

# Guidewire ClaimCenter®

## ClaimCenter Best Practices Guide

RELEASE 8.0.2

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# About ClaimCenter Documentation

The following table lists the documents in ClaimCenter documentation.

| Document                           | Purpose  |
|------------------------------------|--|
| <i>InsuranceSuite Guide</i>        | If you are new to Guidewire InsuranceSuite applications, read the <i>InsuranceSuite Guide</i> for information on the architecture of Guidewire InsuranceSuite and application integrations. The intended readers are everyone who works with Guidewire applications.   |
| <i>Application Guide</i>           | If you are new to ClaimCenter or want to understand a feature, read the <i>Application Guide</i> . This guide describes features from a business perspective and provides links to other books as needed. The intended readers are everyone who works with ClaimCenter.  |
| <i>Upgrade Guide</i>               | Describes how to upgrade ClaimCenter from a previous major version. The intended readers are system administrators and implementation engineers who must merge base application changes into existing ClaimCenter application extensions and integrations.   |
| <i>New and Changed Guide</i>       | Describes new features and changes from prior ClaimCenter versions. Intended readers are business users and system administrators who want an overview of new features and changes to features. Consult the "Release Notes Archive" part of this document for changes in prior maintenance releases.                       |
| <i>Installation Guide</i>          | Describes how to install ClaimCenter. The intended readers are everyone who installs the application for development or for production.  |
| <i>System Administration Guide</i> | Describes how to manage a ClaimCenter system. The intended readers are system administrators responsible for managing security, backups, logging, importing user data, or application monitoring.  |
| <i>Configuration Guide</i>         | The primary reference for configuring initial implementation, data model extensions, and user interface (PCF) files. The intended readers are all IT staff and configuration engineers.  |
| <i>Globalization Guide</i>         | Describes how to configure ClaimCenter for a global environment. Covers globalization topics such as global locales, languages, date and number formats, names, currencies, addresses, and phone numbers. The intended readers are configuration engineers who work with locales and languages.                            |
| <i>Rules Guide</i>                 | Describes business rule methodology and the rule sets in ClaimCenter Studio. The intended readers are business analysts who define business processes, as well as programmers who write business rules in Gosu.  |
| <i>Contact Management Guide</i>    | Describes how to configure Guidewire InsuranceSuite applications to integrate with ContactManager and how to manage client and vendor contacts in a single system of record. The intended readers are ClaimCenter implementation engineers and ContactManager administrators.  |
| <i>Best Practices Guide</i>        | A reference of recommended design patterns for data model extensions, user interface, business rules, and Gosu programming. The intended readers are configuration engineers.  |
| <i>Integration Guide</i>           | Describes the integration architecture, concepts, and procedures for integrating ClaimCenter with external systems and extending application behavior with custom programming code. The intended readers are system architects and the integration programmers who write web services code or plugin code in Gosu or Java. |
| <i>Gosu Reference Guide</i>        | Describes the Gosu programming language. The intended readers are anyone who uses the Gosu language, including for rules and PCF configuration.  |
| <i>Glossary</i>                    | Defines industry terminology and technical terms in Guidewire documentation. The intended readers are everyone who works with Guidewire applications.  |

## Conventions in This Document

| Text style               | Meaning   | Examples  |
|--------------------------|---|---|
| <i>italic</i>            | Emphasis, special terminology, or a book title.   | A <i>destination</i> sends messages to an external system.  |
| <b>bold</b>              | Strong emphasis within standard text or table text.   | You <b>must</b> define this property.   |
| <b>narrow bold</b>       | The name of a user interface element, such as a button name, a menu item name, or a tab name.   | Next, click <b>Submit</b> .   |
| <code>monospaced</code>  | Literal text that you can type into code, computer output, class names, URLs, code examples, parameter names, string literals, and other objects that might appear in programming code. In code blocks, bold formatting highlights relevant sections to notice or to configure. | Get the field from the Address object.  |
| <i>monospaced italic</i> | Parameter names or other variable placeholder text within URLs or other code snippets.  | Use <code>getName(<i>first</i>, <i>last</i>)</code> .<br><code>http://<i>SERVERNAME</i>/a.html</code> . |

## Support

For assistance with this software release, contact Guidewire Customer Support:

- At the Guidewire Resource Portal – <http://guidewire.custhelp.com>
- By email – [support@guidewire.com](mailto:support@guidewire.com)
- By phone – +1-650-356-4955

# Data Model Best Practices

The ClaimCenter data model comprises metadata definitions of data entities that persist in the ClaimCenter application database. Metadata definition files let you define the tables, columns, and indexes in the relational database that supports your application. Typelist definitions let you define sets of allowed codes for specific typekey fields on entities.

This topic includes:

- “Entity Best Practices” on page 7
- “Typelist Best Practices” on page 9
- “Data Model Best Practices Checklist” on page 9

## Entity Best Practices

You can change the base data model of ClaimCenter to accommodate your business needs with *data model extensions*. Extensions let you add fields to existing data entities and add entirely new data entities to the data model of your ClaimCenter application. ClaimCenter uses the data model and your extensions to create and manage the tables, columns, and indexes in the relational database that supports your application.

As a best practice, Guidewire recommends that you edit the metadata definition files of the data model by using the Data Model Extensions editor in Guidewire Studio.

### See also

- “The ClaimCenter Data Model” on page 155 in the *Configuration Guide*

## Observe General Entity Naming Conventions

Generally, entity and field names begin with a capital letter. Medial capitals separate words in compound entity names. For example, ContactAddress.

## Add a Prefix or Suffix to New Extensions to Avoid Name Conflicts

To avoid future naming conflicts when Guidewire adds or changes base entities, Guidewire recommends that you add Ext to your entity names and new field names on base entities.

- As a prefix – Add Ext\_ to beginnings of entity names so Studio and the *Data Dictionary* list them together in one group. For example, Ext\_ServiceArea.
- As a suffix – Add \_Ext to endings of entity names so Studio and the *Data Dictionary* list them next to any entities that they extend. For example, CreditHistory\_Ext.

If you add a new entity, its field names do not need Ext in their names, because you have Ext in the name of the entity.

As an example of field extensions to a base entity, the following sample metadata file extends the base Claim entity with an additional field (column) and an additional typekey.

```
<extension entityName="Claim">
...
  <column desc="Description of the column"
    name="MyCustomColumn_Ext"
    nullok="true"
    default="abc"
    type="varchar"
    <columnParam
      name="size"
      value="60" />
  </column>

  <typekey desc="Description of the typekey"
    name="MyCustomTypekey_Ext"
    typelist="myCustomTypeList_Ext)"
    nullok="true" />
...
</extension>
```

## Use Singular for Field Names Except for Arrays

Guidewire recommends that you name most fields with a singular word such as Phone or Age. However, because array fields reference a list of objects, Guidewire recommends that you name them with a plural word.

For example, Claim.Description and Claim.Policy are single fields on a Claim entity, but Claim.Notes is an array of multiple notes. Also, for arrays fields that are extensions, make the primary name plural and not the Ext prefix or suffix. For example, use Ext\_MedTreatments or MedTreatments\_Ext, and not MedTreatment\_Exts.

## Add ID as a Suffix to Column Names for Foreign Keys

Guidewire recommends that you add ID as a suffix to the column names of foreign keys. By default, the column name of foreign keys have the same name as the foreign key names. Use the columnName attribute of foreignkey elements to override their default column names. For example:

```
<foreignkey
  columnName="ClaimID"
  ...
  name="Claim"/>
```

Adding the suffix ID to the column names of foreign keys helps database administrators identify columns in the database that Guidewire uses as foreign keys.

If you add a foreign key as an extension to a base entity, follow the best practice of adding a prefix or suffix to the name. For example:

```
<foreignkey
  columnName="Claim_ExtID"
  ...
  name="Claim_Ext"/>
```



## Typelist Best Practices

A *typelist* represents a set of allowed values for specific fields on entities in the data model. A *typecode* represents an individual value within a typelist. A typecode comprises:

- A code that the database stores as a column value
- A name that the user interface displays
- A priority setting that drop-down lists use to order the typecode names that they display

As a best practice, Guidewire recommends that you edit typelist definitions by using the Typelist editor in Guidewire Studio.

### See also

- “Working with Typelists” on page 271 in the *Configuration Guide*

## Observe Typelist Naming Conventions

The components of a typelist have these naming conventions:

| Typelist Component | Naming Conventions   | Example          |
|--------------------|--|------------------|
| Typelist           | Names begin with a capital letter. Medial capitals separate words.       | ActivityCategory |
| Code               | Names contain only lower-case letters. Underscores (_) separate words.   | approval_pending |
| Name               | Each word in a name begins with a capital letter. Spaces separate words. | Approval Pending |

To avoid future naming conflicts when Guidewire adds or changes base typelists and typecodes, Guidewire recommends that you append the suffix `_Ext` to your typelist names and typecode codes.

As an example of new typelists, name one that represents types of medical procedures `MedicalProcedureType_Ext`. Name the typecodes in your new typelists without the suffix `_Ext`.

As an example of new typecodes in a base typelist, the following `AddressType` typelist has a new typecode for service entrances.

| Code                 | Name             | Description      | Priority | Retired |
|----------------------|------------------|------------------|----------|---------|
| -----                | -----            | -----            | -----    | -----   |
| billing              | Billing          | Billing          | -1       | false   |
| business             | Business         | Business         | -1       | false   |
| home                 | Home             | Home             | -1       | false   |
| other                | Other            | Other            | -1       | false   |
| service_entrance_Ext | Service Entrance | Service Entrance | -1       | false   |

## Data Model Best Practices Checklist

Use the following checklist before you complete your data model configuration tasks to ensure that your data model follows Guidewire best practices.

| Best Practice to Follow  | Best Practice Was Followed |
|--|----------------------------|
| “Observe General Entity Naming Conventions” on page 7                        | <input type="checkbox"/>   |
| “Add a Prefix or Suffix to New Extensions to Avoid Name Conflicts” on page 8 | <input type="checkbox"/>   |
| “Use Singular for Field Names Except for Arrays” on page 8                   | <input type="checkbox"/>   |
| “Add ID as a Suffix to Column Names for Foreign Keys” on page 8              | <input type="checkbox"/>   |
| “Observe Typelist Naming Conventions” on page 9                              | <input type="checkbox"/>   |



# User Interface Best Practices

ClaimCenter uses *page configuration format* (PCF) files to render the ClaimCenter application. PCF files contain metadata definitions of the navigation, visual components, and data sources of the user interface. Display keys provide the static text that visual components of the user interface display.

This topic includes:

- “Page Configuration Best Practices” on page 11
- “Display Keys Best Practices” on page 12
- “User Interface Performance Best Practices” on page 13
- “User Interface Best Practices Checklist” on page 15

## Page Configuration Best Practices

You can change the user interface of the ClaimCenter application by adding, changing, and removing PCF files from the configuration of your ClaimCenter instance. As a best practice, Guidewire recommends that you edit PCF files by using the Page Configuration (PCF) editor in Guidewire Studio.

**See also**

- “Using the PCF Editor” on page 295 in the *Configuration Guide*

### Modify Base PCF Files Whenever Possible

Modify the base configuration files wherever they can be modified. Create new files only when absolutely necessary.

### Add a Suffix to New PCF Files to Avoid Name Conflicts

Every page configuration file in your ClaimCenter instance must have a unique file name. The location of page configuration files within the folder structure of page configuration resources does *not* ensure uniqueness. To avoid future naming conflicts when Guidewire adds or changes base page configurations, Guidewire recommends that you append the suffix `_Ext` to the names of your page configuration files.

For example, name a new list view for contacts on a claim `ClaimContacts_ExtLV`.

## Display Keys Best Practices

A *display key* represents a single piece of user-viewable text. Display keys in ClaimCenter are equivalent to defined constants in programming languages. A display key comprises:

- A name to use in PCF files and Gosu code, where you want to display textual information
- A text value to display in place of the name, for each locale installed in your ClaimCenter instance

As a best practice, Guidewire recommends that you edit your display key definitions by using the Display Keys editor in Guidewire Studio.

### See also

- “Using the Display Keys Editor” on page 143 in the *Configuration Guide*

## Use Display Keys to Display Text

Guidewire *strongly* recommends that you define display keys for any text that you display to users through the ClaimCenter user interface or in log messages. Do *not* use hard-coded `String` literals. Display keys help you localize your configuration of ClaimCenter with translations for specific languages.

## Use Existing Display Keys Whenever Possible

Before you create a new display key, search the existing display keys to find one with the text that you want. With the Display Keys editor open in Guidewire Studio, in the **Filter** text box, type the word or phrase you want. The explorer pane expands to show only those the display keys that contain the text or phrase in their names.

## Observe Display Key Naming Conventions

Generally, display key names begin with a capital letter. Medial capitals separate words in compound display key names. For example:

```
ContactDetail
```

ClaimCenter represents display keys within a hierarchical name space. A period (.) separates display key names in the paths of the display key hierarchy. For example:

```
Validation.Contact.ContactDetail
```

Generally, you specify text values for display key names that are leaves on the display keys resource tree. Generally, you do *not* specify text values for display key names that are parts of the path to a leaf display key. In the preceding example, the display keys `Validation` and `Validation.Contact` have no text values, because they are parts of a display key path. The display key `ContactDetail` has a text value, “Contact Detail,” because it is a leaf display key with no child display keys beyond it.

## Add a Suffix to New Display Keys to Avoid Name Conflicts

To avoid future naming conflicts when Guidewire adds or changes base display keys, Guidewire recommends that you append the suffix `_Ext` to your new display key names.

For example, your ClaimCenter instance has a branch of the display key hierarchy for text that relates to contact validation.

```
Validation.Contact.ContactDetail  
Validation.Contact.NewContact
```

You want to add a display key for the text “Delete Contact.” Add a new display key named `DeleteContact_Ext`.

```
Validation.Contact.ContactDetail  
Validation.Contact.DeleteContact_Ext  
Validation.Contact.NewContact
```

You can change the text for base display keys to change the text the base application displays. Guidewire recommends that you reuse base display in this way. Do *not* add a new display key with the suffix `_Ext`, which then requires you to modify base PCF files to make use of the new value.

## Organize Display Keys by Page Configuration Component

Guidewire recommends that you organize display keys under paths specific to the page configuration component types and PCF file names where the text values of display keys appears. For example,

```
LV.Activity.Activities.DueDate
```

## User Interface Performance Best Practices

The ways in which you configure the user interface of your ClaimCenter instance affects its performance. As performance best practices for user interface configuration, Guidewire recommends that you always do the following:

- “Avoid Post on Change and Client Reflection for Page Refreshes” on page 13
- “Avoid Repeated Calculations of Expensive Widget Values” on page 13
- “Avoid Expensive Calculations of Widget Properties” on page 15
- “Use Application Permission Keys for Visibility and Editability” on page 15

### Avoid Post on Change and Client Reflection for Page Refreshes

As a performance best practice, Guidewire recommends that you *not* use `postOnChange` or client reflection unless you absolutely must refresh your page for users in response to field changes.

#### Use Post On Change with Extreme Caution

As a performance best practice, Guidewire recommends that you use `postOnChange` fields with extreme caution and only when client reflection cannot be used. Each edit that a user makes to a `postOnChange` field requires a round trip to the server to refresh the page. So, an edit to a `postOnChange` field may create a latency in response for the user. For pages with many queries, a single `postOnChange` can be slow and performance intensive as the server executes each query again. Be sure to remove `postOnChange` whenever your need for immediate page refresh goes away.

#### Use Client Reflection Instead of Post on Change If Possible

As a performance best practice, Guidewire recommends that you use client reflection instead of `postOnChange` if client reflection satisfies your requirements for page refresh. For example, your page has two range widgets. The choice a user makes in the first range widget determines the choices available in the second range widget. If you make the first range widget a `postOnChange` field, the server incidentally executes every non-cached query on the page again at least once. The user may have to wait a long time before the page lets the user choose from the second range widget. If you use client reflection to update the second widget instead, you avoid a server round trip and performance degradation to execute non-cached queries in the server.

### Avoid Repeated Calculations of Expensive Widget Values

As a performance best practice, Guidewire recommends that you avoid repeated evaluation of performance intensive expressions for widget values. Depending on the needs of your application, performance intensive

expressions may be unavoidable. However, you can improve overall performance of a page by choosing carefully where to specify the expression within the page configuration.

For example, the following value range expression has a performance problem. Evaluation of the expression requires two foreign key traversals and one array lookup. If the Exposure instance is not cached, ClaimCenter executes three relational database queries, which makes the evaluation even more expensive.

```
RangeInput
...
valueRange | exposure.Claim.Catastrophe.ClaimsHistory
```

If a page with this range input widget has any `postOnChange` fields, ClaimCenter potentially evaluates the expression multiple times for each `postOnChange` edit that a user makes.

### Use Page Variables Instead for Expensive Value Expressions

Instead of specifying an expensive expression as the value for a widget, create a page variable and specify the expensive expression as the initial value. Then, specify the page variable as the value for the widget. Page variables are evaluated only during the construction of the page, not during the remaining lifetime of the page, regardless of `postOnChange` edits.

The following example suffers a performance problem, because it assigns an expensive expression to the `value` property of a widget.

```
Input: myInput
...
value | someExpensiveMethod()
```

The following modified sample code improves performance. It assigns a performance intensive expression to a page variable and assigns the variable to the widget value.

```
Variables
...
initialValue | someExpensiveMethod()
name | expensiveResult

-----
Input: myInput
...
value | expensiveResult
```

### Use Recalculate on Refresh with Expensive Page Variables Cautiously

ClaimCenter evaluates page variables only during the construction of the page, but sometimes you want ClaimCenter to evaluate a page variable in response to `postOnChange` edits. If so, you set the `recalculateOnRefresh` property of the page variable to `true`. If a page variable specifies an expensive expression for its `initialValue`, carefully consider whether your page really must recalculate the variable. If you set the `recalculateOnRefresh` property to `true`, ClaimCenter evaluates the expression at least once for every `postOnChange` edit to the page.

Although ClaimCenter evaluates page variable with `recalculateOnRefresh` set to `true` for each `postOnChange` edit, page variables can yield performance improvements compared to widget values. If several widgets use the same expression for their values, using a page variable reduces the number of evaluations by a factor equal to the number widgets that use it. For example, the `valueRange` of a range input used for drop-down lists in a list view column are evaluated at least once for each row.

### Do Not Use Post on Change with List Views

Do *not* use `postOnChange` with list views. Each row that a user inserts or removes causes a server round trip. To update list totals, use client reflection instead.

## Avoid Expensive Calculations of Widget Properties

Page configuration widget properties `editable`, `visible`, `available`, and `required`, may need to be evaluated in multiple contexts. If you have a complex or expensive expression in one of these properties, move the expression to a page variable. Otherwise, the expression is evaluated several times before ClaimCenter displays the page.

The following example suffers a performance problem. It assigns a performance intensive expression to the `visible` property of a widget.

```
Input: myInput
...
id          |myInput
...
visible     |activity.someExpensiveMethod()
```

The following modified sample code improves performance. It assigns a performance intensive expression to a page variable. ClaimCenter evaluates page variables only once before it displays a page, regardless how many contexts under which it evaluates widget properties on the page.

```
Variables
...
initialValue |activity.someExpensiveMethod()
name         |expensiveResult

-----
Input: myInput
...
id          |myInput
...
visible     |expensiveResult
```

## Use Application Permission Keys for Visibility and Editability

The `visible` and `editable` properties are evaluated many times during the lifetimes of locations and widgets. As a performance best practice, Guidewire recommends that you structure the page configuration of your user interface so application permission keys determine visibility and editability. This is the most common pattern for user access in business applications.

For example, use the following Gosu expression in the `visible` property of an `Edit` button on a panel that displays information about a claim.

```
perm.Claim.edit(aClaim)
```

Application permission keys evaluate the current user against general system permissions and the access control lists of specific entity instances.

### See also

- “Securing Access to ClaimCenter Objects” on page 93 in the *System Administration Guide*

## User Interface Best Practices Checklist

Use the following checklist before you complete your user interface configuration tasks to ensure that your user interface configuration follows Guidewire best practices.

| Best Practice to Follow  | Best Practice Was Followed |
|--|----------------------------|
| “Modify Base PCF Files Whenever Possible” on page 11               | <input type="checkbox"/>   |
| “Add a Suffix to New PCF Files to Avoid Name Conflicts” on page 11 | <input type="checkbox"/>   |
| “Use Display Keys to Display Text” on page 12                      | <input type="checkbox"/>   |
| “Use Existing Display Keys Whenever Possible” on page 12           | <input type="checkbox"/>   |

| Best Practice to Follow  | Best Practice Was Followed |
|--|----------------------------|
| "Observe Display Key Naming Conventions" on page 12                              | <input type="checkbox"/>   |
| "Add a Suffix to New Display Keys to Avoid Name Conflicts" on page 12            | <input type="checkbox"/>   |
| "Organize Display Keys by Page Configuration Component" on page 13               | <input type="checkbox"/>   |
| "Avoid Post on Change and Client Reflection for Page Refreshes" on page 13       | <input type="checkbox"/>   |
| "Use Post On Change with Extreme Caution" on page 13                             | <input type="checkbox"/>   |
| "Use Client Reflection Instead of Post on Change If Possible" on page 13         | <input type="checkbox"/>   |
| "Avoid Repeated Calculations of Expensive Widget Values" on page 13              | <input type="checkbox"/>   |
| "Use Page Variables Instead for Expensive Value Expressions" on page 14          | <input type="checkbox"/>   |
| "Use Recalculate on Refresh with Expensive Page Variables Cautiously" on page 14 | <input type="checkbox"/>   |
| "Use Application Permission Keys for Visibility and Editability" on page 15      | <input type="checkbox"/>   |



# Rules Best Practices

ClaimCenter rules comprise hierarchies of conditions and actions that implement complex business logic. As a best practice, Guidewire recommends that you edit rules by using the Rules editor in Guidewire Studio.

This topic includes:

- “Rules Naming Best Practices” on page 17
- “Rules Performance Best Practices” on page 20
- “Rules Best Practices Checklist” on page 21

**See also**

- “Rules: A Background” on page 13 in the *Rules Guide*

## Rules Naming Best Practices

Guidewire recommends a number of rule naming best practices to help you identify and locate specific rules during configuration, testing, and production.

- “Observe Rule Naming Conventions” on page 17
- “Observe Operating System Length Restrictions on Rule Names” on page 19
- “Get and Display Rule Names in Messages” on page 20
- “Assign a Dedicated Rules Librarian to Manage Rule Names” on page 20

### Observe Rule Naming Conventions

Each rule name within a rule set must be unique. To help ensure uniqueness, Guidewire recommends that you follow the best practices naming conventions for rules described in this topic. In addition, these naming conventions help you quickly identify each rule within the complex hierarchy of rules in your Guidewire instance during testing and in production.

The basic format for a rule name has two parts:

*Identifier - Description*

Follow these conventions for *Identifier* and *Description*:

- Separate *Identifier* from *Description* with a space, followed by hyphen, followed by a space.
- Limit *Identifier* to eight alphanumeric characters.

---

**IMPORTANT** Guidewire truncates *Identifier* values that exceed eight characters if you include the `actions.ShortRuleName` property in rule actions to display rule names in messages that you log or display. Guidewire also truncates *Identifier* values that exceed eight characters in automatic log messages if you enable the `RuleExecution` logging category and set the server run mode to `Debug`.

---

- Begin *Identifier* with up to four capital letters to identify the rule set or parent rule of which the rule is a member.
- End *Identifier* with at least four numerals to identify the ordinal position of the rule within the hierarchy of rules in the set.
- For *Description* values, keep them simple, short, and consistent in their conventions.
- Limit the total length of rule names to 60 characters.

For example:

```
CV000100 - Future loss date
```

## Rule Naming Summary Principles

Remember these principles for rule names:

- Rule names are unique within a rule set.
- Rules numbers are sequential to mimic the order of rules in the fully expanded set.

The following example demonstrates these principals.

```
Claim Validation Rules
CV001000 - Future loss date
CV002000 - Policy expiration date after effective date
CV002500 - Not Set: Coverage in question
CV003000 - Injury
  CVI03100 - Workmen's Compensation
    CVIW3110 - Claimant exists
      CVIW3120 - Not Set: Injury description
        CVI03900 - Default
          CV004000 - Expected recovery exceeds 100
```

## Root Rules Naming Conventions

Consider the following example rule set, `Claim Validation Rules`. The identifiers of rules in this set all begin with `CV`, a code to identify “Claim Validation” rules.

```
Claim Validation Rules
CV001000 - Future loss date
CV002000 - Policy expiration date after effective date
CV003000 - Injury
  CVI03100 - Workmen's Compensation
    CVI03900 - Default
      CV004000 - Expected recovery exceeds 100
```

The rule set contains four root rules, with identifiers `CV001000`, `CV002000`, `CV003000`, and `CV004000`. The numbers at the end of the identifiers, 1000, 2000, 3000 and 4000, are units of one thousand. This spread of numbers lets you add new root rules between existing ones without renumbering. You want identifier numbers for rules in a set to remain in sequential order to mimic the order of rules within the fully expanded set.

For example, you want to add a rule between `CV002000` and `CV003000`. Assign the new rule the identifier `CV002500`.

```
Claim Validation Rules
CV001000 - Future loss date
CV002000 - Policy expiration date after effective date
CV002500 - Not Set: Coverage in question
CV003000 - Injury diagnosis validity dates
```

```

CVI03100 - Workmen's Compensation
CV103900 - Default
CV004000 - Expected recovery exceeds 100

```

## Parent and Child Rules Naming Conventions

Many rule sets achieve their business function with simple rules in the root of the set. In preceding example, rules CV001000, CV002000, CV002500, and CV004000 are simple root rules. Frequently however, rule sets achieve their business function *only* with a hierarchy of parent and child rules. In the example, rule CV003000 is a parent rule with two child rules.

When you add child rules to a parent, follow these conventions:

- Expand the beginning code for the child rules with an additional letter to identify their parent.
- Assign each child rule an ending number that falls between the number of the parent and the sibling rule that follows the parent.
- Assign the children a spread of numbers so you can add more children later without renumbering.

In the preceding example, the identifiers for the child rules of CV003000 all begin with CVI, a code to identify “Claim Validation Injury” rules.

```

Claim Validation Rules
...
CV003000 - Injury
  CVI03100 - Workmen's Compensation
  CV103900 - Default
CV004000 - Expected recovery exceeds 100

```

The spread of numbers for child rules of a root parent rule generally are units of one hundred. This spread of numbers lets you add new child rules between existing ones without renumbering. Most importantly, the numbers of child rules must fall between the numbers of their parent rule and the sibling rule that follows their parent. In this example, the numbers for child rules satisfy both conventions.

The parent and child naming convention applies to another, third level of children. For example, you want to add two new child rules to the rule CVI03100 - Workmen's Compensation. Begin the child identifiers with CVIW, a code to identify “Claim Validation Injury Workmen's Compensation” rules. At the third level of a rule set hierarchy, the spread of numbers for the child rules generally are units of ten.

```

Claim Validation Rules
...
CV003000 - Injury
  CVI03100 - Workmen's Compensation
    CVIW3110 - Claimant exists
    CVIW3120 - Not Set: Injury description
  CV103900 - Default
CV004000 - Expected recovery exceeds 100

```

## Observe Operating System Length Restrictions on Rule Names

Guidewire stores rules in files within a directory structure that mimics the rule set category structure in Studio. The fully qualified path for a rule file can be quite long, depending on:

- The length of the path to your Guidewire installation directory
- The length of the path from your installation directory to the root of the rules directory, `modules/configuration/cc/config/rules/rules`, which is 36 characters
- The depth of the hierarchy of rule categories, rule sets, rules, and parent/child rules
- The length of individual rule names

In addition, you must add four characters to the path for the name of each rule category, rule set, and parent rule.

You must understand the file system implications of rule names. Windows file systems have a file path limit of 255 characters. To avoid exceeding the limit, Guidewire recommends that you:

- Avoid a long path to your Guidewire installation directory.
- Avoid deep hierarchies of rule set categories.

- Avoid hierarchies of parent and child rules within a rule set deeper than three levels.
- Avoid long names for rule set categories, rule sets, and rules.

## Get and Display Rule Names in Messages

As a best practice, Guidewire recommends that you get and display rule names in messages. So, following the Guidewire best practices for rule names helps you identify specific rules in messages to users, in print statements for testing, and in log messages. The alphabetic beginning of a rule identifier helps you find the rule set or parent rule that contains the rule. The numeric ending helps you determine the order of a rule in a rule set or parent rule.

For example, you want to test an exposure validation rule for vehicular exposures, EXV01000 - Incident not null. The identifier portion of the rule name begins with EXV. That identifies the rule as a member of the Exposure Validation rule set. The identifier ends with 01000. That indicates that rule is near the beginning of the rule set. The rule has the following definition.

```
EXV01000 - Incident not null
Rule Conditions:
exposure.Vehicle.Vin == null or exposure.Vehicle.Vin == ""

Rule Actions:
exposure.rejectField ("Vehicle.Vin", null, null, "newloss",
    "The vehicle VIN should have a value."
)
```

As written, the rejection message that the rule action displays makes it difficult to determine exactly which rule caused an update to fail. To help identify the specific rule in the rejection message, use the `actions.getRule().DisplayName` property to include the identifier portion of the rule name in the message.

```
Rule Actions:
exposure.rejectField ("Vehicle.Vin", null, null, "newloss",
    "The vehicle VIN should have a value. Rule: " + actions.getRule().DisplayName.substring(8)
)
```

By including the rule display name in the rule action, users see the following statement in the **Validation** window when the rule action executes.

```
VIN: The Vehicle VIN should have a value. Rule: EXV01000
```

**Note:** In actual practice, Guidewire recommends that you make all `String` values into display keys.

## Assign a Dedicated Rules Librarian to Manage Rule Names

As a best practice, Guidewire recommends that you appoint someone in your organization to develop and enforce simple and consistent naming conventions for rule categories, rule sets, and rule names. This helps ensure that naming standards are followed to make sure that rule identifiers readily identify specific rules within the total catalog of rules in your Guidewire instance.

## Rules Performance Best Practices

Guidewire recommends performance best practices for rules to help you avoid known performance issues.

### Purge Unused and Obsolete Rules Before Upgrading

As a best practice, Guidewire recommends that you purge unused and obsolete rules from your ClaimCenter configuration. This improves the upgrade process because ClaimCenter does not spend time to evaluate inactive rules that are unused or obsolete.

## Rules Best Practices Checklist

Use the following checklist before you complete your rule configuration tasks to ensure that your rules follow Guidewire best practices.

| Best Practice to Follow   | Best Practice Was Followed |
|---|----------------------------|
| "Observe Rule Naming Conventions" on page 17                            | <input type="checkbox"/>   |
| "Rule Naming Summary Principles" on page 18                             | <input type="checkbox"/>   |
| "Root Rules Naming Conventions" on page 18                              | <input type="checkbox"/>   |
| "Parent and Child Rules Naming Conventions" on page 19                  | <input type="checkbox"/>   |
| "Observe Operating System Length Restrictions on Rule Names" on page 19 | <input type="checkbox"/>   |
| "Get and Display Rule Names in Messages" on page 20                     | <input type="checkbox"/>   |
| "Assign a Dedicated Rules Librarian to Manage Rule Names" on page 20    | <input type="checkbox"/>   |
| "Purge Unused and Obsolete Rules Before Upgrading" on page 20           | <input type="checkbox"/>   |



# Gosu Language Best Practices

Gosu is a general-purpose programming language built on top of the Java Virtual Machine. ClaimCenter uses Gosu as its common programming language.

This topic includes:

- “Gosu Naming and Declaration Best Practices” on page 23
- “Gosu Commenting Best Practices” on page 26
- “Gosu Coding Best Practices” on page 27
- “Gosu Performance Best Practices” on page 33
- “Gosu Best Practices Checklist” on page 39

**See also**

- “Gosu Introduction” on page 15 in the *Gosu Reference Guide*

## Gosu Naming and Declaration Best Practices

Guidewire recommends a number of best practices for naming and declaring Gosu variables, functions, and classes.

- “Observe General Gosu Naming Conventions” on page 24
- “Omit Type Specifications with Variable Initialization” on page 24
- “Add a Suffix to Functions and Classes to Avoid Name Conflicts” on page 24
- “Declare Functions Private Unless Absolutely Necessary” on page 24
- “Use Public Properties Instead of Public Variables” on page 24
- “Do Not Declare Static Scope for Mutable Variables” on page 25
- “Use Extensions to Add Functions to Entities” on page 25
- “Match Capitalization of Types, Keywords, and Symbols” on page 25

## Observe General Gosu Naming Conventions

As a best practice, Guidewire recommends the following general naming conventions.

| Language Element | Naming Conventions   | Examples                                     |
|------------------|--|--|
| Variable names   | Name variables in mixed case, with an initial lower case letter and a medial capital for each internal word. Name variables mnemonically so that someone reading your code easily remembers what they represent. Do <i>not</i> use single letters such as "x" for variable names, except for short-lived variables, such as loop counts. | nextPolicyNumber<br>firstName<br>recordFound |
| Function names   | Compose function names in verb form. Name functions in mixed case, with an initial lower case letter and medial capitals for each internal word. Add the suffix <code>_Ext</code> to the ends of function names to avoid future naming conflicts if Guidewire adds or changes base functions.  | getClaim_Ext()<br>getWageLossExposure_Ext()  |
| Class name       | Compose class names in noun form. Name classes in mixed case, with an initial upper case and medial capitals for each internal word. Add the suffix <code>_Ext</code> to the ends of class names to avoid future naming conflicts if Guidewire adds or changes base classes.   | StringUtility_Ext<br>MathUtility_Ext         |

## Omit Type Specifications with Variable Initialization

Type specifications in variable declarations are optional in Gosu if you initialize variables with value assignments. Whenever you initialize a variable, Gosu sets the type of the variable to the type of the value. As a best practice, Guidewire recommends that you always initialize variables and omit the type specification.

```
var amount = 125.00 // use an initialization value to set the type for a variable
var string = new java.lang.String("") // initialize to the empty string instead of null
```

## Add a Suffix to Functions and Classes to Avoid Name Conflicts

To avoid future naming conflicts if Guidewire adds or changes base functions and classes, Guidewire recommends that you append the suffix `_Ext` to your new functions and classes.

For example, name a new function that calculates the days between two dates `calculateDaysApart_Ext(...)`.

## Declare Functions Private Unless Absolutely Necessary

As a best practice, Guidewire recommends that you declare functions as public only with good reason. The default access in Gosu is public. So, declare functions as private if you intend them only for use internally within a class or class extension. Always prefix private and protected class variables with an underscore character (`_`).

## Use Public Properties Instead of Public Variables

As a best practice, Guidewire recommends that you convert public variables to properties. Properties separate the interface of an object from the implementation of its storage and retrieval. Although Gosu supports public variables for compatibility with other languages, Guidewire strongly recommends public properties backed by private variables instead of public variables.

The following sample Gosu code declares a private variable within a class and exposes it as a public property by using the `as` keyword. This syntax makes automatic getter and setter property methods that the class instance variable backs.

```
private var _firstName : String as FirstName // Declare a public property as a private variable.
```

Avoid declaring public variables, as the following sample Gosu code does.

```
public var FirstName : String // Do not declare a public variable.
```



For general information, see “Properties” on page 193 in the *Gosu Reference Guide*.

## Do Not Declare Static Scope for Mutable Variables

As a best practice, Guidewire recommends that you do *not* use static scope declaration for fields that an object modifies during its lifetime. Static fields have application scope, so all sessions in the Java Virtual Machine (JVM) share them. All user sessions see the modifications that made any user session makes to static properties.

For example, the following sample Gosu code is a bad example.

```
class VinIdentifier {
    static var myVector = new Vector() // All sessions share this static variable.

    static function myFunction(){
        myVector.add("new data") // Add data for the entire JVM, not just this session.
    }
}
```

## Use Extensions to Add Functions to Entities

As a best practice, Guidewire recommends that you add functions that operate on entities as extensions to the existing entity type instead of as static functions on separate utility classes.

### Implement Functions that Operate on Single Entity Instances as Extensions

If you want a new function that operates on single instances of an entity type, declare the new function in a separate class extension to that entity type.

For example, you want a new function to suspend a claim. Name your new function `suspend`. Do not declare the function as static with a `Claim` instance as its parameter. Instead, declare the function as an extension of the `Claim` class, so callers can invoke the method directly on a `Claim` instance. For example:

```
if claim.suspend() {
    // Do something to suspend the claim.
}
```

### Package Entity Extensions for an Entity Type in a Single Package

Package all of your extensions for an entity type together in a package with the same name as the entity they extend. Do not place all of your entity extensions in a single package. Place all of your extension packages in a package folder that identifies your organization.

For example, place all of your extensions to the `Activity` entity type in a package named `com.CustomerName.activity`.

## Match Capitalization of Types, Keywords, and Symbols

The Gosu language is case sensitive.

Guidewire entity types are case insensitive, but it is best to write your code as if they are case sensitive.

Use standard capitalization of program symbols and language elements:

- **Package and subpackage names** – All lower case
- **Type names** – Initial upper case
- **Method names** – Initial lower case
- **Property names** – Initial upper case
- **Variable names** – Initial lower case
- **Keywords, such as ‘var’ and ‘if’** – All lower case
- **All other language elements** – As defined

**See also**

- “Case Sensitivity” on page 25 in the *Gosu Reference Guide*

## Gosu Commenting Best Practices

As a best practice, Guidewire recommends these styles and usages of comments:

- Block Comments
- Javadoc Comments
- Single-line Comments
- Trailing Comments
- Using Comment Delimiters to Disable Code

As a commenting best practice, always place block comments before every class and method that you write. Briefly describe the class or method in the block comment. For comments that you place within methods, use any of the commenting styles to help clarify the logic of your code.

### Block Comments

Block comments provide descriptions of libraries and functions. A block comment begins with a slash followed by an asterisk (/\*). A block comment ends with an asterisk followed by a slash (\*). To improve readability, place an asterisk (\*) at the beginnings of new lines within a block comment.

```
/*
 * This is a block comment.
 * Use block comments at the beginnings of files and before
 * classes and functions.
 */
```

Place block comments at the beginnings of files, classes, and functions. Optionally, place block comments within methods. Indent block comments within functions to the same level as the code that they describe.

### Javadoc Comments

Javadoc comments provide descriptions of classes and methods. A Javadoc comment begins with a slash followed by two asterisks (/\*\*). A Javadoc comment ends with a single asterisk followed by a slash (\*).

```
/**
 * Describe method here--what it does and who calls it.
 * How to Call: provide an example of how to call this method
 * @param parameter description (for methods only)
 * @return return description (for methods only)
 * @see reference to any other methods,
 * the convention is
 * <class-name>#<method-name>
 */
```

Block comments that you format using Javadoc conventions allow automated Javadoc generation.

### Single-line Comments

Single-line comments provide descriptions of one or more statements within a function or method. A single-line comment begins with double slashes (//) as the first two characters on a line.

```
// Handle the condition
if (condition) {
    ...
}
```

If you cannot fit your comment on a single line, use a block comment, instead.

## Trailing Comments

Trailing comments provide very brief descriptions about specific lines of code. A trailing comment begins with double slashes (//) that follow the code that the comment describes. Separate the double slashes from the code with at least two spaces.

```
if (a == 2) {
    return true // desired value of 'a'
}
else {
    return false // unwanted value of 'a'
}
```

If you place two or more trailing comments in a chunk of code, indent them all to a common alignment, as the preceding example shows.

## Using Comment Delimiters to Disable Code

Use the single-line comment delimiter of double slashes (//) to comment out a complete or partial line of code. Use single-line comment delimiters at the beginnings of consecutive lines of code to comment out sections of code.

**Note:** Do *not* use single-line delimiters (//) on consecutive lines for blocks of comment text. Use block comment delimiters (/\*, \*/), instead.

## Gosu Coding Best Practices

Guidewire recommends a number of best practices for Gosu code.

- “Use Whitespace Effectively” on page 27
- “Use Parentheses Effectively” on page 28
- “Use Curly Braces Effectively” on page 28
- “Program Defensively Against Conditions that Can Fail” on page 28
- “Omit Semicolons as Statement Delimiters” on page 29
- “Use != Instead of <> as the Inequality Operator” on page 30
- “Observe Null Safety with Equality Operators” on page 30
- “Use typeis Expressions for Automatic Downcasting” on page 30
- “Observe Loop Control Best Practices” on page 31
- “Return from Functions as Early as Possible” on page 32
- “Use Query Builder APIs instead of Find Expressions in New Code” on page 33

## Use Whitespace Effectively

Guidewire recommends the following best practices for effective use of whitespace:

- Add spaces around operators.
 

```
premium = Rate + (minLimit - reductionFactor) // proper form
premium=Rate+(minLimit-reductionFactor)      // improper form
```
- Add no spaces between parentheses and operands.
 

```
((a + b) / (c - d)) // proper form
( ( a + b ) / ( c - d ) ) // improper form
```
- Indent logical blocks of code by two spaces only.
- Add a blank line after code blocks.
- Add two blank lines after methods, even the last method in a class.

## Use Parentheses Effectively

As a best practice, Guidewire recommends that you always use parentheses to make explicit the operator order of precedence in computational expressions. Otherwise, your computations can easily produce inappropriate results. In the following sample Gosu code, the computation expression without parenthesis produces incorrect results.

```
premium = (rate + limit) * (10.5 + deductible) / (autoGrade - 15) // proper form
premium = rate + limit * 10.5 + deductible / autoGrade - 15      // improper form, bad results
```

Math operators have a natural order of precedence, which controls the order of incremental computations in compound computations if parentheses are absent. The following sample Gosu code makes explicit the operator order of precedence in the computation without parentheses in the preceding example.

```
premium = rate + (limit * 10.5) + (deductible / autoGrade) - 15 // natural order of precedence
```

## Use Curly Braces Effectively

Guidewire recommends the following best practices for effective use of curly braces:

- Surround every logical block, even single-statement blocks, with curly braces ({}).
- Put the opening curly braces ({} on the same line that starts the block.
- Put the closing curly brace (}) on the line after the last statement in the block, aligned with the starting column of the block.

```
if(premium <= 1000) { // Put opening curly brace on line that starts the block.
    print("The premium is " + premium) // Surround even single-line blocks with curly braces.
} // Put closing curly brace on line after last statement.
```

## Program Defensively Against Conditions that Can Fail

As a best practice, Guidewire recommends that you program defensively. Always assume that conditions might fail. Follow these recommendations to avoid common but easily missed programming flaws, such as potential null pointer exceptions and out-of-bounds exceptions.

- **Use case-insensitive comparisons** – Use the `equalsIgnoreCase` method on the string literal to compare it with the value of a variable. Case mismatch can cause comparisons to fail unintentionally.

```
if("Excluded".equalsIgnoreCase(str)) { // proper comparison method
    print("They match.")
}

if(string.equals("Excluded")) { // improper comparison method
    print("They do NOT match.")
}
```

- **Check for null values** – If your code cannot handle a variable that contains non-null values, check the variable for null before you access properties on the variable.

```
function formatName (aUser : User) {
    if (aUser != null) { // Check for null to avoid a null pointer exception later in the code.
        print(aUser.DisplayName)
    }
    else {
        print("No user")
    }
}
```

Also, check variables for null before you call methods on variables:

```
function addGroup (aUser : User, : aGroupUser : GroupUser) {
    if (aUser != null) { // Check for null to avoid a null pointer if you call methods on the variable.
        aUser.addToGroup(aGroupUser)
    }
}
```

If you do not check variables for null:

- Accessing a property on a variable may use null-safe property access, which can cause null pointer exceptions in later code that handles only non-null values.
- Calling a method on a variable risks a null pointer exception.

- **Allow default null-safe property access** – If your code can handle a variable that contains null values, you can rely on null-safe access of simple properties in most cases. With null-safe property access, the entire expression evaluates to null if the left-side of a period operator is null.

For example, the following sample Gosu code returns null if the user object passed in by the caller is null. Default null-safe property access prevents a null pointer exception in the return statement.

```
function formatName (aUser : User) : String {
    return aUser.DisplayName // Default null-safe access returns null if the passed-in user is null.
}
```

- **Use explicit null-safe operators** – If your code can handle an object path expression that evaluates to null, use the explicit Gosu null safe operators:
  - ?. – Null-safe access to properties and methods
  - ?[] – Null-safe access to arrays

The following sample Gosu code uses the explicit null-safe operator ?. to check for null to avoid a null pointer exception while accessing a property. If aUser is null, the entire object path expression aUser?.DisplayName evaluates to null.

```
function formatName (aUser : User) : String {
    return aUser?.DisplayName // An explicit null-safe operator returns null if aUser is null.
}
```

The following sample Gosu code uses the explicit null safe operator ?. to check for null to avoid a null pointer exception while calling a method. If aUser is null, Gosu does not call the method addToGroup, and the entire expression aUser?.addToGroup(aGroupUser) evaluates to null.

```
function addGroup (aUser : User, aGroupUser: GroupUser) {
    aUser?.addToGroup(aGroupUser) // An explicit null-safe operator returns null if aUser is null.
}
```

The following sample Gosu code uses the explicit null-safe operator ?[] to check for null to avoid a null pointer exception while accessing an array. If strings[] is null, the entire expression strings?[index] evaluates to null. However, the null-safe operator does not avoid out-of-bounds exceptions if strings[] is non-null and the value of index exceeds the array length.

```
function getOneString (strings : String[], index : int) : String {
    return = strings?[index] // An explicit null-safe operator evaluates to null if an array is null.
}
```

For more information about null-safe operators, see “Handling Null Values In Expressions” on page 83 in the *Gosu Reference Guide*.

- **Check boundary conditions** – In for loops, check for boundary conditions ahead of the loop. Entering a loop if the boundary condition is satisfied already can cause null pointer exceptions and out-of-bounds exceptions.
- **Use structured exception handling** – Use try/catch blocks wherever required and possible. If you want to catch multiple exceptions, handle them in a hierarchy from low-level, specific exceptions to high-level, generic exceptions.

## Omit Semicolons as Statement Delimiters

Semicolons as statement delimiters are optional in Gosu. As a best practice, Guidewire recommends that you omit semicolons. They are unnecessary in almost all cases, and your Gosu code looks cleaner and easier to read without them.

```
// Omit semicolons with statements on separate lines.
print(x)
print(y)
```

Gosu requires semicolons only if you place multiple statements on a single line. As a best practice, Guidewire generally recommends against placing multiple statements on a single line. Exceptions include simple statement lists declared in-line within Gosu blocks.

```
// Include semicolons with multiple statements on a single line.
var adder = \ x : Number, y : Number -> { print("I added!"); return x + y; }
```

## Use != Instead of <> as the Inequality Operator

Use the != form instead of the <> form of the inequality operator. The <> form in earlier versions of Gosu is deprecated. Studio provides a code inspection to flag this issue.

```
if (activitySubject != row.Name.text) { // The <> form of inequality operator is deprecated.
    ...
}
```

## Observe Null Safety with Equality Operators

The equality and inequality comparison operators == and != are null safe if one side or the other evaluates to null. Operators that are null safe do not throw null pointer exceptions. As a best practice, Guidewire recommends that you use these comparison operators instead of the equals method on objects.

```
if (variable1 == variable2) { // Comparison operators are null safe.
    print("The variables are equal.")
} else {
    print("The variables are NOT equal.")
}
```

## Rewrite Comparison Operators to Avoid the Equals Method

Do *not* write Gosu code that uses the equals method, because it is not type safe.

```
if (activitySubject.equals(row.Name.text)) { // This expression is not null safe.
    ...
}
```

As a best practice, Guidewire recommends that you rewrite your Gosu code with comparison operators instead of equals methods to make your code type safe and easier to read.

```
if (activitySubject == row.Name.text) { // This is expression is null safe and easier to read.
    ...
}
```

## Avoid Implicit Type Coercion with Comparison Operators

Be aware of type coercion that occurs if you use the comparison operators == and != with operands of different types. For example, the following expression evaluates to true.

```
1 == "1"
```

Gosu implicitly coerces "1" to an integer value of 1, without explicit casting. Implicit coercion is convenient and powerful, but it can cause unexpected results if used without caution.

Gosu produces compiler warnings for implicit coercions. As a best practice, Guidewire recommends that you take these warnings seriously. If you want the coercion, explicitly cast the operand on the right by using an as Type expression. If you do *not* want the coercion, rewrite your code to avoid the implicit coercion.

For example, the following expression compares a date value to a string representation of a date value.

```
(dateValue == "2011-11-15")
```

Because Gosu coerces of the string "2011-11-15" to a date, rewrite the code with an explicit type cast.

```
(dateValue == "2011-11-15" as DateTime)
```

## Use typeIs Expressions for Automatic Downcasting

As a best practice, Guidewire recommends that you use typeIs expressions to compare the type of an object with a given subtype. After a typeIs expression, Gosu automatically downcasts subsequent references to the object if the object is of the type or a subtype of the original typeIs expression. Use typeIs expressions for automatic downcasting to improve the readability of your code by avoiding redundant and unnecessary casts.

The automatic downcasting of typeIs expressions is particularly valuable for if statements and similar Gosu flow of control structures. Within the code block of an if statement, you can omit explicitly casting the object as

its subtype. Gosu confirms that the object is the more specific subtype and considers it be the subtype within the `if` code block.

The following sample Gosu code shows a pattern for how to use a `typeis` expression with an `if` statement.

```
var variableName : TypeName           // Declare a variable as a high-level type.

if (variableName typeis SubtypeName) { // Downcast the variable to one of its subtypes.
    ...                               // Use the variable as its subtype without explicit casting.
}
```

The following sample Gosu code follows the pattern and declares a variable as an `Object`. The `if` condition downcasts the variable to its more specific subtype, `String`.

```
var x : Object = "nice" // Declare a String variable as type Object.
var strlen = 0

if (x typeis String) { // Downcast the Object variable to its subtype String.
    strlen = x.length // Use the variable as a String without explicit casting.
}
```

Because Gosu propagates the downcasting from the `if` condition into the `if` code block, the expression `x.length` is valid. The `length` property is on `String`, not `Object`.

The following sample Gosu code is equivalent to the preceding example, but it redundantly casts the variable as a `String` within the `if` code block.

```
var x : Object = "nice" // Declare a String variable as type Object.
var strlen = 0

if (x typeis String) { // Downcast the Object variable to its subtype String.
    strlen = (x as String).length // Explicit casting as String is redundant and unnecessary.
}
```

For general information, see “Basic Type Checking” on page 357 in the *Gosu Reference Guide*.

## Observe Loop Control Best Practices

Gosu provides `for()`, `while()`, and `do...while()` statements for loop control. Guidewire recommends a few best practices for your loop control logic.

### Implement Conditional Operators in Loop Conditions Correctly

As a best practice, Guidewire recommends that you verify the conditional operators in your conditional expressions to be certain that you fully satisfy the requirements for your loop control logic. For example, `<`, `>`, or `=` might need to be `<=`, `>=`, or `!=`.

### Interrupt Loop Execution as Early as Possible

As a best practice, Guidewire recommends that you interrupt loop execution as early as possible with `continue` or `break` commands.

#### Use ‘break’ to Break Out of Loop Iteration Altogether

The `break` command stops execution of the loop altogether, and program execution proceeds immediately to the code that follows the loop.

The following sample Gosu code breaks out of the loop altogether on the fourth iteration, when `i` equals 4.

```
for (i in 1..10) {
    if (i == 4) {
        break // Break out of the loop on the fourth iteration.
    }

    print("The number is " + i)
}

print("Stopped printing numbers")
```

The preceding sample Gosu code produces the following output.

```
The number is 1
The number is 2
The number is 3
Stopped printing numbers
```

Notice that the loop stops executing on the fourth iteration, when *i* equals 4.

### Use 'continue' to Continue Immediately with the Next Loop Iteration

The `continue` command stops execution of the current iteration, and the loop continues with its next iteration.

The following sample Gosu code interrupts the fourth iteration, when *i* equals 4, but the loop continues executing through all remaining iterations.

```
for (i in 1..10) {
  if (i == 4) {
    continue    // End the fourth iteration here.
  }

  print("The number is " + i)
}
```

The preceding sample code produces the following output.

```
The number is 1
The number is 2
The number is 3
The number is 5
The number is 6
The number is 7
The number is 8
The number is 9
The number is 10
```

Notice that the loop continues through all nine iterations, but it interrupts the fourth iteration, when *i* equals 4.

## Return from Functions as Early as Possible

As a best practice, Guidewire recommends that functions return as early as possible to avoid unnecessary processing.

The following sample Gosu code is inefficient. The function uses a variable unnecessarily, and it does not return a result as soon as it detects the affirmative condition.

```
public function foundThree() : boolean {
  var threeFound = 0          // A numeric variable is unnecessary to return a boolean result.

  for (x in 5) {
    if (x == 3) {
      threeFound = threeFound + 1  // The loop keeps iterating after third one is found.
    }
  }

  return threeFound >= 1      // The function returns long after third one is found.
}
```

The following modified sample code is more efficient. The function returns a result as soon as it detects the affirmative condition.

```
public function foundThree() : boolean {
  for (x in 5) {
    if (x == 3) {
      return true              // The function returns as soon as the third one is found.
    }
  }

  return false
}
```



## Use Query Builder APIs instead of Find Expressions in New Code

As a best practice, Guidewire recommends that you query the database by using the query builder APIs instead of find expressions in all new code. Guidewire developed the query builder APIs as an alternative way to more fully query the application database more fully than is possible with find expressions. For example, many requires joining tables to produce useful results. The query builder APIs provide a fuller set of features for joining tables than find expressions can specify. Furthermore, Gosu provides these enhanced capabilities using the structure of traditional API libraries rather than through a special language keyword.

For more information, see “Query Builder APIs” on page 125 in the *Gosu Reference Guide*.

## Gosu Performance Best Practices

The ways in which you write your Gosu code affects compile-time and run-time performance. As best practices for improving the performance of your code, Guidewire recommends that you always do the following:

- “Use the Fastest Technique for String Concatenation” on page 33
- “Consider the Order of Terms in Compound Expressions” on page 34
- “Avoid Repeated Method Calls Within an Algorithm” on page 34
- “Remove Constant Variables and Expressions from Loops” on page 35
- “Pull Up Multiple Performance Intensive Method Calls” on page 35
- “Be Wary of Dot Notation with Object Access Paths” on page 36
- “Avoid Code that Incidentally Queries the Database” on page 36
- “Use Comparison Methods to Filter Queries” on page 36
- “Use Count Properties on Query Builder Results and Find Queries” on page 37
- “Use Activity Pattern Codes Instead of Public IDs in Comparisons” on page 38
- “Do Not Instantiate Plugins for Every Execution” on page 38

## Use the Fastest Technique for String Concatenation

As a performance best practice, Guidewire recommends that your code perform string concatenation using the fastest technique for a given situation. If in doubt, concatenate strings by using a Java string builder.

| Concatenation technique                         | Performance  | Sample Gosu code  |
|---|--------------|---|
| Concatenation (+) on literals                   | Fastest      | <code>var aString = "Test" + " Test"</code>   |
| Gosu string template                            | Faster       | <code>var aString : String<br/>var anotherString : String = "Test"<br/>aString = "Test \${anotherString}"</code>          |
| Java string builder                             | Intermediate | <code>var aString = new java.lang.StringBuilder()<br/>aString.append("Test")<br/>aString.append(" Test")</code>           |
| Java string buffer                              | Moderate     | <code>var aString = new java.lang.StringBuffer()<br/>aString.append("Test")<br/>aString.append(" Test")</code>            |
| Concatenation (+) on a variable with a literal  | Slower       | <code>var aString : String = "Test"<br/>aString = aString + " Test"</code>  |
| Concatenation (+) on a variable with a variable | Slowest      | <code>var aString : String = "Test"<br/>var anotherString : String = " Test"<br/>aString = aString + anotherString</code> |

## Consider the Order of Terms in Compound Expressions

As a performance best practice, Guidewire recommends that you carefully consider the order of comparisons in compound expressions that use the `and` and `or` operators. Runtime evaluation of compound expressions that use `and` proceed from left to right until a condition fails. Runtime evaluation of compound expressions that use `or` proceed from left to right until a condition succeeds. The order in which you place individual conditions can improve or degrade evaluation performance of compound expressions.

### With `and` Expressions, Place Terms Likely to Fail Earlier

Whenever you use the `and` operator, place the condition that is most likely to fail or the least performance intensive earliest in the compound expression. Use the following formula to help you determine which condition to place first, based on the condition with the lowest value.

$$(100 - \text{failurePercentage}) * (\text{performanceCost})$$

For example, you have a condition that you expect to fail 99% of the time, with an estimated performance cost of 10,000 per evaluation. You have another condition that you expect to fail only 1% of the time, with an estimated performance cost of 100 per evaluation. According to the formula, place the second condition earliest because it has the lowest score.

$$\begin{aligned} (100 - 99) * 10,000 &= 10,000 \\ (100 - 1) * 100 &= \mathbf{9,999} \end{aligned}$$

You rarely have accurate figures for the failure percentages or performance costs of specific condition. Use the formula to develop an educated guess about which condition to place earliest. In general, give preference to less performance intensive condition. If the performance costs are roughly equal, give preference to condition with a higher percentage of likely failures.

### With `or` Expressions, Place Terms Likely to Pass Earlier

Whenever you use the `or` operator, place the condition that is most likely to succeed earliest in compound expressions.

## Avoid Repeated Method Calls Within an Algorithm

Calling a method repeatedly to obtain a value often results in poor performance. As a performance best practice, Guidewire recommends that you save the value from the first method call in a local variable. Then, use the local variable to repeatedly test the value.

The following sample Gosu code suffers a performance problem. It calls a performance intensive method twice to test which value the method returns.

```
if (policy.expensiveMethod() == "first possibility") { // first expensive call
    // do something
}

else if (policy.expensiveMethod() == "second possibility") { // second expensive call
    // do something else
}
```

The following modified sample code improves performance. It calls a performance intensive method once and saves the value in a local variable. It then uses the variable twice to test which value the method returns.

```
var expensiveValue = policy.expensiveMethod() // Save the value of an expensive call.

if (expensiveValue == "first possibility") { // first reference to expensive result
    // do something
}

else if (expensiveValue == "second possibility") { // second reference to expensive result
    // do something else
}
```

## Remove Constant Variables and Expressions from Loops

As a performance best practice, Guidewire recommends that you do not include unnecessary variables, especially ones that hold objects and entity instances, within loops.

The following sample Gosu code suffers a performance problem. The loop includes an object access expression, `period.Active`, which remains unchanged throughout all iterations of the loop.

```
var period : PolicyPeriod

for (x in 5) {
  if (x == 3 and period.Active) { // Evaluate a constant expression redundantly within a loop.
    print("x == 3 on active period")
  }
}
```

In the preceding example, Gosu evaluates the expression `period.Active` at least twice unnecessarily. The following modified sample code improves performance.

```
var period : PolicyPeriod

if (period.Active) { // Evaluate a constant expression only once before a loop.
  for (x in 5) {
    if (x == 3) {
      print("x == 3 on active period")
    }
  }
}
```

## Pull Up Multiple Performance Intensive Method Calls

As a performance best practice, Guidewire recommends a technique called *pulling up*. With the pulling up technique, you examine your existing code to uncover performance intensive method calls that occur in multiple, lower-level methods. If you identify such a method call, pull it up into the higher level-method, so you call it only once. Cache the result in a local variable. Then, call the lower-level methods, and pass the result that you cached down to the lower-level methods as a context variable.

The following sample Gosu code suffers a performance problem. It pushes an expensive method call down to the lower-level routines, so the code repeats the expensive call three times.

```
function computeSomething() { // Performance suffers with an expensive call pushed down.
  computeA()
  computeB()
  computeC()
}

function computeA() {
  var expensiveResult = expensiveCall() // Make the expensive call once.
  //do A stuff on expensiveResult
}

function computeB() {
  var expensiveResult = expensiveCall() // Make the same expensive call twice.
  //do B stuff on expensiveResult
}

function computeC() {
  var expensiveResult = expensiveCall() // Make the same expensive call three times.
  //do C stuff on expensiveResult
}
```

The following modified sample code improves performance. It pulls the expensive method call up to the main routine, which calls it once. Then, it passes the cached result down to the lower-level routines, as a context variable.

```
function computeSomething() { // Performance improves with an expensive call pulled up.
  var expensiveResult = expensiveCall() // Make the expensive call only once.

  computeA(expensiveResult)
  computeB(expensiveResult)
  computeC(expensiveResult)
}
```

```

}

function computeA(expensiveResult : ExpensiveResult) { // Use the pushed down result.
    //do A stuff on expensiveResult
}

function computeB(expensiveResult : ExpensiveResult) { // Use the pushed down result.
    //do B stuff on expensiveResult
}

function computeC(expensiveResult : ExpensiveResult) { // Use the pushed down result.
    //do C stuff on expensiveResult
}

```

## Be Wary of Dot Notation with Object Access Paths

As a performance best practice, Guidewire recommends that you be aware of the performance impact of dot notation to access instance arrays on object access paths. You can write an object access path quickly, but your code at runtime can run extremely slowly.

The following sample Gosu code suffers a performance problem. It acquires an array of addresses for all additional interests for all vehicles on the Personal Auto line of business.

```

var personalAutoLine = PersonalAutoLine
var personalAutoAddresses = personalAutoLine.Vehicles.AdditionalInterests.Addresses

```

Most likely this was not what the developer intended. Determine the most efficient means of acquiring just the data that you need. For example, rewrite the preceding example to use a query builder expression that fetches a more focused set of addresses from the application database.

For more general information, see “Query Builder APIs” on page 125 in the *Gosu Reference Guide*.

## Avoid Code that Incidentally Queries the Database

As a performance best practice, Guidewire recommends that you avoid object property access or method calls that potentially query the relational database.

### Accessing Entity Arrays Does Not Incidentally Query the Database

The following sample Gosu code accesses an array of `Vehicle` instances as entity array.

```

policyLine.Vehicles // Accessing an entity array does not query the database.

```

Accessing the entity array does not incidentally query the relational database. The application database caches them whenever it loads a parent entity from the relational database.

### Accessing Finder Arrays Incidentally Queries the Database

The following sample Gosu code accesses an array of `Policy` entities by using a `Finder` method on a `Policy` instance.

```

policy.Finder.findLocalPoliciesForAccount(account) // Accessing a finder array queries the database.

```

Calling a `Finder` method does incidentally query the relational database. However, the application database does not cache finder arrays. Only your code keeps the array in memory.

To avoid repeated, redundant calls that incidentally query the database, Guidewire recommends as a best practice that you cache the results once in a local array variable. Then, pass the local array variable to lower level routines to operate on the same results. This design approach is an example of *pulling up*. For more information, see “Pull Up Multiple Performance Intensive Method Calls” on page 35.

## Use Comparison Methods to Filter Queries

The relational database that supports ClaimCenter filters the results of a query much more efficiently than your own Gosu code, because it avoids loading unnecessary data into the application server. As a performance best

practice, Guidewire recommends that you filter your queries with comparisons methods rather than filter the results with your own code.

The following sample Gosu code suffers a performance problem. It inadvertently loads most of the claims, along with their policies, from the relational database. Then, the code iterates the loaded claims and their policies and process only those few that match a specific policy. In other words, the code loads an excessive amount of data unnecessarily and takes an excessive amount of time to search for a few instances to process.

```
var targetPolicy : Policy
var claimQuery = Query.make(Claim) // Performance suffers because the query loads all claims.

for (claim in claimQuery.select()) {
    if (claim.Policy == targetPolicy) { // Local Gosu code filters claims.
        // Do something on claims of targeted policies.
        ...
    }
}
```

The following modified sample Gosu code improves performance. It finds only relevant policies to process with the compare method:

```
var targetPolicy : Policy
var claimQuery = Query.make(Claim) // Performance improves because the query loads few claims.

claimQuery.compare("policy", Equals, targetPolicy) // Query comparison method filters claims.

for (claim.Policy in query.select()) {
    // Do something on claims of targeted policies.
}
```

## Use Count Properties on Query Builder Results and Find Queries

As a performance best practice, Guidewire recommends that you obtain counts of items fetched from the application database by using the Count properties on query builder result objects. The same recommendation applies to find expression query objects. Do *not* iterate result or query objects to obtain a count.

---

**IMPORTANT** Guidewire recommends the query builder APIs instead of find expressions to fetch items from the application database whenever possible, especially for new code. For more information, see “Query Builder APIs” on page 125 in the *Gosu Reference Guide*.

---

### Use Count Properties If You Want the Number Found

The following sample Gosu code uses the Count property on a query builder API result object.

```
uses gw.api.database.Query

var claimQuery = Query.make(Claim) // Find all claims.
var result = claimQuery.select()
print("Number of claims: " + result.Count)
```

The following sample Gosu code uses the Count property on a find expression query object.

```
var claimQuery = find(c in Claim) // Find all claims.
print("Number of claims: " + claimQuery.Count)
```

### Use Empty Properties If You Want to Know whether Anything Was Found

If you want to know only whether a result or query object fetched anything from the application database, use the Empty property instead of the Count property. The value of the Empty property returns to your Gosu code faster, because the evaluation stops as soon as it counts at least one fetched item. In contrast, the value of the Count property returns to your Gosu only after counting all fetched items.

The following sample Gosu code uses the Count property on a query builder API result object.

```
uses gw.api.database.Query

var claimQuery = Query.make(Claim) // Find all claims.
var result = claimQuery.select()
```

```

if (result.Empty) { // Does the result contain anything?
    print ("Nothing found.")
}
else {
    print ("Got some!")
}

```

The following sample Gosu code uses the Count property on a find expression query object.

```

var claimQuery = find(c in Claim) // Find all claims.

if (claimQuery.Empty) { // Did the query fetch anything?
    print ("Nothing found.")
}
else {
    print ("Got some!")
}

```

## Use Activity Pattern Codes Instead of Public IDs in Comparisons

As a performance best practice, Guidewire recommends that you always use activity pattern codes (Activity.Pattern.Code) in comparison expressions for conditional processing and in queries. Comparisons of activity patterns by codes frequently avoid database reads to evaluate the expression.

The following sample Gosu code suffers a performance problem. The comparison with Activity.Pattern by public ID cc:12345 always requires a database read to evaluate the expression.

```

if (Activity.ActivityPattern == ActivityPattern("cc:12345")) { // Comparisons of activity pattern
                                                                // public IDs always require a
                                                                // database read.
}

```

The following sample Gosu code improves performance by comparing Activity.Pattern.Code with an activity pattern code in the conditional expression.

```

if (Activity.ActivityPattern.Code == "MyActivityPatternCode") { // Comparisons of activity pattern
                                                                // codes generally avoid a
                                                                // database read.
    ...
}

```

Never localize activity pattern codes. These codes are intended for use in Gosu expressions, not for display in error messages of the application user interface.

### See also

See “Localized Columns in Entities” on page 49 in the *Globalization Guide* to learn how to add a column of localized pattern codes to the ActivityPattern entity type.

## Do Not Instantiate Plugins for Every Execution

As a performance best practice, Guidewire recommends that you do *not* instantiate plugins for every execution of code that needs to call them. Plugins are reusable classes that you can instantiate once within application scope and reuse if needed.

The following sample Gosu code suffers a potential performance problem. It instantiates a plugin within local scope, so the plugin must initialize itself for every execution of the code that calls it.

```

var XPRPlugin = new com.acme.pc.webservices.plugin.VehiclePlugin() // low performance

```

The following modified sample code improves performance. It instantiates the plugin within application scope, so the plugin must initialize itself only once, regardless of the number of executions of code that call it.

```

static var XPRPlugin = new com.acme.pc.webservices.plugin.VehiclePlugin() // higher performance

```

The following modified sample code improves performance even more.

```

var XPRPlugin = new com.acme.pc.webservices.plugin.VehiclePlugin()
gw.api.web.Scopes.getApplication().put("XPRPlugin", XPRPlugin) // highest performance

```

## Gosu Best Practices Checklist

Use the following checklist before you complete your Gosu coding tasks to assure your Gosu code follows Guidewire best practices.

| Best Practice to Follow  | Best Practice Followed   |
|--|--------------------------|
| "Observe General Gosu Naming Conventions" on page 24                         | <input type="checkbox"/> |
| "Omit Type Specifications with Variable Initialization" on page 24           | <input type="checkbox"/> |
| "Add a Suffix to Functions and Classes to Avoid Name Conflicts" on page 24   | <input type="checkbox"/> |
| "Declare Functions Private Unless Absolutely Necessary" on page 24           | <input type="checkbox"/> |
| "Use Public Properties Instead of Public Variables" on page 24               | <input type="checkbox"/> |
| "Do Not Declare Static Scope for Mutable Variables" on page 25               | <input type="checkbox"/> |
| "Use Extensions to Add Functions to Entities" on page 25                     | <input type="checkbox"/> |
| "Gosu Commenting Best Practices" on page 26                                  | <input type="checkbox"/> |
| "Use Whitespace Effectively" on page 27                                      | <input type="checkbox"/> |
| "Use Parentheses Effectively" on page 28                                     | <input type="checkbox"/> |
| "Use Curly Braces Effectively" on page 28                                    | <input type="checkbox"/> |
| "Program Defensively Against Conditions that Can Fail" on page 28            | <input type="checkbox"/> |
| "Omit Semicolons as Statement Delimiters" on page 29                         | <input type="checkbox"/> |
| "Use != Instead of <> as the Inequality Operator" on page 30                 | <input type="checkbox"/> |
| "Observe Null Safety with Equality Operators" on page 30                     | <input type="checkbox"/> |
| "Use typeis Expressions for Automatic Downcasting" on page 30                | <input type="checkbox"/> |
| "Rewrite Comparison Operators to Avoid the Equals Method" on page 30         | <input type="checkbox"/> |
| "Avoid Implicit Type Coercion with Comparison Operators" on page 30          | <input type="checkbox"/> |
| "Implement Conditional Operators in Loop Conditions Correctly" on page 31    | <input type="checkbox"/> |
| "Interrupt Loop Execution as Early as Possible" on page 31                   | <input type="checkbox"/> |
| "Return from Functions as Early as Possible" on page 32                      | <input type="checkbox"/> |
| "Match Capitalization of Types, Keywords, and Symbols" on page 25            | <input type="checkbox"/> |
| "Use Query Builder APIs instead of Find Expressions in New Code" on page 33  | <input type="checkbox"/> |
| "Use the Fastest Technique for String Concatenation" on page 33              | <input type="checkbox"/> |
| "Consider the Order of Terms in Compound Expressions" on page 34             | <input type="checkbox"/> |
| "Avoid Repeated Method Calls Within an Algorithm" on page 34                 | <input type="checkbox"/> |
| "Remove Constant Variables and Expressions from Loops" on page 35            | <input type="checkbox"/> |
| "Pull Up Multiple Performance Intensive Method Calls" on page 35             | <input type="checkbox"/> |
| "Be Wary of Dot Notation with Object Access Paths" on page 36                | <input type="checkbox"/> |
| "Avoid Code that Incidentally Queries the Database" on page 36               | <input type="checkbox"/> |
| "Use Comparison Methods to Filter Queries" on page 36                        | <input type="checkbox"/> |
| "Use Count Properties on Query Builder Results and Find Queries" on page 37  | <input type="checkbox"/> |
| "Use Activity Pattern Codes Instead of Public IDs in Comparisons" on page 38 | <input type="checkbox"/> |
| "Do Not Instantiate Plugins for Every Execution" on page 38                  | <input type="checkbox"/> |

