Four Decisions

Yi Ling HWONG

ACEOLE end of project meeting

15 September 2012

Making Decisions

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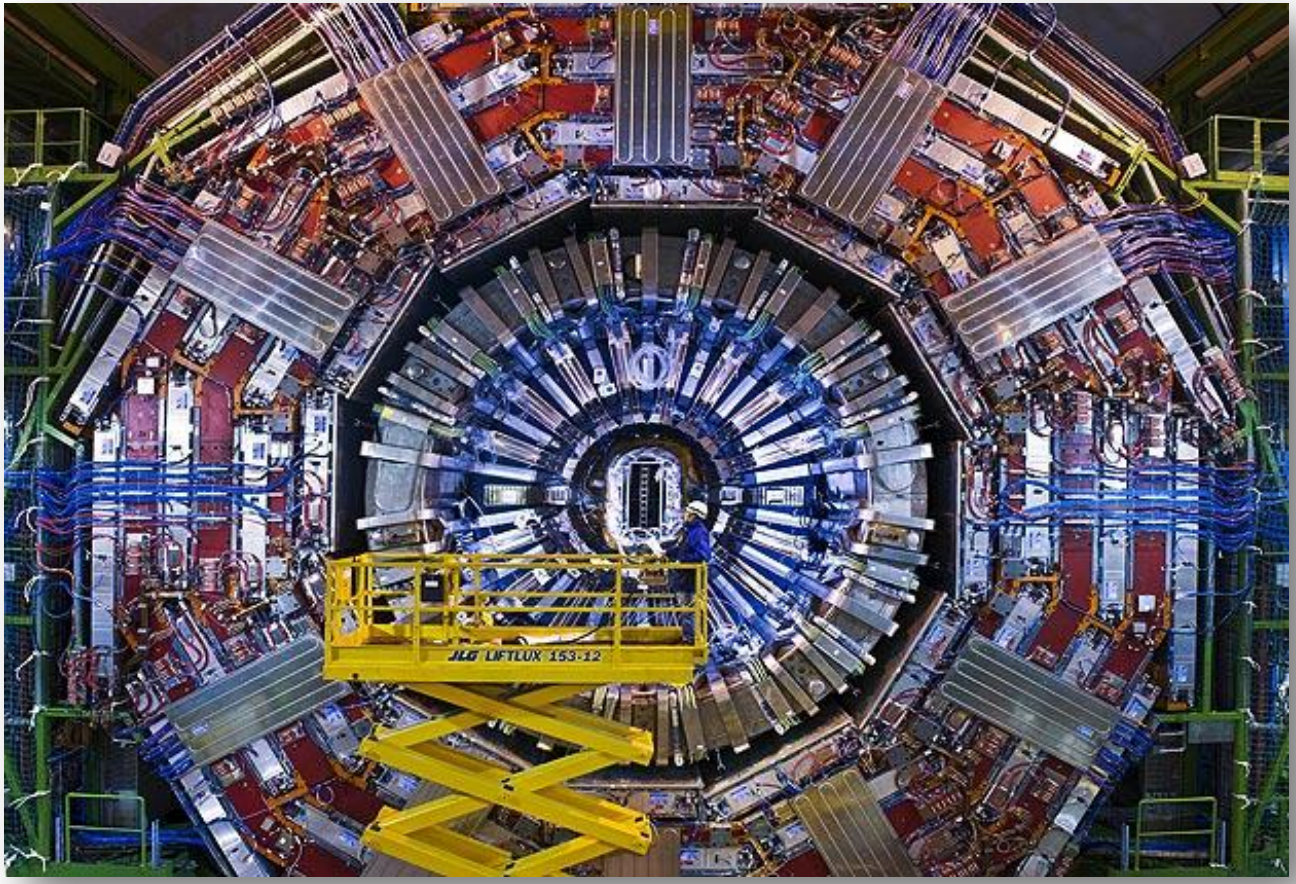
CMS



Research

- To develop a toolset to automatically analyse and verify the Finite State Machine (FSM) system of the Detector Control System of the CMS experiment
- Goal: Optimisation of the FSM system
- Around 27,500 nodes
- By different teams with different development philosophy
- Complex project

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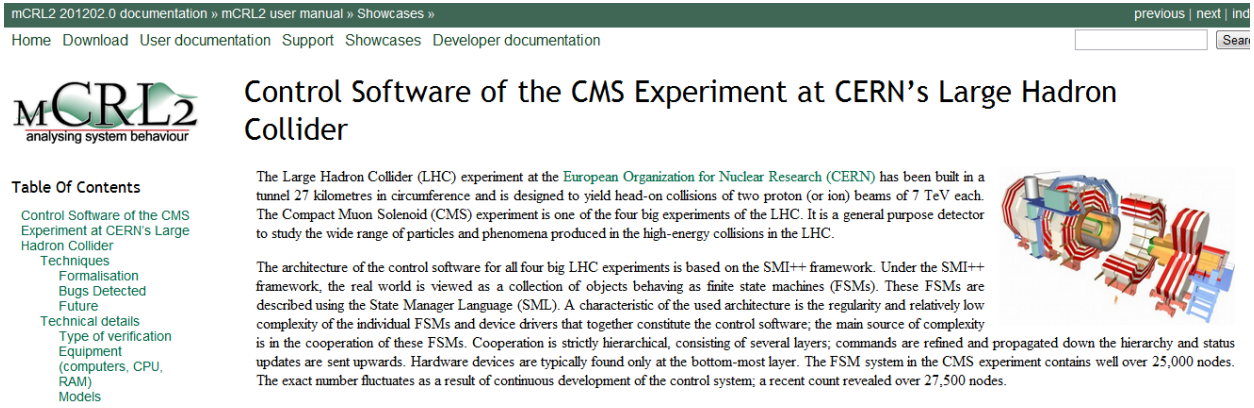
Collaboration

- Technical University of Eindhoven
- mCRL2 and Bounded Model Checking
- FiSMAT - Finite State Machine Analysis Toolkit
- Properties:
  - There are no loops in the FSM
  - There are no unreachable states in the FSM
  - There are no states that an FSM can never leave

Results

- 228 different parent/children combinations.
  - 45 parent/children combinations with the potential to loop
    - 1500 nodes in the control system (5,45%)
  - 79 violate the required reachability of states
    - Nearly 11%
- Three peer-reviewed papers
- An on-going project …



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mCRL2 analysing system behaviour

Control Software of the CMS Experiment at CERN's Large Hadron Collider

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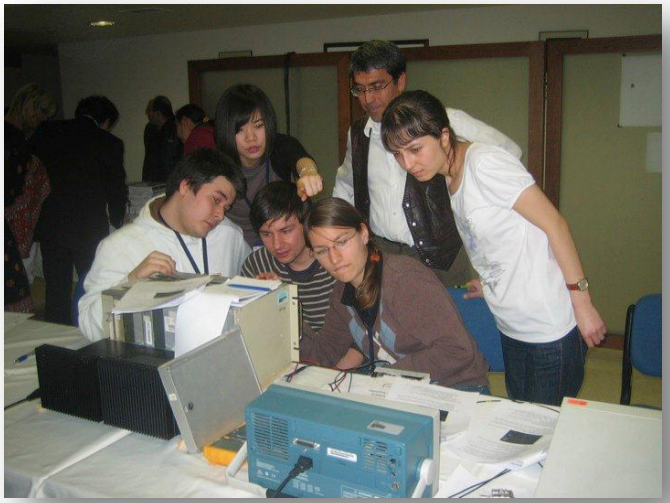
- Control Software of the CMS Experiment at CERN's Large Hadron Collider
  - Techniques
    - Formalisation
    - Bugs Detected
    - Future
  - Technical details
    - Type of verification
    - Equipment (computers, CPU, RAM)
    - Models

The Large Hadron Collider (LHC) experiment at the European Organization for Nuclear Research (CERN) has been built in a tunnel 27 kilometres in circumference and is designed to yield head-on collisions of two proton (or ion) beams of 7 TeV each. The Compact Muon Solenoid (CMS) experiment is one of the four big experiments of the LHC. It is a general purpose detector to study the wide range of particles and phenomena produced in the high-energy collisions in the LHC.

The architecture of the control software for all four big LHC experiments is based on the SMI++ framework. Under the SMI++ framework, the real world is viewed as a collection of objects behaving as finite state machines (FSMs). These FSMs are described using the State Manager Language (SML). A characteristic of the used architecture is the regularity and relatively low complexity of the individual FSMs and device drivers that together constitute the control software; the main source of complexity is in the cooperation of these FSMs. Cooperation is strictly hierarchical, consisting of several layers; commands are refined and propagated down the hierarchy and status updates are sent upwards. Hardware devices are typically found only at the bottom-most layer. The FSM system in the CMS experiment contains well over 25,000 nodes. The exact number fluctuates as a result of continuous development of the control system; a recent count revealed over 27,500 nodes.

Training

- Six technical training courses
  - Highlight: Drupal, How to design an effective website, SQL
- Eight complementary skills training courses
  - Highlight: Project engineering, Entrepreneurship, CV writing and interview skills, Science communication
- Management, teaching and outreach



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Branch Out

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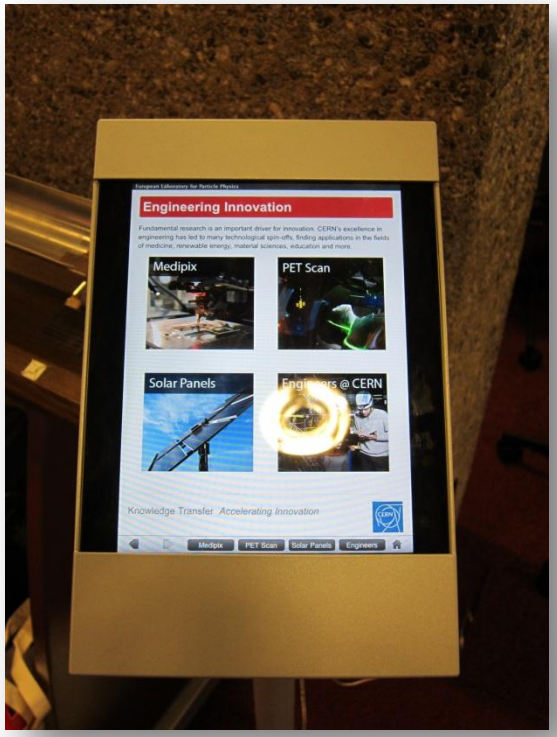
Communications

- Knowledge Transfer group
- World Engineer Convention 2011



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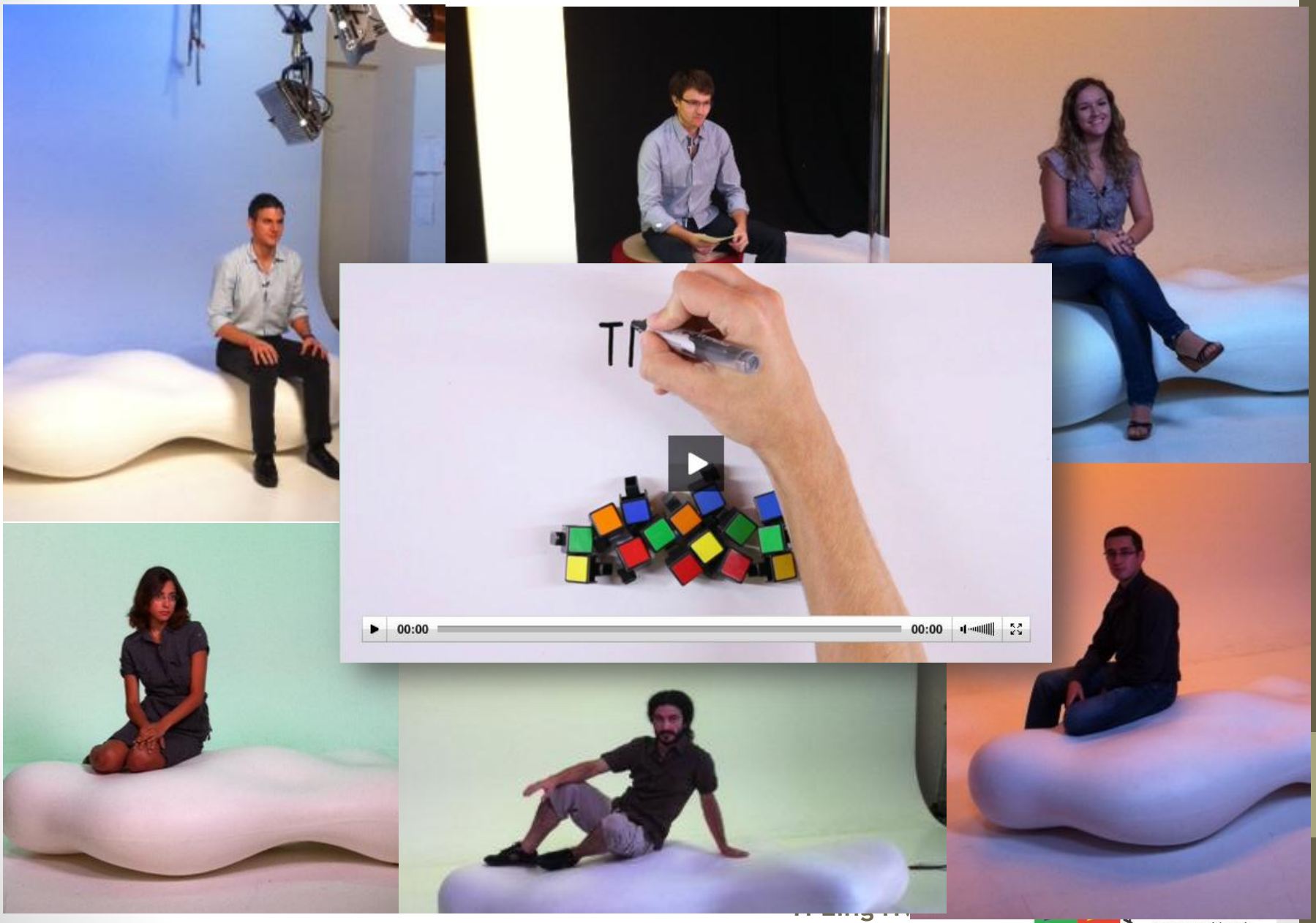
The Rubik's cube video



Feedback

- Unique training methodology
- Going against the grain
- Appropriate guidance, fast feedback
- Flexibility to take charge

- Secondment
- Earlier ice-breaking
- Greater awareness (in SEA, for example)

Post – ACEOLE…

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Start Up

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Médecins Sans Frontières (MSF)

- Web editor
- From basic research to medical humanitarian emergencies
- Drupal - web design and development
- Communication – a delicate balance

Entrepreneurship

ESOF 2012

- Marie Curie Actions conference
  - Workshop speaker “Speaking confidently to a non-scientific audience”
- EU-ASEAN partnership symposium
  - Panel speaker “Researcher’s mobility’

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Conclusion

"One of the greatest and simplest tools for learning more and growing is doing more."

Washington Irving

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