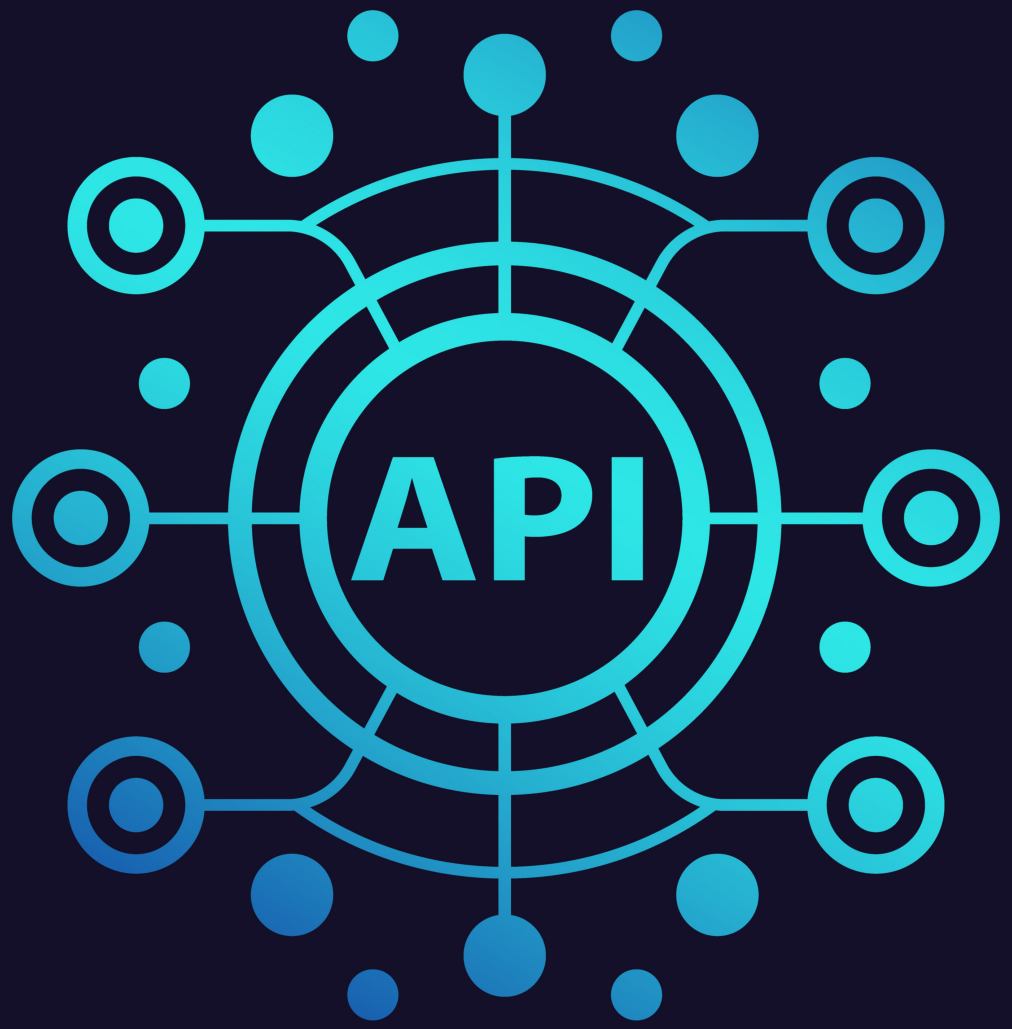

REST

Representational State Transfer

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APIs are everywhere

- We use APIs all the time

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REST

- Client–server
  - By separating the user interface concerns from the data storage concerns, we improve the portability of the user interface across multiple platforms and improve scalability by simplifying the server components.
- Stateless
  - Each request from client to server must contain all of the information necessary to understand the request, and cannot take advantage of any stored context on the server.
  - Session state is therefore kept entirely on the client.
- Cacheable
  - Cache constraints require that the data within a response to a request be implicitly or explicitly labeled as cacheable or non-cacheable. If a response is cacheable, then a client cache is given the right to reuse that response data for later, equivalent requests

- Source: https://restfulapi.net/

CRUD

- Four actions performed by an application:
  - Create: Allows the client to create some new instances of variables and data structures at the server and initialize their values as kept at the server
  - Read: Allows the client to retrieve (read) the current value of variables that exist at the server, storing a copy of the variables, structures, and values at the client
  - Update: Allows the client to change (update) the value of variables that exist at the server
  - Delete: Allows the client to delete from the server different instances of data variables

CRUD and HTTP Verbs

REST (HTTP) Verb	CRUD Term	Action
POST	CREATE (CRUD)	Create new data structures and variables
GET	READ (CRUD)	Read (Retrieve) variable names, structures and values
PATCH, PUT	UPDATE (CRUD)	Update or replace values of some variable
DELETE	DELETE (CRUD)	Delete some variables and data structures

DNA Center

- DevNet DNA Center Always on Lab
  - https://sandboxdnac.cisco.com
  - User: devnetuser
  - Password: Cisco123!
- API documentation:
  - https://developer.cisco.com/docs/dna-center/api/1-3-3-x/?version=1.2.x
- DNA Center hello word documentation
  - https://developer.cisco.com/docs/dna-center/#!hello-world/device-inventory-example

DNA Center Inventory

CISCO DNA CENTER

Inventory

Filter

Device Name	IP Address	Reachability Status	Uptime	Last Updated	Resync Interval	Last Sync Status
cat_9k_1.abc.inc	10.10.22.66	Reachable	117 days 20 hrs 17 mins	27 minutes ago	00:25:00	In Progress
cat_9k_2.abc.inc	10.10.22.70	Reachable	117 days 20 hrs 38 mins	8 minutes ago	00:25:00	Managed
cs3850.abc.inc	10.10.22.73	Reachable	117 days 20 hrs 54 mins	22 minutes ago	00:25:00	Managed
asr1001-x.abc.inc	10.10.22.253	Reachable	28 days 10 hrs 04 mins	7 minutes ago	00:25:00	Managed

Show 10 entries

Showing 1 - 4 of 4

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DNA Center API

Intent API 1.3.3.x

Antman-swagger-v1.annotated.json

Cisco DNA Center Platform v. 1.3.3.x

Filter by tag

Authentication Access Token Request

POST	/dna/system/api/v1/auth/token	Authentication API

Sites Create sites, assign devices to them and get site health

Topology Get topology details and overall network health

Devices Manage network devices

GET	/dna/intent/api/v1/network-device/module/{id}	Get Module Info by Id
GET	/dna/intent/api/v1/network-device/{id}/vlan	Get Device Interface VLANs
GET	/dna/intent/api/v1/interface/network-device/{deviceId}/{startIndex}/{recordsToReturn}	Get Device Interfaces by specified range
GET	/dna/intent/api/v1/network-device	Get Device list
POST	/dna/intent/api/v1/network-device	Add Device

REST (Uniform Resource Identifiers) URI

- URI
  - https://sandboxdnac.cisco.com/dna/intent/api/v1/network-device?type=Cisco ASR 1001-X Router
  - Protocol = https
  - Server / Host URL = sandboxdnac.cisco.com
  - Resource = /dna/intent/api/v1/network-device
  - Parameters = ?type=Cisco ASR 1001-X Router

Postman

postman.com

POSTMAN

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10 million
Developers

500,000
Companies

250 million
APIs

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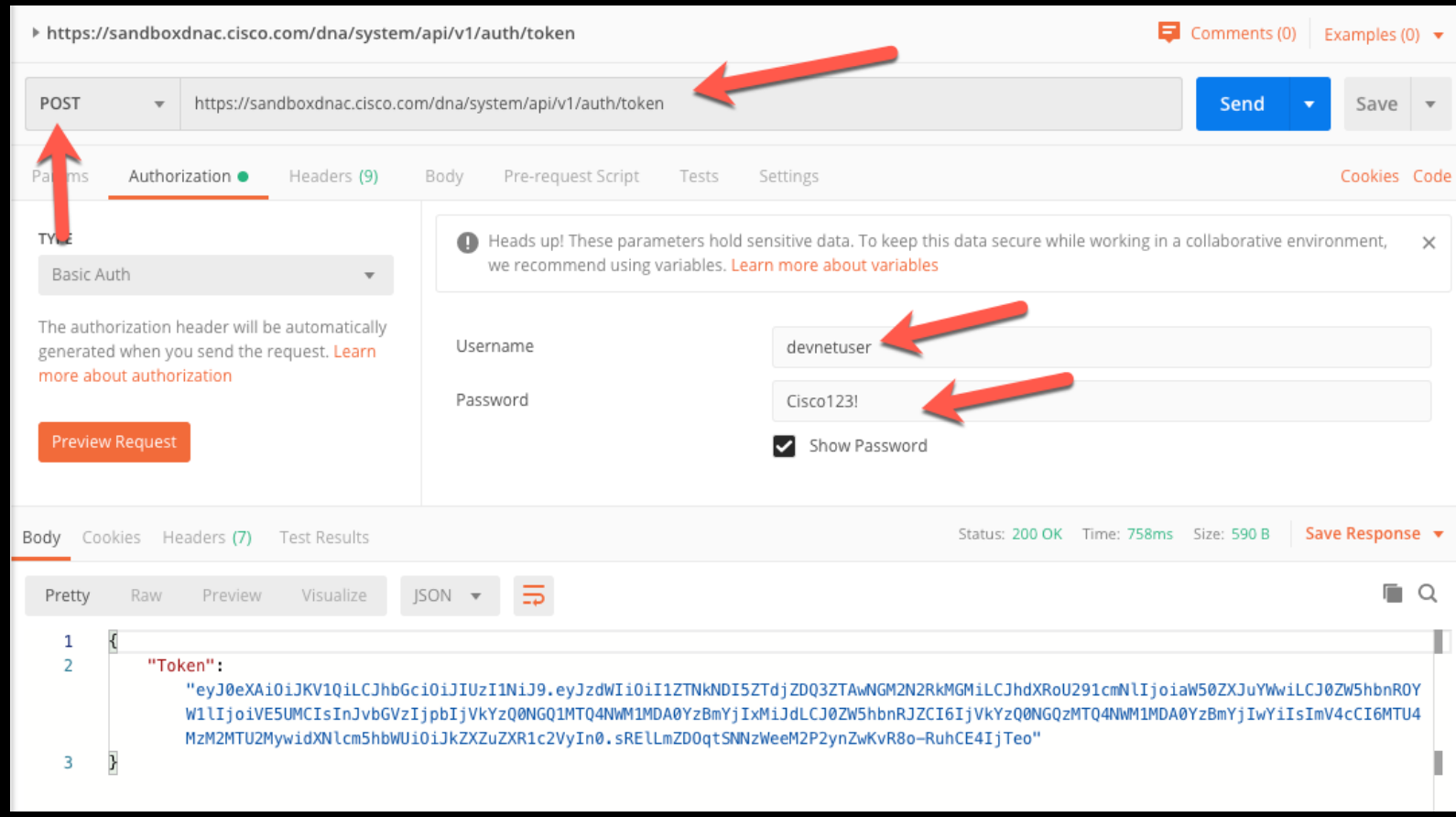
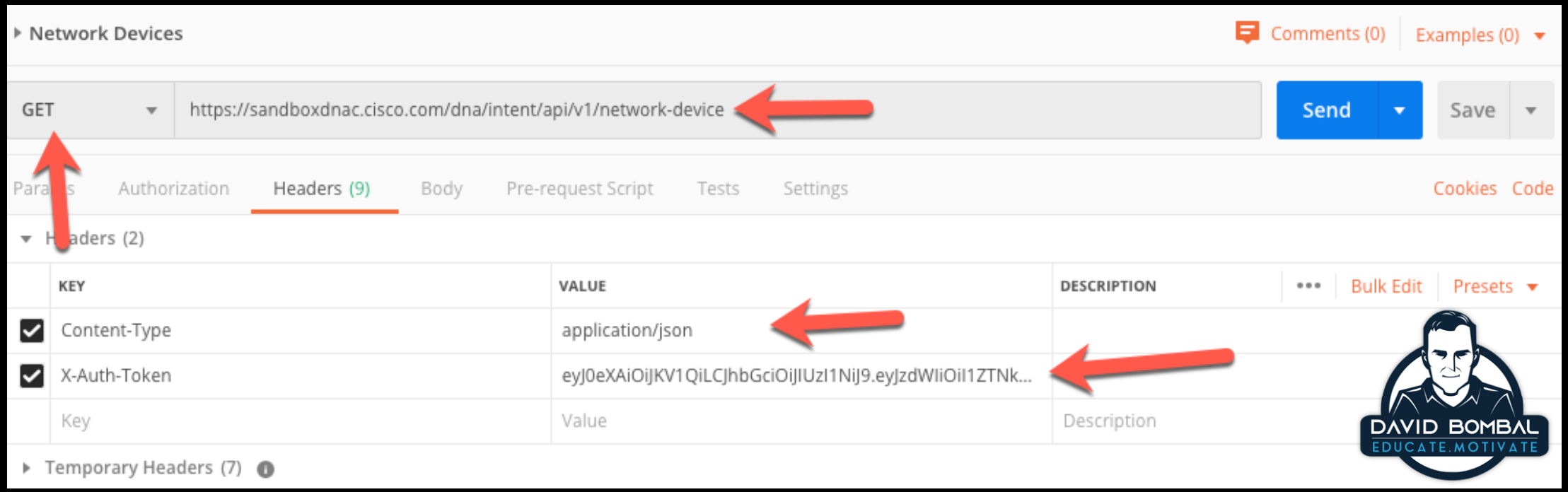
You need a token

- Authorization is required
  - URL: https://sandboxdnac.cisco.com/dna/system/api/v1/auth/token
  - Username: devnetuser
  - Password: Cisco123!
  - Use POST
- Copy the Token you get back



How to get information

- URL: https://sandboxdnac.cisco.com/dna/intent/api/v1/network-device
- Headers
  - Content-Type: application/json
  - X-Auth-Token: <paste in your token>
  - Use GET



Result:

- Get a list of devices

GET https://sandboxdnac.cisco.com/dna/intent/api/v1/network-device Send Save

Authorization Headers (10) Body Pre-request Script Tests Settings Cookies Code

Headers (2)

KEY	VALUE	DESCRIPTION
Content-Type	application/json	
X-Auth-Token	eyJ0eXAiOiJKV1QiLCJhbGciOiJIUzI1NiJ9.eyJzdWIiOiI1ZTNkNDI5ZTdj...	
Key	Value	Description

Bulk Edit Presets

Temporary Headers (8)

Body Cookies Headers (9) Test Results Status: 200 OK Time: 361ms Size: 5.45 KB Save Response

Pretty Raw Preview Visualize JSON


```
{
    "response": [
        {
            "type": "Cisco ASR 1001-X Router",
            "collectionInterval": "Global Default",
            "errorCode": null,
            "family": "Routers",
            "softwareType": "IOS-XE",
```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Status Code 200: OK

- Life is good

Get Router-type ASR 1001-X

Comments (0) Examples (0)

GET https://sandboxdnac.cisco.com/dna/intent/api/v1/network-device?type=Cisco ASR 1001-X Router Send Save

Params Authorization Headers (9) Body Pre-request Script Tests Settings Cookies Code

Query Params

KEY	VALUE	DESCRIPTION
type	Cisco ASR 1001-X Router	
Key	Value	Description

Body Cookies Headers (9) Test Results Status: 200 OK Time: 172ms Size: 1.85 KB Save Response

Pretty Raw Preview Visualize JSON


```
{
    "response": [
        {
            "type": "Cisco ASR 1001-X Router",
            "collectionInterval": "Global Default",
            "errorCode": null,
            "family": "Routers",
            "softwareType": "IOS-XE",
            "location": null,
            "macAddress": "00:c8:8b:80:bb:00",
            "role": "BORDER ROUTER",
            "upTime": "28 days, 9:13:45.91",
            "snmpLocation": "",
            "tunnelUdpPort": null,
            "waasDeviceMode": null,
            "hostname": "asr1001-x.abc.inc",
```


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401 Error Code: Unauthorized

- Token not used

Unauthorized

Comments (0) Examples (0)

GET https://sandboxdnac.cisco.com/dna/intent/api/v1/network-device Send Save

Params Authorization Headers (7) Body Pre-request Script Tests Settings Cookies Code

Query Params

KEY	VALUE	DESCRIPTION
Key	Value	Description

Bulk Edit

Body Cookies Headers (7) Test Results Status: 401 Unauthorized Time: 292ms Size: 289 B Save Response

Pretty Raw Preview Visualize JSON

```
1 {
2     "message": "Unauthorized"
3 }
```

400 Error Code: Bad Request

- network-device123 is not found

Code 400: Bad Request

Comments (0) Examples (0)

Add a description

GET https://sandboxdnac.cisco.com/dna/intent/api/v1/network-device123?type=Cisco ASR 1001-X Router Send Save

Params Authorization Headers (9) Body Pre-request Script Tests Settings Cookies Code

Query Params

KEY	VALUE	DESCRIPTION
type	Cisco ASR 1001-X Router	
Key	Value	Description

Bulk Edit

Body Cookies Headers (8) Test Results Status: 400 Bad Request Time: 88ms Size: 498 B Save Response

Pretty Raw Preview Visualize JSON

```
{
    "response": {
        "errorCode": "Bad request",
        "message": "Invalid input request",
        "detail": "123 is not a valid UUID of device"
    },
    "version": "1.0"
}
```

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Oops, you've found a broken bridge

404 - Page not found.

Code 404 Error: Not found

- Resource not found

Code 404: Not Found

Comments (0) Examples (0)

GET https://sandboxdnac.cisco.com/dna/intent/api/v1/networkdevice?softwaretype=IOS-XE Send Save

Params Authorization Headers (9) Body Pre-request Script Tests Settings Cookies Code

Query Params

KEY	VALUE	DESCRIPTION
softwaretype	IOS-XE	
Key	Value	Description

Bulk Edit

Body Cookies Headers (7) Test Results Status: 404 Not Found Time: 81ms Size: 314 B Save Response

Pretty Raw Preview Visualize Text

```
1 {
2   "error" : "__technicalName,networkdevice is not found."
3 }
```

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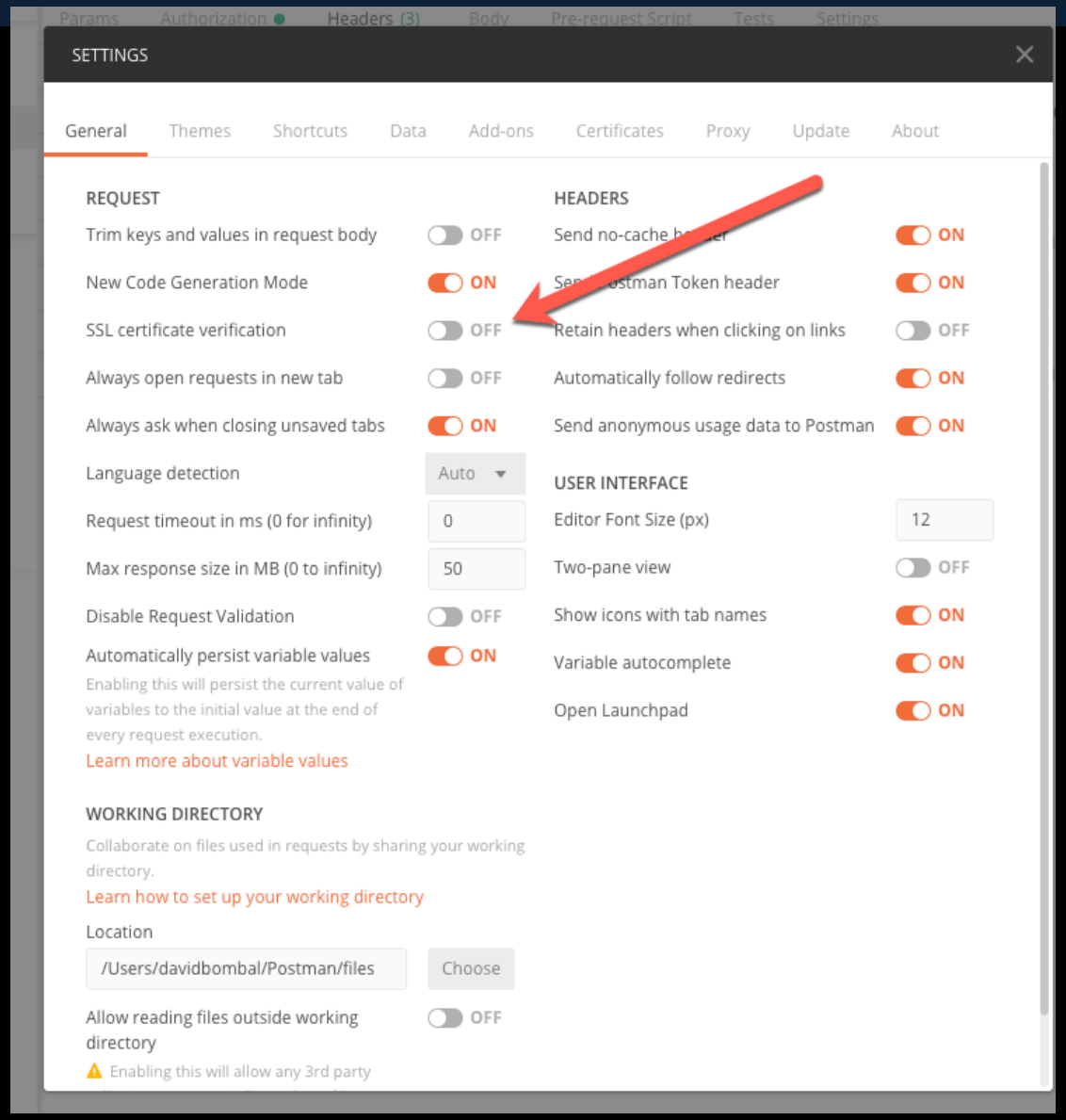
IOS XE

- Use the DevNet IOS XE always on sandbox
  - DNS name: ios-xe-mgmt.cisco.com
  - Protocol: HTTPS
  - Port: 9443
  - Username: developer
  - Password: C1sco12345
- Application:
  - Use Postman
    - Free download from https://www.postman.com

Turn of certificate verification



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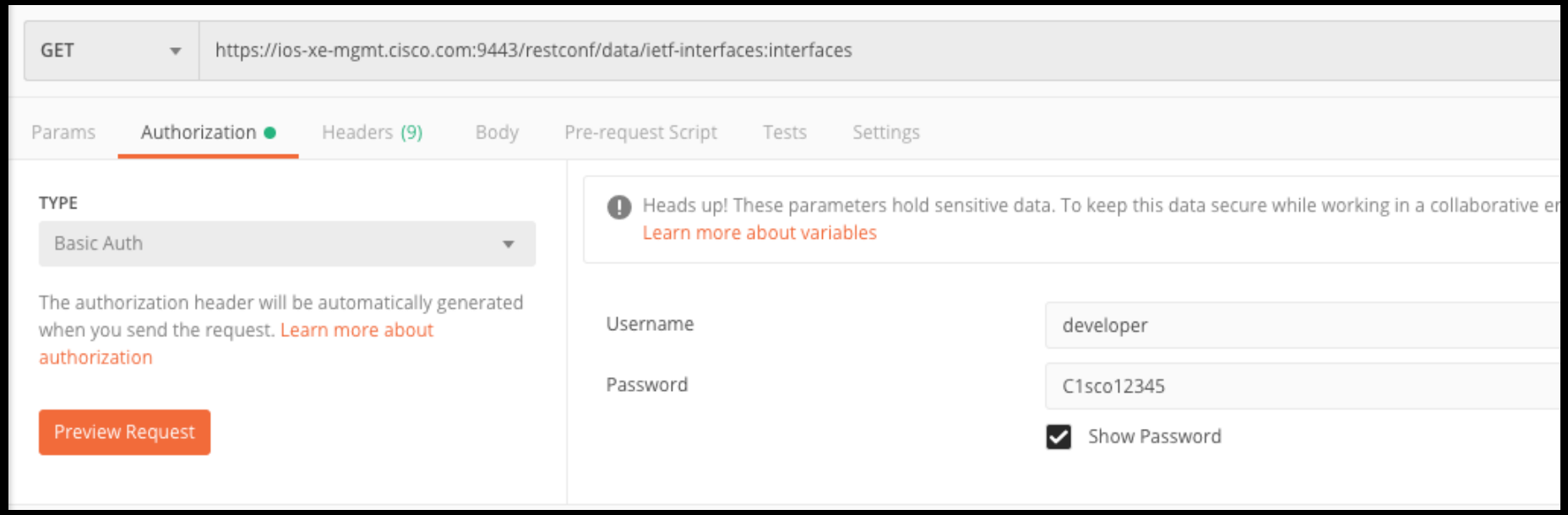
Get interfaces Part 1

- Use the DevNet IOS XE always on sandbox
  - URL: https://ios-xe-mgmt.cisco.com:9443/restconf/data/ietf-interfaces:interfaces
  - Method: GET
  - Username: developer
  - Password: C1sco12345



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Get interfaces Part 2

- Add a header
  - Key 1:
    - Accept
    - application/yang-data+json

Get interfaces Part 3

Body Cookies Headers (7) Test Results

Pretty Raw Preview Visualize JSON


```
{
  "ietf-interfaces:interfaces": {
    "interface": [
      {
        "name": "GigabitEthernet1",
        "description": "MANAGEMENT INTERFACE - DON'T TOUCH ME",
        "type": "iana-if-type:ethernetCsmacd",
        "enabled": true,
        "ietf-ip:ipv4": {
          "address": [
            {
              "ip": "10.10.20.48",
              "netmask": "255.255.255.0"
            }
          ]
        },
        "ietf-ip:ipv6": {}
      },
      {
        "name": "GigabitEthernet2",
        "description": "Network Interface",
        "type": "iana-if-type:ethernetCsmacd",
        "enabled": false,
        "ietf-ip:ipv4": {},
        "ietf-ip:ipv6": {}
      },
      {
        "name": "GigabitEthernet3",
        "description": "Network Interface",
        "type": "iana-if-type:ethernetCsmacd",
        "enabled": false,
        "ietf-ip:ipv4": {},
        "ietf-ip:ipv6": {}
      }
    ]
  }
}
```


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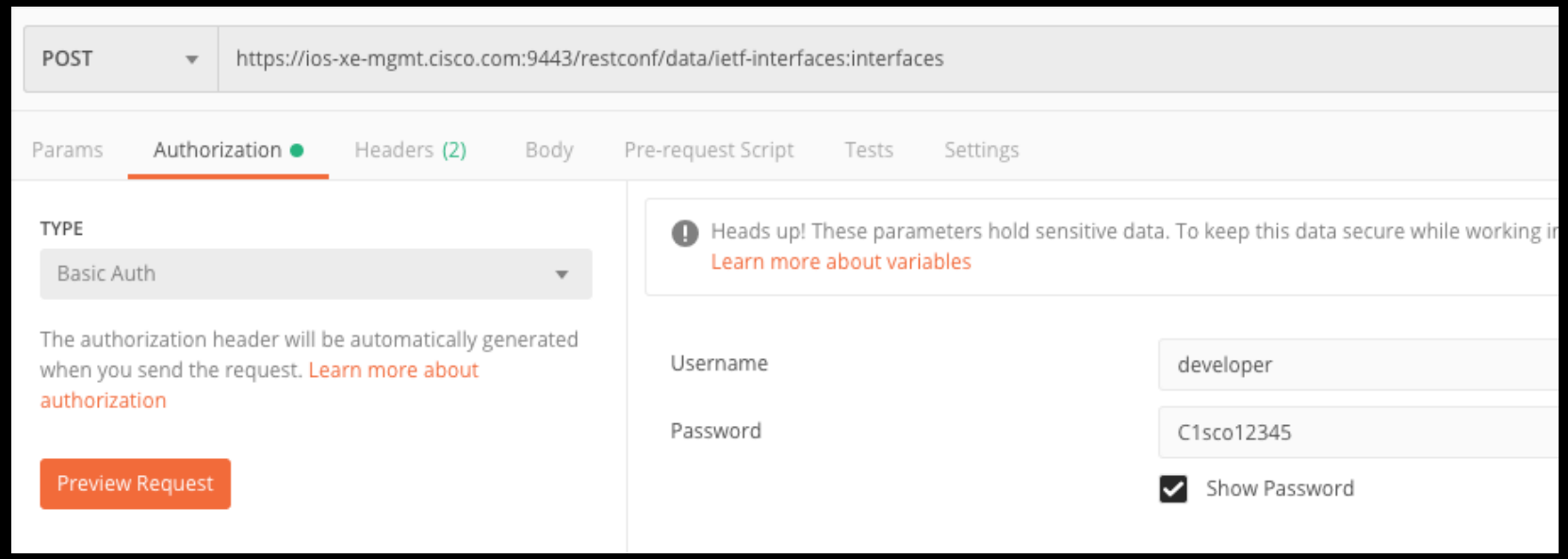
Add an interface Part 1

- Use the DevNet IOS XE always on sandbox
  - URL: https://ios-xe-mgmt.cisco.com:9443/restconf/data/ietf-interfaces:interfaces
  - Method: POST
  - Username: developer
  - Password: C1sco12345



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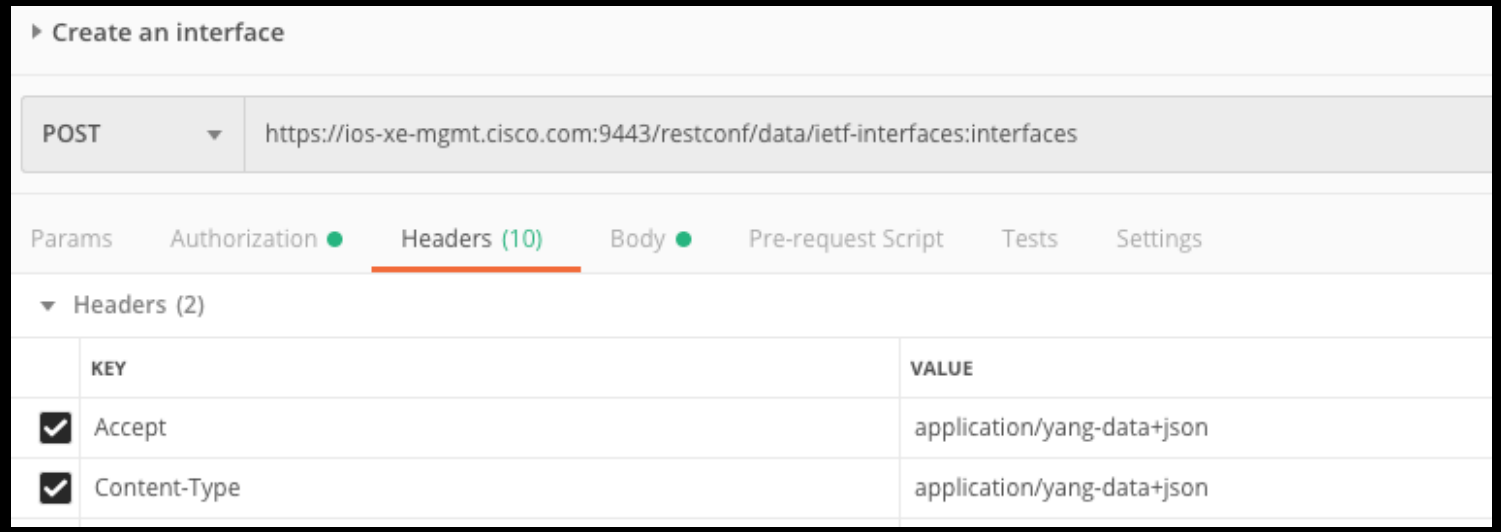
Add Interface Part 2

- Add a header
  - Key 1:
    - Accept
    - application/yang-data+json
  - Key 2:
    - Content-Type
    - Application/yang-data+json



Add Interface Part 3

- Body:

```
{
    "ietf-interfaces:interface": {
        "name": "Loopback1234",
        "description": "Added with RESTCONF",
        "type": "iana-if-type:softwareLoopback",
        "enabled": true,
        "ietf-ip:ipv4": {
            "address": [
                {
                    "ip": "1.2.3.4",
                    "netmask": "255.255.255.255"
                }
            ]
        }
    }
}
```

POST https://ios-xe-mgmt.cisco.com:9443/restconf/data/ietf-interfaces:interfaces

Params | Authorization | Headers (2) | Body | Pre-request Script | Tests | Settings

none | form-data | x-www-form-urlencoded | raw | binary | GraphQL | JSON


```
{
    "ietf-interfaces:interface": {
        "name": "Loopback1234",
        "description": "Added with RESTCONF",
        "type": "iana-if-type:softwareLoopback",
        "enabled": true,
        "ietf-ip:ipv4": {
            "address": [
                {
                    "ip": "1.2.3.4",
                    "netmask": "255.255.255.255"
                }
            ]
        }
    }
}
```

Add Interface Part 4

- 201 Status means success

POST https://ios-xe-mgmt.cisco.com:9443/restconf/data/ietf-interfaces:interfaces

Params | Authorization | Headers (10) | Body | Pre-request Script | Tests | Settings

none | form-data | x-www-form-urlencoded | raw | binary | GraphQL | JSON

```
{
    "ietf-interfaces:interface": {
        "name": "Loopback1234",
        "description": "Added with RESTCONF",
        "type": "iana-if-type:softwareLoopback",
        "enabled": true,
        "ietf-ip:ipv4": {
            "address": [
                {
                    "ip": "1.2.3.4",
                    "netmask": "255.255.255.255"
                }
            ]
        }
    }
}
```

Body | Cookies | Headers (10) | Test Results

Status: 201 Created Time: 390ms Size

Pretty | Raw | Preview | Visualize | HTML

Add Interface Part 5

- Use GET to check that interface has been created

GET https://ios-xe-mgmt.cisco.com:9443/restconf/data/ietf-interfaces:interfaces

Pretty Raw Preview Visualize JSON


```
36          "name": "GigabitEthernet3",
37          "description": "Network Interface",
38          "type": "iana-if-type:ethernetCsmacd",
39          "enabled": false,
40          "ietf-ip:ipv4": {},
41          "ietf-ip:ipv6": {}
42        },
43        {
44          "name": "Loopback1234",
45          "description": "Added with RESTCONF",
46          "type": "iana-if-type:softwareLoopback",
47          "enabled": true,
48          "ietf-ip:ipv4": {
49            "address": [
50              {
51                "ip": "1.2.3.4",
52                "netmask": "255.255.255.255"
53              }
54            ]
55          },
56          "ietf-ip:ipv6": {}
57        }
58      ]
59    }
```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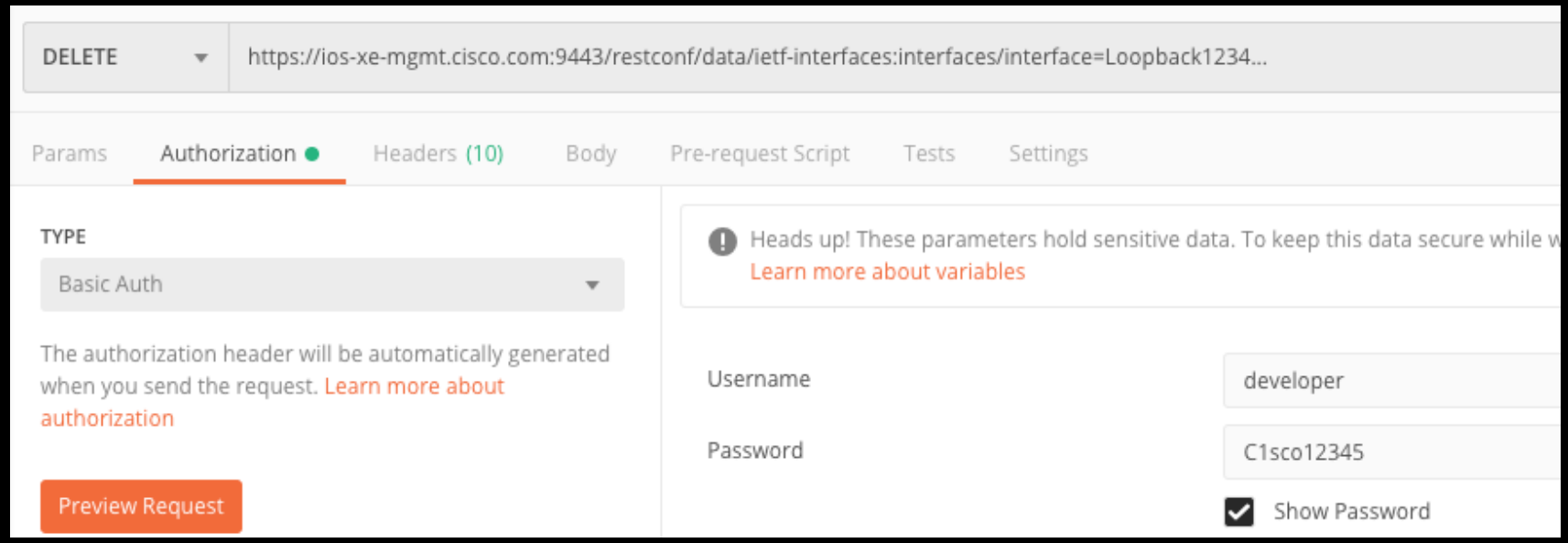
Delete an Interface Part 1

- Use the DevNet IOS XE always on sandbox
  - URL: https://ios-xe-mgmt.cisco.com:9443/restconf/data/ietf-interfaces:interfaces/interface=Loopback1234
    - Replace Interface name with correct name.
  - Method: DELETE
  - Username: developer
  - Password: C1sco12345



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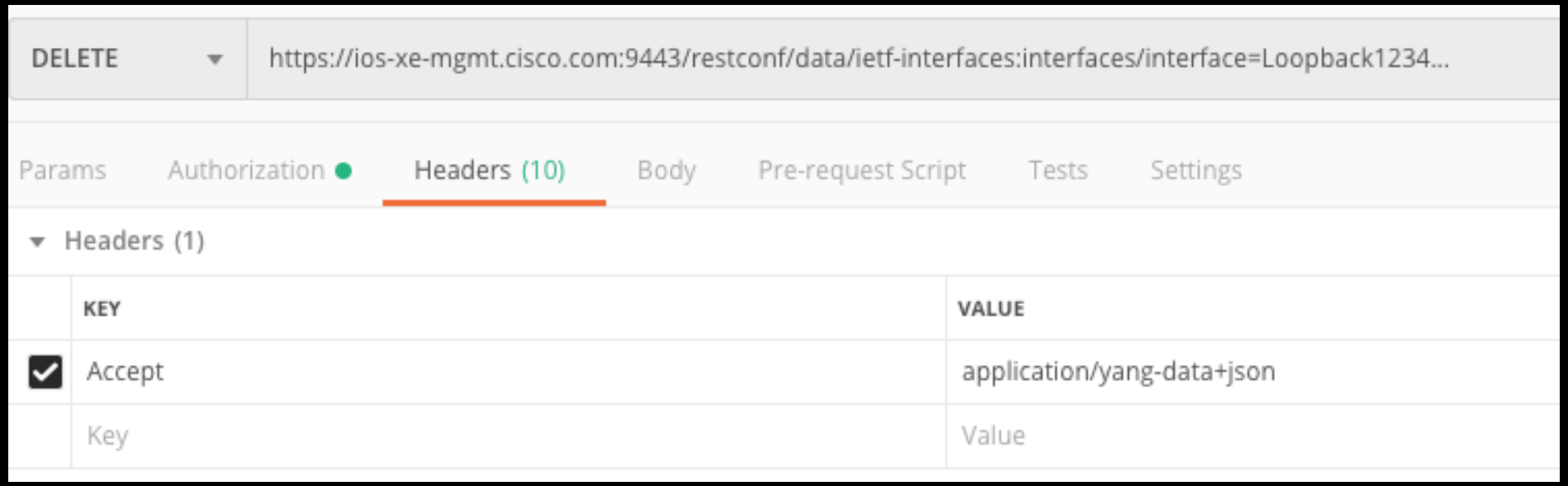
Delete and Interface Part 2

- Add a header
  - Key 1:
    - Accept
    - application/yang-data+json



Delete and Interface Part 3

- Result:
  - Run the get interface command to check that interface has been removed

GET https://ios-xe-mgmt.cisco.com:9443/restconf/data/ietf-interfaces:interfaces

Params | Authorization | Headers (8) | Body | Pre-request Script | Tests | Settings

Headers (1)

	KEY	VALUE
☑	Accept	application/yang-data+json
	Key	Value

Python: Get Interfaces

```
import requests
import sys

# Allow self signed certs
requests.packages.urllib3.disable_warnings()

# Credentials
USER = 'developer'
PASS = 'C1sco12345'
```

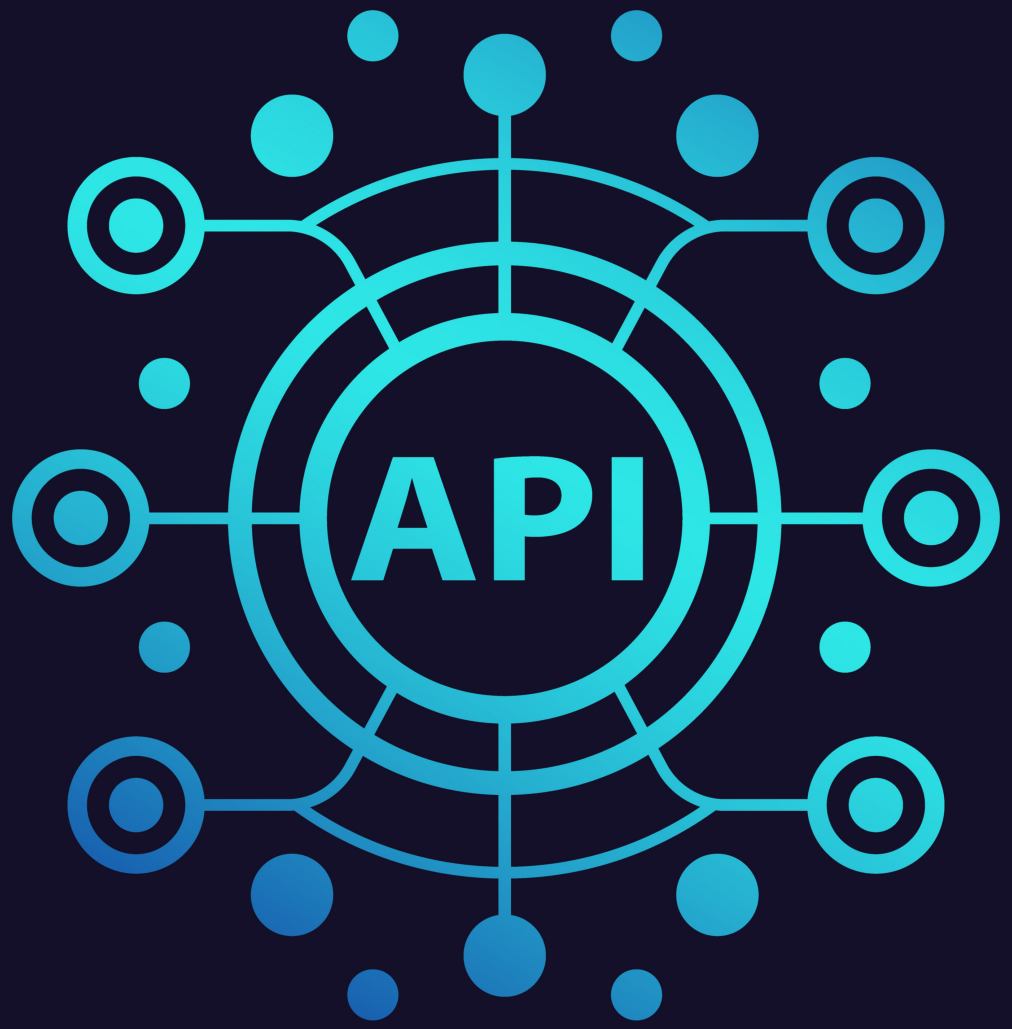
Python: Get Interfaces

```
# URL for GET request
url = "https://ios-xe-mgmt.cisco.com:9443/restconf/data/ietf-
interfaces:interfaces"

# Set yang+json as the data formats
headers = {'Content-Type': 'application/yang-data+json',
           'Accept': 'application/yang-data+json'}

# Run GET
response = requests.get(url, auth=(USER, PASS),
                        headers=headers, verify=False)

print(response.text)
```

Good DevNet labs

- Go here for more:
- https://developer.cisco.com/learning/tracks/iosxe-programmability/intro-device-level-interfaces/intro-restconf/step/1

- https://devnetsandbox.cisco.com/RM/Diagram/Index/27d9747a-db48-4565-8d44-df318fce37ad?diagramType=Topology



REST

Representational State Transfer

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