

Plugin Architecture Reference Design

User Manual

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1. Introduction

1.1. Definitions and Acronyms

SOM – System on Module (NI sbRIO 9651)

1.2. Overview

Plugin Architecture Reference Design is created to provide a development system for LabVIEW embedded developers. The system contains tools which enable to manage RT system, program files, licenses, etc. It facilitates the installation and management of RT applications on NI Linux RT SOM and enables to update software without resetting controller and without stopping FPGA program.

1.3. Scope

The system is based on plugin architecture with LabVIEW packed library, which turns LabVIEW code into a plugin. The system consists of a firmware, an API with an example project and a host application.

The firmware is installed only once on the controller and implements the following operations with the plugin: run, backup, roll back, stop, rewrite, postponed rewrite, implements scenarios, etc.

The example project enables the developer to easily integrate an existing LabVIEW code and web user interface into the *Plugin Architecture Reference Design* using the corresponding API.

The host application is called SOM Plugin Manager. It is a user friendly application which is designed to get and set firmware, create scenario files, upload plugins, etc.

The system is compatible with NI Linux Real-Time operating system.

The current version is designed for NI sbRIO-9651 SOM.

2. Getting Started

2.1. Quick guide

Complete the following steps to launch the toolkit. You can find more detail descriptions and instructions for each step in the next sections.

1. Install *SOM Plugin Manager* on your Windows PC.
2. Open *SOM Plugin Manager* and refresh the list. The list contains only SOM controllers connected to your IP network.
3. Choose the controller by IP Address and apply the firmware included in the package (see [“Recourses”](#) section). So the controller will be reset and will be ready to run the plugin software.
4. Activate your system license using *SOM Plugin Manager*.
5. Open *SOM_Software.lvlib:S_Main.vi* and replace your code with “Main” loop.
6. Once the packed library is built, create your html GUI, create a *.zip with the following file names *SOM_Software.lvlibp* and *www/index.html*. Use *Upload Plugin* button and set the path of your *.zip. After receiving the action reply check if the system has started properly.

7. If error occurs and the program stops, the system automatically rolls back to the previously backed up version if exists.

2.2. SOM Plugin Manager

Run *setup.exe* to install SOM Plugin Manager.

Once the installation process is completed, **SOM Plugin Manager** shortcut will appear on your PC desktop. Restart the system and run the shortcut as administrator.

After initialization of the list of controllers on run, write usernames and passwords, refresh list or refresh by selected controller to indicate activation state.

Note: *Usernames and passwords will be remembered by serial numbers and will be updated on user interface if it is inserted once.*

Note: *Triple click on the field to edit.*

2.2.1. “Home” tab

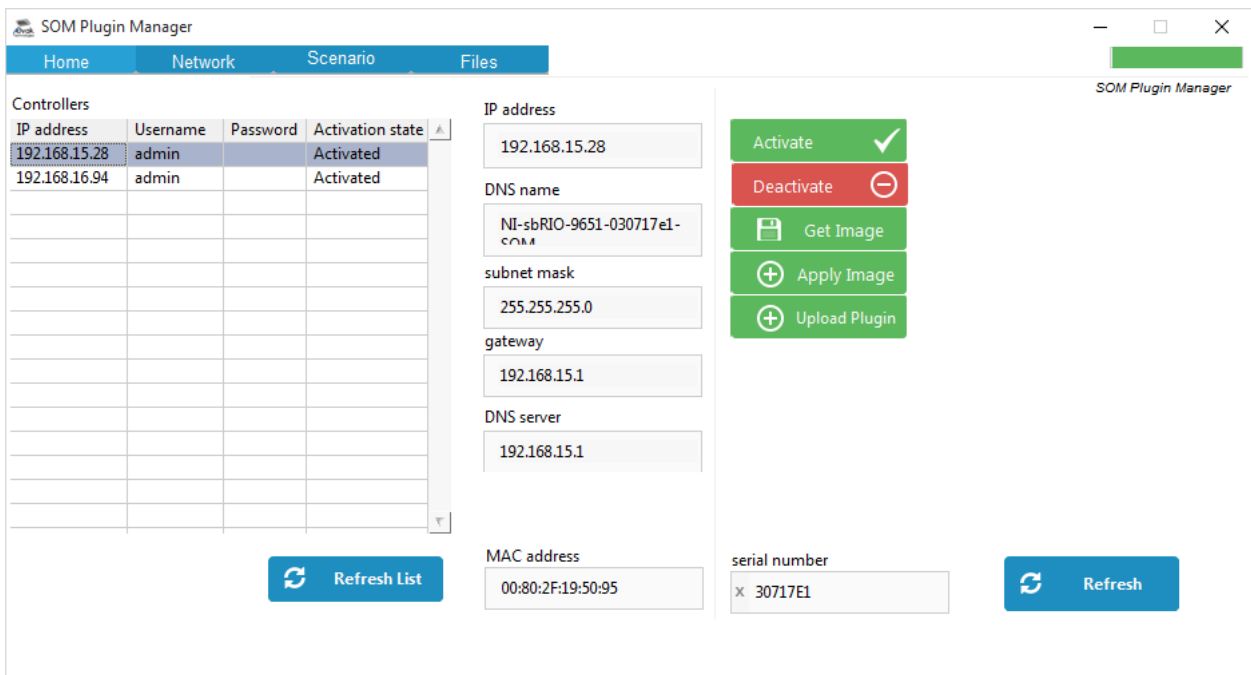


Figure 1 “Home” tab

2.2.1.1. Getting firmware

To save image in PC create an empty archive, press “*Get Image*” button and specify the path to that archive. This process can take several minutes.

2.2.1.2. Applying firmware

To apply image on controller from your local PC, press “*Apply Image*” button and specify the image archive file. This process can take several minutes.

2.2.1.3. Activating/deactivating the system

Complete the following steps to activate the system:

1. Open “*Home*” tab and press “*Activate*” button
2. Select the license file folder path

3. Refresh the list and check the activation state

Use “Deactivate” button to deactivate the system.

Note: If you limit the corresponding permissions on the controller, the activation may fail. But you can still transfer your license file to /C/OvakTechnologies/licensekey.ini path.

2.2.1.4. Upload plugin

Complete the following steps to upload new plugin to the controller:

1. Press “Upload Plugin” button
2. Select plugin path on your local PC
3. Select controller IP address

Note: This can take several minutes.

4. Once the process is finished you will receive reply from controller about successful action or errors.

2.2.2. “Network” tab

In “Network” tab press “Refresh List” button to display the list of controllers connected to local network and select controller from the list.

Network settings of controller should match to settings of local network. Settings of local network can be changed in “Network” tab.

Use “Restart” and “Format” buttons for corresponding action for controller which IP address is selected.

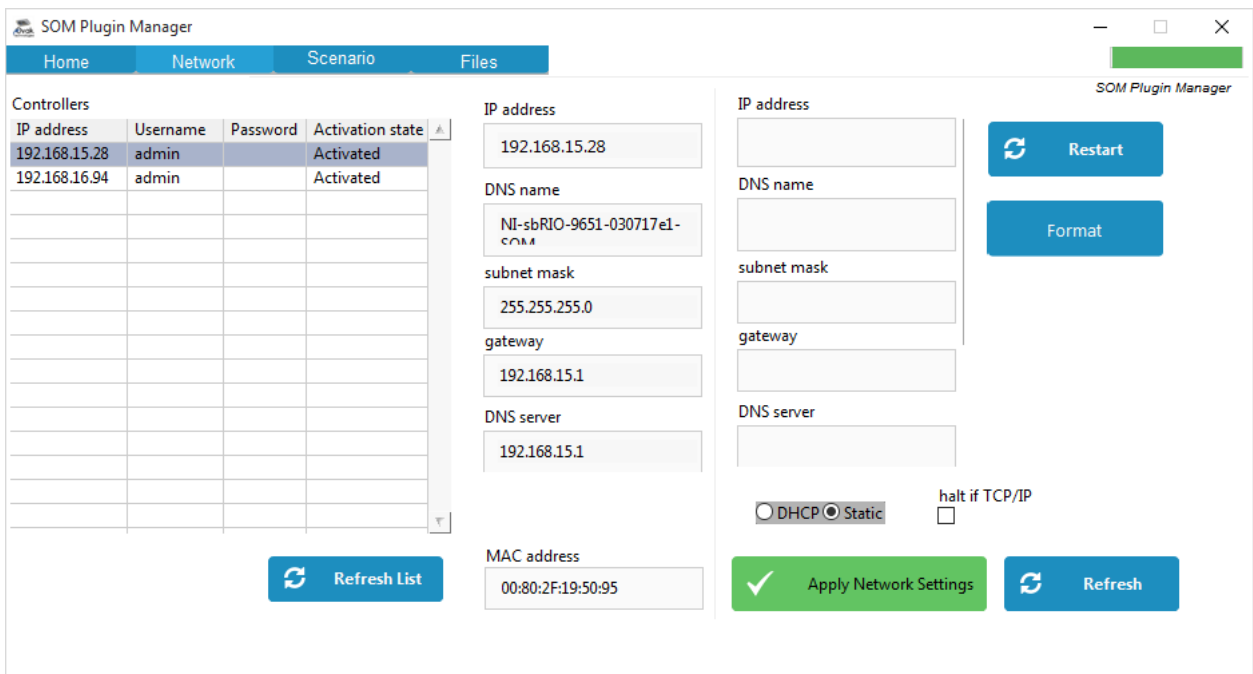


Figure 2 “Network” tab

- In “*Network*” tab user can add or modify the following parameters:
 - IP address – X.X.X.X, where X is any number from 0 to 255
 - DNS name – any name, for example, NI sbRIO-9651
 - Subnet mask – 255.255.255.0
 - Gateway – X.X.X.1, where X is any number from 0 to 255
 - DNS server – X.X.X.1, where X is any number from 0 to 255
 - In “*Network parameters type*” field “*Static*” should be selected
 - Make sure that “*halt if TCP/IP*” checkbox is not checked
- Press “*Apply Network Settings*” button to confirm entered parameters and apply it to controller (this action takes several minutes and will reboot controller).

There are the following default network settings:

- IP address – 192.168.0.102
- Subnet mask – 255.255.255.0
- Gateway – 192.168.0.1
- DNS server – 192.168.0.1

2.2.3. Scenario

Choose “*USB Memory*” path where you would like to save or read a scenario file.

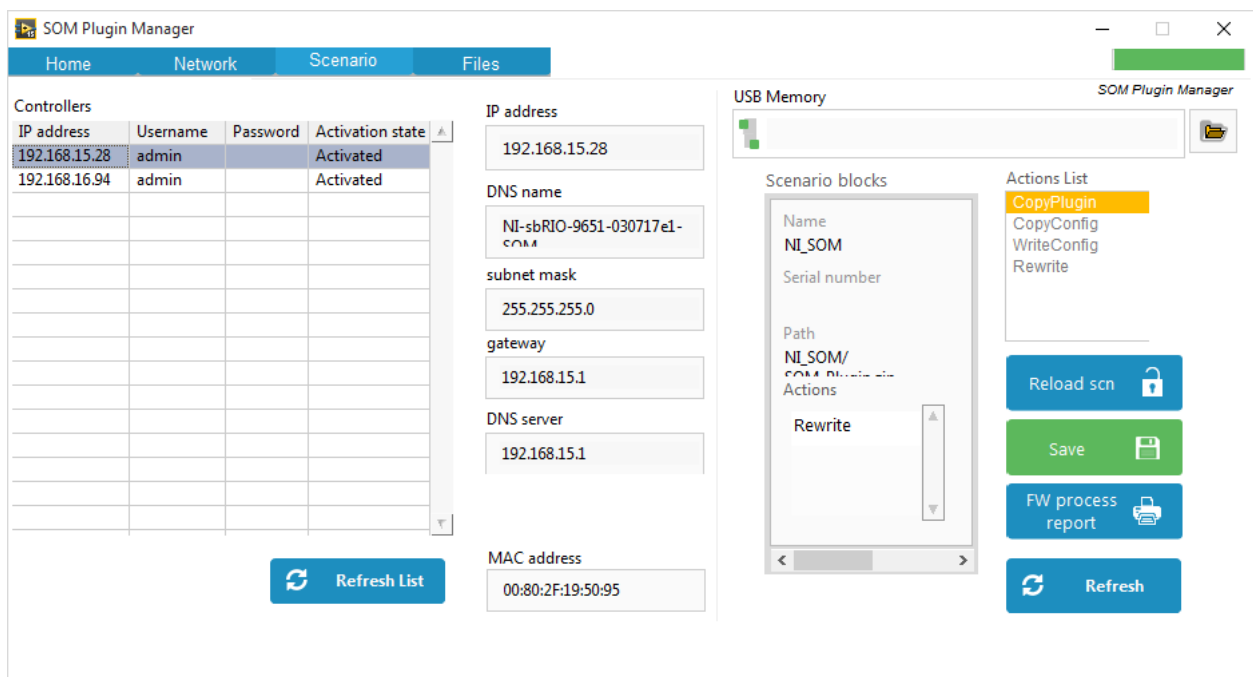


Figure 3 “Scenario” tab

In “Scenario blocks” section you can create your scenario which will be implemented in turn once you put the USB memory into controller.

- Name – the controller name parameter. Can be used “ALL” to implement action on each single controller.
- Serial number – if the “Name” field is empty or does not match the controller name, then the serial number is checked. For both “Name” and “Serial number” field can be used “ALL” parameter which will implement action for each controller to which USB memory is connected.
- Path – this parameter is used for “Rewrite” and “WriteConfig” actions. It specifies the path of the plugin or the configuration files on the USB memory.
- Actions – the set of actions needed for the controller within this block. The following actions are available:
 - CopyFW – copy plugin to USB memory
 - CopyConfig – copy configuration files to USB memory
 - WriteConfig – write the configuration files
 - Rewrite – rewrite and reload the plugin

2.2.4. “Files” tab

Complete the following steps to back up and apply configuration files:

1. Select the files that must be kept in backup (press *Ctrl+a* to select all files)
2. Select folder to backup files
3. Press “Download” button

Select Files on “Local PC” and press “Upload” to apply settings files.

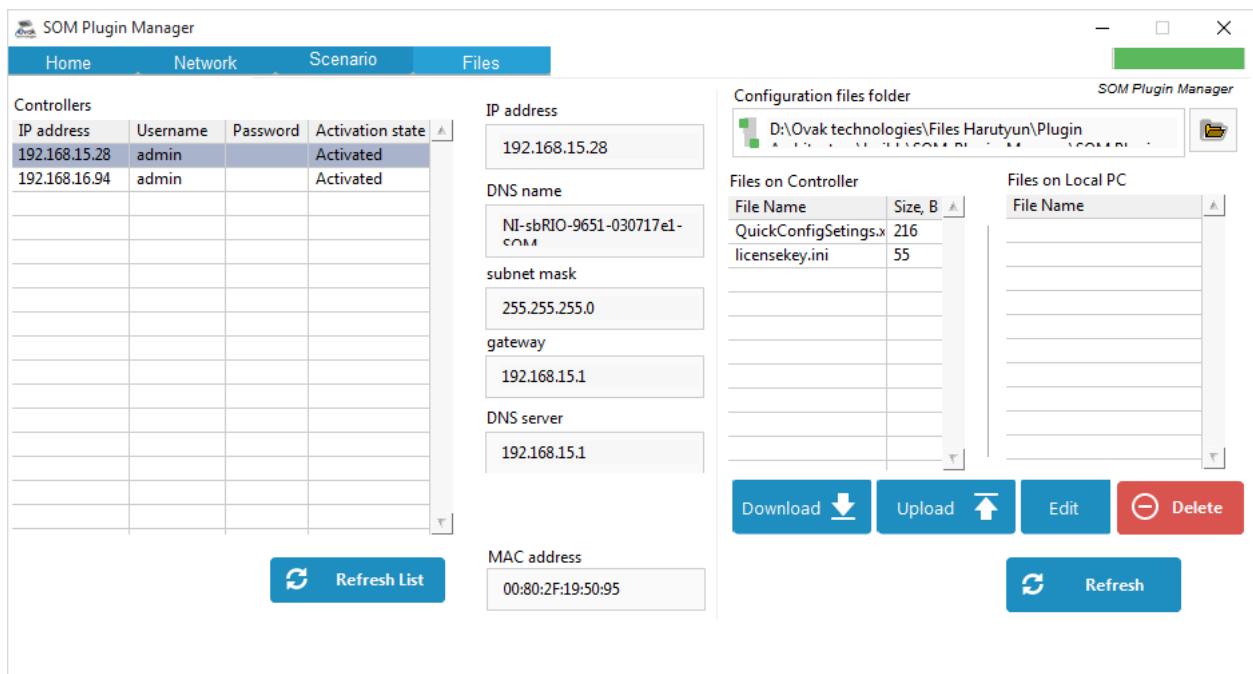


Figure 4 “Files” tab

To open selected file press “Edit Selected”.

2.3. Integrate your code into example project

Open *Example.lvproj* project at NI-sbRIO-9651 target.

From *SOM_Software.lvlib* library open *S_Main.vi*.

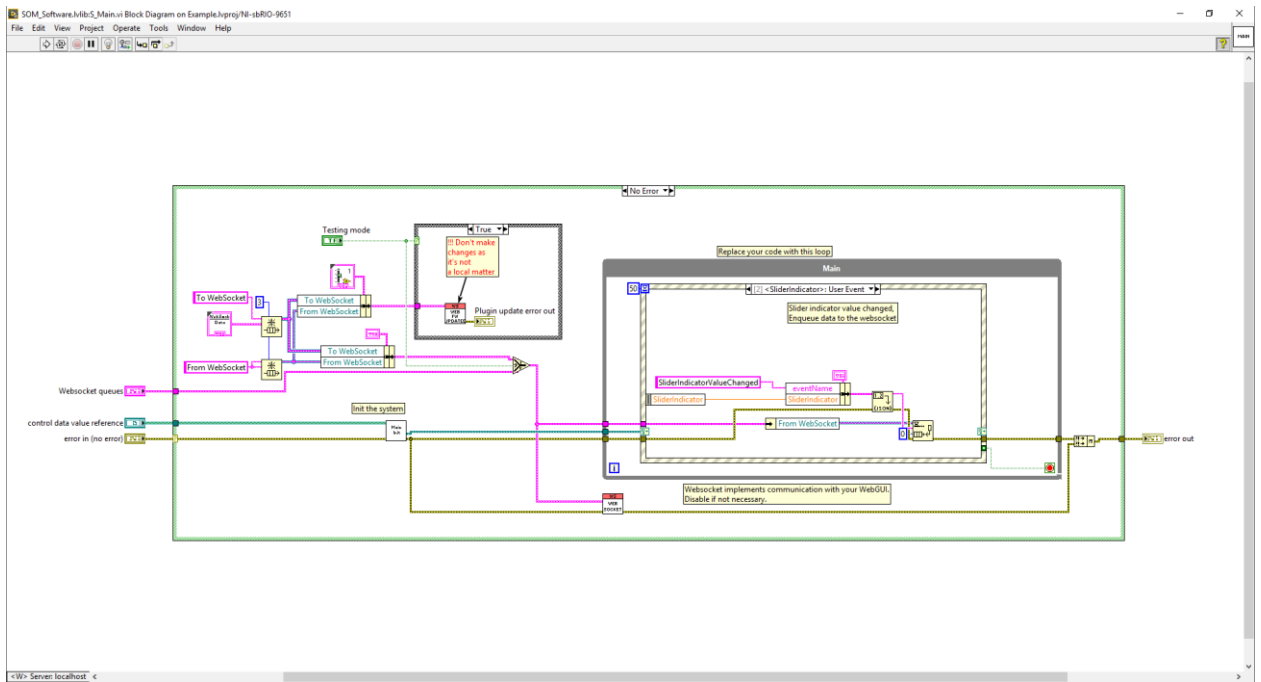


Figure 5 *S_Main.vi* Block Diagram

Current example initializes the system, runs a loop which waits for a user event that is generated by Web GUI message. You can replace your code with this loop.

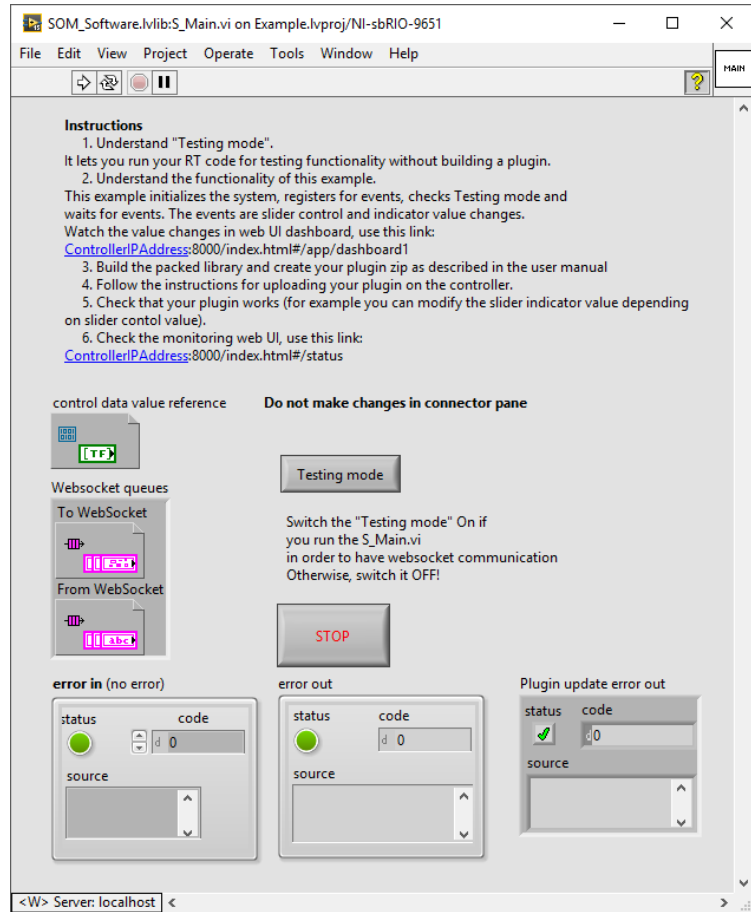


Figure 6 S_Main.vi Front Panel

This VI initializes the system minimum requirements, a slider and slider indicator variables for demo dashboard.

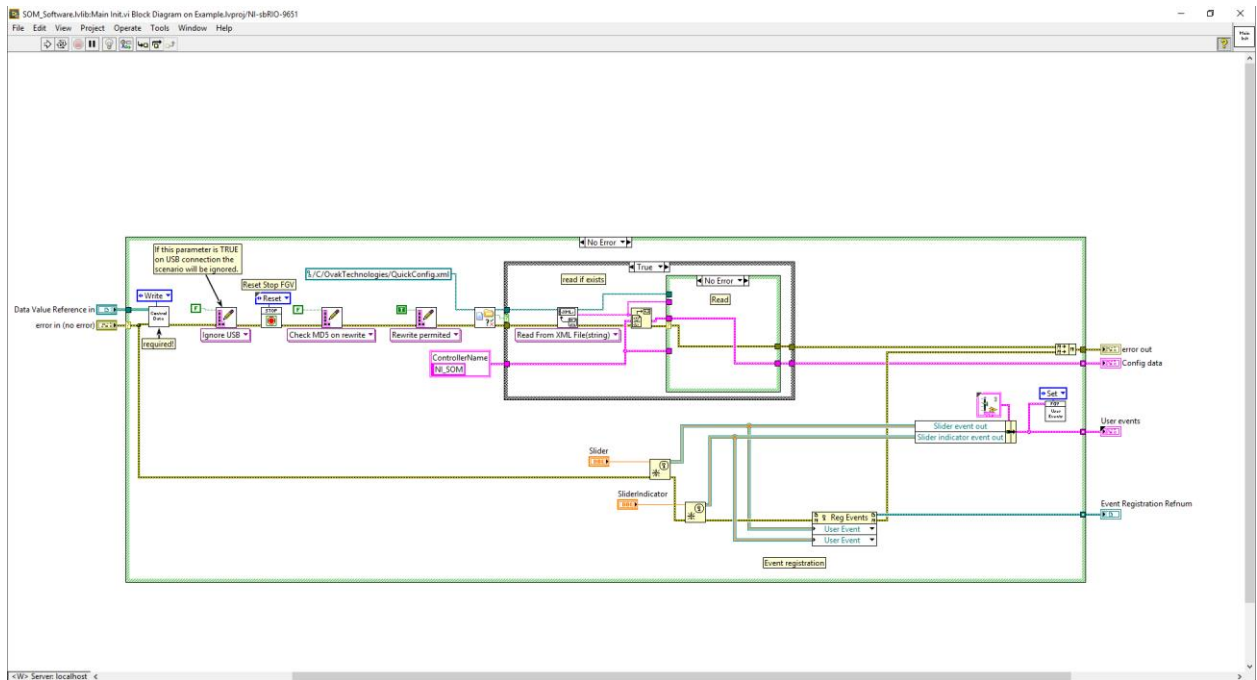


Figure 7 Main Init.vi Block Diagram

2.4. Build a packed library

Right click the library and select build.

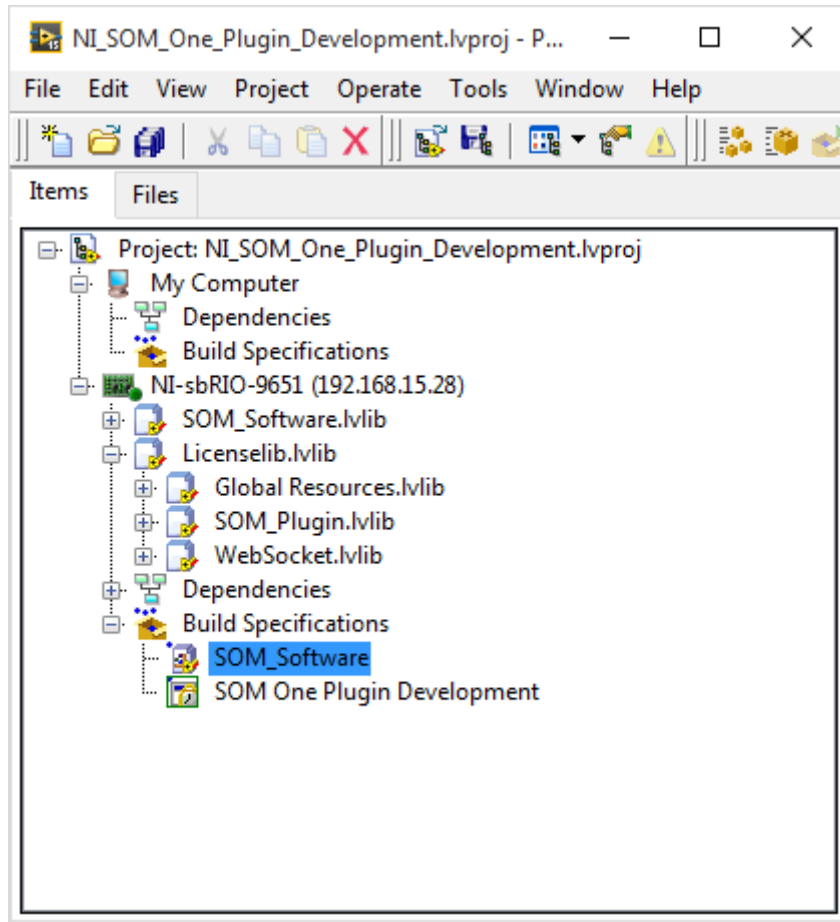


Figure 8 Build packed library

Once the build is completed you can explore *SOM_Software.lvlibp* packed library.

2.5. Create a plugin

The acceptable format for plugin is a *.zip file that includes a folder named *www* which contains all web GUI files and the packed library *SOM_Software.lvlibp*.

2.6. Read/Write Control Data

Use these two polymorphic VIs to communicate with the firmware running on the controller from your application.



Figure 9 Polymorphic VIs

2.6.1. Stop Software

If this parameter becomes true, the plugin stops and it is recommended to use *Global Resources.lvlib:Stop.vi* in all program loops with *OR* condition.

This parameter becomes TRUE after “*Rewrite*” action to start the new plugin.

This parameter becomes TRUE after “*Roll back*” action when an error occurs in the plugin software to run the backed up version automatically.

2.6.2. Safe mode

This parameter becomes TRUE 700 ms before *Stop Software* becomes TRUE. It is designed to create safe mode in FPGA while changing the plugin.

2.6.3. Ignore USB

If this parameter is TRUE on USB connection, then the scenario will be ignored.

2.6.4. USB state

There are 6 states available for USB if enabled. They are as follows:

- None – idle state
- Connected – USB device connection was detected
- Scenario found, in progress – *.scn* file is recognized and actions are started
- Finished – actions are finished successfully
- Error – error has occurred
- No scenario – scenario file was not found

2.6.5. Updating FW

This parameter becomes TRUE when *Plugin Update* action starts.

2.6.6. Rewrite permitted

This parameter FALSE condition will postpone rewrite action until this parameter becomes TRUE. When rewriting by USB, the new plugin will be backed up and USB can be removed.

2.6.7. Check MD5 on rewrite

If this parameter is TRUE when rewriting the plugin, then it will cancel rewrite action in case the MD5s of the new plugin and the current one are the same.

2.6.8. No blocking connection

This parameter is TRUE if the number of WebSocket connections is zero.

2.7. Recommendations

1. It is recommended not to change *S_Main.vi* name and connector pane.
2. It is recommended not to change *SOM_Software.lvlibp* file name.
3. It is recommended to use Global *Resources.lvlib:Stop.vi* FGV with OR condition in all program loops.
4. Enable remote panel server on your controller

The default controller name is *NI_SOM*.

When getting Plugin or config files to USB from controller, directory with controller name is created, if config file does not exist, then serial number is used.

2.8. WebSocket and testing mode

It is possible to deploy your code on the SOM without creating and uploading a plugin. You will need to enable “*Testing mode*”. This will enable you use your web GUI. This switch

transfers WebSocket connection part to your application. If the switch is off, then it's in the firmware part.

The “String in” string parameter is for receiving *JSON* data from your web GUI.

The example how to send *JSON* message to the web GUI is shown in *S_Main.vi* <SliderIndicator>:User Event case.

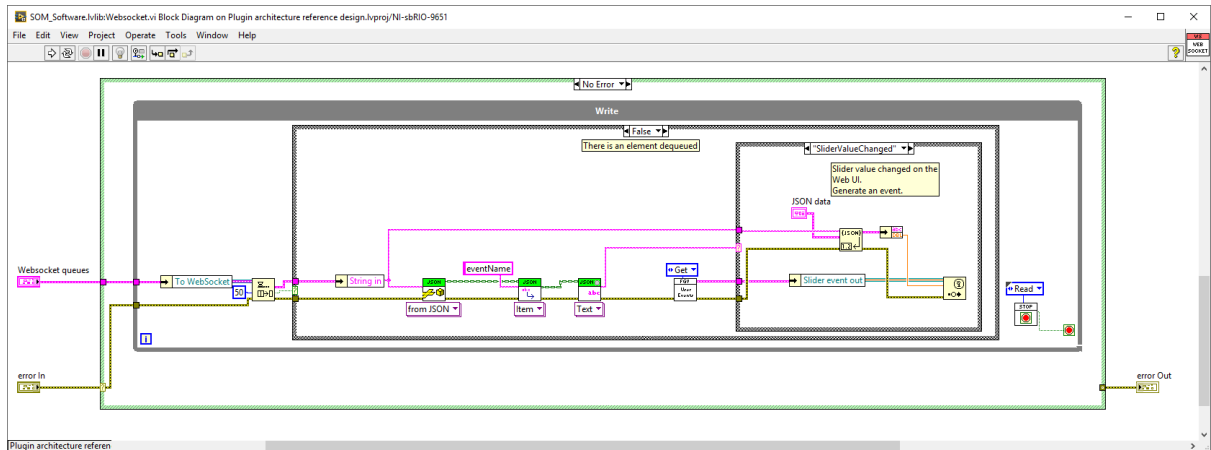


Figure 10 WebSocket Block Diagram

3. Recourses

1. The firmware:

\\LabVIEW 2017\help\Ovak Technologies\ Plugin Architecture Reference Design \SOM_Firmware.rar

2. SOM Plugin Manager:

\\LabVIEW 2017\help\Ovak Technologies\ Plugin Architecture Reference Design \SOM Plugin Manager Installer.rar

3. SOM example plugin:

\\LabVIEW 2017\help\Ovak Technologies\Plugin Architecture Reference Design\SOM_example_plugin.zip

4. Example dashboard link

<http://<ControllerIPAddress>:8000/index.html#/app/dashboard1>

5. Monitoring Tab link

<http://<ControllerIPAddress>:8000/index.html#/status>

4. System Requirements

- LabVIEW Base, Full or Professional Development system
- NI LabVIEW 2017 Real-Time Module
- NI CompactRIO Device Drivers May 2017
- Windows 7 or later
- SOM Plugin Manager requires Windows 7 and later
- JSON API v1.4.1.34 by LAVA (all components)

You can get it from: <https://lavag.org/files/file/216-json-labview/>

- JKI JSON v1.1.10.37 by JKI (all components)

You can get it from: <http://jki.net/tools>

NI Linux Real-Time on NI sbRIO-9651 SOM

5. Support Information

For technical support, please, contact Ovak Technologies at:

Phone: +1.281.506.0020

Email: support@ovaktechnologies.com

Web: www.ovaktechnologies.com