

# High performance computing Infrastructures – How quality service can be coupled to a scientific environment

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# Advanced Infrastructures for Science

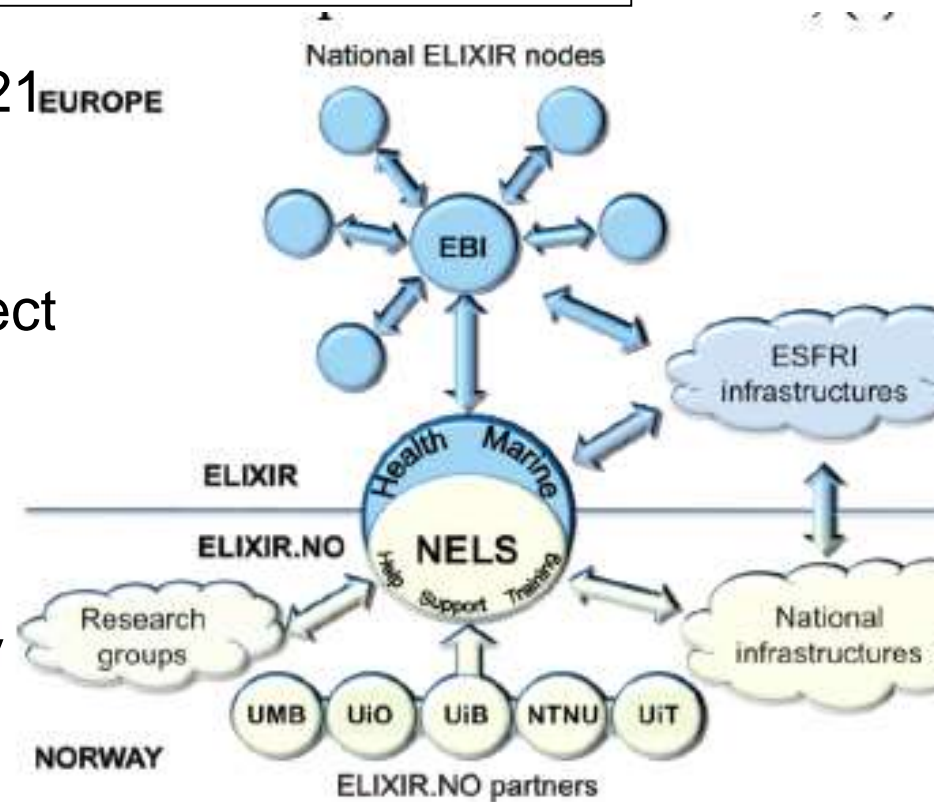
- Large, expensive shared facilities
- CERN, EMBL, ESA - European facilities
- Infrastructures to share knowledge
- Infrastructures to share data
- Human (expert) intensive infrastructures
- Infrastructures that deliver service to science
- Where should such structures be placed?

# ELIXIR – European infrastructure for bioinformatics

## What is ELIXIR?

The mission of ELIXIR is to construct and operate a sustainable infrastructure for biological information in Europe to support life science research and its translation to medicine and the environment, the bio-industries and society.

- 20 member countries + EMBL (21<sub>EUROPE</sub> nodes)
- ESFRI landmark project
- Supported by Horizon2020 project 2016-2019, 19MEuros
- ELIXIR = Platforms + Nodes
  - Platforms: Data, tools, compute, interoperability, training
- Norwegian Node coordinated by University of Bergen



# HPC-infrastructures

- Often located in computing centers
- Para//ab was created as a research project in 1986
- Para//ab evolved into an HPC-infrastructure for UiB and subsequently Norway
- The other parts of a distributed infrastructure in Norway were based on computing centers

# Para//ab – Advantages of running an infrastructure in a scientific environment

- Understand the user, science speaks to science
- Improve and develop best practice
- Invent and/or import new research based tools
- Act as a reference site, obtain better prices
- Recruit people from your research staff (PhDs)
- Provide career paths for young talents
- Low cost of operation, share positions

# A short guide to: How to buy a super-computer?

- Talk to the vendors about technology that is 2 years into the future (long before the tender)
- Talk directly to corporate HQ, never to sales
- Request bleeding edge technology
- Create a competitive atmosphere with vendors
- Make certain that all bids will fail your request
- Go after the performance sweet spot
- It may help to be Editor in Chief of the leading HPC scientific journal

# Parallel Computers

- 1987 - Alliant 8 Story

# Alliant

- Mini-super, competed with Convex
- Chief designers came from Data General
- Obtained via a grant proposal to NAVF
- Challenged the established way to do computing in Norway
- How to move away from the Y-MP?



# Parallel Computers

- 1987 - Alliant 8
- 1990 - MasPar 16384 Story

# MasPar - SIMD

- A radical alternative to accepted practice
- Competed with Thinking Machines
- First sale ever to Europe
- Good machine for research on parallel algorithms
- Failed mainly for political reasons
- Too early for its time, GPU technology today

# Parallel Computers

- 1987 - Alliant 8
- 1990 - MasPar 16384
- 1992 - Paragon 110 Story

# Paragon

- EERP from DEC. 3 M dollars
- DEC and Intel discussed a merger
- How to (legally) spend other peoples money?

# Parallel Computers

- 1987 - Alliant 8
- 1990 - MasPar 16384
- 1992 - Paragon 110
- 1996 - Origin 128 Story

# SGI (Cray) Origin

- Derived from the Dash  
Stanford, John Hennessy and co-workers
- Cache coherence in a way that scales?
- The name should be Ask (a tree!)
- Came in two pieces, one was called Ask,  
what about the other half?

# Parallel Computers

- 1987 - Alliant 8
- 1990 - MasPar 16384
- 1992 - Paragon 110
- 1996 - Origin 128
- 2002 - Regatta 96 Story

# Regatta

- IBM as a vendor, perhaps not perfect for a small organization
- The advertised peak performance seemed hard to achieve? (even approach)
- Our scientific staff proved that the machine had a hardware design flaw



# Parallel Computers

- 1987 - Alliant 8
- 1990 - MasPar 16384
- 1992 - Paragon 110
- 1996 - Origin 128
- 2002 - Regatta 96
- 2007 - Cray 22272 Story

# Cray

- The only machine in Norway to be ranked in the top 50 in the world.
- Contract negotiations at the end of May, slight issues with logistics?
- The machine is still running!

# Parallel Computers

- 1985 - Hypercube 64
- 1987 - Alliant 8
- 1990 - MasPar 16384
- 1992 - Paragon 110
- 1996 - Origin 128
- 2002 - Regatta 96
- 2007 - Cray 22272

# Summary

- Para//ab established itself as a leading research laboratory in Europe
- Para//ab challenged conventional computing centers
- Para//ab led the transition from vector to massively parallel computing in Norway
- Para//ab provided academic career paths for several UiB professors