Estimating Millennium Resources

What will happen to your date-dependent software when the year rolls from 1999 to 2000?

There is no doubt that the millennium date change problem is huge. Thus according to Gartner Group's strategic planning assumptions:

- Addressing the date change through 1999 will cost information technology (IT) between $300 and $600 billion globally. The U.S. portion of the cost for date redesign is thought to be in the $200 billion range.
- By 1999, without corrective measures, 90 percent of all applications and systems will be affected, producing unknown or erroneous results.

Given these figures, a major issue facing companies is to estimate the resources needed to convert their systems to year 2000 compliance. The work consists of finding, fixing, and testing date dependencies.

A Substantial Effort

In quantifying the associated resource required, Quantitative Software Management (QSM) has determined that the effort will be substantial. ***Thus for major organizations, date conversion will require 200 to 400 person years of effort, assuming no delay in starting the effort.***

QSM's expertise is directed at quantifying the effort and time to do these changes, based on:

- categorizing the size of the system portfolio in terms of the density of changes;
- quantifying these changes by sizing the modified and new code required; and
- determining the process productivity of the conversion teams carrying out the work.

These key factors are used as inputs to generate estimates of typical scenarios of conversion time and effort.

Sizing the Problem

Key to estimating a date change effort is determining how much code must be changed and added to the organization's existing systems. This is best done by conducting representative pilot evaluations. Specialized tools are available that scan the pilot systems' source code, identifying date-dependent statements and fields. In this way, the date dependency of an organization's systems is determined, as well as the density of these items.

Each date-dependent item is then examined to indicate date sensitivity. Existing date-sensitive statements must be modified, and new statements must be added where necessary. So the pilot analysis quantifies date-sensitive items in terms of the logical statements that must be modified, and those that are to be added as new statements.

Since the total size of the full system is known, the percentage of modified and new logical statements can be calculated.

Process Productivity

The QSM measure of process productivity is the Productivity Index (PI), which captures all the factors in the conversion process. These include technology, tools, methods, and people-related factors. Other elements that influence the process efficiency include the difficulty of conversion of these old, fragile systems; and the complexities involved.

Process productivity ranges from 1, low productivity, to 40, high productivity. Business systems typically have PI values between 17 and 20.

Conducting pilot system conversions as above also provides data with which to calculate the process productivity of the teams doing the work. This is computed from three input values: the size of the modified and new logical statements, the effort in person months, and the time in months to carry out the conversion.

The effort and time cover *all* the work performed in the pilot conversions. This includes setting up the pilot, performing the analysis to identify date-related statements, investigating all the code to detect and confirm the date-sensitive items, making the modifications, and adding in new statements. Also included is unit testing of the altered programs, as well as the subsequent regression and system testing.

If pilots are not yet available to provide process productivity measures, organizations can use reference measures from the QSM data base of past projects to immediately generate general estimates. However, these default process productivity measures should only be used temporarily, before the company conducts pilots. They must be qualified and updated once real conversion work is begun.

As Time Goes By

Research at QSM is providing clear evidence of exponentially increasing effort and hence cost as development time is compressed. Adding staff to compress the schedule results in communication "noise," and poor communication gives rise to more errors.
In an example scenario, a modest time reduction from 7 months to 6 months was found to result in expensive penalties from increased effort. Effort increased from 35 person months to 65 person months, a near doubling of effort and hence cost.

The consequence of delay is an enormous increase in effort, staffing levels, and cost for each system to be converted.

Conclusion

A significant investment is required to deal with millennium projects. This is especially true for large organizations with an inventory of legacy systems that are highly date dependent. Companies with smaller inventories require lower investments, which are nevertheless substantial.

Although QSM's results are not surprising, and, indeed, confirm others' figures, many companies have not yet woken up to the great size of the millennium challenge. Therefore QSM's quantification of the estimates can serve to focus management attention on the year 2000 problem, and, more importantly, stimulate management action.

The longer an organization delays in getting started, the greater the costs and risks. As time runs out, the pressure increases, and more people will be needed to do the conversion, at enormously increased cost. There will also be fewer resources available, particularly in terms of outsourcing.

Most companies will fix a high percentage of their systems, although 1-2% will undoubtedly slip through the cracks. Five to 10% of organizations will likely have big problems, and go out of business. How early and how fast companies jump on the problem will determine how credible a repair job they do.

More information about millennium issues can be obtained from the following Internet sites:

http://www.qsm.com http://www.system2000.com

This article is a condensed version of Greene, J.W.E., "How to Estimate the Resources Required to Modify Software for the Millennium." The original paper can be found at http://www.qsm.com or by contacting the author. Ed.