Nova Software
Quality Assurance Process

White Paper

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Preface

Quality assurance (QA) is a very significant branch of the entire Software Development Life Cycle (SDLC). It is an integral and critical phase of any software development project. This process not only meets requirements but also ensures reliable and stable software to make sure that any agreed-upon standards and procedures are followed.

The purpose of this white paper is to describe for our clients how the Software Quality Assurance (SQA) program in Nova is structured and how we ensure that the process is followed by every project team.

1. Introduction

Quality Assurance process at Nova Software is to verify that all software we develop meets the specifications and expectations of our client. It is always a very critical aspect from the initial phase to the release phase of software development life cycle.

1.1. Intended Audience

Target audience of this document includes

- Quality Assurance manager and personnel
- Project manager and development personnel
- Clients of Nova Software Development Ltd

1.2. Scope

The scope of this document includes:

- Objective of Quality Assurance activities
- Contents of Quality Assurance activities
- Implementation of Quality Assurance activities

1.3. Reference Document

- Implement a Development Task at Nova.doc
- Nova Designing Standard.doc
- Nova Testing Standard.doc
- Nova Database Coding Standards.doc
- Nova C# Coding Standards.doc

2. Approach

2.1 Overview

Nova's quality assurance strategies are based on those principles:

- The quality assurance activities are not only some tasks executed at the end of the development phase (for example, testing), they run through the entire software development life cycle (SDLC).
- Good quality is a result of team work, the quality is everyone's responsibility, and it is built by everyone's daily work.
- "Prevent bugs from happening" over "Inspection and testing".

Thus we built our quality assurance system as below:

1. Methodologies - Agile Software Development (Nova suggest our clients to building up cross functional teams, who will adopt incremental development with short iterative cycles.)

2. Workflow - Build Quality In (All developers in Nova follow this flow to make sure the task is really DONE: estimate development cost-> create self-test list-> code unit test-> coding->run unit test-> code refactor-> code peer review-> execute self-test-> merge and submit code.)

3. Standards – Standardizing (All Nova developers shall obey to the company's standards - C# Coding Standards, Database Coding Standards, User Interface Standards, Definition of Done, etc.)

4. Best Practices (Teams in Nova adopted a lot of best practices to improve the quality)
   a) Best Practices for Coding
      Unit Test, TDD, Code Review, Refactor, Daily Build/Continuous Integration
   b) Best Practices for Testing
      Self-testing, Cross-testing, Integration Testing, Regression Testing, Test Flow
   c) Best Practices on functional level
      Prototype, Function List, Scrum Review

5. Company Supports (Management in Nova will also monitor and support the teams to make sure that they can meet our clients' satisfaction.)
   a) Training
   b) Inspection Team
   c) Process Improvement

As you can tell from the above strategies (which will be further introduced later on), Nova has built a systematic mechanism to ensure the quality of the software products. And what's more, it is evolving itself.

And one more thing to be mentioned is, as the famous Project Management Triangle indicates, the Quality is not isolated, it will interact with other aspects of the project, such as Budget, Scope and Schedule. Thus to assure the quality, Nova also adopted many best practices to Control Schedule, Manage the Scope, and Control Cost, so that Nova can take good care of the interaction between the quality and other constraints, this in turn further ensures the quality.

2.2 Methodology - Agile Software Development

Agile Software Development is a proven methodology which improves the software quality significantly. Since Agile includes many contents, we will only address three of them here to explain its effects on quality: Cross-Functional Team, Incremental Development, Frequent Delivery.

2.2.1 Cross-functional Teamwork

A cross-functional team is made up of people from all sections of the company, such as Sales Dept., QA Dept., Development Dept., Management Dept. and etc. These people work at the same room, have directly contact, cooperate very closely with each other, thus the team itself is capable of delivering functions, no cross-sections communication is need.

In this way, the communication gap is reduced, feedback cycle is shorten and work efficiency is increased, thus Quality issues can be addressed earlier and fixed at a lower cost.

Below is an example of cross-functional team.

Table: Roles and Responsibility

Dept	Role	Responsibility in QA Activities
QA Dept	QA Engineer	Track the running projects, review and evaluate artifacts, assure project progress and artifact quality accord with relevant standards.
Dev Dept	Project Manager	Grip the overall project management, implement Standards of each phase, and coordinate between the QA and project team members.
	Architect	Cooperate with QA Dept. to specify relevant Standards
Sales Dept	Clients' Feedback Collector	Record and integrate the project information and client's feedback for further improvements.

In Nova, all team members work very closely with each other, they sit next to each other, communicate very directly, and capable of making shippable artifacts. so all of them are cross-functional teams.

2.2.2 Incremental Development

Incremental development is a scheduling and staging strategy, in which the various parts of the system are developed piece by piece, and integrated as a whole when they are completed. Comparing to traditional waterfall model, the final product grows incrementally with short iterative cycles. In this way, it can avoid bringing too many codes or changes in one time, thus it will reduce the chance of errors by an order of magnitude.

All the projects in Nova are using incremental development method to deliver functions, we separate the software development life cycle into many small phases and we will set up many milestones for a product.

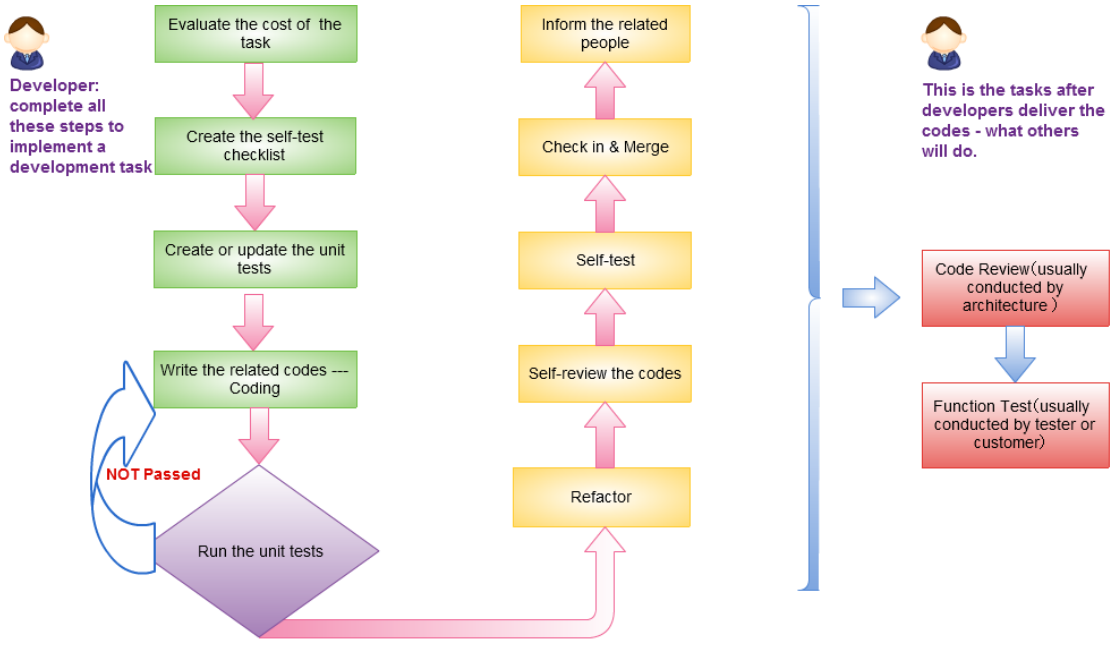
2.2.3 Frequent Delivery

As described in Incremental Development, the software are developed in many short iterative cycles, at the end of each cycle, deliverables will be delivered to testers and customers. In such a frequent manner, testers and clients can test the latest changes and give their feedback more timely and more quickly. Thus many defects can be found and fixed earlier, and similar issues will also be avoided in the following phases. It reduced the cost of errors a lot.

In Nova, the team is suggested to deliver software to our clients every two weeks. But as per the different situation of each project, the longest iteration is less than two months and the shortest reaches one week.

2.3 Workflow - Build Quality In

One of the essential components of Nova's QA process is the participation of standardized workflow, in which we have integrated our quality strategies and methods. Details are listed in Implement a Development Task at Nova.doc, here is a high-level flowchart abstracted from the document.



Implement a development task workflow in Nova

This flow ensures no necessary steps will be skipped by developers, thus many potential issues can be avoided. And as you can tell from the figure above, in this flow many checking will be executed at the

first moment on potential outputs, this will further ensure that issues will be found and fixed in the first place.

2.4 Standards – Quality Baseline

Standards are basic components of any QA system, Nova has made a lot of standards for the team members to follow, including C# coding standards, database coding standards, user interface standards, testing standards etc.

All together, these standards set up a baseline for our Quality. Which will make sure the software quality would be on a reasonable level.

2.5 Best Practices – Improve Quality in Every Aspect

To maximally assure and enhance each project's quality, Nova Software engineers adopt many best practices in every aspect of our projects, basically we can separate those practices into three categories: Best Practices for Coding, Best Practices for Testing and Best Practices on Functional Level.

2.5.1 Best Practices for Coding

These practices are majorly focusing on improving the quality of source codes, which will result in more maintainable products. This means less errors and fewer maintain cost.

2.5.1.1 Unit Test

Unit tests are codes written to validate the correctness of development units (such as functions and classes). They form a safety net to prevent codes from unintended changes. Thus once something goes wrong, unit tests can help the programmer find and fix it very quickly, and it also saves many testing efforts. In Nova, each project will implement unit testing once they get clients' approval.

2.5.1.2 TDD

Test Driven Development requests developers to write tests before implementing functions. This way will force developers thinking from the users' point of view, and making a more thoughtful design before coding. As the infamous over-design issue is avoided by TDD, it will keep the codes' complexity at a minimal level, so many wastes can be saved. Nova teams will adopt this practice if the client understands the cost and benefit of TDD.

2.5.1.3 Code Review

Code Review is a proven practice which can improve the codes' quality a lot. By reviewing the codes, many potential issues will be spotted, deviation of standards will get corrected, and most importantly, experience will be shared between developers, all of these will contribute to the overall quality of the software. Every Nova team is practicing Code Review.

2.5.1.4 Refactor

Refactoring is a disciplined way to clean up code and improve design. It can keep codes tidy so that minimizes the chances of introducing bugs. By refactoring, the codes quality will be improved a lot and the product's lifecycle will be extended. All projects in Nova are requested to refactor codes when new changes are made, and refactor is also a part of Nova's development workflow.

2.5.1.5 Daily Build

Daily Build is the practice of doing software builds on a daily basis. It can minimize integration risk and avoid many time-consuming bugs which would appear in batch integration. Daily Build assures that developers are sync with each other so that any defects caused by misunderstanding and lack of communication can be easily addressed and quickly fixed. All the projects in Nova are requested to check in codes every day and build them.

2.5.2 Best Practices for Testing

These practices are focusing on testing activities, by implementing efficient and effective tests, the products' quality will be guaranteed at a reasonable cost.

2.5.2.1 Self-testing

As indicated in the workflow above, every programmer in Nova should do the self-test according to some checklist before committing the modification. The purpose is to make sure that the outputs of developers are acceptable. By effective self-testing, many issues can be discovered and fixed at an earlier stage with lower costs. Following test activities will also benefit from this.

2.5.2.2 Cross-testing

Cross-testing means A tests B's outputs while B tests A's outputs. Since everyone has his/her blind spots, cross-testing will add value to software quality. Another reason cross-testing works is due to the psychological reason that people don't like their mistakes be found by others, they will be more caution if the team adopt cross-testing. In Nova, cross-testing is suggested practice, but many teams have adopted it because they tried it and it works well for them.

2.5.2.3 Regression Testing

To do a successful regression testing, all test cases need to be run and get passed, every module of this software should be fully tested. By doing this, you can find most issues (maybe over 95%) that hidden in the software, thus it minimizes the chances that an issue might be left out to users. It gives the final product's quality an overall guarantee. In Nova, Regression Testing will be implemented when a version is to be released, the team might arrange two or three weeks for testing and bugs fixing, but it depends on the project's size.

2.5.2.4 Integration Testing

Integration Testing is the testing implemented while integrating, it will make sure the integration won't break the software, and it is also used to make sure the related modules won't be influenced by this integration. Since Nova teams are implementing continuous integration and daily builds, they will only implement integration testing when necessary by running a pre-defined checklist.

2.5.2.5 Test Flow

An appropriate test workflow can make the testing activities more efficient and effective, which in turn enhances the quality of the software. Nova testers follow the following steps in their daily work to contribute to the quality.

Test Flow in Nova

a) Clarify Quality Requirement

The first step is to identify the quality requirement. Nova testers will analyze the requirements provided by the client very carefully, and they will communicate their questions with our clients, they will also confirm their understanding of the quality requirements (such as performance requirements and security requirements etc.) before taking further steps.

b) Create Test Strategies and Test Plan

Once the quality requirements are clear, test strategies will be set up. For example, which type of testing (such as performance testing, security testing, install/uninstall testing, compatibility testing) need to be implemented in this project, how frequently each type of testing will be executed, when to do them, and how to measure the result etc. Then a test plan will be made to guide the incoming testing activities.

c) Create Test Cases

For each feature (user story or specification) of the software, our testers will design some test cases, these cases will indicate how each feature will be tested and what the expected results will be. They will be used both in test execution step and in regression testing. It is very common that testers will find many potential issues while designing tests cases.

d) Test Execution

In this step, test plan will be executed. This involves plenty of activities, such as preparing necessary environments, preparing test data and tools, execute test cases and so on.

e) Report Bugs

If testers find bugs in the previous step, they will log the bugs in the bug management system (for instance, Mantis/Bug Net/Bug Tracker). Thus developers can reproduce and fix them.

f) Verify Bugs

When the bugs are fixed, their status will be changed to 'fixed/resolved' and they will be assigned back to testers, then testers need to verify them to make sure these bugs no long exist.

g) Bug Analysis

By analyzing bugs' status and trends, you will have a better understanding of the quality situation. This activity will generate some valuable information so that you can decide if the original plan should be adjusted. Nova conducts thorough bug analysis both during and after the development phase.

h) Refine Test Process

At the end of each iteration or after a major version is released, Nova testers will analyze if the current test processes and activities are effective enough, and then they will improve them. The refined processes and activities will be applied in the next phase, so as to gain higher quality.

2.5.3 Best Practices on Functional Level

These practices are majorly executed on function level, they can't be sorted into coding or testing activities, but they do help us get better quality, thus we call them Best Practices on Functional Level.

2.5.3.1 Prototype

Though the major purpose of making prototype is to communicate and confirm requirements with clients, quality will also benefit a lot by practicing this. As many missing functionality issues, misunderstandings issues and poor user experience issues will be identified and solved very earlier, prototyping avoids plenty of bugs and saves the cost of quality a lot. It also contributes to quality by setting up some criteria for coming tasks.

All Nova teams adopt some kind of prototyping technology, some of those prototypes are made by our clients, and some of them are made by Nova team.

2.5.3.2 Function List

Function List is an organized list which includes all features of the software, and it will be revised when requirements change. Since Function List can be used in the practice of self-testing and regression-testing, it will minimize the chances of missing something, and it also help the team discovery inconsistent issues. All Nova teams should update the function list before implementing the function.

2.5.3.3 Scrum Review

Scrum Review is a practice originated from the Scrum methodology, it is practiced at the end of each Scrum Sprint (iteration). The team must demonstrate the working software to all stakeholders once they got something deliverable, this activity forces the team deliver something that really works rather than some 90% done garbage. It also gives other stakeholders a chance to make their inputs, which may improve the quality as well. It is a suggested practice in Nova, some teams have adopted this and it works well.

2.6 Company Support

As described at the beginning of this section, "Good quality is a result of team work", management also play a very important role in QA. Company's support is very critical for successful quality assurance.

2.6.1 Training

Training conducted by the company can make sure that the employees have a good understanding of the quality assurance policies, standards, practices etc. Training will also remove some obstacles encountered by the team when adopting best practices. And by sharing experience across different teams, training will help other teams avoid similar mistakes. Besides, technical training will increase the programmers' skills which will result in less errors and better quality.

2.6.2 Inspection Team

The inspection team is an in-house management team to make sure the company policies, standards, workflows, required practices, management regulations are well executed by Nova teams. It is consisted of the most experienced managers and technical experts in our company. The inspection team carries out an inspection every two weeks by randomly select some team in Nova. If your team is selected, an inspector will come to work with the team, find out what they are doing right, what they are doing wrong, and then work out the improvement points and solutions with the team. The team has to adjust its' behavior in limited time period when the inspector will come back to recheck.

By making sure the standards are well executed by Nova teams, Inspection Team is the QA methodology facilitator in Nova.

2.6.3 Process Improvement

Process improvement is another important support to QA offered by Nova, it means the company will continuously improve the processes, standards, practices and so on. By gathering feedback from teams, summarize the experience and learning industry standards, Nova will continuously improve the existing QA methodology to further assure our quality.

3. About Nova

Nova Software Development Inc. is a software development and outsourcing firm based in Chongqing China, specializing in helping Europe and US companies reduce their development costs.

The deepening global division of labor enlightens us that only specialization can create maximum value. Therefore, just at the inception of our offshore outsourcing service, we positioned ourselves as Microsoft .NET expert and considered SMEs (Small and Medium enterprises) as our target clients. We provide a complete range of service including web development, application development, or any other

bespoke development. As long as the solution is based on .NET, Nova can offer the most cost-effective while reliable software development service to our valued clients.

As China has become one of the preferred outsourcing destinations, from 2005 Nova has provided software development service lasting from several weeks to a couple of years to more than 30 clients spread over North America, Europe, and Australia. 94% of our clients choose to continue working with Nova after we successfully accomplish the 1st project. How did we make it? The reason is that we not only put the clients' requirements in the first place but also possess a well-defined internal system to guarantee project quality.

Our experience, skills and the cost advantages enable us to be a partner you can rely on.