As faults accumulate, networks become disconnected.

Past Work
- Separate spanning trees for otherwise)
- Dedicated testing is not required
- Unified implementation in software → low area overhead

Routing in Irregular Networks
- Routing algorithm should disable paths that lead to deadlock.
- Up*/down* routing disables turns to avoid deadlock.
- Construct spanning tree rooted at a node (assumes bidirectional links).
- Mark links towards root: up (down otherwise).
- Disable all down* turns.
- Follow up links towards root and down links to destination.

Routing with Unidirectional Links
- Separate spanning trees for up (up-tree) and down (down-tree) links:
  - Up-tree: unidirectional links towards root.
  - Down-tree: unidirectional links away from root.
  - Consistent ordering/labeling: no link marked both up and down.
- As links are marked according to up*/down* principle (and no conflicts):
  - uDIREC routing is deadlock-free (disable down* up* turns).
  - Network is connected if both trees are complete.

Growing Trees Concurrently
- uDIREC can be constructed:
  - Independently: may lead to inconsistent marking.
  - Concurrently: consistent labeling guaranteed by construction.
- Expand trees beyond a node only if reachable by both up-tree and down-tree.

Fault Diagnosis
- Finest granularity of diagnosis and reconfiguration.
- Faulty irregular network with deadlock-free routes.
- Dedicated testing is not required → no overhead in absence of errors.
- Unified implementation in software → low area overhead.

Performance Results
- Initially latency degrades gracefully; at higher fault rates up*/down* drops much more nodes, hence lower latency.
- uDIREC consistently delivers higher throughput.