

MLQA

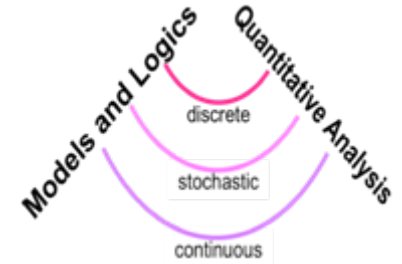
Models and Logics for Quantitative Analysis

Kick Off Meeting at ETAPS 2009

Flemming Nielson

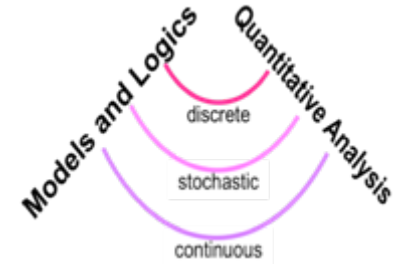
<http://wiki.ercim.org/wg/MLQA>

Why this meeting?



- The purpose of the Kick-Off meeting is to finalise the description of an application for MLQA to become a working group of ERCIM.
- Once established it will be open also to non-ERCIM members.
- The programme of the Kick-Off meeting:
 - Talks delineating the main components of MLQA.
 - Short presentations by participants.
 - Finalising the mission statement.

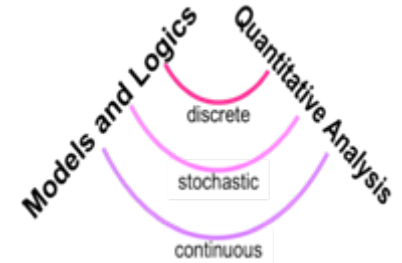
Why a working group?



To cater for:

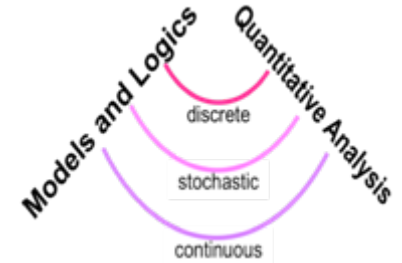
- knowledge sharing,
- networks also for young researchers,
- sharing tools developed within the field,
- discussing research directions, and
- eventually to formulate European projects or networks on formal quantitative analysis.

What is MLQA?



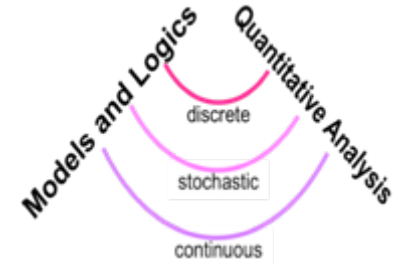
- **Process models** are described by transition systems, automata or process calculi.
- **Properties** are expressed in logics possibly involving stochastic and continuous (control theory) properties on top of discrete ones.
- **The focus** is on algorithms, theory and tools.
- **Applications** will include embedded systems, service oriented systems, biological systems, and IT guided workflow systems.

MLQA: Models of IT Systems



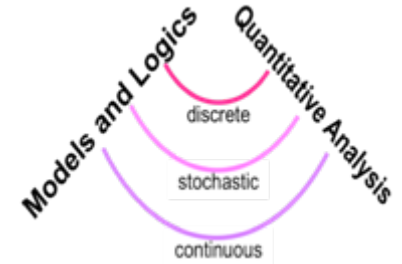
- The construction of IT Systems spans several abstraction levels:
 - low-level, hardware-oriented programming languages (e.g. VHDL),
 - high-level programming languages (e.g. C++ and Java) to
 - object-oriented development notations (e.g. UML).
- To ensure
 - applicability at all levels and
 - independence of concrete programming languages,we will model behaviour as **process models** expressed using
 - process calculi, transition systems or automata.
- The study of open systems is well studied but needs to be extended to the study of IT guided systems where the human components cannot be fully described.

MLQA: Specification of Properties



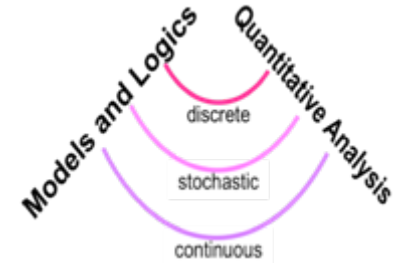
- International standards like
 - the *Safety Instrumented Systems* standard within embedded systems, and
 - the *Common Criteria* standard used for software in many NATO countriesemphasize the need for validating that systems are
 - **functionally correct** (react as expected),
 - **dependable** (do not cause damage on environment or users),
 - **highly efficient** while demanding **few resources**,
 - **secure** (against hackers and viruses),
 - **stable** (do not crash),
 - **fault tolerant** (offers vital functionality even when partially crashed).
- To ensure a uniform approach we will be based on ***logical specification formalisms***.
- They accommodate seemingly dissimilar properties within the same formalism and facilitate automatic validation engines.

MLQA: Discrete Properties



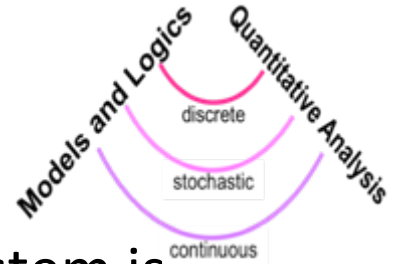
- *Static analysis* and *model checking* are two of the most prominent techniques for discrete systems analysis. In many ways they are complementary and largely developed by independent research communities.
- The techniques are used by some of the largest international companies (e.g. IBM, Intel, Microsoft).

MLQA: Stochastic Properties



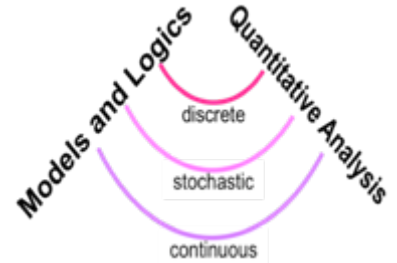
- The quantitative properties of the environment of a given IT System are often accompanied by uncertainties best described using stochastic or probabilistic models, such as *Markov Chains, Markov Decision Processes, and Continuous Time Markov Decision Processes*.
- From the point of view of “*traditional*” *mathematical modelling* the working group offers a unique chance to integrate and further develop recent advances in stochastic models.

MLQA: Continuous Properties



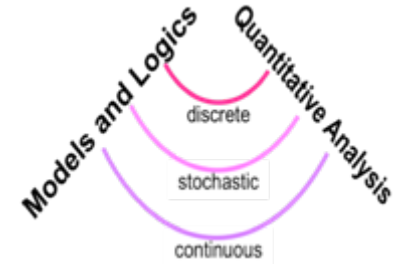
- In classical Control Theory the model of an IT System is through a set of *differential equations* describing the evolution of physical phenomena in the environment when regulated by a given control program.
- The area of Hybrid Systems has emerged in the intersection between Computer Science and Control Theory in order to deal with controllers that are not completely deterministic.
- From the point of view of “*traditional*” *mathematical modelling* the approach offers a unique chance to develop tractable ways of dealing with important control system properties, such as reachability and stability, which is currently beyond state-of-the-art.

What is ERCIM?



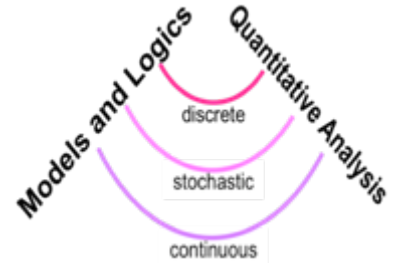
- **ERCIM** is the **European Research Consortium for Informatics and Mathematics**
 - consisting of 19 European research institutions, and
 - sponsoring ETAPS.
- **ERCIM** aims to foster collaborative work within the European research community and to increase co-operation with European industry.
 - This will provide an international forum for the exchange of ideas (and personnel).
 - It may lead to the formulation of EU projects in future calls.
- Please consult www.ercim.org for more information.

Expectations of ERCIM



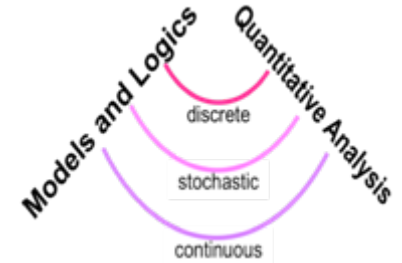
- An annual meeting (for 2009 this Kick-Off meeting, for 2010 a meeting at...).
- Formulating a research programme – that can
 - influence activities at participating institutions and
 - lead to the formulation of an European project or network.
- Exploiting current funding possibilities to support the mobility of young researchers:
 - ERCIM fellowships, Marie Curie stipends, etc.
- A web page with information about activities, tools, and opportunities.

Why a NEW working group?



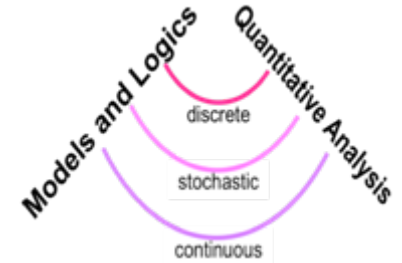
- The working group distinguishes itself from existing ERCIM working groups on
 - Formal Methods for Industrial Critical Systems and
 - Dependable Software-intensive Embedded Systems
- The more narrow focus on models and logics will be effective in fostering new synergies between existing research groups.
- The wider focus on application areas beyond those of traditional IT systems falls well outside existing ERCIM working groups on formal methods.

The programme ...



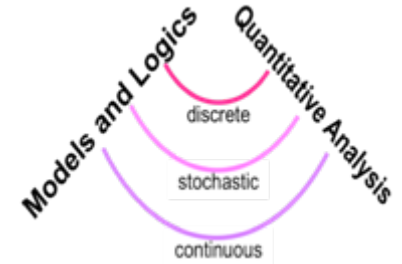
- Opening
 - Flemming Nielson: “An overview of MLQA”
- Invited Talks
 - Stephen Gilmore - stochastic analysis in PEPA
 - Carolyn Talcott - statistical model checking in Maude
 - Rocco De Nicola - process algebras for stochastic features
 - Diego Latella - applications to service oriented systems: “A Stochastic Logic for Mobility and Global Computing”
 - Holger Hermanns - applications to embedded systems
 - Paola Quaglia - applications to biological systems
- Presentations by participants
- Finalisation of mission statement

The programme ...



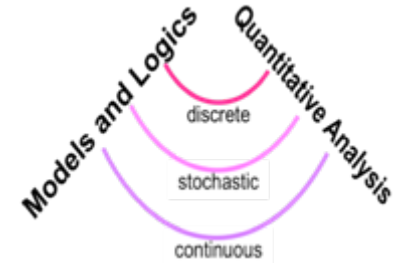
- Presentations by participants
 - TinoTeige (University of Oldenburg)
 - Herbert Wiklicky (Imperial College)
 - VashtiGalpin (University of Edinburgh)
 - Manuela Bujorianu (Cicada)
 - Stefan Kiefer (TU Munich)
 - Erik de Vink (CWI and TU/e)
 - MiladNiqui (CWI)
 - EzioBartocci (UniversitaCamerino)
 - HenrikasPranevicius (Kaunas University of Technology)
 - Sven Schneider (TU Berlin)
 - Mark Timmer (University of Twente)
 - UliFahrenberg (University of Aalborg)
- Finalisation of mission statement

The next steps ...



- Make an application to ERCIM
 - The final mission statement
 - A summary of the present meeting
 - The list of attendees of the present meeting
 - Making sure the national ERCIM board members are informed and supportive
- Deadline April / May

The next steps ...



- Suggested procedure for finalising the mission statement
 - Comments and discussions on mission statement now
 - A small committee prepares the final version
 - Flemming Nielson, ...
 - Request for comments by attendees (and others) by a specific date
 - Contacting national ERCIM board members
 - Submission of proposal