

Gluware® Application Note

Automating Domain Name Service (DNS)
with Gluware Config Modeling

Intelligent Automation of DNS Policy for
Network Engineers and Operators

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Overview

This Gluware *Application Note* is designed to help you understand the approach of using Gluware Config Modeling to automate network features, in this case Domain Name Service (DNS). The Gluware Config Modeling app is built to rapidly onboard your configuration policy, then use the declarative engine to deploy policies reliably at scale.

To onboard your network policy there are three options:

- **Intelligent Model Discovery (IMD) Workflow** - This Gluware workflow provides the ability to connect to a live device, read each of the configured features, then enable the creation of the required constructs in Config Modeling so that they can be used on any other device with the same operating system.
- **Network Feature Design** – This is a workflow option that steps a user through the process to define and create the configuration feature.

Example solution package – One of the most common ways in which users start with Config Modeling is to use example packages provided by Gluware. These packages have commonly configured features and users can customize them to their specific configurations. This application note is based on an example using a solution package that provides DNS features, for which you can copy-and-paste your own CLI policy into each CLI Command list feature. This note includes examples of how to make the policy more capable by leveraging variables. There are also additional capabilities out of scope for this paper including adding conditionals, dynamic discovery and other advanced features.

Automating Global Network Feature

Globals is a generic term for common features configured on network devices that handle standard services. They are configured at the global level of a configuration, not under a protocol or interface. This example will focus on a commonly configured global parameter - domain-name service (DNS). DNS is an important policy to have configured correctly on network devices from a security perspective since corporate DNS servers will implement important filters to prevent access to “known bad” domains.

DNS Definitions

The Domain Name System (DNS) is a distributed database in which you can map hostnames to IP addresses through the DNS protocol from a DNS server. Each unique IP address can have an associated hostname. For this example, we will configure three parameters related to DNS.

DNS Server – A name server is used to keep track of information associated with domain names. It can maintain a database of hostname-to-address mappings. Each name can map to one or more IP addresses. There are public DNS services for registered (public) IP addresses, like Google Public DNS (IPv4) available at 8.8.8.8 and 8.8.4.4. Organizations also often have private name services for domain names and IP addresses in the private IP space. This example is using IP address in the private IP range.

Domain Lookup – By default, any single word entered on an IOS device that is not recognized as a valid command is treated as a hostname with which you want to use telnet. The device will try to translate that word to an IP address in a process that can last about a minute. To eliminate that issue, the command **no ip domain-lookup** can be used to turn that off.

Domain Name - Defines a default domain name that the Cisco IOS software will use to complete unqualified hostnames.

Gluware Assembly

To simplify this example the Assembly will only include a single feature. Features and their policies can be added and removed as part of the modular template to specify exactly what Gluware is automating on all the Nodes that use that Assembly.

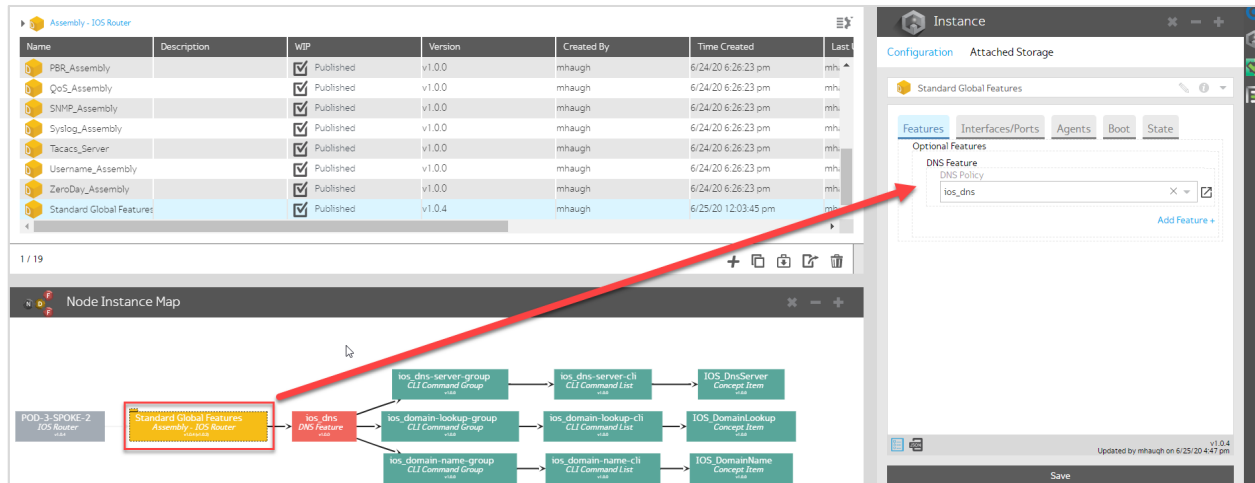


Figure 1. Use the Node Instance Map to view the Assembly Instance

Feature

The Gluware Feature is used to associate all the CLI Command Groups required. The Feature also has a Configurations tab which is used to capture user input as variables. In this case, the DNS Feature is made up of three CLI Command Groups for DNS server, domain lookup, and domain name. The Configuration tab is also used in this example to capture user input for variables including the domain name and the IP addresses of the name servers.

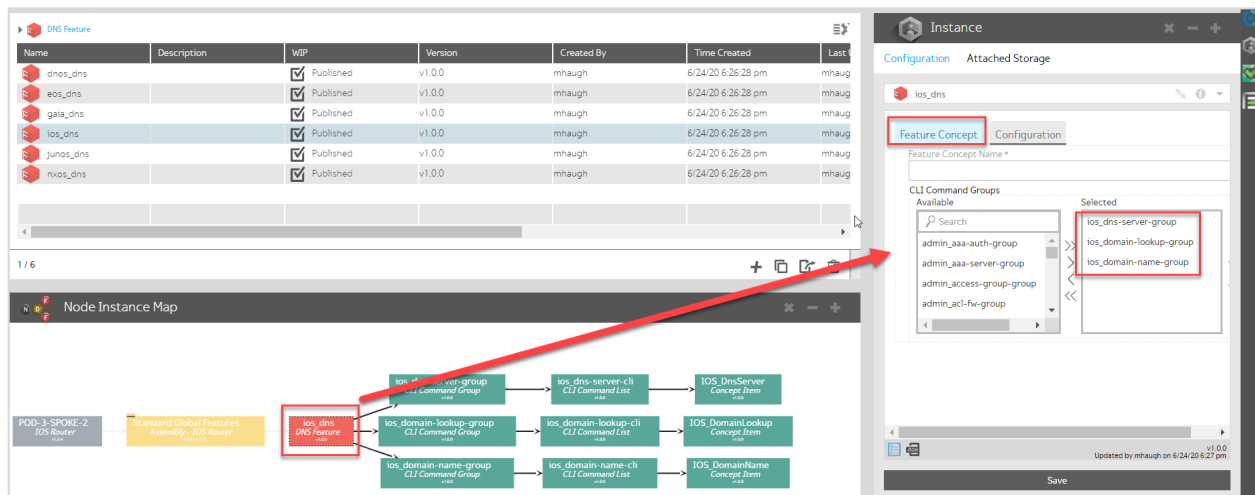


Figure 2. Use the Node Instance Map to view the Feature Instance

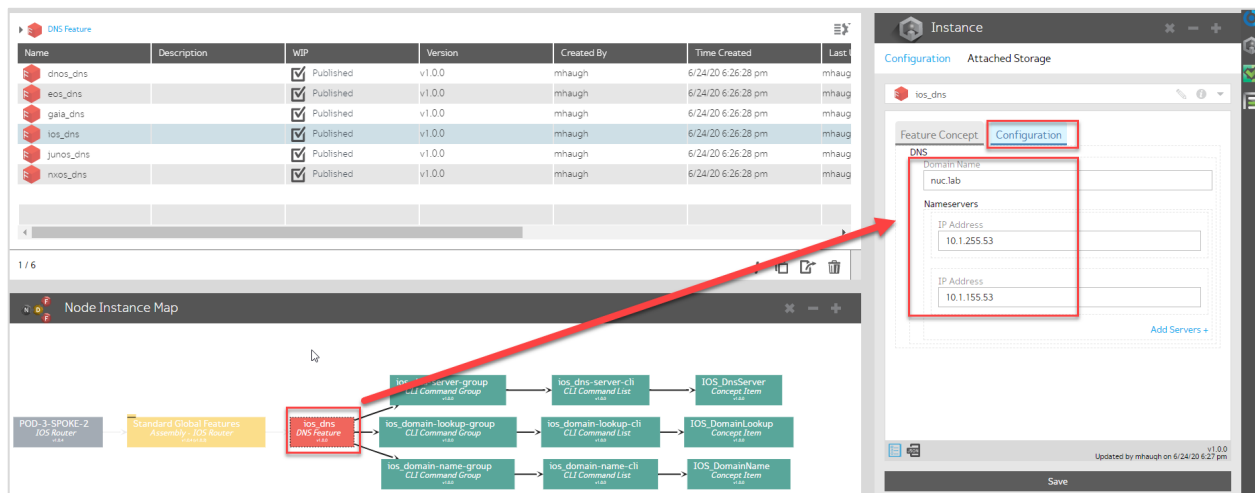


Figure 3. Use the Node Instance Map to view the Configuration parameters in the Feature Instance

CLI Command Group

The CLI Command Group is used to specify all the CLI Command Lists. In this case DNS is a simple feature consisting of a single CLI Command List. Advanced Rendering Conditions are not required for DNS. Since each of the CLI Command Groups each have a single CLI Command List, only one of the three is shown as an example below.

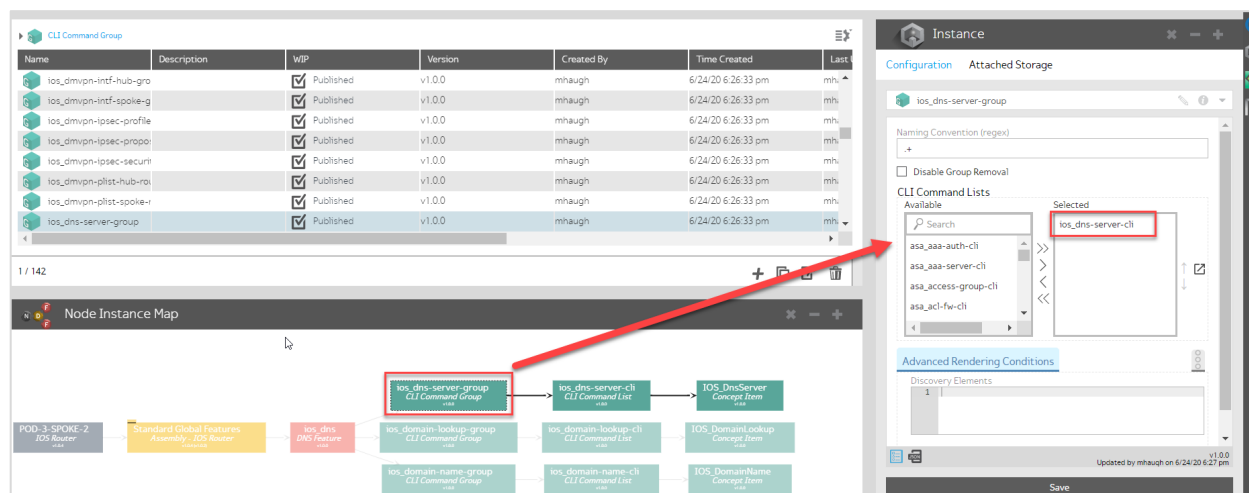


Figure 4. Use the Node Instance Map to view the CLI Command Group

CLI Command List

The CLI Command List gets a little more interesting with the DNS features since two of the three are using Gluware variables. Any time you see a **\$context** it is referring to a variable that is stored locally in the Feature data-model shown in the DNS Feature Configurations tab. For name servers, the variable specifies an array so the CLI line will get rendered for each of the server IP addresses provided in the list. In this string, the bolded part indicates an array: `ip name-server $context.dns.server[*].ip`. The domain lookup Feature is using static CLI. The domain name Feature is using the variable, also pulled in from the DNS Feature Configurations tab using the string `ip domain name $context.dns.domainName`.

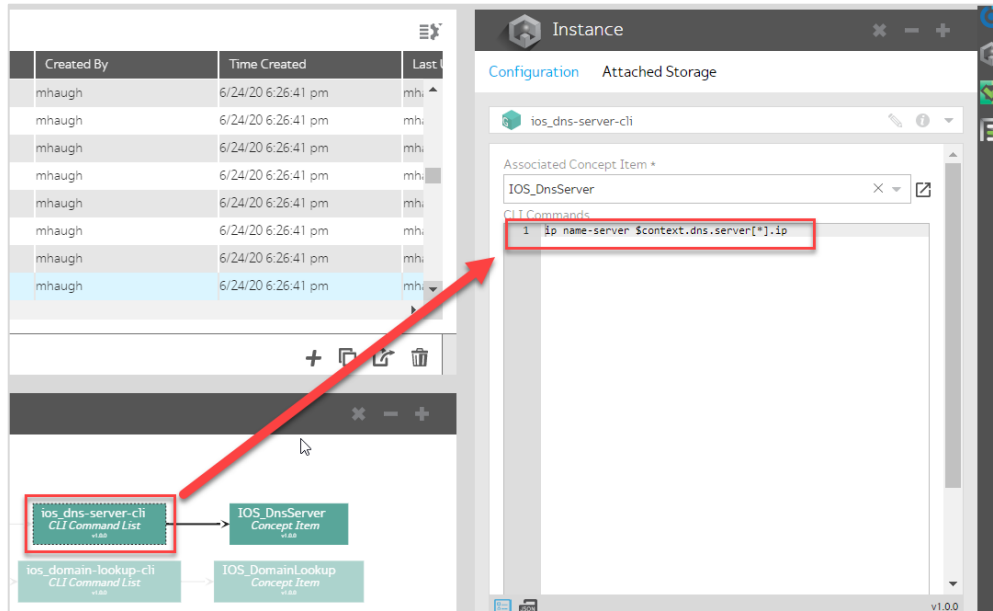


Figure 5. Use the Node Instance Map to view the CLI Command List for the DNS Name Server

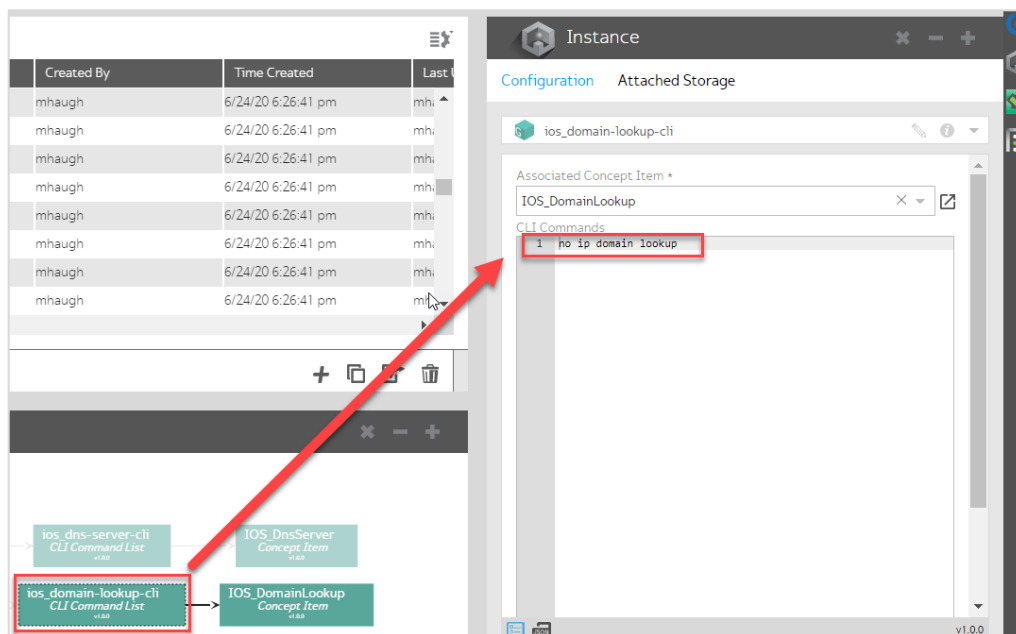


Figure 6. Use the Node Instance Map to view the CLI Command List for the Domain Lookup feature

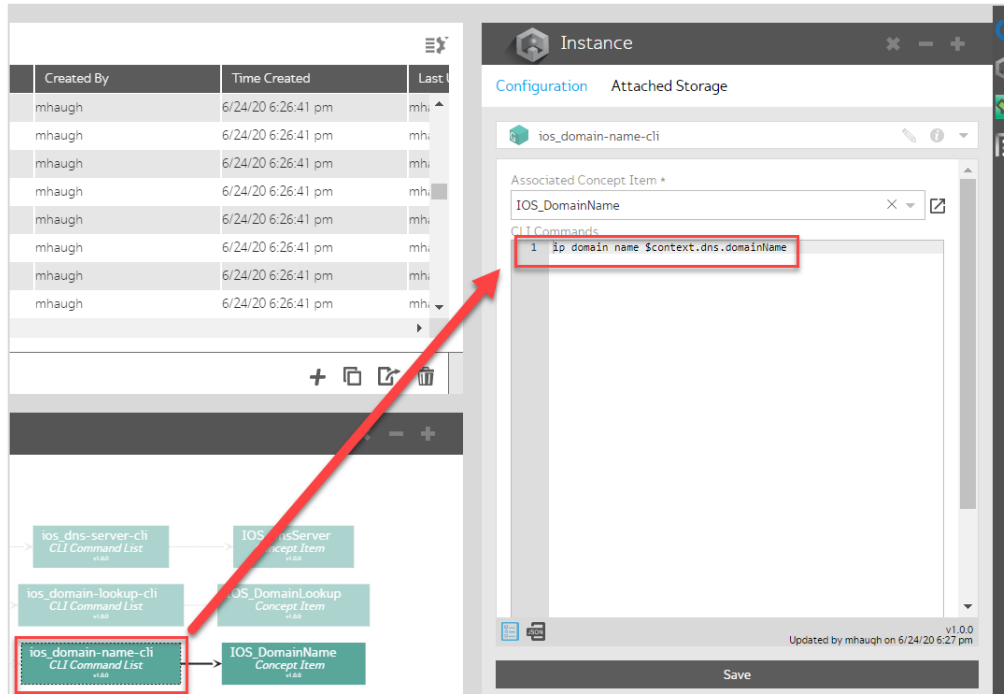


Figure 7. Use the Node Instance Map to view the CLI Command List for the Domain Name feature

Concept Item

The Concept Item is the construct created to enable Gluware to read the currently configured state of the feature and capture any required variables. It is defined with vendor specific show commands and regex to extract the required information. Other advanced features, like Discovery Elements, can be defined in the Concept Item, but are not required for the DNS feature. The DNS Concept Items are part of the Cisco IOS Config Modeling Kit (CMK) provided by Gluware. Since these are simple examples, below is one example of the Concept Items for DNS.

The screenshot displays the Gluware interface. On the left, the 'Node Instance Map' shows a flow of components: 'ios_dns-server-cli CLI Command List' points to 'IOS_DnsServer Concept Item', which in turn points to 'IOS_DomainLookup Concept Item'. Below this, 'ios_domain-lookup-cli CLI Command List' points to 'IOS_DomainLookup Concept Item', and 'ios_domain-name-cli CLI Command List' points to 'IOS_DomainName Concept Item'. The 'IOS_DnsServer Concept Item' is highlighted with a red box, and a red arrow points from it to the right-hand configuration window.

The right-hand window, titled 'Instance', shows the configuration for the 'IOS_DnsServer' concept item. It includes the following fields:

- Concept Item Name ***: DnsServer
- Operating Systems**: A section for 'Cisco Systems' with 'Operating System' set to 'IOS/IOS XE'.
- Show Commands**: A text area containing 'sh run | sec ^ip name-server'.
- Operating Mode**: Set to 'Basic'.
- Key CLI Line**: A text area for 'Key CLI Line'.
- Flat Structure CLI ?**: A checked checkbox.

At the bottom of the configuration window, it says 'Updated by mhaugh on 6/24/20 6:17 pm' and has a 'Save' button.

Figure 8. Use the Node Instance Map to view the Concept Item for DNS Server

Preview and Provisioning

- 1) The next step is provisioning. Gluware recommends that you provision in a test environment to validate the features and procedure before provisioning in a production environment. Using the Node view, select one or more Nodes to provision. On the right slide menu bar, select the **Actions** view. Ensure that the desired Nodes are selected. In this example it is just the single POD-3-SPOKE-2 router. Using the dropdowns at the bottom, choose **Provisioning Utilities** and **Preview Features**, which is always recommended before writing changes to the devices. This generates the CLI commands needed by the Gluware orchestration engine depending on what is already configured on each Node. Click **Start Action** to begin the preview, select the **Connected** preview to enable Gluware to connect to the Node and compare its current configuration to the specified policy for each feature.

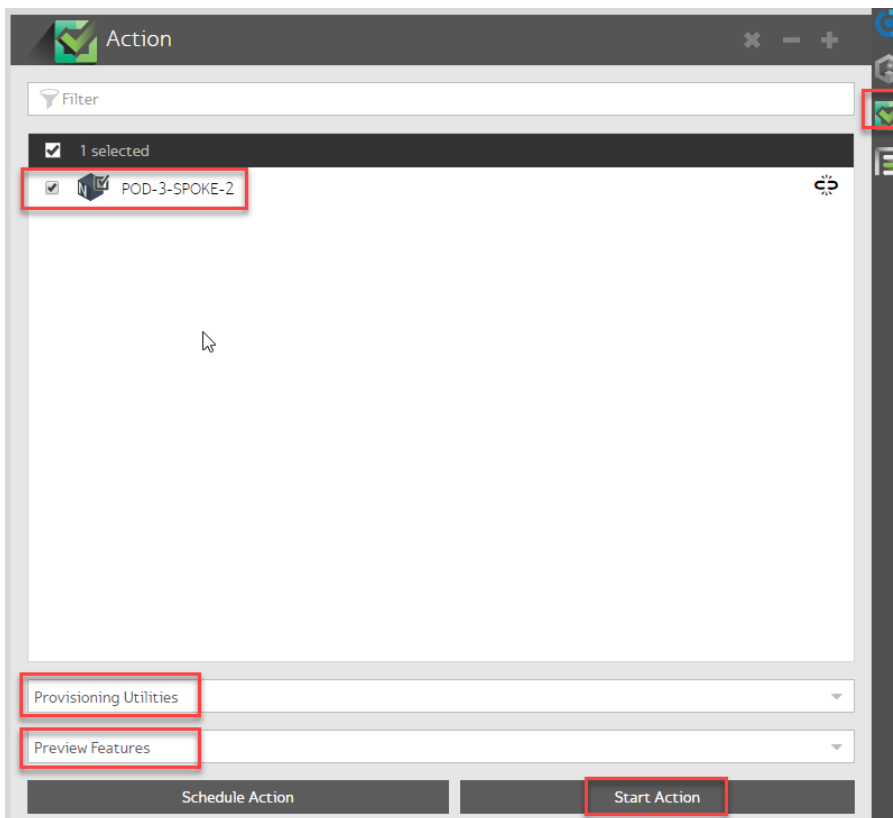


Figure 9. In the Actions view, select the Node(s) and Preview Features as the Provisioning Utility and Start Action

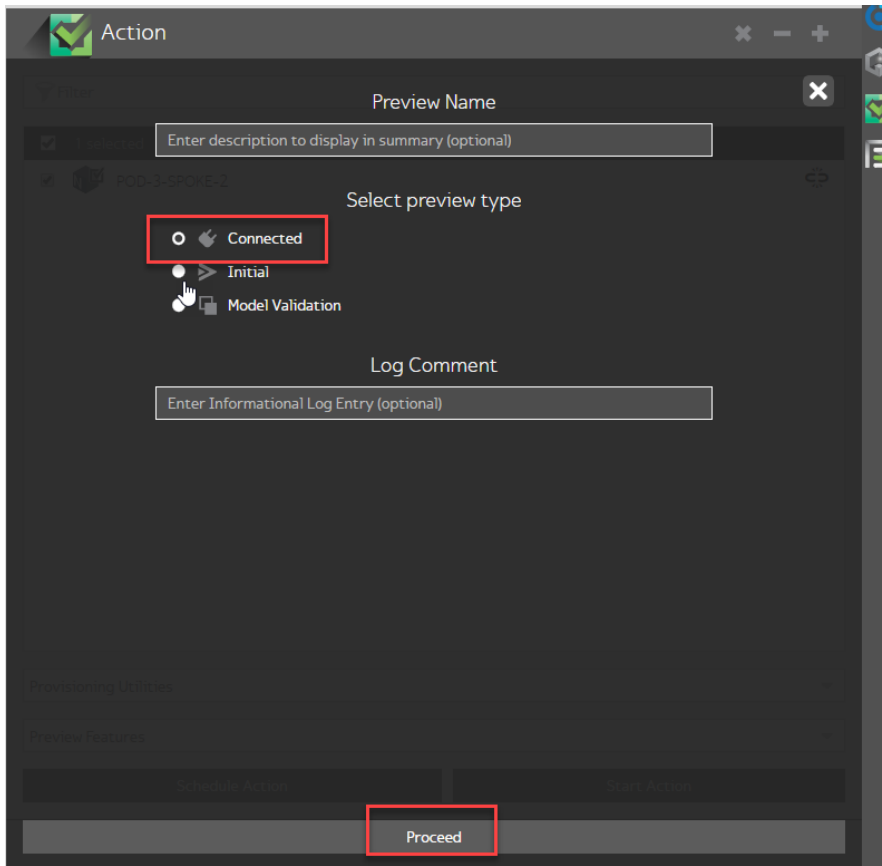


Figure 10. Select the Connected option for the Preview so Gluware can connect to the Node(s) and compare the current config state to the desired state for each feature

- 2) Select the **Provisioning** view using the icon on the right-side bar and double-click on the summary log to see the details.

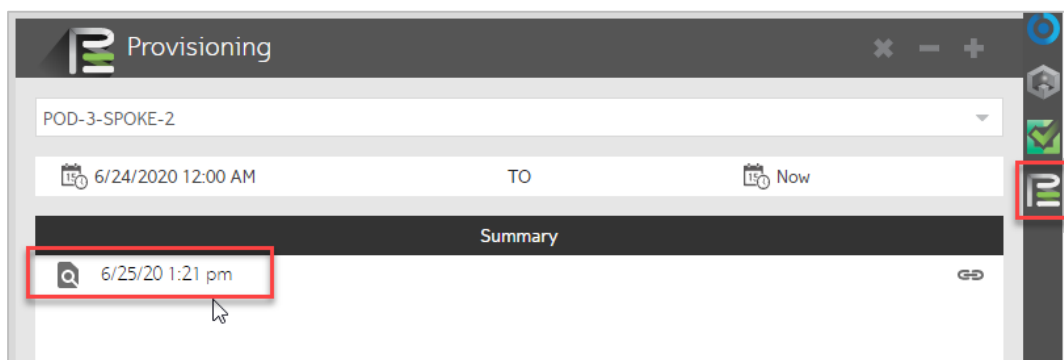


Figure 11. Use the Provisioning view to see the log and double-click to open it

- 3) Scroll down the detailed log to see all the interactions Gluware is having with the Node. The logging level is customizable via the cog on the lower right. For the CLI view, click on the >_ icon and then select the **Processed** view to see exactly what CLI commands are needed for Gluware to configure the Node in the desired state for each feature

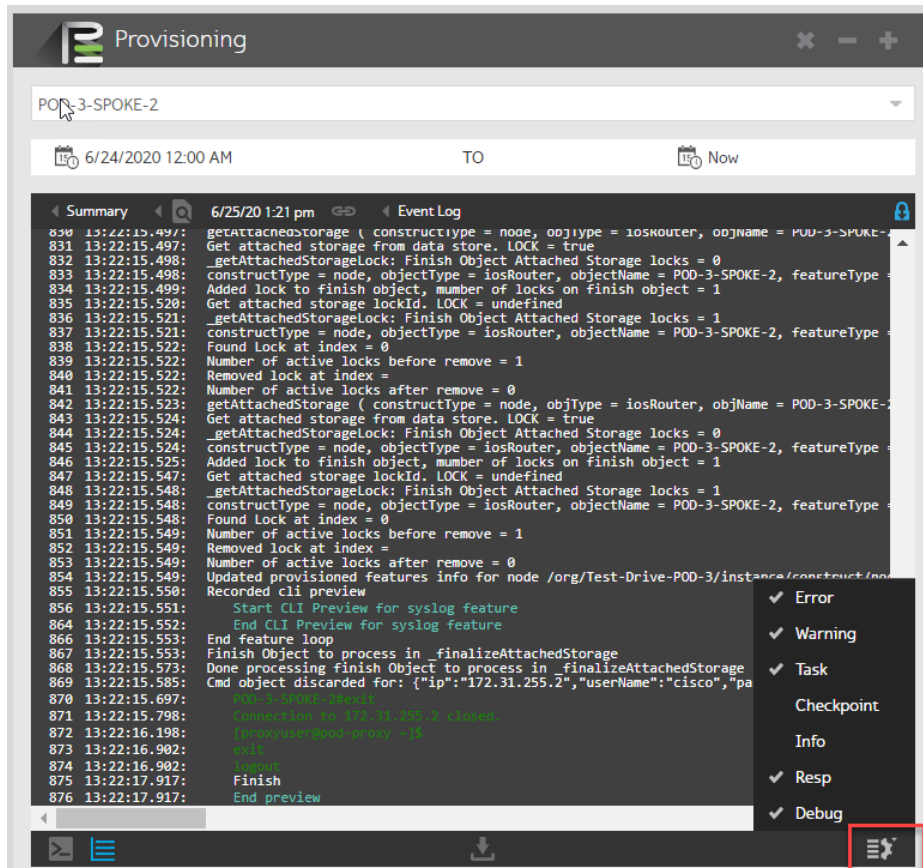


Figure 12. Browse the detailed log and adjust the logging level as needed

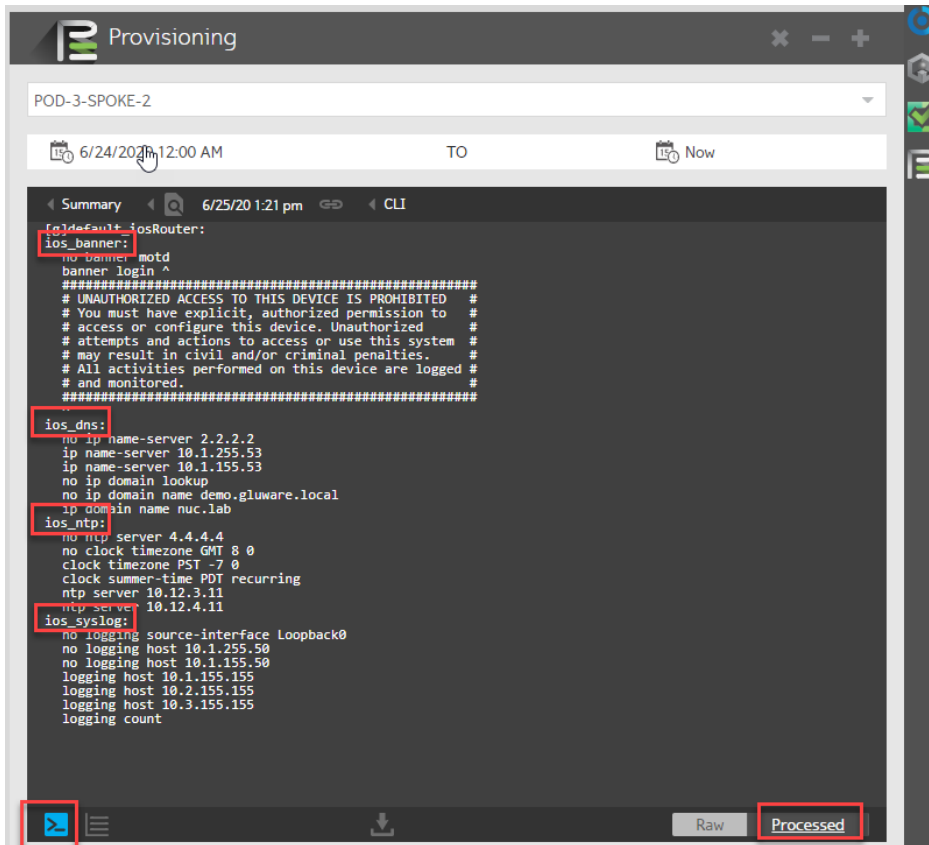


Figure 13. Use the CLI view and click Processed to see the CLI that has been rendered based on what is needed to provision the Node. This example shows multiple features being configured, including DNS.

- 4) Once satisfied with the preview and ready to provision, return to the **Actions** view, ensure you have the Node selected, and change from **Preview Features** to **Provision Features**. Click **Start Action**. Again, you can use the Provisioning view to see all the details.

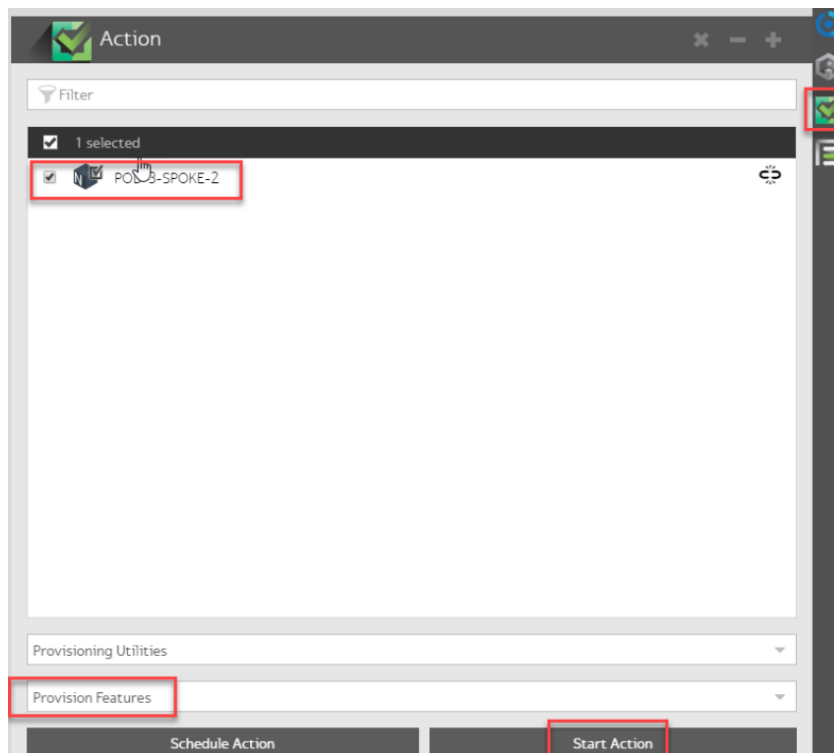


Figure 14. In the Actions view, select the Node and the Provision Features option to implement the changes on the Node(s)

In the Node Grid there is a summary status of the progression of each feature until it reaches synchronization. All Nodes should result in the **Provisioned** state when complete.

The screenshot shows the 'Model Editor' window with the 'Node Grid' view. The grid displays a summary status of the provisioning for various nodes. The row for 'POD-3-SPOKE-2' is highlighted.

| Hostname | Referenced Instances | Feature Config Status | Feature Config Summary | Feature Provisioning Stat... | Features Provisioning | Features In Error | Feature Provisioning Sum |
|---------------|----------------------|-----------------------|------------------------|------------------------------|-----------------------|-------------------|--------------------------|
| POD-3-SPOKE-1 | 0 (0) 0 (1) | ✓ (1) | ✓ Published | ⚙ (1) | | | ⚙ Not provisioned |
| POD-3-HUB-1 | 0 (0) 0 (1) | ✓ (1) | ✓ Published | ⚙ (1) | | | ⚙ Not provisioned |
| POD-3-SPOKE-2 | 0 (1) 0 (5) | ✓ (1) ✓ (4) | ✓ Published | ⚙ (3) ⚙ (1) ... ios_banner | | | ⚙ Provisioning |
| POD-3-HUB-2 | 0 (0) 0 (1) | ✓ (1) | ✓ Published | ⚙ (1) | | | ⚙ Not provisioned |
| POD-3-SPOKE-4 | 0 (0) 0 (1) | ✓ (1) | ✓ Published | ⚙ (1) | | | ⚙ Not provisioned |
| POD-3-SPOKE-3 | 0 (0) 0 (1) | ✓ (1) | ✓ Published | ⚙ (1) | | | ⚙ Not provisioned |

Figure 15. Scroll to the right in the Node View to see a summary status of the provisioning

Conclusion

This *Application Note* was intended to provide a base knowledge for users of Gluware Config Modeling to understand the concepts and constructs used. The DNS global feature example is a straightforward example that uses static CLI along with features that leverage variables. As the configuration gets more complex and models are provisioned at scale, the power of using Gluware will become even more apparent.

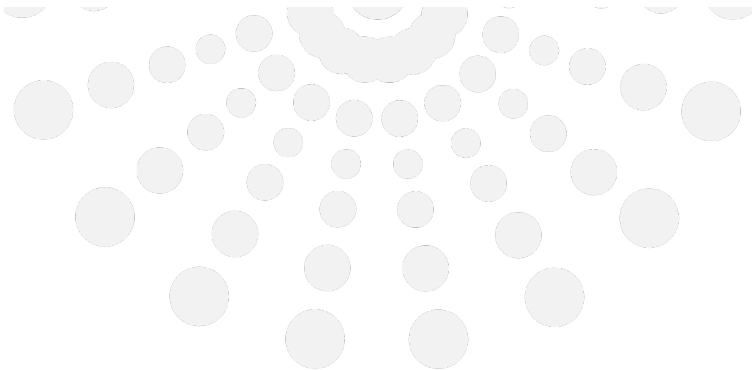
Spending some time to model network features using Gluware can help to standardize configurations across your network devices, eliminate manual errors and configuration bloat.

If you are ready to get started with Gluware system for automation or testing, here are some options:

- 1) **Get started with Gluware from** our free SaaS Network Inventory app offer to Gluware Enterprise for larger networks. Visit [Gluware Pricing Page](#) to learn more.
- 2) **Kick the tires** using a virtual environment we setup for you by requesting a Test Drive. Learn more [here](#).
- 3) **Connect with a network automation expert to** explore your unique network needs, ask questions and request a tailored demo [here](#).

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