



# Scientific Computing @ UiB retrospect and future

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# Summary

- Hexagon - highlight a few of the scientific achievements obtained using this machine
- Scientific computing group: activities
- Changes in the national HPC infrastructure. FRAM new HPC resource in Tromsø





## The Scientific Computing group at the IT division

**Alexander Oltu**  
Senioringeniør

**Saerda Halifu**  
Overingeniør

**Boris Wagner**  
Forsker II

**Tore Linde**  
Prosjekleder

**Csaba Anderlik**  
Senioringeniør, Gruppeleder

**Øyvind Sture**  
Avdelingsingeniør (Vikar)

**Lorand Janos Szentannai**  
Overingeniør





## History of the group ...

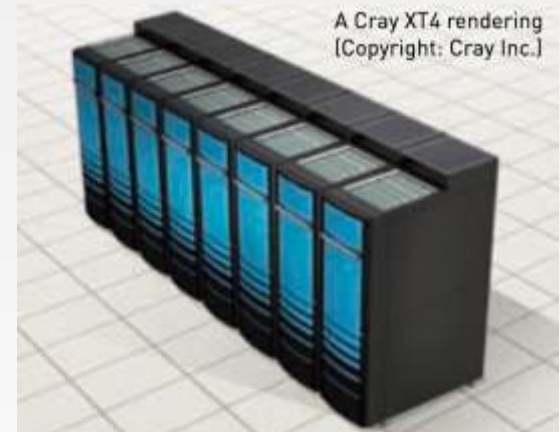
- Para//ab: established in 1986
- Bergen Centre for Computational Science
- Uni Computing
- Scientific Computing, IT-department
- Past projects: Eurogrid, HPC-Europa, ENACTS, BCPL, EGEE, EGI, NDGF.





## History HEXAGON...

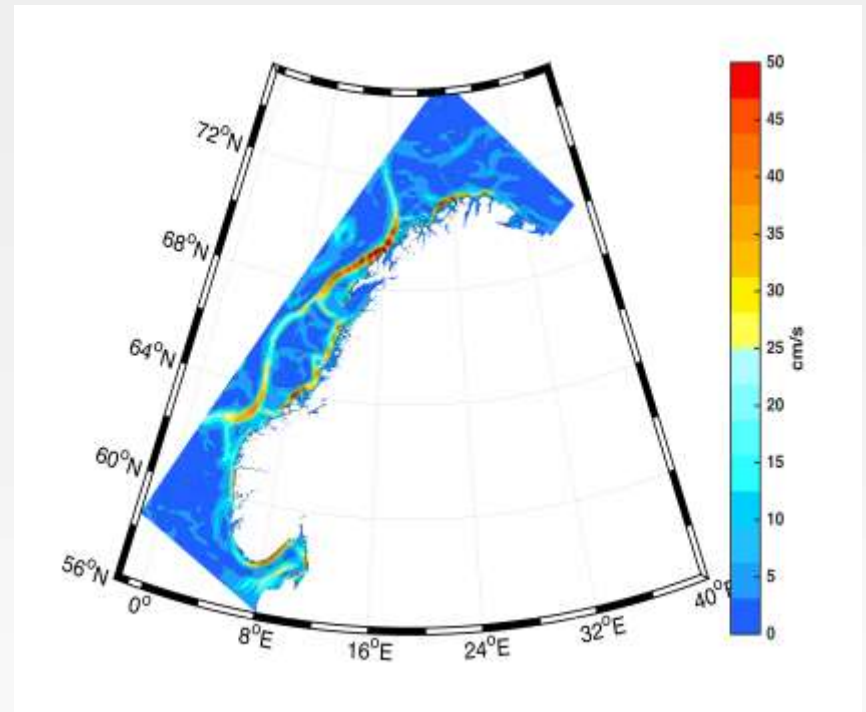
- January 2008: Cray XT4, 5552 cores (AMD Opteron) 4/8 GB memory/cpu; 51.1 Tflops; DDN 288 TB storage
- March 2012: New brain Cray XE6m-200, 22272 cores, 32 cores/node and 32GB/node; 204,9 Tflops; ekstra 260 TB storage





## The NorKyst800 - a current model system for the Norwegian coast; Albretsen J and Asplin L,

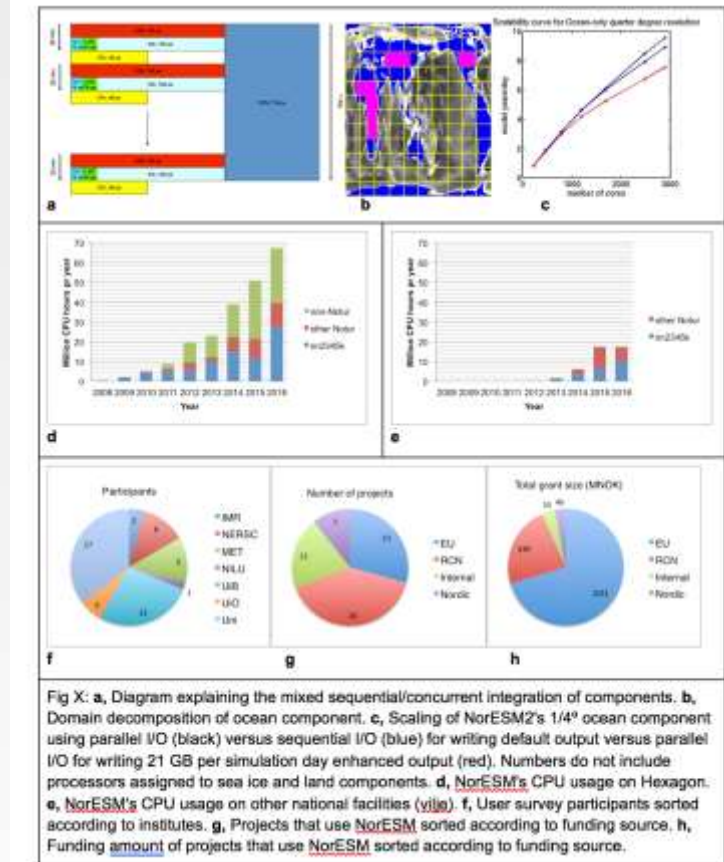
- Knowledge on ocean current is crucial for Aquaculture
- NorKyst800: compromise between the geographical extension of the model and sufficient resolution
- One year simulation takes about 20 days on 1024 processors ~ 500Kcpuh





# Hexagon, the workhorse of Norwegian climate modelling; M. Bentsen, I. Bethke, A. Gupta

- Norwegian Earth System Model  
(NorESM, Bentsen et al. 2013, Iversen et al. 2013, Tjiputra et al. 2013)
- Modeling climate changes involve complex integration of the processes of the atmosphere, land surface, cryosphere and ocean.





# Hexagon provides insights into climate change in India

## Michel d. S. Mesquita and Saurabh Bhardwaj

### Regional Climate Modeling under Tropical Channel Mode

#### Figure. 1

Downscaling of ERA-Interim dataset under tropical channel mode using WRF at 36km horizontal resolution. Plotted here is a snapshot of a simulation showing Outgoing Longwave radiation (OLR).

Source – TERI-Bjerknes Center 36km WRF simulation – Veldore, Mesquita, Lunde, Bhardwaj and Machineni.



- Weather Research and Forecasting (WRF)

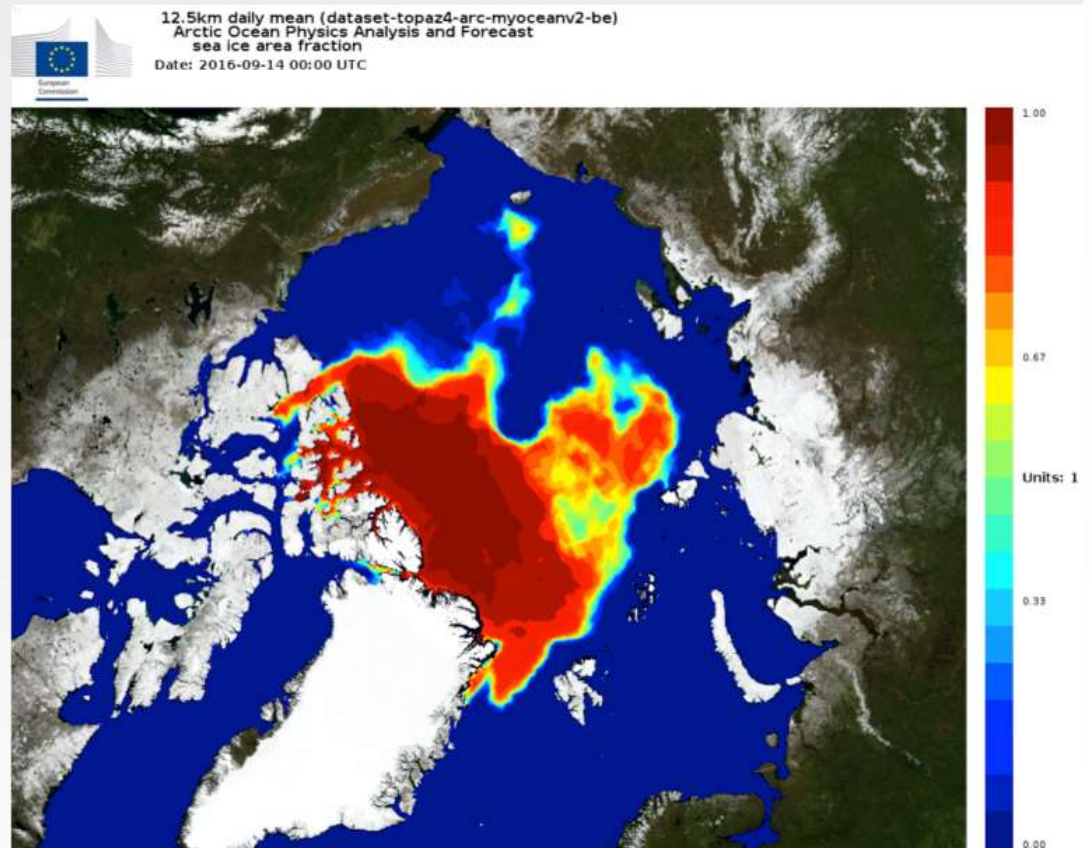






## Operational Oceanography: Laurent Bertino

- Forecast drift of objects at the ocean surface, such as oil spills or search and rescue operations
- CPU-hungry: high horizontal resolution and expensive data assimilation methods
- The forecast and re-analysis products have become the main Arctic contributions of the European Copernicus Marine Services in 2015: <http://marine.copernicus.eu>





# SC Projects

- Norwegian national compute and storage infrastructure (coordinated by Sigma2)
- Worldwide LHC Computing Grid, Nordic e-Infrastructure Collaboration (NeIC) providing compute and storage resource for the ALICE experiment
- GRUNCH (local project with Uni-Klima)
- IMR (local project with the Norwegian Marine Institute)
- SAFE (lead by Tore Linde)



# SAFE

- Service for secure management of sensitive information in research.
- Compliant with existing regulations
- Accessible for the University and College sector
- E-learning course: <https://mitt.uib.no/> (CANVAS)



# SAFE: Resources

## Available:

- 4 x ESXi host (6.5.0) with 132 cores and 3200 GB RAM
- 75TB SAS disk/200TB NL-SAS disk



## Usage:

- 33 virtual + 2 physical terminal servers/projects/secure desktop
- 5 virtual + 1 physical Linux applications servers
- Various requirements:
  - Small projects with 2 cores, 16GB RAM, 100 GB SAS disk
  - Projects with 48 cores (fMRI)
  - Project with large memory 2 TB RAM (IGS)
  - High network bandwidth requirement TB/day (Genome Core Facility)



# SAFE: Projects (highlights)

- HRR, Health Registries for Research:  
SAFE bidrar inn mot arbeidspakke i nasjonalt prosjekt
- Institutt for økonomi:  
«Demografiske og sosiale endringer - utfordringer for sysselsetting og velferd»
- UiB Genomic Core Facility, K2:  
«Whole human genome sequencing and analysis in rare disorders»
- Institutt for global helse og samfunnsmedisin:  
«Cardiovascular Disease in Norway 1994-2009 – The CVDNOR project»
- Institutt for biomedisin:  
«Potential for anti-cancer therapeutics in solid cancers by natural killer (NK) cells.»



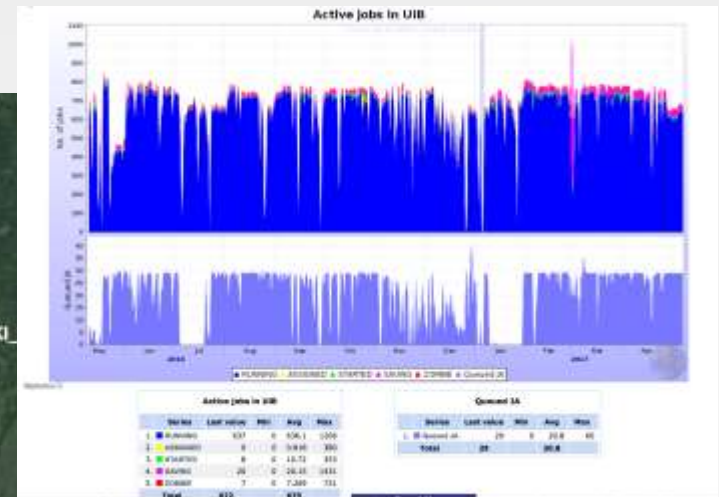
# SAFE: Future

- Provide SAFE as a self-service
- Implement a payment model



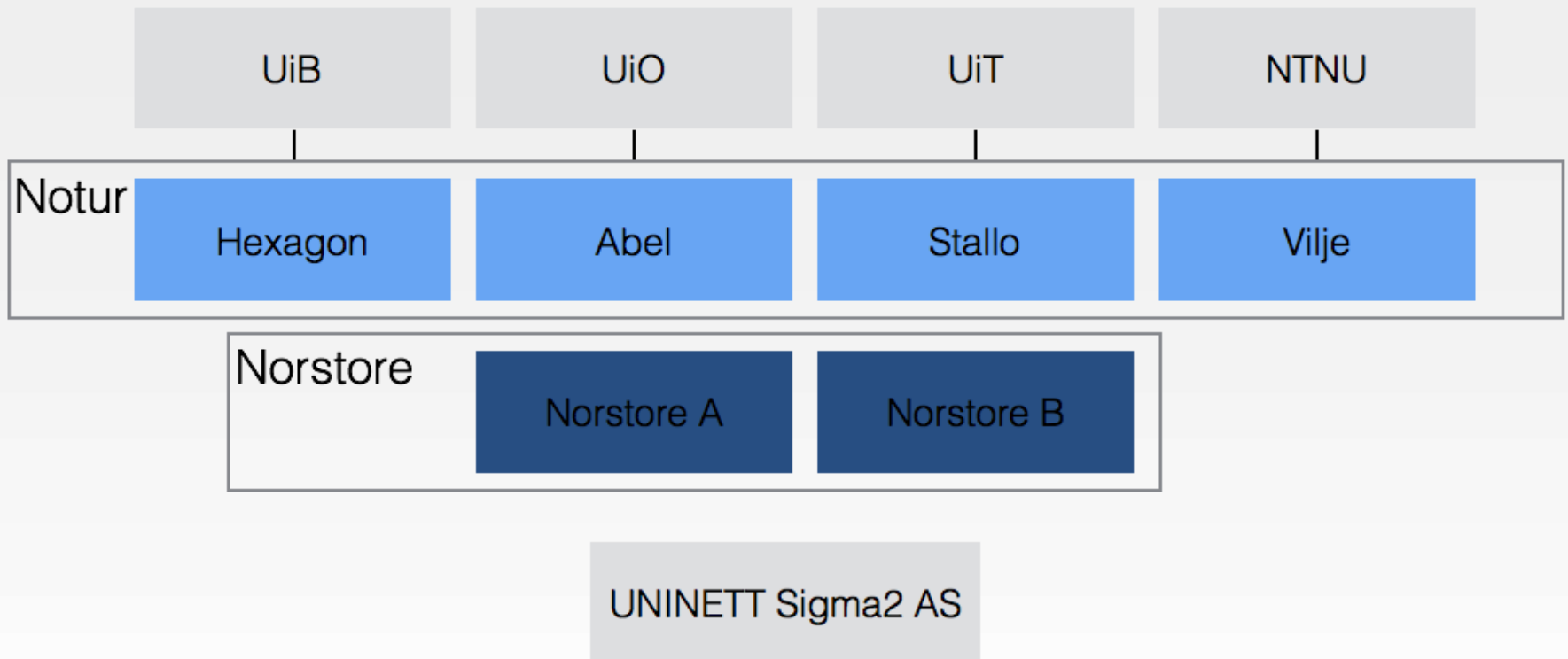
# NEIC: ALICE

- Provide compute and storage resources to the Nordic Tier-1 dedicated for the ALICE experiment.





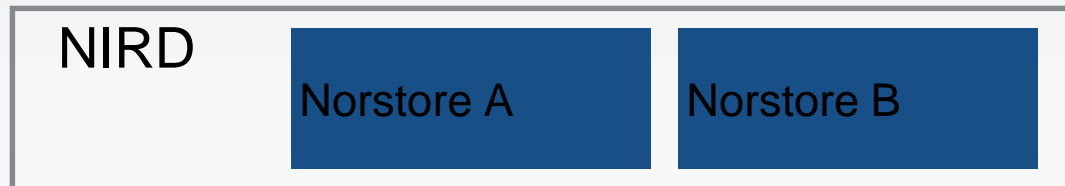
# NOTUR/NORSTORE/SIGMA2







# NOTUR/NORSTORE/SIGMA2



UNINETT Sigma2  
AS




[Home](#) / [Fram](#)

## Official opening 19.05, UiT!

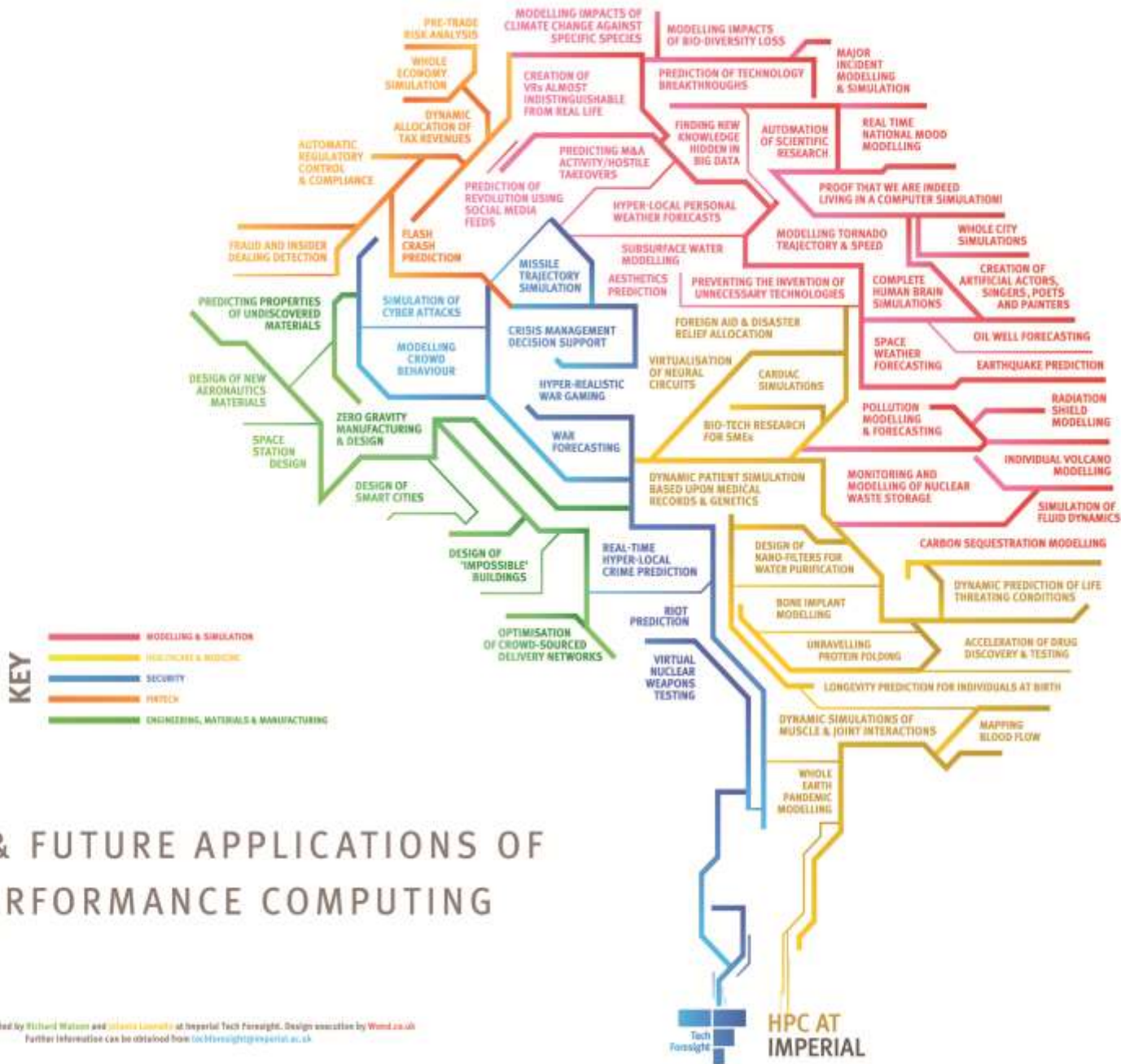
# Fram

Named after the Norwegian arctic expedition ship [Fram](#), the new Linux cluster hosted at UiT is a shared resource for research computing capable of 1.1 PFLOP/s theoretical peak performance. It will enter production during the 2017:1 computing period (starting 1 April 2017).

Fram is a distributed memory system which consists of 1004 dual socket and 2 quad socket nodes, interconnected with a high-bandwidth low-latency Infiniband network. The interconnect network is organized in an island topology, with 9216 cores in each island. Each standard compute node has two 16-core Intel Broadwell chips (2.1 GHz) and 64 GiB memory. In addition, 8 larger memory nodes with 512 GiB RAM and 2 huge memory quad socket nodes with 6 TiB of memory is provided. Additional GPU nodes are planned provided during first half of 2017. The total number of compute cores is 32256.

System	Lenovo NeXtScale nx360
Number of Cores	32256
Number of nodes	1006
CPU type	Intel E5-2683v4 2.1 GHz Intel E7-4850v4 2.1 GHz (hugemem)
Max Floating point performance, double:	1.1 Petaflop/s
Total memory	78 TiB
Total disc capacity	2.5 PB





# CURRENT & FUTURE APPLICATIONS OF HIGH PERFORMANCE COMPUTING

# Thank You



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