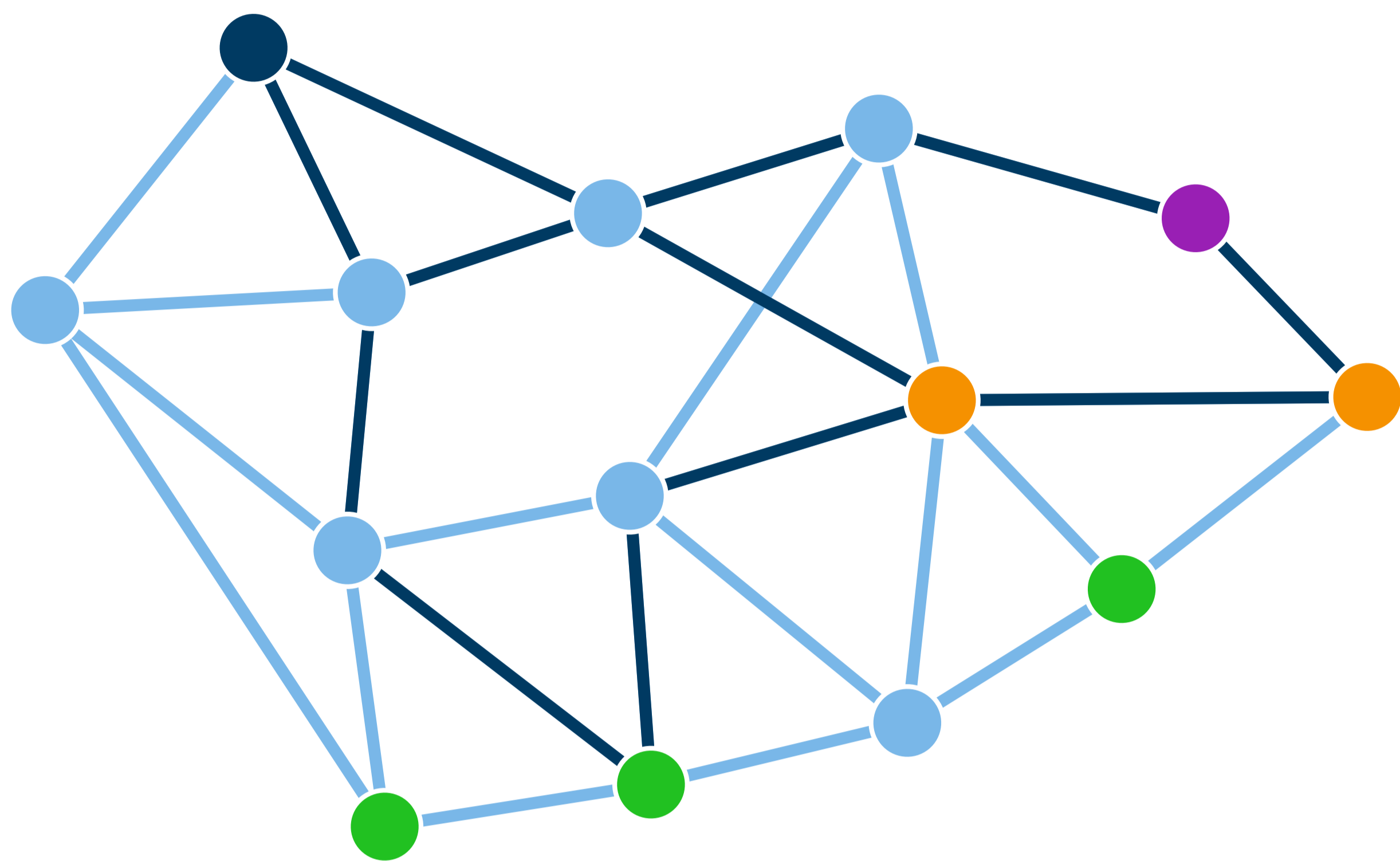


# Survivable Network Design for Group Connectivity in Low-Treewidth Graphs

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## SNDP with Group Constraints



**Goal:**  $k$ -connect a vertex from each group

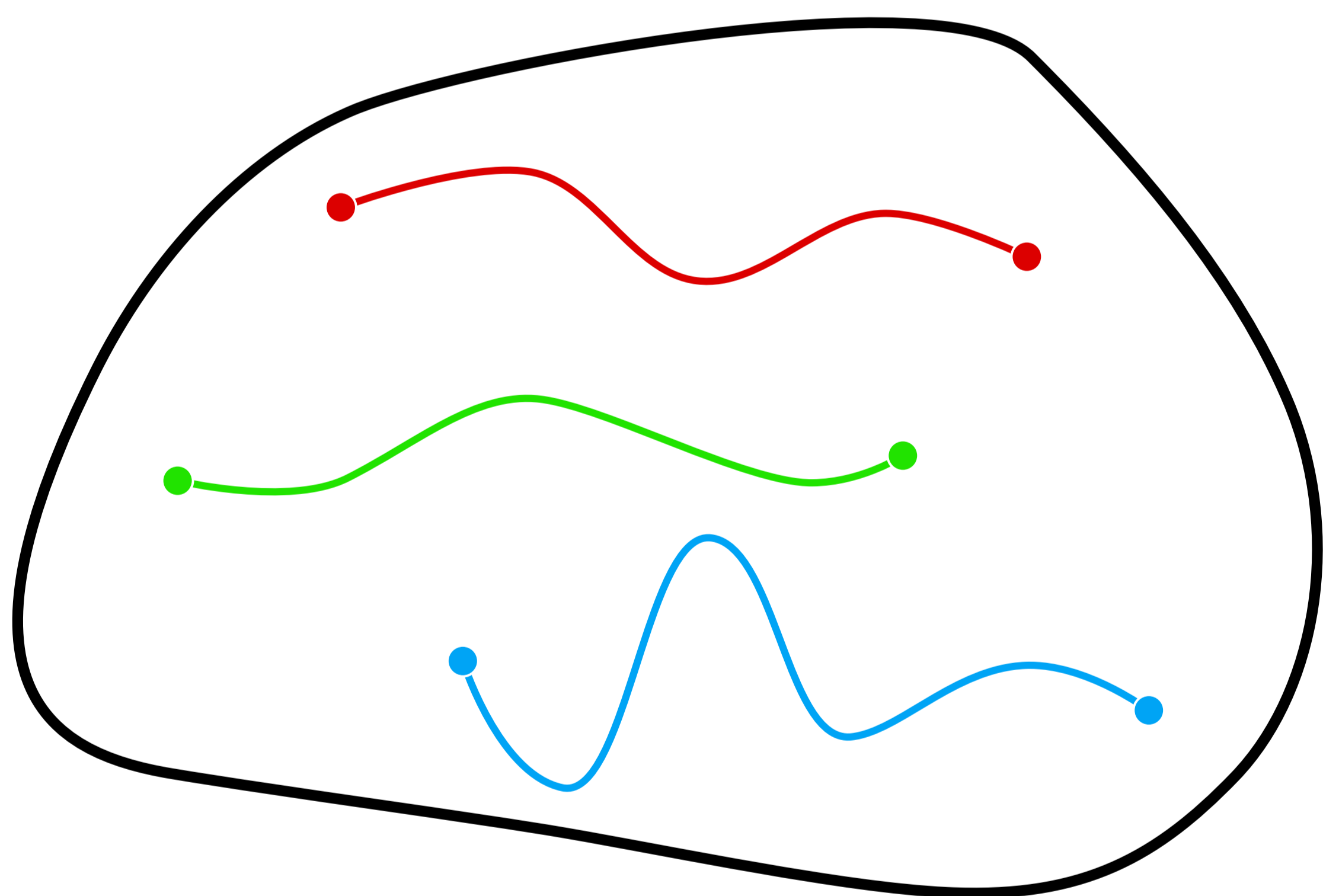
## Known Results

	Apx. Ratio	Hardness
$k = 1$ (GST)*	$O(\log^2 n \log h)$ [GKR'98]	$O(\log^{2-\epsilon} h)$ [HK'03]
$k = 1$ (low TW)	$O(\log n \log h)$ [CDLV'17]	$O(\log^{2-\epsilon} h)$
$k = 2^*$	$\tilde{O}(\log^4 n)$ [GKR'10]	
Non-Group	2 [Jain'00]	APX-hard [CC'08]
General		$2^{\log^{1-\epsilon} n}$ [KKN'12]

\* **Cannot be improved beyond**  $O(\log^3 n)$   
(both use tree embedding, which has distortion  $\Omega(\log n)$ )

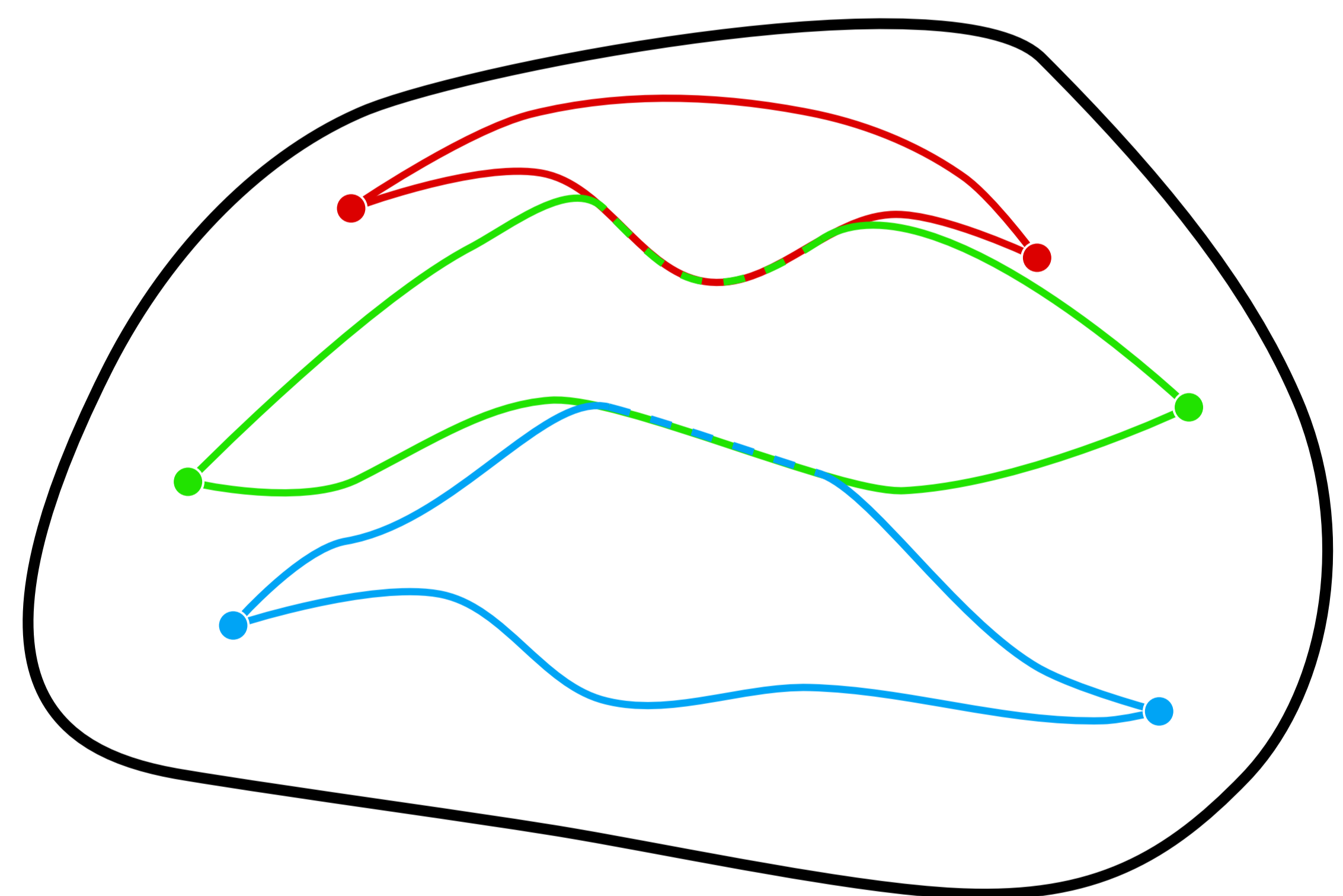
## Similar Problem: Edge Disjoint Paths

Standard approach: Use DP to partition edges



## Group SNDP

Two commodities can share the same edges.  
DP / Partitions do not work.



## Our Results

- Group SNDP:  $O(\log n \log h)$ -approximation
  - Running time:  $n^{f(k, tw(G))}$
- SNDP (groups of size 1)
  - Running time:  $n^{2^{f(k, tw(G))}}$
- Generalizable framework for group problems
  - Also works for vertex weights

## Main Ideas

- Write **DP for non-group problem**
  - Consider connectivity for different partitions
  - Each DP state connects some terminals
- Solve **LP to get DP-like solution**
  - With **group constraints** on DP states

