

How Integrated Micro Scheduling Can Save Your Project Management Initiative^{1, 2}

Dr. Dale S. Deardorff

Engineering Management, CSUN
MSEM, California State University – Tseng College
Northridge, California, USA

Abstract

Modern organizations strive to become more effective and efficient in Project Management activities during the challenges of virtual working situations and environments. Collaboration is disconnected due to the lack of face-to-face accountability and many times people resources do not know exactly what they are responsible for. Additionally, the focus of getting the right people, doing the right thing, at the right time becomes overwhelming due to poor initial project planning and scheduling. Negative risks occur and the possibility of capturing positive risks evaporate due to a lack of accurate schedule planning and forecasting.

Keywords: Integrated Micro Scheduling, Project Management, Project Management Initiatives, Project Effectiveness, Project Efficiency, Project Accountability, Project Collaboration.

Introduction

The purpose of this paper is to provide a framework of opinion, enlightenment and advanced academic learning based on the premise of project Integrated Micro Scheduling. The utilization of the Integrated Micro Scheduling tool can be used for clarity of critical or essential project task elements in addition to optimizing project process flow accuracy. This Integrated Micro Scheduling tool has been adapted to include additional elements of macro views without getting lost in project inch-stone and inch-pebble management.

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The positive elements of project communication are enhanced and optimized including personal accounting when we have an accurate analysis and picture of the current project status. The Project Management Triangle, used since the 1950's, is a questionable measurement of success because it is based on the premise that you can trade (optimize) one constraint to increase another. Unfortunately, as seen in Figure 1 below, many of the constraints are locked and cannot be modified.

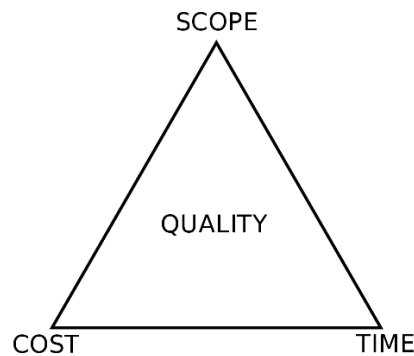


Figure 1: Project Management Triangle

So adjusting “Time” (Project Schedule) may not reduce the cost of the project. Conversely, adjusting the scope or quality of the project may not impact or change the “Time” required to complete and deliver a project. It is proposed that by getting the right people (resources), doing the right thing (scope), at the right time (schedule baseline) is the primary goal of a Project Manager. These are the basic measures of increasing the effectiveness and efficiency (et al. Zidane, 2016) of the project variables as published by a systems thinking perspective for a road construction megaproject. Typical Project Management views of a project schedule include but are not limited to Gantt Charts, Network Diagrams, PERT (Program Evaluation and Review Technique) Analysis and CPM (Critical Path Method). Each of these views illustrate a unique perspective of a project’s performance and current situation.

What the author is proposing is utilizing a technique referred to as Integrated Micro Scheduling. To begin the journey to understanding this technique, we will first require a valid operational definition:

“Integrated Micro Scheduling – a technique for planning, mapping and managing the key activities, tasks, and milestones on a project by graphically identifying the planned sequential project steps and adding baseline start and baseline end dates based on available resources. Additionally, the technique allows for the tracking of the project performance based on calculating an actual start and actual finish date in addition to the percent complete (Deardorff, 2020)”.

Now that we have a solid operational definition, we need to provide some historical context and a clear explanation of the concept of Integrated Micro Scheduling.

Integrated Micro Schedule

The philosophy of micro scheduling is described as planning out work activities or tasks in tiny blocks of time to create a dedicated work routine that prevents time from being wasted and allows you to hit “peak productivity” (K. Strick, 2019). For example, Microsoft founder Bill Gates and SpaceX Elon Musk break their daily focused tasks down into 5 min. chunks. Creating a hyper focus on the execution of project management activities require a tool that allows teams and members to see exactly where they are, at the current moment in time, and what tasks need to be completed to optimize schedule performance. A quick review of what needs to be completed would require the following:

- Write down the tasks and milestones
- Rank order the tasks in hierarchical order
- Establish the predecessor and successor connectivity
- Establish durations for each task and milestone
- Place Baseline Start and baseline finish dates in each cell

All of these activities can be integrated together into 3 “Phases” which can be called the Integrated Micro Scheduling. The simple 3 Phase flow is very powerful because it allows you to create a very simple graphical representation of a project’s status while at the same time integrating logic from multiple perspectives as seen in the Figure 2.

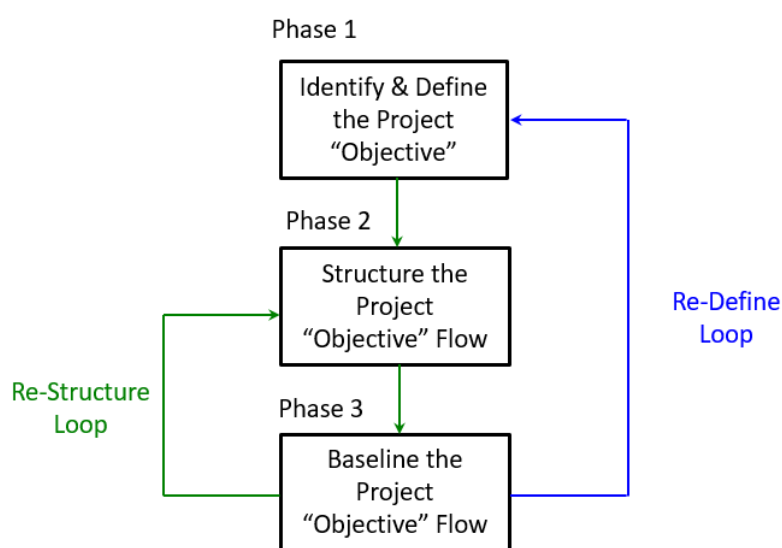


Figure 2: 3-Phase Integrated Micro Schedule Process Flow

Each of the three phases allows you to easily clarify a project objective so that you can ultimately create an accurate graphical representation to share with others. You will notice that there are two additional “Loop’s” in the process flow which allow you to re-define and re-structure the information if required. What makes the Integrated Micro Scheduling method different is that it does not break down every single nuanced detail that must be completed. It focuses only on the key essential or critical events and tasks required to meet the goal. It is a blended project performance view that is a combination of a Tracking Gantt chart, a Process Flow chart and an AON (Activity on Node) analysis. A sample of an Integrated Micro Schedule for a highly technical manufacturing process is illustrated in Figure 3.

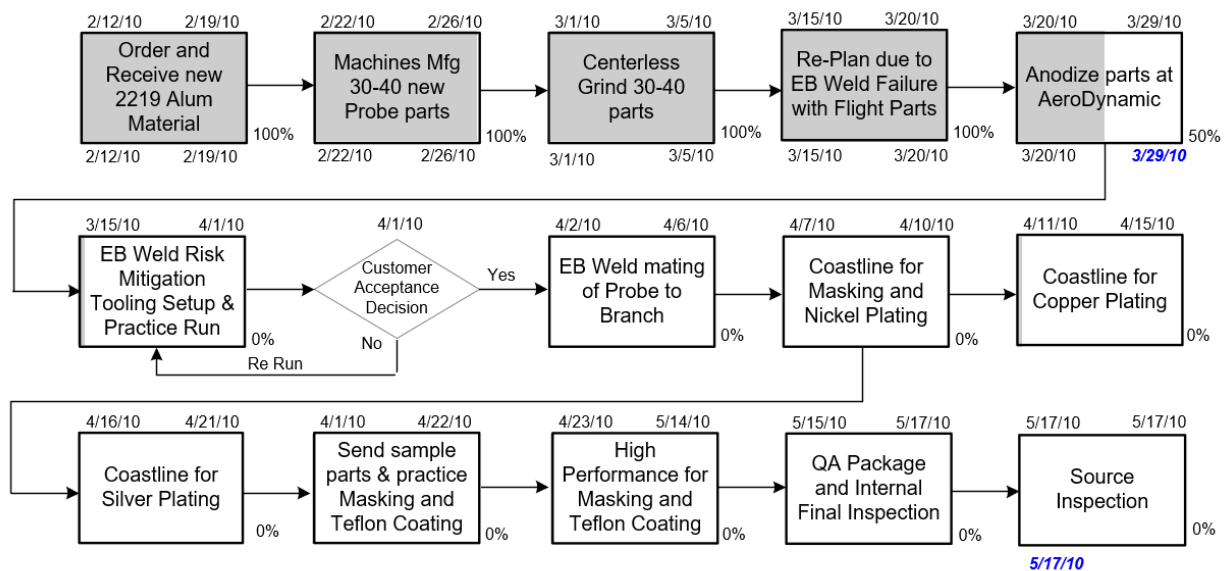


Figure 3: Manufacturing Integrated Micro Schedule

This Integrated Micro Schedule illustrates a complex task logic flow including an acceptance looping decision. The process flow shows the current status including baseline start and finish dates across the top of each element and actual start and finish dates along the bottom of each completed cell. The current cell in work shows a percent completed indication as a graphical shading and a numerical status. Ultimately, what the schedule indicates is that the project flow is on track to deliver on time and shows no current issues or problems.

Additionally, you can see that the decision loop is the only known risk illustrated and that you have not completed it. Because of this, there is a risk to project completion. Creating this level of detail requires input from many different stakeholders to be accurate. If you look at the baseline start and baseline finish dates provided across the top of the task elements, it allows you to predict the “forward pass” of an AON diagram which provides you an estimate of “project slack” or

project float. Project slack is the amount of time that a task can be delayed without affecting the deadlines of other subsequent tasks, or the end project delivery date. Each of the elements (tasks) identified in the chart represents a process step which must be completed in a hierarchy order with some type of precedence structure. For the Integrated Micro Scheduling tool, we minimize the predecessor/successor logic unless it is critical to moving forward in the process flow.

A start-to-finish logic is assumed unless otherwise diagrammed. Finally, the percentage complete for each task is graphically illustrated similar to a Tracking Gantt chart. As each task is completed, you mark it as 100% complete and take a gray progress marker and move it progressively across each cell to provide an indication of project task completion. This provides an instant snapshot of the project status in one view.

Let's walk through Step 1 of the first phase of the process as illustrated in Figure 4. with a very simple objective.

Phase 1

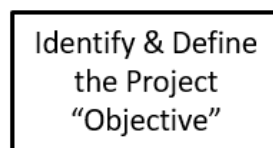


Figure 4: Phase 1 – Identify & Define the Project Objective

To start, you need to identify and define the project overall objective or milestone. We will create a very simple Integrated Micro Schedule for the objective of making a peanut butter and jelly sandwich. The abbreviated process of creating a peanut butter and jelly sandwich includes 7 essential steps:

- Step 1: Gather Ingredients for the sandwich.
- Step 2: Pull out knife to spread ingredients.
- Step 3: Pull out two slices of bread.
- Step 4: Open peanut butter and jelly containers.
- Step 5: Spread the peanut butter onto one slice of bread.
- Step 6: Spread the jelly onto the other slice of bread.
- Step 7: Combine the Two Slices.

If you documented or listed every possible thing that could be included as a task to make a peanut butter and jelly sandwich, it could be over 100 steps. This larger list could include the tasks associated with cleaning the work surface first, identifying which hand you are using to make the

sandwich, identifying the size of the spreadable amounts captured on the knife, the pattern for spreading, trimming the crust away from the bread, cutting the sandwich in half, identifying what to do with the knife when completed and how to hold the sandwich before placing it into your mouth. As you can see, the list of tasks associated with the objective must include only the essential elements.

Logic Flows

What we are illustrating with the use of the Integrated Micro Scheduling tool are “Logic Flows”. A logic flow is defined as a visual representation to gain a deeper understanding of business and personal tasks, processes and activities. Logic Flows evolved from Data flow diagrams (Yourdon, Coad, Gane, Sarson) which were popularized in the late 70’s using a system of symbols to represent external entities, processes and data stores and flows (connections). The book Structured Design (Yourdon, Constantine, 1975, Prentice Hall Inc, Upper Saddle River, NJ) illustrated this methodology and established a common language of standardized symbols, inputs, outputs and interactions.

The concept of a Logic Flow incorporates both a Physical Flow Diagram (PFD) and a Logical Flow Diagram (LFD) into a visual format. This visual format encompasses projects, business activities, information, systems and physical characteristics. The level of detail required in a logic flow should be enough to capture what is actionable as the current state. Understanding the elements of a logic flow allows you to understand business requirements and to communicate these to others. It can be used as a communication tool to explain “What” interactions and “How” activities need to be completed to non-technical people.

Another feature of a logic flow is the ability to model a new or proposed system creating a flowchart of logical interactions. A flowchart is a visual depiction of a sequence of events, tasks or activities in a process and was first used in the early 20th century to describe engineering and manufacturing processes and systems. Today, flowcharts are not only common but are essential to understand complex systems and system of systems.

Planting a Tree Integrated Micro Schedule

Let’s take this same approach to the “Project Objective” of planting a new tree and walk through the 3 phases to create an Integrated Micro Schedule. Let’s start again with *Phase 1 - Identify & Define the Project Objective*. We will create a list of 12 key tasks that are essential and required for us to “Plant a Tree”. Once completed, you will have a list of tasks similar to the list proposed below:

Step 1: Locate spot in the front yard to plant tree.

Step 2: Call Nursery and purchase the tree.

- Step 3: Get the tree delivered to the house driveway.
- Step 4: Dig a hole for the tree.
- Step 5: Prepare the tree for planting.
- Step 6: Put fertilizer in the hole.
- Step 7: Place mulch over the fertilizer.
- Step 8: Place the tree in the hole.
- Step 9: Cover planted tree with mulch and water tree.
- Step 10: Place grass from top of hole in trash.
- Step 11: Spread extra dirt in yard.
- Step 12: Put tools and hose away.

These are the 12 essential tasks we have identified to plant a tree. You could argue that there are additional tasks necessary or that some of these tasks are not essential to the list we created above. In general practice, you want to make sure your team is in agreement that this is an accurate list and that the tasks are in the right order. Using team member consensus to gain buy-in and personal accountability is very important. Now that we have agreement that there are twelve key tasks, we can move on to creating a template to hold the information.

Start with a blank sheet of paper and draw a series of 12 blocks as shown in the Figure 5 below:

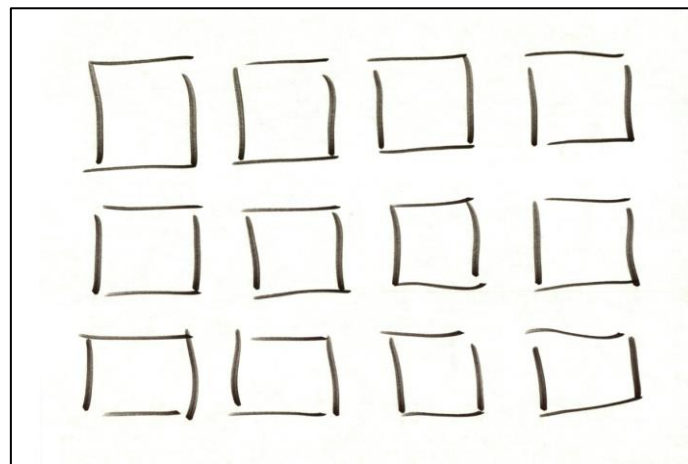


Figure 5: Blank Sheet with 12 Task Squares

The blocks you draw do not need to be perfect squares and can be placed in the approximate positions as shown above. You could also use Post-it Notes to create this proposed format. A Post-it Note is a small piece of paper with a re-adherable strip of glue on its back, made for temporarily attaching notes to documents and other surfaces. A low-tack pressure-sensitive adhesive allows the notes to be easily attached, removed and even re-posted elsewhere without leaving residue.

The next step is to use a marker and join the 12 squares together in a flow to represent the steps required to complete the objective of planting a tree. You simply draw a line between each of the blocks or post-it notes. We are establishing a connectedness logic to the 12 blocks along with an abbreviated predecessor and successor logic to each of the steps as seen in Figure 6 below:

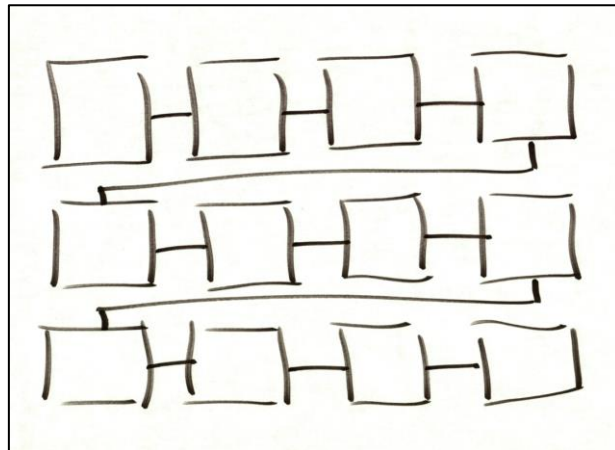


Figure 6: Blank Sheet with 12 Connected Task Squares

This simple format now becomes the structure for the 12 tasks. Write each separate task or sub-task into each of the squares. If you determine that you need another block and task, you can easily add it at any time. When completed, you will have a structured template that looks similar to the Figure 7 below:

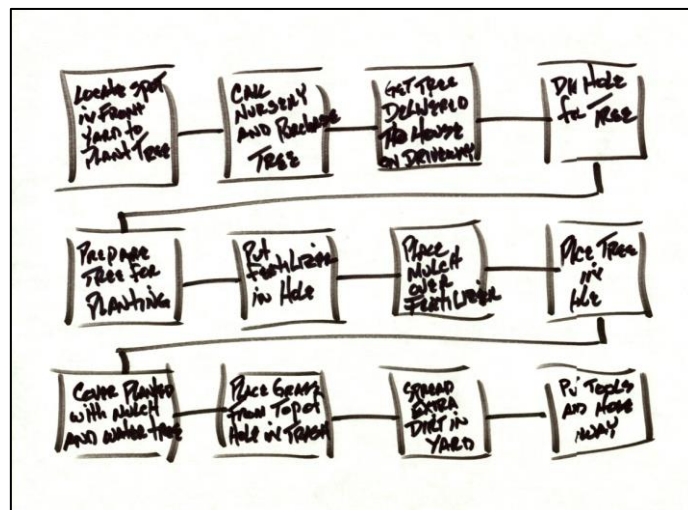


Figure 7: Sheet with 12 Tasks Described

The next step will be to determine how long each of the steps (tasks or sub-tasks) will take to establish realistic durations. If it is a 1-day task, you would simply write 1-day below the square. These can be broken down into hours, multiple hours, half days or multiple days.

Once that step is completed, you now know the rough duration for the tasks and the overall flow. Determine the day you want to start the project and create a flow by identifying the start and stop logic for each task. If you have a two-day task that starts on a Monday, you would write down a start day of Monday ending on Tuesday. This would mean that the next task cannot start until Wednesday as illustrated in Figure 8.

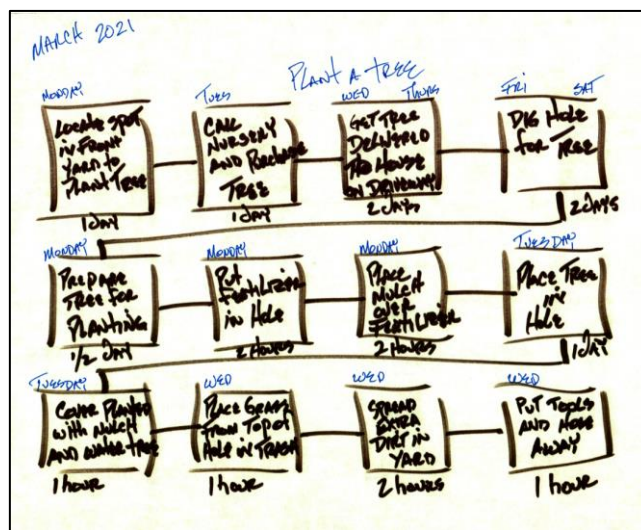


Figure 8: Sheet with Task Durations Identified

This is the point we use a team or additional people to verify that each task's duration estimate is accurate or correct utilizing team consensus. This may also mean that the logic may need to be changed to reflect a longer duration or shorter duration depending on the team's decision. What you have created up to this point is a very coarse project flow that can now be used to add additional schedule detail by utilizing a calendar or scheduling tool that will identify actual dates for starting and stopping the tasks. This is also the time to look for potential days that are holidays or non-working days due to your people resource's work schedules. If required, you could also break this flow structure down into multiple shifts for the same day. Ultimately, you will have a completed template structure that looks similar to the Figure 9.

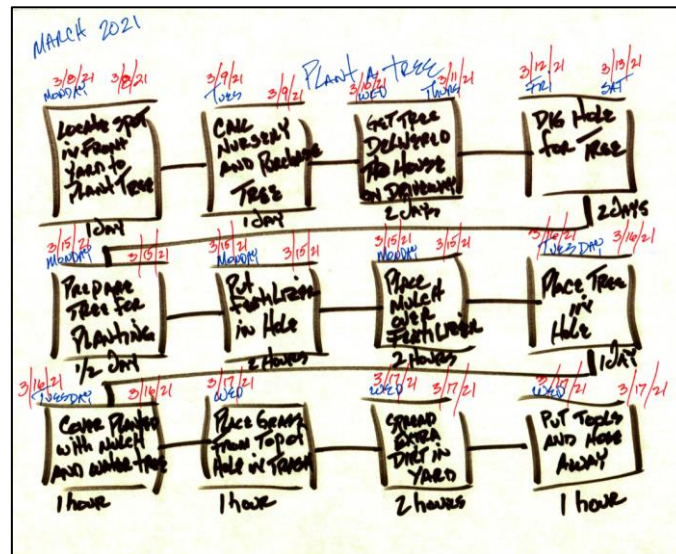


Figure 9: Sheet with Task Baseline Start and Baseline End Dates

This completes the basic template. The final step is to transfer all of the information and data from your marked up sheet into a hierarchical or sequential type of graphic organizer (Bromley, Irwin-Devitis, & Modlo, 1995). A graphic organizer is a learning tool that can be used to organize, clarify or simplify complex information or data. Additionally, they are described as visual representations to illustrate and organize knowledge or ideas. For our use, we are concentrating on using it as an advanced organizer of project task data in a simple modifiable repository.

This next step can be accomplished with any tool that allows you to create the final Integrated Micro Schedule representation. The tool we have used and finalized the illustrated information for this publication is the Microsoft VISIO diagramming application as seen in Figure 10.

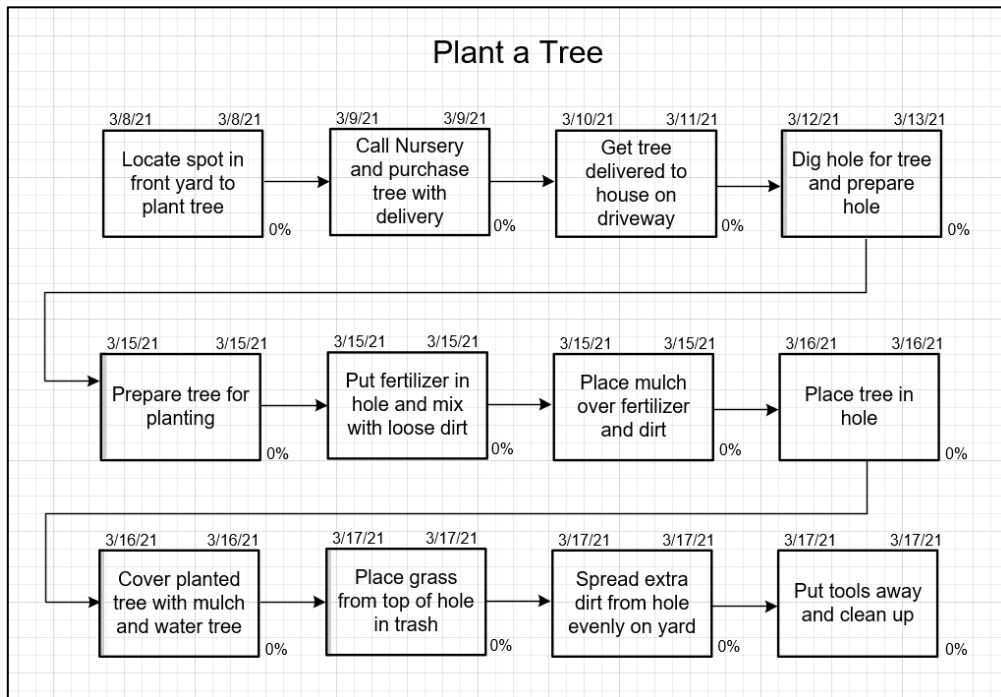


Figure 10: VISIO Template with Information Transferred

Now that you have transitioned the basic project information over to VISIO, you can update the baseline start (BS), and baseline finish (BF), actual start (AS), and actual finish (AF) dates along with a percent completed for each task as shown in Figure 11 below:

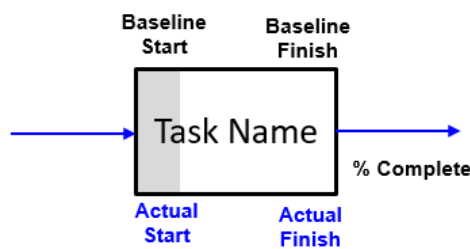


Figure 11: Integrated Micro Schedule Task Legend

In this step, you will also update the percent completed for each task by “dragging” a gray bar across the task cell and change the text on the right lower side to reflect the current percent completed status as seen in the final Figure 12.

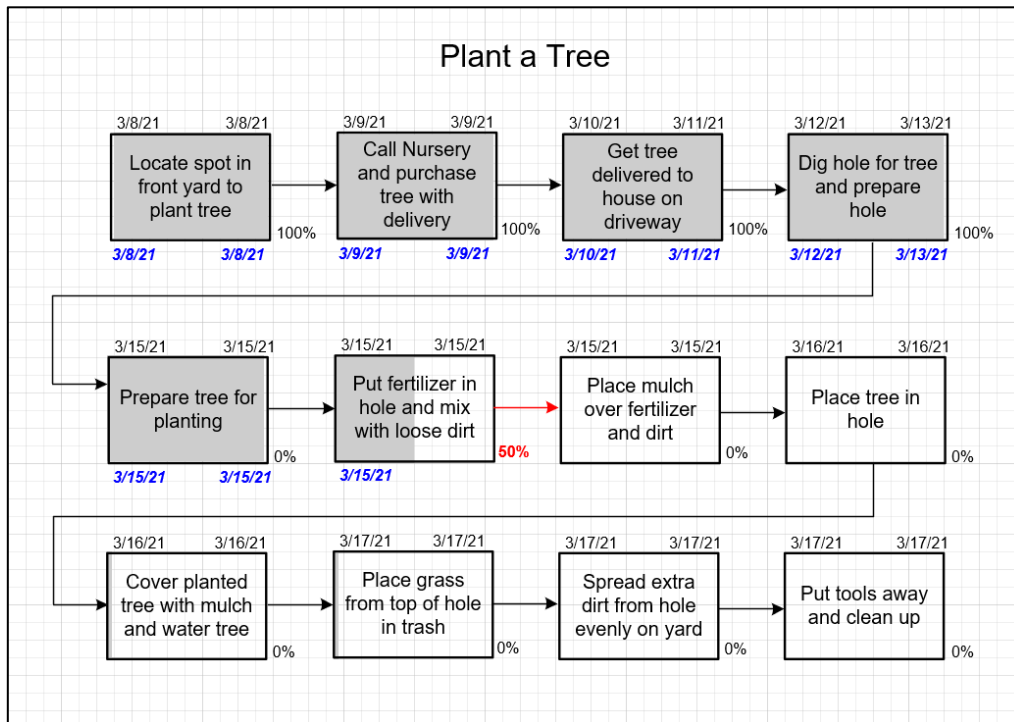


Figure 12: VISIO Template with Current Status and Actual Start and Finish Dates

This completed snapshot of the “Plant a Tree” project, after updating, can be used in a wall-walk or daily standup meeting to communicate with the team members and stakeholders. It can be easily cut and pasted into multiple media formats and sent electronically to share with others. As you track the projects status and update the information, you get a clear focus on where the problem areas and tasks are located.

In the example above, you can see there is a problem or issue with the task labeled “Put fertilizer in hole and mix with loose dirt”. What has happened is that this task cannot be completed because we ran out of fertilizer after we started to pour it into the hole. Unfortunately, we did not have any more fertilizer and we are now in a position where we must go to the nursery to get more fertilizer before we can resume the task.

To clearly articulate the current status, it may require you to create two additional views to track progress. The additional views necessary are a “Split View” and an “Expanded View.” If we use a “split view”, we can create a logic flow and clearly show what is happening as seen in Figure 13.

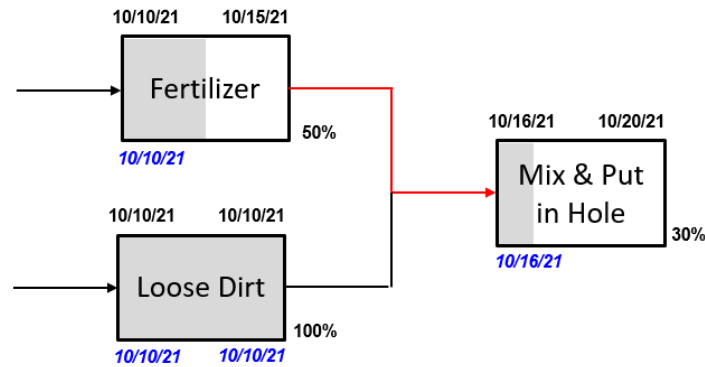


Figure 13: Plant a Tree Split View

The original view cell actually contained two (2) separate tasks that were broken apart. Task 1 (Fertilizer) and Task 2 (Loose Dirt) must both be completed to complete Task 3 (Mix & Put in Hole), but Task 3 (mix and put in hole) can be started separately and be partially completed. Unfortunately, this only describes a portion of the logic associated with what is happening and requires the use of an “Expanded View” to clearly articulate the problem we have encountered with the fertilizer. If we break the “Fertilizer” task apart, it will now require 5 additional tasks as seen in the Figure 14 below:

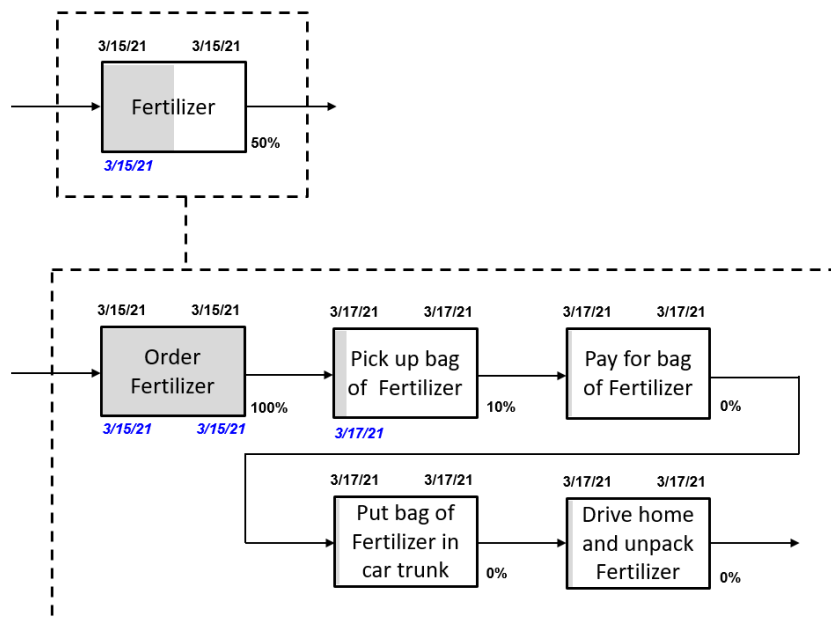


Figure 14: Fertilizer Expanded View

The use of the expanded view illustrates that you were able to order the required fertilizer, but it will not be available for pickup until 3/17/21. This is a 2-day slip to your original schedule. These additional views provide the visual logic and opportunity to fully focus on the new tasks required to complete the project.

Additional Flow Views

The basic views of flow we have illustrated previously are very simple or basic logic flows. In addition to those views, we are sometimes challenged to create logic views that express a more complex interconnected logical process flow. Many times these are at the area where we have a hand-off from one stakeholder group to another. These are also the same areas where communication clarity of tasks is critical to a project's success.

We have identified 6 additional Task flows to create additional clarity based upon the typical problems or issues that arise in a project. By adding the following additional task flows, you can increase or decrease the granularity of your focus:

- Merged Task Flow (Consolidation) [Figure 15]
- Split Task Flow (Clarification) [Figure 16]
- Yes or Repeat Until Task Flow (Conditional) [Figure 17]
- If-Then Decision Task Flow (Conditional) [Figure 18]
- Zoom In Task Flow (Refine Granularity) [Figure 19]
- Zoom Out Task Flow (Abstract Granularity) [Figure 20]

The following is a detailed explanation and a hypothetical example of each additional task flow. These task flows can be used as a quick tutorial for creating a complex Integrated Micro Schedule.

Merged Logic Flow

A Merged Logic flow (see Figure 15) is a consolidation logic flow based on the need to take 2 separate tasks and join them together because they need to be completed at the same time. The logic is that by joining the tasks together you create a clearer or more accurate representation of the required task (Task 3). This can be referred to as dual task performance to create a synchronous occurrence of a merged task flow. Additionally, it may require each of the separate tasks to move forward and/or backward by shifting them until completed.

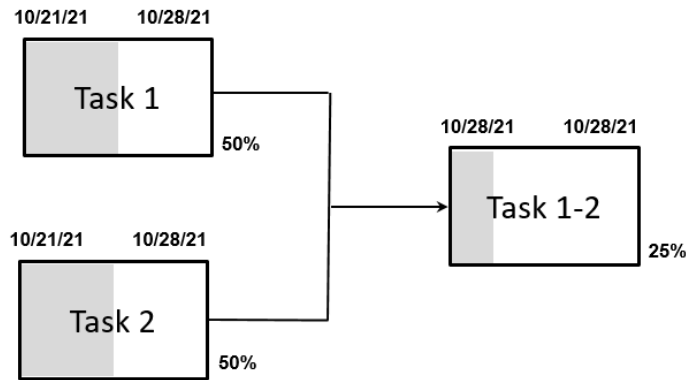


Figure 15: Merged Task Flow

A hypothetical example of this logic flow could be a situation where you are baking a cake. The recipe calls for a step for separately mixing the dry ingredients called Task 1 which were described as salt, sugar, yeast and flour. At the same time, there is a step for mixing the wet ingredients called Task 2 which were described as water, oil and eggs. In this situation it makes more sense to mix all of the ingredients together at the same time called Task 1-2. In this task, we will mix the dry ingredients and the wet ingredients at the same time rather than mixing them separately.

Split Logic Flow

A Split Logic flow is a clarification logic flow based on the need to break a single task into two separate tasks or subtasks. This situation may occur when you find that you cannot complete a task or task sequence and seem stalled. By splitting the original task into two separate tasks, you can see and focus on the required characteristics which may not have been seen previously. As seen in Figure 16, Task 1 was broken or split into two separate tasks (Task 2 and Task 3). These split tasks can have separate start and finish dates but do have the same predecessor logic from Task 1’s original logic.

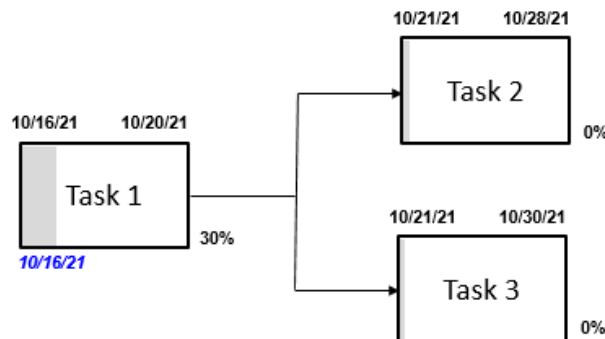


Figure 16: Split Task Flow

A hypothetical example of this logic flow could be a situation where Task 1 was described as getting your car serviced. After the mechanic starts working on your car, they tell you they can do the oil change, replace the fluids, wipers and filters. They also tell you that they can replace the tires on the car but that they cannot align the new tires and recommend that you have that portion of the task done by the local tire dealer. Therefore, you take Task 1 (i.e. Service Car) and break it down into two separate tasks. Task 2 is the oil change, replace the fluids, wipers and filters by your mechanic. Task 3 is the purchase of 4 new tires, balance and alignment at the local tire center.

Yes or Repeat Until Logic Flow

A Yes or Repeat Until Logic Flow is a conditional logic flow based on a single “Decision” being successfully completed before you can move forward. There is a single event that happens (Task 1) which leads to a “Decision” with two conditions. The first condition would be the “Yes” condition which allows you to move forward into Task 2. The “No” condition does not allow you to move forward, it forces you back to Task 1 where you would repeat it. This can be referred to as a gate that only allows you to move forward until you successfully meet the “Yes” condition or criteria of the decision as seen in Figure 17.

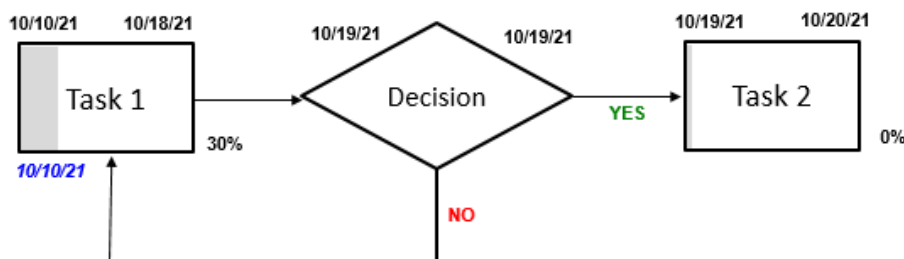


Figure 17: Yes or Repeat Until Task Flow

A hypothetical example of this logic flow could be a situation where Task 1 was to complete a training module. The decision block is a test to determine if you successfully understood the material by scoring a grade of “B” or better. If you did not score a “B” or better, you must repeat the training until you do.

If Then Logic Flows

These are referred to as conditional or hypothetical logic flows – if “X” then “Y”. This conditional premise is at the basis of any elementary logic philosophy and requires very little interpretation. The decision flow task illustrated below shows this philosophy and established the logic that there are only two different options based on a yes or no decision. The “Yes” condition, in the decision

flow, allows you to move forward to the Task 2 flow. The “No” condition, in the decision flow, allows you to move forward to the Task 3 flow as shown in Figure 18 below.

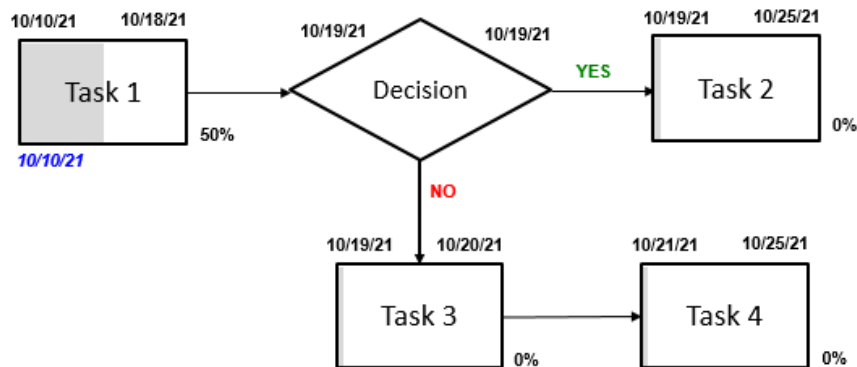


Figure 18: If-Then Task Flow

A hypothetical example of this logic flow could be a situation where Task 1 was to determine if you, a normal adult, have a fever by taking your temperature. The “Decision” task is to determine if you are running a fever over 102 degrees F. If you are running a fever over 102, you would move to Task 2 (take a fever reducer) and you would stay home. If you are not running a fever over 102 degrees, you would move on to Task 3 which could be to go to work. The 2 conditions available are to either take aspirin or go to work. You could create additional conditions in this flow to reflect a more complex situation.

Zoom In Logic Flow

A Zoom-In Logic flow is a refined granularity logic flow based on the need to see additional details or create additional task descriptions to understand the accurate flow. This may mean you break a single major task into sub-tasks to articulate the nuances of the flow. A hypothetical example of this logic flow could be the process for washing your hands. As you can see in Figure 19, our original task was to wash hands.

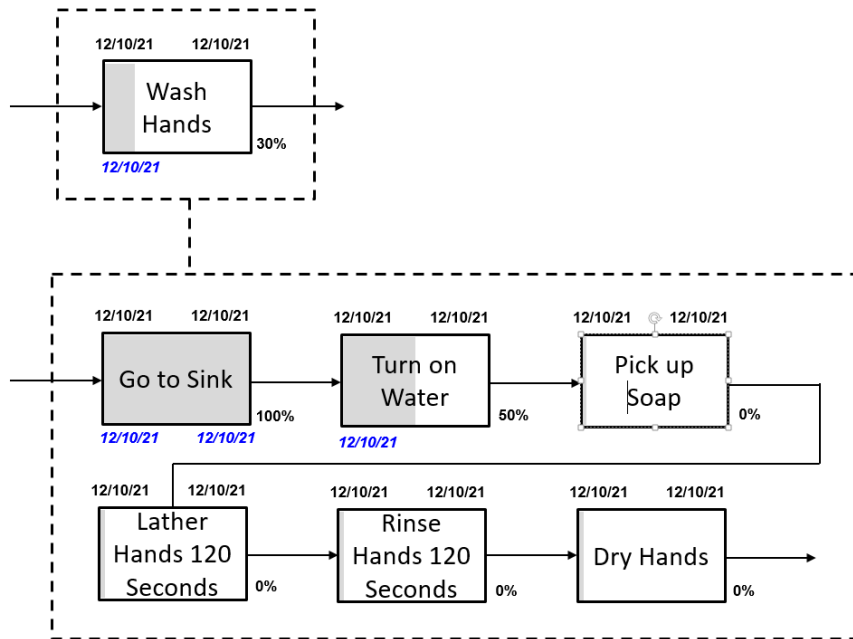


Figure 19: Zoom In Logic Flow (Expanded)

By using the Zoom In logic flow feature, we illustrate a higher fidelity of granularity in the original task. We are not adding new tasks to the original logic flow task but are providing additional clarity.

Zoom Out Logic Flow

A Zoom-out Logic flow is an abstraction granularity logic flow based on the need to remove seeing details or minimizing the steps in a task description to understand the accurate flow or the bigger picture. This may mean you join a series of task elements together by eliminating the detail of a series of sub-tasks into a major task to create an abstraction of the details of the flow. You are not merging the tasks together, you are minimizing the view of them. A hypothetical example of this logic flow could be the same original situation as previously described in the “Zoom In” feature, but in this “Zoom Out” example seen in Figure 20, we minimize our view of the logic flow.

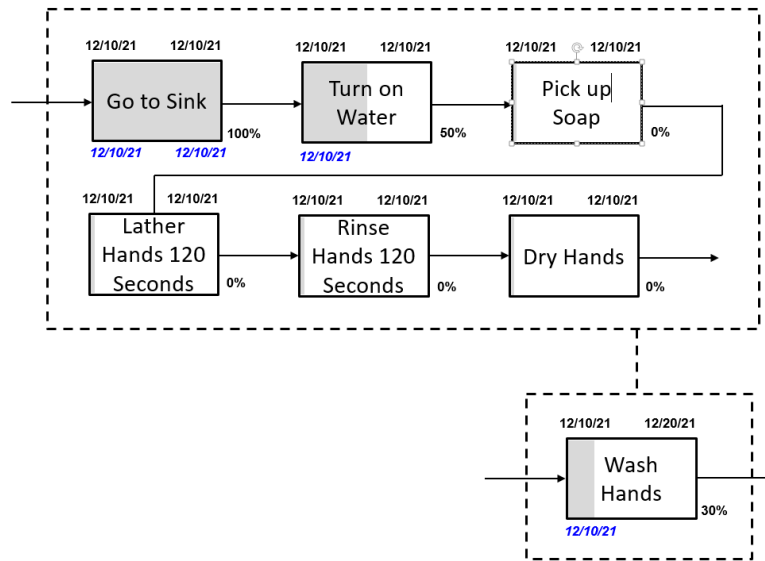


Figure 20: Zoom Out Logic Flow (Abstraction)

The original 6 task elements are collapsed into one single task that describes the detail necessary. This eliminates the situation where we are needlessly micro-managing tasks.

Conclusion

Project Managers have many challenges. One of the critical tasks they face is being able to communicate and share a project’s current position. The next challenge is to make sure that all people resources are focused on what they need to do now and then stay focused on the next tasks to complete. Utilizing a typical project Tracking Gantt chart allows you to see only a portion of the project performance. The project Network Diagram also has a limited ability when you’re trying to make sure you are helping your team move forward in a positive direction. But, utilizing an Integrated Micro Schedule tool provides you with a blended view of the required data and analytics available.

With an Integrated Micro Schedule, the project critical path can be immediately identified. The tasks can be expanded or additional sub tasks can be created to show finer task granularity. Additionally, the impact to the end delivery date and tasks associated with it are also easily visible. Tracking the baseline start and finish dates, along with the actual start and finish dates, provide you instant graphical analytics for determining whether your project is on, ahead, or behind schedule.

Each time the chart is updated, you get to track your project completion performance progress which lets you clearly communicate the logic of task flow to everyone involved or concerned. Any problems can be analyzed in an effective way therefore reducing cost and time. At the

completion of the project, it is very easy to create Lessons Learned based on the specific tasks where problem areas are defined incorrectly. Ultimately, using an Integrated Micro Schedule increases the process defining proficiency of your team and the members. This enhanced skill can be translated into the ability to conduct process mapping and compliance to process standardization and documentation.

The ability to visualize the “current state,” by creating the as-is view, is imperative for decreasing inefficiencies and optimizing task ownership and accountability. Finally, the Integrated Micro Schedule can be used for creating a value chain analysis of a product flow. This will allow you to identify areas or processes that need to be improved and brings to light areas that are non-value added or customer pain points to your overall objective flow.

Finally, the Integrated Micro Scheduling chart can be immediately implemented into Daily Scrum, Daily Huddle, Lean/Agile Stand Up’s or Morning Role Call meetings. By publishing the current Integrated Micro Schedule in a real-time dashboard, you can optimize the actions and performance of your project teams. The information contained in the Integrated Micro Schedule can seamlessly be visually presented in operational, strategic or analytical interactive dashboards to feed KPI’s and Business Balanced Scorecard measurements.

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About the Author



Dr. Dale S. Deardorff

California, USA



Dr. Dale S. Deardorff worked for Boeing Integrated Defense Systems and Space Propulsion Development divisions as a Project and Program manager for over 20 years. He worked for the Lockheed Burbank “Skunk” works and Aircraft division for almost 10 years and a high technology Valencia California start up for a couple of years. This 30 plus years’ experience is a “Pracademic” blending of commercial, military, government, NASA and high technology organizations. Dale has taught Project Management “on-line” for multiple universities as an adjunct instructor since 2003 and continues to contribute to project management methodologies and philosophies as a current thought leader.

He created the Rocky Peak Leadership Center in 2010 and has helped modern organizations as an enterprise and executive consultant in the areas of thinking methodologies, Innovation and leadership training and facilitation. Dr. Deardorff volunteers with youth leadership programs and supports local youth training in the areas of personal mastery and effective collaboration techniques.

Rocky Peak Leadership Center – www.rockypeakLC.com

Dale S Deardorff contact – d.s.deardorff@gmail.com