Unit 3: Techniques of Planning, Controlling and Automating Software Process

B.E. Software VIII Semester

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Iterative Process Planning

- Work Breakdown Structures
- Planning Guidelines
- The Cost and Schedule Estimating Process
- The Iteration Planning Process
- Pragmatic Planning

Project Organizations and Responsibilities

- Line-of-Business organizations
- Project Organizations
- Evolution Organizations

Process Automation

- Tools: Automation Building Blocks
- The Project Environment

Project Control and Process Instrumentation

- The Seven Core Metrics
- Management Indicators
- Quality Indicators
- Life-Cycle Expectations
- Pragmatic Software Metrics
- Metrics Automation

Process Atomization

- Process Discriminants
- Example: Small-Scale Project Versus Large-scale Project

Conventional Breakdown Structures

- Conventional work breakdown structures are project specific, and cross project comparisons are usually difficult or impossible.
- Most organizations allow individual projects to define their own project specific structure tailored to the project manager's style, the customer's demands, or other project specific preferences.
- With no standard WBS structure, it is extremely difficult to compare plans, financial data, scheduled data, organizational efficiencies, cost trends, productivity trends, or quality trends across multiple projects.
- Each project organizes the work differently and uses different units of measure.

Work breakdown structure (WBS)

- A **work breakdown structure (WBS) is a key** project deliverable that organizes the team's **work** into manageable sections.
- The **work breakdown structure visually defines** the scope into manageable chunks that a project team can understand, as each level of the **work breakdown structure provides further definition** and detail.

Work breakdown structure (WBS)

- The development of a work breakdown structure is dependent on the project management style, organizational culture, customer preference, financial constraints and several other hard-to-define parameters.
- A WBS is simply a hierarchy of elements that decomposes the project plan into the discrete work tasks.

Work breakdown structure (WBS)

- A WBS provides the following information
  - A delineation of all significant work
  - A clear task decomposition for assignment of responsibilities
  - A framework for scheduling, budgeting, and expenditure tracking.

Recommended WBS

- First Level
  - Workflows for WBS elements. Can be allocated to single teams.
- Second Level
  - Defined for each phase of the life cycle.
- Third Level
  - Focus on the activities that produce the artifacts of each phase.

What is process breakdown structure?

- Product **Breakdown Structure (BBS) is a project** management tool and important part of the project planning.
- The product **breakdown structure defines subtasks** or work packages and describes the relationship between work packages.
- This **process helps to organize the projects gut and** to define the project frameworks.

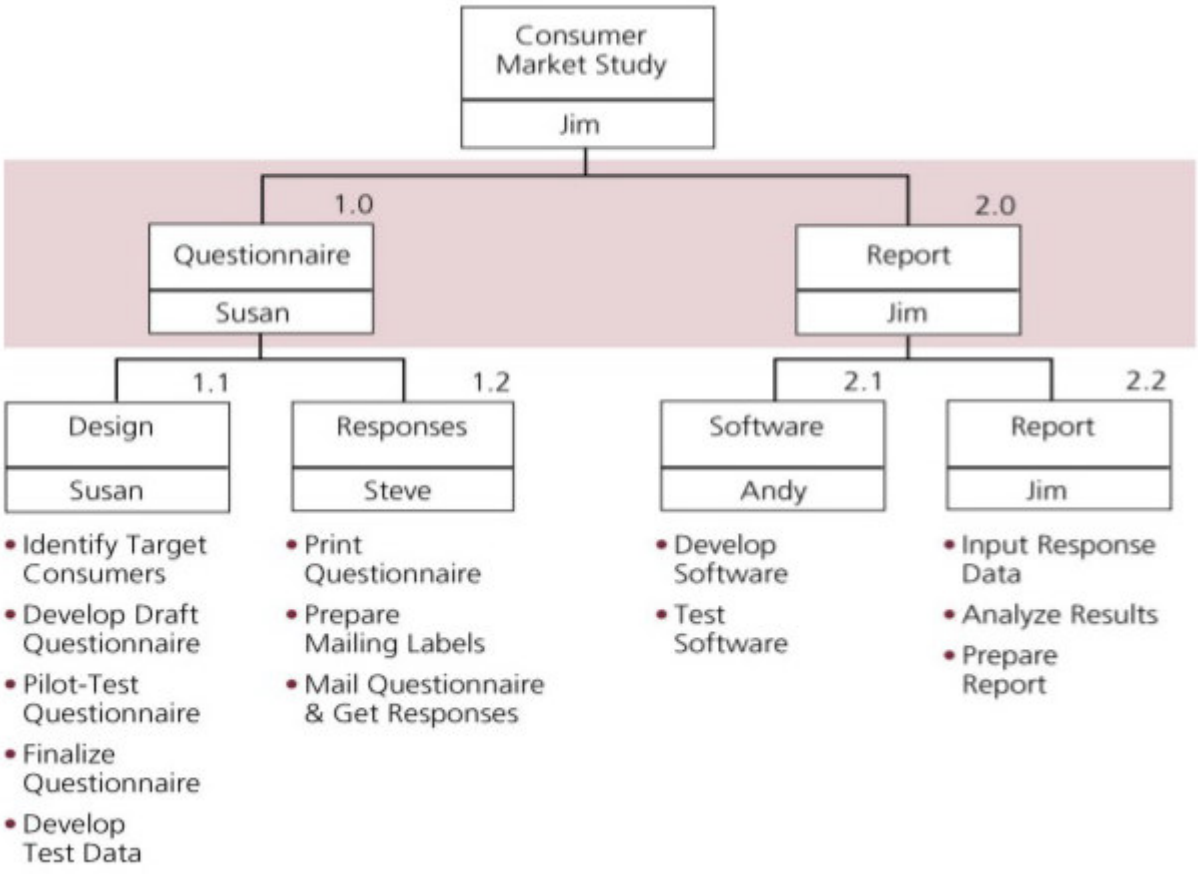
Why use a WBS in project management?

- Estimate the cost of a project.
- Establish dependencies.
- Determine a project timeline and develop a schedule.
- Write a statement of work (or SOW, one of your other acronyms).
- Assign responsibilities and clarify roles.
- Track the progress of a project.
- Identify risk.

How to Create a WBS: The High-Level View

- Determine and describe the project statement.
- Highlight all the necessary phases of the project.
- Create and list the deliverables (as well as how success will be measured)
- Divide the deliverables into manageable tasks.

Work Breakdown Structure for Consumer Market Study Project



Planning Guidelines

- Two simple planning guidelines should be considered when a project plan is being initiated or assessed.
- The first guideline prescribes a default allocation of costs among the first-level WBS elements.
- The second guideline prescribes the allocation of effort and schedule across the life-cycle phases

Planning Guidelines

TABLE 10-1. *WBS budgeting defaults*

FIRST-LEVEL WBS ELEMENT	DEFAULT BUDGET
Management	10%
Environment	10%
Requirements	10%
Design	15%
Implementation	25%
Assessment	25%
Deployment	5%
Total	100%

Planning Guidelines

TABLE 10-2. *Default distributions of effort and schedule by phase*

DOMAIN	INCEPTION	ELABORATION	CONSTRUCTION	TRANSITION
Effort	5%	20%	65%	10%
Schedule	10%	30%	50%	10%

Planning Guidelines

- So, WBS will be help to our project's efficiency and effectiveness, how do we go about it? First, let's look at what all we need to get started.
- There are several inputs you will need to get you off on the right foot:
  - The Project Scope Statement
  - The Project Scope Management Plan
  - Organizational Process Assets
  - Approved Change Requests - (PMBOK Guide)
- **PMBOK stands for Project Management Body of Knowledge and it is** the entire collection of processes, best practices, terminologies, and guidelines that are accepted as standards within the project management industry.

- These above four inputs should give you all the information you and your team needs to create your WBS. Along with these inputs, you will use certain tools as well:
  - Work Breakdown Structure Templates
  - Decomposition - (PMBOK Guide)
- Finally, using these inputs and tools you will create the following outputs:
  - Work Breakdown Structure
  - WBS Dictionary
  - Scope Baseline
  - Project Scope Statement (updates)
  - Project Scope Management Plan (updates)
  - Requested Changes - (PMBOK Guide)

The Cost and Schedule Estimating Process

- Project plans need to be derived from two perspectives.
- **Forward-looking:**
  - The software project manager develops a characterization of the overall size, process, environment, people, and quality required for the project.
  - A macro-level estimate of the total effort and schedule is developed using a software cost estimation model.
  - The software project manager partitions the estimate for the effort into a top-level WBS, also partitions the schedule into major milestone dates and partitions the effort into a staffing profile
  - At this point, subproject managers are given the responsibility for decomposing each of the WBS elements into lower levels using their top-level allocation, staffing profile, and major milestone dates as constraints.

- ***Backward-looking:***
  - The lowest level WBS elements are elaborated into detailed tasks, for which budgets and schedules are estimated by the responsible WBS element manager.
  - Estimates are combined and integrated into higher level budgets and milestones.
  - Comparisons are made with the top-down budgets and schedule milestones. Gross differences are assessed and adjustments are made in order to converge on agreement between the top-down and the bottom-up estimates.

Iterative Process Planning (The Iteration Planning Process)

Engineering Stage		Production Stage	
Inception	Elaboration	Construction	Transition
Feasibility iterations	*Architecture iterations*	*Usable iterations*	*Product releases*

Engineering stage planning emphasis:

- Macro-level task estimation for *production-stage artifacts*
- Micro-level task estimation for engineering artifacts
- Stakeholder concurrence
- Coarse-grained variance analysis of actual vs. planned expenditures
- Tuning the top-down project-independent planning guidelines into project-specific planning guidelines
- WBS definition and elaboration

Production stage planning emphasis:

- Micro-level task estimation for *production-stage artifacts*
- Macro-level task estimation for maintenance of engineering artifacts
- Stakeholder concurrence
- Fine-grained variance analysis of actual vs. planned expenditures

FIGURE 10-4. *Planning balance throughout the life cycle*

Engineering stage planning emphasis

- Macro-level task estimation for production-stage artifacts
- Micro-level task estimation for engineering artifacts
- Stakeholder concurrence
- Analysis of actual vs. planned expenditures
- Tuning the top-down concurrence
- project-independent planning guidelines into project specific planning guidelines.

Production stage Planning emphasis

- Micro-level task estimation for production-stage artifacts
- Macro-level task estimation for engineering artifacts
- Stakeholder concurrence
- Fine-grained variance analysis of actual vs. planned expenditures

3.2 Project Organizations and Responsibilities [Line-of-Business Organizations]

- **Default roles in a software line-of-business organizations**

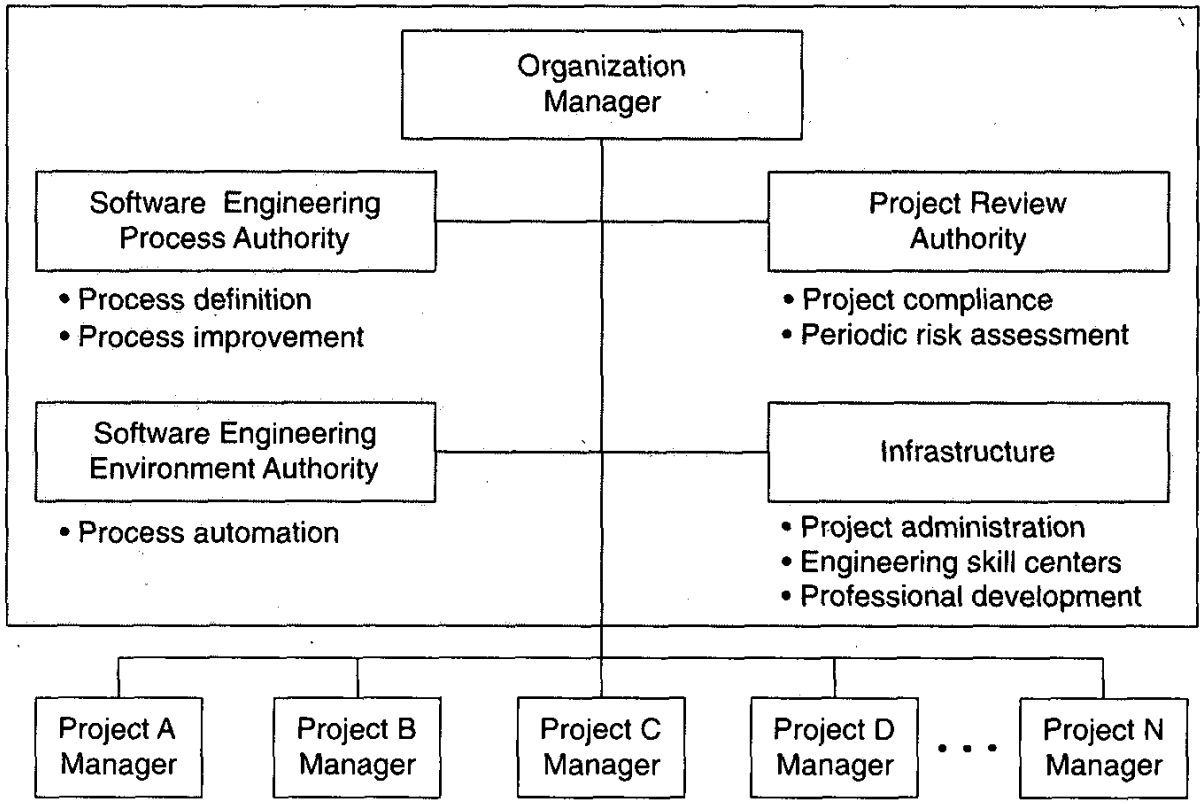
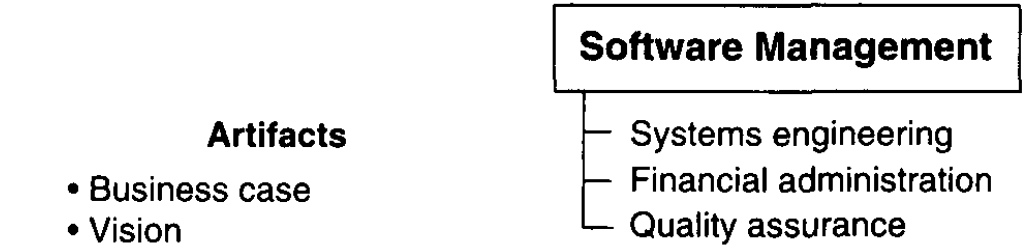


FIGURE 11-1. *Default roles in a software line-of-business organization*

Project Organizations and Responsibilities Project Organizations



Artifacts

- Business case
- Vision
- Software development plan
- Work breakdown structure
- Status assessments
- Requirements set

Responsibilities

- Resource commitments
- Personnel assignments
- Plans, priorities
- Stakeholder satisfaction
- Scope definition
- Risk management
- Project control

Life-Cycle Focus

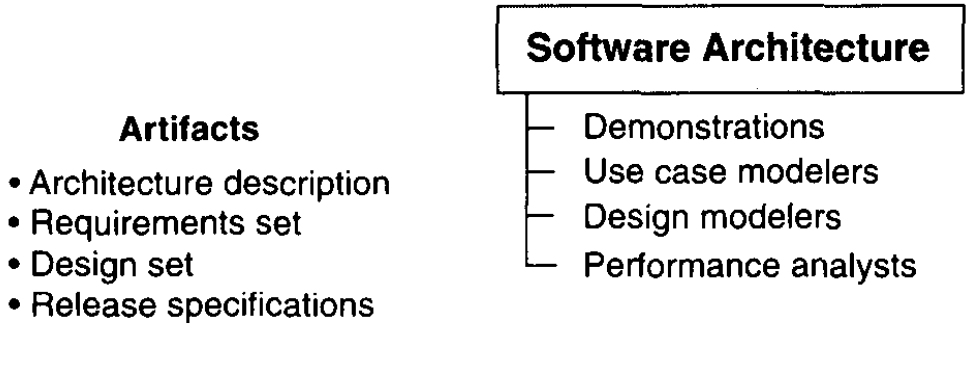
Inception	Elaboration	Construction	Transition
Elaboration phase planning Team formulation Contract baselining Architecture costs	Construction phase planning Full staff recruitment Risk resolution Product acceptance criteria Construction costs	Transition phase planning Construction plan optimization Risk management	Customer satisfaction Contract closure Sales support Next-generation planning

FIGURE 11-3. *Software management team activities*

Software Architecture Team

- "A **software architect is a software expert** who makes high-level design choices and dictates technical standards, including **software coding standards, tools, and** platforms."
- The most common understanding is that an **architect is a person who takes action and** dictates decisions.
- Designing, **planning and developing are** integral tasks in an architect's daily routine

Software Architecture Team



Artifacts

- Architecture description
- Requirements set
- Design set
- Release specifications

Responsibilities

- Requirements trade-offs
- Design trade-offs
- Component selection
- Initial integration
- Technical risk resolution

Life-Cycle Focus

Inception	Elaboration	Construction	Transition
Architecture prototyping *Make/buy trade-offs* Primary scenario definition Architecture evaluation criteria definition	Architecture baselining *Primary scenario* demonstration Make/buy trade-off baselining	Architecture maintenance *Multiple-component issue* resolution Performance tuning Quality improvements	Architecture maintenance *Multiple-component issue* resolution Performance tuning Quality improvements

FIGURE 11-4. *Software architecture team activities*

Component Team

- A **team that focuses on the creation of one or** more **components of a larger product that a** customer would purchase.
- **Team that is cross-functional (multi-disciplinary),** single **component focused. Contrast with feature team.**
- **Component teams : to build, deploy, and** ultimately release.
- CT is capable of delivering end-to-end user value
- Each **team has all the skills necessary to deliver** a feature.

Software Development Team

Software Development

└ Component teams

Artifacts

- Design set
- Implementation set
- Deployment set

Responsibilities

- Component design
- Component implementation
- Component stand-alone test
- Component maintenance
- Component documentation

Life-Cycle Focus

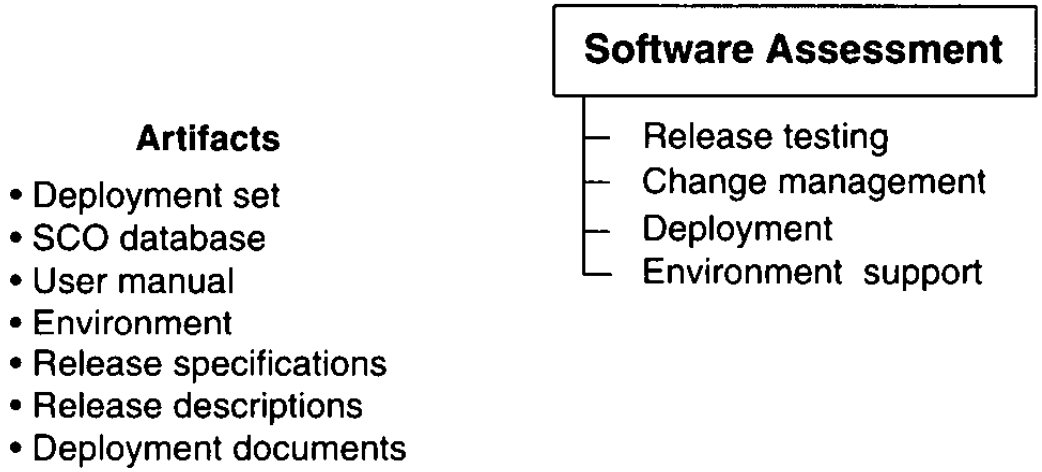
Inception	Elaboration	Construction	Transition
Prototyping support Make/buy trade-offs	Critical component design Critical component implementation and test Critical component baseline	Component design Component implementation Component stand-alone test Component maintenance	Component maintenance Component documentation

FIGURE 11-5. *Software development team activities*

Software Assessment Team

- *Software process assessments are* performed in an open and collaborative environment.
- They are for the use of the organization to improve its *software processes, and the* results are confidential to the organization.
- The organization being assessed must have members on the *assessment team.*

Software Assessment Team



Life-Cycle Focus

Inception	Elaboration	Construction	Transition
Infrastructure planning Primary scenario prototyping	Infrastructure baseline Architecture release testing Change management Initial user manual	Infrastructure upgrades Release testing Change management User manual baseline Requirements verification	Infrastructure maintenance Release baselining Change management Deployment to users Requirements verification

FIGURE 11-6. *Software assessment team activities*

3.3 Process Automation
[Computer-aided software engineering]

- Computer-aided software engineering (CASE) is software to support software development and evolution processes.
- Activity automation
  - Graphical editors for system model development; Data dictionary to manage design entities;
  - Graphical UI builder for user interface construction;
  - Debuggers to support program fault finding;
  - Automated translators to generate new versions of a program.

Computer-aided software engineering (CASE) Technology

- Case technology has led to significant improvements in the software process. However, these are not the order of magnitude improvements that were once predicted
  - Software engineering requires creative thought - this is not readily automated;
  - Software engineering is a team activity and, for large projects, much time is spent in team interactions. CASE technology does not really support these.

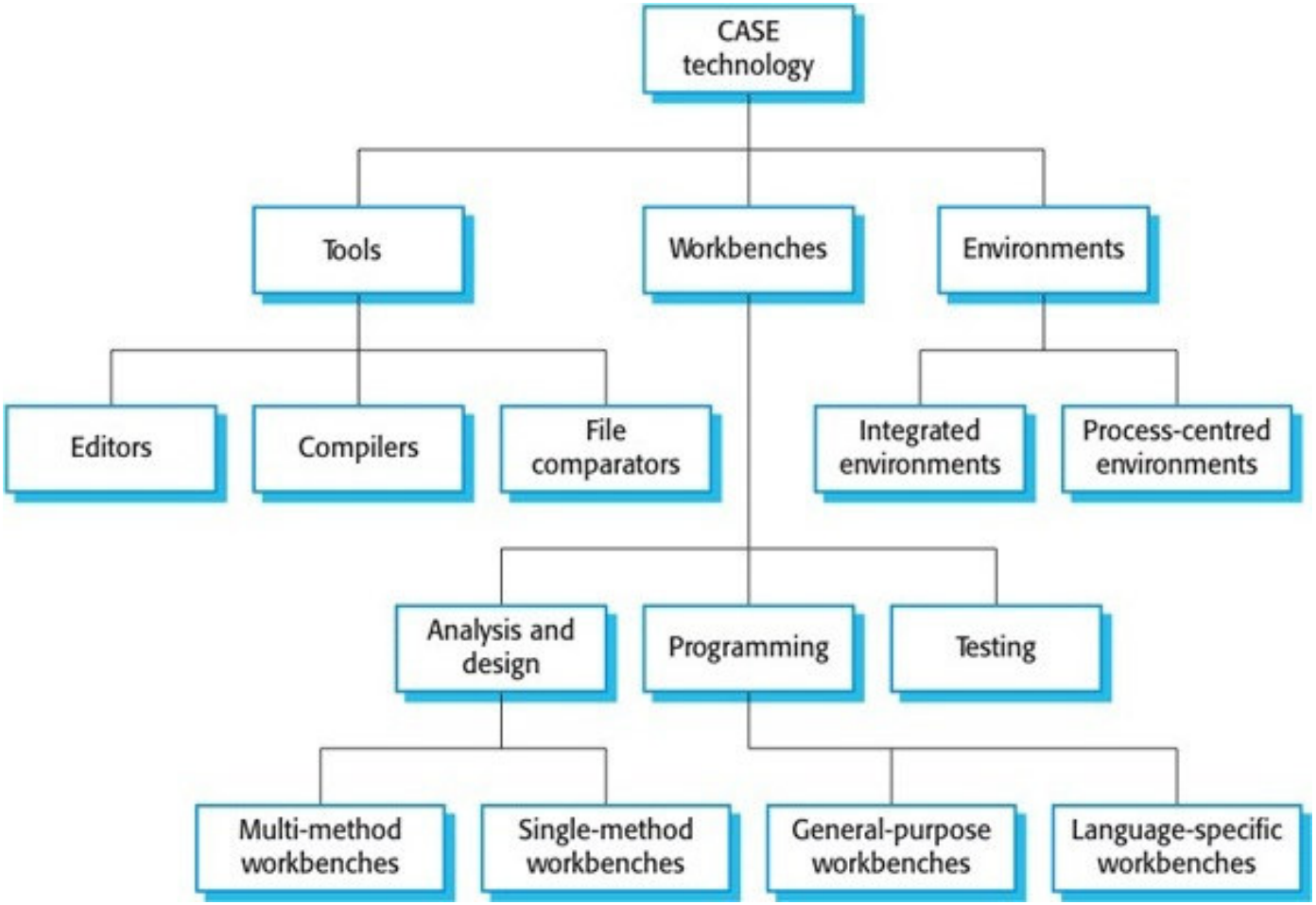
CASE Classification

- Classification helps us understand the different types of CASE tools and their support for process activities.
- Functional perspective
  - Tools are classified according to their specific function.
- Process perspective
  - Tools are classified according to process activities that are supported.
- Integration perspective
  - Tools are classified according to their organisation into integrated units.

CASE Integration

- Tools
  - Support individual process tasks such as design consistency checking, text editing, etc.
- Workbenches
  - Support a process phase such as specification or design, Normally include a number of integrated tools.
- Environments
  - Support all or a substantial part of an entire software process. Normally include several integrated workbenches.

Tools, Workbenches, Environments



3.4 Project Control and Process Instrumentation
The Core Metrics

TABLE 13-1. *Overview of the seven core metrics*

METRIC	PURPOSE	PERSPECTIVES
Work and progress	Iteration planning, plan vs. actuals, management indicator	SLOC, function points, object points, scenarios, test cases, SCOs
Budgeted cost and expenditures	Financial insight, plan vs. actuals, management indicator	Cost per month, full-time staff per month, percentage of budget expended
Staffing and team dynamics	Resource plan vs. actuals, hiring rate, attrition rate	People per month added, people per month leaving
Change traffic and stability	Iteration planning, management indicator of schedule convergence	SCOs opened vs. SCOs closed, by type (0,1,2,3,4), by release/component/subsystem
Breakage and modularity	Convergence, software scrap, quality indicator	Reworked SLOC per change, by type (0,1,2,3,4), by release/component/subsystem
Rework and adaptability	Convergence, software rework, quality indicator	Average hours per change, by type (0,1,2,3,4), by release/component/subsystem
MTBF and maturity	Test coverage/adequacy, robustness for use, quality indicator	Failure counts, test hours until failure, by release/component/subsystem

3.5 Process Customization

- It is important to have visible milestones in the life cycle , where various stakeholders meet to discuss progress and planes.
- **The purpose of this events is to:**
  - Synchronize stakeholder expectations and achieve concurrence on the requirements, the design, and the plan.
  - Synchronize related artifacts into a consistent and balanced state
  - Identify the important risks, issues, and out-of-role rance conditions
  - Perform a global assessment for the whole life-cycle.

Any Queries?