

Network Coding: From Theory to Practice



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Network Coding: Theory

- Does Network Coding (NC) provide scaling improvement in throughput capacity?
- Our study showed that NC does not provide any order throughput gain for multicast in wireless networks.
- Z. Wang, S. Karande, H.R. Sadjadpour, and JJ. Garcia-Luna, "[On the Multicast Capacity of Wireless Ad Hoc Networks with Network Coding](#)" Journal of Communications and Networks, October 2011.
- S. Karande, Z. Wang, H.R. Sadjadpour, and JJ. Garcia-Luna, "[Multicast Throughput Order of Network Coding in Wireless Ad Hoc Networks](#)" IEEE Transaction on Communications, February 2011.

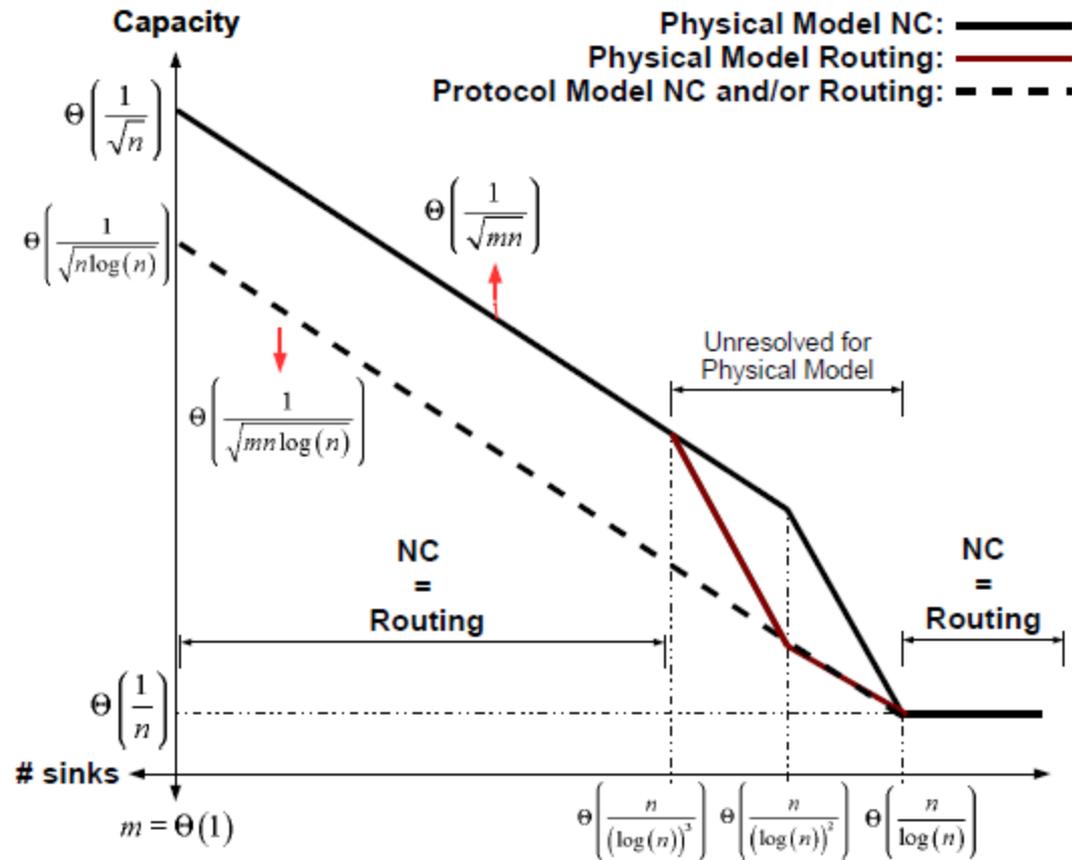


Network Coding: Theory

- What is order throughput capacity?
- This is the capacity behavior as a function of total number of nodes in the network, asymptotic behavior.
- The study does not provide any information related to constant gain for throughput capacity.
- Does this mean that NC cannot improve capacity?
- Actually, it can improve the capacity of systems considerably.



Network Coding: Theory



Network Coding: CBMEN project

- Content-Based Mobile Edge Network (CBMEN) is a DARPA sponsored project based on content-centric networking concept for MANETs.
- We have used Random Linear Network Coding (RLNC) for data dissemination.
- We have compared it with simple data dissemination (no coding) and fragmentation.



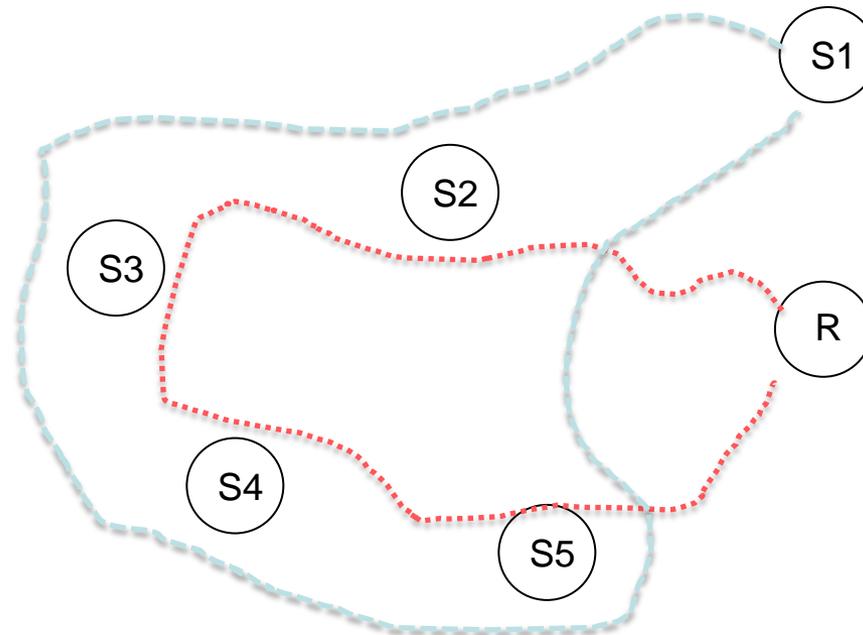
Network Coding: CBMEN project

- Our results have shown that this approach provides improvement in terms of delay and bandwidth usage.
- In many cases, without RLNC, the data cannot be disseminated in these networks.
- Without network coding content may not be delivered, but can this be explained by its inherent fragmentation? No! Even smart fragmentation cannot deliver when network coding.



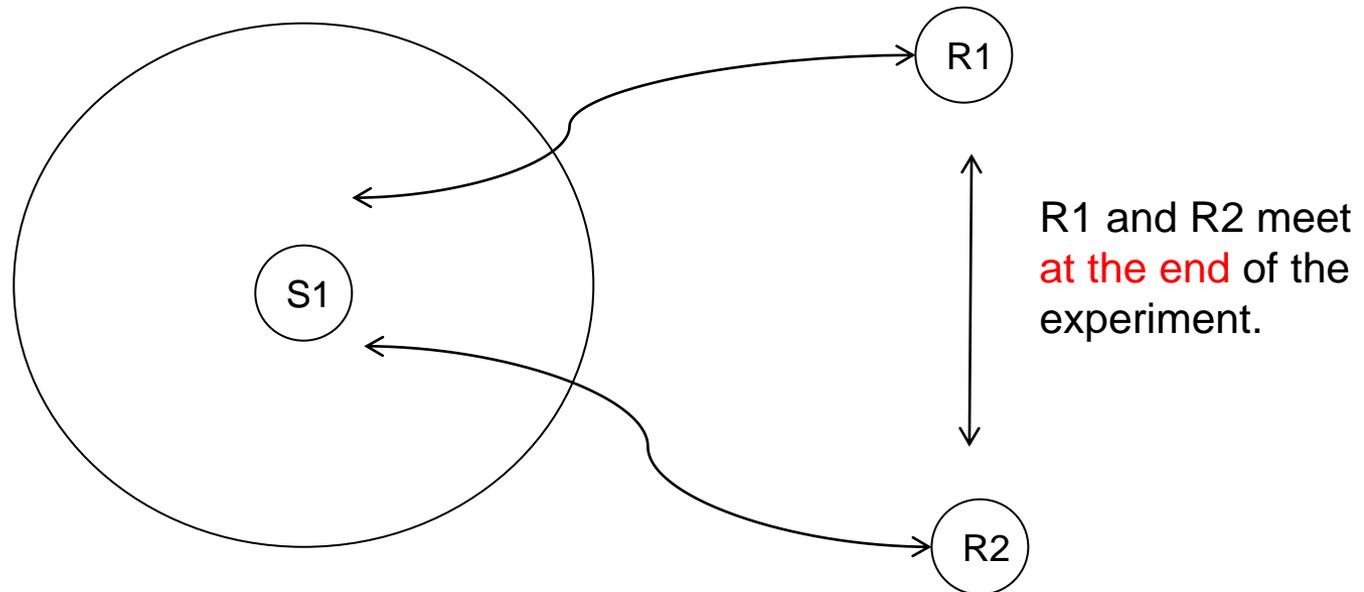
Network Coding: CBMEN project

- Scenario Description: S1 (Publisher) moves around and sends pieces of a file to S2 to S5. Soldier R (subscriber) passes quickly by four other soldiers who have a shared file or part of the file. Soldier R receives pieces of the file from each soldier (S2 to S5) until he can recover the file.
- File Size: different sizes, Fragment Size: 32 KB
- Connectivity: Intermittent, wireless channel
- Meeting time: variable depending on the speed of S1 and R.



Network Coding: CBMEN project

- Soldiers (R1 and R2) patrolling an area and try to download pictures (taken by S1). Due to intermittent connectivity they can only get pieces of the picture which are useless by themselves. By combining their downloads they try to reconstruct the original picture.
- File Size: different sizes, Fragment Size: 32 KB Pause time: varies.
- Connectivity: Intermittent, wireless channel



Network Coding: CBMEN project

Assumptions:

- 30 nodes random waypoint mobility model.
- Content Size: different sizes,
- Data Rate: 1Mbps,
- Node speed random in the range [1.1-1.5] m/s.
- Pause time: [0,5] s.



Network Coding: CBMEN project

- Network Coding does not provide consistent performance improvement for all scenarios.
- How can we design an adaptive network coding?
- Under what conditions is network coding likely to have a benefit ?
- Can we design network coding suitable for content centric network architecture?



Thanks you!

QUESTION??

