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Reducing the Effect of Latency in a GSM (Cellular)Switching Network

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ABSTRACT: *End to end delay (Latency) determine the response time it will take for information to travel between the source and receiver, reducing the delay time will go a long way in improving the efficiency of the service in a GSM network. A model was developed to study how end to end delay can be reduced byapplying the appropriate quality of service to the adaptation layer. The model was Setup to carry three commonly used applications: ftp, voice and email and four quality of service (QoS) was considered Constant Bit rate (CBR), Unspecified bit rate (UBR), Available Bit Rate (ABR) and Variable Bit rate(VBR). Different scenario was considered using each type of quality of service and observing the end to end delay in Email and FTP download, Packet delay variation in Voice application.The result obtainedshows animprovement in end to end response time. Andalso shows that CBR will be preferred when Voice application is considered while other type of quality of service such as UBR,ABR,and VBR can be used for both FTP and Email application in Cellular switching network.*

Keywords: *ATM, QoS, Ftp, Email, Voice.*

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I. INTRODUCTION

Asynchronous Transfer mode (ATM) is a type of packet switching technique that is connection - oriented it is commonly used as a choice for broadband integrated services Digital Network as a backbone, to support high speed connection or networks. It uses fixed length cells, each cell is made of 48 bytes of information field and 5 bytes of header packet making a total of 53 bytes cell size[9], different type of service (voice, video, data) can be carried through the ATM. To accommodate all these Application adaptation layer function is provided which fit information of different type of sizes into ATM cells which are fixed in size and hence provide service specific function, hence ATM is sometimes referred to specific packet oriented transfer mode[1].compared

The ATM adaptation layer(AAL) interface between the ATM and variable length packet or frame sizes, protocols that will be transferred over the ATM, different service will need a suitable adaptation layer function, hence AAL1 and AAL2 were designed to support applications such as voice, that require guaranteed bit[2] rates and AAL3/4 AND AAL5[4] provide support for packet or data transferred over the ATM network. Using riverbed modeler this is investigated .[2]

II. THE RIVERBED MODELER

The riverbed modeler[10] provides a development environment that allow us to simulate and perform analysis of communication networks, it provide the following four tools to allow us to develop a representation of system been modeled: network, Node, Process, and Parameter editors[1].

III. TABLE OF PARAMETER

	Parameters	Settings
1	Area	USA MAP
2	TECHNOLOGIES	ATM ADVANCED MODEL
3	NODE PLACEMENT	RANDOM
4	SIMULATION TIME	10 MINUTE
5	LINKS DATA RATE	DS1
6	APPLICATION CONFIG	FTP, EMAIL, VOICE

7	PROFILE CONFIG	FTP_P, EMAIL_P, VOICE_P
8	SWITCHES	ATM8_CROSSCONN_ADV
9	SUBNET	SUBNET
10	SERVER	ATM_UNI_SERVER_ADV
11	CLIENT	ATM_UNI_CLIENT_ADV
12	CONNECTOR	ATM_ADV DUPLEX
	TABLE OF PARAMETERS: **CBR_UBR VOICE AND DATA**	
	PARAMETERS	SETTINGS
1.	ATM APPLICATION PARAMETERS	CBR ONLY
2.	ATM PARAMETERS QUEUE CONFIGURATION	CBR ONLY
3.	APPLICATION SUPPORT PROFILE	VOICE
4.	APPLICATION SUPPORT SERVICES	VOICE
5.	APPLICATION TRANSPORT PROTOCOL	AAL2
	DATA SERVER	
1.	APPLICATION SUPPORT SERVICE	EMAIL AND FTP
2.	TRANSPORT PROTOCOL VOICE TRANSPORT	AAL2
3.	ATM PARAMETER QUEUE CONFIGURATION	UBR
4.	APPLICATION SUPPORT PROFILE	FTP_P EMAIL_P
	TABLE OF PARAMETERS: **UBR_UBR VOICE AND DATA**	
	PARAMETERS	SETTINGS
1.	ATM APPLICATION PARAMETERS	UBR ONLY
2.	ATM PARAMETERS QUEUE CONFIGURATION	UBR ONLY
3.	APPLICATION SUPPORT PROFILE	VOICE
4.	APPLICATION SUPPORT SERVICES	VOICE
5.	APPLICATION TRANSPORT PROTOCOL	AAL5
	DATA SERVER	
1.	APPLICATION SUPPORT SERVICE	EMAIL AND FTP
2.	TRANSPORT PROTOCOL VOICE TRANSPORT	AAL5
3.	ATM PARAMETER QUEUE CONFIGURATION	UBR
4.	APPLICATION SUPPORT PROFILE	FTP_P EMAIL_P

Table 1: Table of Parameter

IV. SIMULATION SETUP AND SCENARIO

We setup the first scenario consist of two ATM switches and four subnet as shown in figure 1, each subnet located in a geographical region depicted by North East, South East, South West, and North West Subnet. In each subnet: four(4) atm_ uni_client_ adv is used, one atm8_crossconn_adv switch, one atm_uni_server_adv. as shown in figure 2 [1].

NETWORK TOPOLOGY

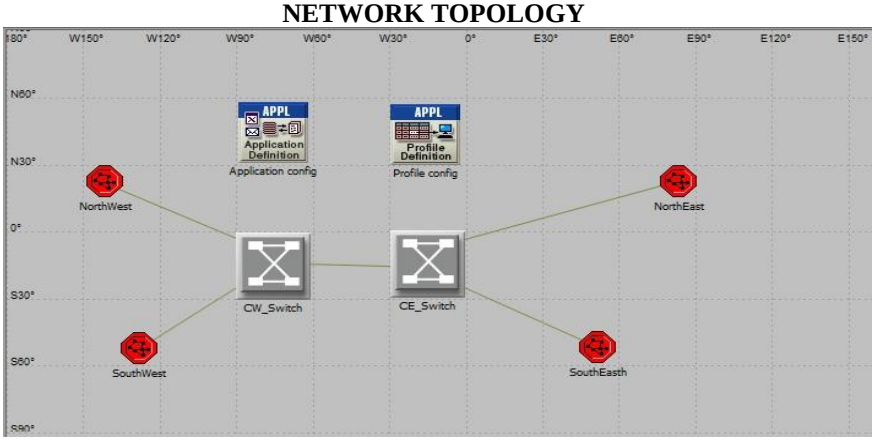

Figure 1: Network Topology

To compare the performance between these service classes(CBR_UBR and UBR_UBR), we limit our criteria to use the following statistic; Download Response Time (sec), Packet Delay Variation, Packet End-to-End Delay (sec).[5]

V. SIMULATION RESULTS AND ANALYSIS

Voice

Considering the result of simulation from voice application, we have

Time Average (Voice Packet Delay Variation)

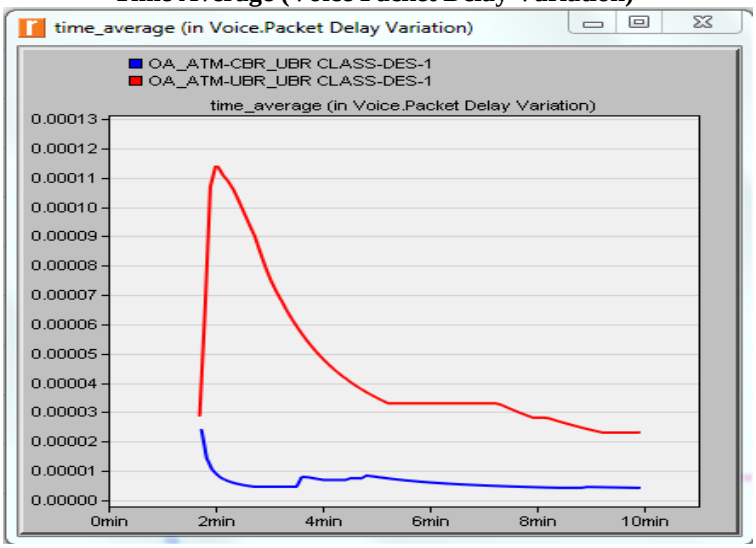

Figure 2: Voice packet delay variation

	Service Class	Maximum Variation	Minimum Variation	Average
	Cbr_Ubr	0.0000245	0.0000046	0.00001455
	Ubr_Ubr	0.0001143	0.0000288	0.00007155

Table 2: Statistic results of voice delay variation

We can also infer from the table that the CBR_UBR class has the lowest variation (0.0000046) very close to zero variation, hence the most suitable for application requiring guaranteed bandwidth such as Voice. The UBR_UBR class is depicted with red color line and CBR_UBR with blue line, from the graph obtain we can deduce that CBR_UBR is closer to 0 (zero) variation hence it is better for any application that needs guaranteed bandwidth while UBR_UBR curve shows high level of inconsistence variation and cannot be used for application requiring guaranteed bandwidth or real time applications[6], considering the values obtain from table 2. We can also see that CBR_UBR is having a lower average value of delay.

FTP download response

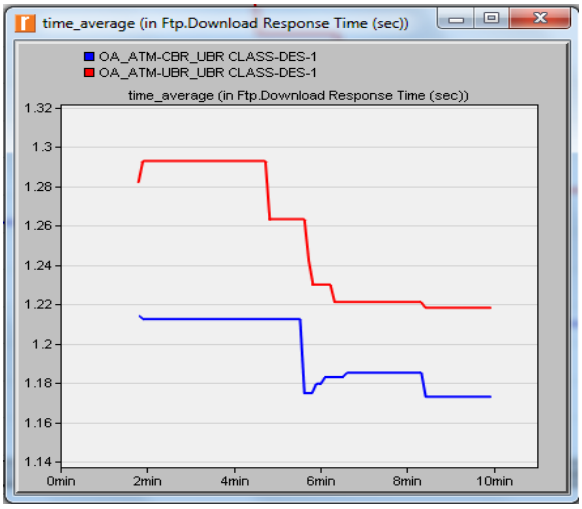

Figure 3: Ftp download Response

	SERVICE CLASS	MAXIMUM (Download Response Time In Sec.)	MINIMUM (Download Response Time In Sec.).	AVERAGE (Sec.)
	CBR_UBR	1.2140	1.1730	1.1935
	UBR_UBR	1.2930	1.2183	1.2556

Table 3:Statistic result of ftp download response time

From the graph it can be inferred that CBR_UBR is having lower download response time 1.1730 while UBR_UBR has higher download response time 1.2183. As expected CBR_UBR class is more efficient.Considering table 4., CBR_UBR is having a lower average response time(1.1935), hence more efficient.

Email download response time

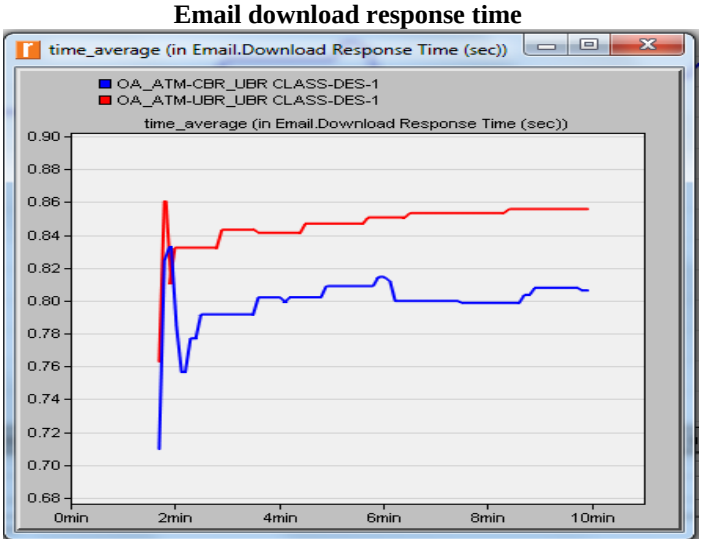

Figure 4: Download Response Time.

	Service Class	Maximum (Download Response Time In Sec.)	Minimum (Download Response Time In Sec.).	Average (Sec.)
	Cbr_Ubr	0.8332	0.7099	0.7715
	Ubr_Ubr	0.8612	0.7628	0.8120

Table 4: Statistic result of email download response time

From the graph we can deduce that CBR_UBR has lower email download response (0.7099 sec.) than UBR_UBR (0.7628) we can then conclude that CBR_UBR is more efficient, the average value of download response time in table 5 also shows that CBR_UBR has lower download response time, hence more efficient for real time application.

VI. CBR_UBR VERSUS CBR_ABR

Voice delay variation

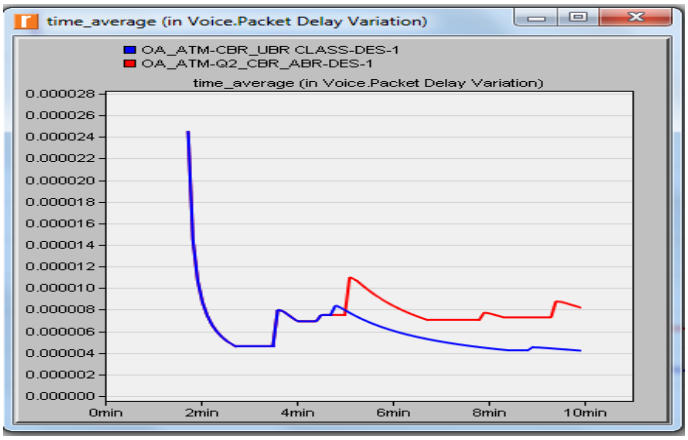

Figure 5: Voice packet Delay Variation

	Service Class	Maximum (Voice Packet Delay Variation)	Minimum (Voice Packet Delay Variation)	Average (Sec.)
	CBR_UBR	0.00002453	0.00000420	0.00000144
	CBR_ABR	0.00001098	0.00000751	0.00000092

Table 5: Statistic result of voice packet delay variation.

We can deduce from the graph that CBR_UBR is preferable because of the lower delay of (0.00000420), while the CBR_ABR class has a higher delay time of (0.00000751). Hence the CBR_UBR is better for voice application on ATM, and CBR_ABR can be used only when real time is of little importance.Hence we can see that CBR_UBR is more efficient as expected[7].

FTP response time

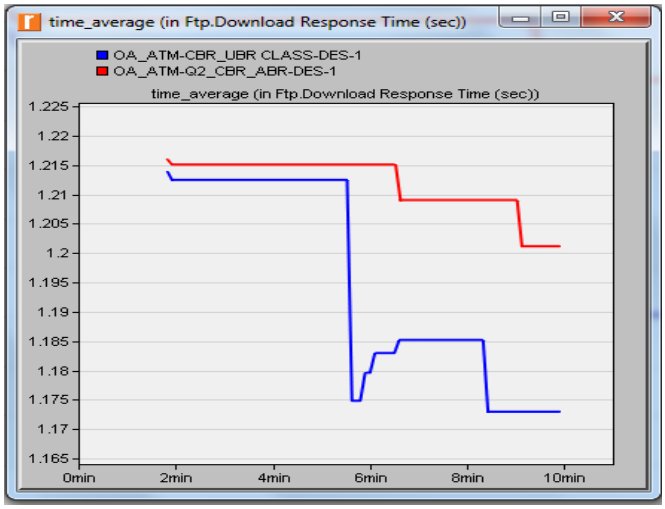

Figure 8: FTP response time

	Service Class	Maximum (Download Response Time In Sec.)	Minimum (Download Response Time In Sec.).	Average (Sec.)
	CBR_UBR	1.21402	1.17296	1.1935
	UBR_ABR	1.21608	1.21140	1.2137

Table 7:Statistic result of ftp download response time

From the graph it can be inferred that CBR_UBR is having lower download response time (1.1730) while UBR_UBR has higher download response time (1.2183) and as expected CBR_UBR is more efficient than CBR_ABR class. Considering table 7., CBR_UBR is having a lower average response time(1.1935), hence more efficient in performance than CBR_ABR[8] as expected.

Email response time

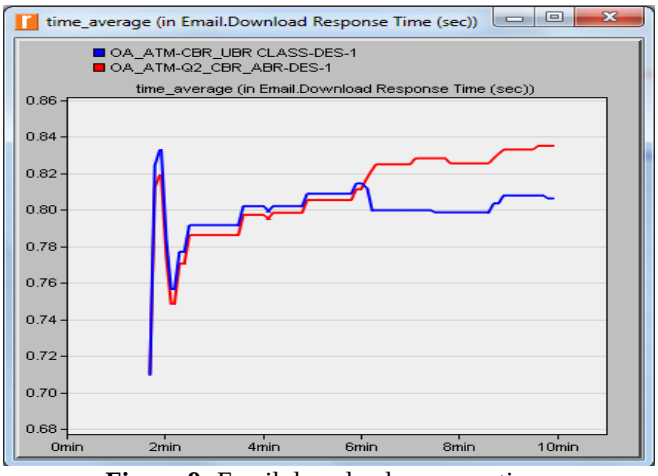

Figure 9: Email download response time

	Service Class	Maximum (Download Response Time In Sec.)	Minimum (Download Response Time In Sec.).	Average (Sec.)
	Cbr_Ubr	0.8332	0.7099	0.7715
	Ubr_Abr	0.8194	0.7104	0.7649

Table 8: Statistic result of Email download response time

From the graph we can deduce that the email download response time is lower for the CBR_UBR class(0.7715) in compares to the CBR_ABR class(0.7649) hence we can conclude that the CBR_UBR class is preferable and more efficient as expected. Also deduce from table 8 [8].

VII. Conclusion

In this paper we have investigated the effect of CBR, UBR and ABR classes (Qos) in an ATM network. Using Riverbed Modeler,the network topology of ATM created using the attributes shown in the parameter table (Table 1), which demonstrate the three set of service classes the results obtain it can be deduce that CBR_UBR would perform more efficiently for data transmission.The result obtained shows an improvement in end to end response time. And also the CBR will be preferred when Voice application is considered while other type of quality of service such as UBR, ABR, and VBR can be used for both FTP and Email application in Cellular switching network.The result obtained is consistent with what I expect by considering similar paper online[11] and books[3].

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