CS F364
Design & Analysis of Algorithms

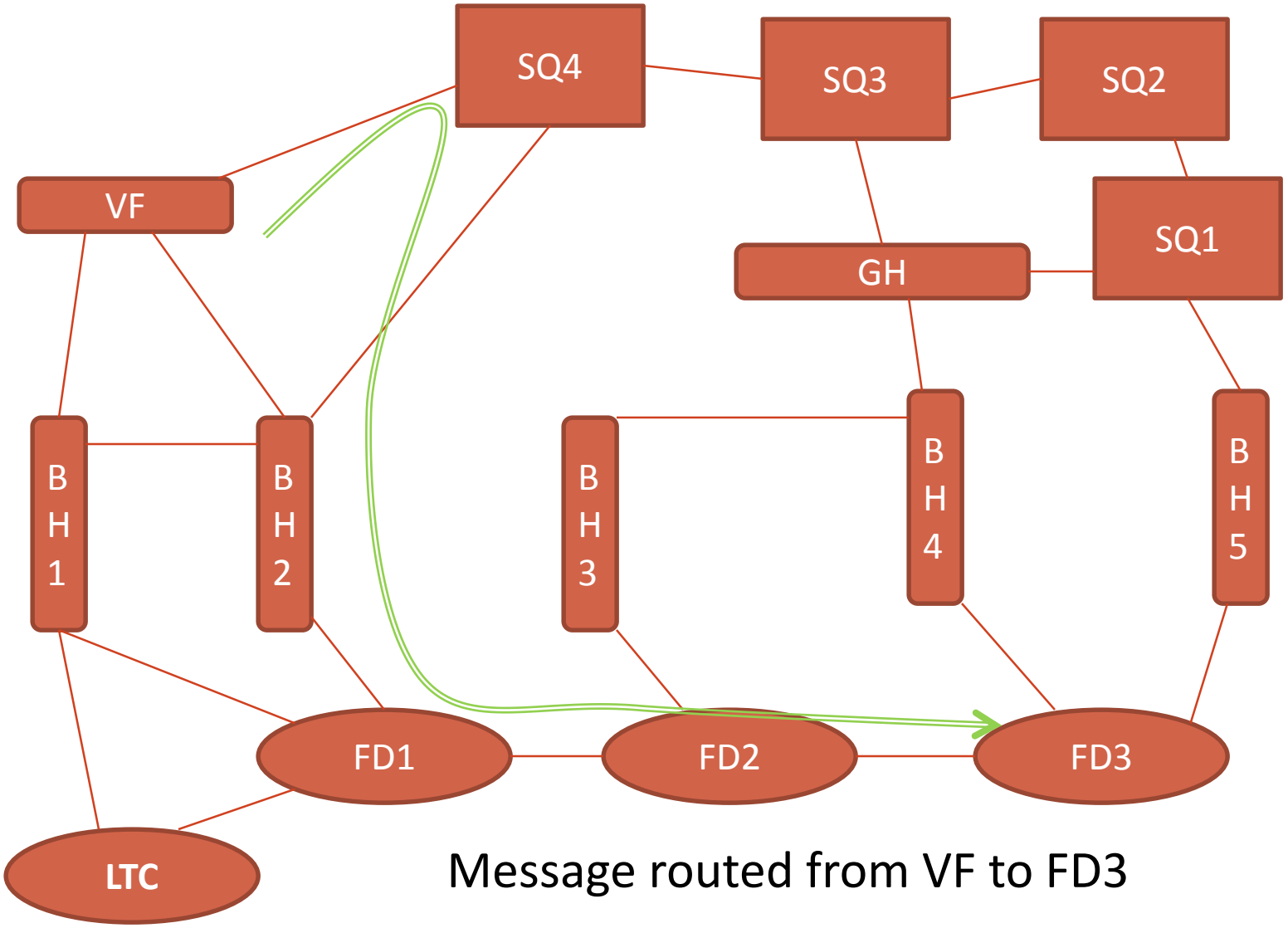
Algorithm Design: Greedy Technique

Minimum Spanning Trees
- Modeling and Definition

Minimum Spanning Trees

- Given a computer network modeled as a graph:
  - A path is computed for routing end-to-end messages
    - Shortest paths minimize the cost of communication per source-destination pair.

Networks And Paths



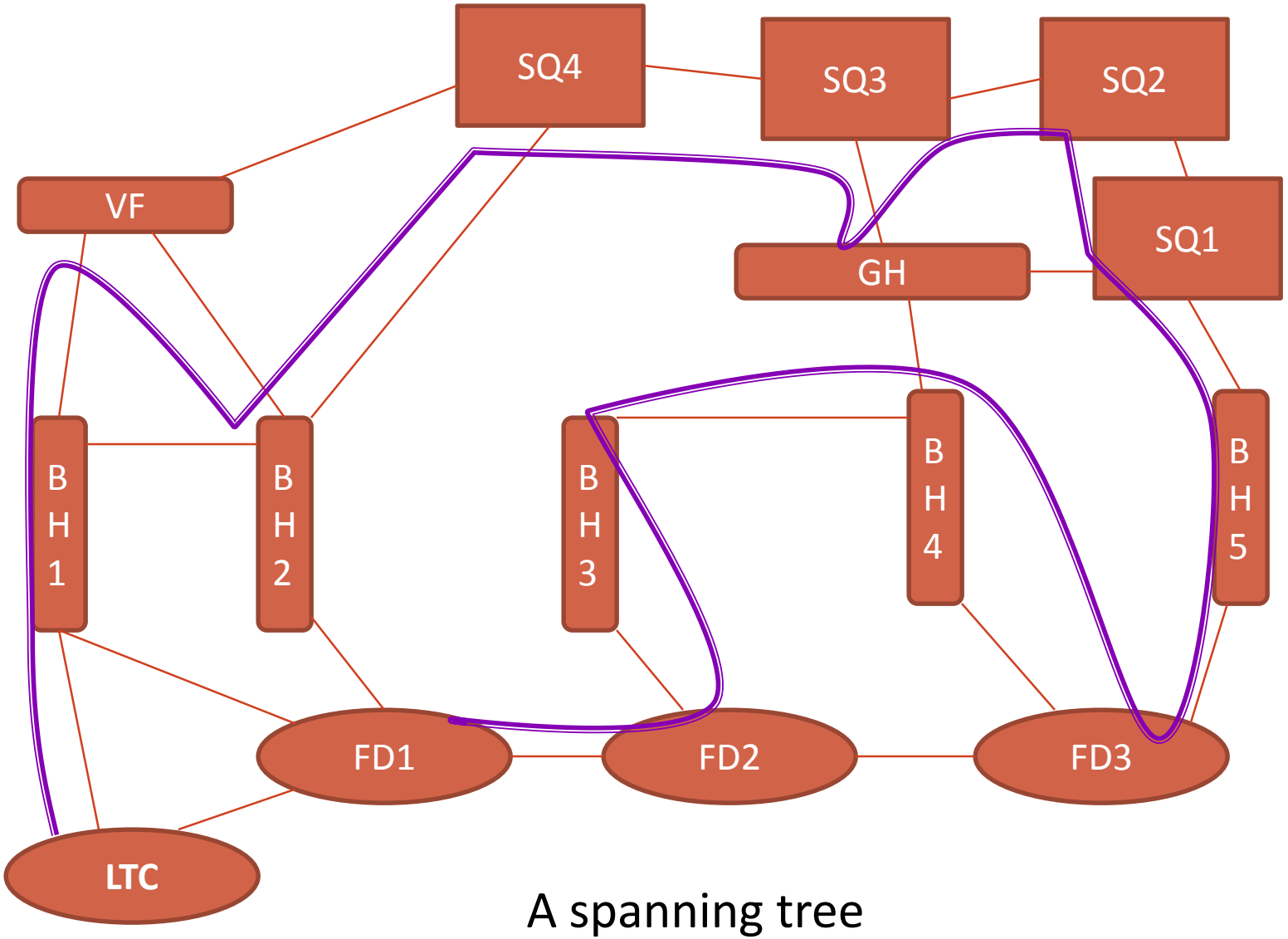
Message routed from VF to FD3

Minimum Spanning Trees

- Given a computer network modeled as a graph:
  - What if the communication is a broadcast? i.e.
    - a single message is to be sent from (any) source to all destinations and
    - nodes can forward messages
  - The goal in this case would be to minimize the *total cost of broadcasting*
  - The (optimal) broadcast path would be

    a tree that spans all vertices such that the sum of weights of edges is minimal.

LAN Design – BRIDGES and CABLES



A spanning tree

Minimum Spanning Trees

- Definitions:
  - Give a weighted, connected, undirected graph G=(V,E,w):
    - ***a spanning tree T*** is a tree (V,E') such that E' is a subset of E.
    - ***a minimum spanning tree*** is a tree **T** with the smallest total weight
      - i.e. $\sum_{e \text{ in } T} \mathbf{w(e)}$ is minimum
- Question:
  - Minimizing the number of edges is meaningless – Why?