



# NX-API

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## About NX-API

### Feature NX-API

- Feature NX-API is required to be enabled for access the device through sandbox.
- | json on the device internally uses python script to generate output.
- NX-API can be enabled either on http/https via ipv4:

```
BLR-VXLAN-NPT-CR-179# show nxapi
nxapi enabled
HTTP Listen on port 80
HTTPS Listen on port 443
BLR-VXLAN-NPT-CR-179#
```
- NX-API is internally spawning third-party NGINX process, which handler receive/send/processing of http requests/response:

```
nxapi certificate {https crt |https key}
nxapi certificate enable
```
- NX-API Certificates can be enabled for https
- Default port for nginx to operate is 80/443 for http/https respectively. It can also be changed using the following CLI command:

```
nxapi {http|https} port port-number
```

## Transport

NX-API uses HTTP/HTTPS as its transport. CLIs are encoded into the HTTP/HTTPS POST body.

The NX-API backend uses the Nginx HTTP server. The Nginx process, and all of its children processes, are under Linux cgroup protection where the CPU and memory usage is capped. If the Nginx memory usage exceeds the cgroup limitations, the Nginx process is restarted and restored.

## Message Format



### Note

- NX-API XML output presents information in a user-friendly format.
- NX-API XML does not map directly to the Cisco NX-OS NETCONF implementation.
- NX-API XML output can be converted into JSON or JSON-RPC.

## Security

NX-API supports HTTPS. All communication to the device is encrypted when you use HTTPS.

NX-API is integrated into the authentication system on the device. Users must have appropriate accounts to access the device through NX-API. NX-API uses HTTP basic authentication. All requests must contain the username and password in the HTTP header.



### Note

You should consider using HTTPS to secure your user's login credentials.

You can enable NX-API by using the **feature** manager CLI command. NX-API is disabled by default.

## Using NX-API

You must enable NX-API with the **feature** manager CLI command on the device. By default, NX-API is disabled.

The following example shows how to configure and launch the NX-API Sandbox:

- Enable the management interface.

```
switch# conf t
switch(config)# interface mgmt 0
switch(config)# ip address 198.51.100.1/24
switch(config)# vrf context management
switch(config)# ip route 203.0.113.1/0 1.2.3.1
```

- Enable the NX-API **nxapi** feature.

```
switch# conf t
switch(config)# feature nxapi
```

The following example shows a request and its response in XML format:

Request:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<ins_api>
```

```

<version>0.1</version>
<type>cli_show</type>
<chunk>0</chunk>
<sid>session1</sid>
<input>show switchname</input>
<output_format>xml</output_format>
</ins_api>

```

**Response:**

```

<?xml version="1.0"?>
<ins_api>
  <type>cli_show</type>
  <version>0.1</version>
  <sid>eoc</sid>
  <outputs>
    <output>
      <body>
        <hostname>switch</hostname>
      </body>
      <input>show switchname</input>
      <msg>Success</msg>
      <code>200</code>
    </output>
  </outputs>
</ins_api>

```

The following example shows a request and its response in JSON format:

**Request:**

```

{
  "ins_api": {
    "version": "0.1",
    "type": "cli_show",
    "chunk": "0",
    "sid": "session1",
    "input": "show switchname",
    "output_format": "json"
  }
}

```

**Response:**

```

{
  "ins_api": {
    "type": "cli_show",
    "version": "0.1",
    "sid": "eoc",
    "outputs": {
      "output": {
        "body": {
          "hostname": "switch"
        },
        "input": "show switchname",
        "msg": "Success",
        "code": "200"
      }
    }
  }
}

```

### Using the Management Interface for NX-API calls

It is recommended to use the management interface for NX-API calls.

When using non-management interface and a custom port for NX-API an entry should be made in the CoPP policy to prevent NX-API traffic from hitting the default copp entry which could unfavorably treat API traffic.



**Note** It is recommended to use the management interface for NX-API traffic. If that is not possible and a custom port is used, the "copp-http" class should be updated to include the custom NX-API port.

The following example port 9443 is being used for NX-API traffic.

This port is added to the `copp-system-acl-http` ACL to allow it to be matched under the `copp-http` class resulting on 100 pps policing. (This may need to be increased in certain environments.)

```
!
ip access-list copp-system-acl-http
 10 permit tcp any any eq www
 20 permit tcp any any eq 443
 30 permit tcp any any eq 9443 <-----
!
class-map type control-plane match-any copp-http
 match access-group name copp-system-acl-http
!
!
policy-map type control-plane copp-system-policy
 class copp-http
  police pps 100
!
```

## NX-API Management Commands

You can enable and manage NX-API with the CLI commands listed in the following table.

**Table 1: NX-API Management Commands**

NX-API Management Command	Description
<code>feature nxapi</code>	Enables NX-API.
<code>no feature nxapi</code>	Disables NX-API.
<code>nxapi {http   https} port port</code>	Specifies a port.
<code>no nxapi {http   https}</code>	Disables HTTP/HTTPS.
<code>show nxapi</code>	Displays port information.

NX-API Management Command	Description
<b>nxapi certificate {httpsrct certfile   httpskey keyfile} filename</b>	Specifies the upload of the following: <ul style="list-style-type: none"> <li>• HTTPS certificate when httpsrct is specified.</li> <li>• HTTPS key when httpskey is specified.</li> </ul> Example of HTTPS certificate: <b>nxapi certificate httpsrct certfile bootflash:cert.crt</b> Example of HTTPS key: <b>nxapi certificate httpskey keyfile bootflash:privkey.key</b>
<b>nxapi certificate enable</b>	Enables a certificate.

Following is an example of a successful upload of an HTTPS certificate:

```
switch(config)# nxapi certificate httpsrct certfile certificate.crt
Upload done. Please enable. Note cert and key must match.
switch(config)# nxapi certificate enable
switch(config)#
```

Following is an example of a successful upload of an HTTPS key:

```
switch(config)# nxapi certificate httpskey keyfile bootflash:privkey.key
Upload done. Please enable. Note cert and key must match.
switch(config)# nxapi certificate enable
switch(config)#
```

In some situations, you might get an error message saying that the certificate is invalid:

```
switch(config)# nxapi certificate httpskey keyfile bootflash:privkey.key
Upload done. Please enable. Note cert and key must match.
switch(config)# nxapi certificate enable
Nginx certificate invalid.
switch(config)#
```

This might occur if the key file is encrypted. In that case, the key file must be decrypted before you can install it. You might have to go into Guest Shell to decrypt the key file, as shown in the following example:

```
switch(config)# guestshell
[b3456@guestshell ~]$
[b3456@guestshell bootflash]$ /bin/openssl rsa -in certfilename.net.pem -out clearkey.pem

Enter pass phrase for certfilename.net.pem:
writing RSA key
[b3456@guestshell bootflash]$
[b3456@guestshell bootflash]$ exit
switch(config)#
```

If this was the reason for the issue, you should now be able to successfully install the certificate:

```
switch(config)# nxapi certificate httpskey keyfile bootflash:privkey.key
Upload done. Please enable. Note cert and key must match.
switch(config)# nxapi certificate enable
switch(config)#
```

## Working With Interactive Commands Using NX-API

To disable confirmation prompts on interactive commands and avoid timing out with an error code 500, prepend interactive commands with **terminal dont-ask**. Use **;** to separate multiple interactive commands, where each **;** is surrounded with single blank characters.

Following are several examples of interactive commands where **terminal dont-ask** is used to avoid timing out with an error code 500:

```
terminal dont-ask ; reload module 21
terminal dont-ask ; system mode maintenance
```

## NX-API Request Elements

## NX-API Response Elements

The NX-API elements that respond to a CLI command are listed in the following table:

**Table 2: NX-API Response Elements**

NX-API Response Element	Description
version	NX-API version.
type	Type of command to be executed.
sid	Session ID of the response. This element is valid only when the response message is chunked.
outputs	Tag that encloses all command outputs. When multiple commands are in <code>cli_show</code> or <code>cli_show_ascii</code> , each command output is enclosed by a single output tag. When the message type is <code>cli_conf</code> or <code>bash</code> , there is a single output tag for all the commands because <code>cli_conf</code> and <code>bash</code> commands require context.
output	Tag that encloses the output of a single command output. For <code>cli_conf</code> and <code>bash</code> message types, this element contains the outputs of all the commands.
input	Tag that encloses a single command that was specified in the request. This element helps associate a request input element with the appropriate response output element.
body	Body of the command response.
code	Error code returned from the command execution. NX-API uses standard HTTP error codes as described by the Hypertext Transfer Protocol (HTTP) Status Code Registry ( <a href="http://www.iana.org/assignments/http-status-codes/http-status-codes.xhtml">http://www.iana.org/assignments/http-status-codes/http-status-codes.xhtml</a> ).

NX-API Response Element	Description
msg	Error message associated with the returned error code.

## About JSON (JavaScript Object Notation)

JSON is a light-weight text-based open standard designed for human-readable data and is an alternative to XML. JSON was originally designed from JavaScript, but it is language-independent data format. The JSON/CLI Execution is currently supported in Cisco Nexus 3500 platform switches.



**Note** The NX-API/JSON functionality is now available on the Cisco Nexus 3500 platform switches.

The two primary Data Structures that are supported in some way by nearly all modern programming languages are as follows:

- Ordered List :: Array
- Unordered List (Name/Value pair) :: Objects

JSON/JSON-RPC/XML output for a show command can also be accessed via sandbox.

## CLI Execution

### Show\_Command | json

#### Example Code

```
BLR-VXLAN-NPT-CR-179# show cdp neighbors | json
{"TABLE_cdp_neighbor_brief_info": {"ROW_cdp_neighbor_brief_info": [{"ifindex": "83886080", "device_id": "SW-SPARSHA-SAVBU-F10", "intf_id": "mgmt0", "ttl": "148", "capability": ["switch", "IGMP_cnd_filtering"], "platform_id": "cisco WS-C2960 S-48TS-L", "port_id": "GigabitEthernet1/0/24"}, {"ifindex": "436207616", "device_id": "BLR-VXLAN-NPT-CR-178 (FOC1745R01W)", "intf_id": "Ethernet1/1", "ttl": "166", "capability": ["router", "switch", "IGMP_cnd_filtering", "Supports-STP-Dispute"], "platform_id": "N3K-C3132Q-40G", "port_id": "Ethernet1/1"}]}}
```

## XML and JSON Supported Commands

The NX-OS supports redirecting the standard output of various **show** commands in the following structured output formats:

- XML
- JSON
- JSON Pretty, which makes the standard block of JSON-formatted output easier to read

Converting the standard NX-OS output to JSON, JSON Pretty, or XML format occurs on the NX-OS CLI by "piping" the output to a JSON or XML interpreter. For example, you can issue the **show ip access** command with the logical pipe (|) and specify JSON, JSON Pretty, or XML, and the NX-OS command output will be properly structured and encoded in that format. This feature enables programmatic parsing of the data and

supports streaming data from the switch through software streaming telemetry. Most commands in Cisco NX-OS support JSON, JSON Pretty, and XML output.

Selected examples of this feature follow.

## Examples of XML and JSON Output

This example shows how to display the unicast and multicast routing entries in hardware tables in JSON format:

```
switch(config)# show hardware profile status | json
{"total_lpm": ["8191", "1024"], "total_host": "8192", "max_host4_limit": "4096",
 "max_host6_limit": "2048", "max_mcast_limit": "2048", "used_lpm_total": "9", "u
sed_v4_lpm": "6", "used_v6_lpm": "3", "used_v6_lpm_128": "1", "used_host_lpm_tot
al": "0", "used_host_v4_lpm": "0", "used_host_v6_lpm": "0", "used_mcast": "0", "
used_mcast_oifl": "2", "used_host_in_host_total": "13", "used_host4_in_host": "1
2", "used_host6_in_host": "1", "max_ecmp_table_limit": "64", "used_ecmp_table":
"0", "mfib_fd_status": "Disabled", "mfib_fd_maxroute": "0", "mfib_fd_count": "0"
}
switch(config)#
```

This example shows how to display the unicast and multicast routing entries in hardware tables in XML format:

```
switch(config)# show hardware profile status | xml
<?xml version="1.0" encoding="ISO-8859-1"?>
<nf:rpc-reply xmlns:nf="urn:ietf:params:xml:ns:netconf:base:1.0" xmlns="http://w
ww.cisco.com/nxos:1.0:fib">
  <nf:data>
    <show>
      <hardware>
        <profile>
          <status>
            <_XML_OPT_Cmd_dynamic_tcam_status>
              <_XML_OPT_Cmd_dynamic_tcam_status__readonly__>
                <_readonly__>
                  <total_lpm>8191</total_lpm>
                  <total_host>8192</total_host>
                  <total_lpm>1024</total_lpm>
                  <max_host4_limit>4096</max_host4_limit>
                  <max_host6_limit>2048</max_host6_limit>
                  <max_mcast_limit>2048</max_mcast_limit>
                  <used_lpm_total>9</used_lpm_total>
                  <used_v4_lpm>6</used_v4_lpm>
                  <used_v6_lpm>3</used_v6_lpm>
                  <used_v6_lpm_128>1</used_v6_lpm_128>
                  <used_host_lpm_total>0</used_host_lpm_total>
                  <used_host_v4_lpm>0</used_host_v4_lpm>
                  <used_host_v6_lpm>0</used_host_v6_lpm>
                  <used_mcast>0</used_mcast>
                  <used_mcast_oifl>2</used_mcast_oifl>
                  <used_host_in_host_total>13</used_host_in_host_total>
                  <used_host4_in_host>12</used_host4_in_host>
                  <used_host6_in_host>1</used_host6_in_host>
                  <max_ecmp_table_limit>64</max_ecmp_table_limit>
                  <used_ecmp_table>0</used_ecmp_table>
                  <mfib_fd_status>Disabled</mfib_fd_status>
                  <mfib_fd_maxroute>0</mfib_fd_maxroute>
                  <mfib_fd_count>0</mfib_fd_count>
```



```

        </__readonly__>
    </__XML__OPT_Cmd_dynamic_tcam_status__readonly__>
</__XML__OPT_Cmd_dynamic_tcam_status>
</status>
</profile>
</hardware>
</show>
</nf:data>
</nf:rpc-reply>
]]>]]>
switch(config)#

```

This example shows how to display LLDP timers configured on the switch in JSON format:

```

switch(config)# show lldp timers | json
{"ttl": "120", "reinit": "2", "tx_interval": "30", "tx_delay": "2", "hold_mplier": "4", "notification_interval": "5"}
switch(config)#

```

This example shows how to display LLDP timers configured on the switch in XML format:

```

switch(config)# show lldp timers | xml
<?xml version="1.0" encoding="ISO-8859-1"?>
<nf:rpc-reply xmlns:nf="urn:ietf:params:xml:ns:netconf:base:1.0" xmlns="http://www.cisco.com/nxos:1.0:lldp">
  <nf:data>
    <show>
      <lldp>
        <timers>
          <__XML__OPT_Cmd_lldp_show_timers__readonly__>
            <__readonly__>
              <ttl>120</ttl>
              <reinit>2</reinit>
              <tx_interval>30</tx_interval>
              <tx_delay>2</tx_delay>
              <hold_mplier>4</hold_mplier>
              <notification_interval>5</notification_interval>
            </__readonly__>
          </__XML__OPT_Cmd_lldp_show_timers__readonly__>
        </timers>
      </lldp>
    </show>
  </nf:data>
</nf:rpc-reply>
]]>]]>
switch(config)#

```

