Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [Resolution to Comment ID # 401 on FCS]
Date Submitted: [25 August 2008]
Source: [M.A. Rahman, R. Funada, T. Baykas, C.S Sum, J. Wang, H. Harada, S. Kato]
Company [NICT]
Address [3-4, Hikarino-oka, Yokosuka, 239-0847, Japan]
Voice: [+81-46-847-5060], FAX: [+81-46-847-5089], E-Mail: [aziz@nict.go.jp]
Re: []

Abstract: [Resolution to Comment ID # 401 on FCS]

Purpose: [802.15.3c contribution]

Resolution to Comment ID # 401 on FCS

Resolution to Comment # 401

- Comment
  - FCS does not appear to be defined for the SC PHY mode. Furthermore, do we believe that a single 32 bit FCS is sufficient for a 1 megabyte frame?
  - Add an appropriate FCS definition.
- Proposed Resolution
  - FCS is already defined in 802.15.3. A 32 bit FCS is sufficient for 1 MB payload.

Present 15.3c Packet Structure

Data 0-1MB(8388608 bits)	FCS 32 bits

IEEE 802.3 CRC-32 Generator Polynomial:

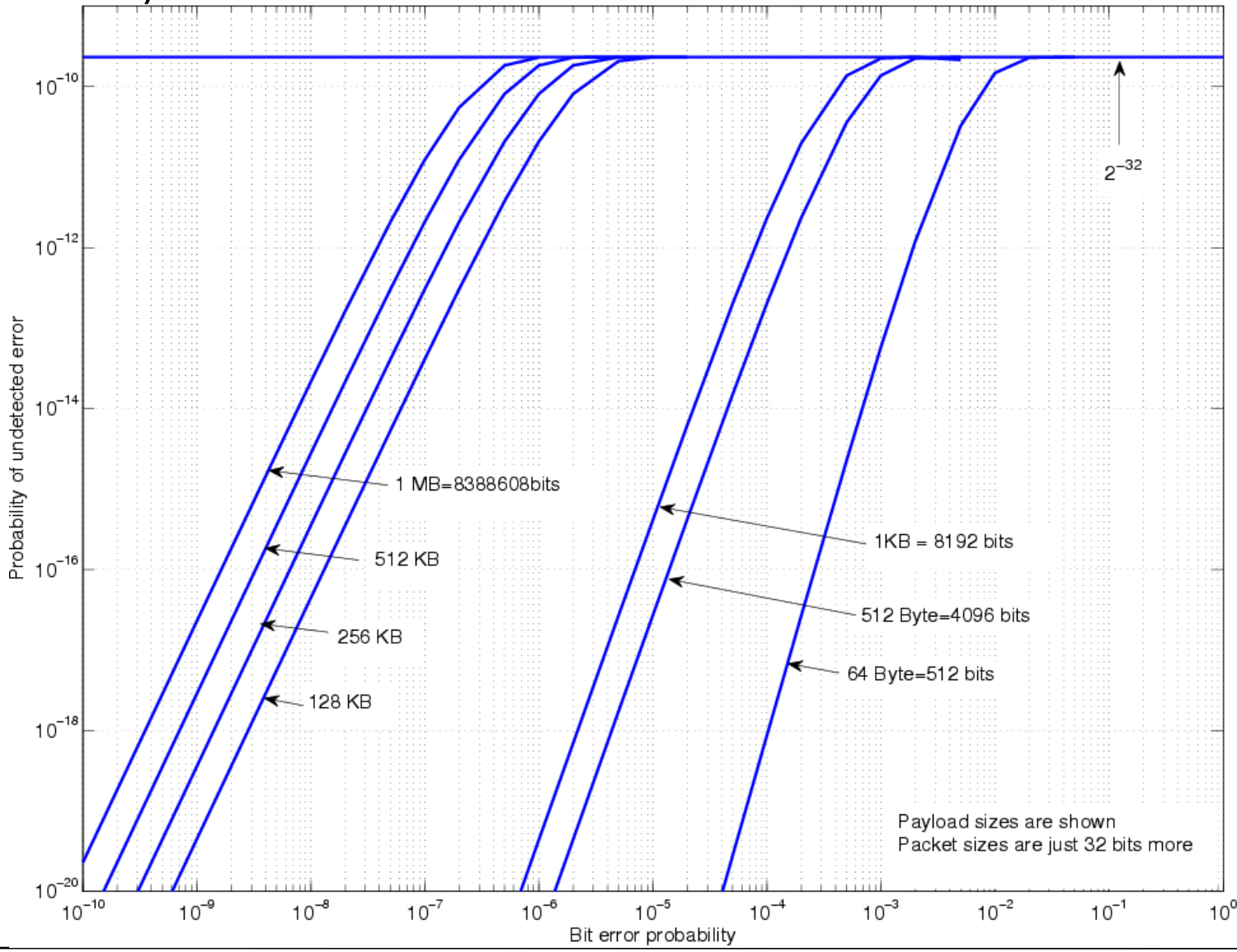
X^32+*x*^26 +*x*^23+*x*^22+*x*^16+*x*^12+*x*^11+*x*^10+*x*^8+*x*^7+*x*^5+*x*^4+*x*^2+*x*+1

IEEE 802.3 CRC 32 Facts

- FCS uses IEEE 802.3 CRC 32, which uses an irreducible polynomial of order 32
- This can detect all one bit errors, two bit errors and single burst errors of length up to 32 bits
- The upper bound of probability of undetected error

  (Pue) = 2^-32 = 2.3283E-10
- The minimum distance of the code dmin for 1 MB = 1048576 octets = 8.388608E-6 bits payload (packet size n =8.388608E-6 + 32 bits) is 3

Analytical Results on IEEE 802 CRC-32



Using eq. (30) or ref. [1]

References

1. J. K. Wolf, A. M. Michelson and A. H. Levesque, “On the probability of undetected error for linear block codes,” IEEE Trans. Comm., vol. 30, no. 2, pp. 317-324, Feb. 1992.
2. T. Fujiwara, T. Kasami and S. Lin, “Error detecting capabilities of the shortened Hamming codes adopted for error error detection in IEEE standard 802.3,” IEEE Trans. Comm., vol. 37, no. 9, pp. 986-989, Sept. 1989.
3. R. Jain, “Error characteristics of fiber distributed data interface (FDDI),” IEEE Trans. Comm., vol. 38, no. 8, pp. 1244-1252, Aug. 1990.
4. G. Castagnoli, S. Brauer abd M. Herrmann, “Optimization of cyclic redundancy-check codes with 24 and 32 parity bits,” IEEE Trans. Comm., vol. 41, no. 6, pp. 883-892, Jun. 1993.
5. G. Castagnoli, J. Ganz and P. Graber, “Optimum cyclic redundancy-check codes with 16 bit redundancy,” vol. 38, no. 1, pp. 111-114, Jan. 1990.

Previous results on IEEE 802 CRC-32

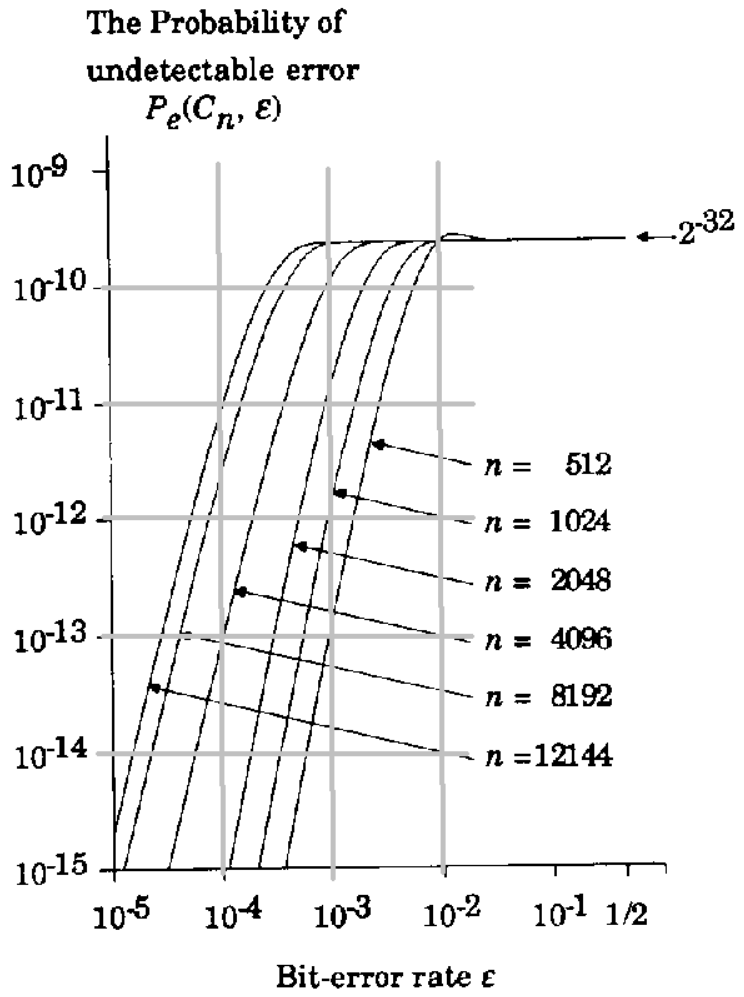


Fig. 1. The probability that a received vector contains an undetectable error pattern, denoted $P_e(C_n, \epsilon)$, for a binary symmetric channel with bit-error rate ϵ.

Exact results from ref. [2]

n is the packet length