Reliability Markov Models are Becoming Unreliable

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**hp**

i n v e n t

Concerns with Markov Models

- Traditionally used for reliability analysis
- Assumes exponential distribution
  - Does not match real failure distributions
  - Elerath & Pecht, DSN 2007
- But, do Markov models provide correct intuition?
  - Sector failures (latent, scrubbing & bit errors)
  - Rebuild in multi-disk FT systems
  - Novel erasure codes (e.g. non-MDS XOR-based codes)
  - Heterogeneous devices
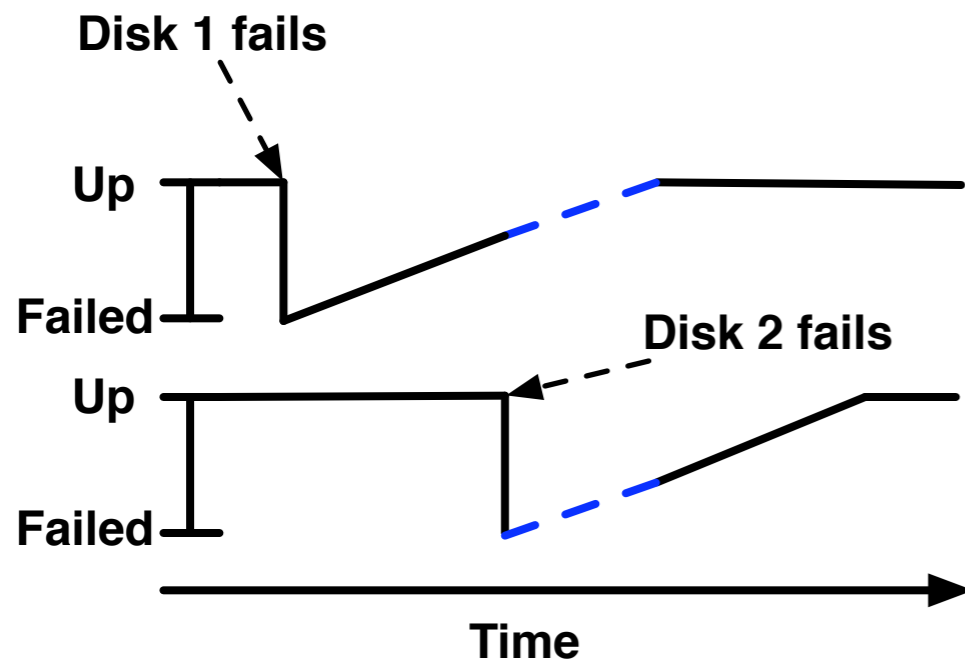
RAID5 Markov Model
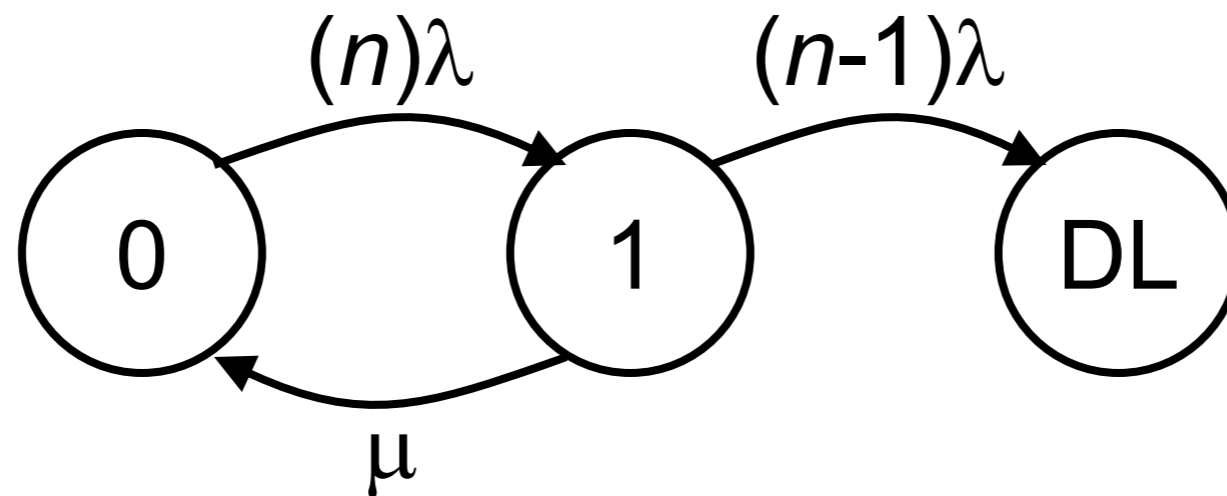
- *n* disks in the array
- λ is the disk failure rate
- μ is the disk repair rate
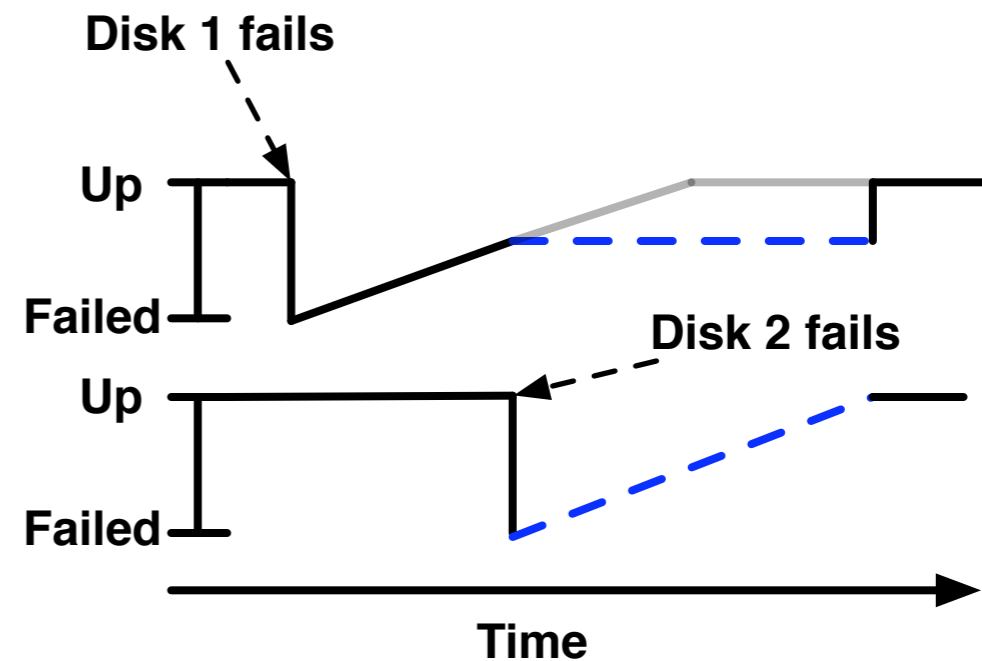- DL is a data loss event

Current 2–Disk Fault Tolerant Model
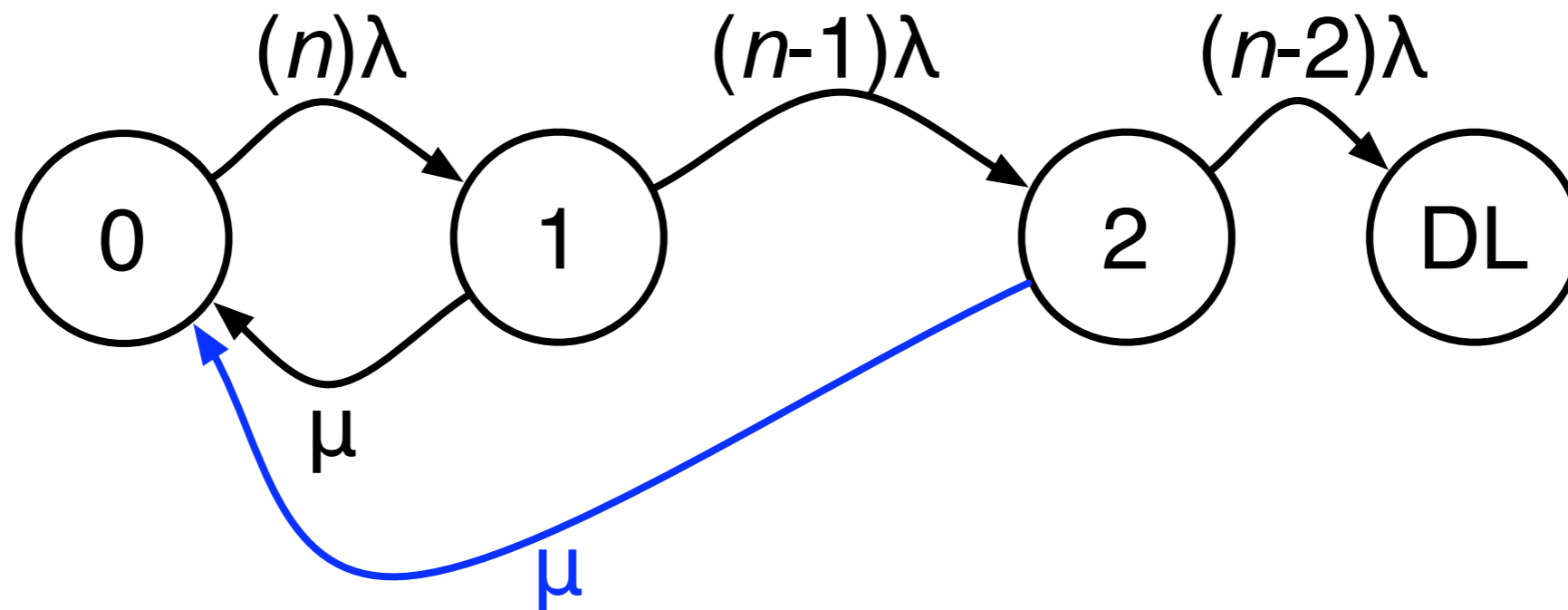
- Concurrent rebuild policy
  - Multiple failed disks recover simultaneously
- Non–failed state once last failed disk recovers

Markov Model vs. Simulation

Simulation

Markov Model

- Memoryless Markov model ignores rebuilt data!
  – Markov model MTTDL 2x less than simulation
- Longer critical mode than simulation

Conclusion

- Concerns with Markov models
  - Is naively extending *RAID5* model wrong?
  - Other issues with modeling sector failures, etc.
  - Are Markov models good enough? New models?
- Visit both of our posters
  - More concerns with Markov models
  - High–fidelity reliability simulation of erasure codes