer network, which includes a physical MANET and a virtual social network.

However, epidemic forwarding is often criticised as being an end-to-end routing protocol, because it consumes substantial resources of the intermediate nodes, which might not be interested in the information to be relayed. However, if MUs can form a social group and request the content of common interest together, epidemic forwarding becomes an efficient way of cooperatively disseminating the content in the target social group1. Content dissemination in purely distributed opportunistic networks was investigated. Epidemic forwarding aided content dissemination was invoked, where the users share any content updates with others that they meet in order to improve the coverage quality and to increase the capacity. A socially-aware content placement algorithm was proposed for enhancing the opportunity of MUs to gain access to their contents of interest.

Some researches focused on a hybrid content dissemination approach. the authors investigated how the content providers and network operators can interact for the sake of efficiently distributing the contents with the aid of a coalition game. At the time of writing, epidemic forwarding aided content dissemination is widely studied for the sake of offloading tele-traffic from cellular networks. the authors proposed a framework for initial content-receiver selection in order to disseminate the content of common interest to as many subscribers as possible before interest in the content subsides. where MUs were categorized into "helpers" and "subscribers", several algorithms were designed for solving the optimization problem of offloading multiple types of contents from the cellular networks.

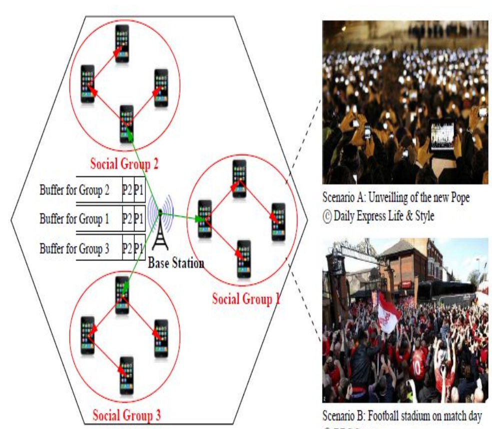

Fig. 1. Infrastructure Wireless Mesh Network

The above-mentioned contributions focused their attention on user-encounter-based MANETs or 'large-scale MSNs', where the mobile nodes are sparsely distributed across a large area. Typically a rudimentary physical layer model is assumed, namely that if a pair of nodes enter each other's transmission range, the packet can be successfully delivered from the source to the target. Hence, the delivery delay is dominated by the inter-contact duration2 of mobile nodes, rather than by the wireless signal propagation. Due to the underlying long inter-contact duration of the MUs, this user-encounter-based content dissemination is only capable of delivering delay-tolerant services in a large-scale area. As a result, the contributions belong to the category of delay-tolerant networks (DTNs). However, typically idealised simplifying assumptions are used in the literature of the DTN paradigm:

- The commonly assumed simplified physical layer model ignores the impact of transmit power, of the path-loss and of the multipath fading, etc.
- The cooperative user-encounter based content dissemination in DTNs is not suitable for delivering delay-sensitive services.

Motivations and Contributions

The conventional method of disseminating the delay sensitive content of common interest relies on BS-aided multicast, where the BS is the sole transmitter. Since the BS aided multicast has to guarantee the quality of service (QoS) at every content requester, the capacity of multicast channels is predetermined by the worst channel amongst those connecting the BS to the content requesters. In this case, due to the time variant nature of wireless channels, when the BS multicasts a packet, some MUs may receive it earlier than their less fortunate counter parts.

Then, the successful receivers have to remain silent, because the BS would not multicast the second packet, before all the MUs successfully receive the current one. In high-user-density scenarios, the MUs often share common interest in delay-sensitive content. For instance,the crowd participating in the inauguration of the new Pope share common interest in close-up video-clips of the Pope on the podium. Similarly, supporters in a football stadium share common interest in video-clips of a spectacular goal from different angles or in the score updates from another stadium, as exemplified by Fig.1. However, the conventional BS-aided multicast is an inefficient technique of disseminating the delay sensitive content of common interest in these typical densely populated scenarios. The reason for this is two-fold:

- As the content requesters' density increases, the worst channel amongst those connecting the BS and the content requesters becomes even worse, which results in excessive dissemination delays.

- Since the dissemination delay is increased, the BS is engaged in multicasting for a longer period, which further delays all other services.

If local MUs form a social group for requesting the content of common interest from the BS together, local communications amongst MUs can be exploited for cooperatively multicasting the packets from the packet owners to the hitherto unserved MUs in the target social group3. The potential performance gain of this social group multicast aided content dissemination over the conventional BS-aided multicast arises from the following two benefits:

- Relying on the cooperative multicast of the multiple packet owners results in rich cooperative diversity gains, which in turn improves the packet delivery performance.

- Activating direct transmissions amongst the MUs is capable of reducing the distance between a transmitter and receiver pair, which in turn reduces the path-loss induced channel attenuation between them.

Furthermore, since we offload the content dissemination task from the BS-aided multicast to the local communications amongst the social group members, the BS becomes capable of satisfying other communication demands, which consequently improves the efficiency of the BS's exploitation. The size of the area covered by a social group should be carefully designed for different scenarios. If the area is as large as a macro-cell, cooperative user-encounter based communication amongst MUs is only suitable for disseminating delay-tolerant information, as we argued at the end of Section I-A. The best option for disseminating delay sensitive information across a large area is that of classic BS-aided multicast. By contrast, if the area is relatively small, such as for example a circular area with a radius shorter than a hundred meters, which is comparable to the default transmission range of a MU4, communication efficiency between a transmitter and receiver pair is dominated by the wireless signal propagation properties, rather than by their inter-contact duration.

Hence, social group aided cooperative multicast is capable of significantly reducing the delay of the conventional BS aided multicast, as we emphasized at the beginning of Section I-B. This scenario is termed as a "small-scale MSN", where the channel attenuation factors dominate the associated delay characteristics. Against this background, our novel contributions are as follows:

- A hybrid content dissemination approach is proposed, which relies both on BS-aided multicast and on social group multicast aided content dissemination. This process is modelled by a Pure-Birth based Markov Chain (PBMC). Various factors that might affect the performance of the content dissemination are accounted for, including the PL-induced path loss, the multipath fading and the users' altruistic versus selfish behaviours, which distinguishes our work from the existing literature of DTNs.

- We model the popularity of different pieces of contents by a Zipf distribution, which affects the specific formation of a social group and hence influences the dissemination process of the content of common interest across the target social group.

- Considering a specific packet of the content of common interest, we analyse the statistical properties of the dissemination delay, which is the time from the BS's instant of multicasting a packet until all the MUs in the target social group receive this packet. We also analyse the individual user-delay, which is the time spanning from the BS multicasting a packet until a specific MU receives this packet.

- The advantages of our social group multicast aided content dissemination scheme over the conventional BS aided multicast are demonstrated by the mobility traces extracted from a realistic subway station scenario. Note that improving the network infrastructure in high-user density areas can certainly enhance the general communication experience of MUs, when supporting phone calls, texts, emails and basic data services.

However, it may constitute an inefficient technique of disseminating the content of common interest. It may also be an unwise investment for the network operators, since people often temporarily get together for attending social events. Hence, improving the infrastructure capacity may be wasteful. By contrast, our social group multicast scheme constitutes a more economical and flexible solution for disseminating the content of common interest amongst the social group members, which is based on direct communications between the social group members. We will demonstrate that our social group multicast aided scheme outperforms the BS-aided multicast in terms of disseminating the popular content of common interest in high-user-density areas.

TABLE I: The request probabilities of $\mathcal{M} = 10$ ranked popular contents for both $\alpha = 0.56$ [?] and $\alpha = 1.0$ [?].

Content	C_1	C_2	C_3	C_4	C_5
$\alpha = 0.56$	21.4%	14.6%	11.6%	9.9%	8.7%
$\alpha = 1.0$	34.1%	17.1%	11.4%	8.5%	6.8%
Content	C_6	C_7	C_8	C_9	C_10
$\alpha = 0.56$	7.9%	7.2%	6.7%	6.3%	6.0%
$\alpha = 1.0$	5.7%	4.9%	4.3%	3.8%	3.4%

Similar to the BS-controlled device-to-device communication services of the LTE network, our system operates by obeying a centralized - control regime combined with a decentralized–transmission paradigm, where the BS acts as a centralised controller in order to support the functions of synchronisation6, of social group formation as well as of coordination and resource allocation for multiple POs etc. By contrast, the information transmission is carried out by direct communications between a transmitter and receiver pair.

Content Popularity and Social Group Formation

The interest of a MU in a specific piece of content Ci may be modelled by the probability Pr(Ci) of this MU requesting Ci from the BS. Having a higher request probability Pr(Ci) indicates that the MU is more interested in the content Ci. The statistical analysis of the realistic video viewing behaviours exhibited by YouTube users revealed that a small fraction of popular contents attract the interest of a large fraction of users. Furthermore, the request probabilities of a set of ranked contents, say {Ci|i = 1, · · · ,M}, may be modelled by a Zipf distribution. Here M is the number of contents studied and the subscript i represents the particular position of Ci in the popularity list. A smaller integer subscript i indicates that the content is more popular and hence it is likely to be requested more frequently.

II. LITERATURE SURVEY

Literature survey is the most important step in software development process. Before developing the tool it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, then the next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the programmers need lot of external support. This support can be obtained from senior programmers, from book or from websites. Before building the system the above consideration are taken into account for developing the proposed system.

The major part of the project development sector considers and fully survey all the required needs for developing the project. For every project Literature survey is the most important sector in software development process.

Before developing the tools and the associated designing it is necessary to determine and survey the time factor, resource requirement, man power, economy, and company strength. Once these things are satisfied and fully surveyed, then the next step is to determine about the software specifications in the respective system such as what type of operating system the project would require, and what are all the necessary software are needed to proceed with the next step such as developing the tools, and the associated operations.

2.1 A SURVEY ON WIRELESS MESH NETWORKS - I.F.AKYILDIZ AND X.WANG

Wireless mesh networks (WMNs) have emerged as a key technology for next-generation wireless networking. Because of their advantages over other wireless networks, WMNs are undergoing rapid progress and inspiring numerous applications. However, many technical issues still exist in this field. In order to provide a better understanding of the research challenges of WMNs, this article presents a detailed investigation of current state-of-the-art protocols and algorithms for WMNs. Open research issues in all protocol layers are also discussed, with an objective to spark new research interests in this field.

2.2 A QOS AWARE MULTICAST ALGORITHM FOR WIRELESS MESH NETWORKS - L.ZHAO,A.Y AL-DUBAI AND G.MIN

Wireless mesh networks have been attracting significant attention due to its promising technology. It is becoming a major avenue for the fourth generation of wireless mobility. Communication in large-scale wireless networks can create bottlenecks for scalable implementations of computationally intensive applications. A class of crucially important communication patterns that have already received considerable attention in this regard are group communication operations, since these inevitably place a high demand on network bandwidth and have a consequent impact on algorithm execution times. Multicast communication has been among the most primitive group capabilities of any message passing networks. It is central to many important distributed applications in Science and Engineering and fundamental to the implementation of higher-level communication operations such as gossip, gather, and barrier synchronisation. Existing solutions offered for providing multicast communications in WMN have severe restriction in terms of almost all performance characteristics. Consequently, there is a need for the design and analysis of new efficient multicast communication schemes for this promising network technology. Hence, the aim of this study is to tackle the challenges posed by the continuously growing need for delivering efficient multicast communication over WMN. In particular, this study presents a new load balancing aware multicast algorithm with the aim of enhancing the QoS in the multicast communication over WMNs.

2.3 TRANSMISSIONS FAILURES AND LOAD-BALANCED ROUTING METRIC FOR WIRELESS MESH NETWORKS - I.ULLAH, K.SATTAR, Z.U.QAMAR, W. SAMI

Wireless Mesh Networks play an important role in the next production wireless communication systems as it can support broadband services with omnipresent coverage and low transmission power with high capacity and high processing power. The efficiency of mesh networks is further improved by a routing path determination mechanism that considers most of the causes of transmissions failures. Our proposed routing metric takes into account transmissions failures by considering the backoff mechanism used in IEEE 802.11 networks and assign weights to each path. These weights act as a metric in route selection among different paths. The proposed scheme further utilizes this metric to provide load balancing. Consequently this metric helps the routing protocols to balance traffic and avoids traffic through congested paths.

2.4 A ROUTING METRIC FOR LOAD-BALANCING IN WIRELESS MESH NETWORKS - L.MA AND M.K.DENKO

This paper proposes a routing metric known as weighted cumulative expected transmission time with load balancing (WCETT-LB) for wireless mesh net works. WCETTT-LB enhances the basic Weighted Cumulative Expected Transmission Time (WCETT) by incorporating load balancing into the routing metric. Unlike other existing schemes proposed for load balancing for wireless mesh networks, WCETT-LB implements load balancing at mesh routers. WCETT-LB provides a congestion aware routing and traffic splitting mechanism to achieve global load balancing in the network. The preliminary qualitative and quantitative analyses show the significance of the proposed scheme.

2.5 A DISTRIBUTED ALGORITHM FOR GATEWAY LOAD BALANCING IN WIRELESS MESH NETWORKS - J.J.GALVEZ, P.M.RUIZ AND ANTONIA F.G.SKARMETA

Wireless Mesh Networks (WMNs) provide a cost-effective way of deploying a network and providing broadband Internet access. In WMNs a subset of nodes called gateways provide connectivity to the wired infrastructure (typically the Internet). Because traffic volume of WMNs is expected to be high, and due to limited wireless link capacity, gateways are likely to become a potential bottleneck. In this paper, we propose a distributed load-balancing protocol where gateways coordinate to reroute flows from congested gateways to under-utilized gateways. Unlike other approaches, our scheme takes into account the effects of interference. This makes it suitable for implementation in practical scenarios, achieving good results, and improving on shortest path routing. Also, it is load-sensitive and can improve network utilization in both balanced and skewed topologies. Simulation results prove the effectiveness of our approach, which outperforms all schemes tested. We have observed throughput gains of up to 80% over the shortest path algorithm.

2.6 OPTIMIZATION BASED DISTRIBUTED ALGORITHMS FOR MOBILE DATA GATHERING IN WIRELESS SENSOR NETWORKS - M. ZHAO AND Y. YANG

Recent advances have shown a great potential of mobile data gathering in wireless sensor networks, where one or more mobile collectors are employed to collect data from sensors via short-range communications. Among a variety of data gathering approaches, one typical scheme is called anchor-based mobile data gathering. In such a scheme, during each periodic data gathering tour, the mobile collector stays at each anchor point for a period of sojourn time, and in the meanwhile the nearby sensors transmit data to the collector in a multihop fashion. In this paper, we focus on such a data gathering scheme and provide distributed algorithms to achieve its optimal performance. We consider two different cases depending on whether the mobile collector has fixed or variable sojourn time at each anchor point. We adopt network utility, which is a properly defined function, to characterize the data gathering performance, and formalize the problems as network utility maximization problems under the constraints of guaranteed network lifetime and data gathering latency. To efficiently solve these problems, we decompose each of them into several sub problems and solve them in a distributed manner, which facilitates the scalable implementation of the optimization algorithms. Finally, we provide extensive numerical results to demonstrate the usage and efficiency of the proposed algorithms and complement our theoretical analysis.

III. SYSTEM ANALYSIS

EXISTING SYSYEM

We model the popularity of different pieces of contents by a zipf distribution, which affects the specific formation of a social group and hence influences the dissemination process of the content of common interest across the target social group. considering a specific packet of the content of common interest, we analyses the statistical properties of the dissemination delay, which is the time from the BS's instant of multicasting a packet until all the Mus in the target social group receive this packet. we also analyses the individual user-delay , which is the time spanning from the BS multicasting a packet until a specific MU receives this packet.

PROPOSED SYSTEM

A hybrid content dissemination approach is proposed, which relies both on BS-aided multicast and on social group multicast aided content dissemination. Tis process is modelled by a Pure-Birth based Markov chain (PBMC). Various factors that might affect the performance of the content dissemination are accounted for, including the PL-induced path loss, the multipath fading and the users altruistic versus selfish behaviors ,which distinguishes our work from the existing literature of DTNs.

IV. SOFTWARE DESCRIPTION

INTRODUCTION TO LINUX

It is a modern very stable multi-user multitasking environment with an inexpensive PC or hardware, at no (or almost no) monetary cost for the software. Linux is VERY standard--it is essentially a POSIX compliant UNIX. Linux includes all the UNIX standard tools and utilities. It is known as advanced graphical user interface. Linux uses a standard, network-transparent X-windowing system with a "window manager".

BENEFITS

Low cost:

There is no need to spend time and money to obtain licenses since Linux and much of its software comes with the GNU General Public License. It is able to start working immediately without worrying that your software may stop working anytime because the free trial version expires. Additionally, there are large repositories from which you can freely download high quality software for almost any task you can think of.

Stability:

Linux doesn't need to be rebooted

Compatibility:

It runs all common UNIX software packages and can process all common file formats.

Choice:

The large number of Linux distributions gives you a choice. Each distribution is developed and supported by a different organization. You can pick the one you like best; the core functionalities are the same; most software runs on most

NETWORK SIMULATOR-2

After setting up the platform, software named ns2 was set up on it which was used for all the analysis and simulation work apart from other tools used. Ns2 is the de facto standard for network simulation. Its behavior is highly trusted within the networking community. It is developed at ISI, California, and is supported by the DARPA and NSF. Ns2 is an object oriented simulator, written in C++, with an OTcl interpreter as a frontend. This means that most of the simulation scripts are created in Tcl. If the components have to be developed for ns2, then both Tcl and C++ have to be used. Ns2 uses two languages because any network simulator, in general, has two different kinds of things it needs to do. On the one hand, detailed simulations of protocols require a systems programming language which can efficiently manipulate bytes, packet headers, and implement algorithms that run over large data sets. For these tasks run-time speed is important and turn-around time (run simulation, find bug, fix bug, recompile, re-run) is less important. On the other hand, a large part of network research involves slightly varying parameters or configurations, or quickly exploring a number of scenarios. In these cases, iteration time (change the model and re-run) is more important. Since configuration runs once (at the beginning of the simulation), run-time of this part of the task is less important.

WIRED VS WIRELESS NETWORKS

The different types of networks available today are Wired and Wireless networks. Wired are differentiated from wireless as being wired from point to point.

WIRED NETWORKS

These networks are generally connected with the help of wires and cables. Generally the cables being used in this type of networks are CAT5 or CAT6 cables. The connection is usually established with the help of physical devices like Switches and Hubs in between to increase the strength of the connection. These networks are usually more efficient, less expensive and much faster than wireless networks. Once the connection is set there is a very little chance of getting disconnected.

ADVANTAGES

- A wired network offer connection speedsof 100Mbpsto1000Mbps.
- Physical, fixed wired connections are not prone to interference and fluctuations in available bandwidth, which can affect some wireless networking connections.

DISADVANTAGES

- Expensive to maintain the network due to many cables between computer systems and even if a failure in the cables occur then it will b every hard to replace that particular cable as it involved more and more costs.
- When using a laptop which is required to be connected to the network, a wired network will limit the logical reason of purchasing a laptop in the first place.

WIRELESS NETWORKS

Wireless networks use some sort of radio frequencies in air to transmit and receive data instead of using some physical cables. The most admiring fact in these networks is that it eliminates the need for laying out expensive cables and maintenance costs.

ADVANTAGES

- Mobile users are provided with access to real-time information even when they are away from their home or office.
- Setting up a wireless system is easy and fast and it eliminates the need for pulling out the cables through walls and ceilings.
- Network can be extended to places which cannot be wired.
- Wireless networks offer more flexibility and adapt easily to changes in the configuration of the network.

DISADVANTAGES

- Interference due to weather, other radio frequency devices, or obstructions like walls.
- The total Through put is affected when multiple connections exists.

PROBLEMS IN WIRELESS COMMUNICATIONS

Some of the problems related to wireless communication are multipath propagation, path loss, interference, and limited frequency spectrum. Multipath Propagation is, when a signal travels from its source to destination, in between there are obstacles which make the signal propagate in paths beyond the direct line of sight due to reflections, refraction and diffraction and scattering. Path loss is the attenuation of the transmitted signal strength as it propagates away from the sender. Path loss can be determined as the ratio between the powers of the transmitted signal to the receiver signal. This is mainly dependent on a number of factors such as radio frequency and the nature of the terrain. It is sometimes important to estimate the path loss in wireless communication networks. Due to the radio frequency and the nature of the terrain are not same everywhere, it is hard to estimate the path loss during communication. During communication a number of signals in the atmosphere may interfere with each other resulting in the destruction of the original signal. Limited Frequency Spectrum is where, frequency bands are shared by many wireless technologies and not by one single wireless technology.

NETWORK SIMULATOR 2.28 (NS2)

Ns-2 is a packet-level simulator and essentially a centricdiscrete event scheduler to schedule the events such as packet and timer expiration. Centric event scheduler cannot accurately emulate “events handled at the same time” in real world, that is, events are handled one by one. This is not a serious problem in most network simulations, because the events here are often transitory. Beyond the event scheduler, ns-2 implements a variety of network components and protocols. Notably, the wireless extension, derived from CMU Monarch Project, has 2 assumptions simplifying the physical world: Nodes do not move significantly over the length of time they transmit or receive a packet. This assumption holds only for mobile nodes of high-rate and low-speed. Consider a node with the sending rate of 10Kbps and moving speed of 10m/s, during its receiving a packet of 1500B, the node moves 12m. Thus, the surrounding can change significantly and cause reception failure. Node velocity is insignificant compared to the speed of light. In particular, none of the provided propagation models include Doppler effects, although they could.

STRUCTURE OF NS-2

- Create the event scheduler
- Turn on tracing
- Create network
- Setup routing
- Insert errors
- Create transport connection
- Create traffic
- Transmit application-level data

5.13 FUNCTIONALITIES OF NS-ALLIONE2.28:

C++/OTcl Linkage

Root of ns-2 object hierarchy

Bind (): link variable values between

TclObject

C++ and OTcl

Command (): link OTcl methods to C++ implementations

TclClass

Create an OTcl object, and create a linkage between the OTcl object and C++ Object

Tcl C++

Methods to access Tcl interpreter

TclCommand

Standalone global commands

EmbeddedTcl

ns script initialization

NETWORK COMPONENTS

The root of the hierarchy is the TclObject class that is the superclass of all OTcl library objects (scheduler, network components, timers and the other objects including NAM related ones). As an ancestor class of TclObject, NsObject class is the superclass of all basic network component objects that handle packets, which may compose compound network objects such as nodes and links. The basic network components are further divided into two subclasses, Connector and Classifier, based on the number of the possible output data paths. The basic network objects that have only one output data path are under the Connector class, and switching objects that have possible multiple output data paths are under the Classifier class.

PACKET

A NS packet is composed of a stack of headers, and an optional data space. A packet header format is initialized when a Simulator object is created, where a stack of all registered (or possibly useable) headers, such as the common header that is commonly used by any objects as needed, IP header, TCP header, RTP header (UDP uses RTP header) and trace header, is defined, and the offset of each header in the stack is recorded. What this means is that whether or not a specific header is used, a stack composed of all registered headers is created when a packet is allocated by an agent, and a network object can access any header in the stack of a packet it processes using the corresponding offset value.

STARTING NAM

NAM is a Tcl/TK based animation tool for viewing network simulation traces and real world packet trace data. The first step to use NAM is to produce the trace file. The trace file should contain topology information, e.g., nodes, links, as well as packet traces. Usually, the trace file is generated by ns2. During ns2 emulation, user can produce topology configurations, layout information, and packet traces using tracing events in ns2. When the trace file is generated, it is ready to be animated by NAM. Upon startup, NAM will read the trace file, create topology, pop up a window, do layout if necessary and then pause at the time of the first packet in the trace file. Through its user interface, NAM provides control over many aspects of animation.

TRACE GRAPH

Trace graph is a free tool for analyzing the trace files generated by ns2. Trace graph can support any trace format if converted to its own or ns2 trace format. Trace graph runs under Windows, Linux, and UNIX and MAC OS systems.
Some of the program features are as follows:

- 238 2D graphs: Tracegraph supports drawing 238 different graphs depending upon different parameters in 2 Dimensional areas.
- 12 3D graphs: Tracegraph supports 12 graphs in 3 Dimensions.
- Delays, jitter, processing times, round trip times, throughput graphs and statistics can be plotted with the help of Tracegraph. These are described below:
- Delay: This is the delay encountered between the sending and receiving of the packet.
- Jitter: This is the unwanted variation in the output.
- Processing Time: The time it takes for a node to process the input.
- Round Trip Time: The time required for a signal pulse to travel from a specific source to a specific destination and back again.
- Whole network, link and node graphs and statistics.
- All the results can be saved to text files, graphs can also be saved as jpeg and tiff.
- Any graph saved in text file with 2 or 3 columns can be plotted.
- Script files processing to do the analysis automatically.

The program does have some disadvantages though, such as it hangs or takes a very long time while trying to open large trace files. Also it sometimes hangs after displaying the graph in 3D. The reason why this tool was used in the simulation work is that there are not too many graph plotting tools available in the market.

V. CONCLUSION

In this system, we proposed a social group multicast aided content dissemination scheme as a supplement to the conventional cellular system. The content popularity is modelled by a Zipf distribution and the concept of FA was introduced for the sake of quantifying the probability of a PO forwarding a packet of the content of common interest. In our scheme, the BSs are invoked for multicasting the packet at the initial stage, as well as when no POs are willing to share the packet with others. By modelling the packet dissemination process as a PBMC, closed-form expressions were derived for the statistical properties of the various delay metrics. We demonstrated that our approach outperforms the conventional BS-adied multicast in terms of both the dissemination delay and the individual user delay, especially when the density of MUs in a target group is high. Furthermore, we found that our approach is more suitable for disseminating a more popular content. By contrast, the conventional BS-aided multicast performs better for disseminating a less popular content.

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