

Real-Time Courses Questionnaire

Dear RT-graduate student and supervisors and others.

ARTES is supporting graduate courses with participants from more than one ARTES-node. The number of Real-Time graduate students have increased a lot the last year and this year. The effect of ARTES has been a substantial increase in the number of RT PhD students in Sweden. There is therefore an increased demand for good courses and possibilities to coordinate the PhD education with larger classes.

ARTES is concerned about the situation and want to make an effort to support the students. One step in this direction has been to make an inventory of the present and planned course that connect to the real-time area. In the May 2000 was a questionnaire sent to all ARTES RealTime-graduate students (see below). However, since descriptions of courses were not complete and since only a fraction of the RT graduate students have indicated their interest, the ARTES board has decided to collect additional information before deciding on courses to support.

ARTES need this information no later than 2000-11-06 to prepare it for the board meeting 00-11-08.

Please forward this questionnaire to any new graduate student that might be interested.

QUESTIONS

	YES	NO	4. WHICH COURSES ON THE LIST BELOW WOULD YOU LIKE TO TAKE ? PLEASE USE THESE PRIORITIES 0=NOT INTERESTED 1=INTERESTING COURSE BUT I CAN NOT PARTICIPATE 2=INTERESTING COURSE I WILL MOST LIKELY TAKE IT 3=I HAVE PLANNED TO TAKE THIS COURSE
1. Are you an ARTES Real-Time graduate student (If not may be you should applysee: http://www.artes.uu.se/gradschool/)			
2. HOW MANY CREDITS WILL YOU TAKE DURING YOUR STUDIES ?			
3. HOW MANY CREDITS REMAIN UNPLANNED TODAY ?			

Course name	Credits	Time	Place	Priority			
				3	2	1	0
Parallel and Distributed Real-Time Systems	4 (+2)	Jan - Mar 2001	Chalmers				
Real Time Communication	4	Spring 2001 (March-May)	Halmstad				
Computer Clusters for Large Real-Time Systems	3	Spring 2001 (or later)	Ronneby				
Real-time computer control systems	5	Jan 19, 2001	Stockholm				
NEW: Models and modelling to support the Design of Embedded Real-time systems; specifically the Unified Modeling Language	5	Under development	Stockholm				
NEW: Real-time operating systems	3	Spring 2001, 2 nd period.	Linköping				
NEW: Advances in real-time systems	3-4	Spring 2001, April-June	Linköping				
NEW: Real-time databases	3	Spring year 2001	Linköping				
NEW: Formal methods for real-time computing	3	Autumn 2001/A 2002	Linköping				
Hardware/Software codesign	4	2001	Linköping				
Design of embedded real-time systems	4	Spring/Autumn 2001?	Linköping				
NEW: Implementation and Scheduling of Real-Time Control Systems	3-5	spring 2001 or 2002	Lund				
NEW: Object-Oriented Real-Time Programming	4	spring 2001/2002	Lund				
Formalisms, Algorithms and Tools in Formal Methods for Real-Time	5	Spring or Autumn in 2001	Västerås				
Component-based Software Engineering	5	Autumn 2001, Q4	Västerås				
NEW: Principles of Formal Methods for Distributed and Real-time Systems	?	?	Uppsala				

This page and the results will be available via
<http://www.artes.uu.se/gradschool/>

Artes also welcomes new ideas in this area. Just send an e-mail to artes@docs.uu.se with your idea.

Send to:

ARTES

Institutionen för informationsteknologi

Box 325

751 05 Uppsala

Fax: 018 55 02 25

e-mail: artes@docs.uu.se

Please answer before 2000-11-06

Course name:

Parallel and Distributed Real-Time Systems

Credit points:

4 credit points (plus 2 optional project points)

Applicant:

Assistant professor Jan Jonsson
Department of Computer Engineering
Chalmers University of Technology

Email: janjo@ce.chalmers.se

URL: <http://www.ce.chalmers.se/~janjo>

Course Description:

Real-time systems play a vital role in many application domains including drive-by-wire automotive systems, intelligent traffic control systems, banking systems, and autonomous robots. For many real-time applications, the system must be designed with multiple processors in order to meet imposed application constraints. Such situations can occur when tasks need to be physically distributed (as in a fault-tolerant vehicle braking system) or when the inherent parallelism of the application need to be fully exploited (as in a high-performance multimedia application). This course is intended to give a deeper understanding of the problems involved in designing real-time systems based on multiprocessor architectures.

The course is organized as a series of seminars constituting 28 lecture hours in total.

In addition, there will be three homework assignments on the specific topics covered during the seminars. The course material is examined by means of a written exam.

An optional term project (offering an extra two credit points) can give a deeper understanding in a specific area of real-time computing.

Contents:

Application constraints, design methods and performance measures; complexity theory and NP-completeness in the context of real-time scheduling; single- and multiprocessor real-time scheduling: problems and algorithms; real-time communication: protocols and end-to-end delay guarantees; fault-tolerance techniques for real-time systems; distributed clock synchronization; estimation of program run times.

Literature:

C. M. Krishna and Kang G. Shin, "Real-Time Systems", McGraw-Hill, 1997, ISBN 0-07-114243-6 (paperback)

Research articles from archival journals and conference proceedings

Lecture notes

Prerequisite:

A healthy interest in the theoretical aspects of real-time computing. Preparatory courses in real-time systems, algorithmics, operating systems and computer architecture are desirable but not a requirement.

Period during which the course will be given:

Spring 2001 (end of January to end of March)

Measures taken to facilitate external participation:

At an introductory meeting (at Chalmers or via email) a schedule will be decided upon where the requirements from external participants will be accounted for. Based on the needs by the students, the seminars can therefore be organized as 14 two-hour lectures or as a couple of two-day intensive lecturing sessions.

The administration of the homework assignments will be done electronically (email or web) to facilitate external participation.

The final exam can be arranged to be held at the local university/industry.

Funding required:

To cover the salaries of lecturer and course assistant, and also to cover the expenses for invited speakers, a support of 50 kSEK are asked for.

Course plan/schedule:

Can be found on the course home page

<http://www.ce.chalmers.se/postgraduate/pdrts/>

Course name: **Real-time communication**

Credit (Points): 4

Applicant(s) including affiliation

Magnus Jonsson, Ph.D., Associate Professor

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Mobile: +46 70 4838566

Email: Magnus.Jonsson@ide.hh.se

Brief description of course

The goal of the course is to give knowledge of terminology, concepts, standardized protocols, and research in the field of real-time communication. The course is based on seminars where, for each seminar, all attendees read paper(s) which are handed out by the teacher. In addition, for each seminar, one attendee penetrates the selected subject further and leads the seminar. Each participant prepares and leads two seminars and attends and reads the papers handed out for 10-12 seminars, including the two own. The exact rules will be given at course start to adapt for the number of participants.

Prerequisite

Undergraduate course in data communication. Basic knowledge of real-time systems.

Period during which the course will be given

March to May 2001.

Measures taken to facilitate external participation

In the event of external participation, several seminars can be concentrated to the same day to reduce travel overhead.

Funding required (i.e.

50 000 SEK.

Course plan/schedule

- Lecture: Introduction, similarities and dissimilarities with process scheduling, static and dynamic communication mapping, refreshment of data communication terminology, system and application examples
- Seminar: traffic models, performance analysis etc.
- Seminar: local area networks (LANs) and medium access methods: bus networks
- Seminar: local area networks and medium access methods: ring networks
- Seminar: switched networks in LANs and parallel/distributed computers
- Seminar: packet-switching, WAN, admission control etc.
- Seminar: Internet: RSVP, real-time transport protocols etc.
- Seminar: wireless real-time communication
- Seminar: fault-tolerant communication
- Seminar: industrial communication and field buses
- Seminar: clock synchronization
- Seminar: selected research projects (in addition to already covered research projects)

The seminar list will be updated at course start to adapt for the number of participants.

Introduction to the course

Computer Clusters for Large Real-Time Systems

3 study points

Lars Lundberg
Department of Software Engineering and Computer Science
University of Karlskrona/Ronneby
S-372 25 Ronneby, Sweden

Email: Lars.Lundberg@ipd.hk-r.se, Phone: +46-457-385833

1. Aim and Scope

The aim of this course is to provide the student with knowledge of cluster systems, including clusters as inexpensive and scaleable high performance computer platforms, and clusters as reliable computer platforms that provide high availability.

2. The Structure of the Course

The course consists of the following parts:

- Definition of and motivation for clusters
- Cluster hardware
- Cluster software
- System aspects on clusters

These parts correspond to the parts in Pfister's book (see below).

3. Course Material

3.1 Literature

We are going to use two books:

- Gregory F. Pfister, "In search of Clusters", Prentice Hall, ISBN 0-13-899709-8 (main book).
- Raykumar Buyya, "High Performance Cluster Computing, Vol. 1", Prentice hall, ISBN 013-013784-7.

3.2 Material on the Web

There is a web-page for the course on: <http://www.ide.hk-r.se/~lasse/courses/cluster-course.html>.

On this page there is a link to a small news-based electronic conference system for the course. The direct address to this conference system is <http://distans.ide.hk-r.se/cluster>.

A lot of the material will be in the form of PowerPoint presentations. We are planning to include sound in some of the presentations, and in order to listen to this you will (obviously) need some kind of speakers or a headset.

3.3 Meetings

We are planning for four to five meetings; each meeting will be two to three hours. Since some will obviously find it hard to travel to Ronneby, we will probably have to use teleconference studios. We will also offer the possibility to "meet" via NetMeeting. In order to use the voice capabilities in NetMeeting, you will need a microphone and speakers (or a headset). NetMeeting sessions will be planned on an individual basis. We will try to minimize the number of meetings in the course and instead use electronic conference systems.

4. Expected Background

The course is targeted to graduate students in Computer Systems Engineering (or similar). I expect a general background in computer architecture, and some basic skills in the C programming language and the Linux (Unix) operating system.

5. Examination

The examination of the course consists of three parts:

- A laboratory exercise (Beowolf)
- A report on a cluster system or on a cluster -related topic
- A small test (we will see if we need to have this or not).

6. Time Plan and Registration

The course starts in early February 2000 and it ends in April 2000. You will need exclusive access to a small cluster in Ronneby in order to do the laboratory exercises (you will be able to work remotely). At the start of the course we will therefore have to make a schedule for the labs.

You register for the course by sending an email to: Lars.Lundberg@ipd.hk-r.se

Include your name, address, email-address, phone- and fax-numbers in your registration mail.

Deadline for registration is January 21, 2000.

When you register for the course you need to indicate if you plan to come to Ronneby for the meetings or if you plan to attend via a teleconference studio (it would be nice if you could come to Ronneby at least for the first meeting). If you plan to use a teleconference studio we need to know which studio you plan to use. Our experience from teleconferencing is that it is often difficult to have a high quality conference with more than two nodes. Our plan is therefore to have separate meetings with each remote node. This will limit the number of remote nodes that we can handle, and you may therefore be requested to coordinate your meetings with other students living reasonably close to you.

We plan to have the first meeting sometime during week 6 of year 2000 (February 7 to February 11). Indicate if you prefer any particular day in that week.

You also need to indicate if you prefer English or Swedish during the meetings (these are the only two options ☺). All course material will be in English.

Course name:

Real-time computer control systems

Credits: Five

Applicant(s): Martin Törngren (PhD, Associate Professor), Ola Redell (Tekn. lic.), Martin Sanfridson (Tekn. Lic).

Brief description of course:

The overall theme of the course is the design of real-time computer control systems. Many parts of the course are generally applicable to such systems; the emphasis is in providing an introductory perspective, and most of the examples, however, are taken from the area of embedded control systems as present in vehicles, robotics, spacecraft and the like.

The main aim of the course is to provide

- (1) basic terminology and orientation regarding both state of the art research and industrial practice
- (2) a perspective to trends and challenges affecting the design of embedded computer control systems
- (3) a link between theory and practice in all the parts of the course
- (4) insight into the relation between the behavior (performance and stability) of closed loop control systems with respect to the computer system implementation. Understanding these relations, i.e. the requirements on the computer systems, has several implications on design that will be treated in the course.
- (5) a "guideline" for the implementation of control systems regarding architectural design issues and trade-offs.
- (6) a number of case studies, taken from industrial embedded systems, as well as from state of the art research architectures.

The course is intended for PhD. students and real-time practitioners in industry.

The course is structured into four main parts: introduction and perspective (throughout the course), timing problems (along with papers and study questions), architectural design (along with papers and study questions), and a design task.

Prerequisite:

A Master of Science in engineering, or similar background is required. Basic knowledge of computer systems, their programming and control theory is required. Knowledge/experiences in computer architecture, microcomputers/microcontroller systems, control applications, and computer communication is strongly recommended.

Period during which the course will be given:

The course starting date is Friday, January 19 at KTH. The course is scheduled from January until early April, 2001; Lecture 1-2 (January), Lecture 3-4 (Feb.), Lectures 5-6 (March), Presentation of design task

(April).

Measures taken to facilitate external participation:

The course lectures comprise seven intensive days at KTH. The exact schedule will be determined on the first day of the course to suit the participants. Each day at KTH will be timed to allow for early morning arrivals (e.g. starting at 10 o'clock if required) and afternoon returns. If required, some of the intensive days can be grouped. The exercises, reading work, and the design task carried out by each participant can be carried out anywhere by the attendants between the intensive days.

Funding required:

50kSEK + additional funding for invited lecturer from CMU.

50kSEK corresponds to approx. 3weeks of preparatory work + course/lab/and exercise material.

Tentatively, Mario Barbacci will be invited to give a one day seminar on the CMU developed architectural design method. This will be organized as an open seminar.

Course plan/schedule: <http://www.md.kth.se/~martin/RTCC.html>

Best regards

Martin Törngren

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<http://www.md.kth.se/~martin>

Models and modelling to support the Design of Embedded Real-time systems; specifically the Unified Modeling Language

Credits: 5

Vi har utvecklat/genomfört denna kurs under våren som en internkurs. Genomförandet av denna kurs hänger mer på intresset från ARTES-doktorander eftersom vi just kört den här.

00-10-23

Vi har inte resurser att genomföra denna kurs under den kommande terminen. (vt2001)

Martin Törngren

Stockholm

<http://www.md.kth.se/~martin/>

Date: Thu, 19 Oct 2000 14:38:36 +0200
From: Jörgen Hansson <jorha@ida.liu.se>
Organization: Department of Computer Science, Linköping University, Sweden
To: Hans Hansson <han@idt.mdh.se>
Subject: ARTES course development application

Hej Hans,

Nedan finns en pdf-fil som innehåller tre ansökningar. Jag kan tänka mig att ge två kurser som mest (om det är intressant), men vilka två kan vi ju alltid diskutera i så fall.

I ansökningarna angav jag 50 KSEK, mest för att det verkade ha varit en standardsumma ni har haft tidigare. Jag har faktiskt inte hunnit räkna i detalj, men den kan väl möjligen stämma grovt.

Hälsningar,

--jörgen

ARTES Application for doctoral course development:
Real-Time Operating Systems, 3 credits

Jörgen Hansson
Real-Time Systems Laboratory
Department of Computer Science, Linköping University
URL: <http://www.ida.liu.se/~jorha>
Email: jorha@ida.liu.se

Course name

Real-Time Operating Systems, 3 credits

Prerequisites

Undergraduate course in the area of operating systems, real-time systems and preferably distributed system.

Schedule

Spring year 2001, 2nd period.

Course format

The format of the course is a seminar course, given in a crash course format. Hence, the course will be given in as three two-day seminars (i.e., 6 six days). The condensed format of the course will facilitate external participation. In addition, we plan to have exercises that can be performed remotely.

Participants are expected to actively participate in discussions and present papers during the course.

Funding required

This is a new course and will be developed during early spring 2001. Expected budget is 50 KSEK, covering salary costs for the applicant when giving and developing the course, and material costs (not text books for students though).

Course plan

This is a course on advanced issues in operating systems, high-lighting the state-of-the-art in the area. The course is about theoretical and practical aspects and requirements of operating systems that are to be used in real-time and embedded computing systems. The theoretical part will cover required/desirable time-cognizant mechanisms. In particular, the course will focus on the following: fault-tolerance support at the operating system level; distributed operating systems mechanisms: migration protocols and distributed scheduling/allocation protocols; resource management and process synchronization; and thread support (possibly).

The course will also study the state-of-the-art with respect to commercial real-time operating systems and their research counterparts. Similarly, we will distinguish general-purpose operating systems (e.g., Windows NT, Solaris, and HP-UX) vs application specific operating systems (e.g., VxWorks, OS/2, and EPOC).

Literature

Literature will be selected research papers (we are currently looking for an advanced textbook, but we have not yet found an appropriate one)

ARTES Application for doctoral course development:
Advances in Real-Time Systems, 3-4 credits

Jörgen Hansson
Real-Time Systems Laboratory
Department of Computer Science, Linköping University
URL: <http://www.ida.liu.se/~jorha>
Email: jorha@ida.liu.se

Course name

Advances in Real-Time Systems, 3 credits

Prerequisites

Undergraduate course in the area of real-time systems and operating systems.

Schedule

Spring year 2001, April-June.

Course format

The format of the course is a seminar course, given in a crash course format. Hence, the course will be given in as three 2-3-day seminars (i.e., 6-9 six days). The condensed format of the course will facilitate external participation. In addition, we plan to have exercises that can be performed remotely.

Participants are expected to actively participate in discussions and present papers during the course.

Funding required

This is a new course and will be developed during early spring 2001. Expected budget is 50 KSEK, covering salary costs for the applicant when giving and developing the course, and material costs (not text books for students though).

Course plan

This course should be seen as a general real-time course for students that have studies real-time during undergrad studies but wants to go one step further in some of the core areas of real-time computing. Topics that will be addressed are:
Synchronization: more sophisticated synchronization protocols such as dynamic priority ceiling protocol; stack resource protocol;
Scheduling: advances in the area of EDF scheduling, making EDF more flexible (precedence constraints, multiple resources etc); imprecise computation scheduling; trade-off scheduling (e.g., predictability vs security vs fault-tolerance), value-driven scheduling.
Communication: deterministic CSMA/CD protocols; process grouping protocols; wireless communication protocols appropriate for RT environments.
Threads

We are willing to discuss the choice of topics with other ARTES nodes and the students if there is something in particular that should be included.

Literature

- (i) Research papers
- (ii) C.M. Krishna's and K. Shin's book "Real-time systems", McGraw-Hill (or similar)
- (iii) Buttazzo's book, "Hard Real-Time Computing Systems", Kluwer Academic Press, or alternativel Stankovic et al.'s book "Deadline Scheduling for Real-Time Systems".

ARTES Application for doctoral course development:
Real-Time Databases, 3 credits

Jörgen Hansson
Real-Time Systems Laboratory
Department of Computer Science, Linköping University
URL: <http://www.ida.liu.se/~jorha>
Email: jorha@ida.liu.se

Course name

Real-Time Databases, 3 credits

Prerequisites

Undergraduate course in the area of real-time systems and database systems. Operating systems is also preferred but not necessary.

Schedule

Spring year 2001 (can be given in both periods)

Course format

The format of the course is a seminar course, given in a crash course format. Hence, the course will be given in as three 2-day seminars (i.e., 6-six days). The condensed format of the course will facilitate external participation. In addition, we plan to have exercises that can be performed remotely.

Participants are expected to actively participate in discussions and present papers during the course.

Funding required

This is a new course and will be developed during early spring 2001. Expected budget is 50 KSEK, covering salary costs for the applicant when giving and developing the course, and material costs (not text books for students though).

Course plan

This course will show how efficient data storing of data can be performed in a real-time computing environment. The course will present the research challenges and solutions to the real-time database systems. In particular, the course will include the following:
Concurrency control protocols: Optimistic and pessimistic concurrency control protocols, protocols with alternative models of consistency, e.g., similarity and semantic-based models.

Transaction models: Definition of the concept of transaction, and the characteristics of transactions.

Scheduling models appropriate for transactions

Buffer management

Logging and Recovery management

State-of-the-art of the research and commercial platforms

Literature

- (i) Research papers
- (ii) possibly the forth-coming book edited by Kuo and Lam, to be published in December 2000.

Hardware/Software Co-Design

Linköping

Goals:

To present techniques for the concurrent design, or co-design, of hardware and software. Special emphasis will be placed upon methods and tools used for the development of embedded systems which are dedicated to specific applications and consist of tightly coupled hardware and software components.

Organization:

The course has two parts. The first part deals with the theory and methods of hardware/software co-design and consists of lectures given by the teachers and invited lecturer. In the second part, the students will be involved in case studies in a selected topic.

Contents and seminar topics:

- Design of embedded and real-time systems;
- Hardware/software co-specification;
- System modeling;
- Architecture selection;
- Application-specific instruction set processors;
- Embedded signal processing systems;
- Embedded and real-time control systems;
- Hardware/software partitioning;
- Co-synthesis and code-generation techniques;
- Interface analysis and synthesis;
- Co-simulation and co-verification;
- Emulation and prototyping;
- Survey of co-design research;
- Case studies.

Literature:

G De Micheli and M. Sami: "Hardware/Software Co-Design", and selected research papers.

Schedule: 2001

Examination: Term paper and seminar presentation.

Credits: 4 points.

Teacher: Zebo Peng and invited lecturers.

Web:

<http://www.ida.liu.se/~zebpe/codesign/>



The Department of Computer and Information Science at Linnaeus University

Design of Embedded Real-Time Systems

Lectures:

20 h

Recommended for

PhD students in computer science and computer systems. ECSEL students.

The course was last given:

New course

Goals

To give the students a broad view of the issues and techniques related to the design of embedded real-time systems.

Prerequisites

Basic knowledge in computer architecture and software engineering.

Organization

Lectures by the teachers and invited lecturers and case studies carried out by the PhD students.

Contents

Embedded real-time systems and their applications.
Heterogeneous systems.
Scheduling and resource management.
System specification and languages.
Modeling techniques.
Formal methods.
Design flow and design methodology.
Hardware/software co-design.
System verification.
Timing analysis and estimation.

Literature

Selected papers.
Lecture notes.

Teachers

Petru Eles, Simin Nadjm-Tehrani and Zebo Peng.

Examiner

Zebo Peng.

Schedule

Oct - Dec 1999.

Examination

Case study or individual project.

Credit

4 credits

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URL: <http://www.ida.liu.se/education/grad/courses/descriptions/1999/autumn/FDAA06.en.shtml>

Implementation and Scheduling of Real-Time Control Systems

An ARTES course proposal

Karl-Erik Årzén

Department of Automatic Control
Lund Institute of Technology

Credits: 3-5 depending on size of projects

Objectives The aim of the course is to present how real-time control systems are implemented and scheduled. The course covers both continuous-time and discrete-time control systems. The course is partly based on the tutorial given at the 1998 ARTES summer school.

Issues covered by the course are:

- overview of sampled control theory
- discretization continuous-time designs
- implementation issues
 - filtering
 - actuator saturations
 - switching and mode handling
 - word-length limitations
- implementation of controllers using real-time kernels
- scheduling of periodic controller tasks
- interprocess communication patterns
- discrete event-based controllers
- Grafcet and Statecharts
- state machines as a structuring mechanisms
- supervisory control theory
- industrial control languages, IEC 1131-3
- scheduling and control co-design
- feedback scheduling
- scheduling and control co-simulation

Schedule The course can be given during Spring 2001 or Spring 2002. The format of the course is two full four-day periods in Lund separated by some weeks. The course consists of lectures, laboratory exercises, and a project.

Material The course is based on the book “Real-Time Control Systems” by Karl-Erik Årzén plus additional hand-out material.

Prerequisite Basic course in automatic control. Basic course in concurrent programming/real-time programming. Basic Java knowledge.

Funding required 75.000 SEK to develop and give the course.

Object-Oriented Real-Time Programming

Objectives

Object orientation is perhaps the most popular paradigm for software design and implementation. In principle, this should also apply to development of embedded software and real-time systems. However, safety and timing requirements are not straightforward to fulfill in combination with demands on flexibility and true object oriented support. Many developers today claim to do real-time object-oriented design/programming, using for instance C++ and UML. It is assumed that participants have a general knowledge about both real-time and object-oriented technology. The aim of the course is to gain a deeper understanding of the problems and recent solutions related to real-time programming using a safe language such as Java. Aspects of industrial applications are included, but formal methods and scheduling theory are not covered. Some issues may be subject to discussion which is very welcome. Topics include:

- Flexibility and safety for embedded software.
- Combining safe and unsafe languages, why and how.
- Real-Time Java, hype and hope.
- APIs for threads, processes, and scheduling.
- Predicting memory needs.
- Predicting execution times.
- Real-time Garbage Collection.
- Tiny embedded systems.
- Object models and performance issues.
- Distributed objects and object distribution.
- Comments about standard proposals for RT-Java.
- Industrial applications.
- Open research issues.

Credits

4 points/weeks

Time

Late March to mid May 2001/2002

Place

Lund, 2 days, 3 or 4 times.

Distance availability

Exercises and mini-project can be carried out @home, with support via e-mail and phone.

Course leader, email

[Klas Nilsson](mailto:Klas_Nilsson@cs.lth.se) klas@cs.lth.se

COURSE NAME:

Formalisms, Algorithms and Tools in Formal Methods for Real-Time

CREDITS: 5p

APPLICANTS:

Hans Hansson and Wang Yi
Mälardalen Univ and Uppsala Univ

BRIEF DESCRIPTION:

Developing reliable computer systems is a difficult task. Formal methods is about how to use mathematical methods and software tools for structuring, modelling and analyzing specification, design and implementation of such systems. This course will present some of the well-studied formalisms for modelling, logics for specification, and efficient algorithms and software tools for analysis. It will also provide an overview on recent advances in this area. The main topics include: transition systems, finite automata, temporal logics, process algebras, and timed automata. The aim of the course is that the students learn to validate formal specifications, in particular of real-time systems, with the aid of software tools e.g. UPPAAL and SPIN. In addition, they should learn to understand the main underlying theoretical and practical problems.

TOPICS:

Introduction to formal techniques.
Formalisms for abstract models and specifications:
Finite state machines, CTL, LTL, Büchi Automata, Timed Automata.
Basic algorithms for model checking and tools e.g. UPPAAL and SPIN

...

PREREQUISITE:

Operating systems
Real time systems,
Basic knowledge in automata theory and logics

PERIOD during which the course will be given:

Spring or Autumn in 2001

MEASURES taken to facilitate external participation:

The course will be given by
- lectures by the lecturers
- seminars by external lecturers and students
- programming assignments and
- projects

Lectures and seminars will be given at MdH, with a slightly more concentrated schedule than usual. The geographical

location of Västerås should make participation from Linköping, Karlstad, Örebro, Stockholm and Uppsala convenient.

FUNDING REQUIRED:

Estimated effort for giving the course is 3 mmonth, roughly corresponding to a cost of 300KSEK. Cost related to guest lecturers and external participation could be in the range of 100KSEK.

SCHEDULE/PLAN:

- 4*45min lectures one day a week (at least) for 6 weeks
- student presentations (depending on the number of participants)
- seminars by external lecturers

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Component Based Software Engineering Course, 5 points

Applicant: Ivica Crnkovic, Mälardalen University, Department of Computer Engineering

Course description

The course is a continuation of CBSE course held 1999/2000 (see <http://www.idt.mdh.se/kurser/phd/CBSE>). The aim of this course is collect and systematize knowledge related to component-based development, different component models existing on the market today, and to give an analysis and comparison of these models . Different issues from a development life cycle are taken into the consideration. However, the emphasize it put on Component development, deployment and integration part.

The lectures will give an introduction to CBSE and a framework for students self studies. Students will choose one of the proposed topics, do investigations on the topics, and write a "state of the art" paper. Several workshops will be organized to follow up the students work. The papers will be presented and discussed at a seminar which also will be open for everyone. Finally, the papers will be collected in a "CBSE - Using standard component models" report.

Several seminars with invited speakers, the experts in this area, from both academia and industry, will be organized during the course.

Participants

Both Ph.D. students and practitioners from industry are welcome. *External participation* is encouraged. The lectures will be grouped in two-days sessions (two of them) and a video conference system can be established if a larger group of students participate. This model has successfully been used in CBSE course. The students should though participate at least in the last workshop where the results will be presented.

Qualifications

The Ph.D students or industry people with at least Bs.C. degree. A knowledge of an object-oriented language (C++ or Java) is preferable.

Examination

Writing a paper. Presentation of the paper.

Course schedule:

The course will take part in Q4 2001.

Request for funds:

If possible the funds should cover:

Course development and execution	30 000
Invited speakers (2):	20 000
Workshop organization and execution	10 000
Printing and binding reports:	10 000
supporting external students (1000 kr/st.)	10 000
SUMMA:	80 000 skr

For more details about the course, you can see the previous CBSE course <http://www.idt.mdh.se/kurser/phd/CBSE>.

Proposal for Development of Artes Course

This short page contains a proposal for course development. It does not precisely fit the instructions and topics provided in the call for proposals, so I will provide only a brief sketch. More information and details can be provided on demand.

Aims and Scope

The purpose of the course is to give a generic introduction to the principles behind modeling, specification, and analysis of reactive systems, including real-time systems.

It is generally agreed that there is a clear lack of good textbooks on the above topic. There are textbooks that cover specific approaches to the problems of modeling, specification, and analysis of reactive systems within a specific context, such as temporal logic, CSP, CCS, etc. However, the aim of this course development is to present generic framework-independent material. In this way students are better prepared to apply techniques from formal methods in practice, within the context of any formalism or program notation. The material should be generic in the same way as a course on automata theory or scheduling is generic. In this way, the subject can also be taught in a simple and understandable way. There should be as little use of heavy formalism as possible, and concentration should be given on principles.

The guiding principles of the course will be

- Presenting principles as simply as possible, and illustrate them richly with examples
- Modules can be provided that treat specific frameworks or languages

A suggested sequence of topics is

- Modeling reactive and real-time systems
- Specifying properties of systems (this will be done in a language-independent way using test processes, which can be understood by most students, avoiding excessive use of logic formalism). In a generic way, we will also introduce sequence charts, and simple forms of temporal logic
- Basic techniques for automated verification
- Principles for symbolic verification
- Principles for deriving real test sequences from test processes

The topics can also be continued with in-depth treatment of

- Real-time aspects
- Model Checking (symbolic approaches, etc)

For the topic of Model Checking, a book by Clarke, Grumberg, and Peled just appeared, which seems to become a standard textbook. It has good coverage of topics, but a definite lack of examples and exercises. Thus, there is still the need for development of teaching material.

Logistics

Parts of the material are currently taught in a course "reactive nsystem", given each year at Uppsala university. Part of the material will also be taken from the course

MODELLING and ANALYSIS of REAL-TIME SYSTEMS

<http://www.docs.uu.se/artes/marts.html> taught by Wang Yi within the scope of ARTES. Optionally, we also plan to develop course material for covering the rapidly developing field of model checking.

We intend to develop the course material in the form of lecture notes that can form the text of individual lectures. In a slightly longer perspective, these should be combined into a textbook.

To give some idea of the beginning of the course material (very sketchy), look at the lecture notes that are reachable from the course page of the current version of Reactive Systems

<http://www.docs.uu.se/docs/undergrad/instances/spring99/reactive/> Our plan is to make lecture notes and exercises in suitably sized quanta, and also to publish a book.

Funding

To prepare all the necessary material for such a course, in an area where there is a lack of good textbooks is a significant endeavour. We will use at least 200 kSEK on the development of the first version during 1999, which can be delivered in year 2000.

yours Sincerely

Bengt Jonsson
Parosh Abdulla
Wang Yi