Quality Process Manual

Ver1.0

Revision History

Ver No	Ver date	Written/Revised By	Comment	Approved By	Approved Date
1.0	July 12th 2006	Sumitra Seshan	Create	Sumitra Seshan	

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1.0 Purpose of the document

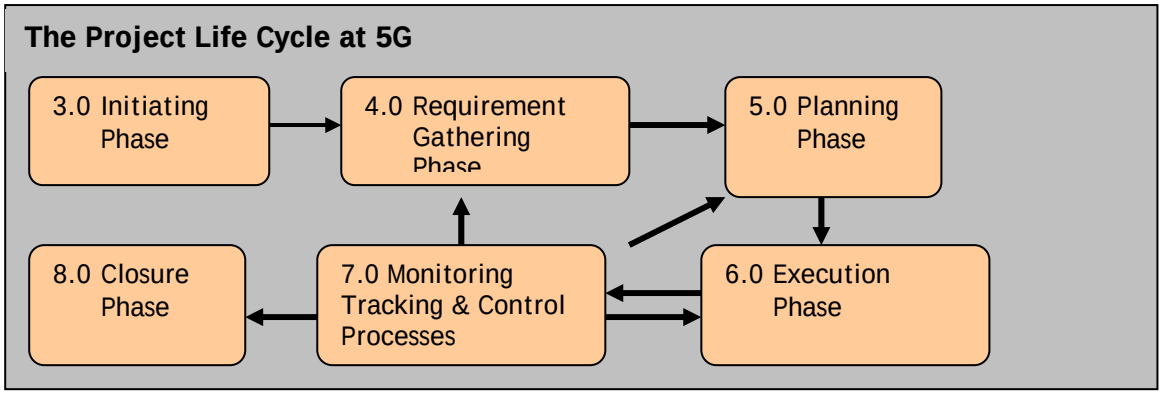
The primary purpose of this document is to describe the different aspects of Project Management Principles and Methodologies that are generally adopted within Fifth Generation Technologies India Ltd. (herein after referred as 5G). “Generally” does not mean that these procedure should be applied to every project development effort of 5G; the project management team is primarily responsible for determining what is appropriate for every project and then adopt the relevant processes to suit the different needs of the project.

2.0 Overview

Project Management activity involves three key elements: People, Technology and Process. This document addresses only one of three aspects viz. the Process and provides an Organization-wide guidance on the different aspects of the Project management Process that are to be followed. People-related and Organizational-wide practices are explained in the following process documents:

- OPD_Organization Structure & Reporting Process
- OPD_Contract Management
- OPD_IP Rights & Security
- OPD_Professional Code of Conduct
- OPD_HR Policies
- OPD_Joining Process
- OPD_Separation Process
- OPD_Training Process

The figure below depicts the complete Life cycle of a Project that is undertaken at 5G:



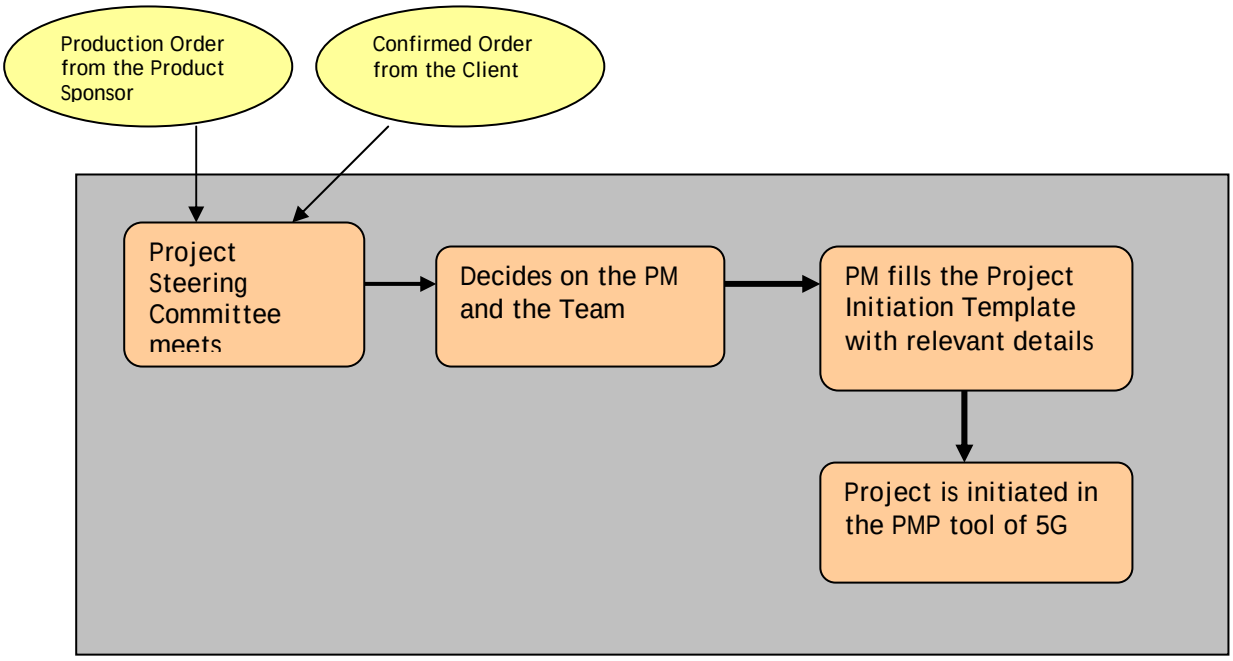
2.1 Structure of the document

The document has been organized in the following manner

Section 3: Project Initiation Process
Section 4: Requirement Gathering Standards & Procedure
Section 5: Project Planning Phase
Section 6: Project Execution Processes
Section 7: Project Monitoring, Tracking & Control Processes
Section 8: Project Closure Process

3.0 Project Initiation Phase

The process flow of the Project Initiation phase is as given below:

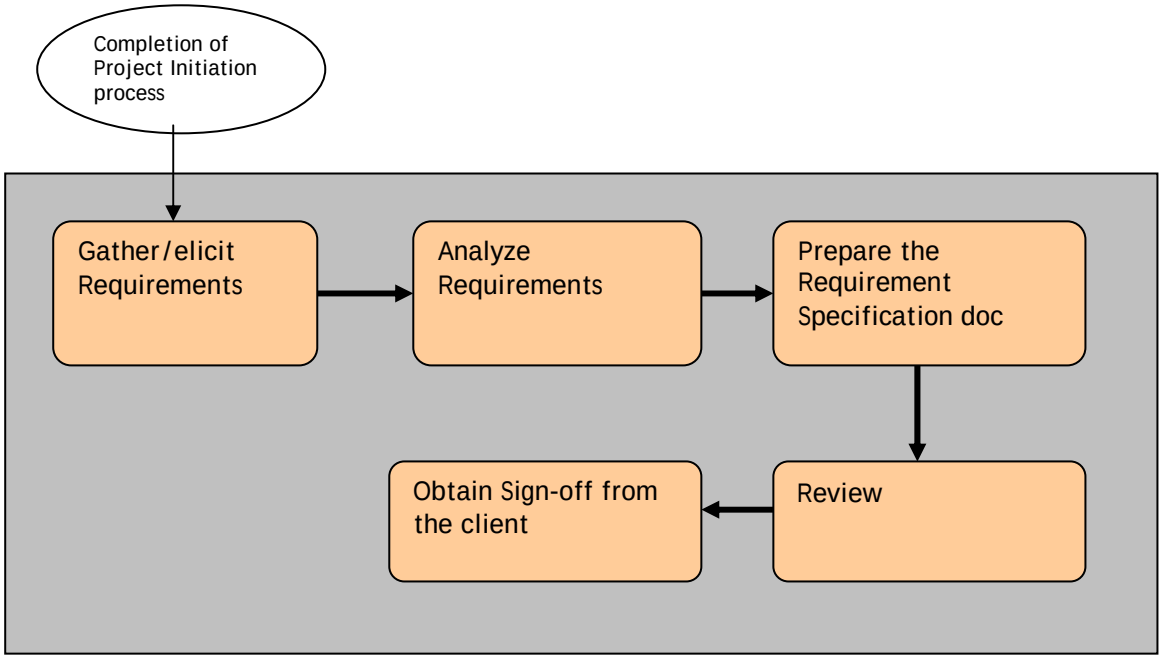


Input for this phase is the confirmed order that is received from the client in case of a Project or a confirmed Production Order issued by the Product Sponsor in case of a Product development. The production order could be for a new product development (or) new feature/enhancement effort for an already existing product. The deliverables of this phase are (a) Project Initiation Document and (b) the Project Creation in the System.

All new development work whether be it project or product is initiated using the standard template Process Template/Project Initiation Template. This is done by the project manager and gets approved by the Head of Operations of the company. Once the project is approved, a unique-id is allotted for the project in the Project Management tool and the project team is also initiated into the system.

4.0 Requirement Gathering Standards & Procedure

4.1 The Process



Typically, the first step in the lifecycle of any development is Requirement Gathering. The Requirement Gathering Process is done at 5G with the intention of ensuring that the specifications of the proposed system meet the needs of the customer and satisfies their expectations. Our Requirement Engineering procedure therefore provides appropriate mechanism for understanding what the customer wants, analyzes their needs, assesses the feasibility, negotiates a reasonable solution, specify the solution unambiguously, validate the specification and manage the requirements as they are transformed to a developed system.

As part of the Requirement Gathering exercise, 5G performs the following tasks:

- Requirement Elicitation

- Requirement Analysis
- Requirement Specification
- Requirement Validation
- Requirements Change Management

4.2 Requirement Elicitation

Normally the requirements are elicited through personal & direct interviews and/or by sending business related and domain specific questionnaires. Through these questionnaires, 5G aims to

- access the business and technical feasibility for the proposed system
- identify the different stake holders from whom the requirements should be gathered
- identify the constraints and boundaries that are required for the proposed system
- access the technical environment in which the system will be implemented.

4.3 Requirement Analysis

Once the requirements are gathered, they are categorized, organized and prioritized. The requirements are analyzed for consistency, omissions and ambiguity. The customers and the stakeholders are requested to rank the requirements and discuss conflicts in priority with the clients.

4.4 Requirements Specification

The requirements thus gathered and analyzed are presented in a simple and consistent manner in the form of a Requirement Matrix for ease of understanding. However in case of development of larger systems, a written document with graphical representations, process flows and use cases are used to depict the requirement (ref:Process Template/Requirment Template).

4.5 Requirements Validation

Requirement validation is done in two phases at 5G. An internal review of the specification is carried out by the Project Management Team that constitutes the PM, PL/TL and the Test Lead. The team examines the specification and reviews against a set of checklist to ensure that all system requirements have been stated unambiguously and that omissions and errors have been detected and corrected.

This verified specification is then sent to the client for obtaining a formal sign-off or acceptance from the client. In case of the product development assignments, a formal sign-off is acquired from the client (or) from the sponsor. This signed-off requirements document is then base-lined and forms the basis for the entire project development effort.

4.6 Requirements Change Management

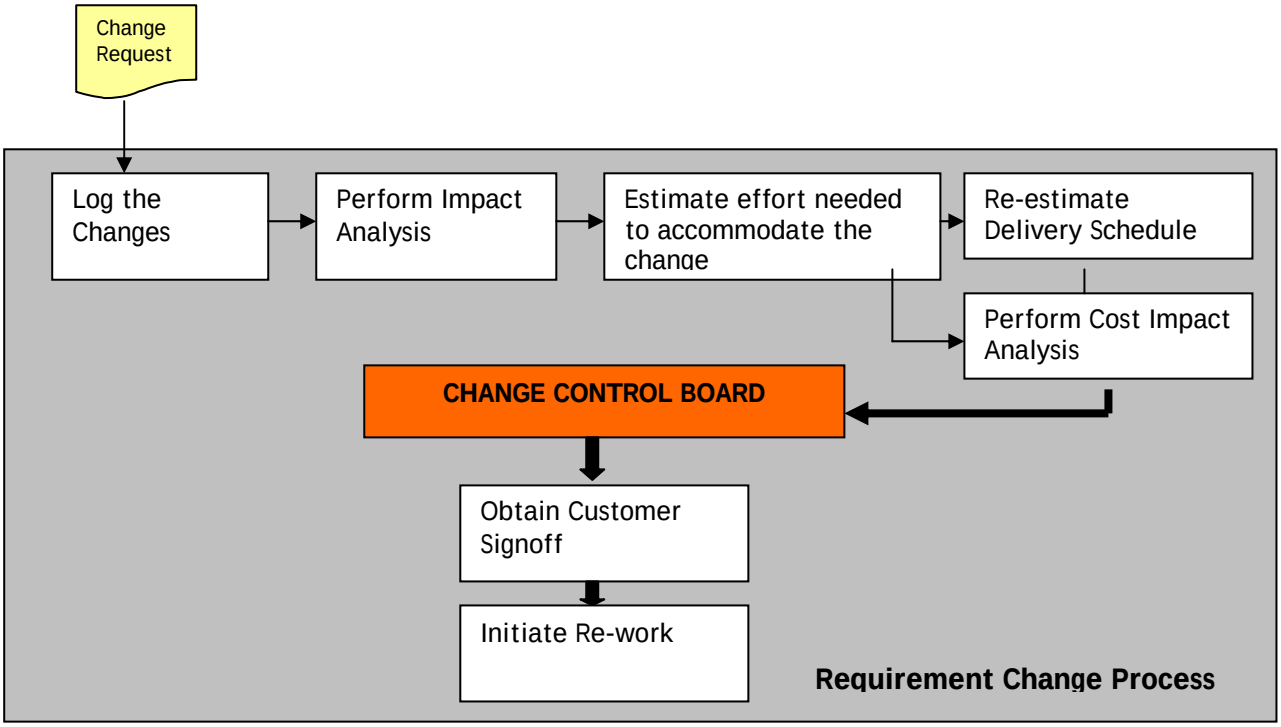
It is a given thing that Requirements Change. Changes in Requirement can change at any point during the project execution phase and might alter the schedule of the project or even alter the scope of the work product. The further down in the life cycle of the project the change occurs more severe is the impact.

Requirement Change Management has two aspects:

(i) Agreement with the customer about how to deal with the changes; and

(ii) The process of actually making the changes.

Whenever a request for a requirement change is received, the requirements change management process must be executed.



A change request log (process template/Change Request Log) is maintained to keep track of the change requests. Each entry in the log contains a Change Request Number, a brief description of the change requested, the effect of the change, the status of the change request and key dates. An impact analysis is performed whenever the change is requested and the Change Control Board evaluates the outcome of the impact. At 5G, the Change Control board typically comprises of a member from the senior management, the project manager, Z-Squad assigned member and the Test Lead.

A change can be classified as minor if the total effort involved in implementing it does not exceed two person-days. This change will be absorbed as part of the project effort and will be accommodated within the planned estimate.

If the impact is more than two days then the effort estimate has to be re-negotiated and revised. The change in the schedule/effort has to be communicated to and approved by the client.

Major changes in the scope/requirement needs formal approval from the client since it would have severe impact on the development effort.

In case of product development, any new feature that the customer wants is documented and maintained as a wish list for the next version of the product. By doing so, it is ensured that the customer feedbacks are not lost and that they get incorporated in the Market requirement document for the product's subsequent releases.

4.7 Traceability Management

Traceability of Requirements is required in order to trace every requirement to design and code that implement the requirement and test cases that test the implementation. Through this tracing, it is possible to validate that the software has met all the requirements and that the software has been tested for all requirements. This also aids in managing the changes.

5G adopts a simplistic way of traceability by mapping all the requirement elements to design elements to code elements to test cases using the Traceability Matrix (ref: Process Template/Traceability). The matrix contains the following information: Requirement #, Description, HLD Doc Ref #, LLD Ref #, Implementation (includes program, class, inherited class equivalent), Unit Test Case #, System Test Case #, Acceptance Test Case #.

This matrix needs to be updated constantly and maintained by the Project Manager and unless maintained properly will have very limited use. At the start of the project, the matrix will have only the first two columns filled and once the HLD is complete the matrix needs to be updated with that information. As the development proceeds, the matrix gets completed and at the end of every phase, the audit team can review this matrix for completeness.

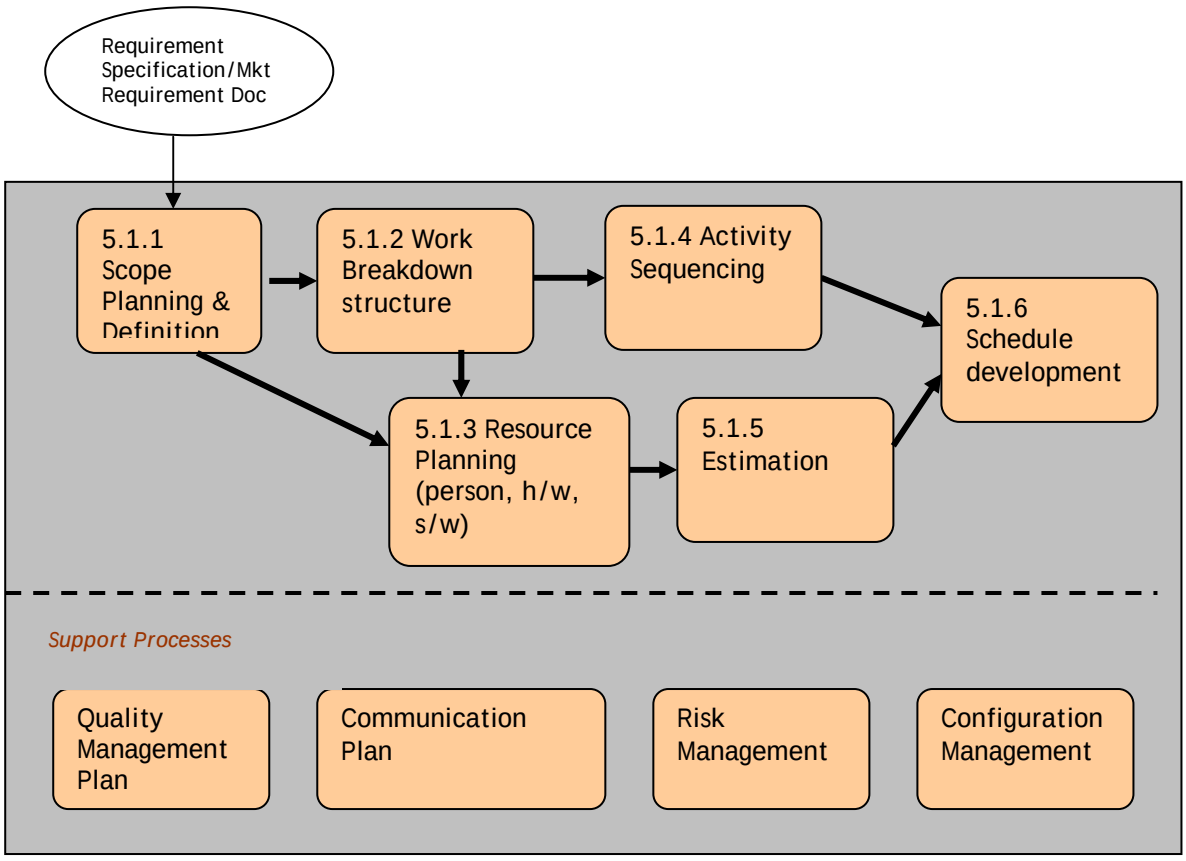
As is always the case, the Traceability Matrix template can be changed to suit that particular project needs and the decision could be made at the time of developing the project plan.

5.0 Project Planning

5.1 Project Planning Process

The Requirement Specification document is the key input to the planning phase. The participants of this phase are the Project Manager, Technical Lead and the Quality Lead. The actual deliverables of this phase would be three documents:

(a) Project Plan (ref:Process Template/Project Plan)
(b) Project Standard Document (ref:Process Template/Standards to be followed)
(c) Control Processes & Procedure (see section 7.0)



5.1.1 Scope Planning & Definition

Scope planning is the process of developing a written scope statement for future project decisions, deliverables as seen by the customer, and the acceptance criteria, assumptions & constraints if any.

5.1.2 Work Break Down Structure

Work Break down structure (WBS) is a deliverable oriented grouping of project elements. All project elements put together forms the scope of the project; work not listed in the WBS is outside the scope of the project. It is normally represented in a chart format and every item in the WBS is generally assigned a unique identifier. (ref: Process Template/WBS)

5.1.3 Resource Planning

Resource Planning is done as soon as the Work Break down structure is completed. Resources mean – all aspects of resource viz. people, hardware and software that are required in order to complete the development. Putting together a project team, its composition and their roles and responsibilities are included in detail in section 5.1.7

5.1.4 Activity Sequencing

Activity Sequencing involves identifying and documenting interactivity dependencies. As part of this exercise, the activities that have been listed in the WBS are sequenced in order to develop a realistic and achievable schedule. The sequencing is done based on the 'Finish-to-Start' (the 'from' activity must finish before the 'to' activities starts) type of dependencies and very rarely the other three types of dependencies are encountered.

5.1.5 Estimation & Schedule

The first step towards developing a schedule is to prepare an exhaustive activity list. The activity list must include all activities that are performed on the project. This will be organized as an extension to the WBS to help ensure that it is complete and that it does not include any activities which are not required as part of the scope. The activities that are listed should be detailed enough so that the team members understand what needs to be done.

Once the activities are listed, based on the size of the activity and the historical data that are available, the start and the end date are given for every activity. If the start and the end date are not realistic then the project is unlikely to be finished as per the schedule (ref: Process Template/Task Schedule)

5.1.6 Milestones & Targets

The schedule thus developed, help the project management team to come up with milestones and their respective target dates. Generally, since these milestones are linked to a payment cycle, this become important dates for tracking the progress and hence gets transferred to the Status Report format. (ref: Process Template/Status Report)

5.1.7 Team Organization

Resource Planning is done before activity sequencing. The team organization that is generally followed for executing any development effort is provided below. However, depending on the individual needs of the particular project or product development the Team composition can vary and this is decided during the project planning session.

A Steering Team that comprises of 5G's Management Representative, 5G's Project Manager & the Client Business Manager normally owns the project's business goals

and objectives. This Steering committee will meet once in a month and review all the measuring points of the project. With the client also forming part of this Steering Committee makes the process transparent and collaborative. This Steering Committee reports to the Management of 5G and the client organization.

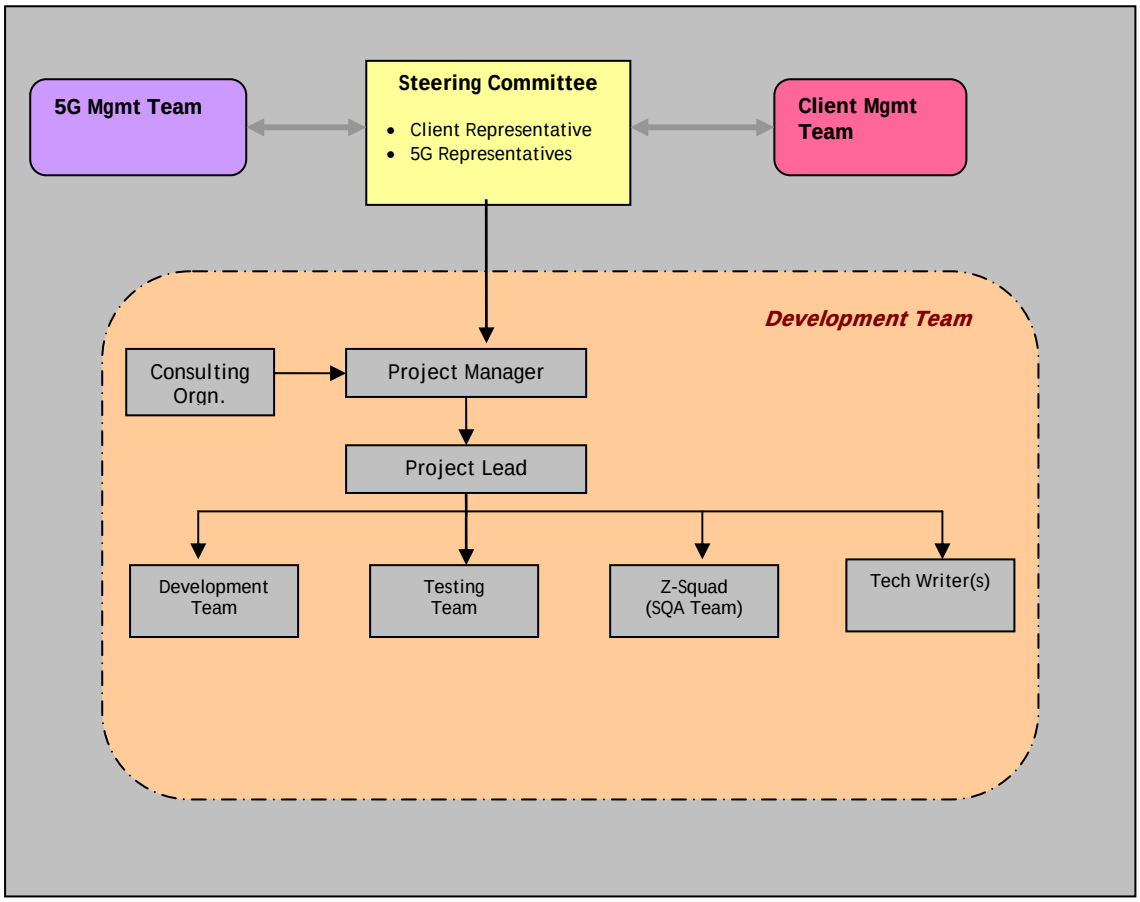
The project team will normally have a Project Manager, a Technical Leader, a Team of dedicated developers with appropriate experience and background, a Quality Leader and a Technical writer.

The Project Manager will be responsible for the requirement gathering and will also act as the contact person for 5G. He/she would then disseminate the information, knowledge and finalized requirements to the back end development Team, which would help in taking design decisions. The Project Manager will also be responsible to provide necessary questionnaires for the Requirement Gathering, perform the requirement gathering analysis, document the Requirements, manage resources, perform task planning and prepare and send out status reports.

5G's Technical Leader will be responsible to set up the hardware/software environment and identify the core software development team for executing the project. The Team leader will also be responsible for all the technical deliverables, Issue and Defect Tracking for the project. Along with the Quality Leader, the Technical Leader is responsible for establishing Quality Assurance Plan and to be overall responsible to monitor whether all the Quality standards are met. The Technical Leader, in short, is responsible for timely and accurate of all the technical deliverables.

The development team will comprise of core developers who have sufficient background experience in database design and coding.

However in smaller projects, the Technical Lead will also take on the role of the Project Manager and perform both the responsibilities.



The Quality Assurance is the responsibility of the Z-Squad Team and the Testing is done by the Testing team that is responsible for testing, documenting the defects and tracking the de-bugging activities. The Technical writer is responsible for preparing the User and the Technical Manuals.

5.1.7.1 Roles and Responsibilities

The following table summarizes the general Technical Responsibilities of 5G staff in a project.

Level	Personnel Responsibility
Project Manager	Client relation and management, monitoring of the progress, evaluating the developed system with respect to the client requirements, Project Planning, Status Reporting, Quality and developing a To-Be model for the client.
Technical Leader	Overall responsibility for Technical deliverables, System Analysis and Design, Leading & coordinating the Build effort, Code Review etc.
Quality Leader	To prepare a Quality Assurance Test plan and to ensure that all the quality related processes are followed properly. Responsible for Integration and System Testing, documenting the defects and issues related to quality.
Developer	Coding & Unit testing.
Technical Writer	Documentation
Z-Squad	Quality Assurance activities

5.1.8 Risks, Assumptions & Constraints

The project team needs to identify the various risk factors that could affect the project and possible solutions. Risks identified at the planning stage of the project typically have high impact and therefore possible solutions need to be identified. 5G adopts a standard Risk Assessment and Management methodology as per the guideline included in the OPD: Risk Assessment and Management document.

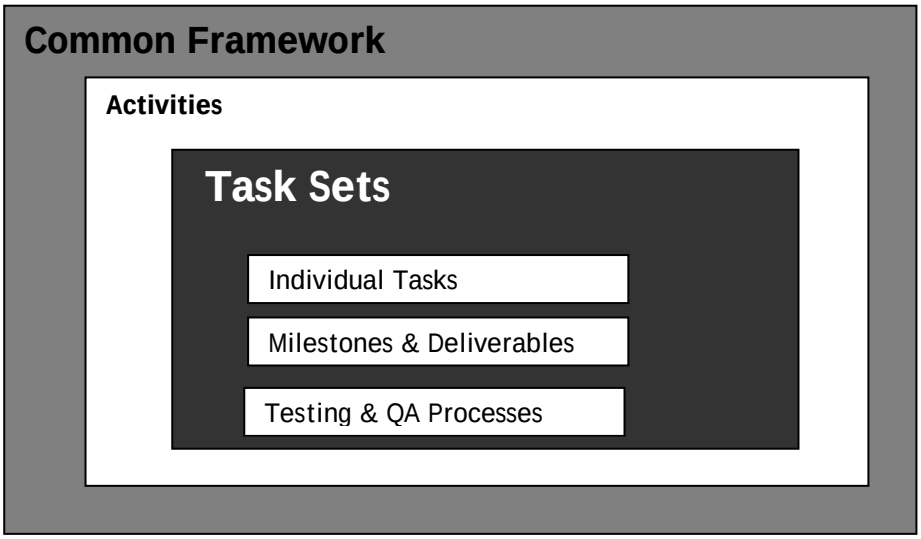
All factors that limit the project management team's options are listed as constraints. (ex: pre-defined budget). The assumptions that have been made for planning and other purposes will be recorded in the plan.

5.2 Development Methodology & Standard

5.2.1 Overview

5G follows the Quality Systems and Procedures established by IEEE standards for its entire project management and development activities.

The Quality Systems will follow a common process framework (as shown in fig. below) by breaking down the processes to activities, which are then defined as individual tasks, milestones, and quality assurance activities. This framework is technology independent and can be applicable to all software projects, independent of project size and complexity.



This provides the necessary flexibility in the development and allows for easier overall management of the project.

5.2.2 Standard Development Methodologies

The development methodologies that 5G adopts for its development of projects/products could be any one of the following (i) Waterfall Model (ii) Incremental Model (iii) Iterative Model (iv) Evolutionary Prototyping (v) Evolutionary Delivery. During the planning phase of the project/product, the team decides on the model that will be adopted depending on the requirement of that specific project.

The metrics that are used for evaluating the development methodology are as follows:

- Product Complexity
- Project Size
- Clarity with which the product requirements have been defined and understood
- Need for early availability of the product functions
- Technology risks
- Number of products that need to be integrated
- Magnitude of anticipated changes during development

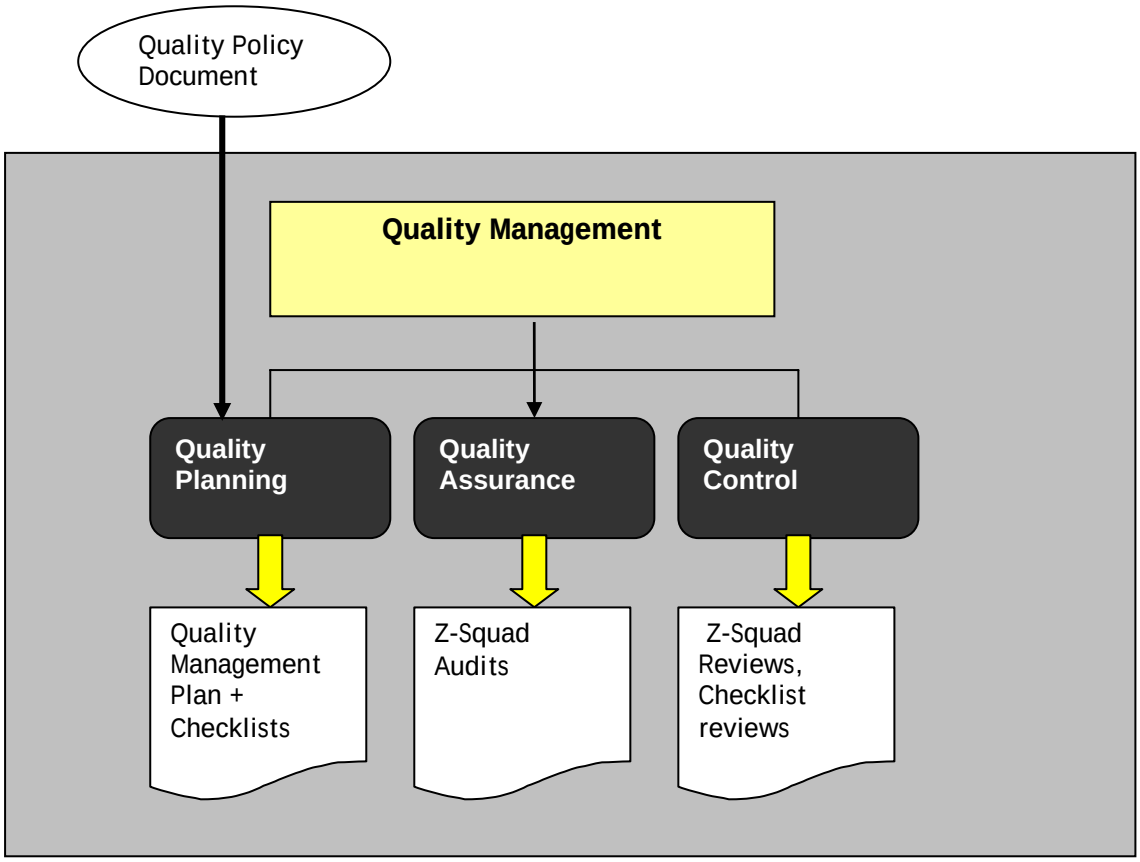
The different development methodologies that we use and process by which we choose the different models for every work product is explained in the OPD-Development Methodology.

5.3 Quality Plan & Management

5.3.1 Overview

The quality system of 5G is designed to ensure that the final release of the work product (a) meets the requirements of the client and (b) has 'zero external defects'.

The Quality Management has three main activities namely Quality Planning, Quality Assurance and Quality Control.



Quality Policy document is the input to the Quality Management Plan (ref: OPD/Quality Management Plan). The quality plan includes the quality standards that are relevant to that particular development effort and the quality processes that need to be followed regularly throughout the development cycle.
The Quality Plan Template is included in Process Template/Quality Plan document.

The Quality Assurance Team uses various checklists/review lists for auditing the processes. The various review lists are included in the quality folder Process Templates/Review Lists

Quality Assurance activity is the primary responsibility of the z-Squad team. The responsibilities of Z-Squad team at 5G are included in the document OPD/Z-Squad Policies.

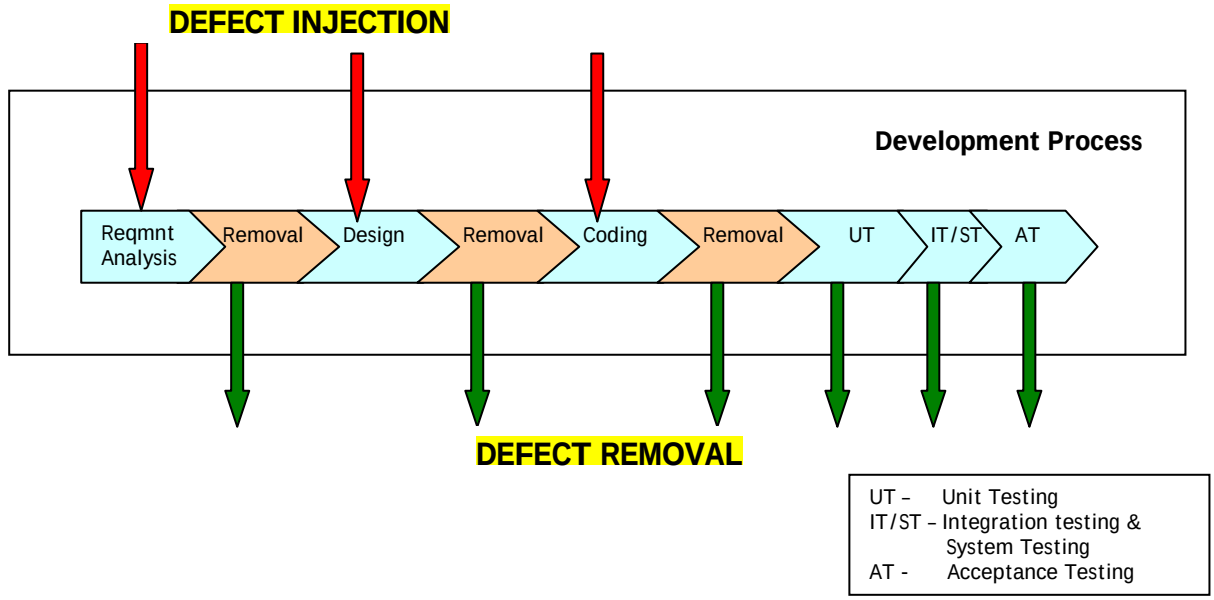
Quality control ensures whether the specific project results comply with the quality standards established for the project and the overall quality metrics set out by the company. The project results include both the project related aspects as the cost and schedule related performance.

The overall quality focus of the organization is to drive towards Zero **External Defects at the time of General Availability of the products** and therefore the Quality Management & Control activities are geared towards achieving this goal.

5.3.2 Defect Injection & Removal Cycle

Quality along with the cost and schedule is a major factor in determining the success of the project. Since Quality Management primarily revolves around defects, the quality at 5G is defined in terms of defects – *'number of defects per unit size in the delivered work product'*

Defects can be injected into the work product at any stage during the entire life cycle viz. Requirement Specification, Hi-Level Design, Detailed Design and Coding. Since it is a known fact that the defects can be injected at any stage and it is the company's mandate to deliver products with zero-external defects, it is therefore very important to remove defects before delivery. This can be done by including Quality Control activities at the end of every phase so that the defects that are injected at that phase are identified and removed.



Typically two different types of activities are performed as part of the Defect Removal System viz: Reviews and Testing. Reviews are more generic in nature and mostly at 5G the reviews are done based on checklists and are performed by designated groups. The different reviews that take place at 5G are:

(a) Requirement Review

Participants: Customers, Designers, Tester (System Testing), Installation Team member, User documentation author & the designated Z-Squad member.

Review Focus: Whether the Requirements meets the customer's needs & can be implemented. Have the omissions, inconsistencies and ambiguities been targeted and eliminated.

Entry Criteria: The requirement documents conforming to the standards

(b) High-Level Design Review

Participants:	Requirements Author, Detailed Designer, Developer & the designated Z-Squad member.
Review Focus:	Whether the high level design implements the requirements & whether the design can be implemented as presented.
Entry Criteria:	The documents conform to the standards. The requirements have been reviewed and finalized

(c) Test Plan Review

Participants:	Requirements Author, Project Manager, Client, Quality Lead & the designated Z-Squad member.
Review Focus:	Whether the test plan describes the who, what when, where and how of conducting the tests.
Entry Criteria:	The documents conform to the standards. The requirement specifications have been reviewed and finalized

(d) Code Review

Participants:	Designer, Tester, Developer
Review Focus:	Whether the code (i) implements the design (ii) is complete (iii) has been written as per the standards

defined at the beginning of the project. The number of defects present in the code.

Entry Criteria: The code compiles and passes styles and other norms

(e) System Test Case Review

Participants: Requirements Author, Tester, Project Leader& the designated Z-Squad member.

Review Focus: Whether (i) the set of test cases checks all conditions in the requirements (ii) System test cases are correct & they are executable

Entry Criteria: Requirements have been base lined. The system test plan is consistent with the standards.

5.3.3 Preparing Test Plan & Strategy

At 5G the software is tested from two different perspectives:

(1) Internal program logic is exercised using "white box" test case design techniques.
(2) Software requirements are exercised using "black box" test case design techniques.

However the intent is to find out maximum number of errors with the minimum amount of effort and time.

The objectives of testing process at 5G are to (i) execute a program with the intent of finding an error (ii) to uncover the as-yet-undiscovered errors

The basic testing principles that are used at 5G are:

- All tests to be traceable to customer requirements;
- Test plans to begin as soon as the requirement phase is complete (ref:Process Template/Test Plan); and
- Detailed definition of the test cases (ref:Process Template/Sample Test Case) to begin as soon as the design model has been firmed up.

5G follows all standard testing practices of the industry. The testing team headed by the Quality Leader is responsible to create Test Plans, put up a test environment within the premises of 5G that mirrors the client's facility and execute the Test Plans.

Following tests are conducted as part of the standard process:

- Unit Testing
- Integration Testing
- System Testing
- Interface Testing
- Security Testing
- Recovery Testing
- Job Stream Testing
- Performance Testing
- Acceptance Testing
- Beta Testing

5.4 Change Management Process

The change management process with respect to Requirement has already been covered in detail in section 4.6. While the customer aspect to the Change management is dealt in section 4.6, this section elaborates on the CCB, their objectives and certain review points that need to be considered by the CCB while evaluating the change request.

Whenever a Change request occurs, it is a known fact that the request will have an impact on any or all of the three factors namely (a) Scope (b) Schedule or (c) Cost. Therefore it is imperative to have a good Change Control Process established as part of the Project Management activities so that all the three factors are kept under control.

Change Control Process has been formulated to address the following key objectives:

- Only necessary changes are made to the product
- Changes are communicated to all
- Changes are implemented in an orderly fashion

Change Request may occur in many forms

- oral or written
- externally or internally initiated (eg. could be a misunderstood requirement)
- legally mandated or optional (eg. Introduction of a new tax by the government can have an effect an accounts module)

Every project has a **C**hange **C**ontrol **B**oard (CCB) which normally comprises of members from the cross functional team. This board is formed during the Team Organization of the planning meeting and is solely responsible for approving/rejecting the Change Proposal.

The CCB considers the following points before approving/rejecting the change proposal:

i. Is the Change necessary ? in this release?

ii. What groups are impacted by the change? How will dependencies and schedules be impacted?

iii. Is there a more effective and preferred change to the one that has been proposed?

iv. What documentation must be produced to document the change properly?

v. How and when can the change best be made with the least negative impact?

The Change Request form is included as a template under Process Templates/Change Request Form

5.5 Configuration Plan & Management

Typically any software development effort produces number of items during its execution: various documents, programs, data, and manuals. The changes can happen at any time and the changes can affect all of the above items. Therefore it is essential to properly control and manage these changes so that consistency is maintained in all the items. The configuration management at 5G provides guidelines to systematically control the changes that occur during the lifecycle of the product/project development.

A member of the project team is normally assigned with the responsibility of this task and he/she will act as the Configuration Co-ordinator and this is done during the initial planning session.

The Configuration Coordinator is responsible for planning and communicating the Configuration Management Plan to all the concerned individuals/groups. The plan includes the procedure and documents that need to be backed up, checked in and out. The sections below describe in detail all the different aspects that the Configuration Coordinator needs to plan and specify while developing the Configuration Management Plan.

5.5.1 Develop a Configuration Plan

5.5.1.1 Identify all the Configurable Items in a Work Product

The items that need to be configured are identified at the planning stage. The items could be work product, documents that are delivered to the clients, plans and review documents.

5.5.1.2 Configuration Management Environment

Need to specifically identify the following that will be used in that particular project:

Operating System:

Configuration Management Tool:

5.5.1.3 Naming Conventions and Organization of files

Every identified Configurable Item has a Unique Identifier which is documented as per the naming convention. Whenever appropriate the filename itself may be used as an identifier, as in the case of program source code. For documentation files, it is necessary for encoding the names in a standard way.

5.5.1.4 Fix Base lining Criteria

The conditions under which the CI will be base lined are outlined here. These baseline criteria will depend on the requirements of that particular work product.

5.5.1.5 Fix Re-Release Criteria

The conditions under which the CI will be re-released are called as re-release criteria. These criteria depends on the requirements of that particular work product

For example: Whether the SRS is to be re-released after every change or the changes will be accumulated and will be re-released.

5.5.1.6 Identify Levels of Control

Each CI can have different requirement for controlling. In broad there are three levels of control, viz.:

a. Formal, Managed & Controlled items
   - Version Control
   - Document Control
   - Changes made through formal change management procedure

b. Managed & Controlled items
   - Version control
   - Document control

c. Controlled items
   - Version control

While planning the designated CC will identify for each CI the level of control that is needed based on the project/product management requirements.

5.5.1.7 User Access Rights

During the planning stage, the team needs to identify and assign the access rights of users for all the Configurable Items.

5.5.2 Review & Approval Process

Change requests and problem reports should be recorded by the PM/PL, the same shall be reviewed and approved by the CCB Manager. CCB should exist for every project for approving the changes to the project software baselines.

5.5.3 Audit Configuration Plan

5.5.3.1 Baseline Audit

Software baseline audit is conducted at least once in a project life cycle as per the project plan. The Configuration coordinator manager does the baseline audits and status accounting. The configuration coordination manager tracks non-conformances that are found during audit to closure.

5.5.3.2 Physical Audit

The specified documents is audited for physical existence by the CCB Manager and checked for appropriate access permissions as stated in the Configuration Management Plan. The configuration coordination manager tracks non-conformances that are found during audit to closure.

5.5.3.3 Functional Audit

The CCB Manager should check whether the correct file is being used for delivery both internal and external. The configuration coordination manager tracks non-conformances that are found during audit to closure.

5.5.3.4 Internal Audit

Internal Audits are done as per the audit procedure, audit reports are to be prepared and sent to the person responsible for configuration management. The configuration coordination manager tracks non-conformances that are found during audit to closure.

5.5.4 Configuration Status Accounting

The status accounting is the process on maintaining records to know the current status and history of every CIs. Products from the software baseline library are built and the release information is maintained. Configuration management status report are developed and made available to project team and support group. Configuration manager is responsible to ensure all the CIs status is traceable.

5.5.5 Library Archival

Library Archival is required to ensure that the work product is available and any component of the product can be recreated. All the files in the production are to be archived and given to Process Group/Library for future use.

In case of testing, the developer needs to add all the related documents like the code, test plans, standards etc. to the test directory. Separate directories are maintained for every round of testing. Once the developer has the final module/part of the module allotted to him/her that was completed with out any error then it is moved into the static directory. Like wise every developer will place the final version of the code and the related standard in the static directory. Once all the modules are done, this documents/code from the static directory is integrated in the development directory and moved to the test directory along with the integration plan and test cases and any other document needed. Integration testing is done from the test directory. Once all the integration issues are sorted and the project is working, the documents/code & the related details are moved to production directory. From the production area (directory) required documents, exe, etc. as per the delivery plan are packed and sent to client after final inspection.

5.5 Communication Standards & Methodolgy

The communication Management plan is included as part of the project plan document, to explain to the project teams the standards and norms that will be followed with respect to the project. This plan (ref:process template/communication plan) will include the methods of

(a) Collection, recording and storing of various information
(b) Distribution of this information and the frequency in which the information will be disseminated
(c) Updating various information

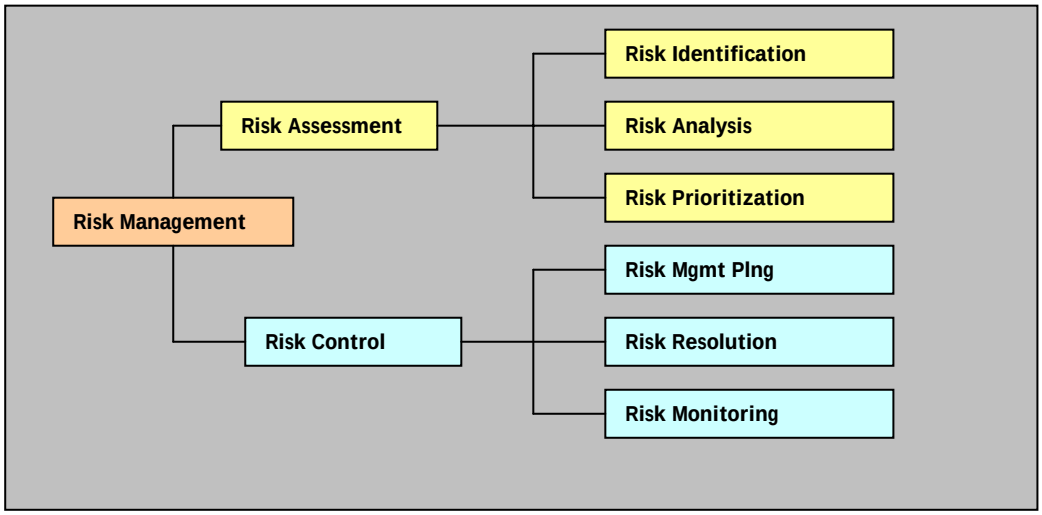
The methodology of communication may vary from project to project dependent on the client's needs.

5.6 Risk Management Plan

Risk Management's primary goal is to

(a) identify the conditions or events whose occurrence is not certain, but that can affect the outcome in an unfavorable manner if it occurs
(b) minimize the chances of failure caused by such unforeseen occurrences.

The key elements of risks are that the occurrences are probabilistic and if it does occur, it can cause damage to the project thereby leading to customer dissatisfaction. Therefore the first step in Risk Management is to identify the possible risks and to assess the consequences. Once the assessment is complete, then a plan should be developed to mitigate these risks.



Risk Assessment: The different activities that are performed in 5G as part of Risk Assessment are

(a) **Risk Identification**: A list of commonly occurring risks have been compiled and is made available as a project management reference material (ref: Checklist/Top Risks Checklist). Using this list, the project leader/manager can identify the risks for his/her project.

(b) **Risk Prioritization**: Based on the two factors namely the possible consequences and the probability of the event occurring, the risk exposure is calculated. (*ex: When the probability of occurrence is 0.3 and the level of consequence is 9 then the Risk exposure will be 7.2)*

The probability of risk occurring can be categorized into three categories viz. Low, Medium & High. The probability range for each of these categories is categorized as:

Risk Category Table:

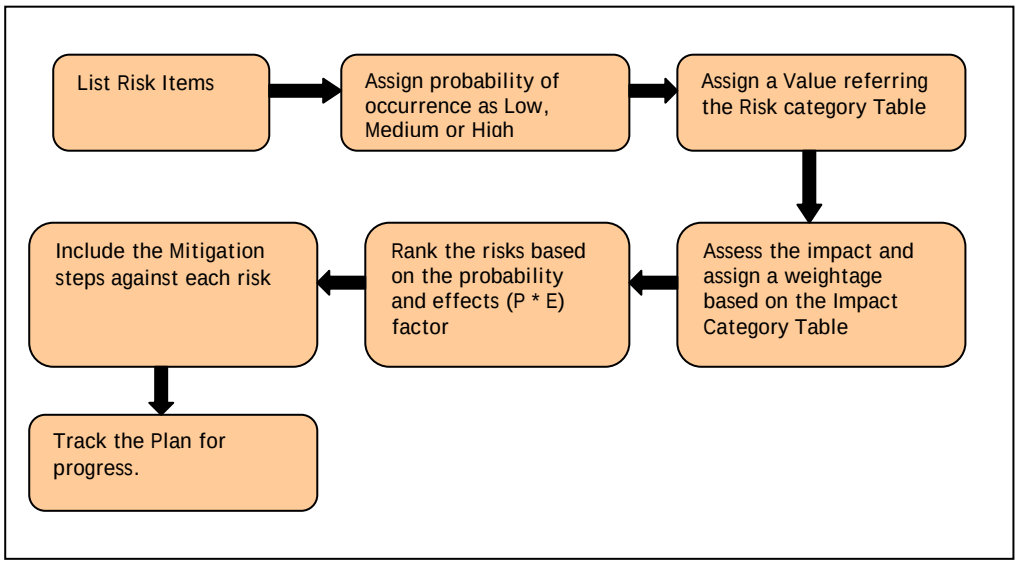
Probability	Range
High	0.7 – 1.0
Medium	0.4 – 0.6
Low	0.1 – 0.3

For ranking the effects of risks on a project, a unit of impact has to be selected. To keep the risk management activity simple, the risk impact is rated on a scale of 1 to 10, which is explained in the table below:

Impact Categories:

Level of Consequences	Range
Very High	9 - 10
High	7 - 8
Medium	4 - 6
Low	1 - 3

The process of risk prioritization based on the above two tables are as follows:



Risk Management Table for Monitoring & Tracking (Process Template/Risk Management Template)

Sl#	Risk Description	Probability (.1 to 1.0)	Consequences (1 to 10)	Risk Exposure (P * C)	Mitigation Plan	Status

As part of Risk Management activity, it is therefore very essential for the project leader/project manager to continuously look for events that may go wrong, identify & prioritize them and act on the top few risks so that they have minimal consequences on the success of the project.

6 Project Execution Phase

Once the project planning is completed and the functional requirements collected, reviewed and documented, the project moves on to the Project Execution phase.

6.1 Framework of the Software Requirement Specification document

Software Requirement Specification document of 5G complies with IEEE std830, "IEEE Recommended Practice for Software Requirement Specifications". The purpose of this document is to describe in detail the specifications of the proposed system to the development and the testing team. The detailed framework of the SRS is included in the document Process Template/SRS Template

6.2 Design Practices

6.2.1 Hi-Level Design

Based on the requirements that are gathered, the proposed system is transformed to High level Design which is carried out by the Design team, the Project Management Team, and the client. **During this phase, the Logical Model of the proposed system is developed**. The solution developed during this phase comprises of functional architecture of the proposed system and the database design. The main input for this phase is the SRS document and the output of this is the high-level design document, the functional design document, the database design document and high-level design review records. (Process Template/Hi-Level Design Document Template)

6.2.2 Detailed Design

During the detailed design phase the high-level design is further broken down into modules and programs. Logic design is carried out for every program and then documented as program specifications. For every program, a unit test plan is also

created simultaneously. Important activities in the detailed design stage include the identification of common routines and programs, development of skeleton programs, and development of utilities and tools for productivity improvement. The participants of this phase are the members of the development team (Process Template/Low Level Design Document Template).

6.3 Project Building Phase

6.3.1 Coding

In this stage, based on detailed design, required programs are developed following the IEEE standards and Code Procedures. The source code, executables, and databases following established coding standards are produced at the end of this phase. The output of this phase is the subject of subsequent testing and validation. The Project Development team and the Project Leader will carry out the coding of the modules and the functionalities.

6.4 Testing

6.4.1 Unit Testing

The unit testing is conducted as part of the Coding phase. Initially, the developer tests each component or unit that is developed in the Coding stage. The defects found at this stage by the developers are not documented. When defects are found, the programmer corrects the code and re-tests the unit. This process is repeated until the satisfaction of the developer that the unit is error-free and then made available to the quality analyst for testing. The quality analyst then tests the unit based on the unit test plan and logs the defects that are found at this stage. The unit is then passed onto the programmer for bug fixing and then sent back for independent testing. This process is repeated until the unit is made bug-free.

6.4.2 Integration Testing

Integration testing is carried out to ensure proper co-ordination between the various units of the system. During this phase, tests are conducted to find defects associated with interfacing. Integration is performed in the order specified in the integration plan and corresponding test cases for each integration phase are executed.

The Quality Leader develops the Integration Planning and the Test plans. The test plan is developed during the Detailed Design of the project. The Quality Analyst/Leader carries out the testing. Based on the plans the tests are carried out and the defects are logged by the tester and handed over to the Project Leader for review. The project leader then specifies a time by which the issues and the defects have to be rectified by the developer.

6.4.3 System Testing

System Testing is carried out to validate the software product against the requirement specification. Attributes such as external interfaces, performance, security, configuration sensitivity, and reliability are validated during this phase of testing. The participants of this phase are the Quality Leader and the testing team. System testing will be carried out to establish that all the functional requirements of CLIENT outlined for this project are met. The whole system will be tested for each of the requirements. The Quality Leader of the project will conduct this.

The testing is done based on the requirement document and the high-level design documents. The testing team then checks the system for each of the feature, determines whether the system passed or failed on the expected results specified for that case and logs the defects. The testing team has the authority to decide whether to continue or discontinue with system testing if major defects are found at this stage of testing. The development team then would analyze each failed test case and decide on an approach to fix defects.

6.5 Acceptance & Installation

Acceptance test plan is prepared and then executed as part of formal acceptance of the developed software work product. Normally the customers prepare the Acceptance Test Plans and 5G helps the customer execute these tests. All defects found as part of the Acceptance Test phase has to be fixed by the development team, so acceptance testing is explicitly planned for in a project. After acceptance, the software is installed in the customer environment and put to product use.

When the work product is delivered or released the following needs to be sent to the client:

- Release Notes
- Installation Procedure
- Acceptance Test plans

6.6 Documentation

The documents are either developed by a designated member in the development team itself or a dedicated Technical writer is identified as part of the project team and is assigned with the work of developing the required documents. The major activities of this phase are:

- Prepare User Manuals
- Prepare Operation Manuals
- Prepare data conversion manuals
- Prepare Online help
- Review Documentation/Manuals

The manuals that need to be developed are decided based on the project scope and are defined in the project plan.

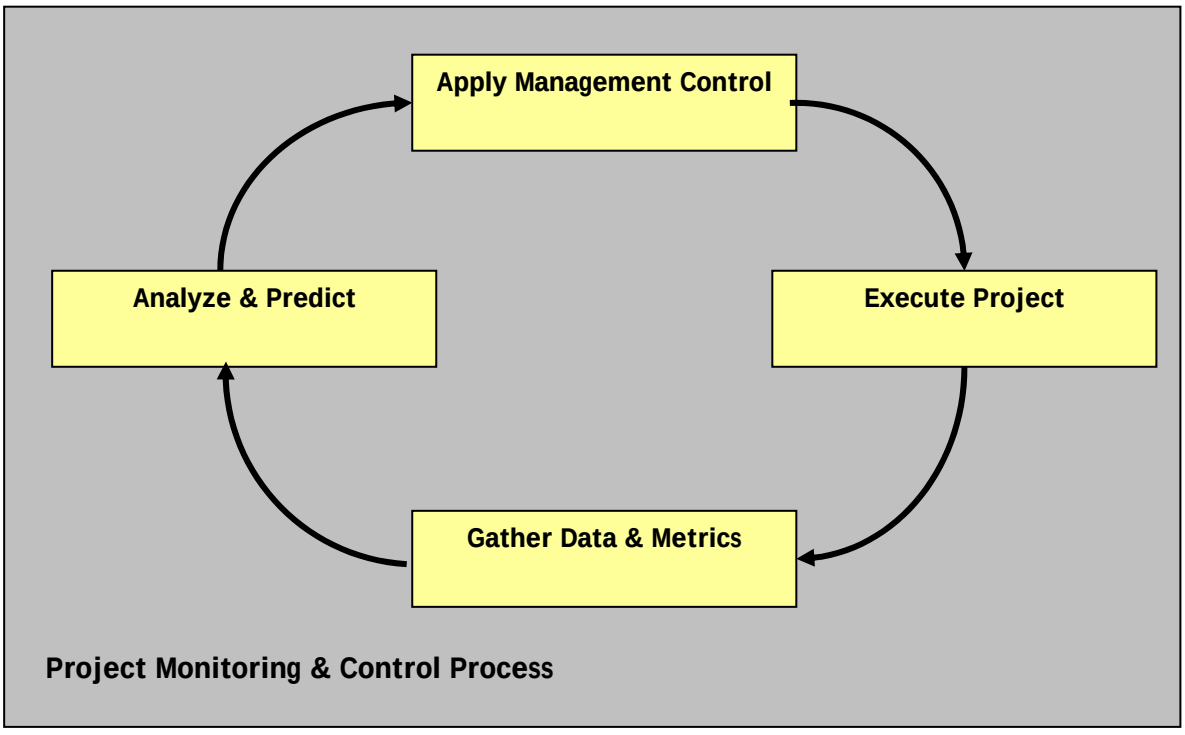
7 Project Monitoring, Tracking & Control Processes

Project Monitoring has two aspects viz:

(a) Data Collection in order to understand the current status of the Project and interpret it suitably to make judgments about the status.

(b) To take 'corrective' actions if the project data proves that the project is not in the state that it has to be.

This collection of data to provide 'feedback' about the current state and application of proper project controls to bring the project 'back in track' is the main basis on which the Project Management functions.



7.1 Effort Data Collection

Effort being the fundamental parameter of a software project, collection and tracking of effort data is given primary importance. At 5G, this is done using a homegrown tool called the 'PayIT' system.

The effort spent on various tasks by an employee is entered into the tool through the Weekly Time sheets and the data is collected for a project/product along with the module on which the work was done from Monday through Sunday.

The data is normally collated and analyzed on a weekly and monthly basis for project related reviews.

7.2 Activity Tracking

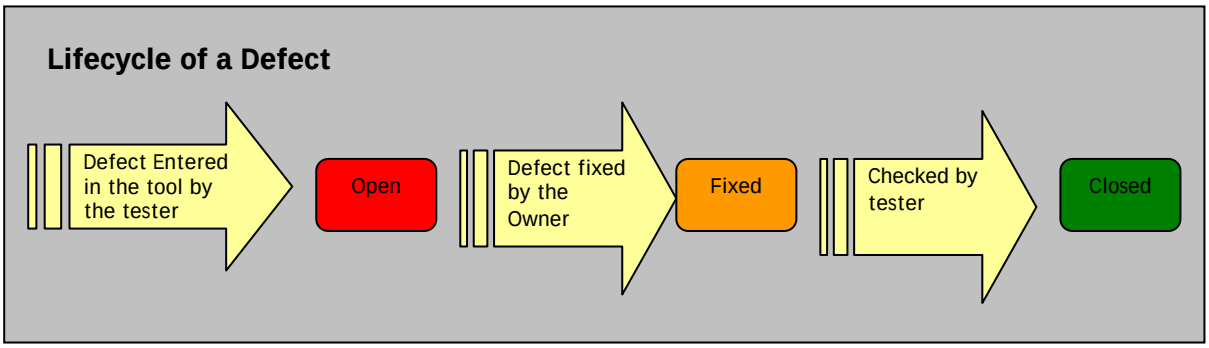
Activity tracking is a very important function that is performed in order to ensure that the planned activities are getting done on time and that the project is going on track. Every activity of the project is scheduled in MS Projects and therefore the tracking is also done using the same tool.

On a daily basis, the project leader or the project manager checks the status of the scheduled tasks and updates their status in MS Projects. In addition a weekly project meeting is held to discuss the project schedule and other issues. Only when the activity is completely done, does the status of the activity is entered as 100% completed, therefore the tool can be used to find out which set of tasks are lagging behind, what percentage of the task is completed, what effects the slippage will have on the execution of the overall project.

7.3 Defect Data Collection & Tracking

Defects are another set of raw data that needs to be collected as part of the project tracking activities. Because defects have direct relationship with the software quality, it is very important to collect and analyze this data. This data also helps in tracking how and when the defects are injected into the system so that long-term improvement measures can be initiated within the organization.

The process of defect detection and removal that is adopted at 5G is explained below. As and when a defect is found, the tester enters the defect in the Defect Management tool (an internally developed tool). The status of the defect is "Open" at this stage. The job of fixing the bug is assigned to the respective developer who is generally the author of the code. However the project leader or the project manager has the authority to re-assign the bug fixing to any other developer.



The person to whom the bug has been assigned does the debugging and fixes the reported defect and changes the state of the defect to "fixed". A defect that has been "fixed" is still not closed, until the tester himself/herself verifies the bugs and changes the status of the defect to "closed".

All defects that are detected are codified as "Critical (or) Severity 1 error", "Major (or) Severity 2 error" and "Minor (or) Severity 3 error" and are then assigned to individual developers.

The errors are classified as **Critical (or) Severity 1 errors** when the Services are not available (or) when a critical functionality is not available. In this scenario an immediate 'alarm' is raised to the Project management team and a resolution of the defect is immediately discussed. Normally these defects are attended to within 24 hours from the time they have been raised

Critical problems with possible work arounds are classified as **Major (or) Severity 2 errors**. Whenever any major functionality is not available but has a work around

then they fall into this category. These defects are attended to within 3 working days.

Minor (or) Severity 3 errors: When all major functionalities are available with work arounds & minor problems may be there with alternatives, then the errors are classified as **Minor** and are attended to in the normal course of project.

The defects are normally analyzed and reviewed by the Review Board that normally constitutes all the cross-functional team members namely Project Manager, Project/Technical Lead, Test Lead and the Z-Squad member and only based on the impact of the defects are they prioritized and fixed.

7.4 Client Issue Tracking

5G being a product development company has a well-structured Support Policy for its product which has been laid out in the document OPD_Support Strategy & Policy.

All issues raised by the client and categorized and a problem ticket raised. The categorization standards are as follows:

a) Priority 1 Issues

Priority 1 issues are defined as **SYSTEM DOWN** with no immediate fix. To determine if it is a Priority 1, the following conditions must exist:

1. A bug results in significant performance problems, operational difficulties, or potential data integrity problems with this or other customers' production systems; **OR**
2. A user account is in jeopardy.

If any of the preceding problems occur **AND** no suitable workaround/fix exists, this will be determined to be a priority 1 call. A "suitable" workaround must be proven effective and able to be implemented in a relatively short period of time.

b) Priority 2 Issues

To determine if it is a Priority 2, the following conditions must exist:

1. A major feature failure exists but the system is operational with limited use;
   OR
2. A specific user is having an isolated but major problem
   OR
3. A Priority 1 Issue with a suitable workaround.

If the preceding problem exists **AND** there is no suitable workaround/fix **AND** the customer cannot wait until the next scheduled release, this will be determined to be a Priority 2 Issue

c) Priority 3 Issue

Defined as a **minor configuration problem** that is not affecting the basic flow of the product. To determine if it is a Priority 3, the following conditions must exist:

1. Feature failure but there is little or no impact to other operations ;
   OR
2. There is a minor performance degradation with a specific component;
   OR
3. A Priority 2 call with a suitable workaround.

If the preceding problem exists **AND** there is no suitable workaround, this will be determined to be a Priority 3 call.

d) Priority 4

Defined as a feature or information request. To determine if this is a Priority 4, the following condition(s) must exist:

1. A feature request or request for information has been made; OR
2. A priority 3 call is made but there is a suitable workaround.

A priority 4 issue that is a feature request will be logged into the product feature request system and will be made part of the Market Requirement Document for the subsequent releases.

Normally the timelines are established with respect to the specific client's requirements and are made part of the SLA agreements/contract that 5G enters with their clients.

8.0 Project Closure Processes

Whenever the software development objectives that were laid out at the beginning by the client are met by the developed software system, then the Project Closure process is initiated.

Although successful delivery of the work product indeed marks the end of the work, it is also necessary for the organization to document the shortcomings and problems encountered in the project so that the organization as a whole can learn from them and work towards improving the process & quality aspects of the organization.

As part of the project closure process, the project team needs to perform the following:

i. Collect and hand over all project records to the clients. This also includes all the proprietary information and records the belong to the clients

ii. Initiate the Sign-Off document (ref: Process Template/Sign-Off Document)

iii. Archive the source code, by taking necessary back up of all project related information for future use. This includes technical documents, emails, correspondence and all other relevant project information

iv. Prepare & submit the Project Closure Analysis report (included below).

8.1 Project Closure Analysis report

1. General Information	
Productivity	Total Actual Effort (Person Days): Productivity (Unit of work/person days):
Quality	Acceptance Defects: Quality (defects/Unit of Work):

2. Project Duration

	Planned	Actual	Variance
Start Date			
End Date			

3. Process Details

Process Tailoring done (if any)

4. Tools Used

Notes on Tools

5. Risk Management

Risks Identified at the beginning of the project
Risk encountered during the project
Notes on Mitigation

6. Size

	Planned	Actual
Number of Simple Units		
Number of Medium Units		
Number of Complex Units		

7. Defects

Distribution of Defects by Severity

Severity	Number of Defects	Percentage of Total Defects
Cosmetic		
Minor		
Major		
Critical		

Distribution of Defects by Defect Type

Type	Number of Defects	Percentage of Total Defects
Design Issue		
Hard-Code		
Initialize		
Logic		
Standards		
User Interface		
Other		

8. Process Assets Submitted

List all the process documents, templates etc. that were prepared and submitted.

The project closure process at 5G is aimed at continuous improvement and making the 'knowledge learnt' available to other projects in the organization.