Process algebras as a usable/used tool for the construction of correct systems

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Where innovation starts

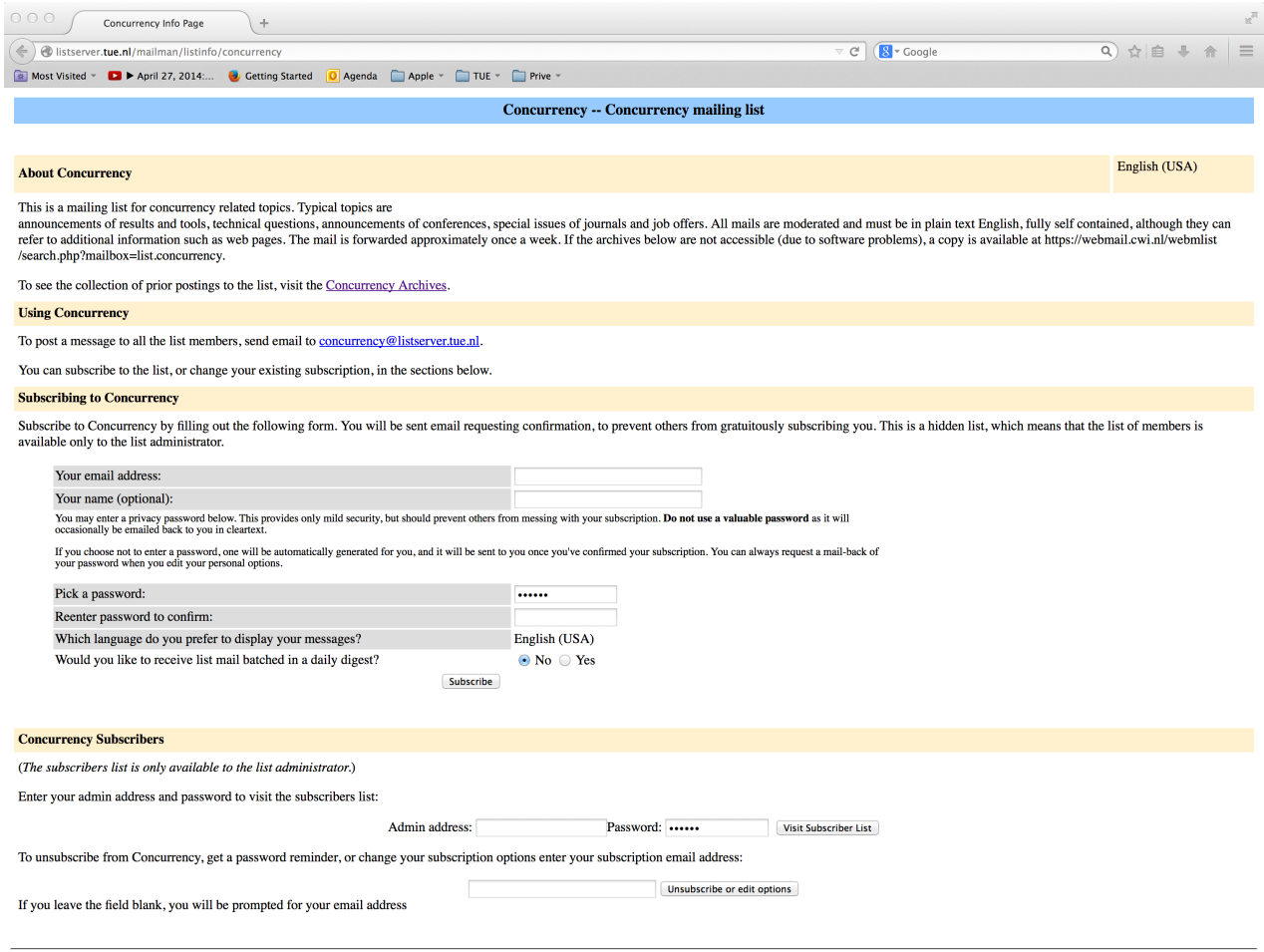
Concurrency mailing list.

1171 members (slowly growing)

I am maintaining it since 1996.

Frits Vaandrager

Albert Meyer



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"Used": ??

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Hardly by colleagues.

Hardly by industry.

Why? Most of us are not interested in the application of concurrency.

We and our colleagues are not really aware of what can be done.

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Verify the source code of the Algrabrug

Algrabrug:
Formulate requirements on good behaviour.
Verify these on the source code.

Detected issues solved.
Concerns about software architecture.

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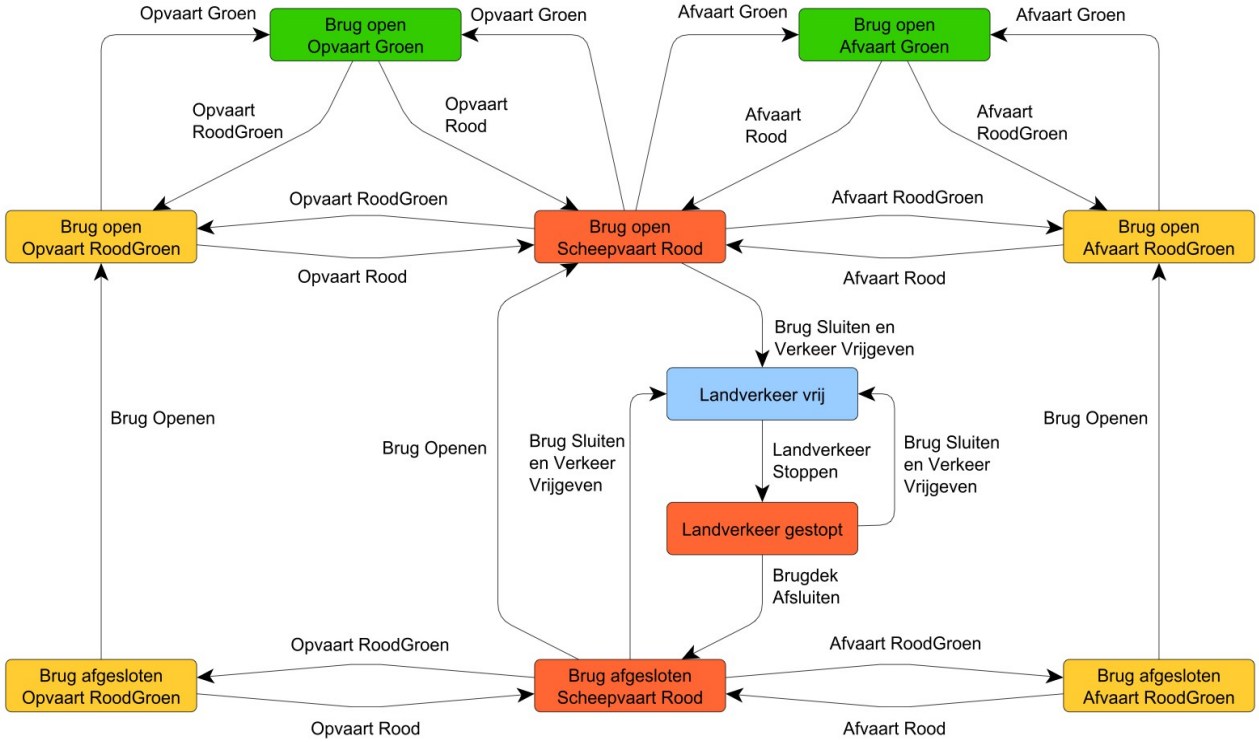
Opdrachtgever
Rijkswaterstaat

Datum
29 april 2014

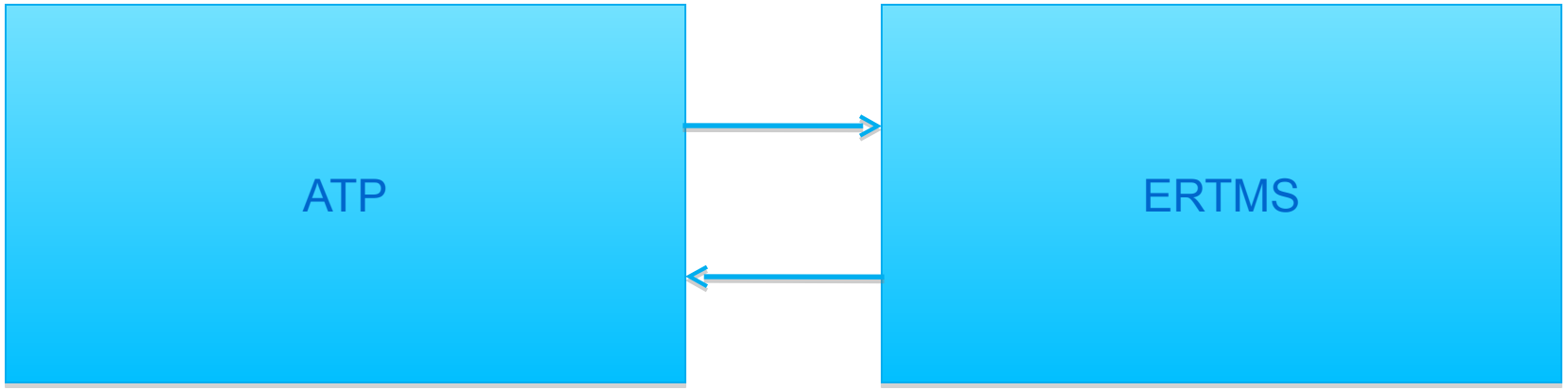
Versie
1.3

Analyse van besturingssystemen voor beweegbare bruggen

Systeemvalidatie Rapport in opdracht van Rijkswaterstaat



Formal modelling of ATP in context of ERTMS



Model the future Automatic Train Protection System that must cooperate with the ERTMS /ETCS system.

10 times quality improvement/Design for verification.

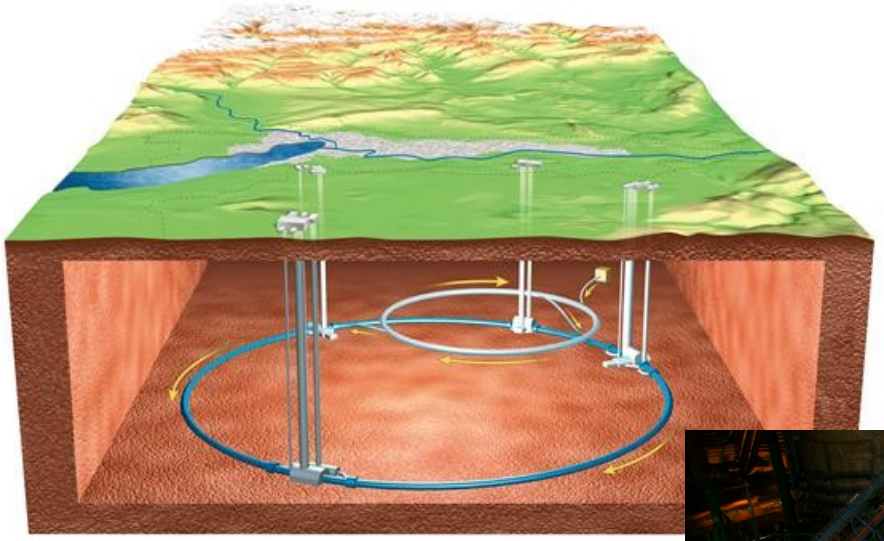
At X-ray (Philips Healthcare) software is developed by staff using formal methods.

Is this better? Yes, up to 10 times less bugs, up to 3 times faster.

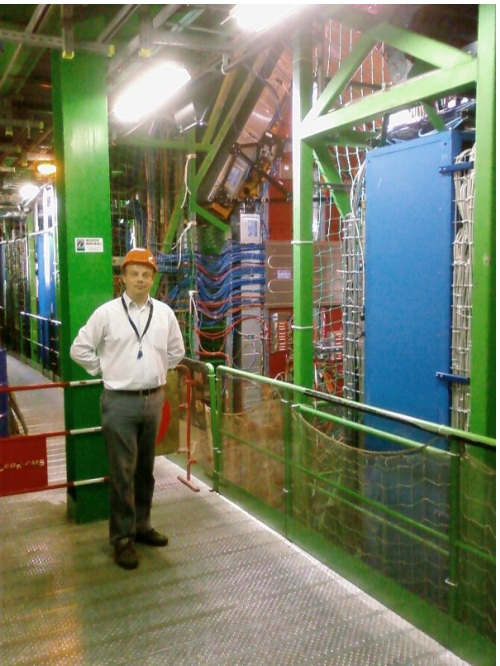
Industry standard 5-50 bugs/Kloc. Formal techniques 0.7 bugs/Kloc.

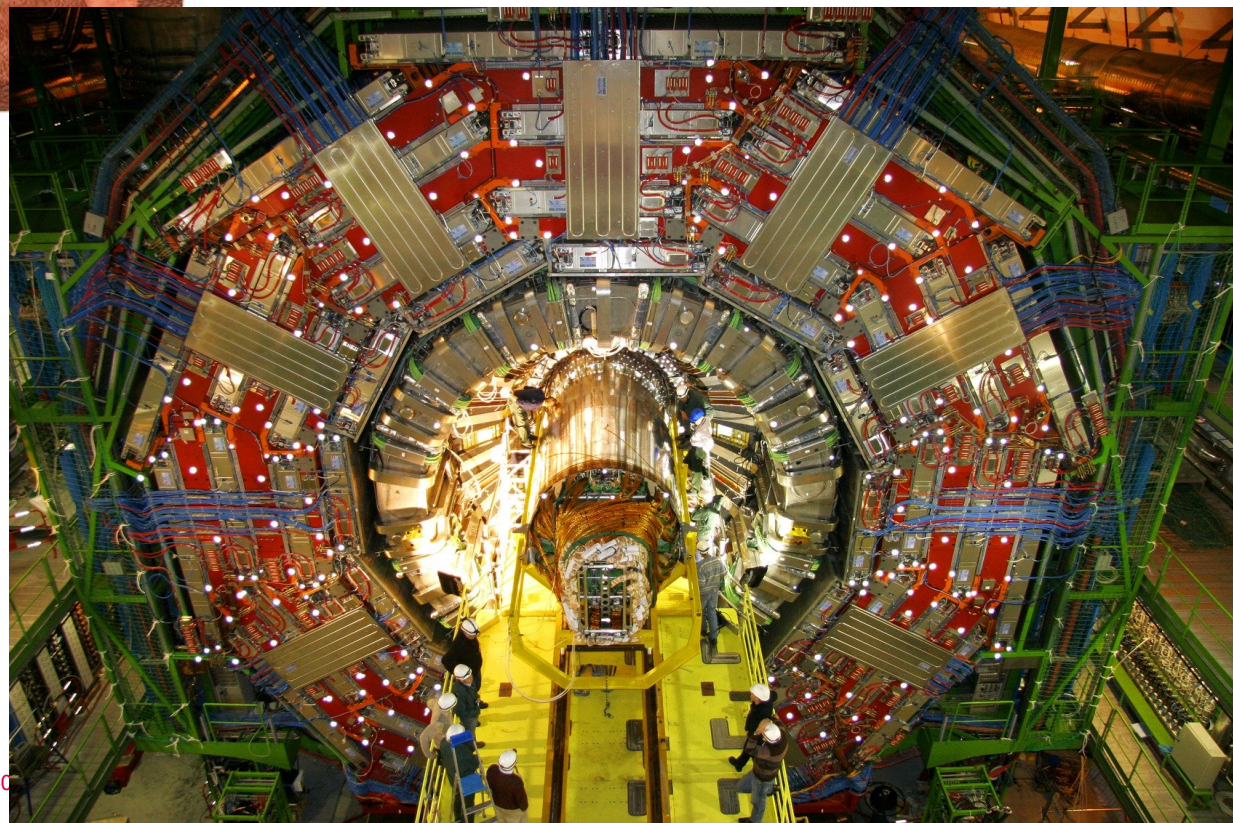
Required: design for verification.

CERN in Geneve: CMS Detector

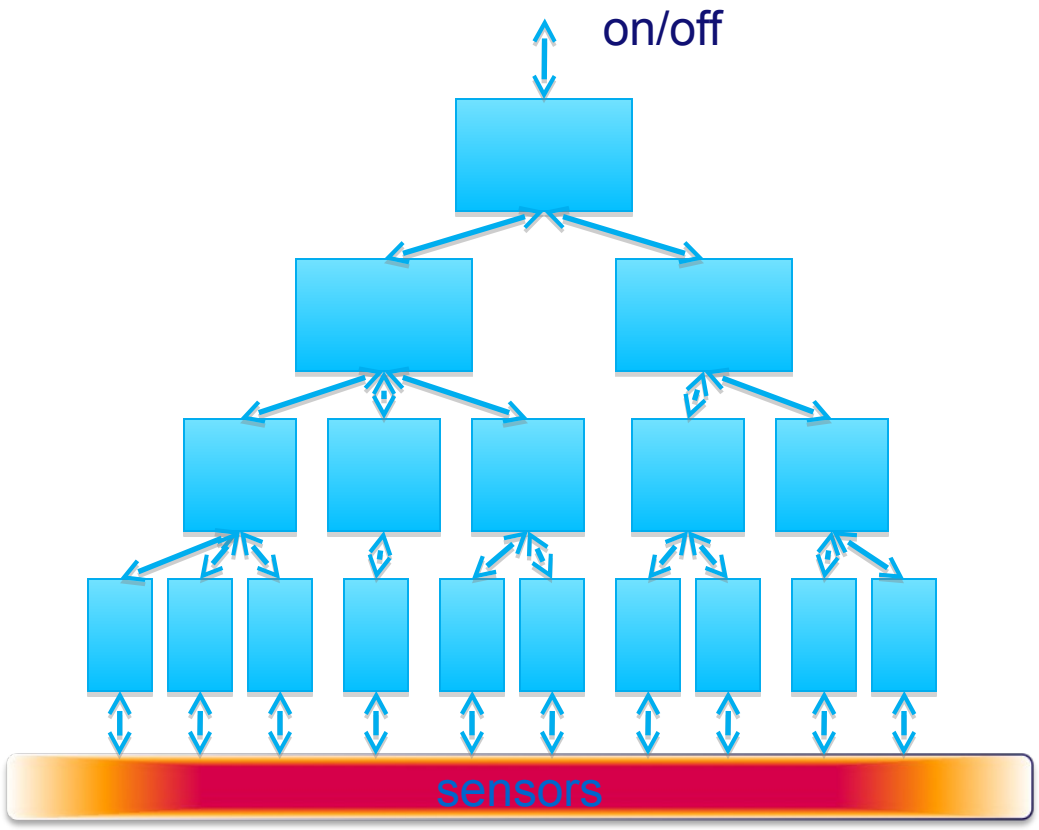


Purpose: detection of the Higgs particle.





Software control by finite state machines



60.000 software modules (Atlas)
180 different types

CERN

Formal verification tools are now standard in the development of control software at CERN.

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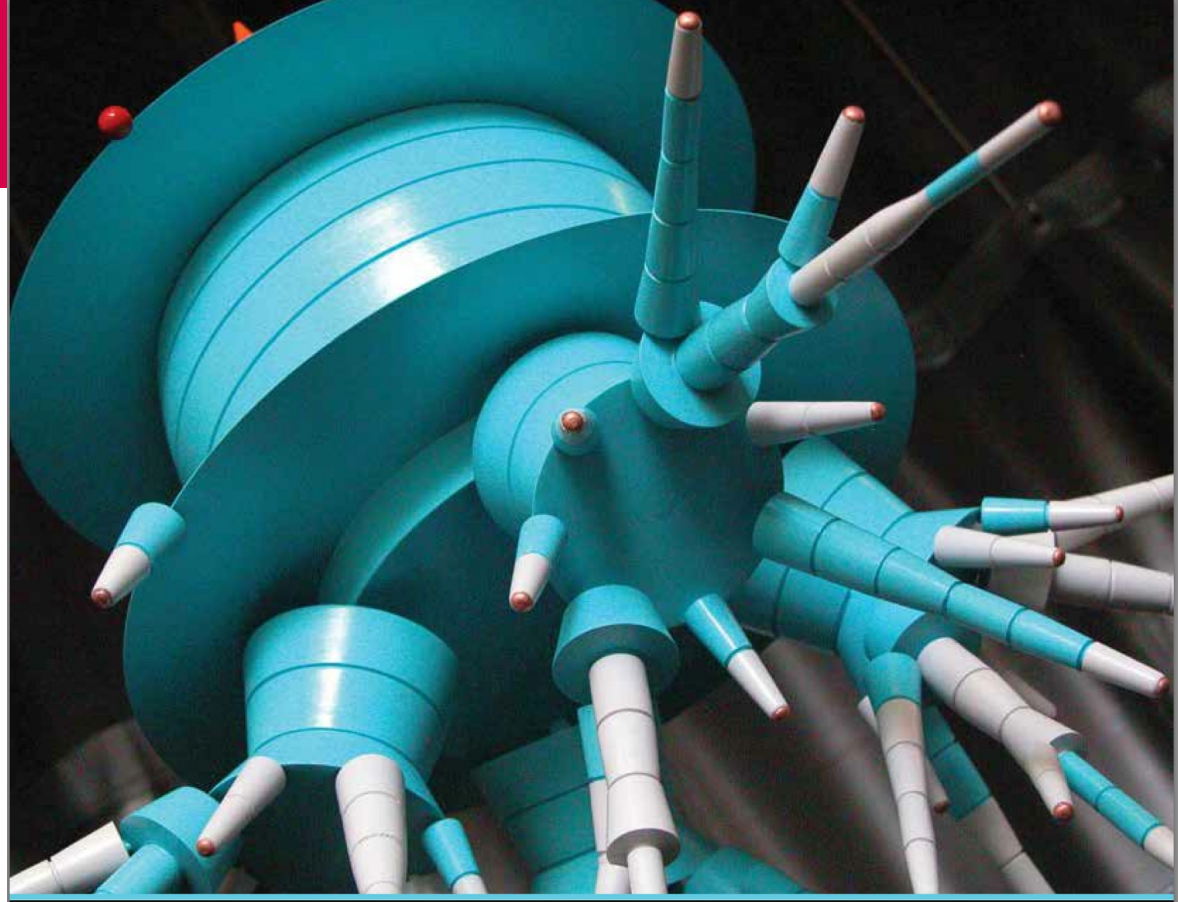
MIT Press.
Available for preorder.
Will appear on August 22, 2014.



MODELING AND ANALYSIS OF COMMUNICATING SYSTEMS

Jan Friso Groote and Mohammad Reza Mousavi

/ Computer science

Why would we eat our own dogfood??

Muhammad Atif. Formal Modeling and Verification of Distributed Failure Detectors. PhD. Thesis. Eindhoven University of Technology. 2011.

26 distributed algorithms 23 not correct.

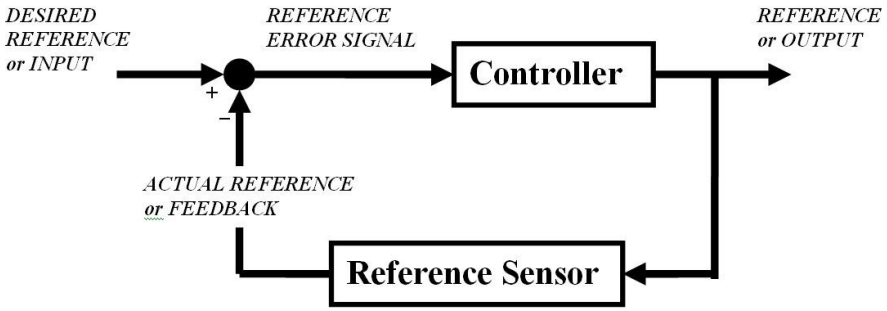
Positive example: Wan Fokkink. Free University, Amsterdam.

Model checking is highly effective. Deadly tool when doing refereeing. Far more efficient than computer assisted/controlled theorem proving, and of course the (my) human brain.

Do we teach students Concurrency Theory and practice in such a way that they appreciate it?

Mechanical and electrical engineering:

Teach control theory as an essential design tool.



How many of us teach concurrency theory as an essential software/algorithm design and verification tool? How many of us have actually designed systems/algorithms in this way?

We underestimate how hard system design is...

In case one might try to design a new system/algorithm only a small amount of the time is in formal modelling and analysis.

Most goes into understanding the problem and finding an appropriate solution.

It requires true interest in the application domain, quite some experience using the tools and a full set of tools to operate efficient in this domain.

How many of us do know somebody that would qualify as a concurrency theory based system engineer?

Why is industry not embarking

There are really great tools available.

FDR3

CADP

mCRL2

Spin

Uppaal

nSMV

Prism

Employees lack understanding and appreciation for concurrency.

- Quite often they are not even capable of abstractly understanding their own software, and they have many other concerns.

Number of contacts between industry and effective sellers of concurrency theory is relatively small.

Industry does not like academic tools.

There are a number of start-ups, but they all have a hard time.

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Open problem:

How to transform the gems from concurrency theory into a common commodity in computer science/system engineering?

Proposal (à la Joachim):

Assemble a group of researchers and model check all distributed algorithms appearing in:

DISC

ICDCN

ICDCS

ICPADS

OPODIS

PODC

PPoPP

SPAA