M-TCP

Improving TCP Performance over Wireless Links with Periodic Disconnection

CMPT 885-3: SPECIAL TOPICS:
HIGH-PERFORMANCE NETWORKS

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Motivation

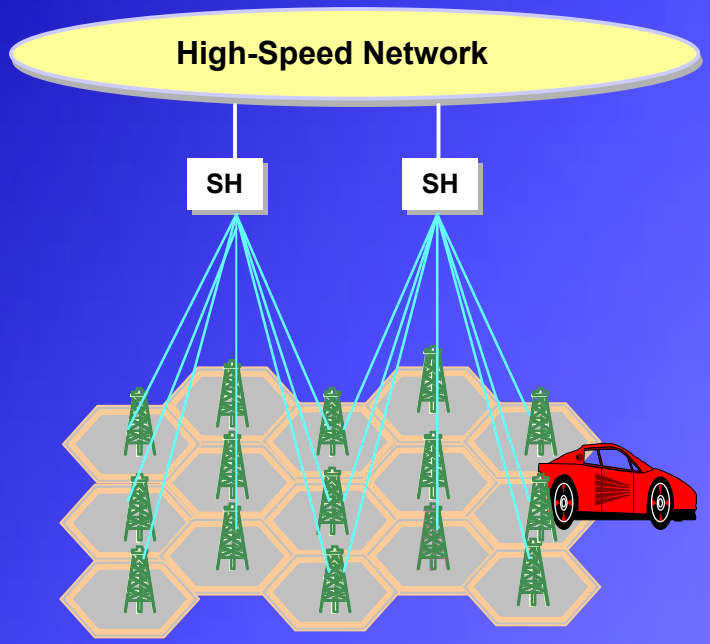
TCP In Wireless Network

- Problem
  - Inproperly trigger congestion control
- Solution
  - Avoid congestion control

Road Map

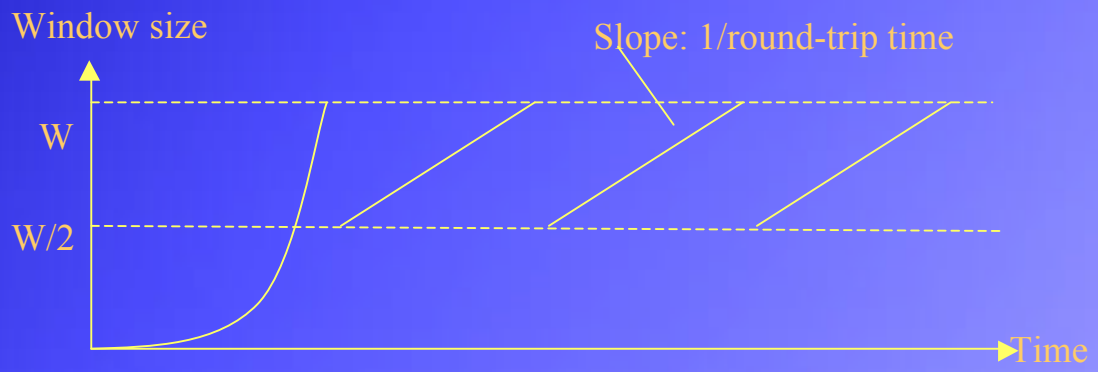
- Introduction
  - Characteristics of wireless network
  - Problem with TCP in wireless network
- Approach to improve TCP performance
  - M-TCP
- Implementation and simulation
  - M-TCP in OPNET (C language)
- References

Introduction: Characteristics of Wireless Network



- Divided into cells, and users share cell bandwidth
- Smaller cells are preferred to provide higher bandwidth to users
- Smaller cells result in smaller cell latencies, that, in turn, cause frequent handoffs
- Handoff: the action that mobile host changes wireless cell

Introduction: TCP Congestion Control



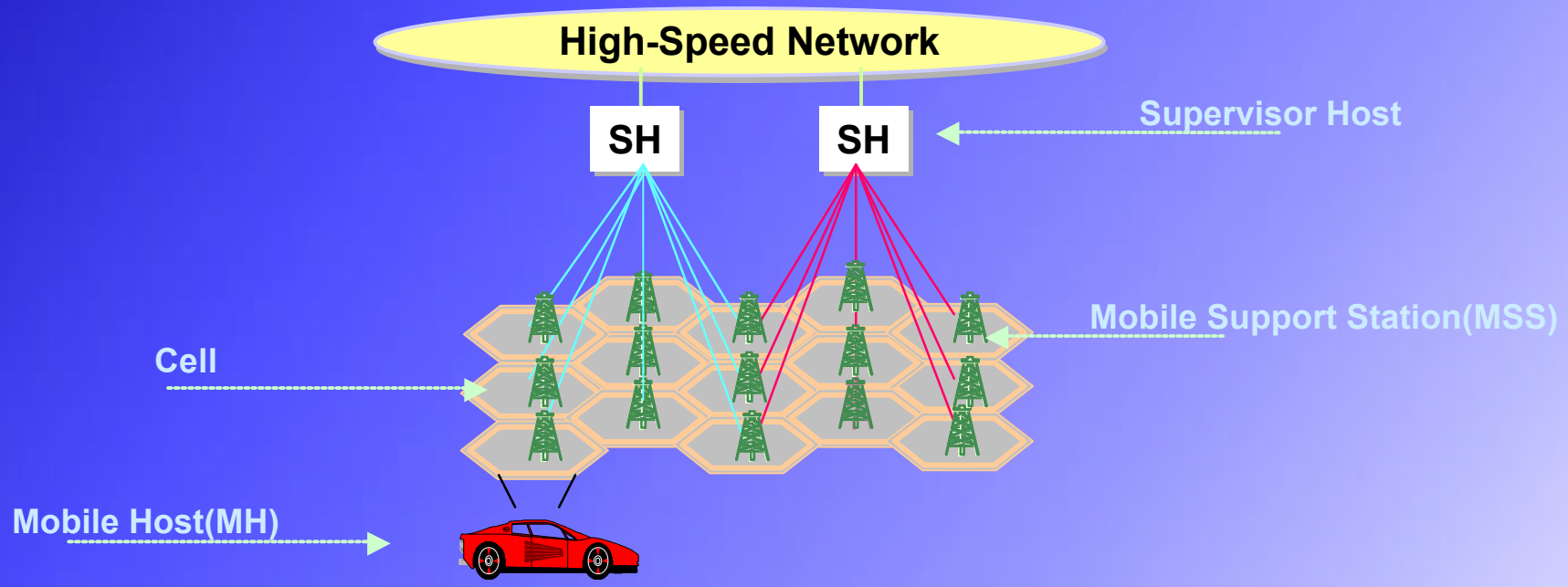
- On detecting packet loss, TCP sender assumes that network congestion has occurred
- On determining congestion, TCP sender drastically reduces the congestion window
- Reducing congestion window reduces amount of data that can be sent per RTT

Introduction: Problem with TCP over Wireless Links

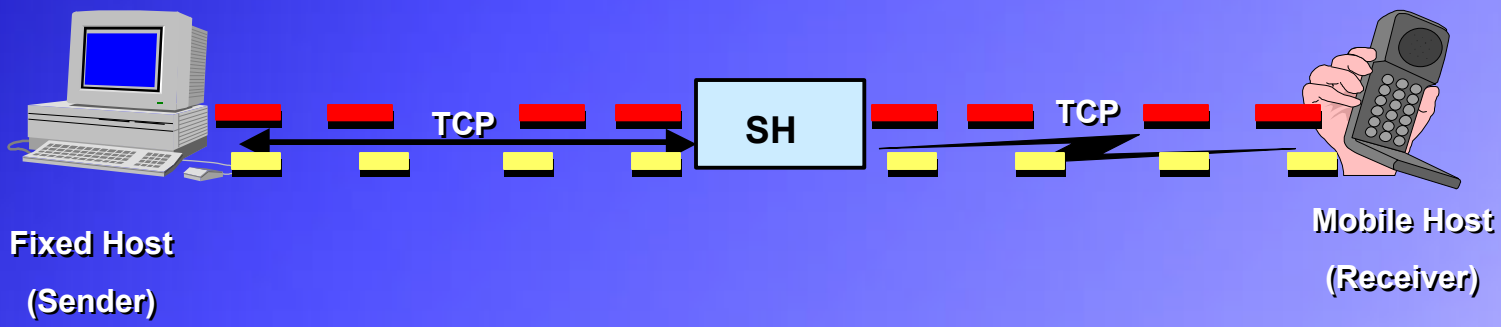
- Congestion control may be inappropriate in wireless environment
  - On a wireless channel, packet loss occurs due to the following reasons:
    - Congestion. It is appropriate to reduce congestion window
    - Transmission error. It is not appropriate to reduce congestion window
    - Handoff. It is not appropriate to reduce congestion window

Approach to improve TCP Performance

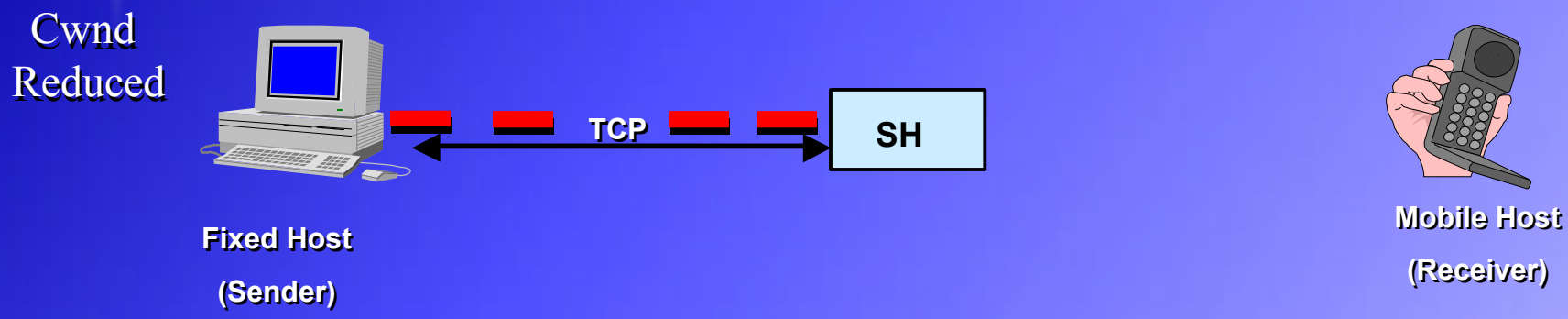
- M-TCP
  - Kevin Brown & Suiresh Singh
  - RFC 3135, 2757
  - Three-level hierarchy of architecture



Comparison: TCP and M-TCP

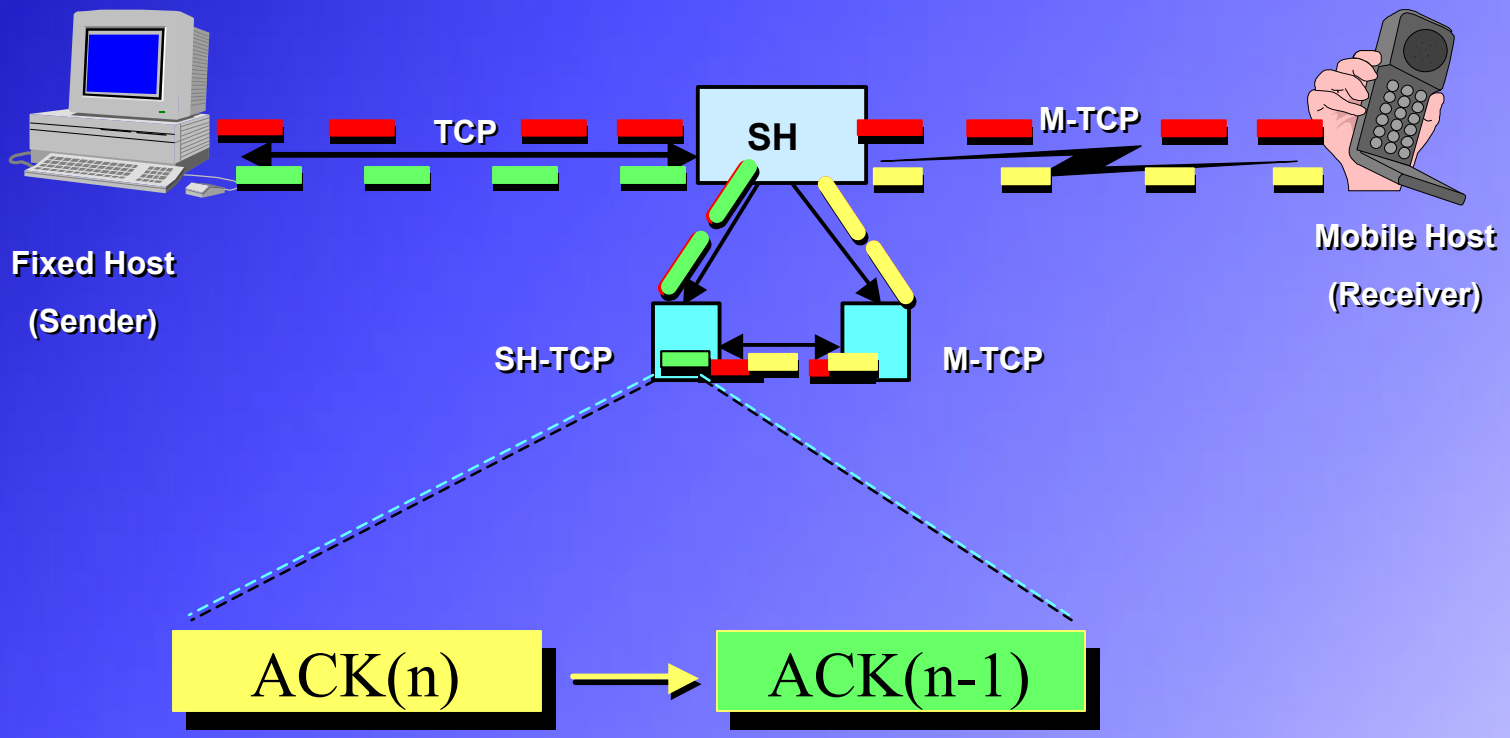


Comparison: TCP and M-TCP (cont'd)



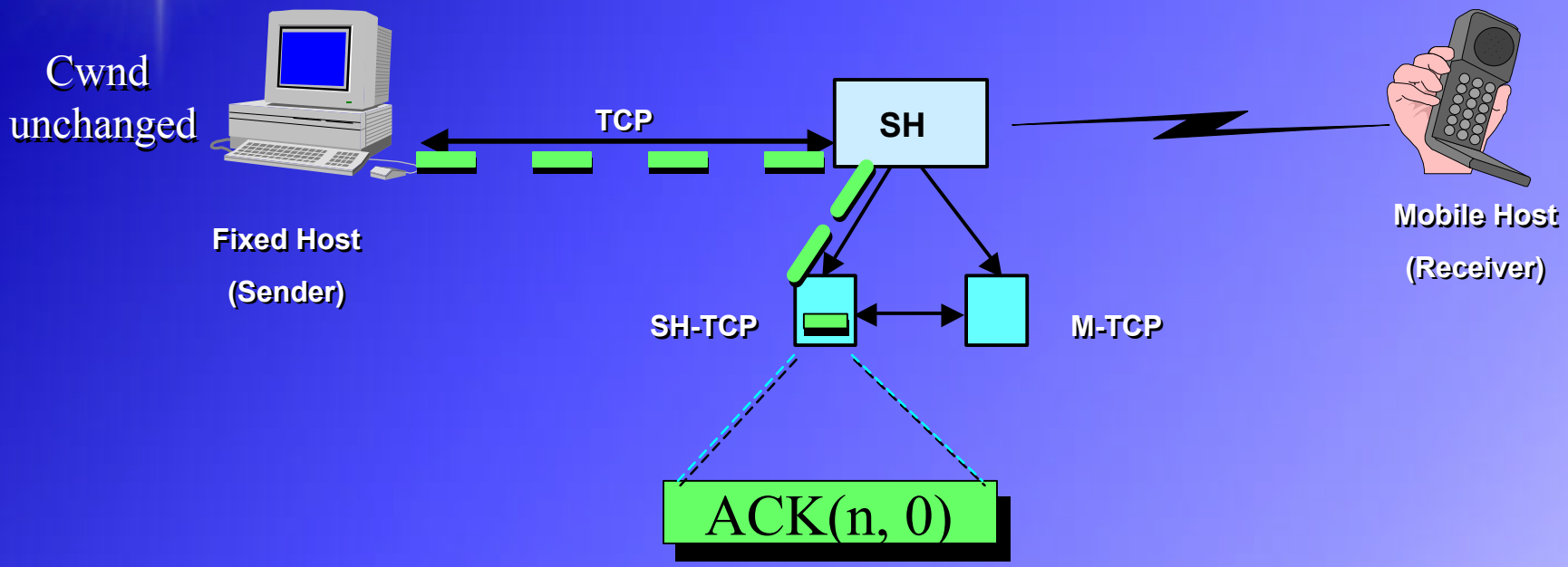
- If the MH disconnects to the network and RTO times out, congestion control is invoked at the sender.
- If the disconnection time is long, the connection may be lost.

Comparison: TCP and M-TCP(cont'd)



- At SH, TCP connection is split into SH-TCP and M-TCP

Comparison: TCP and M-TCP(cont'd)



- If the wireless link is broken, SH-TCP will send an ACK packet to acknowledge the *n*th byte with a receiver window 0.
- This forces the Sender into Persist Mode.

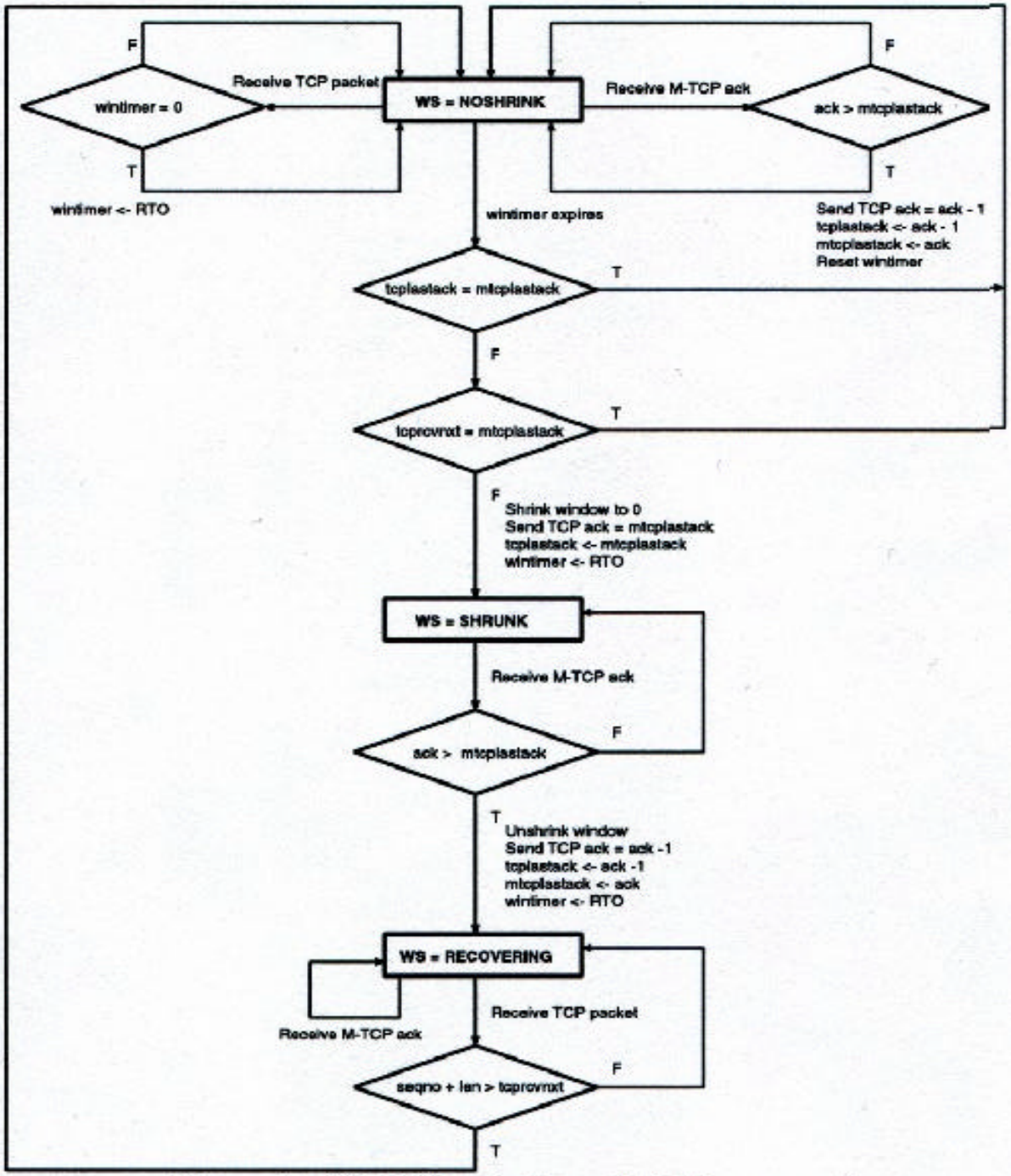


Figure 4: SH-TCP window shrinking causality.

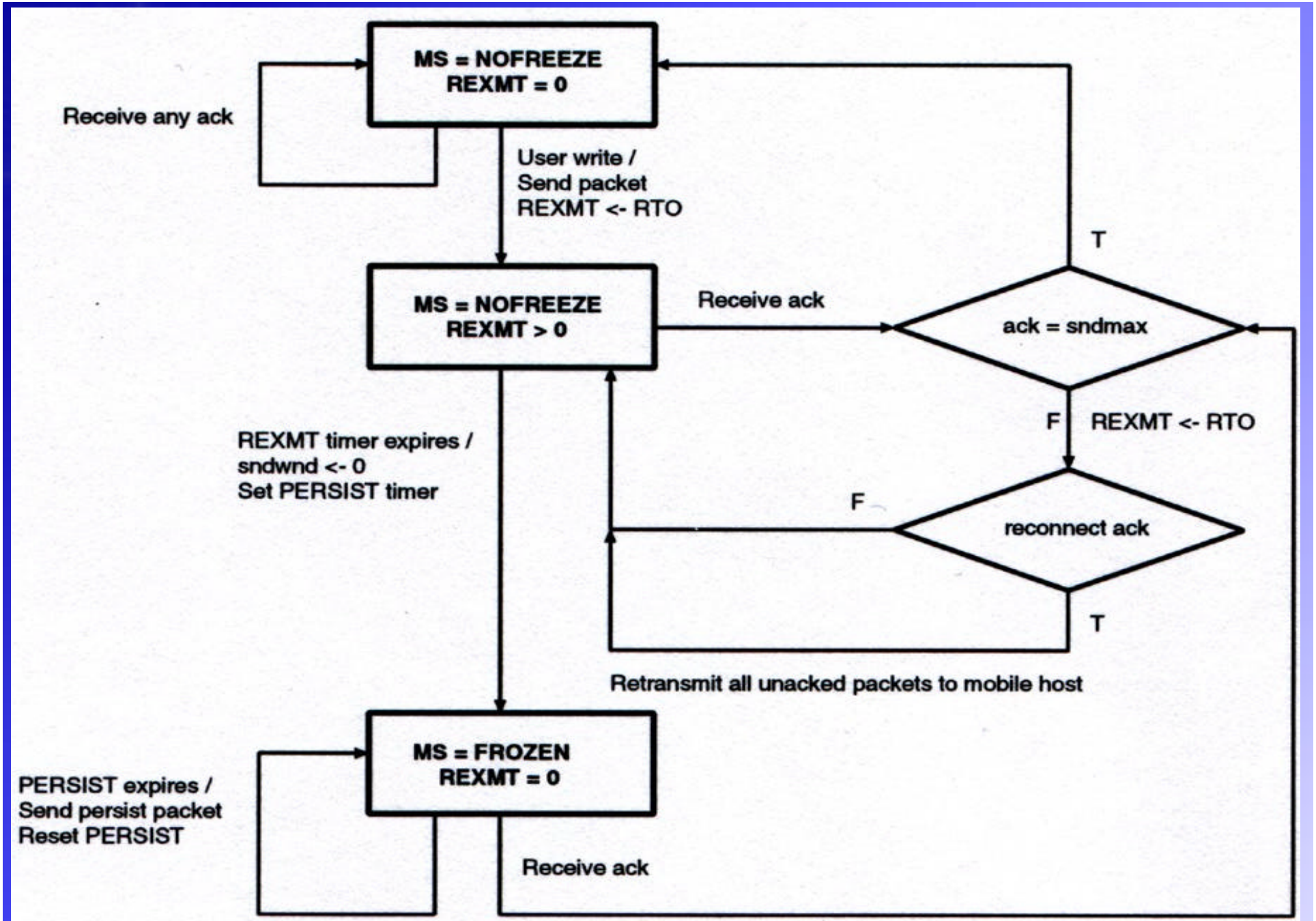
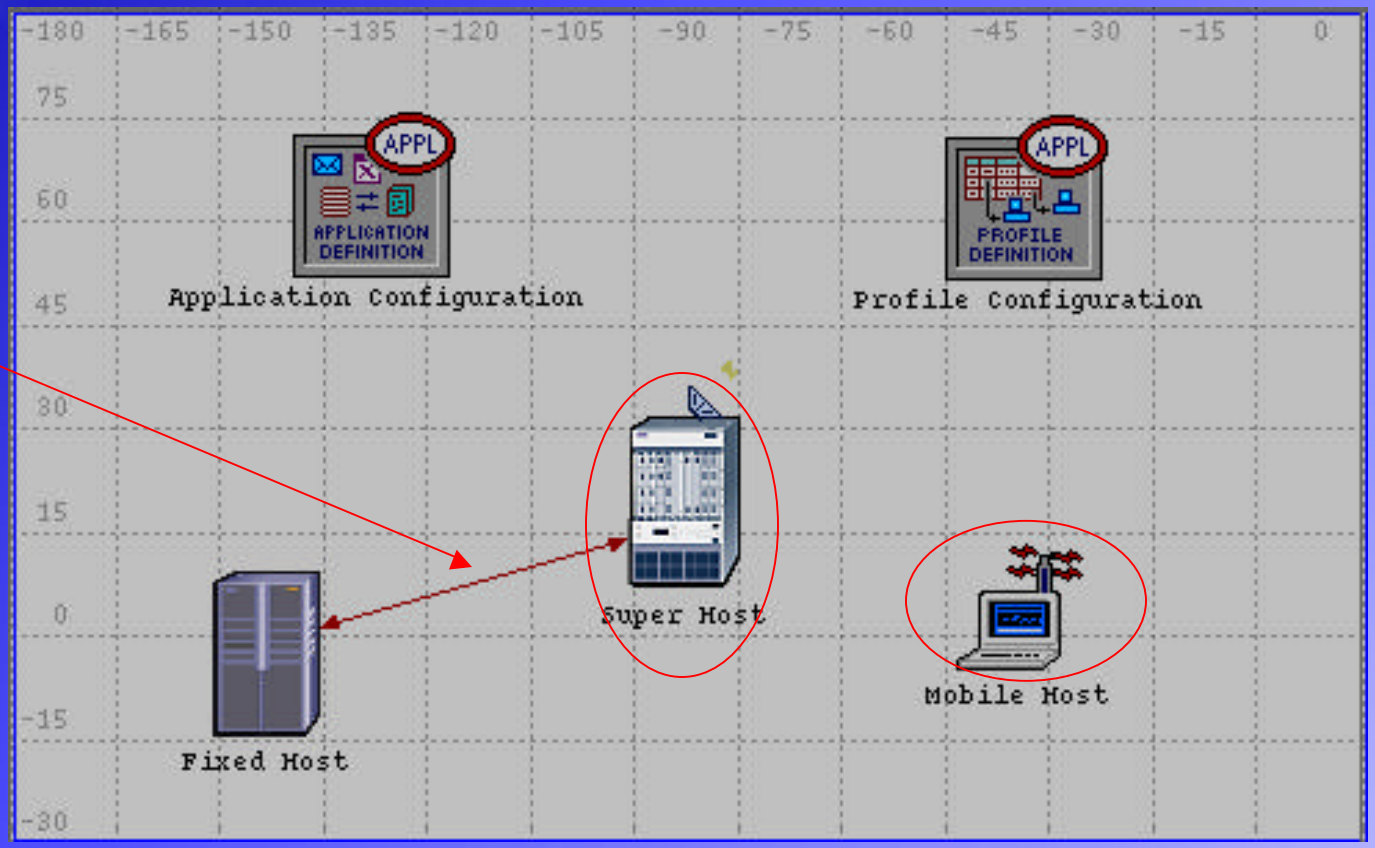


Figure 5: M-TCP timer freezing causality at the SH.

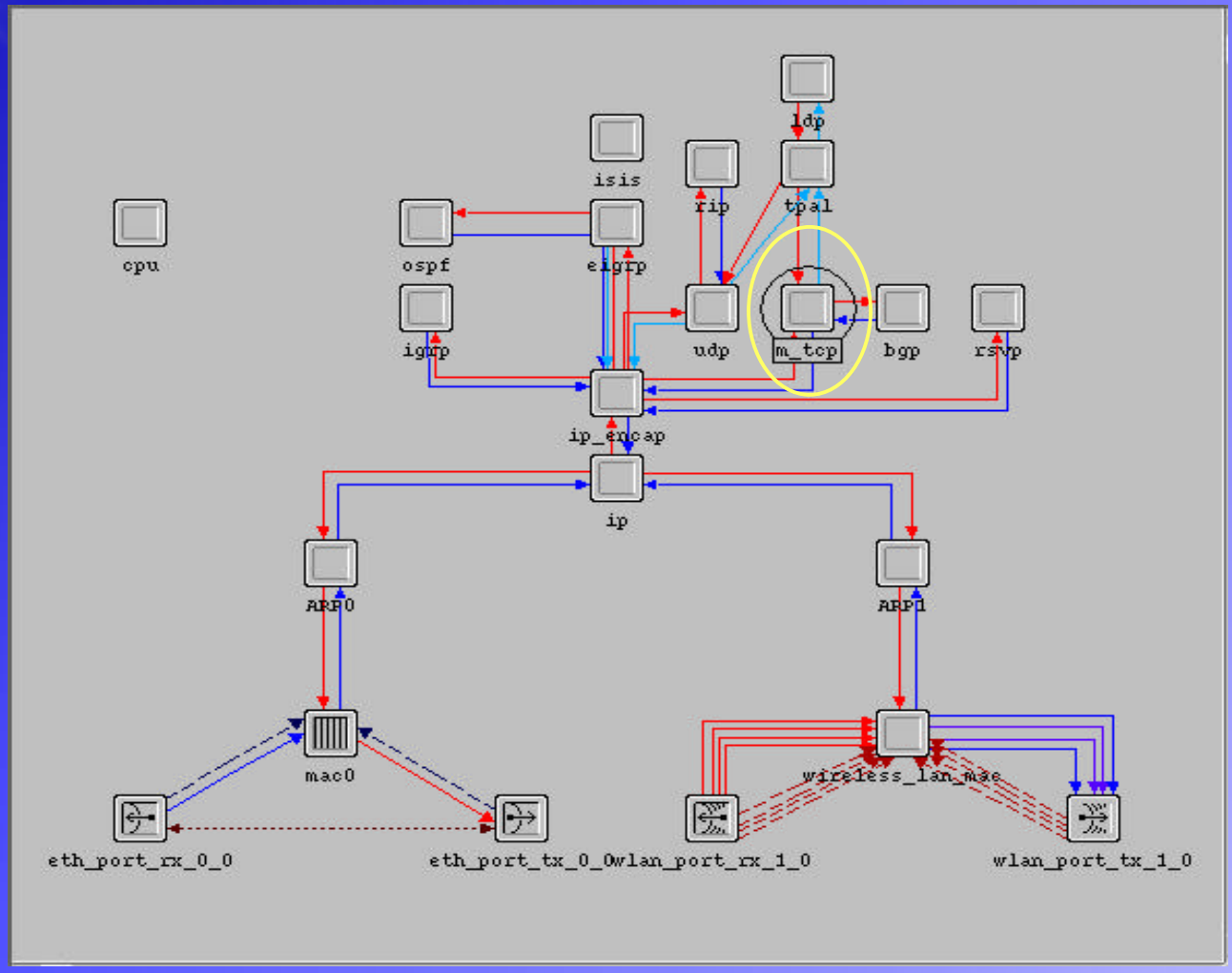
M-TCP Characteristics

- Transport protocol in mobile computing
- Maintain end-to-end TCP semantics
- Be able to deal with the problems caused by lengthy disconnection or by frequent disconnection
- Ensure that handoffs are efficient

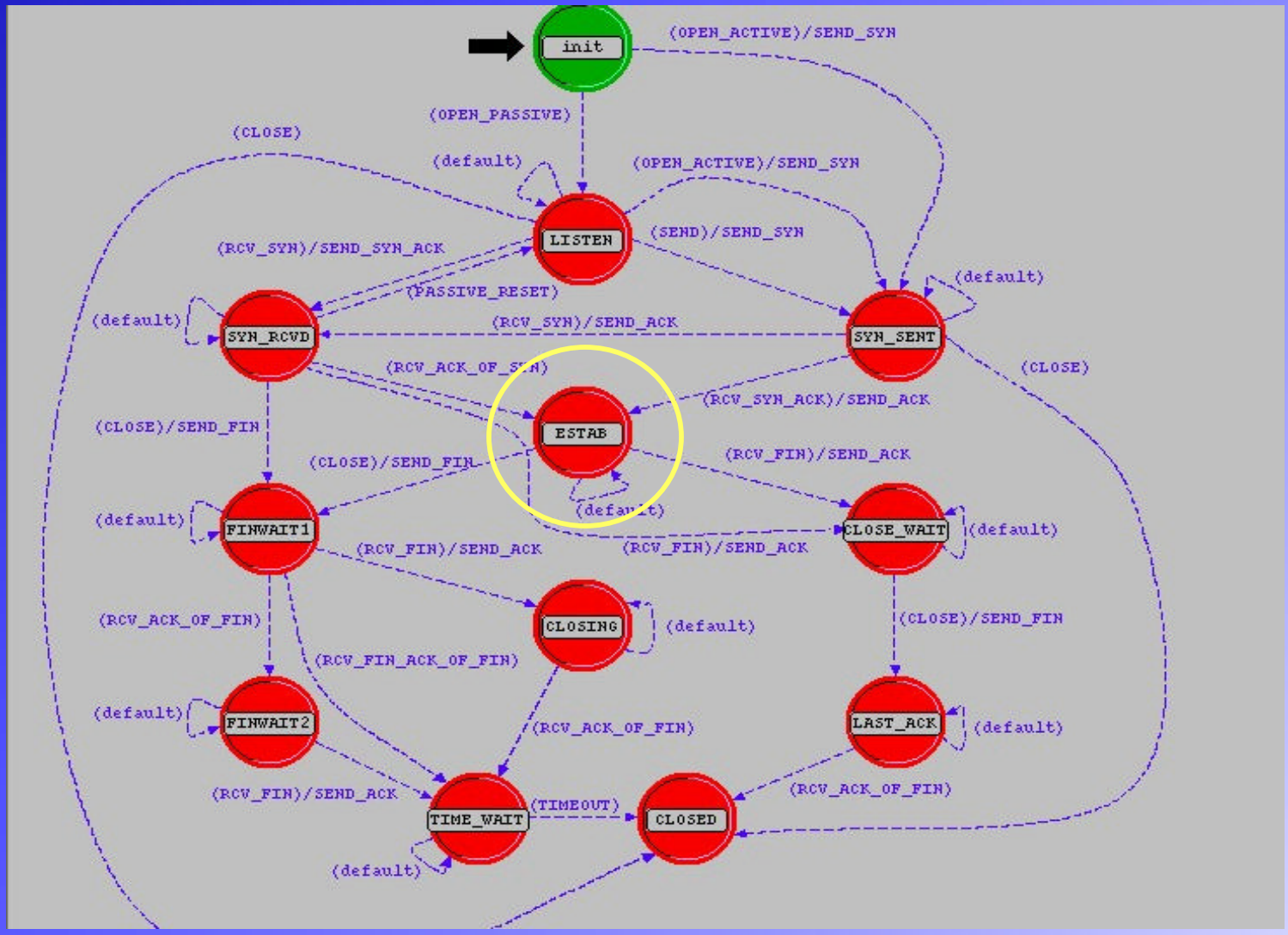
Implementation Details



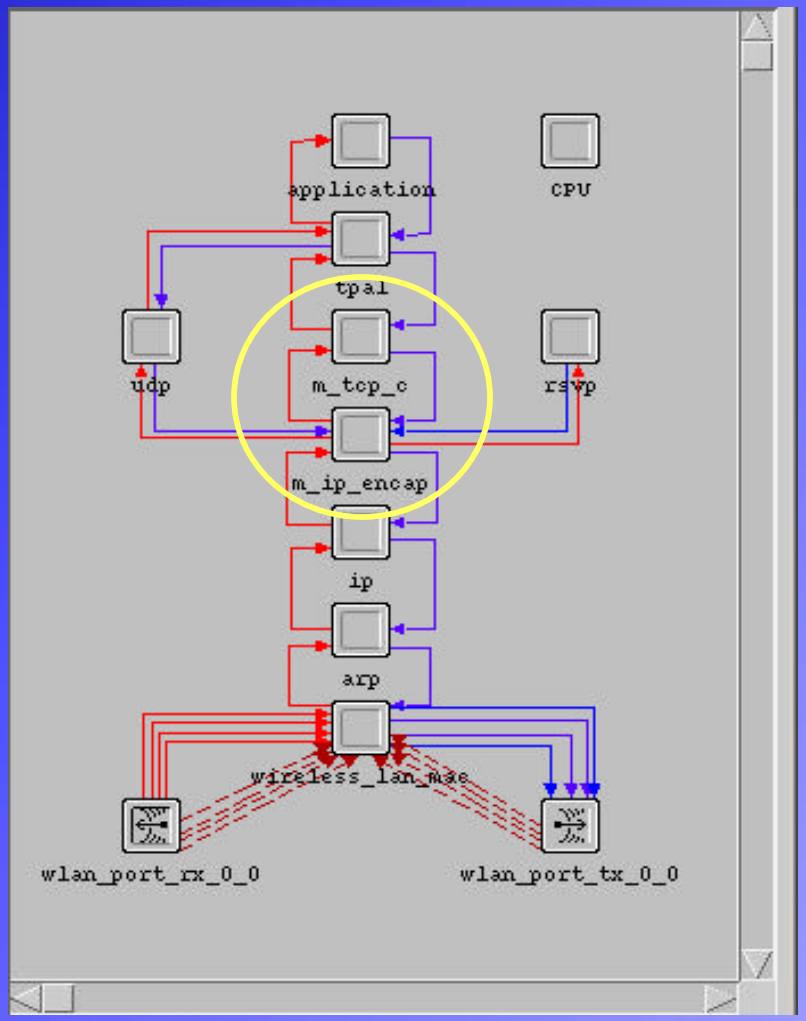
Node Model of Supervisor Host(SH)



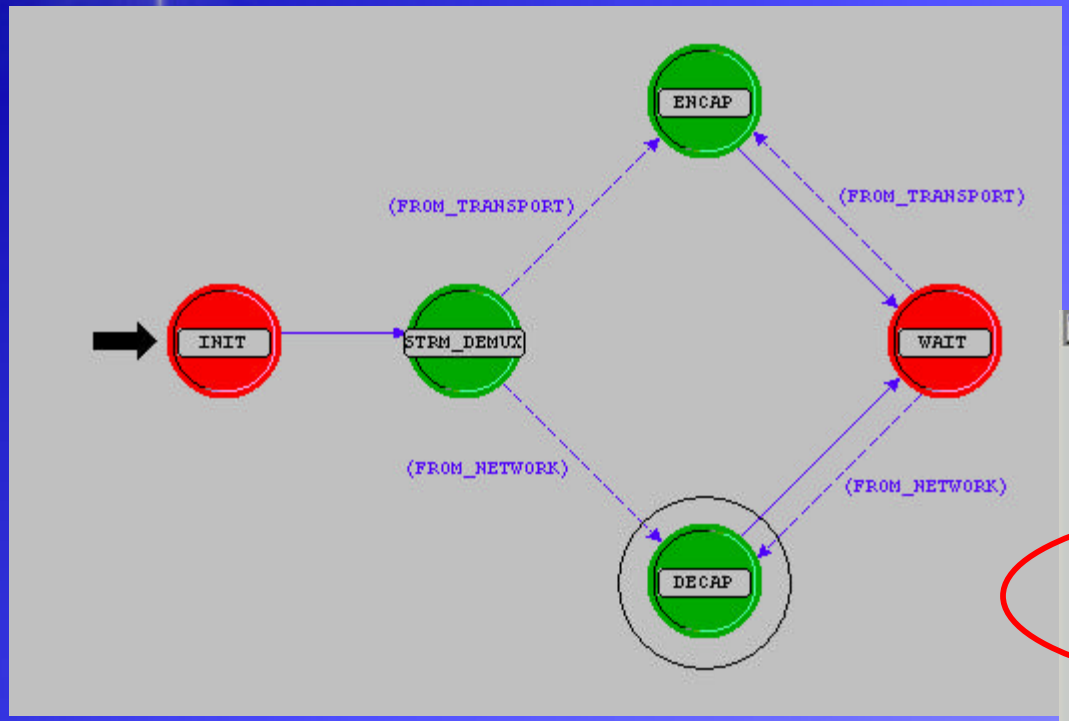
M-TCP State Diagram at SH

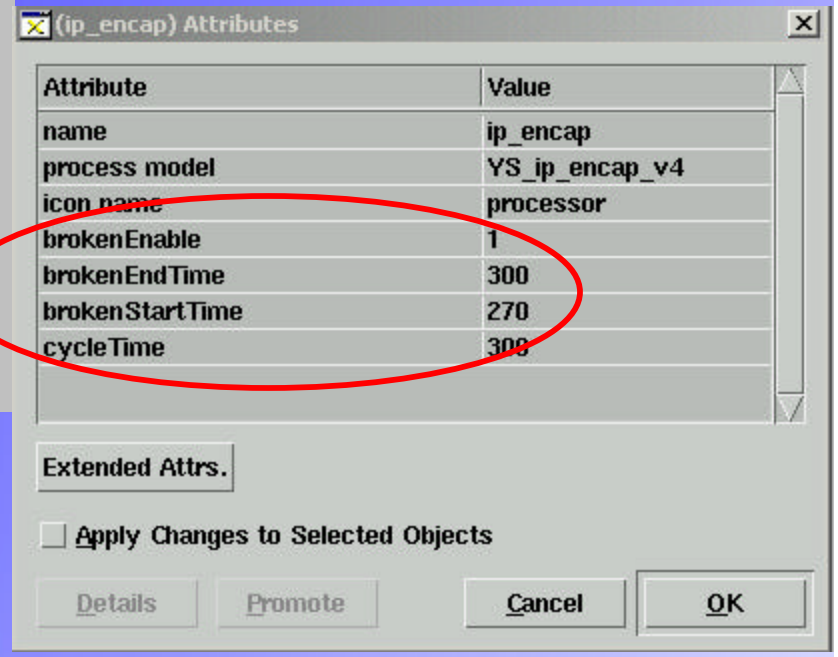


Node model of Mobile Host(MH)

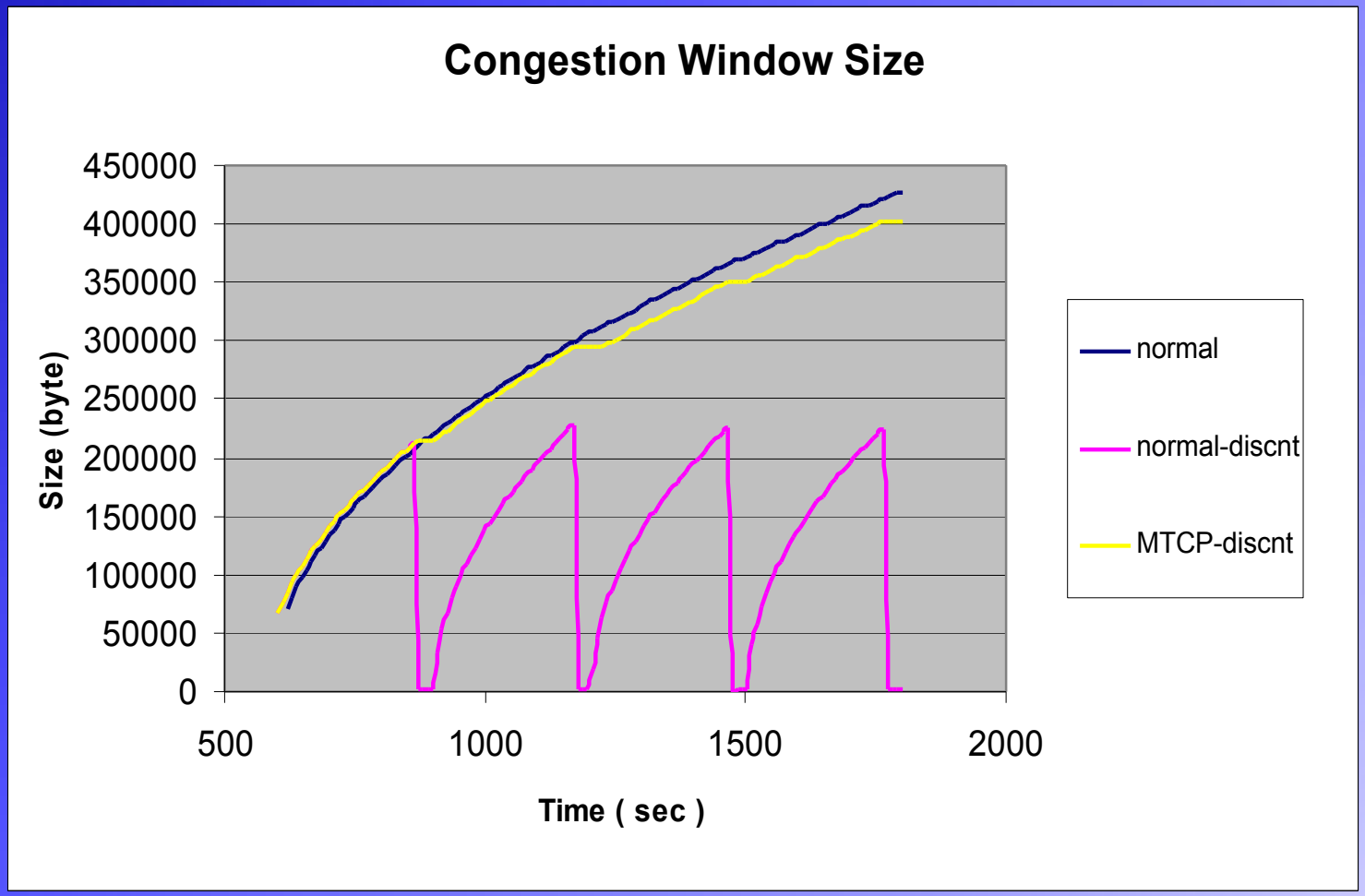


Modification of IP_enca

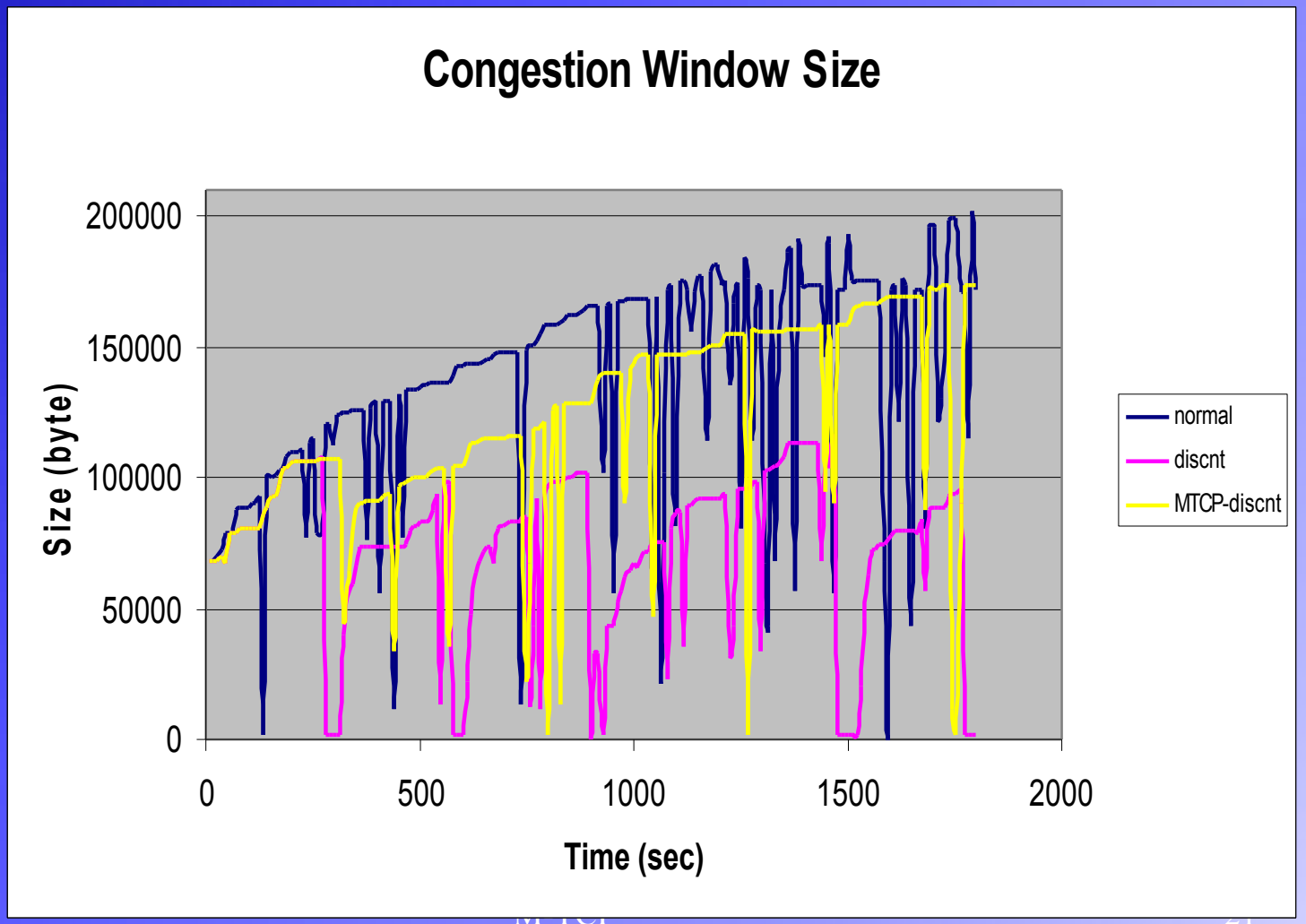




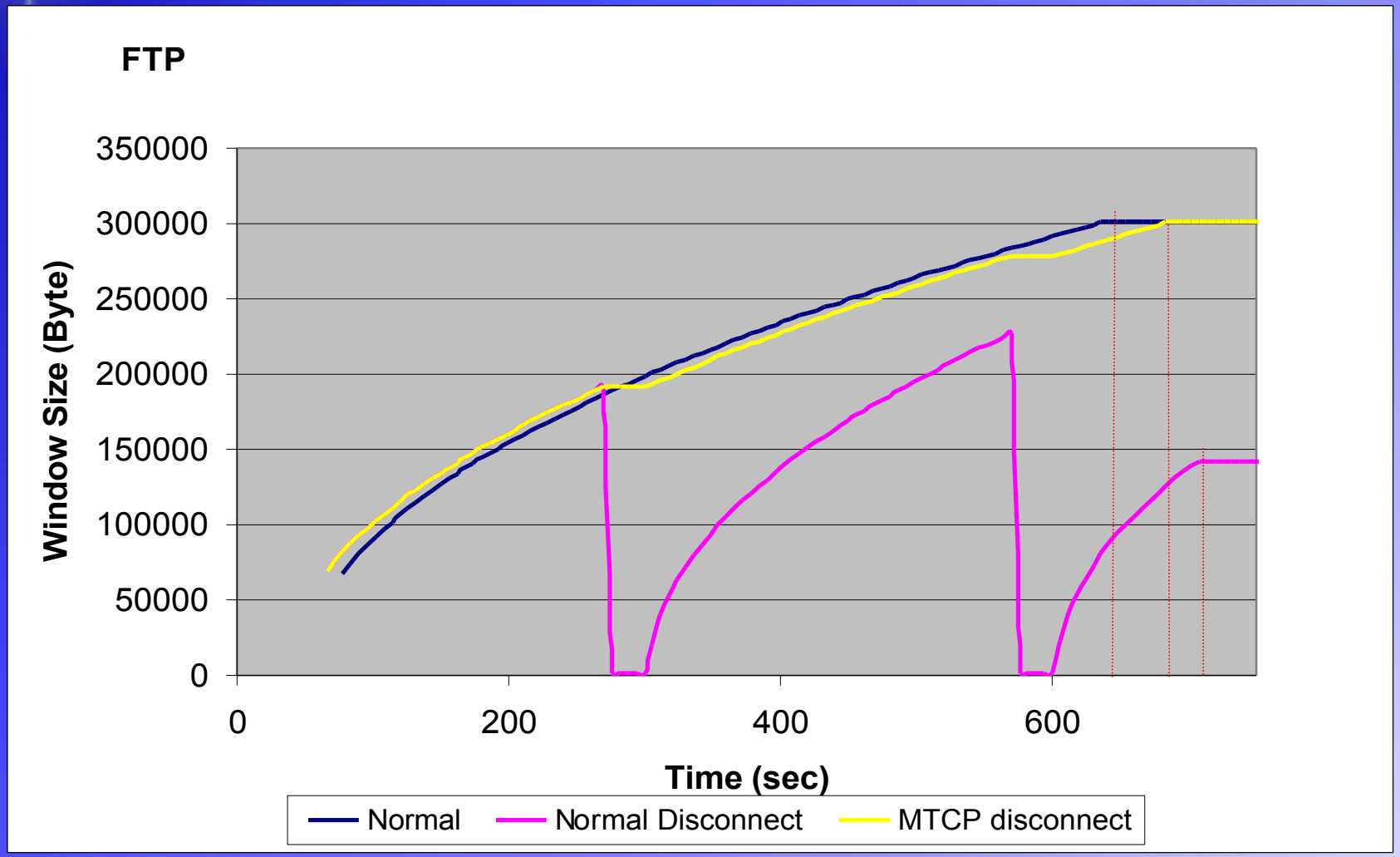
Simulation Results --- FTP



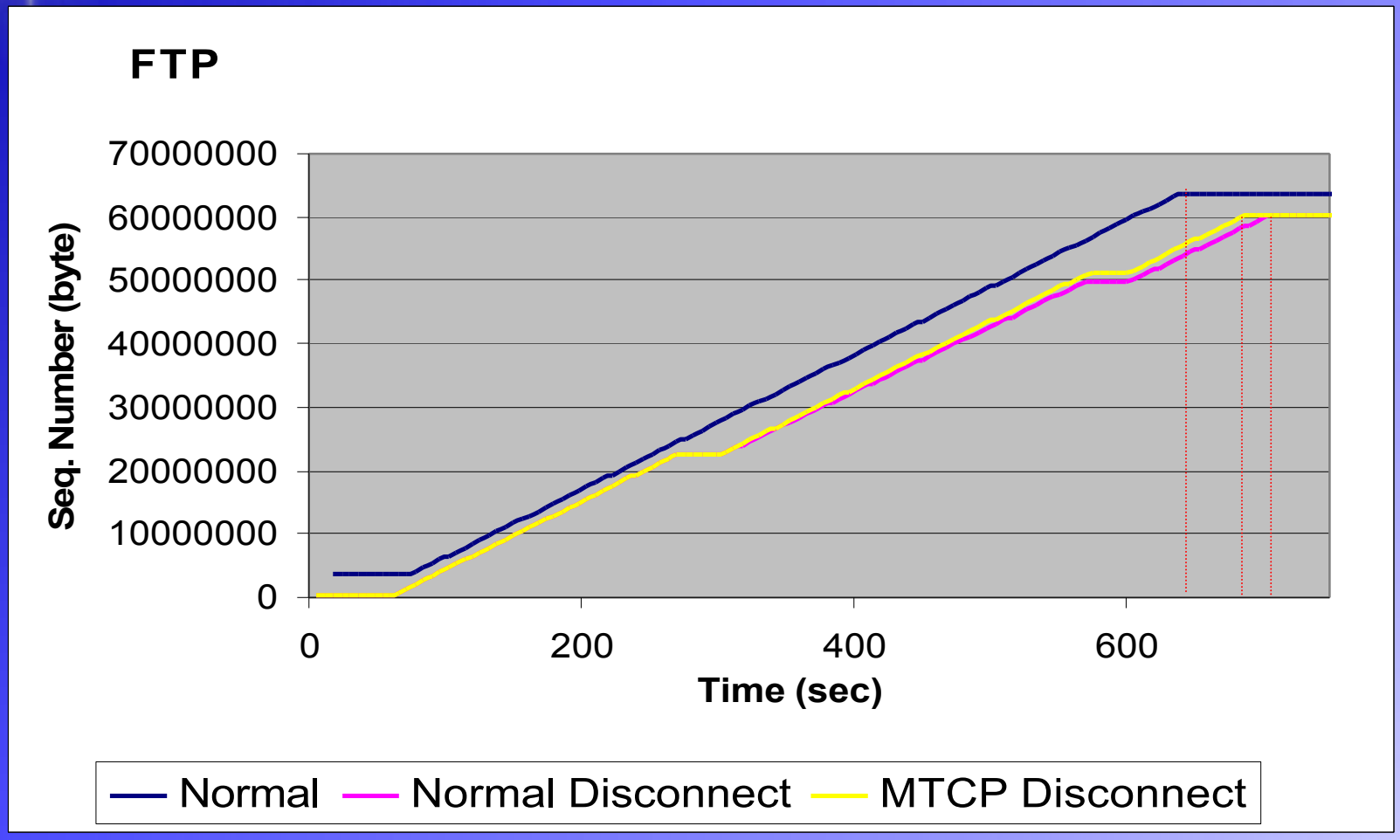
Simulation Results –- DB Access



Simulation Result: data transfer time



Simulation Result: data transmission time



References

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