



Vetenskapsrådet

# INTERNATIONAL EVALUATION OF SNIC

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September 5-8, 2010

INTERNATIONAL EVALUATION OF SNIC

SWEDISH RESEARCH COUNCIL

VETENSKAPSRÅDET

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# PREFACE

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The Swedish Research Council (VR) is a governmental agency with the responsibility to support basic research of the highest scientific quality in all academic disciplines. It is also part of the Council's remit to evaluate research and assess its academic quality and success.

The Council for Research Infrastructures (RFI) at the Swedish Research Council has the overall responsibility to ensure that Swedish scientists have access to research infrastructure of the highest quality. Specifically, the Council evaluates the needs for research infrastructure in a regularly updated roadmap, launches calls and evaluates applications, participates in international collaborations and works on monitoring and assessments. As part of the overall responsibility for research infrastructures in general and e-Infrastructures in particular the Council oversees and evaluates SNIC – the Swedish National Infrastructure for Computing.

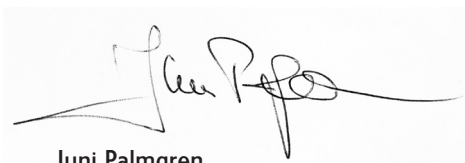
The Council for Research Infrastructures has, for the purpose of reviewing the operation of SNIC, appointed an expert panel with broad expertise in the various activities that fall under the responsibility of SNIC. The members of the Panel were Prof. Morten Dæhlen, University of Oslo, Norway, Dr. Neil Geddes, Science and Technology Facilities Council, United Kingdom, Prof. Risto Nieminen, Helsinki University of Technology, Finland, and Prof. Cherri Pancake, Oregon State University, USA. Neil Geddes was appointed Chair of the Panel, Prof. Lars Börjesson, Chalmers Technical University AB was appointed Chairman of the evaluation and Dr. David Edvardsson, Research Officer, VR, acted as coordinator and secretary of the review.

While the evaluation was initiated by the Swedish Research Council, this report documents the findings and recommendations of the Panel.

The Swedish Research Council would like to express its sincere gratitude to the Expert Panel for devoting their time and expertise to this important task.

The Swedish Research Council would also like to thank the representatives of SNIC, the directors of the SNIC centra and the user representatives for providing the necessary background material and for giving informative presentations.

Stockholm 2012-02-xx



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# I. SAMMANFATTNING AV PANELENS RAPPORT

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SNIC har sedan tillkomsten 2003 åstadkommit väsentliga förbättringar för datorstödd forskning i Sverige. SNIC har i synnerhet inom högprestandaberäkningar haft ansvaret för ökade resurser och förbättrade samarbeten mellan svenska beräkningscentrum. Finansieringen har ökat från ca. 30MSEK/år till över 100 MSEK/år och få, om några, storskaliga datorresurser är inte integrerade i SNIC. SNIC, de sex nuvarande SNIC-centrumen samt användargrupperna har generellt sett uttryckt ett starkt stöd för den koordinering som SNIC tillhandahåller, samt för utvecklandet av en starkare och mer strategisk roll i fördelningen av beräknings- och lagringsresurser för forskning och utbildning i Sverige.

SNIC är lyhört för behoven hos existerande stora användargrupper och har effektivt och ändamålsenligt levererat till dessa grupper. Utnyttjandet av denna expertis och erfarenhet är absolut nödvändigt för Sverige och SNIC behöver utveckla och förbättra samarbetet med nya och kommande användargrupper. Panelen anser att SNIC är väl positionerat för att kunna möta dessa utmaningar. Panelen ger följande rekommendationer för att SNIC ska kunna uppnå sina mål:

1. Det finns ett starkt behov för en löpande 5-årsplan som klargör de mål, tidsramar, delmål och prioriteringar som krävs för att uppnå SNICs vision.
2. SNIC måste bli mer proaktivt inom prioritering av svensk forskning.
3. SNIC måste övergå till att fokusera på användarbehov, istället för HPC-behov.
4. SNIC bör övergå till att bli en distribuerad nationell infrastruktur.
5. Den nya organisationen bör ledas av en oberoende styrelse, tillsatt av Vetenskapsrådet.
6. Den nya organisationen bör ha ett flexibelt, men strategiskt förhållningssätt till centrumen.
7. Alla SNIC-centrum ska använda varumärket SNIC.
8. SNIC ska fortsätta att utveckla sin roll i strategiska internationella frågor.
9. Det behövs mer konsolidering av SNIC-tjänsterna.
10. SNICs tyngdpunkt bör vara på tjänster som endast kan tillhandahållas på en nationell nivå, eller som lämpar sig för nationell koordinering.
11. Användarstöd på alla nivåer (inte endast "helpdesk") behöver förstärkas relativt den totala budgeten.
12. Utveckla användarorienterade enheter för att övervaka tjänster och användning.
13. Investeringar i nya tjänster och hårdvaruresurser måste baseras på utvärderingar av vetenskapliga behov.
14. SNIC bör minska tonvikten på (lokala) basala datorresurser och använda mer ekonomiska resurser till tjänster och HPC på nationell skala.
15. SNIC bör anskaffa "SNIC-tjänster" från centrumen (eller från enheter utanför centrumen då det anses lämpligt).
16. SNIC-styrelsen och föreståndaren behöver ett mer stabilt planeringsunderlag för sina aktiviteter.
17. Särskilda rekommendationer är givna för scenarier med budgetförändringar om  $\pm 20\%$ .

Panelen kunde inte kommentera i detalj kostnadseffektiviteten av datorresurser och användarstöd, men noterar att SNIC har gjort stora framsteg med en väldigt lättviktig organisationsstruktur. Vi är bekymrade över mångfalden av befintliga system. Även om NGSSC inte utvärderades i detalj, anser panelen att SNIC har uppfyllt sin uppgift som "plantskola" för denna satsning och att det är dags att föra över programmet till universiteten. Om programmet fortsätter, bör SNIC vara fortsatt involverade i att finna utbildningspersonal och tillhandahålla beräkningsresurser.

Prof. Morten Dæhlen, University of Oslo, Norway,  
Dr. Neil Geddes, Science and Technology Facilities Council, United Kingdom,  
Prof. Risto Nieminen, Helsinki University of Technology, Finland  
Prof. Cherri Pancake, Oregon State University, USA

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## II. EXECUTIVE SUMMARY OF THE PANEL'S REPORT

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Since its creation in 2003, SNIC has significantly improved the landscape of computing in Sweden. In computing in general, and HPC in particular, SNIC has overseen an increase in resources and improved collaboration across the Swedish Computer Centres. Funding has increased from ~30MSEK/year to over 100 MSEK/year, and few, if any, significant Swedish computing resources are not integrated into SNIC. SNIC, the six current SNIC Centres, and the user communities have in general expressed their strong support for the coordination provided through SNIC and for developing a stronger and more strategic role for the provision of computing and storage resources for research and education in Sweden.

SNIC is responsive to the needs of existing large user communities and has delivered effectively and efficiently for these groups. Exploiting this expertise and experience is vital for Sweden and SNIC needs to develop and improve its interactions with new and emerging communities. The Panel believes that SNIC is well placed to meet these challenges. The Panel makes the following recommendations towards this goal:

1. There is a pressing need to create a 5-year, rolling plan that clarifies the objectives, timeline, milestones, and priorities needed to carry out the SNIC vision
2. SNIC must be more proactive in addressing Swedish research priorities
3. SNIC must transition to focus on user needs, rather than HPC resources
4. SNIC should move towards a distributed National Research Infrastructure
5. The new structure should be led by an independent Board of directors, appointed by the Research Council
6. The new organisation should have a flexible but strategic approach to its centres
7. All SNIC Centres must be required to use SNIC branding
8. SNIC should continue to develop its role in strategic International actions
9. More consolidation is needed in the SNIC services
10. SNIC emphasis should be on services that can only be done at a national-level or that make most sense coordinated nationally
11. User support at all levels (not just helpdesk) needs to be increased relative to total funding
12. Develop user-oriented metrics for monitoring services and usage
13. Investments in new services and hardware resources must be driven by evaluation of scientific requirements
14. SNIC should reduce emphasis on (local) foundation-level computing resources, and put more financial resources into national-scale services and HPC resources
15. SNIC should procure "SNIC services" from the centres (or from units outside the centres if appropriate)
16. The SNIC Board & Director need a more stable planning baseline for their activity
17. Specific recommendations are given for  $\pm 20\%$  budgets.

The panel was not able to comment in detail on the cost effectiveness of computer resources and support, but note that SNIC has made great progress with a very light-weight organizational structure. We are concerned about the multiplicity of current systems. Similarly, although NGSSC was not reviewed in detail, the panel believes that SNIC has fulfilled its role as a "nursery" for this effort and it's time to transition the program to the Universities. If the program is continued, SNIC should continue to be involved in identifying instructors and providing computing resources.

Prof. Morten Dæhlen, University of Oslo, Norway,  
Dr. Neil Geddes, Science and Technology Facilities Council, United Kingdom,  
Prof. Risto Nieminen, Helsinki University of Technology, Finland  
Prof. Cherri Pancake, Oregon State University, USA

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# 1. THE COUNCIL FOR RESEARCH INFRASTRUCTURES AND E-INFRASTRUCTURES

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The Swedish Research Council has established a Council for Research Infrastructures, RFI, (previously the Committee for Research Infrastructures), with the mandate to support the development and utilization of research infrastructures to promote the conditions for Swedish research of the highest scientific quality. The Council advertises and evaluates applications, participates in international collaboration and organisations, and works on monitoring, assessment and strategic work.

The development of research infrastructures involves several different phases – ranging from the first conceptual idea to decommissioning. The various phases have different financial needs and the Swedish Research Council and RFI have various forms of grants for funding infrastructures in various phases of construction. In order to receive support, such infrastructures shall:

- be of broad national interest
- provide scope for outstanding research
- be used by several research groups/users with highly advanced research projects
- be so extensive that individual groups cannot manage them on their own
- have a long-term plan addressing scientific goals, financing, and use
- be open and easily accessible for researchers and have a plan for improving accessibility

Data networks, computing resources and scientific databases constitute a special group of fundamental infrastructures – together often called electronic infrastructures or e-Infrastructures. In Sweden, the three fundamental e-Infrastructures are SUNET (Swedish University Computer Network), SNIC (Swedish National Infrastructure for Computing) and mechanisms for the build-up and provisions of research.

As one of the three pillars of e-Infrastructure in Sweden, SNIC plays an important and role in the coordination of the Swedish Research Council's efforts in the funding of large scale computational resources and storage. SNIC was set up as a metacentre and consists of six centres for high-performance computer systems in Sweden. SNIC reports to RFI, and the Research Council's funding to SNIC is allocated by RFI within its annual budget, together with other research infrastructure activities covered by the Council.

Most other large-scale Swedish and international research infrastructure initiatives and projects prioritized in the Swedish Research Council's Guide to Infrastructures are or will be heavily dependent on the provision of sustainable national e-Infrastructures services and excellent connections to international e-Infrastructure collaborations. For example, there is currently Swedish involvement in 15 of the major initiatives listed in the European Strategy Forum on Research Infrastructures (ESFRI) roadmap, all of which will rely on elements of e-Infrastructure. There are also a number of other existing and planned national and international projects and initiatives, for example within biology and medicine, which will probably bring in new types of requirements to the e-Infrastructure providers and developers. One example of such initiative is the Biobank Infrastructure Committee (BISC) within the Swedish Research Council.



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## 2. SHORT DESCRIPTION OF SNIC

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### 2.1 The SNIC Meta-Center

The Swedish National Infrastructure for Computing (SNIC) is a meta-centre, organizationally within the Swedish Research Council (VR). SNIC is a national resource providing funding for computing and data storage resources in Sweden. SNIC coordinates investments and competence in the area of scientific computing, allocates resources to users and funds and coordinates development projects in e-Science. This includes networks, data storage, computers, visual representation and different Grid technologies. SNIC is responsible for the coordination and development of persistent national computing resources and data storage for academic research in Sweden.

SNIC was formed in 2002 based on six already established computing centers at major Swedish universities, Umeå University (HPC2N), Uppsala University (UPPMAX), Royal Institute of Technology (PDC), Linköping University (NSC), Chalmers University of Technology (C3SE), and Lund University (Lunarc). SNIC is now firmly established as the coordinator of computing resources and data storage for academic research in Sweden. The computing resources cover a full range of facilities, from what has traditionally been called “supercomputers” to commodity clusters with standard interconnects. The SNIC resources are made available to Swedish users both via traditional login access and via grid interfaces through the Swedish National Grid Initiative (NGI), named SweGrid, which is fully integrated in SNIC. SNIC currently coordinates investments and services, user support and competence, provides mechanisms for resource allocation via its subcommittee Swedish National Allocations Committee (SNAC), and hosts the Swedish National Graduate School in Scientific Computing (NGSSC). SNIC also funds and coordinates a number of development projects in different areas of e-Infrastructure and manages the Swedish interface in main international e-Infrastructure collaborations.

SNIC has a Board reporting directly to the Council for Research Infrastructures (RFI) at the Swedish Research Council. The Board is the managing body of SNIC. The members of the SNIC Board are appointed by the Swedish Research Council. The SNIC Board consists of eight members and one chairperson. Its constitution in 2010 was as follows:

Birgit Erngren	<i>Chair</i>
Anna Delin	<i>Royal Institute of Technology</i>
Billy Fredriksson	<i>Saab AB</i>
Paula Eerola	<i>University of Helsinki</i>
Erik Hägersten	<i>Uppsala University</i>
Sinisa Krajnovic	<i>Chalmers University of Technology</i>
Uno Nävert	<i>Chalmers University of Technology</i>
Hans Wallberg	<i>Umeå University</i>

SNIC has a small central administrative organization hosted by Uppsala University. The director is Prof. Sverker Holmgren.

SNIC is a part of the activities of the Swedish Research Council in the area of research infrastructures. The SNIC Board shall provide the Swedish Research Council with the basis for establishing a budget, a mid-term report, an annual report, a yearly account for the strategic and scientific relevance of the activities account for the existing structure of resources and provide a strategy for the build-up of resources. On request from the Swedish Research Council, the SNIC Board shall provide a basis for decision in various principal and strategic questions and take active part in inquiries which fall within the areas of responsibilities of SNIC.

## 2.2 Users

More than 300 research groups in Sweden are today actively using the SNIC resources. In 2010 there was a continued increase in the total number of applications to SNAC and a rapid increase in the amount of resources requested. The majority of the users are still in the fields of physics and chemistry, but the usage of SNIC begins to spread to other disciplines as well, allocations for life science, geoscience and humanities are growing rapidly. A majority of the resources are granted to groups at other academic institutions than where the resource is located.

## 2.3 Resources

The SNIC national ecosystem for computing and data storage is based on providing foundation-level resources at all six SNIC centers and large-scale and special-purpose resources at some of the centers. All SNIC resources are available via a national allocation procedure and form a single, national research infrastructure which is further integrated in major international e-Infrastructure initiatives. Within the national structure, a few consortia-specific resources are made available to selected leading groups e.g. within the KAW/SNAC collaboration. The SNIC strategy for providing computing resources and data storage for Swedish research is based on the pyramid in Figure 1, which is very similar to the model used by many other e-Infrastructure centers and collaborations.

### European/International-level resources

- Grand-scale resources provided within international collaborations like PRACE and EGI.

### Special resources

- A few large-scale computational resources
- A few other special-purpose computational resources
- The national grid and data storage systems (SweGrid and SweStore)
- Collaborative efforts with other partners, e.g. KAW

### Foundation-level resources

- Computing and data storage at all SNIC centers

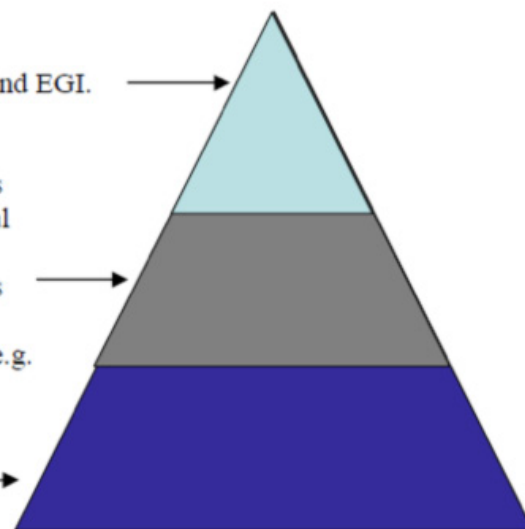


Figure 1. The hierarchy of SNIC resources

The disk storage at the SNIC centers is divided among cluster storage, center storage, and nationally accessible storage for the Nordic WLCG Tier-1. Also, three of the SNIC centers have recently upgraded their tape storage systems for national long-term archiving and backups. SNIC has in 2009 decided to launch the SweStore initiative. Within this effort, center storage systems which are independent of computing resources and accessible from all such resources are built up at all SNIC centers in a coordinated way. Within SweStore, a distributed, nationally accessible infrastructure for large-scale data storage will be put in place in the near future. SweStore also includes cross-site backup and other functions for assuring reliable and flexible long-term storage of large-scale datasets for Swedish researchers.

All six SNIC centers are interconnected via SUNET (the Swedish University Computer Network). The SUNET network connects each university in Sweden with redundant 10 Gbit/s connections. The connection of a SNIC center to SUNET is made through the campus network of the hosting university. In addition to the general SUNET connectivity dedicated 10 Gbit/s connections have been established for three of the SNIC centers in order to fulfill the needs of the Swedish LHC consortium.

In many areas, advanced software for scientific calculations and computer simulations is available at the SNIC centers. This makes it possible for a wide group to benefit from SNIC computing resources by using the software simply as a research tool. In this sense, SNIC functions as a provider of eScience tools and not just hardware resources. SNIC has also initiated several production and pilot projects with the aim of providing alternative modes of accessing computing resources and data storage. This includes grid access, application portals, and nationally transparent data storage.

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## 3. PANEL'S REPORT

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### 3.1 The Role and Function of SNIC

Overall, the SNIC management has made good progress toward building a national infrastructure. The six SNIC Centres are collaborating more than in the past, and each Centre Director commented on the advantages gained by being part of a collective effort. All SNIC Centres, however, see a need for strengthening the central management of SNIC, through additional support for the Director and stronger strategic direction of the Centres.

There is a *pressing need to create a 5-year, rolling plan that clarifies the objectives, timeline, milestones, and priorities needed to carry out the SNIC vision*. While much of the information is included in the Landscape document, there is no consolidated timeline, nor is it clear what the relative priorities are. In order to provide the foundation for managing and evaluating SNIC, this should be a “rolling plan” (i.e., updated annually to describe the next five years). The initial year or two should be defined in detail, with the roles of individual Centres clearly laid out; subsequent years will be less defined but will indicate the general directions and aspirations.

We believe the lack of this kind of plan is the cause of confusion about the role of the SNIC Centres. The Research Council's goal of enabling research and discovery is clear, but the Centres have grown out of a love of the technology and each group seems to have its own agenda. Further, the Board and Director look at the SNIC Centres differently from how they see themselves. There is a clear gap in leadership: everyone is waiting for someone else to define clear roles and responsibilities. SNIC will not be a national infrastructure until these groups are explicitly aligned, and a written plan is the best way to accomplish this.

As an organization, *SNIC must be more proactive in addressing Swedish research priorities*. The new model of identifying strategic domains and explicitly assigning resources to them is excellent in this regard. We suggest that the SNIC Board consider expanding the current areas to include other domains where the Research Council is investing significant funding (e.g., assign SweStore-related resources to environmental and biomedical data). Further, SNIC management should be more proactive in seeking out potential users in these areas, not just wait for them to approach SNIC.

*SNIC must also transition to focus on user needs, rather than HPC resources*. While some generic services are needed, increasing emphasis must be placed on solving user problems (i.e., specialized services in strategic areas). This transformation from a hardware orientation to a human infrastructure orientation will take time, but is critical to the long-term exploitation of SNIC as a research infrastructure. The balance may differ from one SNIC Centre to another, but SNIC as an organization needs to plan its services as a whole portfolio, and give more attention to building the human infrastructure needed to integrate high-performance computing, networking, and storage into scientific research.

Over time, we anticipate that the HPC systems themselves will be concentrated at a smaller number of SNIC Centres. This does not mean that the other SNIC Centres will necessarily go away. On the contrary, we believe it will be key to deploy application experts throughout the country so that they are easily available to distributed or emerging researcher communities, while exploiting existing expertise. Some SNIC Centres may transition entirely to this role, changing their focus to support for specific strategic user communities. A key first step in this transformation will be for the central SNIC management to “reclaim” the advanced user support staff to ensure that the National strategic support role for these staff is not lost. These people should clearly be deployed at the sites of existing and new SNIC Centres, but they should be employed and managed by the SNIC Director as the foundation for SNIC's new human infrastructure.

In general a more coordinated approach to work across SNIC and the e-Science initiatives, SeRC and eSENCE, should be encouraged. It is important to develop the innovation and new opportunities presented by the research aspects of the e-Science initiatives while ensuring the effective exploitation

of the infrastructure on a national scale. The Research Council may wish to consider requiring a joint project plan from the different initiatives (SNIC, eSENCE, SeRC and possibly other initiatives) for the next few years in order to encourage closer working without prejudicing the longer term evolution of these strategic initiatives.

## 3.2 Organisation

*SNIC should move towards a distributed National Research Infrastructure.* This should be an independent unit outside of the Research Council with responsibility for national and international priorities in research computing for Sweden. The new organisation must continue to develop strategic leadership which is responsive to user needs. It is important that this new organisation retains separation between strategic planning and day to day operational activities. A simple Consortium model where, for example, the SNIC Centres themselves jointly take responsibility for delivery of a distributed infrastructure against agreed budgets may not deliver the required strategic flexibility..

*The new structure should be led by an independent Board of directors, appointed by the Research Council.* The Research Council may wish to consider appointing a direct observer. The SNIC management should remain independent of the centers with a strengthening of the position and mandate of the Director, for example a full-time position supported by technical and administrative assistance. The Director should be appointed by, and report to, the Board. The Board should meet periodically with:

- Leadership Group chaired by the Director and including SNIC management plus directors of SNIC Centres. SNIC should consider using an outside facilitator to help with team-building for this group.
- Scientific Advisory Group: drawn from “strategic user areas” defined by Board
- SNAC-like Group: a user-derived group governing resource allocations and policies. The independence of the current SNAC group is a strength which should be maintained. This group should have the opportunity to comment on the use of all SNIC services and input to the procurement discussions. However, they need to be made aware of broader SNIC priorities, e.g. strategic areas.

*The new organisation should have a flexible but strategic approach to its centres, e.g. be open to creation of new centres.*

*All SNIC Centres must be required to use SNIC branding rather than focusing solely on a local centre name (e.g., SNIC-UPPMAX or SNIC@UPPSALA rather than just UPPMAX etc.)*

*SNIC should continue to develop its role in strategic international actions, leveraging expertise and opportunities across all SNIC Centres and in partner organisations.* “Branding” may occasionally be an issue here and we support the approach currently being taken by the Board and Director in this area. Namely, that where required, SNIC Management appoints specific SNIC Centres or individuals to act on behalf of SNIC in international activities. Engagement in new or emerging international actions is also encouraged through “bottom up” processes in the centres and research community, with SNIC Management only taking an active interest where these actions have clear national strategic interest or require national funding commitments.

Sweden and Finland are already collaborating within the PRACE initiative and the Panel feel that the opportunity for further Nordic collaboration should be pursued, as the scale of investment required for e.g. a PRACE tier-1 system may be more readily achieved at a Nordic level. (Most likely, Norway will join the PRACE consortium before the end of 2010.) Historically, it has proven difficult to exploit common Nordic opportunities within computing due in part to the different funding and organisational models in the Nordic countries. This may be helped if SNIC assumes a stronger coordinating role. Ultimately, investment should be guided by scientific research priorities.



### 3.3 Services in Relation the User Needs

Overall level of service provision is good, with significant progress since 2003. Since the establishment of SNIC, the quantity and quality of HPC services to the Swedish academic community have substantially improved, especially during the later years. The procurement of hardware, both for compute-intensive and data-intensive research, put Sweden among the top nations in Europe in terms of resources available to researchers. SNIC has started to provide a more unified access to these resources, and seeks to coordinate the investment and services provided by the participating university-based centres.

In addition to 13 compute systems (58472 cores), the SNIC hardware resources include core hardware for national grid computing (SweGrid) and national data storage (SweStore). These are or will (and should) be tightly coupled to international large-scale initiatives (e.g. LHC computing, ELIXIR) and national efforts (e.g. BILS, SND-HS).

*More consolidation is needed in the SNIC services.* The Panel recommends further consolidation of SNIC to a truly coherent, national (but distributed) research infrastructure. In terms of services, this means a user-focused approach to the resources and support functions. SweGrid does not yet appear to present a consistent and unified interface to users, and SweStore is at a very early stage in its development and needs to be closely connected to key user communities. The multiplicity of the systems should be diminished, with the service providers perhaps becoming more specialized in catering for the needs of different user communities. There should be more emphasis on advanced software support, and the synergies in operational and systems support could be better exploited. The tools for monitoring systems performance, availability and queuing times should be improved through a single portal.

*SNIC emphasis should be on services that can only be done at a national-level or that make most sense coordinated nationally.* The Panel recommends SNIC to move towards providing services at the national and international level, rather than providing local (foundation-level) computing and storage resources. In particular, this means paying attention to national research priorities and initiatives, which require major investments and long-term commitments. Advanced user support, access to critical software, and access to major resources should be the priority, regardless of the geographical location of either the researcher or the resource in question. SNIC should pay attention to monitoring the quality of services and adjust its service-provision contracts accordingly.

*User support at all levels (not just helpdesk) needs to be increased relative to total funding – and should be decoupled from hardware provision.* The amount of resources that SNIC allocates to user support is presently at the level of 15-20 % of the total. With high-performance and data-intensive computing rapidly expanding in volume and breadth, the Panel recommends that high-quality support at all levels (basic, advanced, and software-specific) be increased and made available irrespective of geographical location.

*Develop user-oriented metrics for monitoring services and usage.* For efficient exploitation of the resources and to facilitate future planning, it is important to obtain reliable and timely information of the infrastructure's performance. Such metrics include expansion factors (queuing time as proportion of total time), software usage and performance, system availability, disk failures etc.). The Panel recommends the implementation of monitoring tools, available through a single SNIC portal, to improve the somewhat patchy online information available today. The resource allocation could be more flexible, while critically examined and controlled by the research community itself (Scientific Advisory Group, Allocation Committee). In particular, code development and testing environments should be developed for large-scale projects, and exploratory platforms made available to enable paradigm shifts in high-performance computing (e.g. massively parallel computing, GPU computing).

*Investments in new services and hardware resources must be driven by evaluation of scientific requirements.* This is increasingly important as ones moves up the pyramid hierarchy and the scale of investment increases. There is no high end computing system which is truly general purpose.

## 3.4 Financial

Financial resources from the Research Council of Sweden have roughly doubled since 2003 and are today approximately 100 MSEK per year. In the vision and roadmap document 2010-2013 (the landscape document) SNIC is asking for an increase of approximately 30% in the total annual budget. The need for services and equipment within the realm of HPC will increase in the future, hence the committee supports the general statement in the Landscape document that the investment through SNIC should be increased.

*SNIC should reduce their emphasis on (local) foundation-level computing resources, and put more financial resources into national-scale services and HPC resources.* SNIC should make a clear distinction between investments in services and HPC hardware. National services may be distributed among the SNIC Centres (and even to new SNIC Centres at other universities), while investments in national HPC hardware resources (computing and storage) should be done (nationally) at few centres. SNIC should reduce the number of separate computing (and storage) hardware resources in Sweden.

*SNIC should procure "SNIC services" from the centres (or from units outside the centres if appropriate).* Based on our observation that users perceive services at some centres to be better than others, SNIC should exploit Centre strengths and focus services and investments accordingly. SNIC should move away from funding foundation resources and focus on building national services at the SNIC centres. Services can be fully funded by SNIC, or paid fully/partially by users or other partners (e.g. through joint proposals).

*The SNIC Board & Director need a more stable planning baseline for their activity.* This can be done by giving SNIC five year budgets based on rolling plans.

*20% decrease in funding (from 100 MSEK as of today):* Our first priority under this assumption is that SNIC should stop funding foundation resources at the centres. Our second recommendation is that SNIC reduces the number of computing facilities even if this reduces the number of SNIC Centres hosting national computing facilities (however, maintaining their role in user support). A 20% reduction should not reduce user support actions and SNIC should maintain its focus on data storage and international collaboration.

*20% increase in funding (from 100 MSEK as of today):* SNIC should increase application support (that may include the establishment of SNIC Centres at other universities to provide services to the research community). SNIC should improve the interfaces and exploitation of SweStore and SweGrid; this will require extensive work with users to identify and remove the barriers to use. SNIC should invest in high-end computing, including international efforts.

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# APPENDIX 1. TERMS-OF-REFERENCE

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## Introduction

The Swedish National Infrastructure for Computing (SNIC) is a national meta-centre under the Swedish Research Council (VR). SNIC is responsible for the coordination and development of national computing and data storage services for academic research and was formed based on six already established computing centres at major Swedish universities (HPC2N at Umeå University, UPPMAX at Uppsala University, PDC at the Royal Institute of Technology, NSC at Linköping university, C3SE at Chalmers University of Technology and Lunarc at Lund University). The affiliation of these six centres is formalized in agreements with the host universities. The various computing resources cover a full range of facilities ranging from what has traditionally been called supercomputers to commodity clusters. Resources at SNIC are made available to the user community both via traditional login access and via grid interfaces.

An international review of SNIC will be conducted during 2010. The role of the planned review is to examine in detail SNIC as a national resource and to give expert advice on the future development of this resource. The assessment will be conducted with the help of written material supplied by SNIC and through meetings with key people representing the various functions of SNIC. After completion, the results and conclusions of the review will be made public in a written report.

## Review Panel

The review will be conducted by a panel consisting of internationally recognized experts. The intention is that this panel will represent a broad expertise in the various activities that fall under the responsibility of SNIC. None of the members shall be personally engaged in the activities at SNIC.

The chairperson of the Review Panel will be appointed by the Swedish Research Council and the Council for Research Infrastructures (RFI). The Chair leads the review and is the rapporteur of the Panel. A research officer from VR acts as the co-coordinator of the review.

## Review Schedule

The review shall be made during *September 6-8, 2010*, in Stockholm, Sweden. A preliminary report, including the main findings, shall be presented to the Swedish Research Council by the rapporteur, or his/her representative, on *November 3, 2010*. SNIC will be requested to submit the necessary material on which the review shall be based no later than *July 1, 2010*.

## Review Procedure

The evaluation should focus on how well SNIC fulfills its mission to provide computing resources to the Swedish research community. The quantity, quality and cost-effectiveness of computer resources and support shall be assessed as well as the plans for the future development of SNIC – also with respect to international development and future user groups. The focus should be on the operation of SNIC as a whole and its cohesive organisation rather than on the individual computing centres or on the research carried out by means of SNIC resources.

The Review Panel is asked to write a report addressing the general issues mentioned above and also on the following specific aspects (here listed in no particular order):

1. Comment on how well SNIC meets the *high-performance computing (HPC) needs* of the Swedish research community, quality- and quantity-wise.



2. Comment on how SNIC and its six constituent computing centres work together to meet *both the overall needs of the user groups as well as the diverse needs* in terms of capacity resources, capability resources, research specific resources, large peta-flop resources aiming towards participation in PRACE, data storage and grid environments. Comment on how this relates to major new investments being made in Sweden in terms of e-science research.
3. Comment on the adequacy of the level of *user support* provided by SNIC. Does SNIC and its six different computing centres adequately satisfy the need for support (e.g. in terms of application experts and programming skills)?
4. Comment on the *allocation of computer time* by the SNAC (Swedish National Allocations Committee), the sharing of computer resources and the distribution of different computer types between the six different constituent centres and the distribution of computer resources and human resources.
5. Comment on how well *SNIC as an umbrella organisation works together with its six constituent centres*.
6. Comment on the *management and board* structure and performance of SNIC with regard to SNIC's goals and functions.
7. Comment on the *cost effectiveness* of the SNIC activities and on the *distribution of SNIC financial resources*, especially regarding the division of the resources with regard to the allocation of operating and investment costs.
8. Comment on *SNIC in an international perspective*, e.g. the balance between national and international (PRACE, EGEE, EGI, etc.) efforts and the relations between SNIC and similar organisations in Europe and, especially, in the Nordic Countries?
9. Comment on the *future role of SNIC and its preparedness* to meet the future HPC needs of the Swedish research community with an increasingly broader user base and where a larger proportion of e-science research is carried out in major national and international collaborations. Comment on the envisaged future operation and organization of SNIC.

The panel is also asked to report about any other scientific, administrative or financial issue which can be of importance for the Swedish Research Council.

# APPENDIX 2. TIMEPLAN

## Schedule

	Sunday 5 Sept	Monday 6 Sept	Tuesday 7 Sept	Wednesday 8 Sept
08:30-09:00	Arrival	Panel - Closed session	Panel - Closed session	Panel - Closed session
9.00-10.00		Session 1	Session 3	Report drafting
10.00-11.00				
11.00-12.00		LUNCH	LUNCH	LUNCH
12.00-13.00				
13.00-14.00		Session 1 (cont.)	Session 4a	Report drafting
14.00-14:40		Coffee break	Coffee break	Coffee break
14:40-15:00				
15.00-16.00		Session 2	Session 4b	Presentation of report
16.00-17.00			Report drafting	Departure
17.00-18.00				
18.00-19.00	Introductory Meeting	Report drafting		
19.00-	DINNER	DINNER	DINNER	

### Introductory Meeting , September 5

18:00 – 18:15	SNIC – background	Anders Ynnerman
18:15 – 18:30	International Evaluation of SNIC	Juni Palmgren
18:30 – 18:45	Swedish E-infra landscape	Sven Stafström
18:45 – 19:00	Discussion	Lars Börjesson
19:30 –	Dinner (Host: Juni Palmgren)	

### September 6 – 8

#### *Session 1. Detailed presentation of SNIC and its six computing centres.*

09:00	SNIC welcome
09:10 – 09:50	SNIC – Current Status, Facts and Figures, outline of the future Landscape as described in the SNIC Landscape Document
09:50 – 10:00	Questions and Clarifications
10:00 – 10:20	SNIC Users – Facts and Figures
10:20 – 10:30	Discussion
10:30 – 12:00	SNIC center presentations and response to ToR (6*15 minutes)
12:00 – 13:00	Lunch
13.00 – 13.30	SNIC response to ToR
13.30 – 14.40	“Panel discussion” – SNIC Director and STAC responds to questions from evaluation panel
14.40 – 15.00	Coffee

#### *Session 2 . SNIC users.*

##### **15:00 – 18:00**

15:00 – 15:20	Olle Eriksson (Uppsala University), theoretical material physics.
15:20 – 15:40	Uwe Fladrich (SMHI, Rossby Center), climate modelling
15:40 – 16:00	Anders Hellman (Chalmers), chemical physics
16:00 – 16:20	Johan Nilsson (Lund University), medicine
16:20 – 16:40	Klas Markström (Umeå University), mathematics
16:40 – 17:00	Erik Lindahl (Stockholm University), life science, computational structural biology
17:00 – 17:20	Kerstin Lindblad-Toh (Uppsala University), genomics
17:20 – 17:40	Joerg Tiedemann (Uppsala University), linguistics
17:40 – 18:00	Discussion

**Session 3. Strategic Research Centres for e-Science and e-Science for research infrastructures**

**09:00 – 12:00**

09:00 – 09:25	SeRC	Dan Henningson
09:25 – 09:50	eSSENCE	Sverker Holmgren
09:50 – 10:15	SciLifeLab	Thomas Svensson
10:15 – 10:40	LHC-Consortium	Tord Ekelöf
10:40 – 11:05	IceCube	Klas Hultqvist
11:05 – 11:30	Swedish National Data Service for Climate and environmental data	Uwe Fladrich
11:30 – 11:55	MAX-IV	Darren Spruce
15:00 – 15:25	bbmri.se	Jan-Eric Litton

**Session 4a. E-infra future needs and outlook.**

13:00 – 13:40	Presentation of plans in Landscape Document, Sverker Holmgren
13:40 – 14:40	Discussion (SNIC Board, management, relation to Vetenskapsrådet, etc.)
14:40 – 15:00	Coffee

**Session 4b. Future organisation of SNIC.**

15:25 – 16:00	Future organisation of SNIC
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## APPENDIX 3. INSTRUCTIONS

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### Instructions for users presentation

The presentation should include the following (note: the presentation should NOT be on the research carried out, but instead focus on the experience of using the resources at SNIC):

- Short description of research group and usage pattern of resources (e.g. time-limited intense use or continuous long-term access)
- Period of use of resources at SNIC
- Size of projects carried out (core hours/month)
- Comment on the computing and data storage resources used and how/if they fulfill your needs. Specifically comment on: basic user support, user input/feedback, response on error reports, access and allocation of resources, quality of operation including availability/downtime, access modes, job submissions/queues, available software/applications
- Comment on SNIC's dissemination of information and knowledge on the computing environments, methods and capacities being build-up
- Describe your future needs, including user support, and how these can be accommodated by SNIC  
Maximum length: 10 minutes plus 10 minutes discussion

### Instructions for representatives of strategic centers, national resources and national infrastructures

The presentation should include the following:

- Short description of strategic centre/national resource/infrastructure and how they relate to the Swedish e-science landscape.
- If applicable: Comment on the computing and data storage used at SNIC.
- Comment on SNIC's dissemination of information and knowledge on the computing environments, methods and capacities being build-up
- Present the needs for the future e-infrastructure services (computing capacity, storage, network connections, user support) and how this can be accommodated by SNIC.  
Maximum length: 15 minutes plus 10 minutes discussion

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## APPENDIX 4. DOCUMENTS

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The following documents were made available to the Panel before the review:

- SNIC Landscape Document
- Terms of Reference
- International Evaluation of SNIC, 6–8 September 2010 – Schedule
- Instructions for user presentations
- Instructions for representatives of strategic centers, national resources and national infrastructures
- Regulation between the Swedish Research Council and the Swedish National Infrastructure for Computing (SNIC)
- SNIC Progress Report 2008–2009
- SNIC Organisation
- SNIC Self-Evaluation
- Centers Self-Evaluation
- SNIC User Survey

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## APPENDIX 5. BACKGROUND OF EXPERTS

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### Personal information

**Name:** Dr. Neil Geddes D.Phil. C.Phys. F.Ins.P.

**Affiliation:** UK Science and Technology Facilities Council

**Native country:** United Kingdom

### Academic Degrees

1982 B.Sc. Honors in Physics, University of Bristol

1986 D.Phil. High Energy Particle Physics, University of Oxford

### Recent Employment history (selection)

2007 – e-Science Director, STFC  
2004 – 2007 Head of e-Science, CCLRC  
2001 – 2004 e-Science Director, PPARC  
1986 – 2001 Physicist, Rutherford Appleton Laboratory

### Recent Professional Activities (selection)

2000 Secretary to OECD Global Science Forum HEP Workshop  
2001 – 2005 Member of the Steering Committee for the UK e-Science programme  
2001 – LHC Computing Grid Project Launch Committee and Oversight Board  
2001 – 2003 Member of the UK Government's e-Envoy Technical Advisory Group  
2004 – Member of the JISC Committee for the Support of Research  
2004 – Member of UK High Performance Computing Technology Watch Panel  
2005 – UK member of European Commission e-Infrastructure Reflection Group  
2006 – 2008 Member of ESFRI expert group on e-Infrastructure, Data and Computation  
2006 – 2008 Chairman of the wLCG Collaboration  
2007 – Member of Institute of Physics Fellowship Panel  
2008 – Institut des Grilles International Advisory Board  
2009 Swedish Research Council Expert Panel on e-Science (Chair)  
2009 Swedish Research Council Panel on Large Research Infrastructures  
2009 Helmholtz Alliance Review Panel: "Physics at the Terascale"  
2010 RCUK e-Infrastructure Expert Group  
2010 Review Committee of the pan-Canadian HPC Facility  
2010 – EGI.eu Council and Executive Board member

### Research Interests

Neil's research interests span both physics and computing. In physics Neil has a long standing interest in Quantum Chromodynamics hadronisation models and matter-antimatter asymmetries. He is currently working on the physics at the very highest energies at the Large Hadron Collider. Throughout his career Neil has had a strong interest in distributed computing and how to exploit developments in this field in support of his physics interests. Most recently this has centred on Grid Computing and management of large scale scientific data sets. Neil has a strong interest in scientific computing in general and now leads the e-Science Department in the UK Science and Technology Facilities Council (STFC), with responsibility for data storage and management, scientific computing and grid technology development and exploitation in support of the scientific facilities operated by STFC.

## Personal information

**Name:** Morten Dæhlen

**Affiliation:** Department of Informatics, University of Oslo

**Native country:** Norway

## Academic Degrees

1989 Dr. Scient. (PhD) in numerical analysis, Department of Informatics, University of Oslo

## Recent Employment history (selection)

2005 – Head of department, Department of Informatics, University of Oslo

1998 – Professor, Department of Informatics, University of Oslo

2001 – 2004 Managing Director/research director, Simula Research Laboratory

1999 – 2000 Executive Director, Science and Technology, Research Council of Norway

## Recent Professional Activities (selection)

2010 Mathematical Methods for Curves and Surfaces VII, Springer, editor

2005 – 2009 ESFRI (European Strategy Forum on Research Infrastructures, expert group on Computing and Data Treatment, member

2006 – 2008 eScience; Infrastructure, Theory and Applications, Research programme at The Research Council of Norway, chairman

2006 – iAD – information access disruptions, Centre of Research-based Innovation, chairman of the board

2010 – International Scientific Advisory Board – ICT (ISAB-ICT), KTH, Sweden, member of committee

2009 – Member of Norwegian Academy of Technological Sciences

## Research Interests

Modeling and representation of huge data sets for real-time visualization, real-time physics calculations and efficient data transfer, multi-resolution modeling for streaming and visualization of geometries, geometric modeling, computer graphics and interactive visualization, scattered data approximation, data integration data reduction.

## Personal information

Name: Risto M. Nieminen

Affiliation: Aalto University, School of Science, Finland

Native country: Finland

## Academic degrees

1972 M.Sc. , Engineering Physics, Helsinki University of Technology  
1973 Lic. Tech., Engineering Physics, Helsinki University of Technology  
1975 Dr. Sc. (Tech.), Helsinki University of Technology

## Recent employment history (selection)

2010 – Distinguished Aalto Professor, Aalto University School of Science  
2007 – 2008 Director, NORDITA, Sweden  
1997 – 2008 Academy Professor, Academy of Finland and Helsinki University of Technology  
1994 – 2009 Professor, Helsinki University of Technology  
1989 – 1996 Scientific Director, Center for Scientific Computing, Finland  
1987 – 1994 Associate Professor, Helsinki University of Technology  
1986 – 1987 Visiting Professor, Cornell University, USA  
1979 – 1980 Visiting Professor, Cornell University, USA  
1978 – 1986 Associate Professor, University of Jyväskylä, Finland  
1975 – 1977 Post-doctoral Fellow, NORDITA, Denmark  
1973 – 1975 Pre-doctoral Fellow, Cavendish laboratory, University of Cambridge, UK  
1970 – 1973 Research Assistant, Helsinki University of Technology

## Recent professional activities (selection)

2010 – Board of Directors, Helsinki Institute of Physics  
2010 – Scientific Steering Committee, PRACE High-Performance Computing  
2009 – Materials Science Expert Committee, European Science Foundation  
2007 – Scientific Advisory Board, Center for Atomic-Scale Materials Design, Danish Technical University, Denmark  
2006 – International Scientific Committee, Thomas Young Centre, London, UK  
2004 – Fachbeirat, Fritz-Haber-Institute of the Max-Planck-Society, Germany  
1999 – Scientific Advisory Board, Center for Computational Materials Science, University of Vienna, Austria  
2007 – Millennium Prize Selection Committee  
2005 – 2008 Science and Technology Policy Council  
1982 – Editorial Board, Physica Scripta  
1992 – 2001 Founding Editor, Computational Materials Science (Elsevier)  
1996 – Editor, Lecture Notes in Computational Science and Engineering (Springer)  
1994 – Chairman, National Graduate School for Materials Physics

## Research interests

Risto Nieminen's research interests cover theoretical and computational condensed-matter and materials physics, including applications to nanosciences and -technology. He directs COMP, a national Centre of Excellence in Computational Nanoscience. Current activities cover electronic structure and properties of materials, based on first-principles calculations, surface and interface science, many-body quantum phenomena, statistical physics and complex systems, and biological-physics applications. He is also involved in computational methods research and program development for high-performance computing. He has more than 500 publications in scientific literature with nearly 15000 citations.



## Personal information

Name: Cherri M. Pancake

Affiliation: Oregon State University, USA

Native country: USA

## Academic Degrees

1971 B.S. cum laude in Design & Environmental Analysis, Cornell University

1986 Ph.D. Computer Engineering, Auburn University

## Recent Employment history (selection)

- 1996 – Professor and Intel Faculty Fellow, Electrical Engineering & Computer Science, Oregon State University
- 1995 – Director, Northwest Alliance for Computational Science and Engineering
- 2003 – 2004 Special Expert on Cyberinfrastructure, National Science Foundation
- 2000 – 2001 Visiting Scholar, University of California San Diego
- 1989 – 1994 Visiting Scientist, Cornell Theory Center
- 1988 – 1992 Assistant Professor, Computer Science & Engineering, Auburn University

## Recent Professional Activities (selection)

- 2008 – National Advisory Council for Biomedical Imaging & Bioengineering, National Institutes of Health
- 2008 – National Research Council Standing Committee on Geophysical & Environmental Data
- 2000 – Advisor on Usability, Protein Databank
- 2005 – 2007 Engineering Advisory Committee, National Science Foundation
- 2004 – 2006 National Centers for Biomedical Computing Study Section, National Institutes of Health
- 2003 – 2008 Advisor on Usability, Resource for Biocomputing, Visualization & Informatics
- 2002 – 2004 Earth Observatories' Cyberinfrastructure Coordination Group, National Science Foundation
- 2002 – 2004 Advisor on Usability, Joint Center for Structural Genomics
- 2002 – 2004 National Research Council, Committee on Intersections between Geospatial Information and IT
- 2001 – 2009 Fellows Committee, Association for Computing Machinery
- 2000 – 2008 Strategic Advisor on Usability, San Diego Supercomputer Center
- 1999 – 2004 Computing and Information Science & Engineering Advisory Committee, National Science Foundation

## Research Interests

Prof. Pancake's recent research has focused on how "virtual collaborations" – interactions that may span large, interdisciplinary, and physically distributed communities – differ from situations where colleagues have the opportunity to meet and work together physically. She develops processes and software tools to make remote collaboration fit naturally into the normal patterns of scientific research and practice. Prof. Pancake has worked with a number of virtual communities, including the Protein Databank, the Collaborative Large-scale Engineering Analysis Network for Environmental Research, the Long-Term Ecological Research Network, and the National Biological Information Infrastructure. Her leadership was instrumental in the creation the Parallel Tools Consortium and the Network for Earthquake Engineering Simulation (NEES), organizations which unite researchers, educators, and industry practitioners to expedite the rollover of research advances into education and practice.

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## APPENDIX 6. LIST OF ABBREVIATIONS

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BILS	Bioinformatic Infrastructure for Life Sciences
BISC	Biobank InfraStructure Committee
C3SE	Chalmers Centre for Computational Science and Engineering
CCLRC	Council for the Central Laboratory of the Research Councils
COMP	Center of Excellence in computational nanoscience
DISC	Database InfraStructure Committee
EGEE	Enabling Grids for E-science
EGI	European Grid Infrastructure
ELIXIR	European Life sciences Infrastructure for Biological Information
ESFRI	European Strategic Forum for Research Infrastructures
GPU	Graphics Processing Unit
HEP	High-Energy Physics
HPC	High-performanc Computing
HPC2N	High Performance Computing Centre North
ICT	Information and Communication Technologies
IT	Information Technology
JISC	Joint Information Systems Committee
KAW	Knuth and Alice Wallenberg Foundation
LHC	Large Hadron Collider
MAX-IV	the next generation synchrotron radiation facility in Sweden
NEES	Network for Earthquake Engineering Simulation
NGI	National Grid Initiative
NGSSC	National Graduate School in Scientific Computing
NORDITA	Nordic Institute for Theoretical Physics
NOT	Nordic Optical Telescope
NSC	National Supercomputer Centre
OECD	Organisation for Economic Co-operation and Development
PDC	Paralleldatorcentrum (PDC Center for High Performance Computing)
PPARC	Particle Physics and Astronomy Research Council
PRACE	Partnership for Advanced Computing in Europe
RCUK	Research Councils UK
RFI	Rådet för Forskningens Infrastrukturer
SMHI	Swedish Meteorological and Hydrological Institute
SNAC	Swedish National Allocations Committee
SND	Svensk Nationell Datatjänst
SNIC	Swedish National Infrastructure for Computing
STAC	SNIC Technical Advisory Committe
STFC	Science and Technology Facilities Council
SUNET	Swedish University Computer Network
SeRC	Swedish e-Science Research Centre
ToR	Terms of Reference
UPPMAX	Uppsala Multidisciplinary Center for Advanced Computational Science
VR	Vetenskapsrådet
WLCG	Worldwide LHC Computing Grid
eSENCE	strategic research program in e-science