Distributed System Design

COMP 6231: Winter 2019

Instructor: R. Jayakumar

Distributed Library Management System (DLMS) using Java RMI

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Overview: The distributed library management system is aims to connect a group of libraries. This system is used by two type of users. Those who manage library are managers and those who uses the library facilities like borrowing books are user. In this system managers can perform few actions like:

1. Add Item
2. Remove Item / Decrease the number of items
3. List of the items

Additional feature in this system for managers is the list of people and their required item which is currently is not available.

On the other hand, Users have some functionality like:

1. Borrow Item
2. Return Item
3. Find Item

Additional feature for users are they can see their borrowed item list.

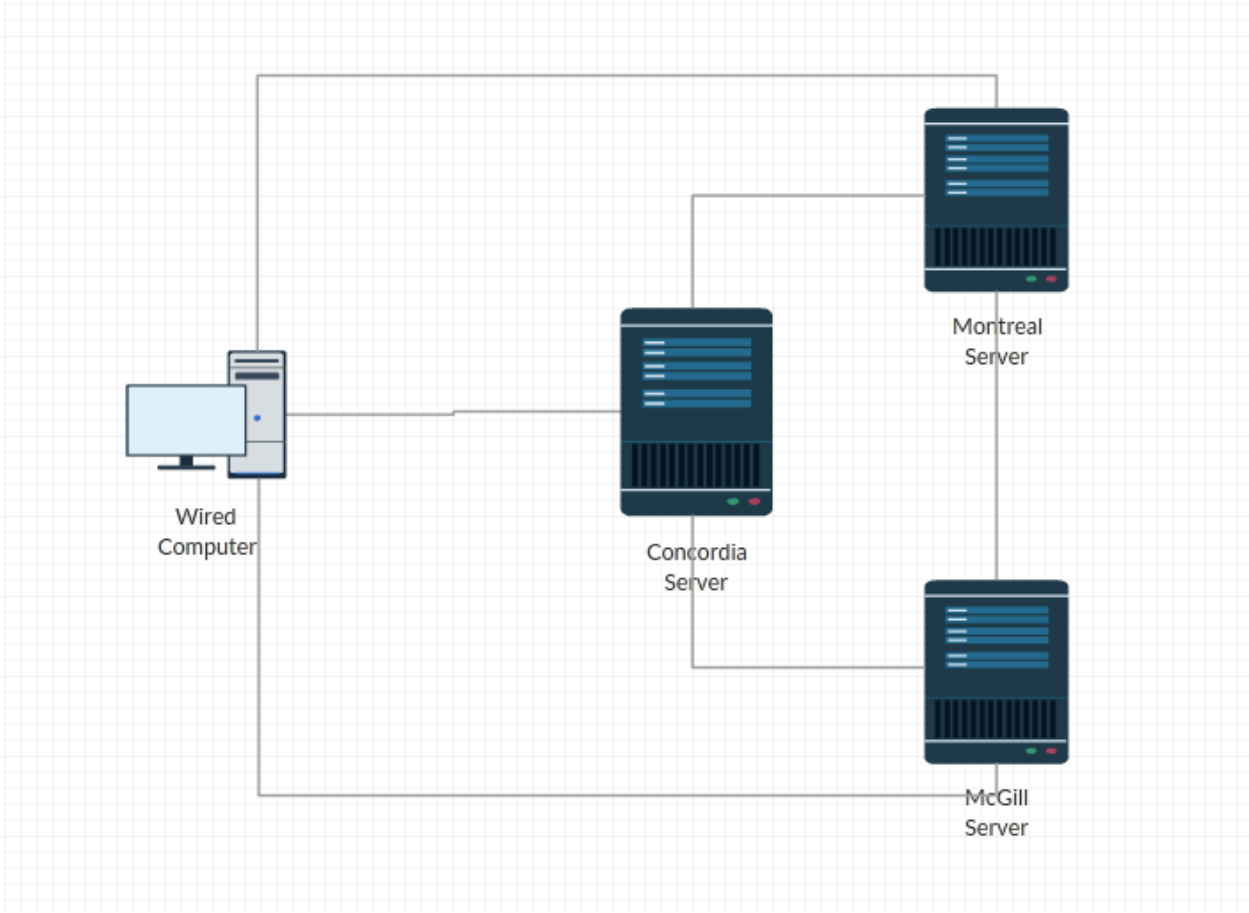
In this project 3 servers are used and the name of the servers are

1. Concordia Server
2. McGill Server
3. Montreal Server

The users of the system are library managers and library users identified by a unique managerID and userID respectively, which is constructed from the acronym of their library and a 4-digit number. Whenever the user performs an operation, the system identify the server that user belongs to by looking at the ID prefix and perform the operation on that server. The user also maintain a log (text file) of the actions they performed on the system and the response from the system when available. There are different managers for the three libraries/servers. They create availability of items in their library along with the quantity of the items. A user can borrow an item offered by any library, if it is still available.

This System is designed to explain the entire functionality of the Java RMI. Java Remote Method Invocation (Java RMI) is a mechanism that allows one Java Virtual Machine (JVM) running object to invoke methods on an object running in another JVM. It facilitates the remote calling of Java object methods and sharing of resources and services.[Google].

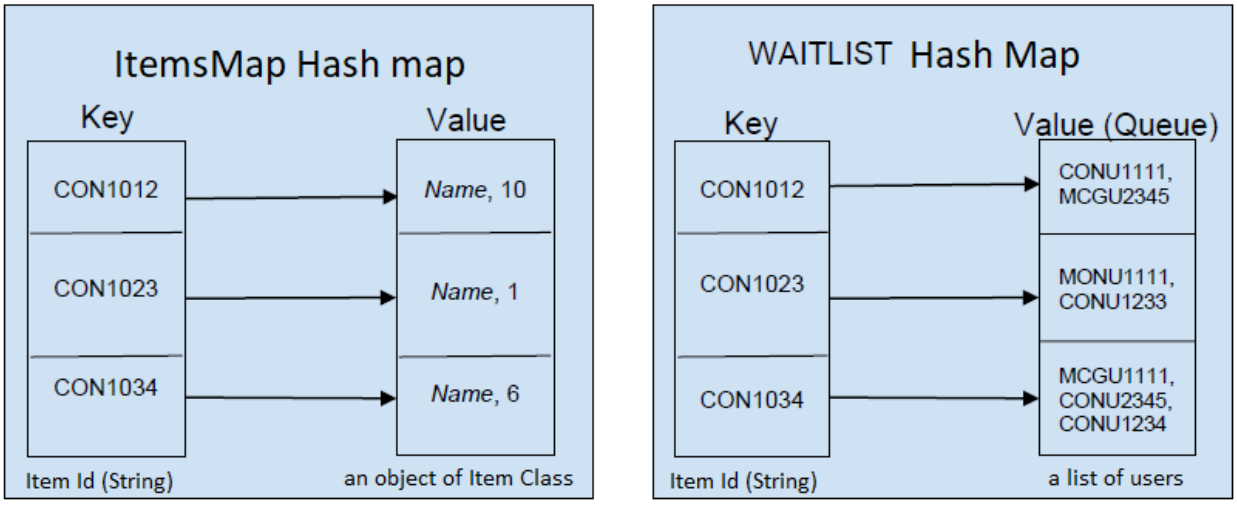
In this assignment, RMI Application and UDP is the main techniques . This application contains 3 servers and 1 client, client where in users and managers are being handled simultaneously.

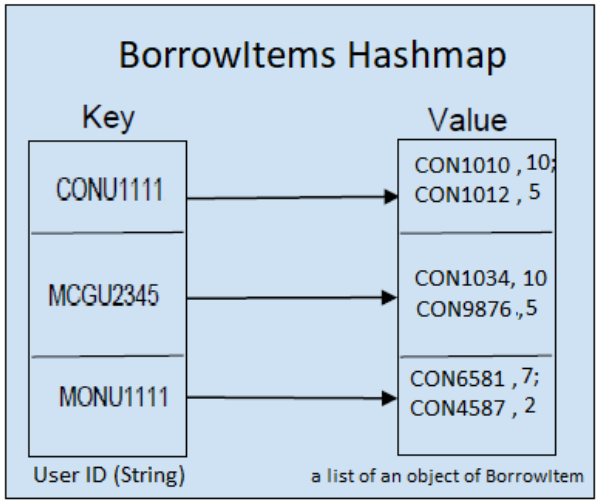


Pic: System Architecture

Client is connected with 3 servers through RMI and 3 server are communicating with each other by UDP connection. Client can decide it's server from the user name . And user and manager operation all are handled from the specific server based on user id or manager id. All the operation in the server side are logged into a log file for each server. And the clients request and response also create a log file for each user .

To store data three different hash maps are used in each server. One hash map is containing item name and quantity with a unique item key which is named itemId here. To store borrowed item list, borrowedItems hash map is used where user id is unique and the list of item with number of days are stored. If the item is not available during borrowing user can wait. To keep this record here waitingList hash map is used.





Pic: Hashmaps

To facilitate the user with the borrow and find item from different server UDP connection is necessary. UDP send and receive method was implemented in each server with multi threading facility. So that concurrent user can borrow and find their item.

Test Scenario:

Sce. Id	Requirement Name	Test Scenario	Test Cases
1	Login	User name	1. Validate with valid user name 2. Validate with invalid username 3. Validate access with username 4. Validate server access with username
2	Manager Facility	Menu Selection	1. Validate menu selection
3	Manager Facility	Add Item	1. Validate Item name 2. Validate Item id with valid id 3. Validate Item id with an invalid id 4. Validate item Quantity 5. Either it will add a new item or will increase the existing id
4	Manager Facility	Remove Item	1. Validate Item Id with valid id 2. Validate item id with invalid id 3. Validate Item Quantity 4. It will decrease item quantity or remove it completely
5	Manager Facility	List Item	1. It will show the items available in the server
6	Manager Felicity	Logout	1. It will logout the user and will ask for username to login
7	User Facility	Borrow Item	1. Validate Item Id with valid item id 2. Validate Item Id with invalid item id 3. If valid the item will be borrowed 4. Validate with an Item id which is not available 5. Validate with item id which is available in different server 6. Validate one user can not borrow multiple item from Different server
8	User Facility	Return Item	1. Validate item id with valid item id. 2. Validate with item id which is available in different server
9	User Facility	Find Item	1. Validate with Item name which is available in one of the server or in any of them
10	User Facility	Logout	1. It will logout the user and will ask for username to login