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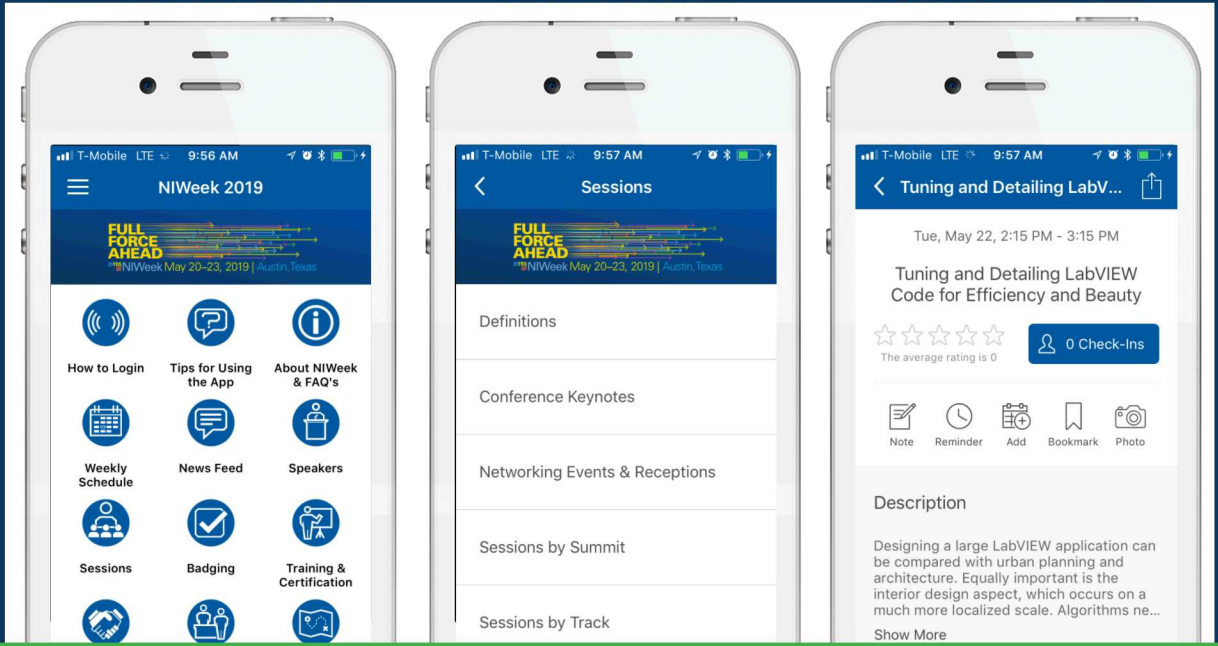

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Scott Walkington

Sandia National Laboratory

Team Lead

CLD & CTD

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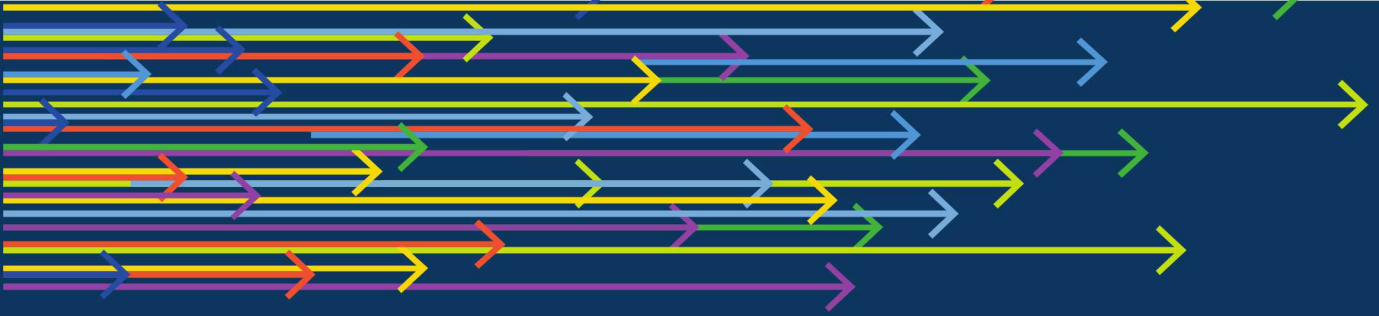


Novel Approaches to Pass Data Between TestStand and LabVIEW

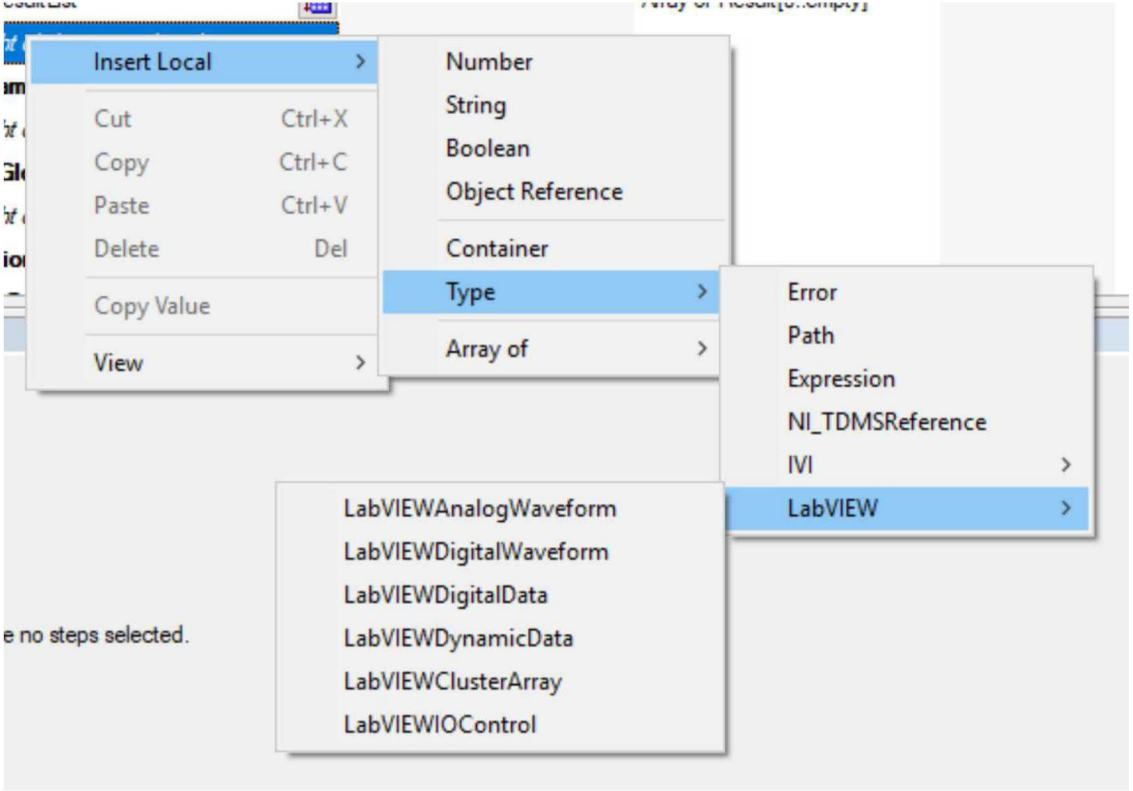
Who has struggled with deciding what is the best approach to share/pass data between TestStand and LabVIEW? This talk will examine the pro's and con's of using variants, variants with attributes, objects, images, DVR's, clusters, pass by reference, pass by value, queues, and events to share/pass data between LabVIEW and TestStand.

NATIONAL INSTRUMENTS

Outline

- Pass by Value
- Pass by Reference
- Clusters
- Objects
- Variants
- Variants with Attributes
- Images
- DVR’s
- Queues
- Events

Standard Variable Options



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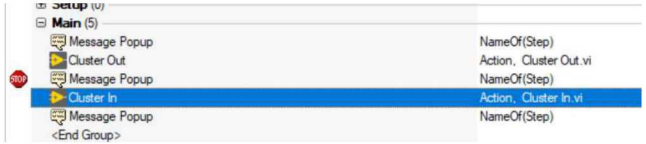
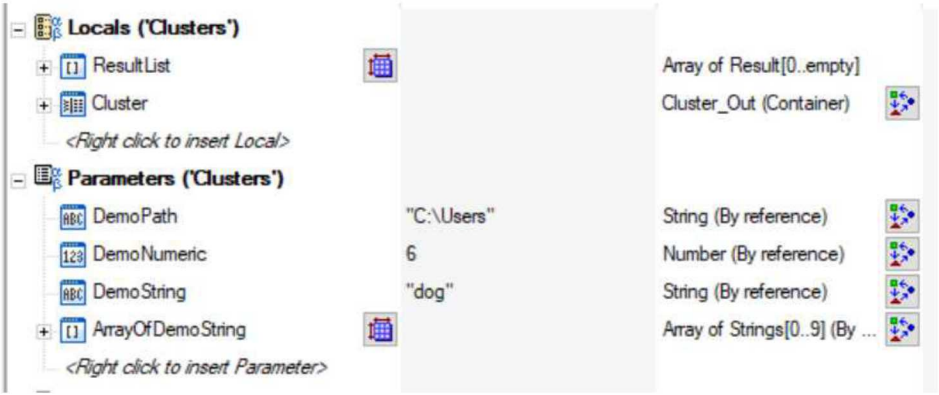
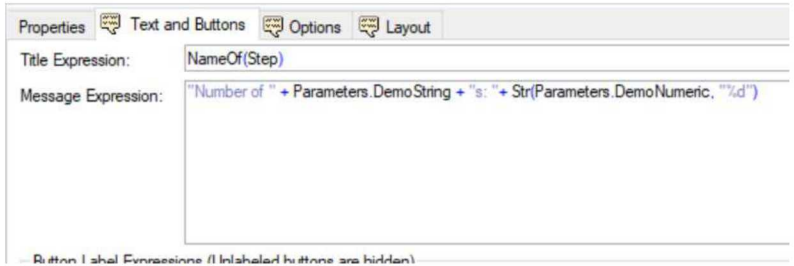
Basic Structure of LabVIEW VI's in Demo

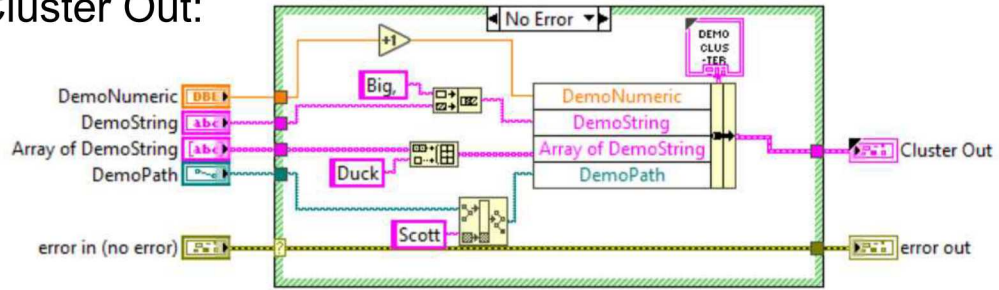




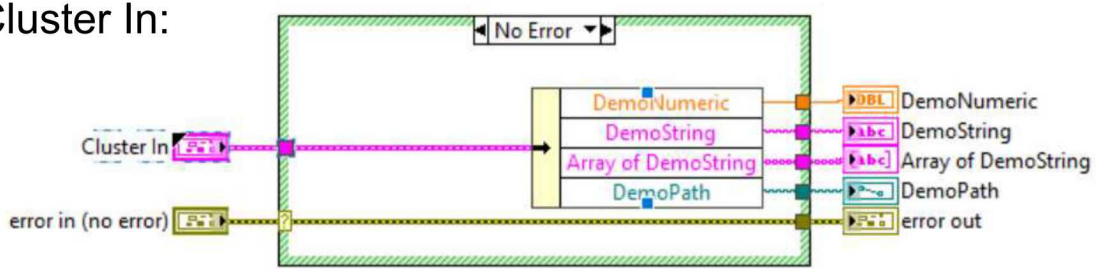


Basic Structure of TestStand Sequence in Demo

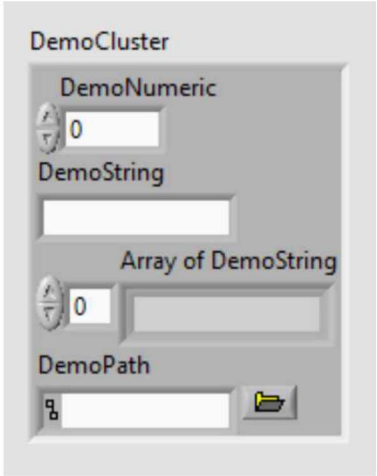
Cluster Out:



Cluster In:



Cluster:



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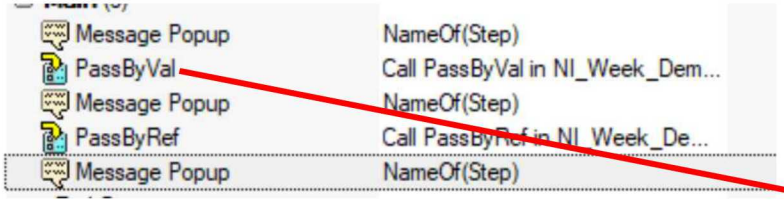
Pass by Value

- Parameter value passed into subsequence does not get passed out



- Pro or Con: Variable of Calling Sequence stays the same

Parameter Name	Type	Log	Default	Value	How Passed	C
DemoNumeric	Number	☐	☐	Parameters.DemoNumeric	by value	
DemoString	String	☐	☐	Parameters.DemoString	by value	

Subsequence:

Main (3)

f(x) Change Dogs to Cats	Parameters.DemoString = "Cats"
f(x) Increment Number	Parameters.DemoNumeric = Parameters.DemoNumeric +1
Message Popup	NameOf(Step)
<End Group>	

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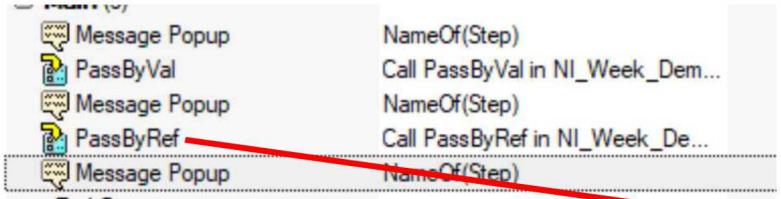
Pass by Reference

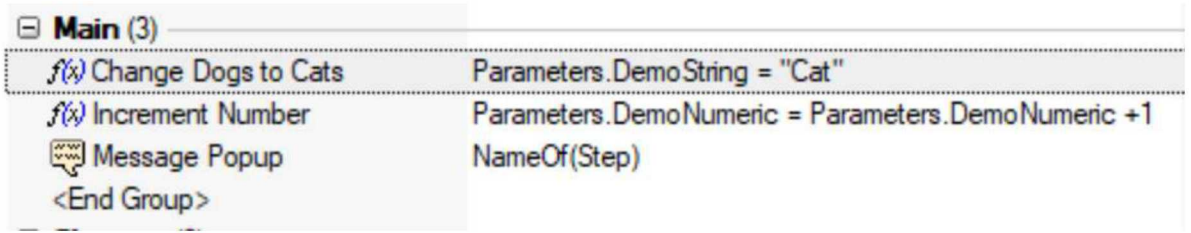
- Default setting in TestStand for all variables



- Pro or Con: Variable of Calling Sequence is updated

Parameter Name	Type	Log	Default	Value	How Passed
DemoNumeric	Number	☐	☐	Parameters.DemoNumeric	by reference
DemoString	String	☐	☐	Parameters.DemoString	by reference

Subsequence:



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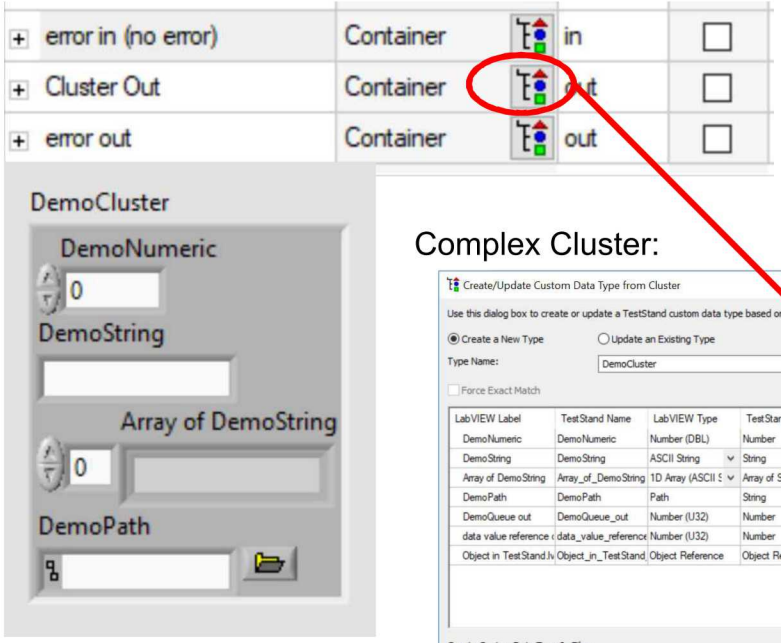
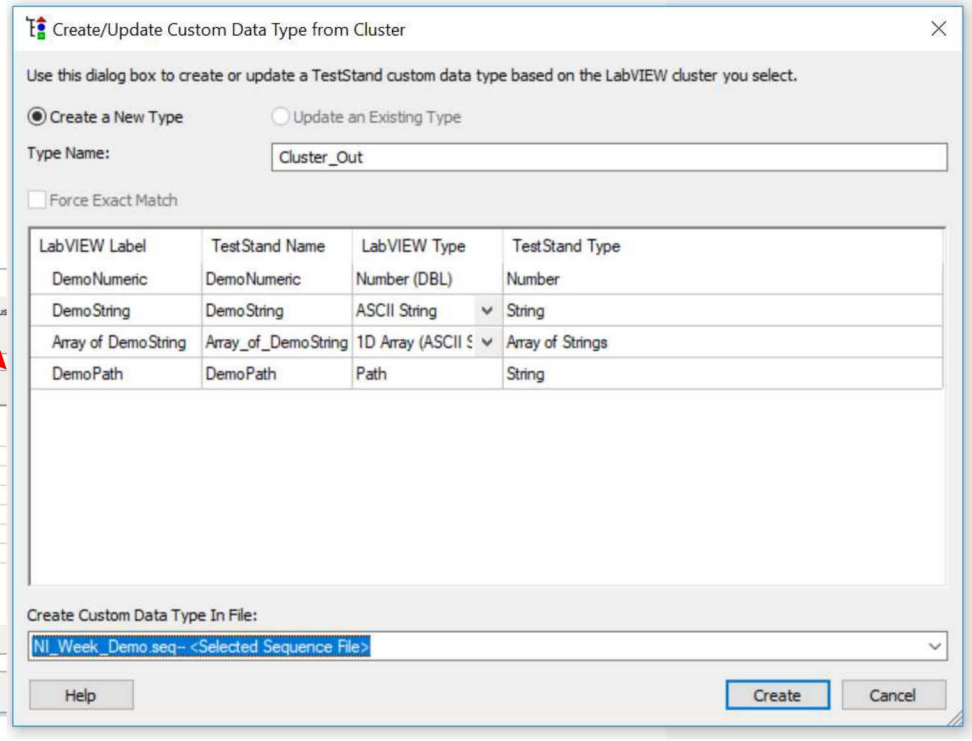
Clusters

- Need to “Create/Update Custom Data Type from Cluster”
- Good for passing data in Sequential steps



Complex Cluster:



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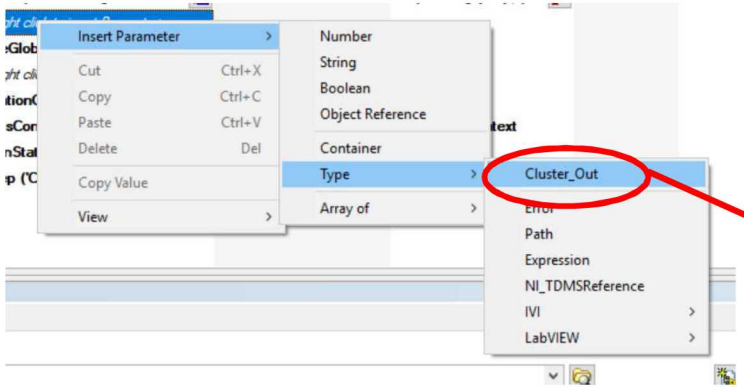
Clusters Continued

- Custom Data types appear in Insert -> Type-> Custom Data Type

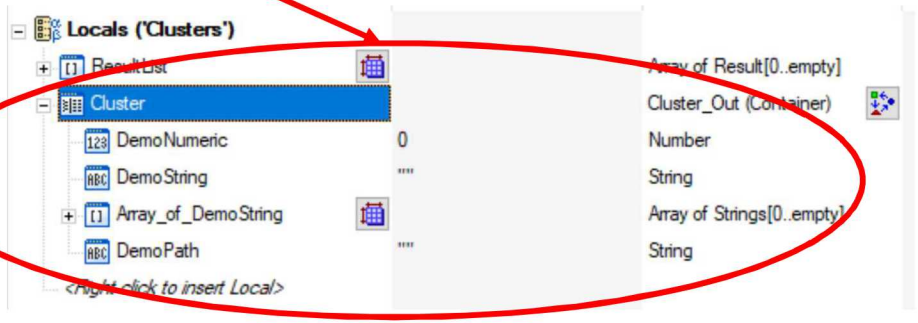


Pro's:

- Data easily visible in TestStand
- Custom data type can be used easily in multiple places
- Better to use Custom Data Type then creating a container with variables
  - Changes to a Custom Data Type will populate throughout sequence

Con's:

- If using just a container and you change the cluster then you must change the container everywhere
- Not very flexible if still making lots of changes in Cluster/Type def.



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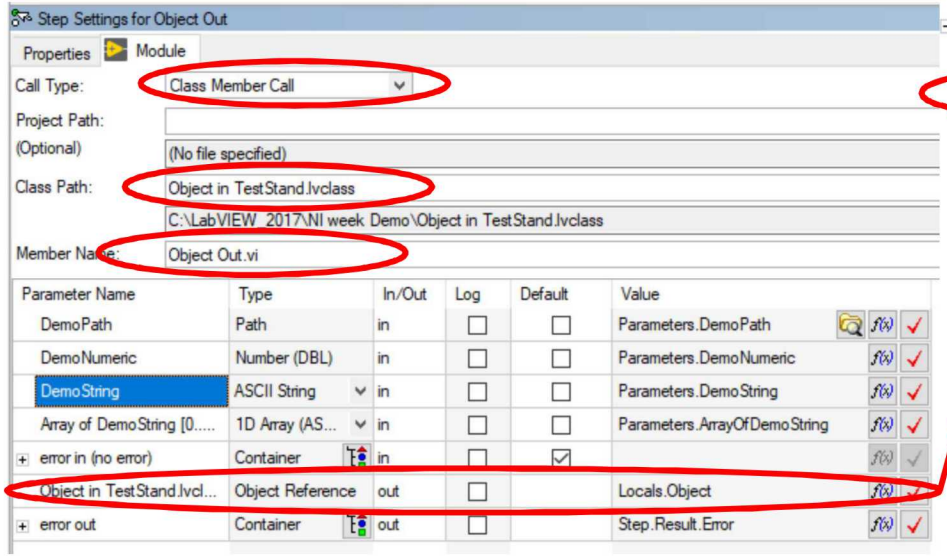
Objects

- Object Oriented Programming fully supported in TestStand
- Ok for passing data in Sequential steps



Pro's:

- Supports Dynamic dispatch
- Encapsulates Data
- Cannot accidentally change data in TestStand
- Good for passing data in Sequential steps

Con's:

- Can not see what is contained in object during execution
- Can not change data in TestStand

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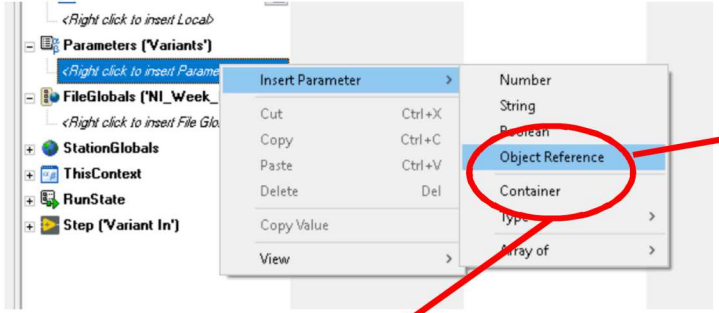
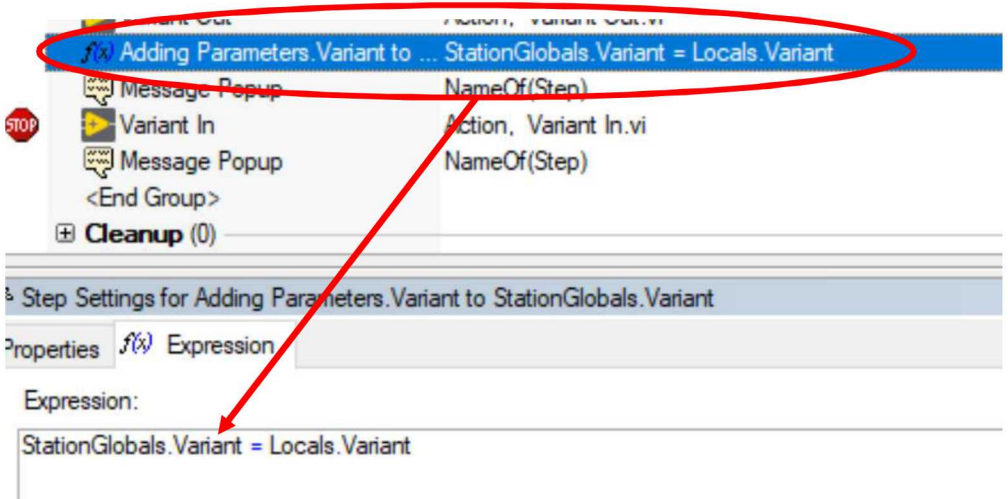
Variants

- Initially, Create an Object Reference or Container



- For troubleshooting create variant in StationGlobals



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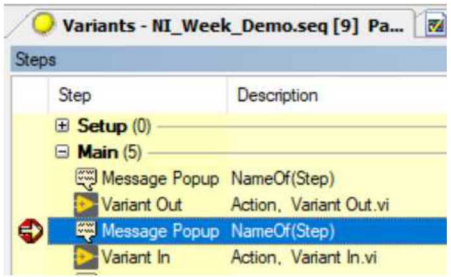
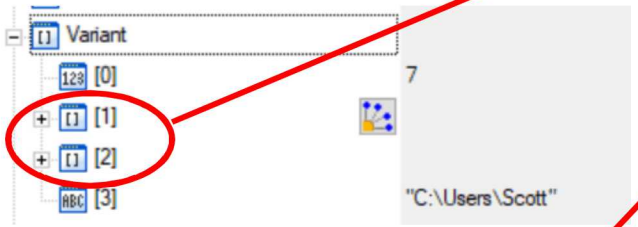
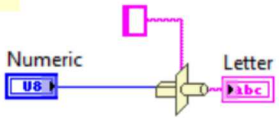
Variants Continued

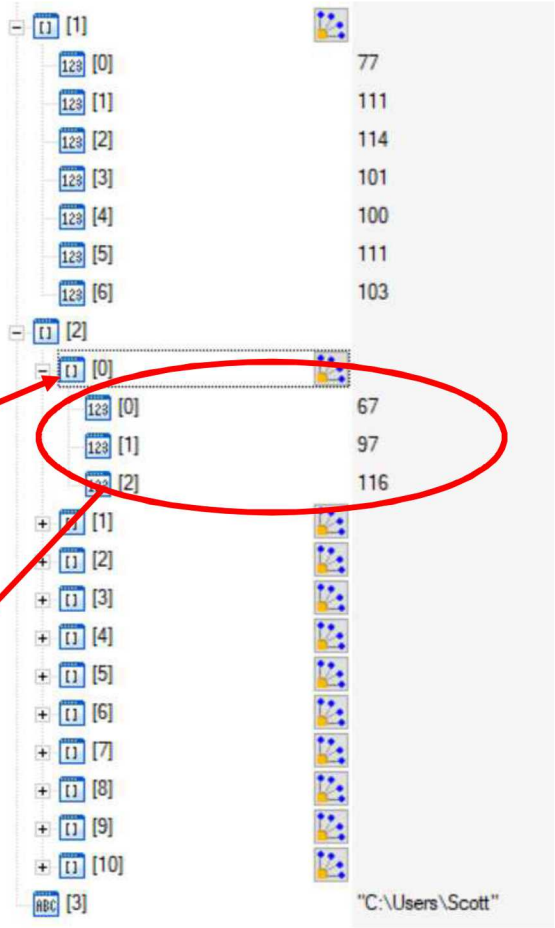
- During runtime Container/Object Reference changes to “Array of Results”
- Variant Values can only be seen in variables tab during execution
  - Variant created in StationGlobals will retain values after run for trouble shooting







67 97 116
“D” “o” “g”



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Variants

Pro's:

- Works well for sequential steps
- Provides some idea of data contained
- Very flexible if you are still changing/deciding the data to pass between steps

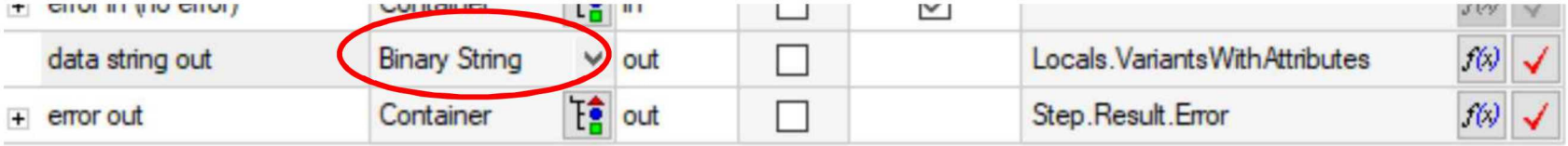
Con's:

- Can be easily overwritten
- Can be confusing when working with large clusters in the variant
- Can be confusing when passing around strings

Variants with Attributes

- Create String Variable

- MUST select Binary String



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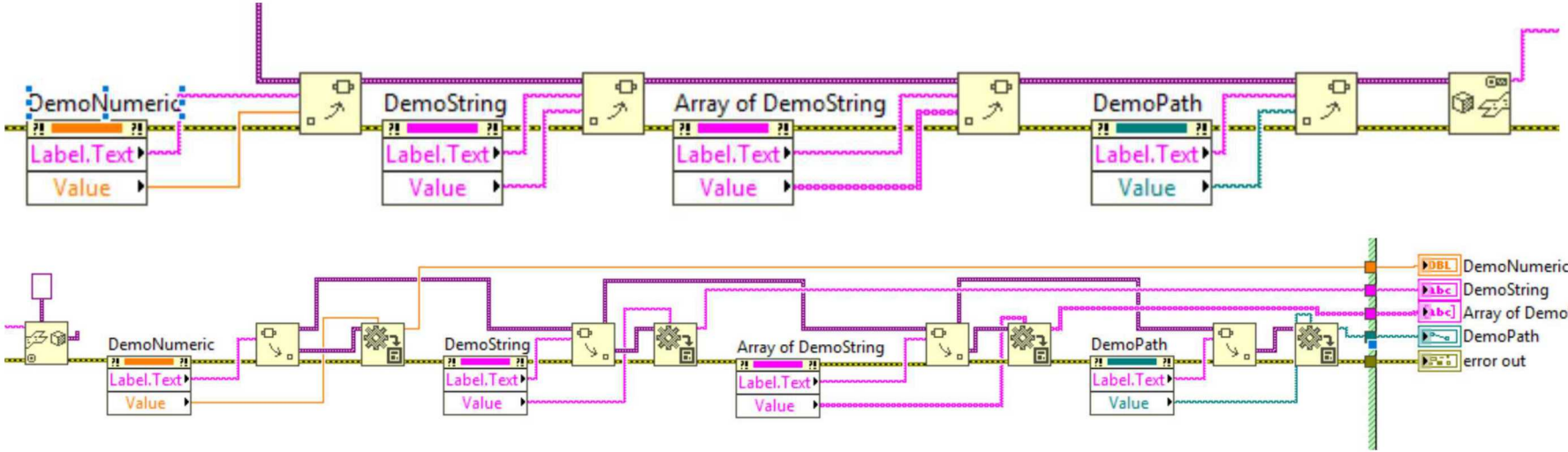
Variants with Attributes

- Must Use “Flatten to String”
  - Don’t use “Variant to Flatten String”
    - The help says this function strips out all variant attributes.
    - Guessing this is what TestStand is Leveraging under the hood



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Variants with Attributes

Pro's:

- Works ok for sequential steps
- Very flexible if you are still changing/deciding the data to pass between steps
- Handy for Variant Attribute Look up tables

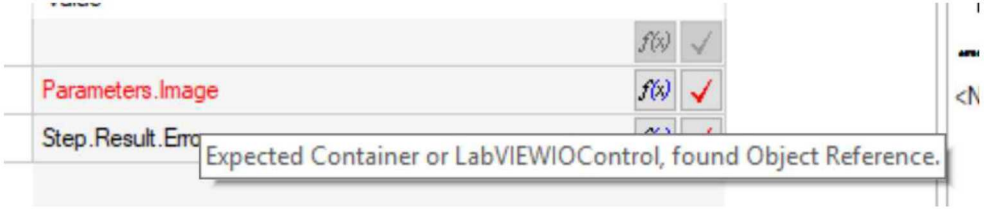
Con's:

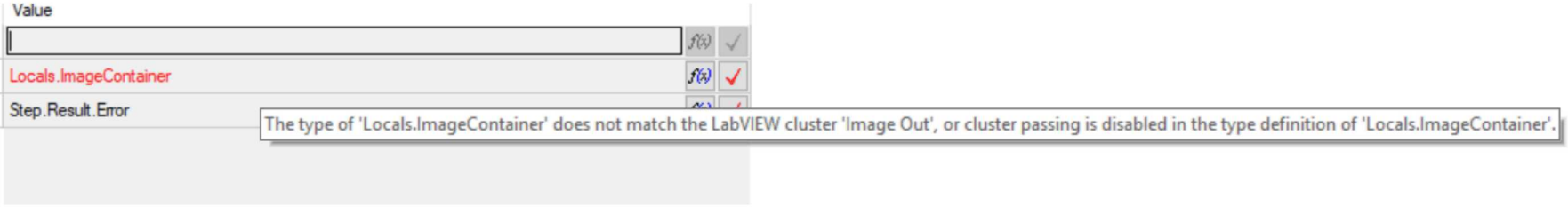
- Forget to change from ASCII string to Binary String
- Previous Variant stuff does not work.
  - Strips the attribute
- Long String of junk

NATIONAL INSTRUMENTS

Images

- Need NI Vision
- Could only get the LabVIEWIOControl to work
  - Not sure why the Container did not work





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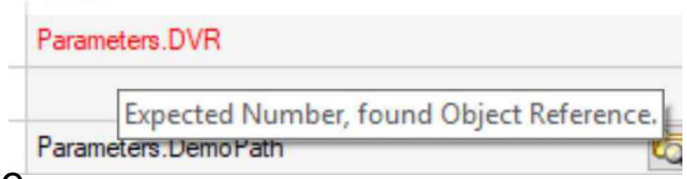
DVR’s

- Pass DVR as a Number
- Pass Reference to DVR as a Number
- Pass DVR as a Data String like variant attribute

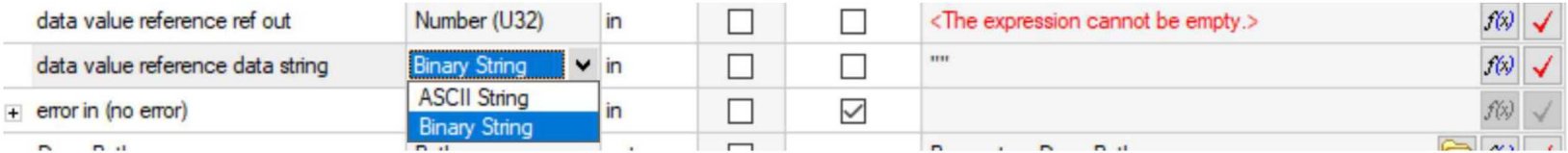


Pro’s:

- Can be nice for large data sets

Con’s:

- Forget to change from ASCII string to Binary String
- Long String of junk



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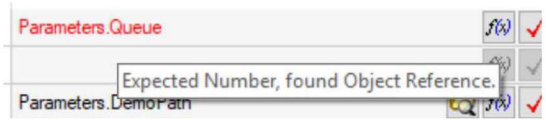
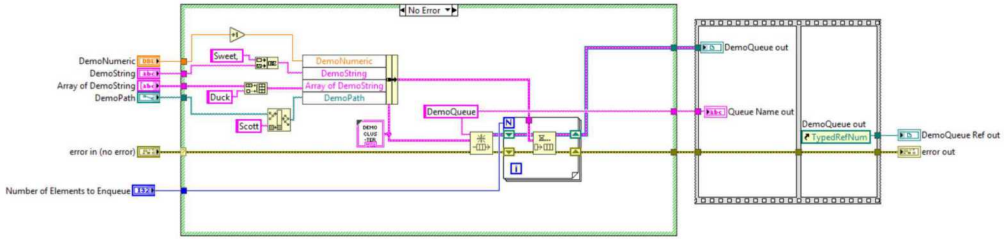
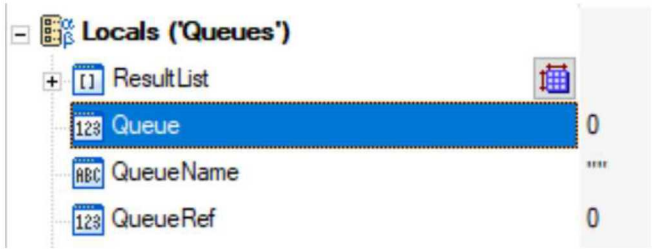
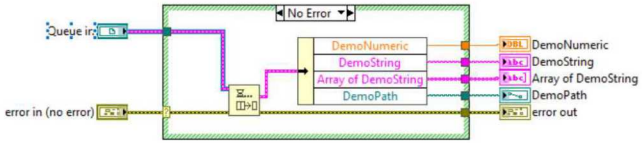
Queues

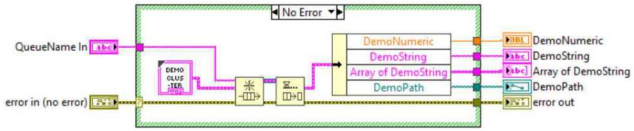
- Pass Queue as a Number
- Pass Reference to Queue as a Number
- Pass Queue as a Data String like variant attribute
- Pass Queue Name

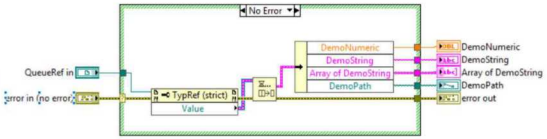












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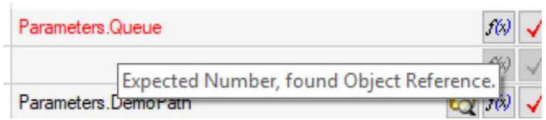
Queues Continued

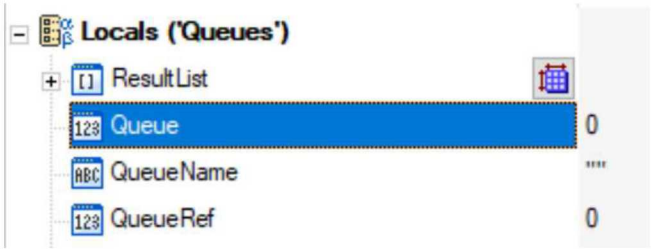
Pro's:

- Can store multiple pieces of data
  - Can be from multiple steps
  - Can then be processed in a single step

Con's

- Must make sure you enqueue enough elements otherwise code will hang waiting to dequeue element
- Can be confusing where elements are enqueue if you have many asynchronously running VI's





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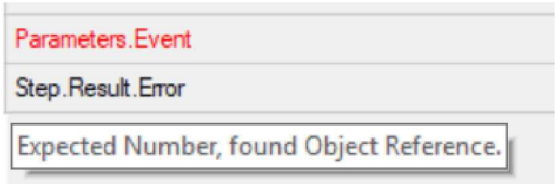
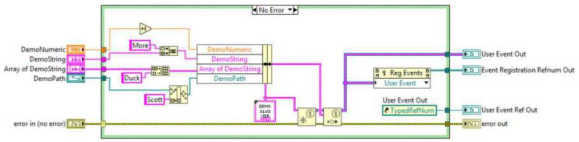
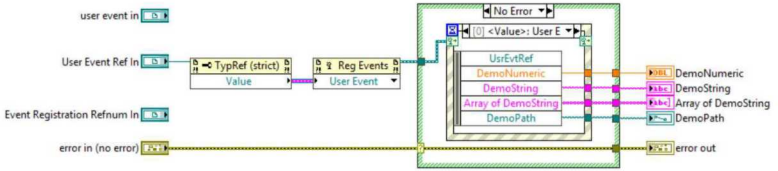
Events

- Cannot pass data between steps in traditional sense
  - Events are not like queues. Once the event fires if nothing is a registered listener then the data is gone.
- Must have a Asynchronously running VI registered to listen to event.
  - Can have as many clones running as you would like
  - All will simultaneously receive data.







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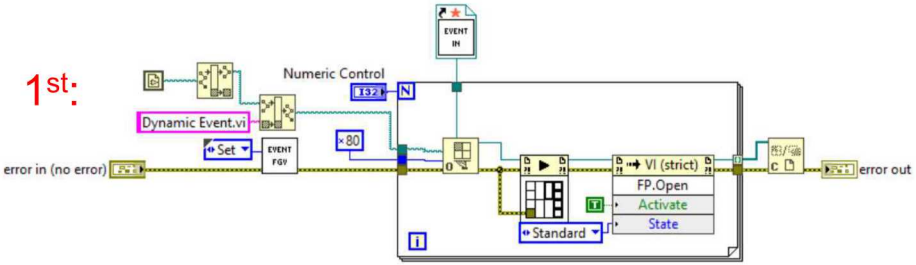
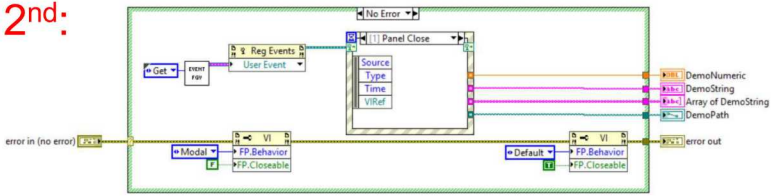
Asynchronous Dynamic Events

- Can easily do One to Many

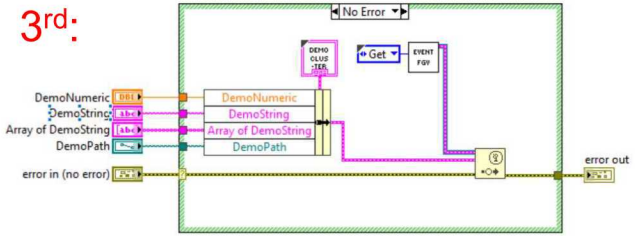
1st:



2nd:



3rd:



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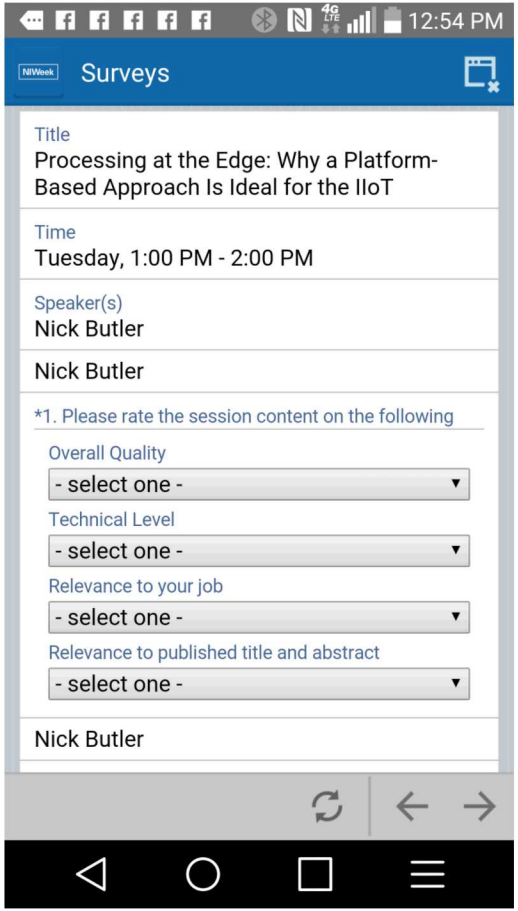
Conclusion

- Can put almost anything into an Object, Cluster, Variant or Data String and pass it between steps
- LabVIEW fully supports Object Orientated Programing
- Queues can be used, just make sure to enqueue enough elements
- Dynamic Events can easily send messages/data to many VI's simultaneously
- Variants work well for sequential steps or Dynamic dispatch
- Varying abilities to view data in TestStand
  1. High – Cluster
  2. Medium – Variant
  3. Low – Object, Data String, Queues, DVRs,



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