Swedish National Infrastructure for Computing

SNIC
Swedish HPC Landscape

Sverker Holmgren

SNIC-Mission

“The Swedish National Infrastructure for Computing (SNIC), under the jurisdiction of the Swedish Research Council, is a national resource intended to create integrated quality access to computational resources for Swedish research purposes where networks, data storage, computers, visualisation and various Grid-techniques can be used to produce a transparent resource”

Stated in the instruction for SNIC issued by the Swedish Research Council

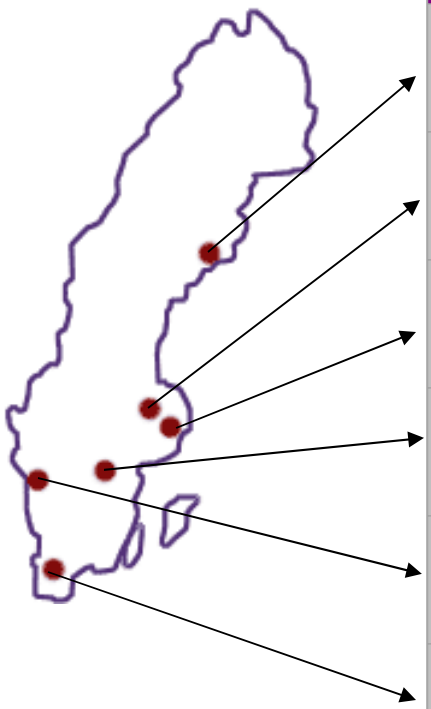
SNIC-Mission

- Provide long term funding for HPC-resources in Sweden
- Coordinate investments in HPC-systems
- Coordinate competence at participating centers to optimize user support and quality of operations
- HPC-related development projects in
  - Computer systems
  - Storage
  - Networks
  - Computational science
  - Visualization
  - GRID-technology
- Disseminate information and knowledge about SNIC resources and their use
- Host the Swedish National Graduate School in Scientific Computing (NGSSC)

Why a Metacenter?

- Limited number of HPC experts in Sweden
- Proximity to users by having regional centers
  - In depth users support
  - Collaborations
  - Induction of new HPC usage
  - Points of entry to national infrastructure
- Load balancing national leading edge systems based on technical assessments and resource availability
- Grid technology
  - A metacenter can contribute to development
  - Grid technology enables metacenter co-ordination
- International collaboration as a unified structure
  - NorduGrid
  - EGEE/LCG
  - BEEGEE

SNIC-centers



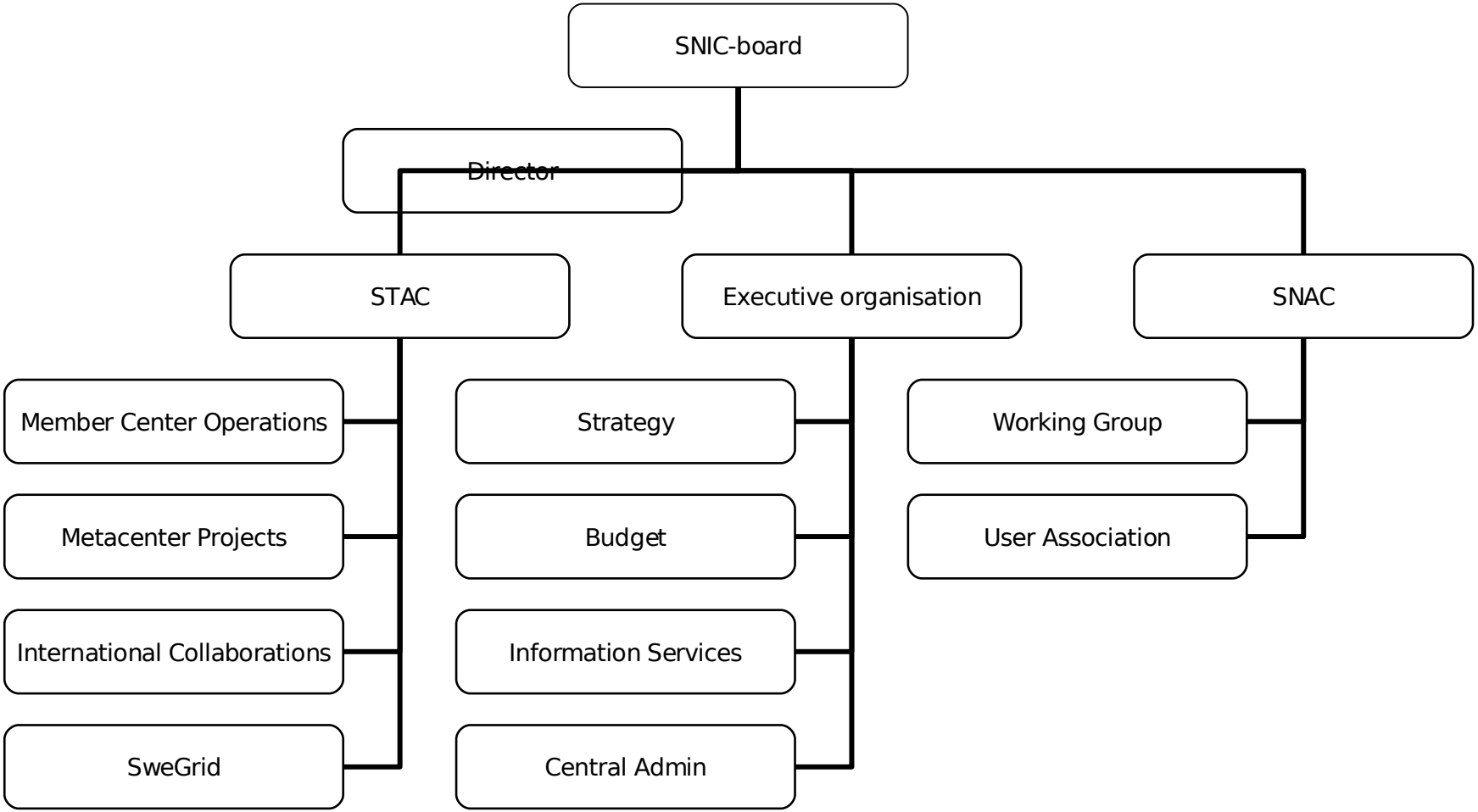
Center	SNIC Funding 2006 (MSEK)
HPC2N	5,5
UPPMAX	5,0
PDC	12,8
NSC	11,5
C3SE (UNICC)	4,0
LUNARC	4,4
Sum	43,2

- Significant contributions from hosting universities and other funding agencies.

Resource Contracts 2006

- Capability cluster, NSC (35 MSEK
- Capacity cluster, LUNARC (6.6 MSEK)
- Capacity cluster, UPPMAX (5.3 MSEK)
- Capacity cluster, UNICC (5.0 MSEK)
- Upgrade of Itanium cluster, PDC (2.0 MSEK)

Organization



SNIC-Board

- Birgit Erngren (Chairman)
- Paula Eerola (GRID, Particle Physics, LU)
- Sinisa Krajnovic (CFD, Chalmers)
- Erland Källén (Climate simulations, SU)
- Bengt Persson (Bioinformatics, LiU)
- Hans Wallberg (SUNET, UmU)
- Erik Hagersten (Computer Science, UU)
- Uno Nävert (Numerical analysis, Chalmers)
- Billy Fredriksson (Saab, Linköping)

STAC

- Lars Andersson, C3SE (UNICC)
- Lennart Johnsson, PDC
- Bo Kågström, HPC2N
- Ingela Nyström, UPPMAX
- Göran Sandberg, LUNARC
- Sven Stafström, NSC
- Tord Ekelöf, SweGrid PI
- Leif Nixon, NDGF national coordinator
- Per Öster, EGEE ROC coordinator

SNAC

- Lars-Erik Lindgren, Luleå Technical University (Chair)
- Oxana Smirnova, CERN/Lund University
- Igor Abrokosov, Linköpigs University
- Per Hyldgaard, Chalmers University of Technologi
- Peter Olsson, Umeå University
- Johan Åqvist, Uppsala University
- Bo Jönsson, Lund University
- Aatto Laaksonen, Stockholm University
- Lars Ojamäe, Linköpings University
- Per Lötstedt, Uppsala University
- Thomas Rylander, Chalmers University of Technology
- Maya Neytcheva, Uppsala University
- Mats Holmström, Umeå University
- Gunilla Svensson, Stockholm University

SNIC User Group

The aims of the user association are to:

3. establish a communication channel between SNIC and users for facilitating:
   - a. the dissemination of information about resources and services,
   - b. awareness of user viewpoints, and
   - c. awareness of needs through analyses and questionnaires;

4. establish a forum for discussions and exchanges between users by arranging user meetings and maintaining a web site; and

6. to ensure user representation in SNIC through the recommendation of two members for the SNIC board, following an election process.

SNUG steering committee

- Sinisa Krajnovic, Chalmers
  - sinisa@chalmers.se
- Mattias Ellert, Uppsala
  - Mattias.Ellert@tsl.uu.se
- Oxana Smirnova, Lund,
  - oxana.smirnova@hep.lu.se
- Bengt Persson, Linköping
  - bpn@ifm.liu.se
- Ann-Charlotte Berglund, Uppsala
  - Ann-Charlotte.Berglund@lcb.uu.se
- Peter Olsson, Umeå
  - peter.olsson@tp.umu.se

Interaction with funding bodies

By coordinating Swedish HPC and interact with other funding bodies SNIC has managed to increase the available funding for Swedish HPC

- Funding bodies
  - Swedish Research Council
  - Knut and Alice Wallenberg Foundation
  - Foundation for Strategic Research
- SNIC guarantees
  - Optimal technology choices
  - Cost sharing with other parties
  - Cost efficient operations
  - High level of service
  - Accounts for usage and scientific production
- Obtained funding
  - 6 SweGrid clusters storage
    - 23 MSEK (KAW)
  - New cluster at HPC2N
    - (10 MSEK) (KAW)
  - Chemistry computer at PDC
    - (4 MSEK) (KAW)
  - Condensed matter computer
    - (4 MSEK) (VR)
  - Climate computer at NSC
    - (5.4 MSEK) (KAW)

International Collaborations

Collaborations co-ordinated through SNIC

- NorduGrid
  - Largest resource contributor through SweGrid
- EGEE (Enabling Grids for EsciencE)
  - North European Regional Operations Center
  - Security co-ordinator
- BalticGrid (Baltic Extension of EGEE), co-ordinator
- Nordic Data Grid Facility (NDGF)
- Metacenter co-ordination with Norway
- ESFRI working group on HPCN
- eIRG (Electronic Infrastructure Reflection Group)
- HET
- SNIC centers have several EU-projects

SNIC review 2005

- Praise for SNIC coordination
- Recommends continued build-up of SNIC
- Increased user and center ambition
- Emphasis on Grid build-up
- Future vision in a landscape document
- SNIC Evaluation recommends increased scope and ambition for Swedish HPC
  - Large scale resources
  - Enabling Swedish world class science
  - Participation in international projects
- Investment in a new large scale shared memory resource
- Continued build-up of storage facilities

The Swedish HPC landscape

- Forms the basis of the SNIC strategy 2006-2009
- Describes Trends
  - Science
  - Services
  - Hardware
- Analyzes needs
- Roadmaps for landscape specified
- Jointly authored by STAC
- Assumes funding at 90 MSEK/year level

Trends

- HPC is the third research paradigm
- Existing and new application disciplines
- Number of users is increasing
- ”Sensor based” science is putting new demands on HPC resources
- Storage and data services of increasing interest
- Technical paradigm shifts are under way
  - PC-clusters with capability nodes
  - Multicore technologies
  - GRID-technology and ”cyberinfrastructure”
  - Light paths

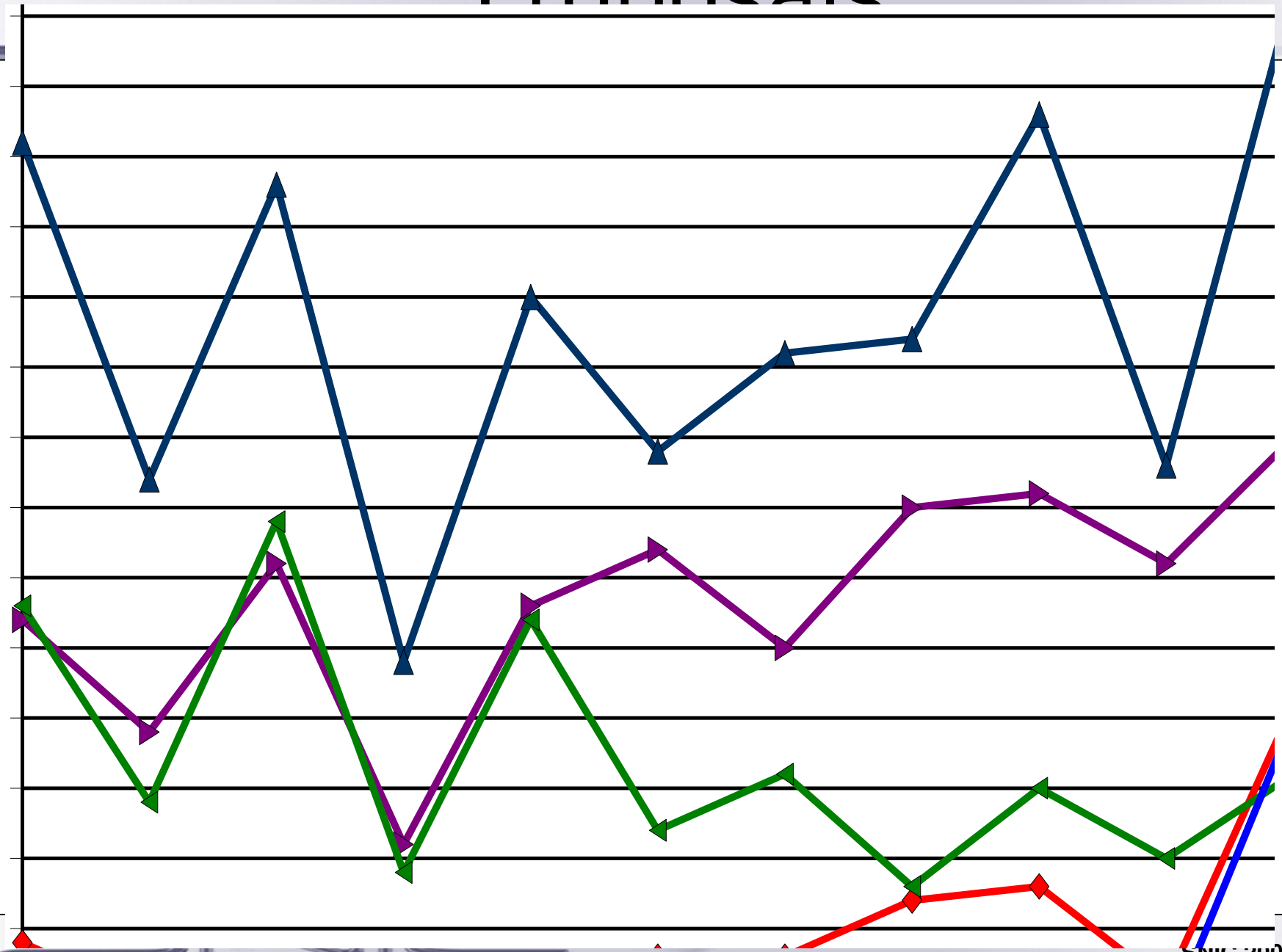
International Outlook

- US has several new initiatives and is building a ”cyberinfrastructure” (PITAC report)
- Japan & US is driving development
- In Europe the EU Framework Programmes are putting increasing emphasis on HPC and Grids
  - European scale HPC centers are being discussed
  - Pan European Grid Infrastructure (EGI)
- In the Nordic region other initiatives similar to SNIC have been launched
- GRID-Technologies will enable extensive Nordic and European collaborations

Needs

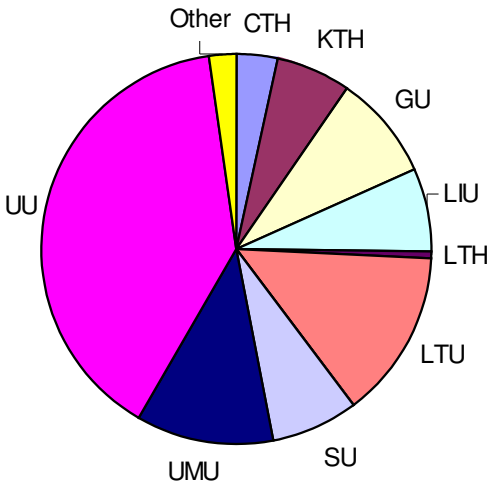
- Sweden is currently in “good” shape
  - Increase of SNAC resources is at par with number of projects
  - Gone from 2 Mh to 10 Mh of allocated time in 5 years
  - A large number of researchers in Sweden crucially depend on the existence of SNIC resources
- Some users/user groups have extreme future needs
  - Some of these are not SNIC users today
  - Significant large investments are needed
- Software is increasingly being regarded as a tool
  - Application oriented portals
- Monitor needs through
  - Statistics from Centers and SNAC
  - User surveys
  - Direct user contact
- Dominant need is still “Fast processors with high availability” followed by need for “large memory and scalability”

Proposals

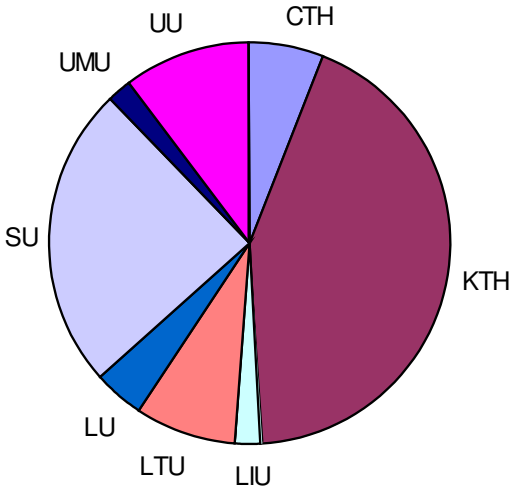


SNAC Usage

HPC2N



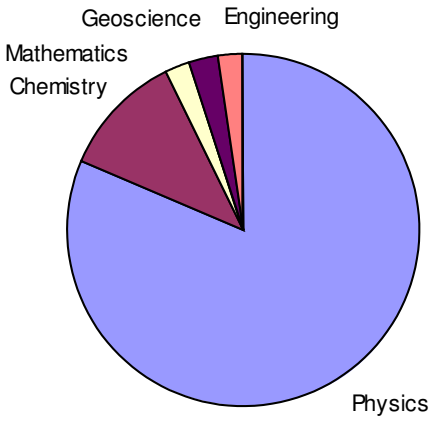
PDC



NSC

SNAC Usage

HPC2N



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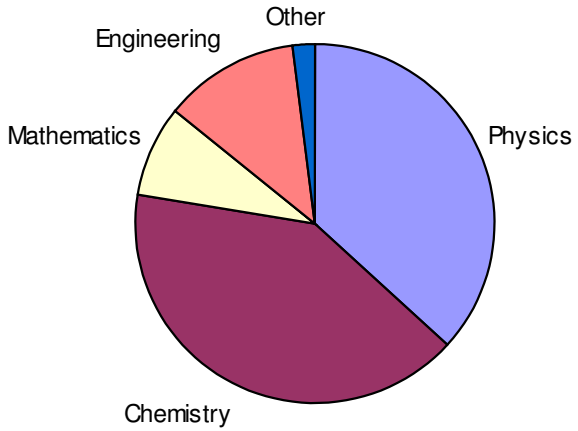
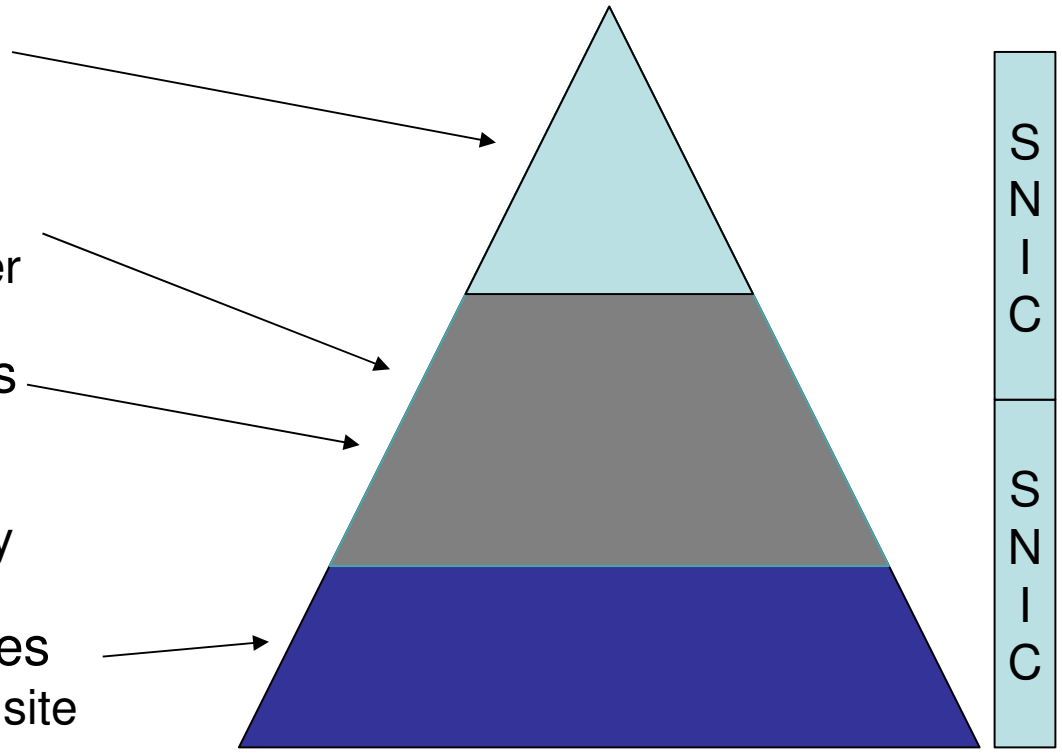


NSC

Computer Landscape

- Super scale computing
  - EU level resources (In Sweden?)
- User specific systems
  - In collaboration with user groups
- National SNAC resources
  - Capacity system (every second year)
  - Capability system (every second year) (SweGrid)
- Foundation level resources
  - For local needs at each site (3 systems per year)



Storage Landscape

- Class 1 **Temporary storage:** The storage is fast and covers a limited amount of computing elements in a local environment.
- Class 2 **Project storage:** Storage of active results during the lifetime of a project. It is accessible from every computing resource that is used in the project.
- Class 3 **Mass storage or long-term storage:** Contains results that are stored after a project is finished.

- Goal: All SNIC Class 2 and Class 3 storage should be transparently accessible from all SNIC computer systems by 2009
- Goal: Collaboration with eScience community (DISC) regarding data bases and data intensive applications

Network Landscape

- Next SUNET 2006: OptoSunet - Hybrid Network with routed and point 2 point connections
- All universities connected to routed 10 Gbit/s
- Applications with special needs can be given point 2 point connections, 1Gbit/s, 2.5 Gbit/s, 10 Gbit/s (40 Gbit/s)
- Selected SNIC centers connected with point 2 point connections in pilot projects to:
  - Other SNIC centers
  - International centers
  - Experiments

Resource and Grid Environments

- Slow Gridification of all resources
  - Only when added value to users are show
  - Let the users decide access method to resources
- Focus on development of application portals
- Goal: All SNIC resources available through Grid interfaces by 2009
- Coordinate software licenses between centers

Human interface

- National Helpdesk
- Advanced consultancy time allocated through SNAC
- SNIC on-line material
- Restart of NGSSC
  - Funding obtained from VR + SSF
- SNIC interaction meetings
  - Next meeting hosted by LUNARC, November 20-21
- Outreach efforts targeting new users and tailored software solutions
  - Data intensive applications
  - Large users
- SNAC focus on “large” users.
  - Default allocations to all users
  - Include technical assessments in SNAC procedures

SNIC development projects

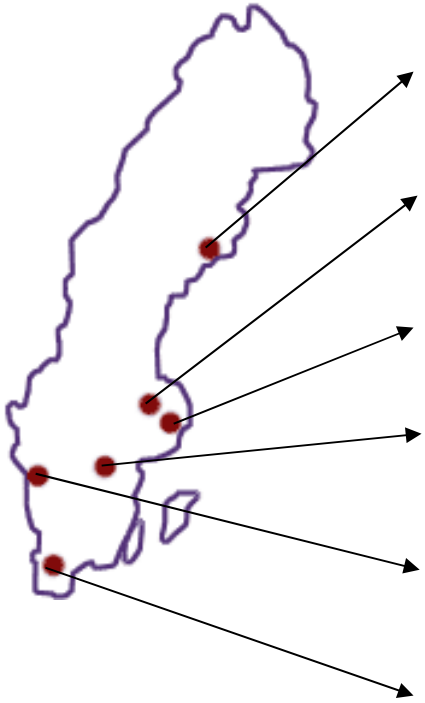
- **Storage Infrastructure:** The development of a national storage infrastructure within SNIC and a transparent access layer to storage services.
- **Network development:** A pilot study on the use of point-to-point lambda networks for some data intensive application as well as a study of optoSunet connections for SNIC.
- **Visualization services:** A pilot study on the distribution of rendered images. The results will beevaluated and form the basis for a policy decision on the future development of visualization services within SNIC.
- **SweGrid co-ordination:** The creation of a SweGrid management structure bridging the gap between the participating sites including subprojects such as the national helpdesk initiative.
- **Performance measurements:** The introduction of procedures and tools for performance measurements of application software in the assessment of SNAC proposals.
- **Grid portals:** Development of several application specific portals in key areas based on previous work on portals at SNIC centers.
- **Software coordination:** A survey of user need for application software and a compilation of existing
- licensing situations for relevant software.
- **CMT systems:** Pilot studies of multithreaded parallelization of important application codes to ensure efficient use of future SNIC resources.

Visualization Landscape

- Paradigm shift is under way
  - Visualize locally or remotely
  - Remotely for large (untransportable) data
  - Locally for smaller data
- Processors, storage and rendering closely coupled
- Distribution of rendered images or graphics primitives to clients over networks
- Visualization services provided by SNIC centers
- Gradual build-up and evaluation of concepts

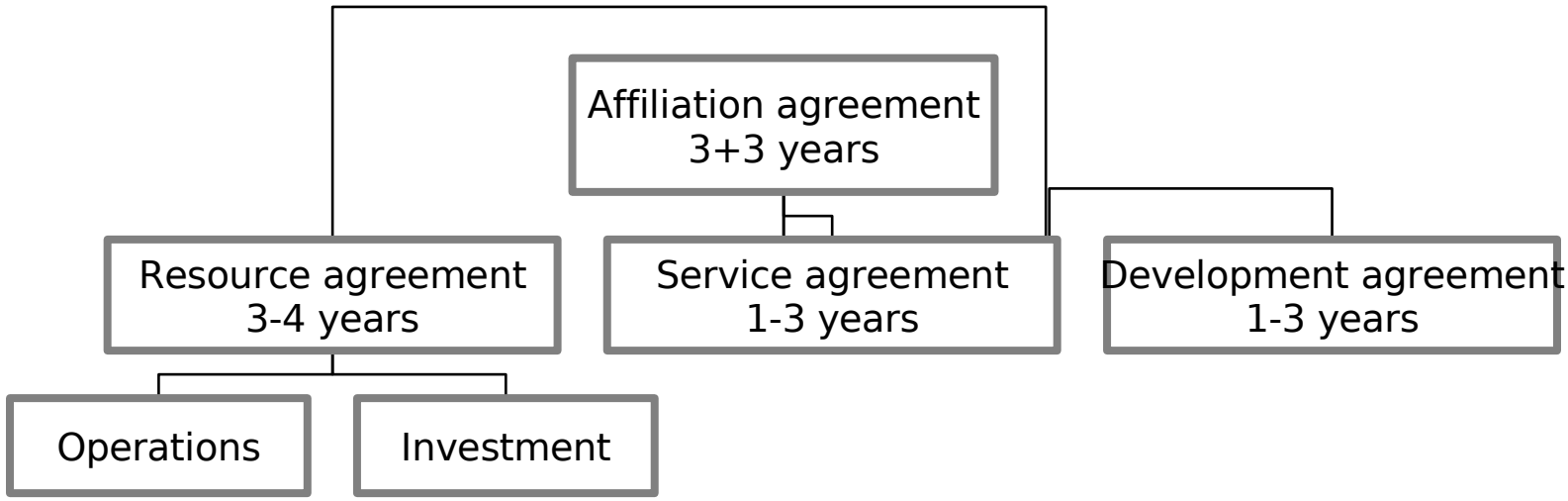
Sweden b4 SNIC

- 3 National HPC-centres
- 3 Regional HPC-centres
- National resource allocations (SNAC)
- Budget
  - 30 MSEK (2001)
  - 45 MSEK (2002)
  - ...
- Several GRID projects
  - DataGrid (PDC, KI)
  - NorduGrid



- HPC2N
- UPPMAX
- PDC
- NSC
- UNICC
- LUNARC

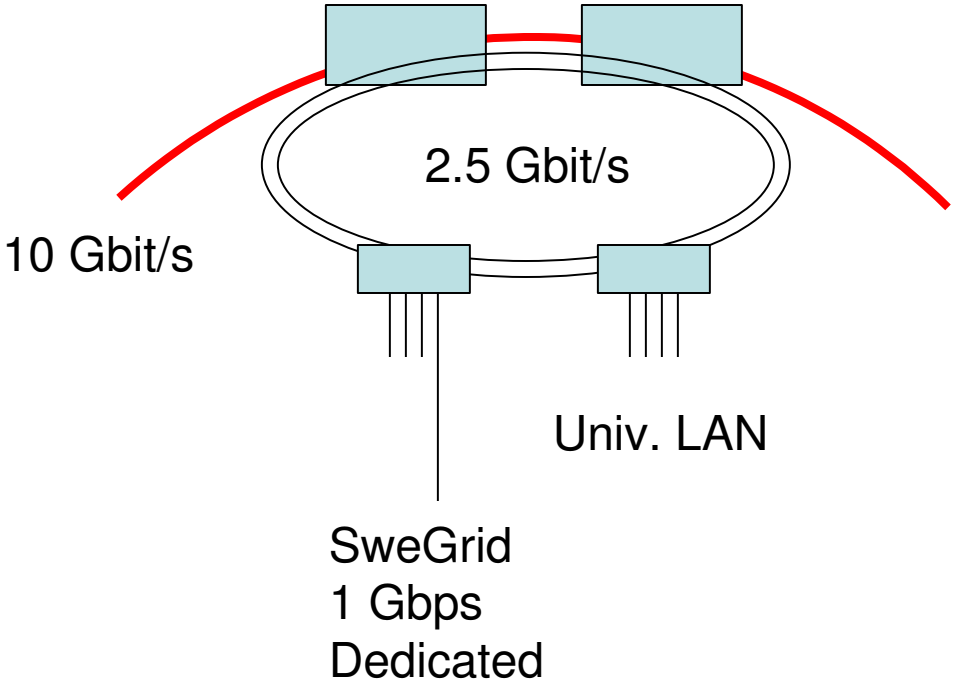
SNIC - Agreements



SUNET connectivity

GigaSunet 10 Gbit/s

Typical POP at Univ.



Trends

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- Technical paradigm shifts are under way
  - PC-clusters
  - Multicore technologies
  - GRID-technology and ”cyberinfrastructure”
  - Light paths

Increased Productivity

- Develop
  - State-of-the-art Integrated development environments
  - High quality user support and training
- Compute
  - Fast and easy access to a multitude of heterogeneous computers in a homogenous way
- Store
  - Temporary (fast), project (available), long term (reliable)
- Transport
  - Fast and seamless access to data from several locations
- Analyze
  - Visualization locally or remotely

Network Landscape

- 2006
  - 10 Gbit/s connections: Investigate how the HPC centres canintegrate 10 Gbit/s
  - Lambda networks: Investigate how point-to-point connectionscan be used.
  - SweGrid II networks: Include costs of 10 Gbit/s and lambda network connections in SweGridII proposal.
- 2007
  - OptoSunet: Connect to OptoSunet with 10Gbit/s. Test and demonstrate the established connections.
  - Full OptoSunet connectivity: Connect the remaining HPC centres
- 2008
  - Point-to-point connections: Test and demonstrate usage of point-to-point.
- 2009
  - Dynamic point-to-point connections: Establish operational procedures together with SUNET for establishing, maintaining and removing point-to-point

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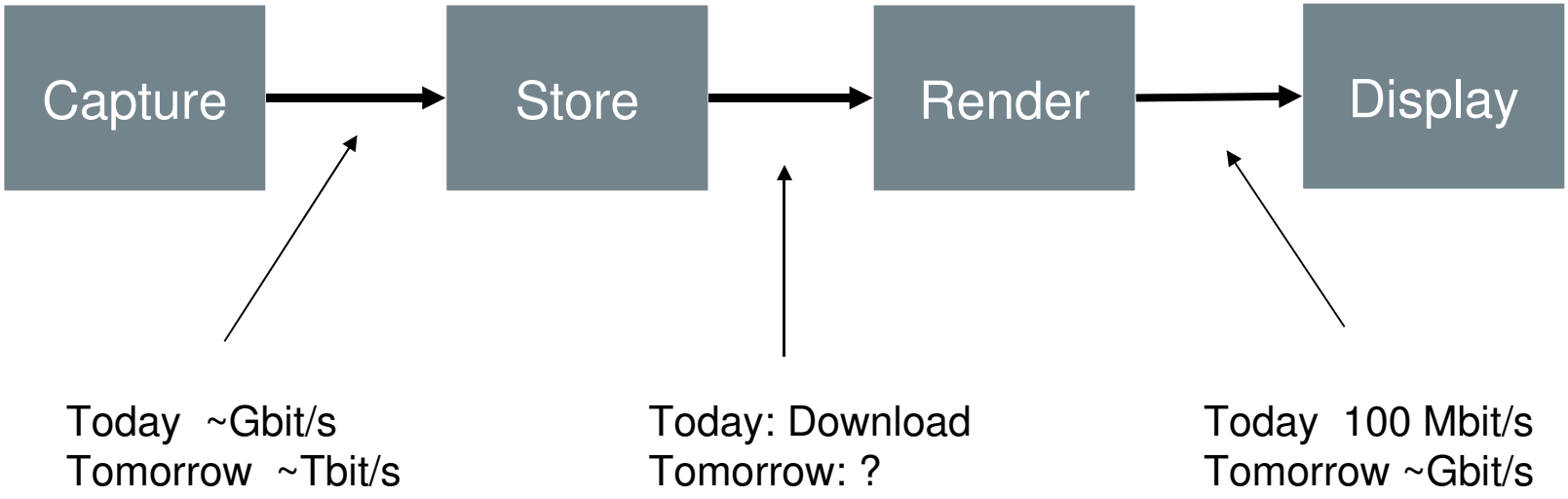
Remote Rendering

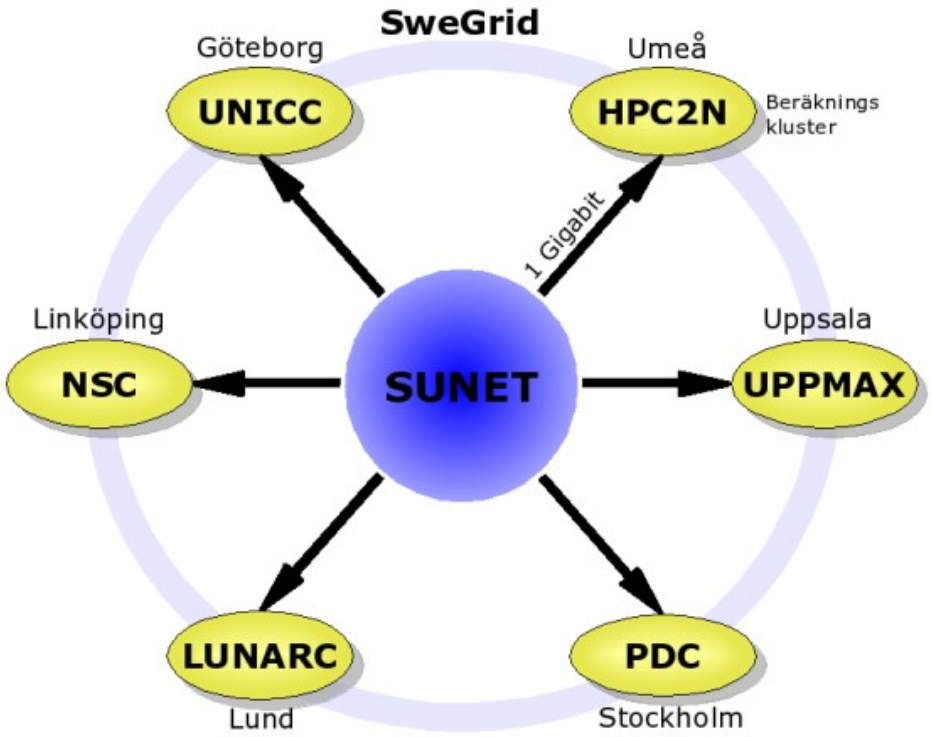
Visualization has become a data reduction pipeline



NVIS remote rendering project

- Evaluate remote rendering solutions
- Joint project with IBM and SGI
  - IBM Deep Computing View
    - Server in Malmö, client in Linköping
  - SGI Visual serving
    - Server in Norrköping, client in Linköping
  - Pilot applications in medical visualization …
  - Project report Q4 06

SweGrid production test bed



- Total budget 3.6 MEuro
- 6 GRID nodes
- 600 CPUs
  - IA-32, 1 processor/server
  - 875P with 800 MHz FSB and dual memory busses
  - 2.8 GHz Intel P4
  - 2 Gbyte
  - Gigabit Ethernet
- 12 TByte temporary storage
  - FibreChannel for bandwidth
  - 14 x 146 GByte 10000 rpm
- 370 TByte nearline storage
  - 120 TByte disk
  - 250 TByte tape
- 1 Gigabit direct connection to SUNET (10 Gbps)

SweGrid II

- Builds on proposal to KAW
- 10x capacity
  - CPU
  - Storage
  - Technical specification being developed
- Application will be submitted in January
- Installation during 2007
- Application specific portals
- Improved user support
- Interface to international projects
  - NDGF/NorduGrid
  - EGEE
- Special agreements for “large users”

Software Landscape

- Some application software can be regarded as infrastructure
  - Collaboration with developers
  - Coordinated licenses
  - Which ones?
- User input through surveys
- Hardware dedicated to special software
- Application portals
- SNIC software policy

Status & Development of Document

- Current version is 0.99
- Version 1.0 available soon
- Sent to SNUG for comments
  - Contact the SNUG steering committee if you wish to provide input on the document
- Version 2.0 produced by mid Dec
- Decision by SNIC board

Resource Contracts

- Centers invited to submit proposals for resources describing
  - Resource ambitions, scientific and technical specialization
  - Operational organization and infrastructure
  - Resource descriptions:
    - Technical solutions
    - Service agreements
    - Software licenses
    - Computer rooms
    - Operators
  - Possible cost sharing
  - Infrastructure investments
  - Other relevant information
- Budget
- Evaluation of material conducted by SNIC director

- Analysis based on
  - Affiliation contracts
    - Available staff for operations
  - Existing resources
  - Center profiles
  - Technology co-ordination and watch, novelty of technology choices
  - User needs (SNAC)
- Discussed and reviewed by SNIC board
- Base funding decided upon 2004-03-19
- Implemented during 2004

Hardware strategy for 2004

- Upgrade of large scale 64 bit resource at PDC
- Build-up of local CPU-capacity at UNICC, LUNARC, and UPPMAX, partly through SweGrid
- Continue existing services at HPC2N, PDC and NSC
- Plan and implement national hierarchical storage based on HPC2N, PDC and NSC
- Focus technical support on usability of SweGrid

SNIC review 2005

- Praise for SNIC coordination
- Recommends continued build-up of SNIC
- Increased user and center ambition
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- Future vision in a landscape document
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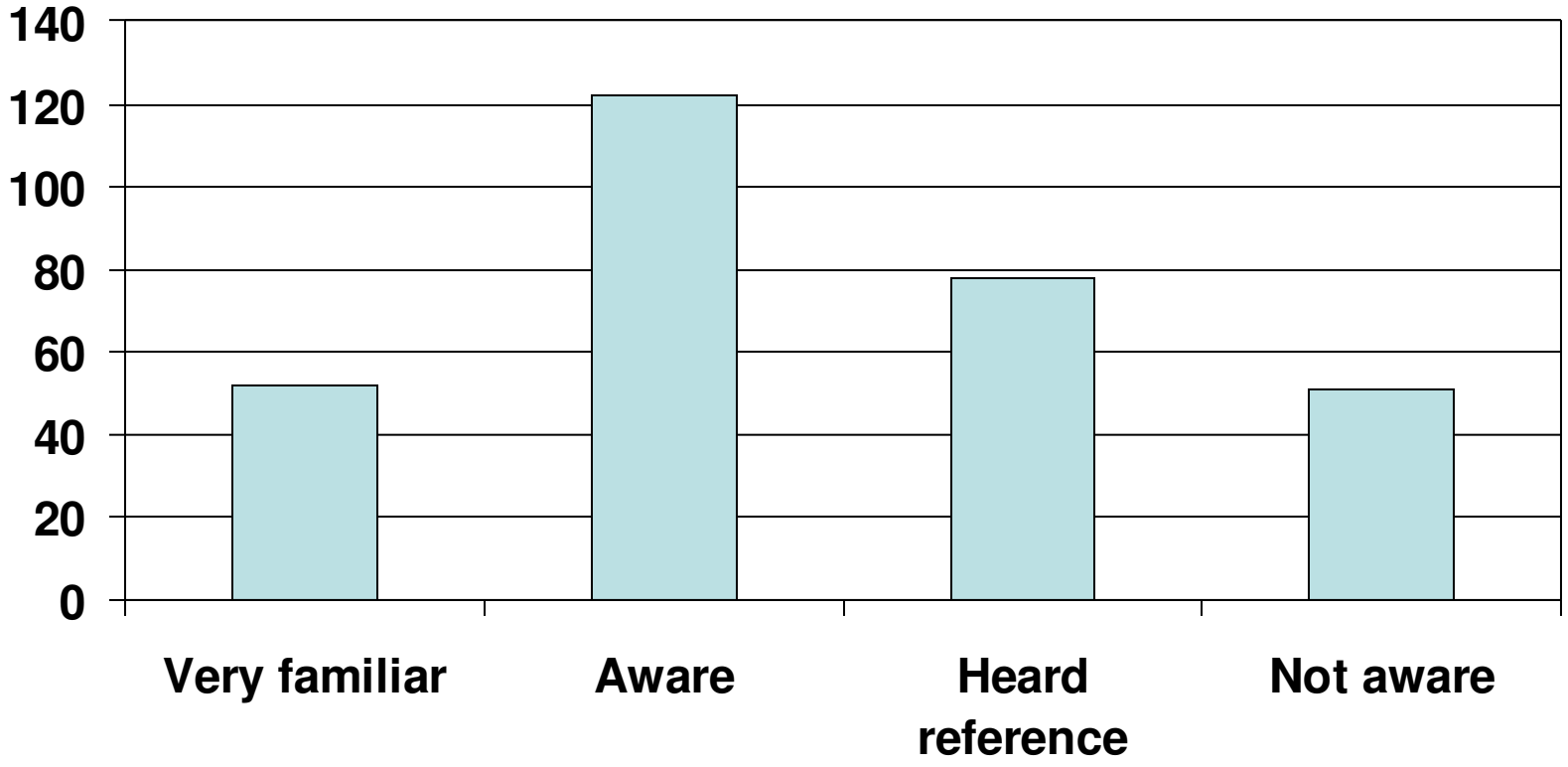
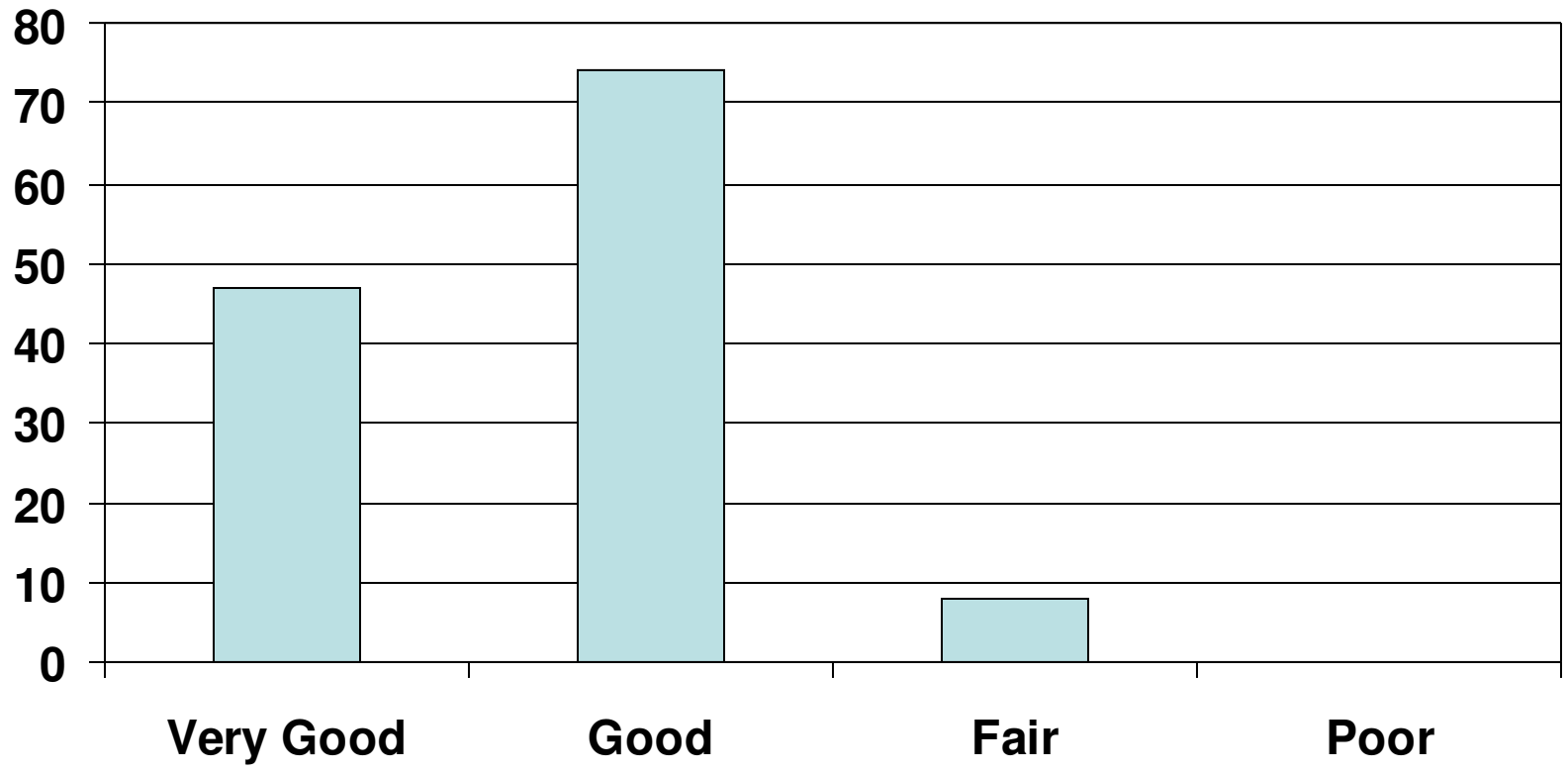
User Survey Results

How familiar are you with SNIC and its initiatives?



User Survey Results

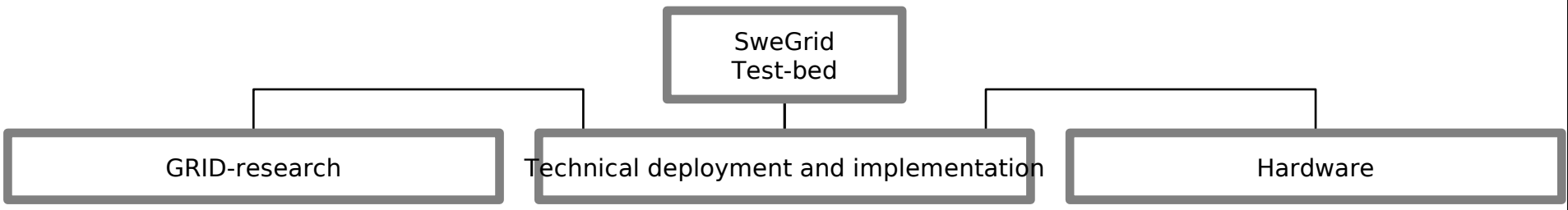
What is your overall opinion of the SNIC initiative?



SweGrid production testbed

- The first step towards HPC center Gridification
- Initiative from
  - All HPC-centers in Sweden
  - IT-researchers wanting to research Grid technology
  - Users
    - Life Science
    - Earth Sciences
    - Space & Astro Physics
    - High energy physics
- PC-clusters with large storage capacity
- Build for GRID production
- Participation in international collaborations
  - LCG
  - EGEE
  - NorduGrid
  - ...

SweGrid production testbed



0.25 MEuro/year
- Portals
- Databases
- Security

Globus Alliance
EGEE - security

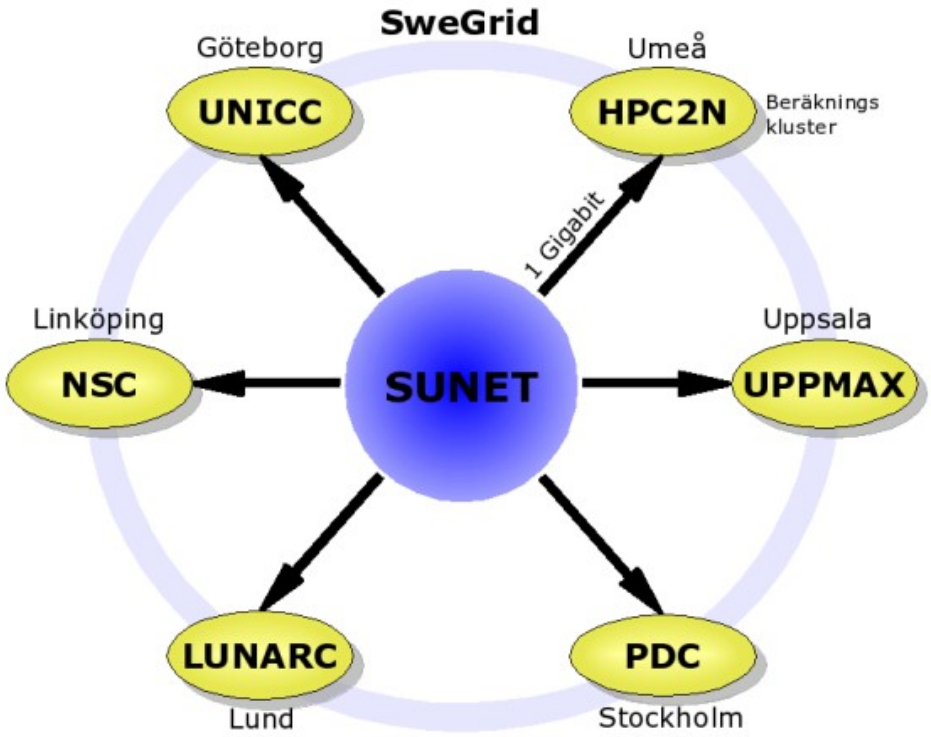
0.25 MEuro/year
6 Technicians

Forming the core team for the Northern EGEE ROC

2.5 MEuro
6 PC-clusters

600 CPUs for throughput computing

SweGrid production test bed



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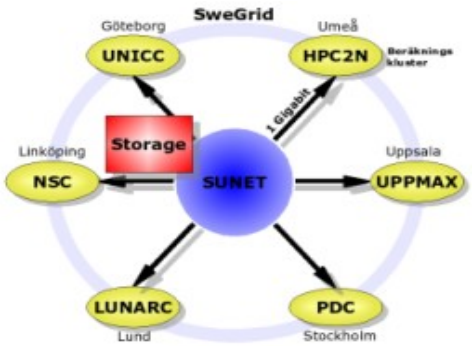
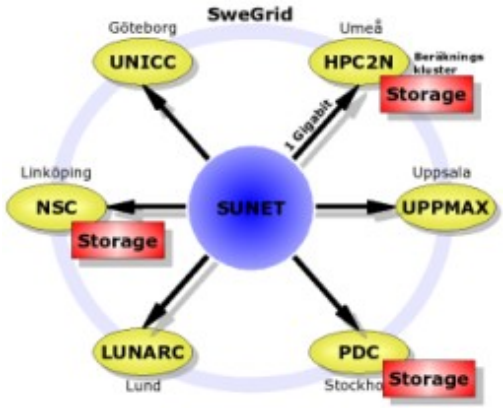
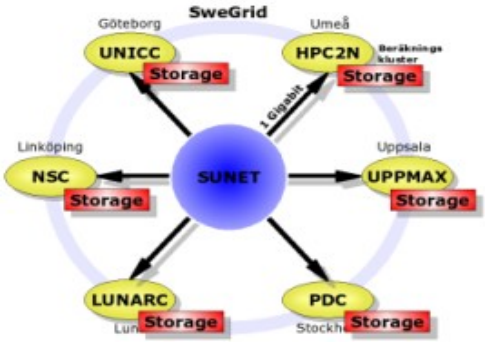
Persistent storage on SweGrid



1



2



3

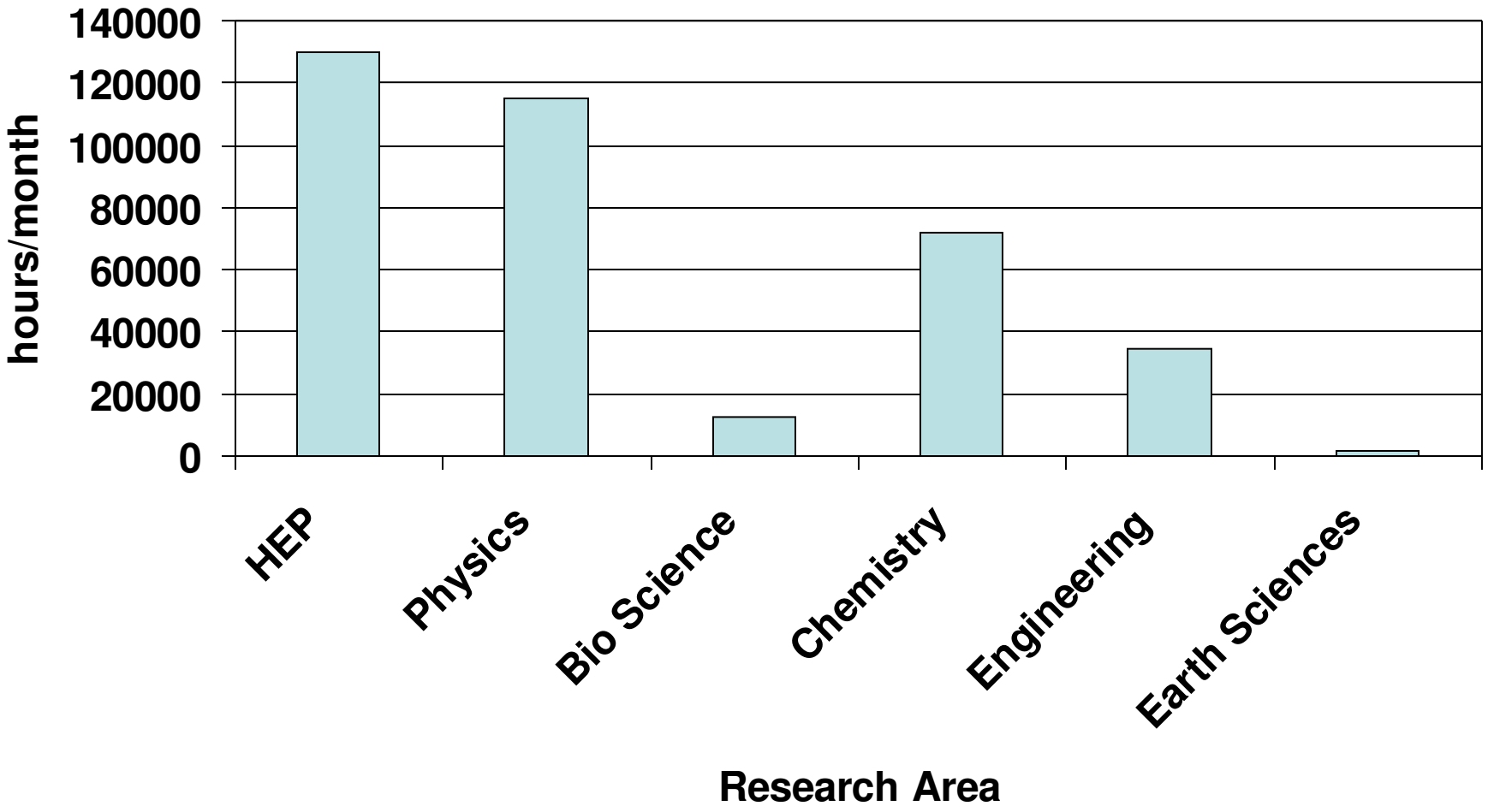
Size
Administration

Bandwidth
Availability

SweGrid status

- All nodes installed during January 2004
- Extensive use of the resources already
  - Local batch queues
  - GRID queues through the NorduGrid middlware - ARC
  - 60 users
- 1/3 of SweGrid is dedicated to HEP (200 CPUs)
- Contributing to Atlas Data Challenge 2
  - As a partner in NorduGrid
- Currently deploying LCG-2
  - Compatibility between ARC and LCG-2 (gLite)
- Forms the core of the Northern EGEE ROC
- Accounting is being installed …

The first users of SweGrid



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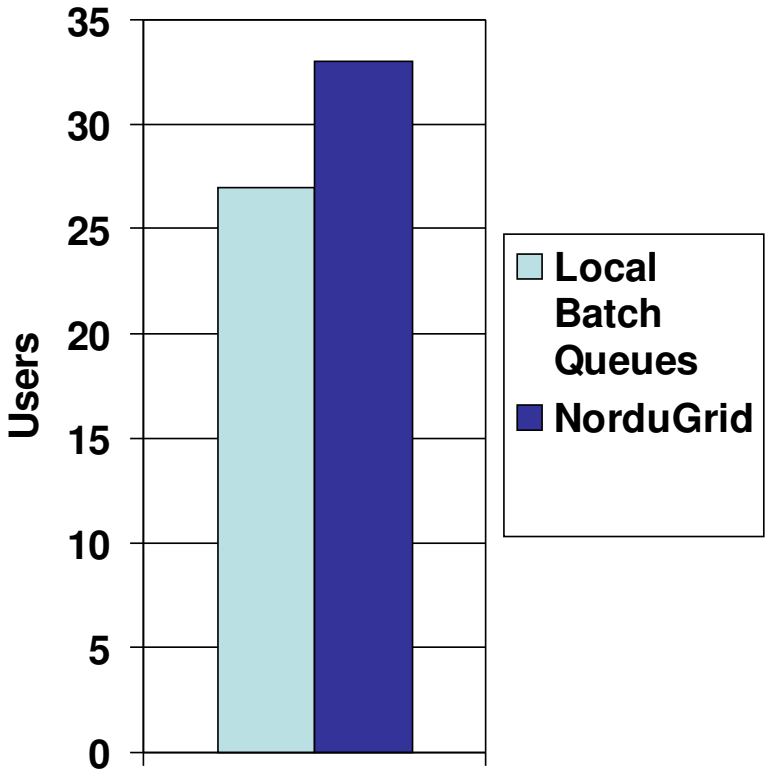

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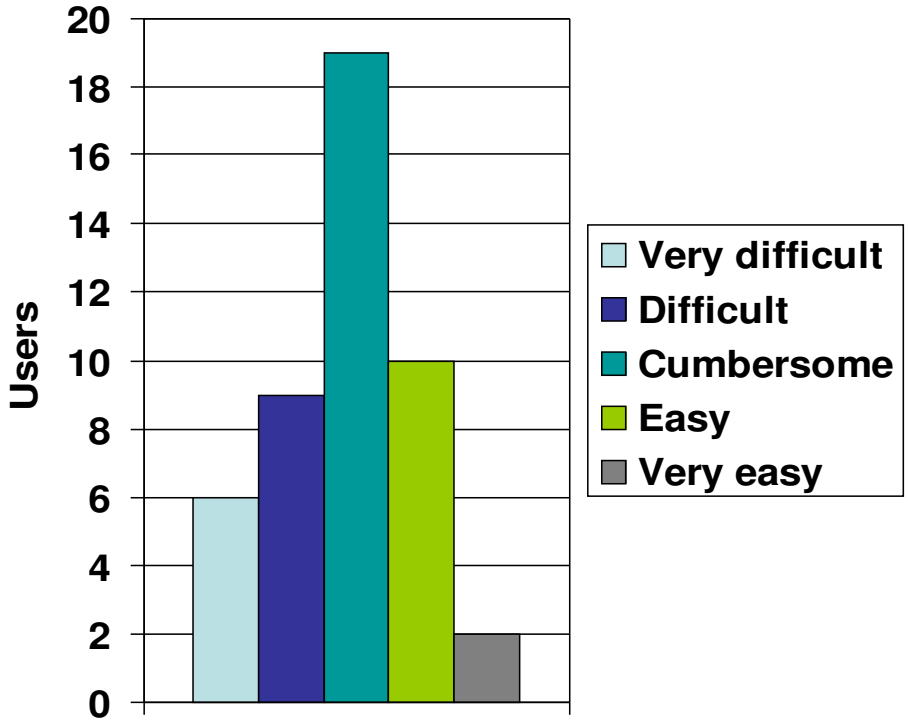

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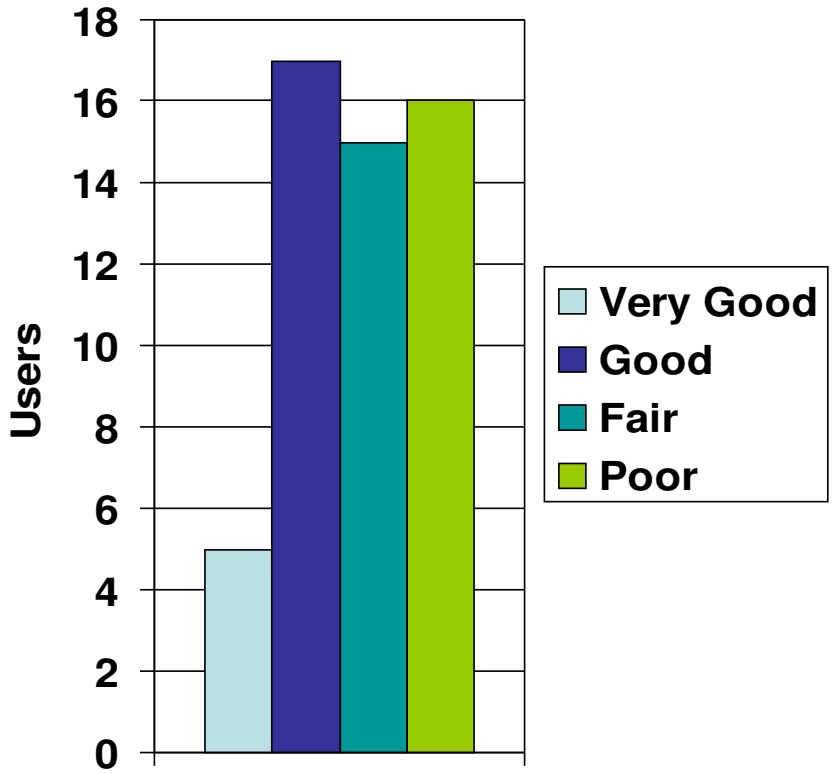

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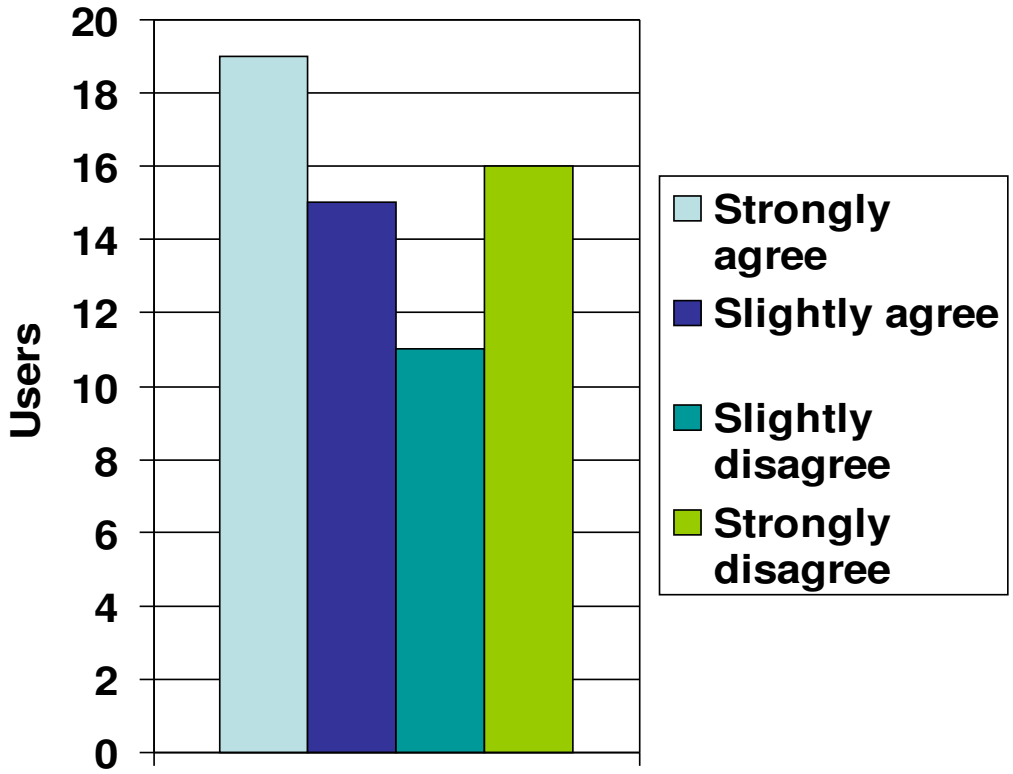
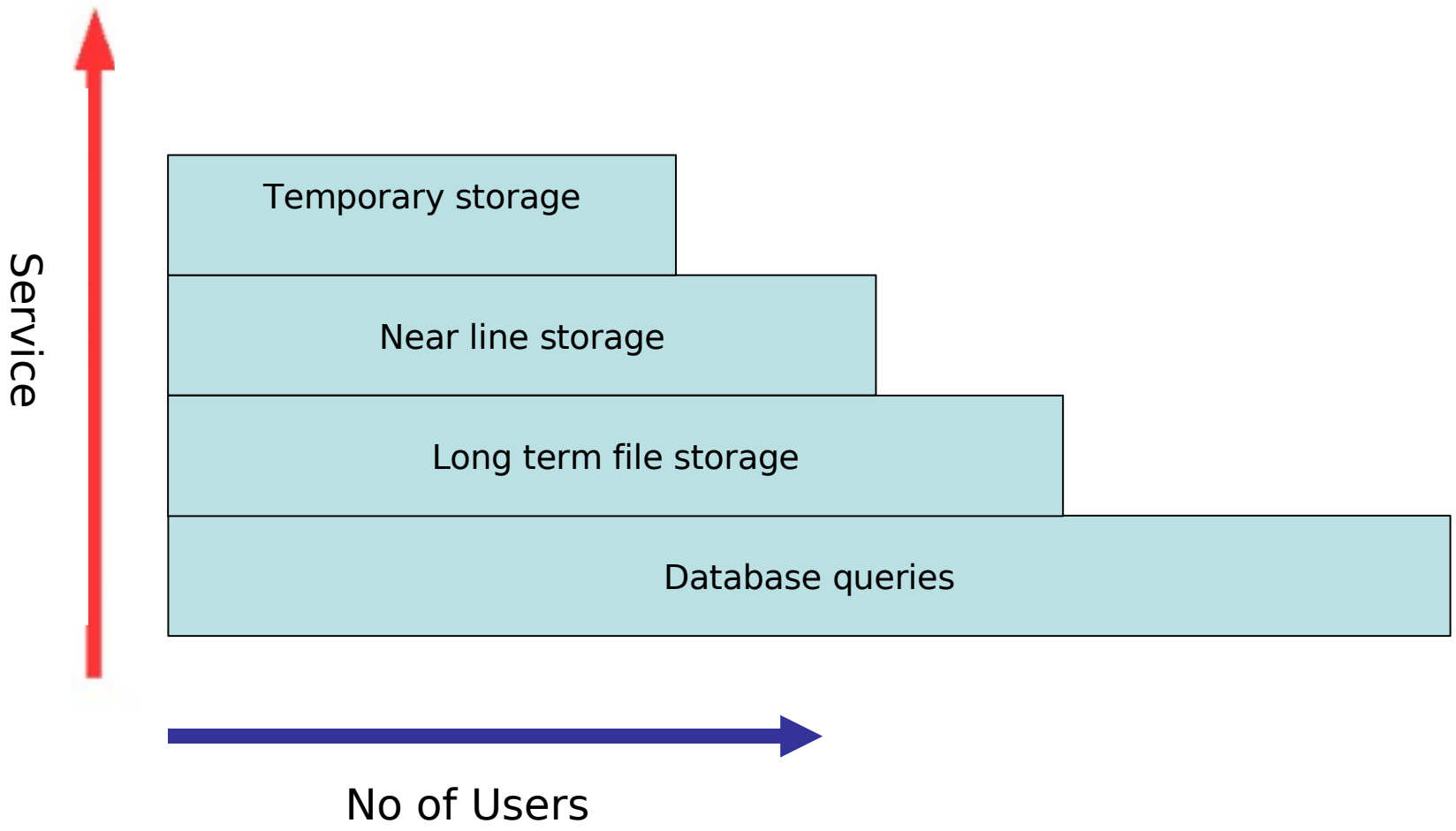


SweGrid II

- SweGrid I
  - Introduced Grid technology in Sweden
  - Enabled collaborations (EU + Nordic + Baltic)
  - Increased throughput capacity
- SweGrid II
  - KAW application for hardware support
  - SNIC funding for operations
  - Will be a key component in NDGF
  - Large effort needed for increased user support (3 FTEs) 3 MSEK/year

Large data at HPC centers



Data Curation and Services

- A Swedish center for data curation and services
  - 5 application experts (curation and user support)
  - 5 technicians (services and tool development)
- Budget 10 MSEK/year
- Hardware infrastructure provided by SNIC
- Software infrastructure
  - Licenses
  - Tools developed by center
- SUNET access

eScience Training

- PITAC report on CSE (June 2005)
  - Substantial difficulty for CSE researchers in finding competence in algorithms, software, architecture, data management, visualization, performance analysis,…
- Education of users to *improve* and *spread* the use of computational methods
  - Education is needed to introduce new user groups to the field of HPC
  - Multiply effect of investments in computational hardware
  - Development of new software will be essential for efficient use of future computer architectures
- Special form of education is needed
  - Users from different field with different backgrounds
  - Geographically distributed

A Swedish opportunity

- Build on experiences from NGSSC!
  - 12 new courses, given at 48 occasions. More than 1000 participants from a variety of fields in science and technology
  - Special course format, expert lecturers
  - Early initiative, followed by interest internationally
  - Praised by the SNIC evaluation committee
- 3 MSEK funding from SSF for adopting to SNIC needs
- Develop new courses for emerging user groups
  - Life Sciences
  - Social Sciences
  - Humanities
  - One important theme: Handling and analysis of data

Short term suggestions

- Current SNIC budget 45 MSEK/year
- New areas of responsibility:
  - Data curation and services + 10 MSEK/year
  - eScience training + 3 MSEK/year
  - Grid user support + 3 MSEK/year

Long term vision

- Infrastructure for eScience
  - Service oriented
    - Learn
    - Develop
    - Compute or Access
    - Transport
    - Analyze
    - Collaborate
    - Disseminate
- Roadmap for these services should be developed
- Needed technology components should be identified
- Application oriented integrated environment for “all” services
- Needed R&D efforts to provide services and components
- An organisational structure with means to implement structure should be set up

European perspective

- The very high end HPC will only be available on the European level.
  - How do Swedish researchers get access to these resources?
    - Participation in EU projects
    - EU level peer review
    - Infrastructure agreements
- European perspective needs to be included in the national infrastructure for eScience
- Which services can Sweden provide in

Metacenter Projects

- HPC portals
  - HPC2N, PDC, NSC
- National help desk
  - HPC2N, PDC, NSC
- National storage solutions
  - NSC, PDC, HPC2N
- National application support in Chemistry
  - LUNARC
- National application support in Bioinformatics
  - UPPMAX
- EGEE Regional Operations Center
  - PDC, NSC, HPC2N

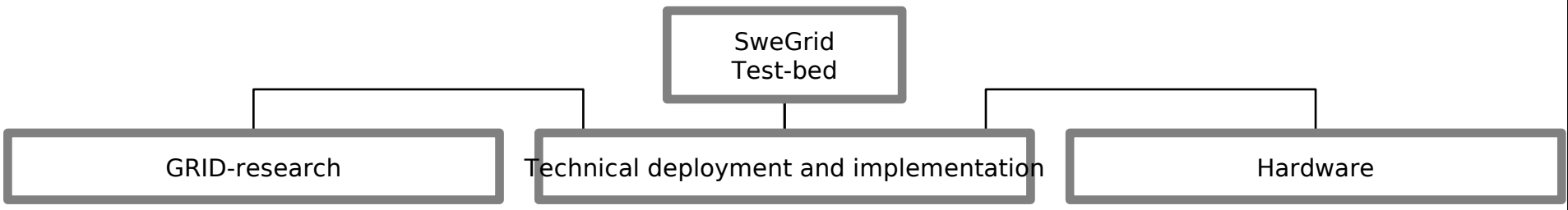
Insatser - Behov

- Utveckling av svensk GRID-kapacitet
  - Throughput computing och nationell lagring
    - 20 Mkr
- Regional hårdvara
  - Understryker regionala centras ansvar för att fånga upp nya användare
    - 15 Mkr
- Nationell spetskapacitet
  - För högt prioriterad forskning som konkurrerar i världsfronten
    - 10 Mkr
- Forskarskola i teknisk-vetenskapliga beräkningar (NGSSC)
  - Fokuserad utbildning i modern beräkningsteknik
    - 10 Mkr

SweGrid production testbed

- The first step towards HPC center Gridification
- Initiative from
  - All HPC-centers in Sweden
  - IT-researchers wanting to research Grid technology
  - Users
    - Life Science
    - Earth Sciences
    - Space & Astro Physics
    - High energy physics
- PC-clusters with large storage capacity
- Build for GRID production
- Participation in international collaborations
  - LCG
  - EGEE
  - NorduGrid
  - ...

SweGrid subprojects



0.25 MEuro/year
- Portals
- Databases
- Security

Globus Alliance
EGEE - security

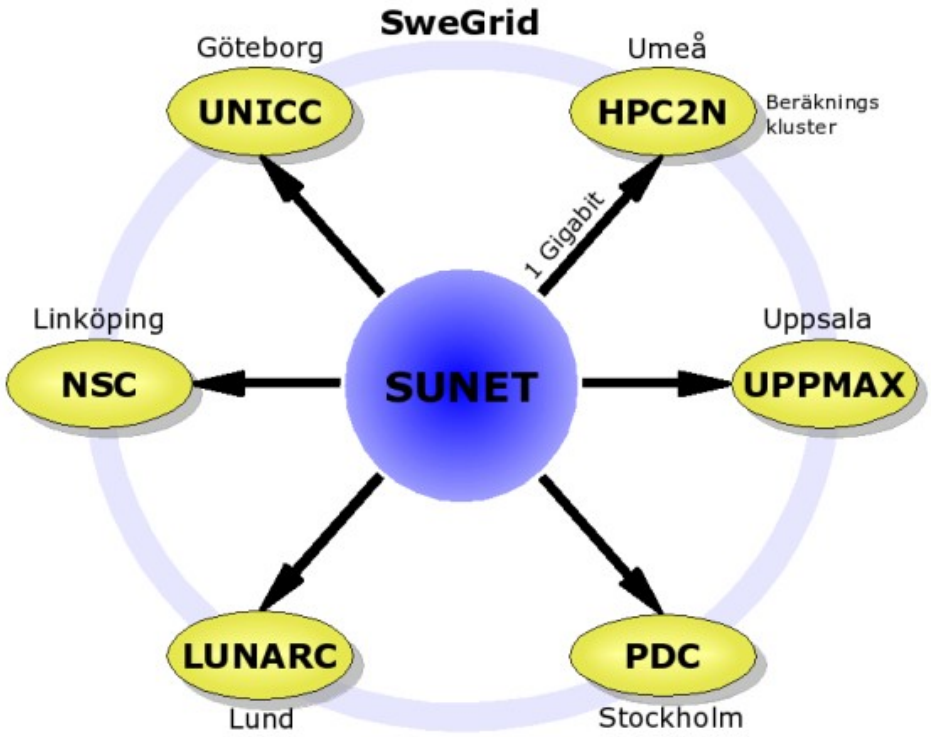
0.25 MEuro/year
6 Technicians

Forming the core team for the Northern EGEE ROC

2.5 MEuro
6 PC-clusters

600 CPUs for throughput computing

SweGrid production test bed

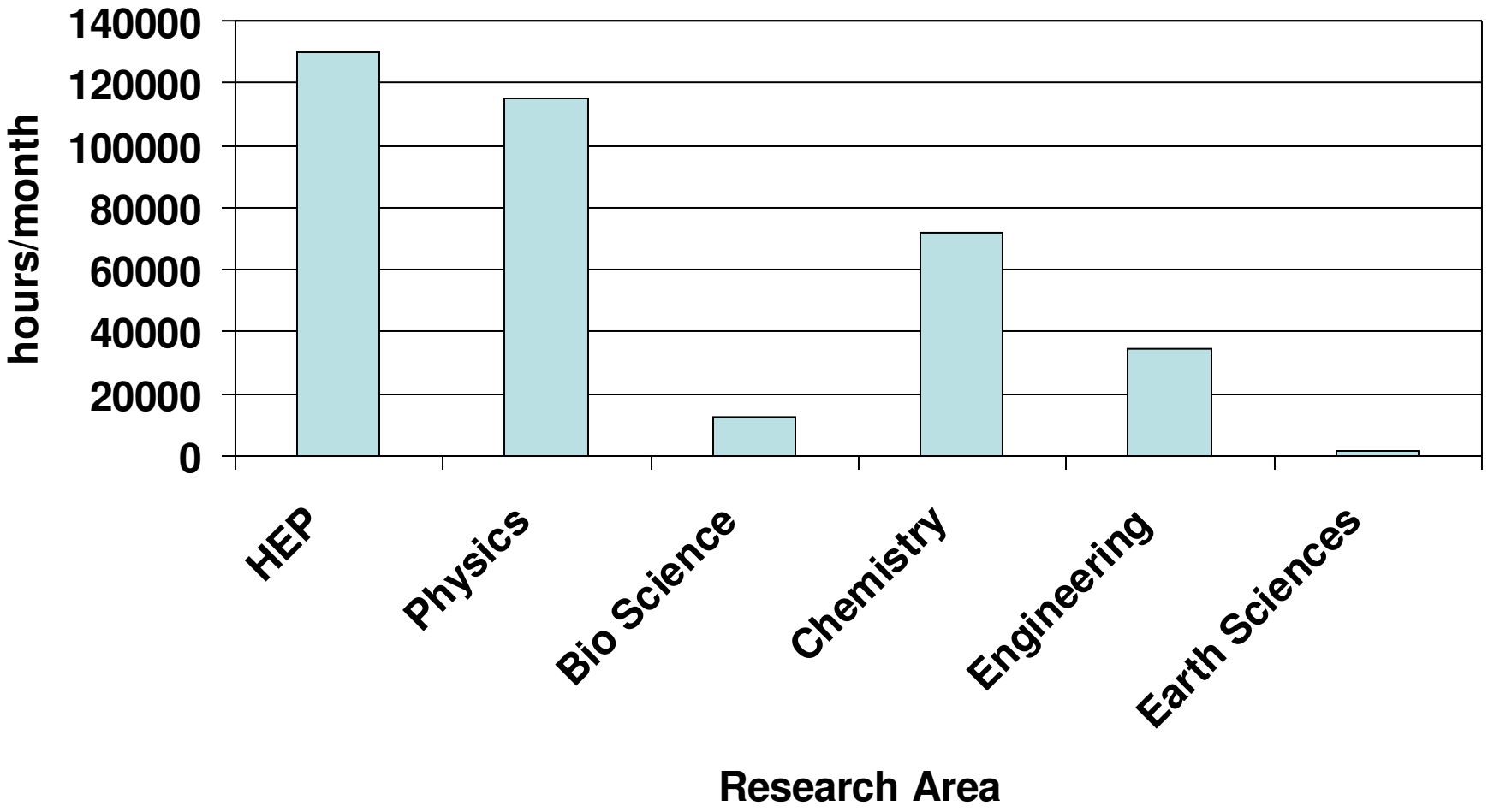


- Total budget 3.6 MEuro
- 6 GRID nodes
- 600 CPUs
  - IA-32, 1 processor/server
  - 875P with 800 MHz FSB and dual memory busses
  - 2.8 GHz Intel P4
  - 2 Gbyte
  - Gigabit Ethernet
- 12 TByte temporary storage
  - FibreChannel for bandwidth
  - 14 x 146 GByte 10000 rpm
- 370 TByte nearline storage
  - 120 TByte disk
  - 250 TByte tape
- 1 Gigabit direct connection to SUNET (10 Gbps)

SweGrid status

- All nodes installed during January 2004
- Extensive use of the resources already
  - Local batch queues
  - GRID queues through the NorduGrid middlware - ARC
  - 60 users
- 1/3 of SweGrid is dedicated to HEP (200 CPUs)
- Contributing to Atlas Data Challenge 2
  - As a partner in NorduGrid
- Currently deploying LCG-2
  - Compatibility between ARC and LCG-2 (gLite)
- Forms the core of the Northern EGEE ROC
- Accounting is being installed …

The first users of SweGrid



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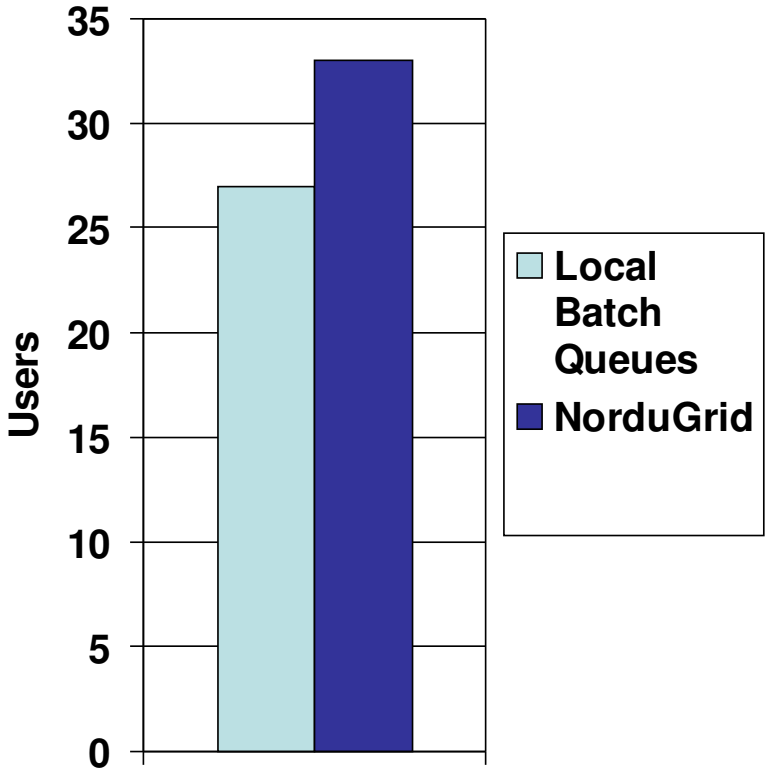

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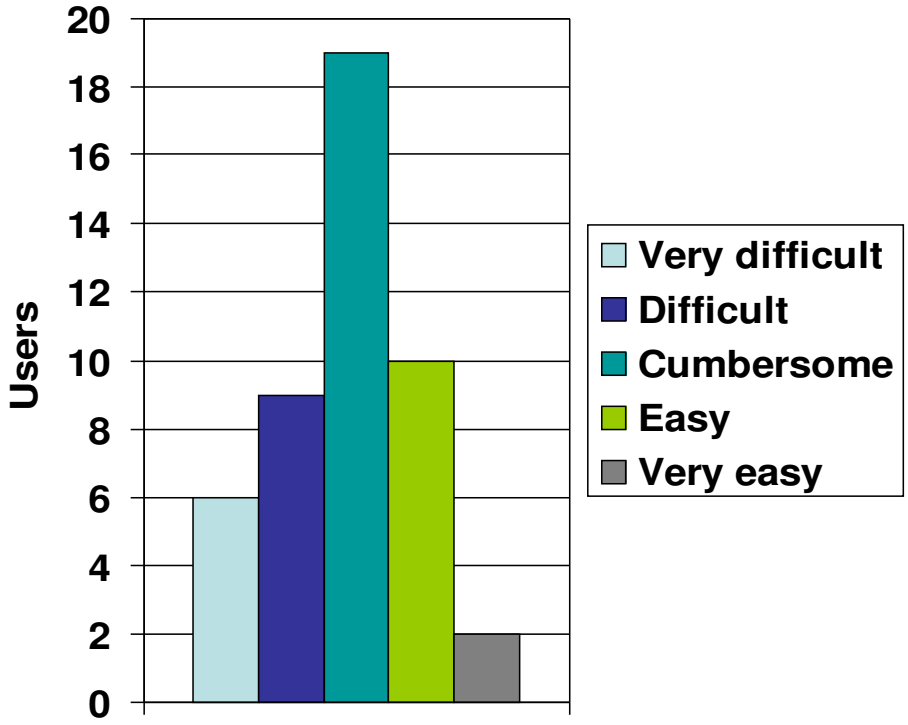

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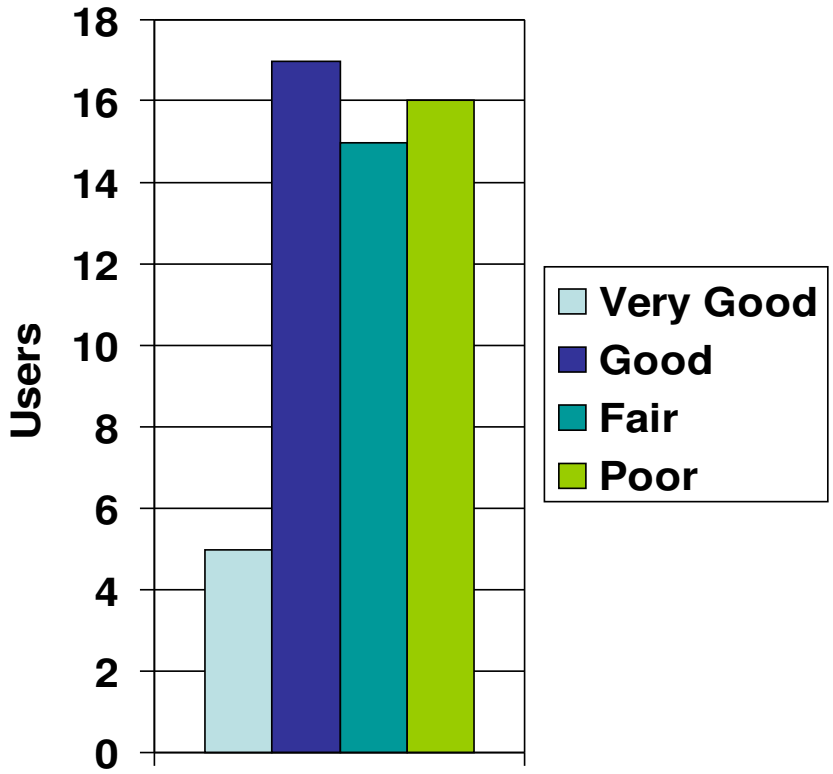

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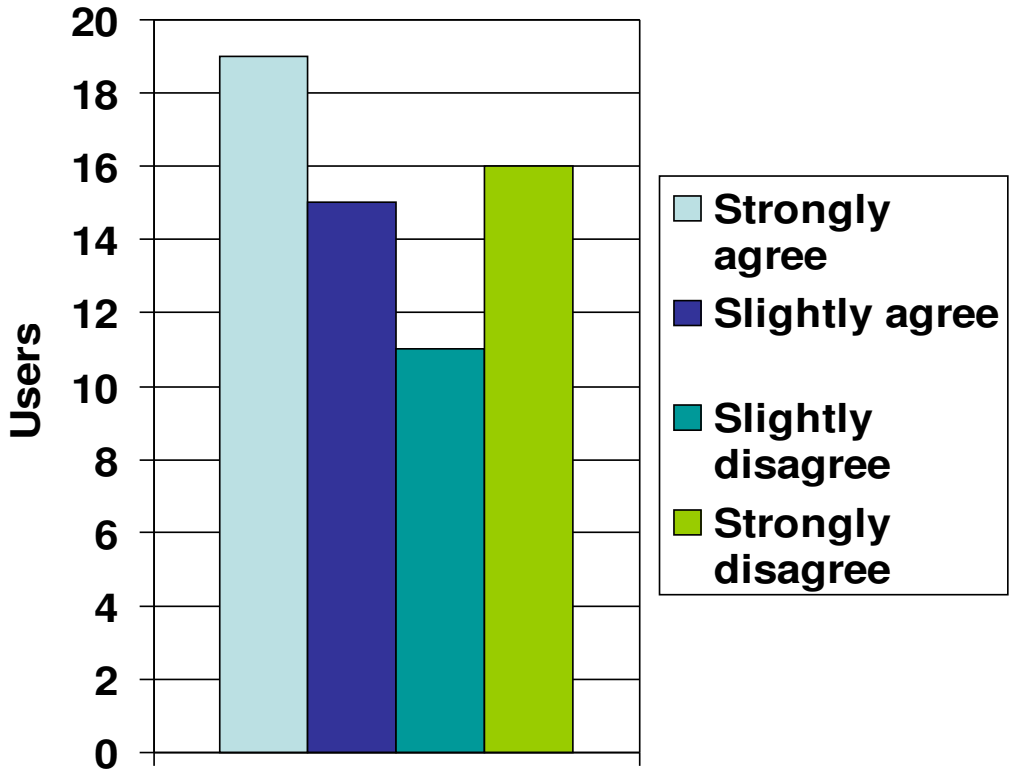
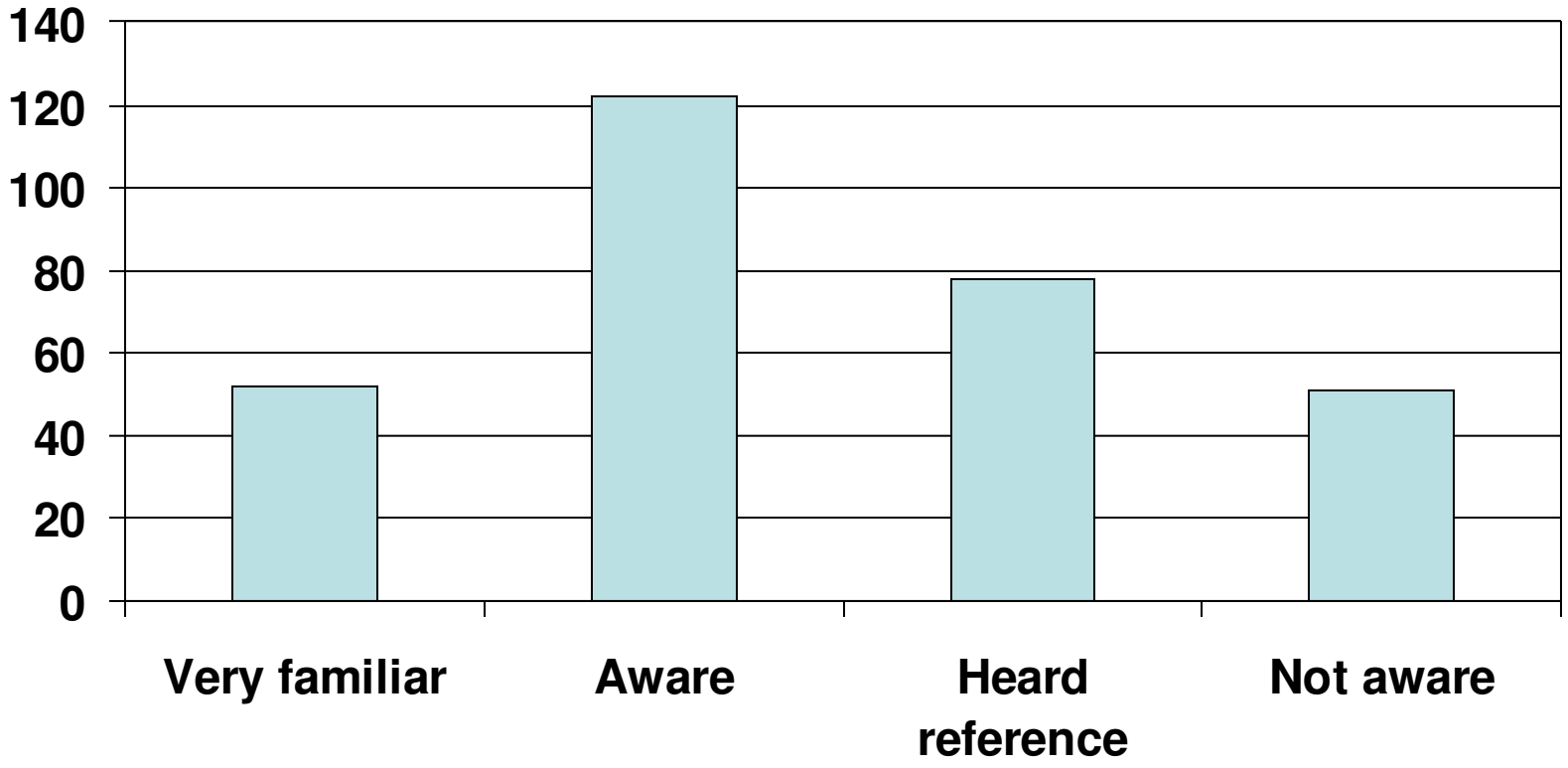


SNIC User Group

- First user meeting held in June 2004
- Organized by PDC
- Fairly low participation – late announcement
- Next meeting planned for June 2005
  - Formalization of user association
  - Nomination of SNIC board members
- Annual user survey could be organized by SNUG

User Survey Results

How familiar are you with SNIC and its initiatives?



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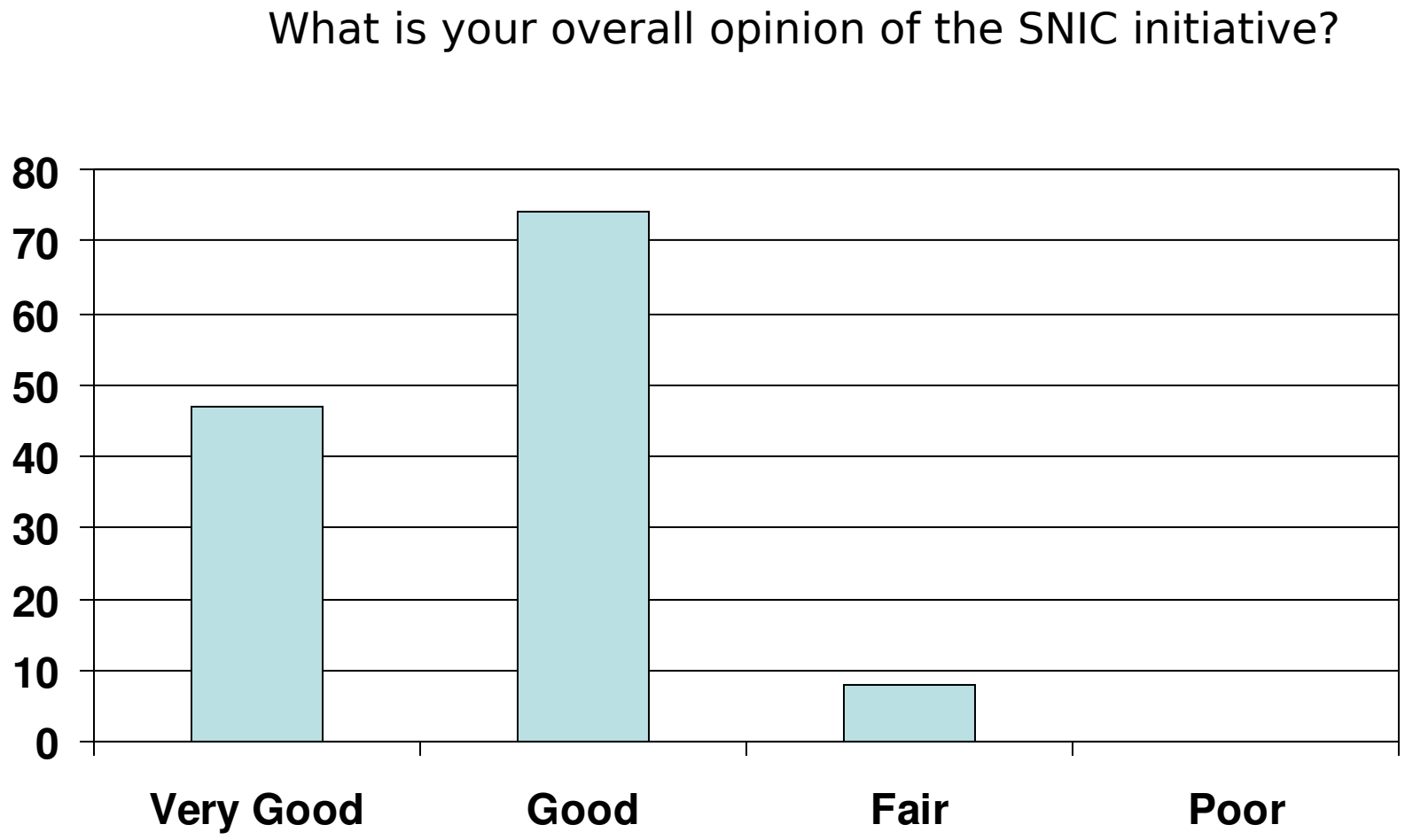

NGSSC

- National Graduate School in Scientific Computing
  - Disseminate knowledge on computational methods
- Comprehensive course package (20 credits)
  - Course located at different universities and given as summer courses
- 60 graduate students currently enrolled
- 20 examined PhDs
  - Very good results, publications, dissertations and employment
- No further SSF funding for new admissions

SNIC plans

- National helpdesk initiative
- Advanced user support allocations
- Policy for local/national allocations
- Promotion of eScience initiative in Sweden
- Increased Grid activities
- Participation in NDGF
- Development and testing of grid economy
- Increased hardware investments

SNOR GRID

4 – year vision

- A common GRID *landscape* for NORGRID and SWEGRID
  - Researchers should be able to submit a job to a Common GRID interface
  - Data should be transparently accessible
  - Accounting should be provided
  - Resources should be allocated through tokens that can be exchanged between the countries

National helpdesk

- 1,5 FTE/center x 3 to conduct users support I
- Sweden has no co-ordination at this point.
- SweGrid support has had slower response times
- Smaller centers have varying support strategies.

In depth user support

Affiliation process

- Centers invited to submit descriptions
  - Overview of organization
  - Center profile
  - Existing services and resources
  - Future plans
  - Proposed role in SNIC
  - Financial overview and proposed budget
- Evaluation of material conducted by SNIC director
- Discussed and reviewed by SNIC board
- Base funding decided upon 2002-12-12
- Implemented during 2003

- Used evaluation criteria
  - National impact
  - Local impact
  - Service levels
  - Center capacity
  - Operational competence
  - User request for center
  - R&D efforts at center
  - International collaborations
  - Cost efficiency
  - Matching funding from university
  - Matching funding from industry
  - Center potential to contribute to the mission of SNIC