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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 by applying 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].

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

### **III. TABLE OF PARAMETER**

8     SWITCHES     ATM8_CROSSCONN_ADV       9     SUBNET     SUBNET       10     SERVER     ATM_UNI_SERVER_ADV       11     CLIENT     ATM_UNI_SERVER_ADV       12     CONNECTOR     ATM_ADV DUPLEX       TABLE OF PARAMETERS: CBR_UBR       VOICE AND DATA     ATM_ADV DUPLEX       PARAMETERS     SETTINGS       1.     ATM PARAMETERS     CBR ONLY       2.     ATM PARAMETERS     QUEUE       CONFIGURATION     CONFIGURATION     CONFIGURATION       3.     APPLICATION SUPPORT PROFILE     VOICE       4.     APPLICATION SUPPORT SERVICES     VOICE       5.     APPLICATION TRANSPORT PROTOCOL     AAL2       DATA SERVER     II.     APPLICATION SUPPORT SERVICE     EMAIL AND FTP       2.     TRANSPORT     POTOCOL     VOICE       3.     ATM PARAMETER     QUEUE     UBR       CONFIGURATION     UBR     CONFIGURATION       4.     APPLICATION SUPPORT PROFILE     FTP_P EMAIL_P       TABLE OF PARAMETERS: UBR_UBR       VOICE AND DATA     IUBR       CONFIGURATION     IUBR       CONFIGURATION     IUBR       QUEUE     UBR       CONFIGURATION     IUBR       I     APPLICATION SUPPORT P	7	DDOFILE CONFIG	ETD D EMAIL D VOICE D
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1.       ATM APPLICATION PARAMETERS       UBR ONLY         2.       ATM PARAMETERS QUEUE CONFIGURATION       UBR ONLY         3.       APPLICATION SUPPORT PROFILE       VOICE         4.       APPLICATION TRANSPORT PROTOCOL       AAL5         DATA SERVER       DATA SERVER         1.       APPLICATION SUPPORT SERVICE       EMAIL AND FTP         2.       TRANSPORT PROTOCOL       VOICE         3.       ATM PARAMETER QUEUE CONFIGURATION       UBR         4.       APPLICATION SUPPORT PROFILE       FTP_P EMAIL_P			
2.       ATM PARAMETERS QUEUE CONFIGURATION       UBR ONLY         3.       APPLICATION SUPPORT PROFILE       VOICE         4.       APPLICATION TRANSPORT PROTOCOL       AAL5         5.       APPLICATION SUPPORT SERVICES       VOICE         1.       APPLICATION SUPPORT SERVICE       EMAIL AND FTP         2.       TRANSPORT PROTOCOL VOICE TRANSPORT PROTOCOL VOICE       AAL5         3.       ATM PARAMETER QUEUE CONFIGURATION       UBR         4.       APPLICATION SUPPORT PROFILE       FTP_P EMAIL_P			
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5.       APPLICATION TRANSPORT PROTOCOL       AAL5         DATA SERVER       Image: Constraint of the second secon			
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1.     APPLICATION SUPPORT SERVICE     EMAIL AND FTP       2.     TRANSPORT     PROTOCOL     VOICE       AAL5     TRANSPORT     NOR       3.     ATM     PARAMETER     QUEUE       CONFIGURATION     UBR       4.     APPLICATION SUPPORT PROFILE     FTP_P EMAIL_P	5.		AALS
2.       TRANSPORT       PROTOCOL       VOICE       AAL5         TRANSPORT       3.       ATM       PARAMETER       QUEUE       UBR         CONFIGURATION       4.       APPLICATION SUPPORT PROFILE       FTP_P EMAIL_P	-		
TRANSPORT       3.     ATM PARAMETER QUEUE UBR       CONFIGURATION     FTP_P EMAIL_P			
3.     ATM     PARAMETER     QUEUE     UBR       CONFIGURATION     4.     APPLICATION SUPPORT PROFILE     FTP_P EMAIL_P	2.		AAL5
CONFIGURATION       4.     APPLICATION SUPPORT PROFILE       FTP_P EMAIL_P	2		UDD
4. APPLICATION SUPPORT PROFILE FTP_P EMAIL_P	3.		UBK
	4		
Table 1. Table of Parameter	4.		

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].

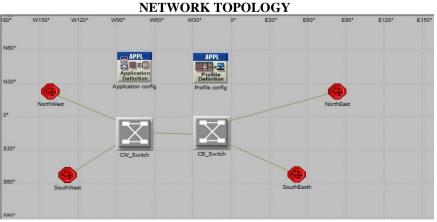


Figure 1: Network Topology

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

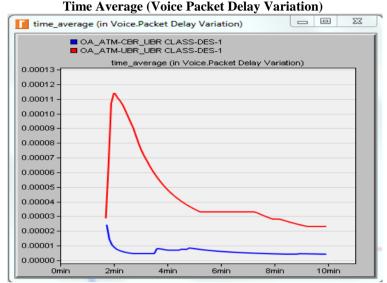


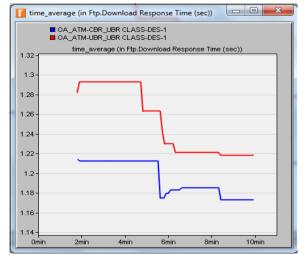
Figure 2: Voice packet delay variation

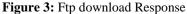
Service Class	Maximum Variation	Minimum Variation	Average
Cbr_Ubr	0.0000245	0.0000046	0.00001455
Ubr_Ubr	0.0001143	0.0000288	0.00007155

 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

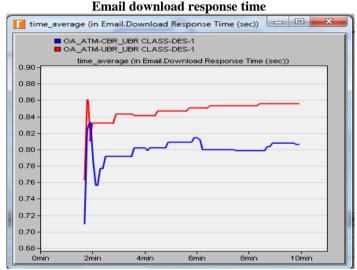




SERVICE CLASS	MAXIMUM (Download Response Time In Sec.)	MINIMUM (Download Response Time In Sec.).	AVERAGE (Sec.)
CBR_UBR	1.2140	1.1730	1.1935
UBR_UBR	1.2930	1.2183	1.2556
T		. 1 1 1 .	

**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.



### 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

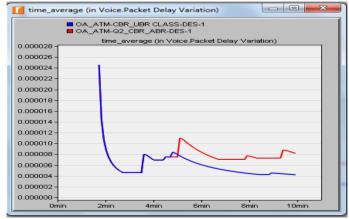


Figure 5: Voice packet Delay Variation

Voice 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

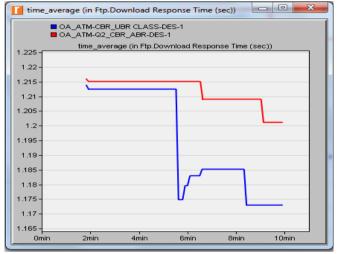


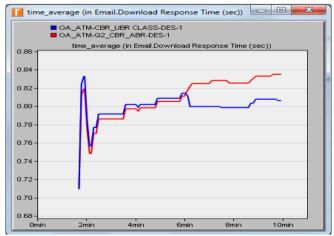
Figure 8: FTP response time

	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**





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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