Enhancing QOS/QOE in MANETs using OLSR Protocol

Hind Ziani, Nourddine Enneya

Abstract*: *Video streaming over Mobile Ad-hoc Networks (MANETs) has been on the fore as one of the most chiefly solicited web services. Within this context, the enhancement of the Quality of Experience (QoE) on such platforms, whose signature characteristic is the real-time fluctuation of their Mobile Nodes (MNs), remains a high-stakes challenge for high-fidelity transmission via the extant MANET routing protocols. Indeed, the free mobility of MNs (i.e. their real-time physical reallocation, viz. intra-network movement), renders network topology often subject to unpredictable fluctuations. It is this margin of relative unpredictability which lends itself to such instances where QoE, as perceived by the Customer/User, may be subject to varying degrees of depreciation.In this perspective, our contribution in this paper aims to optimize the MANETs' mobility system, through the re-adaptation of some extant MANET routing protocols, so as to afford safer routing courses (lower mobility thresholds equate to lower chances of noise and/or data corruption/loss); all for the capital purpose of improving subjective quality (i.e. the anticipated end-user's personal assessment of the service).For the implementation of our MANET network, our two-fold choice consisted of the NS2 version 2.9 (a powerful platform with highly reliable protocol support), supplemented by the Evalvid Framework (a field-proven tool according to many expert ratings, ideal for close monitoring of QoE metrics).We have considered various video transmission scenarios through the OLSR protocol, one of the most well-known and reliable proactive MANET routing protocols .As for QoE prediction, we expect the mean opinion scores (MOS) to provide a metric template for a rough estimation of the end-users' anticipated appraisal .The results are to demonstrate, as we shall see, that the modified heuristic algorithm of OLSR, leaning on the underlying criterion of mobility, can lead to a significant performance boost in MANETs and, by the same token, to higher returns of QoS and QoE.

***Keywords*: Ad-hoc Networks, MANET Routing Protocols, QoE, QoS, Video transmission, mobility, mobility measure.**

I. INTRODUCTION

The technology of wireless networks continues to be an ever livid field of research [3]. the Ad-hoc variety in particular stands out thanks to its ergonomics and autonomous aspect [1].

Revised Manuscript Received on October 30, 2019.
***** Correspondence Author

Hind Ziani*, Informatics, Systems and Optimization Laboratory, Faculty of Sciences, University of Ibn Tofail, BP 133, Kenitra, Morocco Email: hind.ziani@uit.ac.ma

Nourddine Enneya,. Informatics, Systems and Optimization Laboratory, Faculty of Sciences, University of Ibn Tofail, BP 133, Kenitra, Morocco Email: enneya@uit.ac.ma

Indeed, with no installation required, it is quite easy to deploy and initiate such platforms. Thanks to its built-in features, it makes for a convenient and advantageous environment for fostering communication services. However, its dynamic topology means that potentially unpredictable changes may arise. Therefore, and despite their flexibility, MANETs do require particular care insofar as their management, real-time or otherwise, is no simple task.

In Ad-hoc networks [8], when two contacts fail to communicate, an intermediate Mobile Node would promptly proceed with troubleshooting said failure by intervening as a relay, thanks to a dedicated integrated protocol. However, routing is quite complicated for a system of dynamic MNs, which leaves the routing protocols for standard networks woefully wanting in that regard. As such, it is imperative to adapt new scripts of protocols which account for the overall restraints, exceptions and peculiarities of dynamic traffic; including, but not limited to: MN mobility, hidden MNs and asymmetric links, resource conservation and/or optimization, minimal network management, etc.

Routing protocols in MANETs [3] are based on the fundamental principles of routing, namely: flood, distance vector, source routing and link state. Two major categories of protocols have been specified and standardized by MANET: Proactive Routing Protocols, which plot routes in advance; and Reactive Routing Protocols, which search for on-demand routes. Additionally, there are also Hybrid Routing Protocols which are locally proactive, but reactive by distance.

According to various statistics, Video on Demand (VoD) has been, to all intents and purposes, the foremost solicited Web service throughout the last decade, with an ever-growing customer-base; insofar that, over the next four years, the market is expected to achieve an over 50% growth rate compared to 2016, purportedly reaching roughly 469 million video-on-demand users in 2021 [22].

In such a context, successfully devising an implementation of streaming services within MANETs presents itself as a high-stakes, high reward challenge/scenario [8,7], wherein devoting research toward this particular outlet is guaranteed to significantly bolster the network's overall performance. Indeed, improving network infrastructure is no longer as daunting a task as it once was, yet many elements pertaining to quality returns still remain unaddressed [2]: the maxim that "the sky is the limit", as far as quality is concerned, is indeed universal; whereas a truly "ideal" level of quality is yet to be achieved. It should be noted, however, that Quality measurement is no longer exclusively limited to the objective parameters of the quality of Service (QoS); as the more recent concept of "quality" often lends itself to a more subjective (viz. customer-oriented) perception, and is therefore much more delicate to define, measure and anticipate; we have opted, as well we should, to put high emphasis on the Quality of Experience.

Indeed, there has been a variety of researches mainly focused on enhancing video QoE over mobile networks in general (and MANETs in particular), since the gradual deprecation of Cellular networks due to their increasingly unwieldy infrastructure (i.e. high-cost, low-quality returns) [3]. In one such research by Chhagan Lal [19] we can distinguish a unique framework built upon a novel routing algorithm, tailored specifically for video streaming over MANETs, wherein the author(s) underline(s) the QoE issues inherent to routing within multi-hop wireless ad-hoc networks, by putting forth a Pseudo-Subjective Quality Assessment (PSQA) tool (as a milestone towards more accurate QoE measurement), in addition to a well-adapted analysis model geared towards identifying routing problems and offering practical adjustments to the heuristic routing algorithm.

Furthermore, Chhagan Lal et al [20] proposes a Multi-Constraint QoE-centric Routing technique (MCQR) for efficient real-time video streaming over Mobile Ad-hoc Networks. In contrast, [21] worried about the instability of MANET routing, proposes a Route Availability (RA) as a new metric for route non-uniformity, while analyzing its impact on QoS and, eventually, on QoE.

With similar objectives in sight, our paper shall also aim for the enhancement of the QoE related to video streaming services over MANETs, with a particular focus on node mobility within said networks; for it is no secret that this very feature (mobility) is a double-edged factor, the successful management of which can make or break the entirety of a high-fidelity video streaming framework.

To this end, we shall adopt two versions of the OLSR protocol: The more traditional, "untouched" model, Vs. our own improved version. the parallel should with providing insight on mobility behavior and its impact on the heuristic Algorithm(s) of OLSR.

Sections II and III shall include brief descriptions on the principles and features of OLSR protocol: Having meticulously honeycombed its algorithm, we can indeed put forth our own updated version thereof, as a much viable and more optimal alternative. Section IV shall include a tentative definition of Subjective Quality, in addition to a description of its basic metrics, and of the framework for its surveying over the network. The results of our simulation are to be laid down in Section V. Finally Section VI shall be the conclusion of this paper.

II. OLSR ROUTING PROTOCOL

A. Overview

The Optimized Link State Routing protocol (OLSR) [5] is the most common proactive-type protocol. As implied by its nomenclature, OLSR optimizes the links between all MNs within the network and plots the quickest course to be taken (route). Furthermore, OLSR is a table-driven protocol (i.e. regularly exchanges topology information with network MNs).

In addition to controlling and verifying traffic exchange messages "HELLO" and "TC" (Topology Control), OLSR also handles two more types of messages: "MID" (Multiple Interface Declaration) and "HNA" (Host and Network Association).

Within a Link State Protocol, network optimization is first and foremost ensured by the principle that each and every MN declares/forwards its direct links with all its neighbors to the entire network. In the case of OLSR, the MNs will only declare a subset of their neighborhood through the use of MPR (Multipoint Relays).

The Optimized Link State Routing protocol (OLSR) is a table-driven and IP proactive routing protocol optimized for mobile Ad-Hoc networks, but is also quite suitable for other Ad-Hoc variants since, by virtue of its namesake, it allows for the fastest and most optimal intra-node routing/communication.

Simply put: While in standard Link State Protocols, each MN declares its direct links to all neighbors throughout the network; OLSR, on the other hand, has every MN declaring only a specific cluster from their neighborhood via the **Multipoint Relay** process**.** Therefore, OLSR is ideally suited for dense and/or large networks thanks to its inherent and procedural avoidance of network data overload.

B. The Principle of Multipoint Relay

The MPR mechanism consists in minimizing bandwidth allocation, and mitigating redundancy by avoiding useless control messages when flooding the network [6]. Basically, it operates on a hop-by-hop process: each MN nominates a minimal subset of its symmetrical neighbors for a single hop, so that it may reach the entire neighborhood within a strict margin of two hops only. The selected MNs are called MPR (Multi Point Relays) and are responsible for retransmitting broadcast packets (control messages). Additionally, if or when any change whatsoever is detected within the two-hop neighborhood, all multipoint relays must be subsequently recalculated. As such, a network with smaller subsets of MPR will afford swifter response times and, indeed, a higher level of performance.

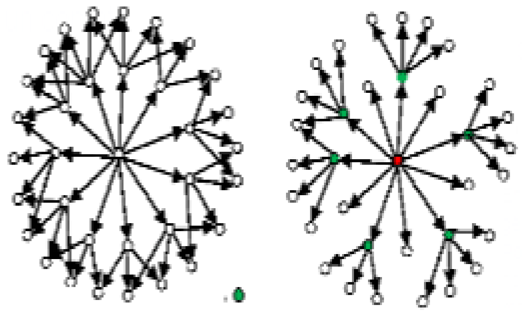

Fig 1. Traditional Flooding of the network Vs. Flooding the network using MPR Scheme.

Figure 1 illustrates the gain on the number of transmitted messages: The first mapping represents the number of messages in the case of a full (traditional) flooding, with 54 generated messages; whereas in the case of Multipoint relay, shown in the second mapping, the number of messages is limited to 32. Statistically, this amounts to a redundancy reduction by about 40%, in this particular example.

Evidently, since OLSR provides optimal routes in numbers of hops, it emerges as a choice system for large networks thanks to its MPR mechanism, but is likely to be sub-optimal for smaller networks.

And yet: what if this flooding mechanism could be improved even further? theoretically, nothing is absolute, and there is no limit to optimization - we may be attempting to achieve higher results, but we can only brush against perfection: delving into untapped potential and opening new venues of improvement - such is the quintessence of research: testing technical limits and pushing them ever higher.

Within this perspective, we shall posit a brief analysis for an eventual version of OLSR which is engineered upon the afore-mentioned pivotal element of the flooding technique, Whereupon we shall conduct a quality improvement experiment by calculating both objective and subjective quality parameters (MOS), using standard Video Streaming as a model.

C. MPR Selection Algorithm

Within the original OLSR, it has been observed that the selection of MPR sets is a complete NP Problem, as finding the **minimum size MPR set** is NP-hard.

For a MN x,

Let N(x) be the neighbor list for MN x being in the same range of the MN and having a bidirectional link with x.

Let N2(x) be the 2-hop neighbors of the MN while eliminating:

1. The MNs executing the selection computation.
2. The MNs only reachable by the set N with striving.
3. The MNs having a symmetric link with the MN.

Then, the default heuristic algorithm for MPR selection is mathematically described as follows [4].

1. U ← $N^2(x)$
2. $MPR(x) \leftarrow \phi$
3. While $\exists v : v \in U \wedge \exists! w \in N(x): v \in N(x)\ do$

a) $U \leftarrow U - N(w)$

b) $MPR(x) \leftarrow MPR(x) \cup \{w\}$

4. while $(U \neq \phi)$ do
    a. choose $w \in N(x)$ such as : $CRITERIA(w) = |N(w) \cap U| = max\ (|w \cap U|: w \in N(x))$
    b. $U \leftarrow U - N(w)$
    c. $MPR(x) \leftarrow MPR(x) \cup \{w\}$
5. return MPR(x)

III. QUALITY OF EXPERIENCE AND ITS METRICS

A. QoE overview

In their article, "The Experience Economy", published in 1988, Joseph Pine and James H. Gilmore were arguably the first to pronounce a new concept: Experience.

"*Economists have typically lumped experiences in with services, but experiences are a distinct economic offering, as different from services as services are from goods. Today we can identify and describe this fourth economic offering because consumers un-questionably desire experiences, and more and more businesses are responding by explicitly designing and promoting them*." Welcome to the customer experience (B. Joseph Pine II and James H. Gilmore)

In the field of telecommunications, high quality and consistent performance are just as pertinent, as elsewhere sought. Network resources and performance have reached a very high level [10], with the bar raised ever higher. Thus, the "objective" quality derived from these characteristics is sure to be subject to similarly high expectations. The customer's evaluation could thus only flow from the final appraisal of the service; an impression of quality thus perceived is said to be "subjective" or, in other words, emanating from the customer's "experience". Such is the crux of this customer-centered approach: "Quality of Experience"(QoE) re-emerges, as the Quality of Service (QoS) as perceived by the customer.

The IUT defines the quality of the experience as: "The overall acceptability of an application or service, as perceived subjectively by the end-user". IUT-T standard [11] [12]

This definition includes the objective structures and effects generated by an e2e system (network, service infrastructure, customer...) and looks at end-customer feedback between needs and expectations that vary.

There are two keywords:

Measure: measurement mechanisms to be adopted.

Subjective: The measurements inherent to the customer's personal profile (cognitive, psychic measure ..)

The dimensions of quality and quantity metrics constitute a space for analyzing the overall quality of service. This space is named "QoE Space". [13]

B. QoE Metrics

The Mean Opinion Score (MOS) is a rating system for Audio Codec fidelity. This rating ranges between 0 (very bad) and 5 (excellent, high-fidelity). It is defined by the ITU-T in the standard "P.800: Methods of subjective evaluation of the quality of transmission"[14]. The MOS is thus a scalar return of the estimate of quality from the customer's point of view [15] [12].

For Manet Services, the Mean Opinion Score is the crucial subjective metric for measuring video quality. MoS is mostly obtained by a conversion of PSNR. Understanding the transition and interlocution between these parameters is essential to developing a "non-intrusive" method for predicting video quality.

The most common Framework for surveying and recording the MOS over the network is Evalvid: a publicly available tool for evaluating the quality of video footage transmitted over a real or simulated communication network. It does not tolerate the distortion of video frames, and cannot calculate video quality if the footage in question is poorly decoded upon reception. It also operates by comparing video (meta)data at both the sender and receiver points.

Evalvid evaluates both QoS and QoE, and features standard QoS parameters such as loss rates, delay, and jitter.

Over and above measuring QoS with the afore-mentioned parameters, Evalvid also supports standard QoS metrics such as PSNR and SSIM, as well as video quality evaluation metrics (MOS) for the received video.

The most up-to-date Video Codecs supported by Evalvid are H.264, MPEG-4 and H.263. **Advanced Audio Coding** (**AAC**) is also integrated.

Table I: Subjective quality scale and impairment for ITU-R

Scale	Quality	Impairment
5	Excellent	Imperceptible

4	**Good**	**Perceptible but not annoying**
3	Fair	Slightly annoying
2	Poor	Annoying
1	Bad	Very annoying

Evalvid so far provides a MOS measure tool that returns a numerical value for an estimated customer evaluation of quality, though it obviously remains an emulative prediction of human (viz. relative) perception of the underlying service.

However, and in view of the logical correlation between QoS and QoE, The measure of subjective quality does also, indubitably, imply the calculation of objective quality; since the MOS tool leans on the PSNR as a parameter for deducting the Quality of Experience we seek.

IV. OUR IMPROVEMENT

It is no secret that mobility is an essential element of MANETs, a double-edged sword that is highly beneficial to harness, yet delicate to sustain. Indeed, despite the multiplicity of routing protocols, mobility still continues to vex many networking algorithms. Nevertheless, our modified version of OLSR aims to efficiency (re)direct mobility in order to adjust and improve the rendering of OLSR protocol.

A. Node Mobility Degree

Due to the mobile aspect of MNs in ad-hoc networks, there are several combinations of mobility between a MN and its neighbor. Thus, the link state joining of MNs is not constant, for it fluctuates all throughout transmission. By "mobility measurement" we refer to the degree of node mobility within the network. Be it noted that this measurement is not dependent on the network structure or the fixed formalities of mobility. Mathematically, the degree of a MN x at a time t is determined as follows [4].

$$M_x^{\lambda}(t) = \lambda \frac{NodesOut(t)}{Nodes(t-\Delta t)} + (1-\lambda)\frac{NodesIn(t)}{Nodes(t)} \qquad (1)$$

Where

NodesIn(t): The number of MNs that joined the communication range of *the MN x* during the interval$[t - \Delta t$, t].

NodesOut(t): The number of MNs that left the communication range of *the MN x* during the interval$[t - \Delta t$, t].

Nodes(t): The number of MNs in the communication range of *i*at time t.

λ : The mobility coefficient that must belong to the interval [0 , 1] and must be optimally fixed depending on the distribution of nodes.

Simplifying the above; the degree of a node x at time t is none other than the changes (of its neighbors) that occur between the given time (t) and the previous instance of neighborhood configuration (t - dt). Thus, the mobility degree of a node reports the difference of neighborhood over a time interval.

The underlying measure has a local dependency and is not influenced by the localization of the node within the network.

B. Link Mobility Estimation

According to several experiments and simulations on MANETs, there is a direct correlation between link fluctuation and communication fluidity: to put it simply, the more stable the inter-node links are, the less likely there will be data loss a/or corruption (i.e. packet losses, hash-fails, etc.)

For its part, OLSR uses its flooding technique to select MPR MNs, which in turn declare their link state data, the sum of which is flooded to all MNs within MANETs; and used by every individual MN to calculate the shortest routes to all hosts. However, according to the precedent theory of mobility, it is incumbent to firstly indentify the links with the least mobility prior to proceeding unto Multipoint Relaying. Such will be the new feature and added value of the modified OLSR protocol that we are to evaluate [4].

Let L be the link between two MNs A and B. The mobility of said link is calculated as shown in the following equation:

$$M_{L(A,B)}^{\lambda} = \frac{M_A^{\lambda}(t)+M_B^{\lambda}(t)}{2} \qquad (2)$$

C. Proposed Criterion

The novel criteria for operating MPRs selection [4] are based on estimating the quality of links between neighbors both at one-hop and two-hop intervals, so as to highlight the most favorable links (mobility-wise) besides choosing the pawns for data transmission/MR flooding.

In this article, we opted for most reliable criteria according to the source research. These represent a product operation between links toward the MNs as showed in the following equation :

$$PRD - CRITERIA(w) = 1 - \prod_{i=1}^{N} M_{L(w,i)}^{\lambda}(t) \qquad (3)$$

V. SIMULATION AND DISCUSSION

The videos proposed by Evalvid do have many characteristics in common (mostly specifications tied to frame rate). On the other hand, however, they each feature differences that set them reasonably apart.

Indeed, according to a certain research [9], many hierarchical and k-means cluster analyses have been conducted to finally close in on the content type of the underlying videos, which are divided into three groups as shown in figure x. The categorization is mostly related to the movement of video frames, of scene fixation and the overall dependency of the images composing the video.

As such, we may distinguish:

Table II: Content Type of Videos.

Content Type	Description
Slight Movement (SM)	This video type generally includes sequences of portraits with a moving face while the background is frozen. It can also feature a slight movement of elements on a fixed background.
Gentle Walking (GW)	This type of videos is generally itemized by a changing close scene at the end, a kind of camera swivel due to the cameraman's own walking motion.

Rapid Movement (RM)	This type of videos is characterized by a Photographic lens dynamically covering a wide field of view while the whole scene is moving uniformly, most commonly seen in sports video footage.

For our analysis, we chose one sample video from each content type, as a tri-fold template for monitoring the direct impact of video movement type on the final quality returns (in both objective and subjective instances). This will also allow us to respectively highlight the OLSR protocol peculiarities sequent to carrying the transmissions under each of the different modes.

Table III: Chosen videos to be transmitted.

Type of Movement	**Slight Movement (SM)**	**Gentle Walking (GW)**	**Rapid Movement (RM)**
The video	**Akiyo** 	**Foreman** 	**Stefan** 
Number of Frames	300 Frames	300 Frames	250 Frames

A. Simulation Environment

Through our simulations, we shall oversee, analyze, compare and contrast the subjective quality (QoE) between the two previous underlying protocols: namely, the "standard" OLSR, versus our own customized variation of OLSR.

For our test runs, we shall make use of a suitably appropriate event-driven Simulator: Network Simulator Ver. 2.9 (NS2.9) - a platform widely used for studying the dynamic nature of communication networks.

In order to establish a two-pronged measurement of quality, i.e. both from its objective and subjective sides, we shall integrated the Evalvid Framework, as previously mentioned, in our Network Simulator (NS2.9). Evalvid shall retrieve and process the trace files generated by NS, and yield a proper output for the requested values.

Our topology shall be as follows: an ad-hoc network consisting of 50 MNs with a range of 200m. The MNs shall move according to the Random Waypoint (RWP) mobility model on a topology of 1000m by 1000m.

Table IV: Values of Simulation Parameters.

Parameter	**Value**
Number of nodes	50
Topology	1000 m x 1000 m
Time of simulation	150 s
Range	200 m
Mobility model	Random Waypoint (RWP)
Type of distribution	Unicast
MAC type	Mac/802_11
Version of NS2	2.9

Since we are to monitor the respective behaviors of two versions of the proactive protocol, it should be mentioned that we shall also adapt the crucial parameters that may influence their performance and rendering. As node mobility is the pivotal element in our context, the speed of MNs is fixed at an optimal value of 20. Furthermore, when fixing mobility practically on the RWP mobility model, another subsequent parameter comes into play: pause time -which will also be subject to adjustment, ranging from an absolute null value (no stop, i.e. Pause time=0) to an extreme superior value (no move, i.e. Pause time= T= Time of transmission).

The variation scale for the pause time we shall observe shall be 10s, while the time of transmission of our simulation shall be 100s.

With regard to quality, we integrated the underlying and recommended set-tool ”Evalvid” for our evaluation of Video Transmission/Fidelity over the network we created on NS2.9. The Framework shall provide the relevant subjective quality reads, allowing for a service appraisal from the user's standpoint, not to mention the eventual objective quality returns. Several Evalvid scripts have been modified for a better compatibility with our choice version of Network Simulator (NS2.9). Additionally, Evalvid includes several predefined videos, all of which share the same fixed Video Frequency (30fps), for our quality metrics simulation.

The videos to be transmitted over the network must be encoded and decoded by Evalvid in adequate formats in accordance with our evaluation process. Evalvid generates a source video trace, with embedded (meta)data within, for each frame of the video. This file will be used by NS-2 as a "traffic source" file. Upon successful execution of the video transmission, NS shall generate, in turn, two files with which Evalvid can re-encode the transmitted video as perceived by the end user. At this stage, Evalvid may calculate the quality metrics we seek: First comes the PSNR, whereupon the MOS is also returned.

B. Results and Discussion

Akiyo : Slight Movement (SM)

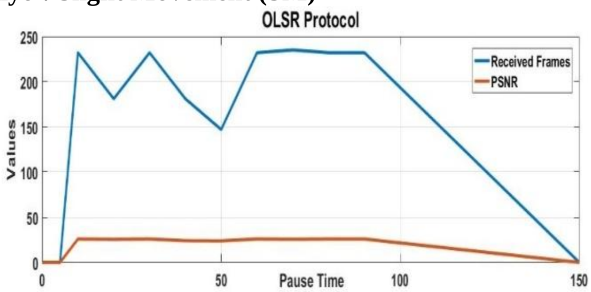

Figure 2.Number of received frames under OLSR vs. PSNR.

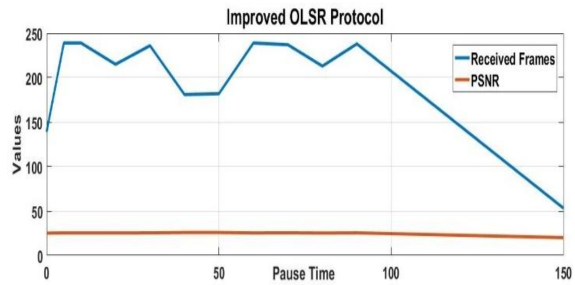

Fig 3.Number of received frames under Improved OLSR vs. PSNR.

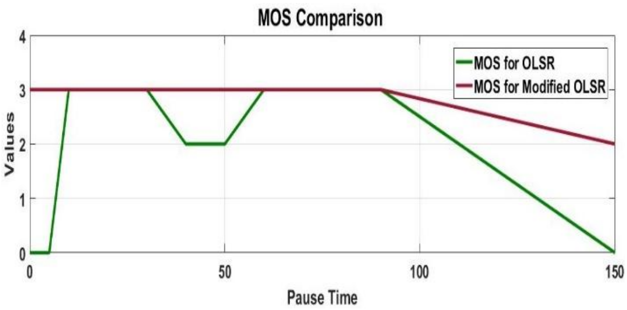

Fig 4.MOS of the overall transmission over OLSR and Improved OSLR.

Analysis 1 (video Akiyo)

When mobility is at its peak (p=0 and p=5) the transmission results in a failure with the original OLSR protocol. However, the transmission is successfully carried out for the modified OLSR, notably in terms of frame rate; which translates into an average MOS and, by the same token, an acceptable QoE. There is, in fact, a noticeable OLSR performance improvement for such a high mobility scenario.

Furthermore, when the pause time is equal to or close to the moiety of the Time of transmission, the MOS for the Modified OLSR (=3) outdoes the value of the original (=4) OLSR. Thus we witness, once more, the obvious improvement afforded by the modified version of the protocol; though it remains less important than in the previous one.

The last bit of improvement which we may eventually notice, is when the pause time is at its maximum value i.e. equal to the time of transmission "T" = zero mobility - whereby the transmission results in a failure. However, and once again, when carried under the modified OLSR, the MOS return for the transmission stands more or less at an average value (MOS=2), even though the number of received frames remains quite paltry compared to what we aim to achieve.

In the other case of transmission, as shown on the graphs herein, we do notice that the transmission and the QoE return is more or less the same for the both versions of the protocol. In terms of PSNR, however, the results are more in favor of the original OLSR.

Foreman : Gentle Walking (GW)

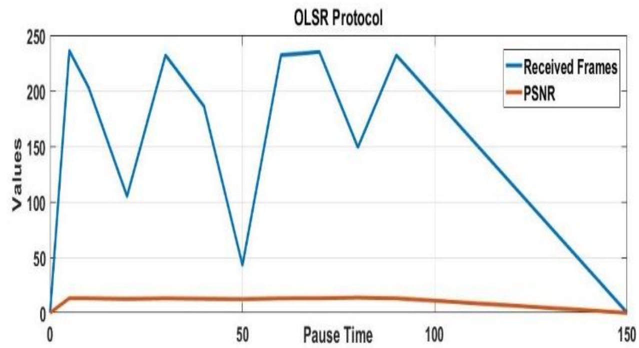

Fig 5.Number of received frames under OLSR vs. PSNR.

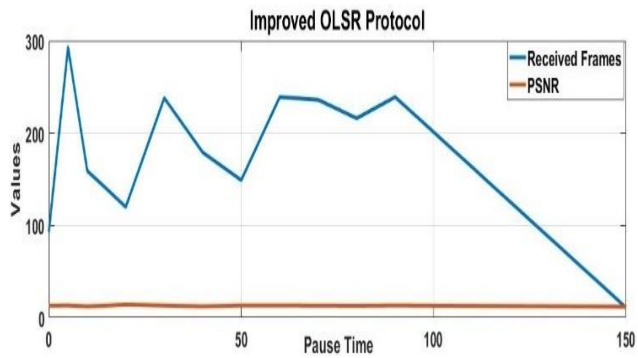

Fig 6.Number of received frames under Improved OLSR vs. PSNR.

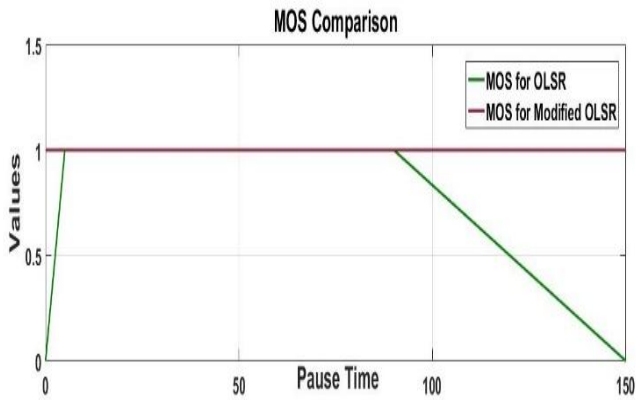

Fig 7.MOS of the overall transmission over OLSR and Improved OSLR.

Analysis 2 (Video Foreman)

For this video, we can resolve that the MOS for all transmissions is very bad (MOS=1) regardless of OLSR either version.

When mobility is at its maximum value, the transmission fails in the original protocol whereas it is successful for the modified version. The same is also true for when pause time is at its maximum threshold.

For the others cases, there is a generally slight variation in terms of the frames received as well as tiny improvement of the PSNR under the modified OLSR: nowhere near enough to yield a decent MOS.

Stefan: Rapid Movement (RM)

Retrieval Number: L32491081219/2019©BEIESP
*DOI: 10.35940/ijitee.*L3249.*1081219*
Journal Website: www.ijitee.org

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

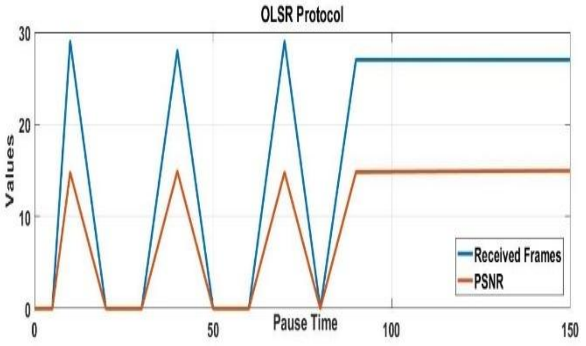

Fig 8.Number of received frames under OLSR vs. PSNR.

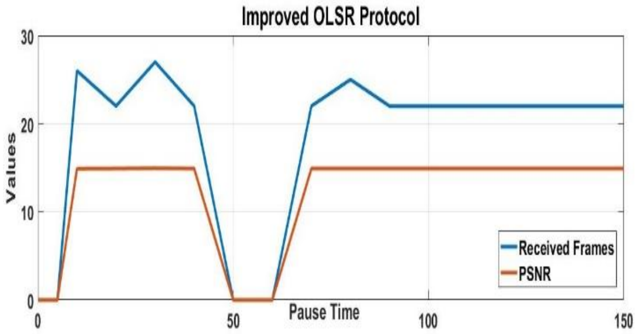

Fig 9.Number of received frames under Improved OLSR vs. PSNR.

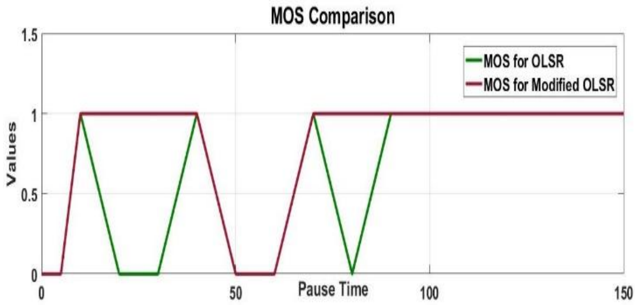

Fig 10.MOS of the overall transmission over OLSR and Improved OSLR.

Analysis 3 (Video Stefan)

The transmission for this video is, overall, quite faulty. Nevertheless, the results tend to lean, quality-wise, toward the modified OLSR rather than the default one.

Note that for both versions, the transmission fails for the minimum value of the pause time (p=0 and p=5) and also for the average value of the time of the video transmission (p=50 and p=60).

Even with a slight pause time delay (p=20 and p=30), the transmission still ends in failure for the original OLSR, while there is at least enough data transmission for the modified OLSR to return a MOS equal to 1. The same can be observed with a pause time value of p=80.

Contrary to the results of the previous videos, when pause time is equal to T, the transmission still takes place in the original OLSR. As for the modified OLSR, there is no noteworthy improvement.

General Analysis

Under similar conditions, the OLSR handles each video content type differently. The first remark we can draw is that this protocol is more favorable for the first content type (Slight Movement) where the Quality of Experience expressed by the MOS is more important compared to the results of the other types of content. A MOS return of 3 is obviously not very good, but remains more or less acceptable -especially considering that the original video transmission suffers a small degradation when undergoing the encoding and decoding process.

On the other hand, for the Slight Movement and Gentle walking content types, the improvement of the modified OLSR is more remarkable in three cases: When mobility is at its peak, when there is no mobility, and when pause time is near equal to the average value of the time of the video transmission. However, this analysis is more convenient for the first content type.

As for the third content type (rapid movement): the transmission for the both versions is bad but we notice a little amelioration for the modified OLSR when pause time varies (between p=30 and p=50, as well as for p=80).

From these analyses, we can resolve that OLSR protocol is better suited to the content type of videos with less mobility. The Gentle Walking content type is quite similar to the Slight Movement type, except for the moving scene at the end of the GW. This is mostly where the improved performance of the modified OLSR comes to the fore, namely at the same pause time value. Still, the MOS is more favorable under the Slight Movement type, due to its lesser mobility. However, when scene movement is more important, which is the case for the Rapid Movement content type, the improvement of the new OLSR is apparent, although the MOS remains at its minimum value.

VI. CONCLUSION

Throughout this paper we reported the results of analytical performance tests on the standard OLSR protocol, versus its modified counterpart, within a MANET network characterized by its dynamic aspect: as such, the link status and topology changes make for a challenging task, as far as management and optimization are concerned. The new version applied by the referred study is based on the estimation of link quality and proposes a new selection of MPRs set. To that end, we opted for a varied range of video content types, through which we analyzed the handling of various transmission scenarios, both by the default OLSR protocol and its modified counterpart, in order to observe more methodically the protocol's behavior. Mobility conditions were varied in terms of the MNs’ Pause Time. All in all, we noticed a solid performance boost under the modified OLSR protocol as previously detailed; a performance which, even while factoring our three content types and their distinct, respective attributes, still nudges in favor of the modified OLSR environment. Nonetheless, it remains expedient, within MANET in particular, to choose and/or adjust the routing protocols for Video Streaming services, in accordance with the content type of the videos to be transmit. Furthermore, and in view of the crucial influence of mobility on MANETs' performance, and the fact that Protocol’s configuration scripts are extensible are quite open for improvement; it would be of the utmost benefit to push the potential of said protocol (and its subscripts) further even, preferably on the basis of a more streamlined perspective on the critical performance parameters we highlighted: such shall be the purpose of our further and forthcoming researches in this venue.

REFERENCES

1. Anh, Q.P.T., Piamrat, K., Singh, K.D., and Viho, C.: 'Video Streaming over Ad-hoc Networks: a QoE-based Optimal Routing Solution', IEEE Transactions on Vehicular Technology, 2017, 66
2. Matre, V., and Karandikar, R.: 'Multipath routing protocol for mobile adhoc networks'. Proc. Symposium on Colossal Data Analysis and Networking (CDAN), Indore, India, 18-19 March 2016
3. Pham, T.A.Q.: 'Algorithms and optimization for QoE aware routing in wireless networks: from centralized to decentralized solutions', IRISA Rennes, 2017
4. ENNEYA, N., OUDIDI, K., and ELKOUTBI, M.: 'Enhancing Delay in MANET Using OLSR Protocol', Int. J. Communications, Network and System Sciences, 2009, 5, pp. 392-399
5. Anbao, W., and Bin, Z.: 'Improving MPR Selection Algorithm in OLSR Protocol Based on Node Localization Technology', JOURNAL OF NETWORKS, 2014, 9, (7)
6. Pham, T.A.Q.: 'Algorithms and optimization for QoE aware routing in wireless networks: from centralized to decentralized solutions', IRISA Rennes, 2017.
7. Mohit, M., and Pal, M.S.: 'Stable MPR Selection in OLSR for Mobile Ad-Hoc Networks', (IJCSIT) International Journal of Computer Science and Information Technologies, 2015, 6, (6), pp. 5121-5125
8. Hekmat, R.: 'Adhoc Networks: Fundamental Properties and Network Topolo- gies', The Netherlands:Springer Dordrecht, 2006
9. Raja, M.L., and Baboo, C.D.S.S.: 'An Overview of MANET: Applications, Attacks and Challenges', International Journal of Computer Science and Mobile Computing, 2014, 3, (1), pp. 408 – 417
10. Khan, A.: 'Video Quality Prediction for Video over Wireless Access Networks ', University of Plymouth, 2011
11. Kingstone, S.: 'Truly Managing the Customer Experience', 'Book Truly Managing the Customer Experience' ,2012
12. Fiedler, M., Hossfeld, T., and Tran-Gia, P.: 'A generic quantitative relationship between quality of experience and quality of service', IEEE Network, 2010, 24, (2), pp. 36-41
13. Union, I.T.: 'Vocabulary and effects of transmission parameters on customer opinion of transmission quality, amendment 2': 'Book Vocabulary and effects of transmission parameters on customer opinion of transmission quality, amendment 2',2007
14. U, I.T.: 'ReferenceGuide to Quality of Experience Assessment Methodologies.', 'Book ReferenceGuide to Quality of Experience Assessment Methodologies.,2010
15. Mukundan Venkataraman Iyengar: 'Measuring And Improving Internet Video Quality Of Experience', University of Central Florida, 2011
16. Chen, K.-T., Tu, C.-C., and Xiao, W.-C.: 'OneClick: A Framework for Measuring Network Quality of Experience'. Proc. IEEE, Rio de Janeiro, Brazil,2009
17. Hoβfeld, T., Schatz, R., and Egger, S.: 'SOS: The MOS is not enough!'. Proc. Third International Workshop on Quality of Multimedia Experience, Mechelen, Belgium, 7-9 Sept. 2011
18. Quang, P.T.A., Piamrat, K., Singh, K.D., and Viho, C.: 'Video Streaming over Ad Hoc Networks: A QoE-Based Optimal Routing Solution', IEEE, Feb. 2017 66, (2), pp. 1533 – 1546
19. Lal, C., Laxmi, V., Gaur, M.S., and Conti, M.: 'Enhancing QoE for video streaming in MANETs via multi-constraint routing', Wireless Networks, 2018, 24, (1), pp. 235–256
20. Lal, C., Laxmi, V., and Gaur, M.S.: 'Video streaming over MANETs: Testing and analysis using real-time emulation'. Proc. 19th Asia-Pacific Conference on Communications (APCC), Denpasar, Indonesia, 13 March 2014
21. Yashima, T., and Takami, K.: 'Route Availability as a Communication Quality Metric of a Mobile Ad Hoc Network', Future Internet 2018, 10, pp. 41
22. Cisco: 'Cisco Visual Networking Index: Forecast and Trends, 2017–2022', 'Book Cisco Visual Networking Index: Forecast and Trends, 2017–2022' 2018.

AUTHORS PROFILE

Hind Ziani is, since 2013, a Computer Science engineer, alumna of the National School of Applied Sciences (ENSAS, Safi-Morocco) with a master's degree in I.T. Engineering, and is currently a PhD student in the University of Ibn Tofail (Kenitra-Morocco). Her research interests are mainly focused on Wireless Networks, Computer Engineering and the Enhancement of the Quality of Experience on digital platforms.

Nourddine Enneya earned his PhD in Computer Science from the University of Mohammed V (Rabat, Morocco) in 2009, whereby he was appointed as Assistant Professor in the university of Ibn-Tofail (Kenitra, Morocco). As of 2013, he was promoted to Associate Professor; and elected as head of the Laboratory of Informatics, Systems and Optimization, within the aforementioned university. His fields of expertise include, among others: QoS, QoE, CE and Wireless networks Security Protocols (with and without infrastructure).