

Radio Frequency Energy Harvesting in Cooperative Networks

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Wireless Networks

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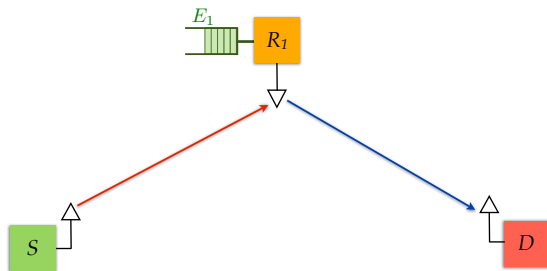
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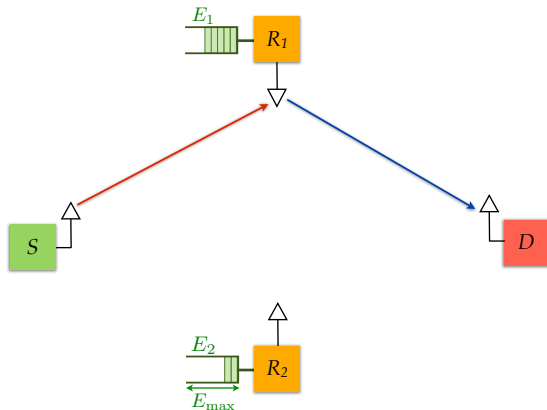
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- Assumptions: perfect Channel State Information (CSI), constant power P_S from the source.

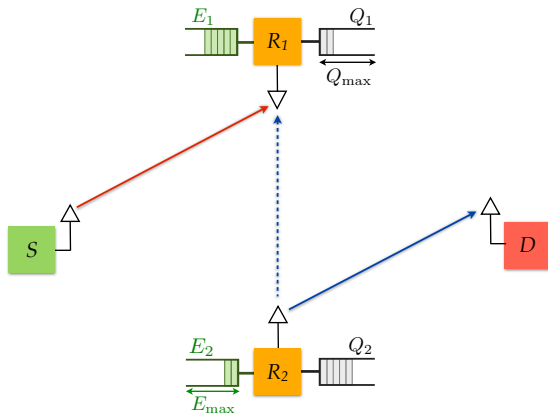
Amplify & Forward (AF) HD **single**-relay network.

-  I. Krikidis, S. Timotheou and S. Sasaki (Nov. 2012)
“RF Energy Transfer for Cooperative Networks: Data Relaying or Energy Harvesting?”
IEEE Commun. Letters vol. 16, pp. 1772–1775.

(N1) Amplify & Forward (AF) HD two-relay network.



(N2) Decode & Forward (DF) HD two-relay network.



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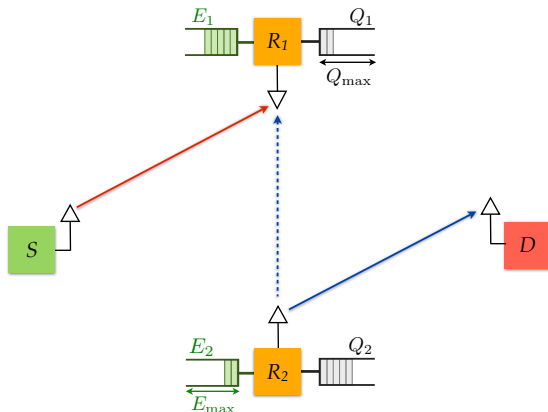
Genie-aided benchmarks

Scheduling Policies

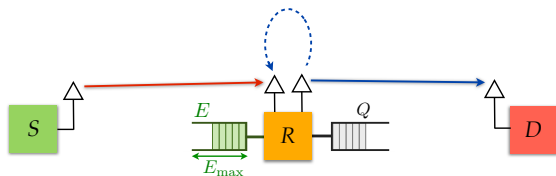
Numerical Results

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- (N2) Decode & Forward (DF) HD two-relay network.
 (N3) DF HD two-relay network without TDMA.



(N4) FD single-relay network.



- Single battery
- Single data queue

- Benchmarks for networks (N1) - (N4)
- CSI known a-priori for the whole transmission period
- Maximize throughput under constraints
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- MILP for AF HD two-relay network (N1):

$$\max_{x_i} \sum_{t=1}^T \sum_{i=1}^2 x_i(t)$$

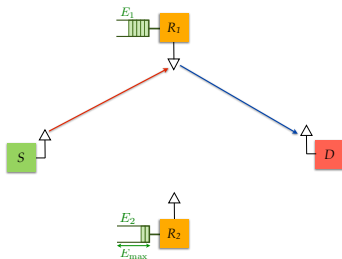
$$\text{s.t. } E_i(t+1) \leq E_i(t) - x_i(t)\epsilon_i(t) + \zeta((1-x_i(t))\epsilon_i^r(t) + x_k(t)\epsilon_{ki}^R(t)),$$

$$x_1(t) + x_2(t) \leq 1,$$

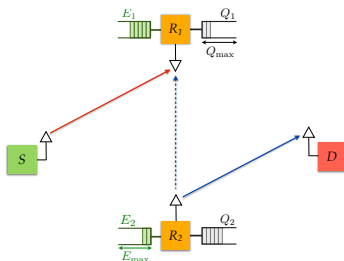
$$\gamma_i x_i(t) \leq \epsilon_i^r(t),$$

$$x_i(t) \in \{0, 1\}, 0 \leq E_i(t) \leq E_{max}.$$

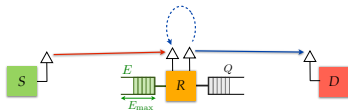
- AF scheduling policy (AFP) for (N1).



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- Priority of Transmission Policy (PoTP) for (N3) and (N4).



- Comparison of the different networks with their scheduling policies and genie-aided benchmarks.

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- Average throughput graphs for lower transmitted power P_S from the source and an outage probability graph for higher P_S .

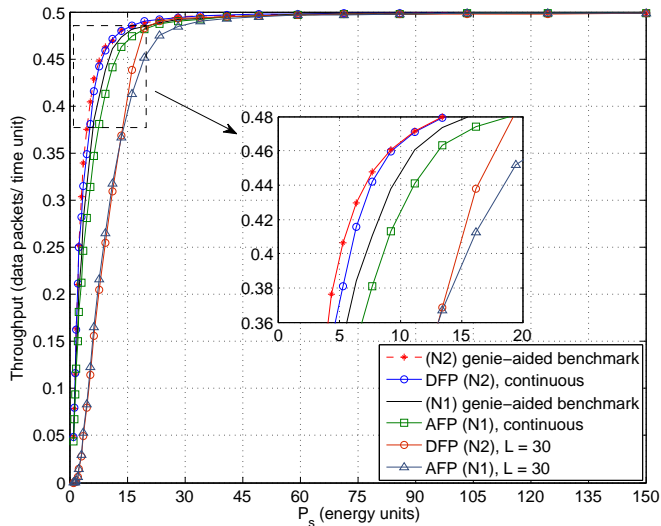


Figure : AFP (N1) and DFP (N2) with their respective genie-aided benchmarks.

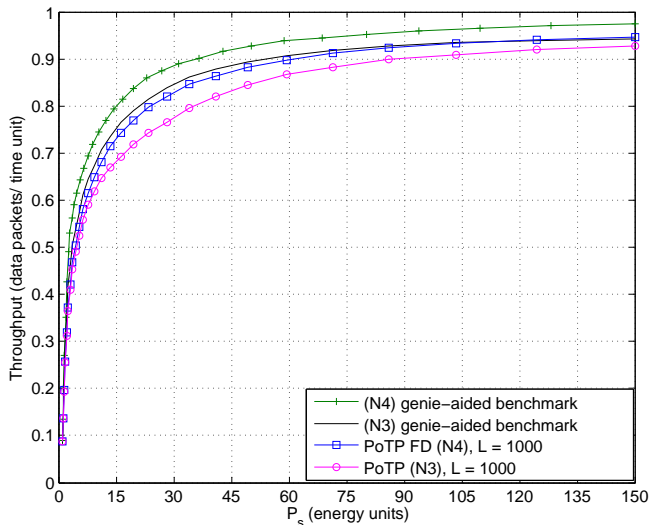


Figure : The FD single-relay network (N4) and HD two-relay network (N3) using PoTP and their genie-aided benchmarks.

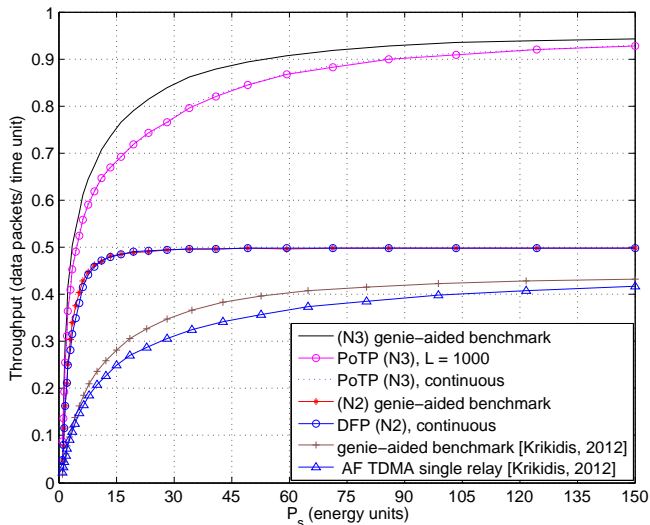


Figure : (N2), (N3) as well as the reference curve from [Krikidis, 2012] with their respective genie-aided benchmarks.

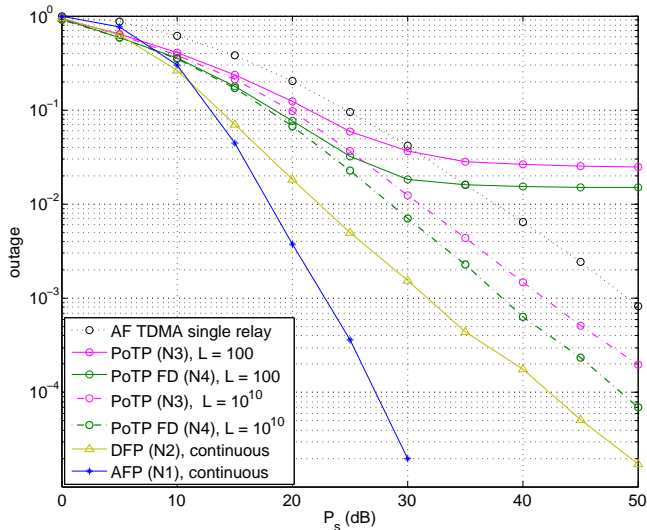


Figure : The outage probability for (N1)-(N4) as well as the reference curve.

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 - AFP useful for delay-sensitive applications.
 - FD single-relay network (N4) outperforming the other networks.