

Ansys GRANTA MI 2021 R1

MI:Workflow Designer Guide

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1 About this document

This document describes how to design and implement GRANTA MI workflows using the MI:Workflow Designer.

For information about installing MI:Workflow server and the Workflow Designer client application, see the *GRANTA MI Installation Guide*.

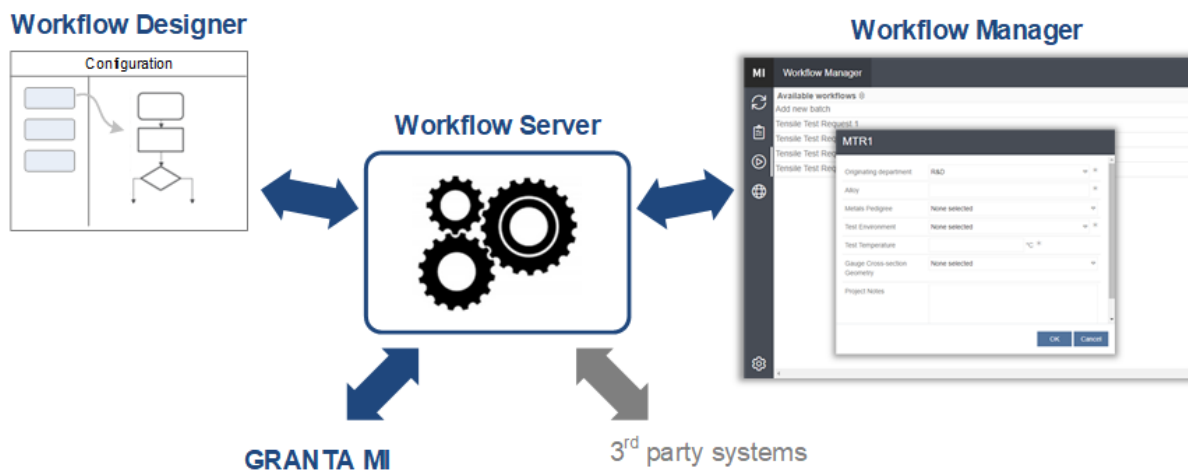
For information on configuration options and troubleshooting system setup, see the *MI:Workflow Configuration Guide*.

2 Introduction to MI:Workflow

MI:Workflow enables users to implement to-do lists, email notifications, approval sequences, moderation queues, and other actions restricted to specified users. It offers a clear user experience for those who consume or contribute to a materials database – they only perform actions relevant to them. Underpinning the system is the MI:Workflow server which ensures workflow rules are adhered to, including a Forms Engine for creating tailored user experiences.

A typical application is processing material test requests, allowing engineers to request test programs, lab managers to schedule and prioritize tasks, and a management chain to sign-off and release the resulting design data to a wider community. Users can see the workflows they are allowed to initiate, review, and approve, depending on their role, and they receive email notifications to take action or to confirm success. Another typical application could allow users to enter comments or 'lessons learnt' about a material, with a simple drag-and-drop of files and images, which can be moderated before being published.

MI:Workflow comprises the Workflow Designer, Workflow Server, and the Workflow Manager:



Workflow Designer is a visual designer for creating and configuring workflow definitions for GRANTA MI. No programming knowledge is necessary to use the MI:Workflow Designer: you only need to know the workflow goal in order to set it up with the provided activity “building blocks”. Workflow definitions created in the Designer are stored in workflow files (.WFX) that completely describe the workflow and its activities.

Workflow Server manages and monitors the state of activities in a workflow, and determines when to transition activities in running workflows. It communicates with GRANTA MI via the Service Layer.

Workflow Manager is a web application for viewing task lists, starting workflows and carrying out workflow tasks. It includes built-in forms that enable users to carry out workflow steps, such as assigning a test to a lab, or approving a request. Workflow Manager is integrated within the GRANTA MI web application (“One MI”).

What does my license entitle me to use?

GRANTA MI:Workflow is licensed in several editions. The edition you have licensed will define:

- The number of workflows you are entitled to deploy.
- The complexity of workflow you are entitled to create, measured by the number of activities in a workflow, and the ability to run Python as part of a workflow.

3 What is a workflow?

A workflow represents a business process in your organization, where tasks or actions must be performed in a specific order, and according to a set of procedural rules. A typical workflow might include creating a request for a new material test project which needs to go through a series of assessments by different teams before it receives final approval (or is rejected).

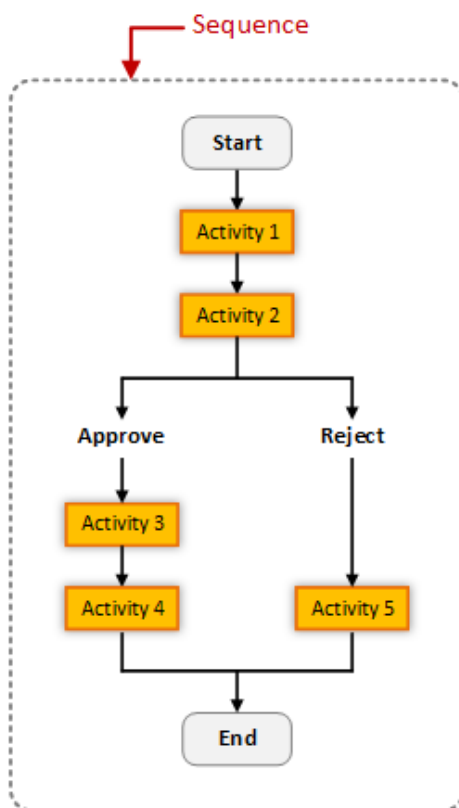
Activities are the fundamental building blocks of MI:Workflow. Each action in the workflow is modeled as an activity. MI:Workflow Designer provides three out-of-the box activities — *Start Workflow: Create Record*, *Start Workflow: Update Record*, and *Progress Workflow: Update Record* — and these are covered in detail in Section 9.

Different models of workflow may be defined in MI:Workflow Designer.

Sequence model

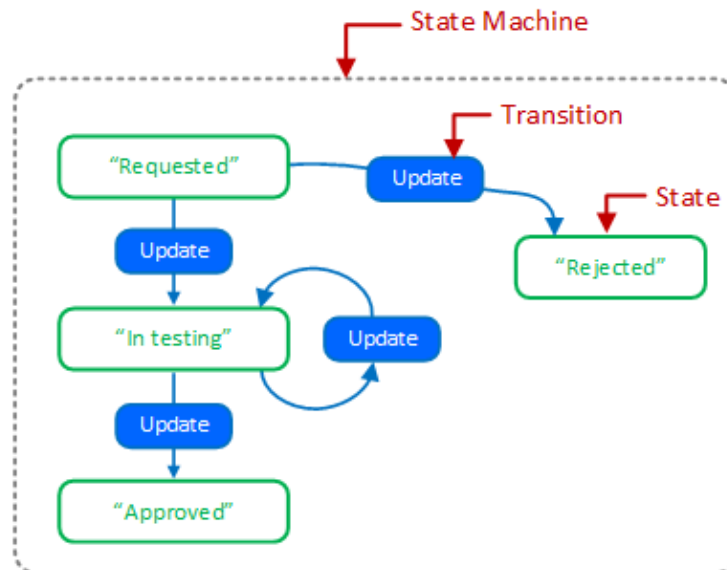
A Sequence workflow provides a structured series of steps in which one activity leads to another, in order, until end of the workflow is reached. No loops are permitted.

The execution path is predictable. It might wait for some event (a request to be approved, for example), but progress will always continue forwards to the next step.



State Machine model

A state machine workflow defines a set of states and transitions between them. The workflow begins in an initial state and ends when it reaches a final state. Transitions between the states define the behavior. The occurrence of an event causes the workflow to transition to another state. Unlike sequential workflows, State Machine workflows typically involve branching and looping.



To create a state machine workflow, **states** are added to a StateMachine activity, and **transitions** are used to control the flow between states. The workflow stays on a state until an event triggers a transition to another state, for example, when an order request is made, or a reviewer approves or rejects an item in the workflow. A state machine workflow must have one and only one initial state, and must have at least one final state.

Which model should I use?

State Machine workflows are good for processes that have multiple possible paths, for example, when a material request can follow different branches depending on whether the request is for a structural material or an aesthetic material, or where there are a lot of human interactions within the process.

Sequence workflows work well where the process is linear, and where the possible paths through contain little or no looping or conditional execution.

A single workflow can contain elements of different workflow models, so, for example, a state machine workflow could include sequence steps.

4 Workflow definitions

A GRANTA MI workflow definition comprises several different elements:

- Workflow **metadata**, which specifies information about the workflow itself, such as its name, the name of the database and table in which it will operate, and who is authorized to review the workflow status.
- One or more **activities** that describe the steps of the workflow. Each workflow must contain at least one activity; each activity can contain sub activities, transitions, triggers, and inputs.
- Optionally, **external files** associated with activities in the workflow, for example, a Python script used in a *RunPython* activity (available in MI:Workflow Advanced edition or higher).

Workflow definitions created in Workflow Designer are stored on disk in Workflow definition (.WFX) files that include:

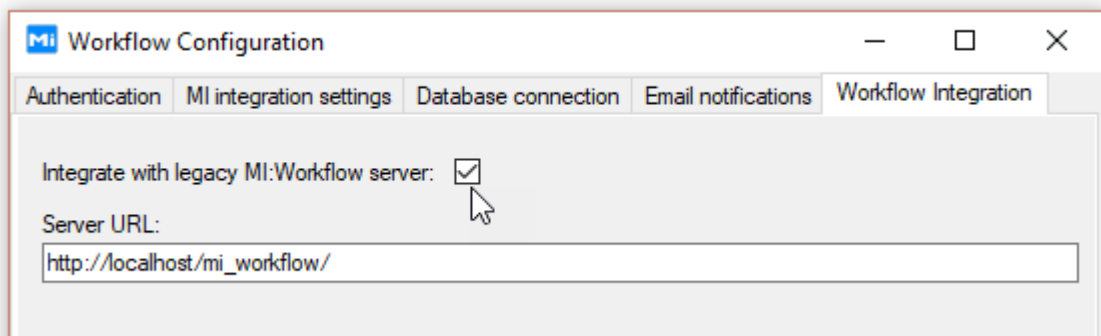
- The Workflow metadata file, *metaData.json*.
- The Workflow markup (.XAMLX) file that defines all the activities, transitions, triggers, and inputs in the workflow.
- Where additional files are associated with the workflow, for example, Python scripts, these will also be included in the .WFX file.

5 Using multiple versions of MI:Workflow

MI:Workflow 2021 R1 is installed without overwriting any existing Workflow v1 installation. This ensures that any critical business processes which depend on workflows created in older versions of MI:Workflow will not be affected, and allows a managed transition from a running v1 environment to version 2021 R1.

The two versions of MI:Workflow can be run in parallel as long as necessary:

- You can continue using your v1 workflows on your v1 server. You can edit v1 workflows using the v1 Workflow Designer, and publish them to the v1 server.
- You can turn on Workflow v1 integration in the MI:Workflow Configuration tool to allow existing v1 workflow definitions to be progressed in the MI:Workflow 2021 R1 server, alongside 2021 R1 workflows:



To take advantage of all the new features available in the latest version of MI:Workflow, we recommend that you upgrade your v1 workflows to the current version when practicable. To do this:

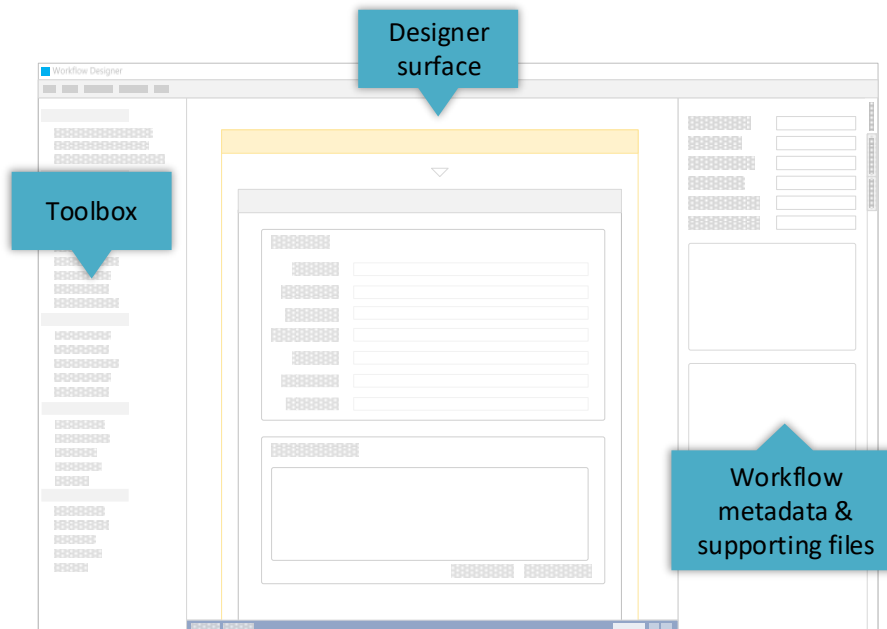
1. Upgrade your v1 workflow definitions in the Workflow Designer: **Workflow > Upgrade**.
2. Validate them, and then publish them on your 2021 R1 Workflow server.

Note that:

- XAMLX workflow definitions created in MI:Workflow versions 1 – 1.3 can be opened in the MI:Workflow 2021 R1 Designer, but only for viewing; they cannot be validated or published.
- WFX workflow definitions created in the MI:Workflow 2021 R1 Designer cannot be opened with older versions of the Workflow Designer.

6 Using the Workflow Designer

The Workflow Designer is organized into three major UI areas:



6.1 Designer surface

The **designer surface**, positioned at the center of the screen, is used to compose the workflow. You drag activities and control flow items onto the surface, and arrange and configure them here.

You can use the toolbar at the bottom of the designer surface to zoom in or out of your workflow, fit the contents of your workflow to the size of your screen, and show or hide the overview map, which displays a small version of the entire activity. You can also zoom in or out of a workflow using the keyboard shortcuts CTRL++ and CTRL+-

6.2 Toolbox

The **toolbox**, on the left of the window, contains the available Granta activities and control flow libraries. You drag items onto the designer surface from the toolbox.

6.3 Workflow metadata and supporting files

On the right of the window are three tabs:

- *Metadata* tab, where you set workflow metadata properties
- *Supporting Files* tab, where you can attach any additional files used in the workflow, such as scripts.

- *Properties* tab, where you can see properties for the item selected in the Designer surface.

6.4 *Toolbar*

- **File** menu: create, open, and save workflow definitions; log into and log out of the Designer.
- **Edit** menu: cut, copy, and paste text in the Designer.
- **Workflow** menu: download, validate, publish, deprecate, delete, and upgrade workflow definitions. You need to be logged in (**File > Log in**) in order to download, validate, publish, deprecate, or delete workflow definitions.
- **Settings** menu: view or change the credentials used to publish workflows to the Workflow server.
- **Help** menu: open the Workflow Designer log file, located in your user profile AppData folder, for example:

%LOCALAPPDATA%\Granta Design\MI\logs\MIWorkflowDesigner.log

7 Managing workflow definitions

7.1 Creating, opening, and saving workflow definitions

Use the **File** menu to create a new workflow definition, to save workflow definitions to disk, and to open existing workflow definitions from disk.

7.2 Validating a workflow

To check for some common errors and configuration issues before publishing a workflow definition, you can validate it: on the **Workflow** menu, click **Validate**.

Validation examines the workflow definition to identify issues that might cause the workflow to fail, and to help you to follow best practices for workflow design. The results are displayed in a report which you can copy to the clipboard and use to help you to resolve any issues found. The Validation Report identifies:

- Errors: critical errors that will prevent the workflow from executing.
- Warnings: potential problems that might compromise the workflow's ability to execute

Be aware that a valid workflow is not necessarily error-free. Workflow validation can only check that a workflow definition is well-formed and meets certain logic checks, and it cannot test whether a workflow does what you want it to.

7.3 Publishing a workflow

On the **Workflow** menu, click **Publish** to upload a workflow definition from the Designer to your Workflow server and make the new workflow available to all users.

The existing workflow definitions that have already been published on the server are listed below the ID field. You must be logged in to the Designer for the Publish option to be available (when logged in, your username is displayed in the top right corner of the window).

The workflow definition ID is used to uniquely identify it on the server. The name must not already be used; you can see all the existing workflow definitions on the server listed under *Existing workflow definitions*. The name must follow standard filename conventions, that is, it may not include any of these characters:

- < (less than)
- > (greater than)
- :
- " (double quote)
- / (forward slash)
- \ (backslash)
- | (vertical bar or pipe)

- ? (question mark)
- * (asterisk)
- % (percent)
- & (ampersand)

Note: An "Unable to get workflow list from server" error on selecting the Workflow > Publish... menu item may indicate a problem accessing the Workflow configuration database on your SQL Server instance; the account used to authenticate MI:Workflow requires db_owner role on the MI:Workflow configuration database; see MI:Workflow Configuration Guide for further information.

7.4 *Modifying published workflow definitions*

Published workflow definitions cannot be modified. This ensures that any existing workflow instances based on a published workflow definition are able to run to completion.

If you want to make a change to a published workflow definition, you need to:

1. Download it from the server and make the required changes in Workflow Designer.
2. Publish it as a new workflow definition.
3. Deprecate the original workflow definition to ensure that no new instances can be created; if there are no active instances of the original workflow, you can delete it.

7.5 *Downloading a workflow definition*

You can download the definition for a published workflow from the server and open it in the Designer: on the **Workflow** menu, click **Download**.

Note that, if you make any changes to a workflow definition you have downloaded, you will need to publish it as a new workflow, as it isn't possible to modify published workflow definitions.

7.6 *Deprecating a published workflow definition*

Published workflow definitions may be deprecated:

- Any active instances of a deprecated workflow will continue to run until finished.
- No new workflow instances can be created from deprecated workflow definitions; they will not appear on the START WORKFLOWS tab in MI:Workflow Manager UI.
- Deprecated workflow definitions that have no active instances can be deleted.

To deprecate a published workflow definition, on the **Workflow** menu, click **Deprecate**, select the workflow, and then click **Update**.

Deprecated workflow definitions can also be un-deprecated in the Deprecate Workflows dialog box by clearing the checkbox and clicking **Update**.

7.7 Deleting published workflow definitions

On the **Workflow** menu, click **Delete**, to delete published workflow definitions from the Workflow server. You can only delete workflow definitions that have no active instances.

All published workflow definitions are listed, and, for each one, you can see how many active instances there are and whether or not it has been deprecated. You will not be able to select/delete any definitions with active instances (where *Instance Count* is not 0).

7.8 Upgrading workflow definitions

Workflow definitions created in older versions of MI:Workflow (MI:Workflow versions 1 – 1.3) can be upgraded: on the **Workflow** menu, click **Upgrade** and then select the workflow definition .XAMLX file.

The upgraded workflow definition will be saved as a .WFX file in the location you specify, and you can then open it in Workflow Designer and edit, validate, and publish it in the usual way.

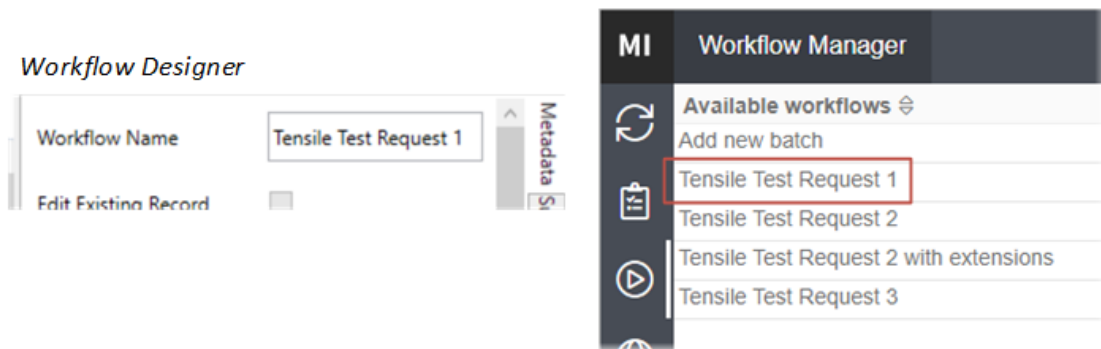
See also Section [5, Using multiple versions of MI:Workflow](#).

8 Workflow properties

All workflows have a set of properties which are set on the **Metadata** tab in Workflow Designer.

8.1 Workflow Name

Specifies the name of the workflow as presented in the Start Workflow page in Workflow Manager. For example:



8.2 Edit existing record

This option is automatically selected when the workflow includes a Granta Activity that modifies an existing record.

8.3 Database Key

Specifies the database key (dbkey) of the database where the workflow will create or modify records. If you are logged in to the Designer and therefore connected to the Workflow server, you can just select from the list of currently-available databases.

8.4 Table Name

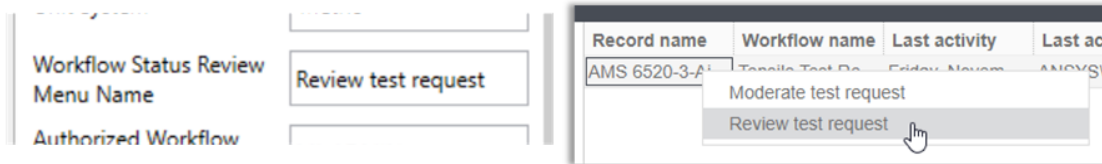
Specifies the name of the table where the workflow will create or modify records. You can select from the list of available tables in the database specified in the **Database Key** field.

8.5 Unit System

Specifies the unit system that will be used to display values for this workflow in the Workflow Manager user interface. You can select from the list of available Unit Systems in the database specified in the **Database Key** field.

8.6 Workflow Status Review Menu Name

Specifies the text for the right-click menu option that opens the workflow status review form on the My items view in Workflow Manager, for example *Review* or *Review Status*:



8.7 Authorized Workflow Status Reviewers

Identifies the roles permitted to review the status of workflow items in Workflow Manager. The names are specified as a comma-separated list, for example:

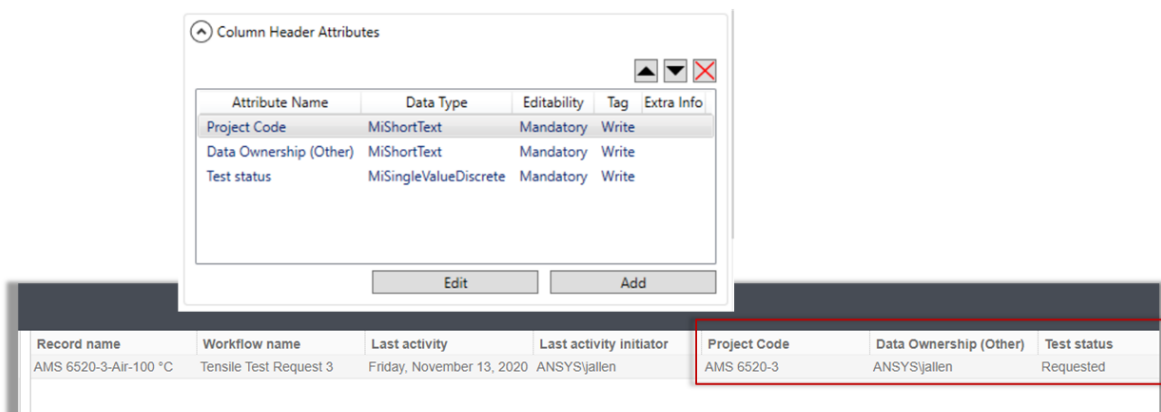
ACMEDESIGN\MATERIALS_REVIEWERS, ACMEDESIGN\MI_ADMIN

Authorized workflow status reviewers can right-click an item on the My items view and see a form containing information about it: the information on this review form is specified in [Workflow Status Review Attributes](#).

The data shown in a review status form is subject to MI access control: users will not see data that they do not have access to.

8.8 Column Header Attributes

The Column Header Attributes section specifies the GRANTA MI attributes that appear as columns on the **My items** view in MI:Workflow Manager, for example:



The *Record name*, *Last activity*, and *Last activity initiator* columns show information about the workflow instance, and these columns are always included; the other columns that appear on this page are specified in the Column Header Attributes section of the workflow definition. The data shown in the columns is subject to MI access control: users will not see data that they do not have access to.

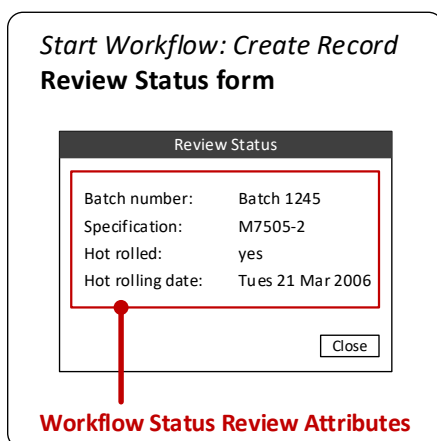
Property	Value
Attribute Name	An attribute in the table specified in the Table Name field.
Data Type	The correct data type is automatically set when you select an attribute.
Editability	One of: <ul style="list-style-type: none"> • Mandatory. The column will be shown by default the first time someone uses the Workflow system • Optional. The column will be hidden by default, but users can show it by right-clicking the column header, and this will be remembered by the user's browser. • Readonly. The column will be hidden • Hidden. The column will be hidden

Performance considerations

- The number of columns shown affects the performance and usability of the Workflow Manager application, so we recommend a maximum of 3 mandatory columns.
- The total number of columns available affects performance of the server and the Workflow Manager application, so we recommend that no more than 7 columns are defined in the Column Header Attributes.

8.9 Workflow Status Review Attributes

The *Workflow Status Review Attributes* section in the workflow definition specifies what data is shown in the Workflow Status Review form in Workflow Manager. For example:



Authorized users can access this form by right-clicking an item in the My Items or Dashboard views and selecting the review option on the shortcut menu. (The review menu label is set in the *Workflow Status Review Menu Name* field.)

9 Granta Activities

Activities are the fundamental building blocks of workflows. An activity represents a step in a workflow, defining actions that can be executed as part of the workflow, for example, to create a new record, or to control the flow of the activities in the Workflow.

MI:Workflow Designer includes three out-of-the box *Granta Activities* that can be used in workflows.

Start Workflow: Create Record

An activity which creates a new record in a specific database and table. This activity can be used to:

- Enable authorized users in Workflow Manager to start a new workflow and enter data in a 'Create record' form.
- Create the new record with the user-supplied data in GRANTA MI.
- Place the new record in a specified subset.
- Release the new record (in version-controlled tables)
- Send an email notification.

Progress Workflow: Update Record

An activity which modifies an existing record. This activity can be used to:

- Provide a form in the Workflow Manager where authorized users can review a record and/or perform actions that progress the record through a workflow, such as approving or rejecting a new material request.
- Modify the record data and/or properties in GRANTA MI.
- Move the record into a specified subset.
- Release the record (in version-controlled tables)
- Send an email notification.

Start Workflow: Update Record

An activity which modifies a record in a specific database and table. This activity can be used to:

- Enable authorized users in Workflow Manager to start a new workflow where they can select a record and modify its data via an 'Update record' form.
- Save the modified record in GRANTA MI.
- Move the record into a specified subset.
- Release the updated record (in version-controlled tables)
- Send an email notification

9.1 Configuring Granta activities

To use one of the Granta activities in a workflow, drag it onto the Designer surface and then configure it as required. Information about all of the available properties is given below.

Table 1. Granta Activity properties

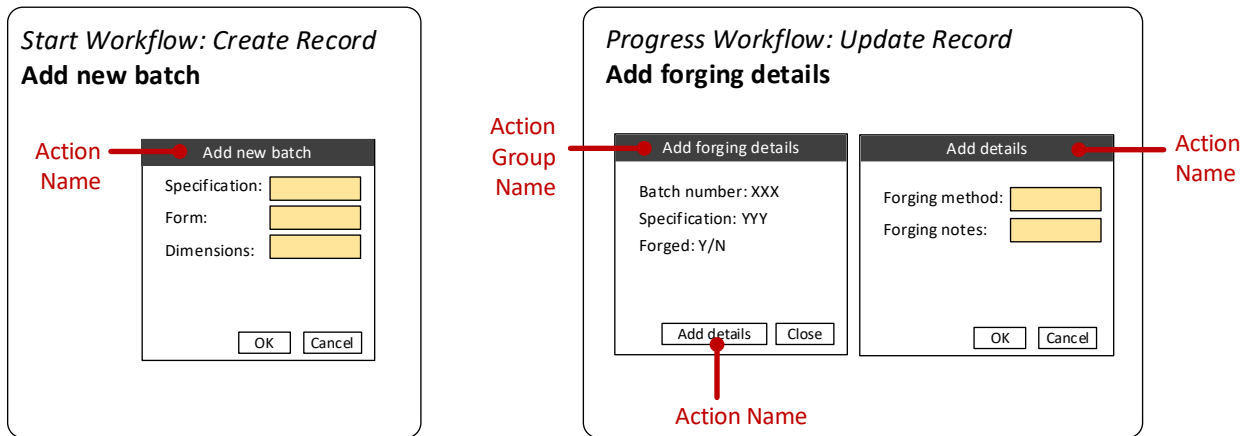
Property	Used in Start Workflow: Create Record	Used in Start Workflow: Update Record	Used in Progress Workflow: Update Record
Subset Name	✓		
Action Name	✓	✓	✓
Action Group Name	✓	✓	✓
Authorized Roles	✓	✓	✓
Record Reference	✓	✓	✓
Placement Path	✓		
Release After Creation	✓		
Release After Update		✓	✓
Summary Attributes			✓
Run Start Script¹	✓	✓	✓
Expected Attributes	✓	✓	✓
Auto Attributes Patterns	✓	✓	✓
Linked Auto Attributes Patterns	✓	✓	✓
Subset Changes	✓	✓	✓
Release Linked Records	✓	✓	✓
Run End Script²	✓	✓	✓
Send Email Notification	✓	✓	✓

¹ Available in MI:Workflow *Advanced Edition* or higher

² Available in MI:Workflow *Advanced Edition* or higher

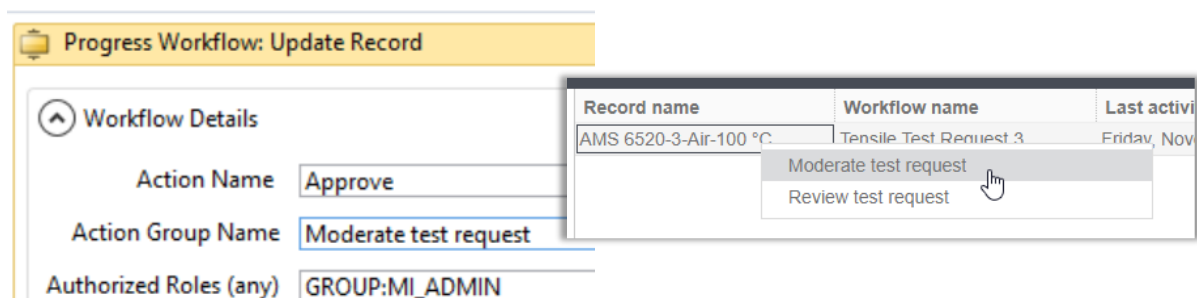
9.2 Action Name

Specifies the name of the workflow action. This appears at the top of the Action form in Workflow Manager and on the action button. For example:



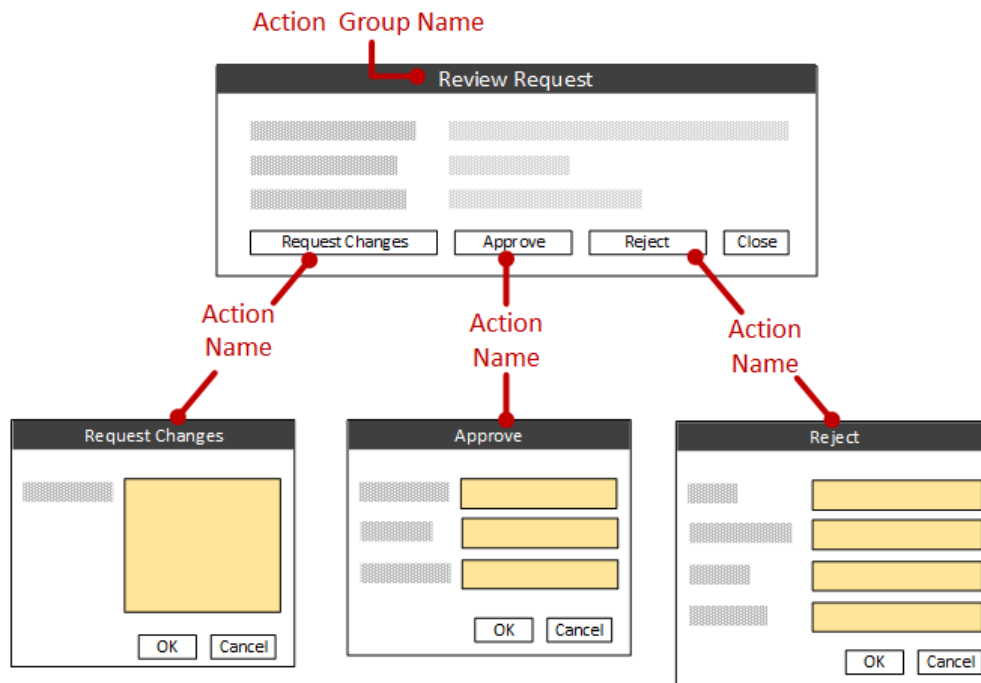
9.3 Action Group Name

In a *Progress Workflow: Update Record* activity, this specifies the text that appears on the right-click menu command for this action in Workflow Manager. For example:



The Action Group Name may be used to group multiple actions. When multiple update workflow activities have the same Action Group Name, they are grouped on the same form (started from the

context menu item). You can then have separate buttons open the form for each activity that has been given this Action Group Name. For example:



9.4 Authorized Roles

These two properties combine to specify the necessary roles/authorizations required to perform a workflow action (e.g. create a record, approve a request).

- **Authorized roles (any)** – The user must belong to one of these roles in order to perform this action.
- **Authorized roles (all)** – The user must belong to all of these roles in order to perform this action.

Note that, if specified, both conditions must be met before the user is able to see the workflow (i.e., they must belong to any of the (any) roles, and all of the (all) roles).

Roles may be specified using two different keywords, GROUP or ATTR; multiple values should be separated with a comma. For example:

Authorized Roles (any)

GROUP:<groupname>

A GRANTA MI system security group, for example, MI_WRITE, MI_ADMIN. The format will depend on the authentication method used.

- If you're using integrated Windows Basic authentication, or Mixed Mode authentication, then it will be DOMAIN\user.name or DOMAIN\groupname.
- If you're using a custom authenticator, then it will be whatever format it uses to identify users and groups.

ATTR:<attributename>

A short text attribute whose value is a username or a group name.

Note that the ATTR: type keyword cannot be used on start steps. This is because, in order to determine if a user can access a record via a security attribute set on the record, the record must already exist. Therefore ATTR: can be used in progress steps, which operate on existing records, but not in start steps, where the record has not been created at the point where the authorization checks are performed.

9.5 Record Reference

This field specifies a variable used internally by the workflow to reference the record being created or updated. In the sample workflows supplied with MI:Workflow, this variable is already defined and you don't need to do anything. If you need to define a record reference variable, see Appendix A.

9.6 Subset Name

In a *Start Workflow: Create Record* activity, this specifies the subset where the new record will be placed. Only one subset can be specified in this field. To add the new record to additional subsets, use the [Subset Changes](#) property.

9.7 Release After Creation

Availability: *Start Workflow: Create Record* activities in version-controlled tables

This option allows a new record created by the activity to be automatically released as part of the workflow (i.e. its version state will be changed to "Released").

To release a record, a user must have Power User privileges or higher.

9.8 Release after Update

Availability: *Start Workflow: Update Record* and *Progress Workflow: Update Record* activities in version-controlled tables

This option allows the record modified in the activity to be automatically released as part of the workflow (i.e. its version state will be changed to “Released”).

To release a record, a user must have Power User privileges or higher.

9.9 Release Linked Records

Availability: all Granta activities in version-controlled tables

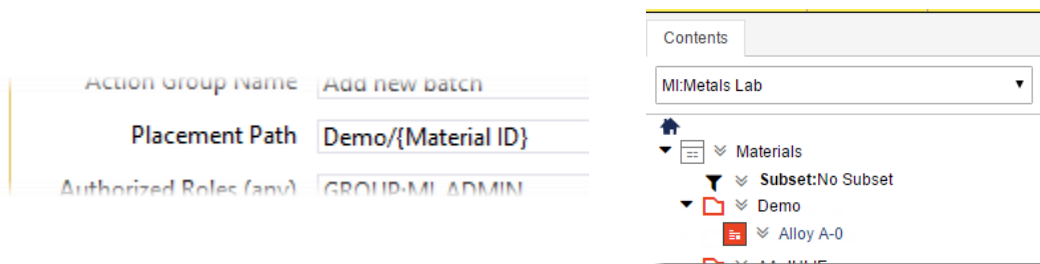
This option allows linked records to be automatically released as part of the workflow (i.e. their version state will be changed to “Released”).

To release a record, a user must have Power User privileges or higher.

9.10 Placement Path

In a *Start Workflow: Create Record* activity, this specifies the location in the Browse tree where a new record will be inserted, and the new record’s name. The placement path can contain plain text, as well as attribute and auto attribute names, specified using single curly braces { }.

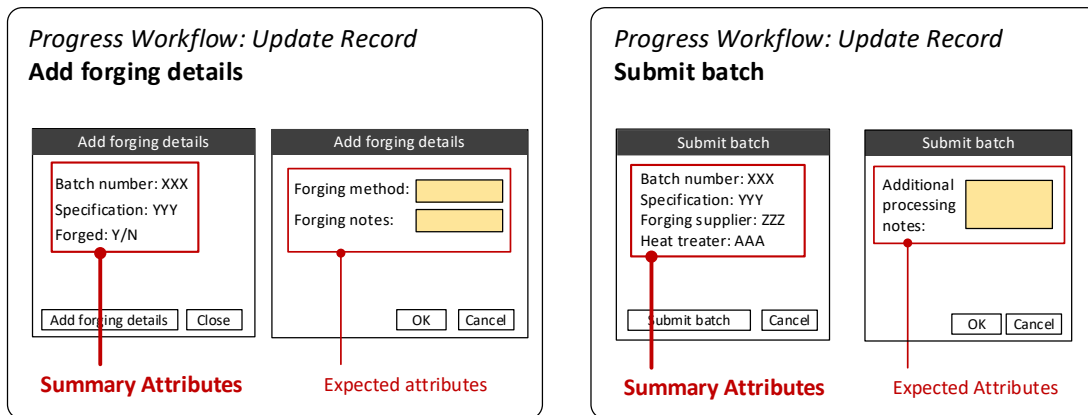
- The table name should not be specified.
- Folder names can be specified.
- The record name is always the final element of the path, for example:



You can use Auto-attributes to generate complex record names; see [Auto Attributes Patterns](#).

9.11 Summary Attributes

In a *Progress Workflow: Update Record* activity, this specifies the fields that appear on the update step review form, allowing users to review a summary of the data before going on to complete the update activity. For example:



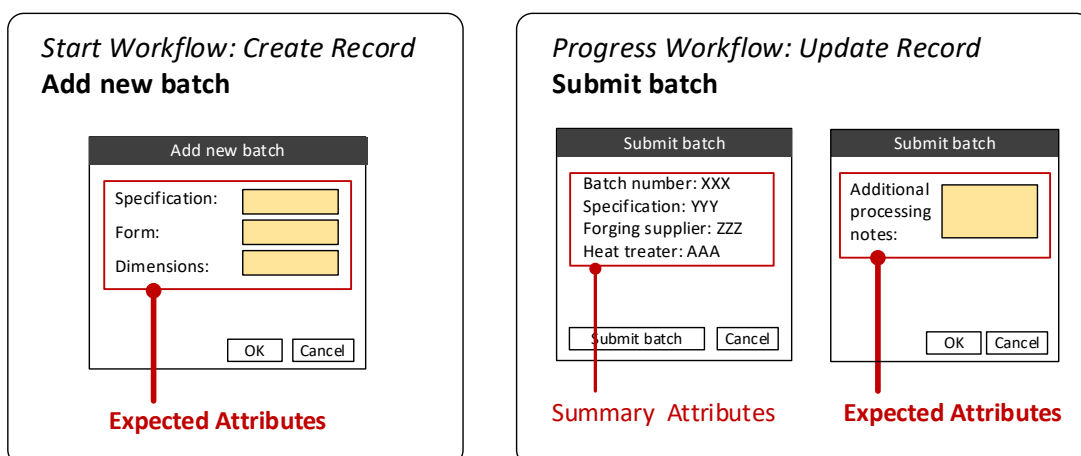
See [Specifying Attributes in the workflow definition](#) for further information.

9.12 Run Start Script

If you have licensed certain MI:Workflow Editions, you will see an option to Specify a Python script which is run at the start of the workflow. Augmenting a workflow with business logic in Python currently requires an engagement with Granta Services.

9.13 Expected Attributes

Specifies the fields that require, or can receive, user input on an action form in Workflow Manager. This may include attributes and record link groups, as well as some record selection controls.



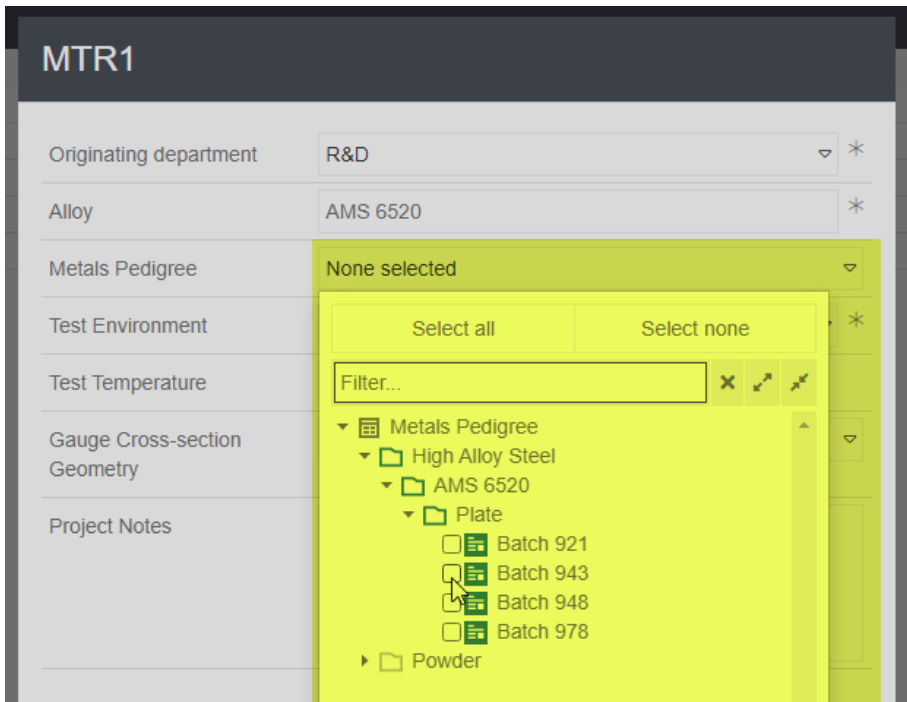
See [Specifying Attributes in the workflow definition](#) for further information.

9.13.1 Record selection: Tree data type

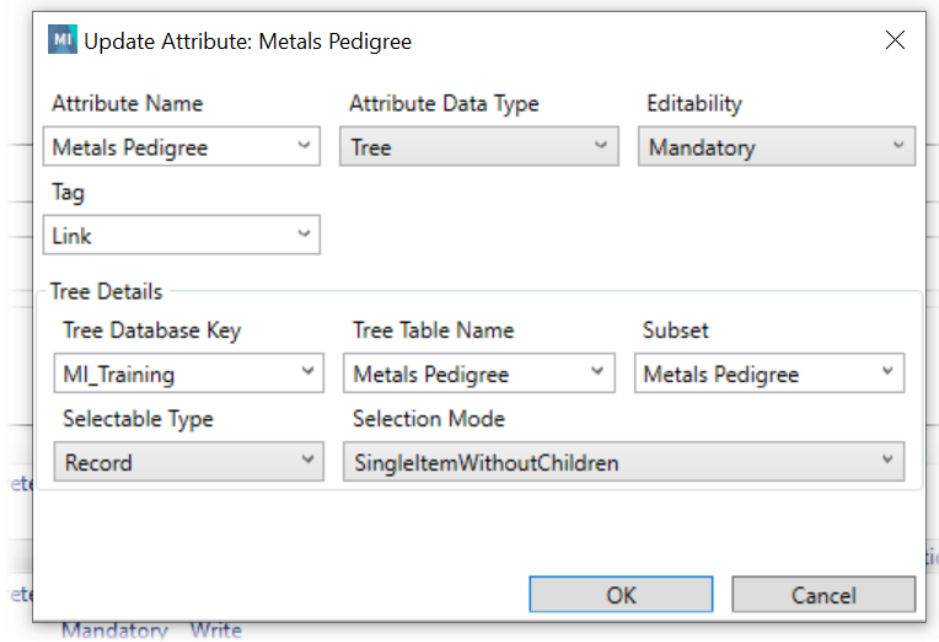
Expected Attributes can include an item that provides a tree-style record selection control in Workflow Manager. This allows users to select a record, for example, to choose which record to update in the activity, or to create a static link to an existing record in a record created in an activity.

Property name	Required value
Attribute Name	Any string, for example, <i>record</i>
Attribute Data Type	Tree
Tag	<p>ExistingRecord – the activity will operate on a single record selected in the tree (<i>Start workflow: Update record</i> activities only)</p> <p>Link – the activity will create a static link to the records selected in the tree (e.g. via a Record Link Group)</p>
Tree Database Key	The same database key specified in the activity Database Key field
Tree Table Name	The same table name specified in the activity Table Name field
Subset	If specified, applies a filter to the tree so that only records in the specified subset are shown.
Selectable Type	One of: Record, Folder, Generic, Table, Database
Selection Mode	<p>SingleItemWithoutChildren – a single existing record can be selected</p> <p>MultipleItemsWithoutChildren – multiple records can be selected e.g. link groups</p> <p>Multicascade – all of the descendants of the selected item will be selected as well.</p>

For example, this *Submit test request* form is used to create a new test record in the Tensile Test data table. The form includes a *Metals Pedigree* field where users can navigate through the Metals Pedigree table and select the relevant batch record:



The configuration for this control is:



The **Tree** data type is also used in *Start workflow: Update Record* activities to enable users to select a record to be updated. In this case, the attribute would be specified in Expected Attributes with the following properties:

Property name	Required value
Attribute Name	Any string, for example, <i>record</i>
Attribute Data Type	Tree
Tag	ExistingRecord
Tree Database Key	The database key specified in the activity Database Key field
Tree Table Name	The table specified in the activity Table Name field
Selection Mode	SingleItemWithoutChildren

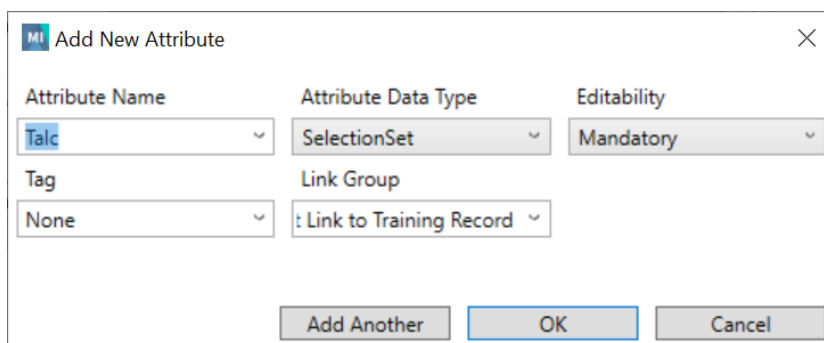
9.13.2 Record selection: SelectionSet

The Expected Attributes may include a **SelectionSet** item which is used to pass selected records from a Record Link Group into the workflow. This be used in Subset Changes or Linked Auto Attributes Patterns.

The **SelectionSet** item is specified with the following options in Expected Attributes:

Property name	Required value
Attribute Name	Any string
Attribute Data Type	SelectionSet
Tag	None SelectionSets should always have the Tag field set to None , as they are used to help with other activities (linked attributes and subset changes), and not to write data to MI.
Link Group	The Record Link Group

For example:



9.14 Auto Attributes Patterns

Auto Attributes Patterns can be used to assign values to existing GRANTA MI attributes programmatically, such as the current date or the value of another attribute.

Auto Attributes Patterns			
Attribute Name	Data Type	Pattern	Tag
Counter	MiInteger	{{Counter}}	Write
Project Code	MiShortText	{Alloy}-{Counter}	Write
Data Ownership (Other)	MiShortText	{{CurrentUser}}	Write
Test status	MiSingleValueDiscrete	Requested	Write

Auto Attributes Patterns have the following properties:

Property Name	Usage																
Attribute Name	The name of the attribute																
Data Type	The attribute data type, one of: Short Text, Long Text, Integer, single value Discrete, Logical, Date, Tabular																
Pattern	One of: <table border="1"> <tbody> <tr> <td>Plain text</td> <td>Stores this text in the attribute</td> </tr> <tr> <td>{attributename}</td> <td>Insert data from the specified attribute. For example {Alloy} will insert the value of the <i>Alloy</i> attribute.</td> </tr> <tr> <td>{{ShortRecordName}}</td> <td>The short record name.</td> </tr> <tr> <td>{{LongRecordName}}</td> <td>The long record name in the value.</td> </tr> <tr> <td>{{Timestamp}}</td> <td>Today's date</td> </tr> <tr> <td>{{utctimestamp}}</td> <td>Today's UTC-formatted date</td> </tr> <tr> <td>{{Counter}}</td> <td>An automatically incremented counter value; this is guaranteed to be unique for each record created. This can only be used on an Integer type and its name must map to an Integer attribute in MI. This will add 1 to the current maximum value.</td> </tr> <tr> <td>{{CurrentUser}}</td> <td>The current user's name. When Windows is used for authentication, this will be of the form DOMAIN\Username</td> </tr> </tbody> </table>	Plain text	Stores this text in the attribute	{attributename}	Insert data from the specified attribute. For example {Alloy} will insert the value of the <i>Alloy</i> attribute.	{{ShortRecordName}}	The short record name.	{{LongRecordName}}	The long record name in the value.	{{Timestamp}}	Today's date	{{utctimestamp}}	Today's UTC-formatted date	{{Counter}}	An automatically incremented counter value; this is guaranteed to be unique for each record created. This can only be used on an Integer type and its name must map to an Integer attribute in MI. This will add 1 to the current maximum value.	{{CurrentUser}}	The current user's name. When Windows is used for authentication, this will be of the form DOMAIN\Username
Plain text	Stores this text in the attribute																
{attributename}	Insert data from the specified attribute. For example {Alloy} will insert the value of the <i>Alloy</i> attribute.																
{{ShortRecordName}}	The short record name.																
{{LongRecordName}}	The long record name in the value.																
{{Timestamp}}	Today's date																
{{utctimestamp}}	Today's UTC-formatted date																
{{Counter}}	An automatically incremented counter value; this is guaranteed to be unique for each record created. This can only be used on an Integer type and its name must map to an Integer attribute in MI. This will add 1 to the current maximum value.																
{{CurrentUser}}	The current user's name. When Windows is used for authentication, this will be of the form DOMAIN\Username																

Note that attribute names are case-sensitive (e.g. {Length} and {length} are not the same), but the pattern names (e.g. {{ShortRecordName}}, {{LongRecordName}}) are not case-sensitive e.g. you could enter {{shortrecordname}}, {{ShortRecordName}} or {{Shortrecordname}}.

To add data to a Tabular Attribute, the Attribute name must be in the format:

```
TabularAttributeName{ColumnName}
```

The Data type should be the type of the Tabular Column you are assigning to; see Section 9.21, [Writing tabular data to records](#), for more information and examples.

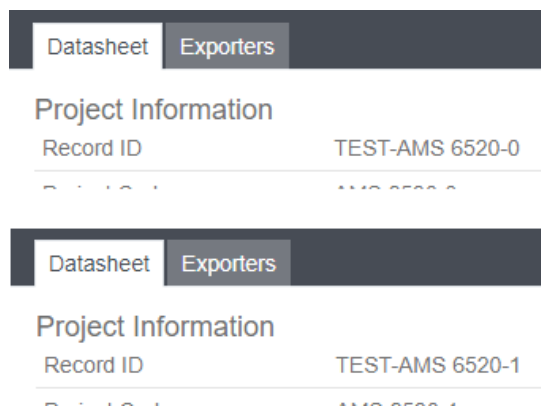
Auto attributes example

A Short Text Attribute *Record ID* is populated by concatenating text and data from other attributes using this pattern:

```
TEST-{Alloy}-{Counter}
```

where

- TEST- is a string
- **{Alloy}** inserts the value of the *Alloy* attribute
- - is a string (a hyphen)
- **{Counter}** inserts the value of the *Counter* attribute



Note that the Counter value must already have been set, i.e. the *Counter* attribute value needs to be defined before it can be used in another auto attribute.)

9.15 Run End Script

If you have licensed certain MI:Workflow Editions, you will see an option to Specify a Python script which is run at the end of the workflow. Augmenting a workflow with business logic in Python currently requires an engagement with Granta Services.

9.16 Send Email Notifications

Customized emails containing information about a step or task may be sent to any combination of domain users and groups, and to users, groups or email addresses specified in attributes. Note that Workflow email notification settings (SMTP server, port, and authentication options) must be configured in the Workflow Configuration tool for this to work (see the *MI:Workflow Configuration Guide*).

The following properties must be specified for Workflow email notifications:

Property Name	Usage
To	<p>Multiple recipients should be specified on separate lines as follows.</p> <ul style="list-style-type: none"> • EmailAddress:user@example.com • UserName:MYDOMAIN\username • GroupName:MI_WRITE • AttributeEmailAddress:attributeName • AttributeUserName:attributeName • AttributeGroupName:attributeName <p>where <i>attributeName</i> is the name of a GRANTA MI attribute which contains either an email address, username, or group name. Note that user and group mapping only works in case of Windows Authentication when email details are defined in Active Directory for these users.</p>
Subject, Message	<p>Defines the email subject line and message content. The following patterns can be defined email subjects/messages. Note that attribute names are case-sensitive (e.g. <i>{Length}</i> and <i>{length}</i> are not the same), but the pattern names (e.g. <i>{{ShortRecordName}}</i>, <i>{{LongRecordName}}</i>) are <u>not</u> case-sensitive e.g. you could enter <i>{{shortrecordname}}</i>, <i>{{ShortRecordName}}</i> or <i>{{Shortrecordname}}</i>.</p> <ul style="list-style-type: none"> • <i>{{longrecordname}}</i> is replaced with the record long name • <i>{{shortrecordname}}</i> is replaced with the record short name • <i>{{workflowurl}}</i> is replaced with a URL allowing the user to open the workflow for that particular record in Workflow Manager. • <i>{{viewerurl}}</i> is replaced by a URL allowing the user to open the record datasheet in MI:Viewer. • <i>{attributename}</i> is replaced with the value of the named short text or discrete text attribute.

The Workflow Manager and MI:Viewer application URLs are obtained from the GRANTA MI Settings Service, and so for this type of link to work:

1. The One MI application URL (for Workflow Manager links) and the MI:Viewer application URL must be specified in the Settings Service.
2. The Settings Service URL must be configured in the MI Workflow Configuration tool.

Message examples

A new material of type {material type} has been created (discrete attribute)

{Submitted by} has added a new comment that requires your moderation (short text attribute)

In this example, an email will be sent to everyone in the Metals team, plus the person who requested the test:

Send Email Notification

To:

GroupName: METALS_TEAM
AttributeUserName: Project Requested by

Subject:

New test project request

Message:

A new test project has been created with ID {ProjectID}
To view this workflow: {{workflowurl}}
To view the project record: {{viewerurl}}

Note that access control on the values of attributes will be applied when the email is created, and will be applied in the context of the user carrying out this step of the workflow, not the recipients of the email. Care should be taken to ensure that sensitive attributes are not used in notification emails, and that the recipient list is carefully controlled.

9.17 Linked Auto Attributes Patterns

Linked Auto Attributes Patterns can be used to programmatically assign values to GRANTA MI attributes in linked records, such as the current date or the value of another attribute.

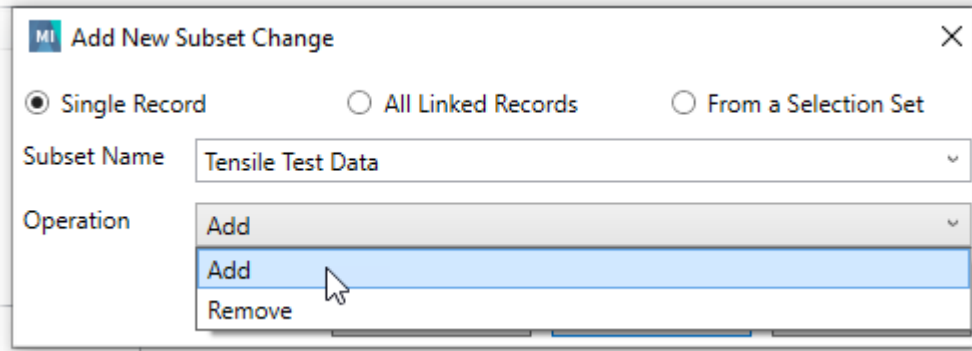
This can use a link group or a Selection Set. If you use a Selection Set, then you must have defined one in Expected attributes. This will change the records that have been selected by the user

The properties are the same as documented above for Auto Attribute Patterns.

9.18 Subset Changes

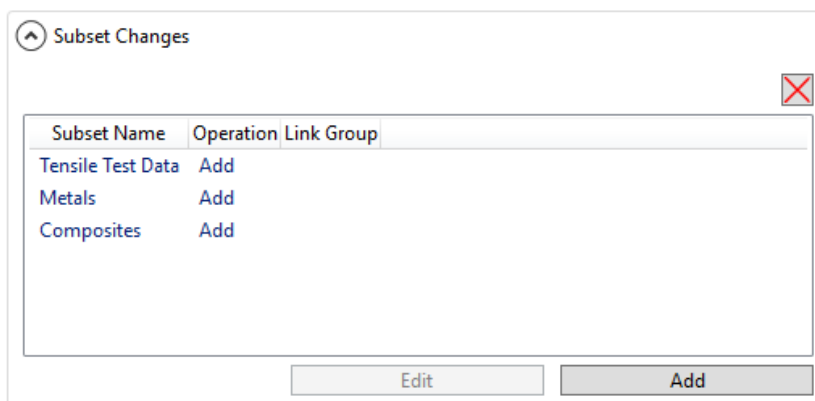
Used in all Granta workflow activities.

Allows one or more records to be moved into or out of subsets.



Option	Usage
Single record	Apply the change to the master record on which the workflow is operating.
All Linked Records	Apply the change to all records in the specified Record Link Group.
From a Selection Set	Apply the change to all records in the specified Selection Set.
Subset Name	The name of a subset
Operation	One of Add or Remove .

For example, in a *Start Workflow: Create Record* activity, Subset Changes can be used to add the new record to multiple subsets (since only one subset can be specified in the [Subset Name](#) field).



9.19 Specifying Attributes in the workflow definition

Attributes can be specified in a number of different places in a workflow definition:

- *Column Header Attributes* and *Workflow Status Review Attributes*
- *Expected Attributes, Auto Attributes Patterns, Linked Auto Attributes Patterns, Summary Attributes*

The following properties can be configured:

Property Name	Usage
Attribute Name	The name of the attribute
Data Type	<p>The data type of the Attribute. One of:</p> <ul style="list-style-type: none"> • MiShortText – Short Text Attribute • MiLongText – Long Text Attribute • MiInteger – Integer Attribute • MiSinglePoint – single value Point Attribute • MiSingleValueDiscrete – single value Discrete Attribute • MiFile – File Attribute • MiPicture – Picture Attribute • MiLogical – Equations and Logic Attribute • MiDate – Date Attribute • MiRange – Range Attribute • MiHyperlink – Hyperlink Attribute • Hyperlink – a link to a website or web application; see 9.20 • Tabular – data to be appended as a new tabular row; see 9.21 <p>In <i>Expected attributes</i>, some additional data types can be used:</p> <ul style="list-style-type: none"> • Tree can be used to provide a record selection control • SelectionSet can be used to pass selected records into the workflow.
Editability	<p>One of:</p> <ul style="list-style-type: none"> • Mandatory. The field must not be empty • Optional. The field may be empty • Readonly. The field cannot be edited • Hidden. The field will not appear on the form

Property Name	Usage
Tag	One of: <ul style="list-style-type: none"> • None. For data you don't want written to MI. e.g. values used to help create AutoAttributes, and SelectionSets. • Write. Use in all other cases except for the special cases below. • File. Use to provide a control that allows files and images to be dragged and dropped into the form. • Link. (<i>Tree</i> data type only) In a tree control, creates a static link to the specified record; see 9.13.1. • ExistingRecord. (<i>Tree</i> data type only) In a tree control, allows a record to be selected; see 9.13.1.
Extra Info	Used to display extra information (for example, about tabular columns written for a tabular row attribute)

9.20 Links to MI:Viewer datasheets via Hyperlink data type

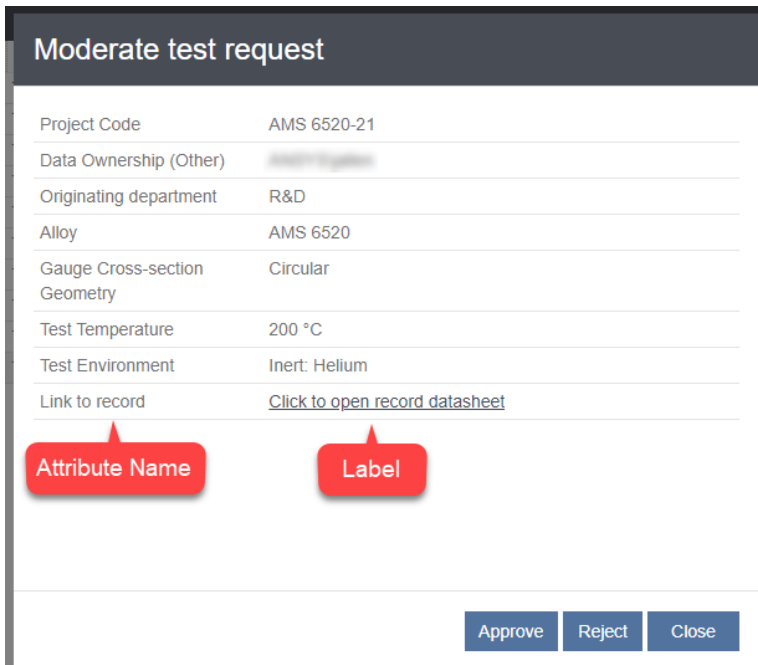
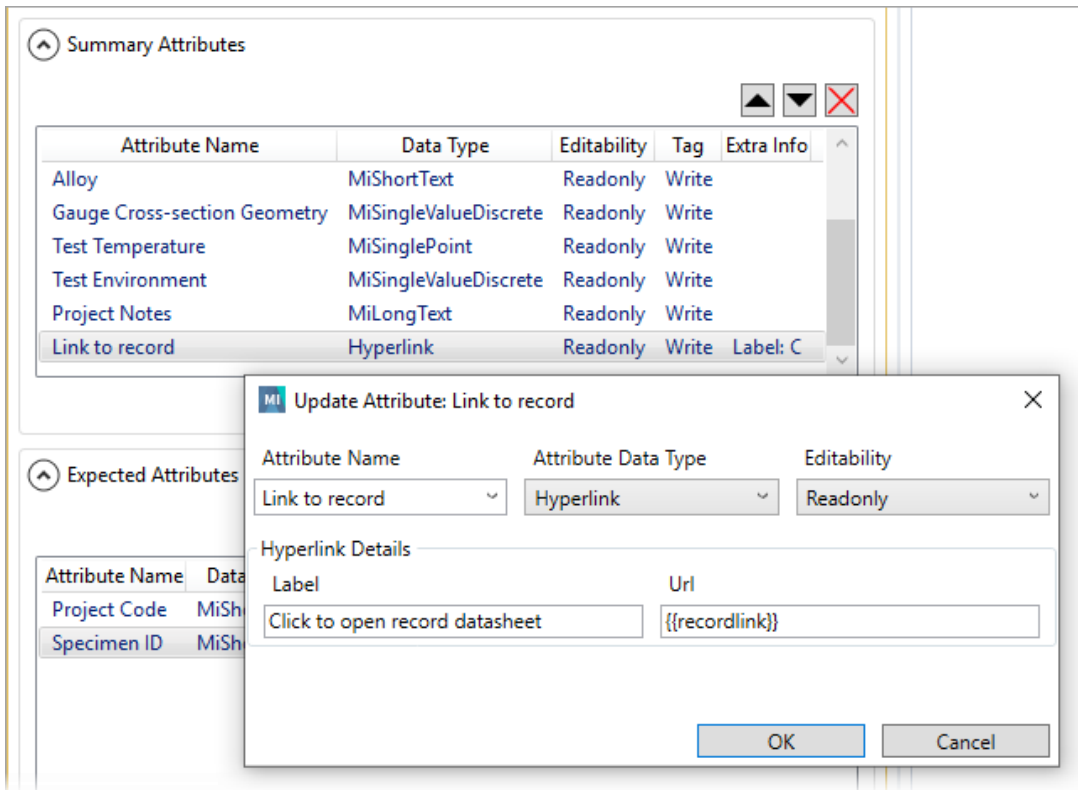
The *Hyperlink* data type can be used to provide a link to an MI:Viewer record datasheet, for example, in *Summary Attributes*; when clicked, the datasheet opens in the MI:Viewer application. Required properties for *Hyperlink* MI:Viewer datasheet links are:

Property Name	Required value
Attribute Name	The link label. For example, <i>Datasheet, Link to record</i> .
DataType	Hyperlink
Editability	Readonly
Label	The link text. For example, <i>Click to open datasheet, View datasheet</i>
Url	{{recordlink}}

The MI:Viewer application URL is obtained from the GRANTA MI Settings Service, and so for this type of link to work:

1. The MI:Viewer application URL must be specified in the Settings Service.
2. The Settings Service URL must be configured in the *MI integration settings* tab of the Workflow Configuration tool; see the *MI Workflow Configuration Guide* for more information.

Example configuration:



9.21 Writing tabular data to records

Tabular attributes can be included on Workflow forms using the *Tabular* data type. For example, you can:

- Add Tabular Columns to the Auto Attribute Patterns.
- Include Tabular Columns on forms, allowing data entered in the form to be appended as a new row to a Tabular Attribute in a record. For example, the *Edit history* tabular attribute on this datasheet includes revision information for the workflow that has been added to the record by MI:Workflow:

Workflow status		Approved
Edit history		Hide table
		Save To Excel (CSV) Copy To Clipboard
Edited by	Edited on	Edit notes
MI-DEMO-VPC64\LocAdmin	Monday, November 7, 2016	Just created this
MI-DEMO-VPC64\LocAdmin	Monday, November 7, 2016	Changed the thickness
MI-DEMO-VPC64\LocAdmin	Monday, November 7, 2016	Changed the heat treatment
MI-DEMO-VPC64\LocAdmin	Monday, November 7, 2016	Looks good - released to design
		Save To Excel (CSV) Copy To Clipboard
General Information		

When including Tabular Attributes as Expected Attributes:

1. Enter the Tabular Attribute name.
2. Set *Data type* = *Tabular*.
3. Set *Tag* = *Write*.
4. Under *Tabular Row Columns* (screenshot below), add all the Tabular Columns that end-users will be expected to input.

Use the *Tag* field in the *Tabular Row Columns* section to specify if the data is local or linked. Select one of these 2 options:

- *None* (for local data)
- *LinkingValue* (the linking value for tabular linked data).

^ Expected Attributes

Attribute Name	Data Type	Editability	Tag	Extra Info
Workflow history	tabular	Mandatory	Write	Column Names: Comments

Attribute Name:

Attribute Data Type:

Editability:

Tag:

Tabular Row Columns

Column Name	Data Type	Editability	Tag
Comments	MiLongText	Mandatory	

Column Name:

Column Data Type:

Editability:

Tag:

None
LinkingValue

When specifying Auto Attributes Patterns or Linked Auto Attributes Patterns, you can address Tabular Columns directly using the syntax `AttributeName{ColumnName}`, and then the Tag is either **Write** (for local data columns) or **LinkingValue** (for the linking value):

^ Auto Attributes Patterns

Attribute Name	Data Type	Pattern	Tag
Workflow history{User}	MiShortText	{{CurrentUser}}	Write
Workflow history{Date}	MiDate	{{Timestamp}}	Write

Linked Auto Attributes Patterns works just like Auto Attributes Patterns, i.e. you can add rows of Tabular data to linked records:

^ Linked Auto Attributes Patterns

Attribute Name	Data Type	Pattern	Tag	Link Group
Tests performed?	MiLogical	True	Write	Metals Pedigree
Test details{Specimen ID}	MiShortText	{Specimen ID}	LinkingValue	Metals Pedigree

Attribute Name:

Attribute Data Type:

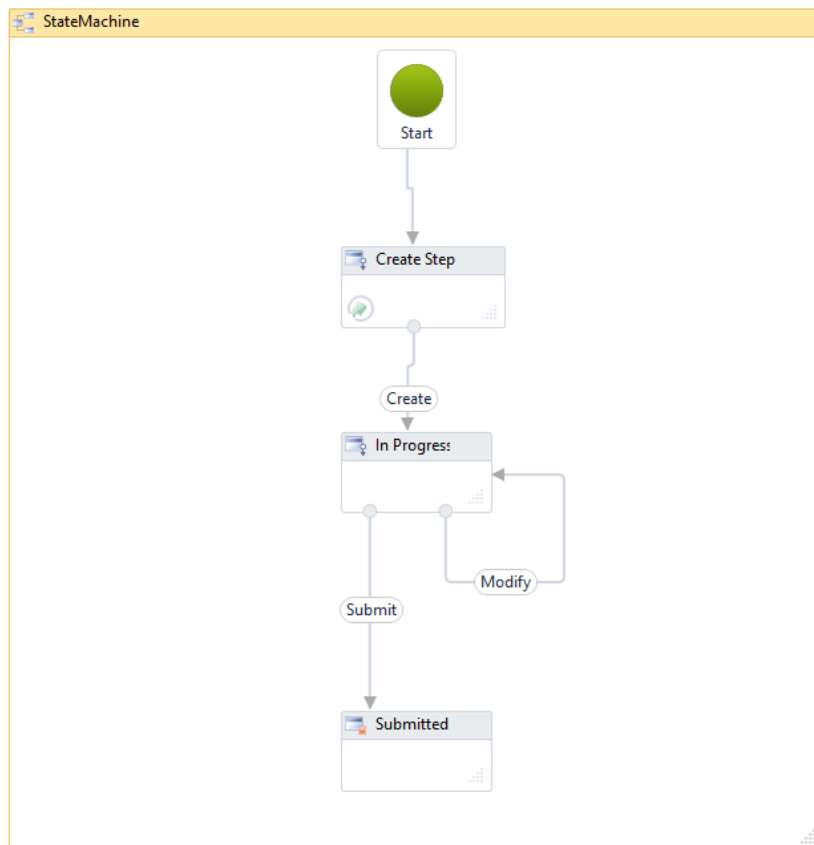
Pattern:

Tag:

Link Group:

10 Getting started

This release of MI:Workflow includes a simple training workflow which is intended to give an idea of what's possible with the MI:Workflow application, and to allow you to experiment with a sample workflow for adding a new batch record to this simple database.



This sample workflow requires the MI:Training database to be installed on your SQL Server instance; this is a lightweight tutorial database that contains a small selection of Granta data and is suitable for use in training classes and for users who wish to familiarize themselves with GRANTA MI. MI:Training can be downloaded from your software download site, and should be installed on your SQL Server instance in the same way as other Granta databases.

To get this workflow up and running:


1. Ensure that the MI:Training database (dbkey *MI_Training*) is installed on your SQL Server instance and has been added to the GRANTA MI system in MI:Server Manager.
2. Open the provided workflow definition file, *example.wfx*, in the Workflow Designer.

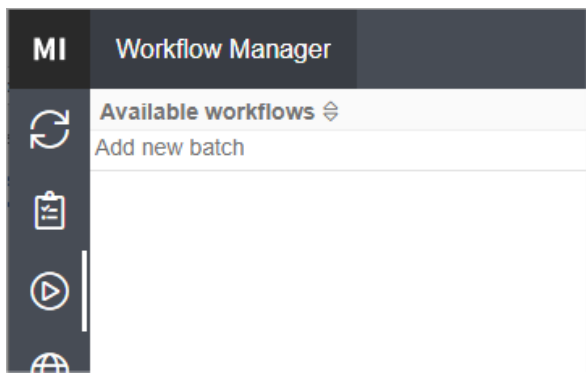
3. Modify the Authorized Roles in the Create Step, if necessary, to ensure they match groups in your organization of which you are a member – see 9.4, *Authorized Roles*.

Action Group Name	Add new batch
Authorized Roles (any)	GROUP:MI_ADMIN
Authorized Roles (all)	

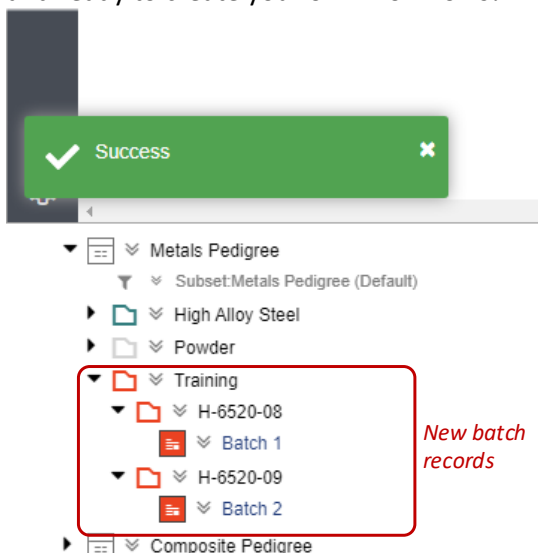
4. Save any changes to the workflow definition, validate it, and then publish it to your Workflow server – see Section 7.
5. In a browser, open your Workflow Manager application using the following URL, substituting the name of your workflow server:

`http://{applicationservername}/grantami/#/workflow`

6. Click on  **Start Workflow** and confirm there's a new workflow which can be started called *Add new batch*.

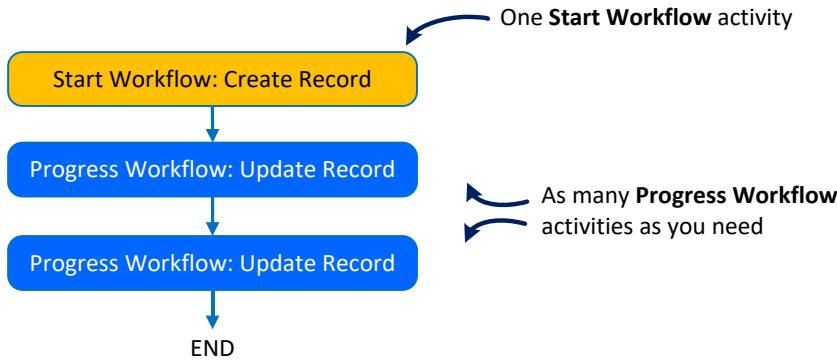


7. If you're able to run the *Add new batch* workflow, congratulations – you're up and running and ready to create your own workflows!

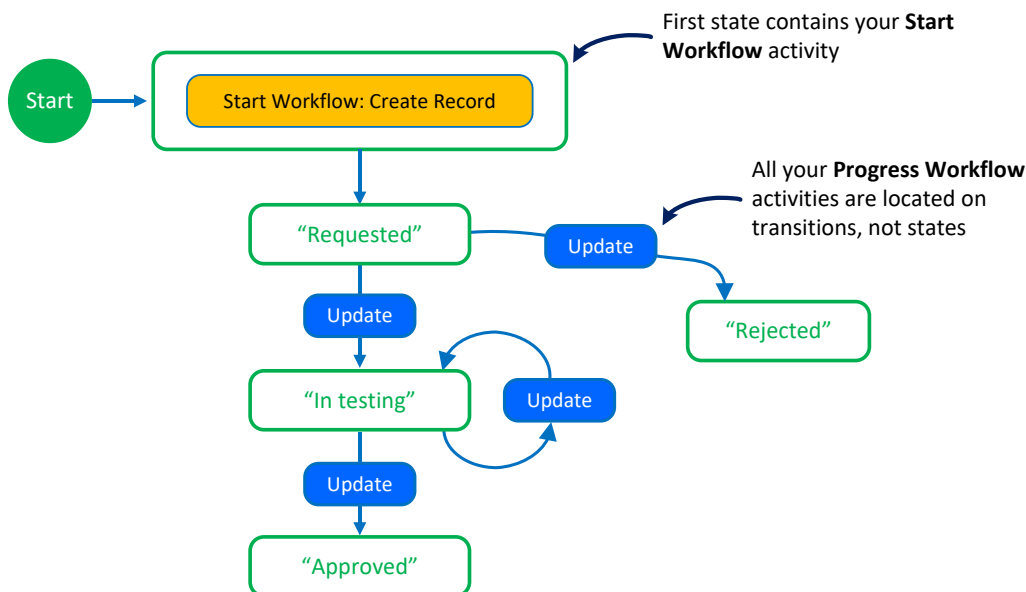


11 Example Granta workflows

In a sequence workflow, you can include one *Start Workflow: Create Record* or *Start Workflow: Update Record* activities, and multiple *Progress Workflow: Update Records* in a sequence. For example:



In a **State Machine** workflow, you must place the ***Start Workflow: Create Record*** or ***Start Workflow: Update Record*** activity in the first state, and place subsequent update activities in the transitions. For example:



Step 1 of the workflow is a ***Start Workflow: Create Record***, with action name = "Request"

1. Create a new test request record
2. Get the user to enter what test conditions are needed
3. Stamp the record with the username and date
4. Change the record workflow status to "Requested"

Step 2 is a **Progress Workflow: Update Record**, with action name = “Approve”

1. Show a form for approvers.
2. Stamp the record with the approver’s comments, name and date
3. Change status to “Approved”

11.1 Sequence workflow example

1. Open the Workflow Designer, and click **File > New**.
2. Drag a *Sequence* activity from the Control Flow section of the Toolbox and drop it onto the Workflow Designer surface.
3. Add a **Start Workflow: Create Record** activity to the sequence by dragging it from the Granta Step Activities Toolbox group and dropping it in the box with the hint text “Drop activity here”.
4. Configure the workflow properties on the *Metadata* tab:

Property	Usage
Workflow Name	This is the name that users will see under <i>Available workflows</i> on the START WORKFLOW tab in the Workflow Manager
Database Key	The database key of the target database
Table Name	The name of the table where the new record will be created
Unit System	The unit system used in the forms in Workflow Manager
Workflow Status Review Menu Name	The label on the menu option that opens the workflow status review form on the My items view in Workflow Manager
Authorized Workflow Status Reviewers	The roles permitted to review the status of workflow items in Workflow Manager
Column Header Attributes	The columns shown on the My items view in Workflow Manager
Workflow Status Review Attributes	The fields shown in the Review Status form

5. Configure the activity by editing the following properties:

Property	Usage
Subset Name	The subset where the new record will be placed
Action Name	The name that appears at the top of the Action form
Authorized Roles (any) Authorized Roles (all)	The GRANTA MI Security role(s) required to execute this step
Placement Path	The location in the record tree where the new record will be inserted
Expected Attributes	The attributes shown on the Action form
Auto Attributes Patterns	Generated attribute values
Send Email Notification	Define the details for email notifications that will be sent by the Workflow server when the new record is requested

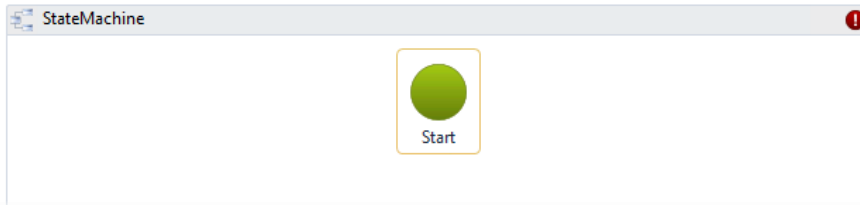
6. Add a *Progress Workflow: Update Record* activity to the sequence by dragging it from the Toolbox and dropping it in the box with the hint text “Drop activity here”, below the *Start Workflow* activity, and configure it as follows:

Property	Usage
Action Name	The name that appears at the top of the Action form
Action Group Name	The label on the menu item that opens the Action form
Authorized Roles (any) Authorized Roles (all)	The GRANTA MI Security roles required to execute this step
Summary Attributes	The fields that appear on the update step review form
Expected Attributes	The fields that appear on the update step Action form
Auto Attributes Patterns	Generated attribute values
Send Email Notification	Define the details for email notifications that will be sent by the Workflow server when the record is updated

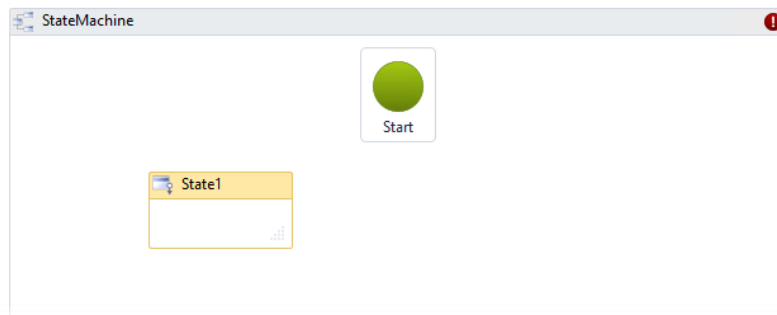
7. When you have finished adding and configuring activities, click **File > Save**.

11.2 State Machine workflow example

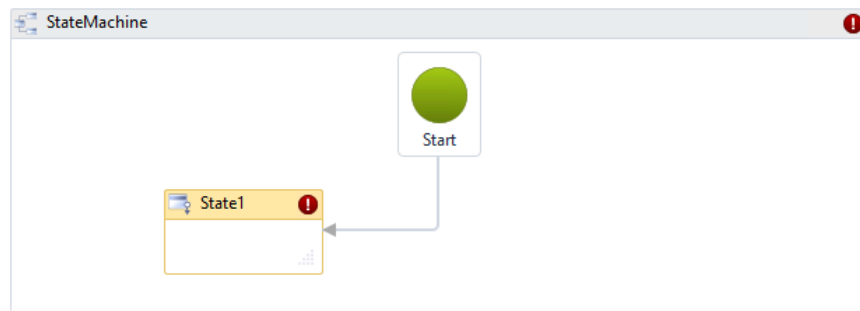
1. Open the Workflow Designer, and click **File > New**.
2. Drag a **StateMachine** activity from the State Machine section of the toolbox and drop it onto the Workflow Designer surface:



3. Add a State to the workflow by dragging the **State** activity from the StateMachine section of the toolbox and dropping it onto the StateMachine activity.

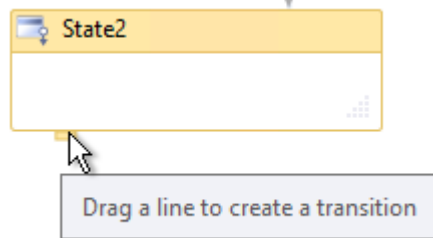


4. To assign a state as the **Initial State**, right-click the state and select **Set as Initial State**, or drag a line from the Start node at the top to the state:

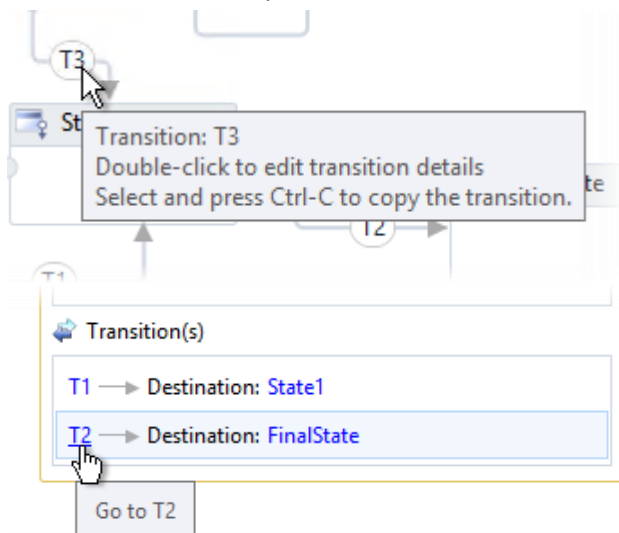


5. Add a child activity to the state by dragging it from the Toolbox and dropping it in the Entry or Exit action box.

- To add a transition, hover the mouse over the border of the source state, and drag a line to the desired destination state:



- To configure a transition, double-click on the bubble in the State Machine overview or click on the transition entry at the bottom of the state definition



The activities in the transition's action execute after the state's action completes.

- To add a final state, drag a **FinalState** activity from the State Machine section of the Toolbox and drop it onto the **StateMachine** activity. A state machine workflow must have at least one final state.
- When you have finished adding and configuring states, transitions, and activities, click **File > Save**.

12 MI:Workflow Manager web application

Workflow Manager is the web application for starting workflows, monitoring the progress of running workflows (known as 'workflow instances') and carrying out workflow tasks. It includes built-in forms that enable users to carry out workflow steps, for example assigning a test to a lab, or approving a request.

Workflow Manager is one of several embedded apps within the GRANTA MI web application (One MI). To open the application, use the following URL, substituting the name of your workflow server:

```
http://my_app_server/grantami/#/workflow
```

Note: By default, Workflow Manager is not included on the One MI application menu (accessed by clicking the "MI" logo in the upper left corner of the One MI window). To add it, it is necessary to edit the One MI menu definition in the Settings Service; see the *MI:Workflow Configuration Guide* for details.

All users have their own appropriate access to what they can and can't view, edit, create, or approve in the Workflow Manager. A user's access to workflows and running workflow instances is determined by the privileges and access levels defined in the workflow definition (see *Authorized Roles*).



My items view

In this view, users can view the workflow items currently assigned to them.

The screenshot displays the 'My items view' in the MI Workflow Manager. It features a table with the following columns: Record name, Workflow name, Last activity, Last activity initiator, and Project Code. The table contains five rows of data, all with a 'Last activity' date of Friday, November 13, 2020. Callouts highlight key features: 'Filter the items listed by workflow type' points to the search bar; 'Filter the items listed by their properties' points to the filter sidebar; 'Remove all filters' points to the 'Reset' button; 'At-a-glance view of all your pending items' points to the table; and 'Download the list to CSV' points to the download icon in the top right corner.

Record name	Workflow name	Last activity	Last activity initiator	Project Code
AMD 5678-11-Vacuum-2...	Tensile Test Request 3	Friday, November 13, 2020	ANSYSjallen	AMD 5678-11
AMD 6520-8-Air-120 °C	Tensile Test Request 1 with ...	Friday, November 13, 2020	ANSYSjallen	AMD 6520-8
AMD 6521-9-Salt Water...	Tensile Test Request 2	Friday, November 13, 2020	ANSYSjallen	AMD 6521-9
AMD 12345-10-Inert: Hel...	Tensile Test Request 2 with ...	Friday, November 13, 2020	ANSYSjallen	AMD 12345-10
AMD 642-7-Air-100 °C	Tensile Test Request 4	Friday, November 13, 2020	ANSYSjallen	AMD 642-7

The filters/search options on the left may be used to narrow down the list of items shown. Right-click on a workflow item to see the actions available. For example:

The screenshot shows a table of workflow items. A right-click context menu is open over the 'Approve test request' action for the record 'AMD 6520-8-Air-120 °C'. The context menu displays the following details:

Approve test request	
Project Code	AMD 6520-8
Data Ownership (Other)	ANSYS\jallen
Originating department	R&D
Alloy	AMD 6520
Test Temperature	120 °C
Test Environment	Air

At the bottom of the context menu, there are two buttons: 'Approve' and 'Close'.



Start Workflow view

In this view, authorized users can start a new instance of workflows. For example:

The screenshot shows the 'Workflow Manager' interface. The 'Available workflows' section is expanded, showing a list of workflow items. A yellow callout box with a play button icon points to the 'Tensile Test Request 1 with extensions' item, with the text 'Double-click to start'.



Dashboard view (Administrators only)

Users with Administrator privileges can see a third view in Workflow Manager, the Dashboard view.

The screenshot displays the MI Workflow Manager interface. On the left, there is a sidebar with navigation icons and a 'Filters' section containing input fields for 'Record name', 'Workflow name', 'Last activity initiator', 'Database', and 'Table'. Below these fields are 'Search' and 'Reset' buttons. The main area shows a table with columns: Record name, Workflow name, Instance started, Last activity, Last activit..., Database, Table, and Record History GI... The table contains several rows of workflow data. A context menu is open over one of the rows, showing 'Cancel', 'Logs', and 'Display test results' options. Yellow callout boxes provide instructions: 'Filter the items listed by workflow type' points to the 'Workflow name' filter; 'Filter the items listed by their properties' points to the 'Last activity initiator' filter; 'Remove all filters' points to the 'Reset' button; 'Right-click to cancel an in-progress instance or see errors' points to the context menu; and 'Download the list to CSV' points to a download icon in the top right corner of the table.

This view shows information about all active workflow instances, including when they were started, when the last activity occurred and who initiated it, the name of the database and table where the workflow operates, and the version of MI:Workflow in which the workflow definition was created (useful when running Workflow v1 and 2021 R1 workflows in parallel).

- Use the filters/search options on the left to narrow down the list of instances shown.
- Right-click to cancel a workflow. Cancelling a workflow will stop all running workflow tasks, and may leave them in an unresolved state. All tasks relating to the workflow will be deleted, and removed from the My items view.
- Right-click to view any error messages logged for each workflow.

You can also see the review status form for workflow instances on this tab, if you are authorized to do so.

13 Workflow glossary

The following terms are used in the MI:Workflow documentation.

Term	Definition
activity	A piece of work that forms one logical step within a workflow. Single activities can be composed together into more complex activities.
instance	A running instance of a workflow. Workflow instances may be monitored in the Workflow Manager.
sequence	A model where activities in a workflow are linked together in a structured series of steps where one activity leads to another, in order, until end of the workflow is reached.
state machine	A model where activities in a workflow are linked together with event-driven state transitions.
transition	Transitions provide the links between activities and dictate the order in which activities will be executed.
validation	Workflow validation examines different characteristics of a workflow to identify issues that might cause the workflow to fail.
WFX	A workflow definition file; includes the workflow metadata file (metaData.json) and the activity definition (.XAMLX) file; may also include additional files such as scripts called in the workflow.
workflow definition	A collection of interrelated workflow activities, used to create new workflow instances.
Workflow Designer	A tool for designing and configuring workflows for GRANTA MI.
Workflow Server	A Granta software service that manages and monitors the state of activities in a workflow, and determines when to transition activities in running workflows. It communicates with GRANTA MI via the Service Layer.
workflow instance	A running instance of a workflow

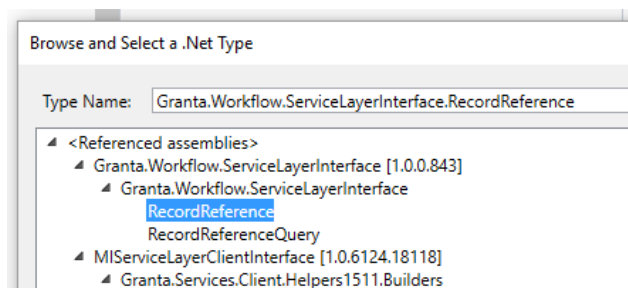
Term	Definition
Workflow Manager	The web application for starting workflows and carrying out workflow tasks. It includes built-in forms that enable users to carry out workflow steps, such as assigning a test to a lab, or approving a request.
XAMLX	A .XAMLX file describes activities in a workflow

Appendix A. Defining a record reference variable

In Granta activities, the Record Reference variable is automatically defined.

If you are developing your own workflow activities, you can define a record reference variable as follows:

1. Click on the sequence or the state machine (this will set the scope of the new variable to all activities in the sequence or state machine).
2. At the bottom of the Designer window, click on the **Variables** tab.
3. Click on the grey *Create Variable* text and enter the name of the variable, for example, RecordRef or R.
4. In the **Variable type** field, click on **Browse for Types** and select Granta.Workflow.ServiceLayerInterface.RecordReference
(*Tip: you can type RecordReference in the Type Name field to help you locate it*)



5. The new variable will now be available for use in **Start Workflow: Create Record** and **Progress Workflow: Update Record** activities within the sequence or state machine, for example:

