

Introduction of Software Engineering

Chapter 8:

Software Quality Management

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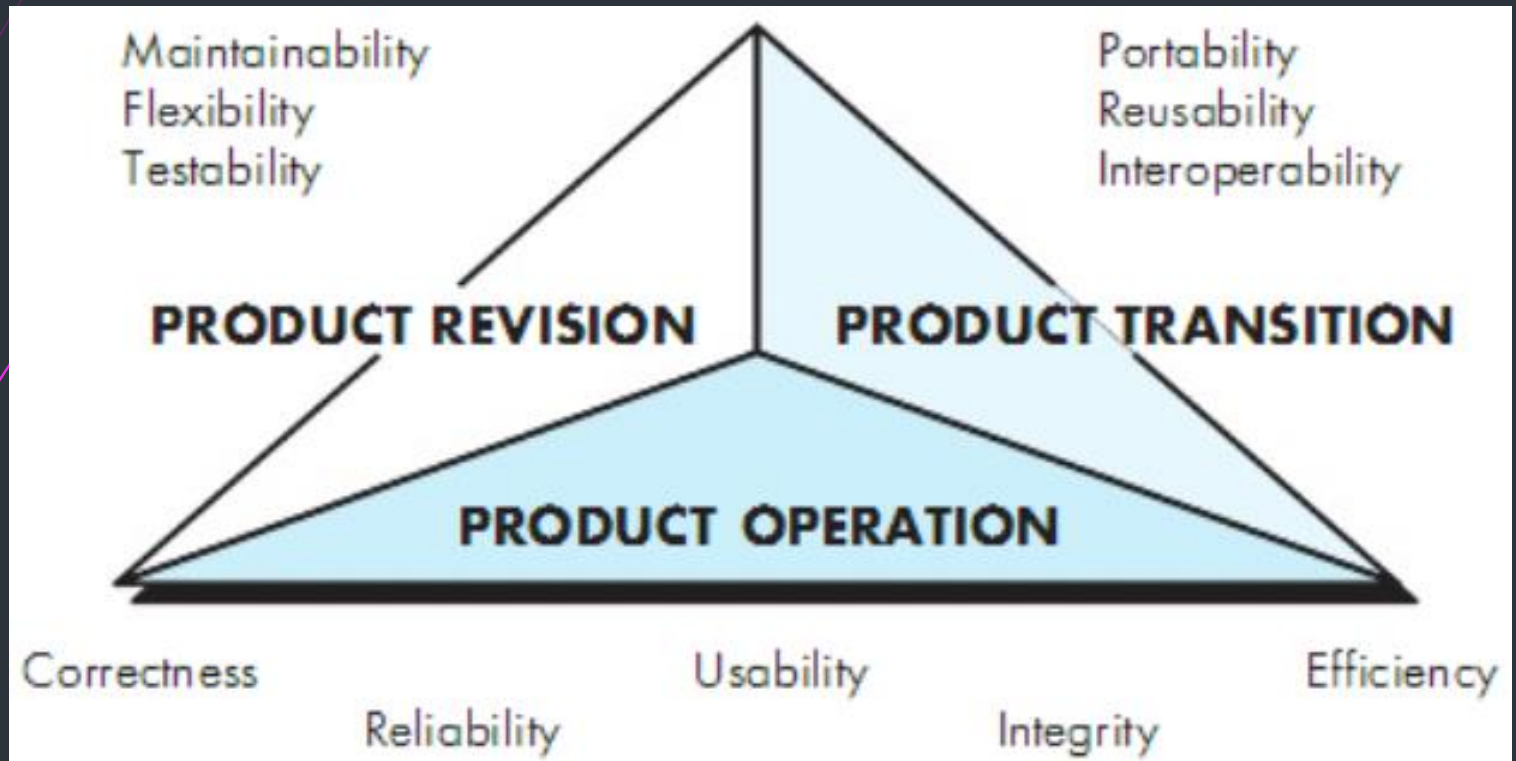
- **Software Quality: Concepts, Assurance, Goals (Attributes & Metrics)**
- **Software Testing Strategies**
- **The Testing Process**
- **Testing Management**

Software Quality

“User satisfaction = compliant product + good quality + delivery within budget and schedule”

(Robert Glass, 1998)

Quality Concepts

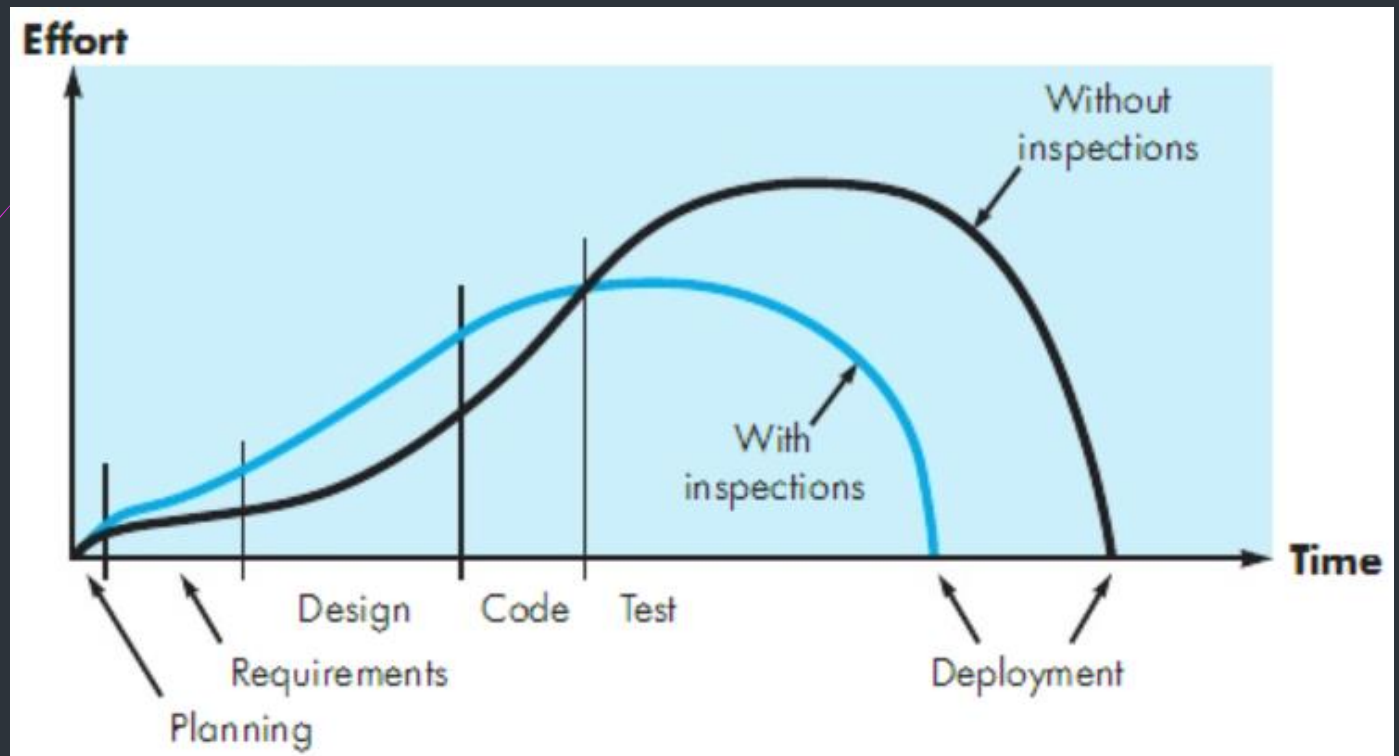


(McCall, Richards and Walters, 1977)

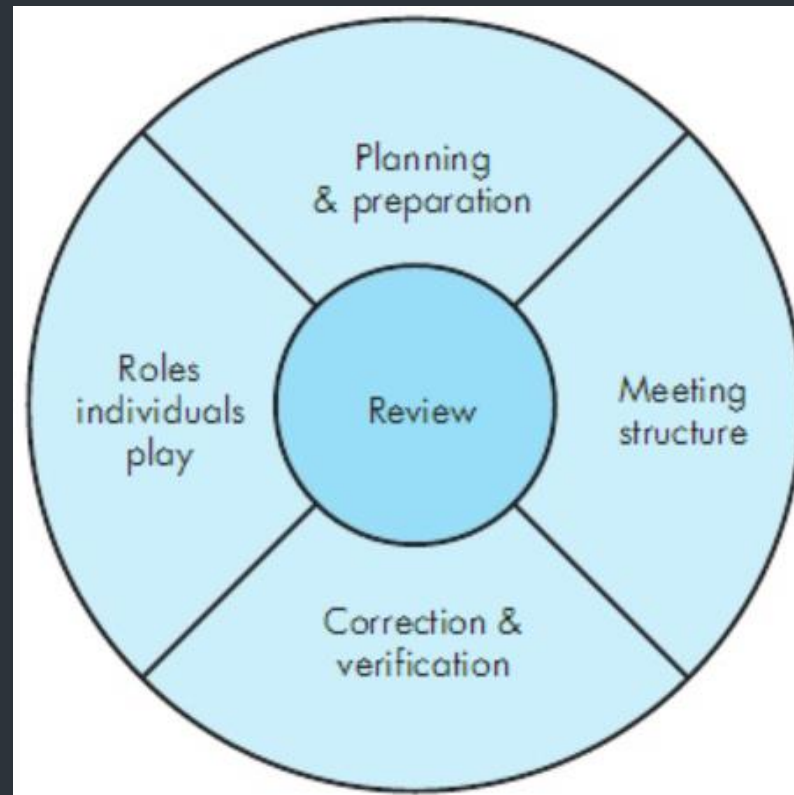
Relative cost of correcting errors and defects



Effort expended with and without reviews



Reference model for technical reviews



Elements of Software Quality Assurance

1. Standards
2. Reviews and audits
3. Testing
4. Error/defect collection and analysis
5. Change management
6. Education
7. Vendor management
8. Security management
9. Safety
10. Risk management

Quality Goals

1. Requirements quality
2. Design quality
3. Code quality
4. Quality Control (QC) Effectiveness

Requirement Quality:: Attributes & Metrics

Attributes	Metrics
Ambiguity	No. of ambiguous modifiers
Completeness	No. of TBA, TBD
Understandability	No. of section/subsection
Volatility	No. of changes per requirement Time (by activity) when change is requested
Traceability	No. of requirement not traceability to design/code
Model clarity	No. of UML model No. of descriptive pages per model No. of UML errors

Design Quality:: Attributes & Metrics

Attributes	Metrics
Architecture integrity	Existence of architectural model
Component completeness	No. of components that trace to architectural model Complexity of procedural design
Interface complexity	Average no. of pick to get to a typical function or contents Layout appropriateness
Patterns	No. of patterns used

Code Quality:: Attributes & Metrics

AttributesE	Metrics
Complexity	Cyclomatic complexity
Maintenability	Design factors
Understandability	Percent internal comments Variable naming conventions
Reuseability	Percent reused components
Documentation	Reliability index

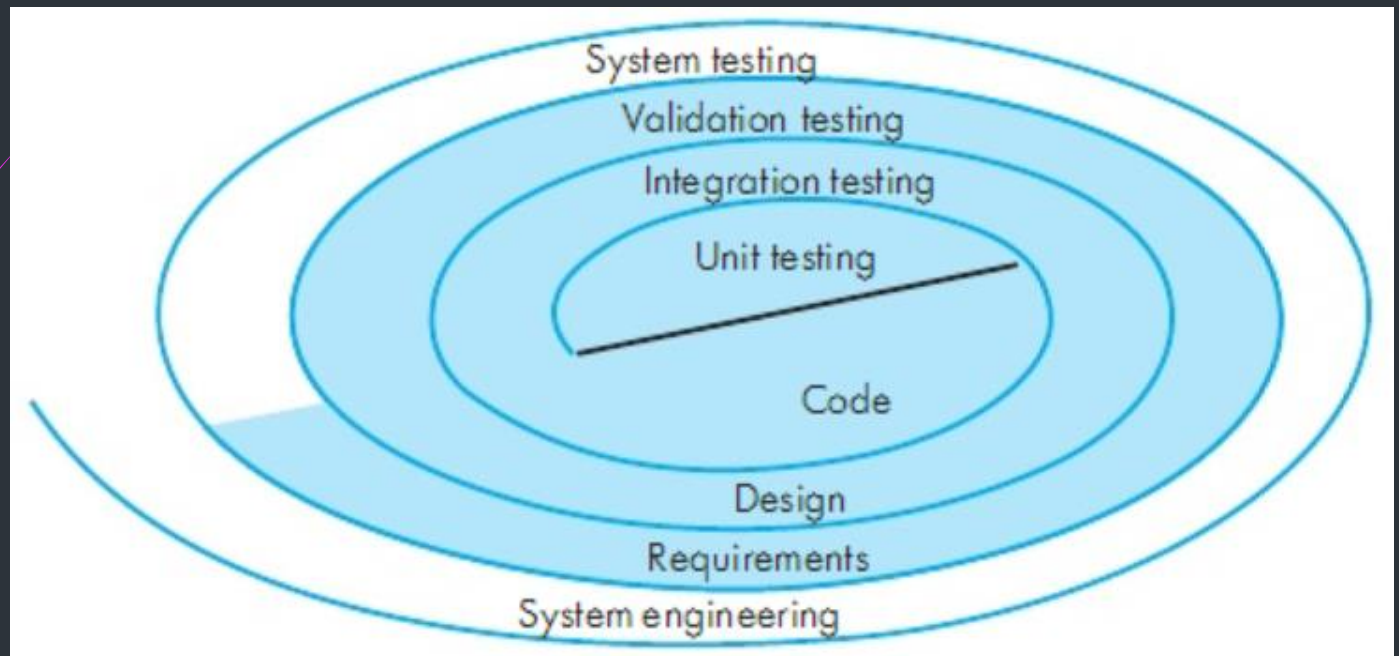
QC Effectiveness:: Attributes & Metrics

Attributes	Metrics
Resource allocation	Staff hour percentage per activity
Completion rate	Actual vs budgeted completion time
Review effectiveness	Review metrics
Testing effectiveness	No. of errors found and criticality Effort required to correct error Origin of error

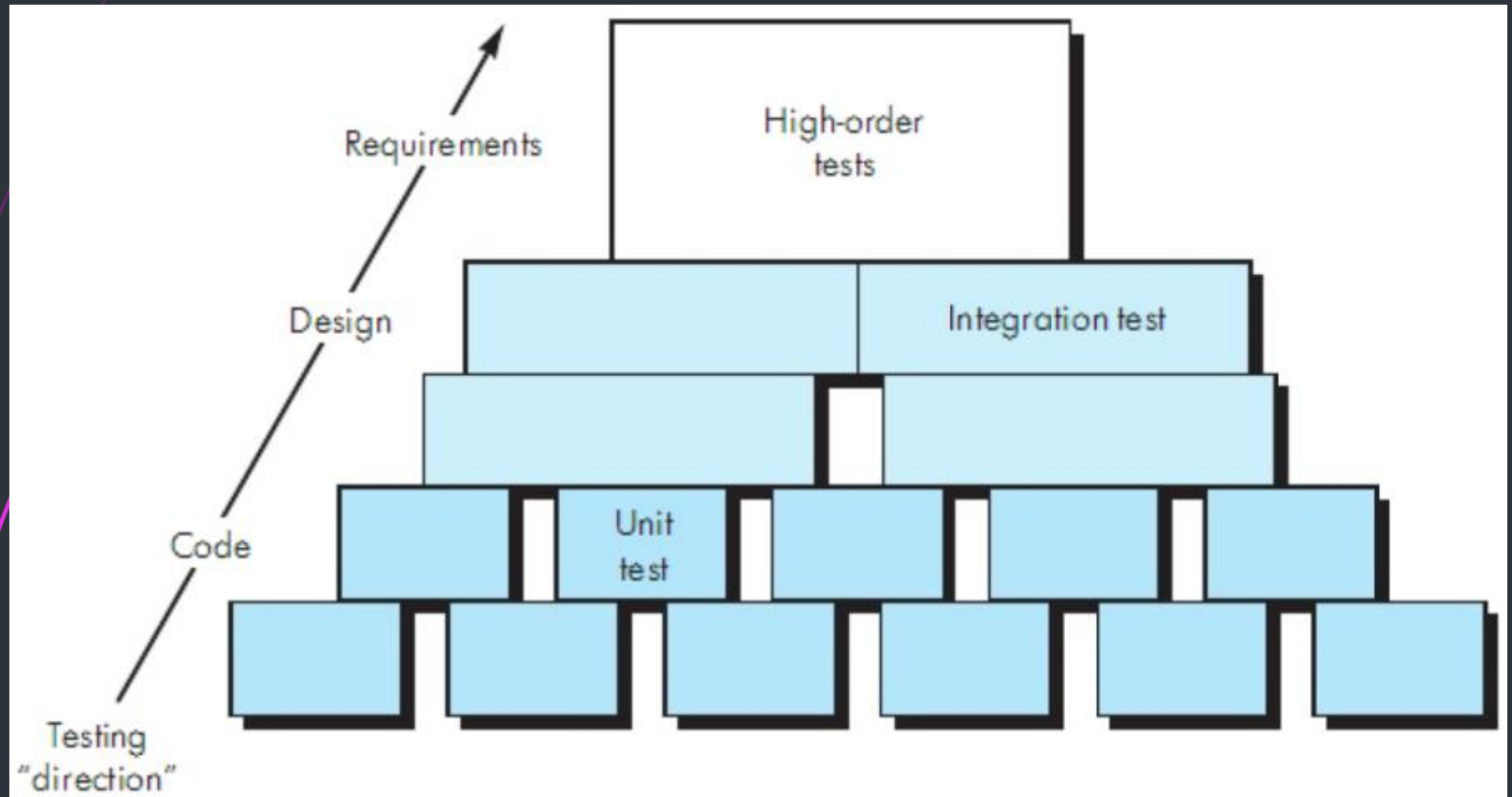
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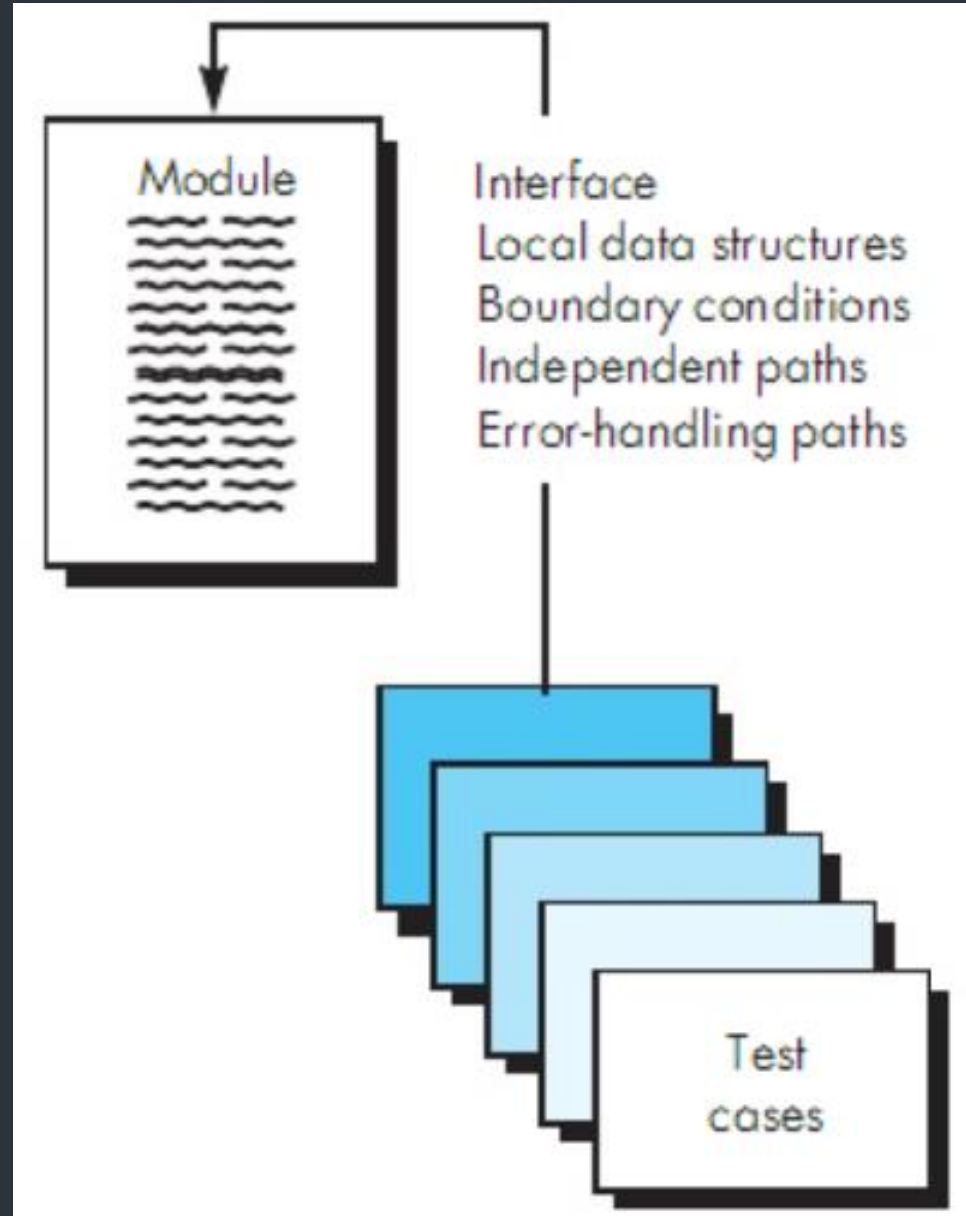
Testing Strategy



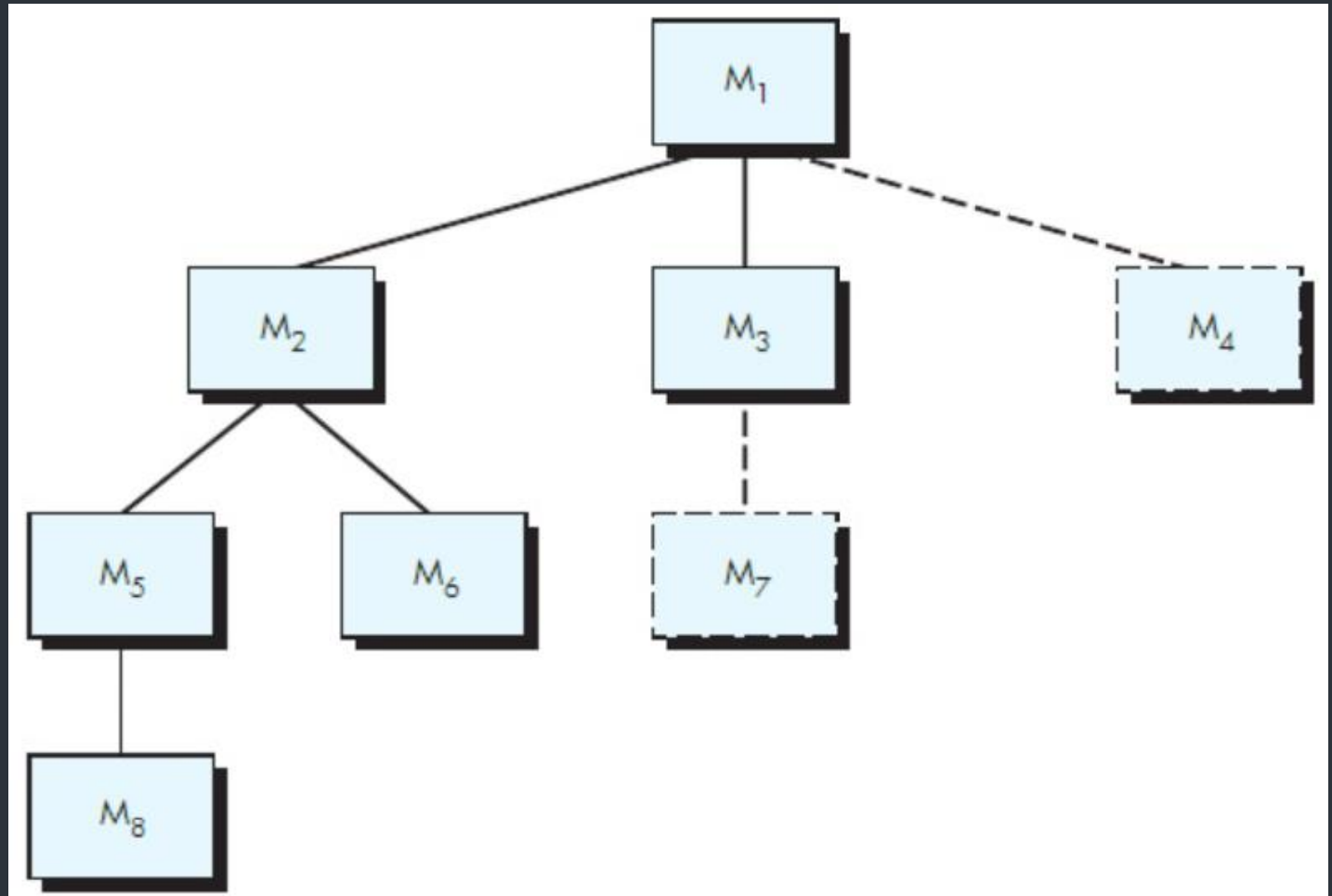
Software Testing Steps



Unit Test

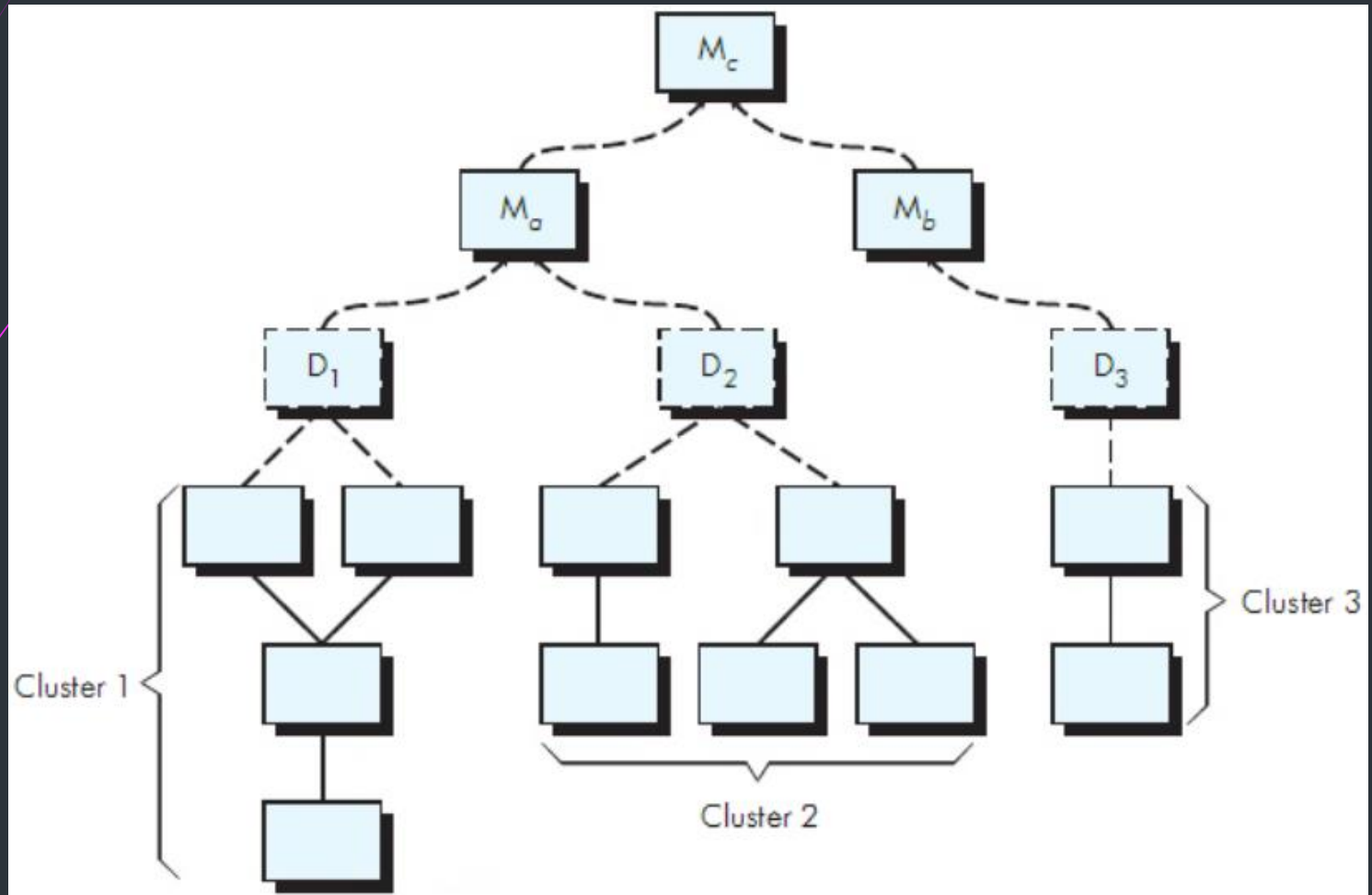


Integration Testing:: Top-down



M: Components

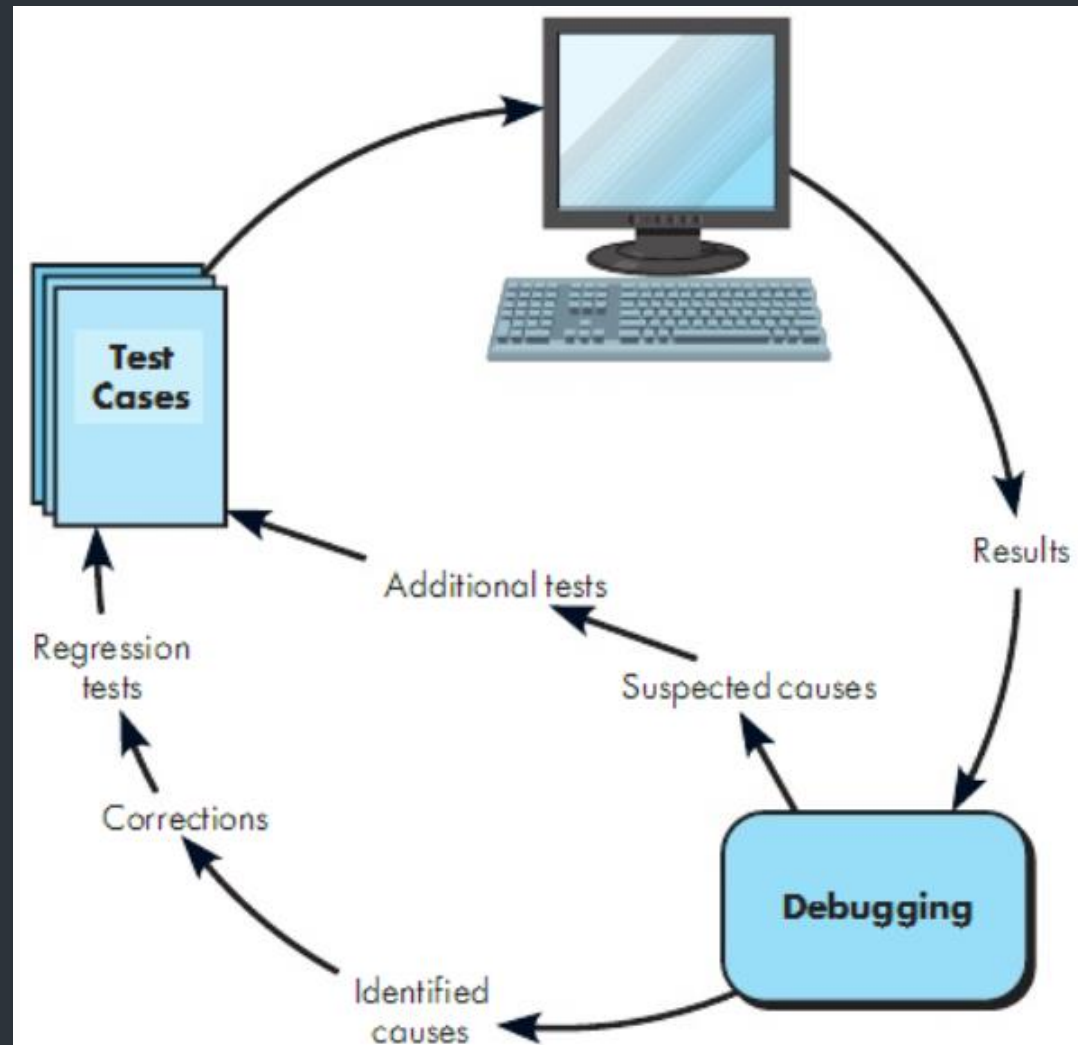
Integration Testing:: Bottom-up



System Testing

1. Recovery Testing
2. Security Testing
3. Stress Testing
4. Performance Testing
5. Deployment Testing

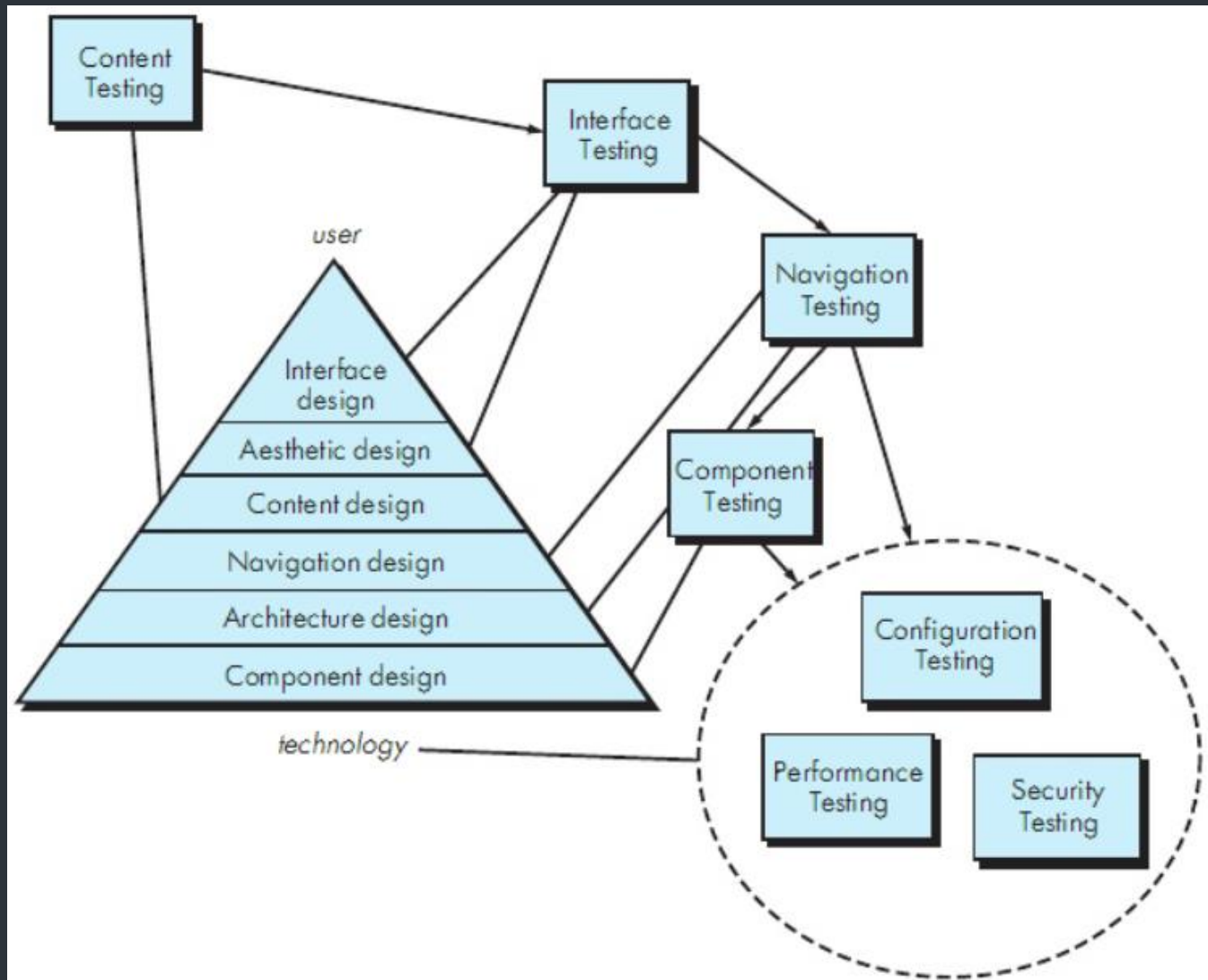
The Debugging Process



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The Testing Process



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Testing Management

1. Write Test Cases and report results
2. Log defects/ errors for tracking them
3. Analysis test results for further actions