A Reliability Model for Context Containment

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mlt_model_01

Is Timer Based Context Containment Reliable?

- Once a fault is detected, nodes to either side of fault signal the need to start protection and context containment
- As other nodes receive the protection message, they stop transmission, flush their STQ and wait until a timer expires to restart transmission
- How long is the timer period?

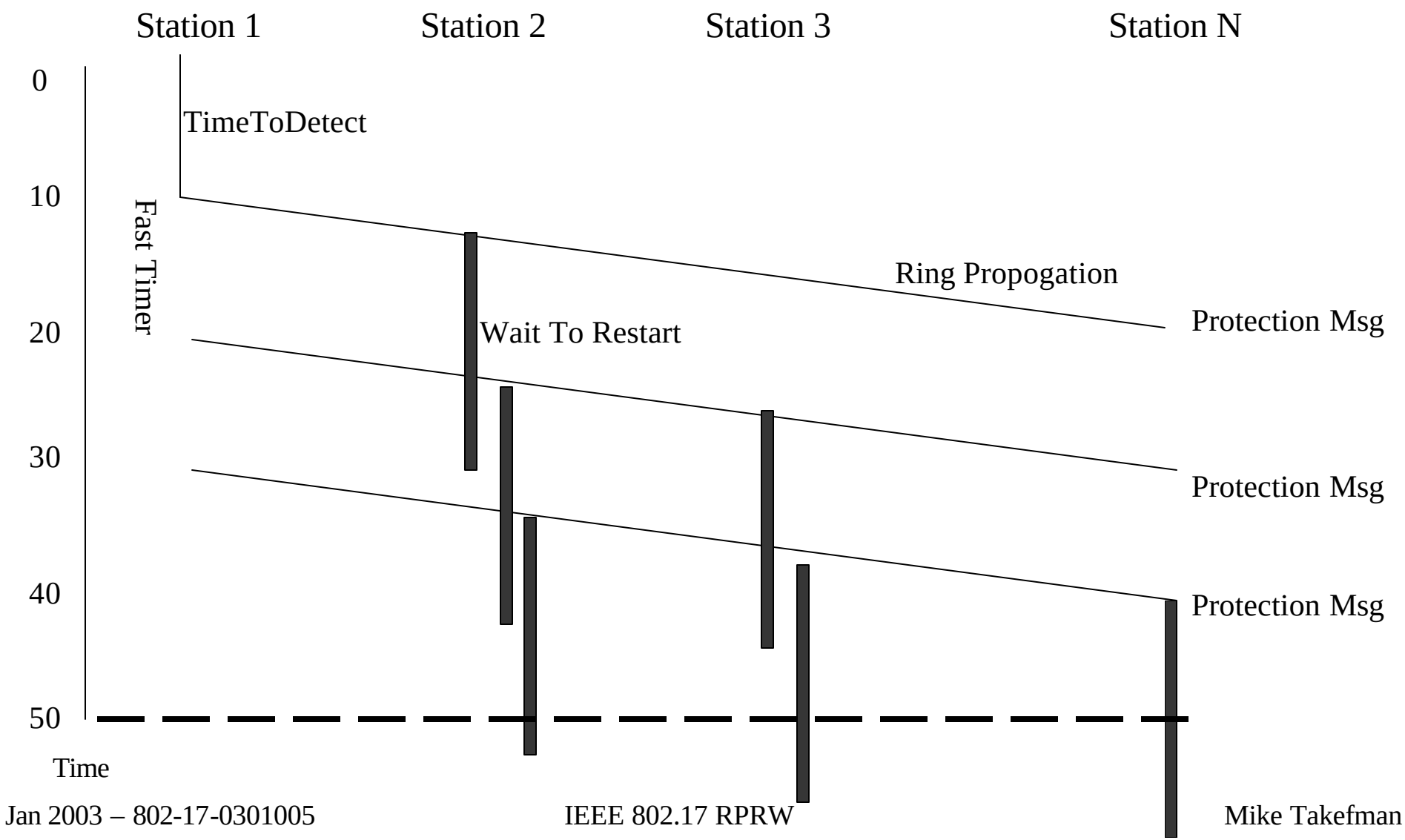
A Simple Model of Performance

- The entire protection event is broken into the following distinct periods
  - Time To Detect error
    - recognize the error and start protection messaging
  - Ring Propogation
    - Time for message to reach far end
- Receive Processing Delay
  - How long for the protection sub-layer to respond
- Fast Timer Period of Protection Message
  - Send or receive protection message
- Wait To Restart
  - Period of flushing and transmission halt
- Restart Transmission

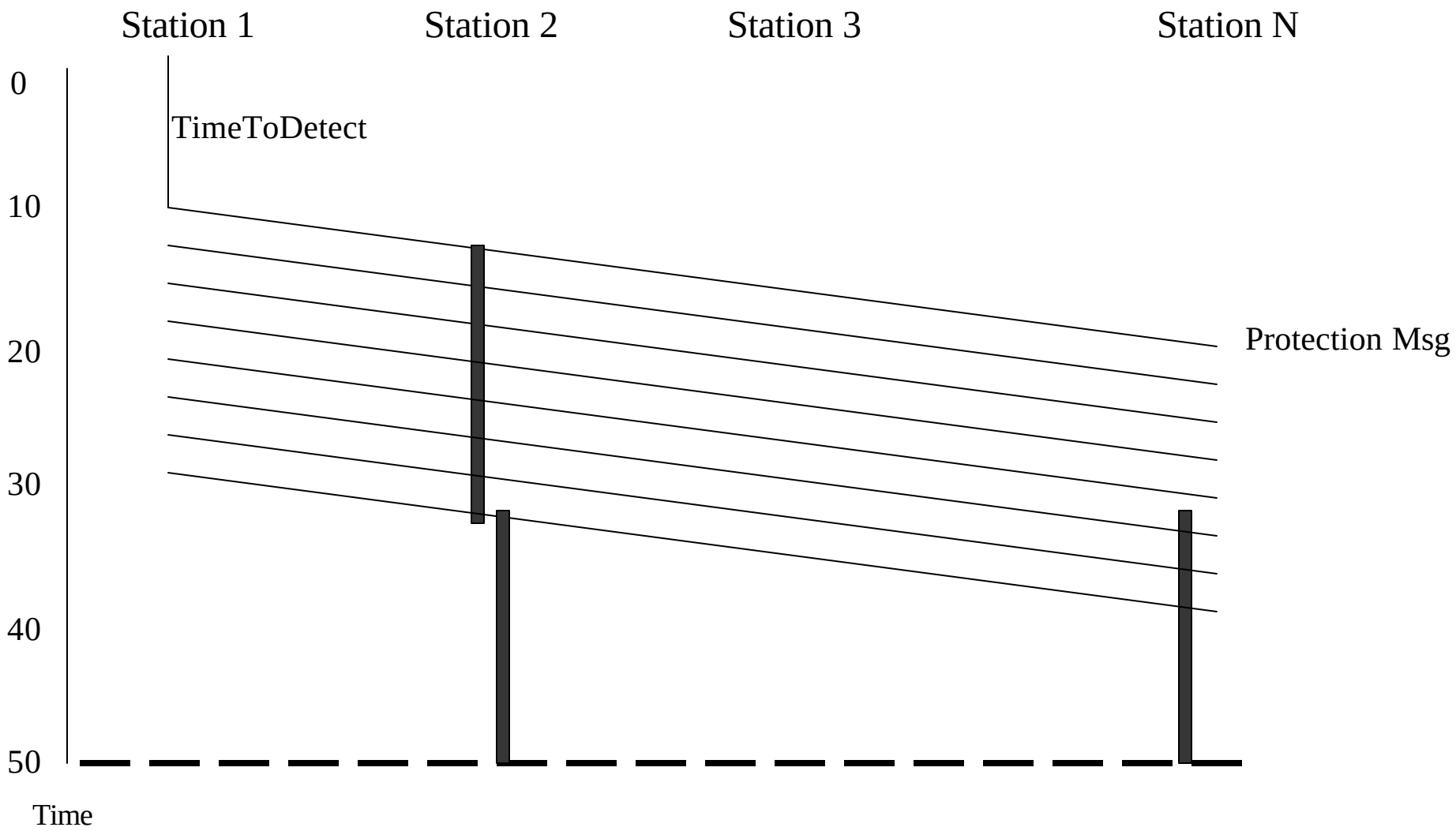
Reasonable Values

- Time To Detect error
  - Sub 10 ms
- Ring Propagation
  - 10 ms max for 2000km ring
- Fast Timer Period of Protection Message
  - Draft indicates 10ms for 8 messages
- Receive Processing Delay
  - Implementation dependant
- Wait to Restart
  - Have to limit this to adhere to 50 ms protection event
- Restart Transmission
  - Immediate upon WaitToRestart timer expiring

A Simple Model



Achieving 50ms



Loss Probability

- The number of protection messages that must be sent in order to “guarantee” reception depends on
  - BERR of the ring
  - protection message size
  - fast timer value
- Note: Large BERR would force a link into a protection state
  - Reasonable BERR above SD is 10-8 to 10-10

Loss Probability (cont)

- 26 byte message size + overhead = 216 bits
- Message Period 1ms
- Effective BERR = 10E-6 (takes into account 100 stations)
- P(of a Lost Protection Message) = 2.16E-4
  - With error multiplication = 4.32E-4
- Probability of losing N messages
  - P(N lost messages) ^{N}
- Assume N = 8
  - P(protection event not reaching all nodes) = 1E-27
    - We'll all be dead by then
  - N=10 -> probability drops to 1E-34

Values Revisited

- Time to detect 10ms
- Propagation Time 10ms
- Fast Timer @ 1ms for 8 periods = 8ms
  - Farthest Station is flushing within 28 ms of event
- If the stations flush for 20 ms
  - 2 ms available for receive processing delay

Conclusion

- Use of timers provides sufficient reliability for context containment
- Acceptable probability of missing a event is tunable
  - Can trade off fast timer period, number of fast messages for processing costs