Deleting and altering triggers
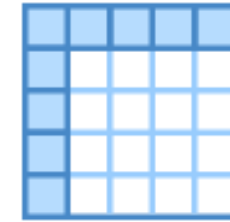
BUILDING AND OPTIMIZING TRIGGERS IN SQL SERVER

SQL

Florin Angelescu
Instructor
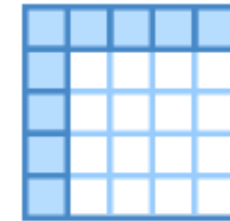
Deleting table and view triggers

```
DROP TRIGGER PreventNewDiscounts;
```

Deleting database triggers

```
DROP TRIGGER PreventNewDiscounts;
```

```
DROP TRIGGER PreventViewsModifications
ON DATABASE;
```
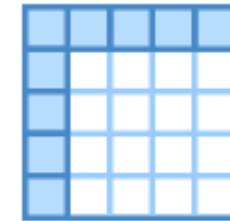
Deleting server triggers

```
DROP TRIGGER PreventNewDiscounts;
```

```
DROP TRIGGER PreventViewsModifications
ON DATABASE;
```

```
DROP TRIGGER DisallowLinkedServers
ON ALL SERVER;
```

Disabling triggers
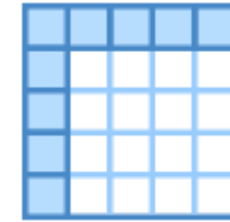
```
DISABLE TRIGGER PreventNewDiscounts
ON Discounts;
```

```
DISABLE TRIGGER PreventViewsModifications
ON DATABASE;
```

```
DISABLE TRIGGER DisallowLinkedServers
ON ALL SERVER;
```

Enabling triggers

```
ENABLE TRIGGER PreventNewDiscounts
ON Discounts;
```

```
ENABLE TRIGGER PreventViewsModifications
ON DATABASE;
```

```
ENABLE TRIGGER DisallowLinkedServers
ON ALL SERVER;
```
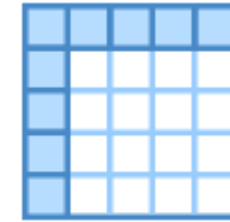
Altering triggers

```
CREATE TRIGGER PreventDiscountsDelete
ON Discounts
INSTEAD OF DELETE
AS
    PRINT 'You are not allowed to data from the Discounts table.';
```

```
DROP TRIGGER PreventDiscountsDelete;
```

```
CREATE TRIGGER PreventDiscountsDelete
ON Discounts
INSTEAD OF DELETE
AS
    PRINT 'You are not allowed to remove data from the Discounts table.';
```

Altering triggers

```
CREATE TRIGGER PreventDiscountsDelete

ON Discounts

INSTEAD OF DELETE

AS

    PRINT 'You are not allowed to data from the Discounts table.';
```

```
ALTER TRIGGER PreventDiscountsDelete

ON Discounts

INSTEAD OF DELETE

AS

    PRINT 'You are not allowed to remove data from the Discounts table.';
```

Let's practice!

BUILDING AND OPTIMIZING TRIGGERS IN SQL SERVER

Trigger management

BUILDING AND OPTIMIZING TRIGGERS IN SQL SERVER

SQL

Florin Angelescu
Instructor

datacamp

Getting info from sys.triggers

```sql
SELECT * FROM sys.triggers;
```

name	parent_class_desc	create_date	is_disabled	is_instead_of_trigger
TrackRetiredProducts	OBJECT_OR_COLUMN	2019-04-19	0	0
PreventOrdersUpdate	OBJECT_OR_COLUMN	2019-04-22	0	1
TrackDatabaseTables	DATABASE	2019-04-23	0	0
KeepCanceledOrders	OBJECT_OR_COLUMN	2019-04-27	0	0
DiscountsPreventDelete	OBJECT_OR_COLUMN	2019-04-27	0	1
PreventNewDiscounts	OBJECT_OR_COLUMN	2019-04-27	0	1
PreventTableDeletion	DATABASE	2019-04-27	0	0

Getting info from sys.triggers

name   trigger name

object_id   unique identifier of the trigger

parent_class   trigger type as integer

parent_class_desc   trigger type as text

parent_id   unique identifier of the parent object

Getting info from sys.triggers

create_date   date of creation

modify_date   date of last modification

is_disabled   current state

is_instead_of_trigger   `INSTEAD OF` or `AFTER` trigger

Getting info from sys.server_triggers

```sql
SELECT * FROM sys.server_triggers;
```

name	parent_class_desc	create_date	is_disabled	...
DenyNewDatabases	SERVER	2019-01-22	0	...
DenyNewLinkedServers	SERVER	2019-01-22	1	...
DenyDatabaseDelete	SERVER	2019-01-22	1	...

Getting info from sys.trigger_events

```
SELECT * FROM sys.trigger_events;
```

object_id	type	type_desc	event_group_type	event_group_type_desc
1285579618	24	CREATE_INDEX	NULL	NULL
1301579675	52	ALTER_PROCEDURE	NULL	NULL
1301579675	53	DROP_PROCEDURE	NULL	NULL
1333579789	1	INSERT	NULL	NULL
1365579903	2	UPDATE	NULL	NULL
1381579960	3	DELETE	NULL	NULL
1557580587	21	CREATE_TABLE	10017	DDL_TABLE_VIEW_EVENTS
1557580587	22	ALTER_TABLE	10017	DDL_TABLE_VIEW_EVENTS
1557580587	23	DROP_TABLE	10017	DDL_TABLE_VIEW_EVENTS

Getting info from sys.trigger_events

`object_id`   unique identifier of the trigger

`type`   event type as integer

`type_desc`   event type as text

`event_group_type`   event group type as integer

`event_group_type_desc`   event group type as text

Getting info from sys.trigger_events

DDL_TABLE_VIEW_EVENTS

CREATE_TABLE   DROP_TABLE   ALTER_TABLE

CREATE_VIEW   DROP_VIEW   ALTER_VIEW

CREATE_INDEX   DROP_INDEX   ALTER_INDEX

CREATE_STATISTICS   DROP_STATISTICS

UPDATE_STATISTICS   CREATE_XML_INDEX

[...]

Getting info from sys.server_trigger_events

```sql
SELECT * FROM sys.server_trigger_events;
```

object_id	type	type_desc	event_group_type	event_group_type_desc
1285579618	24	CREATE_LINKED_SERVER	NULL	NULL
1301579675	52	DROP_DATABASE	10004	DDL_DATABASE_EVENTS

Getting info from sys.trigger_event_types

```sql
SELECT * FROM sys.trigger_event_types;
```

```
| type  | type_name         | parent_type |
|-------|-------------------|-------------|
| 21    | CREATE_TABLE      | 10018       |
| 22    | ALTER_TABLE       | 10018       |
| 23    | DROP_TABLE        | 10018       |
| 24    | CREATE_INDEX      | 10020       |
| 25    | ALTER_INDEX       | 10020       |
| 26    | DROP_INDEX        | 10020       |
| 10018 | DDL_TABLE_EVENTS  | 10017       |
```

Trigger management in practice

```sql
SELECT t.name AS TriggerName,
       t.parent_class_desc AS TriggerType,
       te.type_desc AS EventName,
       o.name AS AttachedTo,
       o.type_desc AS ObjectType
FROM sys.triggers AS t
INNER JOIN sys.trigger_events AS te ON te.object_id = t.object_id
LEFT OUTER JOIN sys.objects AS o ON o.object_id = t.parent_id;
```

Trigger management in practice

TriggerName	TriggerType	EventName	AttachedTo	ObjectType
IndexSecurityTrigger	DATABASE	CREATE_INDEX	NULL	NULL
ProcedureSecurityTrigger	DATABASE	ALTER_PROCEDURE	NULL	NULL
ProcedureSecurityTrigger	DATABASE	DROP_PROCEDURE	NULL	NULL
CustomerDiscountHistory	OBJECT_OR_COLUMN	UPDATE	Discounts	USER_TABLE
TrackRetiredProducts	OBJECT_OR_COLUMN	DELETE	Products	USER_TABLE
PreventOrdersUpdate	OBJECT_OR_COLUMN	UPDATE	Orders	USER_TABLE
PreventDiscountsDelete	OBJECT_OR_COLUMN	DELETE	Discounts	USER_TABLE

Let's practice!

BUILDING AND OPTIMIZING TRIGGERS IN SQL SERVER

Troubleshooting triggers

BUILDING AND OPTIMIZING TRIGGERS IN SQL SERVER

SQL

Florin Angelescu
Instructor

datacamp

Tracking trigger executions (system view)

```
SELECT * FROM sys.dm_exec_trigger_stats;
```

```
| database_id | object_id  | last_execution_time      | execution_count |...|
|-------------|------------|--------------------------|-----------------|...|
| 4           | 1429580131 | 2019-05-26 18:30:12.660  | 1               |...|
| 4           | 1445580188 | 2019-05-26 18:30:26.450  | 2               |...|
```

Tracking trigger executions (custom solution)

```sql
CREATE TRIGGER PreventOrdersUpdate
ON Orders
INSTEAD OF UPDATE
AS
    RAISERROR ('Updates on "Orders" table are not permitted.
               Place a new order to add new products.', 16, 1);
```

Tracking trigger executions (custom solution)

```sql
ALTER TRIGGER PreventOrdersUpdate
ON Orders
INSTEAD OF UPDATE
AS
    INSERT INTO TriggerAudit (TriggerName, ExecutionDate)
    SELECT 'PreventOrdersUpdate',
           GETDATE();

    RAISERROR ('Updates on "Orders" table are not permitted.
                Place a new order to add new products.', 16, 1);
```

Tracking trigger executions (custom solution)

```sql
UPDATE Orders
SET Quantity = 300
WHERE OrderID = 784;
```

```
(1 row affected)
Msg 50000, Level 16, State 1, Procedure PreventOrdersUpdate, Line 11
                                        [Batch Start Line 27]
Updates on "Orders" table are not permitted.
Place a new order to add new products.


(0 rows affected)
```

Tracking trigger executions (custom solution)

```
SELECT * FROM TriggerAudit;
```

```
| ID | TriggerName         | ExecutionDate           |
|----|---------------------|-------------------------|
| 1  | PreventOrdersUpdate | 2019-05-26 19:28:04.483 |
```

Identifying triggers attached to a table

```sql
SELECT name AS TableName,
       object_id AS TableID
FROM sys.objects
WHERE name = 'Products';
```

```
| TableName | TableID    |
|-----------|------------|
| Products  | 917578307 |
```

Identifying triggers attached to a table

```sql
SELECT o.name AS TableName,
       o.object_id AS TableID,
       t.name AS TriggerName,
       t.object_id AS TriggerID,
       t.is_disabled AS IsDisabled,
       t.is_instead_of_trigger AS IsInsteadOf
FROM sys.objects AS o
INNER JOIN sys.triggers AS t ON t.parent_id = o.object_id
WHERE o.name = 'Products';
```

Identifying triggers attached to a table

```sql
SELECT o.name AS TableName,
       o.object_id AS TableID,
       t.name AS TriggerName,
       t.object_id AS TriggerID,
       t.is_disabled AS IsDisabled,
       t.is_instead_of_trigger AS IsInsteadOf
FROM sys.objects AS o
INNER JOIN sys.triggers AS t ON t.parent_id = o.object_id
WHERE o.name = 'Products';
```

```
| TableName | TableID    | TriggerName          | TriggerID  | IsDisabled | IsInsteadOf |
| Products  | 917578307  | TrackRetiredProducts | 1349579846 | 0          | 0           |
| Products  | 917578307  | ProductsNewItems     | 1397580017 | 0          | 0           |
| Products  | 917578307  | PreventProductChanges| 1541580530 | 0          | 1           |
```

Identifying events capable of firing a trigger

```sql
SELECT o.name AS TableName,
       o.object_id AS TableID,
       t.name AS TriggerName,
       t.object_id AS TriggerID,
       t.is_disabled AS IsDisabled,
       t.is_instead_of_trigger AS IsInsteadOf,
       te.type_desc AS FiringEvent
FROM sys.objects AS o
INNER JOIN sys.triggers AS t ON t.parent_id = o.object_id
INNER JOIN sys.trigger_events AS te ON t.object_id = te.object_id
WHERE o.name = 'Products';
```

Identifying events capable of firing a trigger

```sql
SELECT o.name AS TableName,
       o.object_id AS TableID,
       t.name AS TriggerName,
       t.object_id AS TriggerID,
       t.is_disabled AS IsDisabled,
       t.is_instead_of_trigger AS IsInsteadOf,
       te.type_desc AS FiringEvent
FROM sys.objects AS o
INNER JOIN sys.triggers AS t ON t.parent_id = o.object_id
INNER JOIN sys.trigger_events AS te ON t.object_id = te.object_id
WHERE o.name = 'Products';
```

TableName	TableID	TriggerName	TriggerID	IsDisabled	IsInsteadOf	FiringEvent
Products	917578307	TrackRetiredProducts	1349579846	0	0	DELETE
Products	917578307	ProductsNewItems	1397580017	0	0	INSERT
Products	917578307	PreventProductChanges	1541580530	0	1	UPDATE

Viewing the trigger definitions

```sql
SELECT o.name AS TableName,
       o.object_id AS TableID,
       t.name AS TriggerName,
       t.object_id AS TriggerID,
       t.is_disabled AS IsDisabled,
       t.is_instead_of_trigger AS IsInsteadOf,
       te.type_desc AS FiringEvent,
       OBJECT_DEFINITION(t.object_id) AS TriggerDefinition
FROM sys.objects AS o
INNER JOIN sys.triggers AS t ON t.parent_id = o.object_id
INNER JOIN sys.trigger_events AS te ON t.object_id = te.object_id
WHERE o.name = 'Products';
```

Viewing the trigger definitions

```sql
SELECT o.name AS TableName,
       o.object_id AS TableID,
       t.name AS TriggerName,
       t.object_id AS TriggerID,
       t.is_disabled AS IsDisabled,
       t.is_instead_of_trigger AS IsInsteadOf,
       te.type_desc AS FiringEvent,
       OBJECT_DEFINITION(t.object_id) AS TriggerDefinition
FROM sys.objects AS o
INNER JOIN sys.triggers AS t ON t.parent_id = o.object_id
INNER JOIN sys.trigger_events AS te ON t.object_id = te.object_id
WHERE o.name = 'Products';
```

TableName	TableID	TriggerName	...	FiringEvent	TriggerDefinition
Products	917578307	TrackRetiredProducts	...	DELETE	CREATE TRIGGER TrackRetiredProducts ON Produc...
Products	917578307	ProductsNewItems	...	INSERT	CREATE TRIGGER ProductsNewItems ON Products A...
Products	917578307	PreventProductChanges	...	UPDATE	CREATE TRIGGER PreventProductChanges ON Produ...

Let's practice!

BUILDING AND OPTIMIZING TRIGGERS IN SQL SERVER

Wrapping up

BUILDING AND OPTIMIZING TRIGGERS IN SQL SERVER

SQL

Florin Angelescu
Instructor

datacamp

Summary

- Trigger definition

- How triggers are used

- Trigger alternatives

- `AFTER` triggers

- `INSTEAD OF` triggers

- DML, DDL, and logon triggers

- Trigger limitations

- Real-life use cases

- Deleting and altering triggers

- Troubleshooting and managing triggers

Thank you!

BUILDING AND OPTIMIZING TRIGGERS IN SQL SERVER

datacamp