Device-to-Device (D2D) Data Dissemination with Power Budget Constraints
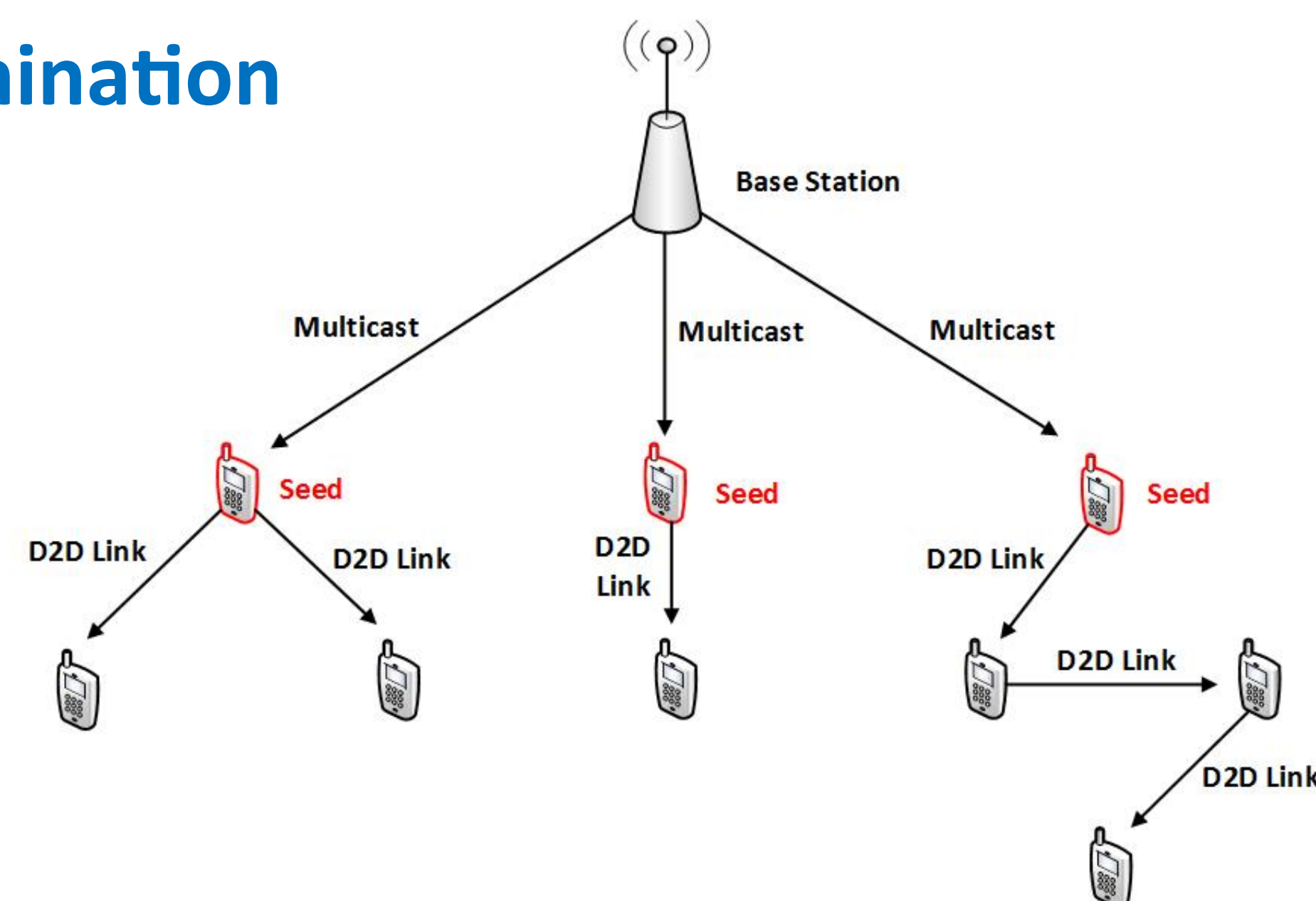
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Data Dissemination Model

Motivation

Design a data dissemination scheme which can properly schedule the data transmission of the base station and D2D users to achieve the following goals:

- Minimize the total power consumption of data dissemination.
- Satisfy each user's power budget constraint for data dissemination.
- Accommodate user social incentive constraint, that is, D2D transmission should occur between two users with social relationships.
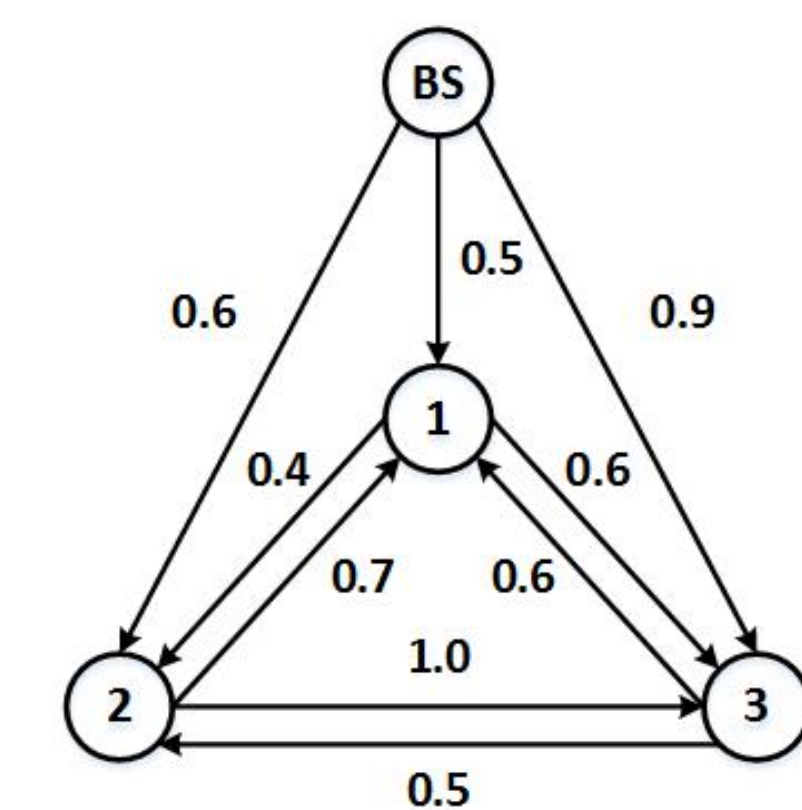
Our Solution: Coalitional Graph Game Approach

We propose a coalitional graph game based approach to form a transmission graph to coordinate the data transmission of the base station and D2D users.
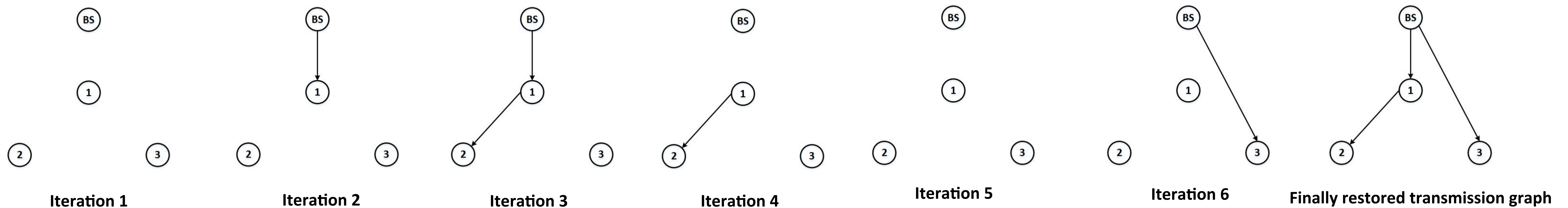
Key idea:

- Model the data dissemination as a directed graph $G(V, E, w)$, where V is the set of the base station and D2D users, E denotes the links from the BS to D2D users and the available D2D links between D2D users, and w gives the transmit power of the corresponding transmission link.
- The algorithm uses an iterated approach:

  ➤ In each iteration, a node is selected randomly. That node calculates the set of feasible strategies and chooses its local best response. The graph is then updated correspondingly.
  ➤ The algorithm keeps iterating until the graph converges to a local Nash network.

- The edges of the finally restored graph are the corresponding data dissemination paths.
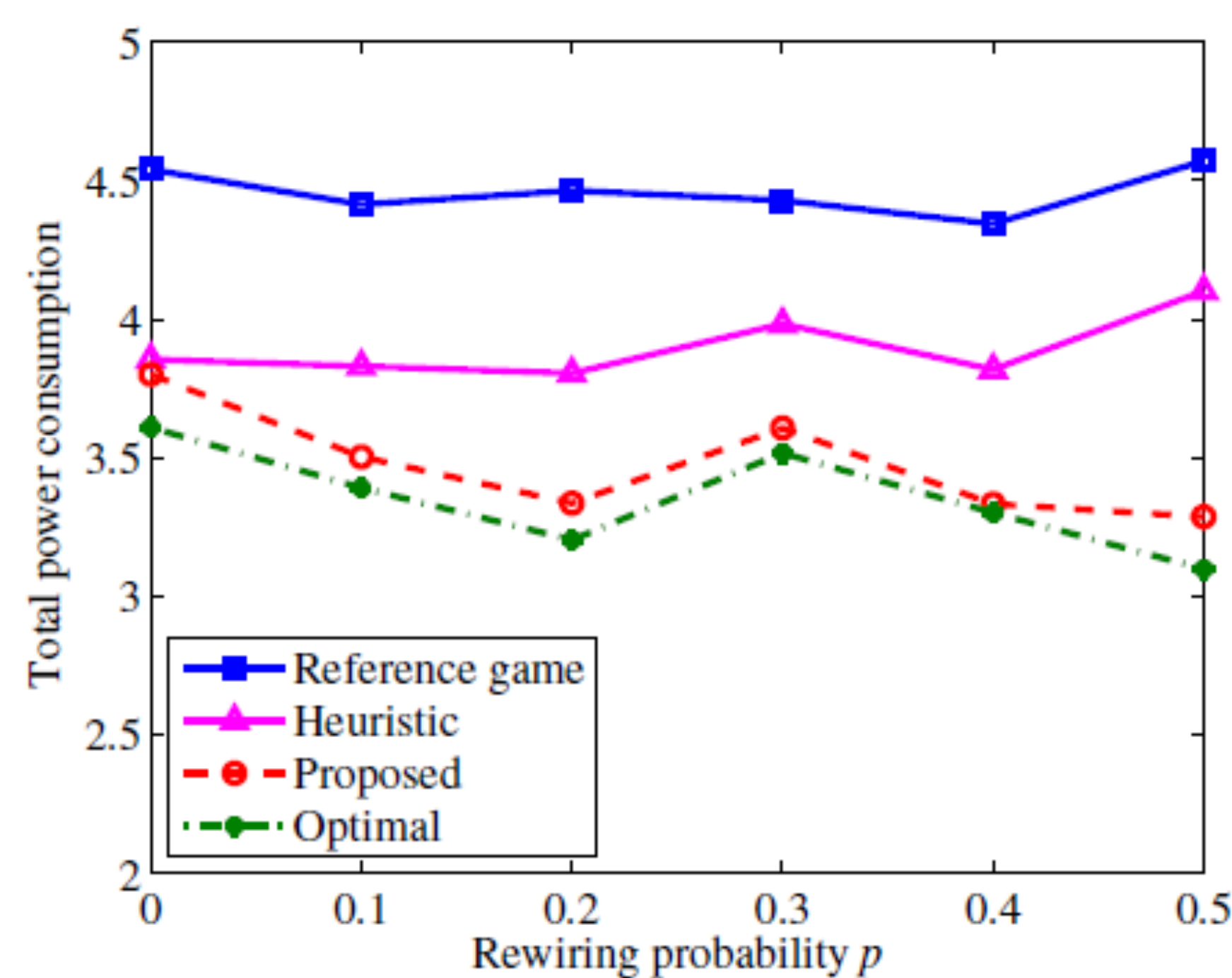
Walk-through example:

Nodes' power budget constraint
- Node 1 : 0.6
- Node 2 : 1.0
- Node 3 : 0.8

Iteration 1   Iteration 2   Iteration 3   Iteration 4   Iteration 5   Iteration 6   Finally restored transmission graph

Reduce total power consumption

Scalability to different power budget constraints

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