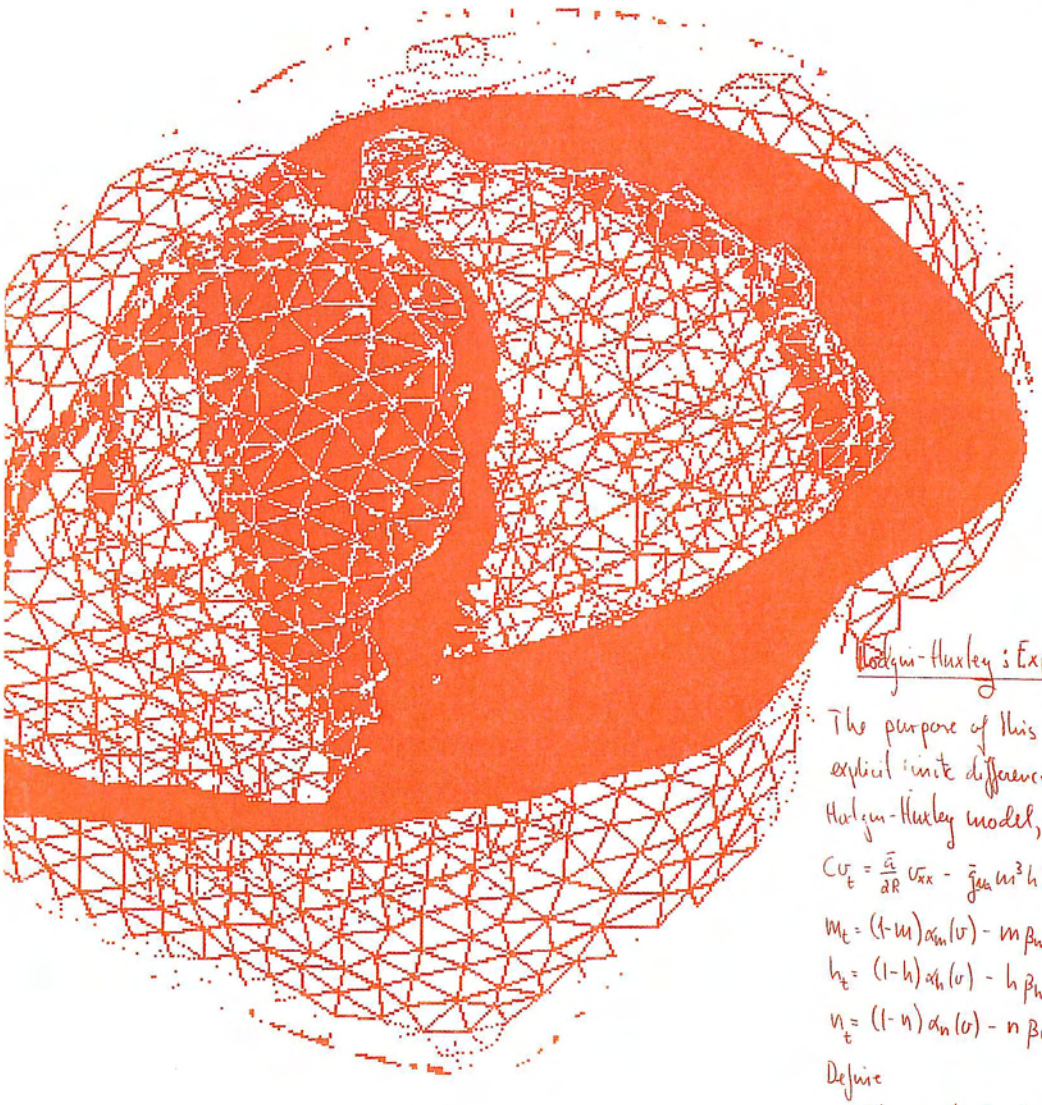
[simula . research laboratory]

Annual Report
Årsmelding
2002



Hodgkin-Huxley : Explicit scheme 8/7-02 (1)

The purpose of this note is to study an explicit finite difference scheme for the Hodgkin-Huxley model,

$$Cv_t = \frac{\bar{a}}{2R} v_{xx} - \bar{g}_{Na} m^3 h (v - \bar{E}_{Na}) - \bar{g}_K n^4 (v - \bar{E}_K) - \bar{g}_L (v - \bar{E}_L) \quad (1)$$

$$m_t = (1-m)\alpha_m(v) - m\beta_m(v) \quad (2)$$

$$h_t = (1-h)\alpha_h(v) - h\beta_h(v) \quad (3)$$

$$n_t = (1-n)\alpha_n(v) - n\beta_n(v) \quad (4)$$

Define $(a, b, c, d > 0)$

$$a = \bar{a}/2R\bar{C}, \quad b = \bar{g}_{Na}/\bar{C}, \quad c = \bar{g}_K/\bar{C}, \quad d = \bar{g}_L/\bar{C}.$$

$$v_t = a v_{xx} - b m^3 h (v - \bar{E}_{Na}) - c n^4 (v - \bar{E}_K) - d(v - \bar{E}_L) \quad (5)$$

Here

$$\bar{E}_K < \bar{E}_L < \bar{E}_{Na} \quad (6)$$

Our aim is to prove that

$$\bar{E}_K \le v \le \bar{E}_{Na} \quad (7)$$

Research, education and new business creation

Simula Research Laboratory has now been in operation for two years. The focus in the first year was on hiring personnel and moving to Fornebu. In 2002, Simula settled in to its new home and focused on research and the creation of a long-term strategy.

The Minister of Education and Research, Kristin Clemet officially opened Simula on April 4, 2002. She said in her opening speech that, "with the Simula Centre we have obtained an environment that sets a focus on quality and gives skilful researchers the time and resources necessary to carry out research of the highest international quality. We will invest extensively in Norwegian research, but we must also dare to concentrate our investment on specific chosen areas."

Professor Aslak Tveito, acting Managing Director.

The Minister of Trade and Industry, Ansgar Gabrielsen also referred to Simula in the Parliament on May 14, 2002. He stated that, "in the information technology field there is often a short distance from basic research to commercial applications. We therefore have high expectations of the Simula Centre newly opened at Fornebu. Simula's goals are to conduct basic research that is internationally recognised and to contribute to innovation and the creation of new businesses."

These two quotations highlight two of Simula's three major responsibilities:

1. research of the highest international quality,
2. education of graduate university students in Informatics,
3. establishment of businesses based on the research it conducts.

Research

Simula Research Laboratory conducts research in the areas of software engineering, communication technology and scientific computing. In all these areas, we have the same goals; long-term research on basic problems with an eye to possible applications in industry and other parts of society. Compared with the universities, Simula puts greater emphasis on possible applications and, in addition, the research is directed towards specific areas for longer periods of time. Hence, individual researchers at Simula have less freedom in choosing research topics than their counterparts at the universities. In 2002 we have worked hard to focus our research effort into relatively few projects. This is necessary in order to acquire and hold a position as a respected international research laboratory.

One of Simula's largest projects involves experiments with computer software development. That activity is described in more detail on page 12. This field has had a long tradition of experiments carried out on students in non-realistic work situations. Simula has addressed these shortcomings directly and is establishing a new standard for how these experiments should be conducted – out in industry and with real practitioners as subjects. The director of the department where these experiments are being carried out, Professor Dag Sjøberg, received Simula's 2002 Research Award.

Education

Simula Research Laboratory co-operates with the four universities in Norway in providing education to Master's and Doctoral students. The staff at Simula achieves this by teaching courses and supervising students from the universities. The universities are responsible for this education and the Simula staff contributes in terms of part time positions. In 2002, Simula staff members supervised five students who successfully defended and obtained their Doctorate degrees. We also participated in the delivery of 19 university courses. Presently, employees at Simula in cooperation supervise 18 doctoral students, in co-operation with professors at the universities. It is Simula's responsibility to continue this work and thereby strengthen higher-level education within the IT field.

Innovation and new business creation

Research and education are traditional roles for researchers, whereas creating new businesses is not. Given that our researchers have limited experience with this activity, we have expended considerable effort investigating how it should be organised and financed. The employment agreements with every employee at Simula Research Laboratory provide a solid foundation. They contain principles and procedures outlining how commercial rights will be shared between individuals and Simula. In 2002, we have started establishing effective structures for applying our research results to solving real life problems. Professor Morten Dæhlen leads this work with enthusiasm. Simula's work with new business creation is described in more detail on page 16.

We look forward to establishing the mechanisms necessary to finance our first new business venture before next year's Annual Report is written.

CONTENT

Simula Research Laboratory is a research centre conducting basic long-term research on selected areas within information and communication technology. Through its operation the centre is supposed to contribute to innovation in Norwegian industry.

Board Report 2002

Simula Research Laboratory (Simula) has made significant progress in 2002, in full accordance with the foundation laid when it was created in January of 2001. During the year, Simula has accomplished several things, including establishing itself in new facilities at Fornebu, becoming fully operational and completing the organisational transformation to a limited company with a new Board.

Simula started as a project at the University of Oslo in 2001, in response to a resolution of the Norwegian Parliament. This resolution established a research organisation in the future IT and Knowledge Center on the site of the former Oslo Airport at Fornebu. Simula's Board notes that Simula has progressed well and according to plan, while the larger IT and Knowledge Center has developed considerably more slowly than predicted.

Simula moved from the Oslo Innovation Center at the end of 2001 and was officially opened in April 2002 by the Minister of Education and Research, Kristin Clemet. The Minister made it clear in her speech that the official opening was an important occasion for the Norwegian research community and that the Norwegian Government would provide funding to Simula at the level originally expected. This meant a grant of NOK 45 million in 2003. A later additional grant resulted in a total budget of NOK 49 million in 2003, which was a significant increase over 2002.

Clemet also noted in her speech that Simula has focussed on the five elements that will be critical for Norwegian research in the future: quality, internationalisation, strong technical leadership, knowledge transfer and researcher mobility. In addition, Simula has committed to maintain a close relationship with industry. The Ministers of Justice, Agriculture, Petroleum and Energy, Trade and Industry and International Development were also present at the official opening

The Board has noticed an increasing level of activity at Simula during the year. There are now three fully staffed research departments which are functioning well. A further increase in activities is planned for 2003.

Simula's Board: Bente Anda, Aslak Tveito, Jarle Nygard, Cecilie Ohm, chairperson Berit Svendsen, Tore Gimse, Odd Gropen, Kjell Bratbergsengen, Lars Holden, Olav Lysne. Linda Ingebrigtsen and Ragni Piene were not present during the photo session.

Styrets beretning

Simula Research Laboratory (Simula-senteret) har hatt en god utvikling i 2002, i full overensstemmelse med grunnlaget som ble lagt ved etableringen i januar 2001. Simula-senteret har i løpet av året blant annet etablert seg i nye lokaler på Fornebu, utvidet virksomheten til full operativ drift, og blitt etablert som aksjeselskap med nytt styre.

Simula-senteret ble etablert som et prosjekt ved Universitetet i Oslo i 2001, med bakgrunn i at Stortinget vedtok at det skulle etableres en forskningsenhet i et kommende IT- og kunnskapssenter ved den nedlagte Oslo Lufthavn på Fornebu. Styret konstaterer at Simula-senteret har hatt en god utvikling i tråd med planene, mens IT- og kunnskapssenteret for øvrig har utviklet seg vesentlig langsommere enn forutsatt. .

Simula-senteret flyttet fra de første lokalene i Forskningsparken i Oslo ved årsskiftet 2001–2002, og ble offisielt åpnet i april 2002 av utdannings- og forskningsminister Kristin Clemet. Statsråden fastslo i sin tale at åpningen var en viktig markering for hele forsknings-Norge, og at Regjeringen ville gå inn for å øke senterets bevilgninger til det nivået som opprinnelig var forutsatt. Dermed la hun opp til en bevilgning på 45 mill. .kr i 2003. En senere tilleggsbevilgning har gjort at Simula-senteret får en budsjettramme på 49 mill. kr i 2003, som er en vesentlig økning fra 2002-nivået.

Clemet påpekte i talen også at Simula-senteret har satset nettopp på de fem elementene som vil bli viktige for norsk forskning i årene fremover: Kvalitet, internasjonalisering, sterk faglig ledelse, samt kunnskapsoverføring og forskermobilitet. I tillegg har Simula-senteret lagt opp til å holde tett kontakt med næringslivet. Også justisministeren, landbruksministeren, olje- og energiministeren, nærings- og handelsministeren samt utviklingsministeren var til stede under åpningen.

Styret har merket seg at det har vært økende aktivitet ved senteret i løpet av året. Simula har nå tre fullt bemannede forskergrupper som fungerer godt, og det planlegges en ytterligere aktivitetsøkning i 2003.

Strategi og etablering

Simula-senterets nye strategi for perioden 2002–2005 har vært presentert for styret ved to anledninger, og skal etter planen ferdigstilles i løpet av første halvår 2003. Strategien bygger på at Simula-senteret fortsatt skal ha tre forskningsavdelinger innen henholdsvis Scientific Computing (SC), Software Engineering (SE) og Networks and Distributed Systems (ND). I tillegg ble det i løpet av året opprettet en egen avdeling for forskningsbasert nyskaping og håndtering av Simula-senterets kommersielle interesser, Simula Innovation (SI).

Simula-senterets drift er basert på en tiårig forskningskontrakt (2001–2010) med Norges forskningsråd. Det er signert en samarbeidsavtale mellom de fire norske universitetene, forskningsstiftelsen SIN-

Front row from left: The Norwegian Minister of Justice Odd Einar Dørum, Simulas Managing Director Morten Dæhlen, the Minister of Education and Research Kristin Clemet, and the Minister of International Development Hilde Frafjord Johnson, present at Simula's opening in April.

Strategy and startup

Simula's new *Strategy for 2002–2005* has been presented to the Board on two occasions and is planned to be competed in the first half of 2003. The strategy builds on the premise that Simula will continue to have three research departments: Scientific Computing (SC), Software Engineering (SE) and Networks and Distributed Systems (ND). In addition, 2002 saw the creation of a department dedicated to developing new businesses based on research results and managing Simula's commercial interests. This new department is called Simula Innovation.

The operation of Simula is based on a ten year research contract (2001–2010) with the Research Council of Norway. Simula has signed a co-operation agreement with the four Norwegian universities, the research organisation SINTEF, the Norwegian Computing Centre and the Research Council. There are also framework agreements which regulate the relationship between Simula and these institutions.

Simula Research Laboratory was established as a limited company at a meeting in the Ministry of Education and Research on June 11, 2002. Six days later, the new Board assembled for the first time. The company is owned by the Norwegian state, which holds 80% of the shares, and SINTEF and the Norwegian Computing Centre which each own 10% of the shares. Two central issues in the Board's work in 2002 were the progress of the "Fornebu vision" and Simula's leasing agreement for office and lab space in the terminal building.

Excellent research

An international review of basic research in information and communication technology (ICT) concluded in 2002 that Norway invests too little in basic research in relation to the country's potential and in comparison to other countries in Western Europe and the United States. The review recognised, however, that Norway has several strong ICT research communities achieving international quality in several areas, the result of competent and hard-working researchers. Simula's Scientific Computing department received the best possible rating, "Excellent", while the other two departments were rated as "Good".

The next major milestone for Simula is an independent review, to be held under the auspices of the Research Council. This is expected at the

TEF, Norsk Regnesentral og Norges forskningsråd, og i tillegg er det utarbeidet rammeavtaler som regulerer forholdene mellom Simula-senteret og hver enkelt av disse institusjonene.

Simula Research Laboratory ble stiftet som aksjeselskap på et møte i Utdannings- og forskningsdepartementet 11. juni 2002, seks dager før det nye styret trådte sammen for første gang. Selskapet er stiftet med staten som eier av 80 prosent av aksjene, og SINTEF og Norsk Regnesentral som eier 10 prosent hver. Både Fornebu-visjonens utvikling og leieforholdene i terminalbygningen på Fornebu har vært sentrale saker i styrets arbeid i 2002.

Fremragende forskning

En internasjonal evaluering i 2002 av grunnforskningen innen informasjons- og kommunikasjonsteknologi (IKT) fastslo blant annet at Norge investerer for lite i grunnforskning i forhold til landets potensial, og i forhold til andre land i Vest-Europa og USA. Evalueringen konstaterte likevel at Norge har flere sterke IKT-miljøer med internasjonal kvalitet på flere områder, noe som skyldes dyktige og hardt arbeidende forskere. Simula-senterets SC-avdeling fikk toppkarakteren «Fremragende» (Excellent) i evalueringen, mens de to andre avdelingene fikk karakteren «Good».

Den neste store milepælen for Simula-senteret er en enkeltstående evaluering i regi av Forskningsrådet, som ventelig vil komme i slutten av 2004. Det er styrets klare ambisjon og erklærte målsetting at SC-avdelingen må opprettholde sitt fremragende nivå, og at de to andre forskningsavdelingene må heves til minst «Very good».

Nasjonalt og internasjonalt samarbeid

Simula-senteret legger stor vekt på ulike former for samarbeid med både eierinstitusjonene og andre miljøer i inn- og utland. Et av de viktigste samarbeidstiltakene består i at hver forskningsavdeling har avtaler med Institutt for informatikk ved Universitetet i Oslo om undervisning og veiledning av hovedfagstudenter.

Simula-senteret var for nyetablert til å komme i betraktning som vertsinstitusjon da Norges forskningsråd opprettet ordningen med Sentre for fremragende forskning (SFF) i 2002, men senteret er likevel med på ulike måter i tre av sentrene. Scientific Computing-avdelingen er offisiell deltager i SFF-institusjonen *Physics for Geological Processes* ved Universitetet i Oslo. Simulas arbeid her konsentrerer seg om utvikling av robuste metoder for å løse termiske strømningsproblemer i geologi, spesielt det som kalles mantelkonveksjon.

SC-avdelingen samarbeider også med SFF-institusjonen *International Centre for Geohazards*, som har sitt hovedsete på Norges Geotekniske Institutt. Dette samarbeidet inkluderer deler av avdeling for mekanikk, Matematisk institutt, og Institutt for Geologi ved Universitetet i Oslo. Målet er å studere

end of 2004. It is the Board's clear ambition and declared goal that the Scientific Computing department maintains it's top rating and that the other two departments improve from "Good" to at least "Very good".

National and international co-operation

Simula attaches great importance to various forms of co-operation with its owner institutions and other research communities, nationally and internationally. One of the most important initiatives in this area is the agreement each research department has with the Department for Informatics at the University of Oslo. These agreements cover the teaching and supervision of Master's students.

Simula had not been established long enough to be considered as a host institution when the Research Council introduced its Centres of Excellence (CoE) program in 2002, but it is still playing a role in three of the Centres. The SC department is an official participant in the CoE institution *Physics for Geological Processes* at the university of Oslo, developing robust methods for solving thermal flow problems in geology, particularly in an area referred to as mantle convection.

The SC department also collaborates with the *International Centre for Geohazards*, a CoE institution situated at the Norwegian Geotechnical Institute. Other participants include portions of the department of Mechanics, Institute of Mathematics and Institute of Geology at the University of Oslo. The goal is to study tidal waves caused by natural disasters such as asteroid collisions og undersea avalanches.

SC also has a research collaboration in the area of robust methods for fluid dynamics with another CoE institution, *Mathematics for Applications*. As a part of this collaboration, staff in the SC department are participating in the development of new study programs in applied mathematics at the University of Oslo (at the Bachelor, Master's and PhD levels.) There are now plans to expand the collaboration. Finally, the SC department works with Chalmers University of Technology in Gøteborg, Sweden on the development of p-FEM software, and the universities of Erlangen and Dortmund in Germany on international workshops and conferences.

The ND department is involved, both nationally and internationally, in several large projects, including *Quality of Service-Aware Component Architecture (QuA)* with the University of Tromsø, SINTEF, Lancaster University, University of California, Irvine and Washington University. The project *Vertical Integration of QoS in Heterogeneous Networks (VINE)* is carried out in collaboration with Universitat de Valencia, University of Southern California, Rice University, Carleton University, Technische Universitet Wien, the international technology corporation ABB and the Norwegian online game developer Funcom.

The SE department has industry as its laboratory. They work closely with companies, carrying out case studies which generate knowledge on improving the processes for developing software. In 2002, these companies included Software Innovation, Ericsson in Asker, Ericsson in Grimstad, WM-data, Nera, Mogul, EDB4Tel and TietoEnator. Process improvement work was carried out in co-operation with the Norwegian University of Science and Technology (NTNU) and SINTEF.

Internationally, the SE Department has contributed to a larger survey in the area of software inspections together with Fraunhofer in Kaiserslautern, Germany. Other international partners included Carleton University, Canada; University of Glasgow, Great Britain and Lund University, Sweden.

The goal of the SE department is to perform more realistic experiments than those normally carried out nationally and internationally. In meeting this goal, the department used approximately 200 programmers as research subjects from companies like Accenture, Cap Gemini Ernst & Young, Tietoenator, Ementor, Software Innovation, Genera and ObjectNet.

Simula Innovation collaborates with the private companies IT Fornebu AS and IT Fornebu Inkubator AS on new business creation, and with the University of Oslo on both new business creation and research. Statens Kartverk is an important partner in the field of map delivery.

Public awareness

Both Norwegian and foreign research communities have shown great interest in Simula this year and many different groups have visited and toured the centre. Simula has also received extensive and positive coverage in the media, focussing on Simula's research, progress in the "Fornebu vision" and not least in connection with the official opening.

flodbølger generert av naturkatastrofer som asteroidekollisjoner og undersjøiske ras.

SC har også et forskningssamarbeid omkring robuste metoder for væskestrømninger med SFF-institusjonen *Mathematics for Applications*. Som en del av dette samarbeidet deltar ansatte i SC i utvikling av helt nye studieprogrammer i anvendt matematikk (bachelor, master og PhD-nivå) ved Universitetet i Oslo.

I tillegg til dette samarbeider SC blant annet med Chalmers tekniska högskola i Gøteborg om utvikling av p-FEM software, samt universitetene i Erlangen og Dortmund i Tyskland i forbindelse med workshops og internasjonale konferanser.

Avdelingen for Networks and Distributed Systems samarbeider både nasjonalt og internasjonalt i flere store prosjekter, blant dem *Quality of Service Aware Component Architecture (QuA)* med Universitetet i Tromsø, forskningsstiftelsen Sintef, Lancaster University, University of California, Irvine og Washington University. Prosjektet *Vertical Integration of QoS in Heterogeneous Networks (VINE)* foregår i samarbeid med Universitat de Valencia, University of South California, Rice University, Carleton University, Technische Universitet Wien, det internasjonale teknologikonsernet ABB og den norske onlinespill-utvikleren Funcom.

Software Engineering-avdelingen har industrien som sitt laboratorium. Derfor samarbeider avdelingen tett med bedrifter der man kan gjennomføre case-studier med siktemål å frembringe kunnskap om hvordan prosesser for utvikling av programvare kan forbedres. Blant firmaene avdelingen samarbeidet med i 2002 er Software Innovation, Ericsson i Asker, Ericsson i Grimstad, WM-data, Nera, Mogul, EDB4Tel og TietoEnator. Forbedringsarbeidet har vært utført i samarbeid med NTNU og Sintef.

Internasjonalt har SE-avdelingen samarbeidet om en større survey innen inspeksjoner sammen med Fraunhofer i Kaiserslautern, Tyskland. Andre internasjonale samarbeidspartnere har vært Universitetet i Carleton, Canada, Universitetet i Glasgow, Storbritannia, og Universitetet i Lund, Sverige.

SE-avdelingen har hatt som mål å gjennomføre mer realistiske eksperimenter enn det som stort sett utføres i fagfeltet internasjonalt. Som et ledd i dette har avdelingen benyttet ca. 200 programmerere fra konsulentselskaper som Accenture, Cap Gemini Ernst & Young, Tietoenator, Ementor, Software Innovation, Genera and ObjectNet.

Simula Innovation samarbeider blant annet med de private selskapene IT Fornebu as og IT Fornebu Inkubator as på området for nyskaping, og Universitetet i Oslo innen både nyskaping og forskning. Statens Kartverk er en viktig samarbeidspartner når det gjelder kartleveranser.

Formidling

Både norske og utenlandske forskningsmiljøer har vist stor interesse for Simula-senteret i løpet av

Administration and work environment

At the end of 2002, there were 60 people in various positions connected to Simula. A large majority were researchers, of which 10 were recruited internationally and 13 were women.

Managing Director Professor Morten Dæhlen was given a one year leave of absence in April 2002 to assume responsibility for building up the new Simula Innovation department. At the same time, Professor Aslak Tveito was appointed Acting Managing Director.

Simula became a member of the employers' organisation Abelia and some employees formed a chapter of The Norwegian Society of Chartered Engineers, a labour union. Procedures were implemented for a workplace safety officer (*verneombud*) and Health, Environment and Safety work. It is the Board's assessment that Simula has a good work environment. There have been no registered cases of work-related illness or accidents in 2002.

Simula's operations do not contribute in any way to environmental pollution.

Finances

In 2002 Simula had operating revenues of NOK 45.8 million. Profit amounted to NOK 4.8 million, which was transferred to equity. The conditions are present to support continued operation and the Financial Statement is presented in light of these conditions.

The Board considers that the company has found a suitable operating structure. No situations have occurred after the end of the year which impacts the Financial Statement as presented.

The way forward

The Board would like to thank Simula's management, researchers and other staff for a substantial and valuable contribution in the past year. Simula is now established in appropriate offices and labs, and the financial foundation for operation appears to have been secured. Further, a strategy for the organisation has been developed, and competent people have been hired to carry out the activities which the strategy prioritises. The next step is to improve the quality of research activity further, leading up to the planned review by the Research Council at the end of 2004. At the same time, Simula's education and new business creation activities must receive the necessary priority.

Despite the challenging times in the IT and Telecom field at present, IT Fornebu stands by its vision of creating an internationally attractive IT and knowledge-based community at Fornebu. It is the Board's ambition that Simula Research Laboratory will be a significant contributor to the fulfilment of that vision.

Berit Svendsen
Chairperson

Bente Anda | Tore Gimse | Odd Gropen | Lars Holden

Linda Ingebrigtsen | Olav Lysne | Ragni Piene

Kjell Bratbergsengen | Cecilie Ohm | Aslak Tveito

året, og mange ulike grupper har vært på besøk og omvisninger. Senteret har også opplevd en stor og utelukkende positiv interesse i mediene, ikke minst i forbindelse med den offisielle åpningen. Mediene har omtalt både forskningen ved Simula-senteret, den offisielle åpningen og utviklingen av den såkalte Fornebu-visjonen.

Administrasjon og arbeidsmiljø

Ved utgangen av året var til sammen 60 personer i ulike stillinger tiknyttet senteret. Det store flertallet er forskere på ulike nivåer. Ti personer var rekruttert internasjonalt, og til sammen 13 var kvinner.

Administrerende direktør professor Morten Dæhlen ble i april 2002 innvilget ett års permisjon, og gikk over til en stilling med ansvar for å bygge opp den nye Simula Innovation-avdelingen. Samtidig ble professor Aslak Tveito konstituert som daglig leder.

Simula-senteret har i løpet av året blitt medlem av arbeidsgiverorganisasjonen Abelia, og det er opprettet en gruppe innen fagorganisasjonen Norske Sivilingeniørers Forening (NIF). Det er også etablert ordninger med verneombud og ansvarlige for Helse, Miljø og Sikkerhetsarbeid. Det er styrets vurdering at arbeidsmiljøet ved Simula-senteret er godt. Det er ikke registrert tilfeller av arbeidsrelaterte sykdommer eller arbeidsulykker i 2002. Simula-senterets virksomhet forurenser ikke det ytre miljø.

Økonomi

Simula hadde i 2002 samlede driftsinntekter på 45,8 mill NOK. Årsresultatet ble på 4,8 mill NOK, som settes av til annen egenkapital. Forutsetningen for fortsatt drift er til stede, og årsregnskapet er avgitt under denne forutsetning.

Styret anser at selskapet har funnet en god driftsform. Det er ikke dukket opp forhold etter årskiftet som påvirker det fremlagte regnskap.

Veien videre

Styret vil rette en takk til Simula-senterets ledelse, forskere og øvrige ansatte for en stor og verdifull innsats i året som har gått. Simula er nå etablert i hensiktsmessige lokaler, og det finansielle grunnlaget for virksomheten synes å være sikret. Videre er det utarbeidet en strategi for virksomheten, og det er ansatt dyktige medarbeidere for å utføre de oppgavene som strategien prioriterer. Det må nå settes fullt fokus på ytterligere kvalitetsheving av forskningsaktiviteten ved senteret fram mot den planlagte forskningsrådsevalueringen i slutten av 2004. Samtidig må senterets undervisnings- og nyskapningsvirksomhet gis nødvendig prioritet.

På tross av de vanskelige tidene innen IT og telekom står IT Fornebu står fast på visjonen om å skape et internasjonalt attraktivt miljø innen IT- og kunnskapsbasert virksomhet på Fornebu. Styret har som ambisjon at Simula-senteret skal være en vesentlig bidragsyter for å nå denne visjonen.

Operating accounts *Resultatregnskap*

	Note	2002
OPERATING INCOME ***Driftsinntekter***	6	45 889 088
OPERATING EXPENSES *Driftskostnader*		
Personnel costs *Lønnskostnad*	4,5	22 613 164
Depreciation of fixed assets *Avskrivning varige driftsmidler*	3	507 254
Other operating expenses *Annen driftskostnad*		19 381 668
TOTAL OPERATING EXPENSES ***Sum driftskostnader***		42 502 086
OPERATING PROFIT ***Driftsresultat***		3 387 002
FINANCIAL ITEMS *Finansposter*		
Other interest income *Annen renteinntekt*		1 456 864
Other financial income *Annen finansinntekt*		324
Other interest expenses *Annen rentekostnad*		19 176
Other financial expenses *Annen finanskostnad*		854
TOTAL FINANCIAL ITEMS ***Sum finansposter***		1 437 158
PROFIT ***Årsresultat***		4 824 160
ALLOCATION OF PROFIT *Disponering av årsresultat*		
Transferred to equity *Overført annen egenkapital*		4 824 160
Total allocated *Sum disponert*		4 824 160

Balance sheet *Balanse*

	Note	2002
ASSETS ***Eiendeler***		
CAPITAL ASSETS *Anleggsmidler*		
Fixed assets *Varige driftsmidler*		
Furniture, equipment, etc. *Driftsløsøre, inventar o.l.*	3	2.191.766
Total Fixed Assets *Sum varige driftsmidler*		2.191.766
TOTAL CAPITAL ASSETS *Sum anleggsmidler*		2.191.766
CURRENT ASSETS *Omløpsmidler*		
Receivables *Fordringer*		
Customer receivables *Kundefordringer*		562.347
Other receivables *Andre fordringer*		346.154
Total receivables *Sum fordringer*		908.501
Bank deposits *Bankinnskudd*		8.949.487
TOTAL CURRENT ASSETS *Sum omløpsmidler*		9.857.988
TOTAL ASSETS ***Sum eiendeler***		12.049.754
EQUITY AND LIABILITIES ***Egenkapital og gjeld***		
EQUITY *Egenkapital*		
Contributed equity *Innskutt egenkapital*		
Share capital *Selskapskapital*	7,8	1.500.000
Total contributed equity *Sum innskutt egenkapital*		1.500.000
Earned equity *Opptjent egenkapital*		
Other equity *Annen egenkapital*	8	4.824.160
Total earned equity *Sum opptjent egenkapital*		4.824.160
TOTAL EQUITY *Sum egenkapital*		6.324.160
LIABILITIES *Gjeld*		
Short-term liabilities *Kortsiktig gjeld*		
Accounts payable *Leverandørgjeld*		1.677.528
Taxes and other government fees due *Skyldige offentlige avgifter*		1.710.486
Other short-term liabilities *Annen kortsiktig gjeld*		2.337.581
Total short-tem liabilities *Sum kortsiktig gjeld*		5.725.594
TOTAL EQUITY AND LIABILITIES ***Sum egenkapital og gjeld***		12.049.754

Note 1 – Accounting principles *Regnskapsprinsipper*

The accounts of Simula Research Laboratory are rendered in accordance with the Norwegian Accounting Act of 1998 and generally accepted accounting practice in Norway.

Principle for valuating and classifying assets and liabilities
Assets determined to be for long-term ownership or use are classified as fixed assets. Other assets are classified as current assets. Receivables to be paid back within one year are still classified as current assets. Corresponding criteria are applied when classifying short-term and long-term liabilities.

Capital assets are valued at acquisition cost, but depreciated to actual value when a reduction in value occurs which is not expected to be temporary. Capital assets with limited economic life are systematically depreciated. Long-term liabilities are booked at their original face value. Long-term liabilities are not revalued to actual value as a result of fluctuations in interest rates.

Current assets are valued at the lowest of acquisition cost or actual value. Short-term liabilities are booked at their original face value. Short-term liabilities are not revalued to actual value as a result of fluctuations in interest rates.

Certain items are valued according to other rules, as explained below.

Foreign currency
Cash items in foreign currency are converted using conversion rates in force at the financial year end.

Fixed assets
Fixed assets are depreciated over their expected economic life. Depreciation is, as a rule, spread in a linear fashion over the assumed economic life of the asset.

Receivables
Customer receivables and other receivables are booked at face value after deducting a provision for expected bad debts. This provision is based on an assessment of the individual receivables. In addition, there is a general provision for expected bad debts applied to all receivables as a whole.

Pensions
Pension items are based on a linear contribution profile and an expected final salary.

Taxes
The company has no tax costs since its activities are not considered to be taxable.

Årsregnskapet er satt opp i samsvar med regnskapsloven 1998. Det er utarbeidet etter norske regnskapsstandarder.

Hovedregel for vurdering og klassifisering av eiendeler og gjeld
Eiendeler bestemt til varig eie eller bruk er klassifisert som anleggsmidler. Andre eiendeler er klassifisert som omløpsmidler. Fordringer som skal tilbakebetales innen et år er uansett klassifisert som omløpsmidler. Ved klassifisering av kortsiktig og langsiktig gjeld er analoge kriterier lagt til grunn.

Anleggsmidler vurderes til anskaffelseskost, men nedskrives til virkelig verdi når verdifallet forventes ikke å være forbigående. Anleggsmidler med begrenset økonomisk levetid avskrives planmessig. Langsiktig gjeld balanseføres til nominelt mottatt beløp på etableringstidspunktet. Langsiktig gjeld oppskrives ikke til virkelig verdi som følge av renteendring.

Omløpsmidler vurderes til laveste av anskaffelseskost og virkelig verdi. Kortsiktig gjeld balanseføres til nominelt mottatt beløp på etableringstidspunktet. Kortsiktig gjeld oppskrives ikke til virkelig verdi som følge av renteendring.

Enkelte poster er vurdert etter andre regler, og redegjøres for nedenfor.

Valuta
Pengeposter i utenlandsk valuta omregnes til balansedagens kurs.

Varige driftsmidler
Varige driftsmidler avskrives over forventet økonomisk levetid. Avskrivningene er som hovedregel fordelt lineært over antatt økonomisk levetid.

Fordringer
Kundefordringer og andre fordringer oppføres til pålydende etter fradrag for avsetning til forventet tap. Avsetning til tap gjøres på grunnlag av en individuell vurdering av de enkelte fordringene. I tillegg gjøres det for øvrige kundefordringer en uspesifisert avsetning for å dekke antatt tap.

Pensjoner
Ved regnskapsføring av pensjon er lineær opptjeningsprofil og forventet sluttlønn som opptjeningsgrunnlag lagt til grunn.

Skatter
Selskapet har ikke innarbeidet skattekostnader da virksomheten ikke er vurdert å være skattepliktig.

Note 2 – Financial market risk *Finansiell markedsrisiko*

The company has little exposure to financial market risk.

Selskapet er i liten grad eksponert for finansiell markedsrisiko.

Note 3 – Capital assets *Anleggsmidler*

	IT equipment and infrastructure *Datautstyr og infrastruktur*	Furniture and equipment *Inventar og utstyr*	Total *Sum*
Acquired 2002 *Anskaffet 2002*	1.149.202	1.549.818	2.699.020
Acquistion cost 31/12 *Anskaffelseskost 31/12*	1.149.202	1.549.818	2.699.020
Accumulated depreciation *Akk.avskrivninger*	230.030	277.224	507.254
Booked value 31/12 *Bokført verdi 31/12*	919.172	1.272.594	2.191.766
Normal depreciation *Ordinære avskrivninger*	230.030	277.224	507.254
Depreciation in % *Avskrivning i %*	20 – 33%	20 – 33%	

Note 4 – Pension costs *Pensjonskostnader*

The company has a retirement pension plan covering a total of 40 people. The pension plan provides defined future benefits. These are dependent, for the most part, on number of contribution years, salary level at retirement age, and size of benefit received from the Norwegian National Insurance plan. The pension plan is financed through funds invested in the Norwegian Public Service Pension Fund.

Selskapet har pensjonsordning som omfatter i alt 40 personer. Ordningen gir rett til definerte fremtidige ytelser. Disse er i hovedsak avhengig av antall opptjeningsår, lønnsnivå ved oppnådd pensjonsalder og størrelsen på ytelsene fra folketrygden. Den kollektive pensjonsavtalen er finansiert ved fondsoppbygning organisert i Statens pensjonskasse.

Note 5 – Personnel costs, number of employees, etc.
Lønnskostnader, antall ansatte, godtgjørelser m.m.

	2002
Personnel costs *Lønnskostnader*	
Salaries *Lønninger*	18.370.898
National Insurance contributions *Folketrygdavgift*	2.675.368
Pension costs *Pensjonskostnader*	1.004.428
Other benefits *Andre ytelser*	562.470
Total *Sum*	22.613.164
Average number of employees *Gjennomsnittlig antall ansatte*	43

Salaries and benefits to top management *Ytelser til ledende personer*	Acting Managing Director *Daglig leder*	The Board *Styret*
Salary *Lønn*	750.331	202.500
Pension contribution *Pensjonsutgifter*	46.520	0
Other benefits *Annen godtgjørelse*	5.174	0

Auditor *Revisor*
There was no fee paid to the auditor in 2002.
Det er ikke utbetalt honorar til revisor i 2002.

Note 6 – Operating Income *Driftsinntekter*

The company's operating income was distributed as follows:
Selskapets driftsinntekter fordeler seg som følger:

Research funding *Tilskudd til forskning*	45 221 440
Reimbursement for research fellows *Refusjon for stipendiater*	425 000
Rental income *Leieinntekter*	186 967
Other income *Øvrige inntekter*	55 681
	45.889.088

Note 7 – Share capital and ownership *Aksjekapital og eierstruktur*

The company's share capital consists of 1,000 shares, each valued at NOK 1,500.-.

The shares are owned by:

The Government of Norway, Ministry of Education and Research	80%
Norwegian Computing Center	10%
Sinvent AS (a company in the SINTEF Group)	10%

The company was incorporated on June 11, 2002. The accounts include transactions for the entire year since the decision to incorporate was taken in 2001. The company is a direct continuation of the "Simula-senteret" project which operated at the University of Oslo prior to January 1, 2002.

Selskapets aksjekapital består av 1.000 aksjer à kr. 1.500,-.

Aksjene er eiet av:

Den norske stat v/Utdannings- og forskningsdepartementet	*80%*
Stiftelsen Norsk Regnesentral	*10%*
Sinvent AS	*10%*

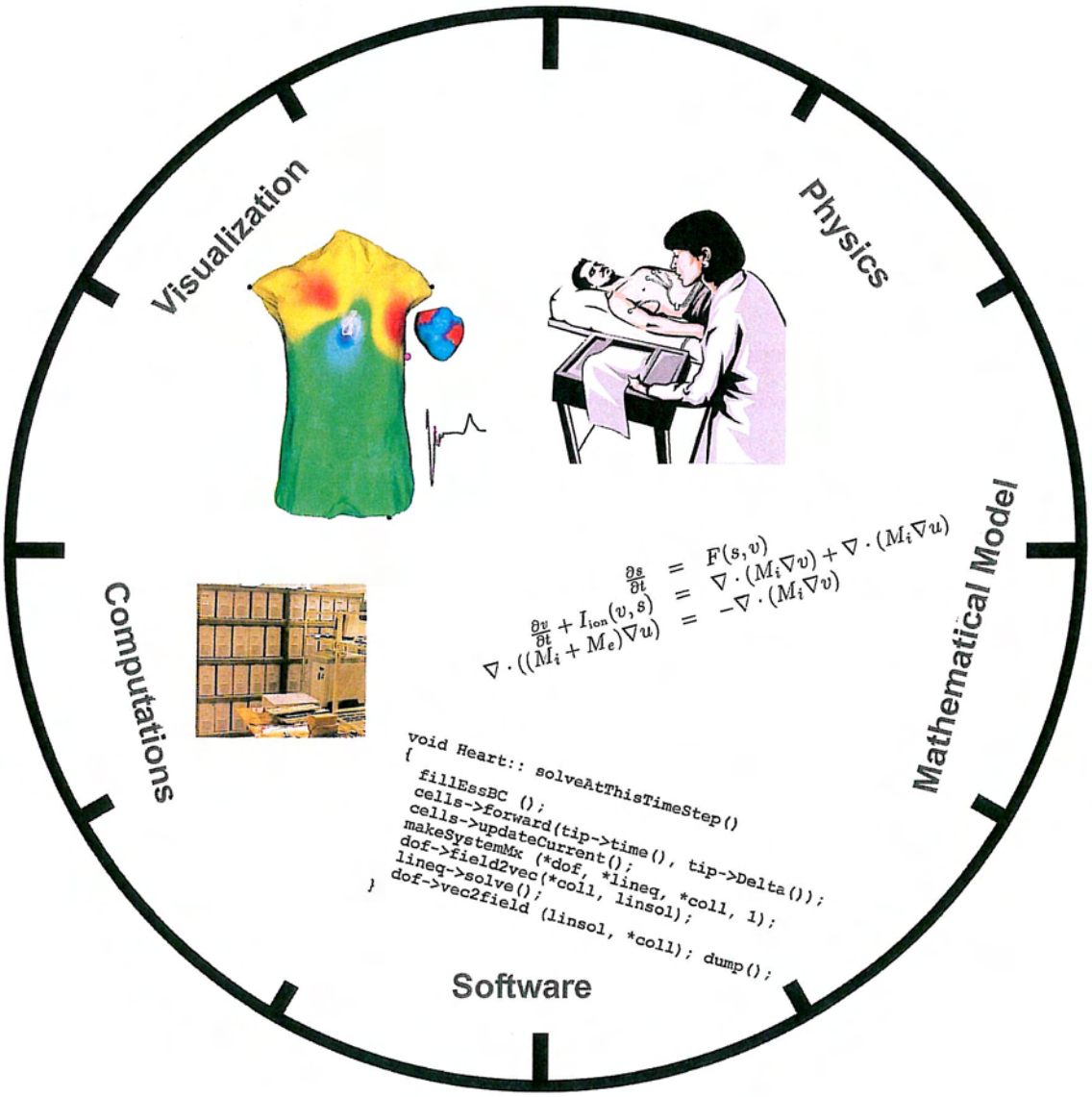
Selskapet ble stiftet 11. juni 2002. Regnskapet inneholder tall for hele året da beslutning om stifting av selskapet ble tatt i 2001. Selskapet er en direkte fortsettelse av prosjektet «Simula-senteret» som før 1/1 2002 var underlagt Universitetet i Oslo.

Note 8 – Equity *Egenkapital*

	Share capital *Aksjekapital*	**Other equity** *Annen egenkapital*	**Total equity** *Sum egenkapital*
Contributed equity *Tilført egenkapital*	1.500.000	-	1.500.000
Retained earnings *Årets resultat*		4.824.160	4.824.160
Equity at 31/12 *Egenkapital 31/12*	1.500.000	4.824.160	6.324.160

Numerical methods and software for solving partial differential equations

The research in the Scientific Computing department focuses on numerical methods and software for solving partial differential equations. Our aim is to develop efficient, reliable, and maintainable software addressing mathematical models based on partial differential equations.



This topic is of major relevance for engineering, natural science, medicine, and finance, because:

- Mathematical models are used, or are expected to be used, to a large extent in these areas,
- The mathematical models are often based on partial differential equations,
- The partial differential equations for complex real-world phenomena can only be solved with advanced numerical methods available in sophisticated software.

Scientific computing is a multidisciplinary subject.. At Simula we focus mainly on numerical algorithms and software.

The rapid development of hardware, numerical methods, and more reliable software leads to an increased importance of mathematical modelling in terms of partial differential equations. Our special focus is on the interplay between software and numerical methods. We have contributed to defining the topic as a scientific field and have already obtained an international position within the field.

Our activities are grouped into two main projects:

The Multi-Physics Simulation Project

The goal of the Multi-Physics (MP) project is to establish generic methods for developing and evaluating advanced software for compound, complicated physical phenomena. Generic means that the results are of practical importance in a wide spectrum of disciplines. The challenge in multi-physics simulation is that software production is competence-demanding and time-consuming, and it is difficult to estimate the quality (accuracy) of the software. We want to develop methodologies to meet this challenge.

The project is a natural extension of our previous work on generic scientific software for partial differential equations (Diffpack.) We now want to realise the potential in that work, namely the possibility to attack complicated partial differential equation models and generate software in a more efficient and safe way than what is possible with today's common tools.

There are three main research topics in this project:

- Numerical methods,
- Verification of numerical codes, and
- Software tools.

The Cardiac Computation Project

The Cardiac Computation (CC) project is a special case of the MP project, where we concentrate on a single model, of the electrical activity in the heart.

The long-term goal is to establish a full scale, realistic simulator with practical processor requirements. This demands comprehensive development of numerical methods and software, in addition to extensive verification and validation of the model. The verification part will require a special focus on mathematical and numerical analysis of simplified models, mimicking essential features in the full model for the electrical activity in the heart.

Possible applications of the simulator will include simulation of pathological conditions. By altering the model parameters in a specified piece of the heart, the effect of e.g. infarction on the hearts´ performance can be studied. Another possible application is to investigate the effects of drugs. If the local action of the drug is known, e.g a specific channel blocker, this can easily be incorporated into the model. This makes it possible to observe the resulting macroscopic behaviour of the heart.

A framework for simpler parallel computing

The hardware development of today's standard single-processor computers can hardly keep pace with the rapidly increasing demand of computational scientists. One solution to this problem is to use a computer with many processors and memory units for a large-scale computation, so-called parallel processing. The entire computation is divided among the processors, so that the computation time is reduced by a large factor. In essence, the power of many processors and memory units is united to provide a significant increase in the computing speed and memory size.

In addition to hardware, the issue of software is also important for parallel computing. This is because existing sequential programming code, which was written for a standard single-processor computer, will not work directly on a parallel computer. New ways of programming are needed in writing software code for parallel computers, making parallel programming a difficult task. One of the projects at the Department of Scientific Computing is therefore focused on establishing an implementation framework and software libraries for coding parallel simulators.

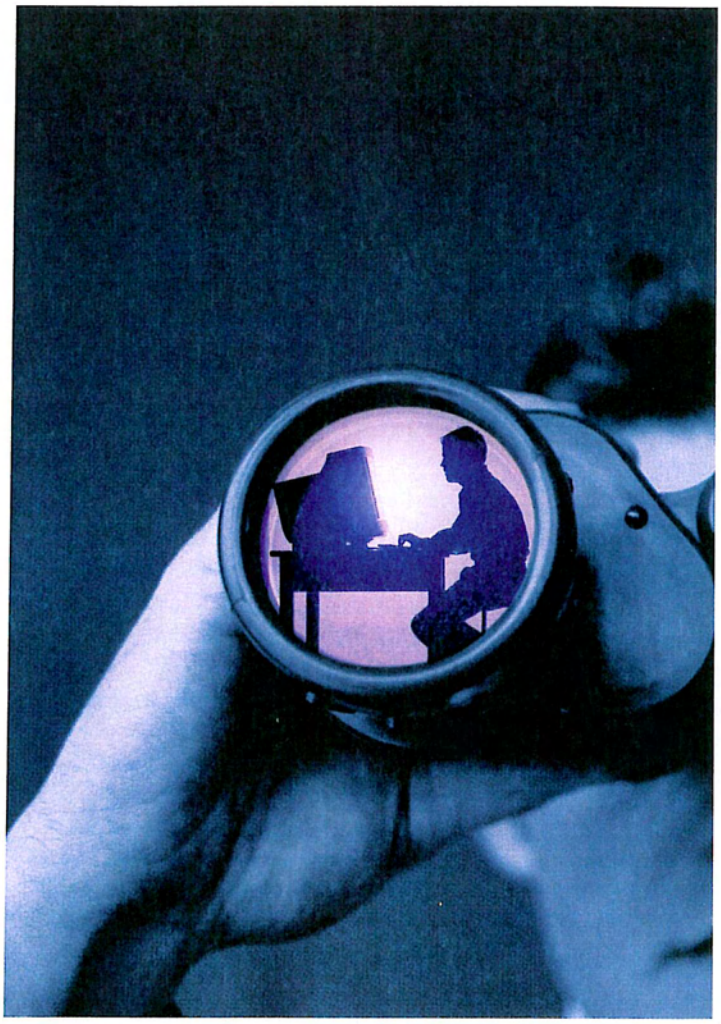
Professor Hans Petter Langtangen, Research Director

The objective is to ease the user effort at writing parallel code for numerical simulations. The basic ideas behind the research project are (i) to allow re-use of many existing sequential software components, and (ii) to prepare libraries of parallel processing-specific code.

Object orientation is the key programming technique used in this project. Such a programming style has earlier achieved great success in developing the sequential scientific computing environment: Diffpack. Using object-oriented programming, we have developed in this project two small parallel libraries that take care of parallel computing specific tasks. The other computing tasks in a parallel simulation are automatically "relayed" to the existing sequential Diffpack libraries. In addition, we have also used object-oriented programming to establish a framework that simplifies the user's actual parallel programming work. The MPI standard is used in the backbone of the parallel software libraries, making them portable to all the major parallel computing systems. In addition, special care has been taken with the library implementation, so that application codes using these libraries can achieve good performance on different parallel computers.

Using the implementation framework and the parallel software libraries, we have successfully transformed many sequential Diffpack simulators into their parallel counterparts. The so-far largest parallel simulation has been done on an SGI Origin 3800 system for simulating the electrical potential field within a human body. The 3D computational grid for the entire body involves 83,005,440 tetrahedra and 13,864,301 unknowns. Further improvement of this parallel simulator is under way to enable simulations of an even larger scale. Consequently, we are looking forward to taking the first step in doing cardiac simulations with sufficient resolutions needed for medical practices.

Underestimating uncertainty in IT estimates



The study of IT projects carried out by researchers at Simula Research Laboratory shows that system developers have a strong tendency to underestimate the uncertainty of their cost estimates.

For example, even when subjects state they are "almost certain" about their estimates, they hit the target only 50–60% of the time. Through experiments with professional software developers and Informatics students, the Software Engineering (SE) department at Simula has analysed the causes of this systematic underestimation of uncertainty. The experiments have led to new methods for analysis and assessment of uncertainty. These methods are now being tested out and results so far indicate that minor adjustments in the estimation process can deliver major improvements in the accuracy of uncertainty reporting. IT-projects often have high uncertainty, or risk, in terms of technology, customer requirements, problem-solving and resource availability. Accurately assessing uncertainty is essential for project managers and budget responsibles to effectively manage projects. A commonly recommended method is to provide minimum and maximum values along with an assessment of how certain one is that the actual cost will fall between these values. For example, a project manager could state that he or she is 90 % certain that the project will cost between 2 and 2.5 million. This means that the actual cost will fall outside this range only 10 % of the time.

It appears that there are problems with this common method. Through

The Software Engineering (SE) department has established new principles for carrying out realistic experiments in this field, developed from several years of direct experience. Researchers in the department have replaced students with professional system developers, traded in paper and pencils for professional tools and moved from the classroom to real workplaces. The goal is to run experiments that have direct relevance for the industry. Such experiments are demanding to organise and can carry higher risks, but in return they give new and important insights into significant problems for both the research community and user groups in industry and society at large.

There is an increasing understanding in the software engineering community that empirical research, like the studies conducted by Simula's SE department, are needed to develop or improve processes, methods and tools for software development and maintenance. The classical method for identifying cause-effect relationships is to conduct controlled experiments where only a few variables vary. Controlled experiments in software engineering often involve students solving small pen and paper tasks in a classroom setting. A major criticism of such experiments is their lack of realism, which may reduce relevance and deter technology transfer from the research community to industry.

To convince industry about the validity and applicability of the experimental results, the tasks, subjects and environments of the experiments should be as realistic as practically possible. Such experiments are, however, more expensive than the traditional type. Consequently, this shift towards more realism requires an increase in the amount of resources spent on software engineering experiments. To support technology transfer, the results of the experiments should be presented back using language and a format accessible to industry.

The motivation for the research conducted in the SE department is to support the private and public IT industry in developing better IT systems using fewer resources. The group is concerned with technical, organisational and human issues that affect systems development processes.

The main goal is to extend the empirically-based knowledge about the effect of different models, methods, techniques and tools on processes and products.

Foto: Jørn Ljøen/PhraseSamfoto

observing many IT projects, we have seen that programmers and project managers have major problems assessing degree of uncertainty and it is often underestimated. In addition to finding that "almost certain" really means "50–60 % certain" as mentioned above, we found that programmers made no significant changes to their minimum and maximum cost estimates regardless of whether they were asked to be 50 %, 75 %, 90 % or 99 % certain. Based on a series of experiments we found two important causes for this:

1) It is particularly difficult to learn to assess degree of uncertainty without systematic analysis of the accuracy of previous estimates. In other words, people cannot adjust their behaviour without receiving direct feedback on it. This type of analysis is seldom, if ever, carried out in the companies we studied.

2) When it is difficult to estimate uncertainty, then it is easy for realism to be pushed aside by other criteria. We found in one of our experiments that system developers and project leaders judged programmers who stated a lower degree of uncertainty as being more competent to estimate and program than those who stated a higher level of uncertainty. Surprisingly, this judgment were present even in situations were they were told that the programmers' statements of uncertainty were strongly overoptimistic and that their estimates were no more accurate than the estimates made by others. In other words, overoptimistic uncertainty assessments were interpreted as indicators of high competence.

There is an increasing understanding in the software engineering community that empirical research are needed to develop or improve processes, methods and tools for software development and maintenance.

In order to improve the assessment of uncertainty of cost estimates, we have developed and evaluated two formal uncertainty models and a new way of expressing uncertainty. The formal models, which are based on data from earlier estimating experience, seem to provide realistic uncertainty assesments. In other words, when the models state that they are 70 % certain, the actual result is, on average, close to this. The disadvantage with the formal models appears to be that they cannot handle certain important uncertainty information that human experts can handle. Therefore, if the project has some "unique" uncertainty characteristics, then expert evaluation without formal models often provides the most accurate degree of uncertainty.

One interesting result from our experiments is that changing the question form seems to significantly increase the accuracy of expert evaluations of certainty. This is accomplished by changing the framing of the question. For example, from *"Provide minimum and maximum cost estimates which you are 90% certain the actual cost will fall between"* to *"How certain are you that the actual cost will fall between 50 % and 200 % of the estimated cost?"*

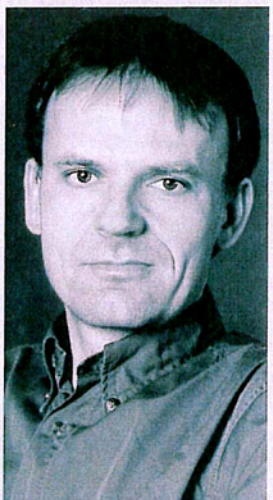
The last alternative also seems to make learning from estimation experience more effective. The new uncertainty models and question form are now being tested in Norwegian companies.

The research is focused around three themes:

Software development effort estimation
The research aims to improve existing and develop new models, processes and tools for estimation, planning and risk analysis of software projects.

Object-oriented analysis and design
The research aims to evaluate the impact of object-oriented analysis and design technologies on various software quality attributes such as understandability, changeability and correctness.

Methods for realistic experiments
To increase the realism of the research, the department aims to conduct controlled experiments involving professionals solving real tasks on real systems. The department is developing sophisticated experimental platforms to collect data with minimal overhead.



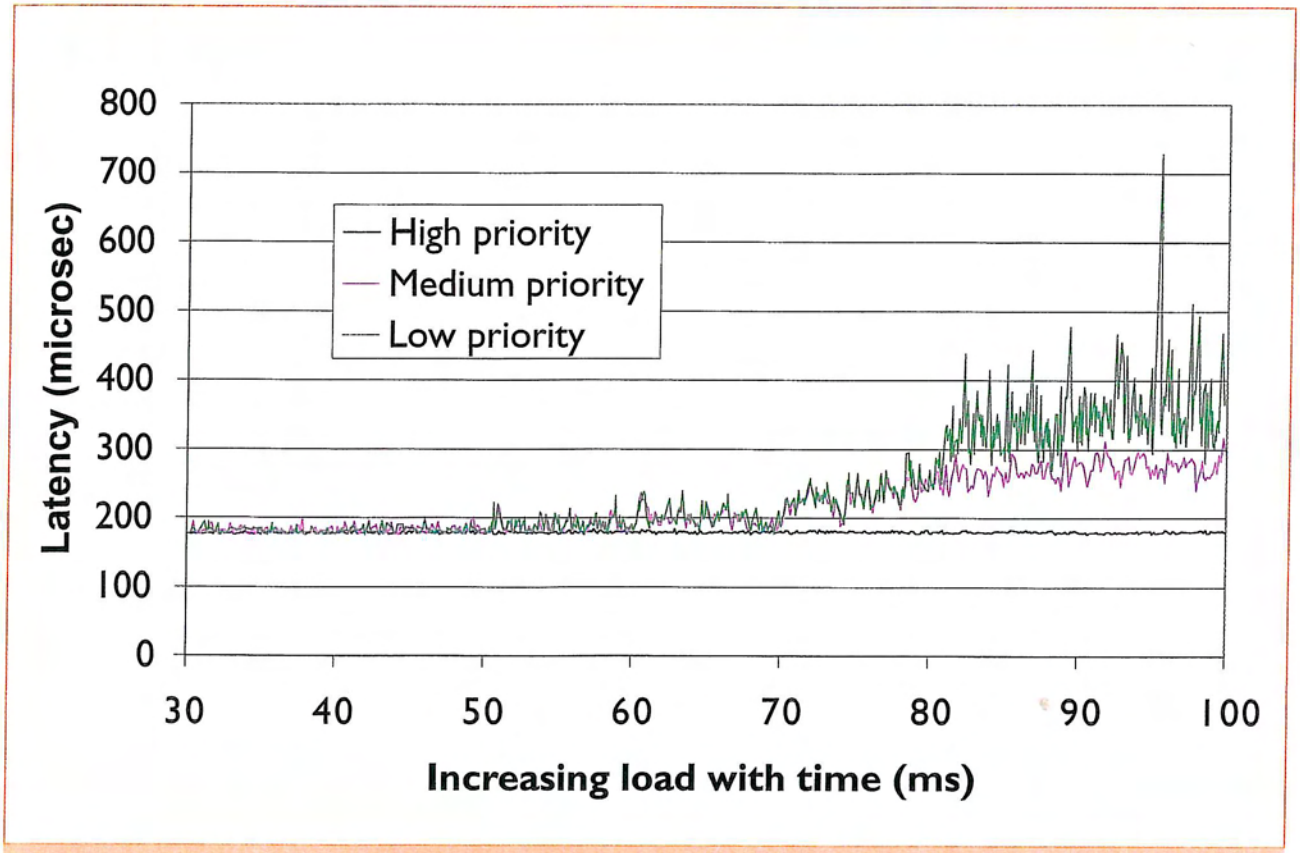
Professor Dag Sjøberg, Research Director

Researchers at Simula are changing the Internet

Researchers at Simula are creating a new generation of network which they believe will form an important part of the future Internet.

The Internet consists of two parts. In a building or an area there is a local area network (LAN.) These are most often "Ethernets" and adhere to a technical standard called IEEE 802. The Internet is built up of many LANs connected together with hardware devices called routers. Routers are becoming more and more complicated and this is leading developers and researchers to examine the possibility of building larger LANs. It is easier to control and manage a LAN than a set of LANs linked together with routers. Concurrently, work is underway to make networks more reliable and able to process different types of information in different ways. For example, telephone and image traffic, which is more vulnerable to delays in transmission, should get a higher priority than data traffic.

Simula is actively involved in the standardisation of this new generation of network which is based on a ring structure. Rings have been used in LANs before, for example in a building or between a few buildings. However, Simula is extending this model to build large rings which can span cities (Metropolitan Area network, MAN) and even regions or small countries.



This image shows how network traffic can develop over time (x-axis.) High priority traffic (e.g. telephone) is shown in blue, medium priority (e.g. video) in purple and low priority traffic (e.g. file transfer) is shown in green. All traffic is somewhat delayed since it can travel no faster than the speed of light. The distance measured here was 36 kilometres so this delay amounts to 180 microseconds. We see that telephone traffic always has a delay of approximately 180 microseconds regardless of how busy the network becomes. This is shown in the far right of the image. The delay in video traffic increases somewhat as overall traffic increases. Delays in file transfer traffic increases significantly as the network becomes busier.

Quality of Service for future distributed applications

Networks and distributed systems are the communication infrastructure of the information society. This infrastructure is the sum of all the computers and devices that are connected through the Internet. Its functionality and quality is, to an increasing extent, necessary for the functioning of modern societies.

The research area of the department is Quality of Service (QoS) management for future distributed applications and services. QoS for distributed applications and services refers to their extra-functional properties, including for example the provided response time, bandwidth, privacy, safety, accuracy, and media-quality (for continuous media). QoS management then refers to the planned allocation and scheduling of network and end-system resources and software algorithms to meet the QoS needs of applications.

Future distributed applications have an increasing demand for QoS. However, applications such as control systems, multimedia and file transfer services have very different QoS requirements. Some are tolerant to occasional loss of data and missed deadlines, while others are not. Hence QoS cannot be satisfied using a single service level, but instead requires differentiated service levels and mechanisms that depend on the application.

QoS is a concern that cuts across network, end-system (middleware) and application layers, and end-to-end across different end-system and networking technologies. The provision of QoS is complicated by the fact that future applications have to operate seamlessly in such an environment of different networks (wireless, wired, system-area, local-area, wide-area) and end-systems (embedded devices, PDAs, PCs, high-end computers).

Our research experience in networking technologies, middleware, and multimedia systems, helps in understanding QoS management integration issues and to propose and evaluate relevant QoS management technologies.

The goal of the department is to become an internationally recognised contributor of solutions for QoS management. The department aims to be internationally leading in two complementary focus areas:

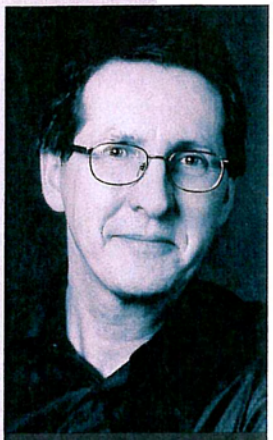
- Vertical and horizontal interoperation of network quality of service mechanisms
- Component architecture support for dynamic management of real time QoS

For the period 2002 – 2005 the department will concentrate its research activities in these two areas.

Component architecture support for dynamic management of real time QoS

Component architectures make it easier for developers to build reliable distributed applications from reusable software components and are widely used today for development of distributed and web-based applications. However, current component architectures lack support for applications with real time constraints and other QoS requirements.

The main goal of this activity is to investigate how to develop complex applications with real time constraints and media quality requirements on a component architecture platform and learn through experimentation how dynamic management and adaptation of real time QoS can be supported in general-purpose component architectures. We aim to develop a component architecture that preserves the essential benefits of existing architectures while adding support for platform-managed QoS.



Professor Frank Eliassen, Research Director

Vertical and horizontal interoperation of network QoS mechanisms

The long term goal of this activity is to contribute to the realisation of cross-cutting, end-to-end QoS support over heterogeneous networks. We aim to devise solutions for integration of the different approaches to QoS that exist. These approaches vary, both horizontally – between different underlying network technologies, and vertically – between the Internet standards and the underlying network technologies. This spans a wide range of issues. We concentrate on the following aspects of the problem area:

- Mechanisms for service guarantees and differentiated service levels in classes of network technologies.
- Interoperability of QoS concepts and mechanisms that exist both in the underlying network technologies and the Internet Protocol layer.
- Methods for optimisation of overall network performance within and between classes of network technologies.

This standardisation is led by the Institute of Electrical and Electronic Engineers (IEEE). The new ring-based standard is called "Resilient Packet Ring" (RPR) or IEEE 802.17 for short.

Researchers at Simula have built an RPR simulator to analyse potential behaviour. The simulator is built using the object-oriented principles developed by Ole-Johan Dahl and Kristen Nygaard forty years ago and is written in the Java programming language, a descendant of Dahl and Nygaard's language, Simula.

The most important advantage of ring-based networks is that there are always two routes between two points on the ring. If an excavator cuts a cable and the ring is broken, traffic can go the other way around the ring, even though it may take longer to get to its destination.
There are many research challenges in RPR. For example, all the stations connected to the ring have the same rights when it comes to sending data. This is simple if the patterns of traffic on the ring are constant, but more complex when traffic patterns change and the new traffic must be sent "fairly" and as quickly as possible.

One of the most important challenges is the handling of different data in different ways. The Standards Group has proposed that information entering the ring will be grouped into three classes: high, medium and low priority. Transferring of files is not usually considered urgent whereas the words and pictures from a telephone conversation must be transmitted in milliseconds. Researchers at Simula have investigated what consequences this will have for the future Internet with the aim of developing a good standard.

EFFECT: A new model for creating commercial businesses from basic research

During the spring of 2002, Simula conducted a study of mechanisms and systems for creating commercial businesses from basic research. This study included selected geographical regions and universities in Europe and USA. The main result is a new model, called EFFECT. The model is developed in collaboration with industrial, financial and governmental partners.

The employment agreements with every employee at Simula contain principles, and to a certain extent procedures, outlining how commercial rights will be shared between individuals and Simula. This ownership model gives balanced incentives for both parties for the long-term creation of new businesses based on research results and ideas. Simula performs basic research, hence production of scientific publications is ranked as the most valuable product from the institution.

We have proposed that the Research Council of Norway provides Simula with a fund to be used as seed capital for creating new businesses. The main goal of the fund, called the EFFECT-fund, is to attract "competent capital" for early investment, hence providing a significant reduction in risk for private investors.

The funding mechanism will, in collaboration with the authorities, be formalised during the spring of 2003. A basic condition is that this funding must be matched with an equal amount of capital from private investors. We also propose that investors, who provide seed capital to match the investment from the EFFECT-fund, can buy out the EFFECT-fund after 3–5 years at cost price. This will only be done if the commercialisation is successful. The funds resulting from this "buy-back" go to Simula, where they become a new set of incentives to reinvest in further research and innovation. The initial ownership of the new businesses will be shared between individuals, Simula itself, the EFFECT Fund and venture capitalists.

To have a forum in which to present our results and ideas to professional investors, Simula Innovation will create and maintain a network of professional entrepreneurs, financial partners (investors) and people with market knowledge. We plan to organise this as both a web-based information channel and a series of focused meetings between researchers and forum members.

Simula Innovation will, through partners, provide courses in entrepreneurship for students and possibly other people involved in business creation.

Practical arrangements with respect to office space, accounting services, etc. will be provided by partners and incubators. However, Simula can, in some cases, provide office space for selected new businesses. Note that the funding mechanism, if established, will have an independent board containing people with experience in seed investments. Note also that new businesses can be established without the special seed investment fund described above.

We believe that it is important to locate innovation activities, including funding mechanisms, as close as possible to the research activities.

From Research to Business

Professor Morten Dæhlen, Director Innovation

Research-based innovation for industrial development and business creation is a complex issue, and many different mechanisms and supporting systems are applied to transfer knowledge and obtain commercial results. Companies all over the world conduct or buy research in order to stimulate innovation and eventually improve their business potential. In various ways such research and innovation is stimulated by governmental funding, ranging from tax reduction mechanisms to direct funding of research projects. Results and ideas from these types of activities are generally owned by the industry. When exploitable research results and ideas are owned by research institutions and researchers, other innovation routes have to be followed.

An obvious and important route for Simula is direct research collaboration with commercial businesses and researchers in industry. Based on such collaboration, innovations in industry are achieved through early transfer of results and general knowledge development. Another important achievement in such collaboration is that Simula gets early feedback on our research and first hand knowledge about challenging industrial problems.

During the past decades an increasing number of new commercial businesses have been created directly from basic research. In particular, this has been the case within areas like information and communication technology (ICT), biotechnology and medicine. Simula has therefore decided to establish a separate unit responsible for business creation from research conducted at Simula and our partners. This unit is called Simula Innovation.

Simula Innovation focuses on two major tasks:

- Business development based on research results and ideas.
- Management of the commercial interests of Simula – ownership in "spin-off" companies, patents and licence agreements.

Foto: Christoffer Askman/BAP/Samfoto

Simula Innovation will create and maintain a network of professional entrepreneurs, financial partners (investors) and people with market knowledge.

Business development includes the whole process of finding results and ideas with commercial potential and refining these to business plans that can be presented for partners, both industrial and financial. It also includes investigating and using other avenues for commercialisation, such as patents and license agreements.

Simula Innovation was set in operation during the fall of 2002. The basic principles of how Simula Innovation will operate were established during a study of business creation systems in selected regions and universities around the world. The main result from this study is the EFFECT-model (see separate article). Simula Innovation is now implementing this model.

In addition to the development and implementation of the EFFECT-model, a number of commercialisation processes has been developed during 2002. Our main goals for 2003 are to establish one or two new commercial companies and to obtain funding for early investments in these "spin-off" companies. Simula Innovation has also during 2002 established close relations to investors and other partners. Of particular importance is the partnership with IT Fornebu and IT Fornebu Incubator, which also provide financial support to Simula Innovation. Moreover, Simula Innovation participates in innovation processes at the University of Oslo, which also plans to implement the EFFECT-model. Finally, Simula is working with various government agencies on establishing seed capital for early investments.

The innovation and business creation activities are currently organised as a separate department within Simula. As we implement the EFFECT-model, we will address organisational issues and important questions on corporate governance. It is likely that Simula Innovation will be established as a subsidiary of Simula Research Laboratory AS.

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Doctorates and Master's Degrees in 2002

Doctorates (Dr.scient)	Supervisors	Thesis
Anders Andersen	Frank Eliassen	A Reflective Middleware Platform including Quality of Service Management
Tarik Cicic	Stein Gjessing	Network Level Deployment and Recovery
Lars Paul Huse	S. Gjessing	A Comparative Study of Different Programming Paradigms in an SCI-based Multi-processor Environment
Joakim Sundnes	Glenn Terje Lines, Aslak Tveito, Per Grøttum	Numerical Methods for Simulating the Electrical Activity of the Heart

Masters (Cand.scient)	Supervisors	Thesis
Harald Berge	Hans Petter Langtangen	Programming of a Navier-Stokes Solver and Coupling with an Energy Equation Solver
Monica Hanslien	G.T. Lines, A. Tveito	Analysis of Numerical Methods for the Monodomain Model in One and Two Space Dimensions
Karl Erik Levik	H.P. Langtangen	Q-Morph – Implementing a Quadrilateral Meshing Algorithm
Daoshan Li	Viktor Eide, F. Eliassen	Distributed Media Journaling – A Case for Event-based Communication with CORBA Notification Service
Anette Cecilie Lien	Erik Arisholm	Guidelines for Process Improvement with a Focus on Change Management in Web-Development Projects
Thor Linell	Magne Jørgensen, Dag Sjøberg	Software Cost Estimation – State-of-the-Art
Kjetil Moløkken	M. Jørgensen	Expert Estimation of Web-Development Effort: Individual Biases and Group Processes
Henrik Olsen	S. Gjessing	Image-based Rendering
Kristin Skoglund	D. Sjøberg, E. Arisholm	Measurement of Changeability in Object-oriented Software Systems
Gunnar Sletta	Xing Cai, H.P. Langtangen	Visualization of Scientific Datasets Obtained From Parallel Simulation
Erik Syversen	Bente Anda	Comparing two Ways of Applying Use Case Models in Object-Oriented Design with UML
Kjetil Tyvand	V. Eide, F. Eliassen	An Evaluation of Event Notification Systems in Distributed Media Journaling
Johan Fredrik Øhman	Tor Skeie	High Availability Time Synchronization in Ethernet

In Memory of Two Outstanding Researchers

Norway lost two of its best and most recognised researchers and scholars within six weeks of each other in the summer of 2002. Professor Ole-Johan Dahl and Professor Kristen Nygaard laid the foundation for major international recognition in the early 1960's when they developed object-oriented programming and the programming language Simula. These two developments rank today among the most significant research results of the previous century.

Ole-Johan Dahl and Kristen Nygaard were awarded both the Turing prize, considered the "Nobel prize" in Informatics, and the prestigious John von Neumann medal before they died on June 29 and August 10.

The computer systems that form the foundation of the modern information society are among the most complex things humans have created. Through their ground-breaking research, Nygaard and Dahl made it possible to manage that complexity. Simula laid the groundwork for the development of later languages like Smalltalk, C++, Eiffel, Beta and especially Java, which has become the central language for application development on the Internet.

Kristen Nygaard was best known in Norway as the leader of the No side in the debate over Norway joining the European Union. He received his Master's degree in Mathematics from the University of Oslo in 1956. He worked for the Norwegian Defence Research Establishment until 1960, then for many years with the Norwegian Computing Center before becoming a Professor at the University of Oslo.

Nygaard made an impression on all who met him, with his vitality, seemingly limitless knowledge, wit, self-irony and not least his open, generous and friendly personality. He was at home with other internationally-acclaimed researchers, but was just as interested in talking to young students. Kristen had an enormous group of contacts, both in Norway and internationally. Even in his last year he made presentations to groups in Europe, North and South America and Asia. He was a living legend who was met with deep respect around the world.

Ole-Johan Dahl was Norway's first professor in Informatics. As a textbook author, lecturer and supervisor of a long line of students at the University of Oslo, Dahl was instrumental in building up Norwegian IT competence during the last half of the twentieth century. He introduced, among other things, object orientation and Simula into the teaching of Informatics in the 1970's. These methods were controversial in the beginning, but became a powerful example for Informatics education in many places around the world.

Dahl's research in later years focussed on theoretical data processing, development of programming languages and proving the correctness of computer programs. Despite his immense contributions to education and research, Ole-Johan remained modest, preferring to talk about other things than his accomplishments.

It is with great sadness we must acknowledge that our good friends and colleagues are no longer with us. We will miss Kristen and Ole-Johan greatly, but they live on as a source of professional and personal inspiration. The employees of the Simula Research Laboratory are honoured to carry forward a proud tradition by working at a research institution named after these two pioneers' momentous achievement.

The owners of Simula

Simula Research Laboratory is a limited company with the following owners:

- Norwegian Government
- Norwegian Computing Center
- Sintef

The operation of the Simula centre is financed with grants from the Ministry of Education and Research, the Ministry of Trade and Industry, and the Ministry of transport and Communication. The grants are administered through the research Council of Norway, who will also run the evaluation of the centre, with support from international experts.

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Glenn Lines	Dr., Research Scientist
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Halvard Moe	Dr., Scientific Programmer
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Trygve K. Nilssen	Post.doc.
Ola Skavhaug	PhD Student
Joakim Sundnes	Post.doc.
Tom Thorvaldsen	PhD Student
Yota Tsompanopoulou	Post.doc.
Åsmund Ødegård	Scientific Programmer

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Gunnar J. Carelius	Senior Engineer
Reidar Conradi	Visiting Professor
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Ragnfrid S. Sjøberg	Data Manager
Marek Vokác	PhD Student

The Department of Innovation

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Øyvind Hjelle	Visiting Research Scientist
Thomas Sevaldrud	Scientific Programmer

[simula . research laboratory]

Simula Research Laboratory (Simula) conducts basic research in selected areas within information and communication technology. The main objectives of Simula are to conduct high quality research, educate graduate university students and support the establishment of businesses based on the research it conducts. Hence, all research projects are designed with a potential for application.

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