

MODEL OF HETEROGENEOUS TRAFFIC IN INFOCOMMUNICATION NETWORKS

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Modern infocommunication networks support a wide range of services with diverse Quality of Service (QoS) requirements. This diversity necessitates a traffic modeling approach that considers heterogeneity in both temporal and spatial characteristics. This paper proposes a hybrid analytical model for heterogeneous network traffic, enabling performance assessment and efficient resource management.

With the increasing proliferation of real-time applications (e.g., VoIP, video conferencing), cloud services, and the Internet of Things (IoT), networks are required to handle heterogeneous traffic with varying behavior patterns and QoS demands. Traditional homogeneous models such as Poisson processes fail to capture long-range dependencies and burstiness inherent in modern network traffic [1,3].

The proposed model integrates self-similar traffic characteristics with multi-class queuing systems. Self-similar sources, such as video and VoIP traffic, are modeled using heavy-tailed distributions (e.g., Pareto, Weibull), based on empirical findings. Background traffic is modeled using Poisson or Markov-modulated Poisson processes. The resulting system is represented as a multi-priority queueing model, which allows class differentiation based on delay sensitivity and resource demands [2].

Simulation and analytical evaluations demonstrate that the model provides accurate estimation of average delay, packet loss probability, and bandwidth utilization for each traffic class. The comparative analysis with classical single-class models shows the superior accuracy and adaptability of the heterogeneous approach in dynamic network environments.

The presented model serves as a practical tool for network designers and operators to assess and ensure QoS under traffic heterogeneity. It supports network planning, resource allocation, and dynamic prioritization strategies.

Keywords: heterogeneous traffic, QoS, traffic modeling, self-similar processes, infocommunication networks.

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