How to Troubleshoot Your Network with AI

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20200422

Introduction

Assurance Challenges

An Opportunity for ML/AI ?

Before Troubleshooting

ML/AI in DNA Assurance

Close

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Business Priorities shaping Dynamic IT Landscape

[1] 2019 Cisco VNI: Global Fixed and Mobile Internet Traffic Forecasts
[2] 2018 IDC: Multicloud is the New Normal
[3] 2017 Gartner: Gartner Predicts 2017: Network and Gateway Security, Dec 13 2016, ID G00317597

Dynamic and hyper-connected is the New Normal

Digital Transformation – Worldwide Spending

70% Programming Services

40% Managed and Support Services

30% Professional Services

Spending Areas by Percentage of Companies

Worldwide Spending on Digital Transformation

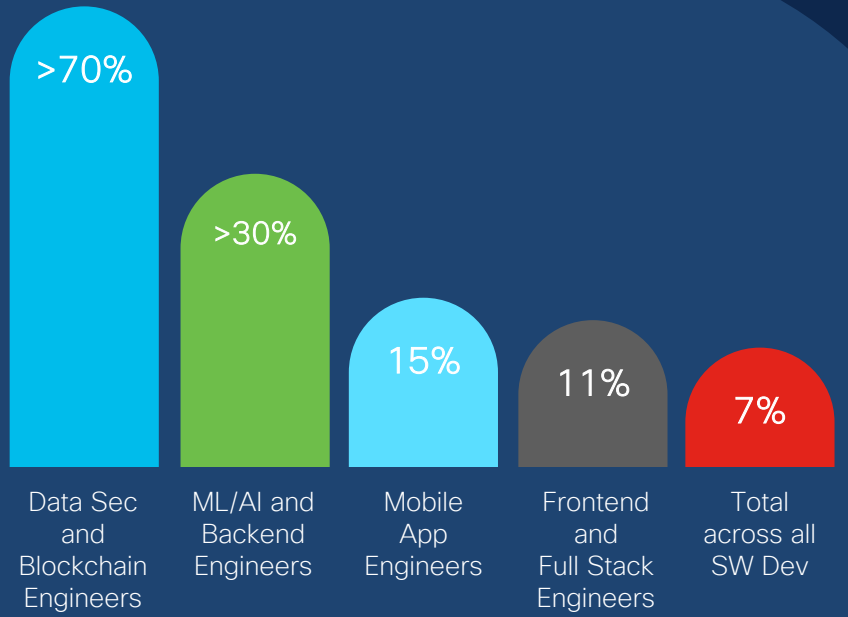
$2 Trillion

by 2025

IDC

Source: Worldwide Semiannual Digital Transformation Spending Guide, 2019, IDC

Digital Transformation – Software Engineers



Software Engineers – 10-year growth by projected demand

Worldwide Spending on Digital Transformation

$2 Trillion

by 2025

IDC

Source: Worldwide Semiannual Digital Transformation Spending Guide, 2019, IDC

“We cannot become what we want by remaining what we are.”

-Max Depree

Digital Transformation

People and Organization

- Skills, Functions, Roles
- Cross Functional Teams

Operating Models

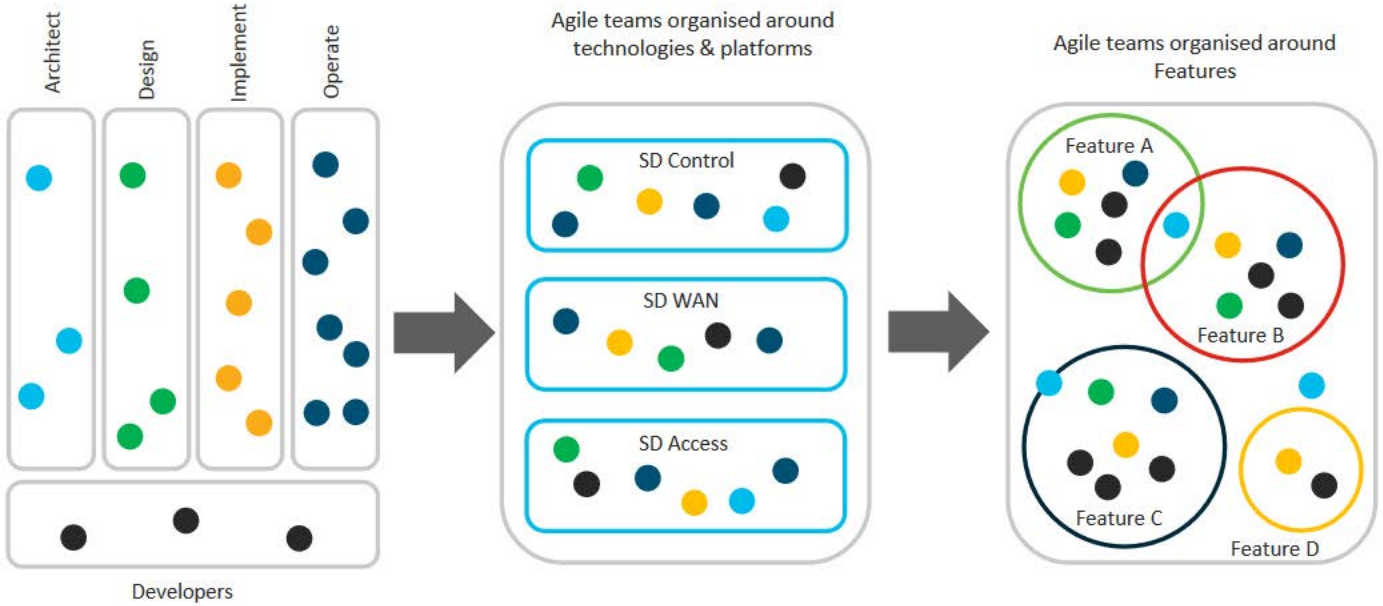
- Bi-/Tri-Modal, Agile, CI/CD, Governance
- Pockets of Success → Centers of Excellence

Technology

- Digital Platform
- Policy and Analytics
- Open, Programmable, Virtual and Physical
- Wired, Wireless, Hybrid Cloud, Multidomain

Digital Transformation – Example: Cisco IT

Reorganized into Agile Teams



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Network Complexity

High costs to operate

$60B

Annually spent on network operations, labor, and tools[1]

95%

of network changes are performed manually

75%

of OpEx is spent on changes and troubleshooting

70%

of policy violations are due to human error

[1]Cisco McKinsey Study

43%

of IT Time spent on Troubleshooting

Data collection

Network operators spend 4x more time collecting data than analyzing while troubleshooting

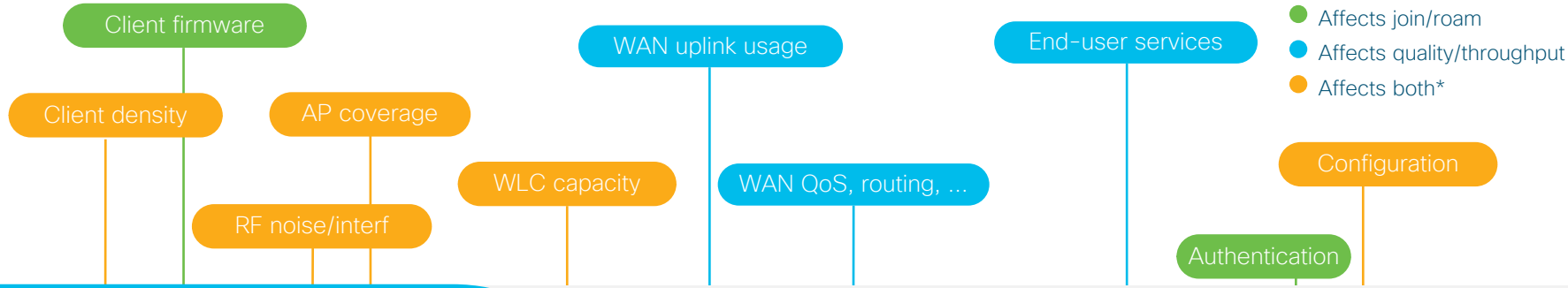
Replication challenge

It's impossible for IT to troubleshoot if they cannot replicate the issue or see it in real time

Slow resolution

Half of Wi-Fi issues take more than 30 minutes to resolve

Network Quality: A Complex End-to-end Problem

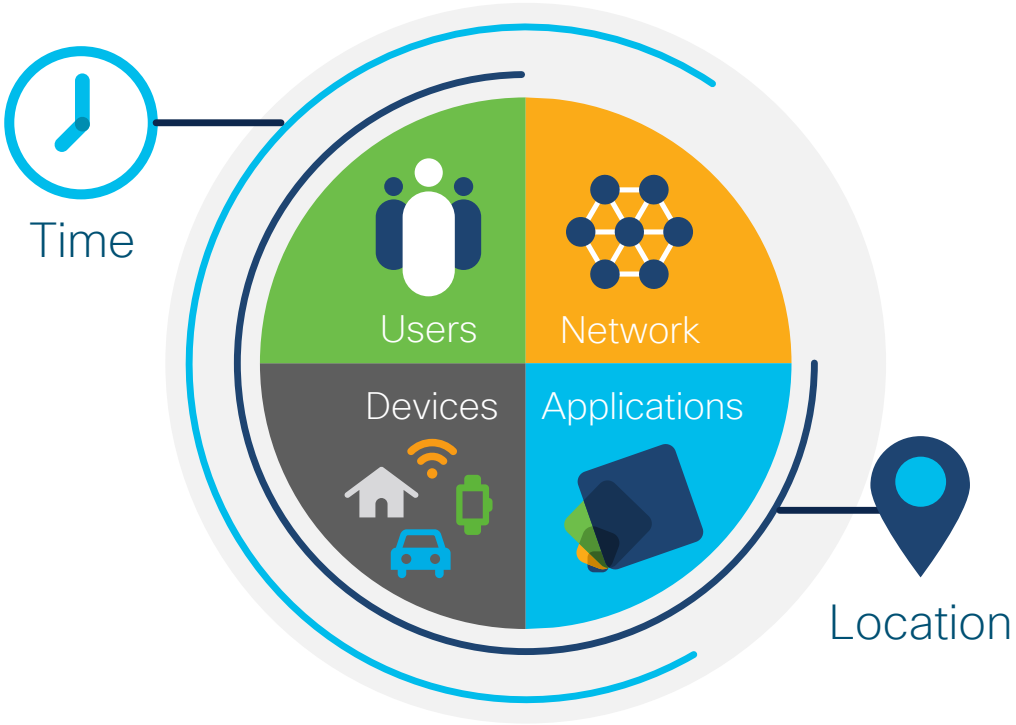


100+ points of failure between user and app With 50,000+ permutations!

- What is the problem?
- Where is the problem?
- How can I fix the problem fast?

* Both = Join/roam and quality/throughput

In This Environment, Context is Key



Cisco Context

360-degree Visibility

+

Data Granularity

+

Historical, Real-time, Future

Rich Context Increase Business Productivity and Frees Up IT Time

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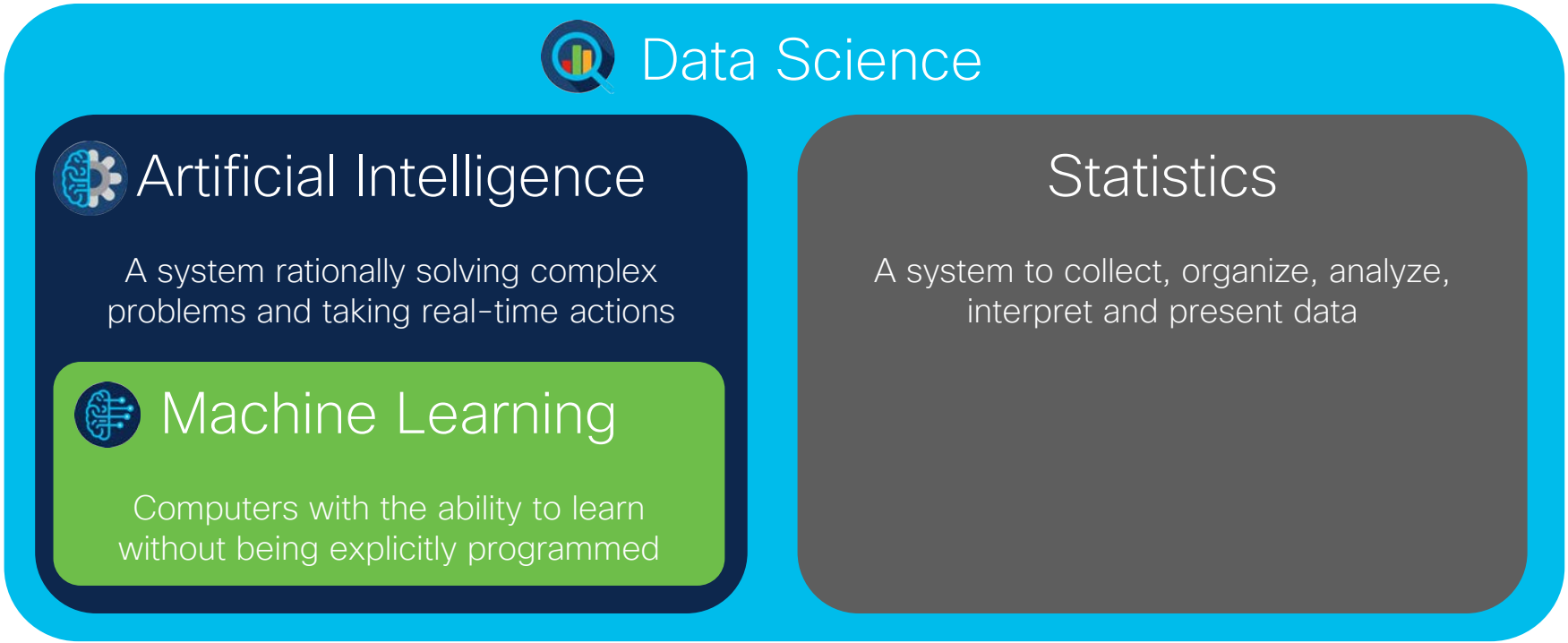
Semantics



Why Do We Need Machine Learning (ML)?

Machine Learning (ML)

Scales the Defintion of how to Process Data

Moore's Law, Parallelization

Quality – Process Differently

Quantity – Process More

More Telemetry Data – More Context

Digitization

Segmentation

Mobility

Compliance

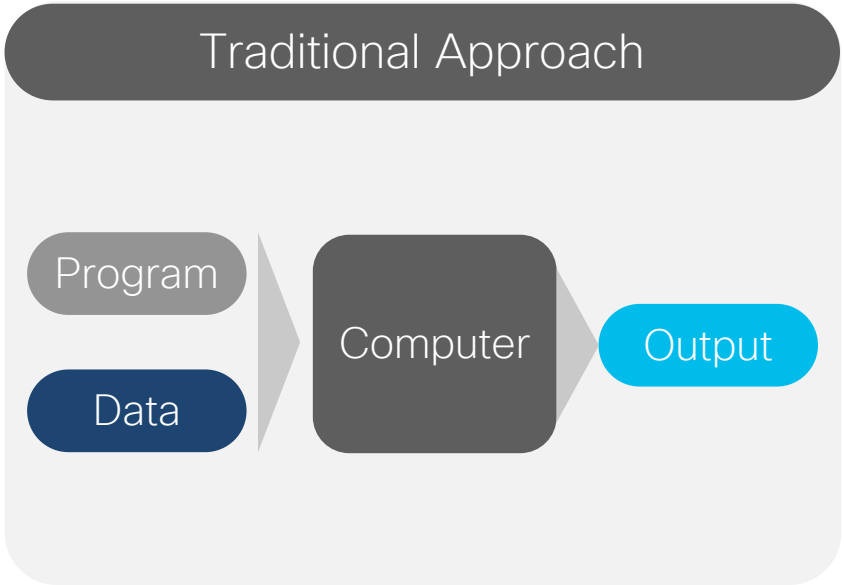
Automation

Scale

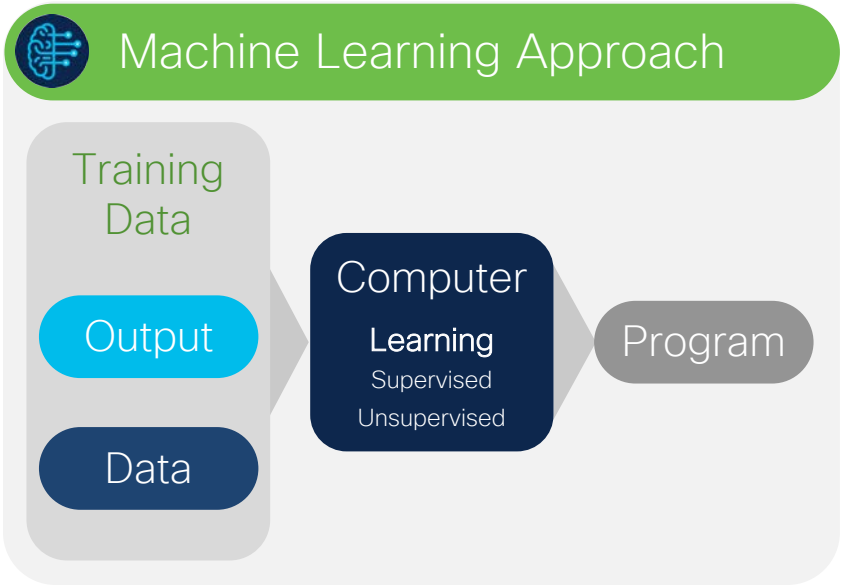
Complexity

Multi-Domain, Hyper-Connected, Dynamic

Machine Learning in a Nutshell



Machine Learning in a Nutshell



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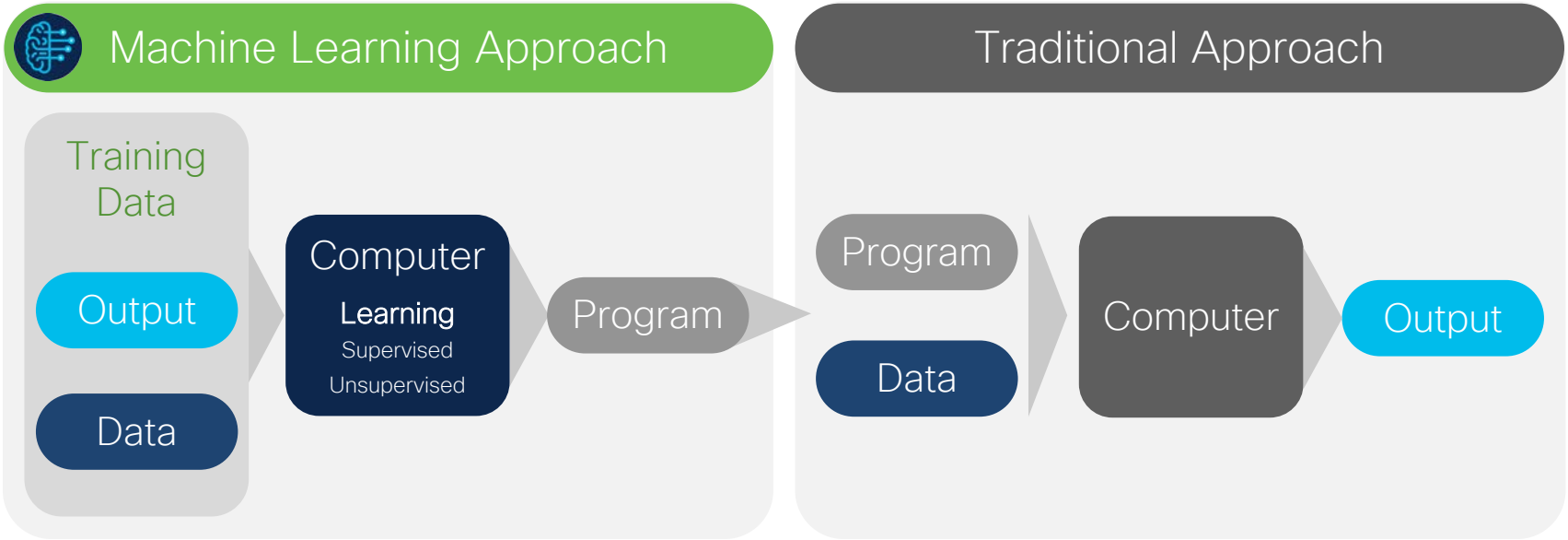
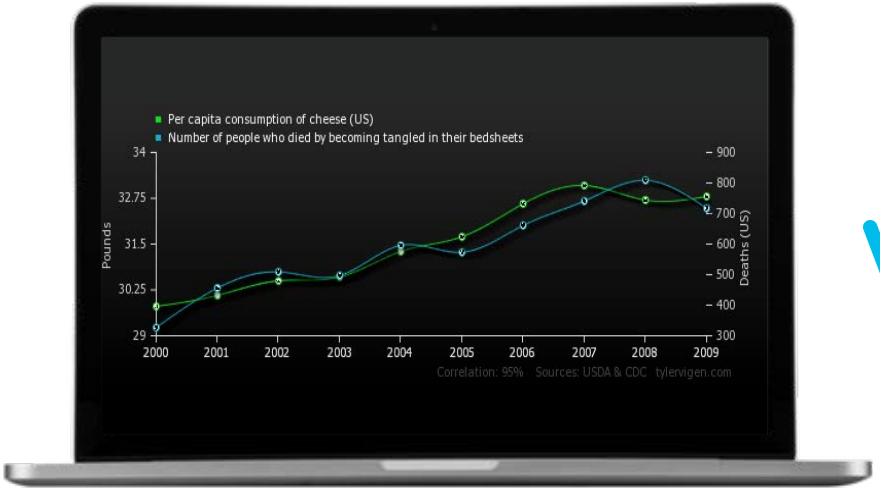
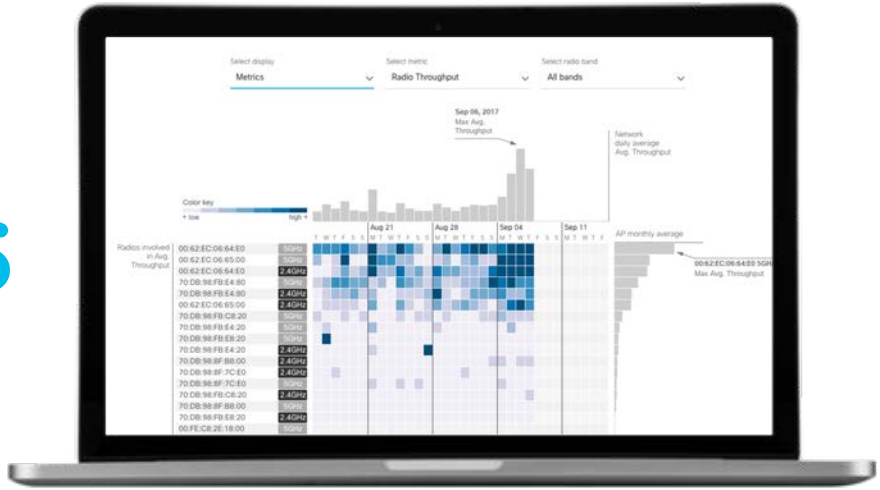


Quality of Training Data is Key

A Note on Correlation vs. Causality



VS



Subject Matter Expertise and Context Information are Key

What can Machine Learning really do?

"If a human can do it in a few seconds, then ML/AI can probably be trained to do it."

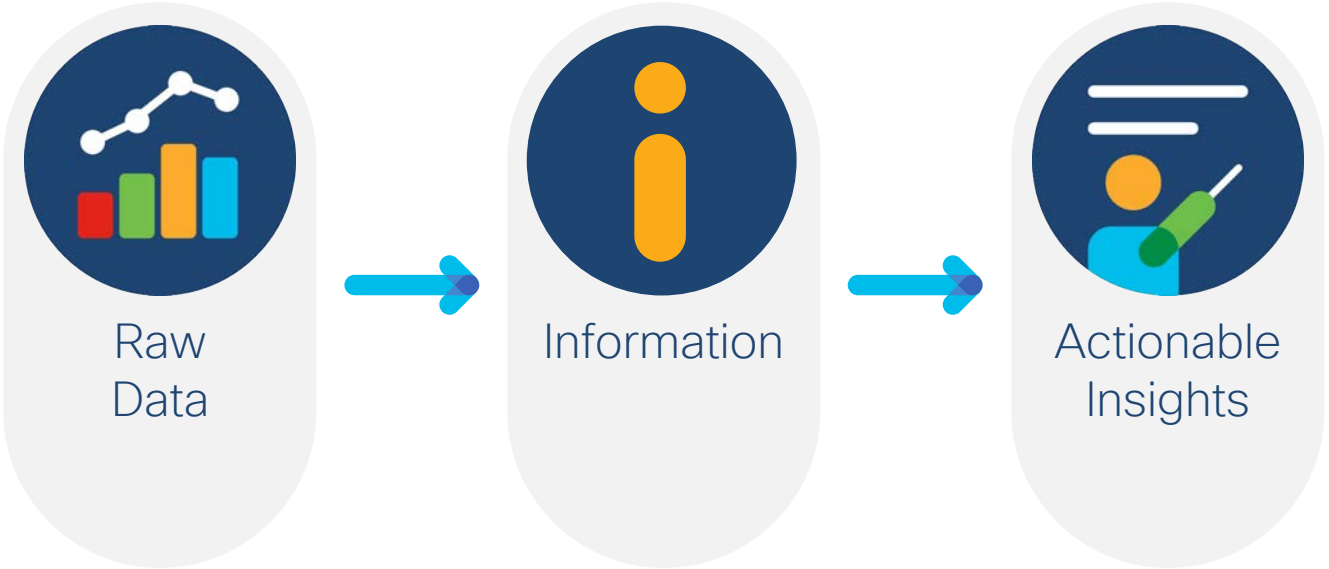
ML does not replace complex Expert Interactions

What can Machine Learning really do?

"If a human could do it in a few seconds, then ML/AI can probably be trained to do it."

ML can augment Traditional Approaches

From Data to Insight



Actionable Insights drive Operational Maturity Evolution

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Trobleshooting

Troubleshooting starts

before

Troubleshooting starts

Trobleshooting

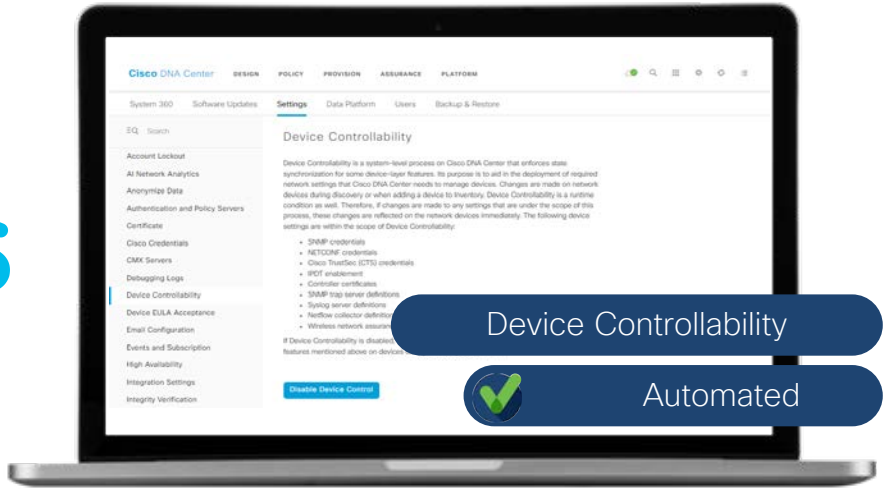
Troubleshooting starts

before

Troubleshooting starts

Network Telemetry is Core

VS

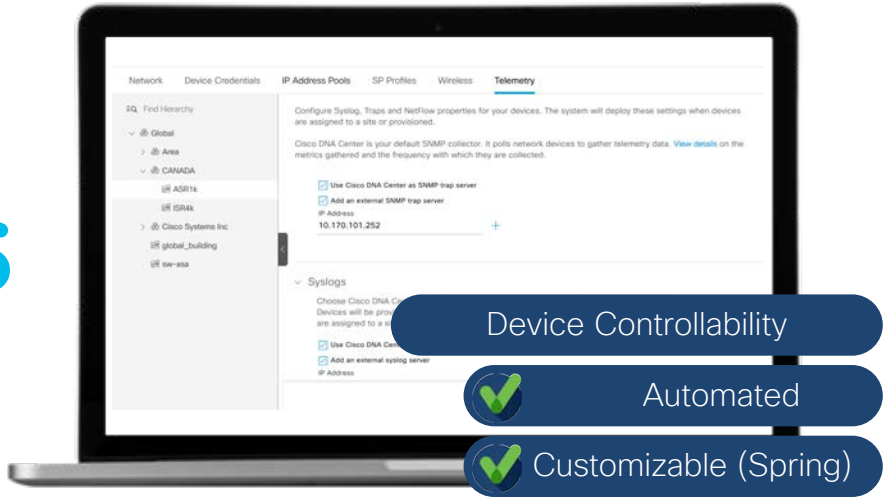


... – SNMP – Syslog – Notifications – Netflow – IPDT – MDT – WSA/TDL – ...

Your DNA Network provides Sensor and Telemetry Data

Network Telemetry is Core

VS



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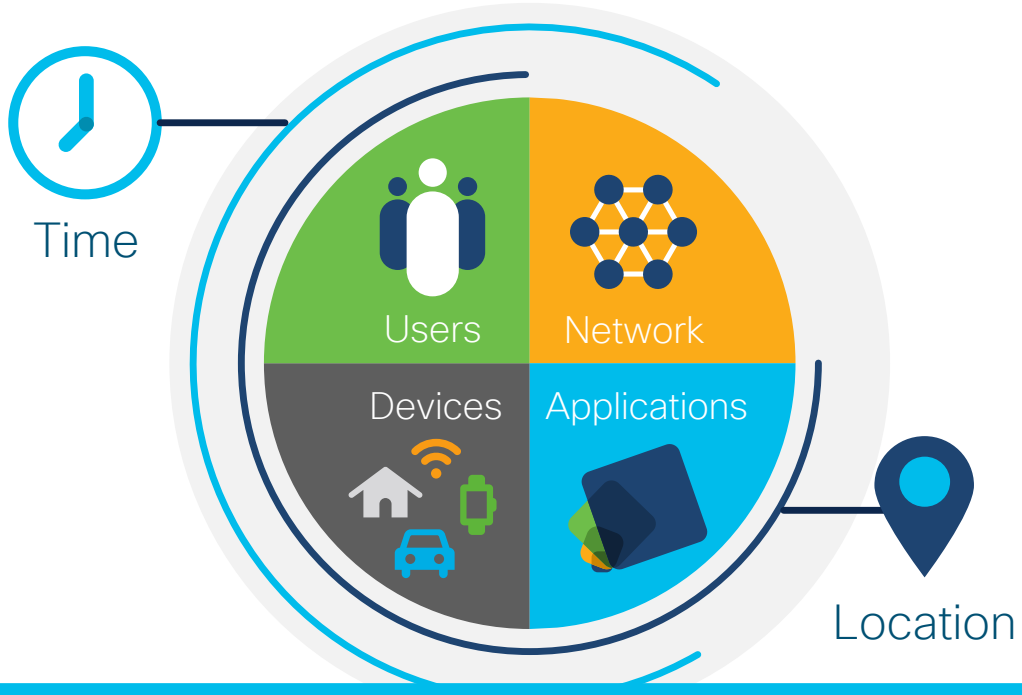
Your DNA Network provides Sensor and Telemetry Data

In This Environment, Context is Key



Cisco Context

360-degree Visibility

+

Data Granularity

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Historical, Real-time, Future

Rich Context Data increases Productivity

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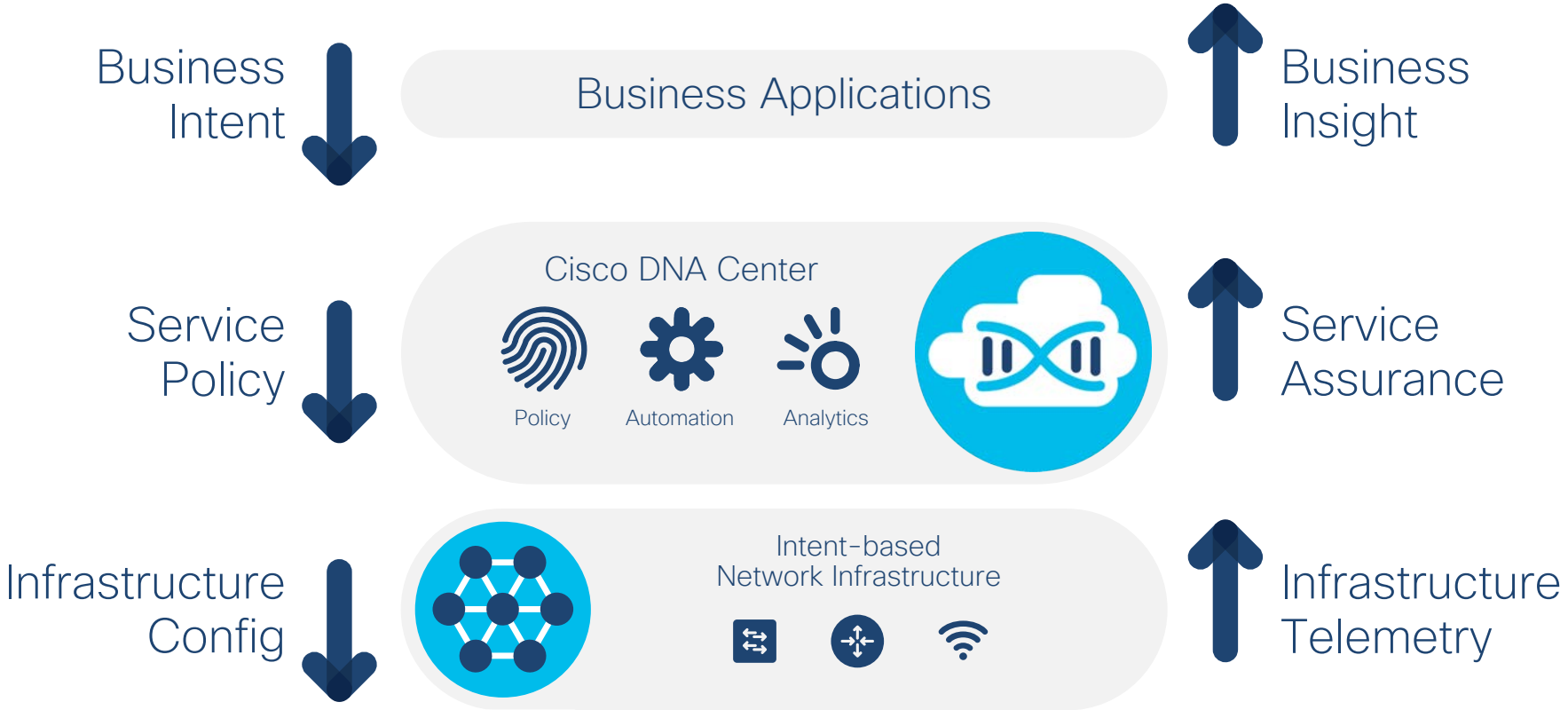
Cisco DNA Center
DNA Assurance

Cisco DNA Center: Abstraction Boundaries



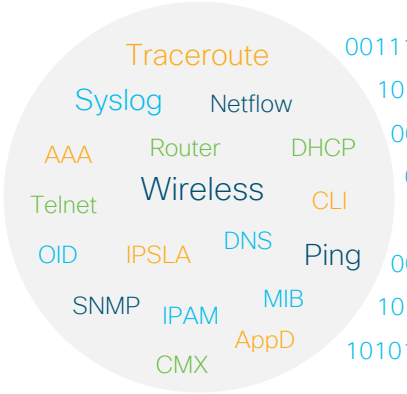
Cisco DNA Assurance

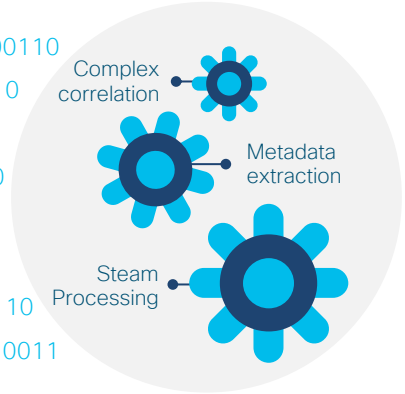
Network Telemetry
Contextual Data

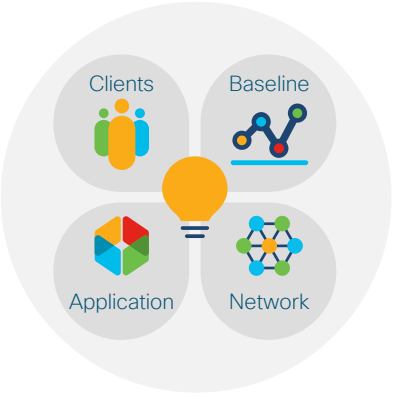
Correlation Complex
Event Processing

Issues
Insights

Guided
Remediation







Telemetry and Sensors at Source

Clients | Applications | Wireless | Switching | Routing

Event Processing

"Event Processing is a method of tracking and analyzing streams of information about things that happen (events) and deriving a conclusion from them."

Complex Event Processing

"CEP is event processing that combines data from multiple sources to infer events or patterns that suggest more complicated circumstances. The goal… is to identify meaningful events."

WIKIPEDIA
The Free Encyclopedia

Cisco DNA Assurance – Full Stack Visibility

Network Experience

Network Health:
Monitor and troubleshoot the overall health of network devices

Device 360:
Comprehensive view to troubleshoot device issues

Time Travel:
Contextual Analysis of historical problems going back up to 14 days in time

Client Experience

Client Health:
Provide visibility into clients connected to the network and their experience

Client 360:
Comprehensive view of client issues, onboarding, event viewer and connectivity status

Intelligent Capture:
Provide packet capture data, AP and Client statistics, and spectrum data

Sensor based SLA Monitoring

1800s Active Sensor:
Proactively test the network and end user experience

Active Testing:
12+ types to onboarding and network performance tests

SLA Dashboard:
Onboarding, Network Services and App Connectivity

Application Experience

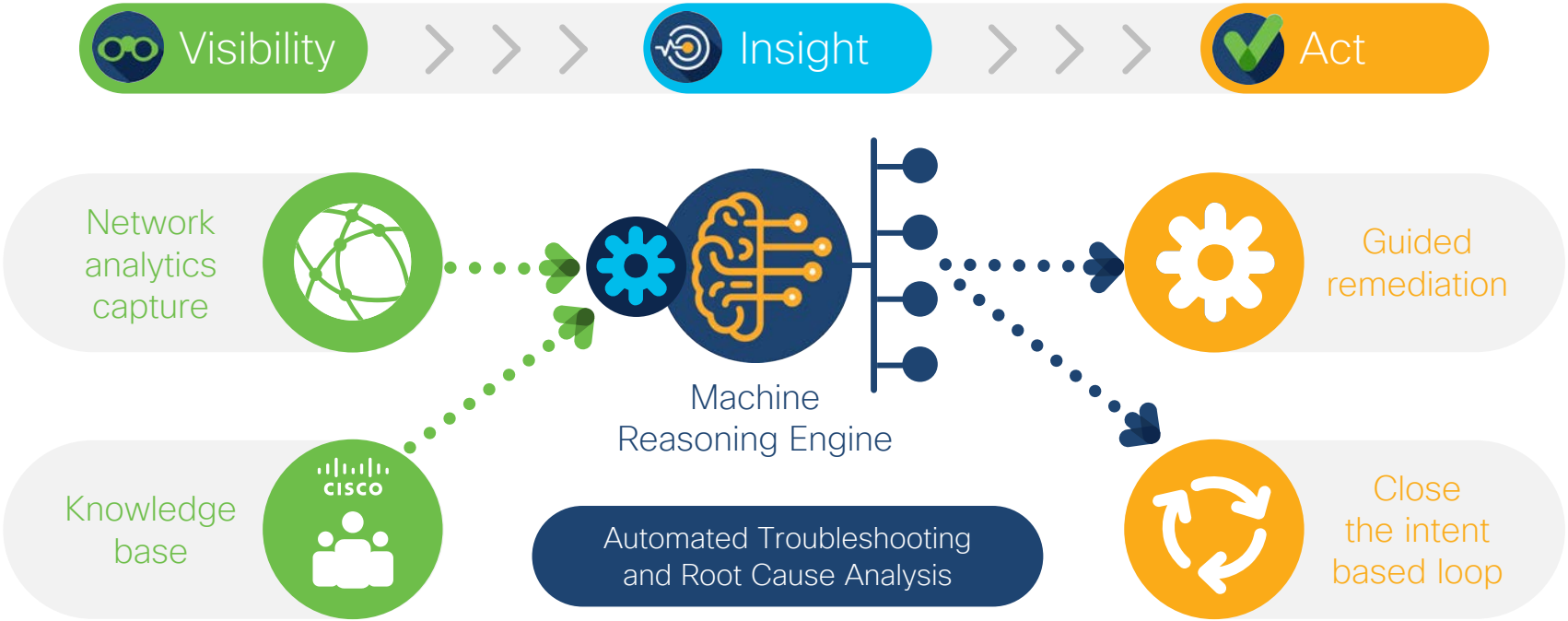
Health Score Dashboard:
Monitor App Health score of business critical apps

App 360:
Troubleshoot App issues with a view on performance metrics

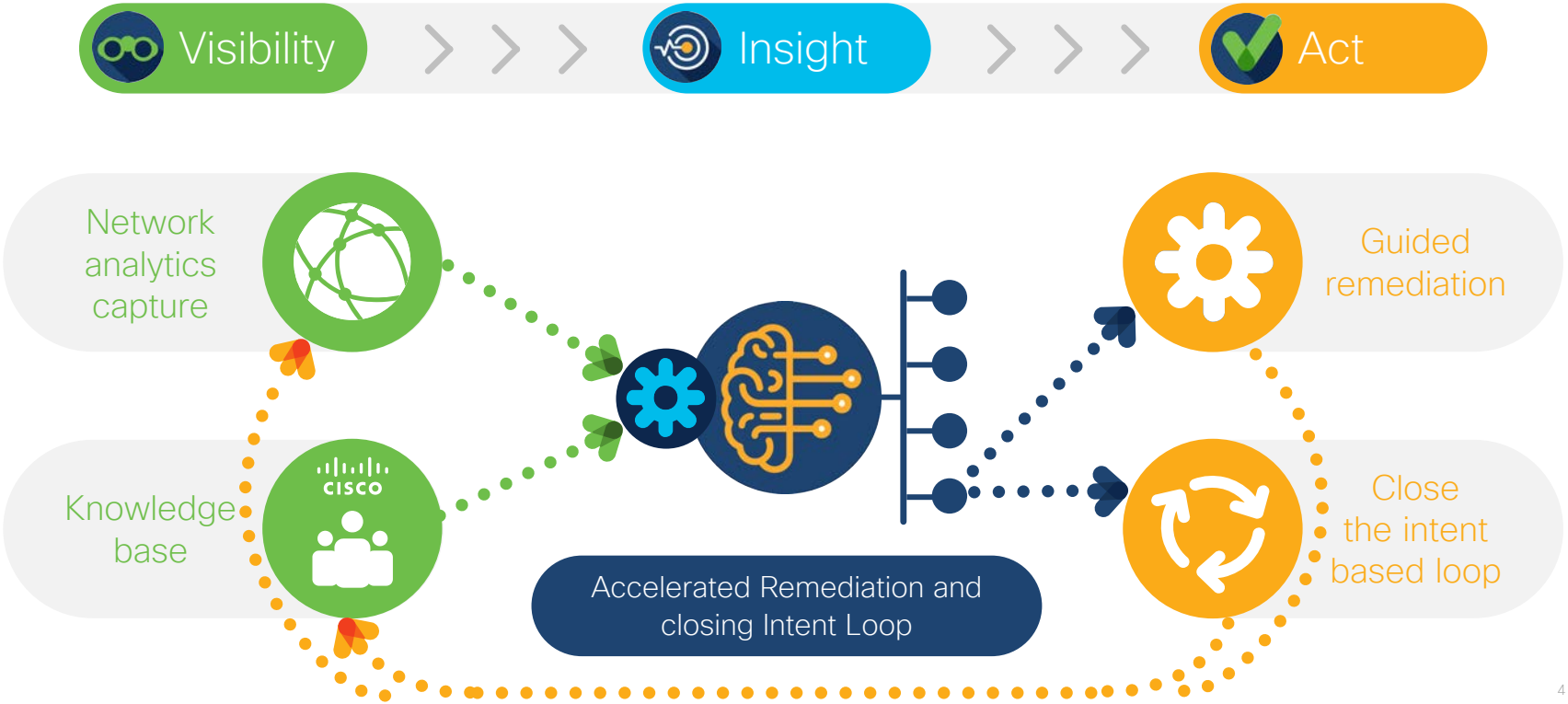
Client 360:
Troubleshoot specific clients facing app experience issues

Cisco DNA Center
DNA Assurance
and
Cisco AI Network Analytics

Cisco AI Network Analytics

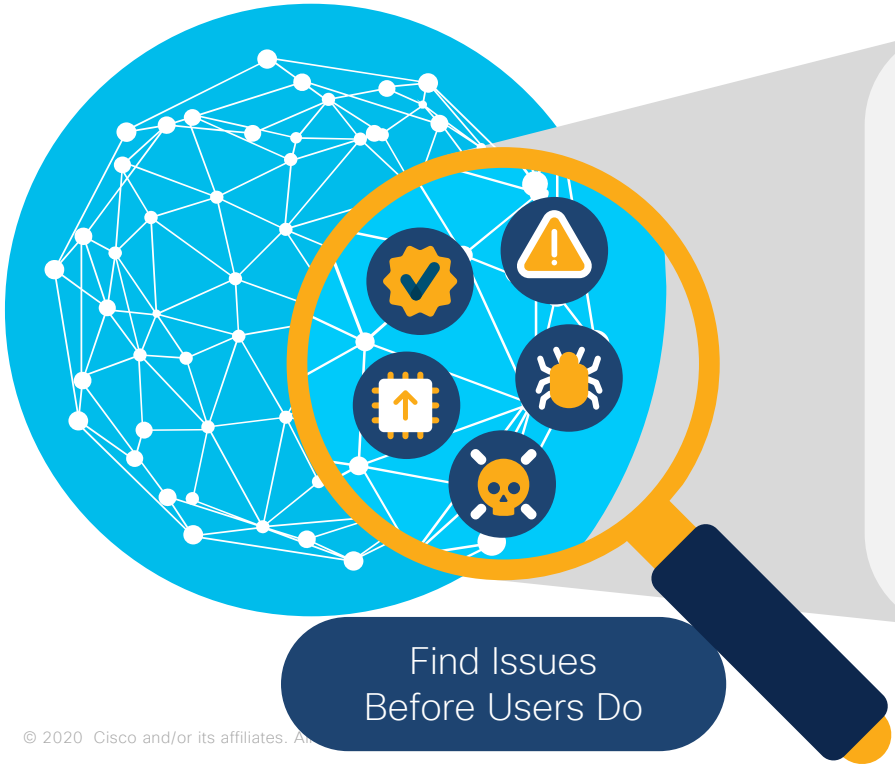


Cisco AI Network Analytics



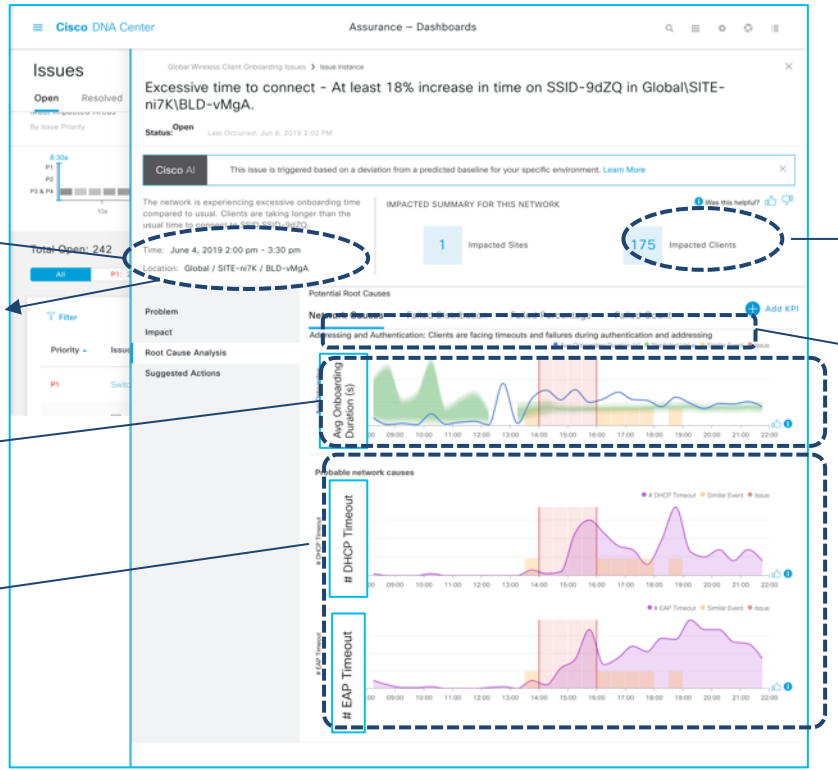
Proactive & Predictive Insights

Intelligent Analysis



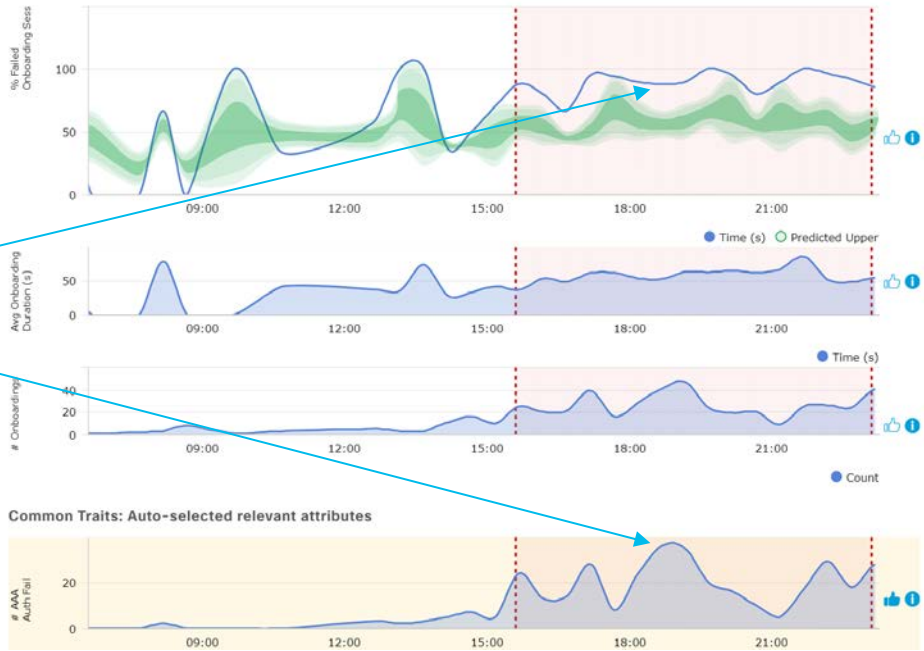
- Proactive Exploration
- System Generated Insights
- Peer-to-peer and Site-to-site Comparison

Cisco AI Network Analytics – 6 “W”s



Example: Onboarding Failure Rate due to AAA

Category	Real-time Anomaly Detection
Context	University / 802.1x SSID
Findings	Detection of abnormal on-boarding failure rate for several hours
Root Cause	AAA auth failures
Actions	Verify RADIUS server status on WLC and auth error reasons on AAA server

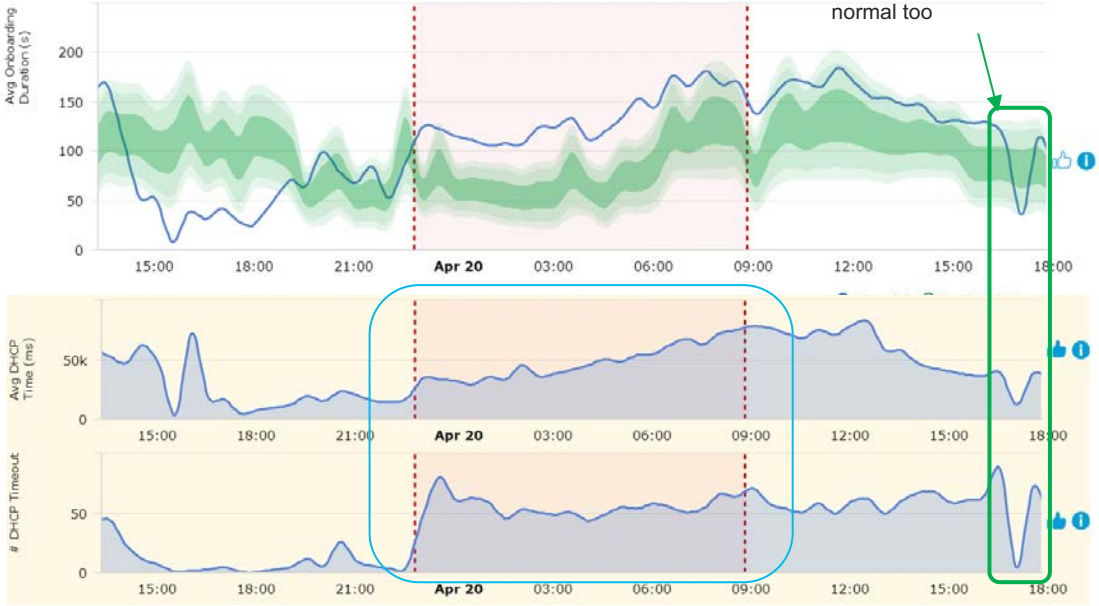


Machine Learning models used to detect an on-boarding failure anomalies (fixed threshold cannot be used here, considering the variation of network conditions) and perform root causing to AAA issue

Example: Onboarding Time due to slow DHCP

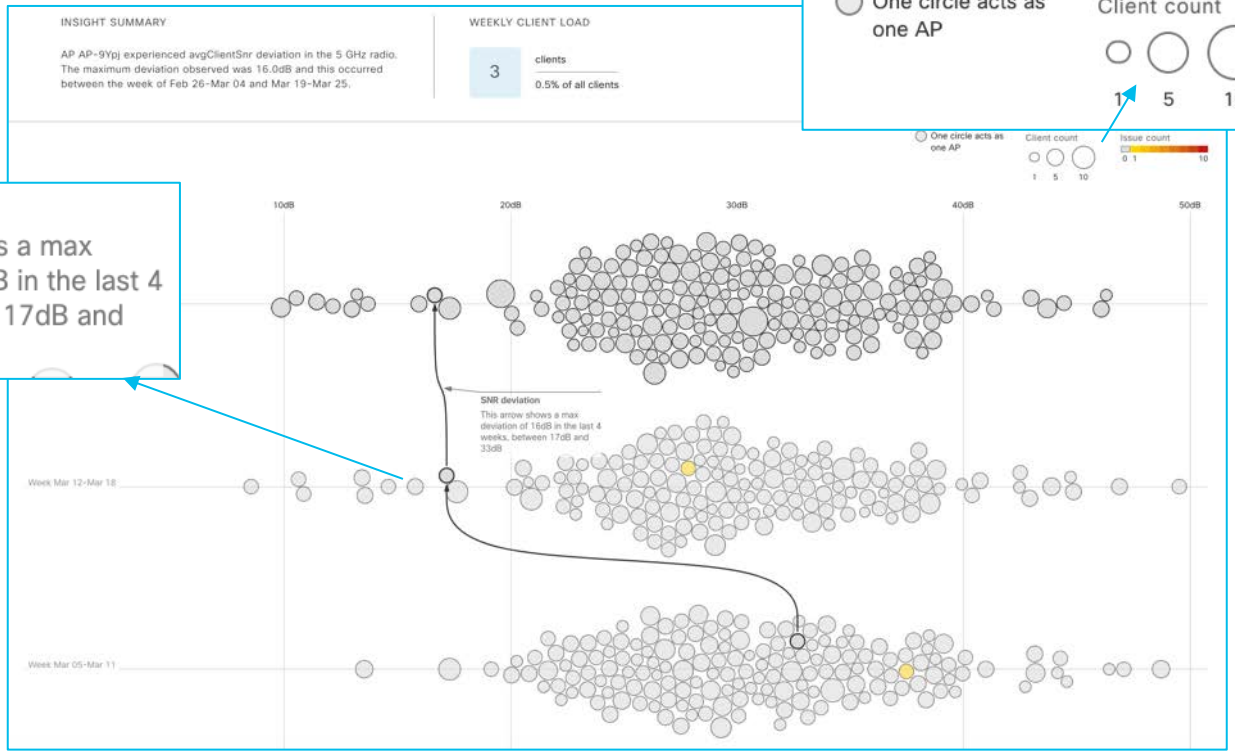
Category	Real-time Anomaly Detection
Context	University / Guest SSID / *Busy network*
Findings	Detection of abnormal on-boarding time for several hours (blue line outside of predicted green band)
Root Cause	**DHCP time** and **DHCP Timeout** errors increasing at the same time
Actions	Verify status of the DHCP Server and DHCP Pools

Interesting to note that on-boarding time back to normal when DHCP issues back to normal too



Machine Learning models used to detect an on-boarding time anomalies (time-based cannot be used here, considering the variation of on-boarding) and perform root causing to DHCP issue

Example: Long-term Trending / Behavior Change



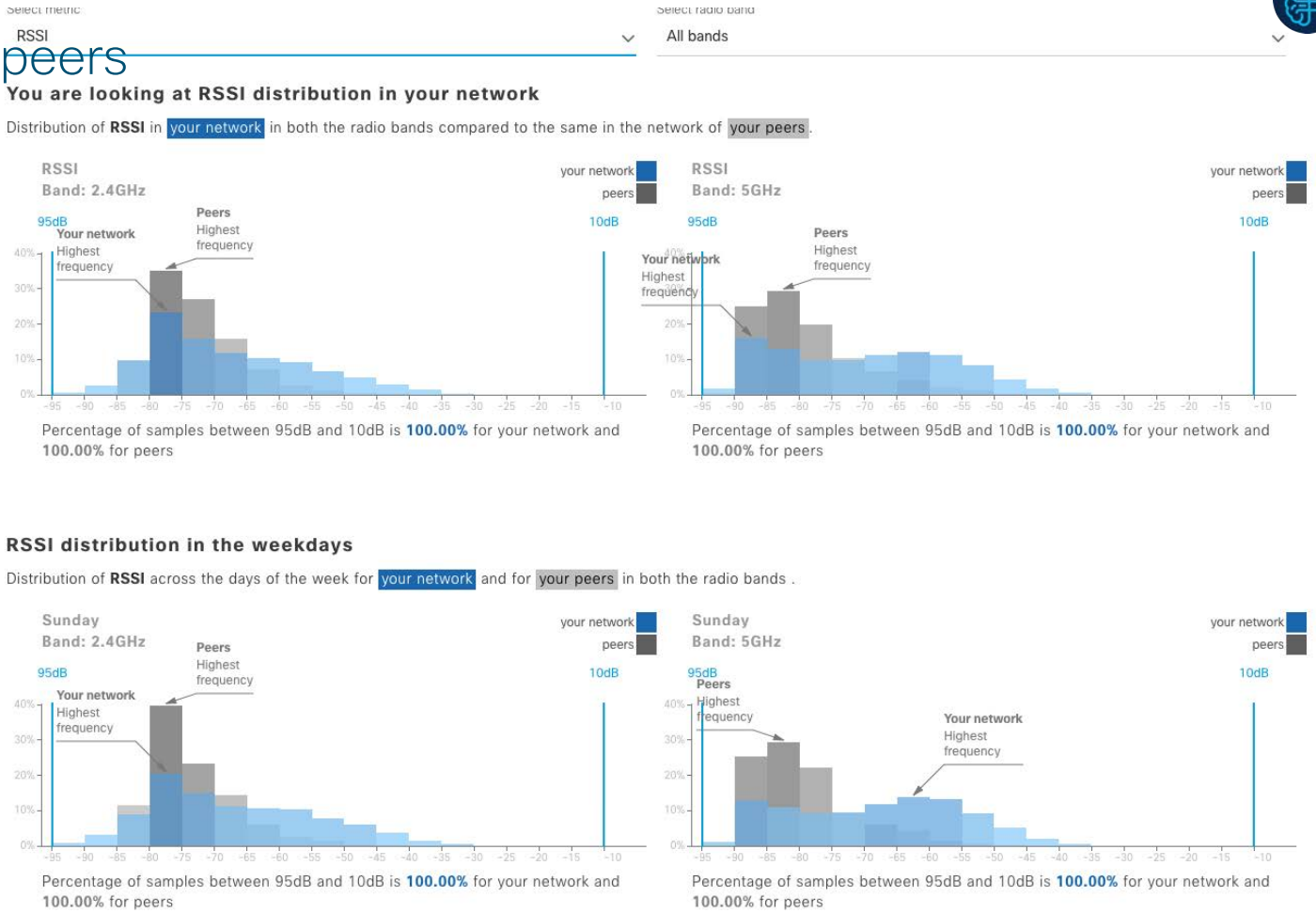
SNR deviation

This arrow shows a max deviation of 16dB in the last 4 weeks, between 17dB and 33dB

Insight – Found AP that exposed by HUGE noise for last 2 weeks

Compare with peers

- DNA Analytics groups networks according to degree of "similarity" using ML, and analyzes how the network performs, comparing with peers
- Provides comparison *metrics* (KPI of interest)



Cisco AI Network Analytics

Cognitive & Predictive Analytics for the Intuitive Network

Wireless Networks

Global/per-application throughput, Roaming and Joining Failure Rates

Network Resiliency

Noise & Interference (Wireless), Link Failures (WAN, Tunnel flaps), Port failures (e.g. PoE), Node failures (routers)

WAN

SLA / QoS (loss, jitter, latency), capacity planning, per-app routing

Switching

Micro-burst, soft error, PoE, optic failures

Close Loop Feedback

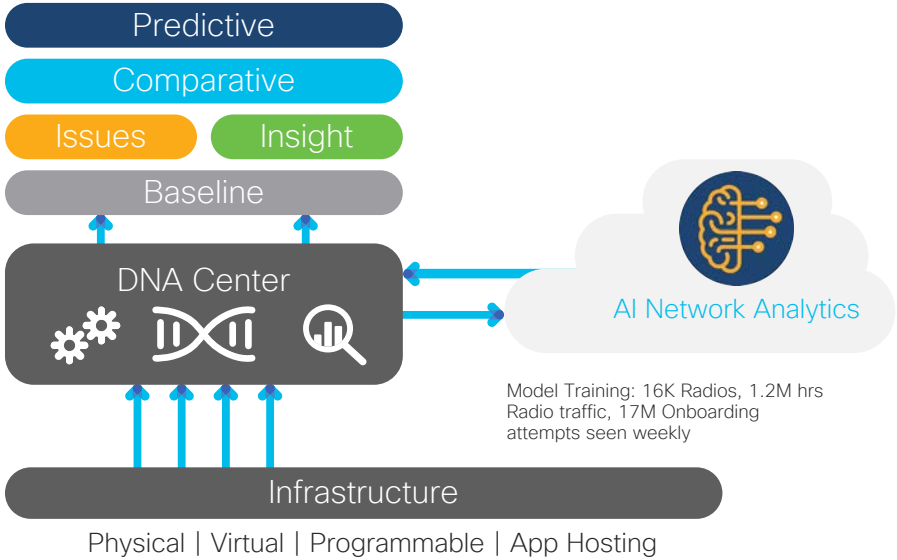
End-to-End Device interaction to optimize SLA, Network loop control for preventive measures

Machine Learning Cognitive & Predictive Analytics

Cisco AI Network Analytics

Key Customer Benefits

Highly personalized	See problems sooner	Solve problems faster	Cut out unwanted noise



Making DNA Center Smarter:

AI-Driven Predictive Analytics
Anticipate and Prevent Failures

AI-Driven Comparative Analytics
Compare KPIs Internally and to Peers

AI-Driven Proactive Insights
Find Global Patterns and Systemic Trends

AI-Driven Anomaly Detection
Surface and Root Cause Complex Issues

AI-Driven Baselining
Define Normal for a Given Network

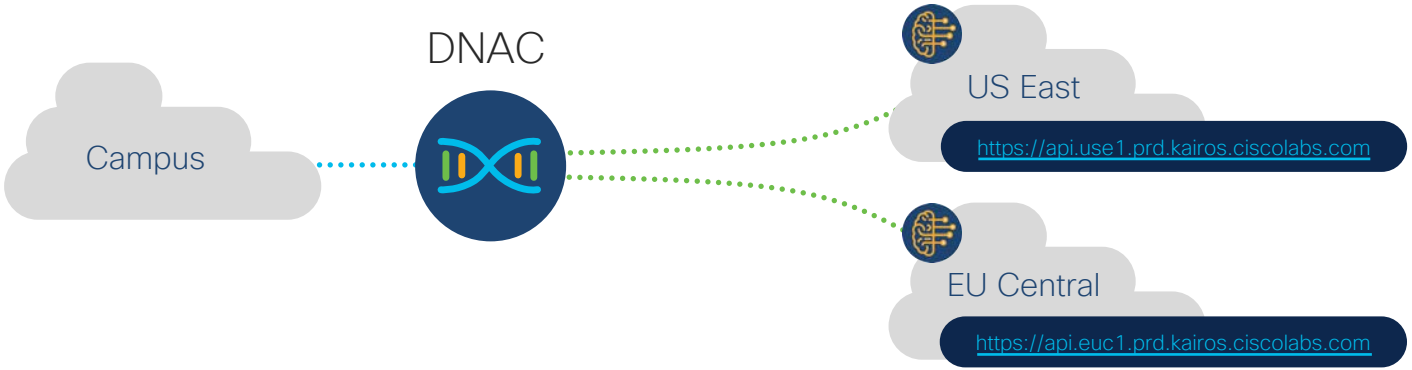
Cisco AI Network Analytics - Data Privacy

All of PII (Personally Identifiable Information) and Network that we are forwarding to AI Network Cloud is encrypted, anonymized and unidentified

End user identity (user name, device MAC address, etc.)

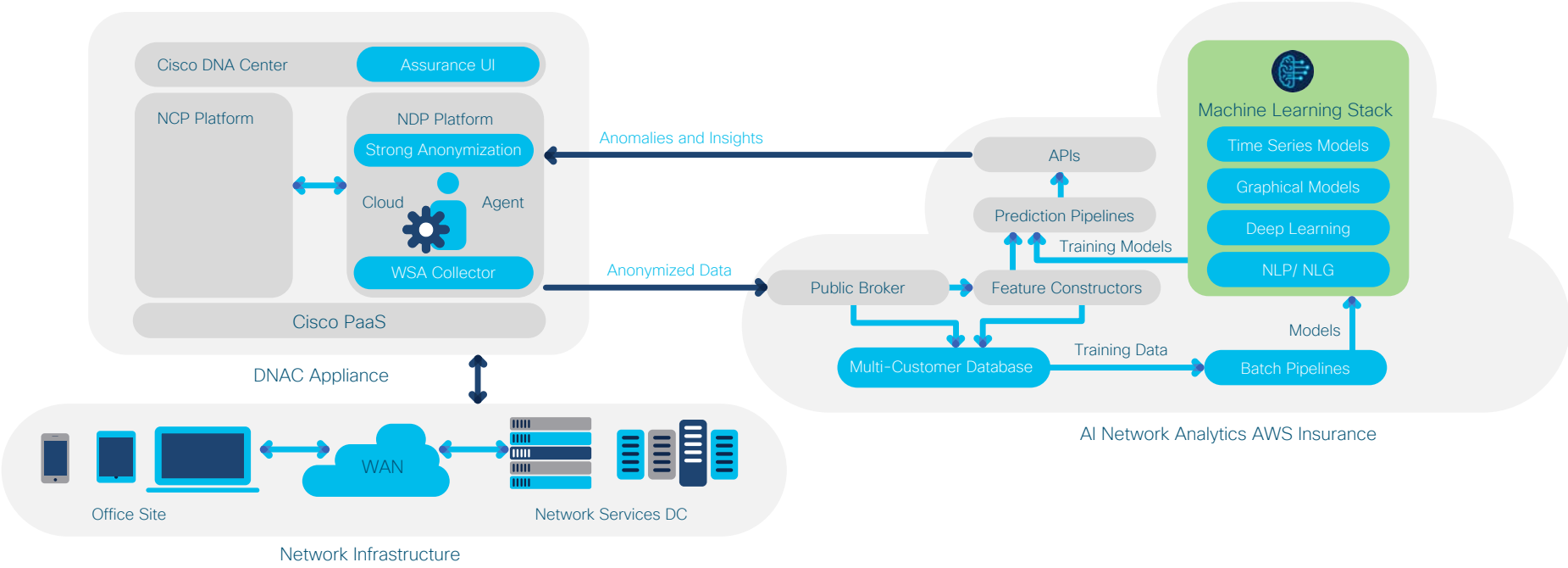
Device location (hostname, AP location string, etc.)

Network addresses (IPv4 / IPv6), including routing table information



https://www.cisco.com/c/en/us/solutions/collateral/enterprise-networks/nb-06-ai-nw-analytics-wp-cte-en.html
https://trustportal.cisco.com/c/dam/r/ctp/docs/privacydatasheet/DNA/cisco-dna-center-privacy-data-sheet.pdf

What We Have Built Is a Scalable, Learning Platform



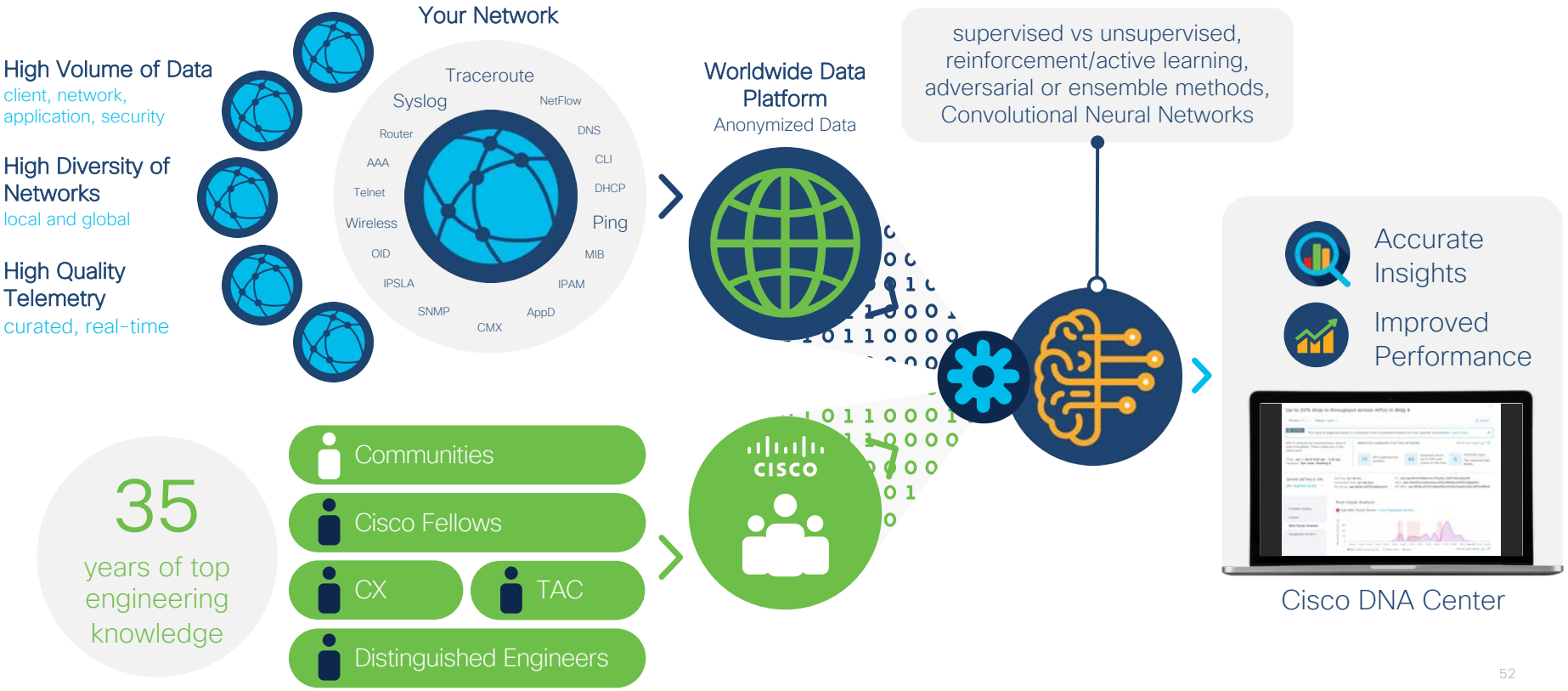
Advanced Telemetry gathering from all platforms

Unified Telemetry Anonymization Schema

Broad set of Machine Learning Algorithms

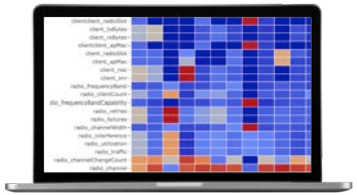
Applied to many Networking areas: Wireless, Switching, SD-WAN… and Cross-Domain with a use-case driven approach

Cisco Advantage: Best Data, Best Knowledge Base



Cisco Advantage: Our Data Lake

Data quality



Data diversity

Success!

Volume of data

Wireless

168	Millions onboarding weekly
63	Millions hours of radio telemetry
2.9M	distinct clients seen every week
400	PB of Telemetry traffic

* Based on only 269 customers since 2019 (12 months)

SD-WAN

7.1	Billion tunnel hours of active traffic
1900	Service providers
935K	Active tunnel every week
800K	failures every day up to 2.1M (248 Million in 12 months)

* Based on 40 SD-WAN Customers since 2019 (12 months)

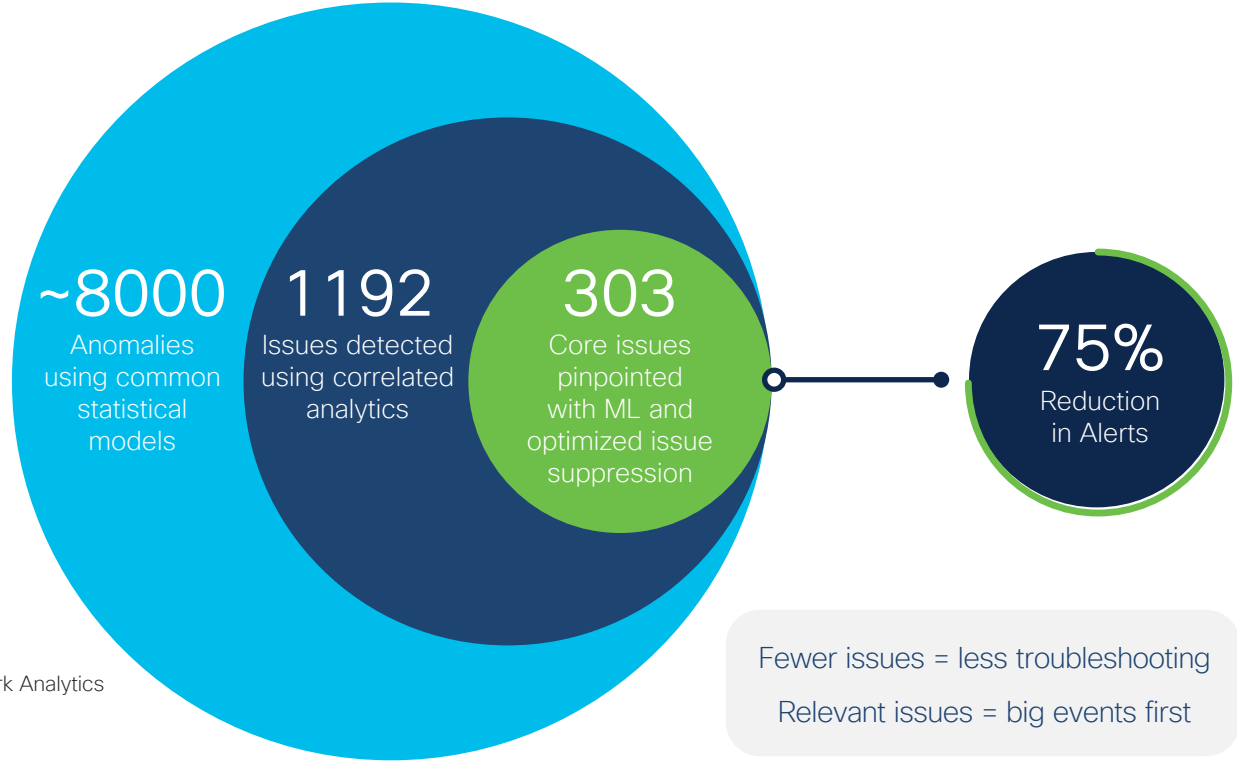
Problem and data understanding

Cisco AI Network Analytics

Efficiency though Noise Reduction

Issues generated for 11 customers over 3-month period

Intelligent Analysis



- Traditional NMS
- Cisco DNA Assurance
- Cisco DNA Assurance with Cisco AI Network Analytics

Fewer issues = less troubleshooting

Relevant issues = big events first

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Make Your Data Actionable

* Streaming interface in planning

Assurance and Analytics

Before	After
More time spent in gathering data from multiple sources	Correlated Visibility across Network, Clients and Apps
Can't troubleshoot transient problems	Network time travel for issue and trend analysis
Long time for troubleshooting and remediation	Insights and contextual analytics to accurately pinpoint root cause

Benefits

End to end visibility of Network Performance and Client Experience

Automated issue detection and prioritization

Reduced Mean Time to Acknowledge/Repair

How we do it

Streaming telemetry and contextual data from 16 different sources

Complex event processing with a series of analytics engines finds anomalies instantly

Correlated insights and analytics for understanding patterns and accurately pinpoint problems

Guided remediation allows for single-click resolution, allowing automation to close the loop

Cisco DNA Assurance

Right Place
Problem Isolation

From: Raw alarms (or no data)

To: Correlated insights

Right Time
Time Travel

From: Challenging replication

To: When and where it happened

Right Action
Guided Resolution

From: Escalation and slow resolution

To: Guided remediation

What's Next

Learn More about ML/AI for Network Analytics
cs.co/ai-ml

Learn More Cisco DNA Assurance
cs.co/cisco-dna-assurance

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Cisco DNA Assurance Live Demo: cs.co/assurance-live-demo-webinar

Is your network ready for a multicloud world: cs.co/multicloud-webinar


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