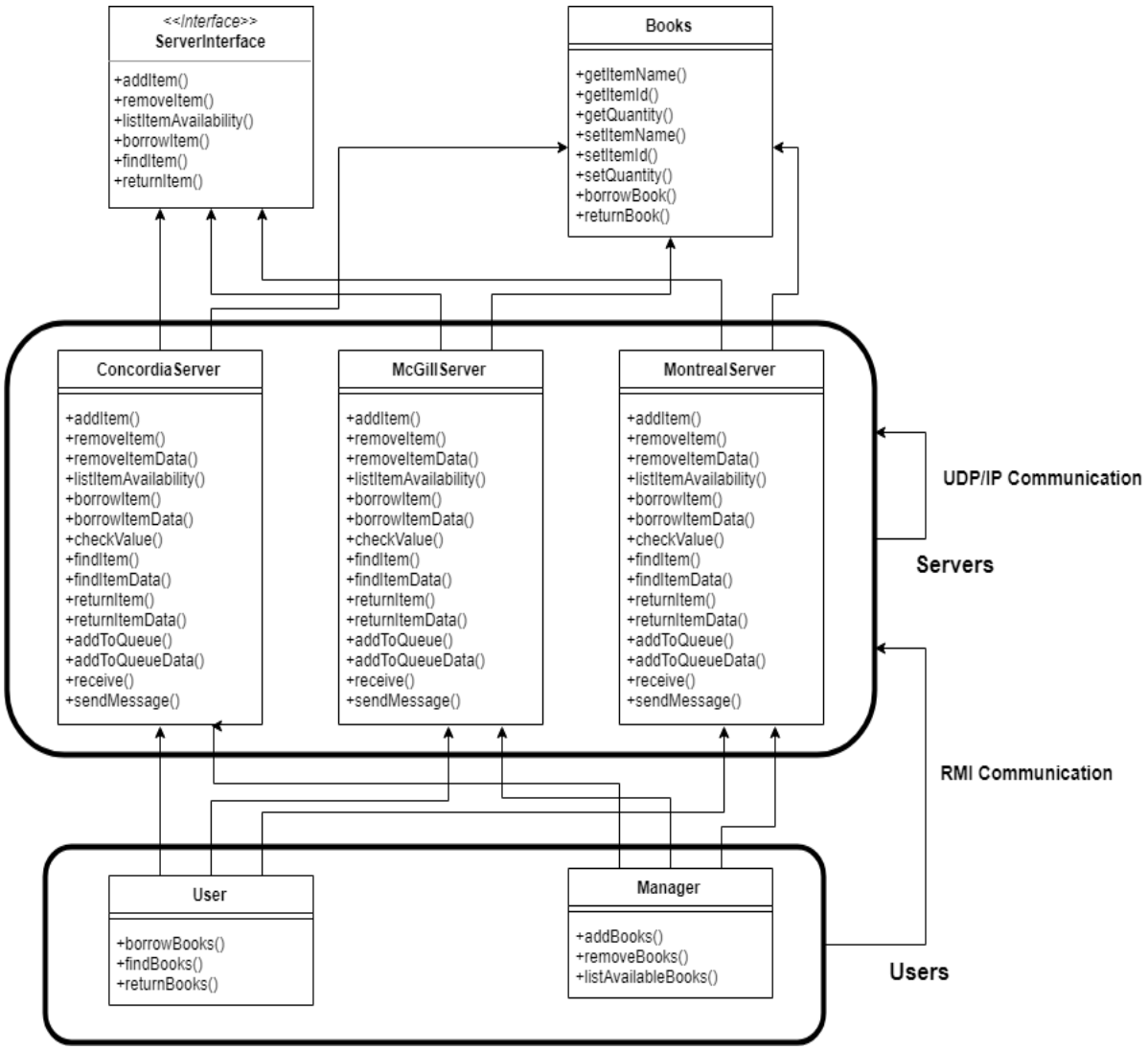
Assignment 1

Techniques:

In this project I have used Java RMI for client-server communication and for server-server communication I have used UDP/IP. Here, I have 3 servers for 3 different libraries which is Concordia, McGill and Montreal which have different users and managers which are differentiated by the prefix.

Here I have used HashMap as a data structure and used to store following things:

```
Map<String,Books> book_shelf = new HashMap<String,Books>();
Map<String,ArrayList> waitlist = new HashMap<String,ArrayList>();
Map<String,ArrayList> borrow = new HashMap<String,ArrayList>();
```



Scenarios:

1) If a person have not borrowed the book but tries to return the book.

```
Enter Book ID You Want to Return:
CON1144
Book Returning Fails
```

2) Add into existing waitlist of other servers users.

```
Enter Book ID:
CON1144

Enter Number of Days:
17
Book is not available to for borrowing.
Item you requested is not available in any library. Want to be in waiting queue?

Enter 1 for yes and 2 for no:
1
Successfully added into new waiting list.

Enter Book ID:
CON1144

Enter Number of Days:
8
Book is not available to for borrowing.
Item you requested is not available in any library. Want to be in waiting queue?

Enter 1 for yes and 2 for no:
1
Successfully added into existing waiting list.

waitlist contains item CON1144
CON1144 [CONU1111, MONU1111]
```

3) When a manager adds book to the library it will automatically give book the first user and reduce the quantity and also removes from the waiting queue.

```
Book is not available to for borrowing.
CON1144 [CONU1111]
Successfully added into new waiting list.
Book is not available to for borrowing.
CON1144 [CONU1111, MCGU1111]
```

```
CON1188 Java 4, CON1144 C 0, CON1122 C++ 1,

 Please select managers's operation. Enter your choice:

 1. Add Book

 2. Remove Book

 3. List Available Books

 4. Exit

 Enter Your Choice:
1

Enter Book ID:
CON1144

Enter Book Name:
C

Enter Quantity:
4
Book C already exist, increased the quantity.


Enter Book ID:
CON1144

Enter Book Name:
C

Enter Quantity:
4
Book C already exist, increased the quantity.

 Please select managers's operation. Enter your choice:

 1. Add Book

 2. Remove Book

 3. List Available Books

 4. Exit

 Enter Your Choice:
3
CON1188 Java 4, CON1144 C 2, CON1122 C++ 1,
```

4) If a person borrows a book but manager removes that book and when user try to return the book it will fail.

```
Enter Book ID:
CON1188

Enter Number of Days:
8
CON1188 is successfully borrowed.

 Please select user's operation. Enter your choice:

 1. Borrow Book

 2. Find Book

 3. Return Book

 4. Exit

 Enter Your Choice:
3

Enter Book ID You Want to Return:
CON1188
Book Returning Fails


Enter Book ID:
CON1188

 1. Completely Remove the Book

 2. Remove Particular Amount of the Book

 Enter Your Choice:
1
Book CON1188 Completely removed from library.
```

```
CON1188 is successfully borrowed.
Book CON1188 Completely removed from library.
Book was not borrowed by a user.
```

5) When the library only have 1 copy the book and a user borrows it and then other user tries to borrow the book he will go into the waitlist when the first user returns the book the other automatically gets the book.

```
Enter Book ID:
CON1122

Enter Number of Days:
8
CON1122 is successfully borrowed.
```

```
Enter Book ID:
CON1122

Enter Number of Days:
17
Book is not available to for borrowing.
Item you requested is not available in any library. Want to be in waiting queue?

Enter 1 for yes and 2 for no:
1
Successfully added into new waiting list.

Book is not available to for borrowing.
CON1122 [MONU1111]
CON1122 C++ is successfully returned.
MONU1111
CON1122 is successfully borrowed.
```

6) If user tries borrows the same book again.

```
Enter Book ID:
CON1188

Enter Number of Days:
7
CON1188 is successfully borrowed.

 Please select user's operation. Enter your choice:

 1. Borrow Book

 2. Find Book

 3. Return Book

 4. Exit

 Enter Your Choice:
1

Enter Book ID:
CON1188

Enter Number of Days:
8
Book is already borrowed by the user.
```

7) If user tries to borrow more than 1 book from other server.

```
Enter Book ID:
CON1188

Enter Number of Days:
8
User can only borrow 1 item from other server.
```

8) When a manager adds the existing book it will increment its quantity.

```
CON1188 Java 3, CON1144 C 0, CON1122 C++ 0,

 Please select managers's operation. Enter your choice:

 1. Add Book

 2. Remove Book

 3. List Available Books

 4. Exit

 Enter Your Choice:
1

Enter Book ID:
CON1144

Enter Book Name:
C

Enter Quantity:
5
Book C already exist, increased the quantity.

Enter Book ID:
CON1144

Enter Book Name:
C

Enter Quantity:
5
Book C already exist, increased the quantity.

 Please select managers's operation. Enter your choice:

 1. Add Book

 2. Remove Book

 3. List Available Books

 4. Exit

 Enter Your Choice:
3
CON1188 Java 3, CON1144 C 5, CON1122 C++ 0,
```

Most difficult/important part:

The most difficult part in this assignment was:

[1] Problem: To auto assign the book to the user whenever books get available.

Solution:

To deal with this problem I made an algorithm:

- Check waitlist is not empty.
- Check waitlist contains item ID.
- Borrow the item and remove from the waitlist until waitlist is empty or book quantity is empty.

[2] Problem: Sending data via UDP/IP.

Solution:

The main problem is when sending data to one server to other server the UDP/IP adds null characters to the strings while encoding with UTF-8. So, the strings don't matches and I don't get the actual output.

To deal with this problem I have printed the size of the string and then I noticed that it's very large. So, I used trim() method to remove the null values from the string.

References:

[1] https://stackoverflow.com/
[2] https://www.draw.io/
[3] https://www.geeksforgeeks.org/
[4] https://www.youtube.com/
[5] https://docs.oracle.com/