NTNU / IDI’s
Software Engineering Group (SU)

Student recruitment meeting, NTNU,
Friday 29. Sept. 2000

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Gruppe for Systemutvikling (SU)

Dept. of Computer and Information Science (IDI)
NTNU

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SU motivation

- Software essential in many important societal activities. 50-60,000 system developers in Norway – many without formal SW education. Still many challenges wrt. software quality and delivery on time and budget; cf. [US Standish report, 1995], cited in [PITAC, 1999], on projects for tailored software:
  - 31% stopped before finish, 81 bill. $ loss/year (1% of GNP!)
  - 53% have serious overruns (189% average), 59 bill. $/year

- Some challenges:
  - Web-systems: Manage time-to-market (TTM) vs. reliability?
  - How do software systems evolve over time, cf. Y2K?
  - What is empirically known about SW products and processes?
  - How can small companies carry out systematic improvement?
  - How to perform valid sw.eng. research in a university
    -- by student projects and having industry serving as a lab?

About IDI

- Roots back to 1969
- Last merged in 1997 to combine engineering and “free univ.” studies in computer science/informatics
- Per 2000: 5% of NTNU resources, 12% of student load -- and 18% in 2004!
- Over 200 siv.ing. per year in 2004.
- Need 8 new teachers per year!
- Need 25 new PhD students per year -- you?
About IDI, future (2)

- => 100 PhD students (now 40)
- => Over 1000 siv.ing. students
- => 70 teachers! (doubling), 10 researchers!
- Active interplay with industry (Telenor …)
- Active interplay with other national partners (UiO, SFF-Fornebu, SINTEF, …)
- Active international contacts: e.g. SU group will have 5 guest researchers this Autumn
- New space from 2001: Gløs & Lade together

Software Engineering Group (SU)

- **Four teachers:**
  - prof. Reidar Conradi
  - prof. Tor Stålhane
  - Assoc. prof. M. Letizia Jaccheri
  - Assoc. prof. (20%) Stig F. Mjølsnes (HiS)

- **Four PhD students:**
  - Roxana E. Diaconescu (CSE proj.)
  - Torgeir Dingsøyr (SPIQ/PROFIT)
  - Tore Dybå (SPIQ/PROFIT), at SINTEF
  - Alf Inge Wang (CAGIS)

- Have educated **13 PhDs** over past 10 years
SU: Scientific Profile

- Software quality (reliability, safety, usability), software process improvement
- Component-based development, reuse, OO
- Web-based development: agents, XML, …
- Process modelling
- Versioning and configuration management
- Empirical studies, experience bases
- Software engineering education

Courses of SU group

- Programming (Mjølsnes), 1st year
- System development (Conradi, Sindre), 2nd
- Programming languages (?), 3rd
- Programming project (Conradi), 4th
- Experts in Team, project (Conradi), 4th
- Software Architecture (Jaccheri), 4th
- SW quality and process impr. (Stålhane), 4-5
- 3 PhD courses (Jaccheri, Conradi)
CAGIS: Cooperating Agents in the Global Information Space

- NFR basic R&D, 1997-2003. 4+1 PhD students, one researcher. 5 IDI groups
- Distributed agents and processes, A.I Wang
- Cooperating transactions, H. Ramampiaro
- Document classification, T. Brasethvik
- Computer-assisted learning, E. Prasolova
- Intelligent agents (IDI), Sobah A. Petersen

CSE project

- NTNU “Strategic University Program in Computation Science and Engineering”.
- CSE stands for those activities in science and engineering where numerical analysis on a computer is important.
- Objective: to improve the level of competence in using numerical mathematics and computer science in engineering.
CSE project (2)

- 9 Ph.D. positions:
  - Dept. of Mathematical Sciences: 3 positions
  - Dept. of Computer Science, IDI: 2 positions
    - Roxana Elena Diaconescu, OO modelling (Conradi)
    - Zoran Constantinescu, visualization (Blake)
  - Dept. of Marine Hydrodynamics: 2 positions
  - Dept. of structural engineering: 2 positions
- NTNU - responsible for one out of three super-computing projects in Norway -- a CRAY T3E, CRAY J90 etc. -- used in CSE.

SPIQ/PROFIT: better software quality for Norwegian IT industry

- NFR industrial R&D project. Jointly with Univ. Oslo and SINTEF in 1997-99, 2000-02. 3 PhD students, 4-6 researchers. 10 active companies.
- Lead by Bravida Geomatikk (Telenor), attn/Tor Ulsund.
- How to help smaller companies to improve? Need insight from organizational sciences!
- Pilot projects in companies, over 20 such.
- Empirical studies, experience bases
- Method book (in Norwegian)
SPIQ/PROFIT (2): PhD students etc.

- Torgeir Dingsøyr, NTNU: experience bases, doing field studies in pilot project at Computas, at Univ. Kaiserslautern in Spring 2001
- Tore Dybå, NTNU: success factor for successful software process improvement, large gapult toward Norwegian IT industry, consulting in many pilot projects towards industry
- Erik Arisholm, UiO: incremental sw development
- Coworkers: Nils Brede Mo, Tor Stålhane and Tore Dybå, SINTEF; Dag Sjøberg, UiO; and others

NAWUS: teaching network in software engineering education

- Web portal with shared educational material: lecture notes, exercises, project descriptions, repeatable experiments.
- Bias towards Ian Sommerville’s book?
- A dozen cooperating colleagues in universities and colleges
SFF-Fornebu: Center of Excellence in Software Engineering (Senter for Fremragende Forskning)

- Proposed by Ifi/UiO (Dag Sjøberg) and IDI/NTNU (Reidar Conradi), July 1999
- Accepted part of SFF-Fornebu, Sept. 2000
- Decentralized: Fornebu, Oslo, Trondheim
- Budget of 16 mill. NOK per year (?).
- 25 teachers, researchers & PhD students; 30-40 MSc students.

SFF and cooperating partners (2)

- SINTEF
- DnV, Telenor, ...
- …> 20 Norw. Compan., partly in PROFIT
- Int’l contacts
- ISERN network
- Other projects
- NTNU T.heim

Presentation of NTNU/IDI’s Software Engineering Group, 29 Sept 2000
Six themes:

<table>
<thead>
<tr>
<th>Theme</th>
<th>Responsible(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object-oriented development and maintenance</td>
<td>D. Sjøberg</td>
</tr>
<tr>
<td>Incremental and component-based development</td>
<td>R. Conradi, D. Sjøberg</td>
</tr>
<tr>
<td>Methods to achieve quality of Web-based, distributed systems</td>
<td>L. Jaccheri</td>
</tr>
<tr>
<td>Estimation, planning and risk evaluation of software projects</td>
<td>M. Jørgensen</td>
</tr>
<tr>
<td>General software process improvement and quality work</td>
<td>R. Conradi, T. Skramstad</td>
</tr>
<tr>
<td>Empirical software engineering</td>
<td>M. Jørgensen, T. Stålhane</td>
</tr>
</tbody>
</table>

Research method: Model construction and subsequent validation in industry, among students and through international cooperation.

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SFF: Industry is our lab! (4)

- Both IDI, NTNU and Ifi, UiO has had an industrial focus over some time. We expect that SFF-Fornebu will offer even better possibilities for industrial cooperation.
- Since 1993 we have published the following published papers, 1/3 based on industrial cooperation:

<table>
<thead>
<tr>
<th>Institution</th>
<th>Total number of papers</th>
<th>Papers with int’l colleagues</th>
<th>Papers with nat’l/industrial colleagues</th>
</tr>
</thead>
<tbody>
<tr>
<td>NTNU</td>
<td>150</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>UiO</td>
<td>60</td>
<td>17</td>
<td>13</td>
</tr>
</tbody>
</table>
### SFF: Published papers so far in 2000, based on industrial cooperation (5)

<table>
<thead>
<tr>
<th>Paper Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Predicting capability of experience software maintainers&quot;</td>
<td>M.T. Breivik and E. K. Salvesen</td>
</tr>
<tr>
<td>&quot;Human judgement in effort estimation of software projects&quot;</td>
<td>Bug, Borrøe, or Seid Multi-Disciplinary Workshop at International Conference on Software Engineering (ICSE 2000), June 5, 2000, Lisbon, Ireland</td>
</tr>
<tr>
<td>&quot;Understanding Use Case Models&quot;</td>
<td>Bug, Borrøe, at Seid Multi-Disciplinary Workshop at International Conference on Software Engineering (ICSE 2000), June 5, 2000, Lisbon, Ireland</td>
</tr>
</tbody>
</table>

### GREC - Project plan and risk analysis

- **Resident A:** M. Jørgensen, G. Kirkbøen, D. Sjøberg, B. Anda, L. Brathall: "Human judgement in effort estimation of software projects" |
- **Resident B:** Bug, Borrøe, or Seid Multi-Disciplinary Workshop at International Conference on Software Engineering (ICSE 2000), June 5, 2000, Lisbon, Ireland |
- **Resident C:** Bug, Borrøe, at Seid Multi-Disciplinary Workshop at International Conference on Software Engineering (ICSE 2000), June 5, 2000, Lisbon, Ireland |

### NTNU/IDI - International cooperating partners, with some candidates for guest researchers/adjoint teachers (6)

1. **Professor Chunnuan Liu, d.ring. (NTH 1983), Beijing Polytechnic University, PBR China** - Area: software engineering, process support, distributed systems.
2. **Professor Alfonso Fuggetta, Politecnico di Milano, Italy** - Area: software engineering, software architecture, feature engineering, middleware.
4. **Professor dr. Hans-Dieter Rombach, Univ. Kaiserslautern and Fraunhofer Inst. for Experimental Software Engineering (IESE), dir. at IESE. IESE areas: SPI and software quality, reuse, component-based SW eng., metrics, empirical studies, experience bases.
5. **Prof. dr.s.r.s Victor R. Basili and Marvin Zelkowitz, Univ. of Maryland** - Area: persistent programming, language design, (distributed) information systems, software engineering.
6. **Associate Professor Lionel C. Briand, Ph.D. (Paris, France)** - Area: software engineering, Web application development, software tools, design methods.
7. **Professor Ray Weall, Head of Computing Science Department, University of Glasgow** - Area: software engineering, project planning and risk analysis, Technology evaluation, experimental SW engineering.
8. **Professor Malcolm Atkinson, University of Glasgow** - Area: Persistent programming, language design, (distributed) information systems, software engineering.

Presentation of NTNU/IDI’s Software Engineering Group, 29 Sept 2000
INCO: Incremental and Component-Based Development

- Newly accepted NFR basic R&D project, 2001-2004. UiO and NTNU. 3 PhDs and one postdoc.
- Need a revolution in project models -- waterfall is dead, “internet” time, extend RUP and similar models. Rqmts => design: a negotiation!
- Component-based development, using Components-Off-The-Shelf (COTS) -- but how to manage the risks?
- Empirical studies towards Norwegian IT industry

MOWAHS: Mobile Work Across Heterogeneous Systems

- Newly accepted NFR basic R&D project, 2001-2004. SU and DB group. 2 PhDs and one postdoc.
- Software infrastructure for mobile agents that can move across fixed and portable PCs, PDAs etc.
- Novel transaction models to regulate access and updates to partly shared data.
- Try out for software engineering and teaching
- Internationalization, Telenor cooperation
WebSys: Web-based systems -- Time-to-market vs. Reliability

- Sought NFR competence R&D project, 2001-2004. IDI, SINTEF and UiO. 3PhDs, one postdoc, and one part-time researcher. Three cooperating companies, incl. Mogul and Consult IT.
- Models for trade-off of “sooner” vs. “correct” Web-based systems. Market is God!
- Empirical studies in cooperating companies.
- Improve industrial technologies and processes.
- Strong international component.

Internal PhD fellowships in SU group:
two in applied software engineering, two in free topics

- Two PhD project fellowships in applied software engineering: Empirical methods and studies against Norwegian IT industry, e.g. on Web-based systems.
  - Deadline ultimo Oct. 2000. Contact Reidar Conradi,
- One PhD univ. fellowship, perhaps on safety.
  - Deadline ultimo Oct. 2000. Contact Tor Stålhane
- One PhD univ. fellowship. general.
Teachers: prof. Reidar Conradi

- Born in Oslo, 1946
- MSc (1970) and PhD (1976) from NTNU
- At SINTEF 1972-75, at NTNU later
- Interests: software quality and process improvement, OO/reuse, distributed systems, versioning.
  Also: politics, jazz, skiing, swimming, ...
- Projects: most in SU group

Teachers (2): prof. Tor Stålhane

- Born in Skien, 1944
- MSc (1970) and PhD (1988) from NTNU
- At SINTEF 1970-2000, prof.II at HIS since 1997, at NTNU from 1.10.00
- Interests: software quality (especially safety and reliability), process improvement, industrial development, data analysis (statistics) and empirical methods
- Projects: SPIQ/PROFIT, WebSys
Teachers (3): assoc.prof. M. Letizia Jaccheri

- Born in Pisa, 1965
- Politecnico di Torino 1991-97, NTNU since 1997
- Interests: software quality, process improvement, software architecture, distributed systems, software engineering education
- Projects: various projects, SFF-Fornebu?

Teachers (4): assoc.prof. (20%) Stig Frode Mjølsnes

- Born in Stavanger, 1956
- MSc (1980) and PhD (1990) from NTNU
- Interests: distributed and mobile systems, digital cryptography and smart cards, location awareness, decentralized cooperation, programming for kids.
- Projects: many SINTEF projects
PhD students (1): Roxana E. Diaconescu

- Born in Romania, 1974
- Topic of thesis: Find appropriate numerical approaches and SW in less human time and effort.
  - Embbody knowledge in a “reusable” framework (design and tailoring principles, reusing OO libraries)
  - Use parallel computing to achieve better cost / efficiency -- by segmentation on Linux PC-clusters?

PhD students (2): Torgeir Dingsøyr

- Born in Søgne, 1974?
- MSc (1998) NTNU, PhD student from Feb. 1998
- Interests: software process improvement, knowledge management, experience databases, organizational learning.
  Also journalism, student organizations
- Projects: SPIQ/PROFIT projects
PhD students (3): Tore Dybå

- Born in Oslo, 1961
- MSc (1986) NTNU, PhD student from July 1997
- Interests: software quality, process improvement, organizational change, organizational learning, qualitative and quantitative methods
- Projects: SPIQ/PROFIT projects, many at SINTEF

PhD students (4): Alf Inge Wang

- Born in Levanger, 1970
- Interests: distributed software architectures, agents/XML, configuration management, process modelling. Also music, and family life
- Projects: EU projects, CAGIS projects
Ex-PhD student: Bjørn P. Munch

- Born in Oslo, 1964
- Interests: robust databases, software quality, distributed software architectures, configuration management
- Projects: EPOS and other projects

Life as a PhD student (1)

- Ltr. 37: 265,000 kr per year, up to 20% more from external or other projects
- Four years: three for dr. studies, one for teaching
- Assists in courses and supervises MSc students

Contributes to value chain:
  - jr. student - sr. student - PhD student - teacher

I.e. research-based education

- Ca. 3 travels to conferences per year, 6-8 months foreign stay during study (UK, USA, Germany)
- PhD study: a researcher education, both narrow and broad
Life as a PhD student (2)

- Exciting and relevant research topics
- Very motivated and international environment.
  Cooperative work in dynamic project groups.
  Soon a larger research group: Gløs and Lade
- Strong couplings to Norwegian industry.
  Cooperation with SINTEF and UiO
- Your PhD is valued after the study,
  in any computer science field (high-tech).
  Ex. FAST and Clustra: 50% of IDI’s PhDs since 1995 -- cannot “afford” more such companies (!)
- **Have fun and WELCOME!!**