# NDGF – A Distributed Computing Centre
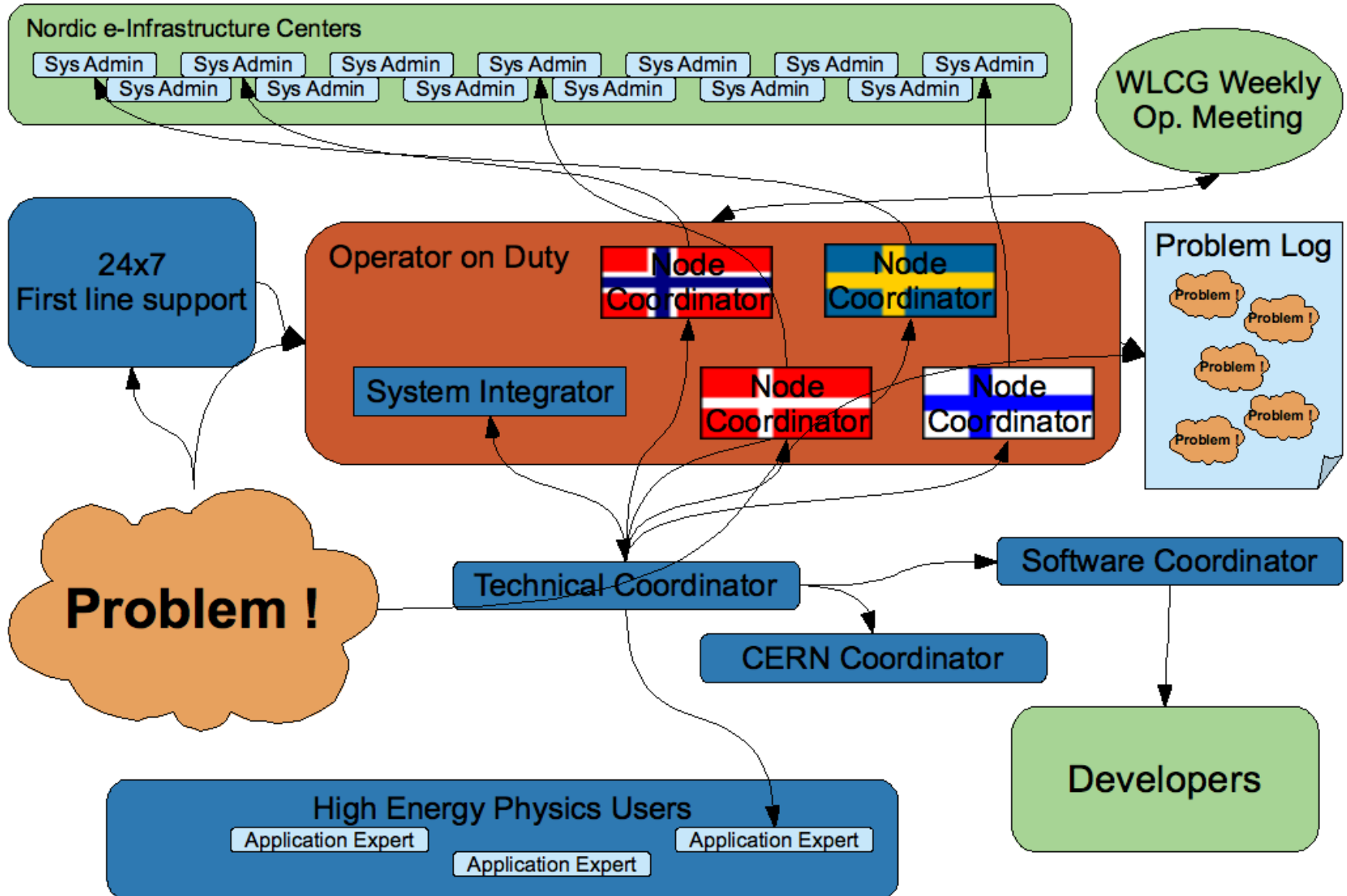
*Mattias Wadenstein*
*System Integrator, NDGF*
Data Retention Workshop at DESY

Hamburg, 2009-01-26
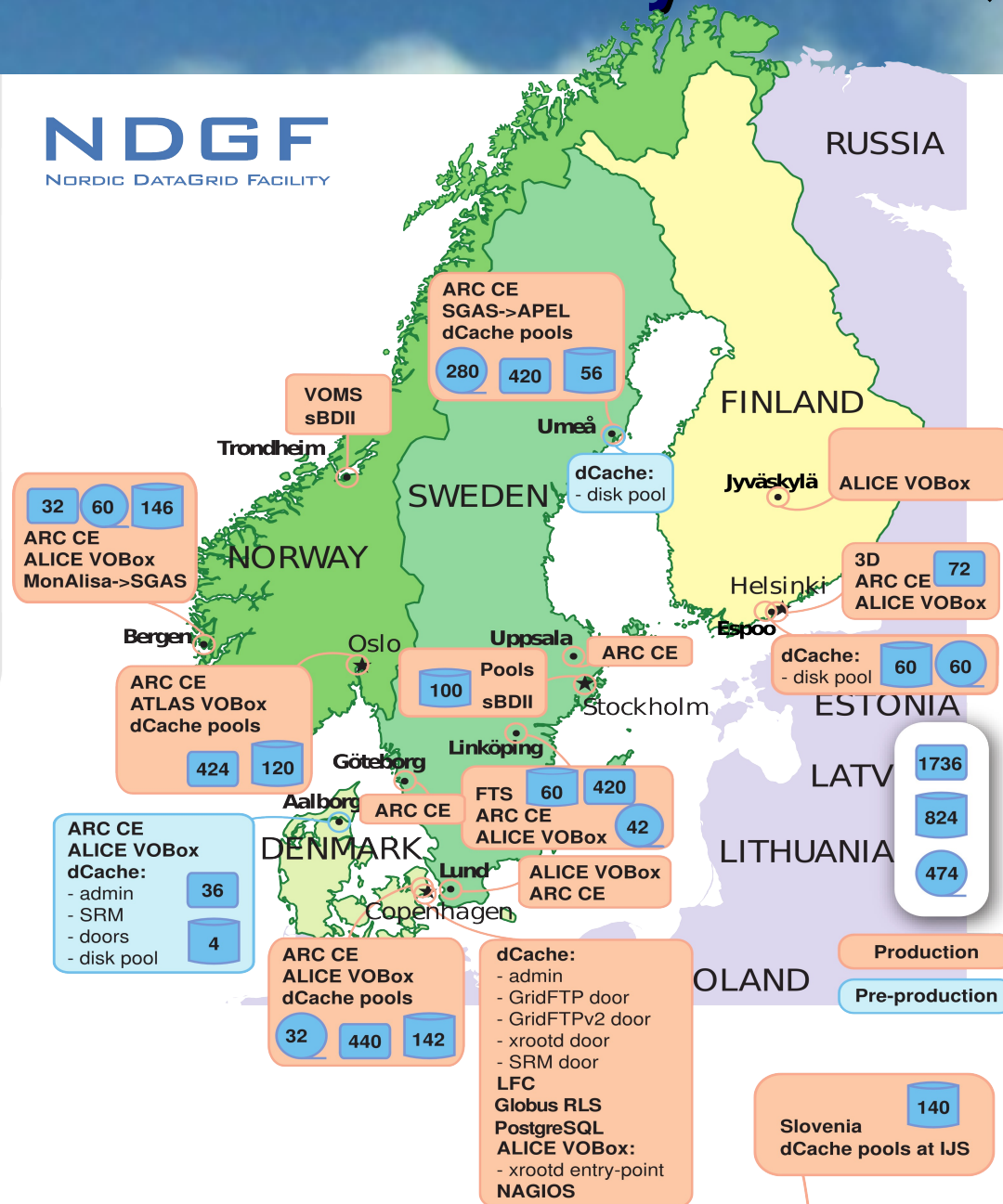
**NDGF**
NORDIC DATAGRID FACILITY

- The NDGF Project
- Status of the infrastructure
    - Resources
    - Services
    - Operation
- The LHC Tier1
- Example site: HPC2N

**NDGF**
NORDIC DATAGRID FACILITY

- A Co-operative Nordic Data and Computing Grid facility
  - Nordic production grid, leveraging national grid resources
  - Common policy framework for Nordic production grid
  - Joint Nordic planning and coordination
  - Operate Nordic storage facility for major projects
  - Co-ordinate & host major eScience projects (i.e., Nordic WLGC Tier-1)
  - Develop grid middleware and services
- NDGF 2006-2010
  - Funded (2 M€/year) by National Research Councils of the Nordic Countries

- NDGF participates in the dicussion of future grid infrastructures
  - Participates in the Nordic Task Force who looks to the long term perspective for grid in the nordic countries
  - Elected observers in EGI-PB (European Grid Inititative Policy Board)

**Nordic e-Infrastructure Centers**

Sys Admin · Sys Admin · Sys Admin · Sys Admin · Sys Admin · Sys Admin · Sys Admin
Sys Admin · Sys Admin · Sys Admin · Sys Admin · Sys Admin · Sys Admin

**WLCG Weekly Op. Meeting**

**24x7 First line support**

**Operator on Duty**
Node Coordinator
Node Coordinator
System Integrator
Node Coordinator
Node Coordinator

**Problem Log**
Problem !
Problem !
Problem !
Problem !
Problem !

**Problem !**

Technical Coordinator

Software Coordinator

CERN Coordinator

Developers

**High Energy Physics Users**
Application Expert
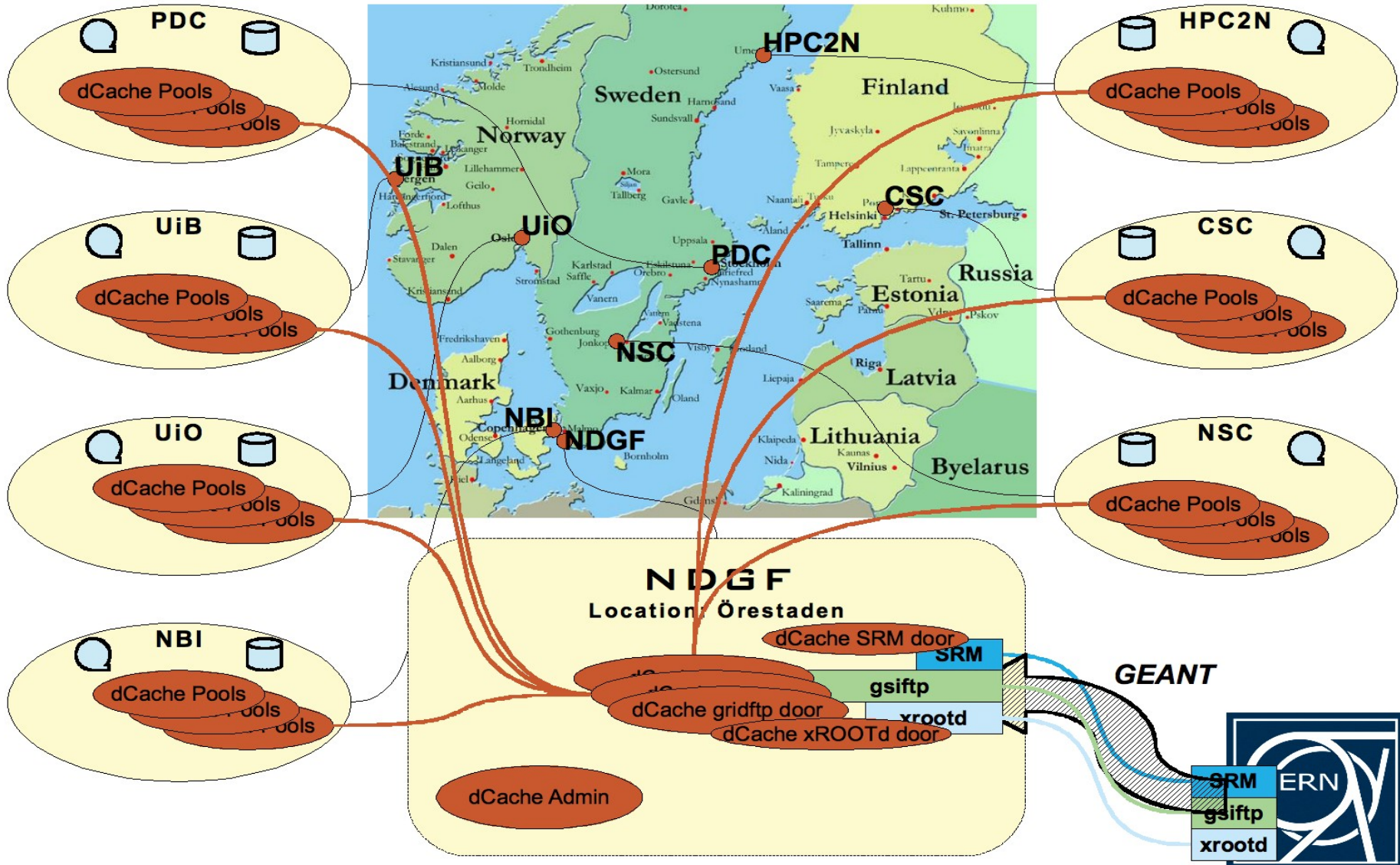Application Expert
Application Expert

- One of several e-science projects
- Currently by far the biggest at NDGF
- Supports ATLAS and ALICE
  - NDGF also provides technical assistance to the Finnish CMS tier2
- Requires long-term comittment
  - Data available at least until 10 years after LHC shutdown
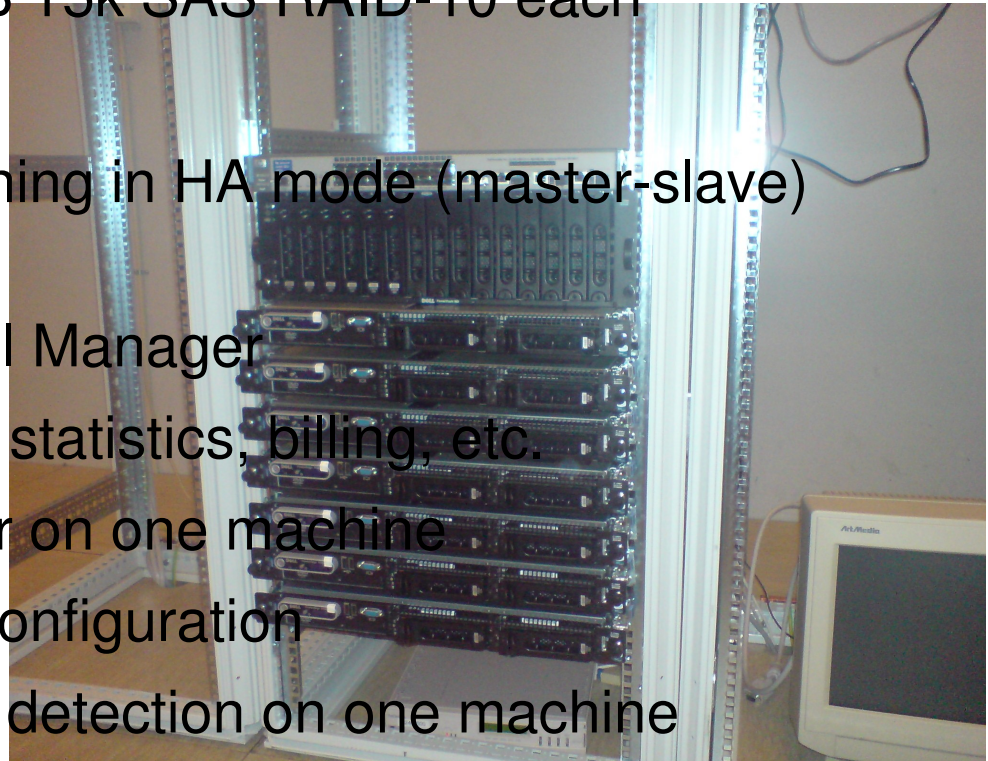    - USB 6.0 stick mailed to anyone interested? :)

- 10 Production sites
- 2-4 MSI2k CPU equivalents
- 800 TB of Disk storage
- 500 TB of Tape storage
- Computing running Ubuntu 6.06/8.04, RHEL/CentOS 3,4,5, fedora, gentoo...
- Storage all the above plus Solaris and AIX

- 1$^{st}$ line support – (ready for operation)
  - NORDUnet NOC – 24x7
- 2$^{nd}$ line support – (in operation)
  - Operator on Duty – 8x365
  - EGEE NE-ROC
- 3$^{rd}$ line support – (in operation)
  - NDGF Operation Staff
  - Sys Admins at sites
- Shared tickets with NUNOC

# NDGF Storage

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- Central Installation:
  - 7 Dell 1950 2xDual Core 2GHz Xeon, 4GB RAM, 2 x 73GB 15k SAS disks (mirrored) (one spare node)
  - 2 x Dell PowerVault MD-1000 direct attached storage enclosures with 7 x 143GB 15k SAS RAID-10 each
- Running:
  - 2 Postgress for PNFS running in HA mode (master-slave) DB on MD-1000
  - 1 PNFS Manager and Pool Manager
  - 1 SRM, location manager, statistics, billing, etc.
  - 1 GridFTP and xrootd door on one machine
  - 2 LFC servers in failover configuration
  - 1 Monitoring and intrusion detection on one machine

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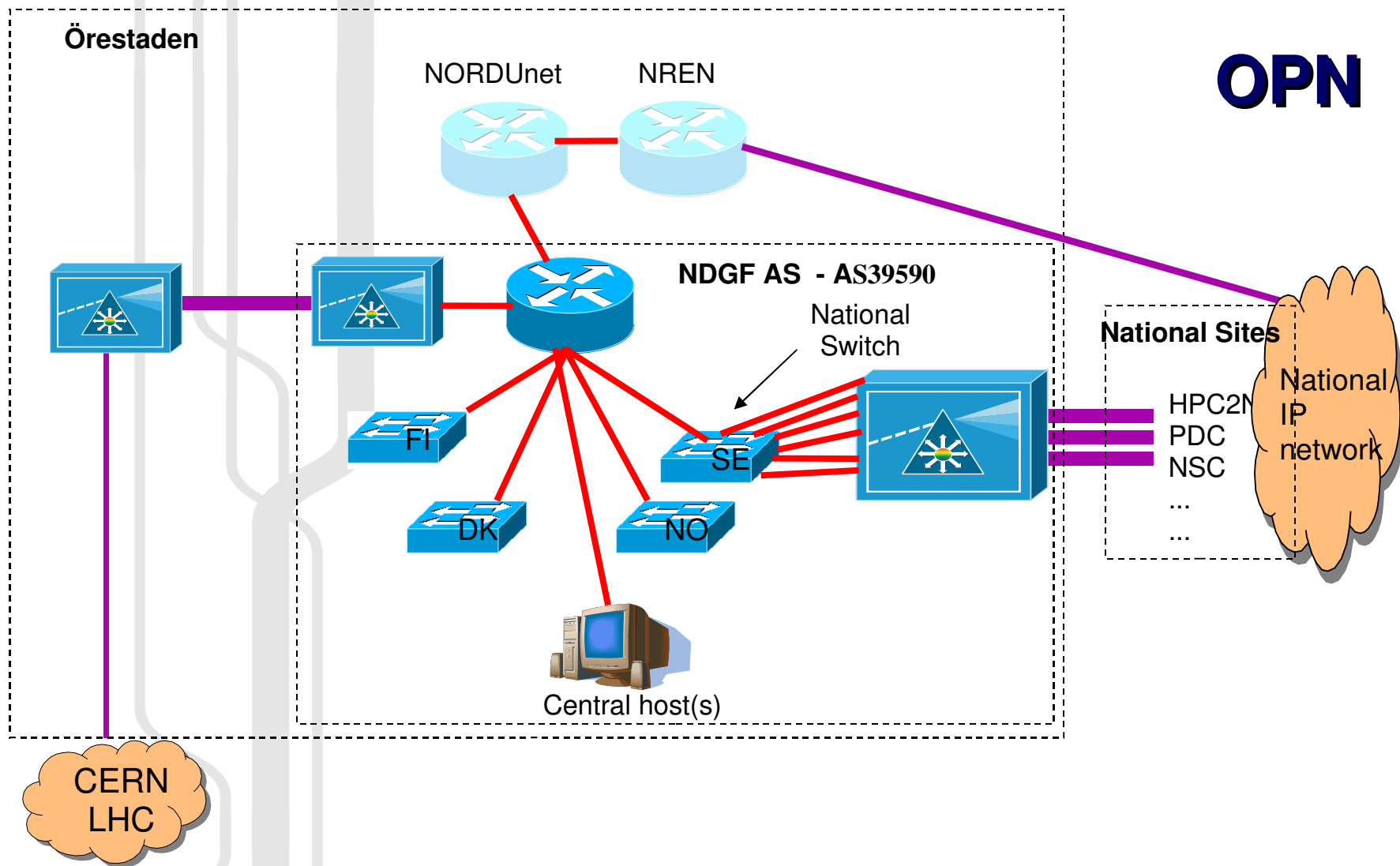
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- NorduGrid / ARC middleware for Computing

- Used routinely since 2002 for e.g. ATLAS data challenges

- Deployed at all the dTier-1 sites



Grid Monitor - Microsoft Internet Explorer

Processes: ■ Grid ▬ Local

| Country | Site | CPUs | Load (processes: Grid+local) | Queueing |
|---------|------|------|------------------------------|----------|
| Australia | Atlas (UniMelb) | 26 | 0+2 | 0+0 |
| Australia | Charm (UniMelb) | 36 | 0+0 (queue down) | 0+0 |
| Australia | Alfred (UniMelb) | 90 | 0+6 | 2+1 |
| Denmark | DistLab (DIKU) | 10 | 0+0 | 0+0 |
| Denmark | Aalborg Grid Gateway | 46 | 38+0 | 0+0 |
| Denmark | Niflheim (DCSC/DTU) | 902 | 0+898 | 0+17 |
| Denmark | Horseshoe (DCSC/SDU) | 1192 | 0+873 | 0+3 |
| Denmark | HEPAX1 | 1 | 0+0 | 0+0 |
| Denmark | Morpheus | 18 | 15+0 | 23+0 |
| Denmark | Theory (DCSC/KU) | 112 | 0+42 | 0+1 |
| Denmark | VCR (VideoRecorder) | 1 | 1+0 (queue down) | 0+0 |
| Estonia | UT IMCB Anakonda clus> | 15 | 3+0 | 0+0 |
| Estonia | UT CS Antarctica Clus> | 20 | 6+0 | 0+0 |
| Estonia | CMS on CERN Linux | 1 | 0+0 | 0+0 |
| Estonia | CMS Production server | 5 | 0+0 | 0+0 |
| Estonia | UT DOUG Cluster | 2 | 0+0 | 0+0 |
| Estonia | CMS test cluster | 1 | 0+0 | 0+0 |
| Estonia | EENet cluster | 6 | 0+0 | 0+0 |
| Estonia | UT Physics Cluster | 3 | 3+0 | 0+0 |
| Finland | CSC Kirppu | 1 | 1+0 | 6+0 |
| Finland | Mill (Physicum) | 60 | 0+15 | 0+0 |
| Finland | Alpha (HIP) | 1 | 0+0 | 0+0 |
| Finland | Testbed0 (HIP) | 1 | 0+0 | 4+1 |
| Germany | FZK cluster | 996 | 83+349 | 0+0 |
| Germany | LRZ cluster | 234 | 0+230 | 0+243 |
| Norway | Oslo Temp Cluster | 11 | 0+0 | 25+0 |
| Norway | Parallab IBM Cluster | 58 | 0+57 | 0+75 |
| Norway | Bergen Grid Cluster | 2 | 2+0 | 7+0 |
| Norway | Oslo Grid Cluster | 41 | 9+15 | 51+0 |
| Norway | UiO Grid | 100 | 0+98 | 0+1 |
| Slovenia | SiGNET | 40 | 6+31 | 6+0 |
| Sweden | Bluesmoke (Swegrid,NS> | 99 | 95+0 | 187+0 |
| Sweden | Kosufy farm | 60 | 36+0 | 0+0 |
| Sweden | ISV | 4 | 4+0 | 14+0 |
| Sweden | Hagrid (SweGrid, Uppm> | 100 | 50+0 | 68+0 |
| Sweden | Ingrid (SweGrid,HPC2N) | 101 | 69+0 | 124+0 |
| Sweden | Monolith (NSC) | 398 | 0+342 | 0+121 |
| Sweden | Quark Cluster | 7 | 0+0 | 0+0 |
| Sweden | Beppe (SweGrid PDC KT> | 96 | 92+0 | 49+0 |
| Sweden | Sigrid (SweGrid, Luna> | 99 | 49+50 | 19+25 |
| Sweden | Toto7/Whenim64 (Lunar> | 192 | 0+161 | 0+11 |
| Switzerland | Bern ATLAS Cluster | 8 | 8+0 | 12+0 |
| TOTAL | 42 sites | 5196 | 570 + 3169 | 597 + 499 |

# The Infrastructure: Networking

NDGF
Nordic DataGrid Facility

Örestaden

NORDUnet    NREN

OPN

NDGF AS  - AS39590

National
Switch

National Sites

HPC2N
PDC
NSC
...
...

National
IP
network

FI

DK        NO

SE

Central host(s)

CERN
LHC

- HPC2N in Umeå, Sweden
  - provides computational resources for swedish academic researches
  - National allocation
  - Mostly MPI jobs
- Also participates in various grid projects
  - Swegrid, NDGF, EGEE, GIRD, ETC
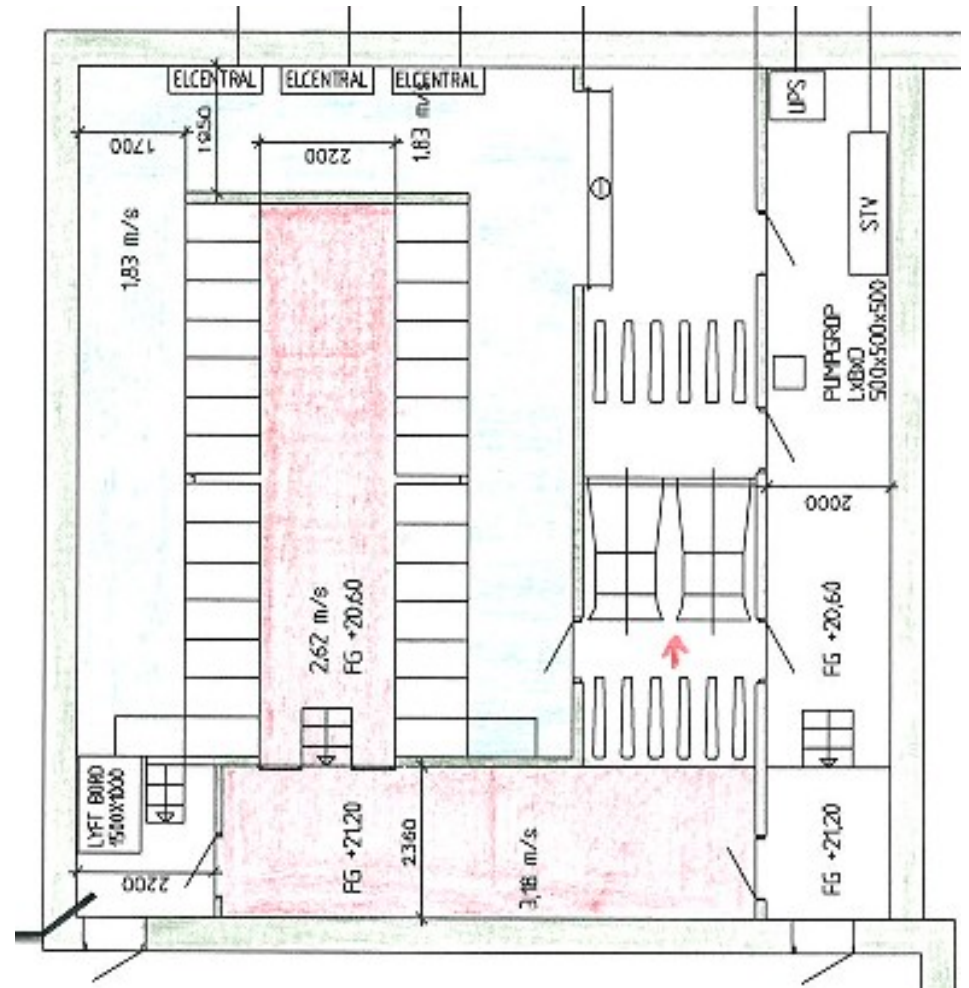
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- compute resource
  - 5376-core IBM blade system with infiniband for general usage
  - 432-core supermicro twin nodes dedicated for grid
  - 380-core opteron & myrinet cluster

- 100 TB GPFS
- 1 TB AFS
  - Software, home, etc
- IBM 3584
  - 1000 tape slots
  - LTO4
- LHC tier1 disk
  - 56TB running
  - 200 TB ordered

- ## New machine room
  - strict hot/cold aisle
  - 28 racks
  - 25 kW front to back aircooling per rack
  - total ~400kW
  - no redundant power
  - Only for computing, storage&servers in old machine room
  - no raised floor
  - 3.5m high

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- Per rack:

- 1 x 32A 400V 3-phase

- Or 3 x 32A 230V 1-phase

- Separate cabling ladders for:

- HPC interconnect (infiniband, myrinet, etc)

- Ethernet

- Power

# Questions?