

# Parameterized and Runtime-tunable Snapshot Isolation in Distributed Transactional Key-value Stores

(SRDS 2017, HongKong)

**Hengfeng Wei**, Yu Huang, Jian Lu

Institute of Computer Software  
Nanjing University

September 12, 2017



# Parameterized and Runtime-tunable Snapshot Isolation

## RVSI: Relaxed Version Snapshot Isolation

- 1 Motivation for RVSI
- 2 Definition of RVSI
- 3 CHAMELEON Prototype and RVSI Protocol
- 4 Experimental Evaluation
- 5 Related Work
- 6 Conclusion

# Parameterized and Runtime-tunable Snapshot Isolation

## RVSI: Relaxed Version Snapshot Isolation

- 1 Motivation for RVSI
- 2 Definition of RVSI
- 3 CHAMELEON Prototype and RVSI Protocol
- 4 Experimental Evaluation
- 5 Related Work
- 6 Conclusion

# Distributed key-value stores

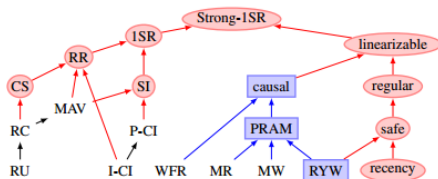


`put(K key, V val)`      `get(K key)`

# Transactional semantics

existential consistency atomic visibility example

# Transactional consistency models



Snapshot isolation (SI):

- ▶ **Read** from the latest consistent snapshot of all data items
- ▶ No **write** conflicts among concurrent transactions

# Distributed SI

Costs of SI

Relaxed variants of SI:

GSI <sup>1</sup>

NMSI <sup>2</sup>

PL-FCV <sup>3</sup>

PSI <sup>4</sup>

---

<sup>1</sup>GSI: Generalized Snapshot Isolation

<sup>2</sup>NMSI: Non-Monotonic Snapshot Isolation

<sup>3</sup>PL-FCV: Forward Consistent View

<sup>4</sup>PSI: Parallel Snapshot Isolation

# Two drawbacks

1. Unbounded inconsistency
  - ▶ no specification of the severity of the anomalies w.r.t SI
2. Untunable at runtime
  - ▶ determined at the system design phase
  - ▶ remain unchanged once the system is deployed



# A Motivating Example

The *Books* table.

Title	Authors	Publisher	Sales	Inventory	Ratings	Reviews	...
-------	---------	-----------	-------	-----------	---------	---------	-----

Customer:

Bookstore Clerk:

Sales Analyst:

# Contributions



# Parameterized and Runtime-tunable Snapshot Isolation

## RVSI: Relaxed Version Snapshot Isolation

- 1 Motivation for RVSI
- 2 Definition of RVSI
- 3 CHAMELEON Prototype and RVSI Protocol
- 4 Experimental Evaluation
- 5 Related Work
- 6 Conclusion





































# Parameterized and Runtime-tunable Snapshot Isolation

## RVSI: Relaxed Version Snapshot Isolation

- 1 Motivation for RVSI
- 2 Definition of RVSI
- 3 CHAMELEON Prototype and RVSI Protocol**
- 4 Experimental Evaluation
- 5 Related Work
- 6 Conclusion





































# Parameterized and Runtime-tunable Snapshot Isolation

## RVSI: Relaxed Version Snapshot Isolation

- 1 Motivation for RVSI
- 2 Definition of RVSI
- 3 CHAMELEON Prototype and RVSI Protocol
- 4 Experimental Evaluation**
- 5 Related Work
- 6 Conclusion



















# Parameterized and Runtime-tunable Snapshot Isolation

## RVSI: Relaxed Version Snapshot Isolation

- 1 Motivation for RVSI
- 2 Definition of RVSI
- 3 CHAMELEON Prototype and RVSI Protocol
- 4 Experimental Evaluation
- 5 Related Work**
- 6 Conclusion

Inspired by





















# Parameterized and Runtime-tunable Snapshot Isolation

## RVSI: Relaxed Version Snapshot Isolation

- 1 Motivation for RVSI
- 2 Definition of RVSI
- 3 CHAMELEON Prototype and RVSI Protocol
- 4 Experimental Evaluation
- 5 Related Work
- 6 Conclusion**





