Lecture 10 Summary

First part of this lecture was about PDES (Parallel Discrete-Event Simulation). Discrete event simulation is a computer model for a system where changes in the state of the system occur at discrete points in simulation time. Each event computation can modify state variables and schedule new events. Each unprocessed event is stored in a pending list and will be processed in time stamp order, which is assigned for each event. There are many PDES scheme. First scheme is Time Warp. There are two mechanisms for Time Warp: one is Local Control Mechanism, the other is Global Control Mechanism. But for Local Control Mechanism, the error would be expensive because once an error is detected, a rollback must be performed. So, there are “Non-rollback” options. First option is Deadlock Avoidance using NULL Message Algorithm. But, Livelock can occur because of un-ending cycle of null messages where no LP can advance. Therefore, Lookahead is important to resolve this problem and necessary to allow concurrent processing of events with different time stamps. Second option is Deadlock Detection and Recovery, which provide a method to detect a deadlock and to recover form deadlocks. To improve the performance when a rollback happens, Reverse Computation is used to deliver negligible overhead for forward computation and lower memory utilization.

Second part is ROSS, which is an open source, massively parallel discrete event simulation engine. For its local control implementation, ROSS uses MPI\_ISend/MPI\_Irecv to transmit core events. Event and network memory are managed directly, and event list is kept sorted using a Splay Tree, which has a run time of log(N). Lastly, LP-2-Core mapping tables are computed and not stored to avoid the need for large global LP maps. For its global control implementation, GVT (Global Control Time) is used to determine how to collect versions of state and perform I/O operations. By observing the benchmarking, there are something to notice: 1. ROSS on Blue Gene indicates billion-events per second model are feasible today, which yield great time compression of current models. 2. LP to PE mapping has less effect on performance, which has greater effect on past systems. 3. Tera-event model require teraflop systems. Also, the benchmarking shows the possible to mode a near peta-event system by using ten PF supercomputers.