# Infor LN Extensions Development Guide

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# About this guide

This guide describes the Extensibility features of Infor ES 10.5.1. To be able to use all features you must at least apply KB 1860730.

# Intended audience

This guide is intended for IT professionals working in implementation projects or IT optimization phases for Infor LN. Basic knowledge about the Infor LN software structure and Infor LN's 4GL programming language is a pre-requisite.

# Related documents

You can find the documents in the product documentation section of the Infor Xtreme Support portal, as described in "Contacting Infor" on page 12.

- *Infor ES Programmer's Guide*
- *Infor LN Studio Application Development Guide*
- *Infor LN Studio Integration Development Guide*
- *Infor LN Document Output Management User Guide*
- *Infor Ming.le-LN Plug-in User Guide (LN UI)*
- *Infor Enterprise Server Connector for Infor Reporting Development Guide*
- *Infor LN Development Tools Development Guide*
- *Infor Enterprise Server Administration Guide*

# Contacting Infor

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# Chapter 1 Introduction

1

The main goal of extensibility is to develop the last-mile functionality for your organization without changing the core standard software components and using only the public interfaces of the standard application. In this way you can develop the extensions completely separate from the standard components. This leads to a situation that upgrading the standard software does not result in additional costs for upgrading customizations. Extensions “survive” the upgrades.

This table shows the types of extensibility in Infor LN:

| Type | Features | Tool |
|---|---|---|
| Personalize | Hide/unhide fields, add customer-defined fields, conditional coloring, personalize menus and forms, suppress dialog boxes / messages, set defaults | LN standard (via User Interface) |
| Tailor | Add fields and logic to existing forms / BODs / web services; add field hooks and commands to existing tables and forms; add secondary table to existing forms; add customer defined fields to existing IR push reports[1] | LN Extension Modeler |
| Extend | Create new tables, domains, labels, screens, sessions, modules, libraries, messages, etc. | LN Studio |
| Integrate | Create new BODs and web services, and call SOAP web services from extensions | LN Studio |

Chapter 2 gives an overview of the personalization features of Infor LN. Those features are not described in detail, but references are made to other guides and online help where you can find more information.

Tailoring is adding functionality to existing components. Tailoring includes the concept of Customer Defined Fields (CDFs). Those fields can be added to tables, screens, reports and BODs and validation and calculation logic can be defined around those fields. A detailed description of CDFs on table level is given in Chapter 3.

How to add the logic around CDFs and how to change the behavior of components with the Extension Modeler is described in Chapter 4 to Chapter Chapter 9.

[1] Not all features are available in Infor LN 10.5.1.

Chapter 10 describes how to debug your extensions.

Chapter 11 is about the creation of new components and even completely new modules within your Infor LN application. The development of new components is done in Infor LN Studio. These guides are available for LN Studio:

- *Infor LN Studio Application Development Guide*
- *Infor LN Studio Integration Development Guide.*

Chapter 11 only describes the topics that are relevant for developing extensions and specific configurations.

The development of extensions that are not impacted by upgrades, and do not impact the upgrades, requires a set of rules and mechanisms to guarantee this. In a cloud environment additional governors are in place to protect the system infrastructure against harmful behavior of extensions, by which the infrastructure may be at risk or other customers using the same cloud environment are negatively affected. Chapter 12 describes those mechanisms.

In Chapter 13 the deployment of extensions is described. Extensions can be developed in one environment, exported, and imported in another environment.

# Supported LN versions

The extensibility concept is available with LN 10.5 or later, and with some limitations[*)] it is also available for LN 10.3 and 10.4.x if Enterprise Server 10.5 (Tools) is installed.

[*)] Limitations extensibility in 10.3 and 10.4.x:

- Report extensibility: Native LN reports must be copied to own VRC, TIV-number must be increased to at least 2020 and the report must be recompiled.
- Session extensibility: (Easy) filtering on additional form fields is not possible.
- BOD extensibility: The BODs must be on 10.5 level to be able to extend them. Check KB 22945150. The related KBs with “Extension Modeler” in the description are the ones that must be applied.

# Licensing

To use the Extensibility features of LN the development license (product ID 10146) is required.

# Chapter 2 Personalization

2

With the personalization features you change more the look and feel of the application. With the extension features that are described later in this document you add functionality to the application.

An overview is given of the personalization possibilities. We want to prevent that you choose to build an extension to achieve a process improvement, which also can be reached by a personalization. On the other hand, applying some personalizations can be necessary to complete the required functionality, which was built with an extension. For example, an extension can add additional fields to a session, but the personalization features are required to position those fields at the desired location in the screen.

The features are not described in detail. For more information, see the *Infor Ming.le-LN Plug-in User Guide (LN UI)*.

## Features

This table shows the personalization features in Infor LN:

| Feature | Description |
|---|---|
| Conditional formatting | Rows and fields can be formatted based on certain conditions. |
| Field location | Fields can be moved to another location within the screen. |
| (Un)hide fields | Fields can be (un)hidden. Unhiding of fields applies to fields that are already present in the session's form (but hidden), but also the other fields of the main table of the session, which are not yet in the form. |
| Mandatory field | Fields can be made mandatory. If a field should be conditionally mandatory, you can achieve that with an extension. |
| Read-only field | Fields can be made read-only. If a field should be conditionally read-only, you can achieve that with an extension. |
| Label change | Field prompts can be changed to make those more clear for the user. |

| | |
|---|---|
| Color change | Fields and field prompts can be colored differently. |
| Size change | Fields and field prompts can get a larger size. |
| Saved filters | Filters can be saved and one can be set as default. |
| Toolbar modification | Buttons in the toolbar can be removed, the order can be changed, specific commands can be added with a custom icon. |
| Menu modification | Menu items in forms can be hidden and the default action for the icon can be selected. |
| Saving defaults | Values filled on dialog boxes (for example selection criteria and options) can be saved. Next time the dialog box pops up, the fields are filled with those values. |
| Quick flow | Once defaults are saved for a dialog box, it can be suppressed. |
| Export to Excel | The set of fields to be included in the Export to Excel can be specified and is retained. |
| Suppress Messages | Message boxes (with OK button) can be suppressed. |
| Suppress Questions | Questions (with other buttons than OK button) can be suppressed; the user defines his default answer. |
| Menu structure | (Un)hide options in the menus. |

# Chapter 3 Customer Defined Fields

3

Use the Customer Defined Fields (CDF) concept to store additional data in the standard Infor LN tables. The CDF definitions are stored separately from the table definitions in the Data Dictionary. For the end user, the CDFs behave in the same way as the standard fields, provided that defaulting, validations, etc. are built using the CDF logic of the table extension point. See Customer defined field logic for more information.

CDFs are configured per package combination. This implies that when you want to move your companies from one package combination to another, you must also have the CDF definitions in the target package combination, otherwise you lose the data in the CDFs. Use the Export Customer Defined Fields (ttadv4291m000) and Import Customer Defined Fields (ttadv4292m000) sessions to copy CDF definitions from one package combination to another. You can also use those sessions to export CDF definitions from one environment (development) to another one (test, production).

## CDF types

CDFs can be defined with standard domains, or your own domains that you can create with LN Studio. If you don't use a standard or own domain, the CDFs are added to the table with an implicit domain that is dependent on the data type. This table shows the supported data types:

| Data Type | Remark | Domain |
|---|---|---|
| String | Multibyte string, length between 1 and 999; default length is 30 | <pk>cdf___str<nnn> (3 underscores)<br><pk>cdf_____str (6 underscores) for CDFs without length specified |
| Integer | Integer number (long) | <pk>cdf_____int (6 underscores) |
| Numeric | Numeric number (double) | <pk>cdf_____num (6 underscores) |
| Date | Date/Time, local time on screen, stored as UTC | <pk>cdf_____dat (6 underscores) |

| | | |
|---|---|---|
| Checkbox | true or false | <pk>cdf_____chk (6 underscores) |
| List | A predefined list of choices | <pk>cdf_lst<list> (1 underscore) |

Explanation for the domain codes:

- <pk> the package code of the table to which the CDF is added
- <nnn> length of the string
- <list> list code that holds the predefined list of choices

The domain codes may be required during the development of the extensions with the Extension Modeler. See chapter Chapter 4 and subsequent chapters.

You can also add calculated CDFs; those are not physically stored in the table, but calculated based on other table fields and presented in the UI. This type of CDF is deprecated. We recommend that you use the Calculated Field extension type of the session extension point; see Calculated Field.

# Configuration

The sessions to define CDFs are available in the **Tools** menu, under **Application Configuration**.

To configure customer defined fields:

1. Start the Customer Defined Fields Parameters (ttadv4590m000) session. Select **CDF Active** and click **OK**.
2. Define customer defined fields in one of these ways:
   - Use the **Customer Defined Fields** option in the **Settings** (gear icon) menu in a session you started in LN UI.
   - Use the Customer Defined Fields (ttadv4591m000) session.

     To create customer defined fields of type ‘List’, specify the lists and their constants in the Lists (ttadv4592m000) and List Constants (ttadv4593m000) sessions.
3. In the Customer Defined Fields (ttadv4591m000) session, click **Actions** and select **Convert to Runtime.** The Convert to Runtime Data Dictionary (ttadv5215m000) session starts. Convert the customer defined fields and the related implicit domains to the runtime data dictionary.

# Limitations

- You cannot define customer defined fields for tables within Tools (the tl and tt packages).
- External integrations, such as Infor Integration, EDI, Office Integration, and SOA-based integration, do not support customer defined fields.

- You can use customer defined fields within 4GL reports, as far as editing the 4GL report layouts is still supported in your environment. For external reporting, only Infor Reporting and Microsoft Reporting (SSRS) support customer defined fields.
- Customer defined fields cannot store application data in multiple data languages.
- There is no direct limitation on the number of CDFs in a table. However, the actual number of fields in a table and the total length of all fields may be limited by the RDBMS you use.
- Only super users are allowed to run the Convert to Runtime Data Dictionary (ttadv5215m000) session to convert the customer defined fields and the related domains to the runtime data dictionary.

**Note:** The full functionality of customer defined fields is only available within Web UI and LN UI. Customer defined fields are not displayed in the classic Infor LN BW UI.

# Chapter 4 Extension Modeler

4

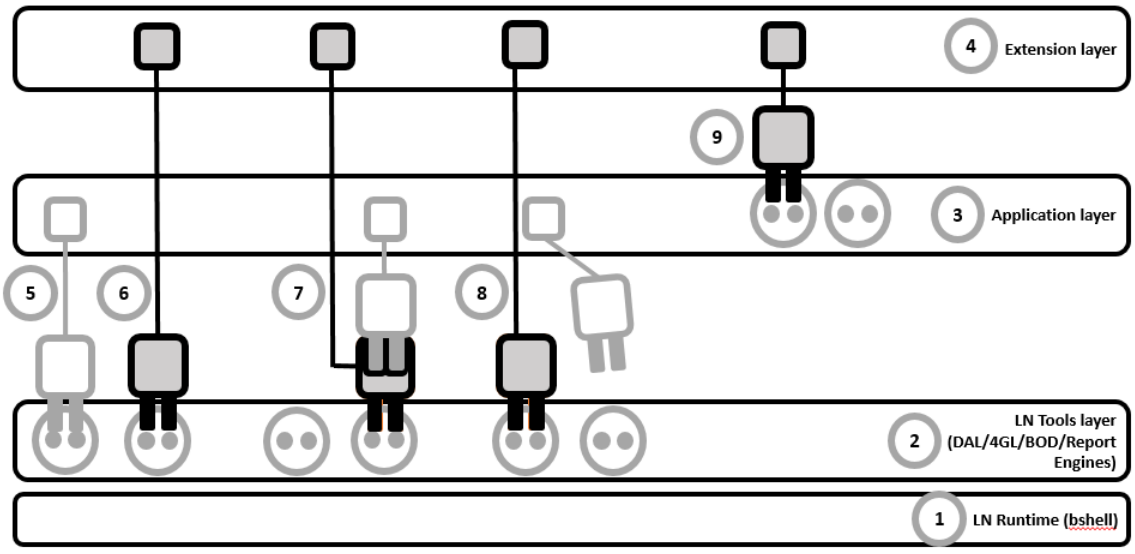
Use the Infor LN Extension Modeler to tailor standard components. Infor LN 10.5 contains these extension points:

- Table
- Session
- Report
- BOD
- Menu

In the Extension Modeler you can set properties and hooks for those components. The implementation of the extension point for one component is called an extension. With an extension built for an extension point you change the behavior of a component. For example, by creating an extension for a session you can add additional fields to that session.

LN's extensibility is built upon LN's pluggable architecture. The standard application components of LN are plugged into the sockets of the runtime layers, which perform all common tasks, such as database access, screen handling, etc. Extensions can be seen as additional plugs into the runtime layers; in some cases, an extension can also handle as an adapter.

This diagram shows this architecture:



1. The LN Runtime layer (bshell) runs the LN programs and handles all RDBMS and operating system actions.
2. The LN Tools layer is responsible for all common tasks regarding tables, screens, reports and BODs. This layer has a number of sockets where the Application layer can plug-in with properties and hooks into to perform the specific application functionality. For the Extension layer additional sockets are available in the Tools layer.
3. The Application layer has a set of standard components that have properties and pieces of code in them to let the different engines (DAL / 4GL / BOD / Report) produce the desired behavior or results.
4. The Extension layer has a set of components with properties and pieces of code to let the different engines (DAL / 4GL / BOD / Report) produce the different behavior or results.
5. The standard Application layer has coded actions that must be performed on a certain event. Those actions are plugged into the socket which is meant for this event. So, those actions are executed by one of the tools engines when that event occurs. Examples:
    a. When a record is updated in a table, also another table must be updated. For example, when the quantity is changed in a sales order line, the inventory allocation also must be updated. In this case the DAL application component has an `after.save.object()` hook to perform the update for the inventory allocation.
    b. When a report is printed, for each detail line also a percentage must be calculated and printed. The report script has a `before.field` hook to calculate the percentage.
6. The Tools layer has also specific sockets for the Extension layer. The plug is created by adding an extension in the Extension Modeler. Examples:
    a. An overview session must show some additional fields (directly from database or a complex calculation). For example, for business partners the number of open purchase orders should be displayed. This field, with the code to calculate the value, must be added in the session extension.
    b. An Infor Reporting report needs to print sub-details. Those sub-details must be added to the XML data source by adding additional rows. This is done in the report extension with the `write.row()` hook.
7. Next to the specific sockets for the extensions, extensions can also act as an adapter. In this case the standard plug is adapted. For example, there is a standard plug that does specific actions when a record is saved, for example an update on the inventory allocation when a sales order line is inserted. The extension plug can do some additional actions, for example inserting data in an own table. Adapters can never bypass the standard behavior.
8. It is also possible that the extension removes a standard plug and connects its own plug to the socket. For example, some form commands of a session can be removed, and other form commands can be added.

9 Another concept of extensibility is that the standard application itself has sockets. Functionality that had to be customized very often in the past, can be influenced by plugging in some own pieces of code[2]. Examples:

   a For export control you use your own application. This application exposes a web service to check whether shipment of an item to a certain country is allowed. In the application extension you can call the web service; if shipping is not allowed, the application blocks the shipment.

   b You want to change the compose invoices algorithm: items that have a different value in a specific customer defined field, should not be combined in one invoice. In the application extension you can check whether the CDF has a different value and if so, inform the standard application that this line cannot be added to the invoice, so it must be on a separate one.

   c Infor LN's Document Output Management has a lot of flexibility. However, it may be that you need an output channel that is not supported in the standard application. In the application extension you can add your own output channel.

You can find the Extensibility sessions in the **Tools** menu under **Application Extensibility**.

# Cloud readiness

We recommend that you build your extensions in a way that they are ready for the cloud. Although you may not consider to make that move with LN on short term, you save a lot of effort in migrating your extensions at the moment you decide to move.

In general, cloud readiness is related to these topics:

- Upgradability.

  Upgrades to new versions should not be impeded by the presence of extensions. This applies both to efforts required to upgrade extensions and the possibility that extensions may break the upgrade itself.

- Stability and performance.

  Extensions may not impact the infrastructure in such a way that other customers within the cloud environment are experiencing adverse effects.

- Security.

  It should not be possible that extensions have access to information of the infrastructure that is a security risk.

[2] The concept of application sockets is not widely implemented in LN 10.5. The Document Output Management example (under c) is available. See *Infor LN Document Output Management User Guide* for more information about custom plug-ins in Document Output Management.

Chapter 12 describes the mechanisms that are built in LN's Extensibility layer to govern the extensions.

# Getting started with extensions

To get started with extensions:

1 Start the Initialize Extensibility (ttext0200m000) session. If your current package combination already has the Extensions (tx) package, this package VRC is displayed and cannot be changed. If your current package combination does not have the Extensions package, you can use the default VRC (B61O_a_ext) or choose your own naming for the VRC. It is not allowed to choose an existing VRC, which is already used in another package combination, so all package combinations need a different VRC for the Extensions (tx) package.

   **Note**: Developing extensions always applies to the current package combination. There is no inheritance via a VRC-derivation structure.

2 To use SCM (Software Configuration Management, see the *Infor LN Studio Application Development Guide* for more information), select **Use SCM** and specify a Development VRC to be created. The **Use SCM** option is only available if your LN server is prepared for using SCM.

   **Note**: Activating SCM is not required to keep the revisions of your extensions. History of extensions is always available and restoring of old revisions is also possible; see Extension history. However, if you use SCM, you can isolate checked-out changes from other extension developers when you share development activities.

3 Click **Initialize**. Close the session.

4 Restart your LN environment via **Restart** in the **Options** menu.

5 By default, your Extensibility environment is setup with the **Extensions Ready for Cloud** setting. See Cloud readiness. If you are not running LN in a cloud environment, you can switch off this setting: Start the Extensibility Parameters (ttext0100m000) session. Unselect **Extensions Ready for Cloud** and click **Save**.

6 Start the Extensions (ttext1500m000) session. Now you can create extensions. See Extension development procedure for the procedure how to create the extensions.

# Extension development procedure

For the development of extensions, you must set a current activity. An activity groups the different extensions, which you must create for a functional unit. Multiple developers can work in the same activity. For more information about activity based development, see the *Infor LN Studio Application Development Guide.*

## Current activity

To set a current activity:

1. Start the Extensions (ttext1500m000) session. Click **Actions** and select **Select Current Activity**. Note that the screen to select a current activity is always displayed if you have not yet selected a current activity and the action you want to do needs one.
2. Select the activity and click **OK**. If your activity is not in the list and or you want to create a new activity, continue with the next step; otherwise you are ready with this procedure and you can start to build an extension.
3. To create a new activity, click **New**.
4. Specify at least **Activity Name**. The other fields are optional. **Activity Documentation** is used as default revision text during check-in of extensions.
5. Click **Save changes and exit**.
6. Click **OK**.

## Building an extension

To build an extension:

1. Start the Extensions (ttext1500m000) session and click **New**.
2. Select the **Extension Point** and specify the **Component Name**. Accept the proposed default in **Library** or specify your own Library code. Note that the package (tx) and the proposed module (esb, esm, esr, ess, est; see Extension scripts) cannot be changed. Click **Save changes and Exit**.
3. Select the Extension. Click **Actions** and select **Check-Out**.
4. Click **Extension Modeler**.
5. In the Extension Modeler specify the **Properties** on component level, if applicable.
6. To implement a hook, right-click the hook and select **Add Implementation** or double-click the hook.
7. Click **Add** to add other extension types for the extension and fill the properties and hooks for those levels.
8. **Note**: The extension types, hooks and properties depend on the extension point to build an extension for. Click **Save** to save the extension. The extension script is automatically generated during save. Compilation problems may be displayed in the Problems view. Solve those problems and click **Save** again.

   **Note**: If a compilation problem must be solved in another component (for example a library which you created with LN Studio), click **Generate and Compile** after changing that other component.
9. Test the extension by starting the session(s) that would reach the extension functionality. For testing a BOD extension, we recommend that you run the relevant BOD publishing session in

simulation mode. Those sessions can be found in the **Common** menu under **BOD Messaging > Publish BODs**.

10 Close the Extension Modeler.

11 Click **Actions** and select **Check-In**. Accept the default revision text or type your own text and click **Save changes and exit**.

Before you checked-in the extension, the new extension or the new version of the extension was only available for you. After check-in the most recent version of the extension is available to all users who set their activity context to your activity.

12 Click **Actions** and select **Commit**. Now the (new version of the) extension is available to all users.

## Activity context

At the moment you start the Extensions (ttext1500m000) session, the activity context is automatically set to your current activity. The activity context is changed when you select another current activity. After the activity context is set, the sessions that are started, run within this context. This means that the sessions include the functionality that is added in the extensions.

You can also set activity context via **Options** and **Debug and Profile 4GL**.

As soon as the extensions are committed, the sessions include the extension functionality without the need to set the activity context.

Hint: To ensure your session runs in the correct activity context, we recommend that you add the activity to the title that is used for the session tab in LN UI. To achieve this:

1 Select **Options > Settings** and select your current profile.

2 Add **–set BAAN_WIN_TITLE="%S-%a** to the **Command** field in your User Profile Details. The **%a** shows the activity context; the result is, for example, Item Defaults-act0001.

# Extension scripts

For each extension, an extension script is generated. This extension script contains the hooks which are programmed in the Extension Modeler and also other generated functions, which are called by the different tools engines to do the required actions of the extension. Those extension scripts are DLLs (libraries), which are stored in the Extension package (tx).

This table shows the modules within the tx-package that are reserved for extension scripts:

| Module | Description |
|---|---|
| esb | Extension Scripts for BODs |

| | |
|---|---|
| esm | Extension Scripts for Menus |
| esr | Extension Scripts for Reports |
| ess | Extension Scripts for Sessions |
| est | Extension Scripts for Tables |

Note that all module codes starting with “es” are reserved for future use.

Extension scripts are visible in Infor LN Studio and also can be debugged using LN Studio (see Chapter 10). We do not recommend that you make changes in the generated scripts. The changes are lost after a change of the extension in the Extension Modeler.

# Extension history

History of extensions is kept in the extension history table.

To view the history:

1 Start the Extensions (ttext1500m000) session.

2 Click **References** and select **History**.

History has two levels:

- Activity level
- Extension level

The activity level history is updated each time an extension is checked-in; the revision of the extension is stored in the history. The extension level history is updated each time an extension is committed or imported into the environment. Note that during commit of an extension, the activity revisions are removed. The revision text of the last revision within the activity is used to create the revision on extension level.

# Activation and deactivation

After developing and committing an extension, the extension is active. In the Extensions (ttext1500m000) session, click **Actions** and select **Deactivate** to deactivate the extension. The extension component itself remains the in the system, but the functions of the generated extension script are not executed anymore by the tools engines. You can use this deactivation to check whether problems with the system are caused by your extension or by the standard software.

Click **Actions** and select **Activate** to activate the extension again.

**Note**:

- Restarting your sessions can be required to see the result of (de)activation.

- During import of extensions deactivated extensions always remain deactivated. Active extensions can be deactivated during import if the extension is not active in the file being imported. See Chapter 13.

# Chapter 5 Table extension point

5

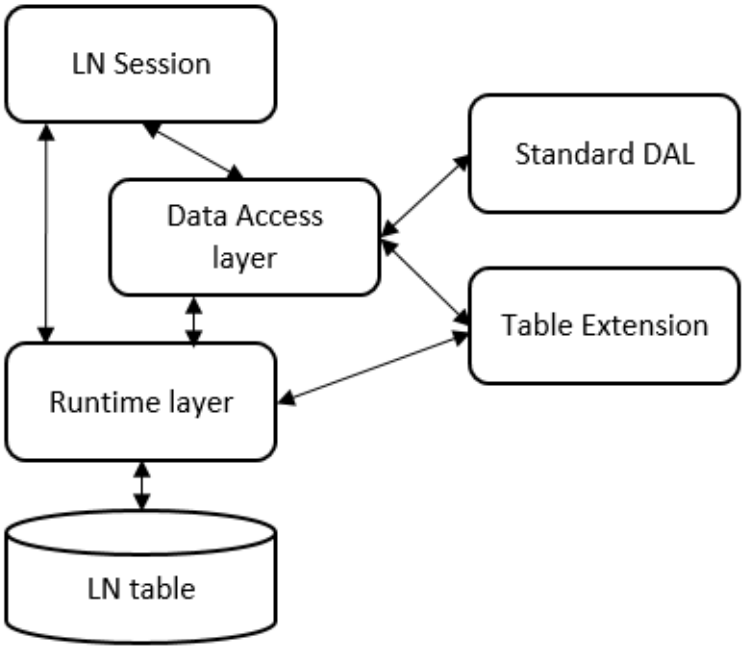
A table extension is used to react on the table events insert, update and delete for standard Infor LN tables. You can also control whether those actions on the table are allowed. For CDFs, you can set defaults, add validations, etc. For standard fields you can also add validations, etc.

Examples:

- When an Item is added to or updated in the Item table, you want to update a CDF that holds the last modification date.
- Make a CDF a mandatory field if the Item is of a certain type.
- Block the adding of new Sales Order Lines for a Sales Order when a CDF on Sales Order level has a certain value.
- Do additional validation on a standard field.

Actually a table extension is an extension to the Data Access Layer (DAL) of the table, although for the table itself no DAL has to be implemented. See the DAL chapters and functions in the *Infor ES Programmer's Guide* for background on hooks, validations, setting error messages, return values, etc.

This diagram shows the position of the table extension:




LN sessions manipulate data in the LN tables. The hooks of the table extension are executed both from the data access layer and the runtime layer. The latter happens in the case the data access layer has not been implemented or is bypassed (for performance reasons) for certain LN tables. So, the table extension is applied regardless of the techniques used in the standard application.

For the table extension point there are three extension types:

1. Table
2. Customer defined field logic
3. Standard field logic

# Table

With the hooks defined for the extension type Table, you can react on events that occur on table level. This table shows the available hooks:

| Name | Signature |
|---|---|
| Declarations | |
| Functions | |
| Before Open Object Set | long before.open.object.set() |

| | |
|---|---|
| Set Object Defaults | long set.object.defaults() |
| Method is Allowed | boolean method.is.allowed(long method) |
| Before Save | long before.save.object(long mode) |
| After Save | long after.save.object(long mode) |
| Before Destroy | long before.destroy.object() |
| After Destroy | long after.destroy.object() |

## Declarations hook

Use this hook to declare tables and variables that must be globally available in all hooks of the extension. Also the references to include files and DLLs that are used by the extension must be coded in this hook with #include and #pragma.

Example:

```
#include        <bic_text>

        table   tccom100          |* Business Partners

        domain  tcnama  old.nama
                string  date.string(14)
                boolean retb

#pragma used dll "otxprcdll0001"
```

## Functions hook

Use this hook to code (common) functions to use in the other hooks of the table extension. This helps you in reusing code and to keep the other hooks small and clear.

Functions that are called via `with.old.object.values.do()` and `with.object.set.do()` in the other hooks of the extension must be coded in this hook.

Example:

```
function get.old.nama()
{
        old.nama = tccom100.nama
}

function string format.date(long i.date)
{
        return(utc.to.iso(i.date, UTC_ISO_DIFF))
}
```

## Before Open Object Set hook

Use this hook to initialize variables for this extension. You can also use this hook to disallow access to the table.

For more information, see `before.open.object.set()`of the standard Data Access Layer in the *Infor ES Programmer's Guide*. Note that the possibility of extending the query is not supported in the extension.

Example:

```
function extern long before.open.object.set()
{
        if txprcdll0001.pricebooks.blocked() then
                dal.set.error.message("@Pricebooks blocked for maintenance")
                return(DALHOOKERROR)
        endif
        return(0)
}
```

## Set Object Defaults hook

Use this hook to set default values for CDFs.

Example:

```
function extern long set.object.defaults()
{
        tcmcs004.cdf_date = utc.num()
        return(0)
}
```

# Method is Allowed hook

Use this hook to control whether new records can be inserted, existing records can be updated or deleted.

The input argument for this hook is the method. Method can have these values:

| Method | Description |
|---|---|
| DAL_NEW | The hook is called to know whether records can be added. There is no current record, but in case of a session with a view, the view fields are available. |
| DAL_UPDATE | The hook is called to know whether the current record can be updated. |
| DAL_DESTROY | The hook is called to know whether the current record can be deleted. |

For more information, see `method.is.allowed()` of the standard Data Access Layer in the *Infor ES Programmer's Guide*. Note that this hook can only be used to set more restrictions. If the standard functionality does not allow a certain action, it is not possible to allow it from the extension.

Example:

```
function extern boolean method.is.allowed(long method)
{
        on case method
        case DAL_NEW:
              select  tdsls400.cdf_blck
              from    tdsls400
              where   tdsls400.orno = :tdsls401.orno
              as set with 1 rows
              selectdo
                   if tdsls400.cdf_blck = tdcdf_____chk.yes then
                          dal.set.error.message(
                            "@Order is blocked, you cannot add Lines to it.")
                          return(false)
                   endif
              endselect
              break
        case DAL_UPDATE:
              break
        case DAL_DESTROY:
              break
        endcase
        return(true)
}
```

## Before Save hook

Use this hook to perform additional actions before the current (new or existing) record is saved. Think of updating fields in other tables, validations that could not be done on field level, etc.

The input argument for this hook is the mode. Mode can have these values:

| Mode | Description |
|---|---|
| DAL_NEW | A new record is being inserted. |
| DAL_UPDATE | An existing record is being updated. |

This hook is executed before the `before.save.object()`hook of the standard Data Access Layer is executed. If the standard hook must be executed before the extension hook is executed, you can force the standard hook to execute at the moment you desire. This can be achieved by calling the `table.super()`function.

All field values of the current record of the table are available.

For more information, see `before.save.object()`of the standard Data Access Layer in the *Infor ES Programmer's Guide*.

Example:

```
function extern long before.save.object(long mode)
{
        table.super()

        tcmcs004.cdf_lcdt = utc.num()
        tcmcs004.cdf_user = logname$

        return(0)
}
```

## After Save hook

Use this hook to perform additional actions after the current (new or existing) record is saved. Think of updating fields in other tables, etc.

The input argument for this hook is the mode. Mode can have these values:

| Mode | Description |
|---|---|
| DAL_NEW | A new record is being inserted. |
| DAL_UPDATE | An existing record is being updated. |

This hook is executed before the `after.save.object()`hook of the standard Data Access Layer is executed. If the standard hook must be executed before the extension hook is executed, you can

force the standard hook being executed at the moment you want. This can be achieved by calling the `table.super()`function.

All field values of the current record of the table are available.

For more information, see `after.save.object()`of the standard Data Access Layer in the *Infor ES Programmer's Guide*.

Example:

```
function extern long after.save.object(long mode)
{
        table.super()

        with.old.object.values.do(get.old.values)

        if tcmcs004.cdf_city <> old.city then
                ret = txcomdll0001.log.city.change(
                                old.city, tcmcs004.cdf_city)
                if ret < 0 then
                        dal.set.error.message(
                                "@Error during logging city change")
                        return(DALHOOKERROR)
                endif
        endif

        return(0)
}
```

## Before Destroy hook

Use this hook to perform additional actions before the current record is deleted. Think of updating fields in other tables, additional checks whether it is allowed to delete the record, etc.

This hook is executed before the `before.destroy.object()`hook of the standard Data Access Layer is executed. If the standard hook must be executed before the extension hook is executed, you can force the standard hook being executed at the moment you want. This can be achieved by calling the `table.super()`function.

All field values of the current record of the table are available.

For more information see `before.destroy.object()`of the standard Data Access Layer in the *Infor ES Programmer's Guide*.

Example:

```
function extern long before.destroy.object()
{
        table.super()

        select  txcom001.*
        from    txcom001
        where   txcom001.crou = :tcmcs004.crou
        as set with 1 rows
        selectdo
                dal.set.error.message(
                       "@Route still being used in Carrier Plan")
                return(DALHOOKERROR)
        endif

        return(0)
}
```

## After Destroy hook

Use this hook to perform additional actions after the current record is deleted. Think of updating fields in other tables, etc.

This hook is executed before the `after.destroy.object()`hook of the standard Data Access Layer is executed. If the standard hook must be executed before the extension hook is executed, you can force the standard hook being executed at the moment you desire. This can be achieved by calling the `table.super()`function.

All field values of the current record of the table are available.

For more information, see `after.destroy.object()`of the standard Data Access Layer in the *Infor ES Programmer's Guide*.

Example:

```
function extern long after.destroy.object()
{
        table.super()

        txcomdll0001.log.deleted.sales.order(
                  tdsls400.orno, tdsls400.crep,
                  tdssl400.otbp, tdsls400.oamt)
        return(0)
}
```

# Customer defined field logic

With the hooks on CDF level you can let the CDFs behave like standard fields. This applies to making the field mandatory, update them automatically based on changes of other fields, validations, etc.

This table shows the hooks that are available for each individual CDF:

| Name | Signature |
|---|---|
| Is Never Applicable | boolean <cdf field>.is.never.applicable(long mode) |
| Is Applicable | boolean <cdf field>.is.applicable(long mode) |
| Is List Entry Applicable | boolean <cdf field>.<constantname>.is.applicable(long mode) |
| Is Derived | boolean <cdf field>.is.derived(long mode) |
| Is Mandatory | boolean <cdf field>.is.mandatory(long mode) |
| Is Read-only | boolean <cdf field>.is.readonly(long mode) |
| Make Valid | long <cdf field>.make.valid(long mode) |
| Is Valid | boolean <cdf field>.is.valid(long mode) |
| Update | long <cdf field>.update(long mode) |

The input argument for all hooks is the mode. Mode can have these values:

| Mode | Description |
|---|---|
| DAL_NEW | A new record is being inserted. |
| DAL_UPDATE | An existing record is being updated. |

In all hooks, except for the `<cdf field>.is.never.applicable()` hook, all field values of the current table record are available.

If CDFs are dependent on standard fields or other CDFs – in other words if in the hooks the values of other fields are used – the hooks are re-executed when the field(s) on which the CDF depends are changed. Those dependencies are registered automatically.

For more information about the hooks, see the corresponding `-field.<hook>()`of the standard Data Access Layer in the *Infor ES Programmer's Guide*.

## Is Never Applicable hook

Use this hook to indicate if the field is never applicable. If a field is never applicable the field is made invisible at startup of a session. A field can become never applicable based on a static constraint, such as a parameter setting.

Example:

```
function extern boolean tcmcs004.cdf_city.is.never.applicable(long mode)
{
        select  txmcs000.icty
        from    txmcs000
        where   txmcs000.sequ = 0
        as set with 1 rows
        selectdo
                if txmcs000.icty = tcyesno.no then
                        return(true)
                endif
        endselect
        return(false)
}
```

## Is Applicable hook

Use this hook to indicate whether the field is applicable. If a field is not applicable, then the field is disabled and the field is cleared.

Example:

```
function extern boolean tcmcs004.cdf_city.is.applicable(long mode)
{
        return(tcmcs004.crou(1;1) = "U")
}
```

## Is List Entry Applicable hook

Use this hook to indicate whether a certain list constant is applicable. If the list constant is not applicable it is not displayed in the field's drop down list box, so the end-user cannot select it.

The constant names to be used in the hooks are the constants that are defined in the CDF Lists session (ttadv4592m000). If a standard enum domain is used for the CDF, instead of a List, the constant names can be found in the Domains session (ttadv4500m000), Enum/Set data.

Example:

```
function extern boolean tdsls400.cdf_brsn.export.is.applicable(long mode)
{
        if tdsls400.orno(1;3) = "EXP" or
           tdsls400.orno(1;3) = "SLE" then
                return(true)
        endif
        return(false)
}
```

## Is Derived hook

Use this hook to indicate whether the field is derived. If a field is derived, then the field is made read-only in the UI. The difference with the <cdf field>.is.readonly() hook is that the field value can be changed within other hooks of the extension, for example in the <cdf field>.update() hook. If a field is really read-only, its value cannot be changed.

Example:

```
function extern boolean tcmcs004.cdf_addr.is.derived(long mode)
{
        if tcmcs004.crou(1;1) = "U" then
                return(true)
        endif
        return(false)
}


function extern tcmcs004.cdf_addr.update(long mode)
{
        if tcmcs004.crou(1;1) = "U" then
               tcmcs004.cdf_addr = tcmcs004.cdf_zip & " " & tcmcs004.cdf_city
        endif
}
```

## Is Mandatory hook

Use this hook to indicate whether the field is mandatory. If a field is mandatory then it should have a value other than "", 0.0, 0 or empty.

Example:

```
function extern boolean tcmcs004.cdf_city.is.mandatory(long mode)
{
        return(tcmcs004.crou(1;1) = "U")
}
```

## Is Read-only hook

Use this hook to indicate whether the field is read-only. If a field is read-only it is made read-only in the UI. The field however, still can have a value.

Example:

```
function extern boolean tdsls400.cdf_blck.is.readonly(long mode)
{
        return(tdsls400.hdst = tdsls.hdst.closed)
}
```

## Make Valid hook

Use this hook to adjust the field's value before it is checked. You can use it for example to round a field's value.

Example:

```
function extern long tdsls401.cdf_mprc.make.valid(long mode)
{
        tdsls401.cdf_mprc = round(tdsls401.cdf_mrpc, 2, 1)
        return(0)
}
```

## Is Valid hook

Use this hook to perform any checks not already defined in one of the other field hooks.

Example:

```
function extern boolean tcibd001.cdf_colr.is.valid(long mode)
{
        select  txcom002.colr
        from    txcom002
        where   txcom002.colr = :tcibd001.cdf_colr
        as set with 1 rows
        selectdo
                return(true)
        endselect

        dal.set.error.message("txcomt002", tcibd001.cdf_colr)
        |* Color %1$s not found
        return(false)
}
```

## Update hook

Use this hook to (re) determine the value of the field based on the current record values. Think of determining defaults and calculating derived values.

Example:

```
function extern tcmcs004.cdf_addr.update(long mode)
{
        if tcmcs004.crou(1;1) = "U" then
               tcmcs004.cdf_addr = tcmcs004.cdf_zip & " " & tcmcs004.cdf_city
        endif
}
```

# Standard field logic

With the hooks on standard field level you can influence the behavior of the standard application. This applies to making the field mandatory, update them automatically based on changes of other fields, validations, etc. For the standard fields also hooks can be present in the standard Data Access Layer. If both hooks are present, so in the DAL and in the table extension, the table extension can only restrict the data further. For example, data that cannot be entered because of an is.valid() hook in the standard DAL can still not be entered even if the table extension would allow it.

This table shows the hooks that are available for each standard table field:

| Name | Signature |
|---|---|
| Is List Entry Applicable | boolean <table field>.<constantname>.is.applicable(long mode [,long element]) |
| Is Derived | boolean <table field>.is.derived(long mode [,long element]) |
| Is Mandatory | boolean <table field>.is.mandatory(long mode [,long element]) |
| Is Read-only | boolean <table field>.is.readonly(long mode [,long element]) |
| Make Valid | long <table field>.make.valid(long mode [,long element]) |
| Is Valid | boolean <table field>.is.valid(long mode [,long element]) |
| Update | long <table field>.update(long mode [,long element]) |

The input argument for all hooks is the mode. Mode can have these values:

| Mode | Description |
|---|---|
| DAL_NEW | A new record is being inserted. |
| DAL_UPDATE | An existing record is being updated. |

The argument ‘element’ is available for all array table fields. The element points to the actual occurrence in the array that is being processed.

In all hooks all field values of the current table record are available.

If standard fields are dependent on other standard fields or CDFs – in other words if in the hooks the values of other fields are used – the hooks are re-executed when the field(s) on which the field depends are changed. Those dependencies are registered automatically.

For more information about the hooks, see the corresponding `-field.<hook>()`of the standard Data Access Layer in the *Infor ES Programmer's Guide*.

## Is List Entry Applicable hook

Use this hook to indicate whether a certain list constant is applicable. If the list constant is not applicable it is not displayed in the field's drop down list box, so the end-user cannot select it.

The constant names to be used in the hooks are the constants that are defined for the domain of the table field. The constant names can be found in the Domains session (ttadv4500m000), Enum/Set data.

Example:

```
function extern boolean tdsls400.osta.closed.is.applicable(long mode)
{
        return(txcomdll0001.sales.order.can.be.closed())
}
```

## Is Derived hook

Use this hook to indicate whether the field is derived. If a field is derived, then the field is made read-only in the UI. The difference with the `<field>.is.readonly()` hook is that the field value can be changed within other hooks of the extension, for example in the `<field>.update()` hook. If a field is really read-only, its value cannot be changed.

Example:

```
function extern boolean tdsls401.pric.is.derived(long mode)
{
        select  txprc100.fixd
        from    txprc100
        where   txprc100.item = :tdsls401.item
        as set with 1 rows
        selectdo
                |* Item price is fixed, user cannot change it
                return(true)
        endselect
        return(false)
}


function extern tdsls401.pric.update(long mode)
{
        select  txprc100.pric
        from    txprc100
        where   txprc100.item = :tdsls401.item
        as set with 1 rows
        selectdo
                tdsls401.pric = txprc100.pric
        endselect

}
```

## Is Mandatory hook

Use this hook to indicate whether the field is mandatory. If a field is mandatory then it should have a value other than "", 0.0, 0 or empty.

Example:

```
function extern boolean tcmcs041.dsca.is.mandatory(long mode)
{
        return(true)
}
```

## Is Read-only hook

Use this hook to indicate whether the field is read-only. If a field is read-only it is made read-only in the UI. The field however, still can have a value.

Example:

```
function extern boolean tcibd001.dsca.is.readonly(long mode)
{
        if mode = DAL_UPDATE then
                return(true)
        endif
        return(false)
}
```

## Make Valid hook

Use this hook to adjust the field's value before it is checked. You can use it for example to round a field's value.

Example:

```
function extern long tcibd001.dsca.make.valid(long mode)
{
        |* Always start with capital
        tcibd001.dsca(1;1) = toupper$(tcibd001.dsca(1;1))
        return(0)
}
```

## Is Valid hook

Use this hook to perform any checks not already defined in one of the other field hooks.

Example:

```
function extern boolean tdsls401.item.is.valid(long mode)
{
        if not txexpdll0001.item.allowed(tdsls401.ofbp, tdsls401.item) then
                dal.set.error.message(
                      "@Item not allowed for this business partner”)
                return(false)
        endif
        return(true)
}
```

## Update hook

Use this hook to (re) determine the value of the field based on the current record values. Think of determining defaults and calculating derived values.

Example:

```
function extern tdsls401.pric.update(long mode)
{
        select  txprc100.pric
        from    txprc100
        where   txprc100.item = :tdsls401.item
        as set with 1 rows
        selectdo
                tdsls401.pric = txprc100.pric
        endselect

}
```

# Functions

In the hooks of a table extension you can use all trusted functions (see Trusted / Untrusted concept) to do string manipulation, calculations, comparisons, etc.

Typical functions to be used in a table extension:

- with.old.object.values.do()
- with.object.set.do()
- dal.set.error.message()
- disable.ue.dll()
- enable.ue.dll()
- ue.get.origin()

Embedded SQL and the sql.* functions are available to read additional data from the LN database. You can also perform database changes with the db.* and dal.* functions.

# Limitations and restrictions

## Transactions

All updates done in the table extension are part of the transaction that is started in the standard LN application. It is not allowed to call `commit.transaction()`, `abort.transaction()` or `db.retry.point()` from within one of the extension hooks. Doing this may lead to fatal applications errors, or data corruption in the database.

## UI

A table extension has no access to the UI. You cannot start sessions or reports.

# User Exit DLL

Older versions of Infor LN had the concept of User Exit DLLs. User Exit DLLs are similar to the extension scripts for table extensions, but are less rich in functionality. User Exit DLLs are still supported, but do not comply with cloud-ready extensions.

If a table extension is present, the User Exit DLL is ignored. If no table extension is present, the User Exit DLL is executed.

# Chapter 6 Report extension point

6

A report extension is used to enrich the XML file that is used as input for the report design in Infor Reporting. Fields can be added to the data rows in the XML. New data rows also can be added.

Examples:

- To add the CDFs of the Purchase Order Header to the Purchase Order report.
- To write additional rows with data from one of your own tables.

When the report is printed the LN session sends data to the native LN report. The unformatted data of this native LN report serves as a data source for Infor Reporting. The report extension adds the fields and the rows to this data source.

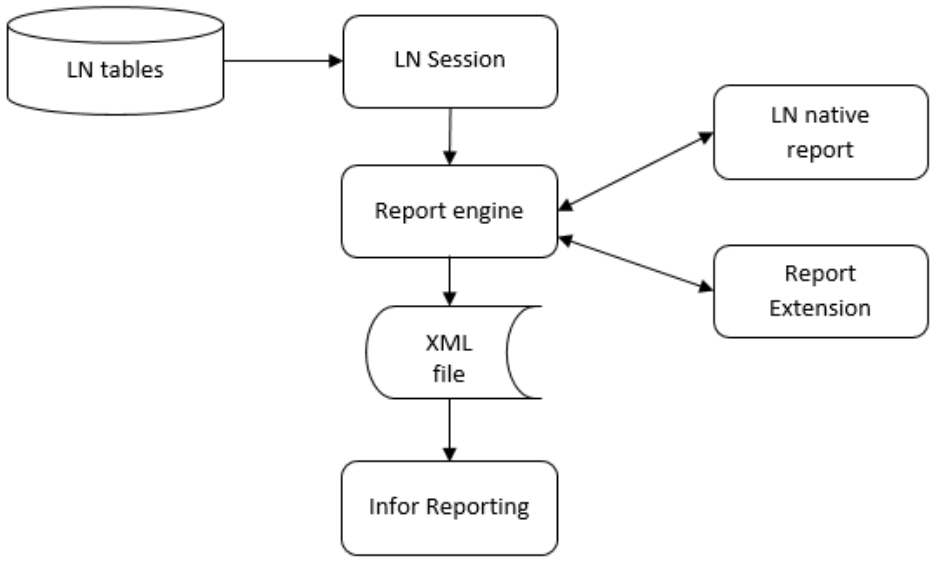
For the report extension point, three extension types exist:

1 Report

2 Table selection

3 Calculated field

This diagram shows the position of the report extension:



When the Report Extension is created, you must change the report design with Infor Reporting's Report Studio to add the new fields to the report. See the *Infor Enterprise Server Connector for Infor Reporting Development Guide* for the steps to be followed.

# Report

With the properties and hooks defined for the extension type Report, you can intervene in the writing of data rows into the XML file for Infor Reporting.

This table shows the available properties:

| Name |
| --- |
| Include all CDFs |

This table shows the available hooks:

| Name | Signature |
| --- | --- |
| Declarations | |
| Functions | |
| Write Row | void write.row() |

## Include all CDFs property

If you check this property, all CDFs of tables, of which already fields are used in the report, are added to the data rows in the XML file. Those tables can be found in the list of tables that is displayed to add a Table Selection for the report.

By default, this property is checked when you add a Report extension. Including all CDFs was the default behavior in ES 10.4.2. If you uncheck this property, you can include all CDFs at table level (in the Table Selection) or select individual CDFs or ignore all CDFs.

If the report has linked tables with a lot of CDFs and you do not need most of them, for performance reasons we recommend that you uncheck this property and select the individual CDFs at table level.

## Declarations hook

Use this hook to declare tables and variables that must be globally available in all hooks of the extension. Also the references to include files and DLLs that are used by the extension must be coded in this hook with #include and #pragma.

Tables that are selected in the extension type Table Selection are implicitly declared, so they do not have to be added to this hook.

Example:

```
#include        <bic_text>

        table   txprc100          |* Prices

                string  date.string(14)
                boolean retb

#pragma used dll "otxprcdll0001"
```

## Functions hook

Use this hook to code (common) functions you want to use in the other hooks of the report extension. This helps you in reusing code and to keep the other hooks small and clear.

Example:

```
function string format.date(long i.date)
{
        return(utc.to.iso(i.date, UTC_ISO_DIFF))
}

function string get.item.description(domain tcitem i.item)
{
        domain  tcdesc     dsca

        select  tcibd001.dsca:dsca
        from    tcibd001
        where   tcibd001.item = :i.item
        as set with 1 rows
        selectdo
                return(dsca)
        endselect

        return("??????????????")
}
```

## Write Row hook

Use this hook to

- Write additional rows to the XML file

- Calculate values for Calculated Fields

The Write Row hook is executed just before the standard row is written to the XML file. If you must have the standard row written before the hook is executed, you can force the standard row being written at the moment you want it to be written. This can be achieved by calling the `report.super()`function.

Example:

```
function extern void write.row()
{
        ext.alternative = tcyesno.no
        report.super()
        ext.alternative = tcyesno.yes
        select  tcibd005.*
        from    tcibd005
        where   tcibd005.item = :tdpur401.item
        selectdo
                rpi.write.additional.row()
        endselect
}
```

In this example there is also an `ext.alternative` Calculated Field. To filter to distinguish the standard rows and the additional rows in the Infor Reporting design, this field is added. It should have the value ‘no’ for the standard rows and value ‘yes’ for the additional rows. The additional rows are written for each record found in tcibd005 for the current Item.

For tcibd005 there should be a Table Selection to select the individual fields, but that Table Selection does not need a Table Read hook. The `ext.alternative` Calculated Field does not require to have a Calculate Value hook, because the value is calculated here.

# Table Selection

With the properties and hooks defined for the extension type Table Selection, you can easily include fields from the selected table in the XML.

When you add a Table Selection, the tables that are already linked to the report are displayed. If the table of which you want to add fields is not in the list, specify “Other Table” and you can select any table.

This table shows the available properties:

| Name |
| --- |
| All Customer Defined Fields |
| All Standard Fields |
| Field List |

This table shows the available hooks:

| Name | Signature |
|---|---|
| Table Read | void <table>.read() |

## All Customer Defined Fields property

If you check this property, all CDFs if the selected table are included in the XML. Note that if you checked the Include All CDFs property on Report level, this property is checked and cannot be changed.

If the table has a lot of CDFs and you do not need them all, for performance reasons we recommend that you uncheck this property and select the individual CDFs in the Field List property.

## All Standard Fields property

If you check this property, all standard fields of the selected table are included in the XML.

If the table has a lot of fields and you do not need them all, for performance reasons we recommend that you uncheck this property and select the individual fields in the Field List property.

## Field List property

The Field List property can be filled only if not all CDFs and standard fields of the table are already selected with the All Customer Defined Fields and All Standard Fields properties. Click **Details** in the property value cell to get the list of available fields. Select the ones you require in the XML data source.

## Table Read hook

Use this hook to write the SQL query to read the data of the table. There are two cases for which it is not required to implement this hook for a Table Selection:

- The table is already linked to the report. However, it can be that not all fields of the table are available; in that case still a Table Read hook is required to read those additional fields.
- The table data is read in the Write Row hook at report level. This is mandatory if you need data of multiple table records being sent in the XML file.

To select the correct data from the tables, all fields that are sent from the print session to the native report are available. Those fields can be found in the Reports session (ttadv3530m000), option Report Input Fields.

Example:

```
function extern void tccom100.read()
{
        select tccom100.*
        from   tccom100
        where  tccom100.bpid = :tdpur400.otbp
        as set with 1 rows
        selectdo
        endselect
}
```

# Calculated Field

Use a Calculated Field extension type if you need additional fields (non-table fields) in the XML data source.

Examples:

- Aggregations of table fields (average, sum, etc.)
- Results of calculations with standard report fields or fields made available with the Table Selections
- Results of called library functions

This table shows the available properties:

| Name |
|---|
| Name |
| Description |
| Label |
| Domain |

This table shows the available hooks:

| Name | Signature |
|---|---|
| Calculate Value | void <name>.calculate() |

## Name property

The Name property is used for the variable name. It is always prefixed with “ext.”. The maximum length of a variable name is 17, including the prefix. This variable name is the name to be used in

the Calculate Value hook or the Write Row hook. This is also the name of the field in the XML data source and available at design time in Infor Reporting's Report Studio.

## Description property

The Description is sent in the XML data source and available at design time in Infor Reporting's Report Studio. If you must print the reports in different languages (based on user language or the recipient language), do not use the Description property, but link a label to the field with the Label property.

The Description property cannot be filled if the Label property is used.

## Label property

Use this property if the report must be printed in different languages. You can select an existing label, or create a new label in the Extensions package. A label can have descriptions in different languages and multiple length variants. See the *Infor LN Studio Application Development Guide* for more information.

The Label property cannot be filled if the Description property is used.

## Domain property

The Domain property is required to define the data type of the Calculated Field. You can select an existing domain or create a new domain in the Extensions package. See the *Infor LN Studio Application Development Guide* for more information.

## Calculate Value hook

Use this hook to calculate the value for the calculated field. The value must be assigned to the variable with the name of the Name property.

In this hook all fields are available that are sent from the print session to the native report. Those fields can be found in the Reports session (ttadv3530m000), option Report Input Fields. Additionally, all fields are available of the tables read in the Table Read hooks of the Table Selections.

This hook is called by the report engine just before the row of data is written to the XML data source. If you need the calculated field values in the Write Row hook, do not use the Calculate Value hook, but calculate the value in the Write Row hook itself.

Example:

```
function extern void ext.no.po.calculate()
{
        ext.no.po = 0
        select  count(tdpur400.orno):ext.no.po
        from    tdpur400
        where   tdpur400.otbp = :tccom100.bpid
        selectdo
        endselect
}
```

For performance reasons you can decide to calculate multiple fields in one Calculate Value hook; in that case you can omit the hooks for the other fields. You can also calculate the values in the Write Row hook. Note that the order in which the Calculate Value hooks are executed is arbitrary.

# Functions

In the hooks of a report extension you can use all trusted functions (see Trusted / Untrusted concept) to do string manipulation, calculations, comparisons, etc.

Typical function to be used in a report extension:

- rpi.write.additional.row()

This function can be used in the Write Row hook to write additional rows in the XML data source.

Embedded SQL and the sql.* functions are available to read additional data from the LN database.

# Limitations and restrictions

## Transactions

Transactions in a report extension are not supported.

## UI

A report extension has no access to the UI. You cannot start sessions or (other) reports.

# Native LN reports

Adding additional fields or making changes in the layouts is not supported for Native LN reports.

# Chapter 7 Session extension point

7

A session extension is used to add fields and commands on the session screen. This applies both to overview screens (grids) and detail screens.

Examples:

- To add the number of Purchase Orders for a Business Partner on the BP overview.
- To show the current weather for a Service Order location.
- To link a new developed print session to an overview session.

Fields and commands that are added by the session extension are automatically visible the session. With the form personalization options, fields can be moved to the desired location and commands can be added to the toolbar.

**Note**: The session extension point is only available for sessions of type Display or Maintain.

For the session extension point you have these extension types:

1 Session

2 Table selection

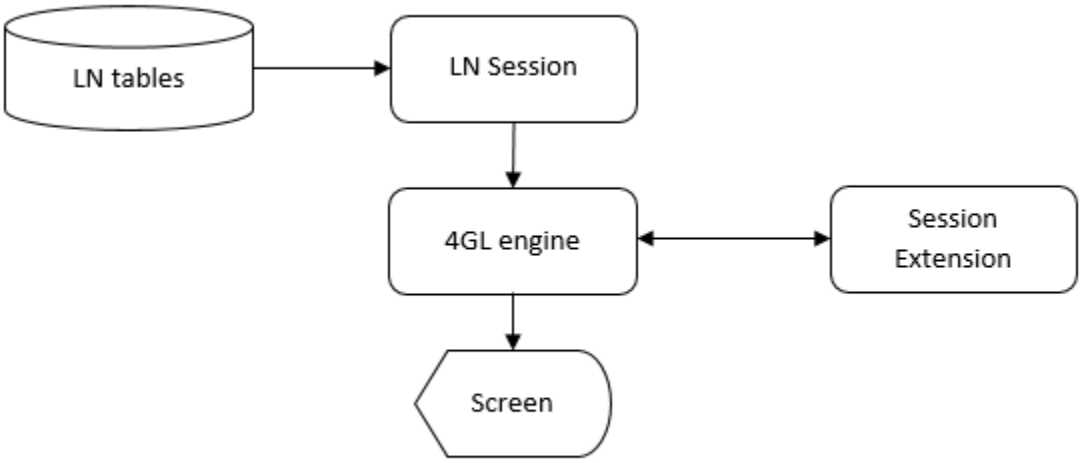
3 Calculated field

4 Standard Command

5 Standard Form Command

6 Custom Form Command

This diagram shows the position of the session extension:




Note on (easy) filtering: Filtering is possible on fields that are added by Table Selections. Filtering on Calculated Fields is also possible, except the ones that are calculated with Expression Type “Function”.

# Session

With the properties and hooks defined for the extension type Session, you can change the behavior of the session.

This table shows the available properties:

| Name |
| --- |
| Include CDFs of Used Referenced Tables |

This table shows the available hooks:

| Name | Signature |
| --- | --- |
| Declarations | |
| Functions | |

## Include CDFs of Used Referenced Tables property

If you check this property, all CDFs of tables, of which already fields are used in the session screen, are added to the form with the initial hidden state. With Personalize Form you can make those fields visible on the screen.

By default, this property is checked when you add a Session extension. Including CDFs of used referenced tables was the default behavior in ES 10.4.1. If you uncheck this property, you can select the required individual CDFs at table level (in the Table Selection).

## Declarations hook

Use this hook to declare tables and variables that must be globally available in all hooks of the extension. Also the references to include files and DLLs that are used by the extension must be coded in this hook with #include and #pragma.

Tables that are selected in the extension type Table Selection are implicitly declared, so they do not have to be added to this hook.

Example:

```
#include        <bic_text>

        table   txprc100          |* Prices

                string  date.string(14)
                boolean retb

#pragma used dll "otxprcdll0001"
```

## Functions hook

Use this hook to code (common) functions you want to use in the other hooks of the session extension. This helps you in reusing code and to keep the other hooks small and clear.

Example:

```
function string format.date(long i.date)
{
        return(utc.to.iso(i.date, UTC_ISO_DIFF))
}
```

# Table Selection

With the properties and hooks defined for the extension type Table Selection, you can easily include fields from the selected table in the session's screen.

When you add a Table Selection, you have two options:

- Referenced Table
- Other Table

If you choose Referenced Table, you can select tables that are linked to the main table of the session. This can be a multi-level reference. For example, for a Business Partner, you can make a reference to the Language of the Country of the Address of the Business Partner.

You can select the same Referenced Table multiple times. However, only if the reference path to that table is different. For example, you can reference to a Language from the Business Partner directly, but also via the Country of the Address of the Business Partner. In this case automatically a new Sequence Number is assigned to the Table Selection.

If you choose Other Table, you can select any other table. However, in this case you must specify the query part to join with this table yourself. Note that this is always handled as an inner join, so you must be sure that the record in the other table exists, otherwise the record of the main table is not displayed. If you cannot be sure that the record in the other table exists, do not use the Table Selection, but use a Calculated Field with the Nested Select option. See Select property.

This table shows the available properties:

| Name |
| --- |
| Field List |
| Reference Type |
| Reference Path |
| Where Clause |

## Field List property

The Field List property specifies the table fields you want to have in the session. Click the Details button in the property value cell to get the list of available fields and select the ones you want to have on the session's screen.

You can leave the Field List empty, if you only want to add the Table Selection to be able to use the table fields in the expression for a Calculated Field. See Table property.

## Reference Type property

This is a read-only property that indicates the reference type that is generated in the query of the session. For a Reference Table it is “Refers”, for an Other Table it is “Where”.

## Reference Path property

This is a read-only property that shows the reference path to the table in the Table Selection of type Referenced Table. The starting point is the main table of the session; the end point is the table in the Table Selection. Click the Details button to see the detailed information of the reference path.

## Where Clause property

The Where Clause property can only be filled for Table Selections of type Other Table. This where clause is added to the query of the session to join the data. Click the Details button to type the where clause in the popup-window.

Example:

```
txprc001.pcod = tcibd001.cdf_pcod
```

This example shows how data from another table is joined to the main table tcibd001. As described above, you must be sure that the data in the joined table exists, otherwise the record of the main table is not visible in the session.

**Note**: In the Where Clause you cannot use form fields.

# Calculated Field

Use a Calculated Field extension type if you need additional fields in session’s screen.

Examples:

- Aggregations of table fields (average, sum, etc.)
- Fields of tables that cannot be joined, because the record to join might not exist
- Results of calculations with standard main table fields or fields made available with the Table Selections
- Results of called library functions

This table shows the available properties:

| Name |
| --- |
| Name |

| |
|---|
| Description |
| Label |
| Domain |
| Display Length |
| Table |
| Expression Type |
| Simple Expression |
| Select |
| From |
| Where |

This table shows the available hooks:

| Name | Signature |
|---|---|
| Calculate Value | void <name>.calculate() |

**Note:** The Calculate Value hook is only available for Calculated Fields with Expression Type “Function”:

## Name property

The Name property is used for the variable name. It is always prefixed with “ext.”. The maximum length of a variable name is 17, including the prefix. This variable name is the name to be used in the Calculate Value hook.

## Description property

The Description is displayed as column header in an overview session or before the field in a details session. If you need the descriptions in different languages (based on user language), do not use the Description property, but link a label to the field with the Label property.

The Description property cannot be filled if the Label property is used.

## Label property

Use this property if the field description must be displayed in different languages. You can select an existing label, or create a new label in the Extensions package. A label can have descriptions in

different languages and multiple length variants. See the *Infor LN Studio Application Development Guide* for more information.

The Label property cannot be filled if the Description property is used.

## Domain property

The Domain property is required to define the data type of the Calculated Field. You can select an existing domain or create a new domain in the Extensions package. See the *Infor LN Studio Application Development Guide* for more information.

## Display Length property

Use this property to limit the display length of the field. If you do not specify this property, the field is created on the screen with the length of the domain.

## Table property

This property is a link to a Table Selection of which you want to use fields in a Simple Expression.

## Expression Type property

Choose an Expression Type to indicate how the value of the Calculated Field must be determined:

This table shows the available Expression Types:

| Expression Type | Description |
|---|---|
| Simple Expression | Use this Expression Type if the table data is already available. The data is available if the used table fields in the Simple Expression are part of:<br>the main table of the session<br>a table that is linked with the Table property<br>For a Simple Expression, you must fill the Simple Expression property. |

| | |
|---|---|
| Query Extension | Use this Expression Type if the table data is not yet available, but can be added to the session's query as an inner join. The complete query extension (Select, From and Where properties) must be specified to determine the value of the Calculated Field. Use this Expression Type only if you are sure the data read by the query extension does exist. If you cannot be sure that the data exists, use the "Nested Select" Expression Type.<br>You cannot use this Expression Type if you need aggregated values (count, average, etc.). For aggregations you must use the "Nested Select" Expression Type. |
| Nested Select | Use this Expression Type if the data is not yet available and an inner join is not possible, because the data may not be present. This Expression Type is also required for aggregations of table data. The complete query (Select, From and Where) needs to be coded in the Select property. |
| Function | Use this Expression Type if the calculation of the field cannot be expressed in a query. For example, a complex calculation or a web service call. Note that Calculated Fields with Expression Type "Function" are not enabled for (easy) filtering. |

## Simple Expression property

A Simple Expression computes a value with table fields that are available in the main table of the session or are part of a table, which is added to the session by means of a Table Selection.

Examples:

```
tccom100.bpid(1;3) & "-" & tccom100.clan
```

```
case tccom100.clan
     when "ARA" then "Arabic"
     when "NLD" then "Dutch"
     else "Other"
end
```

For more information, see the SQL chapter in the *Infor ES Programmer's Guide*.

**Note**: In the Simple Expression you cannot use form fields.

## Select property

Use the Select property for Expression Type "Query Extension" or "Nested Select" to define the fields to be added to the standard session query.

## Expression Type Query Extension

The Select Property must contain one single field or an expression that results in one value.

Examples:

```
tcmcs046.dsca


case tcmcs046.clan
     when "ARA" then "Arabic"
     when "NLD" then "Dutch"
     else "Other"
end
```

## Expression Type Nested Select

The Select Property must contain a complete query to determine the value of the Calculated Field.

Examples:

```
select  count(*)
from    tdpur400
where   tdpur400.otbp = tccom100.bpid


select  txprc001.pric
from    txprc001
where   txprc001.item = tcibd001.item
```

**Note**: In the Where Clause of the Nested Select you cannot use form fields.

# From property

Use the From property to specify the tables to be used for an Expression Type “Query Extension”.

# Where property

Use the Where property to join the tables for an Expression Type “Query Extension”.

**Note**: In the Where Clause you cannot use form fields.

## Calculate Value hook

Use this hook to calculate the value for the calculated field. The value must be assigned to the variable with the name of the Name property. You must implement this hook for Expression Type “Function”.

In this hook you have all fields of the main table available. Those fields can be found in the Table Definitions session (ttadv4520m000). Additionally, you have all selected fields from the Table Selections and the Calculated Fields with other Expression Types than “Function” available. You cannot use other Calculated Fields with Expression Type “Function”, because the order in which the Calculate Value hooks are executed is arbitrary.

Example:

```
function extern void ext.price.calculate()
{
        txprcdll0001.calculate.price(
                                    tcibd001.item,
                                    tcmcs023.catg,
                                    utc.num(),
                                    ext.price)
}
```

# Standard Command

Use a Standard Command extension type to code additional logic around a session’s standard command, such as mark. delete, print, edit. text, etc.

Examples:

- To prevent Excel Import in a session.
- To run an own session after a standard command is executed.

This table shows the available hooks:

| Name | Signature |
|---|---|
| Is Visible | boolean <command>.is.visible() |
| Is Enabled | boolean <command.is.enabled() |
| Before Command | void <command>.before.command() |
| After Command | Void <command>.after.command() |

Using the hooks of the session extension to influence the behavior of updating tables is not recommended. It is recommended to use the table extension, for example the Method Is Allowed and Before Save hooks.

In an overview session with multiple records, you must be aware that multiple records have been selected. The values available in the selection are the ones of the last (un)selected record. If the

command disabling/enabling is dependent on all selected records, you must iterate over the selected records.

## Is Visible hook

Use this hook to remove standard commands from the session. Depending on the standard command, it can be that the command remains visible and it is only be disabled. This is the case when removing the command would change the standard toolbar.

This hook should not use actual values of the form fields. The code in the hook is processed before actual data is read from the database or the form. If you must control the availability of the command based on data on the screen, you can use the Is Enabled hook. It is possible to use data that is not related to actual contents of the screen, for example parameter data.

Example:

```
function extern boolean cmd.ssi.import.is.visible()
{
|* Don’t allow excel import
        return(false)
}
```

## Is Enabled hook

Use this hook to disable standard commands in the session. This hook can use actual values of the form fields.

**Note:** This hook only applies to commands that use the actual data. Commands that are independent of actual data, like Close (abort.program), New (add.set) in a type-2 form (an overview without view fields), etc, can only be disabled by the Is Visible hook.

Example:

```
function extern boolean dupl.occur.is.enabled()
{
|* Don’t allow copying purchased items
        return(tcibd001.kitm <> tckitm.purchase)
}
```

## Before Command hook

Use this hook to perform additional actions before the command is executed. This hook can use actual values of the form fields. It is possible to cancel the execution of the command by calling the `choice.again()` function.

Example:

```
function extern dupl.occur.before.command()
{
|* Don’t allow copying purchased items
        if tcibd001.kitm = tckitm.purchase then
                message("It is not allowed to copy purchased items; " &
                   "add a new item to ensure actual defaults are applied.")
                choice.again()
        endif
}
```

**Note:** This is an alternative for the Is Enabled hook described below. You can keep the command enabled and this hook gives a message why a record cannot be copied.

## After Command hook

Use this hook to perform additional actions after the command is executed. This hook can use actual values of the form fields.

Example:

This example shows that the delete action is completely aborted if one of the selected records cannot be deleted.

```
function extern void mark.delete.after.command()
{
|* Not allowed to delete if purchased item is in selection
        g.pur.selected = false
        do.selection(false, check.pur)
        if g.pur.selected then
                message("Not allowed to delete purchased item")
                choice.again()
        endif
}
```

In the Function hook:

```
function check.pur()
{
        if tcibd001.kitm = tckitm.purchase then
                g.pur.selected = true
        endif
}
```

# Standard Form Command

Use a Standard Form Command extension type to code additional logic around a session's standard form command.

Examples:

- You want to remove the standard form command.
- You want to run an own session after a standard form command is executed.
- You want to disable a standard form command in case a certain condition applies.

This table shows the available properties:

| Name |
| --- |
| Overwrite Description |
| Description Label |
| Short Description |
| Long Description |

This table shows the available hooks:

| Name | Signature |
| --- | --- |
| Is Visible | boolean <command>.is.visible() |
| Is Enabled | boolean <command.is.enabled() |
| Before Command | void <command>.before.command() |
| After Command | Void <command>.after.command() |

In an overview session with multiple records, you must be aware that multiple records have been selected. The values available in the selection are the ones of the last (un)selected record. If the form command disabling/enabling is dependent on all selected records, you must iterate over the selected records.

## Overwrite Description property

If you check this property, you can overwrite the standard description of the standard form command. In this case you need either to fill the Description Label property or the Description property.

## Description Label property

Use this property to have different descriptions for users that are working in different languages. You can select an existing label, or create a new label in the Extensions package. The label used must have the context ‘General use’. A label can have descriptions in different languages and multiple length variants; for the form command you can specify two length variants. The one for the short description (used on text buttons) must not be longer than 17 characters. See the *Infor LN Studio Application Development Guide* for more information.

The Description Label property cannot be filled if the Short/Long Description property is used.

## Short Description property

Use this property if your standard form command description is not language dependent. This is the description that is used if the form command is available as a button.

The Short Description is read-only in case the Overwrite Description property is not checked or the Description Label property is filled. In those cases, the Short Description shows the description that is used when the form command is displayed at runtime.

## Long Description property

Use this property if your standard form command description is not language dependent. This is the description that is used in the menus of the toolbar (Views, References, Actions or a session specific one).

The Long Description is read-only in case the Overwrite Description property is not checked or the Description Label property is filled. In those cases, the Long Description shows the description that is used when the form command is displayed at runtime.

## Is Visible hook

Use this hook to remove standard form commands from the session.

This hook should not use actual values of the form fields. The code in the hook is processed before actual data is read from the database or the form. If you must control the availability of the form command based on data on the screen, you can use the Is Enabled hook. It is possible to use data that is not related to actual contents of the screen, for example parameter data.

Example:

```
function extern boolean function.create.bp.easy.is.visible()
{
|* Quick creation of business partners not allowed for users
|* of department 300
```

```
        select  tccom001.cwoc
        from    tccom001
        where   tccom001.loco = :logname$
        as set with 1 rows
        selectdo
                if strip$(tccom001.cwoc) = "300" then
                        return(false)
                endif
        endselect
        return(true)
}
```

## Is Enabled hook

Use this hook to disable standard form commands in the session. This hook can use actual values of the form fields.

Example:

```
function extern boolean function.approve.order.line.is.enabled()
{
|* Check approval against company rules
        if txpurdll0001.can.approve.line(tdpur401.orno, tdpur401.pono) then
                return(true)
        endif
        return(false)
}
```

Note that this hook applies to standard form commands only that are enabled by the standard application if exactly one record is selected. In that case the extension can disable the command. In case the standard form command allows multiple records being selected, the command remains enabled. In that case you must use the Before Command hook to skip the processing if needed.

## Before Command hook

Use this hook to perform additional actions before the form command is executed. This hook can use actual values of the form fields. It is possible to cancel the execution of the command by calling the `choice.again()` function.

Example:

```
function extern function.approve.order.line.before.command()
{
        string l.mess(200) mb
|* Check approval against company rules
        if not txpurdll0001.can.approve.line.with.mess(
```

```
                        tdpur401.orno, tdpur401.pono, l.mess) then
                message(l.mess)
                choice.again()
        endif
}
```

**Note:** This is an alternative for the Is Enabled hook described above. You can keep the command enabled and this hook gives a message a line cannot be approved.

## After Command hook

Use this hook to perform additional actions after the form command is executed. This hook can use actual values of the form fields.

Example:

```
function extern void function.approve.order.line.after.command()
{
        txpurdll0001.publish.approval(tdpur401.orno, tdpur401.pono)
}
```

# Custom Form Command

Use a Custom Form Command extension type to add a form command to a session.

Examples:

- You want to add a form command to start an own session with the selection made in the standard session.
- You want to execute an own function to calculate a field value.

This table shows the available properties:

| Name |
|---|
| Activation Type |
| Command Type |
| Field |
| Name |
| Description Label |
| Short Description |
| Long Description |

Advanced Properties

This table shows the available hooks:

| Name | Signature |
|---|---|
| Is Visible | boolean <command>.is.visible() |
| Is Enabled | boolean <command.is.enabled() |
| Before Command | void <command>.before.command() |
| Command Executed | void <command>.command.execute() |
| After Command | Void <command>.after.command() |

In an overview session with multiple records, you must be aware that multiple records have been selected. The values available in the selection are the ones of the last (un)selected record. If the form command disabling/enabling is dependent on all selected records, you must iterate over the selected records.

## Activation Type property

The Activation Type is a read-only property that depends on the Command Type.

This table shows the possible Activation Types:

| Activation Type | Description |
|---|---|
| session | This type applies to Command Type “Print”. In this case a print session is started. |
| function | This type applies to Command Type “Form” or “Field”. In this case the Command Execute hook is executed. |

## Command Type property

Use this property to indicate the type of the custom form command.

This table shows the possible Command Types:

| Command Type | Description |
|---|---|
| Form | Use this command type for custom form commands that must be added in the Views, References or Actions menu. |

| | |
|---|---|
| Field | Use this command type for custom form commands that must be linked to a specific field on the form. The Field property has to be specified as well. |

## Field property

Use this property to specify the form field to which the custom form command with Command Type “Field” must be linked. Both standard form fields and fields that are added by the extension can be selected.

This property can only be filled for custom form commands with Command Type “Field”.

## Name property

Use this property to specify the function name for custom form commands with Activation Type “function”. For custom for commands with Activated Type “session” (for Command Type “Print”), the Name property holds the session code of the print session.

## Description Label property

Use this property to have different descriptions for users that are working in different languages. You can select an existing label, or create a new label in the Extensions package. The label used must have the context ‘General use’. A label can have descriptions in different languages and multiple length variants; for the form command you can specify two length variants. The one for the short description (used on text buttons) must not be longer than 17 characters. See the *Infor LN Studio Application Development Guide* for more information.

The Description Label property cannot be filled if the Short/Long Description property is used.

## Short Description property

Use this property if your standard form command description is not language dependent. This is the description that is used if the form command is available as a button.

The Short Description is read-only in case the Description Label property is filled. In this case, the Short Description shows the description that is used when the form command is displayed at runtime.

## Long Description property

Use this property if your standard form command description does is not language dependent. This is the description that is used in the menus of the toolbar (Views, References, Actions or a session specific one).

The Long Description is read-only in case the Overwrite Description property is not checked or the Description Label property is filled. In those cases, the Long Description shows the description that is used when the form command is displayed at runtime.

## Advanced properties

Use the advanced properties to influence the appearance and behavior of the custom form command. The dialog displays a number of properties that control the display, availability and execution of the custom form command. More information about those properties can be found in the *Infor LN Studio Application Development Guide* (the chapter Session Editor / Form Command).

## Is Visible hook

Use this hook to remove custom form commands from the session.

This hook should not use actual values of the form fields. The code in the hook is processed before actual data is read from the database or the form. If you must control the availability of the form command based on data on the screen, you can use the Is Enabled hook. It is possible to use data that is not related to actual contents of the screen, for example parameter data.

Example:

```
function extern boolean function.publish.item.is.visible()
{
|* Publishing only available for production companies

        return(get.compnr() >= 0100 and get.compnr() < 1000)
}
```

## Is Enabled hook

Use this hook to disable custom form commands in the session. This hook can use actual values of the form fields.

Example:

```
function extern boolean function.publish.item.is.enabled()
{
|* Publishing only enabled for manufactured items
```

```
        if tcibd001.kitm = tckitm.manufacture then
                return(true)
        endif
        return(false)
}
```

Note that this hook only applies if the custom form command is defined with the “One Record Selected” option. In case the custom form command allows multiple records being selected, the command remains enabled. In that case you must use the Before Command hook to skip the processing if needed.

## Before Command hook

Use this hook to perform additional actions before the custom form command is executed. This hook can use actual values of the form fields. It is possible to cancel the execution of the command by calling the `choice.again()` function. If multiple records can have been selected to be processed,

Example:

```
function extern function.publish.before.command()
{
|* Publishing only for manufactured items
        if tcibd001.kitm <> tckitm.manufacture then
                choice.again()
        endif
}
```

**Note:** This is an alternative for the Is Enabled hook described above. You can keep the command enabled and this hook gives a message if an item should not be published.

## Command Execute hook

Use this hook to perform the real actions for the custom form command. This hook can use actual values of the form fields.

Example:

```
function extern function.publish.command.execute()
{
        string l.mess(200) mb
|* Publish item
        if not txdll0007.item.publish(tcibd001.item, l.mess)
                message(l.mess)
                choice.again()
        endif
}
```

## After Command hook

Use this hook to perform additional actions after the custom form command is executed. This hook can use actual values of the form fields.

Example:

```
function extern void function.publish.after.command()
{
        message(sprint$("Item %s published", strip$(tcibd001.item))
}
```

# Functions

In the hooks of a session extension you can use all trusted functions (see Trusted / Untrusted concept) to do string manipulation, calculations, comparisons, etc.

Embedded SQL and the sql.* functions are available to read additional data from the LN database.

Calling (own) DLL functions is also possible.

# Limitations and restrictions

## Transactions

Transactions in a session extension are not supported.

# UI

A session extension can add fields to the UI. However, doing other UI actions, such as starting other sessions, is not supported in the hooks that calculate the values. Starting other sessions is supported in the hooks that are available for the session commands. In cloud-ready extensions (see Chapter 12) you can only start own developed sessions in the Extensions package.

A session extension cannot add fields to the view part of a session.

# Chapter 8 BOD extension point

8

A BOD extension is used to publish additional fields with a BOD. You can also process additional fields that are part of an inbound BOD.

Examples:

- You want to include all CDFs of the Purchase Order in the PurchaseOrderBOD.
- You want to include some standard Business Partner fields in the PurchaseOrderBOD.

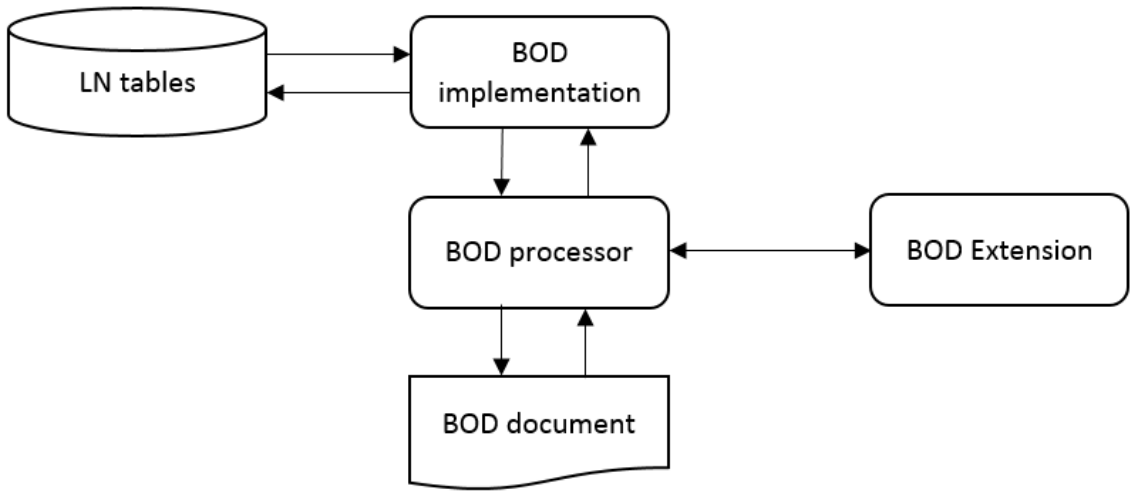
Those fields are added to the UserArea of the component in the BOD.

For the BOD extension point you have two extension types:

1 BOD

2 Component Extension

This diagram shows the position of the BOD extension:



# BOD

The hooks you can define on BOD level are supporting hooks for the hooks on Component level.

This table shows the available hooks:

| Name | Signature |
|---|---|
| Declarations | |
| Functions | |

## Declarations hook

Use this hook to declare tables and variables that must be globally available in all hooks of the extension. Also the references to include files and DLLs that are used by the extension must be coded in this hook with #include and #pragma.

Tables that are used in the field mappings of the BOD Components, are implicitly declared, so they do not need to be added to this hook.

Example:

```
#include        <bic_text>

        table   txprc100          |* Prices

                string  date.string(14)
                boolean retb

#pragma used dll "otxprcdll0001"
```

## Functions hook

Use this hook to code (common) functions you want to use in the other hooks of the BOD extension. This helps you in reusing code and to keep the other hooks small and clear.

Example:

```
function string format.date(long i.date)
{
        return(utc.to.iso(i.date, UTC_ISO_DIFF))
}
```

# Component Extension

With the properties and hooks defined for the extension type Component Extension, you can include fields from the linked tables and other fields to the UserArea of the Component. Note that you can only add fields to the UserArea and not to other structures of the BOD XML. Components that have no UserArea cannot be extended.

When you add a Component Extension, you can select one of the Components that have a UserArea.

This table shows the available properties:

| Name |
|---|
| All Customer Defined Fields |
| Field List |

This table shows the available hooks:

| Name | Signature |
|---|---|
| Add Calculated Fields | Not applicable. The lines of code you add in this hook are included in a function that is generated in the Extension Script. |

## All Customer Defined Fields property

If you check this property, all CDFs of the tables, which are linked to the Component, are included in the UserArea of the Component in the BOD. Use the Details button of the Field List property to see which tables are linked to the Component. If you do not check this property, you can select individual CDFs in the Field List property.

If you select all CDFs by checking this property, the CDF is added to the UserArea with the technical field name (for example tdpur400.cdf_name) as element name. For CDFs of type “List”, the constant name is used as value. To deviate from those defaults (so choosing a different element name or publishing the enum value instead of the constant), do not select all CDFs, but select the CDFs individually in the Field List. Within the Field List you can specify the deviations.

## Field List property

In the Field List property, you can select all fields you want to add to the UserArea. Click the Details button in the property value cell to get the list of available fields and select the ones you want to add to the UserArea. If you didn’t check the All Customer Defined Fields property, you also can select the CDFs in the list.

For each selected field two additional properties are available:

| Name |
| --- |
| Element Name |
| Use Constant Name |

## Element Name property

You can specify the Element Name to be used for the field in the BOD XML. If you do not specify the Element name, the technical field name is used.

## Use Constant Name property

This property is available for enumerated fields only. If you check this property, the constant name of the enum is published in the BOD XML. For example, for the Sales Order status field the string “closed” is published. If you do not check this property, the numeric value is published.

# Add Calculated Fields hook

Use this hook to add additional fields to the UserArea. Examples:

- A concatenation of table fields
- Table fields that are not part of the table(s) which is/are linked to the component
- A result that is returned by calling a DLL function
- An XML tree built up with data from any source

The lines of code in this hook are included in the function that the runtime BOD processor calls to fill the UserArea. The structure of this generated function is:

```
function extern long get.additional.elements(
                const   string   i.component,
                ref     long        o.xml)
{
        ...
        on case i.component
        case "component1":
             |* Generated code for selected fields for component1
             |* Hook code for Add Calculated Fields for component1
             break
        case "component2":
             |* Generated code for selected fields for component2
             |* Hook code for Add Calculated Fields for component2
             break
        default:
             break
        endcase
        ...
        return(0)
}
```

In the Add Calculated Fields hook you can use two macros to add fields to the UserArea:

- addValue
- addXML

**Note**: Those macros only work in the hook itself. You cannot use them in a function you call from the hook.

In the Add Calculated Fields hook you cannot use directly the table fields of the linked table(s) of the Component. The actual values of the table fields are undefined. With some additional macros you have access to the identifying attributes of the current Component and with those attributes you can query the database to get additional values. These macros are available:

- getTableIdentifiers.<Component> (for each component with a UserArea)
- getIdentifierValueFromIdentifierStructure
- getIdentifierDataTypeFromIdentifierStructure

## addValue macro

Use this macro to add a simple value to the UserArea. A simple value has a Name, a Value and a Data Type.

```
addValue(string name, string value, string datatype)
```

This table shows the arguments:

| Argument | Description |
|---|---|
| Name | The element name the field needs to get in the BOD XML |

| | |
|---|---|
| Value | The value of the field; this is always a string |
| Data Type | This table shows the supported data types: |

| Data Type | Remark |
|---|---|
| String | Single byte or multibyte string |
| Integer | Integer number (long) |
| Numeric | Numeric number (float or double) |
| Date | Date in the format<br>"yyyy-mm-ddThh:mm:ssZ" (GMT)<br>"yyyy-mm-ddThh:mm:ss+hh:mm" (local time later than GMT)<br>"yyyy-mm-ddThh:mm:ss-hh:mm" (local time earlier than GMT)<br>See function utc.to.iso() in the Infor ES Programmers Manual for more information on those date formats. |
| Checkbox | “true” or “false” |

Example:

```
addValue("StringElement", "stringValue", "String")
addValue("IntegerElement", "1", "Integer")
addValue("NumericElement", "123.45", "Numeric")
addValue("DateElement", utc.to.iso(utc.num(), UTC_ISO_Z), "Date")
addValue("CheckboxElement", "true", "Checkbox")
```

## addXML macro

Use this macro to add an XML node to the UserArea.

`addXml(long xmlnode)`

This table shows the arguments:

| Argument | Description |
|---|---|
| XML node | The XML node that contains the XML tree to be added to the BOD XML |

Example:

```
long xmlnode
long childnode

xmlnode = xmlNewNode("MyOwnUserAreaExtension")
childnode = xmlNewDataElement("LongName", tccom100.cdf_lnam, xmlnode)
childnode = xmlNewDataElement("Name", tccom100.nama, xmlnode)

addXML(xmlnode)
```

## getTableIdentifiers.<Component> macro

Use this macro to retrieve the identifying attributes of the current Component that is being processed.

```
long getTableIdentifiers.<Component>(ref long xmlnode)
```

This table shows the arguments:

| Argument | Description |
|---|---|
| XML node | XML node that contains the table identifiers after the call |

Example:

```
        long                    ret
        long                    header.xml
        domain  tcorno          orno
        domain  tccom.bpid      otbp

        ret = getTableIdentifiers.PurchaseOrderBOD(header.xml)

        orno = getIdentifierValueFromIdentifierStructure(
                                        header.xml, "tdpur400", "orno")

        select  tdpur400.otbp:otbp
        from    tdpur400
        where   tdpur400.orno = :orno
        selectdo
                select  tccom100.*
                from    tccom100
                where   tccom100.bpid = :tdpur400.otbp
                selectdo
                        addValue("LongBpName", tccom100.cdf_lnam, "String")
                endselect
        endselect
```

In this example the identifying attribute of the current Component “PurchaseOrderBOD” are stored in header.xml. With the macro getIdentifierValueFromIdentifierStructure the individual table field values can be retrieved. Those values can be used in subsequent queries or function calls.

## getIdentifierValueFromIdentifierStructure macro

Use this macro to retrieve the values of the individual identifying attributes.

```
string getIdentifierValueFromIdentifierStructure(
                long xmlnode, string table, string field)
```

This table shows the arguments:

| Argument | Description |
|---|---|
| XML node | XML node that contains the table identifiers (retrieved with macro getTableIdentifiers.<Component>()) |
| Table | The table of which you want to retrieve the identifying attribute |
| Field | The field name of the identifying attribute you want to retrieve |

Example:

```
ret = getTableIdentifiers.PurchaseOrderBOD(header.xml)

orno = getIdentifierValueFromIdentifierStructure(
                                        header.xml, "tdpur400", "orno")
```

## getIdentifierDataTypeFromIdentifierStructure

Use this macro to retrieve the data types of the individual identifying attributes.

```
string getIdentifierDataTypeFromIdentifierStructure(
               long xmlnode, string table, string field)
```

This table shows the arguments:

| Argument | Description |
|---|---|
| XML node | XML node that contains the table identifiers (retrieved with macro getTableIdentifiers.<Component>() |
| Table | The table of which you want to retrieve data type of the identifying attribute |
| Field | The field name of the identifying attribute of which you want to retrieve the data type |

Example:

```
ret = getTableIdentifiers.PurchaseOrderBOD(header.xml)

datatype = getIdentifierDataTypeFromIdentifierStructure(
                                        header.xml, "tdpur400", "orno")
```

## BOD UserArea example

The following table shows an example of the BOD UserArea. The left column shows the XML structure of the BOD UserArea, which is created by the BOD extension. The right column shows the Add Calculated Fields hook that built this User Area.

**BOD UserArea**

```
<UserArea>
 <Property><NameValue name="NegotiationDate"
            type="DateTimeType">2013-05-16T07:46:37Z</NameValue>
 </Property>
 <Property><NameValue name="NegotiationLevel"
            type="EnumerationType">hard</NameValue>
 </Property>




 <Property><NameValue name="StringElement"
            type="StringType">stringValue</NameValue>
 </Property>
 <Property><NameValue name="IntegerElement"
            type="IntegerNumericType">1</NameValue>
 </Property>
 <Property><NameValue name="NumericElement"
            type="NumericType">123.45</NameValue>
 </Property>
 <Property><NameValue name="DateElement"
            type="DateTimeType">2016-07-08T07:38:28Z</NameValue>
 </Property>
 <Property><NameValue name="CheckboxElement"
            type="IndicatorType">true</NameValue>
 </Property>









.<Property><NameValue name="LongBpName"
            type="StringType">LONG BP NAME</NameValue>
 </Property>
 <Property><NameValue name="Name"
            type="StringType">BP Name</NameValue>
 </Property>
 <Property><NameValue name="DatatypeOfOrno"
            type="StringType">DB.STRING</NameValue>
 </Property>


 <MyOwnUserAreaExtension>
  <LongName>LONG BP NAME</LongName>
  <Name>BP Name</Name>
 </MyOwnUserAreaExtension>
</UserArea>
```

**Add Calculated Fields hook**

```
Negotiation Date and Negotiation Level are selected in the
Field List of the PurchaseOrderBOD Component
```

```
  long                    ret, header.xml
  long                    xmlnode
  long                    childnode
  domain  tcorno          orno
  domain  tccom.bpid      otbp


  addValue("StringElement", "stringValue", "String")


  addValue("IntegerElement", "1", "Integer")


  addValue("NumericElement", "123.45", "Numeric")


  addValue("DateElement",
                utc.to.iso(utc.num(), UTC_ISO_Z), "Date")

  addValue("CheckboxElement", "true", "Checkbox")

  ret = getTableIdentifiers.PurchaseOrderBOD(header.xml)
  orno = getIdentifierValueFromIdentifierStructure(
                       header.xml, "tdpur400", "orno")
  select  tdpur400.otbp:otbp
  from    tdpur400
  where   tdpur400.orno = :orno
  selectdo
    select  tccom100.*
    from    tccom100
    where   tccom100.bpid = :tdpur400.otbp
    selectdo
      addValue("LongBpName", tccom100.cdf_lnam, "String")

      addValue("Name", tccom100.nama, "String")
    endselect
  endselect

 addValue("DatatypeOfOrno",
    getIdentifierDataTypeFromIdentifierStructure(header.xml,
                          "tdpur400", "orno"), "String")

        xmlnode = xmlNewNode("MyOwnUserAreaExtension")
        childnode = xmlNewDataElement("LongName",
                                  tccom100.cdf_lnam, xmlnode)
        childnode = xmlNewDataElement("Name",
                                  tccom100.nama, xmlnode)
        addXML(xmlnode)
```

# Functions

In the hooks of a BOD extension you can use all trusted functions (see Trusted / Untrusted concept) to do string manipulation, calculations, comparisons, etc.

Embedded SQL and the sql.* functions are available to read additional data from the LN database.

Calling (own) DLL functions is also possible.

# Limitations and restrictions

## Transactions

Transactions in a BOD extension are not supported. Updates done for the new fields in the UserArea are done in the context of the transaction that is already started for the BOD itself. It is not allowed to call `commit.transaction()`, `abort.transaction()` or `db.retry.point()` from within one of the extension hooks. Doing this may lead to fatal applications errors, or data corruption in the database.

## UI

A BOD extension has no access to the UI. You cannot start sessions or reports.

## Inbound BODs

In the UserArea of BODs you can add fields that can be mapped to the fields of the table(s) that is/are linked to the BOD component. Moreover, in outbound BODs you can add any field or an XML structure with fields, so, also the ones that are not in the linked tables. This is not supported for inbound BODs. For inbound BODs only the fields which are mapped to linked tables are processed.

# CC-library

Older versions of Infor LN had the concept of CC-libraries for BODs. CC-libraries are similar to the extension scripts for BODs, but more complex to construct. CC-libraries are still supported, but do not comply with cloud-ready extensions.

If a BOD extension is present, the CC-library is ignored. If no BOD extension is present, the CC-library is executed.

# Chapter 9 Menu extension point

9

A Menu extension is used to add additional menu items or to hide standard menu items.

Examples:

- Have a sub menu with all own developed sessions in the Extensions package on the main menu.
- Hide some sessions you do not use.
- Overrule standard menu item descriptions.

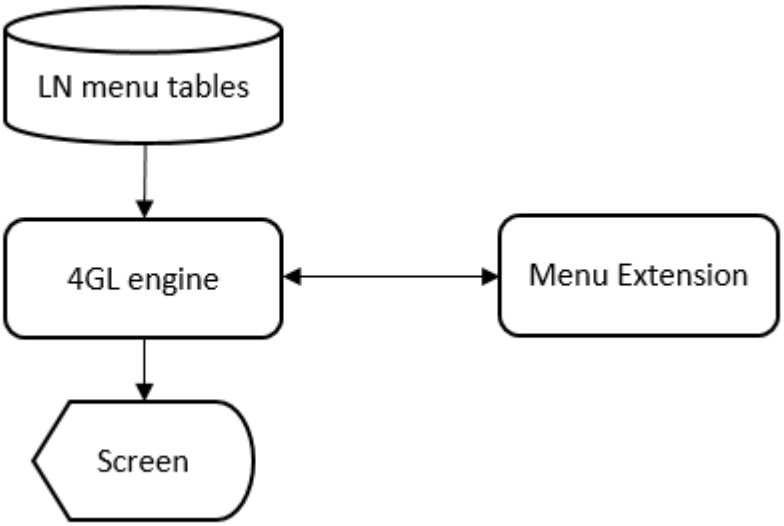
For the Menu extension point you have three extension types:

1 Menu

2 Standard Menu Item

3 Custom Menu Item

This diagram shows the position of the Menu extension:



# Menu

The hooks you can define on Menu level are supporting hooks for the hooks on Component level.

This table shows the available hooks:

| Name | Signature |
|---|---|
| Declarations | |
| Functions | |

## Declarations hook

Use this hook to declare tables and variables that must be globally available in all hooks of the extension. Also the references to include files and DLLs that are used by the extension must be coded in this hook with #include and #pragma.

Example:

```
#include        <bic_tt>

        table   txprc000          |* Price Parameters

#pragma used dll "otxprcdll0000"
```

## Functions hook

Use this hook to code (common) functions you want to use in the other hooks of the Menu extension. This helps you in reusing code and to keep the other hooks small and clear.

Example:

```
function boolean own.pricing.implemented()
{
        txprcdll0000.read.parameter()
        return(txprc000.impl = tcyesno.yes)
}
```

# Standard Menu Item

With the properties and hooks defined for the extension type Standard Menu Item, you can overrule the standard menu item description or make it (conditionally) invisible for the end user.

This table shows the available properties:

| Name |
| --- |
| Overwrite Description |
| Description Label |
| Description |

This table shows the available hooks:

| Name | Signature |
| --- | --- |
| Is Visible | boolean <type>.<name>.is.visible() |

## Overwrite Description property

If you check this property, you can overwrite the standard description of the menu item, which is the sub menu description, the session description or the query description. In this case you must either fill the Description Label property or the Description property.

## Description Label property

Use this property to have different descriptions for users that are working in different languages. You can select an existing label, or create a new label in the Extensions package. The label used must have the context ‘General use’. A label can have descriptions in different languages and multiple length variants; for the menu item the longest one is shown at runtime.

For more information, see the *Infor LN Studio Application Development Guide*.

The Description Label property cannot be filled if the Description property is used.

## Description property

Use this property if your menu item description is not language dependent.

The Description is read-only in case the Overwrite Description property is not checked or the Description Label property is filled. In those cases, the Description shows the description that is used when the menu is displayed at runtime.

## Is Visible hook

Use this hook to remove the standard menu item from the menu.

Example:

```
function boolean menu.tcemm00005001.is.visible()
{
|* Use this hook to remove the menu item from the
|* menu. You can do that based on conditions. To
|* remove it, let the function return the value
|* false.

        select  txcom001.*
        from    txcom001
        where   txcom001.user = :logname$
        and     tccom001.shem = tcyesno.yes
        as set with 1 rows
        selectdo
                return(true)
        endselect

        return(false)
}
```

# Custom Menu Item

With the properties and hooks defined for the extension type Custom Menu Item, you can (conditionally) add menu items to standard menus.

This table shows the available properties:

| Name |
| --- |
| Type |
| Code |
| Overwrite Description |
| Description Label |
| Description |
| Process Info |

This table shows the available hooks:

| Name | Signature |
|---|---|
| Is Visible | boolean <type>.<name>.is.visible() |

## Type property

Choose the Type of the Custom Menu Item.

This table shows the available Types:

| Type | Description |
|---|---|
| Session | The Custom Menu Item is a session. |
| Menu | The Custom Menu Item is a sub menu. |
| Query | The Custom Menu Item is an SQL Query, |

## Code property

The code of the Session, Menu of Query. Sessions and menus can be standard sessions or menus, or own developed sessions or menus in the Extension package. Queries are always own developed queries.

## Overwrite Description property

If you check this property, you can overwrite the standard description of the menu item, which is the sub menu description, the session description or the query description. In this case you need either to fill the Description Label property or the Description property.

## Description Label property

Use this property to have different descriptions for users that are working in different languages. You can select an existing label, or create a new label in the Extensions package. The label used must have the context ‘General use’. A label can have descriptions in different languages and multiple length variants; for the menu item the longest one is shown at runtime. See the *Infor LN Studio Application Development Guide* for more information.

The Description Label property cannot be filled if the Description property is used.

## Description property

Use this property if your menu item description is not language dependent.

The Description is read-only in case the Overwrite Description property is not checked or the Description Label property is filled. In those cases, the Description shows the description that is used when the menu is displayed at runtime.

## Process Info property

Use this property to pass (static) information from the menu to the session. Note that this only makes sense for own developed sessions, because the standard sessions will not pick up this information.

## Is Visible hook

Use this hook to add the custom menu item conditionally to the menu.

Example:

```
function boolean session.txprc5500m000.is.visible()
{
|* Use this hook to remove the menu item from the
|* menu. You can do that based on conditions. To
|* remove it, let the function return the value
|* false.

        return(own.pricing.implemented())
        |* This function is available in the Functions hook
}
```

# Functions

In the hooks of a Menu extension you can use all trusted functions (see Trusted / Untrusted concept) to do string manipulation, calculations, comparisons, etc.

Embedded SQL and the sql.* functions are available to read data from the LN database.

Calling (own) DLL functions is also possible.

# Limitations and restrictions

## Transactions

Transactions in a Menu extension are not supported.

## UI

A Menu extension has no access to the UI. You cannot start sessions or reports, or display messages.

## Top menu

The top menu which is displayed in LN UI can be extended. However, if you add a session directly to this top menu, a sub menu is automatically added. The Xi-style does not allow individual sessions in the top menu.

## Testing menu extensions

Menu extensions can be tested after the Activity Context is set. If a menu is opened already, you must restart LN UI, set the Activity Context and open the menu. For the top menu, you must commit the extension before you see the changes.

After KB 1884185 is installed, the menu (including the top menu) can be refreshed from the Extension Modeler.

# Chapter 10 Extension debugging

10

There are two ways for debugging the extensions in Infor LN:

- Debug Workbench, which runs within LN UI. Use this debugger for simple extensions debugging or when you don't have LN Studio installed.
- LN Studio debugger. Use this debugger for more complex extensions where also new components (developed in LN Studio) are involved. See the *Infor LN Studio Application Development Guide* for more information the setup of the connection to the LN server and debugging in LN Studio. See also chapter Chapter 11 for the setup of LN Studio in combination with extension development.

# Debug Workbench

Although the Debug Workbench is mainly meant for debugging the generated extension scripts (See Extension scripts), also other script components (UI scripts of sessions, DALs and other libraries) can be debugged with de Debug Workbench.

## Starting the Debug Workbench

The Debug Workbench can be started in these ways:

- From session Extensions (ttext1500m000).
- From Debug and Profile 4GL.

To start the Debug Workbench from session Extensions (ttext1500m000):

1 Start session Extensions (ttext1500m000). Select **Tools > Application Extensibility > Extensions**.

2 Select the extension you want to debug. Note that the extension is debugged in the context of the current selected Activity. If no Activity is selected, the committed version of the extension is debugged.

3 Click **Start Debugger** under **Actions**.

To start the Debug Workbench from Debug and Profile 4GL:

1. Select **Debug and Profile 4GL** in the **Options** menu.
2. Check the **Debug Mode** option.
3. Select **Debug Workbench** as the Debug UI.
4. Application Name and Activity Name should show the Application and Activity, which you have current in LN Studio. If Application and/or Activity are not filled with the current Activity, change the fields.
5. Click **OK**.

# Selection of sources

If you started the Debug Workbench via the Extensions (ttext1500m000) session, the generated script for the selected extension is already loaded in the Debug Workbench.

To load (additional) scripts into the Debug Workbench:

1. Select **Select Components** (magnifier glass).
2. Fill selection string (package, module and remainder of code) in the **Selection** field. For example, entering “tx” displays all script components in the Extension package. Entering “txess” displays the generated extension scripts for session extensions.
3. Select one or more components and click **OK**.

## Breakpoints and watchpoints

Before you start the session to debug the script, you must set a breakpoint or watchpoint, otherwise the session process is not suspended. A condition watchpoint suspends the process if the variable changes to a defined value; a modification watchpoint suspends the process if the variable changes.

To set/delete a line breakpoint:

1. Go to the line to set a breakpoint on, or for which to delete the breakpoint.
2. Double-click the line in the area before the line number.

To set a watchpoint:

1. Select a variable for which you want to create the watchpoint.
2. Right-click. Select Condition Watchpoint or Modification Watchpoint.
3. For a condtion watchpoint, enter the value you want to suspend on.
4. Click **OK**.

Breakpoints and watchpoints are visible in the Breakpoints view. In this view the breakpoints and watchpoints can be deleted or temporarily disabled.

## Run the session

After you prepared the breakpoints and watchpoints, run the session that executes the script to debug:

a. For a table extension, this can be a session that uses this table as a main table. But it can also be a session for another table, which does a dependent update in your table. For example, if you have a table extension for the inventory allocations table, you can start the sales order lines session to debug your extension.

b. For a report extension, you must start the print session that produces the report.

c. For a session extension, you must start the session you have extended. Note that it may be necessary to start with another session if your session cannot be started directly from the menu.

d. For a BOD extension, you must start a session that publishes the BOD. This can be a session in the normal process flow, but you can also use the session that simulates the publishing of your BOD. Those sessions can be found in the **Common** menu under **BOD Messaging > Publish BODs**.

e. For a menu extension, just expand the menu.

## Variables and Expressions

The Variables view shows the values of the variables when the process suspends. Which variables are shown depends on the filter. You can change the filter by clicking the arrow down button. Because of the huge list of variables that may appear, table fields are not shown in the Variables view. To inspect the values of table fields you can hover over them in the script view or create an expression for it in the Expressions view.

In the Variables view you can also change the value of variables during the debugging process.

## Call Stack

The Call stack shows all processes that have been started and the state of those processes. It can be cleaned up by right-clicking the Launched Infor LN Sessions and selecting **Remove All Terminated**.

## Toolbar

On the toolbar these commands are available:

- **Save and Exit**: the state of the current Debug Workbench is saved, although without the specific process information. The open sources, breakpoints, watchpoints and expressions are saved and the next time you start the Debug Workbench, those are available. If you close the Debug Workbench with the “X” in the title bar, the state is not saved.
- **Search**: see Selection of sources.

- **Resume**: continue with the suspended process.
- **Suspend**: the selected process in the Call stack is suspended.
- **Terminate**: the selected process in the Call stack is killed.
- **Step Into**: current line is executed, or if the current line contains a function call, the first line of the function is executed.
- **Step Over**: current line is executed; if the current line is a function call, this function is executed completely and the debug pointer goes to next line.
- **Step Return**: current function is executed to the end and the debug pointer goes back to the calling function.
- **Run to Line**: debug pointer is set to the current selected line and the process continues from there.
- **Skip All Breakpoints**: quick way to disable temporarily all breakpoints.

# LN Studio

Debugging with LN Studio is preferred when complex extensions are developed with new tables, sessions, etc. LN Studio handles also other components than scripts. Information of those components may be required during debugging as well.

## Preparations

To prepare for debugging:

1. Open Infor LN Studio.
2. If you have already a current activity in the Extension Modeler, go to step 4. Otherwise click **Create a new Activity**.
3. In the Create a new Activity dialog box, select your **Project Name**, which is typically “EXT” followed by your package combination. Specify a **Name**, **Description** and **Type** and click **Finish**.
4. Click **Open an Infor LN Studio Activity** in the Activity Explorer view. Select your **Project Name** and click **Next**. If you are prompted to configure an Administrator Connection, click **Yes**. Configure the Connection Point as described in the *Infor LN Studio Application Development Guide* or click **Help** to get more information. Repeat those steps, if required, for the Development and Runtime connections.
5. Select your **Activity Name** and click **Finish**.

# Debugging

To debug the extension scripts:

1. After the last step of the previous paragraph the Activity Explorer may contain already some components. This is the case when the activity is also used in the Extension Modeler. If the extension script you want to debug is not in the Activity Explorer, you must retrieve it from the LN server. To retrieve an extension script, expand the **tx package** in the Component Explorer and expand **Libraries**. Choose the module which holds the extension script for your extension point and expand it. Select the extension script, right-click it and click **Get**.

   Alternative: Click **Select a Software Component (Alt+Q)**, specify **txes** in **Component Code** and click **Search Components (Ctrl+Space)**. Select the extension script you want to debug and click **OK**. Click **Yes** as answer to the question whether you want to open the editor for the new software component.

2. Click **Source** at the bottom of the component editor.
3. Set a breakpoint or watchpoint in the source.
4. Switch to LN UI.
5. Select **Debug and Profile 4GL** in the **Options** menu.
6. Check the **Debug Mode** option.
7. Select **LN Studio** as the Debug UI.
8. Application Name and Activity Name should show the Application and Activity, which you have current in LN Studio. If Application and/or Activity are not filled with the current Activity, change the fields.
9. Click **OK**.
10. Start a session that executes the extension script:
    a. For a table extension, this can be a session that uses this table as a main table. But it can also be a session for another table, which does a dependent update in your table. For example, if you have a table extension for the inventory allocations table, you can start the sales order lines session to debug your extension.
    b. For a report extension, you must start the print session that produces the report.
    c. For a session extension, you must start the session you have extended. Note that it may be necessary to start with another session if your session cannot be started directly from the menu.
    d. For a BOD extension, you must start a session that publishes the BOD. This can be a session in the normal process flow, but you can also use the session that simulates the publishing of your BOD. Those sessions can be found in the **Common** menu under **BOD Messaging > Publish BODs**.
11. Use the available options of the debug Perspective in LN Studio to debug your extensions.

# Chapter 11 New Component Development with Infor LN Studio

11

Before you start to use LN Studio for new component development in combination with Extensibility, read Configuration specifics for specific configuration of LN Studio.

## Infor LN Studio

Infor LN Studio is the Eclipse based development environment for Infor LN. Within the Extensions (tx) package you can create new components such as tables, sessions, messages, etc. The development of components in the tx packages does not differ from the normal Infor LN development. However, for extensions to be ready for the cloud, some restrictions apply, which are described in the table below and in the next chapter.

This table shows the component types that can be developed:

| Component Type | Remark |
|---|---|
| Session | Including the UI-script that handles the screen events. |
| Report | LN native reports can be developed, but no layouts can be defined. This report is a container of data: the report input fields define the fields that are available to be sent to Infor Reporting. The design of the report design is made in Infor Reporting's Report Studio. |
| Table | This is including the DAL that handles the table events. For the table fields standard domains can be used, but also new domains can be created. |
| Domain | |
| Library | |
| Function | |
| Menu | |
| Label | |
| Message | |

| | |
|---|---|
| Question | |
| Additional File | |
| Business Object | With an Integration Project. |

For more information about Infor LN Studio and component development see the *Infor LN Studio Application Development Guide* and the *Infor LN Studio Integration Development Guide***.**

# Configuration specifics

If you use LN Studio for the development of new components to be used in your extensions, the configuration of the Base VRC, Development Environment, Application and Project should be done by the Extension Modeler. When you create the first activity in the Extension Modeler, the setup of a Base VRC, Development Environment, Application and Project are automatically done. Those are the ones you must also use in LN Studio.

This table shows the names of the various configuration items that are generated:

| Configuration | Name | Remark |
|---|---|---|
| Base VRC | B61O_a_ext | This is the default Base VRC generated in PMC. If you specify another VRC code during Initialize Extensibility, this VRC code is used as Base VRC. |
| Development Environment | EXT | This value cannot be changed. |
| Application | EXT<package combination> | This value cannot be changed. |
| Project | EXT<package combination> | This value cannot be changed. |

This configuration applies to the Extensions package (tx) only. To combine classic customizations development (customization VRCs for the standard Infor LN packages) and extensibility. Specify a different VRC code for the Extensions package with a separate Base VRC. The classic customizations are in a separate Application and Project. By setting Activity Context (in LN Studio by defining Related Software Projects, in LN UI by **Options > Debug and Profile 4GL**) you can link the activity for the Extensions and the activity for the classic customization.

# Chapter 12 Governance

12

As mentioned already in the Cloud readiness paragraph it is recommended to build the extensions in a way that they are ready for the cloud. This means that upgradability is guaranteed, no infrastructure data is revealed and other customers are not impacted by your extensions.

Infor LN has a number of mechanisms to govern your extensions whether they are ready for the cloud:

- Trusted / Untrusted concept
- Performance governors
- File system governors
- Best practices

If you do not develop with the **Extensions ready for Cloud** parameter switched on, the governors are not activated. See Cloud readiness why we do not recommend this.

## Trusted / Untrusted concept

With the introduction of trusted functions, the LN infrastructure can restrict the extensions (and other software added by customers to the LN environment, such as Exchange scripts) to break the general rules for cloud readiness. Extensions are only allowed to call trusted functions. This applies to the 3GL and 4GL functions of LN's programming language, which are in the *Infor ES Programmer's Guide*. But it also applies to application functions in DLLs, which can be called by the extensions to retrieve and store data via LN's application logic.

The following functions are seen as untrusted, and may not be used within extensions:

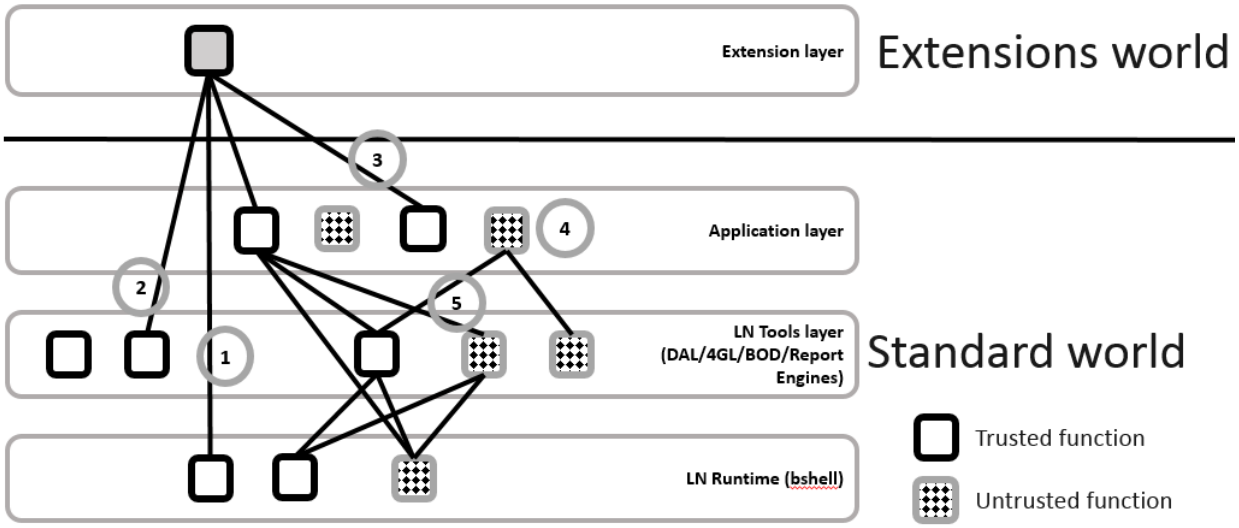
- Functions that may harm the infrastructure if they are used in the wrong way
  - Example: `run.prog()`
- Functions that reveal information about the infrastructure
  - Example: `hostname$()`
- Functions that are deprecated
  - Example: `cf$()`
- Functions that may disturb the flow of the standard application
  - Example: `dal.get.error.message()`

- Functions that may use standard components and the interface of the standard components may break
  - Example: `wait.and.activate()`

Functions in application DLLs (even if declared as “extern”) are untrusted by default. A new specific trusted layer is available with functions that can be used by extensions[3]. Infor LN Studio shows the available trusted application functions in the help pages.

During compilation of an extension script or any other script in the Extensions (tx) package, messages are raised when untrusted functions are called.

This diagram shows the different layers with trusted and untrusted functions:




1 An extension is allowed to call trusted functions in the LN Runtime layer, bshell functions, which are documented as trusted in the *Infor ES Programmer’s Guide*.

2 The extension can also call a trusted function in the LN Tools layer; those are also documented as trusted in the *Infor ES Programmer’s Guide*.

3 And finally the extension can call trusted functions in the application layer, which are documented in the help pages of LN Studio.

4 Untrusted standard functions cannot be called from the extensions. By definition all functions in the extensions are untrusted, but those can be called by the extension itself.

5 With the standard software, the distinction between trusted and untrusted is not considered.

[3] During Infor LN’s 10.5 release this layer was not present yet. It is made available after the release by means of PMC solutions.

# Performance governors

The goal of the performance governors is to restrict the impact your extensions can have on the infrastructure. This especially applies to the resource consumption.

Extensions are restricted in:

- Time spent (elapsed time);
- Amount of data written to the file system
- Future versions may have more restrictions

The counter starts each time the extension starts execution. It is reset at the moment the extension stops execution. This implies that for example each hook in a table extension has its own scope regarding the governors.

The exact limits are set by the Infor Cloud team. If you develop extensions in an on-premises environment with the **Extensions Ready for Cloud** option switched on, you can change the values in the `$BSE/lib/extensibility/config.<package combination>` file:

| Resource | Default | Remark |
|---|---|---|
| governor_elapsed_time | 5000 | Elapsed time in milliseconds. |
| governor_write_file_quotum | 5000000 | 5MB |

Keep in mind that increasing those resources to higher values than required by the Infor Cloud team results in extensions that are actually not ready for the cloud and may not run after they are moved to the cloud.

# File system governors

In cloud environments the file system access is restricted. Cloud-ready extensions should comply with those restrictions.

Extensions are restricted to certain folders with the BSE. Outside those folders it is not possible to read or write data. The LN standard software can read outside those folders, but can only write in a restricted number of folders. So, end users cannot choose all locations where they want to put their files that are output of their sessions.

Extensions are also restricted in writing files with certain file extensions. For example, writing a file with a "`.exe`" file extension is not allowed.

If you develop extensions in an on-premises environment with the **Extensions Ready for Cloud** option switched on, you can change the values in the `$BSE/lib/extensibility/config.<package combination>` file:

| Resource | Default | Remark |
|---|---|---|
| user_writable_dirs | appdata, tmp | Within $BSE. |
| not_trusted_object_accessible | appdata, tmp | Within $BSE. |
| forbidden_filename_extensions | exe,vb*,com | |

Keep in mind that adding folders or extensions to those resources results in extensions that are actually not ready for the cloud and may not run after they are moved to the cloud.

# Best practices

To reduce the risk that your extensions will not be compatible with newer versions of LN, we recommend that you comply with the rules in this paragraph.

## Database

### Queries

The LN development team has the responsibility to keep the data model compatible. However, in some cases it may be required to change indexes. We recommend that you do not refer to indexes, but to the fields directly. See these code examples:

- This syntax is incorrect because it refers to an index:

```
function extern void tdsls401.read()
{
        select tdsls401.*
        from   tdsls401
        where  tdsls401._index1 = {:rep.orno, :rep.pono}
        selectdo
        endselect
}
```

- Instead, use this syntax, which refers to the fields directly:

```
function extern void tdsls401.read()
{
        select tdsls401.*
        from   tdsls401
        where  tdsls401.orno = :rep.orno
        and    tdsls401.pono = :rep.pono
        selectdo
        endselect
}
```

If trusted application functions are available to read data from the database, it is preferred to use those instead of querying the database directly. See these code examples:

- This syntax is incorrect because it queries the database directly:

```
function extern void ext.item.desc.calculate()
{
        select tcibd001.dsca:ext.item.desc
        from   tcibd001
        where  tcibd001.item = :rep.item
        selectdo
        endselect
}
```

- Instead, use this syntax, which uses a trusted application function:

```
function extern void ext.item.desc.calculate()
{
        ext.item.desc = tcibd.dll0001.read.item.description(rep.item)
}
```

## Table definitions

If you create own tables in the Extensions (tx) package, use standard domains if you store copies of standard data in your tables. This ensures that your tables also are reconfigured if the standard tables are reconfigured after a domain change.

Be aware that for enumerated domains, new values may be added. Your extension should be prepared for possible new values.

## Standard table updates

If you update standard tables, use the DAL. Always check the return values of the functions such as `dal.save.object()` and react accordingly.

# Standard components

As a general rule, do not use standard components. Except for the trusted functions, their interfaces may change.

# Chapter 13 Extension Deployment

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Once extensions have been developed, they can be exported from one environment and imported in another environment.

The same procedure must be used when extensions must be copied from one package combination to another package combination.

The Product Maintenance and Control (PMC) module must be used to create PMC solutions with the extensions. Use also PMC to install those solutions in the other environment. See the *Infor LN Development Tools Development Guide* for more information on the distributor (export) side of PMC. See the *Infor Enterprise Server Administration Guide* for more information on the recipient (import) side of PMC.

## Exporting extensions

To export the extensions:

1. If not present yet, create a Base VRC (ttpmc0110m000) which has your VRC for the extensions as Export VRC.
2. Create a PMC solution (ttpmc1100m000).
3. Add your component(s) to the PMC solution. If you add an extension script as a component, the extension data is added.
4. Generate dependencies.
5. Validate the solution.
6. View the report to see whether error messages have been printed. If required, take corrective actions and repeat the previous step. Note that extensions that are being modified in an activity are reported as warnings. The committed versions of those extensions is exported.
7. Follow the standard PMC process to export and release the solution.

# Importing extensions

To import the extensions:

1. If not present, define an Update VRC (ttpmc2140m000) for the Extensions package (“tx”).
2. Scan the PMC dump that was created in step 7 of the export procedure.
3. Run the Check to Install from Process Solutions (ttpmc2101m000).
4. Check to install reports errors in case the extensions that are to be installed are being modified in the recipient environment. Warnings is reported for extensions that are changed in the recipient environment since the previous PMC install.
5. Complete the installation with the normal PMC process and execute also the post-installation instructions.