The effect of reverse traffic on the performance of new TCP congestion control algorithms

Saverio Mascolo - Politecnico di Bari

and

Francesco Vacirca - Università di Roma "La Sapienza"

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Outline

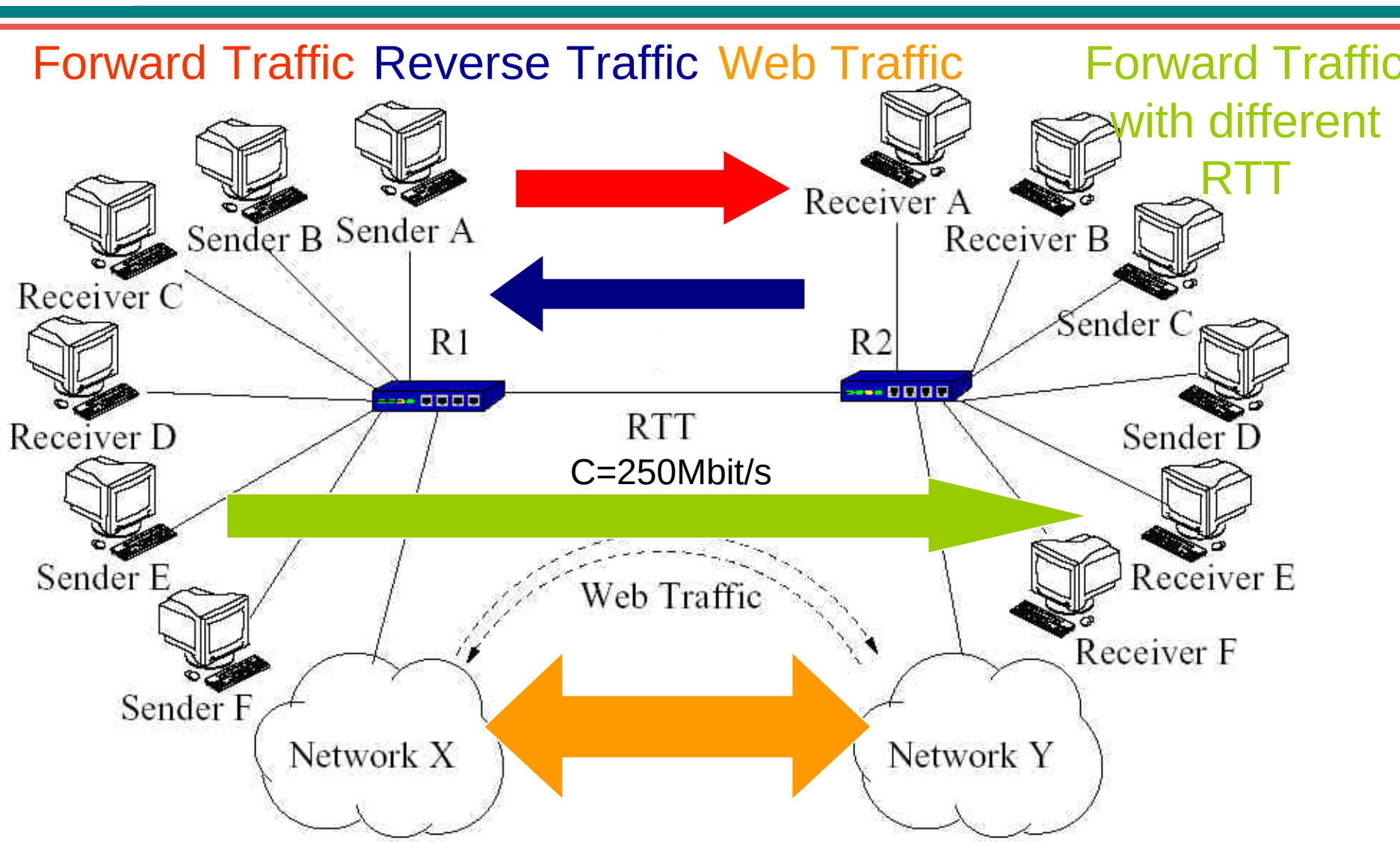
- **Background and objectives**
- **Simulation scenarios to investigate:**
  - The effect of reverse traffic
  - The effect of background web traffic
  - The effect of different RTTs
- **Conclusions (?) and further work**

Background and objectives

- **Drawbacks of TCP in high bandwidth-delay product networks:**
  - TCP Additive Increase probing mechanism is too slow in adapting the sending rate to the available bandwidth.
- **Many modifications have been proposed. We investigate:**

  SACK, HSTCP, H-TCP, BIC, STCP, FAST TCP and Westwood+
- **Objectives: investigate effects of**
  - Reverse traffic of the same type
  - Background web traffic
  - Different RTTs

Simulation scenario



Simulation scenarios

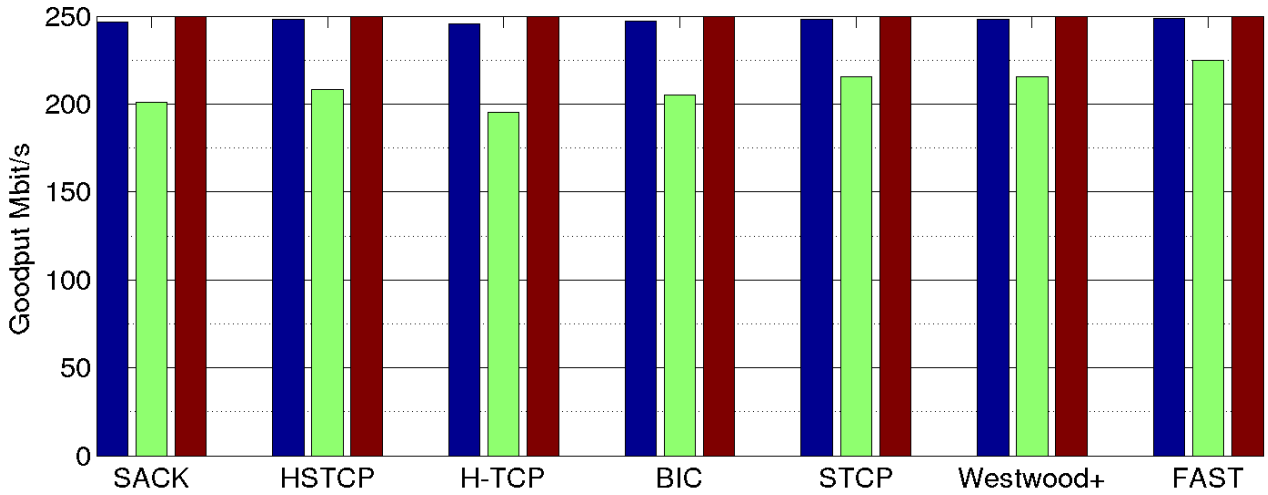
- **1st scenario=**
  - All TCP senders are greedy FTP users and employ the same flavor of the TCP protocol stack.
  - Senders A and B (forward) start at 0s and terminate at 1000s.
  - Senders C and D (reverse) start at 333s and terminate at 666s.
  - Same RTT for all connections.
- **2nd scenario= 1st scenario +**
  - Background web traffic (SACK TCP) from network X->Y and Y->X
- **3rd scenario=**
  - RTT experienced by A,B,C and D is 80ms.
  - RTT experienced by E and F is 40ms.
  - Background web traffic (SACK TCP) from network X->Y and Y->X
  - Senders A and B (forward) start at 0s.
  - Senders E and F (forward) start at 250s.
  - Senders C and D (reverse) start at 333s and terminate at 666s.
  - Senders B and F (forward) terminate at 750s.

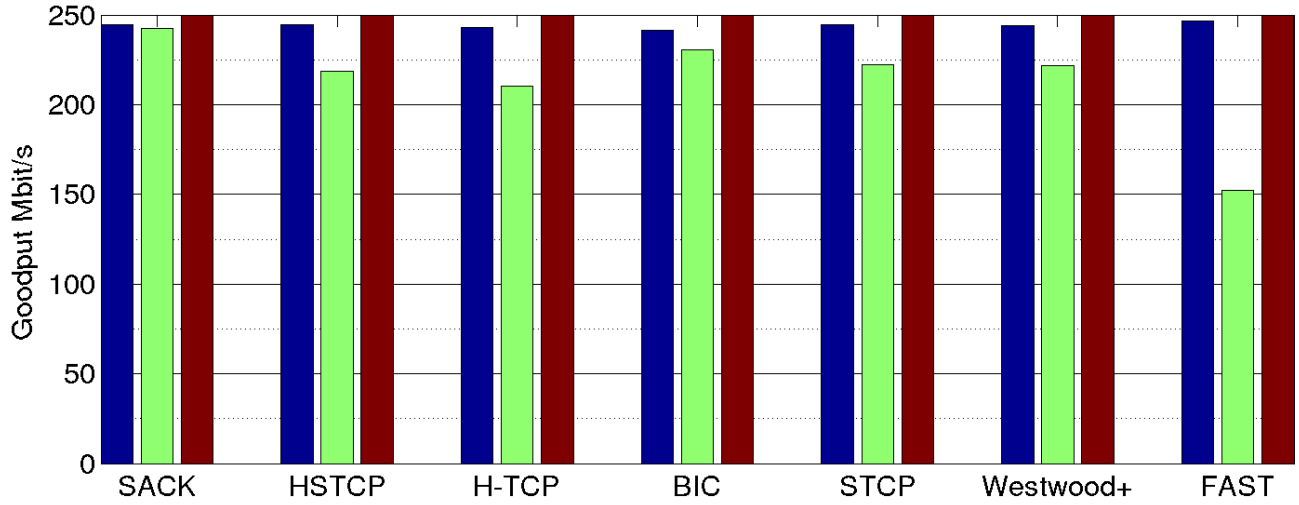
Web traffic generation

- **Web traffic generation:**
  - The interarrival time between new connections is generated with an exponential distribution
  - A random number of packets is associated to each new flow, drawn from an empirical distribution:
    - 50% of flows have 1 packets,
    - 20% have 6 packets,
    - 20% have 18 packets,
    - 10% have 190 packets.
  - In all simulations we set the inter-arrival time to 50 ms, which contributes an offered load of about 5.8 Mbit/s per direction.

- **This simple web traffic model allows us to control the traffic load generated by networks X and Y.**

The effect of reverse traffic





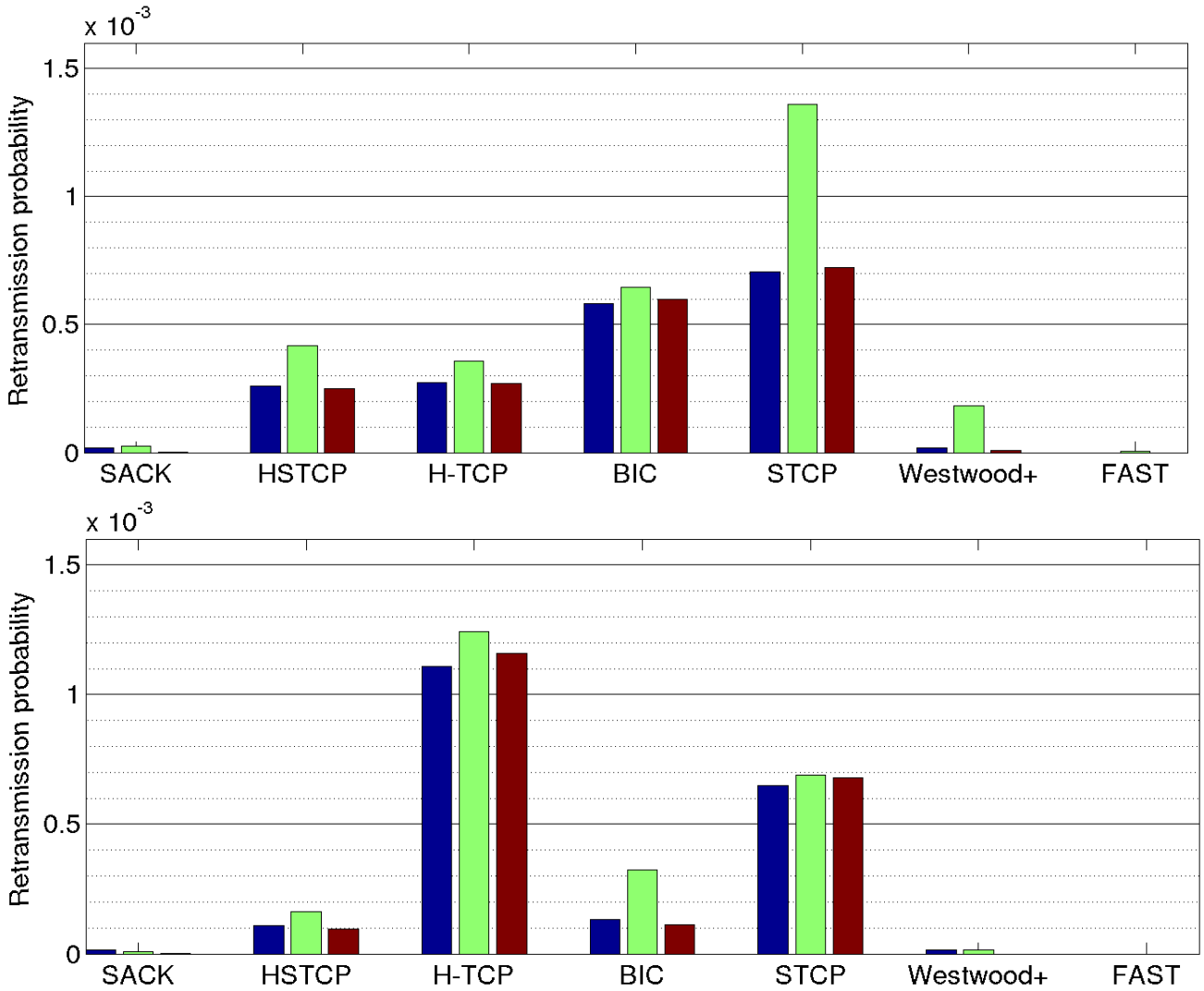
1st scenario

RTT=40ms

Goodput during the three phases of the simulation

RTT=160ms

The effect of reverse traffic

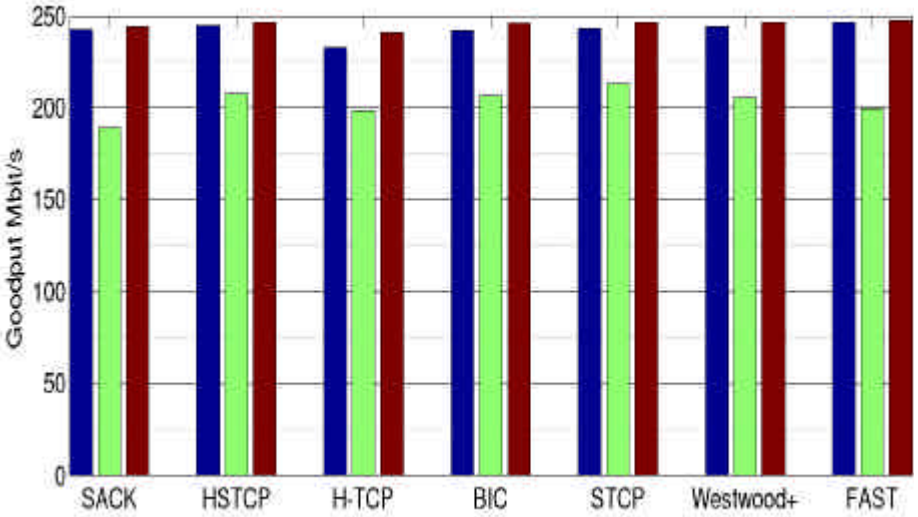


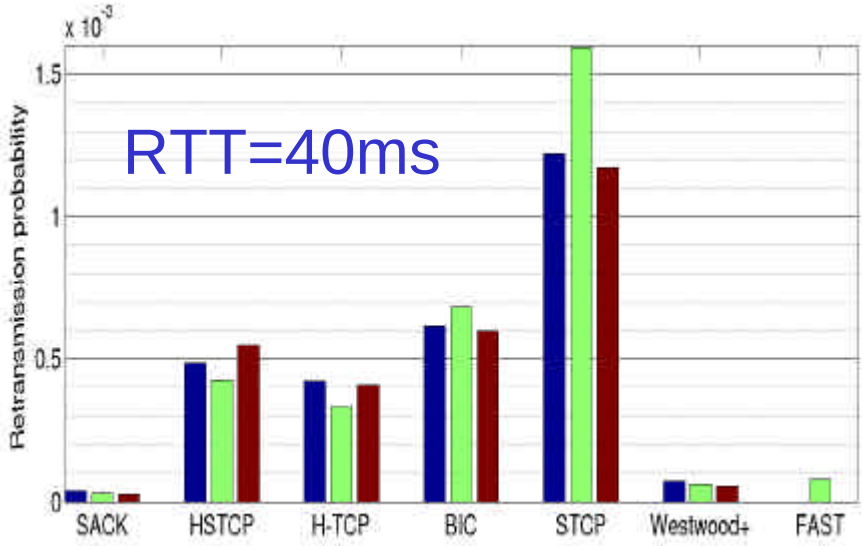
1st scenario

RTT=40ms

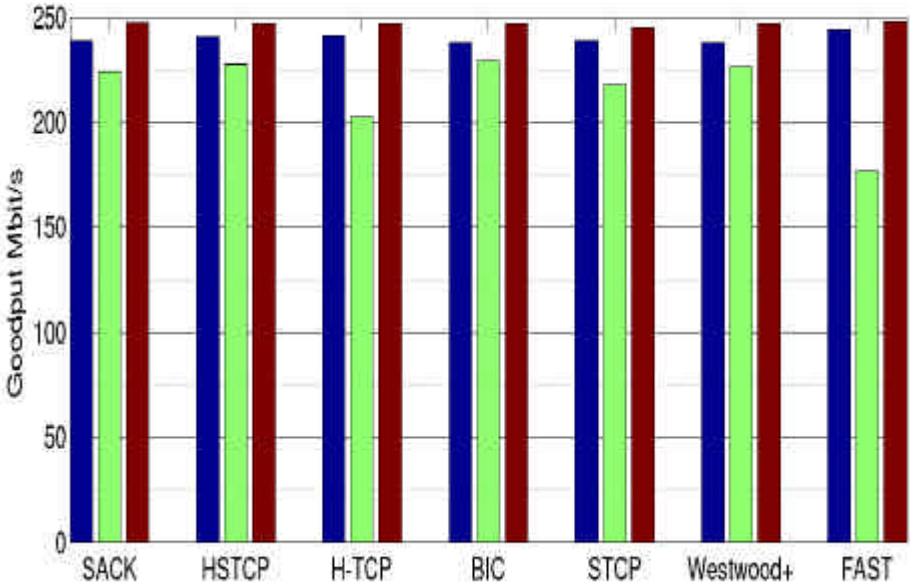
RTT=160ms

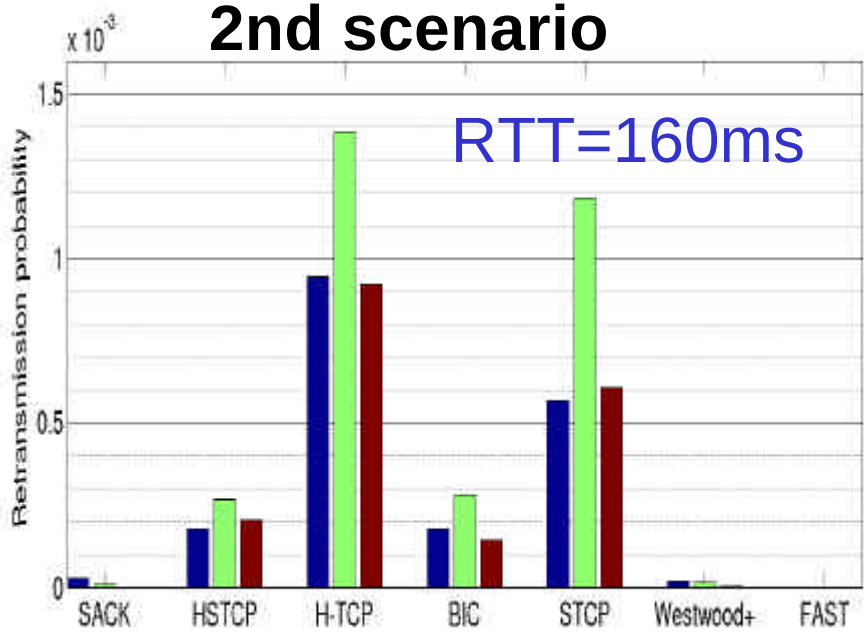
The effect of background traffic



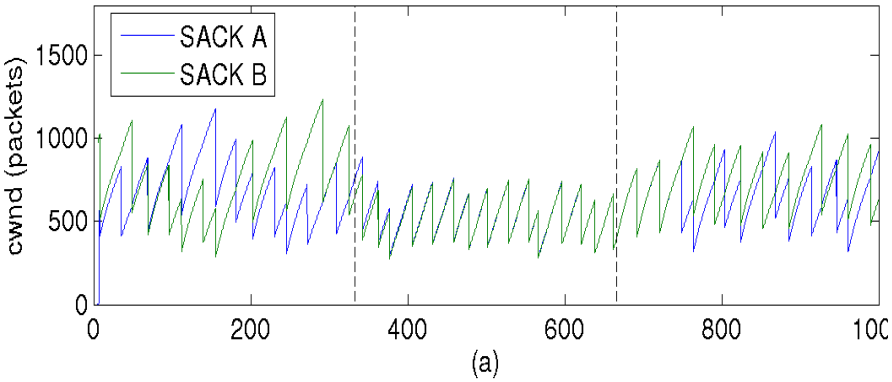


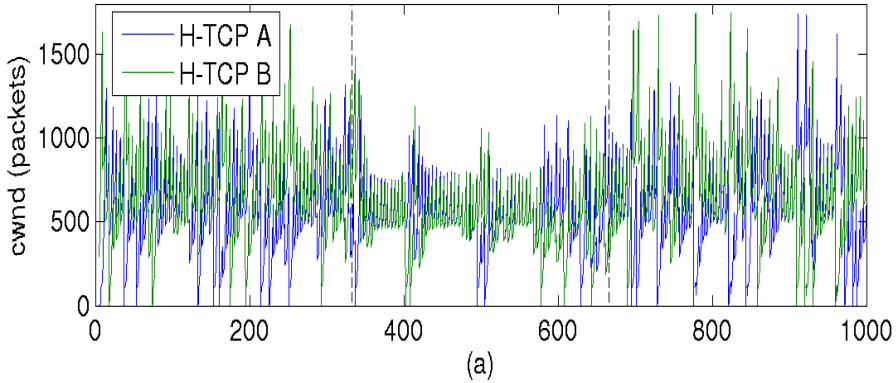
2nd scenario

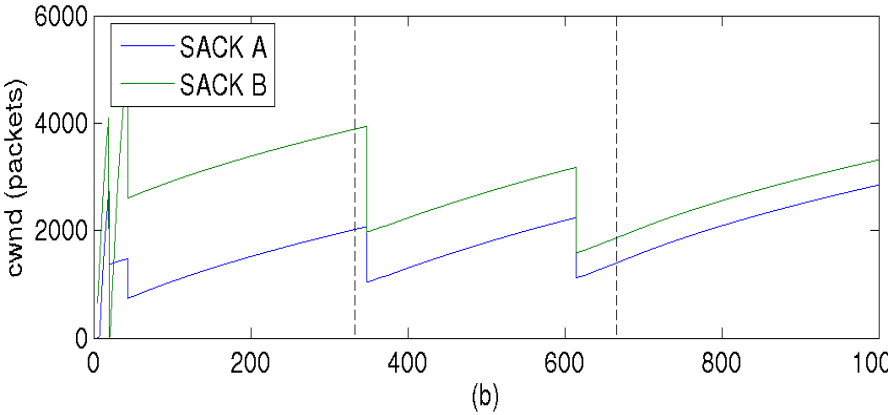


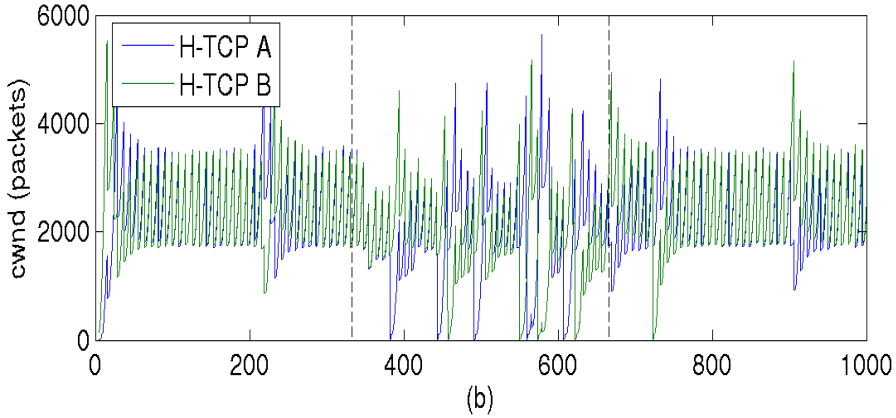


The effect of background traffic



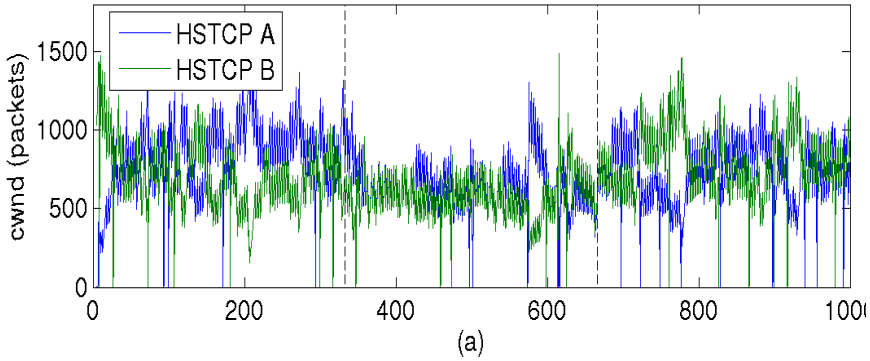


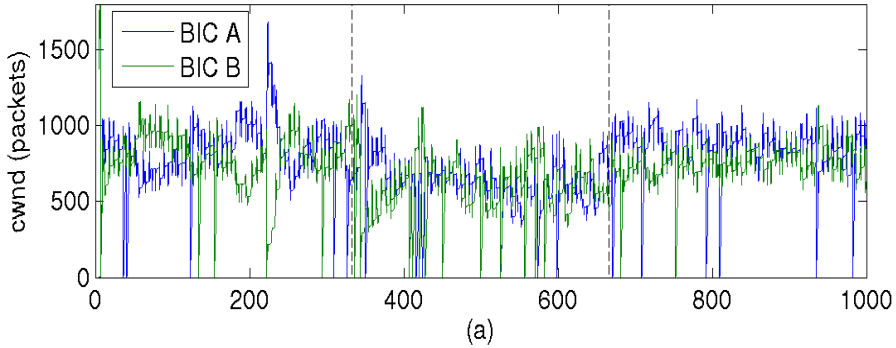


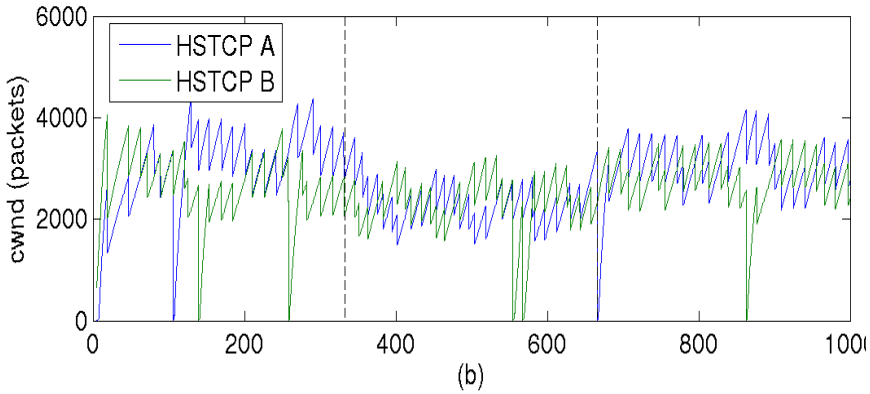


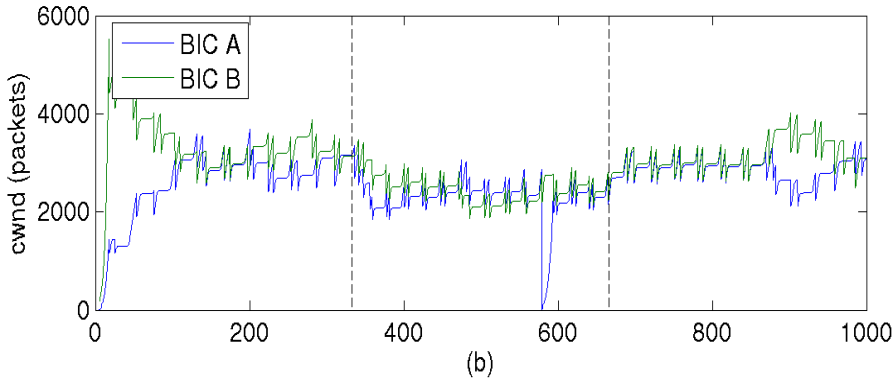
2nd scenario

The effect of background traffic



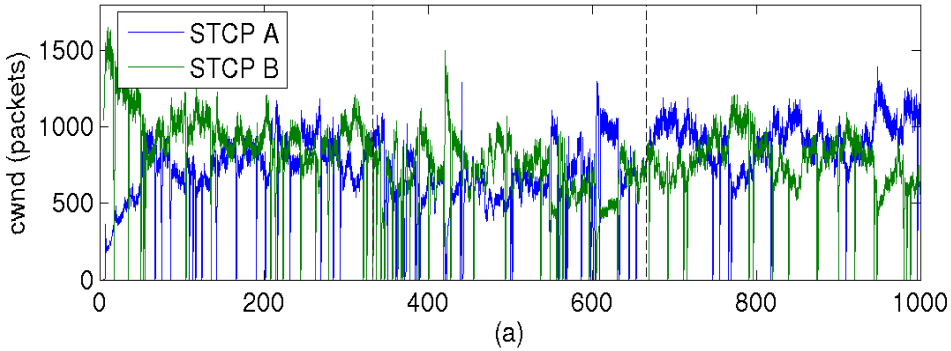


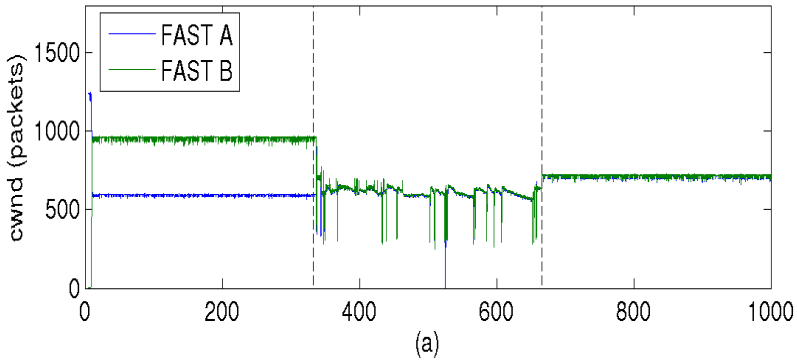


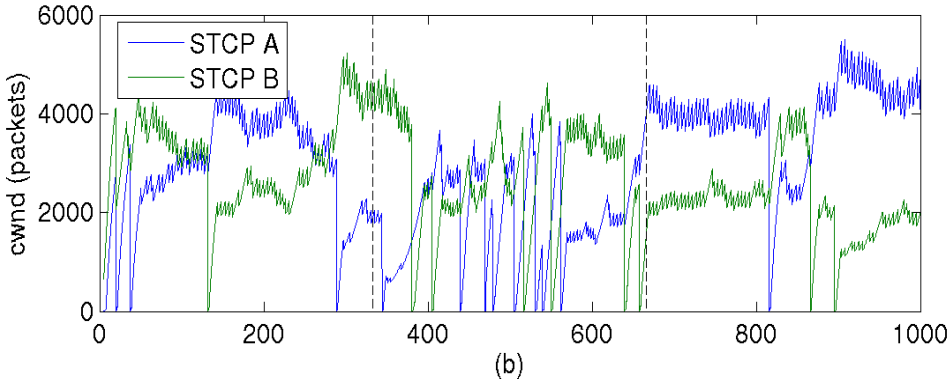


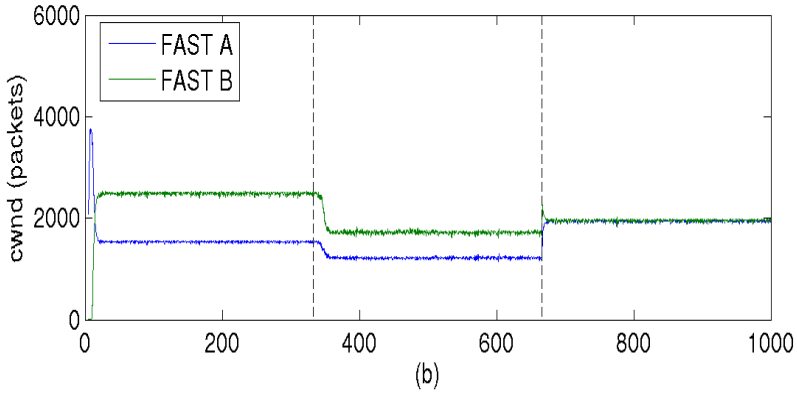
2nd scenario

The effect of background traffic





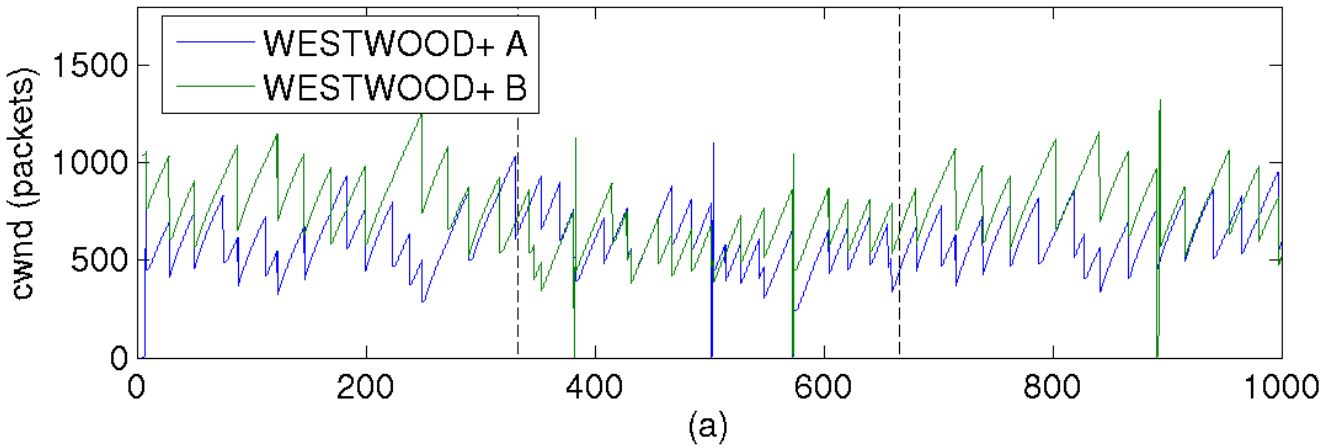


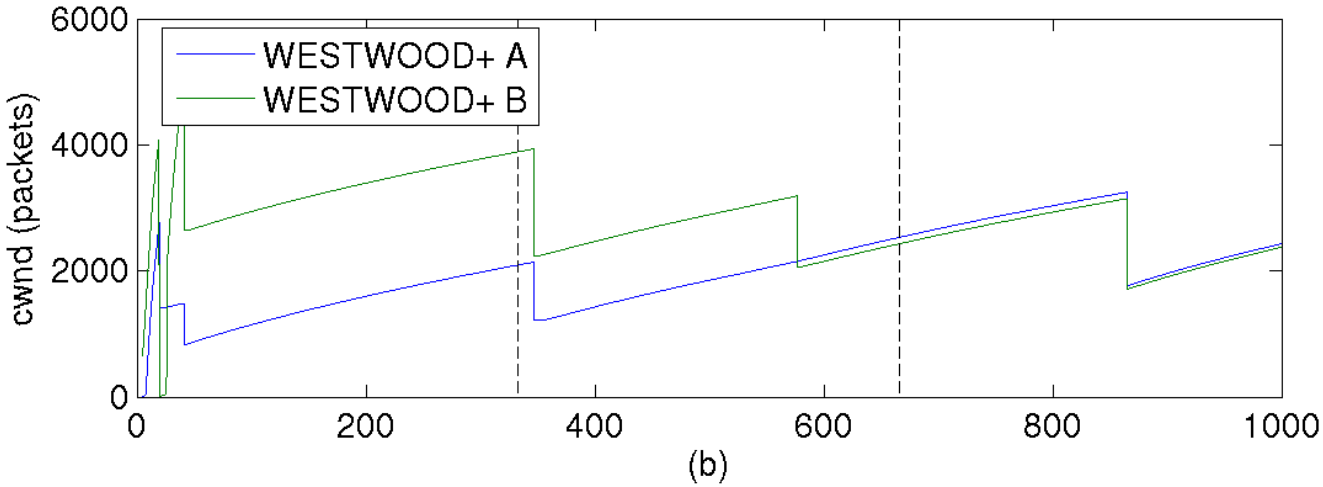


2nd scenario

The effect of background traffic

2nd scenario





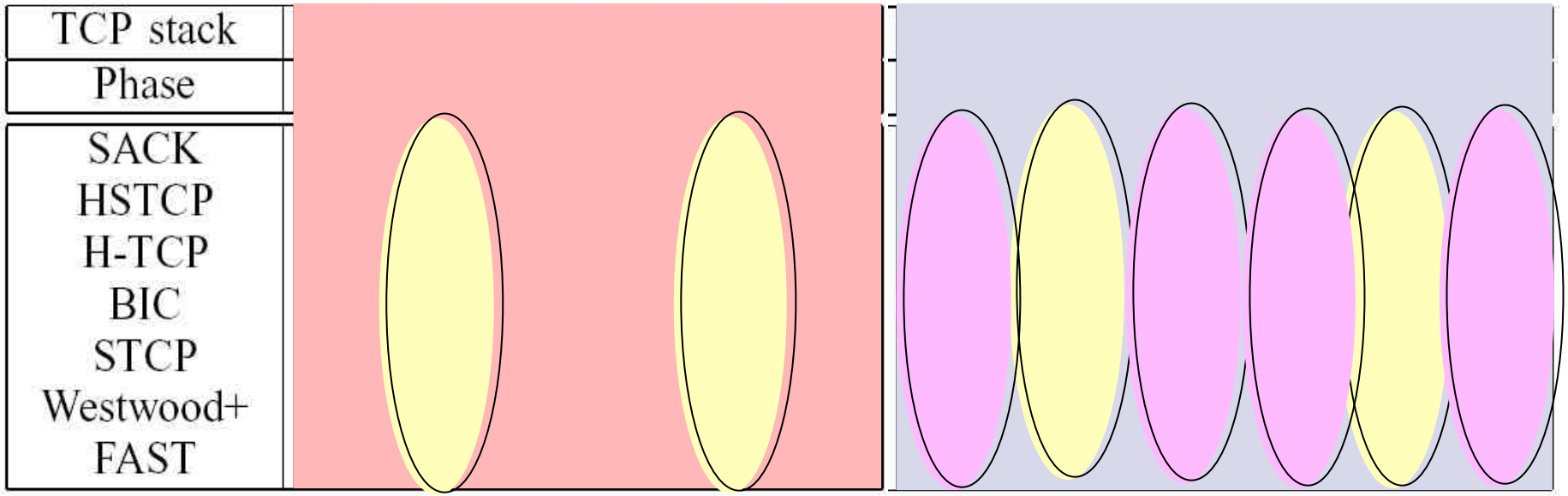
Retransmission timeouts

1st scenario

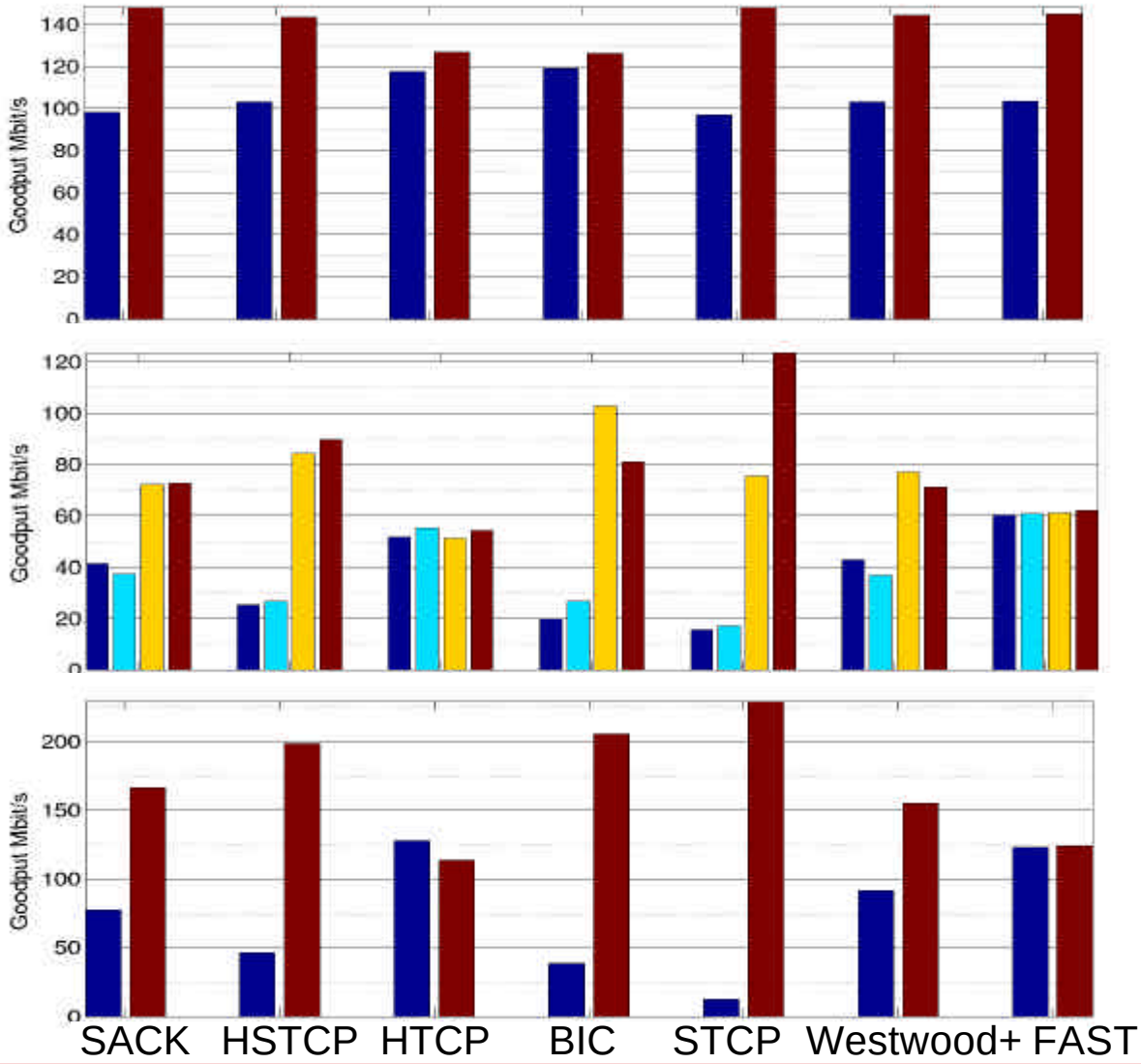
Without background web traffic

2nd scenario

with background web traffic



The effect of different RTTs

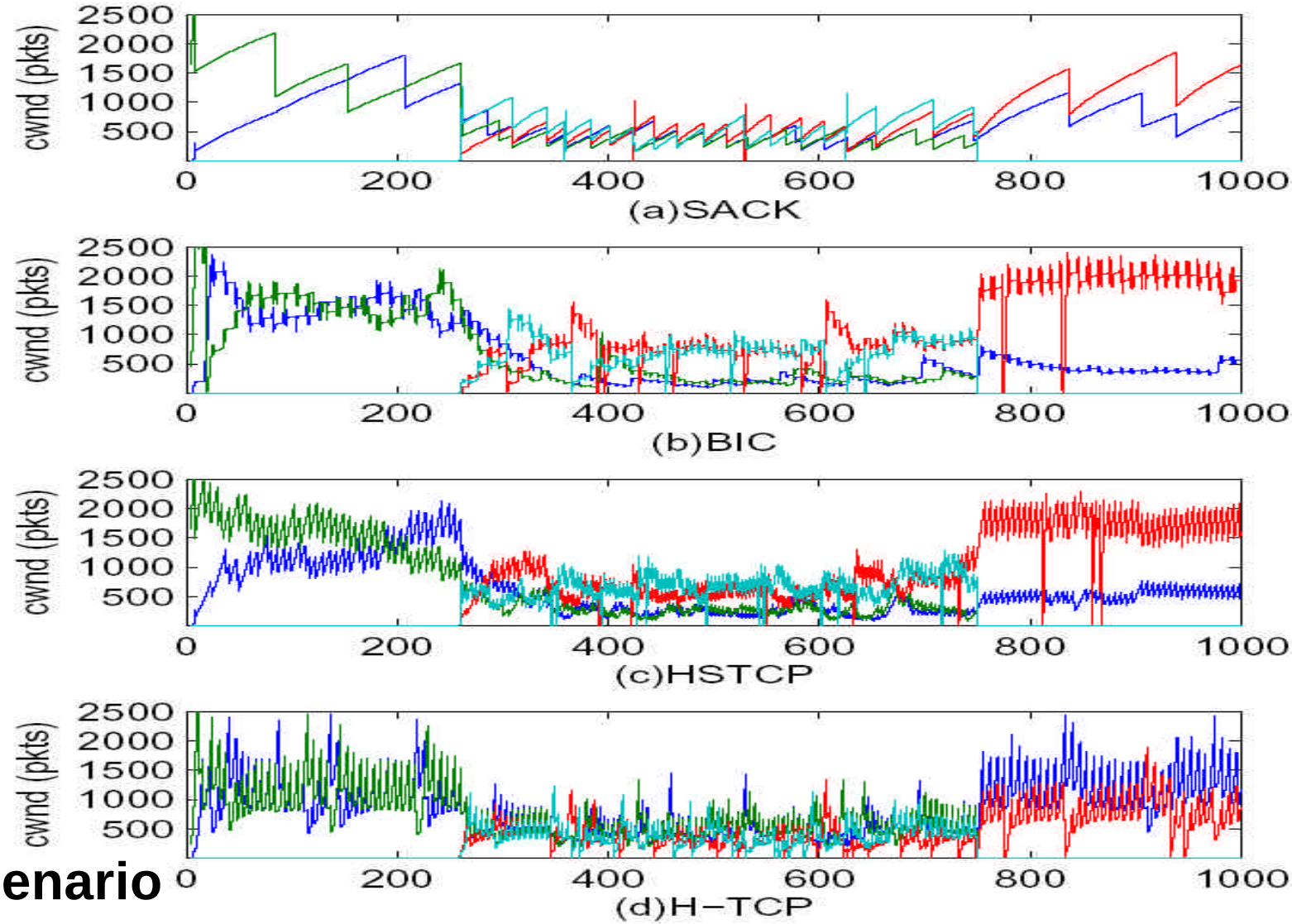


3rd scenario

Goodputs of:

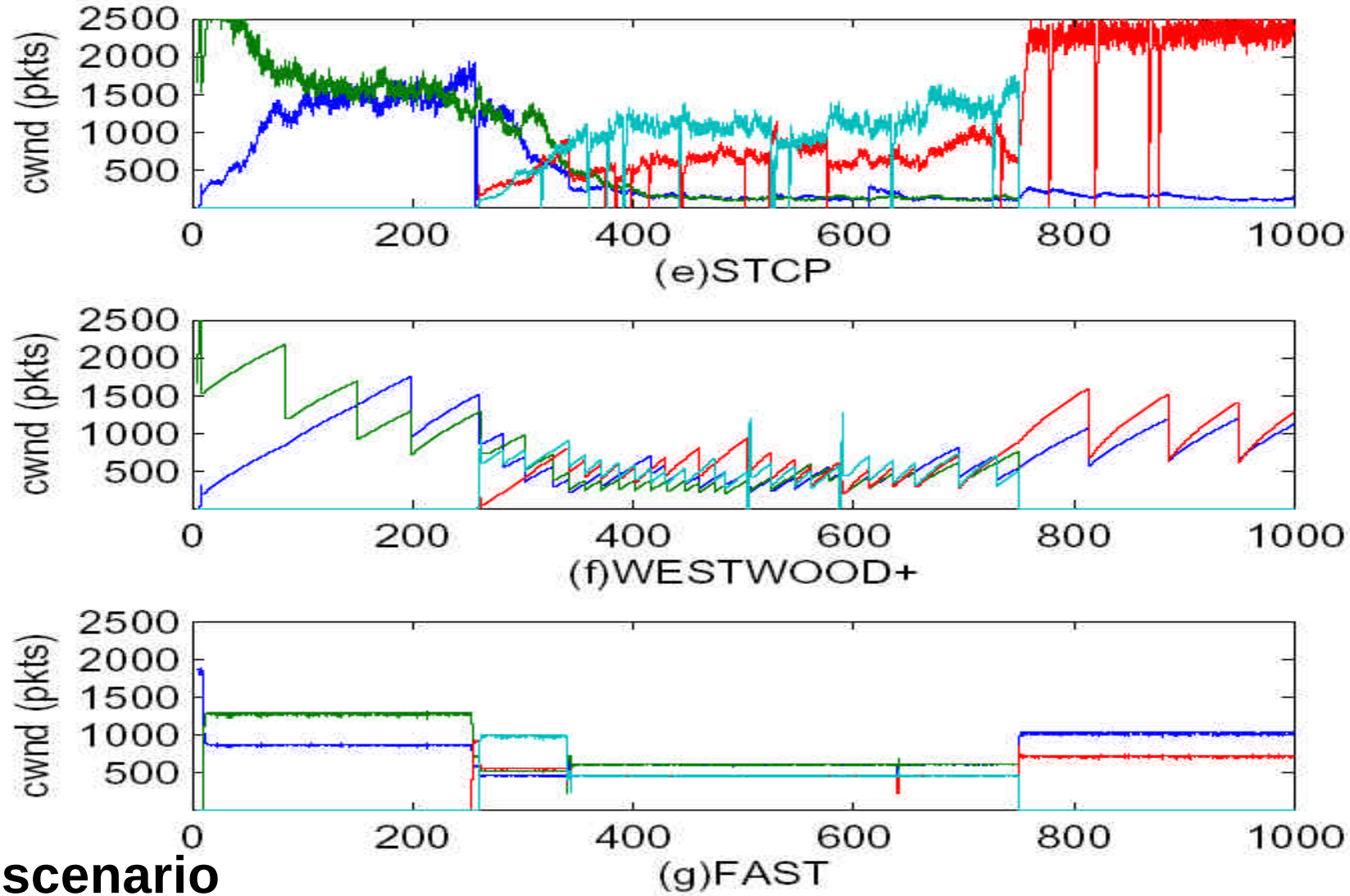
- A and B between 0s and 250s
- A, B, E and F between 333s and 666s
- A and E between 750s and 1000s

The effect of different RTTs



3rd scenario

The effect of different RTTs



3rd scenario

Conclusions and further work

- **Results :**
  - All new protocols are fast enough to reach full link utilization and exhibit a remarkable window oscillation behavior in the presence of reverse traffic of the same nature.
  - All analyzed protocols suffer in some particular scenarios
  - The number of timeouts and retransmissions experienced by NGTCP protocols is very high compared to standard TCP
- **Further work:**
  - More investigations are necessary
    - Behaviour versus router buffer size
    - Inter-protocol issues