ALGOREP Project

Abstract

Gwenegan Bertho
Kévin Guillet
Mathieu Tammaro
Jose A. Henriquez Roa

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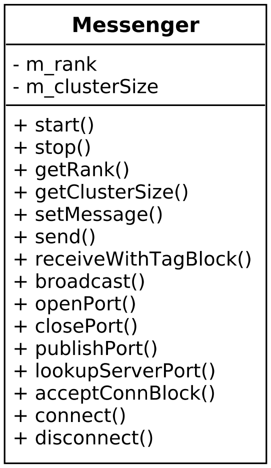
1 Software architecture

This section shall go though all the design choses made throughout the development of the project. First, a description of Messenger class, which fully encapsulates the Open MPI API. Then, an overview of the MessageReceiver virtual class, followed by a description of the 5 classes inheriting from it, and the ReceiverManager class that takes care of managing all instanciations of the derived classes. And finally, a brief description of the Node and Client classes.

1.1 Messenger



The messenger class, located in `src/include/messenger.hh`, is a complete encapsulation of the Open MPI API. All MPI related calls are through the member functions of this class. When it comes to making use of APIs, the design choice encapsulating them is fairly common and easily argumented. And as with any design choice we have done this for the sake of decreasing the complexity of the overall architecture. Thus, we list some of the benefits of this encapsulation;

First, it allowed to safely learn to use the API by localizing any changes made to the program to a single class. Seen as no matter how much the manual of an API is read, it remains very likely during development that the use of a given functionality from the API that was previously used during the early stages might no longer be desired during later stages. For instance during the development of this project a similar scenario was encountered were an ambiguity in the MPI standard led to an incorrect assumption on the behavior of a function; In the 4th version of the Message-Passing Interface Standard in section `11.9.3` detailing the client routines to use when implementing a client/server model with MPI the standard states that:

"*If the port exists, but does not have a pending* MPI_COMM_ACCEPT *, the connection attempt will eventually time out after an implementation-defined time,* ***or*** *succeed when the server calls* MPI_COMM_ACCEPT *.In the case of a time out,* MPI_COMM_CONNECT *raises an error of class* MPI_ERR_PORT *.*"

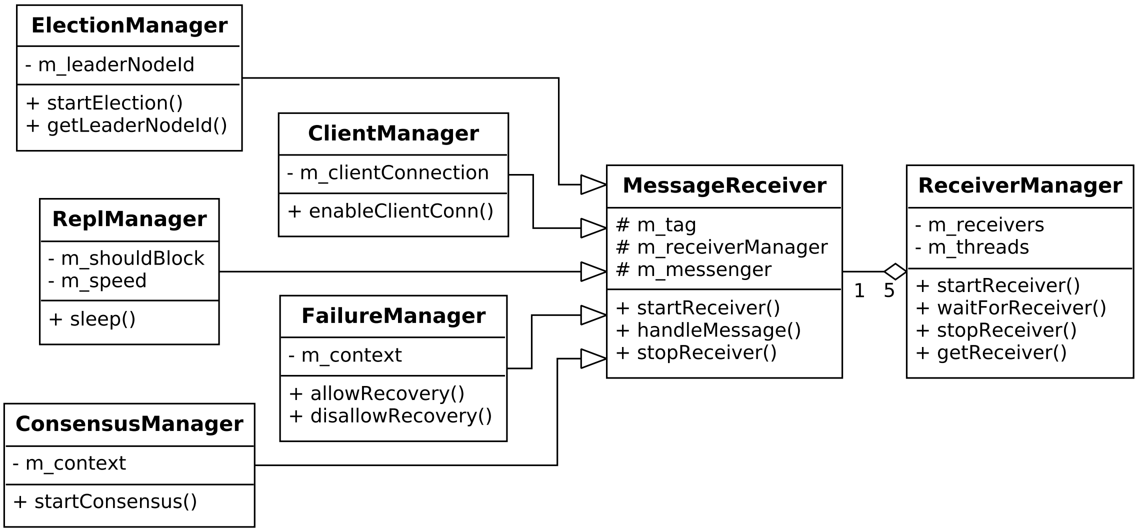
This statement differs in the Open MPI documentation, where the description of the function MPI_Comm_Connect states that:

"*The* MPI_Comm_connect *call must only be called after the* MPI_Comm_accept *call has been made by the MPI job acting as the server.*".

As was found during the actual use of the MPI_Comm_Connect the the highligted 'or' in the quote from the standard turned out to be an exclusive 'or' where the choice to either implement the timeout functionality or allow the 'connect' call to complete upon 'accept' being called on the server was left to the implementation. This meant that there would be an intrisic need to somehow handle race conditions from the client, due to the fact that a failed 'connect' call would eventually timout the client, which would then force the client to exit with an MPI_ERR_PORT error. This was eventually resolved by making the clients synchronize themselves though the use of an external file, located in `etc/turn.txt`. In this scenario this incorrect assumption led to the unforseen implementation of a client synchonization mechanism. However, if for instance an incorect assumption had been made on the use of the MPI_Recv, causing the need for this call to be switched to the non-blocking variant MPI_Irecv. Then having encapsulated the API would then limit the modification required to be made to a single class, instead of every line thoughout the project where the function was used.

Another, use for encapsulating the API is to limit the dependency to said API. For instance, if there ever came a need to switch Open MPI to another MPI implementation then there would only be need to switch out the API calls on a single class instead of the entire project. And the final use for this encapsulation is to simply hide as much logic related to the API as possible from outside classes. And so be able to work on other sections of the project without having to keep in mind the usage of the API and its functionalities. And so, reduce the overall complexity of the design.

1.2 MessageReceiver


ElectionManager
- m_leaderNodeId
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ReplManager
- m_shouldBlock
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MessageReceiver
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