

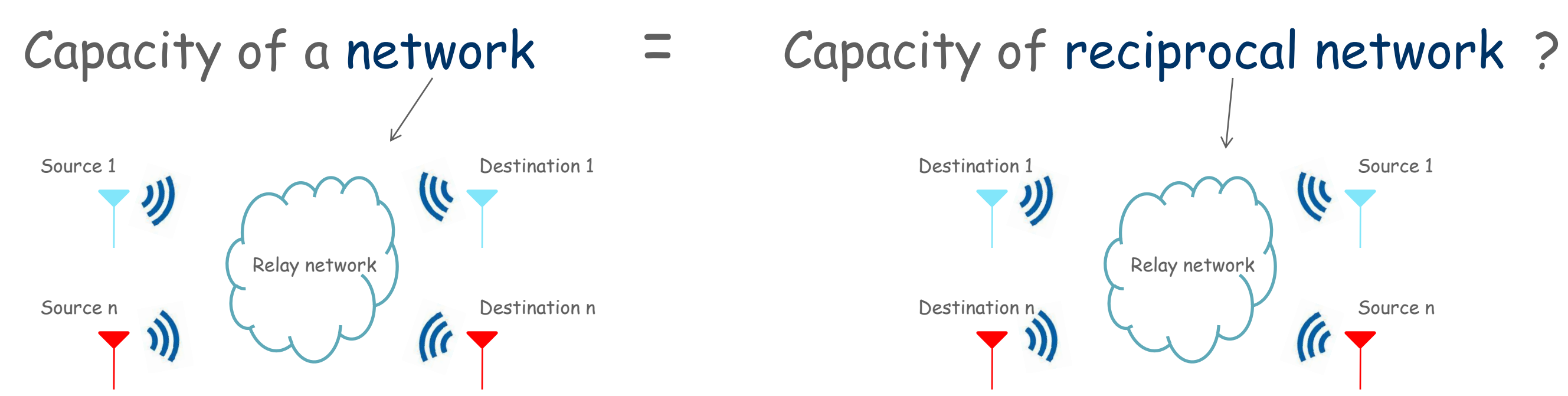


Reciprocity in Wireless Networks

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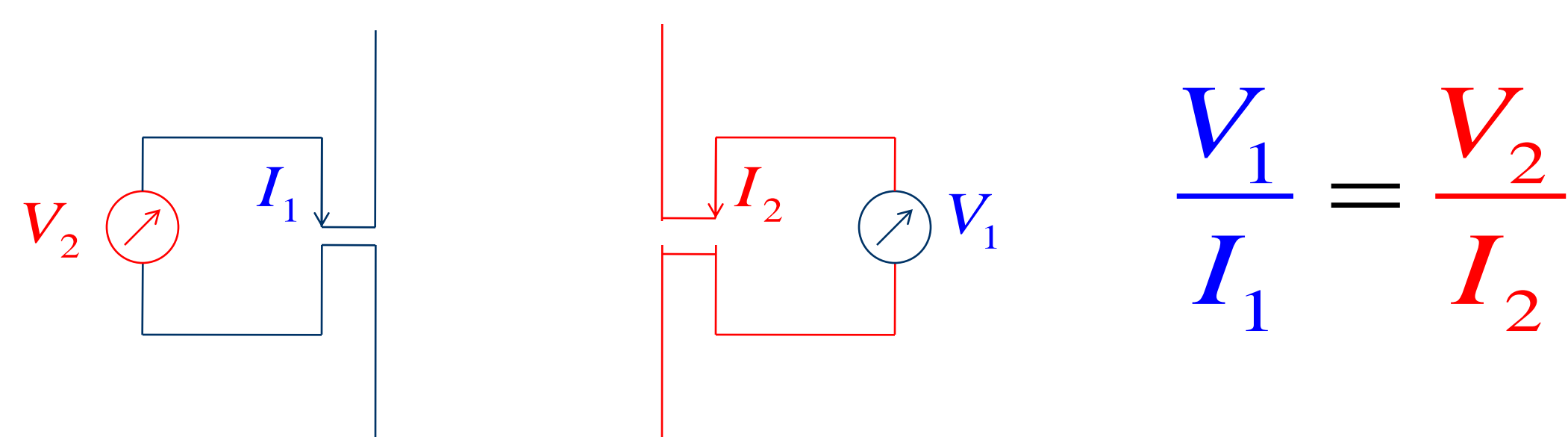


Are wireless networks reciprocal ?

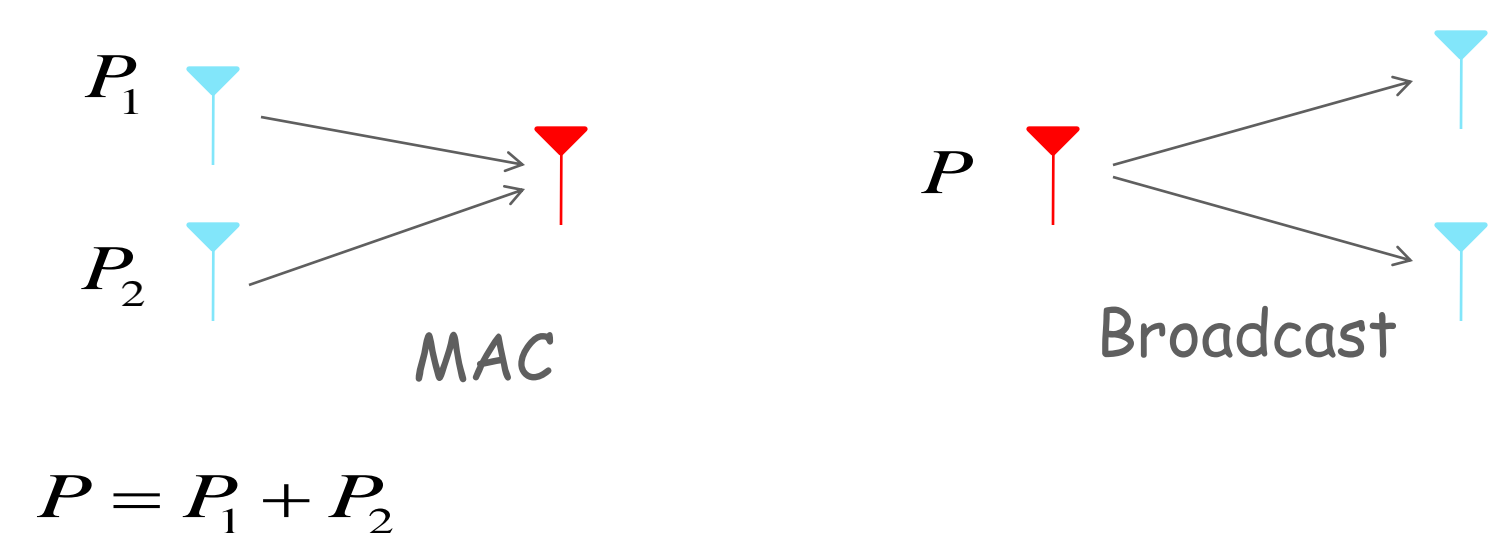


Electromagnetic Reciprocity

Fundamental reciprocity from Maxwell's Equations



Uplink-Downlink Duality



Capacity same under transmit sum power constraint

Other Instances of *Approximate* Reciprocity

Relay network



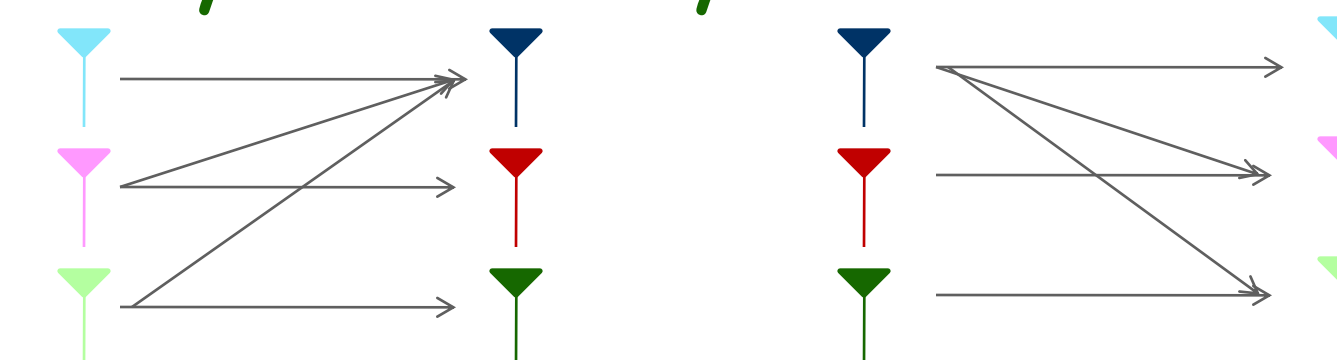
- Capacity within constant bit of cut-set bounds [Avestimeher et al. 2008]
- Cut-set bounds are reciprocal

Two-user interference channel



- Capacity within 1 bit gap [Etkin et al. 2007]
- Also shows reciprocity

One-to-many and Many-to-one interference channel



- Capacity within constant bit gap [Bresler et al. 2008]
- Also shows reciprocity

Interference channel with source cooperation and interference channel with destination cooperation



- Capacity within constant bit gap [Prabhakaran et al. 2008]
- Also shows reciprocity

A Result



"Linear deterministic network under linear coding is reciprocal"

Why linear deterministic network (LDN) ?

- Simplified model to understand wireless networks
- Noiseless - An approximation at high SNR
- Captures key wireless features - interference and broadcast

Is linear coding enough?

- Most known schemes translate as linear schemes for LDN
Eg. Han-Kobayashi scheme, Interference alignment



Is there a fundamental law of reciprocity in Gaussian wireless networks



- Strong indication to believe that there is
- Unearthing it would help understand wireless networks better

