Grand Challenge:

Dependability Benchmarking & Prediction

(IFIP WG 10.4 Benchmark SIG)
http://www.dependability.org

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Vice Chair: Henrique Madeira, University of Coimbra

First Meeting: November 1st, 1999

Problem Scope

- **Implementation Technology**
  - Hardware, software, control algorithms, user interface, mechanical safety backups
- **Operational life cycle**
  - Specification, design, deployment, maintenance, operation, disposal
- **Product deployment scale**
  - Capital equipment, business infrastructure, consumer products, disposable goods
- **What are the stakes?**
  - Would you bet your **life** on a computer running off-the-shelf software?

    You will...

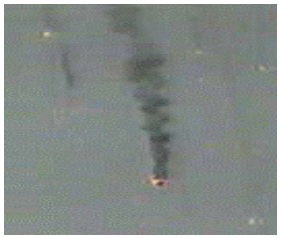
Grand Challenge Goal

- **Be able to *predict* the dependability of a critical system before first product shipment**
  - Including all real-world issues
  - Both comparative and absolute metrics if possible

- **Major Issues:**
  - Can we subset the problem space for tractability … and still be useful?
    - Real Time Mission Critical Systems offer an attractive starting point
  - Can we capture all the critical tradeoffs in any single "benchmark number"?
    - Too many numbers is confusing; too few might be overly simplistic
    - And all the other usual problems with benchmarking

What Makes Dependability Challenging?

- **Dependability prediction for electronic hardware exists**
  - A result of World War 2 adoption of electronics
- **Existing approaches**
  - Brute force redundancy is OK for hardware, but expensive
  - Many approaches assume a perfect design/specification/etc.
    - Software fault tolerance is still an evolving field
- **We still aren't very good at accounting for:**
  - Software
  - People
  - QoS and "soft" dependability issues
  - Security ("malicious" faults)
  - Systems with imperfect maintenance/support/…
  - Systems with constrained budgets



Possible Elements of a Benchmark

- **Create a benchmarking scenario:**
  - Specifications of expected system behavior in different fault situations
  - An operating scenario with a workload
  - A faultload, used to inject:
    - System faults, exceptional situations, component overloads, operator mistakes, maintenance errors, component failures, *etc.*
  - Procedures and rules for benchmarking activities
  - Instrumentation to record the above
  - Measures based on instrumentation

Possible Alternate Approaches

- **Based on discussions in first meeting**
  - Important to get numbers; but they must mean something useful
  - Benchmarking might be too aggressive for a first attempt
- **"Consumer Reports" Approach**
  - Measure whatever we can measure
    e.g. using fault injection; historical trends
  - Weave a pattern about the system based on this information
- **Piggyback on an existing benchmark**
  - TPC/C + dependability?
- **Use a process-based approach**
  - SEI CMM plus dependability best practice?

IFIP WG 10.4 Benchmarking SIG Goals

- **Exchange of ideas**
  - Promote cross-pollination; reduce wasted effort
- **Document state of the art**
  - Set of research white papers on what seems to work; what doesn't (*e.g.*, "Grey Series" dependability book from DCCA series)
  - What can we borrow from others; what is unique to dependability?
  - Encourage/publicize existing tools & techniques
- **Create issues list**
  - What issues must a dependability benchmark address?
  - What about multidimensional composites (performance, security, *etc.*)
  - What are the constraints that must be faced to attain success?
- **Propose path to dependability benchmarks**
  - Or at least published position papers on the alternatives

- **Next meeting in San Jose, early April 2000**
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