Project Management Software
GanttProject for Beginners
Compiled for GanttProject version 2.8.8

Choose (click on) any option below that meets your current need.
Afterwards, scroll back to the top (here) to pick another option.
Maybe you should glance at the Introduction first. It's not long.

Contents

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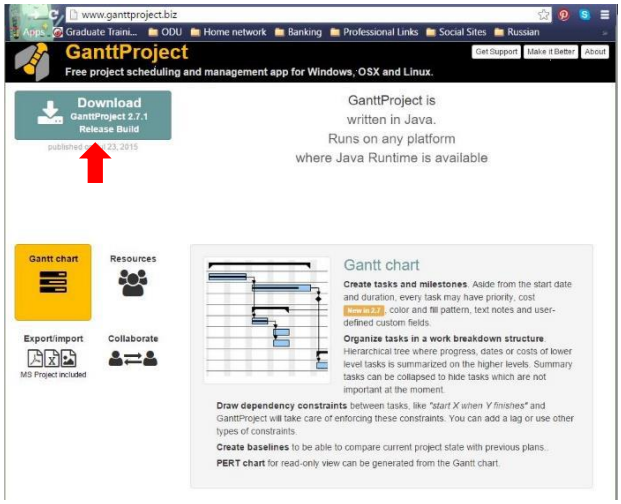
Source: http://www.kvens001.students.digitalodu.com/wp-content/uploads/2015/10/ENGL-334_Project-2_GP-Quick-Guide_KVensland.pdf

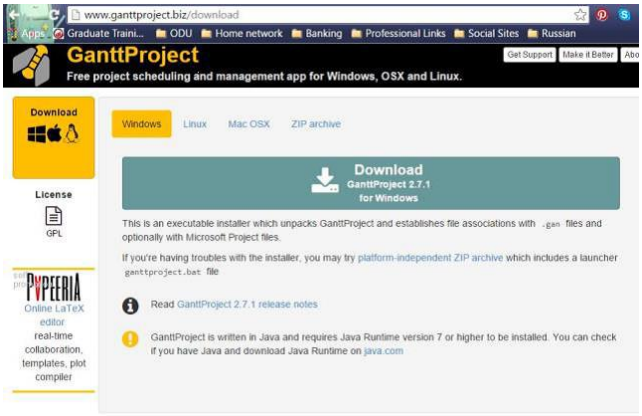
GanttProject: Start Guide

Create a Gantt chart to plan and monitor a schedule and its resources

Before You Start
You will first need to install GanttProject. To begin, use your web browser to navigate to http://www.ganttproject.biz



Then you will need to download and install GanttProject ver. 2.8.7 or later. To do this, click on the *download* icon in the upper left corner of the page.

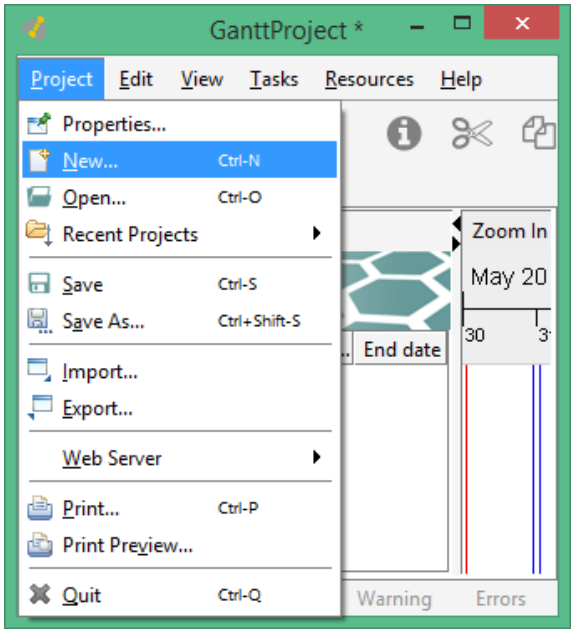


1. Choose *Free download*
2. Choose *Download GanttProject*
3. Choose *Windows* (on the left of webpage)
4. Choose *Download* (yes, again)
5. *Run* the downloaded file

If the program does not open once installed make sure you have updated Java Runtime installed on your computer. You may also find links to help with this at the following web address: http://www.ganttproject.biz/discuss

Step 1
Launch the program by clicking on the newly installed GanttProject icon on the desktop.

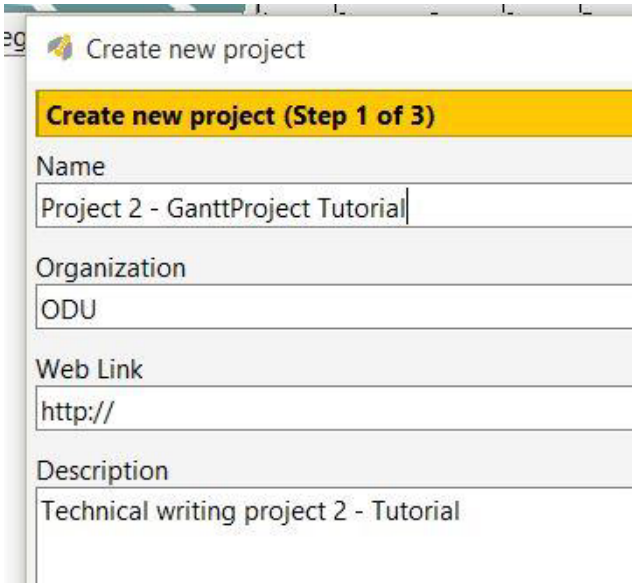
Permit Java to update if need be.

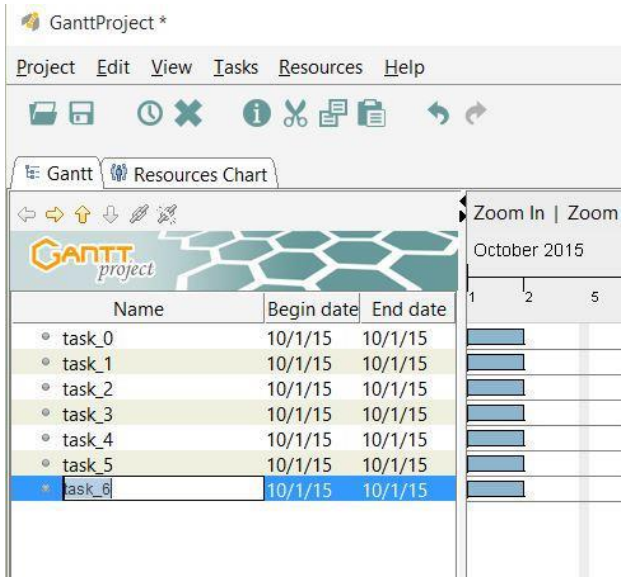


Then, in the menubar, click ***Project > New*** to open a *Create new project* window.

Step 2
Type the name of your project. At this time you may also elect to type in the name of your organization, a web link, and a description.

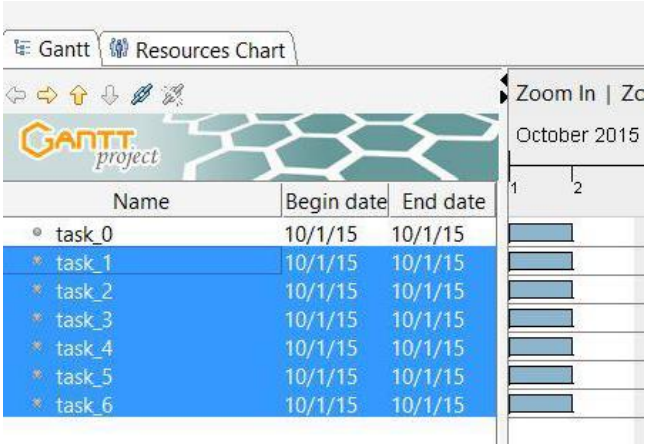
Then select (click on) *Ok*.

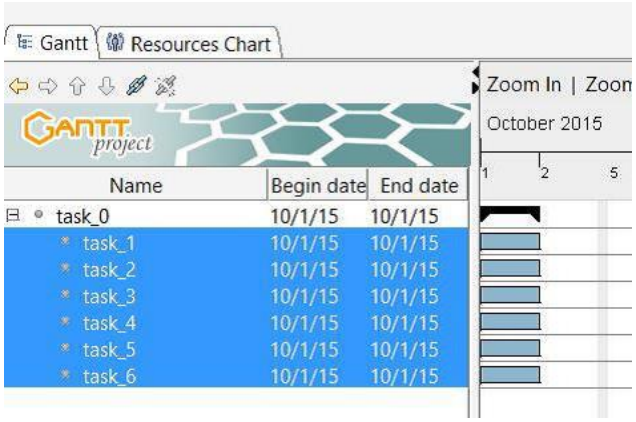




Step 3
Determine how many tasks in your project list (7). From the menubar, choose ***Tasks > New task*** for each task you expect to add. (Or else, in the toolbar, click ***New Task*** or right-click on the table space and choose ***New Task***.)

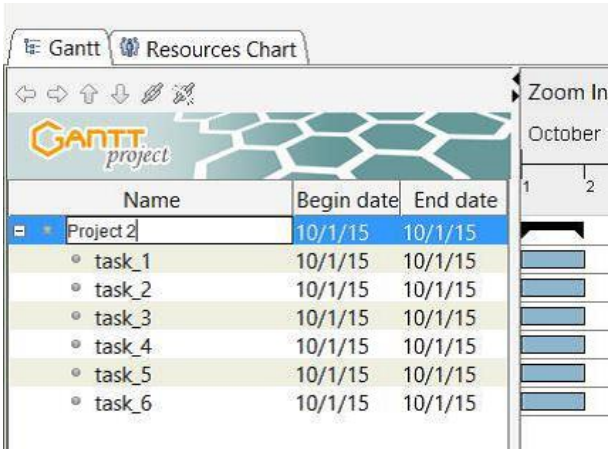
Step 4
Highlight all of the tasks below task_0:
First click on Task_1. Then hold down “Shift” and click on the last task.

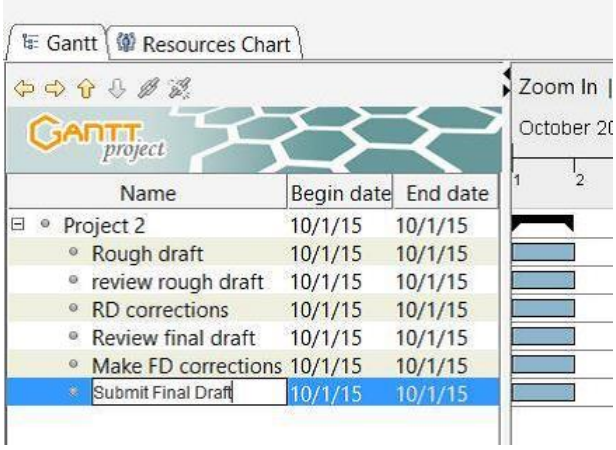




Step 5
Right click the highlighted area with your mouse pointer and then click on *Indent*. All the task names except task_0 will be indented.

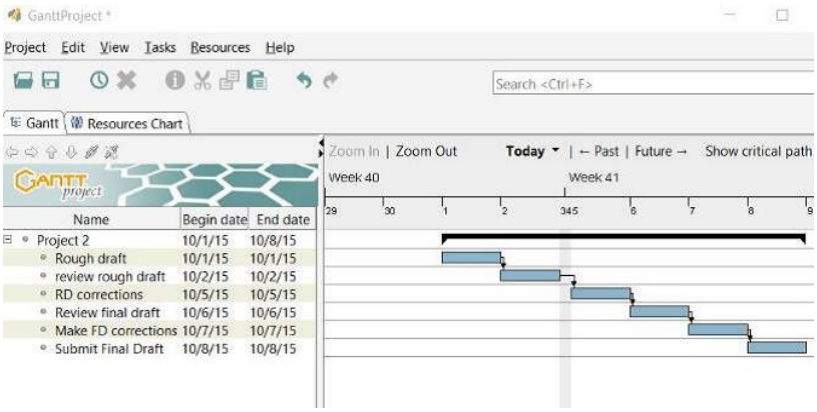
Step 6
Double click on the term *task_0* so that it becomes editable. Then rename task_0 with the project name (*Project 2*). Press [Enter]

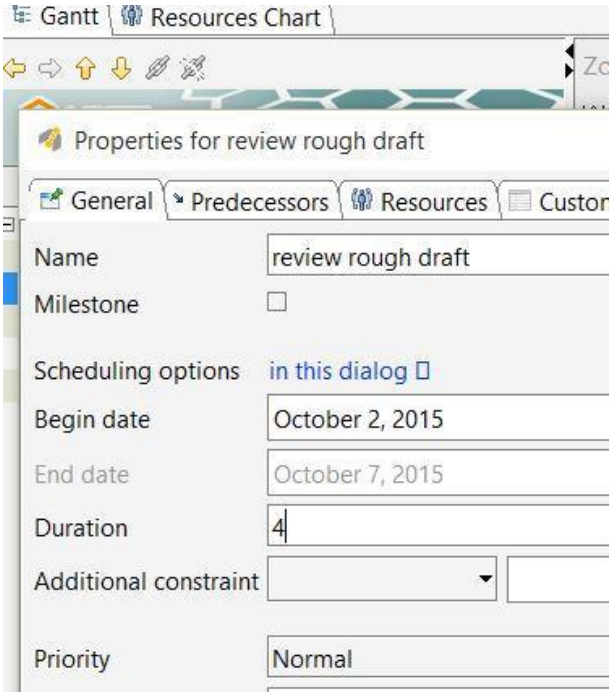




Step 7
Double click on each task name in turn and rename it with a description of the task. See all the descriptions at left.

Step 8
Task bars are the long grey rectangles to the right of each task name. Click and drag from each task bar to the one below, creating a black arrow from the upper bar to the task below. This shows the start of a following task to be dependent upon the completion of its preceding task.



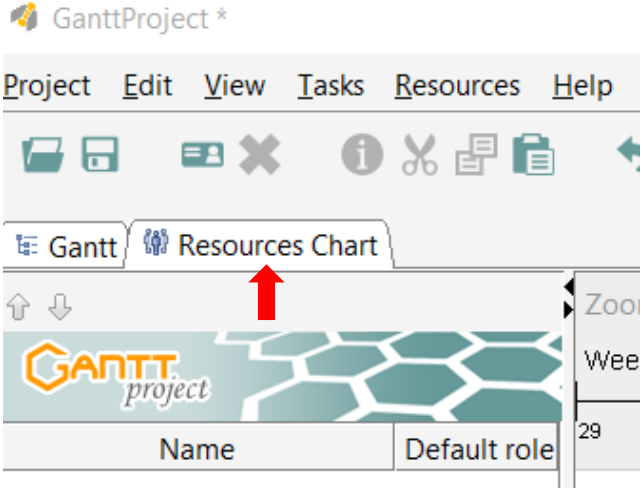


Step 9
Right-click on a task and click *Task properties…* to open a *Properties* dialog box, then estimate and type the duration (time needed to complete the task).

Click *Ok* to close the box.

Do this for each indented task. Use small numbers.

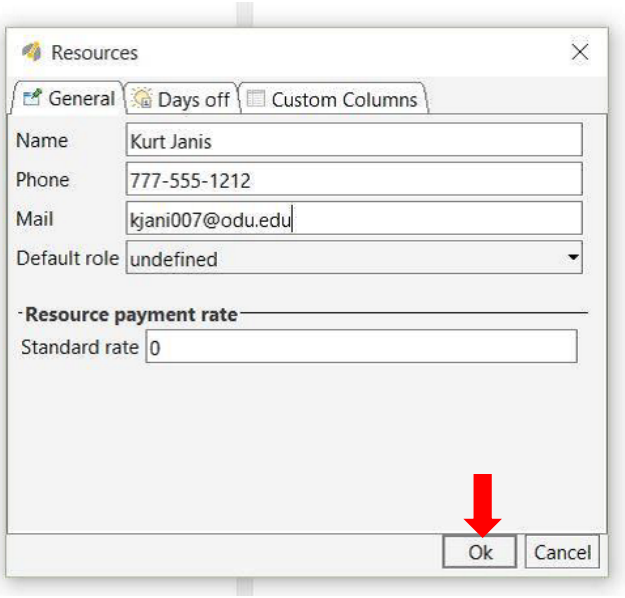
Step 10
Select (click on) the *Resources Chart* tab.

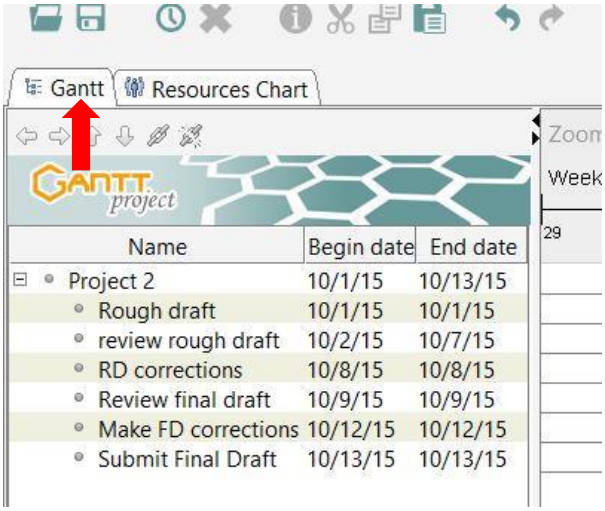


Step 11

On the menubar, click ***Resources > New Resource*** to open a dialog box. Enter the resource name and any additional information of your choice. Then select the *Ok* button to close the dialog box.

Repeat for three additional resources. Make up your own details.



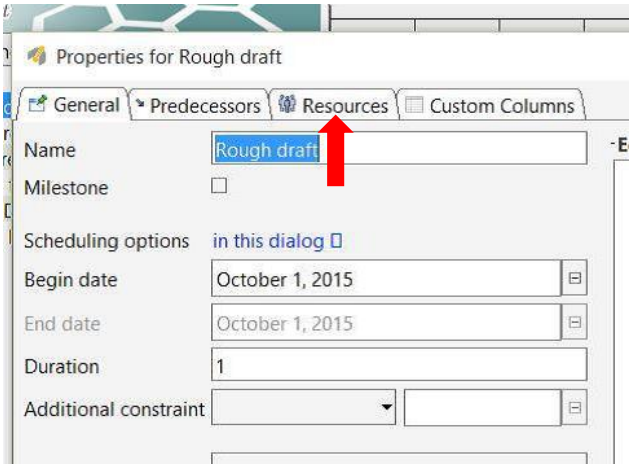


Step 12

If need be, select the *Gantt* tab to get back to the task list.

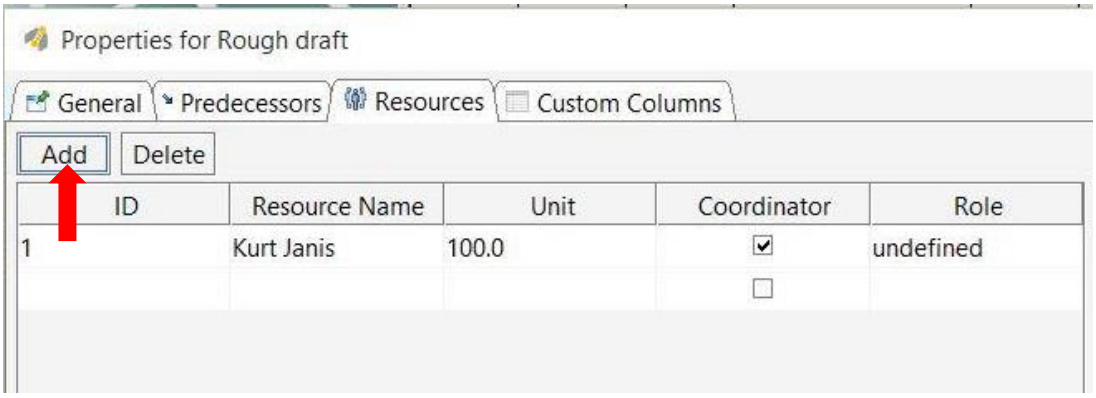
Step 13

Now on the *Gantt* tab, right-click a task and choose *Task Properties*… to open the *Properties* dialog box. In the dialog box, select the *Resources* tab.

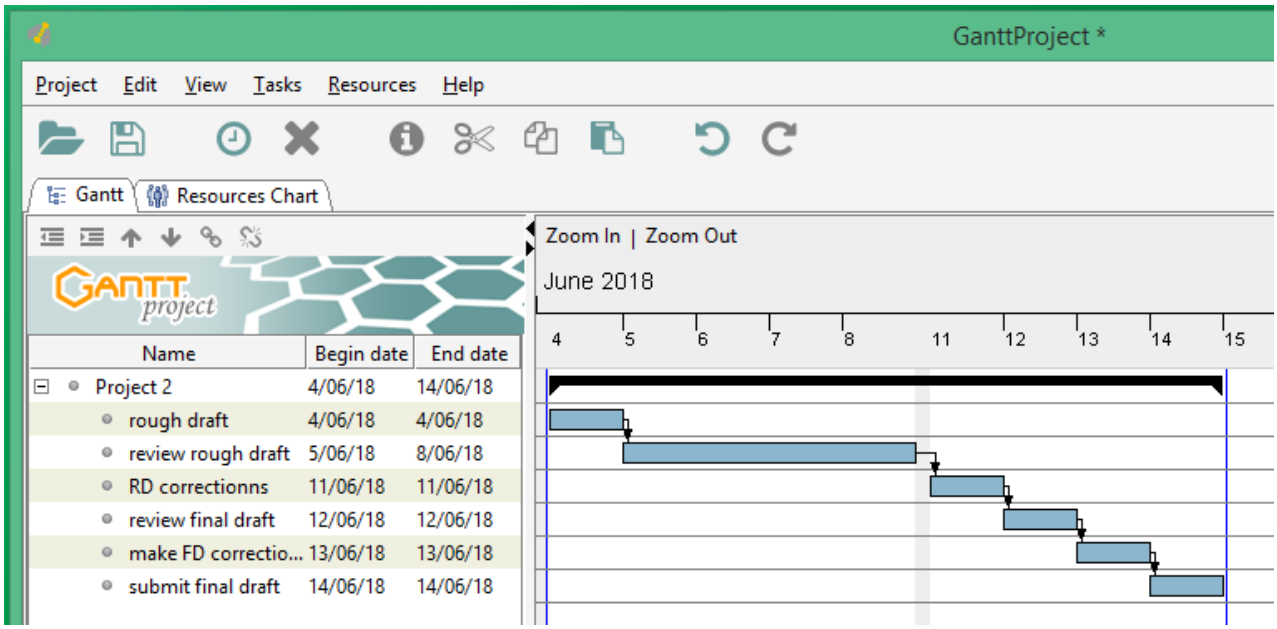


Step 14

Click the *Add* button and use the drop down list to assign a resource to this task. Select the *Ok* button to close the dialog box. Add resources for all of your tasks.



Congratulations!
You have created and populated a Gantt chart
to plan and track the progress of the project

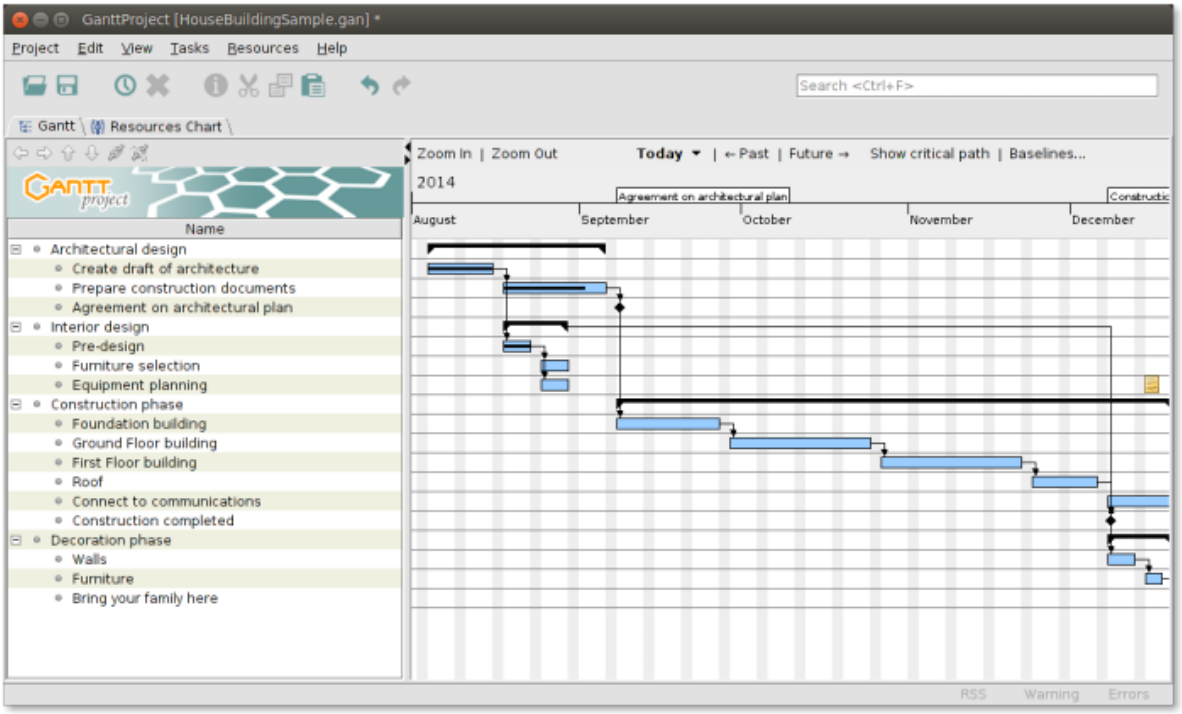


Based on *ENGL-334_Project-2_GP-Quick-Guide_KVensland.pdf* by Kent Vensland

From: https://project-management.com/top-5-open-source-project-management-tools/

GanttProject: Review

Developed in Java as a compact, high-performance Project Management tool, GanttProject strictly follows MS Windows' look and feel. It has limited function features, which works to its advantage because it incorporates features of *MS Project* but with a focus on features having maximum use.



Features

Gantt Project is GPL open source software that offers project scheduling as its main function. Working on a desktop-client architecture, this file based project management tool allows not just scheduling of tasks, but resource management as well, through resource load charts. It supports MS Project, PDF, CSV and HTML file types.

Technical Requirements

Supported by Windows, Mac OS and UNIX / Linux systems and available in 30 languages

Advantages

- Excellent and easy to use with a great user interface
- Simplified MS Gantt-chart 'drawing' features
- Allows great scope for Baselining
- A great number of reporting options
- Data exchange is seamless across spreadsheet applications

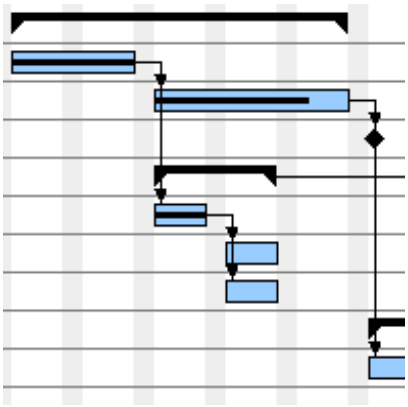
Disadvantages

- The main feature that one would want to add is a clear feature for resource levelling and critical path visualization, but this is an additional level of complexity.

From: http://www.ganttproject.biz/

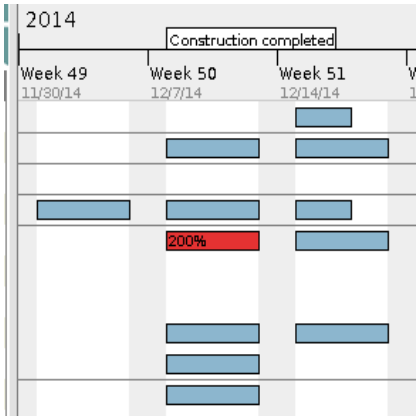
GanttProject: Website snippets

Gantt chart



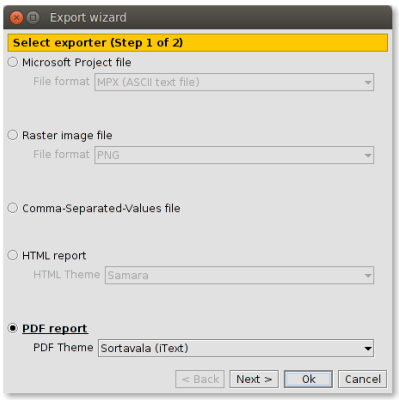
- **Create tasks and milestones**. Aside from the Begin date and duration, every task may have priority, cost, colour and fill pattern, text notes and user-defined custom fields.
- **Organize tasks in a work breakdown structure (WBS)**. Hierarchical tree where progress, dates or costs of lower level tasks is summarized on the higher levels. Summary tasks can be collapsed to hide tasks which are not important at the moment.
- **Draw dependency constraints** between tasks, like *"start X when Y finishes"* and GanttProject will take care of enforcing these constraints. You can add a lag (delay) or use other types of constraints.
- **Create baselines** to be able to compare current project state with previous plans.
- **PERT chart** for read-only view can be generated from the Gantt chart.

Resource chart



- **Create human resources** with the basic contact information, payment rate and role.
- **Assign resources** to work on tasks with different roles and assignment units.
- **Monitor task assignments** and see when some resource gets overloaded or is sitting without work.

Export



- **Generate a PDF report** with a summary, required task and resource information and vector chart images
- **PNG/JPEG images** can be generated from individual charts and printed
- **Export to CSV** to analyse your data in spreadsheet apps. Import from CSV is also supported
- **Microsoft Project** import and export, as smooth as possible
- **Project calendar import** from iCalendar format

Collaboration

- **Use WebDAV servers** with locks support for concurrent work on the same project.
- **Use cloud storage** providers which can mount your cloud disk to your local file system for storing your projects in the cloud
- **On the local network** GanttProject will do its best to prevent concurrent writes

From: https://docs.ganttproject.biz/releases/

GanttProject: Release notes

Headlines (ver.2.8.7)

The major new feature is actually a pretty old one which has been made to work. We had a so called "additional constraint" called *early begin* in task properties for years, and its meaning was pretty vague, mostly because this constraint didn't work.

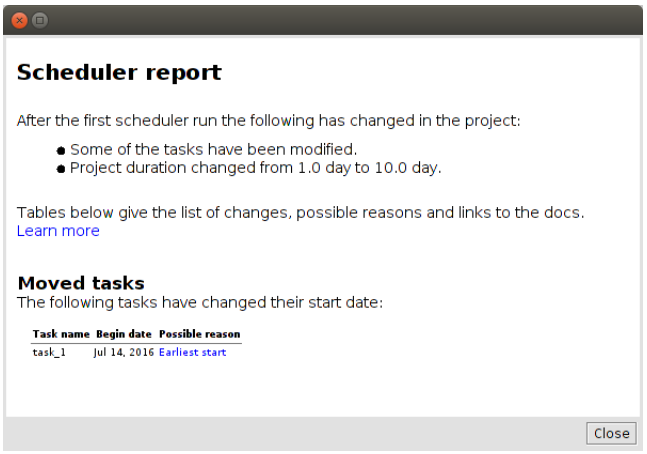
As of version 2.8 this constraint now works and it has clear semantics: a task with an early Begin constraint set to some date X will be scheduled to start no earlier than X and as close to X as possible, provided that other constraints permit that.

The obvious use of this constraint is to set the earliest date when a task can start. For instance, if task begin date was set on July 5 then changing its earliest start constraint to July 14 will move task to the future.

However, there is another use case which is now possible: you can use it as "planned start date", as opposed to the real start date set by the scheduler. If task had initially start date and earliest start constraint set to July 14, and was moved to some later date because of finish-start dependencies on other tasks then removing the dependencies will move the task back to July 14.

Scheduler Audit and Report

Since the Early Begin constraint is now enforced, older projects where it was set and probably forgotten may be affected. When opening older projects GanttProject audits the first run of the scheduler and reports the results to user if at least one task changes its dates after the first run. Scheduler Report looks as shown:



If your project is fine and the scheduler has made no changes, you'll see no report. Otherwise the report shows up a couple of seconds after file has been opened and you need to inspect the changes made by the scheduler.

Other changes

Maintenance updates fixed most of High-DPI compatibility issues and added a new feature: sorting of tasks by begin/end dates

Compatibility

File format has slightly changed: we removed redundant information about the configuration columns shown in the task table. Files produced by GanttProject 2.7 should open fine in GanttProject 2.8. Files produced by GanttProject 2.8 can be opened in GanttProject 2.7, except that only Name, Begin date and End date columns will be shown in the task table by default, no matter what is written in the project file.

System requirements

- Any reasonably modern computer with reasonably modern OS capable of running Java applications is fine for running GanttProject.
- We recommend using Java 8 for running GanttProject, but Java 7 is also fine.
- Android and iOS are not supported.
- You may have issues when running GanttProject on systems with high-density displays.

From: https://docs.ganttproject.biz/user/scheduler/index.html

GanttProject: Scheduler explained

Note: This article explains various aspects of task scheduling in GanttProject which may (or may not) affect task start dates.

The scheduling algorithm in GanttProject, referred hereafter as **the Scheduler**, takes decisions on task start dates taking into account various constraints, with the ultimate goal to make the duration of the whole project as short as possible. The Scheduler continuously runs after every change in the project and updates tasks appropriately.

The Scheduler tries to be logical and unobtrusive, however it may move some tasks or may reject your updates to the task schedule and it is important to understand its decisions.

Simple unconstrained task
A simple task which is created by default with the *Task.New* task action is scheduled to the date set by the user. Default date is the start of the timeframe which is currently shown on the chart. You can change the start date using task table or task properties dialog and you can choose any date as the start date, with the only exception that you can't by default schedule a task on a weekend or holiday.

***Earliest begin* constraint**
A task which has non-empty constraint **Earliest begin** can't be started earlier than the date specified in the constraint and will be scheduled as close to that date as possible. It may start later than that date if other constraints decide so. However if there are no other constraints, the Scheduler will force the task to start at the specified **Earliest begin** date.

Note: **New in GanttProject 2.8**. Earliest begin constraint existed but was mostly ignored until GanttProject 2.8 release. In GanttProject 2.8, however, it was fixed, and this change may affect older projects.

Summary task
A task which groups one or more other tasks is called a **Summary task** or **Supertask**. Provided that there are no other constraints, the Begin date, End date and duration of a summary task are calculated from the dates of its child tasks. The duration of a summary task is always the difference between the earliest start and latest end of its child tasks.

Note: **New in GanttProject 2.8**. Prior to GanttProject 2.8 scheduling properties of summary tasks were technically editable in the UI, despite that any edits would be immediately reverted by the Scheduler. In GanttProject 2.8 start/end dates and duration of summary tasks are not editable anymore.

Dependency constraints
You can create links, or dependencies, between tasks and the Scheduler will take them into account. The simplest and most frequently used dependency is *Finish-Start* dependency which says that successor task can't start earlier than predecessor task finishes. In some cases though, the successor task may start a few days later. Other constraints are: Finish-Finish, Start-Start and Start-Finish.

In general a constraint written in the form <PredecessorDoesThis>-<SuccessorDoesThat> reads as:

In the absence of other constraints:
date when SuccessorDoesThat minus date when PredecessorDoesThis = lag time.

When Scheduler considers some task, it scans through all dependencies where that task plays the role of successor and chooses the earliest start date which satisfies all dependency constraints.

Lag (delay) time
The default value is 0, which can be changed to both positive and negative values, so that, for example, you can have a task which starts one day before its predecessor ends.

Hardness
Hardness is actually equality or inequality comparison in the formula above. Strong hardness is equivalent to **=** while rubber is equivalent to **>=**. In practice it means that, for rubber dependencies, lag between successor and predecessor is allowed to grow bigger than the specified lag (delay) value, e.g. when the predecessor moves backwards in time, successor will stay where it is, other constraints permitting.

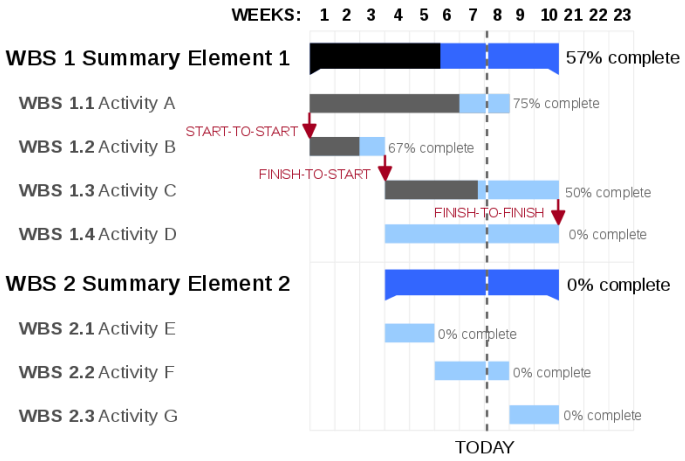
Summary task as successor
When a summary task itself has a dependency and plays the role of successor, the Scheduler creates implicit dependencies of the same type and with the same properties to all its child tasks. This may have consequences which look pretty natural when seen, but which are not exposed. If we consider Finish-Start dependency where successor is a summary task then no child of that task can start earlier than predecessor finishes, and any changes in the child task dates which violate this will be rejected. However, from user perspective it may look as if GanttProject rejects moving a task to an earlier start date for no reason.

From: https://en.wikipedia.org/wiki/Gantt_chart

Gantt chart

From Wikipedia, the free encyclopedia

A **Gantt chart** is a type of bar chart that illustrates a project schedule. Modern Gantt charts also show the dependency relationships between activities and current schedule status.



A Gantt chart showing three kinds of schedule dependencies (in red) and percent complete indications.

Definition

A Gantt chart is a type of bar chart that illustrates a project schedule. This chart lists the tasks to be performed on the vertical axis, and time intervals on the horizontal axis. The lengths of the horizontal bars in the graph show the duration of each activity. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. Terminal elements and summary elements constitute the work breakdown structure of the project. Modern Gantt charts also show the dependency (i.e., precedence network) relationships between activities. Gantt charts can be used to show current schedule status using percent-complete shadings and a vertical "TODAY" line, as shown above.

Gantt charts are usually created initially using an *early start time approach*, where each task is scheduled to start immediately when its prerequisites are complete. This method maximizes the float time available for all tasks.

Historical development

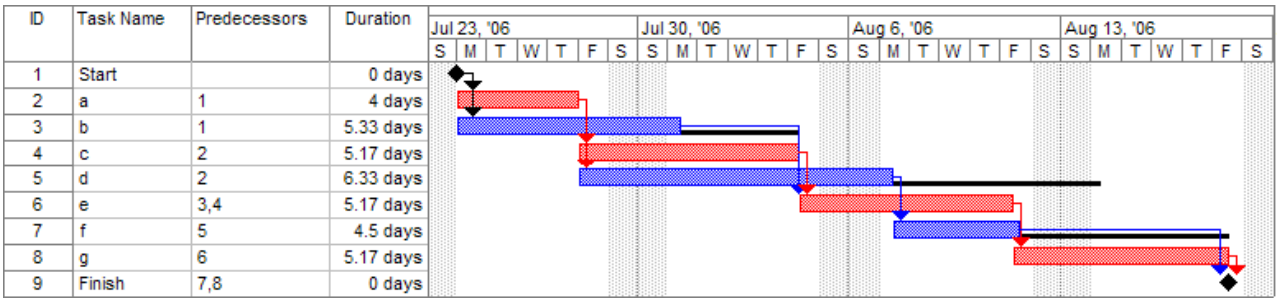
The chart is named after Henry Gantt (1861–1919), who designed his chart around the years 1910–1915. The earliest Gantt charts were drawn on paper and therefore had to be redrawn entirely in order to adjust to schedule changes. In the 1980s, personal computers allowed widespread creation of complex and elaborate Gantt charts. The first desktop applications were intended mainly for project managers and project schedulers. By 2012, almost all Gantt charts were made by software which can easily adjust to schedule changes. In 1999, Gantt charts were identified as "one of the most widely used management tools for project scheduling and control".

Example

In the following table there are seven tasks, labelled *a* to *g*. Some tasks can be done concurrently (*a* and *b*) while others cannot be done until their predecessor task is complete (*c* and *d* cannot begin until *a* is complete). Additionally, each task has three time estimates: the optimistic time estimate (*O*), the most likely or normal time estimate (*M*), and the pessimistic time estimate (*P*). The expected time (T_E) is estimated using the beta probability distribution for the time estimates, using the formula ($O + 4M + P$) ÷ 6.

Activity	Predecessor	Time estimates			Expected time (T_E)
		Opt. (*O*)	Normal (*M*)	Pess. (*P*)	
a	—	2	4	6	4.00
b	—	3	5	9	5.33
c	*a*	4	5	7	5.17
d	*a*	4	6	10	6.33
e	*b*, *c*	4	5	7	5.17
f	*d*	3	4	8	4.50
g	*e*	3	5	8	5.17

Once this data is complete, one can draw a Gantt chart or a network diagram.



A Gantt chart created using Microsoft Project (MSP). Note (1) the critical path is in red, (2) the slack is the black lines connected to non-critical activities, (3) since Saturday and Sunday are not work days and are thus excluded from the schedule, some bars on the Gantt chart are longer if they cut through a weekend.

Progress Gantt charts

In a *progress Gantt chart*, tasks are shaded in proportion to the degree of their completion. In other words, a task that is 60% complete would be 60% shaded, starting from the left. A vertical line is drawn at the current time index when the progress Gantt chart is created, and this line can then be compared with shaded tasks. If everything is on schedule, all task portions left of the line will be shaded, and all task portions right of the line will not be shaded. This provides a visual representation of how the project and its tasks are ahead of or behind schedule.

Linked Gantt charts

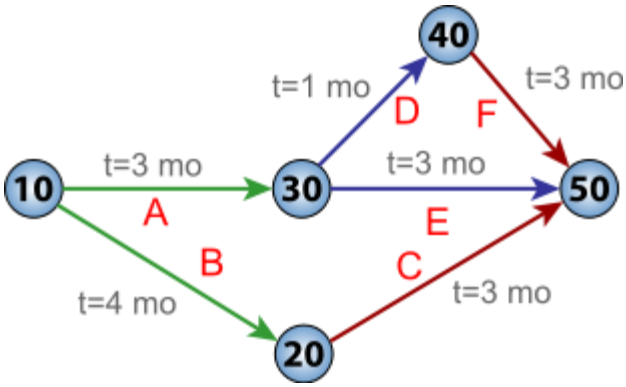
Linked Gantt charts contain lines indicating the dependencies between tasks. However, linked Gantt charts quickly become cluttered in all but the simplest cases. Critical path network diagrams are superior to visually communicate the relationships between tasks. However, Gantt charts are often preferred over network diagrams because Gantt charts are easily interpreted without training, whereas critical path diagrams require training to interpret. Gantt chart software typically provides mechanisms to link task dependencies, although this data may or may not be visually represented. Gantt charts and network diagrams are often used for the same project, both being generated from the same data by a software application.

(*GanttProject* provides for the creation of linked Gantt charts.)

From: https://en.wikipedia.org/wiki/Program_evaluation_and_review_technique

PERT (Project Evaluation and Review Technique)

From Wikipedia, the free encyclopaedia



PERT network chart for a seven-month project with five milestones (10 through 50) and six activities (A through F).

The **program** (or **project**) **evaluation and review technique**, commonly abbreviated **PERT**, is a statistical tool, used in project management, which was designed to analyse and represent the tasks involved in completing a given project. It is commonly used in conjunction with the critical path method (**CPM**).

Overview

Project Evaluation and Review Technique is commonly abbreviated to PERT. PERT is a method of analyzing the tasks involved in completing a given project, especially the time needed to complete each task, and to identify the minimum time needed to complete the total project. It incorporates uncertainty by making it possible to schedule a project while not knowing precisely the details and durations of all the activities. It is more of an event-oriented technique rather than start- and completion-oriented, and is used more in projects where time is the major factor rather than cost. It is applied to very large-scale, one-time, complex, non-routine infrastructure and Research and Development projects.

Program Evaluation Review Technique (PERT) offers a management tool, which relies "on arrow and node diagrams of *activities* and *events*: arrows represent the *activities* or work necessary to reach the *events* or nodes that indicate each completed phase of the total project."

PERT and CPM are complementary tools, because "CPM employs one time estimate and one cost estimate for each activity; PERT may utilize three time estimates (optimistic, expected, and pessimistic) and no costs for each activity. Although these are distinct differences, the term PERT is applied increasingly to all critical path scheduling."

The technique is a management control tool that sizes up the outlook for meeting objectives on time; highlights danger signals requiring management decisions; reveals and defines both methodicalness and slack in the flow plan or the network of sequential activities that must be performed to meet objectives; compares current expectations with scheduled completion dates and computes the probability for meeting scheduled dates; and simulates the effects of options for decision – before decision.

For the subdivision of work units in PERT another tool was developed: the Work Breakdown Structure. The Work Breakdown Structure provides a framework for complete networking. the Work Breakdown Structure was introduced as the first item of analysis in carrying out basic PERT.

Terminology

Events and activities

In a PERT diagram, the main building block is the *event*, with connections to its known predecessor events and successor events.

- *PERT event*: a point that marks the start or completion of one or more activities. It consumes no time and uses no resources. When it marks the completion of one or more activities, it is not "reached" (does not occur) until *all* of the activities leading to that event have been completed.
- *predecessor event*: an event that immediately precedes some other event without any other events intervening. An event can have multiple predecessor events and can be the predecessor of multiple events.
- *successor event*: an event that immediately follows some other event without any other intervening events. An event can have multiple successor events and can be the successor of multiple events.

Besides events, PERT also knows activities and sub-activities:

- *PERT activity*: the actual performance of a task which consumes time and requires resources (such as labor, materials, space, machinery). It can be understood as representing the time, effort, and resources required to move from one event to another. A PERT activity cannot be performed until the predecessor event has occurred.
- *PERT sub-activity*: a PERT activity can be further decomposed into a set of sub-activities. For example, activity A1 can be decomposed into A1.1, A1.2 and A1.3. Sub-activities have all the properties of activities; in particular, a sub-activity has predecessor or successor events just like an activity. A sub-activity can be decomposed again into finer-grained sub-activities.

Time

PERT has defined four types of time required to accomplish an activity:

- *optimistic time*: the minimum possible time required to accomplish an activity (o) or a path (O), assuming everything proceeds better than is normally expected
- *pessimistic time*: the maximum possible time required to accomplish an activity (p) or a path (P), assuming everything goes wrong (but excluding major catastrophes).
- *most likely time*: the best estimate of the time required to accomplish an activity (m) or a path (M), assuming everything proceeds as normal.
- *expected time*: the best estimate of the time required to accomplish an activity (te) or a path (TE), accounting for the fact that things don't always proceed as normal (the implication being that the expected time is the average time the task would require if the task were repeated on a number of occasions over an extended period of time).

$$\mathbf{te} = (\mathbf{o} + \mathbf{4m} + \mathbf{p}) \div \mathbf{6}$$

Management tools

PERT supplies a number of tools for management with determination of concepts, such as:

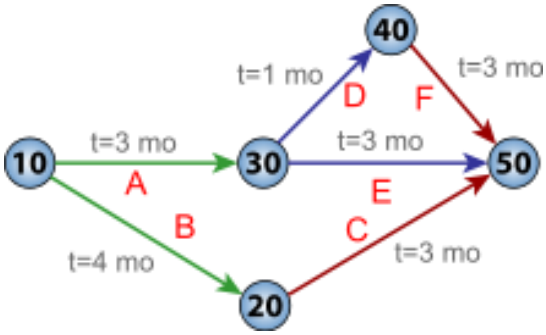
- *float* or *slack* is a measure of the excess time and resources available to complete a task. It is the amount of time that a project task can be delayed without causing a delay in any subsequent tasks (*free float*) or the whole project (*total float*). Positive slack would indicate *ahead of schedule*; negative slack would indicate *behind schedule*; and zero slack would indicate *on schedule*.

- *critical path*: the longest possible continuous pathway taken from the initial event to the terminal event. It determines the total calendar time required for the project; and, therefore, any time delays along the critical path will delay the reaching of the terminal event by at least the same amount.
- *critical activity*: An activity that has total float equal to zero. An activity with zero float is not necessarily on the critical path since its path may not be the longest.
- *lead time*: the time by which a *predecessor event* must be completed in order to allow sufficient time for the activities that must elapse before a specific PERT event reaches completion.
- *lag time*: the earliest time by which a *successor event* can follow a specific PERT event.
- *fast tracking*: performing more critical activities in parallel
- *crashing critical path*: Shortening duration of critical activities

From: https://en.wikipedia.org/wiki/Critical_path_method

CPM (Critical path method)

From Wikipedia, the free encyclopedia



PERT chart for a project with five milestones (10 through 50) and six activities (A through F). The project has two critical paths: activities B and C, or A, D, and F – giving a minimum project time of 7 months with fast tracking. Activity E is sub-critical, and has a float of 1 month.

The **critical path method** (**CPM**), or **critical path analysis** (**CPA**), is an algorithm for scheduling a set of project activities. It is commonly used in conjunction with the program evaluation and review technique (**PERT**).

Basic technique

Components

In using CPM, The essential technique is to construct a model of the project that includes the following:

1. A list of all activities required to complete the project (typically categorized within a work breakdown structure),
2. The time (duration) that each activity will take to complete,
3. The dependencies between the activities and,
4. Logical end points to each activity such as milestones or deliverable items.

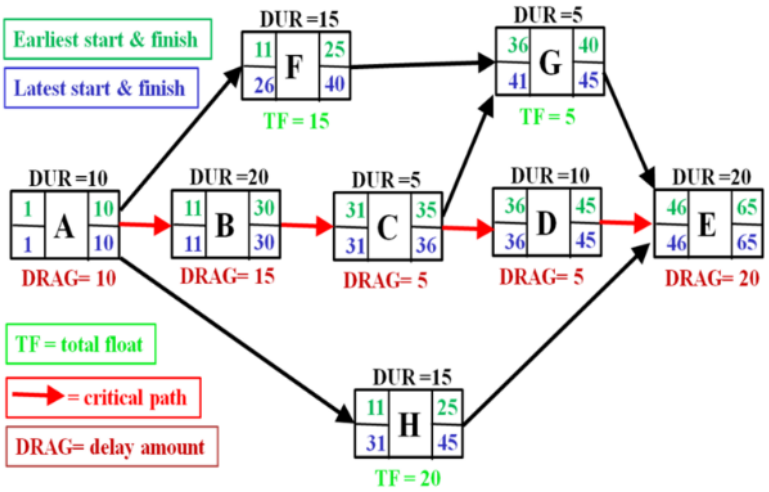
Using these values, CPM calculates the longest path of planned activities to logical end points or to the end of the project, and the earliest and latest that each activity can start and finish without making the project longer. This process determines which activities are "critical" (i.e., on the longest path) and which have "total float" (i.e., can be delayed without making the project longer). In project management, a critical path is the sequence of project network activities which add up to the longest overall duration, regardless if that longest duration has float or not. This determines the shortest time possible to complete the project. There can be 'total float' (unused time) within the critical path. For example, if a project is testing a solar panel and task 'B' requires 'sunrise', there could be a scheduling constraint on the testing activity so that it would not start until the scheduled time for sunrise. This might insert dead time (total float) into the schedule on the activities on that path prior to the sunrise due to needing to wait for this event. This path, with the constraint-generated total float would actually make the path longer, with total float being part of the shortest possible duration for the overall project. In other words, individual tasks on the critical path prior to the constraint might be able to be delayed without elongating the critical path; this is the 'total float' of that task. However, the time added to the project duration by the constraint is actually critical path drag, the amount by which the project's duration is extended by each critical path activity and constraint.

A project can have several, parallel, near critical paths; and some or all of the tasks could have 'free float' and/or 'total float'. An additional parallel path through the network with the total durations shorter than the critical path is called a sub-critical or non-critical path. Activities on sub-critical paths have no drag, as they are not extending the project's duration.

CPM analysis tools allow a user to select a logical end point in a project and quickly identify its longest series of dependent activities (its longest path). These tools can display the critical path (and near critical path activities if desired) as a cascading waterfall that flows from the project's start (or current status date) to the selected logical end point.

Visualizing critical path schedule

Although the activity-on-arrow diagram (PERT Chart) is still used in a few places, it has generally been superseded by the activity-on-node diagram, where each activity is shown as a box or node and the arrows represent the logical relationships going from predecessor to successor as shown here in an "Activity-on-node diagram".



***Activity-on-node diagram* showing critical path schedule, along with total float and critical path drag computations**

In this diagram, Activities A, B, C, D, and E comprise the critical or longest path, while Activities F, G, and H are off the critical path with floats of 15 days, 5 days, and 20 days respectively. Whereas activities that are off the critical path have float and are therefore not delaying completion of the project, those on the critical path will usually have critical path drag, i.e., they delay project completion. The drag of a critical path activity can be computed using the following formula:

1. If a critical path activity has nothing in parallel, its drag is equal to its duration. Thus A and E have drags of 10 days and 20 days respectively.
2. If a critical path activity has another activity in parallel, its drag is equal to whichever is less: its duration or the total float of the parallel activity with the least total float. Thus since B and C are both parallel to F (float of 15) and H (float of 20), B has a duration of 20 and drag of 15 (equal to F's float), while C has a duration of only 5 days and thus drag of only 5. Activity D, with a duration of 10 days, is parallel to G (float of 5) and H (float of 20) and therefore its drag is equal to 5, the float of G.

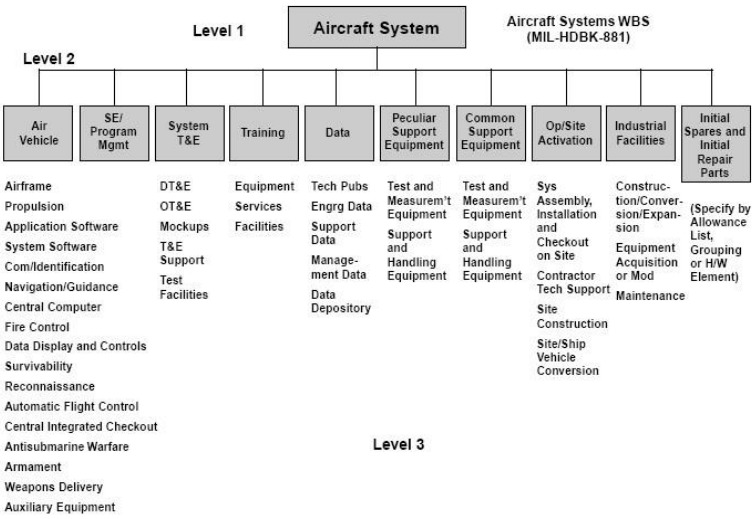
These results, including the drag computations, allow managers to prioritize activities for the effective management of project completion, and to shorten the planned critical path of a project by pruning critical path activities, by "fast tracking" (i.e., performing more activities in parallel), and/or by "crashing the critical path" (i.e., shortening the durations of critical path activities by adding resources).

Critical path drag analysis has also been used to optimize schedules in processes outside of strict project-oriented contexts, such as to increase manufacturing throughput by using the technique and metrics to identify and alleviate delaying factors and thus to reduce assembly lead time.

From: https://en.wikipedia.org/wiki/Work_breakdown_structure

Work Breakdown Structure (WBS)

From Wikipedia, the free encyclopedia



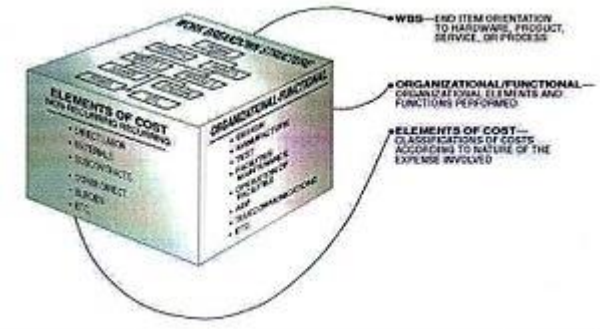
Example from MIL-HDBK-881, illustrating the first three levels of a typical aircraft system.

A **work-breakdown structure** (**WBS**), also referred to as "**contract work-breakdown structure**" or "**CWBS**", in project management and systems engineering, is a deliverable-oriented breakdown of a project into smaller components. A work breakdown structure is a key project deliverable that organizes the team's work into manageable sections. The document, Project Management Body of Knowledge, defines the work-breakdown structure as a "A hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables."

A work-breakdown structure element may be a product, data, service, or any combination thereof. A WBS also provides the necessary framework for detailed cost estimating and control along with providing guidance for schedule development and control.[3]

Overview

WBS is a hierarchical and incremental decomposition of the project into phases, deliverables and work packages. It is a tree structure, which shows a subdivision of effort required to achieve an objective; for example a program, project, and contract. In a project or contract, the WBS is developed by starting with the end objective and successively subdividing it into manageable components in terms of size, duration, and responsibility (e.g., systems, subsystems, components, summary tasks, tasks, and work packages) which include all steps necessary to achieve the objective.



Example of work breakdown structure applied in a NASA reporting structure.

The work-breakdown structure provides a common framework for the natural development of the overall planning and control of a contract and is the basis for dividing work into definable increments from which the statement of work can be developed and technical, schedule, cost, and labour hour reporting can be established.

A work breakdown structure permits summing of subordinate costs for tasks, materials, etc., into their successively higher level "parent" tasks, materials, etc. For each element of the work breakdown structure, a description of the task to be performed is generated.[5] This technique (sometimes called a *system breakdown structure*[6]) is used to define and organize the total scope of a project.

The WBS is organized around the primary products of the project (or planned outcomes) instead of the work needed to produce the products (planned actions). Since the planned outcomes are the desired ends of the project, they form a relatively stable set of categories in which the costs of the planned actions needed to achieve them can be collected. A well-designed WBS makes it easy to assign each project activity to one and only one terminal element of the WBS. In addition to its function in cost accounting, the WBS also helps map requirements from one level of system specification to another, for example a requirements cross reference matrix mapping functional requirements to high level or low level design documents. The WBS may be displayed horizontally in outline form, or vertically as a tree structure (like an organization chart).

The development of the WBS normally occurs at the start of a project and precedes detailed project and task planning.

Design principles

100% rule
An important design principle for work breakdown structures is called the 100% rule.[14] It has been defined as follows:

The 100% rule states that the WBS includes 100% of the work defined by the project scope and captures all deliverables – internal, external, interim – in terms of the work to be completed, including project management. The 100% rule is one of the most important principles guiding the development, decomposition and evaluation of the WBS. The rule applies at all levels within the hierarchy: the sum of the work at the "child" level must equal 100% of the work represented by the "parent" and the WBS should not include any work that falls outside the actual scope of the project, that is, it cannot include more than 100% of the work. It is important to remember that the 100% rule also applies to the activity level. The work represented by the activities in each work package must add up to 100% of the work necessary to complete the work package.

Mutually exclusive elements
Mutually exclusive: In addition to the 100% rule, it is important that there is no overlap in scope definition between different elements of a work breakdown structure. This ambiguity could result in duplicated work or miscommunications about responsibility and authority. Such overlap could also cause confusion regarding project cost accounting. If the WBS element names are ambiguous, a WBS dictionary can help clarify the distinctions between WBS elements. The WBS Dictionary describes each component of the WBS with milestones, deliverables, activities, scope, and sometimes dates, resources, costs, quality.

Plan outcomes, not actions
If the work breakdown structure designer attempts to capture any action-oriented details in the WBS, the designer will likely include either too many actions or too few actions. Too many actions will exceed 100% of the parent's scope and too few will fall short of 100% of the parent's scope. The best way to adhere to the 100% rule is to define WBS elements in terms of outcomes or

results, not actions. This also ensures that the WBS is not overly prescriptive of methods, allowing for greater ingenuity and creative thinking on the part of the project participants. For new product development projects, the most common technique to ensure an outcome-oriented WBS is to use a product breakdown structure. Feature-driven software projects may use a similar technique which is to employ a feature breakdown structure. When a project provides professional services, a common technique is to capture all planned deliverables to create a deliverable-oriented WBS. Work breakdown structures that subdivide work by project phases (e.g. preliminary design phase, critical design phase) must ensure that phases are clearly separated by a deliverable also used in defining entry and exit criteria (e.g. an approved preliminary or critical design review).

Level of detail

One must decide when to stop dividing work into smaller elements. This will assist in determining the duration of activities necessary to produce a deliverable defined by the WBS. There are several heuristics or "rules of thumb" used when determining the appropriate duration of an activity or group of activities necessary to produce a specific deliverable defined by the WBS.

- The first is the "80 hour rule" which means that no single activity or group of activities at the lowest level of detail of the WBS to produce a single deliverable should be more than 80 hours of effort.
- The second rule of thumb is that no activity or group of activities at the lowest level of detail of the WBS should be longer than a single reporting period. Thus if the project team is reporting progress monthly, then no single activity or series of activities should be longer than one month long.
- The last heuristic is the "if it makes sense" rule. Applying this rule of thumb, one can apply "common sense" when creating the duration of a single activity or group of activities necessary to produce a deliverable defined by the WBS.

A work package at the activity level is a task that:

- can be realistically and confidently estimated;
- makes no sense practically to break down any further;
- can be completed in accordance with one of the heuristics defined above;
- produces a deliverable which is measurable; and
- forms a unique package of work which can be outsourced or contracted out.

Consistent to norms

The higher WBS structure should be consistent to whatever norms or template mandates exist within the organization or domain. For example, shipbuilding for the U.S. Navy must respect that the nautical terms and their hierarchy structure put into MIL-STD are embedded in Naval Architecture and that matching Navy offices and procedures have been built to match this naval architecture structure, so any significant change of WBS element numbering or naming in the hierarchy would be unacceptable.

Coding scheme

It is common for work breakdown structure elements to be numbered sequentially to reveal the hierarchical structure. The purpose for the numbering is to provide a consistent approach to identifying and managing the WBS across like systems regardless of vendor or service. For example, **1.1.2 Propulsion** (in the example below) identifies this item as a Level 3 WBS element, since there are three numbers separated by a decimal point. A coding scheme also helps WBS elements to be recognized in any written context and allows for mapping to the WBS Dictionary.

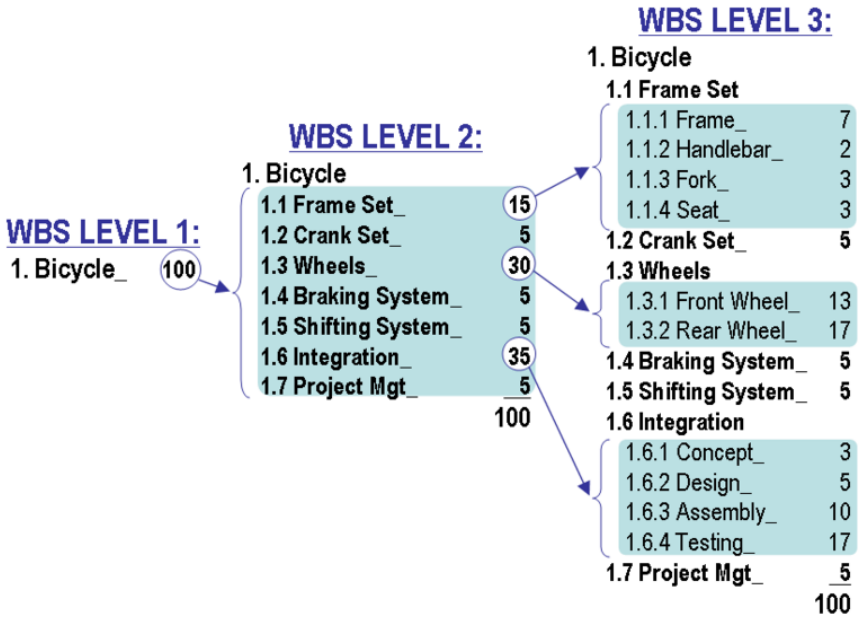
A practical example of a WBS coding scheme is:

1.0 Aircraft System
1.1 Air Vehicle
1.1.1 Airframe
1.1.1.1 Airframe Integration, Assembly, Test and Checkout
1.1.1.2 Fuselage
1.1.1.3 Wing
1.1.1.4 Empennage
1.1.1.5 Nacelle
1.1.1.6 Other Airframe Components 1..n (Specify)
1.1.2 Propulsion
1.1.3 Vehicle Subsystems
1.1.4 Avionics
1.2 System Engineering
1.3 Program Management
1.4 System Test and Evaluation
1.5 Training
1.6 Data
1.7 Peculiar Support Equipment
1.8 Common Support Equipment
1.9 Operational/Site Activation
1.10 Industrial Facilities
1.11 Initial Spares and Repair Parts

Terminal element
This is the lowest element in a tree structure, a terminal element is one that is not further subdivided (sometimes called a leaf). In a Work Breakdown Structure such elements (activity or deliverable), also known as work packages, are the items that are estimated in terms of resource requirements, budget and duration; linked by dependencies; and scheduled. At the juncture of the WBS element and organization unit, control accounts and work packages are established and performance is planned, measured, recorded and controlled.– A WBS can be expressed down to any level of interest. Three levels are the minimum recommended, with additional levels for and only for items of high cost or high risk, and two levels of detail at cases such as systems engineering or program management, with the standard showing examples of WBS with varying depth such as software development at points going to 5 levels or fire-control system to 7 levels.

Example
The figure below (next page) shows a work breakdown structure construction technique that demonstrates the 100% rule and the "progressive elaboration" technique. At WBS Level 1 it shows 100 units of work as the total scope of a project to design and build a custom bicycle. At WBS Level 2, the 100 units are divided into seven elements. The number of units allocated to each element of work can be based on effort or cost; it is not an estimate of task duration.

The largest three elements of WBS Level 2 are further subdivided at Level 3. The largest two elements at Level 3 each represent only 17% of the total scope of the project. These larger elements could be further subdivided using the *progressive elaboration* technique described above.



The WBS construction technique employing the 100% rule during WBS construction.

WBS design can be supported by software (e.g. a spreadsheet) to allow automatic rolling up of point values. Estimates of effort or cost can be developed through discussions among project team members. This collaborative technique builds greater insight into scope definitions, underlying assumptions, and consensus regarding the level of granularity required to manage the projects.

Misconceptions

- A WBS is not an exhaustive list of work. It is instead a comprehensive classification of project scope.
- A WBS is none of a project plan, a schedule or a chronological listing. It specifies what will be done, not how or when.
- A WBS is not an organizational hierarchy, although it may be used when assigning responsibilities. See also: responsibility assignment (RACI) matrix (also called a *Staffing Matrix*).
- A WBS is not a Result Breakdown Structure. Projects are not about work (or effort) but about results in terms of deliverables or capabilities that the project must provide. Planning a project is a reverse process. First, you identify the deliverables, and then the work required to create them. Therefore, creating a Deliverable Breakdown Structure, or a Capability Breakdowns Structure is the first step. Once the deliverables are identified the next step is to define the activities that are necessary to create these deliverables. A cross-check is required to ensure that for each deliverable, there is at least one activity that creates it. Starting project planning with a Work Breakdown Structure is a common misconception causing time and budget overruns.

From: https://superuser.com/questions/601713/how-to-allow-enable-the-weekends-as-working-period-in-gantt-project

GanttProject: Enable weekends as work time

By default, GanttProject allows for a five-day working week, with no activity on Saturdays or Sundays. There are projects (such as weddings, 24/7 and/or urgent projects) where work must span across weekends. GanttProject can be configured to provide for such requirements.

To enable weekends as work time:

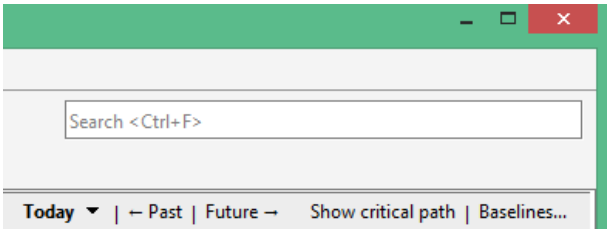
1. Go to *Project* > *Properties* > *Calendar*
2. Choose *On weekends* > *all tasks run as on other days*
3. Click *Ok*

GanttProject only provides for durations measured in days.

Source: direct inspection

GanttProject: Search

Searching in GanttProject is really only useful in large, multipage projects where it is slow to scan through all the data items.

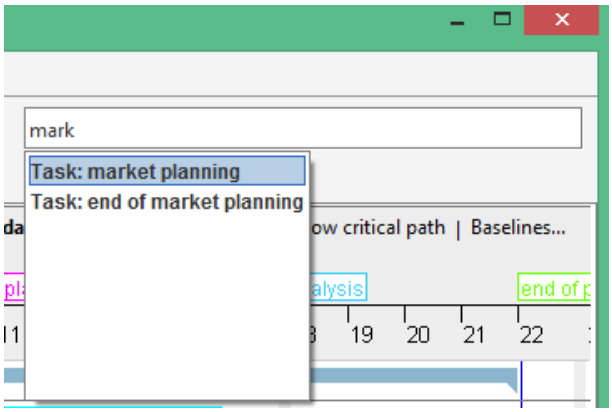


The Search box is always present in the top right corner above the timeline.

Search only examines the data in the *Name* columns under the *Gantt* or *Resource chart* tabs.

To make a search

1. Click in the Search box and delete its prompt
    a. *Edit* > *Search* also places the cursor in the search box
2. Type a fragment of the target into the box and press [Enter]
3. A list appears of all occurrences of the target fragment
4. Click on an item in the list and it will be highlighted in the relevant Name column



To display all available data items

1. Click in the Search box
2. Delete all content in the box
3. Press [Enter]
4. A full list of all data items appears

Source: various fragments

GanttProject: Change the logo

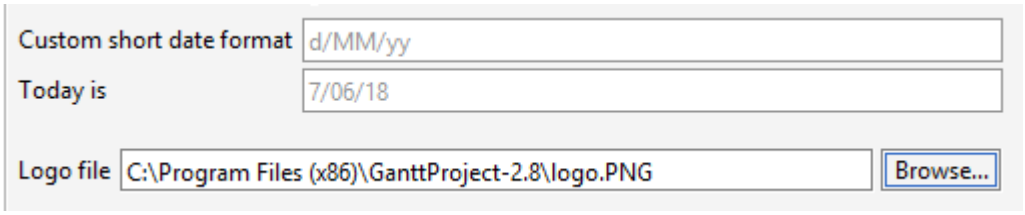
GanttProject has its logo displayed above the data tables in both *Gantt* view and *Resources chart* view. It is possible to use a logo supplied by the user instead.

First, use graphics software such as *MS Paint* to create your replacement logo. It should be:

- a single file:
- 50 x 1200 pixels (height x width) in size
    - Make the leftmost 300 pixels the main logo and the rest some repetitive pattern
- Saved in .PNG (or else .JPG) format
- Preferably without spaces in the name

Save the file in an accessible place, perhaps in "C:\Program Files (x86)\GanttProject-2.8\" with the other GanttProject files.

1. In GanttProject, go to *Edit* > *Settings* > *Application UI* > *Logo file*
2. Click the *Browse*… button to navigate to your logo file



3. Click *Ok*
4. Restart GanttProject and look to see the replacement logo.
5. To revert to the GanttProject logo, simply delete your *Logo file* selection.

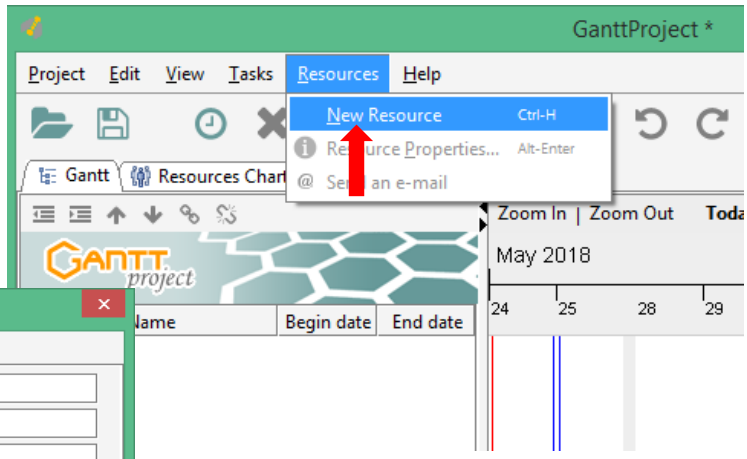
From: https://software.grok.lsu.edu/article.aspx?articleid=7465

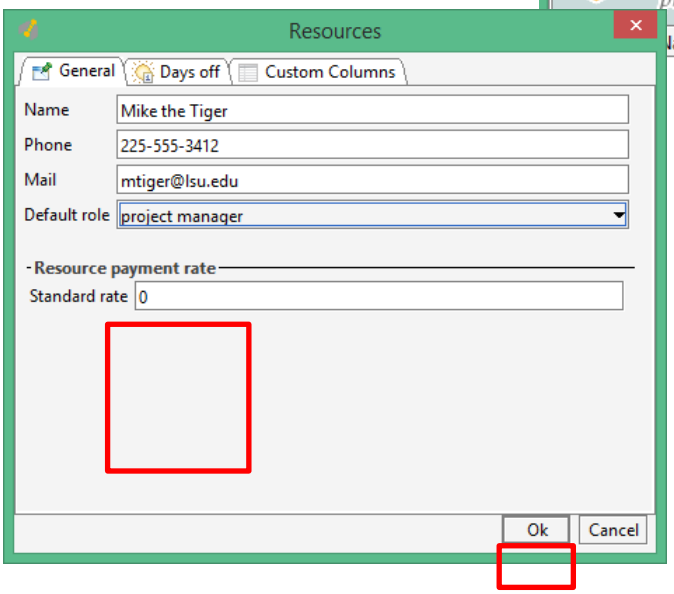
GanttProject: Adding a Resource

With GanttProject, the user can not only create new tasks for their chart, but they can also add personnel (resources) to be assigned to that task. The following steps show how to add a resource in GanttProject.

Adding a Resource:

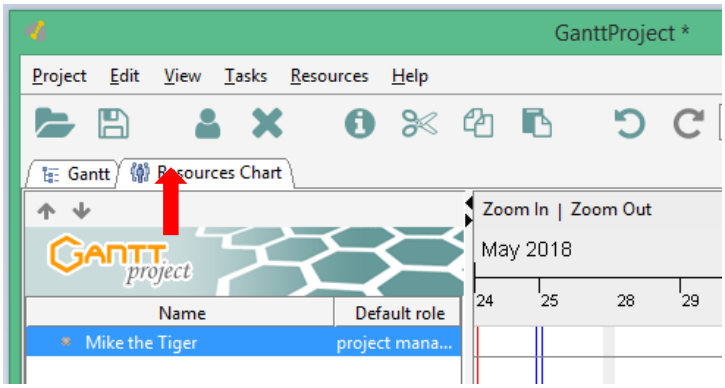
1. In the menubar, click **Resources** and then select **New Resource** from the drop-down menu.





2. A *Resources* dialog box appears. Type in the new resource's information and click *Ok* at the bottom of the window to close it.

3. Above the GanttProject logo, click on the *Resources Chart* tab to view the newly created resource.



Edit a resource

To add to or change details of a resource:

1. On the *Resources chart* tab, highlight (click on) the resource to be edited.
2. On the menubar, choose Resources > Resource properties.

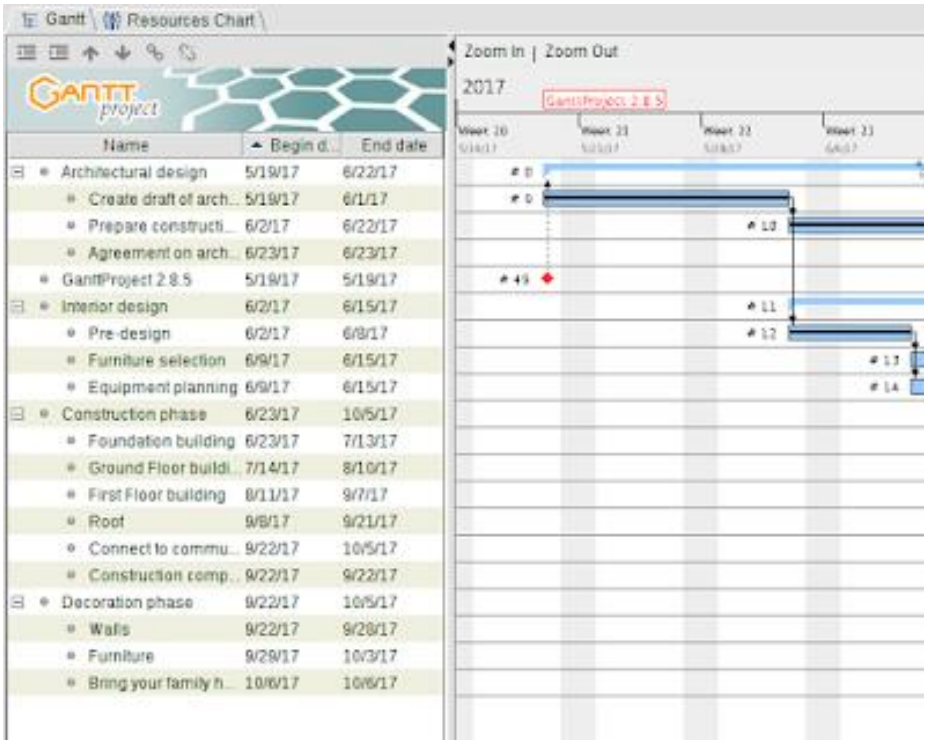
Assign resources

To assign resources to tasks, go to Task Properties in the Gantt view.
Do not assign resources to summary tasks. This may conflict with assignments in subtasks.

From: http://ganttproject.blogspot.com.au/2017/05/ganttproject-285-task-sorting.html

GanttProject: Sorting tasks

GanttProject 2.8.5 and later come with a useful feature: task ordering by begin/end dates.



Sample project with tasks sorted by begin date

Task sorting

Sorting works in the expected way: click the column header to sort in ascending order, click again to toggle to descending order. The sort-order is indicated by an arrow in the column header, showing upwards when order is ascending or downwards when it is descending.

The sort order is compartmented. Sibling tasks are sorted, while tasks from different branches of the task tree (i.e. sitting under different summary tasks) are not necessarily sorted. For instance, on the screenshot above, milestone *GanttProject 2.8.5* goes below the child tasks of *Architectural design*, although it starts earlier.

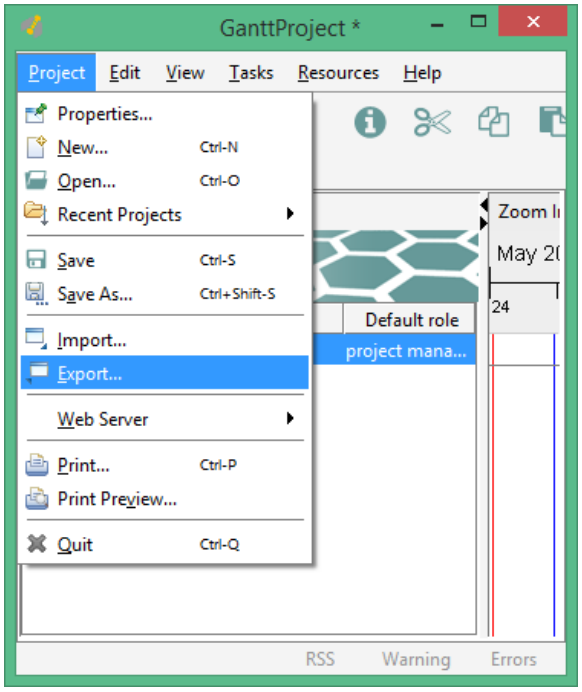
Sorting is not maintained continuously. Any actions on the tasks such as insertion of a new task, reordering, indenting and outdenting may break the sort order. The user must then click in the column header again to restore the ordering.

From: https://software.grok.lsu.edu/article.aspx?articleid=7472

GanttProject: Export a project as PDF

GanttProject allows the user to export a project in many different formats, allowing projects to be easily shared. The following steps will show the user how to export the project as a .PDF file.

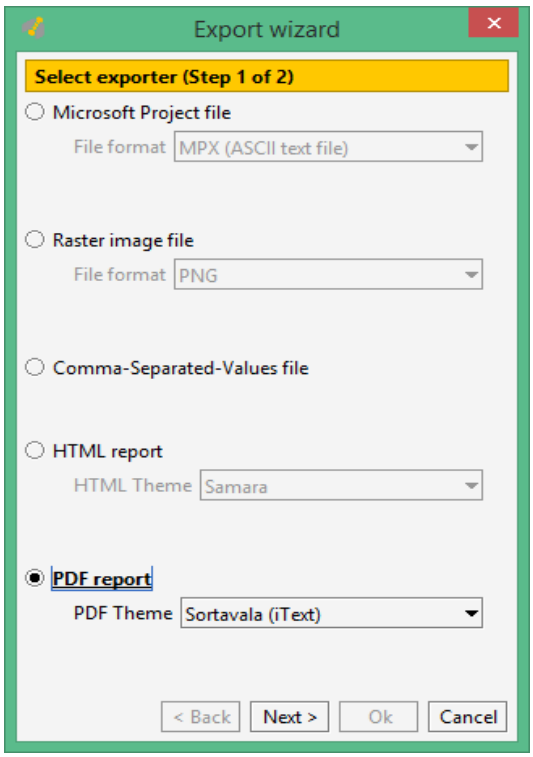
Exporting a Project to a .PDF file:



1. Select *Project* from the menubar at the top of the window, and then select *Export* from the dropdown menu.

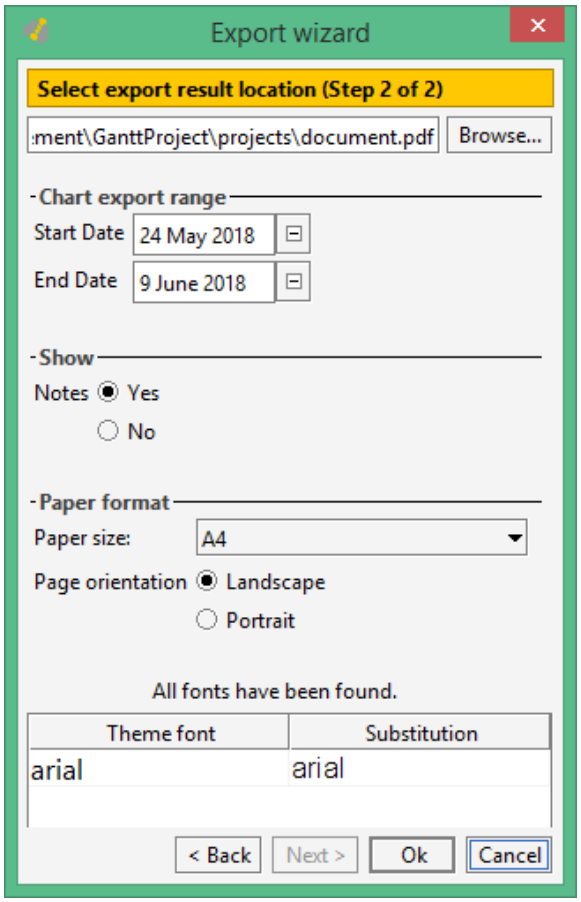
2. The *Export wizard* dialog box opens (below). Select the *PDF report* option at the bottom and choose the desired visual theme from the dropdown menu (there is only one).

3. Click *Next*.



4. Next, choose where the file will be stored with the *Browse* button at the top right; edit the name of the file if needed. You can also edit the date range to be exported, the paper format, and whether to show notes.

5. Click *Ok* at the bottom right when finished.



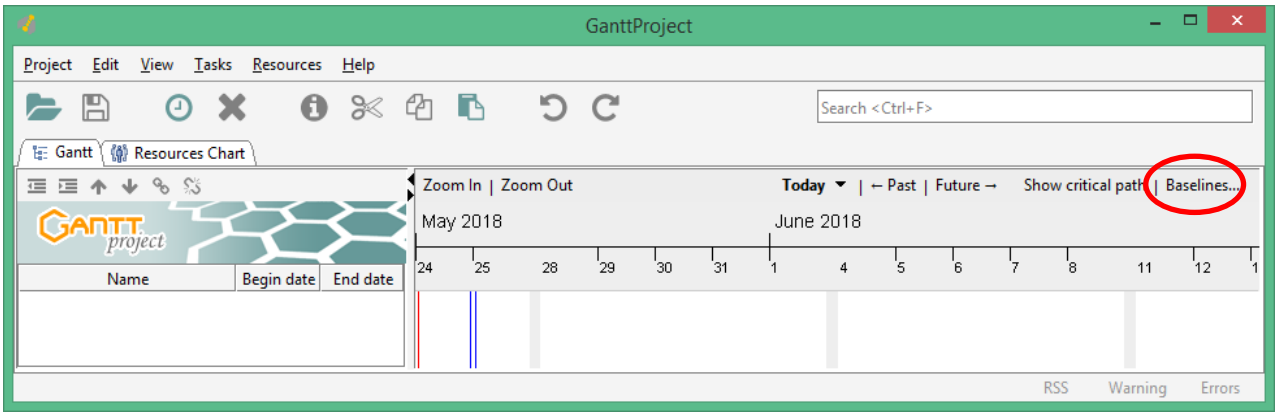
From: http://forum.ganttproject.biz/view/20131002213302_6wfmmu1kbpgeiq6rba172ky4l
And: https://github.com/bardsoftware/ganttproject/issues/919

GanttProject: Baseline use

When you create a baseline, you create a snapshot of all the task **dates**. Afterwards, when you change a task date, the baseline dates and current dates can be shown next to each other on the timeline.

- If some current task completes later than its baseline version, the baseline bar is shown in red
- If the current task completes earlier than its baseline version, the baseline bar is shown in green.
- If there has been no change, no baseline bar is displayed

You can keep creating additional baselines, each with a different name, most likely after any major change to your project, and later see how each compares to your current state.



Create a baseline

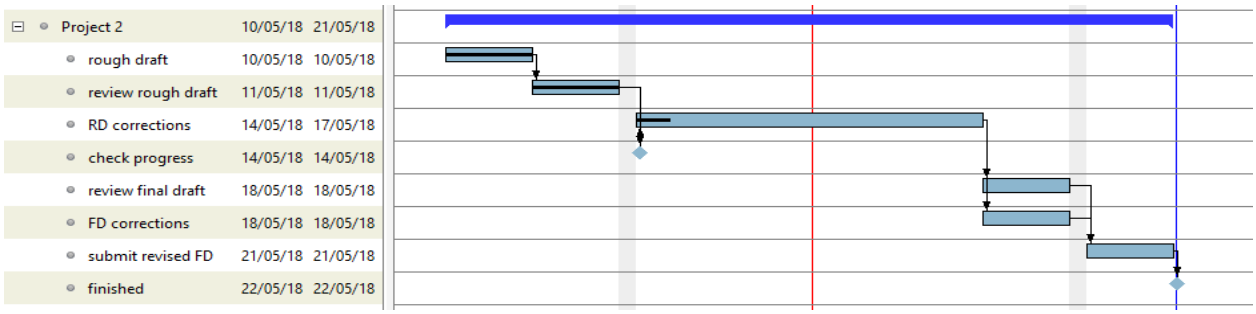
1. On the *Gantt* view, above the Timeline, click the *Baselines*… option
2. In the *Edit Baselines* dialog box that appears, click the *Add* button
3. In the text edit box that appears, type a name for the baseline
4. Change the display colours if desired, and then click *Ok*.

Compare a baseline

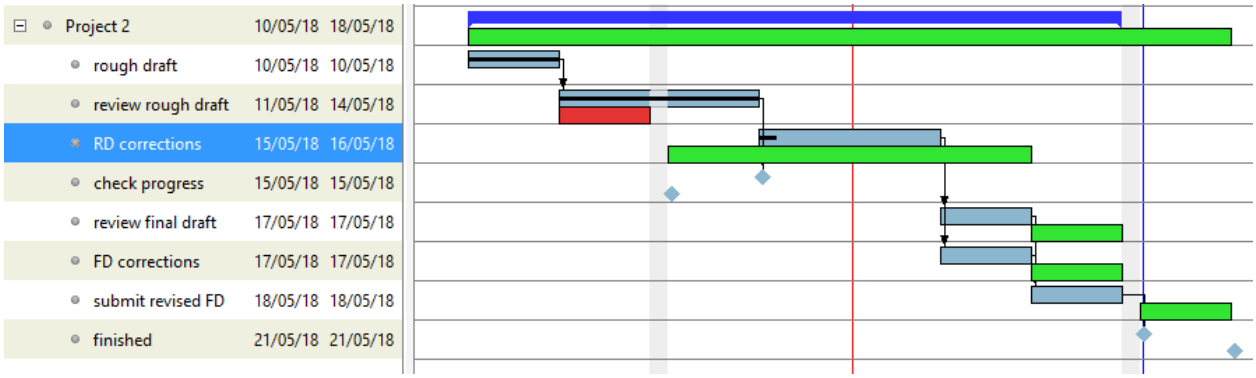
- Click the *Baselines*… option
- In the *Edit Baselines* dialog, select the desired baseline name
- Click *Ok* to close the dialog
- The red/green baseline bars appear immediately after choosing the baseline name.
- If there have been no changes, no baseline bars appear.
- To **deselect** a baseline name, in the dialog box, click on **<Type new baseline name here>**

next page …

Gantt view – saved baseline



Gantt view with baseline after some changes



By inspection, task *review rough draft* has a longer duration, task *RD corrections* has a shorter duration and the whole project is shorter. Task *rough draft* was unaffected.

From: compiled manually from a variety of fragments

GanttProject: Data table columns

The GanttProject user interface has two tab views, called *Gantt* and *Resources chart*. Each view has, on the left, a table with data displayed in columns.

The columns of the tables can be managed extensively:

- Sort by data in the columns
- Change the left to right order of columns
- Show/hide standard columns or Add/Delete custom columns

Sort on a column:
It is only possible to sort on the *Begin date* and *End date* columns on the *Gantt* tab
To sort, click on the date header. Click again to reverse
See task sorting

Column order
To change the column order, drag column headers to the left or right as desired

Column types
There are two types of columns, *standard* and *custom*

Standard columns
Sets of standard columns are provided for the *Gantt* tab, and for the *Resources Chart* tab.
Some standard columns are displayed by default. Additional standard columns must be selected by the user. All standard columns may be hidden if desired.

Properties of standard columns are fixed; they cannot be changed. This is because most standard columns have computed properties.

The standard columns are:		
Gantt	**Resources Chart**	**Default column**
Name	**name**	Yes
Begin date	**default role**	Yes
End date	**phone**	Yes
Alerts	Assignment role	No
Completion	Standard rate	No
Coordinator	Email	No
Cost		No
Duration		No
ID		No
Predecessors		No
Priority		No
Resources		No
Type		No

Begin managing columns

- First choose the tab to work on, *Gantt* or *Resources chart*
- Right-click any column heading and select *Manage columns*…
- A *Custom Fields Manager* dialog box appears.

Show a standard column

- In *Custom Fields Manager*, click on the desired column heading to highlight it (blue)
- Click the *Show selected* button
- The desired heading appears at the right of the existing column headings.
- To **remove** a column, in *Custom Fields Manager*, highlight its heading (in blue) and click the *Hide selected* button.

Gantt Standard Column Functions

- ***Cost*** of a task is, by default, the calculated cost of the resources assigned to the task. Tasks are summed to derive the cost of each summary task.
- ***Duration*** shows the duration of each task and the critical path total for any summary task.
- ***Alerts*** show tasks that are behind schedule or overdue. They consult *percentage complete* for each task. If you show column "Alerts" in the task table, it will show yellow icons for tasks which are partially complete and red for overdue.
- ***Completion*** shows the percentage completed for tasks and summary tasks. It consults percentage complete for each task. Percentages must previously be entered manually.
- ***Coordinator*** can be used to identify the coordinator (a resource) for the summary task.
- ***ID*** shows the Identity number of each task.
- ***Predecessor*** shows the preceding task ID(s) for each task.
- ***Outline number*** displays a decimal numbering system to identify the group and task order for each task. Tasks are defined by indenting. Two indent steps are possible, allowing three levels of grouping. This means that three *Outline number* forms may occur, e.g. 2 and 2.3 and 2.34 could appear.
- ***Priority*** shows the priority ascribed to the task in *Task Properties*
- ***Resources*** shows the resource personnel assigned to the task.
- ***Type*** shows icons that indicate whether a task is a summary task, a task or a milestone.

***Resource chart* standard functions**

- **Assignment role** allows allocation of a specialized role for a particular task
- **Standard rate** is the pay rate of a resource. A currency unit is not specified.

Custom columns

Custom columns must be created and defined by the user. Custom columns cannot be given additional enhanced actions.
Custom columns may be inspected in *Task Properties.*

Add/delete a custom column

- Scroll to the end of the list of standard column names
- Click on the *Add* button
- In the text box that appears below the list, type the desired name of the additional column
- Press *Enter*
- On the right, set the *Type* and *Default values*. Any set default value will automatically appear in each cell of the column.
- To **remove** a custom column, in *Custom Fields Manager*, highlight its heading name (in blue) and click on the *Delete* button.

From: https://software.grok.lsu.edu/article.aspx?articleid=7493

GanttProject: Add Roles

Resources are the personnel who carry out activities.
Roles are the names of the task types (jobs) that personnel can carry out.
For example, (*resource*) Alan Smith is a (*role*) carpenter.
The default roles in a new project are *project manager* and *undefined*. It is usual to add specific roles to a project for reasons of clarity and detail specification.

To add extra role names:

1. In the menubar, choose *Project* > *Properties*
2. In the *Settings* dialog box that appears, choose *Resource Roles*
3. For each desired role name:
    a. In the text box called <*Type new role name here*>, type the desired name
    b. Click the *Add* button
4. To remove a role, in the list of roles, highlight the role name and click on the *Delete* button
5. Click *Ok*

From: https://software.grok.lsu.edu/article.aspx?articleid=7493

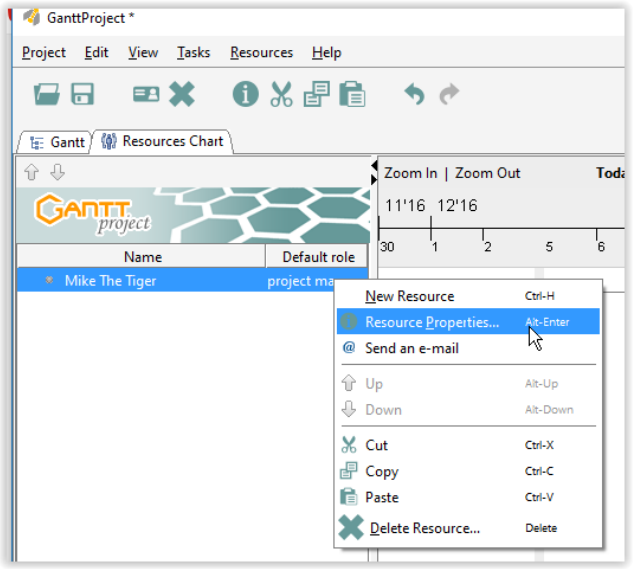
GanttProject: Record time-off for a Resource

GanttProject allows the user to record time off from work, such as vacations, leave, etc., for individual resources.

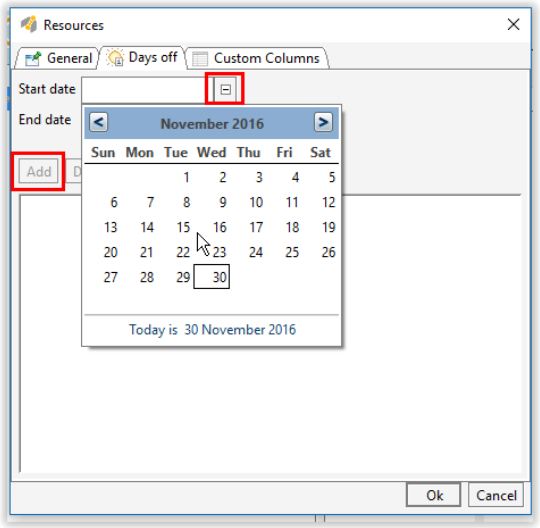
NOTE: Weekends are by default treated as days off. To change this, read here.

Recording Time-off for Resources:

1. Select the *Resources chart* tab (above the *GanttProject* logo), and right-click on the resource for which time off needs to be added. From the drop-down menu that appears, click on *Resource Properties*.

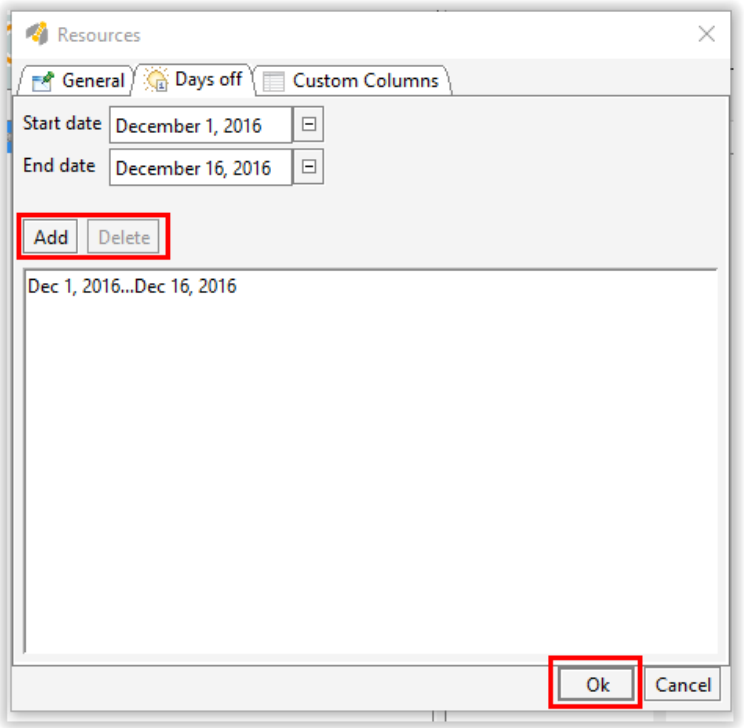


4. The *Resources* dialog box appears. Select the *Days off* tab at the top of the window. Click the button to the right of the start date entry field. A calendar will appear to allow the user to select a start date. Repeat this for the end date as well. When the dates have been selected, click the *Add* button at the left under the End date field.

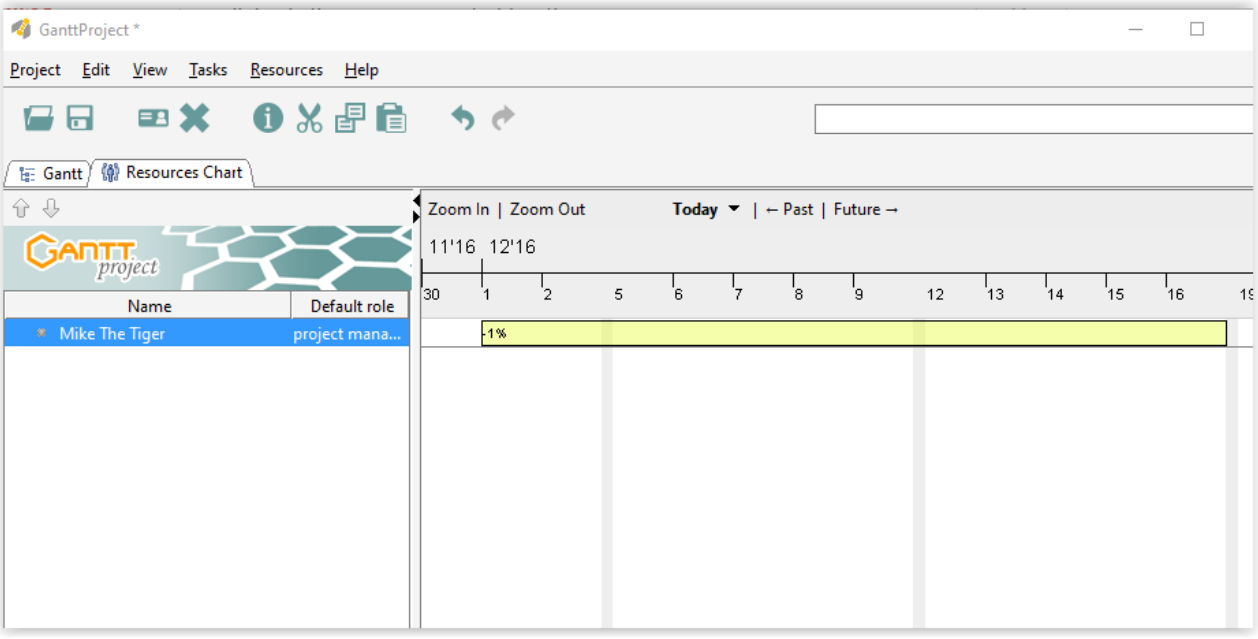


4. The selected time period will be shown below the *Add* and *Delete* buttons.

5. The user can select an additional time period to add if it is desired.
6. When the user is finished adding time off, click *Ok* at the bottom of the window.



7. The time periods that have been selected will now appear in the *Resource chart* timeline.



Based in part on: Project Scheduling with GanttProject

GanttProject: Using GanttProject

The whole experience

There is a lot more to project management than using software to monitor the project plan, but it has a place. First, here is an outline of how to use GanttProject software to good effect:

1. On paper, assemble a WBS (work breakdown structure). This is a list of all the work tasks that must be carried out to bring the project to completion. Some people use mind map software to help with this, especially when consulting clients and team members.
2. Determine the necessary roles (job descriptions of personnel)
3. Select resources (personnel) for the project and identify their roles
4. Plan how resources will be assigned to tasks.
5. Here see the plan, on paper, of the really simple project devised for this tutorial.
    a. It is a plan for a software design project
    b. There is one summary task
    c. There are six action (child) tasks
    d. There are four roles, including the default *Project manager* role
    e. There are four resources (personnel)
6. When you come to create the software design project in GanttProject, you will follow these steps:
    a. Start a new project
    b. Enter roles (types of personnel)
    c. Prepare the task list display format
    d. Enter tasks
    e. Add dependencies (links)
    f. Add resources (personnel)
    g. Allocate resources to tasks
    h. Adjust initial resource allocations
    i. Modify the plan as the project progresses, guided by the Gantt display

Preparation

1. Create the WBS. **This task has been completed for you. See it on p.38 here.**
2. The details of the plan were prepared on paper like this:
    a. List tasks
        i. First identify summary task (the big picture task)
        ii. Identify and group action tasks, in order, under the summary task
        iii. Insert a milestone (checkpoint)
        iv. Add duration of each action task (use only days in GanttProject)
    b. list necessary roles
    c. list and allocate resources

Now Launch GanttProject

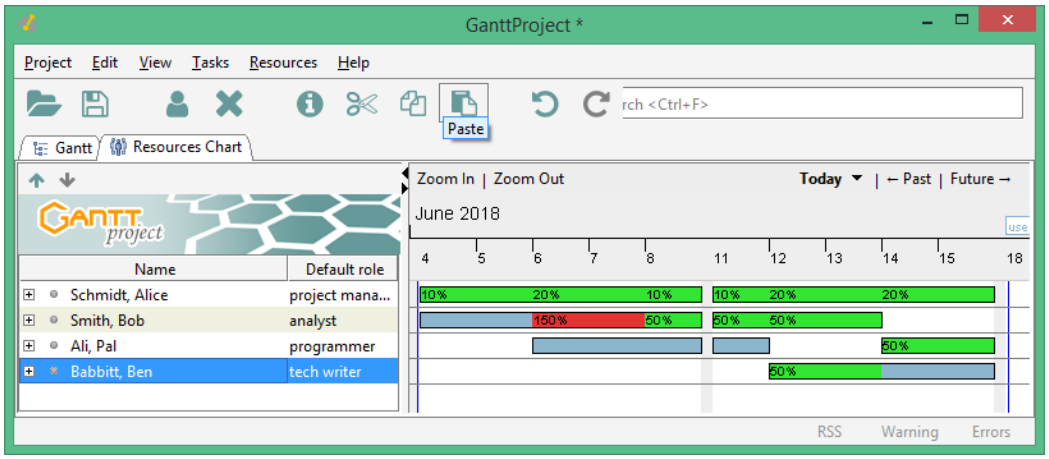
1. In GanttProject, start a new project:
    1. Project > new > Name and description > enter details (look on WBS page) > Ok
2. Enter roles
    a. Project > properties > resource roles >
        i. type role name > click Add > repeat as needed (look on WBS page)
            1. do not add project manager; it is a default role and already there
        ii. click Ok

3. Add the *Outline number* column to task list and reorder the columns:
    a. On the *Gantt* tab, right-click any column heading and select *Manage columns*…
    b. In the displayed list, find and click to highlight *Outline number*
    c. Click *Show selected* (at the top) then click *Ok*
    d. In the column headings, drag the *Outline* heading from far right to far left
4. Enter tasks
    a. For all WBS tasks (including the summary task) in order:
        i. Right-click under headers > new task > type task name > press [Enter]
    b. Indent all child tasks under the summary task:
        i. Highlight the group of child tasks:
            1. click the top one, hold shift, click the bottom one
        ii. right-click the highlighted group of tasks > indent
    c. Add task details (look on WBS page) (not for the summary task):
        i. Click then right click each child task > *Task properties* > add duration > Ok
            1. Summary task duration will be automatically computed
        ii. For the milestone, only tick (check) the *Milestone* box (near the top)
5. Add task dependencies **(see Dependency management for details of link types)**
    a. Do not link a summary task to its members (the indents identify the child tasks)
    b. Highlight the group of child tasks (see above):
    c. click *Create dependencies …* (above the logo),
        i. FS type link arrows appear in the Gantt chart
    d. edit dependencies on the dependent tasks where needed:
        i. *interview analysis* and *GUI mock-up design* should start together (SS) so:
            1. Right-click *mock-up design* > *Task properties* > *Predecessors* tab > click *interview analysis* row > *Type* > SS > Ok
        ii. *User validation of mock-up* can only start if **both** *interview analysis* and *GUI mock-up design* are finished. *GUI mock-up* is already linked to *User validation* … so now add *interview analysis*:
            1. Right-click *User validation* …> *Task properties* > *Predecessors* tab > Add button > choose *interview analysis* from *Task name* drop-down > see *Type* is FS > *Ok*
    e. Notice that dates have been computed, based on your input.
6. Add resources
    a. For each resource (look on WBS page):
        i. Go to *Resources chart* (click the tab)
        ii. Right-click under *Name* header > *New resource*
        iii. Complete *Resources* dialog box (*Name, role* and *payment rate*) and *Ok*
7. Assign resources to tasks (look on WBS page)
    a. For each task:
        i. On the *Gantt* view, right-click the task > *Task properties*
        ii. In the dialog box, click the *Resources* tab
        iii. For each resource
            1. Click *Add* > supply details (pull-down > *name* | *unit* is the %)
        iv. Click *Ok*

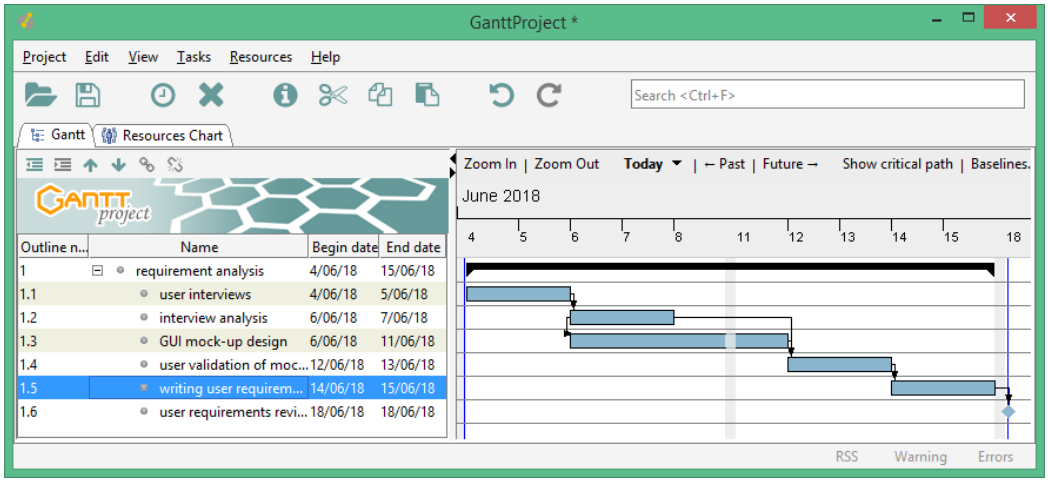
8. Your project is complete. Now to check and adjust.

Next page …

9. Check Resource allocation
    a. On the *Resources chart* view, look for red task bars on the timeline
        i. Red bars indicate over-committed time.
        ii. Green bars indicate committed time
        iii. Grey bars indicate uncommitted time



Resource allocation problem



Gantt chart before resource correction

10. Resolve resource allocation problems
    a. Reallocate tasks if other resources are available
    b. Display critical path and adjust non-critical durations (see display critical path):
        i. On the *Gantt* view, select *Show critical path* (above timeline)
        ii. By inspection, change task durations **
    c. Inspect the *Resources* view to ensure red bars have been eliminated

** To fix the Bob Smith problem:

1. Increase the duration of *Interview analysis* from 2 to 4 (days):
    a. in *Gantt > interview analysis > task properties > duration*
2. Reduce his allocation to interview analysis from 100% to 50%:
    a. in *Gantt > interview analysis > task properties > Resources* tab *> Smith, Bob*

What next?

Explore the project file called *HouseBuildingSample.gan* that came with GanttProject.

Paper based lists used in the *Using GanttProject* tutorial

Sample WBS task list – *Software design* project

WBS #	Name	Duration (days)	
1.0	Requirement Analysis	–	**(WBS# of 1.0 means a summary task)**
1.1	User interviews	2	
1.2	Interview analysis	2	
1.3	GUI mock up design	4	
1.4	User validation of mock-up	2	
1.5	Writing User Requirements	2	
1.6	User Requirements Review Meeting	MS	**MS = milestone; duration is automatically 0 (but is displayed as 1 in *Task Properties*…)**

Sample roles and resources list

Role	Resource	Payment rate
Project manager	Schmidt, Alice	250 *
Analyst	Smith, Bob	200
Programmer	Ali, Pal	150
Tech writer	Babbitt, Den	150

* **GanttProject does not specify monetary units**

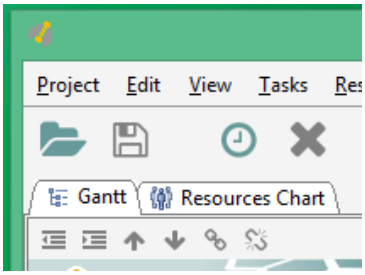
Sample Resource list

Outline #	Task	Schmidt	Smith	Babbitt	Ali
1.1	User interviews	10% *	100%	0%	0%
1.2	Interview analysis	10%	100%	0%	0%
1.3	GUI mock up design	10%	50%	0%	100%
1.4	User validation of mock-up	20%	50%	50%	0%
1.5	Writing User Requirements	20%	0%	100%	50%

* **Percentage of work time allocated to the task for its duration**

Source: compiled from direct inspection

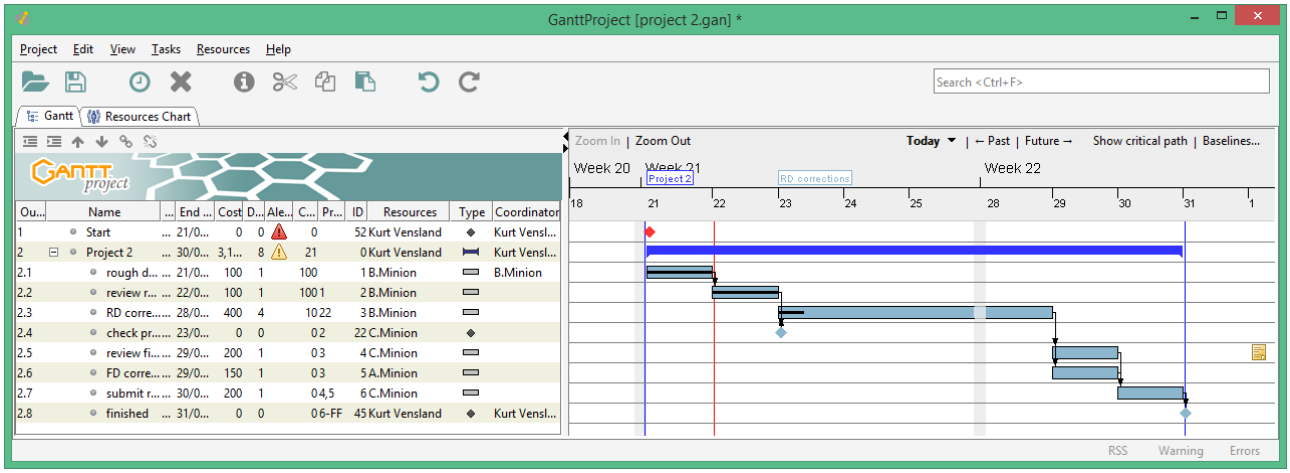
GanttProject: The user interface



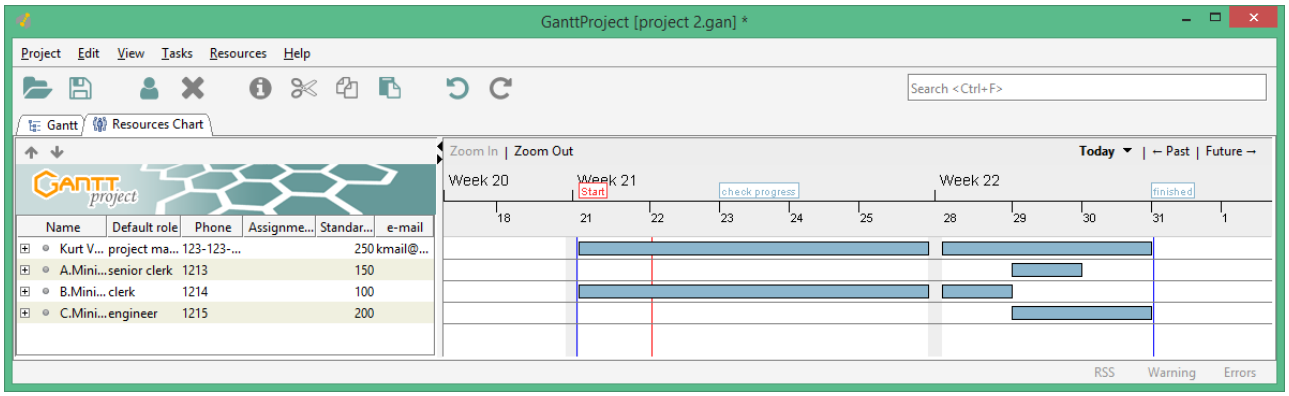
The GanttProject user interface has two views, called *Gantt* and *Resources chart*. Only one view can be seen at a time. The desired view is selected by clicking a tab (either *Gantt* or *Resources chart*) found near the top left of the window.

- The *Gantt* view (default) has a pane on the left that shows a table of task details and a pane on the right with a matching Gantt chart timeline.
- The *Resources chart* view has a pane on the left that shows a table of personnel (resources) and a pane on the right with a matching timeline of task loads.

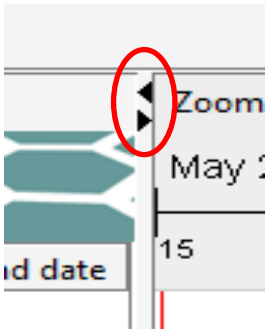
The *Gantt* view



The *Resources chart* view



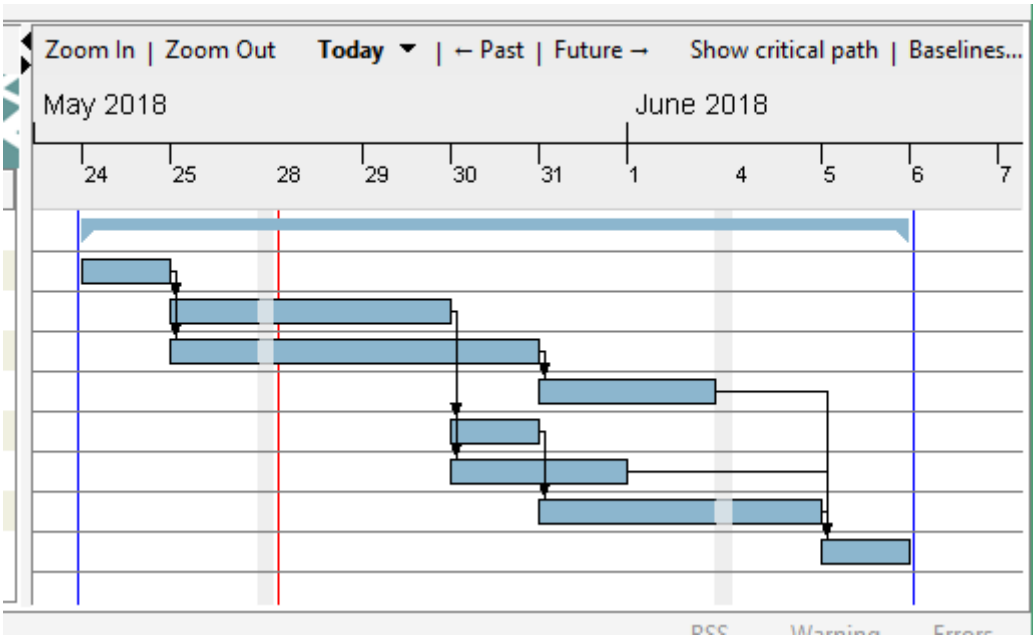
While viewing either the *Gantt* view or the *Resources chart* view, it is possible to extend either the data table pane or the timeline pane across the full width, just by clicking on the small black arrowheads at the top of the vertical separating bar. Click the reverse arrow to go back to the double-pane display.



On both views, the timeline pane can be moved to the left or to the right (and moved up or down if the data table is long) by using click and drag.

Further details (see screenshot below):

- On either view, on the chart pane, vertical blue lines show the boundary dates of the whole project.
- On both views, a vertical red line on the *timeline* pane indicates the position of *today*.
- Clicking on / *Past* / *Future* / (found above the timeline) scrolls the chart display to the left / right.
- Clicking *Today* (also found above the timeline) repositions the chart display with *today* at the left-hand margin.
- *Zoom in* to manage details of short duration projects. The timeline is graduated in individual days.
- *Zoom out* to view the full range of long duration projects. The timeline graduation changes to weeks and then to months (never to years), but the duration of a task continues to be measured in days. Multi-year projects are possible.



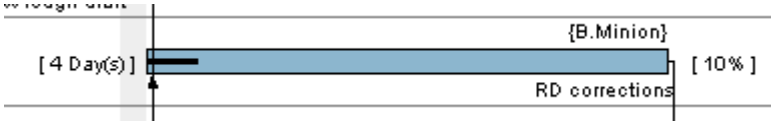
The Gantt chart pane of the *Gantt* view

Source: GanttProject forum

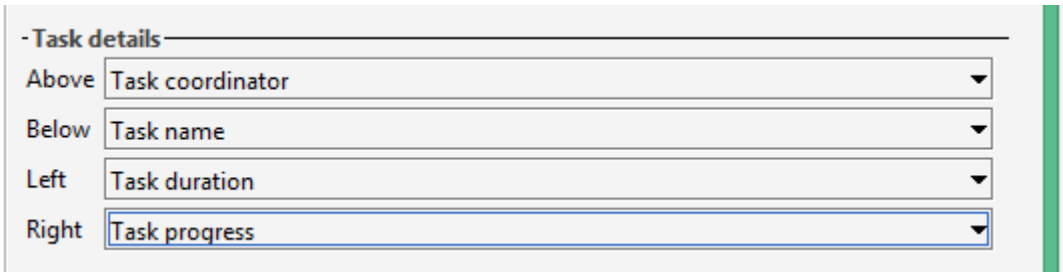
GanttProject: Add comments to Gantt chart taskbars

It is possible to add details to Gantt chart bars, so that this:

will look like this:



To do this, choose *Edit >Settings >Gantt chart >Task details* and select pull-down options (below):



Some locations can be left blank or different options chosen.
When you have made your selections, press *Ok*.

To **remove** the details on the bars, in the pull-down options for each row of *Task Details*, scroll up and choose the blank option at the top.

Source: GanttProject forum

GanttProject: Add and show notes for a task

It is possible to add notes about any task, like this:

1. On the *Gantt* view, in the task table, right-click on the desired task and click *Task Properties…*
2. In the *Properties* dialog box that appears, in the *Edit Notes* field, type any desired notes.

3. Click *Ok*.

When any notes for a task have been entered, an icon appears in that row of the Gantt chart, fixed at the right-hand end. Hover the mouse pointer over the icon to display the notes.

Source: GanttProject forum

GanttProject: Using the Priority setting

Each task has a *Priority* setting, *Normal* by default.
Available settings are: *Very Low* / *Low* / *Normal* / *High* / *Very High*
To view task priorities, a *Priority* column can be added to the task list on the *Gantt* view. In the column, a small coloured circle appears for each task. The circle colour is green for *Very Low* / *Low,* blue for Normal and red for *High* / *Very High* priorities
Priority use is entirely manual. The user imposes the setting and monitors them by inspection.

To change the Priority status of a task:

1. On the *Gantt* view, right-click the task and choose *Task Properties…*
2. A *Properties* dialog box appears; choose the desired setting from the *Priority* pull-down list
3. Click *Ok*

To add a Priority column to the task list

1. On the *Gantt* view, right-click the task and choose *Manage Columns …*
2. In the *Custom Field Manager* dialog that appears, find and highlight the *Priority* option
3. Click the *Show selected* button
4. Click *Ok*
5. If necessary, adjust the column widths in the task table.

GanttProject for Beginners

Introduction

Project management involves the overview of a team whose members work cooperatively to produce an end product or service that benefits an organisation. The project has an **end goal** that is achieved by completing a sequence of interrelated tasks.

GanttProject is a software package that allows effective, on-going management of project data. The application is particularly suited to the so-called waterfall model of project management, in which tasks must be executed in an inter-related sequence, leading to a final end goal state.

This document provides the unfamiliar user with an emerging introduction to *GanttProject*. It will be somewhat easier if the user has a beginning understanding of project management concepts.

Terminology

A few terms will appear repeatedly as we progress. It will help if the reader has an understanding of each of these terms. They are:

Project – a project is a sequence of inter-related tasks that lead to a definite end goal.
Task – A task (or **subtask** for clarity) is an activity with a definite beginning and end that contributes in its turn to delivering the end goal.
Summary task – A summary task achieves an overarching objective by executing a sequence of subtasks.
Resource – A resource is a person, commonly identified by name, who causes a task to be executed.
Role – A role is assigned to a resource to describe its useful ability, such as *clerk* or *engineer*.
Link (or dependency) – Tasks must commonly be executed in order, with one task waiting to start until another has been completed. This is shown on a Gantt chart by arrows (*links*) from task to task in the order of execution.
Milestone – a formal checkpoint in a task sequence, such as at the end of a summary task.
Default – a default setting is the initial setting imposed by the software.
Click – the standard mouse left-click.
Title bar, menubar, toolbar – the top three rows of the GanttProject program window

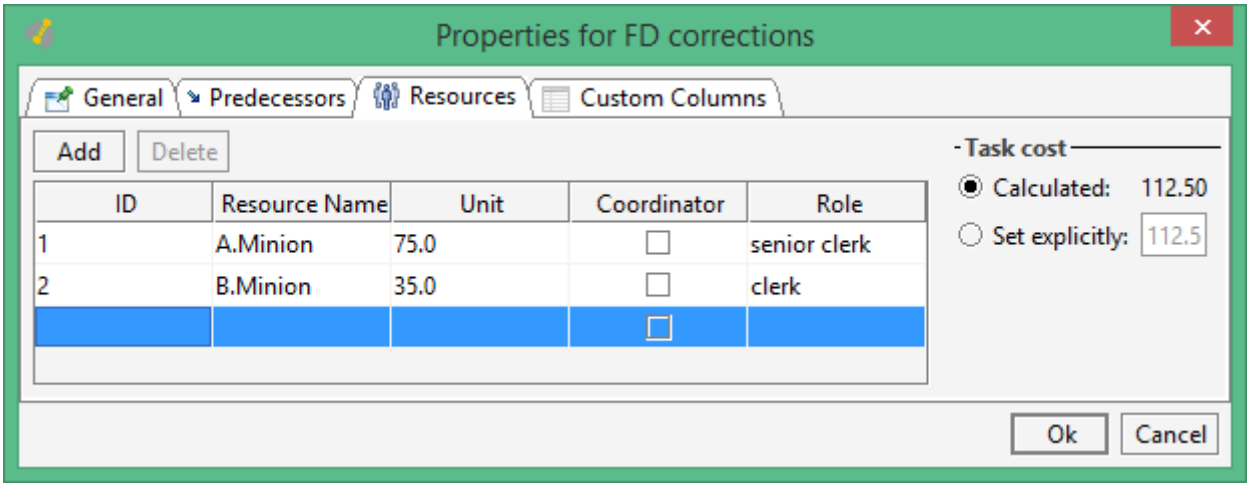
Source: GanttProject forum

GanttProject: Cost management

GanttProject provides for calculating the cost of resources (personnel) assigned to each task, and hence the cost of the whole project. The cost of the project, or of any summary task, is the sum of the costs of individual tasks.

In calculating the cost of an individual task, the contributing factors are:

- The *duration* (in days) of the task, which gives the time for which resources are deployed
- The daily cost of each resource, being the *standard rate* from the *Resource Payment Rate* in *Resource Properties* (this has no stated currency)
- The utilization (as a percentage) of a resource's time devoted to the task; this is the *unit* value found in *Gantt* tab > task > *Task Properties*... > *Resources* tab > *unit* (see below)
- The number of resources assigned to the task



Costs are calculated automatically by default; the cost is calculated for **each resource** by:

Cost = duration X standard rate X unit / 100

The whole cost of a task is the sum of all individual resource costs (even when there is just one).

An explicit cost of a task may be typed in at *Gantt* > *Task properties* > *Resources* tab (see above) The cost of a summary task is the sum of individual task costs, but can also be set manually. There are usually multiple summary tasks in a project. To get a cost for a whole project, just create a single top-level *whole project task* and indent all tasks one more step under that new one.

Cost and *standard rate* can be shown as columns in both task and resource tables (for displaying columns, see GanttProject: Data table columns).

Source: GanttProject forum

GanttProject: Manage calendar details

By default, GanttProject assumes that work on a project takes place, Monday to Friday without weekend work, all year. In reality, work may run for the whole seven-day week (rush job), or Wednesday to Sunday (a restaurant) for example. Further, most communities enjoy public holidays and individual people take leave for a variety of reasons. GanttProject can allow for all of this. However, GanttProject only provides for durations measured in whole days.

To prepare to manage calendar matters

- Go to *Project* > *Properties* > *Calendar*
    - The settings apply to the whole project

To enable working across weekends

- Choose *On weekends* > *all tasks run as on other days*.
    - Tasks then run without weekend disruption, and minor changes are made to the layout of days on the Gantt chart pane
- See also GanttProject: Enable weekends as work time

To relocate the weekend break to other days of the week

- In the row *Choose weekend*, check the two days which form the break. Uncheck the rest.
    - These settings can be varied as you work through the project.

To allow for public holidays

- From the row *Holiday calendar*, choose your relevant list from the pull-down menu.
  You can inspect the selected list just below on the *One-off* and *Recurring* tabs.

To allow for an individual resource's leave of absence

Leave for an individual resource does not apply to the whole project and is handled differently. See *GanttProject: Record Time-Off for Resources*

Allocation of start dates

When a new task is first added (without details), the new taskbar will appear, starting at the earliest date currently displayed in the Gantt chart pane. The *Begin date* and *End date* will be automatically derived and displayed when links are inserted.

Move project start date

In *Project* > *Properties* > *Calendar* there is an option called *Move project start date* (near the bottom of the dialog box). Use this setting to change the whole project to a different starting date.

Import holiday calendars in iCalendar format

The placement of public holidays in the calendar is quite arbitrary and changes from year to year. Assembling a world-wide list is an arduous task. Many individual calendars are now available online in iCalendar format published on Mozilla Holiday Calendars or iCalShare web sites. These calendars can be imported into GanttProject. The procedure is:

1. Find the required calendar online
2. Download the iCalendar as a .ICS file
3. In GanttProject, use *Project* > *Import* to import the .ICS file

Use a *neutral* day

Occasionally it may be necessary to designate a day as *neutral*. This day will then not be considered in any GanttProject analysis. To set a day as neutral, choose *Project* > *Properties* > *Calendar* > *One-off* > *Add* (enter date) > *Type* (choose *neutral).* You can also choose a reminder colour that appears in the timeline charts.

Source: GanttProject forum

GanttProject: Link (dependency) management

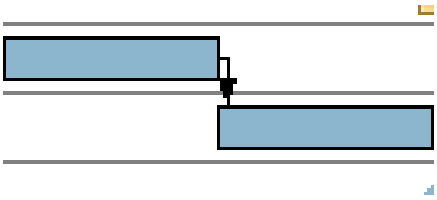
It is usual for project tasks to happen in sequence. For example, a particular task must wait until its predecessor runs to completion. *Paint the wall* (the successor) must wait until *build the wall* (the predecessor) is complete. In a Gantt chart, a relationship like this (called a dependency) is commonly represented by an arrow (called a *link*) from the finish of one task to the start of the next.

There are multiple ways of inserting *links* into a Gantt chart in GanttProject.

To begin, you must have already set up a *Gantt* data table, with task names and durations. This will cause the representative bars to appear on the Gantt chart in the right pane. Linking the tasks automatically inserts Begin dates and End dates.

Insert a single link between two tasks

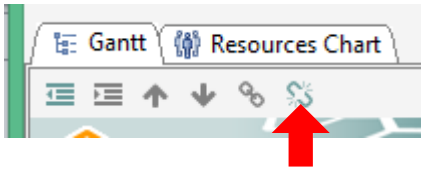
In the Gantt chart on the right:



1. Left-click and hold anywhere on the predecessor task.
2. Drag to anywhere on the successor task
3. Release the left mouse button.
4. A joining arrow will appear between the two.

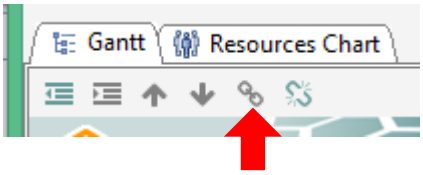
Clear all links within a set of tasks

1. In the data table, highlight the whole set of tasks, like this:
    a. Click and release on the top task. It will remain highlighted.
    b. Hold down a Shift key and click on the bottom task. All tasks between become highlighted.
2. Click the *Remove all dependencies* … toolbar icon
3. All links in the selected region disappear.

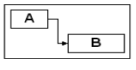
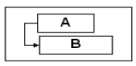
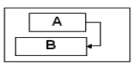
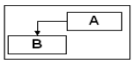


Insert a string of links within a set of tasks

1. Highlight the whole set of tasks (see above)
2. Click the *Create dependencies between selected tasks.*
3. A series of links will appear, running down the tasks.



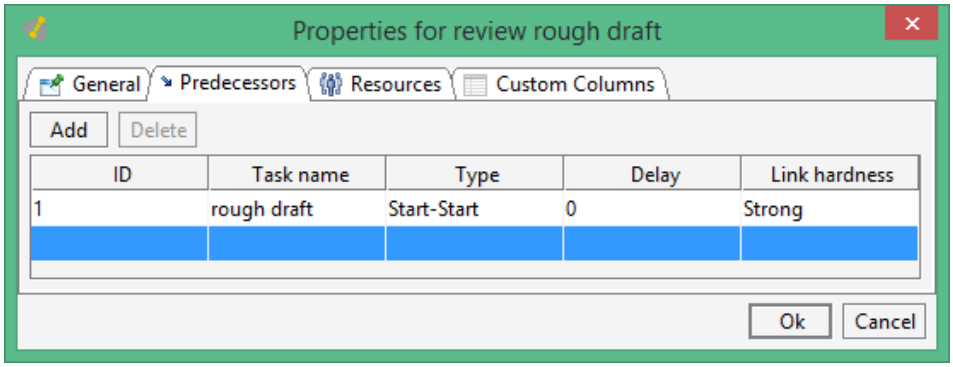
These links, the most common *type*, pass from the finish of the predecessor task to the start of the successor task. They are called finish-to-start or FS links. Altogether, four types of links are possible. See them here:

Possible Task Dependency Relationships	
Finish-to-Start (FS) B cannot start till A finishes A: Construct fence; B: Paint Fence	
Start-to-Start (SS) B cannot start till A starts A: Pour foundation; B: Level concrete	
Finish-to-Finish (FF) B cannot finish till A finishes A: Add wiring; B: Inspect electrical	
Start-to-Finish (SF) B cannot finish till A starts (rare) (rare)	

Insert a link of a less common type

Links created by dragging in the Gantt chart, or by using the icons, are all FS links.
Links of the less common types must be created one at time. Here is how:

1. First create an FS link between the desired tasks; use dragging or icon.
2. Right-click the *successor* task and choose *Task Properties*...
3. In the *Properties* dialog box that opens, choose the *Predecessor* tab
4. Click the cell under the *Type* heading. A pull-down menu appears.
5. Choose *Start-Start*
6. See something like this:



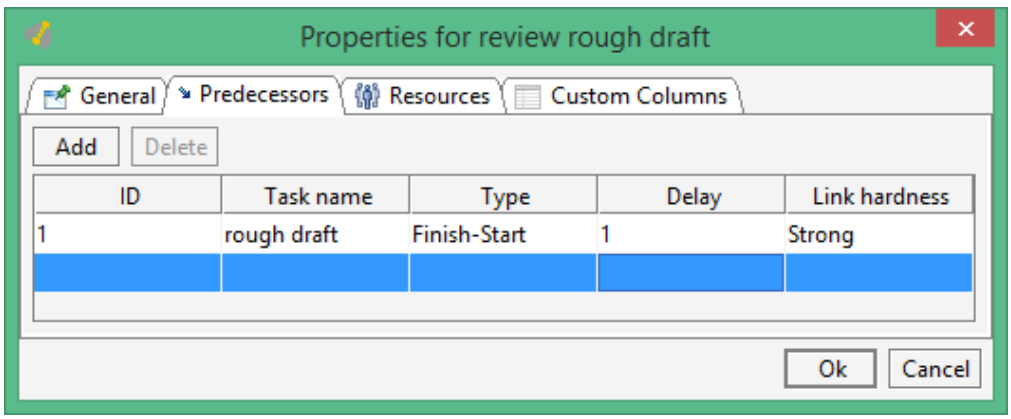
7. Click Ok
8. In the Gantt chart pane, see two bars with a link like this: 

The link indicates that the lower task cannot start until the upper task starts.

Manage a *delay* (also called *lag*) between tasks

Sometimes a successor task cannot begin immediately after a predecessor. For example, after the task *paint the car*, there needs to be a pause while the paint dries, before we execute the task *drive the car away*. To provide for this, we use a *delay* setting, like this:

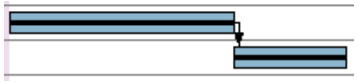
1. First create an FS link between the desired tasks; use dragging or icon.
2. Right-click the *successor* task and choose *Task Properties*...
3. In the *Properties* dialog box that opens, choose the *Predecessor* tab
4. In the delay column change the zero value to the desired delay length (in days)
5. Double-click the cell, change the value, press [Enter]. See something like this:



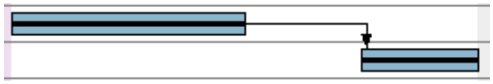
6. Click Ok

7. Inspect the new link in the Gantt chart. The before and after links look something like this:

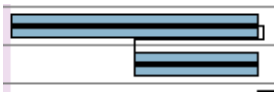
Before:



After:



You can also use negative delay (e.g. -1), after which it looks like this: This allows a task to begin at a fixed time before it precursor finishes.

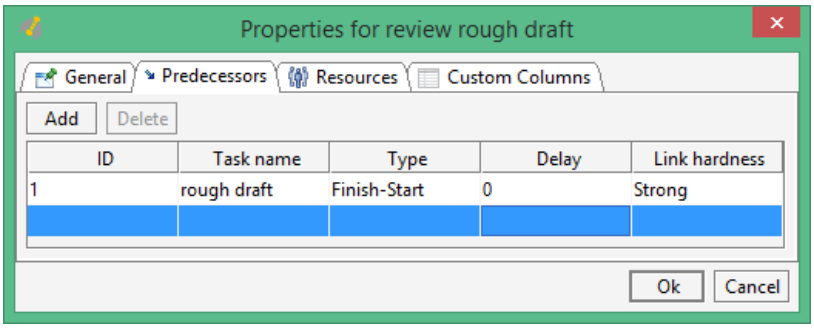


Manage link hardness

Standard practice when creating a Gantt chart is to define the *duration* of each task and the *Begin date* of only the first task. When the links are set up, *GanttProject* computes all the other dates.

The default FS *link* requires that a successor task must start as soon as the predecessor completes. Therefore, later changing a duration can result in the recalculation of multiple task dates. In a complex Gantt chart, this wholesale change of dates can disrupt the whole plan.

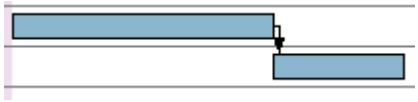
To avoid this worry, a link property called *link hardness* has been incorporated. It has two possible values, *strong* and *rubber*. The link hardness value is chosen by going to the successor task and choosing *Task Properties*… > *Predecessor.* It looks like this (familiar?):



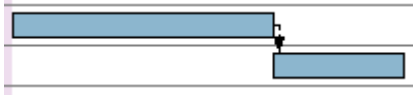
To choose the *link hardness* setting, go to the *link hardness* column. There, click on the current value to open a pull-down list, choose the desired option and click *Ok*.

The effect of the *link hardness* setting is visible in the *Gantt* chart. It all looks like this:

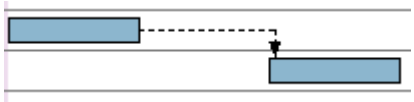
Initial appearance with default *strong* link hardness:



Appearance with *rubber* link hardness (note the line gap behind the arrowhead):



Appearance after reducing the duration of the predecessor task (note the dotted link):



It is generally accepted that *rubber* is the better default *Link hardness* setting. This can be set at *Edit* > *Settings* > *Gantt chart* > *Link hardness*

Source: GanttProject forum

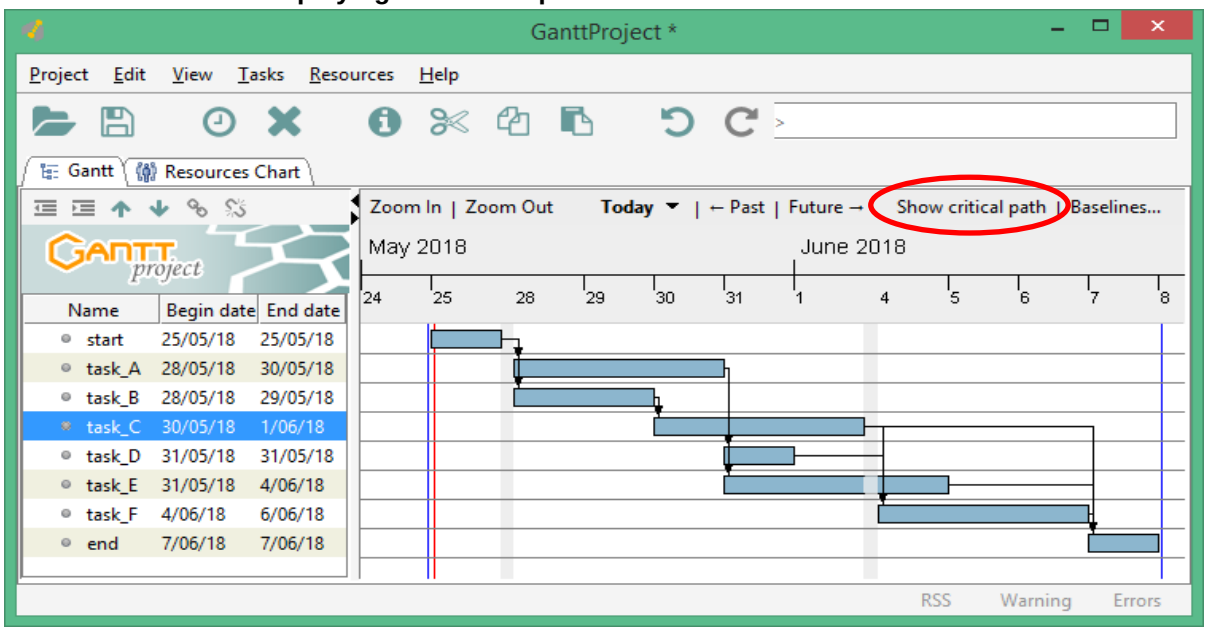
GanttProject: Display the critical path

In a Gantt chart, the *critical path* is the sequence of linked tasks that has the longest total duration. The path has no slack and determines the End Date of the project.

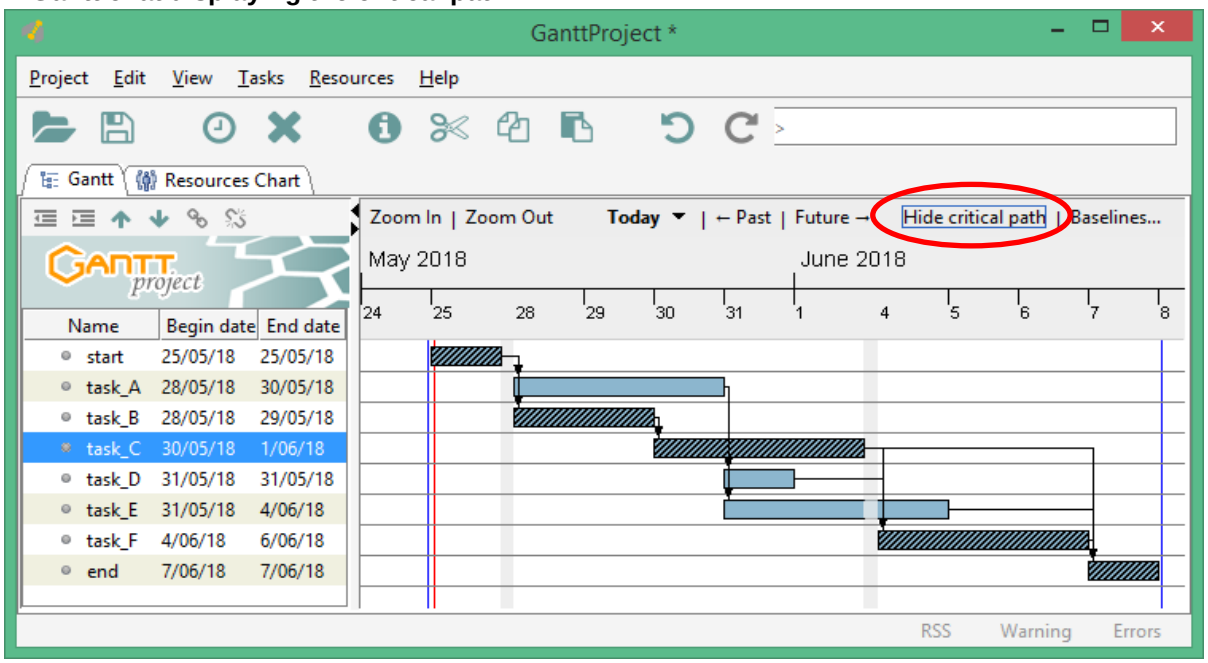
In GanttProject, display the critical path of a project like this:

1. Choose the *Gantt* view
2. Click the option *Show critical path* above the timeline.
3. See critical path taskbars emphasized (cross-hatch)
4. To dismiss the critical path, click the option *Hide critical path* above the timeline

A Gantt chat before displaying the critical path



A Gantt chat displaying the critical path



Source: Manually compiled

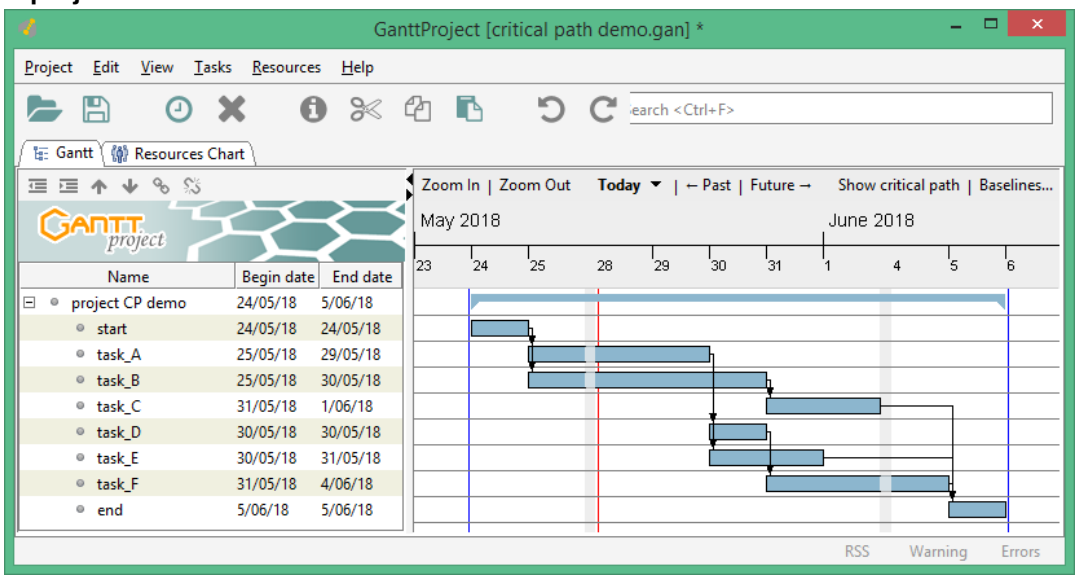
GanttProject: View a PERT chart

The two working views of GanttProject are selected from the tabs *Gantt* and *Resources chart*. A third view is available which displays a PERT chart of the project. This chart is effectively read-only. Its elements can be moved on the view, but dependencies cannot be changed and any changes of layout are discarded whenever the project is closed.

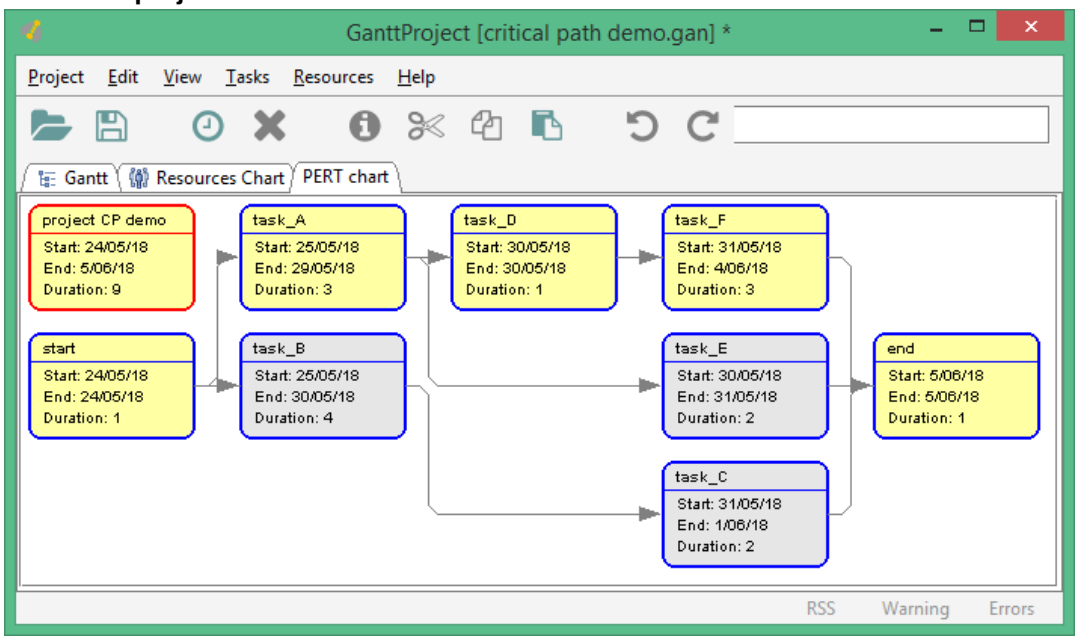
The PERT chart displays dependencies more clearly than does a Gantt chart. It also displays the critical path by the colour of its tasks.

To display the PERT chart, from the menubar, choose *View* > *PERT* (the only option). This adds a view tab beside *Gantt* and *Resources chart*.

A project in *Gantt* view



The same project in PERT view



From: http://www.gantt.com/creating-gantt-charts.htm

Creating Gantt Charts

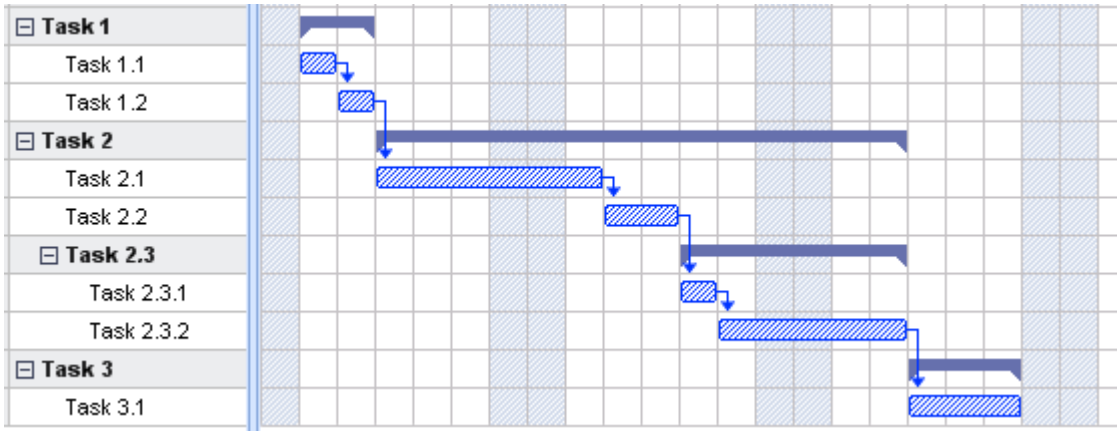
GanttProject does not offer all the options described here

Gantt charts are widely used in business to describe and monitor all kinds of projects, consistent with the rules of project management. In today's world they are usually created by computer applications, such as Microsoft® Project, Primavera Project Planner® and MindView. Here, we refer to such applications as Gantt applications. Different Gantt applications have different features and capabilities: in the discussion below we describe some of the more common characteristics.

The first thing you will need before setting up a Gantt chart is a detailed project plan. A project plan is a series of interdependent tasks that need to be performed in a particular order. When moving into a new office for instance, you cannot start rearranging the office space before the lease agreement has been signed.

Project plans have a specific start date, corresponding to the start of the first task (for instance defining the requirements for the new office), and a specific end date, corresponding to the end of the last task (for instance moving in).

One way to create a project plan is to use a work breakdown structure, a technique for splitting tasks into sub-tasks and creating a task hierarchy. Gantt applications will generally allow you to reflect the project hierarchy in the Gantt's task list at the left of the chart.



Gantt chart task hierarchy

Mind mapping software, which encourages creative thinking, will help you to develop a work breakdown structure and ensure that nothing is omitted from the overall project plan. If the mind mapping software incorporates Gantt charting (e.g. MindView), it will allow you to enter data as you develop the plan, saving time later. Make sure your plan is as complete as possible and its assumptions are realistic.

Once the project plan is complete, enter the data into the Gantt application that will create the chart:

How to Create a Gantt Chart

- Define the project settings, such as its start date, end date and scheduling mode. The most common scheduling mode is forwards from the project start date. In this mode the default is for tasks to start as soon as possible, which means that the whole project finishes at the earliest possible date.
- Define the project calendar. This sets the number of working days in the week, the number of working hours in the day, and so on. GanttProject only works in days.
- Enter or edit task names and durations.
- Set up a global resources list and assign resources to tasks. Although you can often define the resources as you need them, it is usually quicker to start by setting up a global resources list from which you can then select resources to assign to the various project tasks. See Including resources in a Gantt chart.
- Create links to specify the dependencies between the project tasks. See Linking tasks in a Gantt chart.
- Set constraints on the tasks as necessary. See Adding constraints to a Gantt chart.
- Make final adjustments to the project plan. See Enhancing a Gantt chart.
- Once the project has actually started, inspect it at regular intervals to detect potential problems or scheduling conflicts and make any corrections required. See Reviewing a project using a Gantt chart.

Note: If you used mind mapping software that incorporates Gantt chart creation during the planning stage, much of this data will already be in place.

With all the data entered, the Gantt application displays the chart. Any change in the timing of a task affects all the tasks that depend on it. If a task runs ahead of schedule, the Gantt application automatically recalculates the dates of all the tasks that depend on it in order to take advantage of the time gained. Conversely, if a task is delayed, all the tasks that depend on it are automatically rescheduled, which may or may not impact the overall end date of the project.

By using the Gantt display you can build and manage complete project plans in this standard, well-defined format. You can easily add or remove tasks, set or adjust the duration of tasks (length of bars), link tasks (for example to make one task follow immediately after another), and add some constraints (e.g.: dependencies or specify that a task must begin no earlier than a given date).

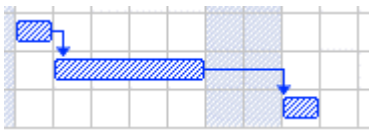
To help you get started, some Gantt applications include various ready-made project plans for common business activities (for example, organizing a tradeshow, producing a publication, launching a product). You can use these for training purposes or as a basis for your own project plans.

Linking Tasks in a Gantt chart

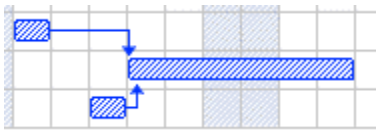
Project plans normally require tasks to be performed in a specific order. For instance, a publication must be written and proofread before it can be printed. To achieve this, the Gantt application lets you link tasks so that they depend on each other.

By default, tasks are usually linked in a 'Finish to Start' relationship (dependency), which means that the first task you select (the predecessor task) must end before the next task you select (the successor task) can start, and so on.

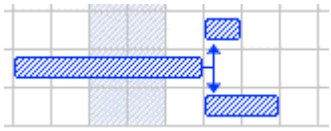
This is typically represented on the Gantt chart by lines with arrowheads joining each task to its successor. The arrowhead indicates the direction of the link: it goes from the predecessor to the successor.



Gantt chart multiple predecessors
A task can have more than one predecessor. In this case its start date is determined by the predecessor link that gives it the latest start date. As dates and times change during the course of the project, the predecessor link that actually determines the start date of the task may change too.



Gantt chart multiple successors
Similarly a task can have several successors. In this case the task determines the start date of all its successor tasks.



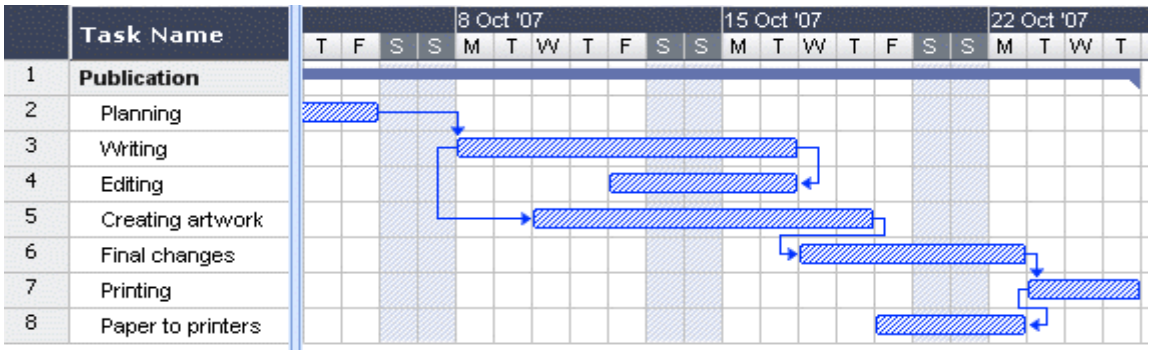
Gantt chart successors
When you are scheduling a project plan from its start date the Gantt application calculates the end date of the project automatically, on the basis of the task durations, the task dependencies and the project calendar.

The possibility of linking tasks in this way is what makes project management software particularly powerful: you can change the duration of one or more tasks, add a task or remove a task from a chain of linked tasks, and all the dates are recalculated automatically so as to maintain the task dependencies you have defined.

Other Link Types
There are four possible relationships (dependencies) between tasks:

- **Finish to Start (FS) - the default:** The successor task cannot start before its predecessor ends, although it may start later. This is the most common type of relationship, and is described above.
- **Start to Start (SS):** The successor task cannot start until the predecessor starts, although it may start later. This can be useful if you have a task whose start date depends on the start date of another task.
- **Finish to Finish (FF):** The successor task cannot end before the predecessor ends, although it may end later.
- **Start to Finish (SF):** The successor task cannot end before the predecessor starts, although it may end later. This task relationship is rarely used.

The following project plan for the preparation of a publication illustrates all these kinds of relationships:



Gantt chart dependencies

In this example:

- The writing task follows on directly from the planning task. If the end date of planning changes, so will the start of writing. This is the normal **Finish to Start** relationship.
- The editing task starts some way through the writing task. The writers and the editors work together as a team until the text is complete. Their tasks effectively end at the same time. If the end date of writing changes, so will the end date of editing. This is a **Finish to Finish** relationship.
- The creation of artwork depends on the start of writing. In this case a lag (delay) has been introduced so that it doesn't start exactly when writing starts. Even so, if the start of writing changes, so will the start of artwork creation. This is a **Start to Start** relationship.
- The final changes task depends on the end of artwork creation, but an overlap is included so that it actually begins two working days before the end date of artwork creation. If artwork creation is delayed, so will be the start of final changes. This is the normal **Finish to Start** relationship.
- Printing starts after final changes are complete. This is also a **Finish to Start** relationship.
- The transferring of paper from the warehouse to the printers must be complete in order for printing to start, but is not related to any of the preceding tasks. The printers have limited storage capacity and do not want the paper to arrive until it is needed ('just in time' or JIT scheduling), so the start of printing drives the delivery of paper. If the start of printing changes for some reason, so will the end date for getting paper to the printers. This is a **Start to Finish** relationship.

Here each task has a single predecessor, the simplest arrangement. However, a task can have several predecessors. In such situations you will need to think carefully about possible undesirable consequences. For example, if you added another predecessor to the "Paper to printers" task above, it would be possible for that predecessor to push out "Paper to printers" so that its end date was later than the start of printing.

Using Lag and Lead Times in a Gantt Chart

When linking tasks you can add a lead or lag time to extend a link backwards or forwards so that the successor task starts earlier or later than it otherwise would. For a default 'Finish to Start' link, this either introduces an overlap (lead time), so that the successor task starts before its predecessor ends, or it introduces a delay (lag time) that makes the successor task start some time after its predecessor ends.

When planning the production of a marketing brochure for instance, you could use lead time to make the creation of artwork start a few days before the writing phase is over. The two tasks are however still linked, which means that a delay of the writing phase will also delay the creation of the artwork.

Adding Constraints to a Gantt Chart (these constraints are not available in GanttProject)

Constraints define the degree of flexibility available to the Gantt application when scheduling or rescheduling a task by imposing restrictions on its start or end date. The following task constraint types offer different degrees of flexibility.

Two "constraints" are actually so flexible that they are not generally regarded as constraints at all:

- **As Soon As Possible (ASAP):** This is generally the default constraint when you schedule your project from its start date, as is normally the case. You should try to keep this default whenever possible as it gives the software the most scheduling flexibility. If you apply this constraint to an unlinked task, the task will be scheduled to start at the project start date. If you apply it to a linked task, it will start as soon as the dependencies with its predecessor tasks will allow.
- **As Late As Possible (ALAP):** This is generally the default constraint when you schedule your project from its end date. If you apply this constraint to an unlinked task, the task will be scheduled so that its end date coincides with the end date of the overall project. If you apply it to a task linked to a successor task, the task will be scheduled to end when the successor needs to start. On the whole, you should avoid this constraint as it does not leave any slack time to deal with possible problems. Any delay on the task is likely to impact the overall end date.

The following constraints all restrict the Gantt application's flexibility when scheduling tasks. Although you might be tempted to use them if you are new to project management, you need to make sure you understand the implications. Keeping their use to a minimum (especially the last two) will allow you to take full advantage of the automatic scheduling possibilities.

- **Start No Earlier Than (SNET):** This means that the task, whether linked or not, may not start before the given date. However, the Gantt application still has the flexibility to start the task later than the given date.
- **Start No Later Than (SNLT):** This means that the task, whether linked or not, may not start later than the given date. However, the Gantt application still has the flexibility to start the task earlier than the given date.
- **Finish No Earlier Than (FNET):** This means that the task, whether linked or not, may not end before the given date. However, the Gantt application still has the flexibility to end the task later than the given date.
- **Finish No Later Than (FNLT):** This means that the task, whether linked or not, may not end later than the given date. However, the Gantt application still has the flexibility to end the task earlier than the given date.
- **Must Start On (MSO):** This rigid constraint means that the task, whether linked or not, must start on the given date. Even if the preceding task is completed earlier, the Gantt application cannot pull in the constrained task to take advantage of the time gained.
- **Must Finish On (MFO):** This rigid constraint means that the task, whether linked or not, must end on the given date. As above, even if the preceding task is completed earlier, the Gantt application cannot pull in the constrained task to take advantage of the time gained.

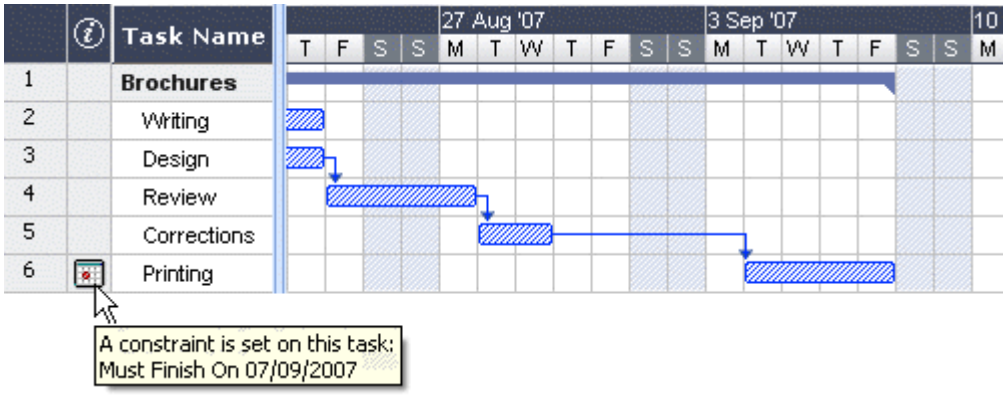
If you decide to apply one of these constraints to a task, it is good practice to attach a note or a comment to the task to explain why you did so. If the constraint causes scheduling conflicts later on as your project evolves, you will be able to refer to the note to decide what to do.

Such notes also allow you to distinguish easily between the tasks you have constrained yourself deliberately and the tasks you may have constrained inadvertently by moving their task bar or editing their start or end date manually.

The effect of a constraint is not always obvious when you schedule your project plan from its end date, so take care to check that it does give the result you want.

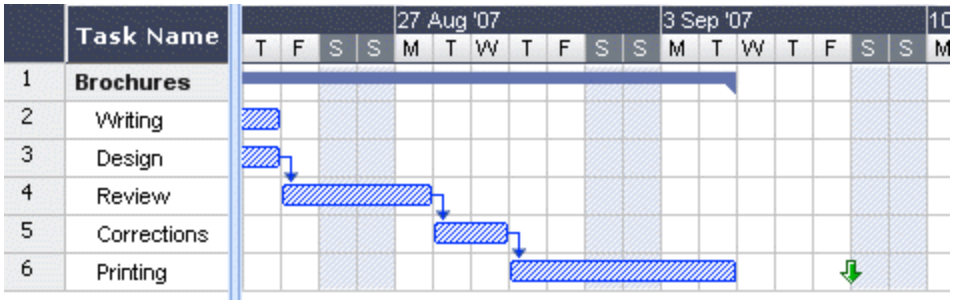
The following example shows some tasks in the preparation of a brochure for a mail shot. The mail shot is scheduled for September 10th. The tasks are linked, but we have set a 'Must Finish On' constraint on the printing task for September 7th, the latest date that will allow the mailing to go ahead on the following Monday, September 10th.

The constraint, as usual, overrides the link. By setting a 'Must Finish On' constraint for September 7th, we have effectively moved the task out so that it ends exactly on September 7th, regardless of whether it could have been completed earlier or not.



Gantt chart constraints

The problem with this is that if the printing task takes longer than expected, the mailing date will be missed. It would be much better to take advantage of the unused time after the end of the corrections task to get started with printing. However, we still need to keep an eye on the September 7th deadline. To do this, we remove the constraint from the printing task, so that the link will determine its start date, and add a deadline marker instead.



Gantt chart deadlines

Now there is a useful three day gap between the end of printing and the deadline, and the deadline is clearly indicated. The deadline indicator will warn us if the task moves past its deadline.

Including resources in a Gantt chart

Many Gantt applications allow you to assign resources to your tasks and project plans. Resources can be people, materials, equipment, budget amounts, or anything else. Typically, you might enter the names of people who will work on the tasks as resources.

The Gantt display will indicate the resources that have been assigned to each task. You may also be able to enter additional information, for example:

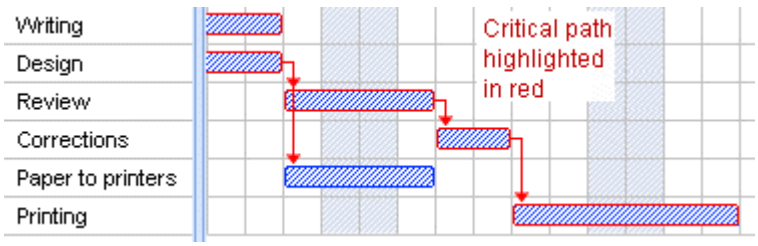
- Where the resource is a person or a team, the amount of time that the person or team will spend on the task. This is usually designated as a percentage, 100% signifying one person full time. So you would enter 250% for a team of three people where one of the people will be working only 50% of the time.
- Where the resource is a material, the amount needed for the task. For a material such as sand it might be 50 tons.
- The cost of the resource. In the case of a person this could be a dollars per hour figure. For a material such as sand it might be dollars per ton, for electricity dollars per kWh.
- The rate of consumption of a material resource. Some resources have a fixed cost but for others the cost depends on the duration of the task. For example, heating might be estimated in kWh per day.

Some Gantt applications will adjust the length of each Gantt bar (task duration) according to the amount of work the people assigned to the task can provide. Overuse of resources may be flagged, as when a schedule change makes two tasks involving the same team of people overlap.

Enhancing a Gantt Chart

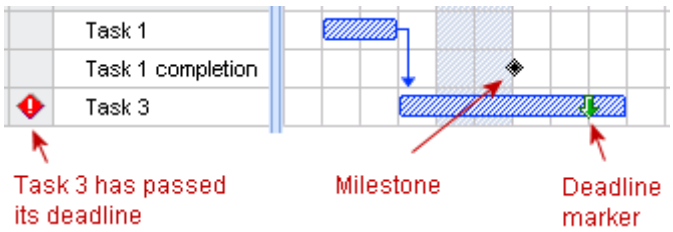
Gantt applications generally include features to make your Gantt chart easier to use. These vary from application to application; here are some examples:

- Adding explanatory notes to tasks. This is especially useful for tasks that have constraints. Constraints override links and can lead to illogicalities or schedule conflicts in the plan, so you will need to keep an eye on them.
- Highlighting the critical path in order to see at a glance the tasks that are currently directly affecting your project end date. In a project plan, the critical path corresponds to the tasks or chain of linked tasks that cannot be delayed without delaying the entire project. A task lies on the critical path if a change to its start date or duration affects the end date of the project (or the start date if you are scheduling from the end of the project). Keeping a close eye on the status of your critical tasks at any time is therefore key to good project management. If the overall project duration is too long, the only way to make it shorter and bring in its end date is to shorten the critical path.
- Setting milestones or deadlines to mark key dates. A milestone is a task with zero duration. It appears on the Gantt chart as milestone symbol. Milestones are generally used to indicate important dates on the project plan, often key events or goals. For example, you might use milestones to mark desired completion dates, or project review meetings.



Gantt chart highlighting critical path

A deadline marker does not affect any of the Gantt calculations, but places a visible marker on the Gantt chart as a reminder. In most Gantt applications an indicator will warn you if a task moves past its deadline marker.



Gantt chart deadlines passing

- Giving tasks priorities.
- Showing a percentage completion for any task, visible on the task bar.
- Customizing the appearance of the project plan on the Gantt chart, for example the color of task bars, the display (or not) of informational labels.

Reviewing a project using a Gantt chart

It's a good idea to review your project plan regularly in order to locate conflicts or other problems. You can then make appropriate changes to remove them.

Here are some questions to ask yourself:

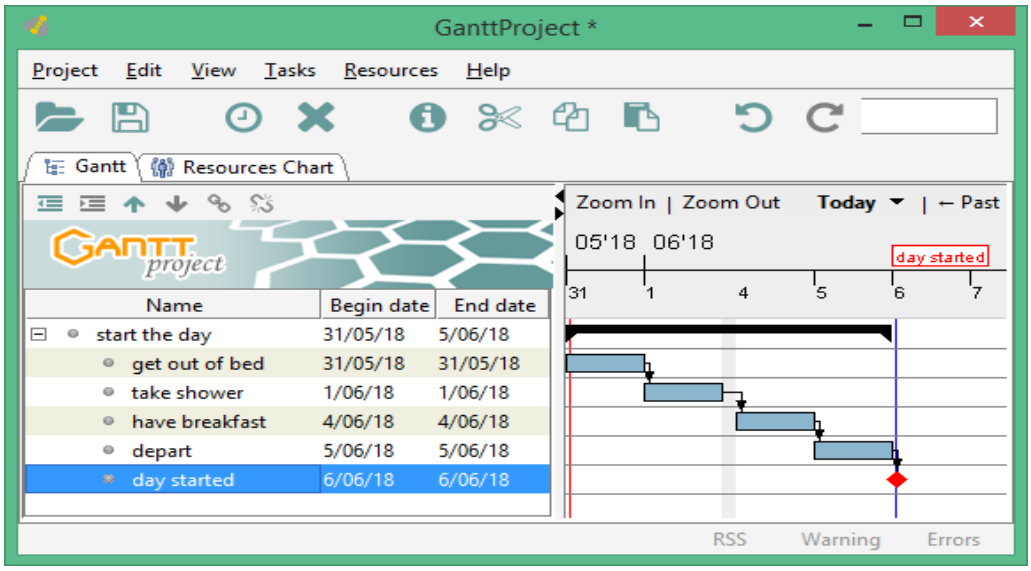
- Is the project on course? View the end date of the last task on the Gantt chart. Check that it looks reasonable.
- Has any task overshot its deadline? If so, you will need to take action: extend or remove the deadline, allow more time for the task or assign more people to it.
- Are all the links between tasks necessary? By unlinking tasks that don't actually depend on each other, you will make use of all the slack time available, thereby shortening your schedule and maximizing its flexibility.
- Consider whether some tasks could overlap each other to reduce the overall duration of the project. If so, assign appropriate lead times (see Using lag and lead times in a Gantt chart). Another possibility is to redefine some of your 'Finish to Start' relationships to either 'Finish to Finish' or 'Start to Start' if the logic of your schedule allows it.
- Are the constraints working as you expect (not in GanttProject)? If you have been adding an explanatory note to every constraint you set, read the notes to check that your intentions are still being met. And look for tasks that have a constraint but no note: these may have been created inadvertently and be causing trouble. Also, because constraints generally override links, they can introduce schedule conflicts.
- Do the tasks that have constraints fall where you expect them to? Do they fit logically with the other tasks around them? Checks that their start and end dates are neither too early nor too late.
- Are there unexpected overlaps or gaps between linked tasks? Often this is caused by a rigid constraint on one or other of the tasks. However, remember that overlaps and gaps can also be caused by intentional lead or lag times.

Source: GanttProject forum

GanttProject: Using milestones

It is common in project management to confirm that intermediate goals have been reached. These goals may be presented in a Gantt chart as *summary tasks*. Using *milestones* (i.e. deadlines), notably at the end of summary tasks, facilitates progress monitoring.

- A *milestone* is created in a project as a configured *task*. It appears on the Gantt chart as a diamond marker. It can also be configured to display a *label* showing the task name, immediately above the timeline in the Gantt chart.
- A *milestone* has zero duration, although *Task properties* show it as having a duration of 1. This cannot be changed.
- Clicking on a *label* causes the corresponding *task* in the *Gantt* data table to be highlighted. This can make it easier to find the *task* in a large project.



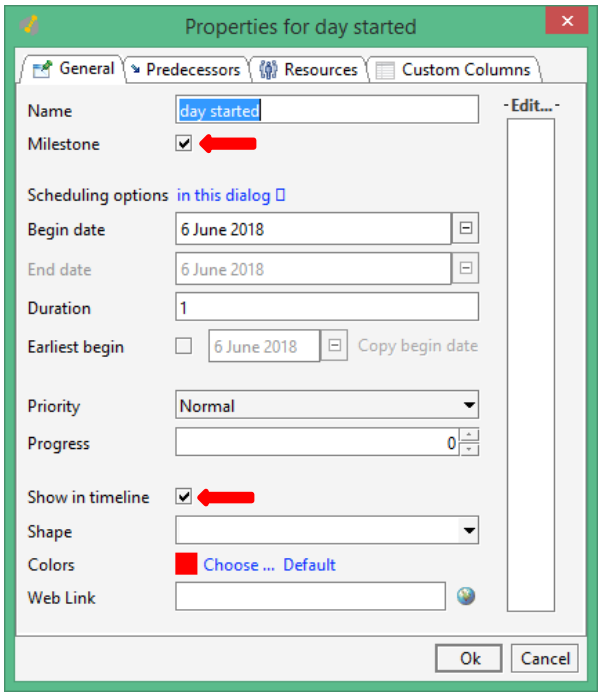
Milestone (red) *day started* on Gantt chart with label above timeline

Set a task as a milestone:

1. On the *Gantt* view, select the *task*
2. Right-click on the *task*
3. Click *Task properties*…
4. In *Task Properties*, near the top, check *Milestone*
5. Click *Ok*

Display the label above the timeline

1. On the *Gantt* view, select the *task*
2. Right-click on the *task*
3. Click *Task properties*…
4. In *Task Properties*, near the bottom, check *Show in timeline*
5. Click *Ok*



Source: various fragments

GanttProject: Summary tasks and subtasks

Start with a WBS process – end with a Gantt table

To begin, we will build a simple *Work Breakdown Structure (WBS)*, a plan for a work day

- For a start, we describe the three *phases* of the day, shown in the left column below.
- These phases need to be expanded upon by the *tasks* in the second column.
- The actual WBS integrates the first two columns, using *outline* numbering.
- In the *Gantt* data table the task *names* would look like the fourth column.

Project: A work day			
Phases	**Tasks**	**WBS**	**Gantt table names**
Start the day		1.0 Start the day	Start the day
	Get up	1.1 Get up	Get up
	Take a shower	1.2 Take a shower	Take a shower
	Eat breakfast	1.3 Eat breakfast	Eat breakfast
	Go to work	1.4 Go to work	Go to work
Run the business		2.0 Run the business	Run the business
	Open the doors	2.1 Open the doors	Open the doors
	Sell things	2.2 Sell things	Sell things
	Close the doors	2.3 Close the doors	Close the doors
Finish the day		3.0 Finish the day	Finish the day
	Go home	3.1 Go home	Go home
	Eat dinner	3.2 Eat dinner	Eat dinner
	Watch TV	3.3 Watch TV	Watch TV
	Go to bed	3.4 Go to bed	Go to bed

All of the actions in the plan, phase or specific, are called *tasks*.
The phase tasks are called *summary tasks*.
Tasks that give detail to a summary task are sometimes called *subtasks*, or even *child tasks*.

When the list of tasks is entered in the *name* data column of a *Gantt* view:

- For clarity, subtasks should be kept in execution order
- Each summary task must be followed immediately by its subtasks
- A task may be indented by either one or two levels
- A summary task is created by indenting at least one following subtask
- If all its subtasks are deleted, a summary task reverts to being a plain task
- If a summary task is deleted, its subtasks are also deleted

How to indent

- The indent level of *linked* tasks cannot be changed
- To indent a task, right-click on the task > *Indent*
- To reverse the indentation, right-click on the task > *Unindent*

Summary details

The details of a summary task (Start date, End date, duration and Cost) are computed from the combined contribution of its subtasks. Entering these details directly in *Task Properties* of the summary task is likely to create errors.

To **show or hide** all subtasks of a single summary task, simple click the **expand**/**collapse** button found on the left of the summary task name. This will toggle the current state.

Source: various fragments

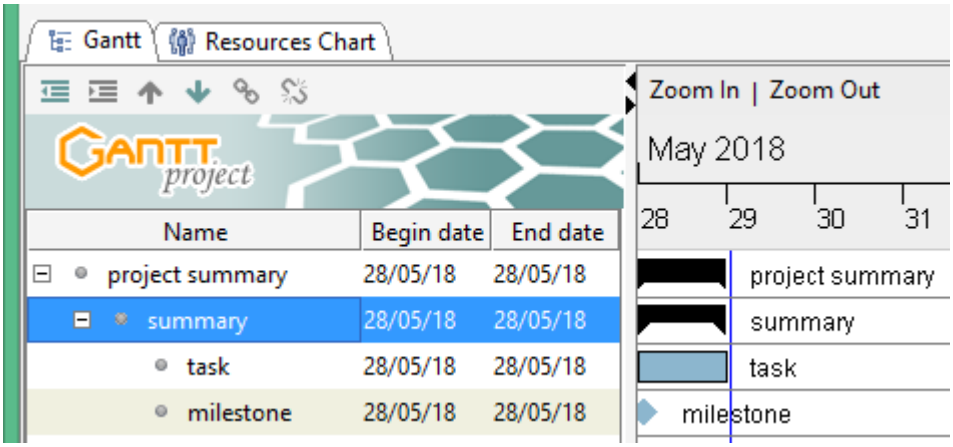
GanttProject: Task types

See also GanttProject: Summary tasks and subtasks

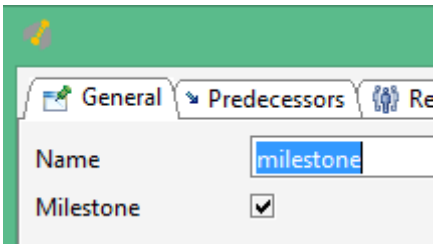
Tasks play a range of types in a Gantt chart. The types are:

- Project summary
- Summary
- Task
- Milestone

Each type of task has its own symbol on the Gantt timeline, as shown in the screenshot below, taken before creating any links. Note the three possible indent levels.



A **milestone** task shows where a deadline occurs. It must be a simple task, not a summary. It is created by ticking the *Milestone* box at the top of the *Task Properties* dialog box. A milestone task has a 0 (zero) duration, although it is shown as 1 (one) in *Task Properties*.



A plain **task** is used to show durations, links and sequence of a series of tasks. It is created with the *New Task* right-click option in the Gantt data table.

A **summary** task identifies a group of closely related tasks. It is created by indenting the group of tasks immediately below it. The group may include lesser summary tasks. It is best not to link summary tasks, but to link directly to their component tasks. Similarly, resources are best allocated to component tasks.

A **project summary** task is usually the top-level task of a project. It is created by ticking the *Project* box at the top of the *Task Properties* dialog box. The only difference of a project summary is that its symbol has a thicker bar. More than one summary in a project can be a Project summary, but only if they are at the same indent level.