A METHOD FOR MODELING SELF-SIMILAR TRAFFIC BASED ON EMPIRICAL DATA

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This paper proposes a method for modeling self-similar traffic based on empirical data, enabling accurate reproduction of typical network load characteristics for further analysis and optimization of Quality of Service (QoS) control mechanisms in telecommunication networks.

Modern telecommunication traffic exhibits self-similarity, significantly affecting the performance of queueing mechanisms and resource allocation strategies [1]. Most classical models rely on Poisson assumptions, which fail to reflect the long-range dependence and burstiness observed in real traffic flows [2].

To develop a traffic modeling method that reflects self-similar properties based on the statistical analysis of real network data, aimed at use in simulating data transmission systems under realistic load conditions.

Main Contributions.

1. Empirical traffic data was collected from real-world IP network segments and analyzed using statistical tools.

2. Self-similarity was assessed using fractal analysis techniques, particularly the estimation of the Hurst parameter via R/S analysis and periodogram methods.

3. A traffic generation method was proposed, utilizing Fractional Gaussian Noise (FGN) and enhanced ON/OFF models with Pareto-distributed active and idle periods.

4. A comparative analysis between synthetic and empirical traffic was conducted using histograms, autocorrelation functions, and spectral density comparisons.

5. Statistical validation confirmed the model's accuracy, highlighting its potential for application in simulation-based studies on QoS mechanisms, traffic shaping, and capacity planning.

The developed method allows for realistic generation of self-similar traffic patterns, replicating key empirical properties. It is suitable for use in the design and evaluation of next-generation telecommunication systems that require precise modeling of bursty and long-range dependent traffic.

Keywords: self-similarity, network traffic, modeling, Hurst parameter, ON/OFF model, QoS.

References:

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