Analysis and performance evaluation of Kitting Processes

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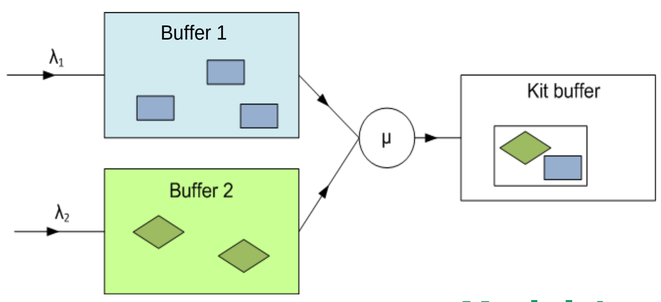
Kitting Process

- Strategy for supplying materials to an assembly line.
- The parts necessary for assembly are collected into a container or kit, prior to arriving at an assembly unit.

Kitting Models

Three Markovian queues models for kitting processes with two parts.

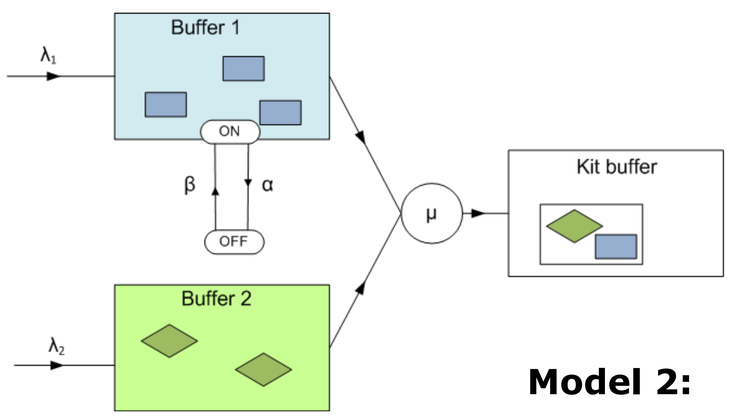
Two equal and indepentent **Poisson Processes.**



Model 1:

« Efficient production »

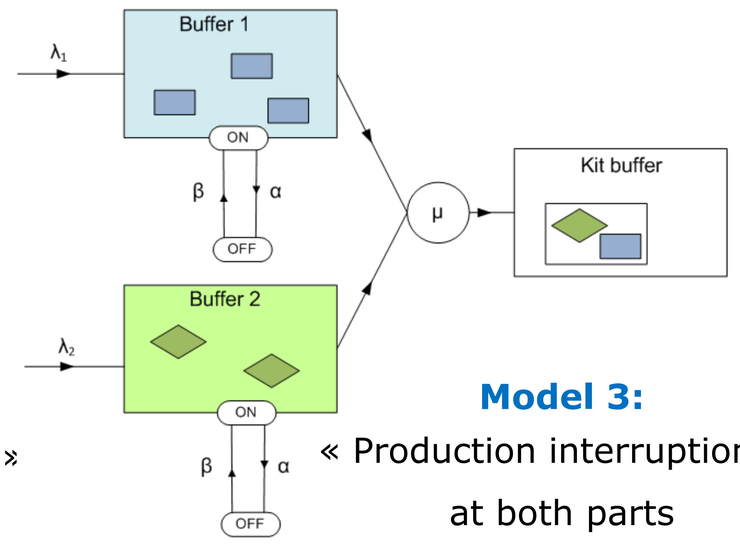
Arrivals of part 1: **Interrupted Poisson Process**,
Arrivals of part 2: **Poisson Process.**



Model 2:

« Production interruptions » at part 1

Two equal and indepentent **Interrupted Poisson Processes.**

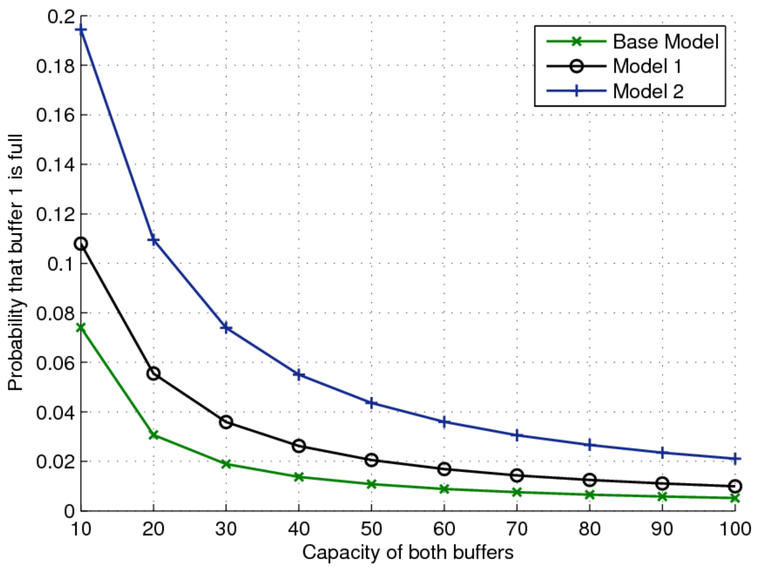


Model 3:

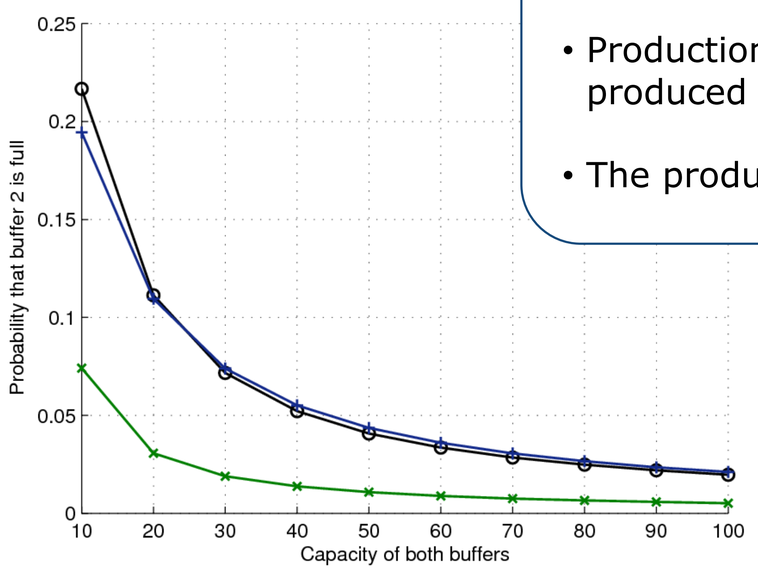
« Production interruptions » at both parts

Numerical Examples: Probability that buffer 1 and 2 are full

Buffer 1



Buffer 2



Parameters

- All Models → 80 % load.
- Production interruptions → on average 10 kits can be produced during a production period of 10.
- The production is interrupted 40 % of the time.

Methodology

Sparse matrix technique

Solution for the « state space explosion problem » due to multidimensionality of the state space (2 buffers).

- Sparse generator matrix
- Use of the GMRES Method (General Minimal Residual Method) to solve the balance equations.

Results

- The larger the capacity, the smaller the probability that the buffer is full.
- Interruptions in the production of part 1 have a greater impact on the buffer 2 than on its own buffer (buffer 1).
- Adding production interruptions for part 2 doesn't have a significant impact on the probability for buffer 2 but does for buffer 1.

Future research

- Expansion of the models to more than 2 parts.
- Calculation of other performance measures such as kit earliness or tardiness.
- Integration of kitting in a production process.
- Cost calculation of the process.