Group Switching Custom Device

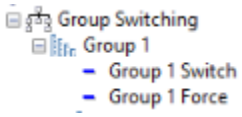
Background

A test system may have multiple modes of operation enabled by switching and routing hardware. A tester may interface to multiple UUT's and want to open and close the connections to each UUT separately. As another example, a tester may have real hardware connected and need to switch between the real hardware and simulated hardware on a per component basis.

The Switch Custom Device enables the creation of channels with one or more assignable values, that will execute pre-configured switch paths on a change of value. Each switch channel has a channel name with an array of states. Each state has a configurable integer value and an array of switch commands. However to enable the situations described above, tens or hundreds of switch channels must be updated to change the execution mode of the tester.

The Group Switching Custom Device simplifies the software for various test modes by allowing multiple switch channels to be configured into groups with a single parent switch channel such that all dependent channels update simultaneously when the value of the parent changes.

Description and Terminology



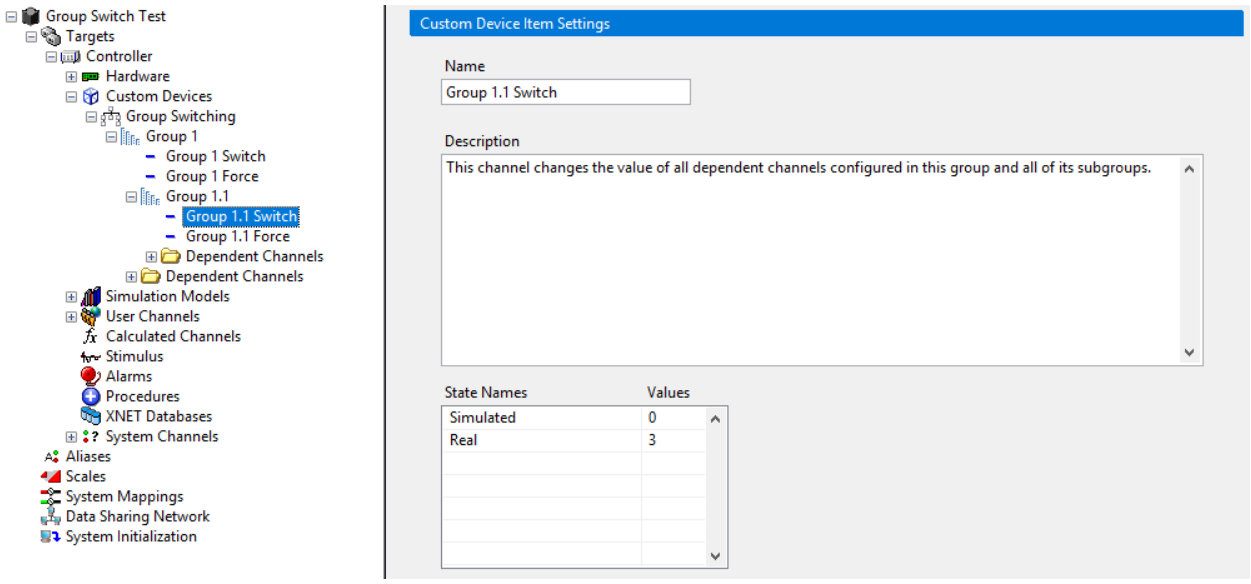
Group, Switch Channel, and Force Channel

Group – A collection of VeriStand channels that enables a user to switch between the same two values for all Dependent Channels simultaneously. A group is currently defined to be binary with a True and False state. Each Group is configured with a Name to identify it.

Switch Channel – Each defined group has its own associated Switch Channel. The Switch Channel is a new VeriStand Channel that stores the intended state of all Dependent Channels and SubGroups.

A change in value of the Switch Channel triggers the engine to update all Dependent Channels and SubGroups. Because an update only happens on value change, it is still possible to have other items mapped to those same channels in the System Explorer, although this should be done with caution to avoid race conditions.

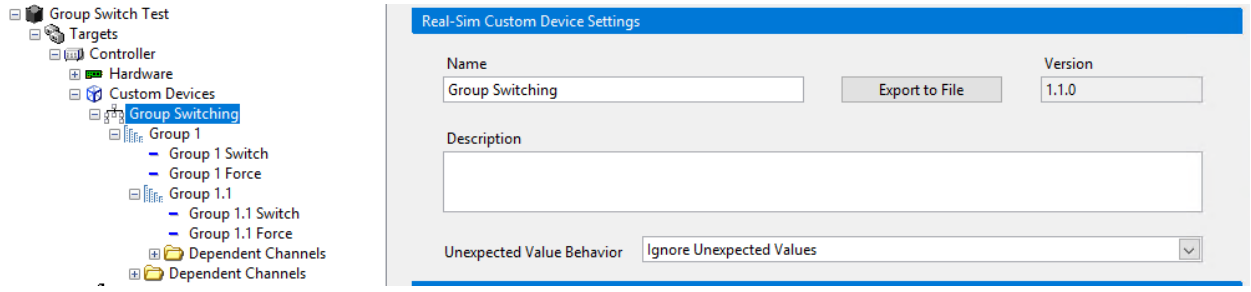
Force Channel – When True, the current state of the Switch Channel is applied to all Dependent Channels. The Force Channel will immediately set itself back to False after the value is applied. This channel is used to reapply the existing Switch Channel state, whose dependent channels may have updated from other writers, without having to toggle the value of the Switch Channel.



State Names and Values

State Values – The integer written to each dependent channel is equivalent to the value applied to the Switch Channel. An update trigger can occur either from a value change of a parent group Switch Channel or Force Channel.

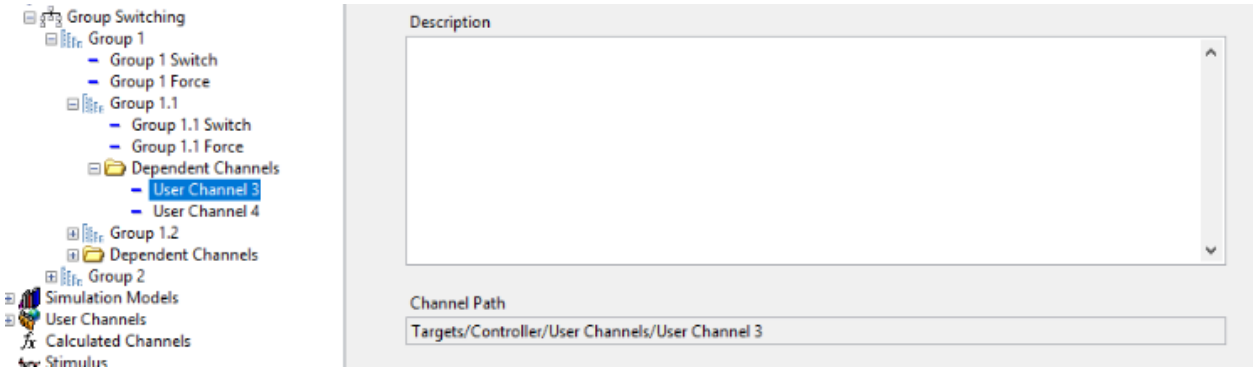
State Names – A name associated with each state value. This name is for configuration and operator usability and is only displayed in the System Definition and Custom Workspace Tool. This name will typically be configured to match the State names configured in the corresponding channels of the Switch Custom Device, but can be any arbitrary string.



Unexpected Value Behavior

Unexpected Value Behavior – How the custom device responds when an unexpected value is entered in the Switch Channel. An unexpected value is considered any value that is not defined in the list of State Values. There are two options for this behavior:

- **Ignore Unexpected Values** – This option will cause unexpected values applied to the Switch Channel to be ignored and the Switch Channel will return to its previous value.
- **Allow Any Value** – This option will allow any value applied to the Switch Channel to be applied to all its Dependent Channels.



Dependent Channels and SubGroups

Dependent Channels – One or more existing VeriStand Channels with values that will update simultaneously with a change in the parent channel's state. This stores a path to a channel that exists elsewhere in the System Definition.

SubGroup – A mechanism to enable group hierarchy. Any group can contain one or more subgroups each with their own Switch Channel, Force Channel, and Dependent Channels. Values applied to parent groups are reflected in all SubGroups of that parent.

XML Schema

VeriStand configuration is only supported through importing a custom XML file when adding the custom device to the System Definition. The XML file uses the following schema:

Expected XML Schema:

```
<Groups>
  <Group>
    <Name>Text</Name>
    <Channels>
      <Channel>
        <Name>Text</Name>
        <Path>Text</Path>
      </Channel>
    </Channels>
    <Subgroups>
      <Group>
        <Name>Text</Name>
        <Channels/>
        <Subgroups/>
      </Group>
    </Subgroups>
    <States>
      <State>
        <StateName>Text</StateName>
        <StateValue>Numeric</StateValue>
      </State>
    </States>
  </Group>
</Groups>
```

Each group has a Name, array of Channels, SubGroups, and any number of state names and values. Each Channel has a name and a full path of the VeriStand channel that it references. For example, the full path to a User Channel in VeriStand would be “Targets/Controller/User Channels/User Channel”. A SubGroup can contain one ore more additional groups.

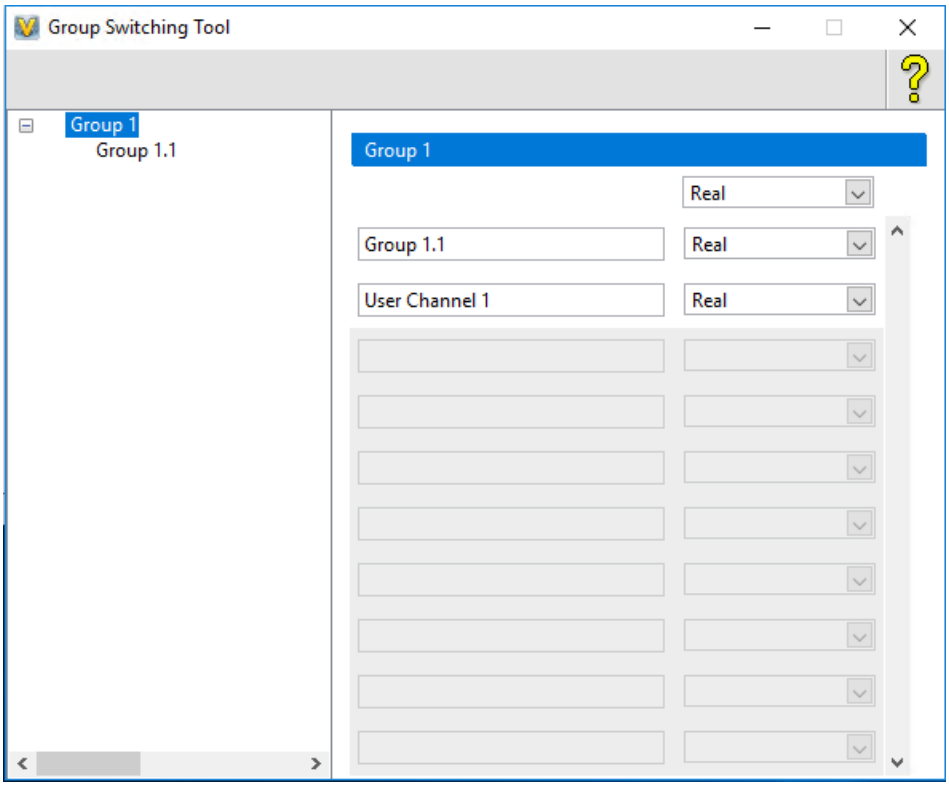
This XML file for import can be generated by hand or from any programming language. There is no formal LabVIEW API provided for this schema, but the ‘Group Switching Shared.lvlib:Groups – Generate XML From Groups.vi’ in the source code can be used as an example.

Workspace Tool

The Group Switching Custom Device also includes a custom workspace tool. This tool will automatically load the configuration of the custom device from the System Definition and present a GUI specific to that project. In the figure shown below, each group and subgroup displayed in the tree to the left will have the name of that group from the custom xml file. Once a group is selected, Switch Channels for the subgroups will appear at the top and any Dependent Channels will be displayed below them.

The drop-down box at the top-right of the figure represents the Switch Channel for the selected group in the tree. The drop-down is populated with all of the configured State Names. Each of the children channels will display their current state. All switch channels will display a state if all children channels are in the same state, or <undefined> if all the children channels do not have all the same value.

Custom workspace tools must be manually added to your project. For more information, reference [Adding a Custom Tool to the NI VeriStand Workspace].



Custom Workspace Tool

Caveats and Known Issues

- All channels in the same group must have the same switch states. Regardless of what states are defined in subgroups in the XML, the states of the top-level group will be applied.
- This custom device references existing System Definition channels for all configured Dependent Channels and looks for their existence when the configuration file is imported. As a result, this custom device should be added to the VeriStand System Definition only after all Dependent Channels have already been defined.
- All configuration must be done by importing a custom XML file. The VeriStand GUI is currently read-only. A scripting API for that XML file is not provided, but examples are included in the source code.
- The state values for any group is fixed. This Custom Device cannot be used to Mux between two existing channels as in the case of switching between two models running in Software.