

Industry Trends and Dependability Research

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Moore's Law

- **Doubling Annually Leads to a three orders of magnitude increase in capacity ever decade**
- **Capacity includes number of transistors, processor performance, bits of data, storage, communications bandwidth**

Implications of Moore's Law

- **One year this decade Intel will be able to produce a simple microprocessor for every ant on earth**
- **Every year or two more computers are produced than in all of previous history**
 - By 1970 only a few thousand computers produced
 - Today ten's of millions of computers shipped annually

Evolution of Artifact Experimental Dependability Research

	1970's	1980's	1990's	2000's
Operational life monitoring	Crash dumps	Error logs	Natural workloads	Human-computer interaction errors

Lessons

- **Crash Dumps**
 - Gross statistics
- **Error Logging**
 - Swamped by house keeping
 - No error logging architecture
 - One man's memory error is another's machine check
- **Natural Workloads**
 - Trend analysis (e.g. diskless workstation, depot level repair)
- **Human Computer Interaction**
 - Touch screen

Operational Life Monitoring

- **Evolution of monitoring and analysis**
 - Summary Statistics - mean time to crash
 - Distribution type and distribution parameter values
 - Trend and symptom analysis
- **Significant findings**
 - Transient faults over an order of magnitude more frequent than permanent faults
 - Probability of crashes follow a decreasing failure-rate Weibull
 - Strong correlation between workload and failure rate
 - Spatial sorting followed by temporal heuristics predicted failures on average a week before catastrophic failure with over 90% accuracy and with one-fourth the number of events for statistical techniques