Apply SQL JOIN

Project description

The management at my organization has asked me to investigate potential security issues and update employee computers as required. As a Linux administrator, I used SQL with filters to perform security-related tasks. But for this scenario, I applied SQL join to play with the values of the two tables. This task is related to relational database management.

Inner Join

I created a SQL query on MariaDB to join two tables focusing on the intersection of two tables, where we only care about rows that have corresponding values in both.

This is the "employees" table.

```
MariaDB [organization]> SELECT * FROM employees;
+-------------+--------------+----------+------------------------+-------------+
| employee_id | device_id    | username | department             | office      |
+-------------+--------------+----------+------------------------+-------------+
|        1000 | a320b137c219 | elarson  | Marketing              | East-170    |
|        1001 | b239c825d303 | bmoreno  | Marketing              | Central-276 |
|        1002 | c116d593e558 | tshah    | Human Resources        | North-434   |
|        1003 | d394e816f943 | sgilmore | Finance                | South-153   |
|        1004 | e218f877g788 | eraab    | Human Resources        | South-127   |
|        1005 | f551g340h864 | gesparza | Human Resources        | South-366   |
|        1006 | g329h357i597 | alevitsk | Information Technology  | East-320    |
|        1007 | h174i497j413 | wjaffrey | Finance                | North-406   |
|        1008 | i858j583k571 | abernard | Finance                | South-170   |
|        1009 | NULL         | lrodriqu | Sales                  | South-134   |
|        1010 | k2421212m542 | jlansky  | Finance                | South-109   |
|        1011 | l748m120n401 | drosas   | Sales                  | South-292   |
|        1012 | m756n668o146 | nmason   | Information Technology  | North-160   |
|        1013 | n205o559p243 | zbernal  | Information Technology  | South-229   |
|        1014 | NULL         | asundara | Information Technology  | West-219    |
|        1015 | p611q262r945 | jsoto    | Finance                | North-271   |
|        1016 | q793r736s288 | sbaelish | Human Resources        | North-229   |
|        1017 | r550s824t230 | jclark   | Finance                | North-188   |
|        1018 | s310t540u653 | abellmas | Finance                | North-403   |
|        1019 | t815u205v470 | mcouliba | Information Technology  | North-108   |
|        1020 | u899v381w363 | arutley  | Marketing              | South-351   |
|        1021 | v200w121x977 | smartell | Information Technology  | South-138   |
|        1022 | w237x430y567 | arusso   | Finance                | West-465    |
|        1023 | x253y759z103 | aalonso  | Information Technology  | West-393    |
|        1024 | y976z753a267 | iuduike  | Sales                  | South-215   |
|        1025 | z381a365b233 | jhill    | Sales                  | North-115   |
|        1026 | a998b568c863 | apatel   | Human Resources        | West-320    |
|        1027 | b806c503d354 | mrah     | Marketing              | West-246    |
|        1028 | c603d749e374 | aestrada | Human Resources        | West-121    |
|        1029 | d336e475f676 | ivelasco | Finance                | East-156    |
|        1030 | e391f189g913 | mabadi   | Marketing              | West-375    |
|        1031 | f419g188h578 | dkot     | Marketing              | West-408    |
|        1032 | g773h303i639 | jrafael  | Information Technology  | Central-309 |
|        1033 | NULL         | yappiah  | Information Technology  | West-387    |
|        1034 | i679j565k940 | bsand    | Human Resources        | East-484    |
|        1035 | j236k3031245 | bisles   | Sales                  | South-171   |
```

This is the "machines" table.

```
MariaDB [organization]> SELECT * FROM machines;
+--------------+------------------+---------------+---------------+-------------+
| device_id    | operating_system | email_client  | OS_patch_date | employee_id |
+--------------+------------------+---------------+---------------+-------------+
| a184b775c707 | OS 1             | Email Client 1 | 2021-09-01   |        1156 |
| a192b174c940 | OS 2             | Email Client 1 | 2021-06-01   |        1052 |
| a305b818c708 | OS 3             | Email Client 2 | 2021-06-01   |        1182 |
| a317b635c465 | OS 1             | Email Client 2 | 2021-03-01   |        1130 |
| a320b137c219 | OS 2             | Email Client 2 | 2021-03-01   |        1000 |
| a398b471c573 | OS 3             | Email Client 2 | 2021-12-01   |           0 |
| a667b270c984 | OS 1             | Email Client 1 | 2021-03-01   |        1078 |
| a821b452c176 | OS 2             | Email Client 2 | 2021-12-01   |        1104 |
| a998b568c863 | OS 3             | Email Client 1 | 2021-12-01   |        1026 |
| b157c491d493 | OS 2             | Email Client 1 | 2021-03-01   |           0 |
| b239c825d303 | OS 1             | Email Client 1 | 2021-03-01   |        1001 |
| b264c773d977 | OS 2             | Email Client 2 | 2021-03-01   |        1157 |
| b265c937d713 | OS 2             | Email Client 1 | 2021-09-01   |        1131 |
| b433c245d868 | OS 1             | Email Client 1 | 2021-06-01   |        1079 |
| b551c837d758 | OS 3             | Email Client 1 | 2021-03-01   |        1105 |
| b566c710d544 | OS 1             | Email Client 1 | 2021-06-01   |        1183 |
| b806c503d354 | OS 2             | Email Client 1 | 2021-12-01   |        1027 |
| b979c871d361 | OS 2             | Email Client 1 | 2021-03-01   |        1053 |
| c116d593e558 | OS 3             | Email Client 1 | 2021-09-01   |        1002 |
| c150d982e144 | OS 2             | Email Client 2 | 2021-06-01   |        1132 |
| c185d679e493 | OS 1             | Email Client 2 | 2021-09-01   |           0 |
| c406d877e950 | OS 2             | Email Client 1 | 2021-06-01   |        1158 |
| c547d140e477 | OS 2             | Email Client 1 | 2021-03-01   |        1054 |
| c568d742e974 | OS 2             | Email Client 2 | 2021-09-01   |        1080 |
| c597d792e215 | OS 2             | Email Client 1 | 2021-09-01   |        1106 |
| c603d749e374 | OS 1             | Email Client 1 | 2021-12-01   |        1028 |
| c986d200e170 | OS 2             | Email Client 2 | 2021-09-01   |        1184 |
| d168e758f876 | OS 2             | Email Client 1 | 2021-09-01   |        1107 |
| d280e557f635 | OS 3             | Email Client 1 | 2021-03-01   |           0 |
| d336e475f676 | OS 2             | Email Client 2 | 2021-06-01   |        1029 |
| d394e816f943 | OS 3             | Email Client 2 | 2021-03-01   |        1003 |
| d647e310f618 | OS 2             | Email Client 2 | 2021-06-01   |        1081 |
| d693e351f221 | OS 2             | Email Client 2 | 2021-09-01   |        1133 |
| d790e839f461 | OS 1             | Email Client 1 | 2021-06-01   |        1185 |
| d831e972f553 | OS 1             | Email Client 1 | 2021-09-01   |        1055 |
| d881e710f732 | OS 3             | Email Client 2 | 2021-03-01   |        1159 |
| e113f288g203 | OS 2             | Email Client 2 | 2021-03-01   |        1108 |
```

This is the query that produces username, operating system, and employee ID from both tables. The username is from one of the tables and so is the operating system. For the table that can be found on both, we use "table.column" format to avoid ambiguity. In this case it is the employee table (employee ID). As the result goes, there are 185 usernames with respective operating systems and device IDs. Other variations can be found in the next pages of Inner Join.

```
MariaDB [organization]> SELECT username, operating_system, employees.device_id
    ->
    ->
    ->
    -> FROM  employees
    ->
    ->
    ->
    -> INNER JOIN machines ON employees.device_id = machines.device_id;
+----------+------------------+--------------+
| username | operating_system | device_id    |
+----------+------------------+--------------+
| elarson  | OS 2             | a320b137c219 |
| bmoreno  | OS 1             | b239c825d303 |
| tshah    | OS 3             | c116d593e558 |
| sgilmore | OS 3             | d394e816f943 |
| eraab    | OS 2             | e218f877g788 |
| gesparza | OS 3             | f551g340h864 |
| alevitsk | OS 1             | g329h357i597 |
| wjaffrey | OS 2             | h174i497j413 |
| abernard | OS 2             | i858j583k571 |
| jlansky  | OS 1             | k2421212m542 |
| drosas   | OS 3             | 1748m120n401 |
| nmason   | OS 1             | m756n668o146 |
| zbernal  | OS 1             | n205o559p243 |
| jsoto    | OS 1             | p611q262r945 |
| sbaelish | OS 2             | q793r736s288 |
| jclark   | OS 2             | r550s824t230 |
| abellmas | OS 1             | s310t540u653 |
| mcouliba | OS 3             | t815u205v470 |
| arutley  | OS 3             | u899v381w363 |
| smartell | OS 2             | v200w121x977 |
| arusso   | OS 2             | w237x430y567 |
| aalonso  | OS 1             | x253y759z103 |
```

```
| lquraish | OS 1             | b566c710d544 |
| ptsosie  | OS 2             | c986d200e170 |
| revens   | OS 1             | d790e839f461 |
| sacosta  | OS 1             | e281f433g404 |
| bbode    | OS 1             | f963g637h851 |
| noshiro  | OS 1             | g164h566i795 |
| slefkowi | OS 3             | h784i120j837 |
| rlaghari | OS 3             | k5701183m949 |
| esantiag | OS 1             | 1186m618n319 |
| zwarren  | OS 2             | m340n287o441 |
| orainier | OS 1             | n516o853p957 |
| sshah2   | OS 3             | o225p357q829 |
| aabara   | OS 2             | p791q114r509 |
| jmartine | OS 3             | q308r573s459 |
| areyes   | OS 2             | r520s571t459 |
+----------+------------------+--------------+
185 rows in set (0.001 sec)
```

This query will produce username, employee ID, operating system, device ID and their respective office.

```
MariaDB [organization]> SELECT username, employees.employee_id, operating_system, employees.device_id,
ice FROM employees INNER JOIN machines ON employees.device_id = machines.device_id;
+-----------+-------------+------------------+--------------+----------------+--------------+
| username  | employee_id | operating_system | device_id    | email_client   | office       |
+-----------+-------------+------------------+--------------+----------------+--------------+
| elarson   |        1000 | OS 2             | a320b137c219 | Email Client 2 | East-170     |
| bmoreno   |        1001 | OS 1             | b239c825d303 | Email Client 1 | Central-276  |
| tshah     |        1002 | OS 3             | c116d593e558 | Email Client 1 | North-434    |
| sgilmore  |        1003 | OS 3             | d394e816f943 | Email Client 2 | South-153    |
| eraab     |        1004 | OS 2             | e218f877g788 | Email Client 1 | South-127    |
| gesparza  |        1005 | OS 3             | f551g340h864 | Email Client 2 | South-366    |
| alevitsk  |        1006 | OS 1             | g329h357i597 | Email Client 2 | East-320     |
| wjaffrey  |        1007 | OS 2             | h174i497j413 | Email Client 1 | North-406    |
| abernard  |        1008 | OS 2             | i858j583k571 | Email Client 2 | South-170    |
| jlansky   |        1010 | OS 1             | k2421212m542 | Email Client 1 | South-109    |
| drosas    |        1011 | OS 3             | l748m120n401 | Email Client 1 | South-292    |
| nmason    |        1012 | OS 1             | m756n668o146 | Email Client 2 | North-160    |
| sbernal   |        1013 | OS 1             | n205o559p243 | Email Client 2 | South-229    |
| jsoto     |        1015 | OS 1             | p611q262r945 | Email Client 2 | North-271    |
| sbaelish  |        1016 | OS 2             | q793r736s288 | Email Client 1 | North-229    |
| jclark    |        1017 | OS 2             | r550s824t230 | Email Client 1 | North-188    |
| abellmas  |        1018 | OS 1             | s310t540u653 | Email Client 2 | North-403    |
| mcouliba  |        1019 | OS 3             | t815u205v470 | Email Client 1 | North-108    |
| arutley   |        1020 | OS 3             | u899v381w363 | Email Client 1 | South-351    |
| smartell  |        1021 | OS 2             | v200w121x977 | Email Client 2 | South-138    |
| arusso    |        1022 | OS 2             | w237x430y567 | Email Client 2 | West-465     |
| aalonso   |        1023 | OS 1             | x253y759z103 | Email Client 2 | West-393     |
| iuduike   |        1024 | OS 2             | y976z753a267 | Email Client 2 | South-215    |
| jhill     |        1025 | OS 3             | z381a365b233 | Email Client 2 | North-115    |
| apatel    |        1026 | OS 3             | a998b568c863 | Email Client 1 | West-320     |
| mrah      |        1027 | OS 2             | b806c503d354 | Email Client 1 | West-246     |
| aestrada  |        1028 | OS 1             | c603d749e374 | Email Client 1 | West-121     |
| ivelasco  |        1029 | OS 2             | d336e475f676 | Email Client 2 | East-156     |
| mabadi    |        1030 | OS 3             | e391f189g913 | Email Client 2 | West-375     |
| dkot      |        1031 | OS 1             | f419g188h578 | Email Client 1 | West-408     |
| jrafael   |        1032 | OS 2             | g773h303i639 | Email Client 2 | Central-309  |
| bsand     |        1034 | OS 1             | i679j565k940 | Email Client 1 | East-484     |
| bisles    |        1035 | OS 1             | j236k3031245 | Email Client 1 | South-171    |
| rjensen   |        1036 | OS 3             | k5501533m205 | Email Client 2 | Central-239  |
| dtanaka   |        1037 | OS 3             | l693m585n528 | Email Client 1 | West-468     |
| btang     |        1038 | OS 1             | m873n636o225 | Email Client 2 | Central-260  |
| cjackson  |        1039 | OS 1             | n253o917p623 | Email Client 2 | East-378     |
| dtarlu    |        1040 | OS 2             | o783p832q294 | Email Client 2 | East-337     |
```

```
| aezra     |       1177 | OS 1 | v691w183x928 | Email Client 2 | East-190    |
| nlannist  |       1178 | OS 3 | w986x187y885 | Email Client 2 | North-196   |
| asalas    |       1179 | OS 1 | x174y934z376 | Email Client 2 | North-445   |
| medwards  |       1180 | OS 2 | y131z211a578 | Email Client 1 | Central-340 |
| sessa     |       1181 | OS 1 | z803a233b718 | Email Client 2 | South-207   |
| mmora     |       1182 | OS 3 | a305b818c708 | Email Client 2 | Central-250 |
| lquraish  |       1183 | OS 1 | b566c710d544 | Email Client 1 | East-400    |
| ptsosie   |       1184 | OS 2 | c986d200e170 | Email Client 2 | Central-247 |
| revens    |       1185 | OS 1 | d790e839f461 | Email Client 1 | North-330   |
| sacosta   |       1186 | OS 1 | e281f433g404 | Email Client 2 | North-460   |
| bbode     |       1187 | OS 1 | f963g637h851 | Email Client 1 | East-351    |
| noshiro   |       1188 | OS 1 | g164h566i795 | Email Client 1 | West-252    |
| slefkowi  |       1189 | OS 3 | h784i120j837 | Email Client 2 | West-342    |
| rlaghari  |       1192 | OS 3 | k5701183m949 | Email Client 1 | East-138    |
| esantiag  |       1193 | OS 1 | 1186m618n319 | Email Client 2 | Central-300 |
| zwarren   |       1194 | OS 2 | m340n287o441 | Email Client 2 | West-212    |
| orainier  |       1195 | OS 1 | n516o853p957 | Email Client 1 | East-346    |
| sshah2    |       1196 | OS 3 | o225p357q829 | Email Client 1 | South-385   |
| aabara    |       1197 | OS 2 | p791q114r509 | Email Client 1 | North-159   |
| jmartine  |       1198 | OS 3 | q308r573s459 | Email Client 1 | South-117   |
| areyes    |       1199 | OS 2 | r520s571t459 | Email Client 2 | East-100    |
+-----------+------------+------+--------------+----------------+-------------+
185 rows in set (0.001 sec)
```

Return More Data

Left Join. The results will include all records from one or the other table. Here, I have to link these tables using the common `device_id` column. In a left join, all records after `FROM` and before `LEFT JOIN` are included in the result. In this case, all records from the `machines` table are included, whether they are assigned to the `employees` table or not.

```
MariaDB [organisation]> clear
MariaDB [organisation]> SELECT *
    ->
    -> FROM machines
    ->
    -> LEFT JOIN employees ON machines.device_id = employees.device_id;
+---------------+------------------+---------------+---------------+-------------+-------------+---------------+----------+------------------------+------------+
| device_id     | operating_system | email_client  | OS_patch_date | employee_id | employee_id | device_id     | username | department             | office     |
+---------------+------------------+---------------+---------------+-------------+-------------+---------------+----------+------------------------+------------+
| a320b137c219  | OS 2             | Email Client 2 | 2021-03-01   |        1000 |        1000 | a320b137c219  | elarson  | Marketing              | East-170   |
| b239c825d303  | OS 1             | Email Client 1 | 2021-03-01   |        1001 |        1001 | b239c825d303  | bmoreno  | Marketing              | Central-276 |
| c116d593e558  | OS 3             | Email Client 1 | 2021-09-01   |        1002 |        1002 | c116d593e558  | tshah    | Human Resources        | North-434  |
| d394e816f943  | OS 3             | Email Client 2 | 2021-03-01   |        1003 |        1003 | d394e816f943  | sgilmore | Finance                | South-153  |
| e218f877g788  | OS 2             | Email Client 1 | 2021-09-01   |        1004 |        1004 | e218f877g788  | eraab    | Human Resources        | South-127  |
| f551g340h864  | OS 3             | Email Client 2 | 2021-12-01   |        1005 |        1005 | f551g340h864  | gesparza | Human Resources        | South-366  |
| g329h357i597  | OS 1             | Email Client 2 | 2021-06-01   |        1006 |        1006 | g329h357i597  | alevitsk | Information Technology  | East-320   |
| h174i497j413  | OS 2             | Email Client 1 | 2021-03-01   |        1007 |        1007 | h174i497j413  | wjaffrey | Finance                | North-406  |
| i858j583k571  | OS 2             | Email Client 2 | 2021-06-01   |        1008 |        1008 | i858j583k571  | abernard | Finance                | South-170  |
| k2421212m542  | OS 1             | Email Client 1 | 2021-03-01   |        1010 |        1010 | k2421212m542  | jlansky  | Finance                | South-109  |
```

Right Join.
Right Join. The results will include all records from one or the other table. Here, I have to link these tables using the common `device_id` column. In a right join, all records after `RIGHT JOIN` are included in the result. In this case, all records from the `employees` table are

included, whether they have values on the `machine` table or not.

```
MariaDB [organization]> SELECT *
    ->
    -> FROM machines
    ->
    -> RIGHT JOIN employees ON machines.device_id = employees.device_id;
+--------------+------------------+--------------+---------------+-------------+-------------+--------------+-----------+------------------------+----------+
| device_id    | operating_system | email_client | OS_patch_date | employee_id | employee_id | device_id    | username  | department             | office   |
+--------------+------------------+--------------+---------------+-------------+-------------+--------------+-----------+------------------------+----------+
| a320b137c219 | OS 2             | Email Client 2 | 2021-03-01  |        1000 |        1000 | a320b137c219 | elarson   | Marketing              | East-17  |
| b239c825d303 | OS 1             | Email Client 1 | 2021-03-01  |        1001 |        1001 | b239c825d303 | bmoreno   | Marketing              | Central-276 |
| c116d593e558 | OS 3             | Email Client 1 | 2021-09-01  |        1002 |        1002 | c116d593e558 | tshah     | Human Resources        | North-434 |
| d394e816f943 | OS 3             | Email Client 2 | 2021-03-01  |        1003 |        1003 | d394e816f943 | sgilmore  | Finance                | South-153 |
| e218f877g788 | OS 2             | Email Client 1 | 2021-09-01  |        1004 |        1004 | e218f877g788 | eraab     | Human Resources        | South-127 |
| f551g340h864 | OS 3             | Email Client 2 | 2021-12-01  |        1005 |        1005 | f551g340h864 | gesparza  | Human Resources        | South-356 |
| g329h357i597 | OS 1             | Email Client 2 | 2021-06-01  |        1006 |        1006 | g329h357i597 | alevitsk  | Information Technology  | East-320 |
| h174i497j413 | OS 2             | Email Client 1 | 2021-03-01  |        1007 |        1007 | h174i497j413 | wjaffrey  | Finance                | North-406 |
| i858j583k571 | OS 2             | Email Client 2 | 2021-06-01  |        1008 |        1008 | i858j583k571 | abernard  | Finance                | South-170 |
| NULL         | NULL             | NULL         | NULL          | NULL        |        1009 | NULL         | lrodriqu  | Sales                  | South-134 |
| k2421212m542 | OS 1             | Email Client 1 | 2021-03-01  |        1010 |        1010 | k2421212m542 | jlansky   | Finance                | South-1  |
```

Both produced 200 rows each, however in the process, some data are written `NUL` due to types of `JOIN`.

Summary

I wrote queries to join two tables in three different scenarios: Inner Join, Left Join, and Right Join.