assignment 4 report

Overview:

We build our p2p system(3 nodes) with distributed mutual exclusion using GRPC. We supply a file with IP addresses/ports of the nodes, which is config.json. We implemented token ring algorithm to guarantee safety, which will be discussed later.

System Requirements:

R1: Implement a system with a set of peer nodes, and a Critical Section, that represents a sensitive system operation.

Answer: We use grpc to build the system, where every node use Unary RPC to communicate with each other, and we implemented a token ring to pass in the background, which also use grpc's Unary RPC to send and receive. The critical section is to print a task from node's own job queue, and is predefined in the config.json file, so after starting the program will read from file to get a list of jobs, and wait for user pressing the enter button to operate the task.

R2: Safety: Only one node at the same time is allowed to enter the Critical Section

Answer: Yes, we use a token ring, and corresponding to each node has their own has_token flag, so certainly this structure prevents two nodes enter critical section at the same time.

R2: Liveliness: Every node that requests access to the Critical Section, will get access to the Critical Section (at some point in time)

Answer: Yes, we use go routine to run the token-passing in background, so it will work automatically without being infected by a stocking job in some nodes, and every node will wait at most (n-1)*token_time to get into critical section.

Git repo:

https://github.com/stupidodie/DistributedSystem/tree/main/assignment4

System logs:

Notice: To understand the log, please see the example:
example1:
2022/11/14 14:47:20 The task is TASK A: node 8000 entered critical section Order is 3
This means node 8000 is doing his job, the current token-timestamp(always+1 after pass to the next node) is 3.

2022/11/14 14:47:21 Send token to the next node port is 8001 and receive the reply Receive token 3 from 8000
This means node 8000 send the token and receive response from 8001 the reply message is "*Receive token 3 from 8000*". The token-timestamp increase by 8001 afterwards.

nodes 8000: 8000.txt

2022/11/14 14:47:09 Log file:8000.txtrecord started.
2022/11/14 14:47:09 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:12 Send token to the next node port is 8001 and receive the reply Receive token 0 from 8000

2022/11/14 14:47:18 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:20 The task is TASK A: node 8000 entered critical section Order is 3
2022/11/14 14:47:21 Send token to the next node port is 8001 and receive the reply Receive token 3 from 8000

2022/11/14 14:47:22 current node does not hold token, so just waiting
2022/11/14 14:47:23 current node does not hold token, so just waiting
2022/11/14 14:47:27 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:30 Send token to the next node port is 8001 and receive the reply Receive token 6 from 8000

2022/11/14 14:47:36 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:39 Send token to the next node port is 8001 and receive the reply Receive token 9 from 8000

2022/11/14 14:47:45 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:48 Send token to the next node port is 8001 and receive the reply Receive token 12 from 8000

2022/11/14 14:47:49 current node does not hold token, so just waiting
2022/11/14 14:47:54 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:56 The task is TASK B: node 8000 entered critical section Order is 15
2022/11/14 14:47:57 The task is TASK C: node 8000 entered critical section Order is 15
2022/11/14 14:47:57 Send token to the next node port is 8001 and receive the reply Receive token 15 from 8000

2022/11/14 14:48:03 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:48:04 current is no task for this node, just handout the token
2022/11/14 14:48:06 Send token to the next node port is 8001 and receive the reply Receive token 18 from 8000

nodes 8001: 8001.txt

22022/11/14 14:47:04 Log file:8001.txtrecord started.
2022/11/14 14:47:12 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:15 Send token to the next node port is 8002 and receive the reply Receive token 1 from 8001

2022/11/14 14:47:21 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:24 Send token to the next node port is 8002 and receive the reply Receive token 4 from 8001

2022/11/14 14:47:26 current node does not hold token, so just waiting
2022/11/14 14:47:30 current node does not hold token, so just waiting
2022/11/14 14:47:30 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:32 The task is TASK D: node 8001 entered critical section Order is 7
2022/11/14 14:47:32 The task is TASK E: node 8001 entered critical section Order is 7
2022/11/14 14:47:33 Send token to the next node port is 8002 and receive the reply Receive token 7 from 8001

2022/11/14 14:47:39 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:41 The task is TASK F: node 8001 entered critical section Order is 10
2022/11/14 14:47:41 current is no task for this node, just handout the token
2022/11/14 14:47:42 current is no task for this node, just handout the token
2022/11/14 14:47:42 Send token to the next node port is 8002 and receive the reply Receive token 10 from 8001

2022/11/14 14:47:48 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:50 current is no task for this node, just handout the token
2022/11/14 14:47:51 current is no task for this node, just handout the token
2022/11/14 14:47:51 Send token to the next node port is 8002 and receive the reply Receive token 13 from 8001

2022/11/14 14:47:57 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:48:00 Send token to the next node port is 8002 and receive the reply Receive token 16 from 8001

2022/11/14 14:48:06 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:48:09 Send token to the next node port is 8002 and receive the reply Receive token 19 from 8001

nodes 8002: 8002.txt

2022/11/14 14:46:59 Log file:8002.txtrecord started.
2022/11/14 14:47:15 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:18 Send token to the next node port is 8000 and receive the reply Receive token 2 from 8002

2022/11/14 14:47:24 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:26 The task is TASK G: node 8002 entered critical section Order is 5
2022/11/14 14:47:27 The task is TASK H: node 8002 entered critical section Order is 5
2022/11/14 14:47:27 Send token to the next node port is 8000 and receive the reply Receive token 5 from 8002

2022/11/14 14:47:33 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:36 The task is TASK I: node 8002 entered critical section Order is 8
2022/11/14 14:47:36 Send token to the next node port is 8000 and receive the reply Receive token 8 from 8002

2022/11/14 14:47:42 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:45 Send token to the next node port is 8000 and receive the reply Receive token 11 from 8002

2022/11/14 14:47:51 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:47:52 current is no task for this node, just handout the token
2022/11/14 14:47:52 current is no task for this node, just handout the token
2022/11/14 14:47:54 Send token to the next node port is 8000 and receive the reply Receive token 14 from 8002

2022/11/14 14:48:00 Now I have the token, it will send to another after 3 seconds
2022/11/14 14:48:03 Send token to the next node port is 8000 and receive the reply Receive token 17 from 8002

2022/11/14 14:48:09 Now I have the token, it will send to another after 3 seconds