Sensitivity Analysis of the ATP Protocol Parameters

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In this report, we have stress-tested the parameters involved in the design of the ATP protocol. The analysis was performed using the NS2 simulator. The scenarios considered involved 100 nodes in 1000m by 1000m. Two values of load were considered, namely 5 and 15 flows. Each of the flows was an ATP flow with FTP serving as the application generating traffic. The packet size considered was 512 byte. Two values of mobility of 10 and 20 m/s were considered in the scenarios that were generated using the random waypoint mobility model. Ten seeds were considered for each of the four combinations mentioned above.

The parameters that were considered in the study are:

1. Epoch timer - that determines the rate at which feedback is sent by the receiver,
2. Guard constant - that helps the connection operate in the maintain phase, and
3. Exponential averaging constants

The parameters were varied approximately from 33% to about 300% of the values used in the results in [1], except for the averaging constants which were varied from 0.75 to 0.95. The following tables summarize the results obtained.

1. Load = 5 flows, Mobility = 10 ms/s

Epoch Timer		Guard Constant		Exp. Averaging Constants	
Value(s)	Throughput	Value	Throughput	Value	Throughput
0.3	670	0.08	669	0.75	675
0.5	667	0.10	652	0.85	692
1.0	648	0.12	655	0.95	670
1.3	673	0.15	673		

2. Load = 5 flows, Mobility = 20 m/s

Epoch Timer		Guard Constant		Exp. Averaging Constants	
Value(s)	Throughput	Value	Throughput	Value	Throughput
0.3	314	0.08	307	0.75	333
0.5	336	0.10	330	0.85	325
1.0	313	0.12	327	0.95	337
1.3	311	0.15	327		

3. Load = 15 flows, Mobility = 10 m/s

Epoch Timer		Guard Constant		Exp. Averaging Constants	
Value(s)	Throughput	Value	Throughput	Value	Throughput
0.3	356	0.08	364	0.75	355
0.5	361	0.10	360	0.85	352
1.0	362	0.12	344	0.95	360
1.3	355	0.15	350		

4. Load = 15 flows, Mobility = 20 m/s

Epoch Timer		Guard Constant		Exp. Averaging Constants	
Value(s)	Throughput	Value	Throughput	Value	Throughput
0.3	180	0.08	183	0.75	182
0.5	172	0.10	173	0.85	174
1.0	173	0.12	176	0.95	174
1.3	169	0.15	181		

Throughput Deviation Results:

	Epoch Timer (%)	Guard Constant (%)	Exp. Avg. Constant %)
5 flows, 10 m/s	± 4.8798	± 4.4634	± 4.7081
5 flows, 20 m/s	± 5.0806	± 4.4877	± 2.4944
15 flows, 10 m/s	± 1.5207	± 3.9607	± 1.6500
15 flows, 20 m/s	± 2.0156	± 1.9804	± 1.8856

In conclusion, it can be seen that the performance of ATP protocol is fairly robust to the parameters involved in its design, indicating a deviation of only about ± 5% of the values obtained in [1]. This can be attributed to the fact, that most of these constants, either directly or indirectly only change (increase or decrease) the time window of rate adaptation and hence do not significantly affect the long-term throughput of the ATP protocol.

References:

[1] "ATP: A Reliable Transport Protocol for Ad-hoc Networks", K. Sundaresan, V. Anantharaman, H.-Y. Hsieh and R. Sivakumar, in Proceedings of ACM Mobihoc, May 2003.