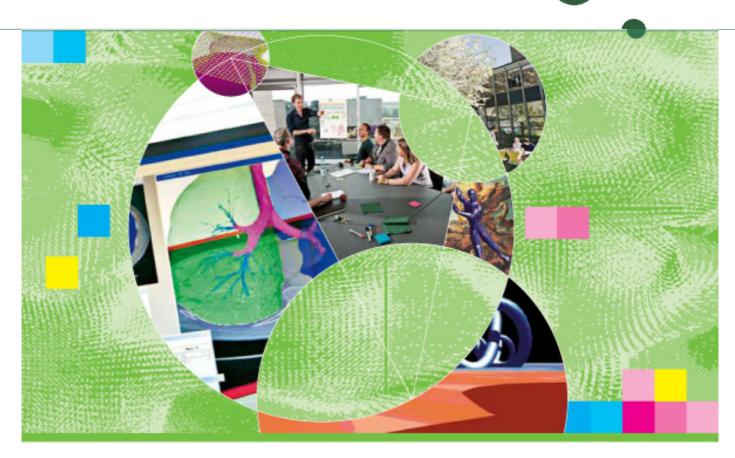# DIKU 2013

**Strategy for the Department of Computer Science at the
University of Copenhagen**

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Preface

The following outlines the strategy of the Department of Computer Science for the period 2009-2013. The strategy has been prepared within the framework of "Strategy of the University of Copenhagen, Destination 2012" and "Strategy of the Faculty of Science, SCIENCE 2013" and the substrategies of the Faculty of Science.

The strategy will be followed by an action plan for the Department of Computer Science, which supplements "Action Plan of the University of Copenhagen – Destination 2012". The action plan comprises the period 2009-2013, but will be updated as required.

The strategy and action plan follow up the recommendations of the Danish Evaluation Institute's evaluation of the department's computer science programme in 2006 made as part of an international benchmarking of computer science programmes in Denmark.

The strategy has been prepared by DIKU management and includes contributions from the department's cooperation and health and safety committee, teaching committee and research committee. In addition, the strategy has been subject to regular discussions at staff meetings and at a strategy seminar for all staff members on 19 November 2008. The final strategy draft has been submitted to and discussed with the Copenhagen University IT Advisory Board, the department's user network, the department's staff-student committee and the deanship.

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1 Department challenges, core values and vision

> **Action plan of the University of Copenhagen, Destination 2012**
> As one of its focus areas, the University of Copenhagen will target the IT area. Currently, low graduate turnover and limited IT competencies constitute a growth barrier to the Danish society at the same time as computer science as a tool has yet to be systematically integrated into the basic sciences of the University of Copenhagen. More specifically, the University of Copenhagen will establish a range of new combination programmes and earmark funds to strengthen research in the field. However, IT must also feature even stronger in all programmes at the University of Copenhagen and ensure that students can develop IT competencies as part of their basic training programme (optional courses) rather than after they have completed their studies (supplementary training).

The Department of Computer Science at the University of Copenhagen (DIKU) is the oldest university department of computer science in Denmark – and among the first in the world. Since its establishment in 1970, the department has strived to achieve the highest academic level in computer science. The department is characterised by offering project-oriented programmes with many optional elements, focusing on the individual student's and researcher's interests. MSc's in computer science are highly sought after among Danish and international companies and public-sector institutions.

Computer science significantly contributes to the information technology that is now an integral part of society and a central component of many university programmes. Society increasingly needs highly educated IT staff – particularly staff capable of combining IT with other skills. At the same time, universities worldwide have experienced a drop in the recruitment of new computer science students, and compared to its size, the University of Copenhagen produces relatively few MSc's in IT.

As a consequence of the low production of MSc's in IT at the University of Copenhagen, a proposal was prepared for a coherent system of IT programmes at the university in Spring 2007. The main idea behind this system is to take the subjects in which the university is strong and combine them with a solid IT foundation. In December 2007, university management decided to establish four new IT bachelor degrees in health informatics ("health and IT", launched in 2008), humanities informatics ("communication and IT", launched in 2009), science informatics (expected to be launched in 2010) and social science informatics (yet to be determined).

1.1 Challenges

Furnishing resources for participating in (new) IT programme and research initiatives
DIKU plays a pivotal role in developing new IT programmes at the university, a development that will influence the department's vision and strategy in the coming years. It is also crucial that the computer science programme volume is increased and that the quality is maintained. For this to materialise, the department must furnish the requisite resources to take part in this development. Department earnings depend on the ability to attract and retain students and researchers, requiring significant coordination at all levels (University of Copenhagen/faculty/department). Moreover, department earnings will increasingly depend on its research production and ability to compete for external funds.

Innovating the research and study programme relationship
Participation in new educational initiatives at the university requires substantial academic width, including teaching students with different (IT) backgrounds – which may widen the gap between the researchers' teaching activities and research activities too much. Conversely, such new educational initiatives should inspire new research and new research cooperation. The researcher must be able to include his/her own research at both basic and continuing courses and project activities – and students must have the necessary framework for research-based academic development.

Developing department identity
The relocation of more than half the department staff in Spring 2008 to South Campus and the eScience centre at North Campus, respectively, places the department identity under pressure and increases the distance between staff and students. The department has in fact been split in two. The pressure on the department identity will intensify further in the coming years due to the administrative integrations at faculty level and the university's IT strategy, which gathers all IT staff at the faculty in one organisation. The department's presence at both North and South Campus poses an organisational and identity challenge but also an opportunity to cooperate across professional and geographical boundaries, allowing development of a department identity. However, a key challenge is balancing the size of the department and its commitment to interdisciplinary research and education cooperation. Furthermore, the department must have the proper backbone to provide considerable contributions in IT research and education in Denmark and internationally.

1.2 Core values

Similar to the Faculty of Science, the Department of Computer Science must be characterised by:
- the *highest academic standard* in research, education and outreach
- considerable development opportunities for *free, researcher-initiated research*
- *academic width and interdisciplinarity* in research and education
- *responsibility* in all academic work and interaction with the outside world
- *pride* among staff and students in their workplace.

The department intends to live up to the values of the Faculty of Science for academic and administrative leadership, which comprise:
- *Shared responsibility* for prioritisations, ownership of problems and solutions and for creating coherence in the faculty's activities
- *Trust* as the foundation for delegating and allocating tasks, commitment, creativity and job satisfaction as well as mutual respect
- *Openness* in communication, knowledge sharing and *best practice* as well as openness to new thoughts and ideas
- *Respect* for professionalism and diversity in a challenging and creative environment where the individual staff member's academic, social, cultural and linguistic background is a valuable contribution to the community.

1.3 Vision

The vision for the years leading up to 2013 is:
- to make DIKU a *department of computer science for the entire University of Copenhagen* – anchored in the Faculty of Science – and the *preferred partner* in connection with cross-faculty and interdisciplinary IT educational and research cooperation at the University of Copenhagen
- to make DIKU among the *best departments of computer science* in Europe
- to provide *bachelors and MSc's and PhD's with long-term knowledge and practical competencies* that are highly valued in the Danish and international labour market
- to focus on research in *core computer science disciplines* – and that this research both

has an applied perspective and helps create deep insight and knowledge
- to engage in *strategic research in the boundary between computer science and other strong academic fields at the University of Copenhagen* (e.g. science, health sciences and humanities).

The department will strive to realise its vision by focusing on five main strategic areas described in the following chapters.

1.4 Objectives

The department will strive to reach the following specific objectives for 2013:
- At least 50% of department earnings must be externally financed (2008: 29%).
- The department must publish at least 100 research publications annually (2008: 78 publications).
- Department STÅ-production must total at least 400, of which at least 75 must be the result of cross-faculty teaching cooperation (2007/08: 244 STÅ).
- In addition to bachelor students from DIKU, at least 50 (mainly international) full-time students at the MSc programme in computer science must be recruited (2008/09: 20 exchange students, very few full-time students).
- 60% of all bachelor students in computer science must complete their studies within standard programme duration and 80% of all MSc students in computer science must complete their studies within standard programme duration.

2 An attractive workplace

Destination 2012
Increasing the attractiveness of the University of Copenhagen as a workplace for
Danish and foreign staff alike.

DIKU's location at Universitetsparken until 2008 has helped shape our identity and create the
framework for a community between staff and students. In addition, the geographic location
has created an invisible barrier to other subjects at the University of Copenhagen and the
surrounding world. Constructive participation in the University of Copenhagen campus plan
and an internal cultural and organisational change that supports openness and cooperation will
contribute to opening the department to external parties.

2.1 Campus plan

The objective of the campus plan is to gather science subjects at North Campus in the long
term with a view to optimising the organisational basis for synergy effects between the
various academic fields, including computer science. In addition, at South Campus, DIKU
will join as a central player in establishing IT research and education in the field of
humanities and assist in strengthening interaction with the neighbouring IT University.

South Campus
South Campus will see the establishment of an interdisciplinary (science-humanities) centre,
forming the framework for cooperation between the Faculty of Science, the Faculty of
Humanities and the IT University. The 2009-2013 strategy planning period offers no further
expansion possibilities at South Campus than already realised in 2008.

North Campus
DIKU has strong ties to the scientific fields, and the majority of our research at North Campus
is based on mathematics and science. This has recently resulted in the establishment of the
eScience centre at H.C. Ørsted Institute where a number of DIKU staff is working in an
academic community with researchers from mathematics, physics and chemistry. This
environment is expected to spawn new academic initiatives, just as an integration of subjects
in connection with the campus plan's realisation of Niels Bohr Science Park seems obvious.

Contemporary physical framework for teaching
Quality in teaching requires space and up-to-date physical framework. Teaching rooms must
boast the newest teaching technology. Decoration of the individual rooms must be flexible to
allow different teaching forms, including lectures, exercises and group work.

Staff and student community
DIKU is characterised by close ties between researchers and students. The short distance
between researchers and students must be retained, as it is the cornerstone of a good study
environment – both in terms of teaching and research.

2.2 Community, diversity and management

DIKU has a strong innovation tradition among staff and students. This tradition is the
framework of the community, diversity and management of the department.

Freedom and co-responsibility as the fulcrum of management
Dialogue and staff involvement are core elements in the management of the department. The
research groups are the key units in the daily running of the department, both in respect of

teaching and research. Management authority and financial responsibility have been allocated to research group managers to have the decision competency closer to the individual staff members. The department's tasks must be organised so that the researchers to the widest possible extent can research and teach rather than perform administrative tasks. Competence development among both scientific and technical-administrative staff must ensure that freedom and co-responsibility are managed expediently. All administrative tasks must be organised to ensure excess capacity in the handling of tasks – both to make work more diverse and less stressful for the individual staff member and to ensure that tasks can be solved in case of absence, etc.

Timely information
DIKU has undergone a massive organisational change in the form of a new management structure, partial relocation to South Campus and the eScience centre and a reorganisation of the administration and IT department. The department is expected to undergo further changes in the coming years, placing heavy demands on providing timely information about organisational changes, including new function descriptions, procedures and rules.

Recognition, appreciation and knowledge sharing as core values
The successes of the individual staff member, research group or department – seen in relation to the department's vision and strategy – must be promoted in e.g. the department newsletter and at information meetings. Mutual professional respect must characterise cooperation across the department and the department's cooperation with the outside world.

Well-qualified decisions
To make well-qualified decisions about the department as a whole, in relation to research groups or other staff groups and in relation to each individual staff member, key management decisions must be identified and collected in a simple and efficient manner and be accessible in a secure manner to the relevant managers. Staff members and students must be included in all important decisions in connection with major meetings and through representation in the department's consultation and health and safety committee, teaching committee and research committee.

3   Focus on basic research

Destination 2012
Performing excellent basic research according to the competitive conditions that apply in Denmark and the international scientific community.

The main thesis behind the department's research activities is that *by means of strategic initiatives, the department must contribute to solving significant problems relevant to society* and that *research in core computer science disciplines constitutes a foundation for the strategic initiatives.* Thus, research in core computer science disciplines must be at the stem of the department's research, and the strategic efforts must be branches extending from that stem. Therefore, the department's research groups are organised on the basis of core computer science disciplines, and major strategic efforts are made at centres in cooperation with other academic groups and external partners.

Future challenge: Computers and data as basis for the knowledge society
Computers and digital data are a foundation of the knowledge society. Digital data are created in an exponentially growing volume, and software is the tool that can contribute to translating digital information into knowledge. Collection of, organisation of, search in, synthesis and analysis of, as well as people's interaction with data require massive parallelism (interconnected computers), efficient and 'intelligent' algorithms and useful tools and methods for software design and construction. The department's research activities will be based on the following societal challenges:
- **Useful software:** Development of techniques and processes for compilation and documentation of software system requirements, including design of information systems for, e.g., the health care sector.
- **Usable software:** Design and assessment of efficient forms of interaction between humans and computers – and more broadly, human's use of digital media (human-centred computing).
- **Flawless software:** Development of formal methods and practical techniques to identify and eliminate software errors and security risks.
- **Environment-friendly software:** Development of energy-efficient software and systems, including algorithms and software that use machine resources optimally.
- **Knowledge-creating software:** Development of software and systems that support data collection and analysis, including intelligent sensors focussing on climate and environment, modelling and simulation of natural phenomena (eScience) as well as predicting disease patterns from medical images.

The common denominator for the department's research will be *software construction*, i.e. human programming of software on computers.

Focus on core computer science disciplines
Computer science – and more generally information technology – is a key element in many basic disciplines such as mathematics, physics and biology. The compulsory courses of the computer science programmes (based on the Association for Computing Machinery Curricula Recommendations) may be characterised as core computer science disciplines. DIKU must focus on research in core computer science disciplines and strengthen computer science research related to new study programme initiatives at the University of Copenhagen. The department's research in core computer science disciplines will focus on the following:
- **Software construction:** Programming languages; algorithms and data structures; software design; usability; system development.
- **Computer systems:** hardware-software interaction; large scale computing; sensor networks.

- **Machine learning**: Modelling and analysis of stochastic phenomena; data mining; signal and image analysis.
- **Simulation**: Digital models of natural phenomena for scientific studies and for use in interaction technology and entertainment.

4 Development of study programmes

Destination 2012
Ensuring that the University of Copenhagen enhances the quality of study
programmes to contribute directly to knowledge society development.

Focus must be directed at *attracting students, retaining students, ensuring timely completion of studies* and at *continued quality development.* A prerequisite for department growth is increased attraction and retention of students, and that students complete their studies within standard programme duration. Focus must simultaneously be on quality development of the department's study programmes so as not to compromise the academic level. Particular focus is on recruiting more female students.

Project work, individual absorption in studies and problem-oriented teaching
Higher education in IT is offered by several players. What distinguishes the DIKU computer science study programmes is the amount of project work. Project work allows students to dive deep into a subject – both individually and as a result of cooperation with the other students. This disciplinary delving allows for research-based teaching already at the introductory bachelor courses. In addition, group work allows the students to acquire cooperation competences combined with problem solving competences – both central to their future carriers as software developers.

Teaching as a common interest
The individual research groups are jointly responsible for conducting the courses of which they have been given responsibility. As far as possible, courses are taught in teams, to ensure professional interaction and development. Planning, performance and assessment of teaching and courses must be characterised by openness and trust. The department's teaching will be characterised by respectful cooperation between teachers and students. The academic, didactic and language competences of teachers must correspond to the department's educational activities, including the requirements that teachers at the COME study programmes (Copenhagen Master of Excellence) have to meet.

Improved promotion of the study programmes
Many secondary education graduates do not know what computer science is, and they often have wrong expectations to the programme. The computer science bachelor programme must therefore be marketed based on the specialties that secondary education graduates can identify with. Likewise, the computer science master programme must allow for various research-based specialties.

International master's degree in computer science – and new business-oriented master's degree
From Autumn 2009, the computer science master's degree will be internationally marketed as an elite programme within the COME framework. The goal is to internationalise and increase recruiting to the master's programme and also to maintain the high academic level. The need for a new, business-oriented master programme is currently being examined in cooperation with the Centre for IT Innovation. Our cooperation with the IT University of Copenhagen must also be strengthened – especially in relation to exchange of courses offered.

5 Partnering with the business community and public companies

> **Destination 2012**
> Strengthening interaction between private as well as public companies in areas where a joint effort can create new knowledge.

Innovation as pivot for the business community and public company cooperation
DIKU's position as initiator of innovation activities is underpinned by the appointment of an innovation ambassador as a central body for coordinating and promoting network activities, etc. A course in entrepreneurship, the student incubator "Katapult" at the science faculties at the University of Copenhagen, as well as cooperation agreements with the corporate sector are all part of our innovative activities.

Knowledge sharing – both ways
The department wants to make its knowledge available by using traditional communication channels, but also by contributing to the open source environment. The knowledge and practise unfolding in Danish IT companies must rub off on department research and programmes. Project proposals from Danish IT companies must be systematically communicated to researchers and students at DIKU. The number of external and assistant lecturers and professors must be increased.

Partnership with companies and alumni
A formalised network of users and alumni must be established so that the academic community and the common interests obtain the best framework to operate. At least one corporate chair must be established at DIKU.

6   In dialogue with the surrounding world

Destination 2012
Supporting research and education by intensifying Copenhagen University's dialogue with the general public. This must be achieved by communicating with potential students and the university's key partners and by giving higher priority to international research communication.

It is vital to strengthen the recruiting effort through targeted and clear communication to future students about the contents of and prerequisites for completing the computer science programme. Moreover, DIKU must consciously raise its profile in respect of future students as well as in the outside world, including the university's partners and in the general public.

A clear communication strategy
DIKU must prepare a communication strategy that represents visions and focus areas relative to target groups and choice of appropriate communication channels. Key elements include a dynamic website reflecting the department's activities both in terms of research and education, an external newsletter communicating news to the outside world on research and other activities, and a plan for the recruiting effort that takes into account young people's preferred information channels and search patterns.

Technologically innovative communication
We must use the strengths of the department to create new types of IT-based communication.

The international aspect
DIKU's international reach/position must be reflected in the general research communication, i.e. groundbreaking research results must be published internationally through press releases and English online news articles. With the website as a base, dialogue and knowledge sharing with our national and international partners must be ensured.