**Motivation**

**TRANSACTIONAL MEMORY (TM)**
- Arguably, a new parallel programming paradigm considered by many researchers promising.
- A lot of work is being devoted to the implementation of TM systems, in hardware or in software.
- Yet, a sound theoretical framework to reason about the TM abstraction needs to be devised:
  - understand properly TM systems,
  - be able to assess and improve them.

**THEORY CHALLENGES for TM**
- Provisioning of a common framework/interface for TM (and concurrent) computing.
- Deep understanding and precise formulation of the correct semantics of TM systems.
- Exploration of valuable complexity measures and performance metrics.
- Formalization of abstractions for the major problems that are encountered when designing TM systems.
- Design of new TM implementations.
- Discovery of TM limitations, lower bounds, impossibility results.

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**TransForm: Research Directions & Progress**

**RESEARCH DIRECTIONS**

**WP1: Common framework/Interface.** Derive a common framework for the design and analysis of TM algorithms and express state-of-the-art algorithms under the derived framework.

**WP2: Safety.** Discover subtleties encountered when defining correctness in TM and derive appropriate consistency conditions to capture these subtleties. Can consistency be traded for performance or liveness? How?

**WP3: Liveness.** Design of mechanisms to transform systems with weak liveness guarantees to others with stronger guarantees; identification of conditions under which transactions may be aborted and exploration of the power of algorithms that ensure them.

**WP4: Complexity Measures & Performance Metrics.** Derive appropriate time and space metrics, as well as complexity measures that can express and measure contention; design contention-wise TM implementations.

**WP5: Locks versus Non-Blocking Synchronization.** Formalize performance properties and limitations of blocking and non-blocking TM.

**WP6: Limitations.** Can existing lower bounds be beaten by trading safety or liveness? Derive new lower bounds and impossibility results for TM.

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**Innovation, Impact & Dissemination**

**INNOVATION & IMPACT**
1. Reduction of the big complexity of concurrent programming by providing formalization that makes it possible to:
   - check the correctness of current TM implementations,
   - capture the details of their performance,
   - discover TM inherent limitations and establish optimality results,
   - determine whether TM design tradeoffs are indeed fundamental or simply artefacts of certain environments.
2. Improvement of Career Prospects of several Early Stage Researchers
3. Establishment of a long-term network of experts in concurrent computing

**DISSEMINATION**
1. TransForm Initial Training School, Rennes, February 2011
2. TransForm/Euro-TM Workshop on the Theory of Transactional Memory, Rome, September 2011
3. TransForm Track on Microsoft Research Cambridge PhD Summer School, UK, July 2012.
5. TransForm Summer School on Research Directions in Distributed Computing, Crete Island, June 2013 (upcoming)
6. TransForm/Euro-TM Workshop on the Theory of Transactional Memory, Israel, September 2013 (upcoming)
7. Interactive web site where external researchers can provide feedback. E-mailing List: Transform@lists.net.t-labs.tu-berlin.de