Exploring Game-Theoretic Formation of Realistic Networks
Tobias Friedrich, Pascal Lenzner, Christopher Weyand

Properties of Real-world Networks:

small-world property:
diameter in $O(\log n)$, small average path length

high clustering:
many triangles and small cliques, average clustering coefficient in $[0.2, 0.8]$

power-law degree distribution:
probability that a node has degree $k$ is proportional to $k^{-\beta}$, for some constant $2 \leq \beta \leq 5$

Networks via Game-Theory
- nodes are selfish and rational agents
- agents strive for good position in the network
- each agent tries to minimize some cost function
- strategy of an agent = subset of other agents
- costly links are formed according to strategies
- strategies of all agents determines the edge-set
- consider pure Nash equilibrium of the game

Our Model:
Strategic Network Augmentation
1. start with sparse connected initial network
2. activate agents in round-robin/random fashion
3. active agent buys local edge to improve centrality
4. edge-cost is proportional to node degree
5. iterate until all agents are happy

Results for the global model ($n = 10000$)

Results for the local model ($n = 20000$)

Hasso Plattner Institute
E-mail: firstname.lastname@hpi.de
Web: https://hpi.de/friedrich/home.html
Prof.-Dr.-Helmert-Straße 2-3 14482 Potsdam, Germany