CPS 610

Assignment One

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Introduction

This report details the steps taken to implement and test database replication and synchronization mechanisms between two Oracle instances, DB1 and DB2. The primary focus was to ensure data consistency across these databases through replication and to automate these processes to minimize manual intervention.

Initial Steps

The project commenced with the establishment of a database link between DB1 and DB2. The `EMPLOYEES` table was created on both instances to test the replication processes. Essential SQL Developer tools were utilized, and connections were established under the school's VPN.

Replication Process

The replication was achieved by creating and using a PL/SQL stored procedure named `sync_employees_to_db2`. This procedure handled the synchronization of new entries, updates, and deletions from DB1 to DB2, ensuring that both databases remained consistent with each other.

Challenges Faced and Solutions

1. **Permission Issues**
    - **Problem:** Initial attempts to grant `CREATE JOB` and `MANAGE SCHEDULER` privileges resulted in `ORA-01031: insufficient privileges`. This restriction prevented the automation of the synchronization process using `DBMS_SCHEDULER`.
    - **Impact:** Without the necessary privileges, it was not possible to automate the database synchronization, which was a significant component of the project.
2. **Workaround**
    - **Approach:** Due to the restricted permissions on the school server, the team was unable to implement the scheduled synchronization. As a result, the `sync_employees_to_db2` procedure required manual execution.
    - **Resolution:** The team scheduled regular intervals manually to run the synchronization script and ensure data consistency.

Stored Procedure, Logging, and Automation

The stored procedure was crafted to check for any changes in the `EMPLOYEES` table in DB1 and replicate these changes to DB2. Enhancements included logging mechanisms that recorded each operation's type, the employee ID involved, and the timestamp, aiding in troubleshooting and auditing processes. Due to permission issues, automation was not implemented, and synchronization remains a manual process.

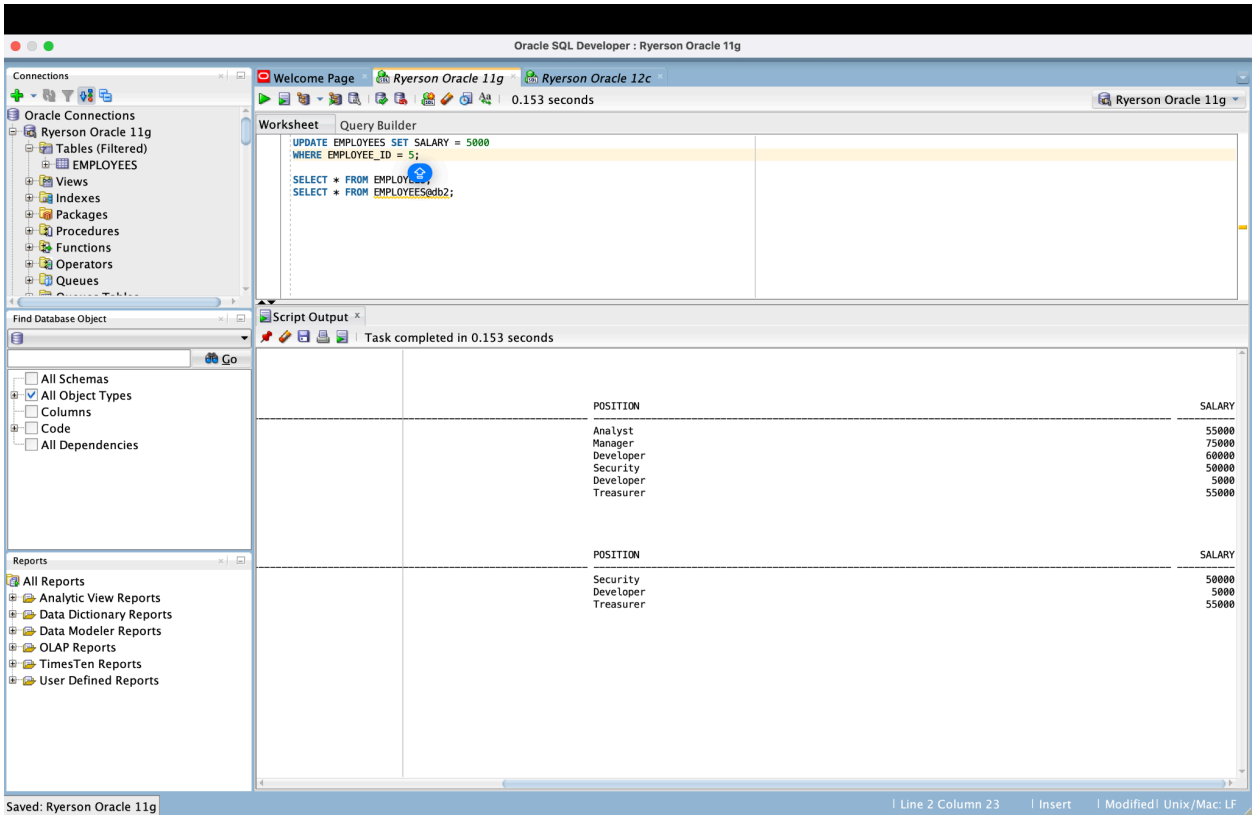
Testing and Verification

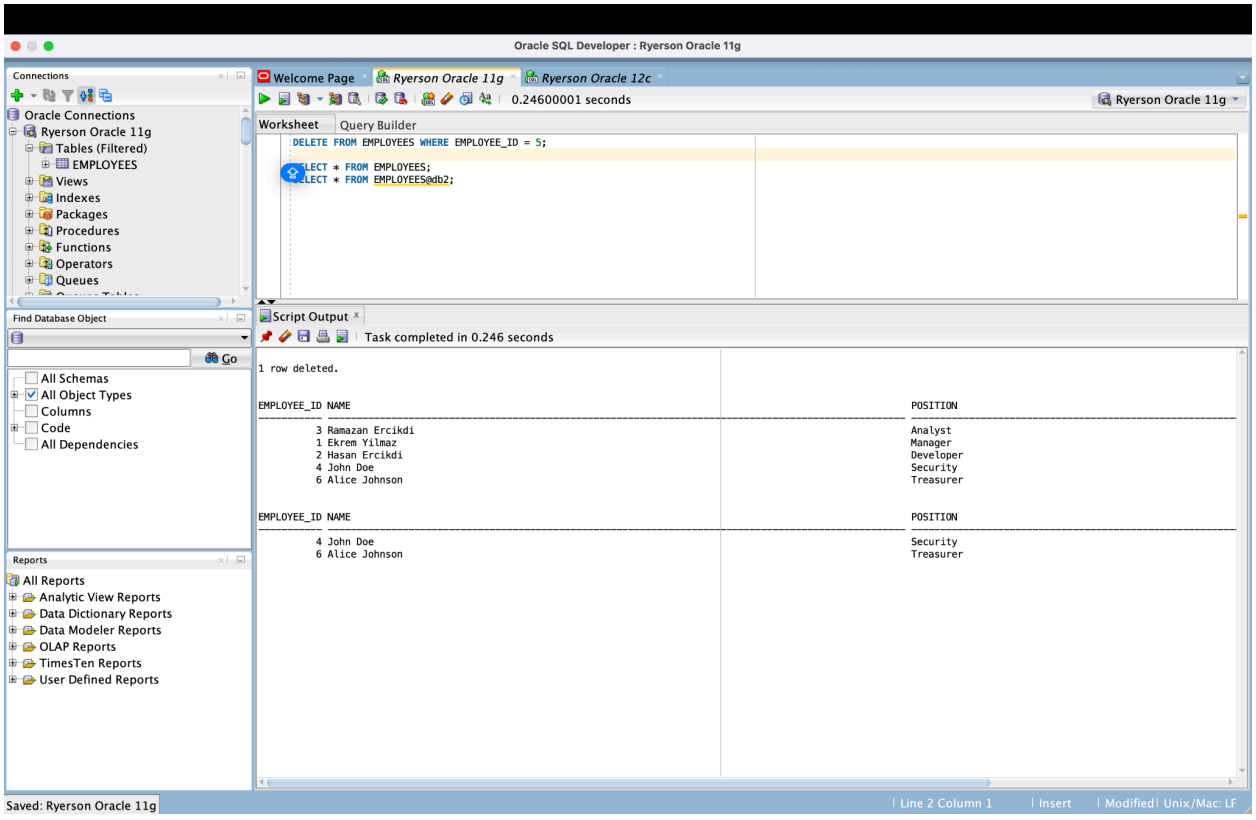
Testing involved manual execution of the `sync_employees_to_db2` procedure. Changes were made to the `EMPLOYEES` table in DB1 to test the replication accuracy in DB2. All insert, update, and delete operations were correctly mirrored in DB2, confirming the effectiveness of the replication setup.

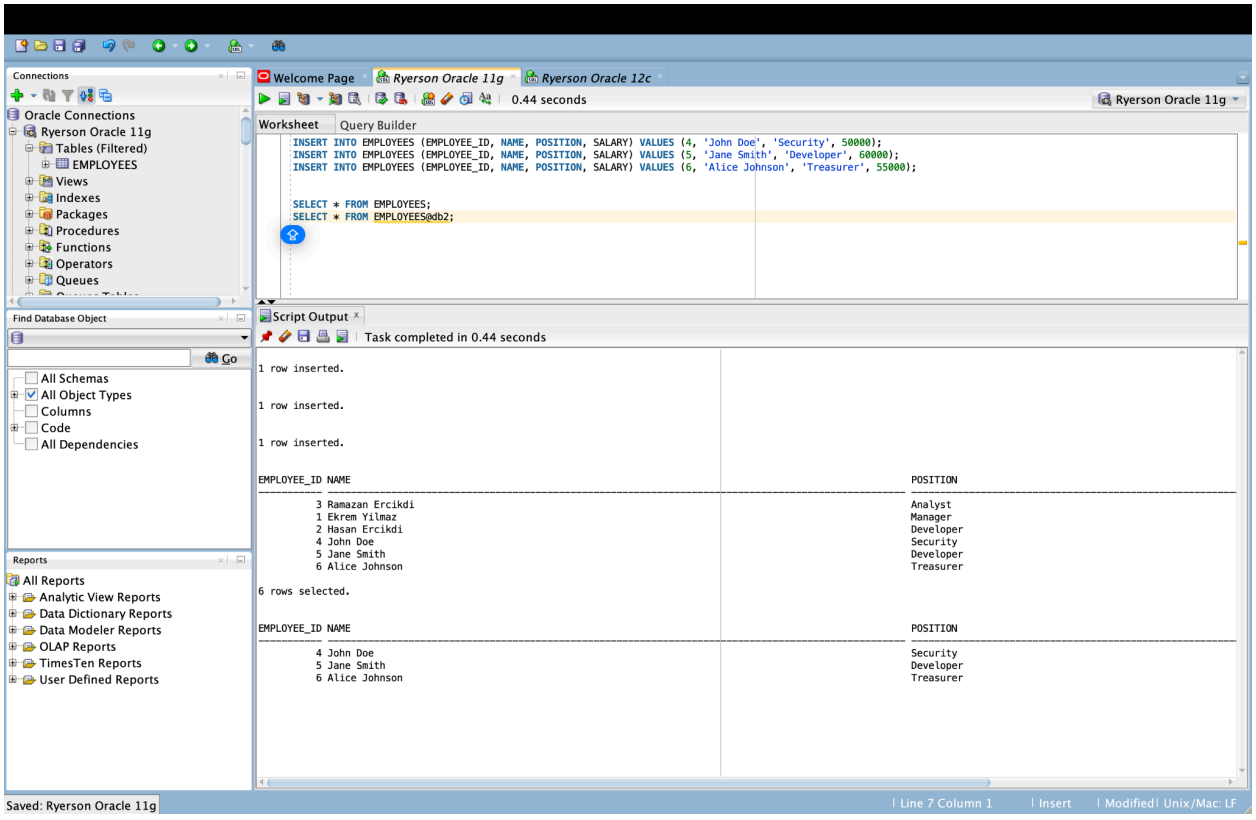
Conclusion

The project successfully demonstrated the ability to synchronize data between two database instances manually. While automation was a desired outcome, the learning experience provided insight into database management's complexities, especially in environments with strict security protocols.

ScreenShots of the code:




Oracle SQL Developer : Ryerson Oracle 11g
Connections
Oracle Connections
Ryerson Oracle 11g
Tables (Filtered)
EMPLOYEES
Views
Indexes
Packages
Procedures
Functions
Operators
Queues
Welcome Page
Ryerson Oracle 11g
Ryerson Oracle 12c
0.24600001 seconds
Ryerson Oracle 11g
Worksheet
Query Builder
DELETE FROM EMPLOYEES WHERE EMPLOYEE_ID = 5;
SELECT * FROM EMPLOYEES;
SELECT * FROM EMPLOYEES@db2;
Find Database Object
Go
All Schemas
All Object Types
Columns
Code
All Dependencies
Reports
All Reports
Analytic View Reports
Data Dictionary Reports
Data Modeler Reports
OLAP Reports
TimesTen Reports
User Defined Reports
Script Output
Task completed in 0.246 seconds
1 row deleted.
EMPLOYEE_ID NAME POSITION
3 Ramazan Ercikdi Analyst
1 Ekrem Yilmaz Manager
2 Hasan Ercikdi Developer
4 John Doe Security
6 Alice Johnson Treasurer
EMPLOYEE_ID NAME POSITION
4 John Doe Security
6 Alice Johnson Treasurer
Saved: Ryerson Oracle 11g
Line 2 Column 1
Insert
Modified
Unix/Mac: LF


Connections
Oracle Connections
Ryerson Oracle 11g
Tables (Filtered)
EMPLOYEES
Views
Indexes
Packages
Procedures
Functions
Operators
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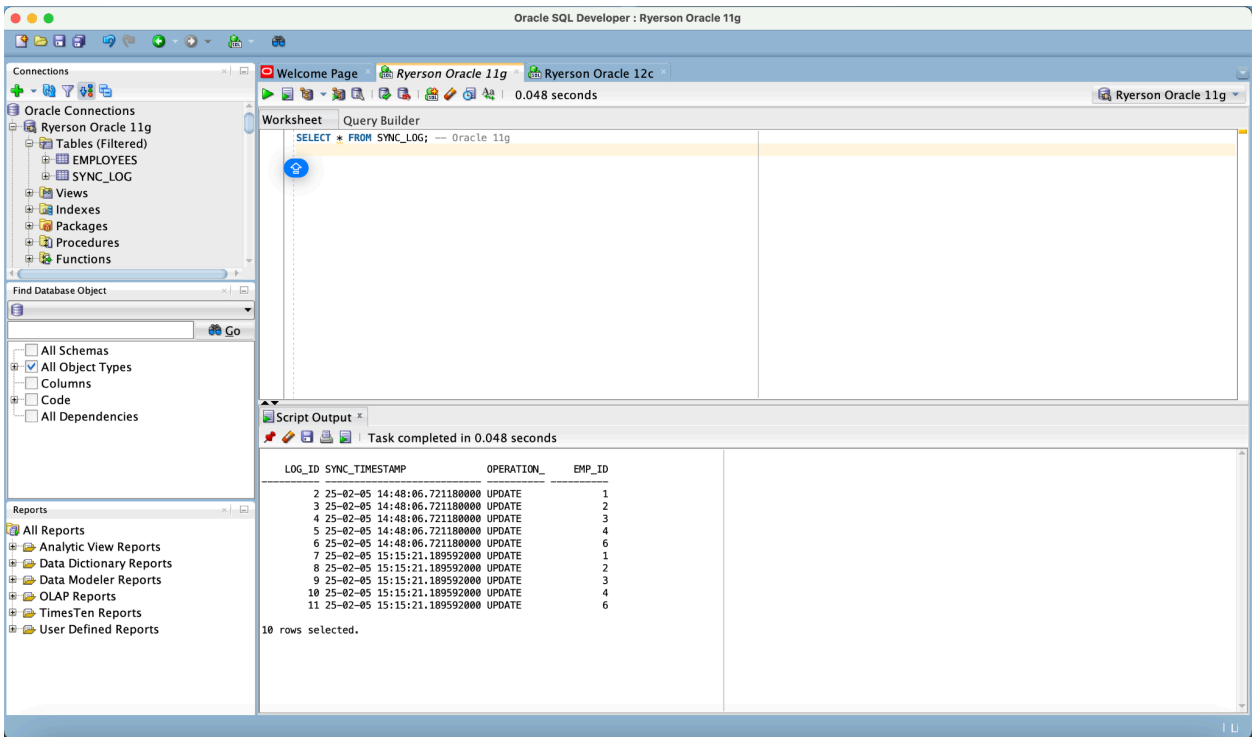
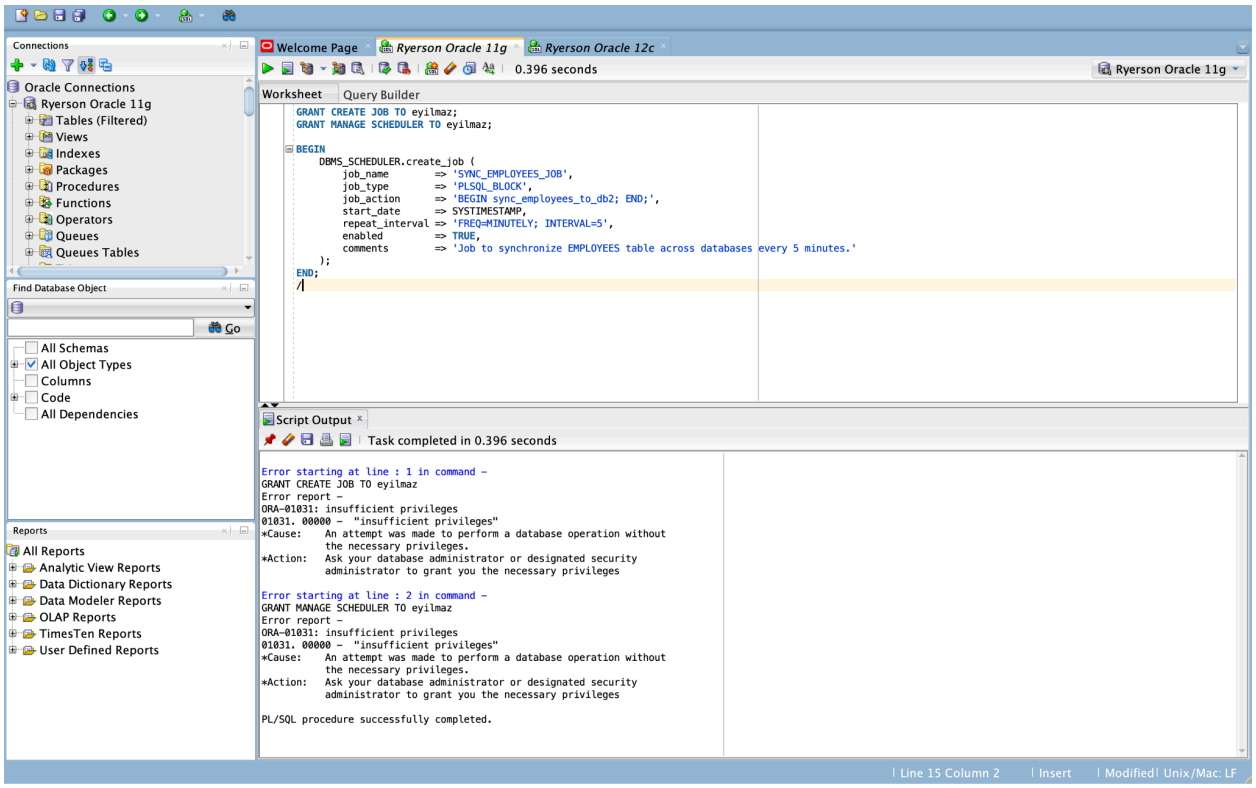
Find Database Object
Go
All Schemas
All Object Types
Columns
Code
All Dependencies
Reports
All Reports
Analytic View Reports
Data Dictionary Reports
Data Modeler Reports
OLAP Reports
TimesTen Reports
User Defined Reports
Welcome Page
Ryerson Oracle 11g
Ryerson Oracle 12c
0.44 seconds
Ryerson Oracle 11g
Worksheet
Query Builder
INSERT INTO EMPLOYEES (EMPLOYEE_ID, NAME, POSITION, SALARY) VALUES (4, 'John Doe', 'Security', 50000);
INSERT INTO EMPLOYEES (EMPLOYEE_ID, NAME, POSITION, SALARY) VALUES (5, 'Jane Smith', 'Developer', 60000);
INSERT INTO EMPLOYEES (EMPLOYEE_ID, NAME, POSITION, SALARY) VALUES (6, 'Alice Johnson', 'Treasurer', 55000);
SELECT * FROM EMPLOYEES;
SELECT * FROM EMPLOYEES@db2;
Script Output
Task completed in 0.44 seconds
1 row inserted.
1 row inserted.
1 row inserted.
EMPLOYEE_ID NAME POSITION
3 Ramazan Ercikdi Analyst
1 Ekrem Yilmaz Manager
2 Hasan Ercikdi Developer
4 John Doe Security
5 Jane Smith Developer
6 Alice Johnson Treasurer
6 rows selected.
EMPLOYEE_ID NAME POSITION
4 John Doe Security
5 Jane Smith Developer
6 Alice Johnson Treasurer
Saved: Ryerson Oracle 11g
Line 7 Column 1
Insert
Modified
Unix/Mac: LF


Oracle SQL Developer : Ryerson Oracle 11g
Connections
Oracle Connections
Ryerson Oracle 11g
Tables (Filtered)
EMPLOYEES
SYNC_LOG
Views
Indexes
Packages
Procedures
Functions
Find Database Object
Go
All Schemas
All Object Types
Columns
Code
All Dependencies
Reports
All Reports
Analytic View Reports
Data Dictionary Reports
Data Modeler Reports
OLAP Reports
TimesTen Reports
User Defined Reports
Welcome Page
Ryerson Oracle 11g
Ryerson Oracle 12c
0.048 seconds
Ryerson Oracle 11g
Worksheet
Query Builder
SELECT * FROM SYNC_LOG; -- Oracle 11g
Script Output
Task completed in 0.048 seconds
LOG_ID SYNC_TIMESTAMP OPERATION_ EMP_ID
2 25-02-05 14:48:06.721180000 UPDATE 1
3 25-02-05 14:48:06.721180000 UPDATE 2
4 25-02-05 14:48:06.721180000 UPDATE 3
5 25-02-05 14:48:06.721180000 UPDATE 4
6 25-02-05 14:48:06.721180000 UPDATE 6
7 25-02-05 15:15:21.189592000 UPDATE 1
8 25-02-05 15:15:21.189592000 UPDATE 2
9 25-02-05 15:15:21.189592000 UPDATE 3
10 25-02-05 15:15:21.189592000 UPDATE 4
11 25-02-05 15:15:21.189592000 UPDATE 6
10 rows selected.

Bonus Part: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All Reports
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Data Dictionary Reports
Data Modeler Reports
OLAP Reports
TimesTen Reports
User Defined Reports
Welcome Page
Ryerson Oracle 11g
Ryerson Oracle 12c
0.396 seconds
Ryerson Oracle 11g
Worksheet
Query Builder
GRANT CREATE JOB TO eyilmaz;
GRANT MANAGE SCHEDULER TO eyilmaz;
BEGIN
DBMS_SCHEDULER.create_job (
job_name => 'SYNC_EMPLOYEES_JOB',
job_type => 'PLSQL_BLOCK',
job_action => 'BEGIN sync_employees_to_db2; END;',
start_date => SYSTIMESTAMP,
repeat_interval => 'FREQ=MINUTELY; INTERVAL=5',
enabled => TRUE,
comments => 'Job to synchronize EMPLOYEES table across databases every 5 minutes.'
);
END;
/
Script Output
Task completed in 0.396 seconds
Error starting at line : 1 in command -
GRANT CREATE JOB TO eyilmaz
Error report -
ORA-01031: insufficient privileges
01031. 00000 - "insufficient privileges"
*Cause: An attempt was made to perform a database operation without
the necessary privileges.
*Action: Ask your database administrator or designated security
administrator to grant you the necessary privileges
Error starting at line : 2 in command -
GRANT MANAGE SCHEDULER TO eyilmaz
Error report -
ORA-01031: insufficient privileges
01031. 00000 - "insufficient privileges"
*Cause: An attempt was made to perform a database operation without
the necessary privileges.
*Action: Ask your database administrator or designated security
administrator to grant you the necessary privileges
PL/SQL procedure successfully completed.
Line 15 Column 2
Insert
Modified
Unix/Mac: LF