

# Queueing networks with time varying rates for modeling call centers

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## **Abstract**

Markovian service networks are a family of stochastic processes inspired by the study of call centers. They model many important features of these systems such as multiple servers, abandonment, preemptive and dynamic priorities, network routing due to service completions as well as service abandonments, and time varying customer traffic.

These stochastic networks can be scaled in a natural way that yields both fluid and diffusion limits. The fluid limits are defined by dynamical systems. In most cases, the diffusion limits are Gaussian process whose mean and covariance matrices are also defined by dynamical systems. In both cases these dynamical systems are a low-dimensional family of differential equations. This dimension is based only on the number of network nodes and is independent of the number of servers at each node.

We discuss these results and use the fluid and diffusion approximation models to analyze specific multi-server queueing systems that are relevant to call centers.