

# Relational Carrying Capacity

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# Overview

- What is Relational Carrying Capacity?
- Theoretical arguments
- Key Questions

# Definition of Terms

- *Relational Carrying Capacity* –
  - The limit to the number of links that can be maintained amongst a set of living nodes
    - Proposition – This limit is generally less than  $\frac{N \times (N - 1)}{2}$
- *“Living” nodes* –
  - Any entity which can “die” if it does not obtain certain resources or avoid certain hazards in an environment
- *A link is...*
  - Any *a priori* bias, preference or “heuristic” to interact or transact with one node by another
    - Includes preference over other nodes
    - Includes preference over other actions

# Inspirations

- Ecological Theory – (Hawley, 1986; Hannan & Freeman, 1977; 1989)
- Are link-making resources distinct?
  - “Densification” –
    - Evidence that Avg. Degree grows with # of nodes (Leskovec, Kleinberg, & Faloutsos, 2007)
    - Rate of growth across networks, but minimally within same network

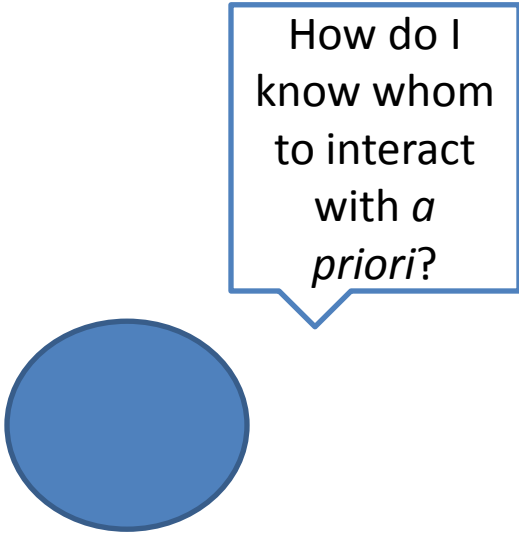
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→ Availability of “good choices” matters  
→ Networks may grow or collapse independent of material resource availability (Monge, Heiss, and Margolin, 2008)

# Theoretical Perspective

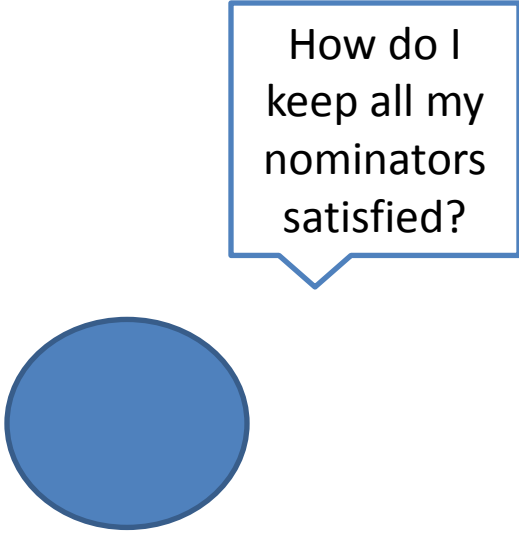
- Evolutionary Tension
  - *Uncertainty*
  - Complexity
  - Lock-in



How do I  
know whom  
to interact  
with *a*  
*priori*?

# Theoretical Perspective

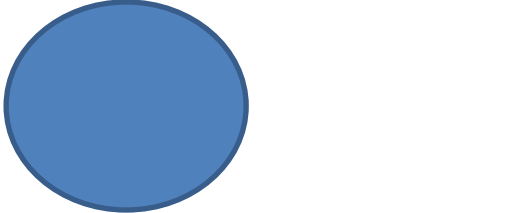
- Evolutionary Tension
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How do I  
keep all my  
nominators  
satisfied?

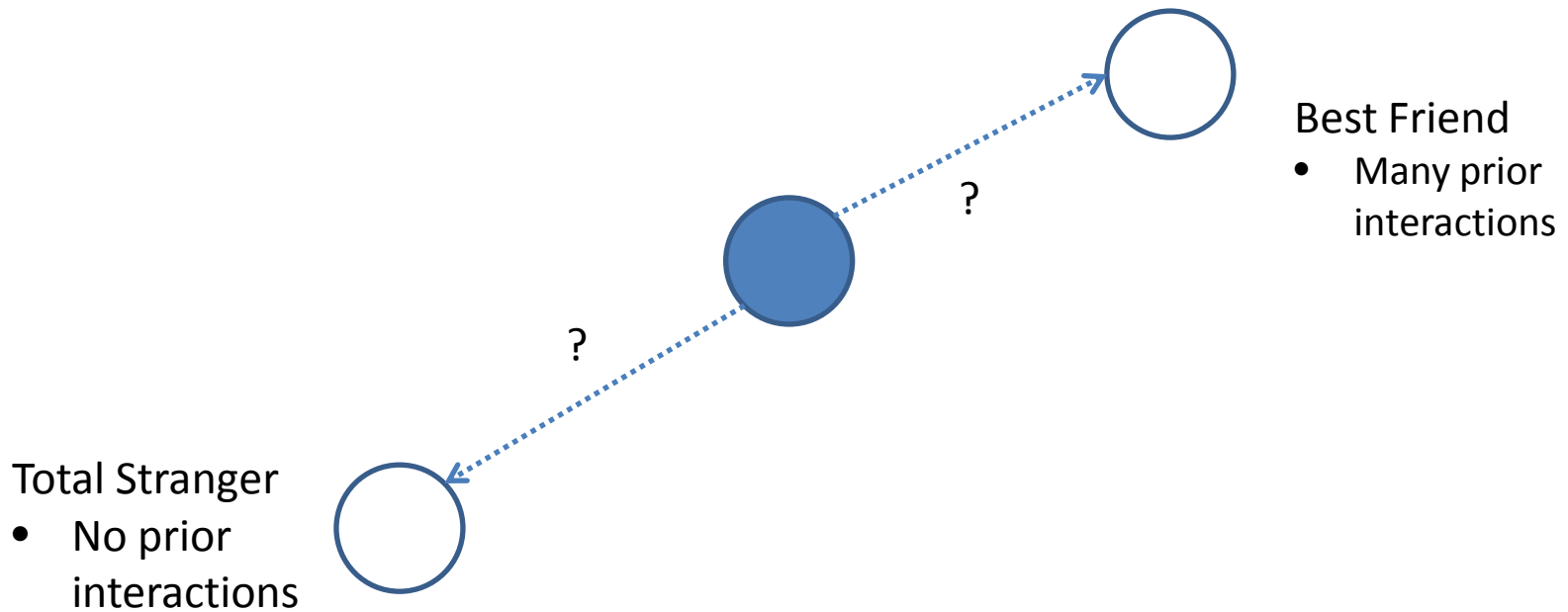
# Theoretical Perspective

- Evolutionary Tension
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  - *Lock-in*



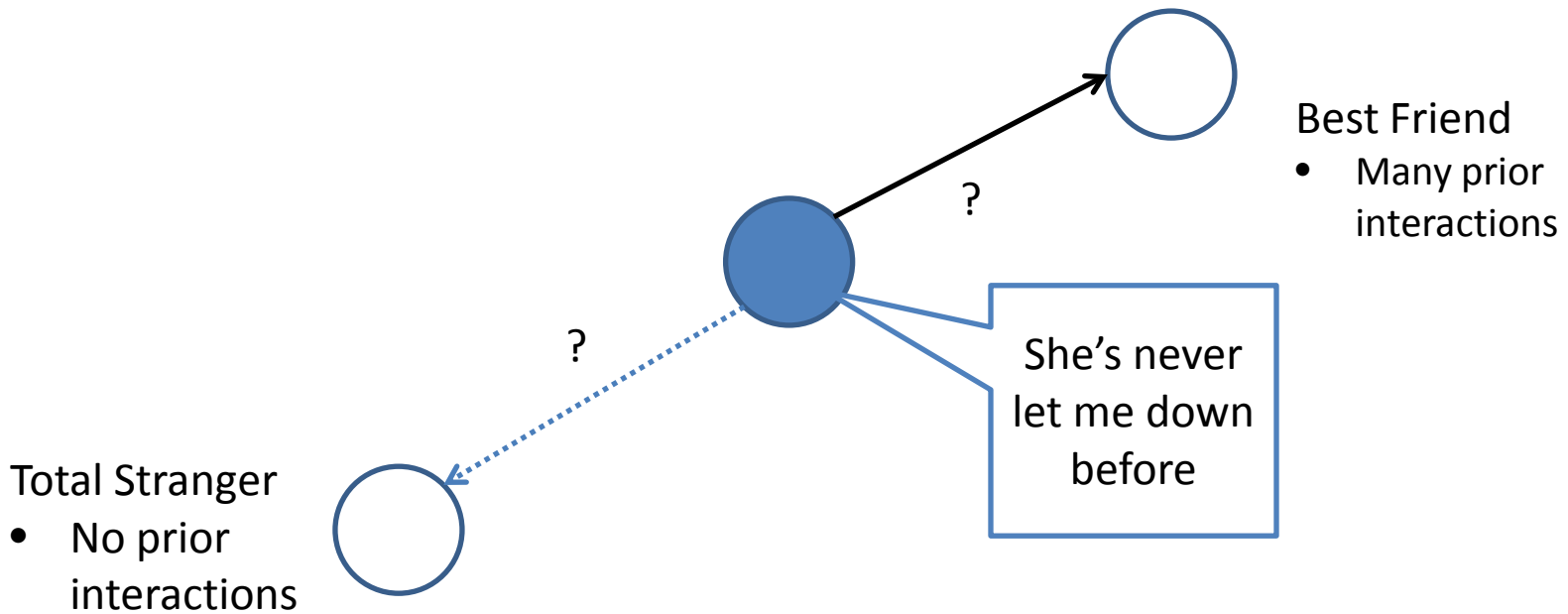
What if I want  
to experiment  
with new  
ideas or  
behaviors?

# Uncertainty



Hume applied to networks

# Uncertainty



Evaluation standards -- Legitimate until violation

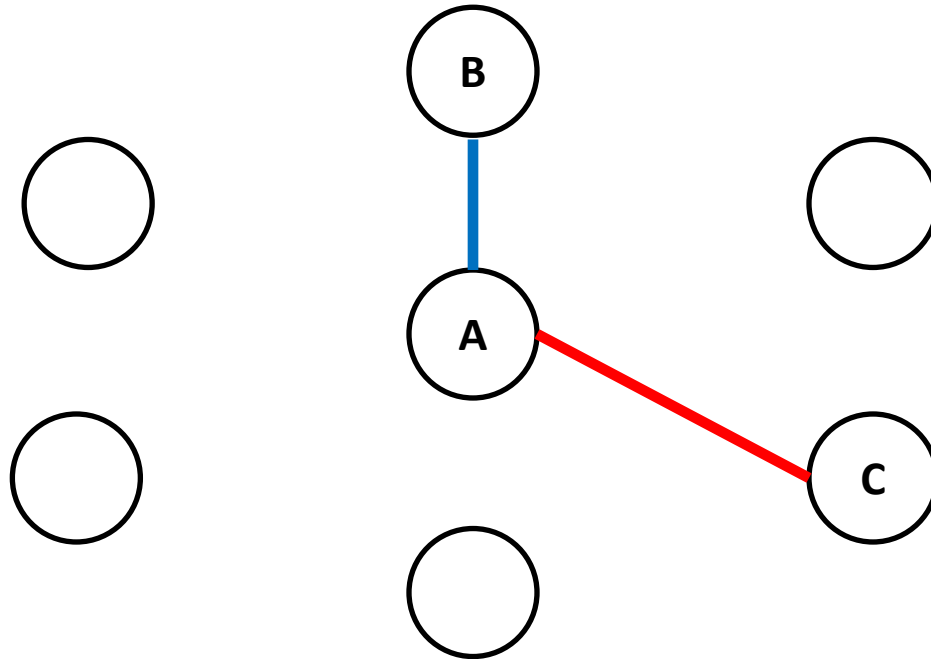
# Uncertainty Proposition

- A violation of a relational standard leads to termination of the relationship (Link)
- Therefore...

$$- \textit{Link Capacity} \propto \frac{1}{P(\textit{Violation})}$$

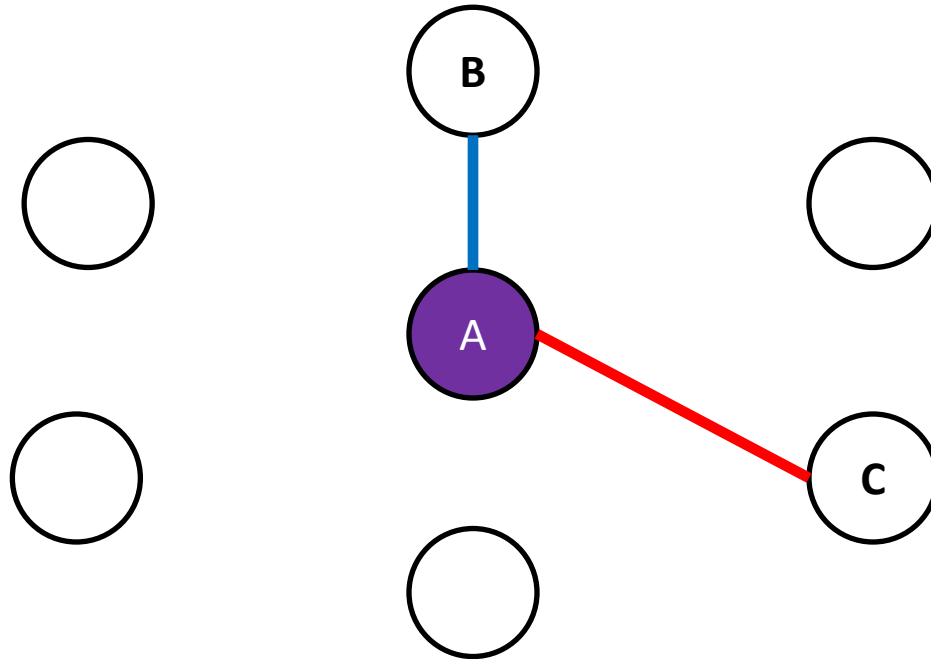
$$- \textit{Link Capacity} \propto \frac{1}{\textit{Strictness of Standards}}$$

# Complexity



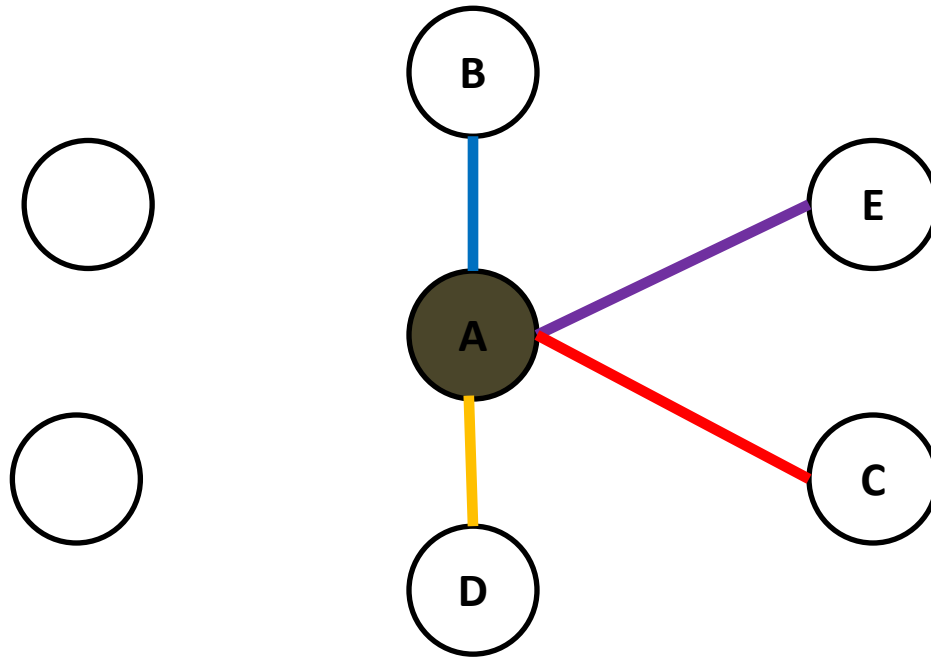
If standards are different, avoiding violations can be tricky

# Complexity



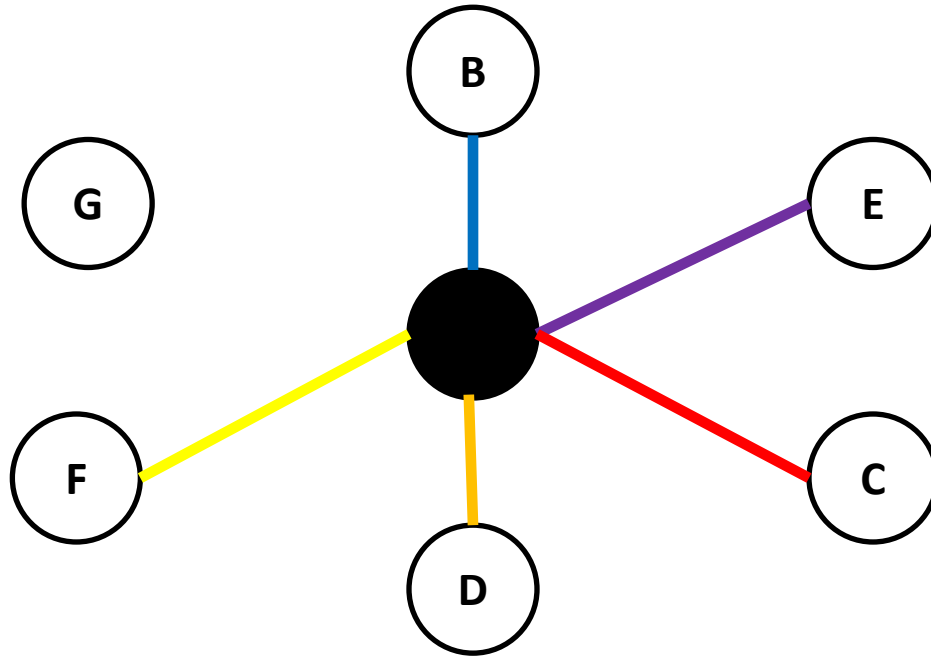
A solution!

# Complexity



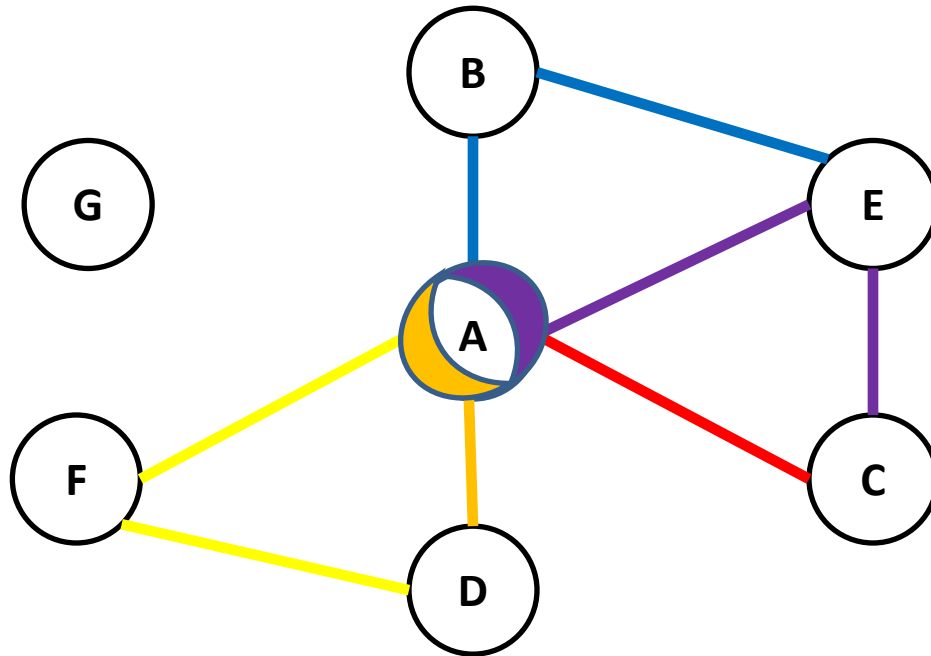
More links require increased precision

# Complexity



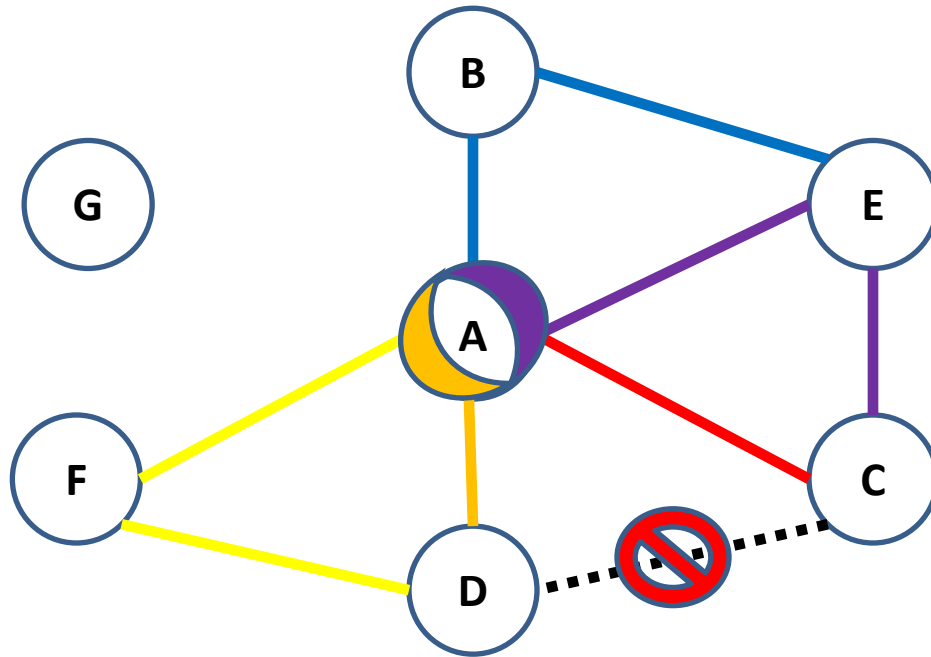
At some point, contradiction is inevitable

# Structural Moderation of Complexity



If B, E, C are unconnected to F and D, a “two-faced” strategy can work

# Structural Moderation of Complexity

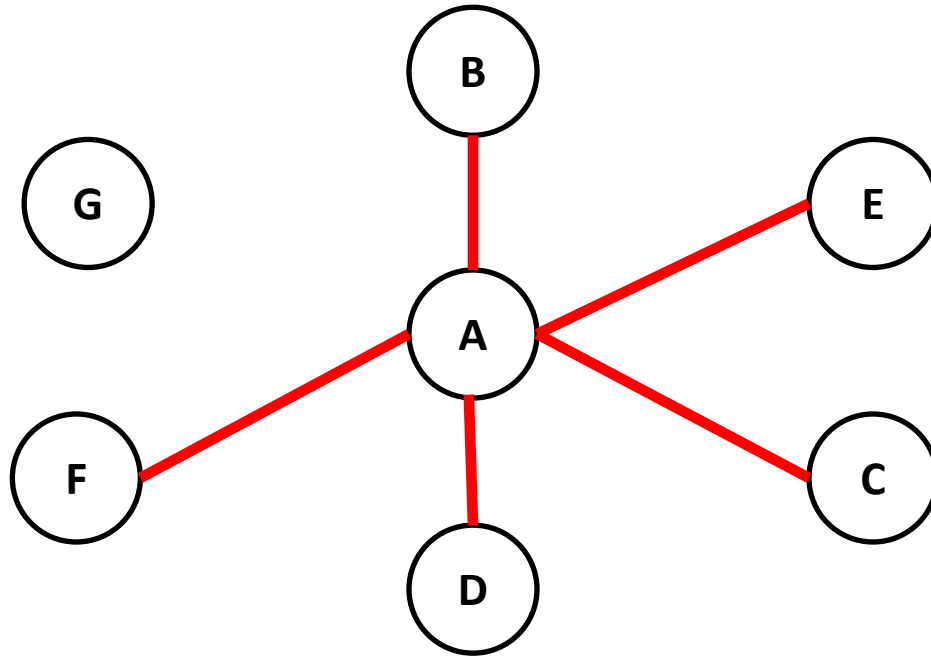


But now network growth is limited

# Complexity Propositions

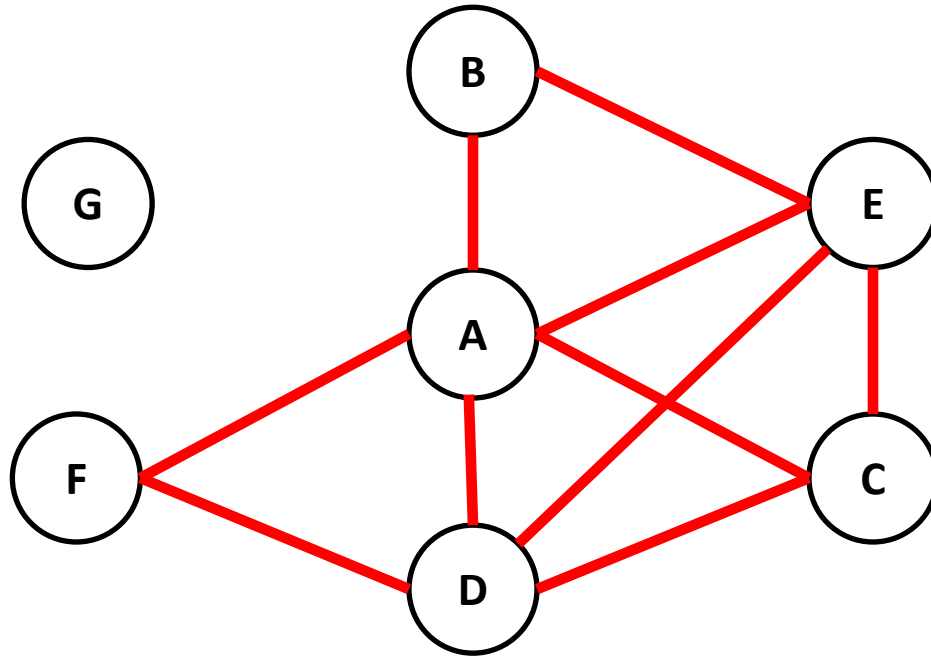
- $P(\text{Violation}) \propto \text{diversity of standards adhered to}$
- $P(\text{Violation}) \propto \frac{1}{\text{path distance between alters}}$
- Therefore...
  - $\text{Link Capacity} \propto \frac{\text{path distance}}{\text{diversity of standards adhered to}}$

# Lock-in



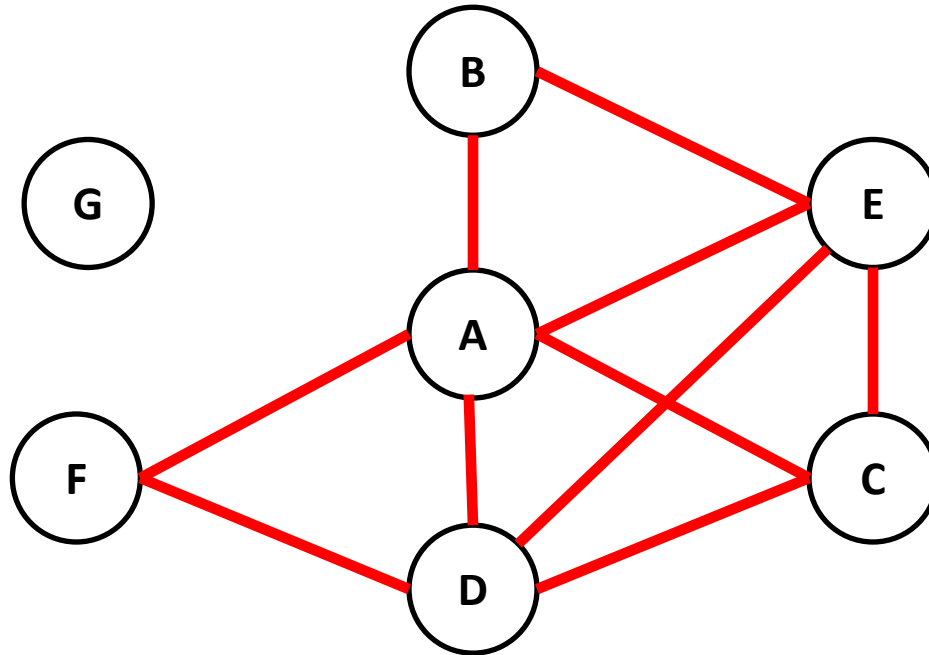
What if everyone agrees to use “red” standard to evaluate one another?

# Lock-in



Network is free to grow...

# Lock-in



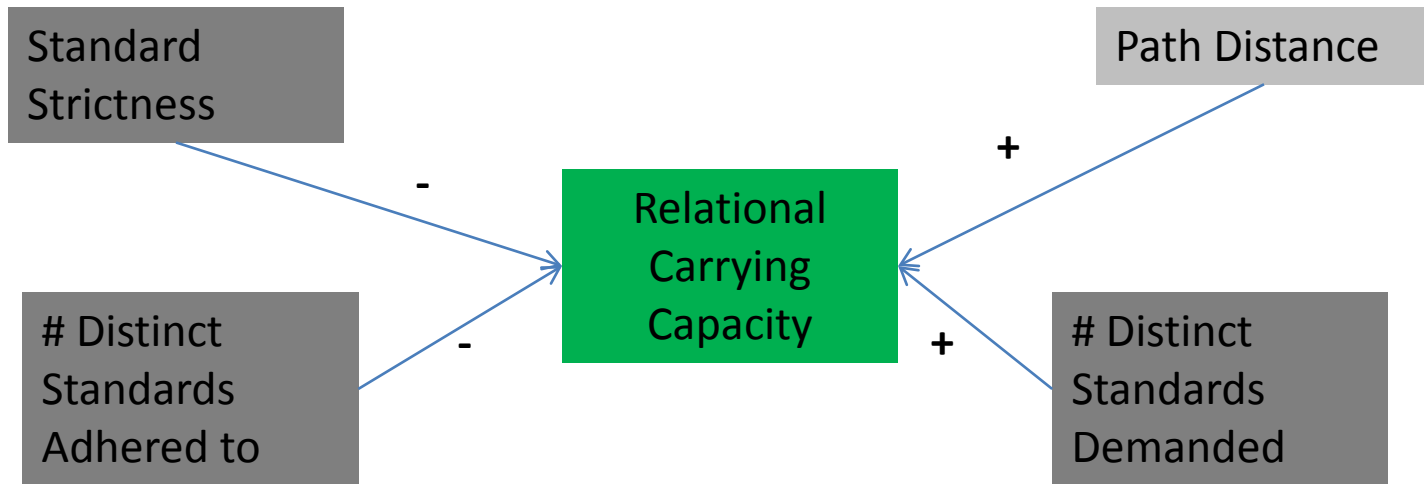
But network is exposed to the “imperfections” of red

- All links are vulnerable to the same errors
- Likely that “broadest standard” is weakest
- No alternative hypotheses from which to find new standards -- who will try a “anti-red” (green) behavior? (March, 1991; Lazer & Friedman, 2007)

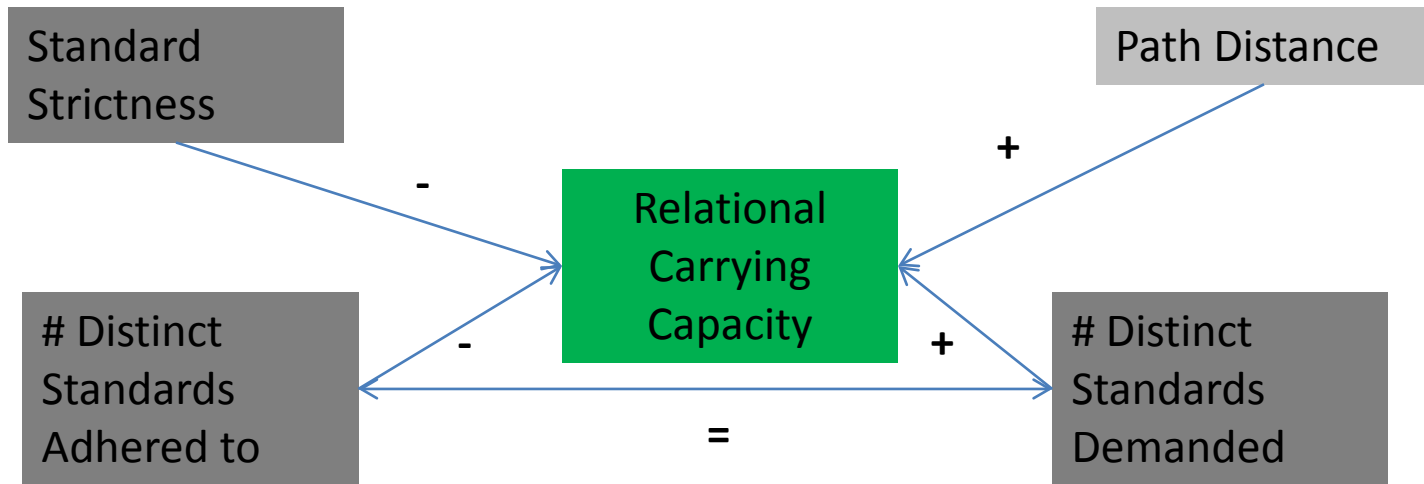
# Lock-in Propositions

- $P(\text{Node Failure}) \propto \frac{1}{\text{Diversity of Standards Demanded}}$
- Therefore...
  - $\text{Link Capacity}^* \propto \text{Diversity of Standards Demanded}$

# Full Model



# Full Model

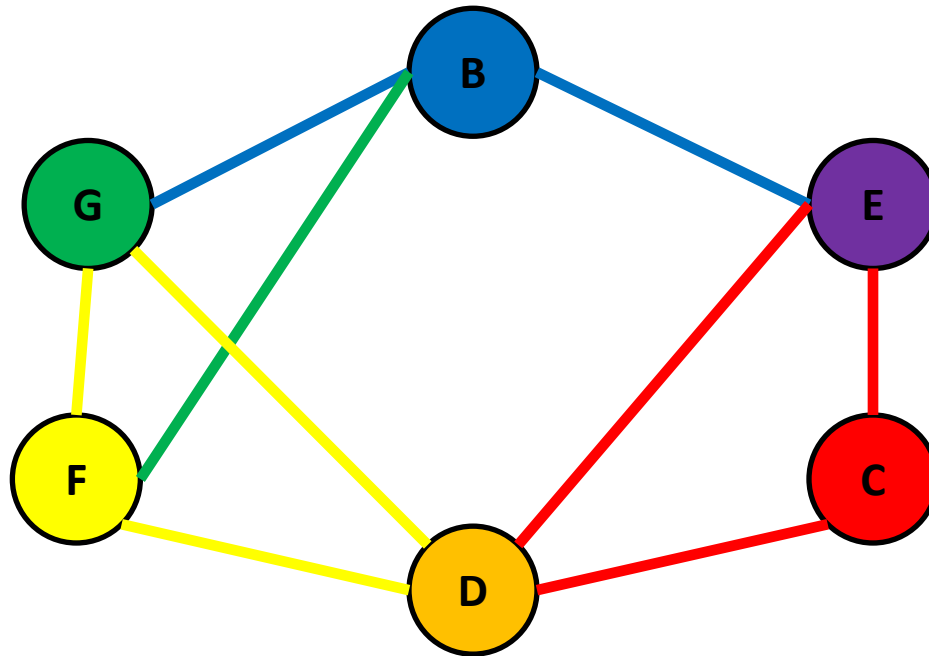


Network growth limited by network structure via...

1. Path distance
2. Distribution of standards (??)

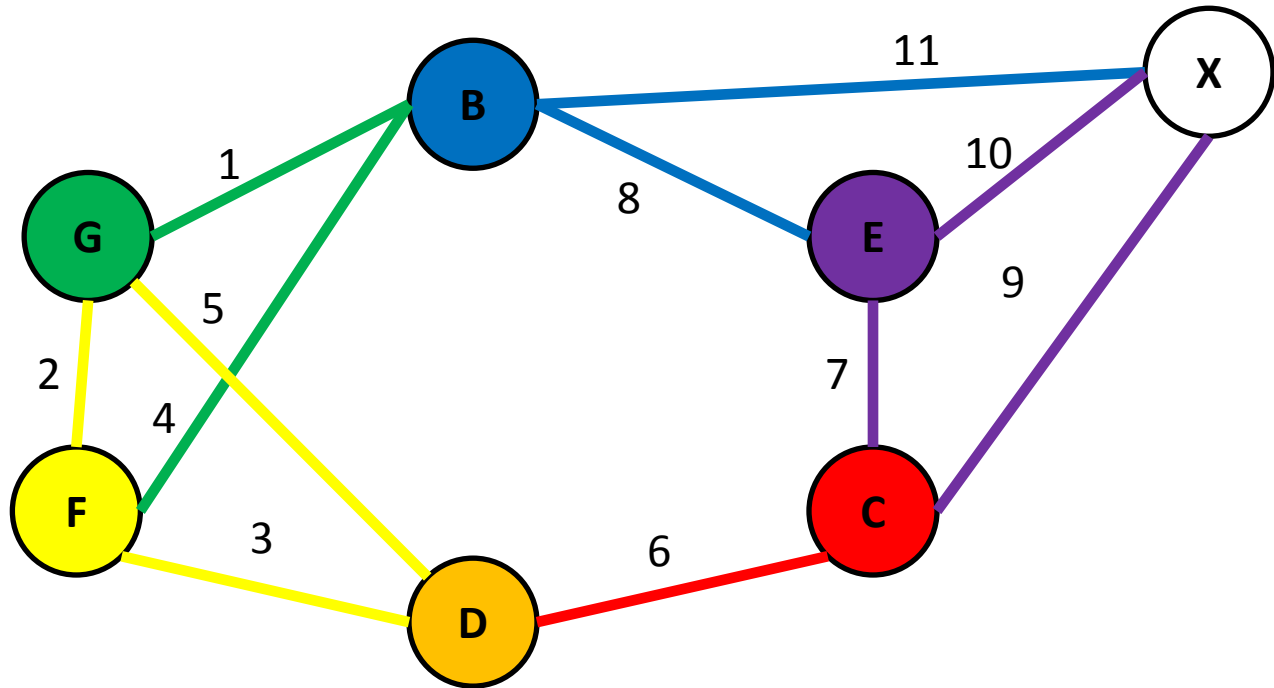


# Empirical signatures



- Nodal “specialization” keeps standards diversified but average degree low
- 2-step paths serve as “transformers”

# Questions...?



- How does adding new nodes create opportunity for densification?
  - Do nodes shift their logics
  - Benefits of “non-commitment?”

# Thank you for your time!

- Questions and suggestions much appreciated!