Network coding for wireless ad hoc networks – a few slides

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Network coding gives significant energy use benefits

- The benefit of network coding is maintained with the number of nodes

Network size	Approach	Average multicast energy			
		2 sinks	4 sinks	8 sinks	16 sinks
20 nodes	MIP algorithm	30.6	33.8	41.6	47.4
	Network coding	15.5	23.3	29.9	38.1
30 nodes	MIP algorithm	26.8	31.9	37.7	43.3
	Network coding	15.4	21.7	28.3	37.8
40 nodes	MIP algorithm	24.4	29.3	35.1	42.3
	Network coding	14.5	20.6	25.6	30.5
50 nodes	MIP algorithm	22.6	27.3	32.8	37.3
	Network coding	12.8	17.7	25.3	30.3

AVERAGE ENERGY OF RANDOM MULTICAST CONNECTIONS OF UNIT RATE FOR VARIOUS APPROACHES IN RANDOM WIRELESS NETWORKS OF VARYING SIZE. NODES WERE PLACED RANDOMLY WITHIN A 10 × 10 SQUARE WITH A RADIUS OF CONNECTIVITY OF 3. THE ENERGY REQUIRED TO TRANSMIT AT UNIT RATE TO A DISTANCE d WAS TAKEN TO BE d^2. SOURCE AND SINK NODES WERE SELECTED ACCORDING TO AN UNIFORM DISTRIBUTION OVER ALL POSSIBLE SELECTIONS.

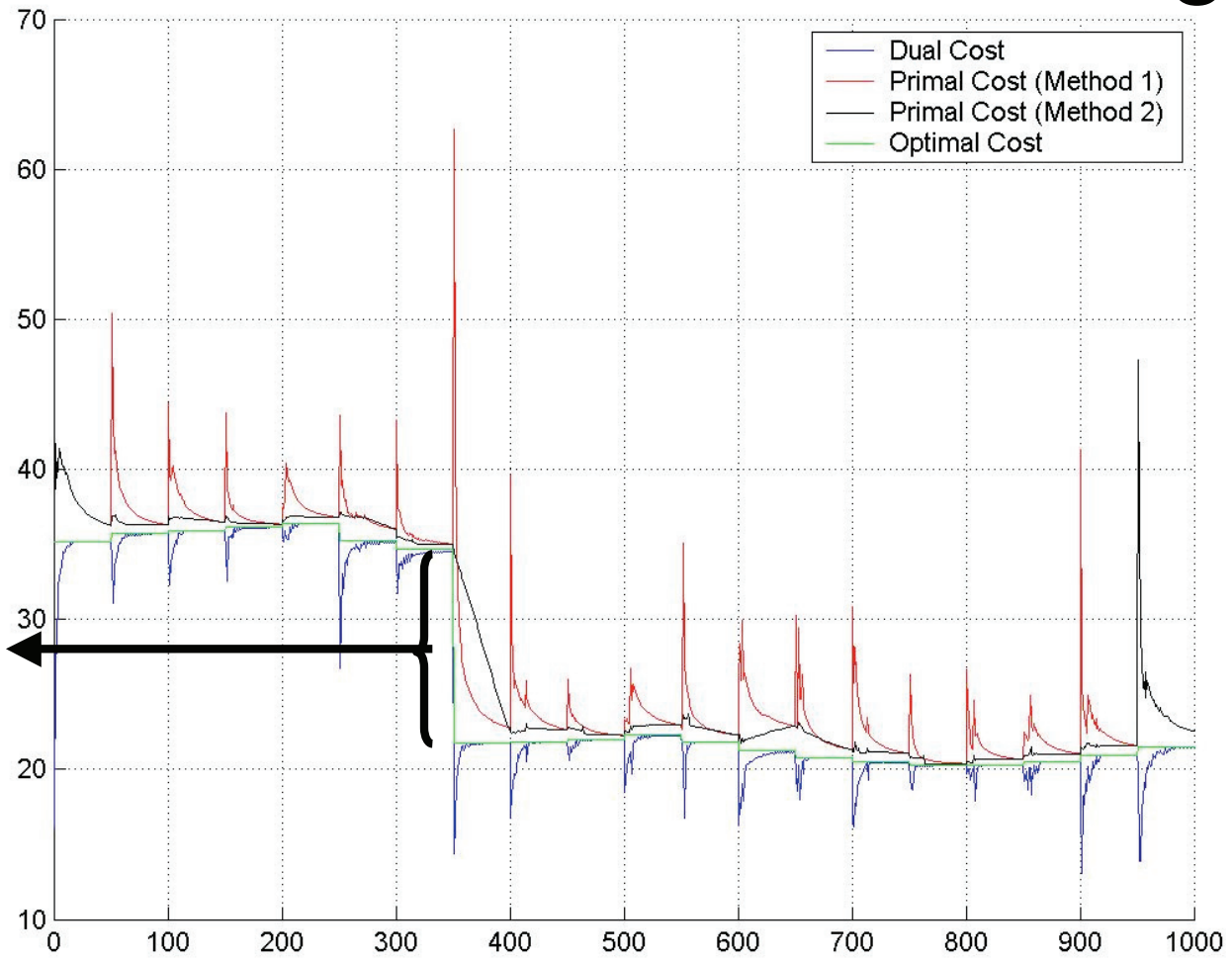
Distributed operation and convergence

- Randomized distributed coding maintains coding feasibility regardless of cost and topology changes
- Distributed network coding optimization works through distributed optimization akin to the DBF approach that underlies OSPF
- It reacts spontaneously to changes in the network (reflected by cost changes) and converges to the correct solution regardless of the initial conditions

Distributed Optimization

- While many approaches will in principle yield convergence, the right approach should provide smooth performance that tracks the optimal performance well and responds quickly to drastic cost changes
- We have developed and compared among them a few techniques and already found one that does not exhibit undesirable oscillatory behavior
- No need for predictive mobility model, but we can use probabilistic models to improve performance

Comparison of distributed mechanisms in a variable setting



Jump corresponds to sudden change in costs

The black line tracks the optimal cost closely – the blue and red lines, although they correspond to techniques that also converge, do not provide the smooth behavior of method 2