FAULT-TOLERANT LIVELOCK-FREE PROTOCOL

Updated April 7, 2020

Original Protocol on 3x3

With One Fault	With Two Faults
Total Scenarios: 1728	Total Scenarios: 15408
Delivered: 1728 (100%)	Delivered: 15136 (98.2347%)
Undeliverable: 0 (0%)	Undeliverable: 263 (1.7069%)
Livelocks Found: 0 (0%)	Livelocks Found: 9 (0.0584%)

Modified Protocol on 3x3

With One Fault	With Two Faults
Total Scenarios: 1728	Total Scenarios: 19872
Delivered: 1728 (100%)	Delivered: 19581 (98.536%)
Undeliverable: 0 (0%)	Undeliverable: 291 (1.7394%)
Livelocks Found: 0 (0%)	Livelocks Found: 0 (0%)

Modified Protocol on 5x5

With One Fault	With Two Faults
Total Scenarios: 48000	Total Scenarios: 1896000
Delivered: 48000 (100%)	Delivered: 1892890 (99.836%)
Undeliverable: 0 (0%)	Undeliverable: 3110 (0.164%)
Livelocks Found: 0 (0%)	Livelocks Found: 0 (0%)

Modified Protocol on 10x10

With One Fault	With Two Faults
Total Scenarios: 3564000	Total Scenarios: 639738000
Delivered: 3564000 (100%)	Delivered: 639654325 (99.987%)
Undeliverable: 0 (0%)	Undeliverable: 83675 (0.013%)
Livelocks Found: 0 (0%)	Livelocks Found: 0 (0%)

Modified Protocol on 15x15

With One Fault	With Two Faults
Total Scenarios: 42336000	Total Scenarios: 17759952000
Delivered: 42336000 (100%)	Delivered: 17759357935 (99.996%)
Undeliverable: 0 (0%)	Undeliverable: 424979 (0.003%)
Livelocks Found: 0 (0%)	Livelocks Found: 0 (0%)

Protocol Description Pseudocode

While the flit isn't delivered:

- If the packet is at its destination, deliver it and mark it delivered.

- Else if the packet is one hop away and the link is available, send on that link

- **Else go west if:**
  - The flit is not on the west edge, AND
  - The west link is not faulty, AND
  - The flit is traveling west or south, or is just injected, AND
  - EITHER the destination is west of the flit, OR
    The destination is north of the flit AND the south link is faulty, AND
  - EITHER the destination is not one column to the east, OR
    The flit is not traveling south

- **Else go south if:**
  - The flit is not on the south edge, AND
  - The south link is not faulty, AND
  - The flit is traveling west or south, or is just injected, AND
  - The destination is not one node north OR the destination is not one node east, AND
  - EITHER The destination is south of the flit, OR
    The destination is north AND the west link is faulty

- **ELSE go east if:**
  - The flit is not on the east edge, AND
  - The east link is not faulty, AND
  - The flit is not traveling west, AND
  - EITHER the destination is at least 2 nodes to the east, OR
    The destination is east of the flit and exactly 1 node north of the flit

- **ELSE go north if:**
  - The flit is not on the north edge, AND
  - The north link is not faulty, AND
  - The flit is not traveling south, AND
  - The destination is north of the flit

- **ELSE go west if:**
  - The flit is not on the west edge, AND
  - The west link is not faulty, AND
  - The destination is in the same column or west of the flit, AND
  - EITHER the flit is not traveling east, OR
    The destination is exactly one node to the north of the flit

- **ELSE go south if:**
  - The flit is not on the south edge, AND
  - The south link is not faulty, AND
  - The destination is in the same row or south of the flit, AND
  - EITHER the flit is not traveling east, OR
    The destination is not on the northeast corner

- **ELSE go east if:**
  - The flit is not on the east edge, AND
  - The east link is not faulty, AND
  - The destination is in the same column or east of the flit, AND
  - EITHER the flit is not traveling west, OR
    The destination is one node to the east of the flit and is not one node north of the flit

- **ELSE go north if:**
  - The flit is not on the north edge, AND
  - The north link is not faulty, AND
  - The destination is in the same row or north of the flit, AND
  - EITHER the flit is not traveling south, OR
    The destination is in the same row or east of the flit