Module Three: Project Scope, Planning, and Time Management

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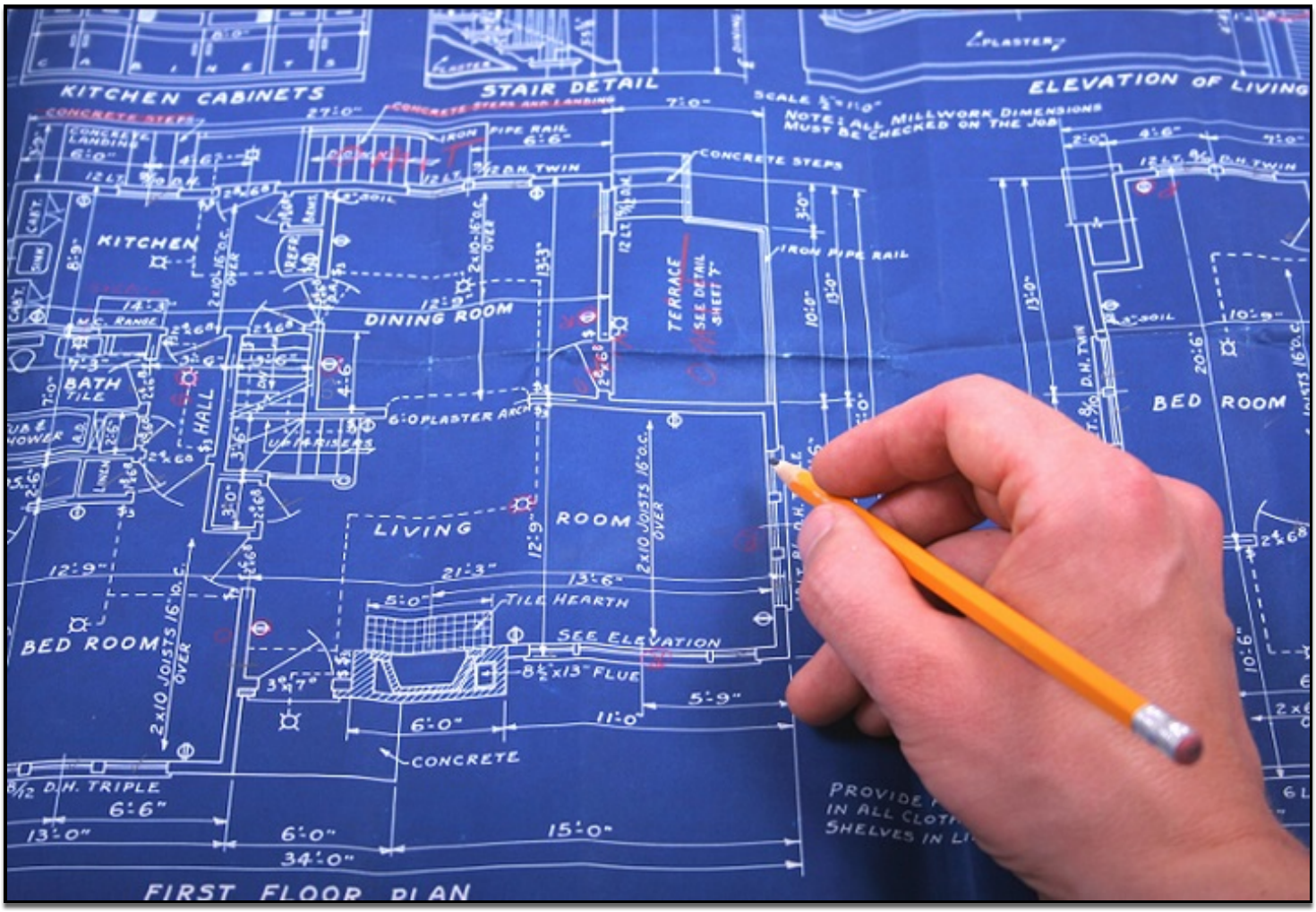
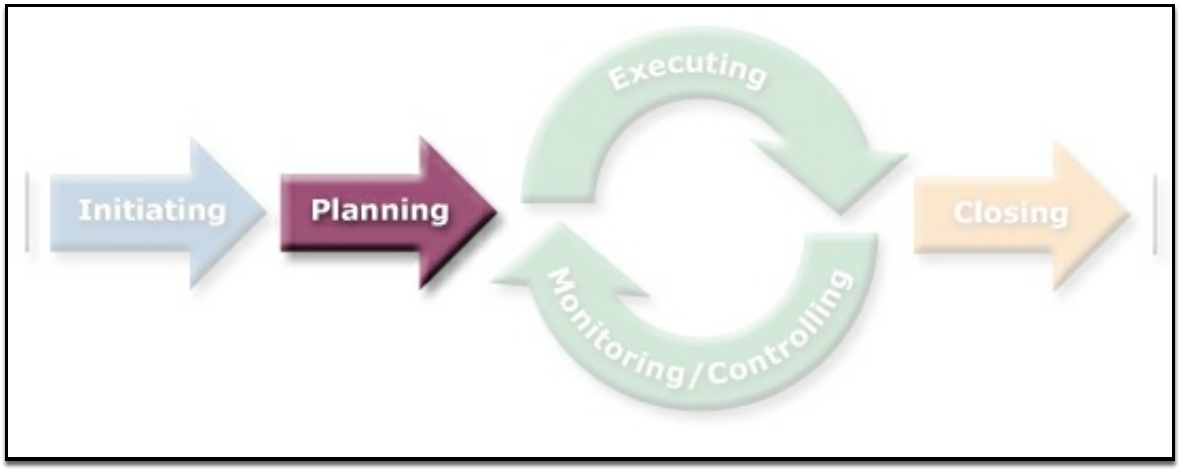


3.01 Learning Outcomes

Module Three: Project Scope, Planning, and Time Management



Before they can begin to tackle a project, project team members and key stakeholders must have a sense of what the project's results will look like and when those results are expected. An ability to understand the scope of the project, to appropriately plan the project's work, and to correctly structure its schedule are vitally important to help practitioners meet the requirements of the project.

In a project's Planning stage, project practitioners will generate a comprehensive project management plan to show*how* they'll complete project work and *how* they'll deliver the results the project was designed to achieve.

They will use the project charter, the stakeholder list, and the milestone chart from the project's Initiating stage as the foundation for creating the project's deliverables. They will design documents to show what work the project entails, to track project progress, and to uncover and monitor the risks that could affect the project. They will connect the people in the project to the project work, and they'll develop a strategy to monitor changes and track contract performance across the project.

By applying effective project scope, planning, and time management practices, project participants will be able to deliver appropriate results in the time frame expected to satisfy the project's objectives and to meet its stakeholders' needs.

Learning Objectives

After completing this module, you should be able to:

1. Assess elements of effective scope statements for project management plans
2. Assess scope statements as an approach to define business requirements
3. Assess the concerns of stakeholders, as well as the support needed, for project success
4. Create a timeline and cost estimate for a project that aligns to an organization's goals
5. Compare and contrast Agile and traditional project management methodologies
6. Utilize software to create a high-level timeline and cost estimate

3.03 Planning the Project

Planning the Project

Planning

In the planning stage, teams develop tactics for executing a project and for getting work done. This is the time to explore how the project will progress to successful completion. In the planning stage, work must be planned in enough detail to create a cohesive and integrated framework for the project. Team members will document the steps they'll use to complete the project. In the planning stage, the emphasis and responsibility for the project shifts from a reliance on management and stakeholders to a reliance on the project manager and project team.

As project manager, you are tasked with making sure the goals in the charter are translated into a comprehensive plan. It should explain what the team will produce and the resources they'll need to produce it. This comprehensive plan becomes a guide and reference for the team executing the work. At a minimum it should include a detailed description of the scope of the project, a breakdown of the work needed to complete the project, estimates and baselines for the cost and duration of the project, an analysis of the risks that may impact the project, a description of team roles and responsibilities, and an explanation of the change control system and process to be used on the project. These plans should be well thought out but must also be flexible enough to adjust to changing conditions as the project progresses and additional information is gathered and incorporated. Planning a project requires a good deal of effort, but the extra effort expended at this stage should pay off in a vaster execution of the project work. Effective project managers encourage the participation of the people who will be doing the work in planning the work. By encouraging the participation of the people who are most closely associated with the completion of work tasks and activities, project plans will include more precise estimates and will be more readily accepted by the project team. This may seem like common sense, but unfortunately it can be missed, especially in projects that are managed from the top down. Another best practice is to incorporate any lessons learned from previous similar projects into the planning for upcoming work. As a project manager, you should recognize the benefits of avoiding the mistakes of the past and capitalizing on successful tools and techniques used in prior projects.

A common challenge that project practitioners face is resisting the temptation to move directly from initiating their project into executing it—a shortcut commonly described as "Ready, Fire, Aim." Jumping too quickly into the Executing stage can endanger a project and limit its chances of survival and success.

Doing project planning and developing a good project plan is critical to avoid the common problems—like scope creep, unclear work assignments, and uncontrolled risk—that could occur later in the project. The true benefit of planning is that it improves the chances of getting the project to where it needs to go.

Planning a project is much more than filling out forms and templates. The act of gathering the information needed to produce good project plans will help participants understand the project in much greater detail than they would by diving directly into project work.

Tailoring Plans

But no matter how well a project is planned, the plan will not be "watertight"; changes *will occur* on the project. Good planning will help practitioners avoid many problems, but not all of them; a situation might change unexpectedly or an unforeseen problem may arise. Furthermore, every project is unique. What worked well on one project may not work so well on another.

Because each project is different and because changes *will* occur that will need to be dealt with, the project plan will need to be tailored to the project and allowed to evolve to meet the demands of the project. By keeping the plan up-to-date project participants will be in a better position to adjust the project to changes as they occur.

Video Commentary

Adapting to Change

Richard Maltzman

Adapting to change. Change, indeed, will occur. Uncertainty will happen. That is why we have jobs as project managers after all. Without changes or uncertainty, anyone who can tick boxes would be a project practitioner or project manager. The ability to change is critical for a project practitioner. We manage scope, but let's say that scope increases on your project and it's formally accepted perhaps an additional node in a telecom network. This is good for your organization and good for you as a project practitioner. But people, in general, are averse to change, so one of your roles as project animator is as a change agent and as someone there to help project team members adjust to, and get used to, and appreciate project change.

Rich Maltzman, PMP®, is the Learning and Professional Advancement Leader at a major telecom supplier. A contributor to the *PMBOK® Guide*, 4th Edition, he has co-authored PMP® Exam study guides. He is co-founder at EarthPM, LLC, and along with co-founder David Shirley, PMP®, has authored the book, *Green Project Management: Planet, Projects, Profits, and People*, published in September 2010. He received a BSEE from the University of Massachusetts in Amherst and has a graduate degree in industrial engineering from Purdue University.

Creating an Appropriate Plan

The Planning portion of a project is really about making a plan that will define and govern the work. But in doing so, project leaders will need to be sure to develop the plan to an appropriate level. Too much planning can bog down a project with too many planning activities and could cause the project team to spend too much time away from doing what the project is designed for—delivering results. But too little planning can cause confusion if the team fails to uncover enough detail to complete the work.

Whatever amount of planning the project needs, it is very important to include the people who *do* the work in *planning* the work. The people who do the work are the ones that know the most about it—they're the ones who will be able to uncover risks that others may not think of or provide more-accurate estimates for the project. And if they participate in the creation of the project plan, they are more likely to buy-into it to a greater degree.

3.03.1 Contrasting Management Methodologies

Contrasting Management Methodologies

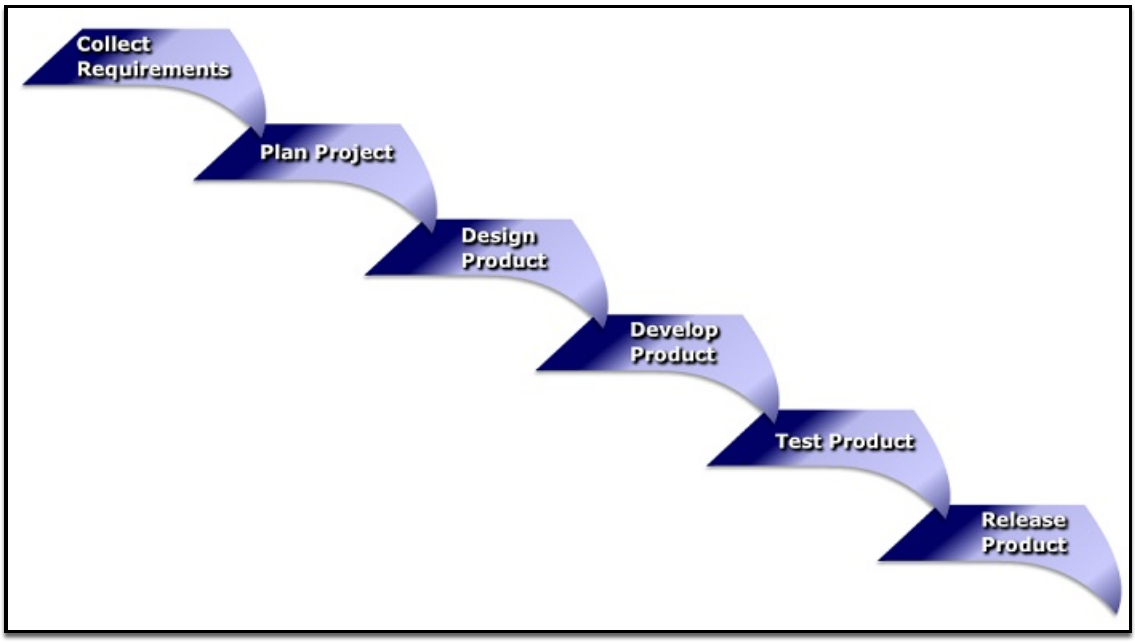
One of the first decisions that project team members must make when planning a project is to determine which project management approach they'll employ—specifically whether they'll use an Agile philosophy or a traditional Waterfall

methodology. Because of the distinct differences among these practices, the selection of an appropriate approach will dramatically affect project planning and execution.

Waterfall Project Management

Waterfall project management is the "typical" form of management that many practitioners are familiar with. In a Waterfall project management model, a project is conceived as a series of sequential steps that begin with the statement of customer requirements and ends with the creation and consignment of a fully predetermined deliverable. The project is planned up front, then monitored and controlled throughout each step of the process. Once a step is completed, it is not revisited. The project can be pictured as a one-way process, much like water coursing over a waterfall—once the water passes over the waterfall, it does not return.

The Waterfall Project Management Process



Agile Project Management

Agile, in contrast, begins with the idea that customers can't identify all requirements at the start of the project. Instead, a series of initial requirements or user stories are surfaced and product features are prioritized. Iterative planning and development cycles then continue to guide execution as customers and the project team work to mold and shape interim deliverables into a final releasable product.

The Stages of an Agile Project Management Cycle

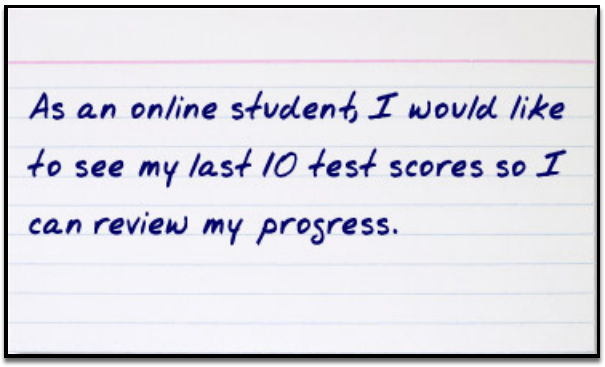
Be aware that, although the stages of an Agile cycle are presented below in a linear format, there is significant overlap and several feedback loops among the stages, so the Agile "process" is much more cyclical and iterative than linear. For example, in any one Agile cycle, planning, design, development, and testing may be completed numerous times before a product is ready for release.

Creating a Product Vision and Product Backlog

An Agile development cycle begins with an Agile team and customers establishing a clear vision of what the product should be. This vision is expressed in a collection of customer requirements called features or stories. Stories are not technical specifications of the product's size, volume, or performance—instead, they are high-level descriptions of what the user wants the product to do. As such, stories are specifically worded to reflect the customer's intended use and to keep the product focused on meeting customer needs rather than meeting technical specifications.

Stories are often captured on 3"x5" index cards to limit the amount of space available to document requirements. Limiting the available space ensures that the story remains simple and concise and that the requirement description is focused.

Example of a story on an index card



Agile product owners then compile stories into a product backlog. The product owner, as the "keeper" of the product backlog, continually updates and prioritizes this list, acting on the customer's behalf to ensure that the highest priority items are delivered first. The product owner refines the highest priority requirements (and, therefore, those that are likely to be implemented first) to a greater degree and leaves requirements of lower priority to be refined later. (The product backlog may also include requirements that are necessary for the creation and improvement of the product, but that may not be visible to the product's customer.)

The product owner then sets the boundaries for the project—what will be delivered, who will be involved, and how the project team will work together. These boundaries are not developed in detail; they include only enough documentation and advanced planning so that the output produces value for the customer. This plan determines how many iterations can be completed before the product will be released to the customer and focuses on increments that meet customer requirements and deliver business value. It also creates a timebox that constrains the time allotted for the project's completion and helps guard against an indiscriminate expansion of scope.

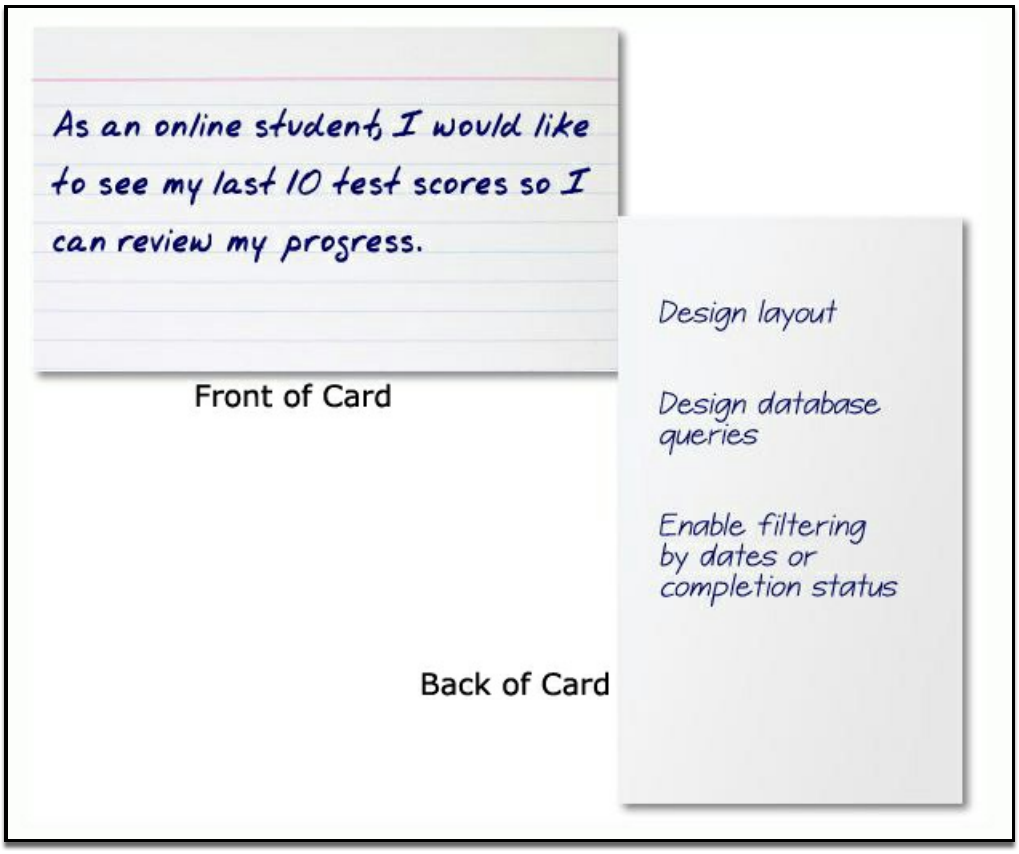
Planning an Iteration

The product owner then convenes a meeting with the development team to plan the iterations for the project. The product owner discusses the vision for the product, the customer requirements, and the priorities for satisfying those requirements. He or she answers any questions the team may have and provides any necessary clarification or elaboration.

Team members then estimate the amount of work that they believe each story will require. These estimates are often set, not as absolute time amounts (like hours or minutes), but rather as story points that compare requirements in relation to each other. Because product developers are individuals that work at different rates based on their experience and effort, estimating tasks in hours or minutes will vary depending on which individual is performing the work. Using story points to estimate time is meant to be an independent measure, regardless of who is performing the task. A story estimated at 20 story points should take twice as much work as a story worth 10 story points, which would take twice as much work as a story estimated at five story points. This allows the team to estimate the amount of work it will need to do based on how "big" the task will be, not on how fast it is thought an individual can do the work.

Team members then select those items from the product backlog that they can complete within the time frame for the iteration, and break the items into the tasks needed to satisfy the requirements. They compile the tasks into a task list that they will use as an inventory of the work in the iteration. The tasks are written in the technical language that team will use to satisfy the requirements. Tasks are often written on the back of the index cards of the customer stories the tasks will address; this allows matching of the tasks to the requirements if needed.

Example of a task on the back of index card



The team selects the items from the product backlog that have the highest priority and that can be completed within the current iteration. Any additional items of lower priority that can also be accomplished in the remaining iteration time are included, but any items that the team would be unable to complete are returned to the product backlog to be reprioritized for subsequent iterations.

Agile teams must be very careful not to include too many tasks in a given iteration. Iterations should be balanced so that the team continues to satisfy requirements but does not take on so much work that members need to put in long hours to accomplish their goals. The amount of work that a team can accomplish in a given iteration is its velocity. Agile teams need to plan their iterations at a velocity that could be maintained indefinitely. Doing so will ensure that the team does not exhaust itself in each iteration.

Executing the Work in an Iteration

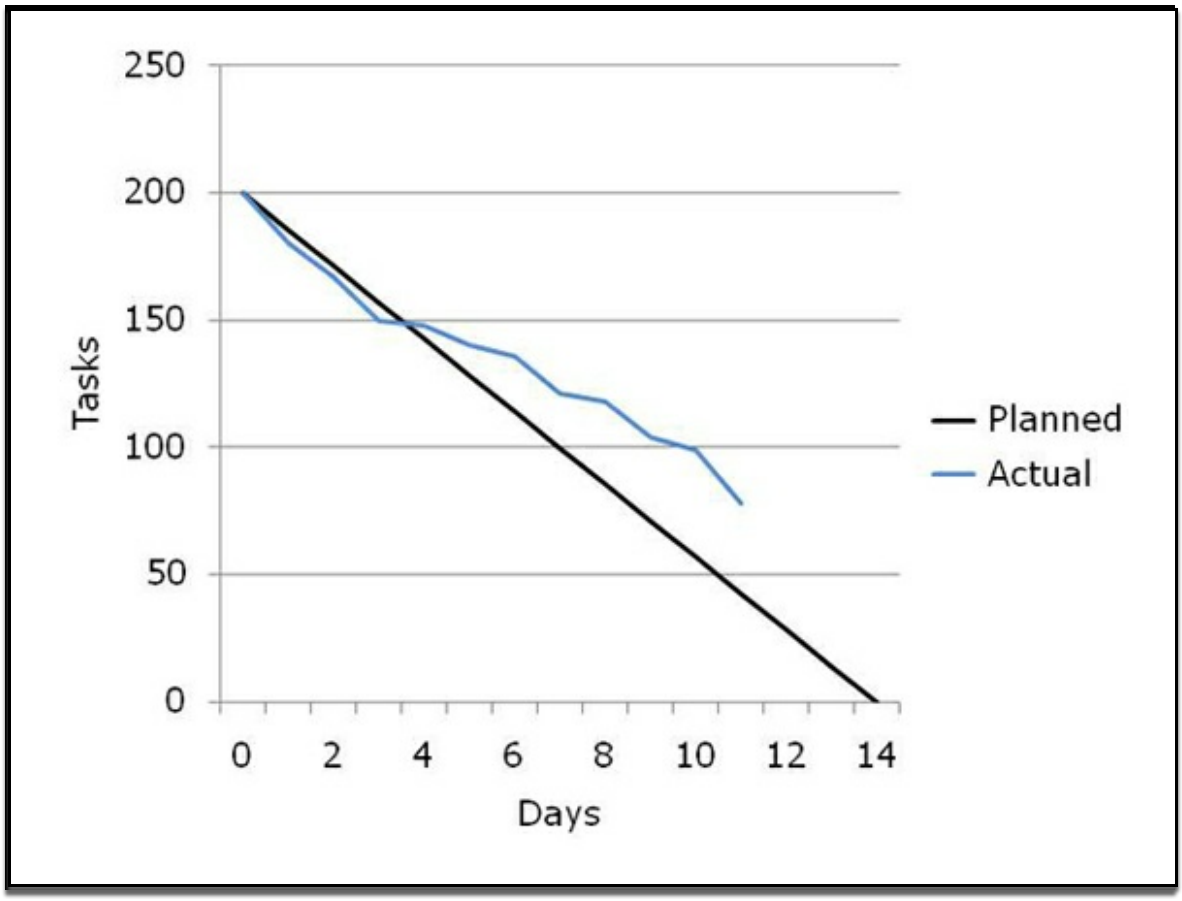
After the iteration is planned, the project team must ensure that work will be completed. Individuals on Agile teams take responsibility for finishing their work on each iteration. Daily stand-ups help to keep team members focused; these 15-minute meetings (which should be attended by all team members) allow each team member to explain:

1. What he or she accomplished yesterday
2. What he or she is working on today
3. What issues are impeding work progress

These meetings not only make completed work visible to team members but also make sure relevant information is shared on a regular basis. They create peer pressure among team members; each team member is *expected* to show progress each day and is held accountable by other team members (not by the product owner or other stakeholders) for getting work done.

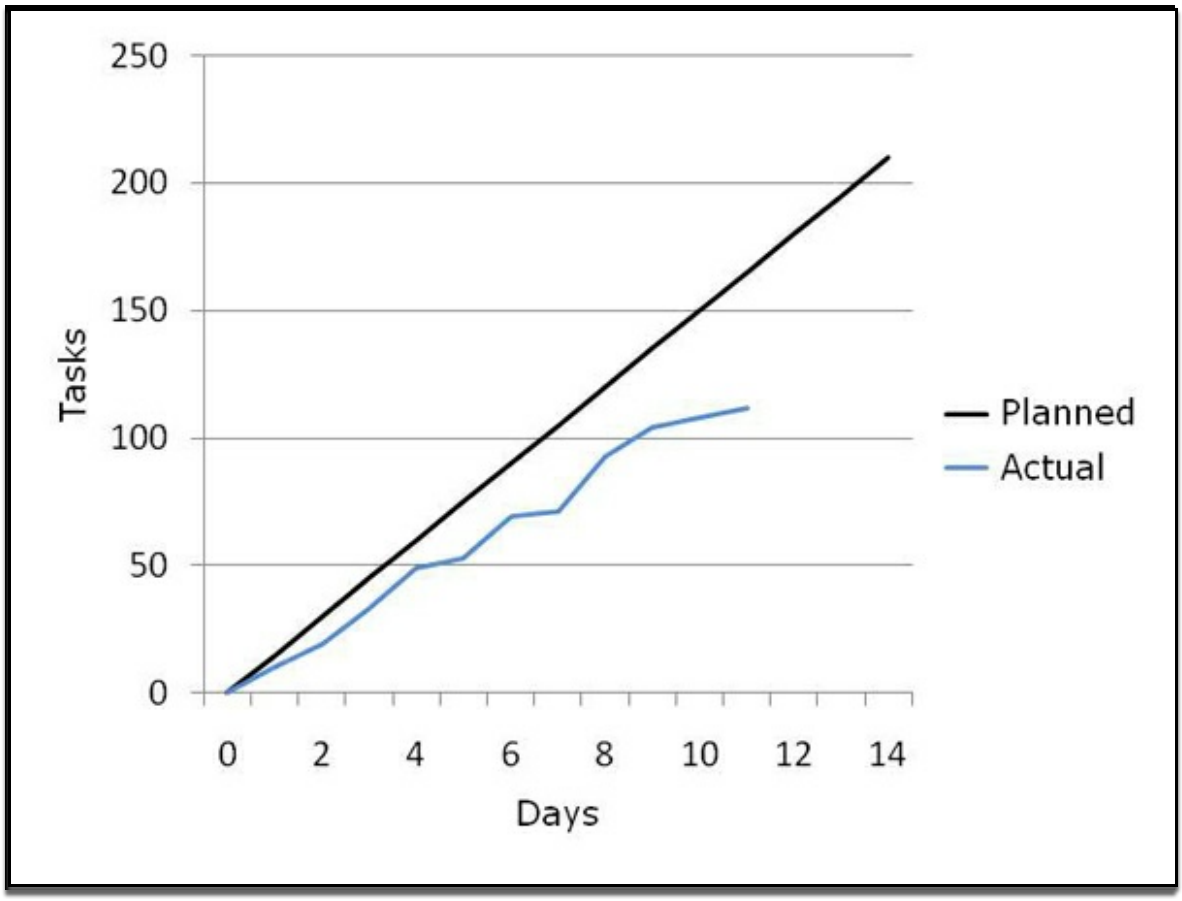
Teams can demonstrate their progress to stakeholders on story boards. Two of the most commonly used story boards are burndown charts and burn-up charts. Burndown charts show how many tasks the team has completed each day and how many tasks remain until the iteration is done. Burndown charts are often drawn as line charts, with time listed on the x-axis and the number of tasks on the y-axis. As the project progresses, the slope of the line decreases until it intersects with the x-axis at the completion of the iteration. Some teams track both the planned burndown and the actual burndown to show how close they will be to an expected iteration completion date.

Burndown chart



Burn-up charts also show team progress, but show the accumulation of completed stories rather than the number of stories yet to be completed. The slope of the line in a burn-up chart increases (instead of decreases) to show team progress.

Burn-up chart



Reviewing the Product Created in an Iteration

At the completion of each iteration, the team meets with the product owner, customers, and other stakeholders to demonstrate the products they created in the iteration. These iteration reviews are short meetings (roughly two-to-four hours in length) that present team results as simply as possible, with little or no fanfare or complex presentations. The team presents **complete working products**—not prototypes or documentation describing how the product *would* work—to customers and stakeholders for review and analysis.

Stakeholders and customers ask questions about the product and provide feedback, which the team then translates into new customer stories and adds to the product backlog for inclusion in subsequent iterations. The lessons learned from iteration reviews allow products to evolve as users and customers interact with working products and voice new expectations and needs.

Reviewing the Iteration's Processes

When iteration review meetings are complete, teams then turn their attention to an analysis of project dynamics: how well team members worked together and how well their processes worked. These iteration retrospectives allow teams to revise their development processes before continuing into subsequent iterations, by analyzing:

- How well the *product* worked, from both the customer's perspective and the technical point of view
- How well the *processes* used to create the product worked
- How well the *team* interacted within the iteration
- How well the *project* met the organization's intended goal

These retrospective meetings are usually one-to-three hours in length and provide the feedback that the team needs to adapt its work structure and its relationships before new iterations or projects begin.

Change Control

The Agile methodology is designed to accommodate change, but that doesn't mean that changes are introduced without regard to structure. Iterations are planned to deliver solutions to specific customer needs; adding additional requests to an ongoing

iteration would only complicate the iteration planning and delay the work already in progress. To prevent such a problem, Agile practitioners incorporate change and make adjustments *between* iterations, not *within* an iteration. Any requests for change should be presented to the product owner, who will then add them to the product backlog for possible incorporation into future iterations of work.

Beginning the Next Iteration or Releasing the Product to the Customer

At the end of each development cycle, the project team either releases the product to the customer or begins the next iteration in the project.

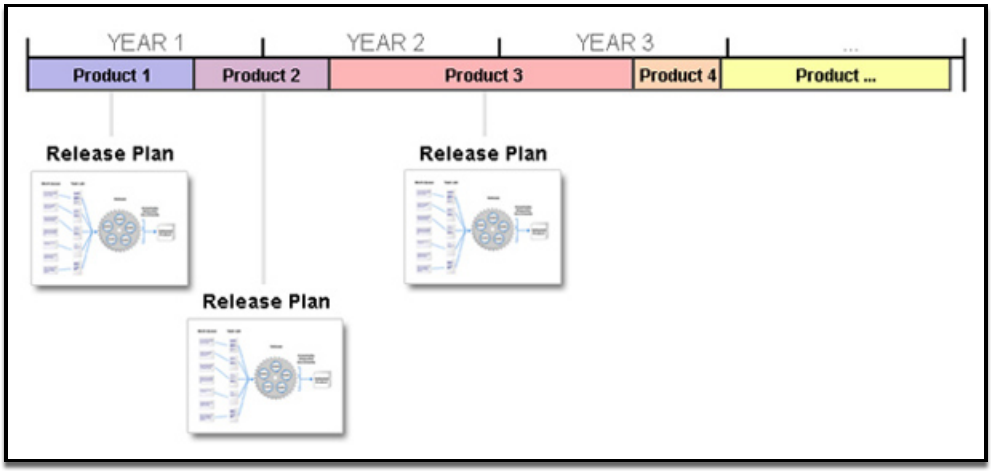
Release Planning

The development cycle previously described is part of a larger organizational cycle—the release cycle. The release cycle specifies when an organization will release products to its customers. The release plan documents the product release dates; these dates may be set by either:

- deciding what date an organization wants to release a product (based on market research or customer requests), then determining how many features can be completed before that date, or
- deciding how many features to include in a new product, then determining how long it will take to complete those features.

Release plans become more detailed as Agile teams mature. As teams complete more iterations, their velocity becomes better understood and release dates can be estimated with greater accuracy. Once a product is released, the organization reviews its product roadmap and begins to develop new products in a new round of release planning.

Release plan



Similarities and Differences

In deciding whether to employ an Agile or a Waterfall methodology, project managers must consider the similarities and differences between these approaches at different stages of the project process. **Click on each of the markers below to compare and contrast Agile and Waterfall in each project step.**

Similarities

Project Step	Agile	Waterfall
Explain why the project is needed and what the end product will be	Create a product roadmap and product vision	Create the project charter
Decide what is most important to the customer and what the project/release will contain	Prioritize the user stories and plan the release	Define the project scope and create a management plan

Break the project work down into smaller components	Plan the iterations	Decompose the work and develop any necessary subprojects
Create increments of the product along the way	Develop potentially releasable or marketable products within an iteration	Develop interim deliverables
Collect and incorporate feedback to improve products and processes	Perform iteration reviews	Use rolling wave planning and perform integrated change control
Create the end product and monitor its development	Complete the development iterations and conduct retrospectives	Manage and control the project execution
Complete the project	Combine the iterations into a release and perform a retrospective	Transition the final deliverable to the stakeholders and review the lessons learned

Differences

Project Step	Agile	Waterfall
Decide on the optimal project management methodology to use	Develop complex products in fast-paced, uncertain markets	Develop well-defined products, products with minimal changes, or products in highly regulated industries
Develop customer requirements	Capture customer requirements as the project or product evolves	Collect customer needs early in project (during scope development)
Plan the project/release	Determine the schedule or budget, then decide what features can be delivered within these constraints	Decide what features are contained in the project scope, then determine the project cost and budget
Create the product	Use shorter product-development iterations to deliver more-focused features in smaller, faster increments	Use longer durations to plan and develop products that include more features
Collaborate with stakeholders	Collect feedback continuously to help prioritize and clarify customer requirements, and adapt the product to ensure that customer requirements are incorporated	Collect customer needs in the project initiation stages and monitor project progress to ensure the final product meets these needs
Assess changes	Promote change and allow the product to evolve and deliver the best value to the customer	Avoid change and institute corrective action to ensure the product conforms to plan
Define the role of the project manager/leader	Allow the team to direct the work; provide the boundaries for the project and remove impediments to the team's progress	Direct and monitor the project work; tell the project team what activities to do, when to do them, and how they should be done

3.04 The Project Plan

The Project Plan

Video Commentary

The Project Plan

Rich Maltzman

The project plan is key, obviously, to running a good a project; it's an all-encompassing collection of documents. So I like to think of it as a file cabinet drawer with hanging folders, and each of the hanging folders represent one of the major planning pieces of the project. So you could pull out that file cabinet drawer and pull out the risk management plan, so if you need to know how you are managing risk, there it is. The project plan itself is more of a container, and the individual plans are where the meat of the project planning is kind of captured, documented, and modified if necessary--re-baselined if necessary. That's the theory.

In the real world, again, it's going to be a collection of different documents, and also, in the real world, a lot of non-project-management folks will ask you for your project plan. When they ask for that project plan, they're not asking you to give them that entire file cabinet drawer. Most likely what they mean is something that looks to them like a Gantt chart--it looks kind of project management-y to them. And my experience says when they ask for the project plan, push back and ask them, "You just want to see a highlight, kind of the highlight deliverables for this project?" And normally they'll say yes. If that's the case, give them what they've asked for, which is normally a milestone chart with some of the key anchor dates of the project, perhaps some time spans, but not a lot of--the work breakdown level of that kind of a chart should be at a minimum. Let them push back for more. If you give a lot of detail, they'll ask a lot of detailed questions.

Again, push back. Ask for, "What do you mean when you say you'd like the project plan?" Start with something that's very important; it gives them the very important information, high-level, on the project, but not necessarily all of the details. The project plan itself, you know and I know, will have these hanging folders with all the details, and you can get from that, for example, how you'll manage change, how you're doing risk management, HR management, communications management. Each of those have their own plan, and you should have documented exactly how you'll manage each of those items, and that becomes your project plan.

Rich Maltzman, PMP®, is the Learning and Professional Advancement Leader at a major telecom supplier.A contributor to the *PMBOK® Guide*, 4th Edition, he has co-authored PMP® Exam study guides. He is co-founder at EarthPM, LLC, and along with co-founder David Shirley, PMP®, has authored the book, *Green Project Management: Planet, Projects, Profits, and People*, published in September 2010. He received a BSEE from the University of Massachusetts in Amherst and has a graduate degree in industrial engineering from Purdue University.

The central component of the Planning phase is the project plan. As the project team develops the project plan, they will document the actions and activities they'll need to define, prepare, integrate, and coordinate all of the project components.

The project plan should include the following items to help manage the tasks, scope, time, costs, risks, and changes for the project:

A project scope statement

> The scope statement describes what is in scope and out of scope for the project—in other words, what the project*will* contain and what it *won't* contain. The project charter frames the project's scope so it should be very helpful in developing the scope statement. The scope statement, along with the work breakdown structure, serves as the scope baseline for any questions about project scope.

A work breakdown structure

> The work breakdown structure (WBS) is a hierarchical breakdown of all of the work needed to complete a project. Work is broken down into smaller pieces that can then be assigned to individuals or groups for completion. A completed WBS will show *all* of the project deliverables included in the project and will enhance planning activities by ensuring that work is not missed.

A network diagram

> A network diagram acts as the schedule for the project. It is more detailed than the milestone chart in that it shows the sequence of project activities *and* the dependencies among those activities. Because the network diagram will serve as the schedule baseline, it is important to make sure that all of the necessary activities are included in the diagram. Reviewing the milestone chart from the project's Initiating stage will help ensure that important activities and due dates are not missed.

Change management plans

> The project plan should include thoughts on how any change requests or unexpected changes that may affect the

project will be managed. Practitioners will need to decide who will compile these requests for changes to the project, how they will analyze the impact of those changes, and who is responsible for accepting or rejecting those requests.

A responsibility assignment matrix

A responsibility assignment matrix (RAM) helps to assign responsibility for project work to project participants. The RAM will ensure that the project team knows who is responsible for the completion of specific tasks as well as who needs to be informed of problems and progress.

A risk register

The team will use a risk register to track project risks, the planned responses for those risks, and the results of implementing those responses. Risk registers are important documents that must be reviewed and updated regularly to ensure that projects proceed with minimal delays and disruptions.

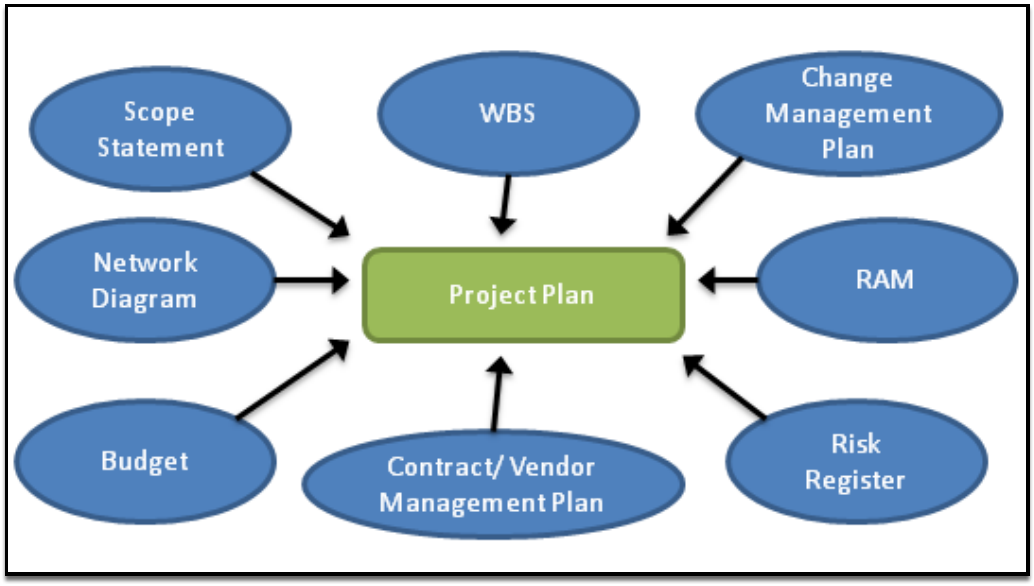
A budget

The budget is an aggregation of the expected costs to complete the project. Project participants will compile estimates of costs into an S-curve that will act as the cost baseline; results can then be compared to the S-curve to ensure that the project stays within project cost boundaries.

Plans for dealing with contracts and vendors

The project leaders will need to decide if additional resources to complete project work are necessary and, if so, how those services will be procured. These leaders should also consider the types of contracts that will work best and develop a strategy for monitoring compliance.

The Major Elements of a Project Plan

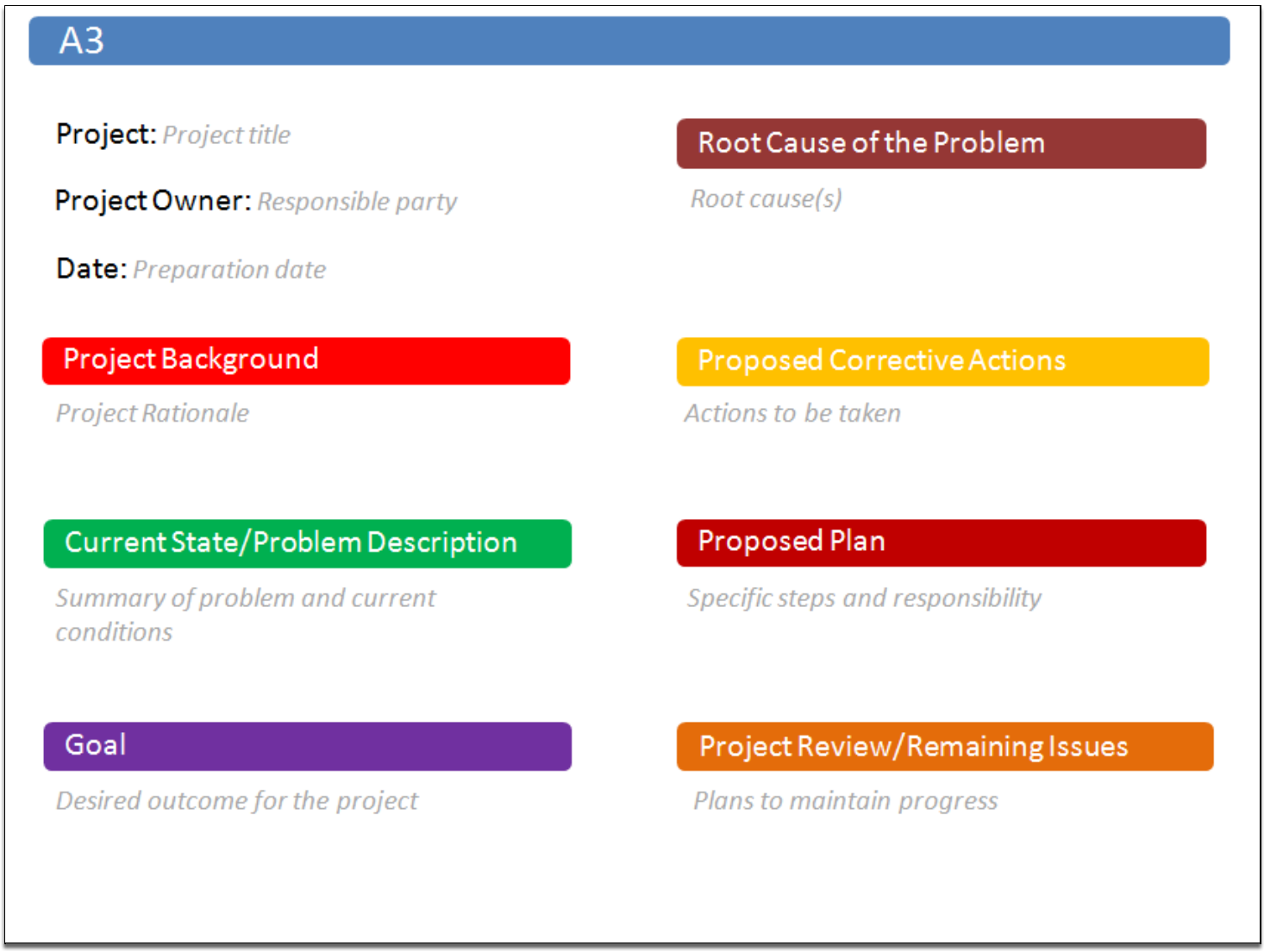


The plan created for the project should match the needs of the project so it is important to not limit the project plan to only the items listed above. The project team will need to reference this plan as they execute the project so it should include as much information as necessary to adequately shape the project. If more information is needed in the plan to successfully complete the project, the team should feel free to add it to the plan.

The A3

Some project teams, especially those that follow Lean practices, choose to combine elements of the project charter and project plan into a single document called an A3. The A3 includes background information and project goals (much like the project charter) as well as proposed countermeasures and a plan to reach the goal (like the project plan). The A3 is highly adaptable

and the act of gathering information about the problem at hand is as important as the document itself.



Project: Record the project title.

Project Owner: List the person responsible for the project's execution.

Date: Record that date that the A3 was created.

Project Background: Explain why the improvement project needs to occur, and why it is important to the organization.

Current State and Problem Description: Describe the problem you are attempting to resolve, and summarize what you know about current process conditions.

Goal: List the specific desired outcomes for the project, or detail what you would like the process to look like after corrections have been implemented.

Root Cause of the Problem: Characterize the root cause(s) that have created the disparity between the current state of the process and the future desired state.

Proposed Corrective Actions: Record the actions that the team will take to correct the problem.

Proposed Plan: Describe the specific steps that will be used to resolve the issue, and assign responsibility for each step to a team member.

Project Review and Remaining Issues: List the plans to ensure that the resolved problem will not reoccur and any progress will be maintained.

3.05 Using Tools and Techniques to Plan Your Project

Using Tools and Techniques to Plan Your Project

Planning is where the project manager defines the important things that will need to be accomplished on the project and explains *how* those things will get accomplished. It takes a significant amount of effort to develop an effective strategy but giving this portion of the project extra effort upfront will help avoid the need for costly and time-consuming changes and rework later on in the project.

As the project is planned, project practitioners need to be sure to review the lessons learned from previous projects (or from previous parts of the current project) again to see if there are things can be adapted—or if there are things that should be avoided—in the execution of the project.

Project participants will also need to consider how various elements—communications, quality, risks, procurement, human resources, and scope—all contribute to the identification of baselines for the schedule, budget, and scope of the project.

At a minimum, the project plan should include the tools discussed in the last assignment:

- the scope statement
- the work breakdown structure
- the risk register
- the responsibility assignment matrix
- the network diagram
- budget baselines

- change management plans
- contracting and vendor management plans

In managing projects, practitioners will need to become familiar with and to utilize these tools to make planning their project easier. These tools will be explored in greater depth in the subsequent assignments of this module as we explain how they can be used to execute and monitor projects.

Video Commentary

Planning the Project

Rich Maltzman

I'd like to talk about project planning and the major elements in this section of your project.

Project planning is really where you're looking at how you're going to do many, many important things on the project. Much of your effort is going to be here, and properly so, because if this is done correctly, you prevent having to repeat this on the fly when you're in trouble. You're doing this work instead now, upfront, when you have a clear mind and you have good information--at least, initial good information. So keep in mind that project planning does have to be re-elaborated as you get new information. However, at this point, you're just starting out, and you're going to be looking at how you're going to be doing a lot of things in project planning, like how will you communicate? To whom you will communicate, with what media, when, how frequently--very, very important. You're going to be determining how you'll look at quality on this project. How will quality be planned into the project, rather than being bolted on. Importantly, risk: How will you deal with risk? What kinds of risks do you have? How will you identify them? You'll be working with procurement: What kinds of things will I need to bring into this project from the outside? Will I be contracting? What types of contracts will I be using? Human resources: What types of people will I bring in? How will I build this group of diverse people into a team that are focused on my project's deliverables? You'll come out with such things as a schedule, a budget, a scope statement. These are all important outcomes from this project planning section of your project. And you'll also be determining baselines. Kind of, bottom line, what does the schedule look like right now so that I can determine how that schedule changes if some of the risks I have identified actually become real, both on a positive or a negative side.

One of the most important tools you'll use in Planning is the WBS, or work breakdown structure. This is really nothing more than an organization chart of the work of your project, with the very top--instead of being a CEO, at the very top is the overall, main deliverable of your project. So if it's a bridge, you put "bridge" there. That's what's at the top of the project. If it's a space shuttle launch, then "space shuttle launch" is at the top. And then you look at the various elements that contribute to that on a very high level, and on a further and further lower and lower level until you get to specific work packages, specific tasks, that have to be done so that the shuttle is launched or that the bridge is built.

This organization chart is critical because it provides for you the workstreams that contribute to that overall deliverable. And so that you can figure out what has to be done. And from that, what dependencies exist--who does what work? And if you leave a piece of work out-obviously if you leave an entire workstream out, you're in big trouble--but even if you do not break the work down such that you consider all the elements that lead to, let's say, the heat shield on the space shuttle, if you don't plan that in, then none of the risks associated with that are planned in. None of the work assignments associated with that work element are planned in. None of the budget is there for it. It's a disaster. So the work breakdown structure is a really nice tool to use to make sure that you've broadly and deeply identified everything that has to fit into the project. And it's is not just that it has to exist; it has to be done well. The other piece that a lot of people forget is that the WBS is a great chance to build rapport and buy-in from people who will contribute to the project. By bringing those people in to help brainstorm

what has to be done, let's say, on the electrical portion of the project by getting the electricians and engineers to participate in that, that they feel engaged, they feel a part of the project, and they won't be averse to communication later on when they say, "You know, I told him he was going to need to do this type of testing, and the project managers never listened to me." Well, by engaging them early and having them help identify the pieces of work, you've kind of got that buy-in very early on in the project.

If you can imagine that you have got down to these work packages, now I'd like to shift to talking about estimation. You'll have a piece of work that has to be done, let's say painting a room, and you ask the painting crew, "How long will it take to do this room?" And that's normal; you now need to start scheduling and sequencing these pieces of work, not just identifying them. So estimation is key during planning. You ask someone how long it is going to take to do it or you ask the crew how long it's going to take, or a crew how long it's going to take to do it, and they may come back and say, "This room, looking at this room, three weeks." Never take a point estimate. If they come to you with a three-week estimate, you need to push back and say, "How long could it take on both a pessimistic and an optimistic basis?" That gives you two pieces of information: it gives you kind of a range, so you can calculate the real, most-likely date, and it gives you more buy-in as well as more information from that painting crew, like what are some of the things that could cause the problems: maybe humidity, maybe a certain type of paint, maybe it depends on whether the finish is matte finish or glossy finish, maybe the wall surfaces aren't prepared properly. So just identifying this pushback also brings in risk identification. So there's an interesting connection between work breakdown, estimation, and identifying risk. And with that I would like to shift to talking about risk planning.

Risk planning in a project involves identification, analysis, and treatment or response to the risk. Obviously, the most important part is identification. Just like with the work breakdown structure, if you don't identify a risk, your chances of treating that risk are zero. So you need to identify risk broadly and deeply. Again, this ties back to the WBS because if a piece of work is missing altogether, you don't even have a chance to start the identification process. But assuming that you have started the identification process, that identification is absolutely critical. It has to be done with knowledge of the particular task at hand, with interviews of people who actually do this work. So you don't sit in your office and guess what the risks are with painting a room. You talk to painters and painting crews so that they can tell you which kinds of things they've seen and go wrong, as well as what can go horribly right, so that you have opportunities identified early on in the project. So it is really important to consider, during the planning process, all of these elements: communications, quality, risks, procurement, human resources, scope, and to determine baselines, which we'll talk about later, and to identify baselines for schedule, budget, as well as scope of the project.

Rich Maltzman, PMP®, is the Learning and Professional Advancement Leader at a major telecom supplier.A contributor to the *PMBOK® Guide*, 4th Edition, he has co-authored PMP® Exam study guides. He is co-founder at EarthPM, LLC, and along with co-founder David Shirley, PMP®, has authored the book, *Green Project Management: Planet, Projects, Profits, and People*, published in September 2010. He received a BSEE from the University of Massachusetts in Amherst and has a graduate degree in industrial engineering from Purdue University.

3.06 The Scope Statement

Defining Scope Through the Scope Statement

A scope statement defines a project by detailing the project's major deliverables, its key objectives, and the work needed to meet those objectives. The scope statement will describe the complexity and magnitude of the project and will account for all the work, time, and cost needed to complete the project successfully. As work progresses and new issues arise, the scope statement will serve as a constant reference for future project decisions.

Scope statements may include other elements as well, as summarized in the chart below:

Other elements of a scope statement	
Product scope description	The requirements of the product as described in the project charter
Acceptance criteria	The process and criteria for accepting completed products
Deliverables	A list of the outputs required for project success. Deliverables may include documentation that will help the team complete the project.
Exclusions	A specific statement that explains what is *not* included in the project
Constraints	Anything that may limit the project (including budget limitations or imposed dates)
Assumptions	A list of the beliefs underlying the project and their potential impact if they prove to be false

By delineating what needs to be accomplished, the scope statement—along with the work breakdown structure—will serve as the scope baseline, which will help to determine if a project is on track and continuing to meet the objectives for which it was designed. Any deviations from the accepted scope of the project—a phenomenon known as scope creep—could negatively impact the project by consuming the time and resources of the project and should be avoided.

3.06.1 Exercise: The Scope Statement Crossword Puzzle

This assignment does not contain any printable content.

3.07 The Work Breakdown Structure

The Work Breakdown Structure

In the Planning stage the milestones developed in the Initiating stage (which are really just large events or activities in the project) are separated into individual work components in a work breakdown structure.

The work breakdown structure (WBS) is a hierarchical chart that divides project milestones into smaller units and arranges project work activities into related areas. The WBS helps project participants get a firm grasp on what they need to deliver to meet project goals. It is essential for designing the project schedule, and it helps in creating the budget and selecting the staff for the project.

The WBS helps:
Identify the major segments of the project so that the work to do is clearly defined
Organize the work sequentially so that it can be scheduled efficiently
Identify what work to assign to which team members
Determine what resources will be required to complete the work so that the team can develop a budget
Clarify the work to do so that it can be clearly communicated to team members

Work Packages

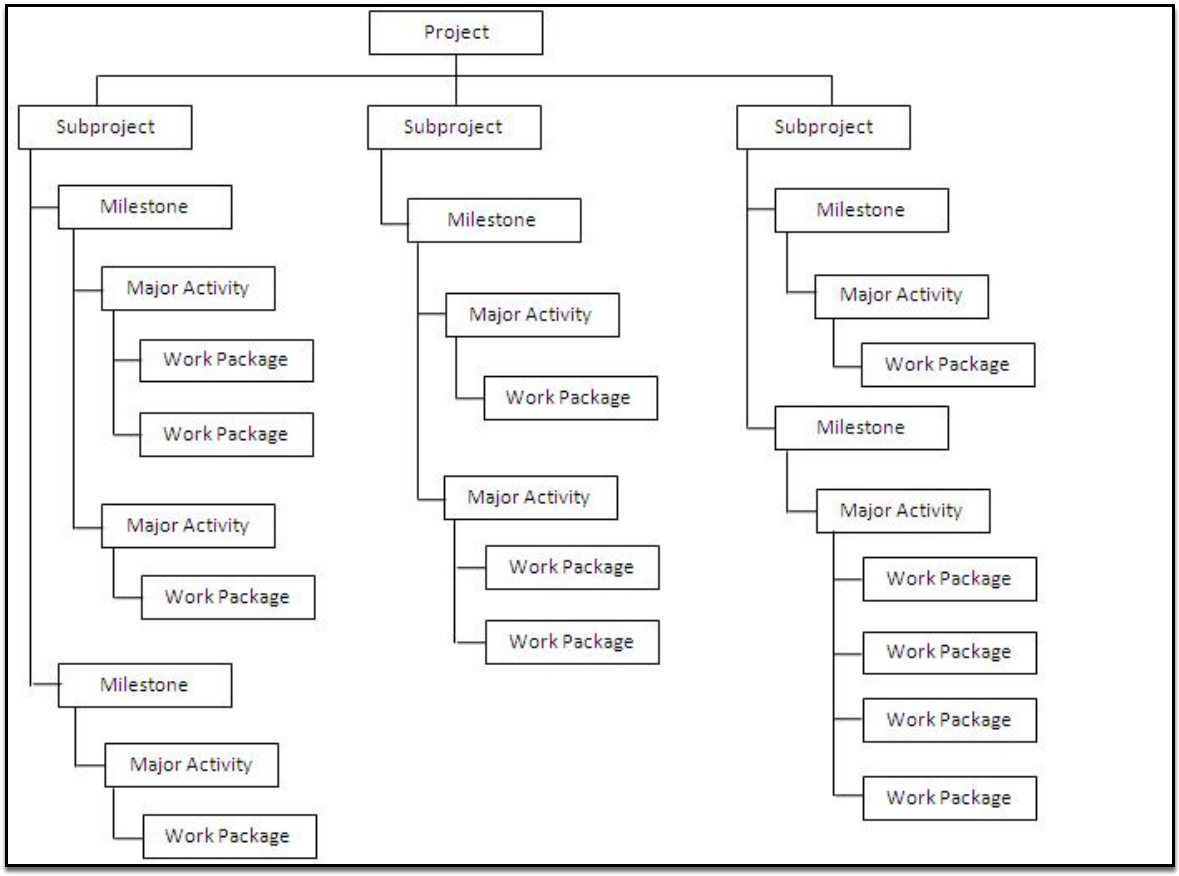
The WBS is often shown as a tree diagram that moves from levels of generality (deliverables, stages, or subprojects) to more detail (work packages).

A work package is the most basic work activity that has both time and cost associated with it. It is a manageable (and assignable) "chunk" of work that, when combined with other work packages, represents a unique deliverable. A set of work packages might represent the handlebars on a bike, the operating system for a mobile phone, or the delivery channel for customer services.

Work packages vary in their level of detail, but they should be broken down to a level that can be easily executed, monitored, and controlled. Work packages should be small enough so that reliable estimates can be made about their cost and scheduling requirements but when teams break the work down excessively, inefficiency of management efforts and planned work can result.

The Parts of a WBS

A WBS may be broken down in a number of ways, but one of the most common forms separates the structure into subprojects, milestones, activities, and work packages.



For large projects with many layers and dollars allocated, a WBS can become quite complex; it is up to the project manager to determine how many subprojects, milestones, major activities, and work packages the WBS and project need.

Developing the WBS

The following steps can be used to create a WBS to support a project and help identify important project parameters:

1. Put the project milestones into a logical order according to when they should occur during execution. (Consulting with subject matter experts on and off the team can prove essential at this point.)
2. Break the milestones into major activities, then into work packages that can be assigned and scheduled. Define the work packages to a level of detail that is appropriate for the project. (Remember that each work package is associated with a deliverable and a time for completing that deliverable.)
3. Look at the entire work breakdown structure and make sure that completion of all of the work packages will result in the completion of all of the project goals and objectives defined in the project plan.

As a project evolves, practitioners learn things that they didn't know at the start of the project. This new information should be used to update and revise the WBS in ways that make it more accurate and robust. Keeping the WBS—and all Planning documents—current will, in turn, support the utility and functioning of the project plan.

Video Commentary

Creating the WBS

Richard Maltzman

Here are some different ways to create a WBS--Work Breakdown Structure. Creating them is critical because of the way we can clearly identify--not sequence or fully understand, mind you--but identify all of the work that's in the project. Sequencing and

fully understanding the tasks comes a little bit later. Here are some tips for creating a WBS:

One idea is to use sticky notes and make it a team exercise where you actually create the WBS almost in a "live" fashion.

Another tip: make use of wisdom that's resident at the "doer" level, as I call it. That means electricians, not electrical designers--people who have done this work before and can come to the table saying "here's what really happens when we do the wiring." They'll tell you what makes up that electrical portion of the work stream and you'll get really good, solid information about that work stream.

Another tip is to use a WBS dictionary to be clear about what's meant by a work package. It's fine to have everything identified, but all team members have to really understand--with a common language--what's meant, for example, by electrical testing. Is that just flicking on the lights to see if they work? Or are you testing the capacity of the circuit with detailed measurements? Not knowing what you mean by electrical testing could spell danger later in the project.

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3.08 The Risk Register

The Risk Register

Defining Risk

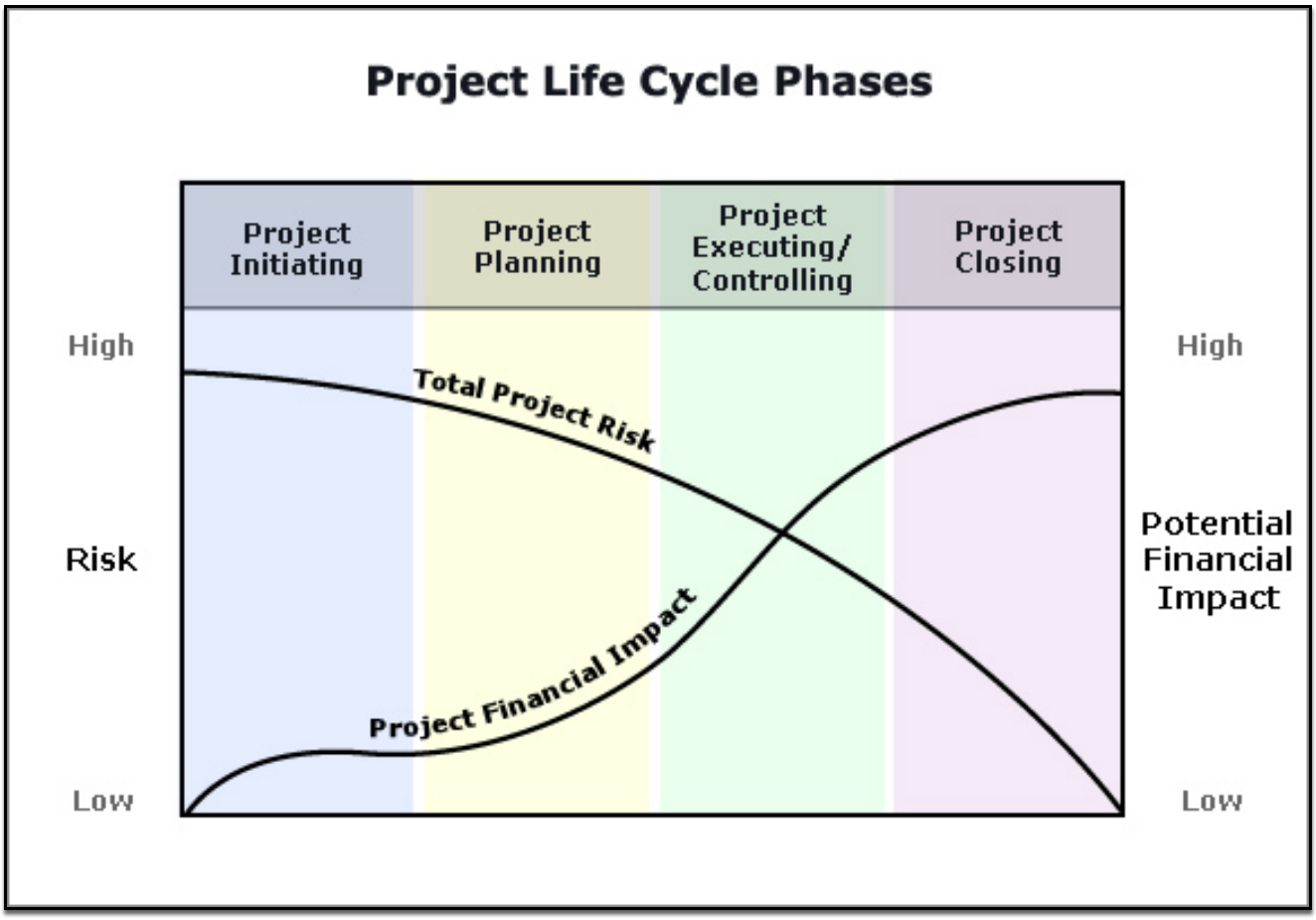
To run a project effectively, practitioners need to identify the risks that could impact the project and develop plans to deal with them. In project management terms, a risk could be a negative event that adversely affects project work or a positive event that provides an opportunity that the project team should pursue to enhance project results.

Every project entails a certain amount of risk; the question is whether the people involved in the project will be able to properly identify and manage it. To be effective, project managers or project leaders will have to identify the risks, analyze their impact, prepare responses, and monitor the project to keep it on track. They will need to ensure that the project stays within acceptable risk levels. And they'll have to limit the impact of negative events while, at the same time, increasing the impact of positive events.

Risks and the Project Life Cycle

Different types of risk occur throughout the project life cycle. For example, in the Initiating stage, risks could include unclear objectives or key personnel being unavailable for the project team. In the Planning stage, risks may include vague specifications or rushed planning practices. And in the Executing and Monitoring/Controlling stages (where the greatest number of risk events typically occur), risks can range from scope creep to schedule changes to unexpected weather.

The level of risk will also fluctuate throughout a project. Early in the project the level of risk is high because the process of identifying, analyzing, and planning risk responses is just getting underway. The financial impact of risks is low because less has been invested and other options remain open.



Later in the project, during the Executing and Controlling stages, the level of risk decreases, but the financial consequences increase. At this point there is substantial investment in the project so unexpected events can cause significant cost issues.

In the Closing stages, although the potential for risks is at its lowest, the financial impact is at its greatest; if, for example, a customer rejects a finished product and changes and rework are required, costs may be significant and can ruin the project.

Tracking Risks with a Risk Register

To track and monitor any risks that could affect projects, effective project managers develop risk registers.

A risk register provides the details about the risks that the project team has identified. These details include a description of the risks, the probability of the risks occurring, their impact(s) on objectives, and a risk score for each risk. The risk register also records the status of each risk and provides an area for any additional comments that may be important.

The risk register also explains how the team will respond to risks if they occur and documents who is responsible for tracking and communicating each risk's current status, as needed. If no one is responsible for handling certain risks, project leaders shouldn't be surprised when those risks interfere with project progress.

Many project practitioners develop risk registers as an Excel spreadsheet while others invest in databases or other software programs that match the size and complexity of the project. No matter what tools are used, the risk register will help ensure that project risks are continuously identified and appropriately managed.

Developing the Risk Register

Risk Number ID	Risk	Probability	Impact	Risk Score	Response	Responsibility	Status	Comments

1. Provide an identification number for each risk. This will allow participants to discuss each risk by its number, making conversations easier.

2. Describe the risk in clear, simple language. Classify the risk as either a positive or negative event.

3. Record the probability of the event occurring (as "high" "medium," "low," or any combination of these ratings). You will need to work with your team (and possibly other important stakeholders) to define what each rating ("high," 'medium-high," "medium," etc.) means.

4. Record the impact (as "high," "medium," "low," or any combination of these ratings) to the project if the risk occurs. Again, you will need to work with your team (and stakeholders) to define what each rating means.

5. Combine the probability and impact into a risk score. The risk score will give you a simple way to prioritize risks and show which ones need to be carefully monitored.

6. Describe the response you'll implement if the risk occurs. Include as much information as necessary to illustrate your plans.

7. Clearly identify the person responsible for monitoring and addressing the risk should it occur.

8. Record the status of each risk as either "open" (i.e., it could still occur) or "closed" (the risk has been addressed or the chance that the risk will occur has passed).

9. Record any important information about the risk that doesn't fit into the other columns of the register.

The Risk Register as a Tool

The project manager will need to review and update the project risk register regularly. As changes occur on the project and new information is learned, risks may need to be added—and removed— from the register.

The project team should also refer to the risk register for important information at the conclusion of the project. During the project's Closing stage, reviewing the risk register will help in recording the lessons learned for the project. The register will help remind project participants about the issues that they had to address on the project, helping them and other members of the organization better manage risk on future projects.

Video Commentary

The Risk Register as a Living Document

Richard Maltzman

How often should you update the risk register and how do you keep it as a living document? Well, first of all, I will re-assert the fact that the risk register does have to be a living document. You, as the project practitioner, have to understand that you need to get the team members to follow your lead in this aspect. Risks change over a project; existing ones go away, either on their own or through your careful treatment of them, and new ones show up. In fact, sometimes your own treatment or response to risk triggers new ones. For example, an airbag deployment could cause new injuries--just as a real-time example.

Creating a risk register and filing it away is bad or even worse than not creating it in the first place. One way to keep this risk register alive and present in people's minds is to make it an agenda item at a weekly or biweekly team meeting.

Another idea you can follow in parallel is to assure that each risk is assigned to a risk owner who's responsible for updating the team on any changes to that particular risk.

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To assist you in managing your own projects, we have made a risk register template available for you to download.

3.09 Video: More Planning Tools

Video: More Planning Tools

Planning Tools

Rich Maltzman

So with the WBS created and the project's work elements identified very clearly, we are in great shape. Except that we have not yet told anyone to do any work.

So we are at a point now in the planning phase of this project where we want to assign work elements to individuals and to organizations. The tool that is very important here in a very pragmatic way is the RAM. RAM stands for responsibility assignment matrix. It is a simple table or grid that connects the organizational chart of your project--in other words the people who are doing stuff on your project--with the "stuff." So if you imagine vertical rows that have the work elements and horizontal rows that show the contributors to the project, at the intersection you have a cell. You could put a check mark in a particular cell that says that the electrical department is going to work on the wiring. You can take it much further by putting a letter in the cell that shows what that responsibility is, not just that they are connected. You might show that the electrical department is accountable for having the wiring completed. Now we know that their "head" is the "head that rolls" if the wiring is not done on time. There are other letters we can use like "responsible," and "must inform," or "consult." In the text you will find some guides for how to use a RAM chart. You will find it is an extremely important tool. It really is a fundamental and extremely useful tool to prevent one of two terrible things from happening on your project; both of them are deadly. Thing one: two, three, or four people or organizations end up working on the same thing. They step on each other's toes, it causes conflict, wrong things get done, and it is just not good. You do not want two, three, or four people, or two, three, or four organizations working on the same task. The other one is that zero people get assigned to something. Then you get the "I thought you were going to do it" syndrome. And the task gets un-done, never done, and there is no one to blame other than the project manager because it is on you to figure out that that piece of work gets assigned and gets done. Remember the milestone chart from the Initiation portion of the project? You said you would have such-and-such done by a certain time. Well, if you did not tell anyone to do it, it is probably not going to get done.

When you are talking about things getting done, we want to have taken information from the WBS and have created a scope baseline. You also need a schedule baseline and a budget baseline. These are, going forward, the starting measurements from which you will decide how you are doing on the project and whether changes need to be made. So keep the term baseline in mind. Baselines are your starting scope, your starting schedule, and your starting budget. As the project proceeds, you will have change.

It is part of this planning section of the project, the Planning portion, where you will determine how you will deal with change on this project. You may determine that, depending on the level of diligence, that you need a change control board--a formal organization or committee that is going to look at any change that comes through. On a smaller project, it may be that you, as the project manager, just oversee change. The important thing is that change is looked at, understood, and formally accepted into the project. As opposed to just creeping into the project incrementally. As we know, that is called "scope creep." It is deadly. It is dangerous. And although you think you are doing the right thing and that you are being a nice project manager by taking in this extra project scope, if it is not accounted for in terms of schedule, scope, and budget, it tends to cause projects to fail in a very slow and insidious fashion. And so the way to do this properly is to account for scope in the planning stage by understanding how you will handle change upfront.

In terms of the RAM, going back to the RAM for a second, some of the work assignments will be given to vendors outside the project, and that means that you will need to contract with them or have some arrangement with them, a formal contract with them or legal agreement. So it is during this planning section that you will determine if you will use contracts, what types of contracts will you use. For example, will you have fixed-price contracts or cost-plus contracts? These are the various types of contracts that you can use and they are tools available to you as a project manager to ensure that deliverables are delivered on time and with the right scope that you promised considering your baselines.

Reviewing, the RAM is a very important tool for assigning work elements to one and only one individual and assigning them such that that individual knows that they are accountable or that they need to be informed about that work element. The establishment of baselines takes place during planning and are important tools for the PM to have available and to accommodate changes to them as they come along in a formal way or at least as formal as necessary and pragmatic for your project. And the existence of contracts is an important tool for project managers to legally understand the relationships between the vendors and the project team.

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3.10 The Responsibility Assignment Matrix

The Responsibility Assignment Matrix

After creating the WBS and identifying the project's work elements, it's now time to begin assigning work to individuals. A simple, pragmatic way to track the work assigned is to use a responsibility assignment matrix (RAM). The RAM is a table or grid that connects the human resources on the project to the work on the project. In other words, it connects the people on the project with the "stuff" that needs to be done.

RAMs can be created at high levels (mapping entire units to groups of work packages) or lower levels (mapping an individual's level of responsibility to each work package).

The RAM assigns the responsibility for the completion of work elements to one—and only one—individual. It allocates work in a way such that each individual knows that he or she is responsible for completing that work element.(Several people may be *accountable* for getting the work done but only one person is held *responsible* for ensuring that it is done.)

The matrix helps interested parties easily view information in two directions. It makes it easy to see what roles each person will play on a project (by looking at a specific column in the chart) as well as everyone involved in a specific part of the work (by examining the rows of the chart).

A common form of the RAM is the *RACI* chart. The RACI chart quickly shows who is *responsible* for an activity, who is *accountable* for it, who should be *consulted* about it, and who should be kept *informed* about it. RACI charts are especially helpful to ensure that roles and expectations are clearly defined when project staff in different units or organizations share work packages.

	Geno	Ann	Mark	Jean
Conception	R	A	I	C
Finalize	A	R	I	C
Test	I	A	R	C
Sell Internally	C	I	A	R
R = responsible, A = accountable, C = consult, I = inform				

Ensuring that assigned work is properly communicated to the project team will help practitioners avoid two potentially hazardous risks. The first risk is that multiple individuals will end up working on the same task, thereby duplicating effort and increasing the chances of conflict on the team. The second risk is the opposite of the first—that nobody will be working on a particular task or work element. The RAM prevents these types of problems by ensuring that work assignments are evenly distributed and that all work activities are accounted for.

To help you track project responsibilities, we have created a responsibility assignment matrix template for you to download.

3.11 The Network Diagram

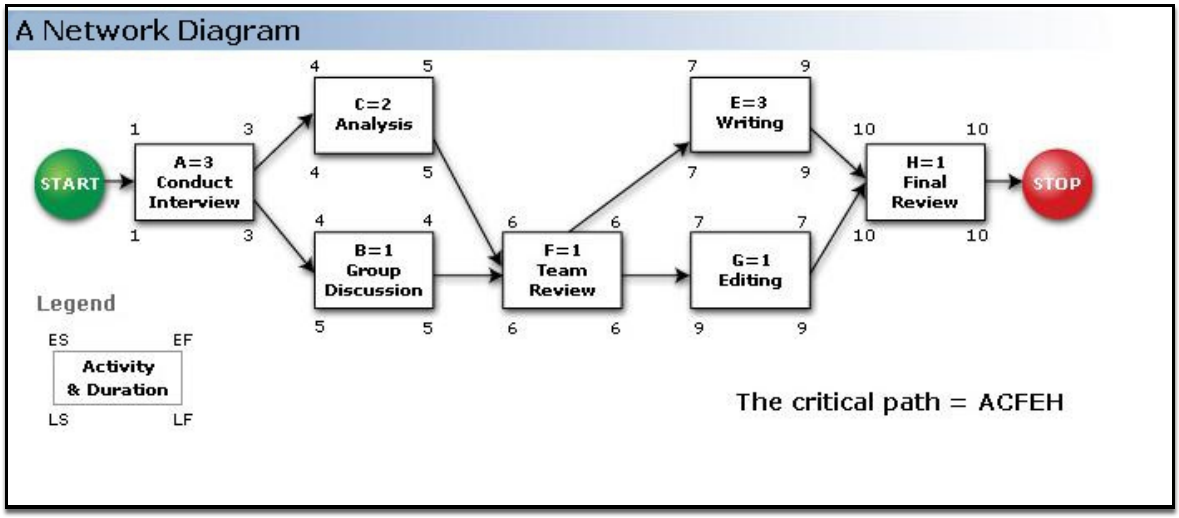
The Network Diagram

The baselines established during Planning are critical to help measure progress and monitor changes throughout the project life cycle.

One of the first and most important baselines created is the project schedule. To create an effective project schedule, practitioners will have to:

- Identify the activities that will help them meet project objectives
- Sequence those activities
- Estimate how long it will take to do those activities
- Decide which activities they'll have to monitor carefully to ensure that they finish the project on time

To create a schedule that will guide the team in executing project work, participants will use a tool called a network diagram. The network diagram is a simple graphic that shows the logical relationships among project activities. Using a simple graphic like this diagram to illustrate these often complex relationships will allow everyone to quickly see the schedule's complexity in a way that project participants can easily understand.



Completing these steps will ensure that the project schedule accounts for all project work and provides helpful information to project participants.

Identifying Activities

Identifying all of the activities that will have to be completed to meet project objectives allows participants to more accurately estimate the project's schedule (and, subsequently, its cost).

The team can begin to identify these activities by looking at the work packages at the lowest level of the work breakdown structure that was already created. (If these work packages are too big to estimate accurately, they can be divided into smaller work units, then those smaller units can be used in the schedule.) The individuals identifying these activities should ask stakeholders and other team members to suggest activities that they might be unaware of or may have overlooked.

The milestone chart created in the Initiating stage should also be reviewed to ensure that all important project dates are included in the schedule. Reviewing the milestone chart will remind the team of any dates that have been imposed on the project (by contract or by the organization authorizing the work) and ensure that these dates are planned and accounted for.

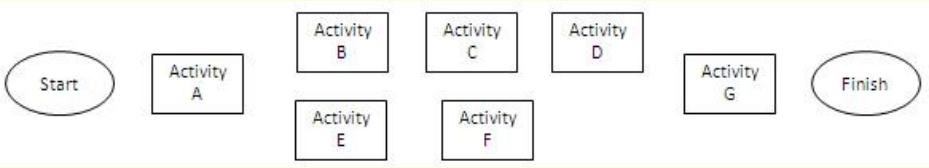
Sequencing Activities

A network diagram shows each activity's predecessors (those activities that must be completed before the activity) as well as any successor activities (those activities that will follow the activity) for all of the activities in the project.

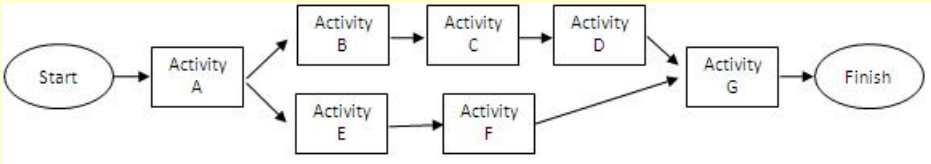
To begin, place the first activity in the project on the far left of a large work surface. Place any activities that can be

completed at the same time above or below this first activity.

Next, place all subsequent activities to the right of this first activity (or activities) in a sequence that shows progress toward the project goal. Again, place any activities that can be completed concurrently above or below these predecessor activities.



Finally, draw arrows between the activities to show any dependencies or relationships among them.



Estimating Activities

Once the sequencing of project activities is finished, an estimate of how long each activity will take should be developed. The duration estimates for each of these activities will, of course, depend on several factors—the availability of resources, the knowledge and skills of participants, etc.—so it's best to ask key stakeholders and project team members to help decide how complex and time-consuming activities may be. Including these project participants in this estimating process will help in creating more-accurate estimates and increase buy-in to the project.

Teams may also be able to look at records from similar projects that their organization has completed, to accurately estimate the activity durations. And in some industries, they might even be able to access informational databases that describe how long typical activities will take. Whatever method is chosen, be sure that the estimates are realistic and that they are agreed upon by the parties involved.

If there is a feeling that the activity estimates might not be completely accurate or if there are significant risks that may adversely affect the project schedule, the team can add reserves or buffers to account for uncertainty and increase the chance that the project will meet the projected completion date. This additional time can be added to individual activities or work packages, or a more-general buffer reserve for the entire project can be created to use at the team's (or project manager's) discretion.

Developing the Schedule

After the activities have been sequenced and an estimate of how long each will take has been made, the team will be able to calculate the expected start and end dates for each activity and for the project as a whole. They should also start to see the critical path of activities that they'll need to monitor closely to ensure that the project stays on schedule.

The critical path for the project is the path through the network diagram that has no flexibility in the time allotted for path activities—any delay in completing the activities on this path will likely delay subsequent activities and the project's completion date.

To understand how the critical path works, a forward pass and a backward pass through the diagram will have to be made.

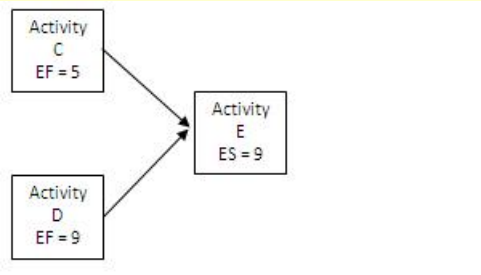
The forward pass uses the duration estimates for activities on the path to calculate the early start dates and early finish dates for each activity. The forward pass tracks the activities *from the beginning of the project to its end*

The backward pass helps to calculate the late start dates and late finish dates for path activities. The backward pass tracks activities *from the end of the project back to its beginning*

Developing the Schedule: The Forward Pass

To complete a forward pass, start at the far left of the diagram and calculate the early start dates (ES) and early finish

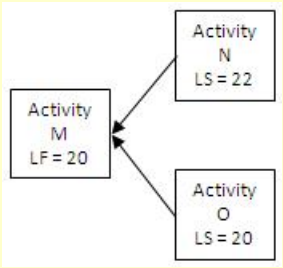
To complete a forward pass, start at the far left of the diagram and calculate the early start dates (ES) and early finish dates (EF) for each activity in the project. The early start date for an activity is the earliest date that an activity can start, based on the completion of any predecessor activities. For example, if Activity B can't begin until Activity A (which takes eight days to complete) is finished, the early start date for Activity B is day eight. (If an activity has two predecessor activities, the earliest that the activity can start is the latest finish date of all of the predecessors. So if Activity C (which is finished on day five) and Activity D (which is finished on day nine) must be done before Activity E can begin, the early start date for Activity E is day nine because it is the larger of the two finish dates for the preceding activities.)



The early finish date (EF) for an activity is the early start date *plus* the amount of time that the activity will take. So if the early start date for an activity is day 12 and the activity takes six days to complete, the early finish date is day 18.

Developing the Schedule: The Backward Pass

To calculate the backward pass, start at the *end* of the project and calculate the late finish dates and late start dates for each project activity. The late finish date (LF) for an activity is the latest that the activity can finish without delaying the project. The late finish date is based on the completion of any successor activities. The late finish date for an activity is equal to the smallest late start date (LS) of any connected succeeding task. So if the successor activities for Activity M are Activity N (which has day 22 as its late start date) and Activity O (which has day 20 as its late start date), the late finish date for Activity M is day 20 because it is the smaller of the two late start dates.



The late start date (LS) is the latest an activity can start without delaying the project. It's equal to the late finish date for the task *minus* the amount of time it takes to complete the activity.

The flexibility in the project schedule (and therefore its critical path) is determined by comparing the start and finish dates for the project's activities. For example, if an activity's ES is day nine and its LS is day 12, then there are three days of flexibility associated with the activity; the activity can start up to three days late and still not affect the project's expected completion date. If, however, the ES and LS both show the same date, then there is no flexibility associated with the completion of the task and any delay in completing the activity will likely delay the project end date.

Remember that, on the critical path, none of the activities on the path have flexibility in their completion—the ES and LS dates are equal for all of the activities on the path so a delay in any activity on the critical path will likely delay the whole path and cause the project to miss its planned completion date.

It is important to note that a project may have more than one critical path. It's also possible for a project's critical path to change if an activity is delayed so much that it uses up any flexibility associated with the task.

Monitoring the Schedule

As a project is planned and scheduled, participants may find that the network diagram shows that they won't be able to meet a milestone or other imposed project date. In such cases, the schedule will need to be adjusted to ensure that the imposed dates will be met.

One adjustment that can be made is to schedule activities that are done in a sequence to be done in parallel. Another adjustment could be to add additional resources to activities to shorten the amount of time it will take to finish them. Practitioners should be aware, however, that either of these responses may increase the risk associated with the project and cause significant problems. If the team decides to use either of these responses to adapt their schedule, they must

be sure to use them sparingly and closely monitor them to ensure that any problems that they might cause can be quickly resolved.

Teams can use the network diagram as a reference to ensure that the project will continue to meet its expected schedule. They can use the diagram to compare actual results to plans, see when corrections are needed, and keep stakeholders informed about changes to the project timeline. As such, they'll need to review the diagram regularly and keep it updated to ensure that activities are completed as expected and the project continues as planned.

3.12 The Cost Baseline

The Cost Baseline

The cost baseline is another important document that will need to be created early in the project. The cost baseline is the budget that will be used to measure, monitor, and control the project's overall cost.

To create an effective cost baseline, practitioners will need to estimate the costs for each project activity and then add those costs together to create the project's budget. This budget can then be used as a reference for project costs; as changes occur on the project, the cost baseline (along with the schedule and scope baselines) can be assessed to determine what impact the change may have.

Estimating Costs

To estimate the cost of the project, team members will have to take into account all of the costs that will be incurred to produce the project's deliverables.

They'll need to include labor and services, materials, information technology, facilities, and equipment. They'll need to plan for uncertainties such as inflation or other unforeseen events, and they may want to add a buffer to account for the costs associated with the risks that can't be planned for. They may need to consider the costs incurred while maintaining and supporting the project result after it is finished, if their organization considers these costs to be part of the project. And they'll have to decide if the project's indirect costs—such as overhead or costs that can't be directly ascribed to this particular project—will be included in their project's costs or if those costs will be accounted for at a higher level in the organization.

As the team develops the cost estimates, they will need to review any existing documentation to uncover information that will help them estimate more effectively. For example, they can review the milestone chart and network diagram to see if these documents include a due date that will require higher-than-usual labor or other costs to meet. They can look at the scope statement and work breakdown structure to ensure that estimates include costs for all of the activities they've planned for the project. And they can consult records from previous projects and lessons learned to expose costs that they may have overlooked.

Finally, they may want to record how confident they are that their estimates are accurate, by describing the confidence level for the estimated cost and the range of possibility for actual cost. For instance, they might estimate the cost for a project phase as $7,000, with a confidence level of 89% that the price will not vary more than $1,000 on each end.

Creating the Cost Baseline

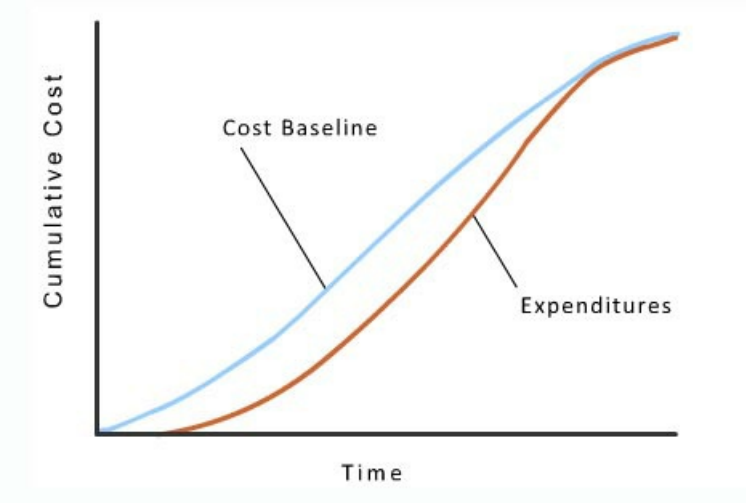
Once cost estimates for the individual activities in the project have been completed, practitioners will need to aggregate those estimates into a cost baseline.

The cost baseline is a graphic form of the budget that will help the team compare actual expenses to planned expenses. Any differences seen between actual and planned expenses should alert team members to potential problems and help them decide whether action will need to be taken to get the project back on track.

The cost baseline stipulates the amount of money that should be spent at every point in time in the project's life cycle. The cost baseline is usually shown as an S-curve, with time on the x-axis and cumulative costs on the y-axis.

The cost baseline shows the summation of all of the costs incurred during the course of the project, so it will always rise over time. Typically, costs are low at the beginning of the project and increase rapidly during execution as work is carried out. Costs then level off as the project nears completion and work slows. The planned project costs are graphed first; as actual results are achieved, they can be added as new lines on the graph for a quick comparison.

As the team uses the S-curve to compare project execution to planned performance, trends will start to appear. These trends will be very helpful in determining if and when action will be need to be taken to prevent the project from going out of control.



In the cost baseline example shown here, the actual expenditure for the project is represented by a line underneath and to the right of the baseline at almost every point except for the end of the project. This suggests that for this project, the expenditures were below the cost baseline at every point, until the project's end, at which time the actual expenditures appear to have caught up to the planned project expenditures represented in the baseline.

Cost Baselines and Earned Value

The cost baseline is actually an integrated reference; it allows participants to measure actual costs against expected costs but it also allows a comparison of schedule and scope progress as well.

To use the baseline this way, practitioners will need to employ a technique called earned value management (EVM).

EVM allows people to objectively measure performance against progress as a project unfolds.

Performance is measured by comparing the earned value (the work that got done) to the planned value (the work that was expected to get done) and by comparing earned value to the actual cost (how much was spent to get the work done).

Term	Definition
Planned value (PV)	The cost baseline or S-curve that you created. This is how much you planned to spend to get a specific amount of work done.
Earned value (EV)	The value of work performed. This is how much work you got done for the amount of money you spent.
Actual cost (AC)	The total cost actually incurred in accomplishing work performed. This is how much you've actually spent to get work done.

The next assignment will cover earned value in greater detail.

Analyzing Cost Performance

The cost baseline helps teams review the project performance, identify trends, and analyze variances on the project.

If a project is off track, practitioners have four options: ignore the variance, take corrective action to remedy the variance, revise the plan to incorporate the variance, or cancel the project.

Regardless of the response chosen, it is the project leader's responsibility (with help from the project team) to identify the causes of variances, assess the magnitude of a variance, and make sure responses to variances are understood, communicated, and carried out.

Video Commentary

Cost Performance Baseline

Gina Abudi

Managing to the cost performance baseline is key to effective cost control. So look for any of the following that's going to affect your cost performance baseline: change requests that are delayed, not managing change requests or not doing your due diligence before approving a change request, not tracking expenditures tied to specific activities, rather you might be tracking expenditures overall to the project. You want to really tie your expenditures to the specific activities of each project. And monitoring project team performance to catch issues that would affect the budget before they become a serious problem.

So for example, if in a team meeting, members of the project team are falling just a couple of hours behind, or just a half a day, if a task was supposed to be completed yesterday and it's not yet completed, but it will be completed by the end of today, monitor that, and keep track of those because those all add up and everything gets pushed behind more and more. So again, you really want to be a stickler for managing to that schedule, for managing to when activities need to be complete, and that enables you to manage against a baseline and better control the project course.

Any of these things we talked about will affect your ability to control costs. By monitoring your actual project results against a cost performance baseline, corrective or preventive actions come to light. So if I'm monitoring every task and the expenditures associated with that task, and I see things start to go a little bit over, they may be minor, but by monitoring that and tracking it and trying to get things back on track, I see where I need to take preventive action to avoid future overage or where I need to take corrective actions to get back on track.

Gina Abudi is President of Abudi Consulting Group, LLC. Gina presents at various conferences, forums, and corporate events—including the PMI® Global Congress—on developing a project management best practice. She was honored as one of the Power 50 from PMI®. She has served on the PM Summit/BA World Advisory Board and has served as Chair of the PMI® Global Corporate Council Leadership Team. Gina received her MBA from Simmons Graduate School of Management and is President of the PMI® Mass Bay Chapter Board of Directors.

3.13 Earned Value Management

Earned Value Management

Video Commentary

Earned Value

Rich Maltzman

Let's say you've been given a computer upgrade project. You're to upgrade ten computers in four weeks, and you have a certain budget and a certain number of people that can work on this and so forth, but basically ten computers to upgrade in four weeks.

It's the end of the second week, so you're halfway done with your schedule. You've spent 70% of the budget, and only two of the ten computers have been upgraded--not a real pretty picture. You're supposed to report progress to management. How do you do that? Do you say you're 70% done because you've spent 70% of money? Do you say you're 50% done because you've used up 50% of the time? Do you say you're 20%

done because you have two of the ten computers finished at this time? It's kind of a quandary, and it certainly could yield different ways of reporting the facts by reporting parts of the facts.

Earned value is meant to be a way to kind of normalize and standardize that so there's a single way to report, and what we're really looking at is variance. How different than the baseline in schedule and budget are we? And variances are calculated by subtracting. So schedule variance, you'd just subtract the baseline from what's actually happening, and cost variance we subtract the budget--what's actually happening from the baseline budget. Getting those differences will give us key information and earned value as a science lets us come up with a single, monetarily based, normalized way of reporting to avoid what could happen in terms of unethical reporting. Certainly in my example, you couldn't really report ethically that you're 70% done by saying that you spent 70% of the money. It's true, but it's not accurately showing a picture of how the project is going. Earned value is all about providing that accurate picture.

Rich Maltzman, PMP®, is the Learning and Professional Advancement Leader at a major telecom supplier. A contributor to the *PMBOK® Guide*, 4th Edition, he has co-authored PMP® Exam study guides. He is co-founder at EarthPM, LLC, and along with co-founder David Shirley, PMP®, has authored the book, *Green Project Management: Planet, Projects, Profits, and People*, published in September 2010. He received a BSEE from the University of Massachusetts in Amherst and has a graduate degree in industrial engineering from Purdue University.

As mentioned in the previous assignment, earned value management (EVM) allows practitioners to objectively measure performance against progress as a project unfolds.

Performance is measured by comparing the earned value (the work that got done) to the planned value (the work that was expected to get done) and by comparing earned value to the actual cost (how much was spent to get the work done).

Planned value (PV), earned value (EV), and actual cost (AC) are used to assess whether work is being performed over time as planned. All three concepts—EV, PV, and AC—are generally recorded in dollar amounts, to make comparisons and calculations consistent.

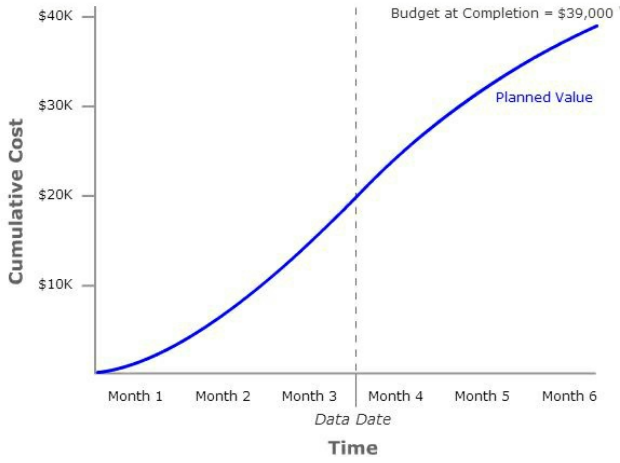
These concepts can be confusing at first, but common sense will tell you that if you planned for a certain amount of work (planned value) by the third week of a project, and the actual work done (earned value) is closer to the amount that should have been completed by the second week, the project is falling behind schedule. Similarly, if you expected to get a certain amount of work done for a specific cost (earned value) but it cost more than you planned to get that amount done (actual cost), the project is over budget.

A simple way to determine if a project is meeting its schedule is to calculate the schedule variance. The schedule variance is calculated by subtracting the planned value at a specific point in time from the earned value at that same time point. If the result of the calculation is a positive number, the project is running ahead of schedule; if the result is a negative number, the project is running behind the plan.

Similarly, practitioners can determine whether the project is under or over budget by calculating the cost variance. Cost variance is calculated by subtracting the actual cost from the earned value. Again, if the calculation result is a positive number, the project is under budget at that point in time; if the result is a negative number, your project is over budget.

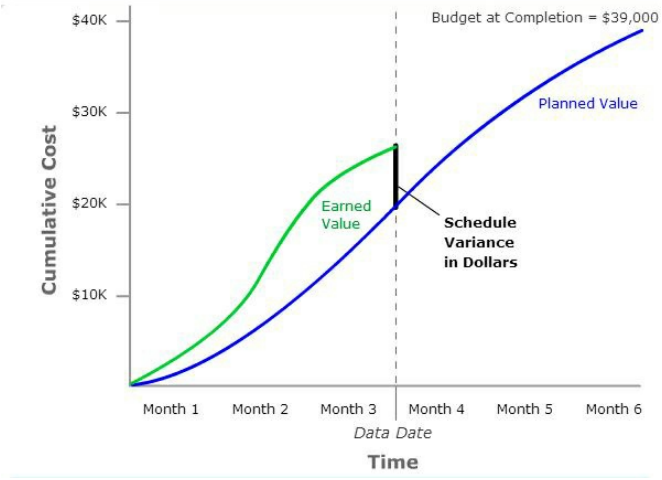
These concepts are illustrated in the example below.

Slide 1



According to the graph shown, this project is three-and-a-half months along and is expected to take six months. The planned value line shows the aggregation of expected activity costs at every stage of the project. It is expected to cost $20,000 at the 3.5-month mark, and its budget at completion is expected to be $39,000.

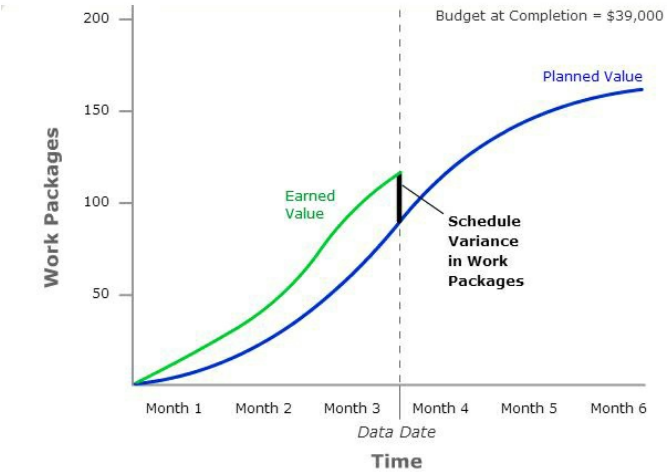
Slide 2



The earned value line indicates that the value of the work performed up until the 3.5-month mark is valued at $25,000. This means that the project has produced $25,000 worth of the total project work packages planned for and represented by the planned value line.

Earned Value - Planned Value = Schedule Variance
$25,000 - $20,000 = $5,000

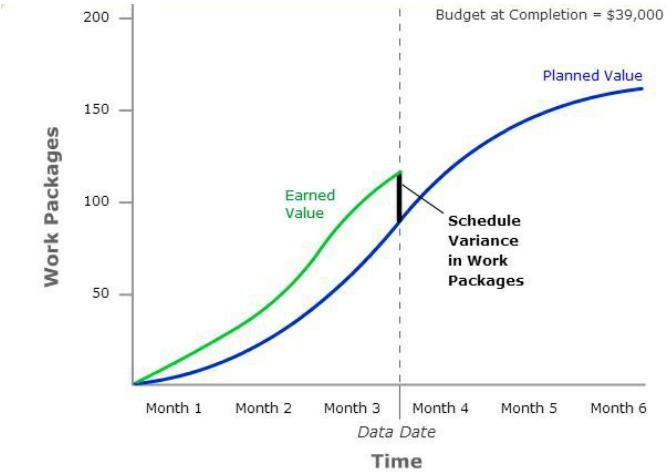
Slide 3



Because earned value can only be aggregated with respect to the planned value of the work packages, schedule variance can also be calculated by comparing the work packages that have been completed to the work packages that were expected to be completed at that point in time. The project, as of the data date, has completed about 125 work packages, and it was supposed to complete about 100 by this time.

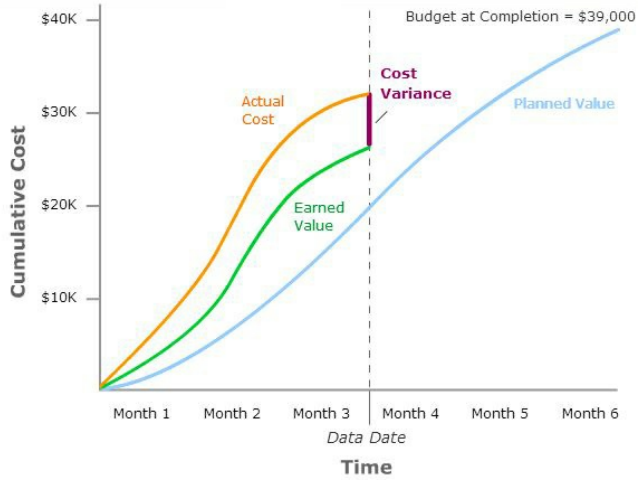
Earned Value - Planned Value = Schedule Variance
125 work packages - 100 work packages = 25 work packages

Slide 4



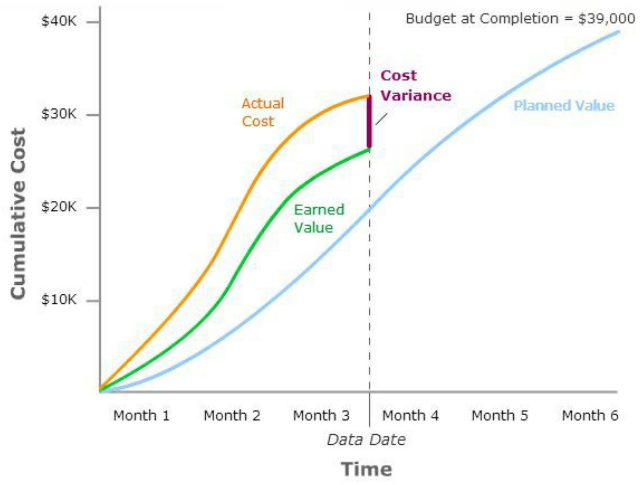
Schedule variance is most helpful when you calculate it for the critical path because the critical path contains the work packages that must be completed on time in order for the project to be delivered on time. For this exercise, we will stipulate that the data above represents the data for the critical path.

Slide 5



Schedule variance should not be confused with **cost variance**, even though both variances are quantified in dollars.

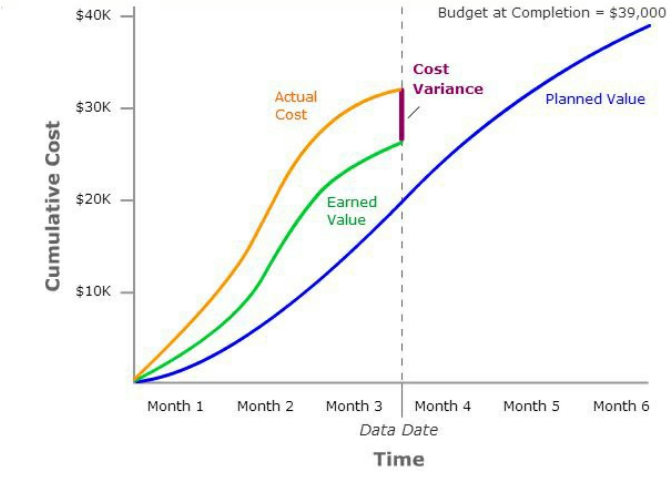
Slide 6



The actual cost of the work performed to date is illustrated by the graph. According to the graph, the work performed as of the 3.5-month mark has cost $32,000 instead of its expected earned value of $25,000.

Earned Value - Actual Cost = Cost Variance
$25,000 - $32,000 = -$7000

Slide 7



Even though the project is currently ahead of schedule ($5000 or by 25 work packages), its actual cost overruns the earned value of the work completed by $7000.

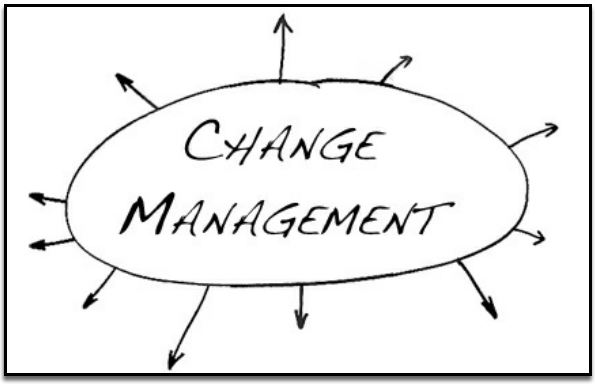
Project practitioners are often asked how close the project is to being done. An easy metric to use to provide this information is the project's percentage of completion. By dividing the earned value *up to that point in time* by the planned value *at the completion of the project* you'll be able to calculate what percent of the project is complete.

3.13.1 Exercise: Evaluating Project Status

This assignment does not contain any printable content.

3.14 Change Management

Change Management



Very few projects—even the simplest and smallest ones—are completed without having a request for change in some form. Circumstances shift, prices fluctuate, and risks develop that could not be predicted. Processes may need to be adjusted because they are not working as planned. And a stakeholder may request a change to any part of a project at any time. Changes *will* happen—they can't be avoided—so it is very important to set up an effective process to help deal with change and ensure that it doesn't delay or derail the project.

How people manage change will depend on how they view change. The project team and performing organization may view change (as many traditional project management organizations do) as something that needs to be avoided and, if possible, eliminated. People in an Agile organization may embrace change as a way to ensure that project results reflect the latest customer needs. Or people may view change management as a process that needs to be streamlined and optimized as much as possible, as Lean practitioners do. In whatever way they view change, project participants will need to think about how they'll analyze any changes and their impacts on the project as well as how they'll implement or reject change requests.

Video Commentary

Change Management

Rich Maltzman

Change is probably the most difficult thing for project managers to deal with. As project managers ourselves, ironically, we are change agents. Why would you have a project in the first place if you didn't want something to change? So we kind of buy into the idea of change, but people in general don't. So there's a lot of conflict involved in change, and as a project manager, we look a little bit crooked at change because what it means is that the scope or the budget or the schedule or our resources are changing, and we don't like that, but we know we have to deal with it. By the way, since we're dealing with a project, we're by definition also dealing with something that's unique because by definition a project is something that has never been done before, so it's new territory. So you're going to face change.

Depending on the scope and size and length of the project and complexity, the amount of change management control that's needed varies. On a small project, the diligence is still important, but it may not be as all encompassing. Therefore you might not have to have a formal change control board. The project manager can track changes, log them, see what effect they have on schedule and budget, determine whether

upscoping is necessary and revision of baselines is necessary, and probably can be handled by the project manager at a smaller size.

Above a pretty small size though, a project is going to need to have a more formal change control system and even a change control board of some kind, and in that case, it's important to formally admit change into the project so you know its source, you know its scope, you know its effect on resources, schedule, budget, risk--you know, risks are going to be introduced with new change. So I think above even a very small project size, you do need to have more formal scope recognition or change management recognition. You can monitor this as you're executing because as you start to implement the project, that's often when some of your assumptions will be proven wrong, some new risks will show themselves, and that's when you're going to have to in parallel execute the project and monitor to see whether the change control process itself is working.

Rich Maltzman, PMP®, is the Learning and Professional Advancement Leader at a major telecom supplier. A contributor to the *PMBOK® Guide*, 4th Edition, he has co-authored PMP® Exam study guides. He is co-founder at EarthPM, LLC, and along with co-founder David Shirley, PMP®, has authored the book, *Green Project Management: Planet, Projects, Profits, and People*, published in September 2010. He received a BSEE from the University of Massachusetts in Amherst and has a graduate degree in industrial engineering from Purdue University.

The Change Request Form

An effective way to track and monitor changes and change requests is to develop a change request form. This form will allow the project team to document requests for project changes and to monitor the results of those requests. It will serve as a record that they can refer to in retrospect to help to develop lessons learned and to understand why a project's final result may differ from initial plans.

To see what information should be included in the change request form, click on each of the headings in the graphic below:

Project

Project Title

Date

Date of Request

Change Request

Specifics of the Request

Requesting Party

Name of Person/Entity Requesting the Change

Impact

How the Change Will Affect the Project

Status

Classification of Request

Project Approval

Signature

Date

Page Number

Record the project title. This will help in archiving and referencing the change request document in lessons learned meetings.

Record the date that the change request was made.

Describe the requested change in detail. Include information as to why the change is needed as well as any information on which portions of the project (scope, budget, schedule, quality, etc.) the change may affect. Consider adding a unique identification code or number that can be used to quickly reference the change in discussions.

Record the name of the person (or persons) requesting the change. Consider including contact information for this person and his/her role on the project.

Explain any potential impacts that the change may have on the project. Consider the effect on the project's scope, schedule, budget, quality, risk, processes, and product characteristics.

Classify the change request as "open/in process," "approved," "rejected," or "escalated" (to a higher level). If the request is rejected or escalated, state the reasoning behind the decision.

Have the request signed (and dated) by the person responsible for accepting or rejecting the request.

Managing and Monitoring Change

Once the change request form has been developed, the project manager and project team will need to decide who will own the change management process and who has the authority to accept or reject the request. The project manager may have some power to make changes (as per the project charter or instructions from senior management) but some changes—especially those that drastically affect project parameters or objectives—may need to be approved by someone with higher authority. Project leaders and executives may even choose to create a change control board of key team members and project participants to analyze and authorize project changes. This change-control group should include people who have a working knowledge of the project and its intended objectives, as well as an understanding of the project's place in furthering organizational goals. They should have the power to get things done and the responsibility to ensure that the changes will be properly implemented. Their approval of a change request will likely depend on factors such as the cost of the change, the effect that the change may have on the project schedule, or specific requirements listed in a contract. If the change will significantly disrupt the project or does not align with strategic goals, they may decide to deny the change request.

The change control process that is developed can be very informal but practitioners should still establish policies in the Planning stage to deal with any mid-project changes, even if those policies are simple guidelines. All change requests should be funneled through some sort of monitoring and management process to ensure that they are analyzed properly and implemented only if they fall within the project parameters. Changes must be coordinated and controlled to prevent them from disrupting project work and compromising the project.

To help monitor and manage change requests on your projects, we have made a change request form template available for download.

3.15 Contract and Vendor Management

Contract and Vendor Management

As a project is planned, practitioners may find that they'll have to acquire or purchase supplies and resources from outside sources to complete some of the project activities.

There are several steps that they'll need to take to manage this process effectively:

- Deciding what they'll need to acquire
- Selecting the appropriate vendor for the resources they'll need
- Negotiating and signing a contract to acquire those resources
- Managing contract and vendor compliance

Because these decisions can have legal and accounting implications, it is very important to consider them carefully and address them appropriately to ensure that the project is successful.

Deciding What Will Need to Be Acquired

To help decide what resources will be needed on the project, take a quick look at the project's scope, schedule, and cost baselines. A quick review of these documents should show what activities need to be performed, when those activities need to be completed, and how much money is needed to complete the needed work. Then decide if there are resources in-house to complete the work or if there is budget available to acquire outside help.

If resources or services from outside sources need to be procured, put some thought into this process to ensure that it goes as quickly and smoothly as possible. Make sure that any directions sent to vendors contain enough information to allow them to correctly bid on the project without limiting their input on the best way to meet project requirements. Consider the time and effort that managing an outside relationship will take and adjust plans as needed. And commit to an ongoing relationship with the vendor to ensure that both parties benefit from project results.

As with all of the other processes used to run projects, tailor this process as necessary to suit project needs and meet organizational requirements.

Selecting Vendors

Project managers will need to think about what criteria they will use to choose the sources they'll procure from. Managers may find that their organization has a list of previous vendors or "prequalified" suppliers to work with, making this effort easier to undertake and manage.

If, however, the organization does not have this type of list, the project manager will have to talk to key stakeholders and project team members to develop some selection criteria. He or she may decide to choose a vendor based on price alone or may consider other factors (like the ones below) before a decision is made:

- How well the vendor understands the project needs
- How well the vendor matches the size and type of business the team would like to work with
- How well the vendor will be able to meet the technical needs of the project
- How well the vendor will be able to manage its part of the project
- How well the vendor has performed on previous contracts with the organization
- How satisfied the vendor's previous customers were with the work produced
- Who assumes the risk (and associated costs) for the vendor's portion of the work

Carefully choosing and explaining the project's selection criteria will ensure that the selection process is as open and fair as possible and should curtail assumptions and misunderstanding as to why a specific vendor was chosen.

Selecting and Negotiating the Contract

In many cases project practitioners may need to draw up and sign a contract with outside sources to ensure that work is completed as needed.

Because contracts are formal documents with legal ramifications, it is in the team members' best interest to be well-versed in their creation and use:

- They will need to think about how the contracts to be used will be prepared
- They will need to agree with suppliers and vendors on a contract that meets both parties needs
- They will need to monitor contract performance throughout its existence
- They will need to be sure that they close the contract appropriately

Contract Types

Most contracts can be classified into two basic types—fixed-price contracts and cost-reimbursable contracts—with a third option, time and material contracts, that represents a hybrid of the other two. Greater detail on these contracts types, as well as tips for negotiating vendor contracts, will be discussed in future assignments in this course.

Managing Vendors

Once an agreement is entered into with a vendor, the project leader must handle this relationship carefully. At its core, vendor management is about working with a partner-organization to reach a deal that benefits both parties.

To encourage a beneficial relationship, leaders may have to work with vendors to help them understand project operations. Project managers might have to explain project basics, discuss how vendors will affect and be affected by the work, and clarify how they are expected to interact with project practitioners. Vendors should be encouraged to ask questions if any parts of the project are unclear, and they should be invited to specific meetings to help them better understand and interact with teams.

The project manager will also have to monitor vendor work to ensure that it complies with project needs and objectives. Managers will have to consider the vendor's performance on the scope, quality, schedule, and cost issues included in the contract. Any claims or disputes that occur will need to be tracked and a record of all issues should be kept in case legal action is necessary. The team should also document how easy (or difficult) the vendor was to work with and how well they met the requirements set forth in the contract. By tracking and documenting this information, a record (that can be accessed by anyone considering this vendor for future contract work) will be created and valuable input for future contracting decisions will be provided.

Video Commentary

Contract and Vendor Management

Rich Maltzman

You draw resources from your own team as much as you can, but when you do not have the resources within the team, you need to bring them in from without. And that means often going to vendors and arranging a contract for resources, whether they're human resources, machines, raw material. So there's acquisition involved in a project.

When that takes place, you need to determine what you want to purchase, when, and with what type of contract, and there's various types of contracts, and there's a whole science around choosing the right kind of contract, and even making this so-called "make-buy" decision. But what's important is that you do this formally so that there's an arrangement and an understanding upfront about what the vendor is supposed to provide, and when, and in what quality, and how you'll know that their deliverable is complete. Otherwise, your project will suffer any of the attributes that--any of the negative attributes from a bad delivery of service or product or raw materials.

To do that and to make selections amongst different vendors, one of the things that can be very practically used, and I've seen them used very successfully, is a weighted table. So a weighted table is a tool that compares vendors amongst each other for different attributes, with you, the project team, determining how important, for example, safety or costs or consistency or any other number of attributes--how much they weigh in an overall percentage of 100%, and you make a decision that's an informed decision, and one that's also transparent. So a weighted table is a very good way to help you make vendor selections.

A contract also helps protect both you and the vendor in terms of relationships so that there's no question about what's being provided. There's a very clear definition of what the expectations are. So it's also a very important way to manage relationships between the project team and its suppliers.

So I would just say that acquiring outside resources is very important, the use of contracts is a very important tool, and that there's quite a bit of written--quite a bit of information out there you can find regarding the different project contract types, and how they apply to your project, to help your project get the right things at the right time and pay the proper amount.

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3.16 Project Scope Management

Project Scope Management

What is Project Scope Management?

Project scope management focuses on defining and controlling what is and is not included in the project. It encompasses all the processes needed to ensure that the project includes *all* the work required, but *only* the work required, to complete the project successfully.

The term *scope* can refer to product scope or project scope. Product scope defines the features and functions that characterize a product, service, or result. In contrast, project scope identifies the work that needs to be accomplished to deliver a product, service, or result with the specified features and functions.

Preventing Scope Creep

When project practitioners focus on project scope, they need to ensure that all the work gets done to complete the project. However, they also need to ensure that extra work is not added to the project unexpectedly. Change is inevitable in most projects so managing project scope and preventing unnecessary scope expansion can be particularly challenging.

Even when a project seems well defined and well managed, it may encounter scope creep. Scope creep is the growth or change of project requirements. One way to manage scope creep is to validate the scope of the project throughout its life cycle.

Validating scope for a project and minimizing scope changes can be difficult. Scope validation activities are especially important in projects because they help the project team determine whether the project is on track or is expanding beyond its original charter.

Tools for Scope Control

Project practitioners can use various tools to control project scope:

A Formal Change Control System

> A change control system is a formal, documented process that describes when and how official project documents may be changed.

Configuration Management

> Configuration management ensures that the descriptions of the project's products are correct and complete. Changes to the characteristics of a project must be recorded and reported as a part of configuration management.

Replanning

Replanning the project scope may be required, if the approved changes significantly alter the originally planned project.

Variance Analysis

When conducting variance analysis, project performance measurements are compared with the scope baseline. The project manager is interested in understanding the cause of the variance between the actual project and the baseline. The variance and its cause will help to determine whether corrective action is needed.

Video Commentary

Controlling Scope Creep

Richard Maltzman

Controlling Scope Creep

Richard Maltzman

How does a project avoid, or prevent, or control scope creep? Well, one can prevent and control it in a number of ways. First, convey the idea to your team--and this is important--that scope change in and of itself is not necessarily bad. If scope is formally accepted into the project, it could enlarge and enhance the work for everyone involved and it's more business for your enterprise. Convey that what is bad is if scope gets into the project that is not accounted for, either in terms of schedule, budget, wear-and-tear on the team, or any combination of the above. That's the first.

The second, use a formal--and by formal, I don't mean tedious, necessarily--but a formal system to accept change; a change control system that is uniquely focused on accepting or rejecting change proposals. Understand the configuration of the product via configuration management (which can also be a science unto itself and that depends on the complexity of the product or service that you're managing).

And then the third one is to use variance analysis: to look for telltale signs that scope is indeed creeping into your project. For example, the overconsumption of a particular raw material, or time charged by a particular subject matter expert, may be telling you that people are (perhaps with the best intentions) doing work that is not in the WBS and, therefore, not in scope and should be either rejected, or looked at to be formally accepted.

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The Importance of Effective Scope Management

Taking the time to define a project's scope is an important contributor to project success. Effective project scope planning provides several benefits for any project, such as:

- Improving the accuracy of time, cost, and resource estimates
- Providing a baseline for performance measurement and project control

- Helping to communicate clear work responsibilities
- Confirming a common understanding of the project scope across all stakeholder groups

Failure to effectively plan scope management practices for a project can cause countless issues and can result in lost time, money, and effort as project practitioners struggle with project objectives that are moving targets. The waste associated with executing unneeded or unnecessary project activities can slow productivity, frustrating the project team to the point that it can seriously damage team morale.

3.16.1 Exercise: Product vs. Project Scope

This assignment does not contain any printable content.

3.17 Setting Project Boundaries With the Scope Statement

Setting Project Boundaries With the Scope Statement

Video Commentary

The Project Scope Statement

Richard Maltzman

How does the scope statement help set boundaries for your project? Well, the scope statement is your way of indicating what deliverables, exclusions, constraints, and assumptions will be part of the project's effort. It's not in as a technical or detailed form as the work breakdown structure, which is geared for later assigning and scheduling of work packages, but rather as a way of communicating the following:

What's in and out of the project, What assumptions you made to help make the decisions, like "the price of fuel will remain between $3.50 and $4.50." (That assumption may need to be revisited from time to time.) Another assumption might be "All work will be done by union labor." These kinds of assumptions should be documented.

What constraints you'll be dealing with--for example, schedule milestones and deadlines (the obvious ones) as well as the not-so-obvious constraints like which regulatory agencies will be doing inspections, where, and when will those occur.

And finally, what deliverables are expected from the project team; this is the last part of the scope statement. Deliverables expected from the project team--these help set boundaries for the project.

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To properly define a project's scope, the project team will need to create an effective scope statement. The scope statement establishes the boundaries that the work must be performed within, encompassing all the work, time, and cost needed to complete the project successfully.

Stakeholders and team members alike must understand the scope of a project so they can carry out their roles appropriately. The project scope acts as a crucial baseline measurement—by delineating what needs to be accomplished, the scope statement provides a reference point that the team can use to measure their ability to meet project expectations. All work performed by the team or work change requests submitted by stakeholders is measured against the initial scope of the project to ensure that the

project remains on track. The project team will use the scope statement as a guide as they execute project activities, to ensure that the project continues along the path set forth at the beginning of the project.

An effective scope statement will describe the project and product scope in enough detail so practitioners can measure project progress against expectations. These descriptions may be updated and refined as the project continues and more information is gathered or disclosed.

To draft a comprehensive scope statement, project practitioners need to consider the following components:

- A description of the product's characteristics or what it is designed to do (which may include product increments or interim deliverables produced during the project)
- Criteria that must be met before stakeholders will accept the deliverables
- Specific details about what will *not* be contained in the project
- Assumptions made about the project or conditions that exist or are expected to exist during the project
- Any constraints, rules, regulations, or other factors that may limit work during the project

Scope statements, like other aspects of a project, may be as formal, complex, or extensive as needed, based on the size and complexity of the project. Some projects may be able to use simple, uncomplicated scope statements like the following:

"Corius Corporation will develop a new mobile application for use in tablets and laptops. The app will allow Corius customers to access their accounts from remote locations but will not allow new customers to sign up for Corius' service. The app will be available to the market in six weeks and project costs will not exceed $12,000. Development will be based on existing Corius IP; no outside resources will be used in development."

Other projects will require more-detailed, multi-paged descriptions like the one listed below:

- Scope Statement for the Software Implementation

3.18 Exercise: Project Scope

This assignment does not contain any printable content.

3.19 Collecting Requirements

Collecting Requirements and Defining Scope

A project's scope will ultimately be based on the needs and requirements of its stakeholders. To guarantee that the project will be viewed as a success, the project team will have to gather and prioritize these requirements to ensure that the scope of the project encompasses all of these needs and that the project will meet the most important stakeholders' requirements to their satisfaction.

Collecting requirements may include activities such as:

- Conducting interviews, focus groups, or facilitated workshops with select groups of stakeholders
- Providing questionnaires and surveys that uncover expectations and help refine requirements
- Executing benchmarking comparisons or developing context diagrams that help in eliciting and understanding requirements
- Developing prototypes and observing customers interacting with products (or product increments) to uncover unspoken (or even unknown) requirements
- Analyzing documentation and reviewing lessons learned from previous projects (or from previous parts of the current project) to expose pitfalls or missing requirements from previous work

Interviews, Focus Groups, and Facilitated Workshops

Interviews, focus groups, and facilitated workshops are similar techniques but do have their differences.

While an interview can be a formal or informal question-and-answer session, focus groups provide a more conversational format for culling the opinions of multiple stakeholders. And while interviews may be more useful to uncover sensitive or confidential information that participants are unlikely to share in a group setting, focus groups are usually more interactive than interviews and can bring together prequalified subject experts or stakeholders to brainstorm or discuss their expectations about a project.

Facilitated workshops resemble focus groups in that they are very useful for bringing together a group of cross-functional stakeholders who may have differing expectations for project deliverables. However, facilitated workshops tend to be more

interactive and conversational than focus groups, so ample time must be provided for all stakeholders to communicate their expectations and concerns. And because representatives are present across functions, potential problems with the project can be identified and resolved in less time than through individual interviews or smaller focus groups. The group might also benefit from a morale boost as bonds of trust are formed across functional groups.

Refining Requirements

Once requirements are discovered and prioritized, the project management team needs to ensure that they are measurable, testable, traceable, complete, consistent, and that stakeholders will be satisfied with them. If requirements aren't collected in enough detail, it will be hard to set objectives that will ultimately satisfy stakeholders.

The requirements can then be included in project baselines so that they can be used in other processes in the project to measure progress and compliance.

Documenting and Tracking Requirements

Once requirements have been uncovered in adequate detail, they should then be compiled into requirements documentation.

Requirements documentation describes, in clear terms, the way in which project requirements meet the need for the project set out in the project charter. These documents may be very detailed, or they may be a simple summary that refers to other related documents that discuss the requirements in more detail.

One of the most helpful requirements documents that a team can use is its requirements traceability matrix (described in a previous assignment in this course) to ensure that each requirement identified for the project can be traced back to a business objective or need that must be met. The requirements matrix will make it easy to link features in project results back to their origin, to show that project deliverables satisfy the needs of the project.

Video Commentary

Collecting Requirements: Tips and Tricks

Rich Maltzman

Let's talk for a moment about collecting requirements. This is a very important piece to any project. Those of you in IT realize the project really can't get off the ground unless you really know what requirements the customer has. A key word here that is not the word "requirement," it's the word "expectations." And the way I like to look at it is that expectations are often hidden behind requirements. Requirements are the formal statements that are handed off to you as a vendor to say, "Here's what we need you to do." But hidden behind those numbers, which could be technical specifications or features are expectations. And sometimes those are not that clearly stated. Sometimes you need to peel back and push back through your sales team, sometimes directly to the customer, to understand what the stakeholders, what the client, really wants, what their expectations are. And getting to expectations are really what's going to make a difference. In fact, I like to say, "Meeting requirements completes your contract, but meeting expectations gets you the next contract."

There's something else called beating requirements, and a lot of people, especially in the technical world, take on the challenge of seeing a requirement like it has to be 3 millimeters, or less than 3 millimeters thick, and they'll take on that technical challenge and they'll get whatever attribute of the material is to get it down to 2 millimeters. Often, that's unnecessary. You're really doing that for yourself and not for the customer's expectation. Some people call that gold-plating. An example I like to give is in the financial industry where sometimes lenders will say, "We can approve your loan in as little as 20 seconds." I don't really... if you're putting a lot of money into that and you're going to charge me an extra 1% to be able to approve my loan immediately, I could probably wait a day if you don't spend a lot of effort and perhaps have some inaccuracies because you've tried to beat your competitor who can do it in 30 seconds. So, this idea of meeting requirements, meeting expectations, and beating requirements should be thought of as you start to plan your project based on the requirements that you get.

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3.19.1 Exercise: Collecting Requirements Fill-in-the-blank

This assignment does not contain any printable content.

3.20 Project Time Management

Project Time Management

One of the key responsibilities for any project leader is implementing the processes needed to complete a project on time.

Project time management is one of the biggest challenges for project leaders and project managers. In fact, many project managers indicate that coordinating work in order to deliver projects on time is one of the primary causes of conflict for their teams.

Why is it Challenging to Deliver Projects On-Time?

As observers assess a project, one of the easiest things to measure is the time that the project takes, so schedule problems tend to be easy to spot. Any minor deviation from the schedule will be easily seen by many, adding stress and pressure for the project team to show visible progress and to keep the project exactly on track. This added stress can lead to mistakes, which only compounds any scheduling problems that already exist. Time is also the variable in a project that has the least amount of flexibility, which can amplify scheduling problems.

Other factors that may contribute to schedule conflicts are individual work styles and cultural differences. For example, if the project team is located in several different countries, the different regional attitudes towards time and work can cause problems for the project schedule.

The Importance of Realistic Schedule Goals

One way that project practitioners can help to keep projects on schedule is to develop *realistic schedule goals*:

1. First, examine the schedule information in the project charter and the milestone chart from the Initiating stage. These can be good starting points to identify high-level expectations around the schedule.
2. Next, develop a more-detailed schedule. Be sure to involve the people who will *do* the work to help *plan* the work.
3. Finally, obtain the approval of the project stakeholders.

Various pressures may lead the project team to use unrealistic schedule estimates. For example, top management may pressure the project manager to set an accelerated project schedule so that a new product can be launched at an important trade show.

Project participants can avoid unrealistic schedules by incorporating buffers or additional resources into the project schedule. For example, a good practice is to schedule resources in such a way that no single resource is utilized more than 75 percent of the time.

Video Commentary

Schedule Buffers

Richard Maltzman

How can schedule buffers help your project? Buffers are time reserves put into the project schedule to account for contingencies--that is, threats that have been accepted into your project with a "We'll cross that bridge when we come to it" philosophy. In real life, buffers also exist in each activity. Through human nature, a project contributor will say "five days" when they are asked how long it will take, knowing that they really need four-and-a-half days to get this done and keeping a half-of-a-day buffer unto themselves for their own contingency. Whether this is done consciously or subconsciously, it happens.

Managing these buffers is an art and a science for the project practitioner. One approach is that of the critical chain, which deserves some follow-up reading if you're interested. In this technique, buffers are more consciously recognized and revealed up-front (it requires a lot of honesty) and given to the overall project, not kept to themselves (not kept to the individual contributor). It involves the use of feeding buffers separate from the overall project buffer.

Project practitioners have to be very aware of team members' propensity to add buffers and can use what are called "should-take hours"/"should-take hour benchmarks" to compare estimates that they're given to look for a variance and for over-padding of the timeline. That over-padding results in unnecessarily late delivery dates for the overall project and you should avoid them.

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In addition, project practitioners should remember to incorporate company holidays, vacation time, and sick time into the schedule—these "off days" can dramatically affect schedules if they are not taken into account during the creation of the schedule.

The Importance of Disciplined Schedule Enforcement

Once the project team has *created* a schedule with realistic goals and estimates, it is equally important to ensure that the schedule will be *met* by the team. Disciplined enforcement of milestones is critical. Setting firm dates for key deliverables can help to minimize project changes. It is especially important to avoid poor instructions and bad communication—both are clear sources of confusion and uncertainty and often result in unnecessary obstacles that slow the progress of a project.

When communicating about deadlines and milestones, specificity is critical. For example, a deliverable may be due on April 1. However, what time of day is it due? Does beginning of day mean before 9 AM? Does end of day mean by 5 PM, or is delivery at 11:59 PM acceptable? Also, if a team is geographically dispersed, project participants should clarify the time zone the delivery time is expressed in. It should not be assumed that everyone has the same assumptions about what a delivery date means. By offering specifics related to the schedule, participants will create a shared understanding across the team about what needs to be done and by when.

Team members usually do not like to admit that they are falling behind schedule. As a result, project leaders and project managers must be proactive in seeking out information from team members—especially when there appears to be a problem.

3.21 Working With Network Diagrams

Working With Network Diagrams

To formally construct a network diagram, graphically map each activity in sequence. Show the activity's early start date (*ES*) and early finish date (*EF*) on top of the activity box and the late start date (*LS*) and late finish date (*LF*) on the bottom of the activity box.

- Early dates are calculated using a forward pass calculation
- Late dates are calculated using a backward pass calculation

These two methods can be used to create a baseline schedule.

Forward Pass

The forward pass calculation answers the question, "What is the earliest that an activity may start or finish?" It can be seen as the best-case scenario.

Begin by setting the project start date, starting with the first activity on day one of the project. Then go through the schedule from the beginning of the job until the end of the job. Consider each activity in its logical sequence.

The early start is the earliest an activity can start, based on the completion of the preceding activities. The early finish is the earliest time an activity can finish, assuming it starts on time and takes no longer than planned.

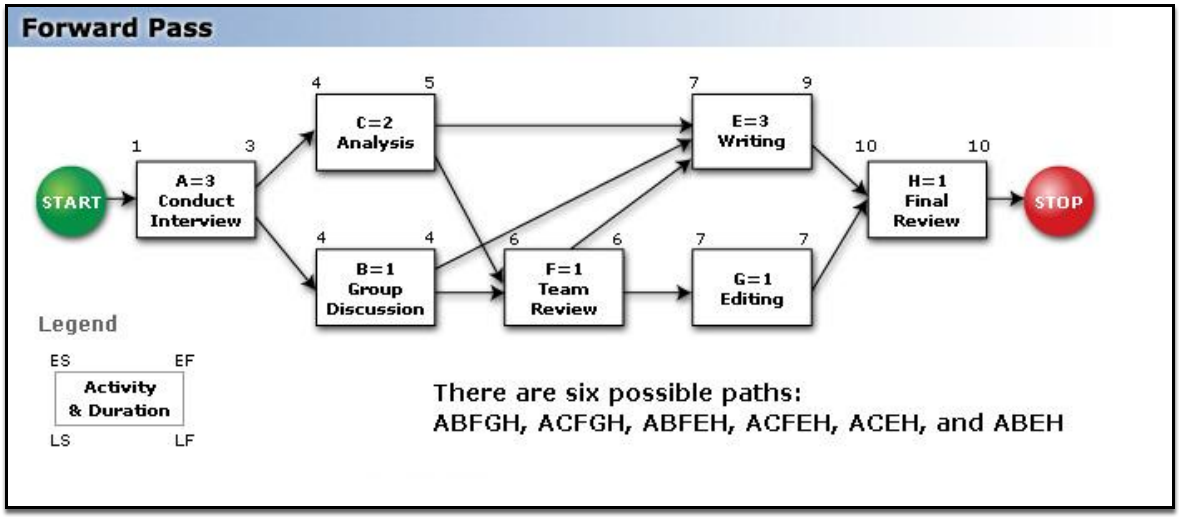
All prior activities have to be finished before the following activity can start. Therefore the early start date of the following activity is equal to the early start date of the prior activity plus the time it takes to complete the activity. When a following activity is connected to more than one prior activity (i.e., arrows from two prior activities are converging onto one following activity), the early start date of the following activity will be the *largest* of the finish dates from the prior activities.

When the last activity in the schedule has been reached, with each early start and finish date set, it is possible to answer the question, "What is the earliest that this project can be completed?"

Formulas for the forward pass calculations are as follows:

Early Start (ES) = Previous activity's EF + 1 + Lag (if any)

Early Finish (EF) = (Early Start + Duration of activity) – 1



Backward Pass

The backward pass calculation answers the question, "What is the latest that an activity may start or finish without delaying the project?"

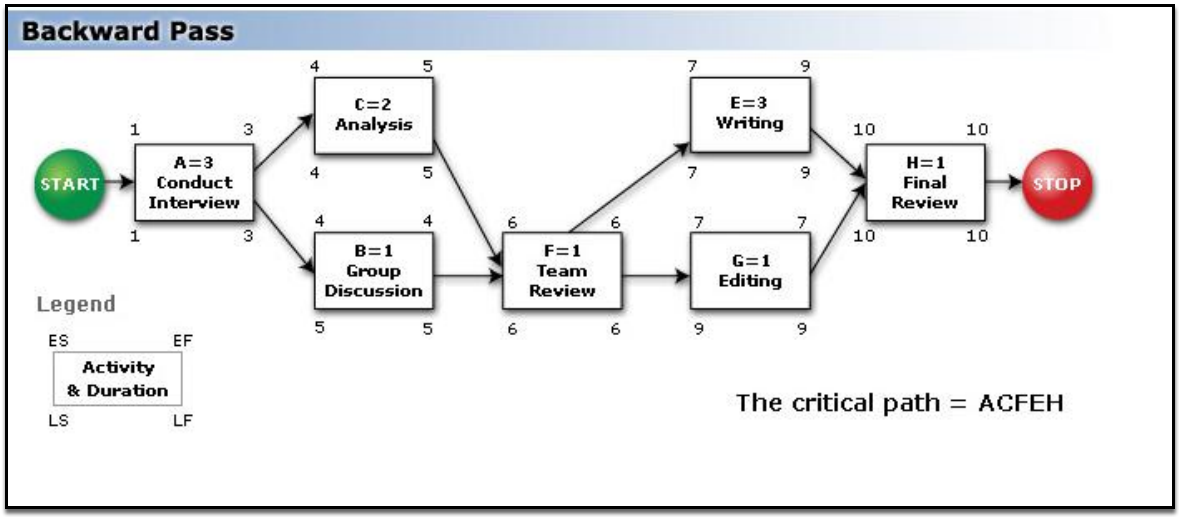
First, set the late finish date of the last activity in the project. Then work your way through the schedule from the end of the project to the start. Address each activity in its logical date sequence. When multiple activities converge into one node in a backward pass, the *smallest* of the late start dates from the activities becomes the late finish date in the node.

Upon reaching the first activity in the schedule, you will know the latest that each activity should finish. While the late start date is the latest an activity can start without delaying the project, the late finish date is the latest an activity can finish without delaying the project.

Formulas for the backward pass calculations are as follows:

Late Finish (LF) = Successor's LS – 1 – Lag (if any)

Late Start (LS) = (LF – Duration of activity) + 1



After you have built the schedule and identified the critical path and the end date, you will determine if it aligns with the customer's due date. If it exceeds their date (which is often the case) you will have to do some additional planning—running activities in parallel or adding resources to finish activities earlier—to align with their expectations.

On the critical path, LS - ES = LF - EF = zero. (Note: if this does not occur for any of the project paths, the path with the smallest difference should be considered the critical path.)

3.21.1 Exercise: Identifying the Critical Path

This assignment does not contain any printable content.

3.22 Schedule Compression

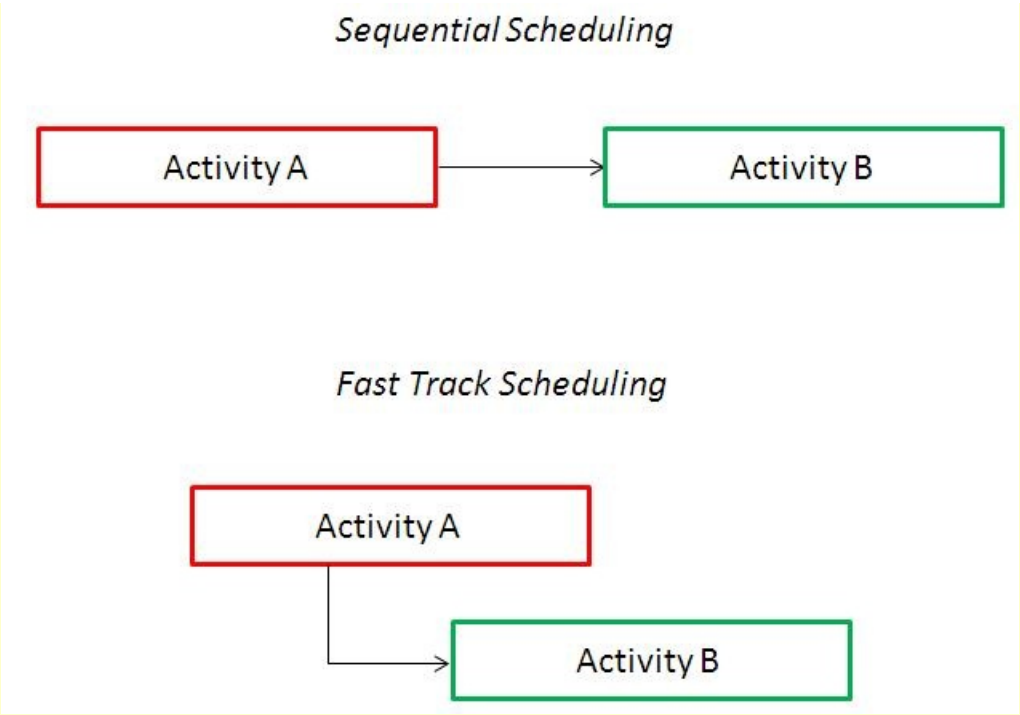
Schedule Compression

After creating a schedule network diagram, project practitioners sometimes find that the end date specified by the diagram does not align with an imposed time constraint or completion date set for the project. But, after bringing this discrepancy to the attention of key stakeholders or project partners, they may be told that the project must be completed by the imposed due dates—and to further complicate matters, it must be done without compromising or changing the project scope in any way.

To meet these requests, there are two commonly used compression techniques that can be used to shorten the project's duration without affecting its scope. These techniques—fast tracking and crashing—are described below:

Fast tracking

Fast tracking allows project activities that would normally be done in sequence to be run simultaneously instead. By performing these activities *in parallel* instead of *in sequence*, the project team can shorten the time needed to complete the project.



Examples of fast tracking include:

- using a prototype to begin testing for quality control problems instead of waiting for the final product to be completed
- ordering the material that a construction crew expects to need before a new building's design is finished

To implement fast tracking correctly, practitioners will need to look at the dependencies among activities and determine which ones can be overlapped; in some cases (where one activity must be completed before a second activity can start), fast tracking is not possible and cannot be employed.

It is important to note that fast tracking a project's schedule may increase the risks associated with the project and could result in rework if the overlapping activities generate outputs that do not integrate or align with each other.

Crashing

Crashing can be used to shorten a project's duration by adding resources to help complete important project activities. Additional personnel, equipment, or other components can be introduced into a project to focus on specific activities and ensure that they are completed sooner than originally planned.

Examples of crashing a project schedule include:

- paying for the expedited delivery of supplies or other materials needed for a project
- increasing overtime for project employees or subcontracting to add resources to the project

These added resources almost always result in increased costs so practitioners will need to consider how crashing can be implemented at the least possible cost increment. Crashing the project may also increase project risk if the additional resources add layers of complexity to the work or do not produce as expected.

These scheduling techniques will be successful only if they are applied to activities on the project's critical path—because the critical path is the determining factor in completing the project on time, applying fast tracking or crashing techniques to non-critical project paths will not help in compressing the schedule or finalizing the project as planned.

Video Commentary

Crashing and Fast Tracking

Richard Maltzman

Crashing and fast tracking: these are two ways to speed a project up. Let's talk about the difference between them and why you might choose one over the other.

For crashing, this is putting more resources on a project or a task than you would normally put on that task. For this, I tend to use an analogy of "The Three Stooges," for those of you who remember "The Three Stooges" or the recent remake. There are scenes in that very, very sophisticated comedy in which there are, for example, too many painters in a room--three stooges trying to paint a room that really one person should be painting. What happens is that they're crashing into each other, they're spilling paint, they're falling off ladders, and so forth for comic effect, but also to illustrate the fact that putting too many resources can actually have a negative effect. It, of course, can help but when you put an overabundance of resources on project work, several things happen; you have this obvious comic issue of people bumping into each other but you also have a learning curve--people who have to learn how to paint or do the task in a very rapid fashion and that can actually take more time. So I'm not advising completely against it, but be advised that when you crash a project and put an overabundance of resources, you are adding additional risk and perhaps even more time.

The other is fast tracking. Fast tracking means doing things in parallel that were best done in sequence--at least, through common wisdom--are best done in sequence and for this, I also use a painting analogy, but we'll leave "The Three Stooges" out of it this time, and that is painting a room. When you paint a room you might use two coats. You put the first coat on and you wait a specific amount of time for that coat to dry--maybe 20 minutes, 25 minutes--before you start the second coat. If you're being pressured to get this room painted in a faster time, you might be tempted to start the second coat in parallel or just after the first coat has been put on. That's going to cause a lot of risk; you'll probably tear the paint, or leave bubbles, or all kinds of things that the paint manufacturer would have advised against. So it can be done and it can, if done skillfully, subtract time from your schedule but it comes with quite a bit of risk if you try to do things that are best done in sequence in parallel.

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3.22.1 Best Practices: Crashing

Best Practices: Crashing

As mentioned in the previous assignment, adding more resources to activities can dramatically increase a project's cost so it is important for project participants to determine how to shorten the project duration for the least possible cost.

When implementing crashing techniques, it is important for practitioners to think about:

1. How much each activity costs under its normal time
2. The shortest possible activity times (i.e., maximum crashing), and
3. Activity costs under maximum crashing

They should use the following "rule-of-thumb" equations to help them decide which activities to focus their attention on:

Maximum possible time saving = normal time - shortest time
Crashing cost = (cost with maximum crashing - normal cost)/maximum time saving

Example: Procedure at a Plastics Injection Molding Plant

Suppose the following parameters exist for the plastics plant:

Activity	Activity Description	Immediate Predecessor	Activity Time
A	Order for parts arrives	None	1
B	Contract signed & paid	A	2
C	Plastic to make parts is ordered	B	1
D	Steel to make mold is ordered	B	1
E	Plastic arrives	C	7
F	Steel arrives	D	5
G	Develop mold for parts	F	10
H	Customer approves mold	G	1
I	Sample mold to ensure part quality	E & H	1
J	Production of parts	I	2
K	Delivery of parts	J	1
		Total:	**32**

Critical path: A-B-D-F-G-H-I-J-K

Activity	Normal Time (days)	Crashed Time	Normal Cost	Crashed Cost	Maximum Time Savings	Crashing Cost Per Day	Calculation of Crashing Cost
A	1	1	$0	$0	0	$0	-
B	2	1	$100	$200	1	$100	= (200-100)/1
C	1	1	$0	$0	0	$0	-
D	1	1	$0	$0	0	$0	-
E	7	3	$10,000	$13,000	4	$750	=(13,000-10,000)/4
F	5	2	$2,500	$4,000	3	$500	=(4,000-2,500)/3
G	10	4	$3,500	$5,700	6	$367	=(5,700-3,500)/6
H	1	1	$0	$0	0	$0	-
I	1	1	$900	$900	0	$0	-
J	2	1	$3,000	$5,000	1	$2,000	=(5,000-3,000)/1
K	1	1	$100	$100	0	$0	-
Totals	32	17	$20,100	$28,900	15	$586.67	=(28900-20100)/15

It is important for practitioners to understand that it may be possible to crash partial days of a schedule. So if part production (Activity J) were shortened to 1.5 days, then it might still be possible to limit the crashing cost to $1,000 (0.5 * 2000 = 1000. Here we assume a linear relationship between activity costs and activity times).

Suppose the customer needed the order delivered in 21 days. Which activities should be crashed? They're likely to be the ones with the lowest crashing costs per day. In this situation, that means negotiating, signing, and paying the contract in one day instead of two and placing a rush order on the steel so it arrives in two days instead of five. It probably also means placing rush orders on the plastic and mold development.

However, any time an activity is crashed, it may change the project's critical path so it is important to reassess the schedule before taking any action. Before they decide to crash the schedule, practitioners will have to work through the project network analysis to be sure each step of the project can be completed in time and on budget.

3.23 Three-point Estimating

Three-point Estimating

During the course of a project, a project practitioner may be asked to estimate how long a project will take or to determine its

expected end date. An effective way to answer questions like these is to use a three-point estimate.

A three-point estimate averages three scenarios to improves the accuracy of estimates when the underlying tasks or components are uncertain.

Three-point estimates are based on the Program Evaluation and Review Technique (PERT). PERT calculates an average of three estimates—an optimistic estimate (based on the best-case scenario), a pessimistic estimate (based on the worst-case scenario), and a most likely estimate. The two most-commonly used formulas in PERT calculations are based on triangular and beta distributions. In a triangular distribution, all three values to be averaged have the same probability—the calculated estimate is just an average of the three points.

$$\text{mean} = \frac{(\text{optimistic} + \text{most likely} + \text{pessimistic})}{3}$$

The beta distribution, however, weights the most likely estimate in the formula by multiplying it by four (which then means that the summation of the estimates must be divided by six to attain the average).

$$\text{mean} = \frac{(\text{optimistic} + (4 \times \text{most likely}) + \text{pessimistic})}{6}$$

The quotient from either of these formulas is called the *expected value* of the duration estimate.

PERT is considered reliable relative to other estimating techniques; however, all estimations are, by nature, imperfect. The degree of confidence in an estimate is known as a *confidence factor*, which is expressed as a percentage. The confidence factor of 95% over a normal distribution assumes that about 95% of the time, work will finish within Â± two standard deviations of the PERT calculation.

When using PERT, standard deviation (used to find a confidence factor and confidence interval) is represented by (Pessimistic - Optimistic)/6. This factor provides the expected statistical variance in duration.

After finding the statistical variance, the confidence interval (the period of time within which the project practitioner is 95% certain that a project will be completed) can be determined. The confidence interval is calculated by multiplying the standard deviation by two (because the project manager assumes that work will finish within Â± two standard deviations) and separately adding (to get the pessimistic confidence interval factor) or subtracting (to get the optimistic confidence interval factor) this number from the expected value as calculated by PERT.

Using these techniques, project participants should be able to provide an estimate for the amount of time that the activity or project should take, as well as the range of error; an example duration might be *between 10 and 15 days with 95% probability of completion within 12 or 13 days (the interval)*.

3.24 Project Time Management Barriers and How to Handle Them

Project Time Management Barriers and How to Handle Them

In a previous assignment, we talked about the challenges of keeping a project's schedule on-track. In this assignment, we will explore some of the barriers that can prevent a project manager from managing a schedule effectively and how those barriers can be avoided.

A project manager first needs to identify the specific problem or problems. Click on the titles below to read about some of the potential problems project managers may face.

A Lot of Small Delays

> A project with many tasks that are all a little bit late is a dangerous problem for any project manager. Each of the small delays adds up quickly and before the project manager knows it, the project is late. It is important for project managers to keep a holistic view of their projects. They cannot let larger issues distract them from noticing small delays with deliverables.

The Noncooperative Team Member

> In some cases, there may be team members who do not agree with what needs to be done on a project. They may

refuse to work on the tasks in the order they have been scheduled, and instead work on what they feel is correct. Warning signs may include reluctance to submit status reports and avoiding the project manager. The project manager must meet one-on-one with each problematic team member and emphasize the importance of working as a team. If this intervention is not effective, stronger measures may be necessary.

The Remote Team Member Who Doesn't Communicate

It can be difficult to manage a team when members work in remote locations or telecommute. When remote team members stop communicating with the project manager, this difficulty increases. For team members working at a remote office location, the project manager may need to have another person at the site to confirm that the employees are actually at work. A senior manager at that site may need to intervene and talk to the employees about the communication issues. If the issues cannot be resolved, the team member may need to be removed from the project. To avoid major delays in the schedule, critical tasks should be reassigned to other team members as quickly as possible.

The Client or Vendor Who Doesn't Communicate

Project teams are often dependent on information or deliverables from clients or vendors. When either of these stakeholders goes silent, the project manager may encounter delays in the project schedule. To deal with non-communicative clients, it can be useful to call an emergency meeting with the client representative or project sponsor. In the case of vendors who do not deliver on schedule, it is important to ensure upfront that contractual agreements specify the consequences of late delivery. With vendor delays, the project manager may organize a brainstorming session with the project team and client to identify substitutes for the vendor's deliverable.

Task Uncertainties

Task uncertainty can be generated in different ways. For example, if a team member is scheduled to work on a task, but the task has not yet been defined, there is likely to be confusion and excess time spent on the task. Alternatively, a team member may not know the status of other team members' tasks. This too can be a source of uncertainty. Communication within the team is a logical remedy to this problem.

"Hurry up and wait" and "Wait and hurry up" Situations

There are two "syndromes" that a project manager may see. "Hurry up and wait" is when a stakeholder has an urgent request for information that turns out to have been unnecessary. "Wait and hurry up" is when emergencies arise due to procrastination on the part of the stakeholder. What can a project manager do in these situations? For cases of "hurry up and wait," the project manager can ask specific questions of the requester. For example: Why is the request so urgent? Who specifically has asked for the information? The project manager should clearly communicate how fulfilling the request will impact the project. It is prudent to put the request and project impact in writing and to copy the person identified as the initiator of the request. In the case of "wait and hurry up," the project manager should implement a process for emergency requests.

Dealing with Emergencies

When emergencies arise on a project, the project manager must act quickly. Even if the emergency is the result of procrastination, it must be addressed. Having a process for dealing with emergencies and unexpected, high priority requests is useful. After the emergency has passed, it can be helpful for the project manager to hold a lessons learned meeting to identify ways of avoiding emergency situations in the future.

3.25 Capstone Case Study: Planning

This assignment does not contain any printable content.

3.25.1 Capstone Case Study I: Creating a Work Breakdown Structure

This assignment does not contain any printable content.

3.25.2 Capstone Case Study II: Developing the Risk Register

This assignment does not contain any printable content.

3.25.3 Capstone Case Study III: Creating a Responsibility Assignment Matrix

This assignment does not contain any printable content.

3.25.4 Capstone Case Study IV: Developing Estimates and Creating a Change Control Board

This assignment does not contain any printable content.

3.26 Discussion Board

This assignment does not contain any printable content.

3.27 Graded Case Study 1: Project Selection and Initiation

This assignment does not contain any printable content.

3.27.1 Graded Case Study 1, Part I: Project Selection

This assignment does not contain any printable content.

3.27.2 Graded Case Study 1, Part II: Initiating

This assignment does not contain any printable content.

3.27.3 Graded Case Study 1, Part III: Project Planning

This assignment does not contain any printable content.

3.27.4 Graded Case Study 1, Part IV: Project Charter

This assignment does not contain any printable content.

Module Feedback

This assignment does not contain any printable content.