ATCP: Adapted TCP for mobile environments

M.Tech Project Final Stage Presentation

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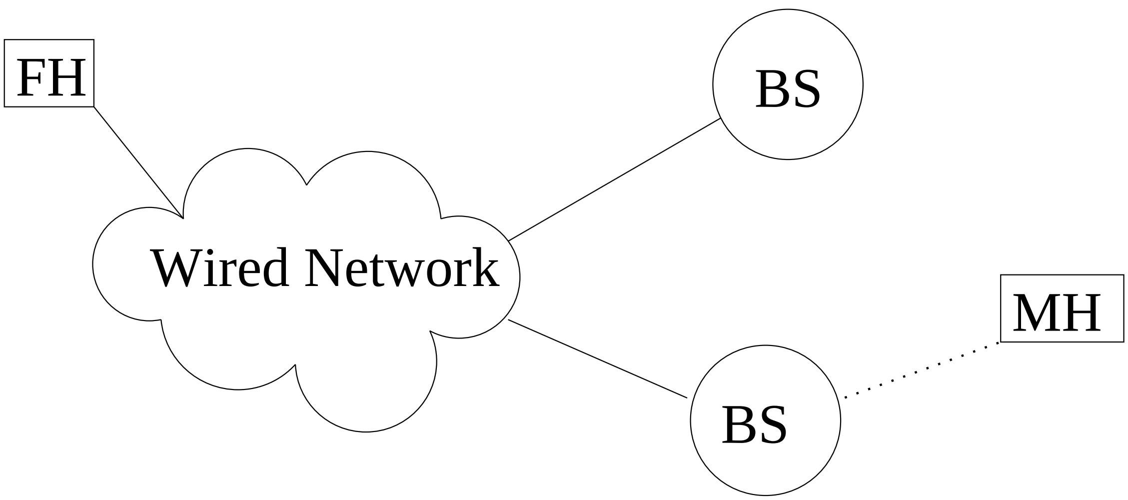
Mobile Wireless Networks



TCP & MW Networks

- An assumption
  - packet loss means congestion
- Does not hold always over Mobile Wireless Networks
  - temporary disconnections
  - high bit error rate

Existing Approaches

- Focusing on temporary disconnection issue
  - ITCP
    - Split connection at BS
  - WTCP
    - New congestion control scheme
    - Modification at FH & MH
  - M-TCP
    - Split Connection at BS
    - BS advertise ZERO window when MH gets disconnected
    - BS advertise FULL window when MH gets reconnected
  - Snoop
    - Fast Handoff by multicasting data to BSs
  - 3 duplicate Acknowledgements (3DA)
    - Send 3 dup Ack at reconnection
  - Freeze TCP
    - Advertise ZERO window just before disconnection (Prediction Reqd)
    - Send 3 dup Ack at reconnection

Motivation for Our Approach

- FH modification
  - not easily feasible
- BS Support
  - Difficulty in
    - interoperability
    - scalability
    - encrypted traffic
    - different acknowledgement path
- MH Modification
  - none of the above disadvantage
  - but 3DA, Freeze TCP have some limitations

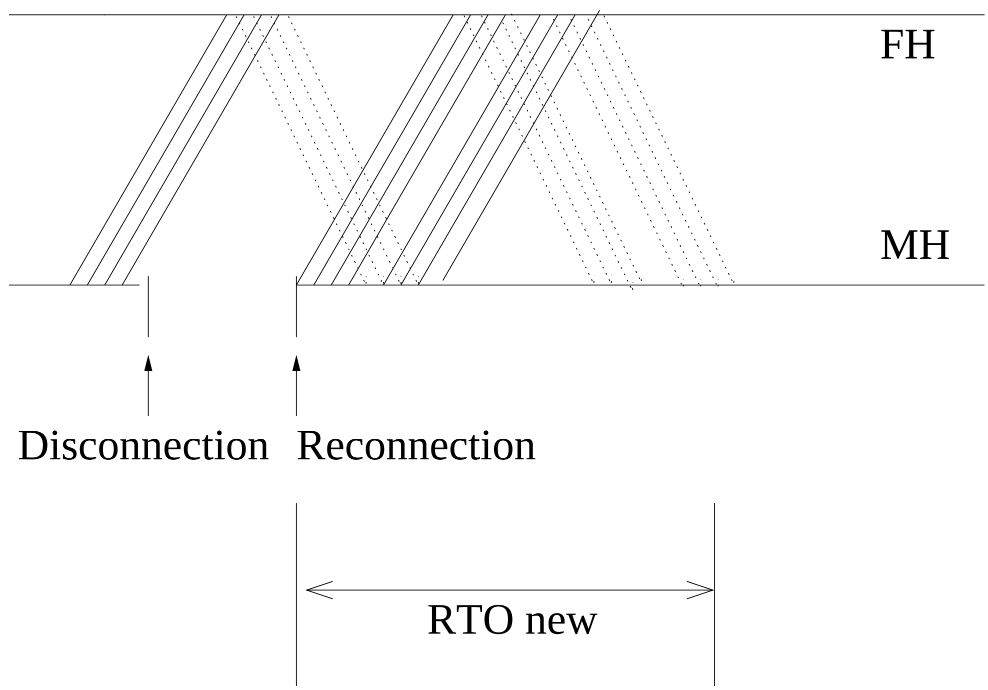
Limitations of 3DA & Freeze TCP

- 3DA
  - Does not always reduce response time
  - some time degrades the throughput
- Freeze TCP
  - Future prediction of impending disconnection
  - Throughput enhancement depends on this prediction period
- No specific action for MH to FH data transfer

Our Approach: ATCP

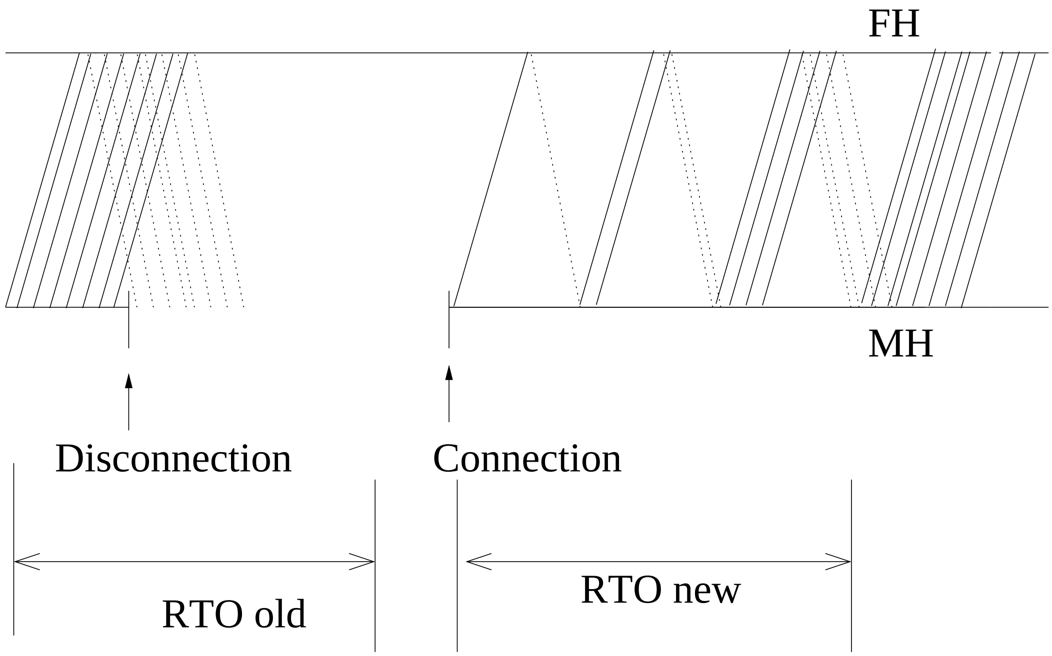
MH to FH data transfer

Case 1:
State : Send window open at disconnection event.
Action: Start sending new packets at reconnection and set new rtx timer.



Initail Window = 8 packets.

Case 2:
State: Send window closed and waiting for acks at disconnection event.
Action: retransmiiting the last unacked packet with ssthresh set to
window reached till disconnection at reconnection.

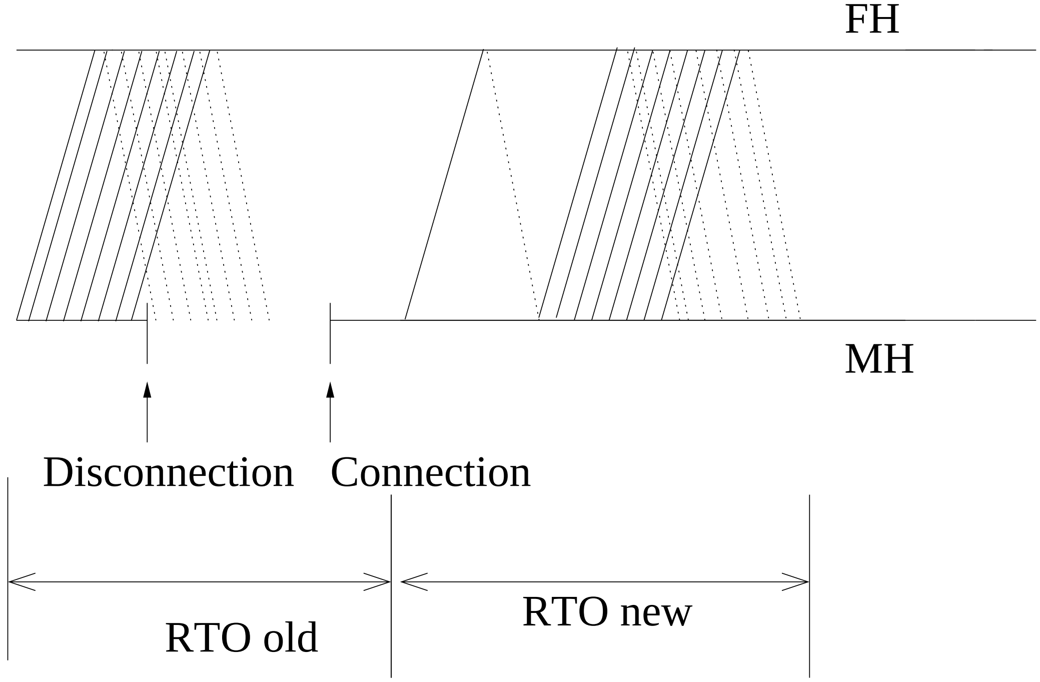


Initial Window = 8 packets.

Case 3:

State: send window was closed and waiting for acks at disconnection event.

Action: lost packet retransmitted without invoking congestion control mechanism as a disconnection event has occurred during wait period of the ack.



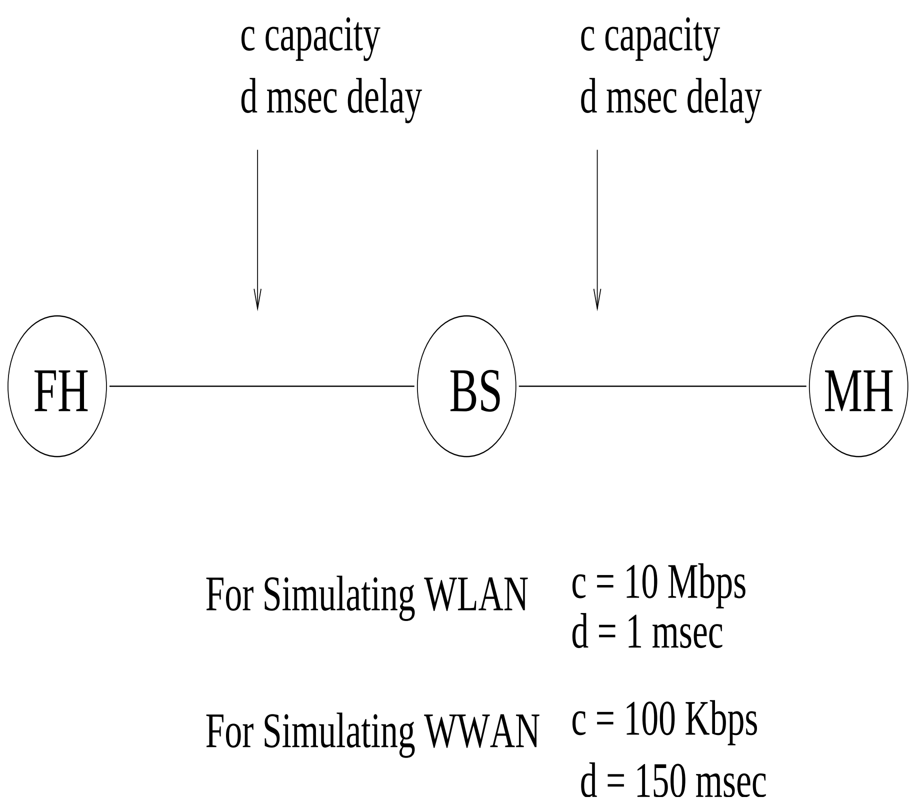
Initail Window = 8 packets.

Our Approach: ATCP

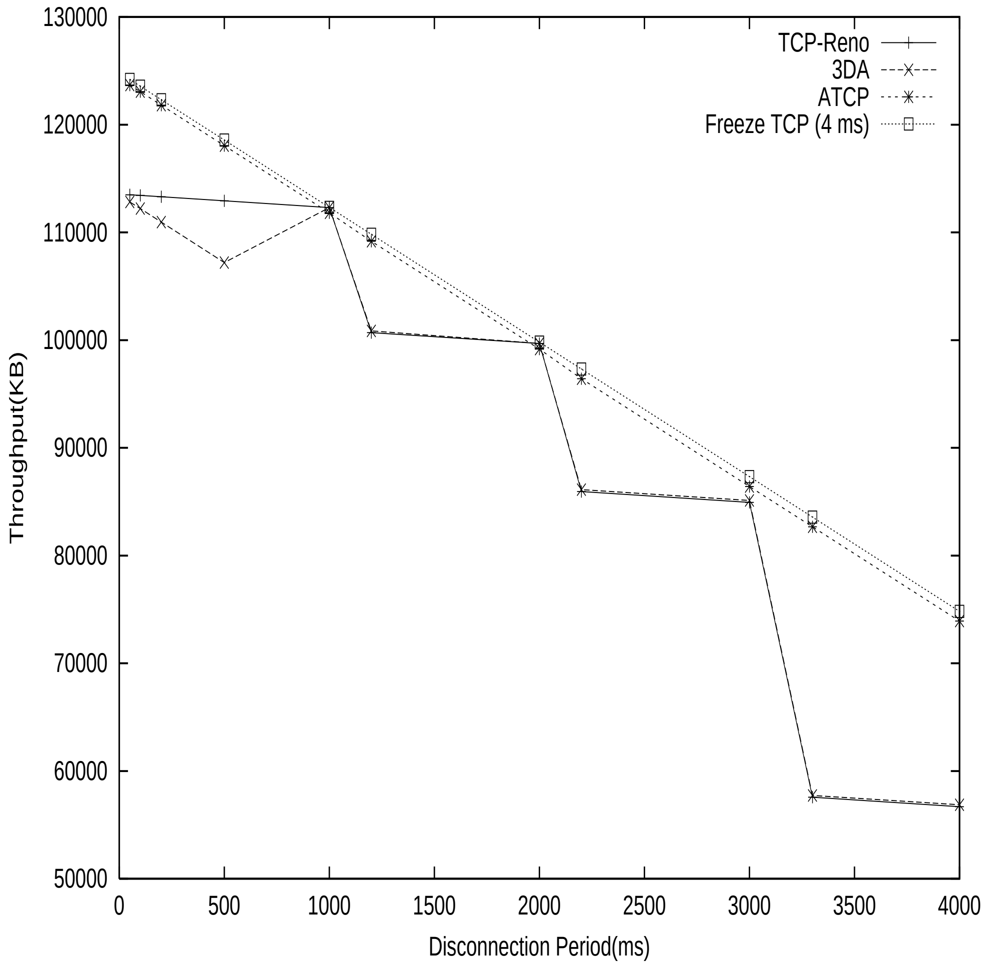
FH to MH data transfer

- Delay the acknowledgement of last 2 bytes by *'d'* msec.
- At reconnection event
  - send ZWA & FWA
    - ZWA: freezes FH sender
    - FWA: unfreezes FH sender
  - Result: retransmission without invoking congestion control mechanism

Simulations



◇ Simulation Setup

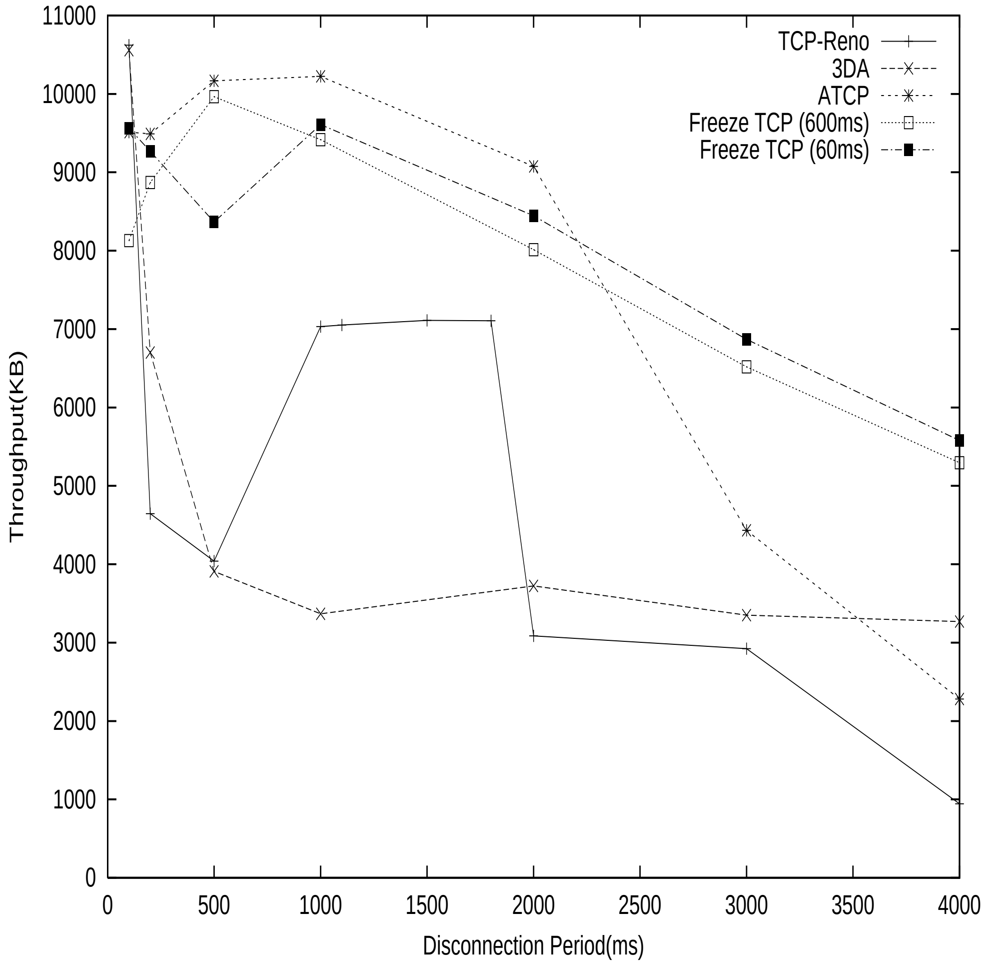


◇ FH to MH data Transfer: RTT $\approx$ 5ms

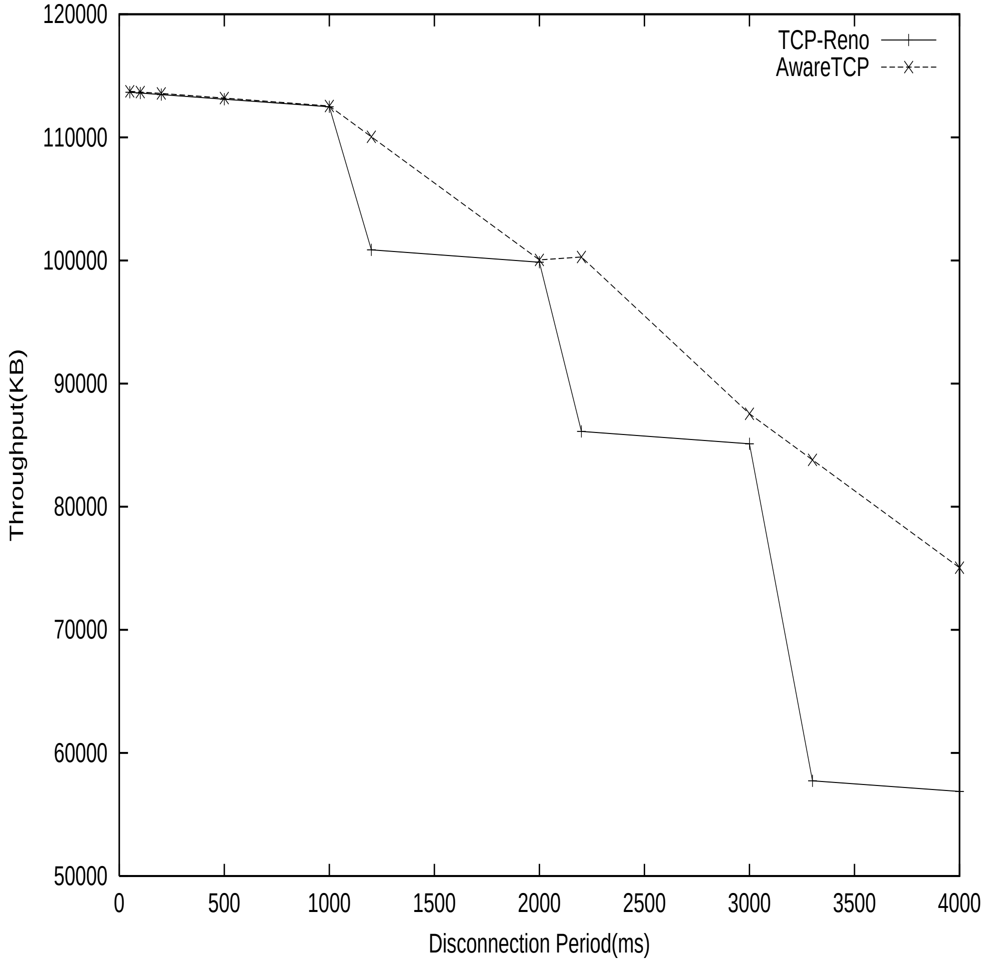
◇ TCP-Reno throughput has step-wise behaviour against disconnection period

◇ 3DA approach does not always improves response time

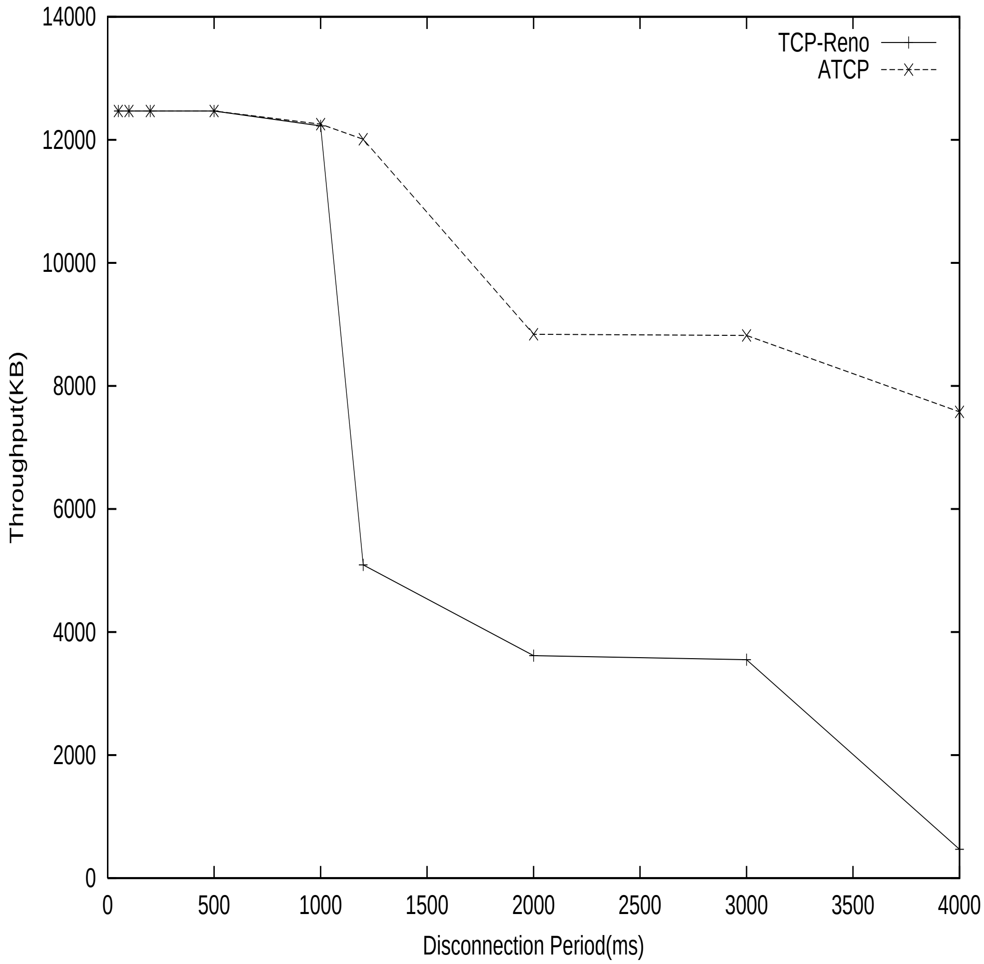
◇ In WLAN environment, ATCP and Freeze TCP performs almost equally well



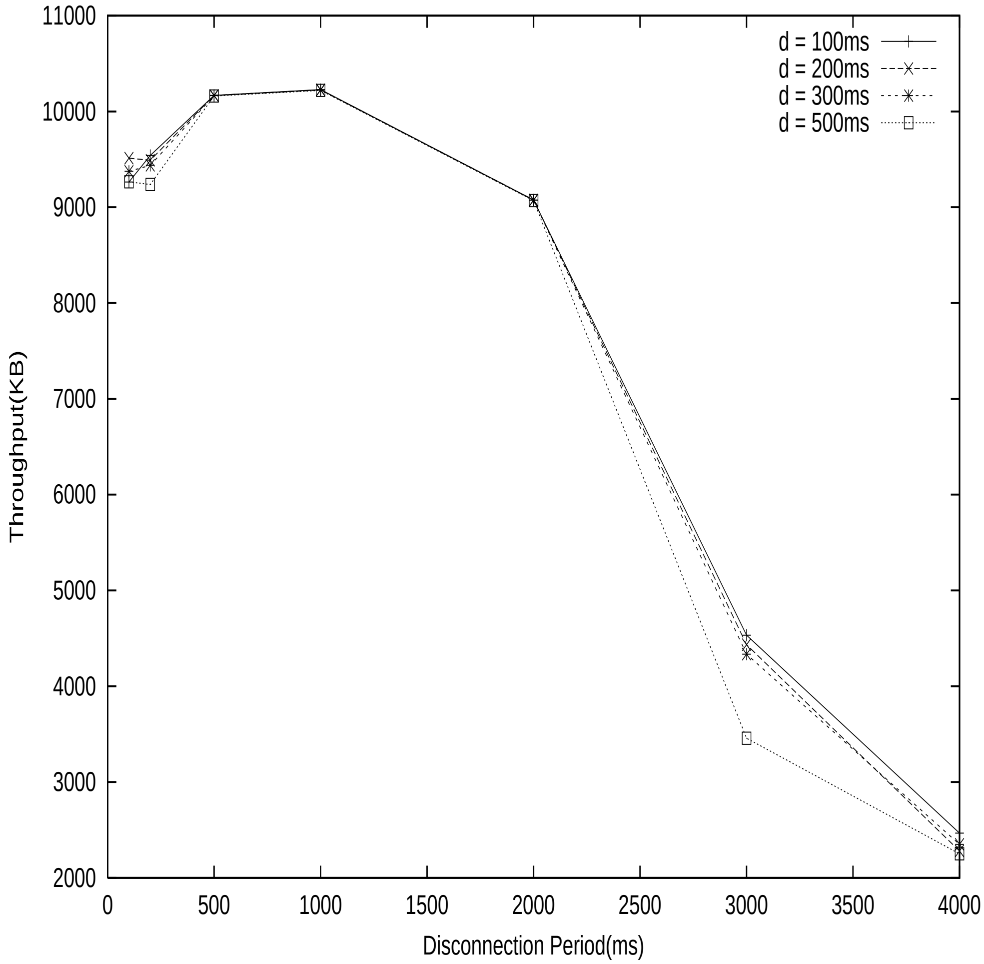
- ◇ FH to MH data transfer: RTT $\approx$ 700ms
- ◇ In WWAN environment, ATCP performs almost equal to Freeze TCP for small disconnection period
- ◇ Freeze TCP throughput is sensitive to prediction period variation
- ◇ 3DA, ATCP, Freeze TCP approach some times degrades the throughput



- ◇ MH to FH data Transfer: RTT $\approx$ 5ms
- ◇ TCP-Reno throughput has step-wise behaviour against disconnection period
- ◇ The enhancement in throughput increases as the duration of a single disconnection increases



- ◇ MH to FH data Transfer: RTT ≈ 700ms
- ◇ Large Improvements in throughput for large RTT connections



- ◇ FH to MH: ATCP throughput for various value of variable d

Comparison

Table 1: Comparison of various approaches

Approach	FH TCP modification	BS Support required	MH Protocol stack modification	Scalable	Interoperable
3DA	No	No	Yes	Yes	Yes
Freeze TCP	No	No	Yes	Yes	Yes
M-TCP	No	Yes	Yes	Difficult	No
WTCP	Yes	No	Yes	Yes	Yes
I-TCP	No	Yes	Yes	Difficult	No
Snoop	No	Yes	Yes	Difficult	No
ATCP	No	No	Yes	Yes	Yes

Table 2: Comparison of various approaches

Approach	End to end semantics preserved	Data transfer direction enhanced	Encrypted IP traffic supported	Different acknowledgement path supported	Comments
3DA	Yes	FH to MH	Yes	Yes	Focus on reducing idle time after reconnection
Freeze TCP	Yes	FH to MH	Yes	Yes	Requires MH to predict disconnections
M-TCP	Yes	FH to MH, MH to FH	No	Yes	Split connection approach
WTCP	Yes	FH to MH, MH to FH	Yes	Yes	New algorithms at FH, MH Focus on WWANs
I-TCP	No	FH to MH, MH to FH	No	Yes	End to end semantics not preserved Split connection approach
Snoop	Yes	FH to MH, MH to FH	No	No	Improves routing protocol to reduce the handoff time and packet loss
ATCP	Yes	FH to MH, MH to FH	Yes	Yes	Focus on both way data transfer performance (delay and throughput)

Conclusion

- ATCP
  - Focus on both way data transfer
  - Does not require future prediction
  - Improve data transfer throughput
  - Require modification only at MH

Future Work

- Implementing ATCP in protocol stack
- Real life scenario testing
- Various TCP implementations behaviour in case of negative window
- Various way of informing mobility status to TCP layer

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