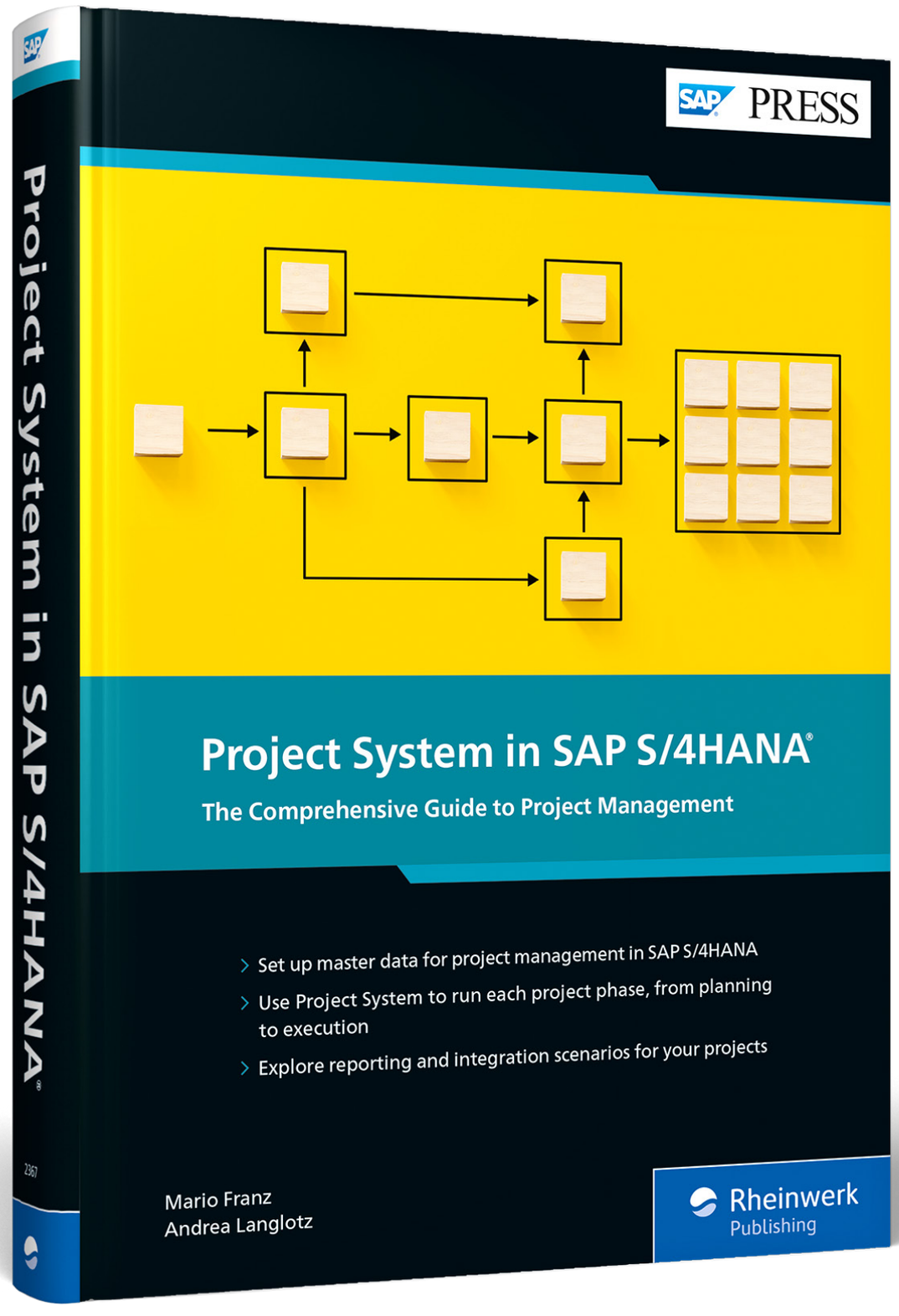

Reading Sample

In this chapter excerpt, you'll learn about Project System's functions for project planning. You'll walk through various strategies for time scheduling and see how to plan resources via network activities.

Mario Franz, Andrea Langlotz

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Chapter 2
Planning Functions

Using project planning, you can preview the time flow, the required resources and materials, and the expected cost and revenues for the individual project parts. It's thus an essential part of project management.

Once you've properly mapped a project using the work breakdown structure (WBS) and the network, you can use various Project System functions to plan the dates of the individual work packages, estimate the expected costs and revenues, and provide internal and external resources and materials on schedule before the project starts.

Preliminary and detailed planning

Depending on your requirements, there are planning functions with different levels of detail. For example, within a quotation phase or approval phase, you can create a preliminary plan of dates and costs with very little effort and then add specifications later, if necessary, using other planning functions or additional structures.

In the implementation phase, the planned data is compared with actual data that is posted to the project structures by different business transactions (see Chapter 4). In the processing transactions, particularly in Project System reporting, you can therefore make a plan/actual comparison later and then monitor the project progress.

In this chapter, we'll first discuss the various possibilities of time scheduling in Project System, which form the basis of several other planning activities. Then, we'll explain how to use networks to plan internal and external resources, as well as material for projects. Lastly, we'll explore the possibilities for planning costs and revenues for your projects in Project System.

2.1 Date Planning

Planning the dates of a project or parts of a project is integral to your project planning. Capacity requirements planning (Section 2.2.1), for example, requires prior scheduling. Cost planning via Easy Cost Planning (Section 2.4.4) or network costing (Section 2.4.5) is automatically aligned with the planned project dates as well.

Depending on whether you use WBSs or networks for structuring your projects, different functions are available for planning dates. These are discussed separately in Section 2.1.1 and Section 2.1.2. If you use both a WBS and networks, scheduling data can be exchanged between the WBS elements and the activities, which is discussed in Section 2.1.2 as well.

Sets of dates

Regardless of the structures you use for mapping your projects (WBS or network), there are two separate sets of dates available for time scheduling in Project System: *basic dates* and *forecast dates*. You can schedule dates in both sets separately; however, you can also copy dates from one set of dates to the other as often as you like. A third set of dates is available for entering actual dates. Figure 2.1 shows the various sets of dates in the **Dates** detail screen of a WBS element.

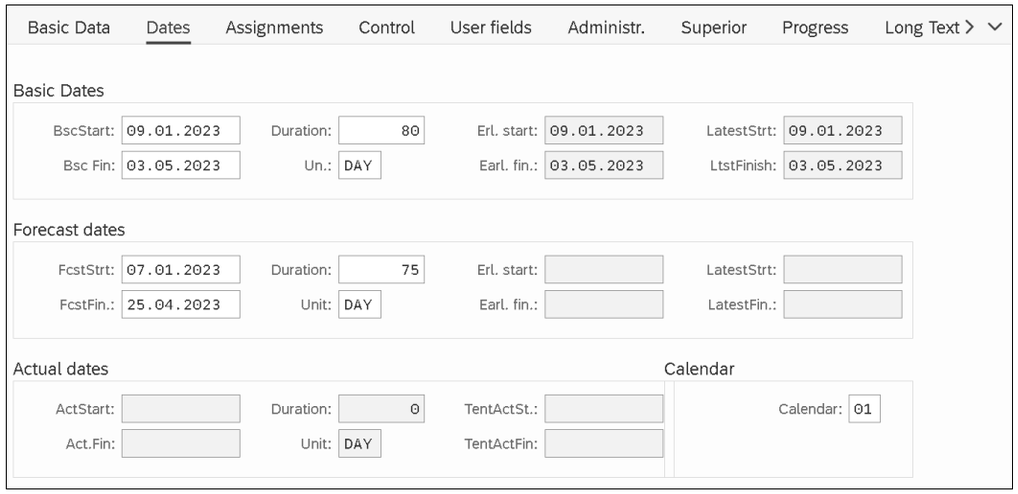

Figure 2.1 Dates Detail Screen of a WBS Element

Exclusive Functions of Basic Dates

The calculation of capacity requirements, the requirement date of material components, or, for example, the Easy Cost Planning and the planned costs calculation using network costing, are exclusively based on the basic set of dates.

Using the forecast set of dates

Typically, the forecast set of dates is used for *baselining*; that is, fixing planned dates at a specific planning stage. To do this, you copy the basic set of dates into the forecast set of dates. Changes to dates at a later stage are made to the basic set of dates, while the dates in the forecast set of dates remain unchanged. Therefore, you can always read the current status of

time scheduling in the basic set of dates, while the forecast set of dates reflects your original time schedule. If you want to maintain several stages of time scheduling, you can use project versions (see Chapter 1, Section 1.9.1).

The presentation of forecast dates depends on the respective transaction. The tabular presentation of structure planning contains, for example, separate tabs for the respective sets of dates (see Chapter 1, Section 1.7.4). In Project Builder, the WBS elements detail screen shows all sets of dates, while either the basic set of dates or the forecast set of dates is displayed for networks, depending on the settings. In the Project Planning Board or the Project Schedule app, you determine the field selection and the options for which dates are to be listed or graphically displayed. Figure 2.2 shows the simultaneous presentation of basic and forecast dates in the Project Planning Board.

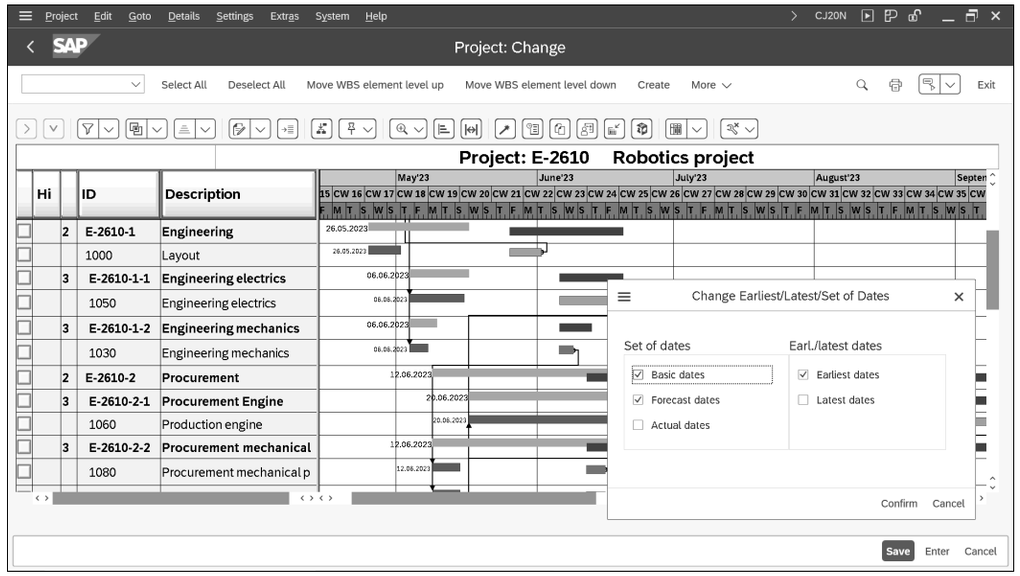

Figure 2.2 Basic and Forecast Dates in the Project Planning Board

2.1.1 Scheduling with WBS Elements

When creating a project, you can enter a planned start and end date for the project in the project definition. When you later schedule dates on the WBS elements level, the system notifies you if the WBS element dates are outside the date range specified in the project definition. If you want, however, start and end dates of the project definition can be adapted to the dates of the WBS elements.

Dates for WBS elements can be scheduled in Project Builder in the WBS elements detail screen, in the Project Planning Board, or via the special maintenance functions, either in a tabular format or, in the Project Planning Board, in a graphical format. Optionally, you can specify both planned start and end dates, or one of the two along with a planned duration for the WBS element. The system then calculates the other date automatically.

Factory calendar

In this time scheduling, the system considers the factory calendar of the WBS element, which distinguishes workdays and non-workdays (holidays, weekends, company holidays, etc.). The entered duration in days, for example, is interpreted as the number of workdays; start or end dates on non-workdays cause system warnings. In the Project Planning Board, the maintenance and presentation of nonworking times are controlled by the **Nonwork. time** tag in the options or the planning board profile, respectively.

The standard version already contains numerous predefined factory calendars. You can also define your own factory calendars in Customizing using Transaction SCAL. Select the factory calendars separately for every WBS element, or enter them as default values in the project definition or in the project profile.

In addition to the manual maintenance of planned dates for WBS elements, there are various functions that—depending on the transaction—support you in your time scheduling tasks. Using the Project Planning Board as an example, we'll explain in detail various time scheduling functions for WBS elements without assigned activities.

Shifting dates

Using the **Shift dates** function, you can shift the planned dates of individual WBS elements, of entire subtrees, or of your entire project. For example, if you select a WBS element and choose the **Shift Dates • Subtree** function, a dialog box opens in which you can either enter a new start date or a new end date, depending on the WBS scheduling parameters (Section 2.1.2). The system then shifts both the WBS element and all subordinate WBS elements accordingly.

Chronologically Shifting WBS Elements of the Same Level

Because WBS elements *don't* have relationships, shifting WBS elements *doesn't* automatically cause the planned dates of WBS elements on the same level to be shifted.

Inheriting dates

Using the **Copy top-down** function, you can copy the start and end dates of a WBS element to all hierarchically subordinate WBS elements and, if required, to the assigned activities. Existing planned dates are thereby overwritten.

Extrapolating dates

Instead of inheriting dates in a top-down fashion, you can, in turn, aggregate dates within the WBS hierarchy using the **Extrapolate dates** function. Using this function, you have to distinguish between *bottom-up* and *strict bottom-up extrapolation*.

Bottom-up extrapolation

If you run the **Extrapolate dates** function for your project and the **Open planning** or **Bottom-up (taking dates of higher level WBS into account)** planning method has been set, the date ranges of the project definition and of all WBS elements are adapted so that they span the dates of the respective subordinate WBS elements. The date ranges of higher-level objects are therefore extended, if necessary, but not reduced. This means the date range of a higher-level object can be larger than that of the subordinate objects.

Figure 2.3 shows an example of the bottom-up projecting of WBS element dates. The dates of the WBS elements **Engineering electrics** and **Engineering mechanics** have been time-shifted, and the dates have been projected to the higher-level **Engineering** WBS element. The upper time bars (forecast dates) correspond to the dates before the shifting and projecting process, and the lower time bars (basic dates) correspond to the dates after the same.

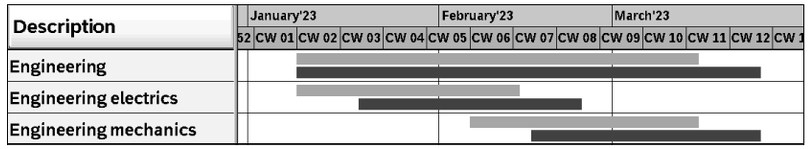

Figure 2.3 Bottom-Up Extrapolation

Strict bottom-up extrapolation

If you execute the **Extrapolates dates** function for a project for which the **Strict Bottom-up (without dates of higher-level WBS)** planning method has been set, the date ranges of the project definition and of all WBS elements are accurately adapted to the scheduling frameworks of the subordinate WBS elements (see Figure 2.4). The date ranges of higher-level objects are thus both extended and reduced, if necessary.

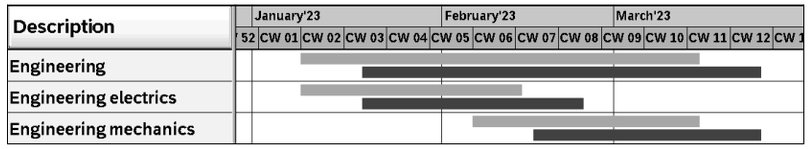

Figure 2.4 Strict Bottom-Up Extrapolation

Checking dates

Another function you can implement when time scheduling with WBS elements is **Check dates within project structure**. The system then highlights WBS elements in color where planned dates of the subordinate WBS

elements are outside of the scheduling framework of the WBS element itself. You can therefore avoid hierarchically inconsistent time scheduling for projects.

Planning methods

Using planning methods, several of the functions just mentioned can be automatically executed during the saving process, regardless of the editing transaction. The following planning methods are available:

- **Top-down**
  When saving, the system automatically checks the dates within the project structure. If the time scheduling isn't consistent, the project can't be saved. However, no dates are automatically changed.
- **Bottom-up**
  When saving, the system automatically changes the dates of WBS elements and project definition via bottom-up extrapolation.
- **Strict bottom-up**
  When saving, the system automatically changes the dates of WBS elements and the project definition using a strict bottom-up extrapolation.
- **Open planning**
  The system doesn't automatically check or change the dates. However, you can manually trigger the **Check dates within project structure** or **Extrapolate dates** functions.

You specify the planning method to be used separately for the basic and the forecast set of dates in the project definition. In the project profile, you can store default values for the planning methods of both sets of dates.

If you work with WBS without assigned networks, the *scheduled dates* of WBS elements, that is, their earliest and latest start and end dates (refer to Figure 2.1), are only relevant if you use milestones, the dates of which are derived from the WBS element dates. Because the dates of milestones are exclusively derived from the scheduled dates, you must run WBS scheduling function at least once in this case. For WBS without assigned networks, WBS scheduling only causes the planned dates to be accepted as scheduled dates.

2.1.2 Scheduling Using Networks

Planned dates

While you enter the planned dates of WBS elements manually or via projecting or inheritance, the planned dates of activities are automatically calculated by the system. This determination of the planned dates of networks is called *scheduling*. Depending on the transaction you used to trigger the scheduling, you use *network scheduling*, *overall network scheduling*, or *WBS scheduling*.

In network scheduling, only one network is scheduled. All activities of the network are selected, and their dates are calculated. If you use overall network scheduling, several networks are scheduled at the same time, provided they are linked via relationships or subnetworks. All activities of these networks are then scheduled. In WBS scheduling, you select one or more WBS elements, or the entire project, and trigger the scheduling process. The system then selects only those activities for scheduling that are assigned to the selected WBS elements and calculates their dates. Before we elaborate on more differences between the various scheduling methods, we'll first describe the scheduling concept, which is the same for all three methods.

Forward and Backward Scheduling

In Project System, the scheduling always takes place both in a forward and backward direction.

Forward scheduling

In *forward scheduling*, the system first determines the activities that—due to their relationships—don't have any predecessors among the selected activities. Beginning with a start date, the system calculates the earliest possible start date for these activities. Depending on the scheduling settings, the start date of forward scheduling can originate from the header of the network or from the assigned WBS elements (WBS determines the dates), or it can be the current date.

After the earliest start date of these activities has been determined, the system calculates the earliest possible end date of these activities using the scheduling-relevant duration. Then, the system selects the direct successors of these activities and calculates their earliest start and end dates. Each type of relationship (see Chapter 1, Section 1.3.1) determines whether the earliest start date must be after the end date of its predecessors (finish-start) or after their start date (start-start), and so on.

Earliest dates

The scheduling now goes through all selected activities in a forward direction and calculates their earliest possible start and end dates. Forward scheduling results in the earliest dates of activities. Thus, the result of forward scheduling is the *earliest date* of activities.

Backward scheduling

In *backward scheduling*, the system first determines the activities that—due to their relationships—don't have any more successors among the selected activities. Starting from an end date—depending on the end date of the network header or the assigned WBS elements—the system now calculates the latest possible end date of these activities. Based on the scheduling-relevant duration of the activities, the latest start dates of these activities are then calculated.

Latest date

The system then goes through the network in a backward direction, following the relationships, and thus successively calculates the latest possible start and end dates for all selected activities, considering their types of relationship and their durations. Backward scheduling determines the *latest dates* of activities.

The earliest start date and the latest end date of the network activities are forwarded to the network header as the scheduled dates. In WBS scheduling, the activity dates are also indicated in an aggregated fashion as scheduled dates at the level of the assigned WBS elements.

This logic of forward and backward scheduling requires a number of additional notes regarding the various influencing factors that are relevant to scheduling.

Relationships in scheduling

Without relationships, the result of scheduling in Project System wouldn't be a chronological sequence of activities. The type of relationship determines how two activities will interact chronologically. If you specified a time interval for a relationship, this will be taken into account during scheduling. This time interval, however, is only interpreted as a minimum time interval; that is, the scheduled time interval between predecessor and successor can be longer than the time interval defined in the relationship.

If the activities selected for scheduling have relationships to activities that aren't scheduled at the same time, these relationships are still taken into account. If relationships can't be met, the system issues warnings that you can analyze in a scheduling log.

Scheduling-relevant duration

The calculation of the scheduling-relevant duration and the consideration of nonworking times depend on the respective activity type; however, for all activity types, the control key of the activities must permit scheduling so that a duration unequal to zero is used during the date calculation.

For internally processed activities, the scheduling-relevant duration—as long as no actual dates have been entered (see Chapter 4, Section 4.1.2)—is derived from the value of the **Normal duration** field or, if a work center has been stored in the activity, from an appropriate *formula* in the scheduling details of the work center. Typically, however, you'll store the standard formula SAP004 in the work center, which references the value of the **Normal duration** field in the activity.

The unit of the **Normal duration** field is relevant as well. For example, if you enter a duration of 24 hours, these hours are interpreted as working hours. If the scheduling-relevant capacity of the work center uses an operating time of 8 hours per day, this results in a scheduling-relevant duration of three (working) days. If you entered a duration of one day, the system would only use one (working) day as the scheduling-relevant duration.

Nonworking times

The scheduling of internally processed activities also considers nonworking times. If you maintained a work center in the activity, the system only uses the working times of the scheduling-relevant capacity of the work center for scheduling. Start and end dates are only scheduled for working days. The differentiation between working and nonworking days originates from a factory calendar that is determined according to the following priority:

1. Factory calendar in the activity
2. Factory calendar in the work center
3. Factory calendar of the plant in the activity

For externally processed activities and service activities, the system, by default, uses the **Pl. Deliv. Time** (planned delivery time) as the scheduling-relevant duration without differentiating between working and nonworking days. But, if you want to use a deviating duration for scheduling, you can define a control key with the **Sched.Ext.Op.** indicator and manually enter the scheduling-relevant duration in the **Normal duration** field of the **Internal** tab.

For general costs activities, you can manually specify the scheduling-relevant duration via the **Normal duration** field. Using factory calendars in the costs activities, you can restrict scheduling to working days.

Reduction

If necessary, the system can automatically reduce the duration of activities if the scheduled dates are outside of the basic or forecast dates of the network header. The system can therefore automatically adapt the duration of activities to enable the network to be carried out in a given time frame. This automatic adaptation of activity durations is called *reduction*. By specifying a minimum duration in an activity, you can ensure that a time interval that is required for processing an activity isn't further reduced.

Reduction levels

The reduction of the activity durations is performed in several successive stages. In the first stage, for example, the durations could be reduced by 10%. If this reduction isn't sufficient, the originally planned durations could be reduced by 15% in a second stage, and so forth. A maximum of six stages could be implemented. After scheduling, you'll find the actual number of required reduction levels in the network header.

Reduction strategy

For a system to automatically reduce the duration of an activity, you must store a *reduction strategy* in the relevant activity. In the definition of a reduction strategy, for each reduction level, you specify the percentage by which the planned duration of an activity is to be reduced. Figure 2.5 shows an example of the definition of a reduction strategy in the Customizing section of Project System.

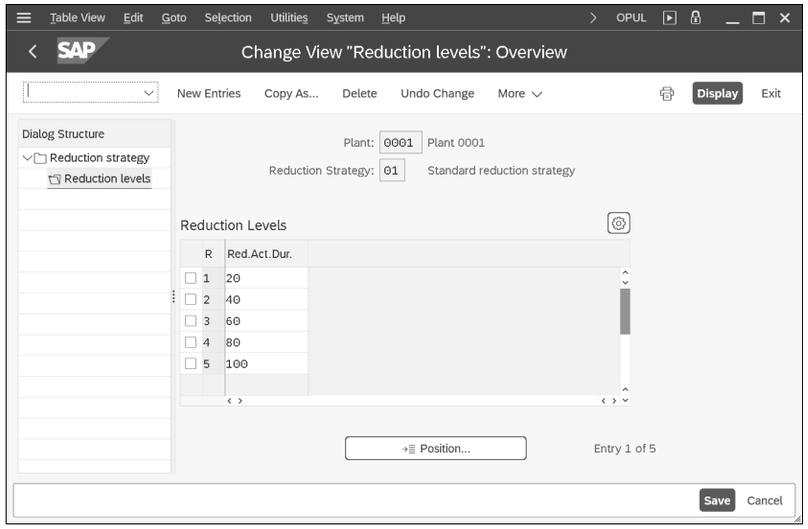

Figure 2.5 Reduction Strategy

Finally, you need to specify in the *scheduling parameters* that a reduction is to be carried out. To do this, you specify the maximum number of levels to run through. In addition, you can specify in the scheduling parameters whether all activities that have a reduction strategy are to be reduced or only the *time-critical* ones.

Copying replenishment lead times

You can adapt the duration of an activity to the replenishment lead times of the assigned material components. Call the function **Transfer delivery time -> duration** for an activity. The system then determines the longest replenishment lead time of the assigned components and uses them as the activity duration.

Scheduling calculates the planned earliest and latest dates of activities, and the scheduled dates of network headers and WBS elements. The corresponding fields can't be changed manually.

Scheduling constraints

However, you may want to assist in scheduling activities to, for example, define fixed dates or to consider constraints that cause activities to be feasible only within specific periods. To do this, you can specify *scheduling constraints* for activities (see Figure 2.6).

Using scheduling constraints, you can either fix the earliest or latest start or end dates of activities (**Must start/finish on**) or restrict them via threshold values (**Cannot start/finish before/no later**). You can manually enter scheduling constraints or graphically determine them in the Project Planning Board, depending on the options or the planning board profile (see Chapter 1, Section 1.7.2).

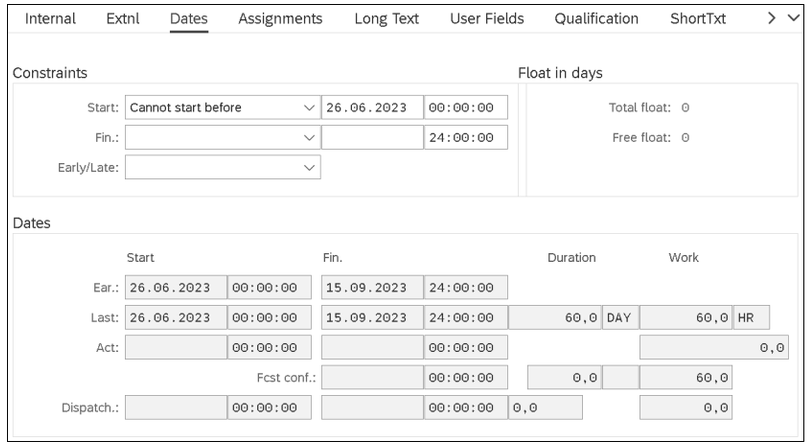

Figure 2.6 Scheduling Constraint for an Activity

In scheduling, the various influencing factors are considered according to the following prioritization:

1. Actual dates (see Chapter 4, Section 4.1.2)
2. Scheduling constraints
3. Relationships
4. Start and end dates of the network header or the assigned WBS elements if the WBS determines dates

Floats

From the scheduled dates of the activities, the system also determines *floats* for each activity, which can be displayed in the detail screen of the activities and the network graphic, or graphically illustrated in the Project Planning Board, respectively. Regarding floats, there is a distinction between a *total float* and a *free float*.

Total float

The total float of an activity results from the difference between its latest and earliest dates, therefore specifying the time interval by which you can shift an activity from its earliest date without exceeding the end date defined in the network header or—if it determines dates—of the assigned WBS element. Activities with a total float smaller than or equal to zero are regarded as time-critical and are highlighted in color in the network graphic and the diagram section of the Project Planning Board. In the Project Planning Board, you can use the options or even the planning board profile to control the total float starting from which activities are to be highlighted in color.

Free float

The free float of an activity is the interval by which you can shift the activity from its earliest date without affecting the earliest date of the succeeding activities. For two activities that are linked to each other by a finish-start relationship (without a time interval), the free float of the predecessor

results, for example, from the difference between the earliest start date of the successor and the earliest end date of the activity itself.

Flexible indicator

Free floats typically result from scheduling constraints of succeeding activities, or they occur when there are parallel paths within the network where one path consumes more time than the other (see Figure 2.7). Because you can use the free float to perform activities without affecting subsequent activities with regard to scheduling, you can set the **Flexible** indicator for an activity to cause the earliest dates of this activity to be calculated based on the normal duration plus the free float. Consequently, the capacities have more time for performing the activity.

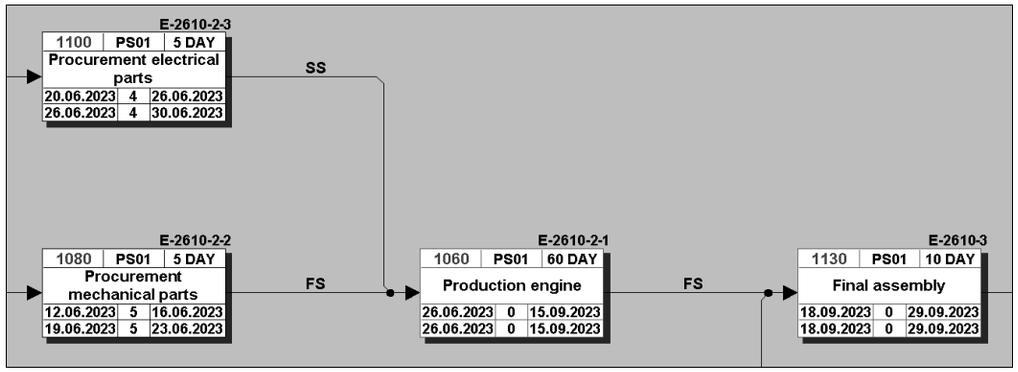

Figure 2.7 Time-Critical Activities and Floats in the Network Graphic

Dates of activity elements

You can supplement activities or add more details (see Chapter 1, Section 1.3.1) via activity elements. Because activity elements don't have a duration or relationships, they don't affect the scheduling result. Just like activities, however, activity elements have earliest and latest start and end dates. These dates are derived from the scheduled dates of the activity to which the activity elements are assigned and from the time intervals you may have entered in the activity elements.

[+]

Date Reference of Activity Elements

The planned dates of the activity elements always fall within the activity dates. Scheduling constraints can be defined at an activity level, but not for activity elements.

Dates of activity milestones

For milestones you've assigned to activities, you can either manually enter *fixed dates* or establish a *time reference* to the activity. If you use a time reference, you can use appropriate indicators to specify whether the milestone date is to be taken from the earliest or latest date, and the start or the end date of the activity. Furthermore, you can specify a time interval either

in absolute terms (e.g., in a number of days), or in terms of percentage based on the duration of the activity. When using a time reference, every date shift of the activity directly affects the milestone date.

Requirement date of material components

Even if you assign material components to an activity (Section 2.3.1), you can select between a fixed requirement date for the material and a requirement date that is derived from the start or the end of the activity. The scheduling parameters control whether the date reference should refer to the earliest or the latest date of the activity. If necessary, you can also specify an absolute time interval that is considered when deriving the requirement date from the activity date.

Network Scheduling

In network scheduling, all activities of an individual network are scheduled. Whenever you call the scheduling from the specific maintenance function (Transaction CN22) or from the Project Builder, provided you've selected a network header or a network activity in the structure tree, you trigger network scheduling.

Parameters for network scheduling

In network scheduling, the scheduling settings are determined from the network scheduling parameters, but they can also be temporarily modified. Before you can create a network, you must have defined network scheduling parameters for the combination of the plant and the network type of the network header in the Customizing section of Project System (Transaction OPU6). Figure 2.8 shows an example of defining network scheduling parameters.

Scheduling types

In the scheduling parameters, you first store the **Scheduling Type**. This value is displayed at the network header level and can be changed there, if necessary. The following scheduling types are available in Project System:

- **Forward**
  The system first performs a forward and then a backward scheduling. You use forward scheduling if you know the start of the execution, but not its end date.
- **Backward**
  The system first performs a backward and then a forward scheduling. You use backward scheduling if you know the end of the execution (e.g., an agreed delivery date), but not its start date.
- **Current date**
  Instead of start dates that lie in the past, the system uses the current date for forward scheduling. You can therefore see if the planned period for the execution is still sufficient and which floats may still be available. This also includes both forward and backward scheduling.

- **Only capacity requirements**
  The activities use the start and end dates from the network header (or the assigned WBS elements, if they determine dates) as the earliest and latest start and end dates. Relationships or the duration of individual activities aren't taken into account in this scheduling type. You can implement this scheduling type if you don't want to specify any details (yet) about the process and duration of individual activities, but you want to calculate the capacity requirements for the total runtime (Section 2.2.1).

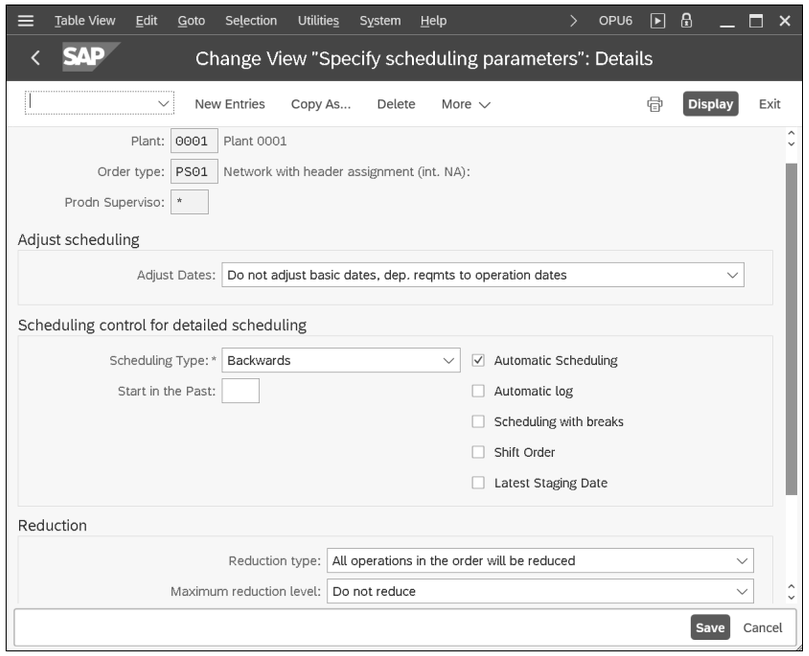

Figure 2.8 Network Scheduling Parameters

Scheduling Type Restrictions

In Project System, start and end dates for scheduling can be specified in the network header or the WBS elements to the day only. Scheduling types with a reference to the time of the day can't be implemented in Project System.

Adjust dates

Using the **Adjust Dates** dropdown in the scheduling parameters, you control if the system accepts the scheduled dates at the network header level as basic or forecast dates. For example, if there is a fixed time frame for the execution, enter the start and end dates manually in the network header,

and set the **Do not adjust basic dates** indicator. Your dates will remain fixed during the scheduling process, and by comparing the scheduled dates, you can determine whether the time frame is sufficient for the execution. If the scheduled dates are outside of the predefined dates, the scheduling log issues appropriate warnings.

However, if you only know the start date, for example, and want the system to calculate the end date and to adjust it if changes need to be made at a later stage, select the **Forward** scheduling type, set the **Adjust Dates** dropdown, and manually enter a start date in the network header. Based on your start date, the system first calculates the scheduled end of the network, inserts it as the end date, and then performs the backward scheduling based on this date.

Start in the past

The number of days you enter in the **Start in the Past** field in the scheduling parameters controls the handling of start dates that have already passed. If the system determines a start date during scheduling that is farther in the past than you permitted in the **Start in the Past** field, the system issues a warning and automatically uses the current date for forward scheduling (this is called *today scheduling*).

Any Start Dates in the Past

If you enter "999" in the **Start in the Past** field, the system permits start dates that can be anywhere in the past without performing a today scheduling.

Automatic scheduling

By setting the **Automatic Scheduling** indicator in the scheduling parameters, you cause scheduling to be performed automatically when the network is saved whenever there has been a scheduling-relevant modification to the network. The indicator is forwarded as a default value to the network header and can be changed there. At the latest, during the implementation phase of a network, it's usually recommended that you remove this indicator from the network header to avoid uncontrolled changes to capacity requirements, purchase requisitions, or reservations of material due to automatic scheduling.

Other indicators in the scheduling parameters control the output of scheduling logs in Transaction CN22, the handling of breaks in the scope of scheduling, the date reference of material components, the consideration of actual dates from partial confirmations (see Chapter 4, Section 4.3), and how later date changes affect a workforce planning (Section 2.2.2).

Overall Network Scheduling

In overall network scheduling, all networks or orders that are linked to each other via external relationships or subnetworks are scheduled at the same time. Overall network scheduling is run automatically within the assembly processing (see Chapter 1, Section 1.8.7) or started from a sales document. You can trigger overall network scheduling in Project System using Transactions CN24 or Transaction CN24N.

During overall network scheduling, the scheduling settings are determined, just like in network scheduling, from the scheduling parameters for the network type.

Transaction CN24 (Overall Network Scheduling)

If you use Transaction CN24 for overall network scheduling, first specify the identification of a network and the set of dates for scheduling. Then you can make temporary changes to the scheduling settings, if necessary, or enter new start and end dates for scheduling (see Figure 2.9).

If you work with maintenance or service orders as assigned subnetworks, you can use the **To schedule** field to determine whether only these orders are to be scheduled, only the networks, or both networks and assigned maintenance or service orders.

After you've performed the scheduling, you can use the **Old/new dates** function to compare the old dates to the newly calculated dates. Afterward, you can save the date changes of the networks or orders, respectively.

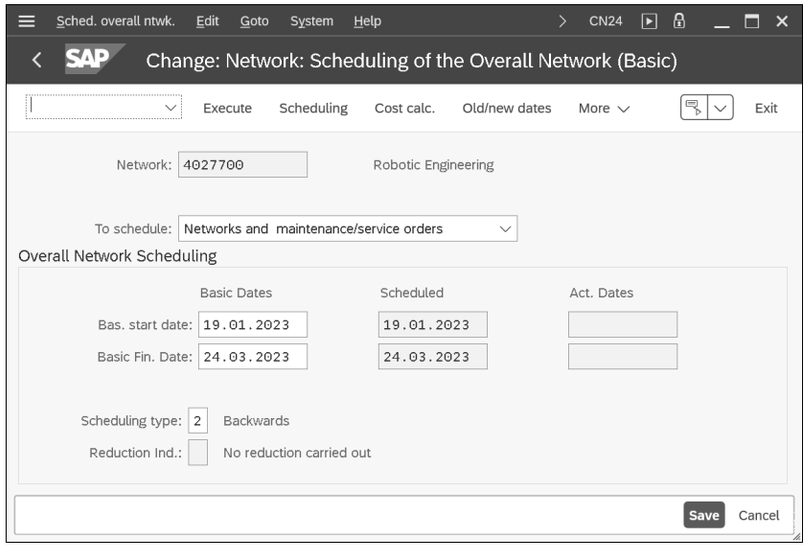

Figure 2.9 Overall Network Scheduling Using Transaction CN24

Transaction CN24N

In contrast to Transaction CN24, Transaction CN24N (Overall Network Scheduling with Selection Options) enables you to influence the selection of the networks and subnetworks to be scheduled before the scheduling process (see Figure 2.10) and to also use a monitor for observing the dates of subnetworks.

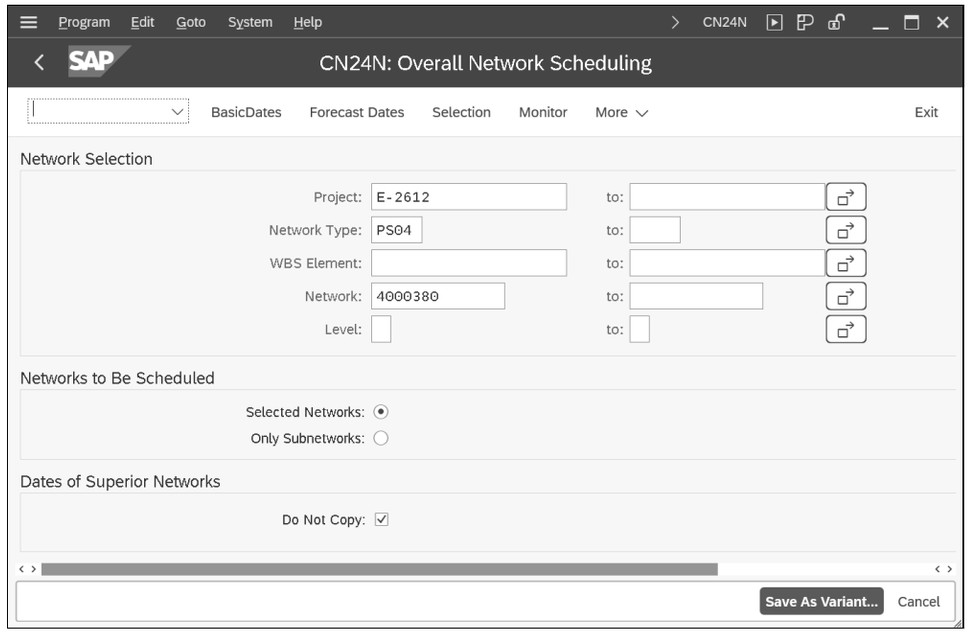

Figure 2.10 Overall Network Scheduling with Selection Options

Subnetwork Monitor

In the *Subnetwork Monitor*, accessed via the **Monitor** function, both data from the selected networks and data from the assigned subnetworks are displayed in a table (see Figure 2.11). You can go to the activity or network header display by clicking on them. In addition, you can enter activity confirmations in the Subnetwork Monitor or call the **Project Information System: Structures** component (see Chapter 6, Section 6.1). Traffic lights indicate when the dates of the subnetworks are outside of the dates of the higher-level activity (**Conflicts**) or don't exactly match (**UpdateReq.**).

Levels

To use the functions of overall network scheduling with selection options in the Customizing section of Project System, you need to define *levels* in addition to the scheduling parameters for the network type, and then manually assign these levels to the network types and number range intervals of the networks and subnetworks. The level definition must reflect the hierarchical arrangement of the networks and subnetworks. The levels serve as selection criteria in Transaction CN24N. A scheduling using Transaction CN24N can span a maximum of two levels. If you use more than two levels

in your project structure, you have to perform scheduling successively several times. Transaction CN24N is intended primarily for companies that work with a large number of multilevel subnetwork structures and that don't always want to schedule all networks and subnetworks at the same time.

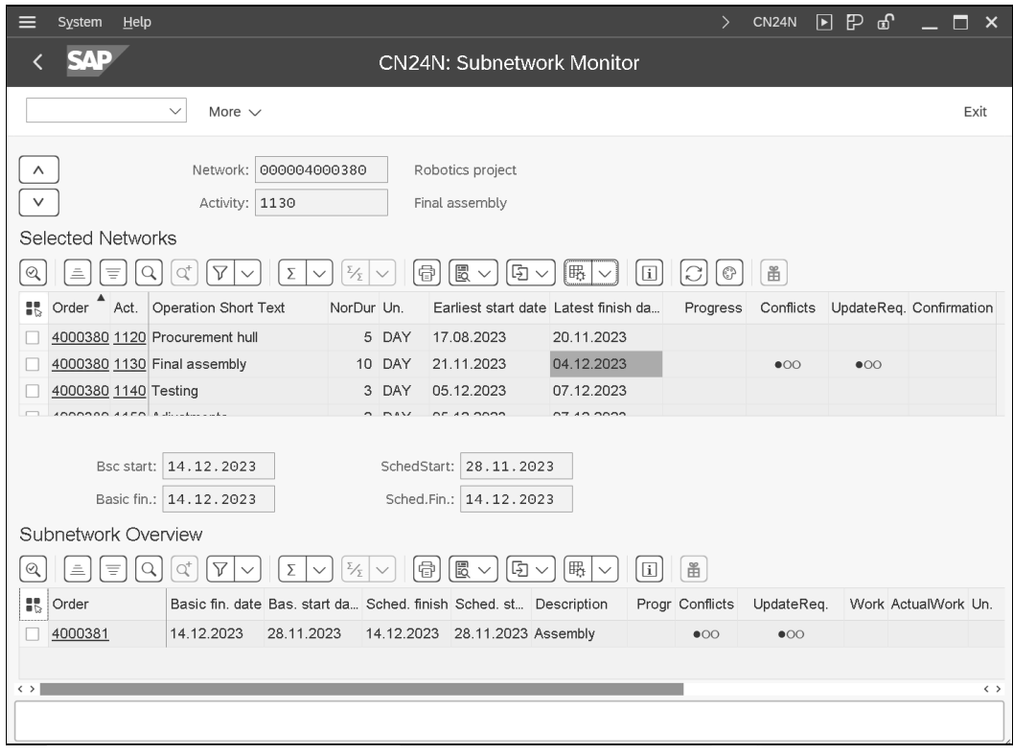

Figure 2.11 Subnetwork Monitor

WBS Scheduling

In WBS scheduling, the scheduling is started based on one or more WBS elements. In WBS scheduling, activities that are scheduled are assigned to these WBS elements. Therefore, you can schedule individual parts of a project without scheduling all activities of a network. A WBS scheduling can be started in the specific maintenance functions (Transaction CJ20 or CJ02), using Project Scheduling (Transaction CJ29), or in the Project Planning Board. In the Project Builder, you can perform WBS scheduling if you've selected the project definition or a WBS element in the structure tree.

Parameters for WBS scheduling

In WBS scheduling, the scheduling settings are determined from the control parameters for WBS scheduling, but can also be changed temporarily. These control parameters are grouped in a profile that you can define in the

Customizing section of Project System (see Figure 2.12) and entered in the project profile as a default value for the project definition.

The control parameters for WBS scheduling basically contain the same settings as the parameters of network scheduling, that is, the scheduling type, an indicator for automatically scheduling at saving time, or reduction settings. If you set the **Adjust bsc date** in WBS scheduling, not only are the network header dates adapted to the scheduled dates, but the planned dates of the WBS elements are also derived from the scheduled dates of the assigned activities. For that reason, the planned dates of activities and WBS elements can be determined at the same time during the WBS scheduling.

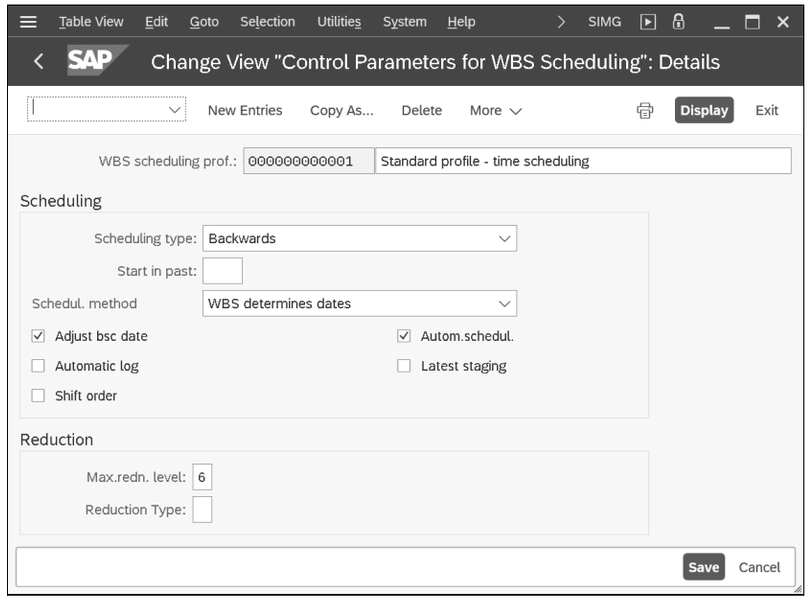

Figure 2.12 Control Parameters for WBS Scheduling

Scheduling methods

In addition, the parameters for WBS scheduling include the **Schedul. method** field with the following two options:

- **Network determines dates**
  The network header determines the start and end dates of scheduling.
- **WBS determines dates**
  The planned dates of the WBS element determine the start and end dates for scheduling the assigned activities.

Therefore, the idea behind choosing **WBS determines dates** as the scheduling method is to first make a manual time schedule at the WBS element level and then schedule the assigned activities. The scheduling of the activities is

then based on the manually planned start and end dates of the WBS elements.

In the time scheduling process using WBS elements and networks, the scheduling parameters that control the scheduling of the activities and the data exchange with the WBS elements play an important role, and the planning methods control the hierarchical exchange of planned dates between WBS elements on different levels. You can define the WBS scheduling parameters in Customizing and specify them together with the planning methods for your project. Alternatively, you can also use predefined *scheduling scenarios* with WBS elements and networks.

Scheduling scenarios

If you select a scheduling scenario for scheduling a project, all settings are determined via the scheduling scenario. The following scheduling scenarios are available:

- **Bottom-up scenario**
  Based on the basic start date of the network header (which may be anywhere in the past), a forward scheduling and then a backward scheduling are performed. The scheduled dates are used as planned dates at the network header level and the assigned WBS elements. The planned dates of the WBS elements are finally projected in a bottom-up fashion.
- **Top-down scenario**
  In this scenario, you first have to perform manual scheduling at the WBS element level. During this process, the system checks the hierarchical consistency of this time scheduling when scheduling or saving. The scheduling of the assigned activities is based on the planned dates of the WBS elements (which may be anywhere in the past).

In both scheduling scenarios, requirement dates for material are derived from the latest date of activities, and reductions aren't performed. The settings of both bottom-up and top-down scheduling scenarios are predefined and can't be changed.

If you want to use one of the two scheduling scenarios, you can store the scenario in the project definition or enter it as a default value in the project profile. However, if you want to use different settings, you need to set the **Scheduling Scenario** field to the **Free Scheduling Value** and specify the appropriate settings manually.

Scheduling

Scheduling enables you to have the system automatically calculate the planned dates of operations and assigned objects, as well as identify time-critical activities. If the activities are assigned to WBS elements, date information can be exchanged between the activities and the WBS elements. If

required, you can also manually schedule dates at the level of WBS elements. There are various functions available to support you in this context, such as the extrapolation of dates or hierarchical consistency checks. Depending on your requirements, you can use different transactions for scheduling.

2.2 Resource Planning

Resource planning without networks

If you mapped a project using only a WBS, you can plan costs for internal or external resources (Section 2.4) and later assign activity allocations, purchase requisitions, purchase orders, goods receipts, and acceptances, for example, to WBS elements, and thereby post the costs of the resource usage to the project (see Chapter 4, Section 4.2). Logistic resource planning in the sense of capacity planning, or an automatic data exchange between the project structure and purchasing documents is only possible in Project System if you also implement networks. Manual cost planning for the required resources and a manual assignment of purchasing documents at the WBS element level aren't necessary when using networks.

The following sections deal with the functions that are available for planning resources via network activities.

2.2.1 Capacity Planning with Work Centers

When structuring your projects, you use internally processed activities or internally processed activity elements for specifying services that will be provided by internal resources, such as machine or personnel resources. Within scheduling, the system has calculated when these services will be performed; however, the scheduling doesn't verify whether there are sufficient internal resources at the planned date. To make statements about the availability of your resources and thus the feasibility of your projects in terms of capacities, you can use *capacity requirements planning* in Project System.

Capacity requirements planning

The primary function of capacity requirements planning is to determine capacity requirements and to periodically (e.g., on a weekly or daily basis) compare these requirements with the available capacity using the appropriate reports (see Chapter 6, Section 6.3.3). The available capacity is defined using work centers, while the required capacity is derived from the activity data of networks or, for example, production orders or maintenance orders. If you discover that the capacity requirement is higher than the available capacities during a specific period, you'll need to perform *capacity leveling* to get your planning in line with the capacities.

Definition of Work Centers and Available Capacity

Work centers are organizational units in the SAP S/4HANA system that define where an activity can be performed and by whom. If you've already defined work centers for production or maintenance, you can use these work centers in networks as well, provided that this is permitted by the application of the work centers. If you haven't yet defined any work centers in the SAP system, or if you want to use separate work centers for projects, you can create new work centers in Project System (Transaction CNR1). A mandatory prerequisite for capacity requirements planning using networks is the definition and usage of work centers.

Work center category

When creating a new work center, in addition to the identification and the plant of the work center, you also specify the **Work center category** (see Figure 2.13). Among other things, the work center category defines the fields (**Field sel.**) and tabs (screen sequence [**Scrn seq.**]) to be displayed in the master record of the work center. By default, you can use the **0006** (**Project management**) work center category in Project System. If required, you can define additional work center categories (Customizing Transaction OP40).

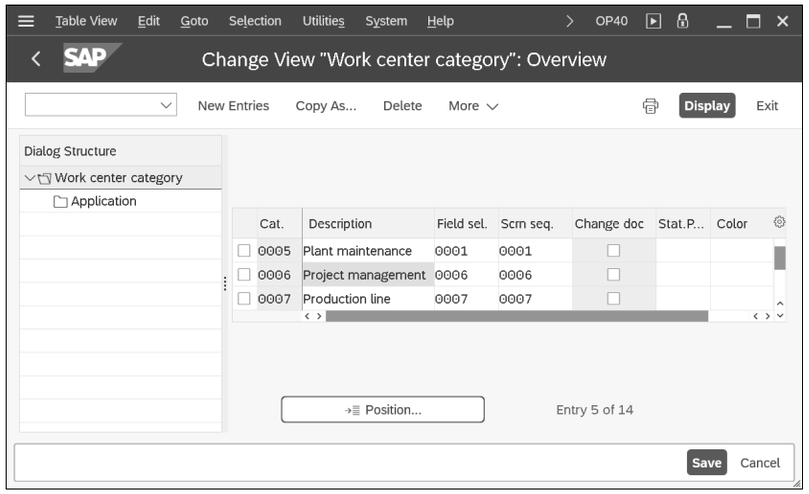

Figure 2.13 Definition of Work Center Categories

Usage

The **Usage** field in the basic data of the work center determines the task list types and order categories in which the work center can be used. For a work center to be used in standard networks and particularly in operative networks, it must have a usage that is assigned to the task list type **0** (**Standard Network**). If the work center is to be exclusively used for networks, you can, for example, enter the usage **003** (**Networks Only**) in the master record of the work center. If you want, you can use Customizing Transaction OP45 to define your own usages and assign them to the relevant task list types.

Depending on the work center category, you can make a number of settings for the time scheduling (Section 2.1.2) and the calculation (Section 2.4.5) of activities in the master data. For capacity requirements planning, however, the settings on the **Capacities** tab are relevant.

Capacity categories

On this tab, you first store one or more capacity categories, for example, for persons or machines, and then define the respective available capacity. Capacity categories are defined in Customizing and specify, among other things, whether the available capacity must be defined in time units or in base or volume units, and whether, for example, you can assign persons from human resources (HR).

Available capacity

In the simplest case, the definition of available capacity consists of the specification of a factory calendar for distinguishing working and nonworking days; information about the beginning, the end, and the duration of breaks of a working day; the specification of a capacity utilization rate; and the number of available individual capacities. The rate of capacity utilization describes how much of the daily working time can actually be used for production. The available capacity finally results from the productive operating time of a capacity, multiplied by the number of individual capacities (see Figure 2.14).

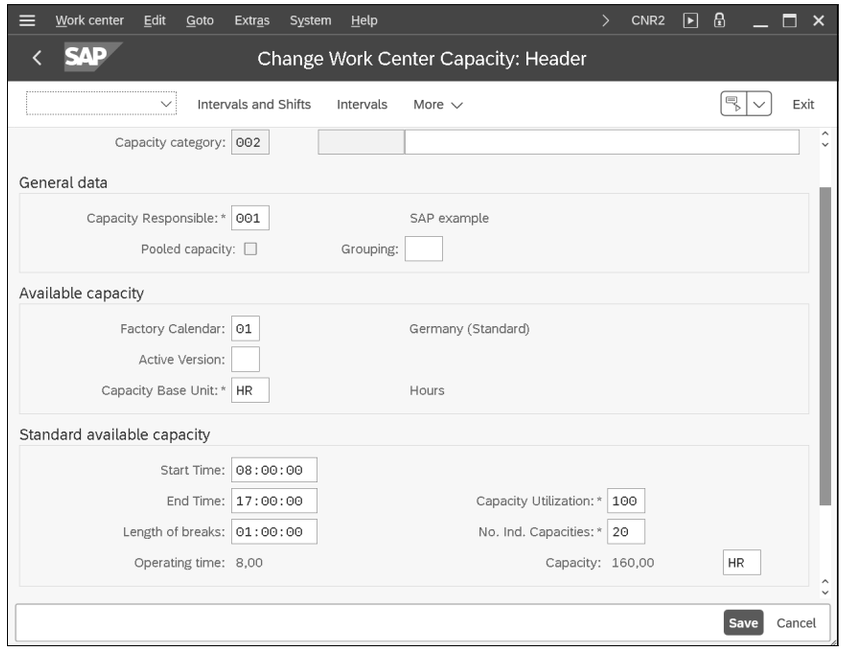

Figure 2.14 Work Center Capacity

In addition to the definition of the standard available capacity, there are several more detailed options for defining available capacities. On the one

hand, you can specify time intervals and define a separate available capacity for every interval. Thus, you can map employment relationships depending on the season, for example.

On the other hand, you can define shift sequences in Customizing (Transaction OP4A) and assign them to the capacity category in the work center. Using shift sequences, you can then specify exact break times that can be considered in capacity requirements planning.

Finally, you can also define *individual capacities* and assign them to the capacity category in the work center. Using appropriate reporting settings, you can then also use the aggregated availability of the assigned individual capacities for capacity evaluations instead of the standard offer. For personnel resources, the availability of individual capacities is derived from the planned working time (infotype 0007) that is maintained for employees in HR.

Formula requirements internal pricing

After you've defined the available capacity, enter a formula in the work center in the **Other Formula** field for the capacity category. The formula determines how the capacity requirements are to be calculated from the activity data. Usually, the standard formula SAP008 is entered here. Figure 2.15 illustrates the definition of this formula. The SAP_07 parameter in the SAP008 formula is linked to the **Work** field in activities or activity elements.

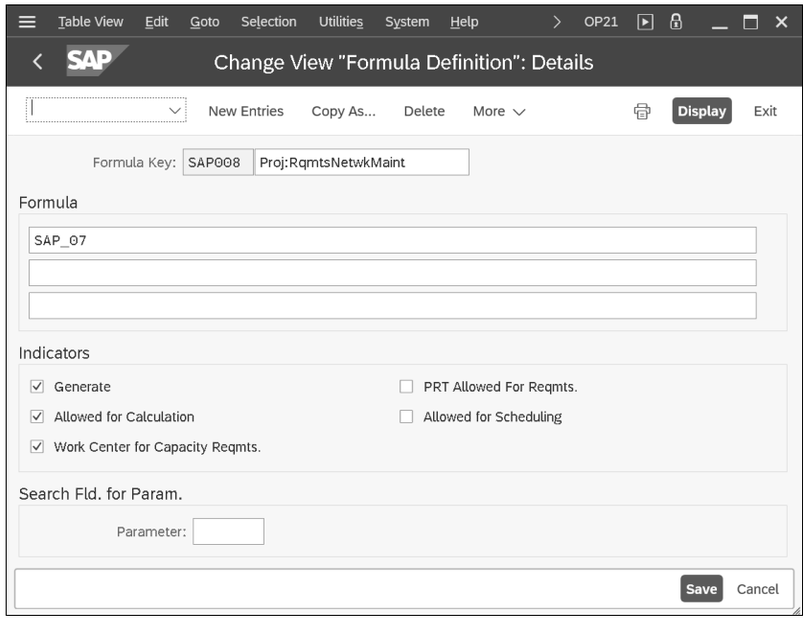

Figure 2.15 Definition of the SAP008 Formula

In Customizing, however, you can also define your own formulas (Transaction OP21) to consider values of other activity fields as well when calculating capacity requirements. This way, you can also include user fields in formulas, for example. To do this, you must define a separate parameter for the corresponding user field and assign it to the user field in the field key definition. This parameter can then be used for the definition of a formula. In the work center, you can first test the calculation of capacity requirements using a formula before you save the work center. If you define your own formulas, however, note that the calculation of capacity requirements should always be clearly documented in reporting.

Distribution key

Using a distribution key in the work center, you can specify how the capacity requirements of an activity are to be distributed across the activity duration. A distribution key consists of a distribution strategy (**Strat** column) and a distribution function (**Function** column), as shown in Figure 2.16.

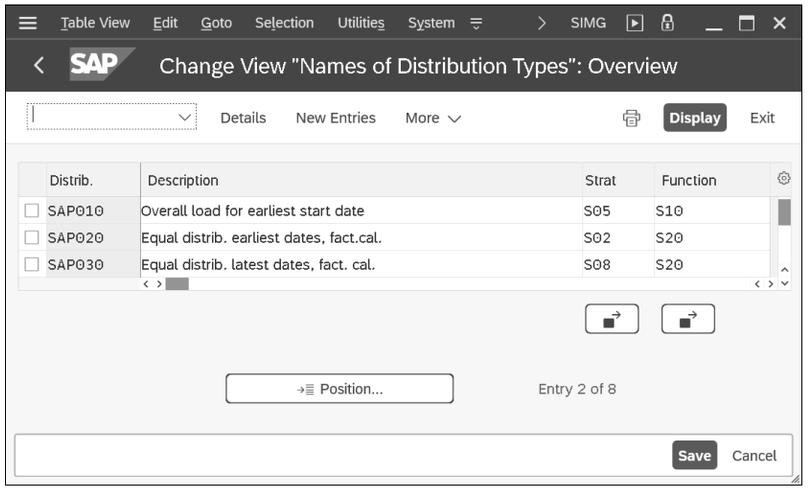

Figure 2.16 Definition of Distribution Keys

The distribution function determines—after which percentage of the activity duration—what percent of the entire capacity requirement is needed (see Figure 2.17).

Among other things, the distribution strategy determines whether the distribution is to take place via the earliest or the latest dates of the activity (see Figure 2.18).

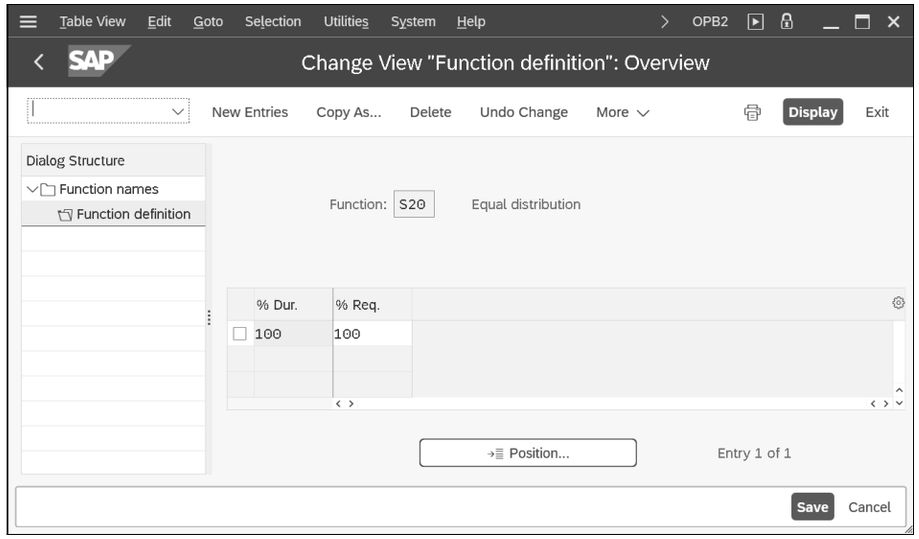

Figure 2.17 Definition of a Distribution Function

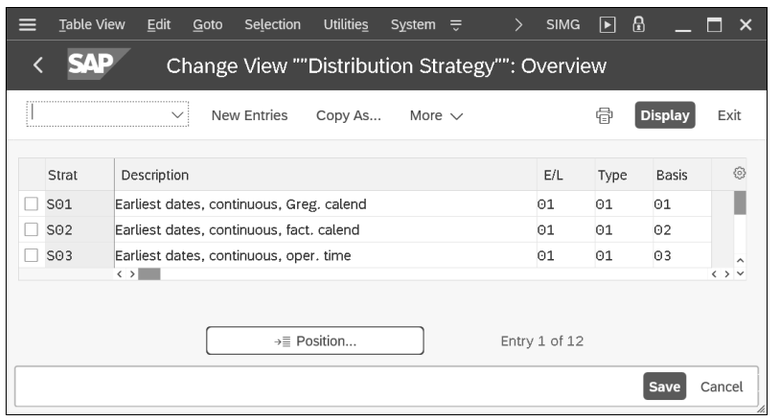

Figure 2.18 Definition of a Distribution Strategy

In the standard version, various distribution keys are already defined, such as SAP030 (**Equal distribution across the latest dates**) or SAP020 (**Equal distribution across the earliest dates**). If you want, you can also define additional distribution keys, functions, or strategies in the Customizing section of Project System.

Prerequisites for Determining Capacity Requirements

To compare the available capacities shown in capacity reports with the corresponding capacities required by your projects, the network must meet various prerequisites:

- The network activities must contain the work centers and planned work.
- The control key of the activities must be identified as relevant to the determination of capacity requirements (see Chapter 1, Section 1.3.2).
- The calculation of capacity requirements must be enabled; that is, the **Capacity Requirements** indicator must be set in the network header.

  You can remove the **Capacity Requirements** indicator from the network header at any time if capacity requirements are no longer required for a network. This may be relevant, for example, if a project is canceled or stopped during the implementation phase.
- After you've enabled capacity requirements, a scheduling must have been performed.

Also note that a final confirmation or setting the status to **Technically Completed** sets the (remaining) capacity requirement of an activity to zero (0).

Capacity Requirements Planning for Suppliers

If you want, you can perform your capacity requirements planning for suppliers as well, that is, using externally processed activities or service activities, if the control key permits this. To do this, you need to define a separate work center with the appropriate required capacities for the supplier, and enter the work center on the **Internal** tab of the activity.

Determining the requirements distribution

If necessary, you can enter a distribution key in the activities just like you would in a work center. Unless the report you use for the capacity evaluation provides a dedicated distribution key, the system determines the distribution of capacity requirements according to the following strategy:

1. Distribution key of the activity
2. Distribution key of the work center
3. Equal distribution across the latest dates of the activity

After you've created the capacity requirements for a network, you can use various reports to compare the capacity requirements of the network plus the requirements of other projects or orders to the corresponding available work centers or capacities, respectively. Figure 2.19 shows the capacity overview of the Project Planning Board, which graphically illustrates the available capacities of work centers and the respective total capacity requirement using bars or histograms. Capacity overloads, that is, requirements that exceed the available capacities during a specific period, are highlighted in color. Additional detailed capacity reports are discussed in Chapter 6, Section 6.3.3.

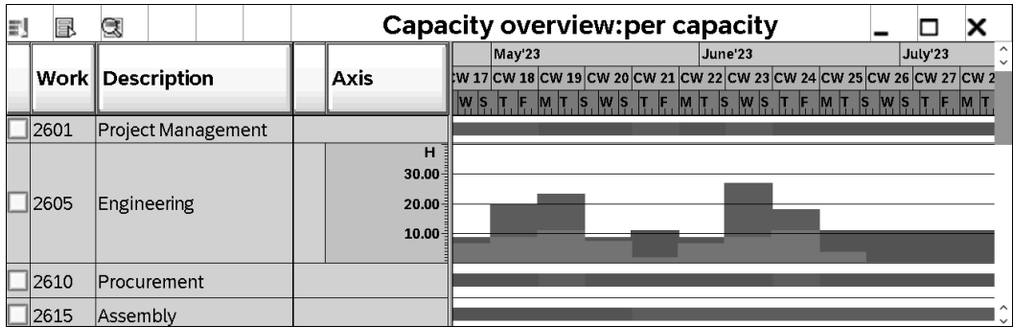

Figure 2.19 Capacity Overview of the Project Planning Board

Planned, remaining, and actual capacity requirements

During the implementation phase of projects, the capacity requirements are adjusted due to the completed work and forecast data from confirmations. Capacity reports therefore distinguish from among three different capacity requirements:

- **Planned capacity requirements**
  The capacity requirement resulting from the planned data of the activities.
- **Remaining capacity requirements**
  The current capacity requirements resulting from the originally planned requirements, the previously confirmed services, and possibly the forecasted remaining work.
- **Actual capacity requirements**
  The service that has actually been used and has already been confirmed.

Prerequisite for Actual Capacity Requirements

In addition to the relevant settings of the extended capacity reports, it's necessary to perform an analysis of actual capacity requirements so that the relevant work centers determine actual capacity requirements.

2.2.2 Workforce Planning

A work center can consist of several available individual capacities; however, if you perform your capacity requirements planning only at the work center level, you won't be able to specify which individual capacity of the work center will provide the respective service. Therefore, you can't create meaningful capacity evaluations for the individual capacities.

Capacity splits

For some projects, however, you must plan individual capacities—particularly as far as personnel resources are concerned—to avoid an overload of

individuals or to consider employees' qualifications when planning the project, for example. To do this, you can distribute the work via capacity splits, that is, split the planned work of an activity into individual capacities. Capacity splits can be individual machines, organizational units, or positions, for example. Usually, however, the Project System performs *workforce planning*, that is, distribution with a direct reference to the personnel numbers. The work distributed to a person can later be used as a default value for the time data recording using the cross-application time sheet (CATS) (see Chapter 4, Section 4.3.3).

Prerequisites for Workforce Planning

HR master data

A prerequisite for workforce planning is that Project System is provided with various HR master data. This can either be maintained in the system as HR mini-master records, or originate from an HR system. The minimum requirement is HR master data of the infotypes 0001 (Organizational Assignment) and 0002 (Personal Data). If you want to consider the availability of the person or their qualifications in your planning, you'll also need infotypes 0007 (Planned Working Time) and 0024 (Qualifications). Another later use of the data in the time sheet also requires infotype 0315 (Default Values Time Sheet).

Prerequisites for Workforce Planning

Before you can distribute the work of an activity to individuals, you must have already determined the capacity requirements. This means you need at least one work center for workforce planning as well.

The persons to whom you want to distribute the work don't necessarily have to be assigned to that work center. Depending on the system settings, you can use the following personnel for workforce planning:

- Persons who are assigned to the work center of the activity
- Persons of a project organization
- Any personnel resources

Personnel assignment to work centers

There are two ways of assigning personnel to a work center: First, you can assign an organizational unit or an HR work center to the work center and therefore indirectly assign personnel. Second, you can directly assign positions or persons to the work center capacity. The benefit of the second option is that you can use the total amount of availabilities of the assigned personnel included in capacity reports as the available capacity of the work center instead of the standard availabilities.

Project organization

Project organization refers to persons, positions, or organizational units that you assign to WBS elements as the default set for later workforce planning. If you use Transaction CMP2 (Workforce Planning – Selection Project View), the system always first suggests the persons, positions, or organizational units of the project organization for your workforce planning. If you haven't assigned a project organization to a WBS element, Transaction CMP2 of the system provides the project organization of the hierarchically superior WBS element for workforce planning. If you only want to store one project organization for the entire project, an assignment at the top project level will suffice. You can assign project organizations to WBS elements in Transaction CMP2 or in most of the processing transactions for WBSs. Figure 2.20 shows an example of assigning a project organization to a WBS element.

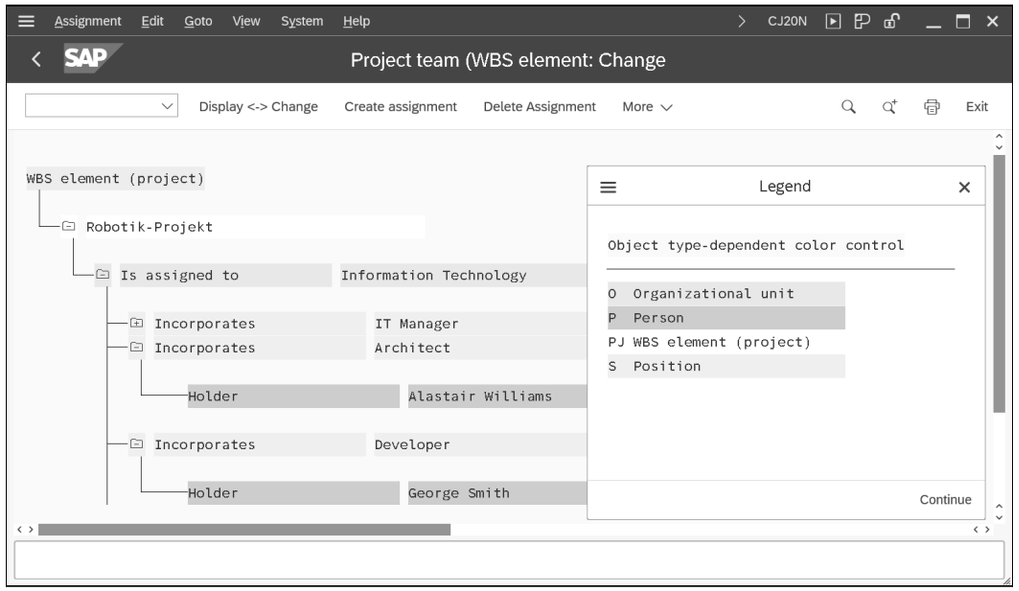

Figure 2.20 Sample Project Organization

If you want, however, you can plan personnel resources in your workforce planning that aren't assigned to the work center or to your project organization. Depending on the transaction you use for workforce planning, however, you must explicitly enable this in the activity or the workforce planning profile.

Ranking lists

If you want to take into account the qualifications of the personnel while planning the workforce (e.g., language skills, education, etc.), you can store a requirements profile in the individual activities that describes the qualifications required for accomplishing an activity. If you also defined the

qualifications of the individual personnel resources (Transaction PPPM), the system can create a ranking list during workforce planning listing those persons who are best qualified to meet the requirements of the activity.

Workforce Planning Process

There are different ways to plan a workforce. You can assign persons to an activity on the **Person assignment** tab and specify the date, the planned work, and the permitted duration for every split; the system then automatically distributes the requirements across the specified duration (see Figure 2.21). You can use Transactions CMP2 (Project View) or CMP3 (Work Center View) for distributing your work to persons, positions, or organizational units. You can also manually distribute the work to different days or weeks, for example, or use the graphical or tabular planning board of capacity requirements planning to include capacity splits (Section 2.2.3).

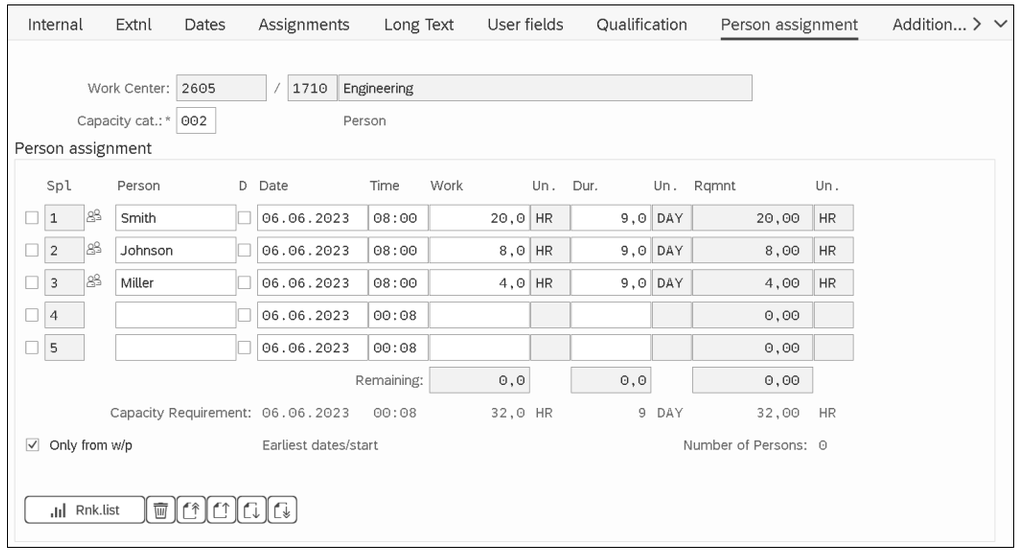

Figure 2.21 Person Assignment Screen of an Internally Processed Activity

Workforce planning profile

To use Transactions CMP2 and CMP3 in Project System, you first need to define a workforce planning profile in Customizing (Transaction CMPC; see Figure 2.22).

Among other things, the profile specifies whether it's permissible to plan resources that don't belong to the work center or to the project organization, and which periods (e.g., days, weeks, or months) are to be used for planning. Here, you can also define mixed period splits to make a day-based planning for the next period, for example, but only a week-based planning for activities that are based more in the future. If you use Transaction CMP9

to evaluate your workforce planning, you can use the profile to define traffic light functions (*exceptions*) indicating, for example, undistributed work or overloaded employees.

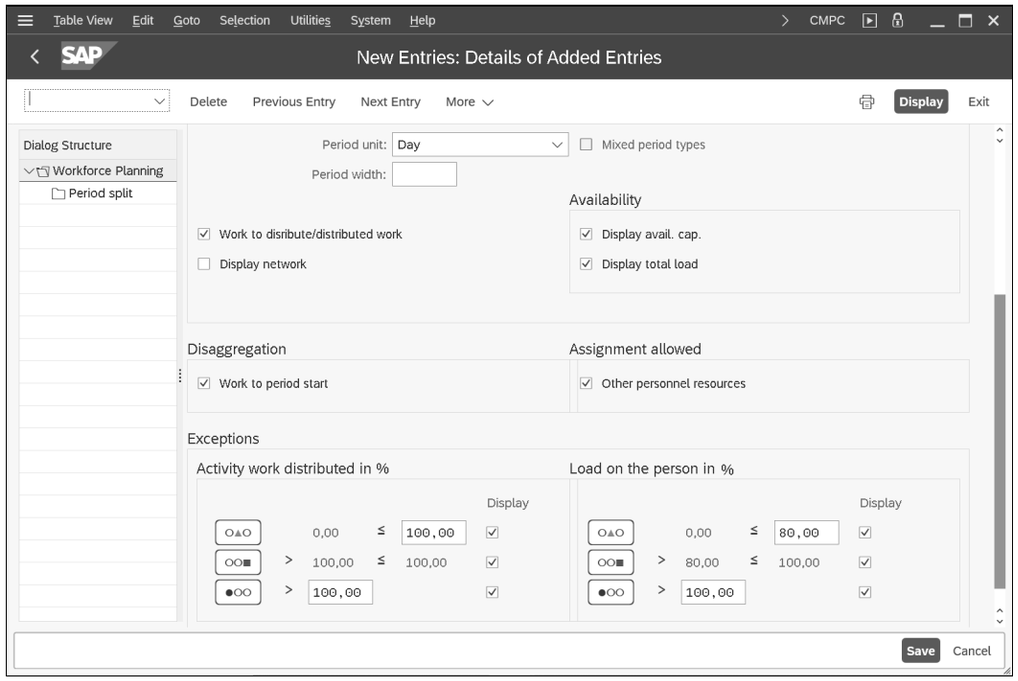

Figure 2.22 Workforce Planning Profile

Transaction CMP2 (Project View)

In workforce planning using Transaction CMP2 (Project View), you select the activities for workforce planning by specifying one or more projects, WBS elements, or networks. You receive a list of activities for which there are capacity requirements and then can create an assignment to organizational units, positions, or personnel resources. If there is a project organization, it will be suggested for the assignment; however, you can also use the work center resources and—provided this is permitted by the profile—any other personnel resources.

Editing period specifications

However, the assignment of a resource isn't sufficient for workforce planning; so, in addition, you need to enter the period in which the resource is to accomplish the specified amount of the planned work of the activity. At first, the system only offers the period for distribution that covers the capacity requirements of the activity. If you want, however, you can also use different periods for workforce planning.

You can also display the availability (planned working time) or the total load of the resources for each period. The total load shows a resource's total

work distribution to network activities for a specific period. Work distributions to other order categories aren't taken into account.

You can also display details of the activities or show the planned distribution of the activities' capacity requirements as well as the work of the activities that has already been confirmed. Figure 2.23 shows an example of workforce planning using Transaction CMP2.

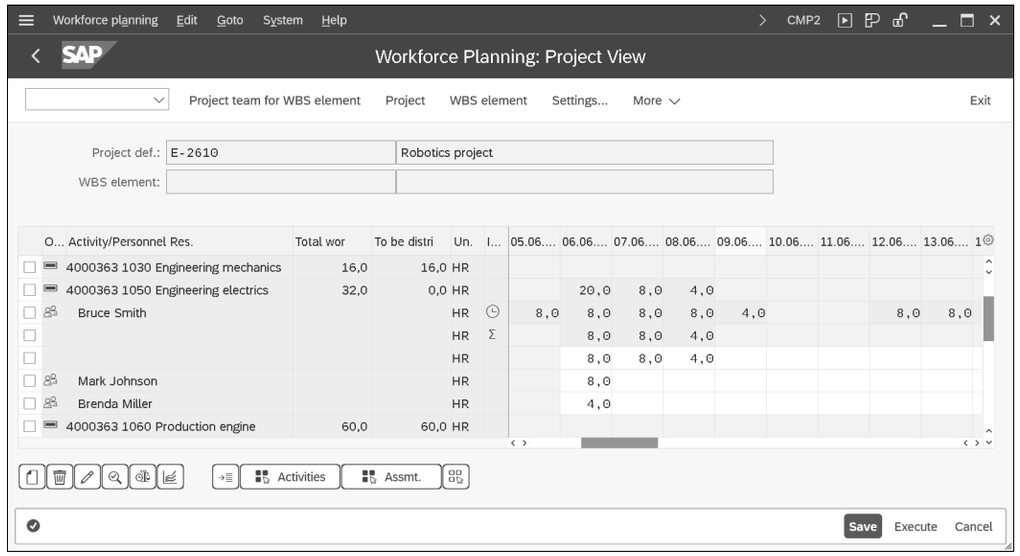

Figure 2.23 Workforce Planning from the Project View

Transaction CMP3 (Work Center View)

In some companies, it's not a project manager who uses Transaction CMP2 for workforce planning; instead, the persons responsible for specific work centers do this planning. They can use Transaction CMP3 (Work Center View) to distribute work to the resources of their work center (see Figure 2.24). Resources and activities are selected by specifying one or more work centers.

Network Lock for Workforce Planning from the Work Center View

You should note that during workforce planning—from a work center view—all activities that have capacity requirements for the selected work centers in the given period are read, and the corresponding networks are consequently locked. We therefore recommend that you use Transaction CMP3 to explicitly specify those networks as filters for which you want to distribute work.

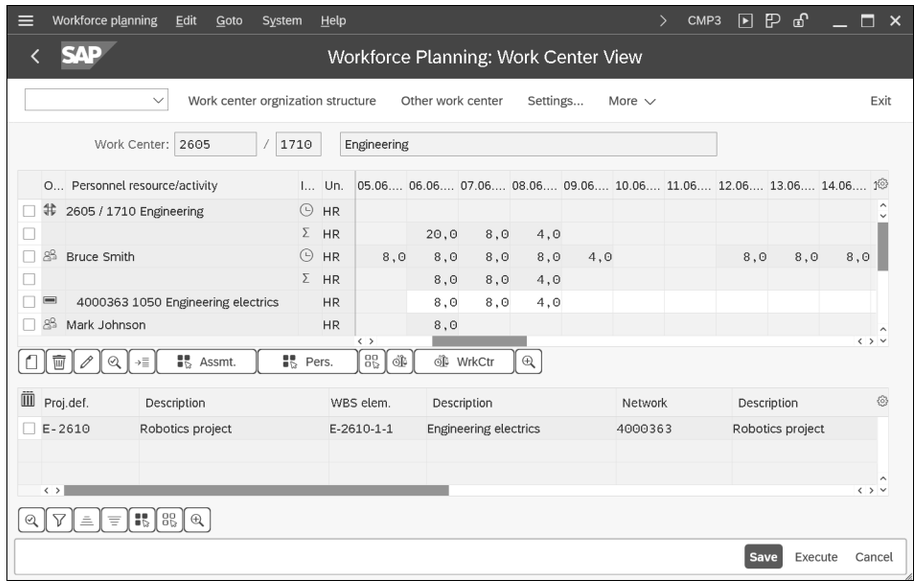

Figure 2.24 Workforce Planning from the Work Center View

Transaction CMP9 (Evaluation)

After you've performed workforce planning, you can evaluate it using the individual capacity reports or Transaction CMP9. In Transaction CMP9, you can use the information about projects, work centers, or personnel resources for selecting workforce planning. In the evaluation, you can use the exceptions defined in the profile to highlight overloaded resources or activities with work that hasn't yet been completely distributed (see Figure 2.25).

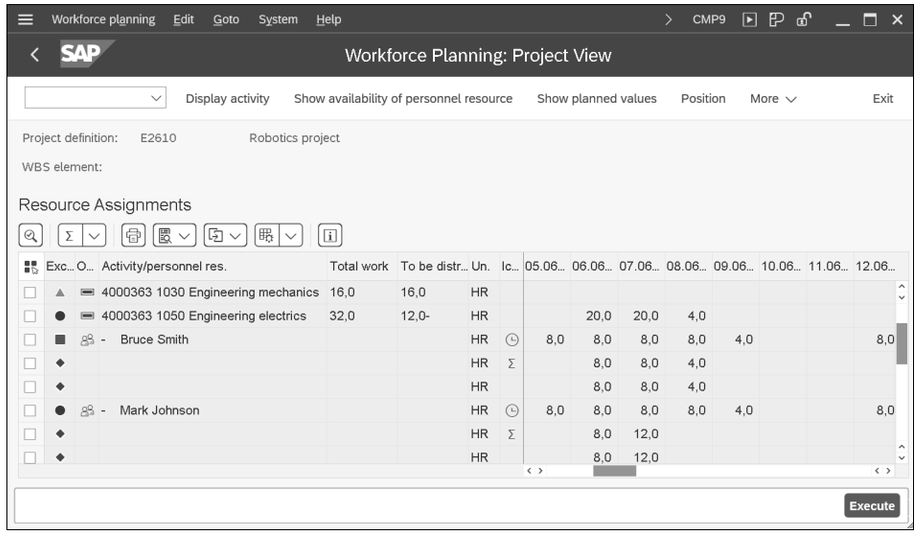

Figure 2.25 Evaluation of Workforce Planning

If activity dates are shifted after a workforce planning has been completed, the **Rescheduling** indicator in the scheduling parameters for the network type (Section 2.1.2) decides whether the workforce planning is to be shifted as well, or distributed work outside the new activity dates is to be deleted, for example.

In addition to the Project System option for workforce planning just described, you can use SAP Multiresource Scheduling or SAP S/4HANA Cloud for projects, resource management (see Chapter 7, Section 7.3.2). Both tools provide even more options for managing individual personnel resources for projects. These options are particularly relevant if you need extended or cross-project system functions for workforce planning.

2.2.3 Capacity Leveling

Rescheduling

If, during your capacity requirements planning, you find that required resources are overloaded, you'll need to adjust your planning. To do so, you must perform *capacity leveling*. This can be, for example, an adjustment of the time scheduling, that is, chronologically shifting activities or increasing their duration. Capacity leveling can also include the creation of new activities or activity elements with additional work centers or resources. If necessary, you can also change the control key of an internally processed activity, and therefore the activity category, to procure the planned work externally (see Section 2.2.4 and Section 2.2.5).

Capacity planning board

In a stricter sense, however, the term *capacity leveling* refers to the usage of graphical or tabular *capacity planning boards*, that is, specific capacity requirements planning tools for fixed chronological planning of capacity requirements. These tools are used primarily in production for planning bottleneck work centers, for example, and are rarely used in companies for project planning.

When using a capacity planning board in capacity leveling, you must first select capacities and activities that have requirements for these capacities. Then, you can plan the requirements to be performed by the planned capacity or by a different one. The planning can be done manually, where either you specify the dates for the planning, or they are specified automatically (e.g., the earliest or latest dates of an activity).

Scheduled status

Activities for which you've planned the requirements by using a capacity planning board automatically obtain the status **Scheduled**. All activity fields that are relevant to capacity requirements planning, such as the planned work and duration, the work center, or the activity dates, are locked against being changed due to this status. You can only shift the

activity or change other capacity-relevant data again if you undo the planning of an activity in a capacity planning board.

You can use capacity planning boards both for capacity leveling of work center capacities and for scheduling individual capacities of the work centers, such as personnel resources.

Graphical planning boards

Graphical planning boards (see Figure 2.26) are based on Gantt chart presentations. The graphical area displays the capacity requirements and the periods they cover, as well as existing scheduled capacity requirements, as individual bars on a time axis. The tabular area shows information about the capacities and the requirements sources. Manual requirement plannings for capacities can be performed via drag and drop.

If a capacity would be overloaded due to this planning, which is more than permitted according to the definition of the available capacity, you're informed via error messages in a planning log that this planning isn't possible.

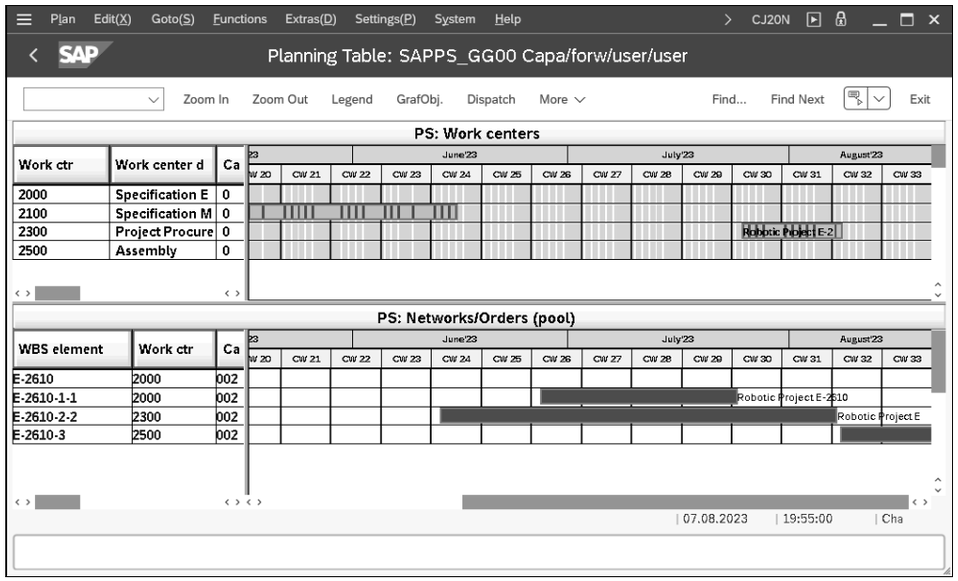

Figure 2.26 Graphical Capacity Planning Board

Tabular planning boards

Tabular planning boards present capacity data, requirements of activities, and additional data of the requirement sources in a tabular format (see Figure 2.27).

In contrast to graphical planning boards, the availabilities of the capacities can be displayed for the respective periods. This enables you to detect whether the capacity will be overloaded even before planning.

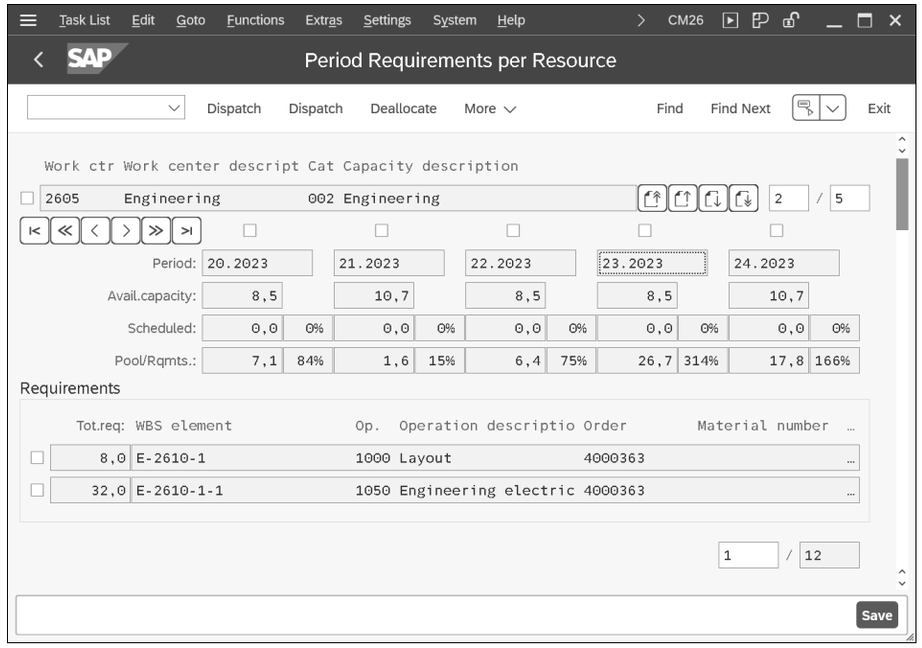

Figure 2.27 Tabular Capacity Planning Board

2.2.4 Externally Processed Activities

Often, not all services necessary for completing a project can be provided by internal company resources. Using externally processed activities (or external elements; see Chapter 1, Section 1.3.1), you can therefore plan, procure, and monitor services that are to be provided by vendors.

Specifications for external services

For a manual specification of external activities, you can use describing long texts, documents, or PS texts, and enter a planned quantity and a unit of measure in an activity. For cost planning of the external procurement, you can also specify a price per unit, the relevant currency, and a cost element (Section 2.4.5). To consider the time frame for the later procurement of the service in the scheduling process, you can store a planned delivery time or duration (Section 2.1.2) in the activity. You can also specify a preferred vendor.

To automatically create purchase requisitions from the activity data later, you must store a purchasing organization, a purchasing group, and the material group of the external activity in the activity. This organizational data and the cost element, currency, and unit of measure can be entered in the network profile (Transaction OPUU) as default values (see Chapter 1, Section 1.3.2).

Purchasing info records, outline agreements

Instead of manually entering specifications of the external activity, price, planned delivery time, material group, and so forth in the activity, as described previously, you can also refer to *purchasing info records* or *outline agreements* from purchasing. If you store an info record for external processing or an outline agreement in an externally processed activity, the activity automatically uses all necessary purchasing data from these purchasing information sources. This data—except for the quantity—can no longer be changed manually in the activity.

Automatic purchase requisitions

From the activity data, the system can automatically create a purchase requisition. Depending on the setting of the **Res./Purc. Req.** field, this can be done even before the activity is released (**Immediately**), automatically by setting the **Released (From Release)** status, or at a later stage. For the last option, first set the indicator to the **Never** value, and then change the setting to **Immediately** later. The value of the **Res./Purc. Req.** field can be preset via the network profile.

The purchase requisition is automatically filled with all data relevant to the purchase. The system uses the latest end date of the activity as a delivery date in the purchase requisition. You can use a customer enhancement to influence the creation of a purchase requisition from the activity data. If relevant data is changed later on, the purchase requisition is adapted automatically. A manual change of the quantity, material group, and purchasing group taken from the activity isn't possible in the purchase requisition.

Displaying purchase requisitions

From an externally processed activity, you can go to the display of the created purchase requisition at any time. In addition, Project System also provides the Purchase Requisitions for Project report (Transaction ME5J), which enables you to analyze or further process purchase requisitions of one or several projects in parallel (see Figure 2.28). Project-Oriented Procurement (ProMan) (see Chapter 4, Section 4.5.3) allows you to evaluate quantity or date information of purchase requisitions and use traffic light functions to highlight deviations from your planning.

Selecting a vendor

The automatically created purchase requisitions are also visible in purchasing and can be further processed by a responsible purchaser. Unless you referred to a purchasing info record or an outline agreement in the activity, the purchaser also selects the vendor. In purchasing, this can be achieved, for example, via a bidding process or an automatic source determination.

Commitments

If a vendor has been selected and assigned to the purchase requisition, the data of the purchase requisition can be transferred to a purchase order. The purchase order authorizes the vendor to offer the services ordered for your project. The services provided can later be documented via goods or invoice receipts. All purchasing documents are assigned to the activity so that you can not only analyze the planned costs but also the commitments according

to the purchase requisition and purchase order, and the actual costs of the external service performed for the activity or the network, respectively. The purchasing process and the corresponding value flows are discussed in detail in Chapter 4.

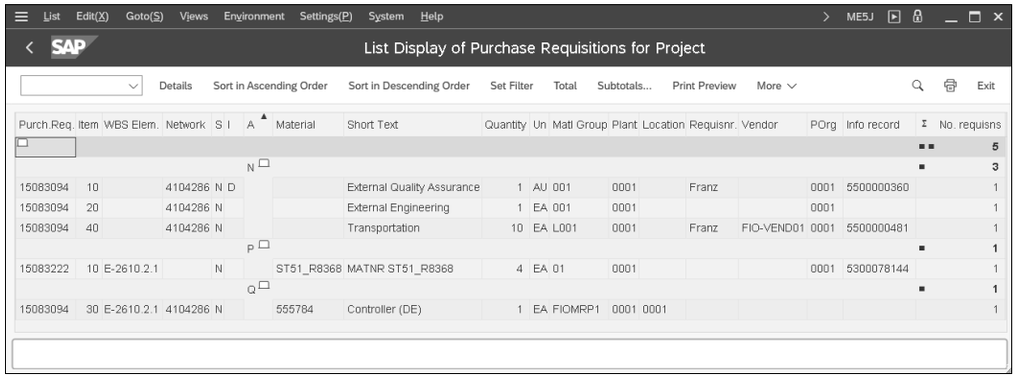

Figure 2.28 Tabular Presentation of Purchase Requisitions for a Project

Document type and account assignment category

In the Customizing section of Project System (Transaction OPTT, see Figure 2.29), you define the *document type* for networks, which is to be used for creating the purchase requisition, and in the **Acct. assgmt. gen.** field, you specify the *account assignment category* that controls the value flows of the purchase requisition and all subsequent purchasing documents. These settings are consistently implemented for all networks and are independent of the plant or network type.

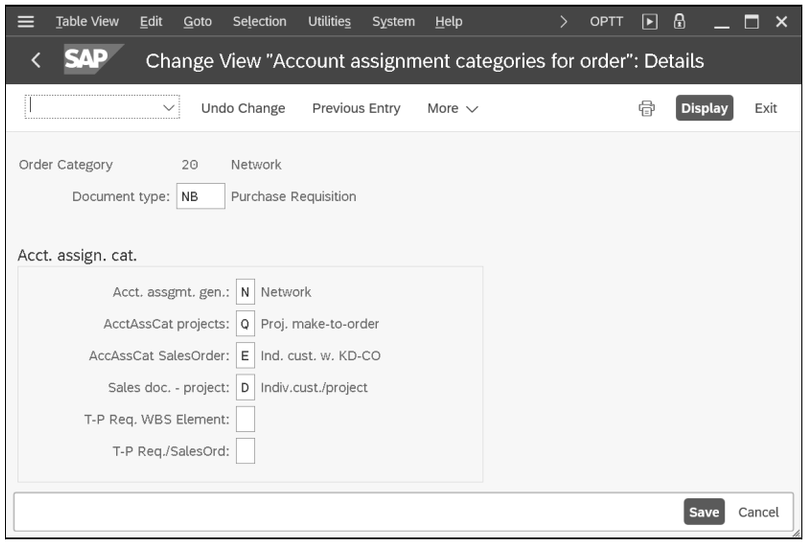

Figure 2.29 Determination of the Account Assignment Categories for Networks

In network type parameters (Transaction OPUV), you can specify per plant and network type whether a separate purchase requisition is to be created for every externally processed activity (and every service activity and every purchased part; see Section 2.3.1), or whether only one purchase requisition is to be created per network, which then has one item for every external procurement (collective purchase requisition).

You can decide how to best summarize purchase order-relevant items within a project, even across different networks, if necessary. To do that, you must activate the same grouping indicator in the **Collective Purc. Req.** field for all externally processed activities and service activities, and for every purchased part you want to aggregate. Possible grouping indicators have to be defined at the project definition level first.

External purchasing systems

If you're implementing an external purchasing system, you can specify for combinations of purchasing and material groups that purchase requisitions are transferred directly to the external purchasing system and that any further purchasing processes are performed there. You can also use a customer enhancement to determine criteria for selecting the purchase requisitions to be transferred.

2.2.5 Services

If your company's purchasing department also supports the procurement of services using service specifications and acceptances of services performed, Project System provides service activities and service activity elements for planning and procuring such services. Similar to externally processed activities, services to be provided by external vendors are planned using service activities by specifying purchasing info records or outline agreements, if necessary. For service activities, purchase requisitions can then be created from activity data as well, and purchasing processes can therefore be triggered automatically.

Service specifications

Contrary to an externally processed activity that you simply use to plan and procure an individual external activity, you can use a service activity to plan several vendor services in one step and specify additional information about services that can't yet be defined in detail. When creating a service activity, the system prompts you to create *service specifications* (see Figure 2.30).

In service specifications, you can create a list of planned services in a hierarchical structure, if necessary. To do this, you can use *service master records* from purchasing that might already store the various data of a service. Using the purchasing condition technique, prices for service master records can then be automatically determined and used for calculating the

activity. You can also select services from other service specifications, for example, from existing purchasing documents or other networks or purchase orders, and copy them into your service specifications.

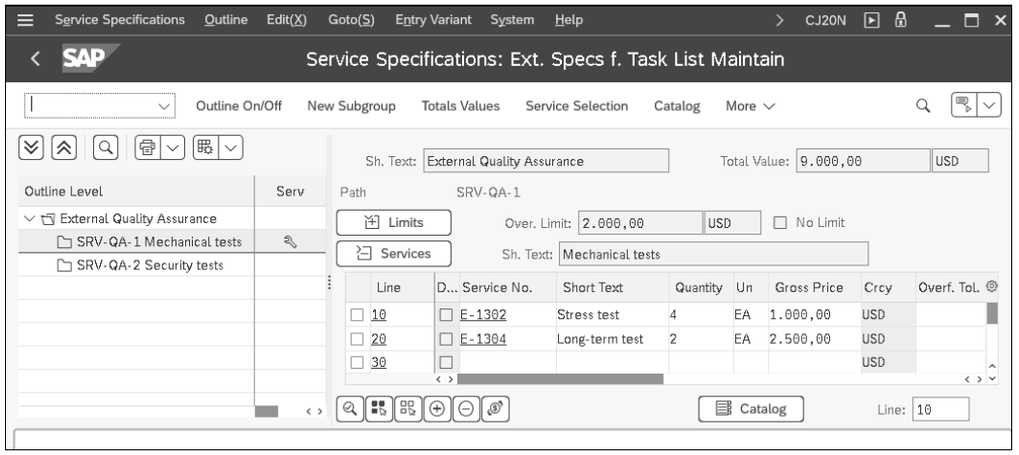

Figure 2.30 Sample Service Specifications

Model service specifications/ standard service catalogs

In purchasing, *model service specifications* can be defined that can then serve as a template for creating service specifications in the network activity. In some industries, it's common practice to specify services using standardized text modules. In purchasing, this can be mapped via *standard service catalogs*. If you refer to a standard service catalog in your service specifications, you can then plan services by selecting individual text modules.

Catalogs

You can also call intranet or external internet catalogs in service specifications to select services from these catalogs and transfer them to the service specifications. This is implemented via the *Open Catalogue Interface* (OCI) (Section 2.3.1).

Unplanned services

Frequently, not all services can be planned in detail before a project starts because the required services may depend on the course of the project, for example. In addition to planned services, you can also specify information about unplanned services in the service specifications. To calculate a service operation, you can store an expected value for unplanned services in the service specifications. This value and the total value of planned services add up to the planned costs of the activity.

Limit of values

In addition, you can limit the value of unplanned services by entering a limit of values in the service specifications. If the vendor later provides services that you didn't explicitly specify in the service specifications, the value of this unplanned service is checked against the limit of values. If the

value of the unplanned services exceeds the specified limit, the entered services can't be saved.

External services management

Another difference between externally processed activities and service activities can be found in further purchasing management. At first, a vendor selection and the purchase order implementation take place for a purchase requisition of a service activity in purchasing as well. While a goods receipt can be posted to document services for externally processed activities (depending on the account assignment category), service activities *always* require a service entry and an acceptance of services performed. More purchasing management details for service activities are discussed in Chapter 4, Section 4.4.2.

Purchase requisitions due to service activities use the same document type and the same account assignment category as externally processed activities (Transaction OPTT). Depending on the material and purchasing group of the purchase requisition, a transfer to an external purchasing system can be performed as well. In the network profile (Transaction OPUU), you can store default values for service operations in the activity, which cover the cost type of the planned services, the material and purchasing group, and the unit of measure.

Planning Internal and External Resources Using Networks

Using networks, you can plan internal and external resources for completing your projects. Internal resources are planned based on work centers (capacity requirements planning). If you want, however, the planning can be carried out in greater detail up to workforce planning. Using externally processed and service activities or activity elements, respectively, you can plan the use of external resources and trigger their procurement via purchasing.

2.3 Material Planning

The completion of many projects requires material. Within the scope of your project planning using Project System, you can plan for material that is required, and its procurement, consumption, and delivery. Using the robotics project as an example, different assemblies, such as parts of the motor, casing, or electronics, must be provided for a final assembly of the robot. If the material isn't available in stock, purchasing processes or the in-house production of the material must be triggered. If necessary, the required material needs to be delivered to the location where the final assembly takes place or to the customer.

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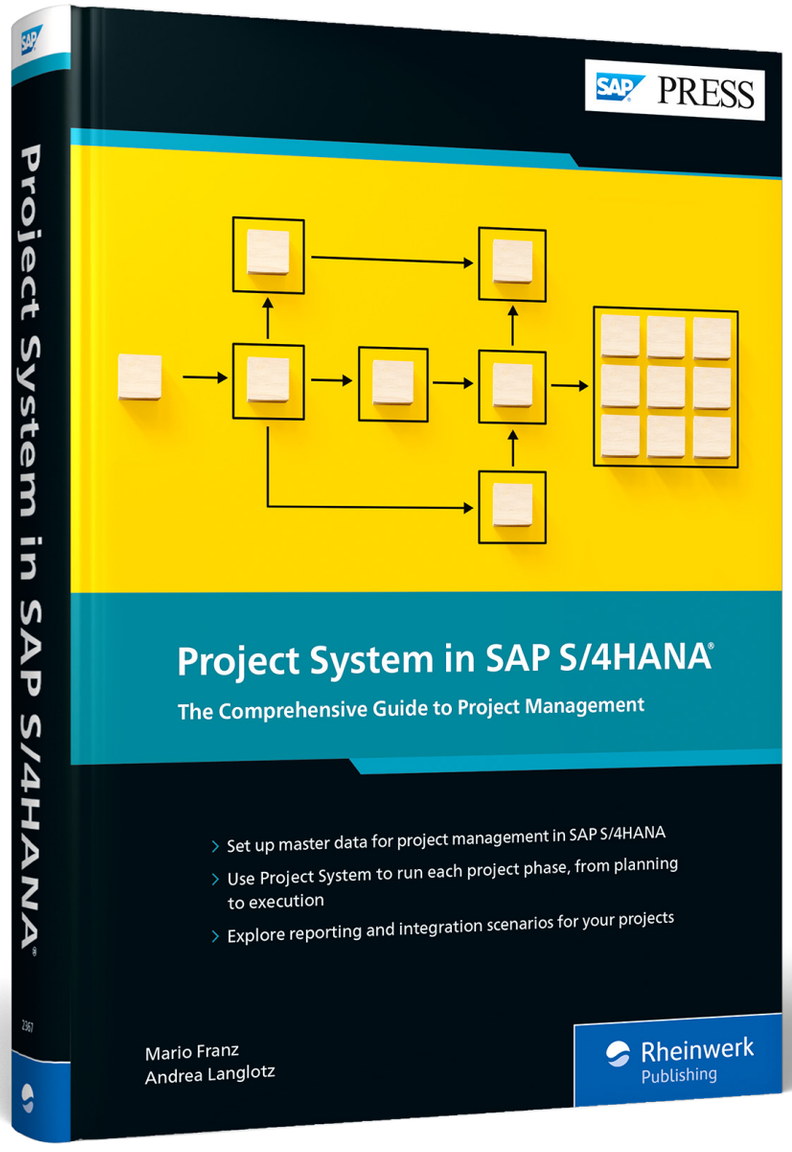

Dr. Mario Franz currently works as a product manager in the area of Enterprise Portfolio and Project Management (EPPM). He has previously worked in this field in various roles at SAP and, in particular, held SAP courses on Project System for several years as well as assisting with consultant training.

Andrea Langlotz has worked in EPPM at SAP SE since 2005. She currently works as a product manager. Her focus is on the SAP S/4HANA-based aspects of the EPPM application. Prior to that, she spent many years as a solution manager responsible for the go-to-market strategy and commercialization of the solution.

Mario Franz, Andrea Langlotz

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