Group Membership Assumptions

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RoSES

Robust Self-configuring Embedded Systems

X-by-Wire Design

Protocol services are proven correct, given assumptions
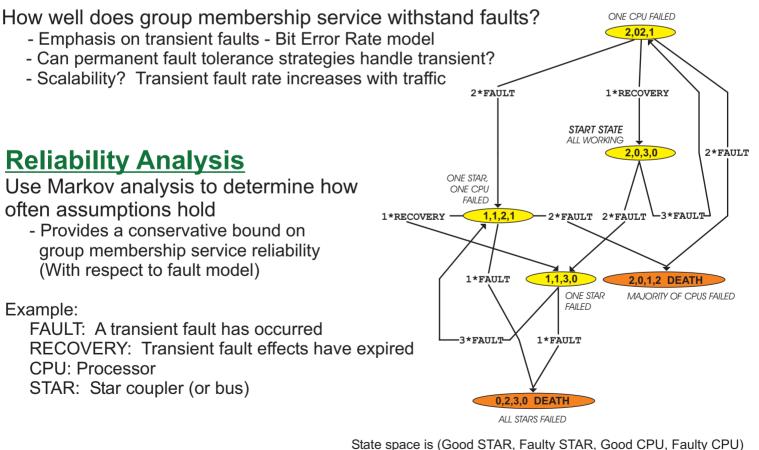- How often do assumptions hold?
- How can we improve the protocol design?

Goal: Determine **viable design space** and make protocol **policy tradeoffs**
- Physical units: # Processors, # Channels (star, bus)
- Fault parameters: Fault types, Fault arrival rates
- Message traffic: Round length, Frame size, Bandwidth
- Design parameters: Diagnosis rate, Recovery time

Group Membership Service

- "The task of a *membership service* is to maintain a list of currently active, connected processes in a group" [Chockler et. al., "Group Communication Specifications", ACM '01]
- Cornerstone of Byzantine fault tolerance policy

How well does group membership service withstand faults?
- Emphasis on transient faults - Bit Error Rate model
- Can permanent fault tolerance strategies handle transient?
- Scalability? Transient fault rate increases with traffic

Reliability Analysis

Use Markov analysis to determine how often assumptions hold
- Provides a conservative bound on group membership service reliability (With respect to fault model)

Example:
FAULT: A transient fault has occurred
RECOVERY: Transient fault effects have expired
CPU: Processor
STAR: Star coupler (or bus)

State space is (Good STAR, Faulty STAR, Good CPU, Faulty CPU)
Yellow: Operational states   Orange: Group membership service failure