

New Efficient Protocols of Aggressive Packet Combining Scheme with Physical Level Representation for Better and Smooth data Transmission

Achyuth Sarkar, Swarnendu K. Chakraborty and C.T. Bhunia
Department of Computer Science and Technology (CSE), National Institute of Technology (NIT),
Arunachal Pradesh, India

Abstract: It's been a research challenge for scientists and researchers to reliably transport data from source to destination. Leung proposed an efficient scheme to tackle this problem known as Aggressive Packet Combining (APC). In literature, several modifications of APC have been proposed by Bhunia and recently by Chakraborty. APC also has several limitations which include low throughput. In this study, we have tried to analyze APC with physical level representation.

Key words: Packet combining scheme, aggressive packet combining scheme, bit shifting, physical level, several modifications, destination

INTRODUCTION

In order to reliably transmit information from source to destination in computer/ data communication networks, ARQ (Automatic Repeat Request) techniques have been used which is also found in literature. Basic techniques for the same included BEC (Backward Error Correction) and FEC (Forward Error Correction) (Liu *et al.*, 1997; Yue, 1996; Chakraborty *et al.*, 1998; Leung, 2000; Bhunia, 2005). Many studies (Sastri, 1975; Chakraborty *et al.*, 2013; Khumukcham *et al.*, 2015a, b; Goswami *et al.*, 2016) have established conclusively that BEC is more appropriate for wired transport whereas FEC is for wireless transmission. The packet combining scheme and its modifications that have got wide applications in variant BEC and FEC are elaborately studied elsewhere (Chakraborty *et al.*, 1998; Leung, 2000; Bhunia, 2005, 2010; Sastri, 1975; Chakraborty *et al.*, 2013; Khumukcham *et al.*, 2015a, b). Aggressive Packet Combining (APC) is an important modification of packet combining scheme (Chakraborty *et al.*, 1998). In this study, we have proposed and reviewed different schemes of APC with physical level representation and analyzed to get throughput of APC instead of logical bit recognitions of the packet.

REVIEW OF AGGRESSIVE PACKET COMBINING SCHEME

APC is a modified form of Packet Combining (PC) scheme and has found its applications in wireless networks. Here, three copies of packet are sent at a time

during transmission. At the receiver side all the three copies are received erroneously. Receiver then applies majority logic bit by bit on the received three erroneous copies. For example:

- Original copy: 01011000
- First copy: 01001000
- Second copy: 01011100
- Third copy: 01001000
- Majority logic: 01001000

After that, the receiver applies the error detection scheme to find out whether there is an error in the generated copy or not. In this case, as it is not correct, the receiver selects the least reliable bit from the majority logic. Here, in the given example the 4th and the 6th bit from left are the least reliable bit. After selecting the least reliable bit, the receiver applies brute force correction to the 4th and the 6th bit, followed by error detection.

PHYSICAL LEVEL REPRESENTATIONS OF DIFFERENT PROTOCOLS

Protocol 1: Suppose original data as "11101001" then physical level representation is: As per proposed new protocol, 1st and 3rd copy will be sent as it is between sender and receiver but 2nd copy will be sent as "10010111" (as per PRPC) moreover, assume that error places will be (-) error at 3rd place from MSB in 1st and 2nd copy and (+) error at 3rd place from MSB in 3rd copy in the environment of non-repeated error syndrome.

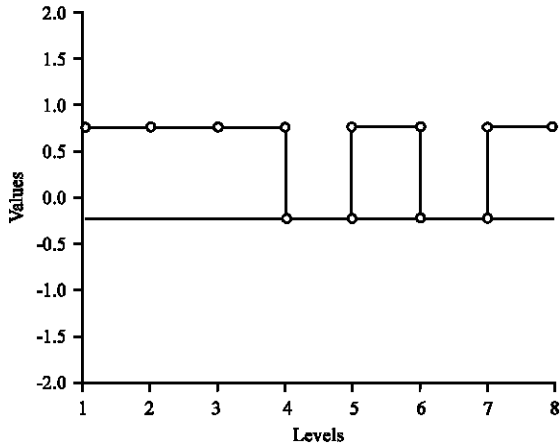


Fig. 1: Physical level representation of 11101001

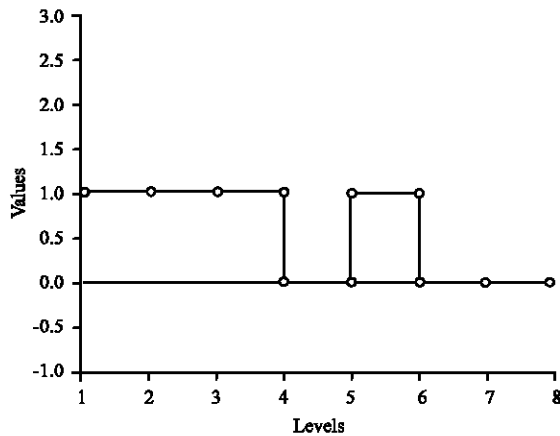


Fig. 2: Physical level representation of 10011110

At receiver end:

- 1 1 1 1 1 0 0 1
- 1 1 1 0 1 0 1 (Reverse of PRPC)
- 1 0 1 0 1 0 0 0
- 1 1 1 0 1 0 0 1 original data stream

Protocol 2: Another example, we like to draw in the environment of repeated error syndrome- suppose original data stream is “1 0 0 1 1 1 1 0” (Fig. 1 and 2) and we represent this data stream in physical level as:

Also, we are assuming that, we will be transferring 1st and 3rd copies as it is from sender to receiver and 2nd copy by shifting one bit circular right. In this transmission error places are (+) error in 3rd bit and (-) error in 5th bit from MSB.

At receiver end:

- 1 0 1 1 1 1 1 0
- 0 0 0 1 1 1 0 1 (one bit circular right shift)
- 1 0 1 1 1 1 1 0
- 1 0 1 1 1 1 1 0 unable to generate original packet

CONCLUSION

In this study, we have depicted physical level representation of different aggressive packet combining scheme theoretically. Numerical and simulation studies may carry out in future research.

REFERENCES

Bhunia, C.T., 2005. IT Network and Internet. New Age International Publishers, Delhi, India.

Bhunia, C.T., 2010. Modified aggressive packet combining scheme. Abdus Salam International Centre for Theoretical Physics, Trieste, Italy.

Chakraborty, S.K., R.S. Goswami, A. Bhunia and C.T. Bhunia, 2013. Two new modified schemes of aggressive packet combining schemes in achieving better throughput. Proceedings of the 2013 10th International Conference on Information Technology: New Generations (ITNG), April 15-17, 2013, IEEE, Las Vegas, Nevada, USA., ISBN: 978-0-7695-4967-5, pp: 729-730.

Chakraborty, S.S., E. Yli-Juuti and M. Liinajarja, 1998. An ARQ scheme with packet combining. IEEE. Commun. Lett., 2: 200-202.

Goswami, A., Y. Saring and C.T. Bhunia, 2016. Aggressive packet combining scheme in multipath routing to achieve higher throughput and error correction rates. Intl. J. Electr. Electron. Data Commun. IJEEDC., 4: 26-30.

Khumukcham, R., A. Goswami and Y. Saring, 2015a. Combined APC-PC scheme for random and time varying channels. Proceedings of the 2015 International Conference on Communications and Signal Processing (ICCSP), April 2-4, 2015, IEEE, Melmaruvathur, India, ISBN:978-1-4799-8081-9, pp: 0358-0360.

Khumukcham, R., A. Goswami and Y. Saring, 2015b. Four new protocols for achieving better correction capability of APC Scheme. Proceedings of the 2015 International Conference on Communications and Signal Processing (ICCSP), April 2-4, 2015, IEEE, Melmaruvathur, India, ISBN:978-1-4799-8081-9, pp: 0741-0745.

Leung, Y.W., 2000. Aggressive packet combining for error control in wireless networks. IEICE. Trans. Commun., 83: 380-385.

Liu, H., H. Ma, M. El Zarki and S. Gupta, 1997. Error control schemes for networks: An overview. Mobile Networks Appl., 2: 167-182.

Sastry, A., 1975. Improving Automatic Repeat-Request (ARQ) performance on satellite channels under high error rate conditions. IEEE. Trans. Commun., 23: 436-439.

Yue, O.C., 1996. Design trade-offs in cellular-PCS systems. IEEE. Commun. Mag., 34: 146-152.