

11/11/2024

Mandatory Activity 4

Markus Sværke Staael - msvs@itu.dk

Patrick Shen - pash@itu.dk

Nicky Chengde Ye - niye@itu.dk

Git repository:

https://github.com/BDIS2024/Distributed_Systems/tree/d15709b6e25973da9d6027e11ff1c75ff4915a63/Assignment_4

11/11/2024

This implementation uses a fixed set of 3 peer nodes that communicate through gRPC. This way we can simply demonstrate a peer to peer system. Because gRPC is being used the architecture of each node consists of a server.go and a client.go file - together they form a node in the system.

The server acts as the contact point in which the other nodes can communicate with. It is capable of and handles setting up sockets on 3 fixed ports (5050, 5051, 5052). When a server receives a message through that port it redirects the message to the paired client, where the client does all the logic of the implemented Ricart and Agrawala algorithm.

The demonstration does not offer intractability and is a poor showing that a node may request access to the Critical Section at any time. However we have laid out the foundations for a node to request a Critical Section again when done using it. Furthermore the demonstration does show that multiple nodes can request at the same time and is therefore not constrained that way.

The Critical Section is emulated by a print statement in the local terminal of the client.

This is why the implementation satisfies system requirement 1.

This implementation has not implemented a way to restrict two nodes from "Accessing" the Critical Section as it is emulated by a print statement. The used Ricart and Agrawala algorithm logic makes sure that no two nodes access the Critical Section at the same time.

This is why the implementation satisfies system requirement 2.

A feature of the Ricart and Agrawala algorithm is that when one node is done using the Critical Section it informs the other nodes that have requested the Critical Section that they may now use it. Considering the fact that who gets access to the Critical Section is determined by time, means the nodes take on a queue-like structure and all eventually gain access to the Critical Section.

This is why the implementation satisfies system requirement 3.

11/11/2024

Server side of the three nodes

```
test:5050
Setting up listener.
Serving port
Server - Recived message: message:"Connect"
Server - Formed a pair with:&{0x140000d0000} at Lamport time: 1
Server - Recived message: name:"5051" message:"Request" timestamp:1
Sucessfully sent message: name:"5051" message:"Request" timestamp:1
Server - Recived message: name:"5052" message:"Request" timestamp:1
Sucessfully sent message: name:"5052" message:"Request" timestamp:1
Server - Recived message: name:"5052" message:"Reply" timestamp:10
Sucessfully sent message: name:"5052" message:"Reply" timestamp:10
Server - Recived message: name:"5051" message:"Reply" timestamp:11
Sucessfully sent message: name:"5051" message:"Reply" timestamp:11
□
```

```
test:5051
Setting up listener.
Serving port
Server - Recived message: name:"5050" message:"Request" timestamp:1
Server - Recived message without pair at Lamport time: 2 - Storing message
for later...
Server - Recived message: message:"Connect"
Server - Formed a pair with:&{0x140000c8000} at Lamport time: 3
Server - Recived message: name:"5050" message:"Reply" timestamp:3
Sucessfully sent message: name:"5050" message:"Reply" timestamp:3
Server - Recived message: name:"5052" message:"Request" timestamp:1
Sucessfully sent message: name:"5052" message:"Request" timestamp:1
Server - Recived message: name:"5052" message:"Reply" timestamp:9
Sucessfully sent message: name:"5052" message:"Reply" timestamp:9
Server - Recived message: name:"5050" message:"Reply" timestamp:14
Sucessfully sent message: name:"5050" message:"Reply" timestamp:14
□
```

```
test:5052
Setting up listener.
Serving port
Server - Recived message: name:"5050" message:"Request" timestamp:1
Server - Recived message without pair at Lamport time: 2 - Storing message for later...
Server - Recived message: name:"5051" message:"Request" timestamp:1
Server - Recived message without pair at Lamport time: 3 - Storing message for later...
Server - Recived message: message:"Connect"
Server - Formed a pair with:&{0x140000d03c0} at Lamport time: 4
Server - Recived message: name:"5051" message:"Reply" timestamp:6
Sucessfully sent message: name:"5051" message:"Reply" timestamp:6
Server - Recived message: name:"5050" message:"Reply" timestamp:5
Sucessfully sent message: name:"5050" message:"Reply" timestamp:5
Server - Recived message: name:"5051" message:"Reply" timestamp:12
Sucessfully sent message: name:"5051" message:"Reply" timestamp:12
Server - Recived message: name:"5050" message:"Reply" timestamp:13
Sucessfully sent message: name:"5050" message:"Reply" timestamp:13
□
```

11/11/2024

Client side of the three nodes

```
test:5050
5050 sending request at 1
I recived message: name:"5051" message:"Request" timestamp:1
I sent message: Name:5050 message:Reply Timestamp: 3
I recived message: name:"5052" message:"Request" timestamp:1
I sent message: Name:5050 message:Reply Timestamp: 5
I recived message: name:"5052" message:"Reply" timestamp:10
I recived message: name:"5051" message:"Reply" timestamp:11
5050 ACCESSED THE CRITICAL SECTION AT LAMPORT TIMESTAMP: 12
Replying to stored replies (2)
I sent message: Name:5050 message:Reply Timestamp: 13
I sent message: Name:5050 message:Reply Timestamp: 14
□
```

```
test:5051
5051 sending request at 1
I recived message: name:"5050" message:"Reply" timestamp:3
I recived message: name:"5052" message:"Request" timestamp:1
I sent message: Name:5051 message:Reply Timestamp: 6
I recived message: name:"5052" message:"Reply" timestamp:9
5051 ACCESSED THE CRITICAL SECTION AT LAMPORT TIMESTAMP: 10
Replying to stored replies (2)
I sent message: Name:5051 message:Reply Timestamp: 11
I sent message: Name:5051 message:Reply Timestamp: 12
I recived message: name:"5050" message:"Reply" timestamp:14
□
```

```
test:5052
5052 sending request at 1
I recived message: name:"5051" message:"Reply" timestamp:6
I recived message: name:"5050" message:"Reply" timestamp:5
5052 ACCESSED THE CRITICAL SECTION AT LAMPORT TIMESTAMP: 8
Replying to stored replies (2)
I sent message: Name:5052 message:Reply Timestamp: 9
I sent message: Name:5052 message:Reply Timestamp: 10
I recived message: name:"5051" message:"Reply" timestamp:12
I recived message: name:"5050" message:"Reply" timestamp:13
□
```

Appendix::

```
2024/11/11 23:41:11 Server: :5050 - Received message: message:"Connect"
2024/11/11 23:41:11 Server :5050 - Formed a pair with:&{0x140000d0000} at Lamport
time: 1
2024/11/11 23:41:11 5050 sending request at 1
```

11/11/2024

```
2024/11/11 23:41:11 Server: :5052 - Received message: name:"5050" message:"Request"
timestamp:1
2024/11/11 23:41:11 Server :5052 - Received message without pair at Lamport time: 2
- Storing message for later...
2024/11/11 23:41:11 Server: :5051 - Received message: name:"5050" message:"Request"
timestamp:1
2024/11/11 23:41:11 Server :5051 - Received message without pair at Lamport time: 2
- Storing message for later...
2024/11/11 23:41:11 Server: :5051 - Received message: message:"Connect"
2024/11/11 23:41:11 Server :5051 - Formed a pair with:&{0x140000c8000} at Lamport
time: 3
2024/11/11 23:41:11 5051 sending request at 1
2024/11/11 23:41:11 Server: :5052 - Received message: name:"5051" message:"Request"
timestamp:1
2024/11/11 23:41:11 Server :5052 - Received message without pair at Lamport time: 3
- Storing message for later...
2024/11/11 23:41:11 Server: :5050 - Received message: name:"5051" message:"Request"
timestamp:1
2024/11/11 23:41:11 5050 received message: name:"5051" message:"Request"
timestamp:1
2024/11/11 23:41:11 Server: :5051 - Received message: name:"5050" message:"Reply"
timestamp:3
2024/11/11 23:41:11 5051 received message: name:"5050" message:"Reply" timestamp:3
2024/11/11 23:41:12 Server: :5052 - Received message: message:"Connect"
2024/11/11 23:41:12 Server :5052 - Formed a pair with:&{0x140000d03c0} at Lamport
time: 4
2024/11/11 23:41:12 5052 sending request at 1
2024/11/11 23:41:12 Server: :5051 - Received message: name:"5052" message:"Request"
timestamp:1
2024/11/11 23:41:12 Server: :5050 - Received message: name:"5052" message:"Request"
timestamp:1
2024/11/11 23:41:12 5051 received message: name:"5052" message:"Request"
timestamp:1
2024/11/11 23:41:12 5050 received message: name:"5052" message:"Request"
timestamp:1
2024/11/11 23:41:12 Server: :5052 - Received message: name:"5051" message:"Reply"
timestamp:6
2024/11/11 23:41:12 Server: :5052 - Received message: name:"5050" message:"Reply"
timestamp:5
2024/11/11 23:41:12 5052 received message: name:"5051" message:"Reply" timestamp:6
2024/11/11 23:41:12 5052 received message: name:"5050" message:"Reply" timestamp:5
2024/11/11 23:41:12 5052 ACCESSED THE CRITICAL SECTION 8
2024/11/11 23:41:12 5052 Replying to stored replies (2) at 8
2024/11/11 23:41:12 Server: :5051 - Received message: name:"5052" message:"Reply"
timestamp:9
```

11/11/2024

```
2024/11/11 23:41:12 Server: :5050 - Received message: name:"5052" message:"Reply"
timestamp:10
2024/11/11 23:41:12 5051 received message: name:"5052" message:"Reply" timestamp:9
2024/11/11 23:41:12 5050 received message: name:"5052" message:"Reply" timestamp:10
2024/11/11 23:41:12 5051 ACCESSED THE CRITICAL SECTION 10
2024/11/11 23:41:12 5051 Replying to stored replies (2) at 10
2024/11/11 23:41:12 Server: :5050 - Received message: name:"5051" message:"Reply"
timestamp:11
2024/11/11 23:41:12 Server: :5052 - Received message: name:"5051" message:"Reply"
timestamp:12
2024/11/11 23:41:12 5050 received message: name:"5051" message:"Reply" timestamp:11
2024/11/11 23:41:12 5050 ACCESSED THE CRITICAL SECTION 12
2024/11/11 23:41:12 5050 Replying to stored replies (2) at 12
2024/11/11 23:41:12 5052 received message: name:"5051" message:"Reply" timestamp:12
2024/11/11 23:41:12 Server: :5052 - Received message: name:"5050" message:"Reply"
timestamp:13
2024/11/11 23:41:12 Error received unexpected message: name:"5051" message:"Reply"
timestamp:12
2024/11/11 23:41:12 Server: :5051 - Received message: name:"5050" message:"Reply"
timestamp:14
2024/11/11 23:41:12 5052 received message: name:"5050" message:"Reply" timestamp:13
2024/11/11 23:41:12 Error received unexpected message: name:"5050" message:"Reply"
timestamp:13
2024/11/11 23:41:12 5051 received message: name:"5050" message:"Reply" timestamp:14
2024/11/11 23:41:12 Error received unexpected message: name:"5050" message:"Reply"
timestamp:14
```