Python API

Python programmabililty supports Python APIs.

About Python

The Cisco IOS XE devices support Python Version 2.7 in both interactive and non-interactive (script) modes within the Guest Shell. The Python scripting capability gives programmatic access to a device's CLI to perform various tasks and Zero Touch Provisioning or Embedded Event Manager (EEM) actions.

Cisco Python Module

Cisco provides a Python module that provides access to run EXEC and configuration commands. You can display the details of the Cisco Python module by entering the **help()** command. The **help()** command displays the properties of the Cisco CLI module.

The following example displays information about the Cisco Python module:

```
Device# guestshell run python

Python 2.7.5 (default, Jun 17 2014, 18:11:42)
[GCC 4.8.2 20140120 (Red Hat 4.8.2-16)] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> >>> from cli import cli,clip,configure,configurep, execute, executep
>>> help(configure)
Help on function configure in module cli:

configure(configuration)
Apply a configuration (set of Cisco IOS CLI config-mode commands) to the device
and return a list of results.

configuration = '''interface gigabitEthernet 0/0
no shutdown'''

# push it through the Cisco IOS CLI.
try:
results = cli.configure(configuration)
print "Success!"
```

```
except CLIConfigurationError as e:
print "Failed configurations:"
for failure in e.failed:
print failure

Args:
configuration (str or iterable): Configuration commands, separated by newlines.

Returns:
list(ConfigResult): A list of results, one for each line.

Raises:
CLISyntaxError: If there is a syntax error in the configuration.

>>> help(configurep)
Help on function configurep in module cli:

configurep(configuration)
Apply a configuration (set of Cisco IOS CLI config-mode commands) to the device
and prints the result.

configuration = '''interface gigabitEthernet 0/0
no shutdown'''

# push it through the Cisco IOS CLI.
configurep(configuration)

Args:
configuration (str or iterable): Configuration commands, separated by newlines.
>>> help(execute)
Help on function execute in module cli:

execute(command)
Execute Cisco IOS CLI exec-mode command and return the result.

command_output = execute("show version")

Args:
command (str): The exec-mode command to run.

Returns:
str: The output of the command.

Raises:
CLISyntaxError: If there is a syntax error in the command.

>>> help(executep)
Help on function executep in module cli:

executep(command)
Execute Cisco IOS CLI exec-mode command and print the result.

executep("show version")

Args:
command (str): The exec-mode command to run.


>>> help(cli)
Help on function cli in module cli:

cli(command)
    Execute Cisco IOS CLI command(s) and return the result.
```

```
    A single command or a delimited batch of commands may be run. The
    delimiter is a space and a semicolon, " ;". Configuration commands must be
    in fully qualified form.

    output = cli("show version")
    output = cli("show version ; show ip interface brief")
    output = cli("configure terminal ; interface gigabitEthernet 0/0 ; no shutdown")

    Args:
        command (str): The exec or config CLI command(s) to be run.

    Returns:
        string: CLI output for show commands and an empty string for
            configuration commands.

    Raises:
        errors.cli_syntax_error: if the command is not valid.
        errors.cli_exec_error: if the execution of command is not successful.
```

```
>>> help(clip)
Help on function clip in module cli:

clip(command)
    Execute Cisco IOS CLI command(s) and print the result.

    A single command or a delimited batch of commands may be run. The
    delimiter is a space and a semicolon, " ;". Configuration commands must be
    in fully qualified form.

    clip("show version")
    clip("show version ; show ip interface brief")
    clip("configure terminal ; interface gigabitEthernet 0/0 ; no shutdown")

    Args:
        command (str): The exec or config CLI command(s) to be run.
```

Cisco Python Module to Execute IOS CLI Commands

Note Guest Shell must be enabled for Python to run. For more information, see the *Guest Shell* chapter.

The Python programming language uses six functions that can execute CLI commands. These functions are available from the Python CLI module. To use these functions, execute the **import cli** command.

Arguments for these functions are strings of CLI commands. To execute a CLI command through the Python interpreter, enter the CLI command as an argument string of one of the following six functions:

- **cli.cli(command)**—This function takes an IOS command as an argument, runs the command through the IOS parser, and returns the resulting text. If this command is malformed, a Python exception is raised. The following is sample output from the **cli.cli(command)** function:

```
>>> import cli
>>> cli.clip('configure terminal; interface loopback 10; ip address
10.10.10.10 255.255.255.255')
*Mar 13 18:39:48.518: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback10, changed
```

```
 state to up
>>> cli.clip('show clock')
'\n*18:11:53.989 UTC Mon Mar 13 2017\n'
>>> output=cli.cli('show clock')
>>> print(output)
*18:12:04.705 UTC Mon Mar 13 2017
```

- **cli.clip(command)**—This function works exactly the same as the **cli.cli(command)** function, except that it prints the resulting text to *stdout* rather than returning it. The following is sample output from the **cli.clip(command)** function:

```
>>> cli
>>> cli.clip('configure terminal; interface loopback 11; ip address
10.11.11.11 255.255.255.255')
*Mar 13 18:42:35.954: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback11, changed
 state to up
*Mar 13 18:42:35.954: %LINK-3-UPDOWN: Interface Loopback11, changed state to up
>>> cli.clip('show clock')
*18:13:35.313 UTC Mon Mar 13 2017
>>> output=cli.clip('show clock')
*18:19:26.824 UTC Mon Mar 13 2017
>>> print (output)
None
```

- **cli.execute(command)**—This function executes a single EXEC command and returns the output; however, does not print the resulting text No semicolons or newlines are allowed as part of this command. Use a Python list with a for-loop to execute this function more than once. The following is sample output from the **cli.execute(command)**

  function:

```
>>> cli.execute("show clock")
'15:11:20.816 UTC Thu Jun 8 2017'
>>>
>>> cli.execute('show clock'; 'show ip interface brief')
  File "<stdin>", line 1
    cli.execute('show clock'; 'show ip interface brief')
                            ^
SyntaxError: invalid syntax
>>>
```

- **cli.executep(command)**—This function executes a single command and prints the resulting text to *stdout* rather than returning it. The following is sample output from the **cli.executep(command)** function:

```
>>> cli.executep('show clock')
*18:46:28.796 UTC Mon Mar 13 2017
>>> output=cli.executep('show clock')
*18:46:36.399 UTC Mon Mar 13 2017
>>> print(output)
None
```

- **cli.configure(command)**—This function configures the device with the configuration available in commands. It returns a list of named tuples that contains the command and its result as shown below:

```
[Think: result = (bool(success), original_command, error_information)]
```

The command parameters can be in multiple lines and in the same format that is displayed in the output of the **show running-config** command. The following is sample output from the **cli.configure(command)** function:

```
>>>cli.configure(["interface GigabitEthernet1/0/7", "no shutdown",
"end"])
[ConfigResult(success=True, command='interface GigabitEthernet1/0/7',
line=1, output='', notes=None), ConfigResult(success=True, command='no shutdown',
line=2, output='', notes=None), ConfigResult(success=True, command='end',
line=3, output='', notes=None)]
```

- **cli.configurep(command)**—This function works exactly the same as the **cli.configure(command)** function, except that it prints the resulting text to *stdout* rather than returning it. The following is sample output from the **cli.configurep(command)** function:

```
>>> cli.configurep(["interface GigabitEthernet1/0/7", "no shutdown",
"end"])
Line 1 SUCCESS: interface GigabitEthernet1/0/7
Line 2 SUCCESS: no shut
Line 3 SUCCESS: end
```

Python Scripts Overview

Python run in a virtualized Linux-based environment, Guest Shell. For more information, see the *Guest Shell* chapter. Cisco provides a Python module that allows user's Python scripts to run IOS CLI commands on the host device.

Interactive Python Prompt

When you execute the **guestshell run python** command on a device, the interactive Python prompt is opened inside the Guest Shell. The Python interactive mode allows users to execute Python functions from the Cisco Python CLI module to configure the device.

The following example shows how to enable the interactive Python prompt:

```
Device# guestshell run python

Python 2.7.5 (default, Jun 17 2014, 18:11:42)
[GCC 4.8.2 20140120 (Red Hat 4.8.2-16)] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>>

Device#
```

Python Script

Python scripts can run in non-interactive mode by providing the Python script name as an argument in the Python command. Python scripts must be accessible from within the Guest Shell. To access Python scripts from the Guest Shell, save the scripts in bootflash/flash that is mounted within the Guest Shell.

The following sample Python script uses different CLI functions to configure and print **show** commands:

```
Device# more flash:sample_script.py


import sys
import cli

intf= sys.argv[1:]
intf = ''.join(intf[0])

print "\n\n *** Configuring interface %s with 'configurep' function  *** \n\n" %intf
cli.configurep(["interface loopback55","ip address 10.55.55.55 255.255.255.0","no
shut","end"])

print "\n\n *** Configuring interface %s with 'configure' function  *** \n\n"
cmd='interface %s,logging event link-status ,end' % intf
cli.configure(cmd.split(','))

print "\n\n *** Printing show cmd with 'executep' function  *** \n\n"
cli.executep('show ip interface brief')

print "\n\n *** Printing show cmd with 'execute' function  *** \n\n"
output= cli.execute('show run interface %s' %intf)
print (output)

print "\n\n *** Configuring interface %s with 'cli' function  *** \n\n"
cli.cli('config terminal; interface %s; spanning-tree portfast edge default' %intf)

print "\n\n *** Printing show cmd with 'clip' function  *** \n\n"
cli.clip('show run interface %s' %intf)


To run a Python script from the Guest Shell, execute the guestshell run python
/flash/script.py command
at the device prompt.
The following example shows how to run a Python script from the Guest Shell:
```

The following example shows how to run a Python script from the Guest Shell:

```
Device# guestshell run python /flash/sample_script.py loop55

 *** Configuring interface loop55 with 'configurep' function  ***

Line 1 SUCCESS: interface loopback55
Line 2 SUCCESS: ip address 10.55.55.55 255.255.255.0
Line 3 SUCCESS: no shut
Line 4 SUCCESS: end

 *** Configuring interface %s with 'configure' function  ***


 *** Printing show cmd with 'executep' function  ***

Interface              IP-Address      OK? Method Status                Protocol
Vlan1                  unassigned      YES NVRAM  administratively down down
GigabitEthernet0/0     192.0.2.1       YES NVRAM  up                    up
GigabitEthernet1/0/1   unassigned      YES unset  down                  down
GigabitEthernet1/0/2   unassigned      YES unset  down                  down
GigabitEthernet1/0/3   unassigned      YES unset  down                  down
    :
         :
```

```
        :
Te1/1/4                unassigned      YES unset  down                  down
Loopback55             10.55.55.55     YES TFTP   up                    up
Loopback66             unassigned      YES manual up                    up


 *** Printing show cmd with 'execute' function  ***

Building configuration...
Current configuration : 93 bytes
!
interface Loopback55
 ip address 10.55.55.55 255.255.255.0
 logging event link-status
end

 *** Configuring interface %s with 'cli' function  ***

 *** Printing show cmd with 'clip' function  ***

Building configuration...
Current configuration : 93 bytes
!
interface Loopback55
 ip address 10.55.55.55 255.255.255.0
 logging event link-status
end
```

Supported Python Versions

Guest Shell is pre-installed with Python Version 2.7. Guest Shell is a virtualized Linux-based environment, designed to run custom Linux applications, including Python applications for automated control and management of Cisco devices. Platforms with Montavista CGE7 support Python Version 2.7.11, and platforms with CentOS 7 support Python Version 2.7.5.

The following table provides information about Python versions and the supported platforms:

Table 1: Python Version Support

Python Version	Platform
Python Version 2.7.5	All supported platforms except for Cisco Catalyst 3650 Series Switches and Cisco Catalyst 3850 Series Switches.
Python Version 2.7.11	• Cisco Catalyst 3650 Series Switches • Cisco Catalyst 3850 Series Switches

Python Version	Platform
Python Version 3.6	Supported in Cisco IOS XE Amsterdam 17.1.1 and later releases. In Cisco IOS XE Amsterdam 17.1.1 and Cisco IOS XE Amsterdam 17.2.1, Python V2 is the default. However, in Cisco IOS XE Amsterdam 17.3.1 and later releases, Python V3 is the default. **Note** Cisco Catalyst 9200 Series Switches do not support Python Version 3.6 in Cisco IOS XE Amsterdam 17.1.1 and Cisco IOS XE Amsterdam 17.2.1. Cisco Catalyst 9200 Series Switches support Python V3 in Cisco IOS XE Amsterdam 17.3.1 and later releases. **Note** Not supported by Cisco Catalyst 3650 Series Switches and Cisco Catalyst 3850 Series Switches.

Platforms with CentOS 7 support the installation of Redhat Package Manager (RPM) from the open source repository.

Updating the Cisco CLI Python Module

The Cisco CLI Python module and EEM module are pre-installed on devices. However, when you update the Python version by using either Yum or prepackaged binaries, the Cisco-provided CLI module must also be updated.

Note When you update to Python Version 3 on a device that already has Python Version 2, both versions of Python exist on the device. Use one of the following IOS commands to run Python:

- The **guestshell run python2** command enables Python Version 2.
- The **guestshell run python3** command enables Python Version 3.
- The **guestshell run python** command enables Python Version 2.

Use one of the following methods to update the Python version:

- Standalone tarball installation
- PIP install for the CLI module

Additional References for Python API

Related Documents

Related Topic	Document Title
Guest Shell	Guest Shell
EEM Python Module	Python Scripting in EEM

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature Information for Python API

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2: Feature Information for the CLI Python Module

Feature Name	Release	Feature Information
CLI Python Module	Cisco IOS XE Everest 16.5.1a	Python programmabilty provides a Python module that allows users to interact with IOS using CLIs. In Cisco IOS XE Everest 16.5.1a, this feature was implemented on the following platforms: • Cisco Catalyst 3650 Series Switches • Cisco Catalyst 3850 Series Switches • Cisco Catalyst 9300 Series Switches • Cisco Catalyst 9500 Series Switches In Cisco IOS XE Everest 16.5.1b, this feature was implemented on the following platforms: • Cisco 4000 Series Integrated Services Routers
	Cisco IOS XE Everest 16.6.2	This feature was implemented on Cisco Catalyst 9400 Series Switches.
	Cisco IOS XE Fuji 16.7.1	This feature was implemented on the following platforms: • Cisco ASR 1000 Aggregation Services Routers • Cisco CSR 1000v Series Cloud Services Routers
	Cisco IOS XE Fuji 16.8.1 Cisco IOS XE Fuji 16.8.1a	In Cisco IOS XE Fuji 16.8.1, this feature was implemented on following platforms: • Cisco ASR 1004 Router • Cisco ASR 1006 Router • Cisco ASR 1006-X Router • Cisco ASR 1009-X Router • Cisco ASR 1013 Router • Cisco 4000 Series Integrated Services Router models with a minimum of 4 GB RAM. In Cisco IOS XE Fuji 16.8.1a, this feature was implemented on Cisco Catalyst 9500-High Performance Series Switches