Graduate Operating Systems

Fall 2018

Paper “Reliability Issues”

- Survey article
- Reliability vs. reliance
- Reliability & fault tolerance
- **Fault -> Error (state) -> Failure (event)**
- MTBF (MTTF), MTTR, MTTDL, Availability
Paper “Reliability Issues”

• *Can you think of a fault-error-failure example?*
• Repair of error vs. repair of fault
• Error detection & error recovery
• *How are parity bits used for detection/recovery?*

Paper “Reliability Issues”

• Faults:
  – HW, communication, timing, user/operator, design, …
  – Duration: permanent, transient
  – Extent: localized, distributed
  – Value: fixed, varying erroneous values
  – User error
    • *What can we do to handle user errors?*
Paper “Reliability Issues”

- Fault tolerance vs. fault avoidance
  - Examples of fault avoidance?
  - Examples of fault tolerance?
- Replication
- What are atomic actions?
- Levels of abstractions; interfaces
- Error detection
  - “Sanity check”
  - Consistency check (replication, TMR)
    - What assumption do we need to make about modules in TMR?
  - Reversal check
  - Coding (CRC, parity, Hamming, etc.)
  - Interface checking
  - Diagnostic checking
Paper “Reliability Issues”

• Fault treatment
  – Transient faults
  – Finding faults (fault injection)
  – Reconfiguration strategies
    – What is “graceful degradation”?
• Damage assessment
• Error recovery
  – Backward error recovery
  – Forward error recovery
  – Pros/cons of backward & forward recovery?

Summary “Reliability Issues”

• Fault, error, failure
• Detection errors and recovering from errors
• Redundancy, reconfiguration, backward/forward recovery, …
• Different stages of “handling” errors/failures:
  – Design of system
  – Development of system
  – Testing of system
  – Operation of system
• Real-time systems: not just functionality, but also timing critical!