

Fault Tolerant Computing

849 Dependable Embedded System

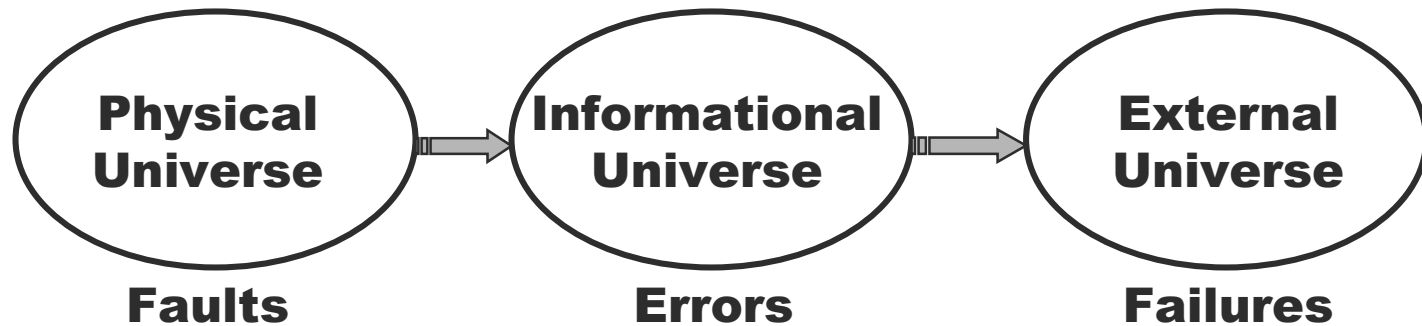
-- *Ying Shi*

Feb.4.99

Outline

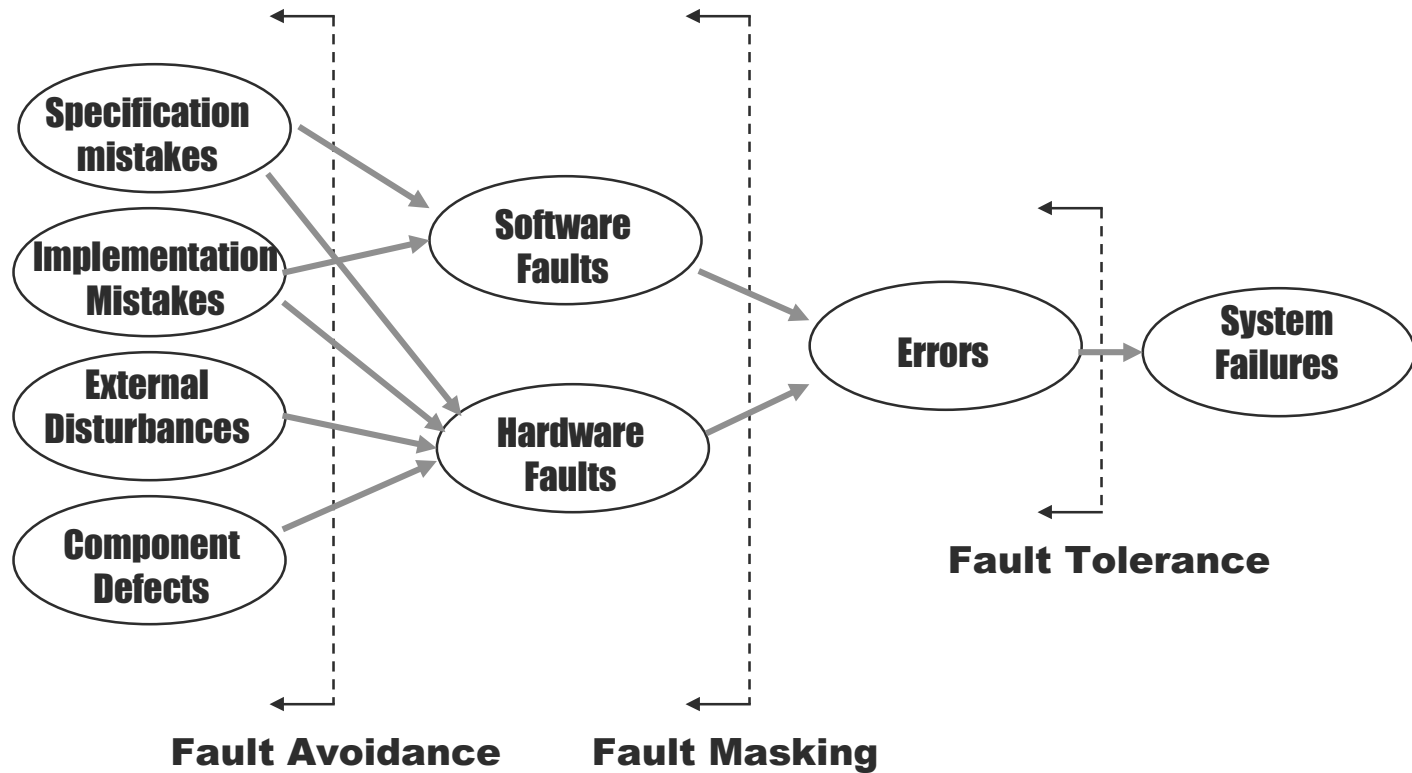
- **The Fact**
- **Classical Methods**
- **Problem**
- **Future Direction**
- **Conclusion**

Fault Propagation



- **Physical universe** *logic gate stuck at “0”*
- **Informational universe** *wrong value in the program*
- **External universe** *deviated service*

Cause-effect relationship



Barriers constructed by design techniques of fault avoidance, fault tolerance, and fault masking

Primary Design Techniques

- **Fault Avoidance**
 - prevent faults in the first place
 - *e.g. design review*
- **Fault Masking**
 - localize fault, prevent error from getting into system informational structure
 - *e.g. error correcting code*
- **Fault Tolerant**
 - allow the system able to perform tasks in the presence of faults

Primary Design Technique(cont.)

- *e.g. Redundancy Technique*
 - hardware redundancy
 - informational redundancy
 - time redundancy
 - software redundancy

- + *Fault detection*
- + *Reconfiguration*

Problem

- **Increase in overall Complexity and Capacity**
 - Evolution of computer technology itself
 - Broader application scope
 - Increasing realtime/runtime interact between Human and computer, more liable to human error
 - etc.

What's its Future

- **No obvious central direction for future activities**
- **However, potential directions**
 - **Advance the technology**
 - **New breakthrough**
 - **Software Fault Tolerance**
 - **User Environment**
 - **Proof of Correctness**
 - **Make Technology Available**
 - **Repackage and Improve**
 - **Transition Mission**
 - **Extend to Other Pressing Problem Areas**

Conclusion

- *Terminology definitions VERY confusing, must adapt to it if stay in this world*
- **Methodology well developed, but facing the increasing complexity and capacity drive**
- **Future direction not quite clear, but several potential places are under consideration**

Reference list

- **FTCS proceedings(CMU E&S Library)**
- **Design and Analysis of Fault Tolerant Digital Systems - Johnson (Book,89, CMU E&S Library)**
- **A Perspective on the State of Research in Fault-Tolerant Systems - C.Weinstock, D.Gluck (TechRep,97, CMU E&S Liabrary)**
- **J.C.Laprie's Dependability Terminology definitions(CMU Library & on-line)**
- *plus the list in Ying Shi's email to you*