

# Lab3 Protocol

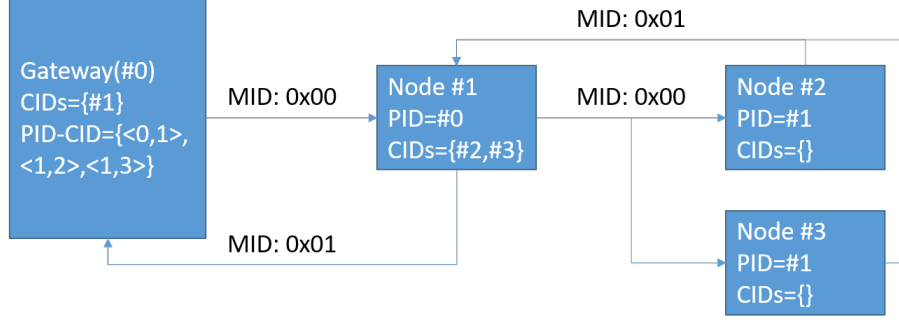
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# 1 Self-Organization



## 1.1 Gateway

### 1.1.1 TX (G-Thread-1): Message ID 0x00

1. Start (re-)organization at time  $t$  (default reorganization interval: 5s configurable)
2. **Mutex lock**
  - (a) Clear parent-child list  $\{<PID, CID>_i\}$
  - (b) Increase round count  $\rho \leftarrow (\rho + 1) \% 256$
3. **Mutex unlock**
4. Broadcast an organization message with  $\rho$ , and node ID  $NID$ :
 

Message ID 0x00 [1B],  $\rho$  [1B],  $NID$  [1B]: e.g. 0x00 0x04 0x00
5. **goto 1**

### 1.1.2 RX (G-Thread-2): Message ID 0x01

1. Get and parse the replied organization message (Message ID 0x01)
  - received round count  $\rho_R$
  - received parent ID  $PID_R$
  - received parent-child pair  $<PID, CID>_R$
2. **Mutex lock**
  - (a) If  $\rho_R \neq \rho$  or  $PID_R \neq NID$ , then **mutex unlock** and **goto 1**
  - (b) Add  $<PID, CID>_R$  to  $\{<PID, CID>_i\}$  and refresh the neighbor list of  $<PID, CID>_R$ :  $PID$  node.
3. **Mutex unlock**
4. **goto 1**

## 1.2 Communication Node

### 1.2.1 RX (N-Thread-1): Message ID 0x00

1. Get and parse the organization message (Message ID 0x00):
  - received round count  $\rho_R$
  - received node ID  $NID_R$
  - RSSI level  $\Phi$
2. If  $\Phi < \Phi^*$  ( $\Phi^*$  is the minimum required RSSI to build a reliable wireless connection), then **goto 1**

3. If its own round count  $\rho = \rho_R$ , then goto 1

4. **Mutex lock**

(a) Set round count:  $\rho = \rho_R$

(b) Set parent ID:  $PID = NID_R$

(c) Reply an acknowledge message with  $\rho$ ,  $PID$ , and  $NID$ :

Message ID 0x01 [1B],  $\rho$  [1B],  $PID$  [1B],  $\langle PID, NID \rangle$  [2B]: e.g. 0x01 0x04 0x01 0x01 0x02

5. **Mutex unlock**

6. Broadcast an organization message with  $\rho$ , and  $NID$ :

Message ID 0x00 [1B],  $\rho$  [1B],  $NID$  [1B]: e.g. 0x00 0x04 0x01

7. goto 1

### 1.2.2 RX (N-Thread-1): Message ID 0x01

1. Get and parse the replied organization message (Message ID 0x01)

- received round count  $\rho_R$
- received parent ID  $PID_R$
- received parent-child pair  $\langle PID, CID \rangle_R$

2. **Mutex lock**

(a) If  $\rho_R \neq \rho$  or  $PID_R \neq NID$ , then **mutex unlock** and goto 1

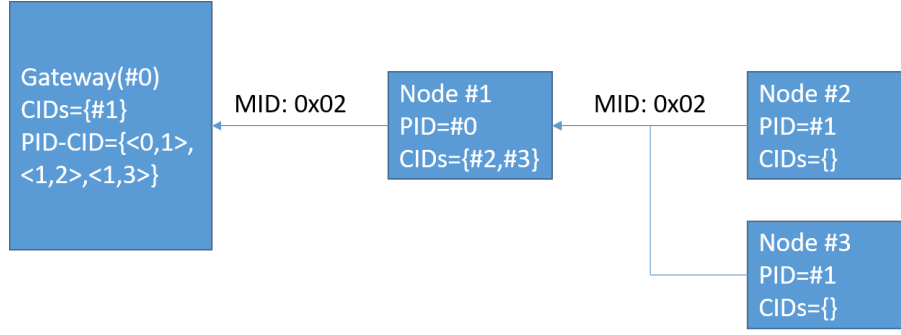
(b) Relay an acknowledge message with  $\rho$ ,  $PID$ , and  $\langle PID, CID \rangle_R$ :

Message ID 0x01 [1B],  $\rho$  [1B],  $PID$  [1B],  $\langle PID, CID \rangle_R$  [2B]: e.g. 0x01 0x04 0x00 0x01 0x02

3. **Mutex unlock**

4. goto 1

## 2 Upload Light Values



### 2.1 Gateway

#### 2.1.1 RX (G-Thread-2): Message ID 0x02

1. Get and parse the light value message (Message ID 0x02)
  - received round count  $\rho_R$
  - received parent ID  $PID_R$
  - received node ID  $NID_R$
  - received light value  $L_R$
2. **Mutex lock**
  - (a) If  $\rho_R \neq \rho$  or  $PID_R \neq NID$ , then **Mutex unlock** and **goto 1**
  - (b) Display light value “ $NID_R$ ’s light value is  $L_R$ ”
3. **Mutex unlock**
4. **goto 1**

### 2.2 Communication Node

#### 2.2.1 RX (N-Thread-1): Message ID 0x02

1. Get and parse the light value message (Message ID 0x02)
  - received round count  $\rho_R$
  - received parent ID  $PID_R$
  - received node ID  $NID_R$
  - received light value  $L_R$
2. **Mutex lock**
  - (a) If  $\rho_R \neq \rho$  or  $PID_R \neq NID$ , then **Mutex unlock** and **goto 1**
  - (b) Relay light value message with  $\rho$ ,  $PID$ ,  $NID_R$ , and  $L_R$  to parent:
 

Message ID 0x02 [1B],  $\rho$ [1B],  $PID$  [1B],  $NID_R$  [1B],  $L_R$  [2B]: e.g. 0x02 0x04 0x00 0x02 0x11 0x23
3. **Mutex unlock**
4. **goto 1**

### 2.2.2 TX (N-Thread-2): Message ID 0x02

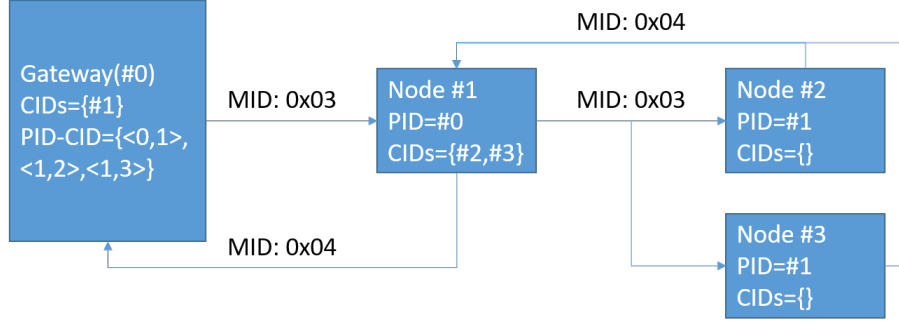
1. Sample start at time  $t$  (sample rate is controlled by  $dt$  ms and is configurable via gateway)
2. Get light value  $L_t$
3. **Mutex lock**

(a) Send light value message with  $\rho$ ,  $PID$ ,  $NID$ , and  $L_t$  to parent:

Message ID 0x02 [1B], $\rho$ [1B], $PID$ [1B], $NID$ [1B], $L_t$ [2B]: e.g. 0x02 0x04 0x01 0x02 0x11 0x23
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4. **Mutex unlock**
5. **goto 1**

### 3 Configure Sample Rate



#### 3.1 Gateway

##### 3.1.1 TX2 (G-Thread-3): Message ID 0x03

1. Give a new sample rate  $dt$
2. **Mutex lock**
  - (a) Broadcast a sample rate message with  $\rho$ ,  $NID$ , and  $dt$  (ms):

Message ID 0x03 [1B],  $\rho$  [1B],  $NID$  [1B],  $dt$  [4B]: e.g. 0x03 0x04 0x00 0x19 0x90 0x11 0x23

3. **Mutex unlock**

##### 3.1.2 RX (G-Thread-2): Message ID 0x04

1. Get and parse the sample rate update message (Message ID 0x04)
  - received round count  $\rho_R$
  - received parent ID  $PID_R$
  - received node ID  $NID_R$
  - received sample rate  $dt_R$
2. **Mutex lock**
  - (a) If  $\rho_R \neq \rho$  or  $PID_R \neq NID$ , then **Mutex unlock** and **goto 1**
  - (b) Display sample rate update info “ $NID_R$ ’s sample rate changes to  $dt_R$ ”
3. **Mutex unlock**
4. **goto 1**

#### 3.2 Communication Node

##### 3.2.1 RX (N-Thread-1): Message ID 0x03

1. Get and parse the sample rate message (Message ID 0x03)
  - received round count  $\rho_R$
  - received parent ID  $PID_R$
  - received sample rate  $dt_R$
2. **Mutex lock**
  - (a) If  $\rho_R \neq \rho$  or  $PID_R \neq PID$ , then **Mutex unlock** and **goto 1**
  - (b) Set  $dt = dt_R$

- (c) Reply a sample rate update message with  $\rho$ ,  $PID$ ,  $NID$ , and  $dt$  (ms):

Message ID 0x04 [1B],  $\rho$ [1B],  $PID$  [1B],  $NID$  [1B],  $dt$  [4B]: e.g. 0x03 0x04 0x01 0x02 0x19 0x90 0x11 0x23

- (d) Relay a sample rate message with  $\rho$ ,  $NID$ , and  $dt$  (ms):

Message ID 0x03 [1B],  $\rho$ [1B],  $NID$  [1B],  $dt$  [4B]: e.g. 0x03 0x04 0x01 0x19 0x90 0x11 0x23

3. **Mutex unlock**

4. **goto 1**

### 3.2.2 RX (N-Thread-1): Message ID 0x04

1. Get and parse the sample rate update message (Message ID 0x04)

- received round count  $\rho_R$
- received parent ID  $PID_R$
- received node ID  $NID_R$
- received light value  $dt_R$

2. **Mutex lock**

- (a) If  $\rho_R \neq \rho$  or  $PID_R \neq NID$ , then **Mutex unlock** and **goto 1**

- (b) Relay sample rate update message with  $\rho$ ,  $PID$ ,  $NID_R$ , and  $dt_R$  to parent:

Message ID 0x04 [1B],  $\rho$ [1B],  $PID$  [1B],  $NID_R$  [1B],  $dt_R$  [4B]: e.g. 0x03 0x04 0x00 0x02 0x19 0x90 0x11 0x23

3. **Mutex unlock**

4. **goto 1**