The Semantics of Progress in Lock-Based Transactional Memory

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Transactional Memory

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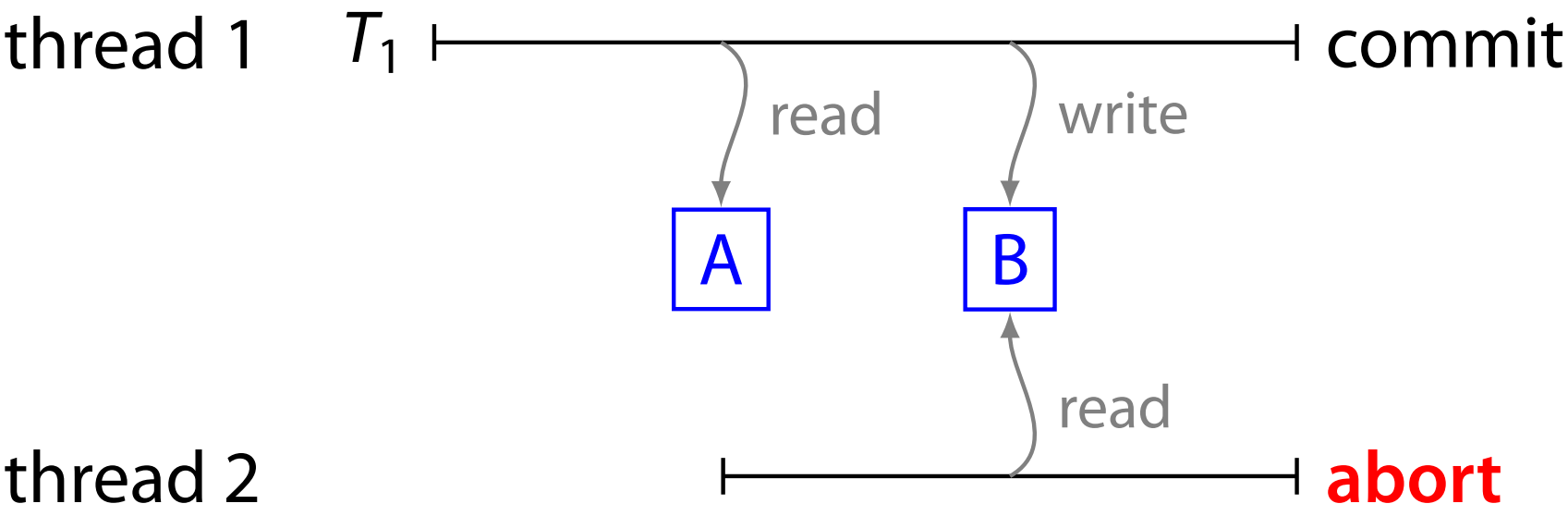


Practice

DSTM, SXM, TL2, RSTM, JVSTM, NZTM,
Haskell STM, TinySTM, McRT-STM, BartokSTM, SwissTM, …

Practice

DSTM, SXM, TL2, RSTM, JVSTM, NZTM,
Haskell STM, TinySTM, McRT-STM, BartokSTM, SwissTM, …

semantics, inherent limitations

Theory

Semantics
of
Transactional Memory

2 aspects

correctness condition

1

nothing bad happens

correctness condition

opacity [PPoPP'08]

nothing bad happens

progress property

something good happens

2

progress property:

When can a transaction be aborted?

progress property

obstruction-freedom [SPAA'08]

something good happens

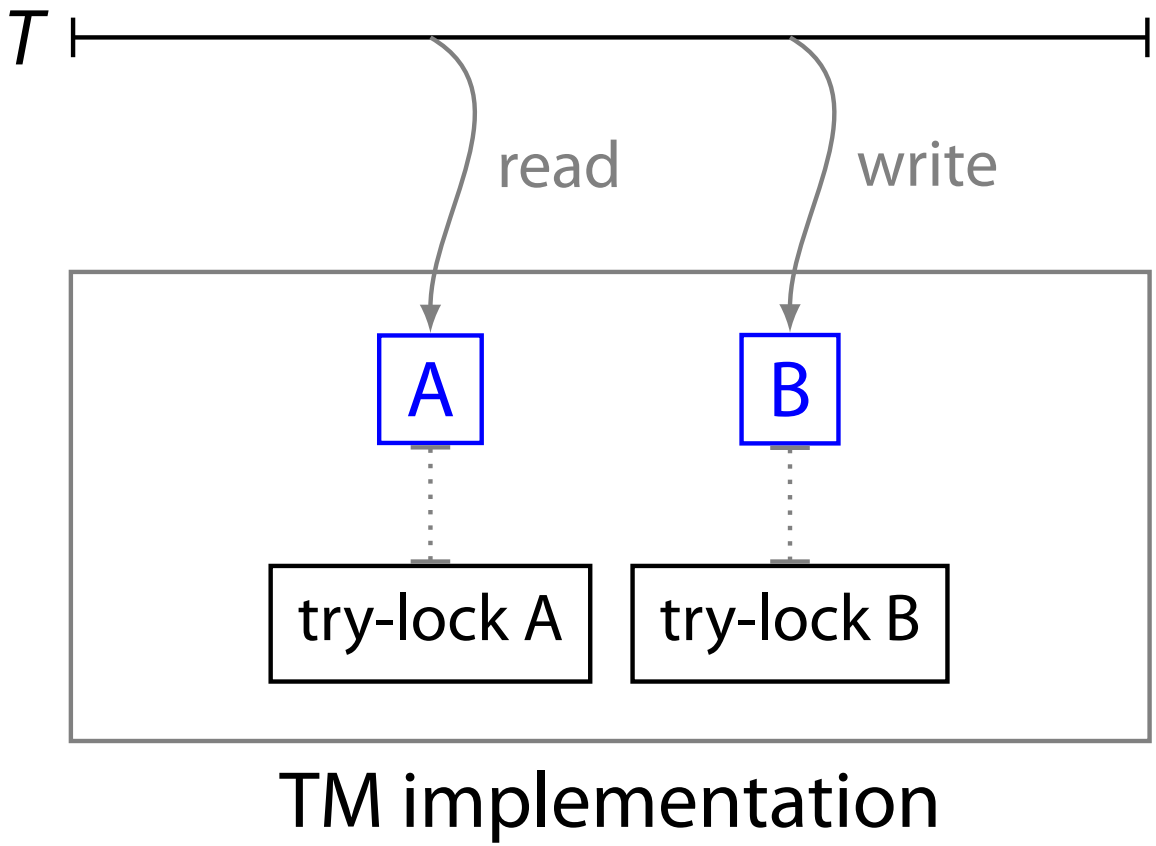
progress property

lock-based TMs?

this talk

something good happens

Lock-Based TM Implementation



progress property

lock-based TM

=

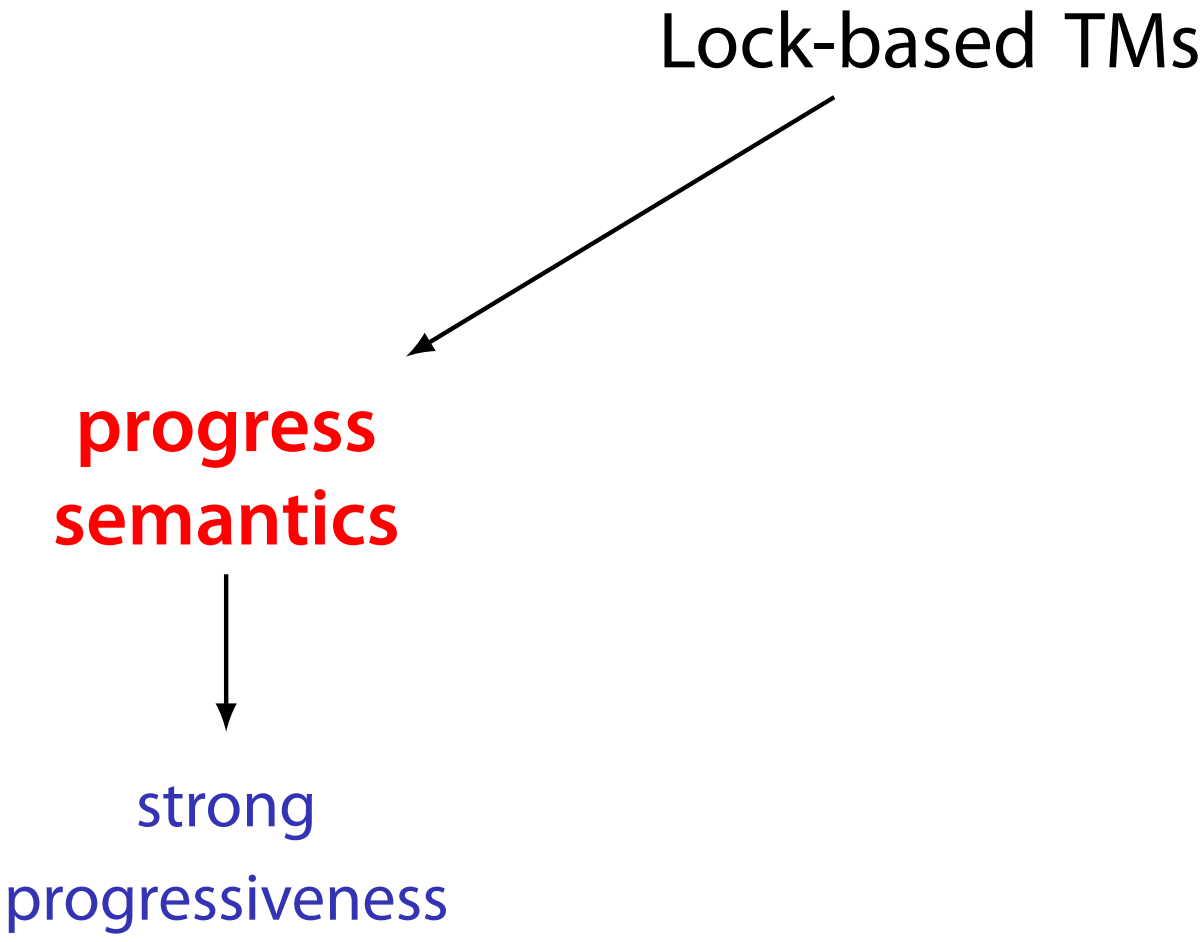
ensures **strong progressiveness**

something good happens

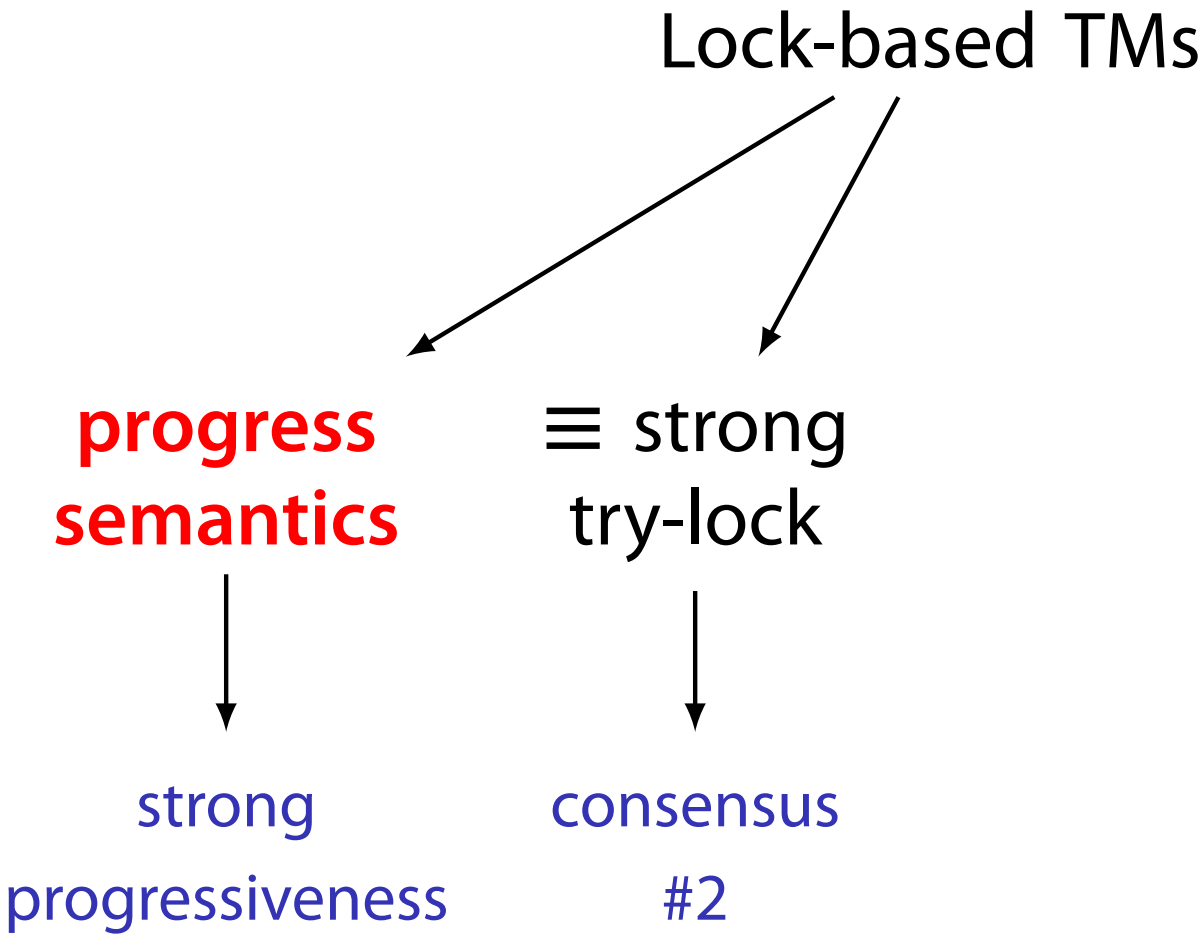
Strongly progressive TMs

TL2, TinySTM, RSTM, BartokSTM, McRT-STM, …

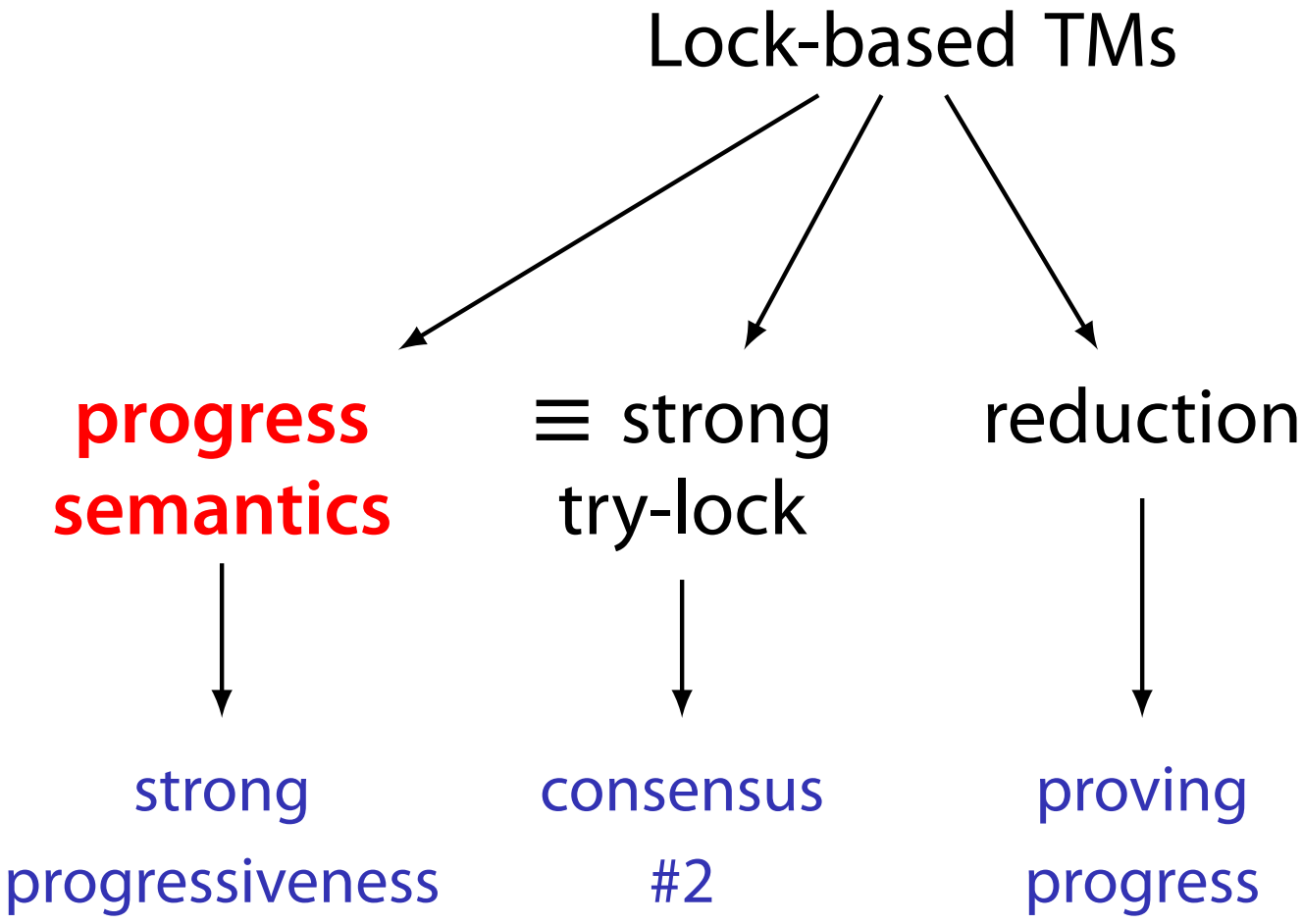
Contributions



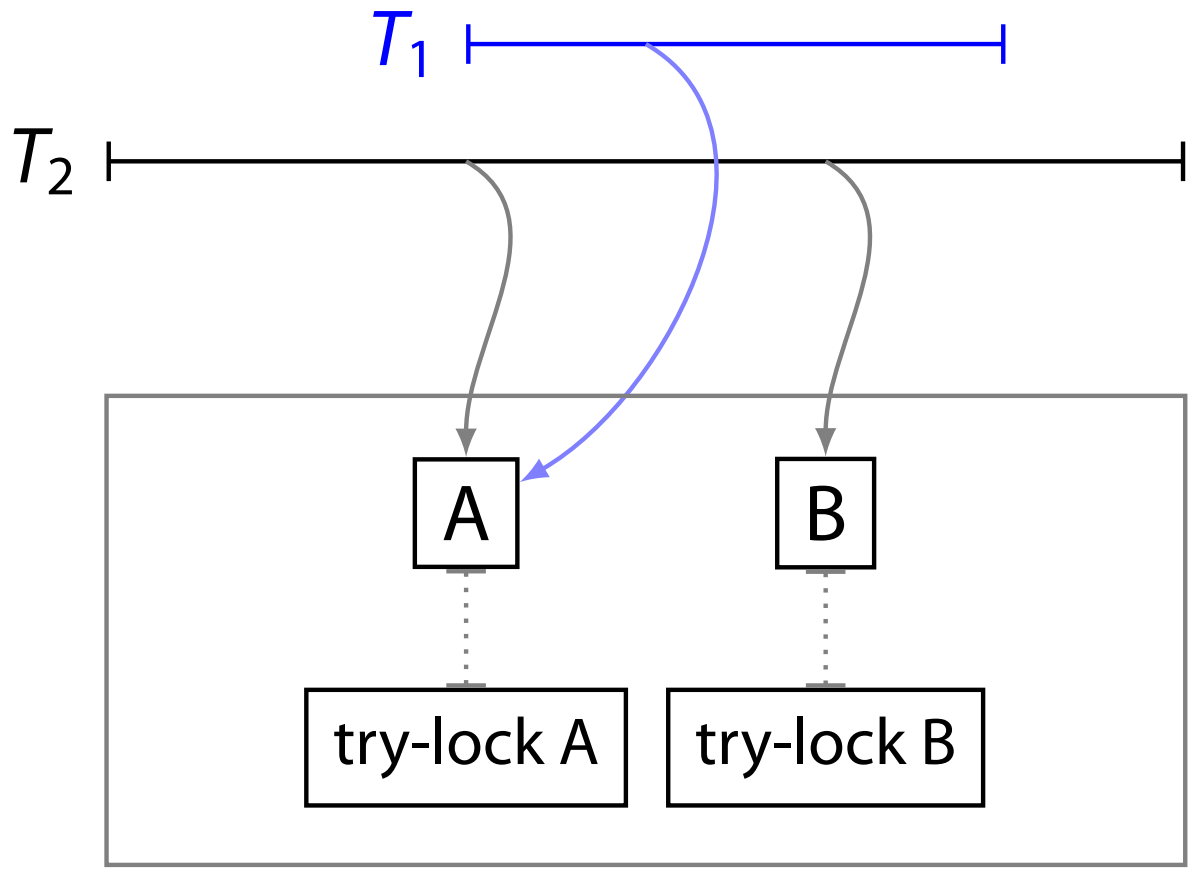
Contributions



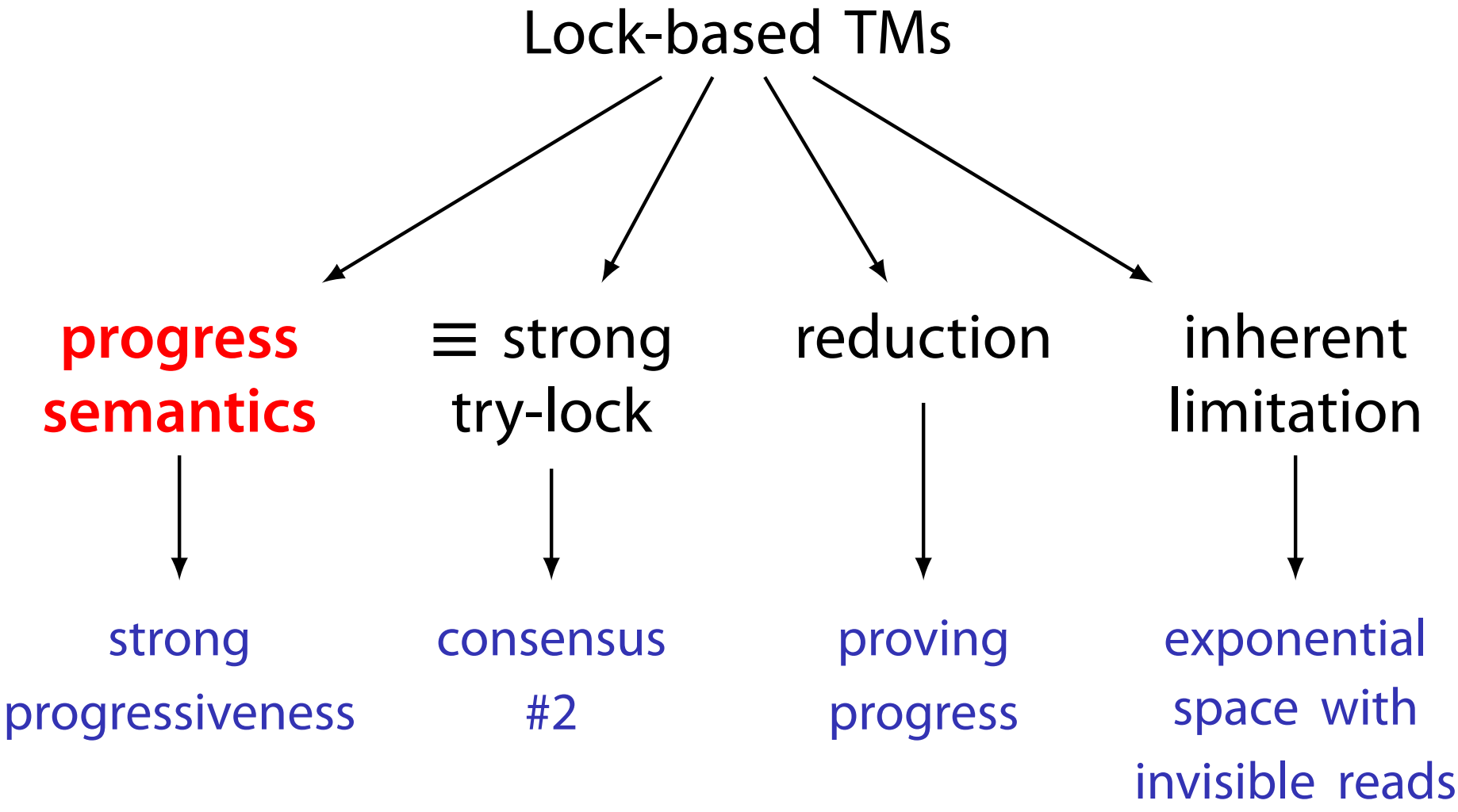
Contributions



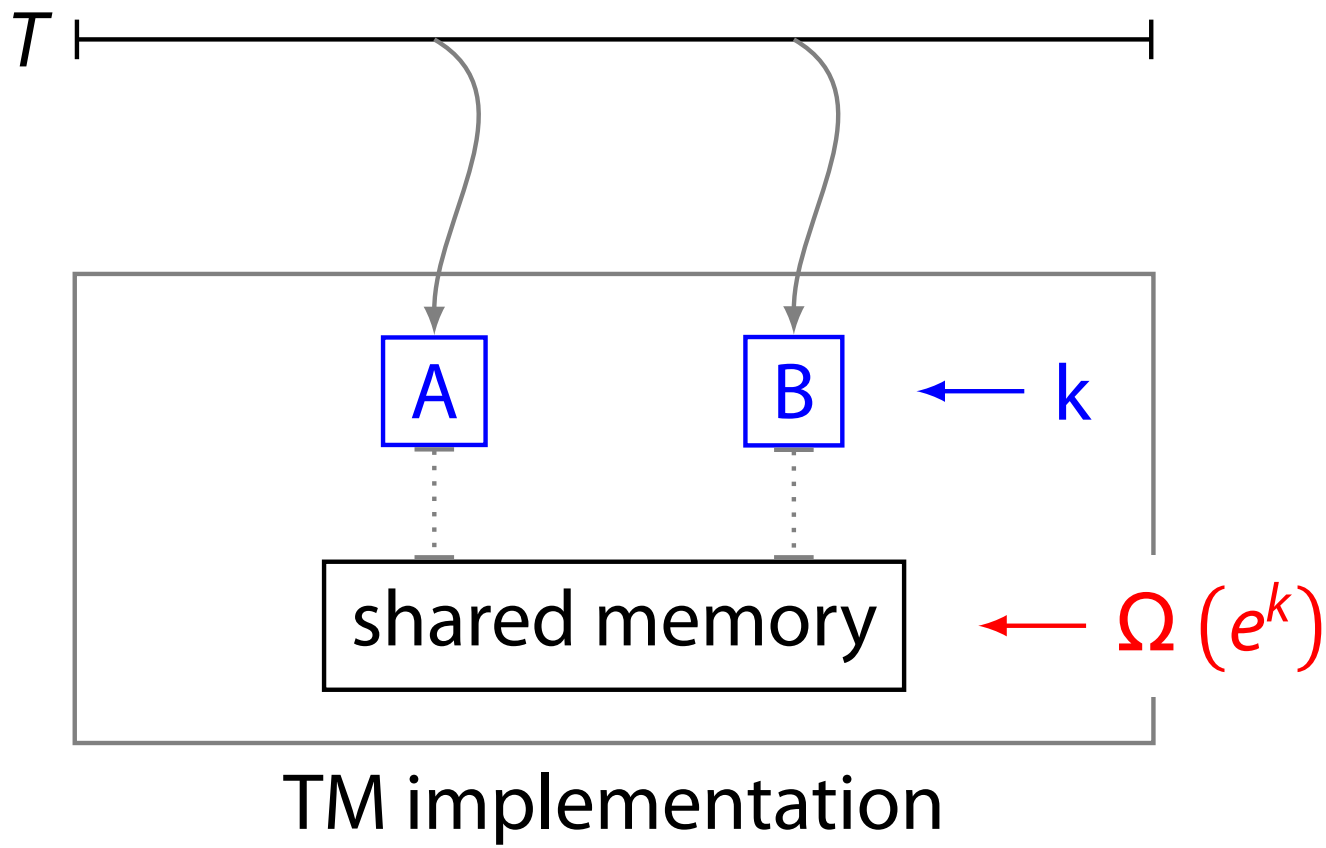
Reduction



Contributions



Inherent Complexity



Strong Progressiveness

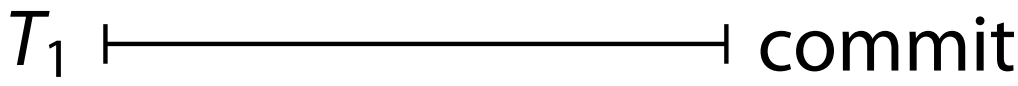
Strong Progressiveness

If a group of concurrent transactions

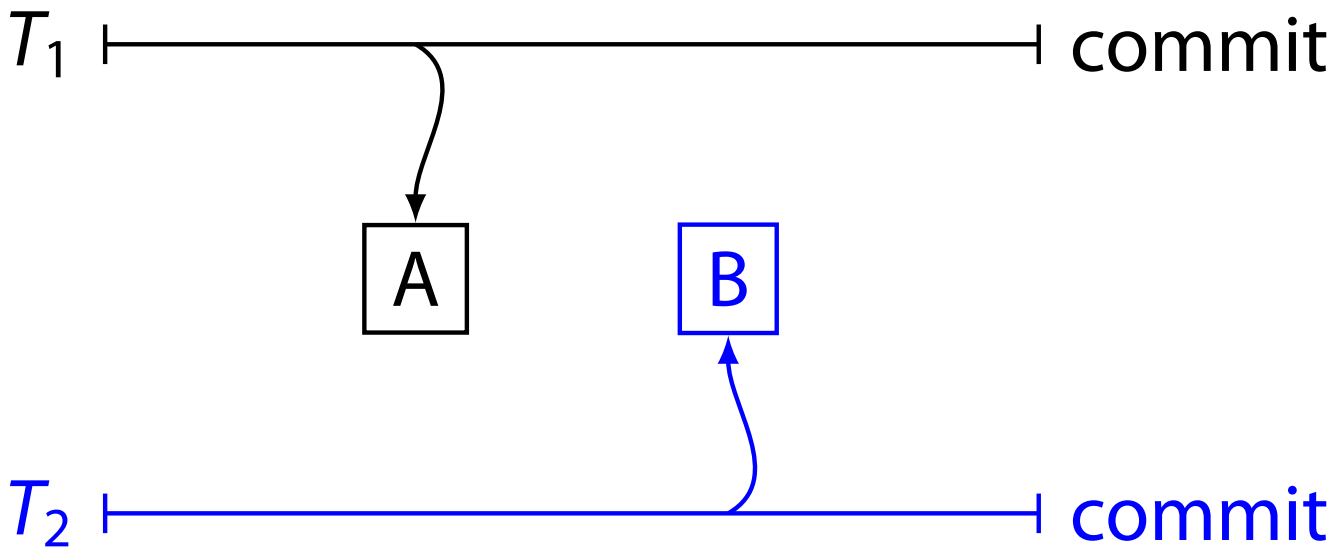
conflict on at most 1 object,

then 1 of those must commit.

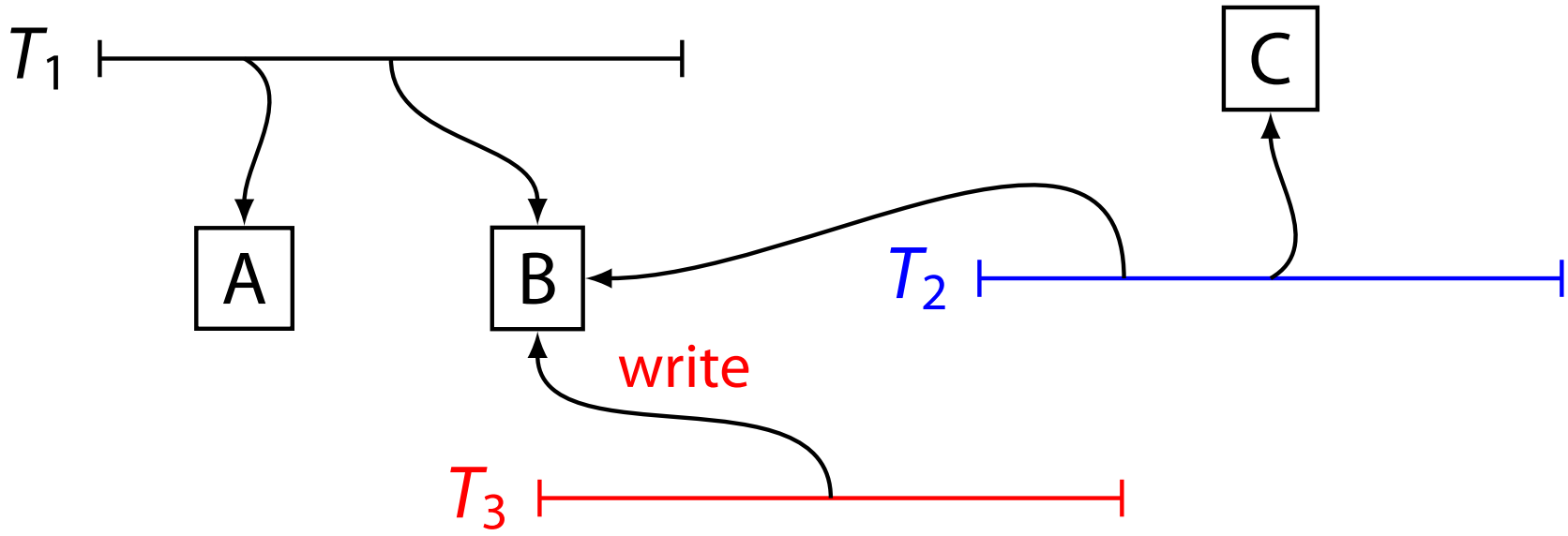
Example 1



Example 2



Example 3



commit or commit or commit

Strong Progressiveness

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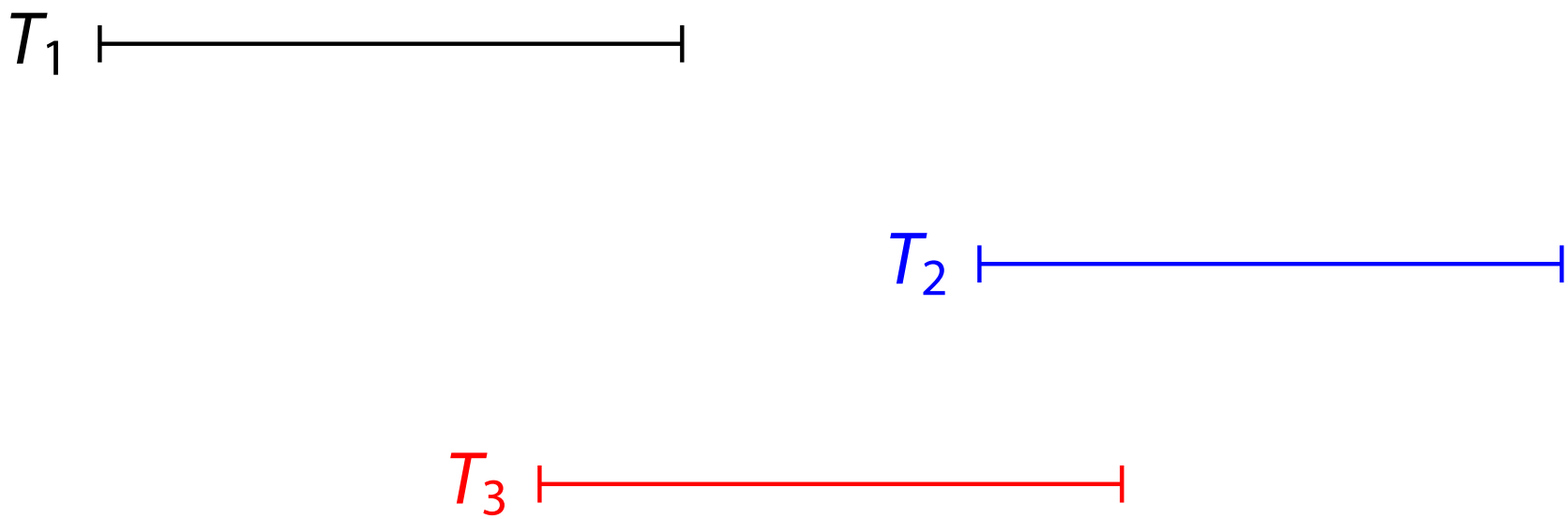
T_1
T_2
T_3

Strong Progressiveness

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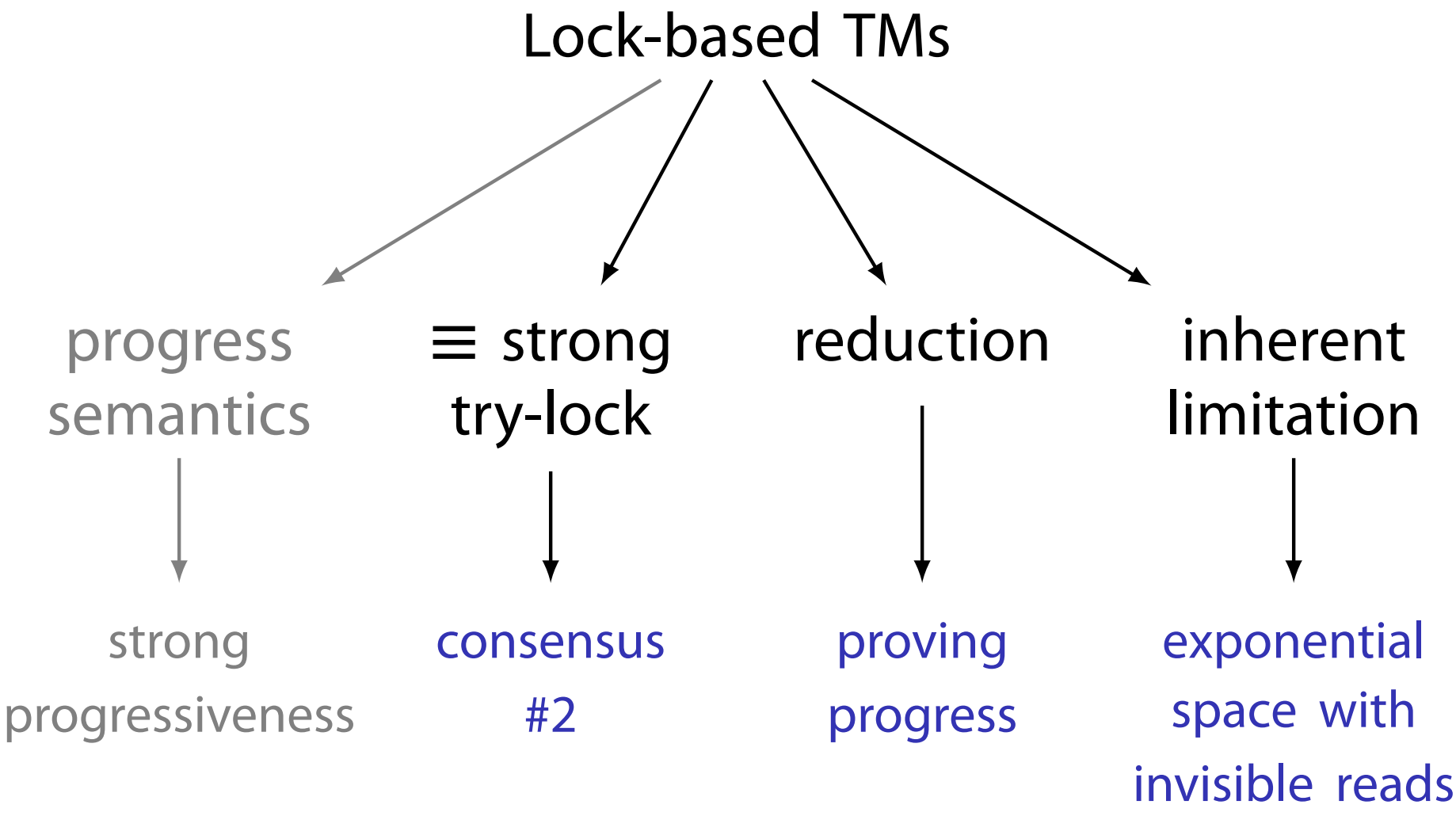
In the Paper…


Lock-based TMs
progress semantics
≡ strong try-lock
reduction
inherent limitation
strong progressiveness
consensus #2
proving progress
exponential space with invisible reads

How much progress can a TM ensure ?