

# **Paper Review Title: DTHREADS: Efficient Deterministic Multithreading**

**Reviewer: swayanshu shanti pragnya**

## ***1. Summarize the (at most) 3 key main ideas.***

In this paper, they have introduced an efficient deterministic multithreading system that system will replace the pthread library from un modified c/c++ applications.

The key idea of the paper includes the following points I.e.

1. Testing on Non determinism debugging
2. Race free execution without any halt
3. Replying *debugging* without logging in
4. Replication of state machine allowance
5. *Comparison of the performances between Dthreads and pthreads*

## ***2. State the main contribution of the paper***

The primary contributions are-

1. Dthreads guarantees deterministic execution in the multithreaded programs
2. Dthreads replace the pthreads which reduces recompilation
3. Making Deployment process straight forward
4. Fast elimination of cache line and false sharing

## ***3. Critique the main contribution***

***3.a. Rate the significance of the paper on a scale of 5 (breakthrough), 4 (significant contribution), 3 (modest contribution), 2 (incremental contribution), 1 (no contribution or negative contribution). Explain your rating in a sentence or two.***

It is a significant contribution so I would rate as 4 points instead of 5 because undoubtedly deterministic synchronization is bit difficult to achieve, but still few methodology which includes the following points strengthen the significance,

1. Starting from isolated memory access to deterministic memory allocation is a long process.
2. The series of steps include time management which may vary from system to system.
3. Deterministic thread creation and shared memory is the solution for time management and gives advantage to Dthreads over pthreads.
4. The deterministic multithreading approach outperforms the conventional multithreading model which has limitations like unsupported external determinism.

*5. b. Rate how convincing is the methodology: do the claims and conclusions follow from the experiments? Are the assumptions realistic? Are the experiments well designed? Are there different experiments that would be more convincing? Are there other alternatives the authors should have considered? (And, of course, is the paper free of methodological errors.)*

They created a deterministic Dthreads which includes both serial and parallel phase.

The architectural view is persuasive as they worked and implemented in different aspects like memory management, synchronization and the protocol as well.

1. Memory allocation allocates superblocks by fetching individual allocation.
2. Performance analysis which includes dirtied pages, serial time and transaction time is well performed in **canneals and reverseindex**.

*3. c. What is the most important limitation of the approach?*

Though it's a brilliant paper but still have few un answered questions with limitations.

1. Is external determinism supported? (not answered in the paper)
2. Any applications which use hoc synchronization is not at all supported
3. Stack variables can not be shared
4. Modified pages per transactions is difficult to exhibit
5. Incurs substantial over heads the large number of short lived transactions.

*4. Rate the writing in the paper on a scale of 5 (great) to 1 (muddled), and justify your ranking. Did you have to re-read sections? Were algorithms clearly explained? Did the paper have a logical flow?*

Writing-5

The paper had a logical flow and proper explanation of methodology like starting from the paper objective, architectural design, limitations, future goal for improvising the performance are well explained.

As the authors clearly explained the design and implementation of DTHREAD model, its easy to understand the logic.

Functions like: `pthread_mutex_unlock`, `kill(tid, SIGKILL)` are clearly explained with usage

*5. Answer one of the following three questions (whichever is most relevant for this paper):*

*1. What lessons should system researchers and builders take away from this work?*

2. *What is the lasting impact of this work?*
3. *What (if any) questions does this work leave open?*

By answering the question 1 these are the following points which researchers can work further,

1. The efficiency calculation of dthreads are efficient
2. Dthreads memory allocation and replacement can be worked to improvise further.
3. All kind of Pthread APIs are supported by Dthreads
4. Using cache lines for false sharing avoids unnecessary memory blockage
5. Shuffling to commit changes are wonderful change for twin pages
6. The performance comparison between Dthreads and Pthreads will provide an idea to new researches based on the evaluation.
7. Twinning and diffing can be used to improvise the