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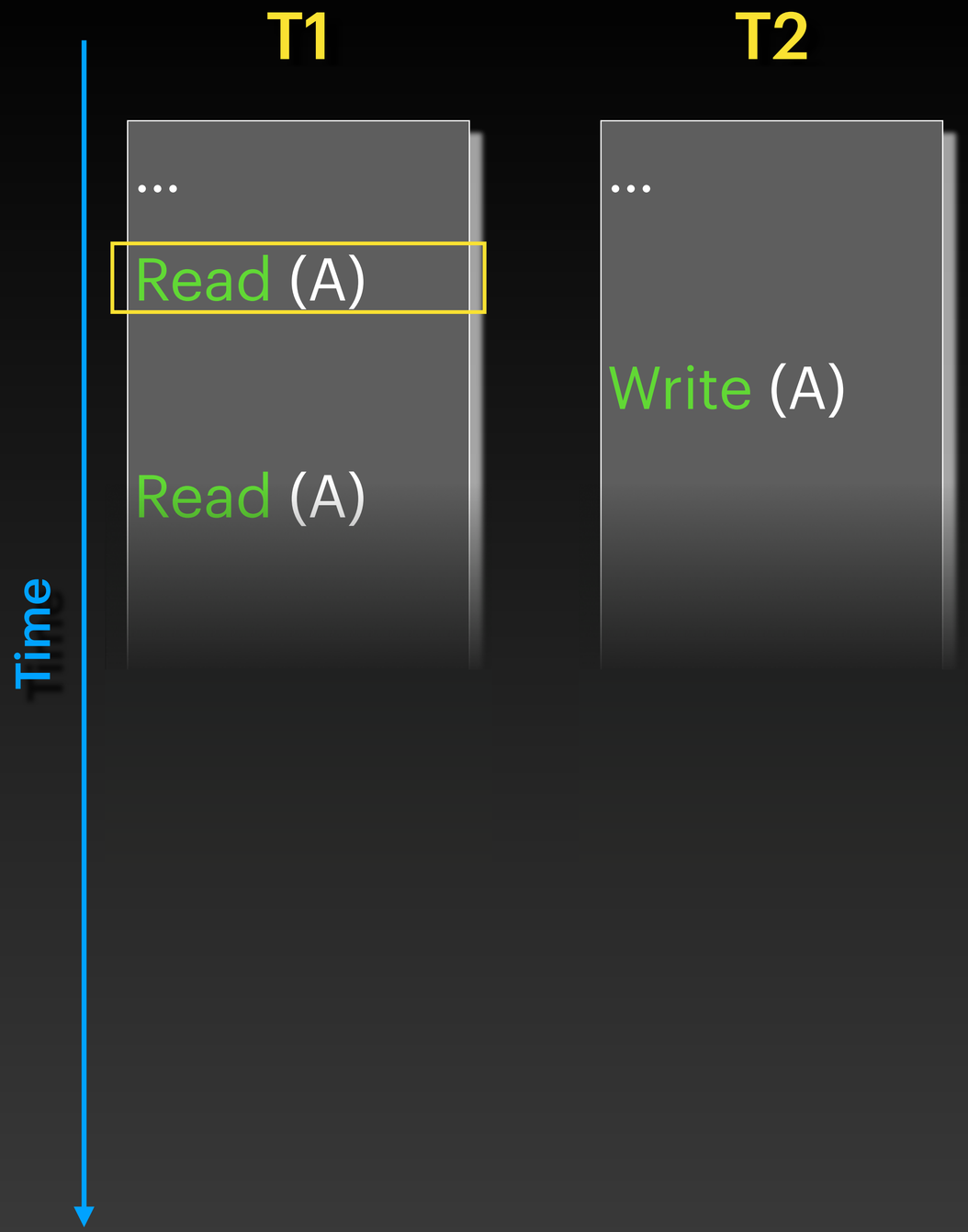
CONCURRENCY CONTROL

Multi Version Concurrency Control

AMR ELHELW



A = 100

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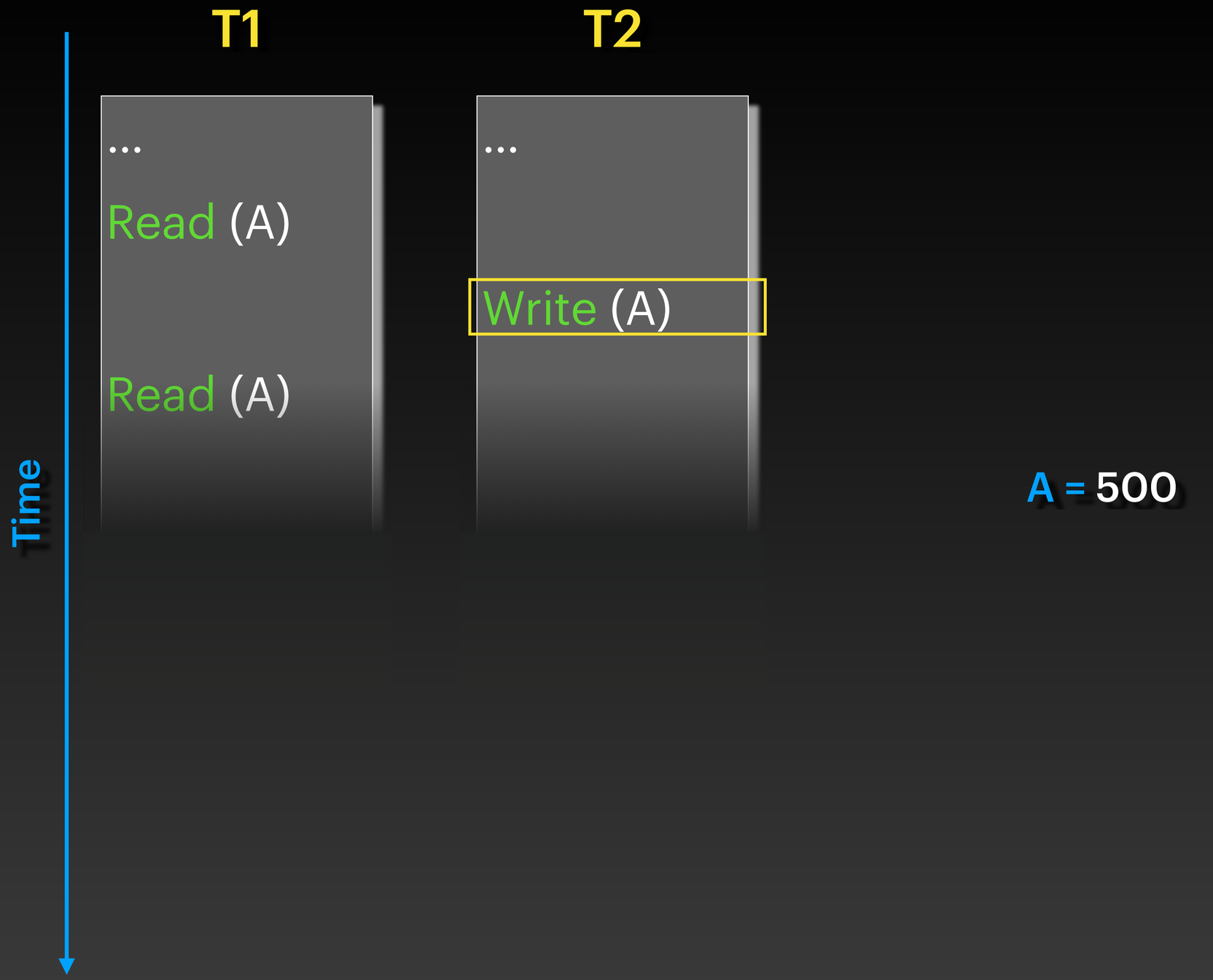

A = 500

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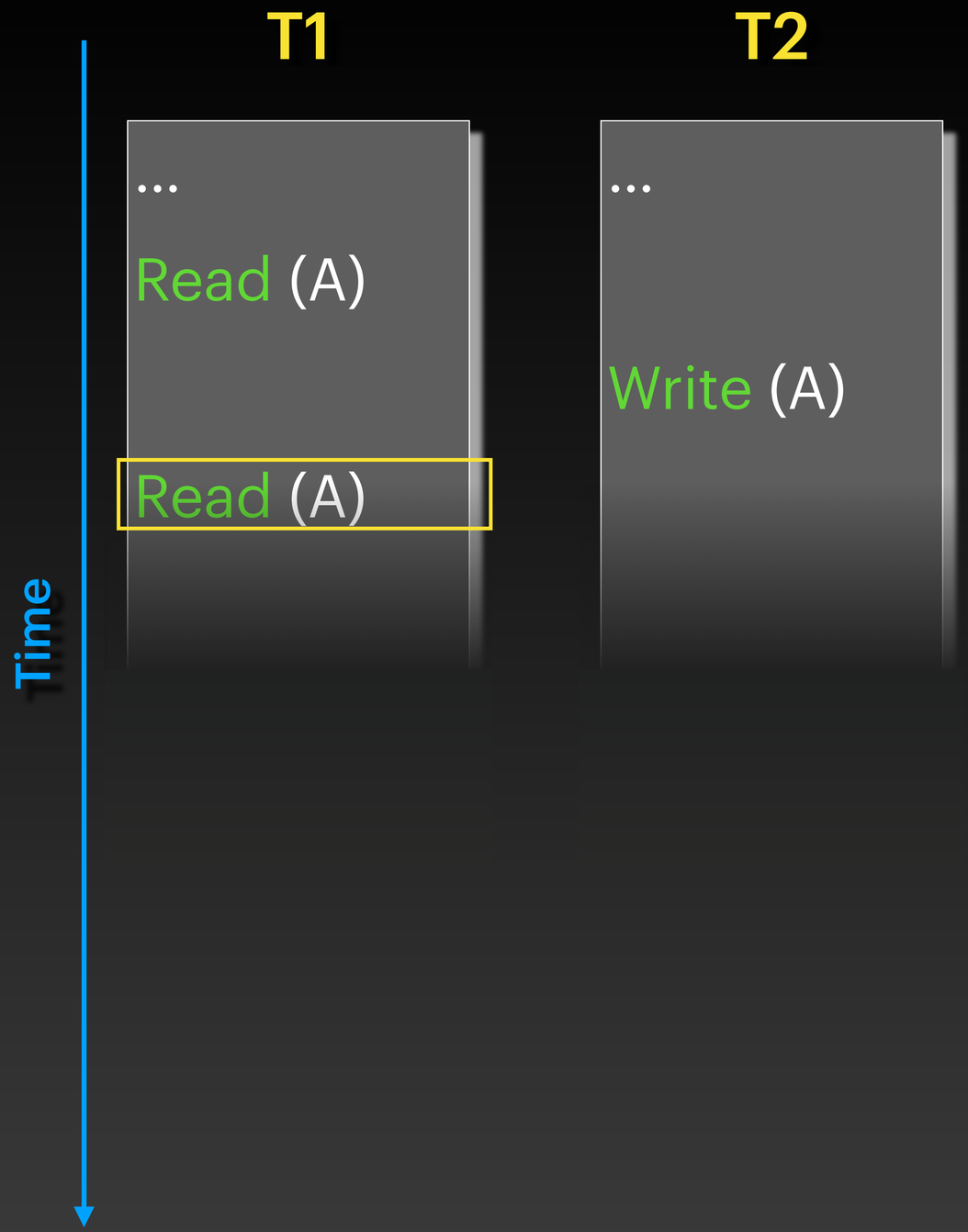

A = 500

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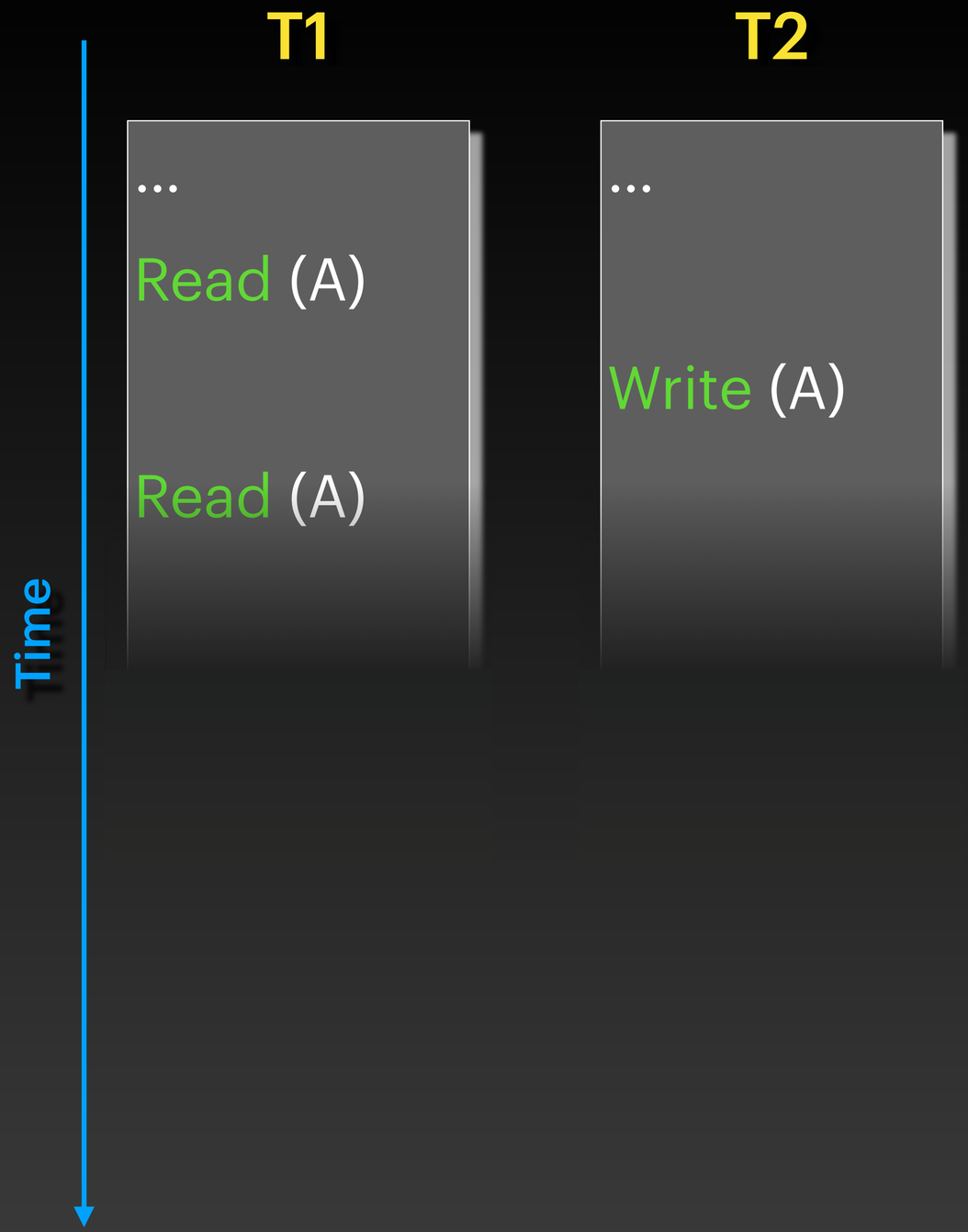

$A_0 = 100$

$A_1 = 500$

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MVCC with Timestamps

- Each transaction is assigned a timestamp *ts*
- Timestamps are monotonically increasing

- If $ts(T_i) < ts(T_j)$ then we want a schedule equivalent to the serial schedule where T_i *runs before* T_j

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MVCC with Timestamps

- For each data item X, we maintain several versions X_0, X_1, X_2, ...
- For each version, we maintain:
  - *Read timestamp* R-TS
    - Largest timestamp of a transaction that read this version
  - *Write timestamp* W-TS
    - Timestamp of the transaction that wrote this version

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MVCC: Reads

- Transaction *T* wants to read object *X*
- Read the latest version X_i that was written before *T* started (or during *T*)
  - i.e. $W\text{-}TS(X_i)$ has the highest value <= $ts(T)$
- Set $R\text{-}TS(X_i)$ to $max(R\text{-}TS(X_i), ts(T))$

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MVCC: Writes

- Transaction T wants to write object X
- Let X_i be the version that has the highest $W\text{-}TS(X_i)$ that is also <= $ts(T)$
- If $R\text{-}TS(X_i) > ts(T)$, then Abort T
- Otherwise, create a new version X_j
  - Set $R\text{-}TS(X_j) = W\text{-}TS(X_j) = ts(T)$

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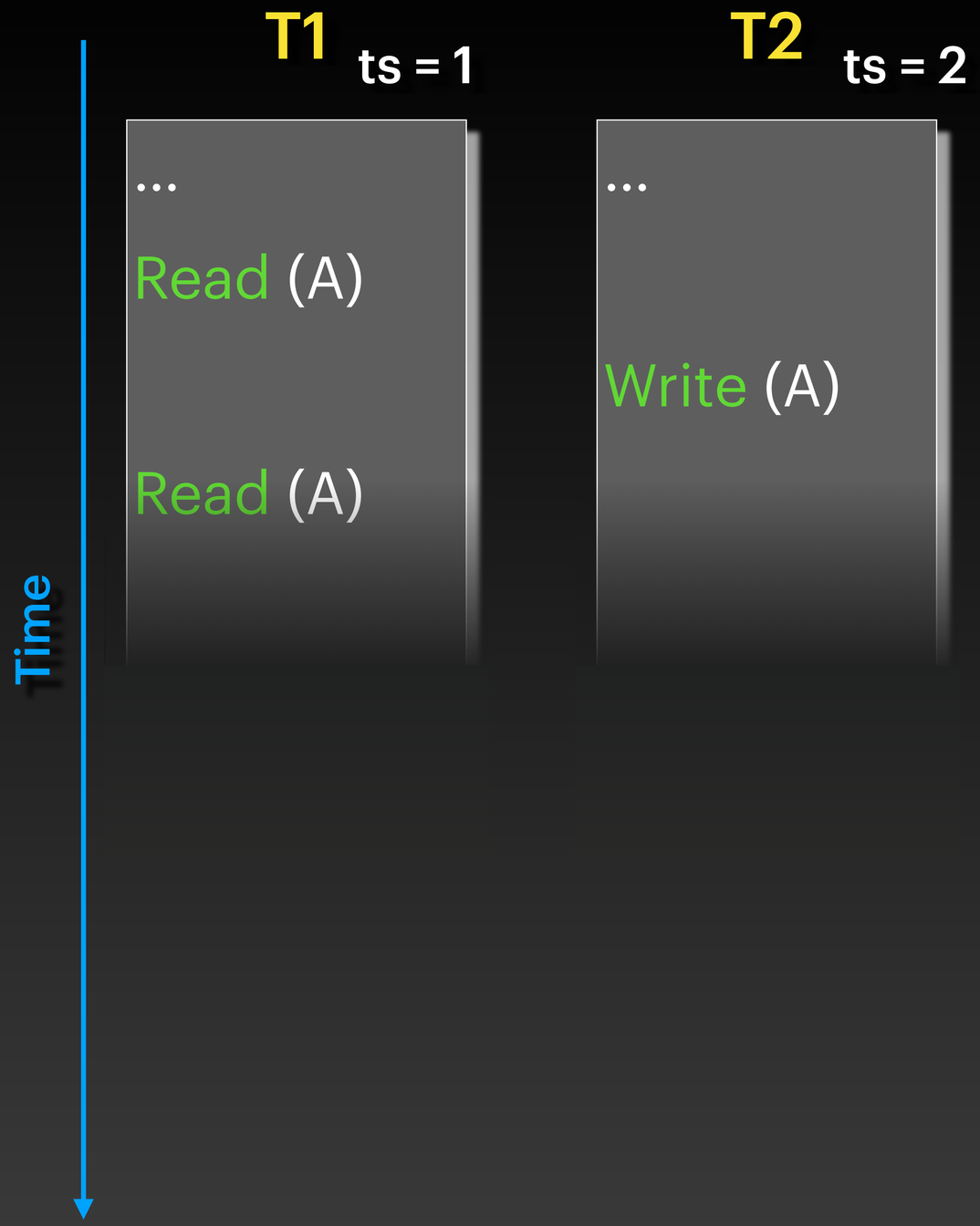

Version	Value	R-TS	W-TS
A_0	100	0	0

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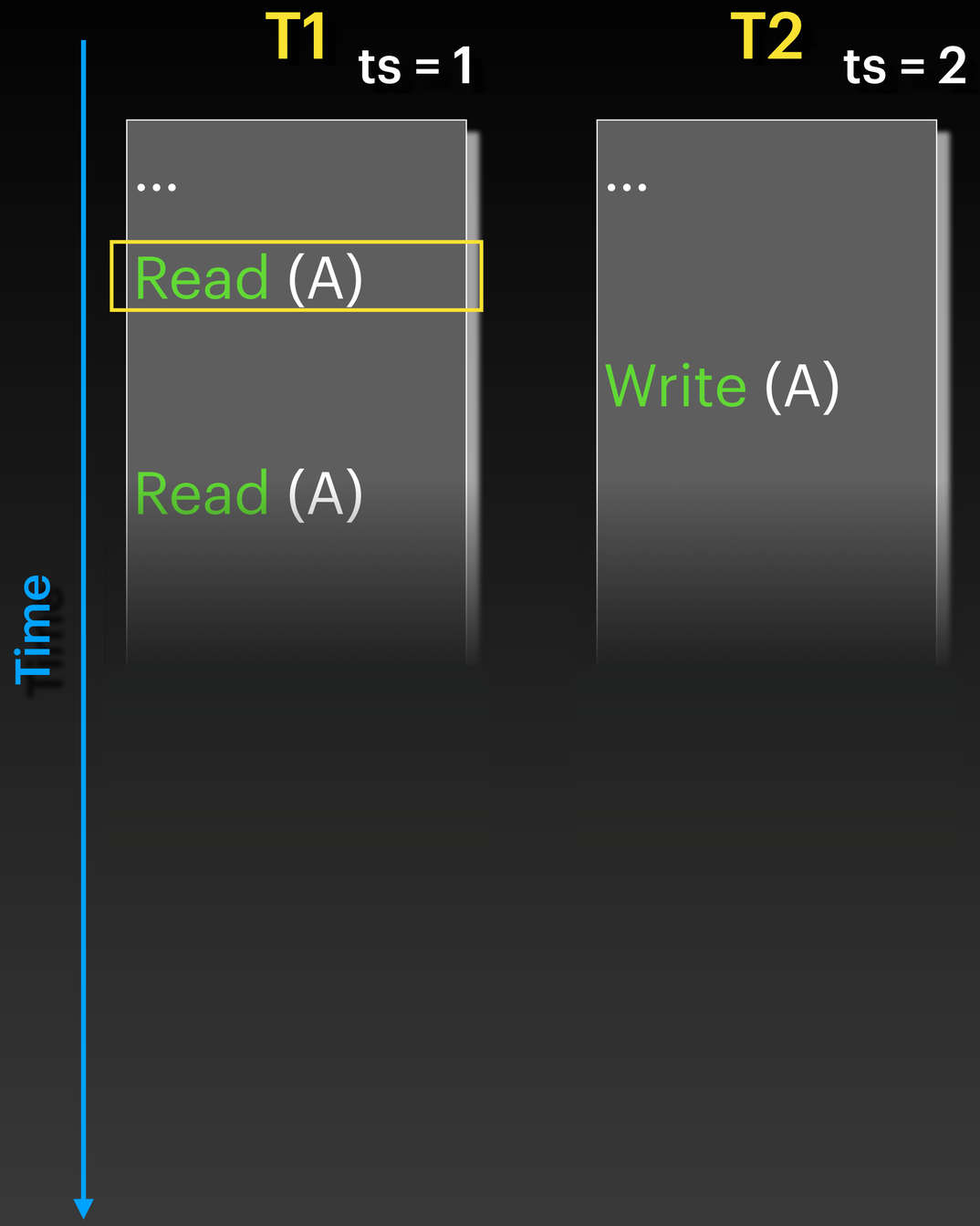

Version	Value	R-TS	W-TS
A_0	100	1	0

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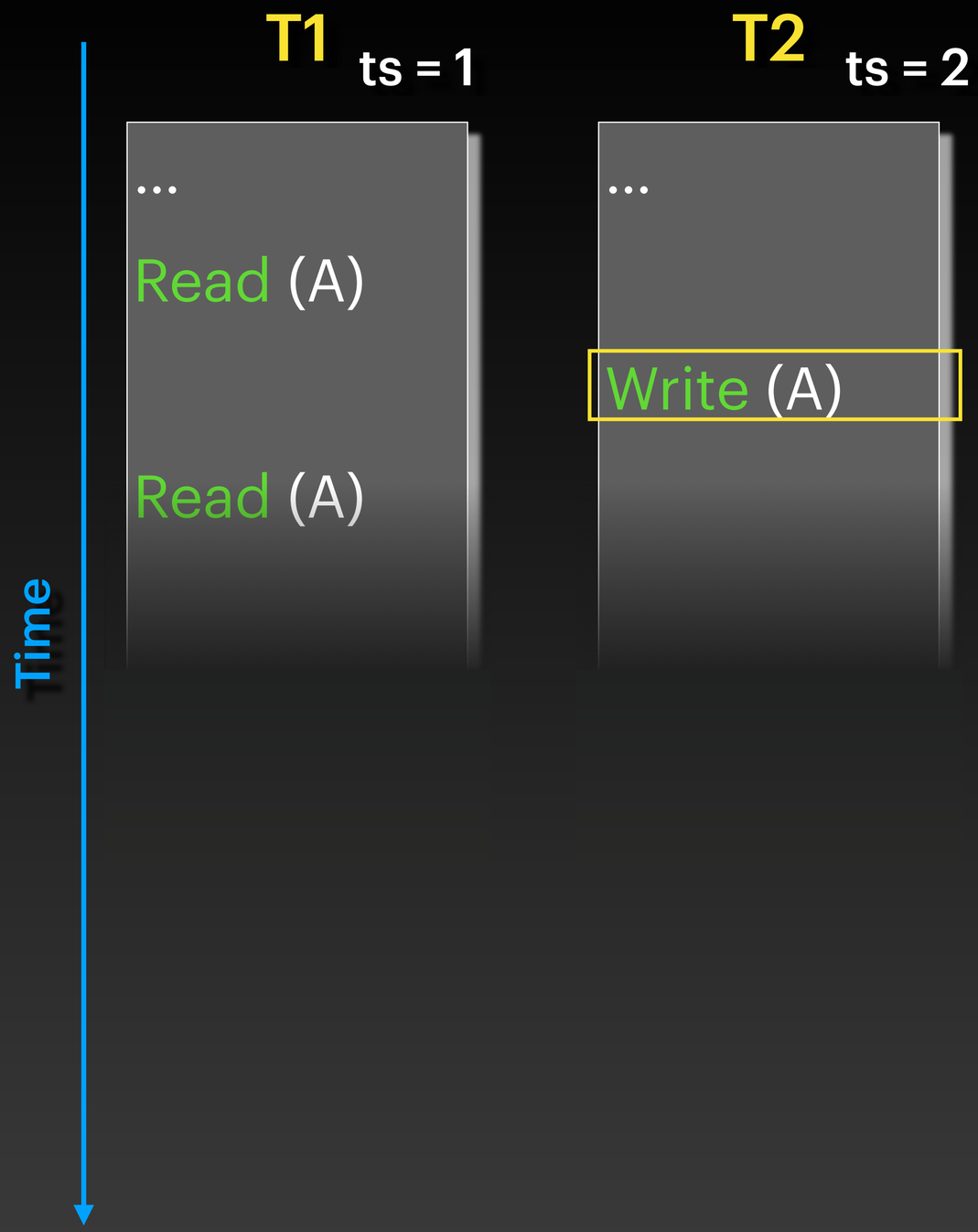

Version	Value	R-TS	W-TS
A_0	100	1	0

Highest W-TS less than or equal ts(T)

R-TS < ts(T)

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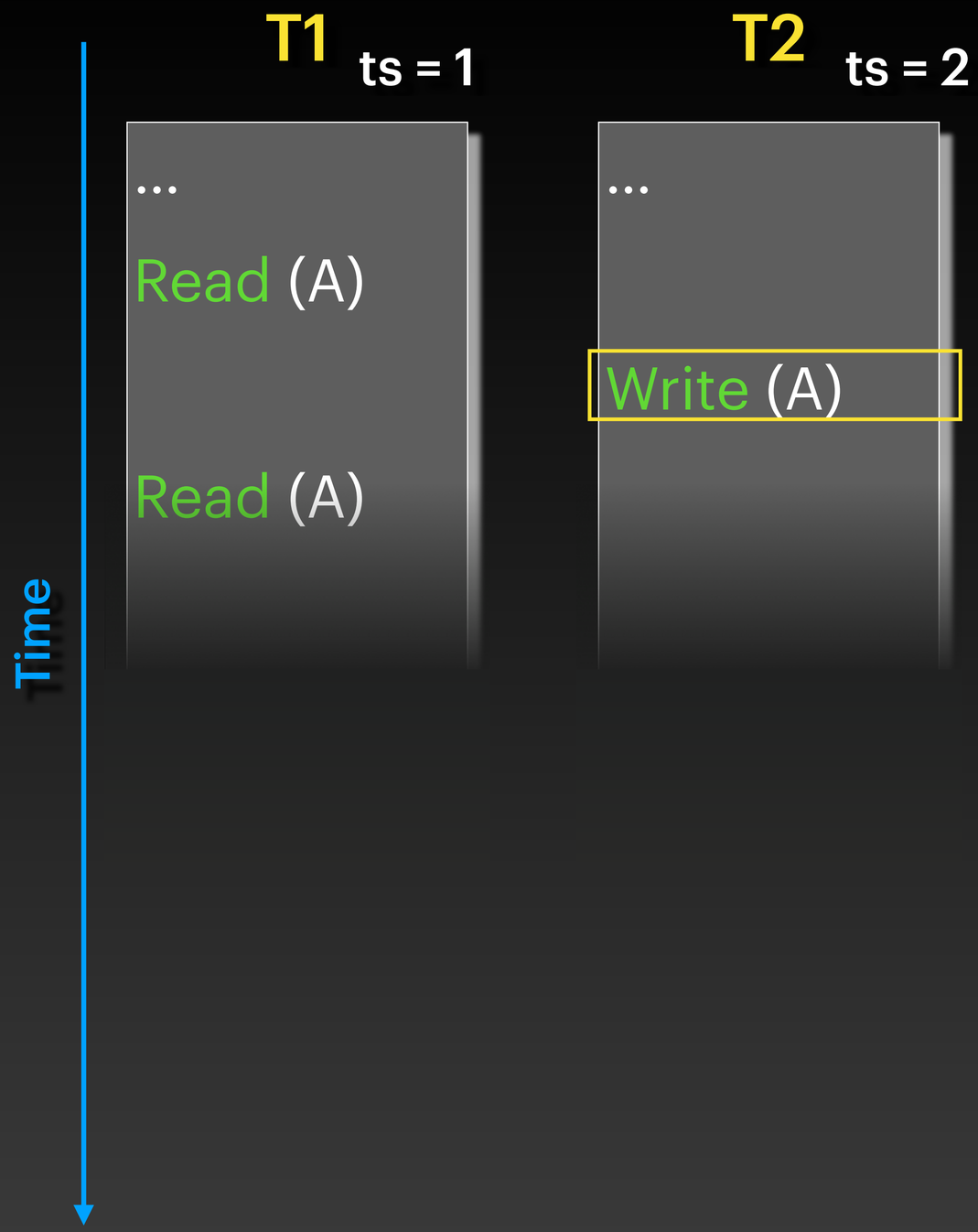

Version	Value	R-TS	W-TS
A_0	100	1	0
A_1	500	2	2

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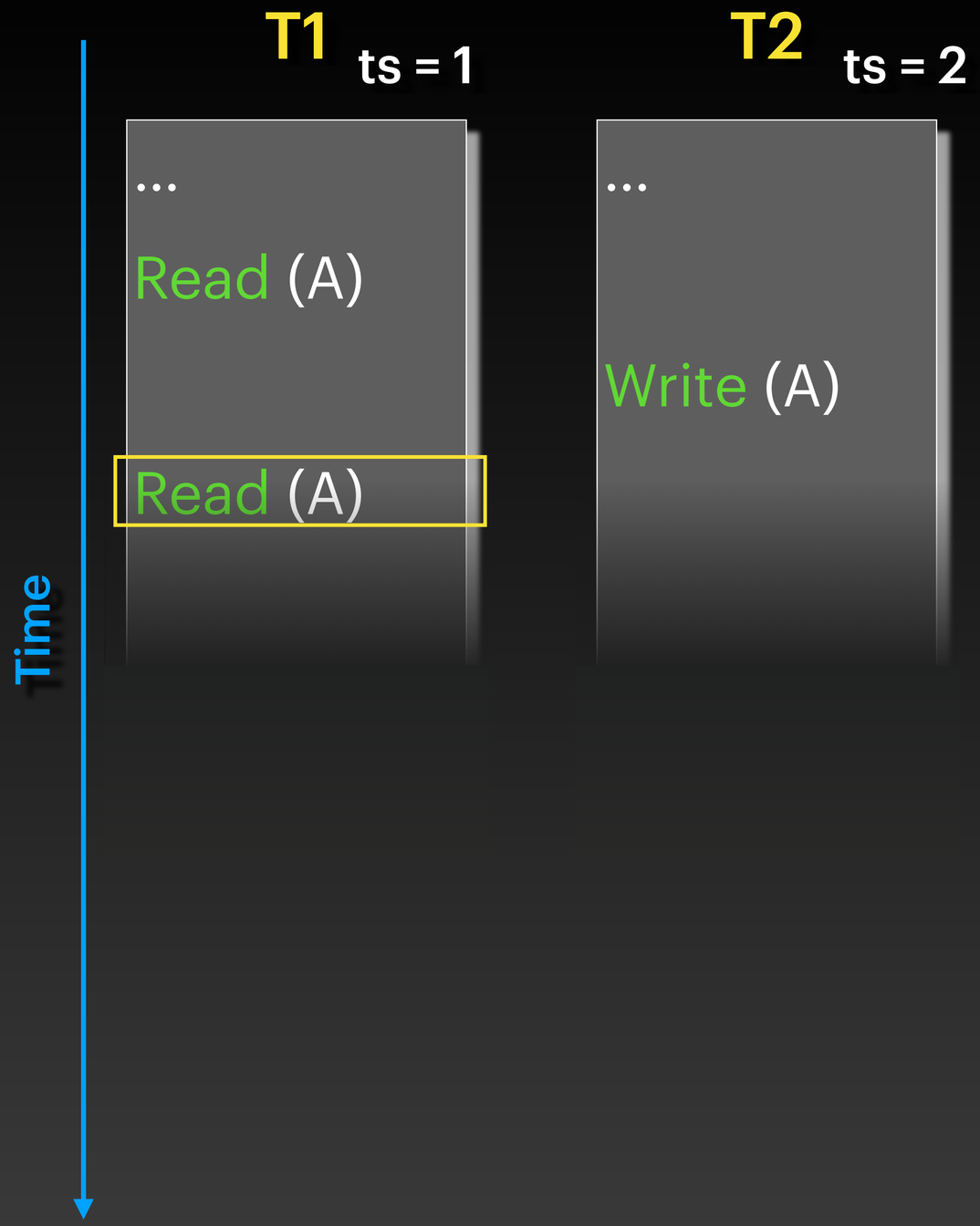

Version	Value	R-TS	W-TS
A_0	100	1	0
A_1	500	2	2

Highest W-TS <=ts(T)

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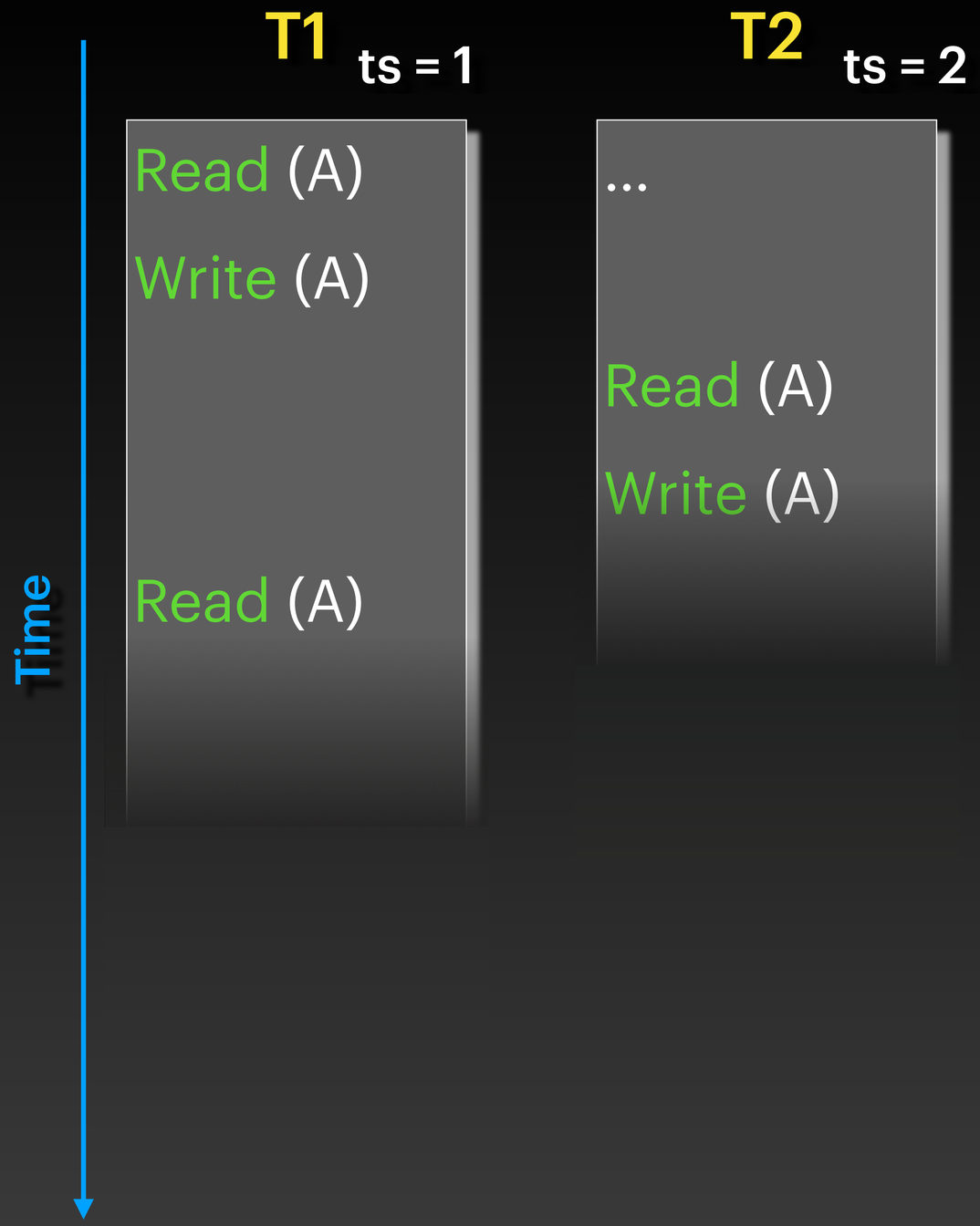

Version	Value	R-TS	W-TS
A_0	100	0	0

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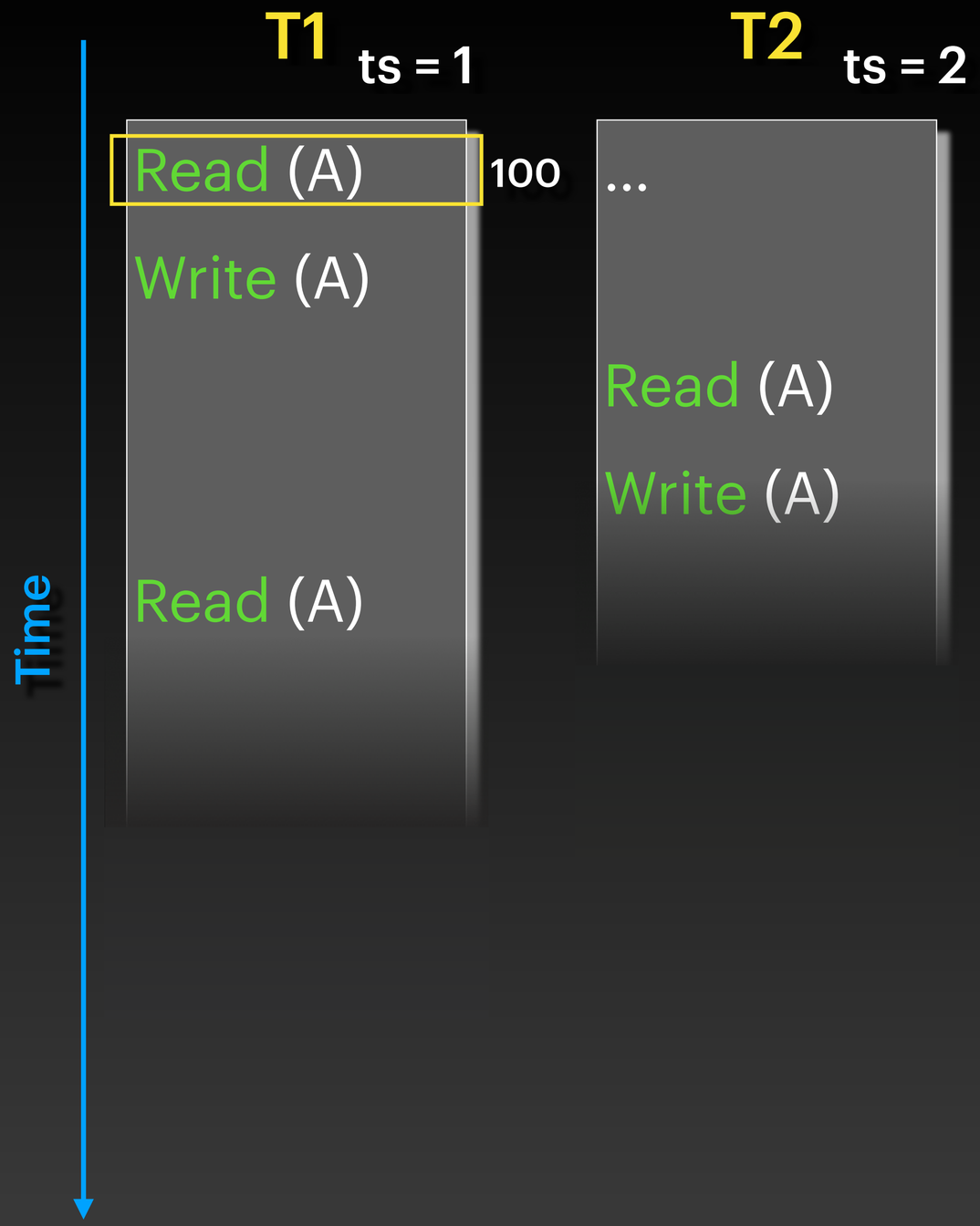

Version	Value	R-TS	W-TS
A_0	100	1	0

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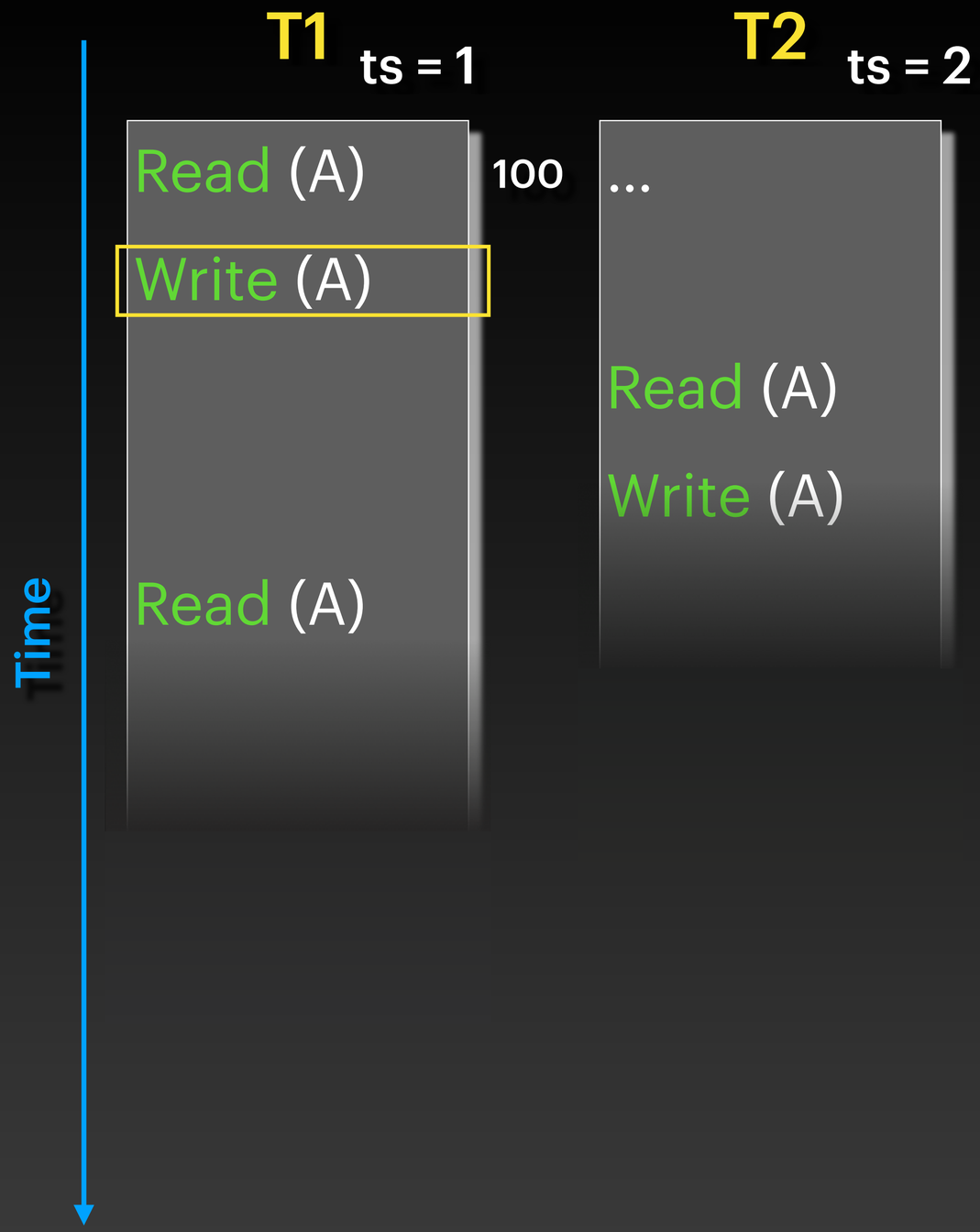

Version	Value	R-TS	W-TS
A_0	100	1	0

R-TS <= ts(T)

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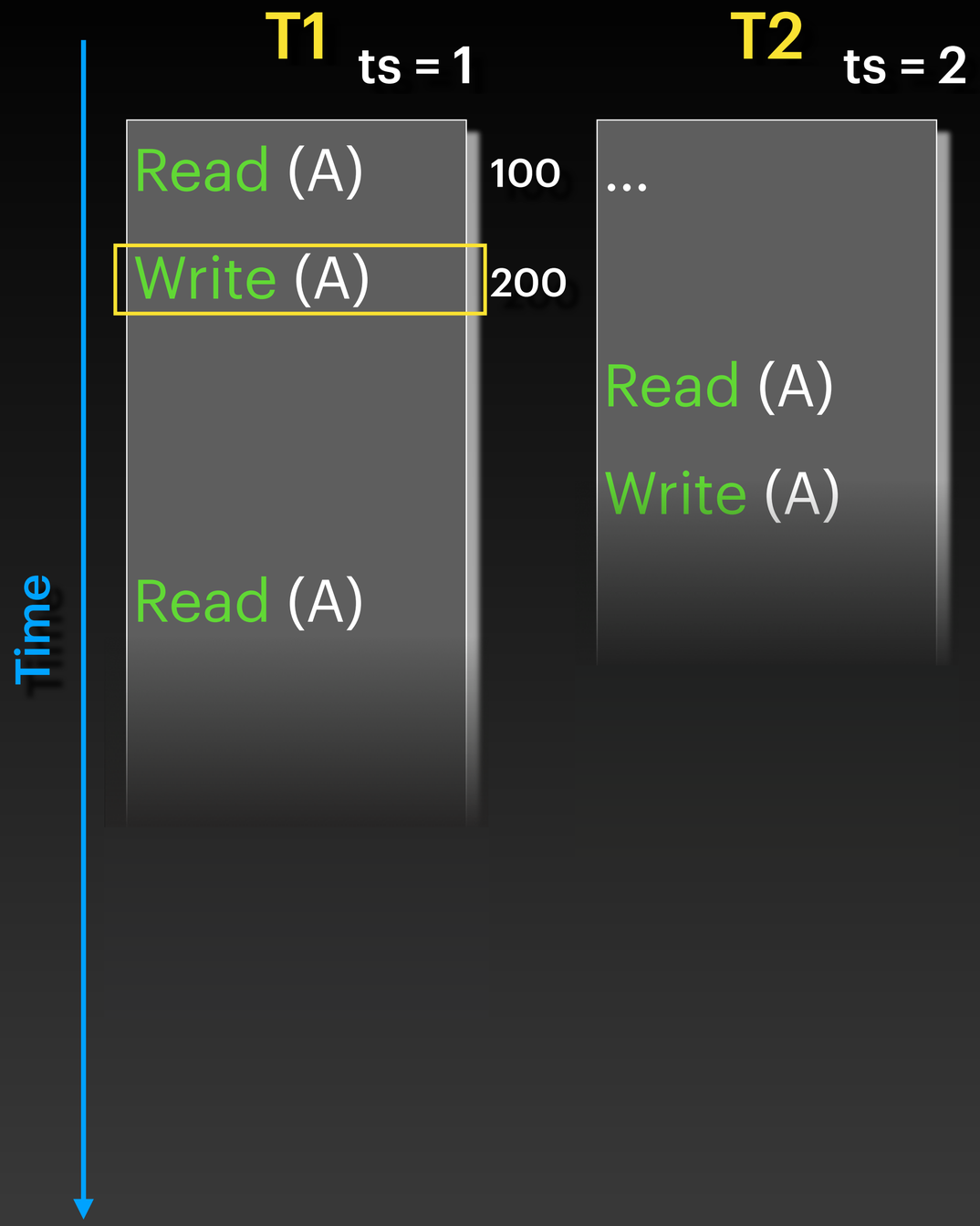

Version	Value	R-TS	W-TS
A_0	100	1	0
A_1	200	1	1

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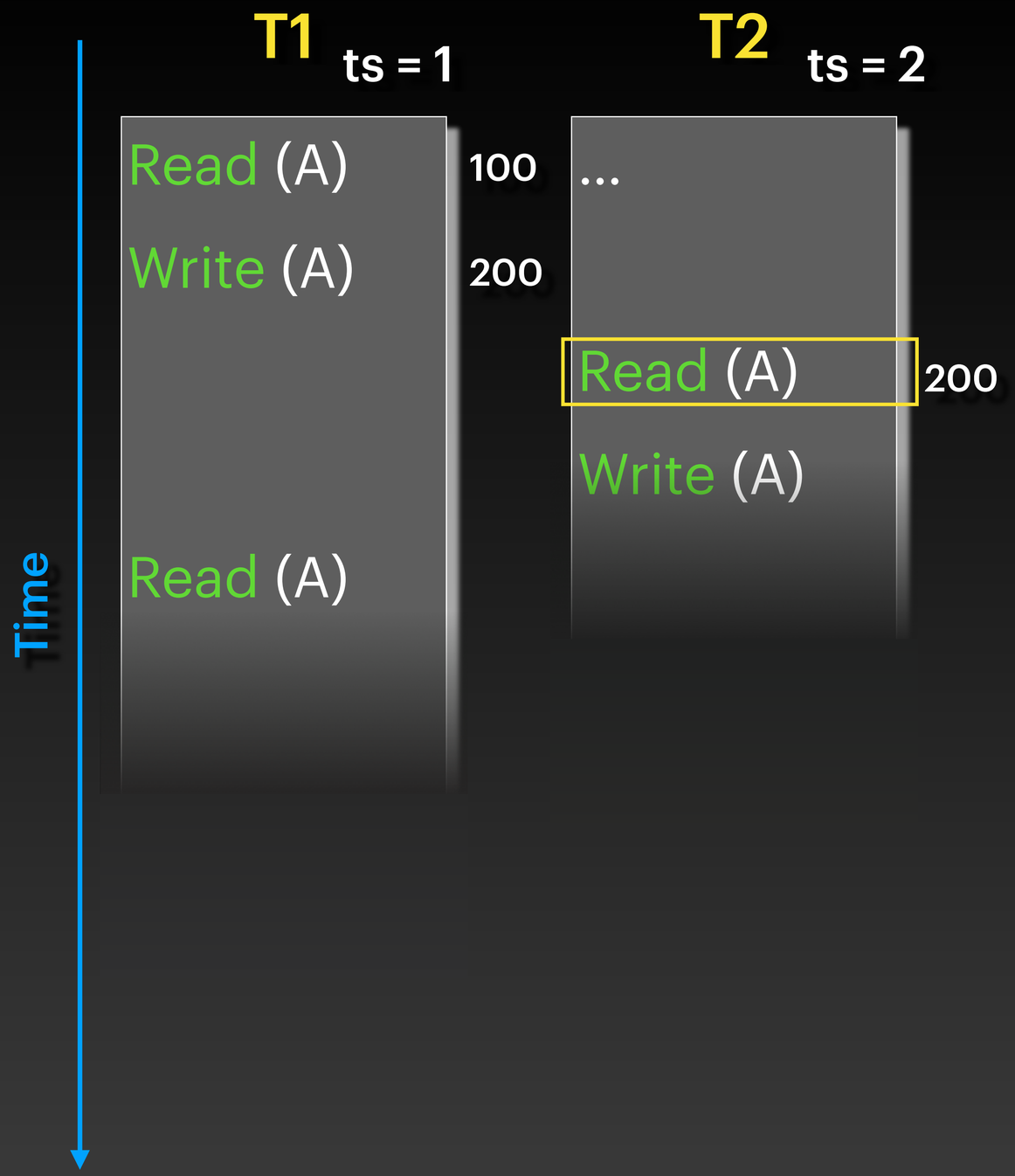

Version	Value	R-TS	W-TS
A_0	100	1	0
A_1	200	2	1

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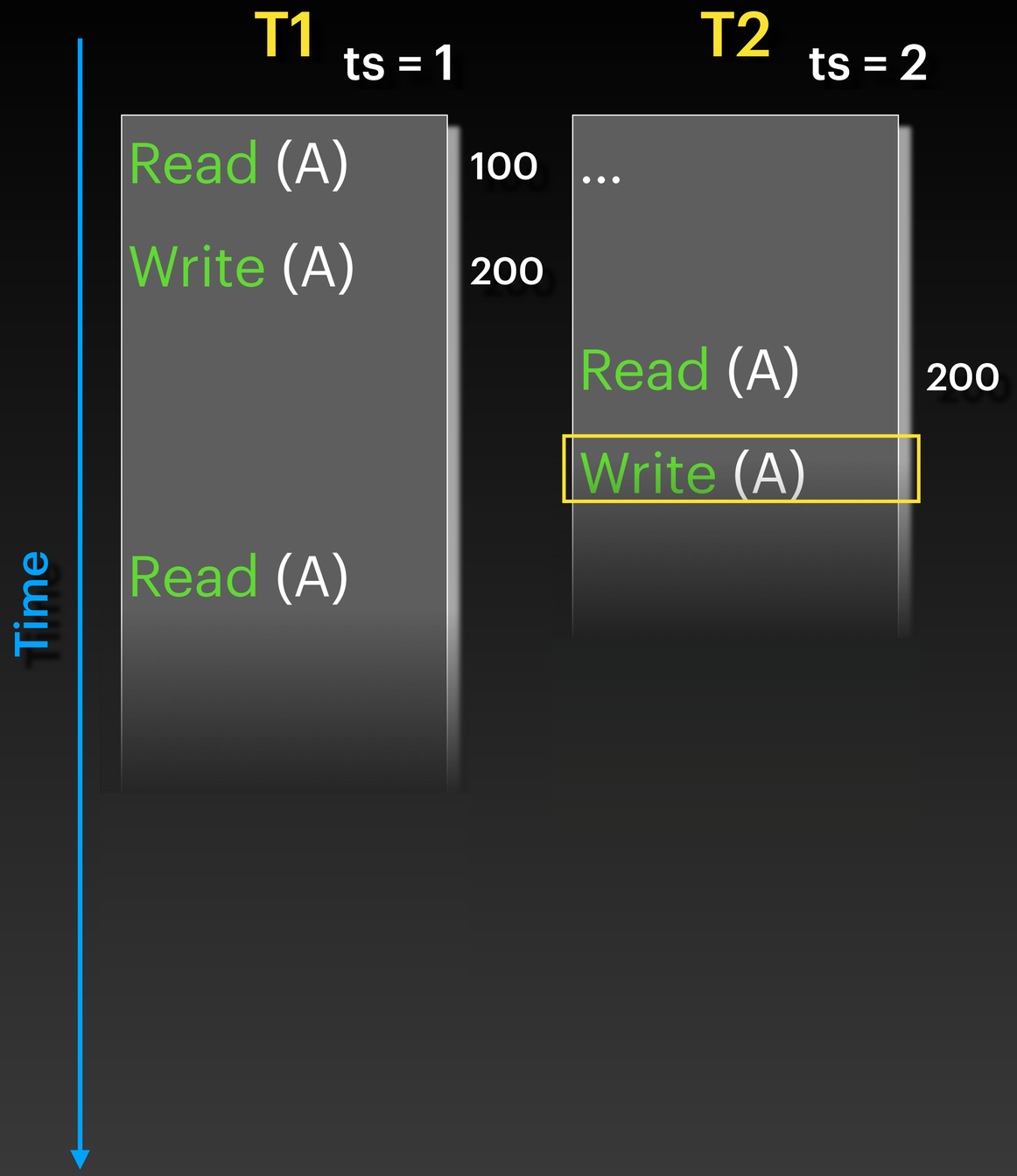

Version	Value	R-TS	W-TS
A_0	100	1	0
A_1	200	2	1

Highest W-TS <= ts(T)

R-TS <= ts(T)

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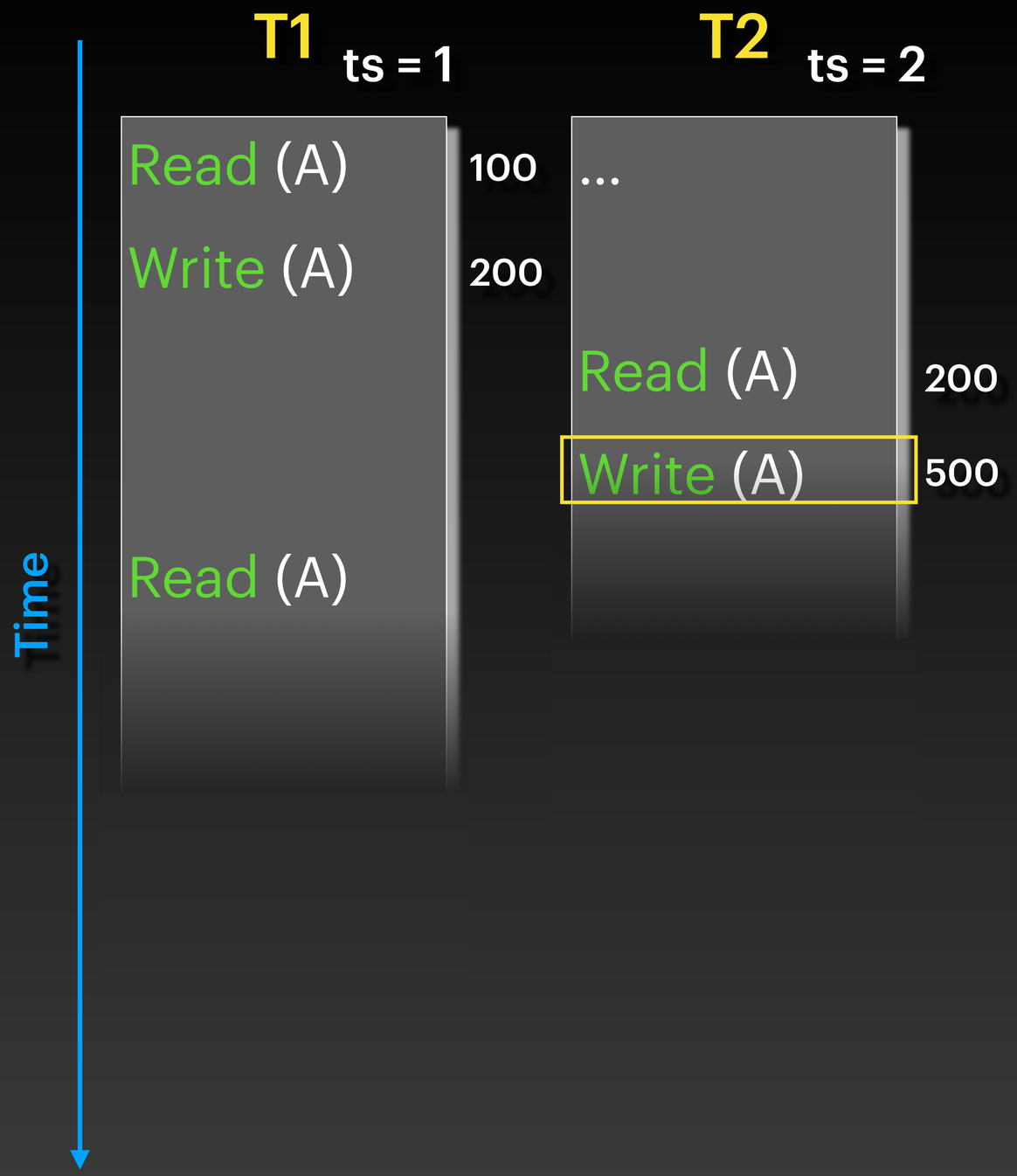

Version	Value	R-TS	W-TS
A_0	100	1	0
A_1	200	2	1
A_2	500	2	2

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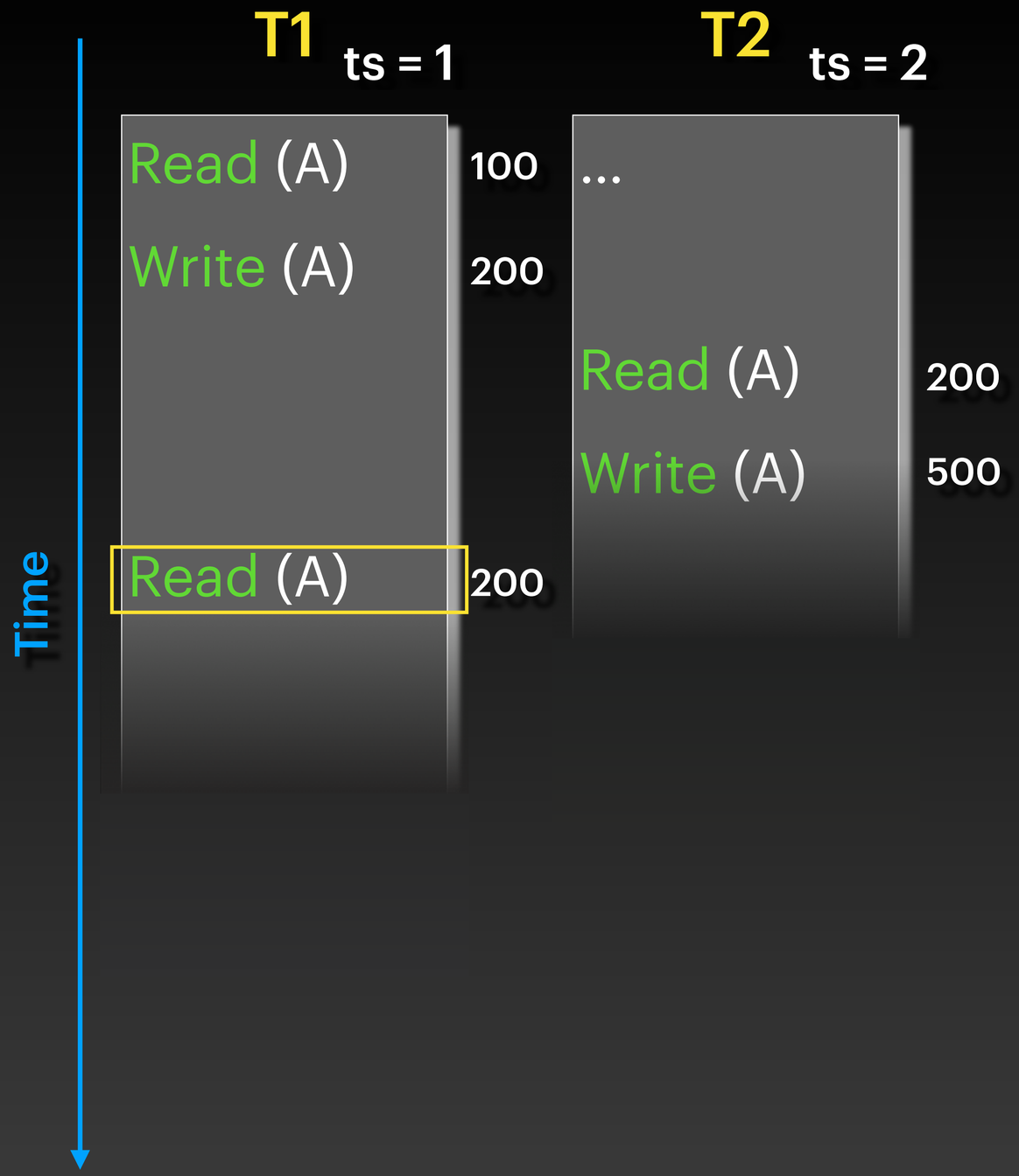

Version	Value	R-TS	W-TS
A_0	100	1	0
A_1	200	2	1
A_2	500	2	2

Highest W-TS <= ts(T)

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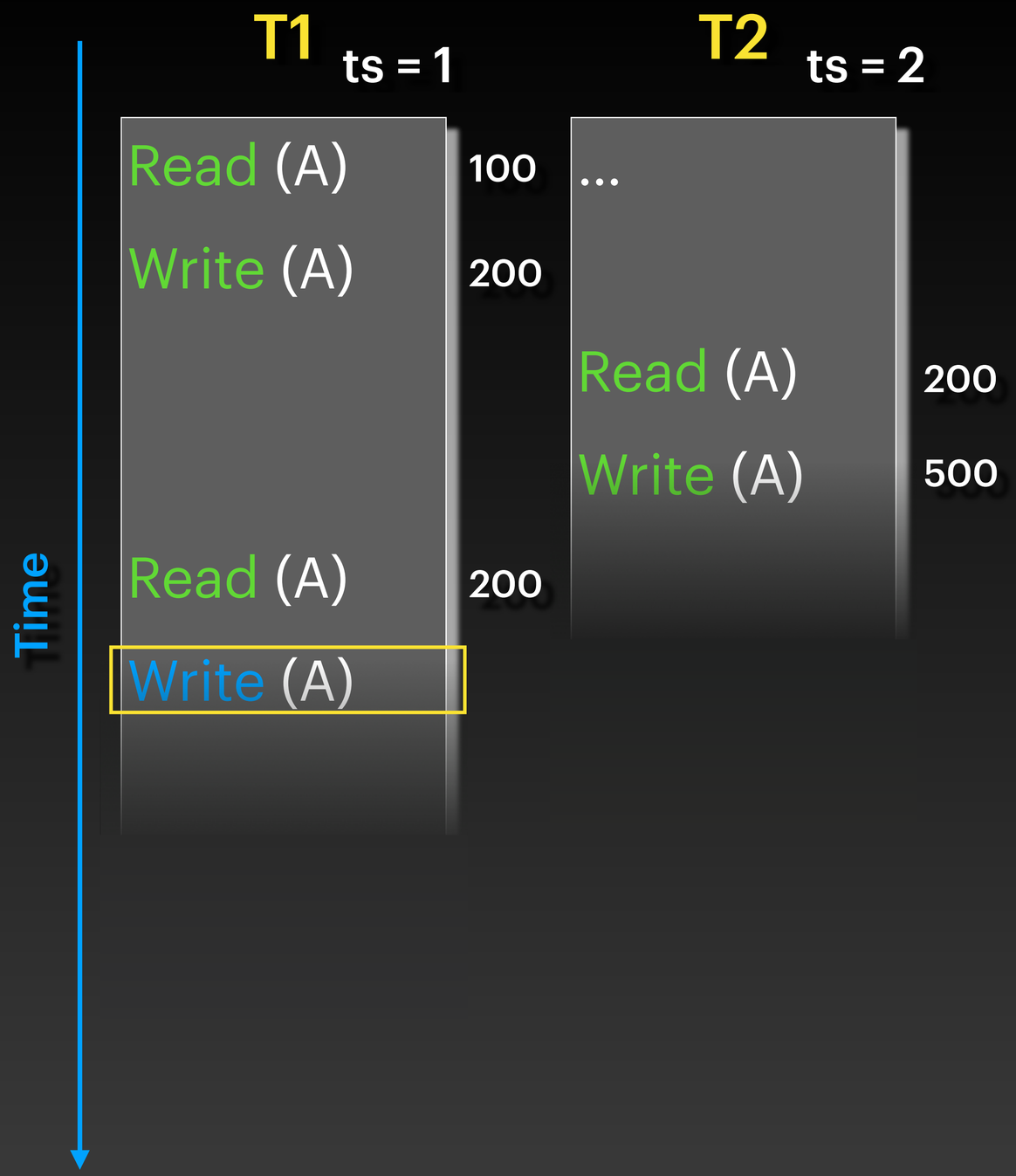

Version	Value	R-TS	W-TS
A_0	100	1	0
A_1	200	2	1
A_2	500	2	2

Highest W-TS <= ts(T)

R-TS > ts(T)

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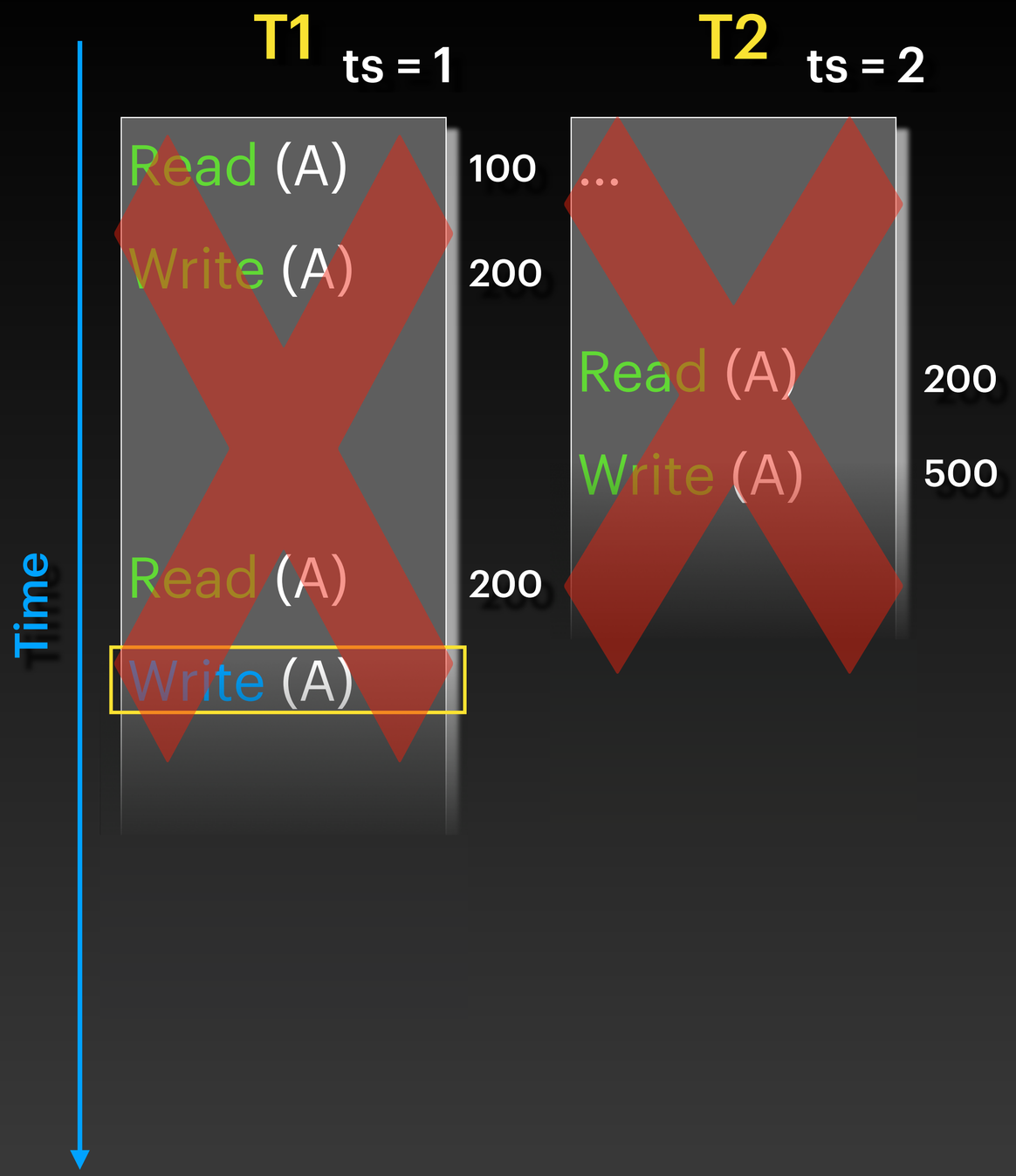

Version	Value	R-TS	W-TS
A_0	100	1	0
A_1	200	2	1
A_2	500	2	2

Highest W-TS <= ts(T)

R-TS > ts(T)

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