

A Stabilized Random Access Protocol for GPRS and UMTS

Jahangir H. SARKER

Information Technology Department
Espoo-Vantaa Institute of Technology
Espoo, Finland

jahangir.sarker@hut.fi, jahangir@evtek.fi

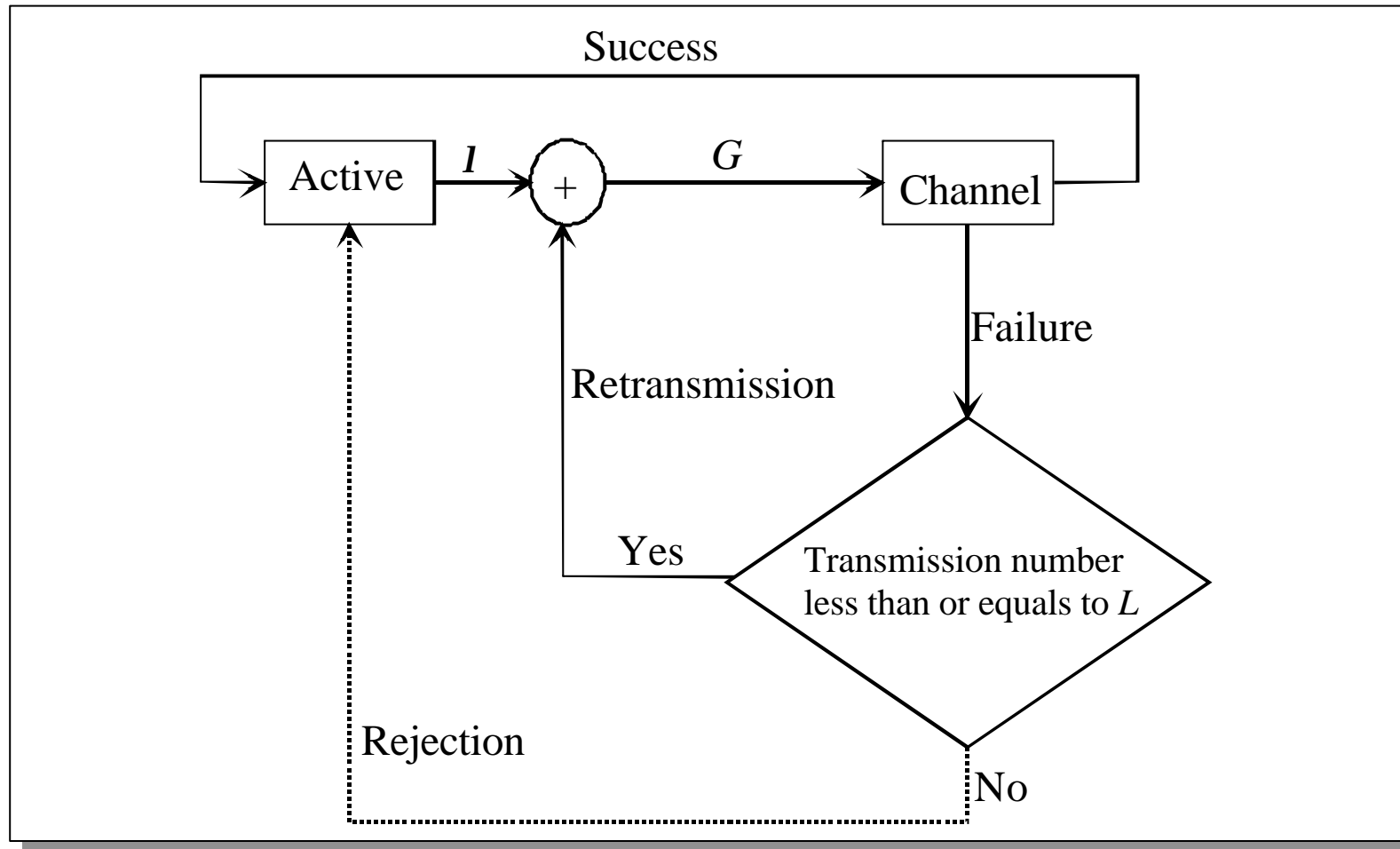
Objective of this paper

- A transmission policy is studied for the random access Slotted ALOHA channel in terms of number of transmissions and transmission probability.
- A stable operation of Slotted ALOHA can be achieved by reducing the transmission number for a specific limit of the new packet generation rate.
- This specific limit can be increased p times, where p is the transmission probability.
- Our results show that the control of transmission number is not needed if the new packet generation rate from all active users is less than $1/pe$ packet per time slot.

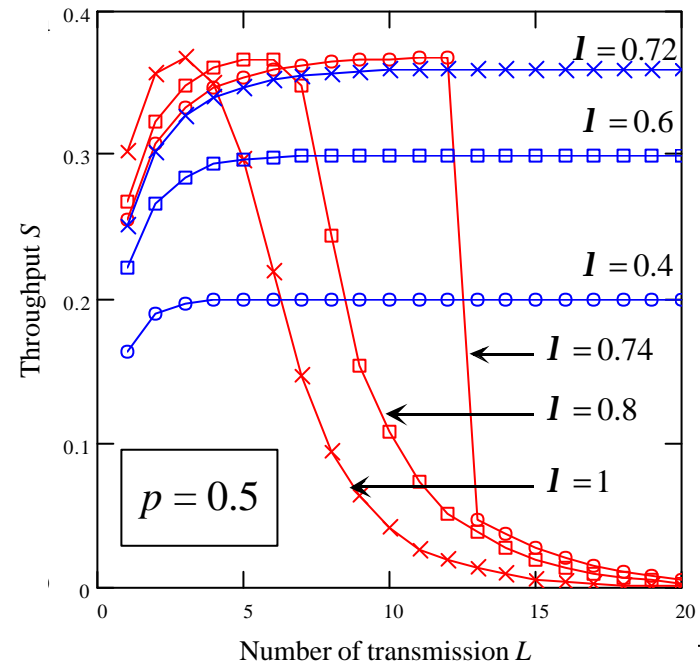
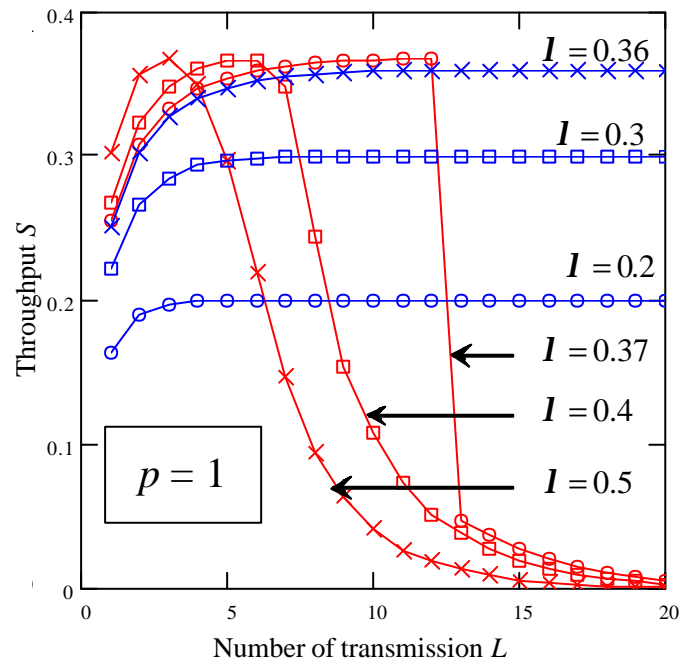
Some Applications of Transmission Number Cut-off policy

1. In the RACH of the Global System for Mobile Communications (GSM) [1].
2. In the wireless ATM [2].
3. In GPRS [3, 4]
4. More can be found in [5].

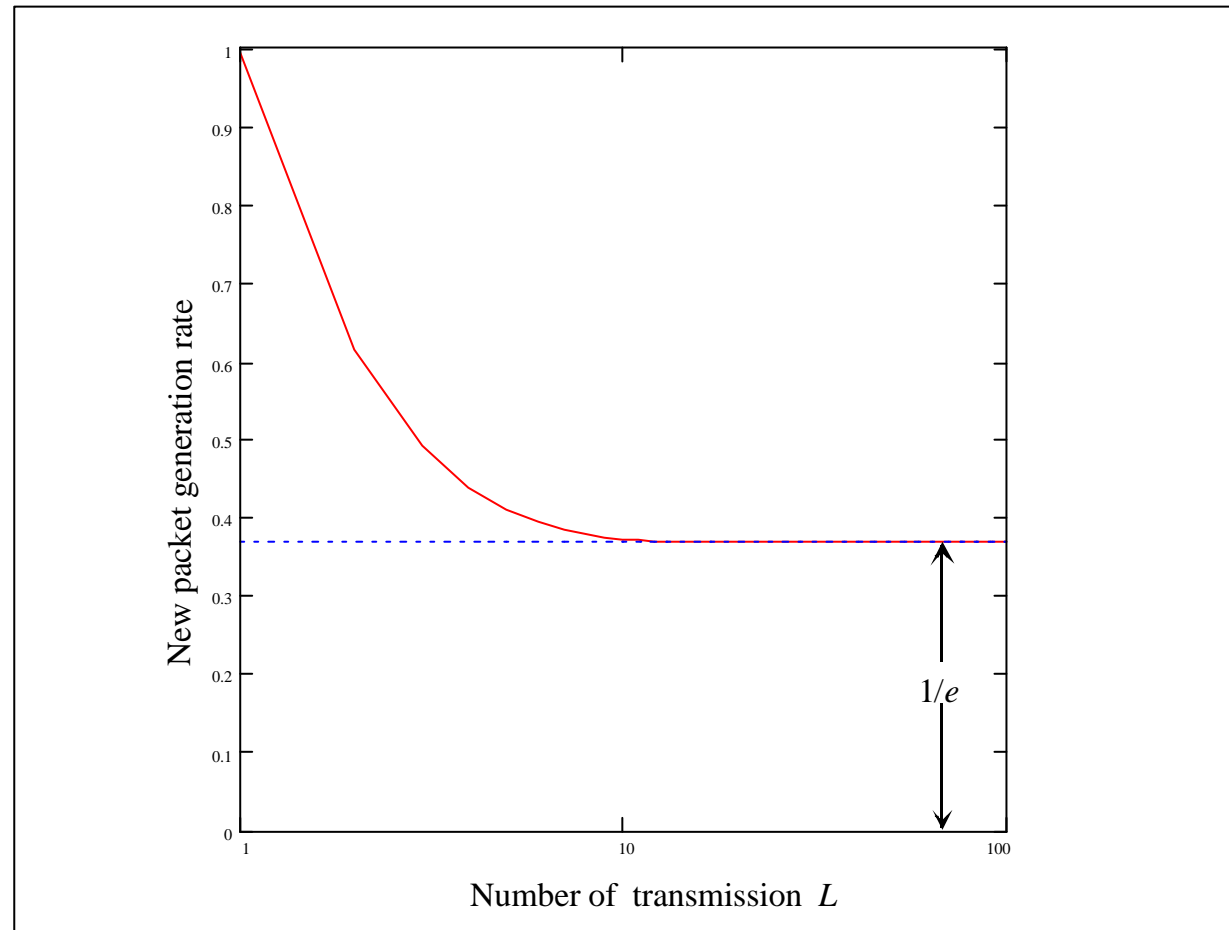
II. SYSTEM MODEL



IDEA BEHIND THE STABLE TRANSMISSION METHOD



III. THE STABILITY WITH INFINITE NUMBER OF TRANSMISSIONS



IV. PERFORMANCE ANALYSIS

A. Throughput

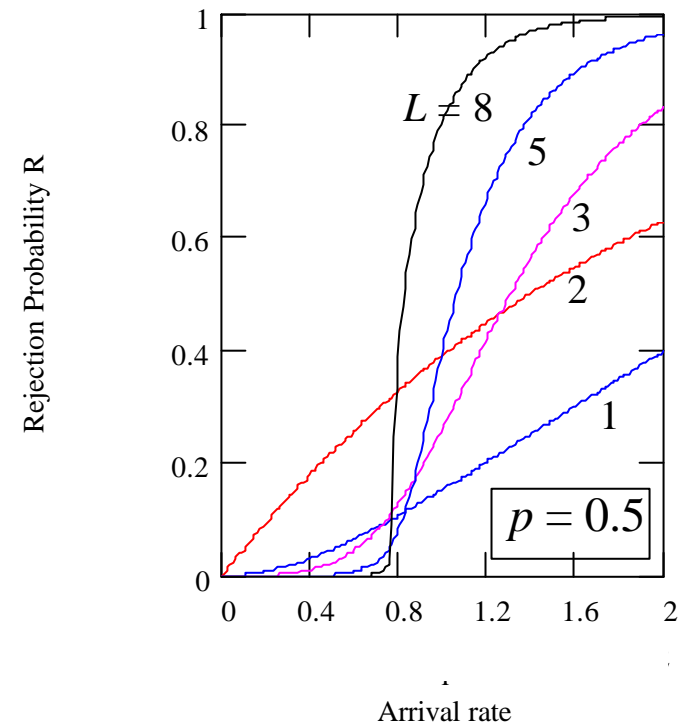
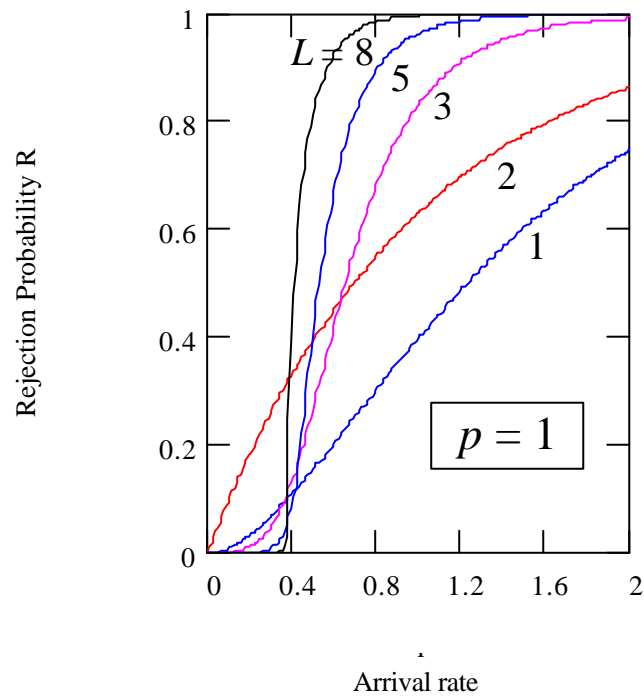
$$S = Ip \left[1 - \{1 - \exp(-G)\}^L \right]$$

$$G = \frac{Ip \left[1 - \{1 - \exp(-G)\}^L \right]}{\exp(-G)}$$

$$S = G \exp(-G)$$

IV. PERFORMANCE ANALYSIS

B. Packet Rejection Probability



V. CONCLUSIONS

- If the new packet generation rate from all active users is less than e^{-1} packet per time slot, the transmission number control is not needed.
- The number of transmission decreases abruptly with the increase of initial access rate, I , when its value is more than e^{-1} packet per time slot.
- Transmission probability reduction is another procedure for stable ALOHA operation.

VI. REFERENCES

- [1] M. Mouly and M.-B. Pautet, *The GSM system for mobile communications*, Published by authors, 1992.
- [2] M. Ivanovich and M. Zukerman, "A Study of Deadlock Models for a Multiservice Medium Access Protocol Employing a Slotted Signalling Channel," *IEEE/ACM Transactions on Networking*, Vol. 8, No. 6, December 2000.
- [3] 3GPP, TSG-RAN: 'MAC protocol specification', 3G TS 25.321 v3.4.0, June 2000.
- [4] 3GPP2, TSG-C: 'MAC standard for cdma2000 spread spectrum systems, release A - addendum I', 3GPP2 C.S003-A-1 v.1.0, September 2000.
- [5] J. H. Sarker and S. J. Halme, "The Prudence Transmission Method I (PTM I): A Retransmission Cut-Off Method for Contention Based Multiple Access Communication Systems", *VTC'97*, Phoenix, AZ, USA (May 4-7, 1997), pp. 397-401.
- [6] Sung Hyun Cho and Sung Han Park, Stabilised Random access Protocol for voice/data Integrated WCDMA System, *Electronics Letters*, 13th September 2001, Vol. 37, No. 19, pp. 1197-1199.

VII. QUESTIONS

