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A Constitutional Method for Massive and Complex Simulation Infrastructure

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Abstract

My objective is to construct an infrastructure that enables large-scale and complex simulations by connecting simulations that have been handled independently, such as those for human movement and wireless communication. And I finished the following three research to make a massive and complex simulation infrastructure.

A Software Architecture for Extensible and Composite Simulation

A specific software architecture must be needed to implement the simulation environment I suggested. I designed and implemented a software architecture for a massive and complex simulation. A set of the software components is shown on this research and the data flow between the components is also described. I also introduced PostgreSQL database as information layer because it has strong functionalities to store the geographical information. I implemented the three typical use cases: output stream, input stream, and signaling stream. I finally described the communication delay is enough small to assemble the whole simulation components.

A Deploy Mechanism using Voronoi Dividing for Scalable Geographical Simulation

I suggest a deployment mechanism to reduce the network sessions over the physical machines. My mechanism executes VMs on a same physical machine, which are "geographically" close to each other. If the simulated position of the moving objects is changed, these VMs are also moved to another physical machine. My approach reduces the network sessions over the physical machines by about one-sixth in the case of 500 VMs and it contributes embodiment of a massive virtual machine based ad hoc network simulation.

A Priority Control Method based on Predicting the Simulation Events

I suggest an interaction Based task group scheduling mechanism. There are several VMs which are executing self-driving AI we are going to verify the behavior, and also several VMs that interact with the target VMs to be verified. I anticipate these

interactions before the self-driving simulation with a traffic simulator and set high priority to them. My approach reduces the processing delay at most one ninetieth in the case of 100 VMs executed on 9 physical machines.

I also describe the other topics related to create a massive distributed simulation. One is the topics related to time synchronization. Another is the topics related to connectivity with the other simulation environment.

Through these researches, I discussed the comprehensive topics those are the major problems to make a massive and complex simulation environment and indicated the solution for these problems. Therefore, I consider that there are few obstacles to embody the simulation environment.

I am convinced that my research contributes the reduction of serious traffic accident caused by self-driving technology.

Key Words: simulation, self-driving, distributed system, scheduling, load balancing