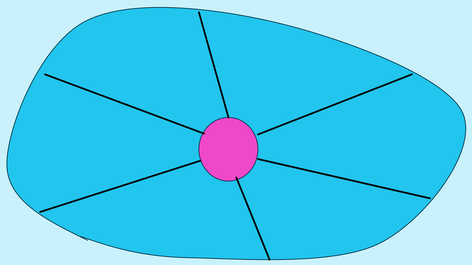
Stronger Barriers for Distributed Distance Computations

Amir Abboud, Keren Censor Hillel and Seri Khoury

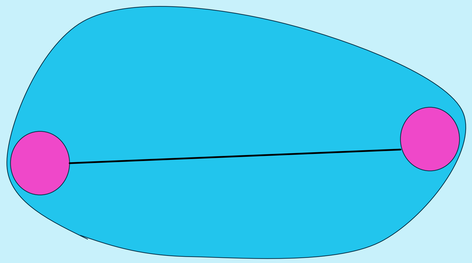
Problem

Given a network, we want to compute its distance parameters, such as radius, diameter etc.

Radius



Diameter



Alice and Bob's Problem

Alice and Bob have k elements each, and they wish to know if they have an element in common

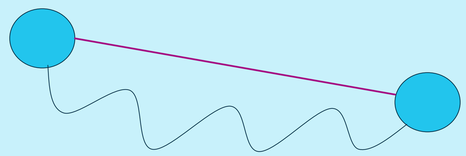
Communication channel

$\Omega(k)$ *lower bound exists*!

Main Idea

Alice and Bob construct a graph according to their elements such that a distance parameter of the graph (for example, the radius) is affected if and only if Alice and Bob have an element in common

Distances between nodes are affected by Alice and Bob's elements



Given an algorithm for computing the radius, Alice and Bob can use it to solve their problem

Lower Bound Results

- *Radius*: $\Omega\left(\frac{n}{logn}\right)$
- *Diameter*: $\Omega\left(\frac{n}{\log^2 n}\right)$
- *Approximations* : $\Omega\left(\frac{n}{\log^3 n}\right)$
- *Spanner verification*: $\Omega\left(\frac{n}{(\alpha+\beta)\log^2 n}\right)$

Bounds hold for sparse graphs as well!

Our Constructions Can Be Simply Modified to Bounded Degree Graphs!