

1 Dynamic Beacon Scheduling Algorithm

The interval I between consecutive beacon transmissions is computed as:

$$I = I_{\text{base}} - I_{\text{contact}} + I_{\text{density}} \quad (1)$$

where:

$$I_{\text{base}} = I_{\text{min}} + 0.7 \cdot (I_{\text{max}} - I_{\text{min}}) \quad (2)$$

$$I_{\text{contact}} = 0.5 \cdot C_s \cdot (I_{\text{base}} - I_{\text{min}}) \quad (3)$$

$$I_{\text{density}} = 0.6 \cdot D_f \cdot (I_{\text{max}} - I_{\text{base}}) \quad (4)$$

The contact score C_s measures recency of neighbor communication:

$$C_s = \max\left(0, 1 - \frac{\Delta t}{20}\right) \quad (5)$$

where Δt is time (in seconds) since most recent neighbor contact. The density factor D_f reflects local network congestion:

$$D_f = \min\left(1, \frac{N}{15}\right) \quad (6)$$

where N is the number of neighbors in communication range. The final interval I_{final} is computed as:

$$I_{\text{final}} = \max(I_{\text{min}}, \min(I, 0.9 \cdot (I_{\text{max}} - I_{\text{min}}))) \quad (7)$$