Verification and **Validation**

Verification and **Validation** are two essential processes in software engineering and quality assurance. Here's a simplified breakdown of the differences:

1. Definition

- **Verification** is the process of checking whether the software meets specified requirements and is correctly implemented. It answers the question, "Are we building the product right?"
- **Validation** is the process of checking whether the software meets the user's needs and expectations. It answers the question, "Are we building the right product?"

2. Focus

- **Verification** focuses on ensuring the product conforms to specifications and design documents.
- **Validation** focuses on ensuring the product is useful and usable for the end-user.

3. Objective

- **Verification** is concerned with the process and aims to detect bugs or errors in the development stages (design documents, code, etc.).
- **Validation** aims to validate the software against the customer's needs and to check if it works as expected in the real-world context.

4. Activities Involved

- **Verification** may include:
    - Reviews (e.g., code reviews, design reviews)
    - Inspections
    - Static analysis (analyzing code without execution)
    - Walkthroughs
- **Validation** may include:
    - User acceptance testing (UAT)
    - System testing
    - Integration testing
    - Functional and usability testing

5. When It Happens

- **Verification** typically happens during the development phases to ensure each step is done correctly.

- **Validation** happens after the product is fully developed or in later stages of development.

6. Nature of Process

- **Verification** is usually an internal process, often carried out by the development team.
- **Validation** is often performed with customer input or feedback to ensure the software meets their expectations.

7. Techniques Used

- **Verification** uses techniques like desk-checking, code inspections, walkthroughs, and formal methods.
- **Validation** uses testing, demonstrations, and customer feedback for evaluating the system.

Example to Illustrate the Difference:

- **Verification**: Checking if a login feature follows the design document, handles input validation, and matches specifications.
- **Validation**: Checking if the login feature provides a good user experience and satisfies the customer's need for a secure and easy way to access their account.

Summary Table

Aspect	**Verification**	**Validation**
Question Answered	Are we building the product right?	Are we building the right product?
Focus	Process-oriented	Product-oriented
Objective	Meets specifications	Meets user needs
Performed When	During development stages	After product is developed
Examples	Reviews, walkthroughs, static analysis	Testing, user acceptance testing
Nature	Internal	Customer-focused