

Coordinating distributed resources

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NeIC

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Nordic Tier1 as a sustainable model for an international infrastructure

- A bit of history:
 - **Idea**: conceived in 2002
 - **Motivation**: while each Nordic country is too small to have a Tier1, together they are bigger than e.g. the Netherlands (which has a Tier1)
 - **Framework**: NordForsk, the joint Nordic Research Council
 - **Facilitator**: NorduNET's support for NorduGrid which developed ARC software for the first Nordic testbed



Nordic Tier1: from NorduGrid to NDGF

- **NorduGrid**: an international R&D project for LHC computing
 - Original goal: create a Globus-based testbed
 - Actual result: new ARC software and a Nordic Tier1 prototype
 - Including a then-top-500 HPC cluster in Umeå
- **NDGF**: Nordic DataGrid Facility
 - 2003-2004: a prototype, focussed in distributed storage
 - 2005-2006: the first distributed Tier1 testbed, including computing and storage services
 - Took part in early ATLAS Data Challenges
 - Since 2006 – a full-scale distributed Tier1 project



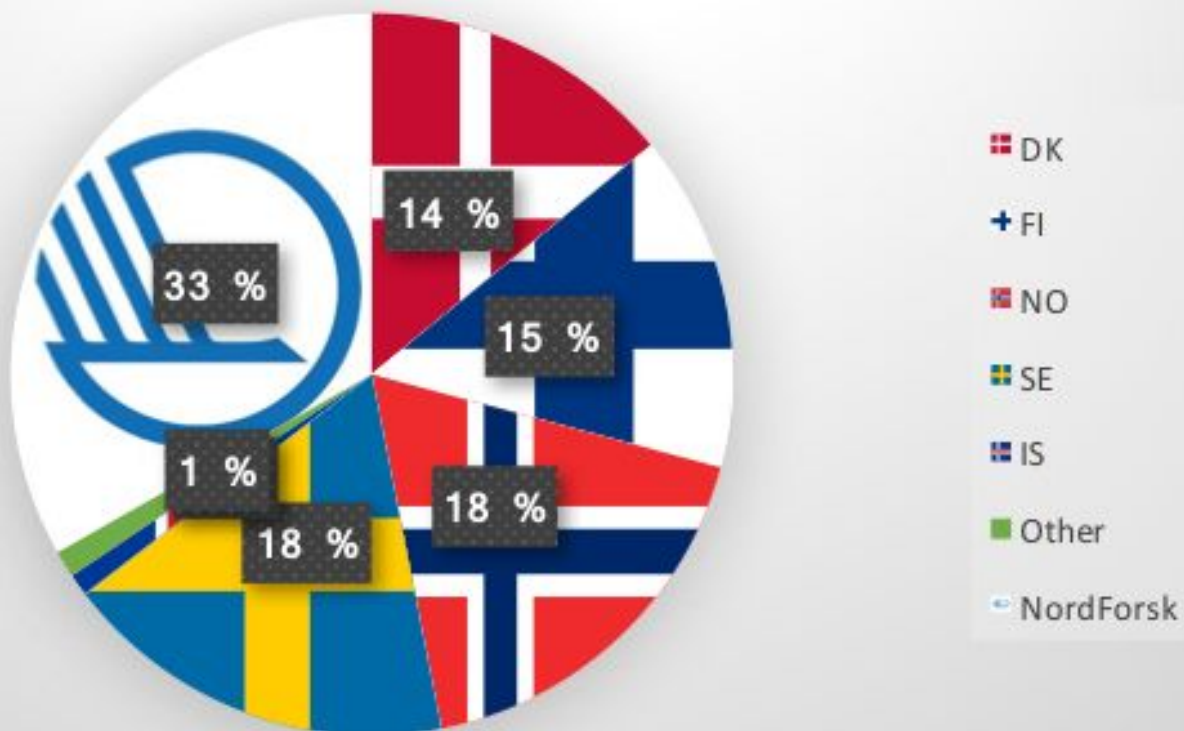
From NDGF to NeIC

- NDGF as a facility:
 - Was hosted by NORDUNet – a network provider
 - Was funded via NOS-N – the Nordic Council of Ministers
 - Primary goal was provide the Nordic Tier1 for LHC
 - ALICE and ATLAS experiments (CMS: only a Tier2 in Finland, LHCb: no Nordic members)
 - Attempted to involve other communities, e.g. ELIXIR
- **NeIC: the Nordic e-Infrastructure Collaboration** – became a continuation of NDGF in 2012
 - Built upon NDGF achievements
 - Has a broader scope, hosted by NordForsk



NelC: a multi-country framework for research

Total funding 2017: 55 MNOK



We do have challenges

- 4 countries, 8 employers
 - Mostly public Universities
- 2 LHC experiments:
 - ALICE and ATLAS
 - Different requirements and different community sizes (e.g., no ATLAS in Finland, very little ALICE in Sweden)
- 5 network providers:
 - 4 national providers and NORDUnet
 - Different service agreements and funding schemes for each

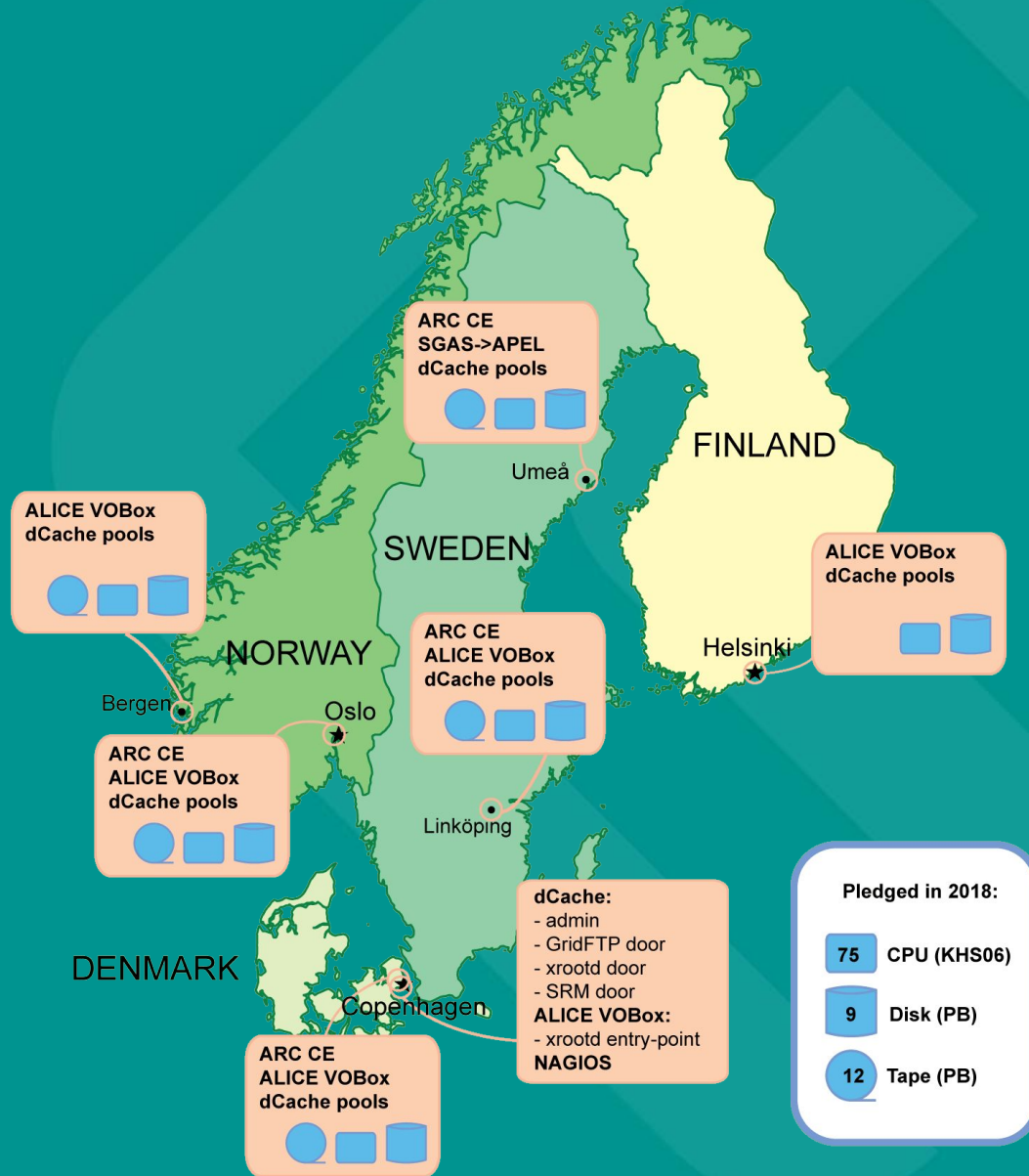


Even more challenges

- Stakeholders: physicists and national research e-infrastructures
 - Physicists obtain funding via research grants
 - These funds are used to acquire hardware, hosted by national centres
- Most hardware and all facilities are shared with all other researchers – non-dedicated
 - HEP requirements are rather special, esp. in terms of I/O, storage and bandwidth
- We have to deliver a common coherent service based on diverse distributed resources
 - While having different funding cycles
 - While complying with different national regulations
 - While speaking different languages
 - While working in different time zones



The Nordic Tier1 floor-chart: 1 000 000 km²



We have solutions

- One host: NeIC
 - NeIC is not a project: it is an activity hosted by NordForsk
 - No expiration date
- Common funds for central operations
 - Provided through national fees and NordForsk
 - Operators are embedded with each individual facility
 - Management is strategically located:
 - Coordinator: at the largest facility
 - CERN liaison: close to both ALICE and ATLAS researchers
- Embedded scientists
 - Strategic partners in Slovenia and Switzerland



Key sustainability components

- Joint stakeholders committee: NLCC
 - From each country, one physicist and one infrastructure representative
 - Decides on pledges
 - Oversees performance
 - Advises on strategic decisions
 - Quarterly meetings
- Careful choice of technologies
 - Distributed storage pools with single entry point – by dCache
 - NORUnet hosts the dCache entry point and provides high-speed link to CERN
 - ARC-CE with built-in cache to handle distributed data
 - In-house developers of both dCache and ARC
 - Constant monitoring and evaluation of new technologies

dCache.org 



A virtual organisation

- All the experts and managers are located across the entire region
- Aided by a range of monitoring tools
- Rotating Operators on Duty and Operators on Call
 - Countries take turn every week
- Continuous communication via a chat room – in English
 - Started with XMPP, then switched to Slack, now researching other options
 - Weekly chat meetings
 - Supported by individual weekly reports in dedicated Wiki
- F2F meetings 3 times a year
- The real key to success: a friendly team of dedicated experts
 - Multi-skilled people helping each other and the LHC



Conclusion

- The Nordic Tier1 is a trailblazer of distributed LHC Grid facilities
 - Is followed by others (e.g. the Midwest Tier2, Russian Tier1)
 - Remains the largest in terms of individual nodes, and the only international one
- The success lies in a long history of regional cooperation and strong commitment of all the stakeholders and employees
 - Human capital is at least as important as technology investments
- We will gladly share our experience!

