# SUMO Performance Comparative Analysis: C vs. Python

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Mobility is an essential part of modern societies. Urban mobility has three important goals, namely Safety, Efficiency and Sustainability. Modern cities have a number of challenges ahead. To name a few, population levels are increasing together with increments in pullution, energy demand and environmental impact.

A very important element within urban mobility is Traffic Simulation[4]. There is no doubt about the importance of the development of accurate traffic simulations in particular for an efficient traffic management and planning. In that context, there is an outstanding tool, SUMO (Simulation Urban Mobility)[3][1], which is not only a complete and customizable microsimulation platform. It is also changing the game rules with its open software approach. Its community of developers is very alive and growing every month, likewise the number of research groups that embrace this tool as main technology for their research plans.

However, SUMO still lacks of something that will be clearly a deal breaker for local administrations regarding other tools and platforms [3][1]. That is performance. Traffic networks are generally very big and computationally expensive to simulate. Realtime performance levels are needed for on-line use.

In our lab we are aiming at the parallelization of SUMO, but before of that move, we are evaluation the performance improvement through shifting from Python to ANSI C as programming language.

We have studied how SUMO works. SUMO makes its calculations in Phyton[2]. Phyton is a high level multi-platform programming languaje. Its object oriented approach and its portability may yield an inncecessary headover regarding SUMO performance.

We use python because the SUMO engine is implemented in that language, and researchers when want to communicate with SUMO through TraCI use that high level language. However, here we present some promissing results using C for several modules. In this work we compare two versions of SUMO, the out-of-the-box based on Python and a second one, developed in our lab with some modules in C instead. We present a performance comparison study, using that two versions of SUMO.

For our experiments we have used a simple network, consisting of in a two lanes motorway. We simulated a vehicle flow, between fifty and one hundred cars

driving along that motorway during five seconds. That vehicles drive along the motorway in a constant speed and don't have to take any decision along the way.

Results are encouraging. We have evaluated the application speed-up by doing an arithmetic average of thirty simulations in both SUMO versions, varying the number of vehicles.

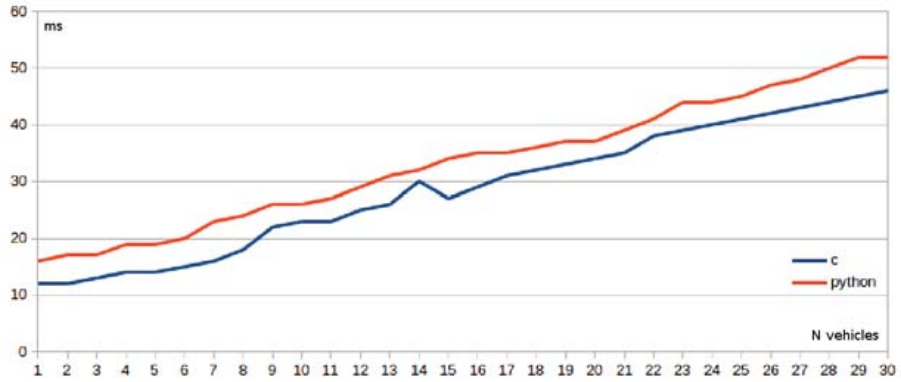


**Fig. 1.** C vs Python

In figure 1 we represent the number of simulated vehicles in the horizontal axis. In the vertical axis we see the averaged execution time in miliseconds. As we can see, C has a clearly better response, and at lease in this range, there seems to be a clearly linear relationship between both variables. For every test, C is faster than Python.

As a future plan, we are preparing more extensive experiments, varying the type of vehicles, number of lanes, streets, highways, to see if in harder conditions we get consistent results regarding both versions of SUMO. Also, we plan to translate some more modules and funcionalities from Python to SUMO before the parallelization of that platform. We have already designed the parallel architecture and we will share the main elements it will include.

## References

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