Parameterized Reliability Prediction for Component-based Software Architectures

Palladio Days 2010
25/11/2010

Franz Brosch
Means to Attain Dependability [ALR04]

Fault Prevention

Fault Removal

Fault Tolerance

Fault Forecasting

Motivation

Parameterized Reliability Prediction – Franz Brosch

Overview

Approach

Validation

Conclusions

\[ P(\text{crash}) = 1\% = 10^{-2} \]

\[ P(\text{crash}) = 0,0001\% = 10^{-6} \]
Applications:
- Identify critical points of failure
- Determine sensitivity of system-level reliability
- Decide between multiple design alternatives

Scenarios:
- Early design time → assume-guarantee analysis
- Change scenarios → exploiting existing failure data
The PCM for Reliability Prediction

- Tasks:
  - Meta-model extensions for reliability modeling
  - Transformation PCM → Markov model
  - Markov solving algorithm

Integration of software reliability and hardware availability into a combined system reliability prediction approach, with explicit consideration of component usage profiles, as well as intra-component control and data flow.
Software failure probabilities:
- Statistical testing
- Reliability growth models
- Code coverage / complexity
- Historical data
- Expert knowledge

Hardware MTTF/MTTR:
- Vendor specifications
- Support contracts

Network failure probabilities:
- Vendor specifications
Fault Tolerance: Recovery Blocks

- Overview
- Approach
- Validation
- Conclusions
Validation goals:

- Prediction accuracy (limited)
- Significance of prediction results
- Scalability
Conclusions

- Architecture-based software reliability prediction
- Explicit consideration of component reliability factors
- Based on Palladio Component Model (PCM)
  - Separation of modeling concerns
  - Usage profile propagation

Future work:
- Extend modeling capabilities
- Extend Markov analysis
- Extend validation