MODULE 5
MONITORING AND CONTROL

INTRODUCTION TO MONITORING AND CONTROL

- According to the Project Management Body of Knowledge (PMBOK), "***the Monitoring and Control Process Group consists of those processes performed:***
  - ***to observe project execution so that potential problems can be identified in a timely manner and***
  - ***corrective action can be taken, when necessary,***
  - ***to control the execution of the project.***"
- The main purpose of monitoring and controlling activities is to be proactive in finding issues ahead of time and taking corrective action.

CREATING THE FRAMEWORK

- **Perform regular monitoring - finding out what is happening** and comparing it with targets.
- If there is a mismatch between the planned outcomes and the actual ones then either re-planning is needed to bring the project back on target or the target will have to be revised.
- **Below figure illustrates a model of the project control cycle and shows how, once the initial project plan has been published**, project control is a continual process of monitoring progress against that plan and, where necessary, revising the plan to take account of deviations.

CREATING THE FRAMEWORK

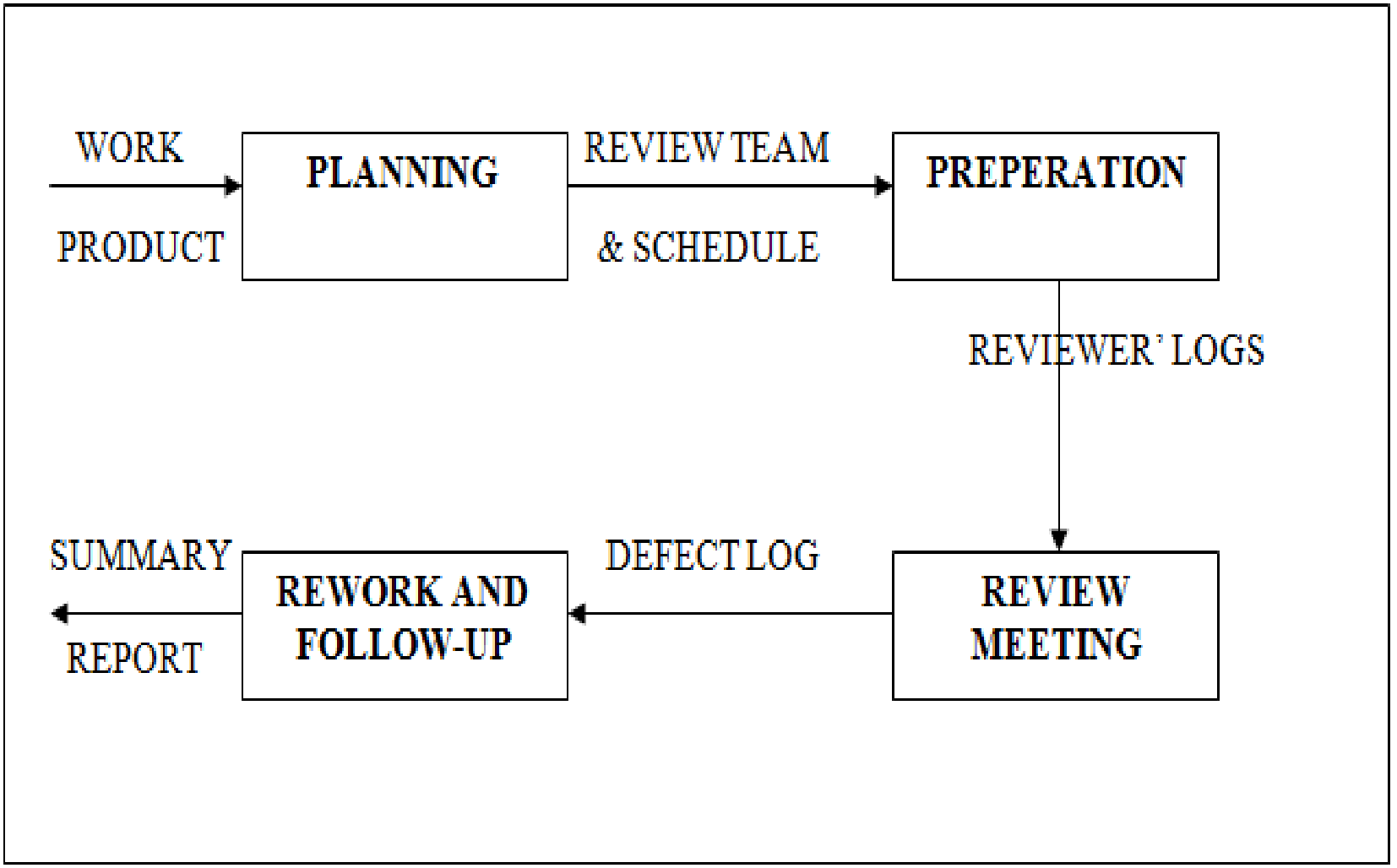
[Figure of Project control Cycle]

CREATING THE FRAMEWORK

REVIEW

Review is a very effective technique to remove defects from all work products including code.
In fact, review has been acknowledged to be more cost-effective in removing defects as compared to testing.
Review Process:
Review of any work product consists of the following **four important activities, like planning, review preparation and overview, review meeting, rework and follow-up.**

REVIEW



[FIGURE OF REVIEW PROCESS MODEL]

REVIEW

1) Planning:

- **Usually, the review process works best when the number of members is between five and seven.**

REVIEW

2) Preparation:

- In the preparation meeting, copies of the work product are distributed to the review team members.
- The reviewers then individually carry out review and record their observations in separate documents called review logs.

3) Review meeting:

- In the review meeting the reviewer's give their comments based on the logs they have prepared beforehand. The comments may related to a defect, work simplification, maintainability etc.

4) Rework:

- The author addresses all the issues raised by the reviewers by carrying out the necessary modifications to the work product and prepare a jointly to all the points described in review log.

PROJECT TERMINATION REVIEW

- Project termination reviews are important for successful, failed, as well as prematurely abandoned projects.
- **Reasons for project termination:**
  - Project is **completed successfully** and handed over to the customer
  - **Incomplete** requirements
  - **Lack** of resources
  - Some key technologies used in the project have become **obsolete during project execution**
  - **Economics of the project has changed**, for example because many competing products may have become available in the market

PROJECT TERMINATION REVIEW

Project termination process:

- The important activities that are carried out as a part of the project termination review process are as follow:
- **Project survey:** The objective of the project survey activity is to collect various types of information related to project, without compromising the confidentiality of the respondents.
- **Collection of objective information:** The different types of metrics that are collected include the cost, schedule and quality metrics.
- **Debriefing [cross-examine] meeting:** It is a preparatory meeting that helps to ensure the final project review meeting focuses on the most relevant aspects.

PROJECT TERMINATION REVIEW

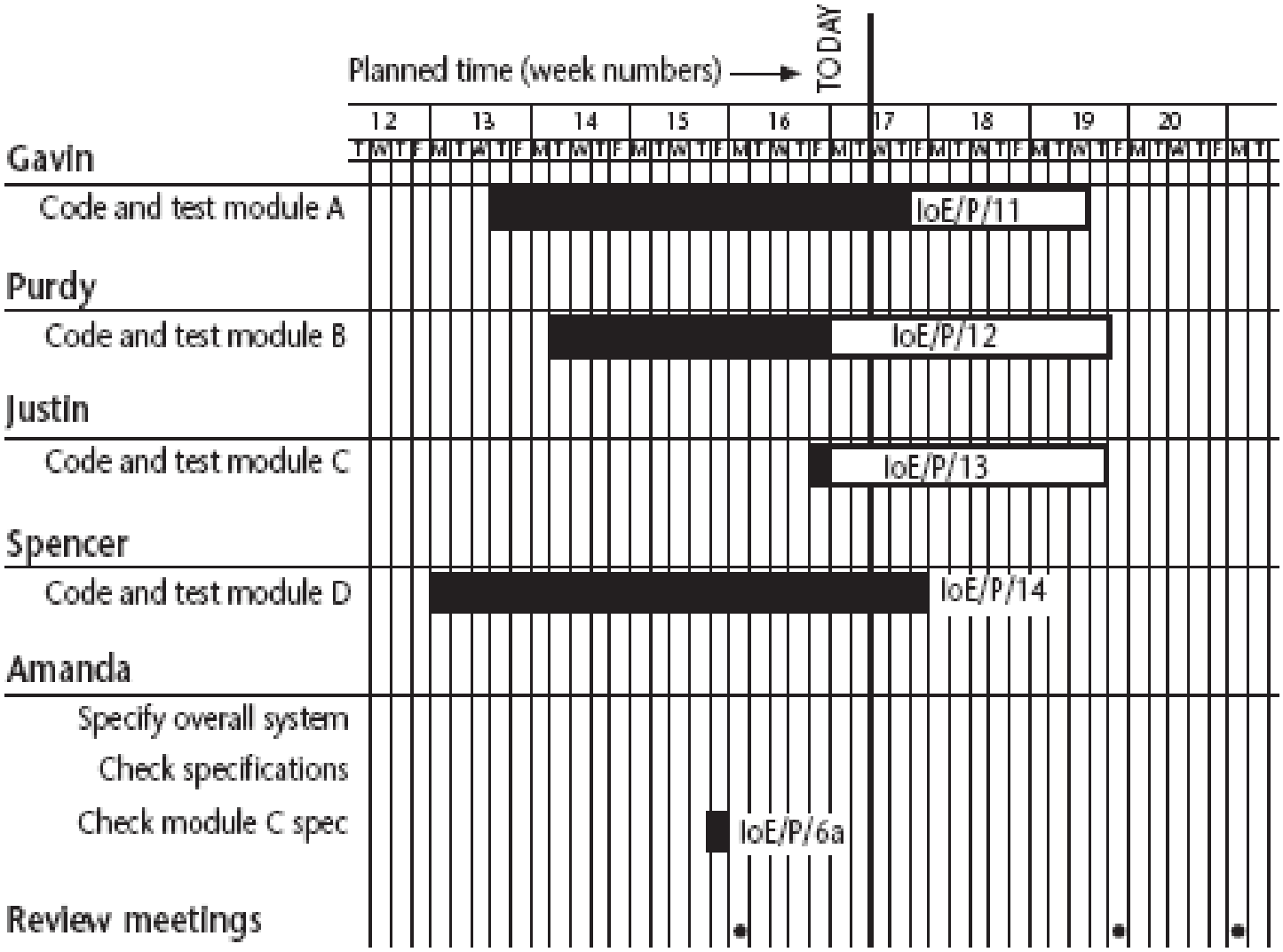
Project termination process:

- **Final project review:** This meeting usually addresses various issues arising out of project planning and tracking, preliminary phases, configuration management, verification and validation.
- **Result Publication:** The project leader summarizes the positive and negative findings arrived at during the termination review process as well as prescriptions for improvement.

VISUALIZING PROGRESS

- Having collected data about project progress, a manager needs some way of presenting that data to greatest effect.
- Some methods such as **Gantt chart provide a static picture, a single snap shot,** whereas others such as **time line charts try to show how the project has progressed and changed through time.**
- **Gantt charts:**
- This is essentially **an activity bar chart indicating scheduled activity dates and durations, frequently expand with activity floats.**
- Reported progress is recorded on the chart (normally by shading activity bars) and a 'today cursor' provides an immediate visual indication of which activities are ahead or behind schedule.

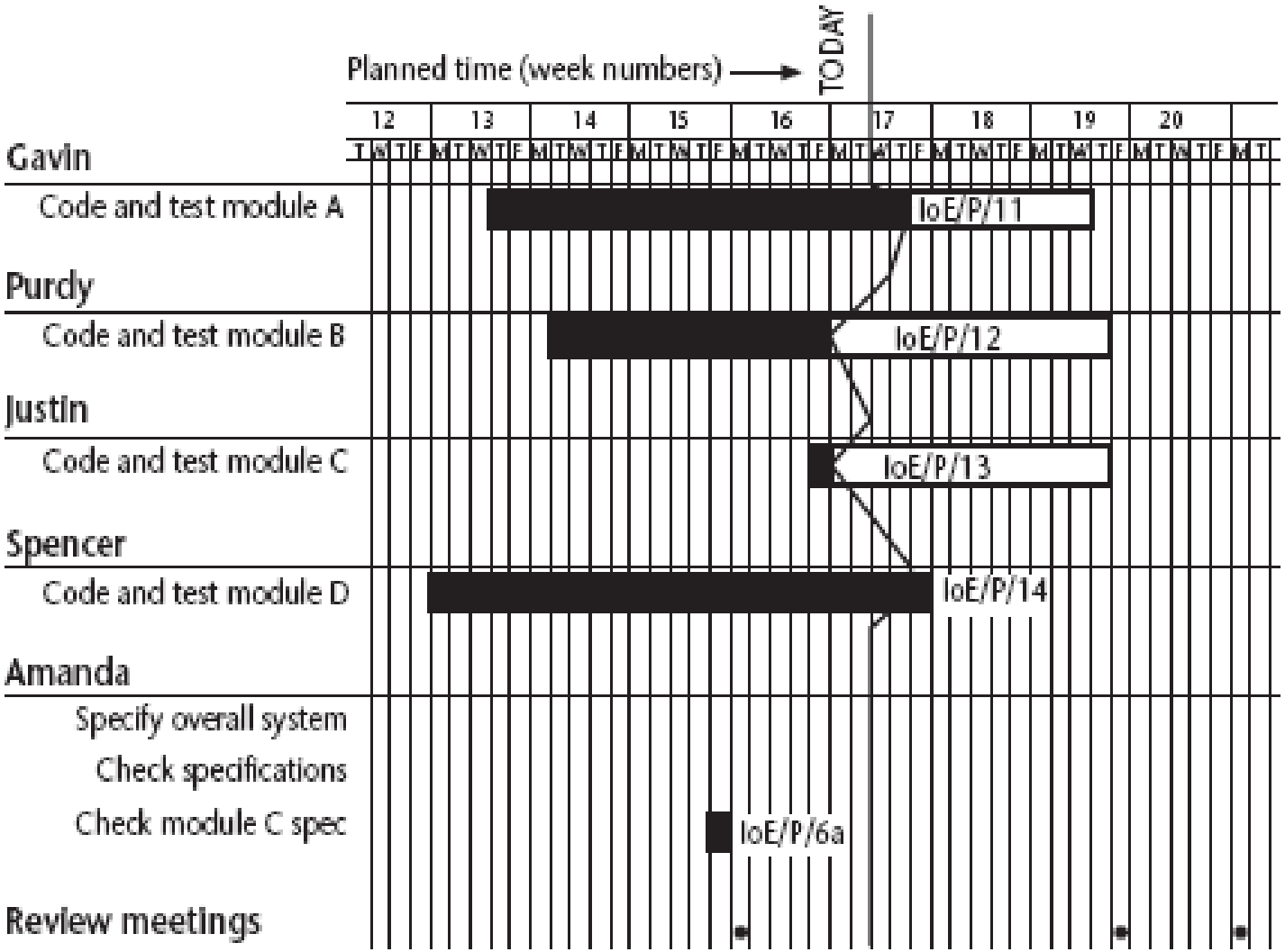
GANTT CHARTS



VISUALIZING PROGRESS

- **Slip charts:**
- A slip chart (shown in below figure) is very similar alternative favored by some project managers who believe it **provides a more striking visual indication of these activities that are not progressing to schedule- the more the slip line bends, the greater the variation from the plan.**
- Additional slip lines are added at intervals and, as they build up, the project will gain an idea as to whether the project is improving or not.
- **A very jagged slip line indicates a need for rescheduling.**

SLIP CHARTS


Planned time (week numbers)
TODAY
12
13
14
15
16
17
18
19
20
Gavin
Code and test module A
IoE/P/11
Purdy
Code and test module B
IoE/P/12
Justin
Code and test module C
IoE/P/13
Spencer
Code and test module D
IoE/P/14
Amanda
Specify overall system
Check specifications
Check module C spec
IoE/P/6a
Review meetings

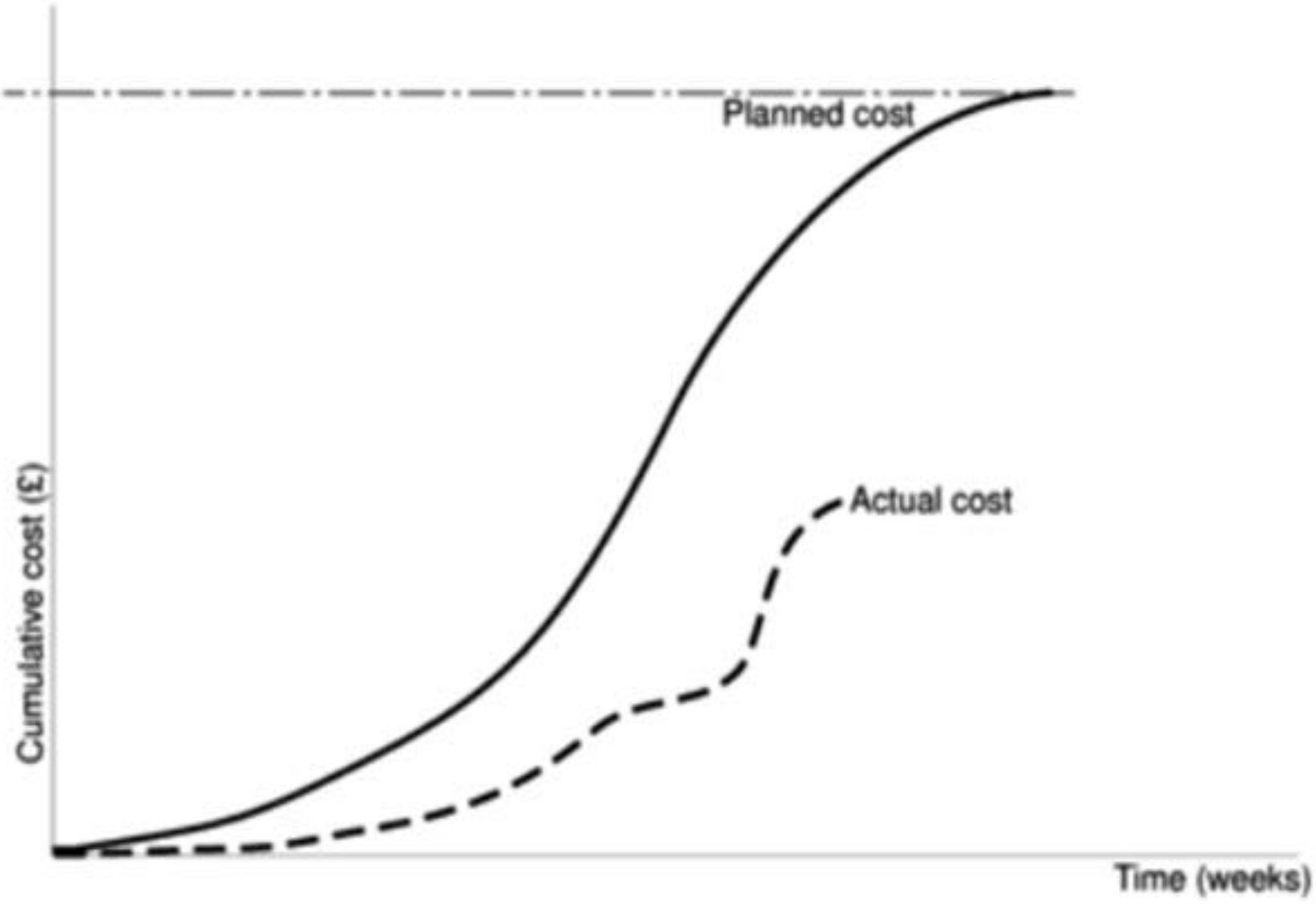
VISUALIZING PROGRESS

- **The timeline chart:**
- The timeline chart is a **method of recording and displaying the way in which targets have changed** throughout the duration of the project.
- Below figure shows a timeline chart of a timeline chart (or Brigeue's project at the end of the sixth week).
- **Planned time** is plotted along the **horizontal axis** and **elapsed time** down the **vertical axis**.
- The lines meandering [indirect] down the chart represent scheduled activity completion dates - at the start of the project analyse existing system is scheduled to be completed by the Tuesday of week 3, obtain user requirements by Thursday of week 5, issue tender, the final activity, by Tuesday of week 9, and so on.

COST MONITORING

- Expenditure [expenses] monitoring is an important component of project control, not only in itself, but also because **it provides an indication of the effort that has gone into (or at least been charged to) a project.**
- A cumulative expenditure chart such as that shown in below figure provides a simple method of comparing actual and planned expenditure.
- By itself it is not particularly meaningful- Figure could, for example, illustrate a project that is running late or one that is on time but has shown substantial costs savings.

COST MONITORING

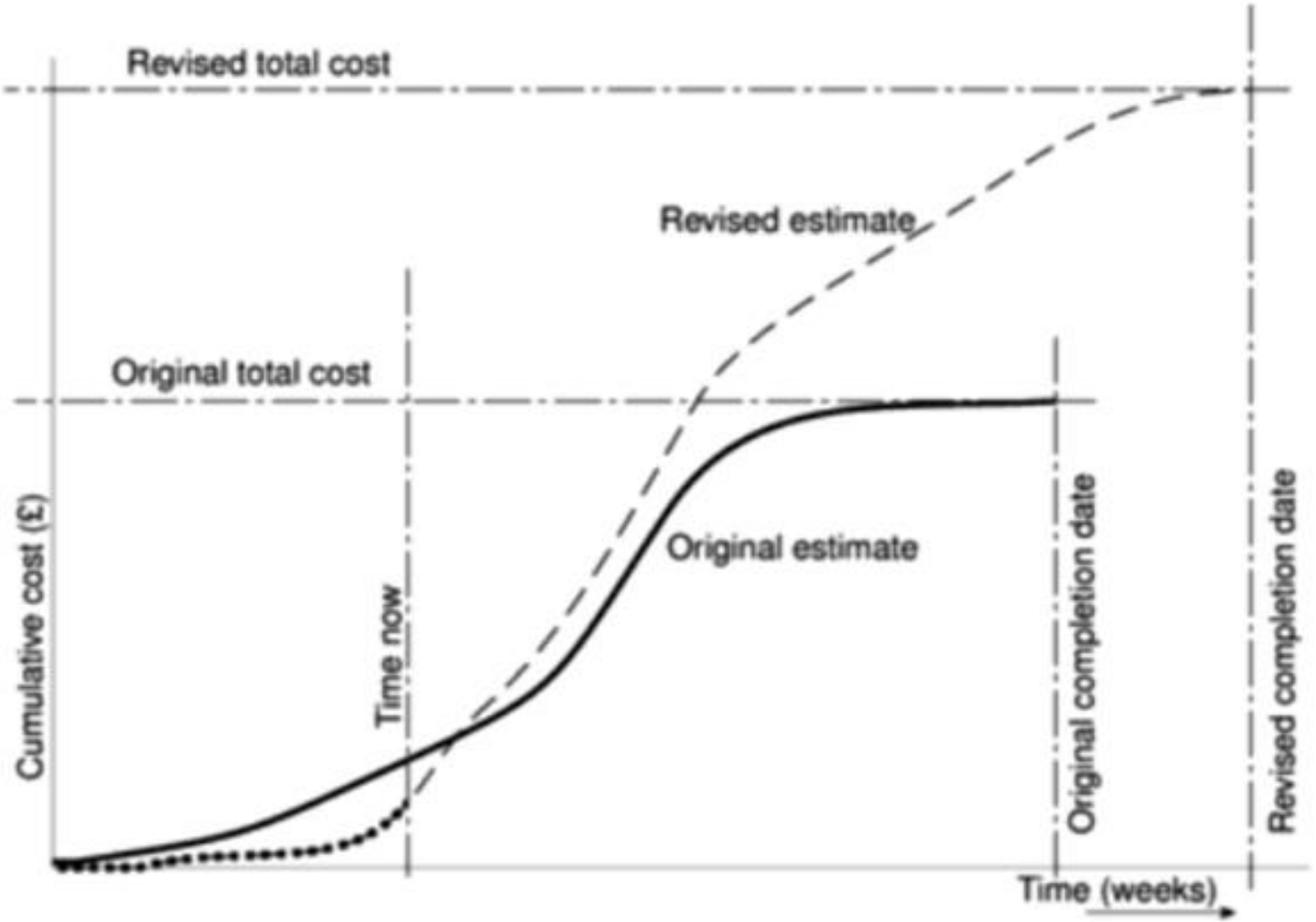


[Figure of Tracking cumulative expenditure]

COST MONITORING

- Cost charts become much more useful if we **add projected future cost calculated by adding the estimated cost** of uncompleted work to the costs already earned.
- Below figure illustrates the additional information available once the **revised cost** schedule is included - in this case it is clear that the **project is behind schedule and over budget.**

COST MONITORING



[Figure of The cumulative expenditure chart can also show revised estimates of cost and completion date]

EARN VALUE ANALYSIS

- Earned Value Analysis has gained in popularity in recent years and may be seen as a refinement of the cost monitoring.
- Earned Value Analysis is based on assigning a 'value' to each task or work package (as identified in the **WBS- Work Breakdown Structure**) based on the original expenditure forecasts.
- The assigned value is the original budgeted cost for the item and is known as the **baseline budget or Budgeted Cost of Work scheduled (BCWS)**.

EARN VALUE ANALYSIS

DAY	QUANTITY	AMOUNT	ACTUAL QUANTITY	ACTUAL AMOUNT	EV
1	10	100	7	120	70
2	10	100			
3	10	100			
4	10	100			
5	10	100			

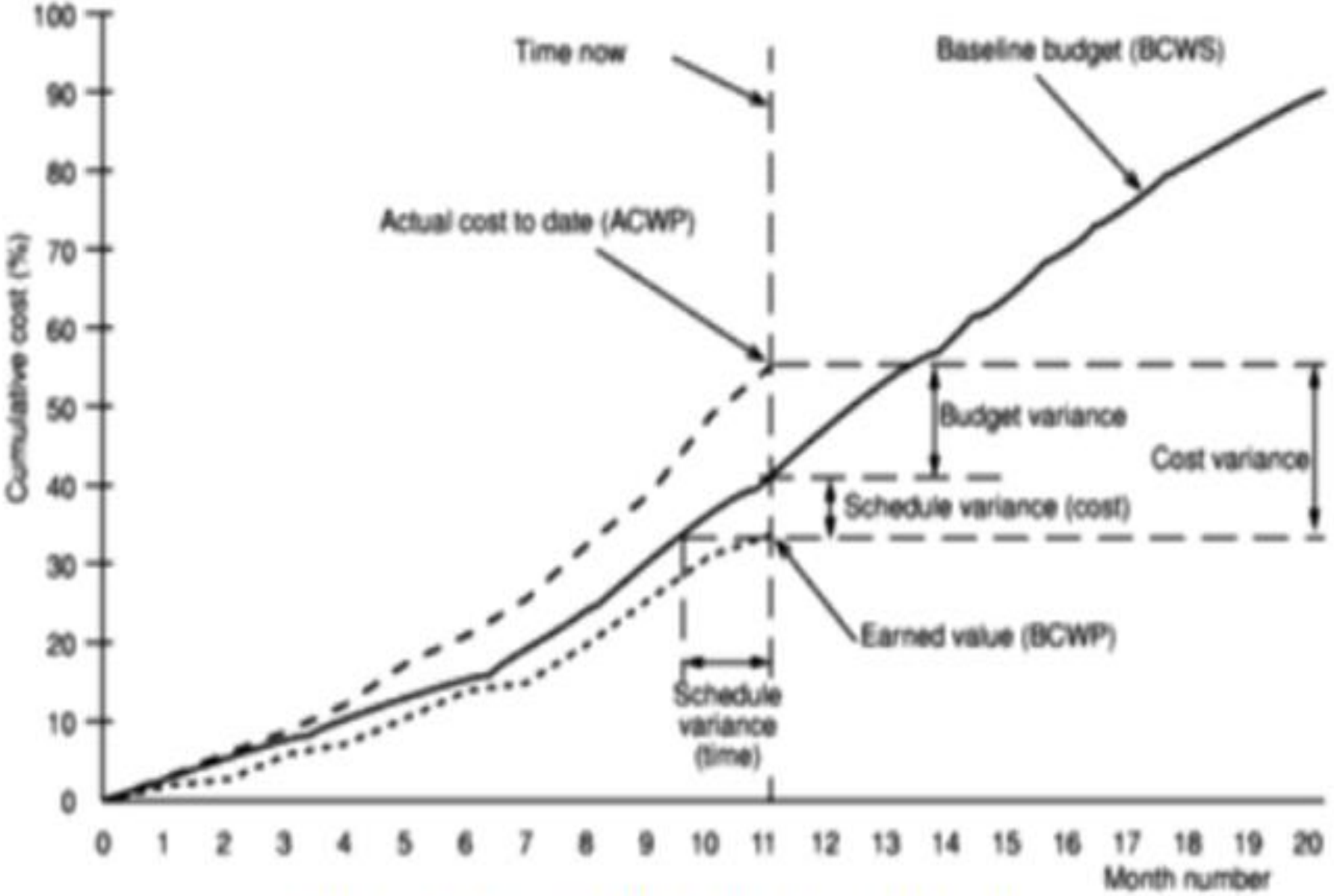
EARN VALUE ANALYSIS

- ***Planned value (PV)* or *Budgeted cost of work scheduled (BCWS)*** – original estimate of the effort/cost to complete a task (compare with idea of a 'price')
- ***Earned value (EV)* or *Budgeted cost of work performed* (BCWP)** – total of PVs for the work completed at this time.

EARN VALUE ANALYSIS

- Common methods in software projects are:
  - **the 0/100 technique:** where a task is assigned a value of zero until such time that it is completed when it is given a value of 100% of the budgeted value;
  - **the 50/50 technique**: where a task is assigned a value of 50% of its value as soon as it is started and then given a value of 100% once it is complete:
  - **the milestone technique:** where a task is given a value based on the achievement of milestones that have been assigned values as part of the original budget plan.

EARN VALUE ANALYSIS



[Figure of Earned Value Tracking Chart]

EARNED VALUE – AN EXAMPLE

- Tasks
  - Specify module 5 days
  - Code module 8 days
  - Test module 6 days
- At the beginning of day 20, PV = 19 days
- If everything but testing completed EV = 13 days
- Schedule variance = EV-PV i.e. 13-19 = -3
- Schedule performance indicator (SPI) = 13/19 = 0.68

EARNED VALUE ANALYSIS – ACTUAL COST

- Actual cost (AC) is also known as Actual cost of work performed (ACWP)
- In previous example, if
  - 'Specify module' actually took 3 days
  - 'Code module' actually took 4 days
- Actual cost = 7 days
- Cost variance (CV) = EV-AC i.e. 13-7 = 6 days
- Cost performance indicator = 13/7 = 1.86
- Positive CV < 1.00 means project under budget

PRIORITIZING MONITORING

- Here the list of the priorities we might apply in deciding levels of monitoring.
- **Critical path activities:**
  - Any delay in an activity on the critical path will cause a delay in the completion date for the project.
  - Critical path activities are therefore likely to have a very high priority for close monitoring.
- **Activities with no free float/time: [Float means the amount of time an activity may be delayed without affecting any subsequent activity]**
  - A delay in any activity with no free float will delay at least some subsequent activities even though, if the delay is less than the total float, it might not delay the project completion date.

PRIORITIZING MONITORING

- **Activities with less than a specified float/time:**
  - If any activity has very little float it might use up this float before the regular activity monitoring brings the problem to the project manager's attention.
  - It is common practice to monitor closely those activities with less than, say, one week free float.
- **High risk activities:**
  - A set of high risk activities should have been identified as part of the initial risk profiling exercise.
  - If we are using the PERT three-estimate approach we will designate as high risk those activities that have a high estimated duration variance. These activities will be given close attention because they are most likely to overrun or overspend.

PRIORITIZING MONITORING

- **Activities using critical resources:**
  - Activities can be critical because they are very expensive (as in the case of specialized contract programmers).
  - **Staff or other resources might be available only for a limited period, especially if they are controlled outside the project team.**
  - In any event, an activity that demands a critical resource requires a high level of monitoring.

CHANGE CONTROL

- When a document such as the user requirements is being developed there may be **many different versions of the document as it undergoes cycles of development and reviews.**
- Any change control process at this point would be very informal and flexible.
- At some point what is assumed to be the final version will be created. **This is baselined, effectively frozen.**
- So any changes to the baselined document could have effects on other parts of project.

TYPICAL CHANGE CONTROL PROCESS

1. One or more users might observe the need for a change.
2. User management decide that the change is valid and worthwhile and pass it to development management.

- It is important that there is a single authorized channel for **requests for change (RFCs)** between the client community and the management of the developers.

3. A developer is assigned to assess the practicality and cost of making the change or RFCs.

TYPICAL CHANGE CONTROL PROCESS

4. Development management report back to user management on the cost of the change; user management decide whether to go ahead.
5. One or more developers are authorized to make copies of components to be modified.
6. Copies modified. After initial testing, a test version might be released to users for acceptance testing.
7. When users are satisfied then operational release authorized – master configuration items updated.

SOFTWARE CONFIGURATION MANAGEMENT[SCM]

- **SCM is concerned with tracking and controlling changes to the software.**
- In any systematic development and maintenance environment, various work products (code, design document, code etc.) associated with the software continually change during the development or maintenance phase.
- In a team development environment, each member of the development or maintenance team would be assigned to handle some modification requests.
- So every work product would have to be accessed and modified by several members.
- **In such situation, unless a proper configuration management system is deployed, several problems can appear.**

SOFTWARE CONFIGURATION MANAGEMENT[SCM]

- Configuration management practices include version control and the establishment of baselines [core products.]
- **Purpose of Software Configuration Management:**
  - Problems associated with concurrent access
  - Undoing changes
  - System accounting
  - Handling variants
  - Accurate determination of project status
  - Preventing unauthorized

SOFTWARE CONFIGURATION MANAGEMENT[SCM]

- **Configuration management process:**
- Configuration management is carried out through the following TWO principal activities:
- **1. Configuration Identification:** this activity involves deciding which parts of the system should be kept under configuration management.
- **2. Configuration control:** this activity is used to ensure that changes to a system occur smoothly.

SOFTWARE CONFIGURATION MANAGEMENT[SCM]

- **1. Configuration Identification:**
- Project manager normally classify the work products associated with a software development process into three main categories,
- i) controlled,
- ii) pre-controlled
- iii) uncontrolled.
- **Controlled work products** are those that are **put under configuration control.** The team members must follow some formal procedures to change these.
- **Pre-controlled work products** are **not yet under configuration control**, but will eventually be under configuration control.

SOFTWARE CONFIGURATION MANAGEMENT[SCM]

- Uncontrolled work products will not be subject to configuration control.
- **Controllable work products** include **both controlled and pre-controlled** work products.
- Typical controllable work products include the following:
  - Requirements specification document
  - Design documents
  - Tools used to build the system such as compilers, linkers, parsers etc.
  - Test cases
  - Source code for each module
  - Problem reports

SOFTWARE CONFIGURATION MANAGEMENT[SCM]

- **Configuration control:**
- The project manager can **give permission** to some members to be **change or access specific work products.**
- In order to change a **controlled work product** such as a code module, a developer can **get a private copy of the module** though a reserve operation.
- Configuration management tools **allow only one team member to reserve module at any time.**
- Once a product is reserved it does not allow anyone else to reserve this module until the reserved module is restored.

SOFTWARE CONFIGURATION MANAGEMENT[SCM]

- **Open source Configuration Management Tools:**
- **SCCS [Source Code Control System] and RCS [Revision Control System]** are two most popular configuration management tools.
- SCCS and RCS can be u**sed for controlling and managing different version of text files.**
- SCCS and RCS **do not handle binary files (e.g. executable files etc)**
- SCCS and RCS provide an efficient way of **storing versions that minimize the amount of occupied disk space.**

SOFTWARE CONFIGURATION MANAGEMENT[SCM]

- The changes needed to transform each baseline file to the next version are stored and are called **deltas.**
- The main reason behind storing the deltas rather than **storing the full version files is to save disk space.**
- The change control facilities provided by SCCS and RCS include the ability **to incorporate restrictions on the set of individuals who can create new versions, and facilities for checking components in and out.**

- **Video**
- https://www.youtube.com/watch?v=AaHaLjuzUm8

THANK YOU