Hochschule
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ATCP: TCP for Mobile *Ad Hoc* Networks

Presentation of a Research Paper

Faculty: Computer Science and Engineering, York University (CA)
Course: CSE 6590 - High Performance Computer Networks

Speaker: Benedikt Iltisberger
Date: 2010-10-08

- **Presentation Time:**
  - 25 Minutes
- **Questions:**
  - I am looking forward to answer your questions after the presentation.

Agenda of the Presentation

- Motivation for the Work on TCP
  - Problems with TCP in MANETs
  - Solutions
- Design of ATCP
- Implementation of ATCP
- Performance
- Conclusion

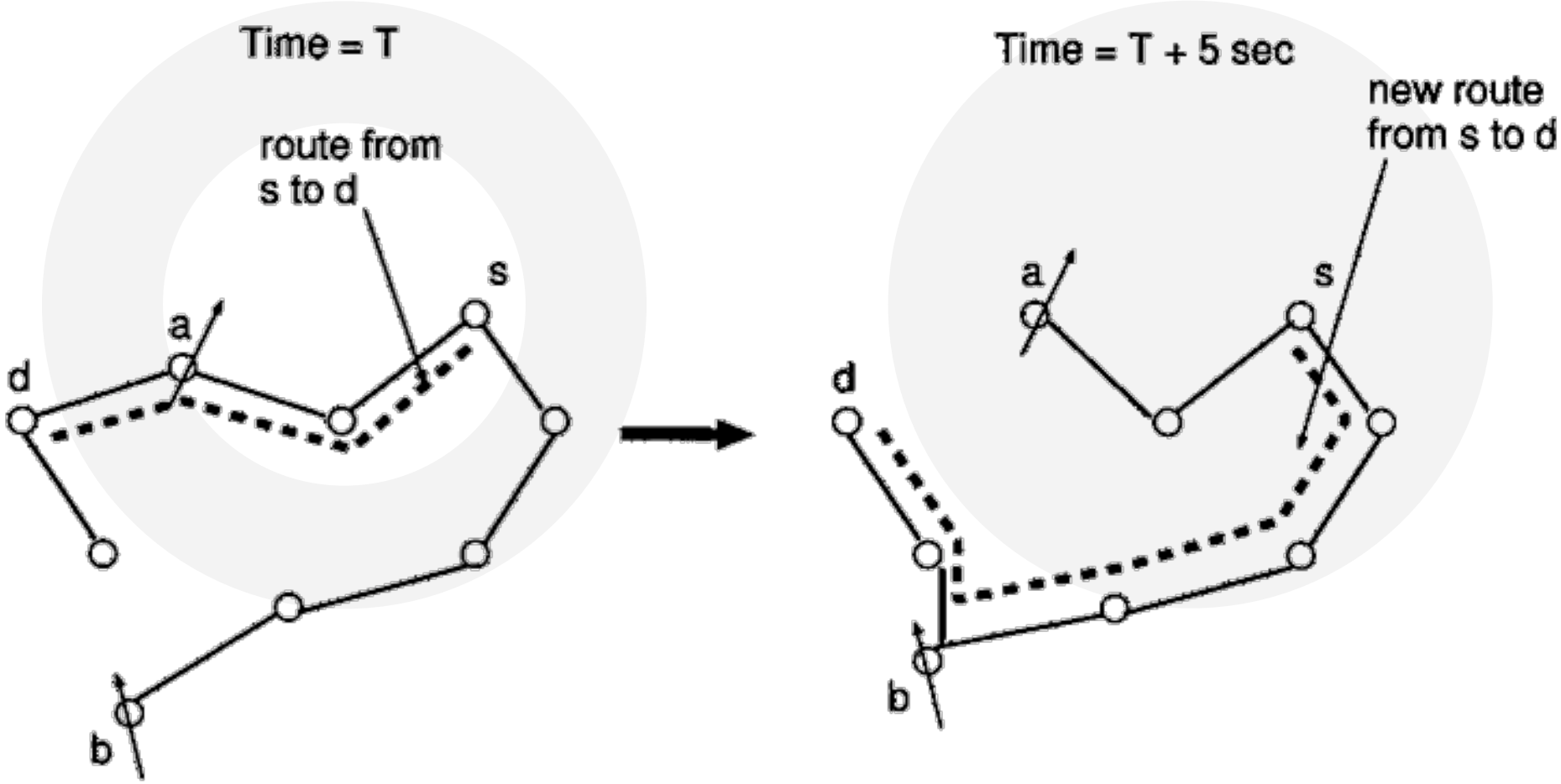
Motivation for the Work

- Node connectivity changes frequently
- Throughput suffers badly because of congestion
- Several problems due to TCP in MANETs
- TCP not designed for MANETs

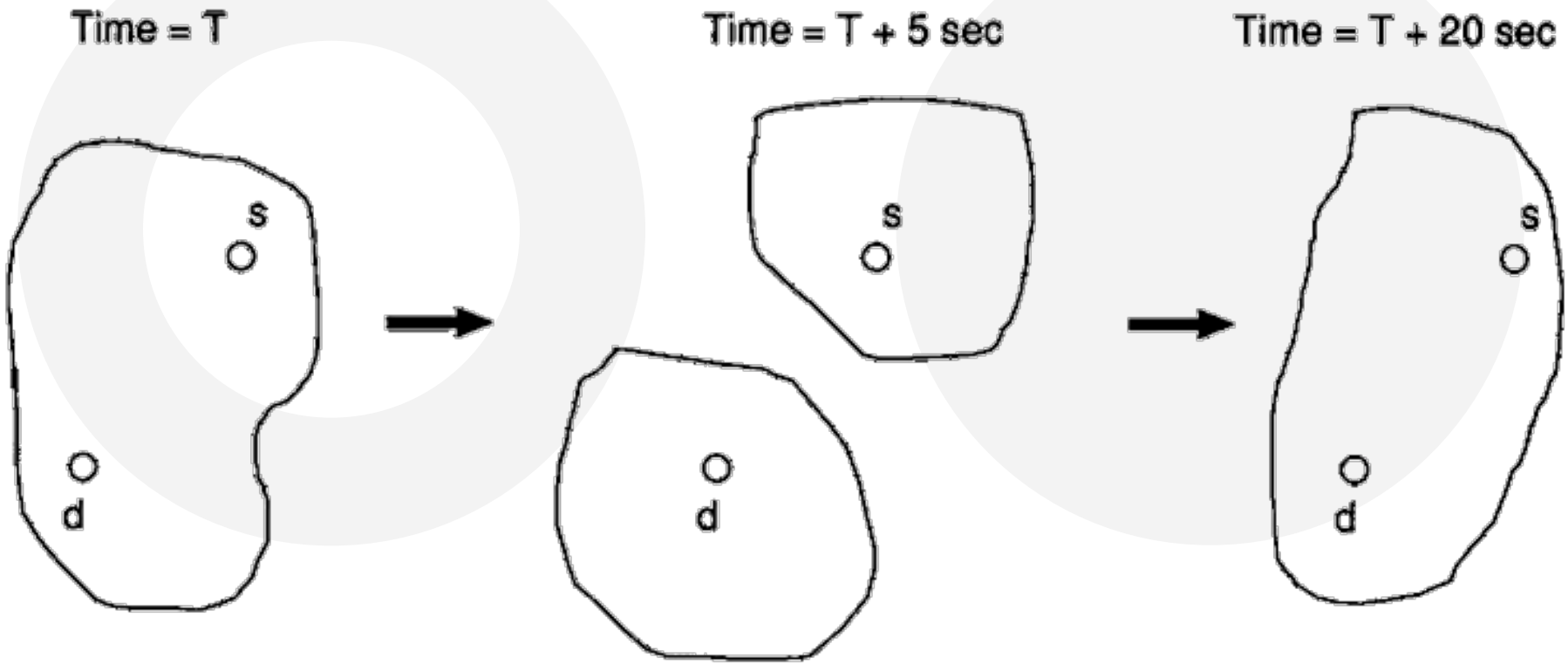
Problems with TCP in MANETs

- High bit error rates (BER)
- Frequent route changes
- Partitions of the network
- Multipath routing
- TCP congestion window problem

Route Change Forced by Mobility



Partitions are Formed and Recombined by Mobility



How ATCP Solves these Problems?

- Use network layer to put TCP in a persistent state
  - Network Partitioning
    - Persistent mode to avoid needless transm. and retransm.
  - Packet Loss
    - Retransmission without invoking congestion control
  - Network Congestion
    - Passing the problem to TCP to let it handle congestion

ATCP Design Goals

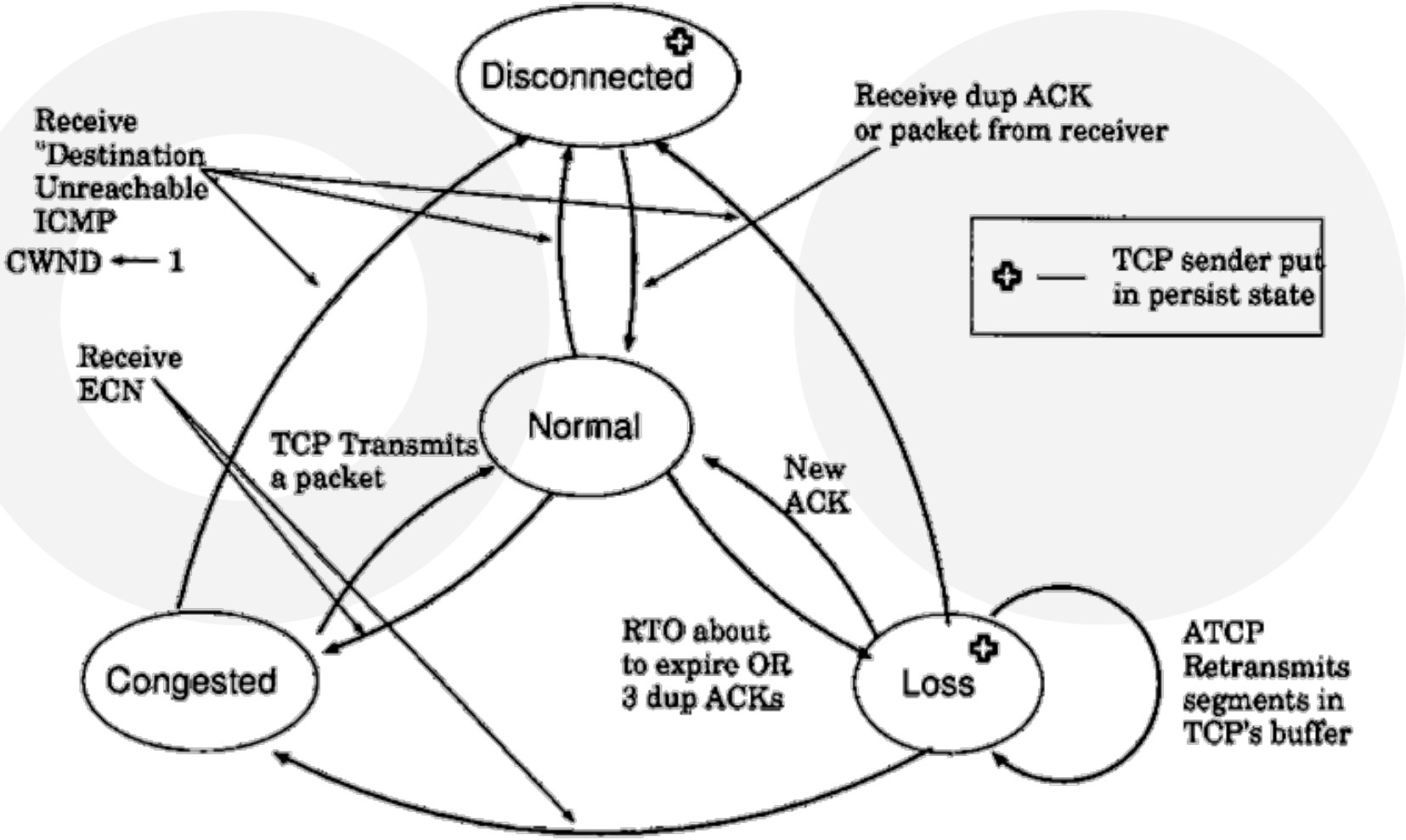
- Improve TCP performance in MANETs
- Maintain TCP congestion control
- Appropriate CWND behavior
- Maintain end-to-end TCP semantics
- Compatibility with standard TCP

How are the Design Goals Implemented?

- ATCP layer only active on the sender side*
- Functioning of the ATCP layer in 4 states:
  1. Lossy Channel
  2. Congested
  3. Disconnected
  4. Effect of Lost Messages

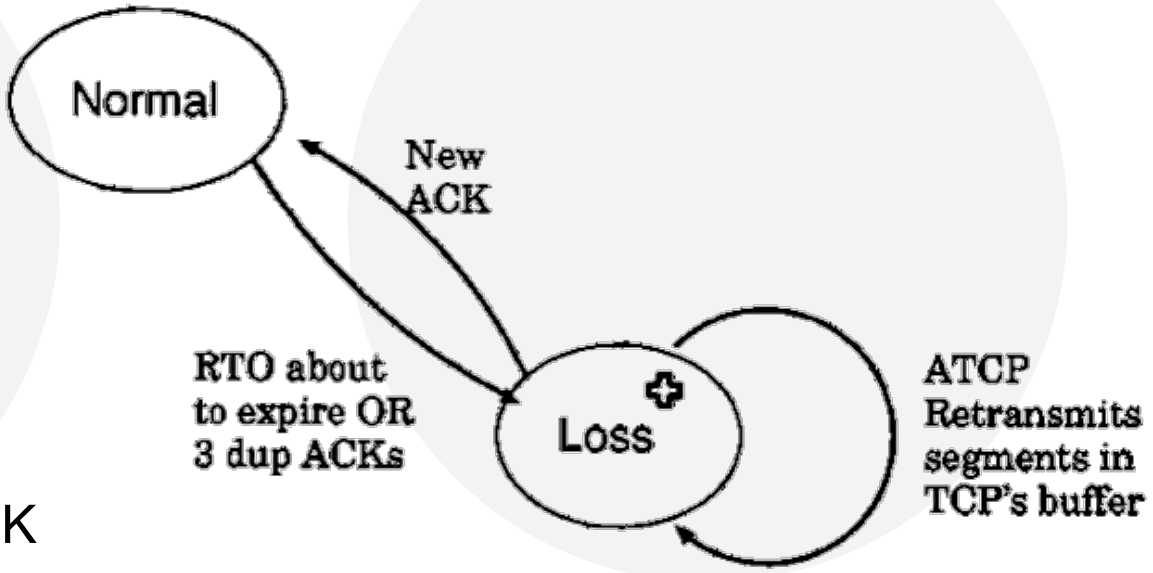
*) Except duplex communication

State Diagram of ATCP at the Sender



Transition: Normal ←→ Loss

- Discription:
  - RTO about to expire or 3 duplicated ACKS
  - ATCP retransmits TCP segments in buffer
  - If successful
    - Return with new ACK to normal state
  - Otherwise:
    - Disconnected, Congested



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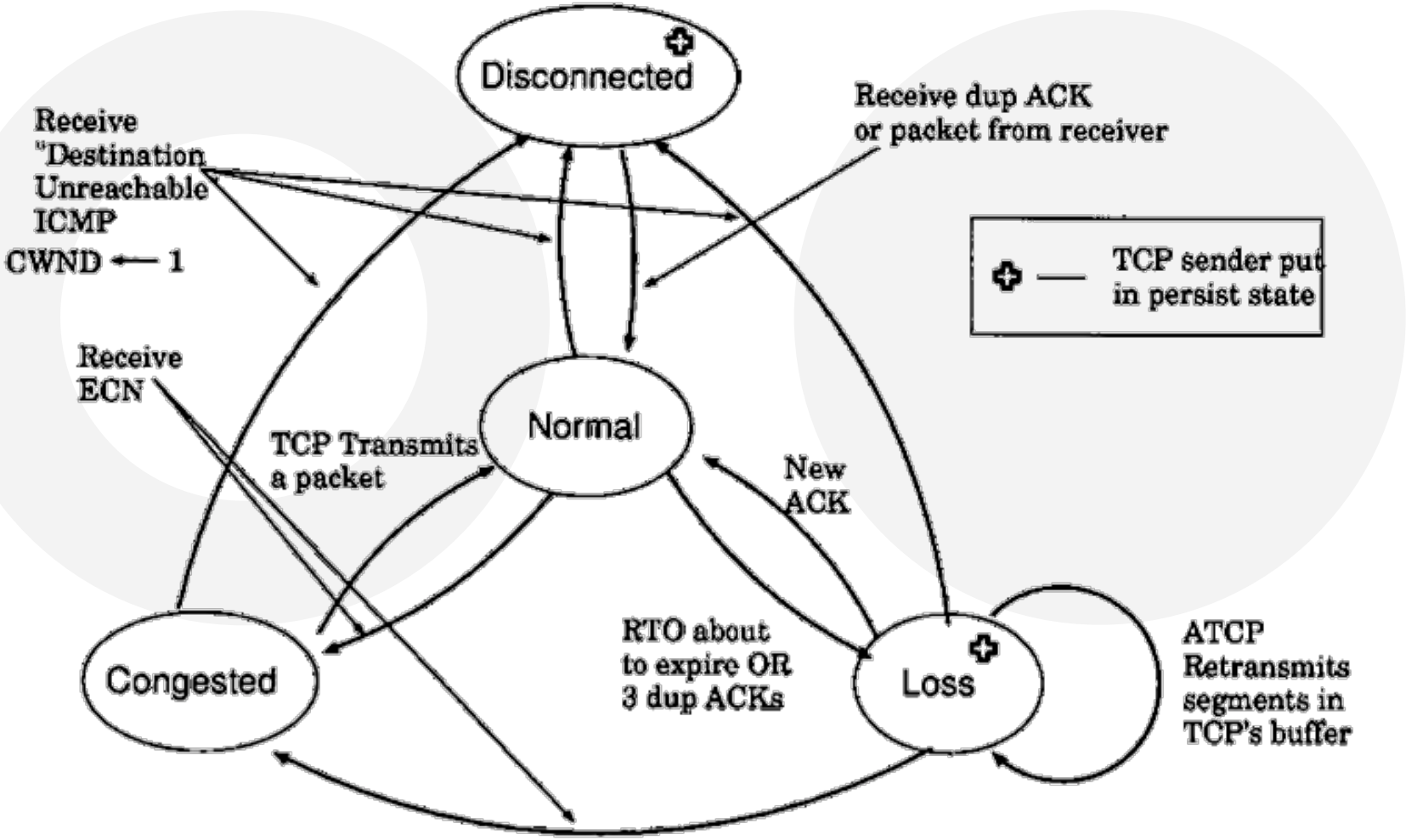
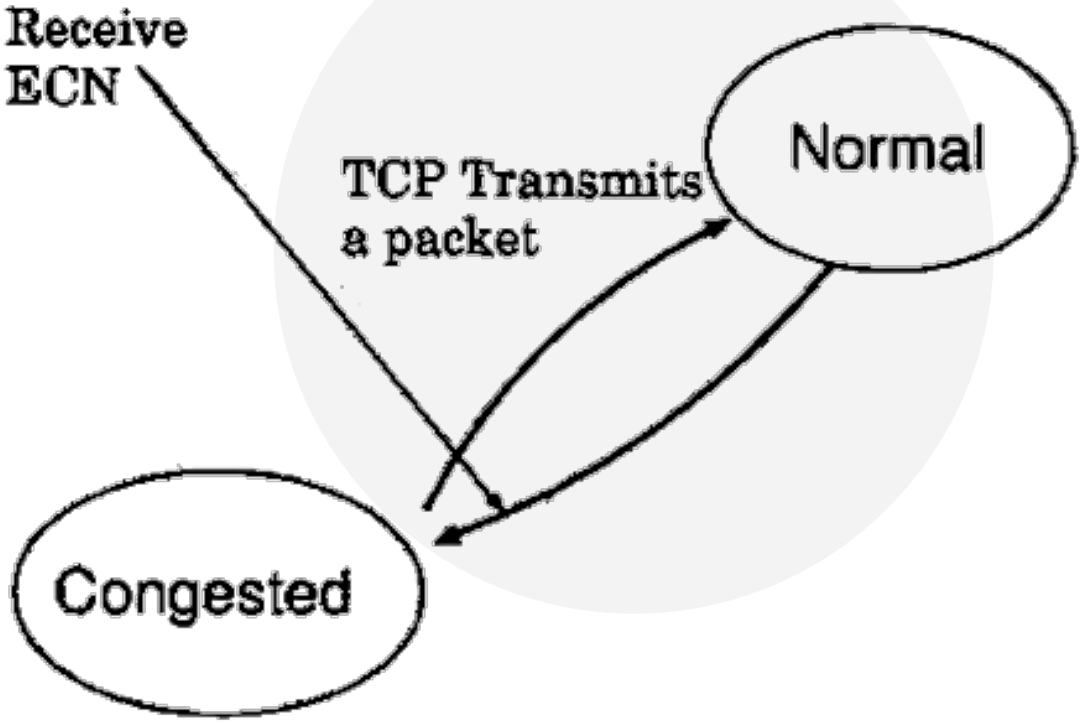


Transition: Normal ←→ Congested

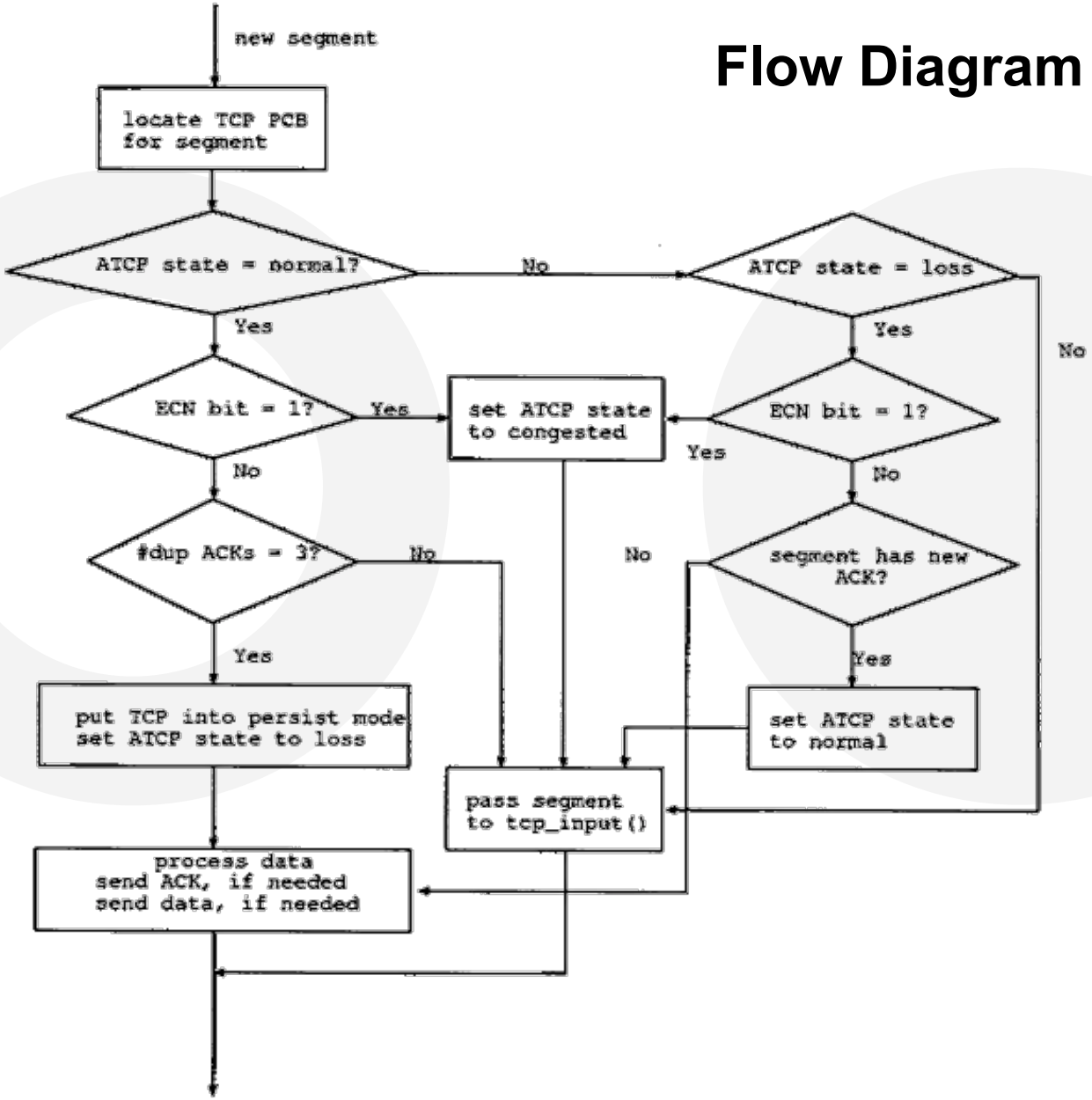
- Discription:
  - Receive ECN
  - Congestion solved
    - TCP transmits packet
  - Otherwise:
    - Disconnected, Loss



Implementation of ATCP in a Real World Environment

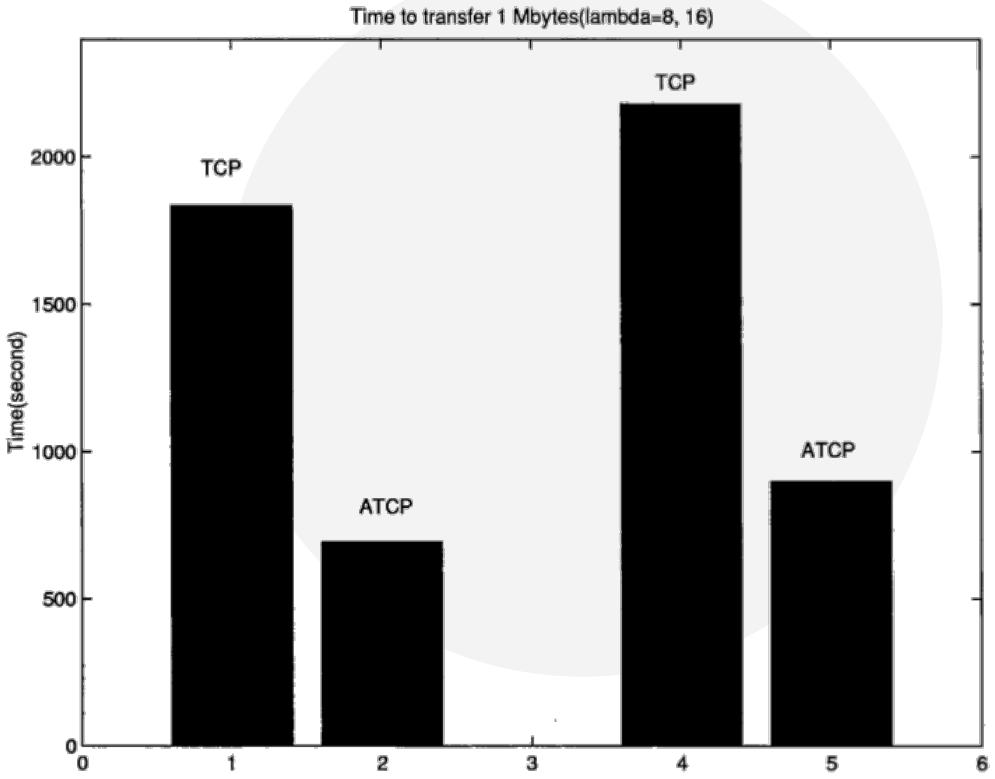
- Protocol implementation in FreeBSD
- Interception of every IP packet
- Check state
- Set it to persistent state if needed
- Set up timer for fast timeout/retransmission
- Save data to special data structure

Flow Diagram of ATCP



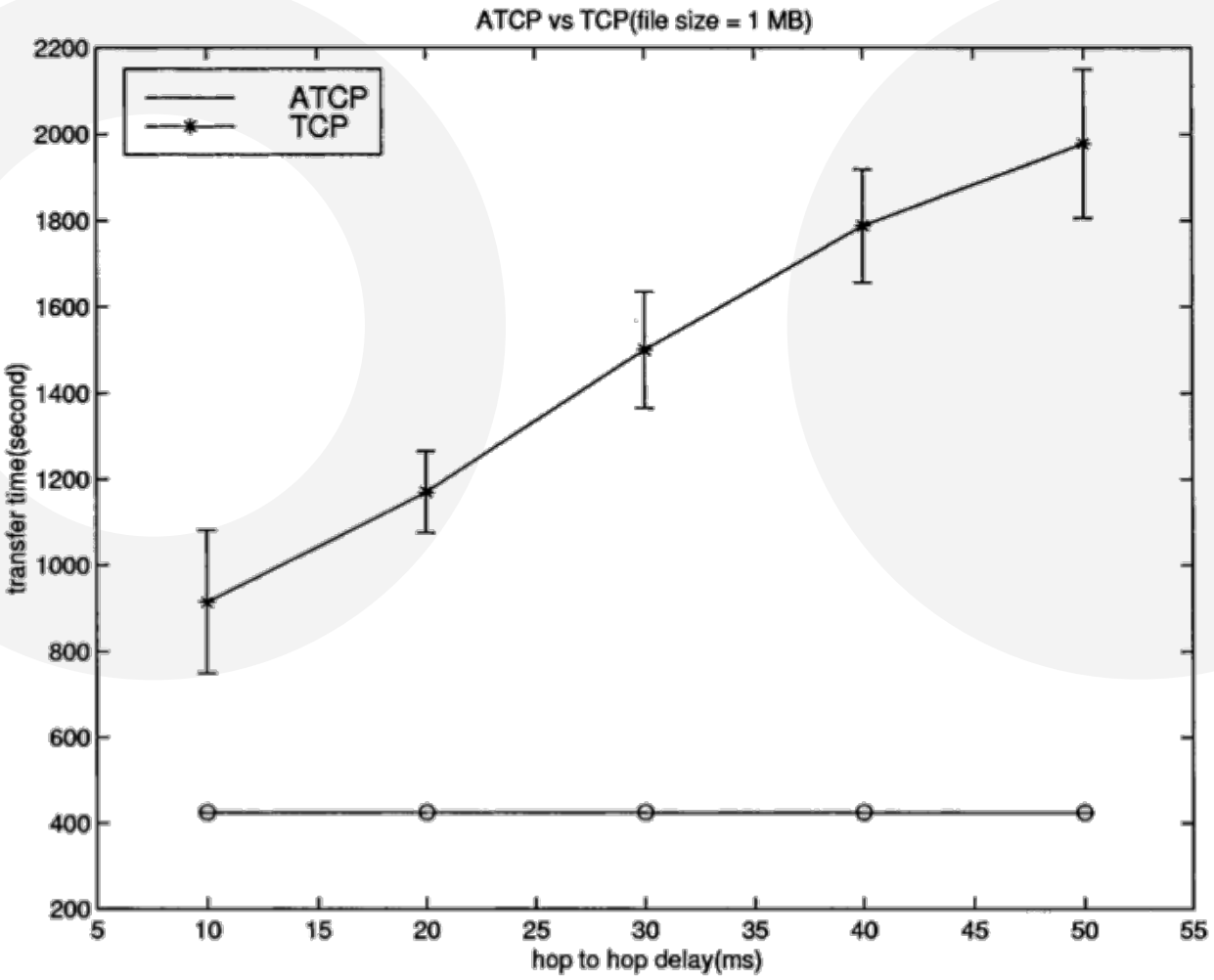
Performance Comparison

- Configuration:
  - 5 Pentium PCs
  - 2 NIC/PC
  - Emulated 32-kb/s channels
  - BER = 10^{-5}
  - Hop-Delay = 10ms-30ms
  - Partition generated by 1 Node which is modified
  - 20 Measurements per Graph with 90% confidence

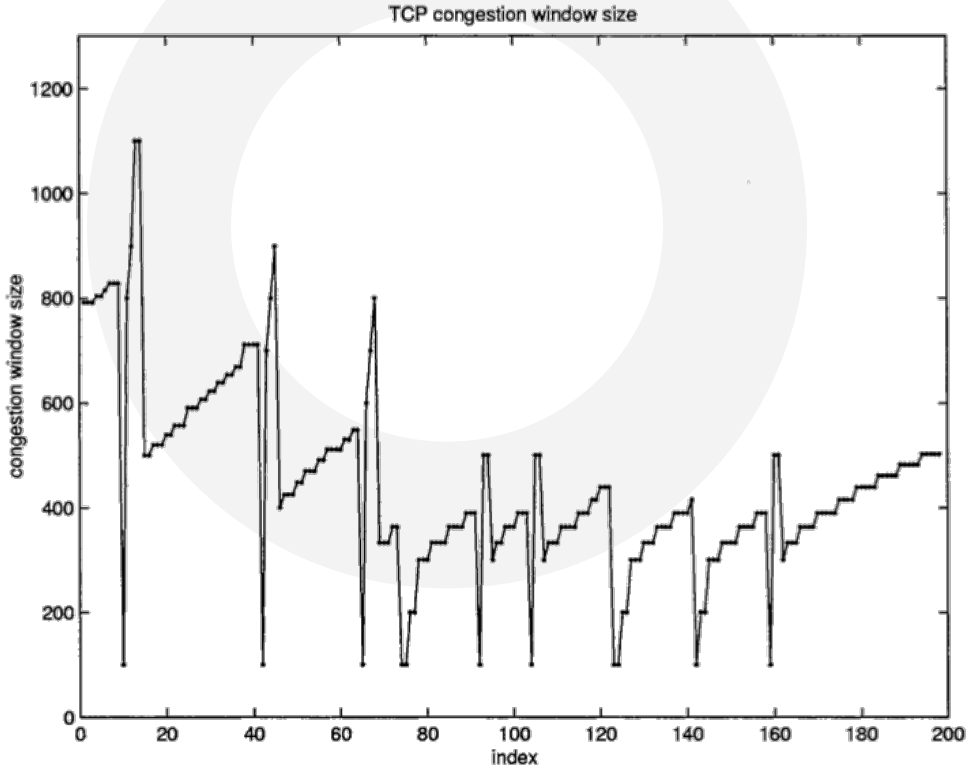


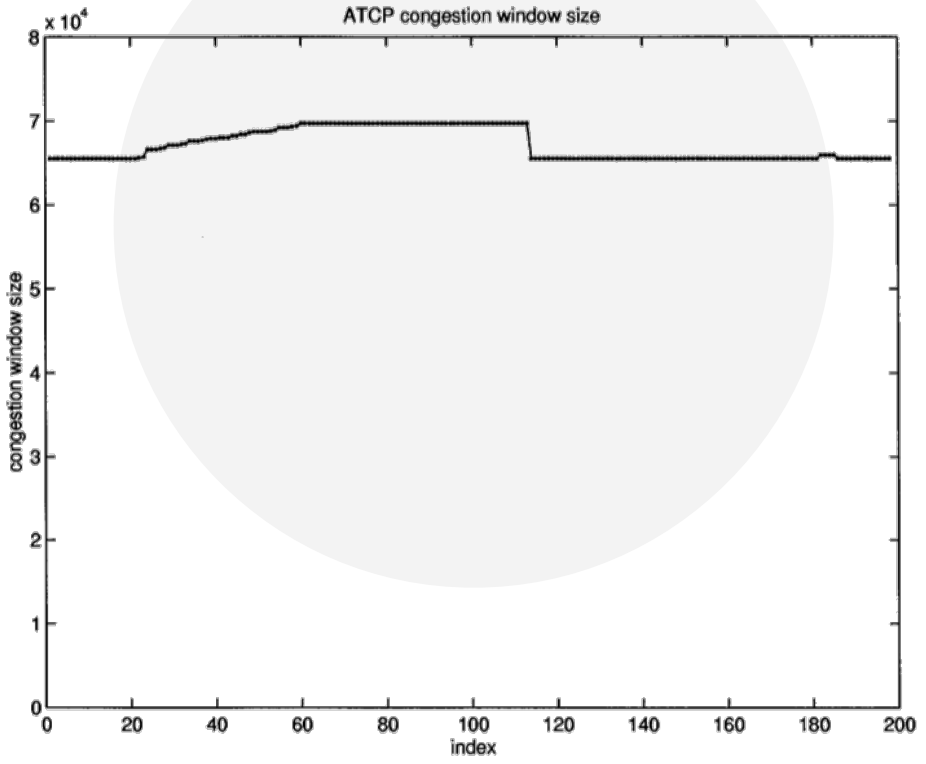
TCP and ATCP transfer time for 1-MB data in the general case.

TCP and ATCP Performance (Bit Errors only)



Congestion Window Size (Comparison between TCP & ATCP)





Conclusions on ATCP

- ATCP between IP and TCP layer
- Ensuring high throughput
- No modification in underlying communication
- Nodes without ATCP can use normal TCP
- Very good performance results
- No interference with congestion control

Thank you for your attention!

Any questions?

Reference:

- „ATCP: TCP for Mobile *Ad Hoc* Networks“, Jian Liu and Suresh Singh, in *IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS*, VOL. 19, NO. 7, JULY 2001.