Modeling Finite-Source Retrial Queueing Systems with Unreliable Heterogeneous Servers and Different Service Policies Using MOSEL

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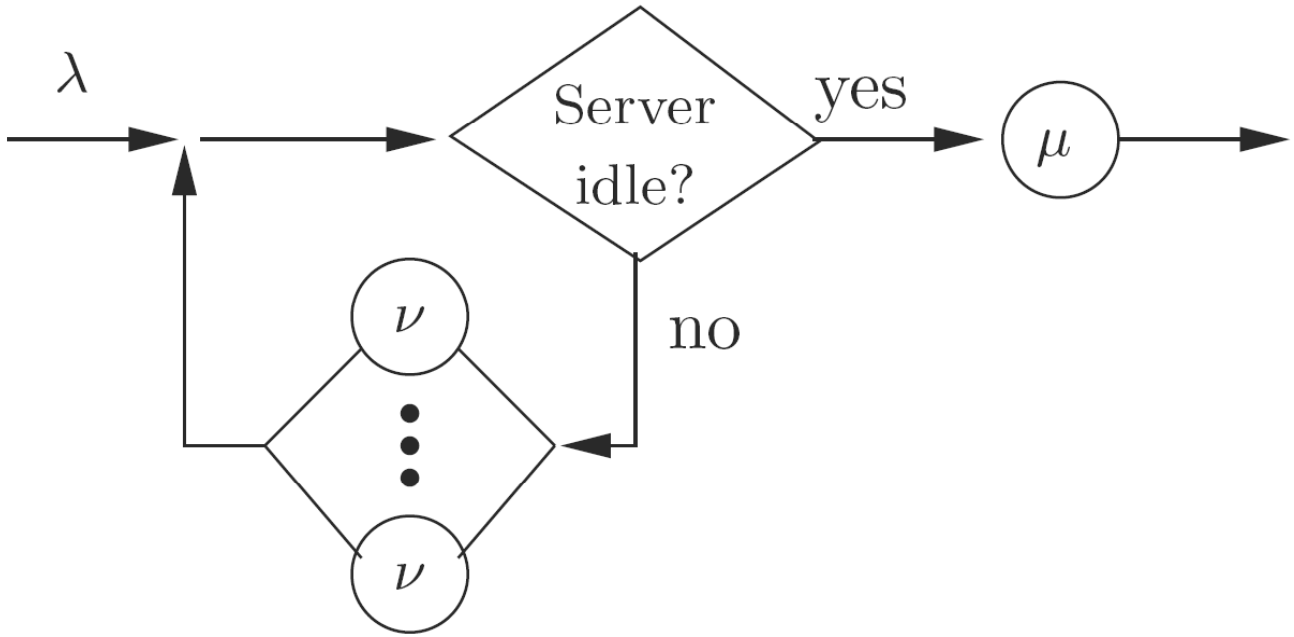
Overview

1. Basic Retrial Queueing System
2. More General Model
3. Performance Measures
4. Numerical Results
5. Conclusion and Future Work

1. Retrial Queueing Systems

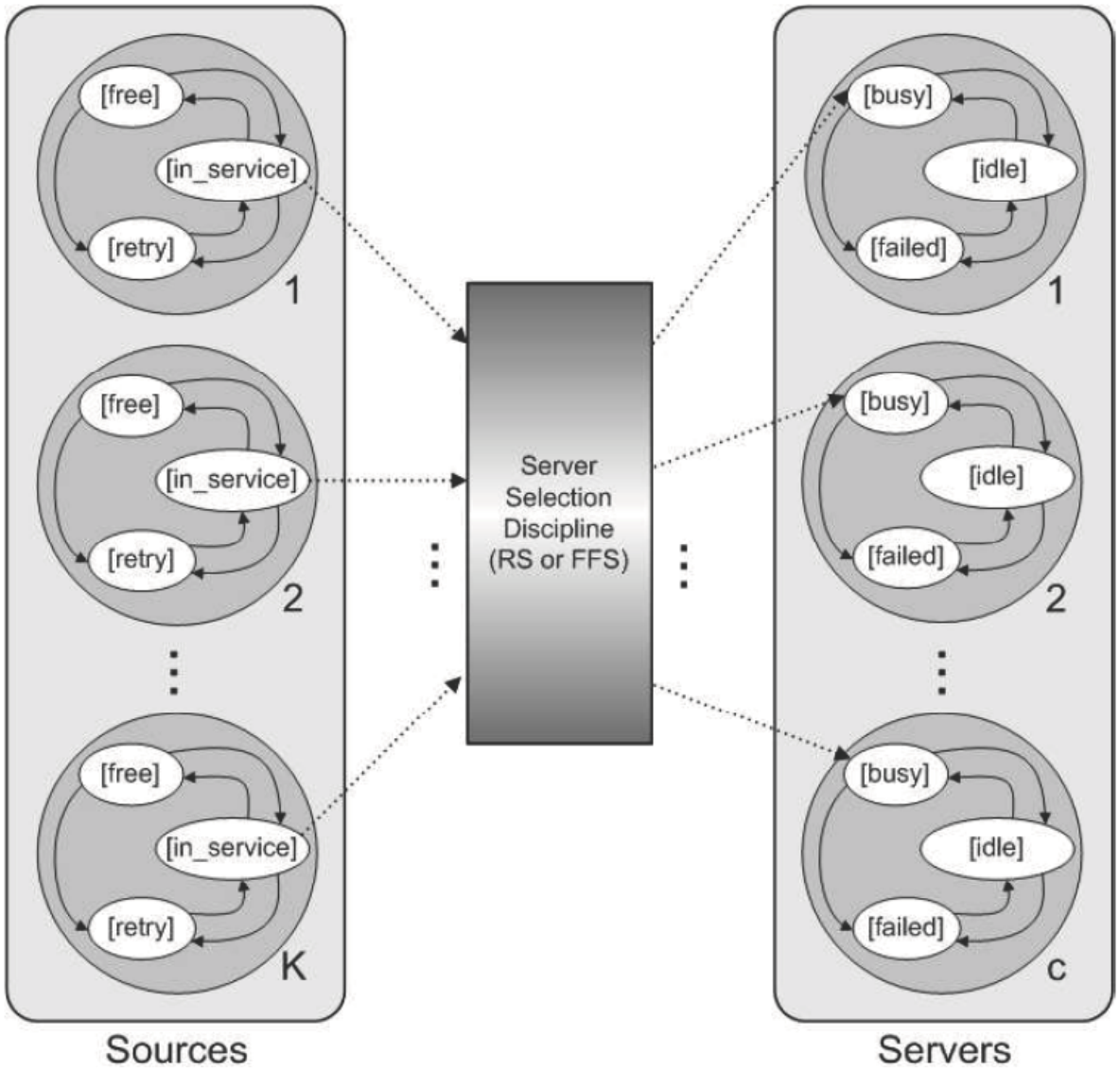
- Example: M/M/1 Retrial Queueing System



2. More General Model

- Finite Source
- Multiple Servers
- Heterogeneous Servers
- Service Selection Policies:
  - Random Selection (RS)
  - Fastest Free Server (FFS)
- Unreliable Servers

2. More General Model



2. More General Model

- Involved times are assumed to be
  - exponentially distributed,
  - mutually independent.
- Finite number of jobs.
- → Steady-state analysis of CTMC:

$$X(t) = (\alpha_1(t), \ldots, \alpha_c(t); N(t))$$

- $\alpha_k(t) = \begin{cases} -1 & \text{(server } k \text{ is failed)}, \\ 0 & \text{(server } k \text{ is up and idle)}, \\ 1 & \text{(server } k \text{ is up and busy)}, \end{cases}$
  - k=1,…,c,
  - N(t) $\leq$ K: Number of retrying sources.

3. Performance Measures

- Mean number of retrying sources:

$$N = E[N(\infty)] \quad = \sum_{s_1,\ldots,s_c} \sum_{j=1}^{K^*} jP(s_1,\ldots,s_c,j).$$

- Utilization of server k=1,…,c:

$$U_k = \sum_{s_1,\ldots,s_c,s_k=1} \sum_{j=0}^{K^*} P(s_1,\ldots,s_c,j)$$

- Mean number of busy servers:

$$C = E[C(\infty)] = \sum_{k=1}^{c} U_k.$$

3. Performance Measures

- Mean number of jobs in process (retrying and in service):

$$M = E[N(\infty) + C(\infty)] = N + C.$$

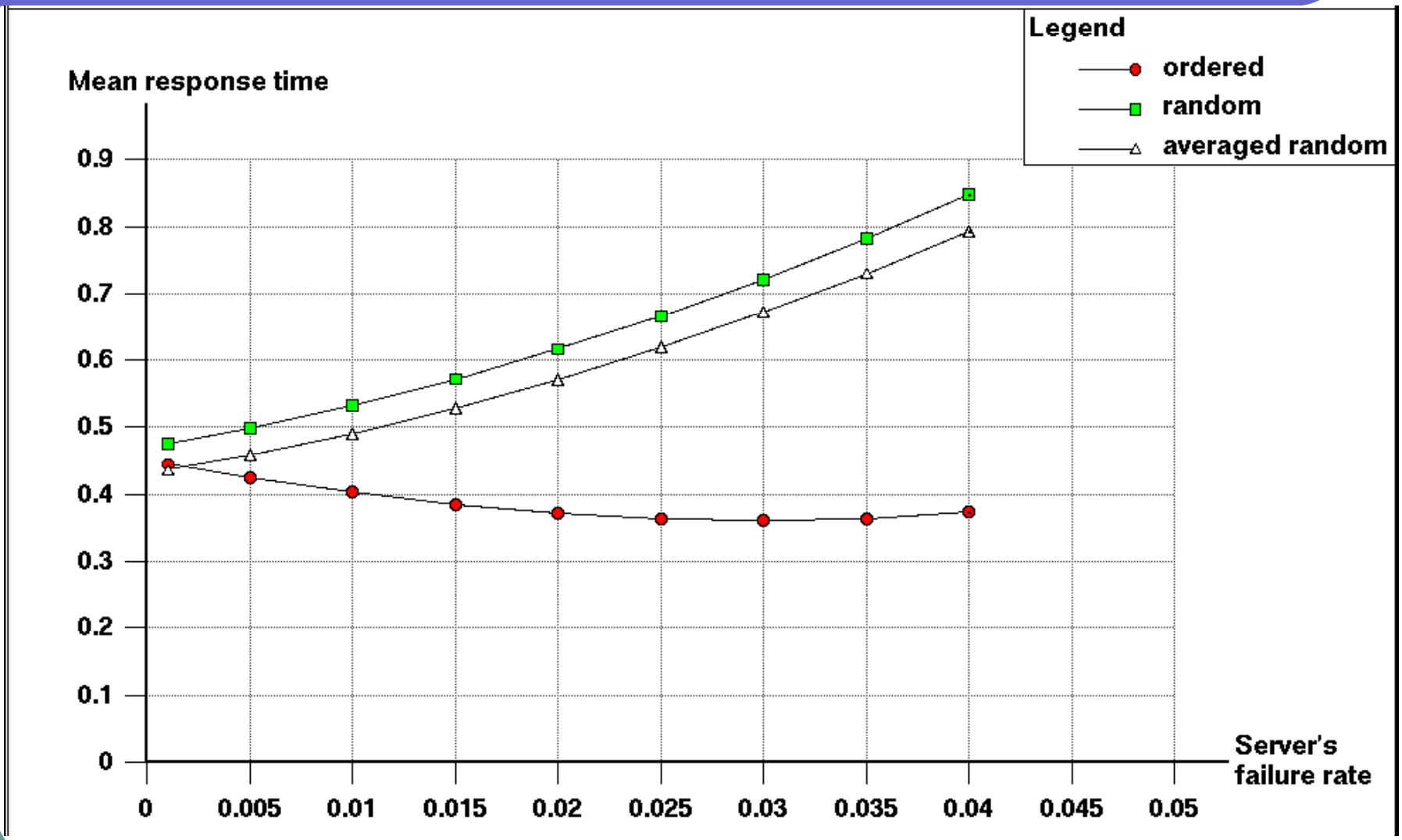
- Mean generation rate of primary calls:

$$\overline{\lambda} = \lambda E[K - C(\infty) - N(\infty)]$$

- Mean response time:

$$E[T] = M/\overline{\lambda}.$$

4. Numerical Results



5. Conclusion & Future Work

- Conclusion
  - Study of finite-source retrial queueing systems with unreliable heterogeneous servers under different service selection disciplines.
  - Implementation and evaluation of the model using MOSEL.
- Next Step:
  - Studying the effect of non-exponentially distributed service and retrial times using MOSEL2.