MODELING THE COEVOLUTION OF NETWORKS AND OPINIONS

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the idea

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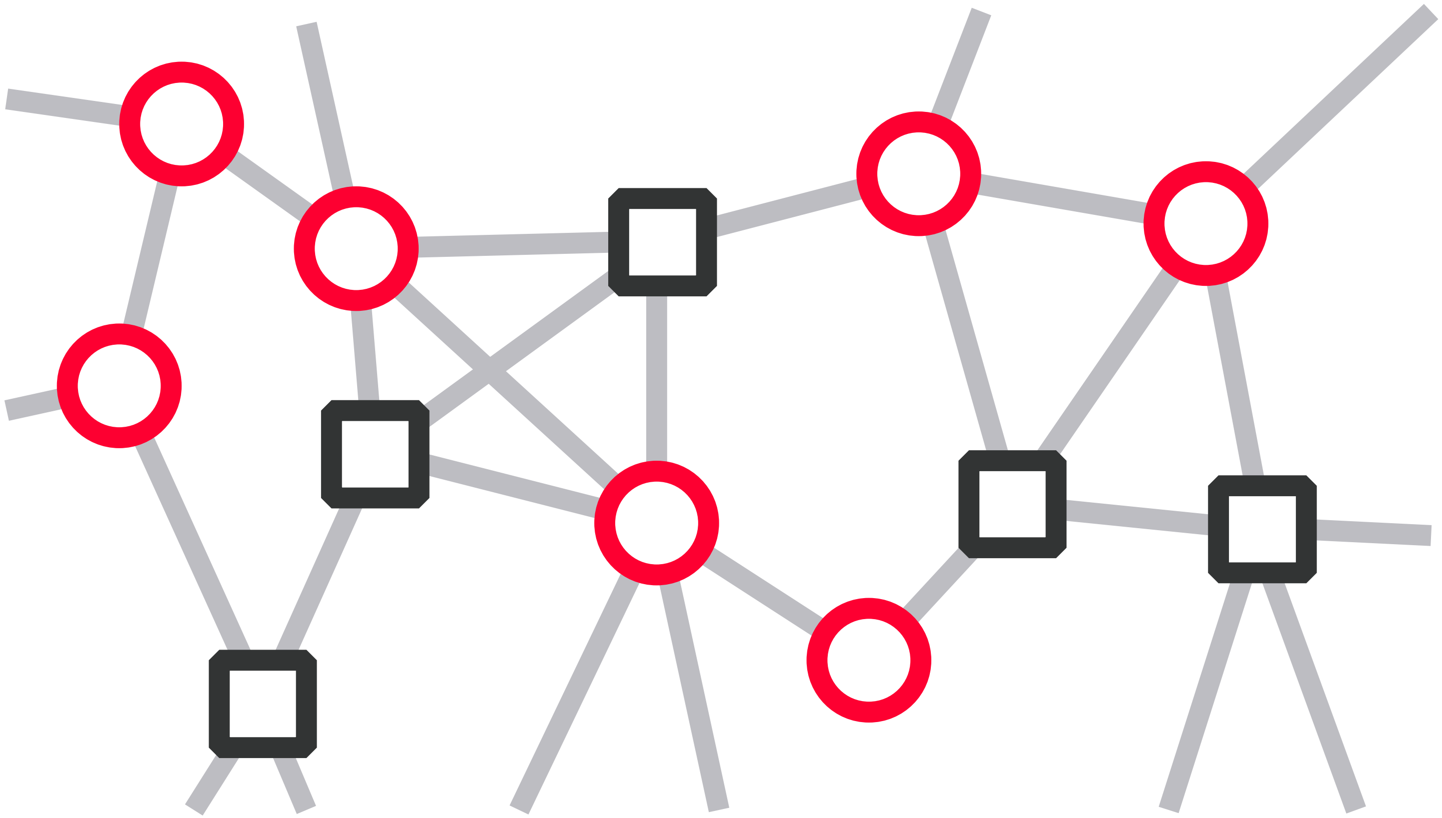
- We try to combine these points into a simple model of simultaneous opinion spreading and network evolution.

the voter model



Clifford & Sudbury, Biometrika **60**, 581 (1973).
Holley & Liggett, Ann. Probab. **3**, 643 (1975).

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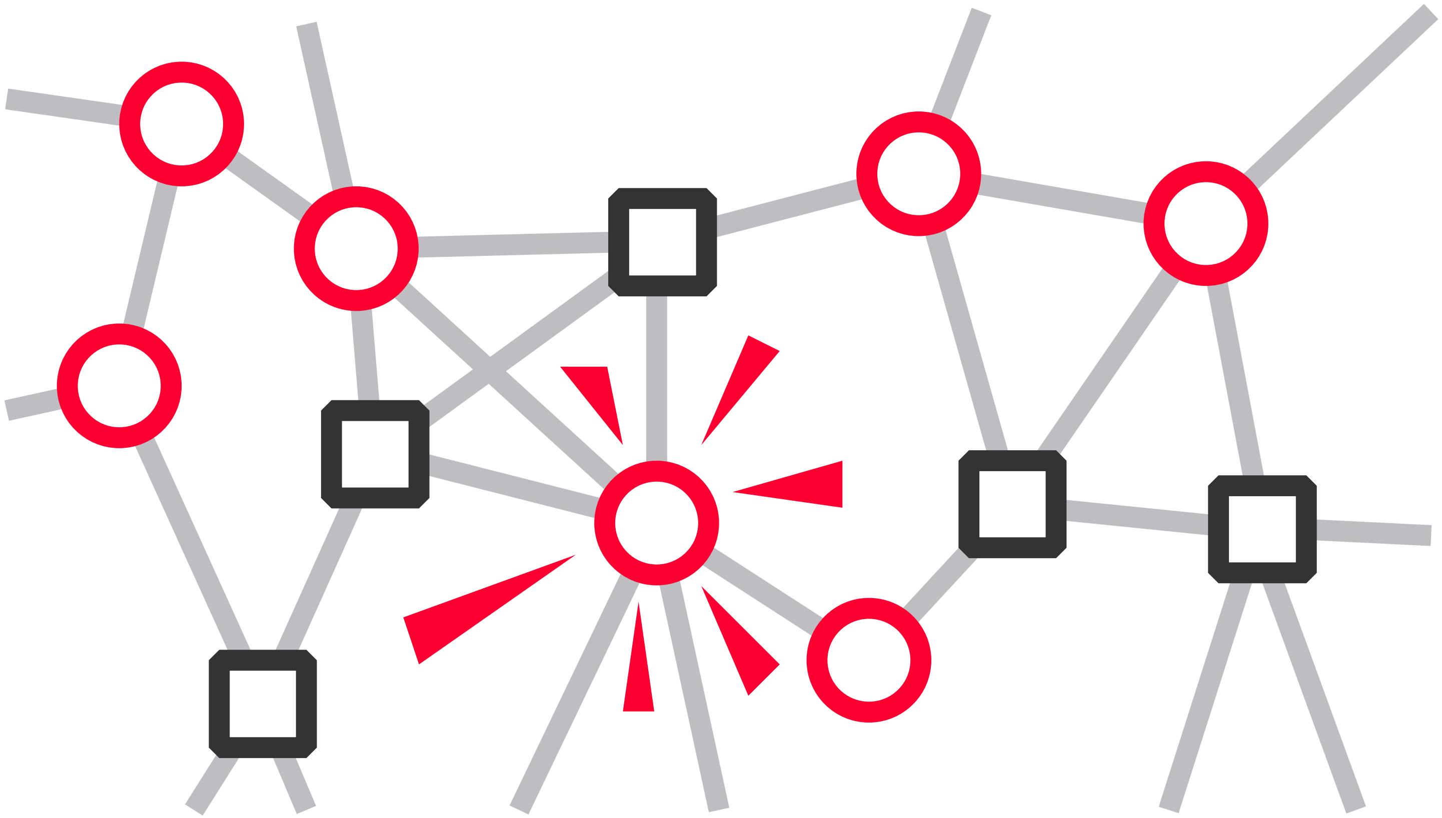
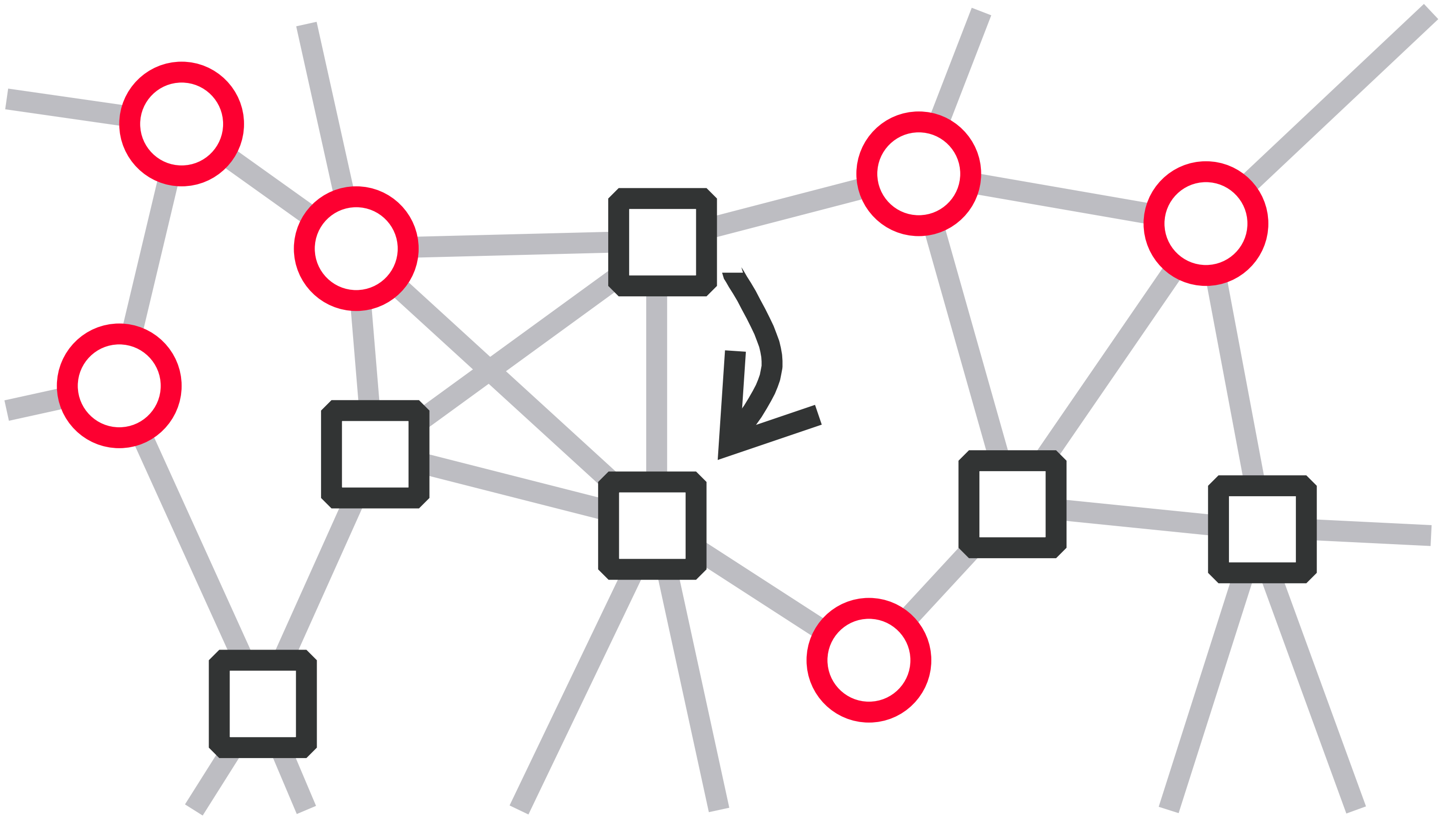


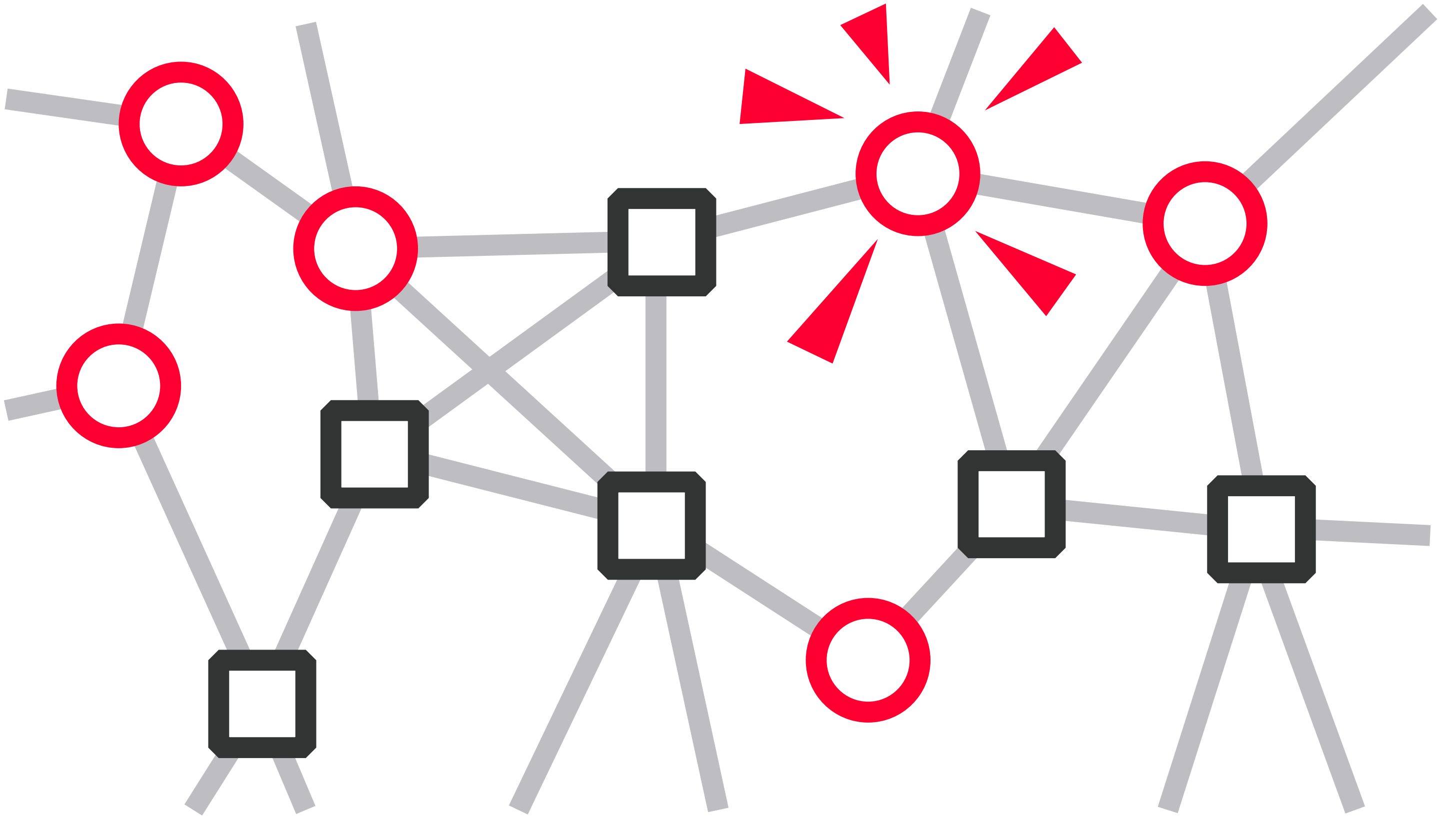
choose one vertex randomly

the voter model



copy the opinion of a random neighbor

the voter model



and so on . . .

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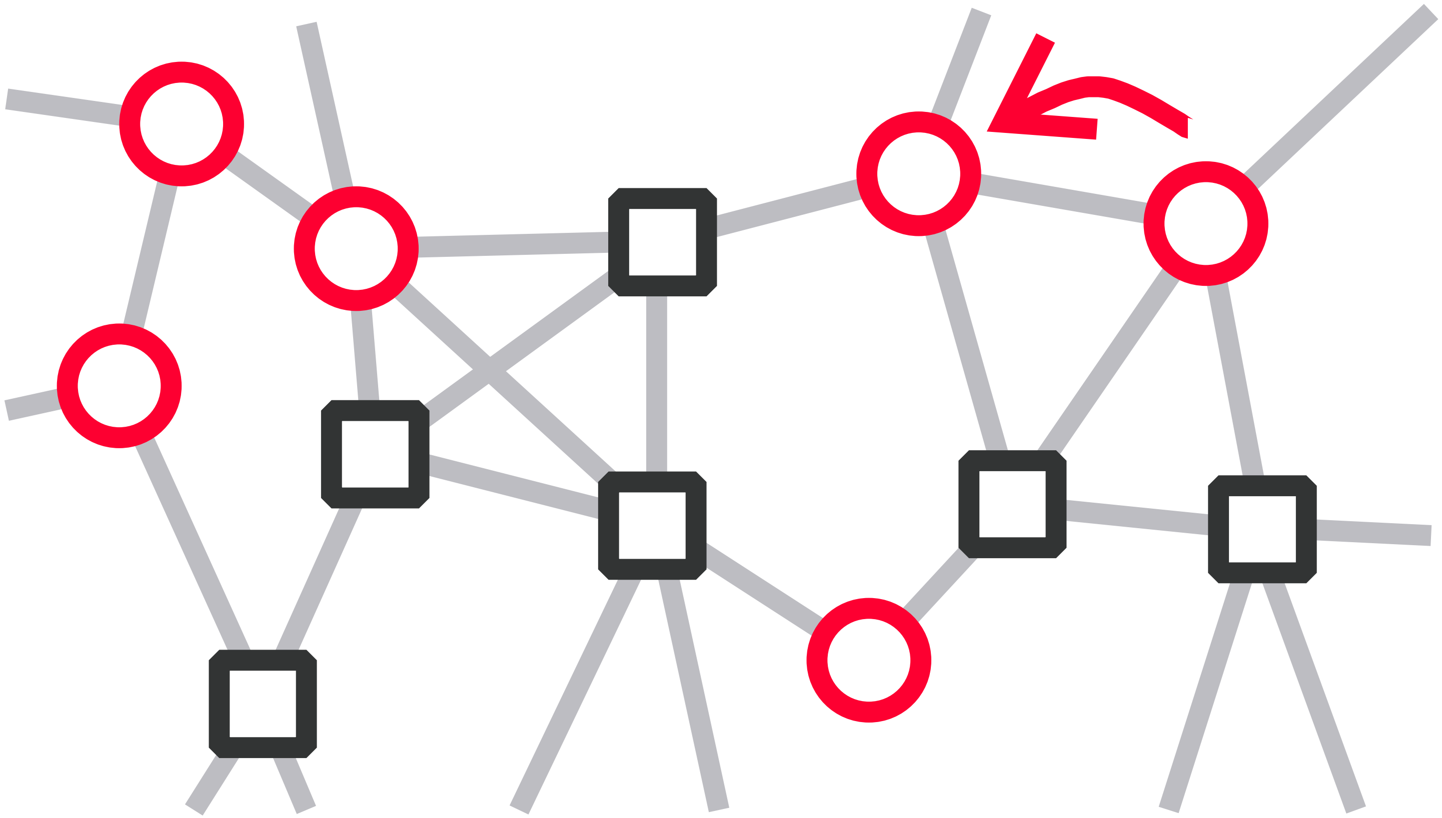

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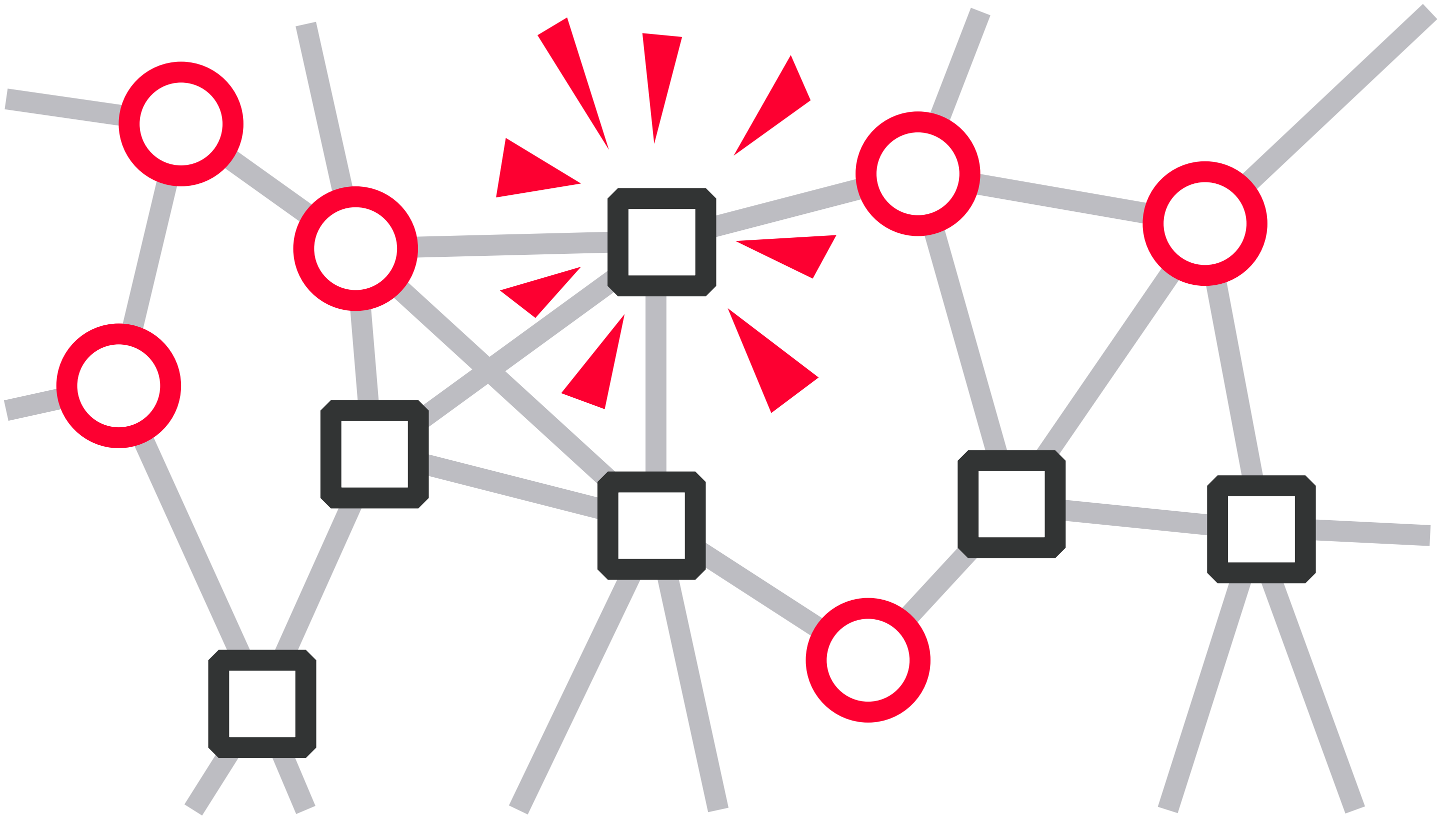

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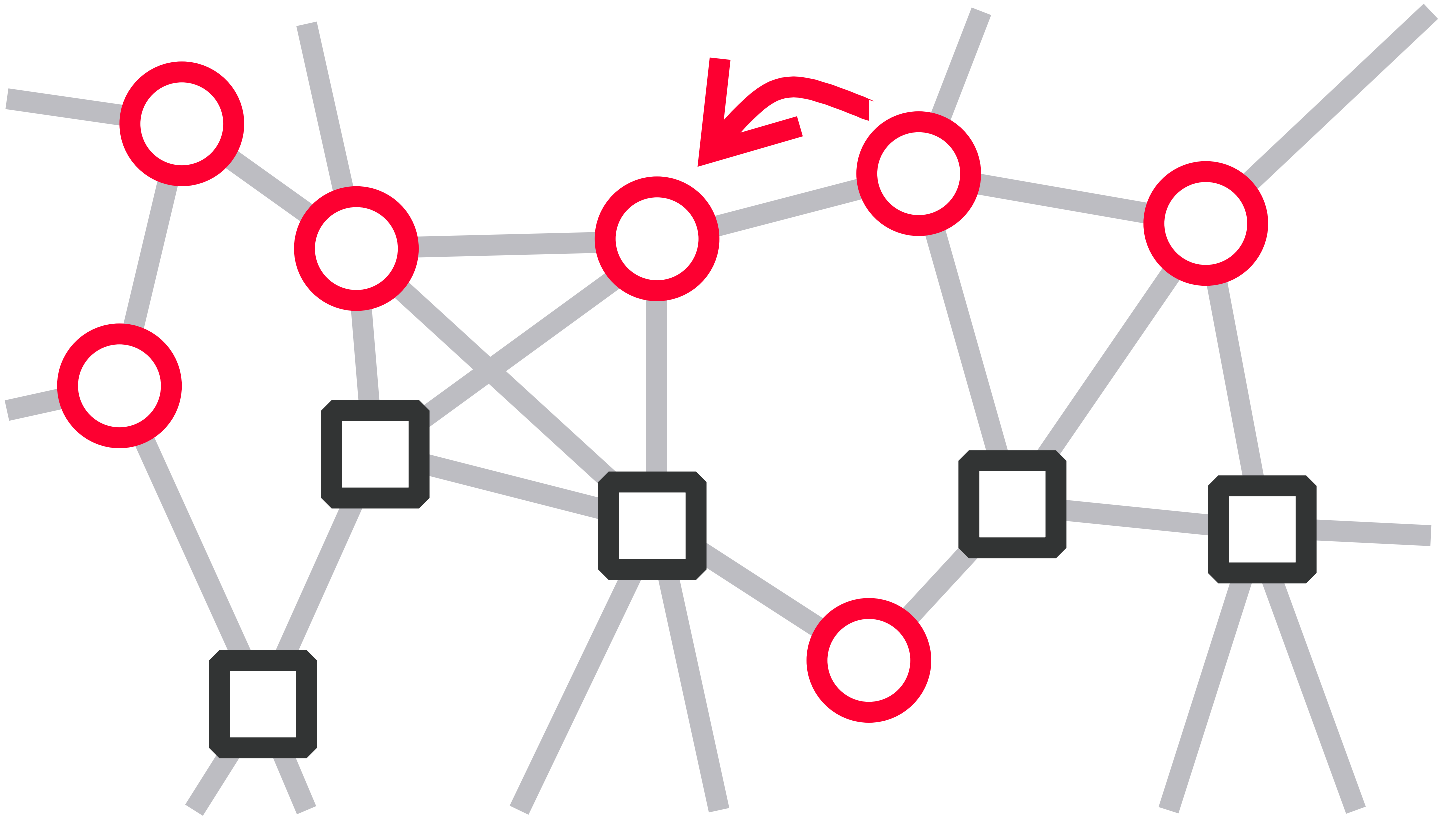

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acquaintance dynamics

- People of similar interests are likely to get acquainted. e.g.: McPherson *et al.*, Ann. Rev. Sociol. **27**, 415 (2001).

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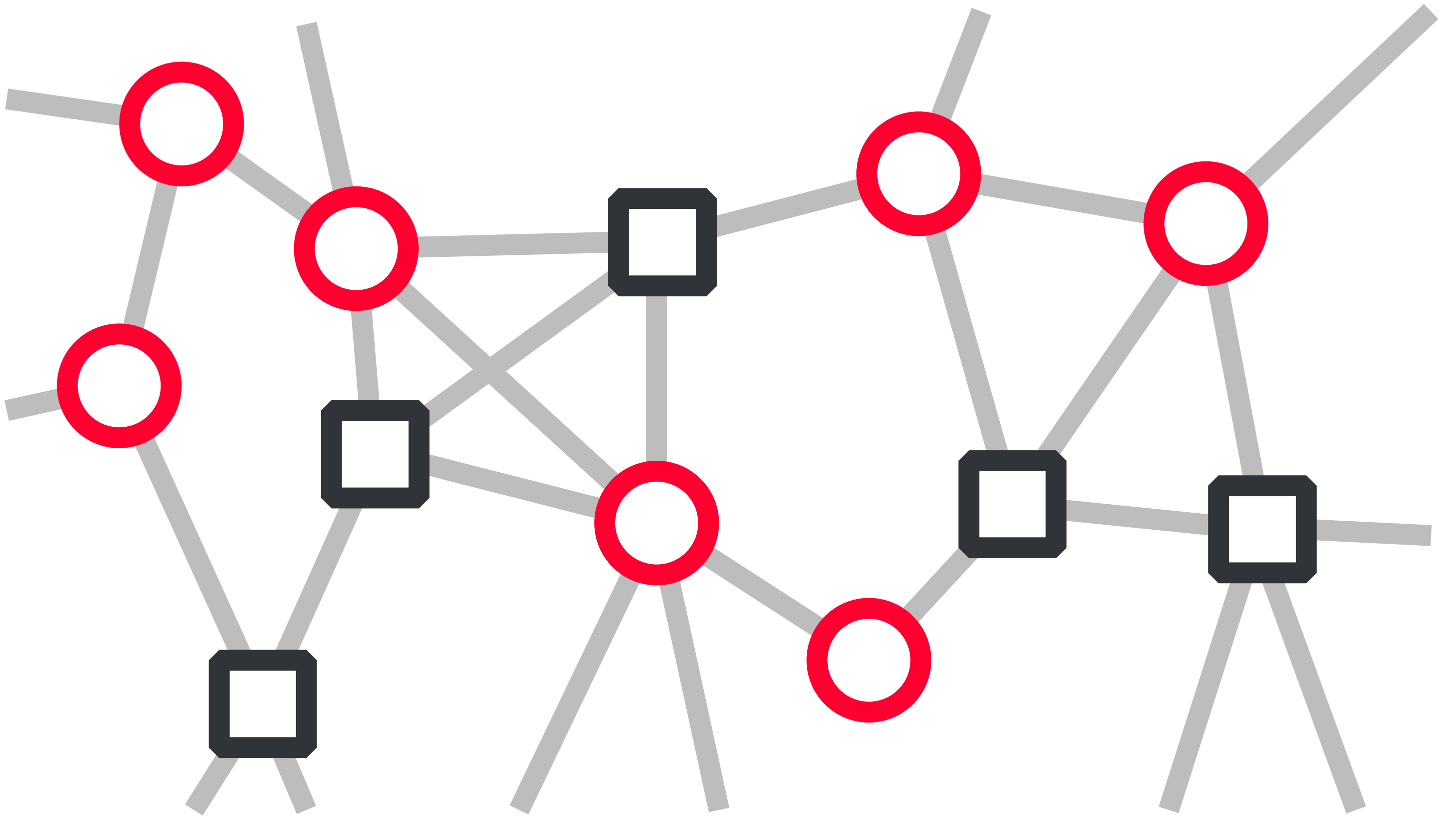
- The number of edges is constant.

acquaintance dynamics



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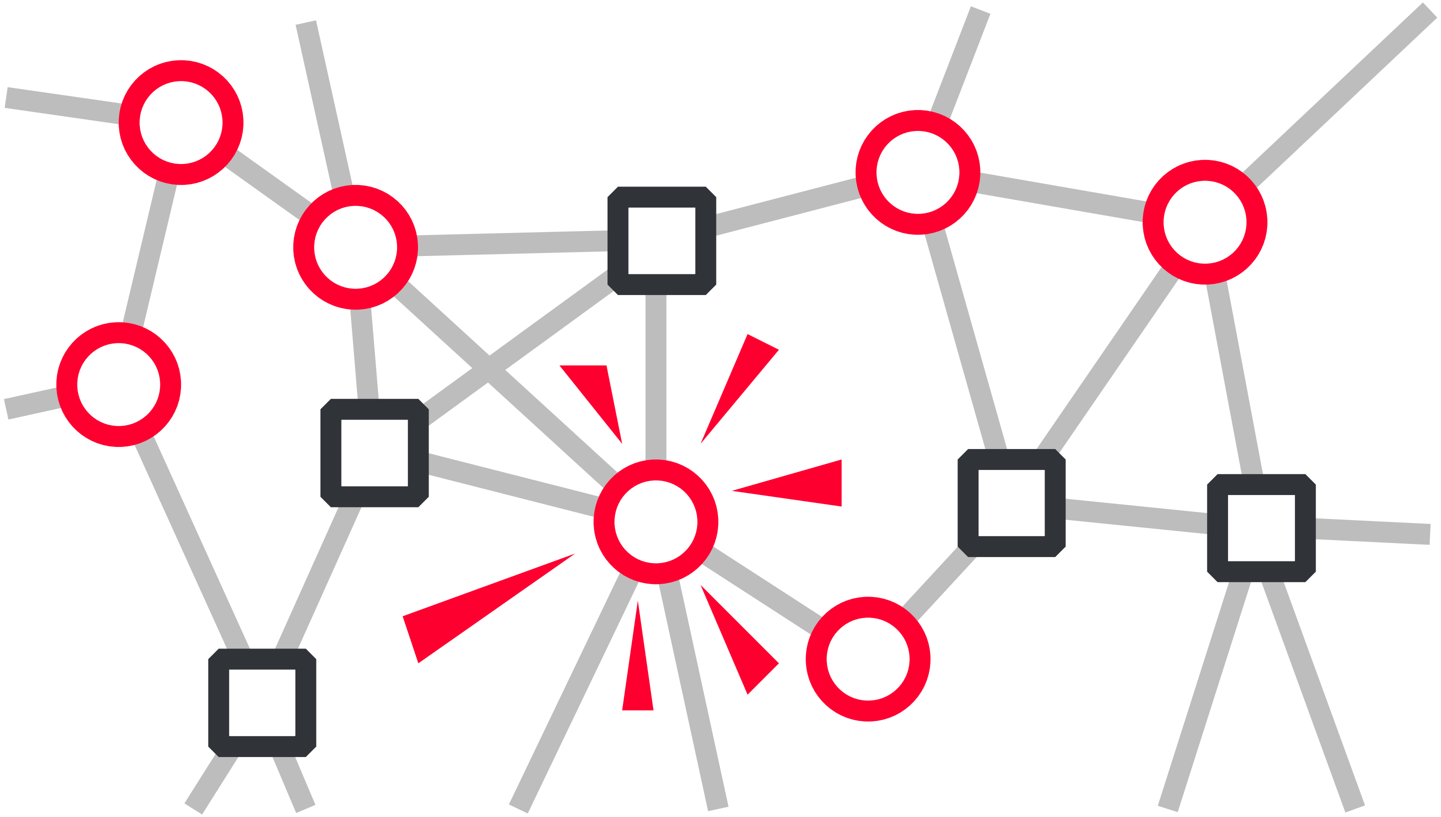
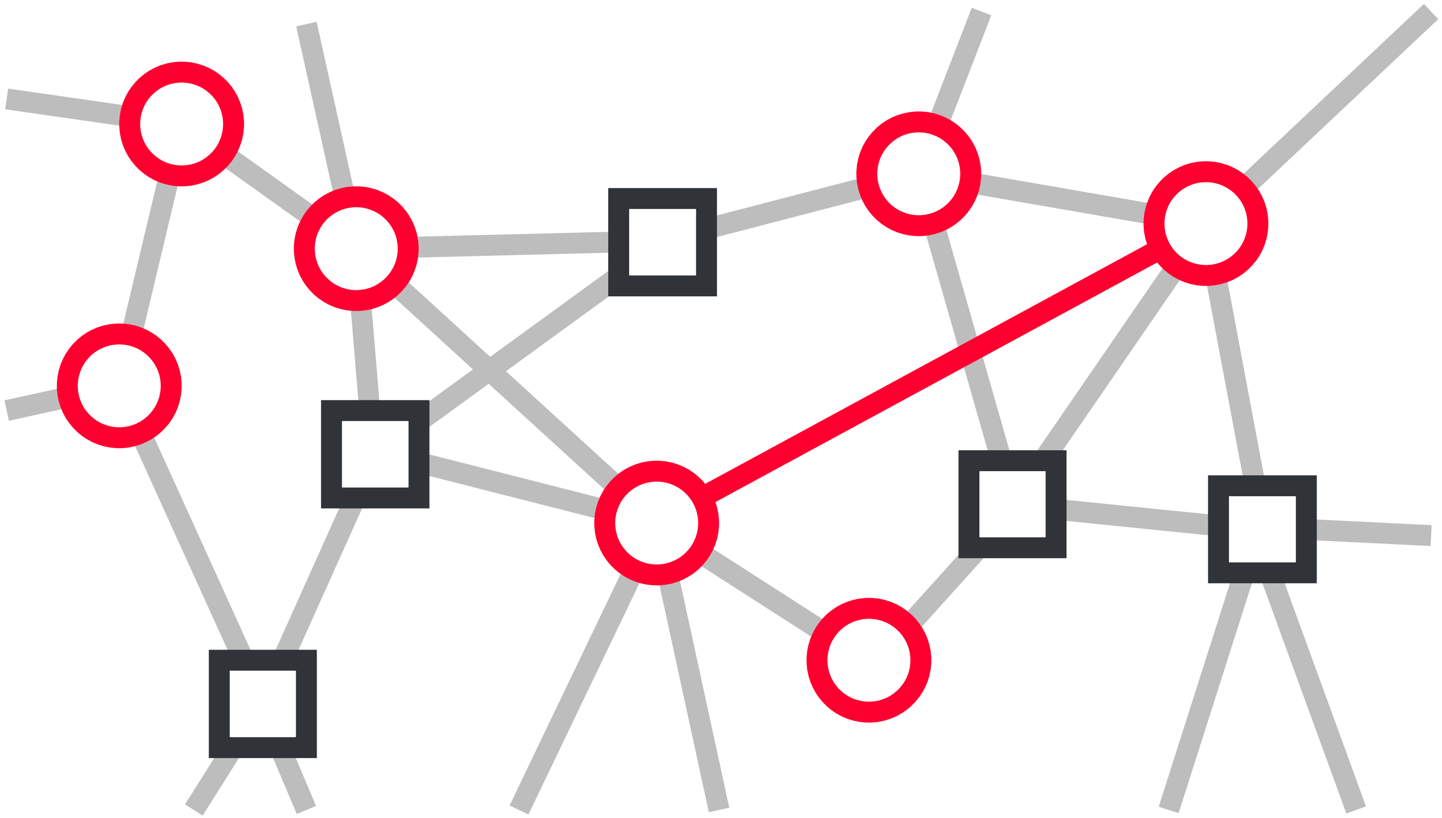


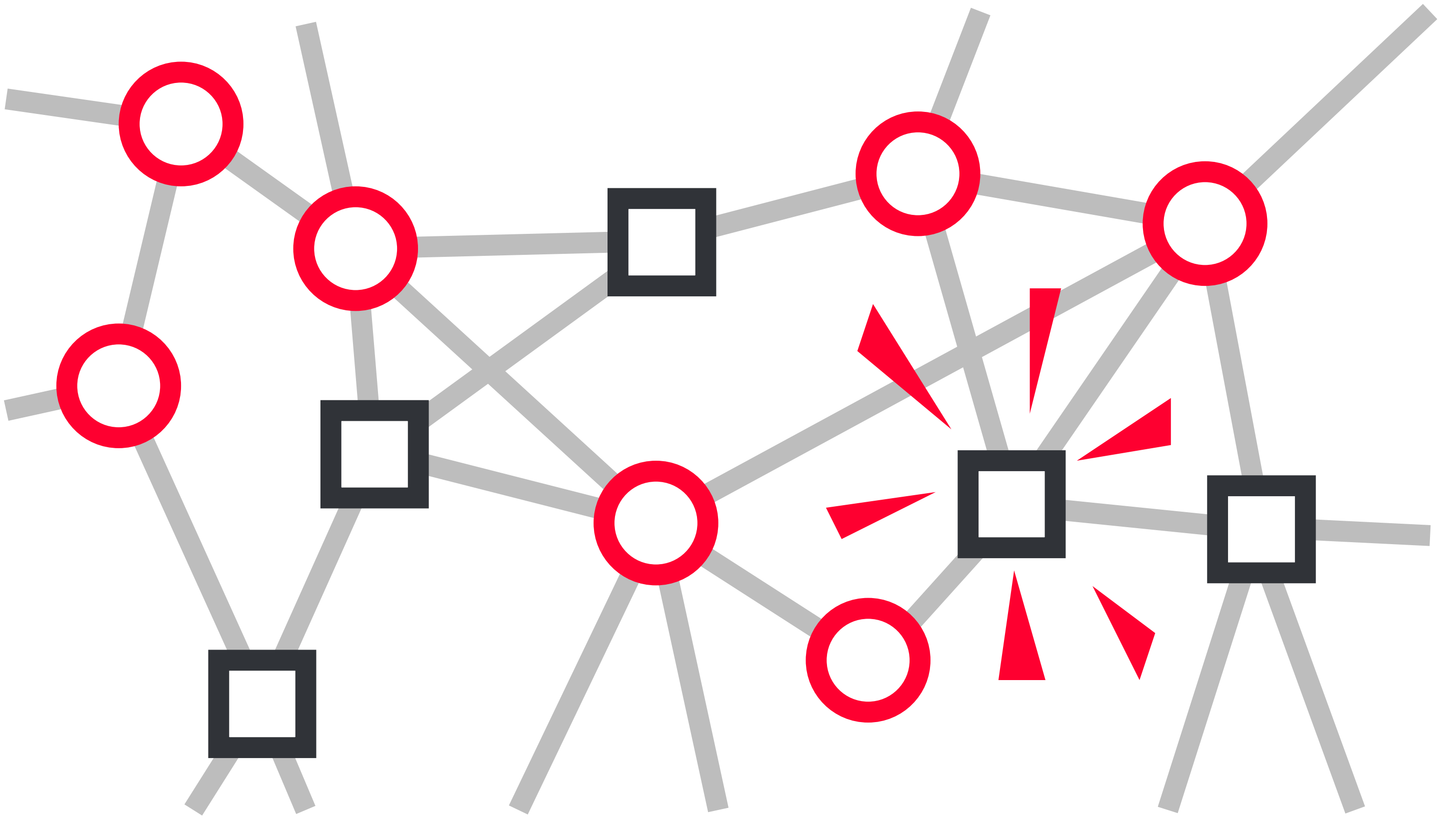
choose one vertex randomly

acquaintance dynamics



rewire an edge to a vertex with the same opinion

acquaintance dynamics



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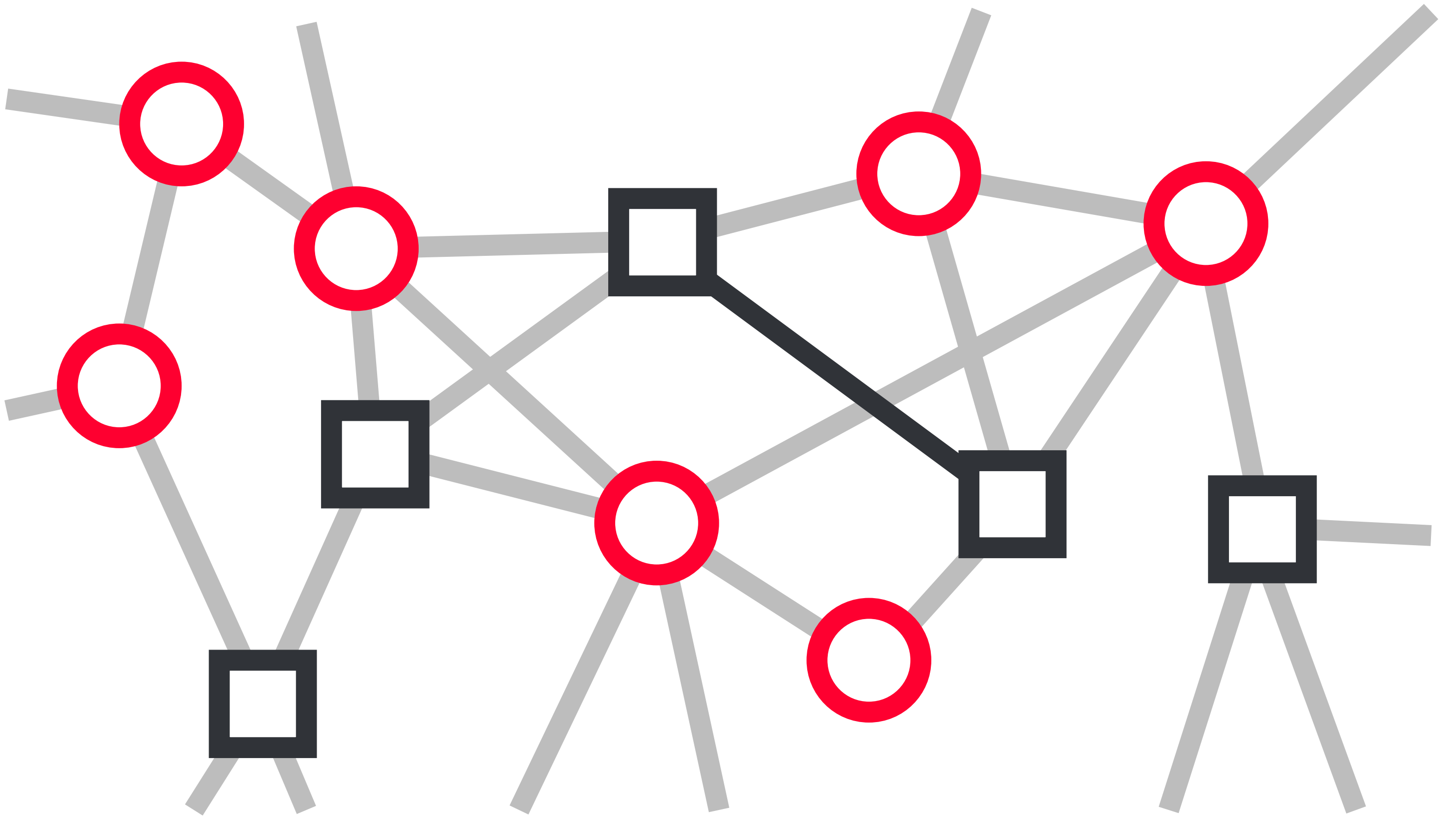

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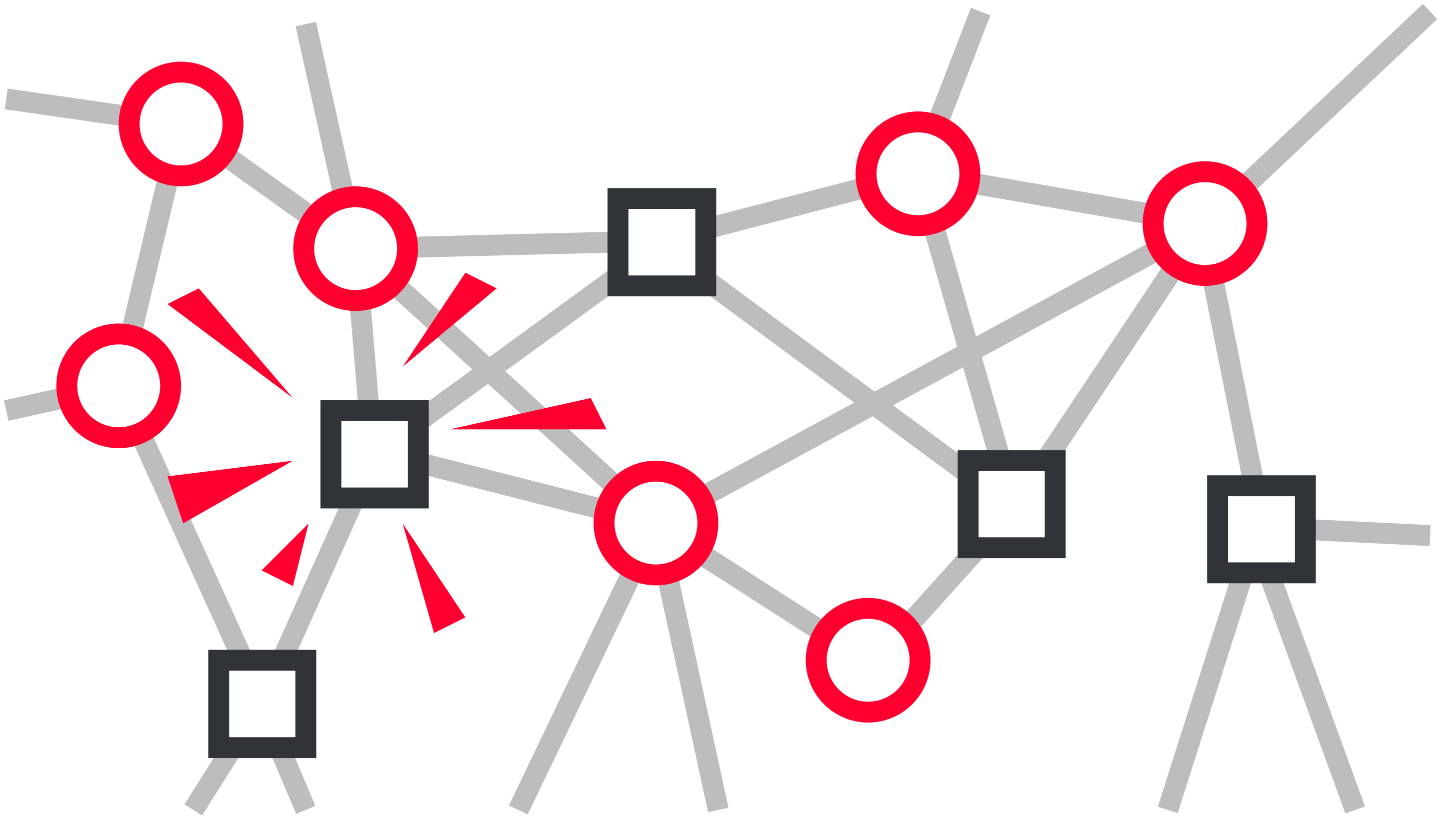

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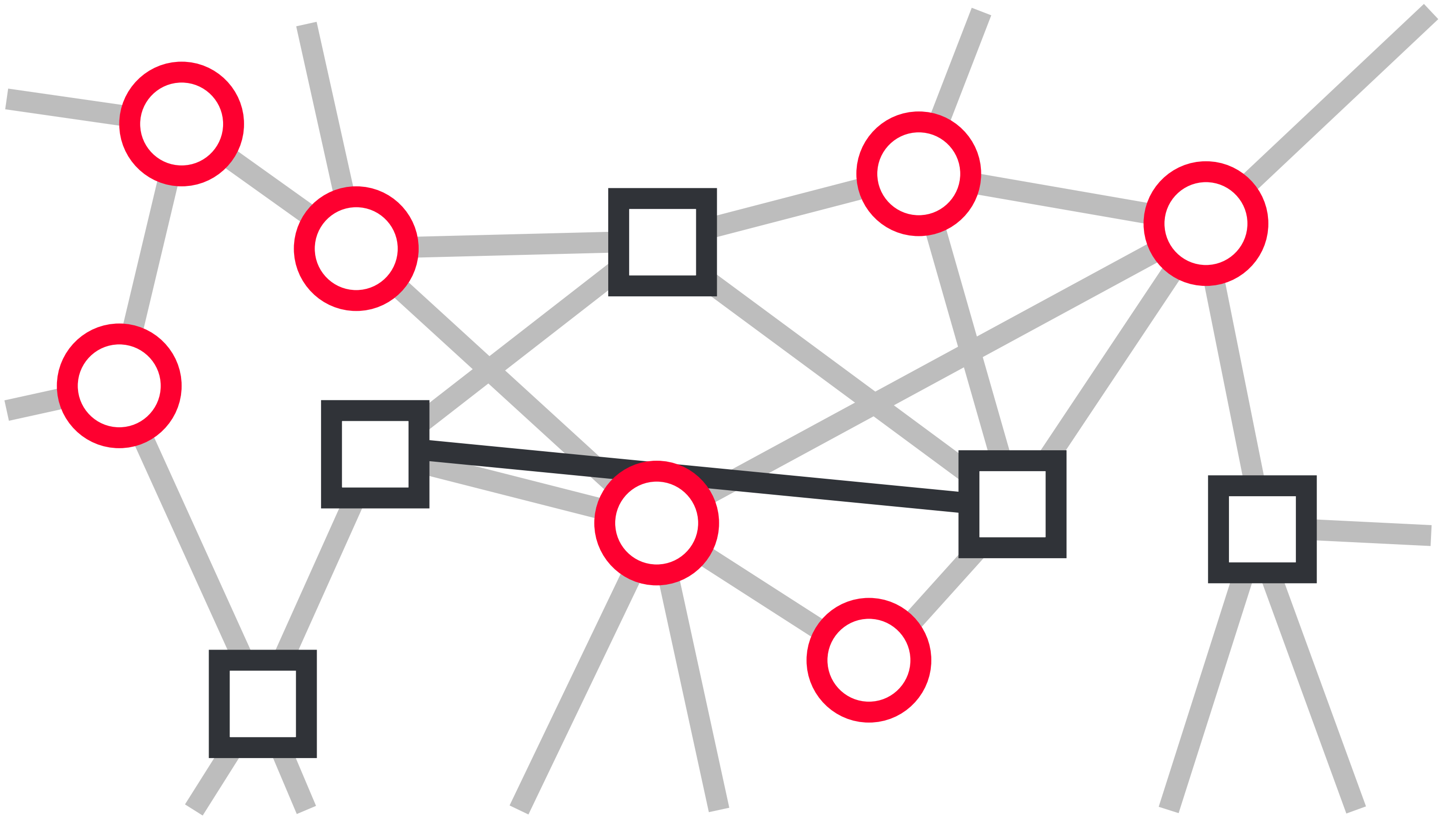

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our model

1. Start with a random network of N vertices $M = \bar{k}N/2$ edges and $G = N/\gamma$ randomly assigned opinions.

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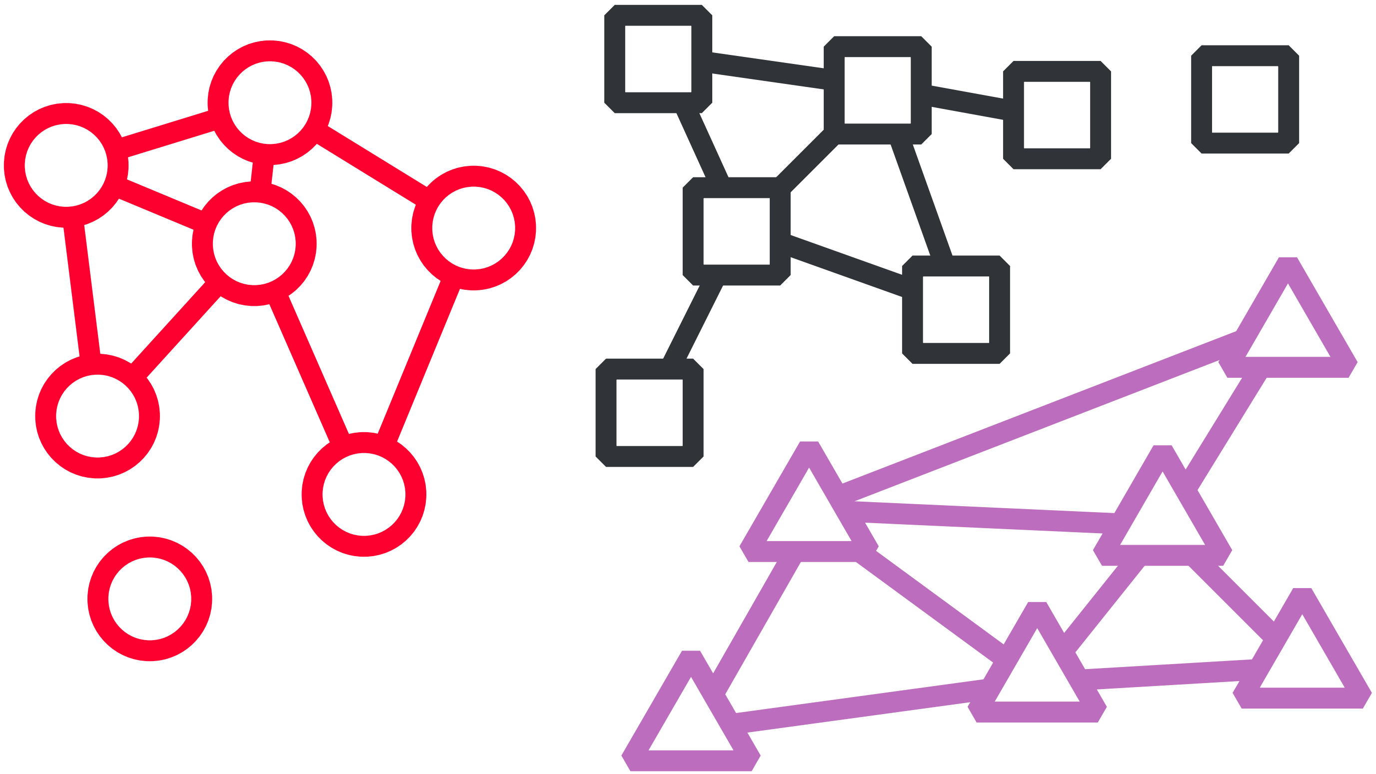
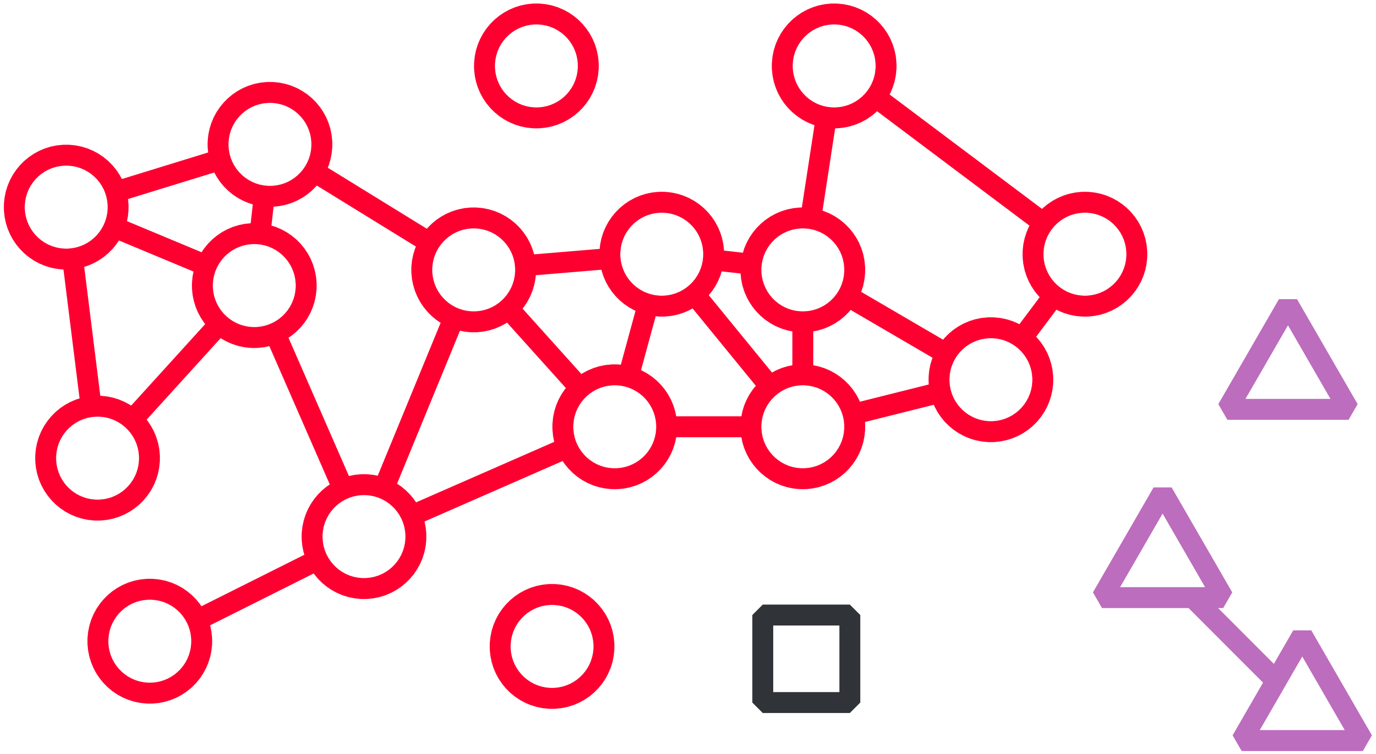
5. If there are edges leading between vertices of different opinions—iterate from step 2.

phases



low ϕ—clusters of similar sizes

phases



high ϕ—one dominant cluster

quantities we measure

- The relative size $s = S/N$ of a cluster (of vertices with the same opinion).

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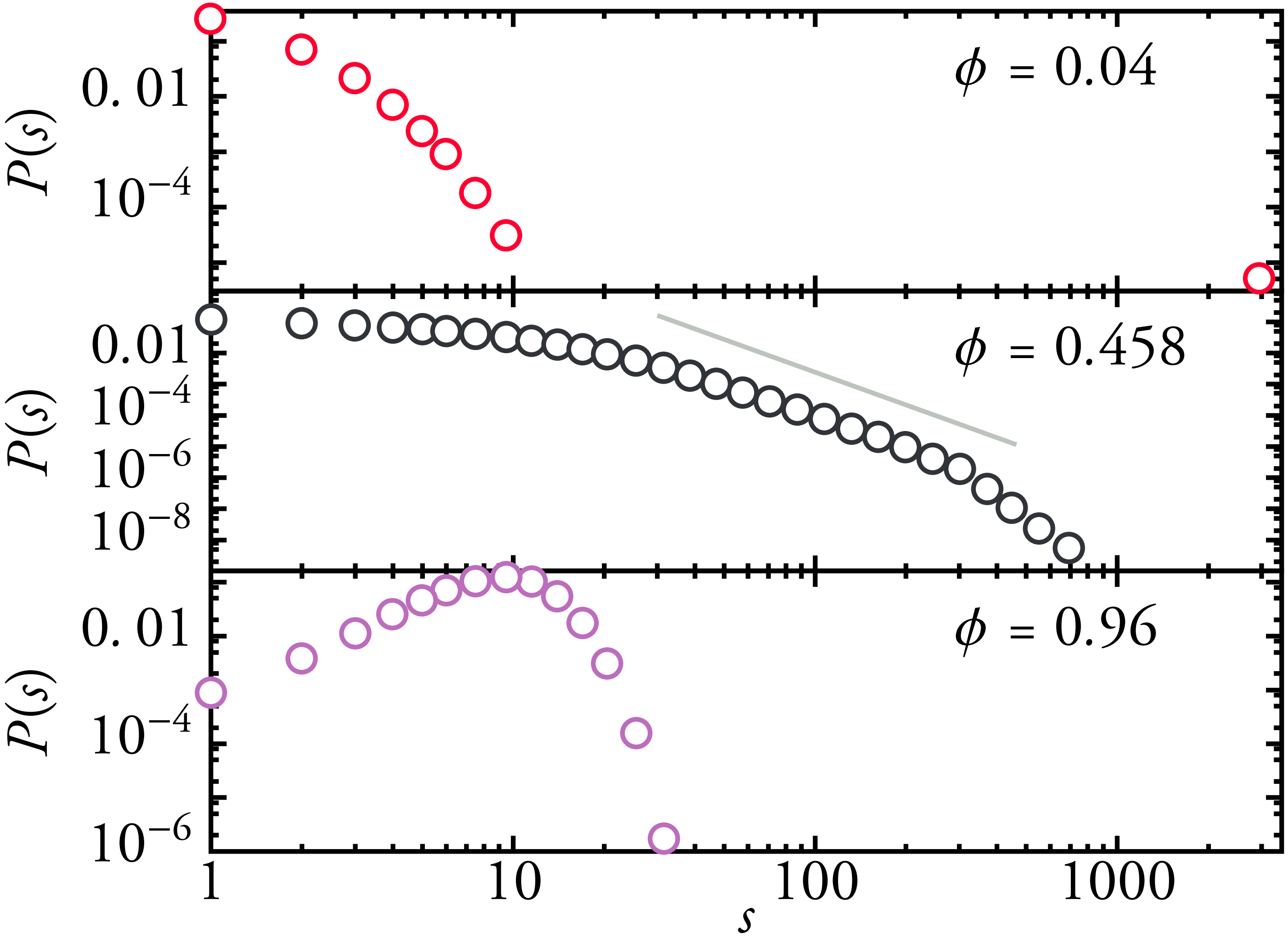
- The average time τ to reach consensus.

cluster size distribution

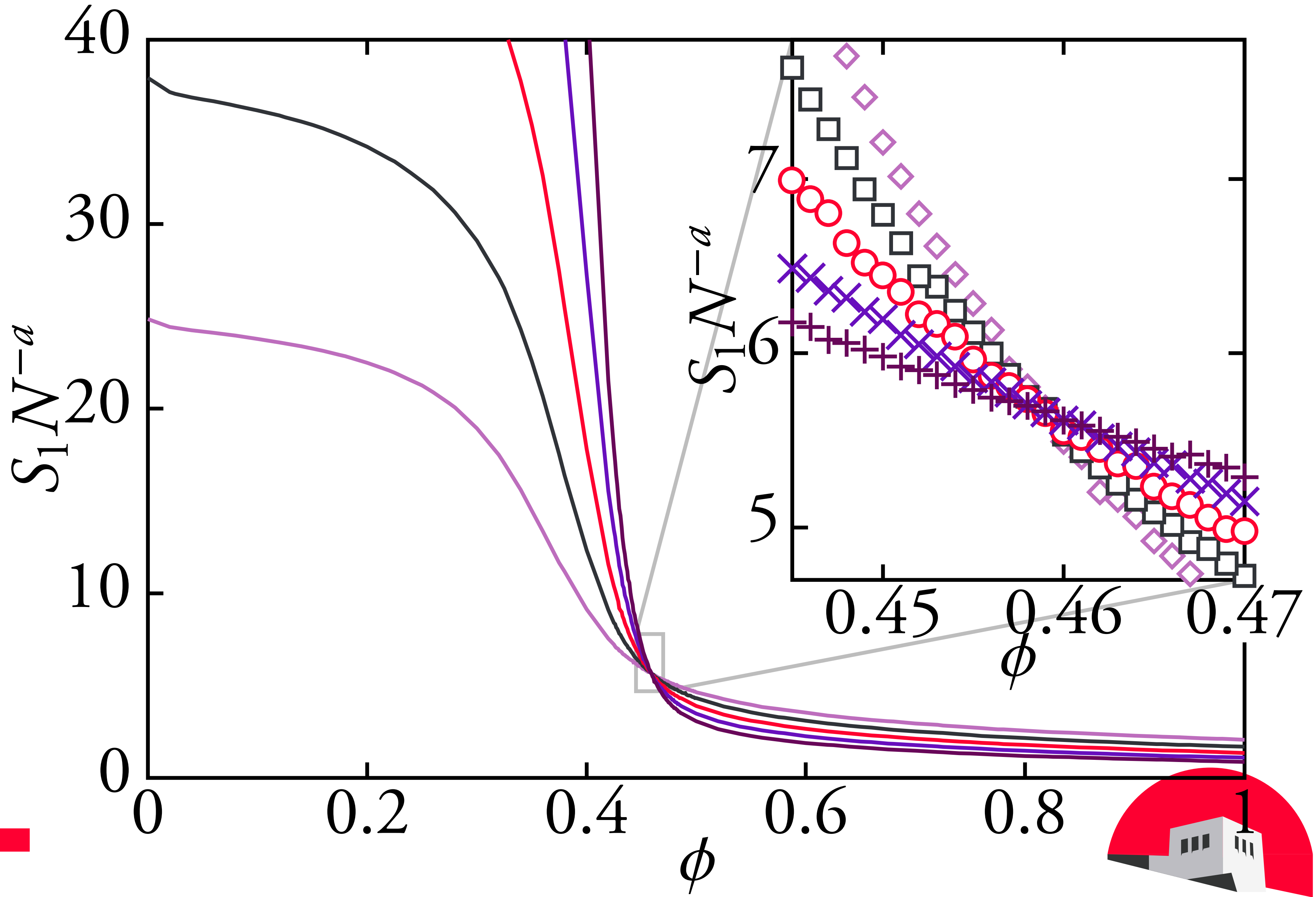


finding the phase transition

Assume a critical scaling form:

$$S = N^{-a} F\left(N^{b}(\phi - \phi_c)\right)$$

finding the phase transition



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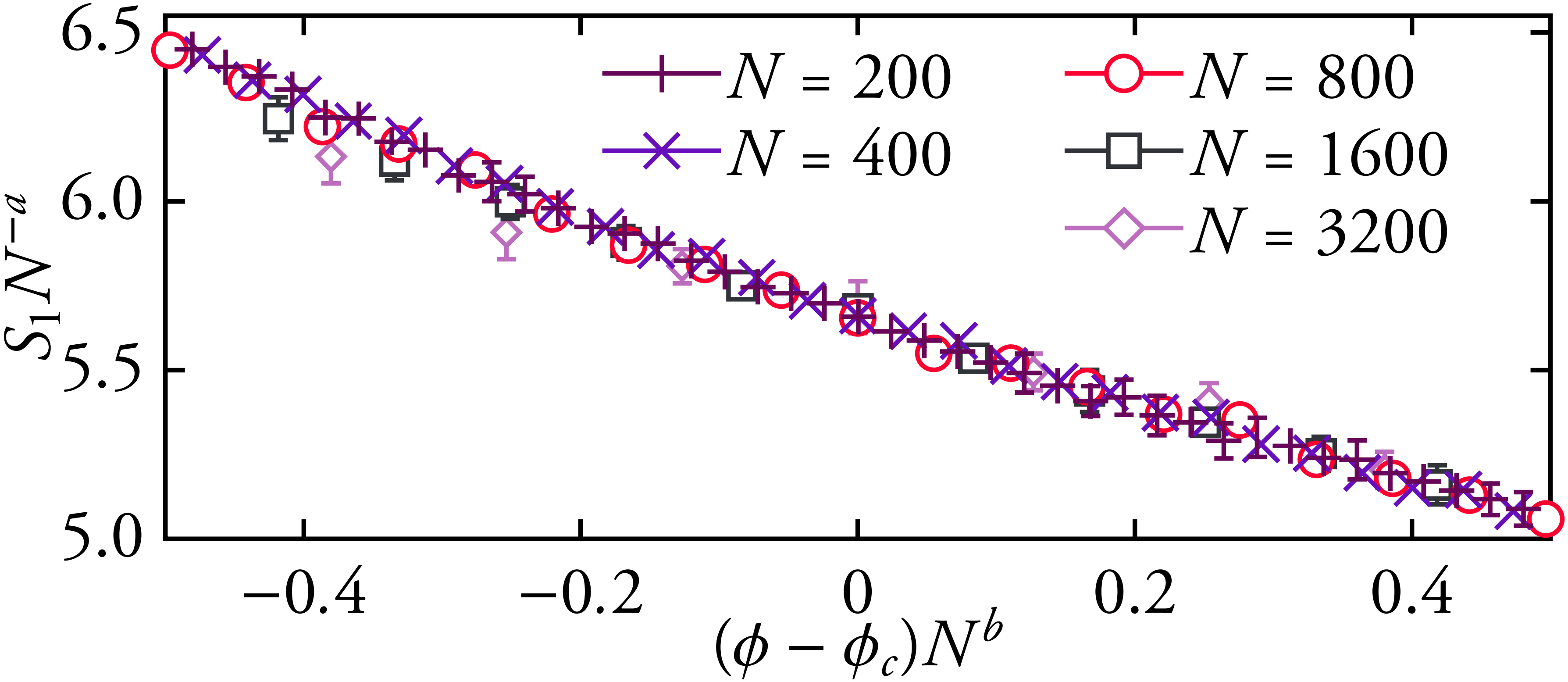

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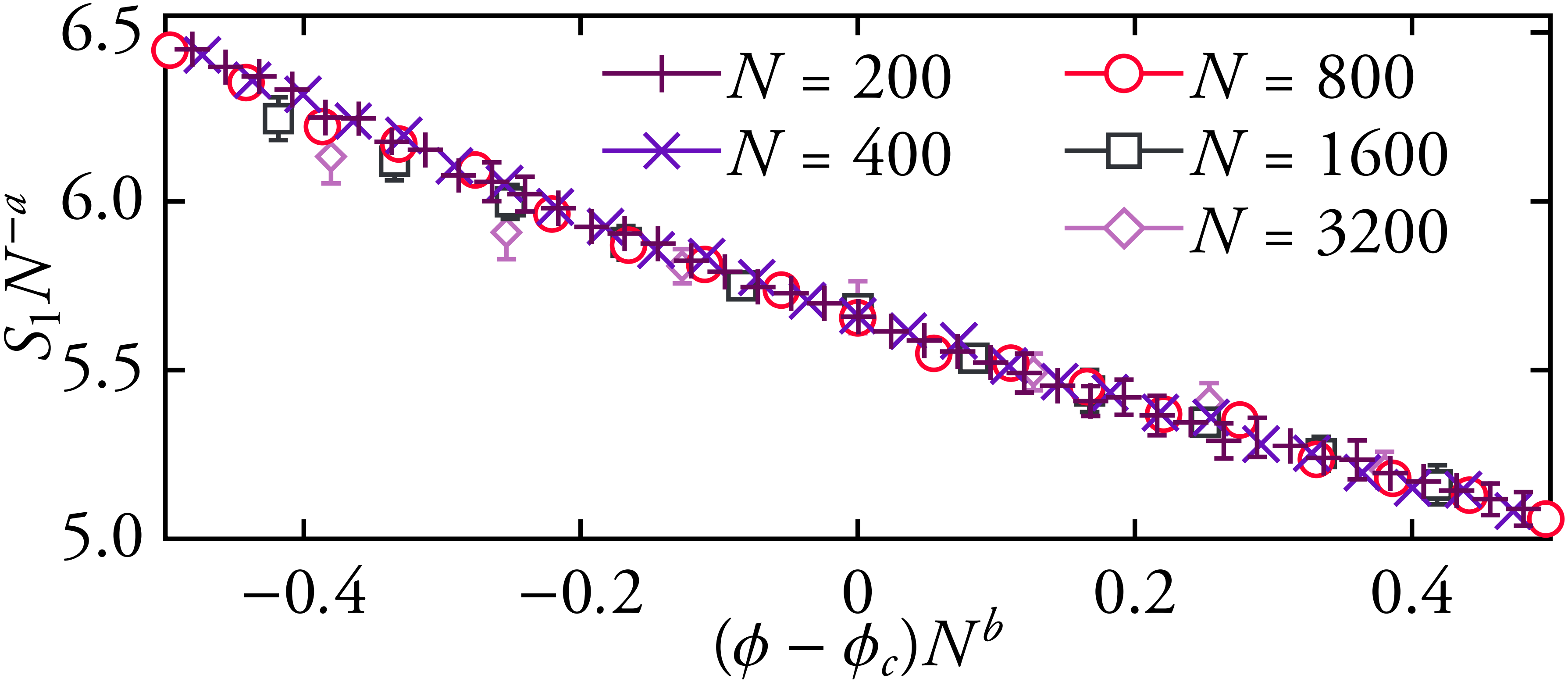

$a = 0.61 \pm 0.05$, $\phi_c = 0.458 \pm 0.008$, $b = 0.7 \pm 0.1$

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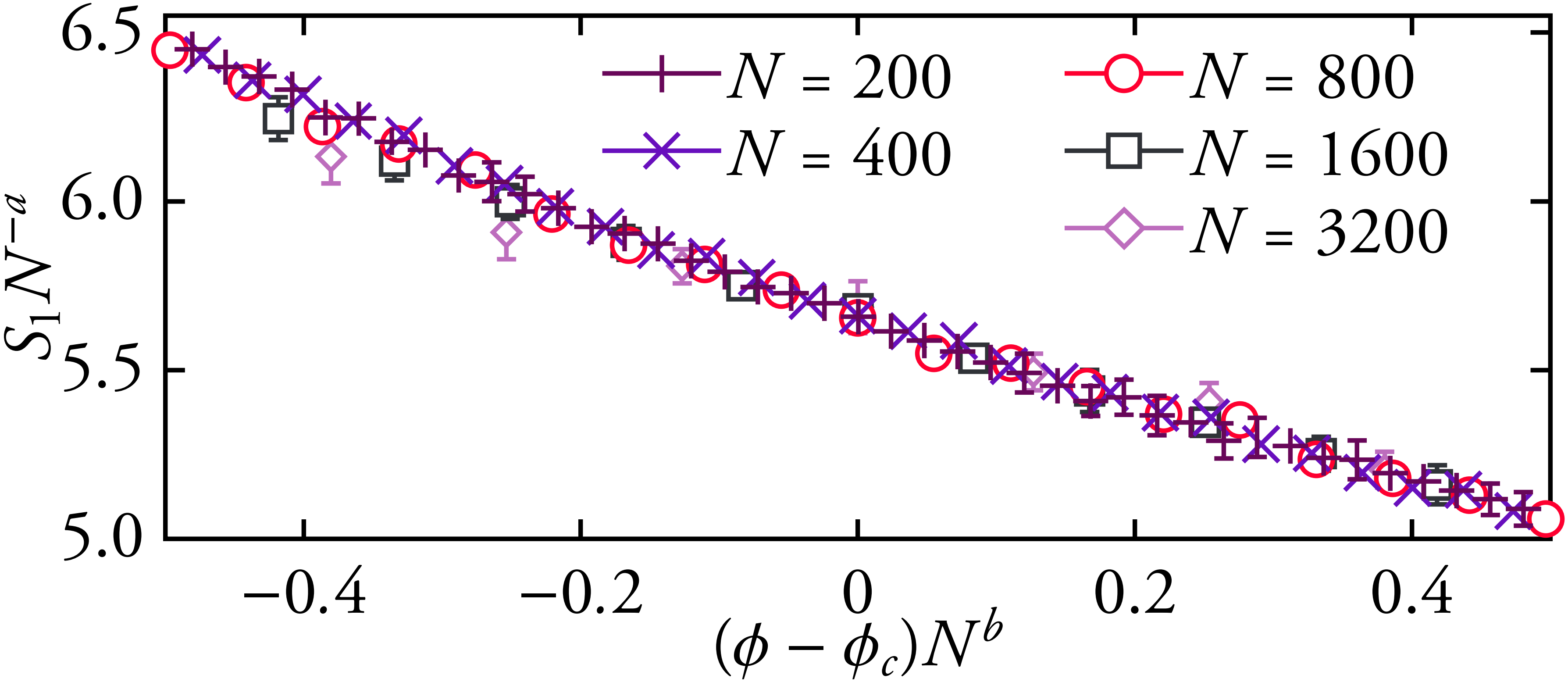

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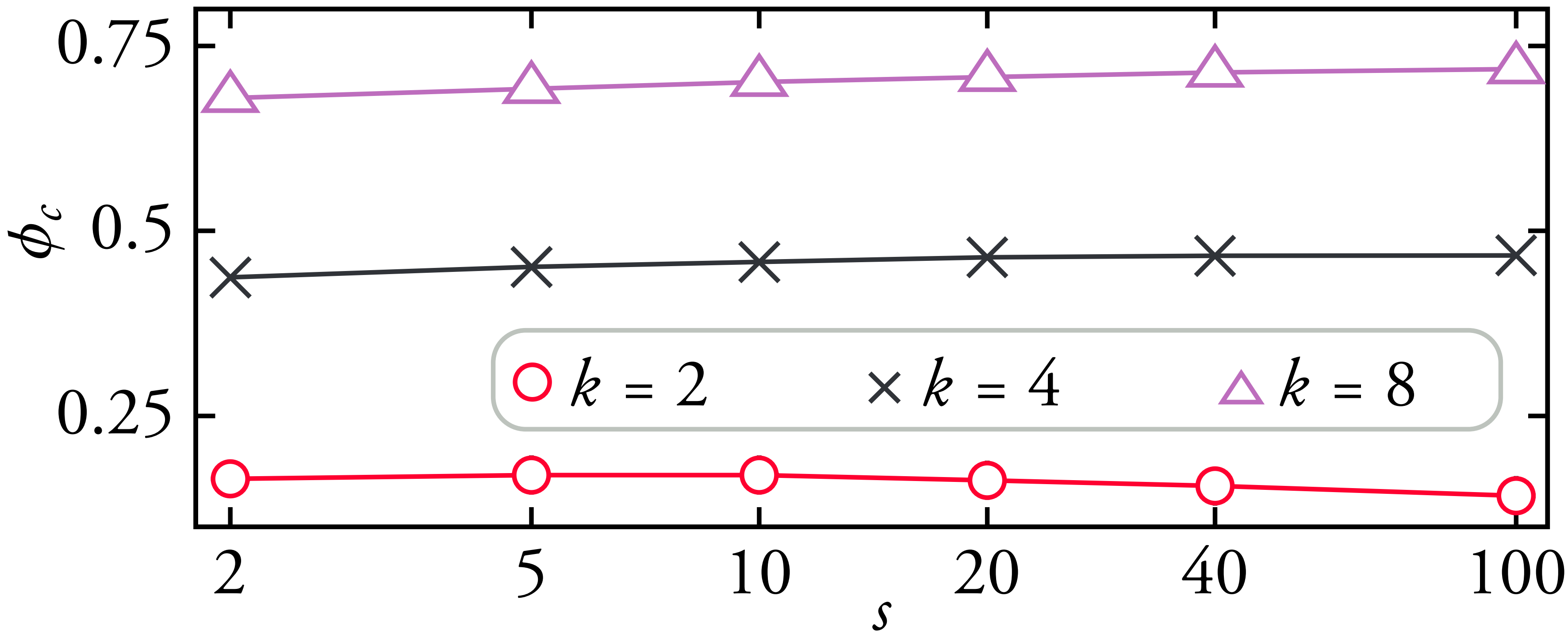
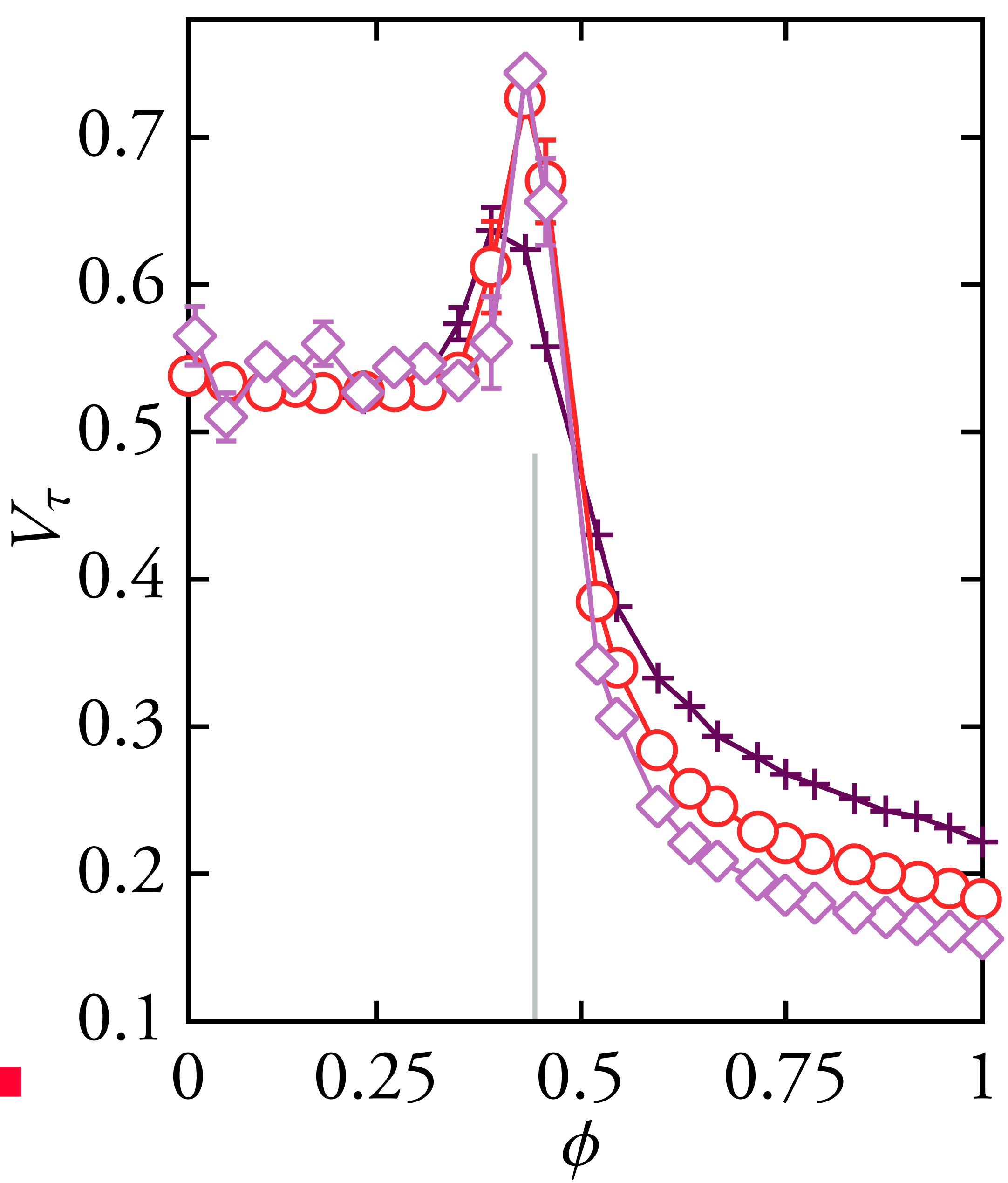
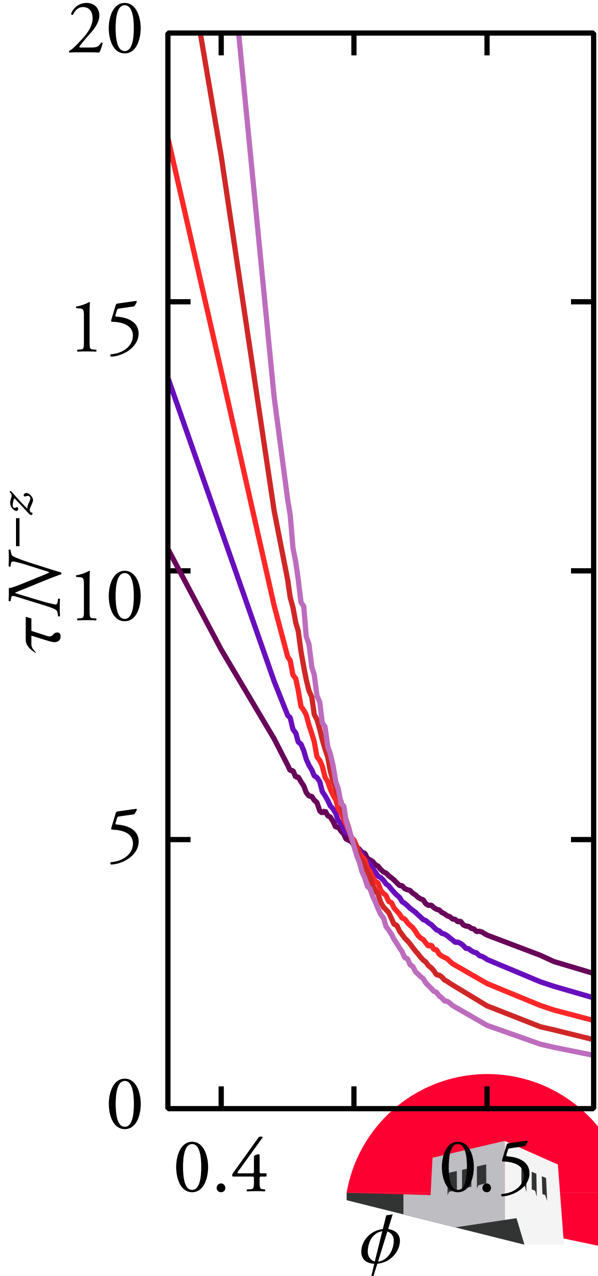
random graph percolation: $a = b = 1/3$

phase diagram



dynamic critical behavior





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- The model undergoes a second order phase transition between: One state of clusters of similar sizes. One state with one dominant cluster.
- The universality class is not the same as random graph percolation.