BBR vs Cubic vs Reno
TCP performance analysis

Design of Networks and Communication Systems
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What is BRR?

BBR stands for Bottleneck Bandwidth and Round-trip propagation time.

It is a new congestion control algorithm developed at Google with the purpose of speeding-up TCP the primary Internet data transmission protocol.

New paradigm: this is an algorithm which **responds to actual congestion** rather than to packet losses.

Working environment

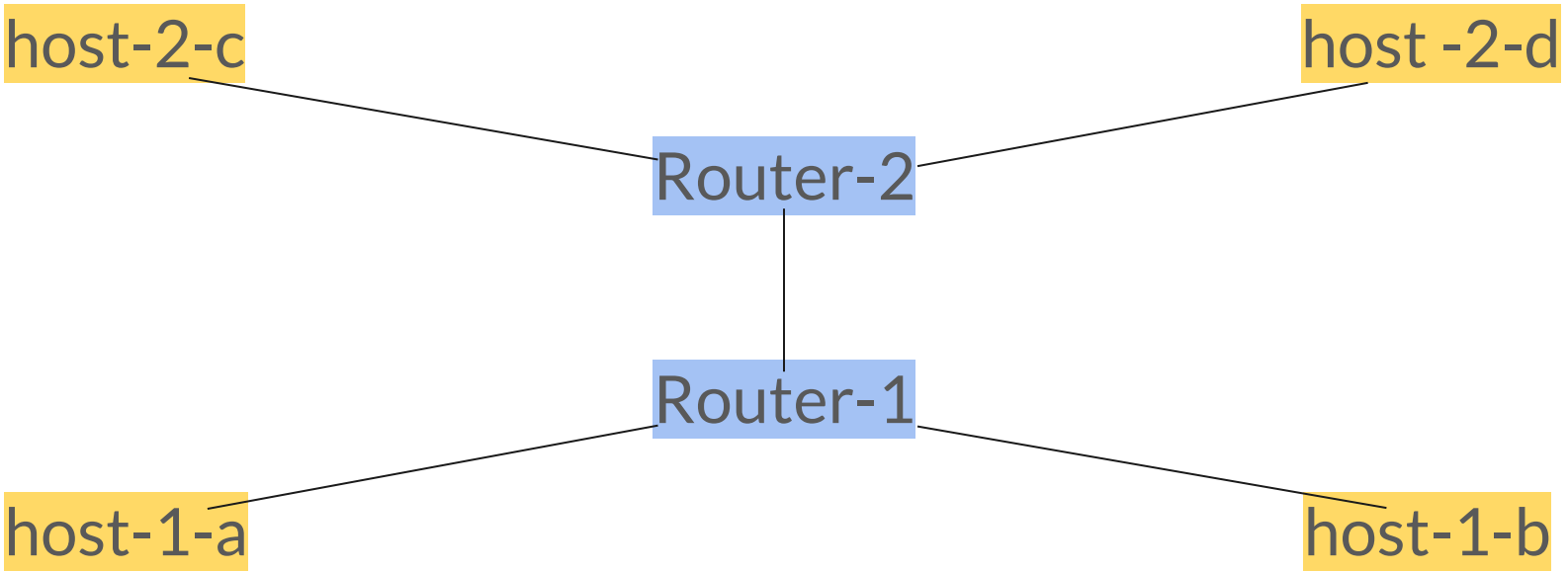
VirtualBox (6.0.8)	for the virtual machines
Vagrant (2.2.1)	for setting up the entire environment
iperf3	for calculating the performance
Gnuplot (5.7)	for plotting the results

All the VMs have Debian 9 OS (kernel 4.9 or newer needed to use BBR TCP)
Everything has been made run and built on Windows 10 OS.

Note: Fair queueing* has been used in all the tests.

*Fair queueing: https://en.wikipedia.org/wiki/Fair_queuing

Network topology

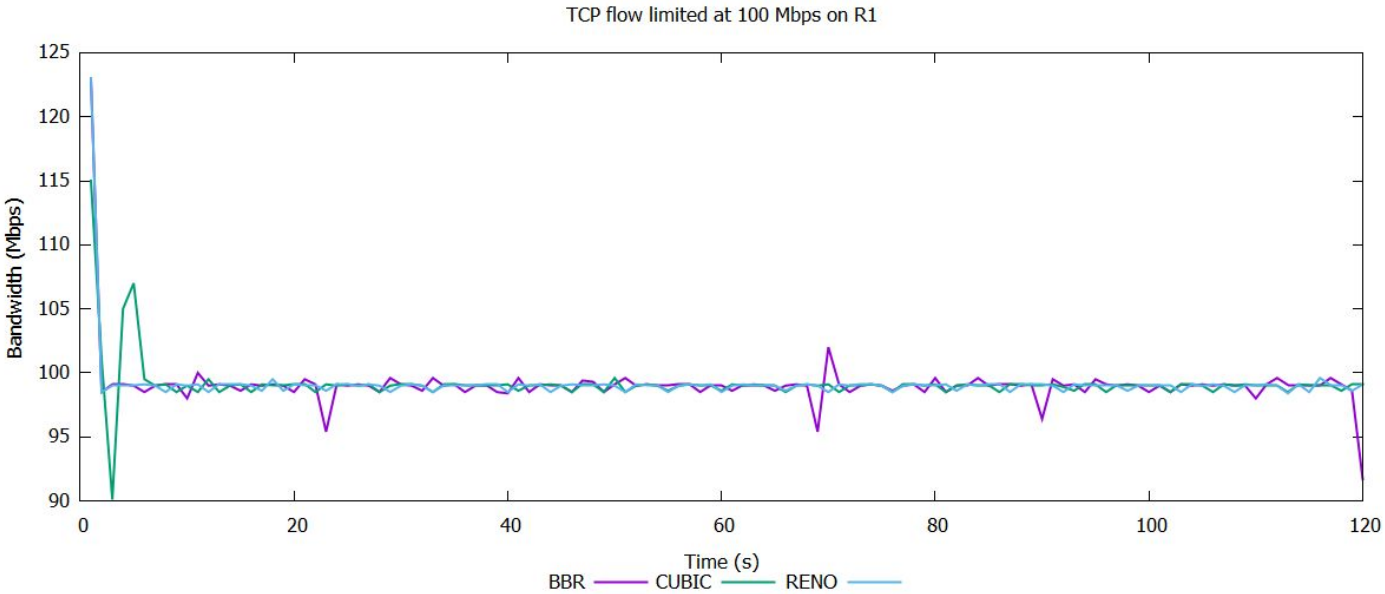


Tests

There have been done two different tests with all the described TCP version:

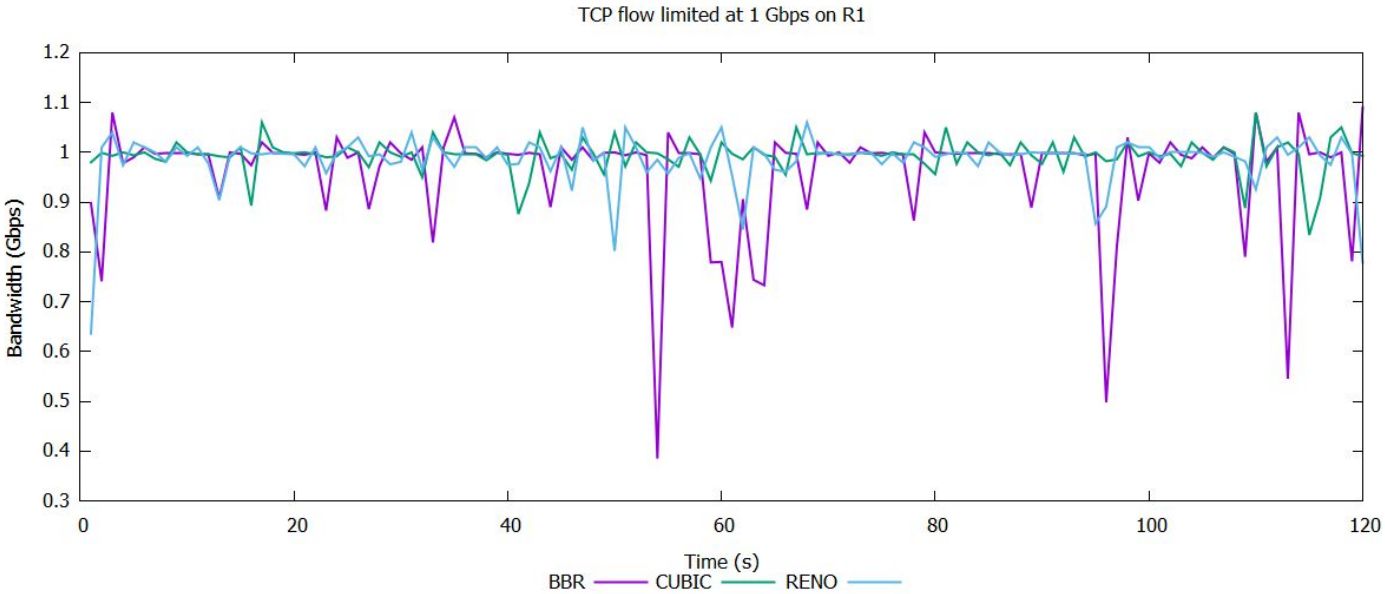
- Single transmission flow, with **host-1-a as Client** and **host-2-c as Server**;
- Dual transmission flow:
  - **host-1-a as Client** and **host-2-c as Server**;
  - **host-1-b as Client** and **host-2-d as Server**.

Single transmission flow - Results (1)



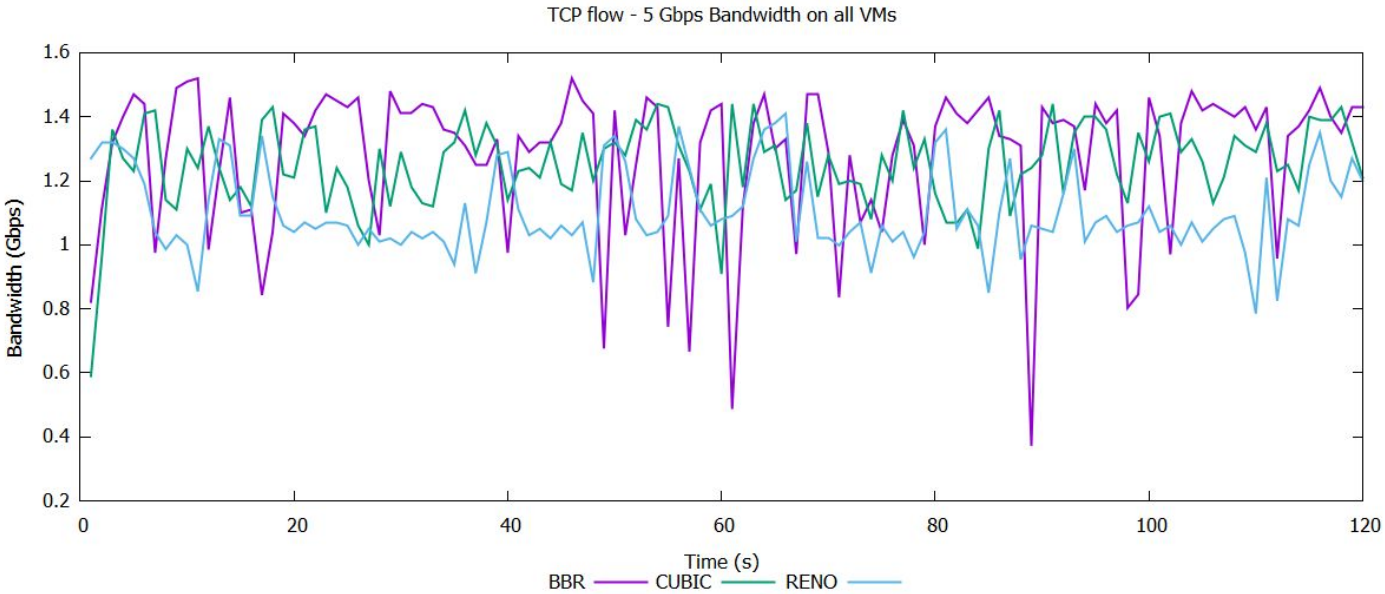
	Average
BBR	99.06 Mbps
Cubic	99.14 Mbps
Reno	99.14 Mbps

Single transmission flow - Results (2)



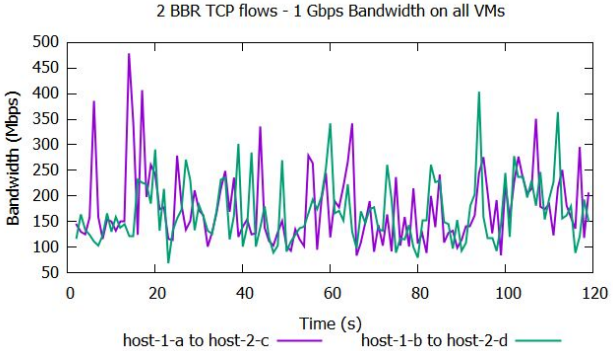
	Average
BBR	0.96 Gbps
Cubic	0.99 Gbps
Reno	0.98 Gbps

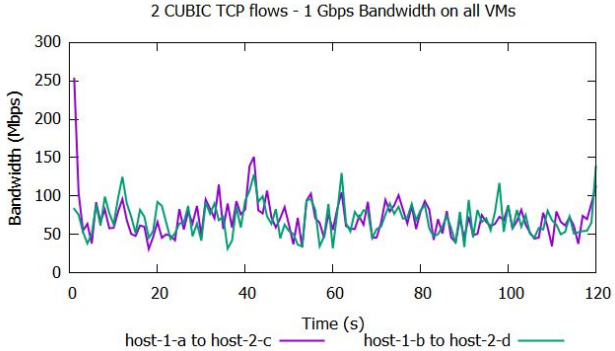
Single transmission flow - Results (3)

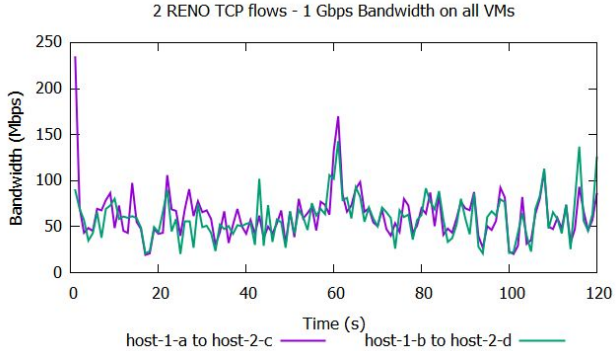


	Average
BBR	1.28 Gbps
Cubic	1.25 Gbps
Reno	1.10 Gbps

Dual transmission flow - Results (1)

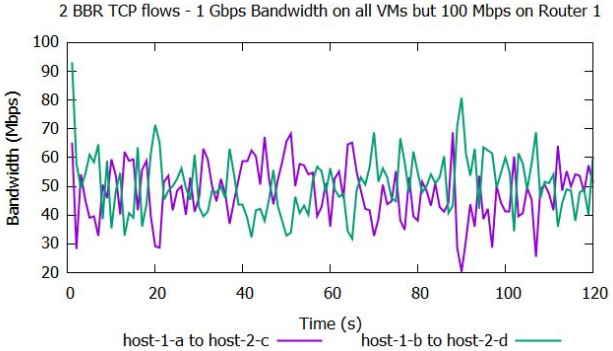


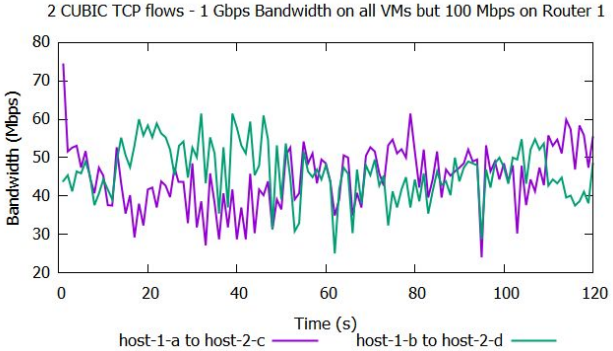


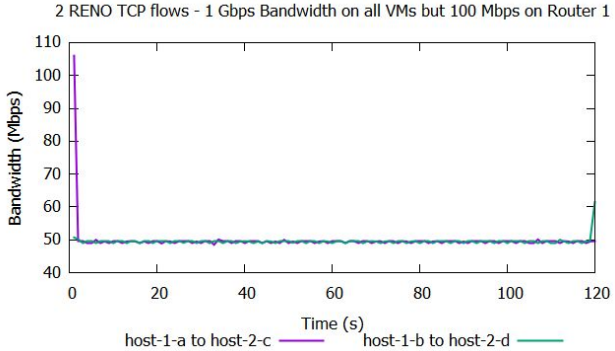


	BBR	CUBIC	RENO
h-1-a → h-2-c	179 Mbps	71 Mbps	62 Mbps
h-1-b → h-2-d	172 Mbps	69.4 Mbps	59.5 Mbps

Dual transmission flow - Results (2)

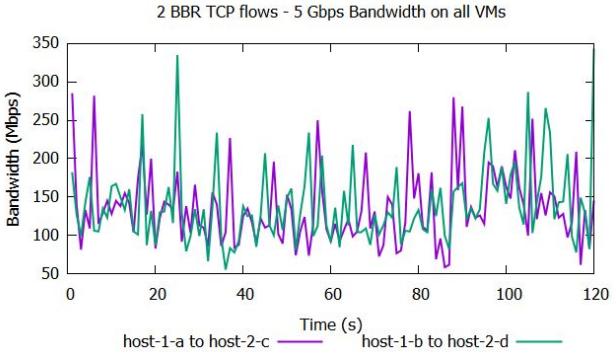


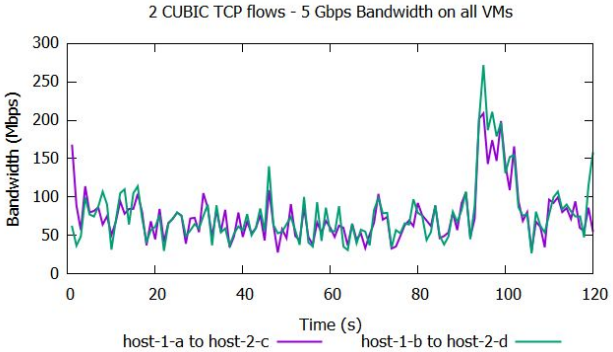


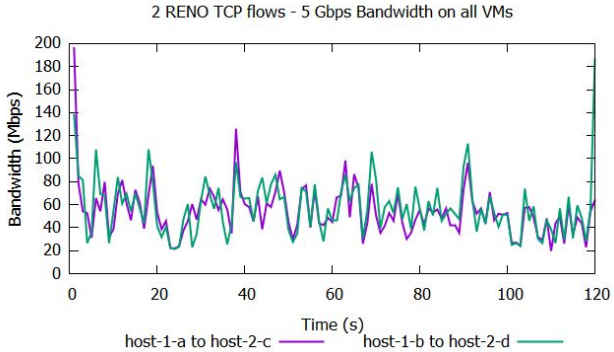


	BBR	CUBIC	RENO
h-1-a → h-2-c	48 Mbps	44.6 Mbps	49.7 Mbps
h-1-b → h-2-d	50.63 Mbps	46.1 Mbps	49.4 Mbps

Dual transmission flow - Results (3)

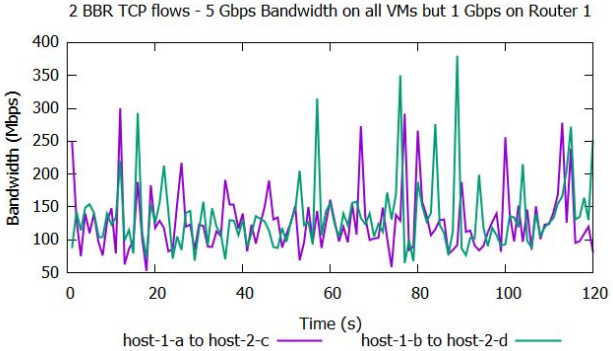


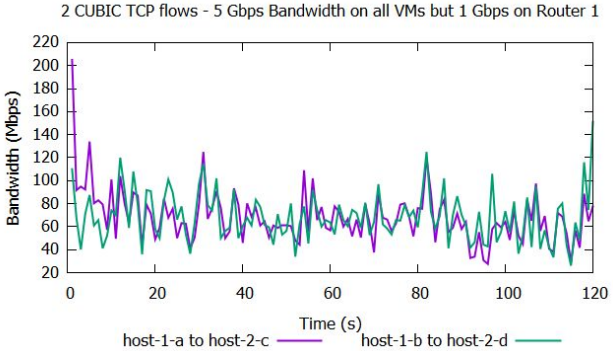


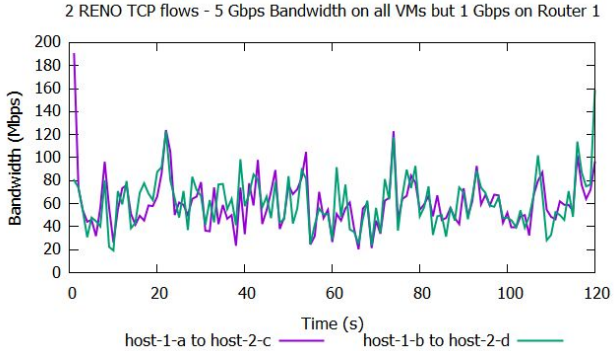


	BBR	CUBIC	RENO
h-1-a → h-2-c	136 Mbps	75.1 Mbps	54.3 Mbps
h-1-b → h-2-d	139 Mbps	77.9 Mbps	57.5 Mbps

Dual transmission flow - Results (4)







	BBR	CUBIC	RENO
h-1-a → h-2-c	128 Mbps	68.4 Mbps	60.3 Mbps
h-1-b → h-2-d	135 Mbps	68.5 Mbps	61.3 Mbps

Conclusions

- Single transmission flow:
  - No matter which TCP version is chosen in mere terms of speed
  - *BBR* TCP version is the one which varies the most though
- Dual transmission flow:
  - *BBR* is the preferred TCP version
  - *BBR* speed on each host is twice as much as the one of *Cubic* which, in turn, performs better than *Reno*.

Final notes

If you want more information, you can go and check my github repository at the link https://github.com/Gioggiomo/bbr

It contains all the material together with the results, the data, all the graphs and the script for the virtual machines used in Vagrant.

There is also a detailed description of the procedure I used in order to have these results.