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QoS based performance analysis of EAODV protocol in Overlay Network

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ABSTRACT

An overlay network is a computer network which is built on the top of another network. Overlay networks can be mainly classified into two types of networks, Peer-to-Peer networks and Content Delivery Networks (CDN). This paper complements the current research on routing in Ad hoc network by proposing a new protocol EADOV. In this paper we have measure the performance of mobile wireless network UPD-based application for various routing protocol and compare them with proposed EAODV protocol. Also QoS based performance analysis of EAODV protocol in different scenario has been done and results are compared. Network Simulator NS2 on Fedora environment is used for simulation which included two mobile nodes with four types of traffic VoIP, video, CBR and FTP for creating heavy load and to simulate the protocols.

Introduction

An overlay is a set of servers deployed beyond the internet that provide infrastructure to one or more applications, take responsibility for the forwarding and handling of application data in ways that are different from or in competition with what is part of the basic internet, and can be operated in an organized and coherent way by third parties [1] .For example, distributed systems such as cloud computing, peer-to-peer networks, and client-server applications are overlay networks because their nodes run on top of the Internet. The Internet was originally constituted as an overlay upon the telephone network while today (through the advent of VoIP), the telephone network is progressively turning into an overlay network built on top of the Internet [1].

Content Delivery Networks (CDNs) give services that improve network performance by maximising information measure, up accessibility and maintaining correctness through content replication. They provide quick and reliable applications and services by distributing content to cache or edge servers situated near users. Content Delivery Network consists of the many mobile nodes that act as each host furthermore as router within the free house air.

Therefore Content Delivery Network works with none pre-existing infrastructure [2,3,4,7]. The standard of service is huge challenge within the field of wireless Content Delivery Networks, since the mobile nodes square measure plug-n-play devices they need to face several problems in several applications of wireless communications. The sector of wireless networking emerges from the mixing of non-public computing, cellular technology, and also the web. This is often as a result of the increasing interactions between communication and computing, that square measure dynamical info access from “anytime anywhere” into “all the time, everywhere.” at this time, an outsized form of networks exist, starting from the well-known infrastructure of cellular networks to non-infrastructure wireless adhoc networks. Once any link of a multi-hop communication path breaks, the trail should be repaired or reconstructed. Throughout this process, packets could also be generated. This loss of packets can have an effect on quality of service (QoS) for each period of time and non-real-time applications and cause important turnout degradation [5,6]. Considering the recent advances in mobile content networking (e.g. WAP, IPv6 etc.), the infrastructure of mobile CDNs may play a leading role in terms of exploiting the emerging technological advances in the wireless web.

Video streaming over the Internet has become increasingly popular in recent years due to the rapid rise in network access speed of the end-users. Media streaming systems are distinct from file-sharing systems, in which a client has to download the entire file before using it. In a media streaming session, the receiver can already consume the tile while downloading. Video streaming applications are highly susceptible to packet delay and packet loss. A packet arriving after its scheduled playback time is useless and considered lost. A lost or corrupted frame creates an avalanche effect in the decoding process, as the decoding of subsequent frames is impaired by spatio-temporal error propagation. Therefore, in the case of loss, decoding is often completely stopped until the next I-frame arrives. In Internet video streaming, variations in transmission quality (throughput, delay etc.) are smoothed using a receiver buffer. The size of the buffer corresponds to the user-perceived initial delay of the application.

Reactive routing protocols for content delivery networks

There are differing kinds of routing protocols are offered, that's proactive, reactive and hybrid protocols. Reactive routing protocols for Content Delivery Networks are known as “on-demand” routing protocols like Ad hoc On Demand Distance Vector (AODV), Dynamic Source Routing (DSR) & Temporarily Ordered Routing Algorithm (TORA) [9,10,11,12]. In CDN, active routes could also be disconnected because of node quality. Ad Hoc networks are challenged due to nodes are constantly mobile, Protocols implemented are co-operative in nature, Lack of fixed infrastructure and central concentration point where IDS can collect audit data and one node can be compromised not have to maintain routing information, For route discovery Source Node broadcast Route-Request packet, each intermediate node gets a Route-Request. This kind of protocols is usually based on flooding the network with Route

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Request (RREQ) and Route reply (RERP) messages [9,10]. Other On Demand driven protocols are Associatively Based routing (ABR) [13],Signal Stability Based Adaptive Routing (SSA) [14],Location-Aided Routing Protocol (LAR) [15].

The Dynamic Source Routing (DSR) utilizes source routing algorithm. In this protocol, every data packet contains complete routing information to reach its dissemination. Furthermore, in DSR each node uses caching technology to maintain route information that it has learnt [11].

Temporarily Ordered Routing Algorithm (TORA) is a distributed routing protocol based on a “link reversal” algorithm. It is designed to discover routes on demand , provide several routes to a destination, create routes quickly, and minimize communication overhead by localizing algorithmic reaction to topological changes when likely. Route optimality (shortest-path routing) is considered of secondary significance, and longer routes are often used to avoid the overhead of discovering newer routes [12].

In Ad hoc On Demand Distance Vector (AODV) routing protocol, routing information is maintained in routing tables at nodes. Every mobile node keeps a next hop routing table, which holds the destinations to which it currently has a route. A routing table way in expires if it has not been used or reactivated for a prespecified expiration time. In AODV, when a foundation node wants to send packets to the destination but no route is accessible, it initiates a route discovery process. In the route discovery operation, the source broadcasts route request (RREQ) packets. A RREQ accommodates addresses of the source and the target, the broadcast ID, which is used as its identifier, the last seen sequence number of the target as well as the source node’s sequence number. Sequence numbers are vital to ensure loop-free and up-to-date routes. To reduce the flooding overhead, a node rejects RREQs that it has seen before and the expanding ring search algorithm is used in route discovery operation. The RREQ starts with a minute TTL (Time-To-Live) value. If the target is not found, the TTL is increased in subsequent RREQs. Ad hoc On Demand Distance Vector (AODV) routing algorithmic rule could be a routing protocol designed for mobile ad hoc mobile networks or wireless network [17].

In addition, AODV forms trees that connect multicast cluster members. The trees are composed of the cluster members and also the nodes required to attach the members. AODV uses sequence numbers to make sure that it is free from count to infinity problem.In AODV protocol routes are established on-demand and destination sequence numbers are used to find the latest route, Thus the connection establish time is less, One of the drawbacks of the above protocol is inconsistent routes due to intermediate nodes, Also multiple “Route-Reply” packets in response to a single “Route-Request” packet can lead to heavy control overhead [17]. Another disadvantage of AODV is that the periodic beaconing leads to unnecessary bandwidth consumption

Enhanced aodv (eaodv) routing algorithm

We proposed an enhanced version of AODV algorithm. That almost recovers the drawbacks of AODV protocol discussed above.

Algorithm 1: Proposed Enhanced AODV Algorithm

01 // Forwarding packets

02 if (route entry to destination exists)

// EAODV uses an active neighbour list to keep track of which neighbours that are using a particular route. These lists are used when sending triggered route replies. The neighbour lists are updated every time a packet is forwarded

03 {

04 if (neighbour who forwarded packet to you != active neighbour for route)

05 {add neighbour to active neighbour list for route entry}

06 }

07 // link breakages are detected by either the link layer which notifies the routing agent or by using hello messages. If a node has not received hello messages from a node for a certain amount of time it will assume that the link is down. Every time a link is detected as down, EAODV will send a Triggered RREP to inform the affected sources(Sending Triggered RREP)

08 for (each address in the active neighbour list for a route entry)

09 {create a link failure notice packet unicast to active neighbour}

10 // every time a Triggered RREP is received informing about a broken link, the affected route entry must be deleted and neighbours using this entry must be informed.(Receiving Triggered RREP)

11 if (have active neighbours for broken route)

12 {send Triggered RREP}

13 delete route entry for broken route

Performance Evaluation Metrics

In wireless network there are various performance evaluation metrics are available. We chose most popular three metrics: throughput, PSNR, average PSNR and end-to end delay.

Simulation Result

Traditional AODV, DSR algorithm & proposed EAODV algorithm Peer-to-peer (P2P) file sharing in mobile ad hoc networks has continuously gained popularity due to its strong adaptability in many practical applications. The AODV protocol used in MANET can also be used in P2P overlay network.

We present a comparison between the traditional AODV and proposed EAODV algorithm. In this study framework for video transmission over the wireless network in NS2 on Fedora environment [16] is used and simulation included 2 mobile nodes with 4 types of traffic VoIP, video, CBR and FTP for creating heavy load. The myEvalvid framework is used for adaptive cross-layer method for MPEG-4 video transmission over IEEE 802.11e EDCA and IEEE 802.11nin heavy load. The simulation topology is shown in figure 2.The simulation parameters and foreman QCIF video characteristics shown in table 1 and 2 respectively. The IEEE 802.11n simulation parameters are shown in table 3, and Comparison of average PSNR, throughput and frame losses is shown in Table 4.

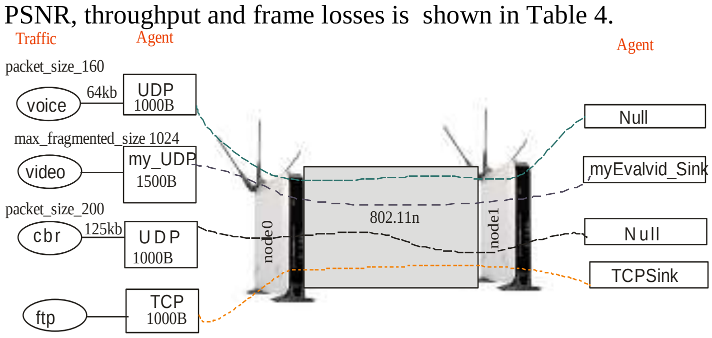


Figure 1: Simulation Topology

Table 1: Simulation parameter

	VoIP	Video	Back-ground	Best Effort
Transport protocol	UDP	UDP	UDP	TCP
Access Category	AC0	AC1	AC2	AC3
Packet size	1500B	1500B	1500B	1500B
Sending rate	64Kbps	512Kbps	256Kbps	256Kbps

Table 2: Total video packets and frames in video source (foreman)

	Number of Packets			Total Packets		Number of Frames		Total Frames	
Video	Format	I	P	B		I	P	B	
Foreman	QCIF	237	149	273	659	45	89	266	400

Table 3: IEEE 802.11n simulation parameter

Parameter	Value
CBR Interval time	80µsec
Packet Size	1500 bytes
Block Acknowledge type	0 (none)
RD-Reverse Direction	0
Aggregation Size	16383 bytes
Flag for Contention Free Burst (*cbr_*)	0
Number of Antenna	4
MIMO System	1

This simulation compare performance of foreman video in high load traffic (VoIP 1 sources, Video 3 sources, CBR 1 source and FTP 1 source) for traditional AODV and purposed EAODV routing algorithm in in this simulation on IEEE 802.11n. The average PSNR, throughput, end-to-end delay were checked for both routing algorithms.

Table 4: Comparison of average PSNR, throughput and frame losses

Routing Algorithm	Average PSNR (dB)	Throughput (Kbps)	Number of Frame Losses			
			I	P	B	Total
ADOV	33.254148	641.15	1	7	38	46
EAODV	34.454985	677.62	0	1	77	78

The comparison of average PSNR, throughput and frame losses show in table 4. The purposed algorithm EAODV give better average PSNR, throughput and less I frame (the main key frame in video which neither is not regenerated at destination) losses. Similarly comparison of PSNR and end-to-end delay shown in figure 2 and 3 respectively. The purposed new algorithms have less end-to-end delay.

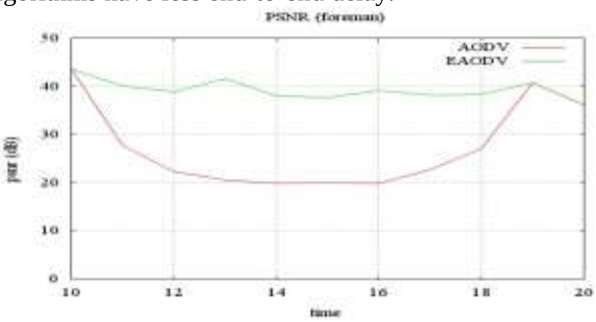


Figure 2: Comparison of PSNR

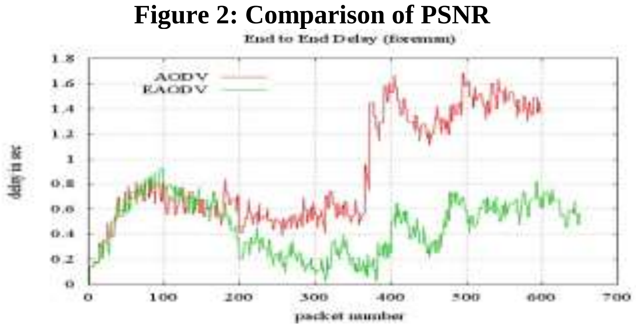
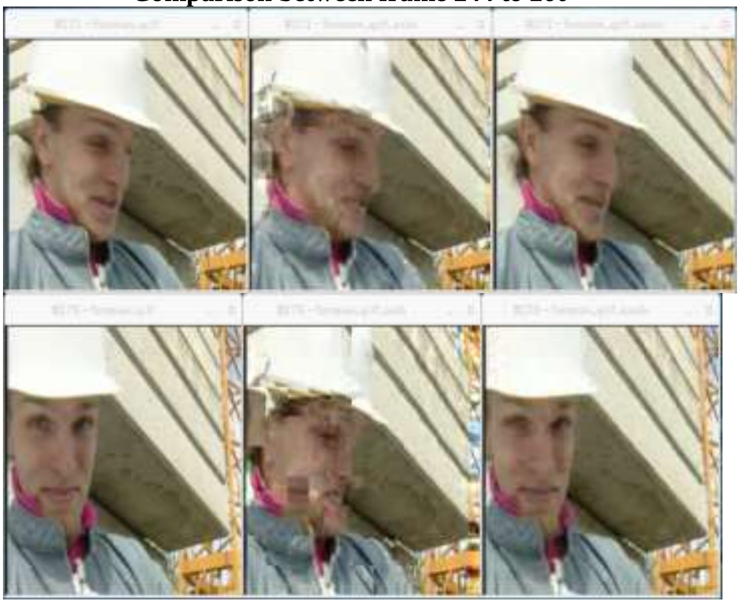


Figure 3: Comparison of End-to-End Delay

We play three YUV video: original foreman_qcif.yuv, foreman_qcif_aodv.yuv and foreman_qcif_eaodv.yuv in yuvviewer.exe utility [18, 19]. The comparison of received vide of routing algorithm as shown below in figure 4.

Comparison between frame 244 to 260



Comparison between frame 271 to 276

Figure 4: Comparison of received *yuv* by AODV and EAODV

The foreman QCIF video has total 400 frames. The figure 4 shows the comparisons of received yuv video. In figure 4(a) frame from 244 to 260 the EAODV give better output than AODV. Similarly in figure 4(b) frame from 271 to 276 EAODV give better output than AODV. Other than above frames rest of the frames received in good quality.

Conclusion

The purposed algorithm simulated over IEEE 802.11n standard in heavy load environment with background traffic. Simulation performance parameters PSNR, average PSNR, throughput, frame losses and end-to-end delay are measured. Our purposed algorithm Enhanced AODV (EAODV) gave better result than the traditional AODV routing algorithm. Received video was also compared for both algorithm, the EAODV give better output and received more good quality frames than AODV.

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