Evaluation of MDP Over Low Bandwidth-Delay Product Links

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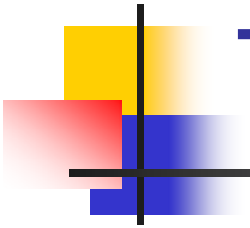
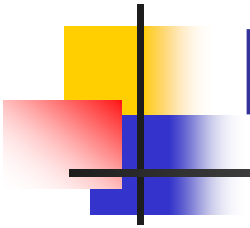


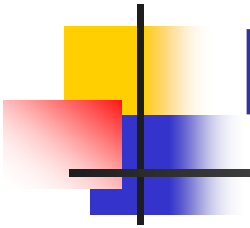
Topics

- Background
- Simulation Environment
- Intact Link Results
- Link Interruption Results
- Conclusion



Background

- Question: Can UDP-based protocols be effectively used in small satellite type links for data file transport?
- Question: Are there any advantages to UDP-based protocols over similar TCP-based protocols?
- Question: How well do other forms of acknowledgment work when compared with positive packet acknowledgment

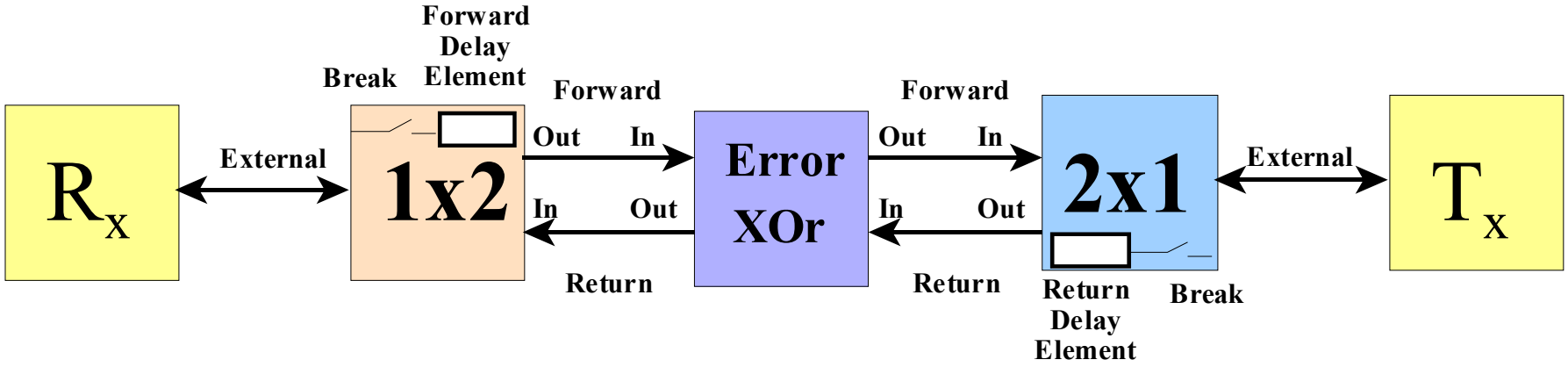


Background

- Why choose MDP?
  - Advertised mechanisms to re-establish links after link outages
  - Does not use a slow-start mechanism or other form of flow control
  - Desire to evaluate how selective negative acknowledgment works in the space channel
  - Protocol is available in Linux, Windows environments to allow for easier testing

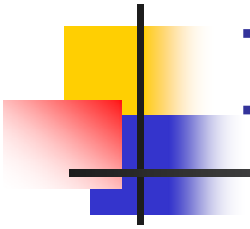
Simulation Environment

- Have developed a space channel simulation environment at NMSU to model small satellite communications links (low bandwidth-delay product links).



Simulation Environment

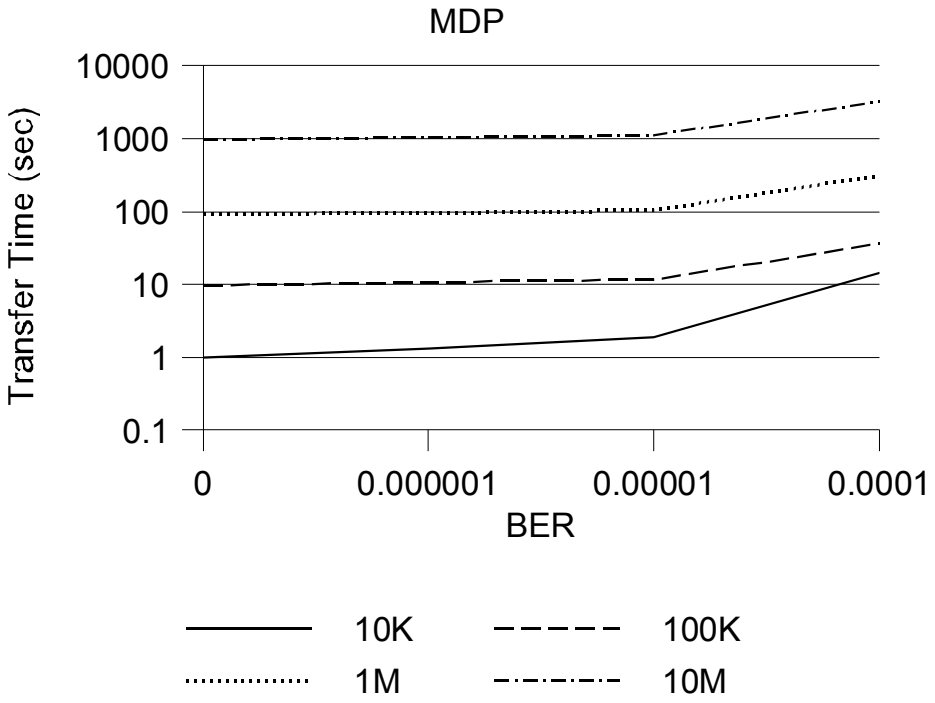
- Simulator has user-selectable parameters:
  - Independent forward and return data rates
  - Independent forward and return BER and channel noise model
  - Independent forward and return delay
  - Independent forward and return break time and break duration

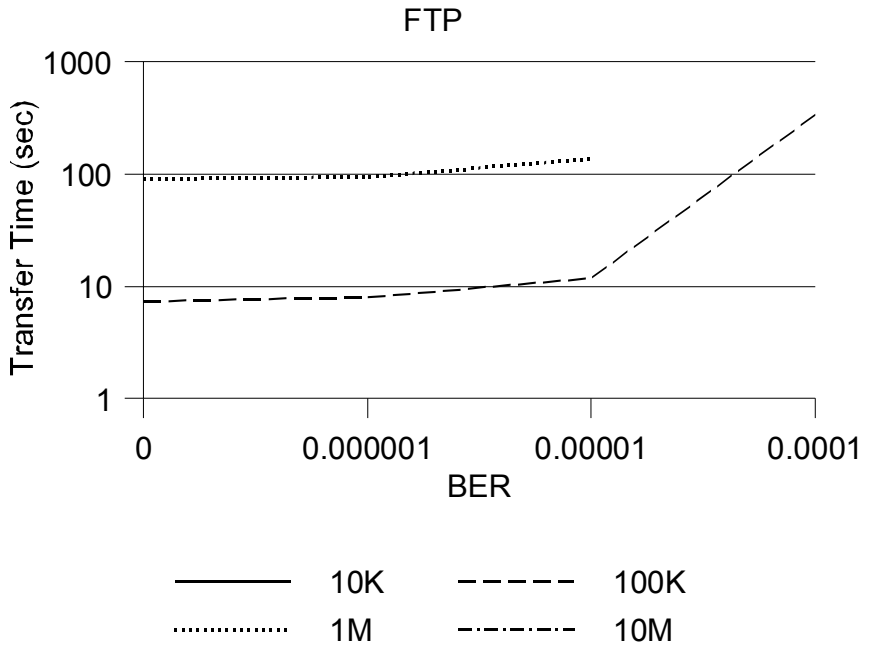


Intact Link Results

- Testing to investigate
  - Effects of channel errors on data throughput
  - Effects of Parity Packets on throughput
  - How does MDP compare with **`ftp`**?

Intact Link Results



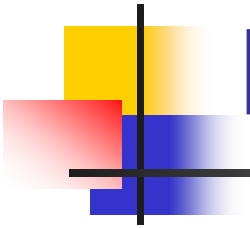


Intact Link Results

- **Parity Packets** add Reed-Solomon FEC capabilities to the MDP transfer
- User can select the level of parity packet transmission in terms of MDP coding blocks (64 units of 1024 bytes)
  - Parity packets act as inserts into the data field
  - Desire to have improved throughput even with greater overhead

Intact Link Results

Effect of Internal FEC @ BER = 0.0001	
# Parity Packets	Transfer Time
0	39 m 55 s
20	39 m 33 s
30	38 m 12 s
60	24 m 4 s



Link Interruption Results

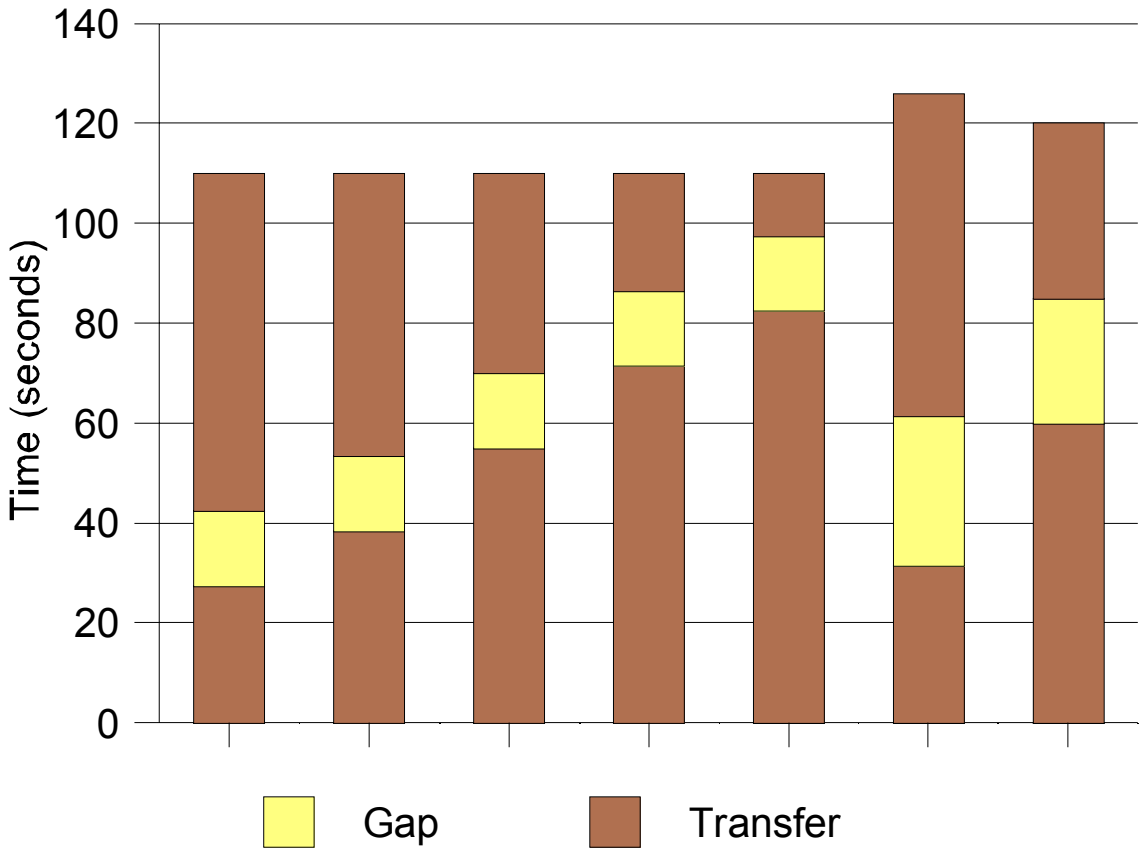
- Testing to investigate the effects of
  - Short gaps (gap length less than transmission lifetime)
  - Long gaps such as between satellite paths
  - How long does it take the client and server to resynchronize after a gap?

Link Interruption Results

- **Transmission Lifetime:** Expected time for the protocol to complete a transmission when there are no errors or transmission gaps. This is based on the file size and the link speed.
- **Example Transmission Lifetimes:** 1 MB file -- 95 seconds; 10 MB file -- 958 seconds

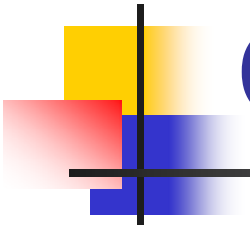
Link Interruption Results

- 1 MB file transfer with a gap in the middle. Gap position and length varied in each experiment. No channel errors.



Link Interruption Results

Typical Re-synchronization Times		
Cut at % of transfer	Gap Duration (sec)	Resynch Time (sec)
25	900	120 - 159
25	1800	105 - 158
25	5400	150
50	5400	150 - 165



Conclusion

- MDP is a robust means of file transfer
  - MDP transfer time is about the same as `ftp`'s at low BER
  - MDP has better performance at high BER
- Resynchronization time may be a problem if there are short satellite passes