

Mission Statement SeSE (Swedish e-Science Education)

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1 Background and motivation

Calculation, simulation and modeling have emerged as an integral part of scientific research today. The need to handle large datasets and to use high performance computing for simulation and analysis emphasizes the importance of extended training beyond the fields where e-Science traditionally has been used. Local initiatives focus normally on certain specific subject fields, and there are not enough e-Science courses at each University to meet the need of the rapidly growing field of e-Science.

In the area of e-Science, two Strategic Research Areas have been funded by VR, the Swedish e-Science Research Centre (SeRC) and The e-Science Collaboration (eSSENCE). These centers have been established to act as coordination points for national e-Science activities. They have taken the initiative to establish a Graduate School, SeSE, to give basic training in fields where the use of e-Science is emerging and where education can have an immense impact on the research, but also advanced training for students in fields that are already computer-intensive. A course curriculum, where the courses are tailored to meet a broad set of prerequisites, will have a critical mass of students on a national level and foster collaborations between Swedish researchers, possibly embracing new research fields utilizing e-Science tools and methods. By opening up the courses for graduate students from the Nordic countries interdisciplinary collaborations on a Nordic level will be possible.

SeSE will initially be based on two existing graduate schools, NGSSC and KCSE. NGSSC (founded 1996) and KCSE (founded 2007) have a long experience of providing graduate e-Science courses to a broad audience of Swedish graduate students. By integration into the national research initiatives within e-Science, eSSENCE and SeRC, it will be possible to create a meeting place for graduate students using e-Science tools and techniques and to identify areas where courses within e-Science are needed.

2 Organization

The activities within SeSE will be jointly organized by NGSSC and KCSE under the umbrella of eSSENCE and SeRC. The daily operation of SeSE will be lead by an Executive Group consisting of Michael Hanke (KCSE), Hans Karlsson (NGSSC), Philipp Schlatter (KCSE) and Anders Hast (NGSSC). Administrative

support will be provided by Kerstin Gustafsson (KCSE). The leadership will regularly alternate between representatives from KCSE and NGSSC. In the beginning, Michael will act as the chairperson.

The Executive Group will

- Determine the course curriculum and propose their budget.
- Have contact with the course responsible teachers.
- Announce the courses.
- Compile information about e-Science courses provided by Swedish actors.
- Identify the need for courses and initiate development of courses, in particular in connection with the upcoming Nordic graduate school in e-Science.
- Promote SeSE courses both in Sweden and within the Nordic countries.

The coordination of SeSE will be lead by a Steering Committee with members from eSENCE and SeRC. The role of the Steering Committe is to promote the activities within SeSE among the Swedish e-Science research community and to give recommendations to the Executive Group.

3 Curriculum

The curriculum of SeSE builds on the experience gained by NGSSC and KCSE and the courses developed and given by them. The courses funded by SeSE should be open for graduate students at all Swedish universities as well as graduate students from the Nordic countries. This means that the courses must be given in a concentrated format with all the lectures in a single week. To fit in the planned format for the Nordic e-Science graduate school the length of each course should be three weeks corresponding to five credits. Two such courses could be joined to form a ten credits course.

The format of a 5 credits course will then be

- One week of literature studies at the home department.
- One week of lectures and computer exercises. Ideally the course should start Monday at lunch and end Friday at lunch. Part of the evenings could be used for computer laborations.
- One week of project work and examination. There will be one responsible examiner for every course who coordinates the final examination and reports the final result.

The founding partners of SeSE have had financial support from VR during the last years and developed models for financing their teaching activities. Both partners will jointly finance the SeSE activities under 2013/4. In order to ensure sustainability of the project, these models will be further developed with respect to the requirements and vision of SeSE, and the possibilities and conditions provided by the previous VR support and the upcoming Nordic graduate school in e-Science. In particular, course development, course implemenation as well

as participation costs for students will be considered. The latter is realized by travel grants.

Below is a list of planned courses for 2013 and a list of tentative courses for 2014. For all courses the experience from previous KCSE and NGSSC courses are taken into account

The courses can be divided in two parts: basic training and advanced courses. The basic courses, e.g. programming (introductory and continued), numerical methods, PDC summer school, software development tools, should be given every year. The advanced courses should be given less frequently.

3.1 Courses 2013

- Introduction to programming in science and technology (basic)
- Continued programming in science and technology (basic)
- Advanced programming in science and technology (advanced)
- Scientific visualization (advanced)
- Introduction to high performance computing/PDC summer school¹ (basic)
- Numerical solution of initial boundary value problems (advanced)
- Stochastic methods in computational sciences (advanced)
- Computational Python (basic)

3.2 Courses 2014

- Introduction to programming in science and technology (basic)
- Continued programming in science and technology (basic)
- Introduction to high performance computing/PDC summer school (basic)
- Software development tools (basic)
- Climate modelling (advanced)
- Numerical methods I (basic)
- Numerical methods II (basic)
- Computational methods in bioinformatics (advanced)
- Computational Python (basic)
- Topics in CFD (advanced)
- Introduction to programming with GPGPU and applications in scientific computing (advanced)
- Advanced molecular simulation techniques (advanced)

¹This course has a different layout compared to the template described above: Two intense weeks at KTH PDC and a larger project at the home universities. Provides 7.5 credits.

3.3 Development of Curriculum

SeSE will further develop the curriculum according to the needs and expectations of the e-Science community.

3.4 Extra Activities

Additional activities which do not fit into the course framework may be supported. This concerns, e.g., retreats, summer/winter schools on specialized topics. Decisions about inclusion are taken by the Executive Group.

Examples:

- Visualization retreat, December 2013,
- Retreat on scientific writing, Autumn 2014,

4 Financing

The cost for a three weeks course can be estimated as

- Development: 80 000 SEK
- Giving: 80 000 SEK
- Travel grants: 10 grants, 6000 SEK each: 60 000 SEK

The travel grants will be paid out to the graduate students home department after the student has passed the course. The student must have passed the course within six weeks after the course's end.

This means that the first year a course costs 220 000 SEK, the coming year 140 000 SEK. In addition it might be possible to get a contribution from the Nordic school for giving the course.

For a course to be fully financed there should, in the normal case, be a minimum of 10 students.