

# Productionline (PL-Model)

## 1 General Description of the Productionline

A production line of a manufacturing plant consists of  $N$  service queues arranged in a row, that is, parts leaving a queue after service are immediately transferred to the next queue (see Figure 1). All queues have a finite capacity  $K$ . Arrivals of parts to the first queue occur according to a Poisson process with rate  $\lambda$ . For subsequent queues we assume arriving parts to get lost if the queue buffer is occupied. Each queue comprises a single server with first-come, first-served (FCFS) service discipline and exponentially distributed service time. The throughput of the Productionline can be easily measured as the throughput of machine  $n$ .

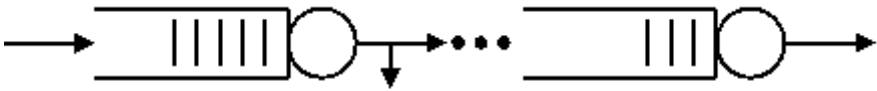


Figure 1: Class based queuing model

## 2 Description of the model

Though the productionline is defined as a model with a variable number  $N$  of service queues, a separate petrinet model for each number of machines has to be created. Figures 2 and 3 represent productionlines with  $N = 2$  and  $N = 3$ . Each service queue has its own number and the names of all components of a service queue end with this number. Therefore a general description of the model which was given in the previous chapter and the description of one service queue provides all information needed.

New tokens arrive at the place  $Parts?$  either from the external storage  $External$  or the previous queue. Note that the  $?$  stands for the number of the queue. If the place  $FreeBuffers?$  is not empty the new token is moved into the queue  $Queue?$  otherwise it is rejected and moved back to the external storage  $External$ . If the machine is currently idle which means place  $ToServe?$  is empty a token is moved from the queue  $Queue?$  to the place  $ToServe?$ . When the token in place  $ToServe?$  is served by transition  $service?$  it is moved either to the next queue or the production is finished and it is moved back to the external storage  $External$ .

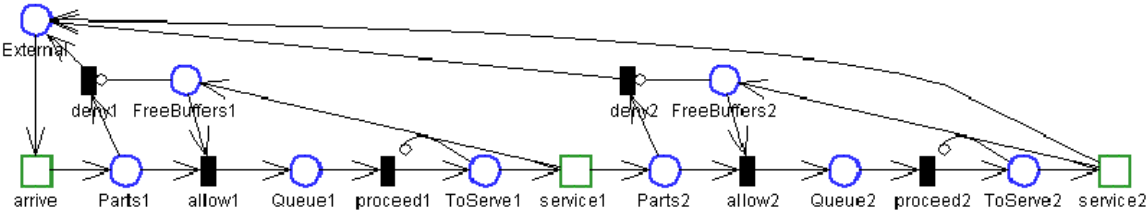


Figure 2: APNN-Model of a two server Productionline

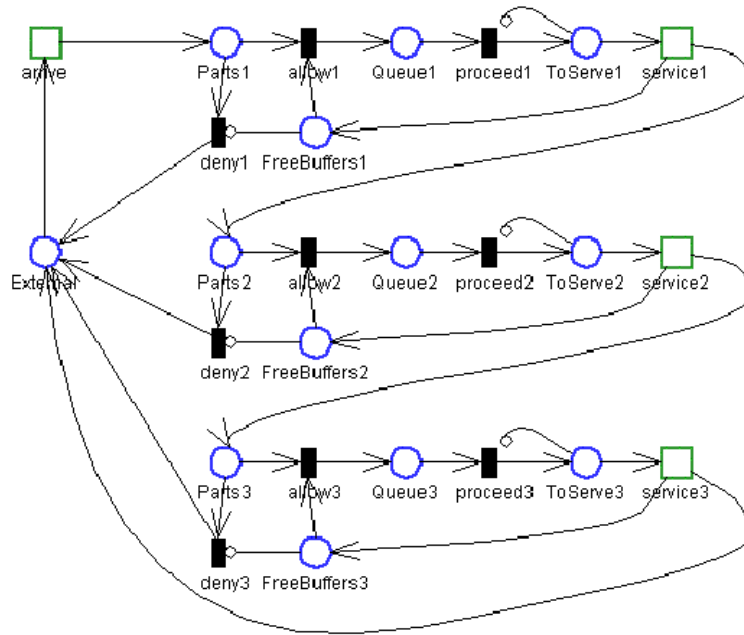


Figure 3: APNN-Model of a three server Productionline

### 3 Tables of places and transitions

If a '?' appears at the end of a name it is a replacement for the number of the machine. As all places and transitions have equal values at the beginning.

#### 3.1 Places

Name	Initial tokens
External	50
Parts?	0
FreeBuffers?	20
Queue?	0
ToServe?	0

#### 3.2 Immediate transitions

Name	Weight
deny?	1
allow?	1
proceed?	1

#### 3.3 Timed transitions

Name	Fire rate
arrive	0.5
service?	variable