Intelligent Cooperative Ad-Hoc Mesh Networks

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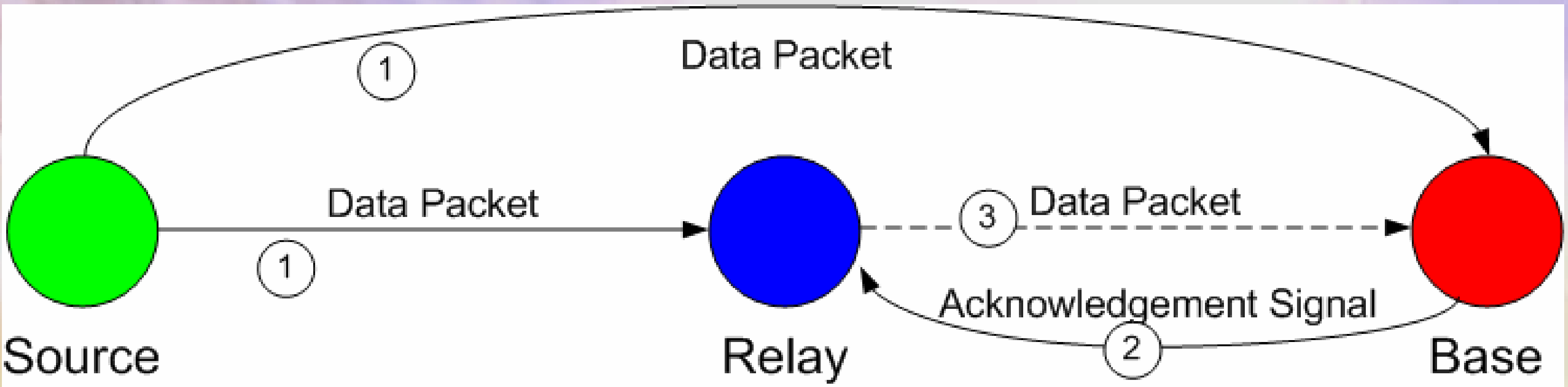


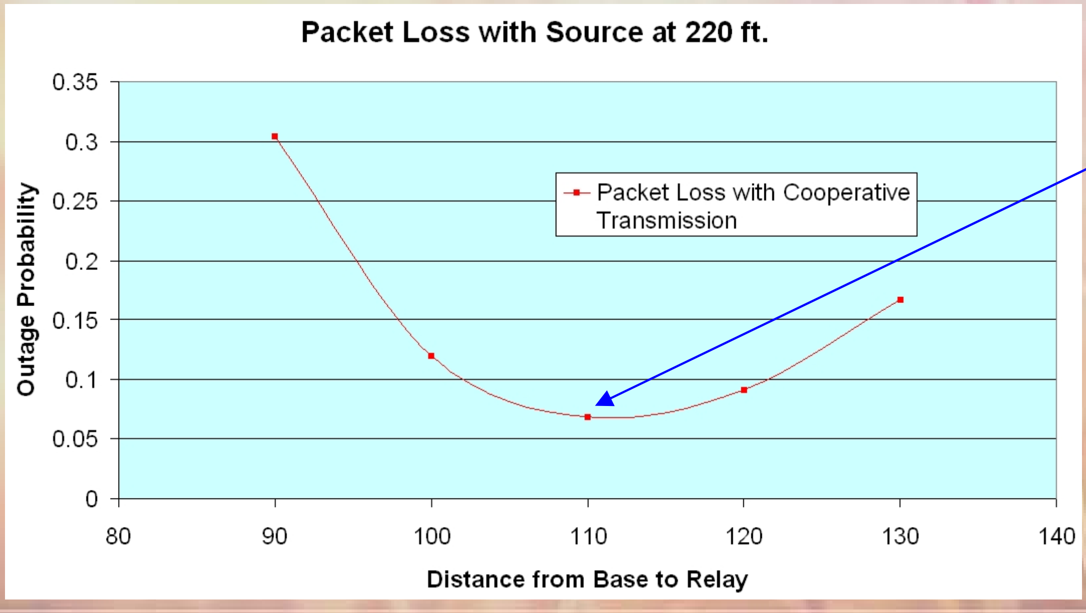
1) Source transmits data packet to Relay and Base every *t* milliseconds.
2) Base signals to the Relay if it has successfully received a packet from the Source.
3) Relay retransmits packet to the Base only if it has not received the acknowledgement signal from the Base within *t*/2 milliseconds.

Formulation and Solution for the Constrained Optimization Problem

$$P_{oc}(r_{sd}, r_{sl}, r_{ld}) = \left(1-\exp\left(-\frac{N_o \gamma r^{\eta}_{sd}}{KP_{TC}}\right)\right)\left(1-\exp\left(-\frac{N_o \gamma (r^{\eta}_{sl} + r^{\eta}_{sd})}{KP_{TC}}\right)\right)$$

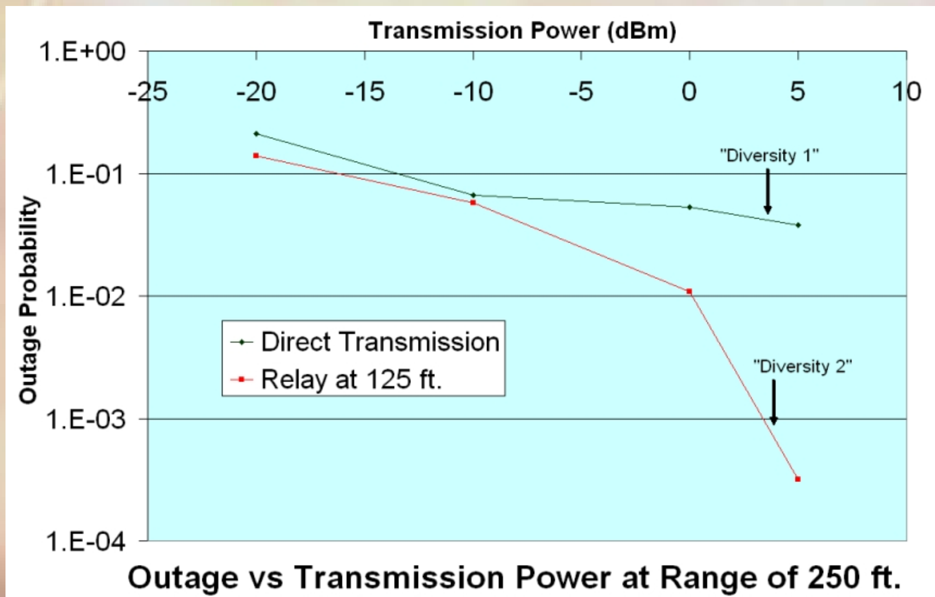
$$r^{*}_{sl} = \arg\min_{r_{sl}} P_{oc}(r_{sd}, r_{sl}), \forall\, 0 \le r_{sl} \le r_{sd}$$

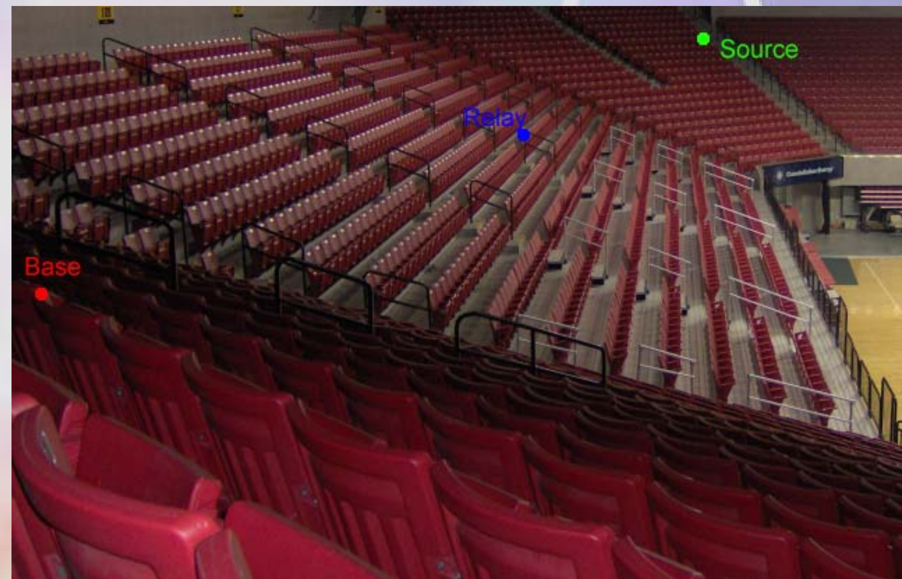
$$\text{Solution: } r^{*}_{sl} = \frac{r_{sd}}{2} \quad \textit{for } \eta > 1$$



The optimal position is at 220/2 = 110 feet.

- Fixed power of base
- Tested both direct- and cooperative- mode transmission at power levels of -20, -10, 0, and 5 dBm.





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- Observed diversity 1 in direct-mode
- Observed diversity 2 in cooperative-mode

- Theoretical optimal positioning of the relay is affected by fading, and is most accurate in areas free from these effects
- Transmission reliability increases with power level faster in a cooperative system
- Future work will focus on implementing systems with more than one relay that intelligently select a single relay to forward data