

# Take Your LabVIEW Development Efficiency to the Next Level

Jeffrey Habets

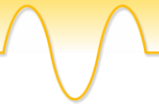


# LabVIEW • TestStand

Realtime • FPGA • Embedded • Object Oriented  
UML • Consultancy • Framework • Architecture  
Machine Vision • Machine Automation

Engineering support • Large Application development  
• Project startup • Training • Integration

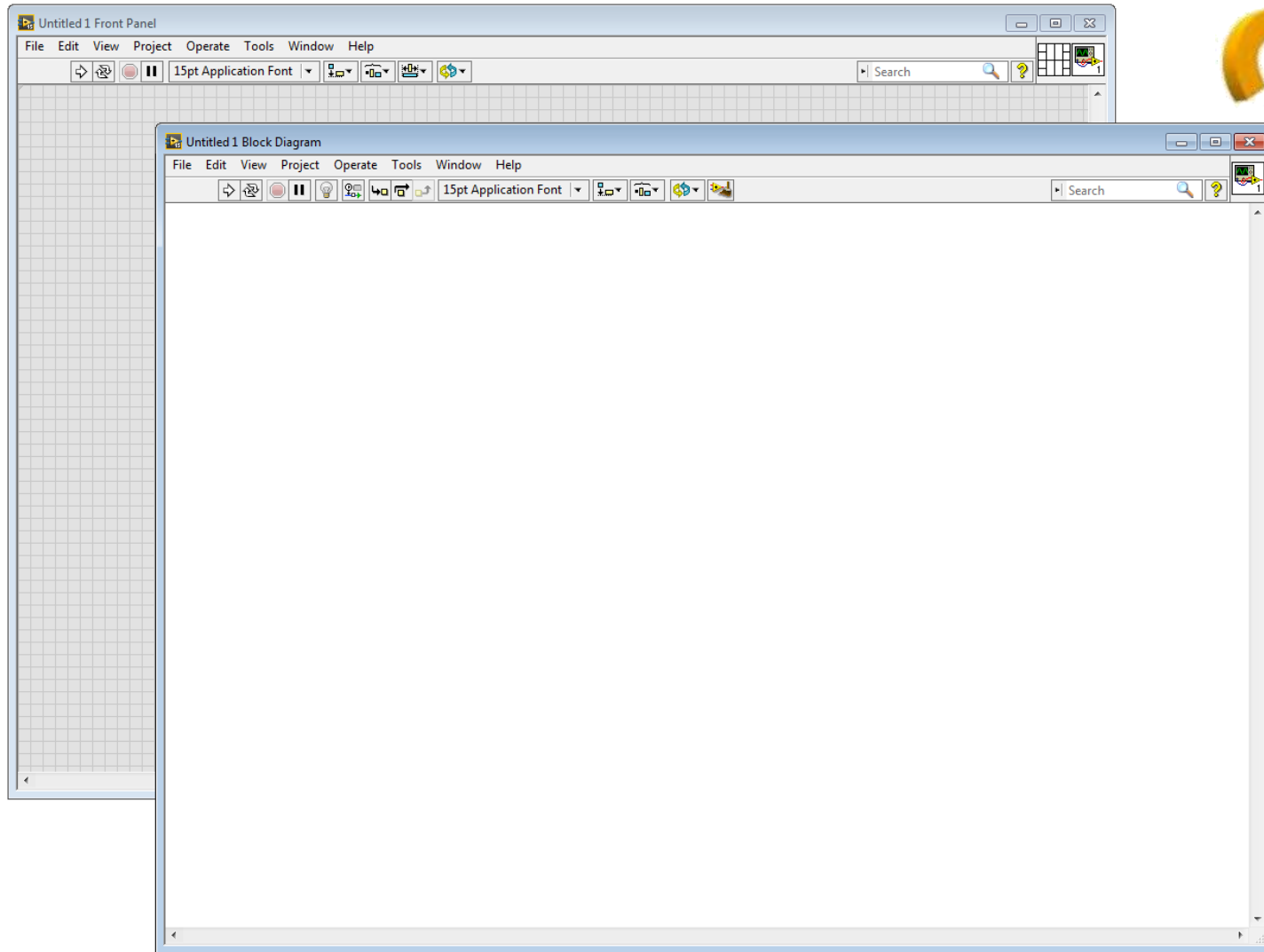


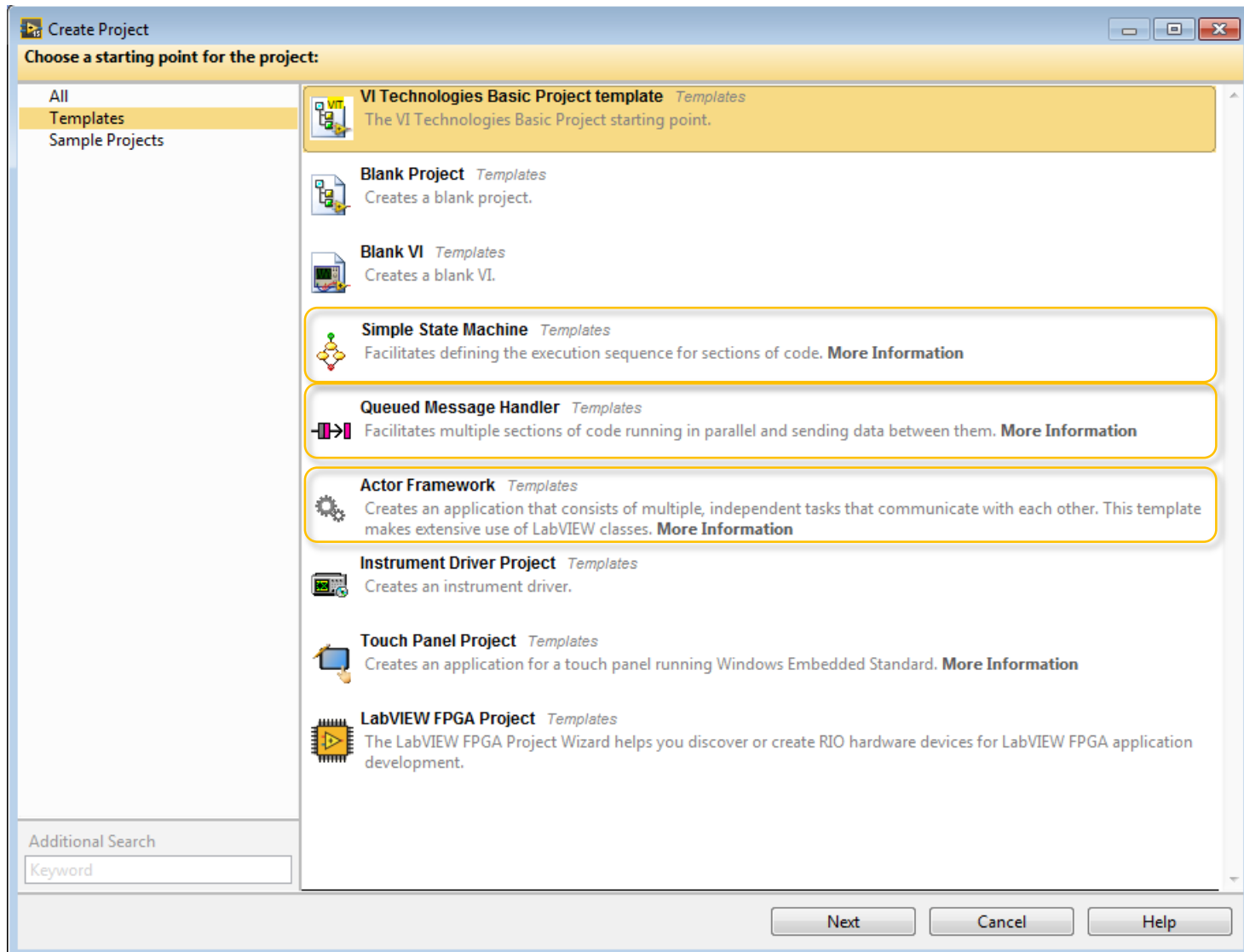


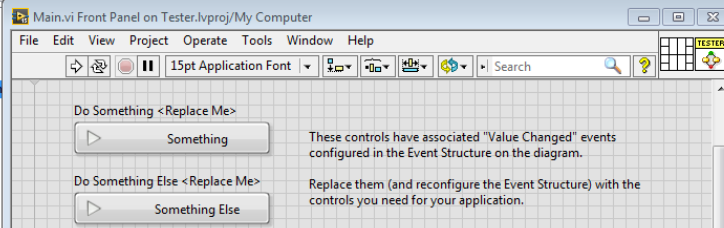
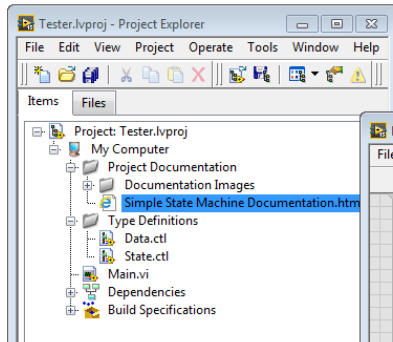
- Why this presentation
- Project templates / frameworks
- Tools, tools, tools
- Building up proficiency
- Web resources
- Questions / discussion



- There's a wealth of tools in LV
- A lot of people don't know all the gems
- There's a very lively online community a lot of beginners don't know of
  - ni.com forums and communities
  - LAVA
  - Blogs







### Simple State Machine

facilitates defining the execution sequence for sections of code. This particular implementation often is referred to as a state machine. The design of this template makes it easy to insert new code, or change the order in which sections execute – all without making major modifications to the structure of the Development System.

States that can be described as a combination of:

- actions that determine when to move to a particular state
- actions that can benefit from the state machine pattern:

Each tab of the dialog box corresponds to a state. A user initiates state transitions by clicking a particular button on the front panel. The states in this application might include waiting for user input, checking the requested amount against the current balance, printing the receipt, and so on. The states in this application might include waiting for a measurement, logging the data, displaying the data, and so on.

Each state corresponds to a subdiagram of the Case structure in Main.vi. Each state:

- defines what the next state is by passing an instruction to a shift register on the While Loop.
- when a state transitions to the Wait for Event state, this state contains an Event structure that waits for front panel button presses and switches to the appropriate subdiagram of the Event structure. This is the appropriate state.
- uses data. The data types in this cluster are defined in Data.ctl.
- are defined in Data.ctl, which is a typedef. Using a typedef for state transitions restricts the transitions you can use, reducing the risk of errors and getting into an unrecognized state.
- in an application. This design prevents accidental and partial shutdowns by guaranteeing that the application runs only when the user wants to stop the application.
- runs to completion.
- and the single While Loop means all tasks execute at a single rate. If you need multi-rate or parallel tasks, consider Actor Framework templates, available from the Create Project dialog box.

### Main.vi Block Diagram on Tester.lvproj/My Computer

**Main VI State Machine**

User State 1 - Replace this state with functionality for your own application.

String <Replace Me>

#CodeNeeded - Use the state data to perform whatever action is associated with this state.

Initial State: Initialize

Next State: Wait for Event

Call Quit LabVIEW if running as a built application.

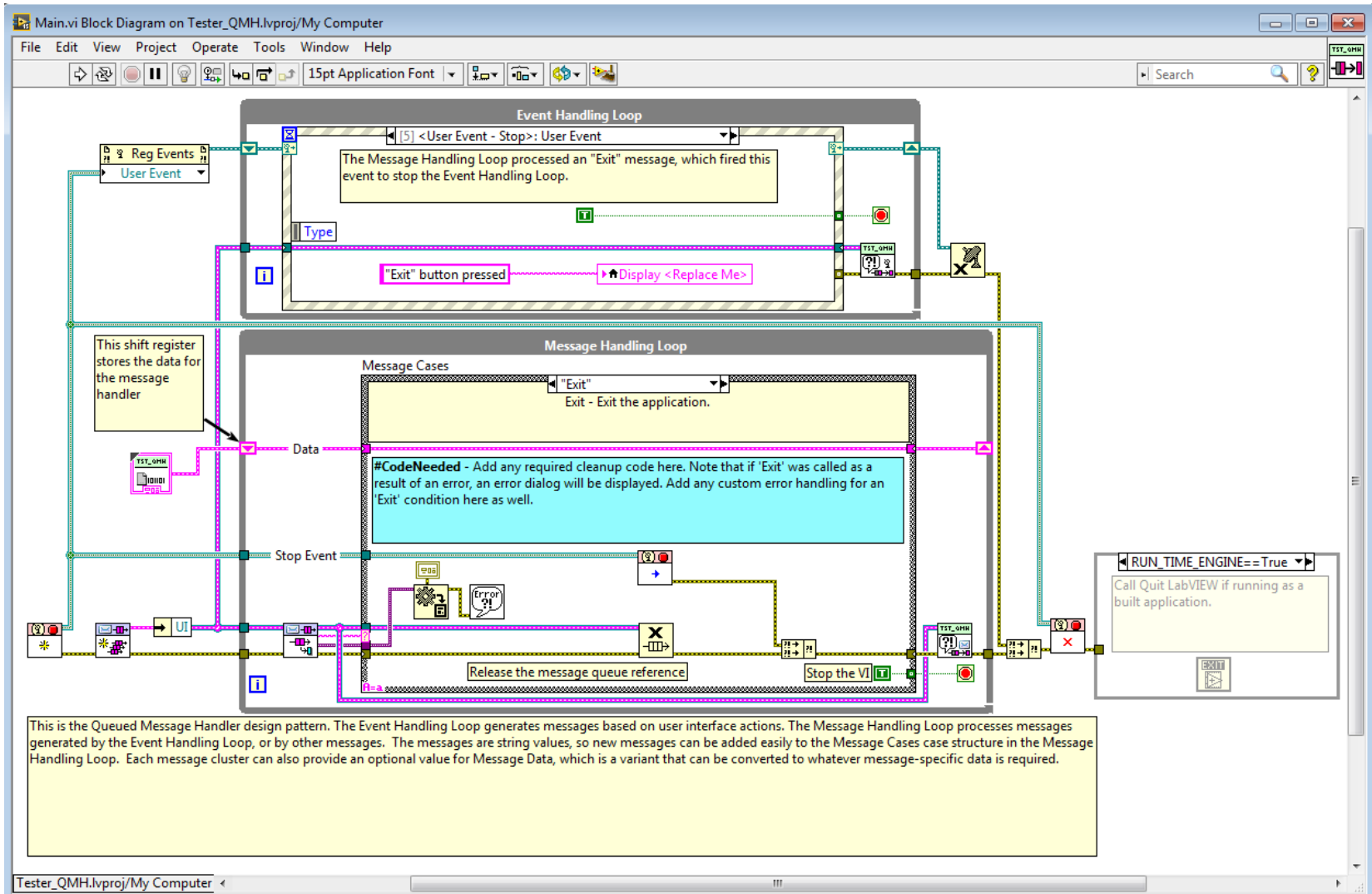
ERROR STATE

The state machine will stop if an error occurs. If you want to handle errors in a more sophisticated way, consider adding an "Error" state that will...

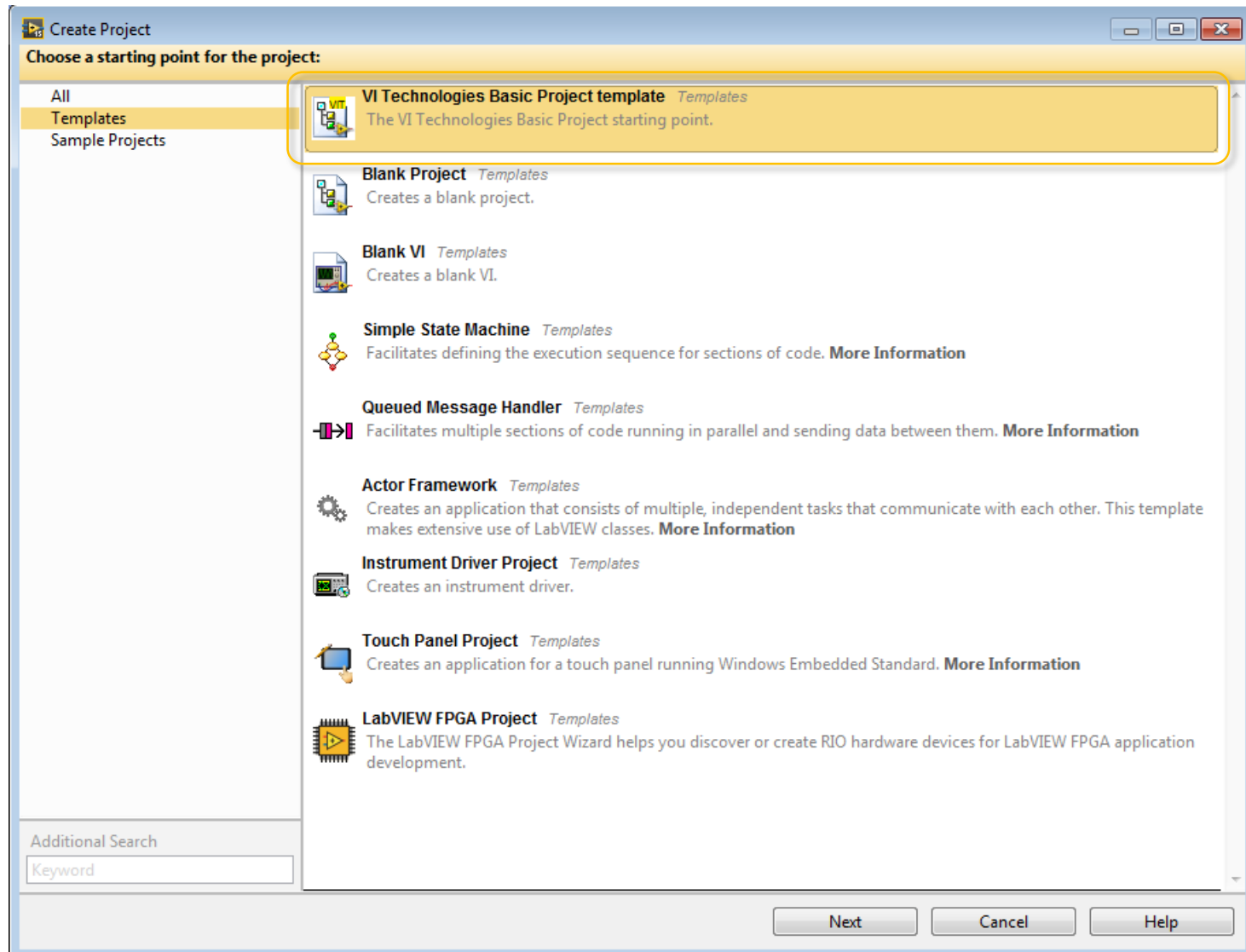
This is the Simple State Machine design pattern. Each frame of this case structure executes code for its state and computes what state to transition to next. States are represented as values of an enumeration. These enumerations are instances of a type definition so that states can be quickly added. To edit the type definition, right click on an enumeration and select **Open Type Def.**

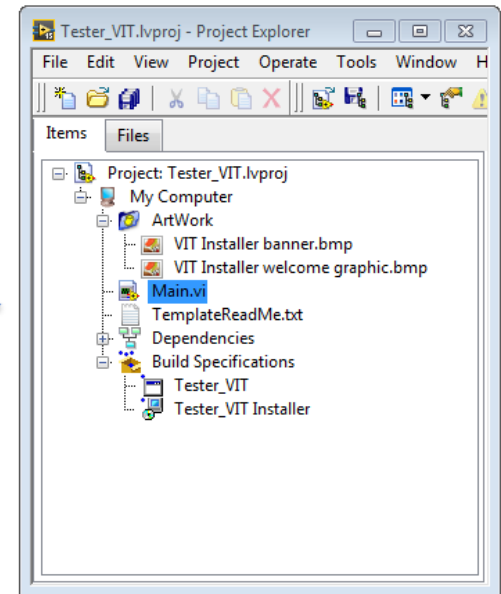
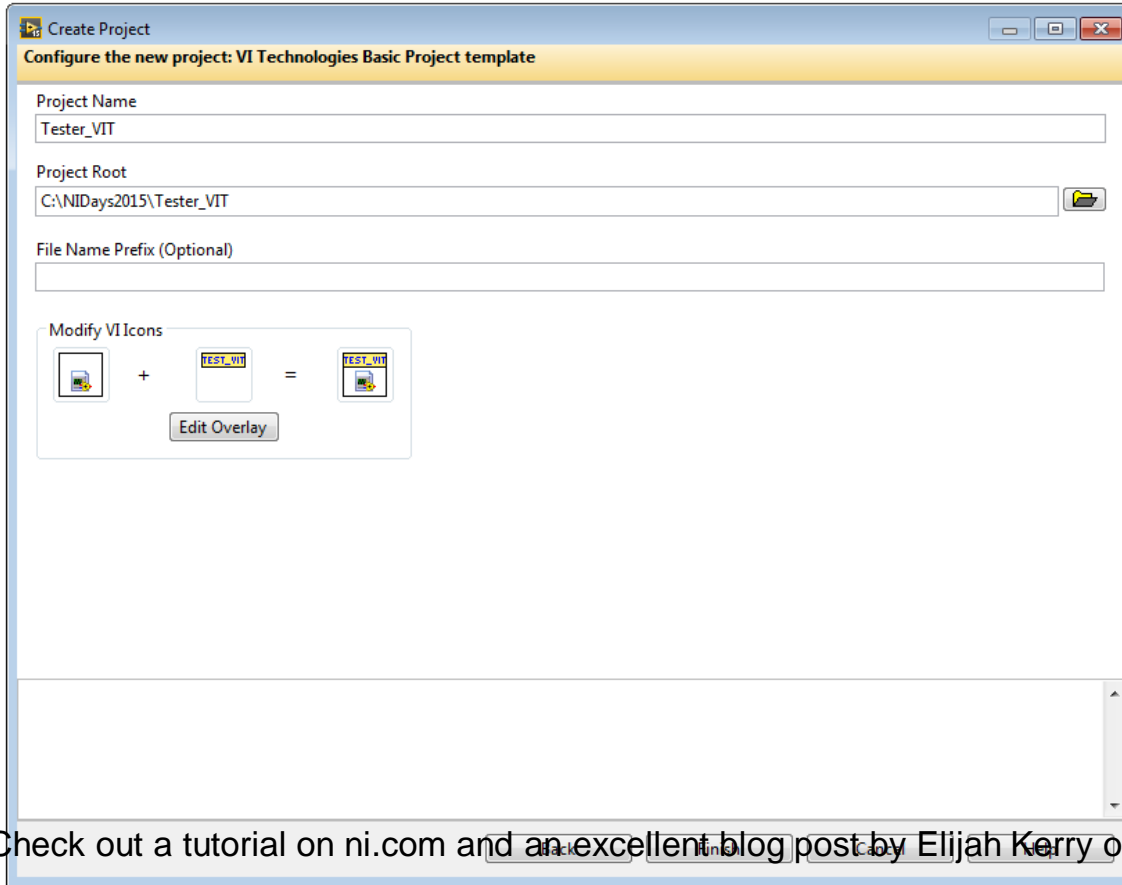
This shift register stores the data for the state machine.

This shift register stores the current state.





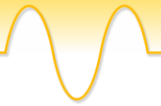




Check out a tutorial on ni.com and an excellent blog post by Elijah Kerry on this topic.

<http://www.ni.com/tutorial/14045/en/>

<https://ekerry.wordpress.com/2012/11/09/creating-and-distributing-custom-templates-with-the-new-create-project-dialog/>

**Wikipedia:**

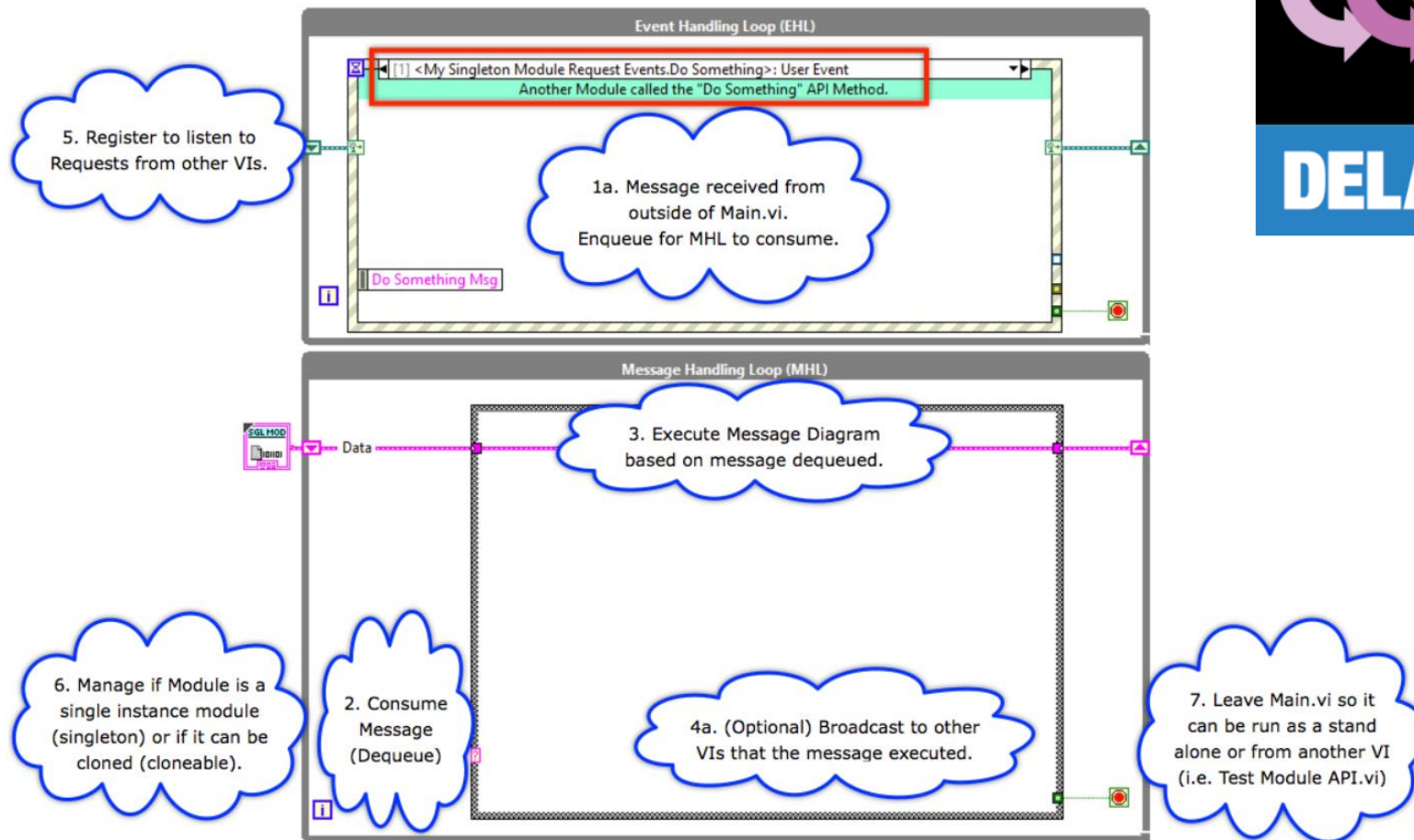
“The designers of software frameworks aim to facilitate software development by allowing designers and programmers to devote their time to meeting software requirements rather than dealing with the more standard low-level details of providing a working system, thereby reducing overall development time.”

**A Framework:**

- Enables us to focus on implementing project requirements
- Needs to fit our use case and ‘standard stuff’ requirements
- Mostly offers multiple parallel processes and communication mechanism out of the box
- Luckily there’s a lot to choose from
- Will often have a first-time learning curve!

## Delacor Queued Message Handler

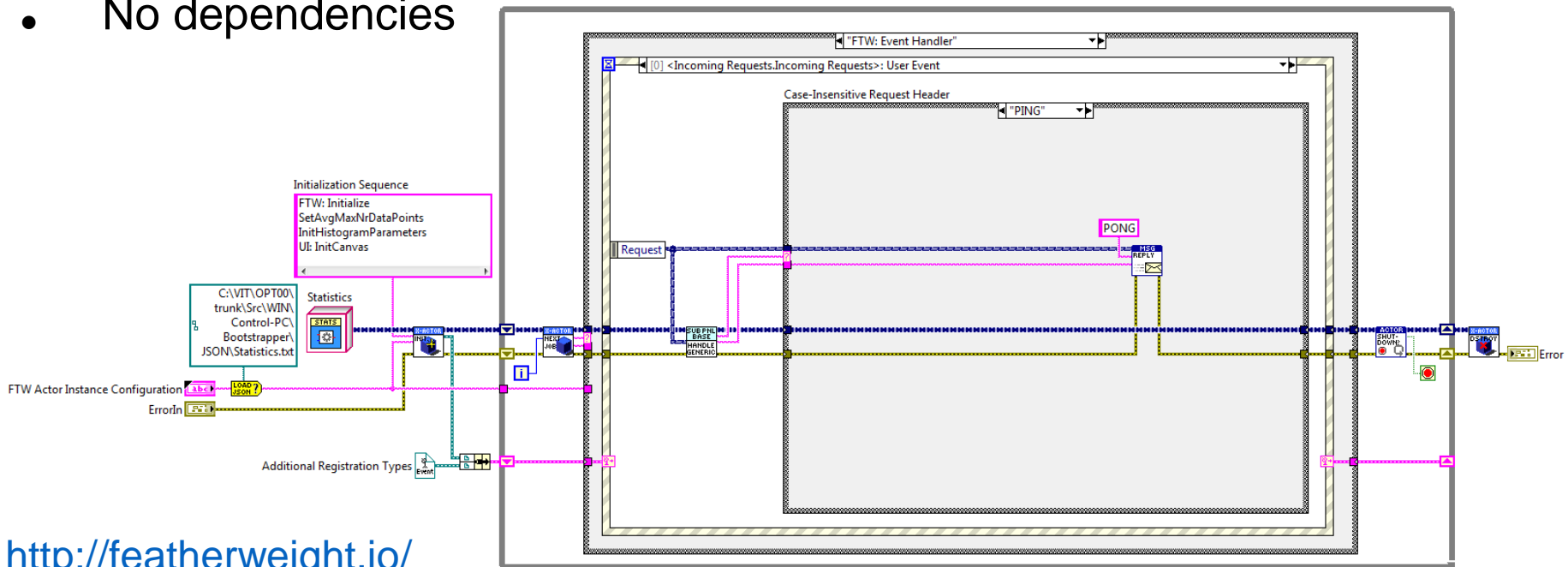
- Based on NI QMH Project Template



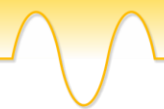
<http://delacor.com/products/>



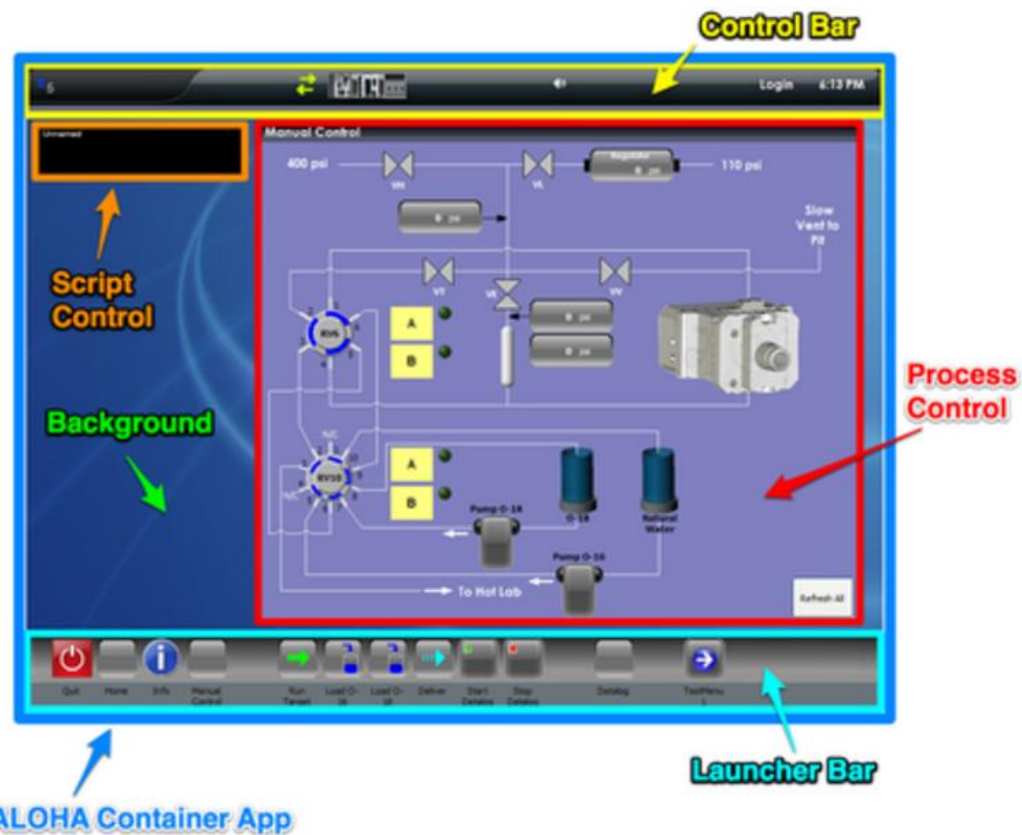
- Actor based applications (not related to NI Actor Framework)
- Also a collection of libraries
  - Messaging (cross-app boundary)
  - SQLite & JSON (with type adaption)
- No dependencies



<http://featherweight.io/>



- KISS approach, no CLA required
- Communication, cross-module and cross platform
- Save / restore persistent data
- Error handling and logging
- GUI management
  - Save/restore windows
  - Combine GUI modules
  - Floating and docking windows



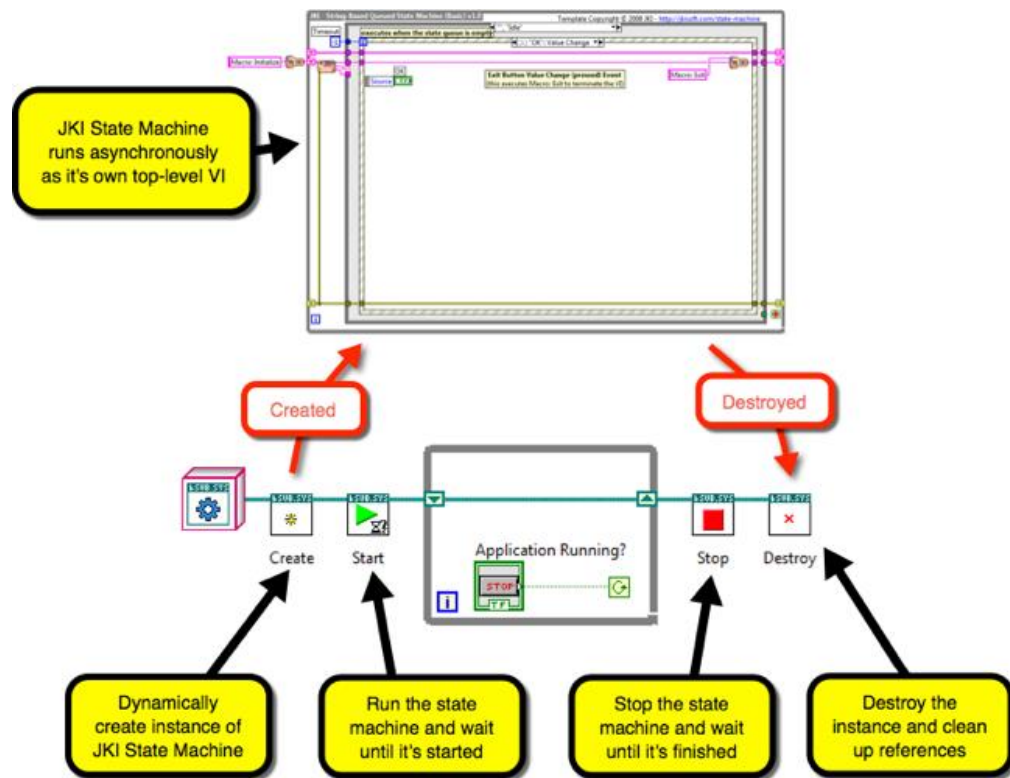
<http://www.s5solutions.com/aloha.html>

ALOHA Container App



Some more frameworks:

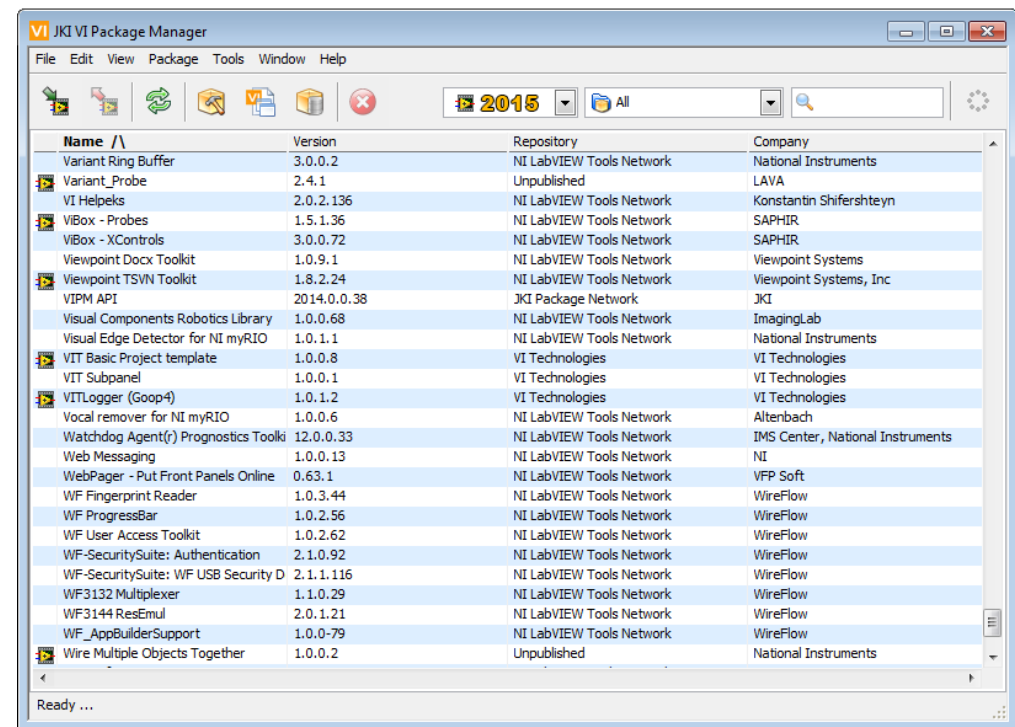
- Actor Framework (comes with LabVIEW)
- JKI State Machine Objects



<http://jki.net/state-machine-objects>



- Comes with LabVIEW
- Opens up access to over 450 libraries and tools for LabVIEW of which a lot are free
- LabVIEW Tool Network
- JKI Package Network
- Create your own packages
- With the Pro version you can create and manage your own package repository















<http://jki.net/vipm>












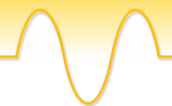


## GPower













 GPower VI Register	2014.0.0.30	NI LabVIEW Tools Network	GPower
 GPower VI Launcher	2012.2.0.26	NI LabVIEW Tools Network	GPower
 GPower Timing	2014.0.0.19	NI LabVIEW Tools Network	GPower
 GPower String	2012.1.0.8	NI LabVIEW Tools Network	GPower
 GPower Overflow	2014.0.0.4	NI LabVIEW Tools Network	GPower
 GPower Numeric	2015.0.0.11	NI LabVIEW Tools Network	GPower
 GPower Math	2012.1.0.6	NI LabVIEW Tools Network	GPower
 GPower Events	2012.0.0.7	NI LabVIEW Tools Network	GPower
 GPower Error & Warning	2014.0.0.38	NI LabVIEW Tools Network	GPower
 GPower Comparison	2012.0.0.3	NI LabVIEW Tools Network	GPower
 GPower Array	2014.0.0.23	NI LabVIEW Tools Network	GPower
 GPower All Toolsets	2015.0.0.9	NI LabVIEW Tools Network	GPower

## JKI / LAVA / MGI



















 JKI State Machine	3.0.0.8	JKI Package Network	JKI
 jki_rsc_toolkits_palette	1.1-1	JKI Package Network	JKI Software
 Variant_Probe	2.4.1	Unpublished	LAVA
 OpenG LabVIEW Data Library	4.2.0.21	JKI Package Network	LAVA
 LAVA Palette	1.0.0.1	NI LabVIEW Tools Network	LAVA
 Robust CSV	1.1.0.4	Unpublished	LAVA
 LabVIEW Task Manager	1.7.0.28	Unpublished	LAVA
 JSON API	1.3.2.27	Unpublished	LAVA
 MGI Actor Framework Message Maker	1.0.0.17	NI LabVIEW Tools Network	MGI



## National Instruments

	Timer Notification	1.0.0.13	Unpublished	National Instruments
	OpenG Time Library	4.0.1.3	JKI Package Network	National Instruments
	NI Syslog Library	1.3.0.20	NI LabVIEW Tools Network	National Instruments
	NI String Tools Library	2.0.0.5	NI LabVIEW Tools Network	National Instruments
	NI LogRotate	1.0.0.18	NI LabVIEW Tools Network	National Instruments
	NI Linked Network Actor	1.2.0.19	Unpublished	National Instruments
	NI Keyed Array Library	2.0.0.11	NI LabVIEW Tools Network	National Instruments
	NI GXML	1.4.2.8	NI LabVIEW Tools Network	National Instruments
	NI Asynchronous Message Communication (AMC) Library	3.3.0.21	NI LabVIEW Tools Network	National Instruments
	Wire Multiple Objects Together	1.0.0.2	Unpublished	National Instruments
	Hidden Gems in vi.lib	1.0.0.8	NI LabVIEW Tools Network	National Instruments
	Structured Error Handler	2.0.6.9	Unpublished	NI

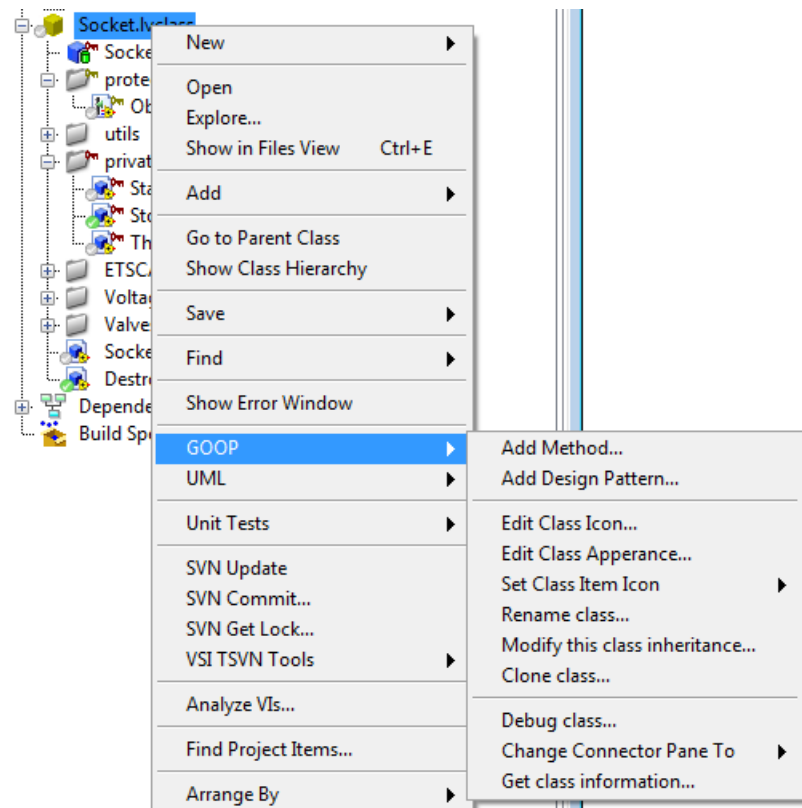
## OpenG

	OpenG Toolkit	4.0.1.9	JKI Package Network	OpenG.org
	OpenG Variant Configuration File Library	4.0.0.5	JKI Package Network	OpenG.org
	OpenG String Library	4.1.0.12	JKI Package Network	OpenG.org
	OpenG Port IO	4.0.0-2	JKI Package Network	OpenG.org
	OpenG Picture Library	4.0.0.13	JKI Package Network	OpenG.org
	OpenG Numeric Library	4.1.0.8	JKI Package Network	OpenG.org
	OpenG Message Queue Library	4.0.0.15	JKI Package Network	OpenG.org
	OpenG MD5 Digest Library	4.1.1.10	JKI Package Network	OpenG.org
	OpenG LabVIEW ZIP Library	4.0.0-2	JKI Package Network	OpenG.org
	OpenG Large File Library	4.0.0.3	JKI Package Network	OpenG.org
	OpenG File Library	4.0.1.22	JKI Package Network	OpenG.org
	OpenG Error Library	4.2.0.23	JKI Package Network	OpenG.org
	OpenG Dictionary Library	4.0.0.4	JKI Package Network	OpenG.org
	OpenG Comparison Library	4.0.0.3	JKI Package Network	OpenG.org
	OpenG Buttons Library	4.0.0.7	JKI Package Network	OpenG.org
	OpenG Boolean Library	4.0.0.7	JKI Package Network	OpenG.org
	OpenG Array Library	4.1.1.14	JKI Package Network	OpenG.org
	OpenG Application Control Library	4.1.0.7	JKI Package Network	OpenG.org

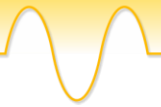


Formerly known as Goop Development Suite

- A must-have if you do Object Oriented Programming
- Contains a UML modeler, able to do code-generation and synchronization
- Plugs into Project Explorer
- Easiest class and method (VI) icon editing ever! (also for non-OOP VI's)
- Easier method creation
- Plug-in template based
- Build-in design patterns



<https://opengds.github.io/>



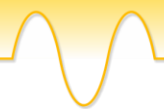
## Source Code Control and issue tracker

- Subversion / TortoiseSVN for SCC
- ViewPoint Systems' TSVN toolkit for SubVersion SCC integration in LabVIEW's project explorer
- Redmine for issue tracking (work items, bugs, etc.) and project management
- All integrate nicely with each other

<http://www.viewpointusa.com/product/ni-labview-toolkits/tsvn-toolkit/>

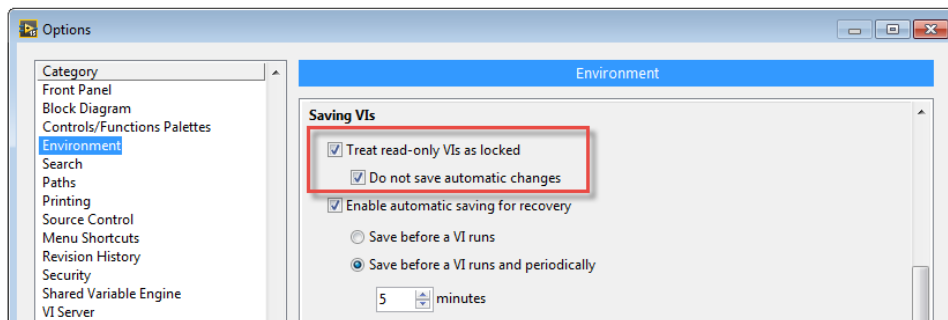
<http://tortoisesvn.net/>

<http://www.redmine.org/>

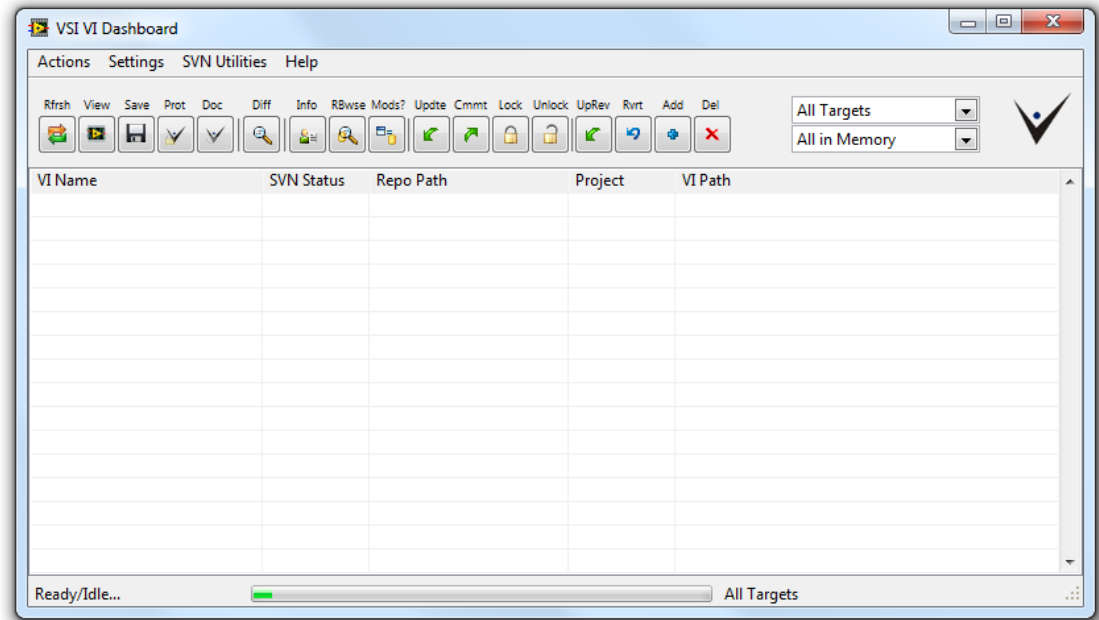
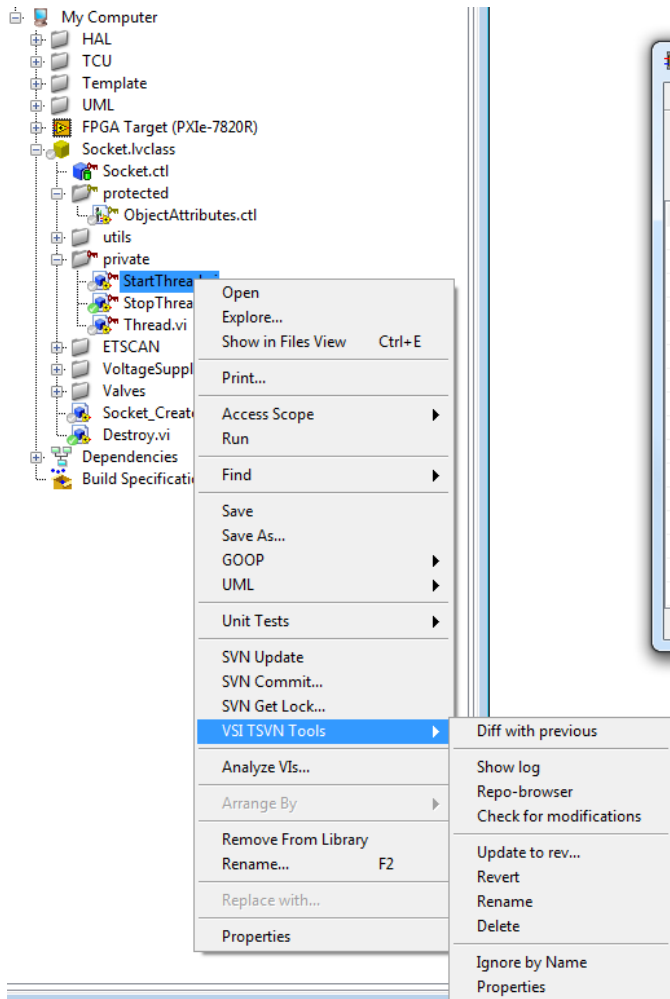


- In TortoiseSVN general settings: add **\*.aliases** and **\*.lvlibs** to the SVN global ignore pattern list
- Set your project to “Separate compiled code from source”  
[http://zone.ni.com/reference/en-XX/help/371361H-01/lvconcepts/saving\\_vis\\_compiled\\_code/](http://zone.ni.com/reference/en-XX/help/371361H-01/lvconcepts/saving_vis_compiled_code/)
- Configure SVN to automatically add the needs-lock property to all LV-related files
- In the LabVIEW Options enable ‘Treat read-only VIs as locked’

```
*.vi = svn:needs-lock
*.llb = svn:needs-lock
*.mnu = svn:needs-lock
*.ctl = svn:needs-lock
*.vit = svn:needs-lock
*.lvproj = svn:needs-lock
*.lvclass = svn:needs-lock
*.lvlib = svn:needs-lock
*.xctl = svn:needs-lock
```



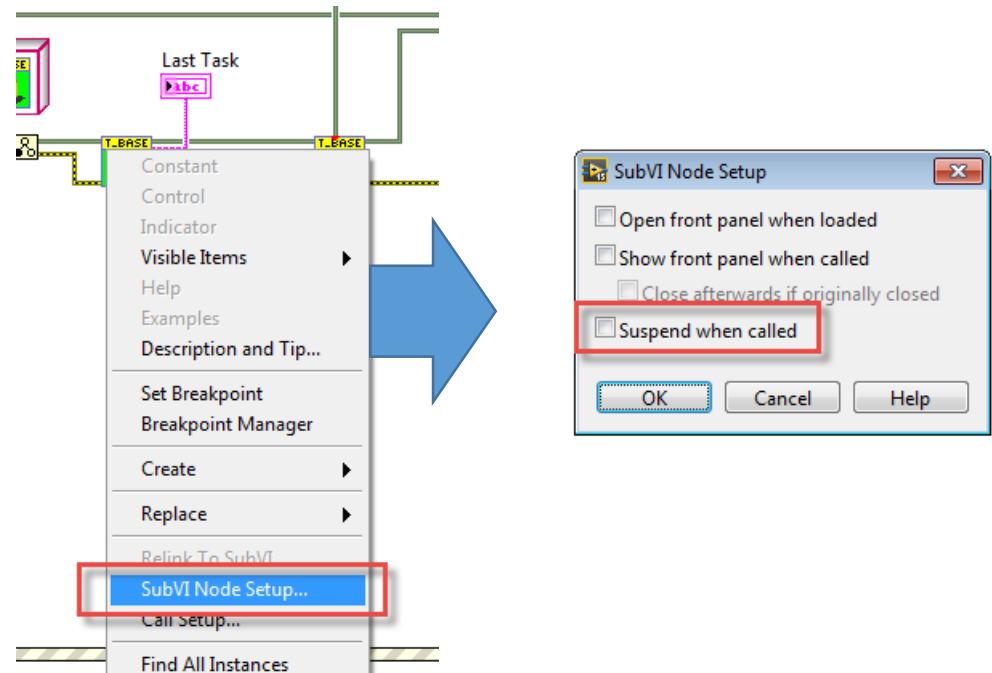
- This toolkit makes using SVN with LabVIEW a breeze



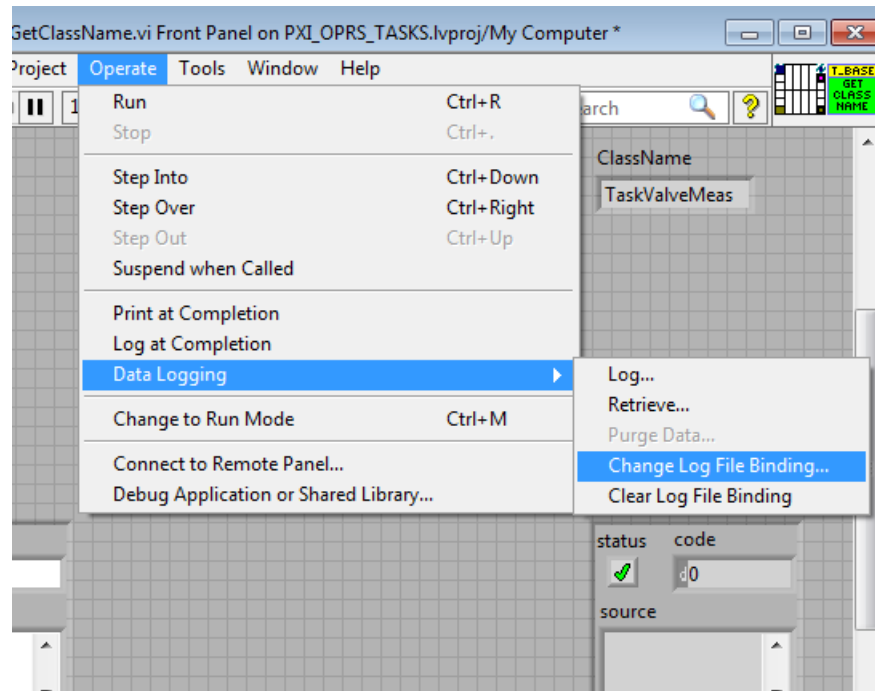
Getting started videos on YouTube  
Just search for “LabVIEW TSVN”



- Debugging
  - Create custom probes to view specific data in a more meaningful way  
[http://zone.ni.com/reference/en-XX/help/371361H-01/lvhowto/creating\\_custom\\_probes/](http://zone.ni.com/reference/en-XX/help/371361H-01/lvhowto/creating_custom_probes/)
  - Suspend when called

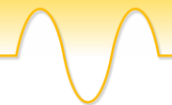


- Debugging
  - Datalog VIs – A feature that has been in LabVIEW since version 1.2































<https://decibel.ni.com/content/blogs/labviewramblings/2015/10/17/datalog-vis--labviews-forgotten-feature#comment-45878>





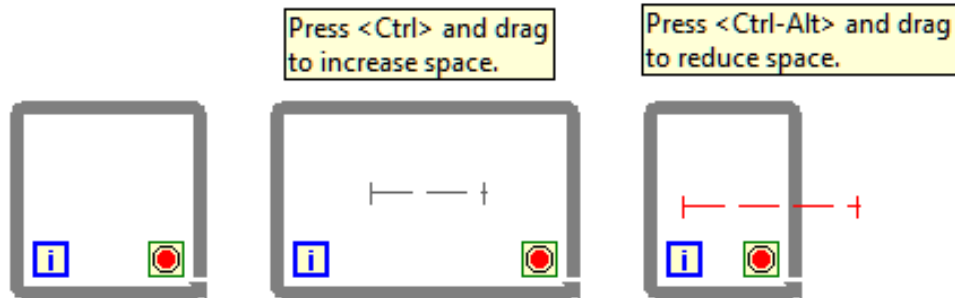
- You can add custom items in shortcut menus!
  - Change to array or element
  - Empty listboxes
  - Remove and rewire objects
  - Size array constants to contents
  - There's more in the community...

 <b>Debugger Notepad.llb</b> 3 weeks ago	by jtagg82 
 <b>Property Node to Invoke Node.llb</b> 1 month ago	by fabric 
 <b>Create SubVI from Selected Wires.llb</b> 1 month ago	by Darren 
 <b>Darren's Favorite Shortcut Menu Plug-Ins.zip</b> 1 month ago	by Darren 
 <b>Wire Multiple Items to Bundler.llb</b> 1 month ago	by Darren 
 <b>Insert Build Array.llb (for broken wires)</b> 1 month ago	by Darren 
 <b>Create Event.llb</b> 1 month ago	by Darren 
 <b>Clear Variant Data.llb</b> 1 month ago	by Darren 
 <b>Create Scalar Constant.llb (from an array terminal)</b> 1 month ago	by Darren 
 <b>Re: Suggestion: Change All To Write (resp. Read) for local/global variables</b> 1 month ago	by X. 
 <b>Multi-select Change Local Direction</b> 1 month ago	by Darren 
 <b>Popout Create Menus.llb</b> 1 month ago	by Darren 
 <b>Copy and Paste Font of text elements</b> 1 month ago	by mr_builder 
 <b>Remove Coercion Dots.llb</b> 1 month ago	by Karsten van Zwol 

<https://decibel.ni.com/content/groups/labview-shortcut-menu-plug-ins>



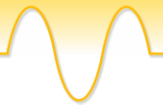
- Adding and **reducing** block diagram or frontpanel space



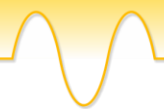
- Hyperlinks in free labels
- Better tool integration for creating Actor Framework classes from the project explorer window



- With proficiency comes efficiency
- NI Courses (Instructor-led irl or online or self-paced)
- Leverage the LabVIEW online ecosystem
  - Forums (LAVA, ni.com)
  - Communities and whitepapers (ni.com)
  - Blogs (ni.com and more...)
- Learn from your peers (in and outside your own company)
  - Communicate, irl and online
  - (Public) Code reviews
  - Go to conferences: CLA/CLD Summit, NIWeek, NIDays, User group meetings



- Blogs
  - Walking The Wires (<http://www.walkingthewires.com/>)
  - Wiresmith Technology (<http://www.wiresmithtech.com/blog/>)
  - LabVIEW Craftsmen (<http://www.labviewcraftsmen.com/>)
  - Software Engineering for LabVIEW (<https://ekerry.wordpress.com/>)
  - Random Ramblings on LabVIEW Design (<https://decibel.ni.com/content/blogs/labviewramblings>)
  - Point of VIEW (<http://ni.com/point-of-view>)
  - JKI (<http://blog.jki.net/>)



## Community

Find the National Instruments network that's right for you! From students to rocket scientists, NI unites users from around the world collaborating on similar applications.

All Content

Your View

Browse:

### Places

#### Spaces

- NI Developer Community ▸
- FIRST Community ▸
- Regional Communities ▸
- Academic Community ▸

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#### Projects

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#### Groups

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#### Search



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[Learn more about NIDays](#)

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Ask questions, watch videos, and learn more about the NI Developer Community.

[NI Community HUB](#)

### Ways to Get Involved...

- Discussion Forums
- Example Code
- Tutorials
- Idea Exchange
- Technical Blogs
- User Groups
- Newsletters

### Popular Bookmarks

- Beginner Tutorial (Very Simple 3-Actor System)
- Datalog VIs - LabVIEW's forgotten feature
- Applying Common Object-Oriented (OO) Design Patterns to LabVIEW
- Measurement Utility (Plugin Hardware Abstraction Layer Using Actor Framework)
- READ THIS FIRST to get started with Actor Framework
- LabVIEW Queued State Machine Architecture
- Getting Started With Channel Wires
- NI RTSA Host Example for the NI 7976R
- CLAD Exam Preparation
- Hands-On: Actor Framework

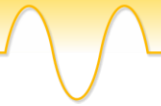
### Popular Documents

- Free 6-Month Evaluation of LabVIEW Student Edition for at-home learning
- LabVIEW Interface for Arduino Setup Procedure
- NI LabVIEW for LEGO® MINDSTORMS® / LabVIEW Module for LEGO MINDSTORMS - Download
- [FRC 2015] NI Software Set Up Guide
- roboRIO Details and Specifications

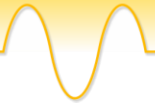
### Popular Blog Posts

- NI Named One of the World's Best Multinational Workplaces for Fourth Consecutive Year in NI News in Real Time
- UAC Virtualization and how it affects your Installers in Windows 7
- LabVIEW UI Tips and Tricks - Part I in UI Interest Group
- IRemoteTools.cpp:5: error: 'TKD2' was not declared in this scope in LabVIEW Interface for Arduino

<https://decibel.ni.com/content/index.jspa>



- Forums
  - LAVA (<http://lavag.org/>)
  - NI Forums (<http://forums.ni.com> )
  - Presentation material (powerpoint / pdf)  
(e.g. <https://decibel.ni.com/content/groups/niweek-2015?view=documents>)  
Some even have videos from the actual presentation
- Videos
  - CSLUG (Central South LabVIEW User Group (UK))  
(<https://www.youtube.com/channel/UCUeR9TSNhJzTLcp8E8aYkkA>)
  - Search YouTube for “LabVIEW <other keyword>”  
Try for example: “LabVIEW SVN” to find a nice instruction video on setting up TSVN.



What do you think should be in this presentation, that isn't right now?

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<http://nl.linkedin.com/in/vitech>

[@JeffreyHabets](https://twitter.com/JeffreyHabets)