Consensus

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Introduction

Consensus is a proof of concept of the Ricart–Agrawala Algorithm. The program is writen in Golang and uses gRPC to pass messages between the clients. The program is ran by first creating a .env file, with a set of ports to be used, and then running the main.go file multiple times in different terminals. Each terminal is running a peer which will begin to ask the other peers for permission to access the critical section.

Various improments can be made, including the ability to run the peers on different ip's and to keep the gRPC connections open for longer periods. It was decided to keep the proof of concept simple, hence the dicision to postpone these improments.

Algorithm discussion

We have chosen to use the Ricart-Agrawala algorithm due to the flexibility and the ability to be responsive. We also debated wether to use chorded structured Peer-To-Peer network instead, but the flexibility of the Ricart-Agrawala algorithm was intriguing, as it could be used in a wide variety of real-world scenarios.

Altough in our implementation we have decided that every peer does not hold a queue of other peers to accept. Instead a peer accepts or denies access where the peer whom asked for permission waits a little while before asking again. We made the decision because it makes it a little easier to see what is going on in the logs. But still ansure that only one peer gets access and that they all get access eventually.

Peers and the critical section

Every peer wants to access to a critical section. In this proof of concept the critical section is the ability to write special message to std out. In a real scenario the critical section could be network share or a form of SQL database.

Only one peer is accessing the critical section at any given time

When a peer wants to access the critical section it requests access by the other peers in the network, and only gets access if all other peers grants access to the peer. If the peer asking for permission and the peer responding both is at the same lamport time, their process id's are used to decide who gets access. A higher process id takes priority in this case. The process id's is given to the peer by the OS when the peer is starting up.

Every peer gets access to the critical section

As every request from peers in the network gets queued in each system if and only if there is already being accessed to the critical section. Therefore if the queue is empty the first peer to request access to the critical section, gets access after being granted access by the other peers.

Link to Github repository

https://github.com/ITU-DISYS2024-CENTRALIZEDSYSTEMS/Consensus

Appendix

Logs - Peer 1

```
2024/11/09 17:16:48 Access denied, retrying...
2024/11/09 17:16:48 Accessing critical resource.
2024/11/09 17:16:53 Releasing critical resource.
2024/11/09 17:16:53 RequestAccess: From Peer(ID: 19418, TS: 0) -> Granted: false
2024/11/09 17:16:53 RequestAccess: From Peer(ID: 19590, TS: 0) -> Granted: false
2024/11/09 17:16:54 RequestAccess: From Peer(ID: 19590, TS: 1) -> Granted: true
2024/11/09 17:16:54 RequestAccess: From Peer(ID: 19418, TS: 1) -> Granted: true
2024/11/09 17:16:59 Access denied, retrying...
2024/11/09 17:16:59 RequestAccess: From Peer(ID: 19418, TS: 2) -> Granted: true
2024/11/09 17:17:04 Access denied, retrying...
2024/11/09 17:17:04 RequestAccess: From Peer(ID: 19590, TS: 1) -> Granted: false
2024/11/09 17:17:05 Accessing critical resource.
2024/11/09 17:17:10 Releasing critical resource.
2024/11/09 17:17:10 RequestAccess: From Peer(ID: 19590, TS: 2) -> Granted: false
2024/11/09 17:17:10 RequestAccess: From Peer(ID: 19418, TS: 2) -> Granted: false
2024/11/09 17:17:10 RequestAccess: From Peer(ID: 19590, TS: 3) -> Granted: true
2024/11/09 17:17:10 RequestAccess: From Peer(ID: 19418, TS: 3) -> Granted: true
2024/11/09 17:17:15 Access denied, retrying...
2024/11/09 17:17:16 RequestAccess: From Peer(ID: 19418, TS: 4) -> Granted: true
2024/11/09 17:17:21 Access denied, retrying...
2024/11/09 17:17:21 RequestAccess: From Peer(ID: 19590, TS: 3) -> Granted: false
2024/11/09 17:17:21 Accessing critical resource.
2024/11/09 17:17:26 Releasing critical resource.
2024/11/09 17:17:26 RequestAccess: From Peer(ID: 19590, TS: 4) -> Granted: false
2024/11/09 17:17:26 RequestAccess: From Peer(ID: 19418, TS: 4) -> Granted: false
2024/11/09 17:17:26 RequestAccess: From Peer(ID: 19418, TS: 5) -> Granted: true
2024/11/09 17:17:27 RequestAccess: From Peer(ID: 19590, TS: 5) -> Granted: true
2024/11/09 17:17:27 RequestAccess: From Peer(ID: 19590, TS: 6) -> Granted: true
2024/11/09 17:17:27 RequestAccess: From Peer(ID: 19418, TS: 6) -> Granted: true
2024/11/09 17:17:32 Access denied, retrying...
2024/11/09 17:17:32 RequestAccess: From Peer(ID: 19418, TS: 7) -> Granted: true
2024/11/09 17:17:37 Access denied, retrying...
2024/11/09 17:17:37 RequestAccess: From Peer(ID: 19590, TS: 6) -> Granted: false
2024/11/09 17:17:38 Access denied, retrying...
2024/11/09 17:17:38 RequestAccess: From Peer(ID: 19590, TS: 7) -> Granted: false
2024/11/09 17:17:38 RequestAccess: From Peer(ID: 19590, TS: 8) -> Granted: true
```

Logs - Peer 2

```
2024/11/09 17:16:48 RequestAccess: From Peer(ID: 19233, TS: 0) -> Granted: false
2024/11/09 17:16:48 RequestAccess: From Peer(ID: 19233, TS: 1) -> Granted: true
2024/11/09 17:16:53 Access denied, retrying...
2024/11/09 17:16:54 RequestAccess: From Peer(ID: 19590, TS: 1) -> Granted: true
2024/11/09 17:16:59 Access denied, retrying...
2024/11/09 17:16:59 RequestAccess: From Peer(ID: 19233, TS: 1) -> Granted: false
2024/11/09 17:16:59 Accessing critical resource.
2024/11/09 17:17:04 Releasing critical resource.
2024/11/09 17:17:04 RequestAccess: From Peer(ID: 19233, TS: 2) -> Granted: false
2024/11/09 17:17:05 RequestAccess: From Peer(ID: 19233, TS: 3) -> Granted: true
2024/11/09 17:17:10 Access denied, retrying...
2024/11/09 17:17:10 RequestAccess: From Peer(ID: 19590, TS: 3) -> Granted: true
2024/11/09 17:17:15 Access denied, retrying...
2024/11/09 17:17:15 RequestAccess: From Peer(ID: 19233, TS: 3) -> Granted: false
2024/11/09 17:17:16 Accessing critical resource.
2024/11/09 17:17:21 Releasing critical resource.
2024/11/09 17:17:21 RequestAccess: From Peer(ID: 19233, TS: 4) -> Granted: false
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2024/11/09 17:17:21 RequestAccess: From Peer(ID: 19233, TS: 5) -> Granted: true
2024/11/09 17:17:26 Access denied, retrying...
2024/11/09 17:17:26 Access denied, retrying...
2024/11/09 17:17:27 RequestAccess: From Peer(ID: 19590, TS: 5) -> Granted: false
2024/11/09 17:17:27 RequestAccess: From Peer(ID: 19590, TS: 6) -> Granted: true
2024/11/09 17:17:32 Access denied, retrying...
2024/11/09 17:17:32 RequestAccess: From Peer(ID: 19233, TS: 5) -> Granted: false
2024/11/09 17:17:32 Accessing critical resource.
2024/11/09 17:17:37 Releasing critical resource.
2024/11/09 17:17:37 RequestAccess: From Peer(ID: 19233, TS: 6) -> Granted: false
2024/11/09 17:17:38 RequestAccess: From Peer(ID: 19233, TS: 7) -> Granted: false
2024/11/09 17:17:38 RequestAccess: From Peer(ID: 19590, TS: 8) -> Granted: true
2024/11/09 17:17:38 RequestAccess: From Peer(ID: 19233, TS: 8) -> Granted: true
```

Logs - Peer 2

```
2024/11/09 17:16:48 RequestAccess: From Peer(ID: 19233, TS: 1) -> Granted: true
2024/11/09 17:16:53 Access denied, retrying...
2024/11/09 17:16:54 Accessing critical resource.
2024/11/09 17:16:59 Releasing critical resource.
2024/11/09 17:16:59 RequestAccess: From Peer(ID: 19418, TS: 1) -> Granted: false
2024/11/09 17:16:59 RequestAccess: From Peer(ID: 19418, TS: 2) -> Granted: true
2024/11/09 17:17:04 Access denied, retrying...
2024/11/09 17:17:05 RequestAccess: From Peer(ID: 19233, TS: 3) -> Granted: true
2024/11/09 17:17:10 Access denied, retrying...
2024/11/09 17:17:10 Accessing critical resource.
2024/11/09 17:17:15 Releasing critical resource.
2024/11/09 17:17:15 RequestAccess: From Peer(ID: 19418, TS: 3) -> Granted: false
2024/11/09 17:17:16 RequestAccess: From Peer(ID: 19418, TS: 4) -> Granted: true
2024/11/09 17:17:21 Access denied, retrying...
2024/11/09 17:17:21 RequestAccess: From Peer(ID: 19233, TS: 5) -> Granted: true
2024/11/09 17:17:26 Access denied, retrying...
2024/11/09 17:17:26 RequestAccess: From Peer(ID: 19418, TS: 5) -> Granted: false
2024/11/09 17:17:27 Access denied, retrying...
2024/11/09 17:17:27 Accessing critical resource.
2024/11/09 17:17:32 Releasing critical resource.
2024/11/09 17:17:32 RequestAccess: From Peer(ID: 19418, TS: 6) -> Granted: false
2024/11/09 17:17:32 RequestAccess: From Peer(ID: 19418, TS: 7) -> Granted: true
2024/11/09 17:17:37 Access denied, retrying...
2024/11/09 17:17:38 Access denied, retrying...
2024/11/09 17:17:38 Accessing critical resource.
```