
SNIC
SWEDISH NATIONAL INFRASTRUCTURE FOR COMPUTING

SNAC
SWEDISH NATIONAL ALLOCATION COMMITTEE

Philipp Schlatter
Chairman SNAC
KTH Mechanics, Stockholm, Sweden

Outline for today

- Short intro about me
- SNIC
- SNAC
- Large-scale applications
- Questions and answers



Who am I?



Philipp Schlatter

PhD in Technical Sciences, ETH Zürich, Switzerland (2005)

Moved as postdoc to KTH Stockholm,
now Professor in Fluid Dynamics, KTH Mechanics

Member of SNAC since 2009

Chairman of SNAC since 2018

Involved in "supercomputing" since Master's thesis at
KTH (1999), at that time running on CRAY J90 (PDC) and
SIG Origin 2000 (NSC)



The Linné FLOW Centre and the Swedish e-Science Reserach Centre

- Centre of excellence in **Fluid Mechanics** at KTH Stockholm (Sweden), 2007 – ...
- Approx. 30 faculty and 50 PhD students



www.flow.kth.se

- Strategic research area in Sweden → **e-Science**
- Collaboration with visualisation, numerics, application experts...



www.e-science.se



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THE CONCEPT OF e-SCIENCE
In its most basic form, the concept of e-Science is the use of information and the processing of this information.

SeRC LEADERSHIP

- Dan Henningson Director, KTH
- Erik Lindahl Codirector, SU
- Olivia Eriksson Coordinator, KTH
- Morten Daelen Chairman of the board, University of
- Anders Ynnerman Vice chairman of the board, LIU
- Juni Palmgren University representative, KI
- Gunnilla Svensson University representative, SU

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Print: Atta 45 Tryckeri AB, Järfalla, 2016

SUCCESS STORY: "VIRTUAL WIND TUNNEL"

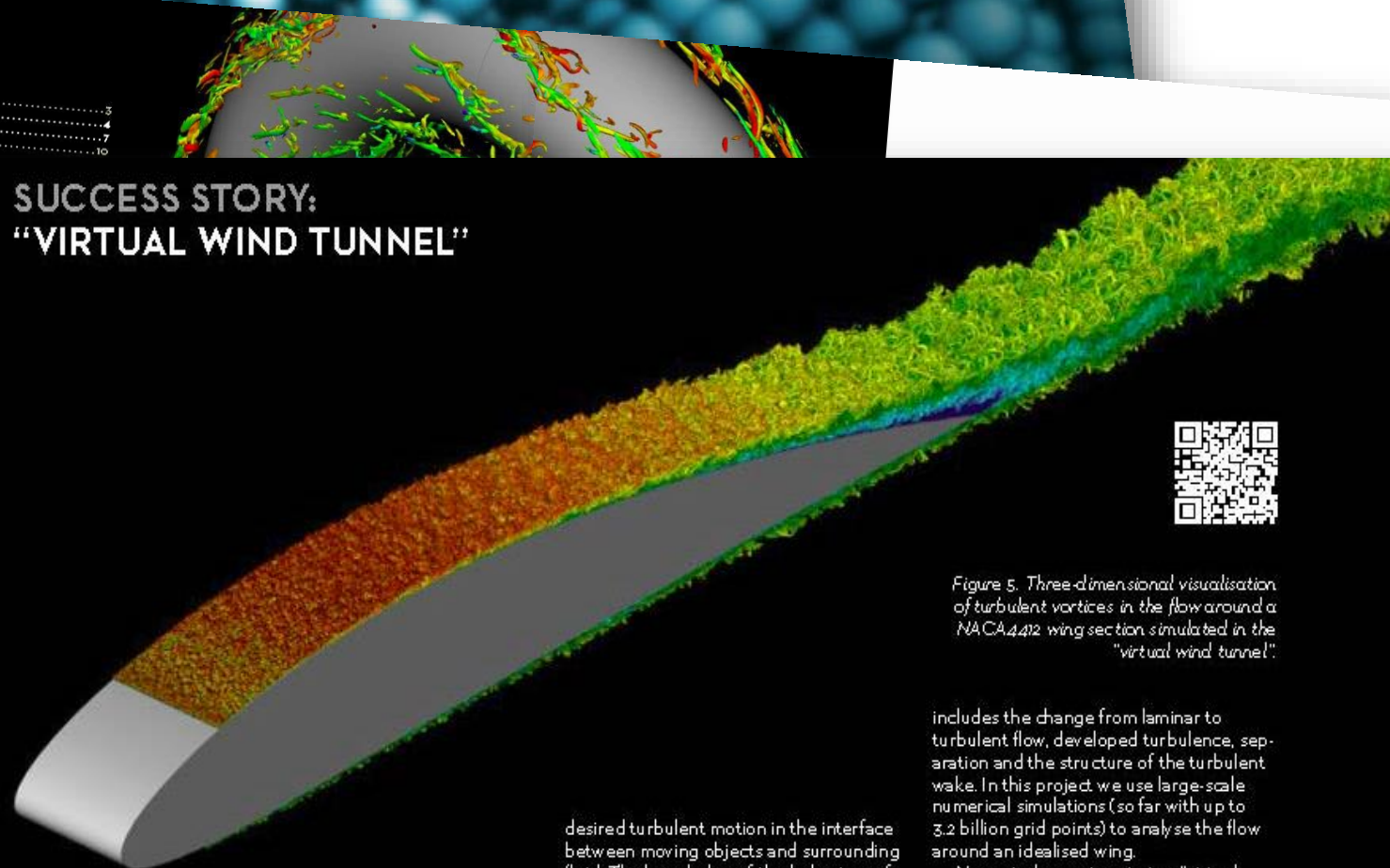


Figure 5. Three-dimensional visualisation of turbulent vortices in the flow around a NACA4412 wing section simulated in the "virtual wind tunnel".

includes the change from laminar to turbulent flow, developed turbulence, separation and the structure of the turbulent wake. In this project we use large-scale numerical simulations (so far with up to 3.2 billion grid points) to analyse the flow around an idealised wing.

Numerical experiments in a "virtual wind tunnel" and the concept of "virtual wind tunnel" aims at replacing, in the future, some real wind-tunnel experiments by corresponding simulations, which will yield a much larger wealth of data relevant for design purposes.

desired turbulent motion in the interface between moving objects and surrounding fluid. The knowledge of the behaviour of turbulence close to these surfaces is of paramount importance if optimal design and perhaps drag reduction via flow control is attempted.

Accurate numerical simulations allow the characterisation, with the highest level of detail, of the multiple physical phenomena present in complex flow cases such as around airplane wings. The physics

Automotive, aeronautic, and maritime transport of people and goods play important roles in the globalised world, but are also using up about five billion barrels of oil per year. Roughly half of the energy being spent worldwide in such transport activities is dissipated by un-



Why are we here...?

- “When a sufficiently **advanced computer** becomes available, we believe it will **replace the wind tunnel** as the principal facility for providing aerodynamic flow simulations”
- “If past trends continue, such computer performance should **be available in the mid-1980s...**”

Chapman, D. R., Mark, H., Pirtle, M. W., “Computers vs. wind tunnels for aerodynamic flow simulations”, *Astronautics & Aeronautics* **13**(4):22-30, 1975 (NASA Ames)



SNIC

Swedish National Infrastructure for Computing

Swedish National Infrastructure for Computing SNIC

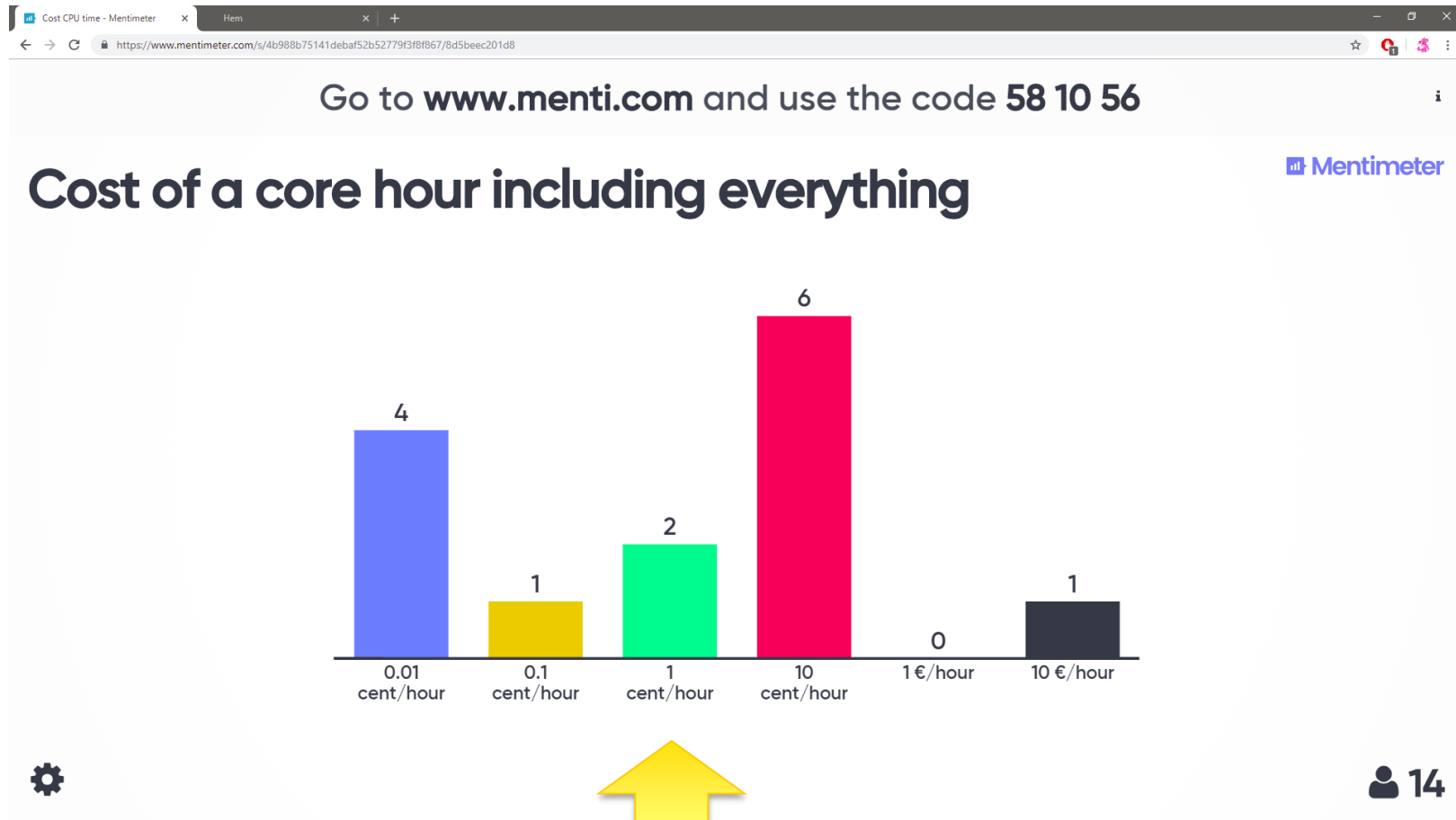
The ***Swedish National Infrastructure for Computing*** is a science enabling e-infrastructure for Swedish research.

SNIC makes available resources for large scale **computing** and **storage**, and provides advanced **user support** in order to facilitate efficient use of the SNIC resources.

SNIC provides these services for Swedish researchers at universities and research agencies, but not commercial companies.

MENTI

Go to www.menti.com and use the code 58 10 56.

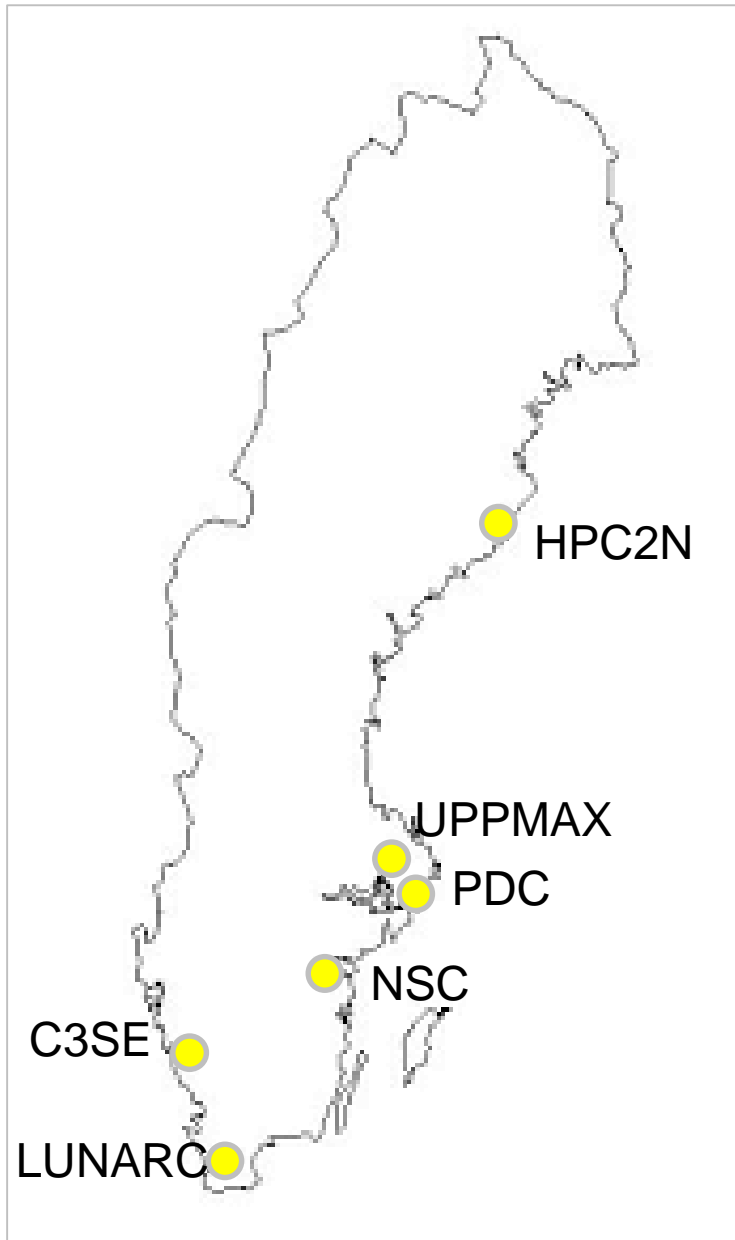


right ballpark

SNIC

- SNIC was **founded in 2003** as a collaboration between six computing centra with funding from the Swedish Research Council (Vetenskapsrådet – VR) and participating universities
- In 2012 Uppsala University became the host for SNIC
- From 2018 SNIC is organized as a consortium of ten universities
- SNIC is the **second largest national research infrastructure** (largest ist MAX-IV)

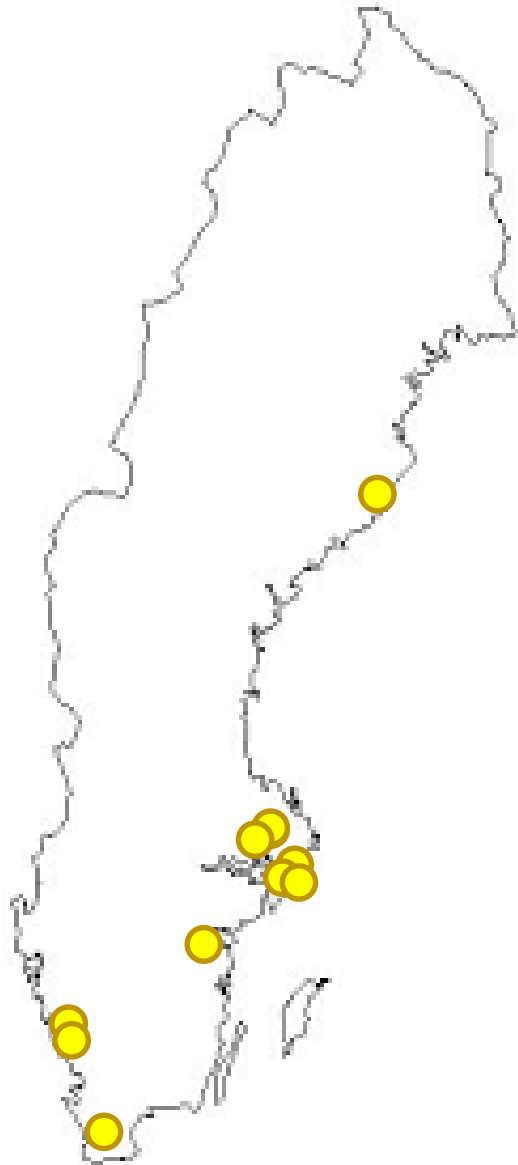
SNIC



SNIC is being reorganized from a collaboration between **six computing centra** ...

- Umeå (HPC2N)
- Uppsala (UPPMAX)
- Stockholm (PDC)
- Linköping (NSC)
- Gothenburg (C3SE)
- Lund (LUNARC)

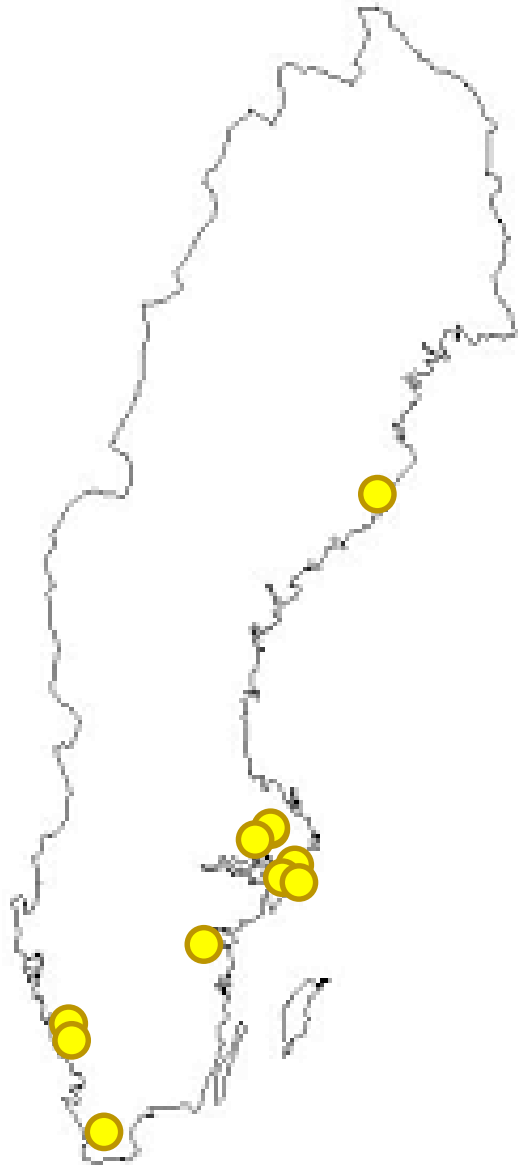
The SNIC consortium



...to consortium of **ten universities**:

- Umeå University
- Swedish University of Agricultural Sciences (SLU)
- Uppsala University
- KTH
- Stockholm University
- Karolinska Institute (KI)
- Linköping University
- Chalmers
- Gothenburg University
- Lund University

SNIC funding 2018-2022



100 MSEK/year from the Swedish Research Council VR.

64 MSEK/year **in-cash** participation and usage fees from the members in the consortium.

32 MSEK/year **in-kind** contributions in the form of provisioning of user support for the general SNIC national services.

Total ~200 MSEK/year + additional projects

SNIC Governance

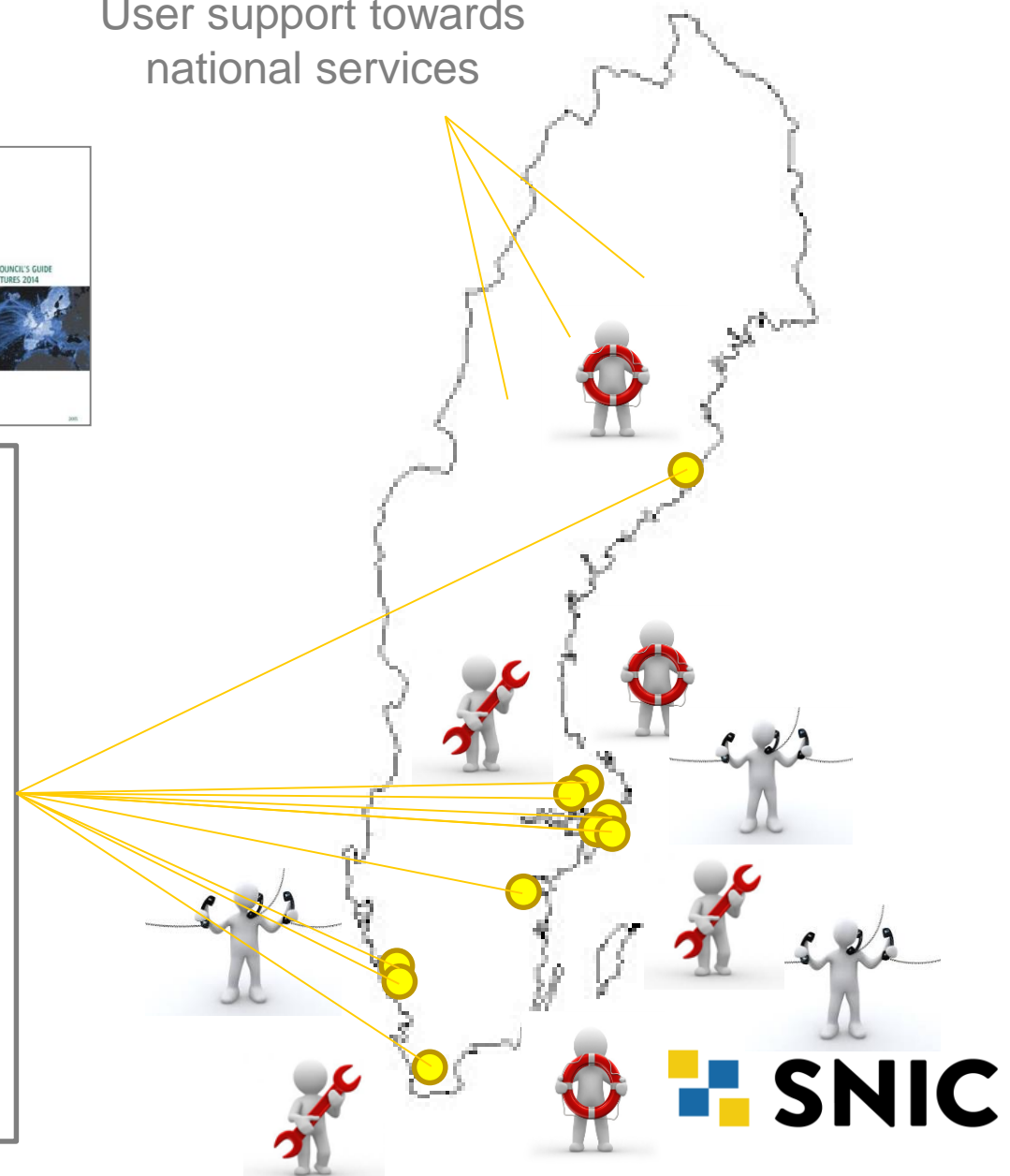
International collaboration



Other RIs



User support towards national services



High-Level Board



Allocation of national services to users (SNAC)

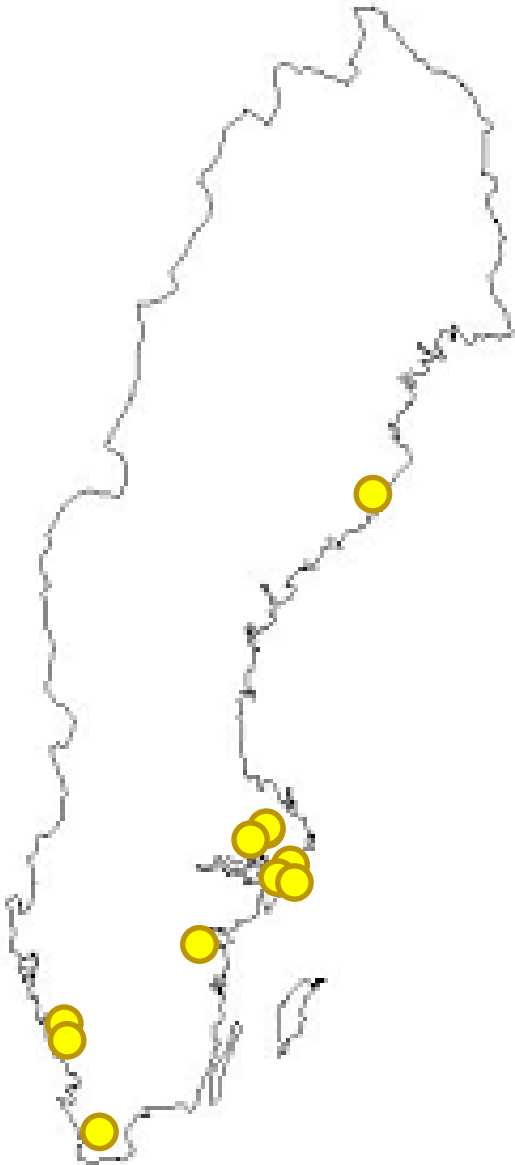


Funds for acquiring national services

Coordinating Office



SNIC National Collaboration



Common resources

Nationally available storage
Common resource allocation (SNAC)
Advanced user support
Shared competences

International collaborations

PRACE, EUDAT, EGI, NeIC, EOSC, EuroHPC

Collaboration with other national RI

Max IV, Scilifelab, Onsala, WLCG, ...

SNIC Board

SNIC board during 2018:

- Mille Millnert (LiU), **chairman**
- Per Dannelun, (LiU)
- Bjørn Hafskjold (**NTNU, Norway**)
- Kristina Edström, (UU), deputy chairman
- Kristina Gold (**Ericsson**)
- Annika Stensson Trigell (KTH)
- Stefan Eriksson (KI)
- Katrine Riklund (UmU)
- Anders Karlhede (SU)

SNIC Office

SNIC Office at Uppsala University during 2018:

- Hans Karlsson, **director**
- Anna-Helena Brandhammar, accountant
- Ann-Charlotte Sonnhammer, technical coordinator
- Lars-Owe Ivarsson, technical coordinator
- Mathias Brännvall, coordinator
- Per-Olov Hammargren, **coordinator**

SNAC

SNAC – Swedish National Allocation Committee:

- Philipp Schlatter, **chairman** (KTH)
Fluid dynamics, HPC, numerics, climate
- Johan Revstedt (LU)
Fluid dynamics, Mechanics, climate
- Lynn Kamerlin (UU)
Biology, chemistry
- Mattias Marklund, **deputy chairman** (GU)
Physics, electromagnetics, plasma and atomic physics, quantum dynamics
- Vacant: **Theoretical chemistry** and **condensed matter physics**
(board will decide on March 27 to initiate the process)

SNAC Working Group

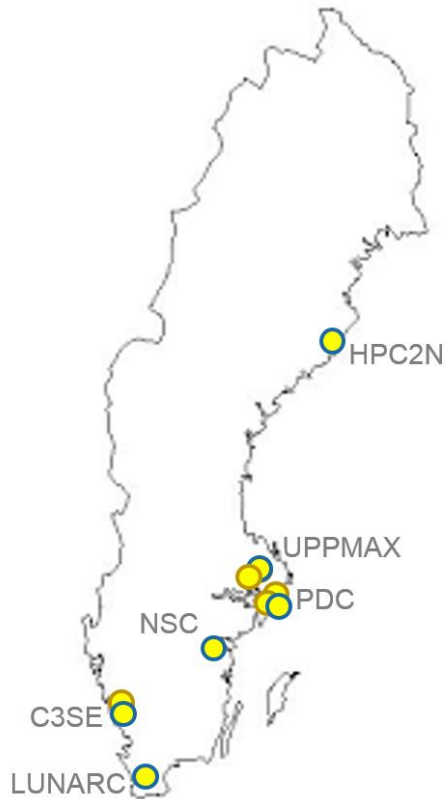
SNAC - WG:

- Philipp Schlatter, KTH, Chair SNAC
- Anders Sjöström, LUNARC
- Thomas Svedberg, C3SE
- Peter Münger, NSC
- Henric Zazzi, PDC
- Marcus Holm, UPPMAX
- Jerry Eriksson, HPC2N

- Dejan Vitacil, PDC (Swestore)
- Jens Larsson, NSC (Swestore)

SNIC Computing Resources

SNIC computing resources

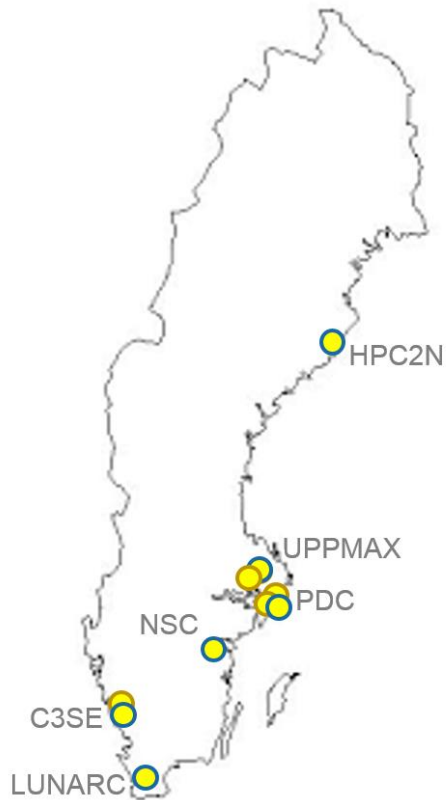


Name	Partner	Approx. performance	Size
Aurora	LUNARC, LU	115 TFLOPS	1.3 Mch/month
Beskow	PDC, KTH	1740 TFLOPS	49 Mch/month
Hebbe	C3SE, Chalmers	180 TFLOPS	3.4 Mch/month
Kebnekaise	HPC2N, UmU	629-1000+ TFLOPS	11 Mch/month
Rackham	UPPMAX, UU	347 TFLOPS	4.3 Mch/month
Tetralith	LiU	2969 TFLOPS	44 Mch/month

Specialized systems

- SNIC Science Cloud (UPPMAX, C3SE, HPC2N)
- SNIC Sens (UPPMAX, PDC)
- Life sciences (UPPMAX)
- WLCG (HPC2N, NSC, LUNARC)

SNIC Storage



SNIC provides generally available national services for storage and management of active research data.

10 PetaByte national storage available, and capacity for 44 PetaByte tape storage.

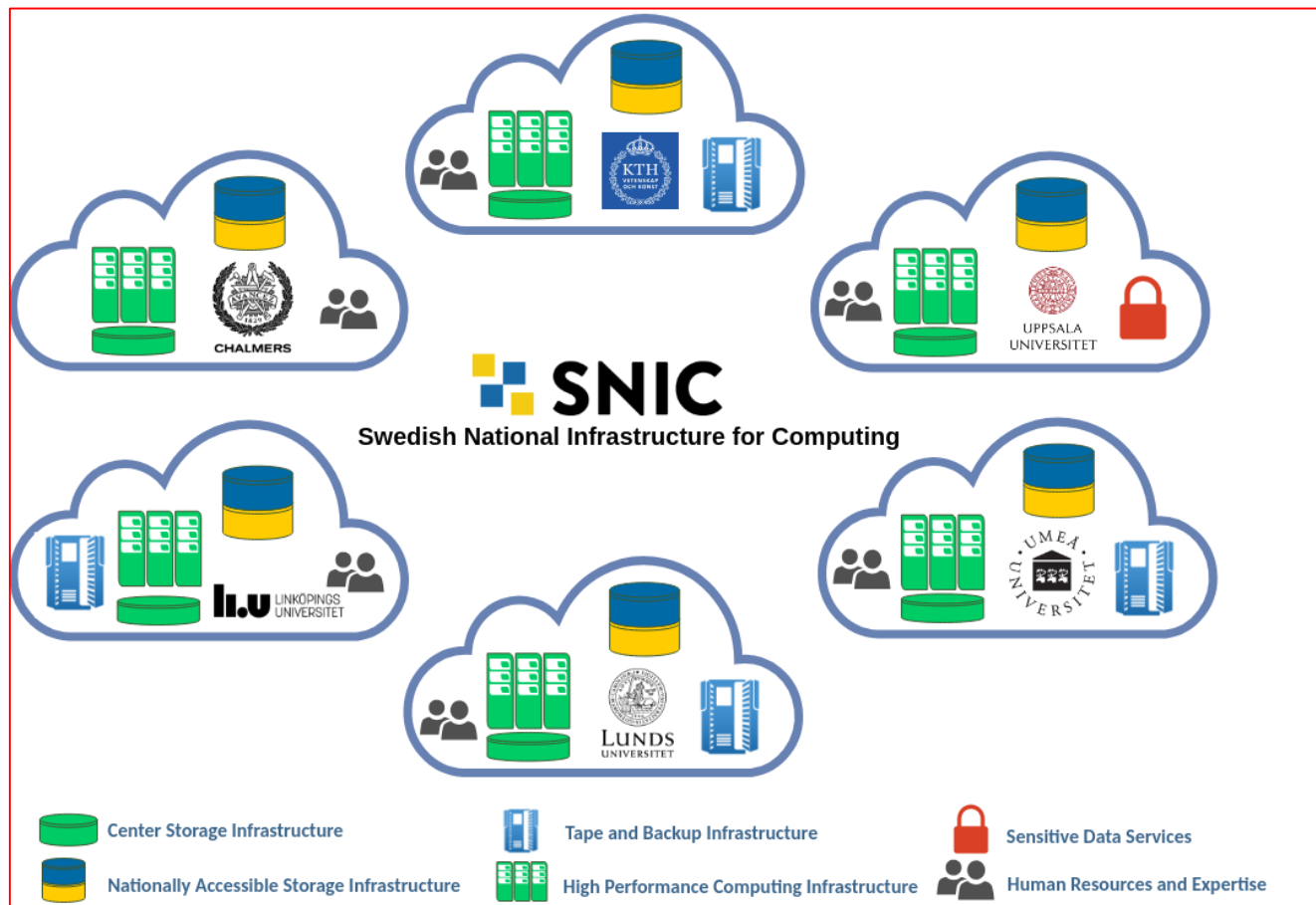
- Nationally available storage (dCache and iRODS)
- Center storage
- Backup
- Sensitive data

Long-term storage however duty of universities, not SNIC.

SNIC Storage

SNIC provides generally available national services for storage and management of active research data.

10 PetaByte national storage available, and capacity for 44 PetaByte tape storage.



DS)

SNIC

Usage of SNIC resources



- Researchers from all major Swedish Universities make use of SNIC resources
- SNIC has approximately 800 + projects, with more 3000 users. The number of projects and users increases every year.
- The largest usage (core-hours – ch) is by researchers in the fields of **condensed matter physics, fluid mechanics, theoretical chemistry, climatology and biosciences** (Gromacs, Gaussian, Vasp, Nek5000, EC Earth, OpenFOAM...)
- During 2015 four universities used 81% of available SNIC resources: KTH (33%), Uppsala University (21%), Linköping University (15%), Stockholm University (12%)

Usage of SNIC resources

SNIC computing resources are allocated as Large, Medium or Small projects

Large projects

- More than **~100 000 ch/month** (1.2 Mch/year)
- Two application rounds per year
- Allocation is based on scientific need, merit, feasibility, efficiency of use, previous use/experience and availability (more later)
- There are 57 projects using 75 % of the SNIC resources
- The ten largest groups used 48 % of the SNIC resources

Usage of SNIC resources

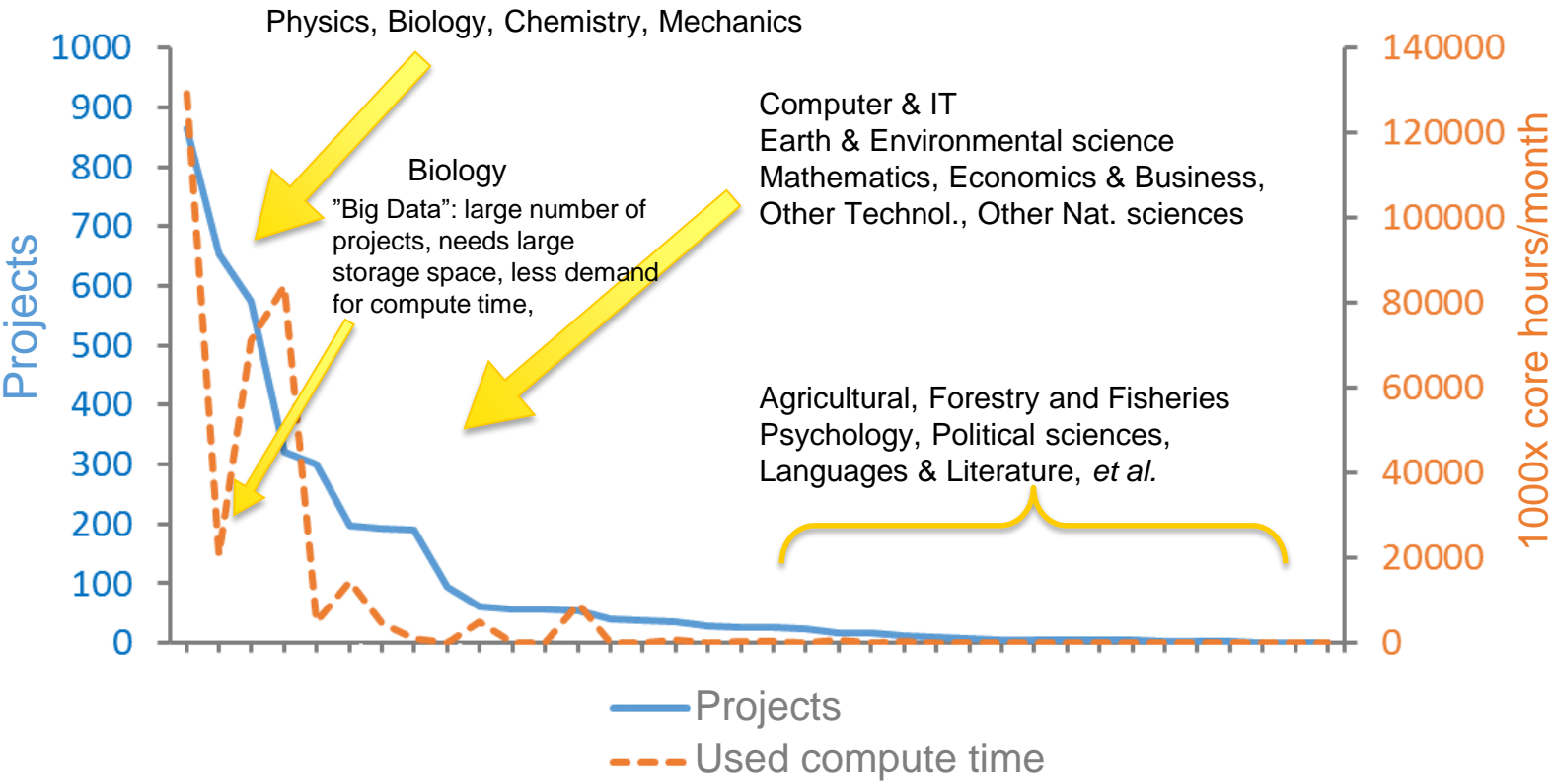
Medium projects (5000 – 80 000 ch/m)

- In 2015 there were 349 Medium projects corresponding to approximately 24 % of the total usage of SNIC resources
- Application is possible throughout the year

Small projects (< 5000 ch/m)

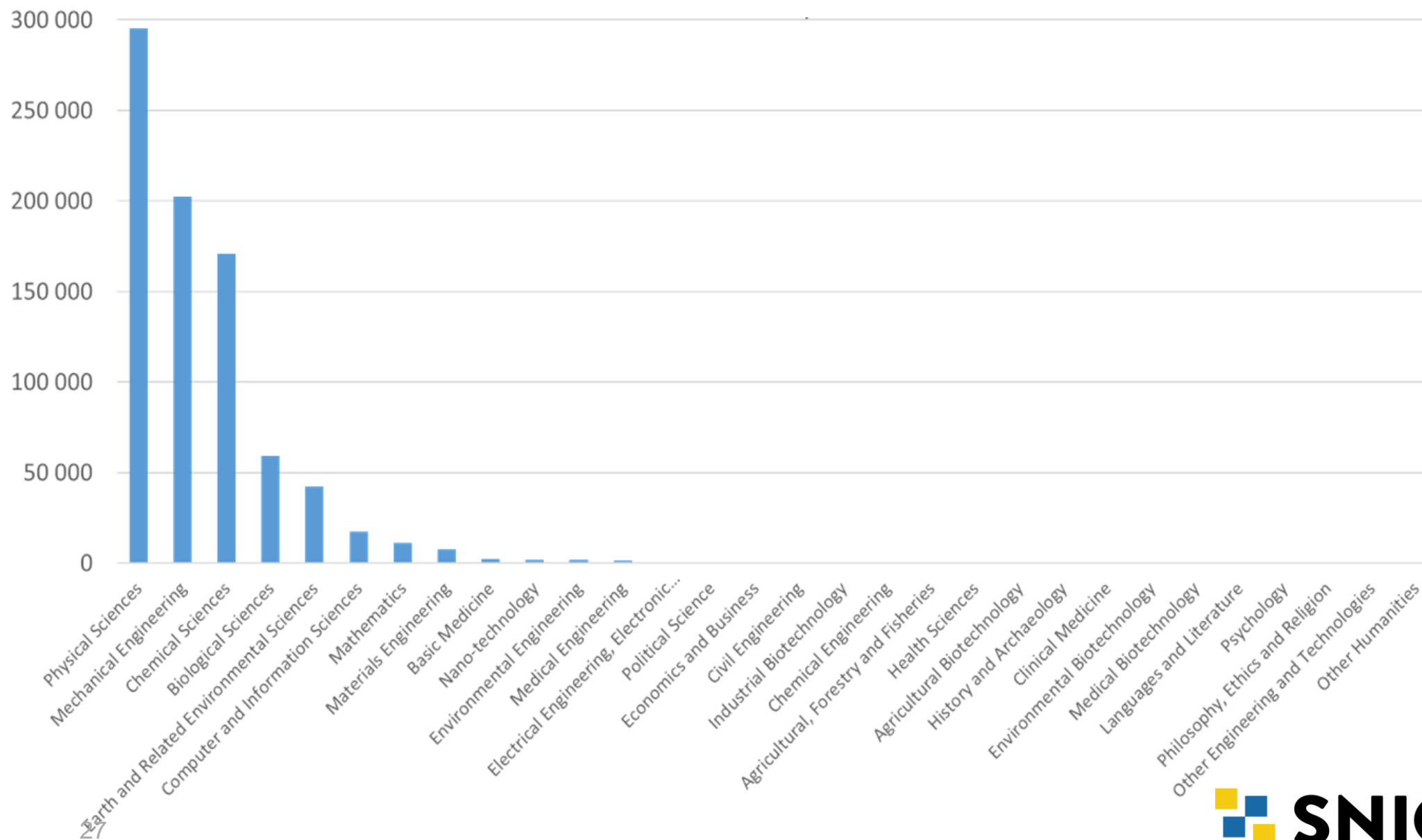
- “Long tail of science”
- Testing of new architectures
- About 28 fields of research utilizing SNIC resources, including archeology, linguistics, political science, and economics
- The number fields of research utilizing SNIC resources is growing

SNIC Usage

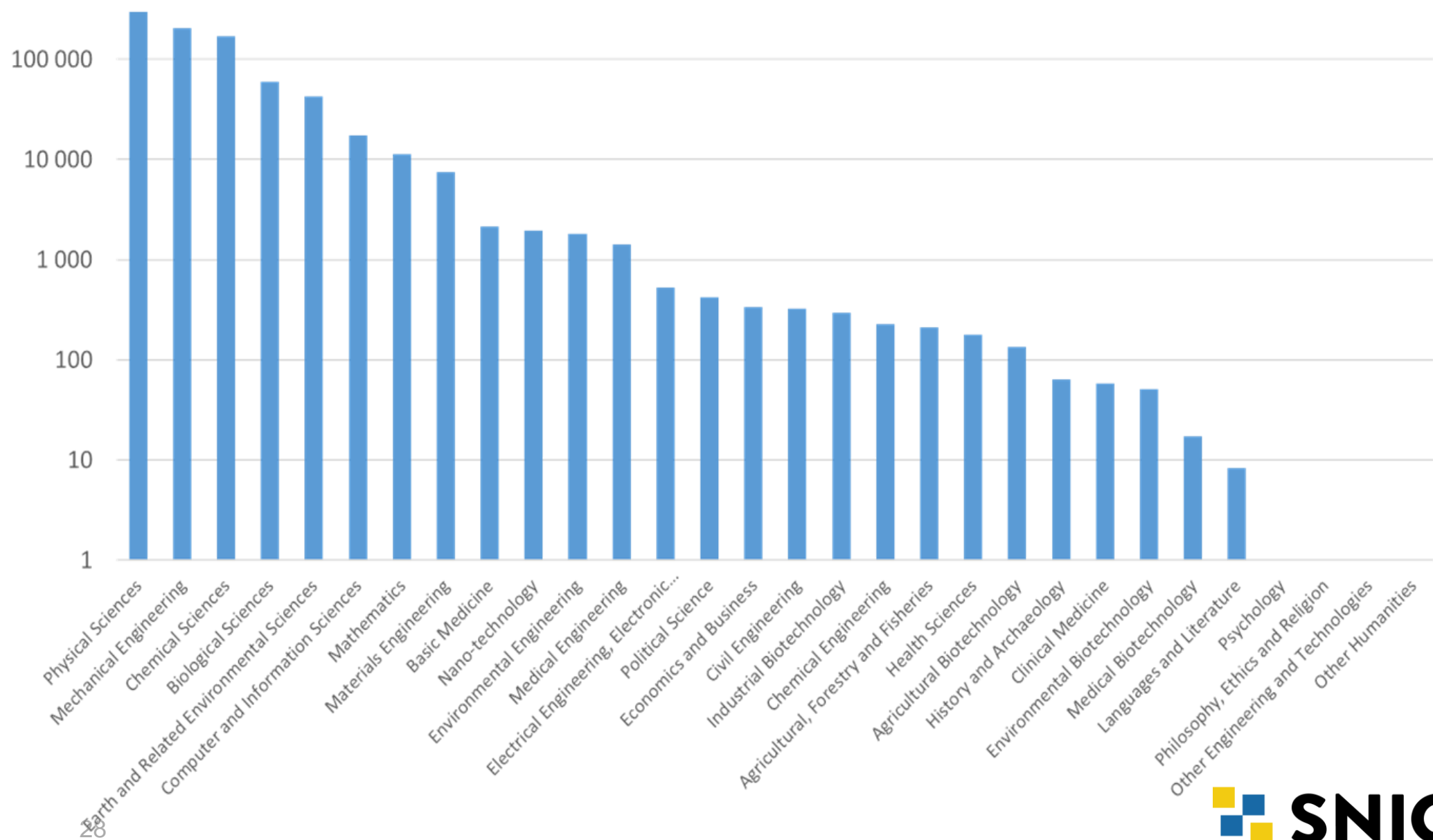


Data summarized over the period January 2012 –May 2018.

Usage 2016 (thousand core hours – kch)



Usage 2016 (thousand core hours – kch)





SNAC Policy

- <http://snic.se/about/governance/policies/> (approved 2018)
- Allocations valid for **one year, twice a year**.
- the PI must be a **senior scientist in Swedish academia** (including research agencies such as FOI, SMHI), at least at the level of assistant professor (forskarassistent), however preferred permanent faculty (continuity). Grey zones (e.g. researcher position): SNIC Director
- Needs to have a formal affiliation at that university/agency (official homepage)
- **Only one large allocation per PI**, medium allocations stop when a large one is allocated. Small ones (to test hardware for instance) can still be granted.
- Preferred to have **larger “consortia”** rather than many “smaller” applications
- SNAC gets around 40-50 applications per round, ~200-300% of available resources.



Next SNAC LARGE call

- **Spring 2019 call**, deadline April 5
- Distribution of referees: April 11, 2h phone
- Referee work, reminders, collection of grades
- **Committee Meeting**: May 23, 6h in person
- Review of referee answers, notification of applicants: May 28, 2h phone
- **Begin of allocation**: July 1

Centre	Resource	Spring 2019	Minimum
C3SE	Hebbe	600 000	100 000
HPC2N	Kebnekaise	4 000 000	200 000
	Kebnekaise Large Memory	500 000	20 000
Lunarc	Aurora	500 000	100 000
NSC	Tetralith*	14 500 000	200 000
PDC	Beskow	11 200 000	200 000
UPPMAX	Rackham	1 000 000	100 000
UPPMAX	Crex 1**	1000 TB	



SNAC Application LARGE

- CV of the PI - principal investigator (**Maximum 2 pages**)
- Publication list of the principal investigator
- SNIC Project Description (**Maximum 5 pages**)
- Activity report (**Maximum 8 pages**)
- Filled in form at SUPR (supr.snic.se) with some technical details



SNAC Application LARGE

SNIC Project Description (Maximum 5 pages.)

- **Overview (0.5 page)**
Provide an abstract of the proposed research and computations.
- **Resource usage, codes and performance (1.5 pages)**
Describe how your applications can make efficient use of the requested resources. Give numbers and/or indicate measures of scalability and performance (for example a graph of execution time versus number of cores).
Include records of usage if you have been granted time for this project (or a similar project) in previous allocation rounds. If the requested time differs significantly from earlier allocations and/or used time, please explain the difference. Also motivate if specific resources (such as large memory, GPUs, etc.) are requested.
- **Scientific challenges (2 pages)**
Describe how the proposed project relate to the state of the art of the scientific area, has the potential to increase the knowledge within its scientific area, and how the proposed project uses adequate computational methods to address scientific questions.
- **Research group and management (0.5 page)**
Describe the complete research group that will be working on the proposed project: name of member, HPC experience, position, and roles. Indicate how the allocated time will be managed within the group. → **also in SUPR**
- **References (0.5 page)**
Include a list of references for the project description.



SNAC Application LARGE

Activity report. (Maximum 8 pages)

Please note that the activity report is compulsory for all applicants.

- **Summary**

The report must include an account of the major scientific achievements emanating from the use of the allocated SNIC resources / comparable resource outside of Sweden. If this is your first application for SNIC resources, but you have previously been using comparable resources abroad, please also provide allocation and usage statistics in the activity report.

- **Publications list**

The activity report must include a list of publications from the **last two years** of all publications that acknowledge the use of SNIC resources. You may include forthcoming / in press publications.

- **Academic achievements**

The activity report must include achievements such as theses defended and graduate degrees completed.

- **HPC related developments**

The activity report must include any developments related to programming, code optimization, visualization etc.

- **What not to include**

Please note that publications that do not acknowledge the use of SNIC resources shall not be included in the activity report.



Acknowledging SNIC

Acknowledging SNIC:

Please note that you must give SNIC credit for research facilitated by SNIC resources.

SNIC should be acknowledged as follows:

"The computations/simulations/[SIMILAR] were performed on resources provided by the Swedish National Infrastructure for Computing (SNIC) at [CENTRE NAME (CENTRE ABBREVIATION)]."



SNAC Application LARGE

What is the decision based on:

- a **peer review** procedure is used with both internal (SNAC) and external reviewers. We have a list of 50+ reviewers for different topics. Anybody with interest to review for SNAC please contact me.
- **Technical and scientific assessment**
- SNAC evaluates the applications and decides on the allocations at the meeting
- The **evaluation** is based on scientific merit, need for the resources, feasibility and efficient use of the requested resources, and impact.
- Consideration of availability of suitable resources.
- **Apply for the time you need!**
- Previous experience and running statistics are also considered. This is mainly to ensure good usage of the resources (resource management, correct usage numbers)
- **Motivate** the computer time, type of resource by showing scaling data of your code/application. If in doubt, start with a medium allocation.

In case of large changes to previous year, describe why this is the case.



What happens then?

- The decision letter contains the granted amount of time on each machine
- Some referee comments are posted, these are mainly thought as help for the next rounds
- The allocation starts July 1 or January 1
- Comments are welcome to snac.chair@snic.se, but note that typically the time is distributed.
- The project list on the SNIC webpage is updated.

Projects - Swedish National Infra. x Large-scale Simulations in Stability x +

Uppsala universitet [SE] | <https://supr.snrc.se/public/project/10370/>

Start / Current Large SNIC Projects / **SNIC 2018/2-4**

Large-scale Simulations in Stability, Transition, Turbulence and Control

Dnr:	SNIC 2018/2-4
Type:	SNAC Large
Principal Investigator:	Dan Henningson
Affiliation:	Kungliga Tekniska högskolan
Start Date:	2019-01-01
End Date:	2020-01-01
Primary Classification:	20306: Fluid Mechanics and Acoustics
Secondary Classification:	10508: Meteorology and Atmospheric Sciences
Tertiary Classification:	10501: Climate Research
Webpage:	http://www.flow.kth.se/

Allocation

- Tetralith at NSC: 2500 x 1000 core-h/month
- Beskow at PDC: 2500 x 1000 core-h/month
- Kebnekaise at HPC2N: 300 x 1000 core-h/month
- Kebnekaise Large Memory at HPC2N: 200 x 1000 core-h/month
- Tegner at PDC: 41 x 1000 core-h/month

Abstract

In this proposal we list our individual projects which rely on HPC resources, grouped into six focal areas. We actively promote collaboration within our large user group to facilitate HPC support, sharing of simulation methods and codes, and user experience. We have thus found it beneficial to apply with a large-level request instead of multiple medium-level requests.

1. Turbulent wall-bounded flows: Simulations of small- and large-scale turbulent motion close to walls, including heat transfer and pressure-induced separation. Simulations of turbulent pipe flow with and without bends and constrictions. Turbulent flows over walls with curvature. Turbulent boundary layers.
2. Receptivity and transition to turbulence: Receptivity of wall flows to external disturbances, growth and breakdown of disturbances close to solid walls. Dynamical-systems approach to study transition in Blasius and suction boundary layers; bypass transition to study percolation models.
3. Flow control, global modes and shape optimisation: Control and optimisation of flows exploiting modern methods of control theory; reduced-order models based on various global modal decompositions.
4. Wind turbines: Interference and breakdown of wind-turbine wakes and atmospheric turbulence.
5. Large-eddy simulations (LES) and reactive flows: Model development and validation for LES of high Reynolds number wall-bounded flows and simulations of turbulent combustion.
6. Geophysical flows: Stratified turbulence and shallow water turbulence.



Future plans

- Recruit SNAC members
- Implement storage allocations
- Implement multi-year projects
- Include publication reporting on homepage?
- Maybe SNIC Interaction (yearly meeting). Local or national?
- ...



SNAC

- Questions?
- In case of any comments, please contact me:
- pschlatt@mech.kth.se
- snac.chair@snic.se for a larger group including SNIC Office (for official matters)