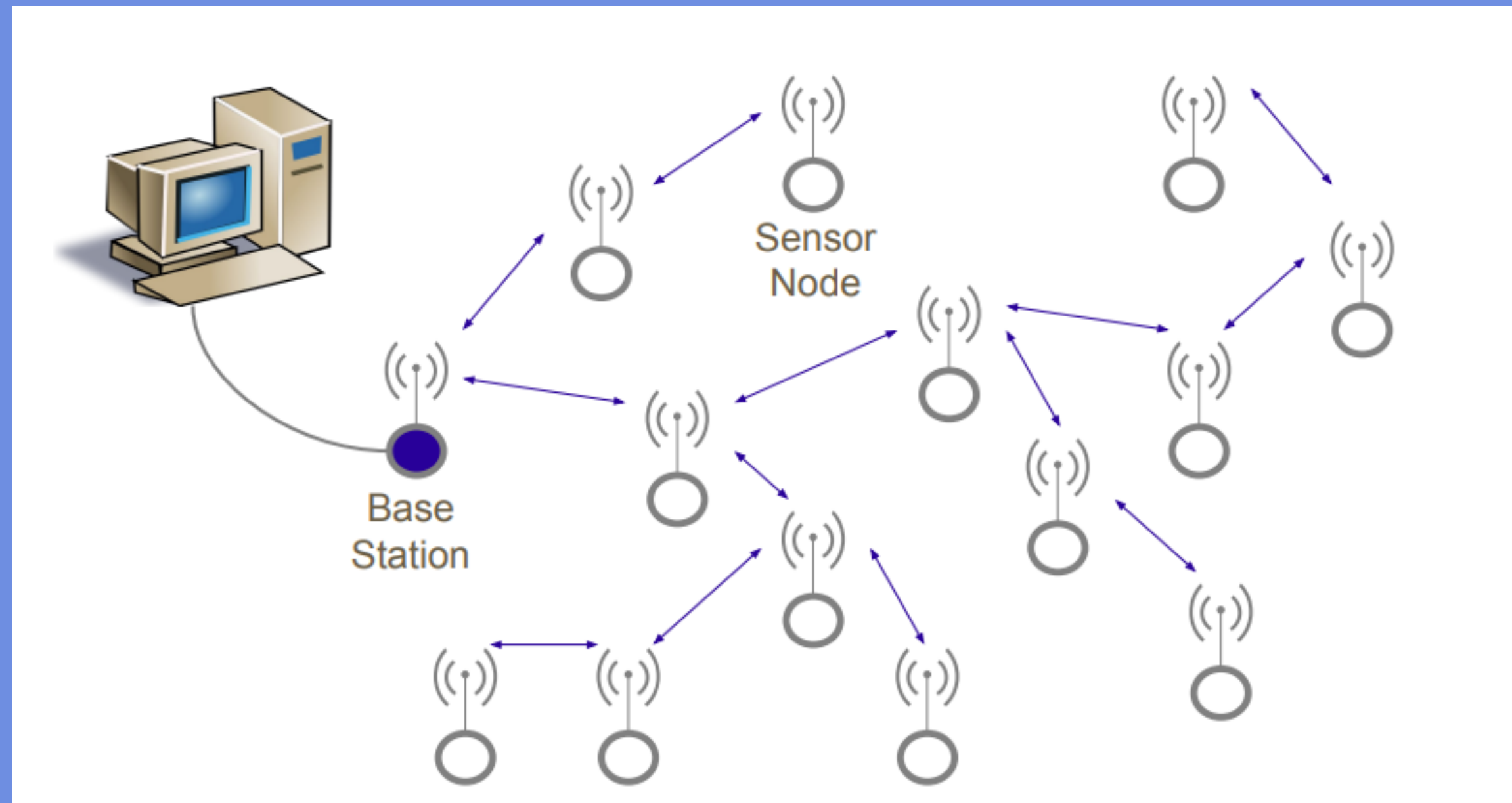
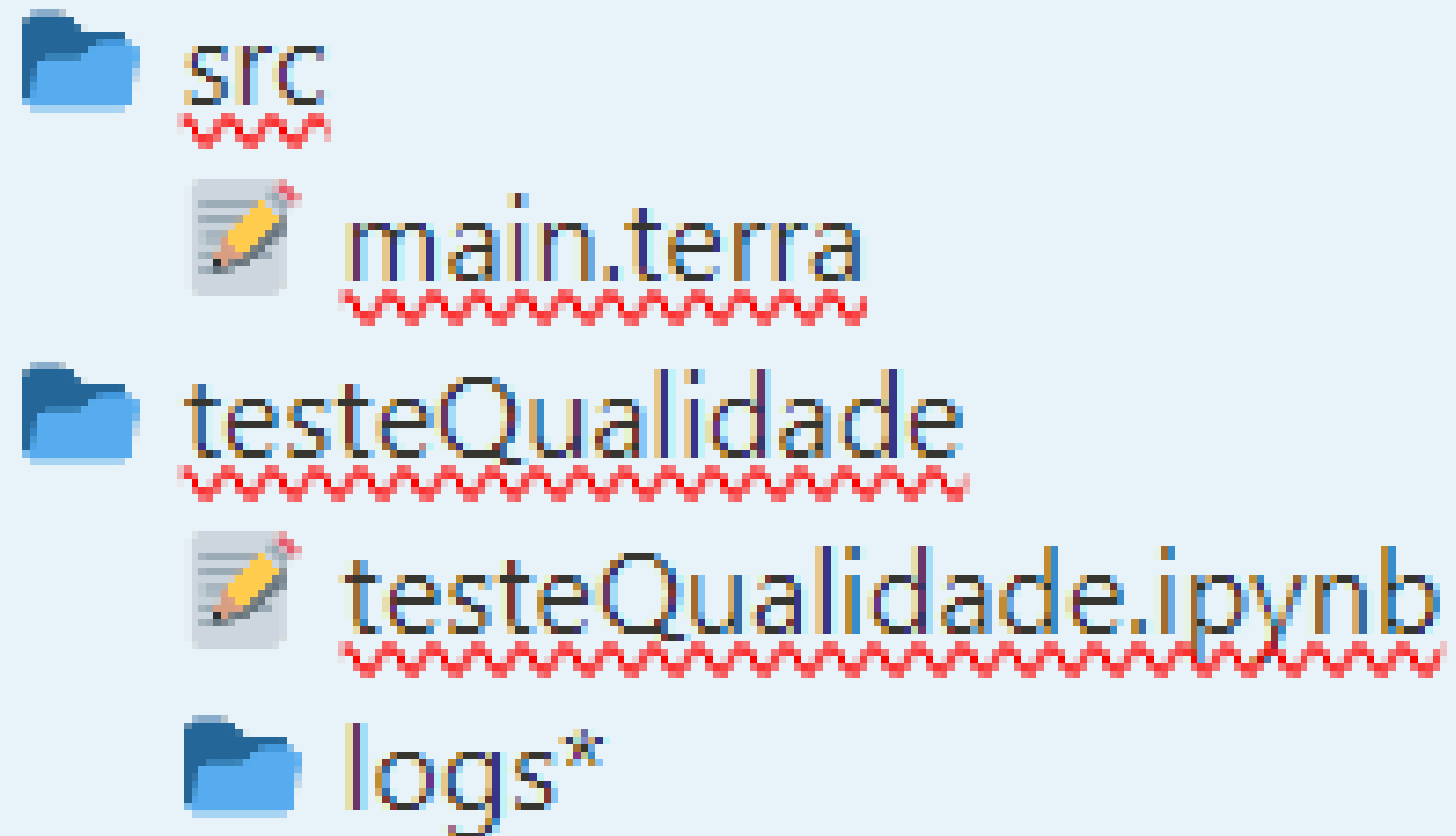


# SISTEMAS REATIVOS



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Paulo de Tarso

# ESTRUTURA DE PASTA



# ESTRUTURA DE CÓDIGO

- 3 tipos de mensagem:
  - Default
  - FINDPAI
  - OFFERPAI
- Delay aleatório
- Flag booleana orfao
- Uso de fila e confirmação de recebimento
- 5 loops sendo executados paralelamente

```
par do
  loop do
    if orfao == TRUE then
      await (random()%500)ms;
      emit SEND(sndDataFindPai);
      await SEND_DONE;
      await (5)s;
    else
      emit REQ_TEMP();
      tempData.d16[0] = await TEMP;
      tempData.target = idPai;
      tempData.d16[1] = idPai;
      stat = qPut(tempData);
      inc tempData.d8[0];
      await (30)s;
    end
  end
end
```

# ESTRUTURA DE CÓDIGO

---

```
with
    loop do
        if qSize() != 0 then
            stat = qGet(sndData);
            await (random()%500)ms;
            emit SEND_ACK(sndData);
            sndAck = await SEND_DONE_ACK;
            if sndAck == FALSE and sndData.type == 1 then
                qPut(sndData);
            end
        else
            await Q_READY;
        end
    end
end
```

```
with
    loop do
        recData1 = await RECEIVE(FINDPAI);
        if orfao == FALSE then
            sndDataOfferPai.target = recData1.source;
            stat = qPut(sndDataOfferPai);
        end
    end
with
    loop do
        recData2 = await RECEIVE(OFFERPAI);
        if orfao == TRUE then
            idPai = recData2.source;
            orfao = FALSE;
        end
    end
end
```

---

```
with
    loop do
        recData3 = await RECEIVE(1);
        recData3.target = idPai;
        stat = qPut(recData3);
        emit LEDS(recData3.d8[0]);
    end
end
```

# DIFICULDADES

## Configurando o ambiente de execução

The screenshot displays the Terra Net Simulation Viewer interface, which is running within an Oracle VM VirtualBox window titled "Terra\_0.30\_NG [Executando]". The interface includes a menu bar (Arquivo, Máquina, Visualizar, Entrada, Dispositivos, Ajuda) and a toolbar with icons for file operations and simulation control.

On the left side, there is a vertical toolbar with icons for various components: a globe, a terminal, a document, a pencil, and buttons for "Terra Control", "TOSSIM Net", "TOSSIM Grp", "Serial Forward", "src", "Log Net", and "Log Grp".

The main area is divided into two panes. The left pane shows a code editor with the following code:

```
88 with
89   loop do
90     recData2 = await RECEIVE(OFFERPAI)
91     if orfao == TRUE then
92       idPai = recData2.source;
93       orfao = FALSE;
94     end
95   end
96 with
97   loop do
98     recData3 = await RECEIVE(1);
99     recData3.target = idPai;
100    stat = qPut(recData3);
101    emit LEDS(recData3.d8[0]);
102  end
103 end
```

Below the code editor, there is a status bar showing "-- mica2 = 1920 bytes" and a "Done." message. At the bottom left, there is a "Shell Output" section.

The right pane displays a network diagram titled "0s of 600s [zoom: x3]". The diagram shows a grid of 16 nodes, each represented by a box containing a number (11 to 44) and three values (1000, 0.400, 0.500). The nodes are interconnected by lines, forming a complex network topology. A legend in the top left corner of the diagram indicates that the values represent "volts", "photo", and "temp".

At the bottom right of the interface, there is a "Stop" button and a status bar showing "TerraNet", "Tab Width: 4", "Ln 46, Col 4", and "INS".

# DIFICULDADES

## Adaptação com a programação Céu-T

Group	Function	Description
Basic	ushort getNodeId()	Return NodeID
	ushort random()	Return 16bit Random
	ulong getTime()	Return internal clock
	ubyte setRFPower(ubyte)	Set Radio Power
Message Queue	ubyte qPut(radioMsg)	Put msg into queue
	ubyte qGet(radioMsg)	Get msg from queue
	ubyte qSize()	Return Queue Size
	ubyte qClear()	Clear all queue entries

# DIFICULDADES

**Descobrir a quantidade de tempo ideal para envio de mensagens**

**Versão antiga**

```
await (nodeId-10)s;  
emit SEND(sndData);  
await SEND_DONE;
```

**Versão atual**

```
await (random()%500)ms;  
emit SEND(sndDataFindPai);  
await SEND_DONE;
```



# RESULTADOS

Control		Monitor	
TCP			
Send progress		Message print (Decimal or Hexa)	Data Messages
100%		<input type="radio"/> Hexa	
2023.11.11 22:41:52:sendBSMsg: Sender= 064, EvtId=01, data=[9,0,0,0,500,55,0,0,0,0,]			
2023.11.11 22:41:53:sendBSMsg: Sender= 054, EvtId=01, data=[9,0,0,0,500,43,0,0,0,0,]			
2023.11.11 22:41:53:sendBSMsg: Sender= 057, EvtId=01, data=[9,0,0,0,500,48,0,0,0,0,]			
2023.11.11 22:41:53:sendBSMsg: Sender= 058, EvtId=01, data=[9,0,0,0,500,48,0,0,0,0,]			
2023.11.11 22:41:54:sendBSMsg: Sender= 034, EvtId=01, data=[10,0,0,0,500,44,0,0,0,0,]			
2023.11.11 22:41:54:sendBSMsg: Sender= 066, EvtId=01, data=[9,0,0,0,500,56,0,0,0,0,]			
2023.11.11 22:41:54:sendBSMsg: Sender= 065, EvtId=01, data=[9,0,0,0,500,55,0,0,0,0,]			
2023.11.11 22:41:55:sendBSMsg: Sender= 053, EvtId=01, data=[9,0,0,0,500,43,0,0,0,0,]			
2023.11.11 22:41:58:sendBSMsg: Sender= 061, EvtId=01, data=[9,0,0,0,500,51,0,0,0,0,]			
2023.11.11 22:41:58:sendBSMsg: Sender= 062, EvtId=01, data=[9,0,0,0,500,53,0,0,0,0,]			
2023.11.11 22:41:59:sendBSMsg: Sender= 026, EvtId=01, data=[10,0,0,0,500,25,0,0,0,0,]			
2023.11.11 22:42:01:sendBSMsg: Sender= 045, EvtId=01, data=[10,0,0,0,500,44,0,0,0,0,]			
2023.11.11 22:42:01:sendBSMsg: Sender= 015, EvtId=01, data=[10,0,0,0,500,14,0,0,0,0,]			
2023.11.11 22:42:01:sendBSMsg: Sender= 036, EvtId=01, data=[10,0,0,0,500,25,0,0,0,0,]			
2023.11.11 22:42:02:sendBSMsg: Sender= 035, EvtId=01, data=[10,0,0,0,500,44,0,0,0,0,]			
2023.11.11 22:42:02:sendBSMsg: Sender= 016, EvtId=01, data=[10,0,0,0,500,15,0,0,0,0,]			
2023.11.11 22:42:02:sendBSMsg: Sender= 063, EvtId=01, data=[9,0,0,0,500,54,0,0,0,0,]			
2023.11.11 22:42:02:sendBSMsg: Sender= 027, EvtId=01, data=[10,0,0,0,500,26,0,0,0,0,]			
2023.11.11 22:42:03:sendBSMsg: Sender= 071, EvtId=01, data=[9,0,0,0,500,61,0,0,0,0,]			
2023.11.11 22:42:03:sendBSMsg: Sender= 073, EvtId=01, data=[9,0,0,0,500,62,0,0,0,0,]			
2023.11.11 22:42:03:sendBSMsg: Sender= 068, EvtId=01, data=[9,0,0,0,500,57,0,0,0,0,]			
2023.11.11 22:42:03:sendBSMsg: Sender= 081, EvtId=01, data=[9,0,0,0,500,71,0,0,0,0,]			
2023.11.11 22:42:04:sendBSMsg: Sender= 077, EvtId=01, data=[9,0,0,0,500,68,0,0,0,0,]			
2023.11.11 22:42:04:sendBSMsg: Sender= 077, EvtId=01, data=[9,0,0,0,500,68,0,0,0,0,]			
2023.11.11 22:42:04:sendBSMsg: Sender= 072, EvtId=01, data=[9,0,0,0,500,61,0,0,0,0,]			
2023.11.11 22:42:05:sendBSMsg: Sender= 075, EvtId=01, data=[9,0,0,0,500,66,0,0,0,0,]			
2023.11.11 22:42:06:sendBSMsg: Sender= 067, EvtId=01, data=[9,0,0,0,500,66,0,0,0,0,]			
2023.11.11 22:42:06:sendBSMsg: Sender= 074, EvtId=01, data=[9,0,0,0,500,75,0,0,0,0,]			
2023.11.11 22:42:06:sendBSMsg: Sender= 084, EvtId=01, data=[9,0,0,0,500,75,0,0,0,0,]			
2023.11.12 18:34:28:sendBSMsg: Sender= 011, EvtId=01, data=[0,0,0,0,500,1,0,0,0,0,]			
2023.11.12 18:34:33:sendBSMsg: Sender= 012, EvtId=01, data=[0,0,0,0,500,11,0,0,0,0,]			
2023.11.12 18:34:33:sendBSMsg: Sender= 021, EvtId=01, data=[0,0,0,0,500,11,0,0,0,0,]			
2023.11.12 18:34:33:sendBSMsg: Sender= 022, EvtId=01, data=[0,0,0,0,500,11,0,0,0,0,]			



# RESULTADOS

Control

Monitor

TCP

Send progress

100%

Message print  
(Decimal or Hexa)

☐ Hexa

Data Messages

Local clock: 1699822897

Local time: 2023.11.12 19:01:37

2023.11.11 22:41:52:sendBSMsg: Sender= 064, EvtId=01, data=[9,0,0,0,500,55,0,0,0,0,]

2023.11.11 22:41:53:sendBSMsg: Sender= 054, EvtId=01, data=[9,0,0,0,500,43,0,0,0,0,]

2023.11.11 22:41:53:sendBSMsg: Sender= 057, EvtId=01, data=[9,0,0,0,500,48,0,0,0,0,]

2023.11.11 22:41:53:sendBSMsg: Sender= 058, EvtId=01, data=[9,0,0,0,500,48,0,0,0,0,]

2023.11.11 22:41:54:sendBSMsg: Sender= 034, EvtId=01, data=[10,0,0,0,500,44,0,0,0,0,]

2023.11.11 22:41:54:sendBSMsg: Sender= 066, EvtId=01, data=[9,0,0,0,500,56,0,0,0,0,]

2023.11.11 22:41:54:sendBSMsg: Sender= 065, EvtId=01, data=[9,0,0,0,500,55,0,0,0,0,]

2023.11.11 22:41:55:sendBSMsg: Sender= 053, EvtId=01, data=[9,0,0,0,500,43,0,0,0,0,]

2023.11.11 22:41:58:sendBSMsg: Sender= 061, EvtId=01, data=[9,0,0,0,500,51,0,0,0,0,]

2023.11.11 22:41:58:sendBSMsg: Sender= 062, EvtId=01, data=[9,0,0,0,500,53,0,0,0,0,]

2023.11.11 22:41:59:sendBSMsg: Sender= 026, EvtId=01, data=[10,0,0,0,500,25,0,0,0,0,]

2023.11.11 22:42:01:sendBSMsg: Sender= 045, EvtId=01, data=[10,0,0,0,500,44,0,0,0,0,]

2023.11.11 22:42:01:sendBSMsg: Sender= 015, EvtId=01, data=[10,0,0,0,500,14,0,0,0,0,]

2023.11.11 22:42:01:sendBSMsg: Sender= 036, EvtId=01, data=[10,0,0,0,500,25,0,0,0,0,]

2023.11.11 22:42:02:sendBSMsg: Sender= 035, EvtId=01, data=[10,0,0,0,500,44,0,0,0,0,]

2023.11.11 22:42:02:sendBSMsg: Sender= 016, EvtId=01, data=[10,0,0,0,500,15,0,0,0,0,]

2023.11.11 22:42:02:sendBSMsg: Sender= 063, EvtId=01, data=[9,0,0,0,500,54,0,0,0,0,]

2023.11.11 22:42:02:sendBSMsg: Sender= 027, EvtId=01, data=[10,0,0,0,500,26,0,0,0,0,]

2023.11.11 22:42:03:sendBSMsg: Sender= 071, EvtId=01, data=[9,0,0,0,500,61,0,0,0,0,]

2023.11.11 22:42:03:sendBSMsg: Sender= 073, EvtId=01, data=[9,0,0,0,500,62,0,0,0,0,]

2023.11.11 22:42:03:sendBSMsg: Sender= 068, EvtId=01, data=[9,0,0,0,500,57,0,0,0,0,]

2023.11.11 22:42:03:sendBSMsg: Sender= 081, EvtId=01, data=[9,0,0,0,500,71,0,0,0,0,]

2023.11.11 22:42:04:sendBSMsg: Sender= 077, EvtId=01, data=[9,0,0,0,500,68,0,0,0,0,]

2023.11.11 22:42:04:sendBSMsg: Sender= 077, EvtId=01, data=[9,0,0,0,500,68,0,0,0,0,]

2023.11.11 22:42:04:sendBSMsg: Sender= 072, EvtId=01, data=[9,0,0,0,500,61,0,0,0,0,]

2023.11.11 22:42:05:sendBSMsg: Sender= 075, EvtId=01, data=[9,0,0,0,500,66,0,0,0,0,]

2023.11.11 22:42:06:sendBSMsg: Sender= 067, EvtId=01, data=[9,0,0,0,500,66,0,0,0,0,]

2023.11.11 22:42:06:sendBSMsg: Sender= 074, EvtId=01, data=[9,0,0,0,500,75,0,0,0,0,]

2023.11.11 22:42:06:sendBSMsg: Sender= 084, EvtId=01, data=[9,0,0,0,500,75,0,0,0,0,]

2023.11.12 18:34:28:sendBSMsg: Sender= 011, EvtId=01, data=[0,0,0,0,500,1,0,0,0,0,]

2023.11.12 18:34:33:sendBSMsg: Sender= 012, EvtId=01, data=[0,0,0,0,500,11,0,0,0,0,]

2023.11.12 18:34:33:sendBSMsg: Sender= 021, EvtId=01, data=[0,0,0,0,500,11,0,0,0,0,]

2023.11.12 18:34:33:sendBSMsg: Sender= 022, EvtId=01, data=[0,0,0,0,500,11,0,0,0,0,]



# RESULTADOS

	datetime	sender	evtId	seq	temp	pai	dados
0	2023.11.11 22:32:22	11	1	0	500	1	[0, 0, 0, 0, 500, 1, 0, 0, 0, 0]
1	2023.11.11 22:32:24	12	1	0	500	11	[0, 0, 0, 0, 500, 11, 0, 0, 0, 0]
2	2023.11.11 22:32:24	21	1	0	500	11	[0, 0, 0, 0, 500, 11, 0, 0, 0, 0]
3	2023.11.11 22:32:25	22	1	0	500	11	[0, 0, 0, 0, 500, 11, 0, 0, 0, 0]
4	2023.11.11 22:32:29	31	1	0	500	22	[0, 0, 0, 0, 500, 22, 0, 0, 0, 0]
...	...	...	...	...	...	...	...
612	2023.11.11 22:42:04	72	1	9	500	61	[9, 0, 0, 0, 500, 61, 0, 0, 0, 0]
613	2023.11.11 22:42:05	75	1	9	500	66	[9, 0, 0, 0, 500, 66, 0, 0, 0, 0]
614	2023.11.11 22:42:06	67	1	9	500	66	[9, 0, 0, 0, 500, 66, 0, 0, 0, 0]
615	2023.11.11 22:42:06	74	1	9	500	75	[9, 0, 0, 0, 500, 75, 0, 0, 0, 0]
616	2023.11.11 22:42:06	84	1	9	500	75	[9, 0, 0, 0, 500, 75, 0, 0, 0, 0]

[illegible]

# RESULTADOS

```
exibe_metricas_log("log3.txt")
```

Quatidade de nós: 16

Quantidado de sequências: 66

Número da sequência máxima: 65

Quantidade de valores duplicados: 0

Quantidade de tentativas conhecidas de envio: 958

Quantidade de mensagens com certeza perdidas: 369

Percentual de tentativas conhecidas recebidas: 61.5%

Percentual de mensagens recebidas:

    Total: 57.3%

    [-1]: 58.1%

    [-2]: 58.4%

    [-3]: 58.4%

# RESULTADOS

```
exibe_metricas_log("log4.txt")
```

Quantidade de nós: 16

Quantidade de sequências: 26

Número da sequência máxima: 25

Quantidade de valores duplicados: 0

Quantidade de tentativas conhecidas de envio: 365

Quantidade de mensagens com certeza perdidas: 23

Percentual de tentativas conhecidas recebidas: 93.7%

Percentual de mensagens recebidas:

    Total: 86.1%

    [-1]: 89.2%

    [-2]: 92.2%

    [-3]: 93.8%

# RESULTADOS

```
exibe_metricas_log("log12.txt")
```

Quantidade de nós: 64

Quantidade de sequências: 7

Número da sequência máxima: 6

Quantidade de valores duplicados: 0

Quantidade de tentativas conhecidas de envio: 298

Quantidade de mensagens com certeza perdidas: 20

Percentual de tentativas conhecidas recebidas: 93.3%

Percentual de mensagens recebidas:

    Total: 76.3%

    [-1]: 88.8%

    [-2]: 92.5%

    [-3]: 92.6%

# RESULTADOS

```
exibe_metricas_log("log13.txt")
```

Quantidade de nós: 64

Quantidade de sequências: 11

Número da sequência máxima: 10

Quantidade de valores duplicados: 3

Quantidade de tentativas conhecidas de envio: 589

Quantidade de mensagens com certeza perdidas: 39

Percentual de tentativas conhecidas recebidas: 93.4%

Percentual de mensagens recebidas:

    Total: 87.2%

    [-1]: 92.2%

    [-2]: 93.4%

    [-3]: 92.8%



# INCREMENTOS

**Simular perda de nó pai**

**Implementar outros tratamentos de colisão**

**Evitar envio duplicado de mensagens**

OBRIGADO!