Weekly Report (2010-03-11)

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I. Theoretical Lower Bound for Time Complexity

- **Network Density**: The network density may not be enough to characterize the difficulty of link scheduling under the SINR model. The location information of each node is also important.
- With further calculation, the network density related bound in last report is not meaningful. That bound is derived by calculating the maximum number X of nodes that can be simultaneously scheduled in a circle of radius R. Suppose the actual number of nodes in that circle is Δ, then Δ/X should be the lower bound of scheduling latency of that region. If we further let Δ to be n and R to be network radius, then we get the lower bound for time complexity.

  However, the problem is that X is larger than $\pi R^2\rho$ or $\frac{2\pi R^2}{\sqrt{3}}+\pi R+1$, which is the maximum possible number of nodes in a circle of radius R.

$$\frac{P/r^\alpha}{N_0} = \beta$$
$$\Rightarrow P = N_0\beta r^\alpha$$

$$\frac{P_M/d^\alpha}{N_0+(X-1)P/(d+R)^\alpha} \geq \beta$$
$$\Rightarrow X \leq 1 + \frac{P_M(1+R/d)^\alpha - (d+R)^\alpha N_0\beta}{N_0\beta^2 r^\alpha}$$
$$\Rightarrow X \leq 1 + \frac{P_M(1+R/r)^\alpha - (r+R)^\alpha N_0\beta}{N_0\beta^2 r^\alpha}$$

X is proportional to $(1+R)^\alpha$ while Δ is proportional to R^2. $\alpha \in (2,6)$.

II. SINR-based Connected Dominating Set Construction

The construction of a connecting dominating set consists of two steps:

- *Spanning Tree Construction*: We can address our *SINR* and *Energy-Efficient* feature in the construction of spanning tree. For the case without interference cancellation, we can construct a Minimum-Spanning-Tree (*MST*) rooted at the sink. The weight of each link i is $1/d_i^\alpha$, where d_i is the link length. Then the *MST* should induce a lower energy complexity.
- *Node Coloring*: Up to now, there have been no better algorithm that can achieve smaller link spanning ratio and constant node degree at the same time compared with *Prof. Wan*'s paper.