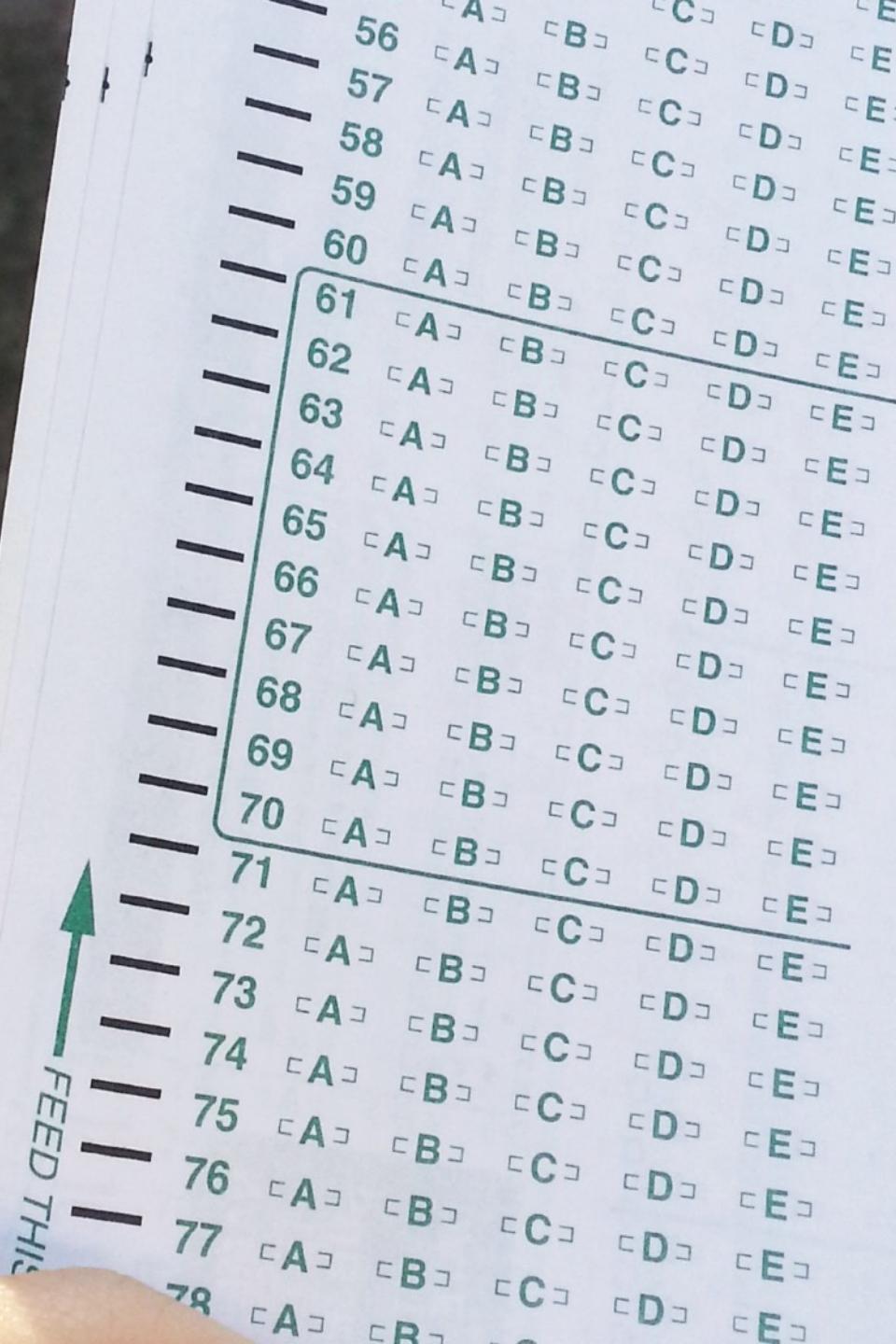


Write More Testable SQL

Riley Major
That Conference
2024-07-31



Riley Major



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The AWS Amplify logo, which features a purple triangle icon followed by the text "AWS Amplify".



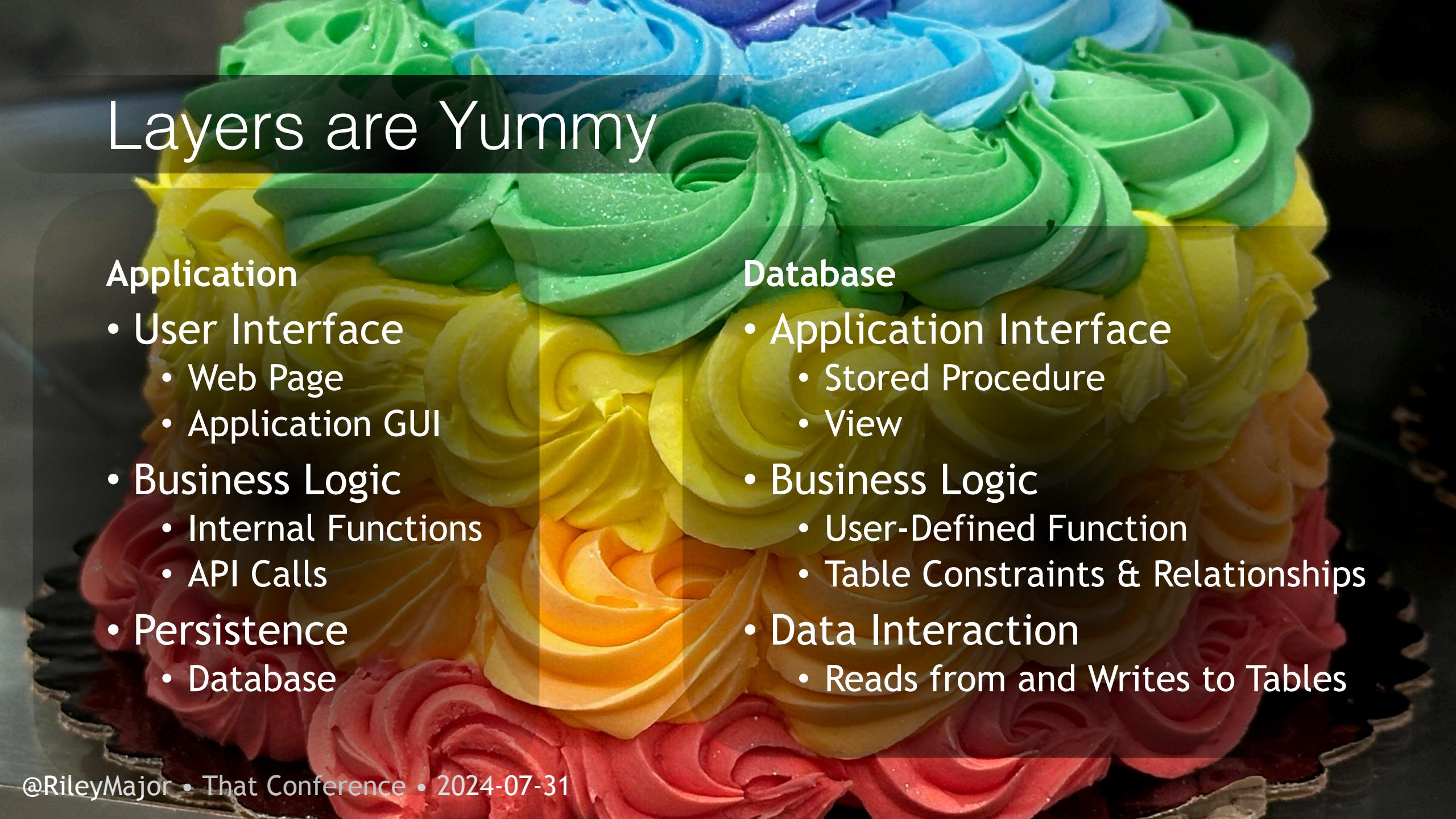
What's the plan, Stan?

- Coding Principles
 - How you should write SQL.
 - Demo / Examples
- Tools of the Testing Trade
 - Mechanics of testing.
 - Demo / Examples
- Bonus: Avoid Mistakes
 - Demo / Examples
- Now you love SQL!



Coding Principles

- Layers are Yummy
- Stay in Your Lane
- Think Before You Act
- Do One Thing at a Time
- Be Predictable
- Build Scaffolding
- Golden Pattern
- Don't Go Overboard



Layers are Yummy

Application

- User Interface
 - Web Page
 - Application GUI
- Business Logic
 - Internal Functions
 - API Calls
- Persistence
 - Database

Database

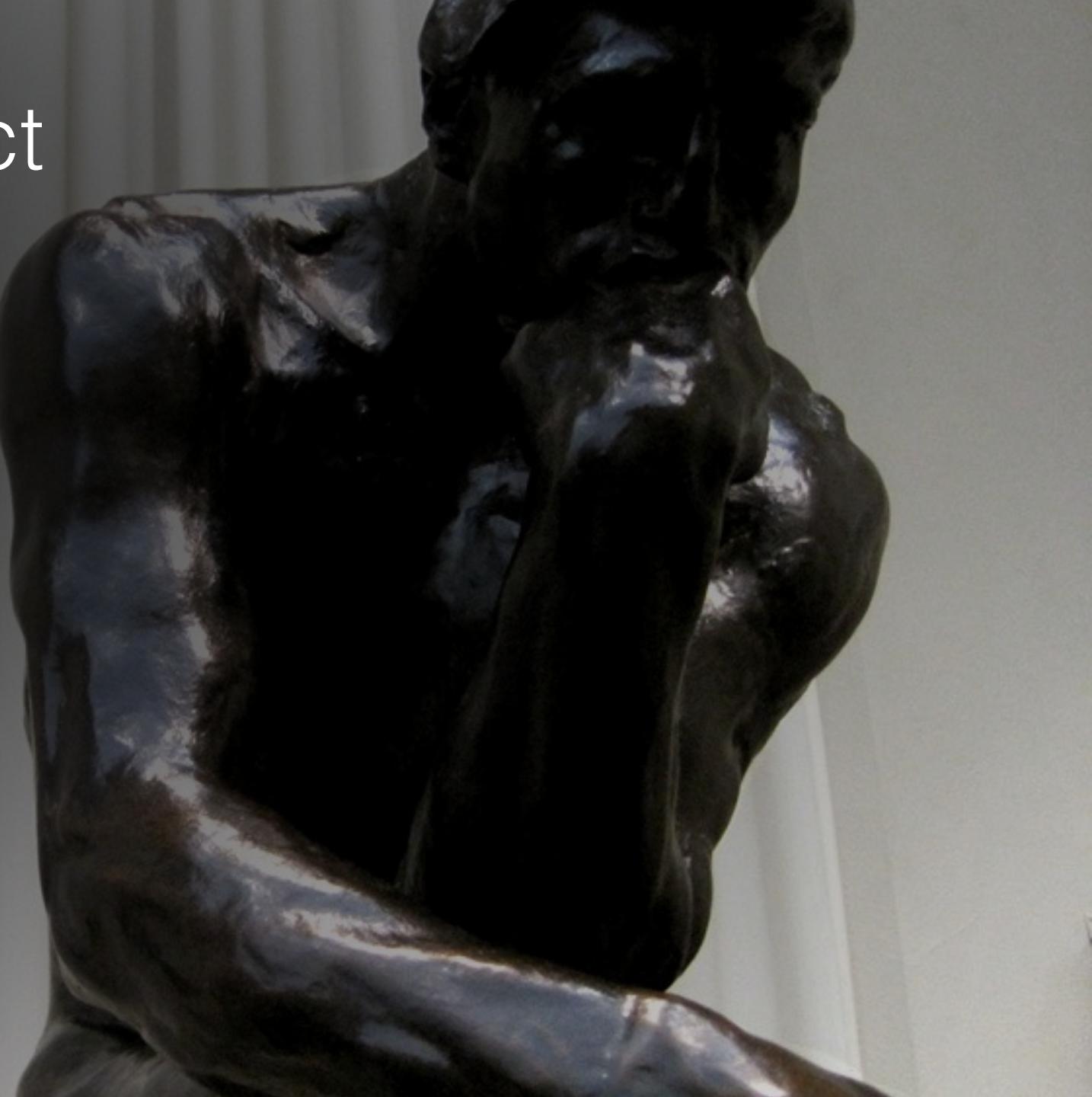
- Application Interface
 - Stored Procedure
 - View
- Business Logic
 - User-Defined Function
 - Table Constraints & Relationships
- Data Interaction
 - Reads from and Writes to Tables

Stay in Your Lane

- Business Logic only thinks.
- Data gathering thinks a little.
 - How tables connect is also business logic.
- Coordinators don't think; they only execute.
 - Data only modified by coordinators.
 - External effects only through coordinators.
- Functions are naturally read-only.
 - ***Inline*** functions only.
- Views can work too, but no parameters.

Think Before You Act

- Put all your logic up top.
- Let your logic dictate your actions.
- Perform actions at the bottom.
- Advantages:
 - Helps prevent spaghetti code.
 - Can test without acting.
 - Allows shorter transactions.



Do One Thing at a Time

- Strive for small code units.
- Minimize what each code unit does.
- For complex logic, compose.
- Advantages:
 - Easier to understand and test.
 - Encourages code re-use.
 - Enables collaboration.

Be Predictable

- Make business logic deterministic.
- Specific inputs always result in specific outputs.
- You can't test if you don't know what it should do.
- Feed your code what it needs.
- Don't get data.
- Don't get system settings.
- Don't get random values.
- Don't *get* anything.



Build Scaffolding

- Think functional programming.
 - Goodbye variables and procedure code.
 - Hello columns in derived tables.
- Remember Layers are Yummy.
 - Each layer is like its own function.
 - It's turtles all the way down.
- Decreases cognitive load.
- Column names aid comprehension.
- Each column like its own PRINT statement.



Golden Pattern

- Top-level stored procedure to coordinate.
- Which calls a data gathering function.
- Which calls feeds a business logic function.
- Which returns actions to perform.
- Which are executed by procedure.

Demo



Don't Go Overboard

- "Internal Query Processor Error: The query processor could not produce a query plan. For more information, contact Customer Support Services."
- Performance still matters.
 - Logic can interfere with index use.
 - Smooshing and exploding sets costs CPU.
- Sometimes front-loading all logic makes things harder and more confusing.

Tools of the Testing Trade

- TRAns
- Mocks and Wrappers
- Stack Traces
- Table Variables
- Fuzz
- tSQLt / Redgate SQL Test



TRANS

- The most important testing tool.
- BEGIN TRAN; ROLLBACK TRAN;
- BEGINs can nest, but ROLLBACK is one and done.
- No data modifications survive.
- Consider checking @@TRANCOUNT in code.

Mocks and Wrappers

- Often no transactions for linked servers or external processes (CLR).
- Wrap external calls in central code.
- Manually alter wrapper to return fake data during testing.
- Could use debug parameter for some scenarios.
- Important for DB Mail, as rollbacks can hang process.

Stack Traces

- Create Proc Call Log Table
- Build Logging Proc
- Call at end of Every Proc
- Use CONTEXT_INFO() to share ID across proc calls
- Feed it start time, OBJECT_NAME(@@procid), and
@@NESTLEVEL
- Optionally feed it all params and/or variables in JSON or XML.
- SELECT from log table for stack trace.

Table Variables

- No data modifications survive ROLLBACK.
- But variables do!
- And table variables are tables!
- Testing flow:
 - Capture your BEFORE data in table variables.
 - Run your Proc.
 - Compare your AFTER data with BEFORE data.
 - ROLLBACK.

Fuzz

- Send weird/bad data to your code.
- Use CROSS JOIN to build all combinations.
- Leverage function design to test all scenarios with a single SELECT.
- Provide business with full list of behavior.



tSQLt / Redgate SQL Test

- Build stored procedures to run tests.
- Automatically run tests and report results.

Demo



Bonus: Avoid Mistakes

- Do the WORM!
- Codify Magic Numbers
- Don't Repeat Yourself
- Use Named Parameters
- Use UPDATE-Style INSERT Syntax



Do the WORM!

- Write Once, Read Many
 - Take time to write clear code.
 - Consider your peers and future self.
- This isn't code golf. Characters are free.
 - Don't skimp on names.
 - Use lots of spacing.
 - Line stuff up.
- Don't use tricks because they're fun.
- Unless performance critical, prioritize readability.

Codify Magic Numbers

- Numbers are meaningless to code readers.
- Hard to change when sprinkled around.
- Centralize all special IDs & type values.
- Expose them as columns (in view or function).
- Compiler enforces accuracy.



Don't Repeat Yourself

- Nice to consolidate boilerplate code.
- Critical to consolidate business logic.
- Repeated business logic will drift.
- Pushing business logic to database makes it universally accessible.

Use Named Parameters

- Sample proc:
 - CREATE PROC Test @Fifteen int, @Six int, @Eight int, @Four int, @Twelve int, @Three int, @Sixteen int, @Fourteen int, @Ten int, @Five int
- Spot the bug?
 - EXEC Test 15, 6, 8, 4, 12, 16, 3, 14, 10, 5;
- How about now?
 - EXEC Test @Fifteen = 15, @Six = 6, @Eight = 8, @Four = 4, @Twelve = 12, @Three = 16, @Sixteen = 3, @Fourteen = 14, @Ten = 10, @Five = 5;
- Also allows you to rearrange parameters in procedure.

Use Named Parameters (cont'd)

Use them even when you “can’t”.

```
SELECT * FROM Function
(
    /* @FunctionParam1 int */    1    ,
    /* @FunctionParam15 int */ 15
);
```

Use Horizontal INSERT Syntax

Spot the bug?

```
INSERT INTO Table (Fifteen, Six, Eight, Four, Twelve, Three,  
Sixteen, Fourteen, Ten, Five)  
VALUES (15, 6, 8, 4, 12, 16, 3, 14, 10, 5);
```

Use Horizontal INSERT Syntax (cont'd)

Now spot the bug:

```
INSERT INTO Table (
Fifteen, Six, Eight, Four, Twelve, Three, Sixteen, Fourteen, Ten, Five
)
SELECT
Fifteen, Six, Eight, Four, Twelve, Three, Sixteen, Fourteen, Ten, Five
FROM ( SELECT Fifteen = 15, Six = 6, Eight = 8, Four = 4, Twelve = 12,
Three = 16, Sixteen = 3, Fourteen = 14, Ten = 10, Five = 5 ) AS t;
```

Now you love SQL!

- Build deterministic calc functions.
- Build data gathering functions.
- Put the data in the calc and drink them both up.
- Query every scenario.
- Send the results to the business and make them sign off.
- No more bugs.
- What's not to love?

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