

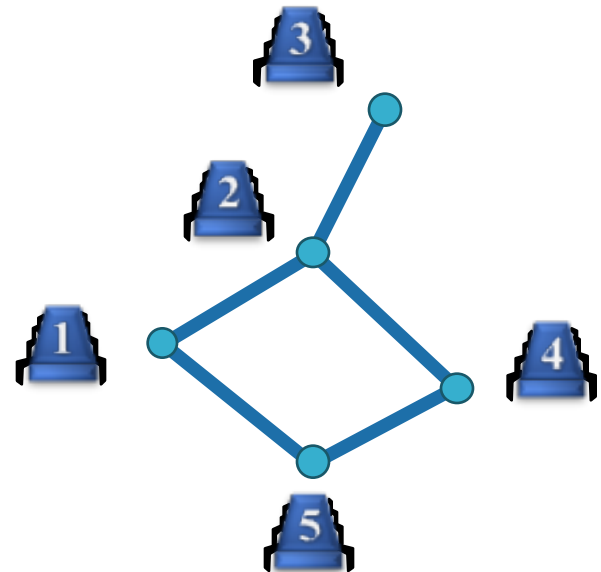
New Lower Bounds for the CONGEST Model

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Joint work with Keren Censor-Hillel and Seri Khoury

The CONGEST Model

- $G = (V, E)$: network's topology
- n nodes = processors, unique ids
- Edges = communication links
 - $O(\log n)$ -bit messages
- Synchronous communication
- Goal: **minimum number of rounds**



Problems & Complexities

$$\Theta(n^2)$$

- ?

$$\Theta(n^\alpha)$$

- ?

$$\Theta(n)$$

- ?

$$\Theta(n/\log n)$$

- Compute unweighted diameter

$$\tilde{\Theta}(\sqrt{n})$$

- Build a MST

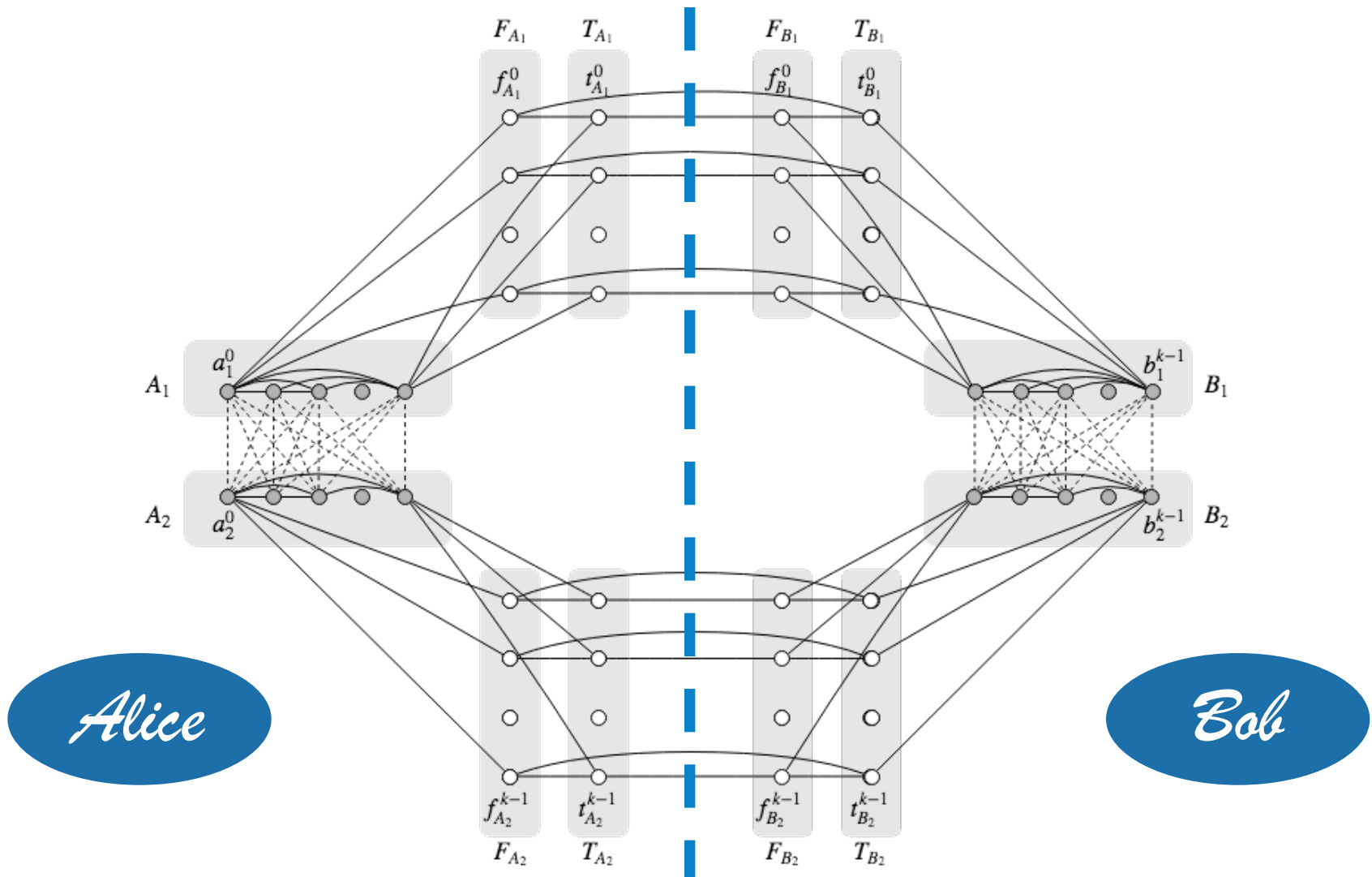
$$\Theta(\log^* n)$$

- 3-color a ring

$$\Theta(1)$$

- Verify coloring

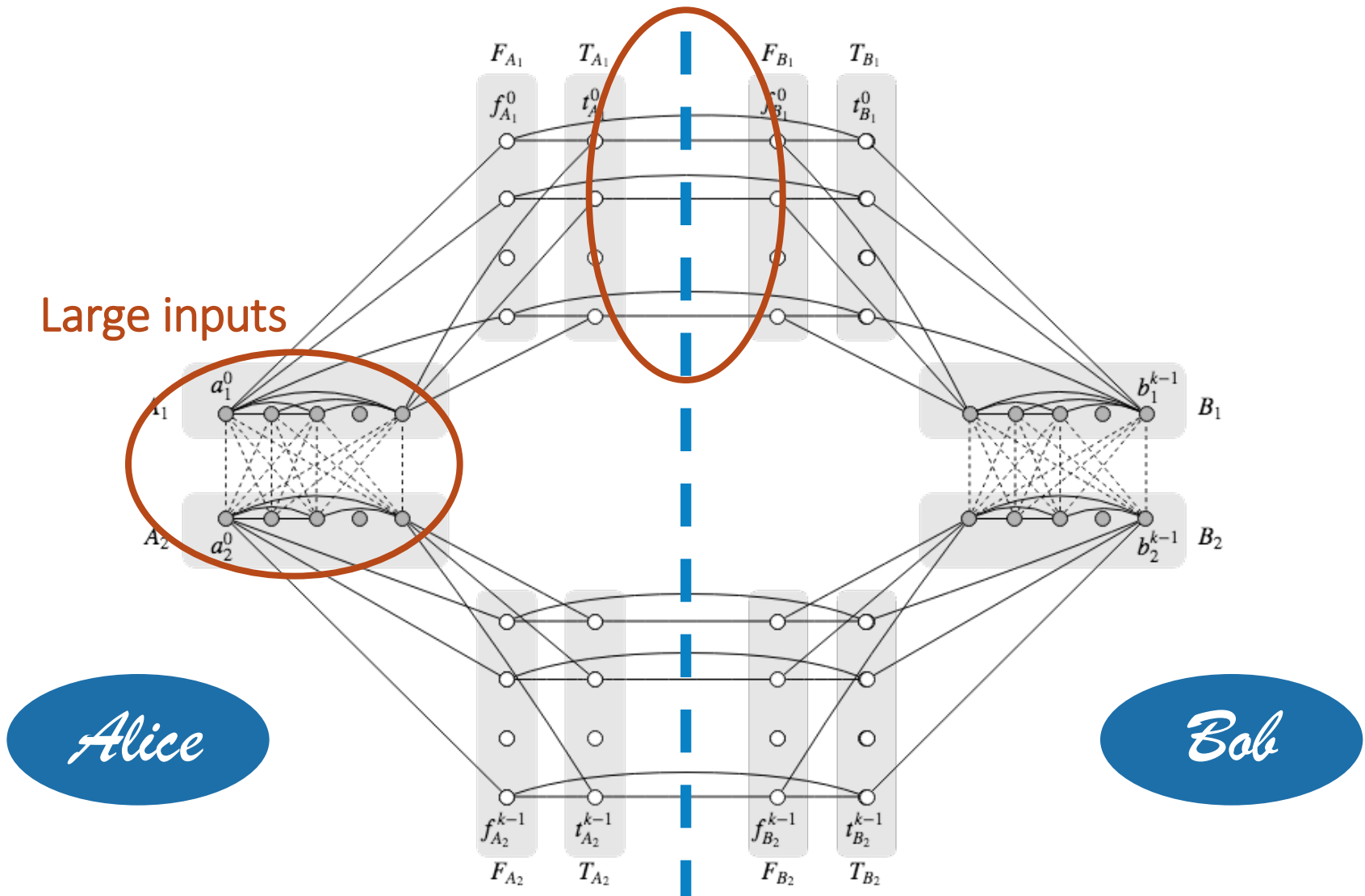
MVC Lower Bound



MVC Lower Bound

Small cut

Large inputs

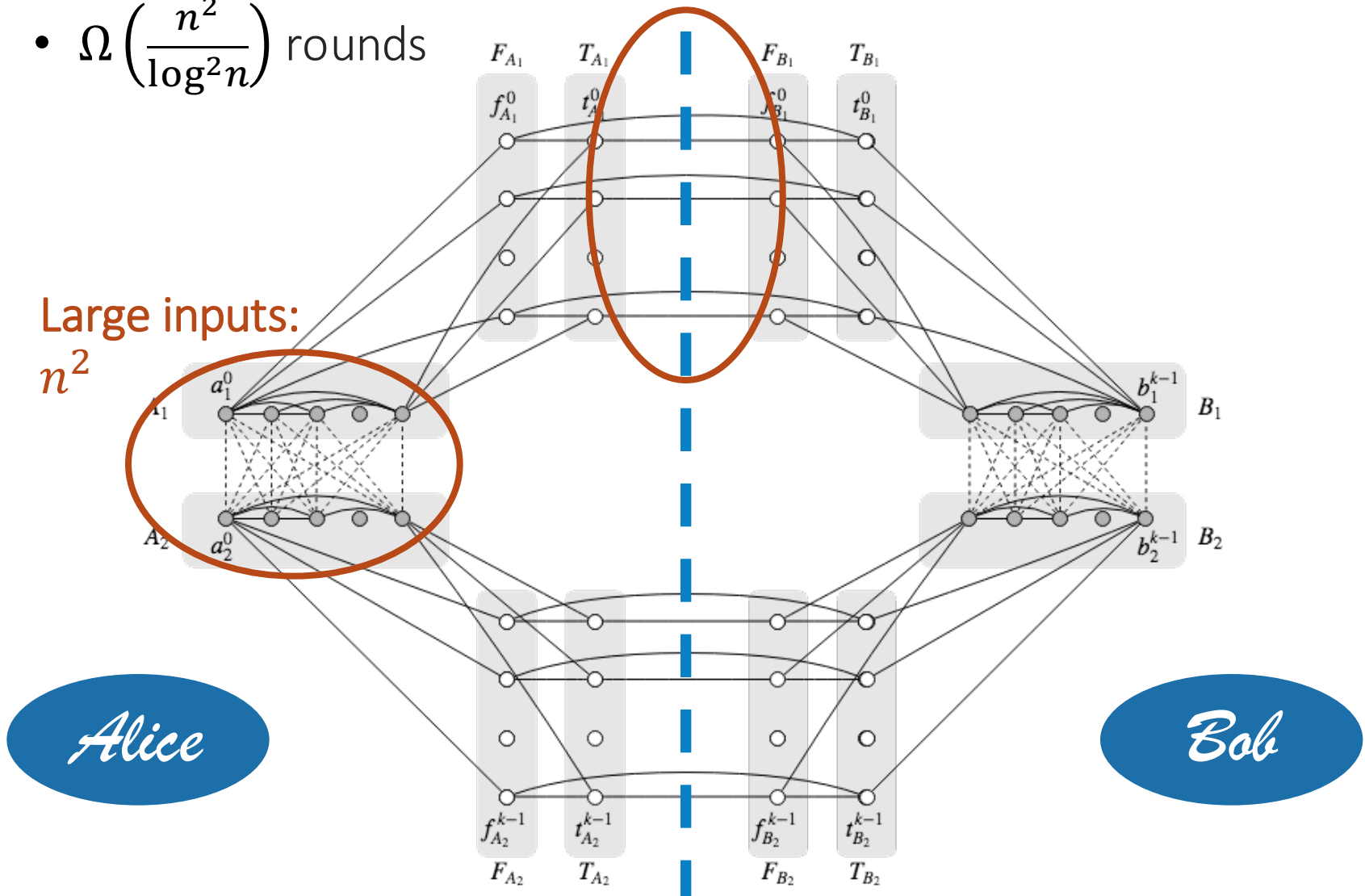


MVC Lower Bound

- $\Omega\left(\frac{n^2}{\log^2 n}\right)$ rounds

Small cut: $\log n$

Large inputs:
 n^2



Results I

$\Omega\left(\frac{n^2}{\log^2 n}\right)$ lower bound for:

- Minimum vertex cover
- Maximum independent set
- Computing the chromatic number χ
- Weighted cycle detection

Results II

- $\Omega(n)$ lower bound for **weighted APSP**
 - Unweighted APSP solvable in $O(n/\log n)$ [HFQ+16]
- Alice and Bob can solve **weighted APSP** in linear time
- $\Omega(n^2)$ lower bound for identical subgraphs – **deterministic**
- $O(1)$ algorithm for identical subgraphs – **randomized**

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- MaxIS, MVC, χ -coloring, cycle detection

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Weighted APSP?

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$\Theta(n^2)$

- Identical subgraphs – deterministic

$\tilde{\Theta}(n^2)$

- MaxIS, MVC, χ -coloring, cycle detection

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Waiting for you at the poster session! ¹³