

HPC at NTNU: Simulating Oil Fields, the Weather and Other Complex Systems.

The need for high performance computing (HPC) will continue to increase, as we try to keep up with the need to store, transmit and analyze the huge amounts of data of the future. One of the goals of NTNU's Computational Science & Visualization Program is to meet Norway's national need for HPC and visualization within basic research and industrial development.

New National Supercomputer at NTNU

This year it is 20 years ago since NTNU installed its first supercomputer – a Cray XMP/22. This year, NTNU again won the contract to host the main national supercomputer supported in part by the Research Council of Norway (RCN).

This time it will be an IBM Power 5 575+ system with 7 racks hosting 62 nodes (incl. 4 I/O & 2 log-in nodes) of which each of the 56 compute nodes host 8 dual core processors and 32 GB of RAM. With an estimated 7 TFlop peak performance, it is 7 times faster than the old SGI Origin system.



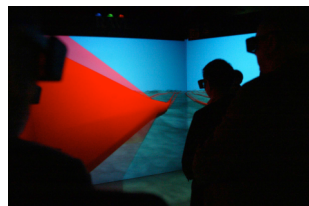
Dr. Anne C. Elster (CSV Director of Infrastructure) and NTNU's new IBM supercomputer

In addition to being a valuable resource for national scientist & engineers, the system will also be used to run the **operational weather simulation codes for Met.no**, Norway's Meteorological Institute. To satisfy their requirements NTNU spent NOK 20 million on upgrading their infrastructure (new machine

room, back-up power generator, etc) in addition to NOK 30 million for the system.

Visualizing Oilfield Data

NTNU's VR (Virtual Reality) Lab houses a RAVE (Reconfigurable Advanced Visualization Environment) from FakeSpace. Lead by Prof. Jon Kleppe, it is a collaboration between the Dept. of Petroleum Technology and Dept. of Computer & Info. Science. External partners include SINTEF Unimed, Hydro, Ceetron and Inside Reality.



Ormen Lange

NTNU, SINTEF and IFE have together with several oil and service companies set up a **Center for e-field and Integrated operations (Io)**. Their lofty goal is to develop new knowledge, methods, tools and educational programs to promote a leap in next generation IO solutions for the upstream petroleum activities, including helping Norway save NOK 250 billion towards 2015 by increasing the recovery factor from oil fields and rationalizing operations efficiency.

The IO Center has signed collaboration agreements with Stanford University, Delft Technical University and Carnegie Mellon University. Its yearly budget is estimated to be NOK 40 million with several major industry partners such as Statoil, Hydro, Total, Gas de France, Conoco Phillips, Aker Kværner, Kongsberg Maritime and IBM, chipping in NOK 25 million.

The RCN has also appointed the Centre as a Centre for Research-based Innovation (CRI) with NOK10 mill annually.



Other Important and Exciting HPC Activities

NTNU Physics Professor – Asle Sudbø – is NTNU's heaviest supercomputer user and uses whatever compute-cycles he can get his hands on. This helped him receive a lot of international scientific attention, in particular in connection with his research team's super fluidity/ superconductivity work which was published by Nature in Oct. 2004. He also received RCN's prize for outstanding research for 2005 for this work.

NTNU researchers are also involved in several other HPC projects including projects in bioinformatics, chemistry, material science, marine technology, physics as well as basic ICT research related to HPC (computer hardware, parallel algorithms, numerical methods, etc)

NTNU also collaborates with CERN on GRID projects and has had CERN host several of their masters students.

<http://www.ntnu.no/gass/documents/sfi.pdf>

http://www.nature.com/cgi-taf/DynaPage.taf?file=/nature/journal/v431/n7009/full/nature02910_fs.html

<http://www.ntnu.no/materialer/>



Met.no's IT Director, Dr. R. Skålin (center) with NTNU's HPC manager B. Lindi and Dr. J. Amundsen