Introduction to Cost and Schedule Management

In this module, we will focus on topics surrounding cost and scheduling. After reviewing cost and scheduling from a management perspective, we will continue to explore project scheduling further by looking at Rolling Wave planning. In the last section of the module, we will discuss cost and scheduling management techniques.

Two critical functions of a Software Project Manager are staying on top of the ever-fluctuating cost and schedule of a project. We will begin by looking at methods or tools used to manage the cost and schedule and we will discuss industry standards in these areas.

Scope of Cost and Schedule Management

A Cost and Schedule Management System (CSMS) is an integrated management control structure used to manage programs that includes planning, accounting, budgeting, scheduling, work authorization, and analysis. CSMS is widely used especially on government programs but it is becoming increasingly widespread on commercial programs. Earned Value Management (EVM) is a project management method for assessing project performance and progress in an unbiased fashion. At the Department of Defense (DoD) and other Federal agencies, EVM is often referred to as the Cost/Schedule Control Systems Criteria (C/SCSC). In 1999, the United States Office of Management and Budget (OMB) began to require EVM use across all government agencies for internally managed projects and for contractors. Contractors' internal systems must meet the US government criteria to be considered acceptable by government procuring agencies.

Project Management Institute (PMI) is one of the world's largest professional membership associations. Its standards are targeted at projects, programs, people, organizations, and the profession. PMI publishes *A Guide to the Project Management Body of Knowledge* (PMBOK Guide), an industry standard, and certifies individuals as Project Management Professional (PMP).

The goal of software cost and schedule management is to ensure that quality software products are produced within the cost and schedule constraints of the program. Cost and schedule management can apply to all projects: large or small, government or commercial, risky or risk free. The amount of rigor will vary from project to project. For example, on a government program, your contract will likely require cost and schedule management, but on a commercial program, it may not be mandatory. The contract may direct specific practices to follow. If practices are not identified, the Program Software Manager must tailor practices to the program/project and obtain concurrence from the Program Manager and the Software Department Manager to ensure solid communication among the teams. The Program Software Manager is responsible for implementing the cost and schedule management program.

The benefits of cost and schedule management are improved planning, clearly defined roles and responsibilities for team members, improved problem traceability should issues arise, the ability to affect the future, early warning of potential problems, and more accurate estimates at completion (EAC).

Management Reviews

Management reviews are conducted throughout the development effort to monitor cost and schedule progress. You should become familiar with two management reviews.

The ***Cost and Schedule Status Review*** is conducted monthly for each open Work Authorization Delegation or Document (WAD), the document that permits the tasks to be executed. The WAD Manager, the Program Manager, and the Financial Analyst must attend the meeting. The Cost Account Schedule

(CAS), which includes a detailed schedule of the current project, is examined and credit is given for task completion. A comparison is made between the work performed, work scheduled, and actual costs to determine the schedule and cost variances. This is the measure of program performance

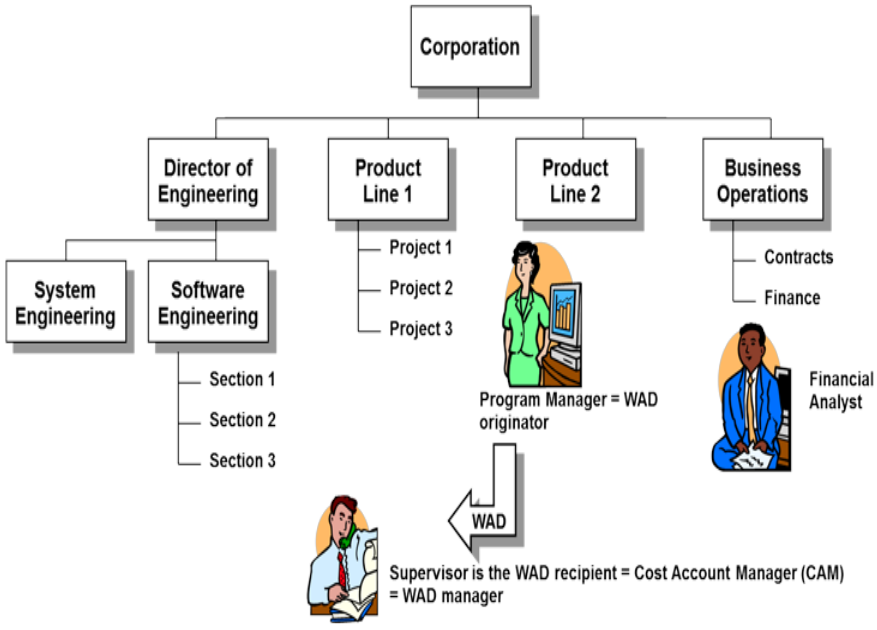
The ***WAD Review*** is also conducted monthly. Here the Engineering Manager chooses which selected programs will be evaluated for that month based on program priority, criticality, or issues. This review addresses the current schedule, problems, solutions, and plans for the future. The Engineering Director, Program Manager, Software Project Manager, and the Lead Systems/Software Engineering attend the WAD Review.

The Software Manager's responsibilities for the group's activities and at these reviews include maintaining cognizance of the status of the work accomplished and hours expended for all of his/her WADs and Work Package Tasks (WPTs), the activities listed in the WAD. This can be accomplished with weekly status reports, weekly status meetings, reviewing the financial reports (such as the Program Cost Status Report and the Program Hours Worked Report), continuously monitoring risk items, assessing issues often by using the Quality Assurance team (an independent entity), and keeping the Department Manager informed of progress at least weekly.

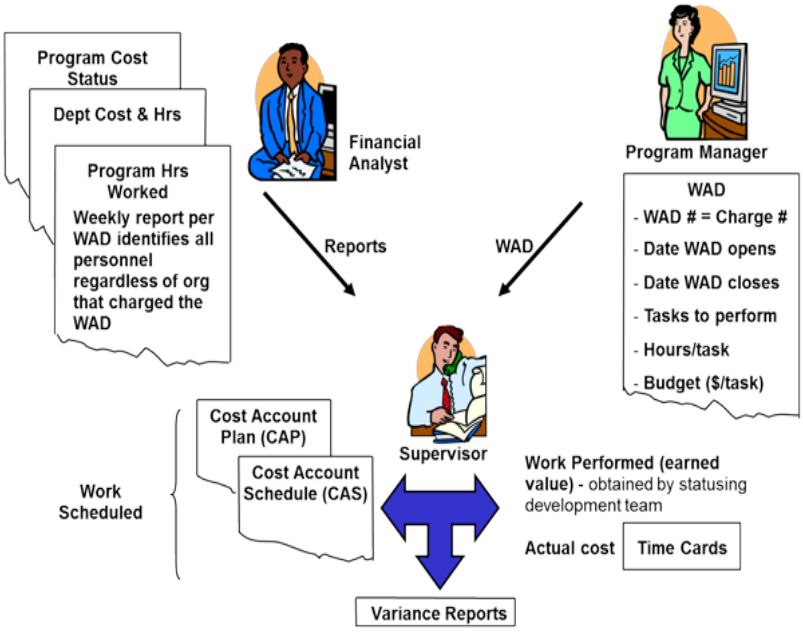
Cost and Schedule Management Techniques

Definitions

Within the organization, personnel have certain roles that include how they must interact with each other. The graphic below illustrates this point using CAM and others interacting with the WAD.



The image below depicts some of the many processes that must be followed to help ensure successful outcomes.



The 27 cost and schedule management terms are divided into four (4) categories as follows:

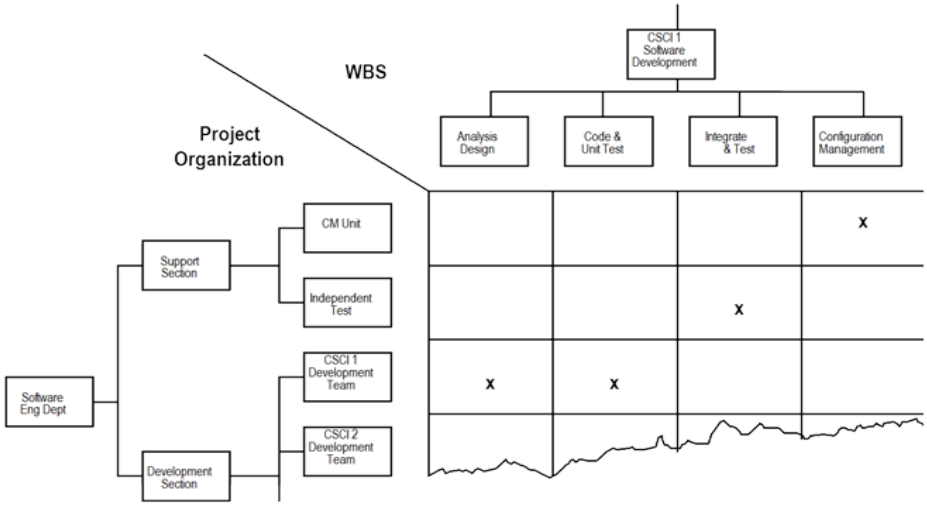
Roles	Documentation	Process	Other
Cost Account Manager (CAM)	*Cost Account Plan (CAP)*	*Actual Cost*	*Direct Labor*
Financial Analyst	*Cost Account Schedule (CAS)*	*Actual Cost of Work Performed (ACWP)*	*Fiscal Year*
WAD Manager	*Department Cost Status Report*	*Budgeted Cost of Work Performed (BCWP)*	*Fringe*
WAD Originator		*Budgeted Cost of Work Scheduled (BCWS)*	*General and Administrative (G&A)*
WAD Recipient	*Funds Expenditure Report*	*Cost Variance*	*Indirect Labor*
	Program Cost Status Report	*Earned Value*	*Overhead*
	Program Hours Status Report	*Rolling Wave*	
	Variance Report	*Schedule Variance*	
	Work Authorization Delegation or	*Work Accomplished*	

Roles	Documentation	Process	Other
	Document (WAD)		
	Work Breakdown Structure (WBS)	*Work Allocated*	
	Work Package Task (WPT)	*Work Budgeted*	
		Work Performed	
		Work Planned	
		Work Scheduled	

See Definitions at the bottom of Course Modules for definitions of these terms.

The Program Manager is the WAD originator and the supervisor is called the WAD recipient, the Cost Account Manager (CAM), or the WAD manager. Determining the status of the development team's work gives you the Earned Value or Work Performed.

Programs create a Work Breakdown Structure (WBS) or discrete work elements organized in a way that helps define the total work scope of the project as shown in the graphic below.



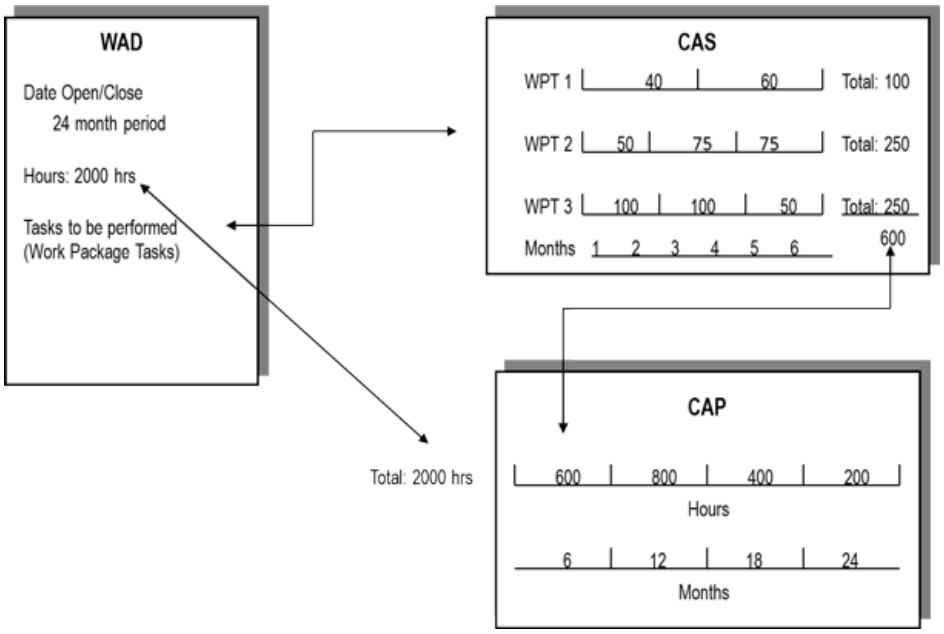
When the Software Manager receives a WAD, he/she assigns the WBS elements or Work Package Tasks (WPTs) to individuals to perform.

Aligning the WAD, CAP, and CAS

The WAD contains the tasks—generally—broken out by each phase of the project lifecycle. The Cost Account Schedule (CAS) is used to schedule milestones for each WPT over a near term period of time (typically 6 months). Each WPT is allocated hours in the schedule for each month it is performed.

The Cost Account Plan (CAP) is used to show how the contract hours (not yet allocated to CAS) are allocated over the remaining months of the schedule. The CAS & CAP are used together to monitor the amount of work performed (earned value) against work scheduled for each Work Package Task (WPT)

defined in the CAS. The WPTs defined in the CAS must match the task description in the WAD. The definition of WPTs is critical to the software cost & schedule management process. The following graphic shows how hours on the WAD reflect on the CAP and CAS when applied.



Earned Value Management (EVM)

A cost and schedule management implementation is used to analyze.

schedule variance = earned value (or work performed) less work scheduled

and

cost variance = earned value (or work performed) less actual cost.

CSMS requires the use of Cost Account Plans (CAPs) and Cost Account Schedules (CASs). It is typically applied to development programs that have less than 10% level-of-effort (LOE) tasking.

LOE is defined as support type activities such as management or clerical activities with no definite or deliverable products. The budget is evenly distributed over period of performance so the activity is never ahead of or behind schedule—that is, the earned value is based on passage of time.

To monitor cost and schedule, formal meetings are held periodically (generally monthly) with the financial analyst, CAM, and Program Manager to compare the amount of work performed (claimed by the CAM) with the amount scheduled (identified in the CAS and CAP) and actual cost of work performed (obtained from employee time cards).

Five Earned Value Methods

Earned Value is the same as Accomplishment or Work Performed.

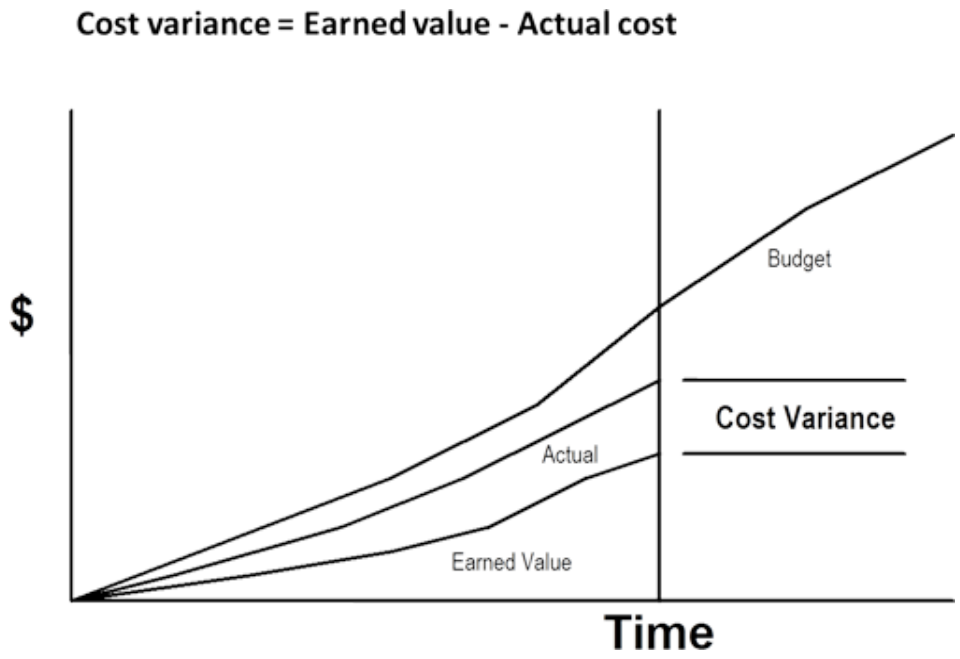
The CAM selects the earned value method and budgets the work to be done for each allocated WAD WPT. There are five widely used earned value methods.

The next item contains a video that provides a brief overview of each of the five most common methods.

Cost and Schedule Variance

As the project progresses, CAMs monitor progress by comparing earned value (or work performed) with the plan (or budget from CAS) and with actual cost (time cards & accounting system) to determine schedule and cost variance. This is done monthly for the preceding month and cumulatively for the schedule to date. Significant variances (top 10 variances or those exceeding some percentage, often 10%) are analyzed and documented in a cost or schedule variance report. The variance report includes what caused the problem, the corrective action planning, and the impact on the project.

Cost Variance is defined as the earned value minus the actual costs as illustrated below.



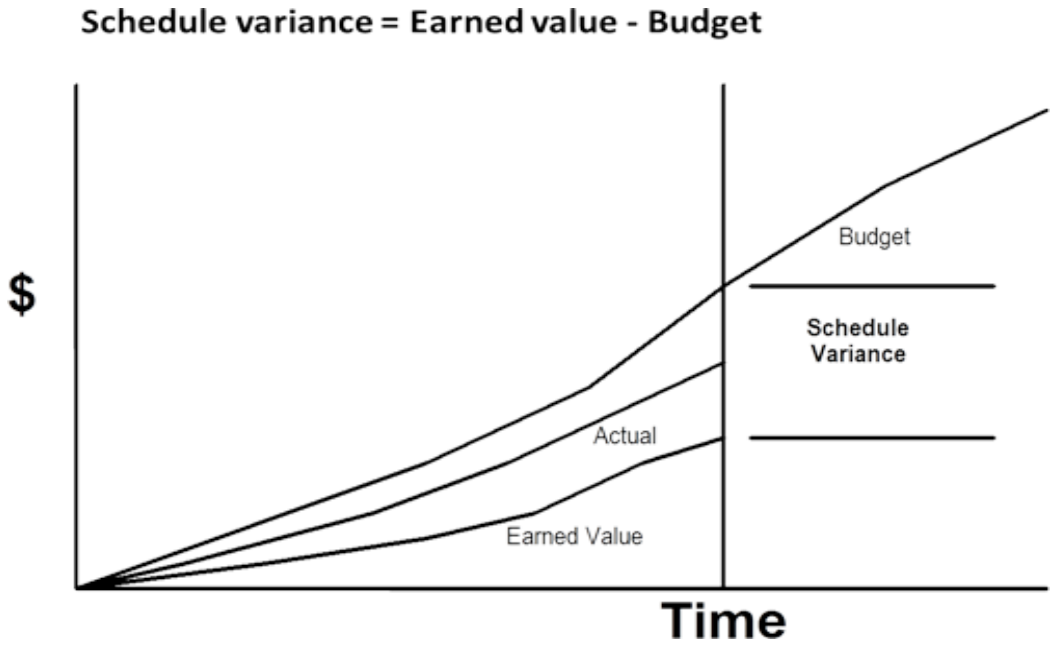
Actual cost consists of direct labor, fringe benefits, overhead, and general and administrative (G&A) costs as shown here.

Actual Cost of the Product is:	Example
Direct Labor	$30.00/hr
Fringe (benefits) 40%	$12.00/hr
Labor and Fringe Subtotal	$42.00/hr
Overhead (office space, utilities, etc.) 50%	$21.00/hr
Labor, fringe, and overhead Subtotal	$63.00/hr
General & Administrative costs (G&A) 10%	$6.30/hr

Actual Cost of the Product is:	Example
Overall Total Billing Rate	$69.30/hr

Projects may allow different combinations of direct labor, fringe benefits, overhead, and/or G&A costs to be charged to the customers and companies will vary in the percentage charged for fringe benefits, overhead and G&A costs.

Schedule Variance is defined as the earned value minus the budget, as shown here.



Effect of Cost and Schedule Combinations

The purpose of these tools, methods, and standards is to help you, as the project manager, keep account of your project's status. Being ahead or behind in cost or schedule impacts the project and can have a ripple effect on future tasks and the entire project. The chart below shows the various combinations.

	Cost variance positive (under running cost)	Cost variance negative (over running cost)
Schedule variance negative (behind schedule)	Behind schedule but under running cost Maybe not so bad	Behind schedule and over running cost Manager's nightmare!
Schedule variance positive (ahead of schedule)	Ahead of schedule and under running cost Manager's delight!	Over running cost but ahead of schedule Maybe not so bad