COMP9332 Network Routing and Switching
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Connected Dominating Set

Lecture overview

This lecture examines the concept and construction of connected dominating set in mobile ad hoc networks.

Topics to be covered

- Concept of CDS
- Construction of CDS (Centralized algorithm)

Dominating Set

- A MANET is represented by a graph *G(V,E)*
  - *V* : set of vertices
  - *E* : set of edges
- A dominating set, *S*, is a subset of *V* such that each node outside *S* is adjacent to at least one node in *S*
- Example: {C,E,G}
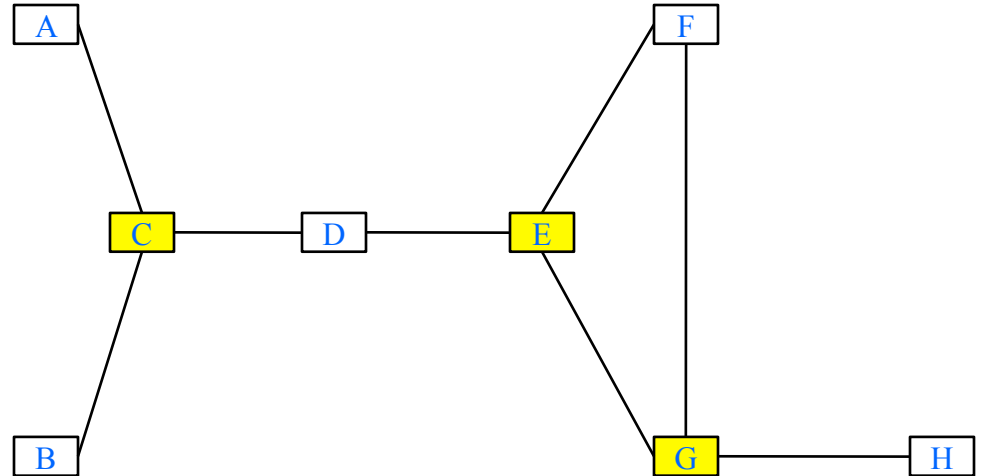
Connected Dominating Set

- A dominating set that yields a connected subgraph is a connected dominating set.
- {C,E,G} is a DS, but not CDS
- {C,D,E,G} is a CDS
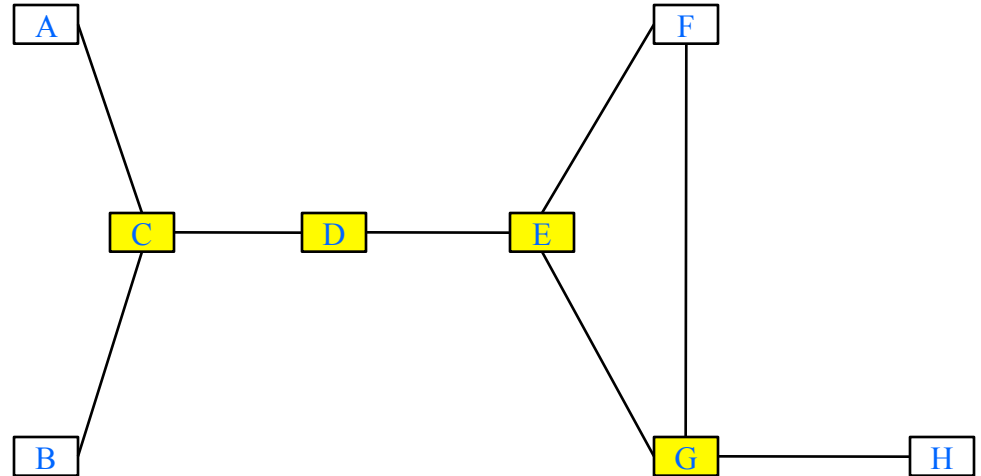
Utility of CDS

- Works as a backbone of a MANET
- Reduces flooding overhead in a large MANET
  - Flooding can be restricted to CDS nodes only
  - Other nodes can access CDS in one hop

CDS Construction

- **Centralized**
  - Guha and Khuller

- **Distributed**
  - RFC5614 (we will not cover it)

- **These algorithms may not yield a minimum CDS**
  - A CDS with minimum number of nodes in it
  - NP-hard

Guha and Khuller

- Mark all nodes WHITE

- Select node with maximal WHITE neighbour, mark this node BLACK and its neighbours GRAY

- Iteratively scan all GRAY nodes and their WHITE neighbours, select the GRAY node or *pair of a GRAY node and one of its WHITE neighbour*, whichever has the maximal number of WHITE neighbours, mark the selected node or the pair BLACK and their WHITE neighbours GRAY

- Terminate when all nodes are BLACK or GRAY (no WHITE left)

- All BLACK nodes form a CDS
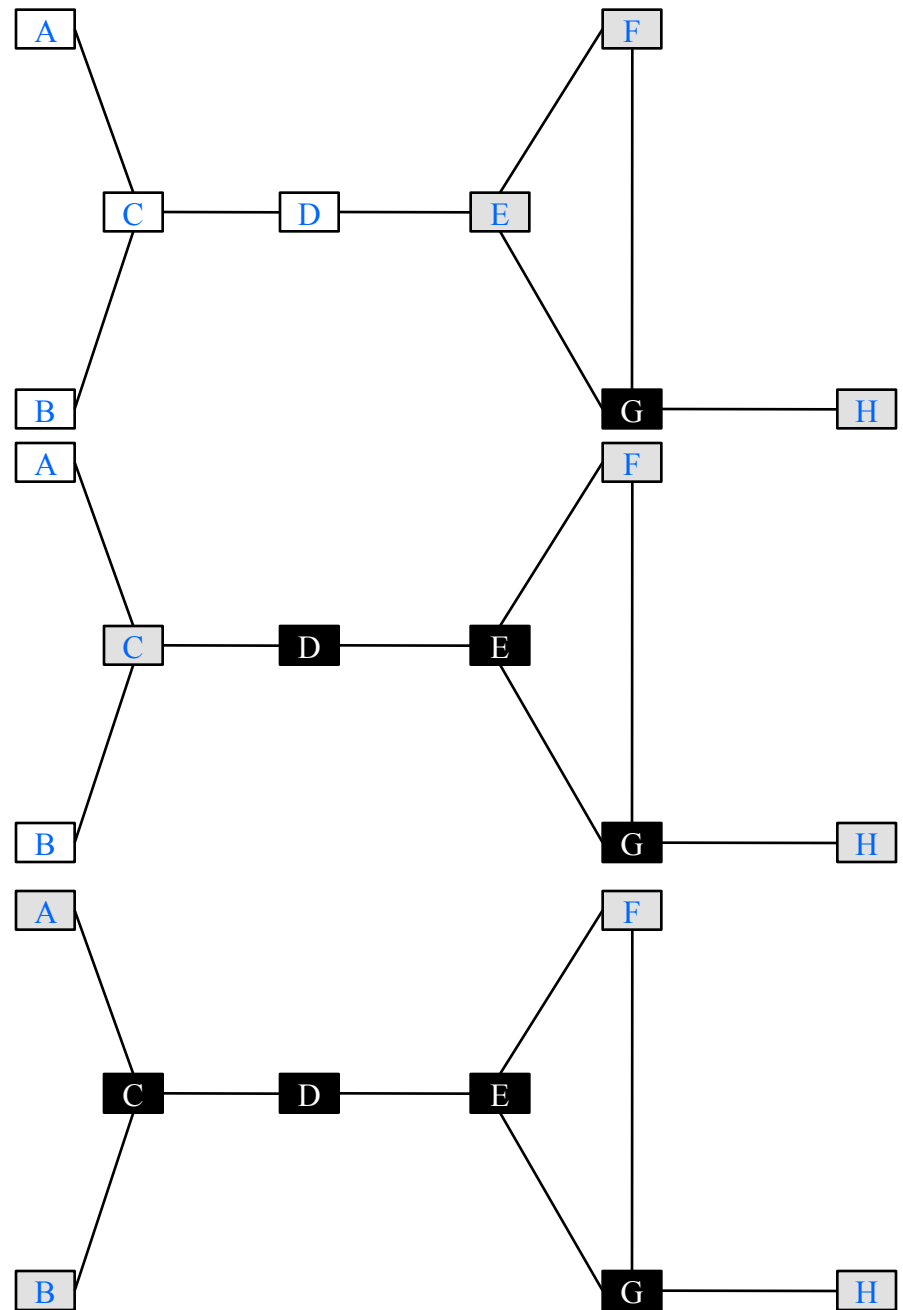
Bibliography

- Blum, Ding, Thaeler, Cheng, "Connected Dominating Set in Sensor Networks and MANETs," Handbook of Combinatorial Optimization, 2004