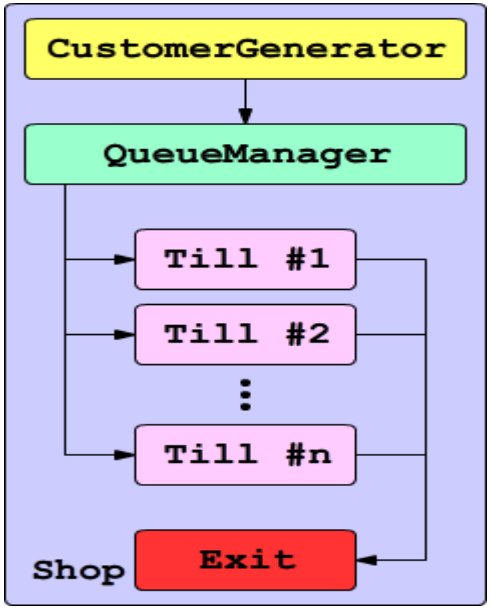
Performance Evaluation Project

Christmas shop

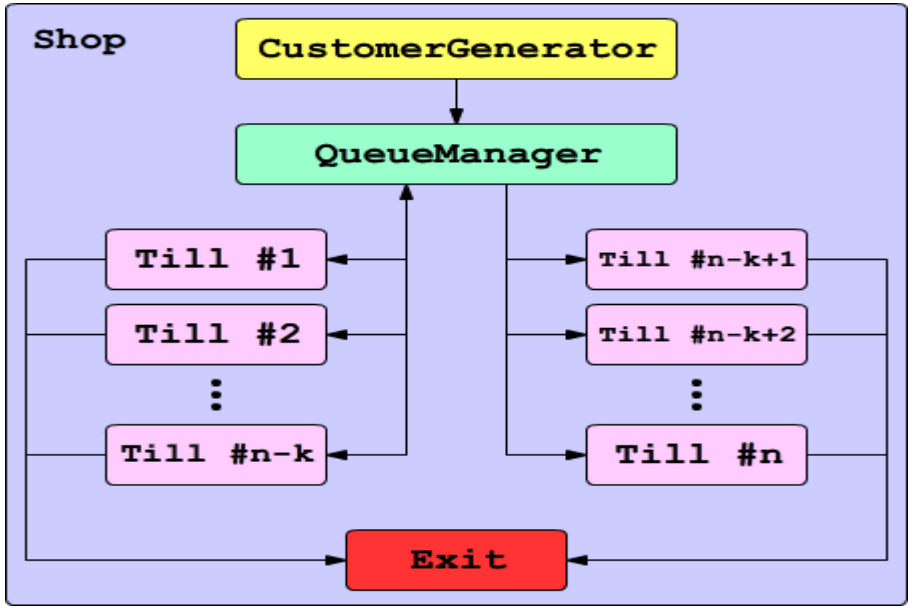
Authors:
Chiara Caiazza, Gionatan Gallo, Lorenzo Biagini

Which shop structure to use?

- United tills (checkout + gift wrap)



- Separated tills (two queues for two services)



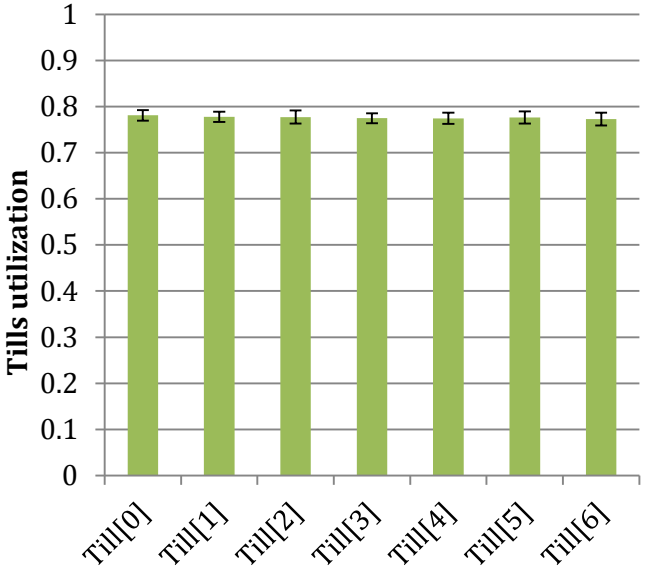
Objectives

- Do the two policies require the same number of tills?
- How the queuing time vary according to the policies
- What changes varying the workload
- Basic relations between factors
- Differences in using the uniform distribution instead of the exponential one
- Are separated tills fairer?

Different policy, different utilization

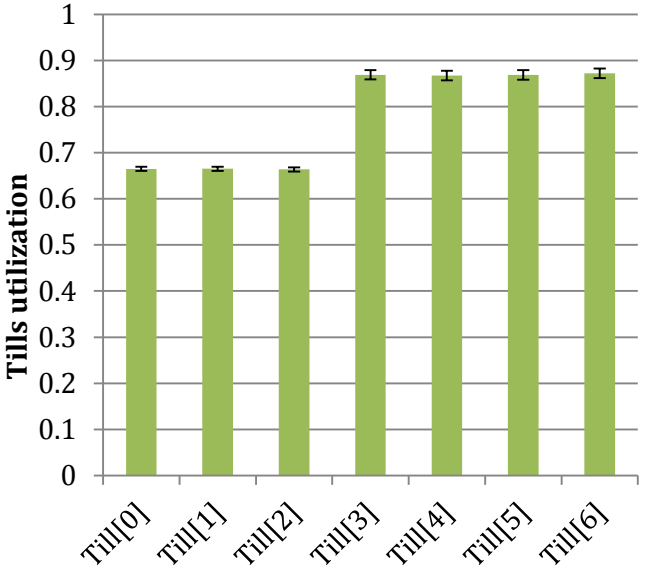
- In *united-tills* policy, all the tills have the same utilization
- In *separated-tills* policy, tills with the same utilization provide the same service

United tills policy



Distribution = exponential
$N = 7$

Separated tills policy

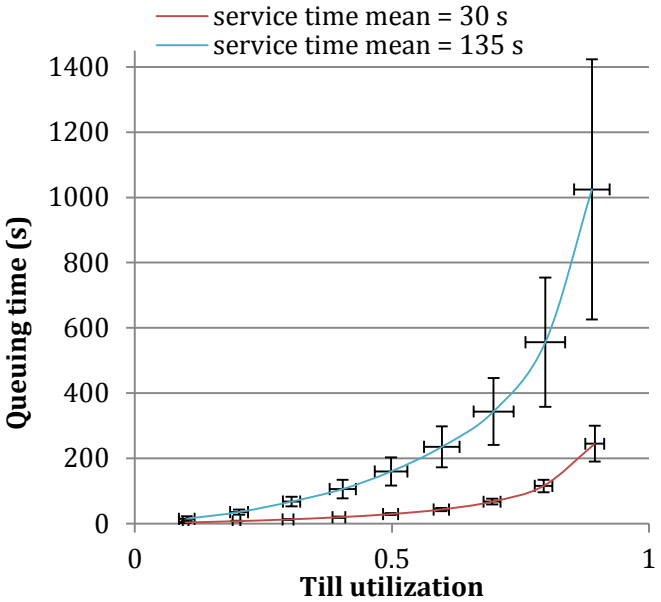


$K = 4$
$\overline{AT} = 15$ s

How queuing time is affected by

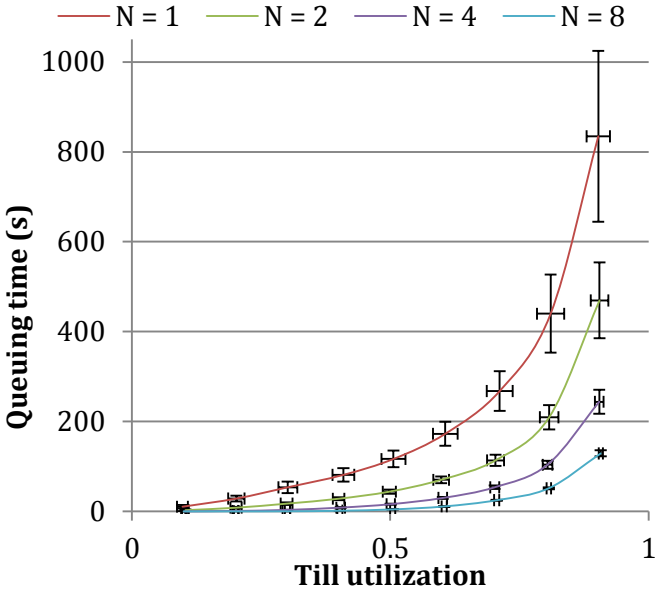
- The higher the service time mean, the higher the $\overline{QT}$
- The higher N, the lower $\overline{QT}$

Service time mean



Distribution = exponential
N = 1

Number of tills

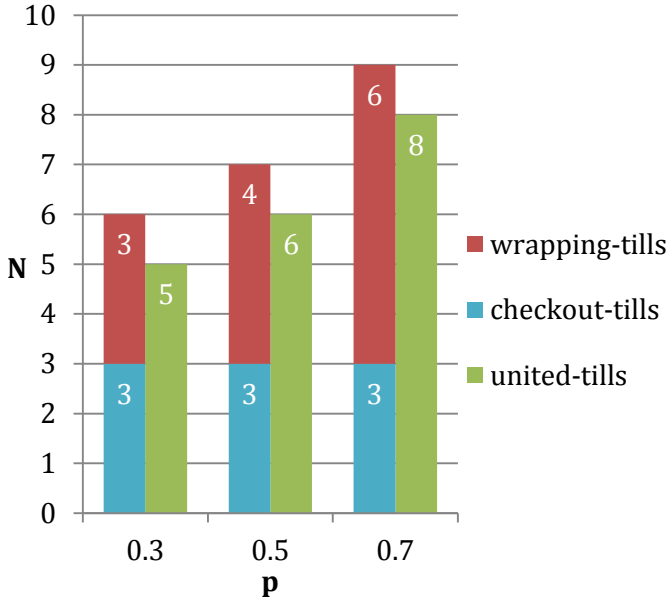


Service time mean = 105 s
Distribution = exponential

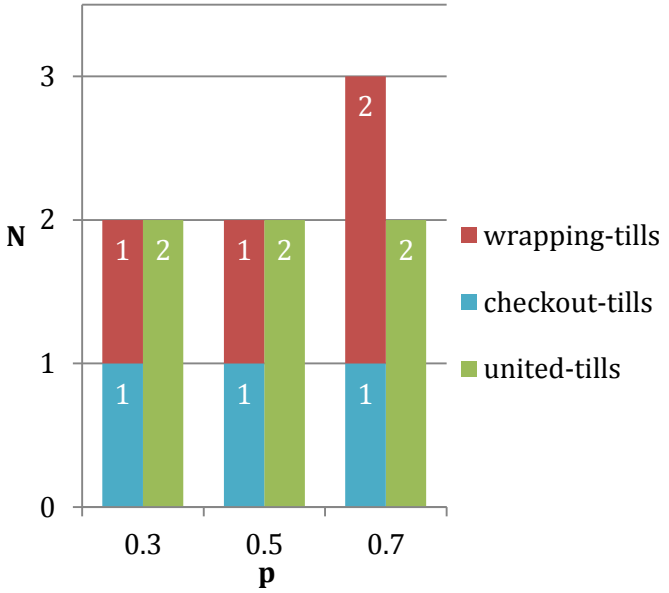
Lowest N and K to have non saturated system

- Both the arrival time and *p* affect *N* and *K*

Peak hours



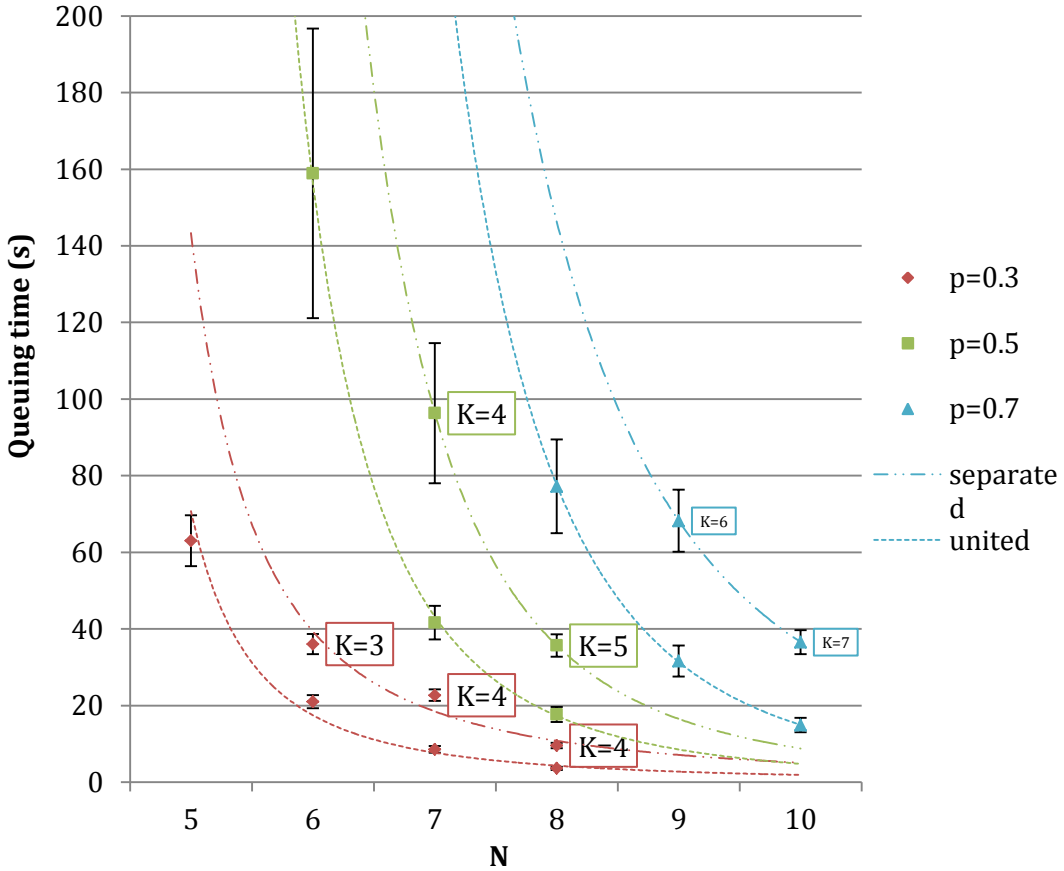
Non peak hours



Distribution = exponential/uniform

Queuing time varing N in both policies

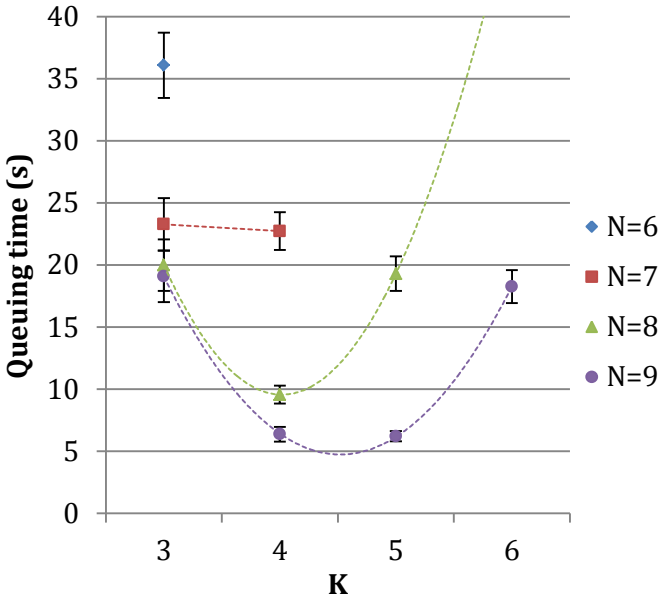
The regression curves for the queuing time of *separated-tills* are always above the *united-tills* curves



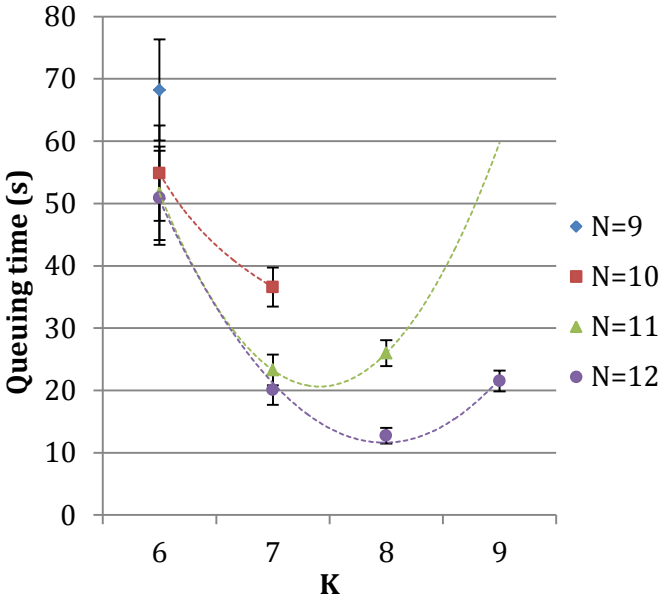
How queuing time is affected by K and p

- Changing K at different p in order to have the minimum $\overline{QT}$

p = 0.3



p = 0.7

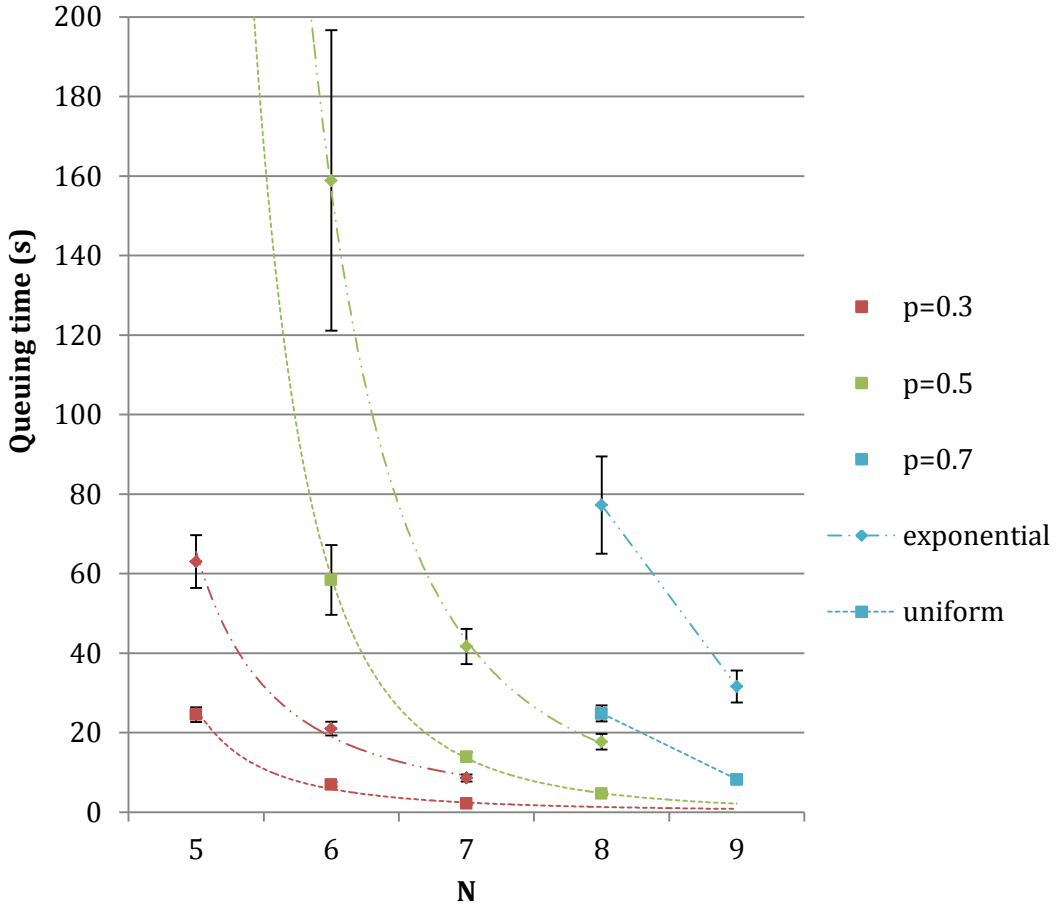


Distribution = exponential
Policy = separated tills

$\overline{AT}$ = 15 s

Queuing time varing N in both distribution

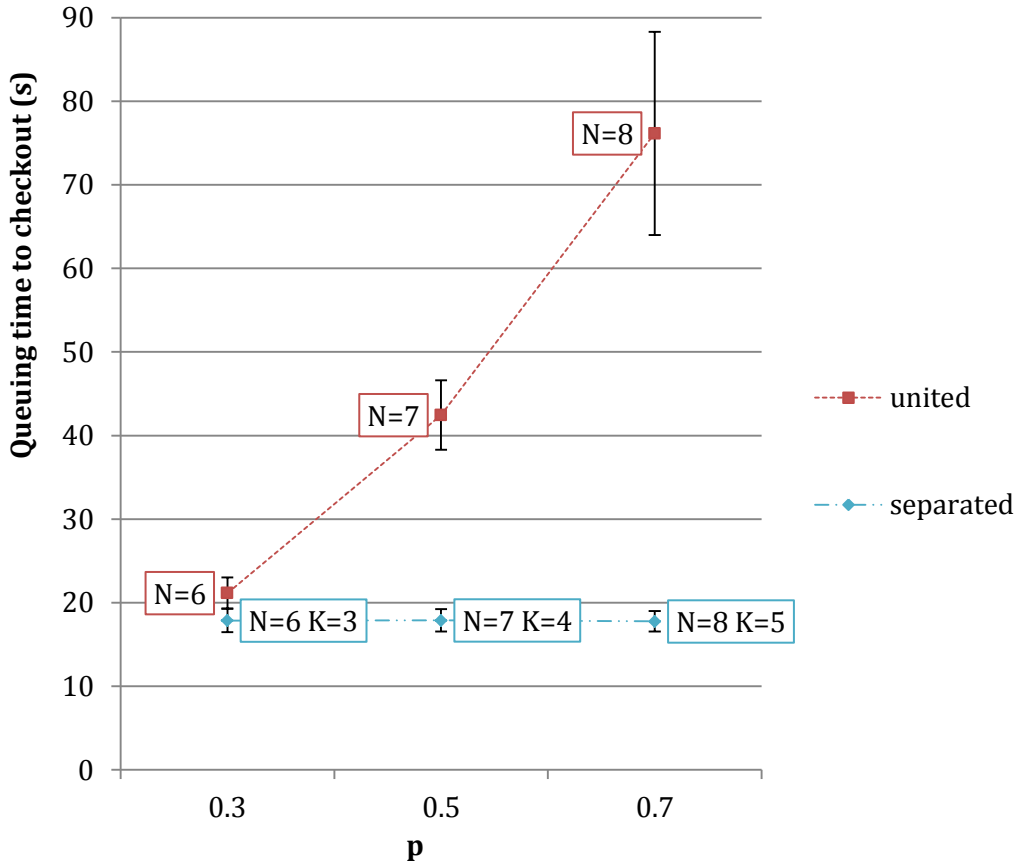
Using uniform random variables, rather than exponential ones, makes $\overline{QT}$ be smaller



Policy = united tills

Separated tills policy is fairer

By allocating always 3 tills for checkout in *separated-tills*, those who only need to checkout do not experience longer queue



$\overline{AT}$ = 15 s

Distribution = exponential

Conclusions

United-tills policy is better for:

- tills utilization
- distribution of the workload
- shorter queuing time mean, other factors being equal

With *separated-tills* policy it is possible to privilege a service: who does not need to wrap his/her good undergoes a much shorter queue (by allocating the right number of K tills) and this is good for the shop reputation.