Chapter 7

Multimedia Traffic
Over ATM VP-Based Ring Network

The performance characteristics of the multimedia traffic over the proposed network are studied in this chapter. The effect of including voice and data to the integration of video/data and video/voice respectively is considered. In order to achieve and guarantee fairness among traffics, the proposed control mechanism method is applied. The results confirm that the proposed network along with the control method is promising enough.

7-1 The Integration of Voice/Video/Data traffics

The performance measurements of including voice traffic with the integrated of video/data traffics, which has been studied in the previous chapter is considered in this section [52, 53, 54].

The same definitions of all parameters we have defined earlier are also used here, such as N_{vo}, N_{vi}, R_{vo} equals to 192 Kbps, R_{vi} equals to 1.5 Mbps, talkspurt period equals to 352 ms, silent period equals to 650 ms, and M_{siz} with interarrival time represents by an exponential distribution with mean value (μ) equals to 5 ms.

We have to mention that the maximum N_{vo} depends upon GR_{vi} and GR_{da}, however the calculation of the ideal maximum values of N_{vo} depends on GR_{vo} (cell/ms), R_T = 352 cell/ms, and transit rate (cell/ms) as shown in following equation (7-1).

$$\text{Max. } N_{vo} = \frac{[352(cell/ms) - transit\_rate(cell/ms)] - (GR_{vi} + GR_{da})}{GR_{vo}} \quad \text{---------} \quad (7\text{-}1)$$

Also, the generation of video and data ($GR_{vi} + GR_{da}$) depends upon GR_{vi}, GR_{da} and N_{vi} as shown from the following equation (7-2).

$$(GR_{vi} + GR_{da}) = GR_{da} + N_{vi}\, GR_{vi} \quad \text{-----------------------------------} \quad (7\text{-}2)$$

Using equations (7-1) and (7-2) helps to determine the ideal maximum N_{vo}, for various values of N_{vi} and M_{siz}. Table 7-1 summaries the ideal maximum N_{vo}. However, the measured values could be less than or equal to those values of N_{vo}. The values of the parameters have mentioned above are used here.

N_{vi}	M_{siz} (cell)	($GR_{vi} + GR_{da}$) (cell/ms)	N_{vo}
10	100	60	227
10	300	100	149
20	100	100	149

Table 7-1 Ideal Maximum N_{vo}.

Figure 7-1 shows video and data MWT versus N_{vo} for various values of N_{vi} such as 10 and 20, and M_{siz} equals to 100 and 300 cells. From the Figure, it is clear the effect of M_{siz} and N_{vi} on the video and data MWT. The increasing of either M_{siz} or N_{vi} yields increases of video and data MWT. The absolute value of data MWT is higher than that of video MWT, this is because the highest priority given to serve the video cells first followed by the data cells. The increasing of N_{vo} corresponding slightly increase of video and data MWT up to the saturation limit (which corresponding the maximum number of N_{vo} that can be supported by the network, and it changes according to the value of M_{siz} and N_{vi}). Beyond the saturation limit the video and data MWT smoothly increase with the increasing of N_{vo}, because the increasing of N_{vo}, increases the number of generated voice cells which yields long queue and delays however the data MWT increases because the scheduling algorithm which gives the voice cells highest priority. It is to be mentioning here that the effect of the proposed control mechanism method is very clear. So, inspire the heavy load carried by the network and the highest priority given to the real-time traffic (video and voice), the non-real-time served properly, and all traffics served with acceptable delays as shown in Figure 7-1.

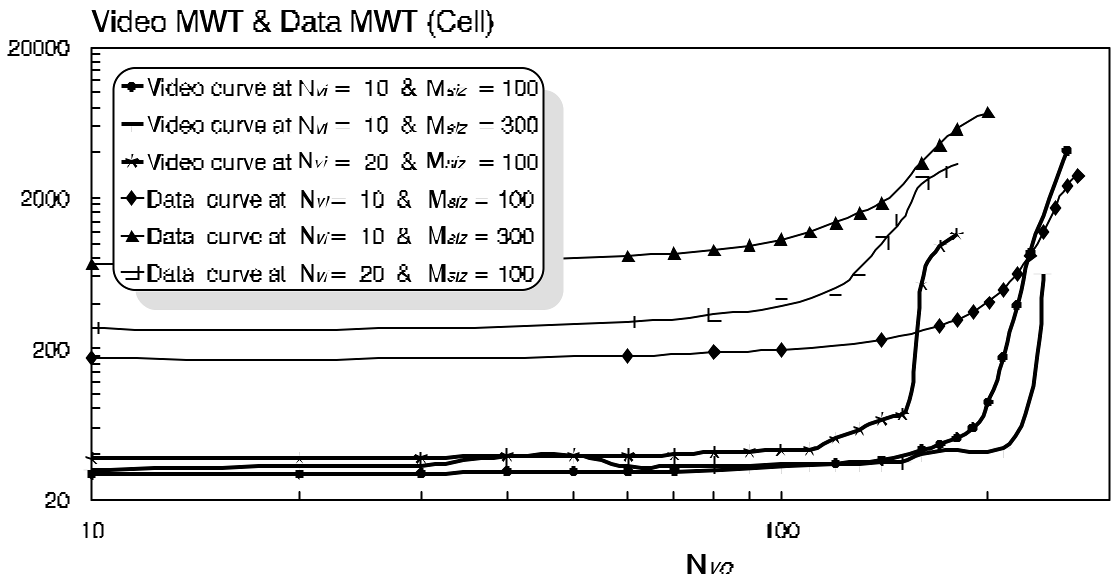

Figure 7-1 Video MWT & Data MWT versus N_{vo}

Table 7-2 summaries the simulation results which represent the fixed generated rates of video/data integration, and corresponding N_{vo}, video MWT, and data MWT.

N_{vi}	M_{siz} (cell)	$(GR_{vi} + GR_{da})$ (cell/ms)	N_{vo}	Video MWT (cell)	Data MWT (cell)
10	100	60	210	175.58	491.49
10	300	100	140	35.29	1869.61
20	100	100	140	68.45	1003.73

Table 7-2 Simulation Results of Figure 7-1.

Figure 7-2 shows video and data MBS versus N_{vo} with the same values of N_{vi} and M_{siz} used above. From the Figure obviously, the effect of M_{siz} and N_{vi} on the video and data MBS. The increasing of either M_{siz} or N_{vi} yields increases of video and data MBS. The absolute value of data MBS is higher than that of video MBS, this is because the highest priority given to serve video cells first followed by data cells. The increasing of N_{vo} slightly increase of video and data MBS up to the saturation limit. Beyond the saturation limit the video and data MBS smoothly increase with the increasing of N_{vo}, due to the increasing of N_{vo}, increases the number of generated voice cells, which yields long queue and delays meanwhile the data cells serve next after video cells served. It is to be mentioning here that the effect of the proposed control mechanism method is very clear. So, inspire the heavy load carried by the network and the highest priority given to the real-time traffic (video and voice), the non-real-time served properly, and all traffics served with acceptable delays as shown in Figure 7-2. Table 7-3 summaries the simulation results which represents the fixed generated rates of video/data integration, and corresponding N_{vo}, video MBS, and data MBS.

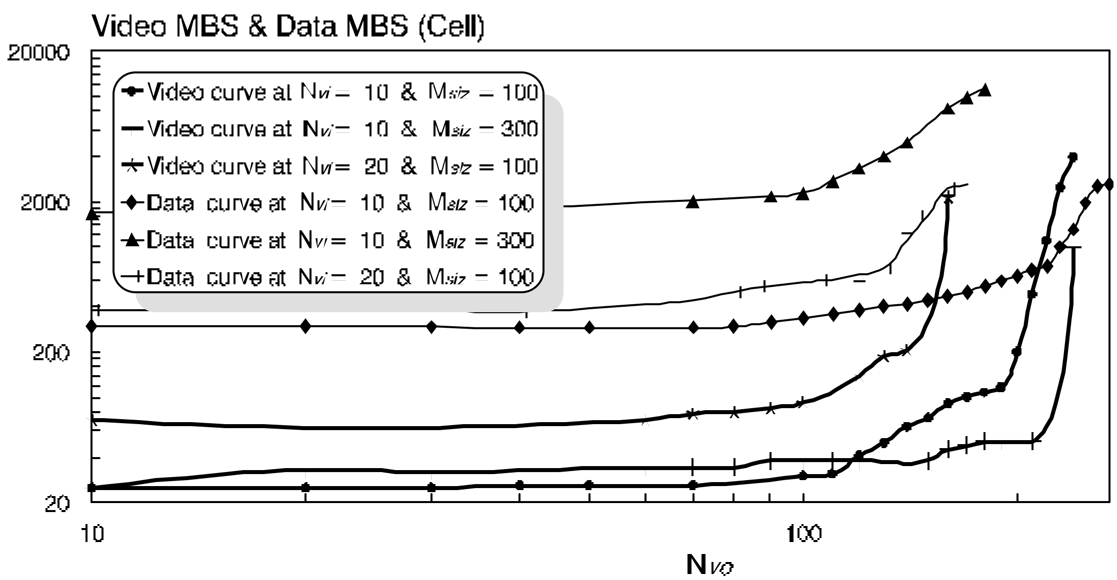

Figure 7-2 Video MBS & Data MBS versus N_{vo}

N_{vi}	M_{siz} (cell)	(GR_{vi} +GR_{da}) (cell/ms)	N_{vo}	Video MBS (cell)	Data MBS (cell)
10	100	60	210	485	708
10	300	100	140	38	4997
20	100	100	140	206	1125

Table 7-3 Simulation Results of Figure 7-2.

Figure 7-3 illustrates TP_{vi} and TP_{da} versus N_{vo}, for R_{vi} =1.5 Mbps, N_{vi} =10, m =5 ms and M_{siz}=100 cells. The Figure shows that TP_{vi} and TP_{da} remain constant at 39.89 cell/ms and 19.98 cells/ms respectively with the increasing of N_{vo} up to the saturation limit after that TP_{vi} and TP_{da} decrease with the increases of N_{vo}. In contrast TP_{vo} increases linearly with the increasing of N_{vo}, that is because, the increasing of N_{vo} increases the number of generated voice cells. It is to be mentioning here that the reasons that make both GR_{da} and GR_{vi} are constant, the M_{siz} and m are constant at 100 cells and 5 ms respectively, therefore GR_{da} remains constant, the N_{vi} and R_{vi} are constant at 10 and 1.5 Mbps respectively therefore GR_{vi} remains constant.

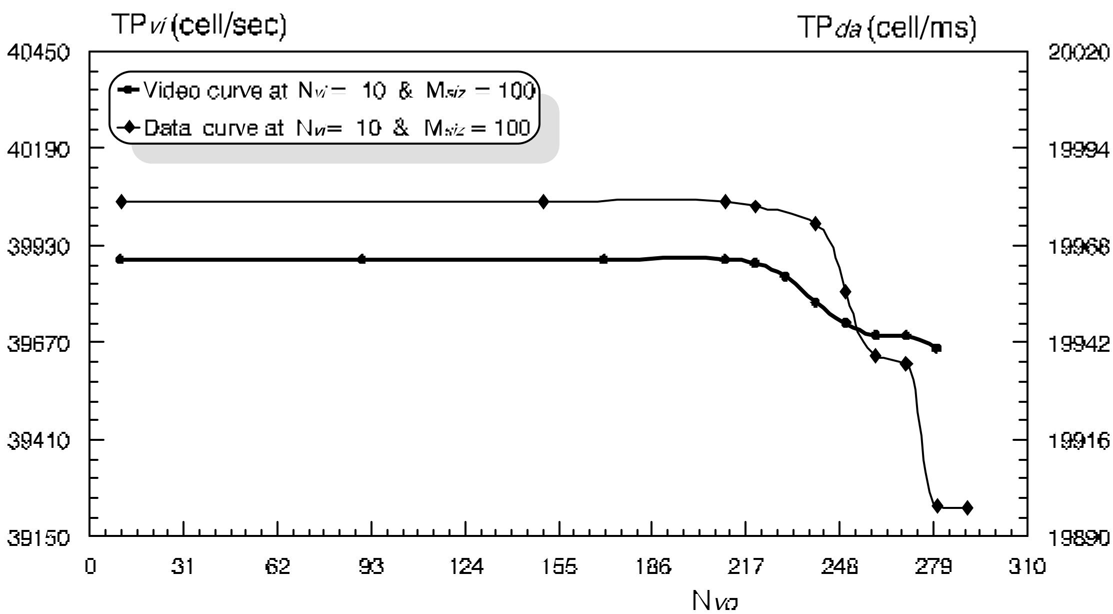

Figure 7-3 TP_{vi} and TP_{da} versus N_{vo}

Figure 7-4 shows the same study of Figure 7-3, except the value of M_{siz} equals to 300 cells. Clearly the behavior is similar to that in Figure 7-3, except that the saturation limit is changed here. So we have to recall the reason of that the saturation limit is depends upon the length of M_{siz}, in which as the length of M_{siz} increases the saturation limit decreases, as shown in Figure 7-3 and 7-4.

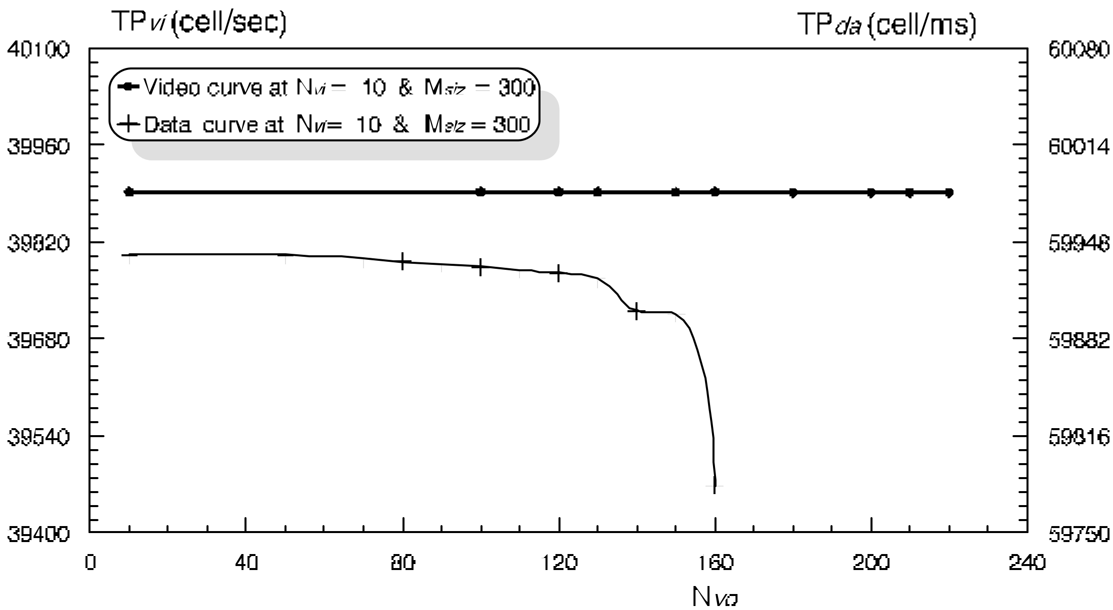

Figure 7-4 TP_{vi} and TP_{da} versus N_{vo}

Figure 7-5 shows the same study of Figure 7-3, except the value of N_{vi} equals to 20 cells. Clearly the behavior is similar to that in Figure 7-3, except that the saturation limit is changed here. So we have to recall reason of that saturation limit is depends upon the N_{vi}, in which as the value of N_{vi} increases the saturation limit decreases, as shown in Figure 7-3 and Figure 7-5.

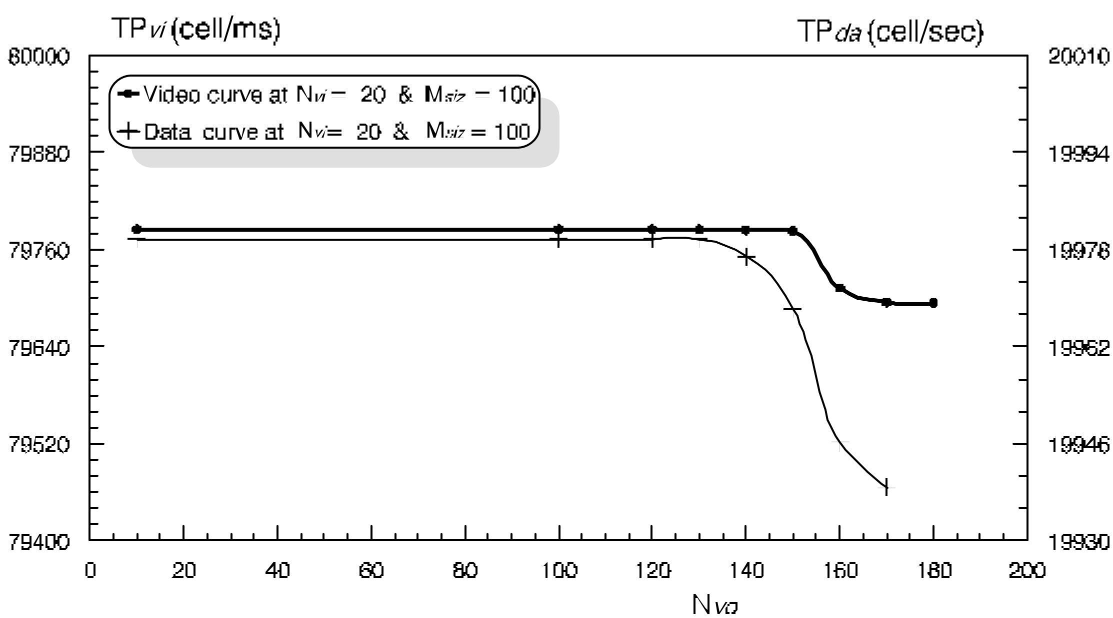

Figure 7-5 TP_{vi} and TP_{da} versus N_{vo}

Figure 7-6 illustrates the video and data MWT versus N_{vi}, for the same values of R_{vi}, R_{vo}, and μ used above, the M_{siz} equals to 100 cells, and the N_{vo} equals to 0, 50, and 200. The Figure summaries the effect of voice traffic on the video/data traffics. Obviously that, the increasing of N_{vi} slightly increase the video and data MWT up to the saturation limit, which depends up on the N_{vo}. Beyond the saturation limit, the video and data MWT sharply increase due to the large number of video cells and queuing delays. The increasing of N_{vo}, slightly increase the video and data MWT and decreases the saturation limit, which corresponding to the maximum number of N_{vi} can be supported by the network.

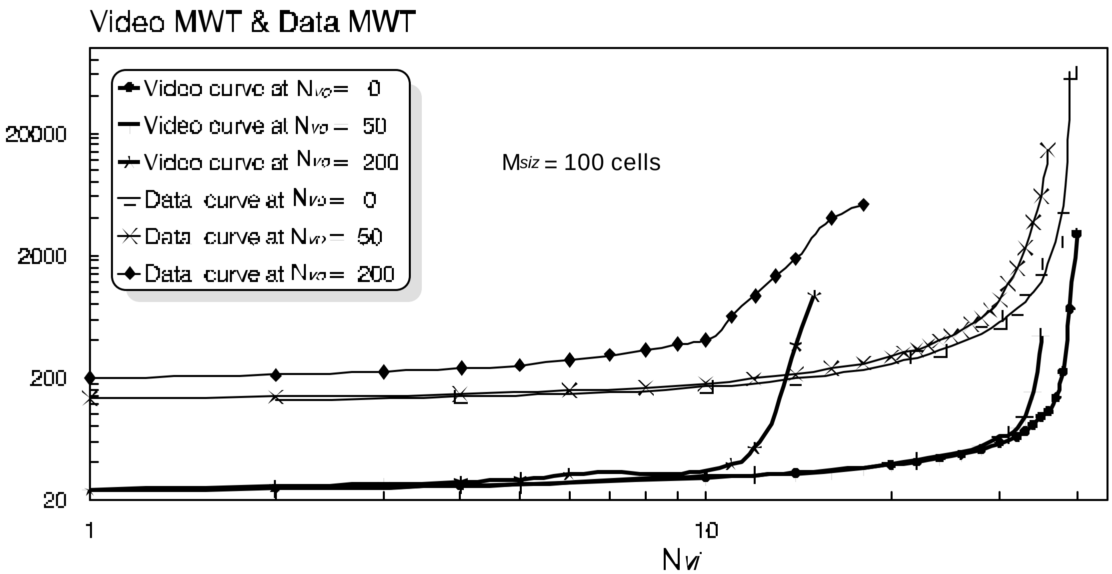

Figure 7-6 Video MWT & Data MWT versus N_{vi}

Figure 7-7 illustrates the video and data MWT versus M_{siz}, for the same values of R_{vi}, R_{vo}, and μ used above, the N_{vi} equals to 10, and the N_{vo} equals to 0, 50, and 100. The Figure summaries the effect of voice traffic on the video/data traffics. Obviously that, the increasing of M_{siz} slightly increase the video and data MWT up to the saturation limit, which depends up on the N_{vo}. Beyond the saturation limit, the data MWT smoothly increases but the video MWT very slightly increases, due to the large number of voice cells, queuing delays, and the scheduling algorithm which gives the video cells the highest priority followed by voice cells and then data cells. That is clear from the absolute values of video MWT and data MWT shown in Figure 7-7.

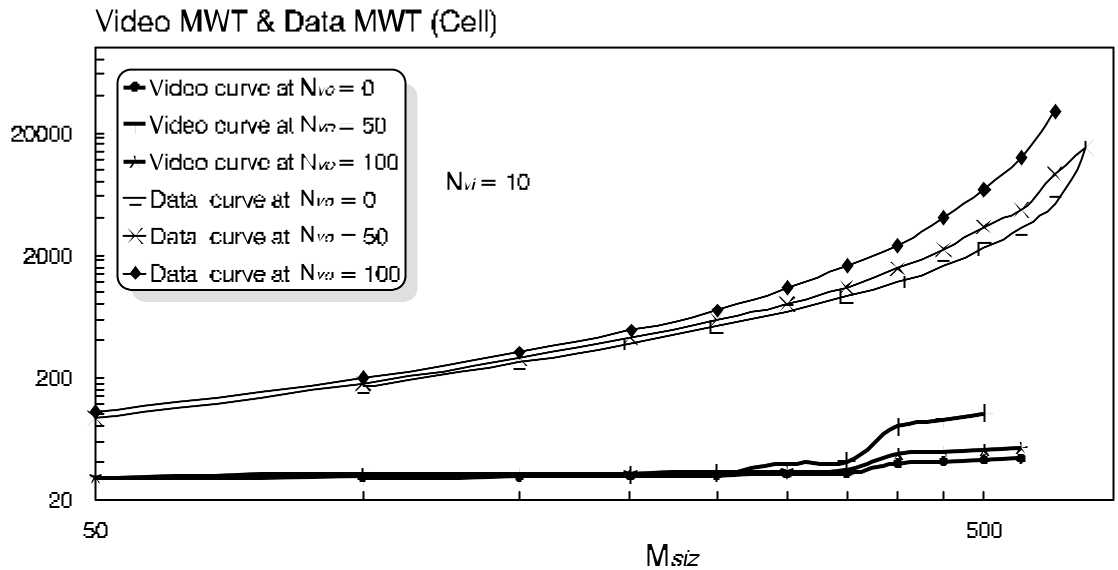

Figure 7-7 Video MWT & Data MWT versus M_{siz}

Table 7-4 summaries the simulation values at two cases: integration video/data and integration voice/video/data. It is clear that the voice traffic has very slightly effect on video traffic but the voice traffic has high effect on data traffic.

At R_{vi} = 1.5 Mbps, R_{vo} = 192 Kbps, μ = 5 ms, and N_{vi} = 10 Sources					
At M_{siz} = 100 cells			At M_{siz} = 200 cells		
N_{vo}	Video MWT (cell)	Data MWT (cell)	N_{vo}	Video MWT (cell)	Data MWT (cell)
0	30	167	0	31	378
50	30	177	50	31	421
200	88	403	100	32	482

Table 7-4 Simulation Results of Figure 7-6 and 7-7