



The bridge to possible

Experience From the Field – How we use Cisco DNA Center to Level up at Region Värmland in Sweden

Fredrik Carlén, IT Operations manager, Infrastructure
David Järpestam, Senior Network Engineer



Agenda

- IT-operations and challenges
- Our network infrastructure
- DNA Center Use Cases
- Insights and final thoughts

[Click here](#) for more details

Who are we?

Fredrik Carlén

Multi-studies at university:
Informatics, management, history,
sociology and project management



IT Operations manager, Infrastructure
(ex Network Engineer)

Spend a lot of time in
the forest with my
dachshund.



David Järpeštam

Philosophy Bachelor's Degree
Computer Science,
Network Engineering

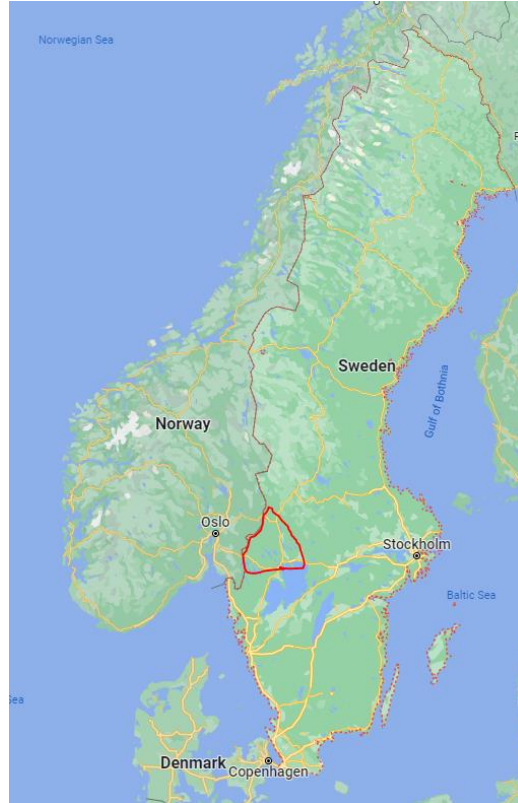


Senior Network Engineer
Scrum master for the network team
IoT-geek and father of two small ones

Riding my homebuilt
1000W e-MTB



Region Värmland – whereabouts in Sweden?



Region Värmland – Into the wild, still high tech ☺



What about the organization Region Värmland?

Is responsible for all the county of Värmland's publicly funded:

Health care
Public transport
Culture
Education



Karlstad – our main site



IT-operations & Challenges



Our unit – IT Platform and Client solutions

40 colleagues in different roles

- Infrastructure
- Client
- Telephone



Operations, 2/3-line support, development and strategy

Agile teams inspired by scrum with a 2-week sprint beat.

The network team

Seven happy network engineers!



"Our mission is to maintain, operate, and develop the network platform to meet the needs of the the users, staff and vistors in our organization."

The Network Infrastructure

The Network Infrastructure

- Hierarchical network model
- 2500 network devices
- 16000 endpoints
- **Core:** Catalyst 9600R
- **Distribution:** Catalyst 9500-48Y4C
- **Access:** Catalyst 9200/9300
- **AAA:** Identity Service Engine 3655



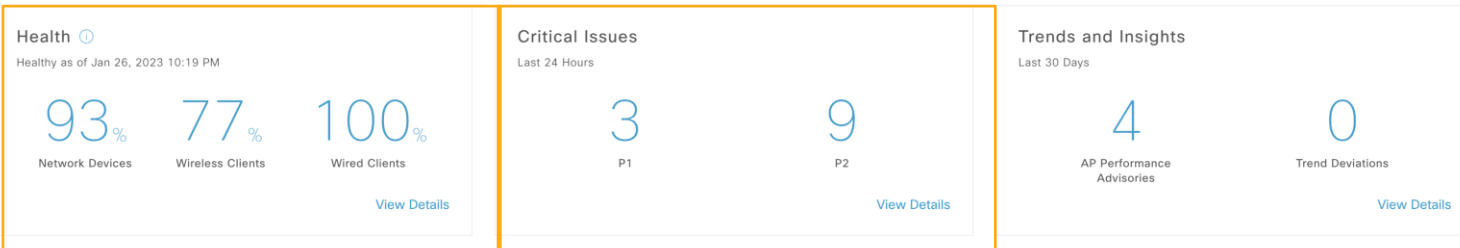
Cisco DNA Center

Cisco DNA Center Appliance 44 Core (Gen 2), 3 node cluster (DN2-HW-APL-U)

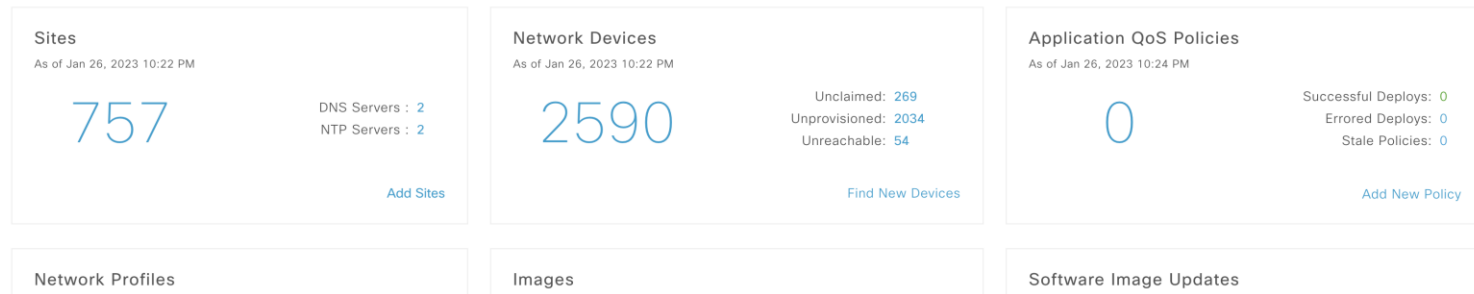
☰ Cisco DNA Center



Assurance Summary



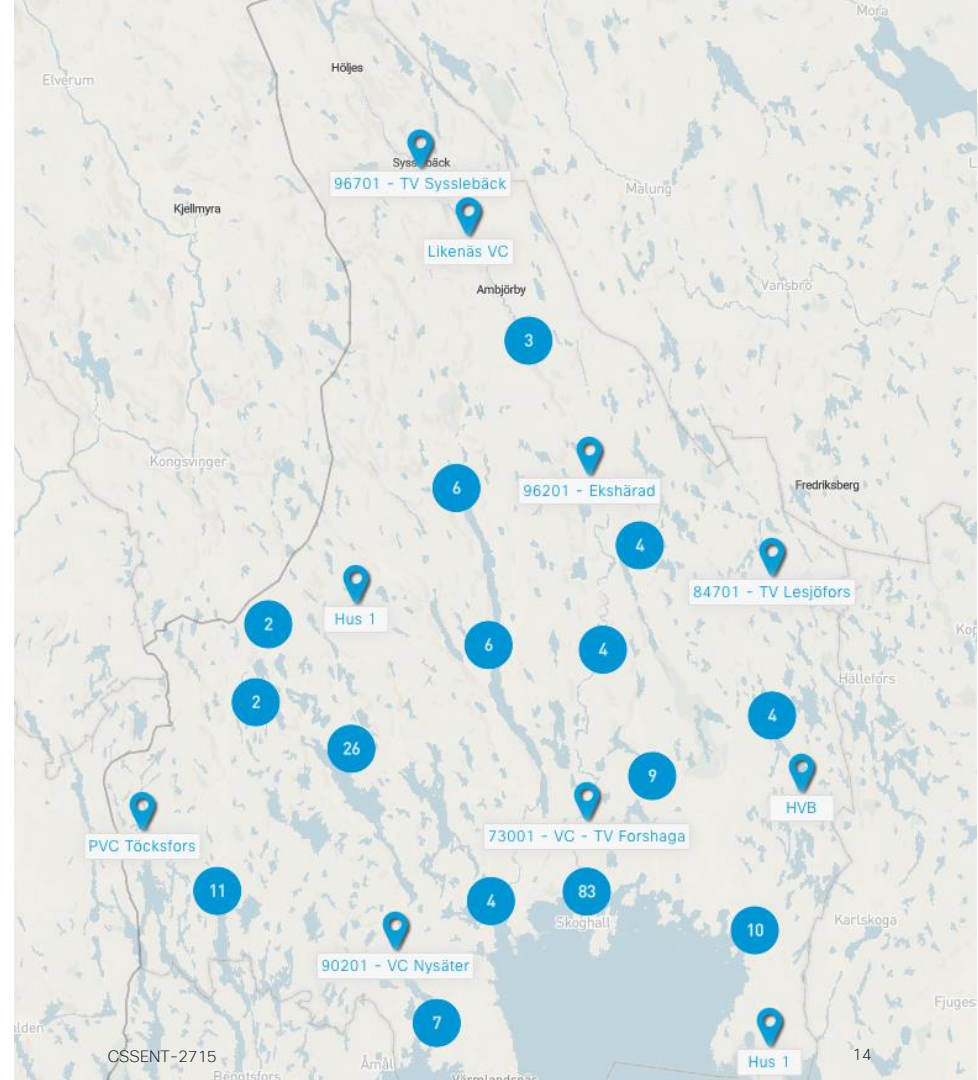
Network Snapshot

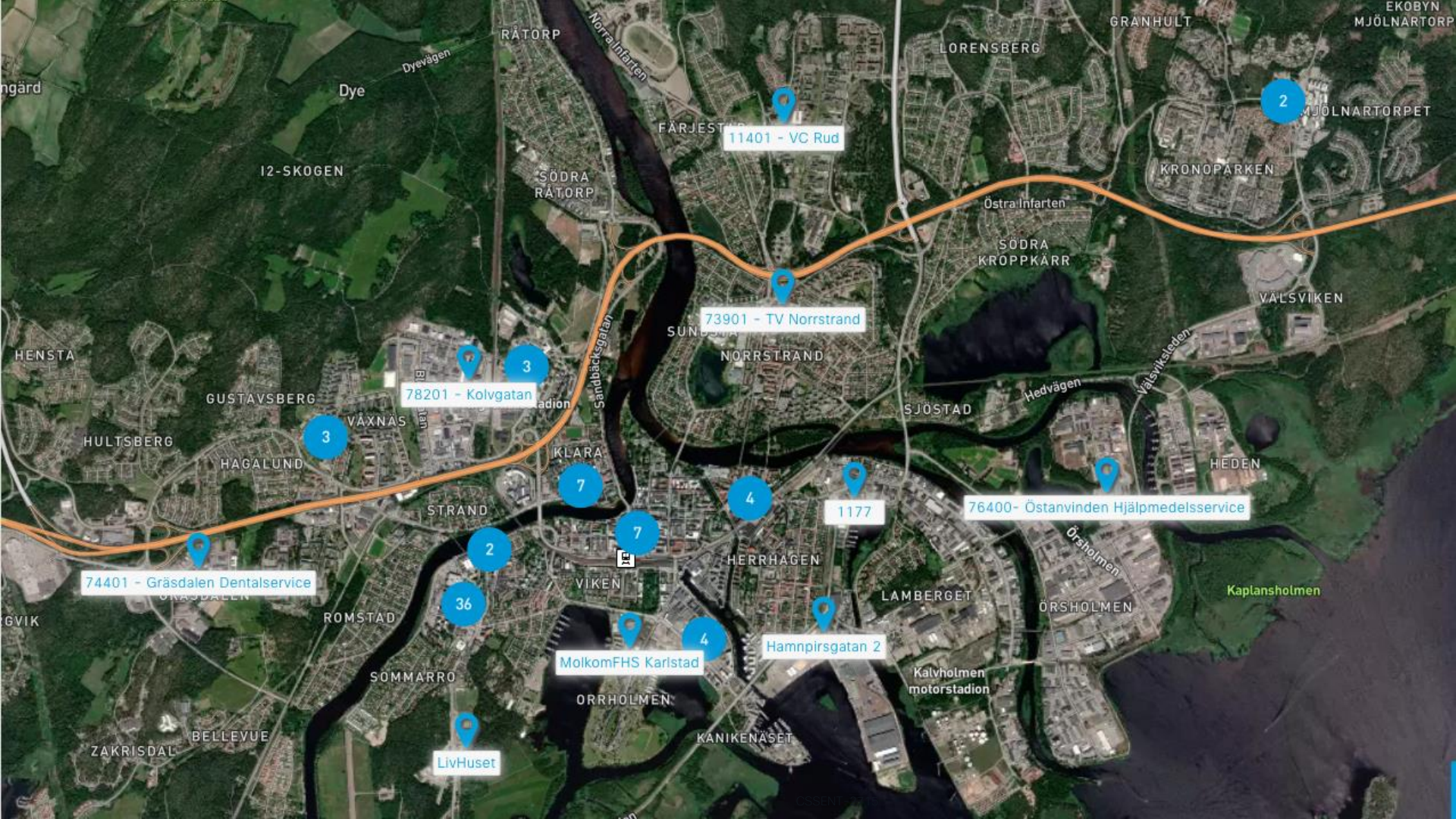


DNA Center Site Hierarchy

- Geographical area/site
- Buildings/Floors with x/y coordinates
- Get maps for your buildings!

Why? Unique Network profiles & Network settings per site





11401 - VC Rud

73901 - TV Norrstrand

78201 - Kolvgatan

74401 - Gräsdalen Dentservice

76400 - Östanvinden Hjälpmedelsservice

Hamnpirsgatan 2

MolkomFHS Karlstad

LivHuset

2

3

3

7

4

7

2

36

4

DNA Center Use Cases

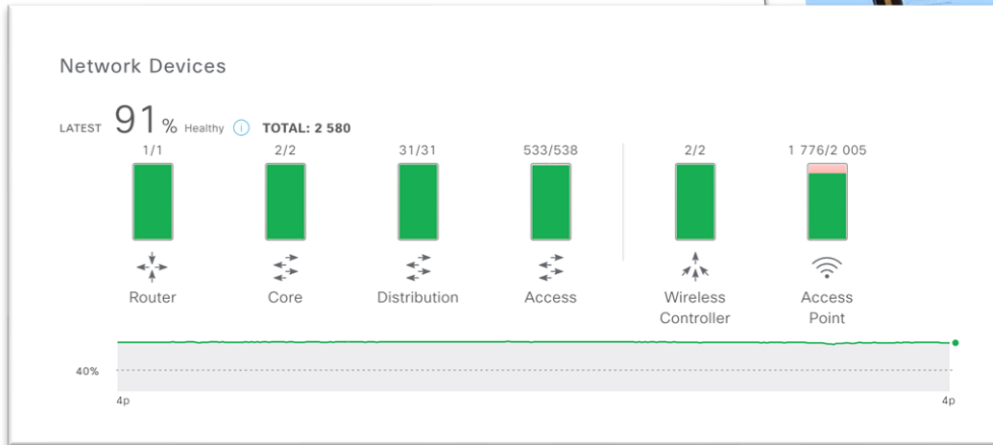
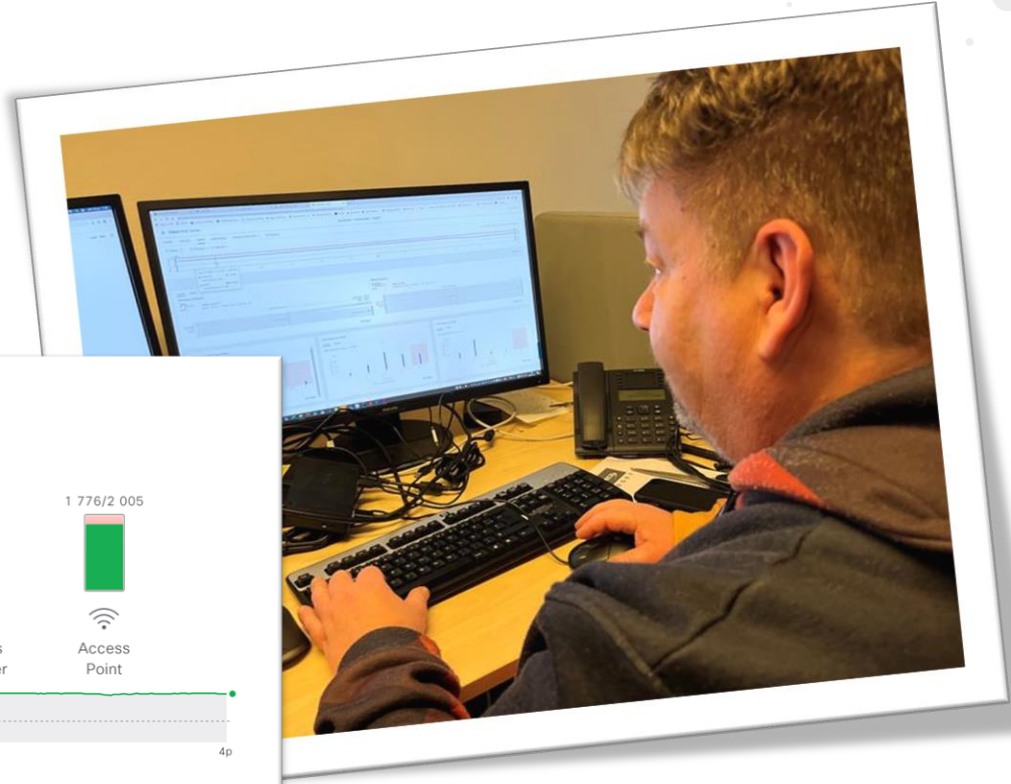


Network Assurance Network Automation



Cisco DNA Center Network Assurance

- Network view
- Client view
- Issues (P1, P2, P3, AI)



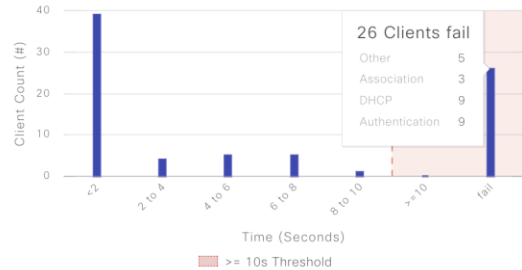
Assurance – Client dashboard

Overall Network **Client** Applications Network Services SD-Access

Client Onboarding Times

LATEST TREND

68% clients with onboarding times < 10 s

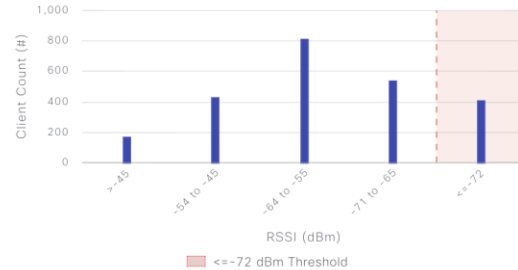


[View Details](#)

Connectivity RSSI

LATEST TREND

83% clients with RSSI > -72 dBm

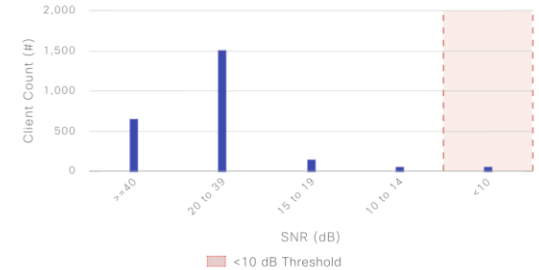


[View Details](#)

Connectivity SNR

LATEST TREND

99% clients with SNR > 10 dB



[View Details](#)

Client / Client 360

Client 360

🕒 24 Hours ▾

Intelligent Capture

Webex 360



4/10 ⓘ CLIENT DETAILS

Jan 22, 2023 9:07 AM - Jan 23, 2023 9:07 AM 🔁 ⚙️

Device: iPad mini 5th Gen OS: iPad11,1 hwp/t8020 build/19G82 MAC: B6:DF:33:10:BC:E5 IPv4: 10.28.25.64 IPv6: -- L3 Virtual Network: -- L2 Virtual Network: -- VLAN ID: 1624 Status: Connected

Capability: 11ac Last seen: Jan 23, 2023 9:04:00 AM Connected Network Device: [ce1ap-53-3-D](#) SSID: RV [View All Details](#)[Issues](#) [Onboarding](#) [Path Trace](#) [Application Experience](#) [Device Info](#) [Connectivity](#) [RF](#) [iOS Analytics](#) [Event Viewer](#)

▾ Issues (1)

P3

Connected

Wireless client exhibiting sticky behavior on AP "ce1ap-53-4-F"

Instance Count: 32

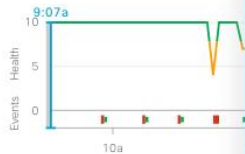
Jan 22, 2023 10:28 PM - Jan 23, 2023 5:48 AM

1 Records

Show Records: 10 ▾ < 1 >

[Resolved Issues](#)[Ignored Issues](#)

Client / Client 360



4/10 CLIENT DETAILS

Device: iPad mini 5th Gen OS: iPad

Last seen: Jan 23, 2023 9:04:00 AM

Issues (1)

P3

Connected
Wireless
Instance C

1 Records

Onboarding

DHCP AAA

Wireless client exhibiting sticky behavior on AP "ce1ap-53-4-F"

Open

Issue Profile: global Edit Issue Settings

Description

This client maintained an association with AP "ce1ap-53-4-F" at -72dBm, which is a weaker signal. It should have roamed to an available AP that has a stronger signal. This client was connected to SSID "RV" on 5.0 GHz radio on AP "ce1ap-53-4-F" in location Global/10100 - CSK/Hus 53/Plan 4. The AP is connected to WLC "ce1wlc-Intern".

Last Occurred: Jan 23, 2023 5:48 AM

Impact of Last Occurrence

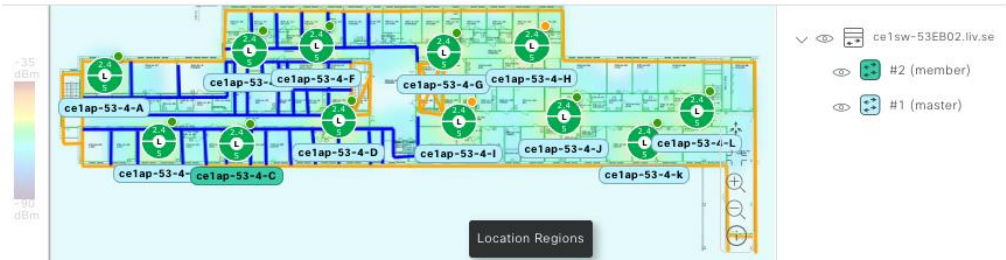
Jan 22, 2023 9:07 AM - Jan 23, 2023 9:07 AM

Location: Global/10100 - CSK/Hus 53/Plan 4
1 BuildingClients
15 Wireless Clients

Floor Map

Jan 23, 2023 5:48 AM

Show 5 GHz



View Most Recent Fullscreen Heatmap

Suggested Actions (2)

- 1 If available, increase the roaming aggressiveness within the client driver, which might fix the problem for clients supporting this option.
- 2 Update the client driver to the latest version, which might resolve this issue.

Client / Client 360

🕒 24 Hours ▾

4/10 ¹ CLIENT DETAILS

Jan 22, 2023 9:07 AM - Jan 23, 2023 9:07 AM 🔁 ⚙️

Device: iPad mini 5th Gen OS: iPad11,1 hwp/t8020 build/19G82 MAC: B6:DF:33:10:BC:E5 IPv4: 10.28.25.64 IPv6: -- L3 Virtual Network: -- L2 Virtual Network: -- VLAN ID: 1624 Status: Connected

Capability: 11ac Last seen: Jan 23, 2023 9:04:00 AM Connected Network Device: [ce1ap-53-3-D](#) SSID: RV [View All Details](#)[Issues](#) [Onboarding](#) [Path Trace](#) [Application Experience](#) [Device Info](#) [Connectivity](#) [RF](#) [iOS Analytics](#) [Event Viewer](#)

▾ Issues (1)

P3 Connected
Wireless client exhibiting sticky behavior on AP "ce1ap-53-4-F"
Instance Count: 32

Jan 22, 2023 10:28 PM - Jan 23, 2023 5:48 AM

1 Records

Show Records: 10 ▾ < 1 >

[Resolved Issues](#)[Ignored Issues](#)

Detail Information Jan 31, 2023 12:53 PM

Device Info Connectivity RF **iOS Analytics**

Neighbor APs (8)

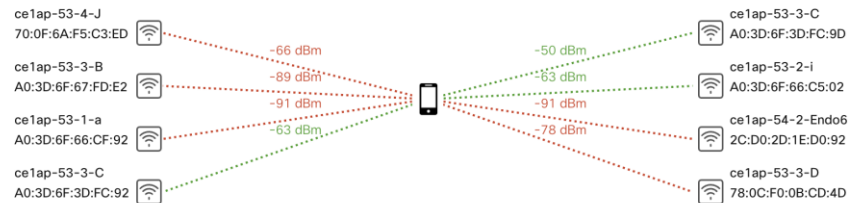
[Export](#)

Client Disassociations

BSSID	AP Name	Channel	RSSI (dBm)	Location
A0:3D:6F:67:FD:E2	ce1ap-53-3-B	6	-89	Global/10100 - CSK
A0:3D:6F:66:CF:92	ce1ap-53-1-a	1	-91	Global/10100 - CSK
A0:3D:6F:66:C5:02	ce1ap-53-2-i	6	-63	Global/10100 - CSK
A0:3D:6F:3D:FC:9D	ce1ap-53-3-C	52	-50	Global/10100 - CSK

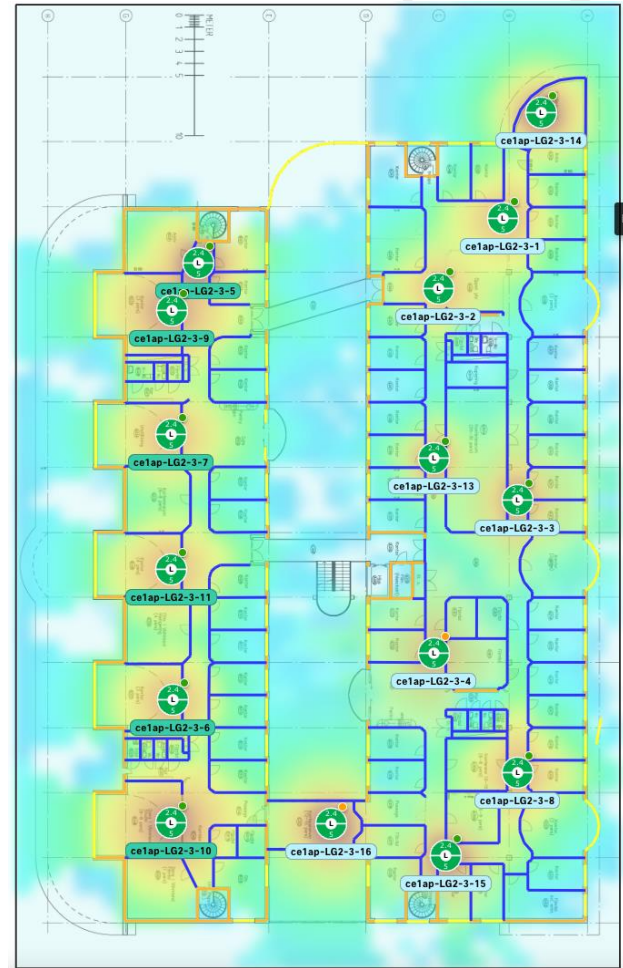
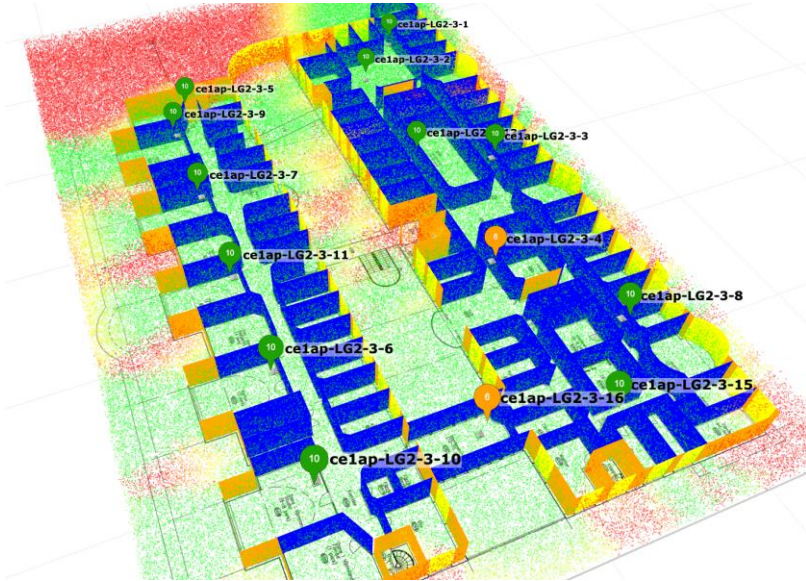
Time Disassociations

Show Records: 10 < 1 >

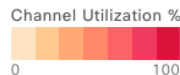


Network Heatmap

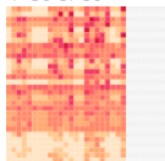
- 2D & 3D



Channel Utilization example



Showing radios
1-30 of 30



1-30

Select AP

APs on the floor

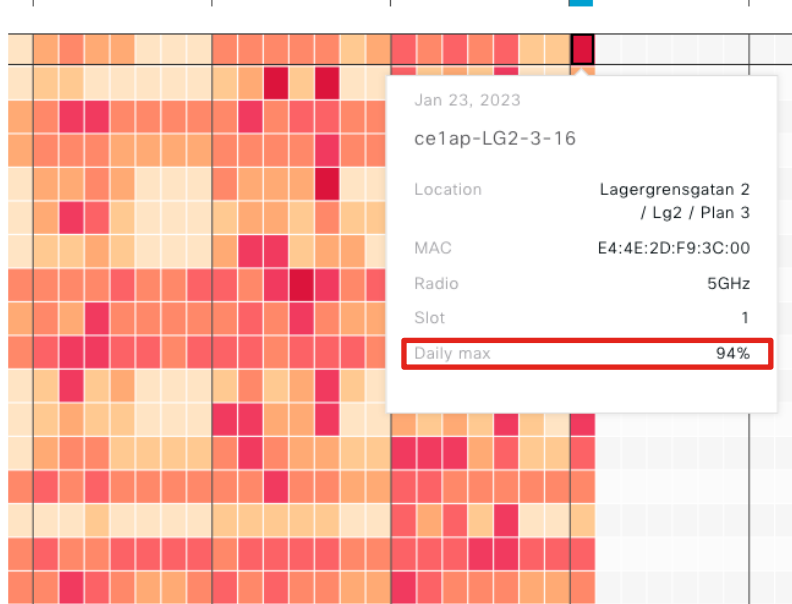


Daily View (January 2023)

Export

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T

Name	Band
ce1ap-LG2-3-16	5GHz
ce1ap-LG2-3-15	5GHz
ce1ap-LG2-3-3	2.4GHz
ce1ap-LG2-3-11	2.4GHz
ce1ap-LG2-3-2	5GHz
ce1ap-LG2-3-11	5GHz
ce1ap-LG2-3-1	5GHz
ce1ap-LG2-3-15	2.4GHz
ce1ap-LG2-3-7	2.4GHz
ce1ap-LG2-3-10	2.4GHz
ce1ap-LG2-3-10	5GHz
ce1ap-LG2-3-8	5GHz
ce1ap-LG2-3-7	5GHz
ce1ap-LG2-3-1	2.4GHz
ce1ap-LG2-3-13	5GHz
ce1ap-LG2-3-16	2.4GHz
ce1ap-LG2-3-6	2.4GHz

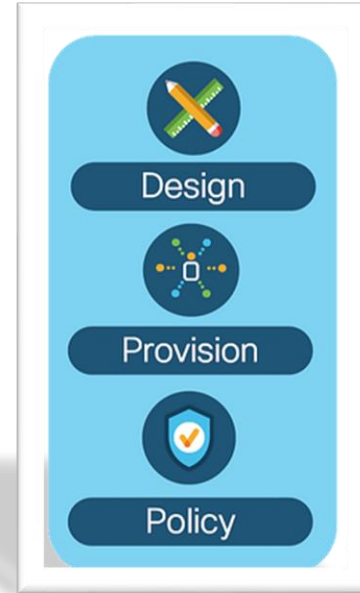


AP daily max

94%

Cisco DNA Center Network Automation

- Configuration Archive & Config drift
- Plug and Play (Day 0)
- Provision (Day 2)
- Software Image Management (SWIM)



Network Device Configuration Backup and Archive

- Latest config in the inventory
- Incremental changes?
- DNA-C is unavailable

The screenshot displays the Cisco DNA Center interface for a specific network device. The top navigation bar shows the device name 'ce1Ro-CSK4a-SWV.liv.se' and the user 'it-admin'. Below this, a status bar indicates the device is 'Reachable' and 'Managed', with an IP address of 192.168.242.40 and a role of 'DISTRIBUTION'. The main content area is divided into a left sidebar and a right pane. The sidebar lists various configuration categories, with 'Configuration' highlighted by a red rectangle. The right pane shows the 'Building configuration...' output, which includes the current configuration size (69856 bytes) and the last configuration change details (14:41:49 cet Mon Jan 23 2023 by daja04adm).

Devices / ce1Ro-CSK4a-SWV.liv.se

ce1Ro-CSK4a-SWV.liv.se Run Commands View 360 Last updated: 1:21 PM Refresh

it-admin

✓ Reachable | ✓ Managed | IP Address: 192.168.242.40 | Device Model: Cisco Catalyst C9500 SVL Switch | Role: DISTRIBUTION
Uptime: 81 days 3 hrs 24 mins | Site: Global/0# Datacenter/Datacenters

DETAILS

Interfaces ▾

Ethernet Ports

Native VLANs

Hardware & Software

Configuration

Power

Fans

Hide line numbers Search Export CLI Output

```
1 |
2 |
3 | Building configuration...
4 |
5 | Current configuration : 69856 bytes
6 | !
7 | ! Last configuration change at 14:41:49 cet Mon Jan 23 2023 by daja04adm
8 | ! NVRAM config last updated at 14:41:50 cet Mon Jan 23 2023 by daja04adm
```

Network Device Configuration Backup and Archive

Config Drift

In-band Config Drift

Out-of-band Config Drift

Labelled Config

Config Drift Version
December 19, 2022 11:45 AM

Label Config

Running Config (4445 Lines)

408 monitoring

409 vlan 10

410 name PXE_Boot_Low_Impact

411 lldp run

412 class-map match-any system-cpp-police-ewlc-control

413 description EWLC Control

2995 no enable

2996 interface HundredGigE5/0/42

2997 interface HundredGigE5/0/43

2998 no enable

2999 interface HundredGigE5/0/44

3000 interface HundredGigE5/0/45

Showing Lines 3000 - 4461

1 no enable

2 interface HundredGigE5/0/46

3 interface HundredGigE5/0/47

10 interface Vlan1

11 no ip address

12 shutdown

Config Drift Version
December 19, 2022 11:59 AM

Label Config

Running Config (4450 Lines)

408 monitoring

409 vlan 10

410 name PXE_Boot_Low_Impact

411 vlan 305

412 name IPTV

413 lldp run

414 class-map match-any system-cpp-police-ewlc-control

415 description EWLC Control

2997 no enable

2998 interface HundredGigE5/0/42

2999 interface HundredGigE5/0/43

3000 no enable

Showing Lines 3000 - 4461

1 interface HundredGigE5/0/44

2 interface HundredGigE5/0/45

3 no enable

4 interface HundredGigE5/0/46

5 interface HundredGigE5/0/47

12 interface Vlan1

13 no ip address

14 shutdown

15 interface Vlan305

16 vrf forwarding vrf005

17 ip address 10.116.105.254 255.255.255.0

Network Device Configuration Backup and Archive

Settings / Device Settings

Configuration Archive

Cisco DNA Center internal server will periodically back up your device's running configuration. You can select the day and time for the backup and select the total number of config drifts being backed up (note: total config drifts being saved included all the labelled configs for the device). To archive all the device's running configurations, you can configure an external server.

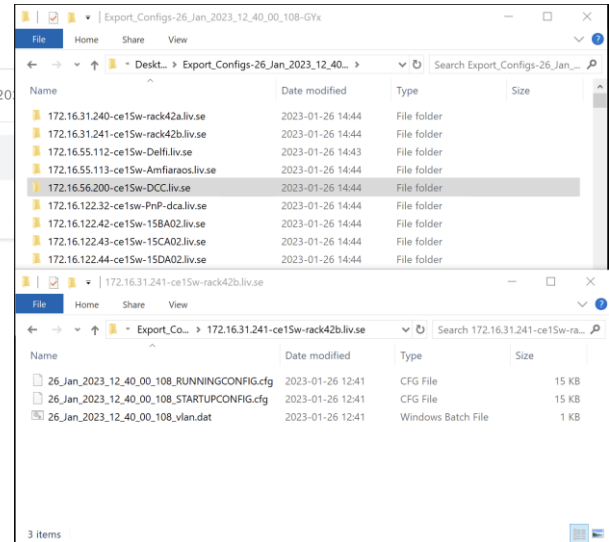
Internal

External

External Repository

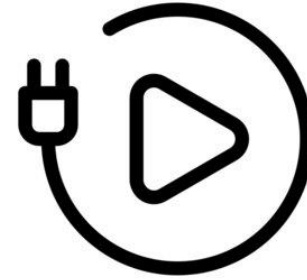
Q Search Table

Host	Protocol	User Name	Backup Format	Backup Cycle	Connectivity
10.16.92.22	SFTP	root	RAW	Daily Time 01:40 PM	Connected



Network Automation - Plug and Play

- How do we use it here at Region Värmland?
 - Option 43 "5A1N;B2;I10.1.1.1;J80;K4";
- One workflow to rule them all
- PNP Startup VLAN



- The Karlstad University incident...

Provision switches using templates

- How about adding the more advanced configurat
 - Using TAG's
 - Variables
 - Jinja scripts

Template

```
95 !
96 vlan 317
97 name vrf017-fallback
98 !
99 vlan 305
100 name vrf005-IPTV
101 !
102 vlan $Management-vlan-AP
103 name RV-accesspoint
104 !
105 vlan $vlan-eklient
106 name RV-eklient
107 !
108 vlan $vlan-IPT
109 name RV-IPT
110 !
111 vlan $vlan-Printer
112 name RV-Printer
```

```

6 interface range g{{ stack_num }}/0/1 - 40
7 {{ user_port() }}
8
9
10 int range g{{ stack_num }}/0/45 - 48
11 {{ ap_port() }}
12
13 int ten{{ stack_num }}/1/4
14 {{ uplink_trunk() }}
15
16 {% endblock %}
17

```

Template

```

1 {% if 10 < 6 %}
2     That's not correct
3 {% elif 6 > 10 %}
4     That's also wrong
5 {% else %}
6     {% if 'o' in "Router" %}
7         Seems to be true
8     {% endif %}
9 {% endif %}
10

```

Template

```

991 ##--- First uplink interface -----
992 #if ( $skipconfig.contains('uplinks') )
993 #else
994 #if( ${VLAN_Link_1} != ' ' && ${VLAN_Link_1} != 0 )
995     vlan ${VLAN_Link_1}
996     #if( ${VLAN_Link_1} < '200' )
997         name REF-D1
998     #elseif( ${VLAN_Link_1} < '300' )
999         name REF-D2
1000 #elseif( ${VLAN_Link_1} < '400' )
1001     name REF-RADIO_LINK
1002 #end
1003 !
1004 interface vlan${VLAN_Link_1}
1005     dampening
1006     #set( $fourthrest_link1 = $fourthnumber_link1%2 )
1007     #if( $fourthrest_link1 == 0 )
1008         #set( $fourthnumber_link1 = $fourthnumber_link1+1 )
1009     #end
1010     ip address ${IP_Link_1} ${netmask_Link_1}
1011     no ip redirects
1012     no ip proxy-arp
1013     ip pim sparse-mode
1014     ip router isis Core
1015     no shutdown
1016     mpls ip
1017     bfd interval 750 min_rx 750 multiplier 3
1018     isis network point-to-point
1019     #if( ( ${VLAN_Link_1} > 299 ) && ( ${VLAN_Link_1} < 400 ) )
1020         isis metric 5000 level-2
1021     #end
1022 #end

```


Software Image Management (SWIM+ISSU)

Stay up to the with the current image

Image Update

- 1 Analyze Selection
- 2 Distribute
- 3 Activate
- 4 Schedule and Cleanup
- 5 Summary

Analyze Selection

Before you proceed for the Update, analyze your selection.

Devices to Update: 1 | Device Family: 1 | Sites: 1

Q Search Table



0 Selected [Update](#) [ISSU](#)

<input type="checkbox"/>	Device ▲	From Image	To Image ①	Comment
<input type="checkbox"/>	ce1Ro-CSK4b-SWV.liv.se (192.168.24.2.41)	cat9k_iosxe_npe.17.06.03.SPA.bin	cat9k_iosxe.17.06.04.SPA.bin ISSU	✔ ISSU Validation Successful Update Readiness Report

The IOS Upgrade incident

- Our colleague
- 30+ years network engineer
- “Old school” 😊



Software Image Management (SWIM+ISSU)

What did he forget?

1 Selected **Update**  **ISSU** 



Device 

Enable ISSU Update

Image

To Image 



ce1Ro-CSK4b-SWV
2.41)

Disable ISSU Update

iosxe

cat9k_iosxe.17.06.04.SPA.bin

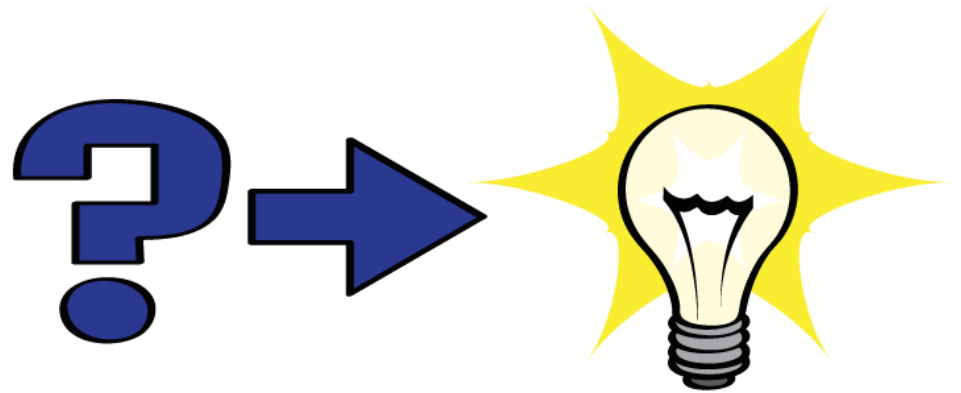
ISSU

Insights & final thoughts



Final thoughts

- Use Cisco CX for guidance/best practice
- Cisco TAC – a good way to get fast help
- Think about your logical site structure
- Push Docker apps via DNAC
- EoX report is very valuable!





The bridge to possible

Thank you

CISCO *Live!*

Are you playing the Cisco Live Game?

Scan the QR code and earn your
Customer Success Stories Theater
points here



CISCO *Live!*

ALL IN