Elmira Yu. Kalimulina (MSU & IITP RAS, Moscow, Russia). Ergodicity problem of some Jackson networks governed by a random graph.

The talk discusses a modification of an open queuing network, which assumes the following conditions are met: – an open Jackson network consists of N nodes; – Poisson arrival flow with parameter $\Lambda > 0$ and at nodes λ_i, $i = 0, 1, ...N$; – exponential service times at nodes with parameters μ_i; – `FIFO` service; – the structure is defined by an oriented graph $G(t) = (V, E)$, each node is subject to failure and recovery with some intensities η_i and ν_i, and $R = \{r_{ij}\}, i, j = 0, ...N$ is the routing matrix. The network process $\xi = (\xi(t), t \geq 0)$ is defined by the following infinitesimal generator:

$$\begin{aligned}\mathbf{Q}f(\mathbf{n}) = &\sum_{i=1}^{N}\sum_{j=1}^{N}(f(T_{0j}\mathbf{n}) - f(\mathbf{n}))\lambda_i r_{ij} + \sum_{i=1}^{N}\sum_{j=1}^{N}(f(T_{ij}\mathbf{n}) - f(\mathbf{n}))\mu_i(n_i)r_{ij} + \\ &\sum_{k\in G^+}(f(T_k\mathbf{n}) - f(\mathbf{n}))\eta_k + \sum_{k\in G\setminus G^+}(f(T_k\mathbf{n}) - f(\mathbf{n}))\nu_k + \\ &+\sum_{i=1}^{N}(f(T_{i0}\mathbf{n}) - f(\mathbf{n}))\mu_i(n_i)r_{i0}.\end{aligned}$$

Theorem 1. For network process with rerouting $\xi(t)$, that has an infinitesimal generator (suppose bounded) $\mathbf{Q}$, minimal service intensity $\min_i \mu_i > 0$, and assumptions satisfying the conditions of regularity , the spectral gap $\mathrm{Gap}(\mathbf{Q}) > 0$ iff for each $i = 1, \dots, N$, the corresponding queuing process with intensities λ_i and $\mu_i(n_i)$ has $Gap_i(\mathbf{Q}_i) > 0$.

Theorem 2. For the network queuing process $\xi(t)$ with bounded infinitesimal generator $\mathbf{Q}$, and minimal service intensity $\min_i \mu_i > 0$, $X(t)$ satisfying the regularity condition, the spectral gap $Gap(\mathbf{Q}) > 0$ iff for each $i = 1, \dots, N$, distribution $\pi = (\pi_i), i \geq 0$ is strongly light-tailed, i.e. $\inf_k \frac{\pi_i(k)}{\sum_{j>k} \pi_i(j)} > 0$.