Project Scheduling Rules

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About the Author

Nader Khorrami Rad is a consultant, author, and trainer in the project management fields. His career started in 1997 and has been involved in many projects in different industries. He has designed a number of project management courses, prepared a number of e-learning materials, and written more than 40 books and plenty of practical articles on project management concepts and standards, planning software, scheduling, etc.

He got his Civil Engineering BSc in 2002 and Philosophy of Science MSc in 2004. He is also certified as PMP® (Project Management Professional), CSM® (Certified ScrumMaster) and PSM I (Professional Scrum Master I).

Preface

Managing a project is like conducting an orchestra, and the project plan is its symphony.

Yes, the project plan is the symphony for the project orchestra; and time schedules are the heart of project plans, making the pleasant sound of success possible.

This heart needs enough attention and care, which is not possible without having enough knowledge and experience on one hand and putting sufficient effort on the other hand. This book tries to cover the most important aspects of the needed knowledge; the aspects that will strongly help you avoid many of the problems usually faced in project time management.

I hope you will find this book helpful, and I would be happy to have your feedback.

You can contact me through my website (www.pmarchy.com), or email me at info@pmarchy.com. I would be happy to be in touch with you at Twitter (@khorramirad) and LinkedIn.

Nader Khorrami Rad, PMP
Jan 2013

Introduction

The audience I had in mind as I was writing this book was mainly the project planning and control engineers, leaders, and managers. This information is helpful to other project management team members as well.

Applying the rules might increase the length and effort of your initial planning, but certainly it will buy you back a lot of time in schedule maintenance and control.

Scope of this eBook

These rules are derived from recommendations, which had been designed to be applied to detailed plans. If you are using rolling-wave planning or planning by stages, you must interpret them before applying.

These are all *abstract rules* which are helpful to planning staff. There are some other rules and recommendations which you should also apply to your work, but are not covered here. For example, the maximum duration of normal activities is discussed here, but other things such as duration padding and best practices in duration estimating are not covered.

Finally, this book is all about planning and does not cover anything about control.

References

The references mainly used in this book are:

- A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th edition, PMI
- Practice Standard for Scheduling, 2nd edition, PMI
- Practice Standard for Work Breakdown Structures, 2nd edition, PMI
- Planning and Scheduling Excellence Guide (PASEG), Draft 1.1b, National Defense Industrial Association
- 14-Point Schedule Assessment, USA Defense Contract Management Agency (DCMA)

The last two resources are referenced here as DoD documents (with some degree of tolerance).

Some other resources also had minor effects on this eBook.

1   Scheduling Methodology Should Be Documented and Approved

When you are preparing to start scheduling, you probably have a vision of the whole process. Your organization might make you document them or not, but almost all standards and codes tell you that you should do so. This document might be named the Time Management Plan, Time Management Strategy, Time Planning Methodology, Scheduling Methodology, Time Planning and Control Methodology, etc.

This document answers questions like: what software will we use? How detailed will our plan be? What control periods will we have? What parameters should we use to monitor performance?

Preparing a time management plan is like planning the time planning period; whenever you want to take control you have to have some kind of plan; if you want to take control over the planning period, plan the period!

You had better hand this document in to the key stakeholders and get their approval. This decreases the chance of misunderstandings and reworks in the future.

The next diagram shows a little part of the project management system which is involved in scheduling.
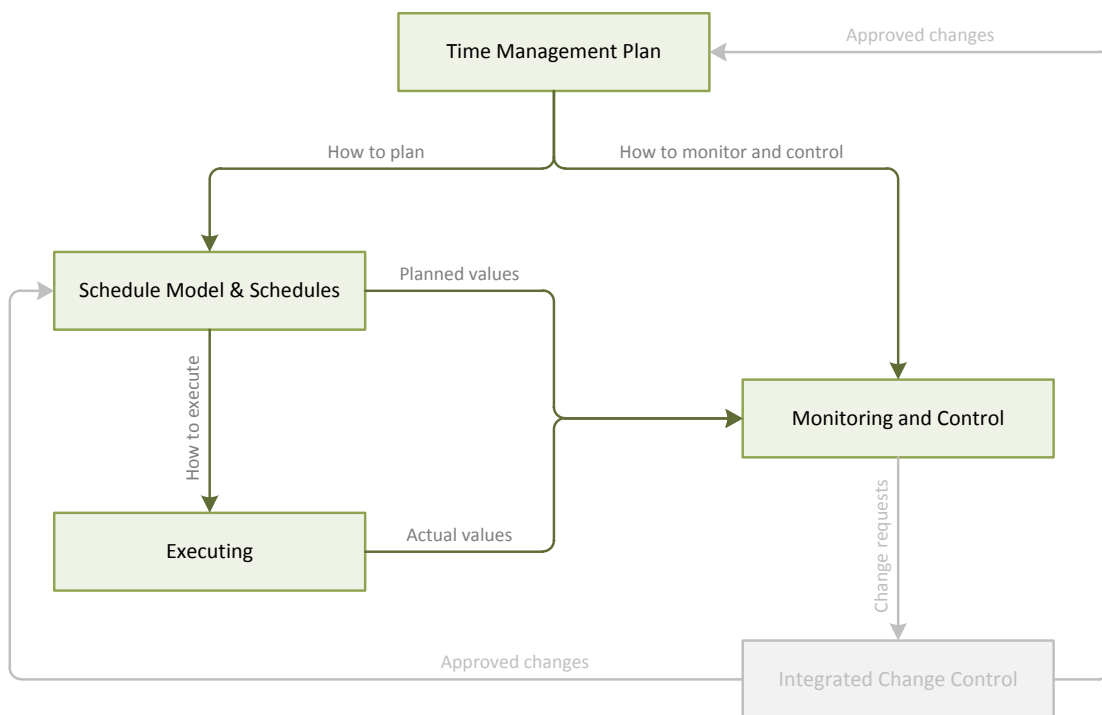
2 The Schedule Should Have a Complete Scope

Your schedule should reflect the whole scope of the work of the project, nothing less and nothing more. When we are talking about project scope, this is not limited to work needed to produce deliverables of the final product; we also need to do some extra work to ensure that we will have what we are expecting (quality activities), we will not miss opportunities and we can face threats (risk response activities), and so on.

Let us review the whole scope planning process: We start by identifying goals. We then go for the requirements; requirements tell us how we expect to reach the goals. The next step is to define the product scope and product breakdown structure; this will give us a complete view of the final product and all its elements. The last step is to convert product elements into work needed to create them, and add the extra work (e.g. quality and risk response work) which produce our project scope and work breakdown structure (WBS for short). The work breakdown structure is a hierarchical structure of project deliverables.

At the end, we should ask ourselves what kinds of work we should do to produce each deliverable and the answer is our activity list.

There are two rules for creating WBS:

- it should be based on deliverables (and not the work)
- it should cover 100% of the scope, nothing less and nothing more

Refer to appendix 1 for more information on WBS rules.

The items in the lowest level of WBS – which host the activities – are usually called work packages. When you are about to break down a work package to activities you should be careful to add every work needed to produce that very deliverable.

This rule applies to all situations. For example, if stakeholders agree on some strategic changes and ask you to prepare a new plan for the remaining of the work, what should you do?

Some planners prepare a new plan which covers only the remaining parts. This is not a good choice. As long as you are working under the same old contract, your schedule should cover all of its scope. You should reschedule the remaining parts based on the new strategy instead of creating a new incomplete plan. If you need to report the performance of the remaining parts, you can easily calculate them within that complete plan.

3 Level-of-Efforts Should not Be Critical and Should not Have Variance

There are some special activities in every project that do not produce any product by themselves and just support other activities to fulfill their job; project management, supervision, and accounting are examples of this kind of activity. These activities are called Level-of-Effort or LOE for short.

Hosting LOEs in schedules is not as easy as normal activities and they barely make any difference in the monitoring and controlling processes. That is why some planners prefer not to include them in their schedules. DoD forbids the use of LOEs in some cases.

If you insist on having a complete scope in your schedule, you have to enter LOEs; that is why PMI does not forbid them, but states that you should be careful with LOEs because they should never be critical and should not report any variances.

LOEs do not have any specific and independent duration; their start and finish are based on other activities. You will never be behind schedule in LOEs as they are ongoing everyday work. That is why it is not acceptable for them to be critical or have variance. In addition, if your LOEs become critical, some other really critical activities will become non-critical, and that is the main problem. It is also better for LOEs not to have predecessors or successors (if the planning software allows).

Primavera P6 uses predecessors and successors for scheduling LOEs, but you do not need to worry about it, because they are not real relationships that PMI recommends you to avoid using for LOEs. You actually do not need to worry about LOEs in P6 at all; you just define them as LOEs and the software handles them as they should be (e.g. they will never become critical). Unfortunately, Microsoft Office Project users should use some tricks to create well-formed LOEs.

4   Activities Should Have Unique Names

When you are naming activities, you should do it in a way that anyone in any situation can understand it. Select an activity, take it out of the WBS and see if you can understand it.

The most important rule in this area is to have unique names. Take a look at this table:

✖ **Names are not unique**	✔ **Names are unique**
Fifth floor	Structure of the fifth floor
Build columns	Build the columns of the fifth floor
Build sheer-walls	Build the sheer-walls of the fifth floor
Build slab	Build the slab of the fifth floor
Sixth floor	Structure of the sixth floor
Build columns	Build the columns of the sixth floor
Build sheer-walls	Build the sheer-walls of the sixth floor
Build slab	Build the slab of the sixth floor

It takes more time to enter the complete and unique names, but believe or not, it is worth the effort. You can easily make a mistake and link the sixth floor slab to another activity instead of the fifth floor slab. But if you use unique names, you will easily find these kinds of mistakes.

There are always many different ways of showing the activities. You can make alternative breakdown structures for your different needs, and in their corresponding views you do not have WBS elements anymore. If activity names are unique, you can understand them outside the WBS, but otherwise, you will not be able to use any alternative breakdown structures in an efficient way.

5   Activity Names Should Have a Verb

Work Breakdown Structure represents the scope of the project. WBS elements are deliverables and you decompose them into different kinds of work (activities) needed to produce those deliverables.

As you can see, WBS elements and activities are two completely different entities. This difference should be also reflected in their names.

Check these two names:

1. prepare shop-drawing for the structure of the second floor
2. shop-drawing of the structure of the second floor

Which one is suitable for WBS elements and which one is suitable for activities?

The first one is an action and shows a work; therefore, it can be used for activities. The second one points to a thing (the drawing), to a deliverable; therefore, it can be used for WBS elements.

In order to show a work, you usually have to use a verb or something equivalent. This rule is not just a formality, but helps you and your audience better understand the activity. If we only say "shop drawing", it does not show the act; is it supposed to prepare it? To check it? To approve it? Or even to execute it? This name just does not answer any of these questions.

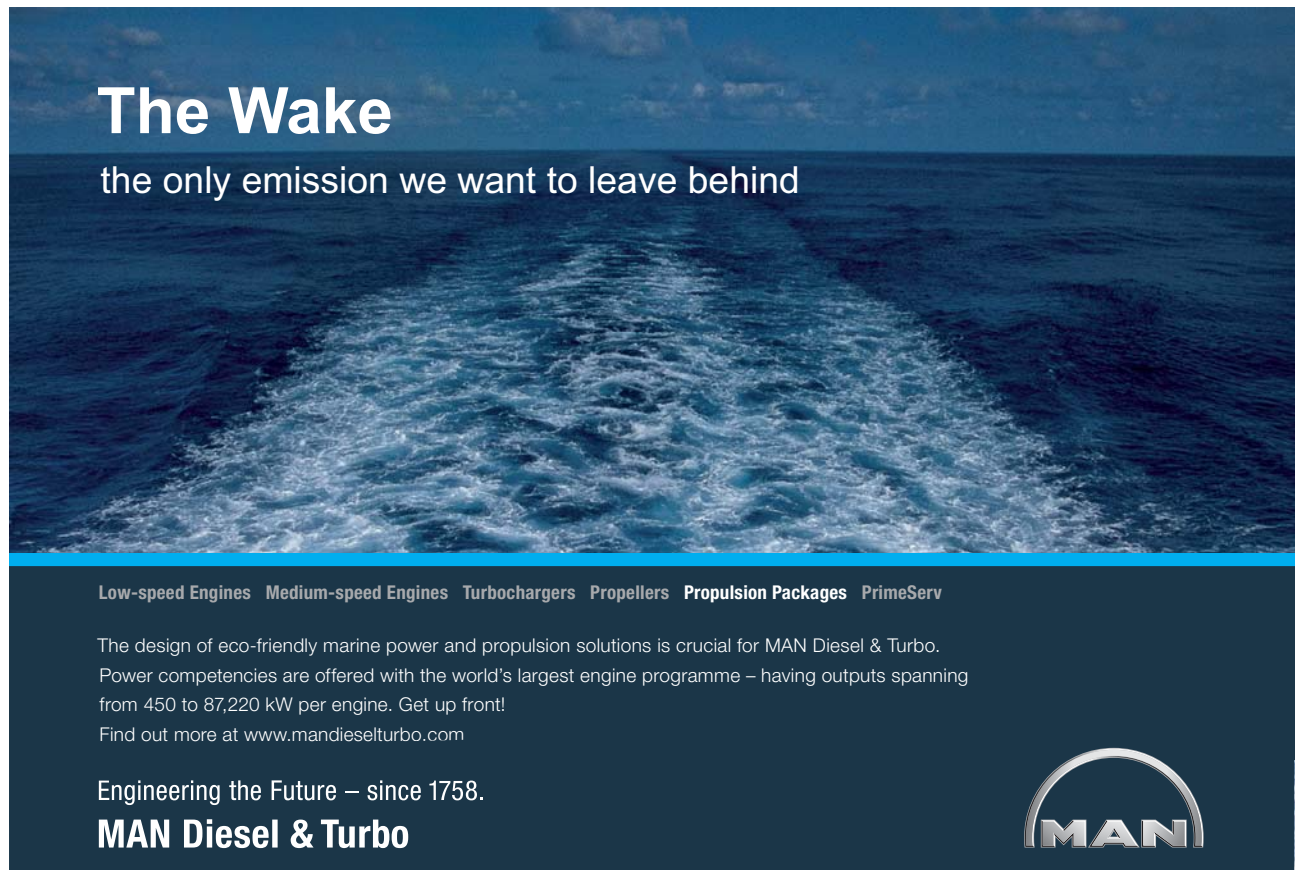# 6 Each Activity Should Have at Least One Predecessor and One Successor

Most planners know this rule:

Each activity or milestone should have at least one predecessor, except for the first one

And

Each activity or milestone should have at least one successor, except for the last one

If you do not imply this rule, some of the activities or milestones will be out of the network and will not have an effective role in the total schedule; this is against the reality of the project work.

If you do not follow this rule, these will be the least problems you will encounter:

- your future schedules will not be realistic
- your performance information and delays analysis will not be realistic

It is recommended to have at least two contractual milestones in every schedule: the start milestone and the finish milestone. In most cases "The effective date of the contract" is the start milestone and "The provisional acceptance" or "The final acceptance" is the finish milestone. The start milestone does not have a predecessor, and the finish milestone does not have a successor; all other activities and milestones need at least one predecessor and one successor.

Always check the integrity of your network logic by this rule. If it fails, you will realize that you have missed some of the relationships. It is common for planners to miss non-driving relationships and you should be careful with them. When you have more than one predecessor, one of them influences the successor the most, in a given time, and it is called the driving predecessor. If you remove all the other predecessors, the schedule remains the same. The point is that each non-driving predecessor has the capacity of becoming driving one day, so you should keep them all. Most of the activities which do not have a successor are actually non-driving predecessors and you should fix them.

In the end:

- If you believe that a specific activity or milestone does not have any predecessor at all (it can start on the first day of the project), make the start milestone its predecessor.
- If you believe that it has no successor at all (it can potentially finish on the last day of the project, and no other work will get into problem), make the finish milestone its successor.

Unfortunately, although some planners know this rule, the only thing they do is making the start milestone (or another early activity/milestone) the predecessor of all activities that do not have other predecessors and make the finish milestone (or another late activity/milestone) the successor of all the activities that do not have other successors. This is cheating! You should always **analyze** and **find** the missing relationships. If you are about to review a plan you can easily check to see if some items have too many predecessors or successors; they usually show this kind of cheat.
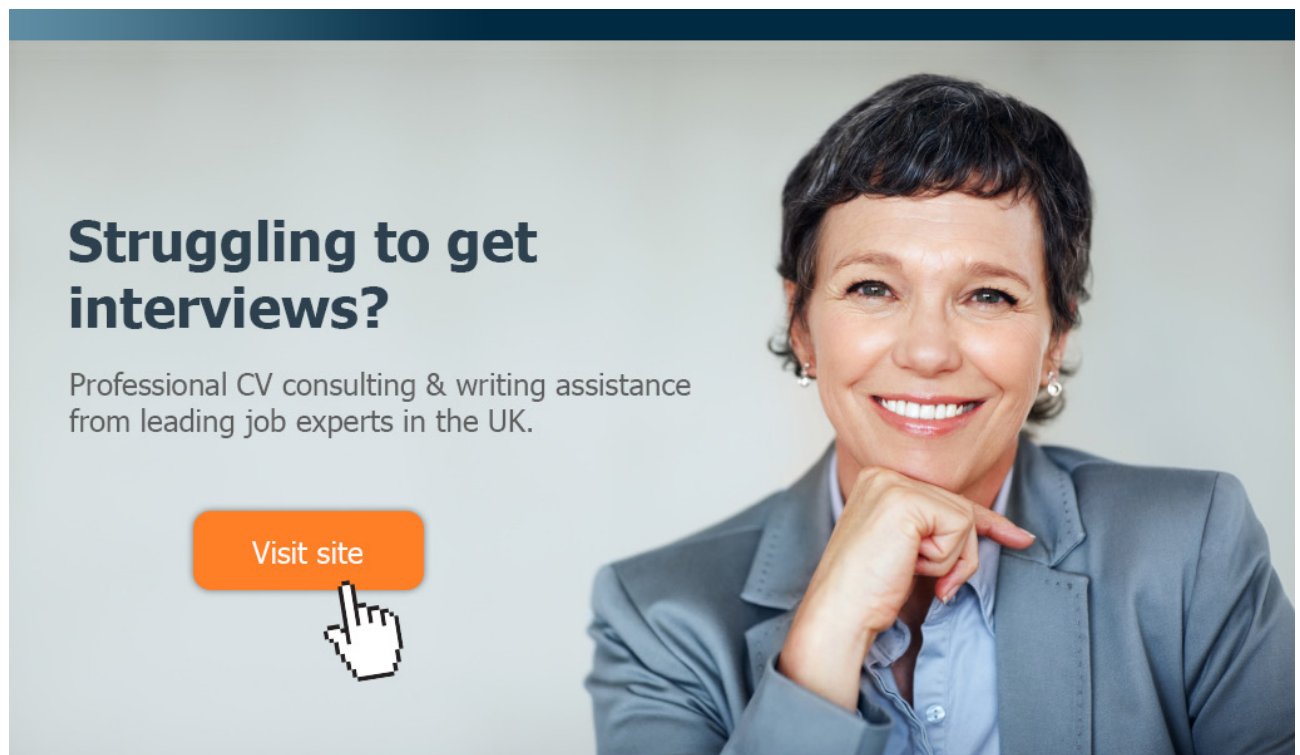
Level-of-Effort activities are exceptions; you do not have to have predecessors and successors for them. Some planning software, like Primavera P6, implements them with relationships and you have no control over it, which is fine, because those relationships are treated in a special and different way by the software. If you are using other software and you can avoid relationships for LOEs you should do so.

All that mentioned before in this rule is the PMI way. In DoD standards, you are able to have at the most 5% of activities without predecessors or successors. This tolerance is built in to cover your need for the activities which have no predecessor or successor at all and you may link them to start or finish milestones otherwise, and also to support LOEs.

Before ending this rule, we should discuss the way Microsoft Office Project, and some other planning software behave relationships. In this kind of software you are allowed to have summary tasks (WBS elements) as predecessors and successors; in this case:

- All predecessors of a summary task act as predecessors for all its children.
- All successors of a summary task act like successors for all its children.

As a result, you might have some activities without direct relationships which inherit them from their upper-level summary tasks. These kinds of predecessors and successors are also enough for this rule, and you do not need to worry. However, have in mind that many resources recommend you to avoid using such relationships because they are harder to manage and you might be subject to lots of mistakes.

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7 Activities Should not Be Dangling

Implementing the previous rule is necessary, but it is not enough. In order to have a dynamic, live, and effective plan, the start of each activity should be also influenced by other activities and the finish of each activity should also influence other activities; of course except for the two starting and finishing activities or milestones of each project. Otherwise, the activity would be called "dangling".

Let us see an example:

Activity B has a predecessor of type FS and a successor of type SS, and it is acceptable regarding the previous rule (rule number 6). However, what happens if B ends up much longer? This would be the result:
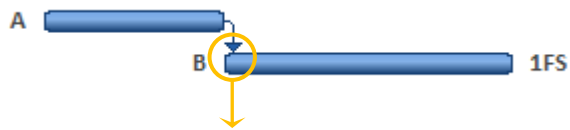

The finish of the Activity B does not influence anything in the schedule. Is it right? Almost all finish dates in a real project influence something else. It just does not seem natural to have dangling activities. If you have a lot of dangling activities, you may not have realistic forecasts and you will not be able to calculate a realistic time delay.

This is the rule for avoiding dangling activities, according to PMI and DoD:

Activity should have at least one FS or SS predecessor and at least one FS or FF successor.

You are not supposed to avoid dangling activities entirely, but you are strongly recommended to decrease their total number as many as you can, e.g. less than 1%.

Back to the rule: the FS and SS relationships influence the successors start date:
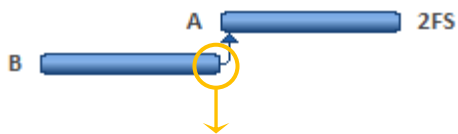

Start of B is influenced by the predecessor because of the FS relationship.

Start of B is influenced by the predecessor because of the SS relationship.

The FS and FF successors are influenced by the finish of the activity:

Finish of B influences the successor because of the FS relationship.

Finish of B influences the successor because of the FF relationship.

Besides avoiding dangling activities, there are two important consequences we can conclude from this rule:

- The only relationship that is always effective is FS. Later on, we will discuss that you should try to use FS relationships most of the time. If you do so, you will not need to be afraid of creating dangling activities.
- Did you realize that one of the four relationship types are missing in this rule? That is SF. We will discuss in another rule that it is better to avoid SF relationships. This relationship is not effective for influencing and being influenced.

8   Most Relationships Should Be FS

PMI insists that you should use FS relationship for most of your activities. DoD states that at least 90% of activities should have FS predecessors.

When scheduling was first modeled with the Arrow Diagramming Method, the only relationship was FS. Later on, the other three kinds of relationships found their way into scheduling. The fact is that most relationships in the real world are still best modeled by FS, regarding their true nature.

Some planners are accustomed to using all the relationships, especially SS. SS is usually applied when a planner comes across statements such as: *…and activity B starts at the same time as activity A…*

In this case, an SS relationship is likely to be chosen, even though it is not usually the right choice.

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When you choose SS for such a case, it means that B cannot start unless A has started. Is it the case? Usually not. When people say B starts at the same time as A, they usually mean that B has the same predecessors as A, and as a result the right choice would be this:
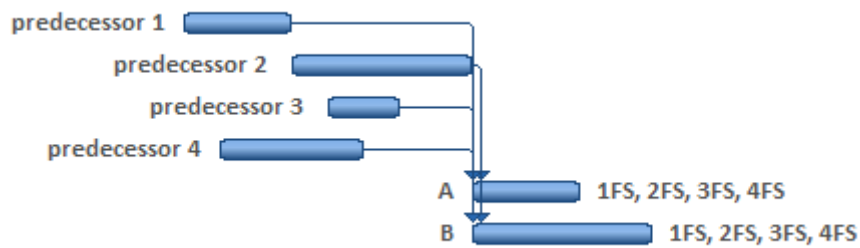
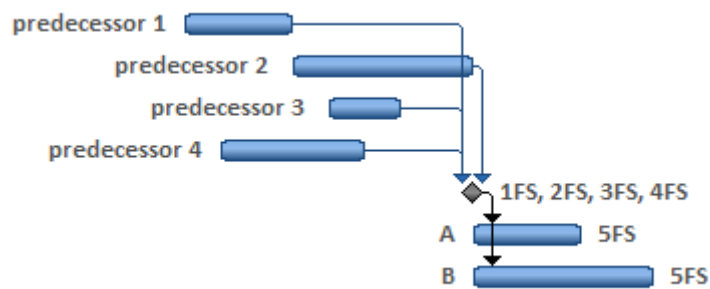You need to enter more relationships when you enter the same set of predecessors for the second activity instead of using a simple SS for it. For example, if you have 16 predecessors for A, you will have to enter all of them for B, too. You can also use a milestone instead. Give all the predecessors to the milestone and make A and B the successors of that very milestone.

When you have lots of successors based on lots of predecessors, you actually have an important event in between and you had better design a milestone for it. This kind of milestone is sometimes called a toll-gate milestone. If you have 10 successors with 10 similar predecessors, you will have to enter 20 relationships when you use toll-gate milestones and 100 relationships otherwise.

Let's take another example: activity A and activity B have 10 days of duration, and activity B has a 50% overlap with A. How do you prefer to model it?

You might use SS+5days for B; but an FS-5days is a better choice.

These were just a few examples of replacing some of the SS relationships with better choices of FS. You can find many other replacing examples yourself. Always count the number of activities with FS relationships; if they are less than 90% of all activities, your network logic is not good enough and needs revision.

9   SF Relationships Should Be Avoided as Much as Possible

PMI recommends you to use SF relationships as few as possible. DoD completely bans the SF relationships.

SF is a strange relationship. The first impression is that this relationship puts the activity before the predecessor. For example:

So, what happens if we have more than one predecessor?

What some people expect   What really happens
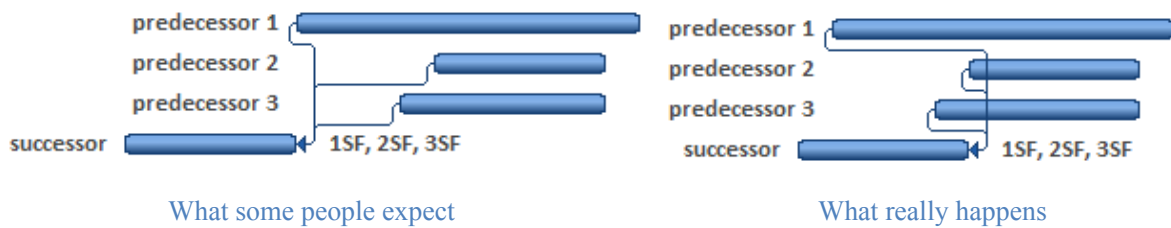
Some people expect the successor to finish before the earliest predecessor, but it finishes before the latest predecessor. An SF relationship states that the successor should not finish unless the predecessor has started; in other words, the successor should not be prior to a certain date. When you have three SFs, it means that your successors should finish when all three predecessors have started, meaning the latest start time for all the predecessors.

When people start learning planning, they are always trying to find good examples of this relationship. One example is procurement. Suppose that we have to build a wall and we have to buy the materials. When should we buy it? It is possible to buy it when the project starts, but we usually prefer to buy it later to avoid having to store that material for a long time. This example shows the activities based on an SF relationship:
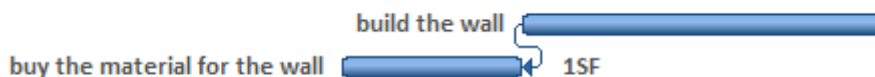
Now the procurement activity is scheduled in a way that finishes right before the start of the construction activity. It is a good schedule, but what happens if we cannot buy the materials in time? This schedule shows the result:

We have started the procurement activity on time but have realized that it will take much longer than expected. The construction schedule in this case will not change, but is it right? Of course it is not; we cannot start construction unless the procurement activity is finished.

An SF relationship is not an appropriate choice in this case. What is a good case for SF? Well, nothing! You had better not use it at all.

10 Long Lags Should not Be Used

Consider a two year long project with a relationship like FS+180days; what does it mean? What is the meaning of an FS relationship which has to wait for 180 days until the start of the successor?

For sure you will not be able to give a suitable interpretation for that. There is no interpretation for even a single long lag; there is nothing in reality which you can model with these kinds of relationships. So why do people use them? The answer is simple: they do not design relationships well enough. It is better to keep in mind that our responsibility is not preparing a static schedule for a specific time. Our goal is to design and develop a living, dynamic schedule model capable of producing meaningful schedules constantly.

PMI emphasizes that you should be careful with lags and do not use them instead of activities or complicated relationships. DoD forbids you from using lags longer than 5 working days.

Let us have an example: we have an activity such as "design xyz" and another activity like "build xyz" and a relationship of FS+20days. The 20 days is the time needed for design approval.

The above case can be modeled without lags, as follows:
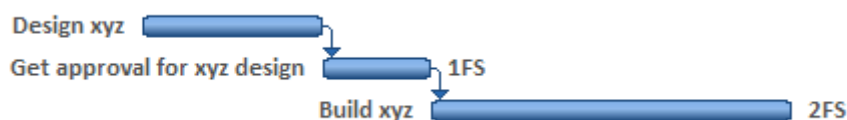
This schedule is easier to understand and manage and does not use any lags at all.

Here is another example: we have an activity such as "build slab, part 1" and another one such as "build slab, part 2". They are built one after another, using the same set of formwork. Therefore, we will need some delay for the concrete to cure before starting the second part. This can be some planners' choice:
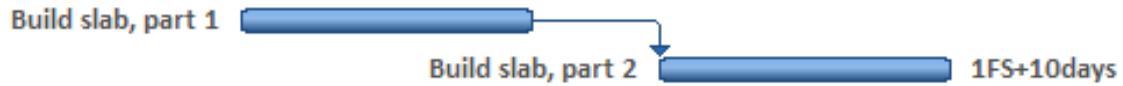
We can use the alternative bellow to avoid lags:
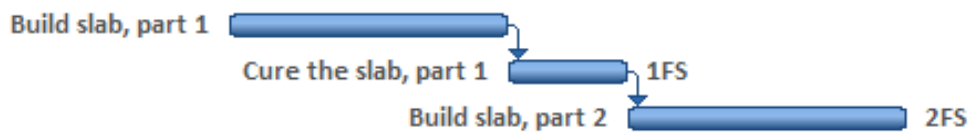
We will have a great opportunity in this case: how long does it take for the slab concrete to cure? It actually depends on temperature, and temperature itself is depended on the time of year, ranging from say 3 to 15 days. We can enter 3*24 hours for this task and design a special 24 hour per day calendar for it. This calendar has 24 hours per day in summer and decreases in other seasons until reaching 4.8 hours a day in winter. Using this calendar, the 3*24 hour activity will automatically be finished in 3 calendar days in summer and in 15 calendar days in winter. Isn't that great? This is the kind of schedule model we call living and dynamic.

What we implement by lags is usually a more complicated and dynamic entity which should be considered as an activity.

11 The Number of Lags Should Be the Fewest Possible

As we discussed before, lags are not strong scheduling elements and you should be careful with them. The subject of the previous rule was the length of the lags, and now, we are going to focus on the number of activities having a lag.

It is not enough to limit the length of lags if you are using them in most activities. Based on DoD's rule you should not use lags in more than 5% of activities.

Do you find this rule hard to implement? If so, you should consider some or all of the following:

- Finding missing relationships
- Using resource leveling as needed
- Breaking down your activities in order to have more flexibility in relationships where needed

12 The Number of Leads Should Be the Fewest Possible

PMI treats leads like lags; you should be careful not to use large leads, but use more detailed activities or better set of relationships instead. DoD is much tougher in this area and completely forbids the use of leads.

Why? And how?

Well, the reason is that leads are usually misused and hard to manage. In some situations, you start with an FS relationship. Later on, you get behind schedule and have to compress the schedule. You change that old FS relationship into an FS-5days. The same thing happens and FS-5days becomes FS-10days, FS-15days and so on. Do you really have a strategy to actualize those overlaps? Most people do not have it. That is the misuse mentioned before.

So, does it mean that we should not use any overlaps? Not necessarily. Let us check this sample plan:

It is a wall that we are going to build and paint. We are not going to wait for the whole wall to be completed before starting the paint job: we want to overlap those two activities. If you want to accept the DoD rule, you can replace that plan with the next one.
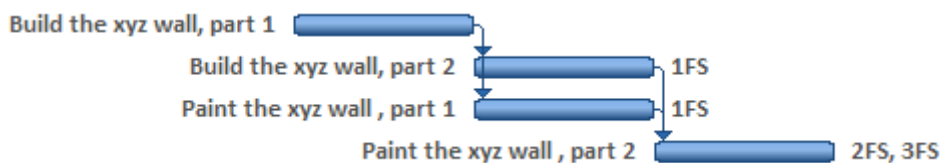
What we did here was breaking down each activity to two separate activities. When the building of the first part of the wall is finished, building the second part and the painting of the first part begins. When the building of the second part and painting of the first part is finished, painting of the second part starts.

Now, consider the painting of the first part. Our initial estimate was 5 days, and it happened to finish in 2 days. What happens? This is the result:
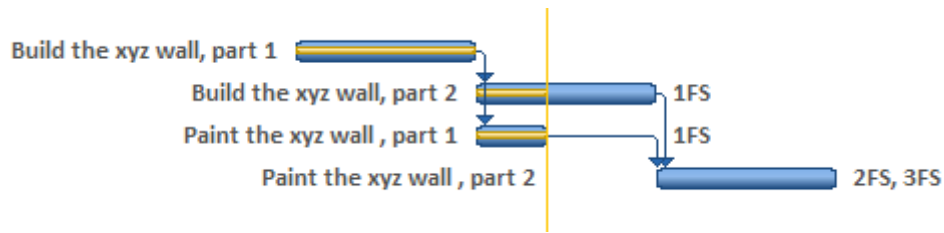
We have just entered the actual start and finish dates, plus duration % completed, and no other maintenance was involved. Now let us check what happens to the first alternative:
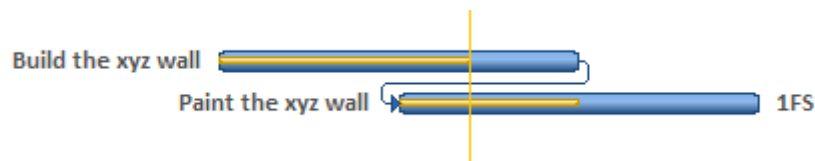
We know that our actual progress should be compatible with the data date. In this case, our progress bar has passed the data date and is not acceptable. What is to be done? Should we change the painting duration? This will be the result:
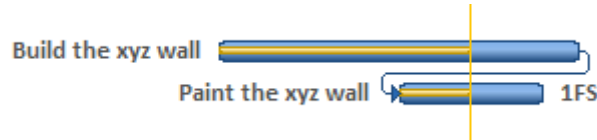
It is not acceptable; our painting has finished even before we finish building the wall. Here is another alternative:
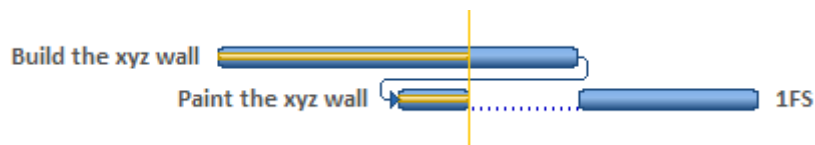
This one is not good either, because it uses split. Another alternative:
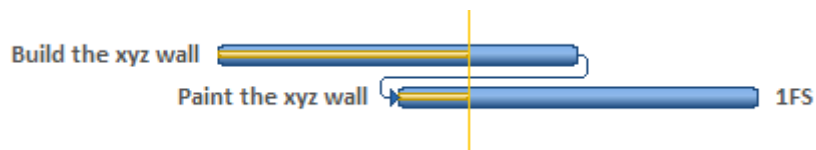
This is not acceptable either because it tells us that we should paint the walls in the next three days, but are we going to do so?

This example shows that schedules which use leads are harder to manage.

Even though this rule is very helpful, it is hard to follow as well. If you are not going to apply it, do yourself a favor and limit the duration of leads by an appropriate maximum, say 5 days (similar to DoD's recommendation for lags). If you believe that you **have to** use lots of leads, especially large leads, you might need to reconsider the way you interpret and design relationships entirely.

13 Activities Should not Have Negative Floats

This is a DoD rule and has no equivalent in PMI.

There are two types of schedules; let's call them free schedules and fixed schedules.

In fixed schedules, you enter all the contractual dates as hard constraints. For example, if you have to finish the project on May 21st 2014, you should add a "Finish No Later Than May 21st 2014" or "Finish On Or Before 21st 2014" to your finish milestone or the project itself (depending on the software you are using). In this case, if you are behind schedule, your project finish date will still be on May 21st 2014, but you will have a negative float. If you have a negative float of say, 50 days, it means that if you do the remaining parts of the project as planned, you will finish 50 days after the contractual finish date.

In free schedules, on the contrary, you should never enter any hard constraint. In this case, your project finish date regularly changes and you should always check it with your baseline. For example, your project finish date might become Jul 10th 2014, and the variance between this date and the baseline date (May 21st 2014) will be 50 days, and you realize that you are 50 days behind schedule.

Both methods are valid, and each has its own pros and cons. As a whole, the free schedules are more common and easier to manage.

If you finish your initial planning and have a negative float in a fixed schedule, it will be similar to having a free schedule with a finish date that is later than the contractual finish date; that is why having negative floats is not acceptable.

It has been seen that some planners do not have enough time to compress the schedule, and they have to issue it right away. Some of them use a trick and add a "Finish No Later Than" or "Finish On Or Before" constraint to the finish milestone. In this case, the schedule seems compatible with the contractual finish date, but the negative float will show the hidden problem.

14 Activities Should not Have Long Floats

You do not have any direct control on floats. Large floats are just a symptom of weak relationships.

Check activity floats; if they are larger than expected, then you realize that you may have missed something. Perhaps some relationships are not implemented, or maybe some of them are wrong.

In DoD's terms, you should not have any floats longer than 44 working days (two calendar months). If so, you have to go back to all your scheduling elements and discover the root problem.

The most common problem is missing non-driving relationships. Take a look at this plan:
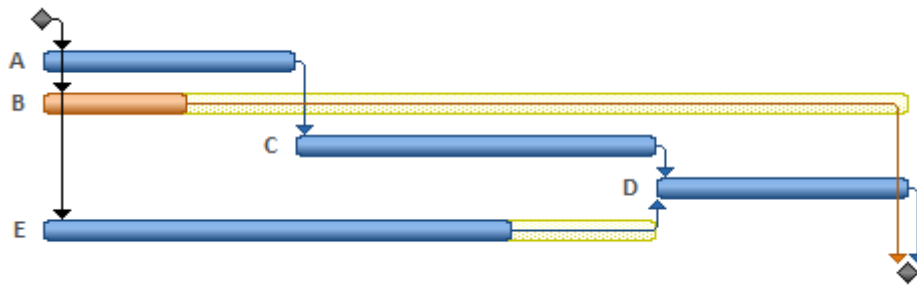
The yellow bars show the total float of each activity. Activity B and activity E have floats and the others are critical. Activity B has a long float; but why? B is finished in the beginning of the project and has no successors except the finish milestone. What happens if B is not finished until the last day? When we ask ourselves such a question, we might realize that D is its successor. We did not add D as a successor to B, because they are so far away, and we are almost sure that B will be finished when D starts. This kind of relationship is called non-driving. When we add the relationship, the schedule will not change. But we will have a more realistic float on B:
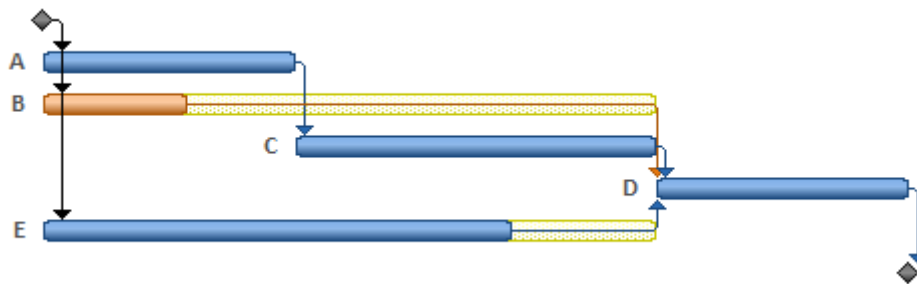
When an activity has multiple predecessors, each of them has a specific tendency to push activity to a later date. One of them has the most powerful tendency and is called driving. If you delete all other relationships, your predecessor will not move, but you will have two problems:

- Floats will not be realistic. When you delete a non-driving relationship, the float of the predecessor may increase.
- Drivers always change. One relationship is driver for the time being, but after updating the schedule, another relationship may become the driver. All non-driving relationships have the potentiality to become a driver someday, and if you do not add them, your future schedules and evaluations will not be realistic.

So, always check all the possible scenarios and add all relationships, even if they are not presently driving.

15 Activities Should not Be Split

In most cases, a planning software has a feature for splitting tasks, but this does not mean that it is correct to split activities.

PMI forbids splitting activities because these kinds of activities are hard to manage, and you cannot implement an effective logic for them.

Whenever you want to split an activity, you should break it down into two separate activities instead.
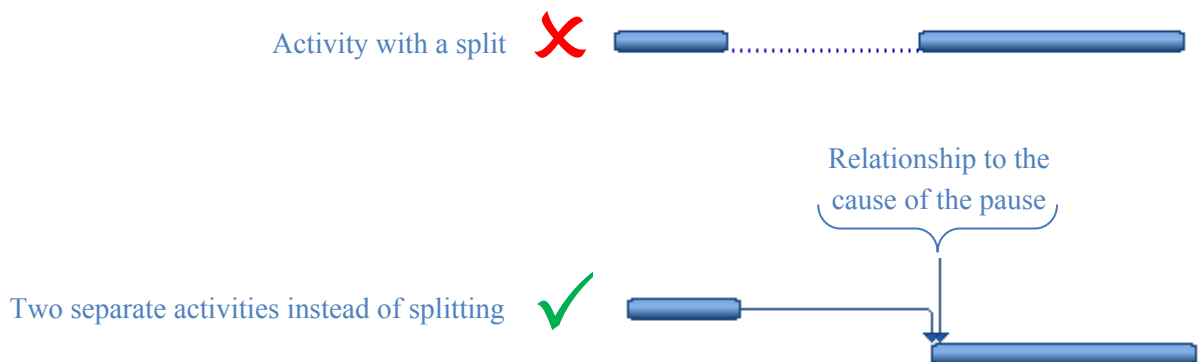
Why do you really have to split an activity? Activity starts, goes on, and then needs to pause until something else happens. That "something else" is a relationship you should have in your plan; you cannot apply this logic to an activity which has split, but you can apply it when you break it down into two separate activities.

Planners usually do not split activities themselves, but maintain their plans in a way that causes automatic splits when they reschedule it. Consider the following schedule:
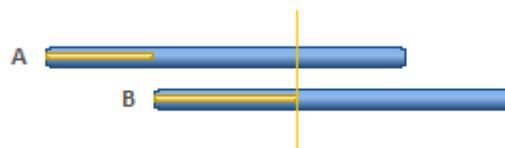
What happens if you reschedule this plan? The answer depends on your planning software and its preferences, but the most common answer is:
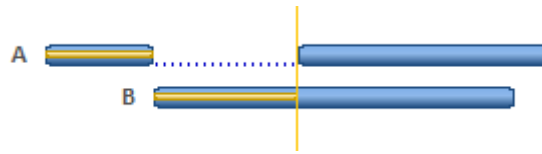
This is not a good result. In this case, the root problem is the way you have updated your schedule. Look at activity B; its progress is compatible with the data date (progress bar is as long as data date position), but as you can see there is something wrong with activity A; maybe the actual start is not correct, and your update should be like this:
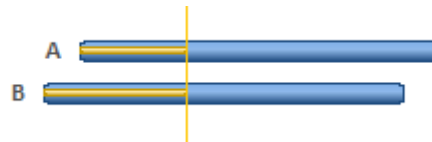
Or, maybe the actual start was correct, but you have to revise your remaining duration:

Although updating processes and requirements are not discussed in this book, you should be reminded that according to PMI and DoD, you have to enter these data for all activities in every update period:

- actual start (provided it has started)
- actual finish (provided it has finished)
- actual and remaining duration, or equivalent data (provided it is in progress)

If you enter all of them correctly, your activities will not split when you reschedule.

16 Date Constraints Should Be the Fewest Possible

Date constraints are not dynamic and you would not find any date constraint in the most real world projects. Some planners use them instead of relationships, and this is wrong.

PMI says that you must be careful not to use hard constraints where you can use relationships instead of them.

DoD says that activities with hard constraints should not be more than 5% of all the activities.

What they mean by hard constraint is a constraint such as 'Finish No Later Than' or 'Finish On Or Before' which all prevent activities from moving to later dates.
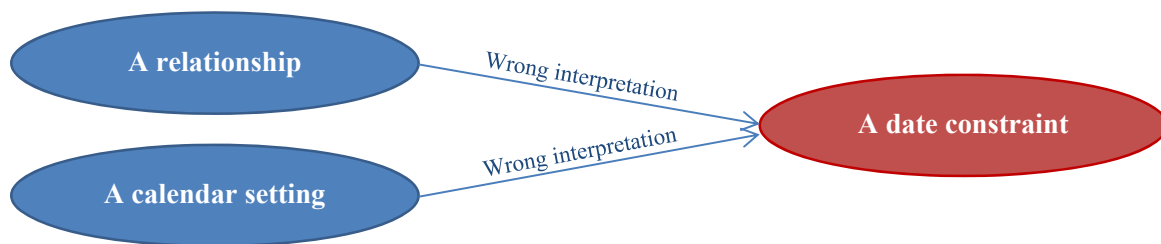
You probably do not need to use any date constraint in most projects. Sometimes a limitation seems like a date constraint, but it actually is another scheduling element like a relationship or a calendar setting. Suppose that the project manager says activity X cannot start before a certain date; will you use a date constraint to apply it? Well, not always. You should check to see the reason behind that date. Maybe it has something to do with weather and seasons (e.g. that work cannot be done in winter), and you might be able to make a separate calendar for that special activity to apply that limitation instead of using a date constraint. It might be also a collection of predecessors, and the mentioned date is when the project manager is sure that they are all finished; you should collect and add all those relationships instead of adding a date constraint in such a case.

17 Date Constraints Had Better Be Implemented Through Milestones

This is not a PMI or DoD rule; this is my own rule which I find very useful, and I am going to share it with you.

Date constraints are special; they reflect important events in our plans. We are used to seeing important events as milestones, so why don't we implement date constraints through milestones?

Suppose we have an activity. We cannot start it because of a regulation. This regulation says that we can only start the work after February 1st. What you probably do is to assign a 'Start No Earlier Than February 1st' or 'Start On Or Before February 1st' constraint to the activity. I prefer not to assign any date constraint to the activities. Instead of that, I make a new milestone named 'Legal start date of…', assign the constraint to that milestone and make the original activity a successor of the new milestone.
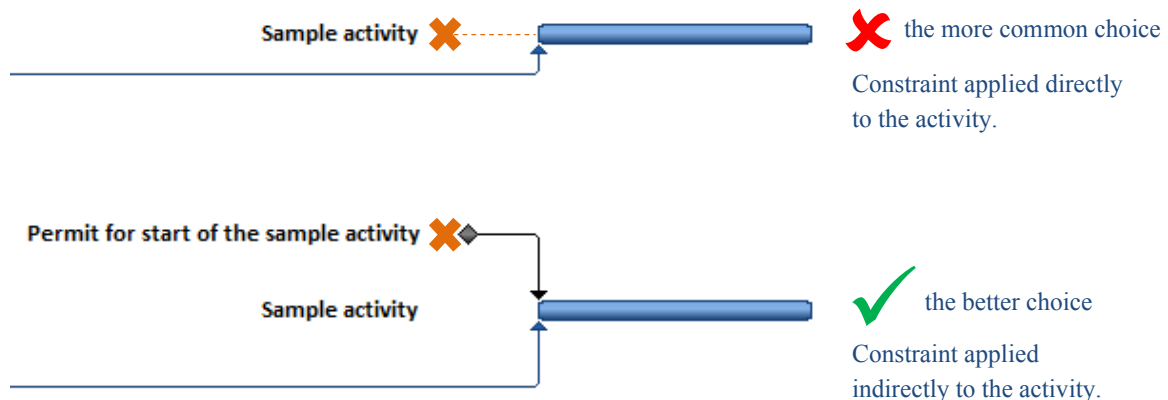
By this, you will always remember the event when you look at the schedule because milestones are far more visible than constraints. Changing the constraint date will be also much easier, especially when you use it for more than one activity.

You would better have a WBS element (or summary task) for your contractual and management milestones in the beginning of the schedule and put these milestones there along with the other milestones.

18 Activities Should not Have Long Durations

A common question: how detailed our activities should be? You might have problems monitoring them, and it would be very hard to design an effective network of relationships if they are not detailed enough. On the other hand, if they are over-detailed we will have to spend more time planning and controlling.

The case is that if the activities are over detailed, you would not lose as much as when they are not detailed enough. That is why PMI and DoD are both more concentrated on the maximum allowed duration and not the minimum.
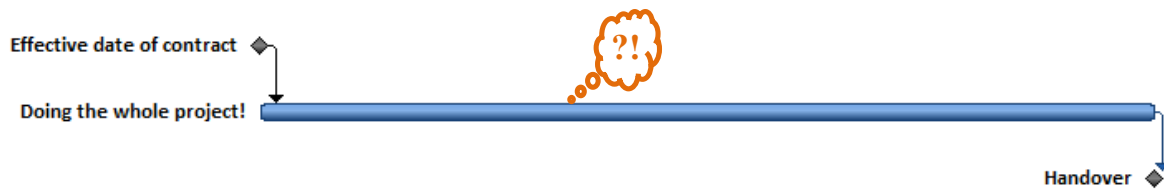
The maximum allowed duration in DoD's terms is 44 working days, equivalent to 2 calendar months.

The 44 working days seems like a good choice, but what about a 4 month long project? 44 days seems so long for a 4 month project. That is why the PMI uses a parametric value. PMI says that you should not have durations longer than two control periods in any normal activity. So, if you have a two year long project and your control period is one month, your maximum allowed duration would be 2 calendar months; but if you have a 4 month long project, you might want to control it weekly and therefore, your maximum allowed duration would be 2 weeks.

PMI's rule is about normal activities, and this rule would not be applicable to Level-of-Effort activities. DoD says that you can have up to 5% of activities with durations longer than the maximum allowed (44 working days) to cover LOEs.

19 Duration Units Had Better Be the Same

There are many different time units in any planning software: days, weeks, months, years, hours and minutes. How do you use them?

The most common unit is days, but planners sometimes use other units along with this unit. For example, duration of most activities might be in days and some of them in months or in weeks.

✔ Straightforward		✖ A little confusing	
WBS element 1	**28 days**	**WBS element 1**	**28 days**
Activity 1	22 days	Activity 1	1 month
Activity 2	15 days	Activity 2	3 weeks
Activity 3	3 days	Activity 3	3 days
WBS element 2	**22 days**	**WBS element 2**	**22 days**
Activity 4	14 days	Activity 4	14 days
Activity 5	17 days	Activity 5	17 days
Activity 6	5 days	Activity 6	1 week
Activity 7	2 days	Activity 7	2 days

DoD recommends you to use only one time unit. This is applied to simplify the schedule.

Appendix 1: Creating Work Breakdown Structures

Work breakdown structure, or WBS for short, is a representation of the scope of the project. Even though it is used in developing time schedules, it is not part of it; that is why there is no discussion about WBS rules in the main body of this book. However, it is impossible to have a good schedule model with a bad WBS, so you should also pay enough attention to how you prepare the WBS, and we are going to have a quick look at the rules of WBS.

There are only two rules for creating a well-formed WBS:

- you should base it on deliverables
- you should follow the 100% rule

WBS Rule 1: Base It on Deliverables

Although it is called **work** breakdown structure, it is not a breakdown for work of the project! This makes lots of confusion and might be the source of many problems. Some professionals have even suggested changing this title to project breakdown structure, deliverables breakdown structure, or product breakdown structure. PRINCE2 methodology uses product breakdown structure (PBS) term instead of work breakdown structure to refer to the very same concept. However, product breakdown structure term might also be misleading, because it is used elsewhere for a similar, but different concept in project management literature.

Anyway, a breakdown structure can be based on any of the following criteria, or even combinations of them:

- deliverables
- responsibilities
- departments
- resources
- time
- types of work involved
- risks
- locations
- etc.

None of these items are wrong, and you should feel free to use any of them based on your control needs. But, you *always* need to have a breakdown based on deliverables. This breakdown is the essential, unavoidable, most useful breakdown you can employ in any project.

When we talk about WBS, we actually refer to the breakdown which is based on deliverables. If a breakdown is not based on deliverables, it will not be named WBS. You can still have alternative breakdowns based on other criteria and use them as you wish.

So, what is a deliverable? In the Practice Standard for Work Breakdown Structures, PMI describes the WBS as follows:

> "Any unique and verifiable product, result, or capability to perform a service that must be produced to complete a process, phase or project. Often used more narrowly in reference to an external deliverable, which is a deliverable that is subject to approval by the project sponsor or customer."

A deliverable is a part of the final product of the project, which is unique and verifiable.

After understanding the final product of the project and all its requirements, we start decomposing it into its elements, in as many levels as we find necessary, and of course as long as it is compatible with the scheduling rule 18. We should then complete it by adding extra elements needed for risk, quality, and other concepts, which are not directly part of the final product, yet needed to produce the product as defined.

Take a look at the following structures, which show the same sample activities in two different breakdowns:

Alternative 1:

  – Zone 1
      - Place reinforcing bars in zone 1
      - Prepare formworks in zone 1
      - Pour concrete in zone 1

  – Zone 2
      - Place reinforcing bars in zone 2
      - Prepare formworks in zone 2
      - Pour concrete in zone 2

Alternative 2:

  – Placing reinforcing bars
      - Place reinforcing bars in zone 1
      - Place reinforcing bars in zone 2

  – Preparing formworks
      - Prepare formworks in zone 1
      - Prepare formworks in zone 2

  – Pouring concrete
      - Pour concrete in zone 1
      - Pour concrete in zone 2

Which one do you prefer to use in your WBS, alternative 1, or alternative 2?

The correct answer is alternative 1, because it is based on elements of the final product or deliverables. Alternative 2 in contrast, is based on types of work.

Now it is a good time to review a part of the PRINCE2 standard, where it describes the sixth core principle of this methodology, '*Focus on Products*':

> *"A successful project is output-oriented not activity-oriented. An output-oriented project is one that agrees and defines the project's products prior to undertaking the activities required to produce them."*

Frankly, this is not limited to the projects, it governs the whole life!

The last thing to mention here is that WBS elements are deliverables (things) and activities are work. That is why they should be titled in two completely different methods. This is explained in the Scheduling Rule 5.

WBS Rule 2: Follow the 100% Rule

The underlying elements of each WBS element should contain 100% of the scope of their parent, not less, and not more. The following figure demonstrates this rule.
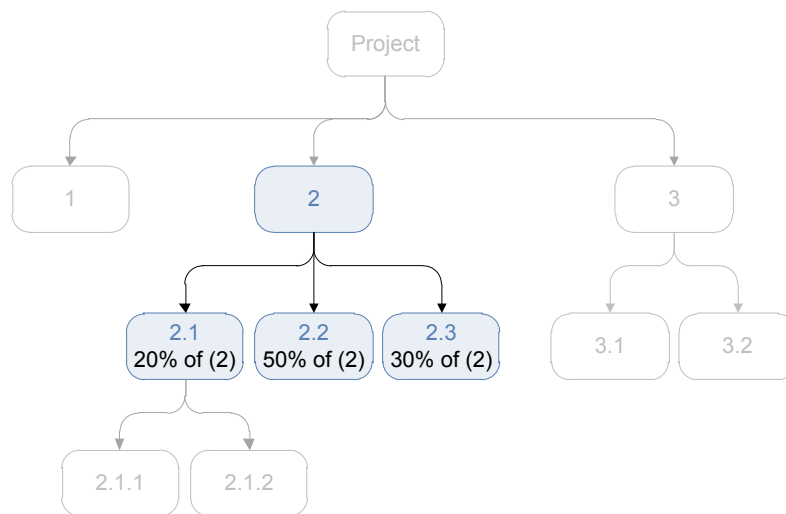
So, let us examine the partial structure below:

- Building A
  - Structure of the Building A
  - Electrical parts of the Building A
  - Mechanical parts of the Building A

- - Architecture and finishing of the Building A
  - Building B
    - Structure of the Building B
    - Electrical parts of the Building B
    - Mechanical parts of the Building B
    - Architecture and finishing of the Building B
  - Building C
    - Structure of the Building C
    - Electrical parts of the Building C
    - Mechanical parts of the Building C
    - Architecture and finishing of the Building C
  - Mechanical tests
    - Mechanical test of Building A
    - Mechanical test of Building B
    - Mechanical test of Building C

Is it compatible with the 100% rule?

The answer is no. When we call a WBS element 'Building A', it should contain everything related to that very building, but its 'mechanical tests' are not included.

Following the 100% rule goes hand in hand with naming elements, even though it is not limited to naming alone. In the previous example, you can simply replace 'Building A' with 'Main parts of the Building A (not including mechanical tests)', and the problem will be solved; except that you will have to deal with those strange names, which is not less than a problem. By the way, the previous sample is not completely deliverable-based either. Can you tell the reason why?

Anyway, naming is important. You cannot create a WBS compatible with the 100% rule, unless the names of the WBS elements are unique, the same as those discussed for the activities in the Scheduling Rule 4.

The highest level of the WBS is the whole project. Applying 100% rule to this element is the same as other elements, but has an especial meaning: the whole WBS should cover 100% of the scope of the project, not less, and not more. This makes the WBS an exact representation of the scope.

Appendix 2: The Distinction between Schedule and Schedule Model

There are two completely different concepts in project management, the schedule, and the schedule model. Understanding the difference between these concepts is crucial to your success in planning and in the quality of your schedules.

The schedule model is the subject of this ebook, even though it is called "schedule" just for simplicity. This model is a live and dynamic simulated model of timely behavior of the project. This is mainly done by defining relationships and durations in a planning software; the start and finish dates are then calculated automatically. Schedule model is supposed to be updated periodically by entering actual data in it. By this, a combination of the logic you have created and the actual data entered will be used to recalculate the dates.

Schedule on the other hand, is only a list of activities and probably WBS elements, with a static start and finish date of a given data date. Schedule is a snapshot of the calculations of the schedule model in a given date.

So, the schedule is the static snapshot of dates, while the schedule model is the dynamic and live engine which produces new schedules and gives you lots of other information. Each time you enter actual data and the model reschedules, you realize how those actual data will change the future of the project. This will create the earliest warnings you can possibly have, and the earlier you get the warnings, the easier it will be to recover. This is the real benefit of an effective schedule model.

Not every schedule model is capable of giving realistic results in every situation. You might have seen schedule models that produce strange and unusable results after a while. The mentioned distinction is important, because some planners and other project stakeholders do not expect a schedule model to have the kind of structure and logic needed in a dynamic and effective schedule model, and only focus on the instant snapshot of the schedule model (aka schedule) and check to see if that very instance seems fine.

How can we develop an effective schedule model? The answer is simple: by following the rules of this book. Indeed, this book is all about developing effective schedule models.