Software Maintenance Costs
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Abstract
Software maintenance and evolution is a considerably understudied area while taking into account its cost effects. This document lists some interesting figures on proportional and absolute maintenance costs, proportions of the main task types, and amount and nature of the existing legacy code. These figures are based on empirical data. Although there has not been much empirical research on this particular area, the magnitude of the maintenance cost effects is clearly identifiable.

1. Proportional software maintenance costs
The relative cost for maintaining software and managing its evolution now represents more than 90% of its total cost. This is refered to as legacy crisis by Seacord et al. (2003). Various studies on this subject are described in Table 1.

<table>
<thead>
<tr>
<th>Year</th>
<th>Proportion of software maintenance costs</th>
<th>Definition</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>&gt;90%</td>
<td>Software cost devoted to system maintenance &amp; evolution / total software costs</td>
<td>Erlikh (2000)</td>
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<tr>
<td>1993</td>
<td>75%</td>
<td>Software maintenance / information system budget (in Fortune 1000 companies)</td>
<td>Eastwood (1993)</td>
</tr>
<tr>
<td>1990</td>
<td>&gt;90%</td>
<td>Software cost devoted to system maintenance &amp; evolution / total software costs</td>
<td>Moad (1990)</td>
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<tr>
<td>1990</td>
<td>60-70%</td>
<td>Software maintenance / total management information systems (MIS) operating budgets</td>
<td>Huff (1990)</td>
</tr>
<tr>
<td>1988</td>
<td>60-70%</td>
<td>Software maintenance / total management information systems (MIS) operating budgets</td>
<td>Port (1988)</td>
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<tr>
<td>1984</td>
<td>65-75%</td>
<td>Effort spent on software maintenance / total available software engineering effort.</td>
<td>McKee (1984)</td>
</tr>
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<td>1981</td>
<td>&gt;50%</td>
<td>Staff time spent on maintenance / total time (in 487 organizations)</td>
<td>Lientz &amp; Swanson (1981)</td>
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<td>1979</td>
<td>67%</td>
<td>Maintenance costs / total software costs</td>
<td>Zelkowitz et al. (1979)</td>
</tr>
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</table>

Table 1. Proportional software maintenance costs for its supplier.

2. Absolute software maintenance costs
- Annual software maintenance cost in USA has been estimated to be more than $70 billion (Sutherland, 1995; Edelstein, 1993).
- E.g. in USA, the federal government alone spent about $8.38 billion during a 5-year period to the Y2K-bug corrections.
- At company-level, e.g. Nokia Inc. used about $90 million for preventive Y2K-bug corrections.
3. Maintenance task types
   - About 65% of maintenance was found to be perfective by Lientz & Swanson (1981).
   - About 75% of maintenance costs are spent for providing enhancements (in the form of adaptive and perfective maintenance) (Martin, 1983; Nosek & Palvia, 1990; van Vliet, 2000).
   - Studies of software maintainers have shown that approximately 50% of their time is spent in the process of understanding the code that they are to maintain (Fjeldstad & Hamlen, 1983; Standish, 1984).

4. Legacy code amount
   - In 1990 there were an estimated 120 billion lines of source code being maintained (Ulrich, 1990).
   - In 2000 there are already about 250 billion lines of source code being maintained, and that number is increasing (Sommerville, 2000).
   - An average Fortune 100 company maintains 35 million lines of code (Müller et al., 1994).
   - These companies add in average 10% each year only in enhancements (Müller et al., 1994).
   - As a result, the amount of code maintained doubles in size every 7 years (Müller et al., 1994).
   - Older languages are not dead. E.g. 70% or more of the still active business applications are written in COBOL (Giga Information Group).
   - There are at least 200 billion lines of COBOL-code still existing in mainframe computers alone (Gartner Group).

References

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