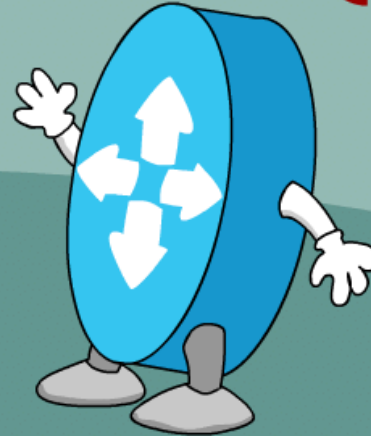




NETDEVOPS {LIVE!}



DEVNET

Building Apps with Cisco DNA Center Platform

Adam Radford

Distinguished Systems Engineer

@adamradford123

Season 2, Talk 9

<https://developer.cisco.com/netdevops/live>

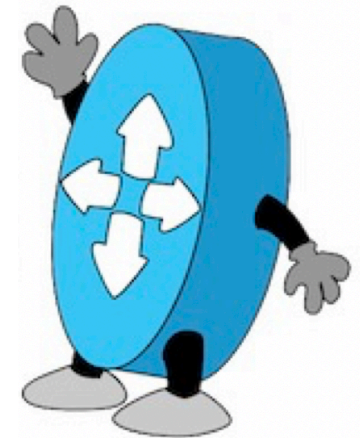


<http://cs.co/ndl>

Help us track NetDevOps Live Interest!

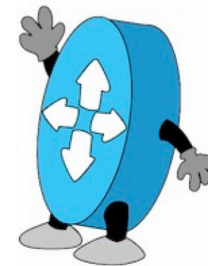
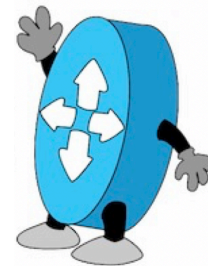
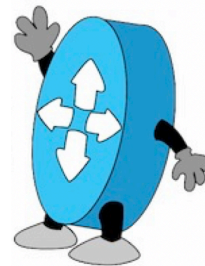
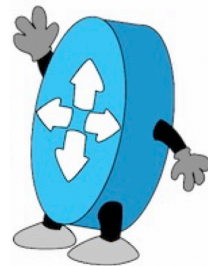
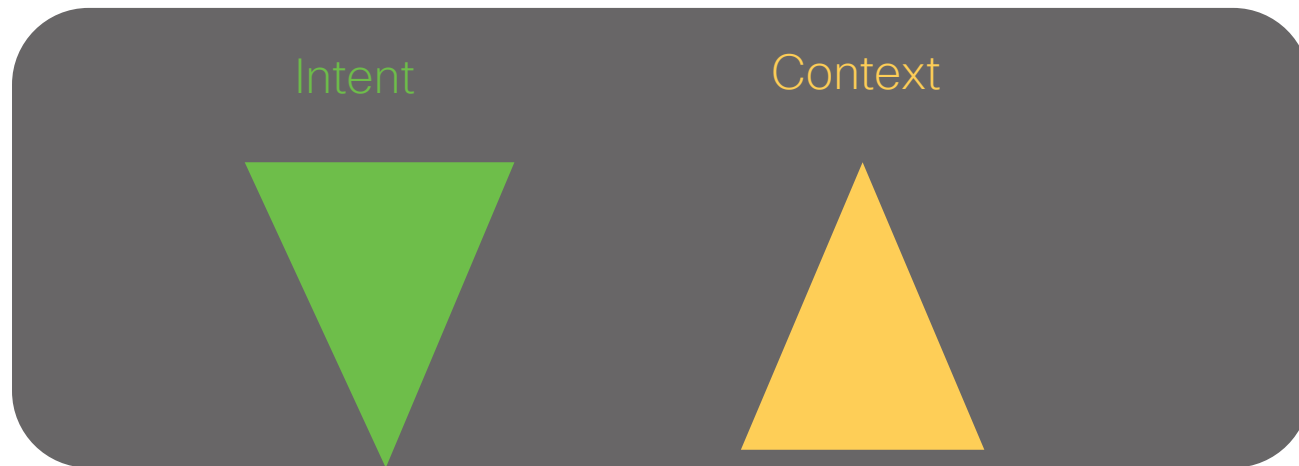
What are we going to talk about?

- What is Cisco DNA Center Platform?
- How to get started
- Types of applications
- Next Steps

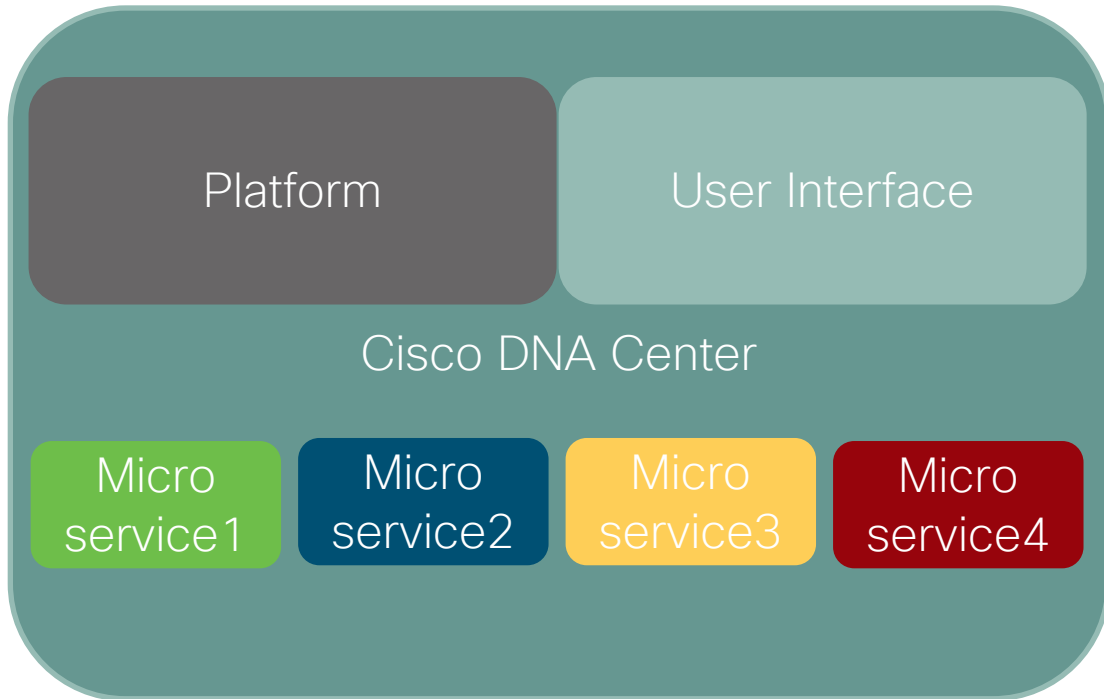


Cisco DNA Center

Cisco
DNA Center



What is "Platform"



- Platform provides an abstraction of internal API
 - Simplified schema
 - Composite API
- /dna/intent prefix for api
- Rate limiting of endpoints
- E-W integration into ITSM (SNOW), IPAM etc

Getting Started

How to Enable Platform

Step 1: Platform -> manage -> bundles

The screenshot shows the Cisco DNA Center interface. The top navigation bar includes 'DESIGN', 'POLICY', 'PROVISION', 'ASSURANCE', and 'PLATFORM'. The 'PLATFORM' tab is highlighted with a red box. Below the navigation bar, the 'Platform' section is visible, with 'Version 1.0.39 - Released 4/26/2019'. The 'Manage' dropdown menu is open, and the 'Bundles' option is highlighted with a red box. A red box also highlights the 'PLATFORM' tab in the navigation bar.

Step 2: Enable "DNA Center REST API"

The screenshot shows the Cisco DNA Center interface with the 'Bundles' page selected. The top navigation bar includes 'DESIGN', 'POLICY', 'PROVISION', 'ASSURANCE', and 'PLATFORM'. The 'Manage' dropdown menu is open, and the 'Bundles' option is highlighted with a red box. Below the navigation bar, the 'Bundles' section is visible, with 'Version 1.0.39 - Released 4/26/2019'. A table lists the bundles, with the 'DNA Center REST API' bundle highlighted by a red box.

Bundle	Status	Description
B Basic ITSM (ServiceNow) CMDB synchronization Cisco Systems, Inc. v1.0.10 DNAC 1.2.5 + Version Dated Apr 23, 2019	NEW	You can schedule a synchronization or trigger an update between the DNA Center device inventory and your ITSM(ServiceNow) configuration management database(CMDB). These activities integrate DNA Center processes into the IT System Management processes of incident, change and problem management. Note: If your network devices...
D DNA Center REST API Cisco Systems, Inc. v1.0.27 DNAC 1.2.5 + Version Dated Apr 26, 2019	ACTIVE	This bundle contains the REST API supported by Cisco DNA Center. These REST APIs provide a rich set of capabilities, including the ability to discover network devices, query network health and provision network devices.

Try it out...

Platform

Version 1.0.39 - Released 4/26/2019

Overview Manage ▾ **Developer Toolkit ▾** Runtime Dashboard

APIs

APIs

Integration Flows

Data and Reports

Multivendor support

EQ Find

> Know Your Network

> Site Management

> Connectivity

> Operational Tools

ork

APIs can be used to discover details about clients, sites, topology and devices. It also provides programmatic REST APIs to add devices to the network and export device data.

Sites

Method ▲

Name

Description

DELETE

Delete Site

Delete site with area/building/floor by siteId.

...

https://developer.cisco.com/site/dna-center-rest-api/

The screenshot shows the Cisco DevNet website for the Intent API. The page is titled "Intent API" and is for Cisco DNA Center Platform v. 1.2.10 (GA). It lists various API endpoints for the Template Programmer, such as creating, updating, and deleting projects and templates. The left sidebar shows navigation options like "Select API Version" and "Cisco DNA Center Platform v. 1.2.10".

Intent API
Cisco DNA Center Platform v. 1.2.10 (GA)
[Terms of service](#)

Template Programmer : Configure and manage CLI templates Show/Hide | List Operations | Expand Operations

Method	Endpoint	Action
GET	/dna/intent/api/v1/template-programmer/project	Get Projects
POST	/dna/intent/api/v1/template-programmer/project	Create Project
PUT	/dna/intent/api/v1/template-programmer/project	Update Project
GET	/dna/intent/api/v1/template-programmer/template	Gets the templates available
PUT	/dna/intent/api/v1/template-programmer/template	Update Template
DELETE	/dna/intent/api/v1/template-programmer/template/{templateId}	Delete Template
GET	/dna/intent/api/v1/template-programmer/template/{templateId}	Get Template Details
POST	/dna/intent/api/v1/template-programmer/template/deploy	Deploy Template
POST	/dna/intent/api/v1/template-programmer/template/version	Version Template
GET	/dna/intent/api/v1/template-programmer/template/deploy/status/{deploymentId}	Get Template deployment status
PUT	/dna/intent/api/v1/template-programmer/template/preview	Preview Template
POST	/dna/intent/api/v1/template-programmer/project/{projectId}/template	Create Template
GET	/dna/intent/api/v1/template-programmer/template/version/{templateId}	Get Template Versions
DELETE	/dna/intent/api/v1/template-programmer/project/{projectId}	Delete Project

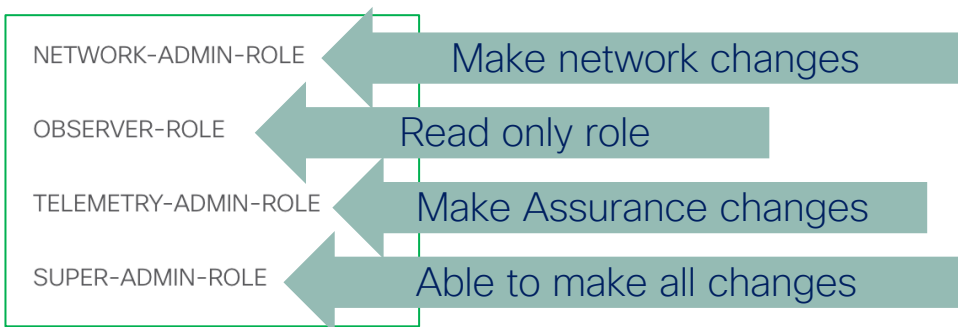
Authentication

```
https://<dnac-ip>/api/system/v1/auth/token POST  
(basic Auth for username and password)
```

```
{  
  "Token":  
  "eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1NiJ9.eyJzdWUiOiI1Y2NiYzcyYjNhZW5ODAwY2Y4ZTVINzkiLCJhdXRoU291cmNlljoiaW50ZXJuYWwiLCJ0ZW5hbnROYW1lIjoieVE5UMCIsInJvbGVzIjpbIjVjY2JjNzJhM2FIYTk4MDBjZjhINWU3OCJdLCJ0ZW5hbnRjZCI6IjVjY2JjNzJhM2FIYTk4MDBjZjhINWU3NiIsImV4cCI6MTU1ODc2ODUzNjCwIiwiaWF0IjoxNTU4NzY0OTM0LCJqdGkiOiJhNWQ1ZTZIZC0wYmE2LTQ1MzUtYmI3Ni00YjEzMDA1YjlkODMiLCJ1c2VybmFtZSI6ImFkbWlud0.QYCGbFqgbGyxNHE3XEDxXygrU7XJ8fViZwHHJXMuj---2FMCRFDyavKoZSQclglqK3Ln86LQ9qo2UldSfODRczshBT18jThXgpDk0NAzFRSJ7CI8JxBwK3rL3HK7r5_UZBgEYrFGXgYbCNmf5eqskMjCL7AZ8N0N4IJgc8urmKszKutvEgaELhgJUVMcZuWt-BPVbLealEXWrF2KiiMRBEjefOVta7vm3VxUaC6V0J5pr4u0VUzzlPk_KXkZE5ZABtrRocTeudo-V2SIWx-r3R-_8jA2sm6LkTglJqZ_7a3T82RFC5xiC6WcNVShhcLDPcayBzT9cbaCzhlpoopoxA"  
}
```

Need to use the token as a header in all other API calls
"x-auth-token" : response['Token']

Roles:



Rate Limiting

```
{
  "error": "Rate Limit exceeded; BapiName: Get Overall Network Health, RateLimit config details:
RateLimitContext{rate=5, windowUnit='minute', windowDuration=1,
maxConcurrentExecutionsPermitted=0}",
  "bapiExtendedStatusCode": "REJECTED_ABOVE_THROTTLE_LIMIT",
  "bapiExtendedStatusDescription": "For BAPI: Get Overall Network Health, maximum allowed BAPI
instances per 1 minute is 5. The limit has been reached for the time-window between Fri May 24
06:11:02 UTC 2019 and now"
}
```

Rate limiting per API endpoint
Range between 5-100/minute
Displayed in on-box API documentation

Types of Applications

Assurance – Visibility
Events – Notification
Automation – Change

Assurance

Health ▾ Dashboards ▾ Issues ▾ Manage ▾

May 27, 2019 1:55 pm

Overall Health

Last 24 hours ▾

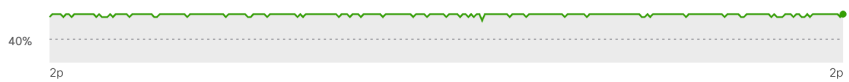
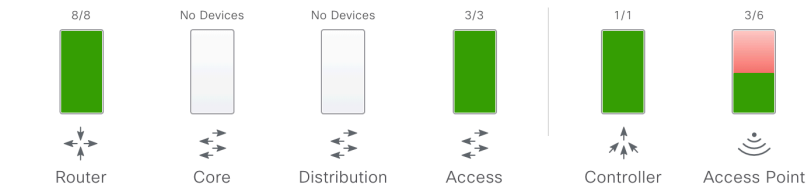
Actions ▾

Location: Global

☰ 🔔 👁 Show

Network Devices

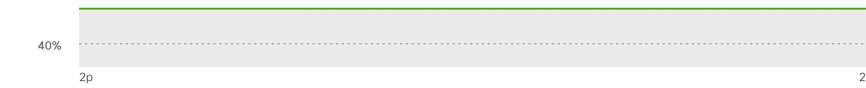
LATEST **83%** Healthy ⓘ **TOTAL: 18**



[View Network Health](#)

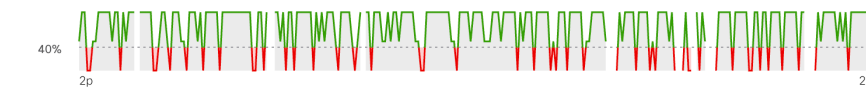
Wired Clients

LATEST **100%** Healthy ⓘ **CONNECTED: 1**



Wireless Clients

LATEST **100%** Healthy ⓘ **ACTIVE: 1**



[View Client Health](#)

Current Assurance API

/site-health

Health of devices and users in each location (site)

/client-health

Breakdown of wired and wireless health
Global
KPI fail for poor health score

/network-health

Breakdown of scores for device types
Global
KPI fail for poor score

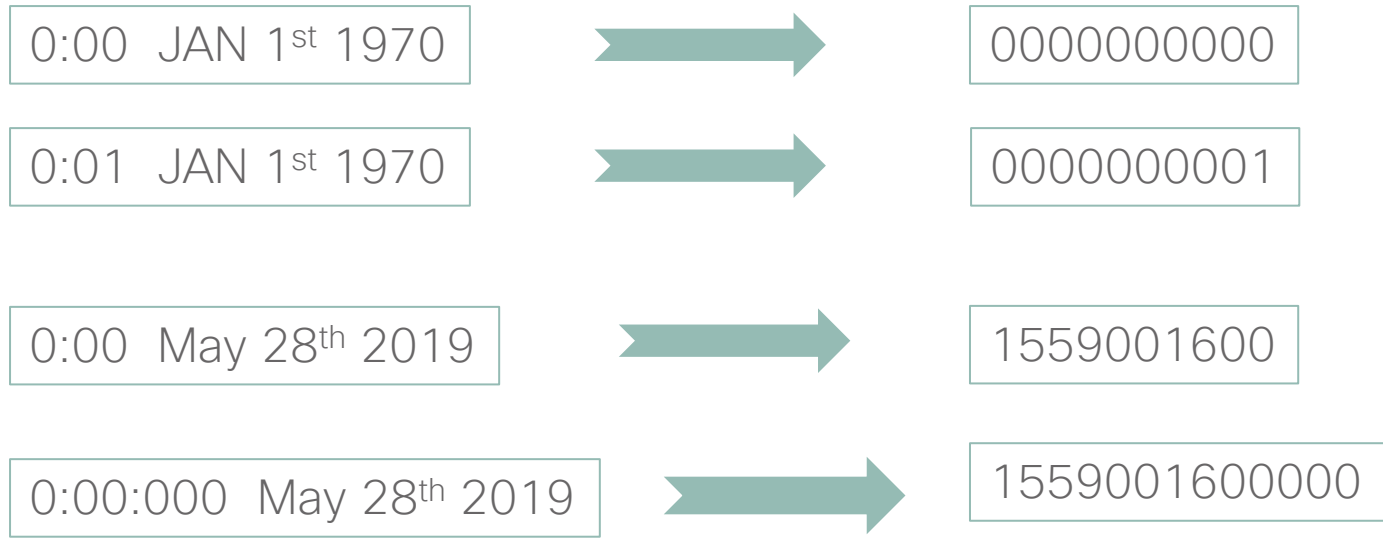
/client-detail

All information for a specific client

/device-detail

All information for a specific network-device

EPOCH... Keys to the time machine



Timestamps are in milli-epoch

Getting Access to hosts

```
https://<dnac-ip>/api/assurance/v1/host POST  
{ as the body
```

```
{  
  "version": "1.0",  
  "response": [  
    {  
      "id": "70:F3:5A:7C:8A:31",  
      "connectionStatus": "DISCONNECTED",  
      "hostType": "WIRELESS",  
      "userId": "fake_user1",  
      "hostName": null,  
      "hostOs": null,  
      "hostVersion": null,  
      "subType": "Sensor-Client-1800S",  
      "lastUpdated": 1558765560000,  
    }  
  ]  
}
```

Unofficial API – this can and WILL change
Can filter on sites, status, type etc
Can also provide timestamp range

Filters

```
https://<dnac-ip>/api/assurance/v1/host POST
{
  "filters": {
    "typeIdList": [
      "e074bec6-dc0a-462b-acc7-c93a05ba4bf2"
    ]
  }
}
```

```
{
  "startTime": 1559051940000, "endTime": 1559052240000,
  "limit": 25, "offset": 1,
  "filters": {
    "devType": ["WIRED"],
    "typeIdList": [
      "e074bec6-dc0a-462b-acc7-c93a05ba4bf2"
    ]
  }
}
```

SiteId obtained from site-health API
Optional

- startTime endTime
- Pagnation: limit, offset
- "devType":["WIRED"]

Getting Access to network devices

```
https://<dnac-ip> api/assurance/v1/network-  
device?startTime=1558681800000&endTime=1558682100000 POST  
{ as the body
```

```
{  
  "version": "1.0",  
  "response": [  
    {  
      "id": "d3499d32-69e9-4ae1-a657-95a369362e55",  
      "deviceModelType": "Cisco Catalyst 9300 Switch",  
      "platformId": "C9300-48P",  
      "location": null,  
      "issueCount": null,  
      "connectivityStatus": "100",  
      "communicationState": "REACHABLE",  
      "healthScore": [  
        {  
          "healthType": "OVERALL",  
          "reason": "",  
          "score": 10  
        }  
      ],  
    }  
  ],  
}
```

Unofficial API – this can and WILL change
Can filter on sites, status, type etc
startTime and endTime mandatory

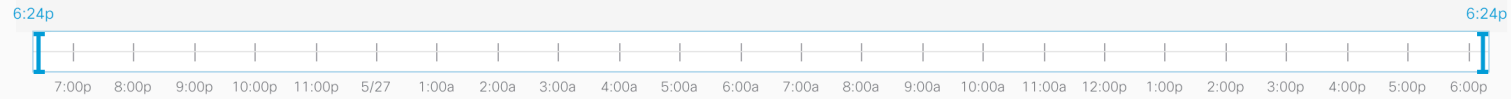
Issues

Health ▾ Dashboards ▾ **Issues ▾** Manage ▾

All Issues

Last Updated: May 27, 2019 6:24 pm

🕒 24 Hours



Onboarding Connectivity Connected Device Availability Utilization AP Anomaly Others

🔍 Filter

🔍 Find

Issue Name	Instances ▾
Wired client DHCP issue or authentication failures	22
Wireless Client Onboarding Issues	21
802.11r client roaming slowly	0
Global Wireless Client Onboarding Issues	0
Client DNS reachability issue	0

Wired client DHCP issue or authentication failures

Issue Description

Wired client has failed to obtain an IPv4 address from DHCP server or dot1X/MAC Authentication failed

Root Causes

- 1 Wired Client authentication failures - Dot1.x failure
- 2 Wired Client authentication failures - MAB failure
- 3 Client DHCP reachability issue

Enable Notifications (1/4)

Activate the Network Events Bundle

Platform

Version 1.0.39 - Released 4/26/2019

Overview **Manage** ▾ Developer Toolkit ▾ Runtime Dashboard

Bundles

 Filter

 Find

Bundle ▲

Status

Description

DNA Center REST API

Cisco Systems, Inc.
v1.0.27 | DNAC 1.2.5 +
Version Dated Apr 26, 2019

ACTIVE

This bundle contains the REST API supported by Cisco DNA Center. These REST APIs provide a rich set of capabilities, including the ability to discover network devices, query network health and provision network devices.

Network Events for REST API Endpoint

Cisco Systems, Inc.
v1.0.11 | DNAC 1.2.5 +
Version Dated Apr 23, 2019

ACTIVE

You can use this bundle to publish DNA Center events to any REST API endpoint, as well as to receive updates about the event and its associated artifacts(incident , problem or request for change). The bundle then populates the Runtime Dashboard with this data.

[Configure](#)

Enable Notifications (2/4)

Cisco DNA Center DESIGN POLICY PROVISION ASS

Platform Version 1.0.39 - Released 4/26/2019

Overview **Manage** Developer Toolkit Runtime Dashboard

Configurations

Set global settings or across multiple bundles for a custom platform experience.

Event Settings

General Settings

General Settings

Filter

Name

Destination to receive events (v1)

> Rest Endpoint for Publishing Event

ServiceNow Access Settings (v1)

Set Operational Limit and Source ServiceNow (v1)

Add Instance > Rest Endpoint for Publishing Event

INFORMATION

Instance Name *

Description

REST ENDPOINT FOR PUBLISHING EVENT

REST End Point *

Username *

Password * [SHOW](#)

[Check connectivity](#)

[Cancel](#) [Add](#)

- Create a REST Endpoint
- Needs to be https
 - Will be vereified
 - Auth only enforce server side

Enable Notifications (3/4) (to change soon)

Schedule Events (internal polling)
Will move soon to pure notification
Shortest interval is 15min
Same API call, just instant update

Platform

Version 1.0.39 - Released 4/26/2019

Overview Manage ▾ **Developer Toolkit** ▾ Runtime Dashboard

Integration Flows

≡ Find

> Integrations

Integrations

View details of integration flow components that enable integration between DNA and other third party systems of various Domains like ITSM, IPAM etc. Integrations are based on two types of triggers - REST Based (Can be invoked as a Rest Call) or Schedule Based (Runs on a schedule, performs a task and pushes the information to a REST end point or other vendor specific destinations). Scheduler based flows can be edited here to modify the schedule.

ITSM Integration

Name ▲	Description	Trigger
Schedule to publish Network Events - REST Endpoint connector	This scheduler is used to push network event details to the REST Endpoint system at any set frequency.	Schedule Based Scheduled Reoccurring on Daily every 15 minutes

Enable Notifications (4/4)

Platform Version 1.0.39 - Released 4/26/2019

Overview **Manage** ▾ Developer Toolkit ▾ Runtime Dashboard

Configurations

Set global settings or across multiple bundles for a custom platform experience.

Event Settings

General Settings

Event Settings

Filter | 225 Selected EQ Find

<input checked="" type="checkbox"/>	Event Name ▲	Domain	Type	Category	Priority	Workflow	Actions
<input checked="" type="checkbox"/>	802.11r client roaming slowly	Onboarding	Network	Warn	P3	Incident	Edit
<input checked="" type="checkbox"/>	802.11r FT client roaming slowly	Onboarding	Network	Warn	P3	Incident	Edit
<input checked="" type="checkbox"/>	AP Anomaly	AP ILM Event	Network	Warn	P3	Incident	Edit
<input checked="" type="checkbox"/>	AP Coverage Hole	Availability	Network	Warn	P3	Incident	Edit
<input checked="" type="checkbox"/>	AP CPU High Utilization	Utilization	Network	Warn	P3	Incident	Edit
<input checked="" type="checkbox"/>	AP Down	Availability	Network	Warn	P2	Incident	Edit
<input checked="" type="checkbox"/>	AP Flap	Availability	Network	Warn	P3	Incident	Edit
<input checked="" type="checkbox"/>	AP License Exhausted on WLC	Utilization	Network	Warn	P3	Incident	Edit
<input checked="" type="checkbox"/>	AP License Utilization on WLC	Utilization	Network	Warn	P3	Incident	Edit
<input checked="" type="checkbox"/>	AP Memory High Utilization	Utilization	Network	Warn	P3	Incident	Edit

Select Events of interest
By default none are selected.
Can change category/priority etc

Sending to email/IM

-Contact Cisco TAC for support - <https://www.cisco.com/c/en/us/support/web/tsd-cisco-worldwide-contacts.html>



dnac 5:35 pm

ALERT: *****

Event:Client DHCP reachability issue, Severity:P2, Category:Warn

This client 70:F3:5A:7C:04:90 has not been assigned an IPv4 address by DHCP server.

Suggested Actions:

- Verify that the DHCP server is reachable.
- Verify the DHCP scope is configured correctly and has adequate free IP addresses.
- Verify the IP helper address is configured correctly on the first hop switch [10.10.6.2](#).
- Initiate a Path Trace tool to verify the DHCP server can reach the first hop switch [10.10.6.2](#).

ALERT: *****

Event:Wireless client failed to connect - DHCP Server Timeout, Severity:P3, Category:Warn

This client failed to get an IPv4 address during onboarding. The '[192.168.200.201](#)' DHCP server is not responding to DHCP messages. This client was connecting to 'CiscoSensorProvisioning' SSID on '10' VLAN on 2.4 GHz radio on 'pnp3802' AP in location 'Global/Perth/PER1/PER1-F5'. The AP was connected to '[WLC9800.adamlab.cisco.com](#)' WLC.

Suggested Actions:

- Verify that the DHCP server is reachable.
- Verify that the DHCP scope is configured correctly and has adequate free IP addresses.
- If all new clients are not getting assigned IP Address, verify that the IP helper address is configured correctly on the first hop router servicing the VLAN.
- Initiate the Path Trace tool to verify that the DHCP server can reach the first hop router servicing VLAN.



Automation

Cisco DNA Center

Template Editor



Find template...



interface-list x

adam

config-raw

interface-list

toggle

binding

Onboarding Configuration

Actions | Edit | interface-list



Template

```
1 #foreach($intDesc in $intDescList)
2   interface $intDesc.int
3   description $intDesc.desc
4 #end
```

Examples

- ```
./template.py
./template.py --help
./template.py --template adam/interface-list
./template.py --template adam/interface-list --device 10.10.50.2 --params
'{"intDescList" : [{"int":"gig1/0/10", "desc" : "first"}, {"int": "gig1/0/11", "desc"
:"second"}]}'
```

<https://github.com/CiscoDevNet/DNAC-TemplateProgrammer>

# NOTES

- All templates are versioned. Need to save && Commit. (There is API for this)
- Semantics of "**forcePushTemplate**". Default is NOT to re-apply a template with same variables.
- Default provisioning behavior is to apply a single (or nested template) to a device. Also includes **site specific settings** (aaa, ntp etc). API just pushes template to device(s)
- Multiple device requires unique parameters for template (can duplicate)

# Template API Summary

| Endpoint                                                            | Verb            | Description                                        |
|---------------------------------------------------------------------|-----------------|----------------------------------------------------|
| api/v1/template-programmer/project                                  | GET/POST/DELETE | CRUD on template projects                          |
| api/v1/template-programmer/template                                 | GET/POST/DELETE | CRUD on templates. A template is part of a project |
| api/v1/template-programmer/template/deploy                          | POST            | Deploy a template to a device                      |
| /api/v1/template-programmer/template/deploy/status/{{deploymentId}} | GET             | Status of the deployment job                       |

# Summary, what did talk about?

- What is Cisco DNA Center Platform?
- How to get started
- Types of applications
- Next Steps



# One more thing..

# NetDevOps Live! Code Exchange Challenge

[developer.cisco.com/codeexchange](https://developer.cisco.com/codeexchange)

***Use the SDK (when it comes out) to access information you need.***

The image shows two overlapping screenshots of the Cisco Code Exchange website. The top screenshot displays a search interface with the heading "Discover code repositories related to Cisco technologies". Below the heading is a search bar with the placeholder text "What are you looking for?". Underneath the search bar are four circular icons representing different technologies: a blue and white icon, a colorful circular icon, a white circle with the word "Kinetic", and a white circle with the word "Meraki". Below these icons are three dropdown menus: "Recommended", "Python", and "Networking". The bottom screenshot shows the "Submit your project" form. The form includes a "Git Repo URL" field with the example "https://github.com/organization/repository". Below this is a section titled "Select all technologies associated with this repo:" with a list of checkboxes for IoT, Cloud, Networking, Data Center, Open Source, Collaboration, Analytic & Automation, Security, and Mobility. There are also checkboxes for "Do you own or have permission to submit this repo?" and "Is this a Cisco repo?". At the bottom of the form is a checkbox for "Agree to Terms and Conditions" and a blue "Submit project" button. To the right of the form is a large illustration of three people (two men and one woman) sitting around a laptop, with a GitHub logo and code symbols above them.

# Webinar Resource List

## Docs and Links

- <https://developer.cisco.com/site/dna-center-rest-api/>
- Blog Series.

## Learning Labs

- Laptop Setup <http://cs.co/lab-dev-setup>
- DNA Center Learning Labs <https://learninglabs.cisco.com/tracks/dnacenter-programmability>

## DevNet Sandboxes

- DNA Center Always On <https://sandboxdnac.cisco.com>

## Code Samples

- <https://github.com/CiscoDevNet/DNAC-onboarding-tools>
- <https://github.com/CiscoDevNet/DNAC-TemplateProgrammer>
- <https://github.com/CiscoDevNet/DNAC-Assurance>
- <https://github.com/CiscoDevNet/DNAC-Platform>





# Got more questions? Stay in touch!



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[@adamradford123](https://twitter.com/adamradford123)



<http://github.com/aradford123>



# DEVNET

LEARN CODE INSPIRE CONNECT

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[facebook.com/ciscocodevnet/](https://facebook.com/ciscocodevnet/)



<http://github.com/CiscoDevNet>

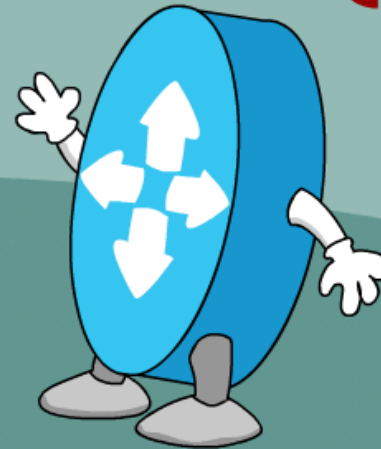


NETDEVOPS

{LIVE!}



DEVNET



<https://developer.cisco.com/netdevops/live>

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