



# SAS<sup>®</sup> Workflow Manager 2.2: User's Guide

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**SAS® Workflow Manager 2.2: User's Guide**

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# Introduction to SAS Workflow Manager

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## What Is Business Process Management?

Organizations of all sizes are forced to deal with a changing business environment. The changing marketplace, technological advances, and shifting customer priorities create challenges that businesses must overcome every day. All successful organizations need efficient processes to convert their competencies and resources into value for their customers. Success requires a delicate balance between establishing efficient, repeatable processes, and maintaining the agility to adjust or completely replace these processes to fit current conditions.

Common challenges include the following:

### people acting in concert

The actions of good managers, along with prior training and experience, largely determine how effectively members of a group can work together to bring about an aggregate result. Yet all of these factors take time to develop, and might never fully develop if the pace of change is high. A well-designed process management system can help by orchestrating—by way of notifications, reminders, delivery of resources, and tracking—the work of many individuals involved in a business process. It can also automate much of the start up and cleanup in each individual activity. For example, it can automate finding the right forms and locating relevant policies, or automate forwarding to the next person in the process.

### interleaving automation

Not all processes can be usefully automated, but even partially automated processes are more efficient than completely manual processes. A well-designed process management system can help identify where automation can have the highest impact, along with an operational framework for deploying and managing automated processes.

### performance analysis and optimization

High-level summary results can indicate problems, but detailed analysis is required in order to pinpoint and fix bottlenecks and inefficiencies in operations. A properly implemented process management system can collect detailed metrics on the actual performance of key processes in real time. These metrics give management a concrete basis for making decisions about how and when to make improvements.

Business process management (BPM) is a disciplined approach focused on aligning all aspects of an organization on fulfilling the needs of its clients. It emphasizes integrating technology into the business process such that the process itself drives the business goals, decoupled from the underlying systems and applications. Specifically, BPM emphasizes how the work is done within an organization, in contrast to what a product does.

BPM can also be used to understand relationships between processes and relationships within the organization and across organizational boundaries. The analysis of those relationships, when included in a process model, enable sophisticated, horizontal reporting and analysis.

Critical success factors for BPM include the following:

- understanding the current state business process and client needs
- applying governance and standards based on business policies and practices
- using metric and key performance indicator (KPI) definitions that support measurable business goals

More specifically, a business process is a collection of activities designed to produce a specific output for a particular objective, possibly involving both human and system interactions. Essentially, a process is an ordered sequence of work activities defined with respect to time and place, with a beginning, an end, and clearly defined inputs and outputs: a structure for action.

Initially, BPM focused on the automation of business processes. It has evolved to integrate manual processes in which human interaction takes place in series or parallel with the use of technology. For example, when individual steps in a basic workflow require human intuition or judgment, these steps are assigned to members within the organization. Consequently, the difference between workflow and BPM is not distinct. Generally, workflow management is considered to be a subset of BPM that emphasizes static routing and administration of human tasks. In contrast, a business process might include a combination of automated and manual activities with dynamic routing based on embedded business logic. Today, many products include varying aspects of customization and control, but both approaches emphasize the elimination of bottlenecks, minimization of redundancies, and improved operational efficiency.

In short, workflow systems can be thought of as a type of operating system for the enterprise. The function of this system is to orchestrate and track work, whether automated or carried out by people. In the same way that databases capture what an organization consumes and produces, workflow systems encapsulate how the organization operates.

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## Why Use SAS SAS Workflow Manager?

Integration and interoperability of applications and data has improved with the emergence of the web, middleware technologies, enterprise application integration (EAI) efforts, and adherence to software standards like Java, J2EE, and XML. However, businesses in many industries manage the integration of applications, data, and people by adopting business process management (BPM) practices. Popular workflow features include the following:

- systematic routing of tasks requiring manual intervention
- automated triggering of basic actions and alerts

Process management systems offer the option to define, automate, audit, and refine business operations by leveraging the web, middleware, and standards to more efficiently and effectively manage by process. SAS Workflow Manager provides the tools to rapidly integrate fundamental workflow management into business operations and business offerings based on SAS solutions and products.

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## SAS Workflow Manager on SAS Viya

SAS Workflow Manager 2.2 integrates with the platform workflow service, which is based on an open-source engine that complies with the Business Process Model and Notation (BPMN) 2.0 standard. It supports industry standards for visual representation and behavior, and it provides support for established workflow patterns. Specifically, SAS Workflow Manager supports workflows that are compliant with the BPMN 2.0 standard. SAS Workflow is efficient and scalable, and it integrates with other standard business process implementations.

## The Workflow Definition Lifecycle

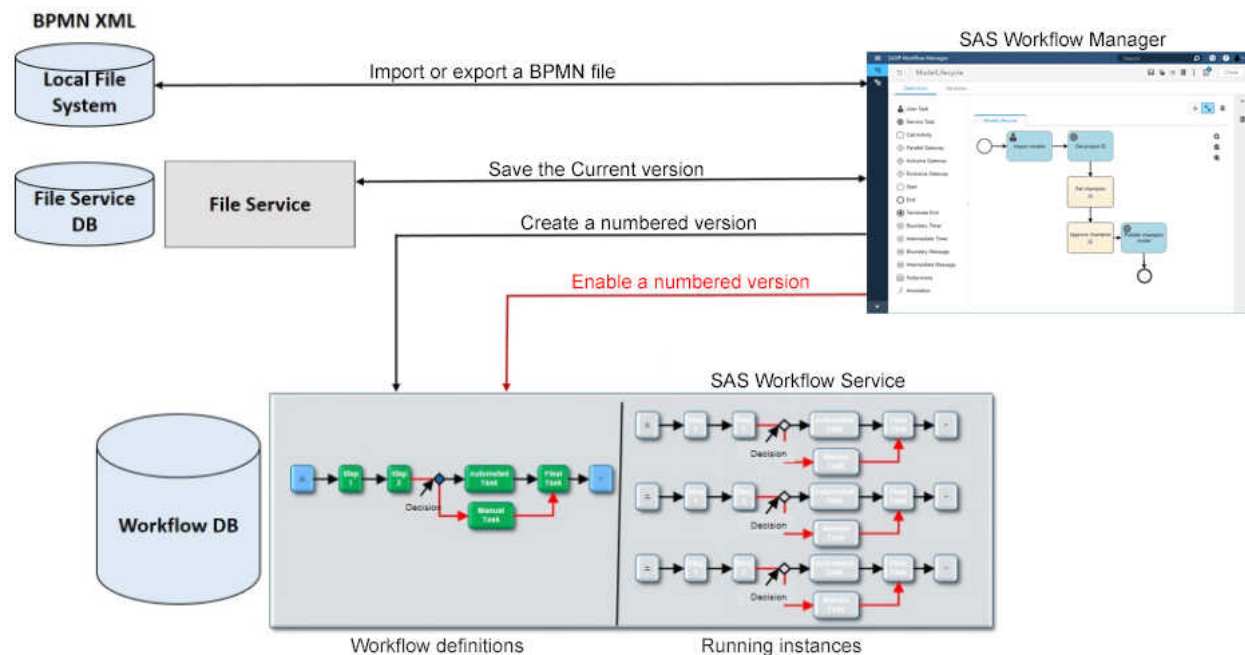
To develop and enable workflow definitions with SAS Workflow Manager:

- 1 Develop a draft of your workflow definition. You can create a new workflow definition or import an existing definition and modify it.
- 2 Save the working draft of your definition. SAS Workflow Manager saves the draft as the Current version. Only you can view and edit your Current version.
- 3 Create a numbered version of your workflow. Any user that has the appropriate permissions can view numbered versions of workflow definitions.
- 4 Enable a specific version of the workflow. In order for end-user client applications to be able to create running instances of the workflow, you must enable a specific version of a workflow definition.

Both the [Quick Start Tutorial](#) and [“Create and Enable a Workflow Definition”](#) on page 6 describe these steps in detail.

**Note:** Workflow definitions are stored in the BPMN 2.0 XML format.

Figure 1.1 The Workflow Lifecycle



If you determine that you need to make changes to a workflow that has already been enabled, you can edit the workflow definition, create a new version, and enable the new version. Client applications can create instances of the new version without affecting any running instances of the old version. Instances of the old version terminate as the workflows are completed.

Only one version of a workflow can be enabled at a time. As soon as you enable the new version, all new instances of the workflow use the new version of the definition. The older version of the definition is disabled.

---

## Sign In to SAS Workflow Manager

**Note:** If you are already signed in to SAS Drive, you can access SAS Workflow Manager by clicking **Manage Workflows**.

To sign in to SAS Workflow Manager:

- 1 In the address bar of your web browser, enter the URL for SAS Workflow Manager and press **Enter**. The Sign In page appears.

**Note:** Contact your system administrator if you need the URL for SAS Workflow Manager. The default URL is `http://host_name/SASWorkflowManager`.

- 2 Enter a user ID and password.
- 3 Click **Sign In**.

# Creating and Editing Definitions

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
## About Workflow Definitions

A workflow is a series of tasks, together with the participants and the logic that are required to complete the tasks. A workflow definition is a model of a workflow. A workflow definition can include events, gateways, activities, and other elements. SAS Workflow Manager enables you to create a visual model of the workflow definition as a node-link diagram. When you save the workflow definition, it is saved as a Business Process Model Notation (BPMN) file that conforms to the BPMN 2.0 standard.

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## Create and Enable a Workflow Definition


**TIP** Before you model your workflow in SAS Workflow Manager, review the workflow patterns described in [“Understanding Workflow Patterns” on page 47](#). Using the right workflow pattern for the right purpose helps ensure that your workflow is efficient and produces the intended results.




- 1 Click  on the navigation bar.
- 2 Click **New Definition**. The New Definition window appears.
- 3 Enter a name for the definition if you do not want to use the default name. Definition names must start with a letter and can contain only alphanumeric characters and the underscore (\_). Definition names are limited to 255 characters and must be unique.
- 4 (Optional) Enter a description for the new definition.
- 5 Click **OK**. SAS Workflow Manager opens the new definition and displays the **Definition** tab. You define the main process for your workflow on this tab. Any subprocesses that you add to the workflow are displayed on separate tabs.
- 6 Add the **Start** element to the workflow. To add an element, drag the element from the list of elements onto the workflow diagram.  
**Note:** A workflow definition must contain a **Start** element and at least one **End** or **Terminate End** element.  
**Note:** If an element in your workflow uses a data object, you must define the data object before you can configure that element.
- 7 Define the data objects that are required by the workflow. You define data objects in the Definition Properties window. See [“Create and Manage Data Objects” on page 12](#) for more information.
- 8 (Optional) Configure the **Start** element.  
You configure workflow elements by editing the element properties. See [“Edit Element Properties” on page 8](#).
- 9 Add and configure the elements required in the workflow. For additional information, see the following topics:
  - [“Working with User Tasks” on page 17](#)
  - [“Working with Service Tasks” on page 23](#)
  - [“Working with Subprocesses and Call Activities” on page 29](#)
  - [“Using Timers” on page 33](#)
  - [“Using Messages” on page 37](#)

- [“Using Gateways” on page 39](#)
- [“Add Annotations and Associations” on page 10](#)

10 Add an **End** or **Terminate End** to the workflow definition.

**TIP** The End element ends the process defined by the workflow path to which it is added, but it allows any parallel paths and subprocesses to complete. The Terminate End element terminates the process and all of its subprocesses.

11 Add sequence flows to connect the elements in the workflow. To connect two elements together, click  to enable link mode, and then drag the cursor from the first element to the next.

**TIP** To move elements in the diagram, click  to enable move mode. You can switch between link mode () and move mode () as needed.

For more information, see [“Add Sequence Flows” on page 9](#).

12 (Optional) Specify conditions for the sequence flows. The conditions on sequence flows are evaluated when a workflow instance executes, and the results determine which paths are taken. See [“Add Sequence Flow Conditions” on page 9](#) for more information.

13 (Optional) Add tags to the definition. Tags enable you to categorize related definitions on a user-defined basis. See [“Create and Manage Tags” on page 14](#) for more information.

14 Click  to save the workflow definition. The definition is saved as the Current version.

**Important:** An application cannot create instances of the Current version of a definition. In order for an application to use a workflow definition, you must specify a client identifier in the definition properties, create a numbered version, and enable the version.

15 Specify a client identifier for the definition. The client identifier is the name of the SAS solution that will create instances of the workflow. See [“Specify a Client Identifier” on page 9](#) for more information.

16 Create a numbered version of the definition. For information, see [“Manage Versions of Workflow Definitions” on page 15](#).

17 (Optional) Set permissions on the definition. For information, see [“Set Permissions on a Workflow Definition” on page 11](#).

18 Enable the version. After a numbered version of a definition is enabled, the solution that is specified by the client identifier can create new instances of the workflow definition. See [“Enable a Version” on page 15](#) for more information.

**Important:** Changes to workflow definitions do not take effect until you enable a revised version of the definition. Instances of a workflow that are already running continue to run with the version of the definition with which they were started. When new workflow instances are started, they use the newly enabled version of the definition.




19 Click **Close** to close the definition.

---

## Control the Definitions Tab Display

You can control the size and content of the **Definitions** tab in the following ways:


- Click **>>** to hide the properties pane for the selected element.

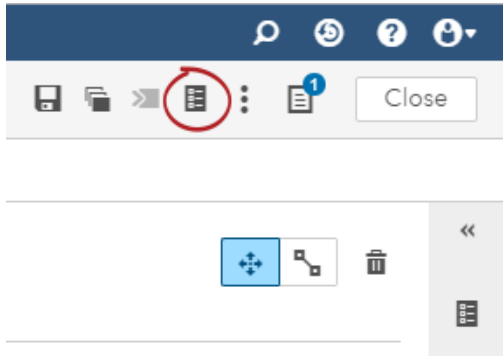
- Click  or  to enlarge or shrink the diagram.
- Click  to resize the diagram to fill the display.

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## Edit Definition Properties

**Note:** If you have not created a numbered version of a workflow definition, you can edit all of a definition's properties. After you create a numbered version of a definition, you can edit only the data objects.

- 1 Click  in the application bar above the diagram.




The **Definition Properties** window appears.


- 2 Edit the definition properties as needed. See [“Specify a Client Identifier” on page 9](#) and [“Create and Manage Data Objects” on page 12](#) for more information.
- 3 Click **OK**.

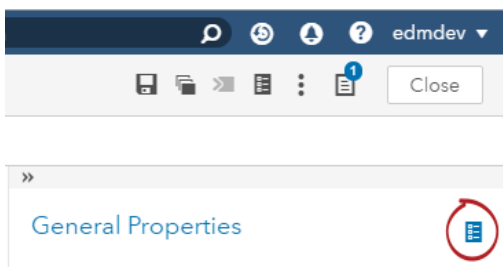
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## Edit Element Properties

Click  to hide the properties pane for the selected element.

All elements have a name and description. These properties are displayed on the **General Properties** pane.


Click  to display the general properties for the selected task.



Element names are limited to 255 characters and descriptions are limited to 1000 characters.

## Specify a Client Identifier

The client identifier is the name of the application that will create instances of the workflow.

- 1 Click the tab for the main process in the workflow. You cannot specify a client identifier if the current tab is a subprocess tab.
- 2 Click  in the application bar above the diagram. The Definition Properties window appears.

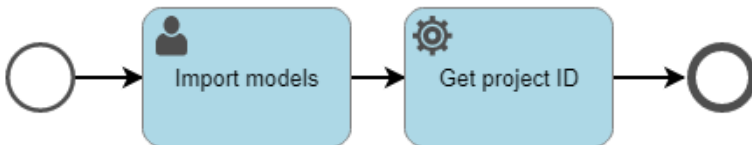
**TIP** If you have not created a numbered version of a workflow definition, you can edit all of a definition's properties. After you create a numbered version of a definition, you can edit only the description and data objects.


- 3 Select the client identifier and click **OK**.


## Add Sequence Flows

A sequence flow connects two events, gateways, or activities in a workflow definition. Sequence flows show the order in which the elements in a workflow are executed. A sequence flow is depicted as a solid arrow. For example, each task in the definition shown in [Figure 2.1](#) has one incoming sequence flow and one outgoing sequence flow.

Figure 2.1 Sequence Flows



To connect two elements together, click  to enable link mode, and drag the cursor from the first element to the next.

**TIP** You can also click  to add the next element using the current element context menu, which includes the sequence flow.

## Add Sequence Flow Conditions

You can specify conditions on most outgoing sequence flows. A condition has the following form:

*data-object operator value-or-data-object*

For example:

```
Approved == 'True'
```

When a workflow instance is run, the condition is evaluated depending on the workflow pattern that the workflow uses. If the condition evaluates to True, the outgoing sequence flow is taken. For more information, see [“Understanding Workflow Patterns” on page 47](#).

To add a condition to a sequence flow:

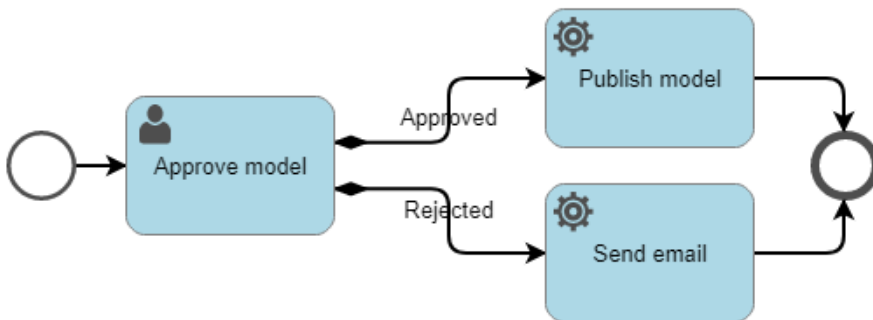
- 1 Select the sequence flow.
- 2 (Optional) Enter a name and description for the sequence flow.

**TIP** If you enter a name, it is displayed in the diagram. Names enhance the readability of the diagram and make it easier for others to follow the logic of the workflow.

- 3 Click ☰.
- 4 Enter the condition in the **Condition** field. You can use the **Data Objects** and **Operators** fields to add object names and operators to the condition.
  - Select a data object, and click ⚙ to add the data object to the **Condition** field.
  - Select the operator, and click ⚙ to add the operator to the **Condition** field.

For example, the sequence flows from the user task to the service tasks in [Figure 2.2](#) are assigned the conditions shown in [Table 2.1](#).

*Figure 2.2 Example Workflow with Sequence Flow Conditions*

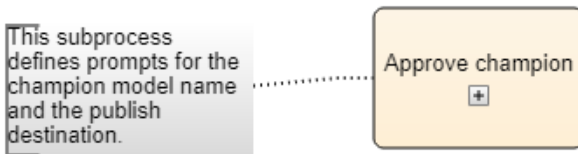


*Table 2.1 Sequence Flow Conditions*


Sequence Flow Name	Condition	Endpoint
Approved	Approved=='True'	Publish model
Rejected	Approved=='False'	Send email

## Add Annotations and Associations

An annotation is a note that you can associate with events, activities, and gateways. Annotation elements are connected by an association to the executable element that they describe. An association is depicted by a dotted line.



To add an annotation:

- 1 Drag the Annotation element onto the diagram.
- 2 On the **General Properties** pane for the Annotation, enter the text of the note.
- 3 Click  to enable link mode.
- 4 Drag the cursor from the annotation to the element to which it refers.

## Manage Permissions for a Definition

Before an authenticated user can work with workflow definitions and instances in SAS Workflow Manager, they must be given the appropriate permissions.

Any authenticated user can create workflow definitions. Users have full permissions to any definition that they create. Members of the Application Administrators group have full permissions to both workflow definitions and workflow instances. The SAS Workflow Editor, SAS Workflow Viewer, SAS Workflow Definition Administrator, and SAS Workflow Process Administrator groups are no longer defined for you. See [“Granting Permission to Work with Instances” in SAS Workflow Manager: Administrator’s Guide](#) for more information.

### Ways to Set Permissions



Permission to work with workflow definitions and instances is controlled in two ways:

- through group membership. For more information, see [“Granting Permission to Work with Instances” in SAS Workflow Manager: Administrator’s Guide](#).
- by setting permissions on specific workflow definitions. For more information, see [“Set Permissions on a Workflow Definition” on page 11](#).


### Set Permissions on a Workflow Definition

**Note:** Permissions that you set on specific workflow definitions override permissions that you set through group membership.

To set permissions on a workflow definition in SAS Workflow Manager:

- 1 In the Definitions view, open the definition for which you want to set permissions.
- 2 Click  and select **Authorization**. The Authorization window appears.
- 3 (Optional) Add an identity.
  - a Click . The Select Identity window appears.
  - b Select **User** or **Group** depending on the type of identity that you want to add.
  - c In the search field, enter the identity or enter an asterisk (\*) to display the list of identities.

## 12


- d Select the identity that you want to add, and click **OK**.
- 4 (Optional) Delete an identity. To delete an identity, select the identity and click .
- 5 Modify the permissions for the identities. Select or clear the check boxes to set or remove the appropriate permissions.

Permission	Abilities
Read	View the definition.
Update	Modify and delete the definition. Create new versions of the definition.
Enable	Modify, delete, and enable the definition. Create new versions of the definition.
Secure	Modify, delete, and enable the definition. Create new versions of the definition, and set permissions on the definition.

- 6 Click **Save** to save the permissions and close the Authorization window.

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
## Import a Definition

- 1 On the Definitions category page, click **Import**. The Import Definition window appears.
- 2 Click .
- 3 Select the Business Process Model and Notation (BPMN) file that you want to import, and click **OK**.

---

## Export a Definition

You can export workflow definitions as Business Process Model and Notation (BPMN) files.

- 1 Open the definition that you want to export.
- 2 Click  and select **Export**. SAS Workflow Manager adds the BPMN file to the download bar in your browser.

---

## Create and Manage Data Objects

### About Data Objects and Scope



Data objects are similar to variables. They hold pieces of business data that are required by the workflow. Data objects that are defined in the main process of a definition are global data objects and can be used by elements anywhere in the workflow. Data objects that are defined in a subprocess are local data objects and can be used only within the subprocess and its children.

**Note:** Do not duplicate application data structures in data objects. Instead, define only the data that is referenced in the workflow definition elements. This practice results in a more efficient workflow that is less likely to be affected by changes in the application data model.

## Create a Data Object



You can define new data objects by using the Definition Properties window, or you can select the **Create a new data object** option in most fields where you can specify a data object.

To create a data object by using the Definition Properties window:

- 1 Ensure that the correct tab is displayed. To define global data objects, select the tab for the main process. To define local data objects, select the tab for the subprocess.
- 2 Click  in the application bar above the diagram. The Definition Properties window appears.
- 3 Click . The New Data Object window appears.
- 4 Enter a name for the data object. Data object names must start with a letter and can contain only alphanumeric characters and the underscore (\_). Data object names are limited to 50 characters and must be unique within a workflow.
- 5 Select the data type for the data object.
- 6 (Optional) Specify a default value for the data object.
- 7 Click **Save**.



To create a data object after you select the **Create a new data object** option, follow [Step 4](#) through [Step 7](#) above.

## Edit a Data Object

- 1 Ensure that the correct tab is displayed. To edit a global data object, select the tab for the main process. To edit a local data objects, select the tab for the subprocess in which the data object is defined.
- 2 Click  in the application bar above the diagram. The Definition Properties window appears.
- 3 Select the data object, and click . The Edit Data Object window appears.
- 4 Edit the data object properties as needed.
- 5 Click **OK**.

## Delete a Data Object

**Note:** You cannot delete a data object that is used by an element in the definition.

- 1 Ensure that the correct tab is displayed. To delete global data objects, select the tab for the main process. To delete local data objects, select the tab for the subprocess.
- 2 Click  in the application bar above the diagram. The Definition Properties window appears.
- 3 Select the data object, and click .
- 4 Click **OK**.

---



## Create and Manage Tags

### About Tags

Tags are alphanumeric labels that are associated with definitions. Tags enable you to categorize related definitions on a user-defined basis. For example, you can define a tag for workflow definitions that is based on the application or organization that owns the definitions.


- Tags are static labels. They have no effect on active workflow instances and cannot be modified at run time.
- Tags do not control access to a definition. They do not prevent the sharing of workflow definitions among different applications. They do not affect whether or how a workflow is enabled.
- Tags are defined at service level, and you can assign them to any definition in that environment. If a definition is moved to another environment, you are prompted to create the relevant tags in the new environment when you create a numbered version of the definition.

### Create a Tag



- 1 On the Definitions category page, click . The Manage Tags window appears.
- 2 Click . The New Tag window appears.
- 3 Enter the name of the new tag, and click **Save**.
- 4 Click **Close** to close the Manage Tags window.

### Add a Tag to a Definition

**Note:** You must have permission to edit a definition in order to add a tag to it. See [“Manage Permissions for a Definition” on page 11](#) for more information.

- 1 Open the definition to which you want to add tags.
- 2 Click  in the application bar above the diagram, and select **Tags**. The Select Tags window appears.
- 3 Select the tags that you want to add to the definition, and click **OK**.

### Delete a Tag

- 1 On the Definitions category page, click . The Manage Tags window appears.
- 2 Select the tag that you want to delete, and click .
- 3 Click **Close** to close the Manage Tags window.

---

## Manage Versions of Workflow Definitions

### About Versions

The most recent version of a definition is the Current version. Only you can see your Current version. Other users cannot see changes that you have made to a definition until you create a numbered version of the definition.


**Important:** Changes to workflow definitions do not take effect until you enable a revised version of the definition. Instances of a workflow that are already running continue to run with the version of the definition with which they were started. When new workflow instances are started, they use the newly enabled version of the definition.

### Set the Displayed Version

The displayed version is the version whose information is displayed on the **Definition** tab. On the **Versions** tab, a ✓ indicates the displayed version. To change the displayed version, select the version that you want to view and select **Set Version**.

### Create a Numbered Version

**Note:** In order to create a numbered version of the definition, you must specify a **Client identifier** in the Definition Properties window.

**Note:** You cannot save changes to a numbered version. If you edit a numbered version and click , SAS Workflow Manager saves your changes as the Current version. If a Current version does not exist, SAS Workflow Manager creates it. If a Current version already exists, it is replaced.

To create a new version:

- 1 Click .
- 2 Click **Save**.

---

## Enable a Version

Only one version of a workflow definition can be enabled at a time. If a version is already enabled and you enable a different version, the previously enabled version is disabled and cannot be used by other applications.

**Important:** Changes to workflow definitions do not take effect until you enable a revised version of the definition. Instances of a workflow that are already running continue to run with the version of the definition with which they were started. When new workflow instances are started, they use the newly enabled version of the definition.



**Note:** You cannot enable the Current version of a definition. To enable a definition, you must first create a numbered version. See [“Manage Versions of Workflow Definitions” on page 15](#) for more information.

To enable a numbered version of a definition, open the version, and click .

---

## Delete Definitions

**Note:** You cannot delete a definition after it has been enabled.

- 1 Click  on the navigation bar.
- 2 Select the check box for the definitions that you want to delete, and click .

# Working with User Tasks

---

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---

## About User Tasks

User tasks are tasks that are performed by a human participant. Typically, the user tasks in a running workflow are managed through a software application that provides the ability to claim and complete the tasks. For example, SAS Model Manager provides a Tasks category through which users can claim and complete the tasks to which they are assigned. When workflow execution reaches a user task, an instance of the task is created and each potential owner who has access to the task must complete it. The user task then appears in each potential owner's task list.

**Note:** Some workflows can have a separate list for claimed tasks. If a task has multiple owners, that task appears only in the task list of the owner who claimed the task.

---

## Add a User Task

- 1 Drag the **User Task** object from the list of elements onto the workflow diagram.
- 2 (Optional) On the **General Properties** pane, edit the name and description. See [“Edit Element Properties” on page 8](#) for more information.
- 3 (Optional) Select **Set a due date** and specify a due date.

- To enter the due date that is relative to when the task starts, select **When the user task is reached**. If you do not enter a delay, the task becomes due as soon as the task starts. You can select a delay under **Add this delay**.
- To use a data object to specify the due date, select **Specified in the following data object**, and select the data object. The data object is evaluated when the user task starts and does not change even if the value of the data object changes.

**TIP** The due date is a task property that is available for use by the application that starts the workflow. The due date does not affect the execution of the workflow. To set deadlines that affect the execution of the workflow, use a timer. See [“Using Timers” on page 33](#) for more information.

- 4 Add the participants for the task. For more information, see [“Managing Participants” on page 18](#).
- 5 (Optional) Add any prompts that are needed for the task. For more information, see [“Managing Prompts” on page 21](#).

---

## Managing Participants

### About Participants and Roles

When you define a user task, you associate users with the task by adding them to the task as participants. A participant can be an individual user or a group of users.

You can assign a participant to one of two roles:

#### Potential Owner

A potential owner can claim and complete a task.


#### Excluded Owner

An excluded owner cannot claim or view a task. Excluded owners are typically used when a task needs to be reviewed or approved by at least two people. Using excluded owners ensures that the same person does not review the task twice and can increase the transparency of an organization’s processes.

**Note:** SAS Workflow supports an additional role: Actual Owner. A participant becomes an actual owner after they claim a task in a running workflow, but you cannot assign this role in a workflow definition.

Participants must be available through the SAS Viya Identities service and have the appropriate permissions. For additional information, see [SAS Workflow Manager: Administrator’s Guide](#) and [SAS Viya Administration: Identity Management](#).

### Add Participants to A User Task



- 1 Click  to display the **Participants** properties pane.
- 2 Specify the participants for the task either by using a data object or by selecting user or group identities. Typically, a user task has a set of potential owners, but only one person can claim and complete the task. You can specify one or more users or groups as potential users.

**TIP** If the set of potential owners is unknown at design time, you should use a data object to configure participants dynamically. See [“Specifying Groups as Participants” on page 20](#) for more information.

**Note:** The data object is evaluated when the user task starts and does not change even if the value of the data object changes.



To specify participants by using a data object, select **Listed in this data object**, and select the data object. See [“Data Object Format for Participants” on page 20](#) for more information.

To specify participants by selecting identities, select **Listed in this table**, and complete the following steps for each participant:

- a Click . The Add a Participant window appears.
  - b Select the workflow role for the participant. For more information, see [“About Participants and Roles” on page 18](#).
  - c Select **User name** or **Group name**, and click . The Select Identity window appears.
  - d In the search field, enter the first characters of the identity, or enter an asterisk (\*) to display the list of all identities.
  - e Select the identity that you want to add, and click **OK**.
- 3 (Optional) If more than one potential owner must complete the task, the workflow service must create a separate instance of the task for each person. To enable more than one potential owner to complete the task:
- a Select **Create a new instance for each participant**. See [“Enabling Multiple Participants to Complete a Task” on page 19](#) for more information.
  - b Select **Run the instances in parallel** or **Run the instances sequentially**.
  - c (Optional) Specify a completion condition. This condition is an expression that controls how multiple instances are handled or how the user task is determined to be completed. For more information, see [“Enabling Multiple Participants to Complete a Task” on page 19](#).

For descriptions of the variables that you can use in the expression, see [“Completion Conditions and Instance Variables” on page 21](#).

To specify a completion condition:

- i Select an instance variable, and then click  to add the variable to the **Completion condition** field.
- ii Select the operator, and then click  to add the operator to the **Completion condition** field.
- iii For the second operand in the expression, either enter a literal value or add a second instance variable to the **Completion condition** field.

## Enabling Multiple Participants to Complete a Task

Typically, a user task has multiple potential owners, but only one person is required to claim and complete the task. In this case, only one instance of the task is required. Do not select **Create a new instance for each participant** when you define the task.

If a user task has multiple potential owners and more than one person must claim and complete the task, select **Create a new instance for each participant**. A new instance of the task is created for each person that is assigned to it. A task for which multiple instances are created is referred to as a *multi-instance* task. You can use multi-instance tasks to repeat activities in a workflow without defining the same task multiple times.

For multi-instance tasks, you can control the number of instances that are created or when the task is considered complete by specifying a completion condition. [Table 3.1 on page 20](#) lists the criteria for determining when a multi-instance task is complete.

**Note:** When you specify a group as a potential owner, the number of potential owners that are assigned to a task and the number of instances that are created depend on how you specify the group. For more information, see [“Specifying Groups as Participants” on page 20](#).

Table 3.1 Criteria for Completing Multi-instance User Tasks

Create a new instance for each participant is selected	Completion condition is specified	Criteria for Determining When a Task Is Complete
Yes	Yes	The completion condition evaluates to True, and the required number of potential owners claim and complete the task.
Yes	No	Every potential owner claims and completes the task.
No		One of the potential owners claims and completes the task.

For more information, see [“Completion Conditions and Instance Variables” on page 21](#) and [Step 3 of “Add Participants to A User Task” on page 18](#).

## Data Object Format for Participants

To specify participants by using a data object, the value of the data object must follow this format:

```
[{ "principalType" : "type", "role" : "role", "principal" : "identity" }
<, { "principalType" : "type", "role" : "role", "principal" : "identity" }...>]
```

### **type**

specify **user** for individual users and **group** for groups.

**TIP** If more than one member of a group needs to complete a multi-instance task, the data object must list the name of the group once for each member that must complete the task. See [“Specifying Groups as Participants” on page 20](#) for more information.

### **role**

specify **PotentialOwner** or **ExcludedOwner**. See [“About Participants and Roles” on page 18](#) for descriptions of these roles.

### **identity**

specify an identity that is available through the SAS Viya Identities service. See [SAS Viya Administration: Identity Management](#) for additional information.

## Specifying Groups as Participants

If you specify a group name only once, then only one member of the group can claim and complete the task. The first member to claim the task becomes the actual owner and can complete the task. The remaining members of the group can no longer claim the task.

If more than one member of a group needs to complete a task, then you must specify the potential owners by using a data object with a multi-instance task. The data object must list the name of the group once for each member that must complete the task. For example, if the group Approvers defines ten users, and three users must claim and complete the task, then the data object must contain the following value:

```
[{ "principalType" : "Group", "role" : "PotentialOwner", "principal" : "Approvers" },
{ "principalType" : "Group", "role" : "PotentialOwner", "principal" : "Approvers" },
{ "principalType" : "Group", "role" : "PotentialOwner", "principal" : "Approvers" }]
```

## Completion Conditions and Instance Variables

For multi-instance user tasks, you can specify a condition that indicates when the task is complete. SAS Workflow Manager provides three predefined variables that you can use to construct a completion condition:

### **numberOfInstances**

specifies the total number of active and completed instances for the task. For example, if you specify a completion condition of `numberOfCompletedInstances >= numberOfInstances / 2`, the task is considered complete when half of the potential owners have claimed and completed the task.

### **numberOfActiveInstances**

specifies the total number of instances that can be active at the same time. If the instances are run sequentially, this number must be equal to 1. If the instances are run in parallel, this number cannot exceed the value of **numberOfInstances** (if it is specified).

For example, suppose you have a user task that has ten potential owners and the instances for each user are run in parallel. You can limit the number of people that can claim the task at the same time to two by specifying the following condition:

```
numberOfActiveInstances==2
```

As soon as one of the two participants completes the task, a third participant can claim and complete the next instance of the task.

### **numberOfCompletedInstances**



specifies the number of instances that must be completed. This number cannot exceed the value of **numberOfInstances** (if it is specified).

For example, suppose you have a user task that has five potential owners, but only three people need to complete the task. You would specify the following condition:

```
numberOfCompletedInstances==3
```

If a fourth person claims a parallel task, but does not complete the task before the third person completes the task, the fourth instance of the task is terminated.

## Delete or Edit a Participant

On the **Participants** property pane, select the participant, and click either  or . For additional information about editing a participant, see [Step 2b](#) through [Step 2e](#) of “Add Participants to A User Task” on page 18.

---

## Managing Prompts

### About Prompts, Scope, and Reuse




Prompts enable you to request information from workflow participants and store the user’s response in data objects. By using prompts, you can set values that are required to evaluate sequence flow expressions or to execute other tasks.


You can define prompts for start elements and user tasks. You must define prompts for required values before the values are needed. For example, if a data object value needs to be initialized when a workflow instance is created, define a prompt on the start element. If a value is required by the sequence flow expressions for a gateway, define the prompt on a start element or on a task that is earlier in the workflow than the gateway.

A prompt has the same scope as the data object that is used to store the user’s response. Depending on the scope of the data object, a prompt that is defined for one element can be reused by (added to) other user tasks.

If the scope of the data object is global, the prompt can be reused anywhere within the workflow definition. If the scope is local, the prompt can be reused only within the process where it is defined and within any children of that process. See [“About Data Objects and Scope” on page 12](#) for more information.



## Define a New Prompt

- 1 Select the **Start** element or **User task** for which you want to define a prompt.
- 2 Click  to display the **Prompts** property pane.
- 3 Click . The New Prompt window appears.
- 4 In the **Display text** field, enter the text that you want to be displayed for the prompt.
- 5 (Optional) Select **This value is required** if the user is required to enter or select a value for this prompt.
- 6 Select or create the data object in which you want to store the user’s response. See [“Create a Data Object” on page 13](#) for additional information.
- 7 (Optional) Specify the list of valid values for the response. To add a new value:
  - a Click . SAS Workflow Manager adds a new row to the **Values** table.
  - b In the **Values** table, enter a name and value.



**TIP** To delete a prompt value, select the value and click .

- 8 Click **OK** to close the New Prompt window.

## Reuse an Existing Prompt

- 1 Select the **Start** element or **User task** for which you want to define a prompt.
- 2 Click  to display the **Prompts** property pane.
- 3 Click  above the prompt table. The Add Prompts window appears.
- 4 Select the prompts that you want to add, and click **OK**.

## Delete or Edit a Prompt

On the **Prompts** property pane, select the prompt, and click either  or . For additional information about editing a prompt, see [Step 3 through Step 8 of “Reuse an Existing Prompt” on page 22](#).

**Note:** You can add prompt values to or remove them from an existing prompt definition without affecting previous associations.

# Working with Service Tasks

---

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---

## About Service Tasks

A service task is a task that invokes an executable business action. These actions are triggered automatically when workflow execution reaches the service task. For example, you can use service tasks to perform the following actions:

- send email to process participants and groups about deadlines or status changes
- communicate with other applications by executing web services
- execute business logic or rules
- integrate the system with other back-end systems

When you define a service task, you select one of six different actions:

### **Invoke REST web service**

invokes a REST web service

### **Invoke web service**

invokes a SOAP web service

**Send email**

sends email using the SAS Viya Mail Service

**Send notification**

enables you to send separate notifications to individual users or groups using the SAS Viya Notification Service

**Send group notification**


enables you to send a single notification to individual users and groups, and to copy additional users and groups using the SAS Viya Notification Service

**Invoke job execution**

enables you to execute jobs that are defined in the Job Execution service

---

## Add a Service Task

- 1 Drag the **Service Task** element from the list of elements onto the workflow diagram.
- 2 (Optional) On the **General Properties** pane, edit the name and description. See “[Edit Element Properties](#)” on [page 8](#) for more information.
- 3 Click  to display the **Action** property pane.
- 4 Select the action.
- 5 Enter the information for the service task. See the following topics:
  - “[The Invoke REST Web Service Action](#)” on [page 24](#)
  - “[The Invoke Web Service Action](#)” on [page 25](#)
  - “[The Send Email Action](#)” on [page 26](#)




For information about the SAS Viya APIs, see [developer.sas.com](http://developer.sas.com).

---

## The Invoke REST Web Service Action

This action enables you to invoke a REST web service.


*Table 4.1 Properties for the Invoke REST Web Service Action*



Field	Description
URL	Specifies the URL of the web service endpoint for the task.
Method	Specifies the HTTP method for the web service such as <b>GET</b> , <b>POST</b> , <b>PUT</b> , and so on.
HTTP request headers	Specifies the names and values of the HTTP header fields in the request. Click  to add a new header. To delete or edit a header, select the header and click either  or  .

Field	Description
<b>HTTP response header</b>	Specifies the data object mapping to field values of the HTTP header in the response. Click the heading to add a new mapping. To delete or edit a mapping, right-click the heading, and then click <b>Delete</b> or <b>Edit</b> .
<b>Expected result code</b>	Specifies the HTTP status code that indicates that the request was successful.
<b>Input type</b>	Specifies the type of the input body. The type can be JSON, XML, or empty (no input body).
<b>Input body</b>	Specifies the content of the input body of the request.
<b>Output type</b>	Specifies the output type of the response. The type can be either JSON or XML.
<b>Output data objects</b>	Associates data objects with result fields in the response. See <a href="#">“Manage Output Data Objects for REST Web Service Tasks” on page 25</a> for instructions.

## Manage Output Data Objects for REST Web Service Tasks

To associate a data object with a result field in the response:

- 1 Click . The Add an Output Data Object window appears.
- 2 Select the name of the data object, or select **Create a new data object**. See [“Create a Data Object” on page 13](#) for more information.
- 3 Enter the name of the result field in the HTTP response that contains the information that you want to store in the data object. If the output type is JSON, specify the name using JSON path expression syntax. If the output type is XML, specify the name using an XPath expression.
- 4 Click **OK**.

To delete or edit a data object, select the data object, and click either  or .

## The Invoke Web Service Action

This action enables you to invoke a SOAP web service.


*Table 4.2 Properties for the Invoke a Web Service Action*



Field	Description
<b>URL</b>	Specifies the URL of the web service endpoint.
<b>Action</b>	Specifies the URI of the SOAPAction header field.
<b>XML input document</b>	Specifies the content of the XML input body.

Field	Description
<b>Output data objects</b>	Associates data objects with XPath expressions that extract information from the SOAP response. See <a href="#">“Manage Output Data Objects for SOAP Web Service Tasks” on page 26</a> for instructions.

## Manage Output Data Objects for SOAP Web Service Tasks

To associate a data object with an XPath expression in the responses:

- 1 Click . The Add an Output Data Object window appears.
- 2 Select the name of the data object, or select **Create a new data object**. See [“Create a Data Object” on page 13](#) for more information.
- 3 Enter the XPath expression that is required to extract the value of the output parameter from the SOAP response.
- 4 Select the data type of the value of the target output parameter.
- 5 Click **OK**.

To delete or edit a data object, select the data object, and click either  or .

## The Send Email Action

This action enables you to send email using the SAS Viya Mail Service. For more information, see [“Mail Service” in SAS Viya Administration: Configuration Properties](#).

*Table 4.3 Send an email Action Properties*

Field	Description
<b>To</b>	Specifies the recipients for the mail message. You can list each recipient individually in the service task properties, or you can specify a data object that contains the list of recipient IDs.
<b>Subject</b>	Specifies the subject of the email message.
<b>Message</b>	Specifies the message text.

**Note:** The sender’s email address is populated by the email service with the system account information. You cannot modify the sender’s email address in SAS Workflow Manager.

## The Send Notification Action

This action enables you to send separate notifications to individual users or groups using the SAS Viya Notification Service.

**Note:** The notification channel is determined by the user preference settings. Supported channels include store, email, and, SMS messages. The portal retrieves stored messages.

**Table 4.4** Send Notifications Properties

Field	Description
<b>To</b>	Specifies the recipients for the message. You can list each recipient or group individually in the service task properties, specify a data object that contains the list of recipients, or notify only task owners. <b>Note:</b> If the task is unclaimed, the message goes to all potential owners. If the task is claimed, the message goes only to the owner who claimed the task.
<b>Template</b>	Specifies the notification template that you want to use for the notification. The notification template is managed by the Template service.
<b>Template Mapping Variables</b>	Specifies the template variable to data object mapping.

## The Send Group Notification Action

This action enables you to send a notification to individual users and groups where all recipients are addressed together in a single message. You can also copy additional users and groups.

**Table 4.5** Send Group Notifications Properties

Field	Description
<b>To</b>	Specifies the recipients for the mail message. You can list each recipient or group individually in the service task properties, specify a data object that contains the list of recipients, or notify only task owners. <b>Note:</b> If the task is unclaimed, the message goes to all potential owners. If the task is claimed, the message goes only to the owner who claimed the task.
<b>CC</b>	Specifies one or more recipients. You can list each recipient or group individually in the service task properties or specify a data object that contains the list of recipients.
<b>BCC</b>	Specifies one or more blind copy recipients. You can list each recipient or group individually in the service task properties or specify a data object that contains the list of recipients.
<b>Template</b>	Specifies the notification template that you want to use for the notification. The notification template is managed by the Template service.

Field	Description
<b>Template Mapping Variables</b>	Specifies the template variable to data object mapping.

**Note:** Email is the only delivery channel supported by using the group notification policy.

---

## The Invoke Job Execution Action

This action enables you to execute code that has been registered with the SAS Viya Job Execution Service. A single job can execute a single task or multiple tasks bundled together.

*Table 4.6 Invoke Job Execution Properties*

Field	Description
<b>Job Definition</b>	Specifies the available job definitions.
<b>Arguments</b>	Specifies the arguments defined for the selected job definition. The user must specify a value for each job definition if no default value is provided.
<b>Results</b>	Specifies the output values and associated data objects.
<b>Result State</b>	Specifies the data object used to store the job execution status.

**Note:** In order for the job definition to be displayed in the Job Definition list, you must define the job definition with the appropriate access for all registered SAS applications or with SAS Workflow Manager.

# Working with Subprocesses and Call Activities


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## About Subprocesses and Call Activities

Subprocesses and call activities are ways to modularize and reuse workflow logic. Subprocesses and call activities both define workflow processes. Subprocess definitions are embedded in the main workflow definition. Call activities are defined separately and referenced from the main workflow definition. For a running workflow instance, a subprocess runs within the same process as the main process. Call activities run as separate processes.

Using subprocesses and call activities improves readability of a workflow definition and promotes consistent reuse of business logic within an organization.

## Add a Subprocess

- 1 Drag the **Subprocess** from the list of objects onto the workflow diagram.
- 2 (Optional) On the **General Properties** pane, edit the name and description. See [“Edit Element Properties” on page 8](#) for more information.
- 3 Click  on the subprocess to open it on a separate tab.
- 4 Add the **Start** element to the subprocess. To add an element, drag the element from the list of elements onto the subprocess diagram.

**Note:** A subprocess definition must contain a **Start** element and at least one **End** or **Terminate End** element.

**Note:** If an element in your subprocess uses a data object, you must define the data object before you can configure that element.

- 5 Define the data objects that are required by the subprocess. You define data objects in the Definition Properties window.

**Note:** The tab that is selected when you define a data object determines the scope of the data object. See [“Create and Manage Data Objects” on page 12](#) for more information.

- 6 (Optional) Configure the **Start** element.


You configure subprocess elements by editing the element properties. See [“Edit Element Properties” on page 8](#).




- 7 Add and configure the elements required in the subprocess. For additional information, see the following topics:

- [“Working with User Tasks” on page 17](#)
- [“Working with Service Tasks” on page 23](#)
- [“Working with Subprocesses and Call Activities ” on page 29](#)
- [“Using Timers” on page 33](#)
- [“Using Messages” on page 37](#)
- [“Using Gateways” on page 39](#)
- [“Add Annotations and Associations” on page 10](#)


- 8 Add an **End** or **Terminate End** to the subprocess definition.

**TIP** The End element ends the subprocess defined by the workflow path to which it is added, but it allows its subprocesses to complete. The Terminate End element terminates the entire subprocess and all of its subprocesses.

- 9 Add sequence flows to connect the elements in the subprocess. To connect two elements together, click  to enable link mode, and then drag the cursor from the first element to the next.



**TIP** To move elements in the diagram, click  to enable move mode. You can switch between link mode () and move mode () as needed.

For more information, see [“Add Sequence Flows” on page 9](#).



- 10 (Optional) Specify conditions for the sequence flows. The conditions on sequence flows are evaluated when a workflow instance executes, and the results determine which paths are taken. See [“Add Sequence Flow Conditions” on page 9](#) for more information.
- 11 Click  to save the workflow definition.

---


## Add a Call Activity

- 1 Drag the **Call Activity** from the list of objects onto the workflow diagram.
- 2 (Optional) On the **General Properties** pane, edit the name and description. See [“Edit Element Properties” on page 8](#) for more information.
- 3 Click  to display the **Process** tab.
- 4 Select the process (workflow) definition that you want to call.
- 5 (Optional) Specify the input parameters for the call activity. Input parameters pass data object values into the call activity. Select the data objects in the current workflow (source) whose values need to be passed to the call activity process (target).
  - a Click  above the **Input Parameters** table. The New Input Parameter window appears.

- b** In the **Source** field, select the data object whose value you want to pass to the call activity.
- c** In the **Target** field, select the data object in which you want to store the value of the source data object.

**TIP** To edit or delete an input parameter, select the parameter and click  or .

- 6** Click **OK** to close the New Input Parameter window.

**TIP** Click  on the call activity to open it.

- 7** (Optional) Specify the output parameters for the call activity. Output parameters pass data object values from the call activity.

- a** Click above the Output Parameters table. The New Output Parameter window appears.
- b** In the **Source** field, select the data object whose value you want to pass to the current workflow.
- c** In the **Target** field, select the data object in which you want to store the value of the source data object.

**TIP** To edit or delete an output parameter, select the parameter and click **Edit** or **Delete**.

- 8** Click **OK** to close the New Output Parameter window.



# Using Timers

---

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## About Timers

You can use timers to trigger workflow activities at specific times or after specified intervals. For example, you can use timers to delay the start of a task or subprocess, cancel an activity after a specified interval, or send an email reminder at a specific time.

SAS Workflow Manager provides two different types of timers:

### boundary timers

are associated with a specific activity. The timer starts when process execution arrives at the associated activity. The timer can be set to fire immediately, after a relative delay, or at a specific time. You can set boundary timers to repeat at specific intervals, or you can use them to cancel the associated activity. When the timer fires, all of the outgoing paths from the timer are followed. If the timer is set to repeat, all outgoing paths are followed every time the timer fires. If the associated activity completes before the timer fires, the timer is canceled.

### intermediate timers

are independent elements of a workflow. They are not attached to a specific activity. The timer starts when process execution arrives at the timer. The timer can be set to fire immediately, after a relative delay, or at a specific time. Intermediate timers cannot be set to repeat, and they cannot be used to cancel an activity. When the timer fires, all of the outgoing paths from the timer are followed.

If you set a timer to fire at a specific time and that time has already passed when the timer starts, then the timer fires immediately.

## Add a Boundary Timer

- 1 Drag the **Boundary Timer** from the list of objects onto the task with which you want to associate the timer.

**TIP** You can also highlight the activity and select **Boundary Timers** in the properties pane. Select **New** to configure a timer.

- 2 (Optional) On the **General Properties** pane, edit the name and description. See “[Edit Element Properties](#)” on [page 8](#) for more information.

- 3 Click  to display the **Boundary Timers** property pane.

**TIP** When you add a boundary timer, the property pane automatically displays the properties for the boundary timer. To display or edit the properties of a boundary timer later, right-click the boundary timer, and select **Set Properties**. You can also highlight the activity and select **Boundary Timers** in the properties pane.


- 4 (Optional) Clear the **Cancel the activity** check box if you do not want the timer to cancel the activity when it fires.
- 5 Set the time at which you want the timer to fire.
  - If you want the timer to fire immediately when the workflow reaches the activity, select **When the timer is reached**.
  - If you want the timer to fire after a delay, select the delay under **Add this delay**. This delay is relative to the time at which the timer started.
  - If you want the timer to fire at a specific time, select **At the date and time specified by this data object**, and select the data object of type DATETIME. The data object is evaluated when the associated task starts.
 

**Note:** If you set a timer to fire at a specific time and that time has already passed when the timer starts, then the timer fires immediately.
- 6 (Optional) Set the timer to repeat.
  - a Clear the **This event occurs only once** check box.
  - b Specify the recurrence interval.
  - c Specify when you want the timer to stop repeating.
    - To specify a maximum number of occurrences, select a value for **Maximum number of occurrences, including the first**.
    - If you want the timer to repeat as long as the associated activity is active, select **No end date**.
    - To specify a specific end date and time, select **Repeat until the date and time specified by this data object**, and select the data object.

**Note:** If you specify both a maximum number of occurrences and an end date and time, the timer stops firing when the first of those conditions is met.

---

## Add an Intermediate Timer

- 1 Drag the **Intermediate Timer** from the list of objects onto the workflow diagram.
- 2 (Optional) On the **General Properties** pane, edit the name and description. See [“Edit Element Properties” on page 8](#) for more information.
- 3 Click  to display the **Time** property pane.
- 4 Set the time at which you want the timer to fire.
  - If you want the timer to fire immediately when the workflow reaches the activity, select **When the timer is reached**.

- If you want the timer to fire after a delay, select the delay under **Add this delay**. This delay is relative to the time at which the timer started.
- If you want the timer to fire at a specific time, select **At the date and time specified by this data object**, and select the data object of type DATETIME. The data object is evaluated when the instance that contains the timer starts.

**Note:** If you set a timer to fire at a specific time and that time has already passed when the timer starts, then the timer fires immediately.



# Using Messages

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## About Messages

Messages provide a way for applications to communicate with the workflow. Messages are character strings that are sent to a running workflow instance by another process. The process sends the message through the workflow service.

You can use messages to trigger workflow activities and to cancel activities.

SAS Workflow Manager provides two different types of messages:

### boundary messages

are associated with a specific activity. You can use boundary messages to cancel the associated activity. When process execution arrives at the associated activity, the workflow waits for the message to arrive before either proceeding with the process or canceling the activity. When the message arrives, all of the outgoing paths from the message event are followed. If the associated activity completes before the message arrives, the message event is canceled.


### intermediate messages

are independent elements of a workflow. They are not attached to a specific activity. When process execution arrives at the intermediate message event, the workflow waits for the message to arrive. When the message arrives, all of the outgoing paths from the message event are taken.

## Add a Boundary Message

- 1 Drag the **Boundary Message** from the list of objects onto the task with which you want to associate the message.

**TIP** You can also highlight the activity and select **Message** in the properties pane. Select **New** to configure a message event.


- 2 (Optional) On the **General Properties** pane, edit the name and description. See [“Edit Element Properties” on page 8](#) for more information.
- 3 Click  to display the **Message** property pane.

**TIP** When you add a boundary message, the property pane automatically displays the properties for the boundary message. To display or edit the properties of a boundary message later, right-click the boundary message, and select **Set Properties**. You can also highlight the activity and select **Message** in the properties pane.

- 4 (Optional) Clear the **Cancel the activity** check box if you do not want to cancel the activity when the message arrives.
- 5 Enter the **Message reference**. The message reference is the label used to identify the appropriate character string that is sent to the running workflow.

---

## Add an Intermediate Message

- 1 Drag the **Intermediate Message** from the list of objects onto the workflow diagram.
- 2 (Optional) On the **General Properties** pane, edit the name and description. See [“Edit Element Properties” on page 8](#) for more information.
- 3 Click  to display the **Message** property pane.
- 4 Enter the **Message reference**. The message reference is the label used to identify the appropriate character string that is sent to the running workflow.

# Using Gateways

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## About Gateways

Gateways enable you to control or synchronize how sequence flows converge and diverge in a workflow. For example, your workflow might have five workflow paths that converge to a gateway that has two outgoing paths, and the outgoing paths must all be taken at the same time. You can use a parallel gateway to control this flow.

If you do not need to control how paths diverge and converge, then you do not need to use a gateway. For more information about controlling the flow of a workflow, see [“Understanding Workflow Patterns” on page 47](#).


[Table 8.1 on page 39](#) describes the gateway types provided by SAS Workflow Manager.

**Table 8.1** Gateway Types

Type	Action when used to fork paths	Action when used to merge paths
Parallel	The workflow takes all of the outgoing paths. You cannot specify conditions for outgoing paths on a parallel gateway. For more information, see <a href="#">“Using Parallel Gateways (AND-split)” on page 49</a> .	The workflow waits for all of the incoming paths to arrive before it allows the workflow process to continue executing. If any incoming path is not active, the workflow becomes deadlocked. For more information, see <a href="#">“Merging with Parallel Gateways (Join)” on page 52</a> .
Exclusive	The workflow takes only one outgoing path. The path that is taken is the first path whose condition evaluates to True. For more information, see <a href="#">“Using Exclusive Gateways (XOR)” on page 49</a> .	You should not use exclusive gateways to merge paths.  When an exclusive gateway is used to merge paths, it behaves like a simple merge. See <a href="#">“Merging Alternate Paths (Simple Merge)” on page 51</a> for more information.
Inclusive	The workflow either takes all of the outgoing sequence flows whose conditions evaluate to True, or it takes the default path if none evaluate to True and you have designated a default path. For more information, see <a href="#">“Using Inclusive Gateways (OR-split)” on page 50</a> .	The workflow waits for all of the active incoming paths to arrive before it allows the workflow process to continue executing. If at least one of the incoming paths is active, the gateway allows the workflow process to continue. For more information, see <a href="#">“Merging with Inclusive Gateways (Inclusive Merge)” on page 53</a> .



---

## Add a Parallel Gateway

- 1 Drag the **Parallel Gateway** object from the list of objects onto the workflow diagram.
- 2 (Optional) On the **General Properties** pane, edit the name and description. See [“Edit Element Properties” on page 8](#) for more information.
- 3 Click  to enable link mode, and connect the appropriate workflow elements to the gateway.



---


## Add an Exclusive Gateway


- 1 Drag the **Exclusive Gateway** object from the list of objects onto the workflow diagram.
- 2 (Optional) On the **General Properties** pane, edit the name and description. See [“Edit Element Properties” on page 8](#) for more information.
- 3 Click  to enable link mode, and connect the appropriate workflow elements to the gateway.
- 4 Enter conditional expressions for the outgoing sequence flows. For each sequence flow that requires a conditional expression, complete the steps listed in [“Add Sequence Flow Conditions” on page 9](#).
- 5 Select the gateway.
- 6 Click  to display the **Conditions** property pane.
- 7 Verify that the conditional expressions are listed in the order in which you want them to be evaluated when the workflow is running. For more information, see [“Using Exclusive Gateways \(XOR\)” on page 49](#).

---

## Add an Inclusive Gateway

- 1 Drag the **Inclusive Gateway** object from the list of objects onto the workflow diagram.
- 2 (Optional) On the **General Properties** pane, edit the name and description. See [“Edit Element Properties” on page 8](#) for more information.
- 3 Click  to enable link mode, and connect the appropriate workflow elements to the gateway.
- 4 Enter conditional expressions for the outgoing sequence flows. For each sequence flow that requires a conditional expression, complete the steps listed in [“Add Sequence Flow Conditions” on page 9](#).
- 5 Select the gateway.
- 6 Click  to display the **Conditions** property pane.
- 7 Verify that the conditional expressions are listed in the order in which you want them to be evaluated when the workflow is running. For more information, see [“Using Inclusive Gateways \(OR-split\)” on page 50](#).

- 8 (Optional) To designate a default sequence flow, select the row for the sequence flow, and click . SAS Workflow Manager displays a check mark (✓) next to the default sequence flow. For more information, see [“Using Inclusive Gateways \(OR-split\)” on page 50](#).

**TIP** To remove the default designation, select the default and click .



# Localizing Workflow Text

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## About Languages and Workflows

You can specify localized text for the following items in a workflow definition:

- names and descriptions of definitions, subprocesses, user tasks, and service tasks
- names of data objects
- display text for prompts

You can also specify a default language for use when you are working with a workflow definition in SAS Workflow Manager.

---

## Localized Text in SAS Workflow Manager

When you are defining a workflow in SAS Workflow Manager, the text that you see is determined as follows:

- 1 If localized text is defined for your current locale, you see text in the language for your locale.
- 2 For any element that does not have localized text for your current locale, you see the localized text for the default language that is specified in the definition.
- 3 If an element does not have localized text for the default language specified in the workflow definition, you see English text for the **en-US** locale.

**Note:** Date and number formats are localized for the locale that was in use when the workflow definition was created. If you import the definition into an environment that is using a different locale, the localized date and number formats remain localized for the original locale.

---

## Localized Text in A Workflow Instance


For users that are working with a running instance of a workflow, the text that the users see is determined by the locale that is specified in the ACCEPT-LANGUAGE header field. This header field is in the request that is sent to the workflow service by the client application.

- 1 If localized text is defined for the locale that is specified in the ACCEPT-LANGUAGE header, the user sees the text for that locale.
- 2 For any element that does not have localized text for that locale, the user sees the text that was entered into SAS Workflow Manager when the workflow was defined.

---



## Set the Default Language

**TIP** The default language specified in the workflow definition is used only in SAS Workflow Manager. The default language does not affect what the user sees in a running workflow instance.

- 1 Click the tab for the main process.
- 2 Click , and select **Languages**. The Localize Text window appears.
- 3 Select the default language, and click **OK**.

---



## Localize Definition Names and Descriptions

- 1 Click the tab for the main process.
- 2 Click , and select **Languages**. The Localize Text window appears.
- 3 Complete these steps for each language:
  - a Click  above the **Name** table. The Localized Text window appears.
  - b Select the language.
  - c Enter the definition name in the selected language.
  - d Click **OK**.
- 4 Repeat [Step 3](#) for the **Description**.

---



## Localize Subprocess, User Task, and Service Task Information

- 1 Select the element for which you want to localize the name and description.

- 2 Click  to display the **Localization** property pane.
- 3 Complete these steps for each language:
  - a Click  above the **Name** table. The Localized Text window appears.
  - b Select the language.
  - c Enter the element name in the selected language.
  - d Click **OK**.
- 4 Repeat [Step 3](#) for the **Description**.



---

## Localize Data Object Names

- 1 Click the tab for the main process or a subprocess, depending on whether you want to localize global or local data object names. See [“About Data Objects and Scope” on page 12](#) for more information.
- 2 Click . The Definition Properties window appears.
- 3 For each data object, complete these steps for each language:
  - a Select the data object and click **Localize**. The Localize Text window appears.
  - b Click . The Localized Text window appears.
  - c Select the language.
  - d Enter the data object name in the selected language.
  - e Click **OK** to close the Localized Text window.
- 4 Click **OK** to close the Localize Text window.

---

## Localize Prompts

- 1 Select the user task or Start element for which you want to localize the prompts.
- 2 Click  to display the **Prompts** property pane.
- 3 For each prompt, complete these steps for each language:
  - a Select the prompt and click **Localize**. The Localize Text window appears.
  - b Click . The Localized Text window appears.
  - c Select the language.
  - d Enter the prompt text in the selected language.
  - e Click **OK** to close the Localized Text window.
- 4 Click **OK** to close the Localize Text window.



# Understanding Workflow Patterns

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---

## About Workflow Patterns

Only the most basic workflows can be represented as a single, sequential flow. Most workflows contain combinations of activities, events, and gateways. A workflow definition defines the possible paths through these elements and is based on your organization's business processes. The actual path that is taken by a workflow instance is determined at run time by the outcome of each activity and by the evaluation of conditional expressions associated with sequence flows.

A workflow definition typically uses one or more workflow patterns. A workflow pattern is a process construct that defines how a workflow behaves. For example, many workflows have a decision point where the main workflow path diverges, and alternative paths are available through the workflow. Alternate paths might be mutually exclusive, or they might run in parallel. You can control how the alternate paths are followed by using conditional expressions. How the workflow behaves depends on the workflow patterns that are modeled in the definition.

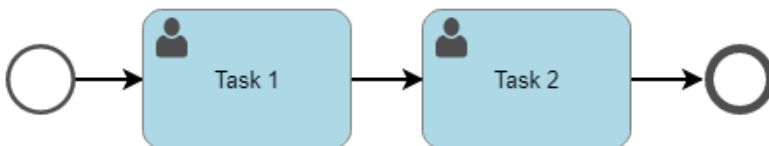
Table 10.1 Types of Workflow Patterns

Type	Description
Sequential	The workflow defines a single path through the workflow elements. See <a href="#">“Sequential Flow” on page 48</a> for more information.
Divergent	The workflow defines a path that splits into multiple alternative paths. If more than one path is executed, they are executed in parallel. You can use conditional sequence flows or gateways to implement divergent patterns. See <a href="#">“Divergent Patterns” on page 48</a> for more information.
Convergent	The workflow defines multiple paths that merge at the same element. See <a href="#">“Convergent Patterns” on page 51</a> for more information.
Termination	A workflow path reaches an End or Terminate End element. See <a href="#">“Termination Patterns” on page 53</a> for more information.
Cancellation	An activity or process is canceled, and the workflow does not reach an End or Terminate End element. See <a href="#">“Cancellation Patterns” on page 54</a>
Multiple Instance	A separate instance of a task is created for each participant. See <a href="#">“Multiple Instance Pattern” on page 53</a> for more information.

## Sequential Flow

The most basic workflows are represented as a single sequential flow. Each task is completed in sequence, and no conditions are associated with the sequence flows. However, most workflows are not this simple.

Figure 10.1 Sequential Workflow Diagram



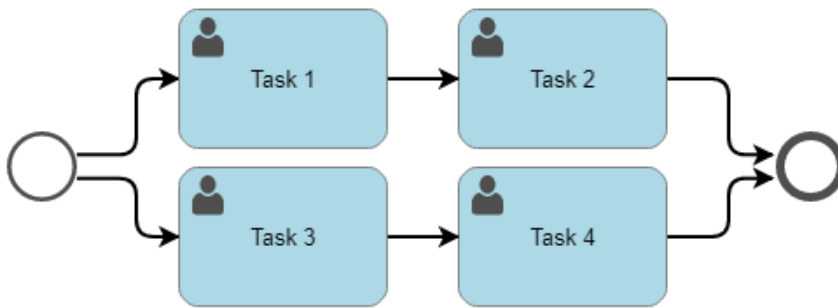
## Divergent Patterns

### Using Alternate Paths

Some workflows have decision points and alternate paths, and each path represents a different business case. For example, a specific path might depend on the value of a data object or on a participant's response to a prompt. Suppose you have the workflow shown in [Figure 10.2 on page 49](#). You can define a prompt for the Start node. Then, you can define conditional expressions for the outgoing sequence flows on the Start node that evaluate the participant's answer. Depending on the results, the running workflow might take the path to Task 1, the path to Task 3, or both paths. If it takes both paths, then Tasks 1 and 3 are executed in parallel.

If neither of the conditional expressions defined for the sequence flows on the Start node evaluate to True, the workflow process terminates.

Figure 10.2 Workflow with Alternate Paths

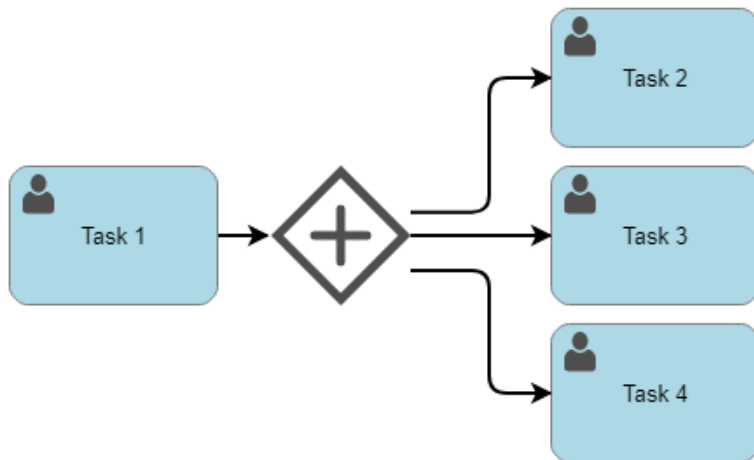


An alternative to simple alternate paths is an inclusive gateway. For more information, see [“Using Inclusive Gateways \(OR-split\)”](#) on page 50.

## Using Parallel Gateways (AND-split)

You can use a parallel gateway when the workflow needs to take multiple paths at the same time. You cannot associate conditions with the outgoing sequence flows from a parallel gateway. All of the outgoing paths are followed, and the subsequent activities run in parallel. In the workflow shown in [Figure 10.3](#), Tasks 2, 3, and 4 all run in parallel

Figure 10.3 Divergent Workflow with Parallel Gateway



For more information, see [“Add a Parallel Gateway”](#) on page 40.

## Using Exclusive Gateways (XOR)

With an exclusive gateway, only a single outgoing path is executed. The path that is chosen is based on the conditions that you specify for the outgoing sequence flows. The conditions are evaluated in the order in which you define them. Only the sequence flow for the first condition that evaluates to True is executed.

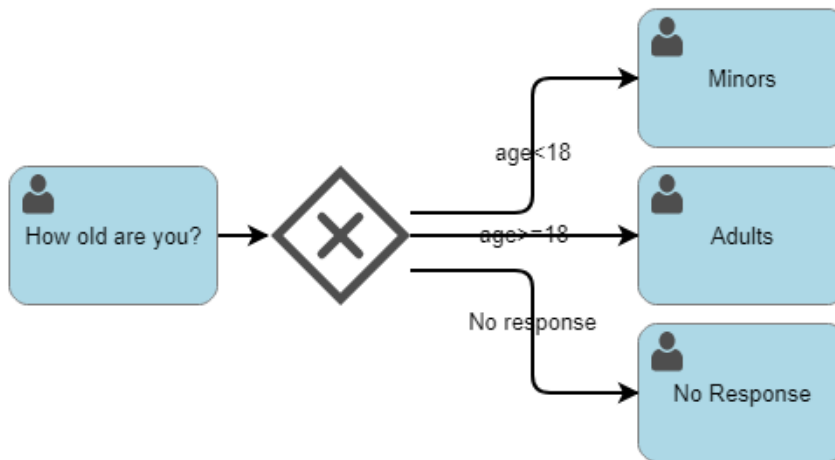
A sequence flow with no associated conditions becomes the default sequence flow. If the conditions on all of the other sequence flows evaluate to False, the default sequence flow is taken. When you specify the order in which the sequence flows are evaluated, the default sequence flow must be the last one in the list.

For example, suppose the workflow shown in [Figure 10.4](#) defines an optional prompt for the task Enter Order that prompts the participant to enter their age. The conditions that are defined for outgoing sequence flows on the gateway are as follows:

Condition	Endpoint
age<18	Minors
age>=18	Adults
	No Response

If the prompt is optional and the user chooses not to enter their age, the workflow sets the value to zero and takes the path to the No Response task.

**Figure 10.4** Divergent Workflow with Exclusive Gateway



For more information, see [“Add an Exclusive Gateway”](#) on page 40.

## Using Inclusive Gateways (OR-split)

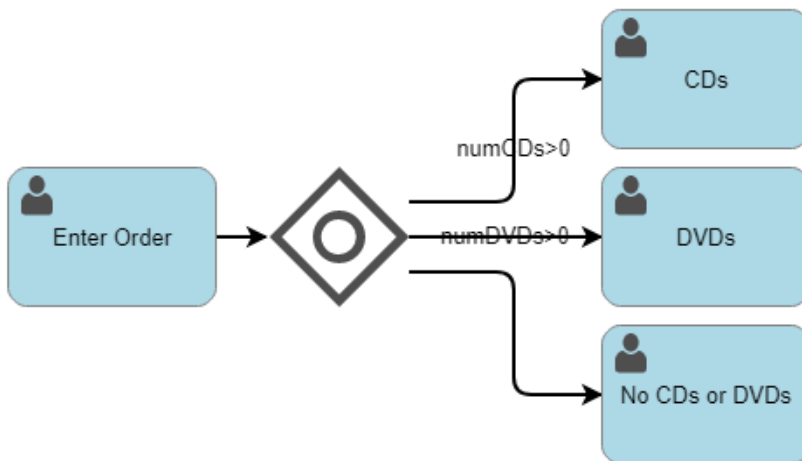
For an inclusive gateway, all of the sequence flows whose conditions evaluate to True are taken. A sequence flow with no associated conditions always evaluates to True, and that path is always taken. (A sequence flow with no associated condition is an *unconditional* sequence flow.)

For example, suppose Task 1 in [Figure 10.5 on page 51](#) requires that the participant enter a customer’s order information. The customer could order CDs and DVDs, which require special handling. The following conditions are defined for outgoing sequence flows on the gateway:

Condition	Endpoint
numCDs>0	CDs
numDVDs>0	DVDs
	No CDs or DVDs

If a customer orders CDs, the CDs task starts. If the customer orders DVDs, the DVDs task starts. If the customer orders both CDs and DVDs, then both of those tasks start. If the customer’s order does not contain any CDs or DVDs, then only the default task (No CDs or DVDs) starts.

Figure 10.5 Divergent Workflow with Inclusive Gateway



When you configure the gateway, you specify the order in which the sequence flows are evaluated. You can also designate a default sequence flow. The default sequence flow is taken only if all of the other paths evaluate to False. If any of the sequence flows are unconditional, you can designate one of the unconditional sequence flows only as the default flow. If all of the sequence flows have conditions, then you can designate any of the sequence flows as the default flow.

For example, suppose you have an inclusive gateway that diverges to three tasks. Only one of the outgoing sequence flows has a condition, and the first of the unconditional sequence flows is designated as the default flow. The last sequence flow in the list is unconditional. The table for this gateway is shown in [Table 10.2 on page 51](#).

If the condition on the first sequence flow evaluates to False, this workflow takes only the path to Task 3.

Table 10.2 Inclusive Gateway Conditions That Execute Only Task 3

Condition	Endpoint	Default	Path Is Taken
Evaluates to False	Task 1	No	No
No condition (always True)	Task 2	Yes	No
No condition (always True)	Task 3	No	Yes

For more information, see [“Add an Exclusive Gateway” on page 40](#).

## Convergent Patterns

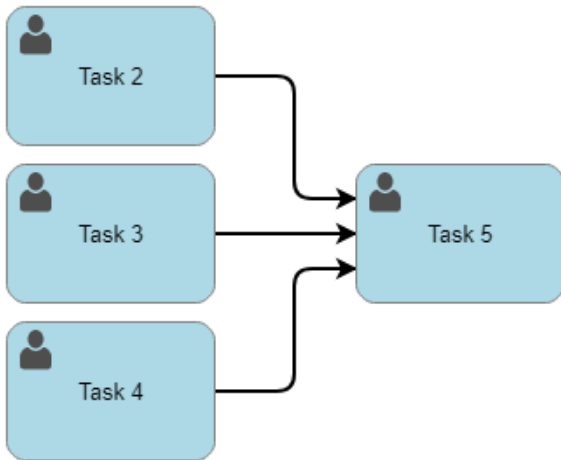
### Merging Alternate Paths (Simple Merge)

It is possible to merge workflow paths by doing a simple merge in which multiple outgoing paths merge at the same element. Simple merges do not use a gateway.

Simple merges are most appropriate when the paths are mutually exclusive. Suppose you have the workflow shown in [Figure 10.6 on page 52](#). If the paths are mutually exclusive, the workflow takes only one of the incoming paths to Task 5, and only one instance of Task 5 is created. If the paths are not mutually exclusive and

the workflow takes more than one of the incoming paths, a new instance of Task 5 is created for each path taken.

*Figure 10.6 Merging Paths without a Gateway*



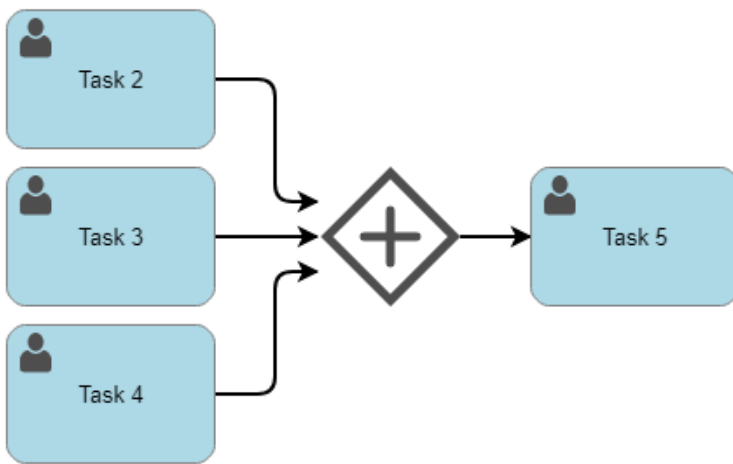
**TIP** To run multiple occurrences of the same task, you can specify that a new instance of the task is created for each participant. See [“Enabling Multiple Participants to Complete a Task”](#) on page 19 for more information.

**Note:** A special situation exists if the paths converge at a Terminate End element. See [“Explicit Termination”](#) on page 54 for more information.

## Merging with Parallel Gateways (Join)

When you merge paths by using a parallel gateway, the gateway waits for all of the incoming tasks to complete before it allows the workflow process to continue executing. (The Workflow Service knows which tasks are active and when they complete.) In [Figure 10.7](#) on page 52, the gateway waits for Tasks 2, 3, and 4 to complete before allowing Task 5 to start.

*Figure 10.7 Convergent Workflow with a Parallel Gateway*

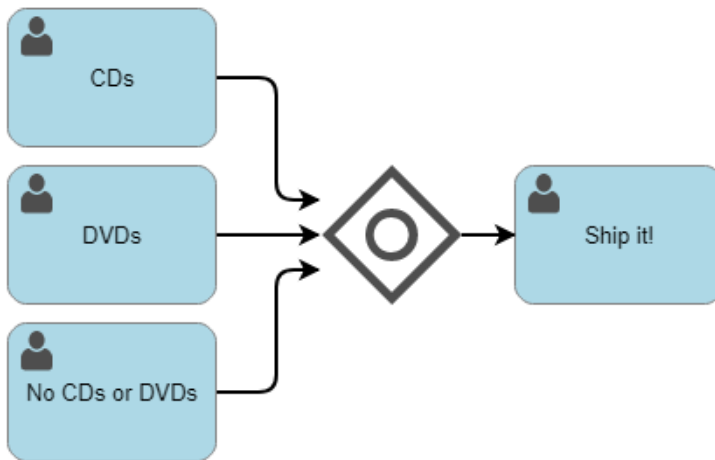


For more information, see [“Add a Parallel Gateway”](#) on page 40.

## Merging with Inclusive Gateways (Inclusive Merge)

An inclusive gateway waits for all of the active tasks to complete. (The Workflow Service knows which tasks are active and when they complete.) For example, in [Figure 10.8 on page 53](#) if only the paths from the CDs and DVDs tasks to the gateway are taken, the gateway triggers the Ship it! task when the CDs and DVDs tasks are complete. The workflow does not wait for the No CDs or DVDs task to run.

**Figure 10.8** Convergent Workflow with an Inclusive Gateway



For more information, see [“Add an Inclusive Gateway” on page 40](#).

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## Multiple Instance Pattern

When you assign multiple participants to a user task, you can specify that a separate instance of the task is created for each participant. This pattern is referred to as Multiple Instances with a priori Design-Time Knowledge. For more information, see [“Enabling Multiple Participants to Complete a Task” on page 19](#).

**Note:** A simple merge as described in [“Merging Alternate Paths \(Simple Merge\)” on page 51](#) can create multiple instances of a task if the incoming paths are not mutually exclusive.

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## Termination Patterns

Termination patterns are workflow patterns in which the workflow completes normally.

### Implicit Termination

The Workflow Service ends processes and subprocesses when all of their activities complete regardless of whether they encounter an End or Terminate End element. For example, suppose you have the workflow shown in [Figure 10.2 on page 49](#). If neither of the conditional expressions defined for the sequence flows on the Start node evaluate to True, the Workflow Service terminates the process.

However, the recommended practice is to explicitly end the paths in your workflow by adding either an End or Terminate End element to each process and subprocess.

## Explicit Termination

To explicitly end workflow paths, add an End element to each path in the workflow. An End element terminates the path to which it is added, but it does not affect any other paths in workflow.

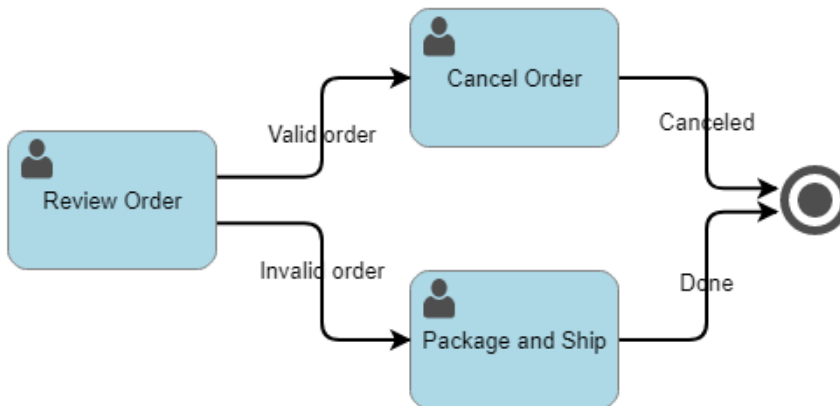
To explicitly terminate an entire process or subprocess, add a Terminate End element.

**Important:** If multiple paths merge into a Terminate End element and the paths are mutually exclusive, a single Terminate End event is triggered. If the paths are not mutually exclusive, a race condition is created. All active paths in the workflow are terminated when the first path reaches the end. The recommended practice is to use an End element. See [“Implicit Termination” on page 53](#).

If you use a Terminate End element, you should either add mutually exclusive conditions to the paths leading to the Terminate End element or merge the paths by using a gateway.

For example, the paths that merge into the Terminate End event in the workflow shown in [Figure 10.9](#) are mutually exclusive.

**Figure 10.9** *Explicit Termination with Mutually Exclusive Paths*




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## Cancellation Patterns

Cancellation patterns are workflow patterns in which the workflow did not complete normally.

### Canceling Activities

You can use a boundary timer or a boundary message to cancel the activity with which the timer or message is associated.

For more information, see [“About Timers” on page 33](#) and [“About Messages” on page 37](#).

### Canceling a Workflow (Cancel Case)

Only workflow administrators can cancel a running instance of a workflow. For more information, see [SAS Workflow Manager: Administrator's Guide](#).

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## Additional Information about Workflow Patterns

For more information about workflow patterns, see the [www.workflowpatterns.com](http://www.workflowpatterns.com) website. The following documents are of particular interest:

- N. Russell, A.H.M. ter Hofstede, W.M.P. van der Aalst, and N. Mulyar. [Workflow Control-Flow Patterns: A Revised View](#). (PDF, 1.04Mb) BPM Center Report BPM-06-22, BPMcenter.org, 2006.
- W.M.P van der Aalst, A.H.M. ter Hofstede, B. Kiepuszewski, and A.P. Barros. [Workflow Patterns](#). (PDF, 718 Kb). Distributed and Parallel Databases, 14(3):5-51, July 2003.

