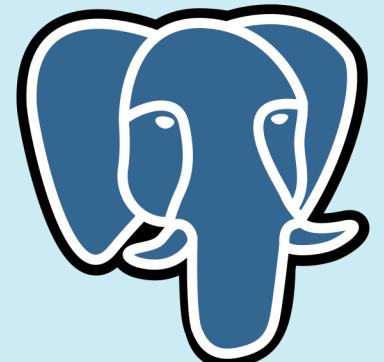


BACKEND MASTER CLASS
LECTURE 9

Transaction Isolation Level



PostgreSQL

ACID Property



ACID Property



ATOMICITY (A)

Either all operations complete successfully or the transaction fails and the db is unchanged.



ACID Property



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Data written by a successful transaction must be recorded in persistent storage



ACID Property



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Read Phenomena



Read Phenomena



- **DIRTY READ**

Read Phenomena



DIRTY READ

A transaction **reads** data written by other concurrent **uncommitted** transaction

Read Phenomena



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NON-REPEATABLE READ

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A transaction **reads** the **same row twice** and sees different value because it has been **modified** by other **committed** transaction

Read Phenomena



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SERIALIZATION ANOMALY

Read Phenomena



DIRTY READ

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NON-REPEATABLE READ

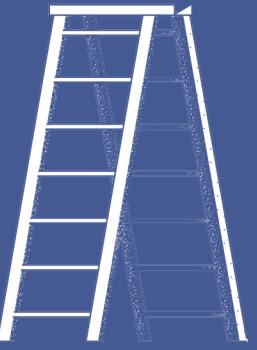
A transaction **reads** the **same row twice** and sees different value because it has been **modified** by other **committed** transaction

PHANTOM READ

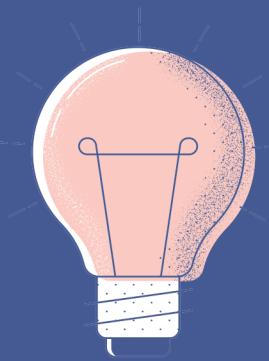
A transaction **re-executes** a query to **find rows** that satisfy a condition and sees a **different set** of rows, due to changes by other **committed** transaction

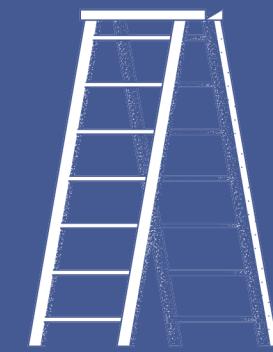
SERIALIZATION ANOMALY

The result of a **group** of concurrent **committed transactions** is **impossible to achieve** if we try to run them **sequentially** in any order without overlapping

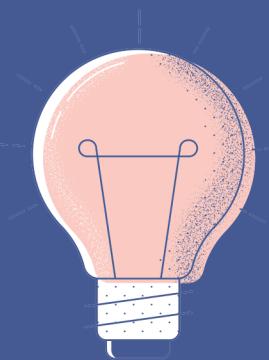


4 Standard Isolation Levels

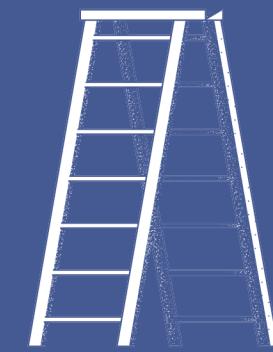




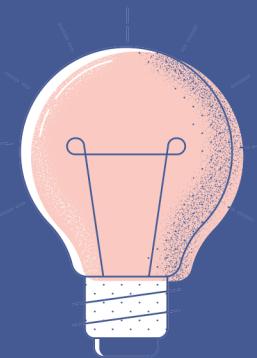
4 Standard Isolation Levels



American National Standards Institute - ANSI



4 Standard Isolation Levels

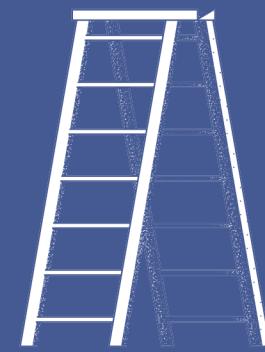


American National Standards Institute - ANSI





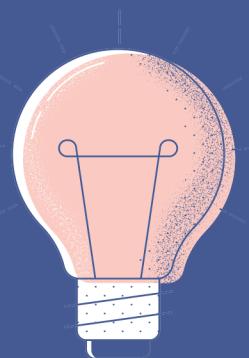
4 Standard Isolation Levels



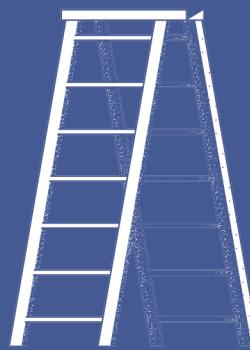
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Low





4 Standard Isolation Levels



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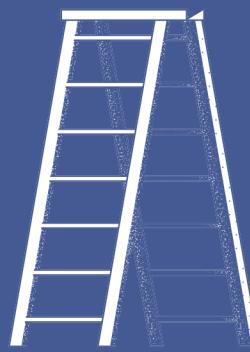
Low

High





4 Standard Isolation Levels

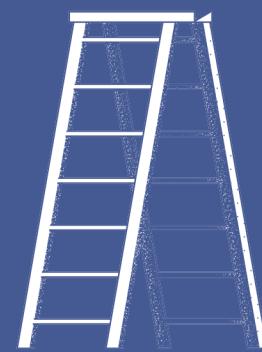


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4 Standard Isolation Levels



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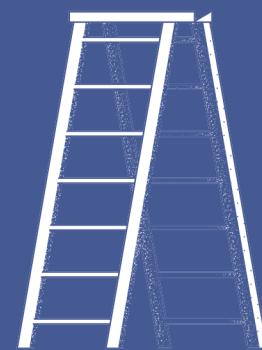


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**READ
UNCOMMITTED**



4 Standard Isolation Levels



American National Standards Institute - ANSI



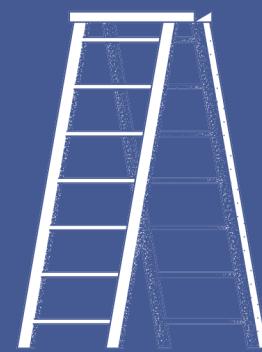
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**READ
UNCOMMITTED**

Can see data written by
uncommitted transaction



4 Standard Isolation Levels



American National Standards Institute - ANSI

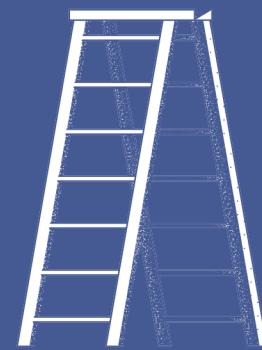


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4 Standard Isolation Levels



American National Standards Institute - ANSI



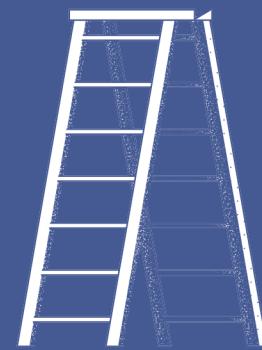
**READ
UNCOMMITTED**

Can see data written by
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**READ
COMMITTED**



4 Standard Isolation Levels



American National Standards Institute - ANSI



**READ
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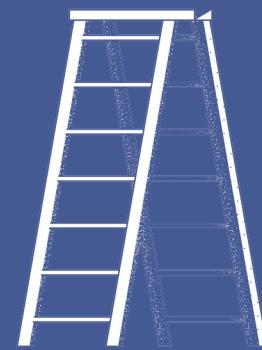
Can see data written by uncommitted transaction

**READ
COMMITTED**

Only see data written by committed transaction



4 Standard Isolation Levels



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**READ
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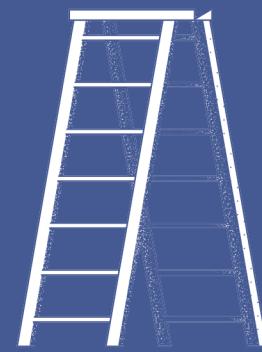
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4 Standard Isolation Levels



American National Standards Institute - ANSI



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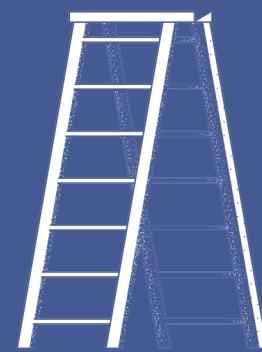
**READ
COMMITTED**

Only see data written by committed transaction

**REPEATABLE
READ**



4 Standard Isolation Levels



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READ UNCOMMITTED

Can see data written by uncommitted transaction

READ COMMITTED

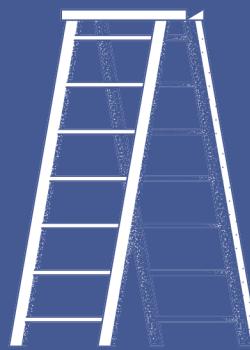
Only see data written by committed transaction

REPEATABLE READ

Same read query always returns same result



4 Standard Isolation Levels



American National Standards Institute - ANSI



READ UNCOMMITTED

Can see data written by uncommitted transaction

READ COMMITTED

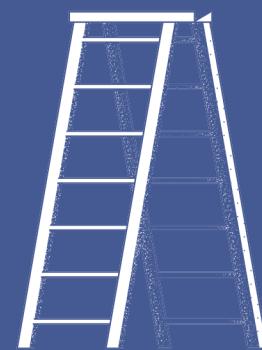
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4 Standard Isolation Levels



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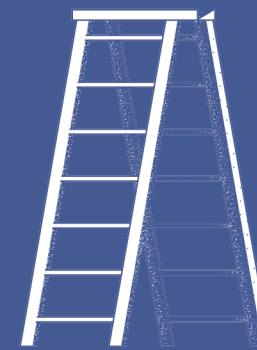
REPEATABLE READ

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SERIALIZABLE



4 Standard Isolation Levels



American National Standards Institute - ANSI



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READ COMMITTED

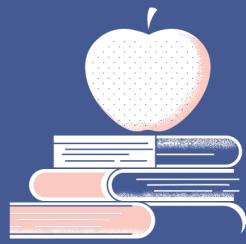
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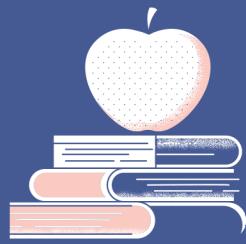
SERIALIZABLE

Can achieve same result if execute transactions serially in some order instead of concurrently



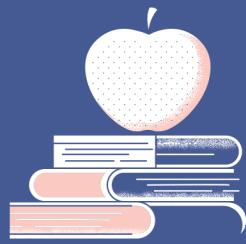
Isolation Levels in MySQL

	READ UNCOMMITTED	READ COMMITTED	REPEATABLE READ	SERIALIZABLE
DIRTY READ				
NON-REPEATABLE READ				
PHANTOM READ				
SERIALIZATION ANOMALY				



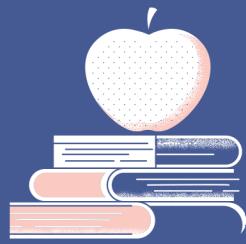
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DIRTY READ				
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SERIALIZATION ANOMALY				



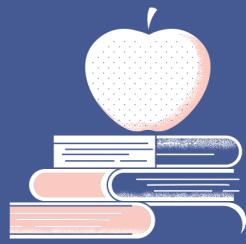
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	READ UNCOMMITTED	READ COMMITTED	REPEATABLE READ	SERIALIZABLE
DIRTY READ	✓			
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PHANTOM READ				
SERIALIZATION ANOMALY				



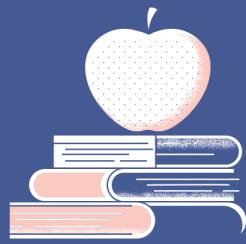
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SERIALIZATION ANOMALY				



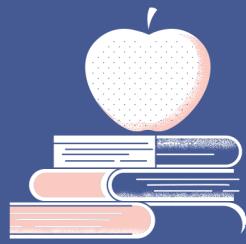
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PHANTOM READ	✓			
SERIALIZATION ANOMALY	✓			



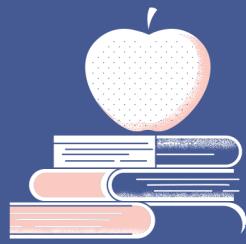
Isolation Levels in MySQL

	READ UNCOMMITTED	READ COMMITTED	REPEATABLE READ	SERIALIZABLE
DIRTY READ	✓	✗		
NON-REPEATABLE READ	✓			
PHANTOM READ	✓			
SERIALIZATION ANOMALY	✓			



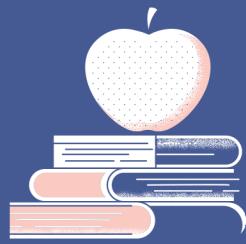
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NON-REPEATABLE READ	✓	✓		
PHANTOM READ	✓			
SERIALIZATION ANOMALY	✓			



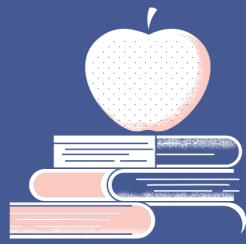
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PHANTOM READ	✓	✓		
SERIALIZATION ANOMALY	✓			



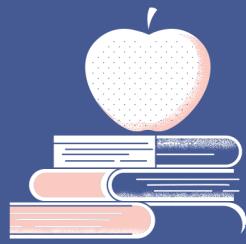
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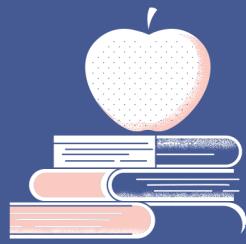
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PHANTOM READ	✓	✓		
SERIALIZATION ANOMALY	✓	✓		



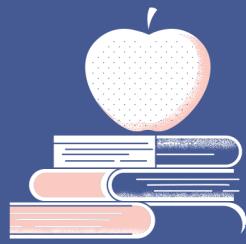
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PHANTOM READ	✓	✓		
SERIALIZATION ANOMALY	✓	✓		



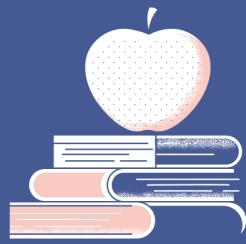
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NON-REPEATABLE READ	✓	✓	✗	
PHANTOM READ	✓	✓	✗	
SERIALIZATION ANOMALY	✓	✓		



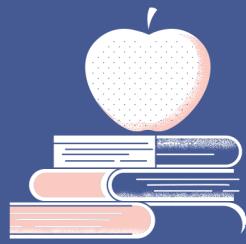
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DIRTY READ	✓	✗	✗	
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PHANTOM READ	✓	✓	✗	
SERIALIZATION ANOMALY	✓	✓	✓	



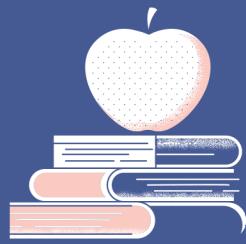
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	READ UNCOMMITTED	READ COMMITTED	REPEATABLE READ	SERIALIZABLE
DIRTY READ	✓	✗	✗	✗
NON-REPEATABLE READ	✓	✓	✗	
PHANTOM READ	✓	✓	✗	
SERIALIZATION ANOMALY	✓	✓	✓	



Isolation Levels in MySQL

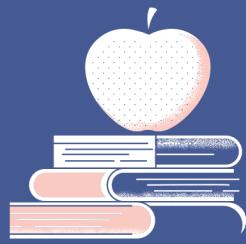
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DIRTY READ	✓	✗	✗	✗
NON-REPEATABLE READ	✓	✓	✗	✗
PHANTOM READ	✓	✓	✗	
SERIALIZATION ANOMALY	✓	✓	✓	



Isolation Levels in MySQL

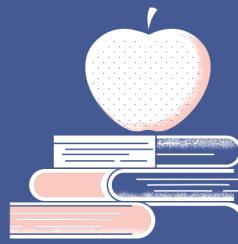
	READ UNCOMMITTED	READ COMMITTED	REPEATABLE READ	SERIALIZABLE
DIRTY READ	✓	✗	✗	✗
NON-REPEATABLE READ	✓	✓	✗	✗
PHANTOM READ	✓	✓	✗	✗
SERIALIZATION ANOMALY	✓	✓	✓	





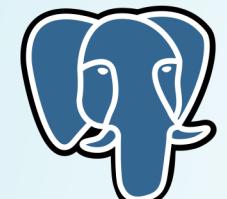
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DIRTY READ	✓	✗	✗	✗
NON-REPEATABLE READ	✓	✓	✗	✗
PHANTOM READ	✓	✓	✗	✗
SERIALIZATION ANOMALY	✓	✓	✓	✗

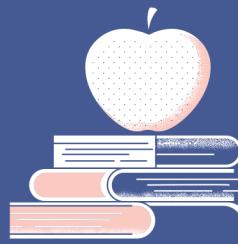


Isolation Levels in PostgreSQL

	READ UNCOMMITTED	READ COMMITTED	REPEATABLE READ	SERIALIZABLE
DIRTY READ	✗	✗	✗	✗
NON-REPEATABLE READ	✓	✓	✗	✗
PHANTOM READ	✓	✓	✗	✗
SERIALIZATION ANOMALY	✓	✓	✓	✗

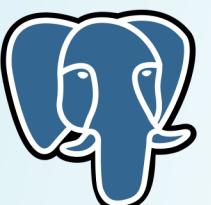


PostgreSQL

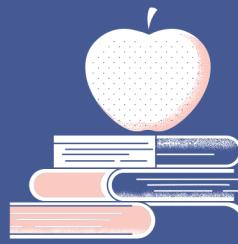


Isolation Levels in PostgreSQL

	READ UNCOMMITTED	READ COMMITTED	REPEATABLE READ	SERIALIZABLE
DIRTY READ	✗	✗	✗	✗
NON-REPEATABLE READ	✓	✓	✗	✗
PHANTOM READ	✓	✓	✗	✗
SERIALIZATION ANOMALY	✓	✓	✓	✗

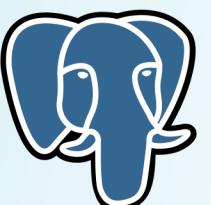


PostgreSQL

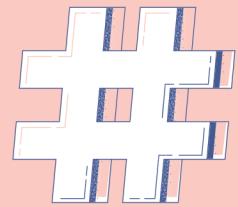


Isolation Levels in PostgreSQL

	READ UNCOMMITTED	READ COMMITTED	REPEATABLE READ	SERIALIZABLE
DIRTY READ	✗	✗	✗	✗
NON-REPEATABLE READ	✓	✓	✗	✗
PHANTOM READ	✓	✓	✗	✗
SERIALIZATION ANOMALY	✓	✓	✓	✗



PostgreSQL

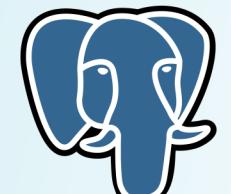


Compare MySQL vs Postgres

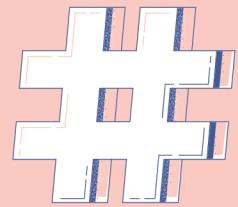
4 ISOLATION LEVELS



3 ISOLATION LEVELS



PostgreSQL



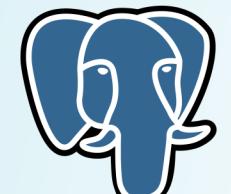
Compare MySQL vs Postgres

4 ISOLATION LEVELS

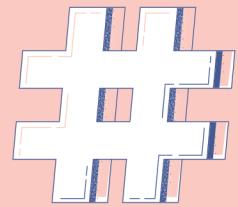
LOCKING MECHANISM



3 ISOLATION LEVELS



PostgreSQL



Compare MySQL vs Postgres

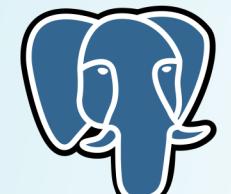
4 ISOLATION LEVELS

LOCKING MECHANISM

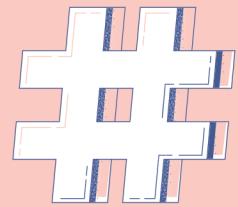


3 ISOLATION LEVELS

DEPENDENCIES DETECTION



PostgreSQL



Compare MySQL vs Postgres

4 ISOLATION LEVELS

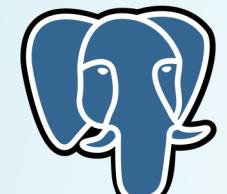
LOCKING MECHANISM



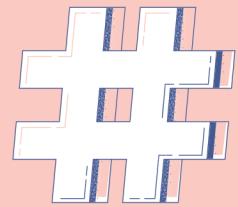
3 ISOLATION LEVELS

DEPENDENCIES DETECTION

READ COMMITTED



PostgreSQL



Compare MySQL vs Postgres

4 ISOLATION LEVELS

LOCKING MECHANISM

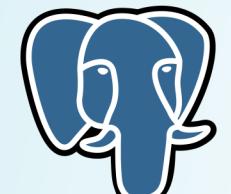
REPEATABLE READ



3 ISOLATION LEVELS

DEPENDENCIES DETECTION

READ COMMITTED



PostgreSQL

Keep in mind



Keep in mind



RETRY MECHANISM

There might be errors, timeout or deadlock

Keep in mind



RETRY MECHANISM

There might be errors, timeout or deadlock

READ DOCUMENTATION

Each database engine might implement isolation level differently