

Wireless Data Network Traffic

Measurement, Analysis and Simulation

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Long-range dependence (LRD) has been shown in

- Ethernet Local Area Network traffic
- Wide Area Network traffic
- Variable Bit Rate video traffic over ATM networks
- World Wide Web traffic

Users experience poor performance due to incorrect assumptions in designing and provisioning data networks.

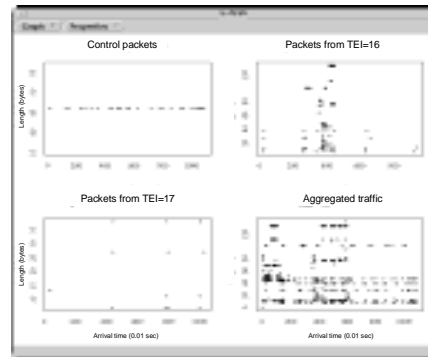


Traffic generated by new services (voice, data, image and video) available in current data networks differs from traffic patterns observed in circuit switched voice networks.

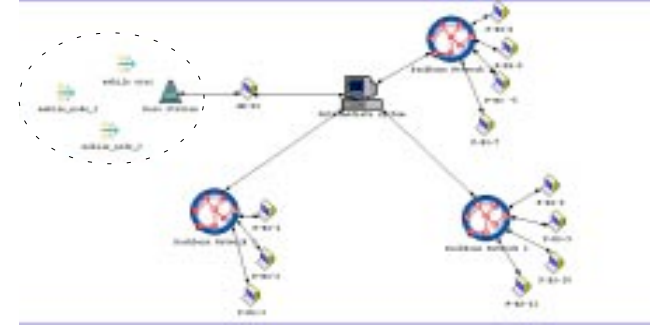
These new services require new traffic models that are different from traditional Poisson models used for modeling voice traffic.

Does the traffic in wireless data networks exhibit LRD behavior?

The result of our measurements: packet arrival process from each M-ES and the aggregated arrival process at the mobile data base station (MDBS)

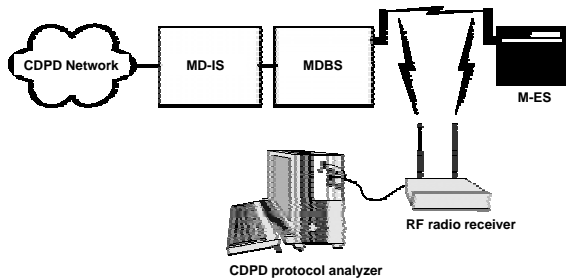


OPNET model of simulated BC Tel Mobility wireless network



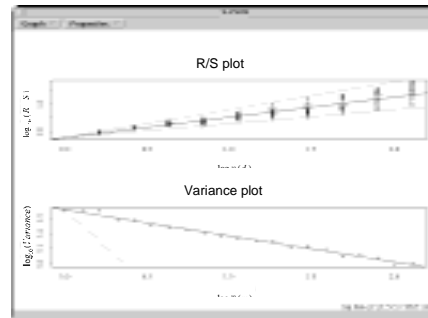
- trace driven simulation
- ATM backbone network

Measurement



- cellular digital packet data (CDPD) network traffic
- measurement of the traffic to one base station
- duration: 30 minutes
- 10 mobile end systems (M-ES)

Analysis



LRD is implied by Hurst parameter: $0.5 < H < 1$

- R/S plot of our traces indicates that $H = 0.8$
- Variance-time plot of our traces indicates that $H = 0.9$

Conclusions:

- traditional traffic models are not adequate for wireless data networks
- new traffic models should capture
 - long range dependency
 - heavy-tailed distributions
 - fractal nature
- there is no substitute for using genuine traffic traces in simulations of network performance
- accurate traffic models are essential for engineering, control, and performance analysis of wireless data networks

References:

- W. E. Leland, M. S. Taqqu, W. Willinger, and D. V. Wilson, "On the self-similar nature of Ethernet traffic (extended version)," *IEEE/ACM Trans. on Networking*, vol. 2, no. 1, Feb. 1994.
- M. E. Crovella and A. Bestavros, "Self-similarity in World Wide Web traffic: evidence and possible causes," *IEEE/ACM Trans on Networking*, vol. 5 no. 6, Dec. 1997.
- B. B. Mandelbrot and M. S. Taqqu, "Robust R/S analysis of long run serial correlation," *42nd Session of the International Statistical Institute*, Manila, Dec. 1979, pp. 1-37.
- OPNET Documentation V.5.1.D, MIL3 Inc., Washington D.C.

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