

Stored procedures

WRITING FUNCTIONS AND STORED PROCEDURES IN SQL SERVER



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What is a stored procedure?

What?

Routines that

- Accept input parameters
- Perform actions (`EXECUTE` `SELECT` , `INSERT` , `UPDATE` , `DELETE` , and other SP statements)
- Return status (success or failure)
- Return output parameters

Why use stored procedures?

Why?

- Can reduce execution time
- Can reduce network traffic
- Allow for Modular Programming
- Improved Security

What's the difference?

UDFs

- Must return value
 - Table-valued allowed
- Embedded `SELECT` execute allowed
- No output parameters
- No `INSERT` , `UPDATE` , `DELETE`
- Cannot execute SPs
- No Error Handling

SPs

- Return value optional
 - No table-valued
- Cannot embed in `SELECT` to execute
- Return output parameters & status
- `INSERT` , `UPDATE` , `DELETE` allowed
- Can execute functions & SPs
- Error Handling with `TRY...CATCH`

CREATE PROCEDURE with OUTPUT parameter

```
-- First four lines of code
-- SP name must be unique
CREATE PROCEDURE dbo.cuspGetRideHrsOneDay
    @DateParm date,
    @RideHrsOut numeric OUTPUT
AS
.....
```

CREATE PROCEDURE with OUTPUT parameter

```
CREATE PROCEDURE dbo.cuspGetRideHrsOneDay
    @DateParm date,
    @RideHrsOut numeric OUTPUT
AS
SET NOCOUNT ON
BEGIN
SELECT
    @RideHrsOut = SUM(
        DATEDIFF(second, PickupDate, DropoffDate)
    ) / 3600
FROM YellowTripData
WHERE CONVERT(date, PickupDate) = @DateParm
RETURN
END;
```

Output parameters vs. return values

Output parameters

- Can be any data type
- Can declare multiple per SP
- Cannot be table-valued parameters

Return value

- Used to indicate success or failure
- Integer data type only
- 0 indicates success and non zero indicates failure

You're ready to **CREATE PROCEDUREs!**

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Oh CRUD!

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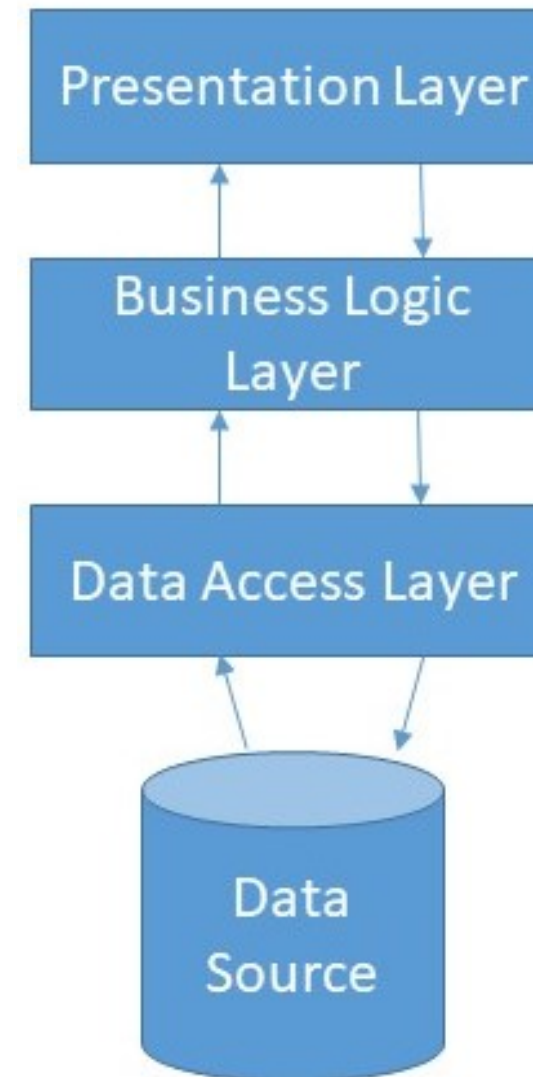


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Why stored procedures for CRUD?

- Decouples SQL code from other application layers

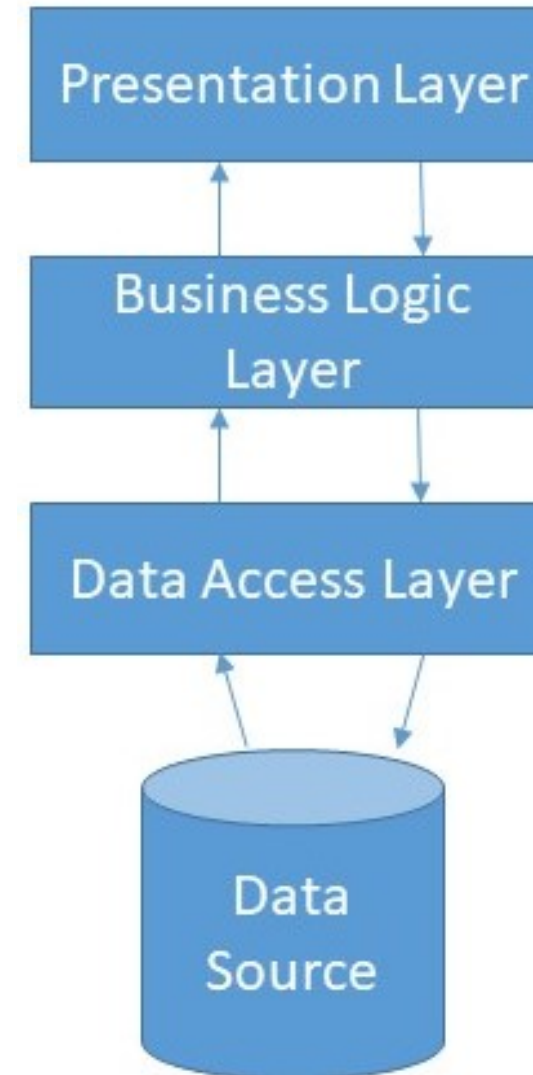
N-Tier Architecture



Why stored procedures for CRUD?

- Decouples SQL code from other application layers
- Improved security

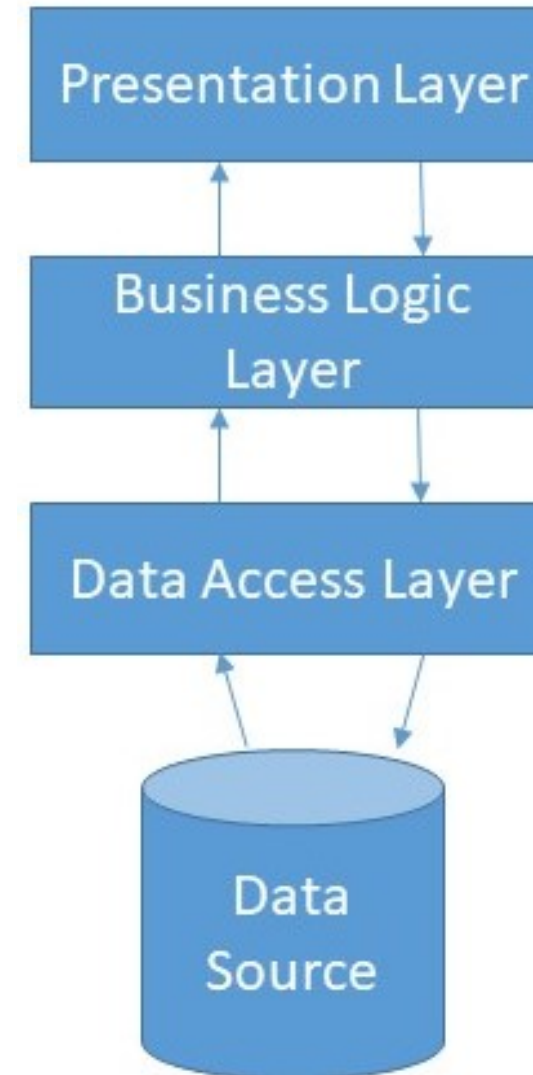
N-Tier Architecture



Why stored procedures for CRUD?

- Decouples SQL code from other application layers
- Improved security
- **Performance**

N-Tier Architecture



C for CREATE

```
CREATE PROCEDURE dbo.cusp_TripSummaryCreate (  
    @TripDate as date,  
    @TripHours as numeric(18, 0)  
) AS BEGIN INSERT INTO dbo.TripSummary(Date, TripHours)  
VALUES  
    (@TripDate, @TripHours)  
SELECT Date, TripHours  
FROM dbo.TripSummary  
WHERE Date = @TripDate END
```

R for READ

```
CREATE PROCEDURE cusp_TripSummaryRead
    (@TripDate as date)
AS
BEGIN
    SELECT Date, TripHours
    FROM TripSummary
    WHERE Date = @TripDate
END;
```

U for UPDATE

```
CREATE PROCEDURE dbo.cusp_TripSummaryUpdate
    (@TripDate as date,
    @TripHours as numeric(18,0))
AS
BEGIN
    UPDATE dbo.TripSummary
    SET Date = @TripDate,
        TripHours = @TripHours
    WHERE Date = @TripDate
END;
```

D for DELETE

```
CREATE PROCEDURE cusp_TripSummaryDelete
    (@TripDate as date,
     @RowCountOut int OUTPUT)
AS
BEGIN
DELETE
FROM TripSummary
WHERE Date = @TripDate

SET @RowCountOut = @@ROWCOUNT
END;
```


Your turn for CRUD!

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Let's EXEC!

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Ways to EXECute

- No output parameter or return value
- Store return value
- With output parameter
- With output parameter & store return value
- Store result set

No output parameter or return value

```
EXEC dbo.cusp_TripSummaryUpdate  
    @TripDate = '1/5/2017'  
    @TripHours = '300'
```

With output parameter

```
DECLARE @RideHrs as numeric(18,0)  
  
EXEC dbo.cuspSumRideHrsOneDay  
    @DateParm = '1/5/2017',  
    @RideHrsOut = @RideHrs OUTPUT
```

```
SELECT @RideHrs as TotalRideHrs
```

```
+-----+  
| TotalRideHrs |  
+-----+  
| 77733      |  
+-----+
```

With return value

```
Declare @ReturnValue as int

EXEC @ReturnValue =
    dbo.cusp_TripSummaryUpdate
    @TripDate = '1/5/2017',
    @TripHours = 300

Select @ReturnValue as ReturnValue
```

```
+-----+
| ReturnValue |
+-----+
| 0          |
+-----+
```

With return value & output parameter

```
Declare @ReturnValue as int
Declare @RowCount as int

EXEC @ReturnValue =
    dbo.cusp_TripSummaryDelete
    @TripDate = '1/5/2017',
    @RowCountOut = @RowCount OUTPUT

Select @ReturnValue as ReturnValue,
       @RowCount as RowCount
```

```
+-----+-----+
| ReturnValue | RowCount |
+-----+-----+
| 0          | 1        |
+-----+-----+
```

EXEC & store result set

```
DECLARE @TripSummaryResultSet as TABLE(  
    TripDate date,  
    TripHours numeric(18,0))  
INSERT INTO @TripSummaryResultSet  
EXEC cusp_TripSummaryRead @TripDate = '1/5/2017'  
SELECT * FROM @TripSummaryResultSet
```

```
+-----+-----+  
| TripDate | TripHours |  
|-----+-----|  
| 2017-01-05 | 200      |  
+-----+-----|
```

Time to EXEC your SPs!

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TRY & CATCH those errors!

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To handle errors or not

What is error handling?

- Anticipation, detection and resolution of errors
- Maintains normal flow of execution
- Integrated into initial design

What happens without error handling?

- Sudden shut down or halts execution
- Generic error messages without helpful context are provided

Let's TRY

```
ALTER PROCEDURE dbo.cusp_TripSummaryCreate
    @TripDate nvarchar(30),
    @RideHrs numeric,
    @ErrorMsg nvarchar(max) = null OUTPUT
AS
BEGIN
    BEGIN TRY
        INSERT INTO TripSummary (Date, TripHours)
        VALUES (@TripDate, @RideHrs)
    END TRY
    . . . . .
```

Time to CATCH

```
ALTER PROCEDURE dbo.cusp_TripSummaryCreate
    @TripDate nvarchar(30),
    @RideHrs numeric,
    @ErrorMsg nvarchar(max) = null OUTPUT
AS
BEGIN
    BEGIN TRY
        INSERT INTO TripSummary (Date, TripHours)
        VALUES (@TripDate, @RideHrs)
    END TRY
    BEGIN CATCH
        SET @ErrorMsg = 'Error_Num: ' +
            CAST (ERROR_NUMBER() AS varchar) +
            ' Error_Sev: ' +
            CAST(ERROR_SEVERITY() AS varchar) +
            ' Error_Msg: ' + ERROR_MESSAGE()
    END CATCH
END
```

Show me the ERROR...

```
DECLARE @ErrorMsgOut as nvarchar(max)

EXECUTE dbo.cusp_TripSummaryCreate
    @TripDate = '1/32/2018',
    @RideHrs = 100,
    @ErrorMsg = @ErrorMsgOUT OUTPUT

SELECT @ErrorMsgOut as ErrorMessage
```

```
ErrorMessage
-----
Error_Num: 241 Error_Sev: 16
Error_Msg: Conversion failed when converting date and/or time from
           character string
```

THROW vs RAISERROR

THROW

- Introduced in SQL Server 2012
- Simple & easy to use
- Statements following will **NOT** be executed

RAISERROR

- Introduced in SQL Server 7.0
- Generates new error and cannot access details of original error (e.g. line number where error originally occurred)
- Statements following can be executed

Your turn to CATCH!

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