Diplomarbeit / Master Thesis

Adaptation of the Time Dilation Factor in a Time Virtualized Emulation Environment

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Timeframe: 6 months, starting immediately

Description:

The NET (Network Emulation Testbed) project has established an emulation system for computer networks at the Distributed Systems department. The system is based on a PC cluster and consists of a combination of flexibly configurable hardware and software tools, which emulate specified network properties. This allows the comparative performance analysis of distributed applications and communication protocols.

To support the emulation of scenarios with a number of nodes beyond the number of physical cluster nodes, virtualization concepts are used to partition the available resources (CPU, memory). Using resource virtualization, it is possible to increase the number of supported nodes in a scenario. However, the available processing power and network capacity limits the size of the supported scenarios. Understanding also time as a resource, we can run an experiment with a factor (called time dilation factor, TDF) slower or faster than realtime and, therefore, get a factor more processing power or network capacity. This allows us to emulate resources beyond those resources physically available in the testbed. To achieve best resource utilization, it is necessary to adapt TDF to the current load. Since the demand on the resource changes during an experiment, continuous adaptation of TDF is required.

The period of time between two TDF changes is called epoch. In previous work, we implemented a time virtualized environment running on a single node of the cluster able to change TDF at runtime.

In this work, a mechanism, that adapts the TDF to the load of the emulation environment, shall be developed and evaluated. To achieve minimum experiment runtime the used TDF should be minimal. Smaller TDFs result in shorter experiment runtime but require higher resource consumption. Knowing that an overloaded emulation environment adulterates emulation results, the mechanism to be developed has to guarantee that no overload takes place. Switching the TDF requires some overhead and, therefore, costs for running without the optimal TDF and switching to a new TDF must be trade off. The avoidance of oscillations is essential. During the thesis, the developed mechanism has to be evaluated by integrating a prototype implementation into the time virtualized emulation environment.

The achieved results have to be documented in a detailed written report and presented in a final talk.

NET project home page: http://net.informatik.uni-stuttgart.de