Performance of a Video production company

- Tools used:
  - Matlab (traces fitting)
  - JMT (model definition and analysis)
  - Excel (data visualization of the simulation results)

Project Structure

- This PDF containing a resume of the work
- open.jsimg: contains the model used for the project
- closed.jsimg: contains a closed model version of the project, not considered here
- result.xls: contains the result of the simulation of the Open Model with confidence interval and some graphs
- fitting.m: the matlab code used to fit the trace on several distributions

Goal of Performance Evaluation Project

Performance evaluation in computer systems aims to measure and optimize system behavior to achieve optimal functionality and user satisfaction.

KPI (Key Performance Index):

- Throughput
  - Number of episodes produced in a given time
  - The Series Producer wants to maximize it
- Response Time
  - Time taken for the system to respond to a request
  - Users want it to be as little as possible

An optimization problem

$$\begin{cases} \max \text{Throughput} \\ R \leq 60\ days \end{cases}$$

The problem is that R and X are counterposed:

- Shorter response time means lower throughput
- Higher throughput means higher response time

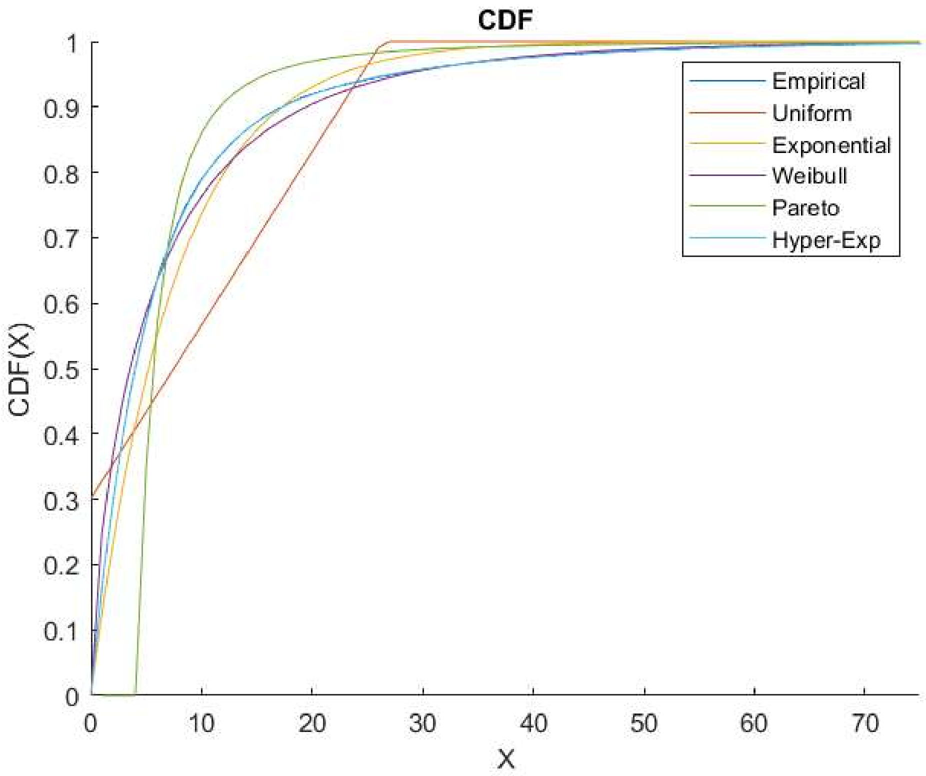
We must find a balance producing a **model** to be analyzed

Fitting

Fitting is done against:

- Uniform Distribution
- Exponential Distribution
- Erlang Distribution
- Weibull Distribution
- Pareto Distribution
- Hyper-Exponential Distribution
- Hypo-Exponential Distribution

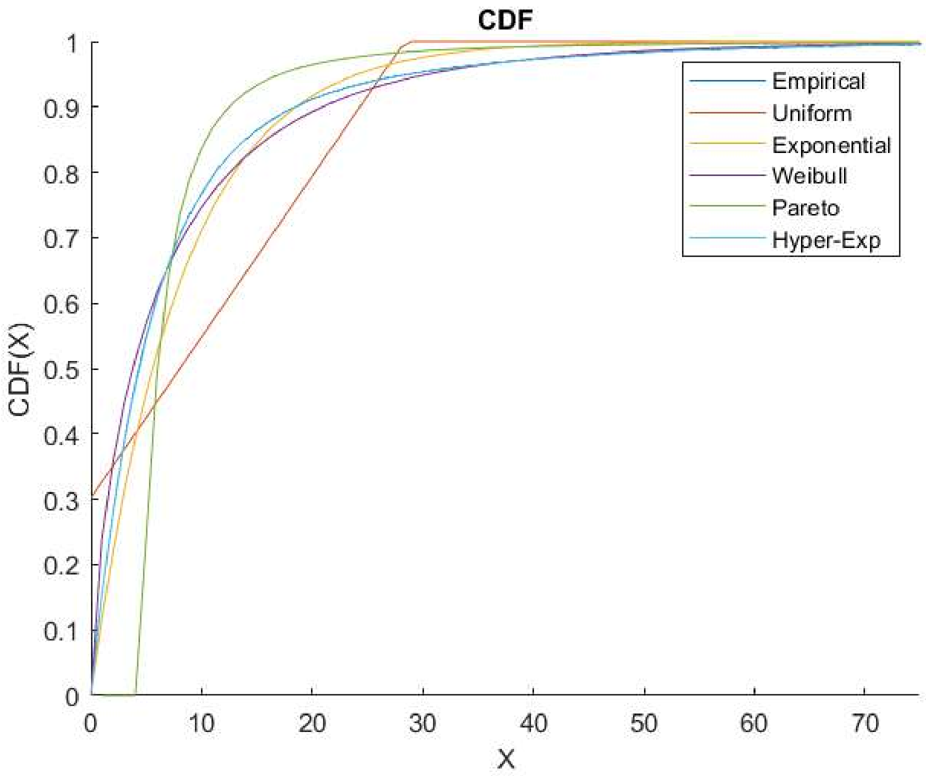
Fitting Result – Audio Editing



Zooming in to the Empirical Distribution, we can see that the Hyper Exponential is the closest one.

$$X \sim HyperExp(\lambda_1 = 0.0542269, \lambda_2 = 0.216503, p_1 = 0.20801)$$

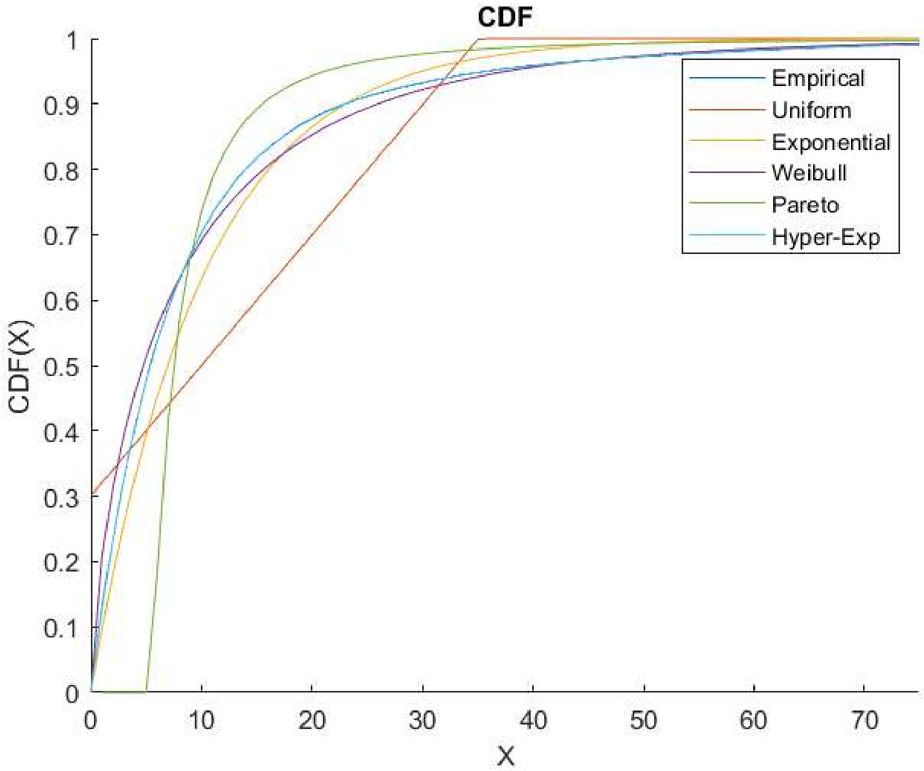
Fitting Result – Video Editing



Zooming in to the Empirical Distribution, we can see that the Hyper Exponential is the closest one.

$$X \sim HyperExp(\lambda_1 = 0.0492715, \lambda_2 = 0.19638, p_1 = 0.194409)$$

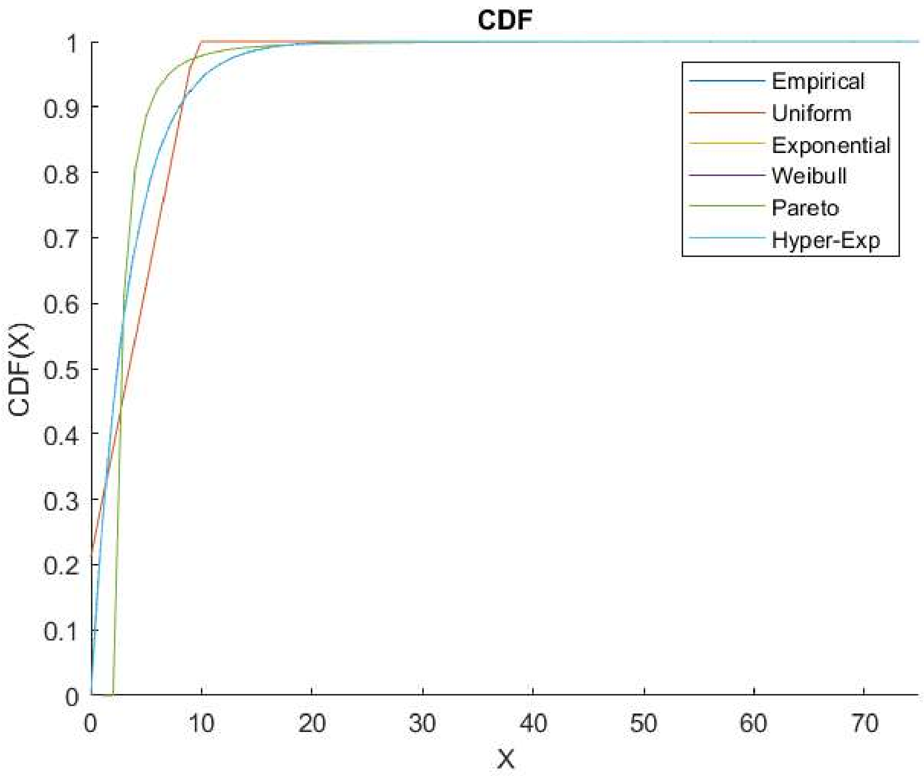
Fitting Result – VFX



Zooming in to the Empirical Distribution, we can see that the Hyper Exponential is the closest one.

$$X \sim HyperExp(\lambda_1 = 0.0405977, \lambda_2 = 0.160212, p_1 = 0.204244)$$

Fitting Result – Compositing



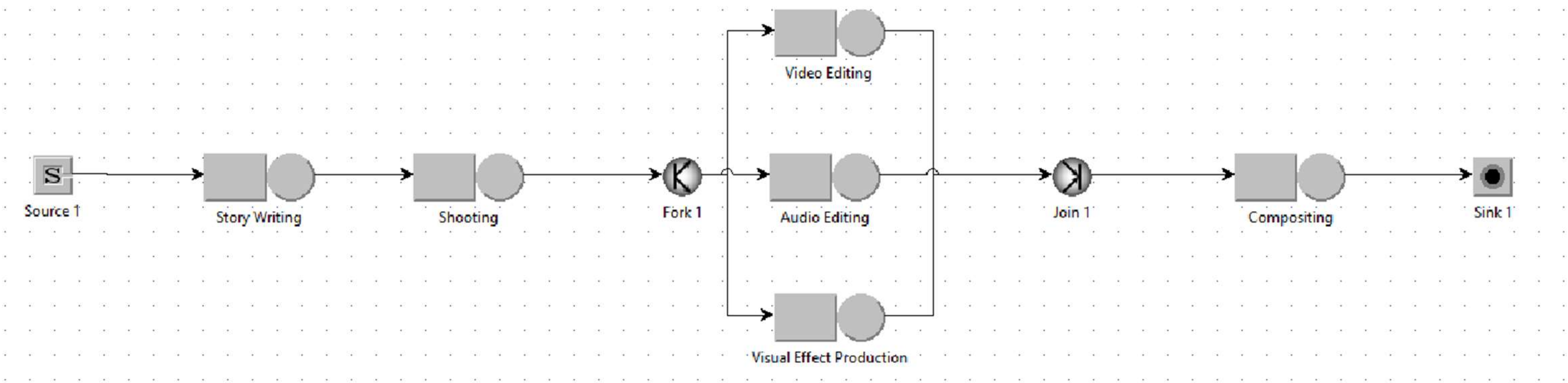
Zooming in to the Empirical Distribution, we can see that the Hyper Exponential is the closest one.

$$X \sim HyperExp(\lambda_1 = 0.288123, \lambda_2 = 4.98502, p_1 = 0.998407)$$

Note: in this case also the Weibull and Exponential Distributions seems to fit well the trace

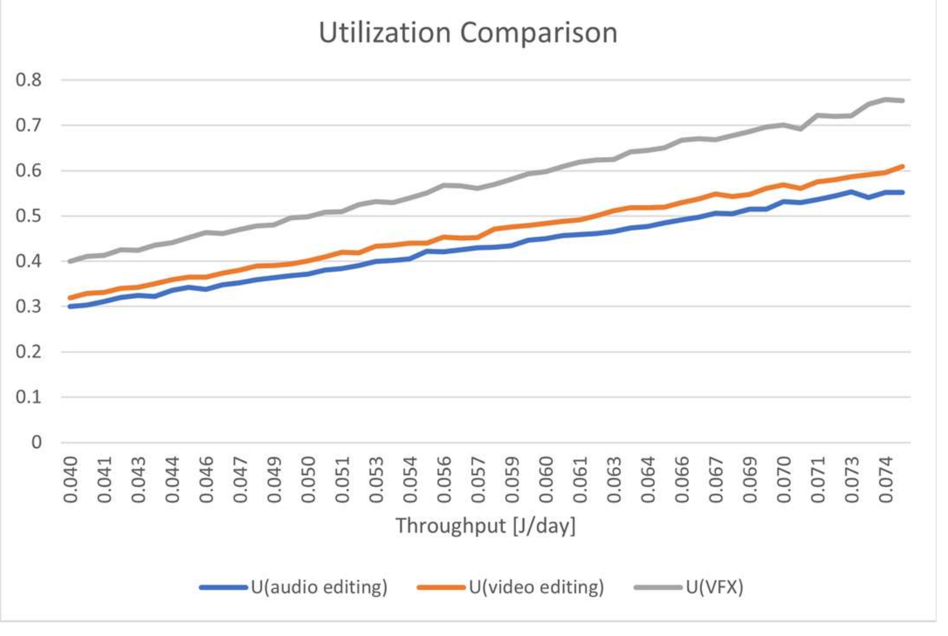
The (open) Model

- Arrival Rate = Target Throughput



Find the bottleneck(s)

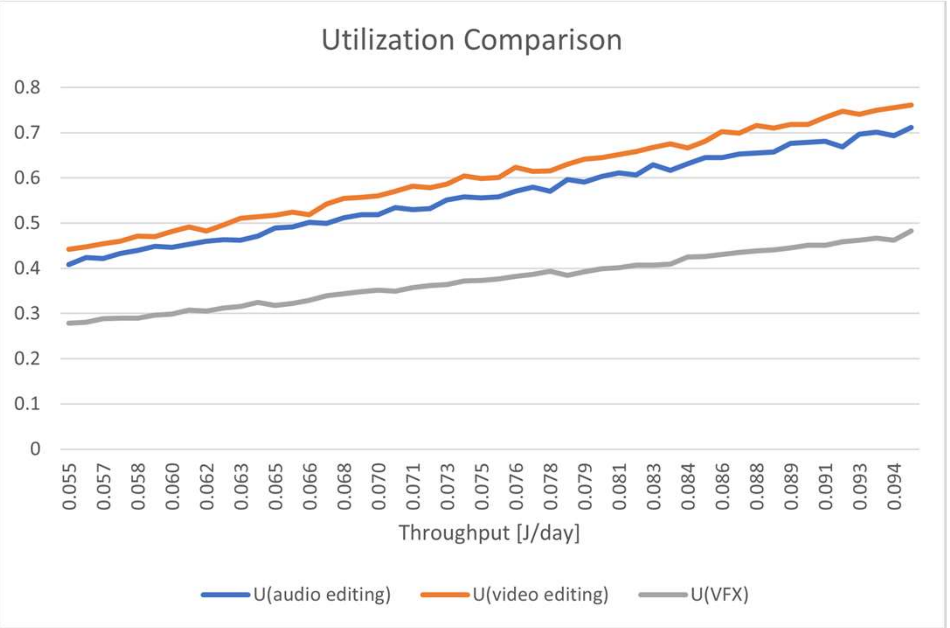
Run a What-If analysis to identify what is the bottleneck (highest utilization in the parallel section)



As we can see the VFX utilization clearly dominates the other ones, then we can add another VFX by putting `2` into Number of Servers in JMT upon double clicking on the VFX queue (service section)

Find the bottleneck with an extra VFX

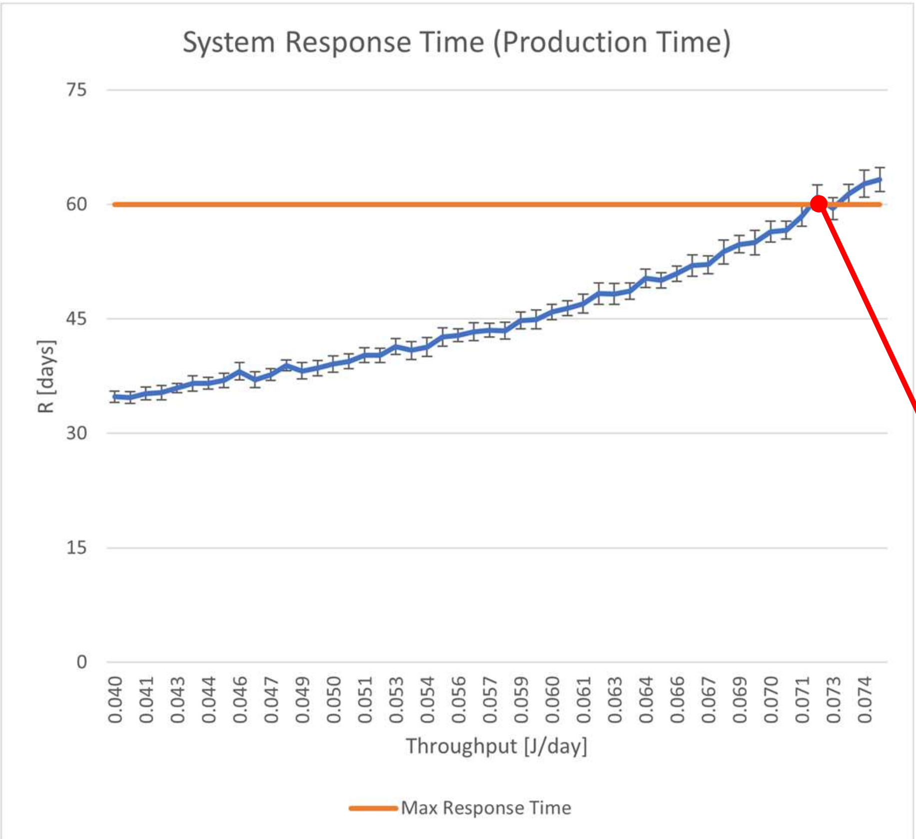
Run a What-If analysis to identify what is the bottleneck (highest utilization in the parallel section)

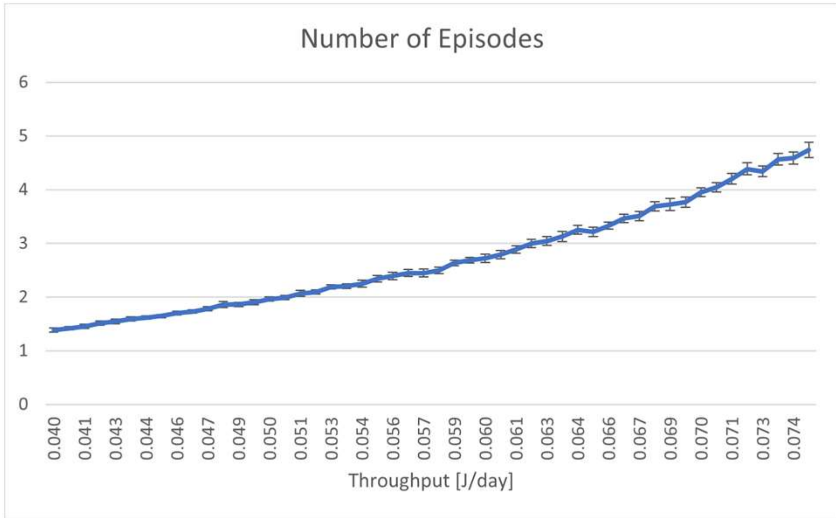


In this case the bottleneck is the Video Editing, we add another one

How to find the optimum? (Case w. no extra unit)

Run a What-If analysis to identify what is the maximum throughput possible in this scenario



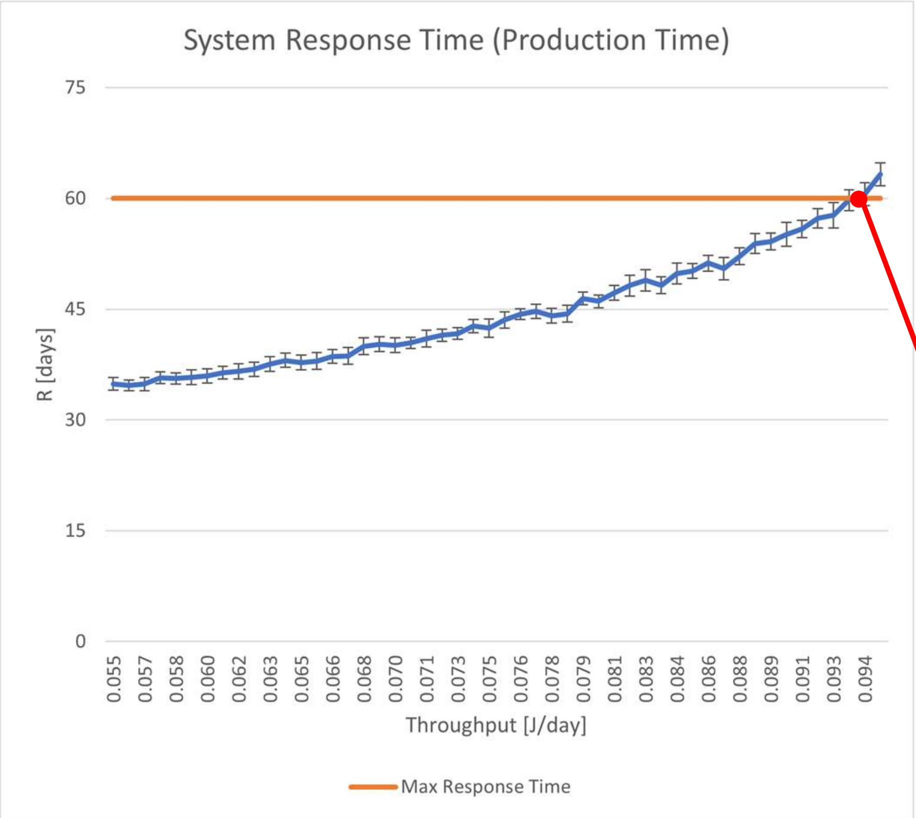


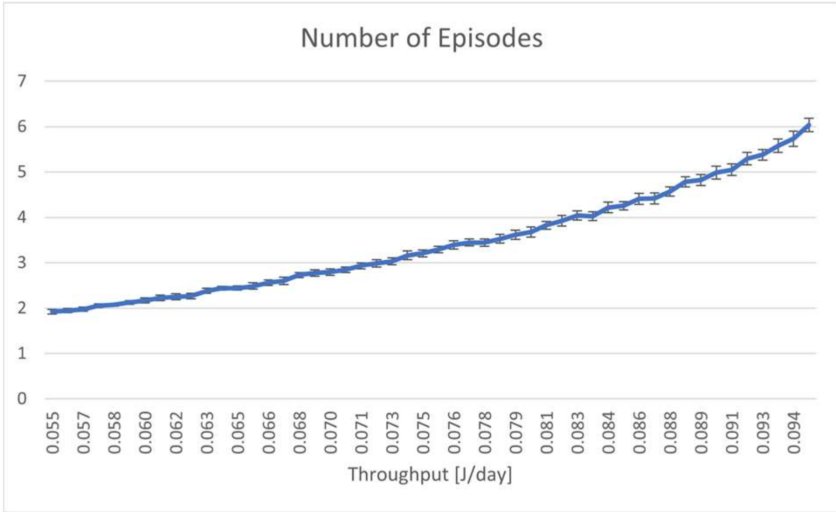
X ≈ 0.073214 j/day or 1 episode every 13.65 days

This corresponds to N ≈ 4.4 jobs in the system

How to find the optimum? (Case w. 1 extra VFX)

Run a What-If analysis to identify what is the maximum throughput possible in this scenario



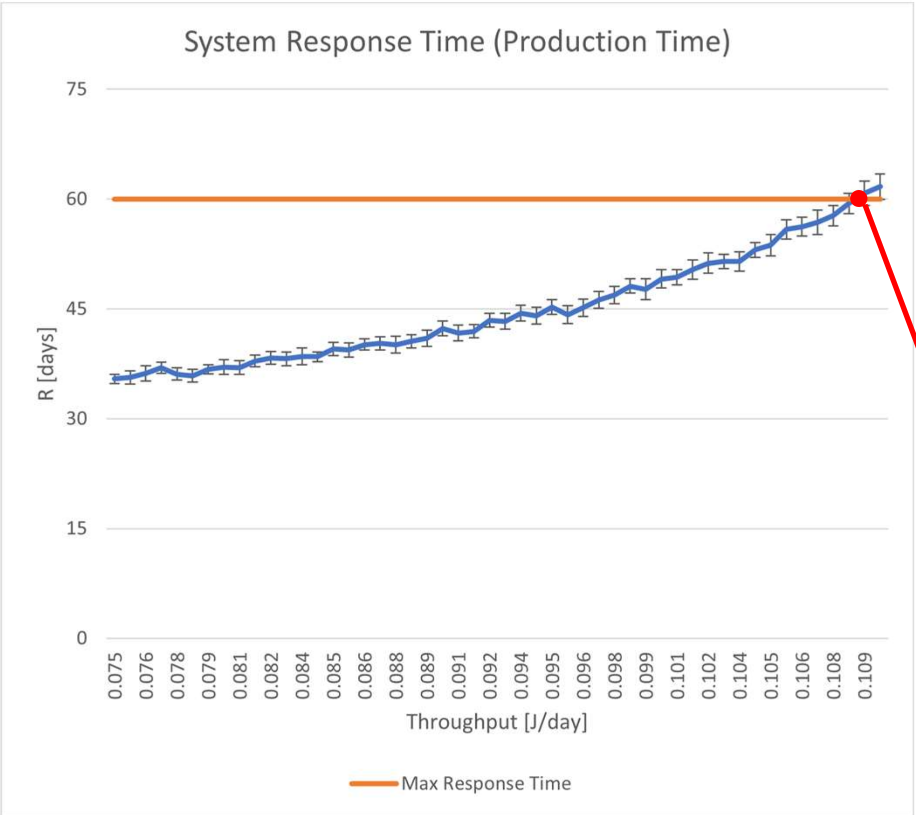


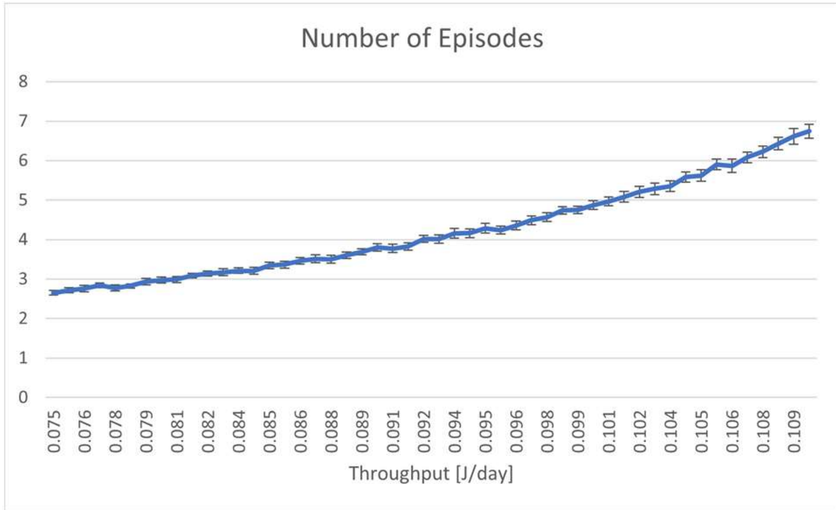
X ≈ 0.093776 j/day or 1 episode every 10.66 days

This corresponds to N ≈ 5.6 jobs in the system

How to find the optimum? (Case w. VFX + V_Edit)

Run a What-If analysis to identify what is the maximum throughput possible in this scenario





X ≈ 0.108929 j/day or 1 episode every 9.18 days

This corresponds to N ≈ 6.42 jobs in the system

Final Remarks

- To ensure accurate fitting, it was necessary to eliminate data entries containing 0 from the traces, resolving issues with MATLAB.
- I opted to present and utilize the open model as I believe that the creation of new episodes should not be constrained by the completion of older episodes. However, I acknowledge that a closed model also holds merit since the total number of episodes to produce (N) is, at the end, an integer.