PERFORMANCE EVALUATION OF TCP, UDP AND DCCP FOR VIDEO TRAFFICS OVER 4G NETWORK

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Abstrak

Sistem mudahalih Generasi Keempat (4G) telah digunakan secara lebih meluas berbanding generasi terdahulu seperti 3G dan 2G. Antara sebabnya termasuklah kadar penghantaran data 4G yang lebih tinggi, dan ia menyokong keseluruhan fungsi multimedia. Selain itu, sokongannya terhadap lokasi geografi yang luas membolehkan teknologi tanpa wayar menjadi semakin canggih. Matlamat utama 4G ialah bagi membolehkan komunikasi berasaskan suara dilaksanakan oleh pengguna tanpa batasan. Bagi memenuhi matlamat tersebut, kajian ini berusaha menjawab persoalan-persoalan berikut: (1) adakah protokol lama sesuai dengan teknologi baru ini; (2) protokol manakah mempunyai prestasi terbaik; Selain itu, kajian ini juga mempersoalkan dan (3) protokol manakah yang mempunyai kesan terbesar terhadap truput, lengah, dan kehilangan paket; Persoalan-persoalan tersebut amat penting, ditimbulkan bagi menilai kesan 4G terhadap protokol-protokol utama (khasnya *User Datagram Protocol* (UDP), *Transmission Control Protocol* (TCP), dan *Datagram Congestion Control Protocol* (DCCP)). Menggunakan *Network Simulator-3* (NS-3), prestasi penghantaran MPEG-4 video merangkumi aspek truput, lengah, kehilangan paket, dan nisbah kadar penghantaran paket serta kesesakan pada stesyen utama menggunakan UDP, TCP, dan DCCP telah dinilai melalui teknologi *Long Term Evolution* (LTE) 4G. Hasil ujian menunjukkan DCCP mempunyai truput dan lengah yang lebih baik. Namun, jumlah kehilangan paket adalah lebih tinggi berbanding UDP dan TCP. Berdasarkan dapatan tersebut, DCCP adalah disarankan sebagci protokol penghontaran bagi video waktu nyata membuat penghantaran video.

Keywords: 4G, LTE, TCP, UDP, DCCP, Kawalan Kesesakan, protokol penghantaran

Abstract

Fourth Generation (4G) system has been used more widely than the older generations 3G and 2G. Among the reasons are that the 4G's transfer rate is higher and it supports all multimedia functions. Besides, its' supports for wide geographical locus makes wireless technology gets more advanced. The essential goal of 4G is to enable voice-based communication being implemented endlessly. To achieve the goal, this study tries to answer the following research questions: (1), are the old protocols suit with this new technology; (2), which one has the best performance and, (3) which one has the greatest effect on throughput, delay, packet delivery ratio and packet loss. The aforementioned questions are crucial in the performance evaluation of the most famous protocols (particularly User Datagram Protocol (UDP), Transmission Control Protocol (TCP), and Datagram Congestion Control Protocol (DCCP)) within the 4G environment. Through the Network Simulator-3 (NS-3), the performance of transporting MPEG-4 video stream including throughput, delay, packet loss, and packet delivery ratio are analyzed at the base station through UDP, TCP, and DCCP protocols over 4G's Long Term Evolution (LTE) technology. The results show that DCCP has better throughput, and lesser delay, but at the same time it has more packet loss than UDP and TCP. Based on the results, DCCP is recommended as a transport protocol for real time video.

Keywords: 4G, LTE, TCP, UDP, DCCP, Congestion Control, Transport Protocol

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Wisam Abduladheem Kamil

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List of Abbreviations

1G	First Generation
2G	Second Generation
3G	Third Generation
3GPP	Third Generation Partnership Project
4G	Fourth Generation
AVC	Advanced Video Coding
CLEP	College Level Examination Program
CPU	Central Processing Unit
DCCP	Datagram Congestion Control Protocol
DCE	Direct Code Execution
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
ECN	Explicit Congestion Notification
EDGE	Enhanced Data rates for GSM evolution
ENBs	Evolved Node B
GPLv2	General Public License, version 2
GSM	Global System for Mobile Communication
GSoC	Google Summer of Code
GUI	Graphical User Interface
HSPA	High Speed Packet Access
HVXC	Harmonic Vector eXcitation Coding
IMT-Advanced	International Mobile Telecommunications-Advanced
IPS	Internet Protocol Suite
IR	Infrared Wireless
ITU	International Telecommunication Union
ITU-R	International Telecommunication Union-R
LTE	Long Term Evolution
LTE BS	LTE-Base Station
MAC	Media Access Control
MIMO	Multiple-Input Multiple-Output

MPEG4	Moving Picture Experts Group
NACK	Negative Acknowledgement
NS-3	Network Simulator
PHY	Physical Layer
QoS	Quality of Service
RIP	Routing Information Protocol
RTP	Real-time Transport Protocol
RTT	Round Trip Time
SC-FDMA	Single-Carrier Frequency Division Multiple Access
SCTP	Stream Control Transmission Protocol
SS	Subscriber Station
SVC	Scalable Video Coding
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UEs	User Equipment's
UMTS	Universal Telecommunication System
VoIP	Voice over IP
VOPs	Video Object Planes
WIMAX	Worldwide Interoperability for Microwave Access

CHAPTER ONE
INTRODUCTION

Wireless communications become an everyday commodity. It has evolved from being an expensive technology for a few selected individuals to today's ubiquitous systems used by a majority of the world's population. Wireless communication technologies are often divided into generations. First Generation (1G) was the analog radio systems of the 1980s. Second Generation (2G) was the first digital wireless systems. Third Generation (3G) was the first wireless systems handling broadband data.

The Long-Term Evolution (LTE) is often called the Fourth Generation (4G) [1]. Wireless communication network under Information and Communication Technologies (ICT) is perhaps the most vital element reshaping the economic growth of the world. With the evolution from IG to 2G and from 3G to 4G, the technology shifts from telecommunication to multimedia communication. Nowadays mobile technology has changed the perspective of user towards the real-time world by enabling people to live in both business and social environment. These trends induced the invention of 5G which, comparing with 4G, will have 1000 times the system capacity, 10 times the spectral efficiency, 25 times power efficient and data rate up to 10Gbps for low speed and 2Gbps for high speed moving mobiles [2]. As a result of the advancements in wireless communication the network traffic has been increased.

The LTE delivered higher data rates and met the burgeoning data demand [3]. In LTE deployment, three transport layer protocols are the most recommended and

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