Modeling and Simulation of Discretized Data Transmission in Very High-Speed Digital Subscriber Line

Embedded Software Systems

Literature Survey

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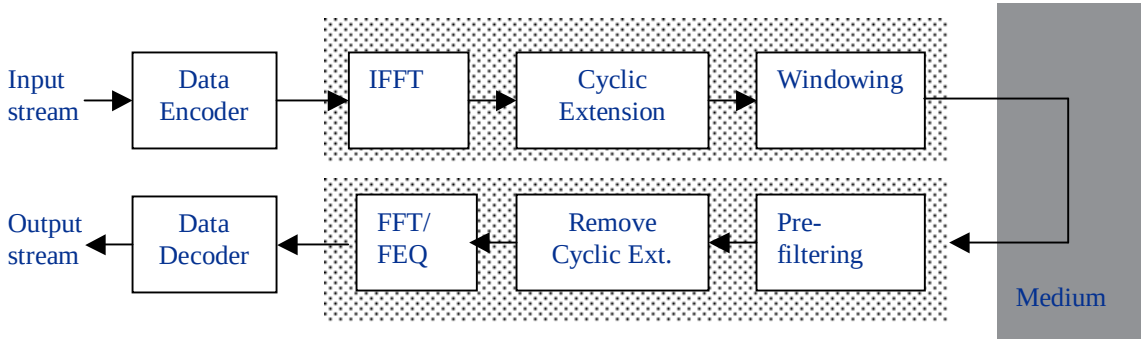
Very High-Speed Digital Subscriber Line (VDSL)

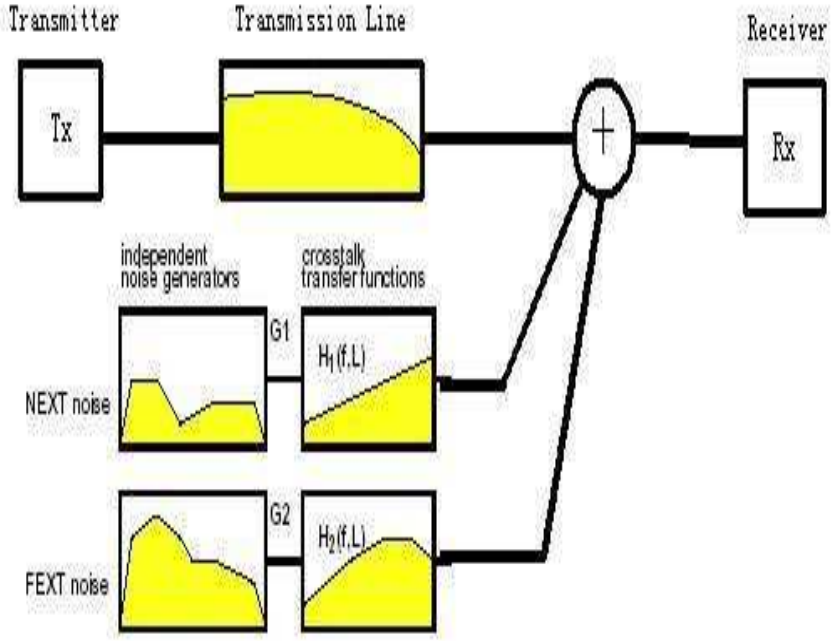


- Data Encoder/Decoder: Quadrature Amplitude Modulation (QAM)
- Discrete Multitone (DMT): Using IFFT/FFT to generate orthogonal channels for optimal bit allocation [Chow91, 95]
- Cyclic Extension and Windowing: Intersymbol interference mitigation, alignment of symbols, suppression of sidelobes [ETSI99, 01]

VDSL Transmission Environment

- Channel Modeling: *linemod* program from Stanford University
  - Model channel as a FIR filter
- Noise Modeling:

  A two-term Gaussian mixture model [Dai01]
  - Include both the crosstalks and impulse noise



Proposed Work

- Model VDSL transceiver and the channel in Synchronous Dataflow (SDF)
  - Bit processing communication systems are best modeled by SDF
- Main open issue: Optimization of the transceiver design
  - Use Advanced Design System (ADS) software from Agilent to simulate the system and evaluate the bit error rate performance

References

- [Chow91] Chow, J.S., Tu, J.C., Cioffi, J.M., “A discrete multitone transceiver system for HDSL applications,” *IEEE Journal on Selected Areas in Communications*, Volume 9, Issue 6, pp. 895 –908, Aug. 1991.
- [Chow95] Chow, P.S., Cioffi, J.M., Bingham, J.A.C., “A practical discrete multitone transceiver loading algorithm for data transmission over spectrally shaped channels,” *IEEE Transactions on Communications*, Volume 43, Issue 2 Part: 3, pp. 773 –775, Feb.-March-April 1995.
- [Dai01] Dai, H., Poor, H.V., “Crosstalk mitigation in DMT VDSL with impulse noise,” *IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications*, Volume 48, Issue 10, pp. 1205-1213, Oct. 2001.
- [ETSI99] “Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Very high speed Digital Subscriber Line (VDSL); Part 1: Functional requirements,” *ETSI TS 101 270-1 V1.2.1* (1999-10).
- [ETSI01] “Transmission and Multiplexing (TM); Access transmission systems on metallic access cables; Very high speed Digital Subscriber Line (VDSL); Part 2: Transceiver specification,” *ETSI TS 101 270-2 V1.1.1* (2001-02).