



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

SOFTWARE ENGINEERING

Question Bank

UNIT:3-4

B. Tech. III YEAR A & B / BATCH : 2021 -25

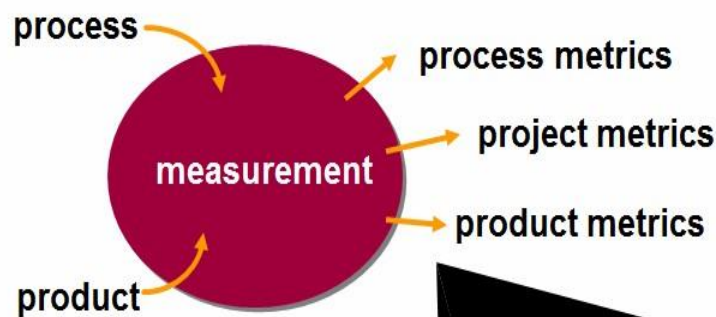
Dr. Archana Sharma

1) Describe the Metrics?

Ans: Software Process and Product Metrics are quantitative measures.

- They are a management tool.
- They offer insight into the effectiveness of the software process and the projects that are conducted using the process as a framework.
- Basic quality and productivity data are collected.
- These data are analysed, compared against past averages, and assessed.
- The goal is to determine whether quality and productivity improvements have occurred.
- The data can also be used to pinpoint problem areas.
- Remedies can then be developed and the software process can be improved.

2) Need for Software Metrics:



To **characterize** in order to

- Gain an understanding of processes, products, resources, and environments.
- Establish baselines for comparisons with future assessments

To **evaluate** in order to

- Determine status with respect to plans

To **predict** in order to

- Gain understanding of relationships among processes and products.
- Build models of these relationships

To **improve** in order to

- Identify roadblocks, root causes, inefficiencies, and other opportunities for improving product quality and process performance.

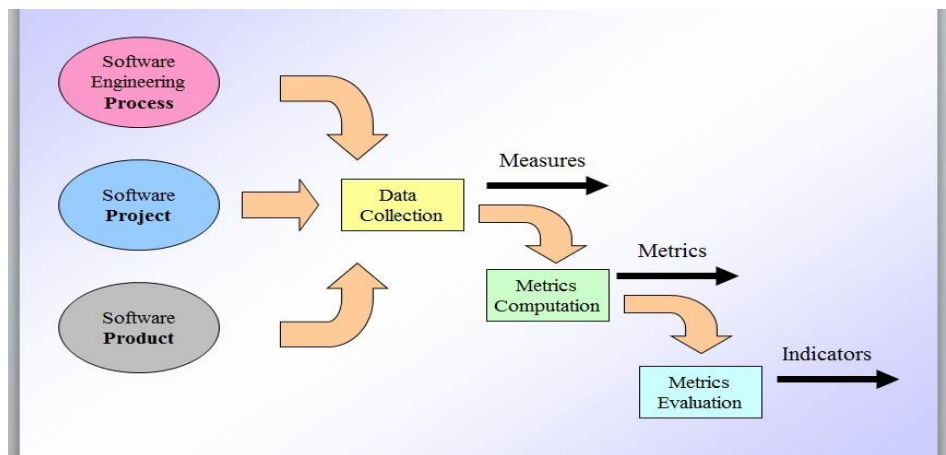
3. Describe the Process Metrics?

Ans: Process metrics are collected across all projects and over long periods of time.

- They are used for making strategic decisions.
- The intent is to provide a set of process indicators that lead to long-term software process improvement.

The only way to know how/where to improve any process is to

1. Measure specific attributes of the process.
2. Develop a set of meaningful metrics based on these attributes.
3. Use the metrics to provide indicators that will lead to a strategy for improvement.



3) How can we measure the effectiveness of a Process?

Ans: We measure the effectiveness of a process by deriving a set of metrics based on outcomes of the process such as:

- Errors uncovered before release of the software.
- Defects delivered to and reported by the end users.
- Work products delivered.
- Human effort expended.
- Calendar time expended.
- Conformance to the schedule.
- Time and effort to complete each generic activity.

4. Describe is Product Metrics?

Ans: They focus on the quality of deliverables. Product metrics are combined across several projects to produce process metrics.

Metrics for the product:

- Measures of the Analysis Model.
- Complexity of the Design Model
- Code metrics.

Furthermore, Complexity of the Design Model is classified as-

1. Internal algorithmic complexity.
2. Architectural complexity.
3. Data flow complexity.

4. Highlight the attributes of a software metrics?

Ans: Following are the attributes of a software metrics-

- 1. Simple and computable.** It should be relatively easy to learn how to derive the metric, and its computation should not demand inordinate effort or time.
- 2. Empirically and intuitively persuasive.** The metric should satisfy the engineer's intuitive notions about the product attribute under consideration
- 3. Consistent and objective.** The metric should always yield results that are unambiguous.
- 4. Consistent in its use of units and dimensions.** The mathematical computation of the metric should use measures that do not lead to bizarre combinations of unit.
- 5. Programming language independent.** Metrics should be based on the analysis model, the design model, or the structure of the program itself.
- 6. An effective mechanism for quality feedback.** That is, the metric should provide a software engineer with information that can lead to a higher quality end product.

5. Justify the need of Normalization for Metrics.

Ans: It tells us how an organization combines metrics that come from different individuals or projects.

- Depend on the size and complexity of the project.
- Normalization: compensate for complexity aspects particular to a product

6. Differentiate the different approaches of Normalization.

Ans: Normalization approaches:

1. Size oriented (lines of code approach): Derived by normalizing quality and/or productivity measures by considering the size of the software produced.

- Thousand lines of code (KLOC) are often chosen as the normalization value.
- Metrics include

1. Errors per KLOC - Errors per person-month.
2. Defects per KLOC - KLOC per person-month.
3. Rs per KLOC - Rs per page of documentation.
4. Pages of documentation per KLOC.

- Size-oriented metrics are not universally accepted as the best way to measure the software process.
- Opponents argue that KLOC measurements-

1. Are dependent on the programming language.
2. Penalize well-designed but short programs.
3. Cannot easily accommodate nonprocedural languages.
4. Require a level of detail that may be difficult to achieve

2. Function oriented (function point approach): Function-oriented metrics use a measure of the functionality delivered by the application as a normalization value

- Most widely used metric of this type is the function point: $FP = \text{count total} * [0.65 + 0.01 * \text{sum (value adj. factors)}]$
- Function point values on past projects can be used to compute, for example, the average number of lines of code per function point (e.g., 60).

7. Describe importance of Software

Metrics. Ans: Importance of software

Metrics:

- Most software developers do not measure, and most have little desire to begin.
- Establishing a successful company-wide software metrics program can be a multi-year effort. But if we do not measure, there is no real way of determining whether we are improving.
- Measurement is used to establish a process baseline from which improvements can be assessed.
- Software metrics help people to develop better project estimates, produce higher-quality systems, and get products out the door on time.

8. How can we compute FP?

Ans: FP can be computed as by following steps-

1. Analyze information domain of the application and develop counts.
2. Establish count for input domain and system.
3. Weight each count by assessing complexity.
4. Assign level of complexity or weight to each count.
5. Assess the influence of global factors that affect the application.
6. Grade significance of external factors, such reuse, OS, concurrency.
7. Compute Function Point.

$$FP = \text{count total} * [0.65 + 0.01 * \text{sum (value adj. factors)}]$$

9. What is software quality?

Answer: Software quality refers to the overall attributes and characteristics of a software product that determine its ability to meet specified requirements, satisfy customer needs, and function properly.

10. Why is software quality important?

Answer: Software quality is important because it directly affects customer satisfaction, productivity, and the overall success of a software product. High-quality software reduces the risk of failures, improves user experience, and helps build trust and loyalty among users.

11. How can software quality be measured?

Answer: Software quality can be measured through various metrics and indicators, such as defect density, code coverage, test coverage, customer satisfaction surveys, and adherence to predefined quality standards. Additionally, software testing and quality assurance processes play a significant role in measuring software quality.

12 What are some common challenges in achieving software quality?

Answer: Some common challenges in achieving software quality include meeting strict deadlines, managing complex software systems, ensuring compatibility across different platforms, addressing changing user requirements, and balancing quality with cost and resource constraints.

13. What is the role of software testing in ensuring software quality?

Answer: Software testing is an essential process in ensuring software quality. It involves systematically executing a software system to identify any defects, inconsistencies, or errors. By conducting various testing techniques, such as functional testing, performance testing, and security testing, software testers can uncover issues and help improve the overall quality of the software product.

14. What are some best practices for maintaining software quality?

Answer: Some best practices for maintaining software quality include adopting a robust software development lifecycle, conducting thorough testing and quality assurance activities, implementing code reviews and continuous integration processes, documenting requirements and design specifications, and actively involving stakeholders in the quality assurance process.

15. How can software quality be improved throughout the development lifecycle?

Answer: Software quality can be improved throughout the development lifecycle by emphasizing early and continuous testing, encouraging collaboration and communication among development and testing teams, adopting agile or DevOps methodologies, conducting regular code reviews and inspections, and implementing automated testing and quality assurance processes.

16. What are the benefits of investing in software quality assurance?

Answer: Investing in software quality assurance can lead to several benefits, including reduced software

defects and failures, improved customer satisfaction, enhanced reliability and performance, increased productivity, reduced maintenance costs, and strengthened brand reputation.

17. How does software quality impact the overall cost of software development?

Answer: Although ensuring software quality involves additional upfront costs, it ultimately reduces overall development and maintenance costs. Higher software quality leads to fewer defects, which results in reduced bug fixes, rework, and customer support costs. Additionally, high-quality software typically has a longer lifespan, reducing the need for frequent software replacements or upgrades.

Answer: User feedback plays a crucial role in software quality improvement. By actively seeking and incorporating user feedback, software developers and testers can identify issues, understand user requirements better, and make necessary improvements to enhance the overall quality and usability of the software product.

18. Describe is a software quality model?

A software quality model is a framework that defines the attributes and characteristics of high-quality software. It provides a structured approach to assess and measure the quality of a software product.

19. Compare the common software quality models used in industry?

Some common software quality models used in the industry are:

- ISO 9000: This is a standard that focuses on quality management systems and processes.
- Capability Maturity Model Integration (CMMI): This model focuses on process improvement and maturity levels.
- ISO/IEC 9126: This model defines a set of quality characteristics and metrics for software.
- Six Sigma: This is a data-driven approach to improve process quality and reduce defects.

20. How do software quality models help in improving software development processes?

Software quality models provide guidelines and best practices for software development organizations to improve their processes. They help in identifying areas of improvement, setting quality objectives, and measuring progress. By following these models, organizations can ensure that their software products meet the desired quality standards.

21. Highlight the main components of a software quality model?

The main components of a software quality model typically include:

- Quality characteristics: These define the desirable attributes of software, such as functionality, reliability, usability, efficiency, maintainability, and portability.
- Quality metrics: These are measurable attributes that quantify the quality characteristics of a software product.
- Assessment methods: These are techniques and criteria used to evaluate the quality of a software product.
- Improvement guidelines: These provide recommendations and best practices to improve the quality of software development processes.

21. Describe is the importance of measuring software quality using models?

Measuring software quality using models is essential for several reasons:

- It provides an objective and quantitative assessment of the quality of a software product.
- It helps in identifying areas that need improvement and setting realistic quality goals.
- It allows for benchmarking and comparison with industry standards and competitors.
- It facilitates effective decision-making regarding software development and resource allocation.
- It ensures that the software product meets the expectations and needs of the end-users.

22. How can organizations implement software quality models effectively?

To implement software quality models effectively, organizations should:

- Understand the specific requirements and characteristics of their software products.
- Define appropriate quality metrics and measurement methods aligned with the chosen quality model.
- Establish a quality management system to monitor and control the software development processes.

- Train and educate the development team on the principles and practices of the quality model.
- Continuously review and improve the processes based on the feedback and measurement data.

23: Describe is a software reliability model?

A: A software reliability model is a mathematical representation or framework that predicts or measures the reliability of software systems. It helps in estimating the probability of failure occurrence, tracking software reliability over time, and evaluating the effectiveness of reliability improvement techniques.

24: Why do we need software reliability models?

A: Software reliability models are needed to assess the reliability of software systems early in the development process, to allocate resources for testing and maintenance, and to estimate the software failure rates in real-world use. These models also aid in identifying potential reliability bottlenecks and guiding improvements in software development and testing practices.

25: Compare the different types of software reliability models?

A: There are various types of software reliability models, including the exponential model, the power-law model, the non-homogeneous Poisson process model, and the Markov model. Each model has its own assumptions, equations, and parameters to estimate software reliability.

26: How does the exponential model work?

A: The exponential model assumes that the failure rate of software follows an exponential distribution over time. It predicts that the failure rate will gradually decrease as time progresses. The model uses the exponential hazard function to estimate the software reliability.

27: What is the non-homogeneous Poisson process model?

A: The non-homogeneous Poisson process model is a popular model used for software reliability prediction. It assumes that the software failure rate changes over time and follows a non-homogeneous Poisson process. This model allows for the incorporation of various factors that affect software reliability, such as testing effort, fault removal efficiency, and usage profile.

28: How does the Markov model work?

A: The Markov model represents the software system as a set of interconnected states, where each state represents a particular configuration or condition of the system. It describes the transition probabilities between different states and takes into account the impacts of fault detection, error correction, and system environment on reliability. The Markov model is useful for analyzing the reliability of complex software systems with multiple states and events.

29: What are the limitations of software reliability models?

A: Software reliability models have limitations, such as the assumptions they rely on, the data requirements for estimation, and the complexity of model selection and calibration. The accuracy of these models depends on the quality and availability of historical failure data, the suitability of the assumptions made, and the ability to incorporate all relevant factors affecting reliability. Additionally, software reliability models may not capture all unpredictable events or unknown failure mechanisms.

30: What is the QMM (Quality Measurement Model) in software quality?

The QMM (Quality Measurement Model) is a framework used in software quality assurance to define and measure the quality characteristics of a software product. It provides a structured approach for evaluating the software's quality attributes and its adherence to specific quality standards. The model consists of various quality factors, sub-factors, and metrics that are used to assess the software's performance, reliability, maintainability, security, and other critical aspects of quality.

31: How does the QMM (Quality Measurement Model) help in software quality assurance?

The QMM plays a crucial role in software quality assurance by providing a systematic approach to

evaluate, measure, and improve the quality of software products. It helps to identify the most critical quality attributes and establish metrics to measure them objectively. By using the QMM, software development organizations can set quality goals, track their progress, and ensure that their software meets the required quality standards. The model also assists in identifying areas of improvement and implementing appropriate corrective actions to enhance the overall software quality.

32: What are the main components of the QMM (Quality Measurement Model)?

The QMM consists of several key components, including:

1. **Quality Factors:** These are the main dimensions or categories of quality attributes that define the overall quality of a software product, such as functionality, reliability, performance, usability, maintainability, and security.
2. **Sub-Factors:** Under each quality factor, there are sub-factors that further break down the specific aspects of quality. For example, under the reliability factor, sub-factors could include fault tolerance, error handling, and failure recovery.
3. **Metrics:** Metrics are quantifiable measures that are used to assess the quality characteristics of the software. Each sub-factor has associated metrics that help in measuring and evaluating the quality attributes objectively. Examples of metrics could be response time, defect density, code complexity, or user satisfaction.
4. **Evaluation Procedures:** The model provides guidelines and procedures for conducting evaluations and measurements based on the defined metrics. It specifies the techniques and tools to be used for data collection and analysis, enabling consistent and repeatable evaluations.
5. **Improvement Actions:** The QMM also includes recommendations for improvement actions based on the evaluation results. These actions suggest specific corrective measures that can be taken to enhance the software's quality attributes and overall performance.

33: What are the benefits of using the QMM in software quality assurance?

The benefits of using the QMM in software quality assurance include:

1. **Clear Quality Focus:** The model helps in defining and prioritizing the important quality factors and sub-factors for a software product, ensuring a clear quality focus for development and testing activities.
2. **Objective and Measurable Evaluation:** By establishing metrics and evaluation procedures, the QMM enables objective and measurable assessment of the software's quality attributes, making it easier to track progress and identify areas for improvement.
3. **Consistency and Standardization:** The model provides a consistent approach to software quality evaluation across projects and teams, allowing for benchmarking and standardization of quality measurements.
4. **Improvement Guidance:** Based on evaluation results, the QMM suggests improvement actions that can be taken to address any identified shortcomings and enhance the software's quality attributes.
5. **Quality Communication and Reporting:** The model facilitates effective communication and reporting of software quality by providing a common language and structure for discussing quality aspects, both within development teams and with stakeholders.

Overall, the QMM promotes a systematic and data-driven approach to software quality assurance, leading to improved software quality, customer satisfaction, and overall project success.

A maturity model is a framework that helps organizations assess and improve the effectiveness and efficiency of their processes, practices, and capabilities. It provides a structured and staged approach to measure and benchmark an organization's maturity level in a specific area.

34. Describe is a maturity model?

A maturity model is a framework used to assess and improve the effectiveness and efficiency of processes, practices, and capabilities within an organization.

35. How does a maturity model work?

A maturity model works by defining specific stages or levels of maturity and providing criteria to assess an organization's capabilities within those levels. It typically involves a structured assessment process to measure the current state and identify gaps for improvement.

36. Highlight the benefits of using a maturity model?

Using a maturity model can provide several benefits, such as:

- Identifying areas for improvement and establishing a roadmap for development.
- Setting benchmarks and targets for achieving higher levels of maturity.
- Enhancing organizational efficiency and effectiveness.
- Enabling better decision-making by assessing risks and opportunities.
- Facilitating collaboration and alignment across different teams and departments.

37. How to assess maturity levels using a maturity model?

Assessing maturity levels involves evaluating an organization's processes, practices, and capabilities against predefined criteria for each maturity stage. This assessment can be done through surveys, interviews, documentation reviews, or other evaluation methods designed to gather relevant data and insights.

38. Compare are the typical maturity levels in a maturity model?

The maturity levels in a maturity model may vary, but commonly include:

- Initial/Ad-Hoc: Processes are unpredictable with no defined methodologies.
- Repeatable: Basic processes are in place but are not fully documented or standardized.
- Defined: Well-documented and standardized processes are established across the organization.
- Managed: Processes are measured, monitored, and controlled for effectiveness.
- Optimized: Continuous improvement is emphasized, and processes are refined for maximum efficiency.

39. How long does it take to move from one maturity level to another?

The time required to move between maturity levels depends on various factors, such as the organization's size, resources, commitment to change, and complexity of processes. It could take several months or even years to progress from one level to the next.

40 Are there any maturity models available for specific areas?

Yes, there are various maturity models available for specific areas like project management, software development, cybersecurity, and more. These models provide tailored frameworks and criteria to assess maturity and improvement in their respective domains.

41. Describe the software testing?

Software testing is a process of evaluating a software application to ensure that it meets the specified requirements and works as expected. It involves running various tests on the software to identify bugs, faults, or any other defects before it is released to end users.

42. Why is software testing important? Justify your answer?

Software testing is important because it helps in identifying and fixing defects in the software application, which can improve the overall quality and reliability of the software. It ensures that the software meets

the requirements of end users and performs as expected in different scenarios. Testing also helps in identifying potential risks and vulnerabilities that can impact the security and integrity of the software.

43. Mention the different levels of software testing?

The different levels of software testing include unit testing, integration testing, system testing, and acceptance testing. Unit testing involves testing individual components or modules of the software, while integration testing verifies the interaction between different components to ensure they work together correctly. System testing tests the entire system to ensure it meets the specified requirements, and acceptance testing involves testing the software from the user's perspective to ensure it meets their expectations.

44. Compare functional testing and non-functional testing?

Functional testing checks whether the software application meets the functional requirements, i.e., if it performs the actions it is supposed to do. Non-functional testing, on the other hand, focuses on the non-functional aspects of the software, such as performance, usability, security, and reliability. It ensures that the software is efficient, user-friendly, secure, and meets the predefined quality standards.

45. Describe regression testing?

Regression testing is performed after making changes or modifications to the software to ensure that the existing functionality has not been affected. It involves retesting the previously tested functionalities to verify that they still work correctly. Regression testing helps in uncovering any new defects or issues introduced due to the changes made to the software.

46. What is a test case?

A test case is a set of predefined conditions or actions that are executed to verify whether a specific feature or functionality of the software works as expected. It includes information about the test inputs, expected outcomes, and preconditions for running the test. Test cases are documented and executed during the testing phase to ensure that all aspects of the software are adequately tested.

47. Compare between black box testing and white box testing?

Black box testing is a testing technique where the tester does not have any knowledge of the internal structure, design, or implementation of the software application. It focuses on testing the functionality and behavior of the software from the end user's perspective. White box testing, on the other hand, involves testing the internal structure and implementation of the software. The tester has access to the source code and uses it to design and execute test cases.

48. Describe test automation?

Test automation is the process of automating the execution of test cases using specialized software tools. It involves writing scripts or test cases that can be executed automatically to perform repetitive or time-consuming tests. Test automation helps in enhancing the efficiency, accuracy, and repeatability of the testing process, and it is particularly useful for regression testing or for test cases that need to be executed multiple times.

49. What is a defect or bug?

A defect or bug is an error or fault in the software application that causes it to deviate from its expected behavior. It can result from mistakes made during the development process or from external factors. Defects can lead to the software malfunctioning, producing incorrect outputs, or leading to other undesirable consequences. The goal of software testing is to identify and report these defects so they can be fixed before the software is released.

50. Compare between verification and validation in software testing?

Verification is the process of evaluating a system or component at various stages of development to ensure compliance with the specified requirements. It involves static techniques such as inspections, reviews, and walkthroughs. Validation, on the other hand, is the process of evaluating a system or component during or at the end of the development process to determine whether it satisfies the specified

requirements. It involves dynamic techniques such as testing.

51. Describe the software maintenance?

Answer: Software maintenance refers to the process of making modifications, bug fixes, and enhancements to an existing software application after it has been deployed to users. It involves updating the software to meet changing user requirements, fixing any bugs or issues that may arise, and improving its performance or functionality. Software maintenance is an essential part of the software development life cycle and ensures that the software continues to meet the needs of its users over time.

52. Why is software maintenance important?

Answer: Software maintenance is important for several reasons:

1. Bug fixing: As software applications are used by users, bugs or issues may be discovered. Maintenance tasks involve identifying and fixing these bugs, ensuring that the software runs smoothly and without errors.
2. User requirements: User needs and requirements can change over time. Maintenance allows for the adaptation of the software to meet these changing requirements, ensuring user satisfaction.
3. Optimization and performance improvement: Through maintenance, software developers can identify areas where the software can be optimized or improved to enhance its performance, making it more efficient and effective for users.
4. Security updates: With the increasing threat of cyber attacks and security breaches, software maintenance plays a crucial role in identifying vulnerabilities and implementing necessary security updates to protect the software and its users.
5. Technology changes: New technologies and frameworks are constantly emerging, and software maintenance allows for the integration of these new technologies into the existing software, keeping it up to date and ensuring compatibility with modern systems.

53. What are the different types of software maintenance?

Answer: There are typically four types of software maintenance:

1. Corrective maintenance: This type of maintenance involves fixing bugs or issues that are discovered after the software has been released. It aims to restore the software to its intended functionality.
2. Adaptive maintenance: Adaptive maintenance involves modifying the software to meet changing user requirements or to adapt to changes in the system or environment in which it operates. It ensures that the software remains useful and relevant over time.
3. Perfective maintenance: This type of maintenance involves making improvements to the software's performance, efficiency, or user experience. It aims to enhance the software's functionality and effectiveness, often based on user feedback or evolving industry standards.
4. Preventive maintenance: Preventive maintenance focuses on identifying and fixing potential issues before they cause problems. It involves activities such as code reviews, security audits, and performance optimizations to ensure that the software remains reliable and high-performing.

54. What are the challenges faced during software maintenance?

Answer: Software maintenance can present several challenges, including:

1. Legacy code: Maintaining older software applications can be challenging, especially if the original developers are no longer available or if the codebase is complex and poorly documented. Understanding and modifying legacy code can require significant time and effort.
2. Interdependencies: In large software systems, different components may have interdependencies, making it difficult to modify one component without affecting others. Ensuring that changes are implemented correctly and do not introduce new issues can be challenging.
3. Lack of documentation: Inadequate documentation of the software architecture, design decisions, or code can make maintenance tasks more difficult. Understanding the existing system and making modifications without proper documentation can be time-consuming and error-prone.
4. Time and resource constraints: Maintenance tasks often need to be performed within tight timeframes and resource constraints. Balancing maintenance activities with other development or business priorities can be challenging, potentially leading to delays or compromised quality.
5. Compatibility issues: As software evolves and new technologies emerge, compatibility issues may arise. Maintaining compatibility with different operating systems, browsers, or hardware configurations can be challenging, requiring additional effort and testing.
6. Cost considerations: Maintaining software can be expensive, especially for large or complex systems. Determining the optimal balance between maintenance efforts and cost can be a challenge for organizations.

55. What strategies can be used to facilitate software maintenance?

Answer: To facilitate software maintenance, several strategies can be employed:

1. Establishing clear requirements: Clearly defining and documenting user requirements during the initial development can help reduce the need for extensive maintenance later. Well-defined requirements enable developers to build software that meets user needs more accurately.
2. Regular updates and patches: Staying proactive with regular updates and patches can help address potential vulnerabilities and bugs before they become major issues. Regular maintenance releases demonstrate the commitment to software quality and help keep the software up to date.
3. Version control: Utilizing version control systems allows developers to track changes made to the software over time. This makes it easier to revert to earlier versions if issues arise during maintenance and ensures that changes can be managed and documented effectively.
4. Documentation: Properly documenting the software's architecture, design decisions, and code can greatly aid maintainability. Clear documentation makes it easier for developers to understand the existing system and modify it without introducing errors.
5. Modular design: Utilizing a modular design approach can make maintenance easier by separating different components of the software. This allows for more targeted modifications and helps minimize the impact on other parts of the system.
6. Continuous testing and monitoring: Regularly testing the software and monitoring its performance can help identify issues early on. Automated testing and monitoring tools can assist in detecting bugs and performance problems, enabling swift resolution.

7. Knowledge transfer: Promoting knowledge sharing and ensuring that multiple developers have an understanding of the software can help mitigate the risks associated with reliance on individual developers. Cross-training and documentation can facilitate knowledge transfer within the development team.

By implementing these strategies, organizations can streamline software maintenance processes, reduce risks, and ensure the longevity and effectiveness of their software applications.