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Cooperation with Strangers

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First a confession.....

- Although my background is CompSci / A.I.
- I have spent time with.....
- Sociologists!
- I have *even* spent time working with....
- Economists!
- It was a dirty job but someone had to do it

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Sociological and “new” economics approaches and theories

- Agent Based Social Simulation (ABSS) - much new and existing social, economic and biological theories presented as simulations
- A lot of work on Cooperation (using PD-type game theory abstractions)
- Can we apply these to realistic task domains to solve our problems?

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Yes - its already happening!

- Workshops - Economics in P2P (P2Pecon 2003, 2004), Berkeley, Harvard.
- Concept of incentives (endogenous grounding - not external)
- Even deployed (well kind of) Axelrod et al. (TFT in BitTorrent) - reciprocity
- The incentives work of Ngan et al presented on Wednesday (the chain of credit idea) indirect reciprocity

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Problem - How to deal with strangers

- Evidenced in the gossip protocol presentations yesterday
- Without stable on-going interactions how can we make incentives work
- We can’t use reciprocity
- We want scalable solutions with minimal overheads

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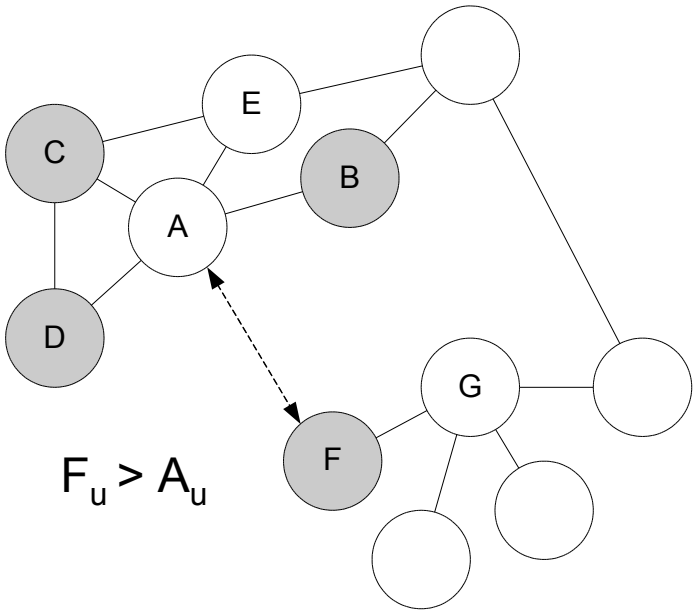
Solution - dynamically rewire in a random overlay network

- Adapting “tag” / “social cue” based ABSS results from Riolo, Cohen, Axelrod (2001) and Hales (2000) - try to preserve desirable properties (no proofs)
- Apply in unstructured P2P overlay sim.
- Basic idea is this: ***if you’re not happy with your neighbours then go elsewhere***
- Applied to file-sharing scenario of Qixiang Sun & Hector Garcia-Molina 2004, and suppresses free-riding

Nodes copy to optimise (greedy and stupid) - **replication**

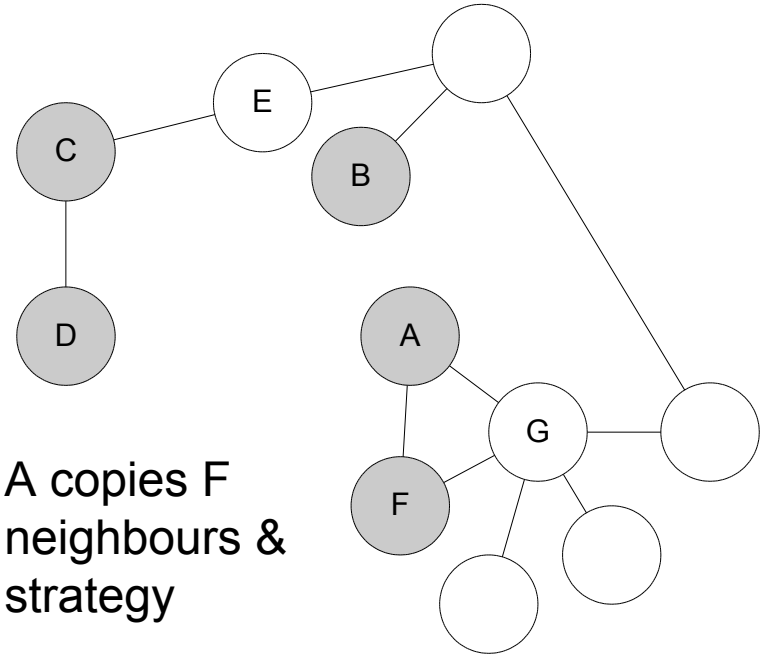
Before



$F_u > A_u$

Where A_u = average utility of node A

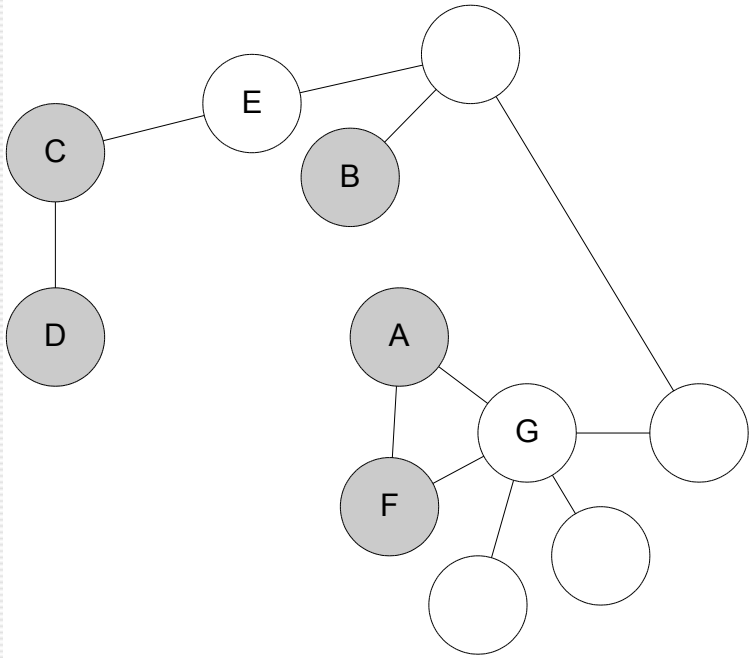
After



A copies F neighbours & strategy

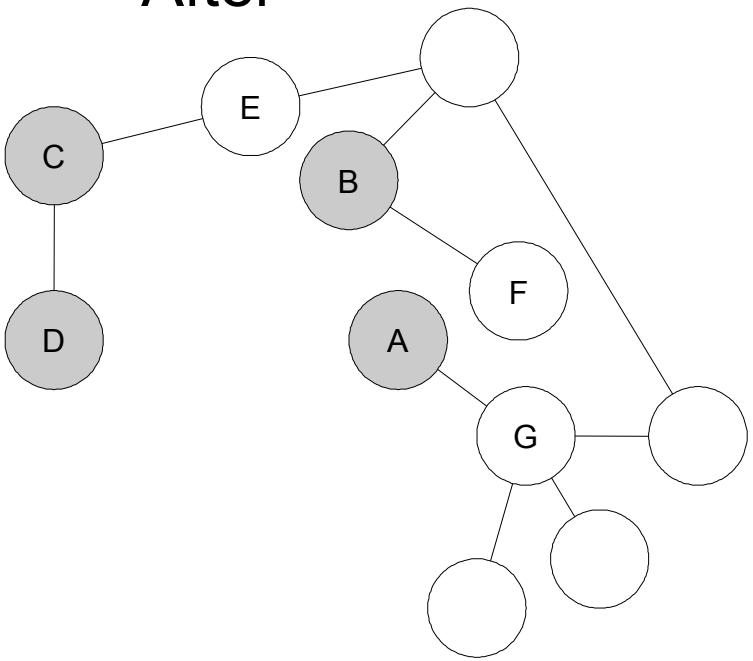
Nodes occasionally randomly move and change behaviour - **mutation**

Before



Mutation applied to F's neighbourhood and behaviour

After



F is wired to a randomly selected node (B)

F changes behaviour

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Get high altruism and cooperation

- Because bad guys end-up isolated and/or surrounded by bad guys
- good guys keep moving
- bad guys do so well they attract emulators who then are all bad
- There are crucial parameters (fiddle factors) that need to be sorted out of course

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Results.....

Great!

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But its early days....

- **assumption** can copy behaviours and links of other nodes (does this make sense?)
- **assumption** of boundedly rational nodes (but what about whitewashers, non-boundedly rational coordinated attacks)
- **assumption** can read others utilities
- what about under various churn
- get disconnected network - but highly dynamic

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Am I forgiven?

- Upcoming papers: ESOA2004 & MABS2004 both @ AAMAS2004 in NY July, IEEE-P2P2004 Zurich August
- Soon all on **www.davidhales.com** for your enjoyment and convenience
- Next step - build on top of Newscast
- The end of my 5 mins