The bridge to possible

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

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@ekktor

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DEVNET-2778

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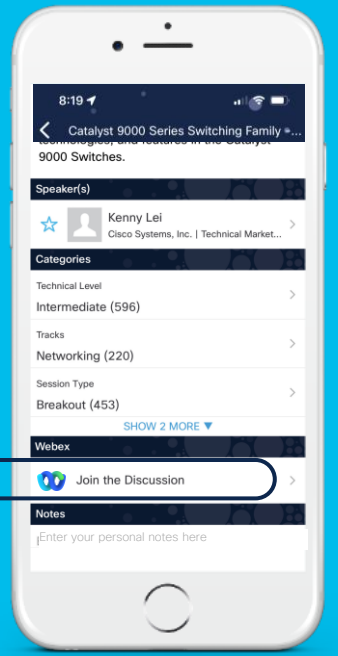


Abstract

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.

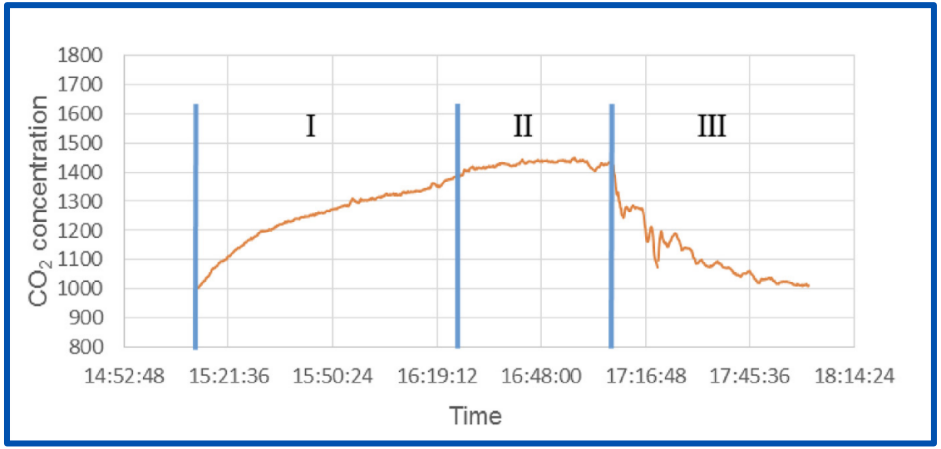
Agenda

- 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_2 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_2 concentration and the risk of infection [4]

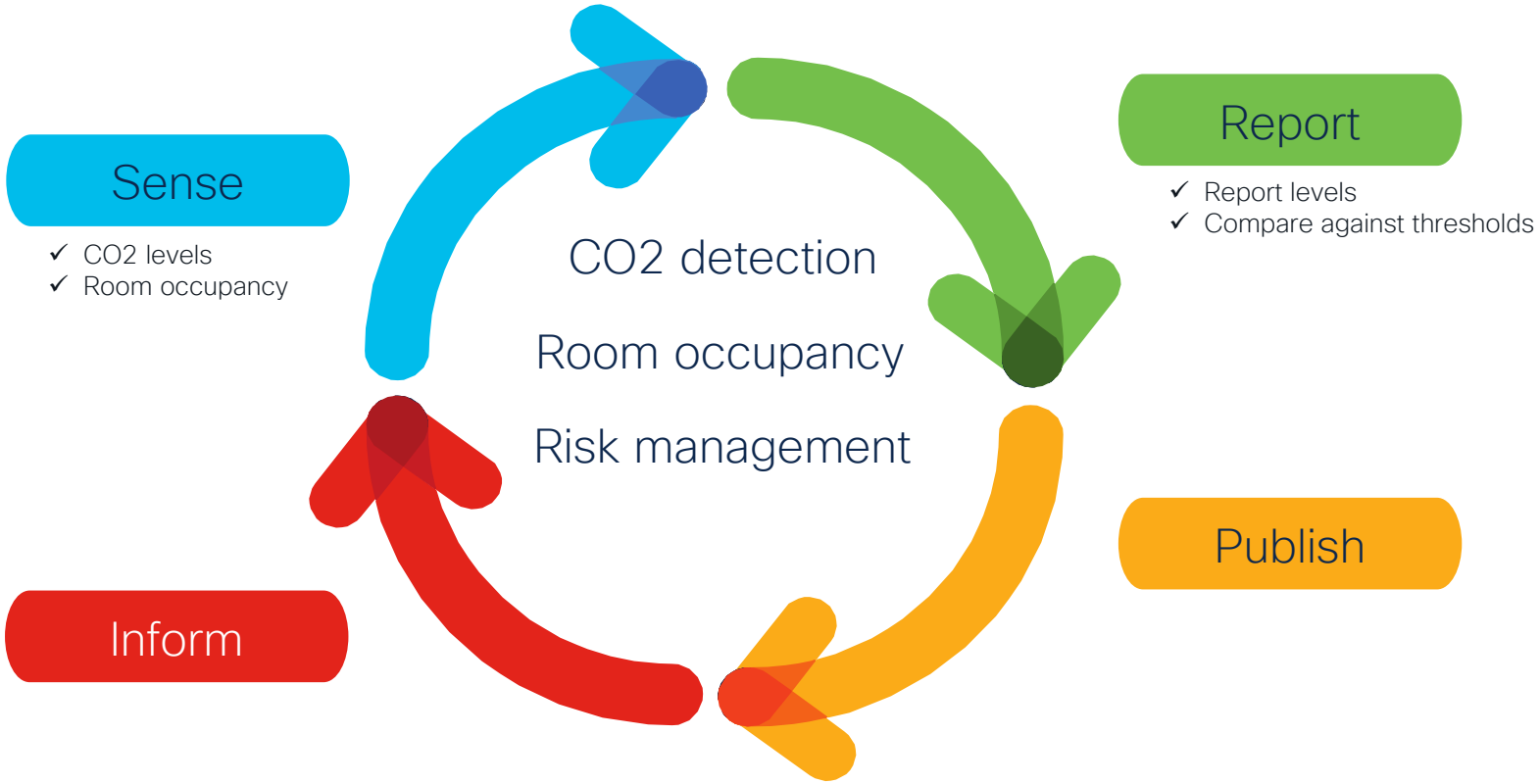


SOURCE - Changes in CO_2 concentration in the conference room from "Recommendations for ventilation of indoor spaces to reduce COVID-19 transmission", Chung-Yen Chen et-al. 5 August 2021. https://www.sciencedirect.com/science/article/pii/S092966462100365X

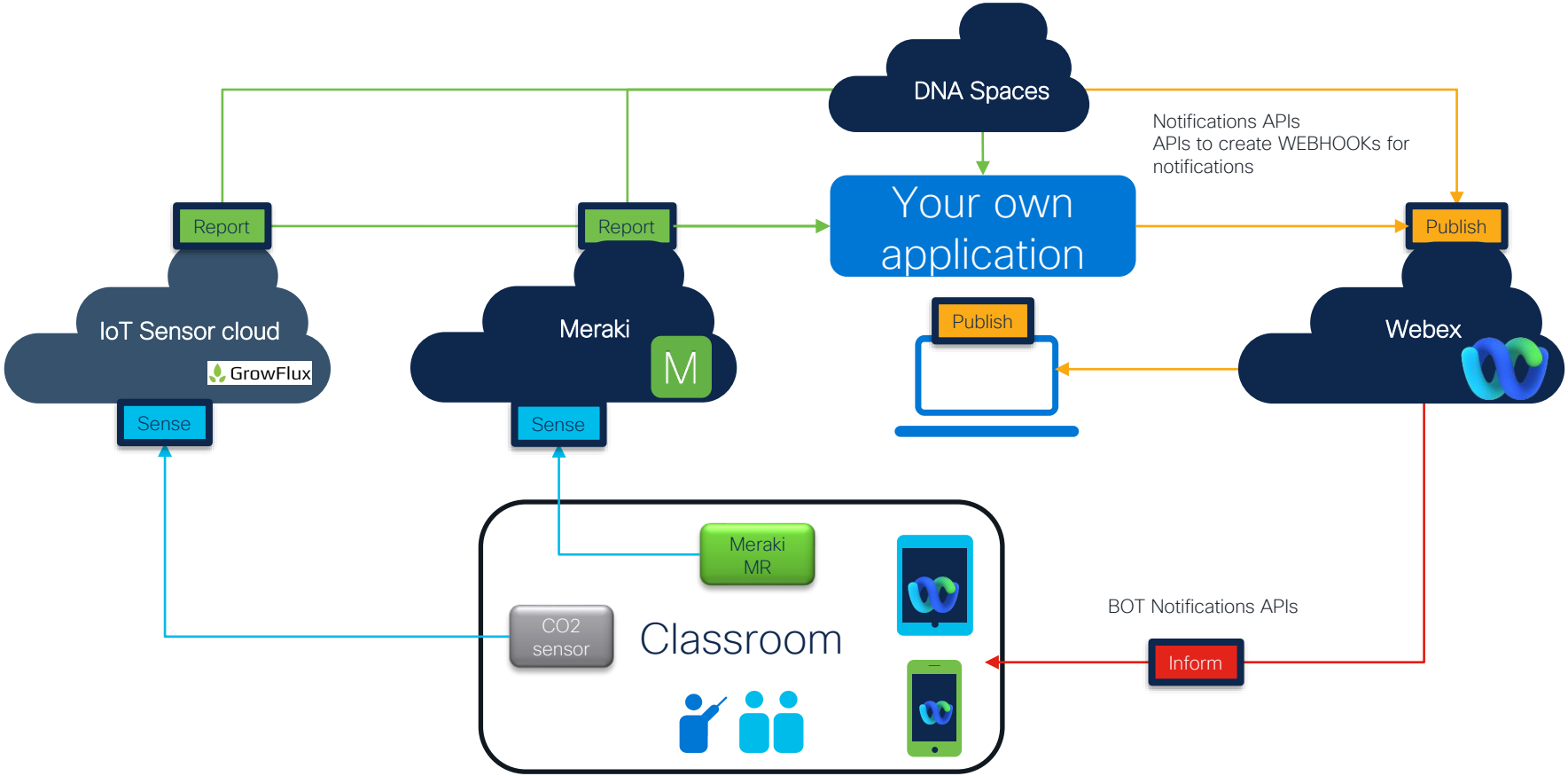
Proposal

- 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

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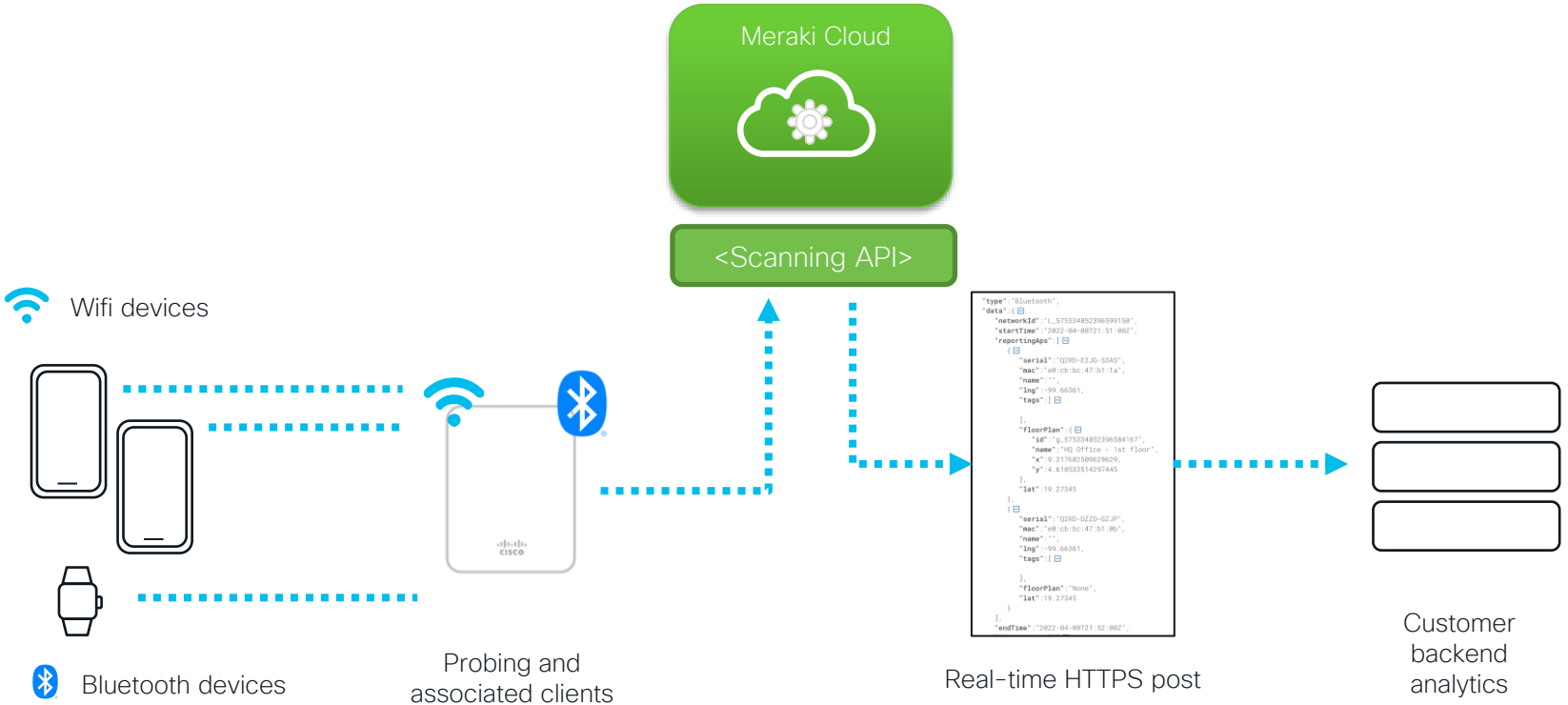
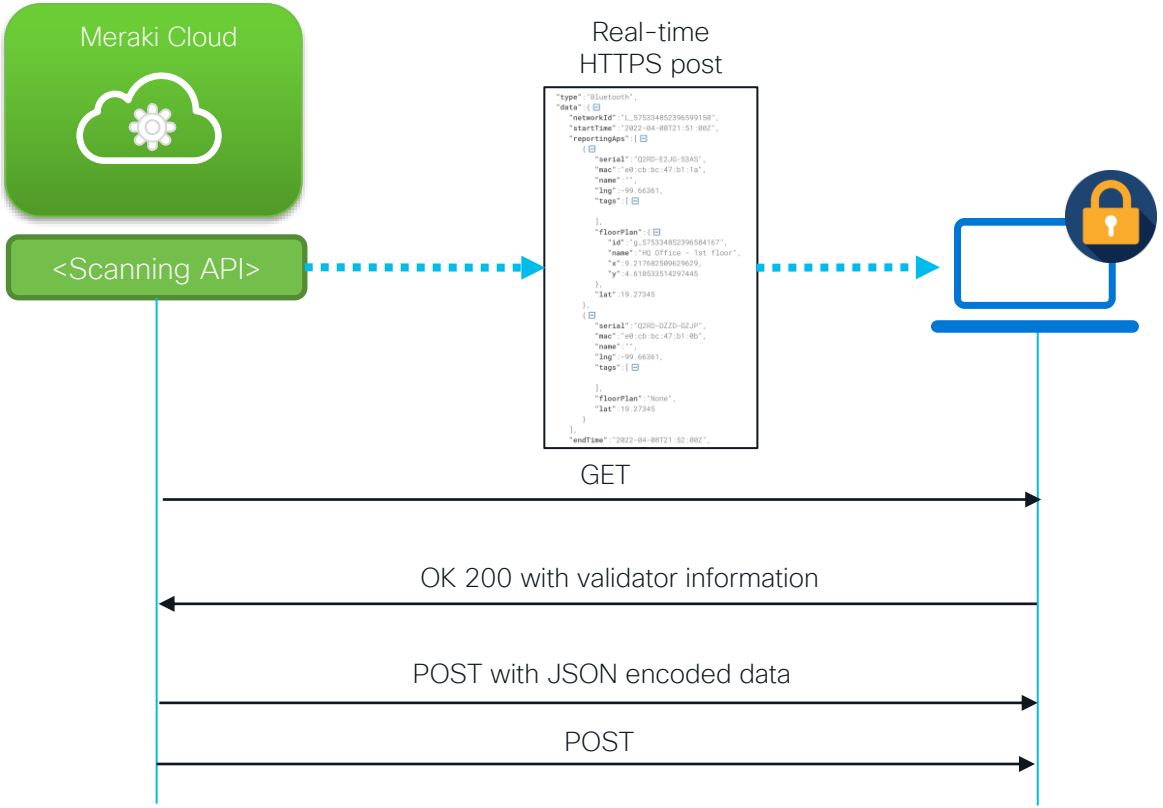
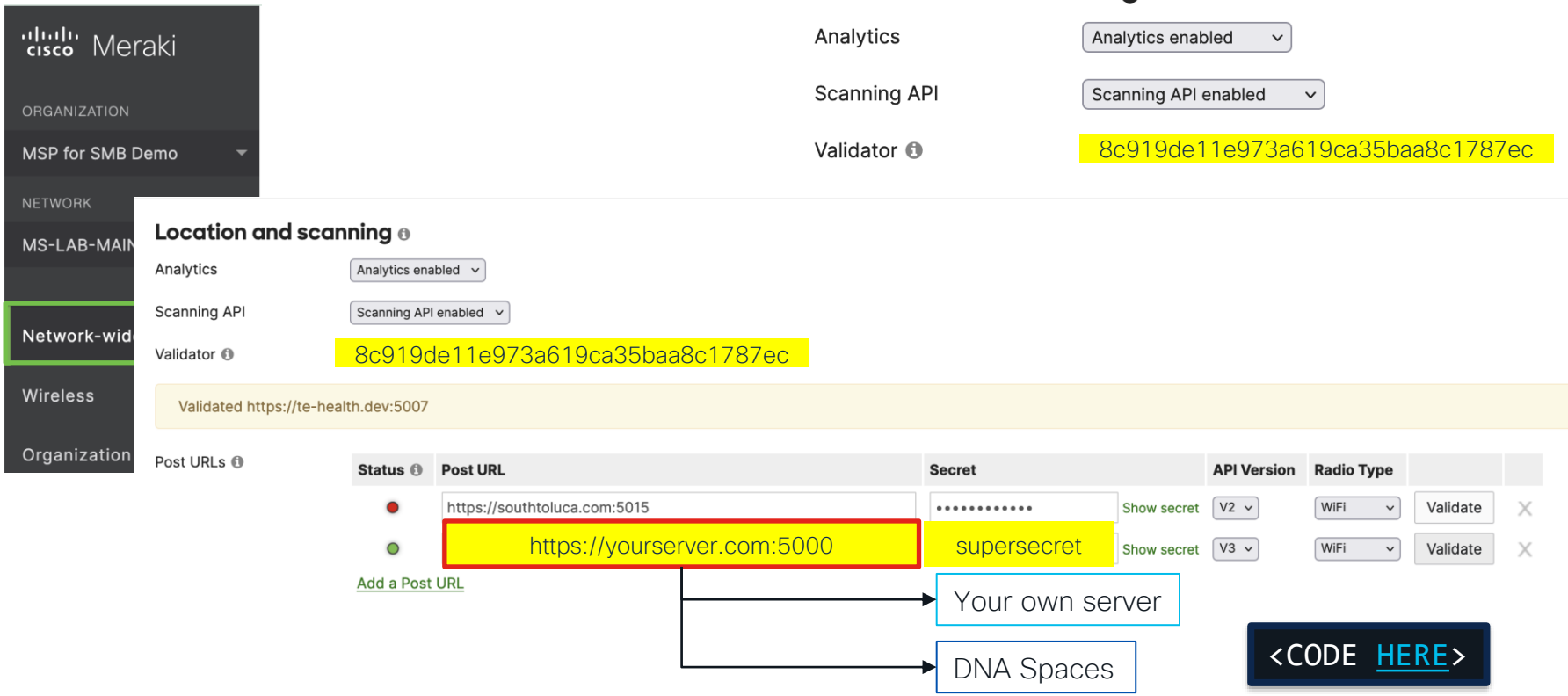
How Scanning API works



Meraki Scanning API flow



Configuring Scanning API



Meraki + DNA Spaces integration

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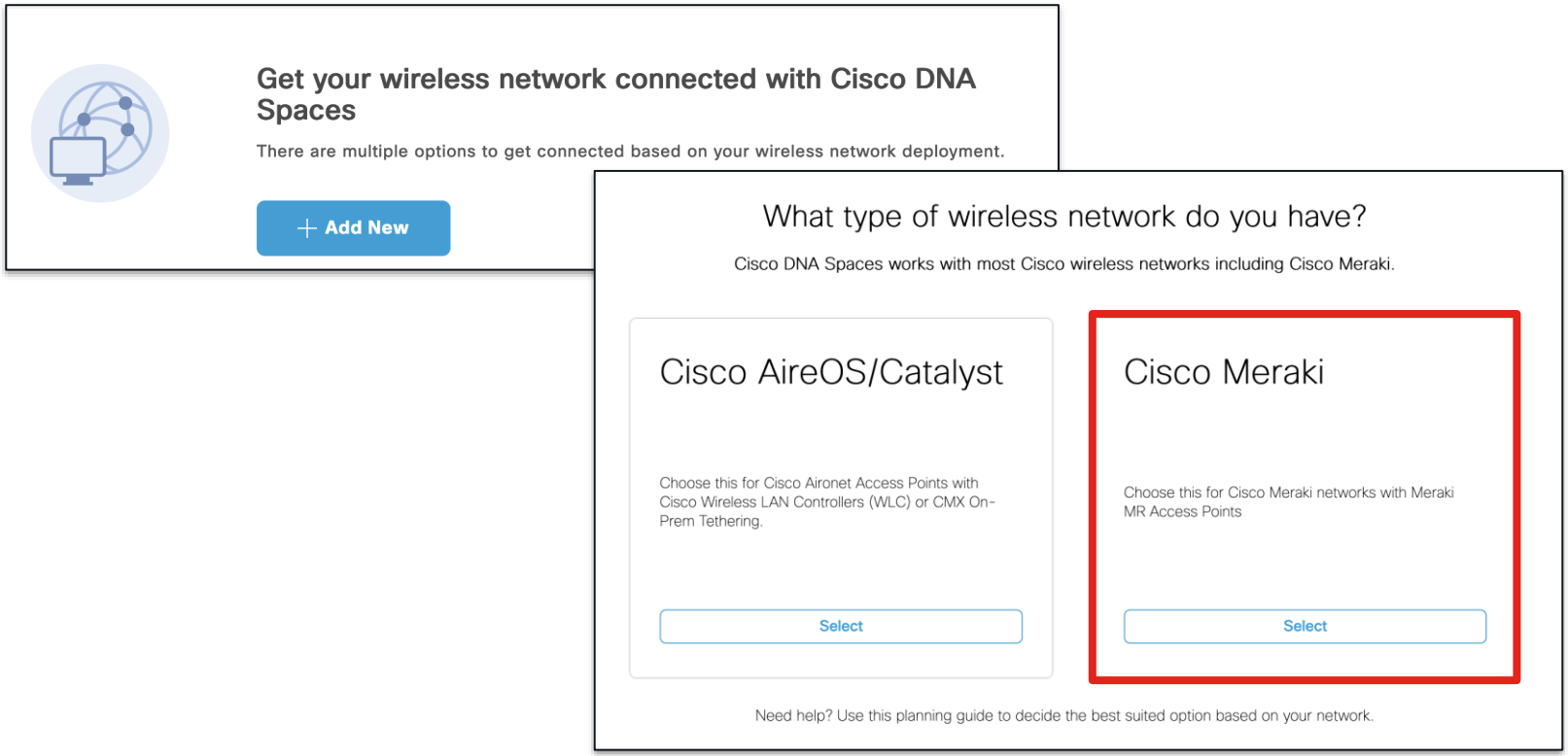
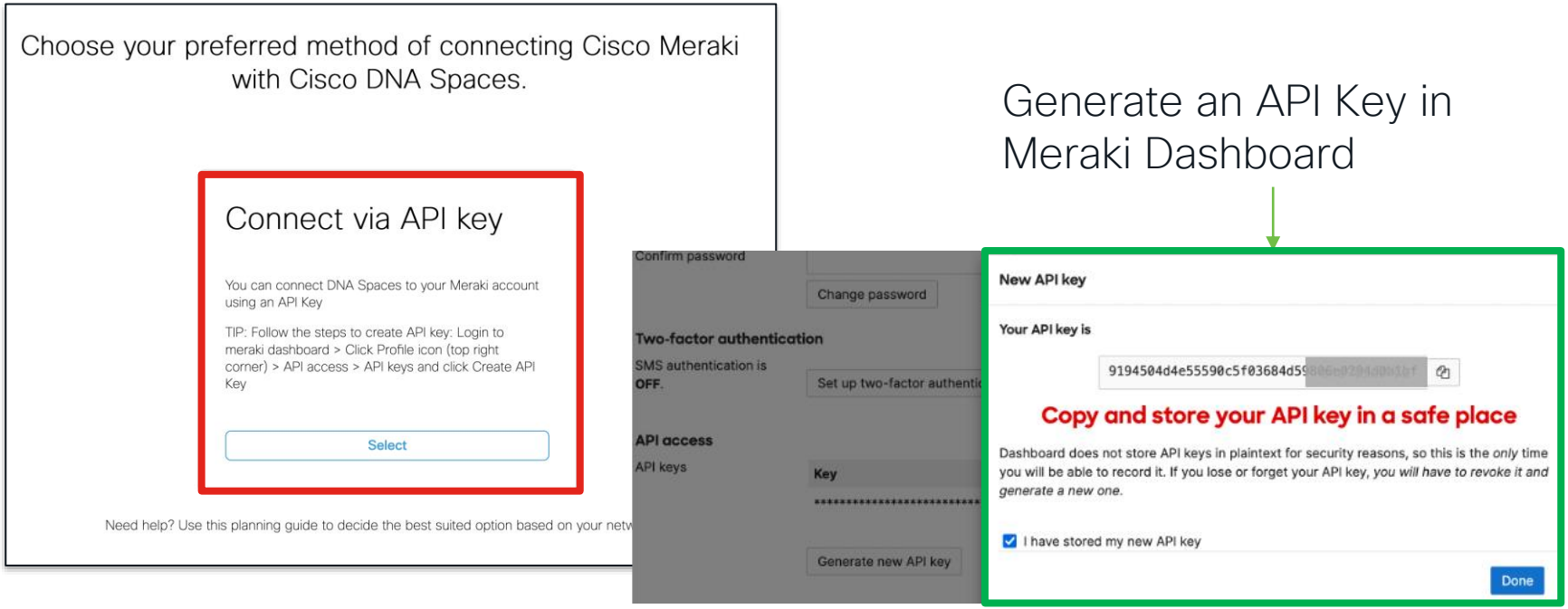
Meraki and DNA Spaces integration

1 – Add new wireless network

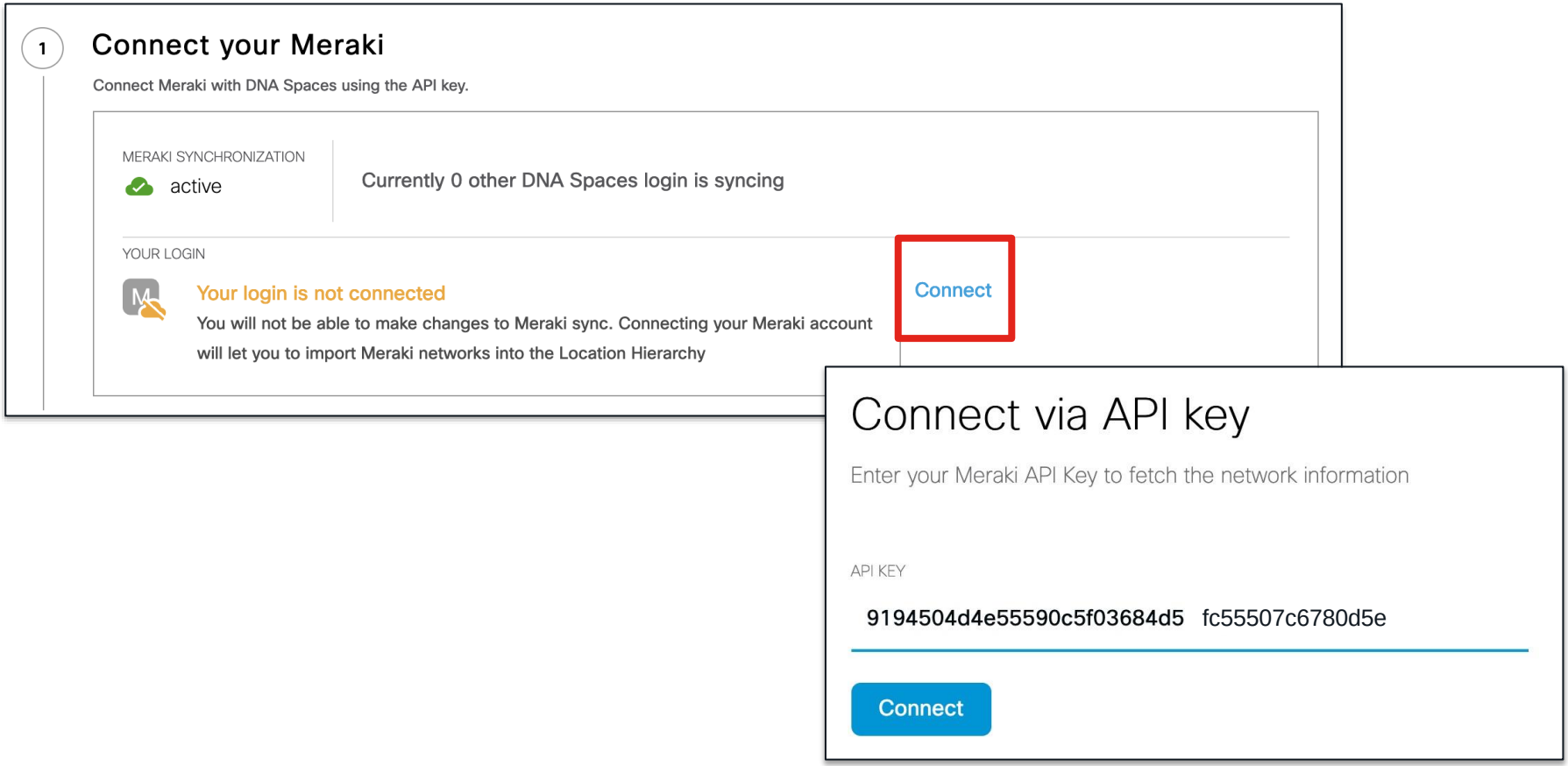


Meraki and DNA Spaces integration

2 – Add Meraki API Key

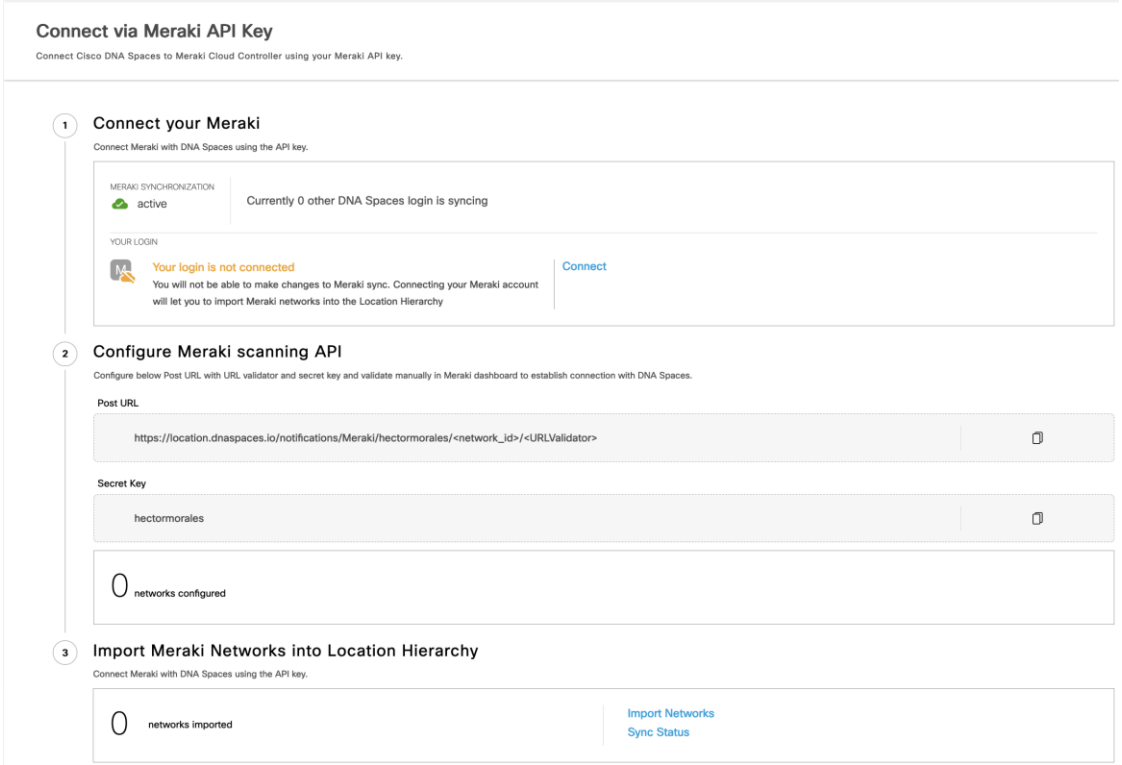


Meraki and DNA Spaces integration

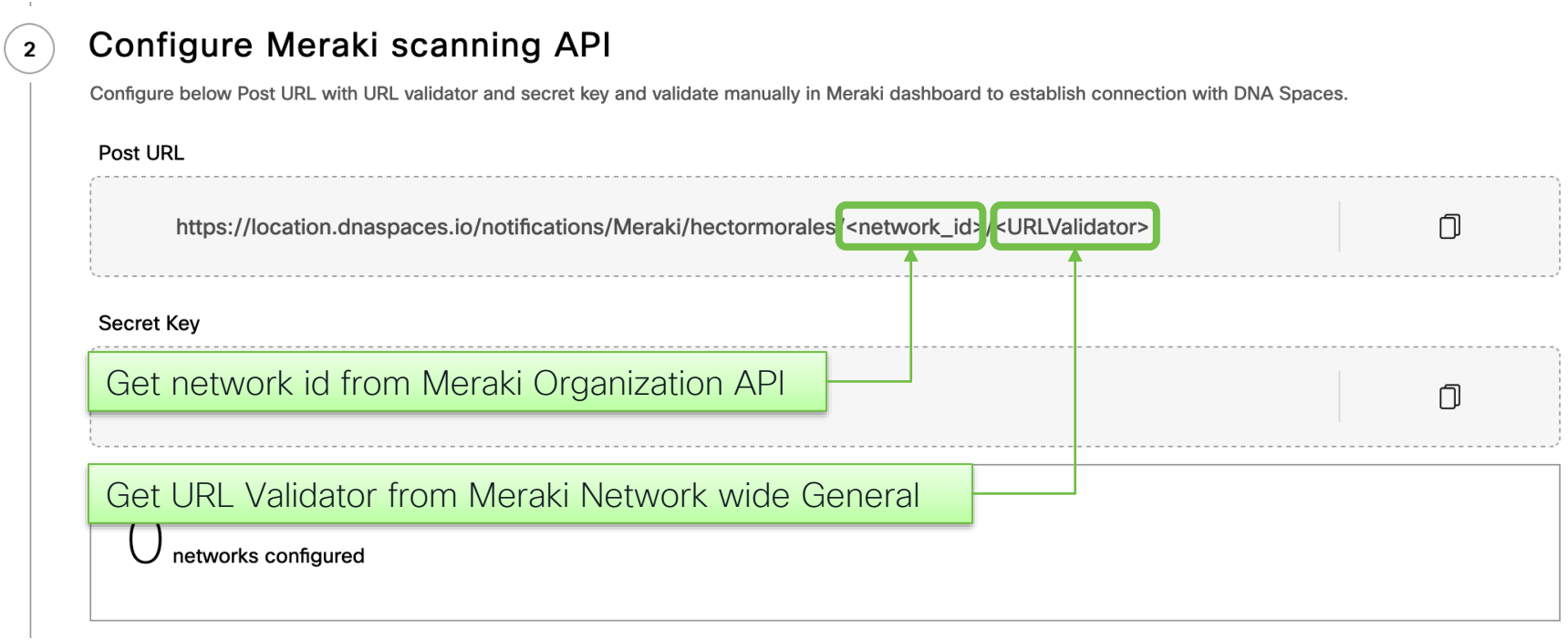


Meraki and DNA Spaces integration

3 – Connect via Meraki API Key



Meraki and DNA Spaces integration



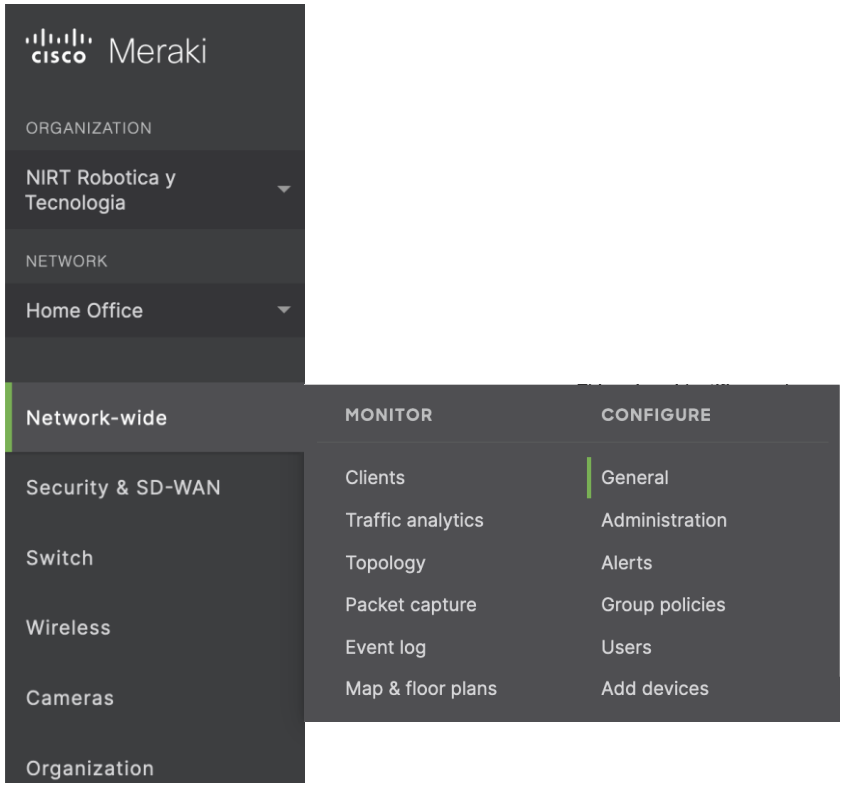
Meraki Dashboard API Documentation

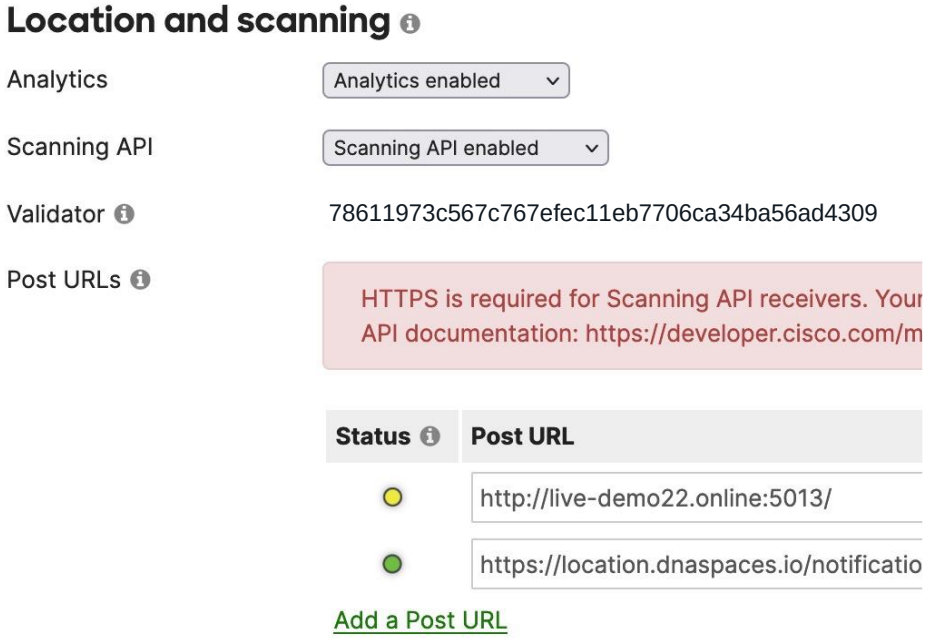
Meraki and DNA Spaces integration

Get network id from the organization

Meraki and DNA Spaces integration

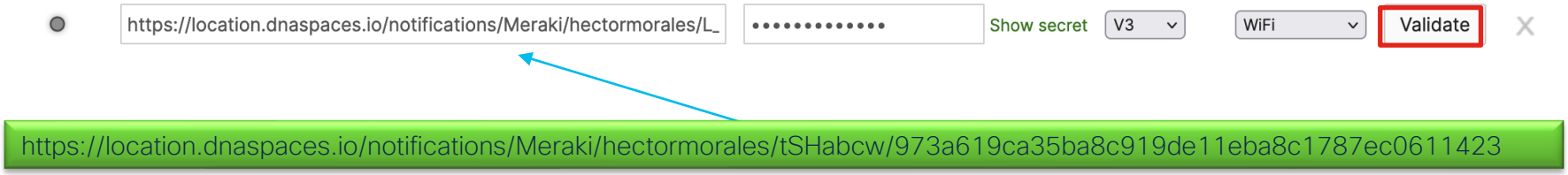
Get Validator





Meraki and DNA Spaces integration

Validate URL



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CO2 meter and Meraki MR as sensors

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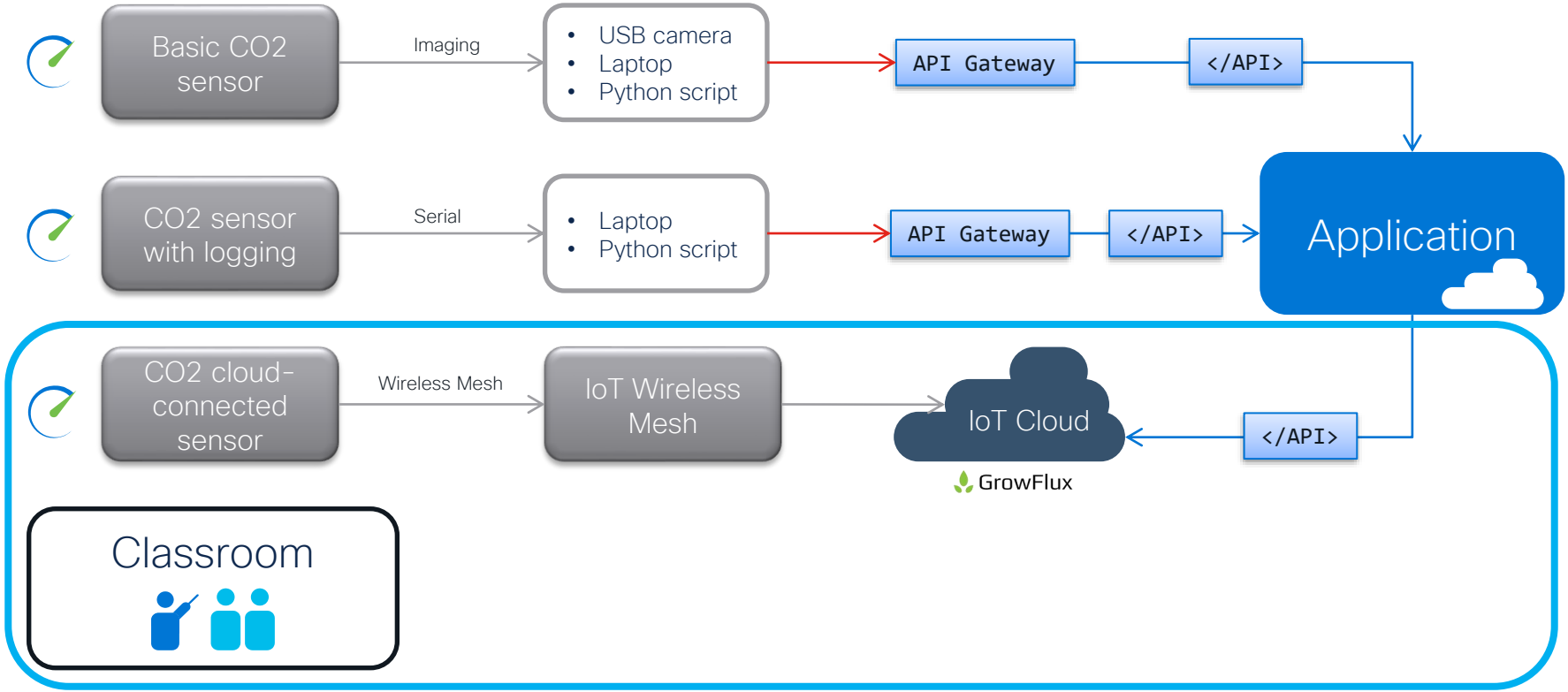
Solution components

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

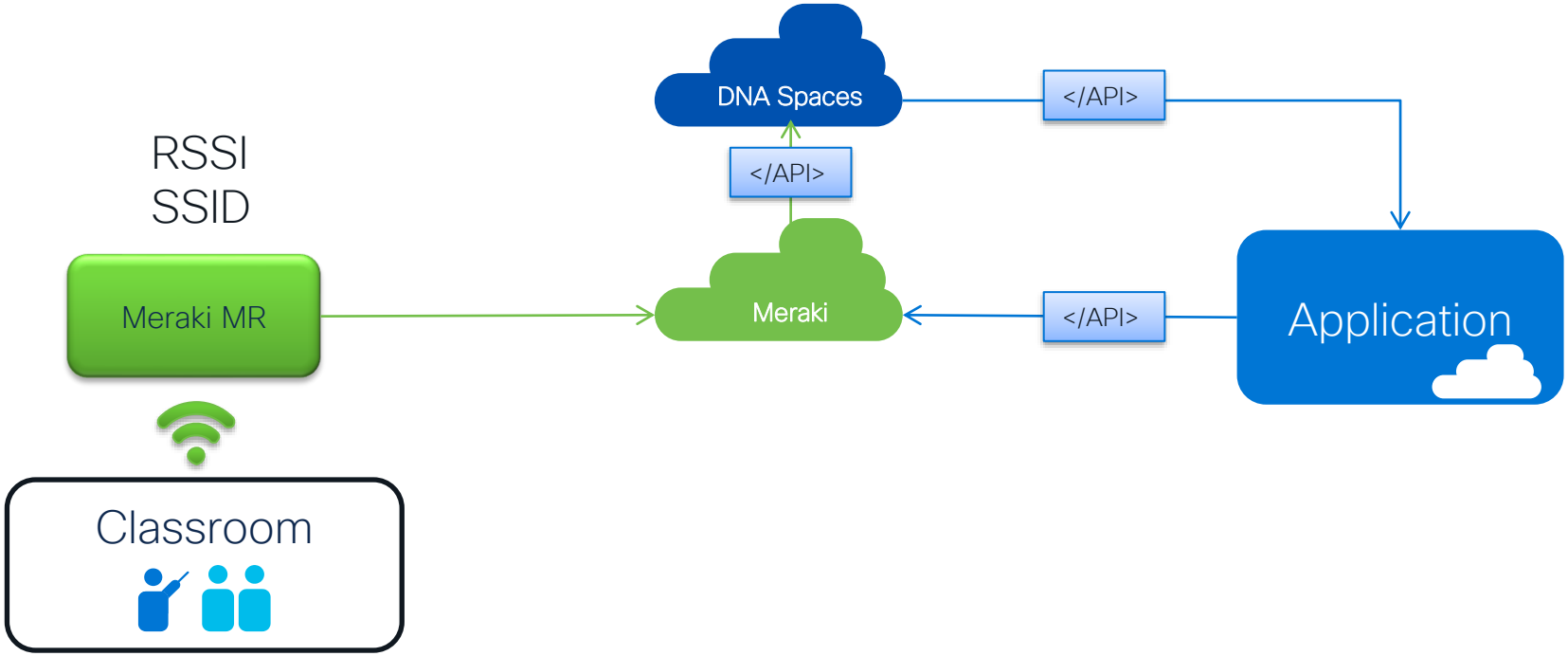


GrowFlux API Documentation

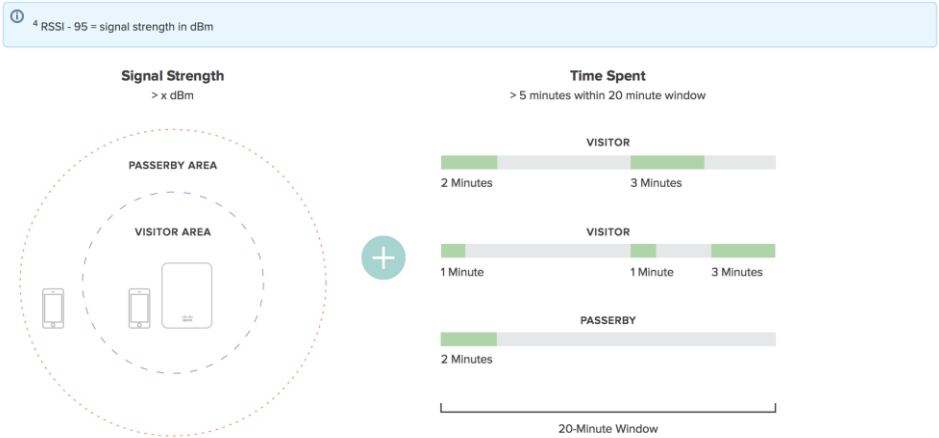
GrowFlux API

```
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?



- 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

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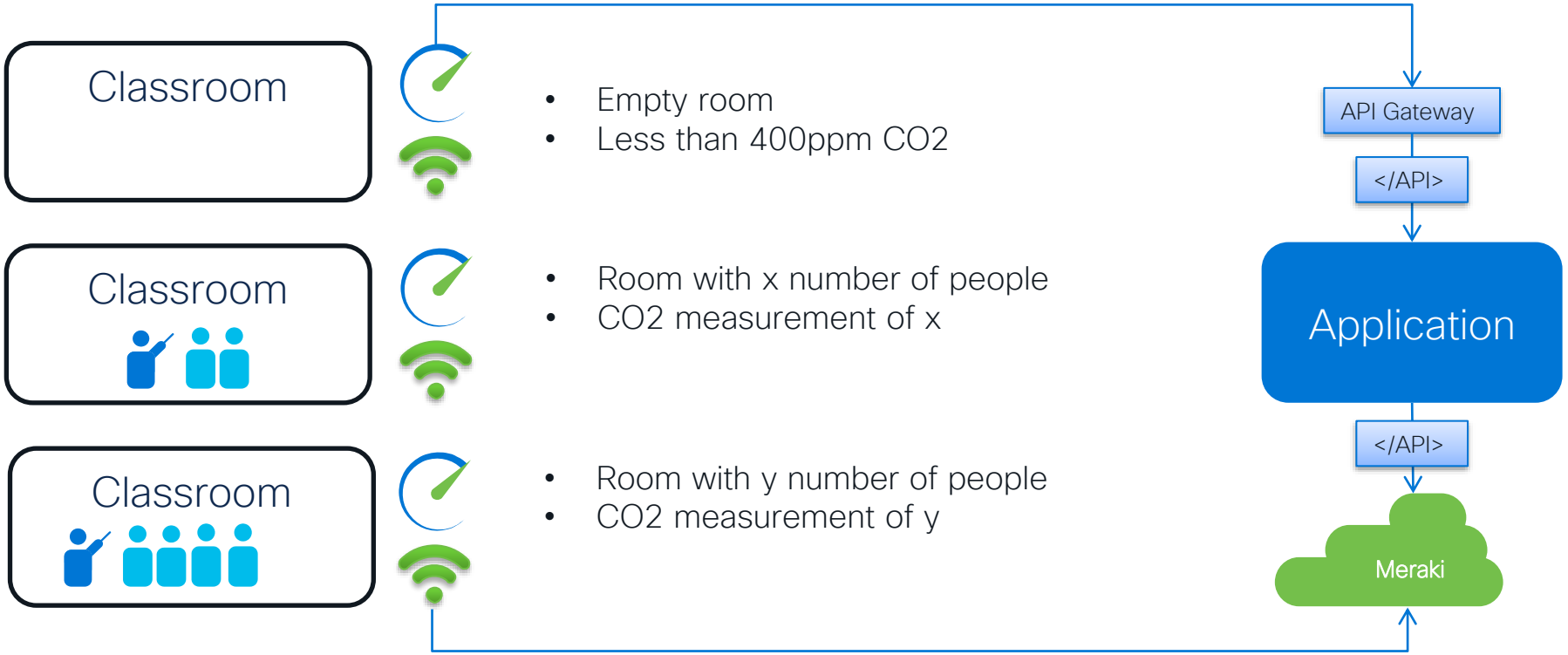
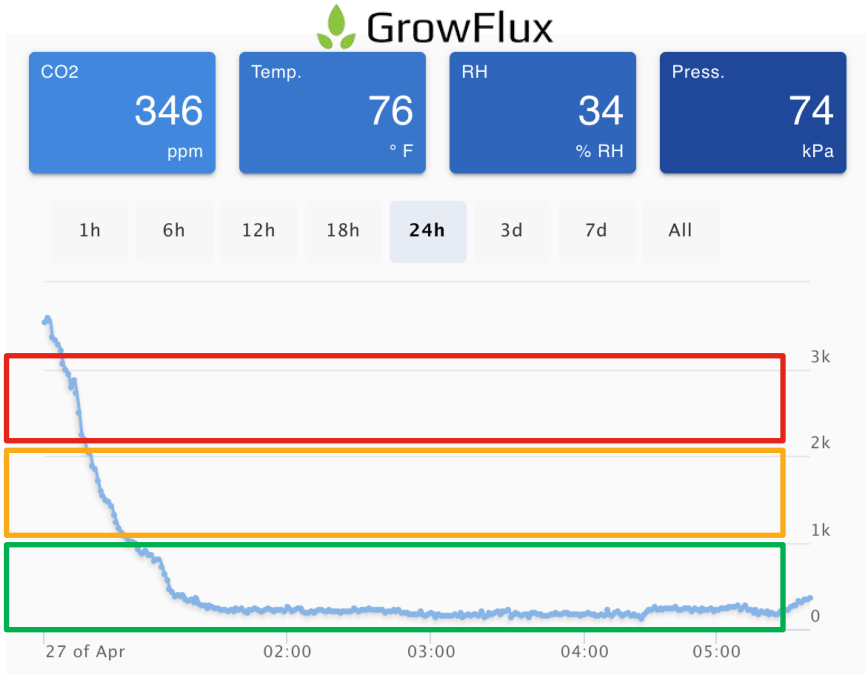
Dynamic Room Calibration



Dynamic Thresholds

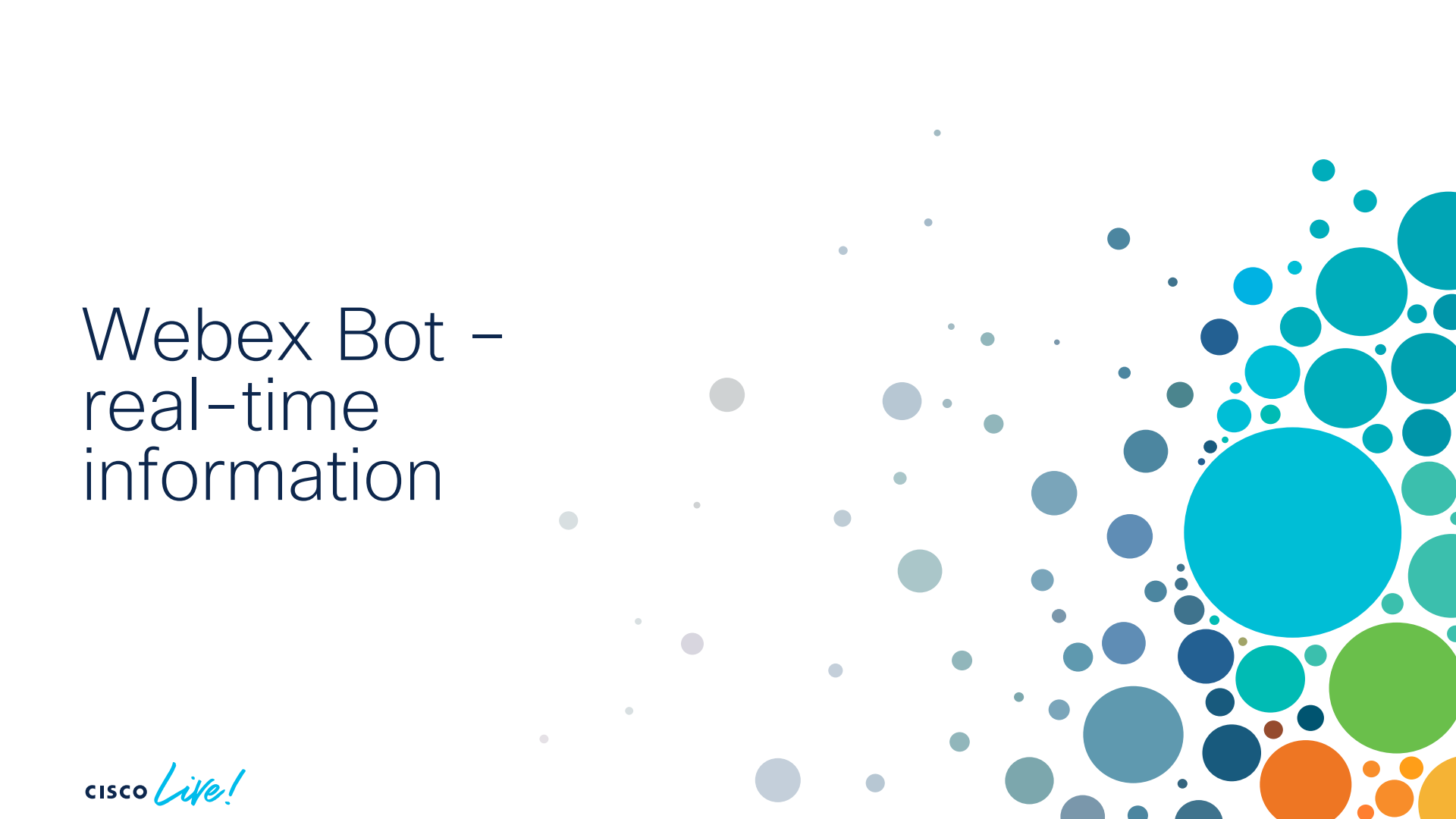


CO2 levels + People in the room

Danger zone

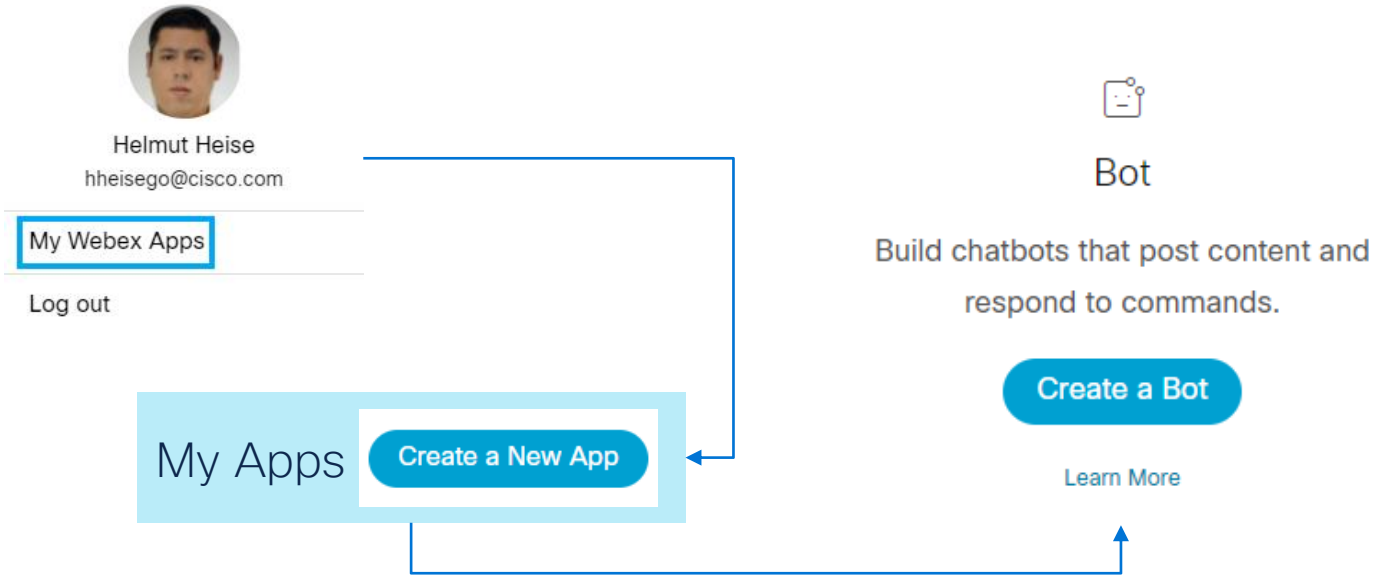
Safe zone

Webex Bot – real-time information

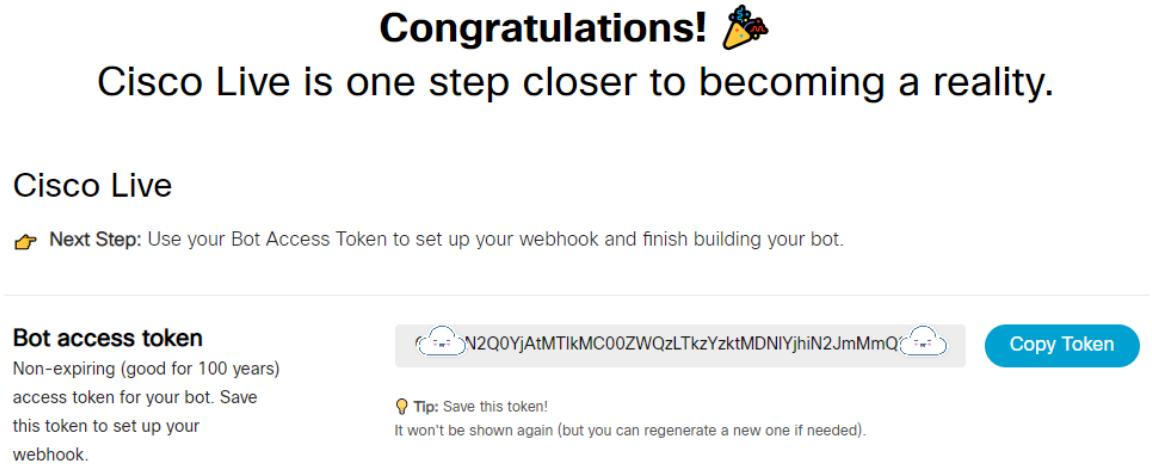


Create a Bot account

https://developer.webex.com/



Get your bot’s access token

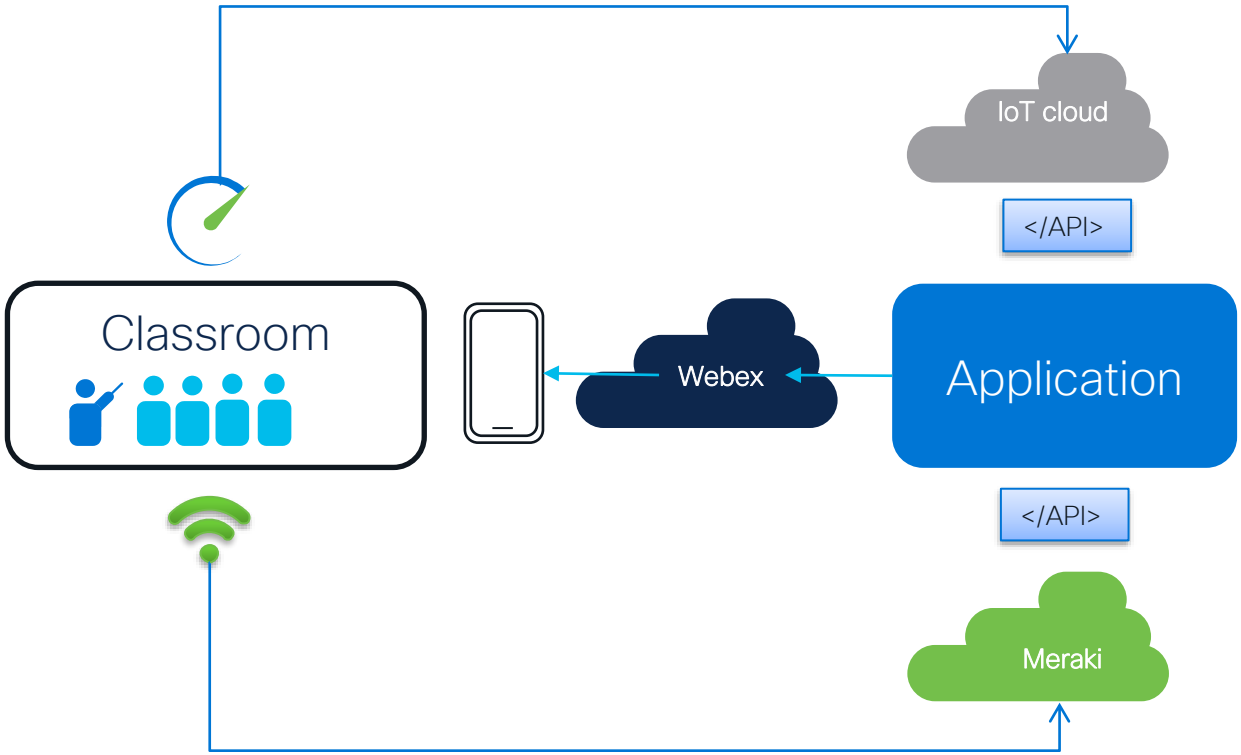


Webex Python SDK

https://github.com/CiscoDevNet/webexteamssdk

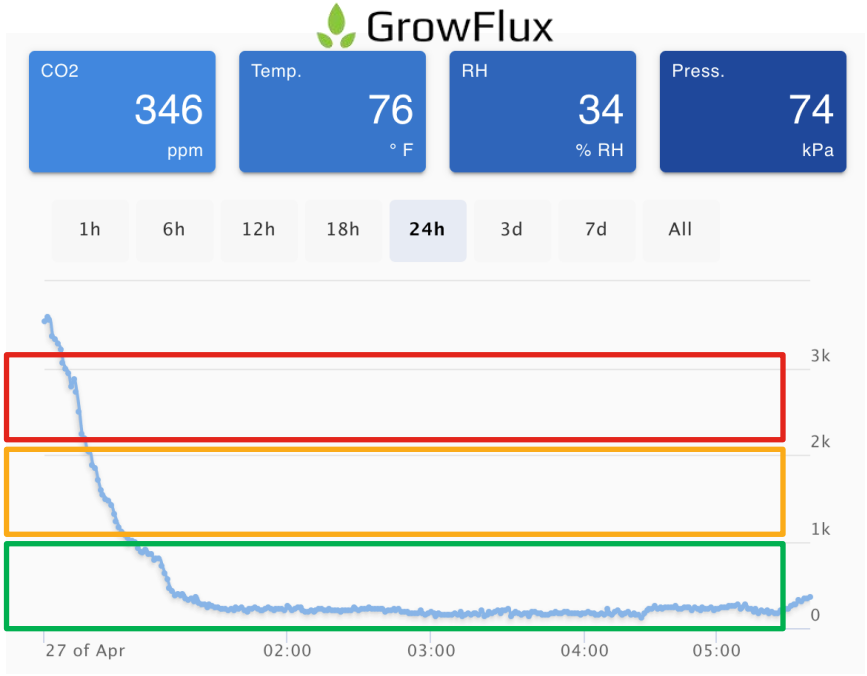
```
from webexteamssdk import WebexTeamsAPI

# 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 += "\nCO2: " + 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 += " CO2: " + 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>.

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