



Cross-Layer Optimization to Improve TCP Performance in MANETs

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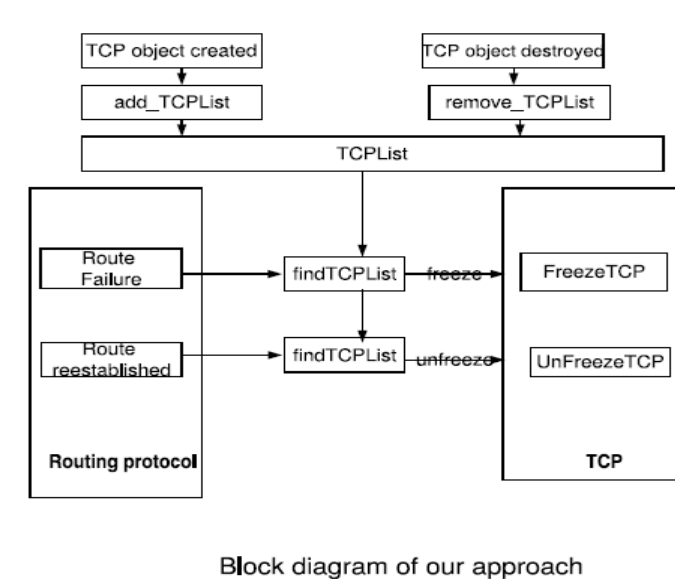
Abstract

In MANETs, packet losses occur due to **less reliable** wireless medium of communication as well as **mobility** of the nodes that leads to loss of routes. TCP performs poorly in terms of the **throughput** achieved as it interprets these packet losses as **congestion**. We hope to improve TCP performance through cross layer optimization to handle these packet losses separately.

Problems of TCP performance in MANETs

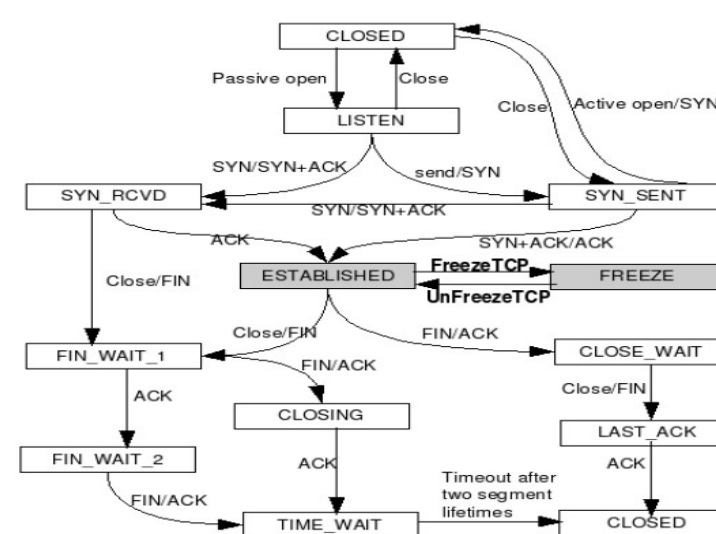
- TCP is unable to distinguish between losses due to route failures and losses due to network congestion.
- The contention on the wireless channel.
- TCP unfairness.

Our proposal Block diagram



Block diagram of our approach

State Transition Diagram



Cross Layer optimization

Introduce a **cross-layer trigger** (FreezeTCP) to TCP whenever it detects a route failure so that **TCP freezes** its transmission on **all** the connections with that destination.

When a new route is discovered to a destination, the routing protocol sends **another trigger** (UnFreezeTCP) to **resume** data transmission.

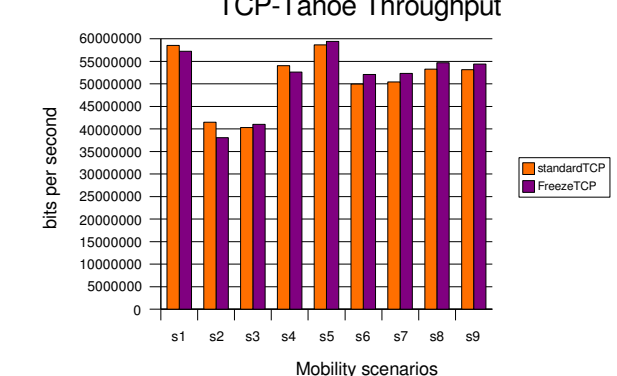
We use TCP handlers which is unique for each object of TCP agent to store its state information.

Simulation Results

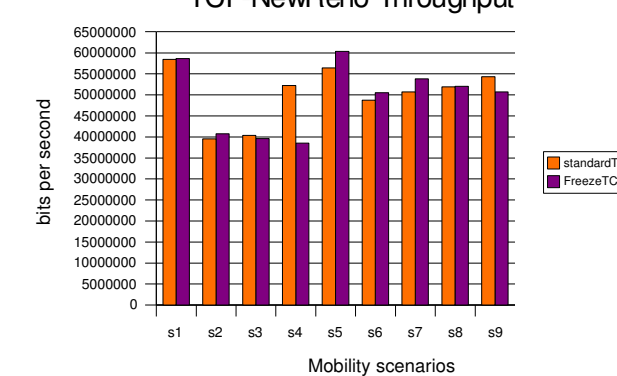
Mobility scenarios

s.no	Topology	Nodes	Power	Time	RTT	Link	Route	Destination
s1	1250*1500	25	0	1	30	200	1000	24
s2	1250*1500	25	20	1	30	210	1000	24
s3	1250*1500	25	0	1	30	200	1000	24
s4	1250*1500	25	20	1	30	210	1000	24
s5	1250*1500	25	0	1	30	200	1000	24
s6	1250*1500	25	20	1	30	210	1000	24
s7	1250*1500	25	0	1	30	200	1000	24
s8	1250*1500	25	20	1	30	210	1000	24
s9	1250*1500	25	0	1	30	200	1000	24

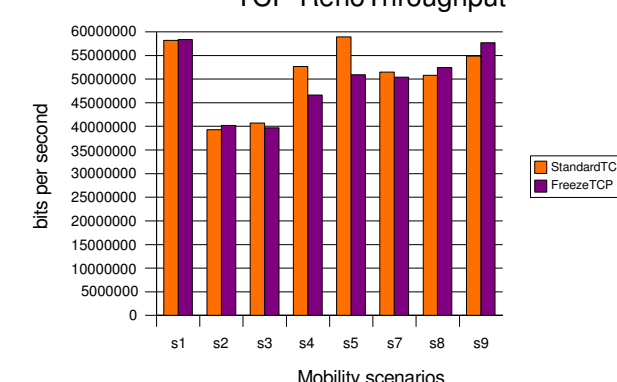
TCP-Tahoe Throughput



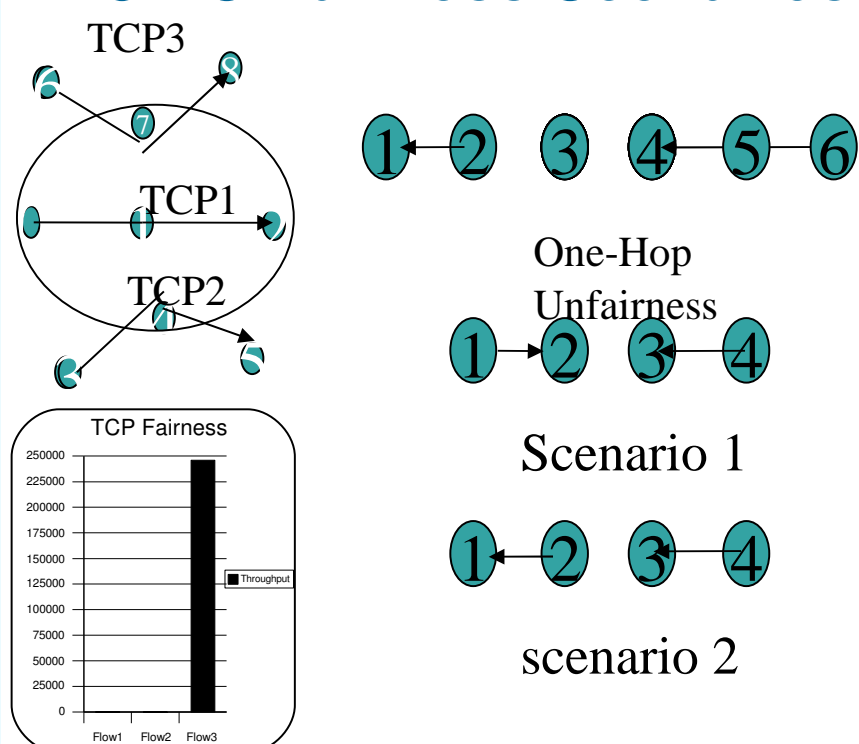
TCP-NewReno Throughput



TCP-Reno Throughput

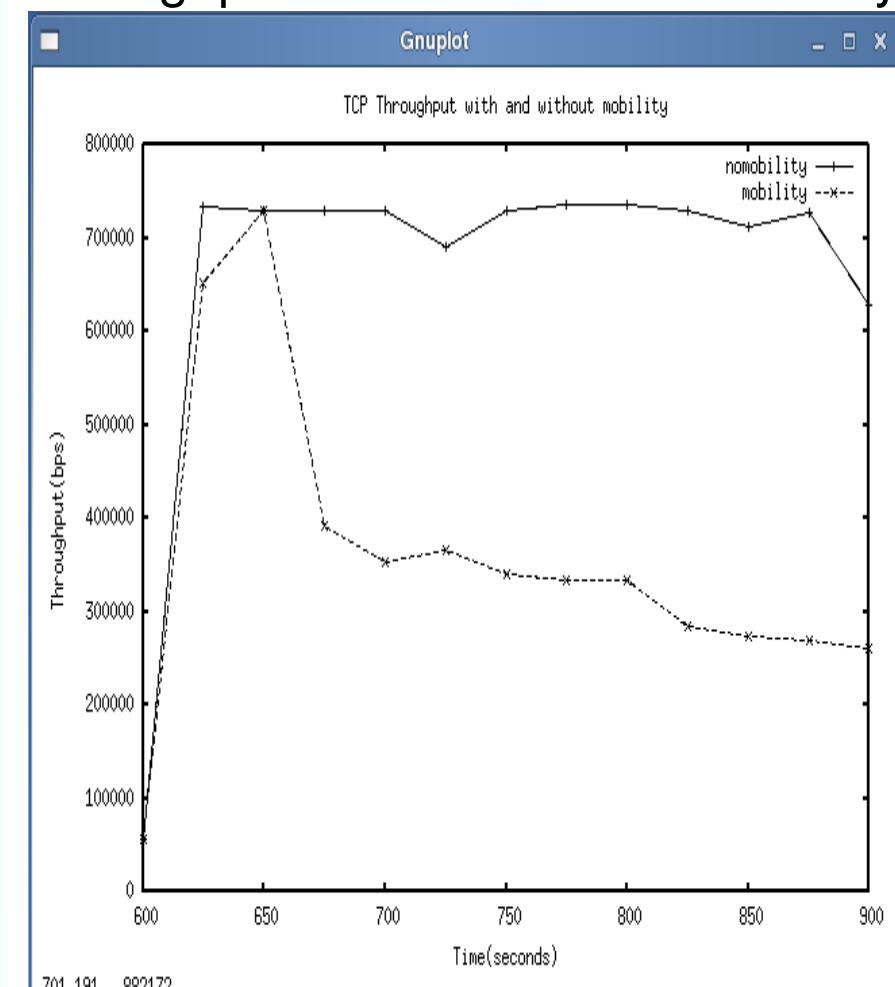


TCP Unfairness Scenarios



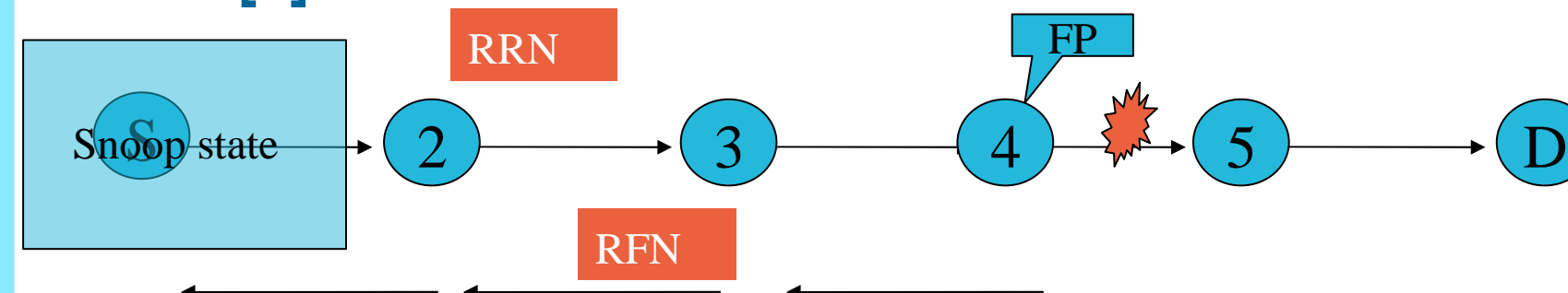
Motivation

Throughput with and with out mobility

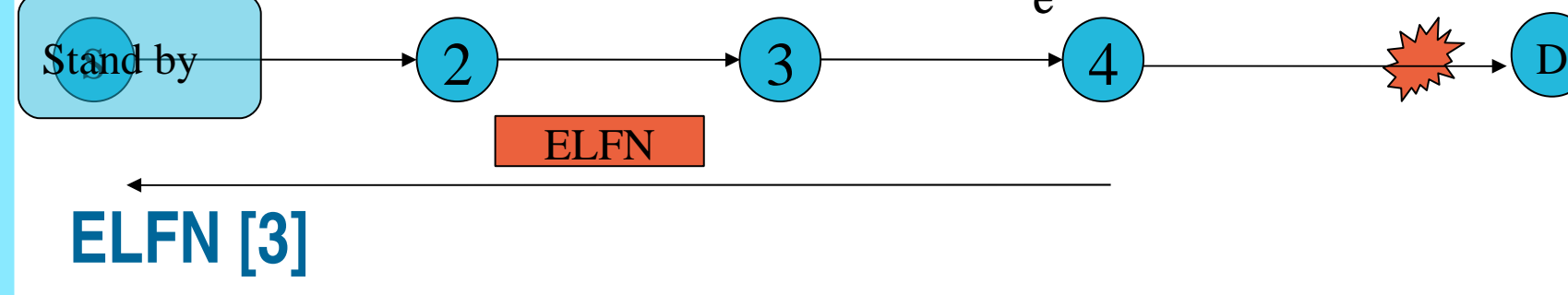


Previous proposals

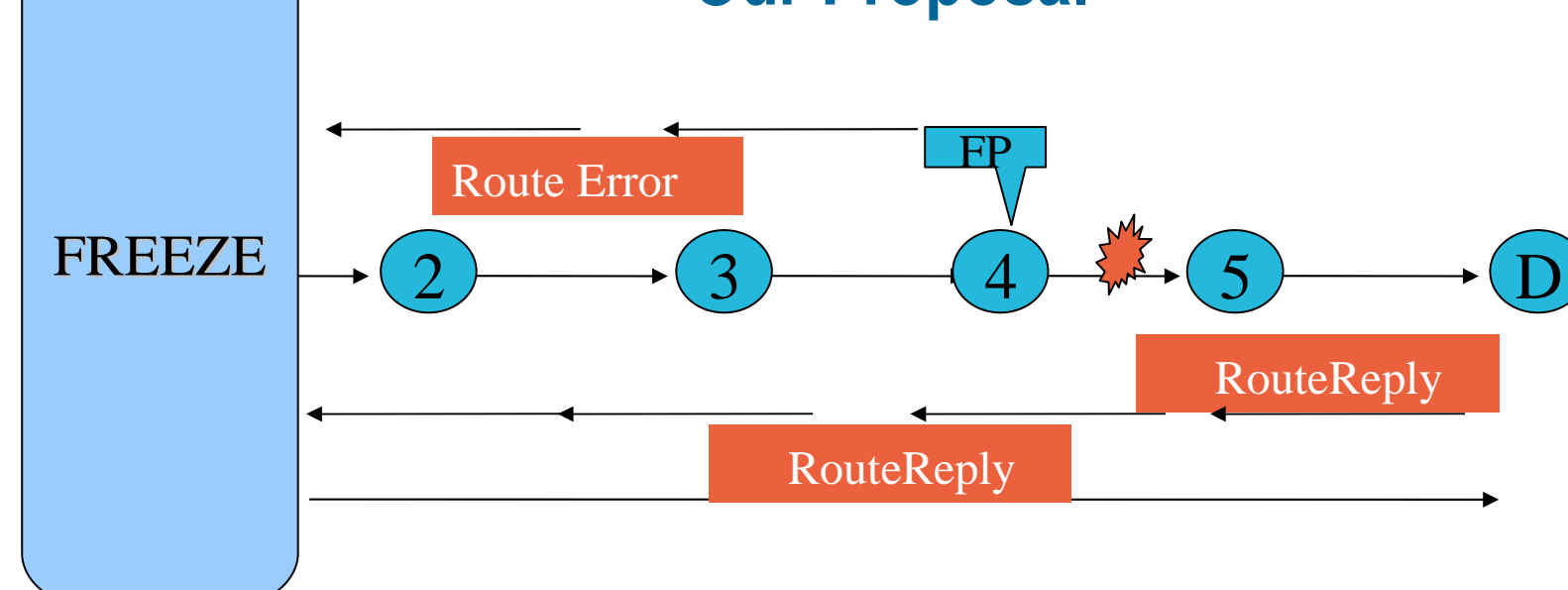
TCPF [2]



ELFN [3]



Our Proposal



New APIs: FreezeTCP, UnfreezeTCP

Global List of active TCP objects

Concluding remarks

- We proposed a solution which appears to be a lighter loading solution as compared to other approaches since it does not add new probe packets into the network.
- We made simulations using standard protocols and by using our proposal for various mobility patterns and captured *cwnd* values for each flow.
- We repeated simulations for three TCP flavors namely Tahoe, Reno and NewReno.
- In most of the cases our proposal gives better result than that of standard proposal.

References

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5. Kaixin Xu et al, "TCP unfairness in ad hoc wireless networks and a neighbourhood RED solution", Wireless Networks, 2005, pp. 383 – 399.