Reliability
Markov Models
are Becoming
Unreliable

Kevin M. Greenan and Jay J. Wylie
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
- $\lambda$ is the disk failure rate
- $\mu$ 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

- 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