Lab3 Protocol

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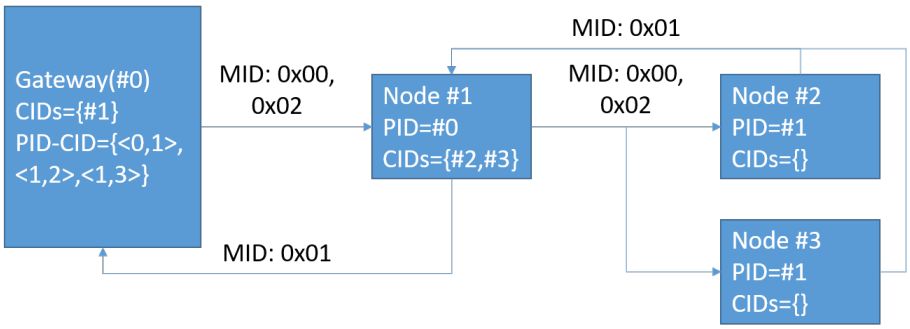
Contents

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. Clear parent-child list $\{< PID, CID >_i\}$
3. Increase round count $\rho \leftarrow (\rho + 1)\%256$
4. Broadcast an organization message with ρ, and node ID NID:
Message ID 0x00 [1B], ρ [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 ρ_R
   - received parent ID PID_R
   - received parent-child pair $< PID, CID >_R$
2. If $\rho_R \neq \rho$ or $PID_R \neq NID$, then goto 1
3. If $PID_R =< PID, CID >_R :: PID$, then reply an acknowledge message with ρ, NID:
Message ID 0x02 [1B], ρ [1B], NID [1B]: e.g. 0x02 0x04 0x00
4. Add $< PID, CID >_R$ to $\{< PID, CID >_i\}$ and refresh the neighbor list of $< PID, CID >_R :: PID$ node.
5. 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 ρ_R
   - received note ID NID_R
   - RSSI level Φ
2. If $\Phi < \Phi^*$ (Φ^* 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. Set round count: $\rho = \rho_R$

5. Set parent ID: $PID = NID_R$
6. Reply an acknowledge message with ρ, PID, and NID:
Message ID 0x01 [1B], ρ [1B], PID [1B], $< PID, NID >$ [2B]: e.g. 0x01 0x04 0x01 0x01 0x02
7. goto 1

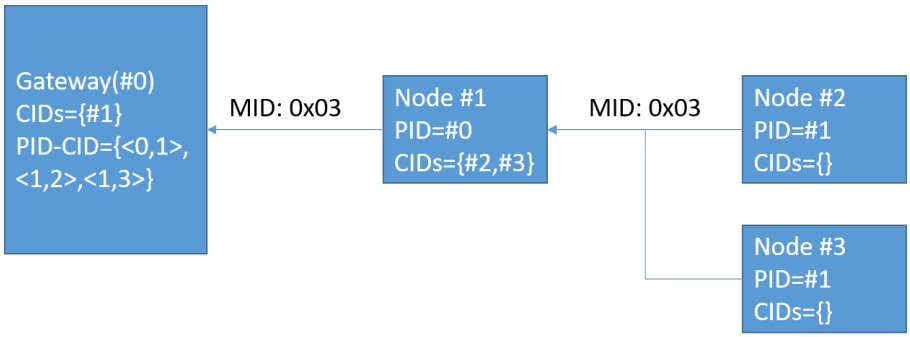
1.2.2 RX (N-Thread-1): Message ID 0x01

1. Get and parse the replied organization message (Message ID 0x01)
   - received round count ρ_R
   - received parent ID PID_R
   - received parent-child pair $< PID, CID >_R$
2. If $\rho_R \neq \rho$ or $PID_R \neq NID$, then goto 1
3. If $PID_R =< PID, CID >_R :: PID$, then reply an acknowledge message with ρ, NID:
Message ID 0x02 [1B], ρ [1B], NID [1B]: e.g. 0x02 0x04 0x01
4. Relay an acknowledge message with ρ, PID, and $< PID, CID >_R$:
Message ID 0x01 [1B], ρ [1B], PID [1B], $< PID, CID >_R$ [2B]: e.g. 0x01 0x04 0x00 0x01 0x02
5. goto 1

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

1. Get and parse the replied organization acknowledge message (Message ID 0x02)
   - received round count ρ_R
   - received parent ID PID_R
2. If $\rho_R \neq \rho$ or $PID_R \neq PID$, then goto 1
3. Broadcast an organization message with ρ, and NID:
Message ID 0x00 [1B], ρ [1B], NID [1B]: e.g. 0x00 0x04 0x01
4. goto 1

2 Upload Light Values



2.1 Gateway

2.1.1 RX (G-Thread-2): Message ID 0x03

1. Get and parse the light value message (Message ID 0x03)
   - received round count ρ_R
   - received parent ID PID_R
   - received node ID NID_R
   - received timestamp Sec_R, $NSec_R$
   - received light value L_R
2. If $\rho_R \neq \rho$ or $PID_R \neq NID$, then goto 1
3. Display light value "Sec_R s + $NSec_R$ nsec : NID_R's light value is L_R"
4. goto 1

2.2 Communication Node

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

1. Get and parse the light value message (Message ID 0x03)
   - received round count ρ_R
   - received parent ID PID_R
   - received node ID NID_R
   - received timestamp Sec_R, $NSec_R$
   - received light value L_R
2. If $\rho_R \neq \rho$ or $PID_R \neq NID$, then goto 1
3. Relay light value message with ρ, PID, NID, timestamp $Sec_R + NSec_R$, and L_t to parent:

Message ID 0x03 [1B], ρ[1B], PID [1B], NID_R [1B], Sec_R [4B], $NSec_R$ [4B], L_R [2B]
e.g. 0x03 0x04 0x00 0x02 0x19 0x90 0x11 0x23 0x19 0x88 0x10 0x25 0x11 0x23

4. goto 1

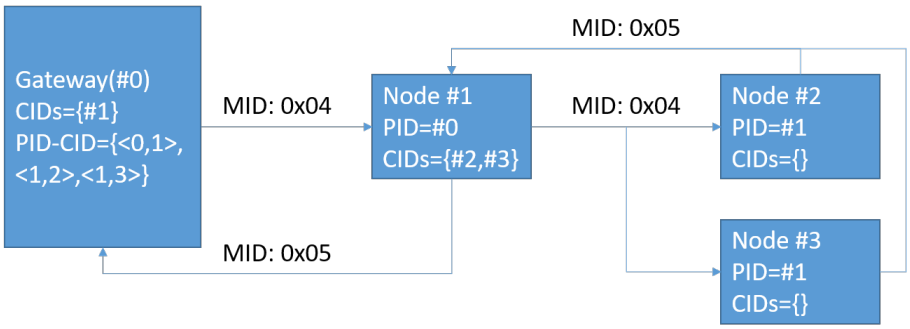
2.2.2 TX (N-Thread-2): Message ID 0x03

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. Send light value message with ρ, PID, NID, timestamp $Sec + NSec$, and L_t to parent:

Message ID 0x03 [1B], ρ[1B], PID [1B], NID [1B], Sec [4B], $NSec$ [4B], L_t [2B]
e.g. 0x03 0x04 0x01 0x02 0x19 0x90 0x11 0x23 0x19 0x88 0x10 0x25 0x11 0x23

4. goto 1

3 Configure Sample Rate [This can be done via broadcast]



3.1 Gateway

3.1.1 TX2 (G-Thread-3): Message ID 0x04

1. Give a new sample rate dt
2. Broadcast a sample rate message with ρ, NID, and dt (ms):

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

3.1.2 RX (G-Thread-2): Message ID 0x05

1. Get and parse the sample rate update message (Message ID 0x05)
   - received round count ρ_R
   - received parent ID PID_R
   - received node ID NID_R
   - received sample rate dt_R
2. If $\rho_R \neq \rho$ or $PID_R \neq NID$, then goto 1
3. Display sample rate update info "NID_R's sample rate changes to dt_R"
4. goto 1

3.2 Communication Node

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

1. Get and parse the sample rate message (Message ID 0x04)
   - received round count ρ_R
   - received parent ID PID_R
   - received sample rate dt_R
2. If $\rho_R \neq \rho$ or $PID_R \neq PID$, then goto 1 [No need to check PID_R with PID if using broadcast]
3. Set $dt = dt_R$
4. Reply a sample rate update message with ρ, PID, NID, and dt (ms):

Message ID 0x05 [1B], ρ[1B], PID [1B], NID [1B], dt [4B]: e.g. 0x05 0x04 0x01 0x02 0x19 0x90 0x11 0x23

5. Relay a sample rate message with ρ, NID, and dt (ms):

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

6. goto 1

3.2.2 RX (N-Thread-1): Message ID 0x05

1. Get and parse the sample rate update message (Message ID 0x05)
   - received round count ρ_R
   - received parent ID PID_R
   - received node ID NID_R
   - received light value dt_R
2. If $\rho_R \neq \rho$ or $PID_R \neq NID$, then goto 1
3. Relay sample rate update message with ρ, PID, NID_R, and dt_R to parent:
   Message ID 0x05 [1B], ρ[1B], PID [1B], NID_R [1B], dt_R [4B]: e.g. 0x05 0x04 0x00 0x02 0x19 0x90 0x11 0x23
4. goto 1

4 Message Protocol

ID	Code	Length	Note	Directions	Need Relay
0x00	0x00 [1], ρ [1], NID [1]	3	Organization Message	Parent $\rightarrow$ Child	Y
0x01	0x01 [1], ρ [1], PID [1], $< PID, NID >_{(R)}$ [2]	5	Organization Message Reply	Child $\rightarrow$ Parent	Y
0x02	0x02 [1], ρ [1], NID [1]	3	Organization Message Reply Ack	Parent $\rightarrow$ Child	N
0x03	0x03 [1], ρ [1], PID [1], $NID_{(R)}$ [1], $Sec_{(R)}$ [4], $NSec_{(R)}$ [4], $L_{t/R}$ [2]	14	Light Value Message	Child $\rightarrow$ Parent	Y
0x04	0x04 [1], ρ [1], NID [1], dt [4]	7	Sample Rate Message	Parent $\rightarrow$ Child	Y
0x05	0x05 [1], ρ [1], PID [1], $NID_{(R)}$ [1], $dt_{(R)}$ [4]	8	Sample Rate Updated Message	Child $\rightarrow$ Parent	Y