Distributed System Design

COMP 6231: Winter 2019

Instructor: R. Jayakumar

Distributed Library Management System (DLMS) using CORBA

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By: Md. Hasibul Huq

ID – 40087646

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
4. Exchange Item

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

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

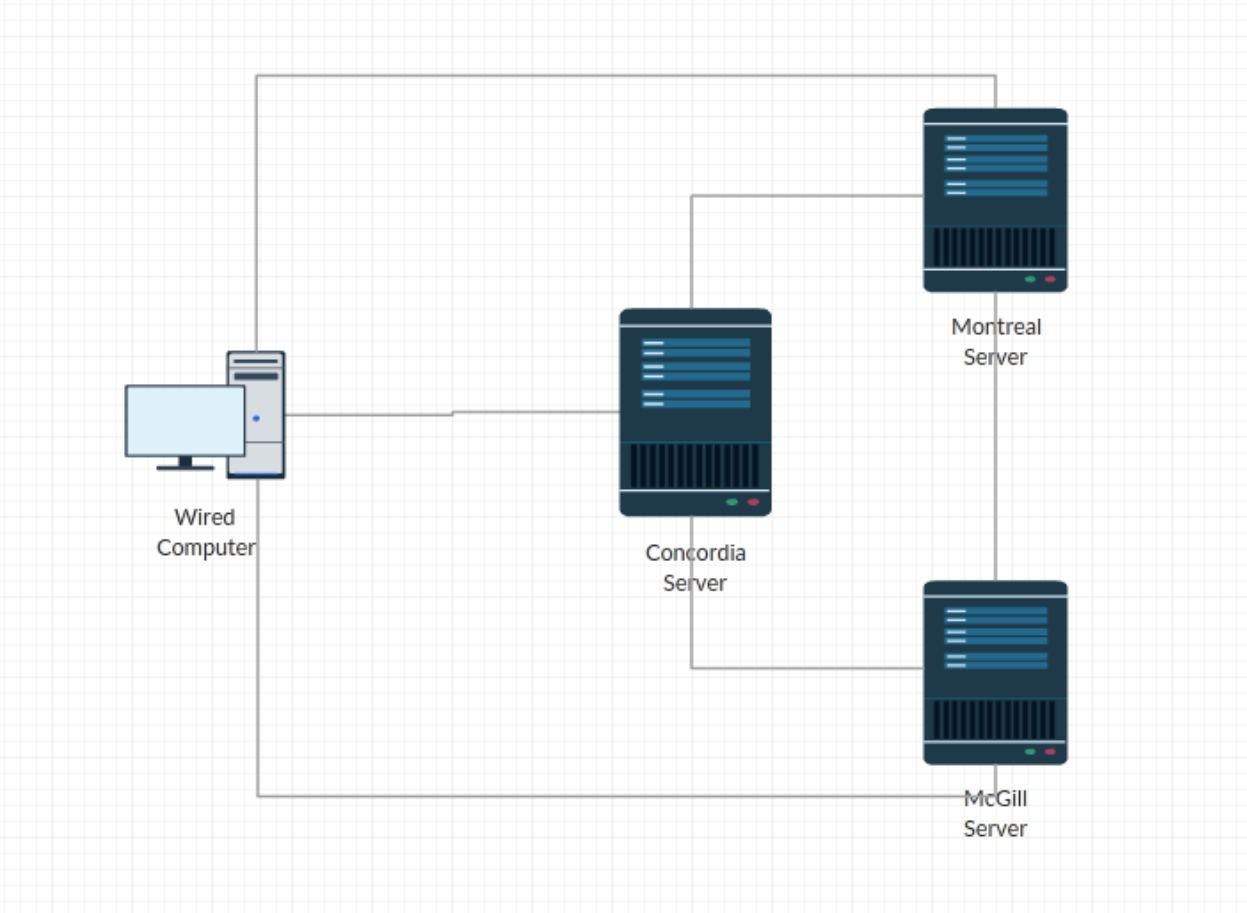
1. Concordia Server
2. McGill Server
3. Montreal Server

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 identifies the server that user belongs to by looking at the ID prefix and perform the operation on that server. The user also maintains 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 CORBA. The Common Object Request Broker Architecture (CORBA) is a standard defined by the Object Management Group (OMG) designed to facilitate the communication of systems that are deployed on diverse platforms. CORBA enables collaboration between systems on different operating systems, programming languages, and computing hardware. CORBA uses an object-oriented model

although the systems that use the CORBA do not have to be object-oriented. CORBA is an example of the distributed object paradigm [Wiki].

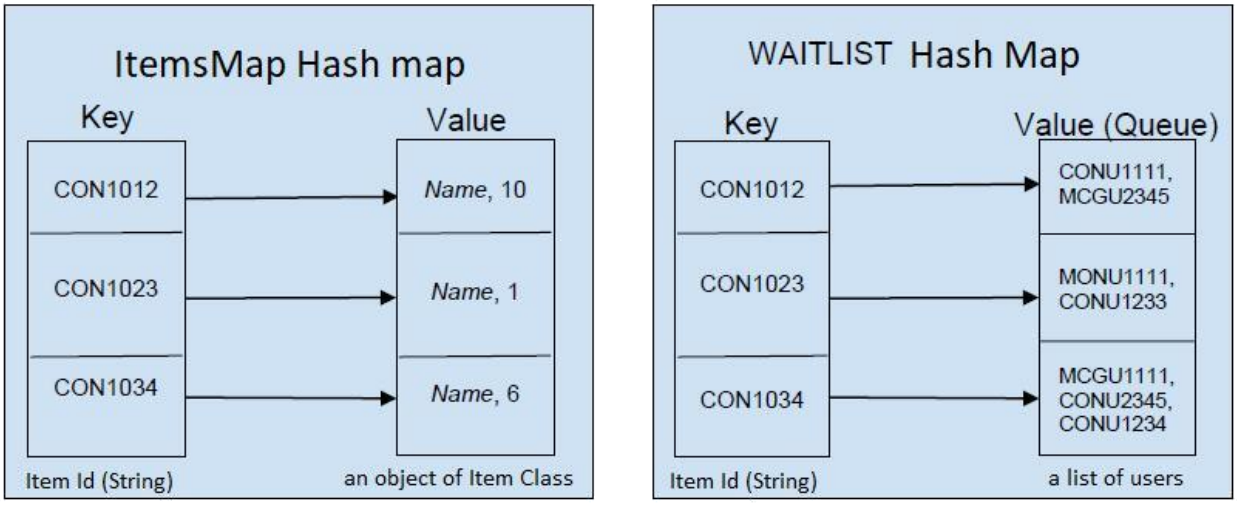
In this assignment, CORBA Application and UDP is the main techniques. This application contains 3 servers and 1 client, client where in users and managers are being handled simultaneously.

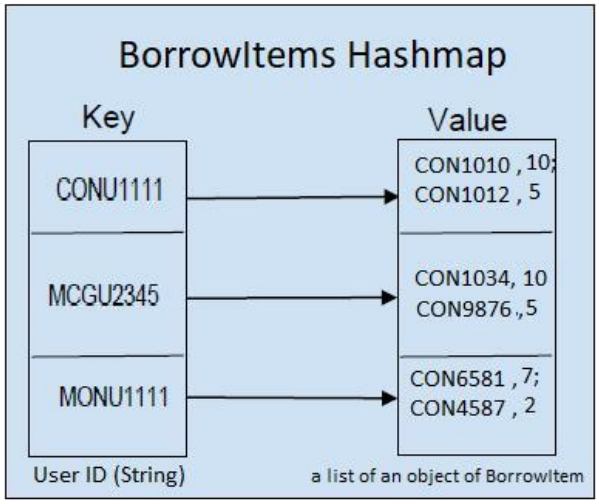


Pic: System Architecture

Client relates to 3 servers through CORBA and 3 servers are communicating with each other by UDP connection. Client can decide its 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 client requests 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 items 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.

Instead of Java RMI interface here CORBA works with the IDL interface and the idl interface is executed by IDLJ .exe files and creates an interface App directory with few files like Java operations Interface , Java Signature Interface Class, for providing auxiliary

functionality an helper file is generated. The Java class called *Holder holds a reference to an object that implements the Hello interface. A stub created for using as a client-side proxy. The Java class *ImplPOA is the skeleton, the server-side proxy, combined with the portable object adapter.

The term CORBA object is used to refer to remote objects. A CORBA object implements an IDL interface, has a remote object reference and its methods can be invoked remotely.

Here most difficult part is replacing java RMI with CORBA. For that, Refactoring needed and need to change the binding methodology of RMI with CORBA. To run the CORBA application ORBD needed. This is why specific environment needed to setup. As the idl interface creates app package. IDLJ installation was needed. It has some complication with the OS and source file folder structure. After configuring IDLJ need to run the IDL interface to generate the IDL app. Then need to replace the client binding code with the CORBA object.

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 servers or in any of them
10	User Facility	Exchange Item	1. Enter a new Item Id and old item id to exchange the book.
11	User Facility	Logout	1. It will logout the user and will ask for username to login