How to Stop Worrying by using Transactions and Exceptions

When all them pending transactions hit at once.

Source: ladiesandlemo...

Postgres Transactions

- PostgreSQL ***REALLY*** focuses on providing safety and sanity

Two main places

- Statement Blocks
- Concurrent Scenarios

```sql
UPDATE cookies SET deliciousness = 11
WHERE name = 'Ginger Molasses';
```

```sql
BEGIN;

UPDATE cookies SET deliciousness = 11
WHERE name = 'Ginger Molasses';

COMMIT;
```

```
SELECT deliciousness FROM cookies
WHERE name = 'ANZAC';
```

Statement Block breakdown

```
UPDATE cookies SET quantity = 2
WHERE name = 'ANZAC';

INSERT INTO to_bake_list (name, quantity)
VALUES ('ANZAC ', 12);
```

Statement Block breakdown

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UPDATE cookies SET quantity = 2
WHERE name = 'ANZAC';
```

💥

```
INSERT INTO to_bake_list (name, quantity)
VALUES ('ANZAC ', 12);
```

wHy DoN't I jUsT dO tHiS

iN pYtHoN wItH tRy/CaTcH?

Statement Block Transaction

```
BEGIN;

UPDATE cookies SET quantity = 2
WHERE name = 'ANZAC';

INSERT INTO to_bake_list (name, quantity)
VALUES ('ANZAC ', 12);

COMMIT;
```

Nested Transactions

Savepoints

```
BEGIN;
    UPDATE cookies SET quantity = 2
    WHERE name = 'ANZAC';

    INSERT INTO to_bake_list (name, quantity)
    VALUES ('ANZAC ', 12);

    SAVEPOINT inventory_removal;

    INSERT INTO ingredients (name) VALUES ('flour');
    RELEASE SAVEPOINT inventory_removal;
COMMIT;
```

```sql
BEGIN;
    UPDATE cookies SET quantity = 2
    WHERE name = 'ANZAC';

    INSERT INTO to_bake_list (name, quantity)
    VALUES ('ANZAC ', 12);

    SAVEPOINT inventory_removal;

    INSERT INTO ingredients (name) VALUES ('flour');
    ROLLBACK TO SAVEPOINT inventory_removal;
COMMIT;
```

MULTITHREADING

THEORY AND PRACTICE

dirty read

- A transaction reads data written by a concurrent uncommitted transaction.

nonrepeatable read

- A transaction re-reads data it has previously read and finds that data has been modified by another transaction (that committed since the initial read).

phantom read

- A transaction re-executes a query returning a set of rows that satisfy a search condition and finds that the set of rows satisfying the condition has changed due to another recently-committed transaction.

serialization anomaly

- The result of successfully committing a group of transactions is inconsistent with all possible orderings of running those transactions one at a time.

When all them pending transactions hit at once.

Source: ladiesandlemo...

Isolation Level	Dirty Read	Nonrepeatable Read	Phantom Read	Serialization Anomaly
Uncommitted	🔴	✅	✅	✅
Committed	⛔	✅	✅	✅
Repeatable	⛔	⛔	🔴	✅
Serializable	⛔	⛔	⛔	⛔

```
START TRANSACTION ISOLATION LEVEL READ COMMITTED;
SELECT COUNT(*) FROM cookies WHERE name = 'lemon drop';
 count
-------
     5
(1 row)

-- Cookie 6 has been added in an external transaction.

SELECT COUNT(*) FROM cookies WHERE name = 'lemon drop';
 count
-------
     6
(1 row)
COMMIT;
```

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SERIALIZABLE

- Emulates serial transaction execution for all committed transactions.

REPEATABLE READ

- Sees data committed before the transaction began
- Sees results of previous statements in the transaction
- Does not sees any changes committed by concurrent transactions.

```sql
START TRANSACTION ISOLATION LEVEL REPEATABLE READ;

UPDATE ffiec_reci
SET RCON2237 = CAST(RCON2237 AS FLOAT) * .65
WHERE CAST(RCON2237 AS FLOAT) > 1000000;
SAVEPOINT first;

UPDATE ffiec_reci
SET RCON2237 = CAST(RCON2237 AS FLOAT) * .95
SAVEPOINT second;

COMMIT;
```

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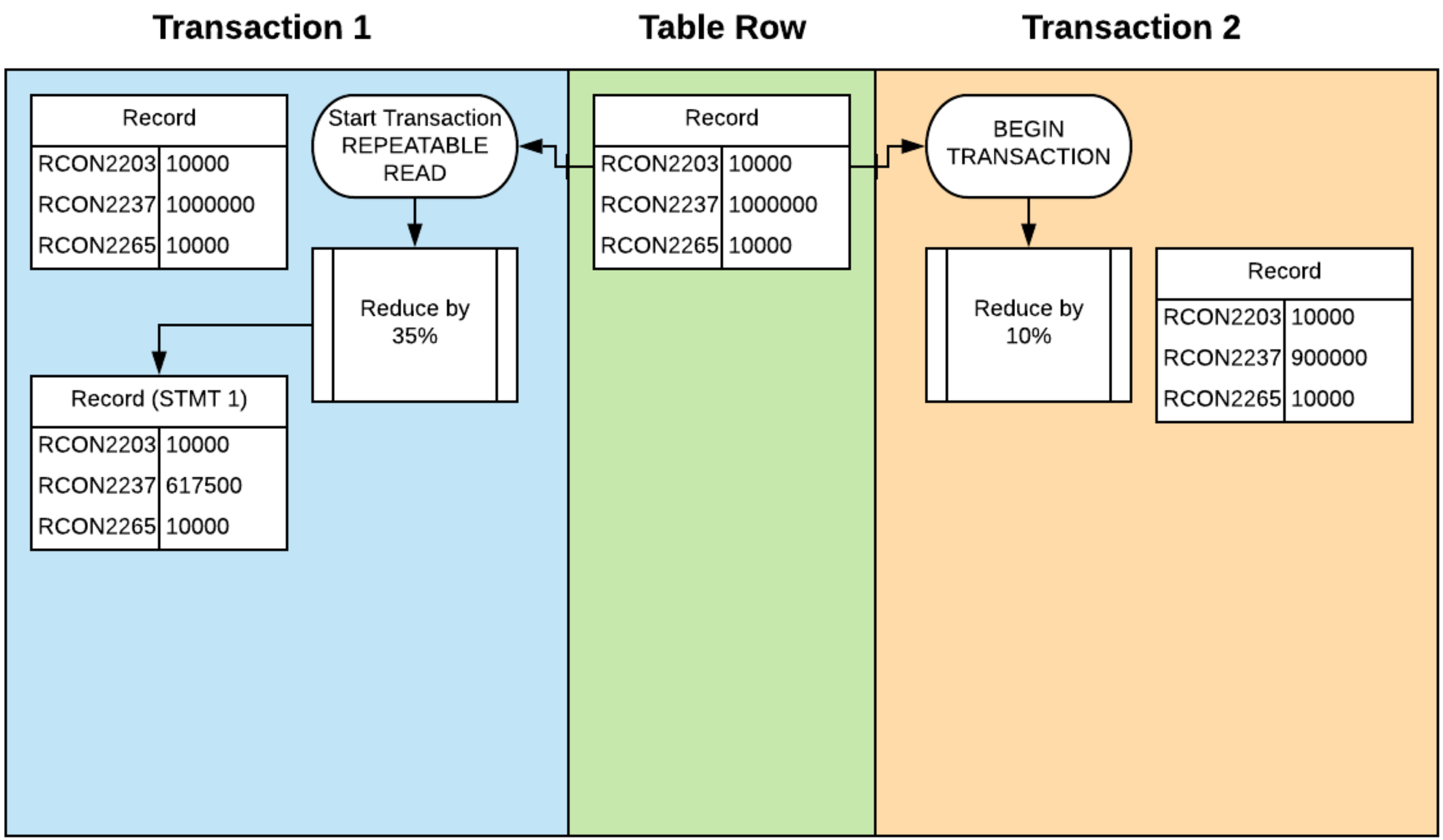
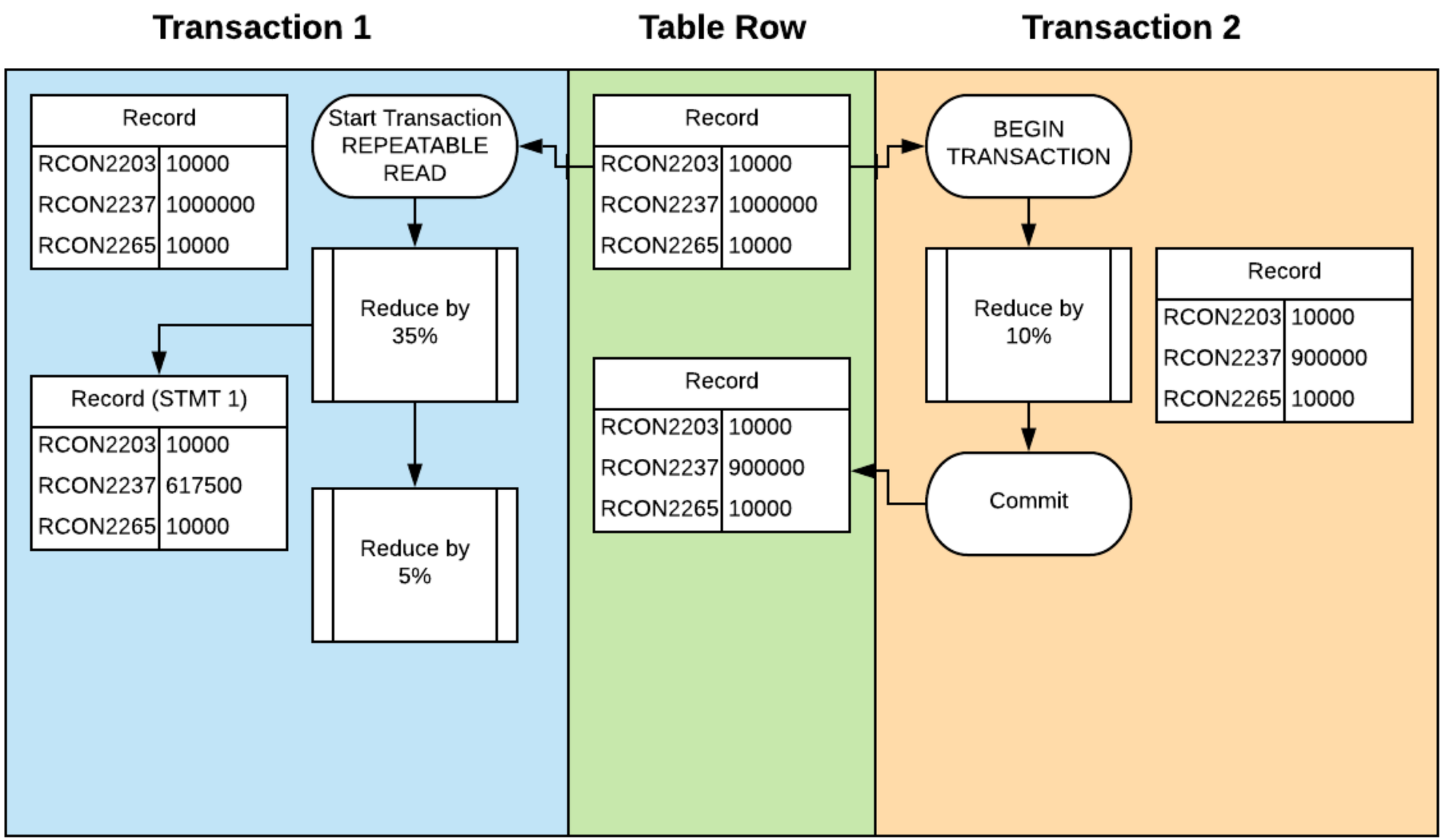

Transaction 1
Table Row
Transaction 2
Record
RCON2203 10000
RCON2237 1000000
RCON2265 10000
Start Transaction REPEATABLE READ
Reduce by 35%
Record (STMT 1)
RCON2203 10000
RCON2237 617500
RCON2265 10000
Record
RCON2203 10000
RCON2237 1000000
RCON2265 10000
BEGIN TRANSACTION
Reduce by 10%
Record
RCON2203 10000
RCON2237 900000
RCON2265 10000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RCON2203 10000
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RCON2265 10000
BEGIN TRANSACTION
Reduce by 10%
Commit
Record
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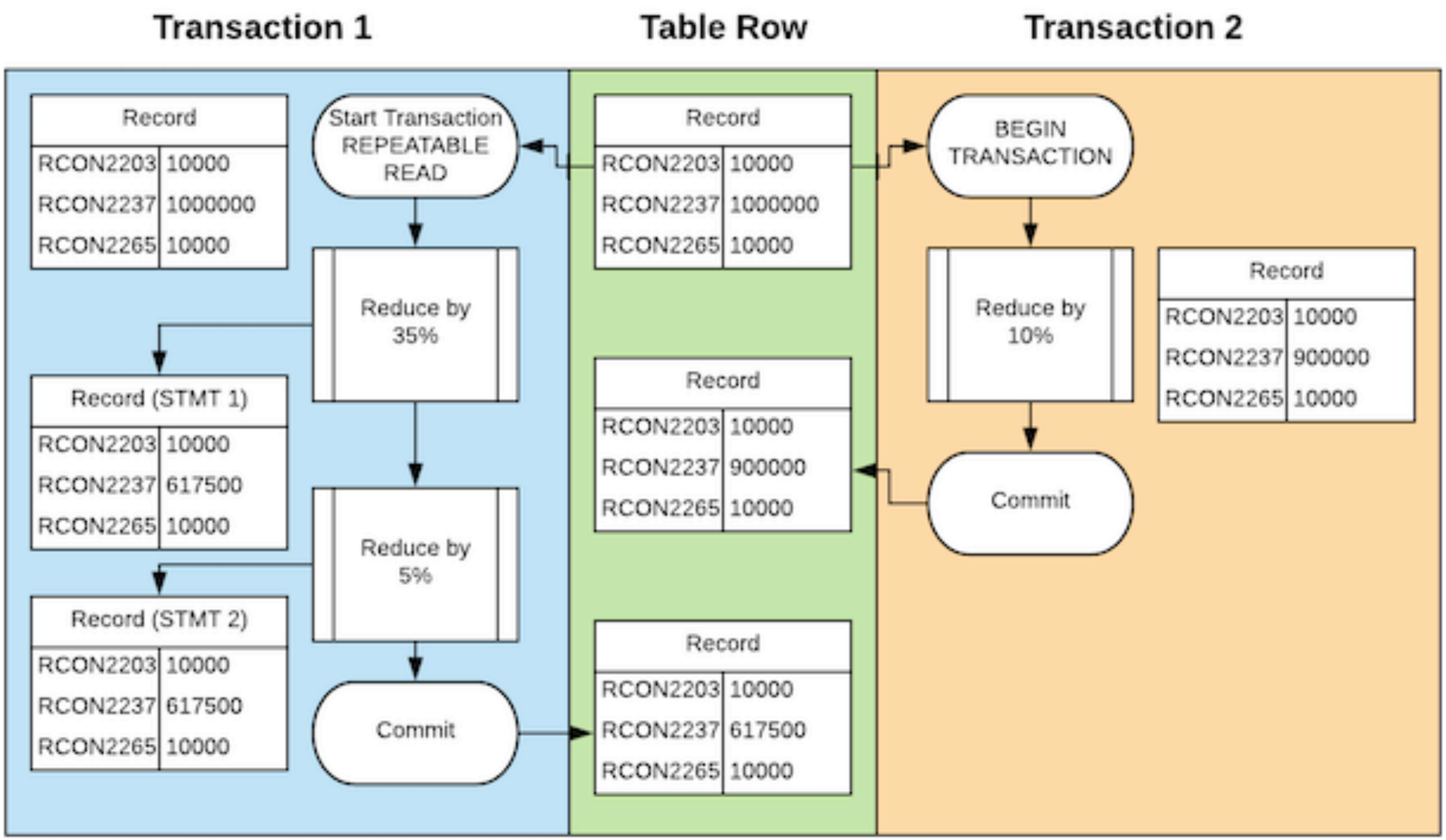
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Detour

Anonymous DO Funtions

```
DO $$
DECLARE
    --- Variables
BEGIN
    --- Statements
END; $$ language 'plpgsql';
```

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```

Exception Handling

Exception Example

```
DO $$f
DECLARE
    v_msg TEXT;
BEGIN
     INSERT INTO patients (a1c, glucose, fasting) values (20, 800, False);
EXCEPTION WHEN check_violation THEN
    v_msg = 'This A1C is not valid, should be between 0-13';
    INSERT INTO errors (msg) VALUES (v_msg);
END; $$ language 'plpgsql';
```

Exception Example

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Graceful Fallback

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- This is delightfully evil

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- Think long and hard before you do this...

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- I'm so not responsible for what you do with this...

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- seriously...

Graceful Fallback

- This is delightfully evil
- Think long and hard before you do this...
- I'm so not responsible for what you do with this...
- seriously...
- You can perform other data actions in the exception handling section!

W... T... F...

Gracefal Fallback Example

```
DO $$
DECLARE
    v_msg TEXT;
BEGIN
     INSERT INTO patients (a1c, glucose, fasting) values (20, 800, False);
EXCEPTION WHEN check_violation THEN
    v_msg = 'This A1C is not valid, should be between 0-13';
    INSERT INTO errors (msg) values (v_msg);
    INSERT INTO patients (a1c, glucose, fasting) values (13, 800, False);
     v_msg = 'Set A1C to the maximum of 13';
    INSERT INTO errors (msg) values (v_msg);
END; $$ language 'plpgsql';
```

error_id	state	msg	detail	context
2	null	This A1C is not valid, should be between 0-13	null	null

Stacked Diagnostics

Name	Description
`RETURNED_SQLSTATE`	the SQLSTATE error code of the exception
`COLUMN_NAME`	the name of the column related to exception
`CONSTRAINT_NAME`	the name of the constraint related to exception
`PG_DATATYPE_NAME`	the name of the data type related to exception
`MESSAGE_TEXT`	the text of the exception's primary message

Name	Description
`TABLE_NAME`	the name of the table related to exception
`SCHEMA_NAME`	the name of the schema related to exception
`PG_EXCEPTION_DETAIL`	the text of the exception's detail message, if any
`PG_EXCEPTION_HINT`	the text of the exception's hint message, if any
`PG_EXCEPTION_CONTEXT`	line(s) of text describing the call stack at the time of the exception

Debug as a function

```
CREATE OR REPLACE FUNCTION debug_statement(
    sql_stmt TEXT
)
RETURNS BOOLEAN AS
$BODY$

    DECLARE
        v_state   TEXT;
        v_msg     TEXT;
        v_detail  TEXT;
        v_context TEXT;
    BEGIN
        BEGIN
            EXECUTE sql_stmt;
        EXCEPTION WHEN others THEN
            GET STACKED DIAGNOSTICS
                v_state   = RETURNED_SQLSTATE,
                v_msg     = MESSAGE_TEXT,
                v_detail  = PG_EXCEPTION_DETAIL,
                v_context = PG_EXCEPTION_CONTEXT;
            INSERT into errors (msg, state, detail, context) values (v_msg, v_state, v_detail, v_context);
            RETURN False;
        END;
        RETURN True;
    END;

$BODY$
LANGUAGE plpgsql;
```

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CREATE OR REPLACE FUNCTION debug_statement(
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        v_state   TEXT;
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        v_context TEXT;
    BEGIN
```

```
        v_context TEXT;
    BEGIN
        BEGIN
            EXECUTE sql_stmt;
        EXCEPTION WHEN others THEN
            GET STACKED DIAGNOSTICS
                v_state   = RETURNED_SQLSTATE,
                v_msg     = MESSAGE_TEXT,
                v_detail  = PG_EXCEPTION_DETAIL,
                v_context = PG_EXCEPTION_CONTEXT;
            INSERT into errors (msg, state, detail, context) values (v_msg, v_state, v_detail, v_context);
            RETURN False;
        END;
        RETURN True;
    END;
$BODY$
```

```
        RETURN True;
    END;
$BODY$
LANGUAGE plpgsql;
```

Debug example

```
DO $$
DECLARE
    stmt VARCHAR(100) := 'INSERT INTO patients (a1c, glucose, fasting)
                          VALUES (20, 800, False)';
BEGIN
     EXECUTE stmt;
EXCEPTION WHEN OTHERS THEN
    PERFORM debug_statement(stmt);
END; $$ language 'plpgsql';
```

error_id	state	msg
2	23514	new row for relation "patients" violates check constraint "patients_a1c_check"

detail

Failing row contains (5, 20, 800, f, 2020-03-06 19:09:36.335213).

context

SQL statement "INSERT INTO patients (a1c, glucose, fasting) VALUES (20, 800, False)"
PL/pgSQL function debug_statement(text) line 10 at EXECUTE
SQL statement "SELECT debug_statement(stmt)"
PL/pgSQL function inline_code_block line 10 at PERFORM

Thank you