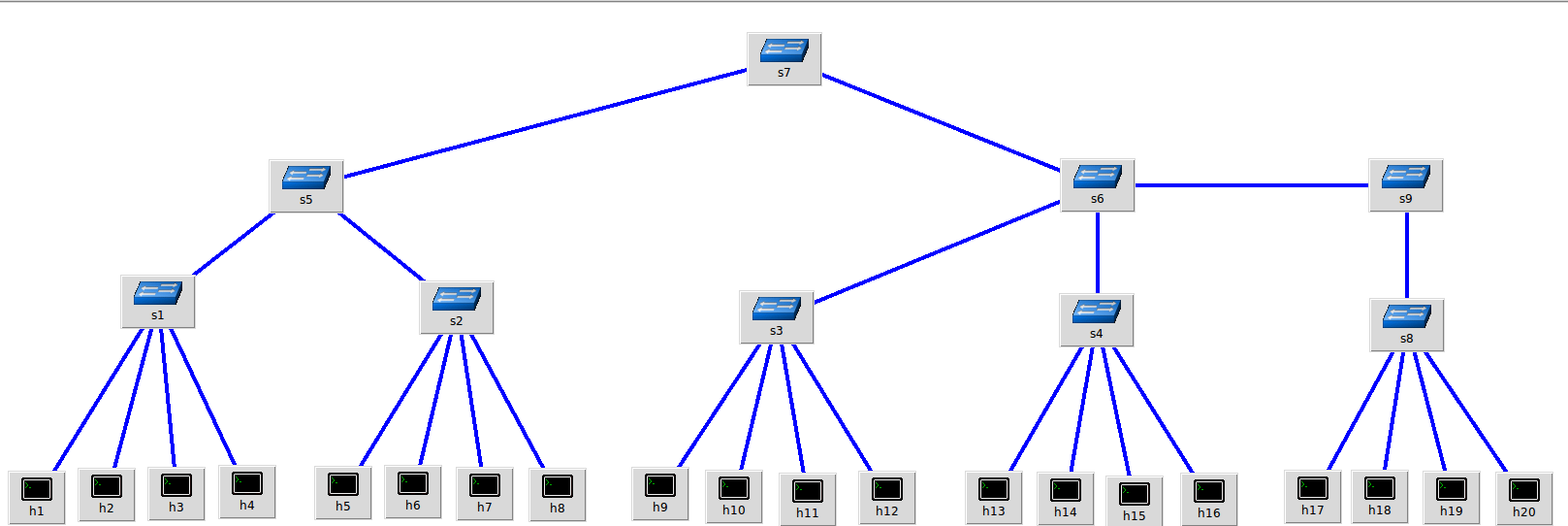
# 1. topo

topo as following



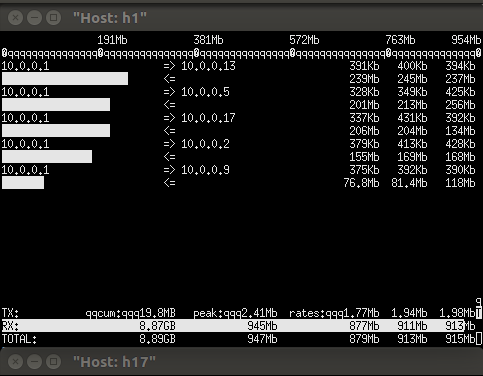
topo.png

end to end network as table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No | From | To | Delay(ms) | Bandwidth(Mbps) |
| 1 | h1(10.0.0.1) | h2(10.0.0.2) | 2 | 1000 |
| 2 | h1(10.0.0.1) | h5(10.0.0.5) | 20 | 1000 |
| 3 | h1(10.0.0.1) | h9(10.0.0.9) | 30 | 1000 |
| 4 | h1(10.0.0.1) | h13(10.0.0.13) | 40 | 1000 |
| 5 | h1(10.0.0.1) | h17(10.0.0.17) | 50 | 1000 |

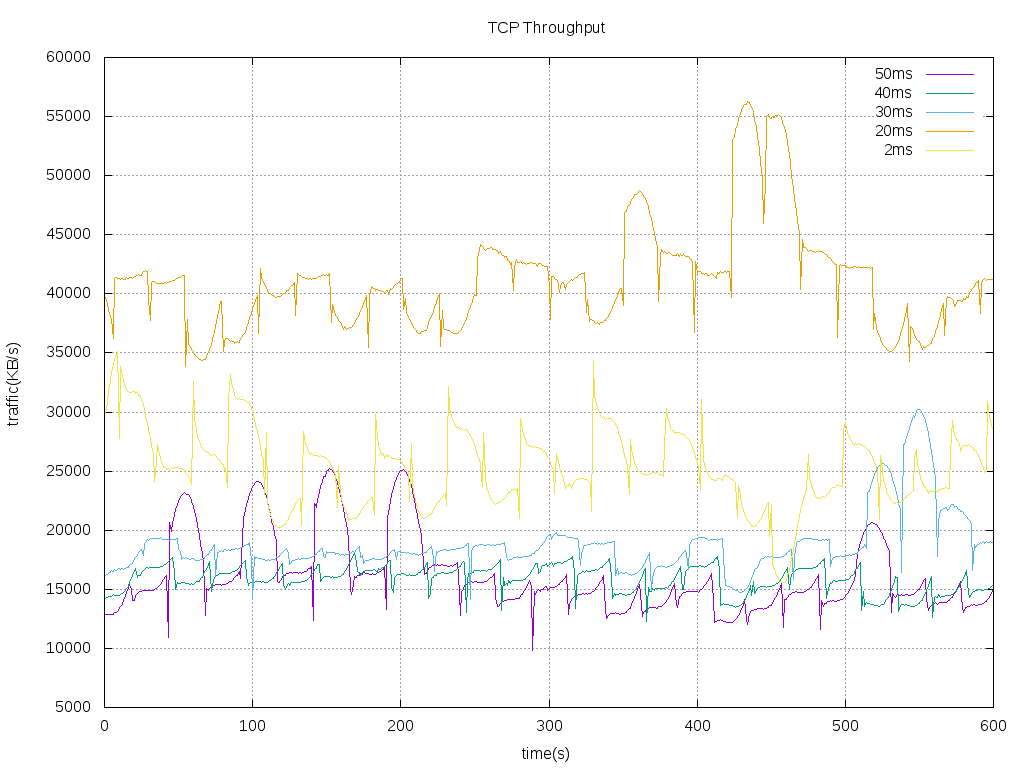
# 2. TCP Fairness

## 2.1 Test 1

setup 5 concurrent flow,  
启动顺序h5(20ms), h9(30ms), h13(40ms), h17(50ms), h2(2ms),  
traffic distribution as following  


throughput faireness details as below

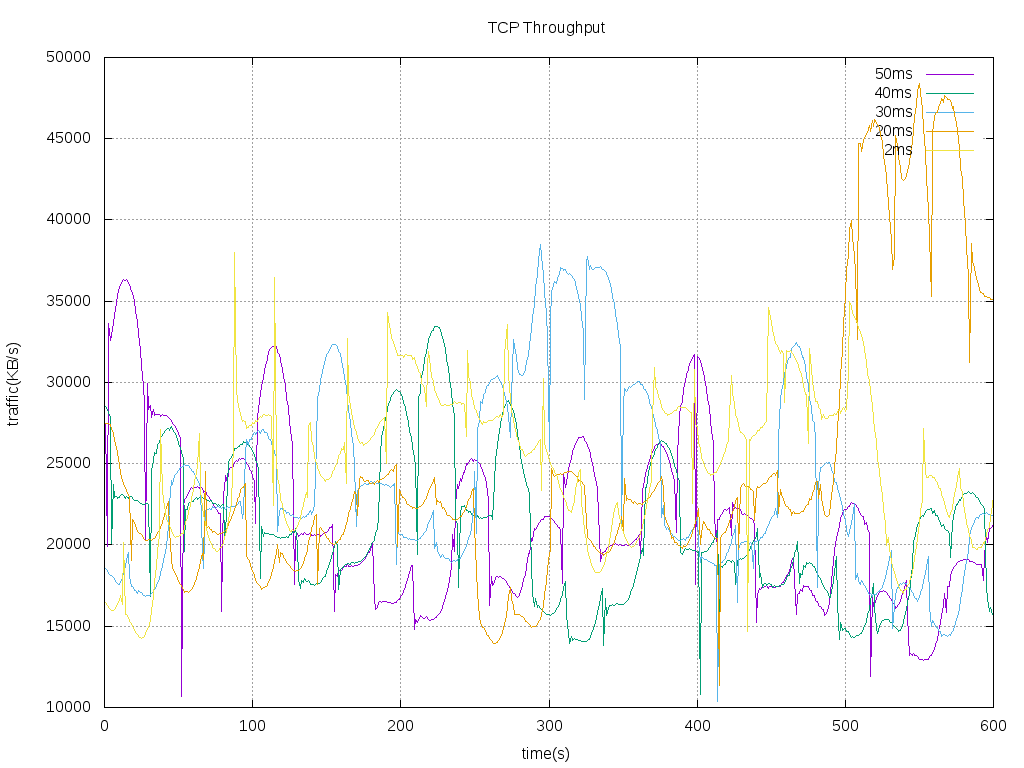
|  |  |  |
| --- | --- | --- |
| No | delay(ms) | throughput\_AVG(Mbps) |
| 1 | 2 | 202 |
| 2 | 20 | 330 |
| 3 | 30 | 150 |
| 4 | 40 | 127 |
| 5 | 50 | 129 |

流量对比示意图如下图所示  


## 2.2 Test 2

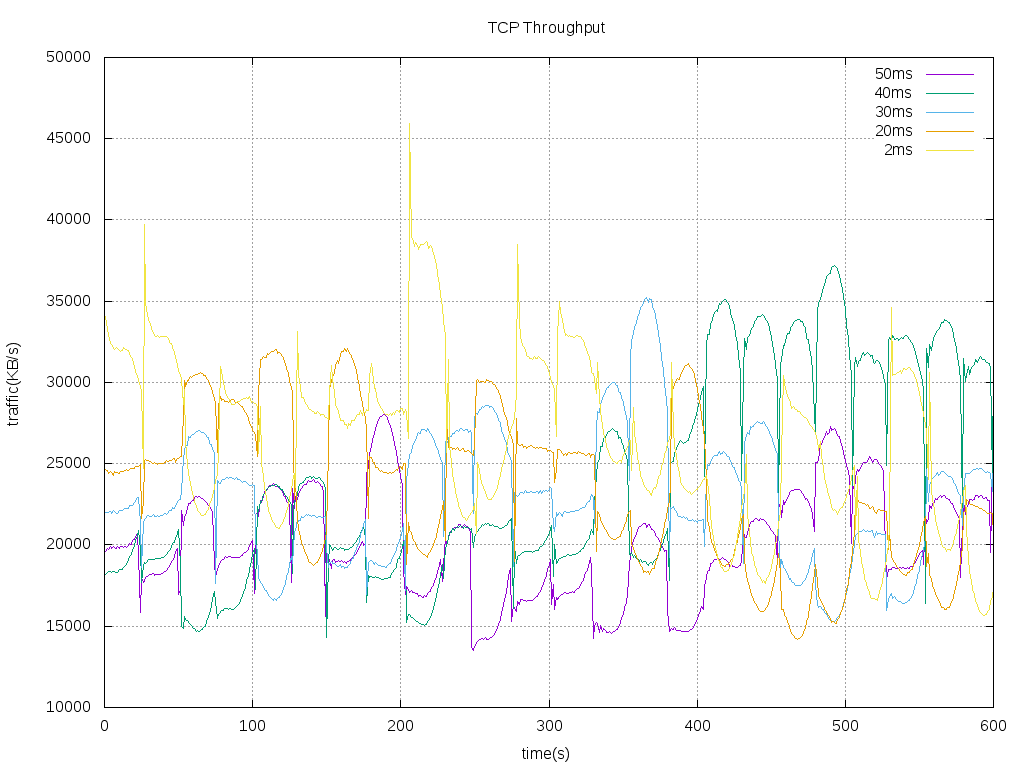
setup 5 concurrent flow, 启动顺序h2(2ms), h5(20ms), h9(30ms), h13(40ms), h17(50ms)  
throughput faireness details as below

|  |  |  |
| --- | --- | --- |
| No | delay(ms) | throughput\_AVG(Mbps) |
| 1 | 2 | 201 |
| 2 | 20 | 198 |
| 3 | 30 | 191 |
| 4 | 40 | 168 |
| 5 | 50 | 173 |

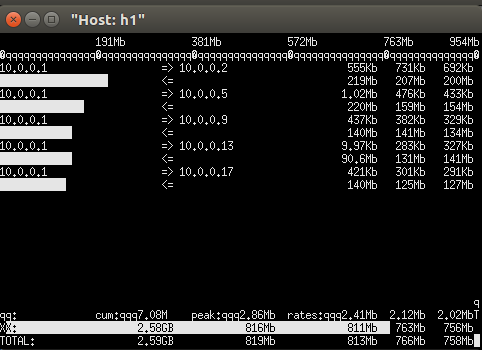
流量对比示意图如下图所示  
  
## 2.3 Test 3

setup 5 concurrent flow,  
启动顺序 h17(50ms), h13(40ms),h9(30ms),h5(20ms),h2(2ms),  
其中各个流的时间轴严格对齐

|  |  |  |
| --- | --- | --- |
| No | delay(ms) | throughput\_AVG(Mbps) |
| 1 | 2 | 211 |
| 2 | 20 | 187 |
| 3 | 30 | 183 |
| 4 | 40 | 193 |
| 5 | 50 | 161 |

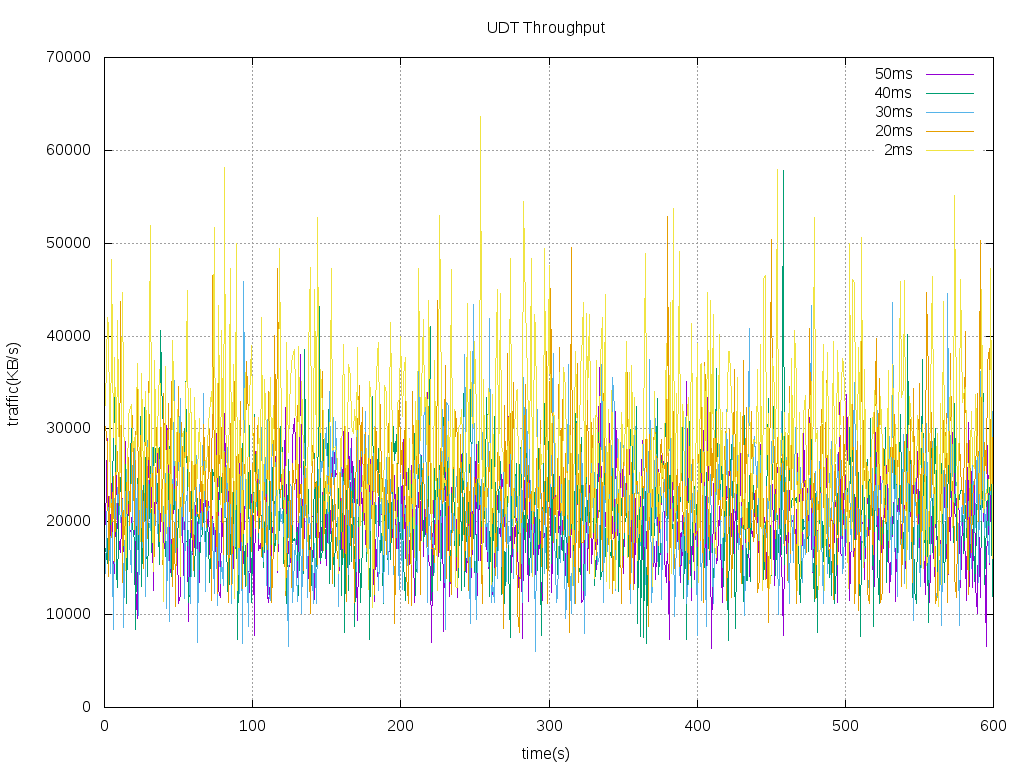
流量对比示意图如下图所示  


# 3. UDT Fairness

setup 5 concurrent flows, traffic distribution as following  


throughput faireness details as below

|  |  |  |  |
| --- | --- | --- | --- |
| No | delay(ms) | throughput\_AVG(Mbps) | 下降比例 (%) |
| 1 | 2 | 233 | 0 |
| 2 | 20 | 189 | 19 |
| 3 | 30 | 170 | 27 |
| 4 | 40 | 167 | 28 |
| 5 | 50 | 161 | 31 |

流量对比示意图如下图所示  


# 4. conclusion

|  |  |  |  |
| --- | --- | --- | --- |
| No | delay(ms) | TCP throughput\_AVG(Mbps) | UDT throughput\_AVG(Mbps) |
| 1 | 2 | 202 | 233 |
| 2 | 20 | 330 | 189 |
| 3 | 30 | 150 | 170 |
| 4 | 40 | 127 | 167 |
| 5 | 50 | 129 | 161 |
| sum | - | 938 | 920 |

在带宽相同的条件下，TCP 拥塞控制算法(cube) 会为延迟较小的节点分配较高的带宽  
UDT的拥塞控制也有这个趋势，但是带宽分配随延迟的变化幅度较小