BIRZEIT UNIVERSITY
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Department of Electrical and Computer Engineering

Wireless and Mobile Networks, ENCS5323

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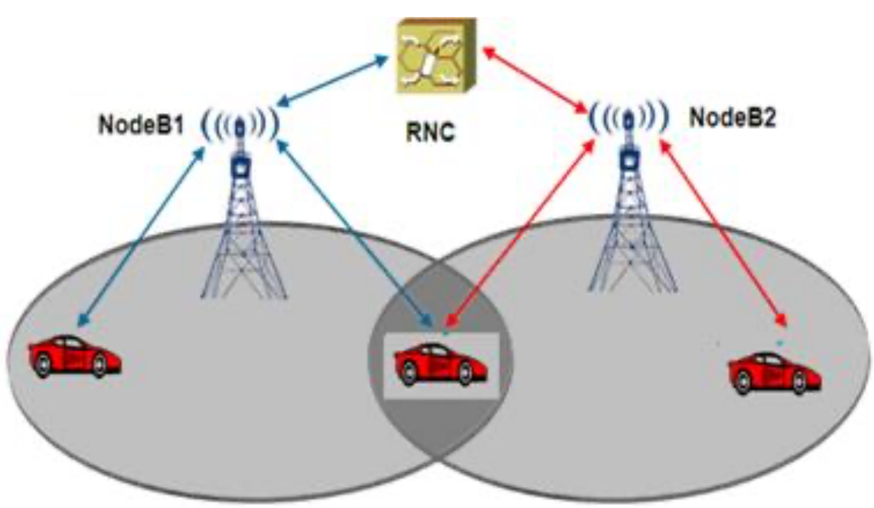
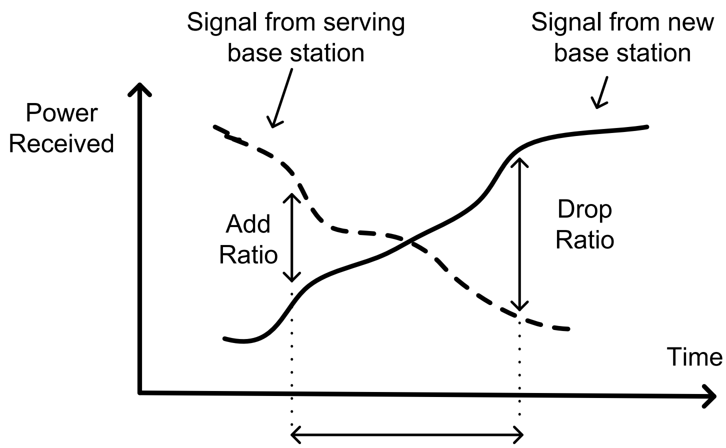
Working Sheet #3

Problem #1:

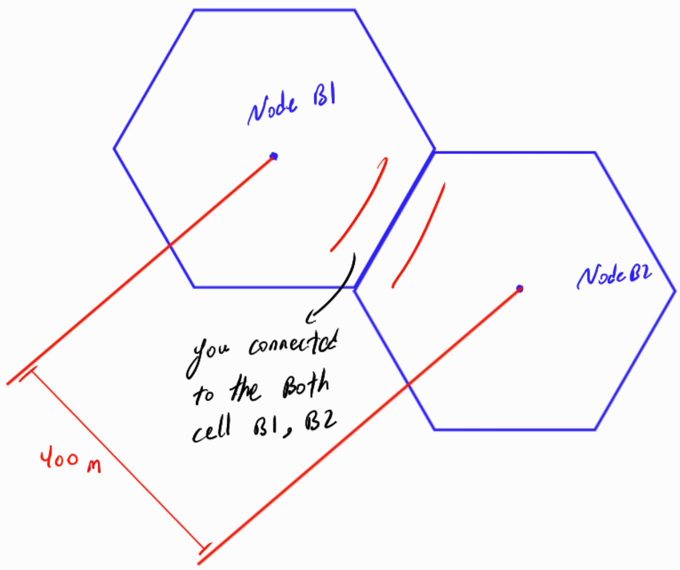
In a 3G network, a connected mobile is moving from NodeB1 (serving base station) to NodeB2 (new base station). A mobile is served by two base stations if the ratio between the power received from NodeB2 to the power received from NodeB1 exceeds 70%. Then, one of the two serving base stations will be dropped, if the ratio of the power received from one of them (NodeB1) to the other one (NodeB2) decreases below 50%. Assume the distance between the two base stations is 400 meters, the power measured at d_o=20 is 7dBm and the path loss exponent is 3.

a) Determine the distance from NodeB1 at which two base stations will start serving the Mobile Terminal.
b) Determine the Power received from NodeB1 at that distance
c) Determine the Power received from NodeB2 at that distance
d) Verify the ratio





Soft-handover: signal will be received from two base stations



* $\frac{P_{r,\,Node\,B2}}{P_{r,\,Node\,B1}} \geq 0.7$

then Both node are serving

* $\frac{P_{r,\,node\,B1}}{P_{r,\,node\,B2}} \leq 0.5$

then drop B1 , keep B2

* $P_r(d_0 = 20) = 7\ dbm$
$= 10^{-2.3}\ watt$

$n = 3$

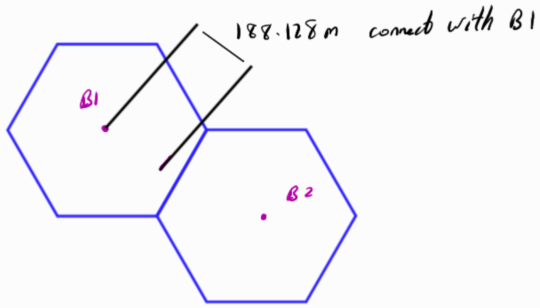
ⓐ

$$\frac{P_r(B_2)}{P_r(B_1)} = \frac{P_r(d_0)\left(d_0/[400-d_1]\right)^n}{P_r(d_0)\left(d_0/d_1\right)^n} = \left[\frac{d_1}{400-d_1}\right]^n$$

Hence $\left[\frac{d_1}{400-d_1}\right]^3 \geq 0.7$

$$d_1 \geq (0.7)^{\frac{1}{3}}\left[400-d_1\right]$$

then $d_1 \geq 188.128$



ⓑ

$$P_r(B1)\Big|_{d_1=188.125\,m} = 10^{-2.3}\left(\frac{20}{188.125}\right)^3 = 6.022 * 10^{-6}\ watt$$

ⓒ

$$P_r(B_2)\Big|_{d_1=188.125\,m} = 10^{-2.3}\left(\frac{20}{400-188.125}\right)^3 = 4.2155 * 10^{-6}\ watt$$

(e) $\frac{P_r(B_2)}{P_r(B_1)} = 0.7$ that mean our solution

(f) Determine the distance from B_1 at which the moving will be served by B_2 only. [MT moving from B_1 to B_2].

$$\frac{P_r(B_1)}{P_r(B_2)} = \frac{P_r(d_0)\,(d_0/\ d_3\ )^n}{P_r(d_0)\,(d_0/[400-d_3])^n} = \left[\frac{400-d_3}{d_3}\right]^n$$

Hence $\left[\frac{400-d_3}{d_3}\right]^3 < 0.5$

$$400 - d_3 < (\tfrac{1}{2})^{\frac{1}{3}}\ d_3$$

$$400 < [1 + (0.5)^{\frac{1}{3}}]\ d_3$$

$$223 < d_3$$