

WHY DOES IT TAKE SO LONG TO TEST?

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Introduction

- Vice President of Quality Management Group at FIS
- ASQ Section 1508 Internet Liaison and Voice of the Customer Chair

- Quality Assurance
- Quality Control / Test
- Project Management

- ASQ Certified Manager of Quality/Organizational Excellence
- ASQ Certified Six Sigma Black Belt
- PMI Certified Project Management Professional
- CMMI v 1.2 Intermediate Concepts

Questions

- For commercial product on large market, on average, for 3000 development hours ?? test hours are required
- For the Development and Test teams of the same size, 3 month development effort requires ?? months of test effort
- For the Development team twice as large as the Test team, 3 months of development requires ?? months of testing

Facts

- For commercial product on large market, on average, for 3000 development hours **2000** test hours are required
- For the Development and Test teams of the same size, 3 month development effort requires **2** months of test effort
- For the Development team twice as large as the Test team, 3 months of development requires **4** months of testing

■ Effective Software Testing by Elfriede Dustin, Addison-Wesley 2003

Effort and Duration

- Factors that increase test effort (number of hours)
 - ▣ Constant factors
 - ▣ Variable factors
- Factors that increase test duration (number of days)
 - ▣ Variable factors

Factors That Increase Test Effort

Factors That Increase Test Effort

- Constant Factor

- The size of the test effort does not have linear relationship to the size of the development effort. A larger testing scope may be required for a relatively small development change.

Factors That Increase Test Effort

▣ Examples:

- For applications further along in the product lifecycle, the majority of the modifications are to existing code. Based on the systems' architecture, such changes have impact across several functions. **Regression testing** must be done to validate that previously working functionality has not been broken.
- For new GUI development (e.g. branding) a relatively small development change is needed, but a significantly larger amount of **verification testing** is required to verify this change across large number of screens.
- For a requirement to verify functionality with multiple browsers, (operating systems, etc), execution of the same set of test scenarios must be repeated for each processor. Such **repetitions** increase test scope n times, where n is the number of repetitions.

Factors That Increase Test Effort

- Constant Factor
 - ▣ Testing of a business-critical product where a defect has high customer impact requires higher number of hours.

Factors That Increase Test Effort

▣ Examples:

- A change to an application used by Financial Institutions, their customers and cardholders requires higher testing effort in order to cover multiple combinations and permutations, full regression scope, multiple cycles of test case execution and re-test of defect fixes.
- On the other hand, a change to an internally used application requires less testing hours; regression testing may only be done for a subset of scenarios, and verification testing may cover only part of all combinations and permutations.

Factors That Increase Test Effort

Table 12.1. Test-Team Size Calculated Using the Development-Ratio Method^a

Product Type	Number of Developers	Ratio of Developers to Testers	Number of Testers
Commercial Product (Large Market)	30	3:2	20
Commercial Product (Small Market)	30	3:1	10
Development & Heavy COTS Integration for Individual Client	30	4:1	7
Government (Internal) Application Development	30	5:1	6
Corporate (Internal) Application Development	30	4:1	7

a. Ratios will differ depending on system complexity or when building systems where there is no tolerance for error, such as medical device systems or air traffic control systems.

Factors That Increase Test Effort

- Variable Factor
 - ▣ Insufficient testing during development results in lower code quality and increased system test hours.

Factors That Increase Test Effort

□ Example:

- For projects where unit and integration testing were done during development, the effort for system testing was under 15%. The cost of addressing a defect increases as the project lifecycle progresses.

Project	Testing in Development		Percentage of System Test Hours to Development Hours
	Unit Testing	Integration Testing	
A	extensive	low	44.63%
B	extensive	extensive	11.29%
C	moderate	none	22.94%
D	moderate	none	19.19%
E	extensive	extensive	13.70%
F	extensive	extensive	4.57%
H	extensive	extensive	11.72%

□ Solution:

- Increase the extent of unit and integration testing by Development, and include these activities in the project schedule.

Factors That Increase Test Effort

- Variable Factor
 - ▣ Lack of test automation increases test hours since manual test execution takes longer.

Factors That Increase Test Effort

▣ Example:

- By automating 52% of manual test cases, the estimated savings are 48%.

Percentage of automation coverage	Total estimated hours to execute manual test cases	Total estimated hours to execute automated test scripts	Total estimated hours to execute full regression suite
0%	3,293		3,293
currently: 24%	2,415	56	2,471
Savings from increasing automation coverage from 0% to 24%			25%
2011 planned: 52.0%	1,582	122	1,704
Savings from increasing automation coverage from 24% to 52.0%			31%
Savings with 52% automated testing as compared to all manual testing			48%

▣ Solution:

- Replace manual test cases with automated scripts, where appropriate.

Factors That Increase Test Effort

- Variable Factor

- Test Analysts with low or moderate system and process knowledge take longer to develop and execute test cases, and troubleshoot defects.

- Solution:

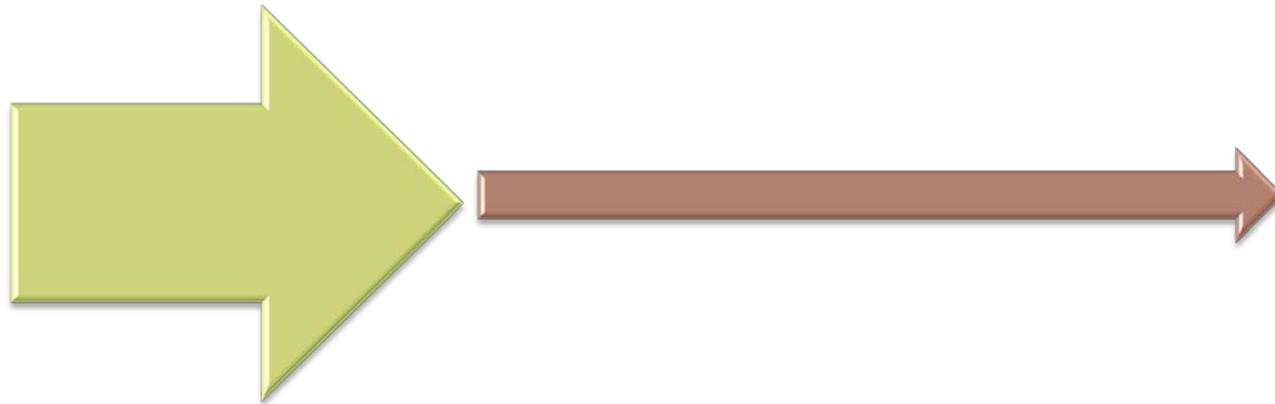
- Employee retention, system knowledge and skill development through cross-training and increased quality in documentation.

Factors That Increase Test Duration

Factors That Increase Test Duration

- Variable Factor

- Test duration increases because there is not enough Test Analysts to quickly process Development output.



- Solution:

- Increasing the number of Test Analysts to meet the required 3:2 ratio for large market commercial product.

Factors That Increase Test Duration

- Variable Factor
 - ▣ Test duration increases due to non-compliance with the standard process by stakeholders throughout the project lifecycle.

Factors That Increase Test Duration

▣ Example:

- For Project A, no standard Functional Specifications Document (FSD) was provided to the Test team. The functionality had to be discovered through non-standard practices such as meetings, conversations, and application training. The actual cost of test case development increased by 45% as compared to the original estimate. Since no additional resources were available to maintain the original duration, as effort increased so did test duration.

▣ Solution:

- Adherence to the standard process by all project stakeholders.

Factors That Increase Test Duration

- Variable Factor
 - ▣ Scope changes in the later project phases increase test duration.

Factors That Increase Test Duration

▣ Example:

- For multi-month Project B, resources and schedule were planned based on the agreed-upon scope. Three weeks prior to the release date, the scope continued to change, but the target delivery date remained unchanged. With no additional test resources, and testing activities on the critical path, there was a risk of not meeting the target date with the full scope and desired level of quality.

▣ Solution:

- Adherence to the project scope and project change control process (PCR) by all project stakeholders to avoid scope creep and not impact test activities on the critical path.

Factors That Increase Test Duration

- Variable Factor
 - ▣ Lower level of code quality results in increased test duration.

Factors That Increase Test Duration

□ Example:

- For Project C, 21 builds were delivered to the Test team within 17 weeks, with the average frequency of a build on every fourth day.
- Testing is often on-hold while Test Analysts wait for defects to be resolved in a new build.
- For each new build, testing must be put on-hold while installation takes place, extending test duration.
- For each defect that failed on retest due to partial defect fixes, there is additional test and development effort to communicate the failure, address the failure, and retest the failure. For 66% of the builds, the failure on retest rate was greater than 15%.

□ Solution:

- Better code quality (e.g. less defects of lower severity) will reduce the number and frequency of builds, waiting time and amount of rework.

Why Does It Take So Long To Test?

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- The size of test effort **does not have linear relationship** to the size of the development effort. A relatively small development change may require a significantly larger test effort.
- Test phase is at the end of the project lifecycle and it is on the critical path. Failure to meet deliverable dates with quality throughout **preceding phases** delays the start of testing, and therefore extends project completion date.
- **Quality of deliverables** throughout the entire lifecycle (BRD, FSD, TSD, code) always has either a positive or negative impact on the test hours and duration of test execution.

Why Does It Take So Long To Test?

- **Extent of automated testing** decreases test execution cycles as compared to manual testing; higher investment is required up-front to develop automation scripts.
- Adherence to the **standard processes** ensures streamlined operations and reduces test hours associated with information gathering, waiting and rework.
- The **Test team composition** in skill, system knowledge and ratio to the Development team impacts the number of test hours as well as the duration

Questions