Aplicando Analytics e ML na operação de redes Wi-Fi

Flavio Correa, Technical Solutions Architect, CCIE Wireless #38913

Wendel Nery, Customer Success Specialist

Agenda

- Desafios no gerenciamento e operação de redes Wi-Fi
- Porque ML e o que nos possibilita
- Arquitetura de telemetria e analytics com DNA Center
- Casos de uso na resolução de problemas em redes Wi-Fi
- Demonstrações das soluções de Analytics e ML

Desafios no gerenciamento e operação de redes Wi-Fi

New Workplace needs for a Mobile Hybrid Workforce

Best Mobile Experience

Pervasive mobility at office spaces to accommodate a Hybrid Workforce

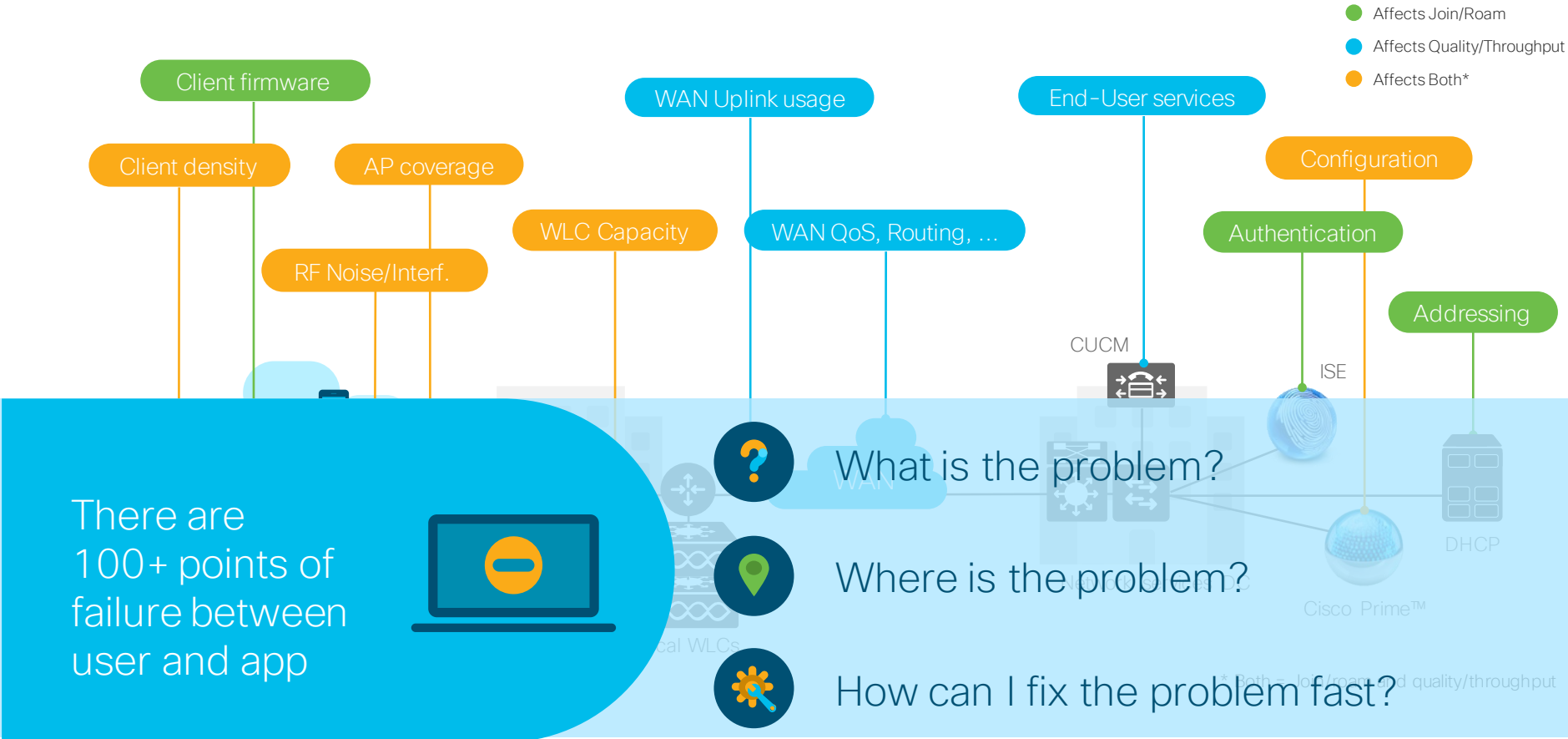
Intelligent Infrastructure

Use of the latest technologies to keep the business running with maximum visibility, simpler operations and safer

Increase Security Capabilities

Cisco Zero Trust for Workplace to handle more user and IoT in a intelligent and secure manner

“The Network is Slow” problem statement



SLIDO 1

ou via

slido.com

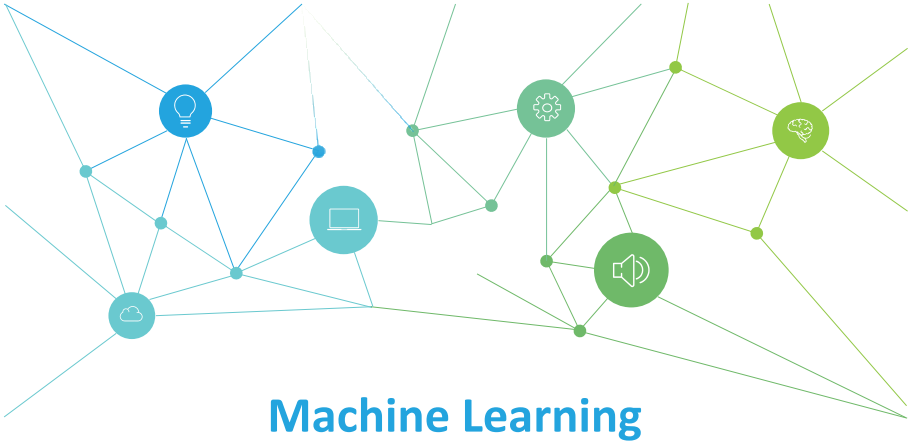
#336372

Qual o seu principal desafio na gestão da infraestrutura Wi-Fi?

Porque ML e o que ele nos possibilita

What is Machine Learning?

- **Machine Learning** is an application of **Artificial Intelligence (AI)** that provides systems the ability to automatically learn and improve from experience without being explicitly programmed to do so



- The process of learning begins with observations of data, and **looking for patterns** within the data so as to make **increasingly better** correlations, inferences and predictions

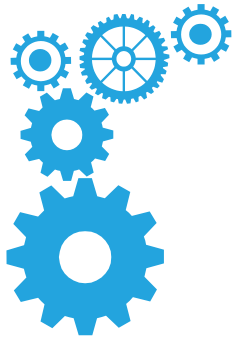
- **The primary aim is to allow these systems to learn automatically** without human intervention or assistance and adjust actions accordingly

What Machines Can and Can't Do

Machines can see, hear, talk and … they can *learn*

Used in Networking for a number of Cognitive & Predictive Analytics Use Cases (Security, Enterprise, SP, Collab, IoT)

But machines do not have common sense, no true thinking (science fiction !!)



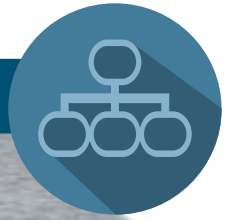
Understanding what ML can and can't do is undoubtedly (one) of the keys to success

But the gap between what is being claimed and what can be deployed at scale increases

The Key for Success for ML/AI in Networking

Data Lake: Volume, Diversity and Quality

- **Data more important than algorithms** (a proven fact)
- **Volume** is key, **Diversity** is crucial, **Quality** is a must

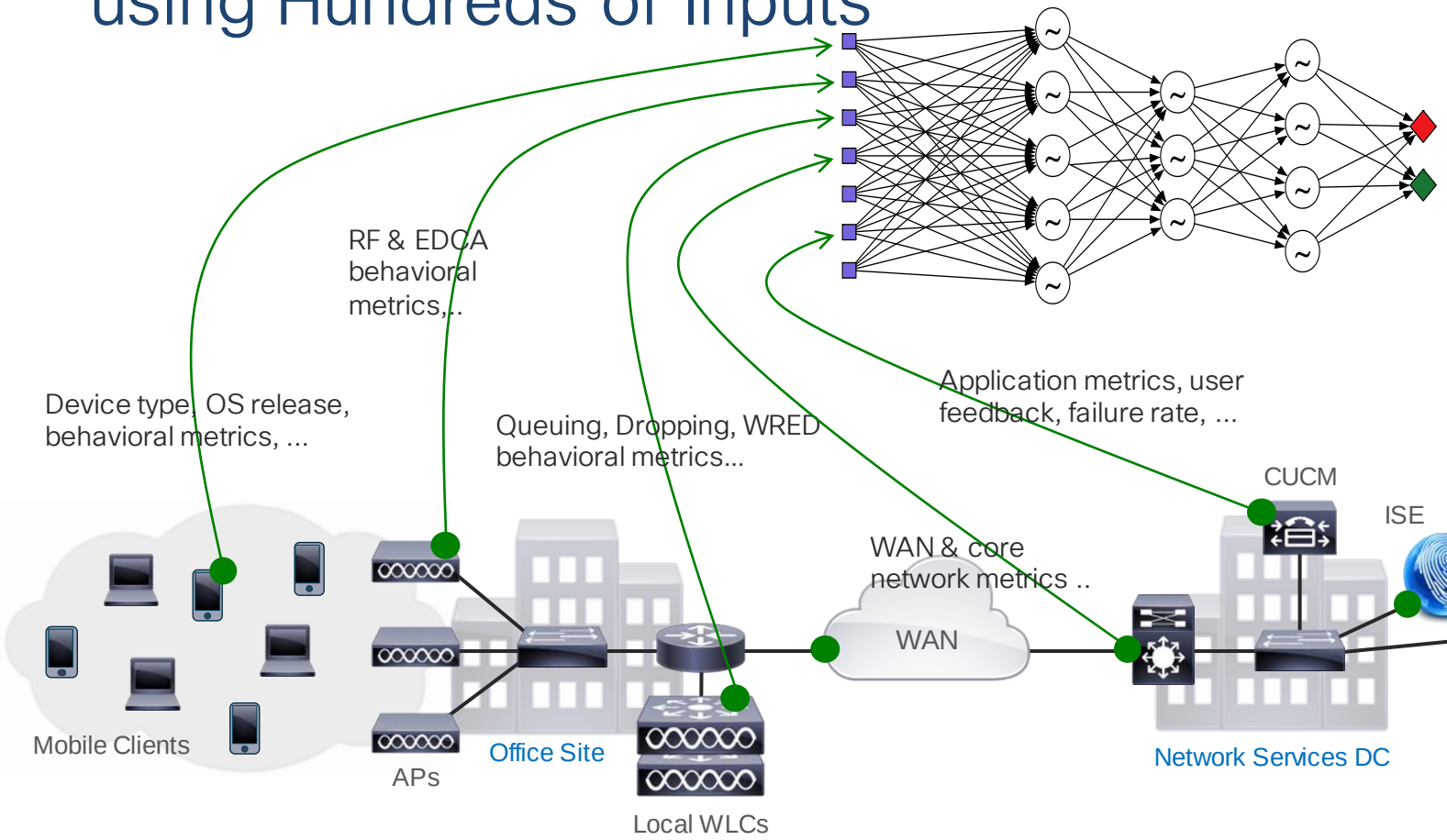


Combined Expertise in **Networking** & **Machine Learning**

- **Finds signal** in data, **removes noise**

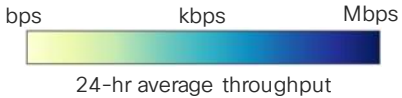
End-To-End (leading to Cross-domain)

Machine Learning Algorithms Build Their Models using Hundreds of Inputs



Can We Set a Threshold or Do We Need to Learn ?

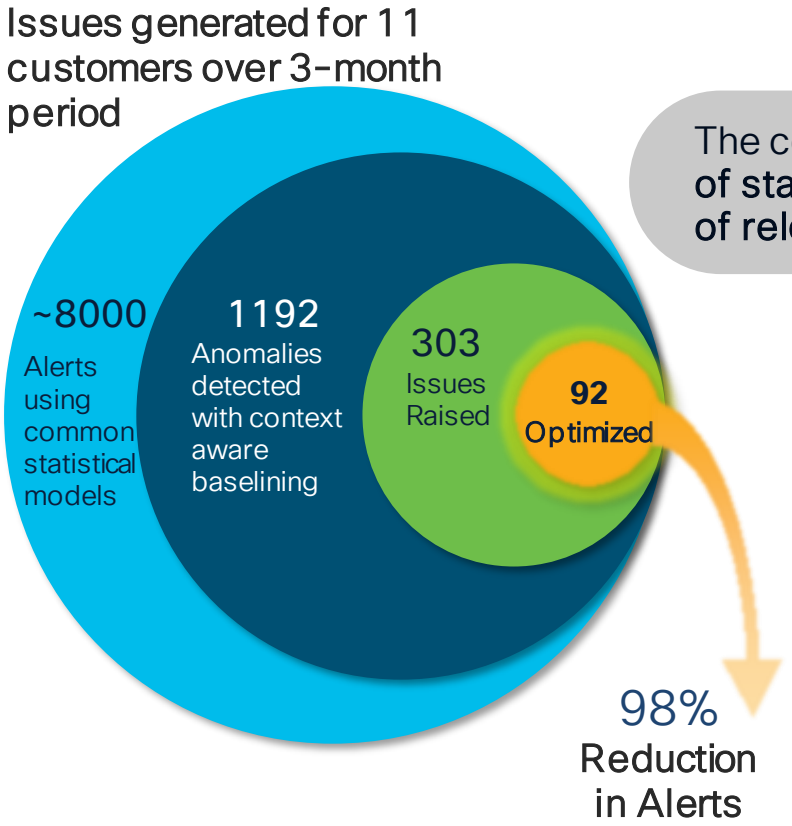
Global throughput varies wildly between networks, and also **between APs and locations on the same network**, and **varies with many parameters**: time, # active apps, RSSI/SNR, interference, … for example:



Impossible to model using classic threshold-based techniques and simple baselining. Advanced models with high-dimensionality are required.

What is needed: automatic performance of deep analysis and models of the observed throughput patterns **based on a high number of input variables** (time of day, type of AP, number of clients, …)

The Key for Success: Small Number of Relevant anomalies



The core challenge is to turn a potentially **LARGE number of statistical / model anomalies** into a **SMALL number of relevant anomalies** for the user

- **ML Models:** model type and architecture, parameter optimization (e.g. sensitivity)
- **Select anomalies more likely relevant** (existence of root cause, impact measurability, transient/persistent, …)
- Potentially **reinforcement learning** (adapting type of anomaly liked by the user)
- **Issue generation:** aggregation heuristics, …

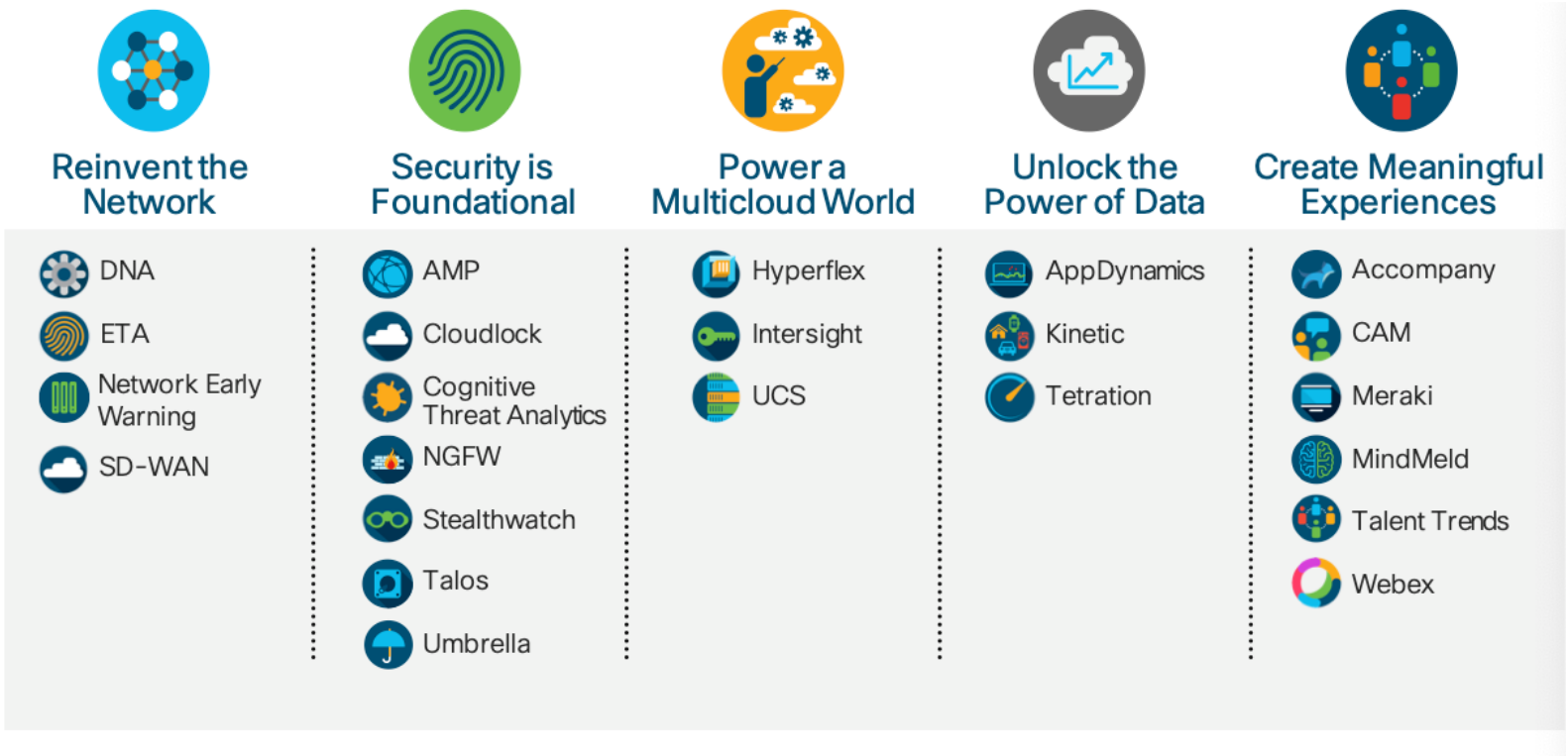
How are we Root Causing ?

There is no one-size-fits-all algorithms but a collection of approaches:

- Configure attributes, build tags &traits, analyze Precision & Recall, set thresholds…
- Build complex rules from SME evaluation, and keep adjusting according to feed-back
- Use cross-signal correlation for continuous & categorical variable (e.g., Pearson coeff…)
- Association Rule Mining, Sequential Pattern Analysis…

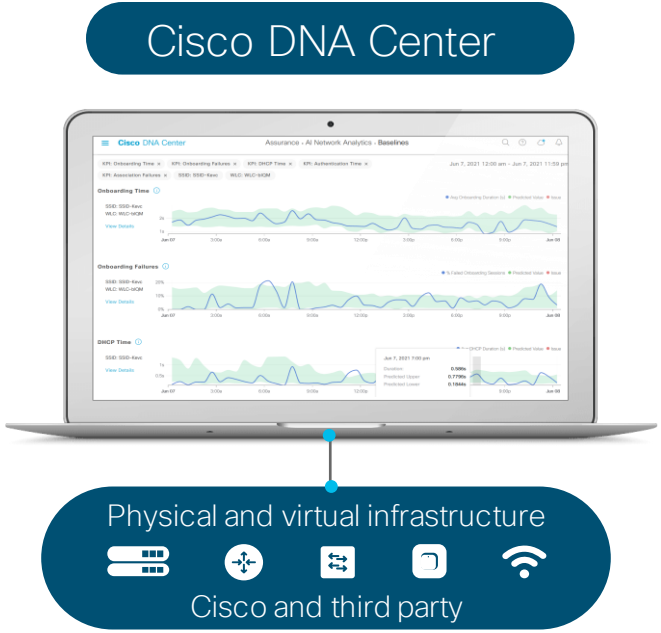
Good news is that AI Network Analytics does it for you, at high scale, across vast number of (diverse) datasets

Cisco's Adoption of AI/ML Across Portfolio



Arquitetura de telemetria e analytics com DNA Center

Cisco DNA Center is a Foundational Platform Technology
Command and control center for Cisco Catalyst



NetOps

Automation and workflows simplify building and maintaining large scale networks. AI/MR streamlines and simplifies complex tasks

SecOps

AI/ML and DPI Identify and classify endpoints, enforce security policies and mitigate threats for a complete workplace zero trust solution

AIOps

AI/ML and insights to ensure the health, performance and reliability of applications and infrastructures

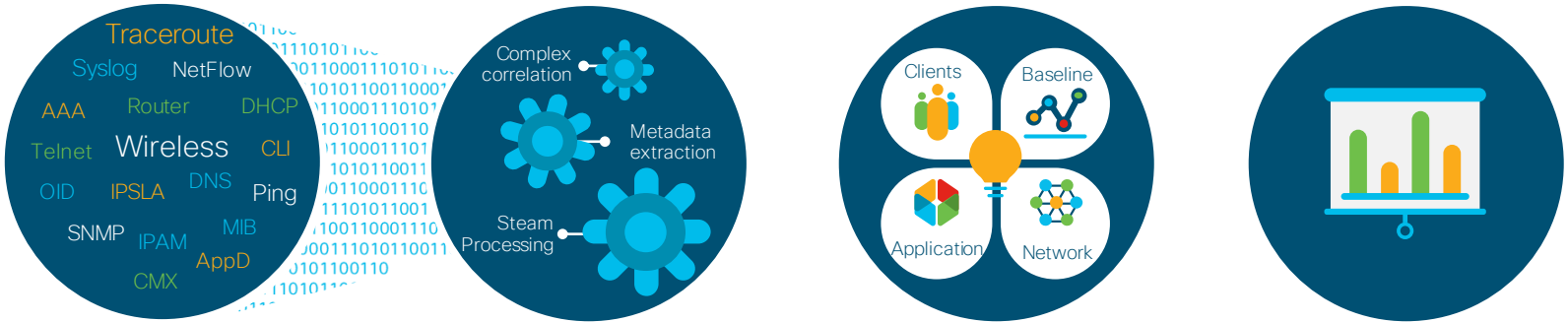
DevOps

Mature APIs, SDKs, and closed-loop integrations, untangle the complexities of interconnecting third party systems.

Cisco DNA Assurance

From network data to business insights

Network telemetry contextual data | Complex event processing | Correlated insights | Suggested remediation

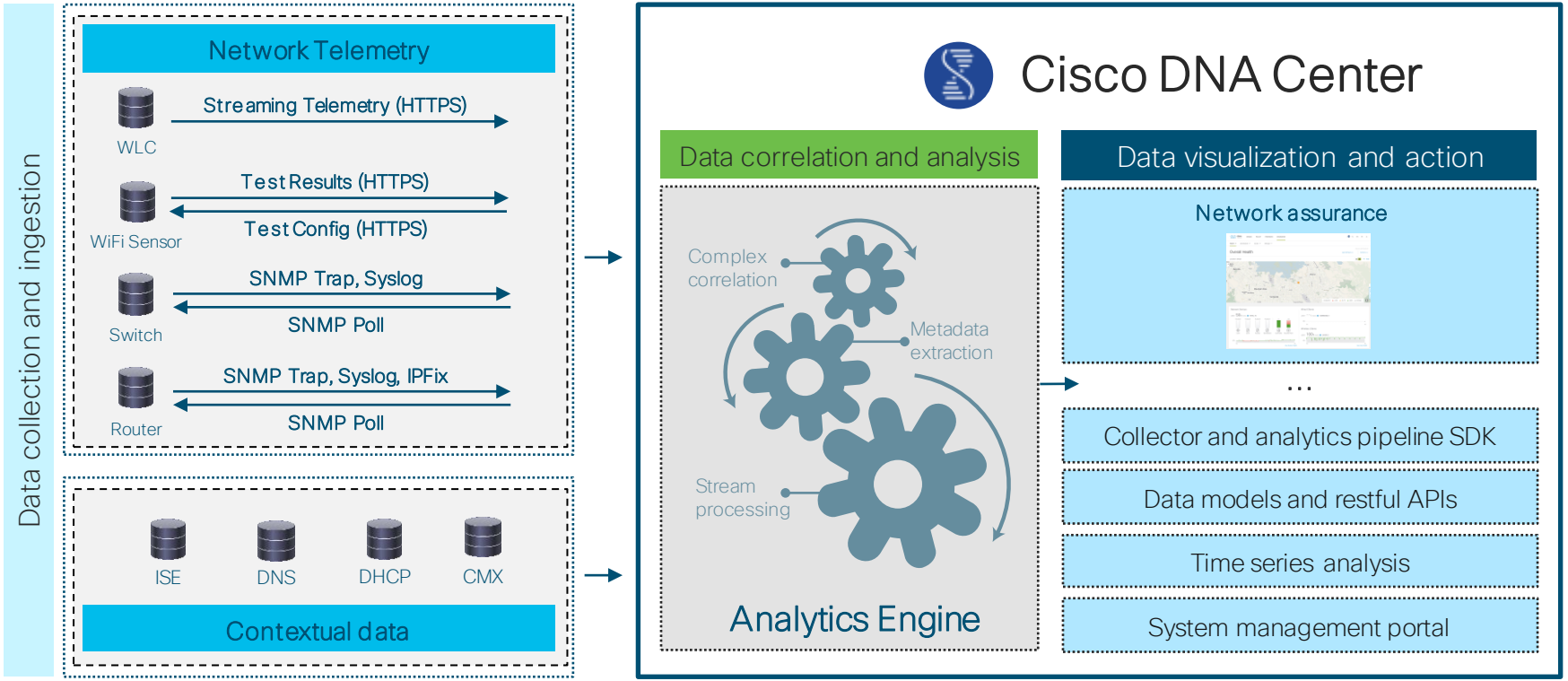


Everything as a sensor

Over 150 actionable insights

Clients | Applications | Wireless | Switching | Routing

Cisco DNA Assurance Architecture Overview



Cisco DNA Assurance Capabilities

End-to-End Visibility

360° view across network

Historical view

Ability to follow the network path

Proactive & Predictive Insights

Proactive to get ahead of the problem

Predictive to stay ahead

Assessment to see impact of changes

Guided Remediation

Today–Remediate with user input

Future–Automated remediation

Transforming network operations through actionable insights and simplicity

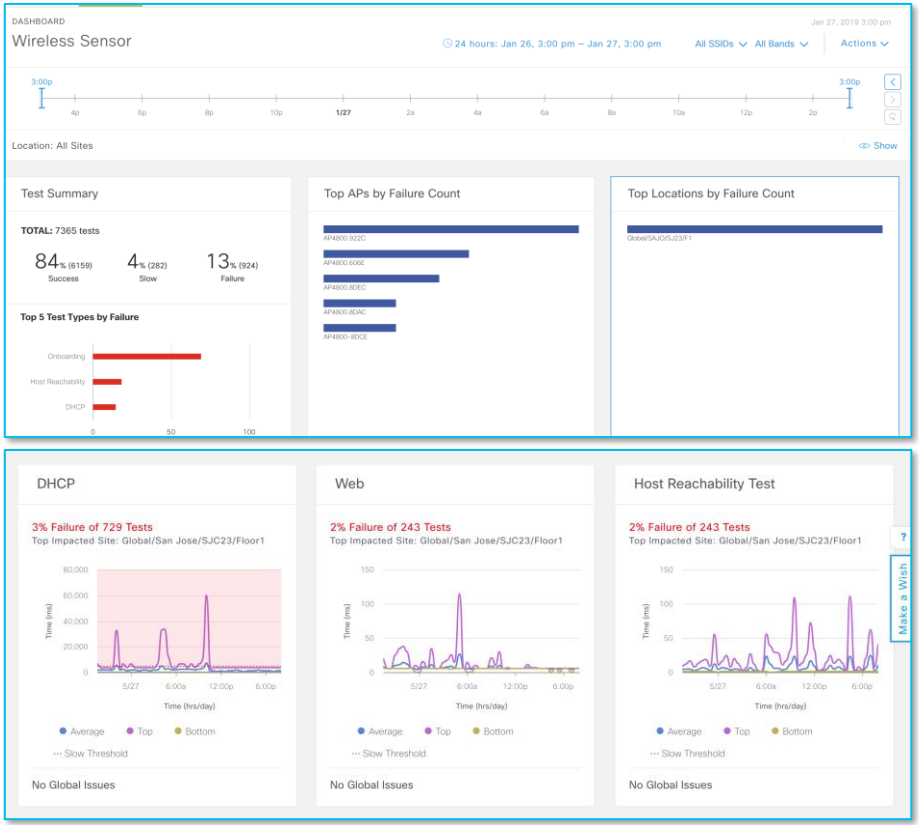
Key Cisco DNA Assurance Features

Health	360° Views	Insights	Advanced Features
Network Health Wireless & Wired	Device 360° Routers, Switches, WLCs, APs	Device Insights	WiFi Sensors
Client Health Wireless & Wired	Client 360° Wireless & Wired	Client Insights	Intelligent Capture
Application Health	Application 360°	Suggested Actions	iOS Analytics

Cisco DNA Center Platform: APIs & Reporting

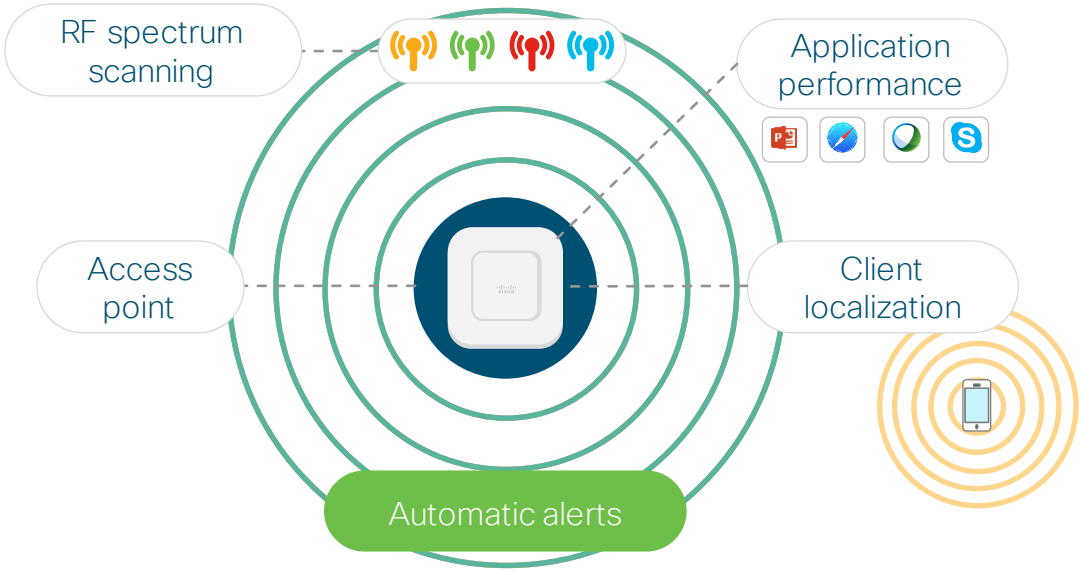
Cisco wireless active sensor

- Speed Test
  - NDT
  - iPerf3
- Heatmap Dashboard
  - Locations of interest
  - Location-based drill down
- Plug and play provisioning
  - Easy remote branch install
- Dedicated Backhaul support
  - Reliable Wi-Fi connectivity
- Sensor 360 view
  - Verify sensor functionality



Packet capture

Intelligent capture

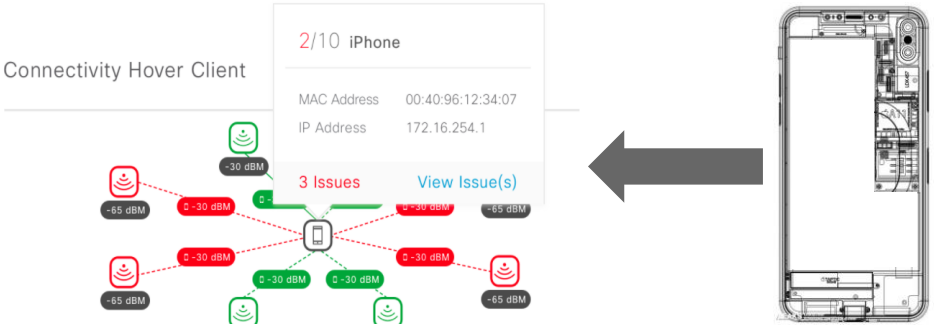


Use your Cisco access points for packet capture to troubleshoot:

- Client connectivity
- Application performance
- RF spectrum issues

Access point + AireOS | Anomaly-triggered PCAPs | RF scanning and application analytics | Real-time client location

Wireless client insights



Device profile

Client shares these details
1. Model: iPhone 7
2. OS: iOS 11.2

1

Support per-device-group policies and analytics

Wi-Fi analytics

Client shares these details
1. BSSID
2. RSSI
3. Channel number

2

Insights into the client's view of the network

Assurance

iOS client shares the reason (error code) for the disconnect.

3

Clarity into the reliability of connectivity

Apple and cisco

Wi-Fi analytics for iOS

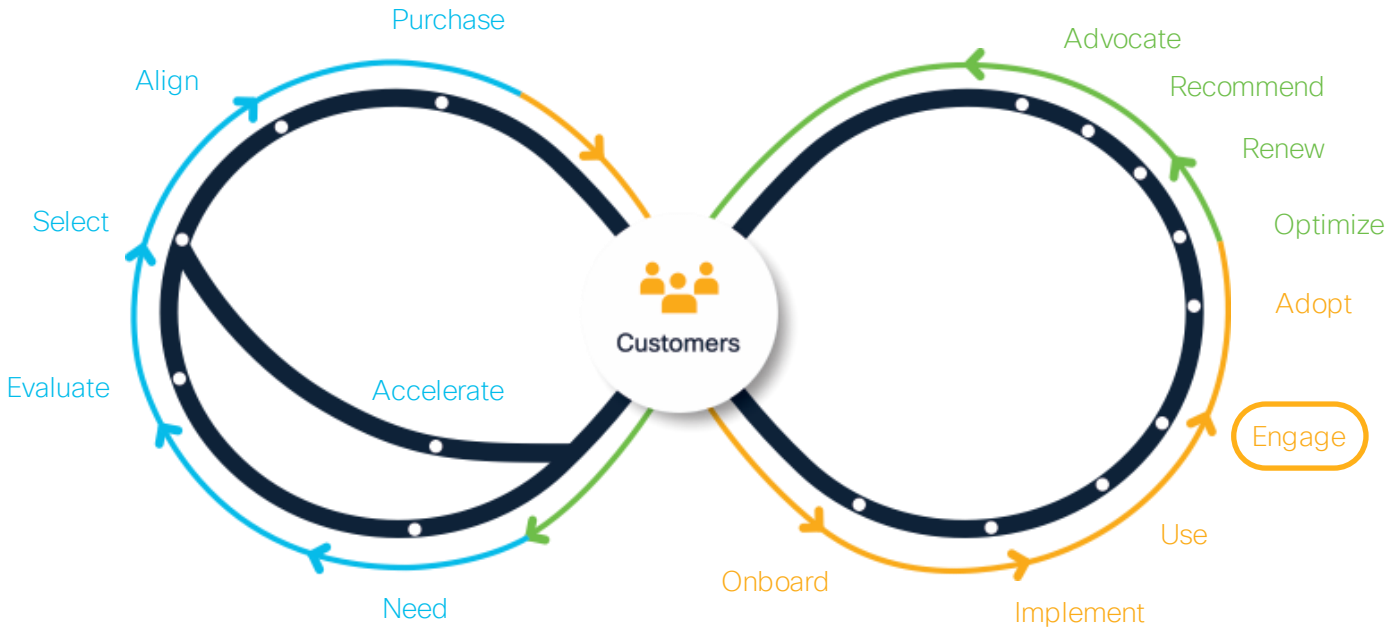
This partnership with Apple enables any iOS 11 client to speak to Cisco DNA Center with client diagnostics.

Provides a more comprehensive view of all potential root causes of wireless issues.

Problems affecting iOS clients are likely affecting all wireless clients.

Similar capabilities available for Samsung devices

Getting you to your business outcomes faster



Designed to maximize value at the **Engage** stage

Experts will present the AI Network Analytics feature and feature details.

SLIDO 2

ou via

slido.com

#336372

Qual solução de Analytics você gostaria ver demonstrada no evento de hoje?

Demonstração das soluções de Analytics

1. Entendendo a experiência ao se conectar na rede Wi-Fi
2. Troubleshooting detalhado de Wi-Fi
3. Medição proativa da experiência dos clientes
4. Qual o impacto do Wi-Fi6 na minha infraestrutura

Demo time!

… What about the use of ML?

Why To Use AI / Machine Learning

Cisco AI
Network Analytics

Lack of Visibility (on User experience), End2End

- Find INSIGHTS (anomalies) ! Naïve static rules: (lack) of scalability (e.g., NMS), *non adaptive*, (False) alarms, …
- Root Cause Analysis & Correlation are extremely difficult, without a model, difficult to propose a solution
- Lack of understanding of complex patterns (e.g., group of tunnels flapping, trends, …)

Cognitive Analytics

- (Processing of Billion of data records per day) **Cisco AI Network Analytics** finds and highlights Patterns
- Learning of networking patterns through **diverse** datasets & Computes models to detect anomalies
- Find and highlight top-most issues with Smart contexts with probable cause
- Ability to detect find Common Traits & Root Cause

A Layered Approach for Anomaly Detection

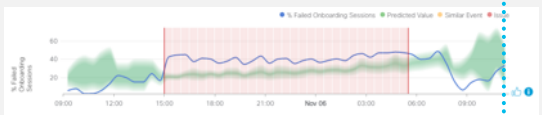
Issue Generation & Relevance Learning

- Algorithms combined with Heuristics used to build issues, shown to the user
- Relevance via user-feed-back used to improve relevancy

Root Causing Layers

- Models are used to determine the Root Cause (correlation <> causation)

Computation of ML Models



- Models are computed for several metrics. Anomalies are raised when deviating from a “Baseline” (unsupervised learning) or an issue is predicted (supervised)

Learning, Analyzing and Transforming How You Manage Your Network

Cisco AI Network Analytics

Cognitive Issue Detection & Analysis

AI-Driven Baselining
Define Normal for a Given Network

AI-Driven Anomaly Detection
Find + Root Cause Complex Issues

Trends and Insights

AI-Driven Proactive Insights
Find Patterns and Systemic Issues

Network Heatmaps

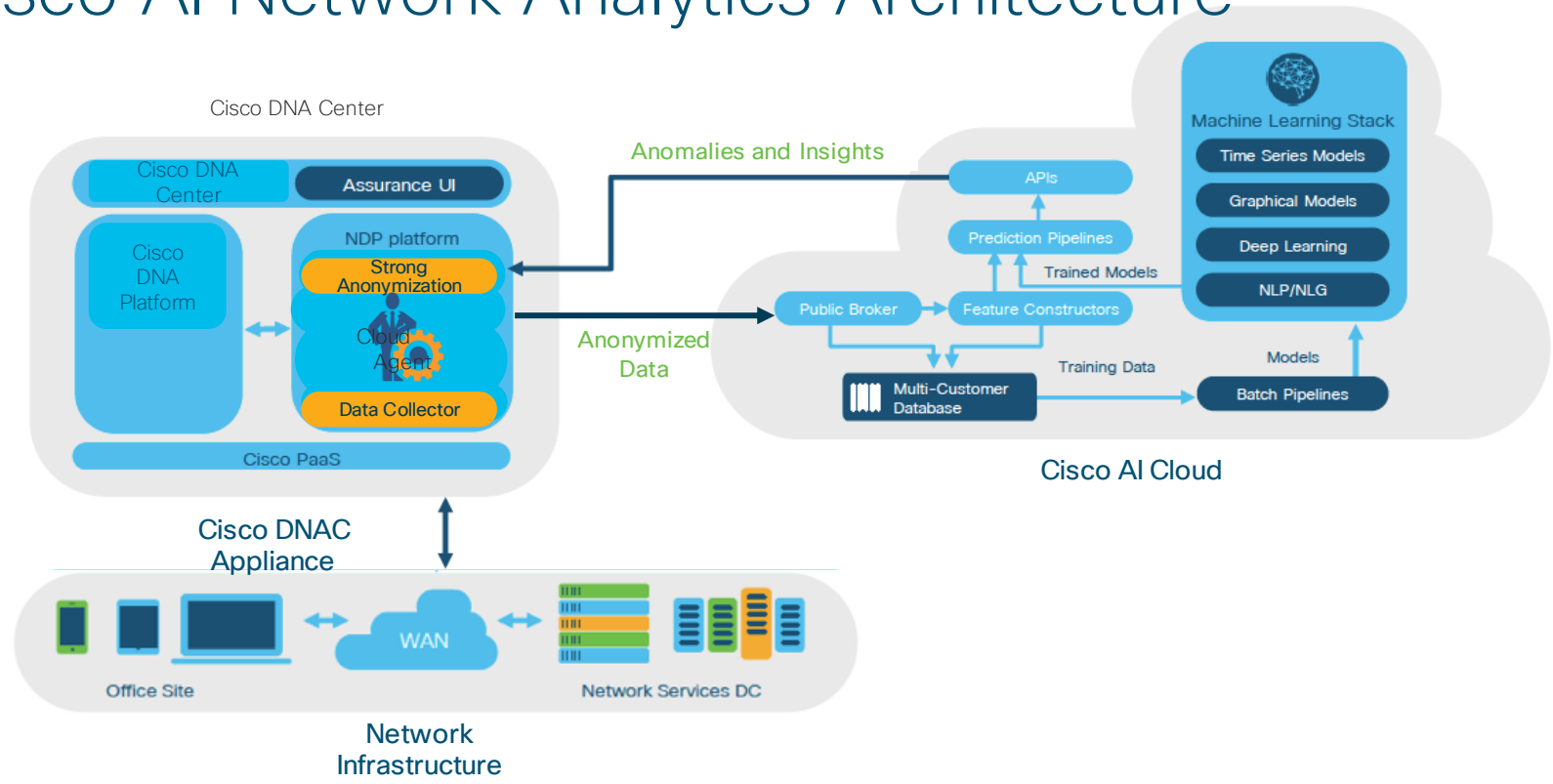
AI Baseline Dashboard
Explore Network Performance Baselines

Comparative Analytics

AI-Driven Peer Comparison
Compare to Peers

AI-Driven Network Comparison
Compare Performance by Sites, AP Models, Clients

Cisco AI Network Analytics Architecture



More details on data privacy and security available at: https://trustportal.cisco.com/c/dam/r/ctp/docs/privacydatasheet/DNA/cisco-dna-center-privacy-data-sheet.pdf

SLIDO 3

ou via

slido.com

#336372

Qual solução de AI/ML Network Analytics você gostaria ver demonstrada no evento de hoje?

Soluções e Demos

1. Baseline automático da rede e desvios de comportamento
2. Heatmaps de indicadores de performance (KPIs)
3. Análise da performance entre prédios, APs e Endpoints
4. Análise comparativa entre rádios dos APs
5. Problemas detectados pelo engine de AI/ML

Demo time!

Next steps and call to action

ou via

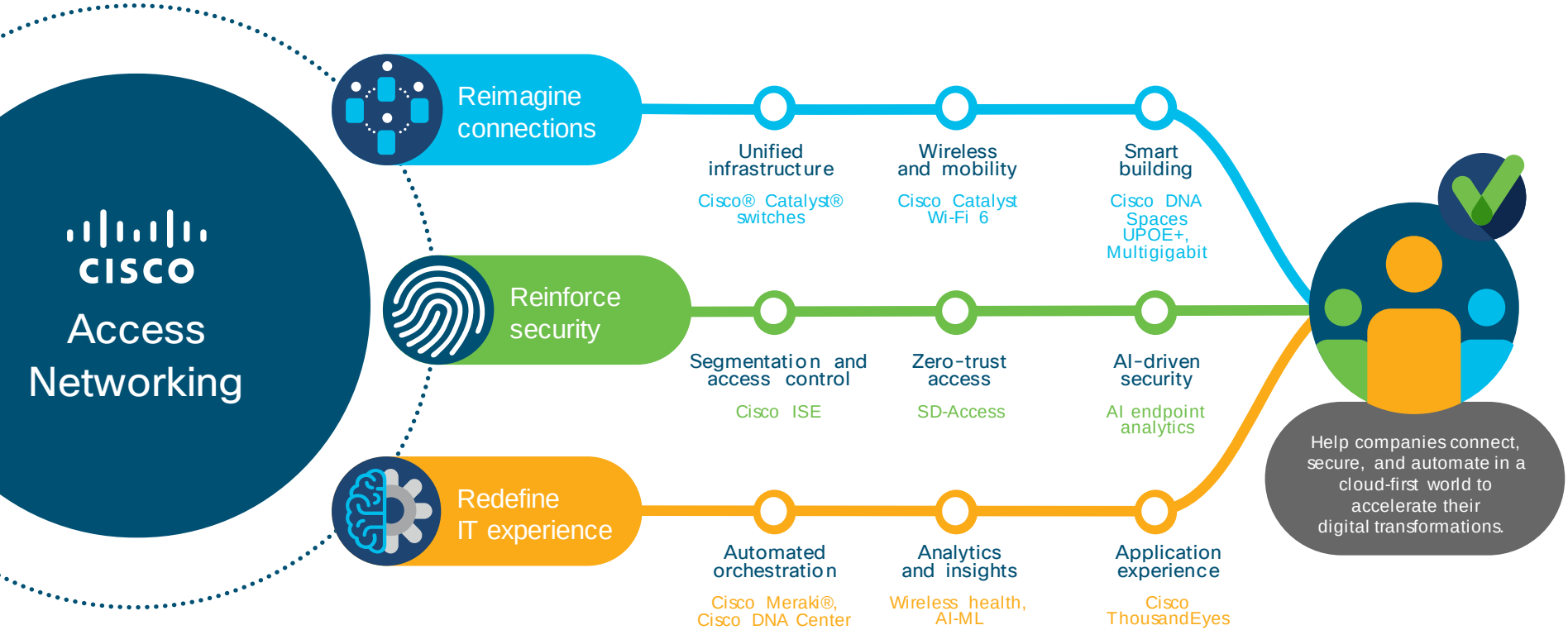
slido.com

#336372

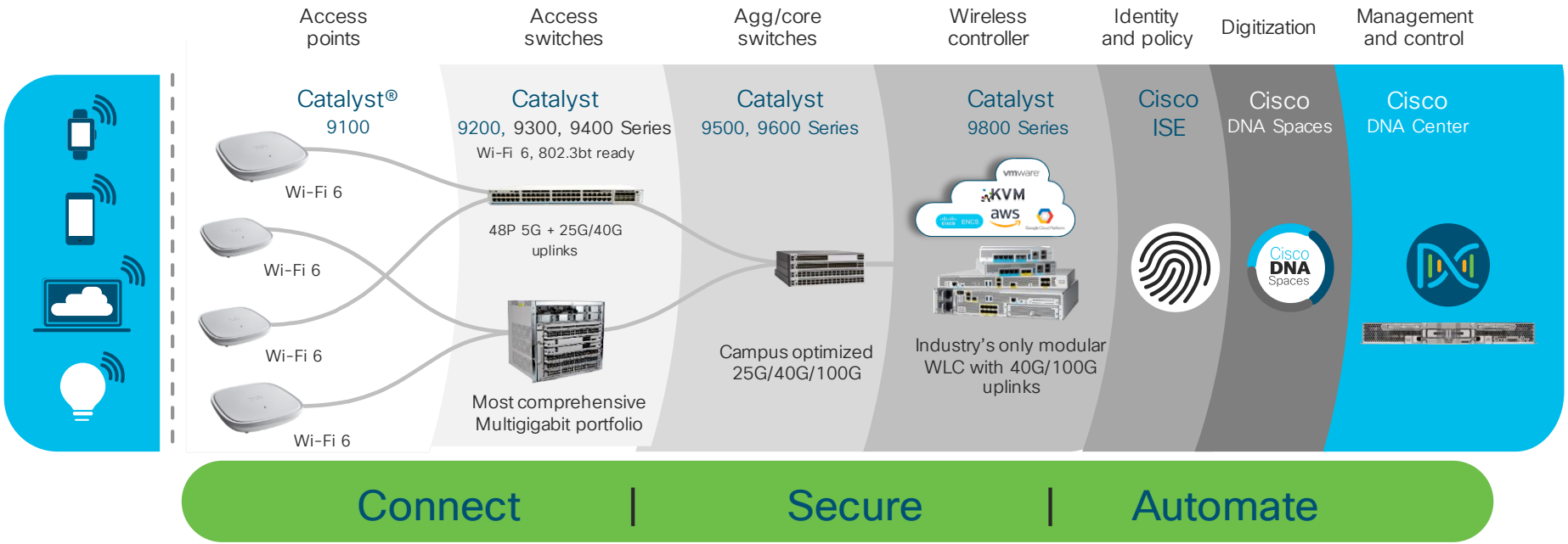
Slido 4

Quais das soluções apresentadas tem mais aplicação na sua empresa?

Cisco Access Networking journey



Wired and wireless LAN infrastructure



Você gostaria de conhecer mais e testar a solução na sua rede

https://bit.ly/3I4V3Y3

Dúvidas?

Muito Obrigado!

Backup slides

Cisco DNA Assurance: Actionable insights

Right Place: Problem Isolation

- 360-degree contextual graph
- Everything as a sensor
- Event-driven telemetry

Right Time: Problem replication

- 14 days history: full context
- Predictive trends
- Proactive tests

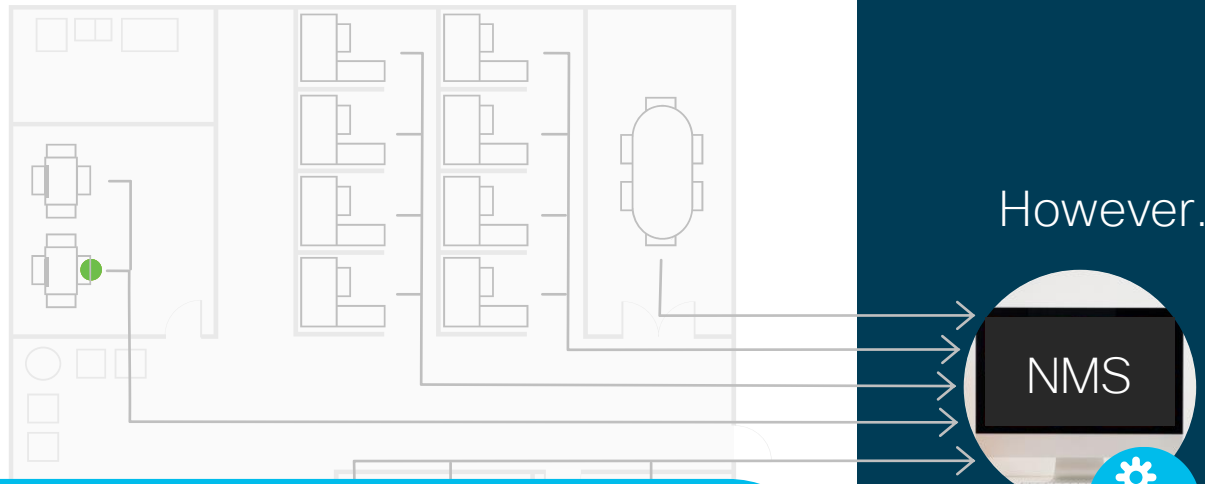
Right Action: Problem resolution

- Step-by-step guided remediation
- Integrate with IT operations

SNMP

SNMP

Open standard
Universal support
Universal practice



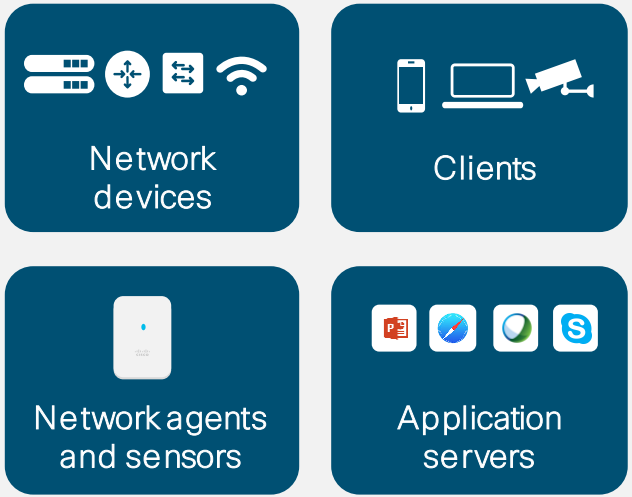
However…

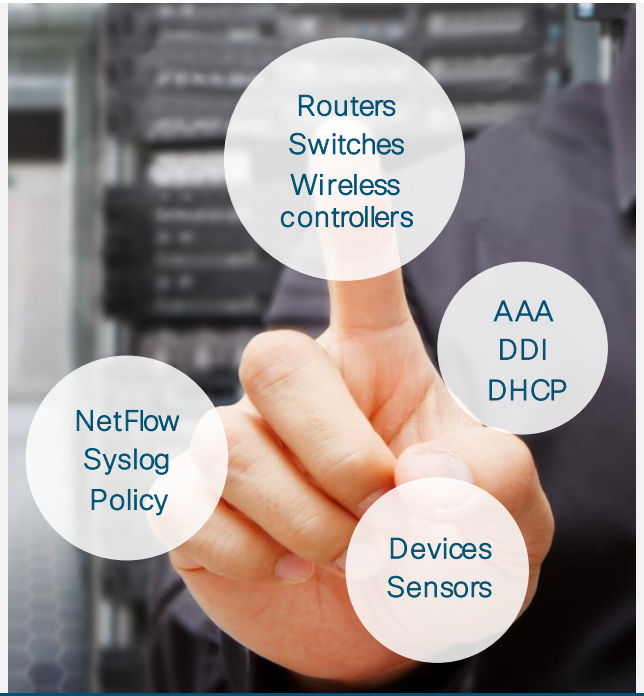
Not real time
Creates overhead
Limited data
Does not scale

SNMP is important to support for universal third-party monitoring. But it has many disadvantages in today's networks.

Streaming telemetry

Real time
Auto-generated
Performs at scale
Low overhead
Secure
Open standard





Leverage and analyze data from every point on the network

Rich Set of Telemetry

Types of telemetry used by Cisco AI Network Analytics:

JSON over HTTPS for AireOS, TDL for Catalyst 9000 Switches and WLCs, NetFlow

ISE context for endpoints:
- Location
- Posture state
- Authentication type
- Device type
- Access method
- Detected vulnerabilities
- Detected compromises
- Authentication patterns (time of the day, volume etc.)

DPI Statistics
- Applications
- Flow

- Wireless AP and Radio Stats

WSA Telemetry:
- Network (e.g. DHCP, Radius, Fabric....)
- System (e.g. Core Stats, Dataplane stats, Port stats..)
- Wireless (e.g. AP, Client, Rogues, Interferers..)
- Events (e.g. Client Events, AP Events, RADIUS Events, Redundancy)

Edge-Router Device Info
- Provider, Configuration, CPU/Memory, NetFlow

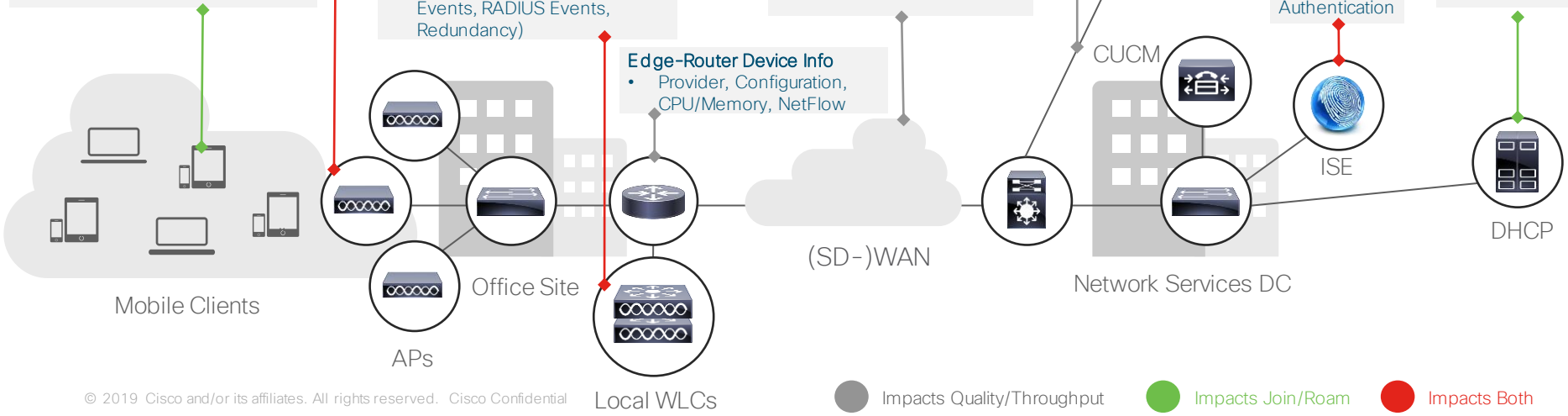
BFD Probes:
- Tunnel loss, latency, jitter, traffic,...

Snail Trail:
- Per-hop RTT, loss, Provider,...

Cloud-on-ramp HTTP probes:
- Loss, latency

DPI Stats:
- Applications
- Flows

- Addressing
- Roaming



Impacts Quality/Throughput Impacts Join/Roam Impacts Both

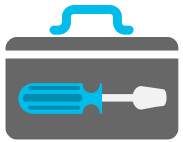
Network time travel

Network health score
9/10

Client health score
10/10

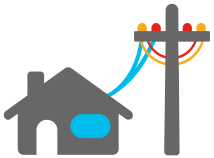
Issues and trends

Issues:
Go back in time and investigate: The dual-band-capable **client is preferring 2.4 GHz over 5 GHz.**



Look at "Suggested Actions" from noon to fix the issue from the past.

Sensor-driven test:
Proactively schedule a test with Aironet® Active Sensor to help ensure a great user experience.



SJC08-1 WAN will be oversubscribed.

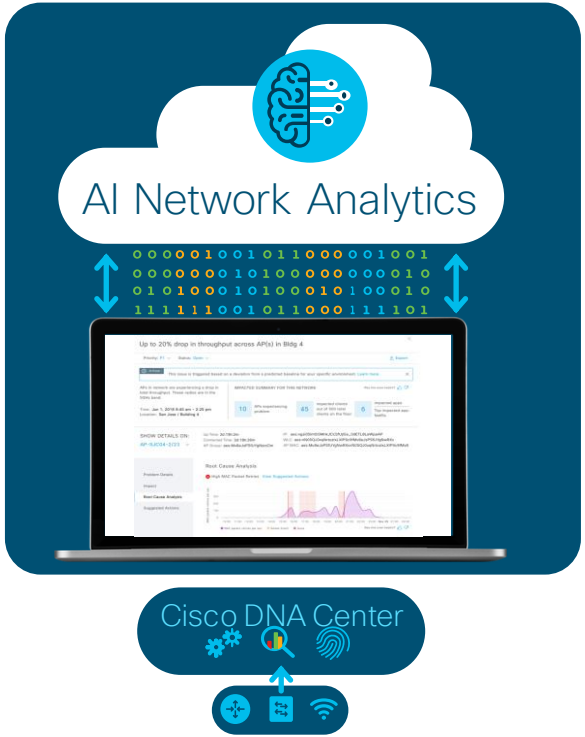
Look at "Suggested Actions" now to prevent the issue from happening.

-24 hours | - 3 hours | Now | + 3 hours | +24 hours

No need to replicate issues; just go back and see exactly what happened.

Cisco AI Network Analytics

Machine learning makes Assurance smarter



Visibility: Personalized baselining

Intelligently define personalized "network normal" using unified global telemetry collected

Insight: Intelligent data analysis

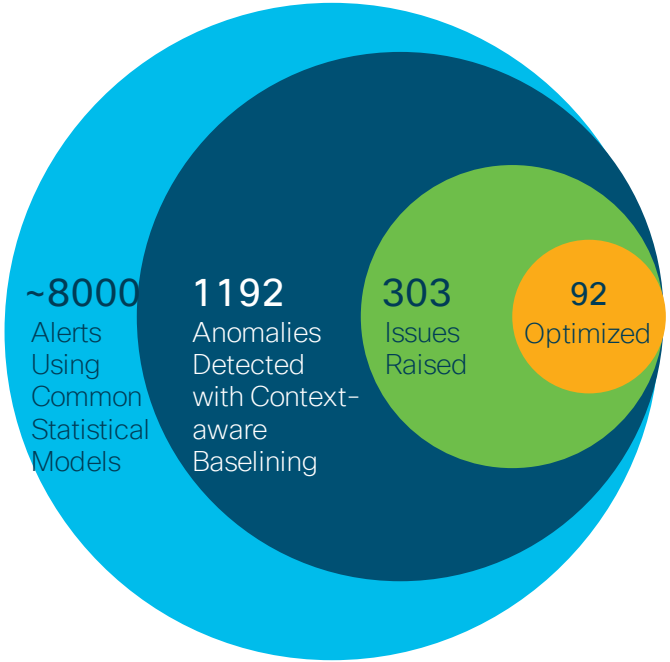
Increase signal to noise, reduce false positives, and accurately identify trends and root causes.

Action: Accelerated remediation

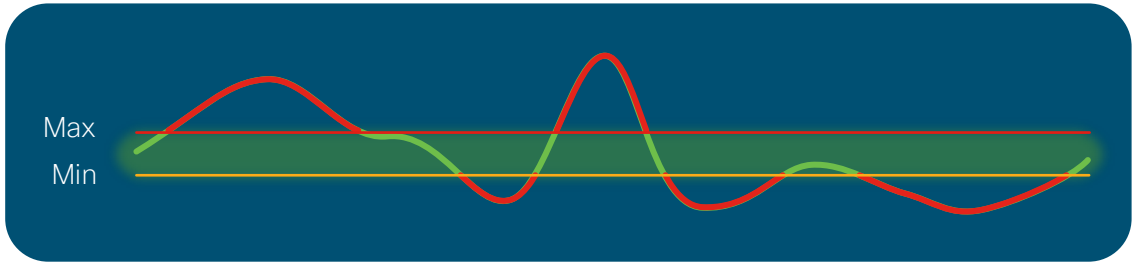
Create automated resolution options for IT to act on based on machine reasoning algorithms.

Improve incident alert personalized baseline

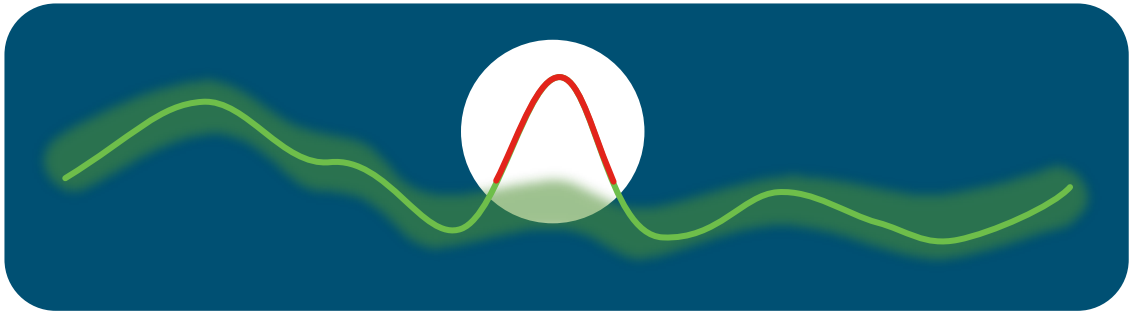
98%
Reduction in Alerts



Before: Custom Thresholds = Alert Overload



AI-driven: Dynamic Baselines = Relevant Anomalies



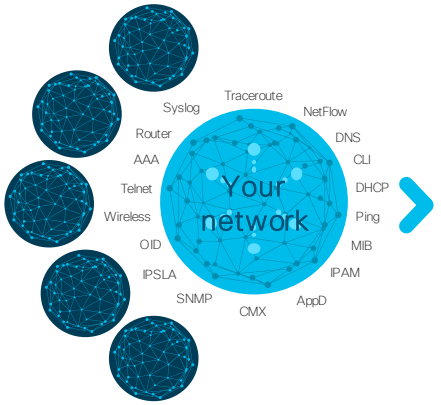
Cisco advantage

Best data, best knowledge base

Diverse data:
Network, application, security

Diverse networks:
Local and global

Streaming telemetry :
Cloud connected



Worldwide data platform
Anonymized data

AI/ML

Accurate insights

Improved performance

Cisco DNA Center

35 years of top engineering knowledge

Communities

Cisco Fellows

CX

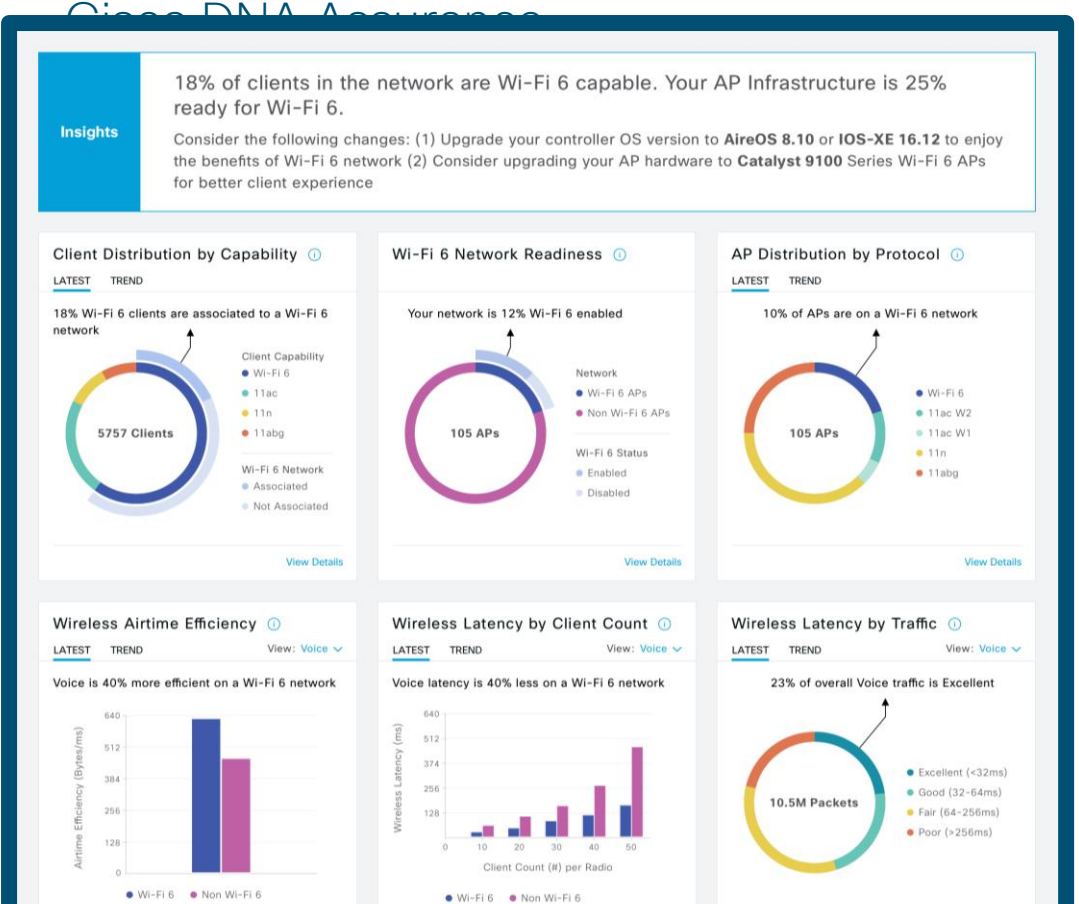
TAC

Distinguished Engineers

cisco Knowledge base

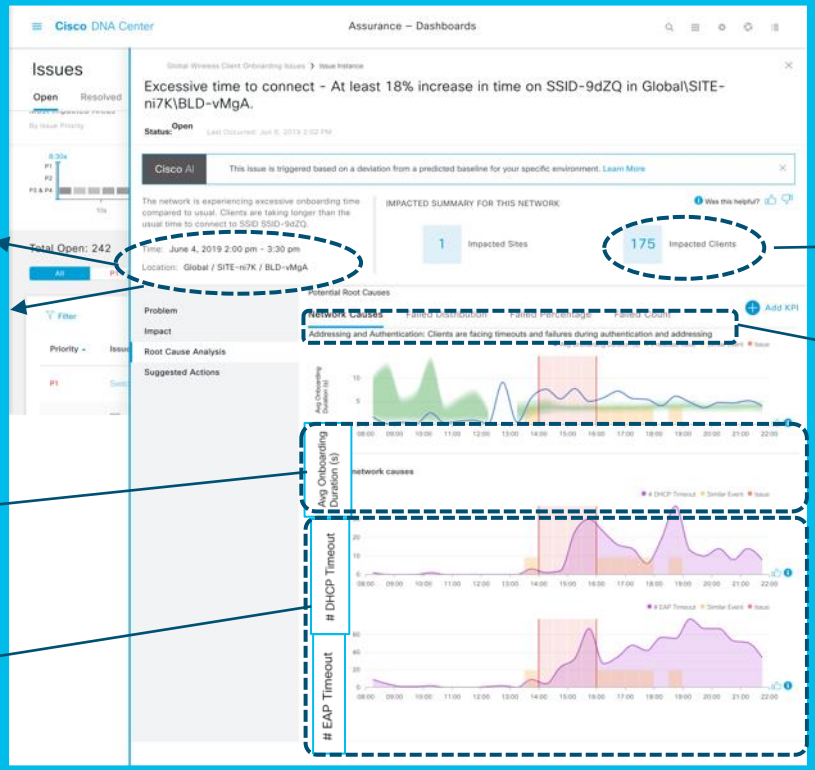
Measure Wi-Fi6 Benefits with Wi-Fi 6 Analytics Dashboard

Cisco DNA Assurance



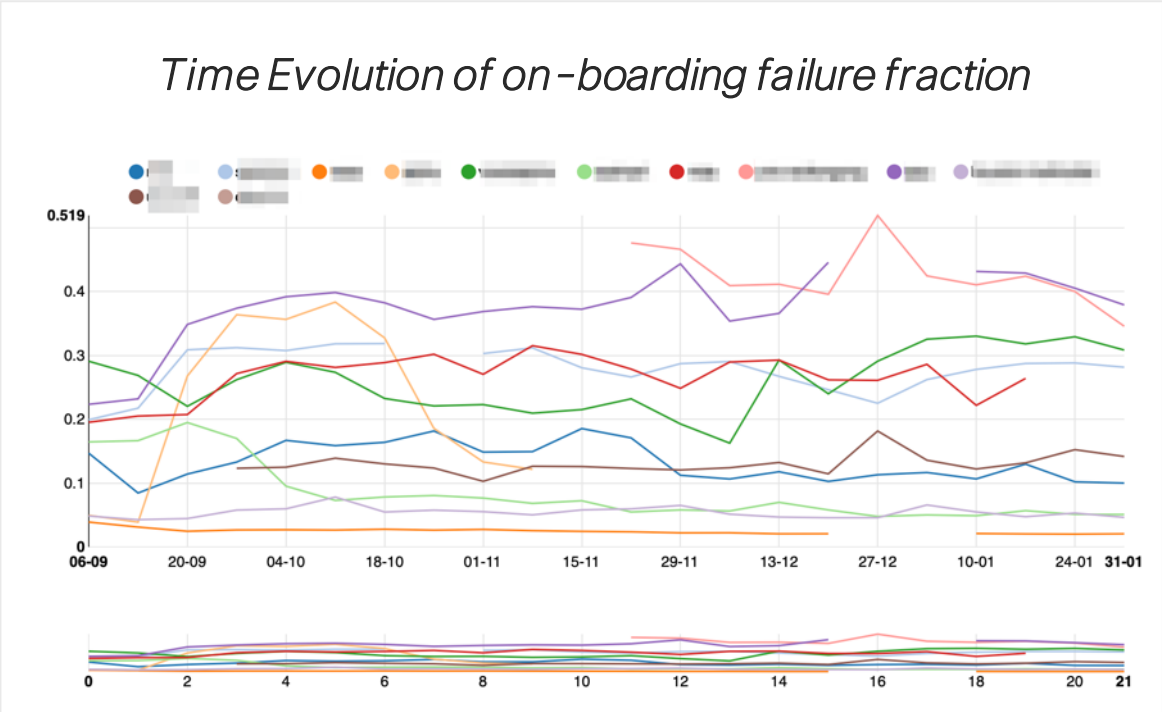
- Analytics on W-Fi 6 APs and devices
- Wi-Fi 6 readiness and benefits analytics
- Advanced wireless performance troubleshooting

Root cause analysis



Wireless Percentage of On-Boarding Failures …

Percentage of on-boarding failures vary between 5% and 35% !



Wireless On-Boarding Time

On boarding times vary between 500ms and +4 seconds !