Software Engineering
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Lecture - 31
Project Time Management

Today we are going to talk about project time management. Managing schedules is a very important activity for a project manager. If you have to ask some project manager as to what is the major cause of conflict throughout the life of the project the answer will be schedule issues. Why schedule issues are so common?
There are many reasons. For instance, the simple reason is that the time is very easy to measure. Measuring cost and scope of the work is far more difficult than measuring time.

Another simple reason is that there is no flexibility and it just passes by whether you like it or not, it is not a matter of throttling it, keeping it, holding it back. And another particular part is that the planned and actual times are often compared without reference to the changes that might have occurred to the scope and other aspects of the project. So you just blindly compare the plane and the actual and then you are complaining that the schedule has not been kept up to date. Time management is a very important activity from a project manager's point of view. And the time management processes are aimed at for ensuring timely completion of the project.

Secondly, it is to conform that the triple constraints of scope, time and cost are balanced. So, project time management processes often lead to clarifications in respect of the work breakdown structure and are generating more supporting details for the scope activity that we considered earlier. If the estimated completion date for a project was to change significantly. It is very important for project manager to go back and renegotiate the triple constraint of scope, quality and time with the top management.

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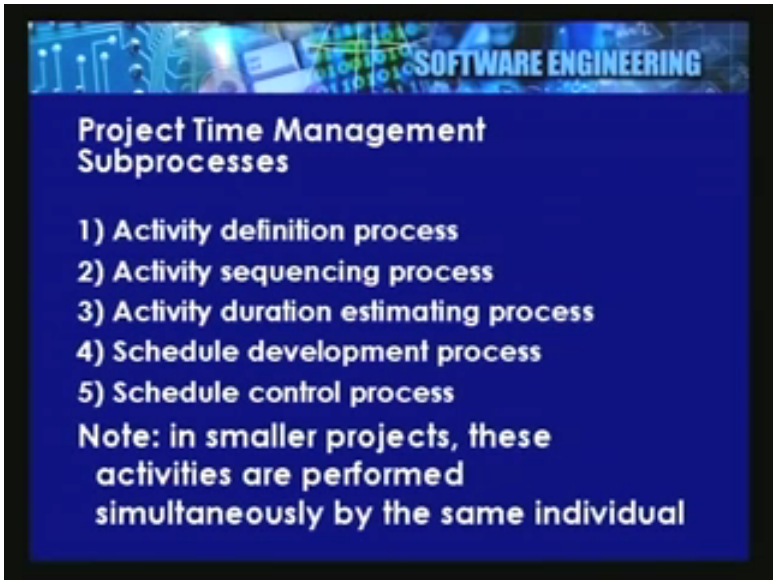

Let us look at the slide and see what main time management subprocesses are there.
1) Activity definition process
2) Activity sequencing process
3) Activity duration estimating processes
4) Schedule development processes and
5) Schedule control process

Now remember, some of these terms may look quite self explanatory but we need to study them in detail. And one thing should be clarified, in case of small projects many of these activities are often performed simultaneously by the same individual and from that point of view you may not see these processes offering operating sort of one half and another but they may operate concurrently. Now let us first look at the activity definition subprocesses.

The activity definition process involves identifying and of course documenting the activities necessary for producing the deliverable and this has to be consistent with the deliverable breakdown structure that has already been defined. As we have already seen, the activity basically consumes time, requires resources and ultimately causes something to the project.

Sometime it looks surprising as to why identification has come in the schedule rather than or being duplicated after the same having already been considered in the scope. When we consider the scope management we came out with a work breakdown structure, similarly there is a deliverable work down structure. There is a many to many relationship between the work and the deliverables and from that point of view you need to establish exactly what kind of activity is going to be performed before you can finalize the schedule for any particular project. How do you go about doing it?

The first particular technique you use is of course decomposition, taking the job and break it down to a reasonably small, activities which are individually identifiable and monitored and controlled. In this respect it is possible to use standard templates. Templates are available for resources required, for expected deliverables, for associated risk and so on and so forth and these templates come very handy when we are trying to identify the activities for schedule development. So, activity definition process sometimes may result in causing changes to the work breakdown structure.

For example, if you have to identify a missing deliverable in this particular process of re-look you may have to go back and make changes to the work breakdown structure. So basically what we are doing here is to look at this particular activity in the second process and convert that work breakdown structure into some kind of a precedence diagram.

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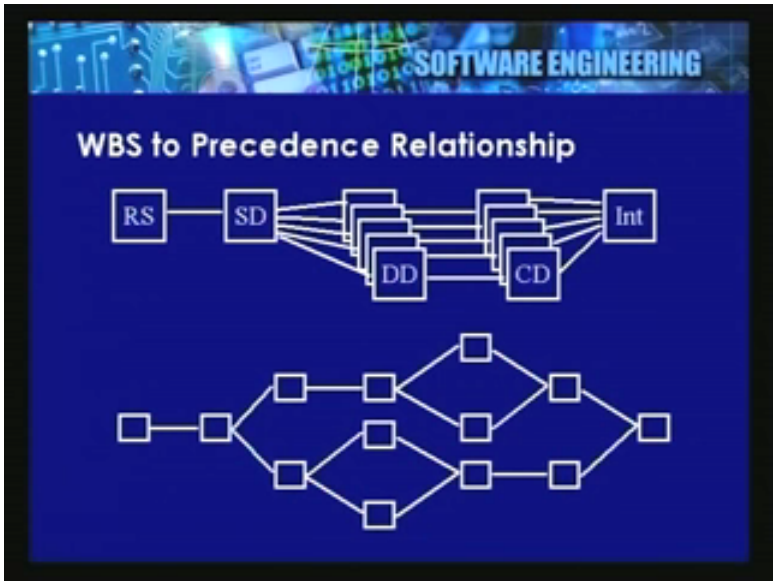

The diagram is only for our convenience but we need to establish the precedence between the various activities. If you look at your screen you will see that we have a work breakdown structure which needs to be converted into a precedence relationship for all the activities. Basically this is the activity sequencing subprocess. Activity sequencing processes involves identifying and documenting. Identification always follows documentation, identifying and documenting, the logical relationships between the identified activities. So you need to have work breakdown structure, product description, assumptions and constraints all these particular things as your inputs and based on that you can establish the relationship between the activities.

Now, the dependencies between the activities can be broadly classified into three groups. The first particular one is called mandatory dependencies or hard logic as it is sometimes called. So, between these particular activities, all these activities are incidentally within a project, there is an inherent relationship which goes by the nature of work.

For instance, we cannot test the program unless the code is written and no amount of [h…..8:55] is going to change this particular kind of a relationship. The second particular set of dependencies is what is called external dependencies. Here there are things which are outside the control of the project and you need to depend on it.

For instance, if somebody else was to give you hardware and you were to install your software for doing the job and if hardware delivery was not part of your project then you have a situation where you cannot do your loading until somebody has delivered the hardware. Similarly, in case you have to buy some software you cannot do that buying until the budget is approved which is usually done outside the project scope, done by somebody in the organization to approve your budget. There is a third set of dependencies which are called discretionary dependencies which are self imposed dependencies between the activities of the project. These are also within the project activities.

For instance, we may have a concept of not beginning the design work until the SRS is reviewed or you might say that we will not start work on the project till SRS is signed by the client. You may also have situations where you might require exceptionally higher constraints in terms of coding and errors identified and all kinds of things as a precondition before you start the next work. But these are discretionary dependencies in the sense that it is the project's own imposition of the dependencies. So basically we have mandatory, external and discretionary dependencies. Discretionary dependencies also sometimes called as soft logic.

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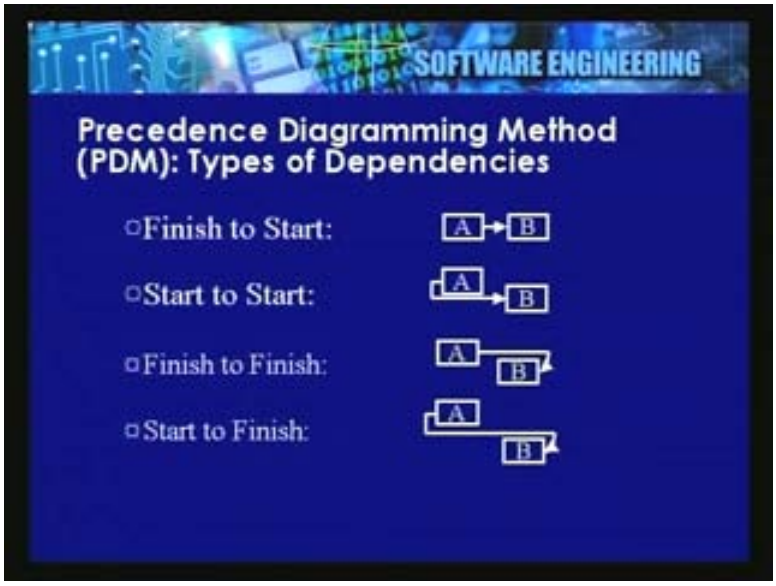

So once you have got these particular relationships what are the ways in which we can organize this job and we say the job is organized by identifying either your precedence relationships in the form of ADM network or PDM network. So let us first begin by looking at the Precedence Diagramming Method PDM method. This particular method

also is known as activity on node kind of a network. It depicts the activities on the nodes and the activities are connected to each other by the arrows or the events are basically shown by the arrows.

The advantages of PDM network over ADM network is that it does not involve use of dummy activities, allows depiction of different types of relationships more than one, and otherwise end of one activity is the beginning of the next activity is a very common kind of a relationship and most project management software also support these particular types of dependencies. Now let us look at what type of dependencies we have in PDM network.

The first particular dependency which we have is called finish to start dependency. Now the finish to start dependency is the most simplest and the one that is also found in the ADM Arrow Diagramming Method that is, that the task B cannot start until task A is complete. Installing a network card in a PC before connecting it to the network is a very good example of a finish to start kind of a relationship.

The second type of relationship that we have is start to start relationship. What start to start relationship basically means is that the two tasks A and B. The preceding task A and the succeeding task B must start at the same time. So if you are planning for a physical implementation of a network and determining an IP address of the configuration then both these particular things can to some extent start simultaneously. So when many tasks must start simultaneously then we have a start to start relationship.

The third particular type of relationship we have is the finish to finish type of a relationship. In finish to finish relationship, just like the start to start relationship the two activities are required to finish at the same instance. So rolling out of new software and completing the user training probably need to occur at the same time or in case you are releasing particular software at multiple locations then that release must coincide with the same particular type. What it means is many tasks must end simultaneously together in that particular relationship.

The fourth kind of relationship is start to finish which is more difficult to observe where we say that the preceding task A cannot finish until the succeeding task B has started. In a very trivial kind of an example in case you are having a relay race then you find that there is an overlapped running by the two players, the one who is giving the baton and the one who is taking the baton and the activity of the earlier fellow cannot finish until the next fellow has taken the baton and got to hand. So we say counting network jacks after they have been installed is the activity, the counting cannot be complete until the installation work is also finished. So the activity “counting installed jacks” cannot start unless the activity “installed network jacks” is complete.

Of course please remember, in most of our day-to-day situations we do not use many of these particular kinds of relationships and of course finish to start is the most commonly used kind of a relationship most commonly used kind of a relationship.

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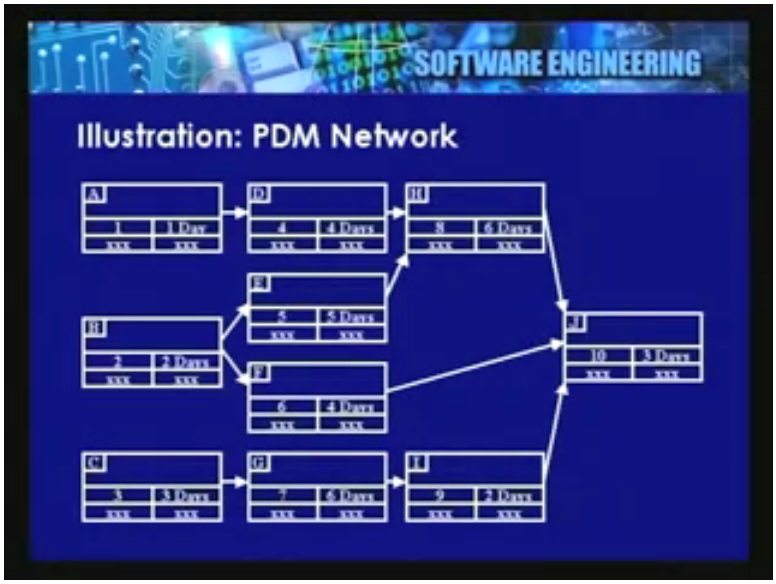

Now look at this slide again, you see an example of a PDM network. So PDM network basically is going to have all the activities in the boxes with the starting time, finishing time and other descriptions but the sequencing is determined by the arrows. Another important type of network that we have is Arrow Diagramming Method or ADM network.

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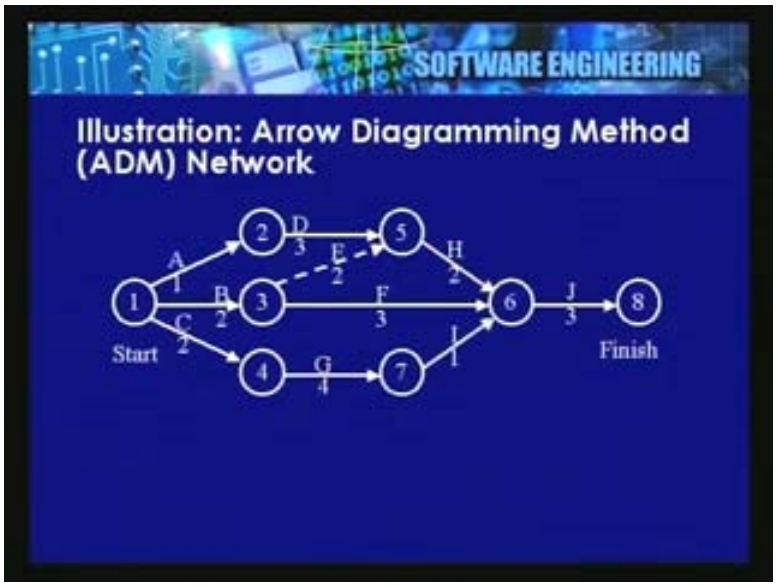

Here in this slide we have an illustration of Arrow Diagramming Network. This particular network is basically activity on arrow. As against the PDM network we put the activity on the arrow and the events on the nodes. Basically it uses only one type of connector

that is start to finish like whatever you finish then you end there in that particular place and here we may use dummy activities.

Now again look at the particular activity E, look at the diagram on the board. Activity E for instance is a dummy activity, actually it should not be showing any kind of a value on it and from that particular point of view this indicates that if two activities are likely to have the same starting and finishing nodes we may need to add a dummy activity to make sure that the diagramming notations are conformed to. So in this particular manner we can show the relationship.

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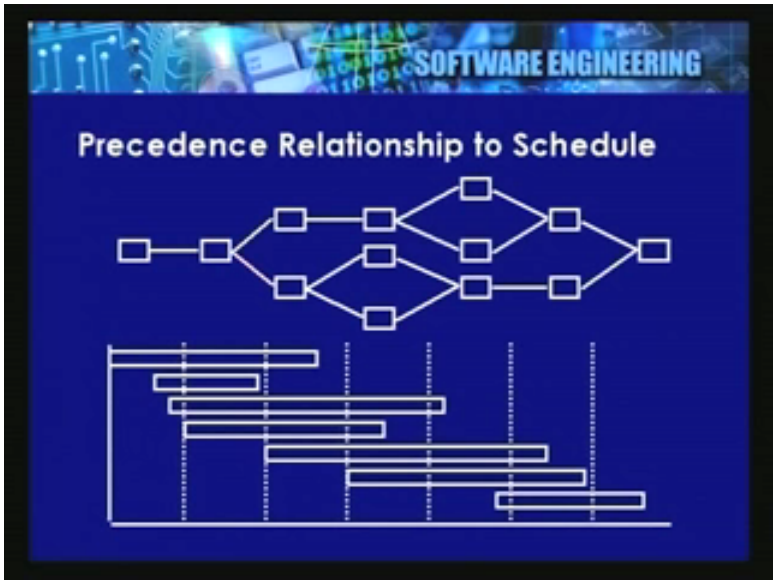

So we have either ADM or the PDM kind of a network on which we can show the precedence relationship between the various activities that the project is supposed to perform. Once we are done with the identification of sequence the next particular thing is that we need to do an estimation of the individual activity. So activity duration estimation process involves developing a time frame for all activities.

Please remember, here we are not estimating the time for total completion of the project, we are trying to estimate the time required for individual activity. So these activities are going to be progressively elaborated and then the total time required for completing the project will be identified. Therefore, activity duration includes both the time required for doing the activity and also if there is an elapse time requirement associated with completion of that particular activity. Again these estimates can be done both ways either in the probabilistic or deterministic way though we do not often go into the probabilistic kind of estimation because it requires yet another level of sophistication in doing analysis of this particular network.

Project management software can take care of some of these elapse time differences by using alternative calendars and so on and so forth but many times you will have to

manually establish the relationships and put the estimates physically there for making this particular schedule workable. One of the things that you need for estimating is different calendars. That is you have situations like for a specific […..19:33] if you have a project going on in the Middle East and they follow Friday as a weekly off and you are having a Monday as a weekly off certain amount of problems will come in estimating the time required for completing if there is a dependency between the activities. So in this particular aspect it is very desirable that persons or groups of persons who are most familiar with the nature of the activities should be involved in providing the inputs and estimating the durations for this particular activity.

Approving the duration must be also done by the people who are likely to be working on these particular projects. So, after we have done identifications, sequencing and estimating now we come to project scheduling. What we need to now convert is to convert your precedence diagram into a schedule which will be acceptable or implementable.

From your particular point of view what you need to do is identify the precedence relationship, look at the availability of the resources and estimates for individual activities and put all these three together to come out with a realistic kind of a schedule. The activities, their estimates, sequencing and resources basically form the input for meeting a schedule. Again, sequencing of activities is very different from meeting a schedule.

Schedule has an implication of deploying or committing resources along with the activity. So you cannot possibly thing in terms of doing an activity just because the sequence is adequate. In case you had infinite resources available then the sequence diagram will form the lower bound for completing the task or making the schedule but this is rarely so. We need to always text this particular schedule to make sure that our resources are values.

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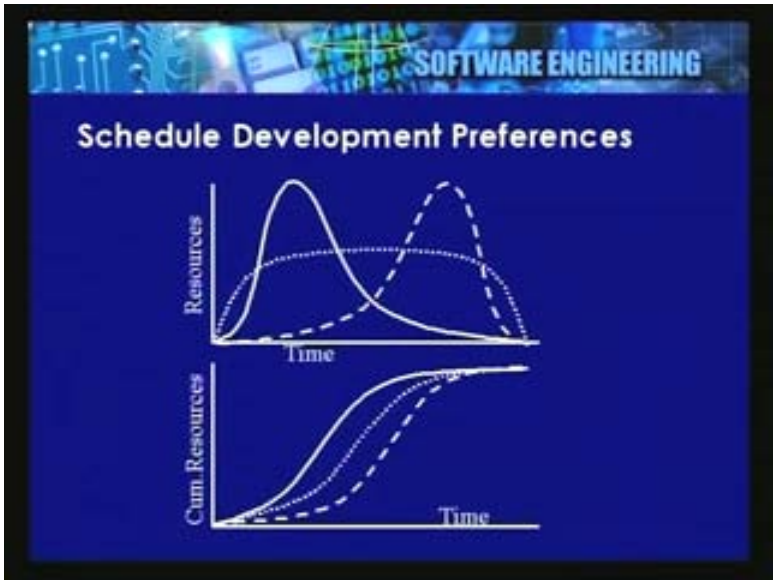

In case you have a project and you were to perform all activities as early as possible then you will get this type of a curve. This particular curve will have its hump on the left hand side what is often known as the right skewed curve indicating that each activity is performed as early as possible in the slacks if any are left to the tailing. The graph below gives a cumulative curve for this particular type of diagram. It is a cumulative curve for the histogram that you see on top of it.

Now see what is happening, suppose your boss was asking you to do this job as early as possible then you will find that all the activities will be done as early as possible but there is one person who is not going to be happy about it and that is going to be your accountant. But why is it?
From the accountants' point of view, as soon as the job is complete he needs to shell out money. So from an accountant's point of view an accountant says why you complete the job early if you can delay this particular job or task without having an impact on the overall time required for completing the project then I would prefer that you complete all the activities as late as possible without delaying the project. So what will happen is, I will need to pay the money for the work done or the attributed expenses will be as low as possible.

Again if you look into the slide we can say that we can have another particular curve. Here in this particular diagram, instead of all the activities being performed as early as possible we have now performed all the activities as late as possible without delaying the total time required for completing the project.

Now, on the cumulative curve below you see a typical hysteresis kind of a curve and this from an accountants' point of view will be very easily viewed as what we call interest cost to the project, it is the additional interest cost to the project.

So here you see two conflicting views; one from the top management of asking you to complete all the activities as early as possible and there is an accountant who would like you to complete all the activities as late as possible.

Now what do you feel as a project manager?
As the project manager you have a totally different view of the situation. The first two views are not acceptable to you for a very simple reason. The resources required for completing the jobs are not evenly distributed over the life span of the project.

As a project manager you do not want a daily shuffling and reshuffling and adding and subtracting of people to a project and you would like to have a study a man power allocation to your particular job and if this so happens you are likely to have a most comfortable peaceful kind of a sailing. So we have seen now from the diagram that there are three preferences for doing this particular kind of a scheduling activity.

There is one more thing you must remember; whenever you are developing a schedule you must keep certain amount of reserved time continuously or [b…26:07]. Now this can either be built into individual activity durations or they can be kept separately and you can keep the results at your project level or you can keep these particular results at the organizational level. So what is important for you to know is that the results are not required to be displayed to the people who are actually working on the project.

From their point of view the reserve does not exist but at the same time the manager must act at the back of his mind to know that there is some leave way possible in performing these particular jobs. So you can either take the approach of having the continuous or reserve times built into individual estimates or keep them separately. So reserve times though they may be kept separate must be documented along with the data and the assumption. But as we mentioned already we need not necessarily make this data available to everybody.

Now during re-planning in case you see that a particular project or activity is lagging behind, some amount of reserve time can be utilized. It is like spending some money so the available reserve for that particular project or company as a whole will go down as soon as you use some part of it. This and many other things we are going to see will bring you to one conclusion. Schedule development is not a very straight forward kind of an activity and it involves sort of iterating the earlier steps a few times before you come to a reasonably satisfying kind of a schedule.

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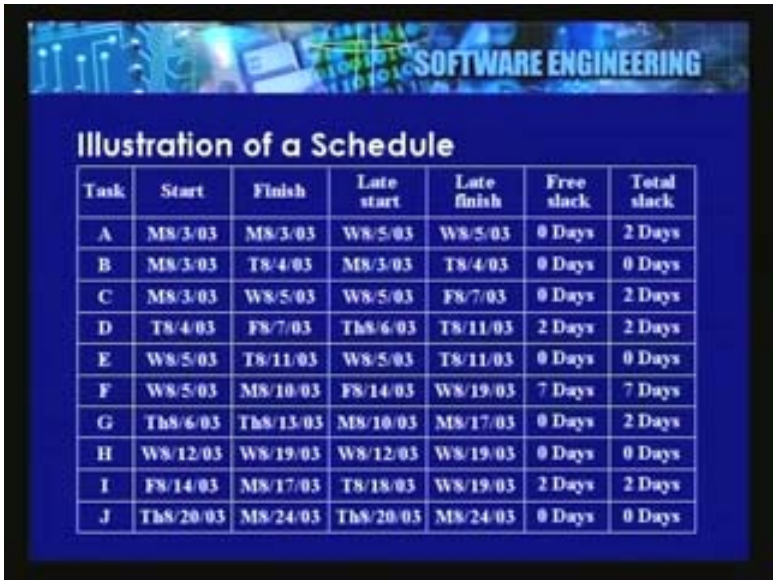

Task	Start	Finish	Late start	Late finish	Free slack	Total slack
A	M8/3/03	M8/3/03	W8/5/03	W8/5/03	0 Days	2 Days
B	M8/3/03	T8/4/03	M8/3/03	T8/4/03	0 Days	0 Days
C	M8/3/03	W8/5/03	W8/5/03	F8/7/03	0 Days	2 Days
D	T8/4/03	F8/7/03	Th8/6/03	T8/11/03	2 Days	2 Days
E	W8/5/03	T8/11/03	W8/5/03	T8/11/03	0 Days	0 Days
F	W8/5/03	M8/10/03	F8/14/03	W8/19/03	7 Days	7 Days
G	Th8/6/03	Th8/13/03	M8/10/03	M8/17/03	0 Days	2 Days
H	W8/12/03	W8/19/03	W8/12/03	W8/19/03	0 Days	0 Days
I	F8/14/03	M8/17/03	T8/18/03	W8/19/03	2 Days	2 Days
J	Th8/20/03	M8/24/03	Th8/20/03	M8/24/03	0 Days	0 Days

Here in the slide you see some kind of an illustration of a schedule. The schedule that you actually print out and put it on the board or e-mail it to everybody basically says that what are the tasks, what is the start time, finish time, what is the late finish, early finish, all slack is available, free slack, total slack, it is not our objective at this particular stage to teach you pert CPM. The terminology comes from pert CPM topic. If you are doing this particular job on a machine you can easily add some additional columns like who is going to be the person, who is going to do the job and say where the job will be done and so on and so forth. But this is how ultimately the schedule looks like.

Now, one of the things that you need to worry about the schedule is to realize this schedule is not going to be final and you need to find ways and means of shortening the project schedule. Shortening the project schedule is one of the frequent requirements of the people who are concerned. Let us look at the next particular topic or sub aspect of scheduling and that is, in case we need to shorten a project schedule how do you do it.

It is possible to use several techniques for compressing a project schedule. So the compression can be done by reducing the scope of the project. This would totally require a different cycle of change management activities to be undertaken but it is possible that we can reduce the time required for completing the project by reducing the scope thereby eliminating or scaling down certain activities that are associated with the completion of this particular task.

The second way of doing it is by applying more resources. One of the most commonly used techniques for reducing the time required for completing the project is called crashing of the schedule. What it simply means is, basically you are trying to reduce the time required for completing an individual activity by applying extra resource.

A trivial example is, it is like giving your clothes to a laundry and in case you want them urgently you pay a little more money and the turn around time for getting your clothes back is reduced. The crashing cannot be applied indiscriminately. There is something very interesting about the networks and that is, in case the time required for completing a critical activity gets delayed then the time required for completing the project also gets delayed. But this is not true, in case the time required for performing a critical activity is slashed down, why, for a simple reason that there may be more than one critical path or when you reduce the time requiring for performing the activity then some other path may become a critical path.

So, when you are doing the crashing it is not possible for you to reduce this particular kind of a time by applying all extra resources and making the [c….. 31:54] of, no. What you need to do is, at every step find out how much reduction can be obtained by applying how much resource to which particular activity, and then may be draw a simple Pareto kind of a chart and say that initially you would like to have minimum expense for maximum schedule compression and progressively you will have to pay more and more and more for compressing the schedule to the same extent. So the least incremental cost kind of an approach will have to be used here. What its disadvantages will mean is that the crashing will have to be done usually one unit at a time. So this is the disadvantage and you often require that you do that.

Another dangerous way of compressing schedule is what we call doing fast tracking. What is fast tracking?
It involves doing some activities in parallel which would otherwise have been done sequentially. There are many situations where we do this particular kind of a thing, when you look at it many kind of computer architectures will go and say that while you still execute the previous instruction they start breaking down the next particular instruction and all this effort will go waste in case there is a IF statement or some kind of a deviation of the root and from the current instruction that is being executed there is a jump to yet another place. So, obviously all the earlier work that you did as what you call breaking down the next instruction and trying to save time goes waste.

Here is a simple example; Suppose you are preparing a proposal for one of your clients on the other side of the earth so whatever is your end of the day is the beginning of the day for that particular person and one day your morning or that person’s morning he sends a message that I want a proposal for doing a specific small job by the end of the day. Of course to you it means staying over night and doing this particular job, that is fine but your company may have a requirement that you cannot send a proposal to the client or make a proposal to the client unless it is thoroughly reviewed.

Now you have a problem, not only you need to stay whole night and you do not know when you are going to complete this particular proposal making, somebody will have to sit late with you and also do the review and that person’s time is going to be really wasted or difficult to put in place.

Now, suppose you have great deal of experience in making similar types of proposals and your prior experience shows that you rarely make mistakes in doing a proposal, it is possible for you to fast track and do the proposal and send it to the client and concurrently send the proposal for review. Now here you are taking a big risk. In case the review finds some mistakes you may have to sort of eat your words and approach the client and ask for some modifications or something. This kind of thing can work very well in case you have a very good client relationship but may not work in other situations.

Therefore, fast tracking is an activity which you should not always do unless you have very good deal of confidence in the type of work you are doing. Here the disadvantage is, increasing the project schedule at the risk of having to re-do certain work that you have already done. Another important consideration in preparing a schedule is leveling of resources. We have already made a reference to it earlier. What happens is, if you have to undertake a mathematical analysis it may suggest a schedule which may conflict with the availability of resources. So many times we need to have heuristic approaches when we use for partly dissolving the leveling conflict. Remember, the basic idea behind leveling is this that if you can have uniform requirement of a resource it seems to solve many problems.

Take a simple example; if you require a programmer to be with you for two days and then not be with you for one day and then again be available for one day and not there for two days this kind of an arrangement is going to be more difficult. Rather that this person works with you for prolonged period of time say a month or two months and something like that. So this may involve that occasionally you may have to hire out some minor resources for a day or two or it might have a situation where the person may not have work for a day or two. So, heuristic approach just can help you in partly resolving the resource leveling conflicts. You may take care of some of these things by applying extra resources but this does not really work out very well and you need to use different techniques for doing it.

Resource leveling often results in project schedule becoming longer that the preliminary schedule or the minimum possible schedule that we have. And in that particular sense occasionally you might have to take recourse to things like extended working hours, weekend work, shift work, use of different technologies or may be hiring resources from outside for small durations of time so that the overall resource requirement is leveled.

Yet one more particular and important activity you need to do while doing scheduling is to do some kind of a “what if” analysis then the simulation. Here is a simple example; suppose we have decided to write some five thousand programs and we are expecting that the time required for doing each particular program is so much and so forth it is always likely that some of these particular activities may get performed well before time and some of them may get delayed.

Now what you want to know is, what will happen over a period of time.

So let us take a “what if” analysis kind of a thing. Suppose we hire one extra programmer what is likely to be the impact of this particular decision on the project schedule as against we take a decision not to hire this programmer but to occasionally contract out some few programs. So” what if “analysis can be made using logic networks to simulate different kinds of scenarios.

Thus, delay in major component delivery or introducing some external factors like strikes happening in the city or there may be natural calamities and something like that and in case we need to find out how will this affect the schedule, then we can take resource to, one is simple things like excel sheet but this will give you a very deterministic kind of answers. If you want more realistic answers to your questions then one way is to undertake simulation. Therefore, simulation techniques are in at computing multiple project durations with different sets of activity assumptions.

Let us take an example; suppose you say that if I assign a work to a particular programmer then in how many percent of the situation does he complete the job before time and what percentage of time he exceeds the time required for completing that particular program.

Now we may make the assumption that 90% of the time the job comes in time and ten percent is the delay but this assumption may not be correct and in reality that person may be only eighty percent good in delivering that on time jobs. So we may require trying out that in case we make an assumption of ninety percent on time delivery of components as against eighty percent what will be the total impact of this kind of outcome on the project. So we can use techniques like Monte Carlo analysis and make some assumptions about the probable distributions for each activity that we are performing.

I gave you an example; time required for completing a program or time required for testing a program or the number of bugs that you expect in say thousand lines of code, all of them could really depict some kind of a probability distribution and then based on this we can get a distribution of results that are likely to come, probable results with different or a particular thing. Once we have this situation in our hand we can use the simulation techniques for assessing the feasibility of the entire project schedule in case of adverse conditions.

Also, simulation will help you in preparing mitigation plans and continuance plans to phase the undesirable situations. So you can try out this particular situation and find out you whether you are well within your risk profile or not. So when you have done all these particular considerations right from sequencing to availability of resources trying out different alternatives, crashing of networks and fast tracking and leveling of resources and all that ultimately some kind of a schedule will come out for your project.

Now, after all these problems you would have sort of expected the schedule to run without any problems for the rest of the project’s life but that is not so. Changes are inevitable; changes to every aspect from the scope to quality to schedule and to many other particular things are inevitable. So you will find that during the life of a project

various aspects pertaining to schedule may change. Change in availability of resources is the simplest thing.

Take a simple example; if somebody promises to give you ten persons with java skills and ultimately you end up with getting three persons with experience and seven persons who are of fresh stream that is going to have a direct impact on your project schedule, you might have to do many things including for instance arranging some kind of training for these particular people, there are number of mistakes they make may be on the higher side and so on and so forth. So, from your particular point of view please remember the revisions will always happen.

If there are revisions to your schedule then that may change your critical path. If you change your critical path it may have a different impact on different aspects of schedule like resource requirement, the pattern that you might have chosen and many of the project decisions may have to be either reversed or totally differed or deviated or scraped or whatever. So, productive project team always stays on top of the changes and if they stay on top of the changes they are anticipating.

Remember, more the uncertainty more the need for planning can always say think before and not after. One of the quotes says “time is nothing planning is everything”. Think ahead, that is the point. So, if you keep on doing this then you will be able to take more informed decisions and make changes to your decisions when required. Now, making changes is only one part of the story. Communicating these changes to the stake holders who are affected by this particular kind of a change is very important. So you need to be sort of on top not only making the changes but conveying these particular changes to the concerned stake holders. We come to the last process the schedule control processes.

Schedule control processes is concerned with first, influencing the factors that create schedule changes. You would like to influence these factors in such a manner as to keep the number of changes to the minimum or a quantum of change as small as possible.

Secondly, determine that the schedule has changed and once you have made the changes to the schedule managing the actual changes as and when they occur in terms of them being properly, adequately brought into the plan and performed. So, influencing the factor, determining the schedule changes and making those particular changes and all the corresponding activities is what is achieved by the schedule control process. Schedule control activity must be integrated with the overall change control processes of the project.

Remember, we have a change control process in every knowledge area. For instance we have a scope change control, now we have schedule change control, we have a quality related change control, we have risk related change control, we have procurement related change control etc. All these change controls must be integrated in our lost knowledge area of project integration or integrated sort of change control process. So the integrated change control process incorporates change control subprocesses from the other eight areas.

When you are doing this schedule control you must give some reality checks. For instance, do not be a prey for unreasonable pressures from senior management and marketing department for making commitment to a schedule to which you cannot meet.

Specially the marketing people in their zest for getting others may go and make commitments which are not realistic, never hesitate to call a spade a spade. Get all the affected stake holders involved in preparing the schedule. It is not a theoretical schedule that you are preparing on a piece of paper but ultimately what is important is that this schedule works in practice.

How will you be sure that this particular schedule works in practice unless all the people who are affected by the schedule concur with the schedule?
So you must involve all the stake holders in preparing the schedule and obviously have their tacit acceptance of the realisticness of the schedule. Then prepare a detailed schedule and get the stake holders' approval where possible in writing, customers for instance. It would be a good idea on your part that the schedule is formally accepted by the customer. So getting the schedule done and getting it accepted is a totally different particular activity.

Schedule progress meetings with the stake holders periodically must take place. These particular meetings will take place at two levels, the minor particular thing is within the team then at the project level with the project manager and then with the top management and when required with the customer. So the progress meetings will highlight or bring out if there are any problems with the schedule and those particular problems must be taken care of and resolved. Always remember, do not spring any surprises at any of the stake holders. Do not pose fact to say that this particular thing will be delayed. Anticipate and say that this is likely to be delayed, how the conflict is to be resolved, let all the concerned people put their heads together and come out with the agreed modifications. So schedule control must be done.

Once you have done this particular modification to the schedule if at all then updating this schedule on all the files and computers etc is equally important. Agreeing on a schedule and not putting it onto writing and making the appropriate changes at different particular places will be of no use. So whenever you are doing this particular kind of a thing after completion of the activity the actual completion time should also be documented revisions to the schedule of incomplete activities if any should also be documented and once you have done this particular job then your schedule control can be somewhat in place. So remember, try to influence the changes that are kept to a minimum in quantity or at all, make sure that they are properly incorporated in the schedule and convert to all concerned people.

Now we come to the next particular part. What we do with all these complications going on of schedule being made then the resources being in scarcity and all that, and that is we need some help but where does the help come from and one of the simplest places to expect help is to have some kind of software support for project management. Obviously software support for project management is not restricted only for schedule management

it is also available for other knowledge areas but it has a particular use in schedule management.

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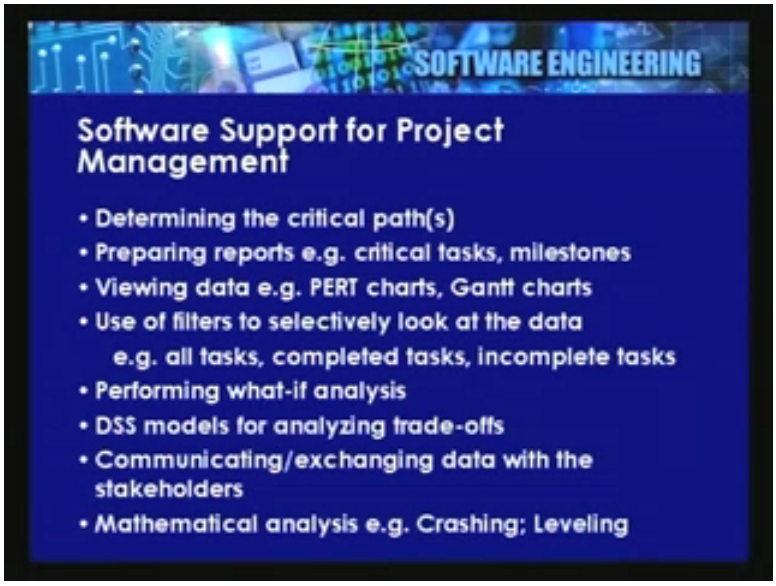

Now let us look at the slide. Typically what kind of assistance can we expect from software in our schedule management?
First and the foremost the software can very easily help you in determining the critical paths. An activity which will take you a very long time to do by hand especially the number of activities is large. Then preparing reports all kinds of reports are required, critical tasks, milestones PERT charts, today's task, start finishing which were supposed to start today and then start today and so on so you need to prepare reports. Then you need to view the data, you want to see on a display screen a PERT chart or Gantt chart of the schedule which shall be possible. If you use filters then you can selectively look at the data that you want.

For instance, you are interested in the resource required for doing the software design then you can hide the other things or you can look at the work of a software designer and as to his availability. So we can filter out the activities which we do not want. The software can also help you in doing "what if" analysis.

Similarly, a DSS module can be incorporated for analyzing different trade offs and you may also have some kind of warning system where if a particular activity gets delayed beyond a particular point then the machine would automatically warn you that there has been some delay. The machine can also be very useful for communicating and exchanging data with the stake holders and obviously for doing any other mathematical kind of an activity. To summarize now we can say that project time management process is aimed at making sure that the project does get completed on time. It consists of basically five subprocesses.

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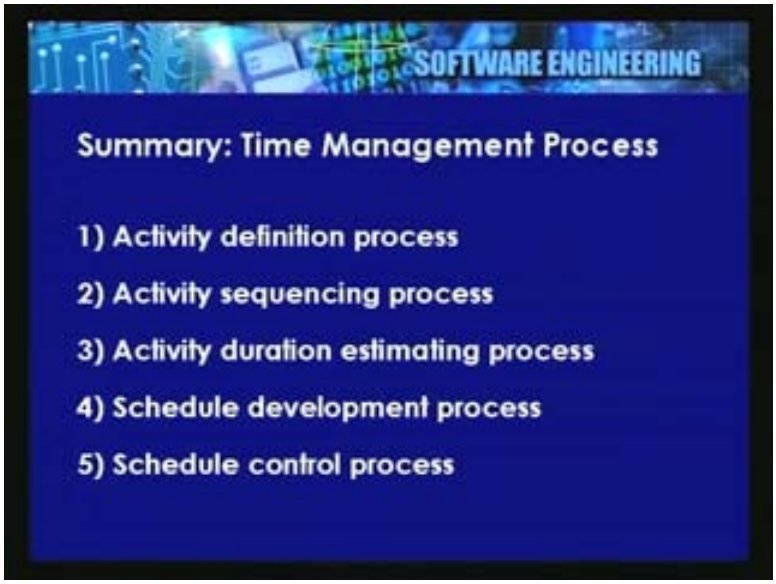

First is the activity definition process. In this particular process we identify the activities. In second process we sequence these particular activities, determine what is the precedence between the activities that is to be given, then here at this particular stage we have seen that we can use two types of networks PDM and ADM and depending on the appropriateness of these particular networks we can choose one to depict it. Then the individual activities need to be estimated for in terms of time.

We are going to see more about it in the subsequent topic on estimation but at this stage it is enough for us to say that individual activity needs to be estimated for the duration, time required for completing this particular job. Then we have a schedule development process.

Schedule development is different from sequencing in that it sort of looks at the availability of resources and availability of resources and the requirement of resources together put conveniently will give you a schedule development process. here we have seen that many times we need to make changes and you will need to do activities like fast tracking and crashing and simulation and basically the schedule development will be a iterative processes.

Last but not the least our usual background music that no schedule is going to be perfect, it will require changes for a variety of reasons and in case we have to make changes then the changes must be done in a controlled manner. If you look at the slide it will bring you to the end of our session on project time management process.