

The Cisco Live! logo features the word "CISCO" in a dark blue, sans-serif font, followed by "Live!" in a dark blue, cursive script font. The background of the entire image is a vibrant, multi-colored abstract pattern of overlapping, wavy lines and geometric shapes, transitioning from dark blue on the left to bright yellow and white in the center, and then to various shades of blue and green on the right.

CISCO *Live!*

Let's go



The bridge to possible

Saving Energy and Money with Your Cisco Wireless Network

Simone Arena, Distinguished TME, Cisco Wireless

CISCO *Live!*

BRKEWN-2043

It all started 7000 Years Ago....



There is
NO Planet B

Why Now?

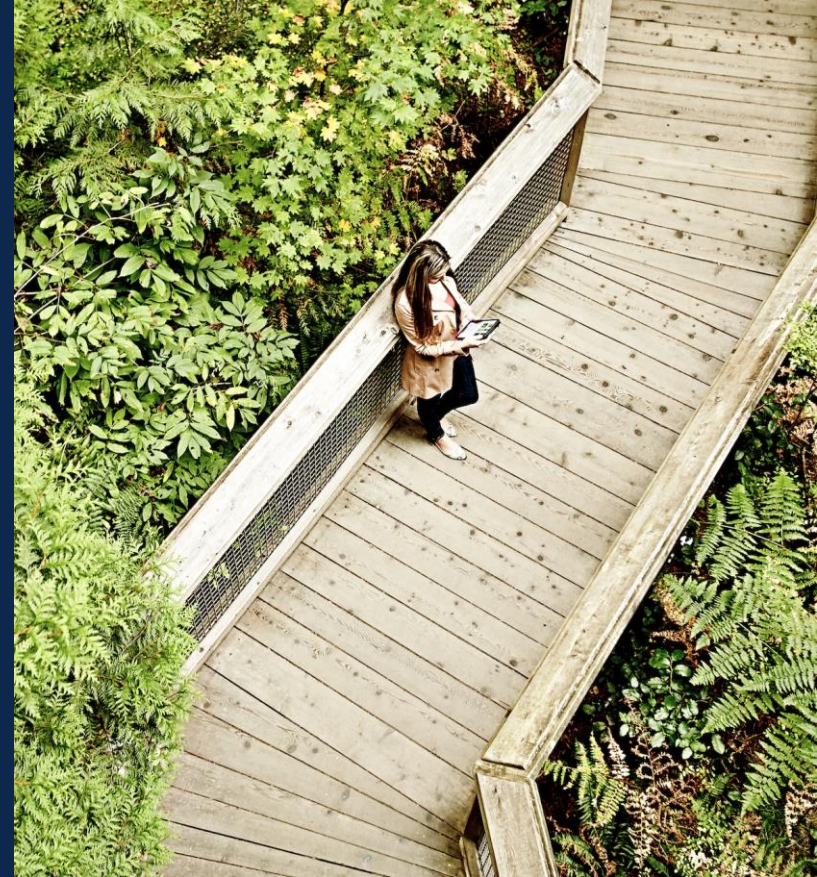
63%

sustainability
is a business
priority



37%

have formulated their
targets and goals



Enabling Sustainability Through Investments in Technology Is
Critical to Driving Business Value, IDC, 2023



ORANGE VELODROME

- 1041 APs
- 43 switches

This infrastructure is turned on day and night and 365 days per year and consumes **105 MWh** for only **30 days** of use.

Goal:

- Cut network equipment energy consumption by 50%
- Save 70K€/year on energy bill
- Significant reduction in MWh and CO2 emission

Solution:

- Turn off APs and switches in unused areas
- Possibility to turn off the network infrastructure dynamically depending on presence
- More here: <https://www.youtube.com/watch?v=8Y5kD9VEJzI>



Wrexham County Borough Council

Rethinking IT infrastructure to reduce cost and carbon emissions across 70 schools

Wrexham County Borough Council

- 1100+ Meraki MR Wi-Fi 6
- 250 Meraki MS switches

Wrexham is the fourth-largest city in Wales. Wrexham County Borough Council (WCBC) manages 70 schools, used by 20k students.

Goal:

- WCBC itself wants to be carbon neutral by 2030
- Future-proofs the schools' networks to reduce energy use and enable smart building management

Solution:

- Using WiserWatts* and MS port schedules, the network starts-up at 7:30am, and switch off at 8:30pm
- £22,000 in potential cost reductions for fiscal year 2023/2024
- Expected annual reduction of ten metric tons of CO₂e

More here: <https://meraki.cisco.com/customers/wrexham-county-borough-council/>

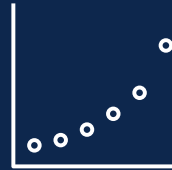
* in partnership with

CAE
TECHNOLOGY ON POINT

Where to start?



Sustainable Goals



Metrics



Data



<https://sdgs.un.org/goals>



Goals

Cisco's Goal Net zero GHG emissions across our value chain by 2040

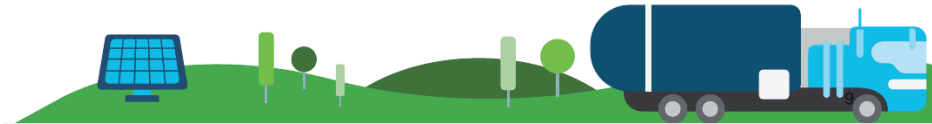
Our 2040 net-zero goals and near-term targets are approved by the Science Based Targets initiative (SBTi).



DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

CISCO *Live!*

BRKEWN-2043



Sustainability Metrics

Scope 1

Direct emissions from operations owned by the company

Examples:
Heating fuel, company vehicles

Scope 2

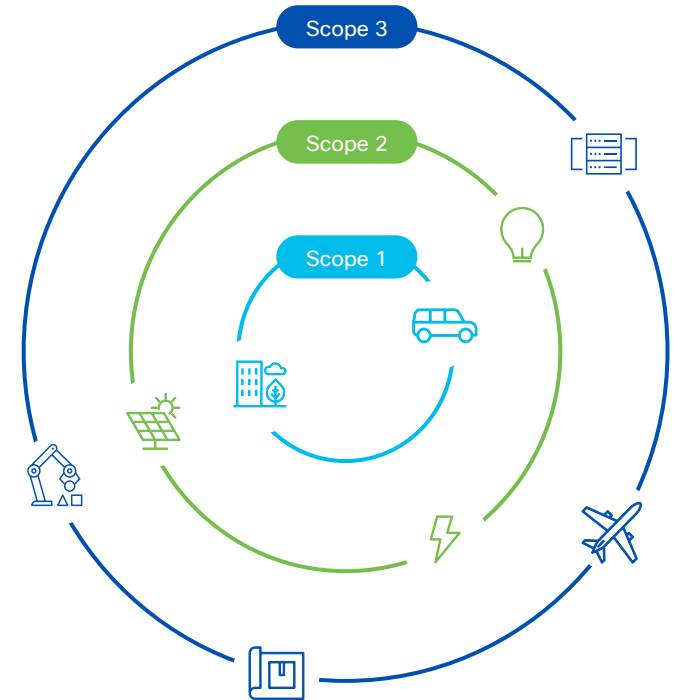
Indirect emissions from the generation of purchased electricity, steam, heating and cooling

Examples: Electricity used in company buildings

Scope 3

All other indirect emissions that occur in a company's value chain

Examples: Employee business travel and commuting, supplier emissions, use of sold products, transportation and distribution



The three scopes of greenhouse gas emissions

Scope 1
Emissions from
fuels we buy
and burn within
our operations.

- Natural gas used to heat our buildings
- Back-up generators that run on diesel
- The gasoline and diesel used in Cisco-owned vehicles

The three scopes of greenhouse gas emissions

Scope 2
Emissions from
electricity we buy
for our operations.

- Electricity we use in our labs and data centers to run our equipment
- Running our HVAC systems and keeping the lights on

The three scopes of greenhouse gas emissions

Scope 3
Emissions related to our business that we don't own or control.



- Electricity our products consume after we sell them
- Our suppliers' energy use
- Transporting our products
- Employee commuting in their personal vehicles

Goals

Cisco's Goal Net zero GHG emissions across our value chain by 2040

Our 2040 net-zero goals and near-term targets are approved by the Science Based Targets initiative (SBTi).

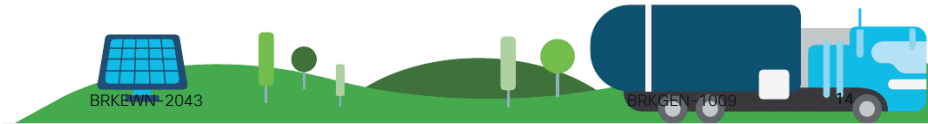
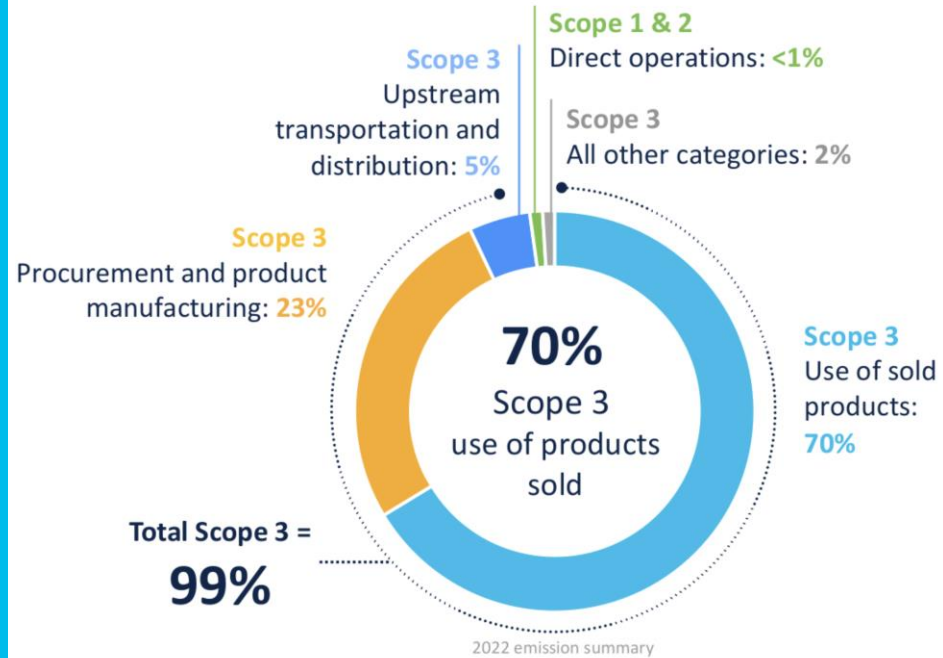


DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

CISCO *Live!*

BRKEWN-2043

Metrics

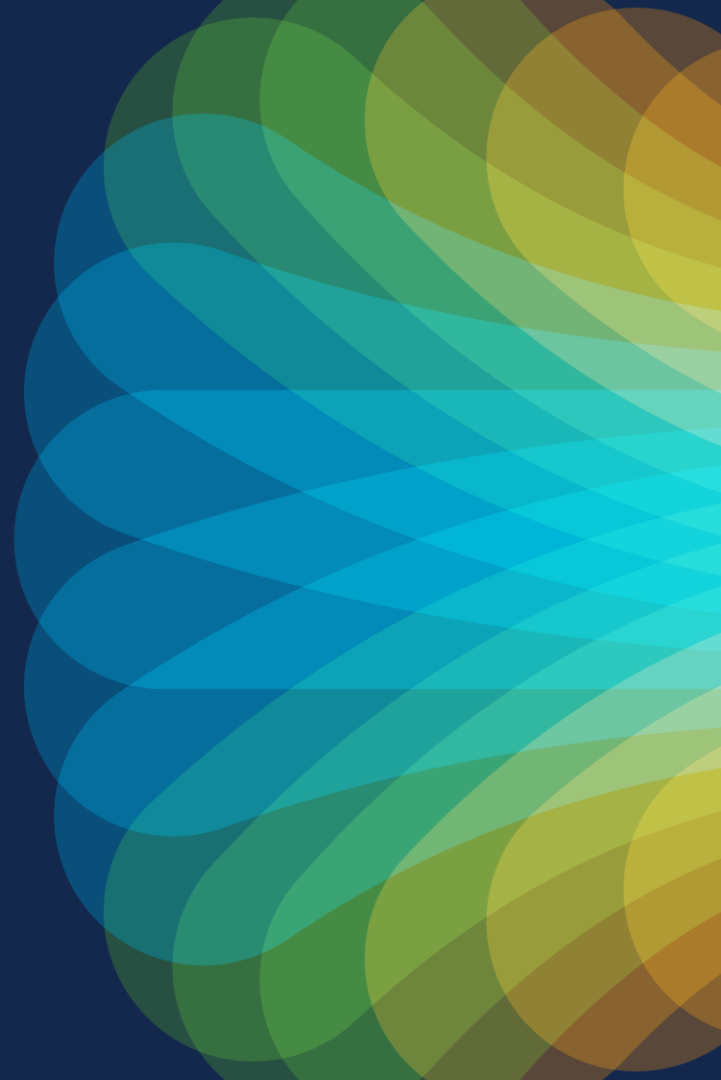


BRKEWN-2043

BRKGEN-7009

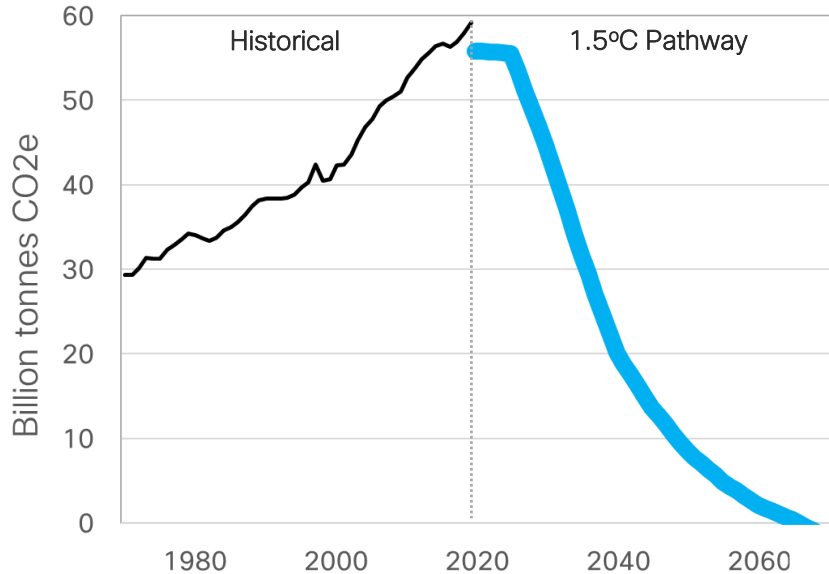
34

Sustainability: What about the data?



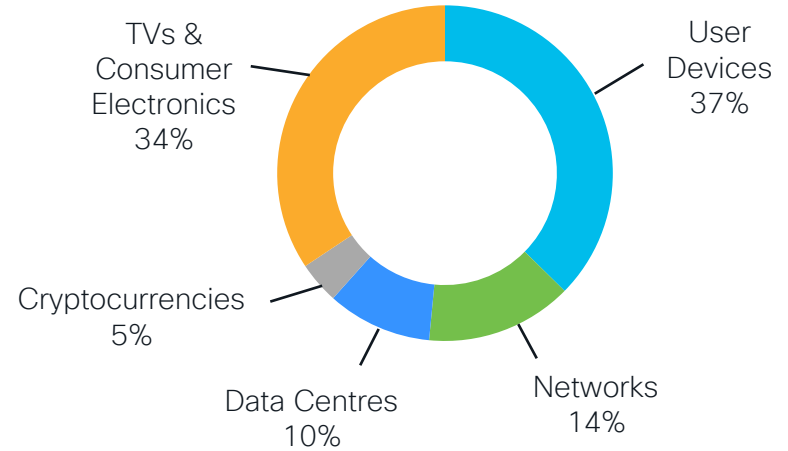
What is the role of the Network and IT?

Total GHG emissions
~60 Billion tonnes CO₂e



Based on data from: EDGARv7.0, Crippa et al (2021, 2022), IIASA (AR6 Scenario database)

Digital GHG emissions
~1.4 Billion tonnes CO₂e (2-4% Total)



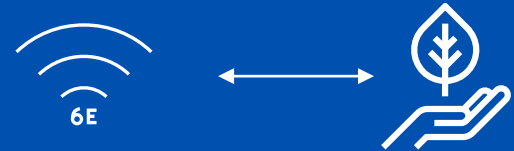
Digital = ICT + Entertainment & Media

Source: Freitag (2021), Malmodin (2018), Andrae (2019)

What is the role the Network and IT?



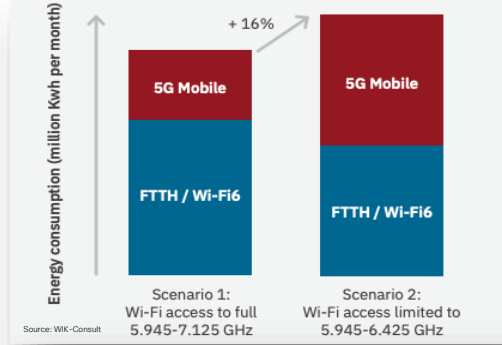
IT plays a bigger role than you think in Sustainability and NetZero strategy



* Berners Lee (2020) - <https://howbadarebananas.com/>
* https://smarter2030.gesi.org/downloads/Full_report.pdf

Wi-Fi 6E and Sustainability?

No full 6GHz spectrum > 16% higher energy consumption which would lead to 3.2 megatons of additional CO2 emissions in EU per year by 2030



<https://www.youtube.com/watch?v=6PGrnX-P28s>



<https://www.wifi.org/download.php?file=/sites/default/files/private/SustainabilityBenefitsof6GHzSpectrumPolicy202307.pdf>

Wi-Fi 6E and Sustainability?

<https://6ghz.info/>

6 GHZ FOR LICENCE-EXEMPT ACCESS

[Home](#) [Global Progress](#) [Policy Resources](#) [Media Resources](#) [Blog](#)

Presenting an evidence base
for enabling licence-exempt
access to the 6 GHz band (5925–7125 MHz)

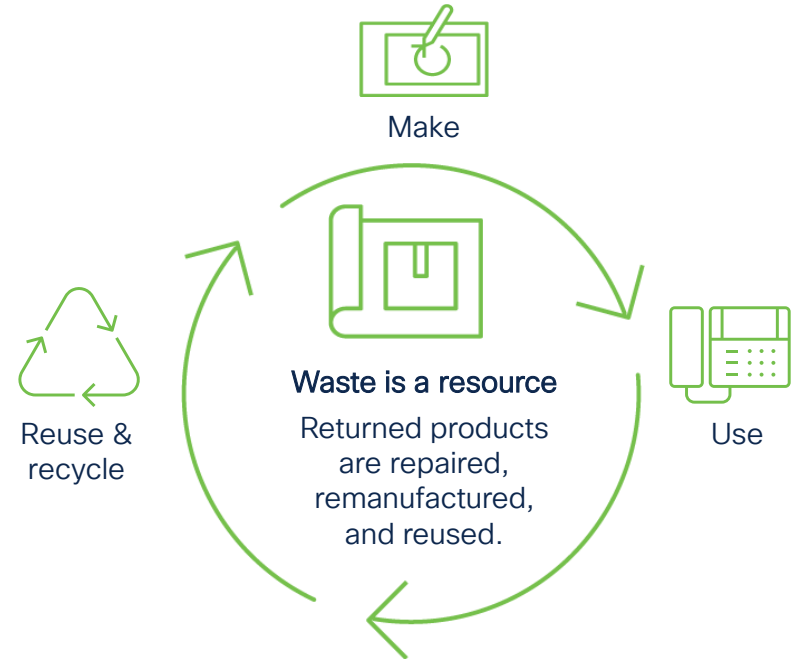
Circular Design for Cisco Wireless

Circular Design

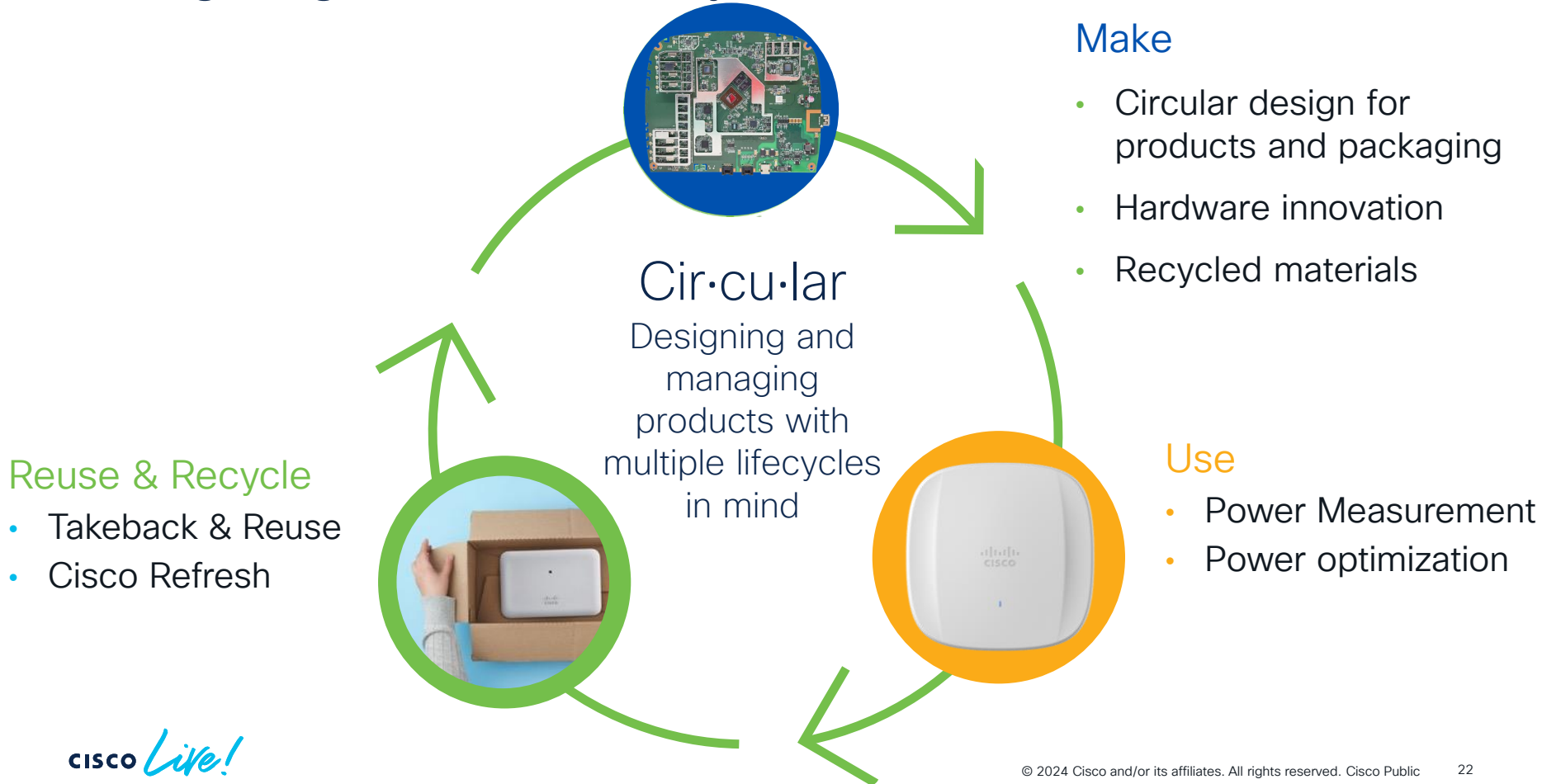
Linear Design



Circular Design



Designing for Circularity



Not all APs are created equal!

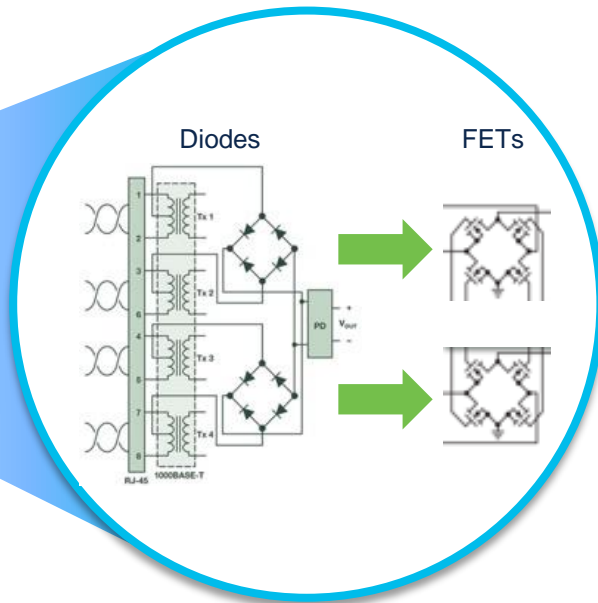
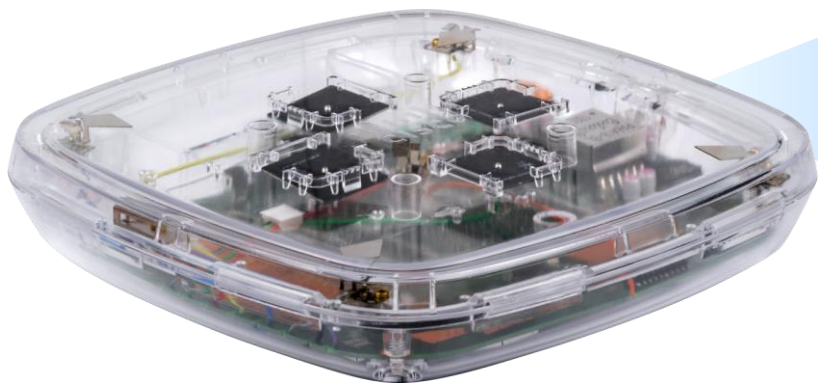
Printed Circuit Board Design



- Design of the PoE front end
- Transformer custom design
- FETs (Field Effect Transistors)



Not all APs are created equal!



Every Watt, or fraction of a Watt matters!

Not all APs are created equal!

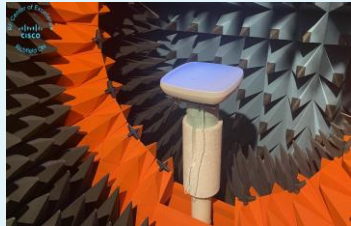
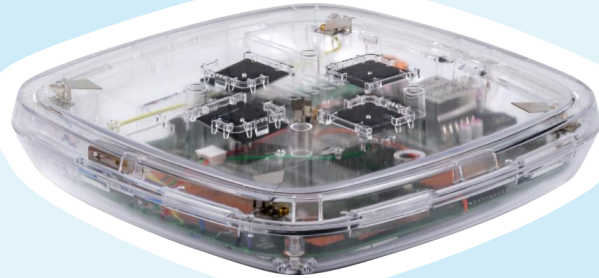
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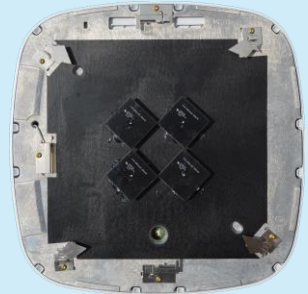
Antenna Design and Prototype

- No off-the-shelf components
- Radio Frequency (RF) Design
- Cisco Custom Antenna Designs and Characterizations



- RF Antenna modeling
- Electromagnetic compliance
- RF interoperability testing

- Housings/3D printing & Mounting Bracketry
- Co-existence of all the different radios in the same AP with no performance degradation



Spectrum analysis & Compliance

Housing design & Antenna Layout

Not all APs are created equal!

Printed Circuit Board Design



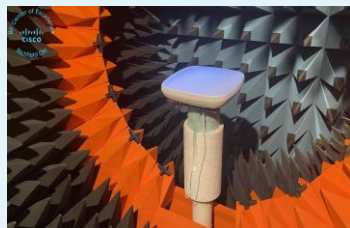
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Antenna Design and Prototype

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RF Excellence
=
Power Efficiency

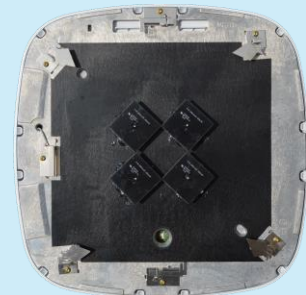


- RF Antenna modeling
- Electromagnetic compliance
- RF interoperability testing

Spectrum analysis & Compliance

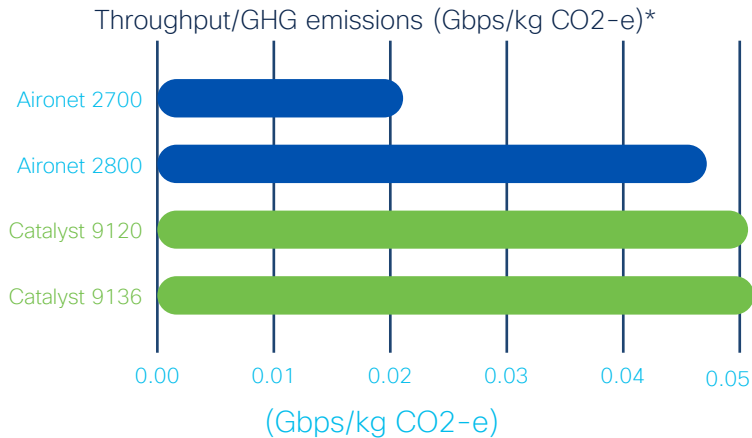
- Housings/3D printing & Mounting Bracketry
- Co-existence of all the different radios in the same AP with no performance degradation

Housing design & Antenna Layout

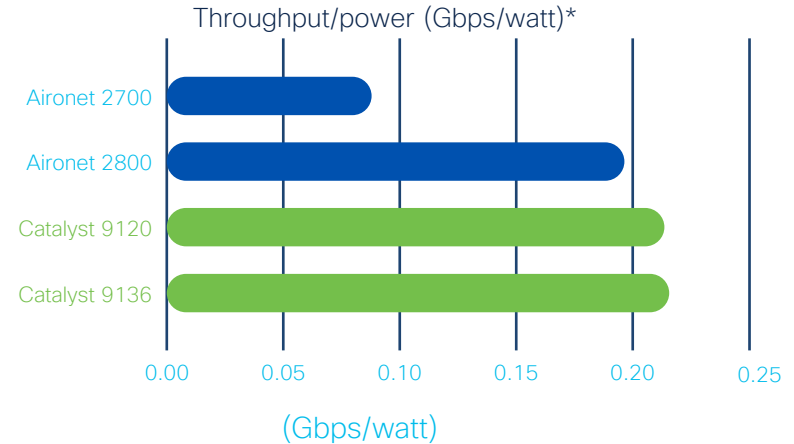


Throughput efficiency has improved with each new generation of Cisco APs

Make



Throughput efficiency relative to CO₂-e emissions in the Catalyst series



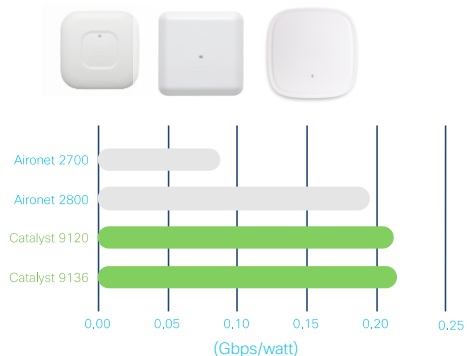
Throughput efficiency relative to power (W) required in the Catalyst series

(* based on internal testing)

Sustainability Built into Product Design

Sustainable Hardware Designs

- Power-efficient ASICs
- High efficiency power supplies
- Post consumer resin in plastic housing



Throughput efficiency relative to power has improved with each AP generation

Reusable Mounting Brackets

- Same mounting bracket has been in use for over a decade
- Simplify upgrades and reduce waste by reusing existing brackets
- Save time during deployment
- Opt-out for bracket*



* Catalyst mode only

Sustainable Packaging

- Minimize use of plastic packaging materials
- No more paper documentation
- Multi-packs to reduce waste



Multi-pack

CW9166

Sustainability Built into Product Design

Replace plastic bags for **existing** Catalyst APs and accessory kits, with paper packaging.

Estimated to save **22 metric tons** of plastic by FY2026 or 88 metric tons of Co2*.

Wi-Fi 6 APs

C9115
C9120
C9130
C9124

Wi-Fi 6E APs

CW9162
CW9164
CW9166
CW9166D1

Accessory kits

AIR-AP-BRACKET-1=
AIR-AP-BRACKET-2=
AIR-AP-T-RAIL-R=
AIR-AP-T-RAIL-F=
AIR-CHNL-ADAPTER=

i CW9163E will be no plastic bags from start. Same for future platforms

i Wi-Fi 6E APs that are “Meraki born” (-MR) are already no-plastic



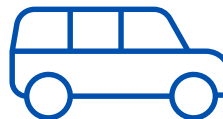
(*). For 1 kg of plastic, between 1.7 and 6 kg CO₂ are emitted

Sustainable Packaging – CO₂ Savings

88 tons
of CO₂
saved



CO₂ emission from **9,711,007**
smartphone charged



GHG emission from **204,654**
driven miles by average
gasoline-powered car



CO₂ emission **15.5 homes'**
electricity use for one year

Source: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

What about the USE
and re-USE phase?

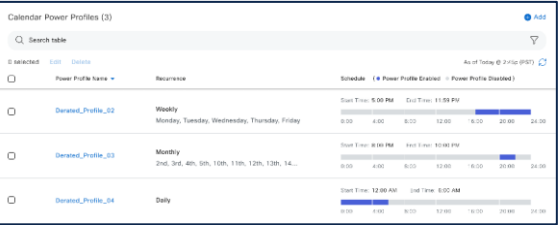
AP Power Optimizations Feature Suite

Save Power, reallocate power, and visibility into saving

AP Power Save Mode

Lower AP Power Usage

- Create a calendar profile for off-peak hours.
- Create a power profile to lower the power consumption budget during off-peak hours.
- Power Profile: Shut AP Radio or lower spatial Stream, lower port speed, disable USB port.

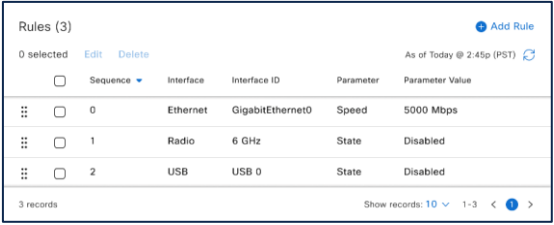


IOS-XE 17.8

AP Power Distribution

Control over how power is used

- Reallocate extra AP Power to different radios while operating on PoE+ (30W).
- Example: Disable 2.4 GHz radio -> use extra power for 6 GHz radio.
- Power Profiles: Control the speed of the radio, e.g., from 4x4 to 1x1 spatial stream



IOS-XE 17.10

AP Power Savings Insight

Power, Money, and Emissions Savings on Cisco DNA Center*

- Catalyst Center PoE dashboard integration.
- Power Savings, Money Savings, Emissions Reductions.
- Visibility into trends and insights.
- Both site level and AP level view.



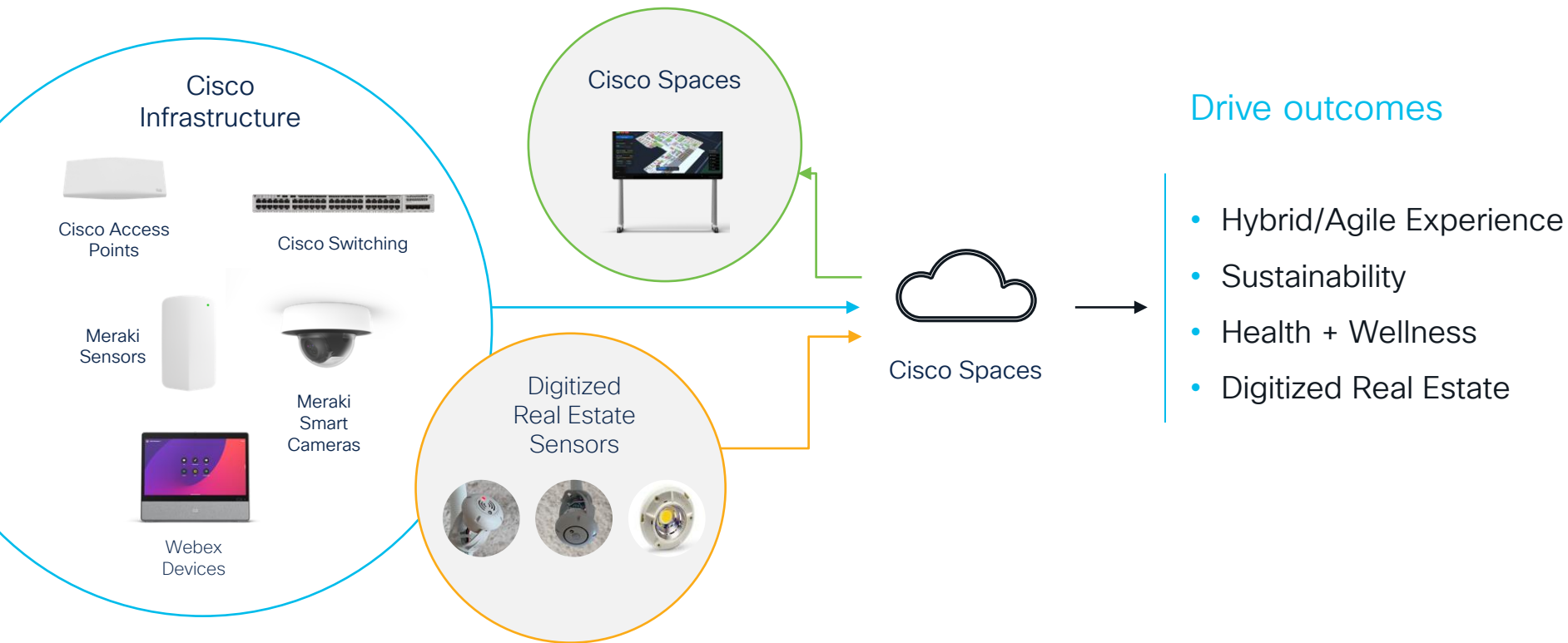
(*) DNA Center Automation and Assurance PoE Visibility is in release 2.3.6, Visibility of \$ and CO2 is later in the roadmap

Supported only on Catalyst APs: 9115, 9120, 9130, 9136, 9166, 9164, 9162



Cisco Wireless + Cisco Spaces

An easy way to get started on your Sustainability Journey



Cisco Wireless + Cisco Spaces

An easy way to make your building smarter and sustainable

Do you know...

How many of your buildings and floors operated on low occupancy in the last month? Is there a need for consolidation?

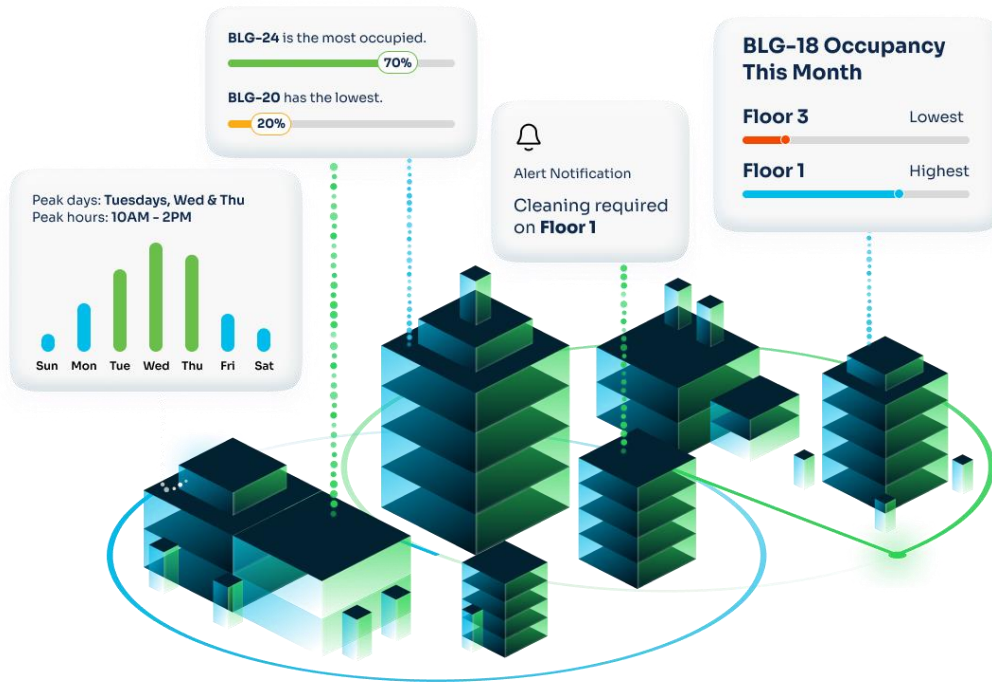
Do you know when your buildings are busiest? What time of the day and what day of the week?

Is your energy optimized against the actual usage and occupancy of the buildings?

Do you know how many people are in your building, floors, real-time?



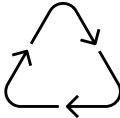
[Calculate your potential energy savings with Cisco Spaces using our Sustainability calculator](#)



Reuse: Product Takeback & Reuse Program

Simple, secure, and sustainable

Free removal and transport of equipment at customer end-of-use. Returned equipment is stored in a secure location and data is cleared from returned hard drives to protect data security. Cisco reuses and recycle nearly 100% of products that are returned.



Cisco Take Back

Available in 100+ countries
Also available via APP in EU, UK and US



Send IT Back Mobile App

Available in EU, UK and US



Green Pay

Part of Cisco Capital



Customer Recycling Solutions

Available globally; for equipment that cannot be powered on

https://www.cisco.com/c/en/us/about/circular-economy.html?socialshare=lightbox_takeback

Saving Energy with Cisco Wireless

What are the customers asking?

- Network products with clear **Sustainability requirements**:
 - An example: Design recommendations from **UK Department for Education***
 - **4.7.2.1** Enterprise-level Active switching, edge, and core shall be provided that:
 - n) **PoE ports should be configured to save energy by powering down devices when they are not required**
- **Product Carbon Footprint (PCF)** of Cisco products:
 - Lots of info on the Cisco Environment Social and Governance (ESG) Hub**
- **Typical AP power consumption** to estimate power savings and/or properly size their PDU / UPS systems, install the proper number of outlets with proper amperage, etc.
- Answers to the following Qs:
 - What are the Cisco Best Practices to implement power saving modes?
 - What happens to an AP MTBF if powered on/off at night, every night?
 - Would the RF network be back to “normal” after powering APs back on?

(*) https://assets.publishing.service.gov.uk/media/6580017d95bf65001071912b/FE-OS_GDB_GenericDesignBrief-A-C04.pdf

(**) https://www.cisco.com/c/m/en_us/about/csr/esg-hub/environment/product-sustainability.html



AP Power Consumption



Catalyst 9136



Power Allocated

48.3 W

Power Consumed

16.5 W

PoE Power Negotiation happens at boot time through CDP/LLDP

Power allocation is what you need to consider for power budget

Actual Power consumption is dependent on the AP operation

AP Power Consumption

Catalyst 9166 data sheet

PoE power consumption	2.4GHz radio	5GHz radio	6GHz radio (LPI)	Link speed	USB	Link Layer Discovery Protocol (LLDP)
802.3bt (UPOE)	4x4	4x4	4x4	5 Gbps	Y (4.5W)	30.5.W
802.3at (PoE+)	4x4	4x4	4x4	5 Gbps	N	25.5 W
802.3af (PoE)	-	-	-	1Gbps	N	14.0 W
DC power	4x4	4x4	4x4	5Gbps	Y(4.5W)	-

- This should say (we will change it) **Max PoE Power consumption**
- The max power consumption is measured under the **worst conditions**:
 - 100m of Cat5 cable between AP and switch
 - Max temperature as per data sheet
 - 80% CPU load
 - 80% duty cycle on all radios
 - MCS0 data rates

AP Power Consumption

Input power requirements

- 802.3bt, Cisco Universal PoE (Cisco UPOE), 802.3at Power over Ethernet Plus (PoE+)
- Cisco power injectors: AIR-PWRINJ7=, AIR-PWRINJ6=, MA-INJ-6
- 802.3af PoE (only for configuration staging, all radios off)
- DC power input (54V/MA-PWR-50WAC)

Catalyst 9166

Power Source	2.4GHz radio	5GHz radio	6GHz radio (LPI)	Link speed	USB	Max PoE Power Consumption
802.3bt (UPOE)	4x4	4x4	4x4	5 Gbps	Y (4.5W)	30.5.W
802.3at (PoE+)	4x4	4x4	4x4	5 Gbps	N	25.5 W
802.3af (PoE)	-	-	-	1Gbps	N	14.0 W
DC power	4x4	4x4	4x4	5Gbps	Y(4.5W)	-

Note: Actual power consumption may vary depending on AP usage. It is recommended that you ensure that LLDP/CDP is enabled to allow proper power negotiation.

- Catalyst and Meraki data sheets have been updated to use the right terminology
- The typical/normal/real power consumption depends on multiple factors:
 - Cable length and quality
 - Number of clients
 - Client traffic
 - Temperature
 - Features
 -
- So, it depends...hence we don't report it because it's not a deterministic number

OK, but I need a “typical” power consumption

Input power requirements

- 802.3bt, Cisco Universal PoE (Cisco UPOE), 802.3at Power over Ethernet Plus (PoE+)
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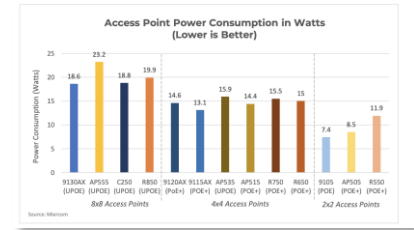
- Not official testing, this is my home lab 😊
- CW9166 power measured via the switch:
`3560-CX#sh power inline gig 1/0/4 detail | i Measured`
Measured at the port: 12.3
- AP in idle (no clients): **12.3 W/h**
- AP with #4 clients (no traffic): **12.5 W/h**
- AP with #4 clients doing speed test: **13.66 W/h**
- “Typically” CW9166 would consume between 12.3 and 25.5 W/h (assuming no USB)

Max power from data sheet for CW9166

Calculating AP energy savings

If you want calculate AP energy savings, you need to consider three different tiers/modes of operations for the APs when it comes to energy consumption:

- **AP is fully operational/full power** > Catalyst Wi-Fi 6 and 6E APs have the highest power efficiency in the market* thanks to the Cisco hardware and software innovation
- **AP Power Save mode** > Power save mode optimizations (e.g. radio off) can save an additional 20% in energy cost vs. regular idle mode
- **AP shut down** > Automating the power off/on of the Access Points during off-peak hours, you can maximize your energy savings

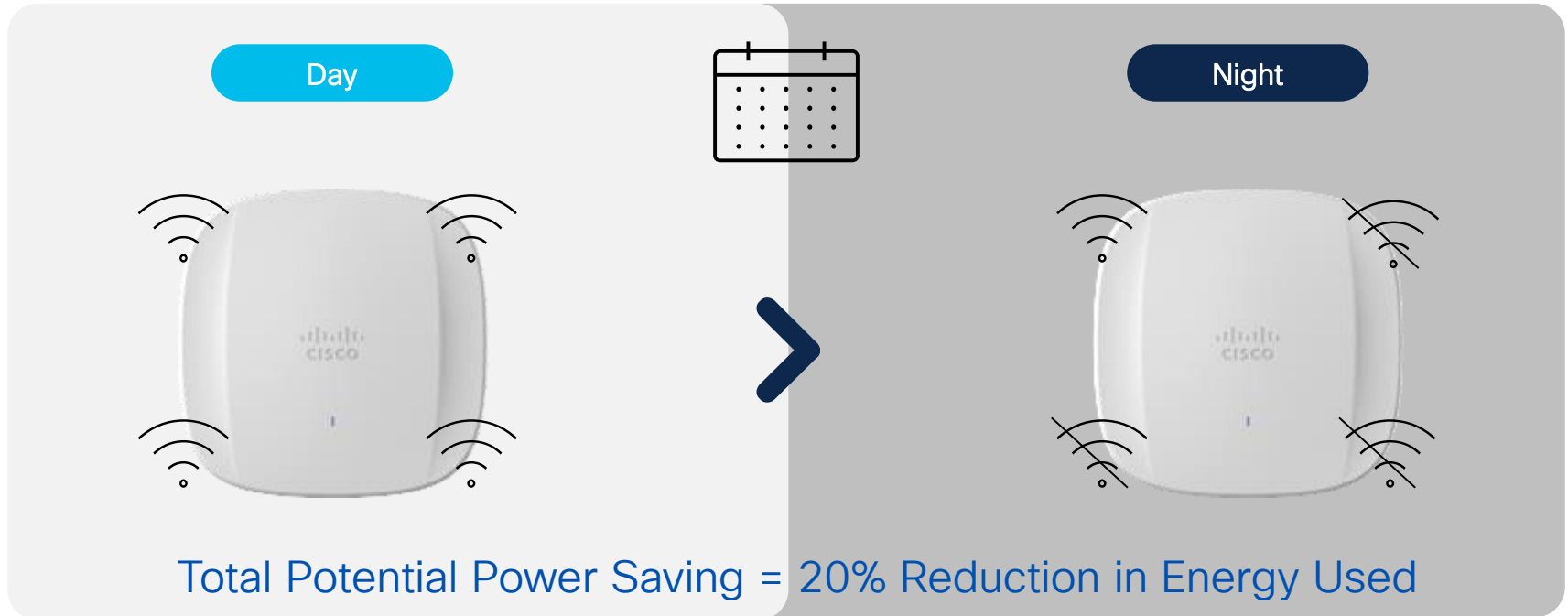


MAX savings

(*) Miercom report: <https://miercom.com/pdf/reports/DR201007K.pdf>

AP Power Save Mode

AP power save mode allows administrators to schedule periods of time where APs should, for example, turn off radios to save power



AP Power Profile

AP Power Profile



- Prioritized set of rules that define how the AP can reduce power consumption
- Interfaces that can be configured:
 - Radios: 6GHz, 5GHz, 2.4GHz
 - Ethernet uplinks and RLAN
 - USB port
- Applied via Calendar profile

Edit AP Join Profile

Calendar Profile - Power Profile Map

+ Add

× Delete

Calendar

Recurrence

Start Time

End Time

Power Profile

Add Calendar - Power Map

Calendar Profile Detailed

Calendar* Off-peak

Recurrence Daily

Start Time 00:00:00

End Time 06:00:00

Power Profile Detailed

Power* turn-off-radios

Sequence	Interface	Interface ID	Parameter	Parameter Value
0	Radio	6 GHz	State	Disabled
1	Radio	5 GHz	State	Disabled
2	Radio	2.4 GHz	State	Disabled
3	Radio	Secondary 5 GHz	State	Disabled

1

5

1 - 4 of 4 items

Calculating AP energy savings (Power Save)

C9120 AP in idle with all radios up:

```
3560-CX#sh power inline gig 1/0/3 detail | i Measured  
Measured at the port: 8.6
```

C9120 with power profile to shut 5GHz, 2.4 GHz with SS 4x4

```
3560-CX#sh power inline gig 1/0/3 detail | i Measured  
Measured at the port: 7.9
```

C9120 with power profile to shut 5Ghz and 2.4 with SS 1x1

```
3560-CX#sh power inline gig 1/0/3 detail | i Measured  
Measured at the port: 7.7
```

C9120 with power profile applied to shut all radios

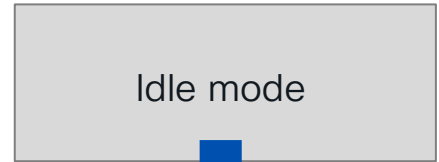
```
3560-CX#sh power inline gig 1/0/3 detail | i Measured  
Measured at the port: 7.1
```



Calculating AP energy savings (Power Save)

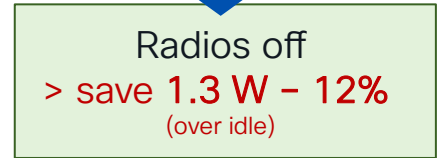
C9164 AP in idle with radios up:

```
3560-CX#sh power inline gig 1/0/3 detail | i Mea  
Measured at the port: 12.1
```



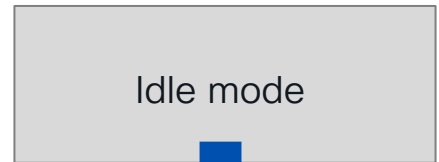
C9164 with power profile to shut all radios:

```
3560-CX#sh power inline gig 1/0/3 detail | i Mea  
Measured at the port: 10.7
```



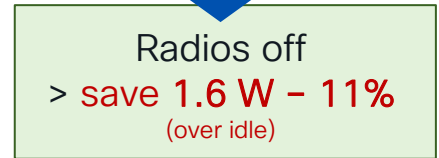
C9136 AP in idle with radios up:

```
3560-CX#sh power inline gig 1/0/3 detail | i Mea  
Measured at the port: 14.4
```

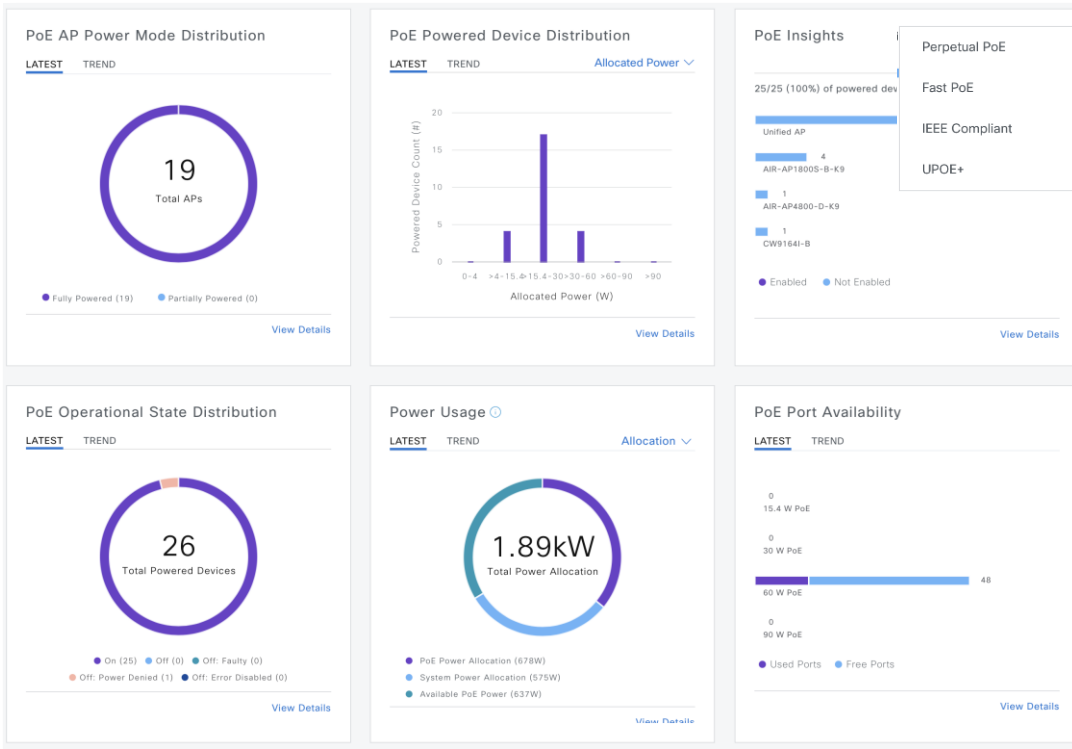


C9136 with power profile to shut all radios:

```
3560-CX#sh power inline gig 1/0/3 detail | i Mea  
Measured at the port: 12.8
```

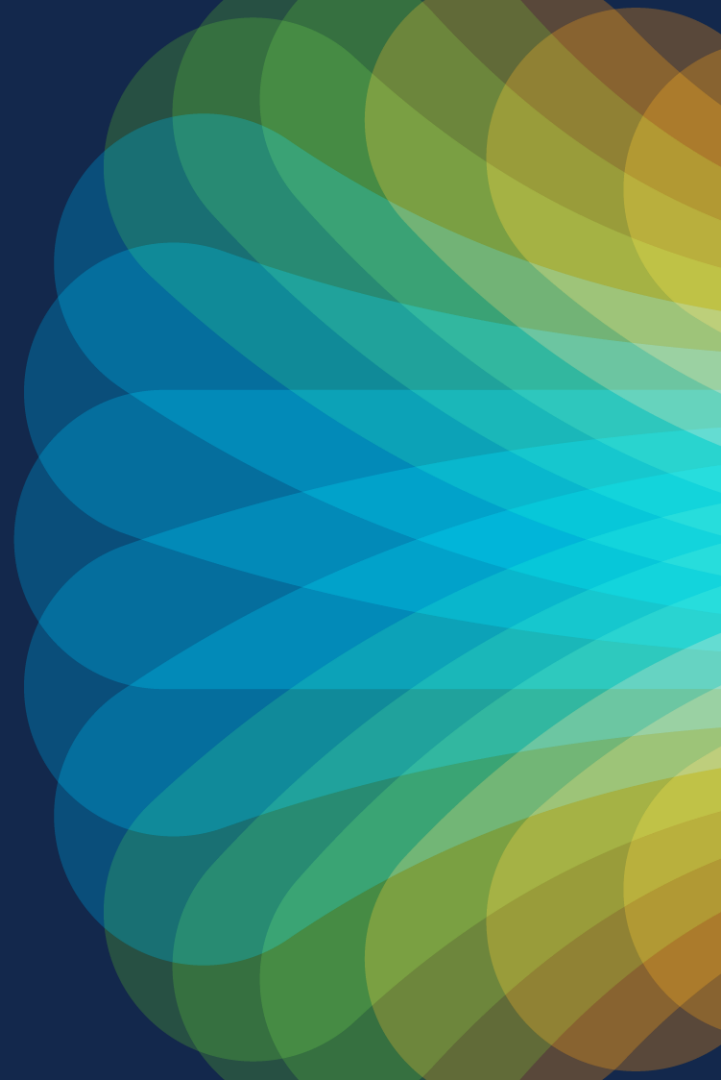


PoE Power Management In Catalyst Center Dashboard



- Monitor Catalyst switches and PoE enabled devices power consumption
- Provides information such as:
 - Used power, remaining power, and power usage
- Monitor switch's power budget
- Relay on streaming telemetry from Catalyst switches to Catalyst Center

Demo time!



Power, Money, and Greenhouse Gas Savings on the Usage Insights Dashboard (Proof of Concept)

roadmap

Visualize Savings

The screenshot shows the Cisco DNA Center interface with the 'Usage Insights' section selected. It displays a summary for 'AP Power Savings Report' covering the period from Jan 26, 2023, to Feb 1, 2023. Three key metrics are visualized in cards:

- Power Savings:** 368.41 kWh
- Money Savings:** 122.40 \$
- Greenhouse Gas Reduced:** 132056.10 kg CO2e/kWh

The screenshot shows the configuration page for 'Cisco Building 14'. A navigation tree on the left highlights the building, with an 'Edit' button next to it. The main content area displays two configuration fields:

- Power Rate*:** 0.33 (Power Rate (per W) in \$)
- GHG Emission Factor*:** 382.4 (kg CO2e/kWh)

Configure Power Rate and Emission Factor

Save Energy with AP Power Save

We estimate that using Power Save on 2,000 APs (1.5 W) for 10 hours a day (10pm to 8am), saves up to ca.*:

- 54,600 kWh energy
- £8800 cost (€ 10200)
- 21 metric tonnes CO2e emissions

over 5 years.

*Based on internal analysis. Actual estimate that varies depending on the location where the devices are operated. Location in the example: UK, assumed energy price: 40p/kWh



Discover

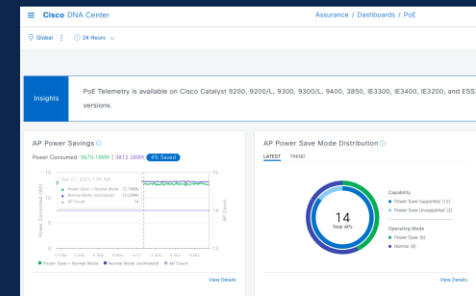
AP Name	Model	IP Address	Power Save
AP001-0001	WLC8500-10000	10.10.10.1	Power Save
AP001-0002	WLC8500-10000	10.10.10.2	Power Save
AP001-0003	WLC8500-10000	10.10.10.3	Power Save
AP001-0004	WLC8500-10000	10.10.10.4	Power Save
AP001-0005	WLC8500-10000	10.10.10.5	Power Save
AP001-0006	WLC8500-10000	10.10.10.6	Power Save
AP001-0007	WLC8500-10000	10.10.10.7	Power Save
AP001-0008	WLC8500-10000	10.10.10.8	Power Save
AP001-0009	WLC8500-10000	10.10.10.9	Power Save
AP001-0010	WLC8500-10000	10.10.10.10	Power Save

Act

The screenshots show the configuration interface in Cisco DNA Center. The top screenshot shows the 'Edit Power Profile' page with a table of rules. The bottom screenshot shows the 'Edit Access Point Profile' page where a power profile is assigned to a specific AP.

Sequence	Interface	Interface ID	Parameter	Parameter Value
0	Radio	6 GHz	State	Disabled
1	Radio	5 GHz	State	Disabled
2	Radio	Secondary 5 GHz	State	Disabled
3	Radio	2.4 GHz	State	Disabled

Report



Turn APs off, or not turn
APs off

...THAT is the question!



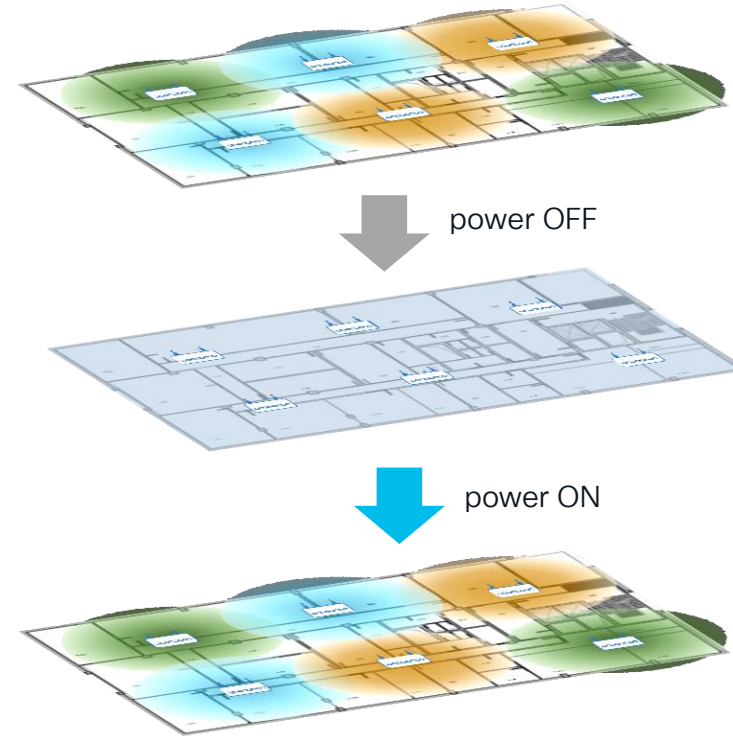
Turning off APs – What do you need to consider?

- You need to consider the possible impact on:
 - Hardware and Mean Time Between Failure (MTBF)
 - AP software integrity



Turning off APs – What do you need to consider?

- You need to consider the possible impact on:
 - Hardware and Mean Time Between Failure (MTBF)
 - AP software integrity
 - RF stability and Radio Resource Management
 - Wireless Security
 - IT operations (how to select the ports? alarms?)
- If you decide to do it, which APs to turn off?
 - Turn off all APs; turn off a floor, an area, salt and pepper style?

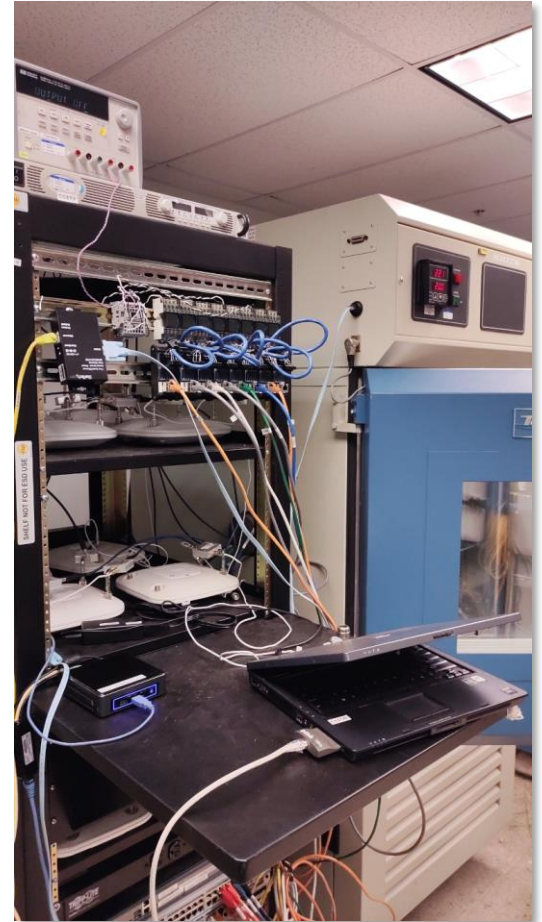


Turning ON/OFF APs – MTBF

EIM (Ethernet Interrupter Module) test:

- Fully automated procedure
- Verify the proper function of the AP after multiple power ON/OFF cycles. At least 300 cycles
- Test is done at the different temperatures supported in the data sheet
- Test includes client connectivity through the AP to verify proper functions

No impact on MTBF and hardware quality is expected by switching ON and OFF APs.

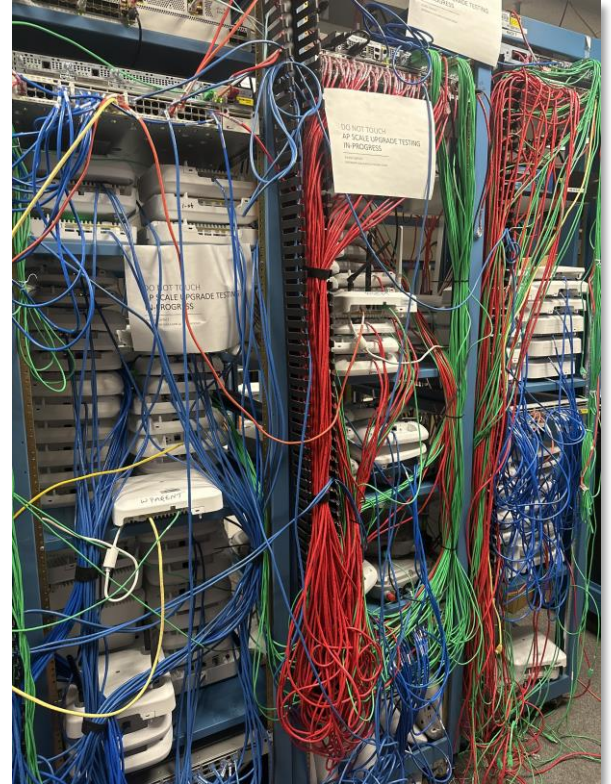


Turning ON/OFF APs – Software Integrity

Catalyst AP Software integrity test:

- Verify that AP image doesn't get corrupted upon a non-grateful shutdown (AP port is shut down)
- #120 APs test bed of all Wi-Fi 5/6/6E models. Tests run against all the CCO recommended images (17.3.7, 17.6.5, 17.9.4)
- Script to automate the following behavior:
 - AP is turned on, connects to WLC and download software
 - In the middle of the download, AP switchport is shutdown
 - Verify AP reboot, and start downloading again

No impact on software integrity is expected. Cisco recommends to be on 17.9.3 or above

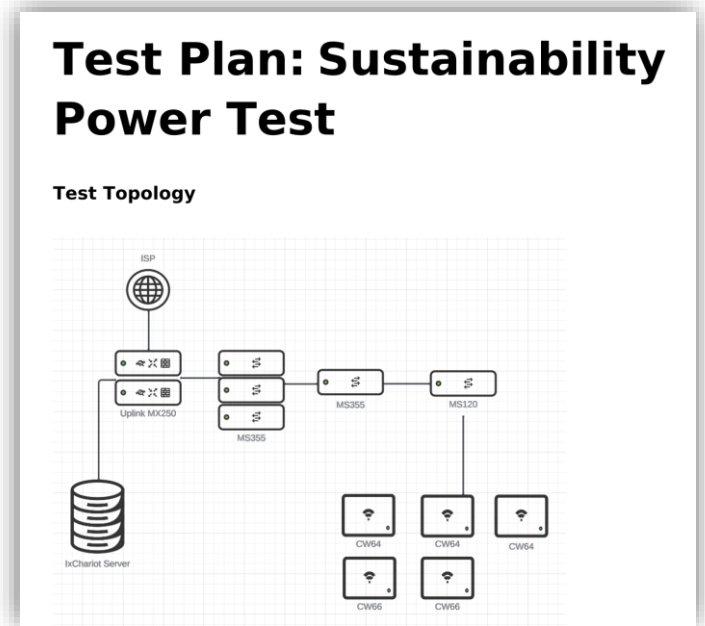


Turning ON/OFF APs – Software Integrity

Meraki MR Software integrity test:

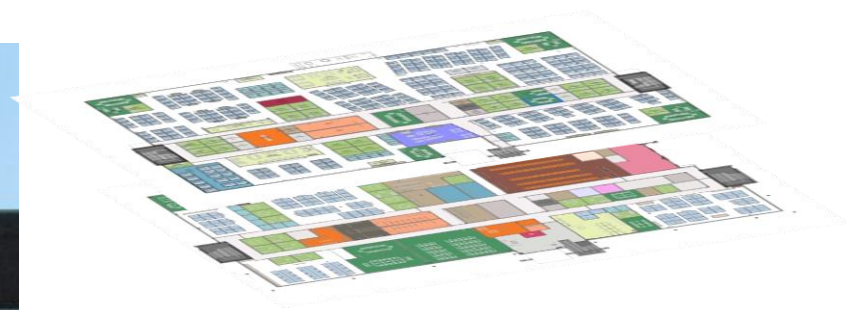
- Verify that AP image doesn't get corrupted upon a non-grateful shutdown (AP port is shut down)
- Initial test with CW9166/64 with MR29 code
- Few different tests conducted:
 - AP power turned off/on during firmware upgrade.
 - AP power cycle during configuration radio channel change.
 - Verified AP recovers and behaves as expected

No impact on software integrity is expected



RF Stability > Radio Resource Management (RRM) Considerations

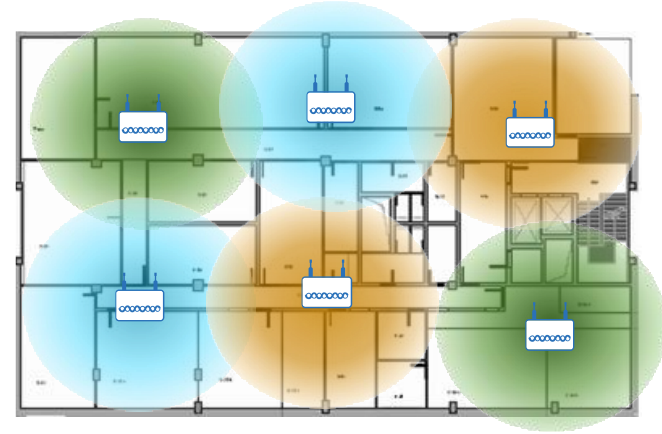
We are testing...



- #2 floors building in RTP campus, North Carolina
- 58 APs (Aironet 4800) and #2 C9800-L in SSO pair
- #3 switches (one per IDF + distribution)
- DNA Center 2.3.7
- Building is RF isolated

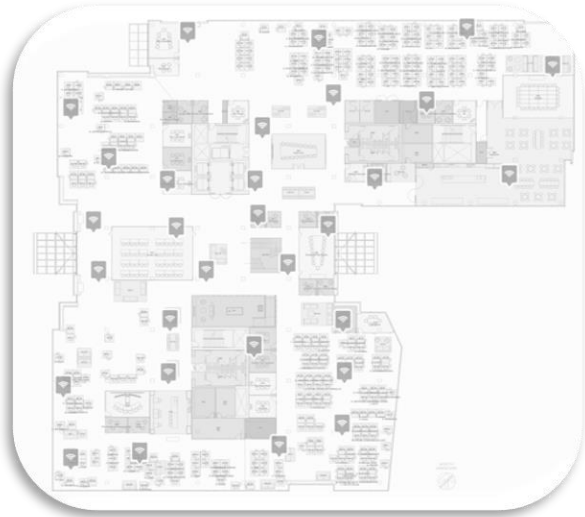
RRM Facts

- RRM's algorithms operate automatically:
 - Dynamic Channel Assignment (DCA) runs either every 10 mins (auto) or periodically, configured for Anchor Time with an interval (every x hours)
 - Coverage Hole Detection (CHD) runs when triggered (threshold -80 dBm default)
 - Transmit Power Control (TPC) runs every 10 mins
- RRM always uses the last 10 minutes of collected data:
 - For Auto, that's 10 minutes after the controller boots up.
 - For a configured Anchor time and interval – that is 10 mins before the scheduled time
- APs store last channel/power/bandwidth settings
 - This means, if you turn off APs at 10pm and you have channel/power distribution X, you will get same distribution X at 7am when you turn the network back on



Meraki RRM: Auto-RF

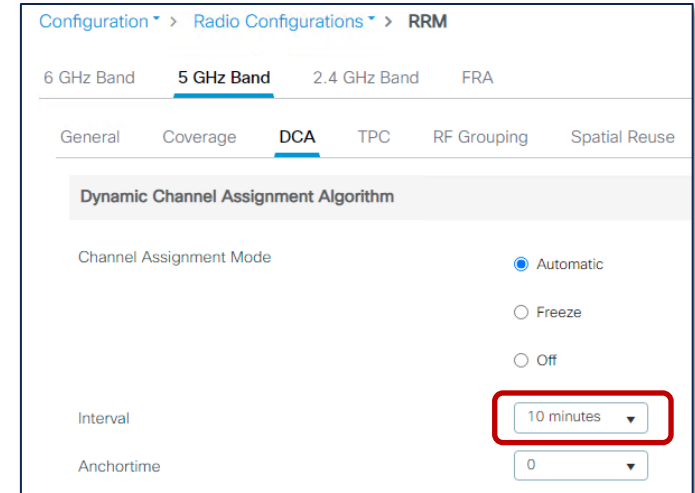
Restore Access Points after shutdown



After wake-up from quiet time shutdown, Meraki APs restore exact last-known good radio settings (Channel, Power, Channel Width). Settings are retained for 7 days.

RRM Design Considerations

- How do we choose the DCA interval?
 - Why only DCA, why not TPC? DCA channel changes might create disruptions to clients. Changing power have marginal effect on clients.
 - If DCA running every 10 mins > potential disruption to clients during business hours, as RRM might do channel changes during a voice call for example.
 - If DCA running rarely (e.g., once/twice a day), shall I run it on peak time or off peak? The risk of running on peak is potential disruption due to channel changes; the risk of running it off peak is that RRM doesn't have a correct representation of the RF network.



RRM Design Considerations

- Cisco recommendations for DCA
 - Running DCA every 10 mins is the default and it's recommended for most networks.
 - If you have interactive or **delay sensitive traffic like voice**, the recommendation would be to run DCA less often, but at least **twice a day**
 - Should be same settings for all RF Bands
 - When configured with Anchor time, RRM runs an “aggressive” cycle at every anchor time > runs every 10 mins for 60 minutes (six times)

Configuration > Radio Configurations > RRM

6 GHz Band 5 GHz Band 2.4 GHz Band FRA

General Coverage **DCA** TPC RF Grouping Spatial Reuse

Dynamic Channel Assignment Algorithm

Channel Assignment Mode

Automatic

Freeze

Off

Interval **6 hours**

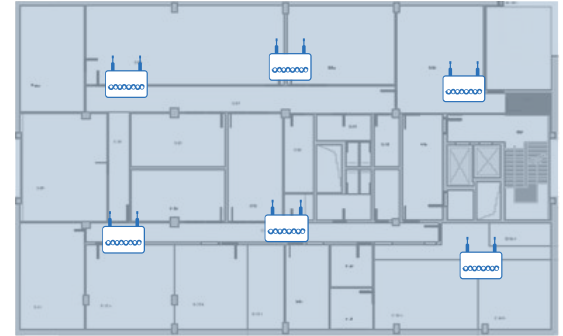
Anchortime **7**

Powering off/on: RRM Design Implications

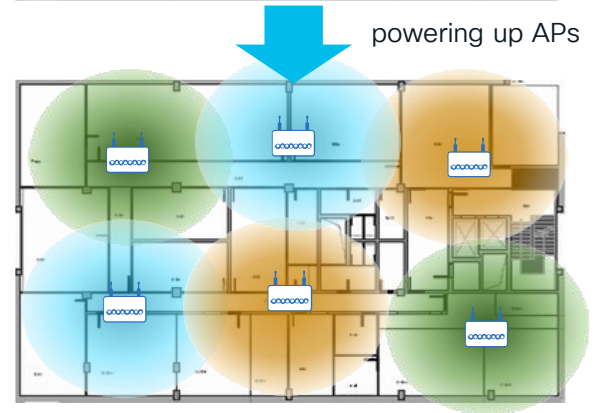
RRM learning process:

- If you shut down APs > when APs are coming back up, RRM need to learn again all AP neighbors.
- This will take some time for the on-channel neighbor discovery messages. For DFS channels it takes even more time if we don't have clients.
- It's important to run RRM when the network is back to stable state, with all APs that are UP, and all neighbors discovered.
- At anchor time, RRM runs a startup procedure which will optimize the RF present when it executes.
- If you run RRM every 10 mins, then the first run after APs are powered up may not have all the APs joined > this may trigger some channel changes and possible disruption. A second DCA run will be needed to optimize.

AP powered down

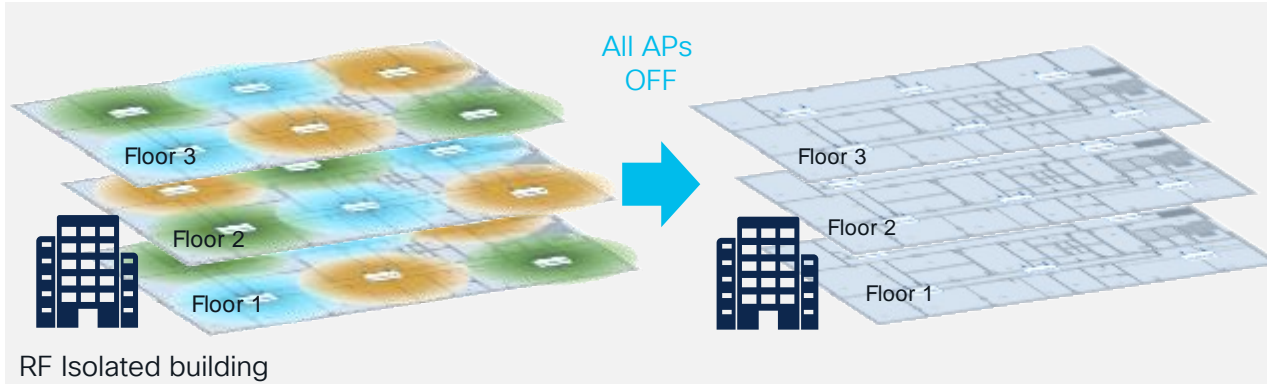


powering up APs

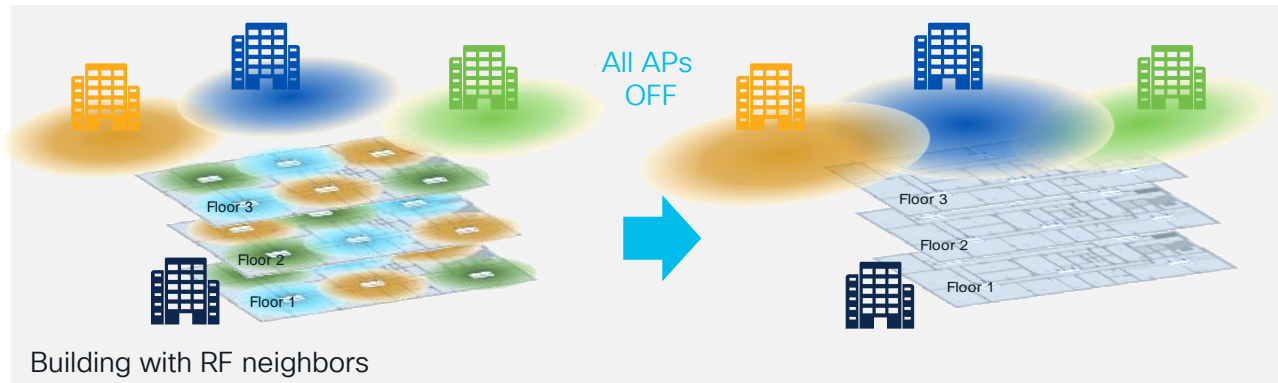


Powering off/on: RRM Design Implications

Building total shutdown



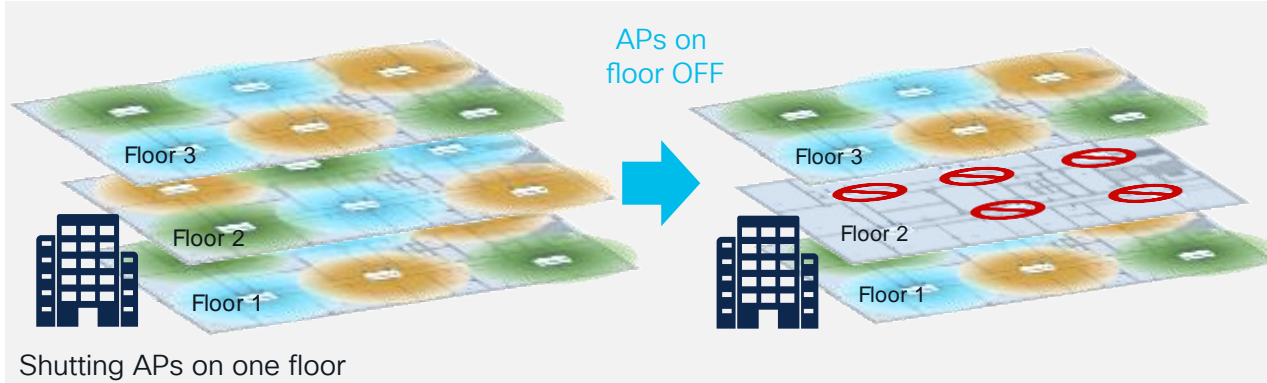
If shutting down **all APs** in the building and **no RF neighbors** > no RF changes are expected when powering back up



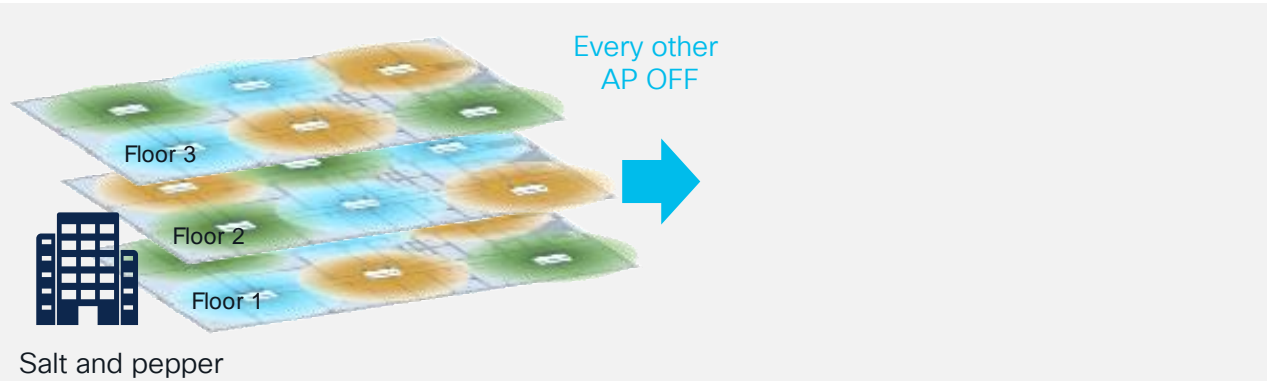
If shutting down **all APs** in the building **with RF neighbors** > RF changes are expected when powering APs back ON as the RF neighbors (**rogue APs**) might have taken over the channels previously used

Powering off/on: RRM Design Implications

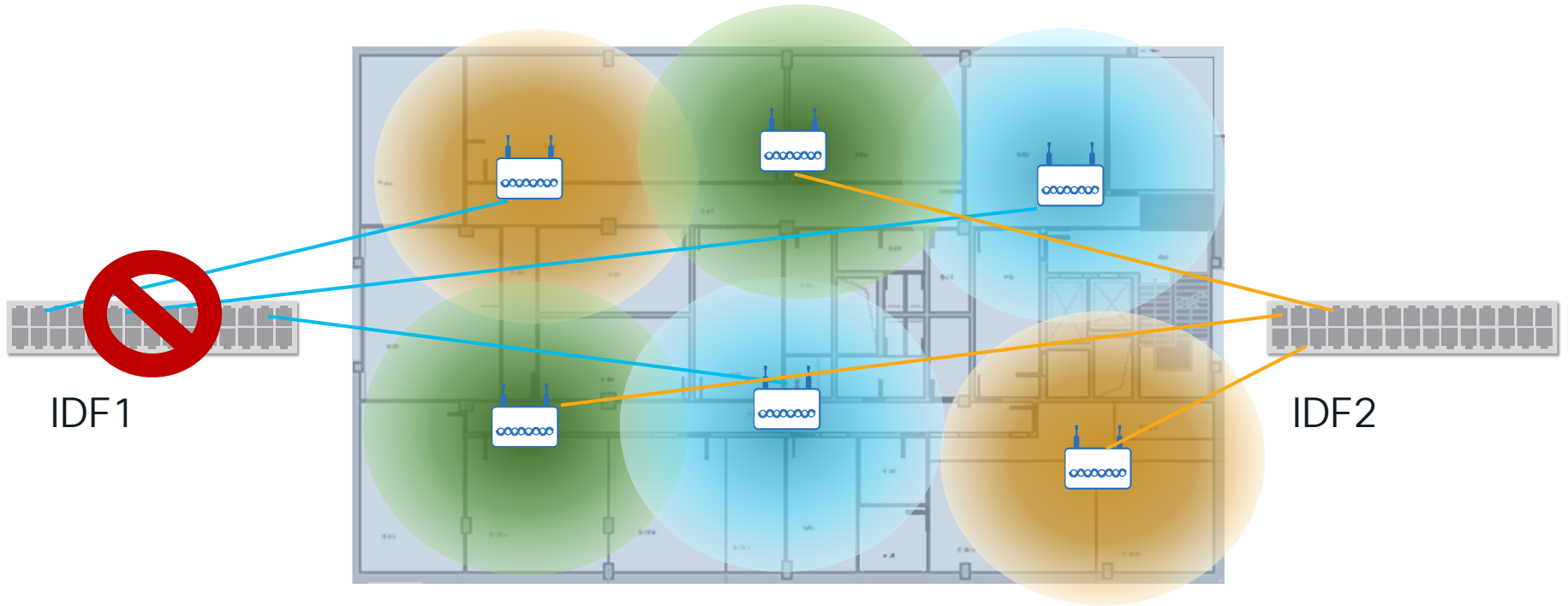
Building partial shutdown



If shutting down all APs on a floor, if there is RF leakage between floors > RF changes are expected after powering back up the APs

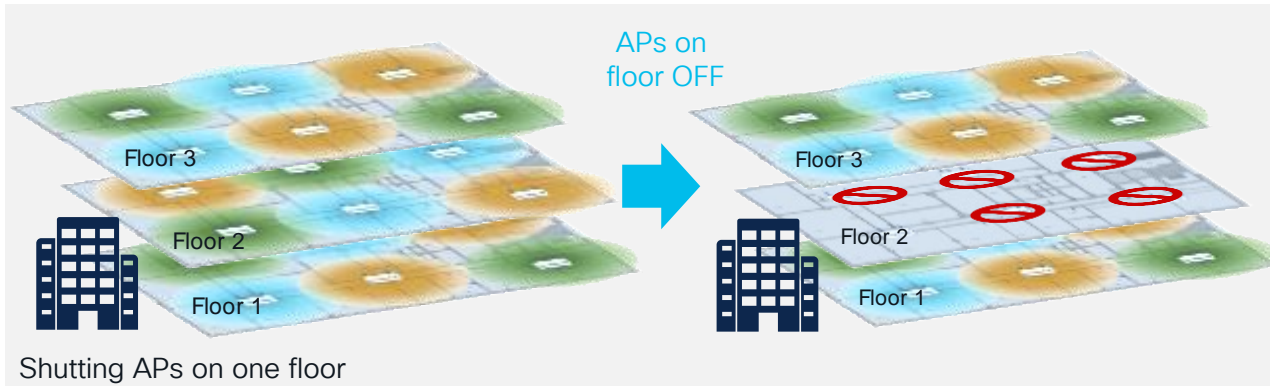


Powering on/off APs: Salt and Pepper

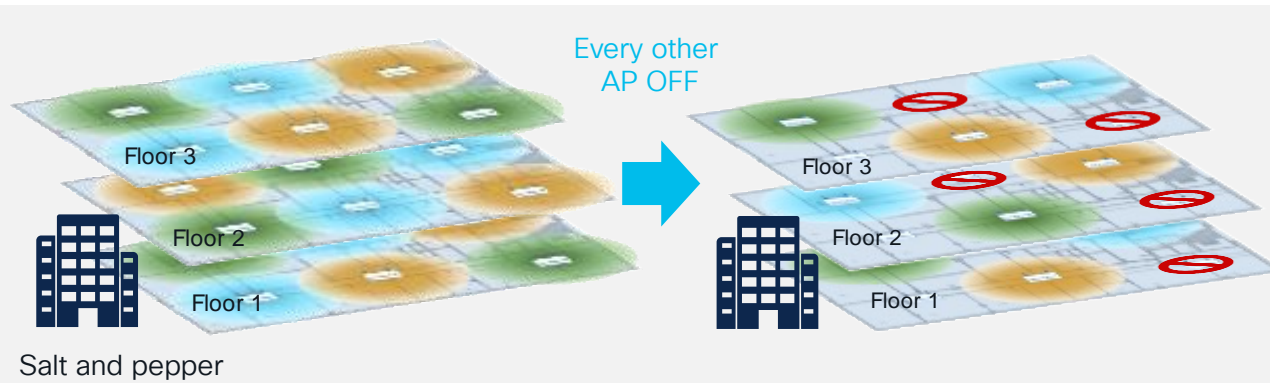


Powering off/on: RRM Design Implications

Building partial shutdown



If shutting down all APs on a floor, if there is RF leakage between floors > RF changes are expected after powering back up the APs

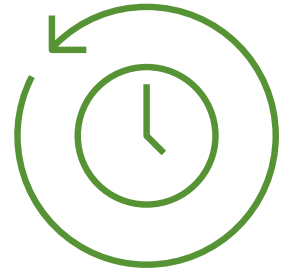


If shutting down APs in a “salt and pepper” way on each floor > RF changes may happen as the remaining APs might take over the channels previously used by APs powered down

Powering off/on: RRM Recommendations

How to choose the Anchor time:

- During business hours or off-peak?
- Usually this is not so important as the network is always operational.
- But if you are planning to shut APs during non-working hours...Make sure that the **Anchor time is within the time the APs are up.**
- If not, RRM would come up and run in the state where the AP are all down; if you shut off the network before RRM Anchor time, RRM would never run again 😊

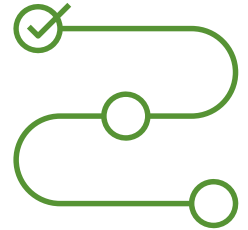


Powering off/on: RRM Recommendations

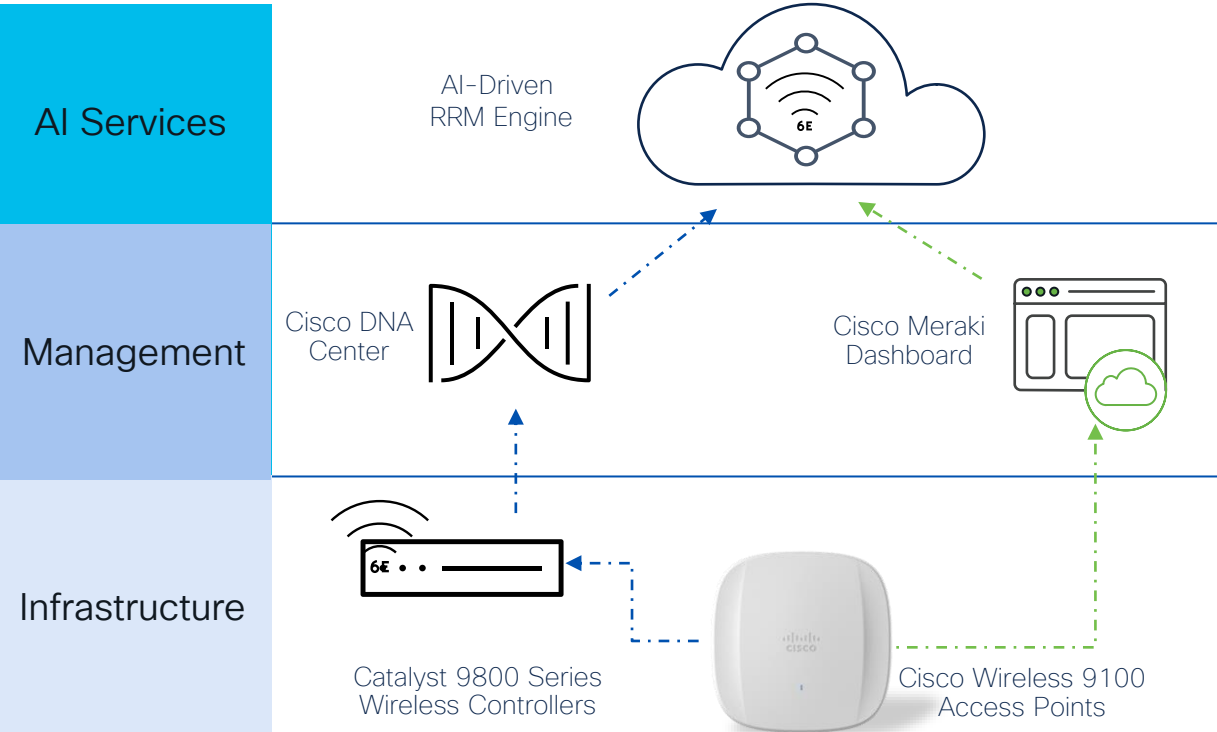
Recommended procedure for RRM:

Same if you run RRM every 10 mins or with Anchor time:

1. **Freeze RRM (DCA)** before shutting down APs > no changes are done when APs are down
2. **Power APs at least 1h before** the clients shows up in the morning, to give time for RRM to build the neighbor relationships.
3. If RRM runs few times a day, make sure to **turn the APs back on 1 hour before the next RRM run**, to allow neighbor relationships
4. After the APs have all joined back and are stable, **unfreeze DCA**



Powering off/on: AI Enhanced RRM



- No need to decide between Anchor time or interval > **AI RRM always runs** in the Cloud
- No need to identify best time to run RRM > RRM **automatically learns and set business hours**
- **Changes happen outside busy hours** > minimize impact on the production network
- **Changes optimize** the network for business hours operations
- **Optimizations** are proactive and powered by Cisco's AI Cloud.

Meraki Dashboard:

AI powered Channel Planning and Busy Hour

Radio settings

Overview RF profiles Auto RF

AI channel planning AI channel planning OFF

AI channel planning ON (Recommended)

Auto RF will optimize channel planning by learning from this network

2 RF Jammed AP's mitigated

3 DFS Hit AP's mitigated

Busy hour Minimize RF changes during busy hour

Auto RF will minimize changes during the most active hours of the day

Daily busy hour (UTC-4)

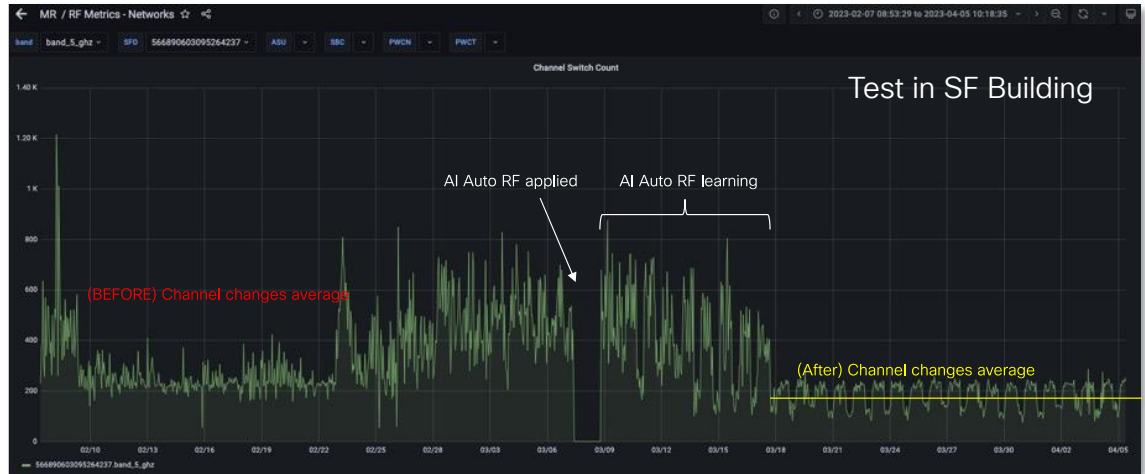
Auto

Based on historical data of up to the last 6 weeks

19:00

→

02:00



- Uses ML to tune and select channels best suited for your network environment
- Learns network usage patterns to auto determine busy hours
- Optimizes client experience

Powering off/on: Switch Port Schedules

Meraki MS Switches

The screenshot shows the Meraki dashboard interface. At the top, there is a green navigation bar with the Cisco Meraki logo, 'Show admin', 'Demo Networks', and a search bar. The left sidebar contains navigation options: Network (Meraki San Francisco SFO12), Secure Connect, Network-wide, Security & SD-WAN, Switching (highlighted), Wireless, Systems Manager, Cameras, Sensors, Insight, and Organization. The main content area is titled 'Port schedules' and shows a configuration window for 'Energy Savings' used by 1 port. It includes a 'Templates' section with options like '8 to 5 daily' and 'weekdays only'. Below is a table with columns for Day, Status, and During (start and end times). To the right of the table is a 24-hour time display grid showing power on/off status for each hour. The 'Status' column shows 'enabled' for all days. The 'During' column shows 8:00 to 17:00 for all days. The time display grid shows green bars from 8:00 to 17:00 for all days, indicating power is on during these hours.

Day	Status	During
Monday	enabled	8:00 - 17:00
Tuesday	enabled	8:00 - 17:00
Wednesday	enabled	8:00 - 17:00
Thursday	enabled	8:00 - 17:00
Friday	enabled	8:00 - 17:00
Saturday	enabled	8:00 - 17:00
Sunday	enabled	8:00 - 17:00

Energy Saving Port Schedules

Create port schedules to turn off POE power to access points during off peak hours

AP Power Measurement In Meraki Dashboard

SFO12-1-AP08
MRS3 88:15:44:60:73:b4

Live data

Ports
0 1

FIRMWARE
Up to date
Current version: MR 29.5.1
[Open source licenses](#)

CONFIG
Up to date

POWER
9.38 W
PoE 802.3at

REGULATORY INFO
Enforced Country: US

UPLINK TRAFFIC
500 Kbps
340 Kbps
180 Kbps
80 Kbps
0 Kbps

Current clients 2

Description	IP address	VLAN
08:ad:16:19:ffe2	10.96.2.28	1001
08:ad:16:1a:02:fc	10.96.0.25	1001

DHCP
● OK

AP Real Time Power Monitor

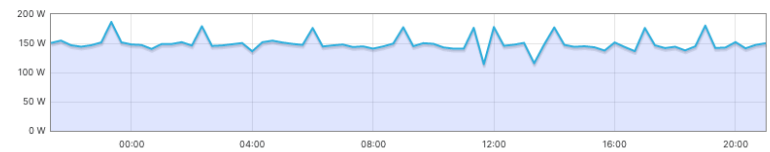
- Monitor the actual power consumption of each AP on your network

Summary Report from the last day

NETWORK(S) DEVICE TAG SSID SHOW TOP RESULTS

Ethernet Power Details

Power rate over time



Top switches by power usage

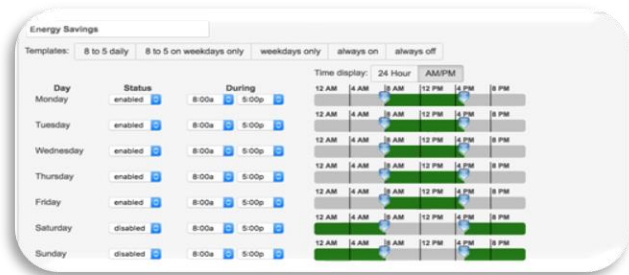
Name	Model	Power usage
9300_M	C9300-24U	3.16 kWh
MS220-Simo	MS220-8P	429 Wh

Power Monitor at Org level

- Monitor the actual power consumption for all the switches in the network or Org

AP Power Measurement In Meraki Dashboard

Problem: Every time the AP goes down, you get a notification...



Alert for 10.110.0.0 255.255.255.0 - Simone Home Lab - wireless - APs went down

CM Cisco Meraki - No Reply <alerts-noreply@meraki.com>
To: Simone Arena (siarena); simone.arena@gmail.com

To protect your privacy, some external images in this message were not downloaded.

Cisco Systems, Inc.

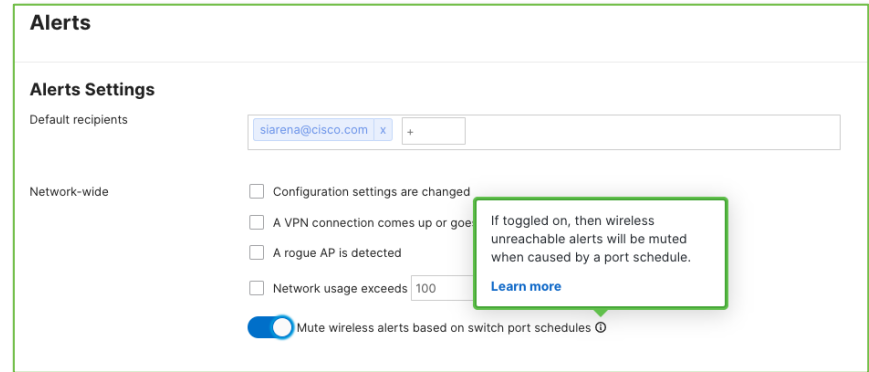
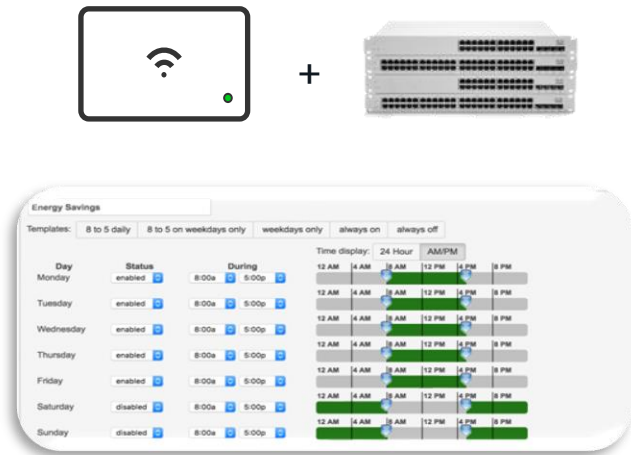
1 access point on the [10.110.0.0 255.255.255.0 - Simone Home Lab - wireless](#) network has become unreachable from the Meraki cloud.

[CW9162-garden](#) 68:49:92:01:85:50 08:02 PM CEST on Sep 29

- Cisco Meraki

AP Power Measurement In Meraki Dashboard

Solution: Mute Wireless Notification based on switch port schedule !!
Helping Customers meet Sustainability Goals without the 📢 noise >



- Configure under Network-wide > Alerts or [via API](#)
- Only alerts related to schedule will be muted
- Alerts outside of the schedule will still be sent

See also: https://documentation.meraki.com/MS/Access_Control/Port_Schedules#Muting_Notifications

Save Energy with Meraki Switch Port Schedules

- Powering off 2,000 PoE devices (10W) for 10 hours a day, is estimated* to save up to ca.:
- 364,000 kWh energy
- £145,000 (€ 168,000) cost
- 76 metric tonnes CO2e emissions
- over 5 years.

*Based on internal analysis. Actual estimate that varies depending on the location where the devices are operated. Location in the example: UK, assumed energy price: 40p/kWh

Discover



Act



Report



Takeways



3 Steps to Save Energy with Cisco Wireless

01

Refresh to energy-efficient APs

- Catalyst Wi-Fi 6 and 6E APs are on average 53% more efficient than older generations*
- Cisco 6/6E APs have the highest power efficiency in the market
- With new Catalyst APs you can leverage Power save mode

(*) based on internal testing

02

Optimize AP Power

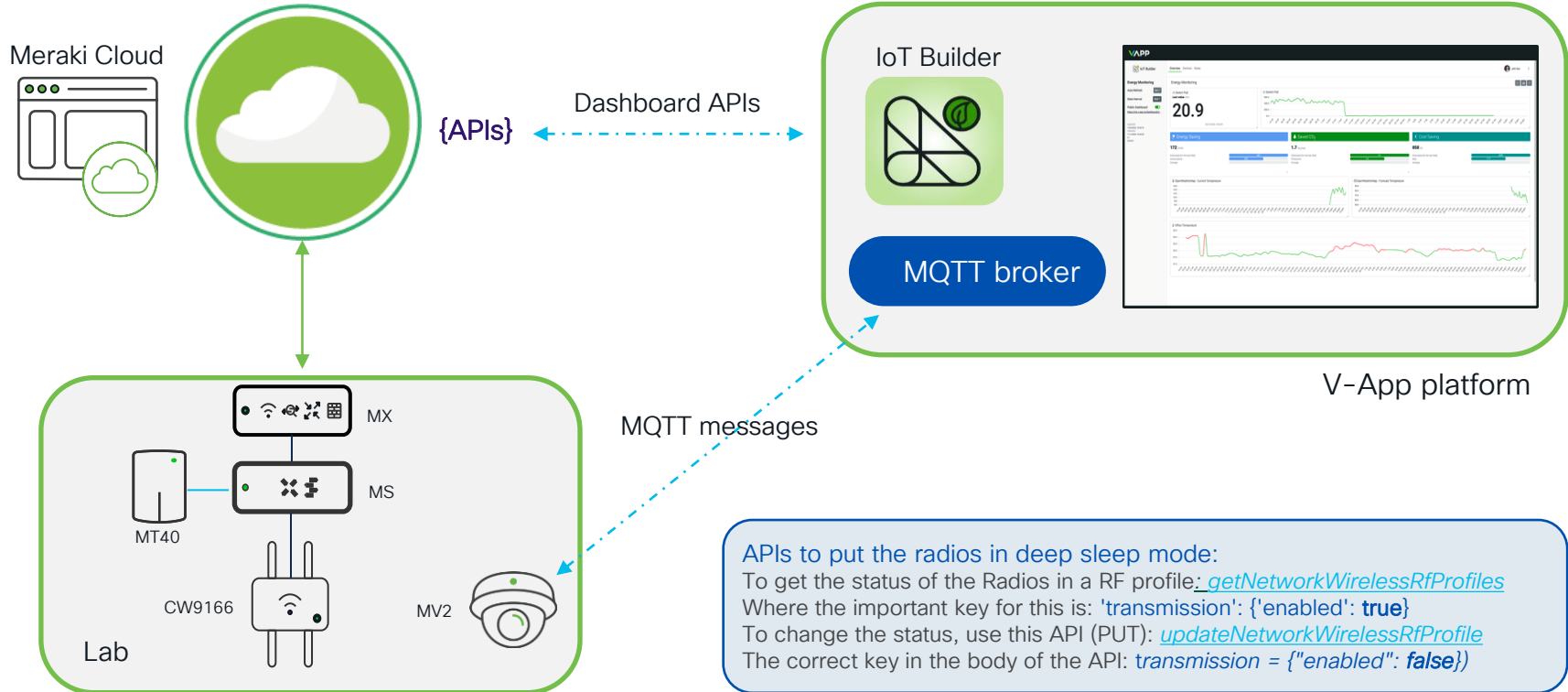
- Use Power Save Mode to turn off AP features when they are not required (Catalyst only)
- Use AP Power Distribution to allocate AP resources at reduced power levels (Catalyst only)
- Example: Reducing AP functions during off-peak hours could potentially save an estimated additional 20% in energy costs compared to regular idle mode*

03

Measure & Act

- New Power Save Insights on Catalyst Center to quantify reduction in energy & costs
- Use Meraki Dashboard to easily schedule AP power OFF and measure impact
- Use occupancy data from Spaces to enable informed decisions about powering down resources in off-peak hours

My sustainable Lab!



APIs to put the radios in deep sleep mode:
To get the status of the Radios in a RF profile: [getNetworkWirelessRfProfiles](#)
Where the important key for this is: `'transmission': {'enabled': true}`
To change the status, use this API (PUT): [updateNetworkWirelessRfProfile](#)
The correct key in the body of the API: `transmission = {'enabled': false}`



The bridge to possible

Thank you

CISCO *Live!*

The Cisco Live! logo features the word "CISCO" in a bold, black, sans-serif font, followed by "Live!" in a black, cursive script font. The background of the entire image is a vibrant, multi-colored abstract pattern of overlapping, wavy bands in shades of red, orange, yellow, green, and blue, creating a sense of motion and energy.

CISCO *Live!*

Let's go