An Introduction to Transactional Memory

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Outline

Why Transactional Memory

Is adding a new programming model a good idea?

- Parallel programming seems inevitable
- Humans evolved to reason sequentially
- Humans like abstractions (OOP, Virtual Memory, Garbage Collection)
- Locks are bad, mmmkay?

RDBMS

Those who cannot remember the past are condemned to repeat it.

- Databases running in parallel for decades!
- Successfully exploiting concurrency.
- Correctness and performance are essential (banks, huge corporations...)
- Managed to hide complexity from users!

Transaction

A Transaction

is a sequence of actions that appear indivisible and instantaneous.

- `Atomicity:` all or nothing
- `Consistency:` state should remain consistent after a transaction
- `Isolation:` execution of one transaction doesn't affect other concurrent ones (serializability).
- `Durability:` once committed, results are permanent.

Transactional Memory

Transactional Memory is...

- An abstraction, or a programming model, similar to DB transactions
- Interested in ACI... not **D**urability
- Like Hiro Nakamura (stops time)!
- We are **not** talking about implementation, just the model

Transactional Memory

Apply transactions to critical sections

Instead of:-

```
LOCK(global_lock);
counter = counter + 1;
UNLOCK(global_lock);
```

Use:-

```
atomic {
    counter = counter + 1;
}
```

Differences between DBs and TM

Different problem domains

- DB data resides on disks
- DB data needs to be permanent (durability)
- Changes to a DB need to leave a log (accountability)
- DBs had a clean slate to work with (legacy code)

Skeptical Look

Is TM all it's cracked up to be?

- TM doesn't solve all problems
- Been around for a while but not really used
- Legacy code
- IO and nontransactional access
- Lack of convincing benchmarks

Skeptical Look

It depends...

- It (arguably) took garbage collection decades to become mainsteam
- Chicken and egg problem
- Currently a hot topic!
- IO and nontransactional access

References and Further Reading

Refer to the following for more information

- Wikipedia: ACID
- Larus and Rajwar: Transactional Memory (ch 1 & 2)
- Jim Gray: The Transaction Concept