

## **Independent Project Description**

Summer 2004

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The purposes of this project are to further explore what is possible to do with MPI based clusters. It would be an extension of work done in the CS417 class, both topics of study and the final project work.

The main goal of this project is to further the research that was begun with the final project of CS417. The project pursued in CS417 was a particle explosion simulator on a hybrid system of MPI networked nodes using SMP through OpenMP on each node to further the vectorization of the problem on the nodular level.

To further this project, advanced topics in MPI will be used to make the simulator more efficient and use fewer resources. Topics such as MPI data types, data packing, scatter/gather using `MPI_Scatter()` and `MPI_Gather()`. Also topics such as communicators and embedded topologies will be explored.

The goal of the project will be a continuation of the same problem used in CS417, although a much more complex system, with advanced physics such as collisions, air drag, and angular momentum, to be implemented to produce a problem complexity that will benefit from parallel processing.

As the project progresses, smaller problems will be solved using currently studied techniques, as a test of their methods of implementation. These smaller project may in no way assist in the over all project goal, but rather further the understanding of the method being studied.