



The bridge to possible

# Using IOT + Collab + Meraki APIs for a safer return to the school

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@ekktor

# Cisco Webex App

## Questions?

Use Cisco Webex App to chat with the speaker after the session

## How

- 1 Find this session in the Cisco Live Mobile App
- 2 Click “Join the Discussion”
- 3 Install the Webex App or go directly to the Webex space
- 4 Enter messages/questions in the Webex space

Webex spaces will be moderated until February 24, 2023.



# Abstract

During 2020 1.5 billion of students were taken off from schools due to the COVID-19 pandemic. Different methodologies were applied to make students, professors, school staff and parents' environments much safer before vaccination, with mixed results. In 2021, different scientific papers discussed a very simple but powerful way to prevent COVID19 contagions by measuring CO2 levels in the room. In this session, we will provide a simple solution using a cloud connected CO2 meter with wireless mesh and in combination with Meraki Scanning API, we will provide safer metrics for room utilization. Webex API's will provide the feedback and messaging mechanism to send real time alarms when necessary.



# Agenda

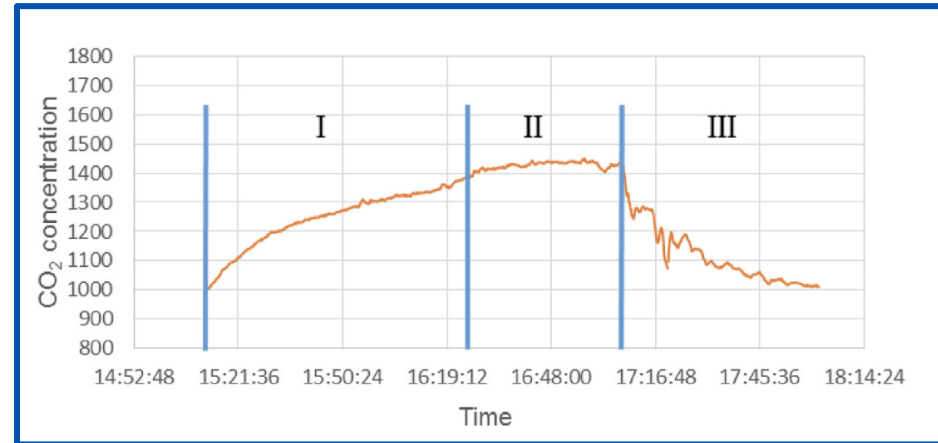
- Background, Framework and High-level concept
- Meraki Scanning API
- Meraki and DNA Spaces integration
- CO2 meters + Meraki MR as sensors
- Sensors and Room Utilization Application Integration
- Webex Bot – real-time reporting
- Demo
- Q&A

# Background, Framework and High-Level Concept



# Background

- SARS-CoV-2 transmission via aerosols – tiny droplets that do not settle due to gravity – is known to play some role in the pandemic [1].
- In rooms without technical air refreshing systems, the aerosol concentration can be reduced with simple natural ventilation activity [2].
- CO<sub>2</sub> monitoring could be implemented as a COVID-19 risk mitigation tool in restaurants [3].
- There is a direct positive correlation of number of people in a room via CO<sub>2</sub> concentration and the risk of infection [4]

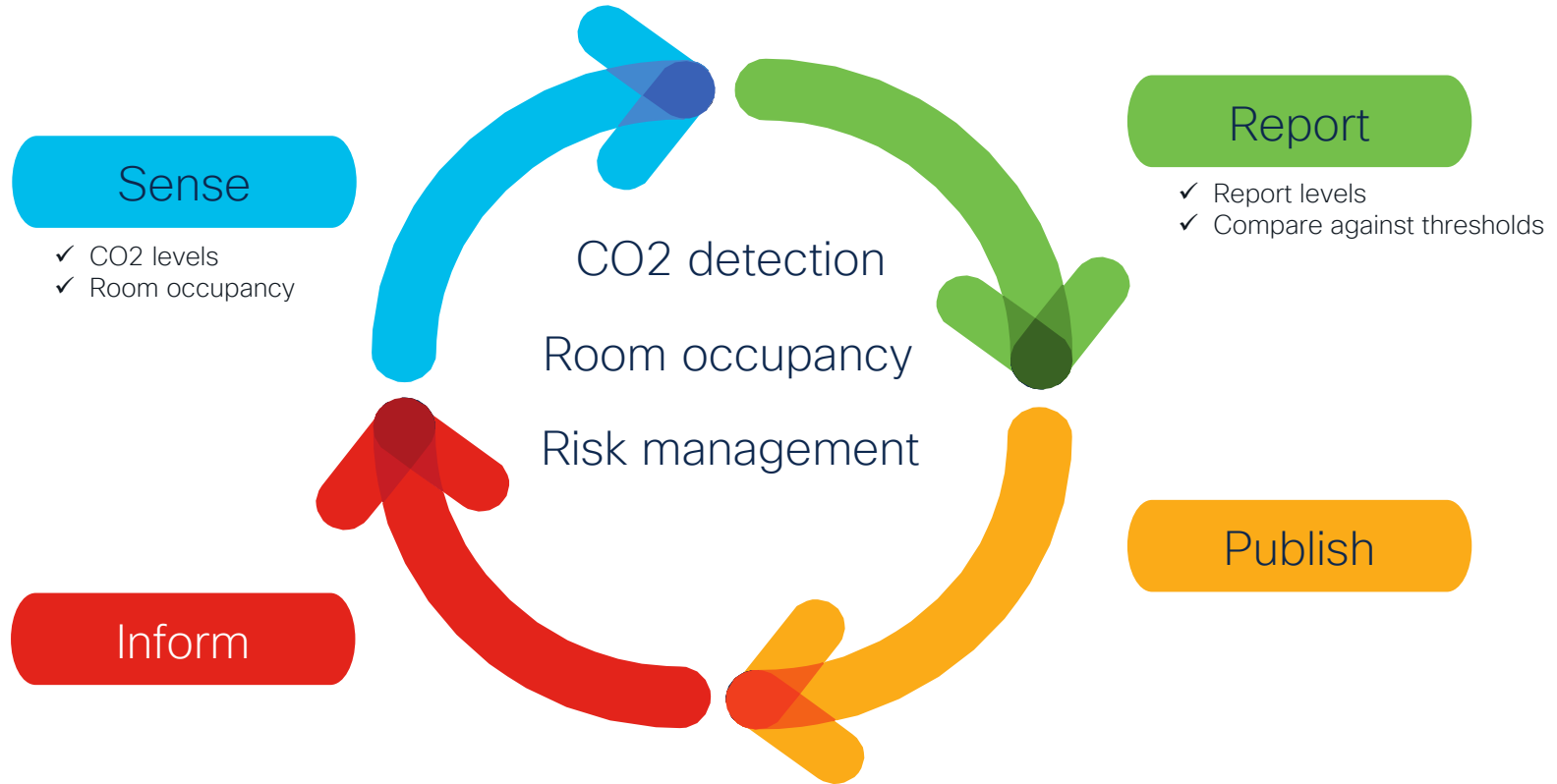


SOURCE – Changes in CO<sub>2</sub> concentration in the conference room from “Recommendations for ventilation of indoor spaces to reduce COVID-19 transmission”, Chung-Yen Chen et-al. 5 August 2021. <https://www.sciencedirect.com/science/article/pii/S092966462100365X>

# Proposal

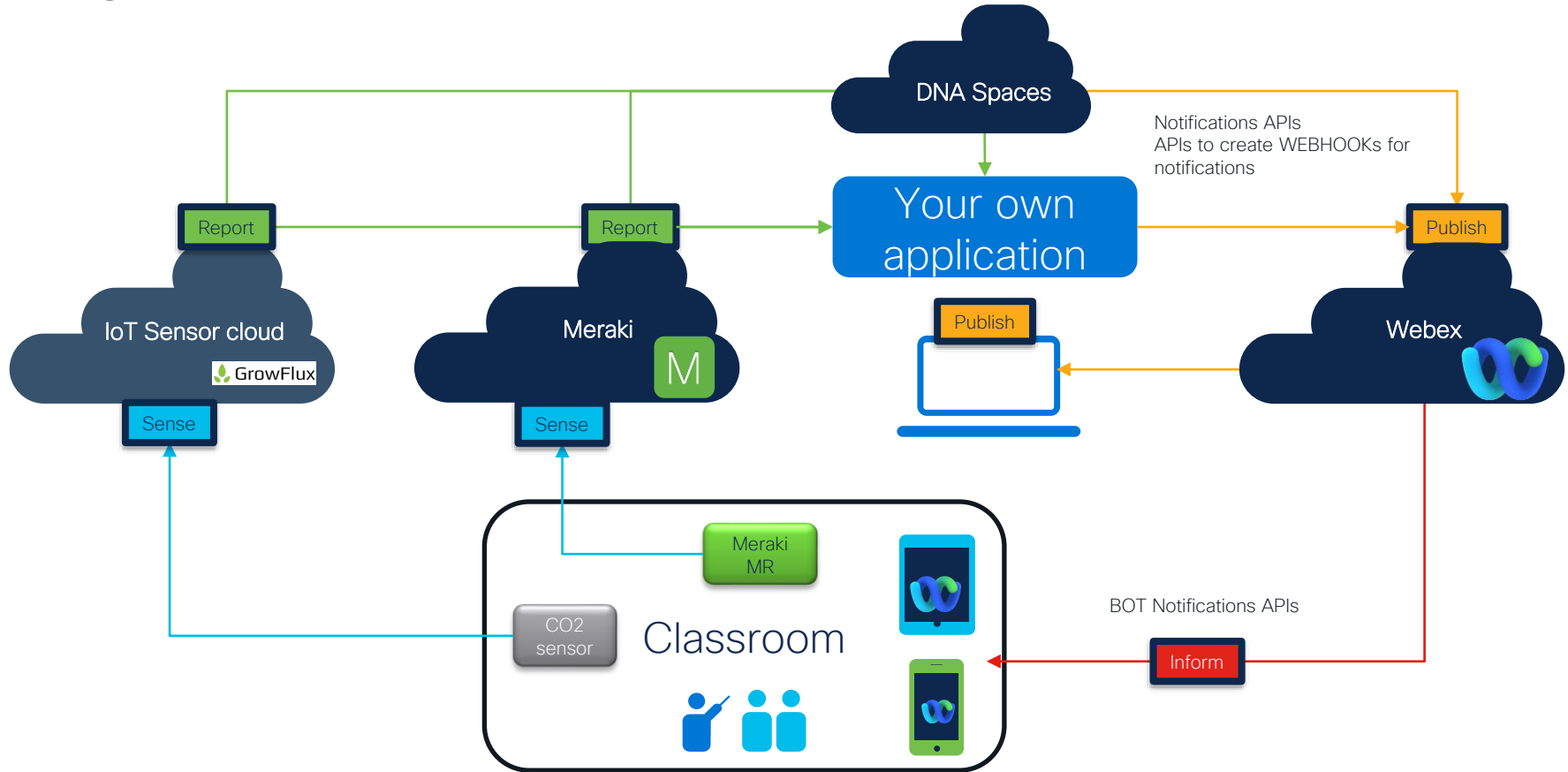
- Based on the research there are two facts:
  - CO2 concentration determines the risk of COVID19 contagion
  - Room characteristics such as ventilation and actual space, determines the amount of people in a room
- Even with vaccination, it's observed that COVID19 continue spreading, (at lower levels). The risk is to develop a variant that escapes from vaccine protection.
- Young population, between 5 and 18 years, might be subject of contagion due to school attendance and lack of vaccination in some places.
- CO2 concentration and Room occupancy can be determined and actions to make decisions can be automated

# Framework





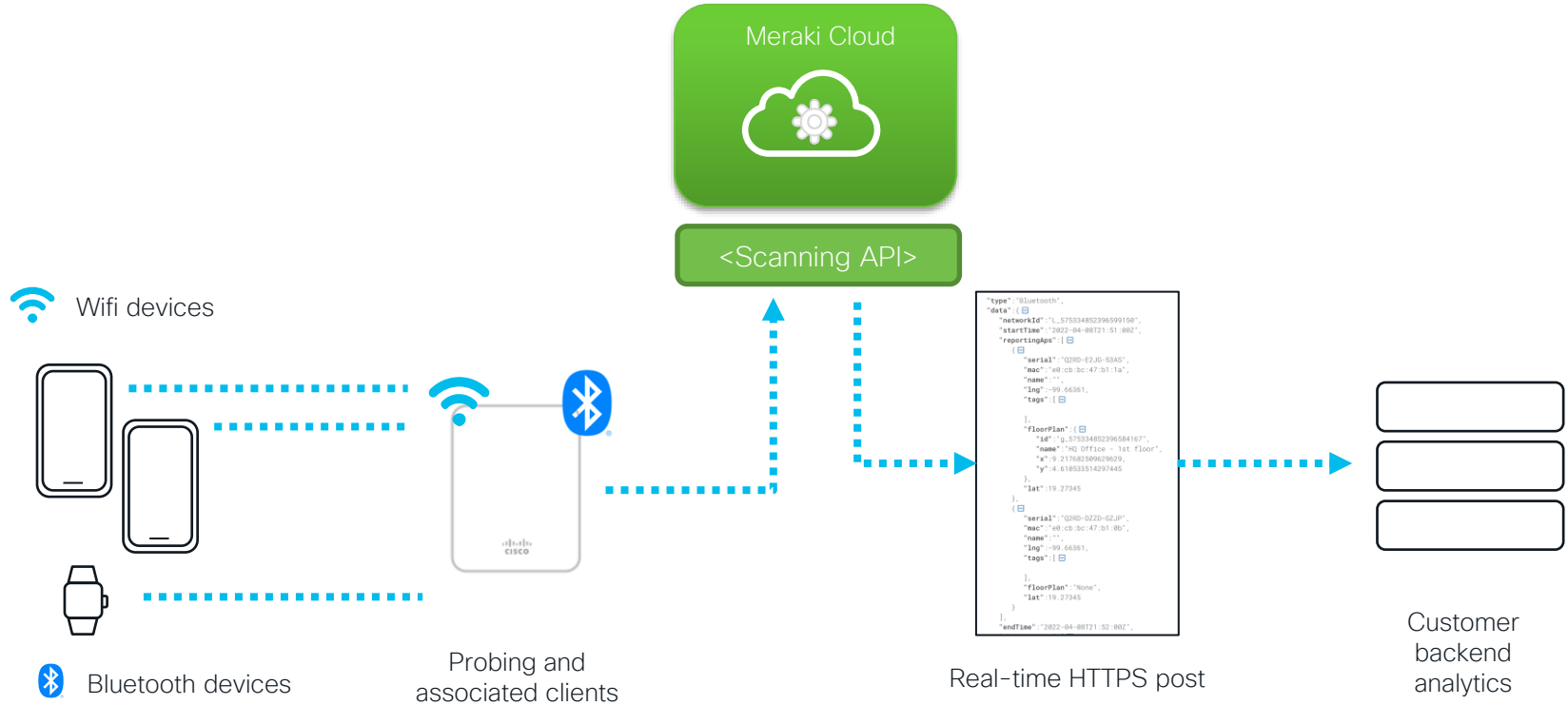
# High Level concept



# Meraki Scanning API



# How Scanning API works





# Configuring Scanning API

**Meraki**

ORGANIZATION

MSP for SMB Demo

NETWORK

MS-LAB-MAIN

**Network-wide**

Wireless

Organization

## Location and scanning ⓘ

Analytics

Analytics enabled ▾

Scanning API

Scanning API enabled ▾

Validator ⓘ

8c919de11e973a619ca35baa8c1787ec

## Location and scanning ⓘ

Analytics

Analytics enabled ▾

Scanning API

Scanning API enabled ▾

Validator ⓘ

8c919de11e973a619ca35baa8c1787ec

Validated https://te-health.dev:5007

Post URLs ⓘ

Status ⓘ	Post URL	Secret	API Version	Radio Type	
●	https://southtoluca.com:5015	.....	V2 ▾	WiFi ▾	Validate X
●	https://yourserver.com:5000	supersecret	V3 ▾	WiFi ▾	Validate X

[Add a Post URL](#)

Your own server

DNA Spaces


<CODE [HERE](#)>

# Meraki + DNA Spaces integration



# Meraki and DNA Spaces integration

## 1 – Add new wireless network



**Get your wireless network connected with Cisco DNA Spaces**

There are multiple options to get connected based on your wireless network deployment.

[+ Add New](#)

What type of wireless network do you have?

Cisco DNA Spaces works with most Cisco wireless networks including Cisco Meraki.

Cisco AireOS/Catalyst

Choose this for Cisco Aironet Access Points with Cisco Wireless LAN Controllers (WLC) or CMX On-Prem Tethering.

Select

Cisco Meraki

Choose this for Cisco Meraki networks with Meraki MR Access Points

Select

Need help? Use this [planning guide](#) to decide the best suited option based on your network.

# Meraki and DNA Spaces integration

## 2 – Add Meraki API Key

Choose your preferred method of connecting Cisco Meraki with Cisco DNA Spaces.

### Connect via API key

You can connect DNA Spaces to your Meraki account using an API Key

TIP: Follow the steps to create API key: Login to meraki dashboard > Click Profile icon (top right corner) > API access > API keys and click Create API Key

Select

Need help? Use this planning guide to decide the best suited option based on your network

Generate an API Key in Meraki Dashboard

Confirm password

Change password

Two-factor authentication

SMS authentication is OFF.

Set up two-factor authentication

API access

API keys

Key

\*\*\*\*\*

Generate new API key

**New API key**

Your API key is

9194504d4e55590c5f03684d59086e9201a003e1

**Copy and store your API key in a safe place**

Dashboard does not store API keys in plaintext for security reasons, so this is the *only* time you will be able to record it. If you lose or forget your API key, you *will have to revoke it and generate a new one.*

☒ I have stored my new API key

Done




# Meraki and DNA Spaces integration

1

## Connect your Meraki

Connect Meraki with DNA Spaces using the API key.

MERAKI SYNCHRONIZATION

 active

Currently 0 other DNA Spaces login is syncing

YOUR LOGIN



**Your login is not connected**

You will not be able to make changes to Meraki sync. Connecting your Meraki account will let you to import Meraki networks into the Location Hierarchy

[Connect](#)

## Connect via API key

Enter your Meraki API Key to fetch the network information

API KEY

9194504d4e55590c5f03684d5 fc55507c6780d5e

[Connect](#)

# Meraki and DNA Spaces integration



## 3 – Connect via Meraki API Key

### Connect via Meraki API Key

Connect Cisco DNA Spaces to Meraki Cloud Controller using your Meraki API key.

#### 1 Connect your Meraki

Connect Meraki with DNA Spaces using the API key.

<div>MERAKI SYNCHRONIZATION</div> <div> active</div>	Currently 0 other DNA Spaces login is syncing
<div>YOUR LOGIN</div> <div> Your login is not connected</div> <div>You will not be able to make changes to Meraki sync. Connecting your Meraki account will let you to import Meraki networks into the Location Hierarchy</div>	
<a href="#">Connect</a>	

#### 2 Configure Meraki scanning API

Configure below Post URL with URL validator and secret key and validate manually in Meraki dashboard to establish connection with DNA Spaces.

Post URL
<div>https://location.dnaspaces.io/notifications/Meraki/hectormorales/&lt;network_id&gt;/&lt;URLValidator&gt;</div> <div></div>
Secret Key
<div>hectormorales</div> <div></div>
<div>0 networks configured</div>

#### 3 Import Meraki Networks into Location Hierarchy

Connect Meraki with DNA Spaces using the API key.

<div>0 networks imported</div>	<a href="#">Import Networks</a> <a href="#">Sync Status</a>
--------------------------------	--

# Meraki and DNA Spaces integration

2

## Configure Meraki scanning API

Configure below Post URL with URL validator and secret key and validate manually in Meraki dashboard to establish connection with DNA Spaces.

Post URL

https://location.dnaspaces.io/notifications/Meraki/hectormorales<network\_id><URLValidator>



Secret Key

Get network id from Meraki Organization API



Get URL Validator from Meraki Network wide General

0 networks configured

[Meraki Dashboard API Documentation](#)

# Meraki and DNA Spaces integration

Get network id from the organization

2

## Configure Meraki scanning API

Configure below Post URL with URL validator and secret key and validate manually in Meraki dashboard to establish connection with DNA Spaces.

Post URL

https://location.dnaspaces.io/notifications/Meraki/hectormorales<network\_id>/<URLValidator>

0

Secret Key

hectormorales

0 networks configured

https://n168.meraki.com/api/v0/organizations

5:  
id: "657525545596093462"  
name: "ACME SD-WAN"  
url: "https://n168.meraki.com/o/zi7yVc0c/manage/organization/overview"

https://n168.meraki.com/api/v0/organizations/657525545596093462/networks

0:  
id: "L\_657525545596103966"  
organizationId: "657525545596093462"  
name: "HQ Site"  
timeZone: "America/Los\_Angeles"  
tags: null  
productTypes:  
0: "appliance"  
1: "wireless"  
type: "combined"  
disableMyMerakiCom: false  
disableRemoteStatusPage: true

CISCO *Live!*

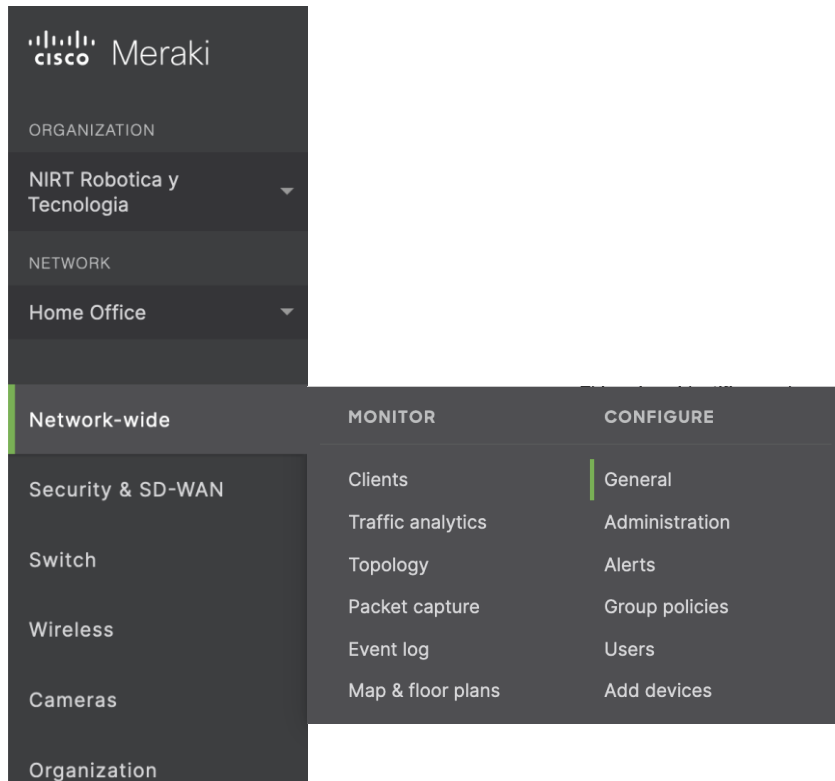
DEVNET-2778

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# Meraki and DNA Spaces integration

## Get Validator



## Location and scanning ⓘ

Analytics

Analytics enabled ▾

Scanning API

Scanning API enabled ▾

Validator ⓘ

78611973c567c767efec11eb7706ca34ba56ad4309

Post URLs ⓘ

HTTPS is required for Scanning API receivers. Your API documentation: <https://developer.cisco.com/m>

Status ⓘ

Post URL



<http://live-demo22.online:5013/>



<https://location.dnaspaces.io/notificatio>

[Add a Post URL](#)

# Meraki and DNA Spaces integration

## Validate URL

☐   [Show secret](#) V3 ▾ WiFi ▾ Validate ✕

<https://location.dnaspaces.io/notifications/Meraki/hectormorales/tSHabcw/973a619ca35ba8c919de11eba8c1787ec0611423>

**You have unsaved changes.**

or [cancel](#)

[<CODE HERE>](#)

# CO2 meter and Meraki MR as sensors

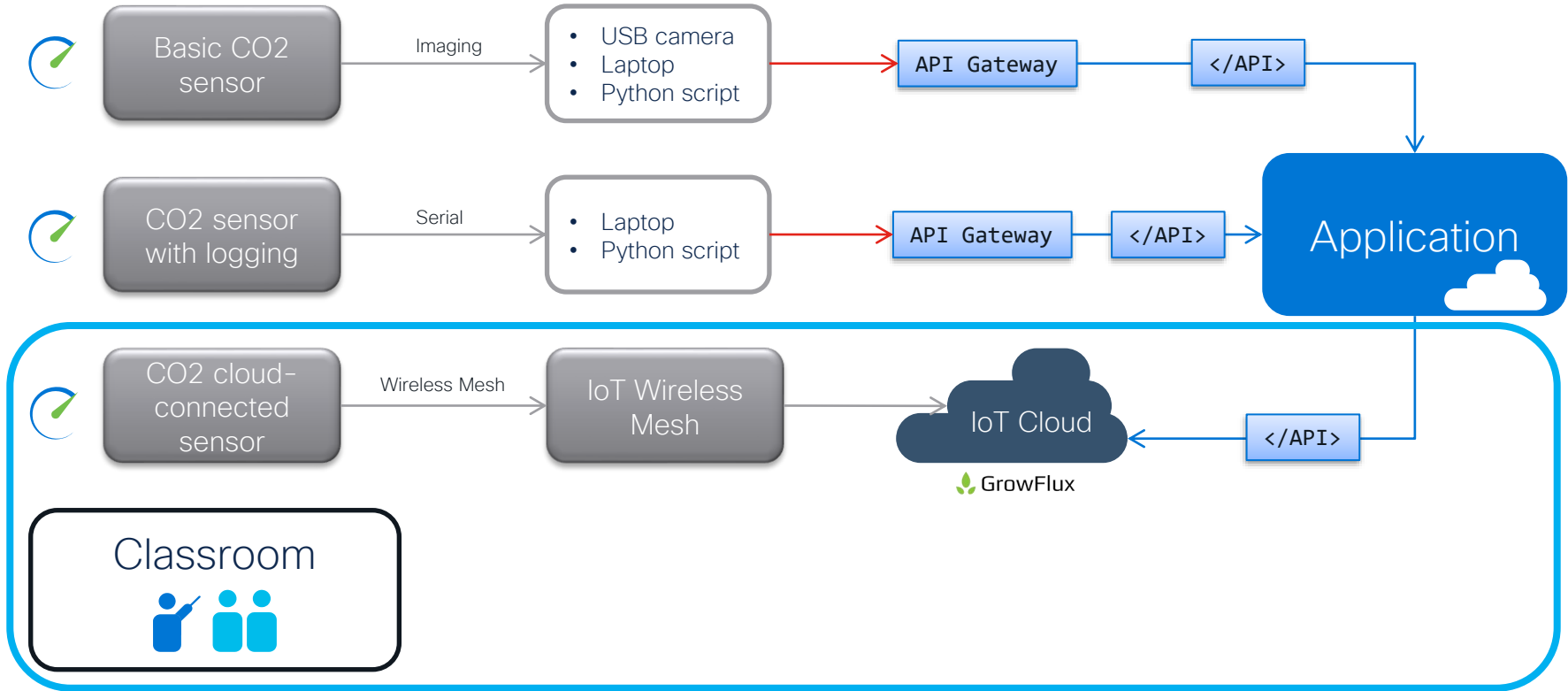


# Solution components

1. Get CO2 room values
2. Get number of people on the room
3. Dynamic Room Calibration
4. Dynamic Thresholds
5. Publish room information
6. Inform when actions must be taken



# Get CO2 room values



[GrowFlux API Documentation](#)

# GrowFlux API

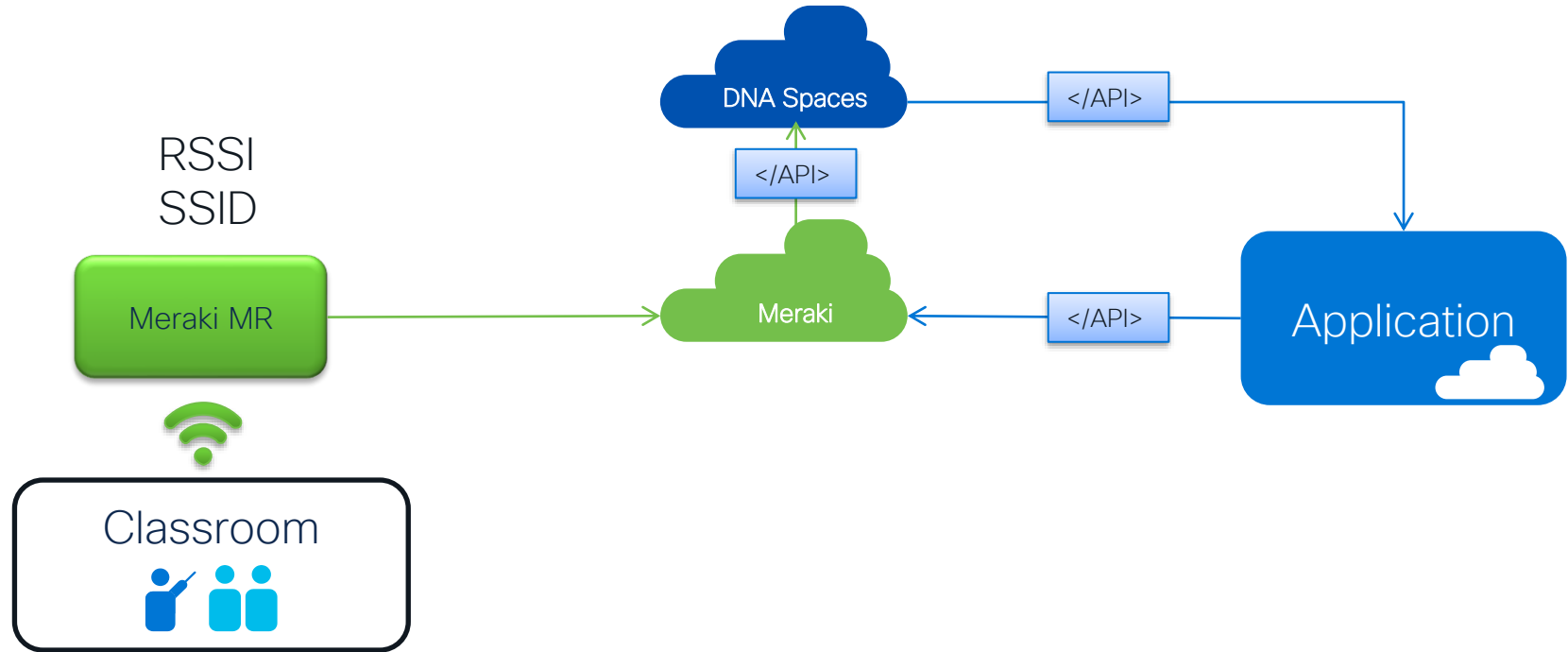
```
for ap in aps:

    # get all CO2 sensors per AP
    resource = "/v1/ap/" + ap["id"] + "/co2_sensors"
    response = requests.request("GET", url + resource, headers=headers, data=payload)
    response_parsed = json.loads(response.text)

    co2_sensors = response_parsed["message"]["co2_sensors"]

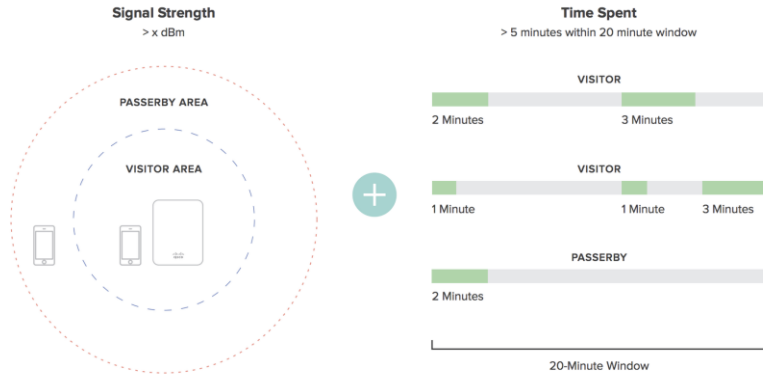
    # for each sensor, print out its values
    for sensor in co2_sensors:
        co2_levels += "\nTimestamp: " + str(datetime.today().strftime('%Y-%m-%d %H:%M:%S.%f')[:-3])
        co2_levels += "\nCO2 levels: " + str(co2_sensors[sensor]["metrics"]["data"]["C_co2"])
        co2_levels += "\nTemperature: " + str(co2_sensors[sensor]["metrics"]["data"]["C_t"])
        co2_levels += "\nHumidity: " + str(co2_sensors[sensor]["metrics"]["data"]["C_rh"])
        co2_levels += "\nVoltage: " + str(co2_sensors[sensor]["metrics"]["data"]["C_v"])
        co2_levels += "\nPressure: " + str(co2_sensors[sensor]["metrics"]["data"]["C_p"])
        co2_alarm = co2_sensors[sensor]["metrics"]["data"]["C_co2"]
        print("\nTimestamp: " + str(datetime.today().strftime('%Y-%m-%d %H:%M:%S.%f')[:-3]))
        # datetime_to_utc
        # print("\nTimestamp: " + str(datetime.fromtimestamp(co2_sensors[sensor]["metrics"]["data"]["timestamp"] / 1000).strftime('%d-%m-%y %H:%M:%S')))
        print("CO2 levels: " + str(co2_sensors[sensor]["metrics"]["data"]["C_co2"]))
        print("Temperature: " + str(co2_sensors[sensor]["metrics"]["data"]["C_t"]))
        print("Humidity: " + str(co2_sensors[sensor]["metrics"]["data"]["C_rh"]))
        print("Voltage: " + str(co2_sensors[sensor]["metrics"]["data"]["C_v"]))
        print("Pressure: " + str(co2_sensors[sensor]["metrics"]["data"]["C_p"]))
```

# Get number of people on the room



# What is RSSI?

<sup>4</sup> RSSI - 95 = signal strength in dBm



- RSSI, or “Received Signal Strength Indicator,” is a measurement of how well your device can hear a signal from an access point or router. It’s a value that is useful for determining if you have enough signal to get a good wireless connection.

- RSSI is a term used to measure the relative **quality** of a received signal to a client device, but has no absolute value. The IEEE 802.11 standard specifies that RSSI can be on a scale of 0 to up to 255. Each chipset manufacturer can define their own “RSSI\_Max” value. Cisco uses a 0-100 scale, which is why RSSI is a relative index, but you can infer that the higher the RSSI value is, the better the signal is.
- More information on [Meraki Location Analytics](#)
- Location analytics in [Meraki Dashboard](#)

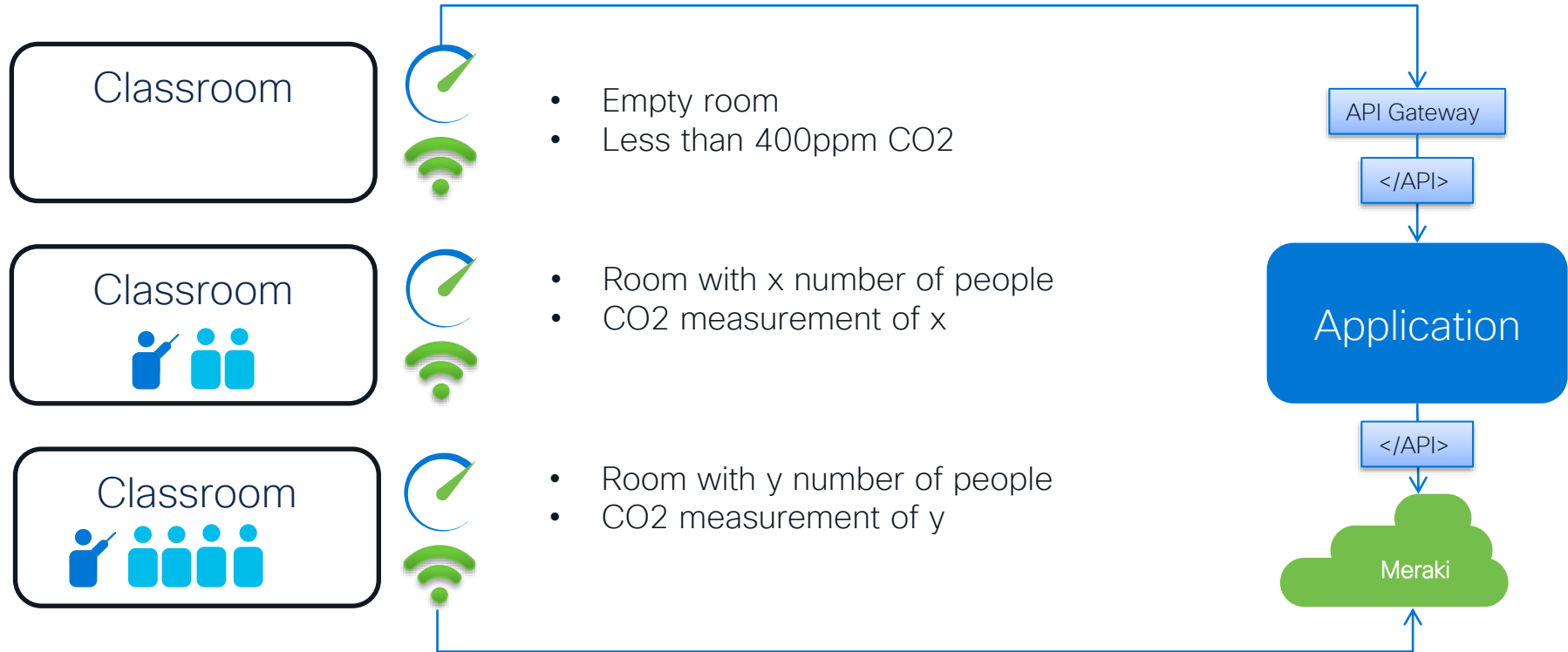
# Get number of people on the room using RSSI

```
if meraki_post['type'] == 'WiFi':  
  
    for i in meraki_post['data'].get('observations'):  
  
        manufacture = str(i.get('manufacturer'))  
  
        if i.get('ssid') is not None:  
            ssid = str(i.get('ssid'))  
  
            if i.get('ssid') is not None and i['latestRecord'].get('nearestApRssi') >= -61:  
  
                ap_connected += "\nDevice mac: " + i.get('clientMac') + "\nRSSI: " + str(i['latestRecord'].get('nearestApRssi'))  
                room_count += 1  
  
            elif i.get('ssid') is None and i['latestRecord'].get('nearestApRssi') >= -55 and manufacture != 'Meraki':  
  
                nearby += "\nDevice mac: " + i.get('clientMac') + "\nRSSI: " + str(i['latestRecord'].get('nearestApRssi'))  
                room_count += 1
```

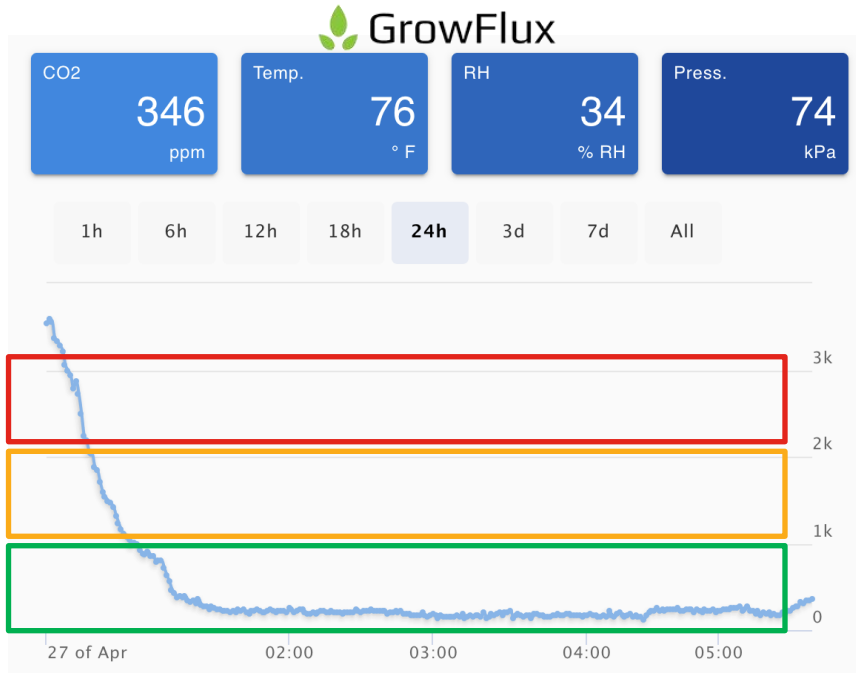
# Sensors and Room Utilization Application Integration



# Dynamic Room Calibration



# Dynamic Thresholds



CO2 levels + People in the room

Danger zone

Safe zone



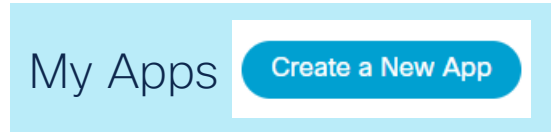
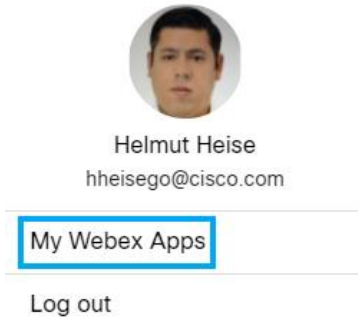


# Webex Bot – real-time information



# Create a Bot account

<https://developer.webex.com/>



Bot

Build chatbots that post content and  
respond to commands.

Create a Bot

Learn More

# Get your bot's access token

**Congratulations!** 🎉



Cisco Live is one step closer to becoming a reality.

## Cisco Live

👉 **Next Step:** Use your Bot Access Token to set up your webhook and finish building your bot.

### Bot access token

Non-expiring (good for 100 years)  
access token for your bot. Save  
this token to set up your  
webhook.

 N2Q0YjAtMTIkMC00ZWQzLTkzYzktMDNIYjhiN2JmMmQ?=

Copy Token

💡 **Tip:** Save this token!

It won't be shown again (but you can regenerate a new one if needed).

# Webex Python SDK

<https://github.com/CiscoDevNet/webex teams sdk>

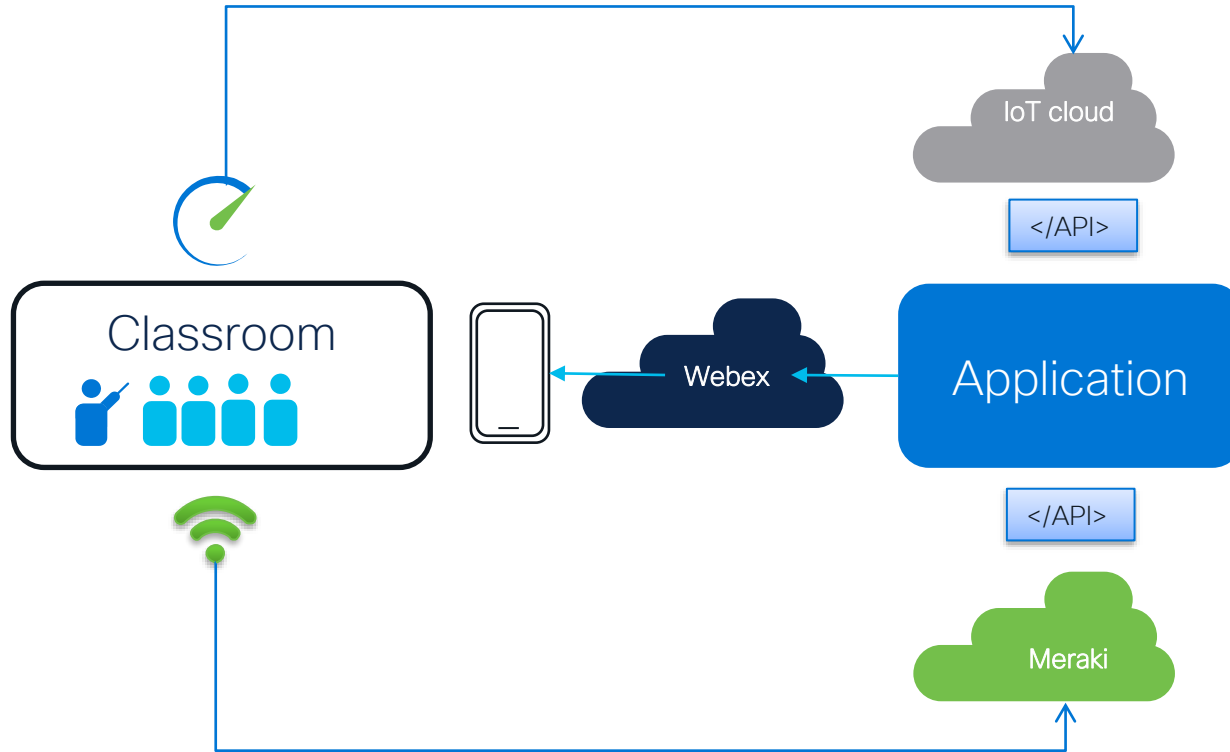
```
→ from webex teams sdk import WebexTeamsAPI

# Webex Teams Object
live_bot = WebexTeamsAPI(access_token=os.environ['BOTOKEN'])

def send_message(self, msg):
    mails = ['hemorale@cisco.com', 'hheisego@cisco.com']

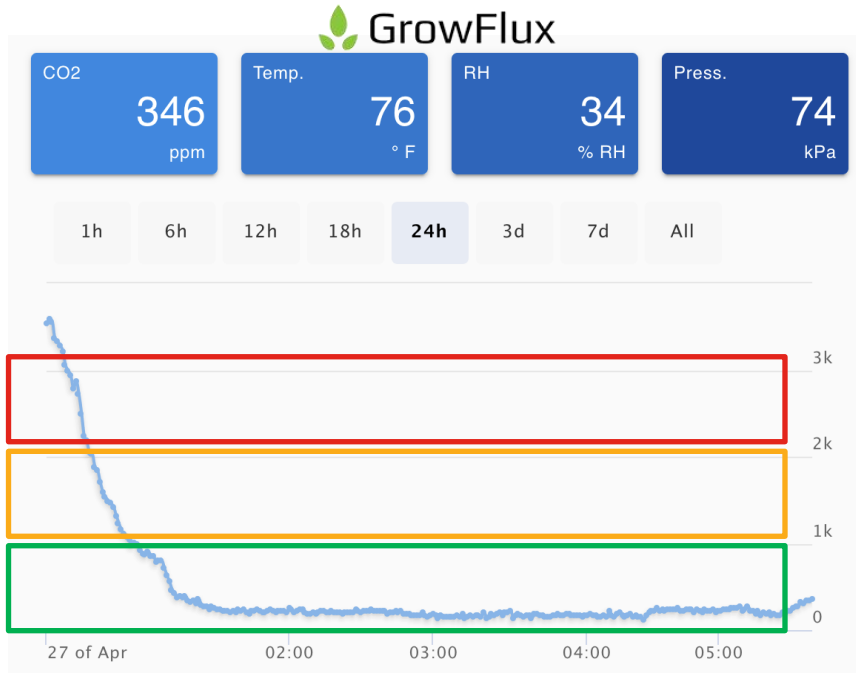
    for i in mails:
        live_bot.messages.create(toPersonEmail=i, text=msg)
```

# Publish room information



- Room with y number of people
- CO2 measurement of y
- Provide room insights based on data
- Inform via Webex Bot

# Inform when actions must be taken



CO2 levels

Red zone → Better run!!

Yellow zone → Open windows

Green zone → Be happy

# Publish room information

```
if co2 > 800 and room_count > 0:

    msg = ssid + str(ap_connected) + '\n' + str(nearby)
    msg += "\nC02: " + str(co2) + " | Devices count: " + str(room_count) + " -- > Run Away!!\n" + co2_levels
    self.send_message(msg)

elif co2 < 800 and room_count > 0:

    msg = str(ap_connected) + '\n' + str(nearby)
    msg += " C02: " + str(co2) + " | Devices count: " + str(room_count) + "\n" + co2_levels
    self.send_message(msg)
```

# Demo Putting all together



# Our demo running live...



Cisco Live Yesterday, 8:29 PM

Device mac: c2:3a:b0:30:3c:29

RSSI: -55

CO2: 333 | Devices count: 1

Timestamp: 2022-06-11 20:29:21.530

CO2 levels: 333

Temperature: 20.04

Humidity: 59.48

Voltage: 3.42

Pressure: 74.14

# Q&A



# References

- 1) O'Keeffe J, Freeman S, Nicol A-M. The basics of SARS-CoV-2 transmission [evidence review]. Vancouver, BC: National Collaborating Centre for Environmental Health; 2021 Mar 21. Available from: <https://ncceh.ca/documents/evidence-review/basics-sars-cov-2-transmission>.
- 2) CO2 measurements in instrumental and vocal closed room settings as a risk reducing measure for a Coronavirus infection. Manfred Nusseck, Bernhard Richter, Ludwig Holtmeier, Dominik Skala, Claudia Spahn. medRxiv 2020.10.26.20218354; doi: <https://doi.org/10.1101/2020.10.26.20218354>
- 3) Eykelbosh, A. Indoor CO2 Sensors for COVID-19 Risk Mitigation: Current Guidance and Limitations. Vancouver, BC: National Collaborating Centre for Environmental Health. 2021 May. <https://ncceh.ca/documents/field-inquiry/indoor-co2-sensors-covid-19-risk-mitigation-current-guidance-and>
- 4) Changes in CO2 concentration in the conference room from “Recommendations for ventilation of indoor spaces to reduce COVID-19 transmission”, Chung-Yen Chen et-al. 5 August 2021. <https://www.sciencedirect.com/science/article/pii/S092966462100365X>
- 5) University of Colorado at Boulder. "Carbon dioxide levels reflect COVID-19 risk: Research confirms value of measuring carbon dioxide to estimate infection risk." ScienceDaily. ScienceDaily, 7 April 2021. <[www.sciencedaily.com/releases/2021/04/210407143809.htm](http://www.sciencedaily.com/releases/2021/04/210407143809.htm)>.

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- All surveys can be taken in the Cisco Events Mobile App or by logging in to the Session Catalog and clicking the "Attendee Dashboard" at <https://www.ciscolive.com/emea/learn/sessions/session-catalog.html>



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Attend any of the related sessions at the DevNet, Capture the Flag, and Walk-in Labs zones.



Visit the On-Demand Library for more sessions at [ciscolive.com/on-demand](https://ciscolive.com/on-demand).



The bridge to possible

# Thank you

CISCO *Live!*

CISCO *Live!*

ALL IN