

CISCO *Live!*



#CiscoLive



The bridge to possible

Evolving Public Wi-Fi with OpenRoaming

Seamless, secure connectivity

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@ddapeterson

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@correaflavio

CSSGEN-1100



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Agenda

- Introduction
- Evolution of public Wi-Fi
- The OpenRoaming opportunity
- Open Roaming in Action
- How Open Roaming Works
- Steps to activate it in your network today

Boingo: 20 Years of Wireless Leadership



LARGEST

DAS Operator

Largest indoor DAS provider in the U.S.

40,500

Small cell nodes



FIRST

Commercial DAS Network
to market ('99)



LARGEST

Wi-Fi Operator

Largest operator of airport Wi-Fi networks in the world

1+ MM

Hotspots worldwide



FIRST

Passpoint Network
to market ('14)



FIRST

CBRS Airport Private Network
to market ('18)



FIRST

Wi-Fi 6 Airport Network
to market ('19)



LARGEST

Military Provider

Largest Wi-Fi & Cell Tower provider to US Military bases

2,000 + 340,000

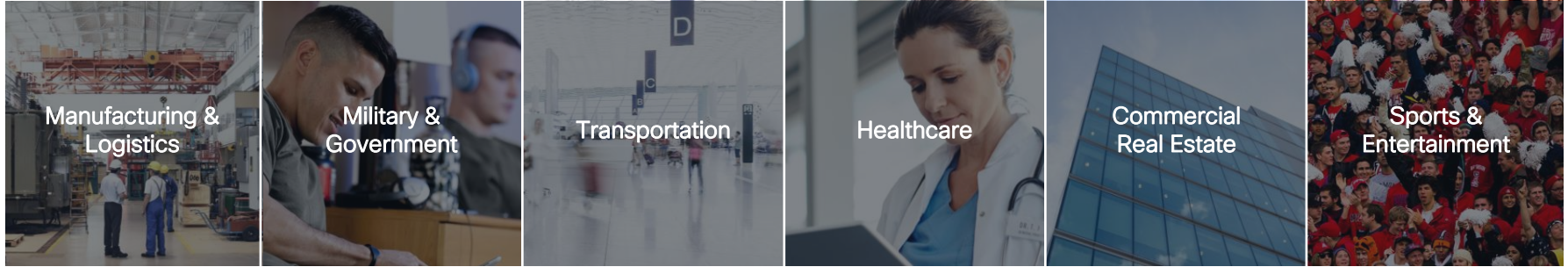
Buildings

Beds

1+ BILLION CUSTOMER REACH/YEAR

A Trusted Connectivity Partner

INDUSTRIES



CUSTOMERS



Connecting Enterprise's Digital Transformation

Boingo simplifies complex wireless challenges to connect people, business and things.

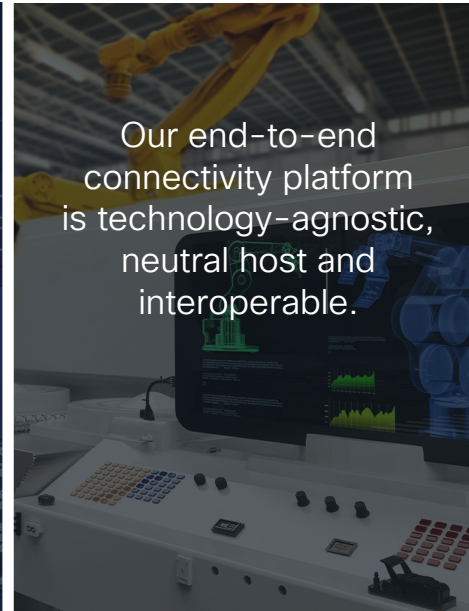
VISION



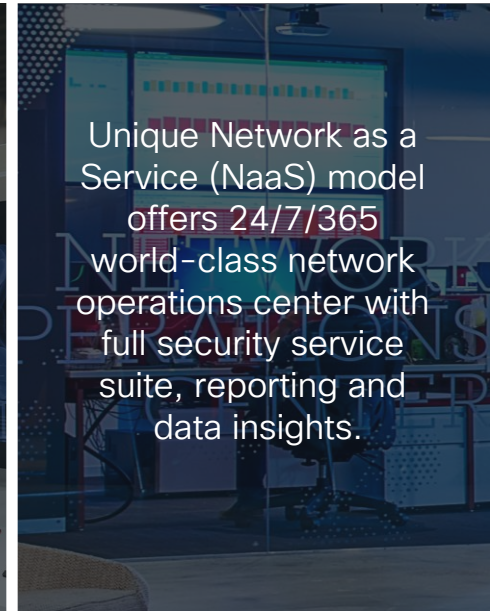
DESIGN



BUILD



MANAGE



Evolution of Public Wi-Fi

2015: Customized Carrier Offload with Passpoint

31 AIRPORTS
NATIONWIDE
AND OTHER SELECT LOCATIONS



Developing Carrier-Grade Wi-Fi

Consistent User Experience

- Network discovery and access
- Authentication and security
- Service experience

Fully Integrated End-to-End Network

- Network architecture
- End-to-end service provisioning

Network Engagement

- Network quality
- Network security
- Network manageability

2021: More Locations, Carriers, Platforms

150K

Passpoint locations

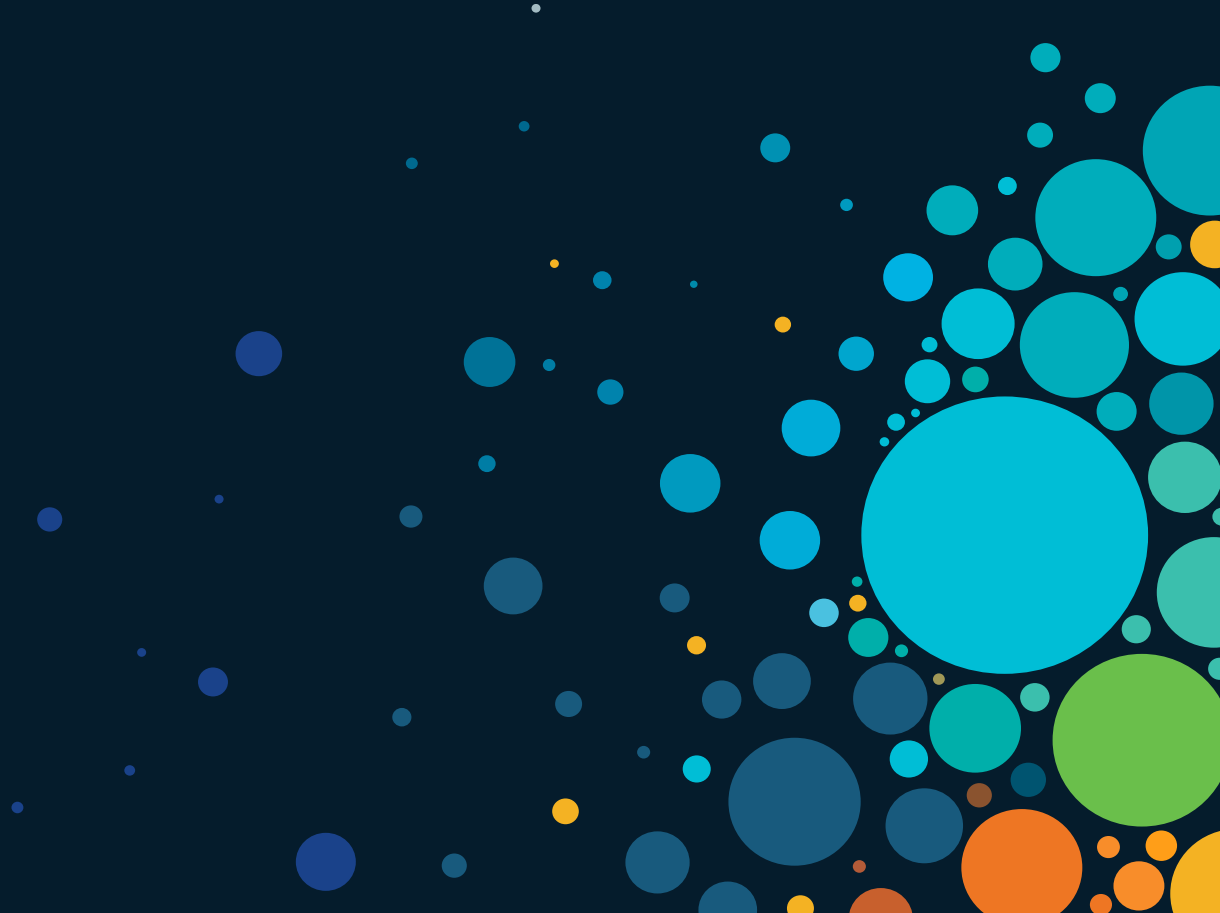
3+

Carrier & cable
provider
relationships

Mass

Device & platform
support

The Open Roaming Opportunity






What is OpenRoaming?

WBA OpenRoaming™ is based on a set of business and technical components that enables the function of the roaming federation

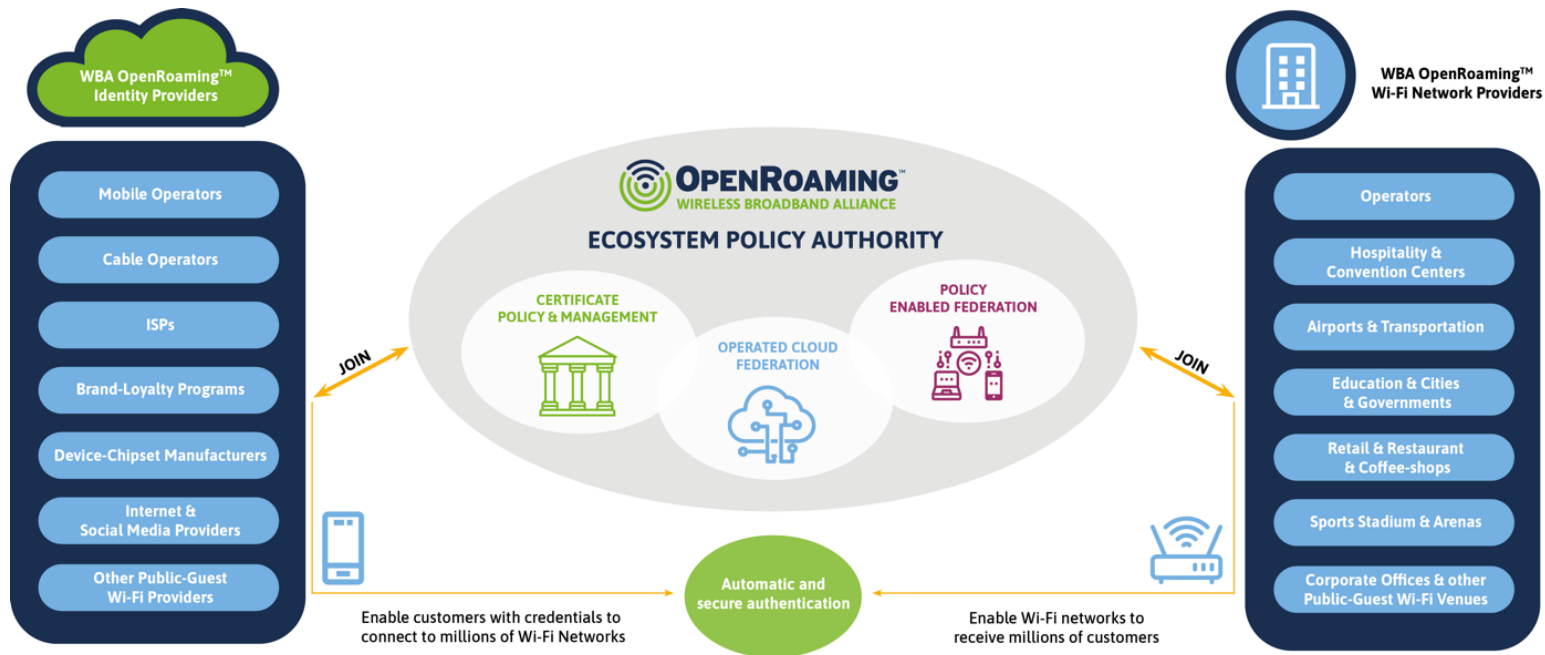


WBA OpenRoaming™ is a roaming federation service enabling an automatic and secure Wi-Fi experience globally. With WBA OpenRoaming™, we are creating an open connectivity framework for all organizations in the wireless ecosystem to power new opportunities in the 5G era. It encompasses three key elements:

WBA OpenRoaming™ Dimensions	WBA OpenRoaming™ Components & Standard & Technical specs
 Cybersecurity Service	<ul style="list-style-type: none">• Manages secure public keying infrastructure (PKI) / RadSec Technology for certificates policy, management and broker services• Supports dynamic & static interconnection technologies
 Cloud Federation	<ul style="list-style-type: none">• Operates centralized federation policies and global identifiers for Wi-Fi networks & identity providers• WBA unique Wi-Fi network identifier (WBAID) for federation partners• Wireless Roaming Intermediary eXchange (WRIX) standard enables roaming services harmonization and multiple business models
 Network Automation	<ul style="list-style-type: none">• Manages automated roaming consortium codes and policy provisioning mechanisms• Utilizes Passpoint® technology

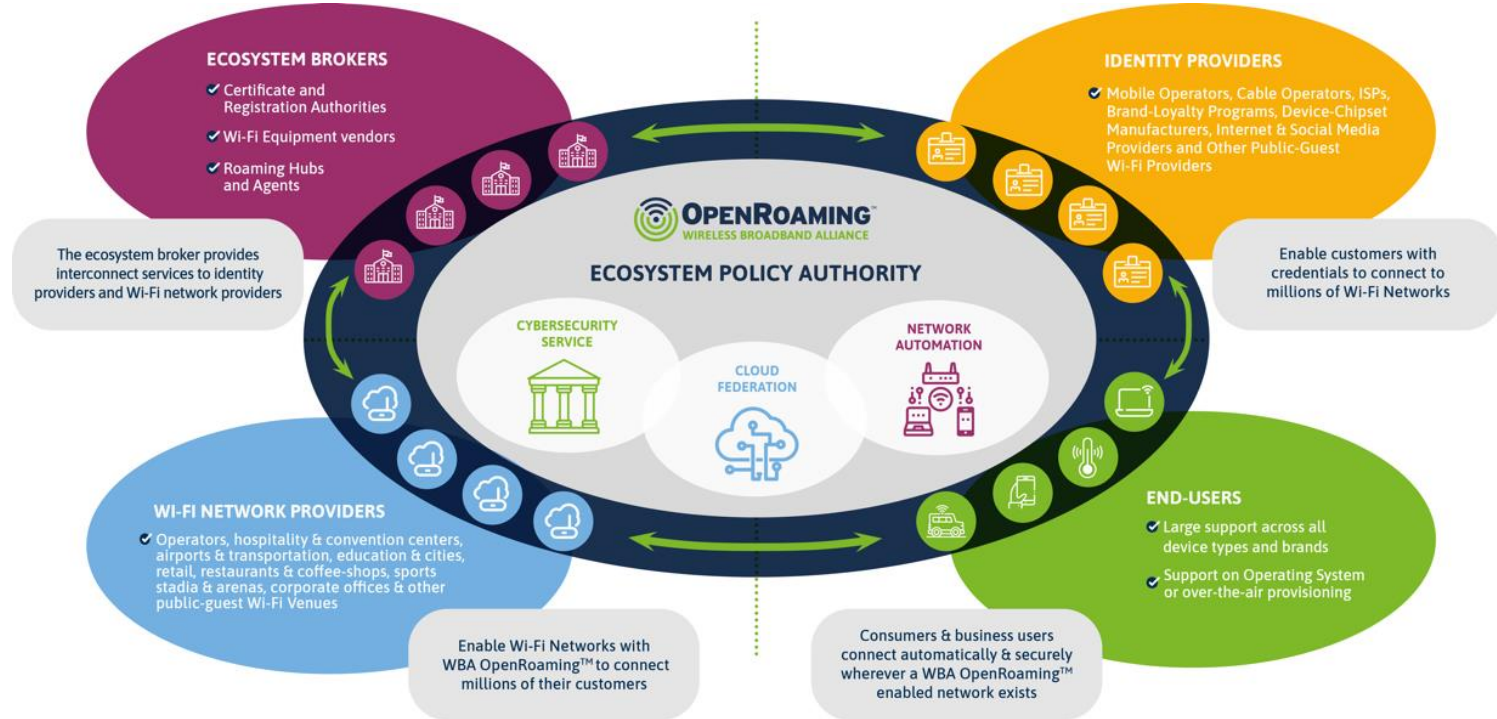
Opening the Ecosystem for New Business Models

WBA OpenRoaming is a framework that brings together key capabilities to create the federation and enables it to scale and work on a global basis.



OpenRoaming Players

Within the WBA OpenRoaming ecosystem, each player has a role and can enhance and increase their business value by becoming part of the federation.



OpenRoaming Business Benefits

Global standards for interconnecting the millions of Wi-Fi hotspots available worldwide.

Wi-Fi game changer
facilitates seamless, secure
and automatic connected
roaming experience for
customers



Network Providers & Venues

- ✔ Solve your Wi-Fi authentication challenge for your customers and visitors by providing automatic and secure Wi-Fi with WBA OpenRoaming
- ✔ Provides Wi-Fi access in your property to billions of Wi-Fi devices supported by WBA OpenRoaming members
- ✔ Grow your business opportunities with Wi-Fi Roaming & Offload
- ✔ Prepare your Wi-Fi network for convergence with 5G and be ready to be used by any device with a cellular SIM-Card & services
- ✔ Provide a better Wi-Fi experience with innovative services for your customers and visitors

Operators & Identity Providers

- ✔ Provide a state-of-the-art Wi-Fi experience by enabling automatic and secure connectivity to Wi-Fi networks to your customers
- ✔ Provide unprecedented global reach to millions of Wi-Fi Hotspots supported by WBA OpenRoaming partners for your customers in venues from operators, enterprises, cities, among others
- ✔ Extend value for your customers and increase relevancy of your services
- ✔ Enlarge your customer satisfaction and show innovative services by enabling WBA OpenRoaming
- ✔ Keep customers connected with WBA OpenRoaming while reducing operating expenses by way of Wi-Fi offload

OpenRoaming in Action



1 Million Hotspots & Counting; 120+ Trials

Seamless and secure roaming across cities, airports, stadiums, ports, universities and more.



World's First Airport OpenRoaming Network over Wi-Fi 6

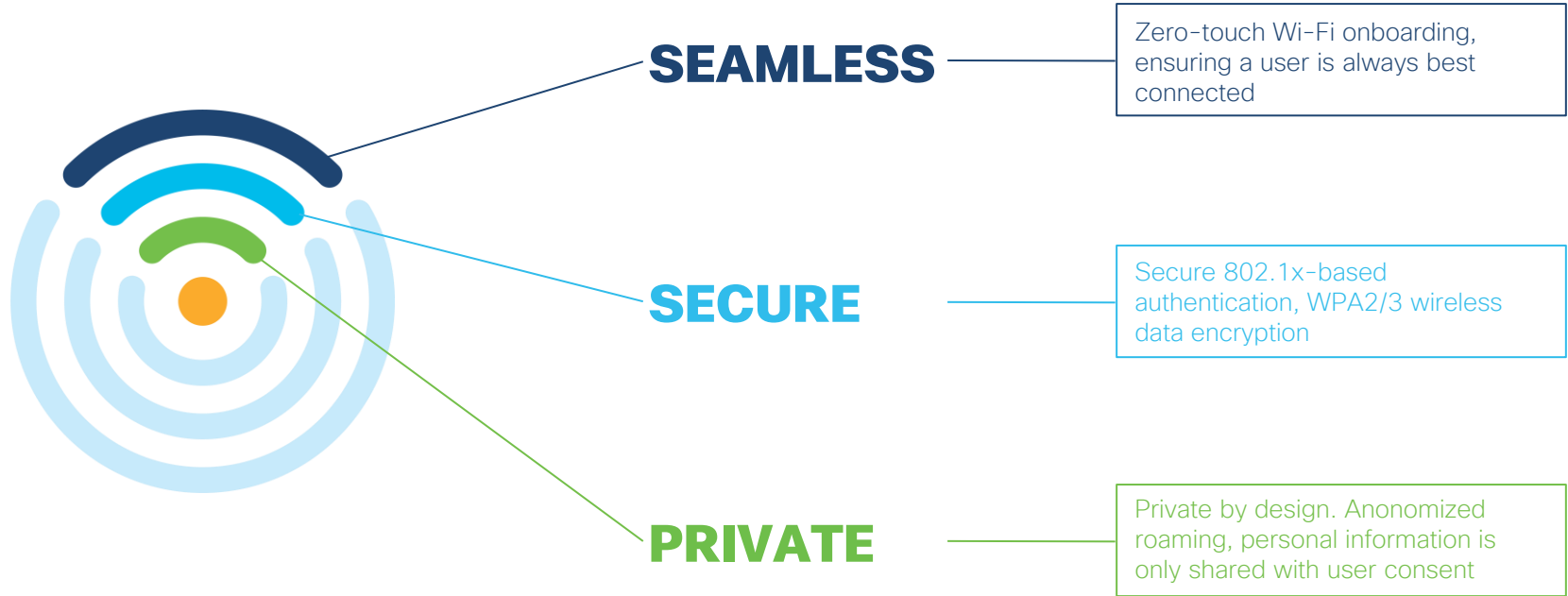
São Paulo/Guarulhos
International Airport (GRU)

Largest airport in South
America, with more than
24 million passengers per
year

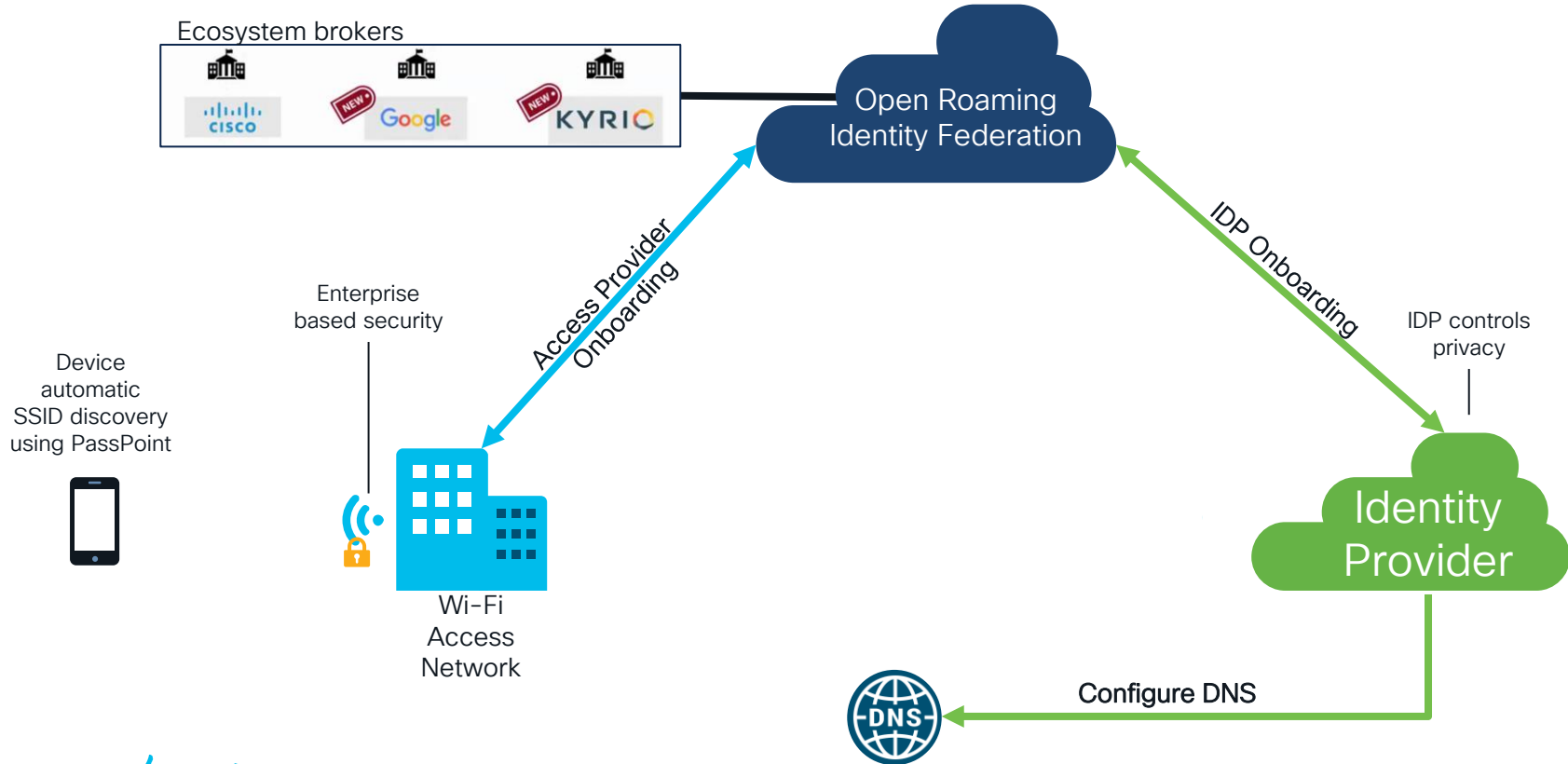
- Boingo managed network features Cisco Catalyst access points, controllers, and switches
- Instead of re-registering or re-entering log-in credentials, GRU users enjoy convenience of instant network access matched with enterprise-grade security
- When coupled with the Wi-Fi 6 infrastructure, OpenRoaming helps provide a 5G Wi-Fi experience

How Open Roaming Works

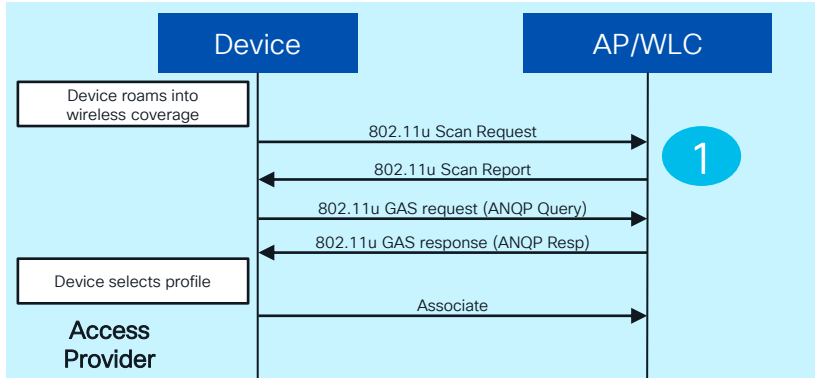
OpenRoaming: Seamless, Secure & Private



Secure Wi-Fi Onboarding



SSID discovery and selection using 802.11u



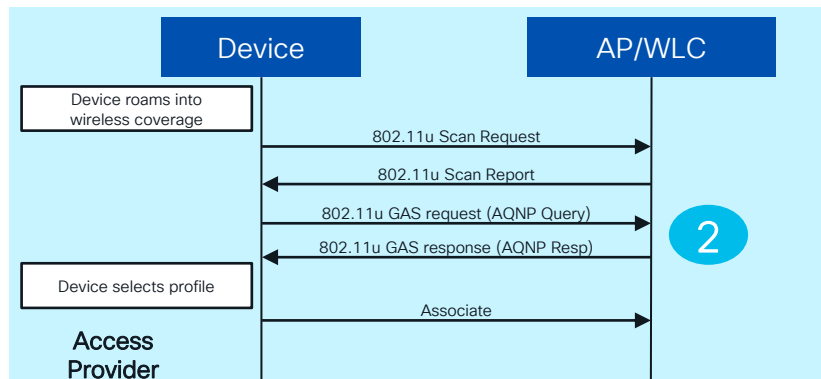
AP Beacon or Probe response info

No.	Source	Destination	Protocol	Access Network Type
52	Cisco_b2:51:a5	da:f8:43:32:7b:7a	802.11	Free public network

```
> Tag: RM Enabled Capabilities (5 octets)
> Tag: Mobility Domain
> Tag: HT Capabilities (802.11n D1.10)
> Tag: HT Information (802.11n D1.10)
> Tag: Extended Capabilities (10 octets)
v Tag: Interworking
  Tag Number: Interworking (107)
  Tag length: 1
  ... 0011 = Access Network Type: Free public network (3)
  ...1 ... = Internet: 1
  ..0. .... = ASRA: 0
  .0.. .... = ESR: 0
  0... .... = UESA: 0
v Tag: Advertisement Protocol
  Tag Number: Advertisement Protocol (108)
  Tag length: 2
  v Advertisement Protocol element: ANQP
    v Advertisement Protocol Tuple: Access Network Query Protocol
      .111 1111 = Query Response Length Limit: 127
      0... .... = PAME-BI: 0
      Advertisement Protocol ID: Access Network Query Protocol (0)
  v Tag: Roaming Consortium
    Tag Number: Roaming Consortium (111)
    Tag length: 5
    Number of ANQP OIs: 0
    ... 0011 = OI #1 Length: 3
    0000 ... = OI #2 Length: 0
    OI #1: 004096 - Cisco Systems, Inc
```

RCOI: 004096

802.11u GAS Initial Request (STA) and Response (AP)



AP response .11u and ANQP

```
IEEE 802.11 Wireless Management
  Fixed parameters
    Category code: Public Action (4)
    Public Action: GAS Initial Response (0x0b)
    Dialog token: 0xd5
    Status code: Successful (0x0000)
    GAS Comeback Delay: 0
    Tag Number: Advertisement Protocol (108)
    Tag length: 2
  Advertisement Protocol element: ANQP
    Advertisement Protocol Tuple: Access Network Query Protocol
  Query Response: ANQP Response - Domain Name list, ..
    Query Response Length: 185
    Info ID: Domain Name list (268)
      Length: 10
      Domain Name Length: 9
      Domain Name: cisco.com
    Info ID: NAI Realm list (263)
      Length: 148
      NAI Realm Count: 5
      NAI Realm Data (1.openroaming.org)
      NAI Realm Data (2.openroaming.org)
      NAI Realm Data (3.openroaming.org)
      NAI Realm Data (4.openroaming.org)
    NAI Realm Data (open.openroaming.org)
      NAI Realm Data Field Length: 38
      .... = NAI Realm Encoding: Formatted in accordance with RFC 4282 (0)
      NAI Realm Length: 20
      NAI Realm: open.openroaming.org
      EAP Method Count: 3
      EAP Method: TLS EAP (EAP-TLS)
      EAP Method: Tunnelled TLS EAP (EAP-TTLS)
      EAP Method: UMTS Authentication and Key Agreement EAP (EAP-AKA)
    Info ID: 3GPP Cellular Network Information (264)
      Length: 5
      GUD: 0
      UDHL: 3
      IEI: 0 (PLMN List)
      PLMN Length: 1
      Number of PLMNs: 0
```

Domain: cisco.com

NAI Realm: openroaming.org

STA request additional information .11u and ANQP

```
IEEE 802.11 Wireless Management
  Fixed parameters
    Category code: Public Action (4)
    Public Action: GAS Initial Request (0x0a)
    Dialog token: 0xb4
    Tag Number: Advertisement Protocol (108)
    Tag length: 2
  Advertisement Protocol element: ANQP
    Advertisement Protocol Tuple: Access Network Query Protocol
  Query Request: ANQP Request - ANQP Query list
    Query Request Length: 14
    Info ID: ANQP Query list (256)
      Length: 10
      ANQP Query ID: Venue Name information (258)
      ANQP Query ID: Roaming Consortium list (261)
      ANQP Query ID: NAI Realm list (263)
      ANQP Query ID: 3GPP Cellular Network information (264)
      ANQP Query ID: Domain Name list (268)
```

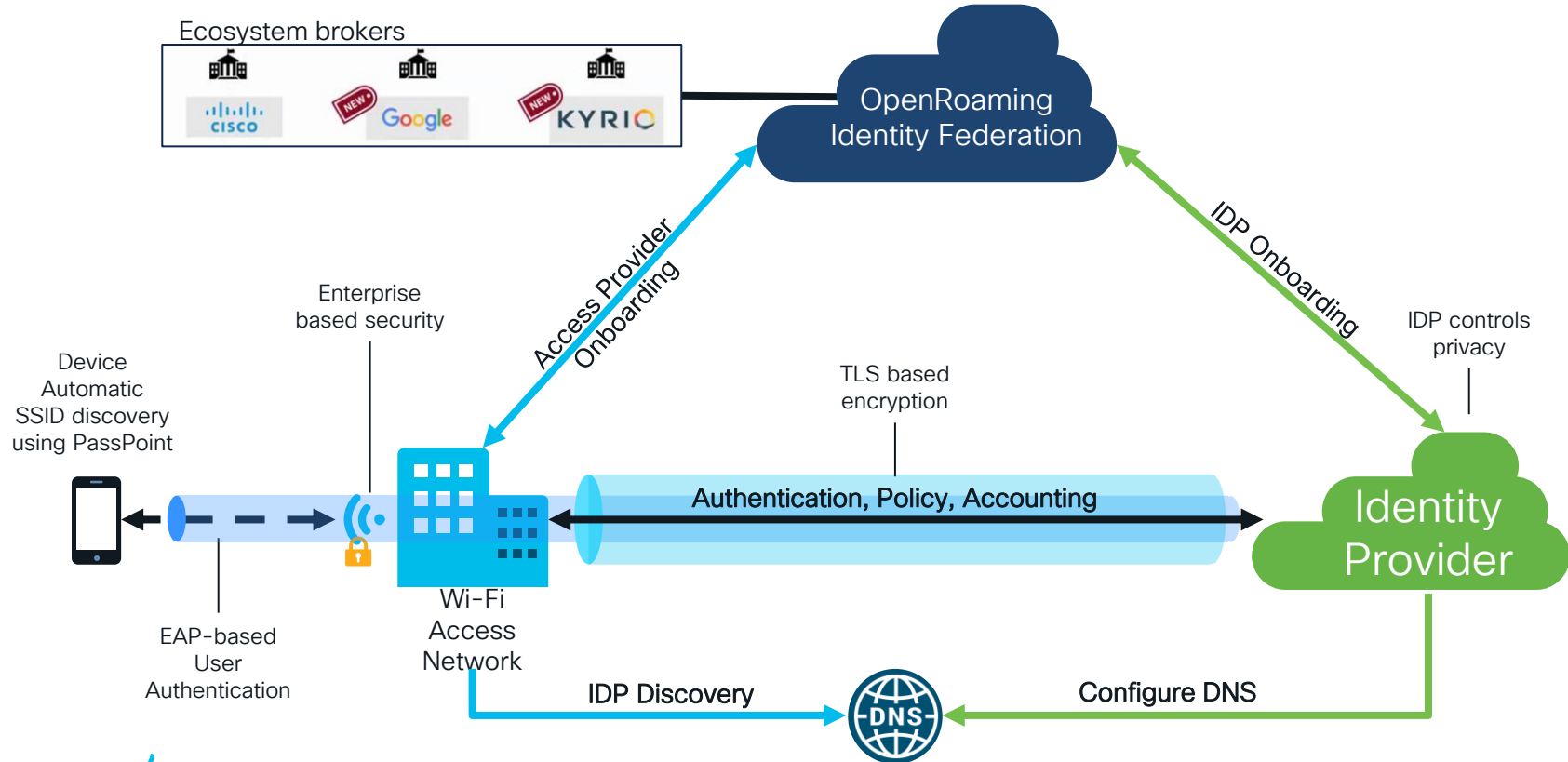
OpenRoaming RCOI

Roaming Consortium Organization Identifier (RCOI) :

- Allow all: Accepts users from any identity provider (IDP), with any privacy policy.
- Real ID: Accepts users from any IDP, but only with a privacy policy that shares real identity (anonymous not accepted).
- Custom: Accepts users of select identity types and privacy policies associated with the identity types.

Description	Roaming OI numerical value	Roaming OI Alias
All	004096	allow-all
All with real-id	00500b	real-id
All paid members	00500f	paid
Device manufacturer all id	00502a	dev-manufacturer-id
Device manufacturer real id only	0050a7	dev-manufacturer-real-id
Cloud/Social ID	005014	cloud-social-id
Cloud/Social real ID	0050bd	cloud-social-real-id
Enterprise Employee ID	00503e	employee-id
Enterprise Employee real ID	0050d1	employee-real-id
Enterprise Customer ID	005050	customer-id
Enterprise Customer real ID	0050e2	customer-real-id
Loyalty Retail ID	005053	retail-id
Loyalty Retail real ID	0050f0	retail-real-id
Loyalty Hospitality ID	005054	hospitality-id
Loyalty Hospitality real ID	00562b	hospitality-real-id
SP1 (best effort)	005073	sp1
SP1 (best effort) real ID	0057d2	sp1-real-id
SP2 (QoS class 2)	005080	sp2
SP2 (QoS class 2) real ID	0059dc	sp2-real-id
SP3 (QoS class 3)	0050a2	sp3
SP3 (QoS class 3) real ID	005d73	sp3-real-id
Trial	000216	trial
Test	CSSGEN-1100 00000c	test

Secure Wi-Fi Onboarding



Steps to activate in your network

Enabling you company as an Open Roaming Network Provider

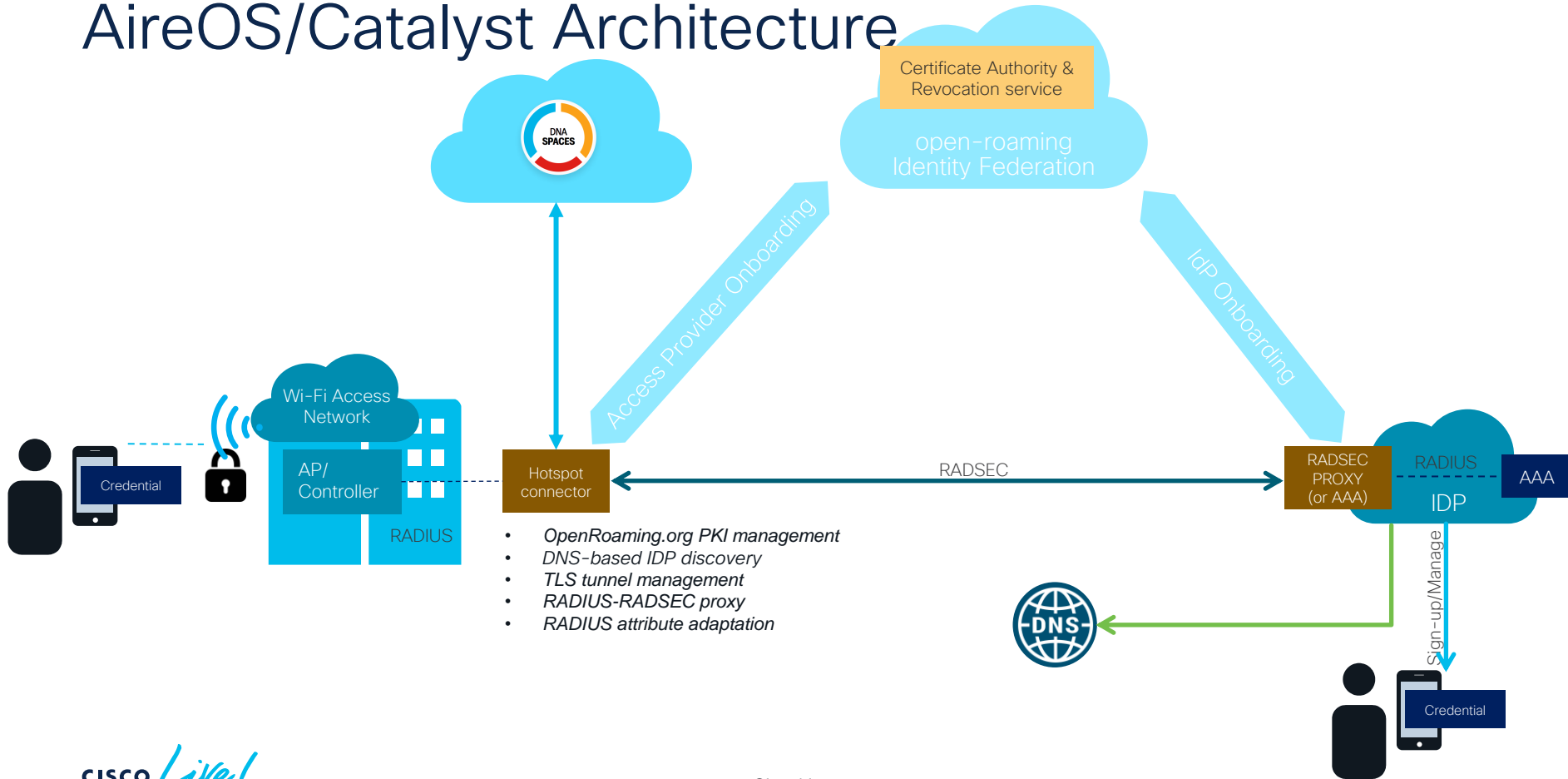
What do I need?

3 Scenarios

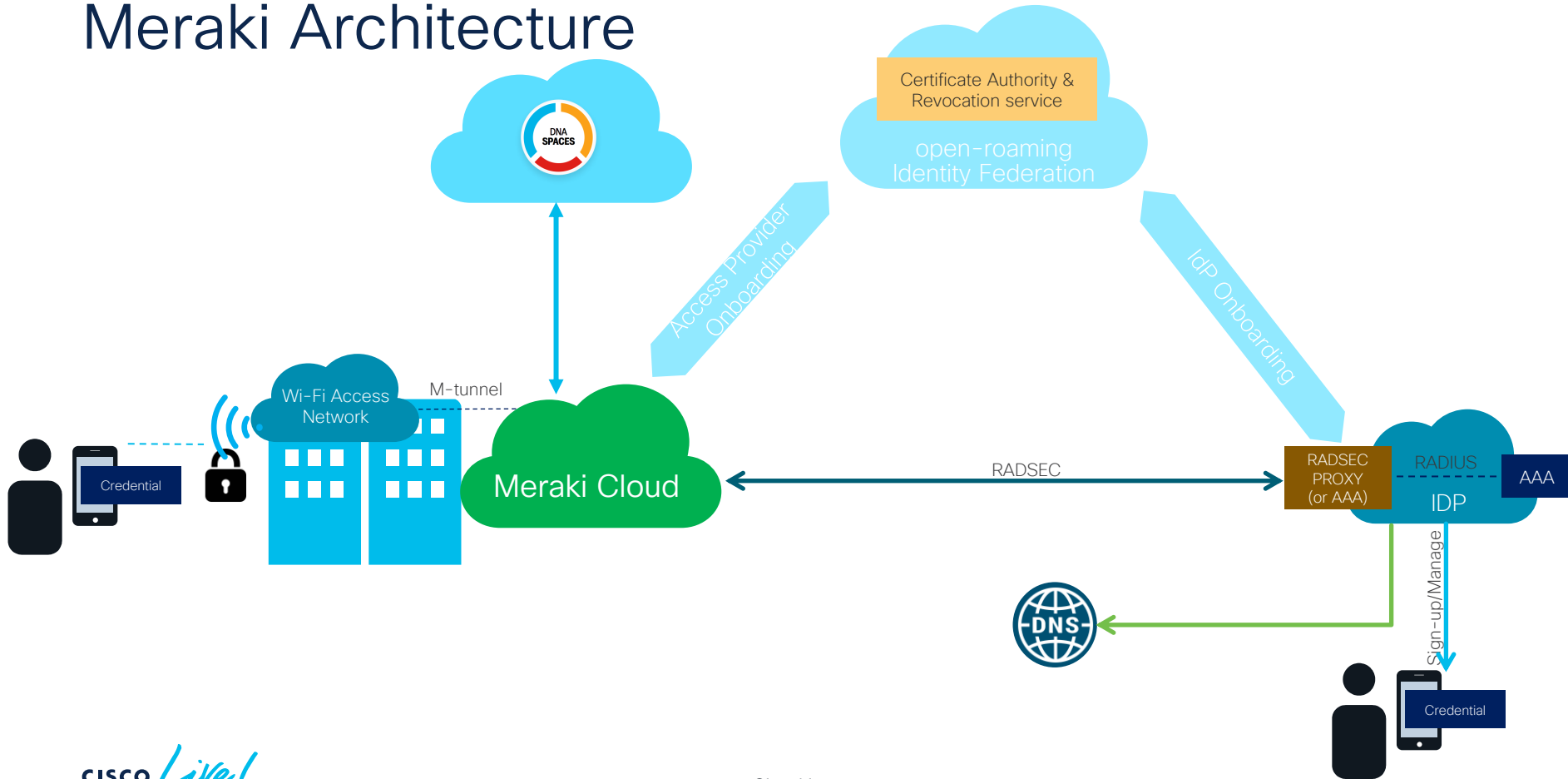


1. Cisco AireOS WLC 8.3 or newer (8.5 or newer recommended) + DNA Spaces (with Connector)
2. Cisco Catalyst 9800 16.12 or newer + DNA Spaces (with Connector)
3. Meraki + DNA Spaces

AireOS/Catalyst Architecture



Meraki Architecture



Configuration Steps for 9800 with DNA Spaces Connector



- 1 Create an Open Roaming Profile
- 2 Enable Hotspot Connector
- 3 Configure the DNAS Connector as AAA
- 4 Configure the Open Roaming SSID



Configuration Steps for 9800 with DNA Spaces Connector

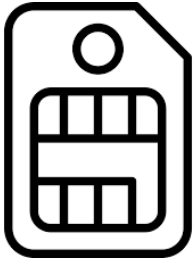
@DNA Spaces

1 Create an Open Roaming Profile

- Select the types of users who can access your Open Roaming SSID
- Optionally enable Carrier Offload

Which ID's are available?

Service
Provider



Enterprise

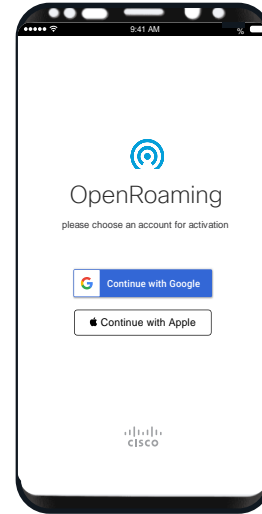


Device
Embedded

SAMSUNG



Cloud ID



Loyalty



DNA Spaces Policies (1)

Create an OpenRoaming Profile

1

2

3

4

Set Access Policy

Pick an SSID

Configure Carrier Offload

Summary

Access Policy

Set your policy on who can access your OpenRoaming network

Select the types of users who can access OpenRoaming

☐ Accept all authenticated users (Default)

☐ Accept only users who provide their identity (e.g. email)

☒ Accept users with specified identity types

1 selected

☐ Identity Name

Require real identity

☒ Cloud/Social ID

☐ Enterprise Employee ID

Selected Identity Types (1)

REAL IDENTITIES

Cloud/Social ID

ANONYMOUS IDENTITIES

None

☐ Accept only your users (You will need to be added as an identity provider)

Cancel

Previous

Next

- Accept all (Default)
- Accept only users who provide identity (e.g. email)
- Accept users with specific identity types
- Accept only your users (your IDP)

DNA Spaces Policies (2)

Create an OpenRoaming Profile

☐ Enterprise Employee ID

☐ Accept only your users (You will need to be added as an identity provider)

Preferred Credentials

Set your policy on who can access your OpenRoaming network

☐ I do not have preferred credentials

☒ I have preferred credentials, which I want to use

Domain

cisco.com

Add

Custom Domains (1)

cisco.com

Cancel

Previous

Next

- I do not have preferred credentials
- I have preferred credentials – add domains

DNA Spaces Policies (3)

Create an OpenRoaming Profile

✓

2

3

4

Set Access Policy

Pick an SSID

Configure Carrier Offload

Summary

SSID Details

Enter the SSID details for this OpenRoaming Profile - this is a secure SSID different from your guest SSID.

i

If you are entering an existing SSID, please ensure the SSID matches exactly on the network

SSID Name

OpenRoaming_9800

Advanced

Default status

☒ Enable ☐ Disable

Fast Transition (802.11r)

☒ Adaptive ☐ Enable ☐ Disable

Cancel

Previous

Next

Need Help?

[SSID Configuration for OpenRoaming](#)

- SSID Name
- SSID Advanced – status and fast transition (11r)

DNA Spaces Policies (4)

Create an OpenRoaming Profile

✓

✓

3

4

Set Access Policy

Pick an SSID

Configure Carrier Offload

Summary

Carrier Offload

Leverage your Wi-Fi network to provide voice and data service to mobile carrier subscribers.

Allow Carrier Offload ☒

Select Carriers based on your existing relationship.

<input type="checkbox"/> Carrier	Offloading Partner	Static Routing	Realms	MNC/MCC
<input type="checkbox"/> AT&T-US	boingo	<input type="checkbox"/> Enable	network.org, wlan.mnc280, mcc310.3gpp network.org, wlan.mnc100, mcc313.3gpp network.org, wlan.mnc410.	310 410,310 150,310 280,313 100

[+ Add Custom Carrier](#)

To add more offload partners, activate them through [DNA Spaces Partner App Center](#).

[Cancel](#)[Previous](#)[Next](#)

- Allow Carrier Offload
- Select the Service Provider (US Only)
- Agreement with your SP / Settlement provider

Configuration Steps for 9800 with DNA Spaces Connector

@DNA Spaces

1 Create an Open Roaming Profile

- Select the types of users who can access your OR SSID
- Optionally enable Carrier Offload

2 Enable Hotspot Connector

- Select the DNAS Connector
- Generate a token
- Paste the token at the Connector

Configuration Steps for 9800 with DNA Spaces Connector

@DNA Spaces

@9800

1 Create an Open Roaming Profile

- Select the types of users who can access your OR SSID
- Optionally enable Carrier Offload

2 Enable Hotspot Connector

- Select the DNAS Connector
- Generate a token
- Paste the token at the Connector

3 Configure the DNAS Connector as AAA

Target and config Called-station-id

Configuration Steps for 9800 with DNA Spaces Connector

@DNA Spaces

1 Create an Open Roaming Profile

- Select the types of users who can access your OR SSID
- Optionally enable Carrier Offload

2 Enable Hotspot Connector

- Select the DNAS Connector
- Generate a token
- Paste the token at the Connector

@9800

3 Configure the DNAS Connector as AAA Target and config Called-station-id

4 Configure the SSID

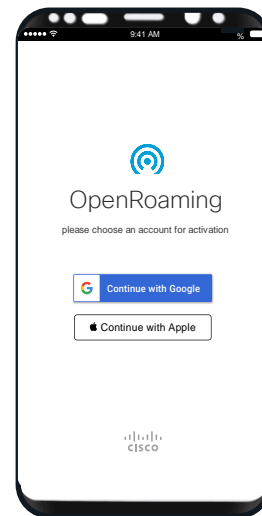
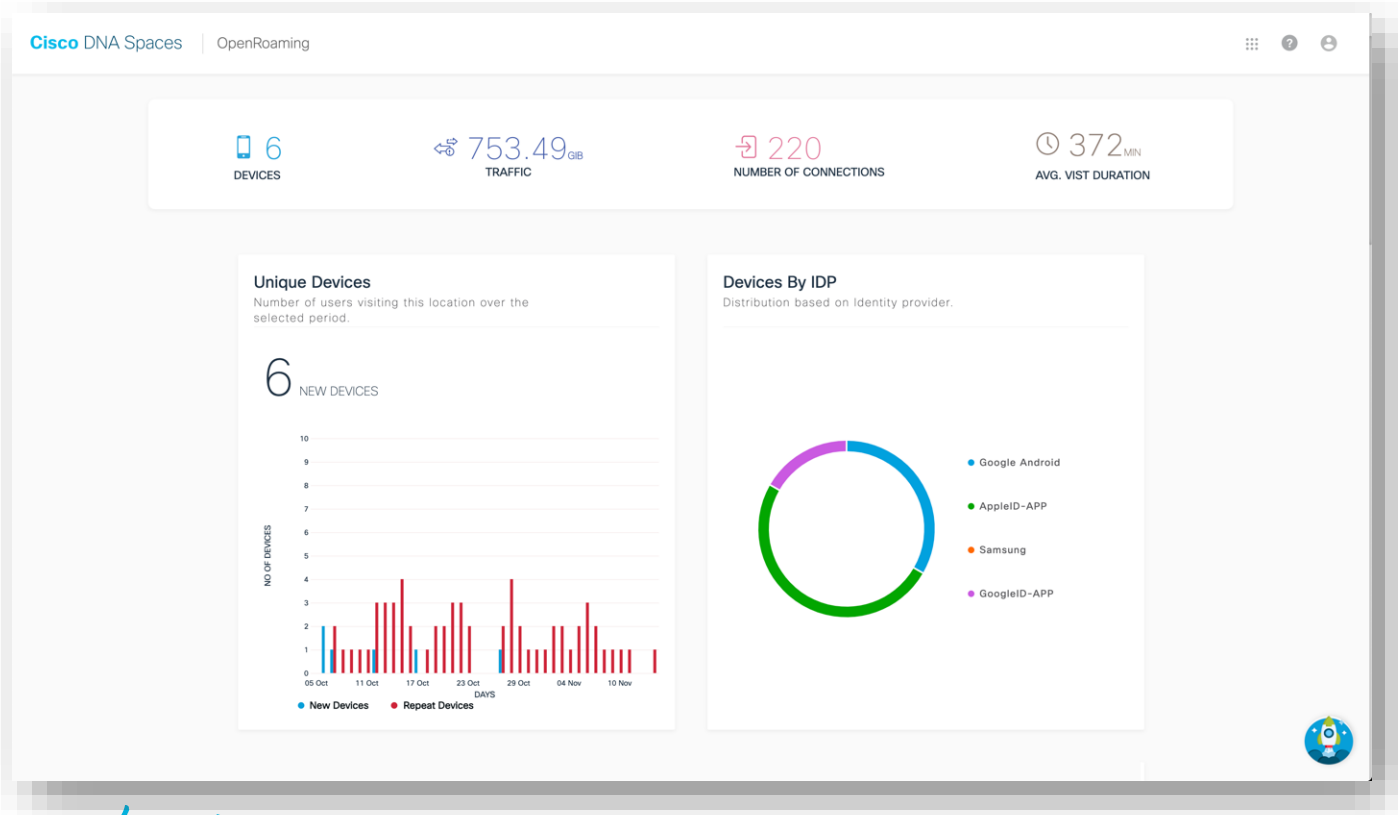
- Layer 2 Security: WPA+WPA2 / WPA3
- Auth Key Management: 802.1x
- AAA: Open Roaming Connector
- 802.11u config: copy config generate by the connector at 9800 CLI

Add 802.11u configurations in your 9800 WLC

Go to the CLI of the 9800 and paste the configuration.

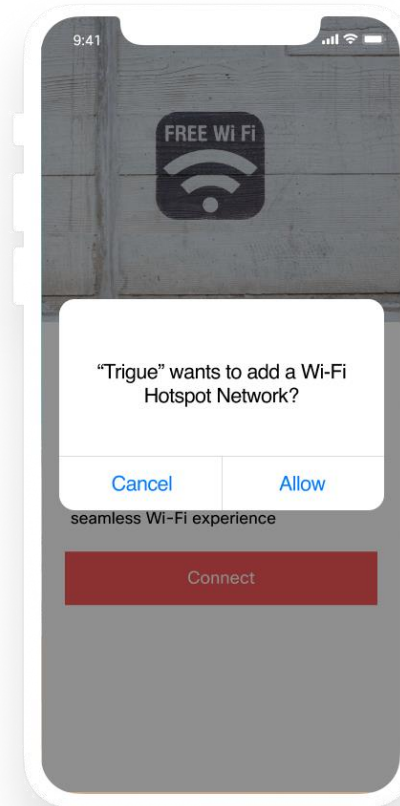
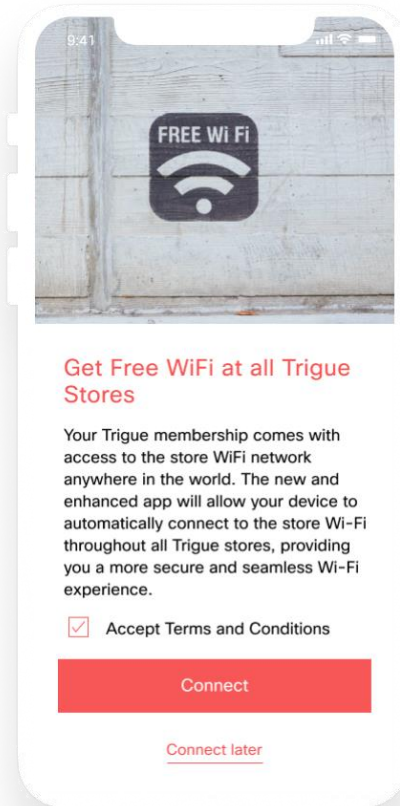
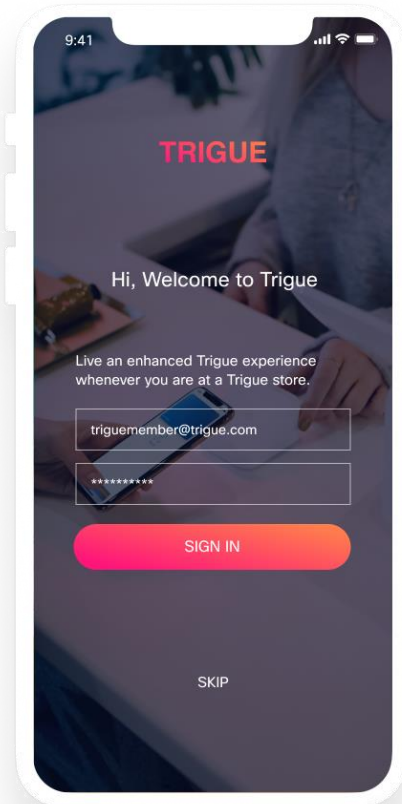
```
C9800#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
C9800(config)#wireless hotspot anqp-server OpenRoaming type open-roaming
C9800(config-wireless-anqp-server)#domain cisco.com
C9800(config-wireless-anqp-server)#nai-realm 1.openroaming.org
C9800(config-anqp-nai-eap)#eap-method eap-ttls
C9800(config-anqp-nai-eap-auth)#inner-auth-non-eap pap
C9800(config-anqp-nai-eap-auth)#nai-realm 2.openroaming.org
C9800(config-anqp-nai-eap)#eap-method eap-ttls
C9800(config-anqp-nai-eap-auth)#inner-auth-non-eap mschap-v2
C9800(config-anqp-nai-eap-auth)#nai-realm 3.openroaming.org
C9800(config-anqp-nai-eap)#eap-method eap-tls
C9800(config-anqp-nai-eap-auth)#nai-realm 4.openroaming.org
C9800(config-anqp-nai-eap)#eap-method eap-aka
C9800(config-anqp-nai-eap-auth)#nai-realm open.openroaming.org
C9800(config-anqp-nai-eap)#eap-method eap-ttls
C9800(config-anqp-nai-eap-auth)#inner-auth-non-eap pap
...
```

OpenRoaming App and Stats & Metrics @ DNA Spaces



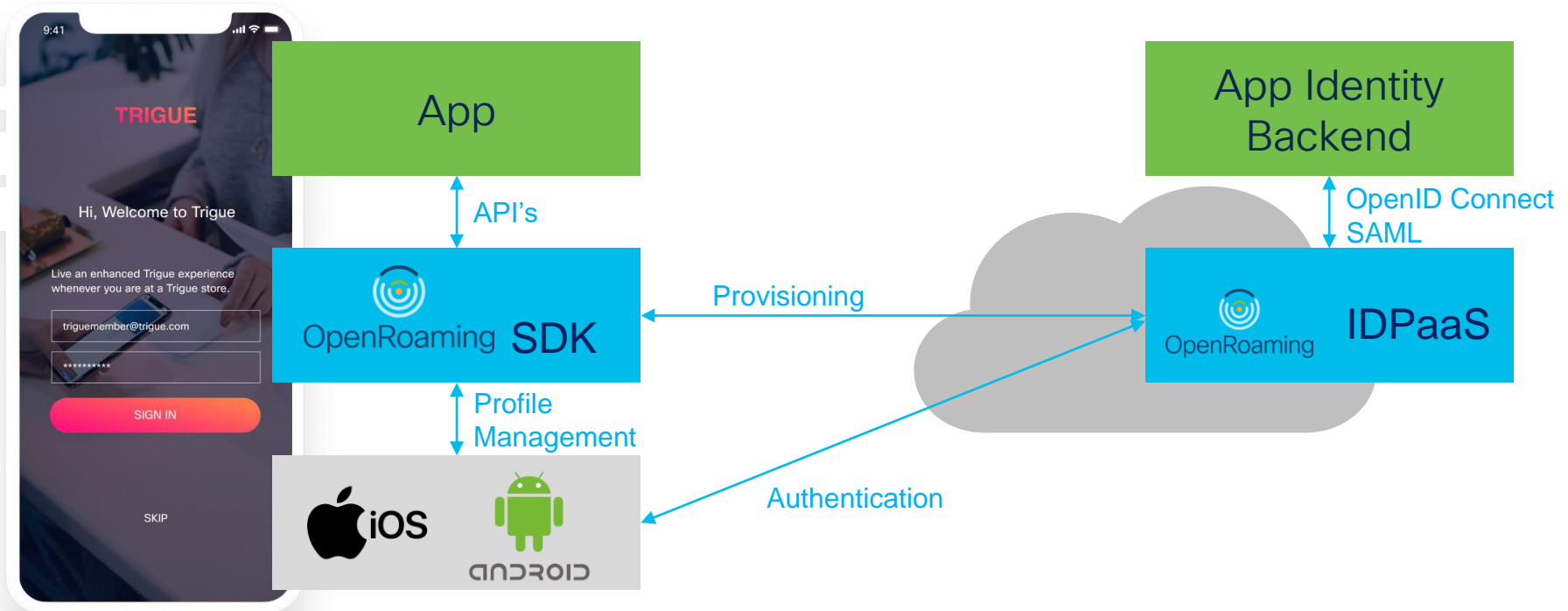
Enabling you company as an Open Roaming Identity Provider (IDP)

APP integration



SDK for iOS & Android

<https://developer.cisco.com/dna-spaces-sdk/>



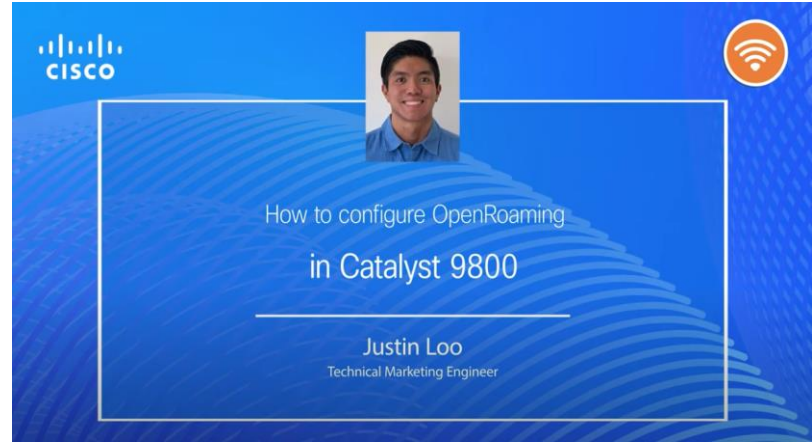
References to learn more about Open Roaming



OpenRoaming
Automatic and secure connectivity to Wi-Fi anywhere

Bart Brinckman, Principal Engineer, Cisco
Matt MacPherson, Wireless CTO, Cisco
Ed Vanderpool, IT Technical Manager, Adventist Health
BRKEWN-2004

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How to configure OpenRoaming
in Catalyst 9800

Justin Loo
Technical Marketing Engineer



Cisco DNA Spaces SDK Videos

A video series to introduce iOS and Android developers to the DNA Spaces SDK. Enhance Wi-Fi experience and boost Wi-Fi adoption by seamlessly onboarding guests through OpenRoaming.



References to learn more about Open Roaming

- Catalyst 9800 WLC Config Guide
- DNAS Open Roaming Config Guide
- DNAS Connector Config Guide
- WBA Open Roaming: <https://wballiance.com/openroaming/>
- How to configure Open Roaming at C9800: <https://youtu.be/XsD6e6F6u4k>
- DNAS SDK Videos: <https://developer.cisco.com/dna-spaces-sdk/>
- CL2021 On-Demand OR Session with detailed call flow (BRKEWN-2004)

Technical Session Surveys

- Attendees who fill out a minimum of four session surveys and the overall event survey will get Cisco Live branded socks!
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Cisco Modeling Labs

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Cisco Learning Network

Resource community portal for certifications and learning



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Certify

Cisco Certifications and Specialist Certifications

Award-winning certification program empowers students and IT Professionals to advance their technical careers

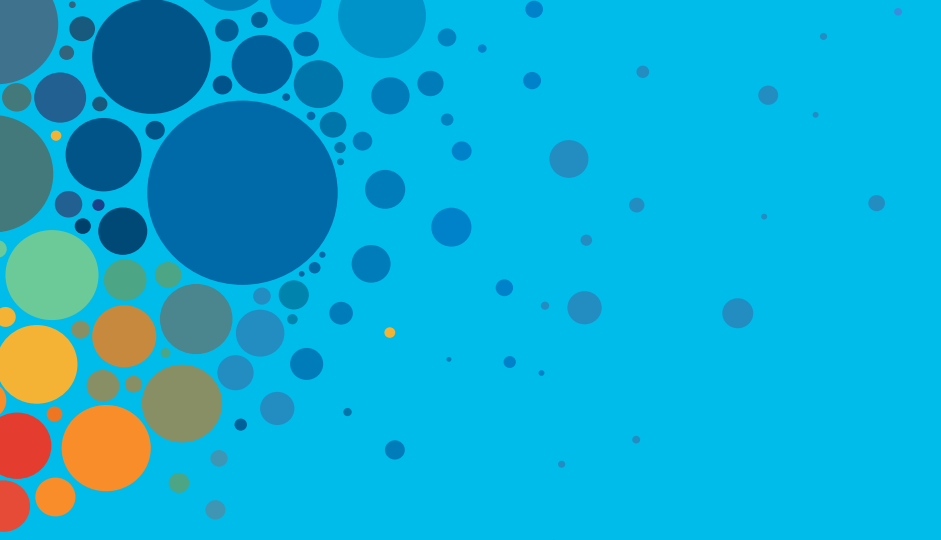
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- Book your one-on-one Meet the Engineer meeting
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The bridge to possible

Thank you

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