

Unit-6:

Software Quality.

1.1 Portability

Software Quality:- A software quality product is defined in terms of its fitness of purpose. That is, a quality product does precisely what the users want it to do. For software products, the fitness of use is generally explained in terms of satisfaction of the requirements laid down in the SRS document.

Ex:- Consider a functionally correct software product. That is, it performs all tasks as specified in the SRS document. But, has an almost unusable user interface. Even though it may be functionally right, we can't consider it to be a quality product.

The modern view of a quality associated with a software product several quality methods such as the following:

1. portability: A software device is said to be portable, if it can be freely made to work in various OS environments, in multiple machines, with other software products etc.
2. usability: A software product has better usability if various categories of users can easily invoke the functions of product.
3. Reusability: A software product has excellent reusability if different modules of the product can quickly be reused to develop new products.

Correctness: A software product is correct if various requirements as specified in the SRS document have been correctly implemented.

Maintainability: A software product is maintainable if bugs can be easily corrected as and when they show up, new tasks can be easily added to the product, and the functionalities of the product can be easily modified.

Software Quality Mgmt System:

A quality management system is the principal methods used by organizations to provide that the products they develop have the desired quality.

A quality system subsists of the following:

① Managerial structure and Individual responsibilities:

A quality system is the responsibility of the organization as a whole. However, every organization has a quality department to perform various quality system activities. The quality system of an arrangement should have the support of the top management. Without the help for the quality system at a high level in a company, some members of staff will take the quality system seriously.

Quality system Activities: The quality system activities encompass the following:

Auditing of projects.

Review of the quality system.

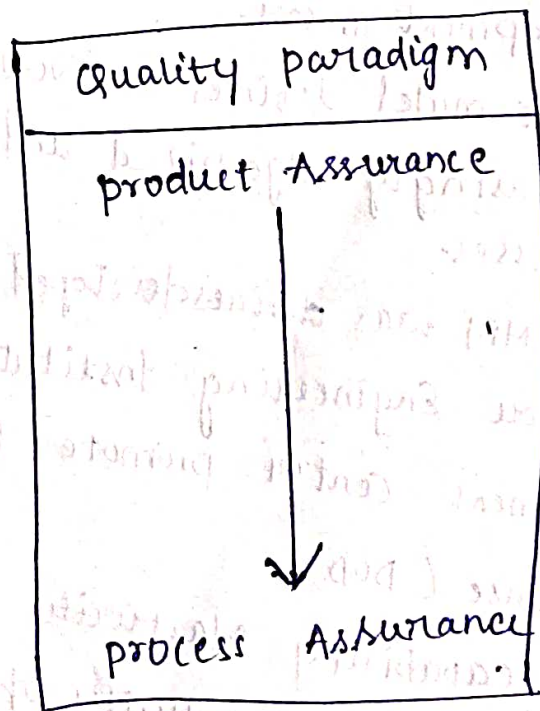
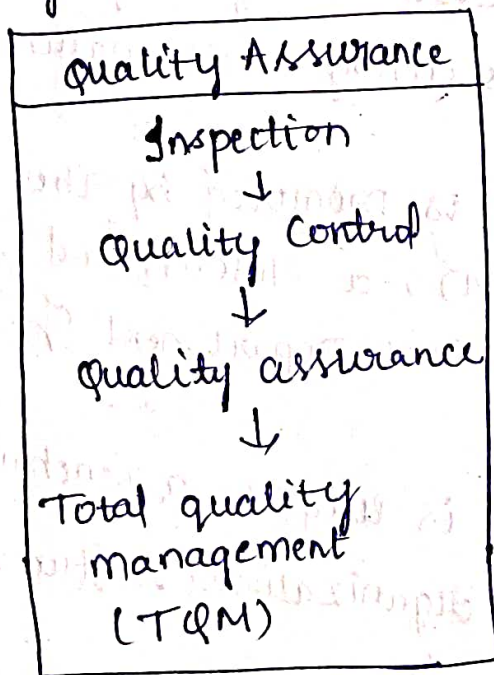
Development of standards, methods, guidelines etc.

production of documents for the top mgmt summarizing the effectiveness of the quality system in the organization.

Evolution of Quality Mgmt System:

Quality systems have increasingly evolved over the last five decades. Before world war II, the usual function to produce quality products was to inspect the finished products to remove defective devices. Since that time, quality systems of organizations have undergone through four steps of evolution, as shown in the fig. The first product inspection task gave method to quality control (QC).

Quality control target not only on detecting the defective devices and removes them but also on determining the causes behind the defects. Thus, quality control aims at correcting the reasons for bugs and not just rejecting the products. The next break through in quality methods was the development of quality assurance methods.



Total quality management (TQM) advocates that the process followed by an organization must be continuously improved through process measurements. TQM goes stages further than quality assurance and aims at frequently process improvement. TQM goes beyond documenting steps to optimizing them through a redesign. A term linked to TQM is Business process Reengineering (BPR).

BPR aims at reengineering the method business is carried out in an organization. From the above conversation, it can be stated that over the years, the quality paradigm has changed from product assurance to process assurance, as shown in fig.

Software Engineering Institute Capability Maturity Model (SEI CMM):

The capability maturity model (CMM) is a procedure used to develop and refine an organization's software development process.

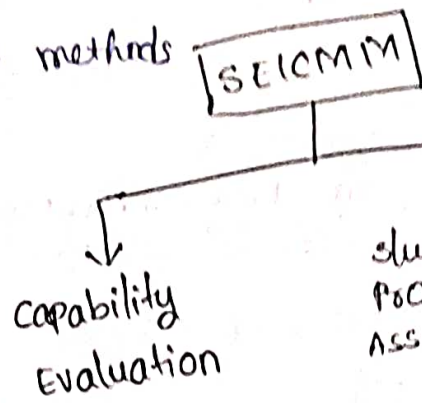
The model defines a five-level evolutionary stage of increasingly organized, and consistently more mature processes.

CMM was ~~defined~~ developed and is promoted by the software Engineering Institute (SEI), a research and development center promote by the U.S. Department of Defense (DOD).

capability Maturity model is used as a benchmark to measure the maturity of an organization's software process.

Methods of SEI CMM:

There are two methods of SEI CMM:-



Debugging techniques:-

① Back tracking

② Rule force

③ Program slicing

④ ~~Cause~~

Software Process Assessment

~~Cause~~ - Elimination methods

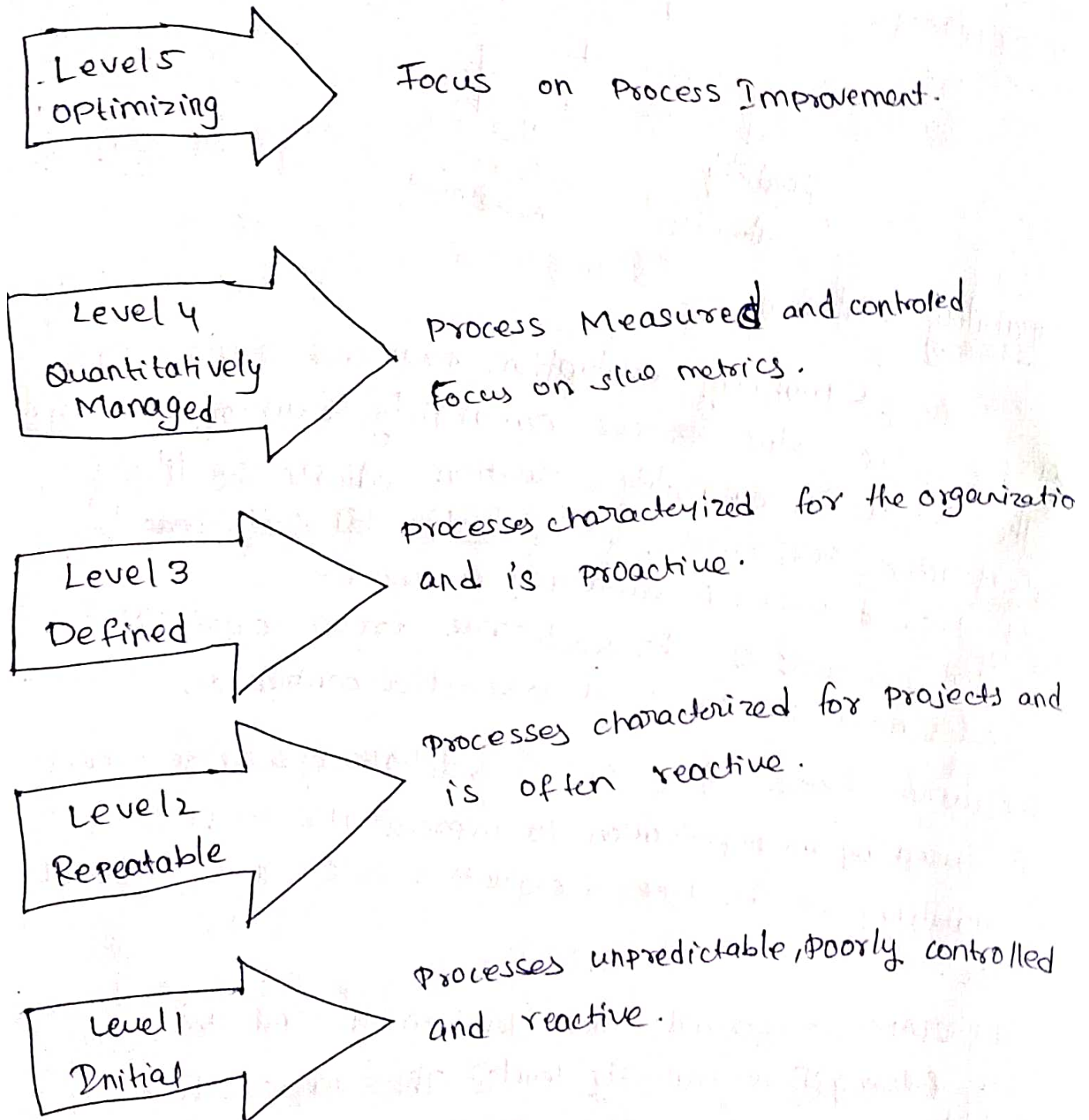
Capability Evaluation:-

Capability evaluation provides a way to assess the software process capability of an organization. The results of capability evaluation indicate the likely contractor performance if the contractor is awarded a work. ∴ The results of the software process capability assessment can be used to select a contractor.

Software Process Assessment:- Software process assessment is used by an organization to improve its process capability. Thus, this type of evaluation is for purely internal use.

SEI CMM categorized software development industries into the following five maturity levels. The various levels of SEI CMM have been designed so that it is easy for an organization to build its quality system starting from scratch slowly.

Levels of SEICMM.



slow Metrics:-

Product Metrics:- measure the features of the product being developed, such as its size, reliability, time complexity, understandability, etc.

Process Metrics:- follow the effectiveness of the process being used, such as average defect correction time, productivity, the avg number of failures detected during testing per LOC, etc.

→ various tools like Pareto charts, fishbone diagrams, etc are used to measure the product and process quality.

Key Process Areas (KPA) of a SW organization:-

Except for SEI CMM level 1, each maturity level is featured by several key process areas (KPA's) that contains the areas an organization should focus on improving its SW process to next level.

The focus of each level and the corresponding key process areas are shown below.

CMM level	Focus	KPA.
1. Initial	competent people	NO KPA'S.
2. Repeatable	Project Management	SW project planning SW configuration Management.
3. Defined	Definition of Processes	Process Definition Training program Peer reviews.
4. Managed	Product & process quality	Quantitative process Metrics, SW quality Mgmt.
5. Optimizing	continuous process improvement	Defect prevention Process change Mgmt.

SEI CMM provides a series of key areas on which to focus to take an organization from one level of maturity to the next.

Quality Paradigm:-

The modern quality paradigm includes certain guidance for recognizing, defining, analyzing and improving the production process.

→ Total Quality Mgmt advocates that the process followed by an organization must be continuously improved through process measurements.

→ TQM aims at continuous process improvement.



MCCall's Quality Model :-

MCCall's Quality model was introduced in 1977. This model is incorporated with many attributes, termed as quality factors, which influence a quality. The model distinguishes between two levels of quality attributes.

① Quality Factors:

The higher level quality attributes which can be assessed directly are called quality factors. These attributes are external attributes. The attributes in this level are given more importance by the users and managers.

ex: correctness, efficiency, reliability, usability, ---

② Quality Criteria :-

The lower or second level quality attributes which can be assessed either subjectively or objectively are called Quality criteria. These attributes are internal attributes. Each quality factor has many second level of quality attributes or quality criteria.

ex

slus Engineering | Debugging Approaches. | unit-5 |

Debugging: It is the process of finding and resolving defects or problems within a computer program - ~~that prevent correct operation of~~

Need for Debugging:- Once errors are known during a program code, it's necessary to initially establish the precise program stmts. liable for the errors and so to repair them.

Debugging Approaches:- The following are a number of approaches popularly adopted by programmers for debugging.

* Brute Force Method:

* It is the least economical method.

→ During this approach, the program is loaded with print stmts to print the intermediate values with the hope that a number of the written values can facilitate to spot the stmt in error.

(Refer geek for geeks).

slw Reliability.

#slw ors slw reliability.

Reliability metrics,

Reliability :-

slw reliability means "operational Reliability." It is described as the ability of a system or a component to perform its required functions under static conditions for a specific period.

Reliability Metrics :-

Reliability metrics are used to express the reliability of slw product quantitatively.

some reliability metrics which can be used to quantify the reliability of the slw product are as follows:

- ① Mean time to failure (MTTF)
- ② Mean time to Repair (MTTR)
- ③ Mean time b/w failure (MTBF)
- ④ Rate of occurrence of failure (ROOF)
- ⑤ Probability of failure on Demand (POFD)
- ⑥ Availability (AVAIL)

① Mean time to failure (MTTF) :- It is described as the time interval b/w two failures. An MTTF of 200 mean that one failure can be expected each 200-times. The time units are entirely dependent on the system & it can even be stated in the no. of transactions.

To measure MTTF, we can evidence the failure data for n failures. Let the failures appear at the time instants $t_1, t_2, \dots, t_n$.

MTTF can be calculated as

$$\sum_{i=1}^n \frac{t_{i+1} - t_i}{(n-1)}$$

② Mean Time to Repair (MTTR):

once failure occurs, some time will be required to fix the errors. MTTR measures the average time it takes to track the errors causing the failure and to fix them.

③ Mean Time Between Failure (MTBF):

We can merge MTTF + MTTR to get MTBF metric.

$$MTBF = MTTF + MTTR.$$

④ Rate of Occurrence of Failure: (ROCOF):

It is the number of failures appearing in a unit time interval. The no. of unexpected events over a specific time of operation.

A ROCOF of 0.02 mean that two failures are likely to occur in each 100 operational time unit steps. It is also called the failure intensity metric.

⑤ Probability of Failure on Demand (POFOD):

POFOD is described as the probability that the system will fail when a service is requested.

A POFOD of 0.1 means that one out of ten service requests may fail.

⑥ Availability (AVAIL):-

Availability is the probability that the system is applicable for use at a given time. An availability of 0.995 means that in every 1000 time unit, the system is feasible to be available for 995 of these.

Slow Metrics for Reliability:-

The metrics are used to improve the reliability of the system by identifying the areas of requirements.

Different Types of Slow metrics are:

- ① Reliability Metrics.
Requirements
- ② Design & Code Reliability Metrics.
- ③ Testing Reliability Metrics.