



PMP Specialists

DURATION vs UNITS vs WORK

(And, effort driven scheduling)

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The goal of this document is to try and explain a very complicated topic – how task types affect a schedule.

Task types are not unique to Microsoft Project but this document discusses task types from the Microsoft Project perspective. In Microsoft Project, we have the ability to “mix” the task types. I generally recommend against this due to sheer complexity of managing this methodology.

Microsoft Office Project uses one of three task types to calculate the duration of tasks and subsequently their **finish dates** (or their **start dates** if you schedule your project from the project finish date rather than the project start date).

The three types of tasks are: Fixed Duration, Fixed Units and Fixed Work, often referred to just as Duration, Units and Work.

At its most basic, the Collin definitions of these are:

Duration: The overall amount of time given to accomplish a task – usually measured in days.

Units: How much of their total available time a resource gives to a task – usually measured in percentage.

Work: The amount of time that it takes to do actually do the task – usually measured in hours.

Most companies as a whole and individuals in particular, tend to think of and use duration as an intuitive task type. People generally consider only the amount of time that a person/unit/department has to complete a task – they don’t generally consider the effect of specific people or the affect of how much effort (units) those people can give. We tend to measure duration in “whole days”. For example, we often say that a certain task will take “40 days”. We don’t generally say that a task will take “1600 hours” or that a resource has “20 hours of work in 40 days”.

Here is an example with explanation:

If I tell you that I will work one normal work day, all day, devoted to your task, then I am saying that I have Duration of one day, Work of 8 hours, and 100% of my units.

But, if I tell you that I will accomplish your task in one day, but I will only spend half my time on it, then I am saying that Duration is one day, Work is 4 hours, and you are only getting 50% of my units during that one day Duration.

More detailed explanations and examples are given below but this is a rough framework of how to think of Duration, Units and Work. And, the wrinkle of adding Effort Driven Scheduling is explained, starting on page 12.



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Definitions and Quick Explanation

A single task must be set in Microsoft Project to be either “Fixed Duration”, “Fixed Units” or “Fixed Work” – but a task can only have one of those designations. Different tasks within the same schedule can be different task types though. Therefore, we need to look specifically at how the system defines these task types.

Here are two sets of definitions to further clarify (or muddy??) the Collin definitions as written above. The first definition is from Microsoft and then the second one is taken from Project Bible (Microsoft Office Project 2003 Bible, written by Elaine Marmel).

Microsoft Definition:

Fixed Duration – “A task in which the duration is a fixed value and any changes to the work or the assigned units [that is, resources] don't affect the task's duration.”

Project Bible Definition:

Fixed Duration – “The number of resources does not affect the timing of this type of task. To allow a week for a committee to review the company's new ad campaign – not matter how many people are on the committee – give the task a fixed duration. You can't shorten the task's duration by adding resources to it.”

Microsoft Definition:

Fixed Units – “A task in which the assigned units [or resources] is a fixed value and any changes to the amount of work or the task's duration do not affect the task's units.”

Project Bible Definition:

Fixed Units – “Resource driven tasks are referred to as fixed-unit tasks. Here's a simple example. You have to plant a tree. One person needs two hours to plant a tree. If you add another person (another resource), together they need only one hour to complete the task. That is, two resources, each putting in an hour of effort, complete the two hours of work in only one hour. With resource-driven scheduling, when you add resources, the task duration becomes shorter; if you take away resource, the task takes longer to complete. And, on the flip side, the resource assignments to a task don't change when the work increases or decreases. (**Note:** This is a strict math calculation in Project. Ten people get the work done in 1/10th the amount of time – there are no calculations for efficiency or other variables.)”

Microsoft Definition:

Fixed Work – “A task in which the amount of work is a fixed value and any changes to the task's duration or the number of assigned units [or resources] do not affect the task's work. “

Project Bible Definition:



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Fixed Work – “When you create a fixed-work task, you set the duration of the task, and Project assigns a percentage of effort that is sufficient to complete the task in the time that is allotted for each resource that you assign to the task. For example, if you assign three people to work on a one-day task, Project would say that each person should spend 33 percent of his or her time on the task to complete it in one day. Similarly, a task may take 48 hours to complete (its fixed-work value). With one resource assigned working 8 hours a day, the task will require 6 days to complete. With two resources assigned 8 hours a day, the task will require 3 days to complete. In either case, the amount of work that’s required remains constant. The task’s duration changes based on the number of resources that are assigned to the task.”

A key point often overlooked is that Microsoft Project uses fixed units by default. While this might be the best (most detailed) method, we normally change that in Microsoft Project to fixed duration as organizations are usually not prepared to schedule at that finite of a level. No matter which method is used, as we add resources, the system automatically recalculates variables for us, as the following paragraph explains.

For all tasks, after you assign a resource, the task is scheduled according to the formula $Duration = Work / Units$. For any task, you can choose which piece of the equation Project calculates by setting the task type.

(This goes along with calendar choices. The calendar that a resource is on and the project’s calendar affect the duration, work or units depending on the task type and the resources hours and resource availability. This can cause dramatic movement in the overall schedule. Calendars really affect the “working time” available and can push durations around. Calendars are out of the scope of this document but it is important to realize that they affect the schedules as well.)

Project dates sometimes move as we load resources and the system automatically re-calculates for us based on the calendars and on the grid below. This sometimes causes a “one day” task to go across multiple days. This is a great example of how calendars, task types and resource availability/hours all work together.

Basically:

In a...	If you revise units...	If you revise duration...	If you revise work...
Fixed-units task	Duration is recalculated.	Work is recalculated.	Duration is recalculated.
Fixed-work task	Duration is recalculated.	Units are recalculated.	Duration is recalculated.
Fixed-duration task	Work is recalculated.	Work is recalculated.	Units are recalculated

With all that as the overview, let’s take a look at how Microsoft explains it:



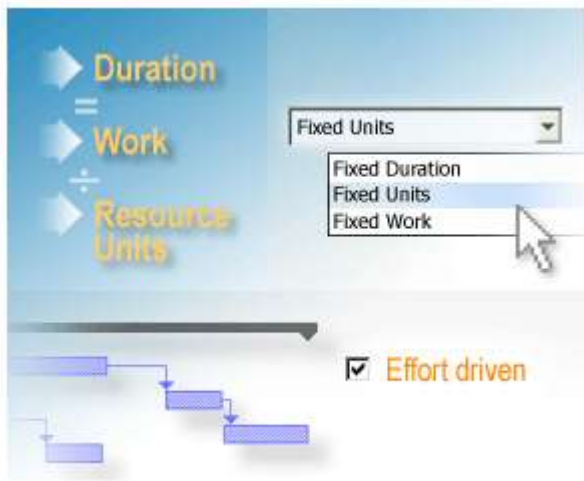
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Microsoft Online Project Training

Following course information taken from:

<http://office.microsoft.com/training/Training.aspx?AssetID=RP010783891033&CTT=6&Origin=RC010779041033>

Project scheduling basics



Depending on how deeply you've delved into scheduling in Project in the past, you may not be familiar with all of these scheduling options.

Basic formulas and features work behind the scenes in Project whenever you create a project plan. This lesson shows how you can tailor these scheduling aids to get the exact results your project requires.

We'll discuss:

The scheduling formula

Project uses a scheduling formula to calculate the different elements of a project schedule, **Duration = Work ÷ Resource Units**.

Task types

Task types are settings that you can apply to tasks, which affect the way that those tasks are calculated by the formula. For example, if you "fix" a task's duration, the value that you set for the task's duration will remain unchanged as the formula calculates the work and resource units.

Effort-driven scheduling

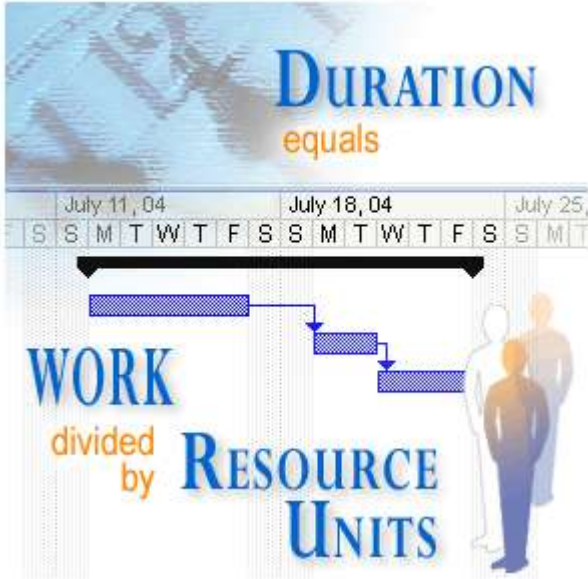
Effort-driven scheduling takes effect when you add resources to or remove resources from tasks. This scheduling setting keeps the amount of work constant when you change assigned resource units, helping you estimate task duration.

While these are all independent scheduling techniques, they also work together. This lesson will help you to understand how they work, both individually and in concert, so you can better adjust and control your project schedule.



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Introducing the scheduling formula



Project dates and deadlines are a top concern when you are planning a project. As you develop your project plan, you'll want to get some idea of when things will start and finish, and you may have a concrete date when the whole project needs to be completed.

Task duration is a critical factor. Your project's finish date is determined by the latest finish dates of its tasks, and *those* finish dates depend on how long it takes to complete their tasks.

The duration of each task is determined by the assigned resource units and estimated work (resource effort) and is calculated by this scheduling formula: **Duration = Work ÷ Resource Units.**

You can control which of the scheduling formula values has the most influence over a task's scheduling. As you progress through this lesson, you'll see how setting task types and applying effort-driven scheduling affect the scheduling formula.

The scheduling formula is always calculating quietly in the background, adjusting your project schedule based on the values you assign its three elements: **Duration = Work ÷ Resource Units.**



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The 3 pieces of the scheduling formula



Duration is the length of working time between the start and finish of a task. Project bases the calculation of a task's duration on the amount of work and the amount of resource units assigned to it. The *working time* for a task is defined by the project calendar, resource calendar, task calendar, or any custom calendars you set for a project.

Before you assign a resource to a project task, the task has duration but has no *work* associated with it. Why not? Because work represents the amount of effort a resource or resources will spend to complete the task.

To get the most out of scheduling in Project, you need to understand and effectively use all three parts of the scheduling formula: **Duration = Work ÷ Resource Units**.

When you assign resources to a task, based upon the scheduling formula, Project calculates the task's effect on the schedule by using the values assigned to the Work, Duration, and Resource Units associated with the task.

Note For this lesson, we only refer to "people" resources, also called *work resources*, not *material resources* such as lumber, paint, concrete, or video tape.

These three elements of the scheduling formula also correspond to task types, a setting which you can apply to individual tasks, allowing you to adjust that task type's influence on the schedule.



Work is the amount of effort, measured in time units (like hours or days), that a resource needs to complete the task. The total work for a task is the sum of all those time units, no matter how many resources are assigned to the task.



Resource Units indicate how much of a resource's available time, according to the resource calendar, is being used to work on a particular task. Resources are the people, equipment, or other materials that are applied to completing a task. In a project schedule, resource effort is expressed as assignment units or sometimes just as units.



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Using task types



Use this table to see how each task type setting affects the other two variables in the scheduling formula.

Project uses task type settings to calculate the work, duration, and resource units for a task. By applying a task type setting to tasks, you can control how Project calculates the other two formula values as you modify your schedule.

There are three task types:

- Fixed Duration
- Fixed Work
- Fixed Units (resource assignment units)


The default task type setting when Project calculates duration is Fixed Units.

"Fixed" doesn't mean that *you* can't change those values; you can. It means that the scheduling formula will calculate the other two elements according to which element is set as "fixed." Later in this lesson, you'll create a tool that will enable you to experiment with these settings.

As you begin planning a project, consider the scheduling formula and task types and determine the best setting for the majority of your project tasks. If you mix too many task types throughout the project, you may forget which settings you have applied to individual tasks.

Tip To always keep task types in view in your project plan, add the **Type** field to your project view.

Once you set the most effective task type for the project, you can then use the Smart Tag feature to make changes to tasks on an individual basis as needed. When you change a scheduling value for a task, a

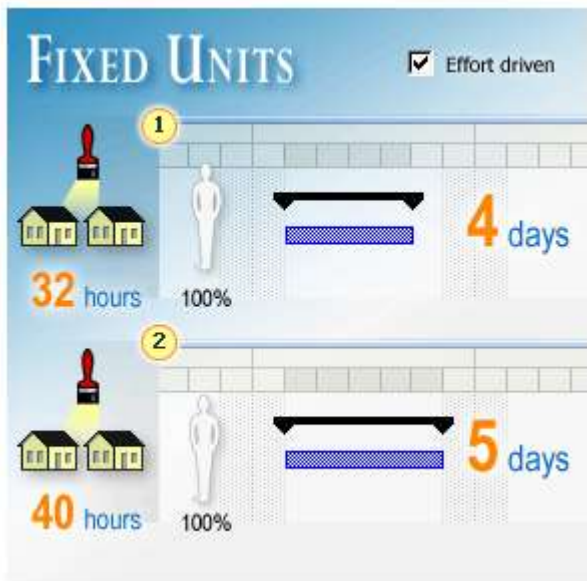
Smart Tag indicator  appears, offering you options based upon how your change affects the other two scheduling formula elements and how this may modify your project schedule.

Let's examine the three task types and how you can use them to adjust and exert control over your schedule.



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Fixed-units task type



$$\text{Duration} = \text{Work} \div \text{Resource Units}$$

Project gauges work in terms of resource assignment units—the percentage of available working time, based on the resource calendar, that a resource spends on an assigned task.

Resource assignment units in Project are expressed either in percentages or decimals. At 100% units, a resource is working full-time; at 50% units, the resource is working half-time, and so on.

The default setting in Project scheduling is **Fixed Units**, meaning that whatever resource units you allocate, that value will remain fixed and the other two elements of the scheduling formula will be affected by changes.

An example of the basic scheduling behavior that you'll see when you change the **Work** on a **Fixed-units** task:

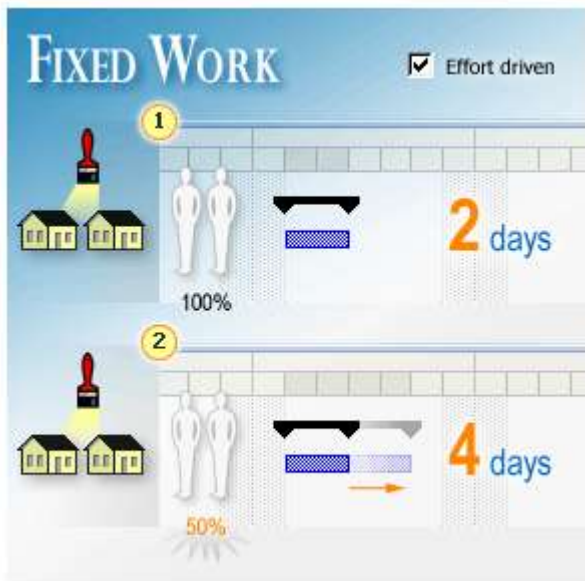
- 1 You assign 1 painter full-time (100%) to paint walls in 4 days (the duration). The work (the time it will take the painter to complete the task at 100% effort) is 32 hours, or 4 days.
- 2 If you increase the amount of work to 40 hours, Project recalculates the duration as 5 days. Now the painter has an extra day of work on the task.

If you assign another painter full-time, both painters, applying 100% of their time to the task, will get the job done in only 2 days.



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Fixed-work task type



$$\text{Duration} = \text{Work} \div \text{Resource Units}$$

Set the task to Fixed Work when you want the amount of work to remain constant, regardless of any change in duration or resource units.

Remember, in Project, work is measured in time units, such as hours, and it is the amount of effort that a resource needs to complete a task. The total work for a task is the sum of all those time units, no matter how many resources are assigned to the task.

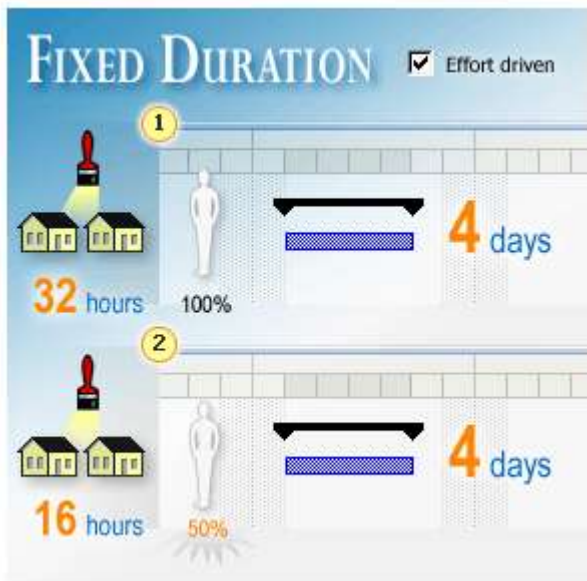
An example of the basic scheduling behavior that you'll see when you change the **Duration** on a **Fixed-work** task:

- 1 Two painters are assigned full-time (100%) to paint the walls in 2 days (work equals 32 hours—16 hours per painter).
- 2 If you increase the duration of the task from 2 days to 4 days, Project sets each painter's assignment units to 50% so that each painter works only half-time and work remains constant at 32 hours.



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Fixed-duration task type



An example of the basic scheduling behavior that you'll see when you change the **Resource Units** on a **Fixed-duration** task:

- 1 Your painter is assigned full-time (100%) to paint a room in 4 days. The work is 32 hours.

Then you assign the same painter another room to paint. Unfortunately the painter is committed elsewhere in 4 days and cannot work on the task beyond that. The painter can only work part-time (50%) painting the additional room.

- 2 When you enter 50%, Project keeps the duration fixed at 4 days, and recalculates work to be 16 hours.

$$\text{Duration} = \text{Work} \div \text{Resource Units}$$

Duration is the length of working time between the start and finish of a task. When you choose to make a task Fixed Duration, the task's duration remains at whatever value you enter and Project recalculates the resource units as you change assignments.

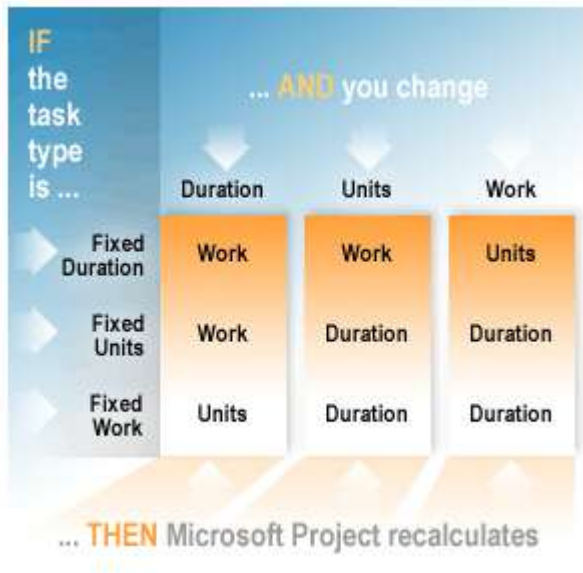
Note A *summary* task always has a Fixed-duration task type. A summary task is based on the earliest start date and the latest finish date of its subtasks, and the calculation for a summary task's duration is based on its subtasks. So, you cannot directly change duration for a summary task.



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Quick Reference Card - Dig deeper into scheduling

Build the framework for your project schedule



This table shows how each task type setting affects the other two variables in the scheduling formula.

Project uses a scheduling formula to calculate the different elements of a project schedule: **Duration = Work ÷ Resource Units.**

Each piece of the formula corresponds to a task type:

- Fixed Duration
- Fixed Work
- Fixed Units (resource assignment units)

By applying task type settings to tasks, you can control how Project calculates the other two formula values when you change them as you modify your schedule. The task type you apply will keep that value constant during calculations, unless you change the value.

You can also use the **effort-driven setting** to keep the work value on a task constant.

Tip Adjust any of these settings on the **Advanced** tab of the **Task Information** dialog box.



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Effort Driven Scheduling:

Effort driven scheduling is also a possibility. When this is turned on it affects the above task types in certain ways at certain times.

The Project Bible has one of the easiest definitions to understand:

“For fixed-duration and fixed-unit tasks, you can tell Project to modify the percentage of total work that is allocated to each resource, based on the number of assigned resources, if the number of resource changes. In effect, you create an *effort-driven task*. The work that’s required to complete the task remains the same, but Project redistributes the work equally among all assigned resources. Note: fixed-work tasks are always effort-driven.”

Microsoft’s definition: “When you assign or remove people from a task, Microsoft Office Project 2003 lengthens or shortens the duration of the task based on the number of resources assigned to it, but it does not change the total work for the task.”

The catch is that the effort-driven calculations apply only after the first resources are initially assigned to the task. After the first resources are assigned, the work value doesn't change as new resources are assigned to or removed from the same task.

Basically:

In a...	If you assign more resources...	Effect on Assigned Work Hours...	Decrease resources...
Fixed-units task	Duration is shortened	Work hours remains constant	Duration is lengthened
Fixed-work task	Duration is shortened	Work hours remains constant	Duration is lengthened
Fixed-duration task	Individual Units decrease	Work hours remains constant	Individual units increase

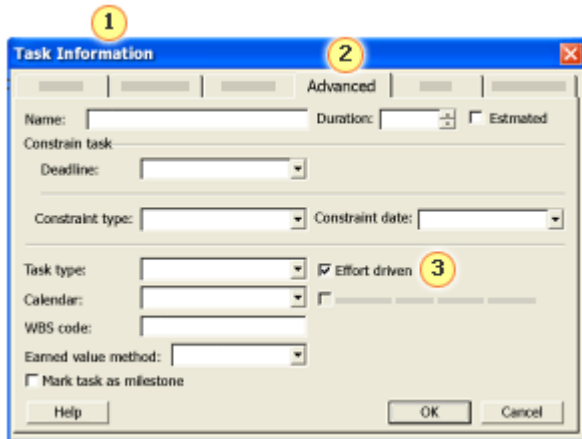


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The following course from Microsoft learning is from this link:

(<http://office.microsoft.com/training/training.aspx?AssetID=RP010783961033&CTT=6&Origin=RP010784031033>)

What does effort-driven scheduling do?



- 1 To view the effort-driven setting for a task, click the **Task Information** button on the toolbar.
- 2 The **Advanced** tab contains most of the information you need to know about how a task is being scheduled, including the effort-driven setting.
- 3 To turn effort-driven scheduling off, clear the **Effort driven** box.

Effort-driven means that when you assign or remove people from a task, Project lengthens or shortens the duration of the task based on the amount of resource units assigned to it, but it doesn't change the total amount of work for the task.

In many cases when you begin planning a project, you know "what" needs to be done when adding a task to your project. For example, you know (or have solid estimates of) the square footage of the walls to be painted or how much software code needs to be written for a particular set of features.

So when planning a project, you often have a pretty good idea of the "work" that needs to be done. To complete your project schedule, you then adjust the anticipated times to complete this work (duration) and the number of resources (resource units) you can assign to it to complete the work.

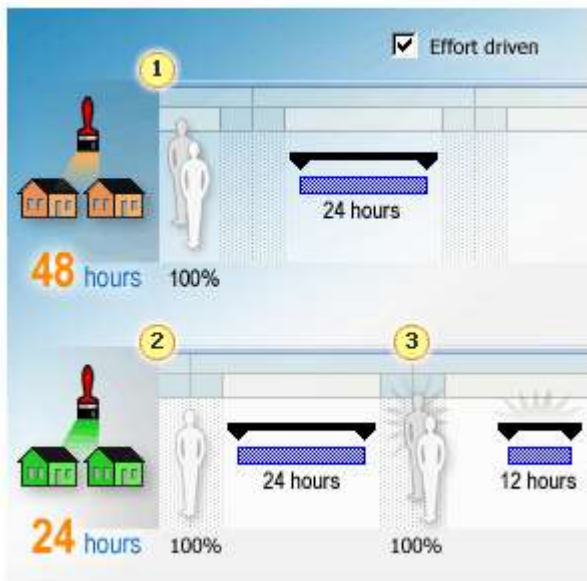
With this idea in mind, the effort-driven scheduling feature is turned on by default in Project. You can turn the effort driven setting off, however, if your project tasks have different requirements.

So, how do you decide if it should be on or off?



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When is effort-driven scheduling applied?



Even though the effort-driven setting is turned on by default, it doesn't make a difference in your scheduling until you add resources to or remove resources from a task.

Effort-driven scheduling behaves differently depending on when you assign resources:

Effort-driven calculations are applied only *after* the first time one or more resources is assigned to the task. After a resource is assigned, the Work value doesn't change as new resources are added to or removed from the same task.

Effort-driven calculations are not applied to multiple resources that are assigned at the same time *and* that are the first assignments on a task. After this initial assignment of multiple resources, however, the Work value does not change as new resources are assigned to or removed from the same task.

- 1 If you initially assign 2 resources to a task with a duration of 24 hours, Project schedules each resource to work 24 hours, for a total of 48 hours of work (Work, not Duration!).

The resources each work 24 hours, on a task with a duration of 24 hours.

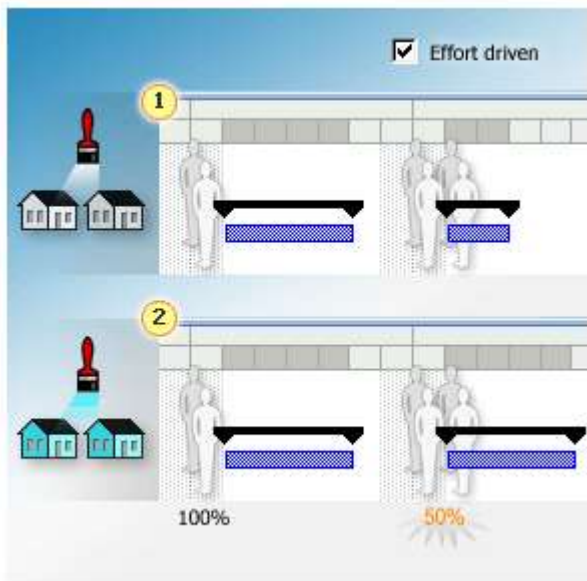
- 2 Start over and create the same task, with a duration of 24 hours, and assign only one resource at 100%. Work for the task is 24 hours.
- 3 Then later, add a second resource at 100%. Effort-driven scheduling will cause Project to schedule each resource to work 12 hours on the task.

Total work for the task remains 24 hours and the task's duration is reduced to 12 hours.



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How does effort-driven scheduling work with task types?



- 1 Fixed Units** With effort-driven scheduling turned on, the more resources you add to a task, the shorter the duration becomes.
- 2 Fixed Duration** With effort-driven scheduling turned on, adding more resources decreases the time units each resource will have to work on the task.

Now that you know more about how effort-driven scheduling works, it helps to understand how to apply it to tasks and how it affects the calculations the scheduling formula makes.

While effort-driven scheduling may sound like it affects task scheduling in a manner similar to the way the Fixed-work task type does, it operates independently from the task types. It does, however, affect how the scheduling formula calculates (or doesn't calculate) the Work value.

What's the difference?

Task types determine what happens to the other two variables in the scheduling formula.

Effort-driven scheduling determines what happens to the duration or resource units for a task when you add or remove resources.

Let's look at how effort-driven scheduling affects the scheduling formula when you apply task types:

Fixed Units If effort-driven scheduling is turned on for the task, Project adjusts the task's duration when you add or remove resources. If you have the means, adding more people is one option for shortening your schedule.

Fixed Duration If effort-driven scheduling is turned on for the task, changing resource assignments changes the amount of effort the resources will put in on the task. You may want to consider this option when scheduling a project if you feel the need to lighten the load on some of your people, or if you need to assign some of them part-time to other tasks.

Fixed Work The Fixed-work task type and effort-driven scheduling both keep the Work value constant and you cannot turn off the effort-driven setting for a task set as Fixed Work.



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Why would you turn off effort-driven scheduling?



An example of the basic scheduling behavior that you'll see when you turn off effort-driven scheduling:

- 1 You have 4 weeks to test your software. By the original work estimate, the project manager assigned 1 tester.

But after the Test Manager sees the test plan, he decides it will take 2 testers to complete the task on time.

- 2 By assigning an additional resource to the testing task with a set duration of 4 weeks, Project recalculates the work needed to complete the task.

Effort-driven scheduling might not apply to all tasks in a project and you can turn it off on a task-by-task basis. When would it not be helpful to keep effort-driven scheduling turned on? Here are a couple of examples:

Complex tasks You may have a task that is very complex or requires highly-skilled resources. Adding more resources may slow the team down if task activities need additional coordinating or if people need instruction before they can perform.

Uncertain/undetermined amount of work If you're not sure how much work there will be for a task, turning off effort-driven scheduling can let the assignment of resources and duration determine work accordingly.

With effort-driven scheduling turned off, the amount of work *can* change.

Next, you'll practice using the scheduling tool (the one you created in the last practice) to apply the effort-driven setting to the different task types to see how it affects task scheduling.