Distributed Algorithms: A Simple Example
How Many Nodes in Network?
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With a simple flooding/echo process, a network can find the number of nodes in time $O(D)$, where $D$ is the diameter (size) of the network.
Diameter (Size) of Network?

- **Distance** between two nodes = Number of hops of shortest path
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- **Distance** between two nodes = Number of hops of shortest path
- **Diameter** of network = Maximum distance, between any two nodes
Networks Cannot Compute Their Diameter in Sublinear Time!

(even if diameter is just a small constant)
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Pair of nodes not connected on both sides? We have $\Theta(n^2)$ information that has to be transmitted over $O(n)$ edges, which takes $\Omega(n)$ time!

[Frischknecht, Holzer, W, 2012]