The Software Quality Center of Excellence
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Introduction

The Axis Technical Group Software Quality Centre of Excellence (QCOE) is configured to cater to the Technology Quality needs of today’s high-performance corporate IT enterprises. This document presents an overview of the activities and approaches that are adopted by the team at the QCOE to successfully assist the CIO office in maintaining an effective IT application portfolio.

Engagement Models

At the Axis QCOE following engagement models are usually provided to the clients:

1. **Captive units**
   In this engagement model, a captive team of test engineers is made available to the client. The engagement duration is usually one year or more. This model provides the clients to have an extended offshore testing team to work on multiple projects at a time.

2. **Project specific software testing service**
   In this engagement model, the software testing team is mobilized for a particular project or program. This model provides the flexibility to add the resources as needed to complete projects on schedule.

In both the engagement models the typical team structure is as below:

1. **On-Site Coordinator**: A senior technical resource with ample experience and expertise in offshore engagement model is made available at the client’s office. This resource works as the Single Point of Contact for client’s team. All task requests, change requests, project artifacts, reports and other information are routed to this person.

2. **Off-Site Team Lead**: A senior hands on Test Engineer with experience in the client’s domain and with expertise in various technology aspects is made available in the Axis office in Pune, India. This person leads all the project activities in Pune and coordinates on a day to day basis with the On-Site Coordinator for the inputs, as well as for creating the work artifacts

3. **A team of Test Engineers**: A certified team with expertise in hands-on testing is mobilized at the Axis Pune office. Also, senior members of this team perform role of BA-QA role to Understand/Identify/Define/Interpret the business requirement from quality point of view

Advantages

1. Making all the functions work towards a common goal
2. Ensuring the effective implementation of processes
3. Consistent quality deliverables
4. 24-hour turnaround cycle
5. Reduced total cost of ownership
Areas of Expertise

1. **Programming Languages:**

2. **Bug tracking tools:**
   - Mantis, Quality Center, Fogbugz, Bugzilla, SharePoint

3. **DBMS:**
   - SQL, MySQL, MariaDB, PostgreSQL, SQLite, Oracle, dBASE, MongoDB, FoxPro, IBM DB2, LibreOffice Base, FileMaker Pro, Microsoft Access and InterSystems Cache

4. **Quality Skills:**
   - Quality Management System Development
   - Quality Planning
   - Measuring Quality – Metrics Implementation
   - Reviews, Walkthroughs, Inspections
   - Quality Audits

5. **QC Techniques:**
   - Functional Testing
   - Integration Testing
   - Regression Testing
   - System Testing
   - Performance Testing (Load and Stress)

**Special purpose QC Techniques:**
- ETL Testing
- Cube Testing
- Mainframe Testing
- DB Testing (White box & Black Box)
- XML Testing

6. **Test Management Tools:**
   - HP Quality Center, IBM Rational Quality Manager, TestComplete, TestLink

7. **Automation tools:**
   - Quick Test Professional, Rational Robot, Load Runner, Auto IT, Watin, Selenium, Visual Studio Test Automation, nUnit

8. **Source Control Tools:**
   - SVN, Tortoise SVN Client, TFS, MS VSS
Quality Objectives

Correctness, Reliability, Efficiency, Integrity, Usability, Maintainability, Testability, Flexibility, Portability, Reusability, and Interoperability are standard quality factors.

In every project, considering the standard quality factors and project dynamics (like Business Domain, Requirements, Schedule, Cost etc.) Axis QCOE works with the client to identify the 'Quality Objectives' which need to be satisfied in the available timeframe.

In any case, following are the common objectives established for the majority of the projects undertaken by Axis QCOE.

1. Ensure that end product meets the standard quality expectations:
   Standard quality expectations are -
   • Doing the right thing
   • Doing it in right way
   • Doing it right first time
   • Doing it on time

2. Ensure that End product is 'Fit for Use':
   a. Product should satisfy all 'Functional' business requirements
   b. Product should satisfy all 'Non-functional' business requirements such as:
      i. Usability
      ii. Performance
      iii. Scalability

Testing Practice Details

Axis Testing Team typically follows 5 primary phases of the testing lifecycle while testing any new development which is either in the form of a new project, new enhancements or hot fixes. Each phase has its own purpose which is mostly supported by a unique set of processes. Considering the nature of development, sometimes phases may run concurrently with others.

<table>
<thead>
<tr>
<th>Test Phase Details</th>
<th>List of Deliverables during the Phase</th>
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</thead>
<tbody>
<tr>
<td>**1. <strong>Test Preparation Phase:</strong></td>
<td>Query Log</td>
</tr>
<tr>
<td>This phase mainly includes 'Project Initiation' and 'Project Planning' for the testing Team. Project initiation mainly consists of Project kick off, Requirement Analysis and Query log creation. Whereas Project Planning mainly deals</td>
<td>Test Plan</td>
</tr>
<tr>
<td></td>
<td>Test Strategy for Manual Testing</td>
</tr>
<tr>
<td></td>
<td>Test Strategy for Automated Testing</td>
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with Resource identification, Test plan creation, Test strategy preparation.

Query Log is the first published document by the Team as a result of business requirement analysis. It mainly consists Functional, NonFunctional, Setup/Environment related queries which are shared with Business Analysis Team and Development Team for the appropriate responses.

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<tr>
<th>2. <strong>Test Execution Phase:</strong></th>
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<tbody>
<tr>
<td>Test case execution and Defect tracking using standard defect tracking tool are the primary objectives of this phase. This is a vital phase to validate the effectiveness of designed Quality Control process distributed across various testing techniques as per the nature of development. But mainly this phase gets classified into two testing types - 'Functional Testing' and 'Integration Testing'. In case of maintenance projects 'Regression Testing' will also be performed on regular basis.</td>
</tr>
</tbody>
</table>
| • Test Scenario/ Test Case Document  
• Requirement Traceability Matrix  
• Gap Analysis  
• Test Data Request (if applicable) |
| • Test Result Sheets  
• Defects  
• Downtime log (if applicable)  
• Lessons Learnt Sheet (If applicable)  
• Daily Test Summary Report  
• Weekly Test Summary Report |

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<th>3. <strong>Stability Verification Phase:</strong></th>
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| In this phase, the team verifies that the deployment package intended for the production rollout is reliable.  
This testing consists of mainstream functionality along with third party components associated with an application (if any). Focus of this phase is to ensure that all system components are getting deployed correctly along with the significant functional verification.  
To achieve this, Priority One cases designed for new development and in the event of an enhancement, selected Priority One cases of earlier development are executed by the Team. Also defects fixed during the Functional and Integration testing, are tested. |
| • Test Result Sheet for Testing  
• Test Result Sheet for Client User Testing  
• Defects  
• Lessons Learnt Sheet (if applicable)  
• Downtime log (If applicable)  
• Ad-hoc Testing Log  
• Daily Test Summary Report  
• Weekly Test Summary Report |

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<th>4. <strong>Production Verification Phase:</strong></th>
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|  |  |
The team verifies the deployment in a Production environment during the Production release. Test cases executed here are a Priority One subset of the total number of test cases. This subset is focused on the core functionality being deployed as part of the project and/or enhancement and/or maintenance release and validate that all tested features are working properly in the live Production environment.

- Test Result Sheet
- Defects (if any)
- Lessons Learnt Sheet (If applicable)
- Downtime log (If applicable)
- Daily Test Summary Report
- Weekly Test Summary Report

5. **Post Release Wrap Up:**

After the successful Production release, the team needs revisit all the previously released artifacts before freezing these documents. As per the Production fixes, the team also needs to update Test Scenario/Test Case documents for Manual and Automation Testing along with the Lessons Learnt Sheet (If required).

If Project/Enhancement is related to the maintenance, then Regression Test Case Suite should get updated with the Priority One verifications in the recent development.

In the end, the team needs to prepare a ‘Closure Report’ and deliver it to all the stakeholders including the client.

- Lessons Learnt Sheet (If applicable)
- Updated Regression Test Suit (for Maintenance Projects)
- Closure Report
Quality Metrics

Metric is a measurement of unit for calculating the effectiveness of Testing Practices and to assure quality. The Axis QCOE team works with the client to create the Quality Metrics as per project necessity and objectives. The quality metrics are generally published at the end Release or Phase or Sprint.

Some of the Quality Metrics as per the different project objectives are listed below.

Measuring Project/Product Size

1. **Number of Requirements identified/reviewed**
   High-level Business Requirements are identified during project initiation and detailed requirements are created during the planning phase.

2. **Number of Test Cases developed/reviewed**
   High-level Test Scenarios are identified during the planning phase and the detailed Test Cases are prepared during the execution phase of the development of the code.

3. **Effort in Person-weeks**
   Based on the project timeline and resources in the schedule the effort in person-weeks is calculated.

Measuring Progress/Coverage of Testing

1. **Number of Test Cases Executed vs. Developed (Percentage)**
   This measurement indicates the test coverage achieved based on the number of Test Cases executed during a test cycle.

2. **Number of Requirements Tested vs. Available (Percentage)**
   This measurement indicates the test coverage achieved based on the number of Requirements covered by the execution of Test Cases during a test cycle.

3. **Test Case Automation Percentage**
   Automation of test cases is particularly useful when regression testing is involved, resulting in iterative, system-wide retests for all new changes being made.

4. **Rate of defect reporting vs. fixing**
   This measurement is the number of defects reported in a fixed duration (weekly, bi-weekly) vs. the number of defects fixed during the same duration.

5. **Average Turnaround time for fixing Defects**
This measurement is the time took to fix defects once they are reported. The defects reported in Test Cycle 1 are fixed and verified in Test Cycle 2 and so on.

Measuring Product Quality

1. **Pass Percentage of Test Cases**
   Pass Percentage is calculated using the following formula,
   \[
   \text{Number of Test Cases Passed/Number of Test Cases Executed} \times 100
   \]
   A Higher percentage of passing would mean better quality.

2. **Defect Quality**
   Number, Type and Severity of Defects are reported by Testing Team in each phase/test cycle/Environment. Status is shared with the customer after each test cycle. The more severe defects are found in test environment itself and fixed in the earlier test cycles. Thresholds are set for each test cycle to indicate whether these are within acceptable limits.

3. **Defects Re-opened/Fixed Ratio**
   This metric measures the count of defects fixed in a previous cycle that are determined to be “broken” in a subsequent test cycle. These are classified as “re-opened.”

Measuring Test Efficiency

1. **Defects Acceptance Rate (Accepted/Total Reported percentage)**
   Most of the defects reported by testing team get accepted by the Customer (or development team). At the same time, there are few defects which get rejected due to various reasons like not reproducible or inconsistent errors, typical behavior of the test environment, etc.

2. **Customer Reported Defects**
   Number, Type and Severity of Defects reported by Customer that have escaped all software quality processes. These are commonly a result of a discrepancy between the production and the test environments. After all System and Functional Testing cycles are completed the application (product of the project) is deployed in the production environment for UAT (User Acceptance Testing) with real-time data. The product is tested by actual end users to gauge the production readiness.

3. **Test Efficiency**
   The counts, as well as severity of defects reported by customer, play an important role in determining the efficiency of the team.
Project Management Methodology

Axis Technical’s Project Management Methodology (PMM) will be inherent in the approach to staffing and managing the project. This will be used for managing both our deliverables for the project as well as project dependencies on any Third Party project deliverables.

Axis Technical has a 5-point program management model that has helped the organization deliver projects successfully.
Strategize
A strategy is the most important step before the actual execution. The difference between a successful project and a failed one is the presence or absence of the right strategy. At Axis a team of strategist’s brainstorms for the optimum solution based on client objectives, industry issues and value targets.

Organize
Organization starts with fine-tuning the outsourcing process so that it benefits both the parties concerned. A Project Roadmap that outlines the three phases of the project lifecycle: Build a plan, Track and manage a project, and Close a project is prepared. This roadmap helps keep the project on track and monitor the progress.
Transition
Transition phase is a learning phase for both the parties involved. During this phase, agreed-upon processes are implemented both at the customers’ end and the offshore location. Once processes are deployed, they are verified and validated using audits and tools to establish their applicability to the project.

Execute
The executing phase of a project is where the actual development begins. Execution tests the business plan and the processes outlined therein. Monitoring the project is a continuous activity and it is to provide an understanding of the project’s progress so that appropriate corrective actions can be taken when the project’s performance deviates significantly from the plan.
Manage

Analyzing team performance and measuring client’s expectation is the important step in improving the relationship with the customer. SLA statistics is vital in performance measurement.
About Axis Technical Group:

Axis Technical Group, LLC is a premiere Information Technology Services firm headquartered in Anaheim, California with offices in Pune India. Axis Technical Group has been built upon its core values of Quality, Consistency, Honesty, Loyalty, and Excellence through hard work. The company’s focus on unparalleled customer service allows Axis Technical to provide every client with the cost-effective resources and solutions necessary to help them achieve their business goals.

California Contact Information:
300 S Harbor Blvd, Suite 910
Anaheim, CA 92805
Phone: (714) 491-2636
Fax: (714) 491-2685

Colorado Contact Information:
4610 S. Ulster Street, Suite 150
Denver, CO 80237
Phone: (303) 290-7478
Fax: (303) 379-6919

For more information about the Axis QCOE and other value added services, please visit www.axistechnical.com or contact info@axistechnical.com.