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Exploiting Dataflow Parallelism in Teradevice Computing

a Proposal to

Harness the Future Multicores

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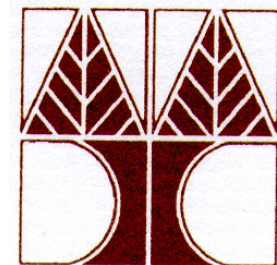
05/05/2010

Microsoft

THALES



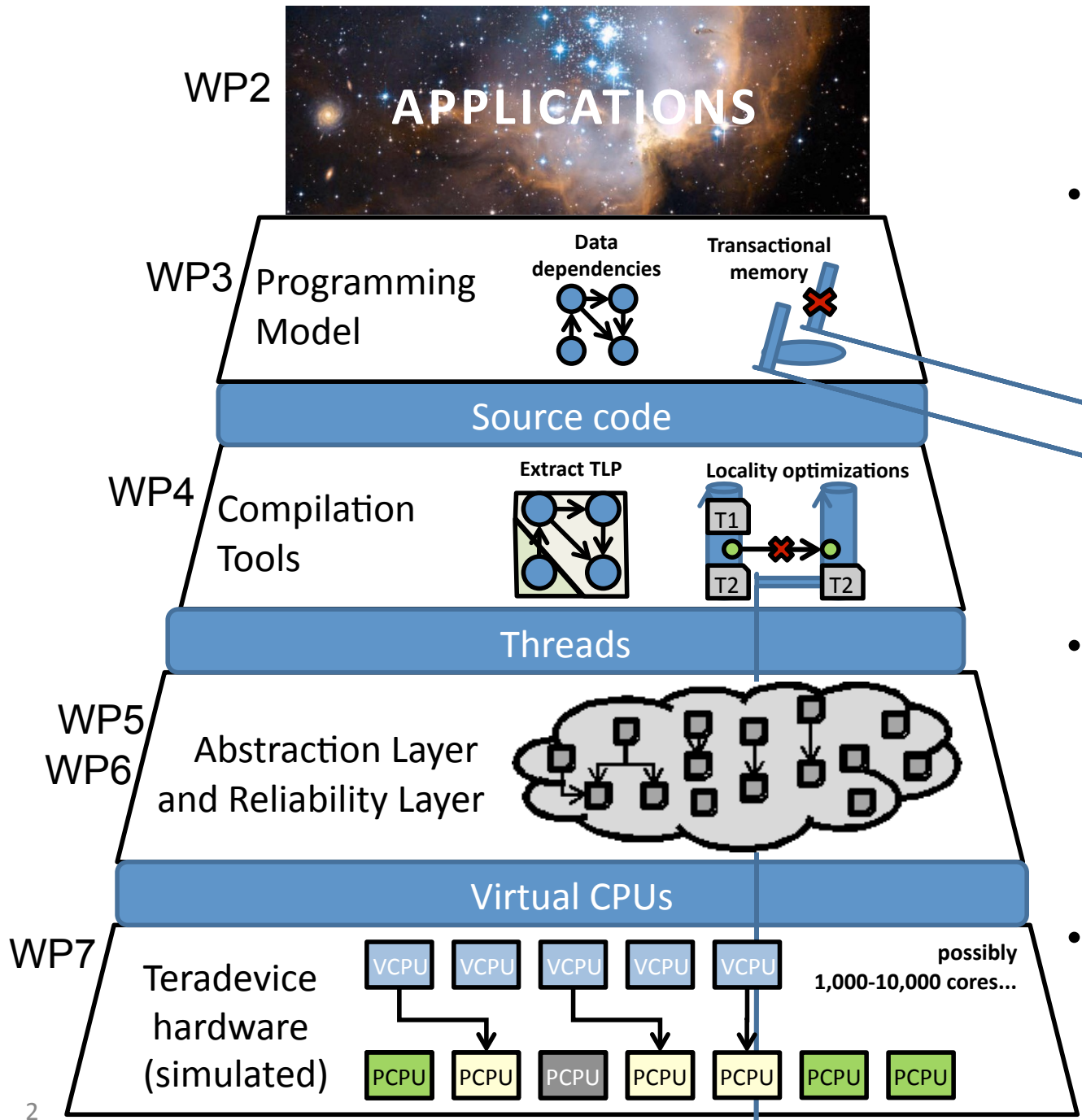
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What is about

- 1000 Billion- or 1 TERA-device computing platforms pose new challenges:
 - (at least) programmability, complexity of design, reliability
- TERAFLUX context:
 - High performance computing and applications (not necessarily embedded)
- TERAFLUX scope:
 - Exploiting a less exploited path (DATAFLOW) at each level of abstraction

TERAFLUX key results we are aiming at & long term impact

- Coarse grain dataflow model (or fine grain multithreaded model)
 - fine grain transactional isolation
 - scalable to many cores and distributed memory
 - with built-in application-unaware resilience
 - with novel hardware support structures as needed
- A solid and open evaluation platform based on an x86 simulator based on COTSon by TERAFLUX partner HPLabs (<http://cotson.sourceforge.net/>)
 - enables leveraging the large software body out there (OS, middleware, libraries, applications)

TERAFLUX: toward a different world

- Relying on existing architectures as much as possible and introduce key modifications to enhance programmability, simplicity of design, reliability.
 - not a brand new language, but leverage and extend other open efforts [C+TM, SCALA, OPEN-MP]
 - not a brand new system, but leverage and extend other open software frameworks [GCC]
 - not a brand new CPU architecture, but leverage and extend industry standard commodities [x86]
- However: the implications on “classical limitations” can be huge
 - requirements of the hardware memory architecture which limit extensibility (a.k.a. scalability) can be relaxed significantly
 - Turning dataflow model into a general purpose approach through the addition of transactions

Technical problems to be addressed in Computing Systems

- Teradevices: new challenges are posed by the huge number of transistors and cores available on a chip. Once again:
 - Programmability
 - Effective Architectures
 - Reliability and Real-time

THANKS FOR YOUR ATTENTION