

Mar 27th, 2014. ITG Workshop, Hamburg.

Cooperative Relaying in Large Scale Networks

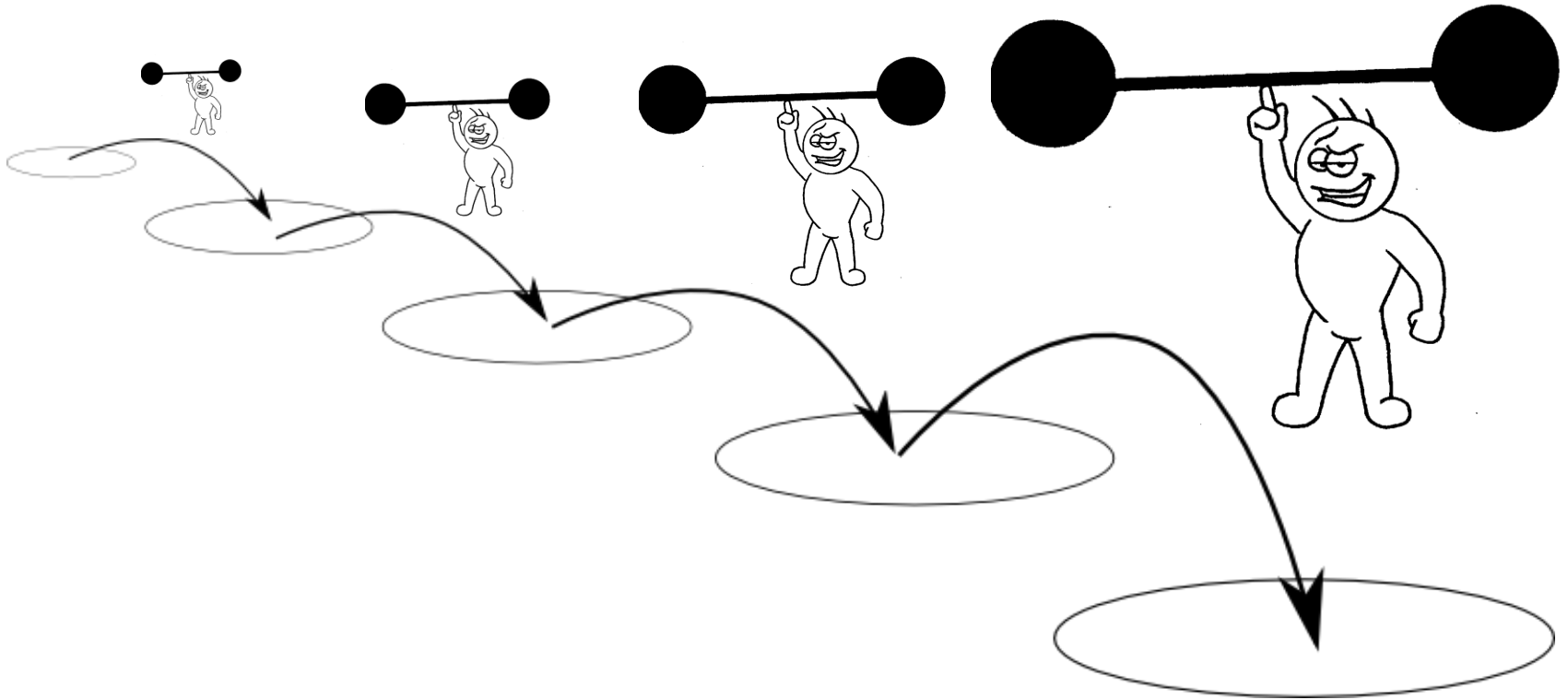


ALPEN-ADRIA
UNIVERSITÄT
KLAGENFURT | WIEN GRAZ

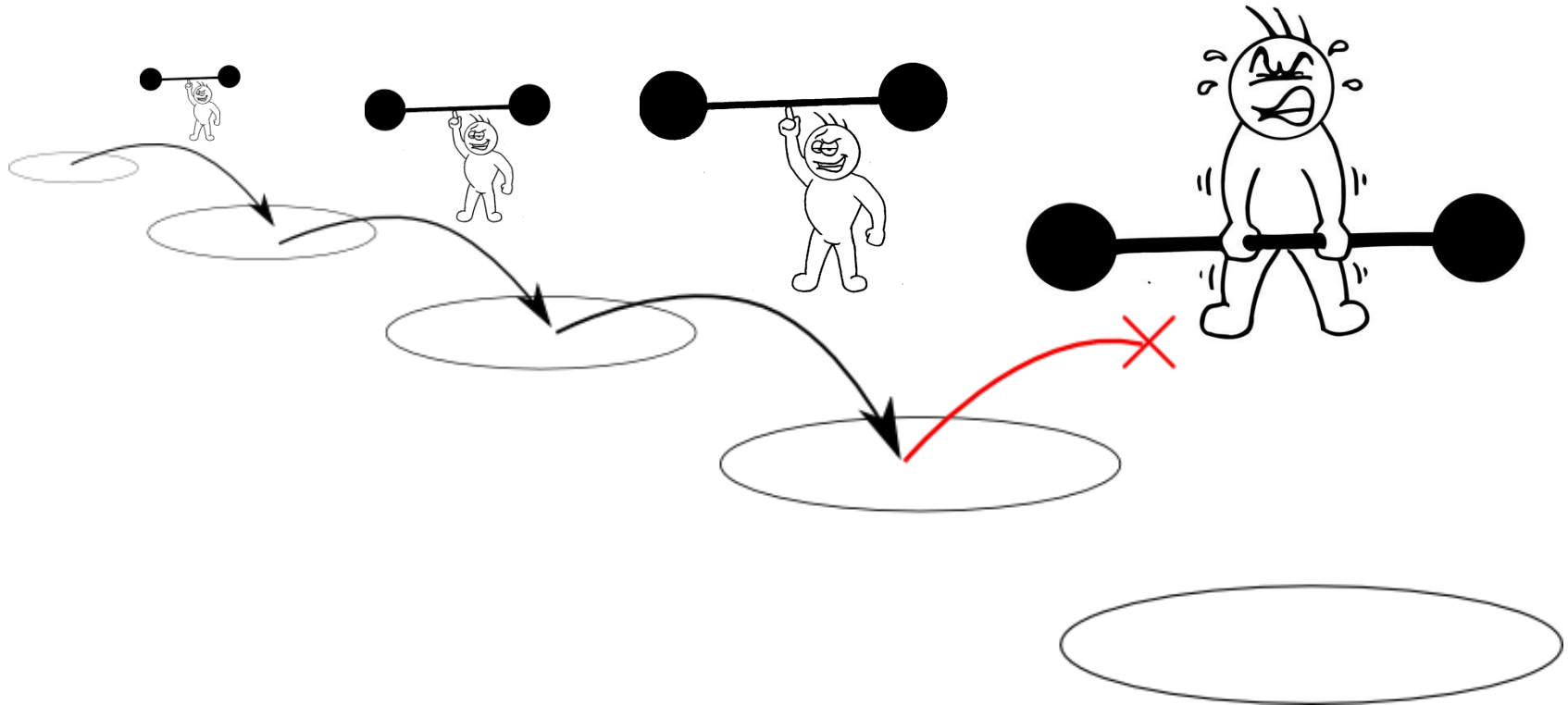
Torsten Andre

Networked and Embedded Systems, University of Klagenfurt, Austria

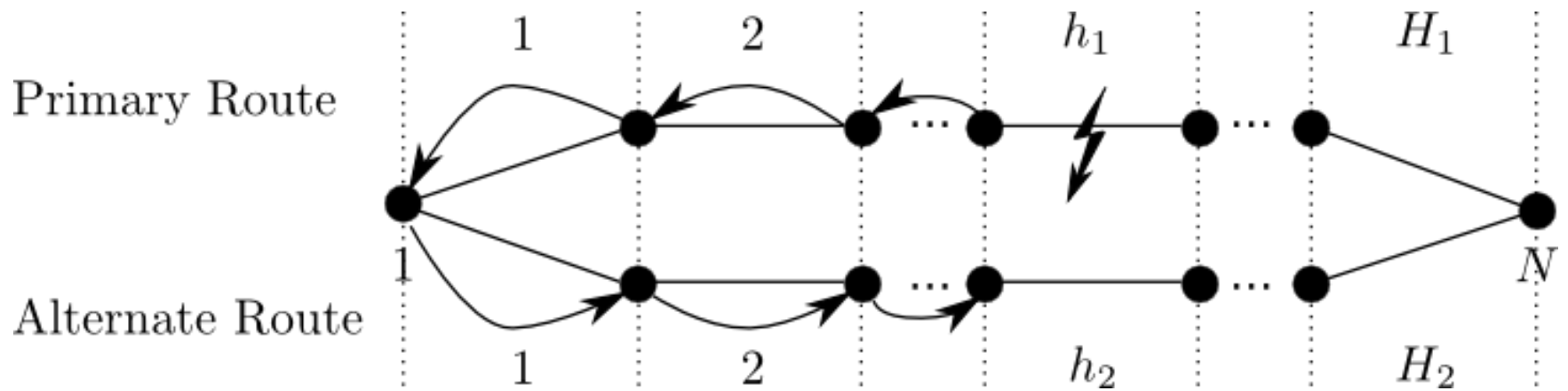
Multihop Networks



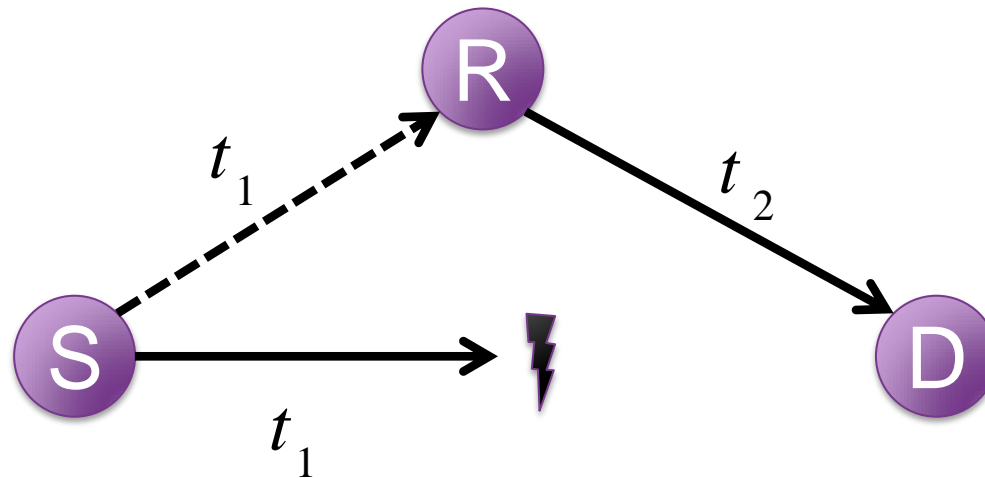
Multihop Networks



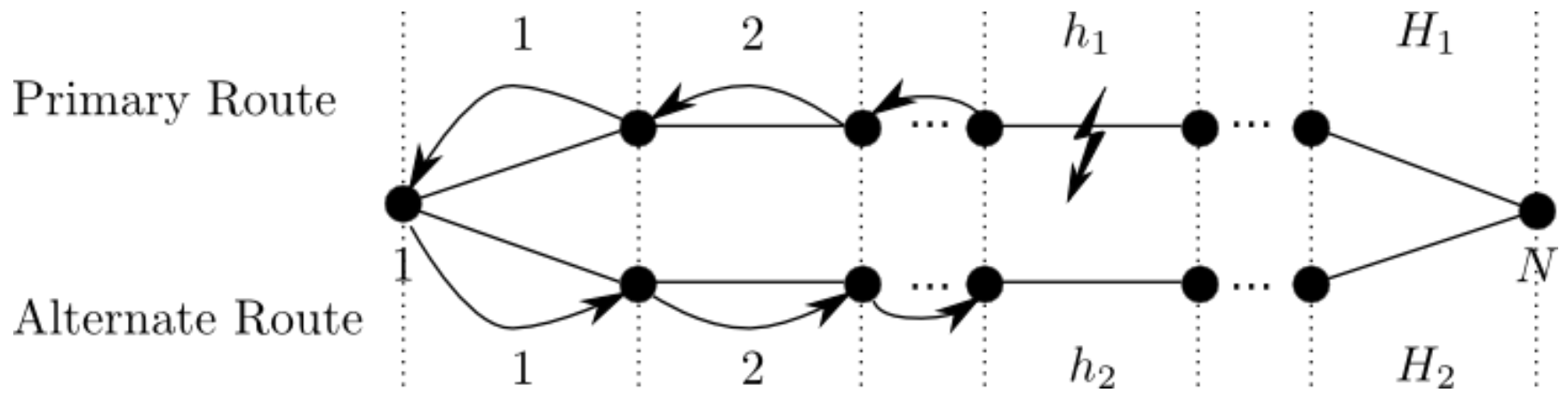
Route Failure



Cooperative Relaying

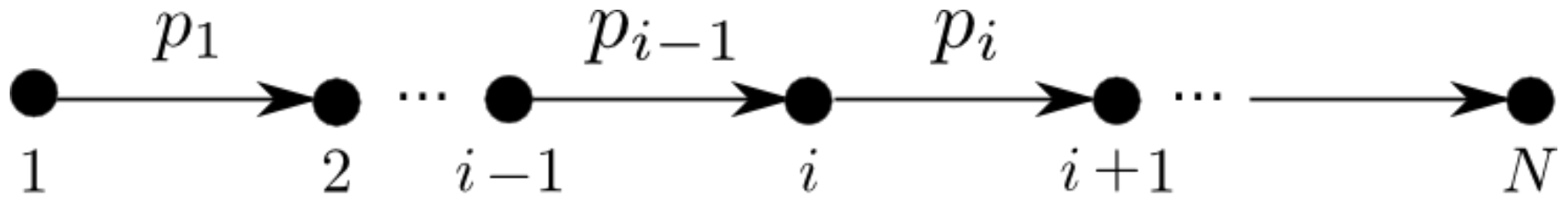


Route Failure



Is cooperative relaying **efficient** for multihop networks?

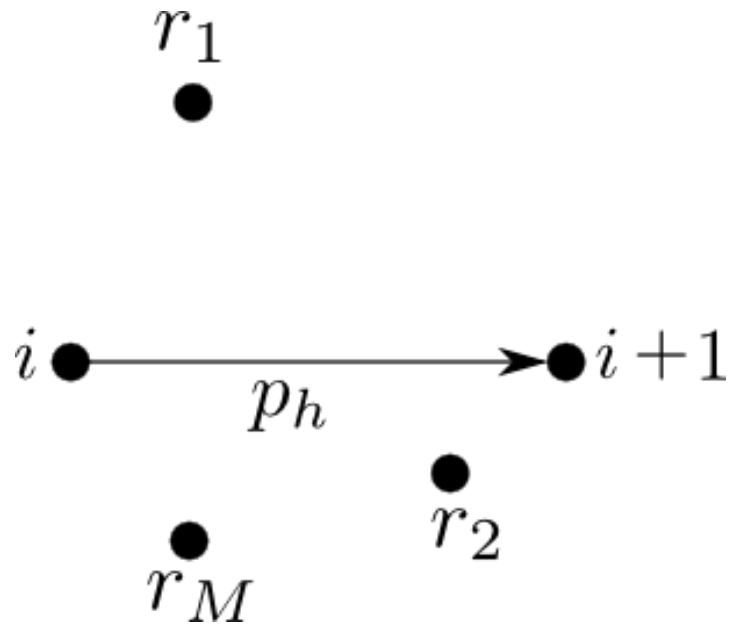
THE MODEL



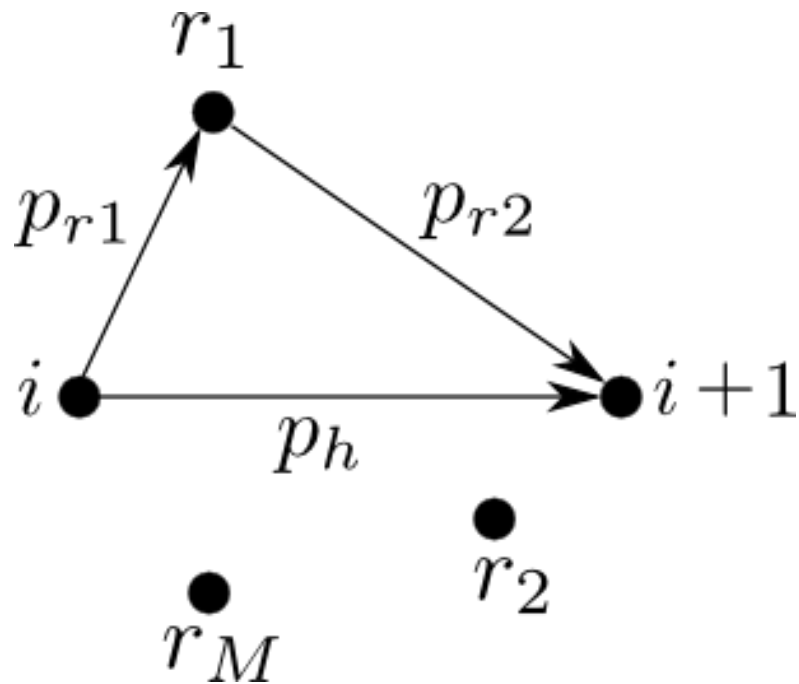
$$p_{EE} = \prod_{i=1}^{N-1} p_i$$

$$p_i = p_h \quad \forall i = 1 \dots N - 1$$

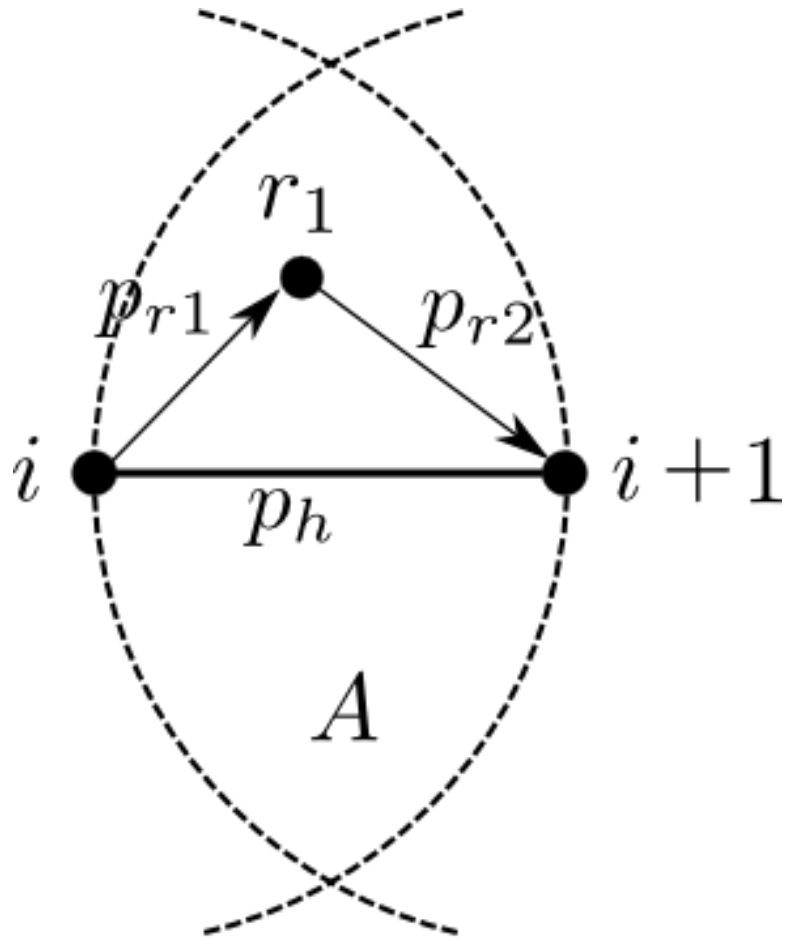
Relay Transmission Probability



Relay Transmission Probability



Expected Relay Position

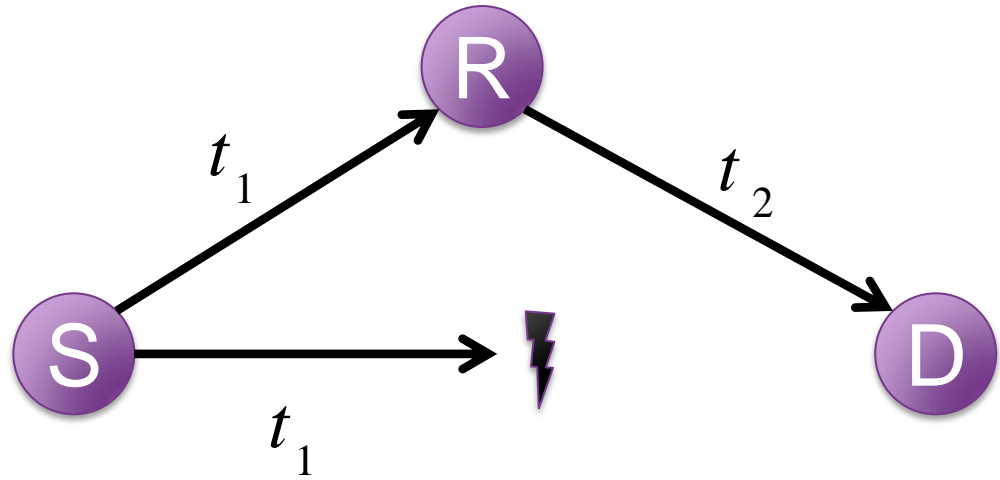


P_h	P_{relay}
0.73	0.89
0.85	0.89
0.99	1.00

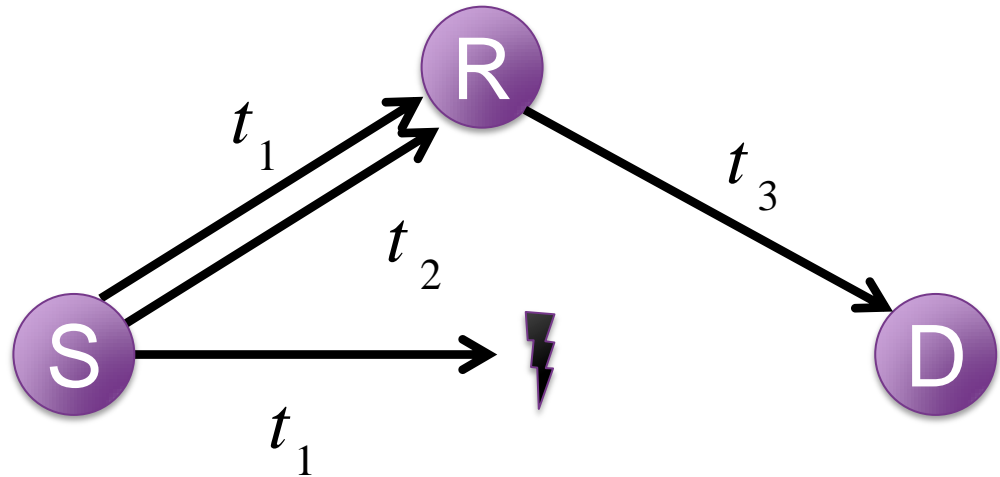
THE RELAY TRIGGER

Relay Transmission Trigger Types

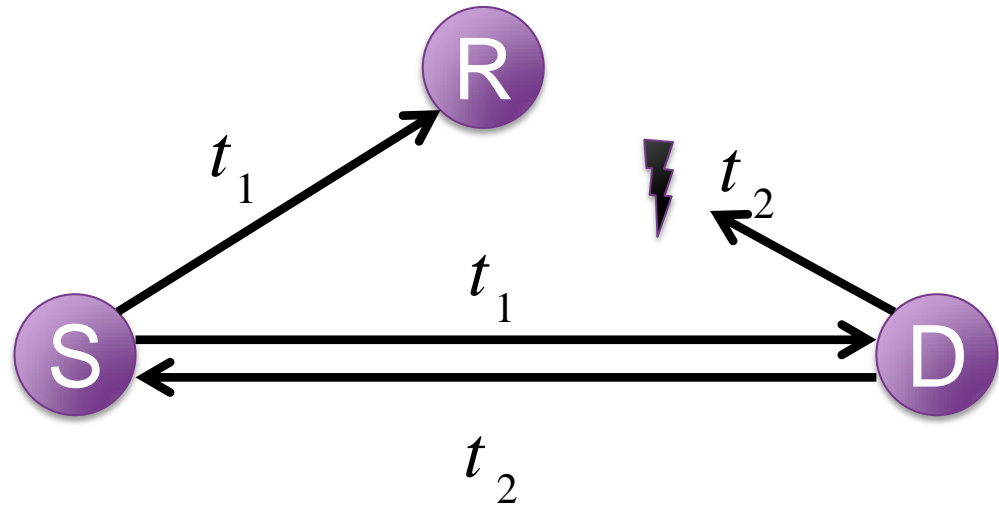
IMP



EXP

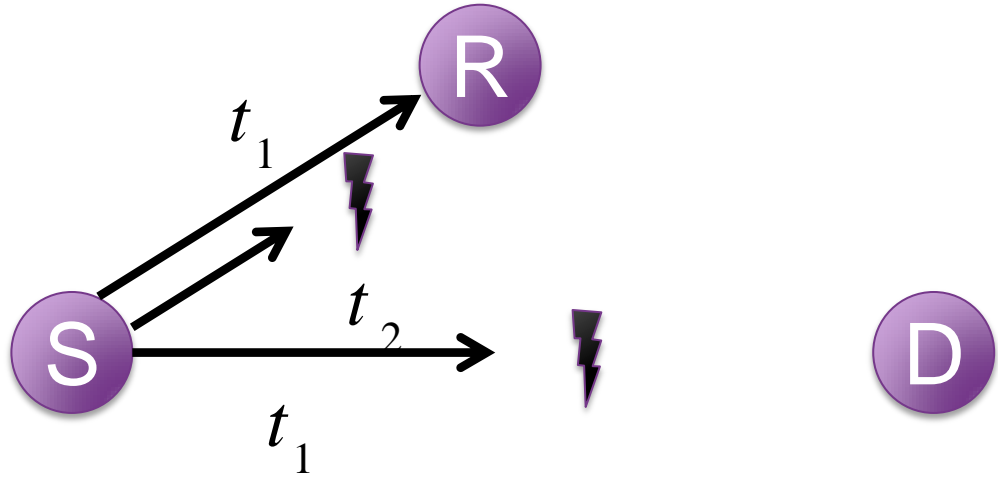


IMP



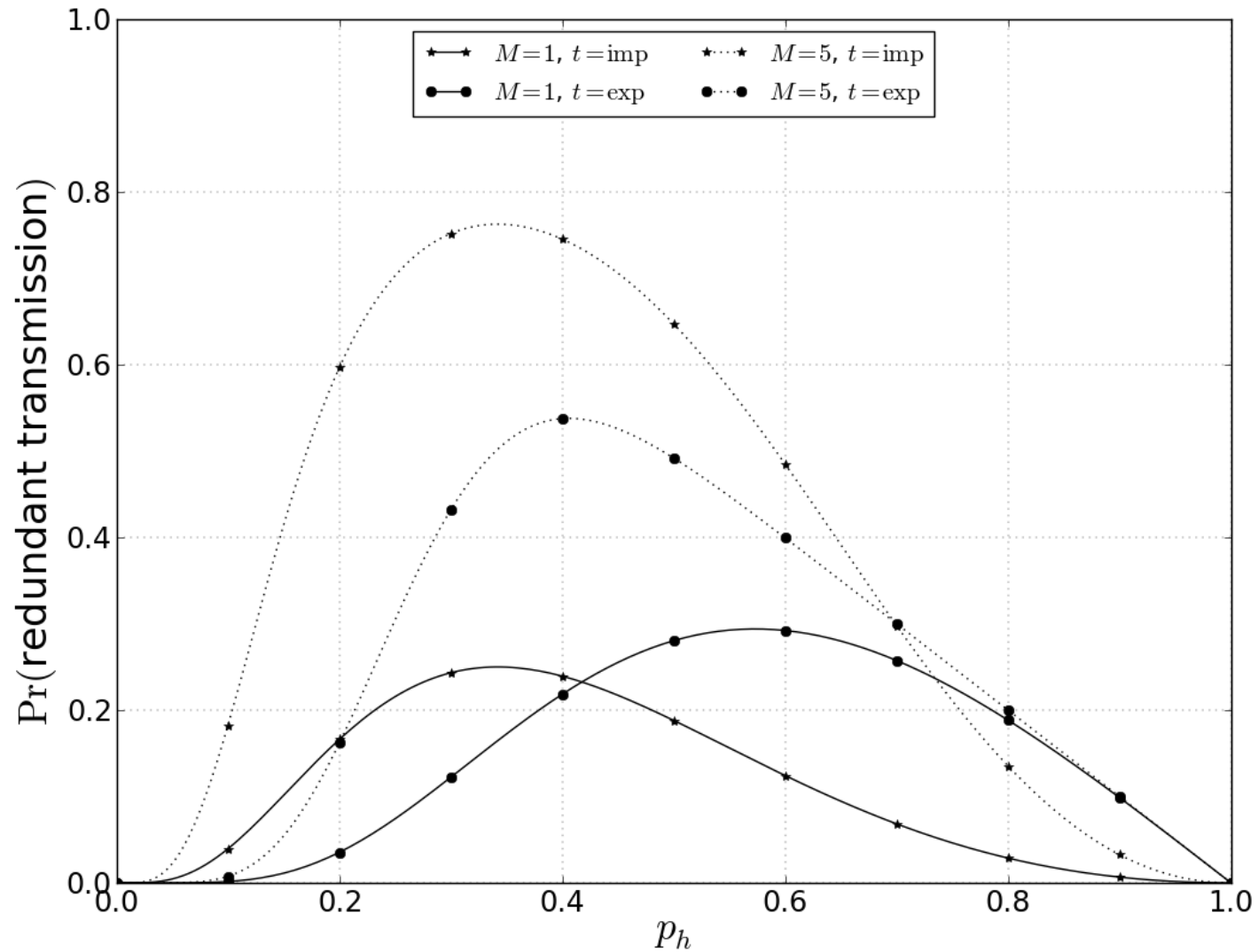
→ Redundant Relay Transmissions

EXP

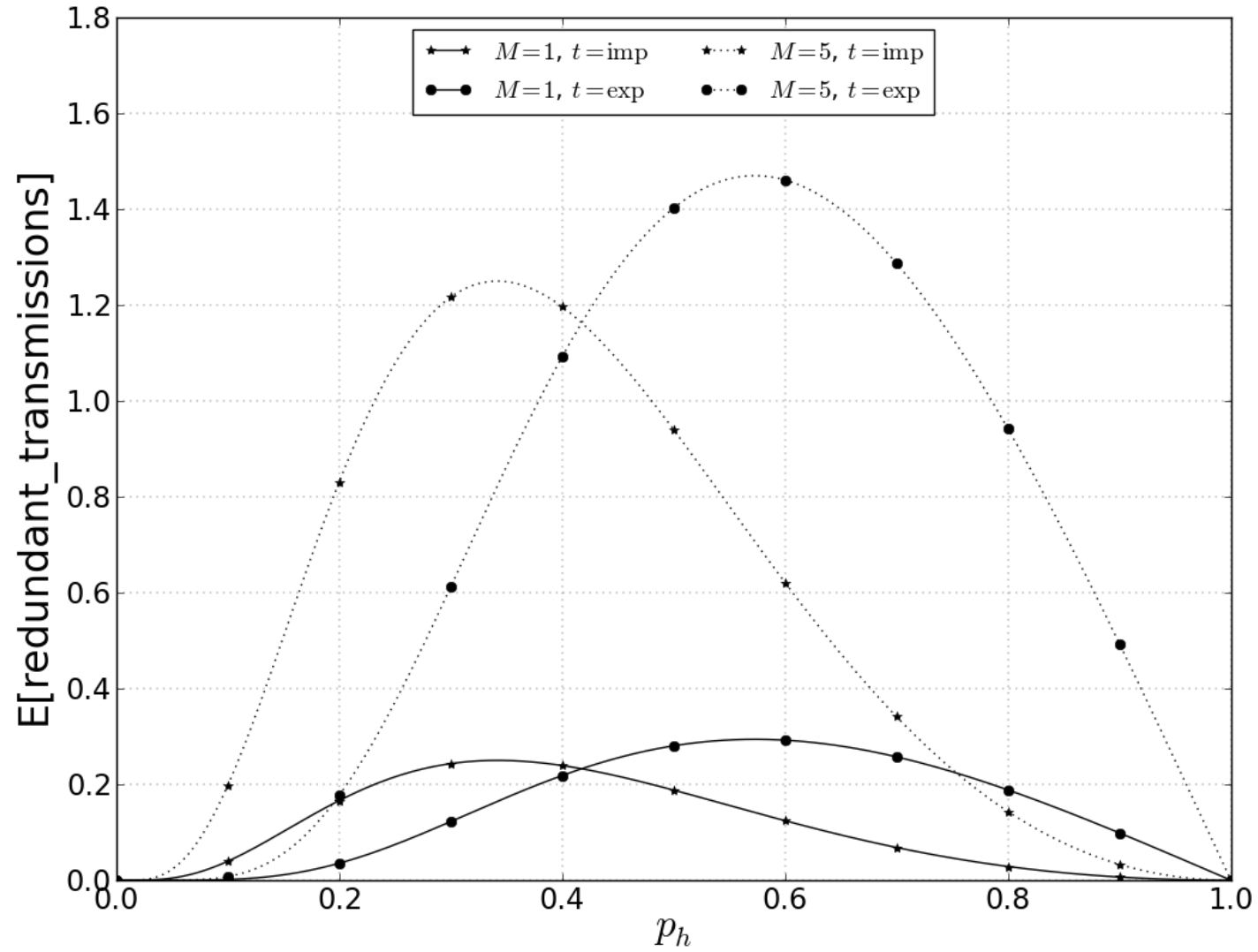


→ Failed Relay Trigger

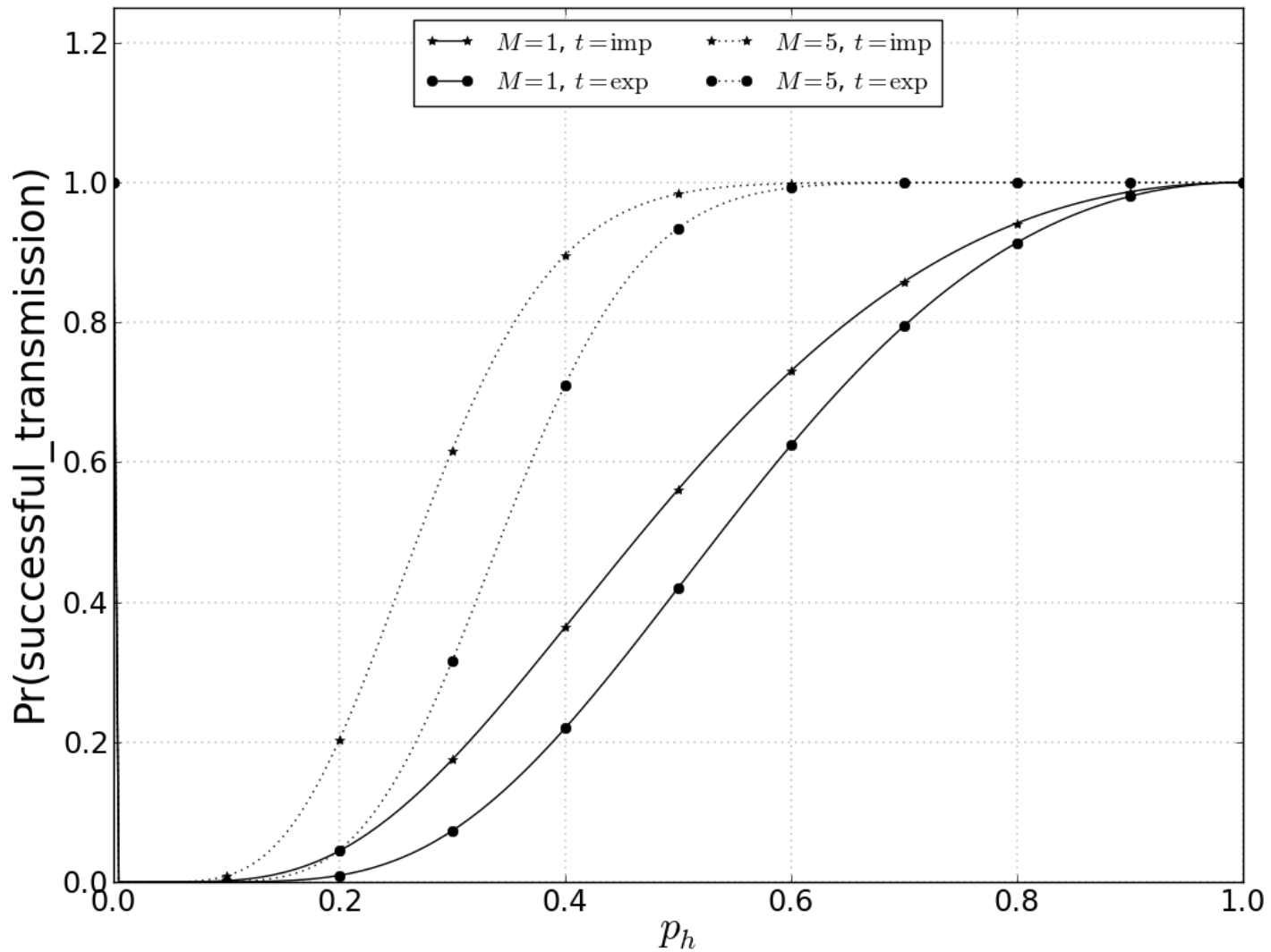
Probability Redundant Transmission

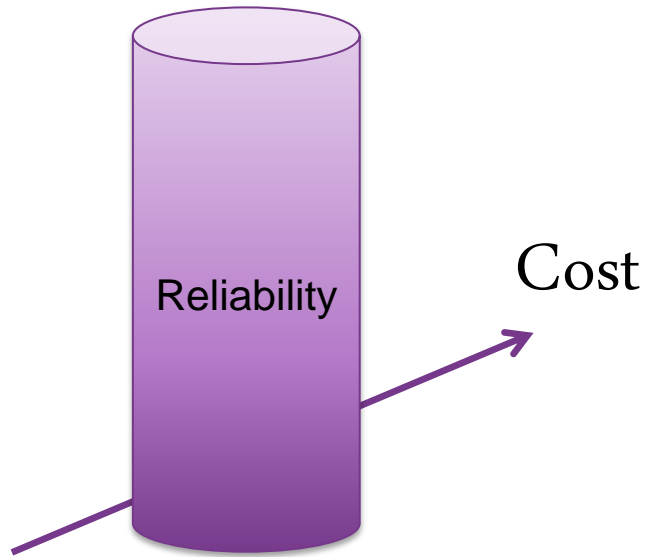


Expected Redundant Transmissions

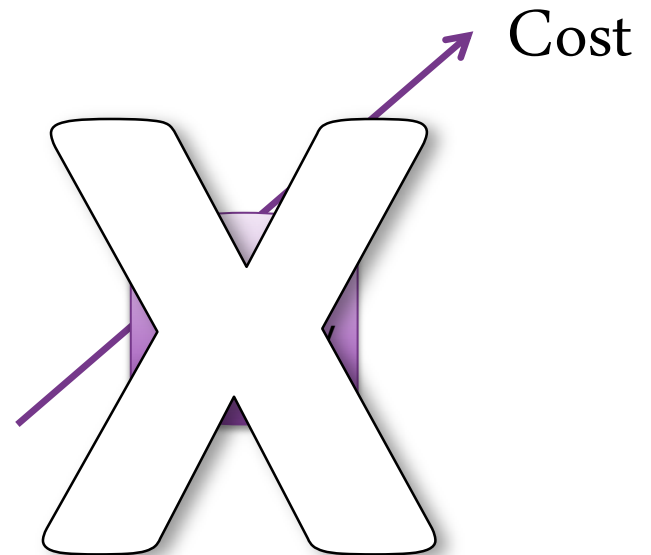


Probability Successful Retransmission





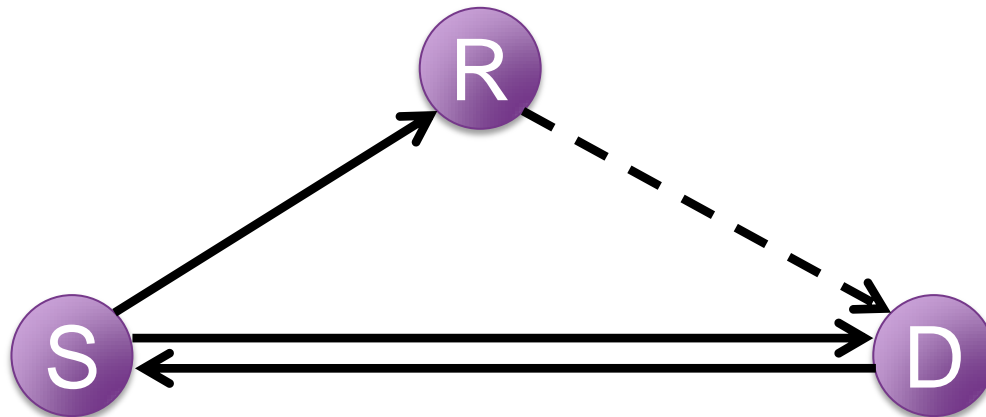
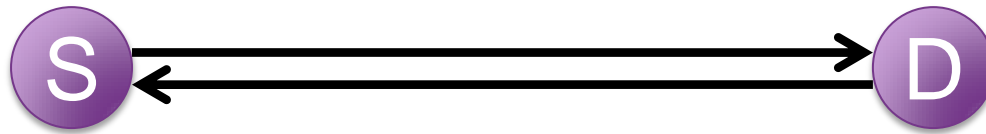
IMP



EXP

THE EFFICIENCY

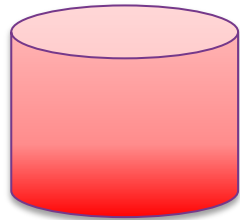
Costs



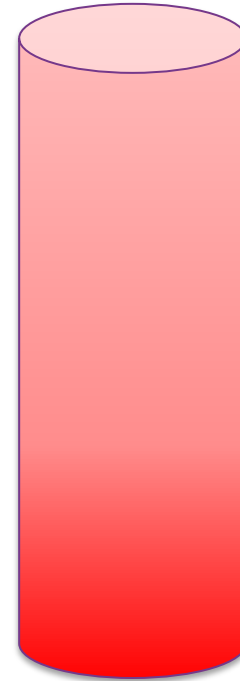
Costs

Depend on

- Number of relays
- Error probability



Without Relaying



With Relaying

End-to-end Reliability p_{EE}

Using 3 relays per hop

10 hops total

0.09%



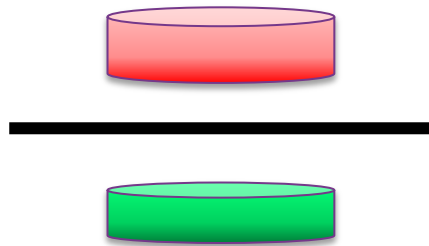
Without Relaying

98%

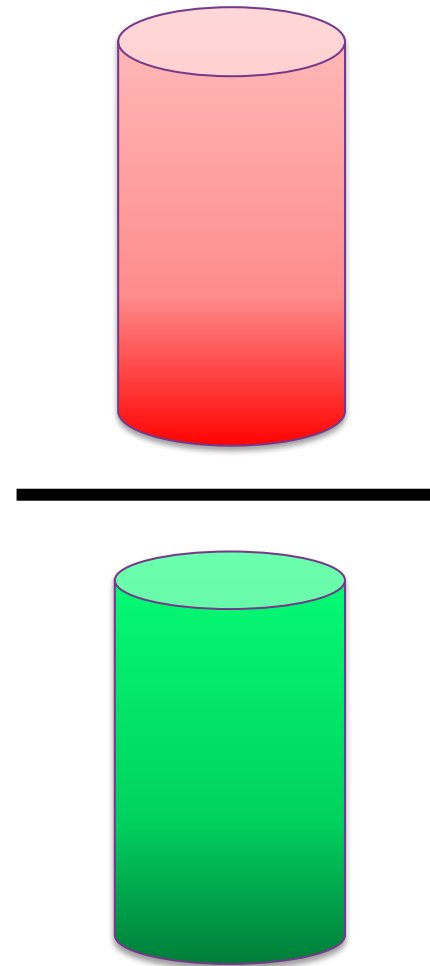


With Relaying

Efficiency η



Without Relaying



With Relaying

Mode	P_{EE} (10 hops)	η
w/o relays	0.009	1619.1
with 3 relays	0.895	95.0
w/o relays	0.09	169.1
with 3 relays	0.98	48.7
w/o relays	0.9	24.1
with 3 relays	1.	45.2

REALLY ?

Conclusions

- Simple stochastic model yields qualitatively correct results
- Implicit or explicit trigger depending on requirements
- Cooperative relaying reduces costs per successful transmission for large networks

Thank you for your attention!





ALPEN-ADRIA
UNIVERSITÄT
KLAGENFURT | WIEN GRAZ

Torsten Andre

Networked and Embedded Systems

Torsten.Andre@aau.at

<http://nes.aau.at>