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Simulated TCP, SCTP, DCCP and UDP Protocol Output through 4G Network

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ABSTRACT: Network coverage for large geographical locations 4G (Forth Generation) illustrates its use as a more advanced wireless technology. The LTE (Long-Term Evolution) is a 4G mobile communications standard set by the ICU, specifically the ITU-R (ITU Radio Communication Sector). Today, under the extension of LTE, which is known to be the real driving 4G network access infrastructure, video streaming and telecommunications are growing. During LTE implementation, numerous connectivity protocols are recommended and commonly tested, such as TCP, SCTP, DCCP and UDP, which can be implemented individually on 4G networks according to network conditions and parameter settings. Although the deployment of LTE is rapidly improved, its protocols are lacking in performance evaluation. Therefore, the evaluation of the operation of numerous protocols for high-end applications such as multimedia requires widespread scrutiny. It is a challenging task to implement such technologies for versatile service quality restrictions and better use of capital. In this article, the performance effects are evaluated by detailed simulations of different transport protocols for multimedia streaming applications, e.g. video. An MPEG-4 video streaming performance is assessed using NS-3. Delay, jitter, throughput, and packet loss are the performance metrics used. Those measurements are measured over the 4G-LTE network at the base station utilizing TCP, SCTP, DCCP and UDP protocols. The results obtained indicate that, relative to UDP, TCP, and SCTP, the DCCP does the highest in increasing performance with reducing latency and jitter.

Keywords: 4G, LTE, TCP, SCTP, DCCP, UDP.

INTRODUCTION

When varied wireless communication systems are proliferating and connectivity becomes a norm of mobile communication anywhere, mobile devices should be able to operate smoothly while traveling across wireless networks even under high mobility. Emerging fixed wireless air interface standards, such as EEE 802.16 m and 3GPP(Third Generation Partnership Project) LTE (Long Term Evolution)-Advanced, was intended to provide quality of service (QoS) for current and future mobile network networks with strict delay time requirements after handover.

Wireless communication networks are becoming a common service because of its flexibility in access and utilization for offering high transmission rate every time and everywhere. Such kinds of networks were built from an expensive technology by small chosen individuals of the current omnipresent services that are used by a huge number of masses around the globe. Wireless technology can be divided into four different generations, i.e. 1G (First Generation), which was the analog radio system; 2G (Second Generation), which was the earliest digital wireless system; 3G (Third Generation), which was the leading wireless broadband communication system; 4G (Fourth Generation), famous for LTE (Long-Term Evolution). In the modern mobile age, video usage is growing rapidly and at the same time as LTE is progressing, which is recognized for 4G network's real fundamental connectivity technology. Four transport layer protocols, called TCP (Transmission Control Protocol), SCTEP (Stream Control Connection Protocol), DCCP(Datagram Congestion Control Protocol), and UDP(User Datagram Protocol), are the most supported and frequently checked during the implementation of LTE. The transmission rate is significantly motivated by the performance of the transmission protocols used in wireless networking scenarios.

Although LTE deployment is rapidly accelerated, its protocols are deficient in performance evaluation. Thus, for the performance evaluation of several protocol suits for high-end applications like multimedia and so on, a large evaluation is indispensable. For the transmission of multimedia applications, the demanding behaviors of the three listed transport protocols need to highlight the positive and negative aspects of their efficiency. The present comparative reports do not demonstrate the efficiency of the LTE communication networks TCP, SCTP, DCCP and UDP protocols for video transportation. Due to the opposing inferences, the correct communication technique for video data transfer is not even explained. Thus, presenting an important investigation into the performance of the above-mentioned protocols for the LTE environment may help researchers and academics select the precise protocol for video application transmission.

The transport layer protocols used to stream video are examined in this report. In addition, the strength and limitations of TCP, SCTP, DCCP and UDP are provided by simulation results performed inNS-3, which may provide the idea of selecting the best protocols for the LTE setting. Moreover, this performance evaluation can also provide a basis for which protocol can be better for which of the four metrics, i.e. end-to-end delay, throughput, packet loss, and average jitter.

For LTE implementation, the most preferred and widely studied four transport layer protocols are UDP, TCP, SCTP, and DCCP12. Given the rapid pace of LTE implementation, the specifications are deficient in performance evaluation. To determine the output of different protocols for high end consumer applications such as multimedia applications, a thorough review is therefore needed. The issue conduct of the four protocols in multimedia applications indicates that the pros and cons of their output are illustrated.

Thanks to the opposing assumptions, even the best performing procedure in video transmission is not defined. Because of several causes, this downside. Second, the understanding of current comparative studies14, 15 did not take into account the efficiency of TCP, SCTP, DCCP and UDP protocols in LTE communication system video transmission. Furthermore, the focus is on determining which protocol will make the MPEG-4 video QoS best over the local wireless zone network.

In this study, the simulation scenario of TCP, SCTP, DCCP, and UDP transport layer protocols in terms of video transmission in 4G environment is verified using NS-3 simulator, and the performance of these protocols in terms of jitter, throughput, delay, and packet loss is analyzed to highlight the variety impacts of video transmission layer behavior in 4G.

LITERATURE REVIEW

This paper suggests a cellular network (WiMAX and LTE-Advanced) activity modeling methodology. The methodology allows the system to forecast signal quality in two different networks between the mobile user equipment (UE) and eNodeB stations / access points (APs). Using the dynamic regressive integrated moving average (DRIMA) model, prediction is accomplished by keeping track of mobile user signal strength. Using the forecast, layer-3 handover events will occur prior to layer-2 handover, thereby minimizing overall latency of handover[1]. Different performance metrics are to be assessed and evaluated in this study. No. of nodes used, network power transmission, form of wireless link, bits / joule energy efficiency data rate, SNR(signal-to-noise ratio), power transmission(Pt), bandwidth of subcarrier, protocol & throughput. The different performance parameters are to be chosen for the wireless communication device on the basis of optimum metrics study[2]. This paper therefore suggests the Dynamic Cost-Reward-based (DCR) CAC, which consists of two main mechanisms: (1) implementing a cost function based on a Markov decision process (MDP) and (2) having specific reward functions for different types of nodes and different types of interactions. In addition, DCR is modeled on a mathematical analytical Markov chain. The results of the simulation are very close to the results of the analysis, which justifies the analytical model being correct. Numerical results show that DCA beats the comparable CACs in the probability of falling new blocking, MS-handoff, and RS-handoff, FRL, GoS, and device compensation[3]. The purpose of this study is to provide insight into the economic efficiency of incorporating satellite communications into 4 G networks to reach the most rural areas. To this end, this paper suggests a converged approach integrating satellite communication as a backhaul network with 4G as a front haul network to introduce improved broadband connectivity to European rural areas, along with a techno-economic model to examine this integration's economic viability. The

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model is based on a5-year TCO (Total Cost of Ownership) model, taking into account both capital and operating expenses, and aims to calculate both the TCO and the ACPU (Average Cost Per User) for the study[4]. This paper presents a new method called STS (Smart Tabu Search) that takes into account network conditions, network monetary expense, application QoS specifications, consumer expectations, and mobile device energy consumption in choosing the optimum FIA that achieves the best trade-off among all the parameters considered. Using models and testbed tests, we confirm our idea[5]. This paper discusses the function of a multi-radio mobile device in heterogeneous wireless environments and suggests that when using the current radio connectivity technologies, such a computer can effectively control its network interfaces. In particular, we explore the ability of versatile allocation of transmit power and establish a provably efficient power control scheme that strictly maximizes the mobile device's energy efficiency while at the same time meeting the minimum required user data rate standard[6]. This paper provides a novel examination of the effects on a 3 G wireless fidelity (Wi-Fi) system of 4G UWB (ultra wide band) signaling. They illustrate by analytical and mathematical research that the Wi-Fi system's throughput efficiency can be adversely affected by up to 20 percent. They agree that to reduce the downside of current 3 G communication systems, cautious deployment of new 4 G UWB services will take place[7]. This paper uses ns2 to assess the efficiency of TCP, UDP, and SCTP with regard to various quality metrics. Results of simulation reveal that SCTP performs better in ad hoc networks than TCP and UDP in terms of latency, jitter, error rate, packet distribution ratio and end-to-end pause[8]. This study tries to assess whether the old protocols are compatible with this new technology. And which one has the best performance and which one has the greatest effect on the loss of performance, delay and packet. The above questions are critical in the performance evaluation of the most popular 4 G environment protocols (especially User Datagram Protocol (UDP), Transmission Control Protocol (TCP) and Datagram Congestion Control Protocol (DCCP)[9]. This paper presents SCTP's performance analysis against TCP and UDP using two NS2 simulator topologies. The two topologies are: single-home and dual-home SCTP dumb-bell topology. Measured output metrics are loss of efficiency, latency, jitter, and packet. The results show that SCTP's throughput is better than TCP and UDP's throughput. In SCTP, the jitter problem is less than in TCP. The transmission delay of SCTP is greater than the transmission latency of TCP and UDP[10].

METHODOLOGY

NS-3.22 is used in this analysis to introduce scenarios and test communication protocols, i.e. TCP, SCTP, DCCP, and UDP to transmit a video stream in the LTE 4G environment, the summary models parameter has been described in the Table 1.

Table 1: Summary of the Model Parameter Which is used for the Simulation Experiment

Parameters	Description
Simulation Environment	NS-3
Protocol	TCP, SCTP, DCCP,UDP
Number of nodes	10, 20, 30, 40, 50, 60 node
Base station	1
Number of packet	1024 byte
Connection channel	Point-to-Point
Net device type	Long Term Evaluation
Interval	100ms
Mobility model	Constant Position Mobility model
Channel data rate	20 Mbps
Simulation time	30.0 second

Throughput: It is defined as the amount of effective packet delivery over a communication channel.

$$\text{Throughput} = \frac{\text{Number Of received Packets}}{\text{Last Packet Send - First Packet Send}}$$

Number of Packet loss: The discrepancy between the total number of packets sent by the sender and the total number of packets received by the receiver is specified

$$\text{Packet Lose} = \sum \text{Packets Send} - \sum \text{Packets Received}$$

End-to-End Delay: It is defined as the interval that packets experience when they travel from one node to another through multiple networks

$$\text{End To End Delay} = Tr - Ts$$

Ts is transmitting time of the specific packet, while Tr is the reception time for the packet.

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Average Jitter: It is defined as the difference of latency from packet to packet.

$$\text{Average Jitter} = \frac{\text{Delay } (j) - \text{Delay } (i)}{N}$$

The maximum number of nodes including 10, 20, 30, 40 50 and 60 is used to test the effect of different network nodes with 1,000 bytes packet size.

The network throughput refers to the successful delivery of packets over a communication channel. The LTE network environment, the DCCP protocol has a reasonable throughput value with 10 network nodes. Here the scenario is supposed to send all the 10 nodes to the base station node at the same time the MPEG-4 video files. In addition, continuity of the DCCP protocol is shown when the number of nodes is increased from 10 to 20, 30, 40 50 and 60 nodes in the LTE network environment. The outcome indicates the reliability of this protocol even with an increasing number of video file transfers, while the rise in a number of nodes will affect the protocol's impact.

Therefore, as the nodes are expanded, the whole network's performance increases. The consistent growth of the graph demonstrated that this node density can be managed by the network. There is no bottleneck up to this node number cap to obtain the highest performance. As the number of nodes grows, the output rises too high. Due to its two schemes used in it, the DCCP protocol has a good performance than UDP, TCP, and SCTP. Both systems are management of pollution and regulation of flows.

This outcome is for 10 nodes that concurrently transmit video files to the internet. When the number of nodes is increased from 10 to 20, 30, 40 50 and 60, respectively, there is no such difference. It is also shown that when the nodes also increased, the number of packet loss is increased. It occurred because the base station became the bottleneck influenced by the number of nodes in the topology of the network as all nodes send packets to one base station at the same time.

CONCLUSION

Video streaming transmission requires more bandwidth and high communication quality. In terms of communication quality, the main contribution is the development of the LTE technology, which helps to increase data throughput and reduce latency. The transport layer protocols are the best players of the new developments in multimedia technologies in the LTE world. This developments encourage the performance evaluation criteria of the popular LTE protocols, i.e. TCP, SCTP, DCCP and UDP for MPEG-4 video data transmission. TCP, SCTP, DCCP and UDP protocols are tested on different performance parameters, i.e. latency, failure of packets, jitter, and throughput. The analysis reveals that in terms of latency, jitter, and delay, DCCP outperforms other protocols. On the other hand, due to its connection-oriented feature, TCP provides a higher packet delivery rate and minimum packet loss count. Finally, developers can go to TCP for multimedia apps where packet loss is difficult to handle, while DCCP is the best choice for better video sharing through the LTE network in MPEG-4.

REFERENCES

1. Gagandeep Singh, Vishal Jain, “Information Retrieval through Semantic Web: An Overview”, Confluence 2012, held on 27th and 28th September, 2012 page no.114-118, at Amity School of Engineering & Technology, Amity University, Noida.
2. Gagandeep Singh, Vishal Jain, Dr. Mayank Singh, “ An Approach For Information Extraction using Jade: A Case Study”, Journal of Global Research in Computer Science (JGRCS), Vol.4 No. 4 April, 2013, page no. 186-191, having ISSN No. 2229-371X .
3. Usha Yadav , Gagandeep Singh Narula, Neelam Duhan , Vishal Jain , B. K. Murthy, “Development and Visualization of Domain Specific Ontology using Protege “,Indian Journal of Science and Technology, Vol. 9, No. 16, April, 2016, page no. 1-7 having ISSN No. 0974-6846.
4. Balamurugan Shanmugam, Dr.Visalakshi Palaniswami, Santhya. R, Venkatesh. R.S., “Strategies for Privacy Preserving Publishing of Functionally Dependent Sensitive Data: A State-of-the art Survey. Aust. J. Basic & Appl. Sci., 8(15): 353-365, 2014

5. R Santhya, S Balamurugan, "A Survey on Privacy Preserving Data Publishing of Numerical Sensitive Data", International Journal of Innovative Research in Computer and Communication Engineering , Vol. 2, Issue 10, October 2014
6. A. M. Miyim, M. Ismail, R. Nordin, and M. T. Ismail, "Technique for Cross-layer Vertical Handover Prediction in 4G Wireless Networks," *Procedia Technol.*, 2013.
7. H. Shah and R. Bansode, "Performance Evaluation and Measurement for Energy Efficient Wireless Networks," in *Procedia Computer Science*, 2016.

   B. J. Chang, Y. H. Liang, and Y. H. Lee, "Dynamic-cost-reward connection admission control for maximizing system reward in 4G wireless multihop relaying networks," *Comput. Networks*, 2013.
8. A. Chiha, M. Van der Wee, D. Colle, and S. Verbrugge, "Techno-economic viability of integrating satellite communication in 4G networks to bridge the broadband digital divide," *Telecomm. Policy*, 2019.
9. M. A. Senouci, H. Senouci, M. R. Senouci, N. Ferdosian, and A. Mellouk, "Flow/Interface Association for -connectivity in heterogeneous wireless networks: e-Health case," *Ad Hoc Networks*, 2019.
10. O. Galinina, S. Andreev, A. Turlikov, and Y. Koucheryavy, "Optimizing energy efficiency of a multi-radio mobile device in heterogeneous beyond-4G networks," *Perform. Eval.*, 2014.
11. A. Kumar, Suman, and Renu, "Comparision of 3G Wireless Networks and 4G Wireless Networks," *Int. J. Electron. Commun. Eng.*, vol. 6, no. 1, pp. 1–8, 2013.
12. G. N. Vivekananda and P. C. Reddy, "Performance evaluation of TCP, UDP, and SCTP in manets," *ARPN J. Eng. Appl. Sci.*, vol. 13, no. 9, pp. 3087–3092, 2018.
13. W. Abduladheem Kamil, S. Awang Nor, and R. Alubady, "Performance Evaluation of TCP, UDP and DCCP Traffic Over 4G Network," *Res. J. Appl. Sci. Eng. Technol.*, vol. 11, no. 10, pp. 1048–1057, 2015.
14. Nagesha and S. S. Manvi, "Performance analysis of SCTP compared to TCP and UDP," in *Advances in Intelligent Systems and Computing*, 2012, vol. 176 AISC, no. VOL. 1, pp. 515–524.