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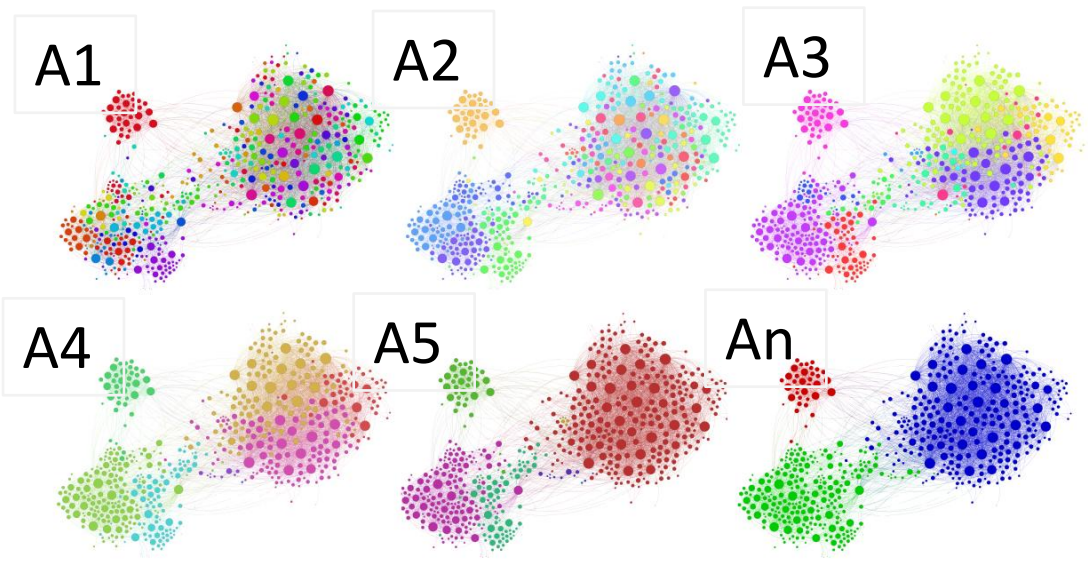
# Influential Spreaders in Networks with Community Structure

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## Problematic

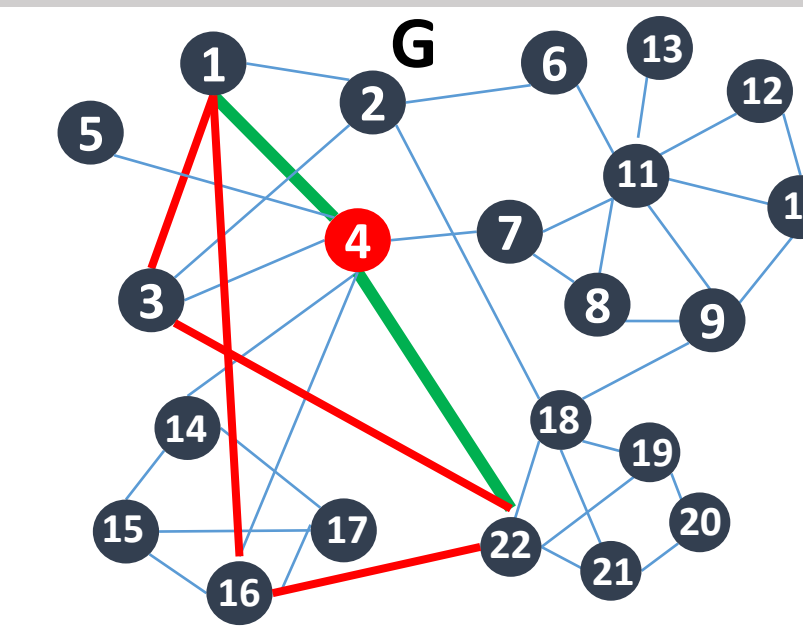


### Centrality in modular networks?

#### Hypotheses:

- Community structure available (Ground-truth or Community detection)
- Non Overlapping community structure

## Example: Betweenness $\alpha$ in non-modular networks

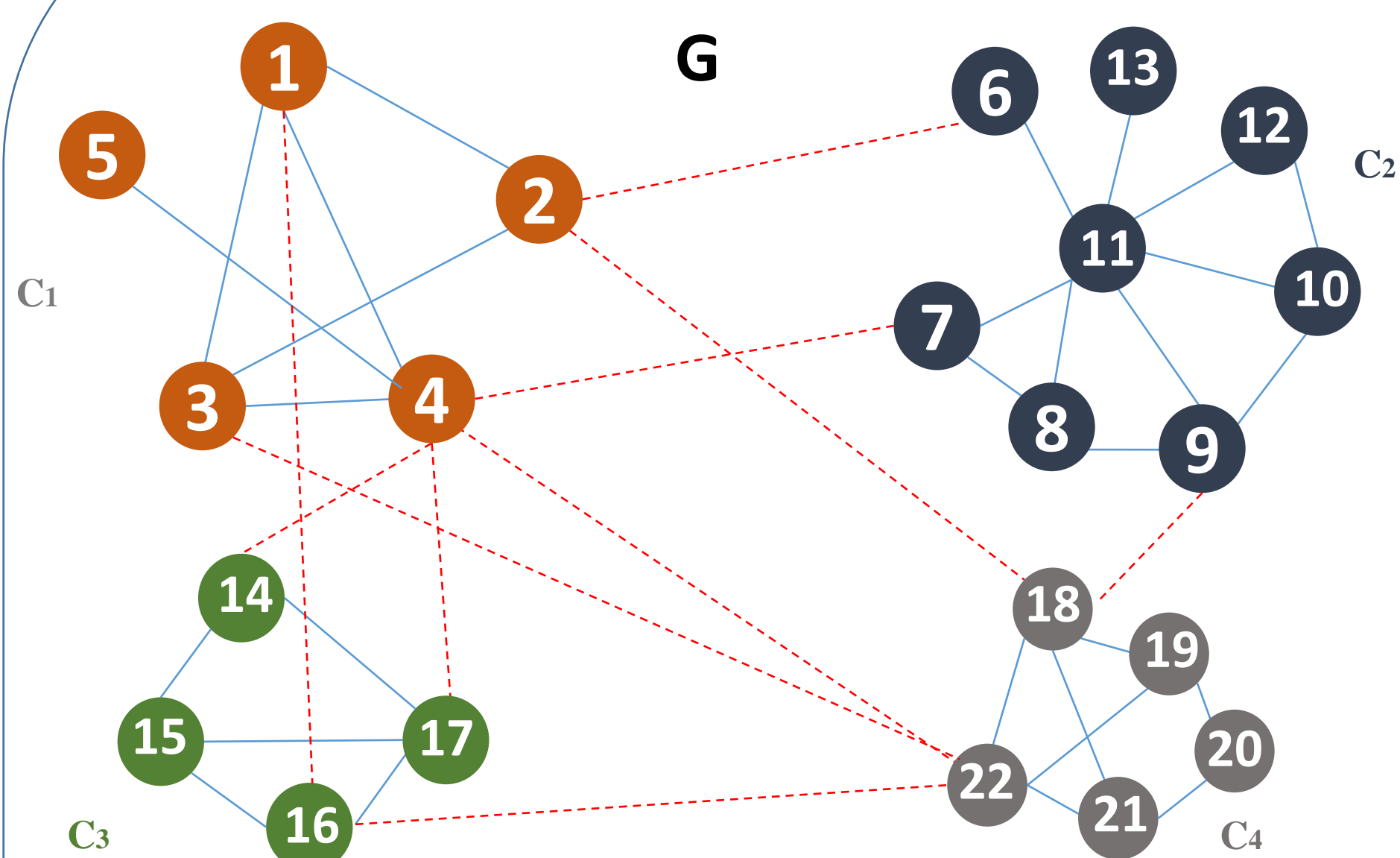


Betweenness  $\alpha$  of a node  $v_i \in G$ :

$$\alpha(v_i) = \sum_{j,k \in G} \frac{\sigma_{jk}(v_i)}{\sigma_{jk}}$$

Complexity:  $O(\ln)$

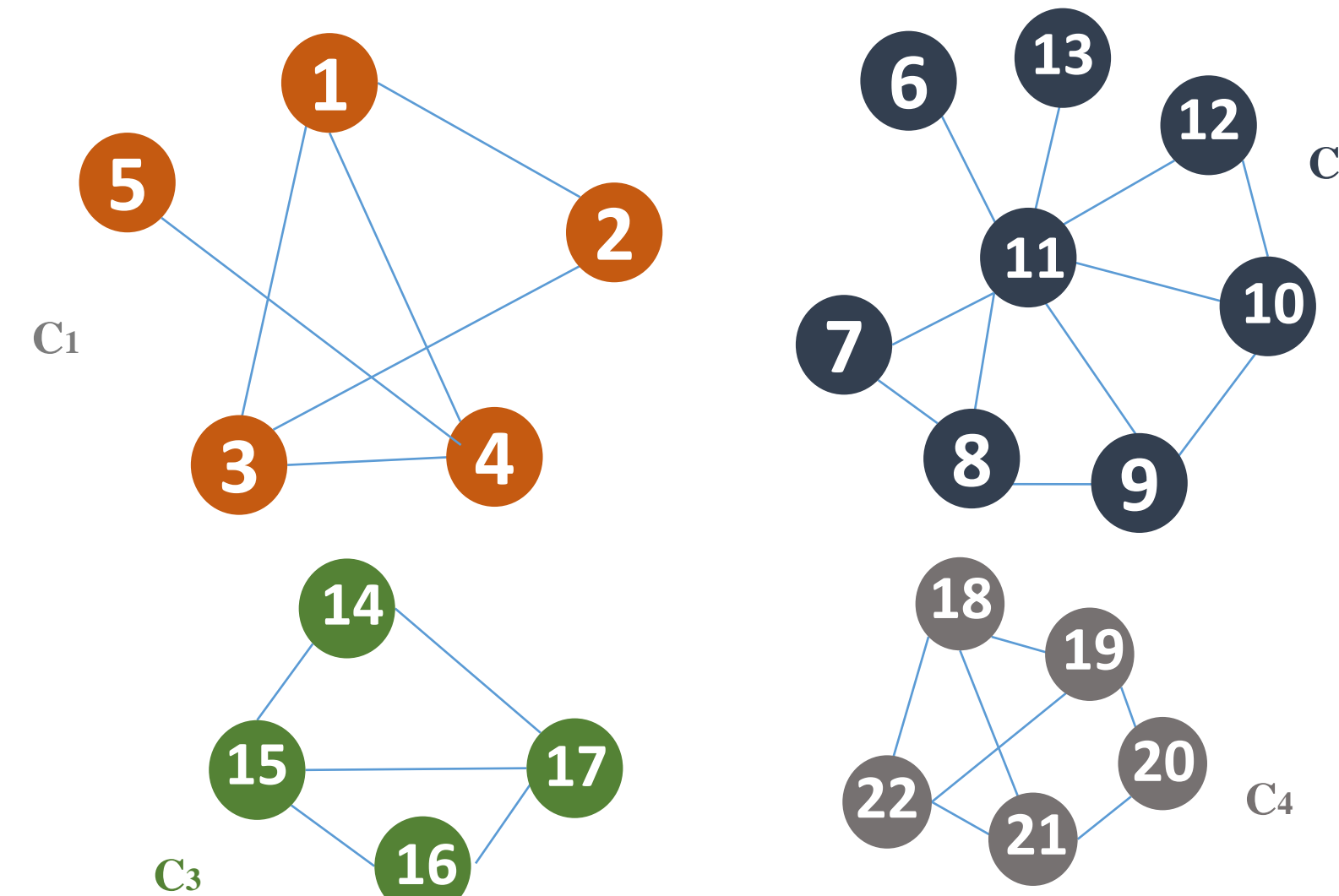
## Betweenness in Modular networks: $A = [\alpha_L, \alpha_G]$



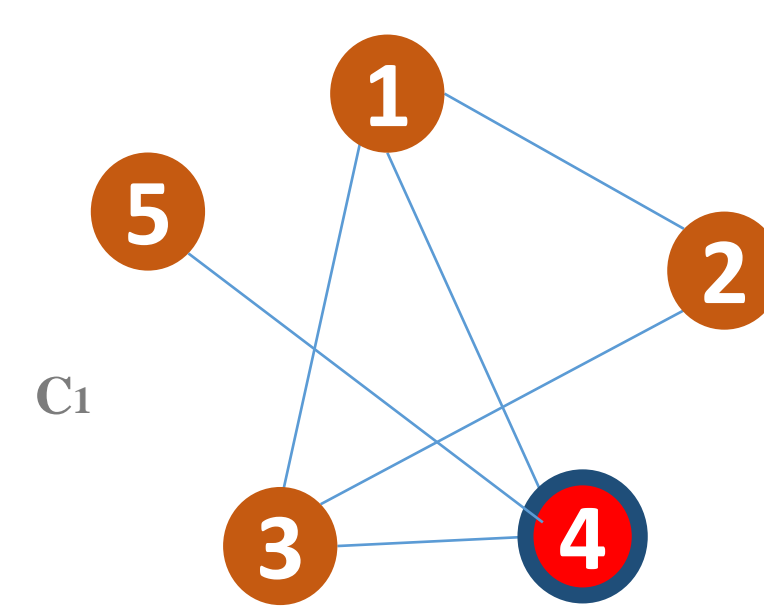
1. Split the original network into two networks

2. Using the classical definition:  
Compute  $\alpha_L$  on  $G_L$   
Compute  $\alpha_G$  on  $G_g$

### Local Network $G_L$

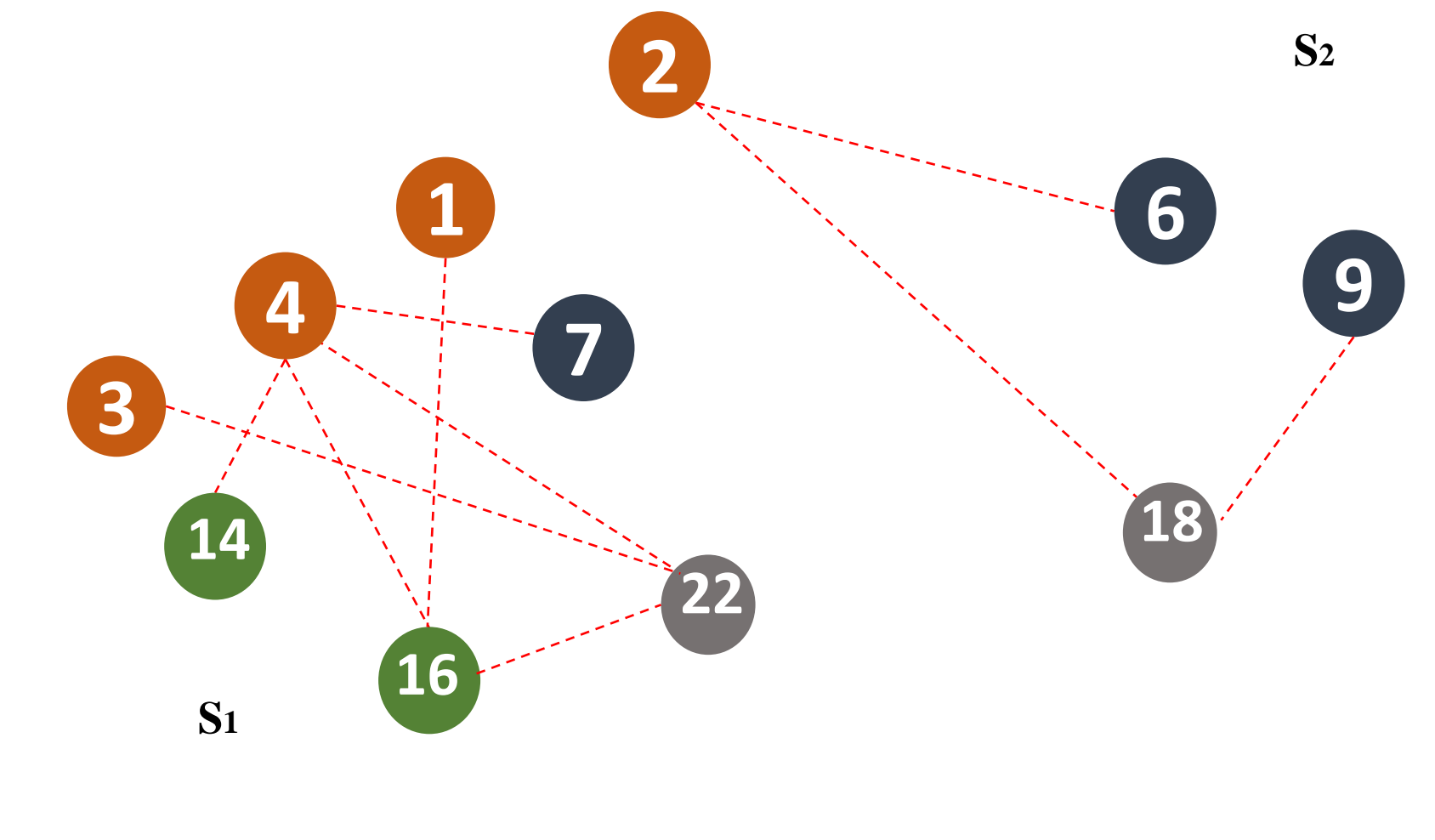


### Local Component $\alpha_L$

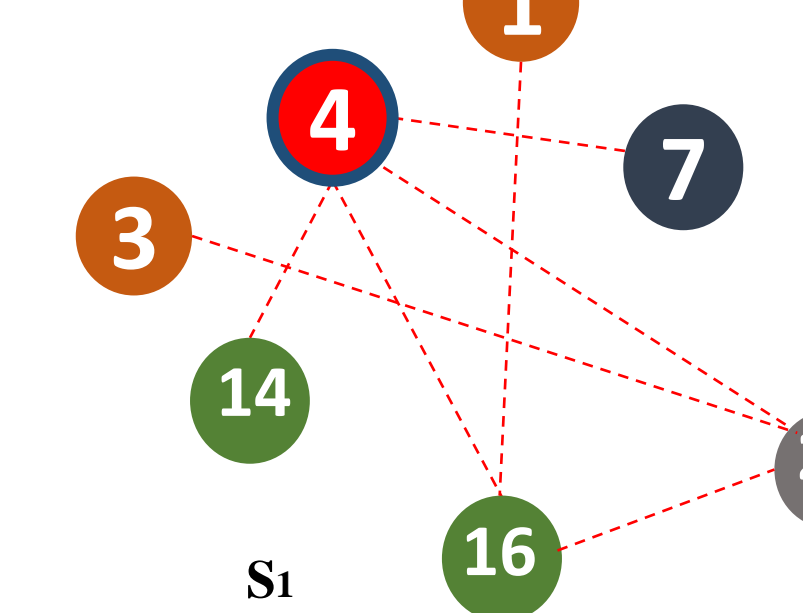


$$\alpha_L(v_i) = \sum_{j,k \in C_1} \frac{\sigma_{jk}(v_i)}{\sigma_{jk}}$$

### Global Network $G_g$



### Global Component $\alpha_G$



$$\alpha_G(v_i) = \sum_{j,k \in S_1} \frac{\sigma_{jk}(v_i)}{\sigma_{jk}}$$

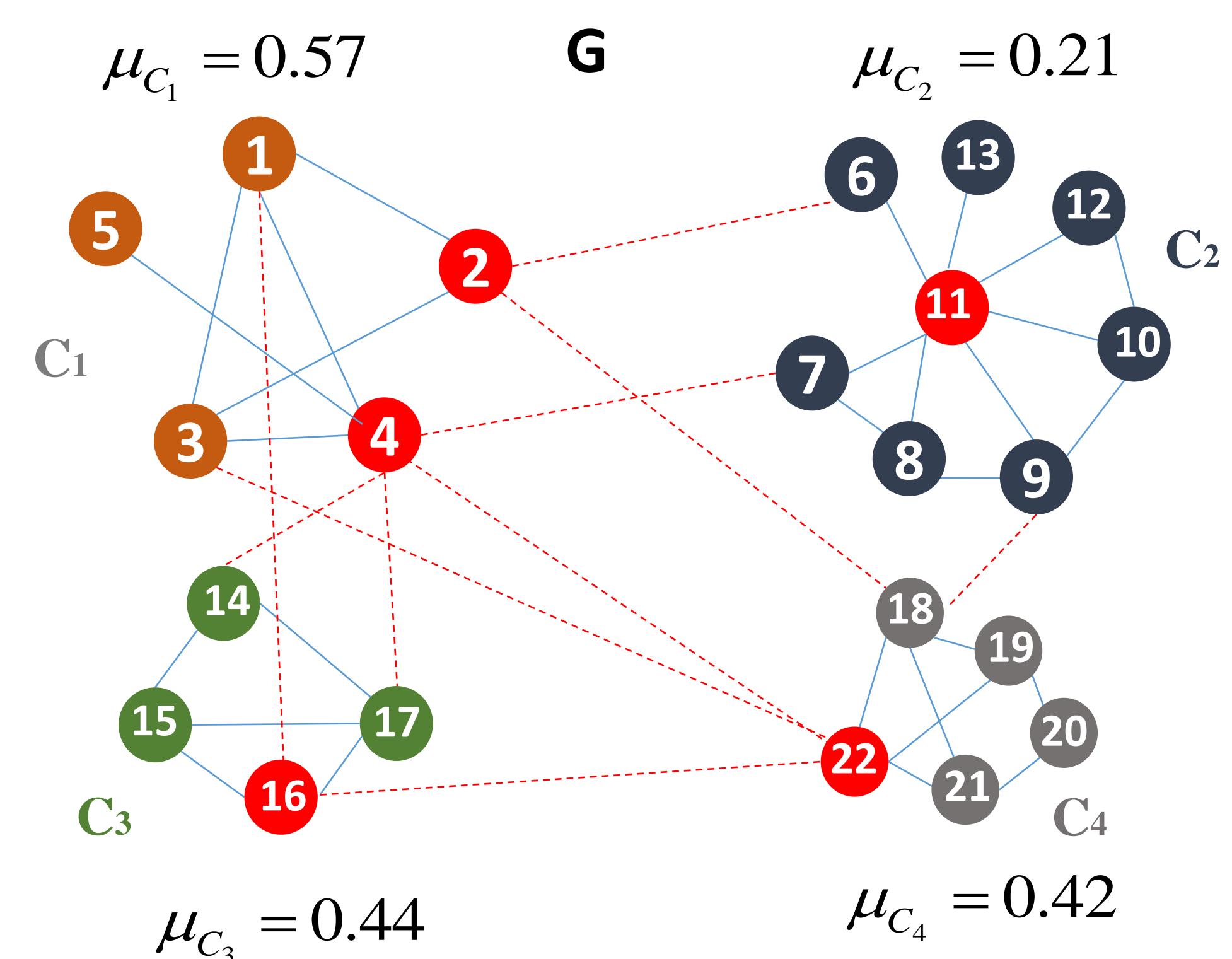
## Ranking the Nodes



### Example: Weighed Modular Betweenness Centrality

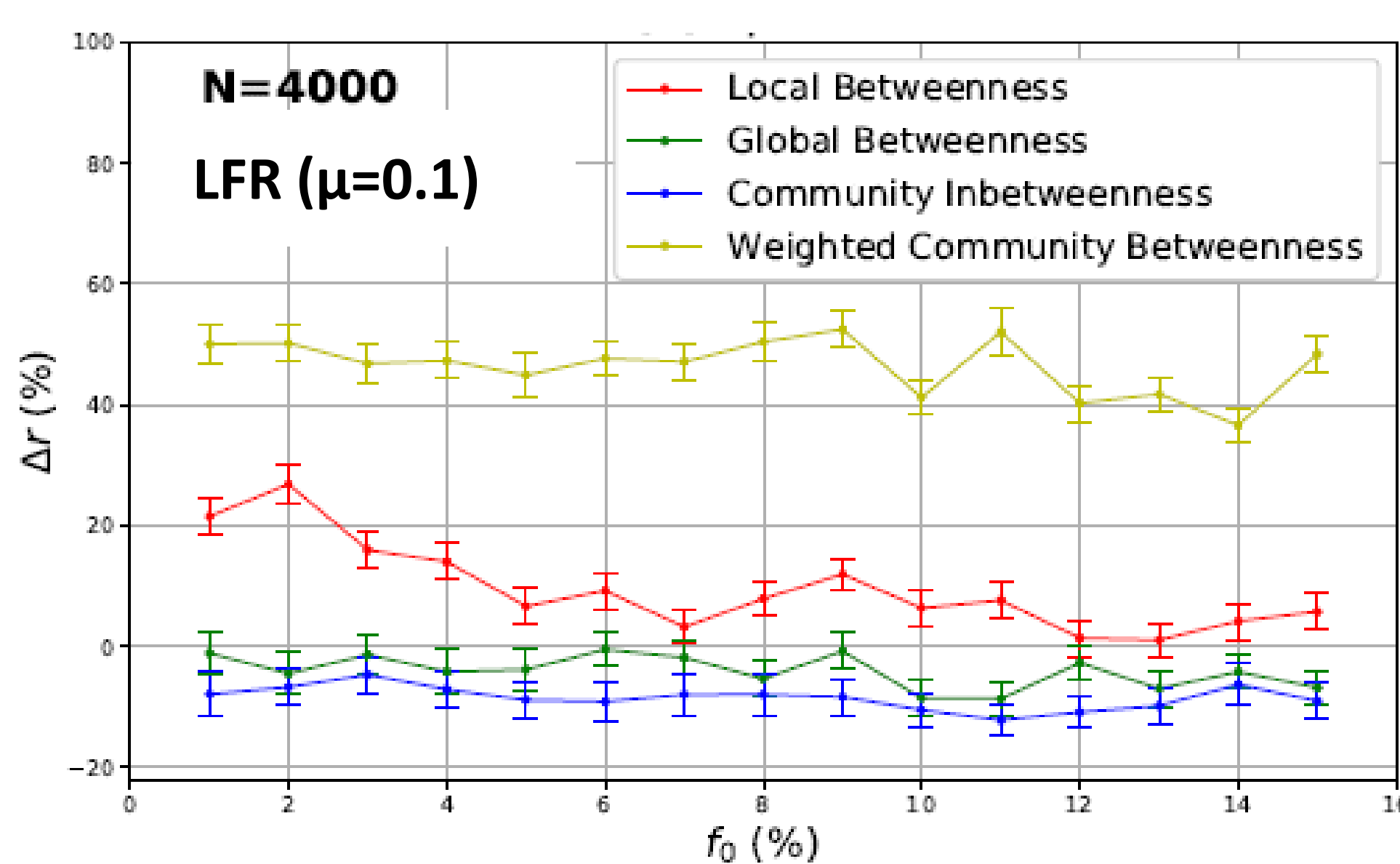
$$\alpha_W(v_i) = (1 - \mu_{C_1}) * \alpha_L(v_i) + \mu_{C_1} * \alpha_G(v_i)$$

$$\mu_{C_1} = \frac{\sum_{v_i \in C_1} k^{inter}(v_i)}{\sum_{v_i \in C_1} k(v_i)}$$

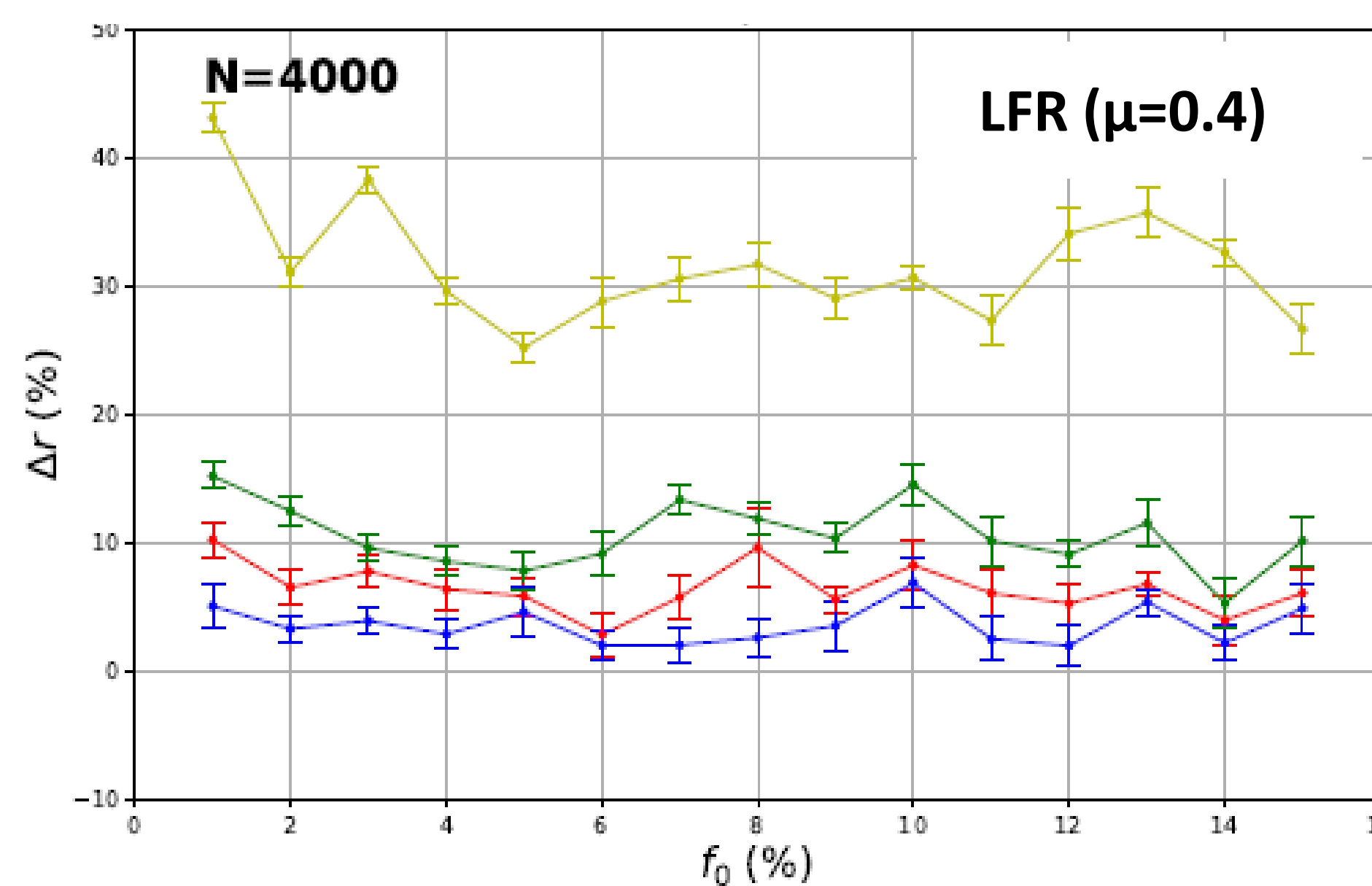


## Results

### Strong community structure



### Medium community structure strength



### Weak community structure

