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UNIVERSITÄT FREIBURG

Algorithms for Radio Networks

Link Reversal

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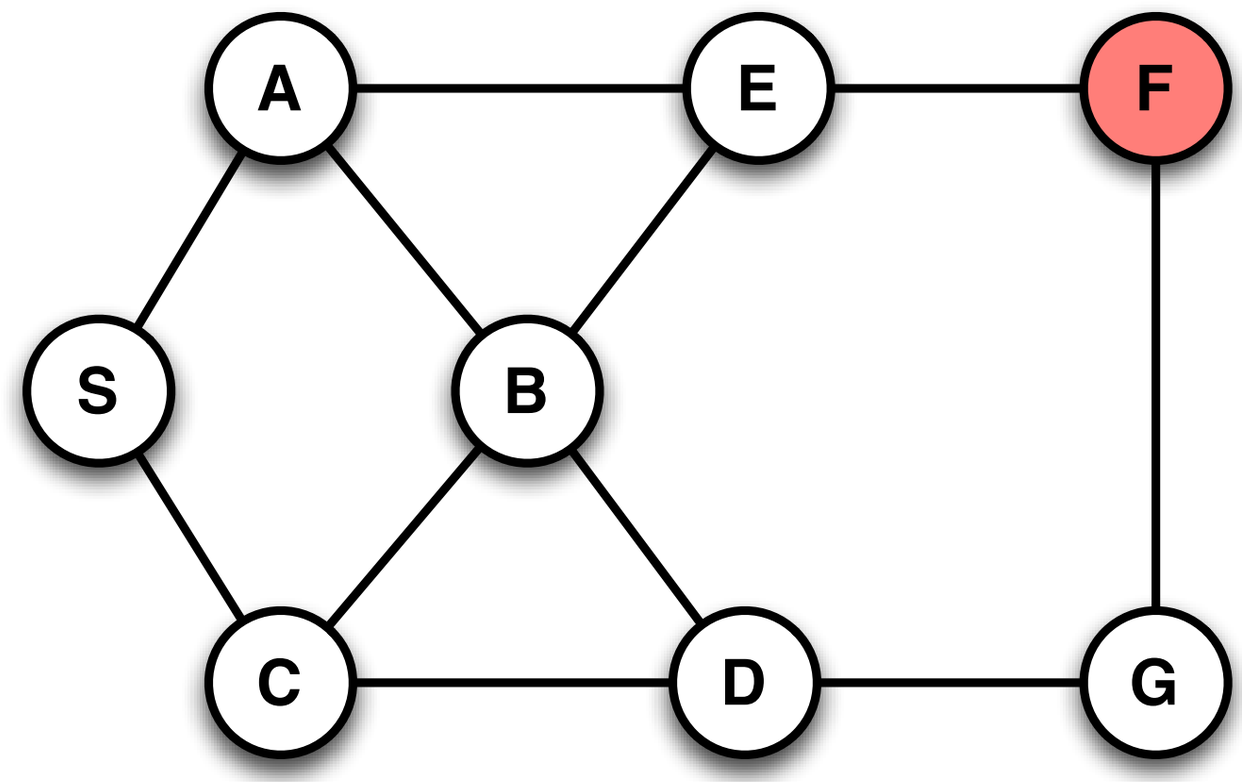
Link Reversal

- **Gafni, Bertsekas,**
  - *Distributed Algorithms for Generating Loop-Free Routes in Networks with Frequently Changing Topology*, IEEE Transactions on Communications, Vol. 29, No. 1 pp. 11-18, IEEE, January 1981
- **Routing protocol**
  - with special repair mechanism

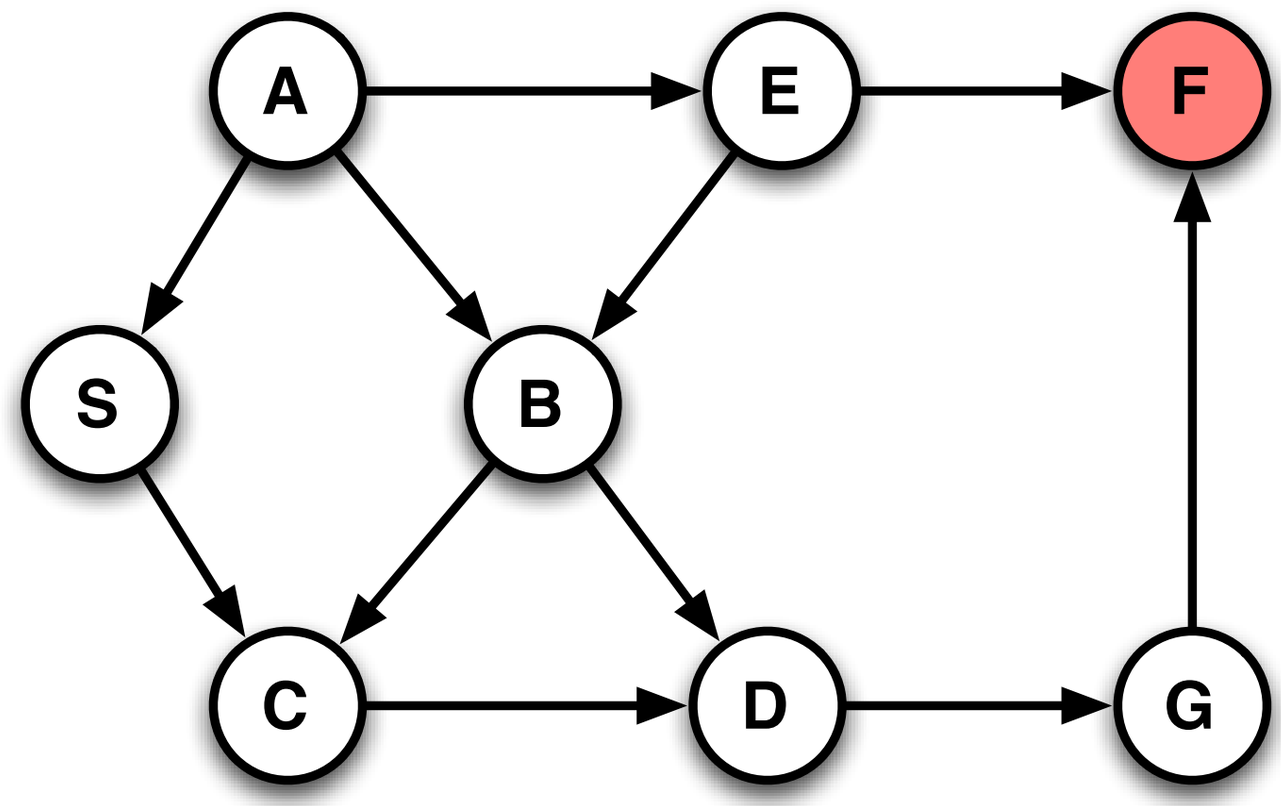
Link Reversal

- **For each target node a direction for each edge is defined**
  - all edges point towards the target
  - e.g. by flooding and topological sorting
- **Routing**
  - Pick any outgoing edge and send packet



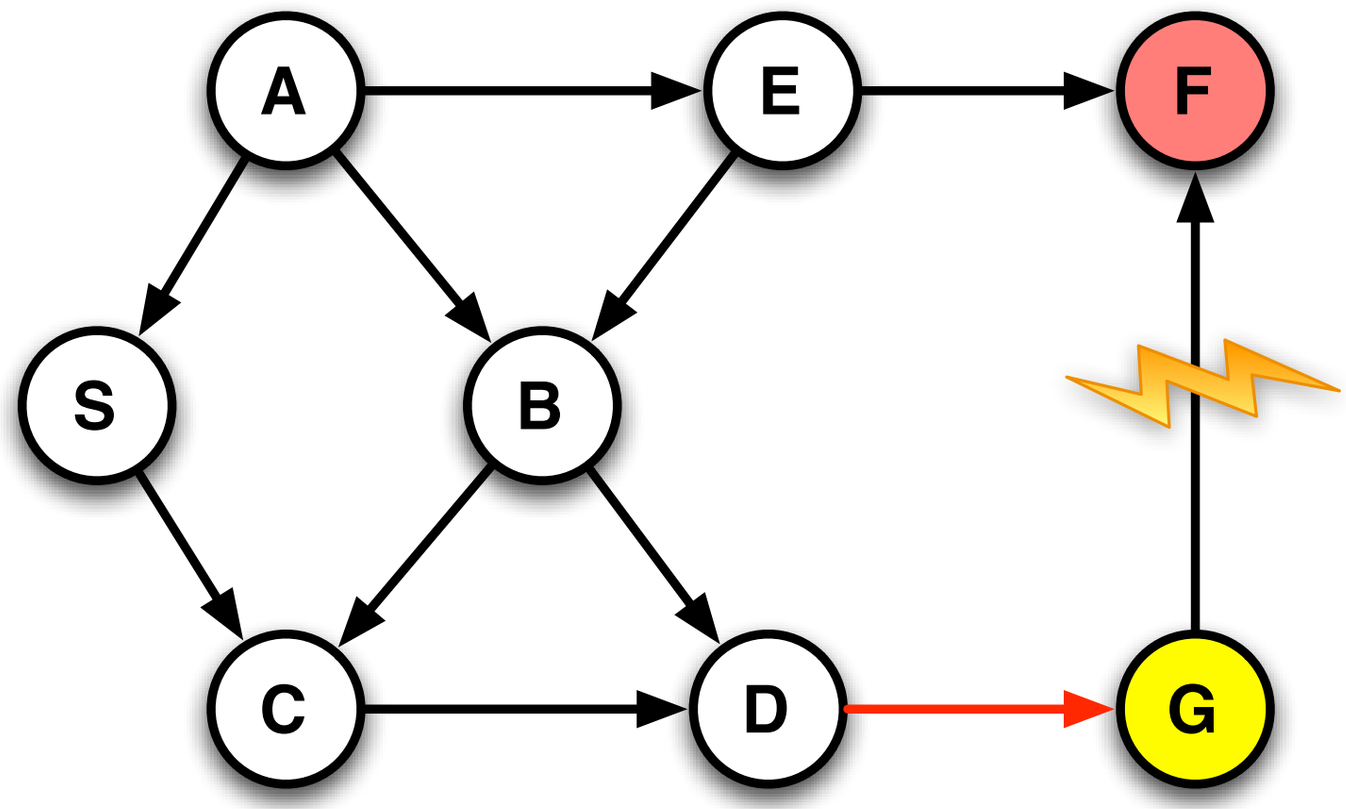
Link Reversal

- **Directed acyclic graph (DAG) for each target**
  - is preserved also in the case of failing edges
- **Connections are symmetrical**
  - direction are only virtual

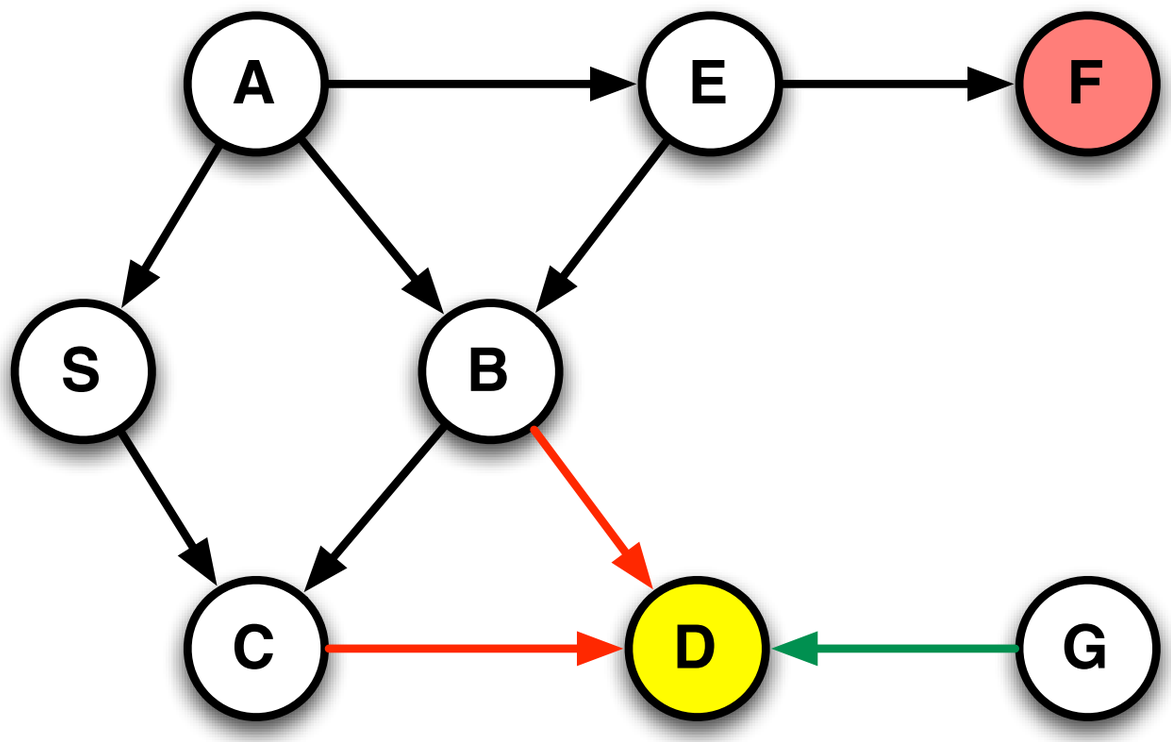


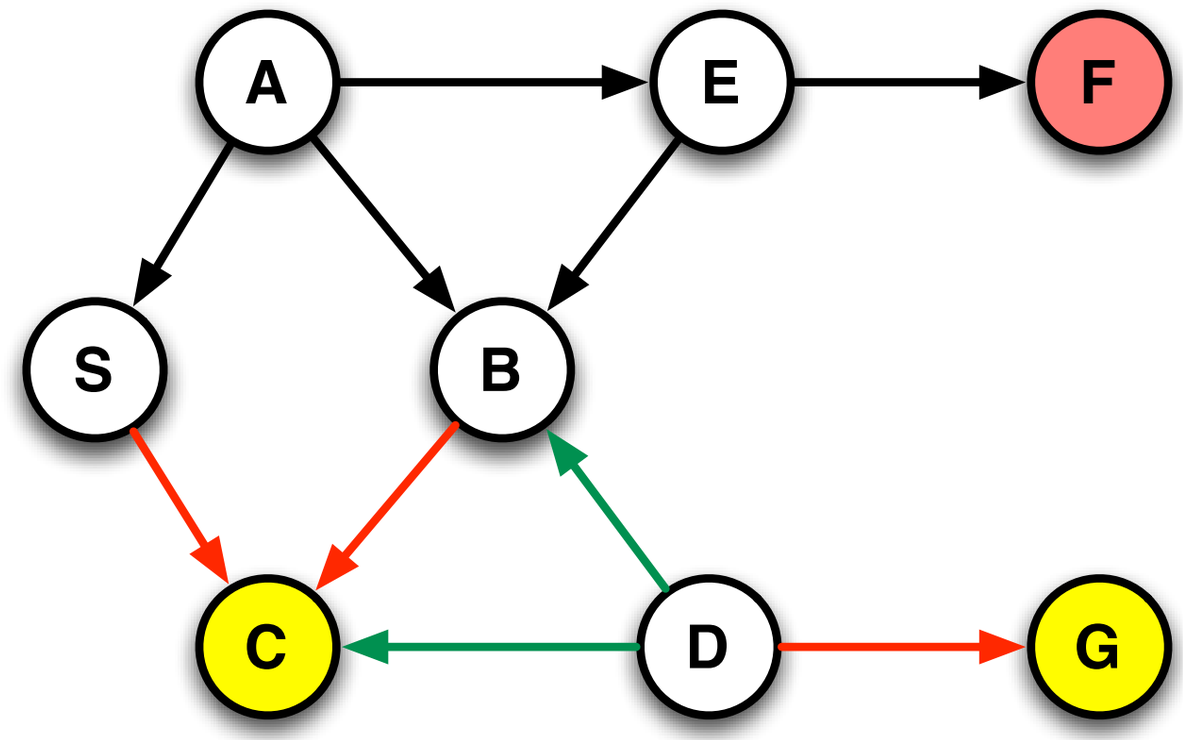
Link Reversal

- **Link F-G is lost**
- **Repair**
  - All nodes without outging edges change the orientation of all incoming edges

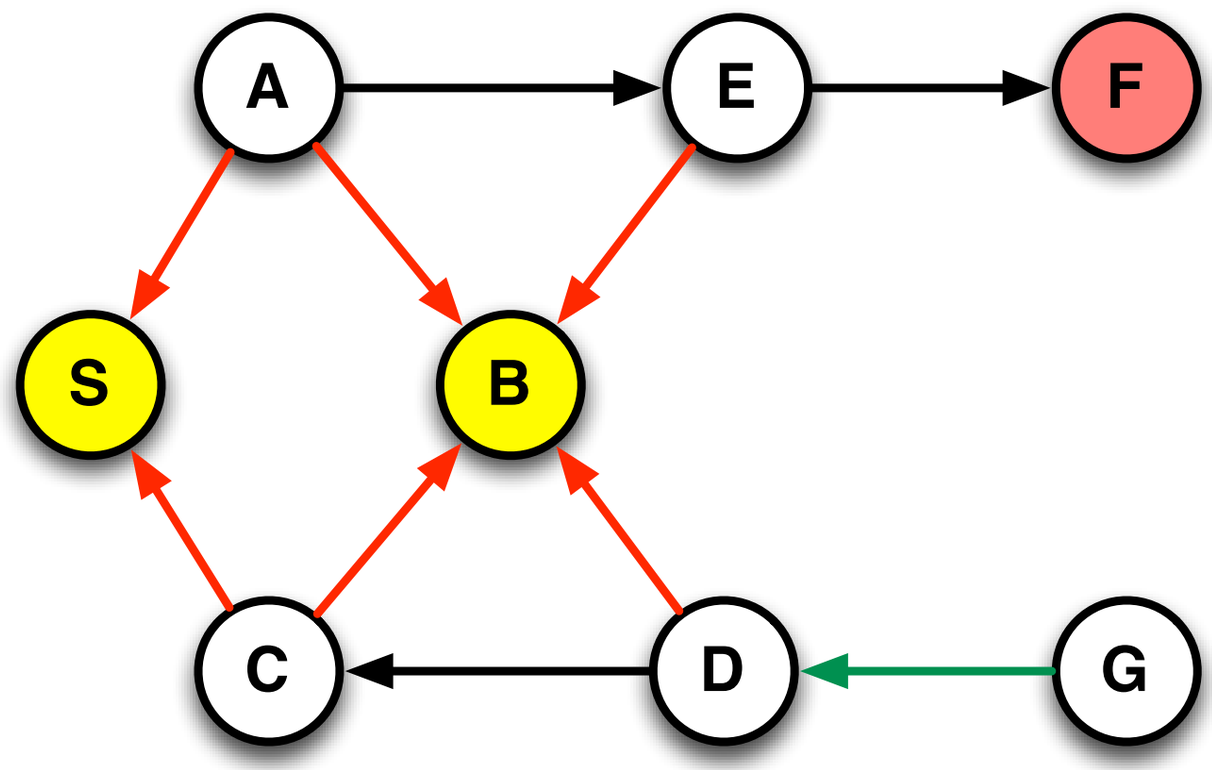


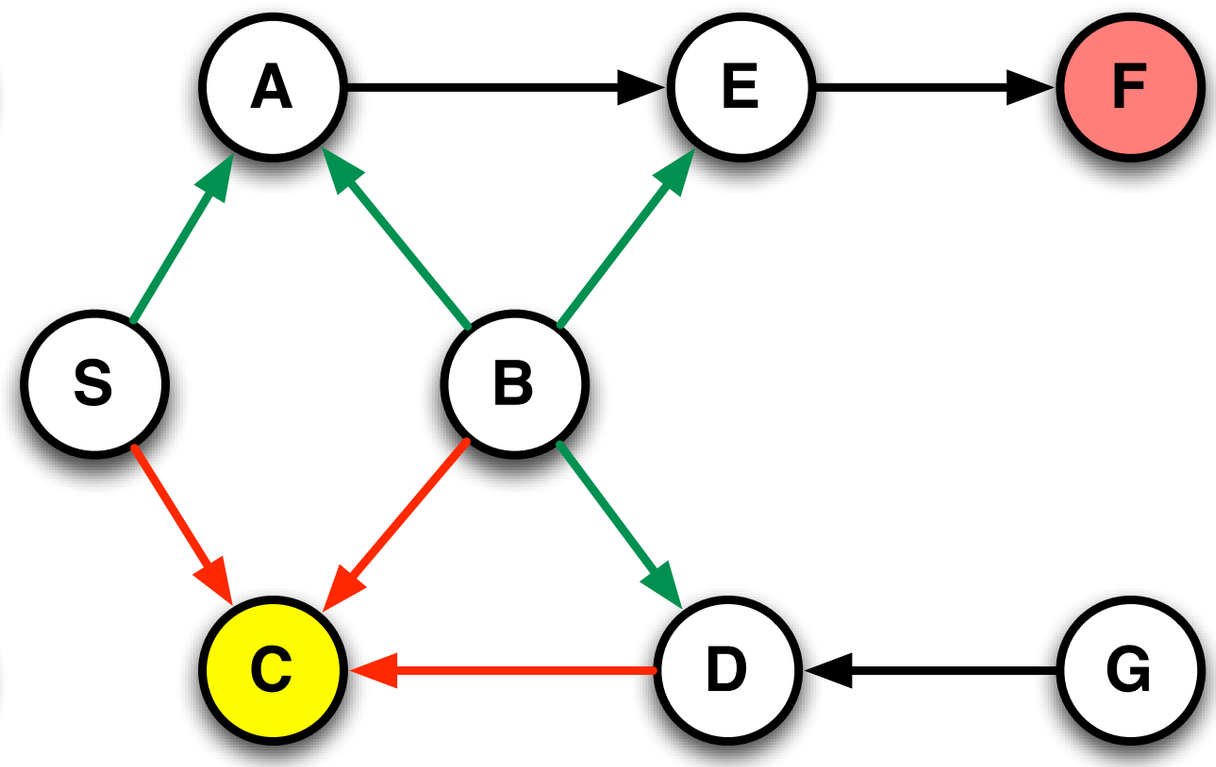
Link Reversal



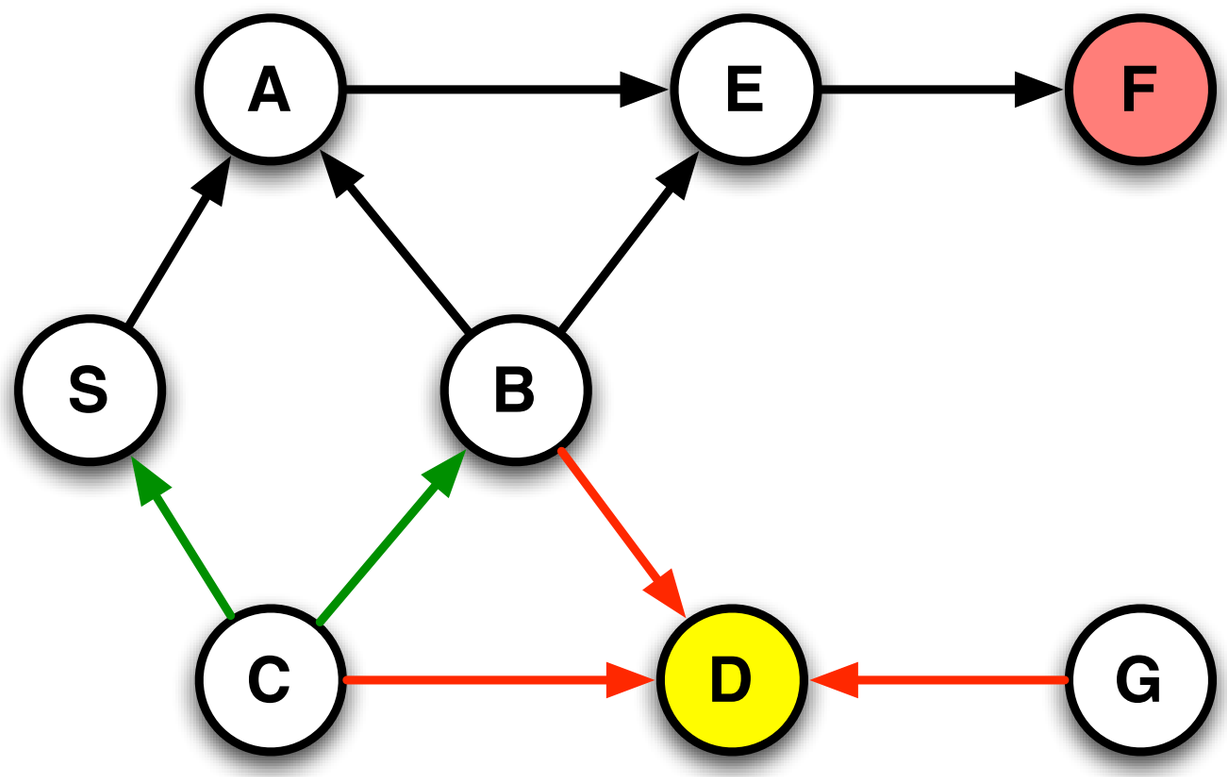


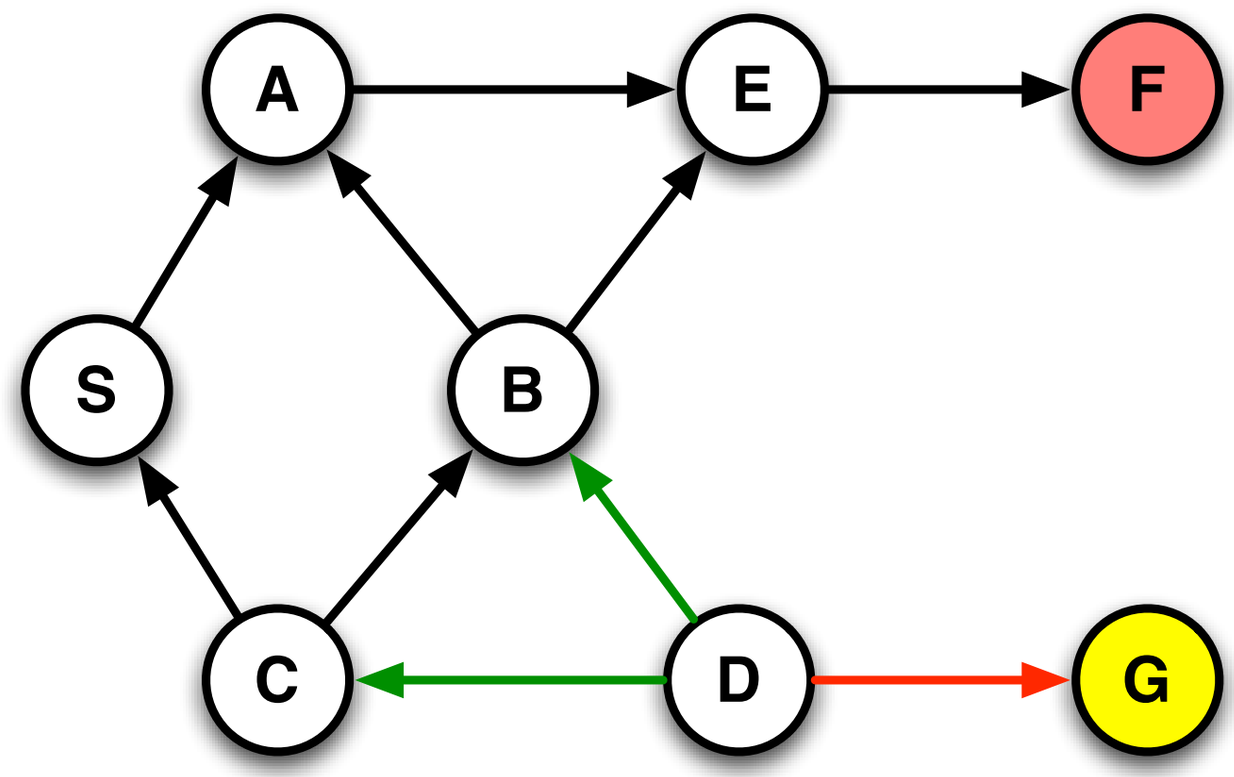
Link Reversal



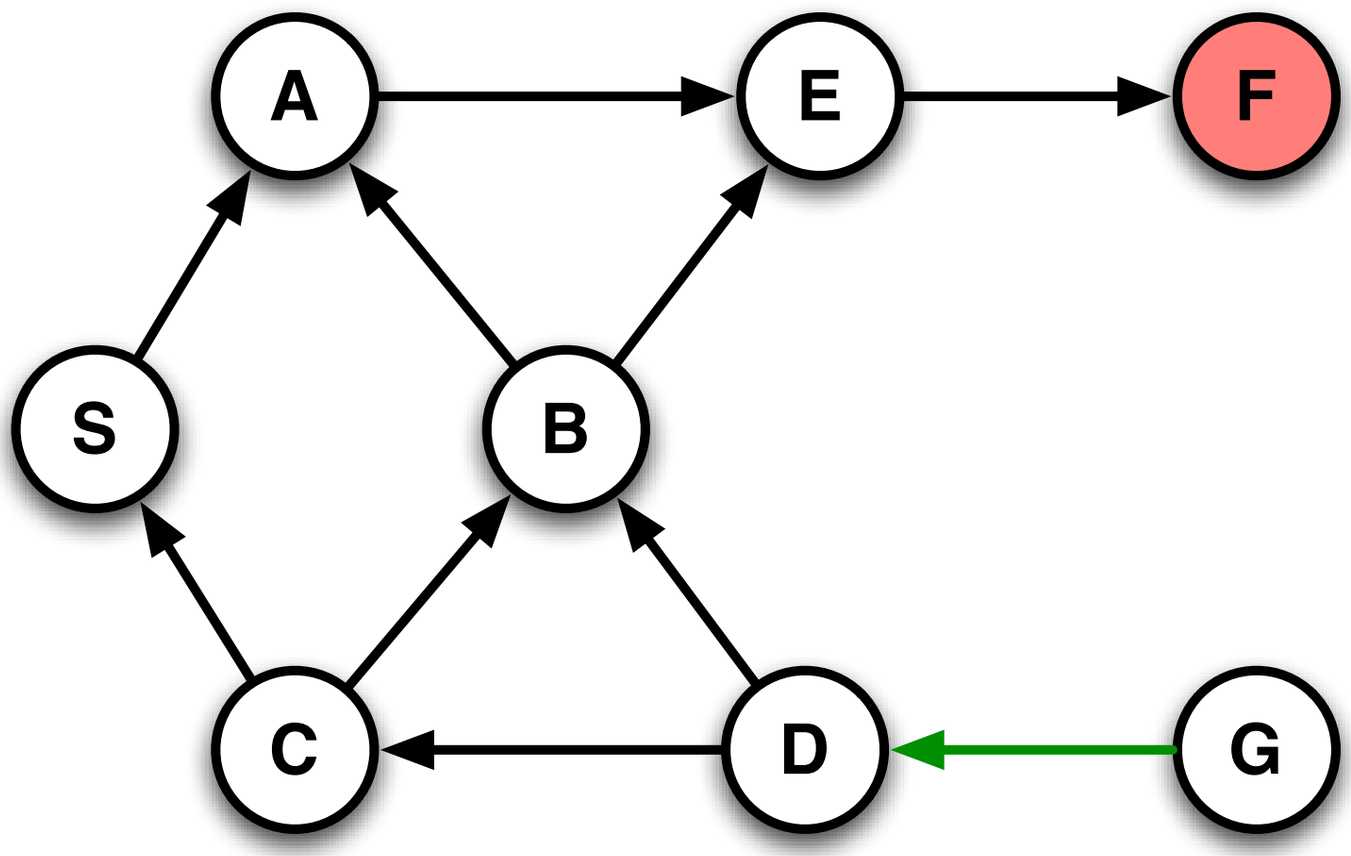


Link Reversal





Link Reversal



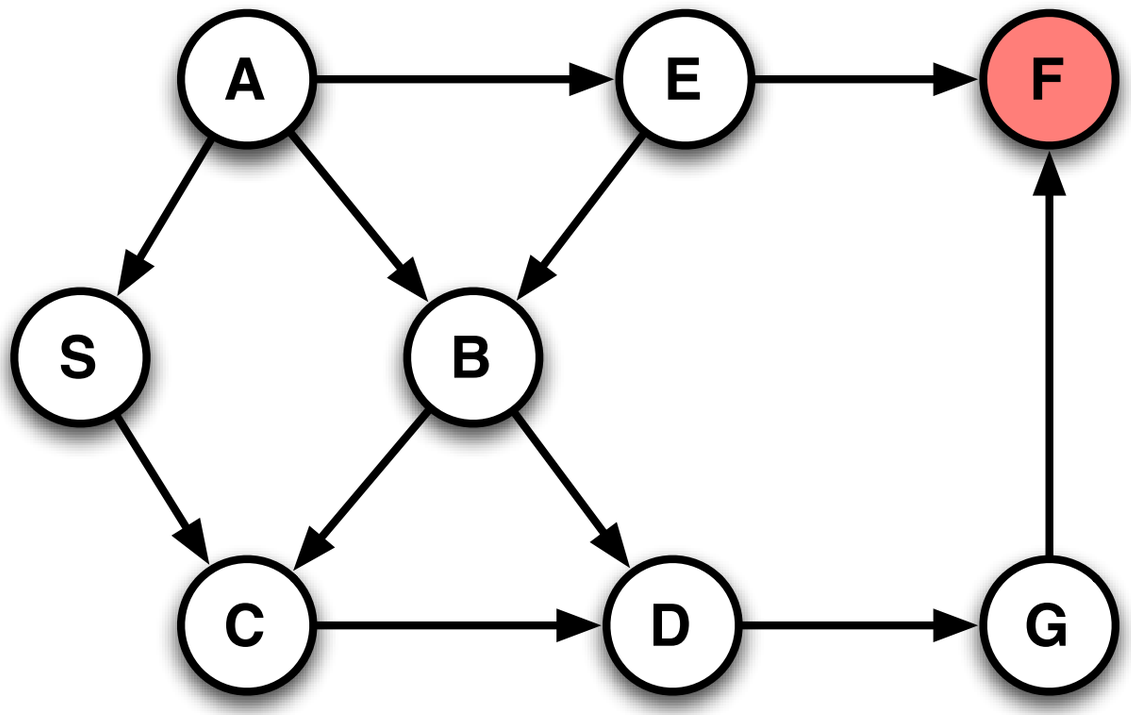
Link Reversal

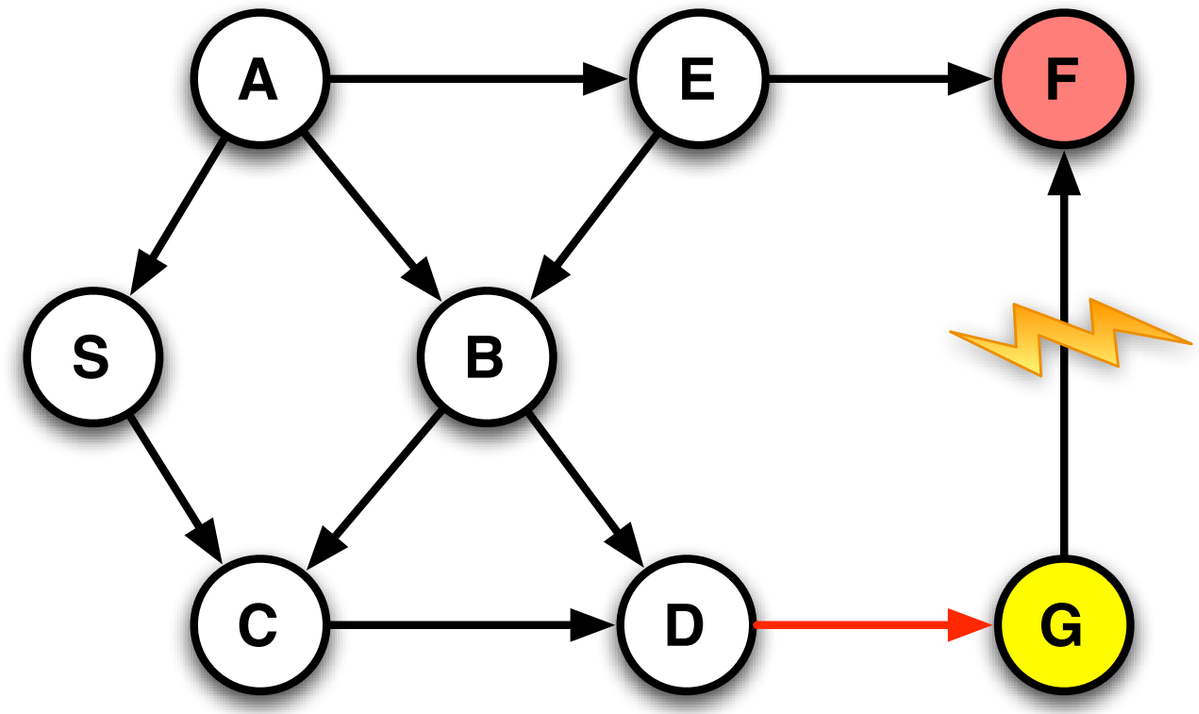
- **Motivation**
  - Link reversal should cause only local changes
  - Not necessarily the case
- **Repair is initiated,**
  - when the first packet is sent
- **Method known as a full reversal**

Partial Reversal

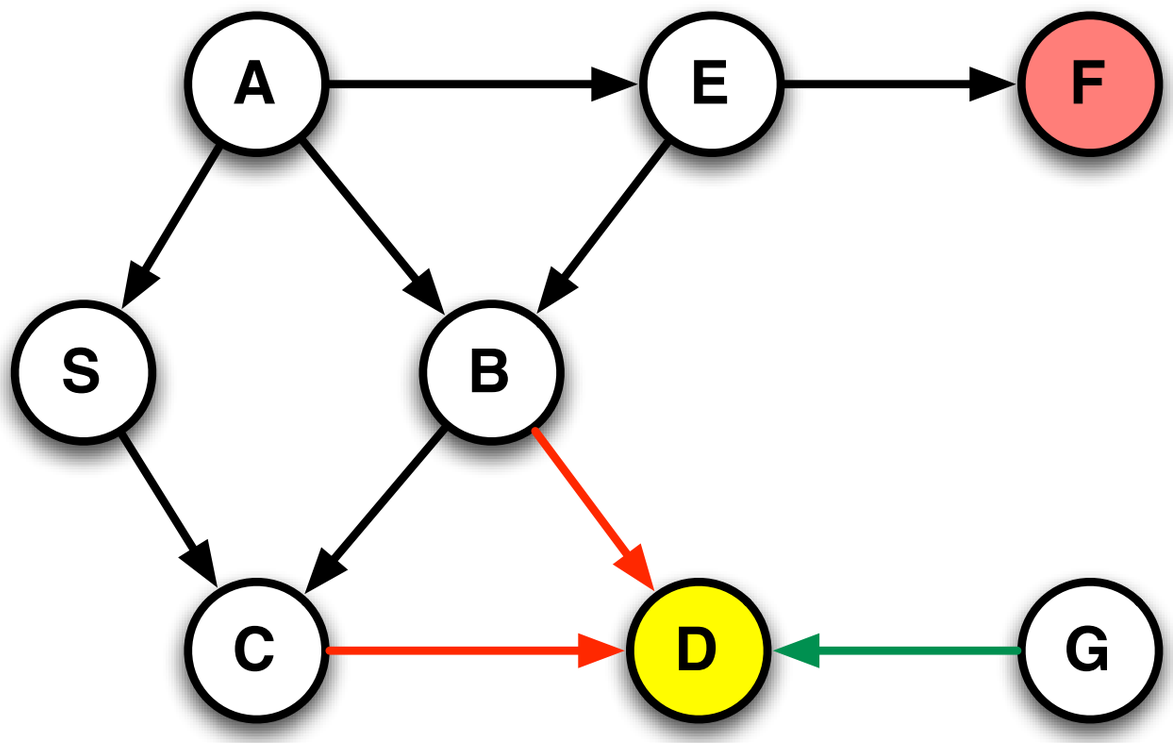
- **Partial reversal**
  - Only the edges are reversed which have not been reversed before
  - If all edges have been already reversed, then reverse all edges again

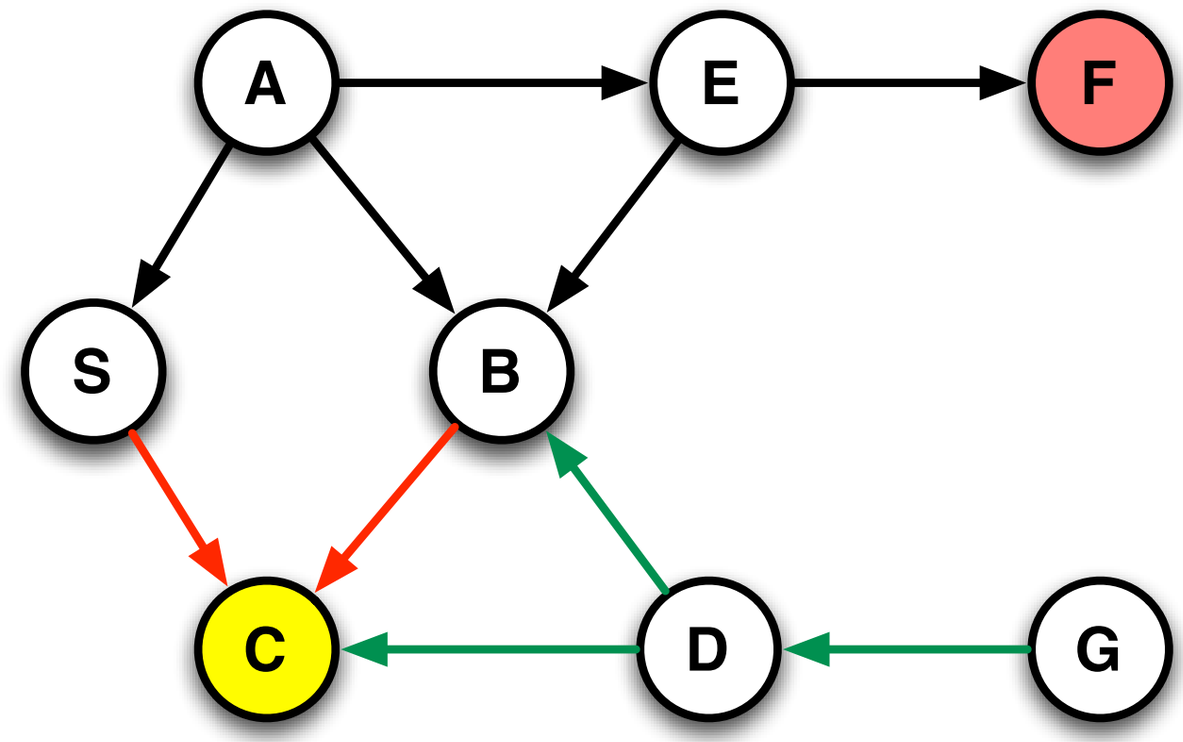
Partial Reversal



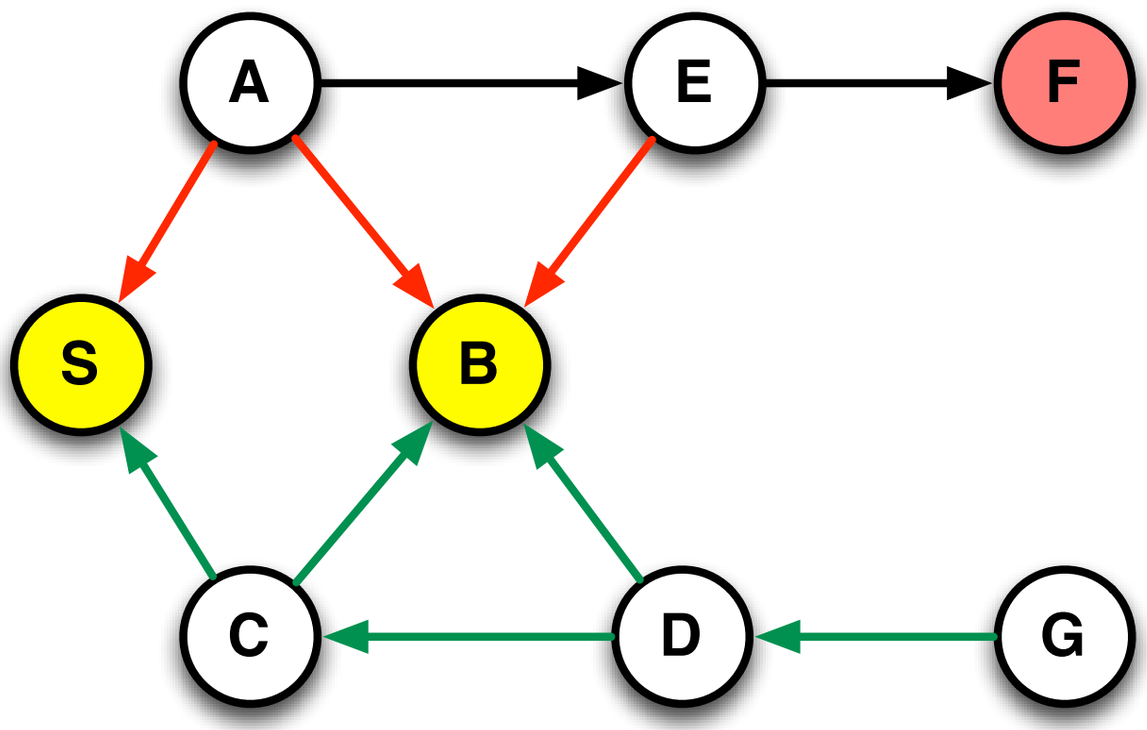


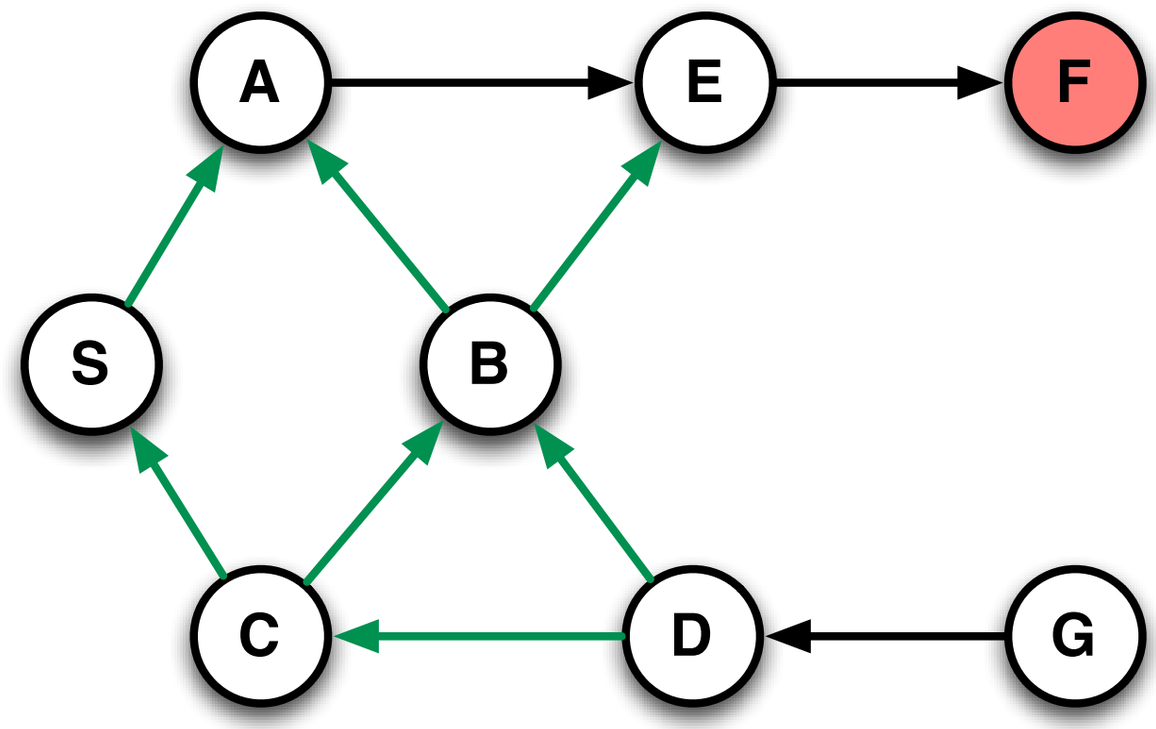
Partial Reversal





Partial Reversal

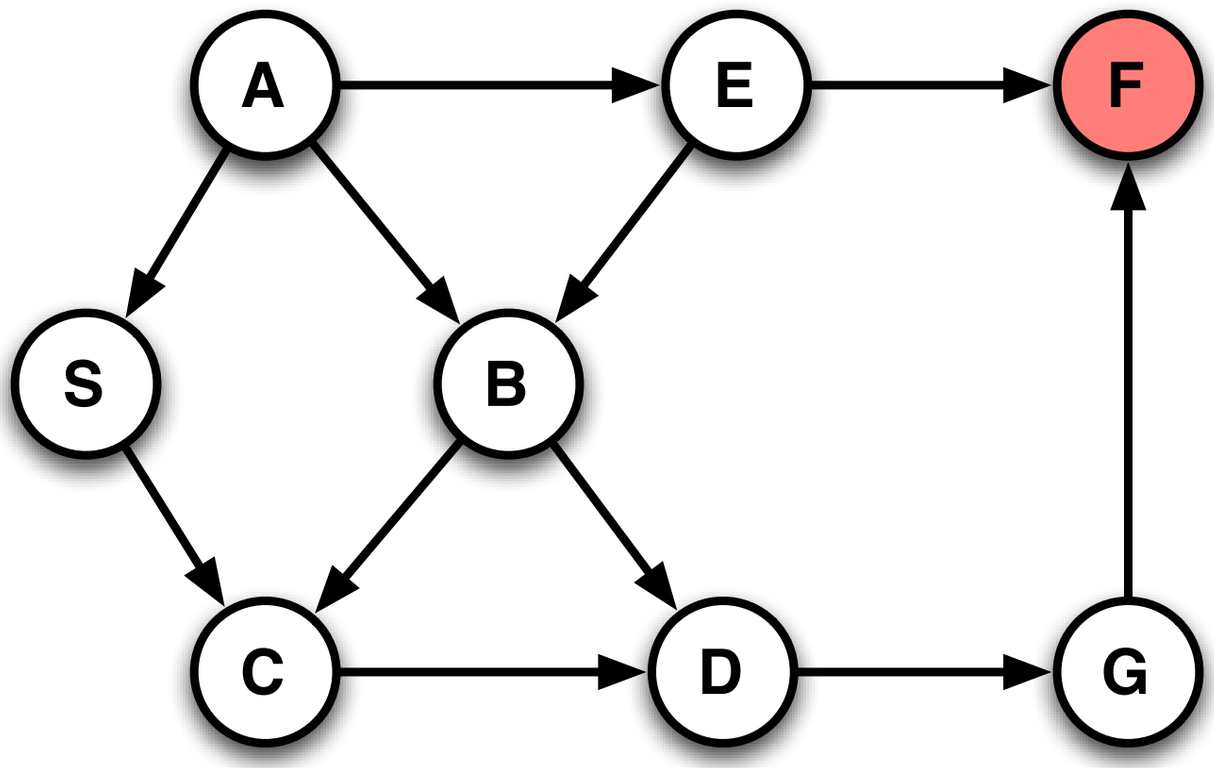


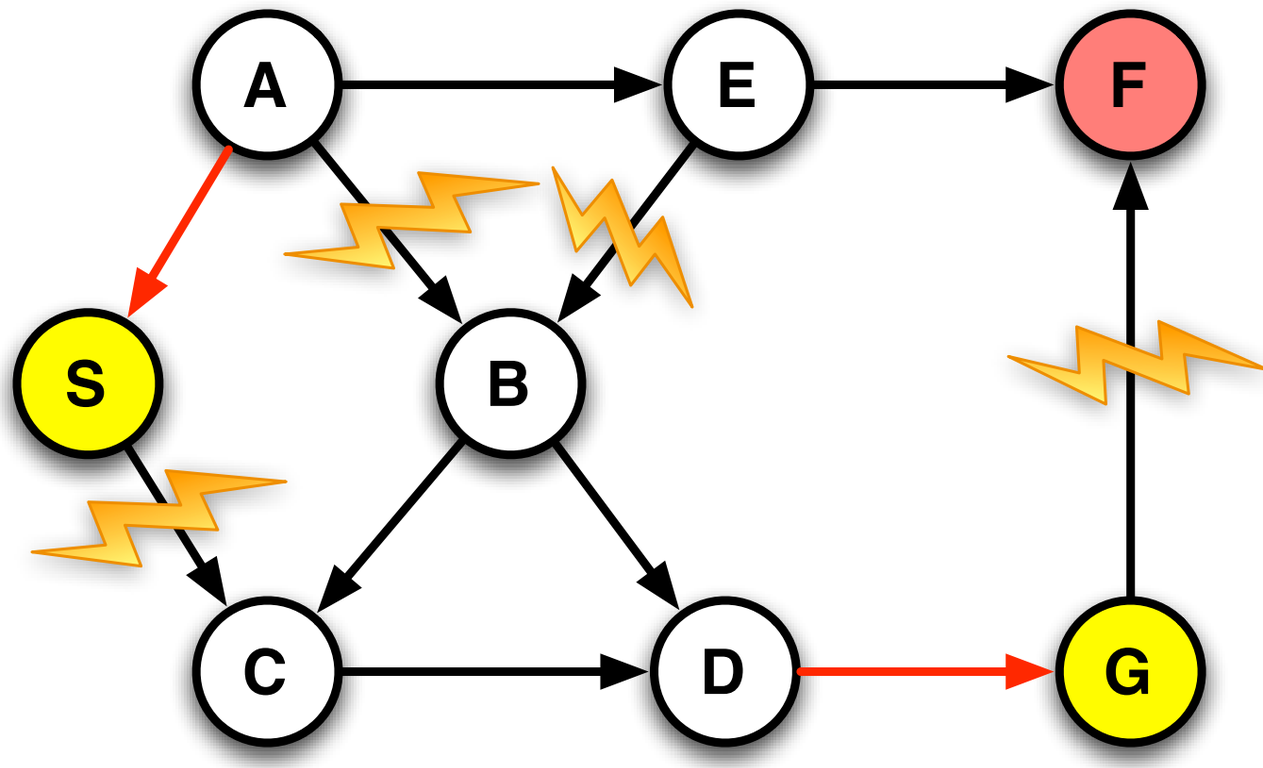


Link Reversal

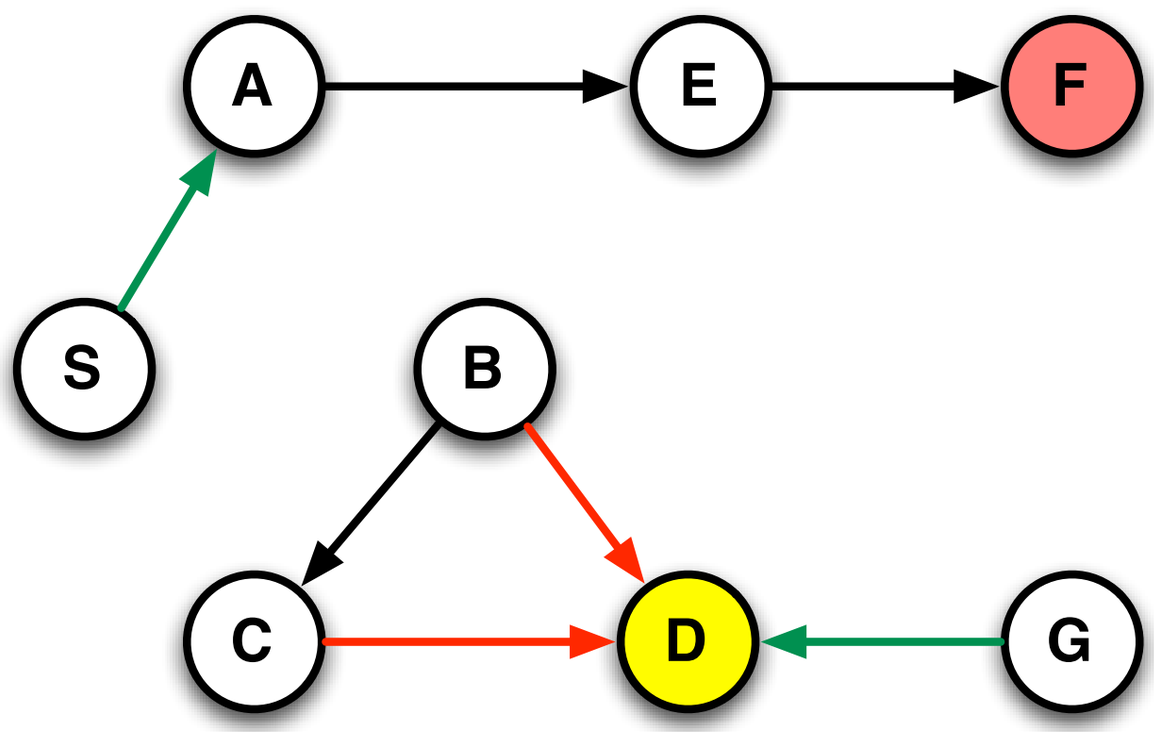
- **Advantages**
  - Link reversal intends local repair
  - Several substitute routes (potentially) available
- **Disadvantages**
  - Connection errors must be detected
    - Hello messages cause additional traffic
  - If network is partitioned, the repair mechanism does not terminate

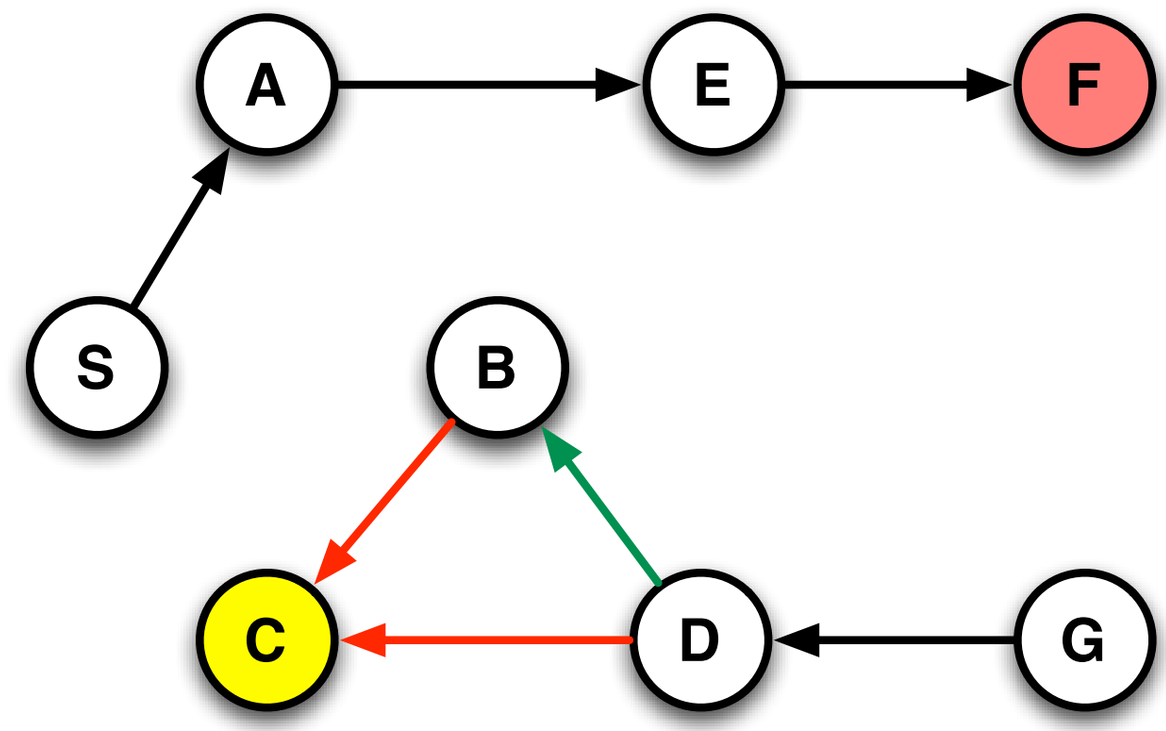
Link Reversal if Network is Partitioned





Link Reversal if Network is Partitioned





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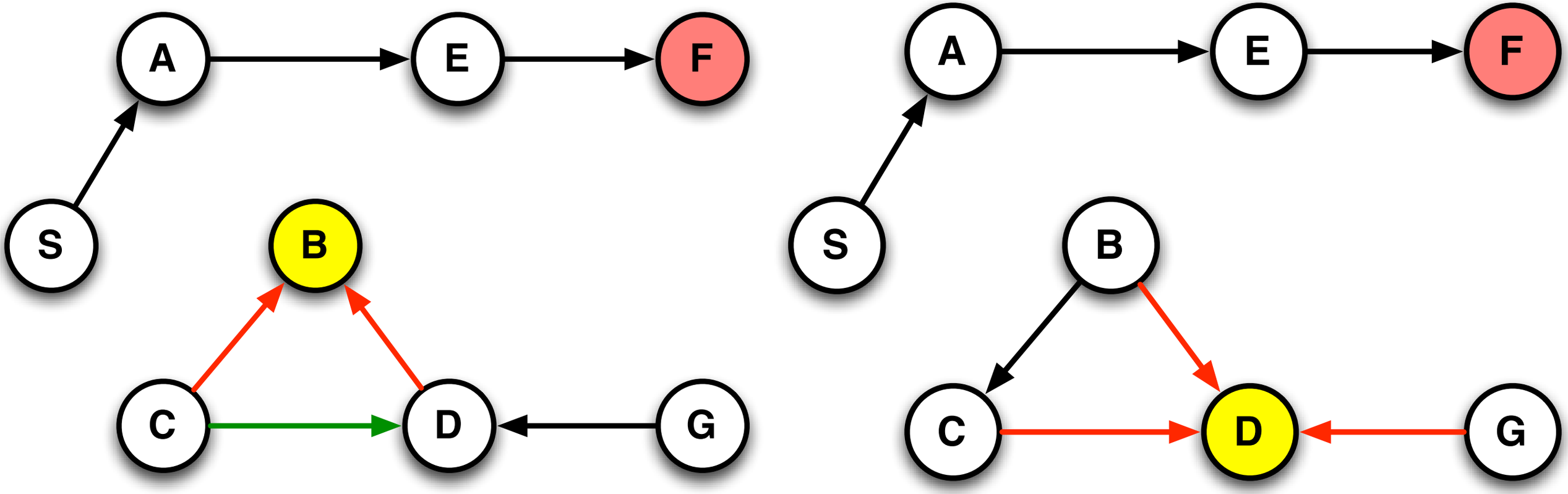
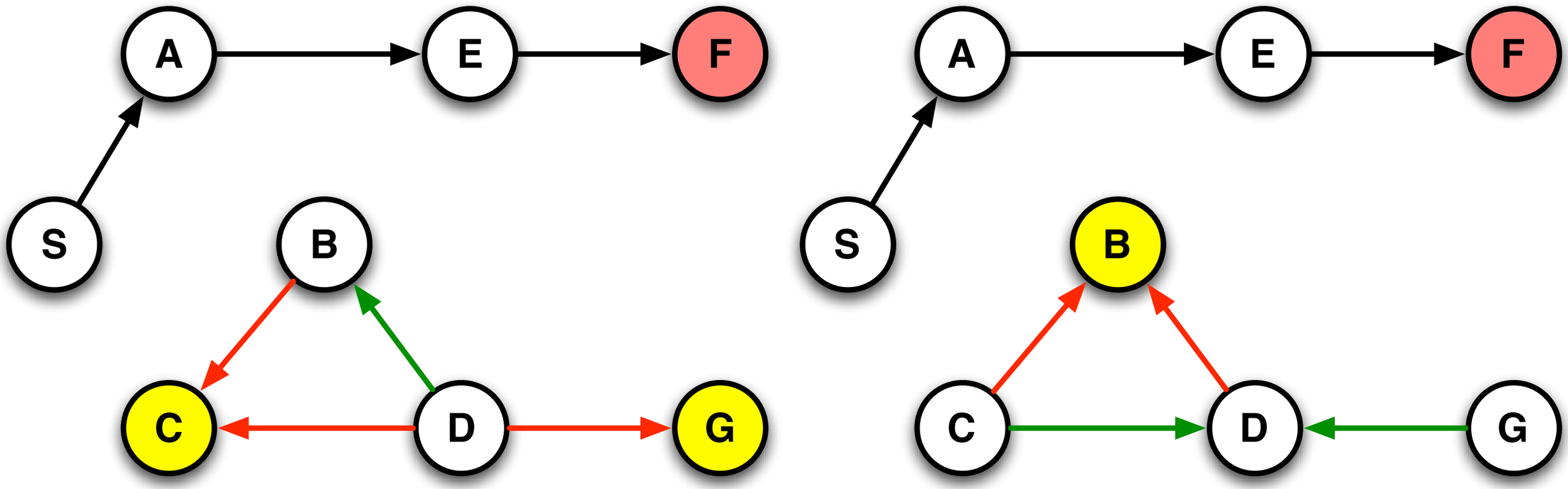


Link Reversal if Network is Partitioned



TORA

- **Separate network does not terminate with link reversals**
- **Mechanism for recognizing partitioning**
  - TORA (Temporally-Ordered Routing Algorithm (TORA)
    - Park, Corson, Highly Adaptive Distributed Routing Algorithm for Mobile Wireless Networks, Infocom 1997
  - Analysis of link reversal provides this information

Link Reversal

- **Reactive protocol**
  - Repair only when data packet is not delivered
- **Proactive protocol**
  - Hello packets check all connections
- **Link reversal can be both proactive and reactive**

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