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# On Resource Allocation in Cooperative Relaying

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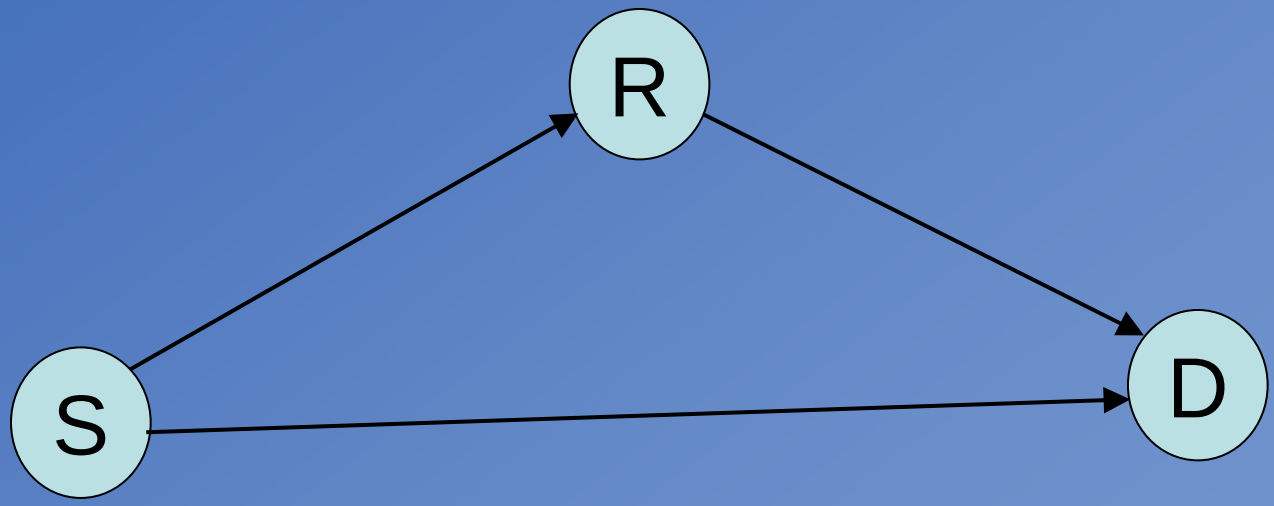
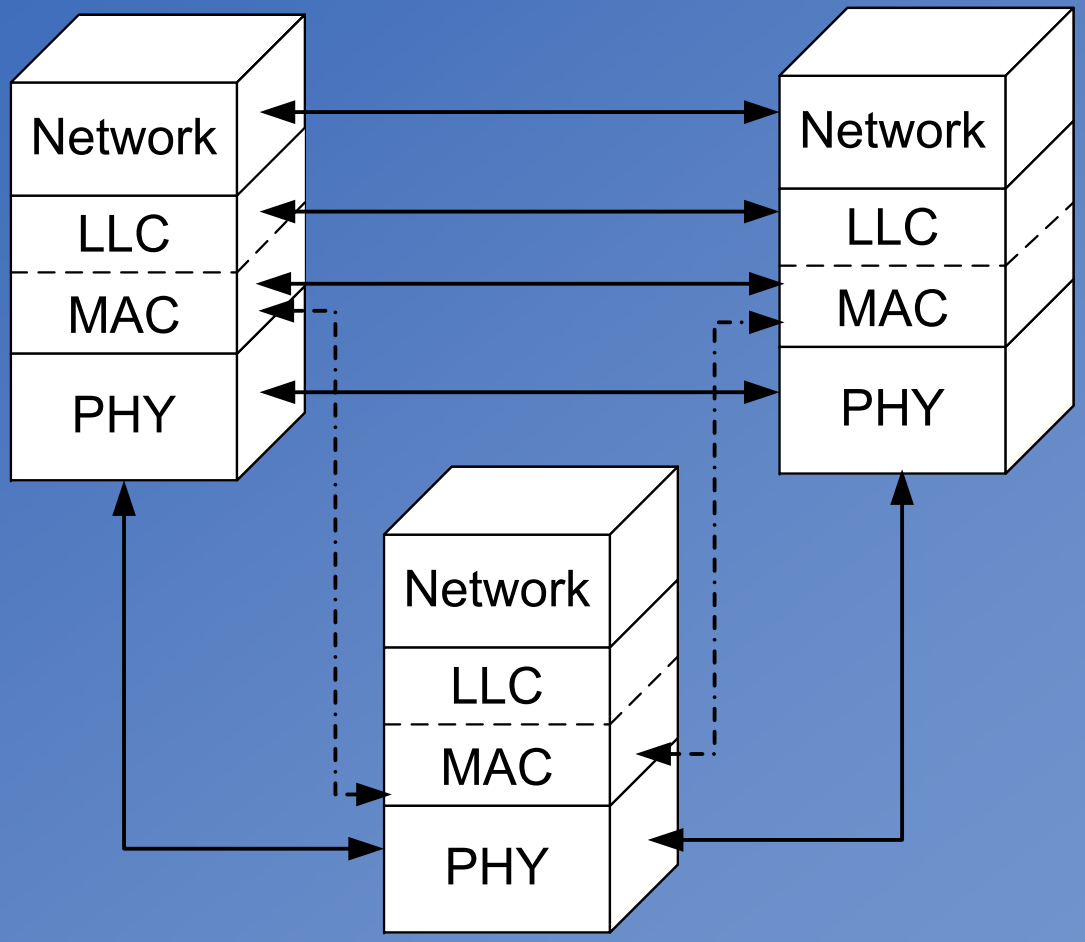
# Cooperative Diversity

Form of space diversity with distributed transmission and signal processing



# Cooperative Relaying



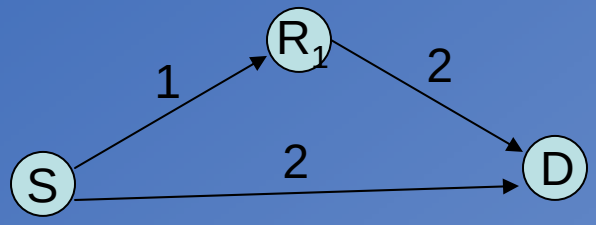
# Cooperative Relaying

## Deterministic

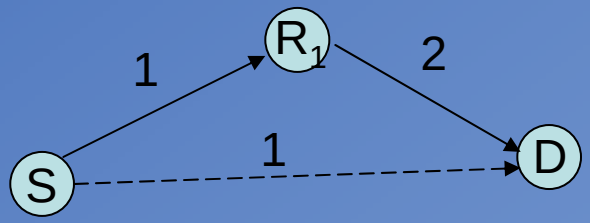
Predefined usage of coop. relays

**Improve SNR (long term)**

Simultaneous transmission



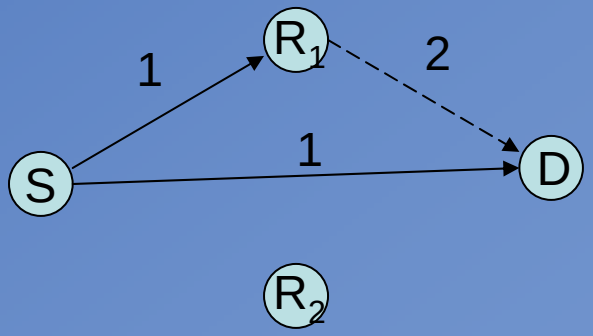

Sequential transmission (MAC routing)



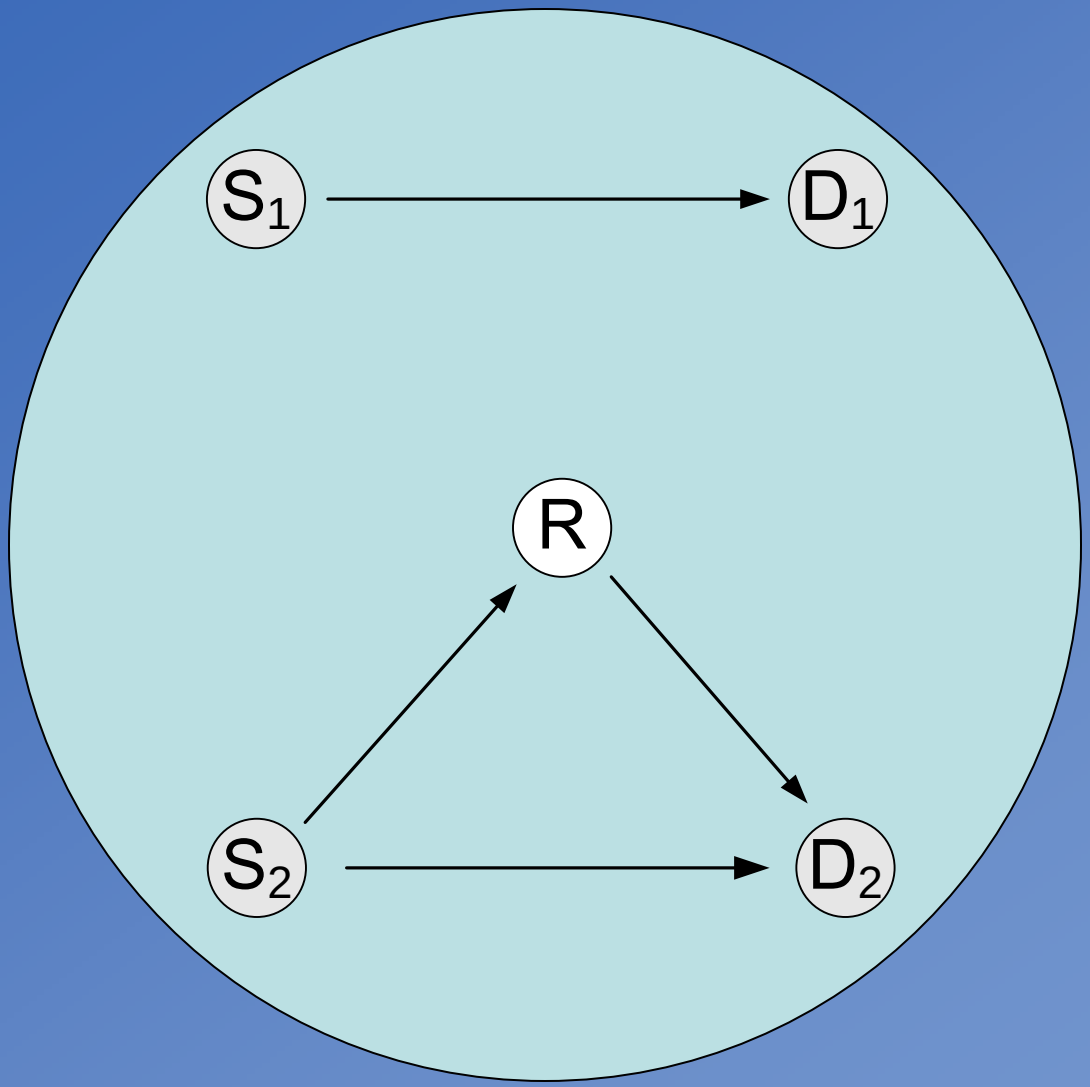

## Probabilistic

Use only if direct transmission fails

**Mitigate small-scale fading (short-term)**



# Cooperative Interference



## — So what is with resource allocation for Probabilistic Cooperative Relaying?

On one side:

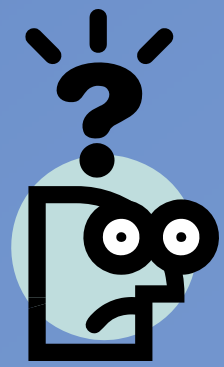
Relaying should be relative fast
(otherwise time-diversity might work just fine)

⇨ Allocate resources for relaying to avoid contention / collisions

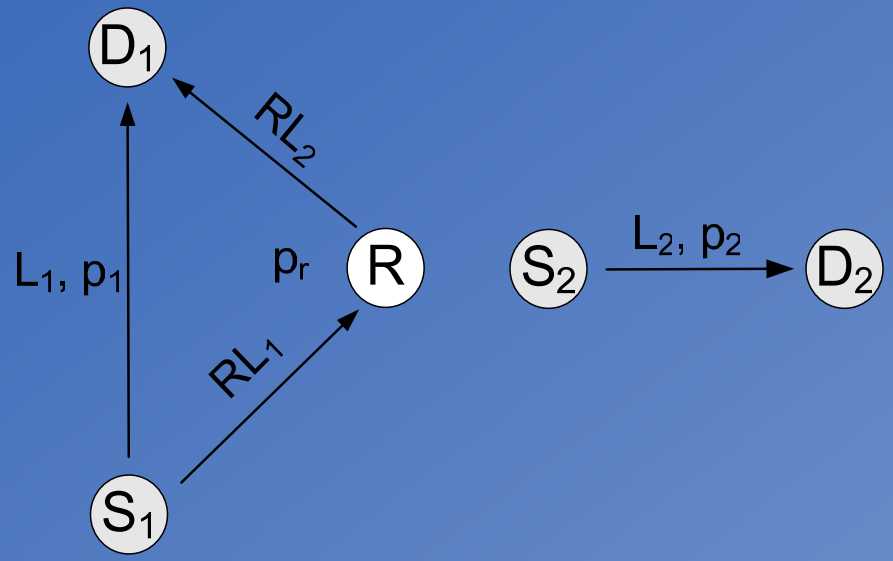
But on the other side:

If direct communication succeeds – resources allocated for relaying are wasted

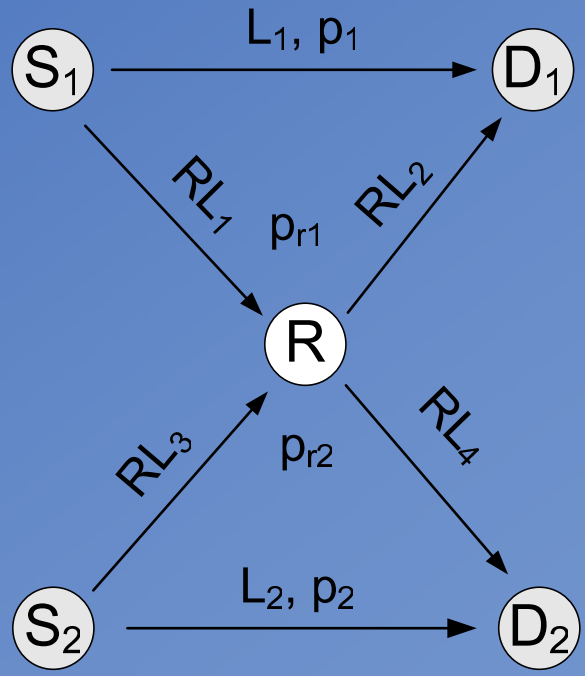
⇨ Do not allocate resources to avoid their waste



## Scenario A




## Scenario B




N. Marchenko, C. Bettstetter and Evsen Yanmaz,
"*On Resource Allocation in Proactive Cooperative Relaying*", CoCoNet'09

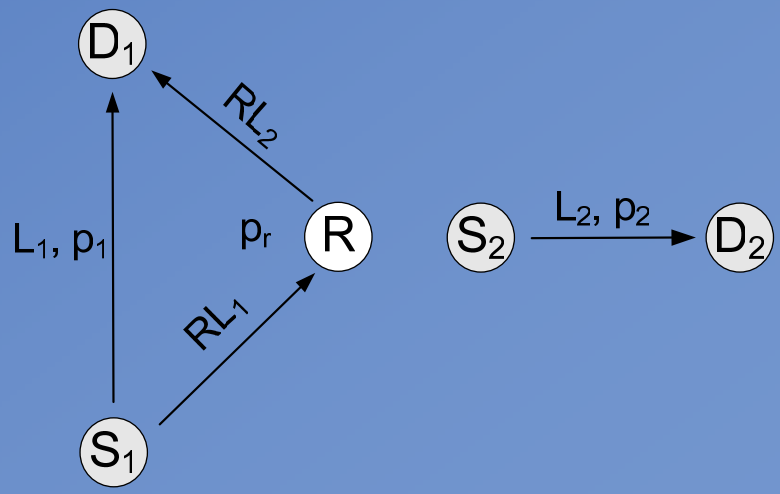
# Overall Throughput

(1) $$T = T_1(1-p_1)+T_2(1-p_2)$$

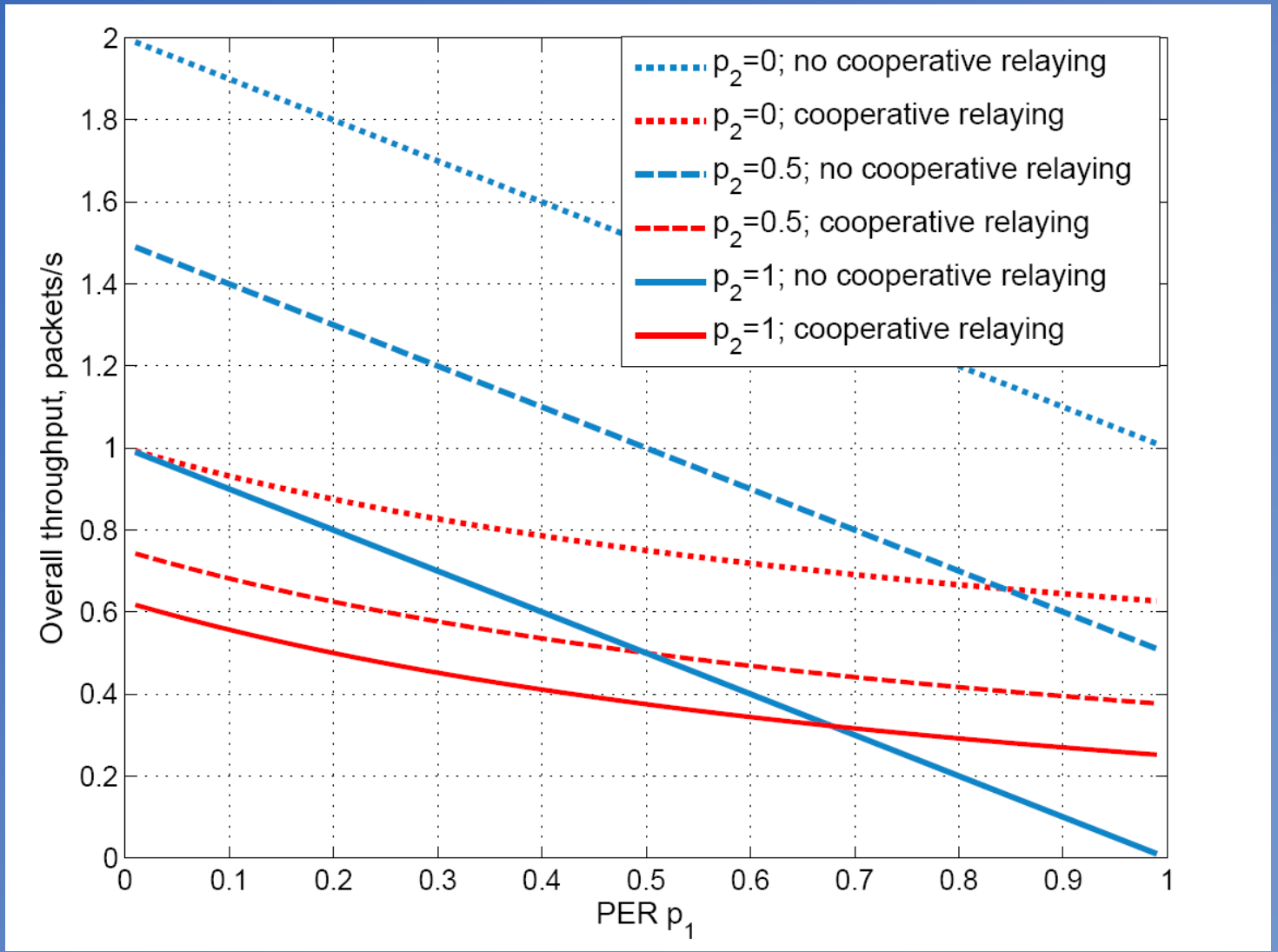
(2) $$T_A = \frac{1}{2}\left(T_1(1-p_1)+T_2(1-p_2)\right)+\frac{1}{2}\frac{T_1}{\alpha}\left((1-p_1)+\frac{1}{2}p_1(1-p_r)\right)$$

(3) $$p_r = 1-(1-p_{RL_1})(1-p_{RL_2})$$

(4) $$\alpha = 1+p_1$$

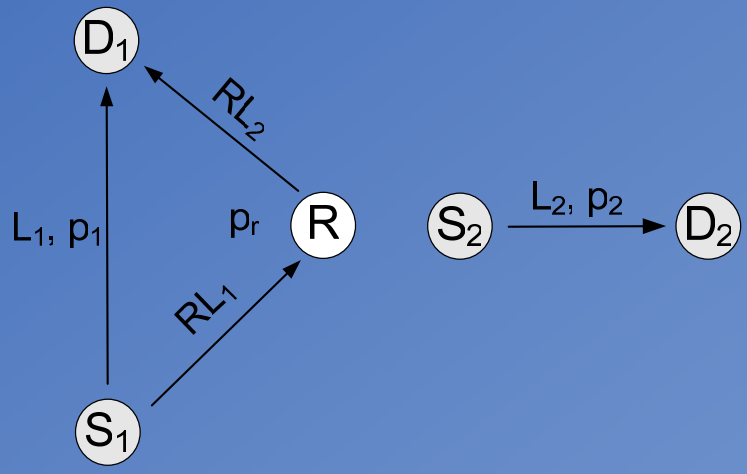


# Overall throughput



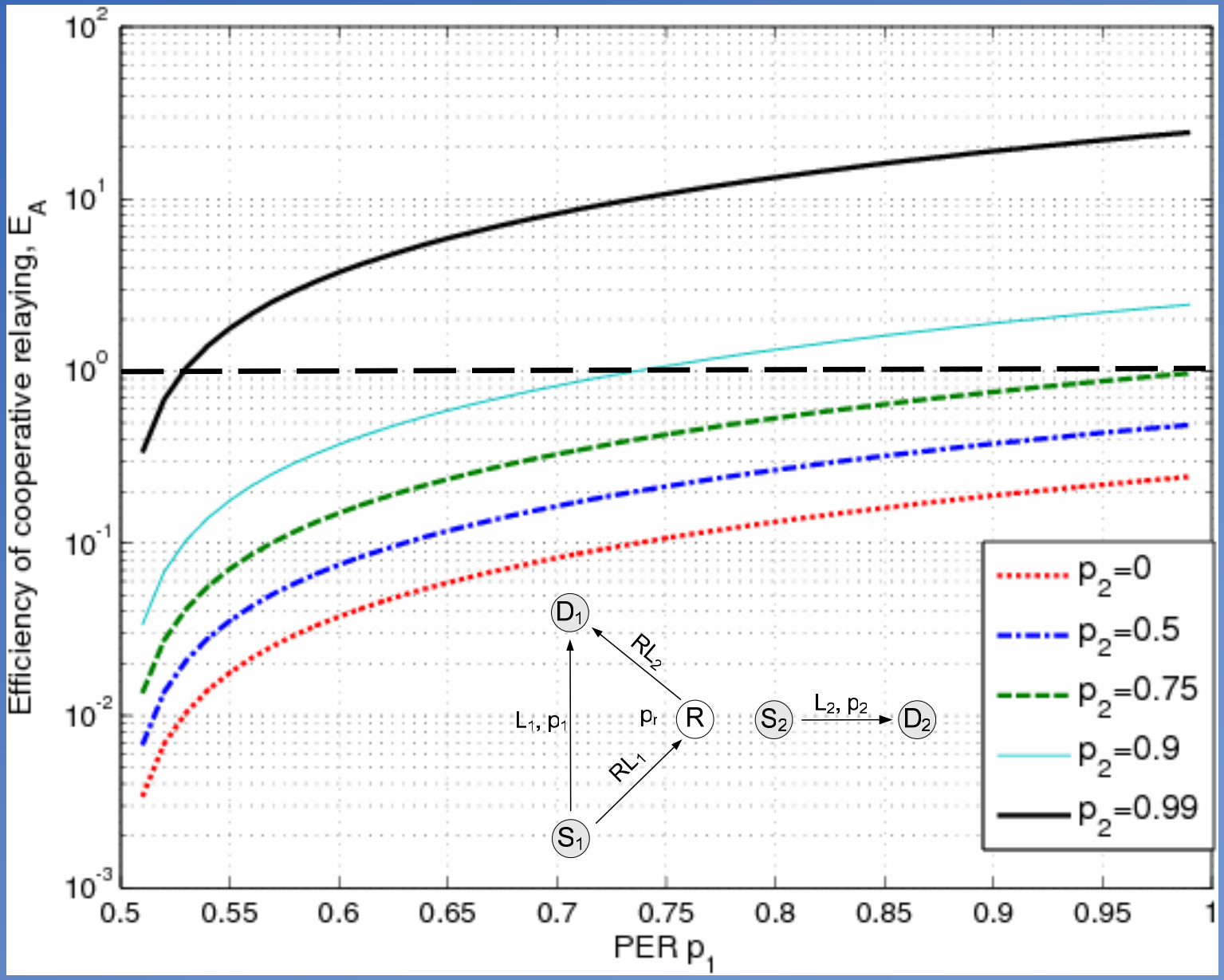
## Efficiency of resource utilization

$$(5)\quad E_A = -\frac{T_{D_1}^{CR} - T_{D_1}}{T_{D_2}^{CR} - T_{D_2}}, \quad T_{D_1}^{CR} \geq T_{D_1}$$

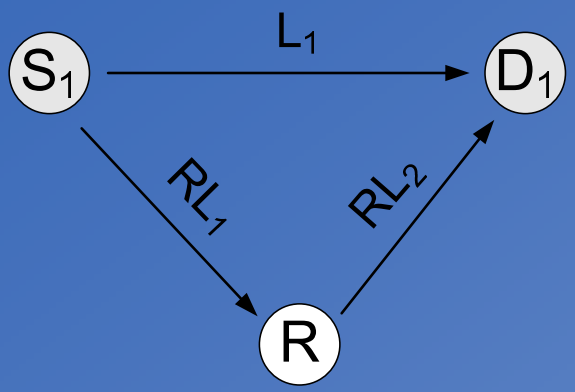


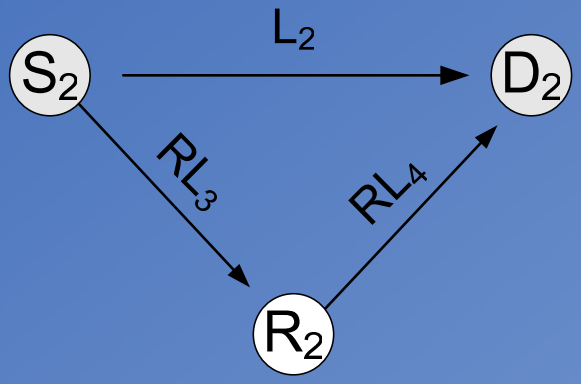

| Value of $E_A$ | Explanation |
|---|---|
| $E_A > 1$ | CR improves $L_1$ more than degrades $L_2$ |
| $E_A = 1$ | CR improves $L_1$ and degrades $L_2$ equally |
| $0 < E_A < 1$ | CR improves $L_1$ but degrades $L_2$ more |

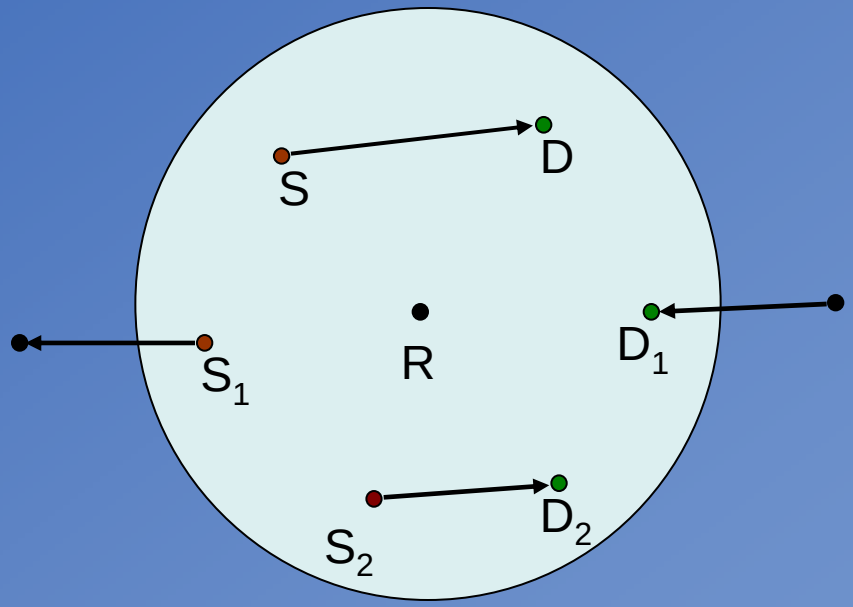
# Efficiency of CR



# Select a relay by additional traffic information




1. Report traffic info around R to the relay selecting authority (S or D)

**or / and**

2. Incorporate traffic info in nomination probability of the node R for cooperation

# Thanks!