

Relatório da Atividade 4: Raft

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Resumo

Esse relatório documenta um trabalho com o protocolo Raft para consenso distribuído. Não será trabalhado com *log replication*.

Index Terms

Raft, Golang, sistema distribuído

I. IMPLEMENTAÇÃO

Os códigos implementados seguiram fielmente os pseudo-códigos sugeridos no roteiro do laboratório. Abaixo estão apresentadas as alterações feitas pela aluna. Embora estejam no código do laboratório, não foram apresentados os *prints* de debug, a fim de tornar os códigos abaixo mais "limpos", não prejudicando a lógica implementada.

A. Ao receber um AppendEntry (heartbeat)

1) *Follower*: Código bastante similar ao pseudo-código:

```
func (raft *Raft) followerSelect() {
    // [...]

    case ae := <-raft.appendEntryChan:

        reply := &AppendEntryReply{
            Term: raft.currentTerm,
        }

        if ae.Term < raft.currentTerm {
            reply.Success = false
            ae.replyChan <- reply
            return
        }

        if ae.Term > raft.currentTerm {
            raft.currentTerm = ae.Term
            raft.votedFor = 0
        }

        raft.resetElectionTimeout()
        reply.Success = true
        ae.replyChan <- reply
        return

    // [...]
}
```

2) *Candidate*: Código bastante similar ao pseudo-código:

```
func (raft *Raft) candidateSelect() {
    // [...]

    case ae := <-raft.appendEntryChan:

        reply := &AppendEntryReply{
            Term: raft.currentTerm,
        }
}
```

```

if ae.Term < raft.currentTerm {
    reply.Success = false
    ae.replyChan <- reply
    return
}

if ae.Term > raft.currentTerm {
    raft.currentTerm = ae.Term
    raft.votedFor = 0
}

reply.Success = true
ae.replyChan <- reply

raft.currentState.Set(follower)
raft.appendEntryChan <- ae
return

// [...]
}

```

3) *Leader*: idem *candidate*.

B. Ao receber um *RequestVote*

1) *Follower*: Código bastante similar ao pseudo-código:

```

func (raft *Raft) followerSelect() {
    // [...]

    case rv := <-raft.requestVoteChan:

        reply := &RequestVoteReply{
            Term: raft.currentTerm,
        }

        if rv.Term < raft.currentTerm {
            reply.VoteGranted = false
            rv.replyChan <- reply
            return
        }

        if rv.Term > raft.currentTerm {
            raft.currentTerm = rv.Term
            raft.votedFor = 0
        }

        if (rv.Term == raft.currentTerm) && (raft.votedFor == 0 || raft.votedFor ==
            rv.CandidateID) {
            raft.votedFor = rv.CandidateID
            raft.resetElectionTimeout()
            reply.VoteGranted = true
        } else {
            reply.VoteGranted = false
        }

        rv.replyChan <- reply
        return

    // [...]
}

```

2) *Candidate*: Código bastante similar ao pseudo-código:

```

func (raft *Raft) candidateSelect() {
    // [...]

    case rv := <-raft.requestVoteChan:

```

```

reply := &RequestVoteReply{
    Term: raft.currentTerm,
}

if rv.Term < raft.currentTerm {
    reply.VoteGranted = false
    rv.replyChan <- reply
    return
}

if rv.Term > raft.currentTerm {
    raft.currentTerm = rv.Term
    raft.votedFor = 0

    raft.currentState.Set(follower)
    raft.requestVoteChan <- rv
    return
}

if (rv.Term == raft.currentTerm) && (raft.votedFor == 0 || raft.votedFor ==
    rv.CandidateID) {
    raft.votedFor = rv.CandidateID
    raft.resetElectionTimeout()
    reply.VoteGranted = true
} else {
    reply.VoteGranted = false
}

rv.replyChan <- reply
return

// [...]
}

```

3) *Leader*: idem *candidate*.

C. Ao receber um Reply

1) *Candidate*: Caso os votos sejam de mais que a maioria dos servers, *candidate* vira *leader*.

```

func (raft *Raft) candidateSelect() {
    // [...]

    case rvr := <-replyChan:

        if rvr.VoteGranted {
            voteCount++
        }

        if voteCount > len(raft.peers)/2 {
            raft.currentState.Set(leader)
            return
        }

    // [...]
}

```

2) *Leader*: Caso *leader* receba resposta falso para o *AppendEntry*, faz *step down*.

```

func (raft *Raft) leaderSelect() {
    // [...]

    case aet := <-replyChan:

        if aet.Success == false {
            raft.currentState.Set(follower)
            return
        }
    }
}

```

```

}

// [...]

}

```

II. RESULTADOS E CONCLUSÕES

Na Figura 1, foi apresentado uma captura de tela de um funcionamento com todas instâncias funcionando.

- Server 2 vira *candidate*
- Server 2 recebe voto de 1
- Server 3 vira *candidate*
- Server 1 nega voto para 3 (já votou em 2)
- Server 2 nega voto para 3 (já é *candidate*)
- Server 2 recebe voto de 4 e 5 (e vira *leader*)
- Server 3 não consegue maioria dos votos
- Server 3 faz *Step Down*
- Server 1, 3, 4 e 5 continuam como *follower* indefinidamente, pois 2 é *leader*

```

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run 80x23
$ go run run.go -id 1
2019/10/07 10:07:40 [SERVER] Listening on 'localhost:3001'
2019/10/07 10:07:40 [FOLLOWER] Run Logic.
2019/10/07 10:07:40 [SERVER] Accepting connections.
2019/10/07 10:07:42 [FOLLOWER] Update old term '0' to new term '1' from 'localho
st:3002'.
2019/10/07 10:07:42 [FOLLOWER] Resetting election timeout.
2019/10/07 10:07:42 [FOLLOWER] Vote accepted to 'localhost:3002' for term '1'.
2019/10/07 10:07:42 [FOLLOWER] Run Logic.
2019/10/07 10:07:45 [FOLLOWER] Vote denied to 'localhost:3003' for term '1'.
2019/10/07 10:07:45 [FOLLOWER] Run Logic.
2019/10/07 10:07:45 [FOLLOWER] Update old term '1' to new term '2' from 'localho
st:3002'.
2019/10/07 10:07:45 [FOLLOWER] Resetting election timeout.
2019/10/07 10:07:45 [FOLLOWER] Vote accepted to 'localhost:3002' for term '2'.
2019/10/07 10:07:45 [FOLLOWER] Run Logic.
2019/10/07 10:07:45 [FOLLOWER] Resetting election timeout.
2019/10/07 10:07:45 [FOLLOWER] Accept AppendEntry from 'localhost:3002'.
2019/10/07 10:07:45 [FOLLOWER] Run Logic.
2019/10/07 10:07:45 [FOLLOWER] Resetting election timeout.
2019/10/07 10:07:45 [FOLLOWER] Accept AppendEntry from 'localhost:3002'.
2019/10/07 10:07:45 [FOLLOWER] Run Logic.
2019/10/07 10:07:45 [FOLLOWER] Resetting election timeout.

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run 80x23
Raft/run <master>
$ go run run.go -id 2
2019/10/07 10:07:42 [SERVER] Listening on 'localhost:3002'
2019/10/07 10:07:42 [FOLLOWER] Run Logic.
2019/10/07 10:07:42 [SERVER] Accepting connections.
2019/10/07 10:07:42 [FOLLOWER] Election timeout.
2019/10/07 10:07:42 [CANDIDATE] Run Logic.
2019/10/07 10:07:42 [CANDIDATE] Running for term '1'.
2019/10/07 10:07:42 [CANDIDATE] Vote granted by 'localhost:3001'.
2019/10/07 10:07:42 [CANDIDATE] VoteCount: 2
2019/10/07 10:07:45 [CANDIDATE] Vote denied to 'localhost:3003' for term '1'.
2019/10/07 10:07:45 [CANDIDATE] Run Logic.
2019/10/07 10:07:45 [CANDIDATE] Running for term '2'.
2019/10/07 10:07:45 [CANDIDATE] Vote granted by 'localhost:3001'.
2019/10/07 10:07:45 [CANDIDATE] VoteCount: 2
2019/10/07 10:07:45 [CANDIDATE] Vote granted by 'localhost:3003'.
2019/10/07 10:07:45 [CANDIDATE] VoteCount: 3
2019/10/07 10:07:45 [CANDIDATE] Becoming leader.
2019/10/07 10:07:45 [LEADER] Run Logic.
^Csignal: interrupt
isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run <master>
$

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run 80x14
Raft/run <master>
$ go run run.go -id 3
2019/10/07 10:07:44 [SERVER] Listening on 'localhost:3003'
2019/10/07 10:07:44 [FOLLOWER] Run Logic.
2019/10/07 10:07:44 [SERVER] Accepting connections.
2019/10/07 10:07:45 [FOLLOWER] Election timeout.
2019/10/07 10:07:45 [CANDIDATE] Run Logic.
2019/10/07 10:07:45 [CANDIDATE] Running for term '1'.
2019/10/07 10:07:45 [CANDIDATE] Vote denied by 'localhost:3001'.
2019/10/07 10:07:45 [CANDIDATE] Vote denied by 'localhost:3002'.
2019/10/07 10:07:45 [CANDIDATE] Update old term '1' to new term '2' from 'localh
ost:3002'.
2019/10/07 10:07:45 [CANDIDATE] Stepping down.
2019/10/07 10:07:45 [FOLLOWER] Run Logic.

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run 80x15
Raft/run <master>
$ go run run.go -id 4
2019/10/07 10:07:46 [SERVER] Listening on 'localhost:3004'
2019/10/07 10:07:46 [FOLLOWER] Run Logic.
2019/10/07 10:07:46 [SERVER] Accepting connections.
2019/10/07 10:07:46 [FOLLOWER] Update old term '0' to new term '2' from 'localho
st:3002'.
2019/10/07 10:07:46 [FOLLOWER] Resetting election timeout.
2019/10/07 10:07:46 [FOLLOWER] Accept AppendEntry from 'localhost:3002'.
2019/10/07 10:07:46 [FOLLOWER] Run Logic.
2019/10/07 10:07:46 [FOLLOWER] Resetting election timeout.
2019/10/07 10:07:46 [FOLLOWER] Accept AppendEntry from 'localhost:3002'.
2019/10/07 10:07:46 [FOLLOWER] Run Logic.
2019/10/07 10:07:46 [FOLLOWER] Resetting election timeout.
2019/10/07 10:07:46 [FOLLOWER] Accept AppendEntry from 'localhost:3002'.

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run 80x16
$ go run run.go -id 5
2019/10/07 10:07:48 [SERVER] Listening on 'localhost:3005'
2019/10/07 10:07:48 [FOLLOWER] Run Logic.
2019/10/07 10:07:48 [SERVER] Accepting connections.
2019/10/07 10:07:48 [FOLLOWER] Update old term '0' to new term '2' from 'localho
st:3002'.
2019/10/07 10:07:48 [FOLLOWER] Resetting election timeout.
2019/10/07 10:07:48 [FOLLOWER] Accept AppendEntry from 'localhost:3002'.
2019/10/07 10:07:48 [FOLLOWER] Run Logic.
2019/10/07 10:07:48 [FOLLOWER] Resetting election timeout.
2019/10/07 10:07:48 [FOLLOWER] Accept AppendEntry from 'localhost:3002'.
2019/10/07 10:07:48 [FOLLOWER] Run Logic.
2019/10/07 10:07:48 [FOLLOWER] Resetting election timeout.
2019/10/07 10:07:48 [FOLLOWER] Accept AppendEntry from 'localhost:3002'.
2019/10/07 10:07:48 [FOLLOWER] Run Logic.

```

Figura 1. Funcionamento normal para os 5 processos.

Na Figura 2, foi apresentado uma captura de tela de um funcionamento com falha do *leader* (com outra instância assumindo a liderança) e retomada do servidor falho (com ele reconhecendo a liderança do outro).

- Server 3 (*leader*) falha
- Server 2 vira *candidate*
- Server 2 recebe voto de 1 e 5 (e vira *leader*), e de 4
- Server 3 é retomado e recebe *AppendEntry* de 2 (que é o novo *leader*)
- Server 1, 3, 4 e 5 continuam como *follower* indefinidamente, pois 2 é *leader*

Na Figura 3, foi apresentado uma captura de tela de um funcionamento com falha de uma instância (o *leader*), agora sem retomada do servidor falho. Note que outro servidor assume a liderança.

- Server 1 (leader) falha
- Server 3 vira *candidate*
- Server 3 recebe voto de 4 e 2 (e vira *leader*), e de 3 e 5
- Server 2, 4 e 5 continuam como *follower*, pois 3 é *leader*

Na Figura 4, foi apresentado uma captura de tela de um funcionamento com falha de duas instâncias, também sem retomadas dos servidores falhos. Note que outro servidor assume a liderança.

- Server 1 (*leader*) falha
- Server 3 vira *candidate*
- Server 3 recebe voto de 4 e 2 (e vira *leader*)
- Server 3 (*leader*) falha
- Server 4 vira *candidate*
- Server 4 recebe voto de 2 e 5 (e vira *leader*)
- Server 5 continua como *follower*, pois 4 é *leader*


```

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hi-rata-juliana-CES-27/Lab4/src/labRaft/run 78x
2019/10/07 10:23:34 [CANDIDATE] Run Logic.
2019/10/07 10:23:34 [CANDIDATE] Running for term '1'.
2019/10/07 10:23:34 [CANDIDATE] Vote granted by 'localhost:3002'.
2019/10/07 10:23:34 [CANDIDATE] VoteCount: 2
2019/10/07 10:23:36 [CANDIDATE] Vote denied to 'localhost:3003' for term '1'.
2019/10/07 10:23:36 [CANDIDATE] Run Logic.
2019/10/07 10:23:36 [CANDIDATE] Running for term '2'.
2019/10/07 10:23:36 [CANDIDATE] Vote granted by 'localhost:3003'.
2019/10/07 10:23:36 [CANDIDATE] VoteCount: 2
2019/10/07 10:23:36 [CANDIDATE] Vote granted by 'localhost:3004'.
2019/10/07 10:23:36 [CANDIDATE] VoteCount: 3
2019/10/07 10:23:36 [CANDIDATE] Becoming leader.
2019/10/07 10:23:36 [LEADER] Run Logic.
^Csignal: interrupt
isabelle@isabelle-Inspiron-5448 ~/Graduacao/hi-rata-juliana-CES-27/Lab4/src/L

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hi-rata-juliana-CES-27/Lab4/src/labRaft/run 78x
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:43 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:45 [FOLLOWER] Update old term '3' to new term '4' from 'localhost:3004'.
2019/10/07 10:23:45 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:45 [FOLLOWER] Vote accepted to 'localhost:3004' for term '4'.
2019/10/07 10:23:45 [FOLLOWER] Run Logic.
2019/10/07 10:23:45 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:45 [FOLLOWER] Accept AppendEntry from 'localhost:3004'.
2019/10/07 10:23:45 [FOLLOWER] Run Logic.
2019/10/07 10:23:45 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:45 [FOLLOWER] Accept AppendEntry from 'localhost:3004'.
2019/10/07 10:23:45 [FOLLOWER] Run Logic.

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hi-rata-juliana-CES-27/Lab4/src/labRaft/run 78x
2019/10/07 10:23:39 [FOLLOWER] Accept AppendEntry from 'localhost:3001'.
2019/10/07 10:23:39 [FOLLOWER] Run Logic.
2019/10/07 10:23:41 [FOLLOWER] Election timeout.
2019/10/07 10:23:41 [CANDIDATE] Run Logic.
2019/10/07 10:23:41 [CANDIDATE] Running for term '3'.
2019/10/07 10:23:41 [CANDIDATE] Vote granted by 'localhost:3004'.
2019/10/07 10:23:41 [CANDIDATE] VoteCount: 2
2019/10/07 10:23:41 [CANDIDATE] Vote granted by 'localhost:3002'.
2019/10/07 10:23:41 [CANDIDATE] VoteCount: 3
2019/10/07 10:23:41 [CANDIDATE] Becoming leader.
2019/10/07 10:23:41 [LEADER] Run Logic.
^Csignal: interrupt
isabelle@isabelle-Inspiron-5448 ~/Graduacao/hi-rata-juliana-CES-27/Lab4/src/L

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hi-rata-juliana-CES-27/Lab4/src/labRaft/run 83x20
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:43 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:43 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:43 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:45 [FOLLOWER] Election timeout.
2019/10/07 10:23:45 [CANDIDATE] Run Logic.
2019/10/07 10:23:45 [CANDIDATE] Running for term '4'.
2019/10/07 10:23:45 [CANDIDATE] Vote granted by 'localhost:3002'.
2019/10/07 10:23:45 [CANDIDATE] VoteCount: 2
2019/10/07 10:23:45 [CANDIDATE] Vote granted by 'localhost:3005'.
2019/10/07 10:23:45 [CANDIDATE] VoteCount: 3
2019/10/07 10:23:45 [CANDIDATE] Becoming leader.
2019/10/07 10:23:45 [LEADER] Run Logic.

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hi-rata-juliana-CES-27/Lab4/src/labRaft/run 83x25
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:43 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:43 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:43 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:43 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:43 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:23:43 [FOLLOWER] Run Logic.
2019/10/07 10:23:45 [FOLLOWER] Update old term '3' to new term '4' from 'localhost:3004'.
2019/10/07 10:23:45 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:45 [FOLLOWER] Vote accepted to 'localhost:3004' for term '4'.
2019/10/07 10:23:45 [FOLLOWER] Run Logic.
2019/10/07 10:23:45 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:45 [FOLLOWER] Accept AppendEntry from 'localhost:3004'.
2019/10/07 10:23:45 [FOLLOWER] Run Logic.
2019/10/07 10:23:45 [FOLLOWER] Resetting election timeout.
2019/10/07 10:23:45 [FOLLOWER] Accept AppendEntry from 'localhost:3004'.
2019/10/07 10:23:45 [FOLLOWER] Run Logic.

```

Figura 4. Funcionamento após a falha no próximo *leader*.

Na Figura 5, foi apresentado uma captura de tela de um funcionamento com falha de três instâncias, também sem retomadas dos servidores falhos. Note que o sistema não consegue mais decidir por um novo *leader*.

- Server 1 (*leader*) falha
- Server 5 vida *candidate*
- Server 5 recebe voto de 3 e 4 (e vira *leader*), e de 2
- Server 5 (*leader*) falha
- Server 3 vira *candidate*
- Server 3 recebe voto de 4 e 2 (e vira *leader*)
- Server 3 (*leader*) falha
- Server 4 vira *candidate*
- Server 4 recebe voto de 2
- Server 4 não virará *leader*, pois só teve 2 votos (o de 2 e o dele mesmo)
- Server 2 continua indefinidamente como *follower* (sem nenhum *leader*)

```

isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run 78x
2019/10/07 10:28:44 [CANDIDATE] Run Logic.
2019/10/07 10:28:44 [CANDIDATE] Running for term '1'.
2019/10/07 10:28:44 [CANDIDATE] Vote granted by 'localhost:3002'.
2019/10/07 10:28:44 [CANDIDATE] VoteCount: 2
2019/10/07 10:28:46 [CANDIDATE] Vote denied to 'localhost:3004' for term '1'.
2019/10/07 10:28:46 [CANDIDATE] Run Logic.
2019/10/07 10:28:46 [CANDIDATE] Running for term '2'.
2019/10/07 10:28:46 [CANDIDATE] Vote granted by 'localhost:3003'.
2019/10/07 10:28:46 [CANDIDATE] VoteCount: 2
2019/10/07 10:28:46 [CANDIDATE] Vote granted by 'localhost:3002'.
2019/10/07 10:28:46 [CANDIDATE] VoteCount: 3
2019/10/07 10:28:46 [CANDIDATE] Becoming leader.
2019/10/07 10:28:46 [LEADER] Run Logic.
^Csignal: interrupt
isabelle@isabelle-Inspiron-5448 ~/Graduacao/hirata-juliana-CES-27/Lab4/src/L
isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run 78x
2019/10/07 10:28:56 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:56 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:28:56 [FOLLOWER] Run Logic.
2019/10/07 10:28:56 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:56 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:28:56 [FOLLOWER] Run Logic.
2019/10/07 10:28:59 [FOLLOWER] Update old term '4' to new term '5' from 'local
host:3004'.
2019/10/07 10:28:59 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:59 [FOLLOWER] Vote accepted to 'localhost:3004' for term '5'.
2019/10/07 10:28:59 [FOLLOWER] Run Logic.
2019/10/07 10:29:02 [FOLLOWER] Update old term '5' to new term '6' from 'local
host:3004'.
2019/10/07 10:29:02 [FOLLOWER] Resetting election timeout.
2019/10/07 10:29:02 [FOLLOWER] Vote accepted to 'localhost:3004' for term '6'.
2019/10/07 10:29:02 [FOLLOWER] Run Logic.
isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run 78x
2019/10/07 10:28:53 [FOLLOWER] Accept AppendEntry from 'localhost:3005'.
2019/10/07 10:28:53 [FOLLOWER] Run Logic.
2019/10/07 10:28:54 [FOLLOWER] Election timeout.
2019/10/07 10:28:54 [CANDIDATE] Run Logic.
2019/10/07 10:28:54 [CANDIDATE] Running for term '4'.
2019/10/07 10:28:54 [CANDIDATE] Vote granted by 'localhost:3004'.
2019/10/07 10:28:54 [CANDIDATE] VoteCount: 2
2019/10/07 10:28:54 [CANDIDATE] Vote granted by 'localhost:3002'.
2019/10/07 10:28:54 [CANDIDATE] VoteCount: 3
2019/10/07 10:28:54 [CANDIDATE] Becoming leader.
2019/10/07 10:28:54 [LEADER] Run Logic.
^Csignal: interrupt
isabelle@isabelle-Inspiron-5448 ~/Graduacao/hirata-juliana-CES-27/Lab4/src/L
isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run 83x26
2019/10/07 10:28:56 [FOLLOWER] Run Logic.
2019/10/07 10:28:56 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:56 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:28:56 [FOLLOWER] Run Logic.
2019/10/07 10:28:56 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:56 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:28:56 [FOLLOWER] Run Logic.
2019/10/07 10:28:56 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:56 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:28:56 [FOLLOWER] Run Logic.
2019/10/07 10:28:56 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:56 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:28:56 [FOLLOWER] Run Logic.
2019/10/07 10:28:56 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:56 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:28:56 [FOLLOWER] Run Logic.
2019/10/07 10:28:56 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:56 [FOLLOWER] Accept AppendEntry from 'localhost:3003'.
2019/10/07 10:28:56 [FOLLOWER] Run Logic.
2019/10/07 10:28:59 [FOLLOWER] Election timeout.
2019/10/07 10:28:59 [CANDIDATE] Run Logic.
2019/10/07 10:28:59 [CANDIDATE] Running for term '5'.
2019/10/07 10:28:59 [CANDIDATE] Vote granted by 'localhost:3002'.
2019/10/07 10:28:59 [CANDIDATE] VoteCount: 2
2019/10/07 10:29:02 [CANDIDATE] Election timeout.
2019/10/07 10:29:02 [CANDIDATE] Run Logic.
2019/10/07 10:29:02 [CANDIDATE] Running for term '6'.
2019/10/07 10:29:02 [CANDIDATE] Vote granted by 'localhost:3002'.
2019/10/07 10:29:02 [CANDIDATE] VoteCount: 2
isabelle@isabelle-Inspiron-5448: ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft/run 83x20
2019/10/07 10:28:47 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:47 [FOLLOWER] Accept AppendEntry from 'localhost:3001'.
2019/10/07 10:28:47 [FOLLOWER] Run Logic.
2019/10/07 10:28:47 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:47 [FOLLOWER] Accept AppendEntry from 'localhost:3001'.
2019/10/07 10:28:47 [FOLLOWER] Run Logic.
2019/10/07 10:28:47 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:47 [FOLLOWER] Accept AppendEntry from 'localhost:3001'.
2019/10/07 10:28:47 [FOLLOWER] Run Logic.
2019/10/07 10:28:47 [FOLLOWER] Resetting election timeout.
2019/10/07 10:28:47 [FOLLOWER] Accept AppendEntry from 'localhost:3001'.
2019/10/07 10:28:47 [FOLLOWER] Run Logic.
2019/10/07 10:28:51 [FOLLOWER] Election timeout.
2019/10/07 10:28:51 [CANDIDATE] Run Logic.
2019/10/07 10:28:51 [CANDIDATE] Running for term '3'.
2019/10/07 10:28:51 [CANDIDATE] Vote granted by 'localhost:3003'.
2019/10/07 10:28:51 [CANDIDATE] VoteCount: 2
2019/10/07 10:28:51 [CANDIDATE] Vote granted by 'localhost:3004'.
2019/10/07 10:28:51 [CANDIDATE] VoteCount: 3
2019/10/07 10:28:51 [CANDIDATE] Becoming leader.
2019/10/07 10:28:51 [LEADER] Run Logic.
^Csignal: interrupt
isabelle@isabelle-Inspiron-5448 ~/Graduacao/hirata-juliana-CES-27/Lab4/src/labRaft

```

Figura 5. Funcionamento após a falha no terceiro *leader*. Note que o sistema não consegue mais decidir por um novo *leader*.

Uma vez que os resultados saíram conforme o esperado, tem-se que o laboratório foi implementado corretamente.