The Selfish Neighbor Selection Problem In Overlay Networks

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Overview

In a typical overlay network for routing or content sharing, each node must select a fixed number of immediate overlay neighbors for routing traffic or content queries. A selfish node entering such a network would select neighbors so as to minimize the weighted sum of expected access costs to all its destinations. Previous work on selfish neighbor selection has built intuition with simple models where edges are undirected, access costs are modeled by hop-counts, and nodes have potentially unbounded degrees. However, in practice, important constraints not captured by these models lead to richer games with substantively and fundamentally different outcomes. Our results indicate that selfish nodes can reap substantial performance benefits when connecting to overlay networks composed of non-selfish nodes. On the other hand, in overlays that are dominated by selfish nodes, the resulting stable wirings are optimized to such great extent that even non-selfish newcomers can extract near-optimal performance through naive wiring strategies.

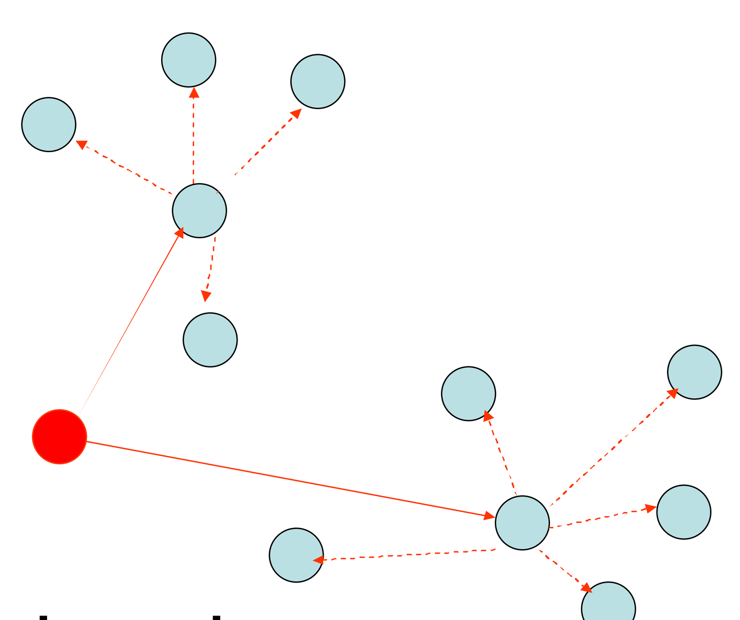
Towards A Realistic Model of Overlay Networks

1. **Bounded in- and out-degrees**
2. **Directed Edges**
3. **Non-uniform preference vectors**
4. **Realistic models of Physical Distance**

Deriving Stable Wirings

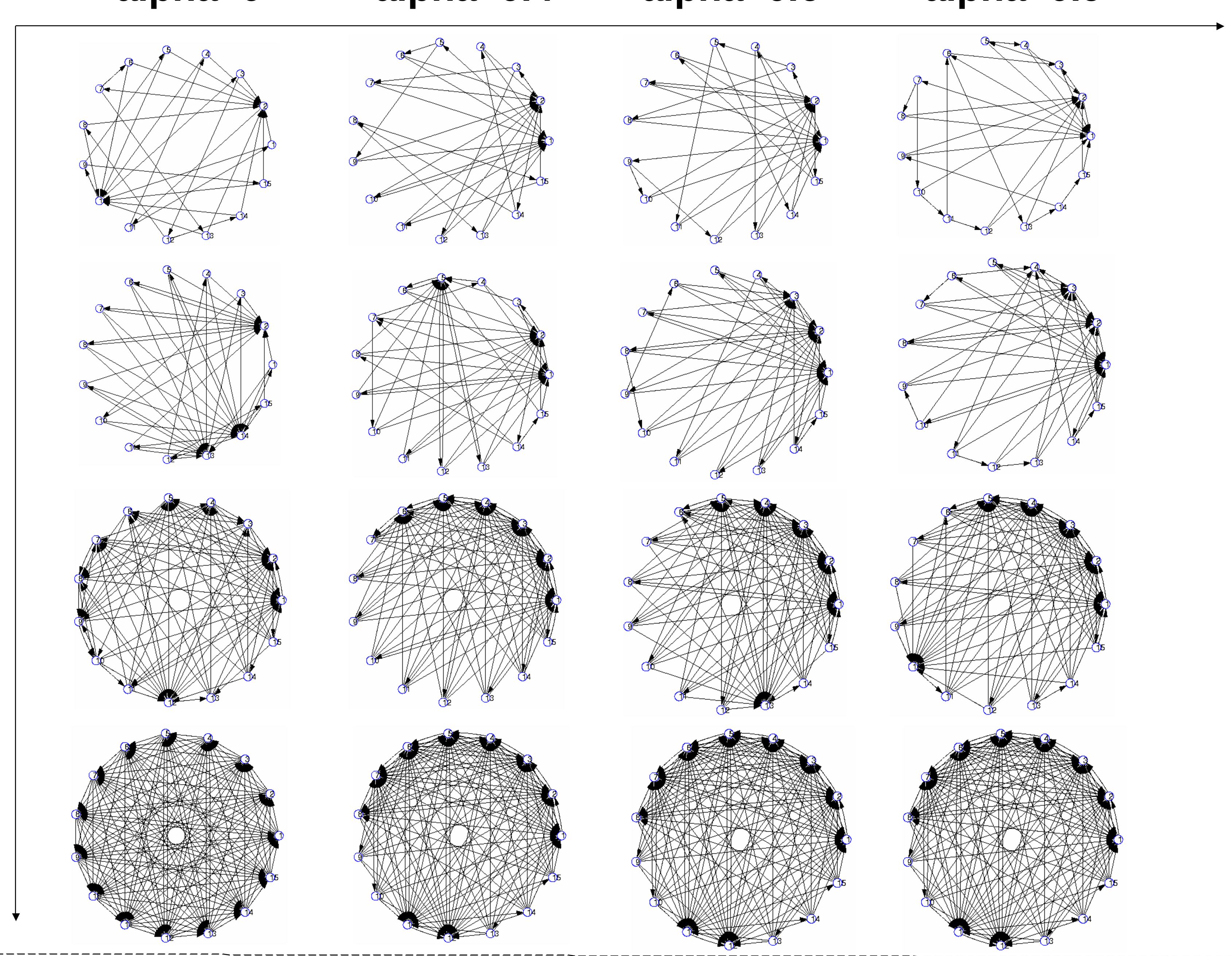
- *Best Response* Wiring:
By solving an Asymmetric k-median problem

- *Equilibrium* Wirings:
Through Iterative Best Response

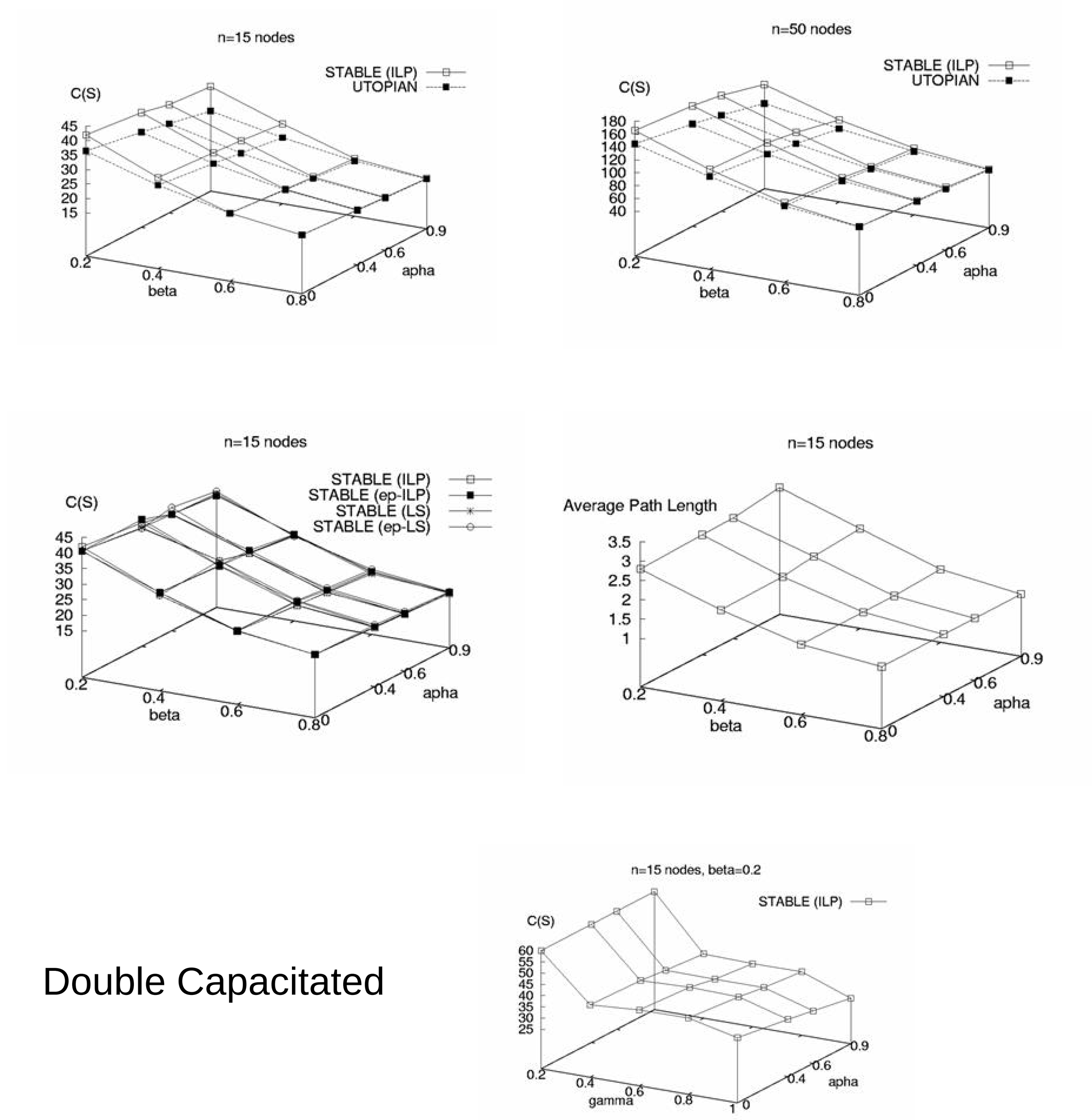


An overlay node applying Best Response wiring policy to the residual overlay graph

Characterization of Stable Wirings



Social Cost of Stable Wirings



Double Capacitated

Experiments

	beta=0.1		beta=0.2		beta=0.4		beta=0.6		beta=0.8	
	k-Random/BR	k-Closest/BR	k-Random/BR	k-Closest/BR	k-Random/BR	k-Closest/BR	k-Random/BR	k-Closest/BR	k-Random/BR	k-Closest/BR
BRITE	1.44	1.53	1.52	1.84	1.38	2.07	1.28	1.46	1.09	1.16
PlanetLab	2.23	1.48	1.75	1.23	1.37	1.13	1.09	1.16	1.04	1.06
AS-level	2.04	1.9	1.83	1.61	1.58	1.39	1.24	1.23	1.12	1.16

Skewness: alpha, Zipf(alpha)

Oudegree: $k = \left\lceil \frac{n^{1+beta}}{n} \right\rceil$