**3. ANALYSIS AND FOLLOW-UP**

The third group of major test activities is analysis and follow-up after test execution. The measurement data collected during test execution, together with other data about the testing and the overall environment, form the data input to these analyses, which, in turn, provide valuable feedback to test execution and other testing and development activities. Direct follow-up includes defect fixing and making other management decisions, such as product release and transition from one development phase or sub-phase to another. We examine these issues in this section.

**Analysis and follow-up based on individual testing runs**

Analysis of individual test runs includes result checking and failure identification we covered in the previous section as part of the test execution activities. When failures are identified, additional analyses are normally performed by software developers or “code owners” to diagnose the problem and locate the faults that caused the failures for defect removal. This activity may involve the following steps:

*Understanding* the problem by studying the execution record, particularly those involving failures.

Being able to ***recreate*** the same problem scenario and observe the same problem. This is important to confirm the problem and rule out possibilities of transient problems due to environmental disturbances or user errors. It also provides input to diagnose the problem causes.

***Problem diagnosis*** to examine what kind of problem it is, where, when, and possible causes. This may involve analyzing the above records and using some diagnostic tools or addition test runs to zoom in on possible causes or to eliminate other possibilities.

***Fault locating,*** to identify the exact location(s) of fault(s) based on information from the previous steps and product knowledge.

***Defect Jixing,*** to fix the located fault(s) by adding, removing, or correcting certain parts of the code. Sometimes, design and requirement changes could also be triggered or propagated from the above changes due to logical linkage among the different software components.

Once an integrated fix is available, the failed test cases were re-run to verify the fix. If successful, the normal test execution continues; otherwise, another round of defect fixing as described above is again initiated.

**Analysis and follow-up for overall testing results**

Various analyses can be performed on the overall testing results and related data to provide various assessments about testing, and to drive follow-up activities, including:

***Reliability analysis*** for usage-based testing, which can be used to assess current product reliability and as input to determine if the pre-set reliability goal has been achieved. If so, product release or test termination decisions can be made. If not, future reliability as well as time and resources needed to reach the reliability goal can be estimated. Sometimes, low reliability areas can be identified for focused testing and reliability improvement. This analysis and its many uses in follow-up activities.

***Coverage analysis*** for coverage-based testing, which can be used as a surrogate for reliability and used as the stopping criterion or as input to various decisions related to testing management. Specifics about this are presented when specific testing techniques and coverage hierarchies.

***Overall defect analysis,*** which can be used to examine defect distribution and to identify high-defect areas for focused remedial actions. In addition, some product internal measurements, such as size and complexity of individual components, and other measurements can also be used together with defect data to identify high-defect areas for focused quality improvement.

These analyses about overall testing results and related follow-up activities, in connection with the overall analysis and feedback for all **QA** alternatives. Possible test process and overall development process improvement based on these and other analyses and feedback is also described therein.

