

Reliability Program Overview for Developers Quality & Reliability

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1

Agenda



- *Overview*
- *Quality & Reliability*
 - Quality Definition
 - Reliability Definition
 - Unreliability Cost
- *Failure*
 - Definition
 - Sources
 - Types
 - Failure Mode
 - Failure Mechanism



Quality Definition (cont.)



- **Manufacturer Point of View (Objective)**
 - As per Taguchi, the **quality of a product** is the minimum **loss** imparted by the product to the society from the time the product is shipped.
 - *Defining **quality as loss** is equivalent to defining quality as the **number of defective parts**, or defining **accuracy** by way of **inaccuracy** (e.g., $100\text{mm}\pm 1\text{mm}$).*



Quality Definition



- **Customer Point of View (Subjective)**
 - Quality is **conformance to customer expectations**
 - E.g., we **expect** a cellular phone to continue working after falling (even though it is **not within the spec.**)



Reliability Definition

- The **probability** that equipment will perform its intended function (**mission**), within stated conditions, for a specified period
- Quality over time



Reliability Vs Quality

- **Quality** is a **snapshot** at the **start of life** and **Reliability** is a **motion picture** of the day-to-day operation

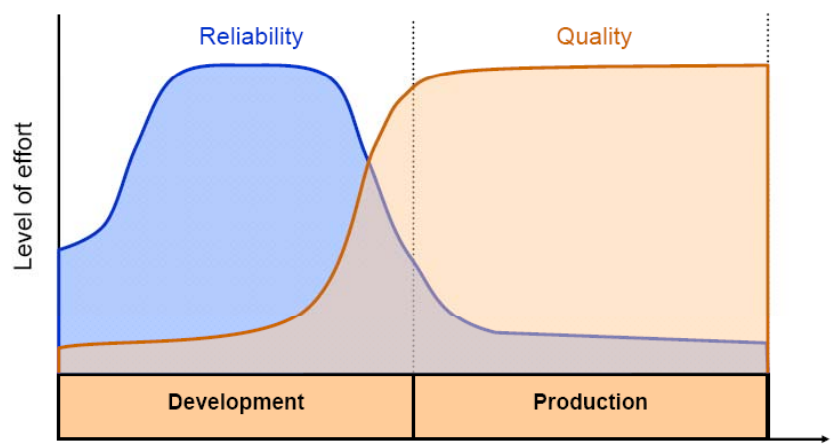


Why Reliability?

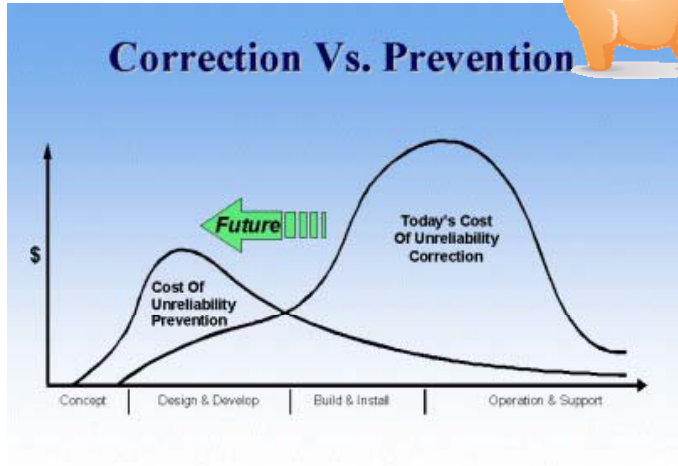
- Utilization (e.g., ink consumption)
- Warranty Period
- Service Period
- Customer expectations
 - "I want German"
 - "I want Japanese"
- Competition
- Reputation



Reliability – When?



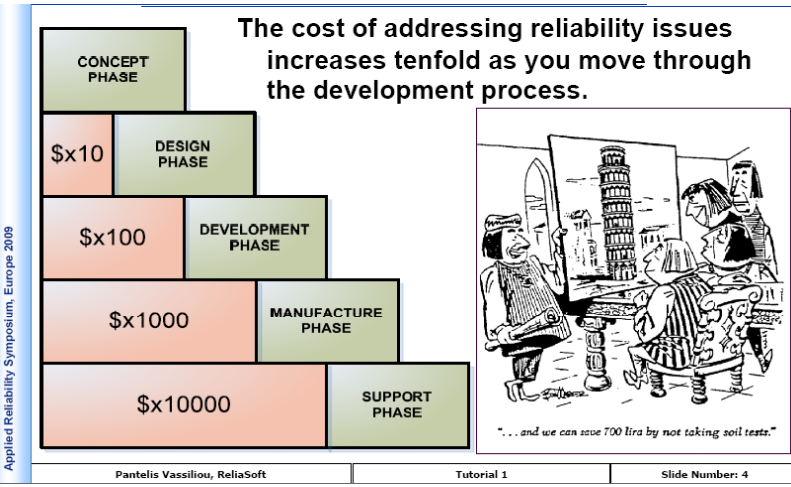
Unreliability Cost



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9

Factor of Ten Rule



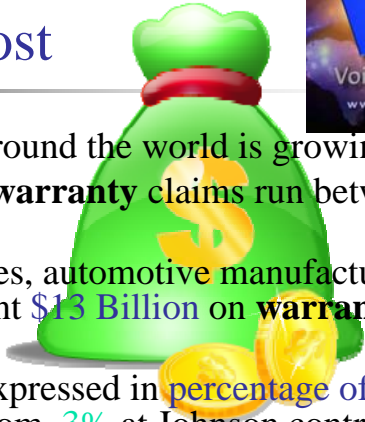
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10

Warranty Cost



- **Warranty** cost around the world is growing
- Global spend on **warranty** claims run between \$45- 50 Billion
- In the United states, automotive manufacturers and suppliers spent \$13 Billion on **warranty** claims in 2006
- **Warranty** cost expressed in **percentage of revenue**, varies from .3% at Johnson controls, .6% at Delphi and Tyco International to 6.2% at Microsoft, 8.6% at Palm, 13% at Lexmark International

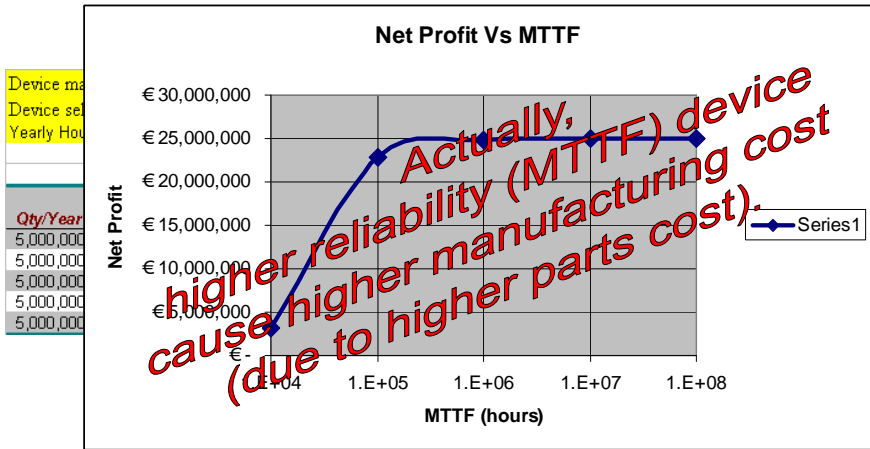


Unreliability - Sample



- **Basic assumptions**
 - The device is used 24/7 – 8760 hours per year
 - Device **MTTF** (non repairable) is **10,000 hours**
 - The failures distributes **exponentially**
 - 5 million devices were sold during the 1st year
 - Device manufacturing cost is 5 €
 - Device sell price is 10 €
 - A failed device is replaced during the warranty year

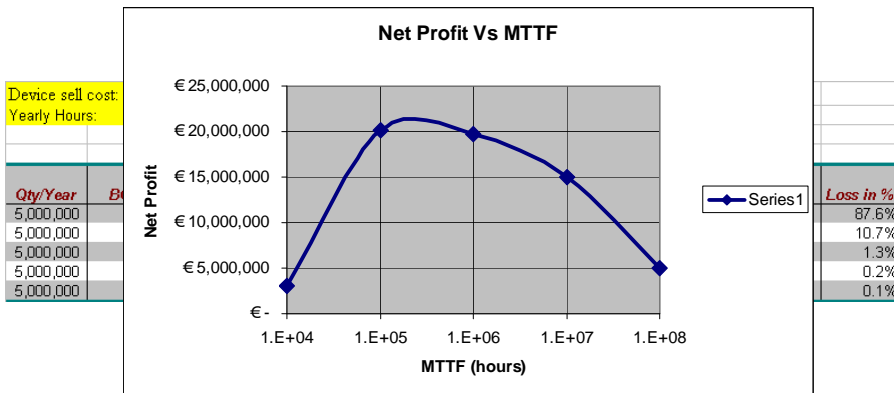
Unreliability - Analyzing



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13

Unreliability - Analyzing



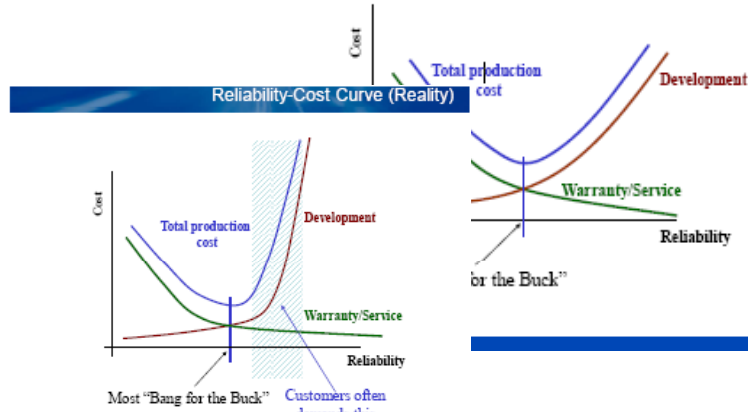
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14

Cost-Reliability Functions



Reliability-Cost Curve (Theoretical)



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15

Summary



- Quality Definitions
 - Manufacturer
 - Customer
- Reliability Definition
- Reliability Vs Quality
- Reliability Why
- Reliability When
- Failure of Ten Rule
- Warranty Cost
- Cost-Reliability Function



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16



Questions?

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17



Thanks for your attention

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18