

COMP 426 Final Project

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1)

CPU:

The CPU handles the generation of the galaxies and assigns their initial position. Every iteration the CPU deletes the galaxy tree and recreates a new one using the recursive solution. Afterwards the tree is traversed to calculate the mass distribution. Then there is a third traversal which creates a serial tree in the form of an array, which will be used by the GPU. Then the CPU calls OpenGL to display the galaxies every 30 milliseconds.

GPU:

The GPU is in charge of the force calculations, the velocity calculation and updating the position.

2)

CPU:

OpenCL creates two Native Kernels using `clEnqueueNativeKernel` and runs the tree deletion, creation, weight distribution and serial array functions for each galaxy. Then there is a `clWaitForEvent` to make sure the two synchronize, before the function is completed.

GPU:

OpenCL creates a kernel using `clEnqueueNDRangeKernel` and has all the Particles in a Memory buffer, utilizing each thread of the GPU. On the GPU the structs contain all the information necessary to calculate the force, which is then added to the velocity which is used to displace the position.

3)

At every step of the kernel creation on the CPU and GPU there are `CL_SUCCESS` tests, so that the kernels never execute under faulty conditions. Performance is guaranteed by deleting everything that is created on the stack. Also the transfer of the particles from the GPU to the CPU is done using `clEnqueueReadBuffer` into the display array, limiting the amounts of writes over the totality of the data points.