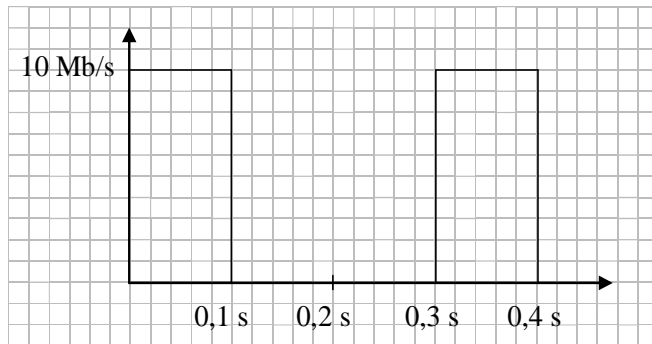


Exercise QoS. Part II LB-TB

Exercise 1

Let us assume a private network with a router that make the traffic shaping using a Token Bucket just before a 10Mbps link that connects to its ISP:

A user in the private network generate burst of traffic following the pattern shown in the figure below:

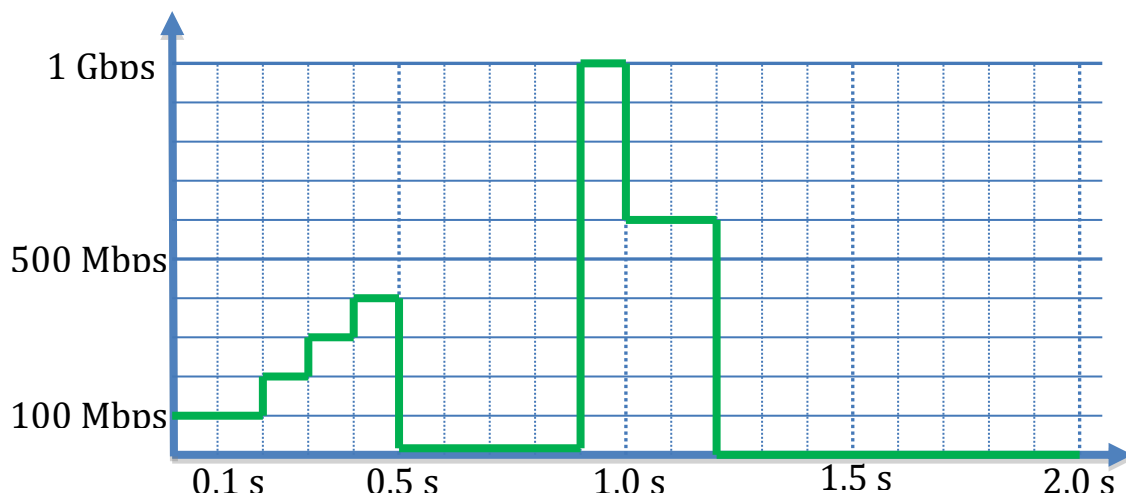


The rate to generate tokens in the Token Bucket is 2Mbps. The bucket size is 1Mbit.

Assuming that the bucket is initially full, draw the output traffic pattern (rate Vs. Time).

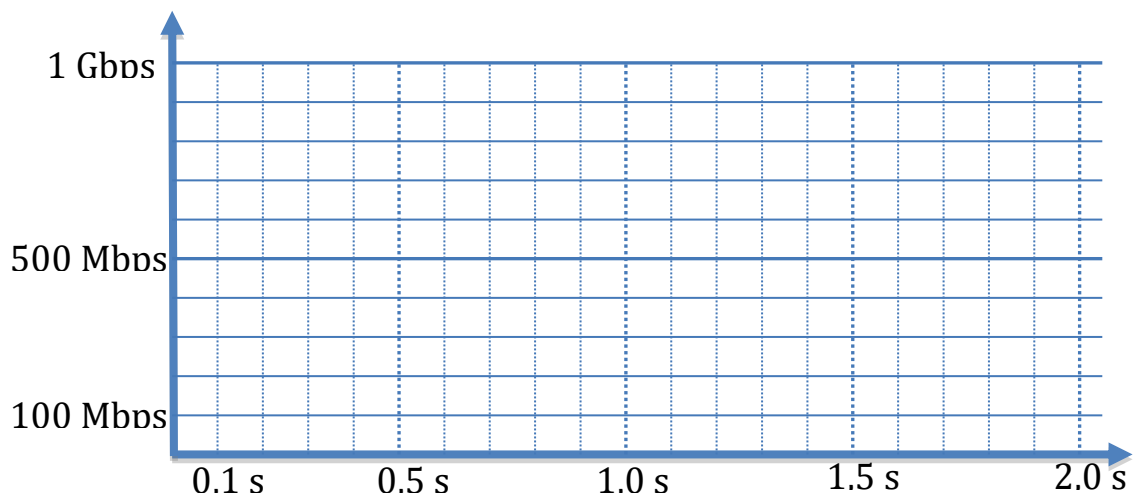
Exercise 2

The access to an 1Gbps Ethernet line has been configured with a *Token Bucket*. This Token Bucket has a capacity of 80Mbits and a bucket rate of 200Mbps (consider that the update of the token bucket counter is ideal: i.e. continuous and instantaneous). The Token Bucket is followed by a Leaky Bucket with an output rate of 500Mbps. Let us assume that we have a large enough buffer associated to the Leaky bucket. Show for the next input traffic, what would be the output traffic after the Token Bucket and the Leaky Bucket, respectively. Assume that the buckets are initially empty:

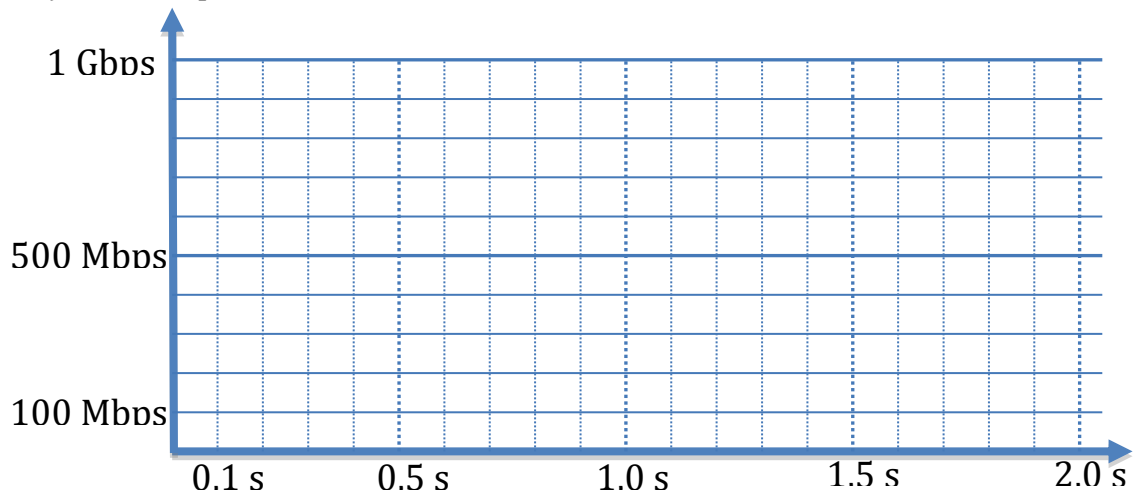


You can use the next figures to plot the results:

Token Bucket output:

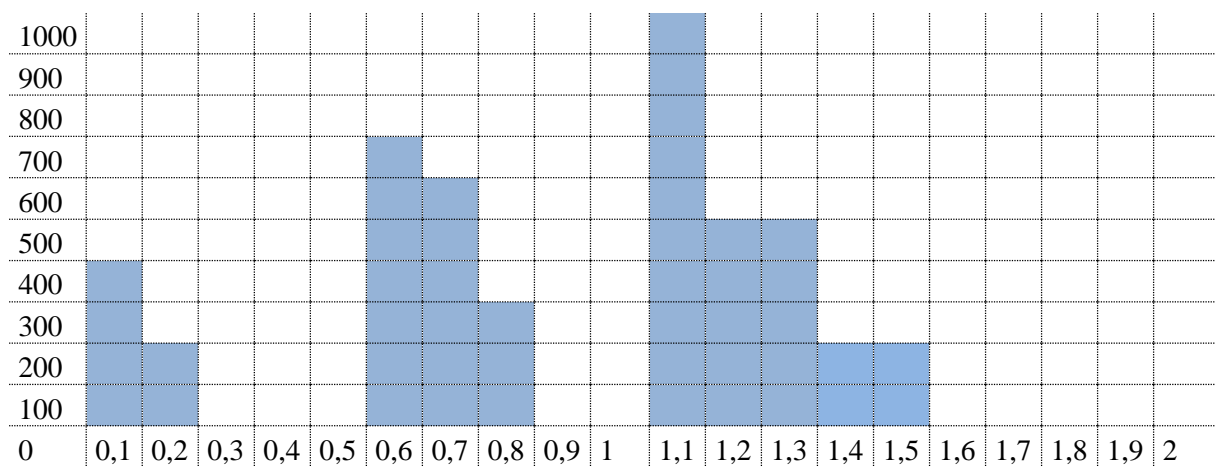


Leaky Bucket output:



Exercise 3

The access to an 1Gbps Ethernet line has been configured with a *Token Bucket*. This Token Bucket has a capacity of 60Mbits and a bucket rate of 200Mbps (make the same assumption for the token arrival than in the previous exercise). The Token Bucket is followed by a leaky Bucket with an output rate of 400Mbps. Let us assume that we have a large enough buffer associated to the Leaky bucket. Show for the next input traffic, what would be the output traffic after the Token Bucket and the Leaky Bucket, respectively. The buckets are initially empty:



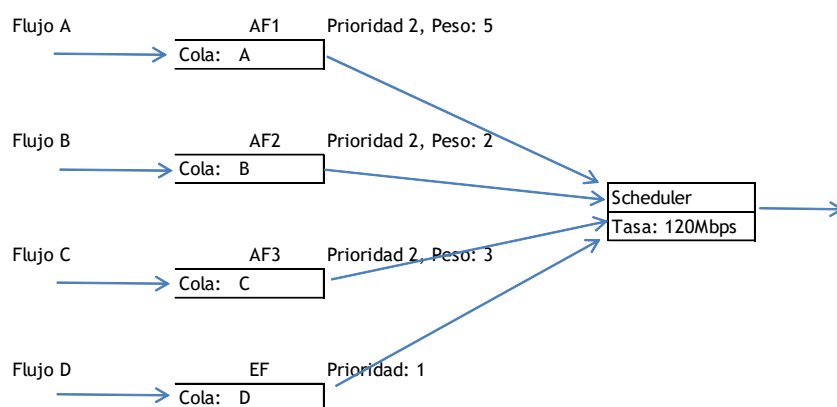
Exercise 4:

1.- A router receives the flow of packets show in the table below. In order to ensure that flow is complaint with the contract, it goes through a traffic shaper base don a Token Bucket with a bucket size of 2500 tokens (bytes). It receives 2500 tokens every 10ms. Fill the table below and show the computation that justifies your answer.

Tiempo (ms)	0	2	4	6	8	10	12	14	16	18
Llegada de paquetes (Bytes)		1000		1400	800		500	1800		1600
Llegada de tokens (Bytes)	2500					2500				
Bytes enviados (Bytes)										
Contenido final del cubo de tokens (Bytes)										

Tiempo (ms)	20	22	24	26	28	30	32	34	36	38
Llegada de paquetes (Bytes)										
Llegada de tokens (Bytes)	2500					2500				
Bytes enviados (Bytes)										
Contenido final del cubo de tokens (Bytes)										

2. We want to share the bandwidth associated to the output interfaz of a router (120Mbps) hmong 4 traffic classes (A, B, C and D). A, B and C correponds to traffic of priority 2 and D has priority 1 (priority 1 > priority 2). The bandwidth available for A, B and C is distributed according to the WFQ weights shown in the figure (Note: In this exercisce we will assume WFQ equivalent to GPS).



Fill the following tables with the throughput that the scheduler assigns to each flow.

	A	B	C	D
Tasa de Entrada (Mbps)	70	70	70	40
Tasa a la Salida del Scheduler (Mbps)				

	A	B	C	D
Tasa de Entrada (Mbps)	80	60	10	10
Tasa a la Salida del Scheduler (Mbps)				

	A	B	C	D
Tasa de Entrada (Mbps)	5	50	10	50
Tasa a la Salida del Scheduler (Mbps)				