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*Subject:* Report on student internship at the University of Stuttgart

### *Objectives and expectations*

Coming to University of Stuttgart my primary goal was to get some idea about the working environment in Germany, the way things are getting done in a German University from scientific aspect of view. I was also interesting in learning something new in the field of parallel and distributed computing which is the area what my internship was given for, but I didn't expect I will learn much for me new material because I already have very large and extensive experience and results in many fields (a good point here was that I didn't have very large experience in the field of parallel and distributed programming, but since I have some basics and I count my self as the best programmer one can ever become what is based on my results and projects I have done already it come to be no challenge at all but more like some relaxation) both in the theoretical and practical mean.

Besides the experience of working environment my goal was also to make something practical on one hand for my own experience on the other hand to do something useful for the university because I was completely sure I will be able to get something done.

### *Assignment*

I didn't have some specific assignment to work on and I worked on many different problems from different areas, but it was all with the same final goal - to make a parallel version of the algorithm. I didn't need any preparation for the programming or reading something because as I wrote above I already had large experience. So all I needed for the problem solution was the description of the problem and the tools which to use for the programming itself.

First I started working on the solution of the problem QAP (Quadratic Assignment Problem) using genetic algorithms and to do that all in parallel using MPI. First we though it will take couple of days or even couple of weeks because of the complexity of the problem. Finally it took me only two days to handle the problem and to make a graphical presentation of the solution in JAVA. The solution was complex and wide, but since my previous experience it was no problem for me.

After that I started working on the octree generator algorithm which was part of the PhD thesis of Mr. Ralf Mundani. Of course after I learned about the problem I started working to make some better version then the one already available and after I finish the serial version to start working on the parallel version. But a little problem raised

here, actually I saw that the serial version can be made much faster than the first one. So I worked to handle that version and I made a version that was useless to parallelize since it was too fast and the parallelization was going to slow down the process since its requirement of intercommunication among the processes and the limited speed of writing the output. So I only developed the structure of the parallel algorithm but I never wrote it. My parallel version was far more complex than all other versions of the algorithm but it was the fastest way of generating an octree for a given object.

Next thing was that we saw that there are some little things missing in the version of the algorithm like the very difficult input data for construction, testing objects missing and the most useful thing to use the complement in the object representation i.e. to handle not only a union of convex objects but to handle whatever expression is given. The new task required a lot of coding and testing. For the purpose of testing objects I made a program COG (complex object generator). I implemented the algorithm for accepting very intuitive input data (i.e. converting the data into the required format for the algorithm) and finally I implemented the expression parser and error checker. Then I started working on the new algorithm. It came to be very slow and it needed parallelization but since it was far too complex it was not very clear whether I will finish it during my stay so I went on with other problem.

Finally the octree problem had one more weak point and that was the visualization. I was about to make the visualization faster since the existing version was not optimized and slow and it needed a lot of initialization time. While learning the problem I already knew how to solve it, so it was only a question of time how much it will take me the coding of the program. It had some very high time bound of execution and of course it needed to be parallelized. I started working and I lost two days on a problem of operating systems nature but after that the problem was solved and my program worked quite faster from the previous version both in the execution and the initialization manner.

That was my last assignment since there was no time left for some other problem to be solved.

### *Evaluation*

I was very happy to see Germany, to feel the working environment of the university and to make contacts with persons from the university. I learned something new, I programmed useful programs and all the problems I started working on I finished successfully during my stay in Stuttgart.

I saw working environment that I think is very good and I would like to continue my post-graduate studies in such institute.

I learned new things, extended my views and meet programming problems from mechanical industry's nature. This was very important for me since it is time to me now to choose where to continue with a PhD, and this was very helpful and productive from that angle.

Overall, I think my stay in Stuttgart was quite useful for me from various aspects of view and also useful and productive from the university's point of view. Before I leave Stuttgart while talking with professor Hans Bungartz He told me "I was fascinated by the speed you solved the problems" and that my stay was very useful for the university.