Operational Excellence Through Efficient Software Testing Metrics

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Abstract

- An effective software test manager needs a way to measure the effectiveness of a test process. Effective test process measurement is essential for designing, evaluating and managing a cost-effective test strategy. Although some existing research has proposed many metrics for these purposes, most of those metrics are ignored or used in isolation. Effective software measurement gives a scientific basis for software engineering to become a true engineering discipline.

- The importance of measurement has been gaining acceptance and recognition as organizations mature. Process measurement and analysis and utilizing quantitative methods for quality management are the two Key Process Activities at Level 4 Maturity of CMM.

- This paper will also cover various aspects of metrics program like: the need for having a metrics program in place, challenges in implementation, addressing the challenges, how we arrived at our ideal set of metrics.

- This paper also presents a case study on the metrics.
Fundamental Objective

➢ Test Metrics is a mechanism to measure the effectiveness of testing quantitatively.

➢ Test Metrics Data Collection is a balanced, leading initiative which guides in predicting the direction and scope of an organization over a long term.

The key benefits are:

➢ Supports the collection of usage data and metrics for particular business needs.
➢ Gains a more holistic view of business and identifies high-level goals.
➢ Optimizes the analytics solution and streamlines the measurement solution.
➢ Facilitates planning for closure of the performance gap.
➢ Quickly identifies and resolves potential problems.
➢ Helps Make faster, more informed decisions.
➢ To Measure the Effectiveness & efficiency of Testing Team.

➢ A process is appropriate and is critical to success when it identifies measurement strategic objectives and measures against those using technology and industry accepted methodology.
Introduction

- How to measure a test process is a required competence for an effective software test manager. Effective test process measurement is essential for designing, evaluating and managing a cost-effective test strategy.

- The key to efficient measurement is to first determine what goals you are trying to accomplish and what problems you are attacking.

- Test metrics are an important barometer used to measure the effectiveness of the software testing process.

- In this article, I describe some basic software measurement principles and suggest some metrics that can help you understand and improve the way your organization operates.
Why do we need Test Metrics?

Some of the key benefits of having good metrics are:

- Provide a Basis for Estimating and facilitates planning for closure of the performance gap.
- Provide a Means of Control/Status Reporting
- Identify Risky Areas That Require More Testing
- Provide Meters to Flag Actions and this helps Make faster, more informed decisions.
- Identify areas of improvement
- Test Metrics is a mechanism to measure the effectiveness of testing quantitatively.
- Test Metrics Data Collection is a balanced, leading initiative which guides in predicting the direction and scope of an organization over a long term and helps to gain a more holistic view of business and identify high-level goals.
- Supports the collection of usage data and metrics for particular business needs.
- Optimizes the analytics solution and streamlines the measurement solution.
- Quickly identifies and resolves potential problems.
- To Measure the Effectiveness & efficiency of Testing Team.
- A process is appropriate and is critical to success when it identifies measurement strategic objectives and measures against those using technology and industry accepted methodology.
What Test Metrics do we need?

- Only collect data that you will actually use (to make informed decisions and alter your strategy). That is, if you were not going to change your strategy regardless of the findings, your time would be better spent doing more testing.

- Do not base decisions solely on data that is variable or can be manipulated. For example, measuring testers on the number of tests they write per day could actually reward them for speeding through superficial tests or punish them for tackling trickier functionality.

- One of the key inputs to the metrics program is the defect tracking system, where the reported process and product defects are logged and tracked to closure, so it is very important to spend enough time on deciding the fields that you will need per defect in the defect tracking system, and be able to generate customizable reports.
Metrics Initiative at Infosys Technologies Limited: Case Study

- A shared need was felt across the Independent Validation Services (IVS) organization to have tangible and realistic metrics across all the projects executed within the organization to be more predictable. These metrics in turn would be used to set the Process Capability baseline of the organization.

- Arriving at common metrics across an organization spread across different locations with projects on varied technologies and different customers across the globe was quite a challenge.
The Process Involved:

- This initiative started off with a kick off meeting where the importance and shared need of metrics was stressed upon to get the buy in from all sections of the team. This initiative was driven at all centers simultaneously forming focus groups and Single Point Of Contact (SPOC) at each location to ensure that the voice of everyone is captured, each location has a SPOC responsible for collating information from everyone from that location.

- Taking stock of existing Metrics:

- Brainstorming sessions were conducted to review the relevance and importance of the existing metrics

- Identifying the pain areas and additional metrics that will add value:

- We defined Metrics Life Cycle to streamline the complete process.
Infosys has come up with a life cycle for the metrics to standardize the process… (Metrics Life Cycle)

1. **Identify / Refine Data Capturing mechanism**
2. **Communicating to the stake holders**
3. **Reporting the metrics**
4. **Analyze & Process the data**
5. **Capturing & Verifying the data**
6. **Revising / Improving the metrics & Goals**
7. **Defining & Classifying the metrics**

**Identifying the Right Metrics**

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Infosys has developed a life cycle for metrics to standardize the process. This cycle involves identifying the right metrics, defining and classifying the metrics, capturing and verifying the data, revising and improving the metrics and goals, reporting the metrics, communicating to the stakeholders, and analyzing and processing the data. This cycle ensures a systematic approach to managing and improving metrics within the company.
Identifying right metrics is Key to successful implementation of Metrics. The various aspects need to be considered are…

- Metrics are the key process indicators. Choosing the right metric for tracking, comparison, prediction and information gathering is a critical and significant process.

- Decide the Audience and key stakeholders (Customer, Analysts, Executive Team, Test team,…etc)

- Identify the metrics which captures each type of testing status in which resources involved.

- Ensure different categories of metrics are considered based on the project needs

- Ease of collecting the data & Data capturing mechanisms.

- Analyze the value/benefit of each metric and the project lifecycle phase in which it provide most value.

- Identify the Goals or Problem Areas where improvement is required.

- Refine the goals using the “Goal-Question-Metric” technique.
Goal-Question-Metric (GQM) is an excellent technique for selecting appropriate metrics to meet your needs. With GQM, you begin by selecting a few project or organizational goals. State the goals to be as quantitative and measurable as you can, then ask questions as to what is it that you want to change to reach the goal, then finally define what is it that you want to measure to quantify your progress towards achieving the goal.

- GQM is a systematic approach for integrating goals to the process.

- Best metrics relevant to the process improvement can be effectively identified and the resulting metrics are tailored to the organization and its goal.

- Measurement provides the most appropriate information for answering the questions thus ensuring consistency with completeness playing a constructive and instructive role in the organization for goal attainment.
MLC - Classification Based on Type of Testing & Common Metrics

- Provide the definition for each Metric
- Define the Benchmark or Goal for each metric.
- Verify whether the Goals or Bench marks are realistic by verifying with Industry standards or with the data of similar projects with in Organization

- Based on Type of testing Metrics are mainly classified into
  - Manual Testing
  - Automation Testing
  - Performance testing

- Each of the Above classifications are once again categorized based on the focus area
  - Productivity
  - Quality
  - People
  - Environment/Infrastructure
  - Stability
  - Progress
  - Tools
  - Effectiveness

- Identifying the Right Metrics
- Defining & Classifying the metrics
- Reporting the metrics & Goals
- Revising/ Improving the metrics & Goals
- Reporting the metrics
- Analyze & Process the data
- Capturing & Verifying the data
- Communicating to the stake holders
MLC - Identify / Refine Data Capturing mechanism

After identification of metrics, analyze the data that needs to be captured for each Metric.

- Based on data Capturing methodology Metrics are mainly classified as
  - Base metrics
  - Derived Metrics
- **Base metrics**: are the metrics for which data can be captured directly (like time, effort, Defects, Test Execution details, test case preparation details... etc)
- **Derived Metrics**: are derived from Base Metrics (Productivity, Quality... etc)

- Identify Source of the data for each of the data point (Base metrics)
- Continuous improvements of data capturing methodology by reducing the Data Capturing effort and sources of inaccurate data.
- Define the common template for capturing all the data points (Base Metrics)
- Take the feedback from the team who captures the data.
- Defining Efficient Means to pull out relevant data
- Streamlining of Significant Data.
Defining Efficient Means to pullout data

- To fill the gap between too general and ambiguous data's and values, the measurement value types has to be verified for data consistency.

- The technique for pulling out relevant data can happen based on the following criteria so as to aid the capture of relevant metrics and supplement activities.

<table>
<thead>
<tr>
<th>DATA</th>
<th>RELEVANT</th>
<th>RELIABLE</th>
<th>VALID</th>
<th>PRACTICAL</th>
<th>MEASURABLE</th>
<th>COMPARABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whether it’s a meaningful data which is linked to the goal</td>
<td>Consistent with respect to time</td>
<td>Measures the outcome</td>
<td>Economical and ease to collect data</td>
<td>Can be measured</td>
<td>Can be compared</td>
</tr>
</tbody>
</table>
Involving stakeholders in metrics identification and planning process will produce better end results and increase buy-in…

- Communicate the need for those metrics to the effected teams.
- Educating Testing team regarding the data points that need to capture for generating those metrics.
- Take the feedback from the stake holders
- Clearly communicate the expectations to stake holders (like how often the data need to be collected or how often the reports will be generated…etc.)
MLC- Capturing & Verifying the data

- Ensure that data capturing mechanism is setup and streamlined

- Communicate and give the proper guidelines to the team members to the data that is required to capture

- Set up verification points to ensure that data is captured.

- Identify the sources of Inaccurate Data for each of the base metric and take the corrective steps for avoiding inaccurate data.

- For each of the Base Metrics define a source of data and procedure to capture the data.

- Ensure minimum effort is spent on capturing the data by automating data capturing process wherever possible (If you are using TestDirector for test management, Data can be got directly by using TestDirector API’s)

- Capture the data in a centralized location or the place where it is easily accessible by all the team members.

- It is recommended to collect the data with minimal manual intervention.
MLC- Analyze & Process the Data

- Once the data is captured, need to analyze whether all the required data is captured or not.
- Verify whether the data filled is accurate, and up-to-date.
- Calculate all the metrics (Derived Metrics) based on the Base Metrics data.
- Verify whether the Metrics are conveying any correct information or not.
- Define the process/Template in which the derived data need to capture.
- Automate the process of calculating derived metrics from the base metrics to ensure minimal effort is spent on processing the data.
MLC- Reporting metrics

- Developing an effective approach like a metrics dashboard for reporting to various stakeholders is a significant task.
- It is always advisable to take the feedback from stakeholders regarding the metrics that are going to present and the way of presenting by providing a sample template.

- Metrics should be presented based on the audience and in a consistent format.
- Report should contain the summary of observations.
- Reporting should be in a clearly understandable format preferably graphs and charts with guidelines to understand the report.
- Report should clearly point out all the issues or highlights.
- Based on the request user should be able to access the data otherwise Data can be abstracted.

- Reports should be presented in such a way that metrics are compared against benchmark and previous periods.
- Reports should be easily customizable based on the user requirement.
- Ensure the effort spent on reporting is minimal, wherever required try to automate (If it is Excel report through usage of Macro’s…etc)
Continuous Improvement

- Once selecting the valuable metrics, need to make them even better.
- After successful implementation of metrics and after achieving the benchmark need to revisit the goals and benchmarks.
- Collect the feedback from the stakeholders regularly.
- Based on the need, metrics to be added/deleted.
- Make metrics reports accessible to everyone.
- Educate other teams regarding the value of metrics.
- Evaluate new metrics to capture.
- Refining the report template.
- Ensuring the effort for capturing & Reporting of metrics is minimal.
To avoid Test Metrics pitfalls the following aspects need to be considered…

- Inaccurate data.
- Collecting the metrics which are easy to collect rather than which are valuable.
- Complexity of Data capturing. (Metrics team developed a simple template for capturing the identified Mandatory Metrics)
- Difficult to analyze the metrics data
- Proper Benchmark is not defined
- Metrics which are not interested by stakeholders
- Template used for presenting the data is not good.
Challenges in implementation of Metrics Program:

- Management Commitment:
- Measuring Too Much, Too Soon:
- Measuring Too Little, Too Late:
- Wrong Metrics:
- Vague Metrics Definitions
- Using Metrics Data to Evaluate Individuals
- Using Metrics to Motivate, Rather than to Understand
- Collecting Data That Is Not Used
- Misinterpreting Metrics Data
- Lack of Communication and Training
  - Explain why
  - Share the results
  - Define Data Items and Procedures
  - Obtain "buy-in"
Summary of activities involved to successfully implement the Test Metrics …

- Decide the audience.
- Understand the expectation (Problem Areas/ pain points where improvement is required.)
- Identify whether it is a derived/inferred information (metric) or direct (basic) metrics.
- Identify the Value/Benefit of each metric
- Identifying Benchmark/Goals for each metrics
- Identifying Definitions for each metrics
- Categorize the metrics based on Audience, Type of testing
- Ensure the Data capturing method is identified for each metric
- Identifying side effects (Inaccurate data) for each metric & define the corrective steps for the same.
- Communicating the benefits of each metrics to the stake holders mainly persons who captures the data.
- Template for presenting the metrics (Like graphs or tabular format…etc)
- Automating the Metrics process to ensure the minimum effort is spent and also to avoid the human mistakes.
Conclusion

- Need for Metrics
- Metrics Life Cycle
- Identified Metrics as part of Metrics initiative
- Avoiding pitfalls in test Metrics

*Note: Recommended List of metrics will be shared during the conference, please let me know in case it is mandatory to share the metrics before hand*
Questions ?
Thank You