

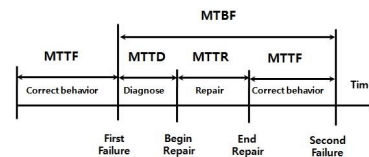
Graduate Operating Systems

Spring 2023

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Paper “Reliability Issues”

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



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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?*

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Paper “Reliability Issues”

- Faults:
 - HW, communication, timing, design, ...
 - Duration: permanent, transient
 - Extent: localized, distributed
 - Value: fixed, varying erroneous values
 - User error
 - *What can we do to handle user errors?*

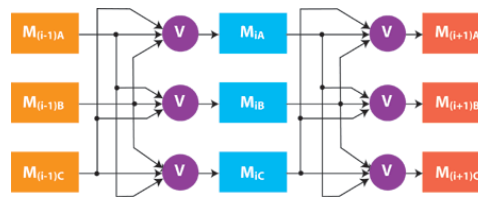
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Paper “Reliability Issues”

- 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

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Paper “Reliability Issues”



Triple Modular Redundancy (TMR)

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Paper “Reliability Issues”

- Fault treatment
 - Transient faults
 - Finding faults
 - Fault injection
 - Replacement and reconfiguration strategies
 - *What is “graceful degradation”?*
- Damage assessment
- Error recovery
 - Backward error recovery
 - Forward error recovery
 - *Pros/cons of backward & forward recovery?*

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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!

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