Lero THE IRISH SOFTWARE RESEARCH CENTRE

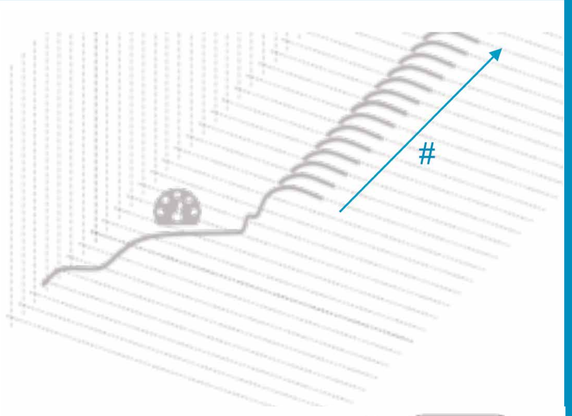
Science Foundation Ireland sfi For what's next

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

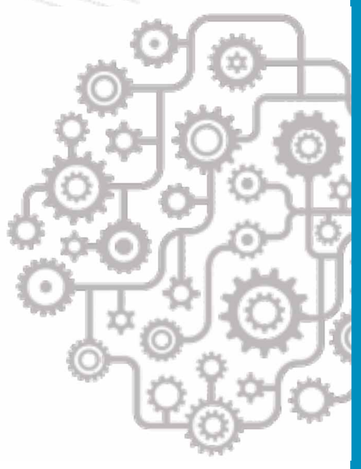
Performance Analysis Tool for Multicore

Dr. Bérenger Arnaud, arnaudb@tcd.ie. Supervised by: Drs. Gavin Doherty & David Gregg

1 Motivations



- **The future is multicore**
  - limits on single core performance
  - parallel software becoming the norm
- users are still expect increasing performance
- ordinary programmers are not prepared
  - diagnose & distinguish performance problems
  - challenging orchestration models
- current tools are designed for experts
  - focused on hardware: cores, threads, ...
  - too generic, too abstract, extensive training needed



Is there a simple way to understand (what's going wrong) software performance on a multicore system?

HCI – HPC – Parallel Performance – Manycore
Taxonomy – Visualisation – Analysis Tool

2 Approach

1: Taxonomy of parallel performance problems

- validated by interviews and surveys
- categories:

1. Resource sharing	4. Data sharing	7. I/O
2. Task granularity	5. Load balancing	
3. Synchronisation	6. Data locality	

- drilldown to problem:
  - Oversubscription *(task granularity)*
  - Alternating sequential/parallel execution *(load balancing)*
  - ... 24 more

2: Tool for analysing

- problem-centric *(not focusing on hardware nor data)*
- Dashboard
  - overview, quick identification of bottlenecks
  - identify a category and drilldown to specific problem
- Detailed views
  - explore more in-depth, profiling operation
  - split concepts, use simple visualisations and data summary
  - help to diagnose problems and educate
- Expert data view

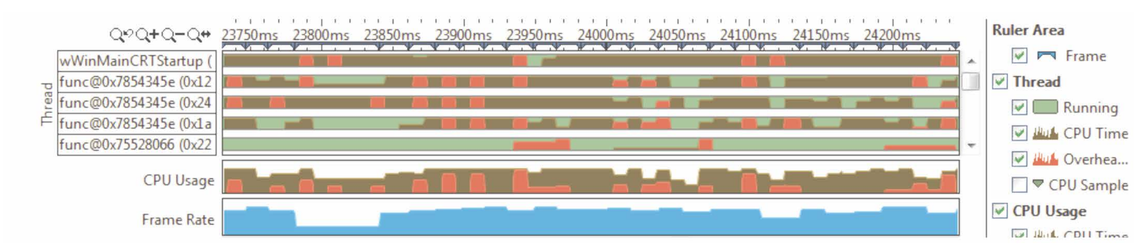
3: Experiments

- *real* people solving *real* problems with our tool
- experiment with end-users, experts and ordinary programmers
- to be done...

3 Sample visualisation result

Current hardware-centric tools

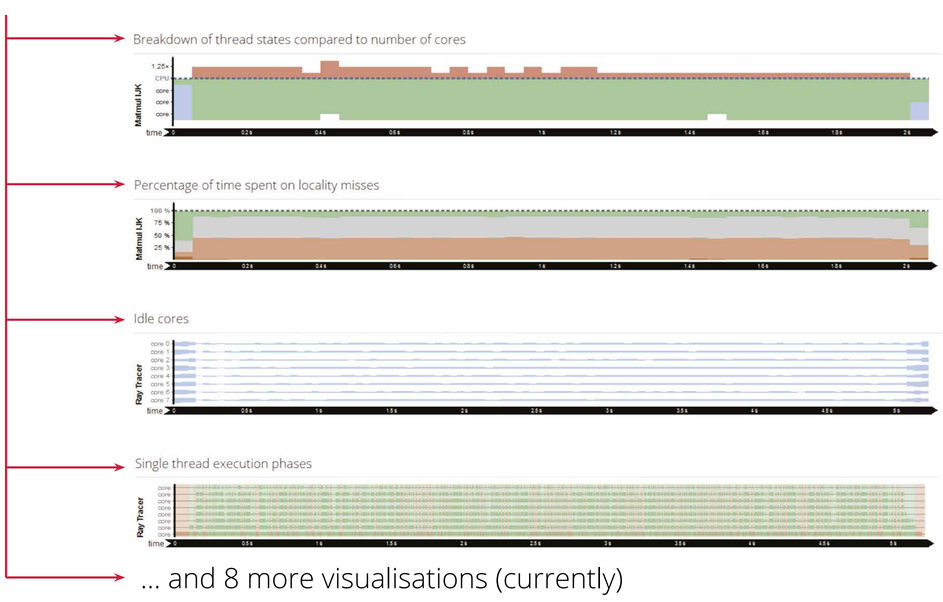
- showing threads and hardware activities



this sample is an extract of a screenshot of Intel VTune Amplifier XE 2015

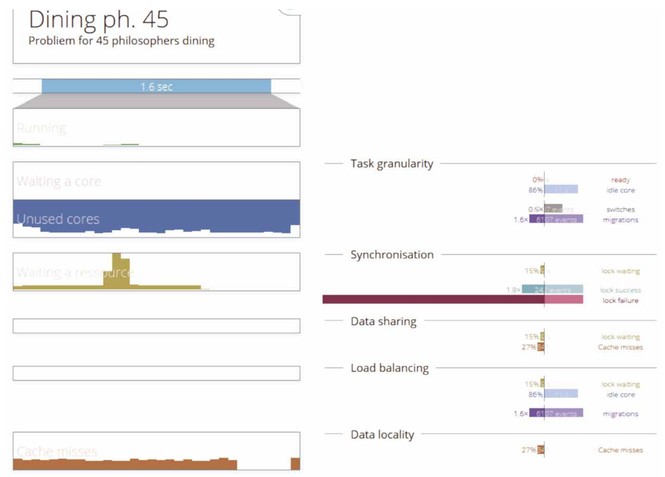
Our problem-centric Analysis tool

- Splits concepts around diagnosing taxonomy problems



... and 8 more visualisations (currently)

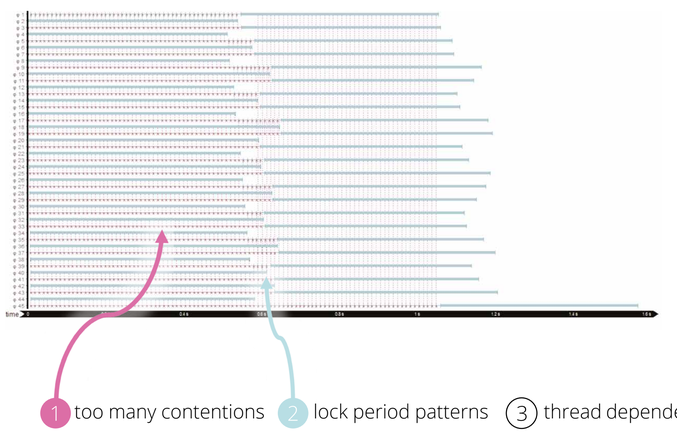
4 Dining philosopher problem (for 45)



Overview

- Highlight too many:
  - unused cores
  - lock failures

explore



Load balancing view

- Time waiting for a lock: *14%*
- Rate of thread migrations: *under the typical value*
- [...]
- Chains of dependencies on locks: *85% with contentions*

5 Future work

- working on data collection *(so far confined in our environment)*
- extract more indicators from cores, memory, network, ...
- extend our prototype with external data

Ireland's European Structural and Investment Funds Programmes 2014-2020
Co-funded by the Irish Government and the European Union

European Union
European Regional Development Fund

SOUTHERN Regional Assembly
Promoting our Region