Queue Burst

Introduction

Burst is a feature that allows satisfying queue requirements for additional bandwidth even if the required rate is bigger than **MIR** (**max-limit**) for a limited period of time.

Burst can occur only if **average-rate** of the queue for the last **burst-time** seconds is smaller than **burst-threshold**. Burst will stop if **average-rate** of the queue for the last **burst-time** seconds is bigger or equal to **burst-threshold.**

The burst mechanism is simple - if a burst is allowed **max-limit** value is replaced by the **burst-limit** value. When the burst is disallowed **max-limit** value remains unchanged.

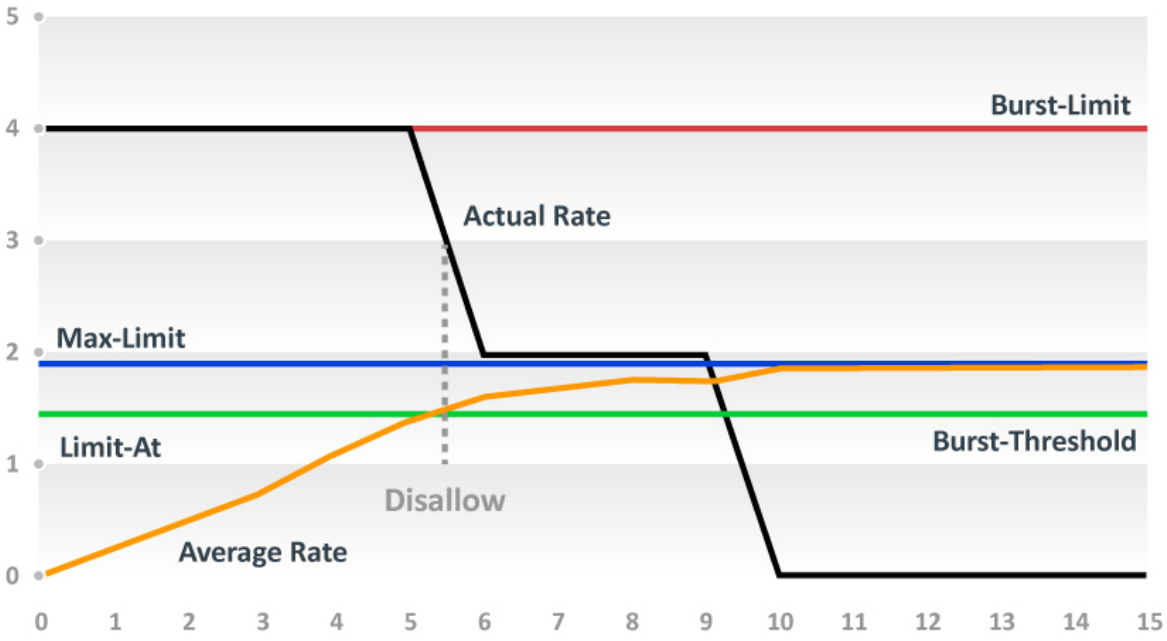
1. **burst-limit** (NUMBER) : maximal upload/download data rate which can be reached while the burst is allowed;
2. **burst-time** (TIME) : period of time, in seconds, over which the average data rate is calculated. (This is NOT the time of actual burst);
3. **burst-threshold** (NUMBER) : this is value of burst on/off switch;
4. **average-rate** (read-only) : Every 1/16 part of the **burst-time**, the router calculates the average data rate of each class over the last **burst-time** seconds;
5. **actual-rate** (read-only) : actual traffic transfer rate of the queue;

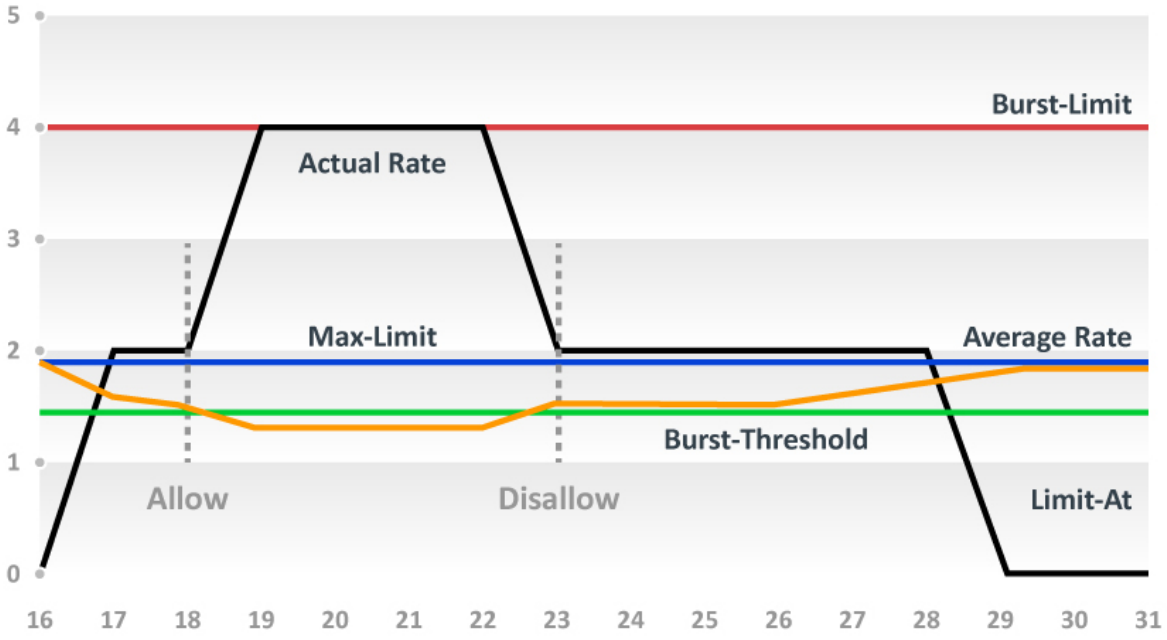
Example

Values: **limit-at=1M** , **max-limit=2M** , **burst-threshold=1500k** , **burst-limit=4M**

The client will try to download two 4MB (32Mb) blocks of data, the first download will start at zero seconds, and the second download will start at 17th second. Traffic was unused at the last minute.

Burst-time=16s





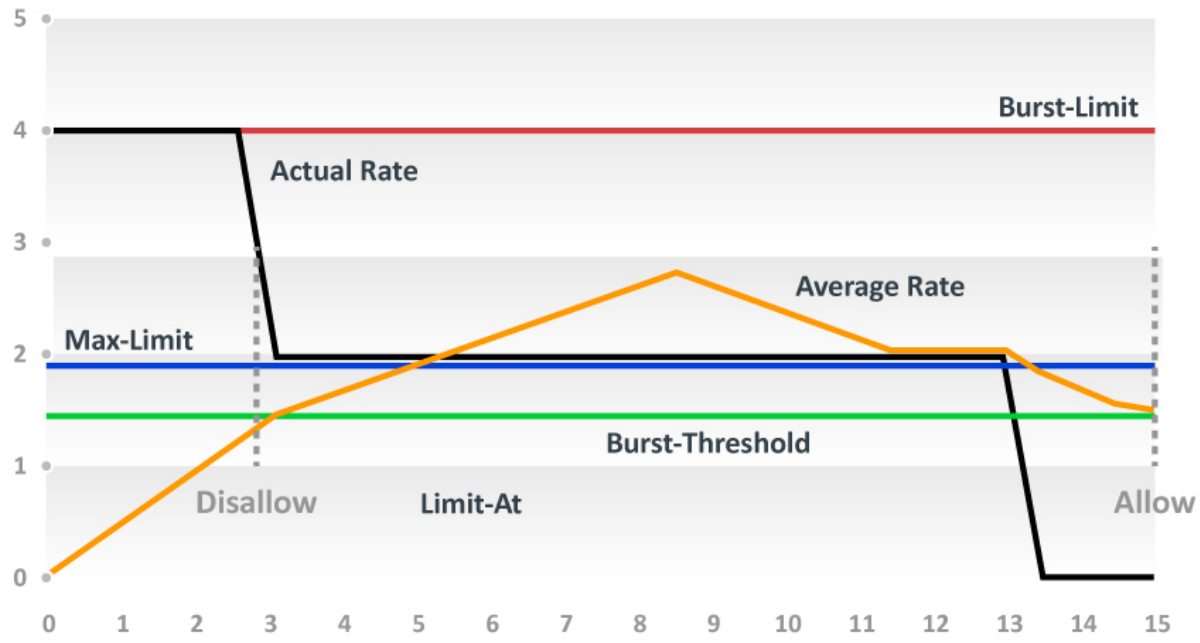
As we can see as soon as the client requested bandwidth it was able to get 4Mpbs burst for 6 seconds. This is longest possible burst with given values *(lon gest-burst-time = burst-threshold * burst-time / burst-limit).* As soon as the burst runs out rest of the data will be downloaded with 2Mbps. This way block of data was downloaded in 9 seconds - without burst, it would take 16 seconds. Burst has 7 seconds to recharge before the next download will start.

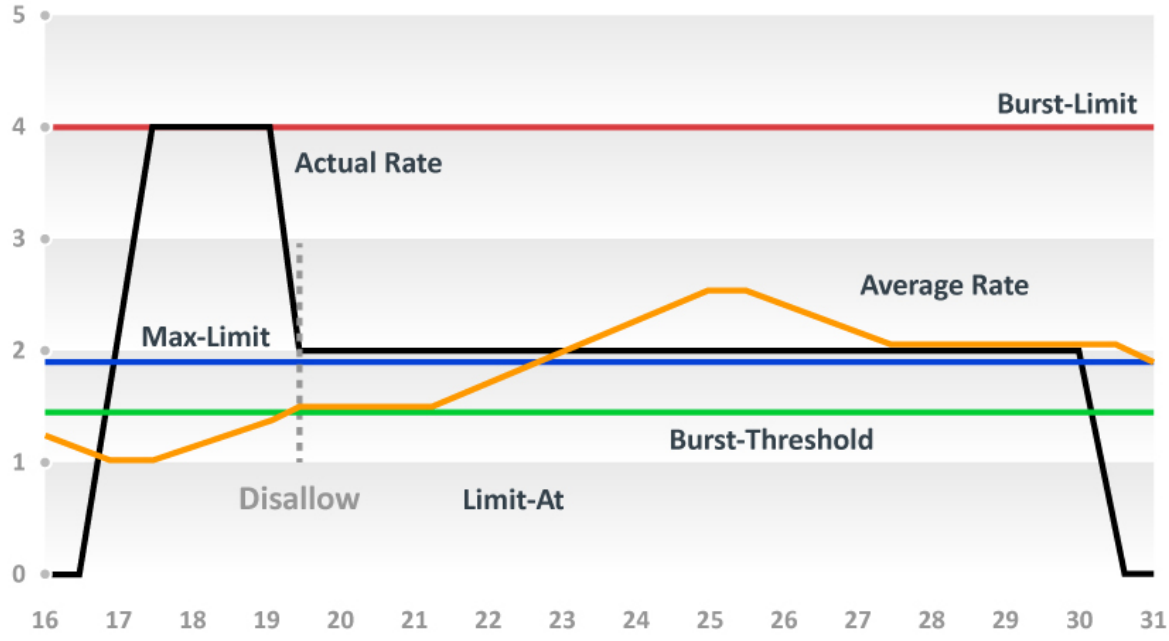
Note that burst is still disallowed when download started and it kicks in only afterward - in the middle of a download. So with this example, we proved that a burst may happen in the middle of a download. The burst was ~4 seconds long and the second block was downloaded 4 seconds faster than without burst.

The average rate is calculated every 1/16 of burst time so in this case 1s

Time	average-rate	burst	actual-rate
0	(0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0)/16=0Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps
1	(0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+4)/16=250Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps
2	(0+0+0+0+0+0+0+0+0+0+0+0+0+0+4+4)/16=500Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps
3	(0+0+0+0+0+0+0+0+0+0+0+0+0+4+4+4)/16=750Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps
4	(0+0+0+0+0+0+0+0+0+0+0+0+4+4+4+4)/16=1000Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps
5	(0+0+0+0+0+0+0+0+0+0+0+4+4+4+4+4)/16=1250Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps
6	(0+0+0+0+0+0+0+0+0+0+4+4+4+4+4+4)/16=1500Kbps	average-rate = burst-threshold → Burst **not** allowed	**2Mbps**
7	(0+0+0+0+0+0+0+0+0+4+4+4+4+4+4+2)/16=1625Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps
8	(0+0+0+0+0+0+0+0+4+4+4+4+4+4+2+2)/16=1750Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps
9	(0+0+0+0+0+0+0+4+4+4+4+4+4+2+2+2)/16=1875Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps
10	(0+0+0+0+0+0+4+4+4+4+4+4+2+2+2+2)/16=2Mbps	average-rate > burst-threshold → Burst not allowed	**0Mbps**
11	(0+0+0+0+0+4+4+4+4+4+4+2+2+2+2+0)/16=2Mbps	average-rate > burst-threshold → Burst not allowed	0Mbps
12	(0+0+0+0+4+4+4+4+4+4+2+2+2+2+0+0)/16=2Mbps	average-rate > burst-threshold → Burst not allowed	0Mbps
13	(0+0+0+4+4+4+4+4+4+2+2+2+2+0+0+0)/16=2Mbps	average-rate > burst-threshold → Burst not allowed	0Mbps
14	(0+0+4+4+4+4+4+4+2+2+2+2+0+0+0+0)/16=2Mbps	average-rate > burst-threshold → Burst not allowed	0Mbps
15	(0+4+4+4+4+4+4+2+2+2+2+0+0+0+0+0)/16=2Mbps	average-rate > burst-threshold → Burst not allowed	0Mbps
16	(4+4+4+4+4+4+2+2+2+2+0+0+0+0+0+0)/16=2Mbps	average-rate > burst-threshold → Burst not allowed	0Mbps
17	(4+4+4+4+4+2+2+2+2+0+0+0+0+0+0+0)/16=1750Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps
18	(4+4+4+4+2+2+2+2+0+0+0+0+0+0+0+2)/16=1500Kbps	average-rate = burst-threshold → Burst not allowed	2Mbps
19	(4+4+4+2+2+2+2+0+0+0+0+0+0+2+2)/16=1375Kbps	average-rate < burst-threshold → Burst **is** allowed	4Mbps
20	(4+4+2+2+2+2+0+0+0+0+0+0+2+2+4)/16=1375Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps
21	(4+2+2+2+2+0+0+0+0+0+0+2+2+4+4)/16=1375Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps
22	(2+2+2+2+0+0+0+0+0+0+2+2+4+4+4)/16=1375Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps
23	(2+2+2+0+0+0+0+0+0+2+2+4+4+4+4)/16=1500Kbps	average-rate = burst-threshold → Burst **not** allowed	2Mbps
24	(2+2+0+0+0+0+0+0+0+2+2+4+4+4+4+2)/16=1500Kbps	average-rate = burst-threshold → Burst not allowed	2Mbps
25	(2+0+0+0+0+0+0+0+2+2+4+4+4+4+2+2)/16=1500Kbps	average-rate = burst-threshold → Burst not allowed	2Mbps
26	(0+0+0+0+0+0+0+2+2+4+4+4+4+2+2+2)/16=1500Kbps	average-rate = burst-threshold → Burst not allowed	2Mbps
27	(0+0+0+0+0+0+2+2+4+4+4+4+2+2+2+2)/16=1625Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps
28	(0+0+0+0+0+2+2+4+4+4+4+2+2+2+2+2)/16=1750Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps
29	(0+0+0+0+2+2+4+4+4+4+2+2+2+2+2+2)/16=1875Kbps	average-rate > burst-threshold → Burst not allowed	0Mbps
30	(0+0+0+2+2+4+4+4+4+2+2+2+2+2+2+0)/16=1875Kbps	average-rate > burst-threshold → Burst not allowed	0Mbps
31	(0+0+2+2+4+4+4+4+2+2+2+2+2+2+0+0)/16=1875Kbps	average-rate > burst-threshold → Burst not allowed	0Mbps

Burst-time=8s





If we decrease burst-time to 8 seconds - we are able to see that in this case, bursts are only at the beginning of downloads The average rate is calculated every 1/16th of burst time, so in this case every 0.5 seconds.

Time	average-rate	burst	actual-rate
0.0	(0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+0)/8=0Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps (2Mb per 0,5sek)
0.5	(0+0+0+0+0+0+0+0+0+0+0+0+0+0+0+2)/8=250Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps (2Mb per 0,5sek)
1.0	(0+0+0+0+0+0+0+0+0+0+0+0+0+0+2+2)/8=500Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps (2Mb per 0,5sek)
1.5	(0+0+0+0+0+0+0+0+0+0+0+0+0+2+2+2)/8=750Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps (2Mb per 0,5sek)
2.0	(0+0+0+0+0+0+0+0+0+0+0+0+2+2+2+2)/8=1000Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps (2Mb per 0,5sek)
2.5	(0+0+0+0+0+0+0+0+0+0+0+2+2+2+2+2)/8=1250Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps (2Mb per 0,5sek)
3.0	(0+0+0+0+0+0+0+0+0+0+2+2+2+2+2+2)/8=1500Kbps	average-rate = burst-threshold → Burst **not** allowed	**2Mbps** (1Mb per 0,5sek)
3.5	(0+0+0+0+0+0+0+0+0+2+2+2+2+2+2+1)/8=1625Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
4.0	(0+0+0+0+0+0+0+0+2+2+2+2+2+2+1+1)/8=1750Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
4.5	(0+0+0+0+0+0+0+2+2+2+2+2+2+1+1+1)/8=1875Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
5.0	(0+0+0+0+0+0+2+2+2+2+2+2+1+1+1+1)/8=2000Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
5.5	(0+0+0+0+0+2+2+2+2+2+2+1+1+1+1+1)/8=2125Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
6.0	(0+0+0+0+2+2+2+2+2+2+1+1+1+1+1+1)/8=2250Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
6.5	(0+0+0+2+2+2+2+2+2+1+1+1+1+1+1+1)/8=2375Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
7.0	(0+0+2+2+2+2+2+2+1+1+1+1+1+1+1+1)/8=2500Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
7.5	(0+2+2+2+2+2+2+1+1+1+1+1+1+1+1+1)/8=2625Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
8.0	(2+2+2+2+2+2+1+1+1+1+1+1+1+1+1+1)/8=2750Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
8.5	(2+2+2+2+2+1+1+1+1+1+1+1+1+1+1+1)/8=2625Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
9.0	(2+2+2+2+1+1+1+1+1+1+1+1+1+1+1+1)/8=2500Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
9.5	(2+2+2+1+1+1+1+1+1+1+1+1+1+1+1+1)/8=2375Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
10.0	(2+2+1+1+1+1+1+1+1+1+1+1+1+1+1+1)/8=2250Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
10.5	(2+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1)/8=2125Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
11.0	(1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1)/8=2000Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
11.5	(1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1)/8=2000Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
12.0	(1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1)/8=2000Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
12.5	(1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1)/8=2000Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
13.0	(1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1)/8=2000Kbps	average-rate > burst-threshold → Burst not allowed	**0Mbps** (0Mb per 0,5sek)
13.5	(1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+0)/8=1875Kbps	average-rate > burst-threshold → Burst not allowed	0Mbps (0Mb per 0,5sek)
14.0	(1+1+1+1+1+1+1+1+1+1+1+1+1+1+0+0)/8=1750Kbps	average-rate > burst-threshold → Burst not allowed	0Mbps (0Mb per 0,5sek)
14.5	(1+1+1+1+1+1+1+1+1+1+1+1+1+0+0+0)/8=1625Kbps	average-rate > burst-threshold → Burst not allowed	0Mbps (0Mb per 0,5sek)
15.0	(1+1+1+1+1+1+1+1+1+1+1+1+0+0+0+0)/8=1500Kbps	average-rate > burst-threshold → Burst not allowed	0Mbps (0Mb per 0,5sek)
15.5	(1+1+1+1+1+1+1+1+1+1+1+0+0+0+0+0)/8=1375Kbps	average-rate < burst-threshold → Burst **is** allowed	0Mbps (0Mb per 0,5sek)
16.0	(1+1+1+1+1+1+1+1+1+1+0+0+0+0+0+0)/8=1250Kbps	average-rate < burst-threshold → Burst is allowed	0Mbps (0Mb per 0,5sek)
16.5	(1+1+1+1+1+1+1+1+1+0+0+0+0+0+0+0)/8=1125Kbps	average-rate < burst-threshold → Burst is allowed	0Mbps (0Mb per 0,5sek)
17.0	(1+1+1+1+1+1+1+1+0+0+0+0+0+0+0+0)/8=1000Kbps	average-rate < burst-threshold → Burst is allowed	**2Mbps** (1Mb per 0,5sek)
17.5	(1+1+1+1+1+1+1+0+0+0+0+0+0+0+0+1)/8=1000Kbps	average-rate < burst-threshold → Burst is allowed	**4Mbps** (2Mb per 0,5sek)
18.0	(1+1+1+1+1+1+0+0+0+0+0+0+0+0+1+2)/8=1125Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps (2Mb per 0,5sek)
18.5	(1+1+1+1+1+0+0+0+0+0+0+0+0+1+2+2)/8=1250Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps (2Mb per 0,5sek)
19.0	(1+1+1+1+0+0+0+0+0+0+0+0+1+2+2+2)/8=1375Kbps	average-rate < burst-threshold → Burst is allowed	4Mbps (2Mb per 0,5sek)
19.5	(1+1+1+0+0+0+0+0+0+0+0+1+2+2+2+2)/8=1500Kbps	average-rate = burst-threshold → Burst **not** allowed	2Mbps (1Mb per 0,5sek)
20.0	(1+1+0+0+0+0+0+0+0+0+1+2+2+2+2+1)/8=1500Kbps	average-rate = burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)

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21.5	(0+0+0+0+0+0+0+1+2+2+2+2+1+1+1+1)/8=1625Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
22.0	(0+0+0+0+0+0+1+2+2+2+2+1+1+1+1+1)/8=1750Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
22.5	(0+0+0+0+0+1+2+2+2+2+1+1+1+1+1+1)/8=1875Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
23.0	(0+0+0+0+1+2+2+2+2+1+1+1+1+1+1+1)/8=2000Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
23.5	(0+0+0+1+2+2+2+2+1+1+1+1+1+1+1+1)/8=2125Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
24.0	(0+0+1+2+2+2+2+1+1+1+1+1+1+1+1+1)/8=2250Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
24.5	(0+1+2+2+2+2+1+1+1+1+1+1+1+1+1+1)/8=2375Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
25.0	(1+2+2+2+2+1+1+1+1+1+1+1+1+1+1+1)/8=2500Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
25.5	(2+2+2+2+1+1+1+1+1+1+1+1+1+1+1+1)/8=2500Kbps	average-rate > burst-threshold → Burst not allowed	2Mbps (1Mb per 0,5sek)
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