

## UNIT 1: Introduction to Project Initiation

Pankaj Jalote, CMM in Practice, Person Education. [PJ#]

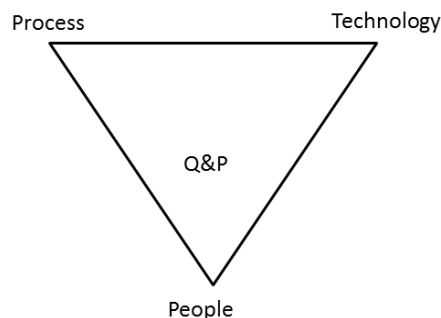
Pankaj Jalote, Software Project Management in Practice, Addison-Pearson. [SPMIP#]

| Unit | Unit Name                          | Sub Unit | Topics                                       | Reference Chapter/Additional Reading    |
|------|------------------------------------|----------|--|---|
| 1    | Introduction to Project Initiation | 1.1      | Process-Based Approach for Project Execution | PJ#1, Page No 2-5, SPMIP#1, Page No. 14 |
|      |                                    | 1.2      | Capability Maturity Model for Software       | PJ#1, Page No 5-15, SPMIP#1, Page No. 5 |
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### 1.1 Process-Based Approach for Project Execution

- A software development project is one in which a software product to fulfill some needs of a customer should be developed and delivered within a specified cost and time period.
- Three main characteristics of project,
  - Cost
  - Schedule
  - Quality
- When all these three meet or exceed the expectations then we can say that the project is successful.
- Improper estimation, loose requirements management, weak project management, improper risk management and poorly engineered solutions are reasons for project failure.
- For a project to succeed, a key success parameter is a set of process followed in project.

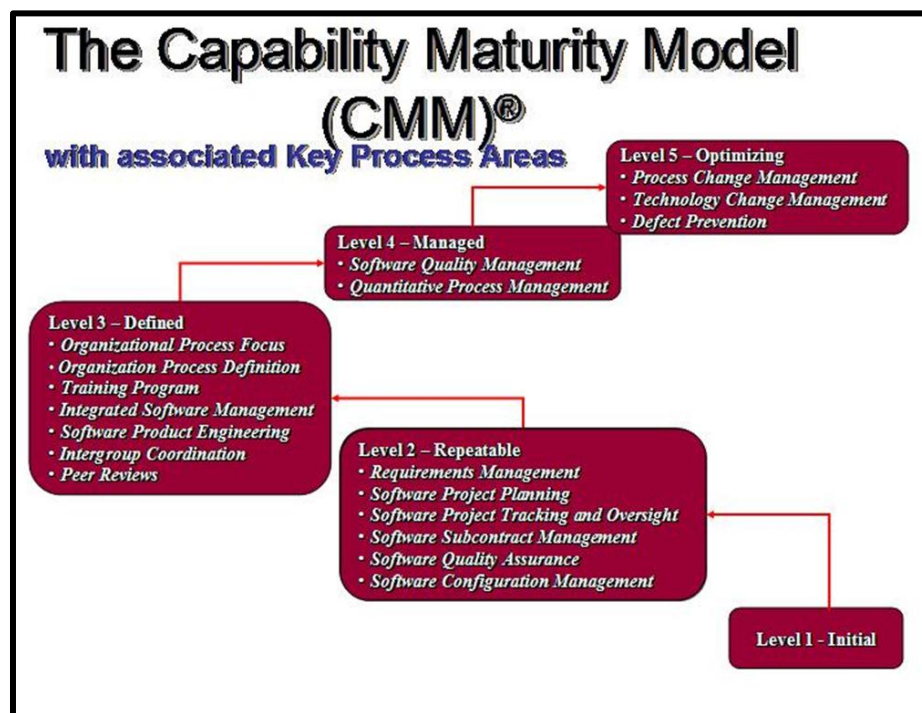
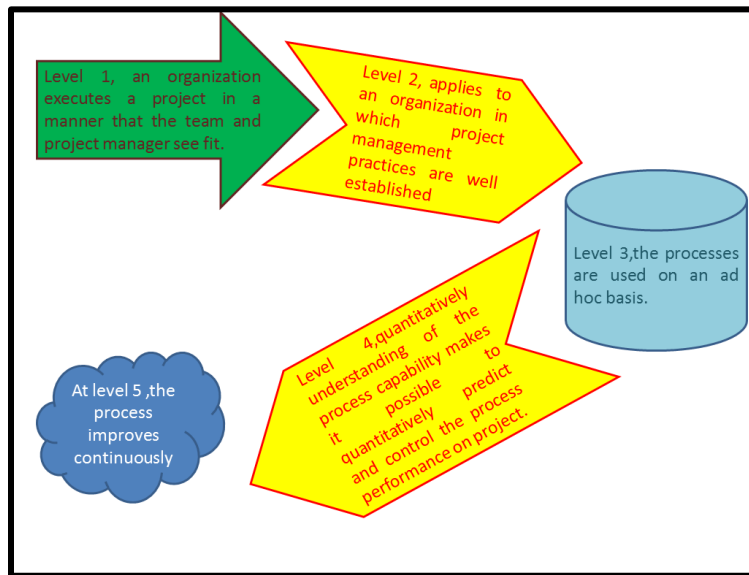
- If suitable process models are chosen for the important task in the project and the chosen processes are executed properly, then the chances of a project succeeding become extremely high.
- As having high productivity is generally reduce cost and minimize the schedule for a project.
- High quality and productivity (Q&P) can be viewed as the twin aims of a project delivering a software product.
- An organization generally wants predictability, it not enough that a project have high Q&P.
- An organization desires continues improvement in Q&P.
- Q&P of an organization depends on three factor:
  - Process
  - People
  - technology
- This relation sometimes called **quality triangle**.
- This quality triangle is similar to the **process-technology-leadership triangle**.
- Also known as **iron triangle**.



- One way to improve Q&P is to improve the processes used by the organization.
- Technically, a process for a task comprises a sequence of steps that should be followed to execute that task. Process also plays a key role in effectively managing the growth of an organization.

## 1.2 Capability Maturity Model for Software

- Once it is accepted that proper processes are essential for an organization to consistently deliver high quality and have high productivity, a question immediately arises:
  - What are the desired characteristics of an organization's processes for executing software projects?
  - How can the organization improve the process for improving the Q&P?
  - What are the characteristics of the improved process?
- A process framework specifies some characteristics that the process must have to "quality" as a process of some maturity.
- The maturity of a process may be classified in some level and a framework may characterize a process in two or more level.
- May frameworks are available for software processes, including ISO 9001, CMM, Trillium, SPICE and BOOTSTRAP.
- ISO 9001 is general standard for providing service.
- CMM for software is a framework that focuses on processes for software development.
- **Maturity Level in CMM**
  - The range of results that can be expected in a project when it is executed using software process of an organization is the software process capability.
  - The actual result achieved in a project executed using the software process is the software process performance.
  - The path to higher maturity includes some well-defined plateaus that are viewed as **maturity levels by the CMM**.
  - Each level specifies certain characteristics for a process.
  - CMM framework describes the key element of software processes at different level of maturity.



○ **There are following reason for selecting these levels:**

- They represent the phase observed in organizations as their processes evolve and mature.
- Each level represents some reasonable process improvement from the previous level.

- The levels provide guidance in defining a set of process improvement areas, once the current level of the organization is determined.
- Each maturity level is characterized by some key process areas (KPAs), which specify the areas on which the organization should focus to elevate its processes to that maturity level.

| Level | KPAs   |
|-------|--|
| 1     | No KPAs  |
| 2     | Project management   |
| 3     | Institutionalization of process and some additional processes for engineering of software. |
| 4     | Quantitatively managing  |
| 5     | Process improvement  |

- **KPAs in Different Levels**

- The KPAs for a particular level can be considered as the requirement for achieving that maturity level.
- Each KPAs specifies group of activities, called key practices.
- The key practices are organized into various groups called commitment to perform, ability to perform, activities performed, measurements and analysis, and verifying implementation
- **Commitment to perform**
  - It describes the action that the organization must take to support the particular KPA.
- **Ability to perform**
  - It focus on issue like training, resource requirements and control structures, all of which are important to developing the ability in specific personnel and the organization as a whole to perform activities for that KPAs.

- **Activity performed**
  - It describes the actual process activities that are recommended.
- **Measurements and analysis**
  - It targets the measurements that should be done for the activities of the KPAs.
- **Verifying implementation**
  - It focuses on ensuring that the implementation of the process is verified through independent person and senior management.
- **Goal for KPAs at level 2**
  - The goal of Requirement Management(RM)
    - It ensures that the requirements are properly documented and the requirement changes are properly managed in the project.
  - The goal of Software Project Planning(SPP)
    - It ensures that proper planning is done for a project, which includes estimation and a listing of activities to be performed, and then the plan is documented.
  - The goal of Software Quality Attribute(SQA)
    - It focuses on reviews and audits carried out to ensure that proper processes are followed.
    - It also makes sure that quality assurance activities are planned and that proper actions are taken when the project fails to submit with the established standard and processes.
  - The goal of Software Configuration Management(SCM)
    - It ensures that programs and documents that must be controlled in project are identified, that changes to them are controlled, and that these activities are properly planned.
  - The goal of Software Project Tracking and Oversight(SPTO)
    - It ensures that, during the project execution, the actual performance of the project is evaluated against the plan and action as are taken when the actual performance deviates from the plans significantly.

- The organization that developing software subcontracts some parts of the development efforts to another organization at that time **Software Subcontract Management (SSM)** KPA is applicable.
- The organization that handle all activities relating to the project themselves, in that SSM in to applicable.

| KPA  | Goals   |
|------|---|
| RM   | <ul style="list-style-type: none"> <li>➤ Software requirements are controlled to establish a baseline for software engineering and management activities.</li> <li>➤ Software plans, products, and activities are kept consistent with requirement.</li> </ul>  |
| SPP  | <ul style="list-style-type: none"> <li>➤ Estimates are documented for use in planning and tracking the project.</li> <li>➤ Project activities and commitments are planned and documented.</li> <li>➤ Affected groups and individuals agree to their commitments related to the project.</li> </ul>  |
| SPTO | <ul style="list-style-type: none"> <li>➤ Actual result and performances are tracked against the software plan.</li> <li>➤ Corrective actions are taken and managed to closure when actual results and performance differ significantly from the software plans.</li> <li>➤ Affected groups and individuals agree with changes to commitments.</li> </ul>  |
| SQA  | <ul style="list-style-type: none"> <li>➤ Software quality assurance activities are planned.</li> <li>➤ Observance of software products and activities to the applicable standards, procedures and requirements is verified objectively.</li> <li>➤ Affected groups and individuals are informed of software quality assurance activities and results.</li> <li>➤ Noncompliance issue that can not be resolved within the project are addressed by senior management.</li> </ul> |

|     |  |
|-----|--|
| SCM | <ul style="list-style-type: none"> <li>➤ Software configuration management activities are planned.</li> <li>➤ Selected software work products are identified, controlled and available.</li> <li>➤ Changes to identified software work products are controlled.</li> <li>➤ Affected groups and individuals are informed of the status and content of software baseline.</li> </ul>                                     |
| SSM | <ul style="list-style-type: none"> <li>➤ The prime contractor and the subcontractor agree to their commitments.</li> <li>➤ The prime contractor tracks the subcontractor's actual results against its commitments.</li> <li>➤ The prime contractor and subcontractor maintain ongoing communication.</li> <li>➤ The prime contractor tracks the subcontractor's actual performance against its commitments.</li> </ul> |

## • Goal for KPAs at level 3

- The goal of Organization Process Focus (OPF)
  - It ensures that process definition and improvement activities are executed in a planned manner in the organization.
- The goal of Organization Process Definition (OPD)
  - It requires that the processes are defined and documented and that information about the use of process is collected and is made available to other projects.
- The goal of Training Program (TP)
  - It ensures that the organization has identified the training needs for the various roles and that project people receive necessary training in a planned manner.
- The goal of Integrated Software Management (ISM)
  - It requires that process used for a project be tailored from the standard process.
- The goal of Software Product Engineering (SPE)



- It focus on the engineering task bring performed in the project, with engineering task being performed properly and the different work, products remaining consistent, even under the face of changes.
- The goal of Peer Review(PR)
  - It ensures that peer review activities are properly carried out in a project and that sufficient support for conducting per reviews and follow up activities is provided.
- When multiple engineering groups are involved at that time Intergroup Coordination (IC) KPA is applicable.

| KPA | Goal   |
|-----|--|
| OPF | <ul style="list-style-type: none"> <li>➤ Software process development and improvement activities are coordinated across the organization.</li> <li>➤ The strength and weaknesses of the software processes used are identified.</li> <li>➤ Organization-level process development and improvement activities are planned.</li> </ul>                                 |
| OPD | <ul style="list-style-type: none"> <li>➤ A standard software process for the organization is developed and maintained.</li> <li>➤ Information related to the use of the organization's standard software process by the software project is collected, reviewed and made available.</li> </ul>   |
| TP  | <ul style="list-style-type: none"> <li>➤ Training activities are planned.</li> <li>➤ Training for developing the skills and knowledge needed to perform software management and technical roles is provided.</li> <li>➤ Individuals in the software engineering group and software related groups receiving the training necessary to perform their jobs.</li> </ul> |

|     |   |
|-----|---|
| ISM | <ul style="list-style-type: none"> <li>➤ The project's defined software process is a tailored version of the organization's standard software process.</li> <li>➤ The project is planned and managed according to the project's define software process.</li> </ul> |
| SPE | <ul style="list-style-type: none"> <li>➤ The software engineering tasks are defined, integrated and consistently performed to produce the software.</li> <li>➤ Software work products are kept consistent with each other.</li> </ul>                               |
| IC  | <ul style="list-style-type: none"> <li>➤ All affected groups agree to the customer's requirements.</li> <li>➤ All groups agree to the commitments between different groups.</li> <li>➤ The group identifies, track and resolve intergroup issues.</li> </ul>        |
| PR  | <ul style="list-style-type: none"> <li>➤ Peer review activities are planned.</li> <li>➤ Defects in the software work products are identified and removed.</li> </ul>  |

- **Goal for KPAs at level 4**

- The goal of Quantitative Process Management (QPM)
  - It ensures that the capability of the organization process is understood quantitatively and that process capability is employed to set quantitative goals for a project.
- The goal of Software Quality Management(SQM)
  - It requires that the project set quantitative quality goals and have suitable plans of achieving this goal.

| KPA | Goal   |
|-----|--|
| QPM | <ul style="list-style-type: none"> <li>➤ The quantitative process management activities are planned.</li> <li>➤ The process performance of the project's defined software process is controlled quantitatively.</li> <li>➤ The process capability of the organization's standard software process is known in quantitative terms.</li> </ul> |

|     |  |
|-----|--|
| SQM | <ul style="list-style-type: none"> <li>➤ The projects' software quality management activities are planned.</li> <li>➤ Measureable goals for software product quality and their priorities are defined.</li> <li>➤ Actual progress toward achieving the quality goals for the software products is quantified and managed.</li> </ul> |
|-----|--|

- **Goal for KPAs at level 5**

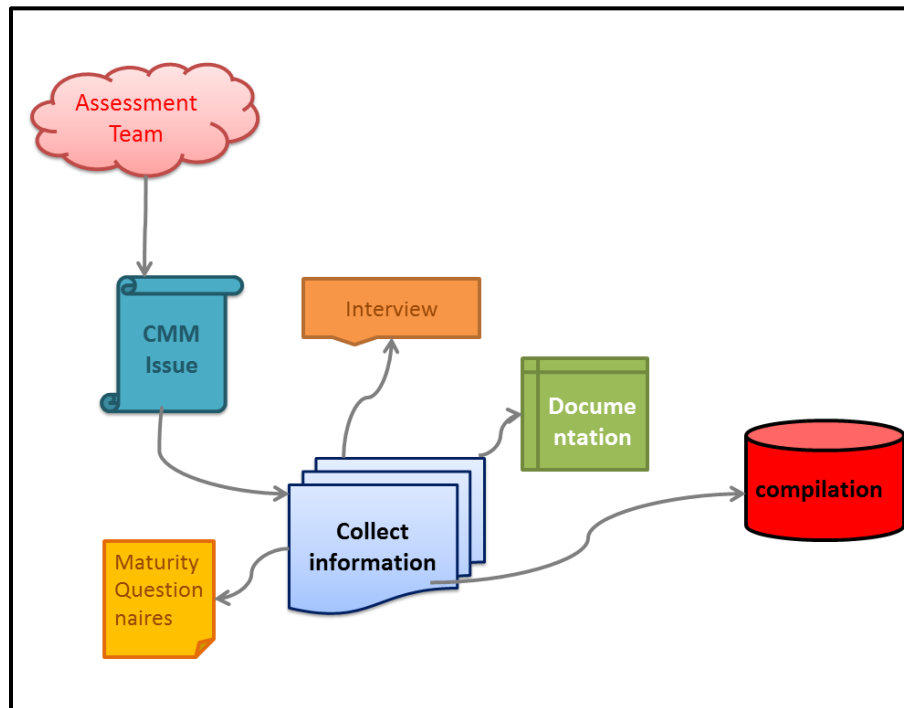
- The goal of Defect Prevention (DP)
  - It requires that the defect prevention be done proactively-by systematically analyzing the causes of defects and then eliminating those causes.
- The goal of Technology Change Management (TCM)
  - It focus o the proactive introduction of technology in the organization to improve quality and productivity.
- The goal of Process Change Management (PCM)
  - It require that process improvement of a large cross-section of the organization

| KPA | Goal  |
|-----|---|
| DP  | <ul style="list-style-type: none"> <li>➤ Defect prevention activities are planned.</li> <li>➤ Common causes of defects are sought and identified.</li> <li>➤ Common causes of defects are prioritized and systematically eliminated.</li> </ul>   |
| TCM | <ul style="list-style-type: none"> <li>➤ Incorporation of technology changes in planned.</li> <li>➤ New technologies are evaluated to determine their effects on quality and productivity.</li> <li>➤ Appropriate new technologies are transferred into normal practice across the organization.</li> </ul> |
| PCM | <ul style="list-style-type: none"> <li>➤ Continuous process improvement is planned.</li> </ul>  |

- Participation in the organization's software process improvement activities is organization-wide.
- The organization's standard software process and the project's defined software process are improved continuously.

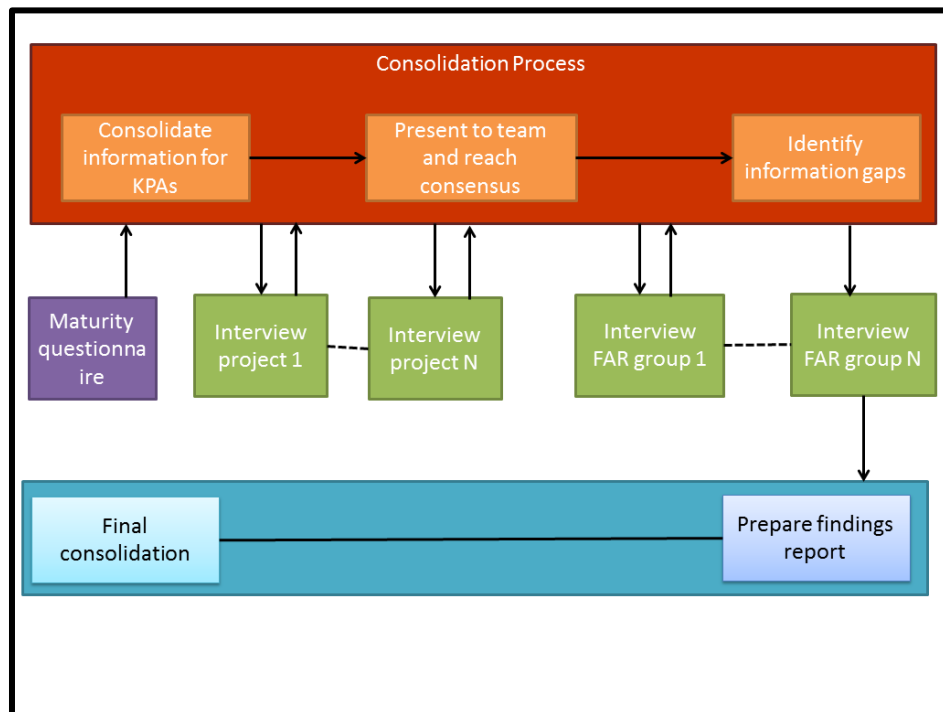
- **Software Capability Assessment Method**

- The approach that organizations use for their process assessment and improvement is called the CMM-based appraisal for internal process improvement (CBA-IPI).
- Software capability evaluation usually takes place at the request of someone outside the organization being evaluated.
- Groups of technical personnel representing different functions are interviewed. This group called functional area representative (FAR) group.
- The assessment is performed by an assessment team.
  - This is led by an SEI-authorized lead assessor and consists of 6 to 10 experienced people from the organization under scrutiny.'
- The team member must be familiar with CMM and processes-related issues and receive assessment training from the lead assessor.
- During the course of assessment, the team members collect information about the software process of the organization
  - there are three main sources of information:
    - Maturity questionnaires
    - Documentation
    - Interviews



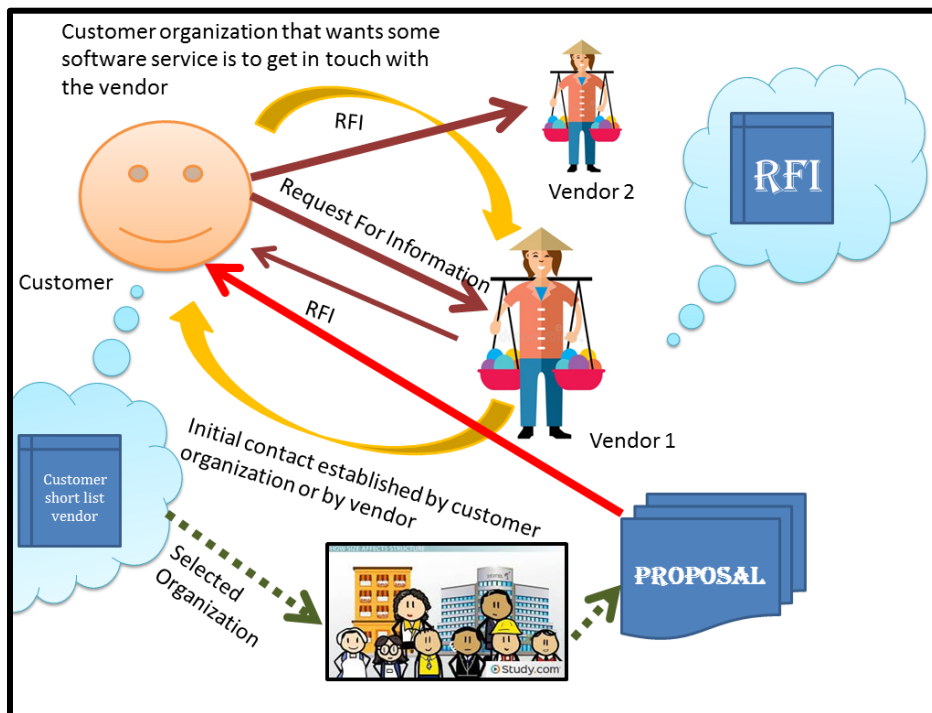
- Maturity questionnaire is an instrument that is used to get some feedback regarding the process being used in the organization.
  - It contains a set of questions for each KPA.
  - The question asks whether a practice is being followed.
    - Possible answer is like yes, no, don't know and does not apply.
    - If the answer is yes, then the statement in the question could be treated as an **observation**.
    - **At least two independent observations from two different sources require.**
  - Questionnaires are given to project leader, their supervisor and some project team member.
- For the assessment, four to six projects are selected that are represent the project profile of an organization.
- Documentation from these projects is made available to the assessment team, and their project leader is interviewed individually to obtain more observations and seek any necessary clarification.
  - Documents describing the processes are examined for the purpose of making observation.

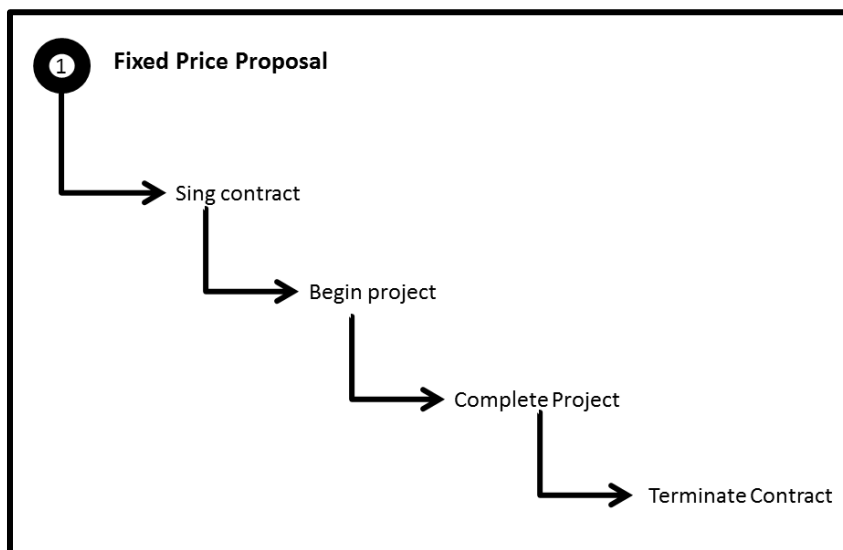
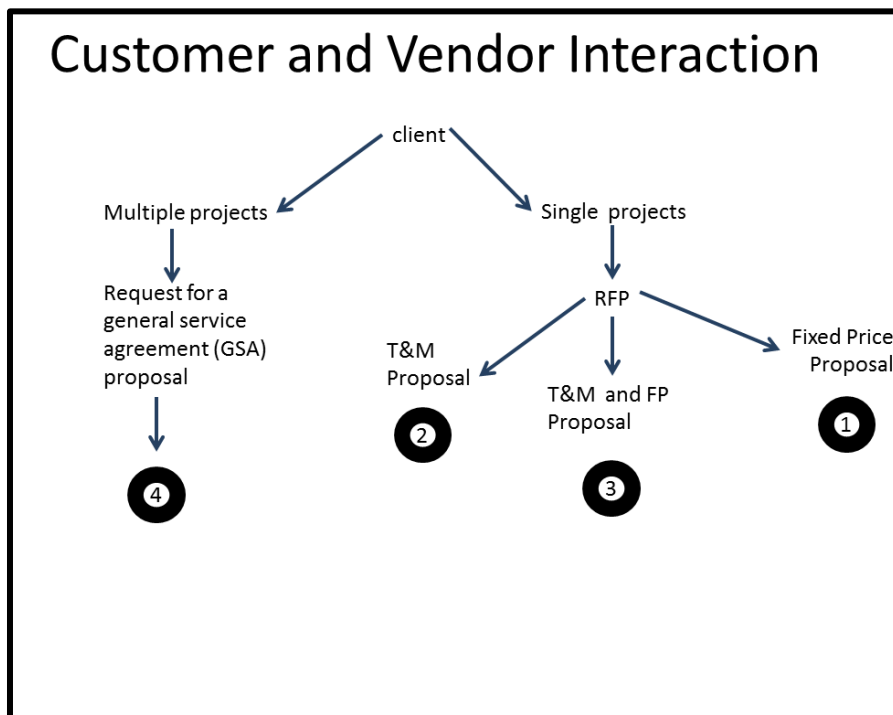
- For technical personnel representing different functions are interviewed called functional area representative (FAR) group.
  - In an **assessment 4 to 6 FAR groups** may be interviewed, with **each FAR group having 4 to 10 people**. Possible FAR groups include following:
    - Project Leaders, Middle managers to whom project leaders report, Configuration controllers, Software engineering process group member, Training personnel ,Developers, Tester, analyst
- The interview attempt to obtain evidence regarding the usage of key practices of different KPAs.
  - It clarifying doubts and as additional sources of information.
- To consolidate the information on a KPA, a coverage sheet is used which lists all requirements for the KPAs and provides space for making observations.



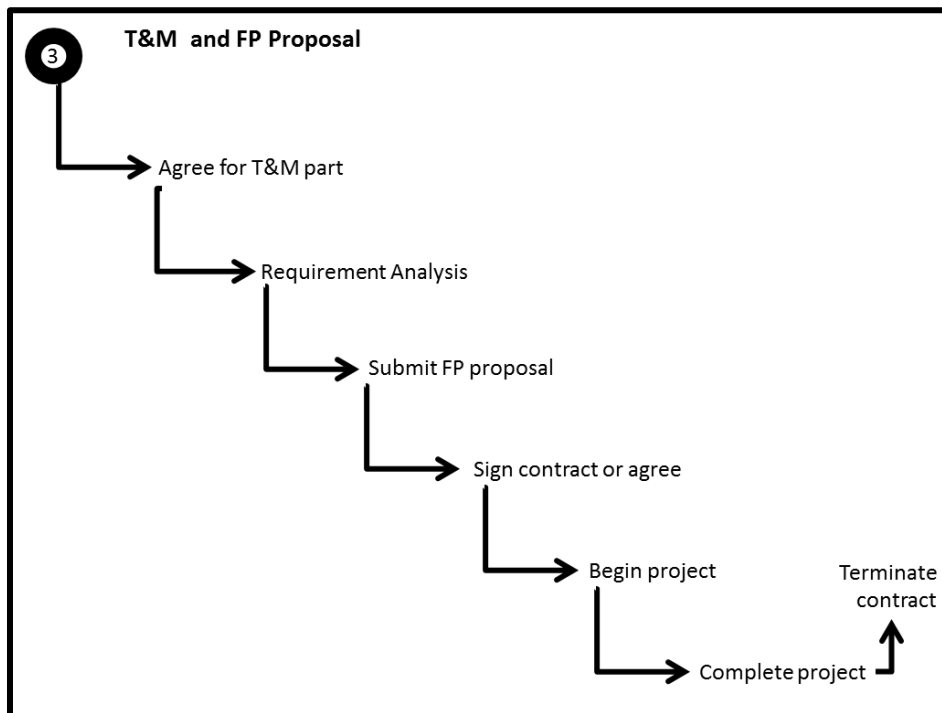
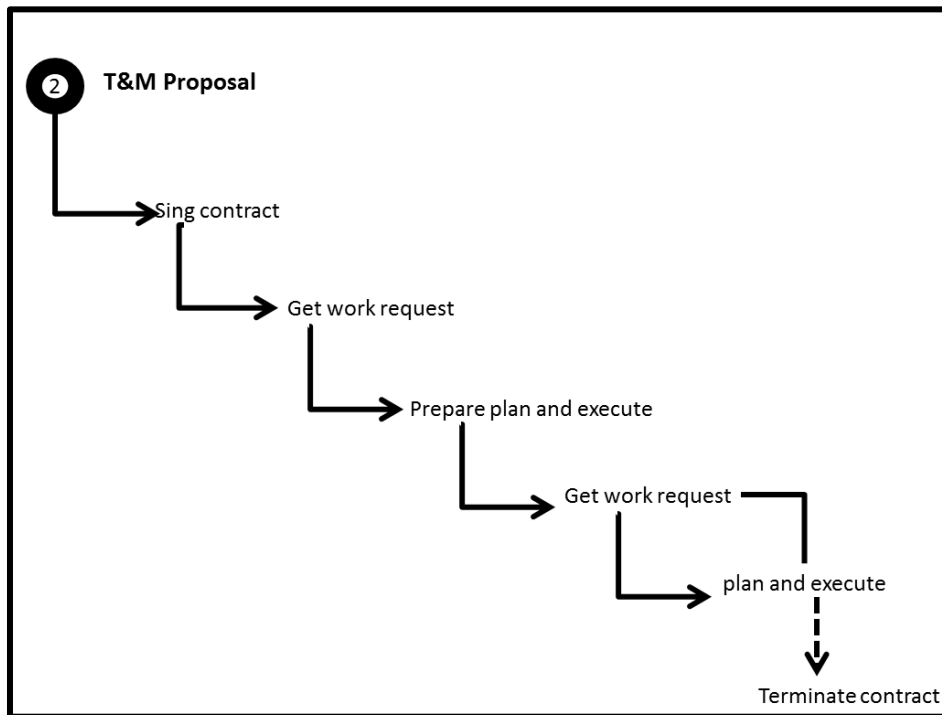
## 1.3 Proposals and Contracts

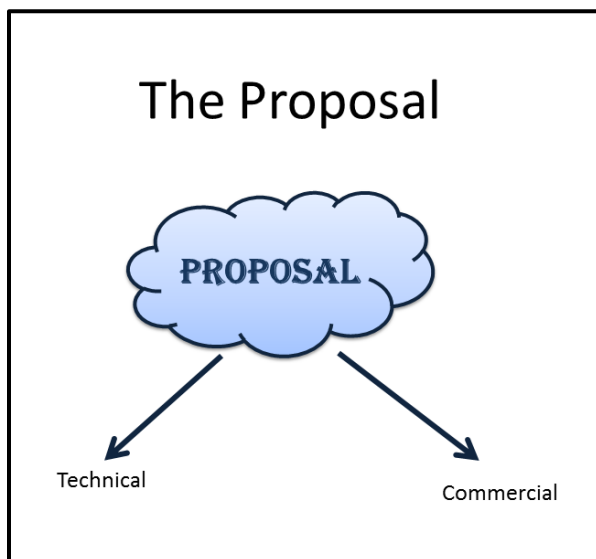
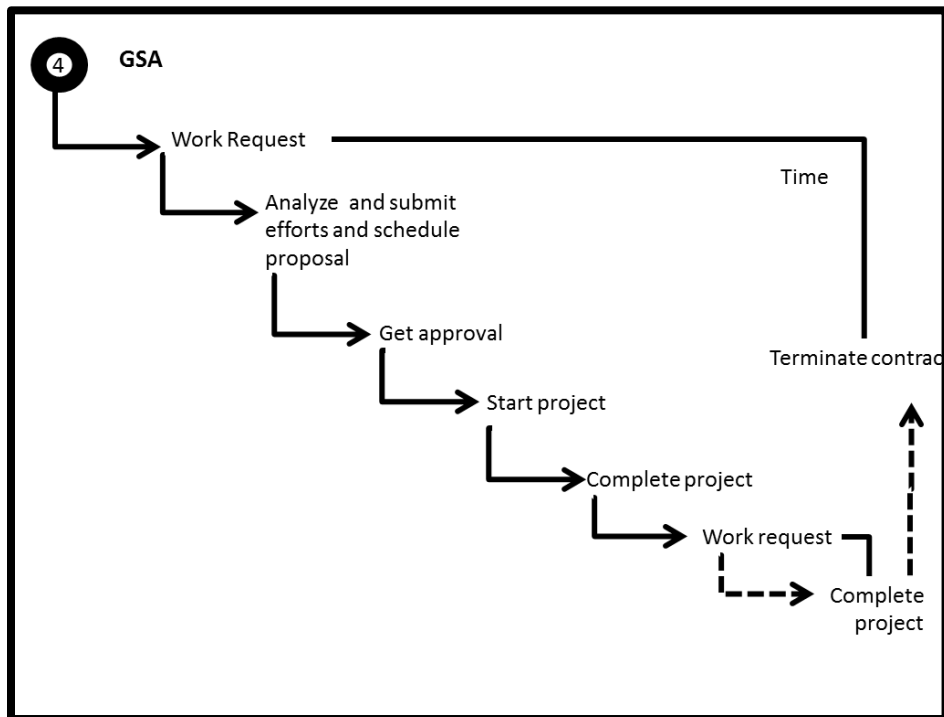
- Contract contains general terms and conditions, and the specific terms for a particular project for providing some software service might be specified in a proposal for that project.
- A vendor precedes with the project only, when the proposal has been accepted and the contract signed.
- Following issues are handled in contract and proposal:
  - Legal concerns
  - Commercial arrangements
  - Intellectual property rights
- **Customer and Vendor Interaction**
- Based on customer requirement, different models are used.
- Following are example of models:
  - Fixed-Price model
  - Time and materials model
  - Time and materials and fixed price model











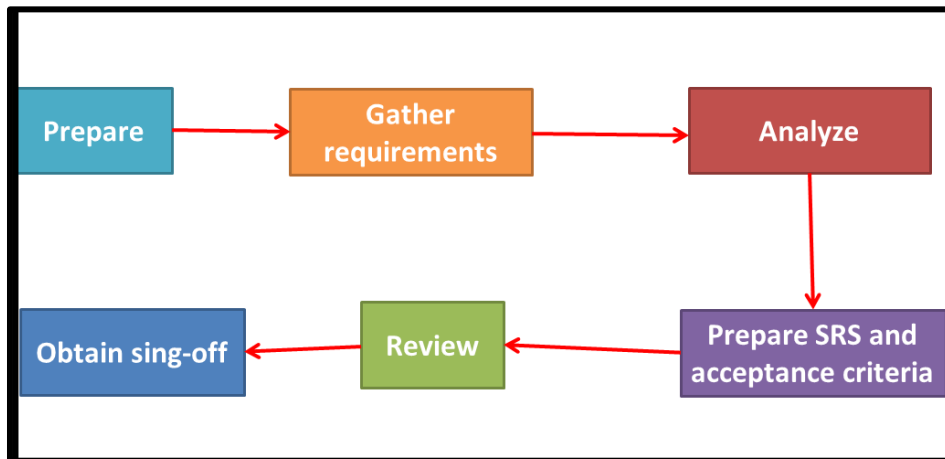
- Following details are included in technical part of proposal.
  - Technical description
  - Assumption
  - Proposed solution
  - Effort estimation
  - Project schedule
  - Customer responsibility

- Penalty/reward for timely delivery
- Risk management
- Requirement changes
- Other requirement and issue.
- Commercial part of proposal basically deals with all of the economic aspects:
  - Pricing details
  - Payment schedule
- Proposal is generally prepared by the project leader.
- **The Contract**
  - A contract is a legal document and generally covers areas not directly related to software development.
  - It preferred before the work, sometimes there is a protected negotiation on the terms of the contract.
  - In this situation, a **“letter of intent”** is given to start the project work, with contract preparation done in parallel.
- Contract agreement is taking a long time, the vendor might require a purchase order from the customer.
- It implies that the work can start and, if an agreement cannot be reached on the terms of the contract, the customer will pay for the amount of work done.
- Following type of clauses are included in contract:
  - Scope of service
  - Estimation
  - Rates and payments
  - Hardware and software
  - Confidentiality
  - Security
  - Rights on data
  - Nonsolicitation
  - Warranty
  - Limitation of liability
  - Indemnity

- **Service-level agreements**
- Beside these options, there are clauses on jurisdiction (which laws apply), arbitration (what to do in case of disagreements), termination of contract, payments defaults.

### 1.3 Requirement Specification and Management

- The three major activity relating to requirements are as follows,
  - Requirement analysis and specification
    - Specification done at the start of the project.
  - Requirements change management
    - Change management is done throughout the project.
  - Requirement traceability management
  - It ensures that all requirements can be traced to elements in the output procedure in later stages of the project and to the origins of the requirements.
- **Requirements Analysis and specification**
  - The main objective of the requirement analysis is to produce a document that properly specifies all requirements of the customer.
    - **Software Requirement Specification (SRS) document is primary output of this phase.**
    - The activities performed during the requirements phase focus on two areas:
      - Problem analysis
      - Product description
      - Problem analysis are grouped in to three phase:
        - Preparing
        - Gathering requirements
        - Analysis
      - Product description are grouped in to three phase:
        - Preparing SRS
        - Reviewing it obtaining the final sign-off from the customer

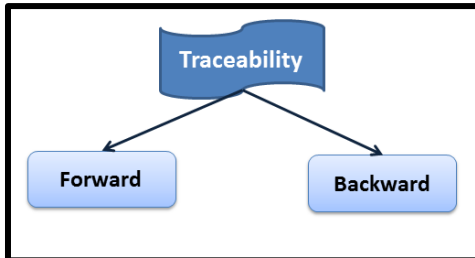


## ○ Requirements Change Management

- Changes in requirements can come at any time during the life of a project or after that.
- When there are some new requirements or changes to existing requirements at that time requirement change management activities performed..
- The basic goal of the requirement change management process is control requirement changes and minimize their effect on the project.
- Requirement change management has two aspects:
  - Agreement with the customer about how to deal with the changes.
  - Process of actually making the changes.
- Project leader is primarily responsible for executing this process.
- Following are steps of requirement change management process:
  - Log the changes
  - Perform impact analysis on the work products
  - Estimate effort needed for the change request.
  - Reestimate delivery schedule.
  - Perform cumulative cost impact analysis.
  - Review the impact with senior management, if thresholds are exceeded obtains customer sign-off.
  - Obtain customer sign-off.
  - Rework work products.

## ○ Traceability Management

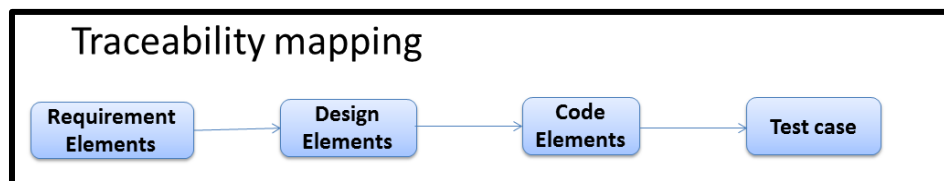
- It is possible to trace each requirement to design and code that implement that requirement and test cases that test the implementation.



- Forward traceability implies that it is possible to trace a requirement to elements in the outputs of later phases in the life cycle.
  - It is essential to ensure that the software meets the requirement.
- Backward traceability implies that it is possible to trace elements in the output of various stages back to requirements.
  - It is useful during change, regression testing.

## ■ Traceability Matrix

- Simplest way to support traceability is to have a mapping from requirement elements to design elements from design elements to code elements and from code elements to test cases.
  - At Infosys this mapping is maintain in a traceability matrix.



| Reqm t# | Descrip tion | HLD doc. Ref# | Design equivalent | Implemen tation equivalent | Unit test case | Integra tion/sy stem test case | Acceptance test case |
|---------|--------------|---------------|-------------------|----------------------------|----------------|--------------------------------|----------------------|
|         |              |               |                   |                            |                |                                |                      |

- Reqmt# is a reference to the requirement specification.
- Description should be obtained from the requirement specification.
- HLD doc. Ref# reference to the functional specification.
- Design is a section number from the corresponding design document
- Implementation refers to the corresponding program.
- Unit test case represent the test case number in unit test plan .
- Integration/system test case refers to the test case for the particular requirement being traced.
- Corresponding acceptance test for the particular requirement is mentioned in acceptance test case.
- **Usage of matrix**
  - Helps track/trace all requirements.
  - Providing a mechanism for reviewer.
  - Impact analysis when requirement changes.
  - Help in demonstrating customer
- Following completeness are check in matrix:
  - Go through the requirement number in the matrix and the requirements in the requirements document and ensure that all requirements are listed in the matrix and **none has been missed.**
  - To ensure that all programs listed in the matrix are needed in the final software and **no unnecessary code appears.**
  - One can check implementation of requirements by ensuring that **functional requirements have no blank columns.**
  - For each performance requirement, **there should be some test cases.**
  - The integration and system test **plan can be cross-checked with the matrix** to ensure that all conditions in the requirements are included in the system test plan.