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EFFECT OF HANDOFF ON FLOW MARKING IN A DIFFSERV EDGE ROUTER

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ABSTRACT

Differentiated Services have been proposed as scalable solution that can satisfy real time traffic. In a diffserv domain an Edge Router performs Multi Field classification and maintain per flow profile. If a mobile node connects to a Diffserv domain, it is subjected to the same policing and shaping as done for the static nodes.
When a mobile node moves and changes its connectivity from one RER to another, the new RER does not have the context unless it is transferred from the old RER. A study is conducted considering a diffserv domain where RERs run three different marking schemes (TSW, srTCM, trTCM) to meter the flows and mark the packets. This thesis presents the results of this study, which show that by transferring context during handoff leads to improvement in marking the flow especially for TSW where the marking of packets reach stability quickly and result in less delay and jitter. If the context is not transferred, then the marking at the new RER takes a while to reach stability. The instability period is proportional to the window size setting. The results also show that the instability caused by the hand off negatively effect the flows of the same class at the new RER.

ملخص البحث

الخدمات المميزة (Differentiated Services) اُقترحت كحلا معيارياً مناسب لتطبيقات تراسل الزمن الحقيقي. في مجال الخدمات المميزة يقوم الموجه الطرفي (Edge Router) بحفظ مواصفات كل تدفق رزمي كما يقوم أيضا بمراقبة وتشكيل كل تدفق.

يمكن للعقدة النقالة (Mobile Node) الاتصال بمجال الخدمات المميزة عبر موجه طرفي يسمى "Radio Edge Router (RER) ". وإذا ما تحركت العُقدة النقالة فإنها تحتاج إلى تغيير رباطها من RER إلى آخر ويسمى ذلك "Hand off". وفي هذه الحالة فإن الموجه الطرفي الجديد يفتقد إلى سياق التدفق لدى الموجه الطرفي القديم.

هذه دراسة أُجريت لمعرفة مدى الفائدة من نقل السياق من الموجه القديم إلى الجديد أثناء انتقال العقدة من الأول إلى الآخر. أجريت الدراسة باستخدام برنامج المحاكاة (NS-2). كما تم استخدام ثلاثة أنواع مختلفة من مخططات التلوين والتأشير (srTCM, trTCM and TSW) لقياس التدفق وتأشير وتلوين الرزم.

نتائج الدراسة تُظهر أن تحويل السياق يؤدي إلى تحسين في تلوين التدفق خصوصا لـ TSW حيث يؤدي إلى استقرار سريع في تلوين وتأشير الرزم. مما يؤدي إلى تقليل التأخر (Delay) والجتر (Jitter). في حالة عدم نقل السياق فإن تأشير وتلوين الرزم يأخذ وقتا أطول لوصول الاستقرار. وتكون فترة عدم الاستقرار متناسبة مع حجم النافذة (Window Size). كما تظهر النتائج أيضا إلى أن عدم الاستقرار في تلوين الرزم الناتج من ال " Hand off" قد يأثر سلبا على التدفقات من نفس الصنف لدى RER الجديد.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Science in Computer and Information Engineering.

Farhat Anwar
Supervisor

I certify that I have read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Science in Computer and Information Engineering.

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Khalid Al-Khateeb
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This thesis was submitted to the Kulliyyah of Engineering and is accepted as a partial fulfillment of the degree of Master of Science in Computer and Information Engineering.

Ahmad Faris Ismail
Dean, Kulliyyah of Engineering

DECLARATION

I hereby declare that this thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by footnotes giving explicit references and a bibliography is appended.

Name: Omer Mahmoud Mohamed

Signature ………………………………… Date …………………………

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Effect of Handoff on Flow Marking in A Diffserv Edge Router

Affirmed by Omer Mahmoud Mohamed

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Signature	Date

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LIST OF ABBREVIATIONS

AF	Assured Forwarding
BA	Behaviour Aggregate
BB	Bandwidth Broker
BER	Bit Error Rate
CBR	Constant Bite Rate
CIR	Committed Information Rate
CN	Corresponded Node
COPS	Common Open Policy Service
CTR	Committed Target Rate
Diffserv	Differentiated Services
DSCP	Differentiated Services Code Point
EF	Expedited Forwarding
EF	Expedited Forwarding
ER	Edge Router
FA	Foreign Agent
FN	Foreign Network
HA	Home Agent
HA	Home Address
HHO	Hard Handoff
HL	Handoff Latency
HN	Home Network
ICMP	Internet Control Message Protocol

Intserv	Integrated Services
ITEF	Internet Engineering Task Force
MF	Multi Field
MN	Mobile Node
PHB	Per Hope Behaviour
PTR	Peak Trag"t Rate
QoS	Quality of Service
RED	Random Early Detection
RER	Radio Edge Router
RSS	Received Signal Strength
RSS	Received Signal Strength
RSVP	Resource reSerVation Protocol
RT-VBR	Real time VBR
SHO	Soft Handoff
SIR	Signal -To-Interference Ratio
SLA	Service Level Agreement
SrTCM	Single Rate Three Color Marker
TCA	Traffic Conditioning Agreement
TOS	Type Of Service
TrTCM	Two Rate Three Color Marker
TSW	Time Sliding Window
VBR	Variable Bite Rate

CHAPTER 1

INTRODUCTION

1.1 Introduction

The current Internet architecture provides what is called a "best effort" service. It implies that the network can make no guarantees about when data will arrive at the destination, or how much it can deliver.

Best effort is acceptable for traditional Internet applications like web, email, file transfer, and the like but it's inadequate for new classes of applications such as audio and video streaming. These new applications demand high data throughput capacity (bandwidth) and have low-latency requirements.

Differentiated services (diffserv) architecture [Blake et al. 1998] has been proposed as a scalable solution that can satisfy the new applications requirement.

On the other hand recent research has begun to focus on the provision of the internet service in wireless network, as this widely seen to be the next growth for the internet [Chan, E 2001]. Based on that researchers have identified the integration of wireless systems and DiffServ as promising research direction.

The thesis is a study that investigates the mobility effect on colouring and marking in diffserv. so that Quality of Service (QoS) of the flow preserved during and after that handoff.

1.2 Literature Review

A number of research and paper that analyse and investigate open issues in Diffserv, [Mahadevany et al 1999] identified modifications that need to be made to make Diffserv suitable for wireless networks. They suggested a lightweight signalling protocol be added to the Diffserv "DiffServ architecture does not require end-to-end signalling and follows an implicit admission control mechanism. In wireless networks a simple signalling scheme would be required and advantageous because: (i) static provisioning is not enough because user mobility necessitates dynamic allocation of resources, (ii) the sender must know the limitations of the wireless link for better performance, and (iii) information on local conditions like power status of the mobile etc. need to be sent occasionally between the Base Station (BS) and the mobile. A signalling protocol that can be used is a modified ICMP (Internet Control Message Protocol). The modified ICMP protocol is scalable and generates reduced control traffic when com-pared to RSVP".

One of the interesting area in wireless network is the effect of hand off situation on QoS [Fikoura et al. 1999] analyse the performance of mobile node with respect to the three available Mobile Internet Protocol (MIP) movement detection methods, namely lazy Cell Switching LCS, Prefix Matching (PM) and Eager Cell Switching (ECS). In LCS MN use agent advertisements lifetime as indication of movement. IN PM it camper subnet prefixes of mobility agent in order to determine new agents In ECS it assumed that MNs tend to change their detection of movement very slowly. That is, if they are moving forward in one direction, it unlikely that they will stop and turn back. Hence, it is appropriate for nodes to hand off immediately upon encountering a new agent [Fikoura, et al 1999] experimentally analysed the performance of communications involving the Transport Control Protocol (TCP) over MIPv4 during handoffs. The efficiency of MIP handoff is measured in terms of service disruption duration. The results indicate that no movement detection method can offer a MIP handoff without suffering some period of service disruption "Web or file transfer application (over TCP) will suffer much disruption during handoff, potentially more than 10 seconds. Also an Internet Telephony application running over UDP would suffer a disruption period between 3 (ECS) and 6 (LCS) second with every hand off"

[Zubairi et al 2001] investigated the effect of shaping and marking on QoS of a VBR stream when it passes through a diffserv domain. Simulations are conducted using NS-2 simulation platform applying VBR streams that are shaped using Token Bucket and dual-Token Bucket shapers followed by srTCM, trTCM and TSWTCM markers "The results show that the lowest delay jitter and maximum number of green packets are obtained when the VBR stream is shaped with dual token bucket shaper and marked using TSW scheme. Such a setup would be useful in handling stored MPEG compressed video in a diffserv domain because an increase in delay jitter would adversely affect this stream."

1.3 Thesis Statement

In a wireless access network an edge router connected to one or more base stations, called RER (Radio Edge Router), provides connectivity to a mobile node. The RER builds *context* for the flows communicated between the mobile and the CN (Correspondent Node). CN is a wired node that communicates with the mobile node. *Context* is defined as the information on the current state of a routing-related service required to re-establish the routing-related service on a new subnet without having to perform the entire protocol exchange with the mobile host from scratch [Kempf 2001]. A service that can potentially modify the default routing treatment of packets to and from the mobile node is a routing-related service, e.g. header compression, QoS etc. A Diffserv enabled access router keeps configuration and state contexts [Syed 2001]. The example of state context is the estimated bandwidth computed by a meter. The parameters with which a meter is configured are known as configuration context, e.g. AVERAGE_INTERVAL, CTR and PTR for TSW meter. [Fang & Seddigh, 2000].

In a Diffserv domain, an edge router performs traffic classification [Blake et al 1998] and maintains the profile as the context. When a mobile node moves from one RER to another, the new RER lacks the context maintained by the previous RER. The context needs to be transferred to new RER to provide similar services to the mobile node. Figure 1 illustrates the situation when a mobile node moves from one RER to another.

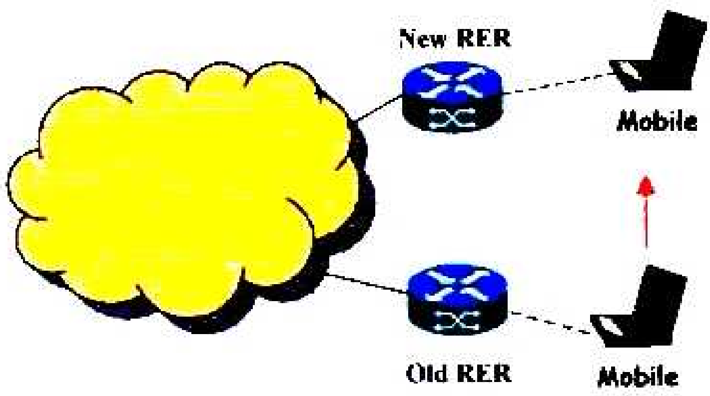

Figure 1-1: Mobile Node mobility from old to new RER

There are two possible ways to deal with the problem of transferring diffserv context.

1. The new RER builds the flow profile from scratch. For example, the new RER computes the average bandwidth estimate afresh.

2. Alternatively, during handoff (transfer of mobile node from one RER to another) the flow profile may also be transferred to the new RER.

Our objective is to study the benefit of context transfer during handoff To understand what are the benefits of transferring context and what is the window of opportunity, that is what is the time period after which the benefits diminish. Furthermore, what are the factors determining the window of opportunity. To achieve that there is a need to define a performance metric. the possible metrics used is this study is I the number of packets that are colored green, yellow, and red. For example, we gather the statistics of the packets that are marked green, yellow, or red in both cases in some intervals, and compare the results II we also consider the packets that are colored green, yellow, and red being transmitted for both cases. III Delay, Jitter and Loss. This thesis report results for Time Sliding Window metering/marking scheme (TSW) [Fang, & Seddigh, 2000], Single rate three color marker (srTCM) and Two Rate Three-Color Marker (trTCM).

1.4 Thesis Structure

The structure of the thesis is as follows

Chapter one gives a general introduction and describes the problem statement or thesis statement.

Chapter two presents three types network architectures that proposed by IETF were present, Integrated Service, Differentiated services Model and MPLS, the chapter gives an over view about Integrated services and it accompanying RSVP protocol while examining the Differentiated services in more detail the s the chapter also include an over view about MPLS protocol.

Chapter three discuss the characteristics of network traffic beside that it examines three types of marking scheme TSW, srTCM and trTCM- that can be used in Diffserv ER or RER as component of traffic conditioner.

Chapter four gives a theoretical background about mobility issues like mobile IP and related definition, quality of service in wireless environment and handoff situations and it effect on the QoS.

Chapter five provides background information about Network simulator Ns2 simulator and also present the simulation setup for mobile node connected to fixed node through a Diffserv domain where the set up is designed to study the benefit of context transferring during the a handoff situation.

Chapter six analyse the simulations results obtained by using three different marking schemes TSW, srTCM, trTCM and

Chapter seven contain the conclusion and suggestion of future works.

CHAPTER 2

QUALITY OF SERVICE ARCHITECTURES

2.1 Introduction

Traditionally, Internet has provided best-effort services to every user regardless of its requirements. This may results in serious degradation for some applications that need certain Quality of Service (QoS).

Work on QoS-enabled IP networks has led to two distinct approaches: the Integrated Services architecture (Intserv) and its accompanying signalling protocol, RSVP, and the Differentiated Services architecture (Diffserv). This chapter gives an over view about Intserv and discuss Diffserv in more details.

2.2 Integrated Services Architecture

Integrated services (Intserv) [Braden et al. 1994] have been developed by IETF to provide different QoS. The architecture assumes that some explicit setup mechanism is used to convey information to routers so that they can provide the requested services. Intserv requires the use of packets classifiers as shown in Fig 2.1 to identify flows that are to receive a certain level of service. It also requires the use of packets schedulers to handle the forwarding of different packets in a manner that ensure QoS commitments are meet. Admission control is also required to determine whether a router has the necessary resource to accept a new flow.

The Resource Reservation Protocol (RSVP), which will be discussed in following section, is used by Intserv to provide the reservation message required to set up a flow with the requested QoS across the network. RSVP is used to inform each router of the