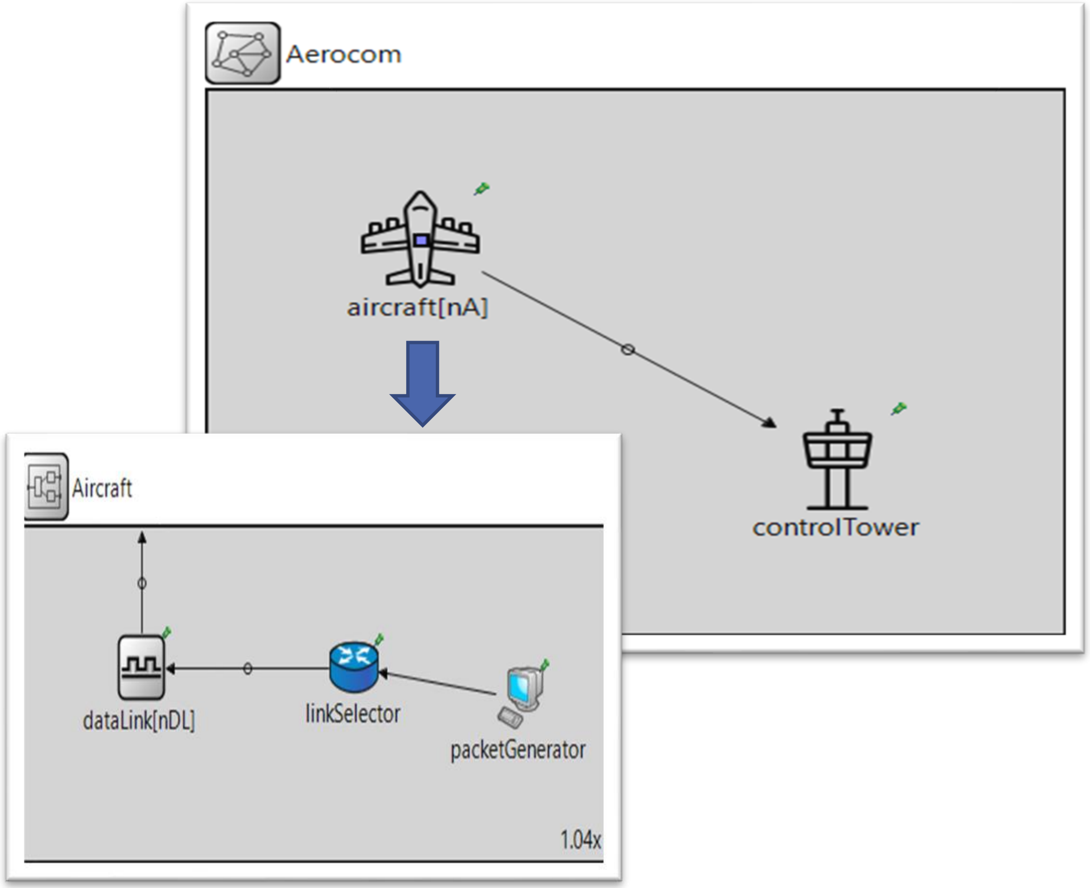
Aerocom System

GAIA ANASTASI

CLARISSA POLIDORI

LEONARDO POGGIANI

Modelling



- **PacketGenerator:** generates packets and forward them

- **LinkSelector:** a queue managed in FIFO mode that forward the packet to the *Data Link*

- **DataLink:** forwards packets to the *ControlTower*

- **ControlTower:** receives packets and drops them

Problem definition

MAIN FACTORS:

- **nAL** number of aircrafts
- **X** malus penalty
- **k** mean Inter-Arrival time
- **m** monitoring period
- **t** mean capacity setting time
- **nDL** number of data links

ASSUMPTIONS

1. Ideal communication channel
2. 3 different RNG
3. DL capacity is bytes per second
4. Fixed packet size to 70 bytes
5. Unbounded queues
6. Uniform DL's capacity

SCENARIO

- Exponential interarrival time
- Capacity setting time:
  - Exponential
  - Lognormal

TWO MODES OF OPERATION

1. To maintain the same serving DL for the whole simulation
2. To monitor DLs and to choose the one with the highest capacity

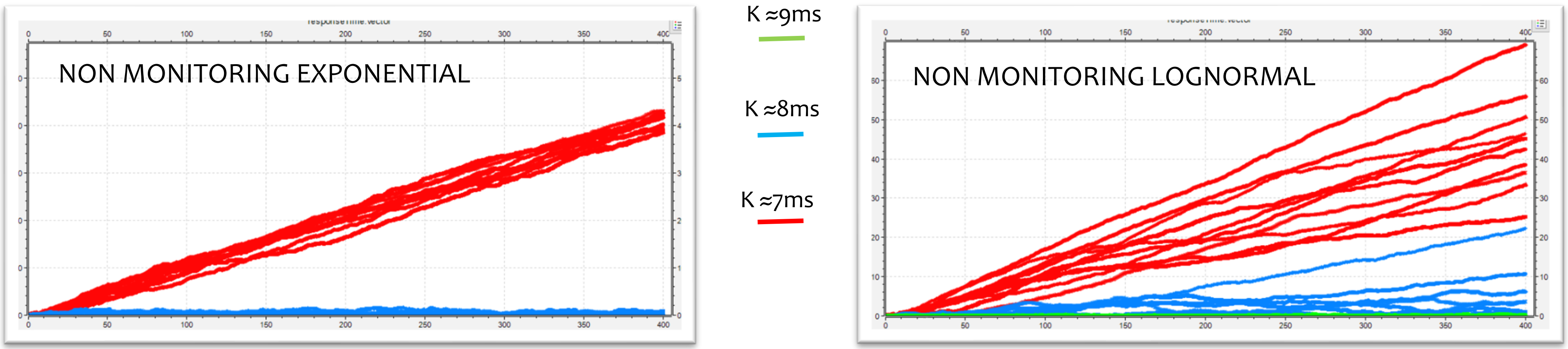
Stability condition

Although the system being stable at k≈8ms it behaves too wild among different repetitions, so we picked k≈9ms as worst stable case.

For simplicity, we report only the case of the scenarios with non-monitoring operation mode.

To validate the model, we also performed:

- ✓ Code verification
- ✓ Degeneracy
- ✓ Packet loss
- ✓ Rate in/out
- ✓ Little's law
- ✓ Continuity



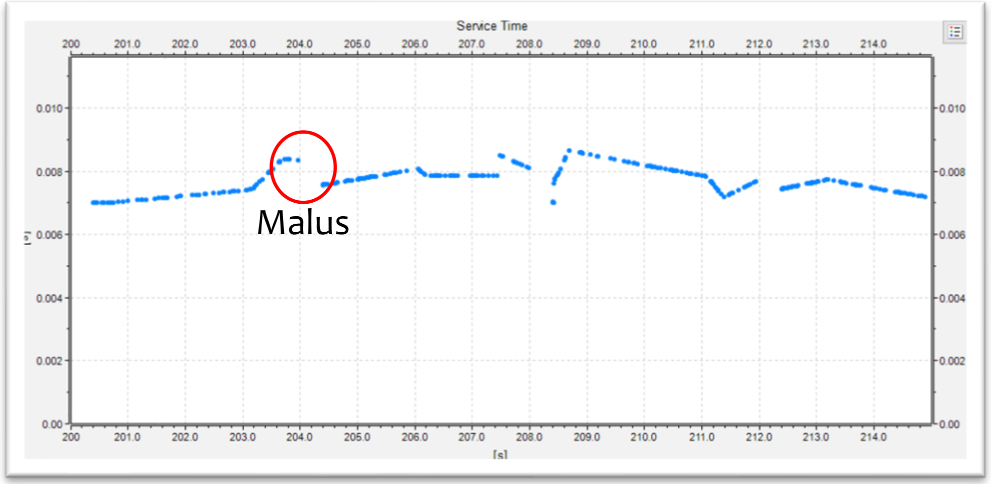
Service time validation

We were interested in checking if the behavior of service time was modeled correctly.

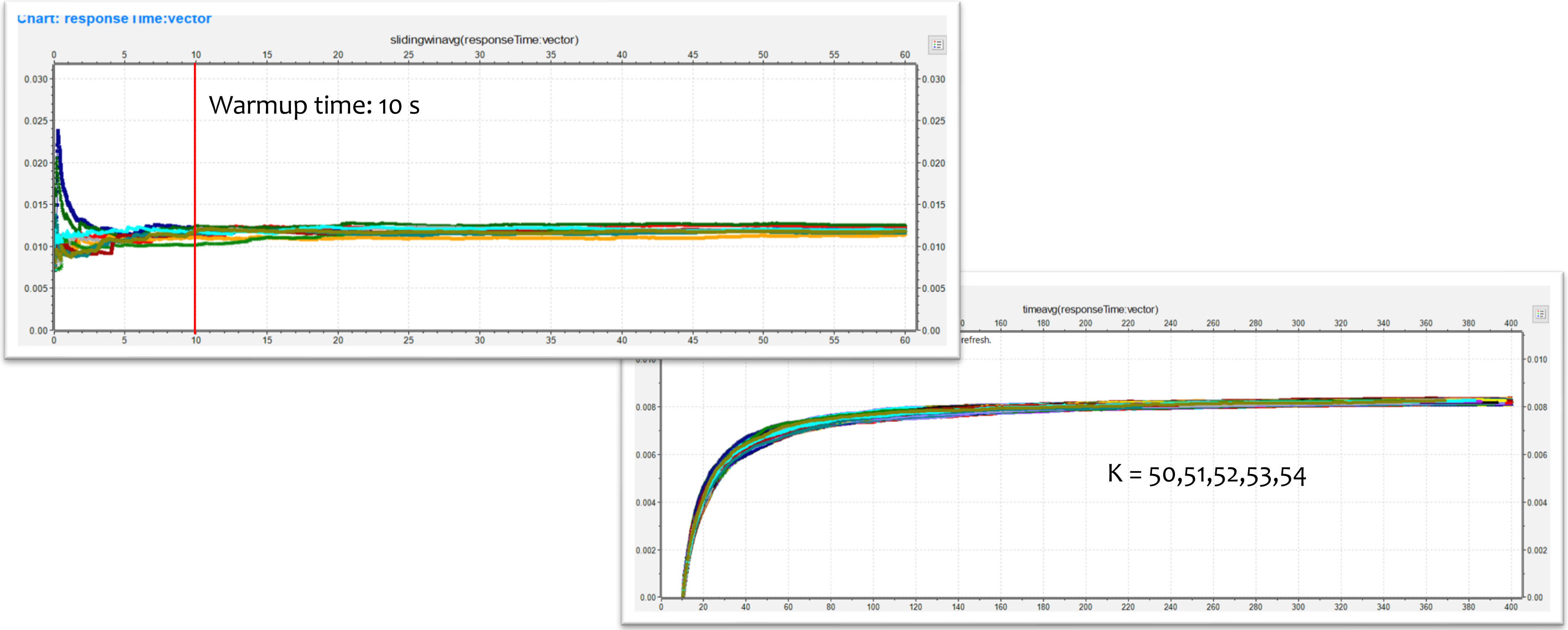
- ❑ We analyzed a small interval of the service time, to identify any problems.

The service time behaves in the way we expected:

- It increases (or decreases) **linearly** from the minimum starting value to the extracted one.
- There are holes that signal a **malus**, which stops data link activities for a fixed number of seconds.

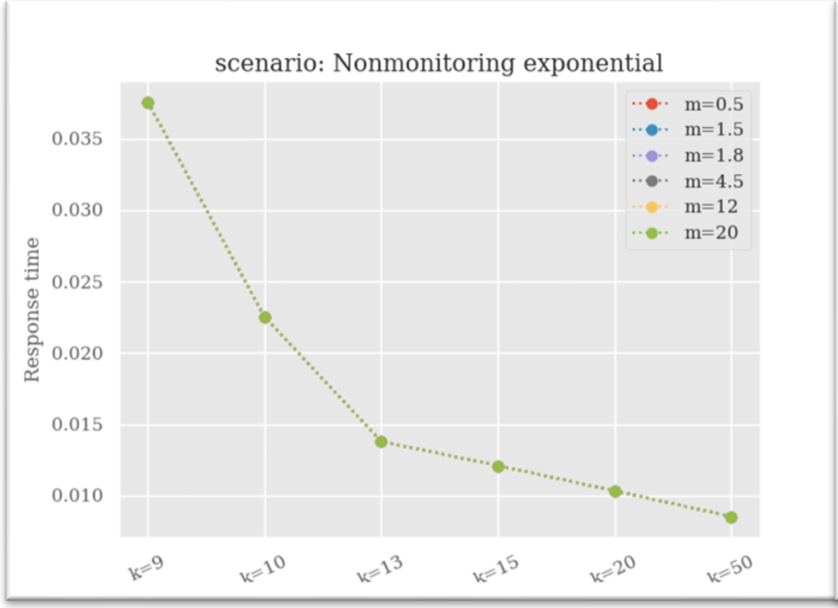


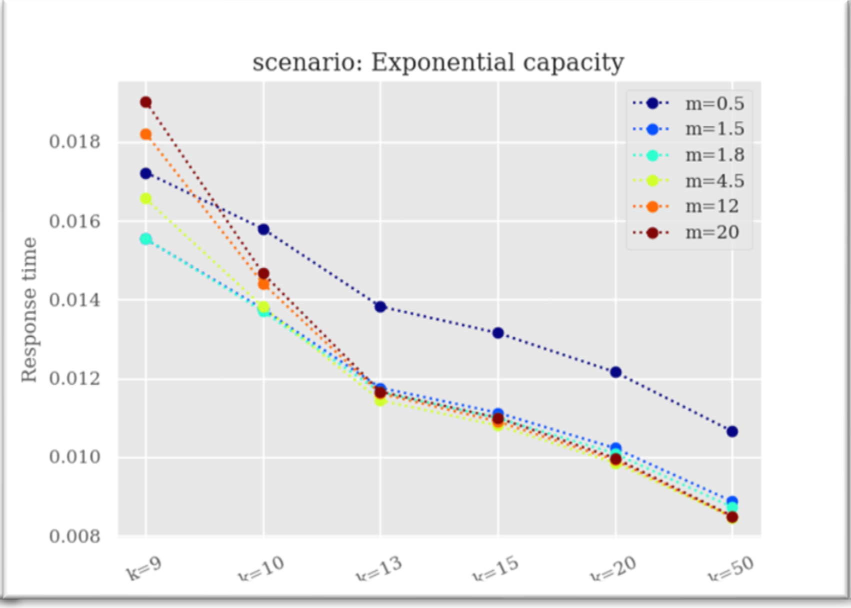
Warmup time and continuity test

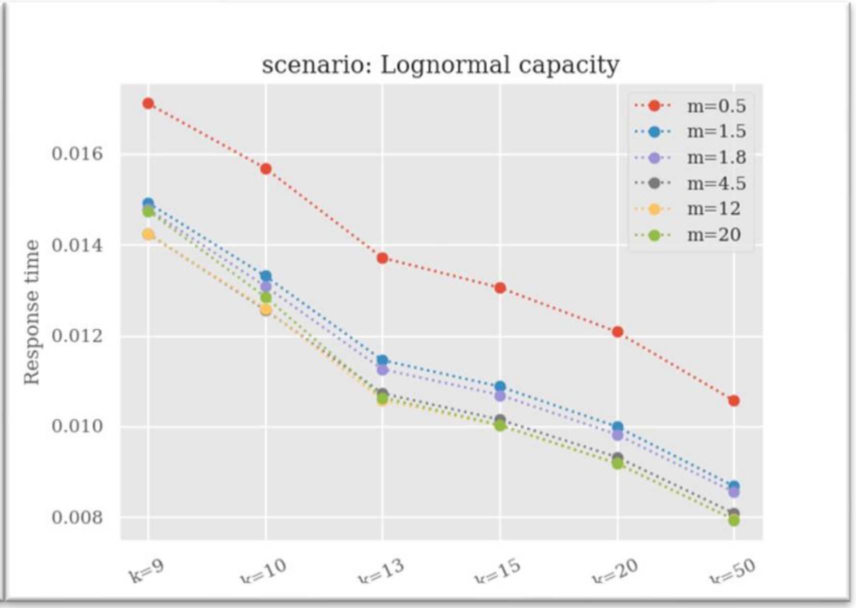


Response time analysis

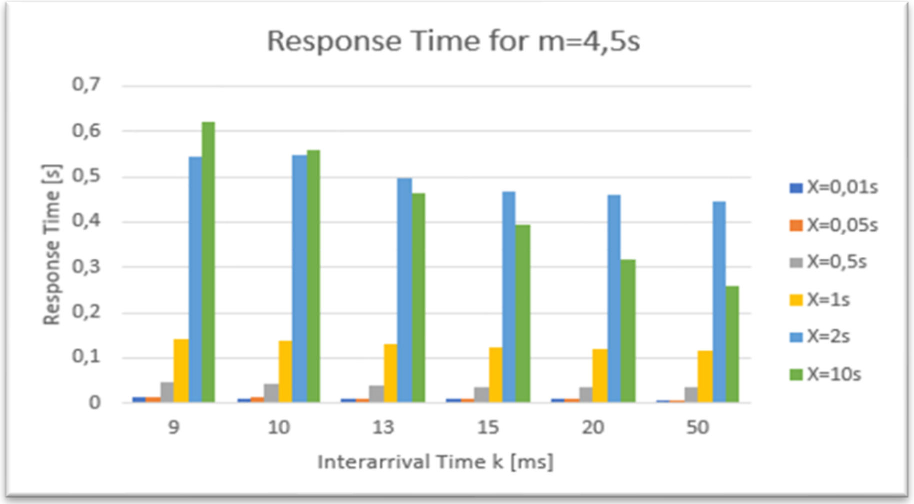
We compared the results obtained from the different scenarios.

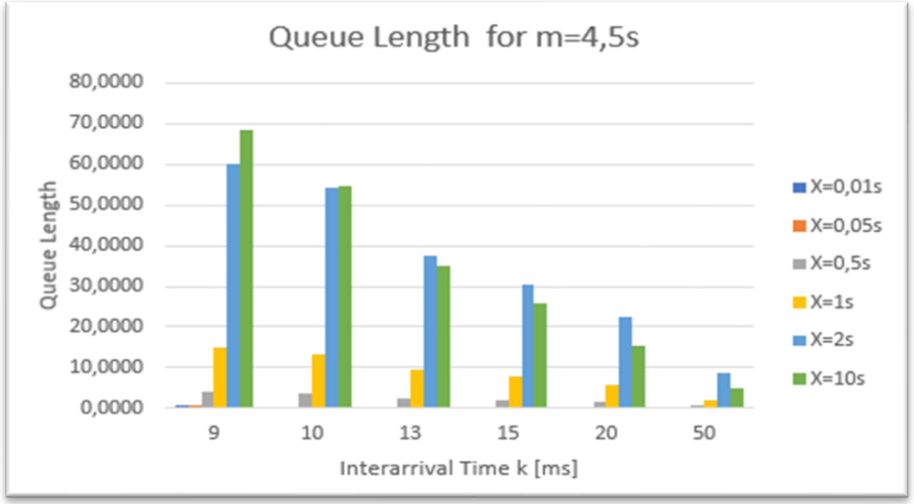






Different penalty time



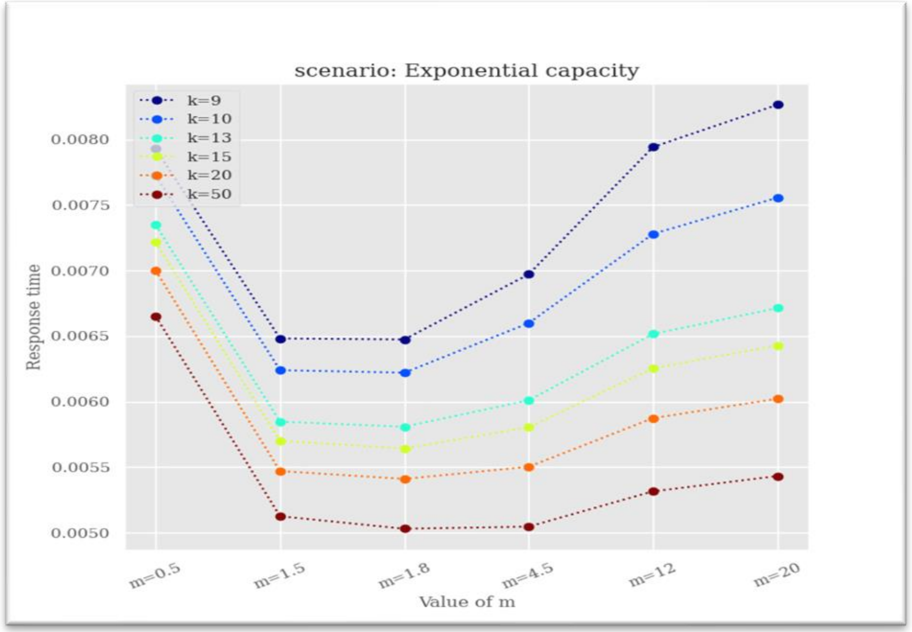


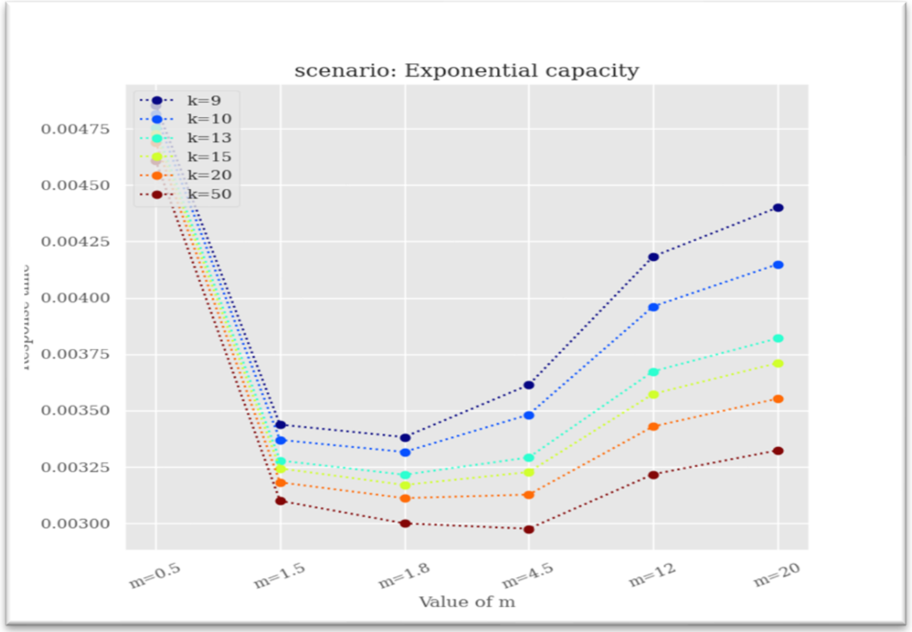
The **penalty time** was found to be a decisive factor for the performance of the system

- It is a factor on which (realistically) it may not be possible to intervene.
- If you could intervene, it is assumed that a shorter penalty time makes the system **more efficient.**

Some strange behavior appeared for specific values of X and m, factors which proved to be closely related.

Possible improvements

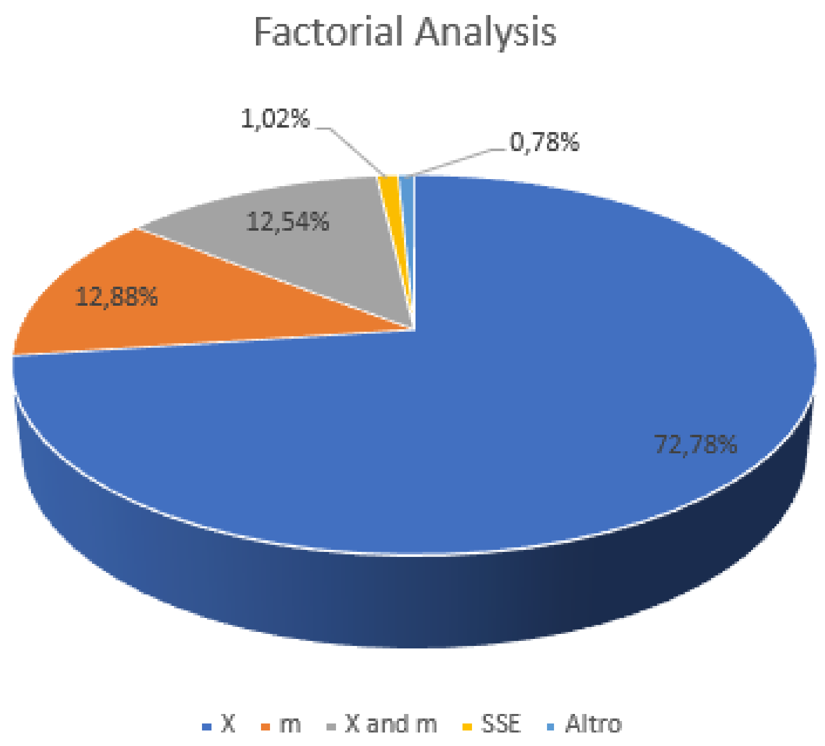




- One way to improve the performance can be observed by **increasing the pool of possible capacities.**
- The minimum value has been set for the stability condition, but there is no maximum value.
- The experiments are done using a very narrow pool of capacities, widening the pool could simulate the **presence of a channel very subject to interference**.

Factorial analysis

Parameters	Values	Unit
Mean set-capacity time(t)	${0.5, 3}	s
Mean interarrival time (k)	${9, 50}	ms
Monitoring period (m)	${0.5,20}	s
Penalty time (X)	${0.01, 2}	s
#DL (nDL)	${2, 50}	



Conclusions

Non-monitoring mode: the interarrival time k is the most influential factor and for higher value of k we will achieve better performance

Monitoring Mode: it is necessary a trade-off between the monitoring time (m) and the malus (X) to achieve better performance.

The system we have studied seems more efficient with high values of the monitoring period:

- Capacity pool is very small so monitoring doesn't bring much benefit because the small improvement in the service time
- We manage to get choosing the data link with the highest capacity will be wasted by the fact that we have to serve the malus.

It's important to remember that the malus value(X) should always be lower than the monitoring time (m) to assure the correct behavior of the system.