Line in the Sand

## Ohio State ·· UT Austin ·· Michigan State ·· Iowa ·· Kent State

Routing on a Logical Grid

New Routing Protocol

❖ We present a new routing protocol that is suitable for the Line in the Sand demo

❖ This protocol is simple:

it requires each mote to send only one three-byte message every 3 seconds

❖ This protocol is reliable:

it can overcome random message loss and mote failure

The Logical Grid

❖ The motes are named as if they form an M*N logical grid

❖ Each mote is named by a pair (i,j) where

i = 0 .. M-1 and j = 0 .. N-1

❖ The mote connected to the PC is (0,0)

❖ Physical connectivity between motes is a superset of their connectivity in a logical grid
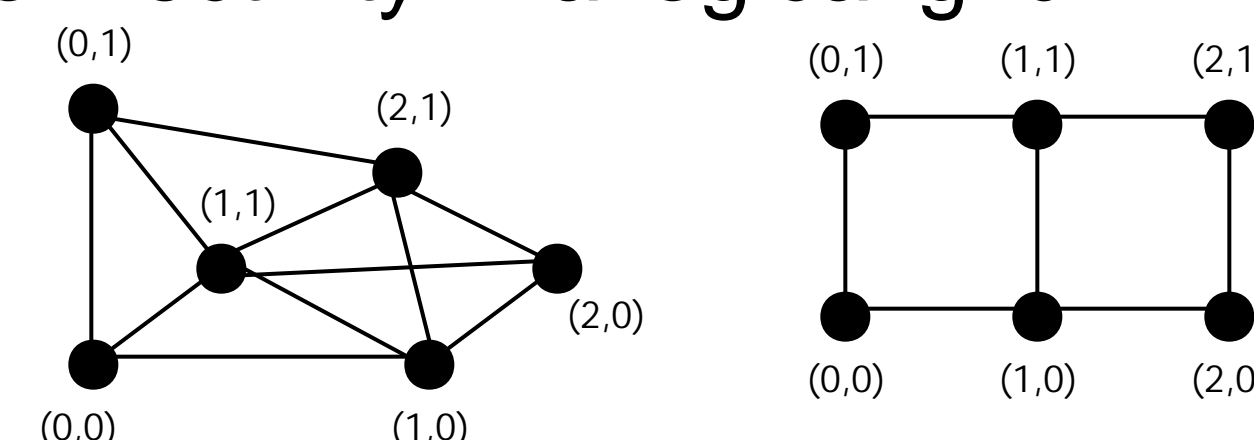

The Routing Protocol

Neighbors

❖ Each mote (i, j) has

❖ two low-neighbors (i-H, j) and (i, j-H)

❖ two high-neighbors (i+H, j) and (i, j+H)
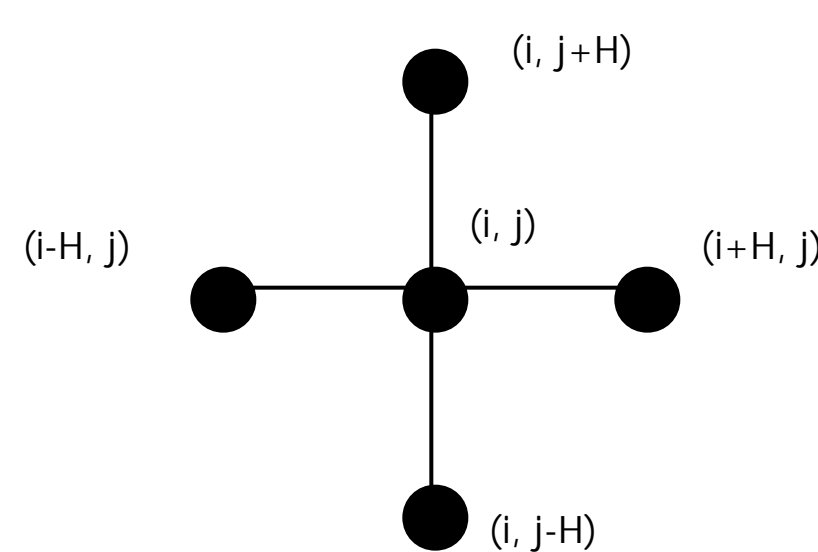
❖ H is a positive integer called the tree hop

❖ If a mote (i, j) receives a message from any mote other than its low- and high-neighbors, (i, j) discards the message

Choosing the Parent

❖ Usually, each mote (i, j) chooses one of its low-neighbors (i-H, j) or (i, j-H) to be its parent

❖ If both its low-neighbors fail, then (i, j) chooses one of its high-neighbors (i+H, j) or (i, j+H) to be its parent. This is called inversion
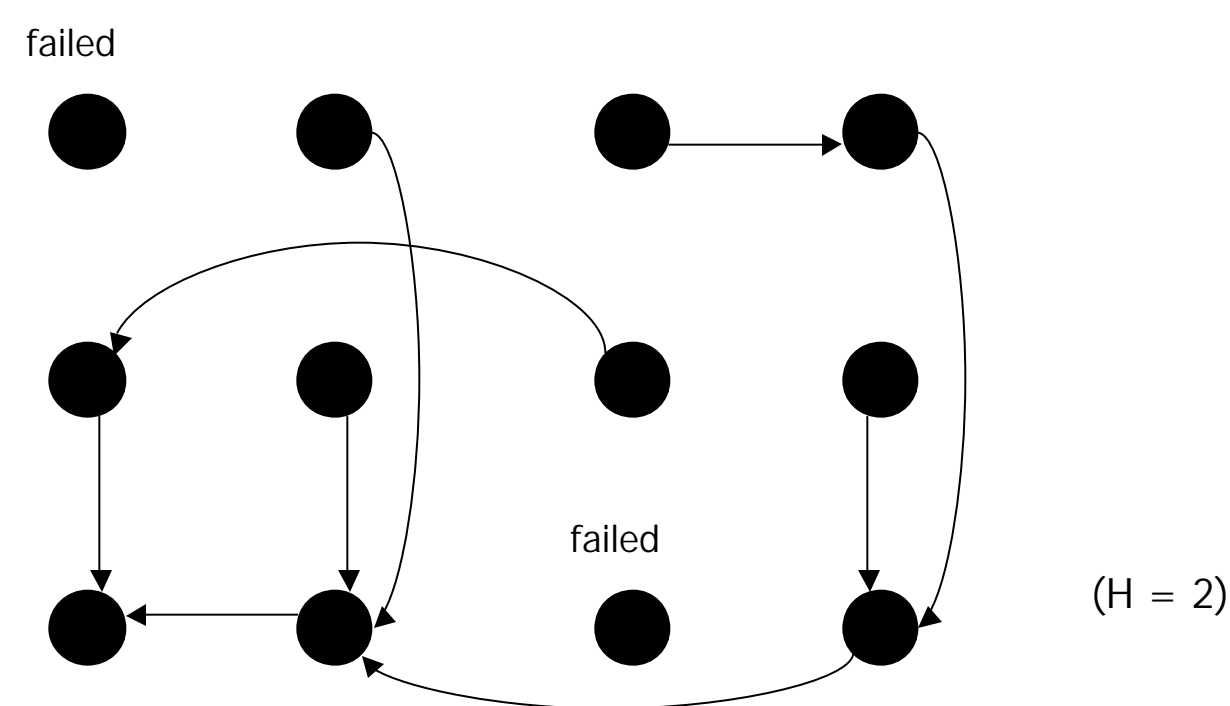
Spanning Tree

❖ Each mote (i, j) can send messages whose ultimate destination is mote (0, 0)

❖ The motes need to maintain an incoming spanning tree whose root is (0, 0): each mote maintains a pointer to its parent
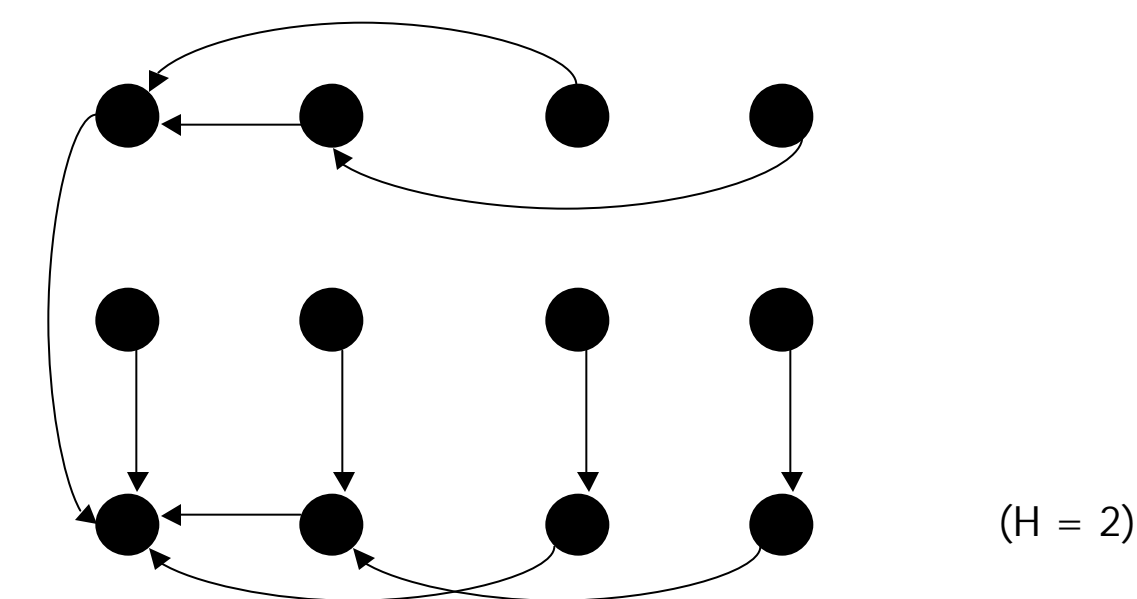
❖ When a mote (i, j) has a message, it forwards the message to its parent. This continues until the message reaches the root mote (0, 0).
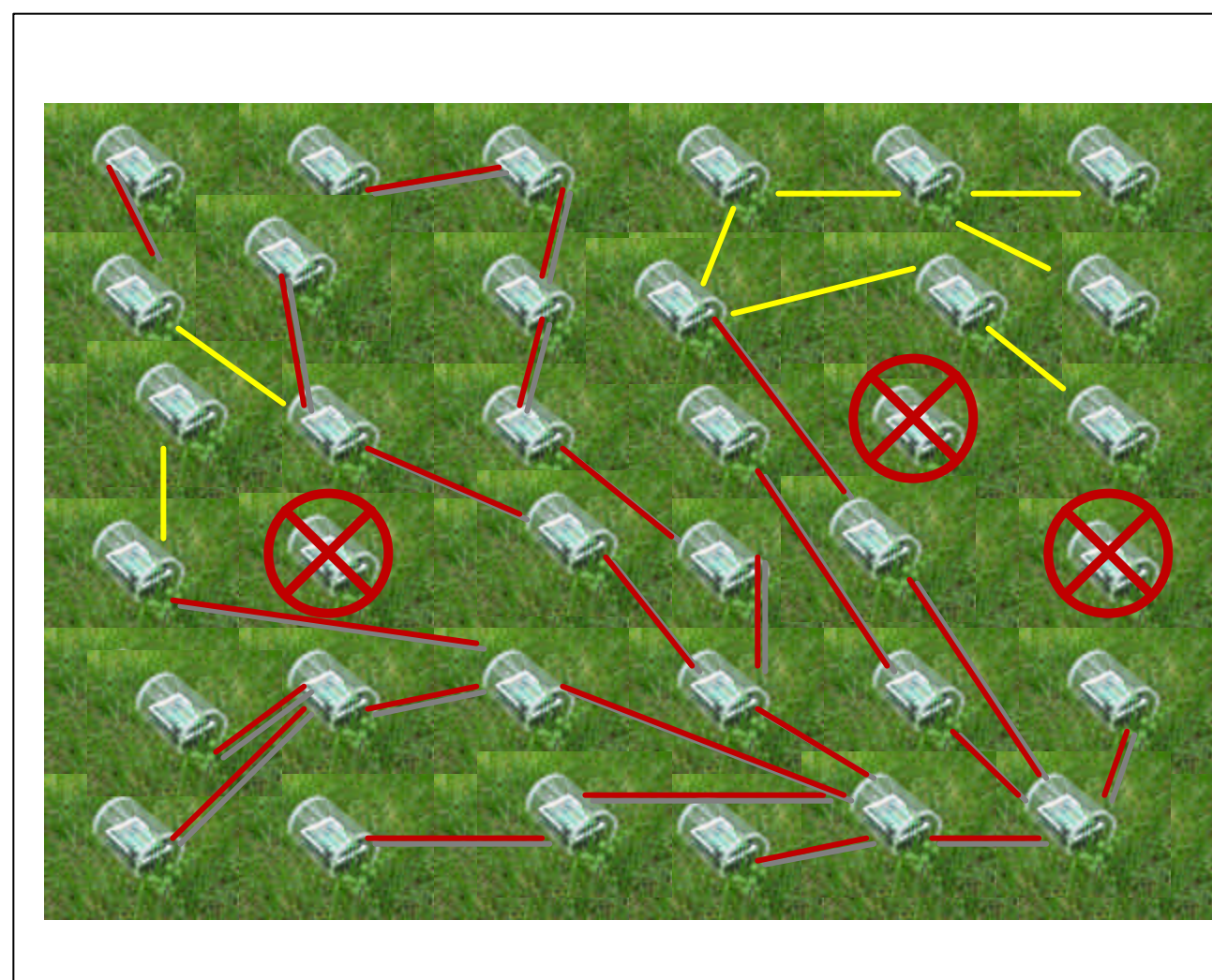
Protocol Message

❖ If a mote (i, j) has a parent, then every 3 seconds it sends a message with three fields:

connected(i, j, c)

(i, j) is the mote's id,

c is the mote's inversion count

❖ Every 3 seconds, mote (0, 0) sends a msg with three fields: connected(0, 0, 0)

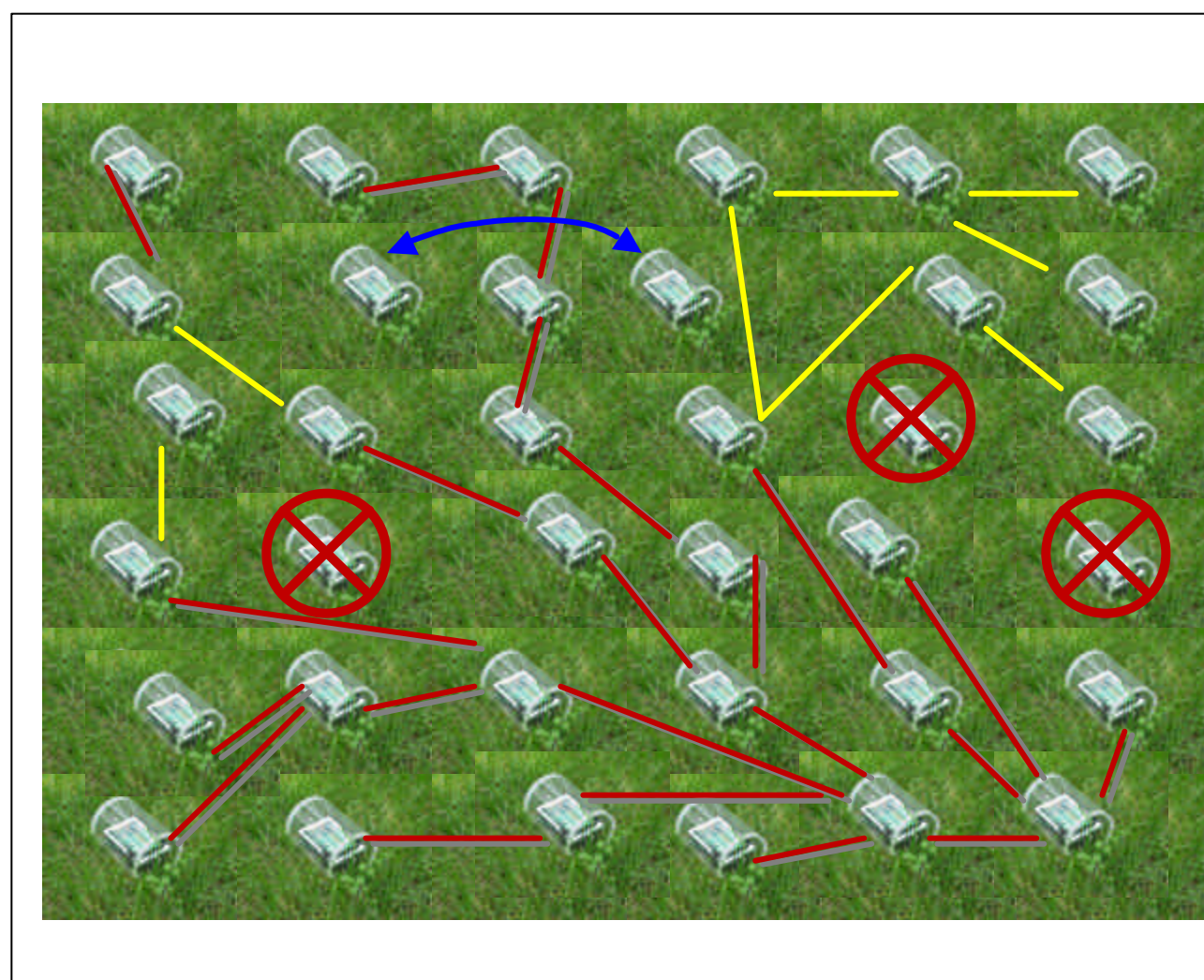## Fault Tolerance of the Routing Protocol
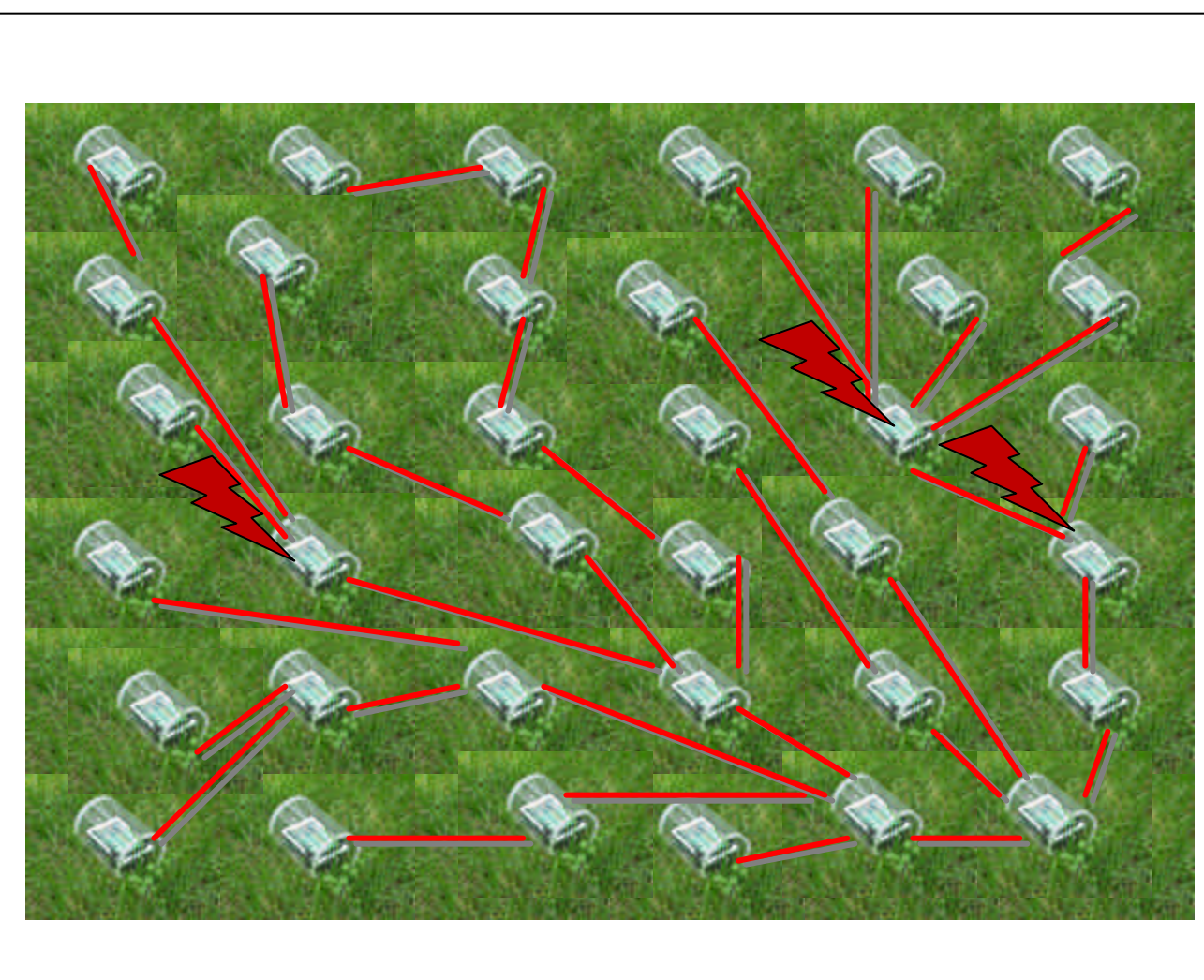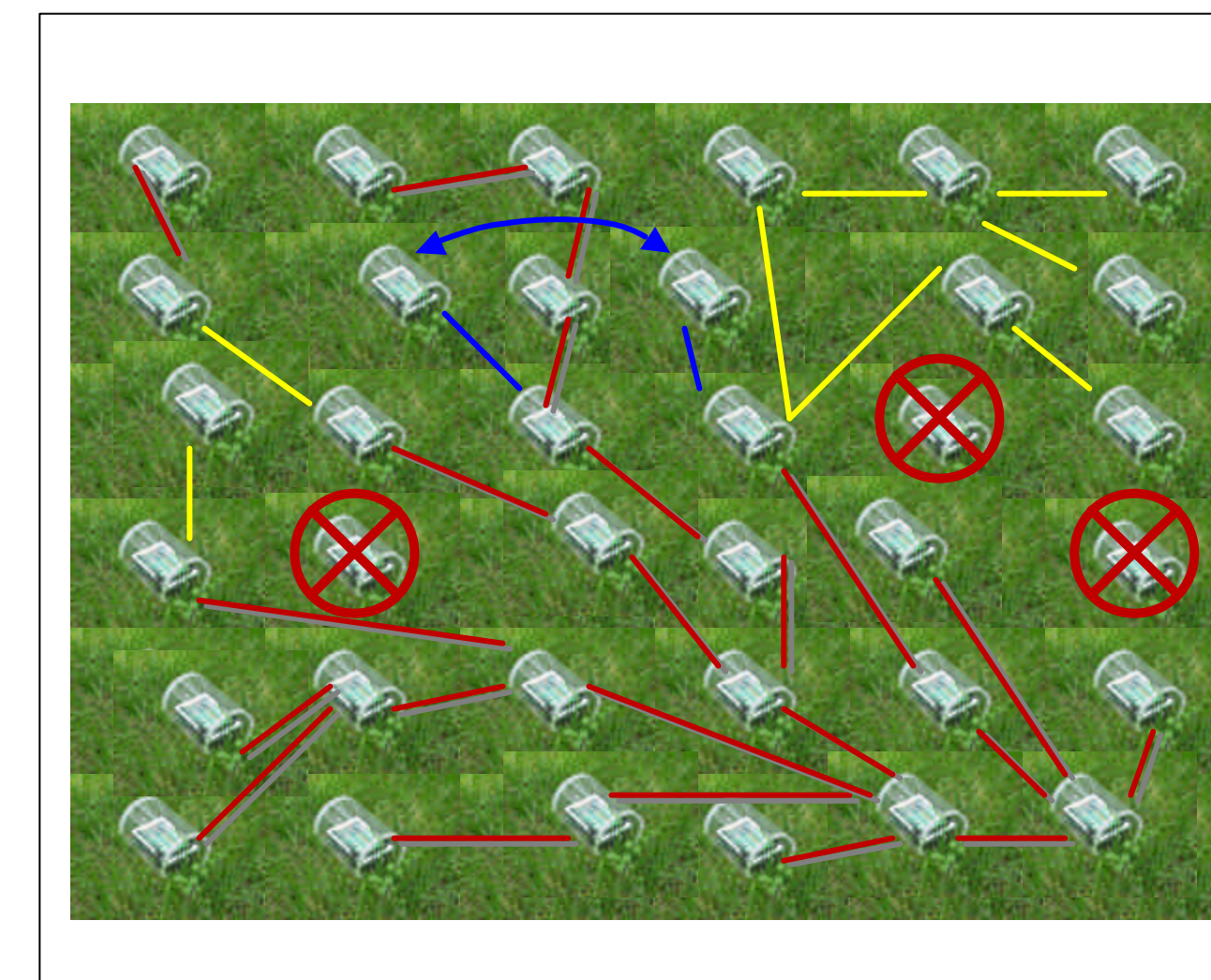

1. One or more nodes are depleted of power or destroyed.

2. The network reforms around the dead nodes and continues to work.

3. Nodes are moved, swapped, or perturbed.

4. Nodes re-establish communication through new neighbors and continue to work.