

CS7NS6 Distributed Systems

2017-18

Exercise 2

Group Membership Management for Distributed Systems

In distributed computing terminology, a 'process group' or 'group' is simply a set of cooperating processes distributed over one or more interconnected computers. For example, the members of a group might be replicas of the same service (required for performance, availability or reliability reasons) or partitions of a distributed calculation.

A 'group membership management service' is a distributed service that can be used by the members (and other processes) to manage the membership of groups, for example, providing services for:

- ✓ Forming, joining, and leaving groups
- ✓ Monitoring group members and reporting member failures to the remaining members
 - A failed process is usually deemed to have left a group
- ✓ Returning the current group membership when required
- ✓ Possibly providing a ranking of members
 - E.g., based on age

It is usually the case that a failed process, or one that becomes disconnected from the other members of its group(s), is deemed to have left the group(s).

The exercise is simply to design, implement and demonstrate a group membership management service that provides the (remaining) members of a group with a consistent view of its membership at any time and that tolerates the full range of failures that commonly arise in distributed systems, e.g., node or process failure, loss messages, and/or network partitions etc, etc.

Note that it may be difficult to ensure that all nodes have the same view of the membership of a group at a particular point in time. Therefore, as a minimum, it is required that all members 'see' the same sequence of membership changes over time. Specifically, a list of the current members of a group is called the 'group view'. Each group view will differ from the previous group view by the addition or deletion of exactly *one* member and the same sequence of group views should be available to each process over time. Hence, when a process sends a message, it is sent in the context of the sender's current group view and the receiver can assess whether the view has changed on reception and act accordingly.

You may use any programming language and/or development technology that is agreed by all members of the group but network communication should be based on use of internet protocols (IP/UDP/TCP/etc) as you see fit. In demonstrating your solution you will be required to demonstrate its operation in a variety of failure scenarios, so you may wish to build a deployment framework that allows any such scenarios to be tested and eventually demonstrated.

You will be required to present and demonstrate your solution during the week of the 26th of March 2018 at a time to be advised, and to submit individual report on your group's solution and your own contribution to that solution by 5.00pm on Thursday the 29th of March 2018.

Plagiarism will not be tolerated.