BCNET 2019

AI and Machine Learning in Campus Networks

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AI Isn't Exactly What we Thought it Was Going to be

AI is Changing the World

- In 2016 AlphaGo (Google Deepmind) defeated the world champion Go master, Lee Sedol
- AlphaGo used innovative moves not seen before

AI@Cisco

Reinvent the Network

- DNA
- ETA
- Network Early Warning
- SD-WAN

Security is Foundational

- AMP
- Cloudlock
- Cognitive Threat Analytics
- NGFW
- Stealthwatch
- Talos
- Umbrella

Power a Multicloud World

- Hyperflex
- Intersight
- UCS

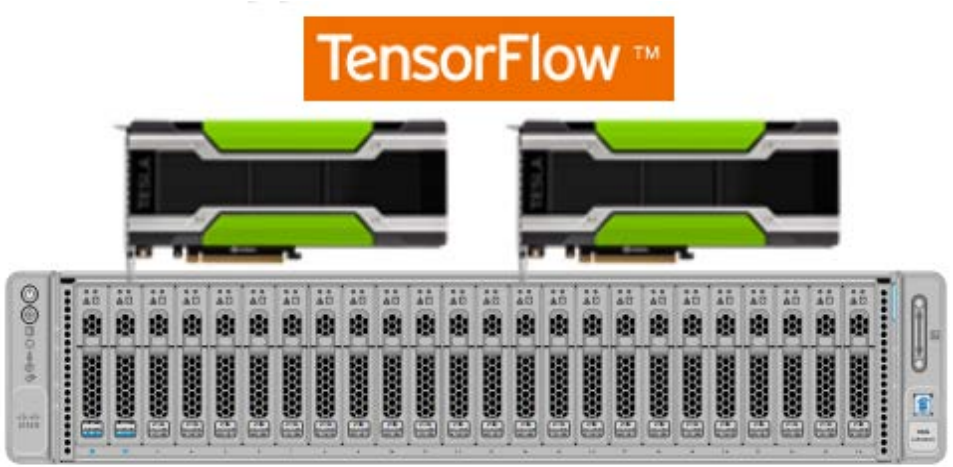
Unlock the Power of Data

- AppDynamics
- Kinetic
- Tetration

Create Meaningful Experiences

- Accompany
- CAM
- Meraki
- MindMeld
- Talent Trends
- Webex

How Cisco Approaches AI/ML



Consumption

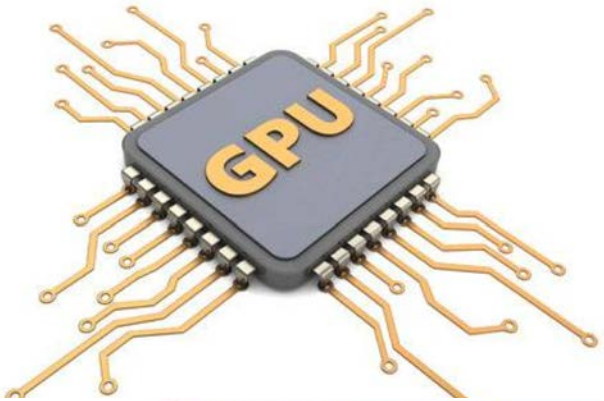
Products use AI/ML to do things better

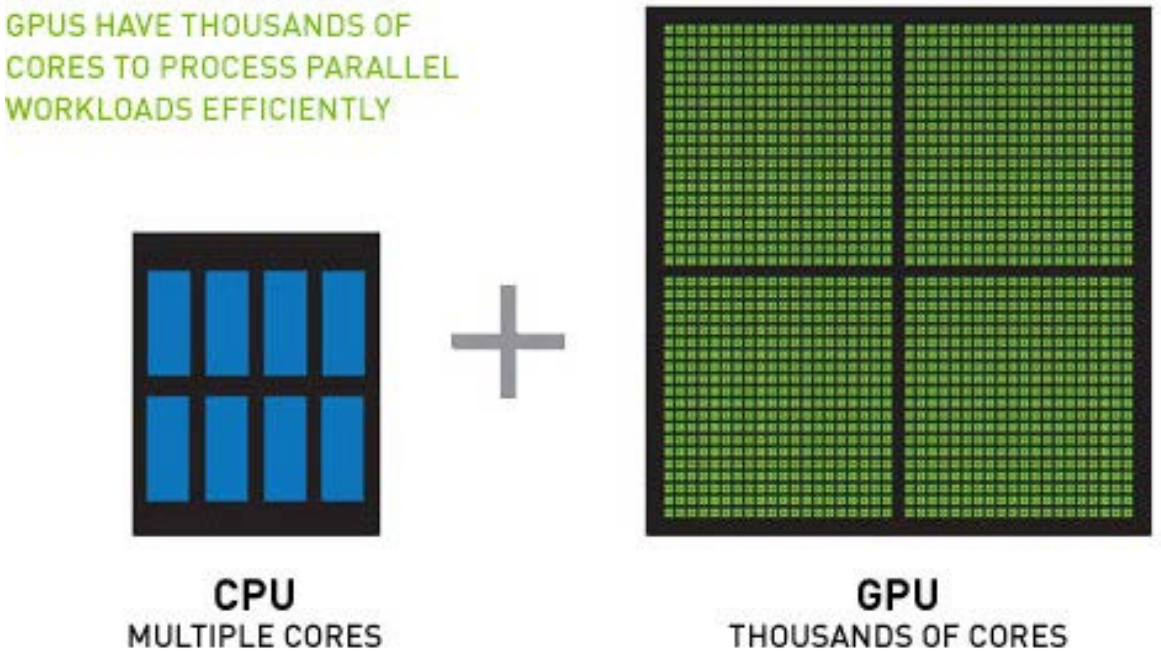
Enablement

Infrastructure Supporting AI/ML workloads

The Power of GPUs for Deep Learning

- Graphical Processing Units are specialized types of electronic circuitry designed to rapidly manipulate memory for graphics
- GPUs support parallel processing, accelerating their ability to execute algorithms that require parallel processes
- GPUs are at the heart of deep learning and neural networks





Comparing CPUs vs. GPUs

- CPUs are capable of almost any task – but at a price

CPUs are like a swiss army knife

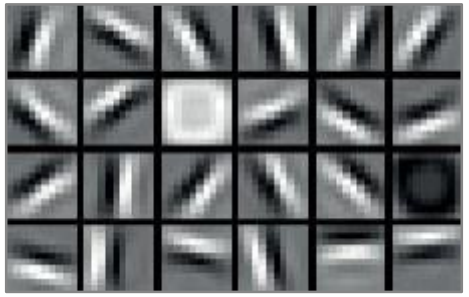
- GPUs are highly-specialized processors used to solve complex math problems

GPUs are like specialized surgical instruments

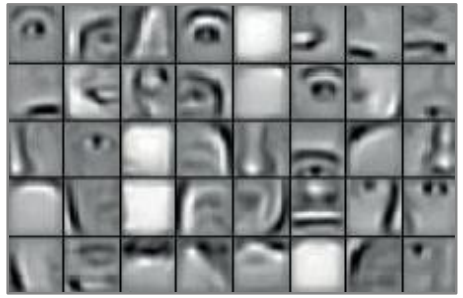
Example: Neural Networks & GPU

Raw data

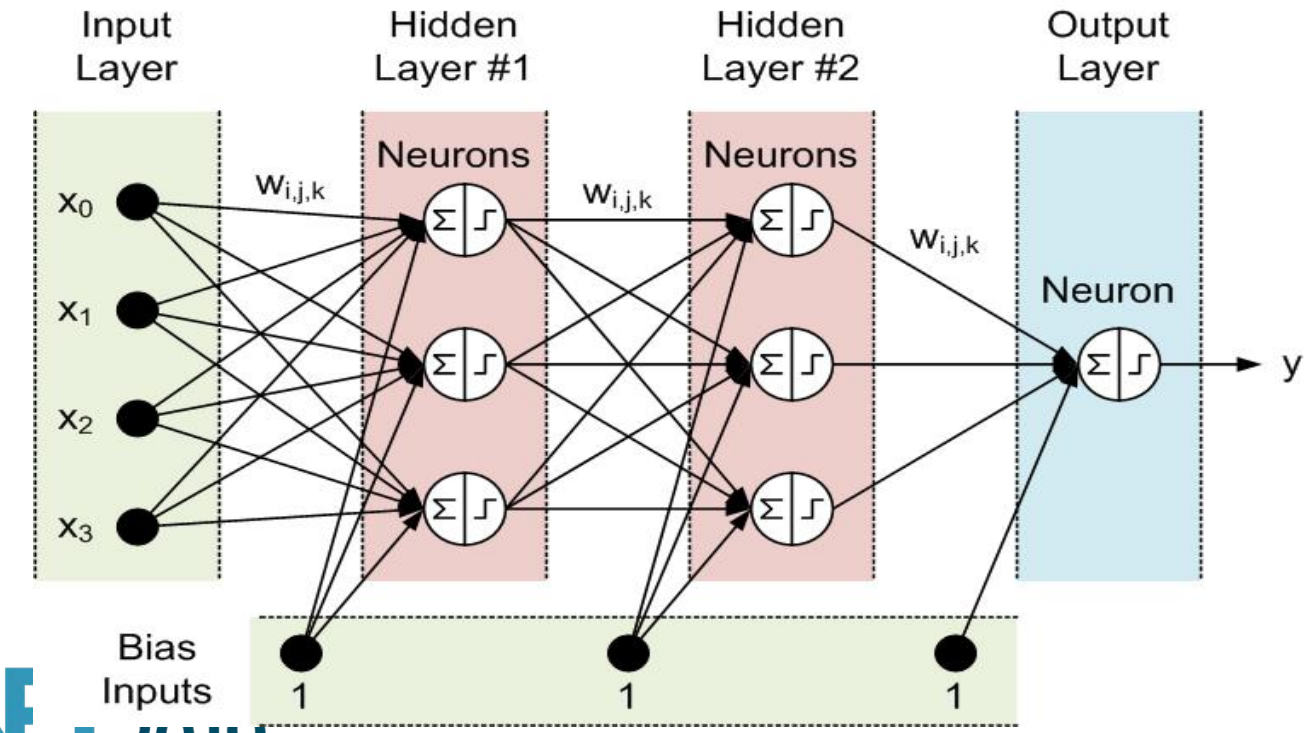
Low-level features



Mid-level features



High-level features



	Neural Networks	GPU
Inherently Parallel	✓	✓
Matrix Operations	✓	✓
Bandwidth	✓	✓

Example: Cisco UCS C480 ML

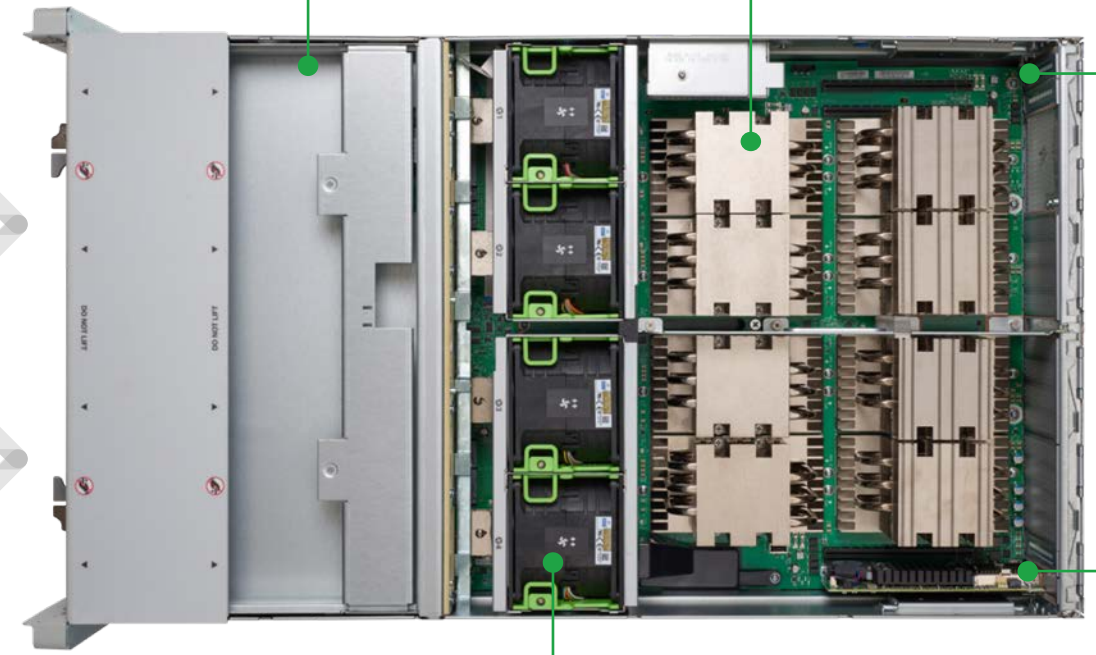
Storage
Up to 24 SAS/SATA SSD/HDDs
Up to 6 NVMe drives
M.2 SATA

CPUs
2 * Intel® Xeon® Scalable processors
(up to 28 cores per socket)
24 DDR4 DIMMs — up to 3 TB memory

NVIDIA

8 X V100 32GB:1st GPU to break 100 teraflops
NVLink interconnect: >300GB/s bandwidth

RAID controller



Choice of 10/25 or 40/100G
Four PCIe slots
Two 10G Base-T shared LOMs on I/O module

Redundant fans

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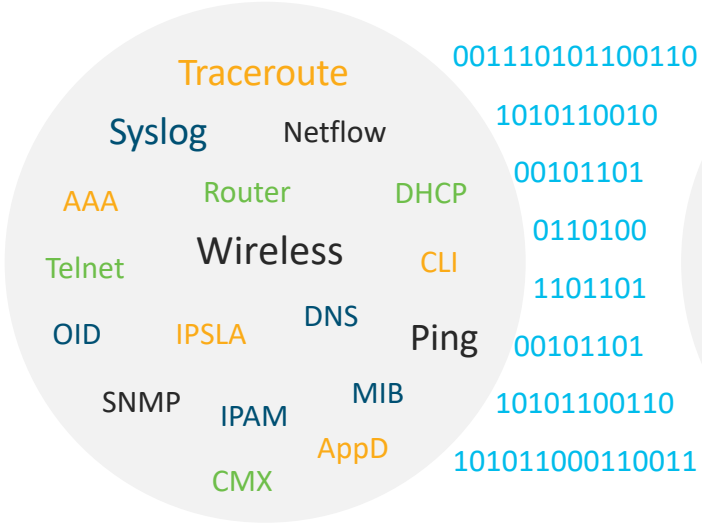
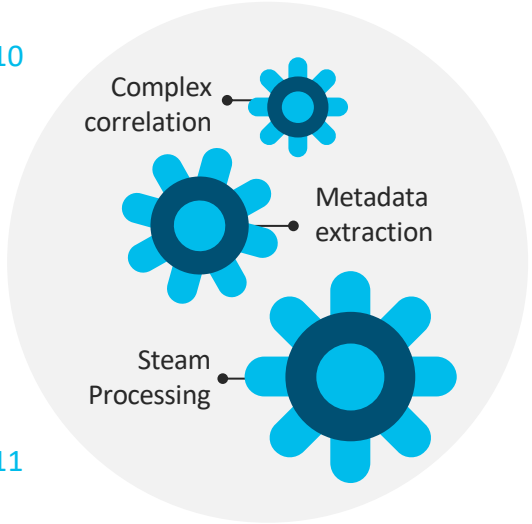
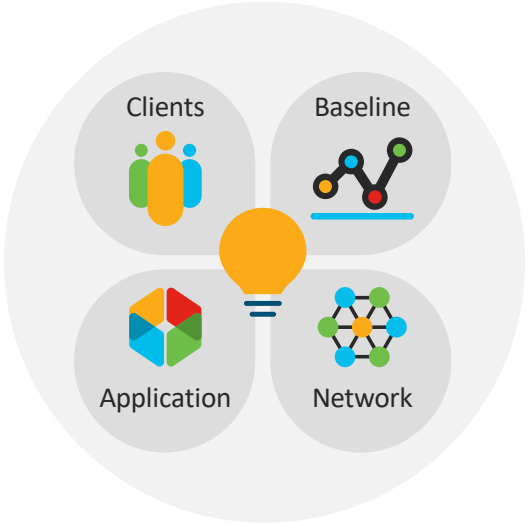
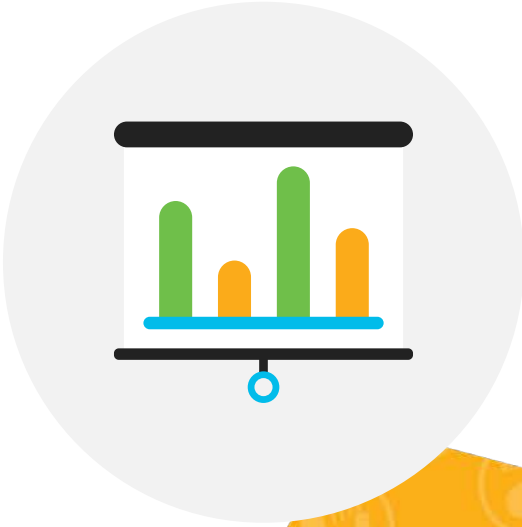
From Network Data to Business Insights

Network Telemetry Contextual Data | Complex Event Processing | Correlated Insights | Guided Remediation









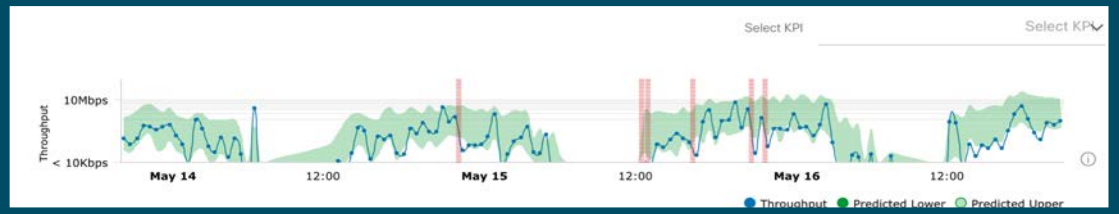
Everything In the Networks is a Sensor

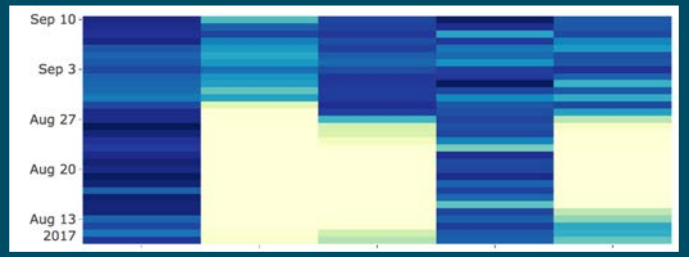
Client | Applications | Wireless | Switching | Routing

isco DNA Analytics or Wireless, Wired etworks and IoT

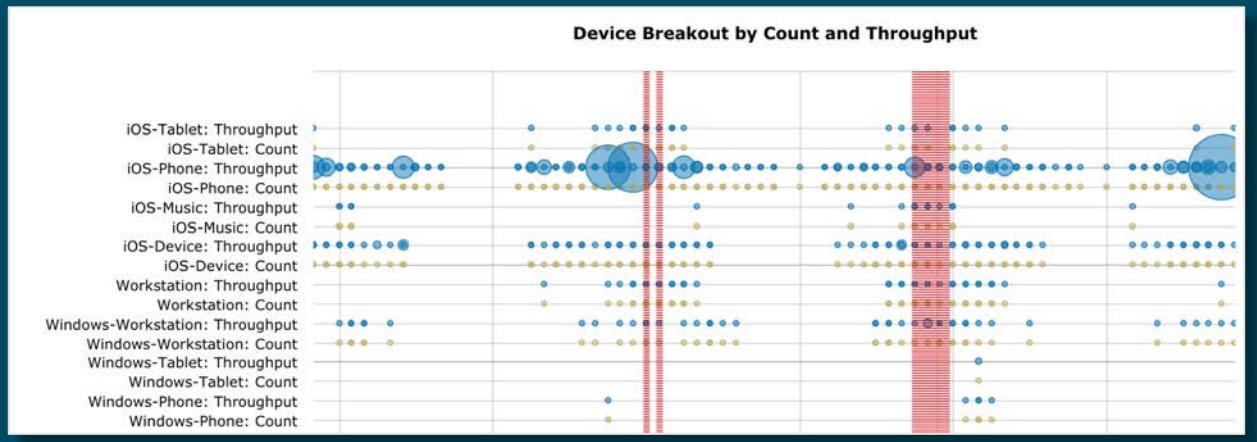
Cognitive Analytics

Anomaly detection across hundreds of thousands of devices and thousands of networks

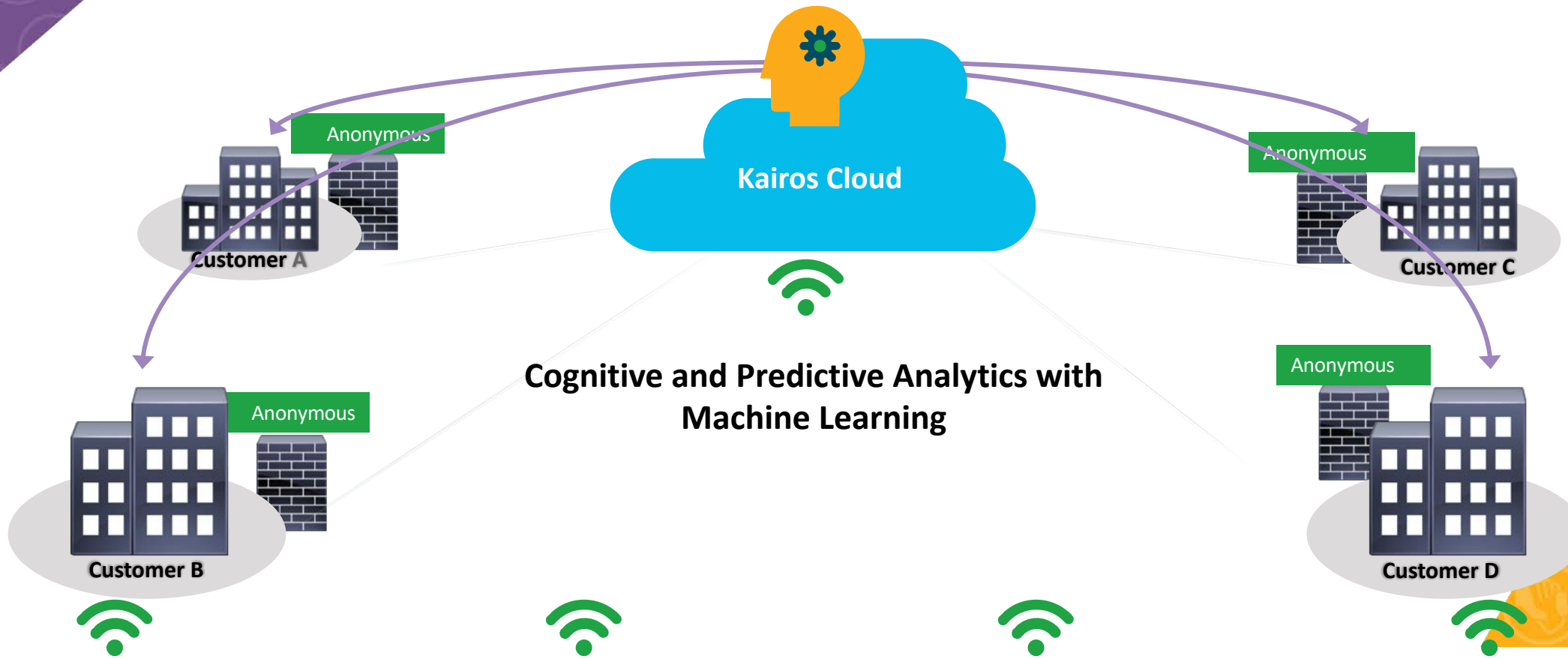




APs



Cisco DNA Analytics Architecture



Example: Radio Performance Issues

Category	Real-time Anomaly Detection
Context	University Customer
Findings	Throughput drops when interference increases as well as 100% of clients have low RSSI and SNR
Root Cause	Coverage issue
Actions	Review the RF design to provide better coverage in this área.

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App Throughput – High Packet Retries

Description

APs in network are experiencing a drop in Media Applications throughput. These radios are in the 5GHz band.

Impact of Last Occurrence

Aug 28, 2018 9:30 pm to Aug 28, 2018 10:30 pm

Location:

1 Building

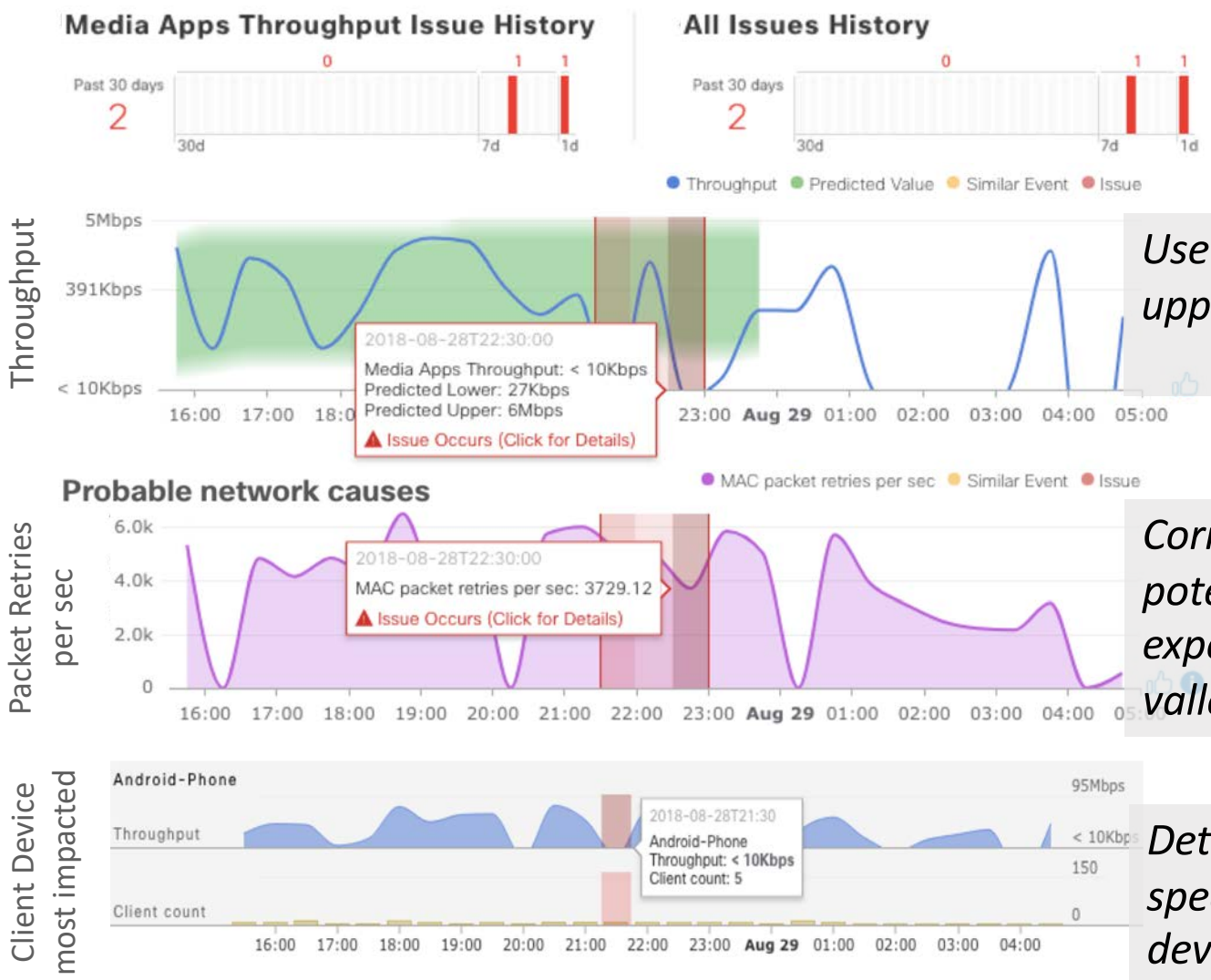
Clients

175 Wireless Clients

Additional Insight

Media Apps Throughput Issues Heatmap

Media Apps Throughput Peer Comparisons

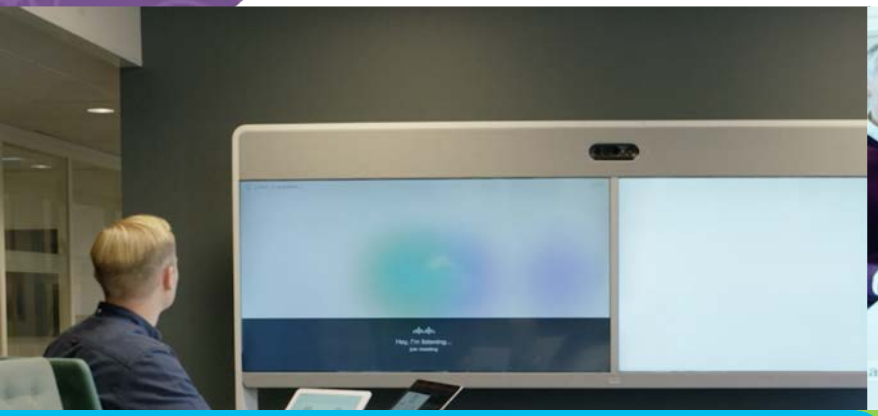


Use regression to predict upper and lower band.

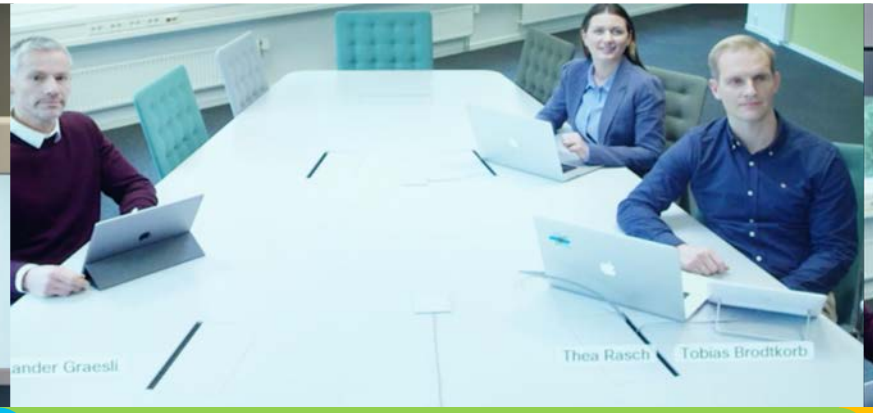
Correlate with other potential issues that are experiencing peaks / valleys in performance.

Determine if issue is specific to any specific devices.

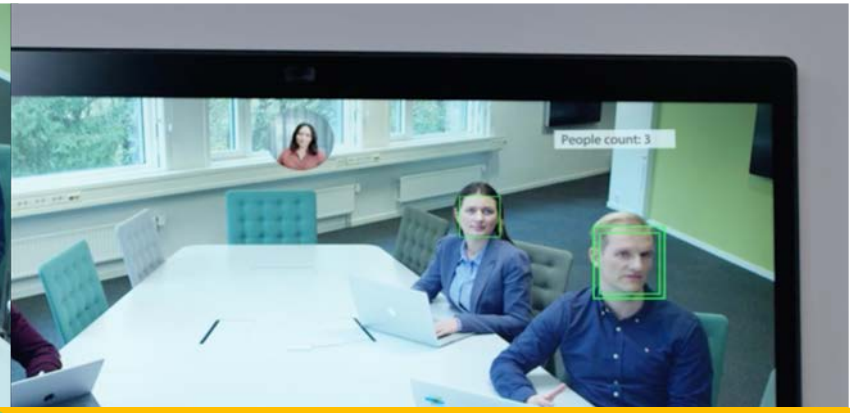
AI-Powered Workspace and Collaboration



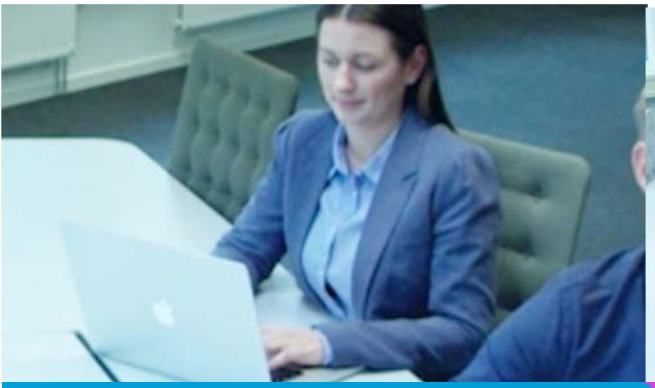
Webex Assistant



Face recognition



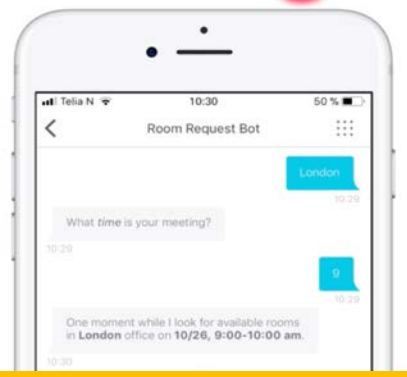
In-Room Analytics



Noise suppression

Speaker Tracking

Best view



Bots

Webex Endpoints Built on Powerful AI (Nvidia Jetson)

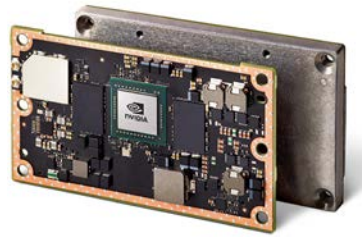
Webex Board 70

Webex Board 55

Room 70D

Room 70S

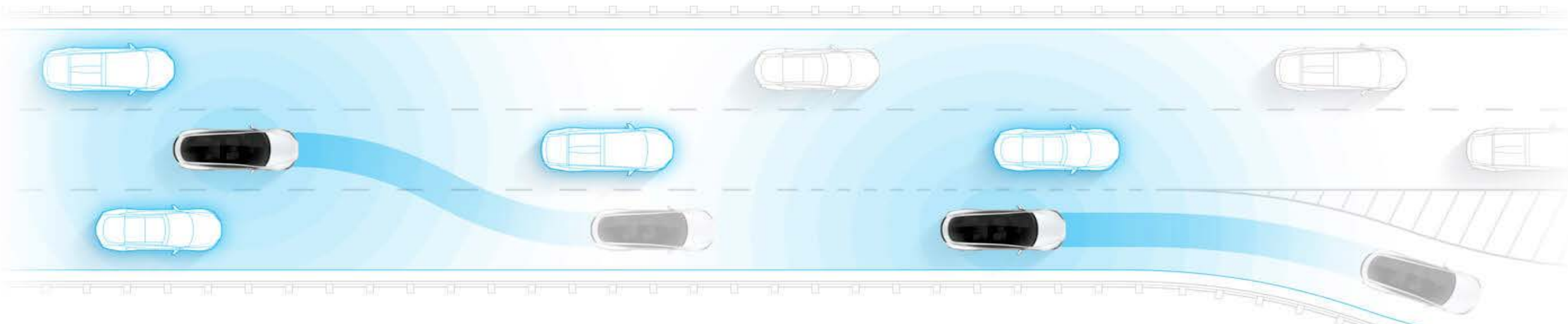
Room 55



Room Kit Plus

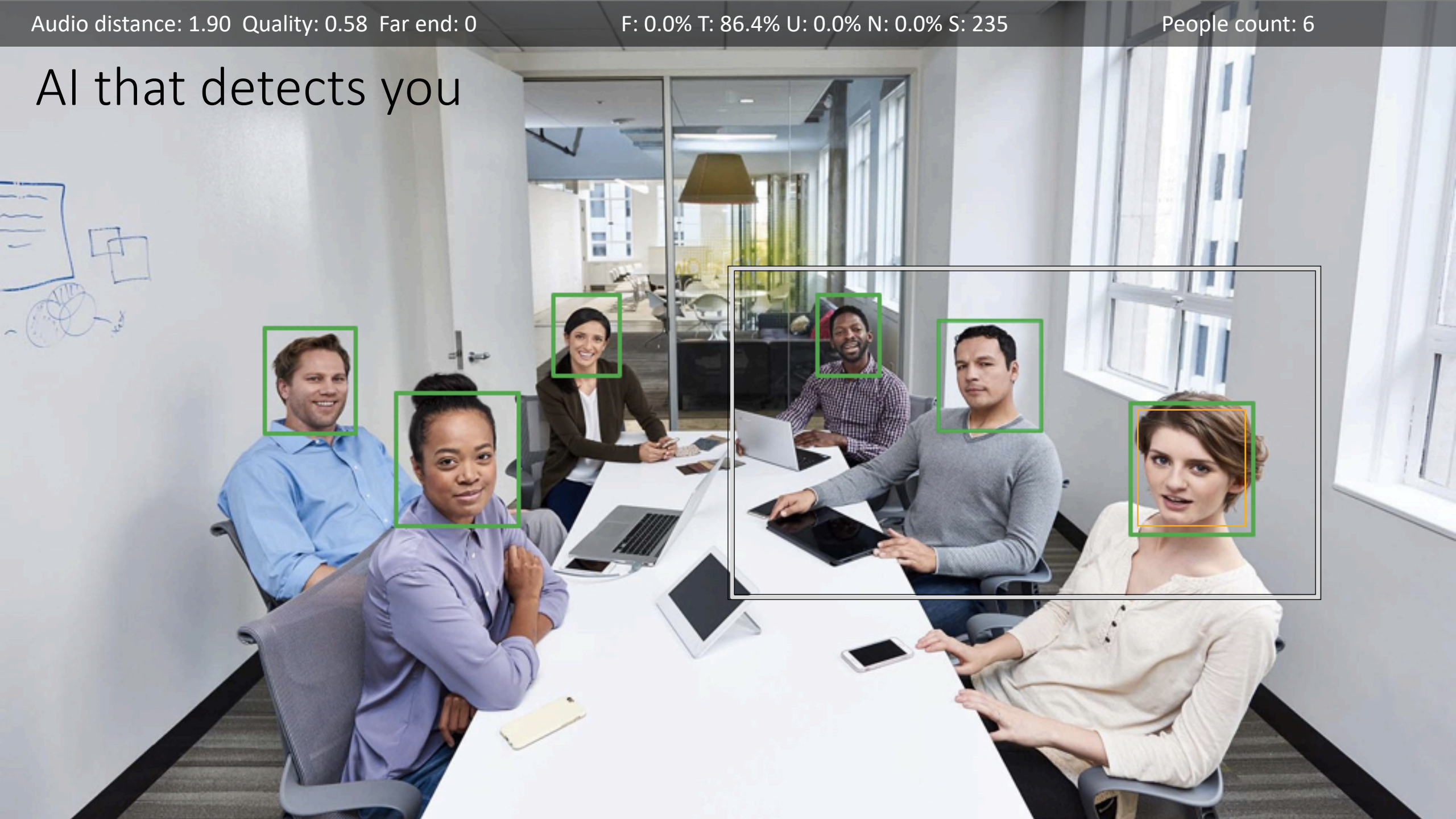
Room Kit

NVIDIA Jetson Platform - The same electronics engine powering self-driving cars



Audio distance: 1.90 Quality: 0.58 Far end: 0 F: 0.0% T: 86.4% U: 0.0% N: 0.0% S: 235 People count: 6

AI that detects you

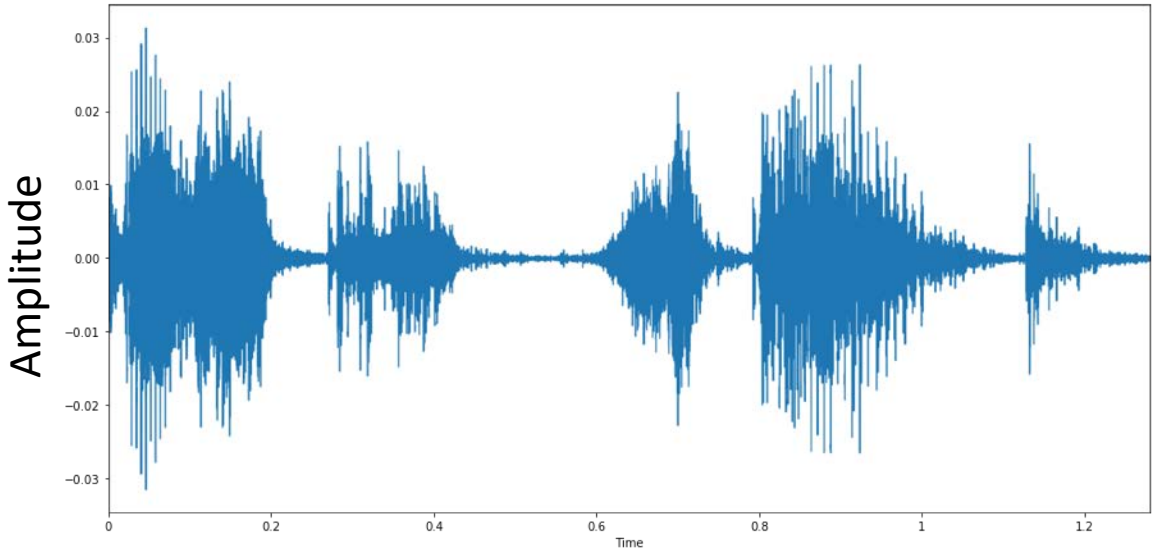


AI that Recognizes you

Basics of Signal Analysis

Acoustical Energy Electrical Energy

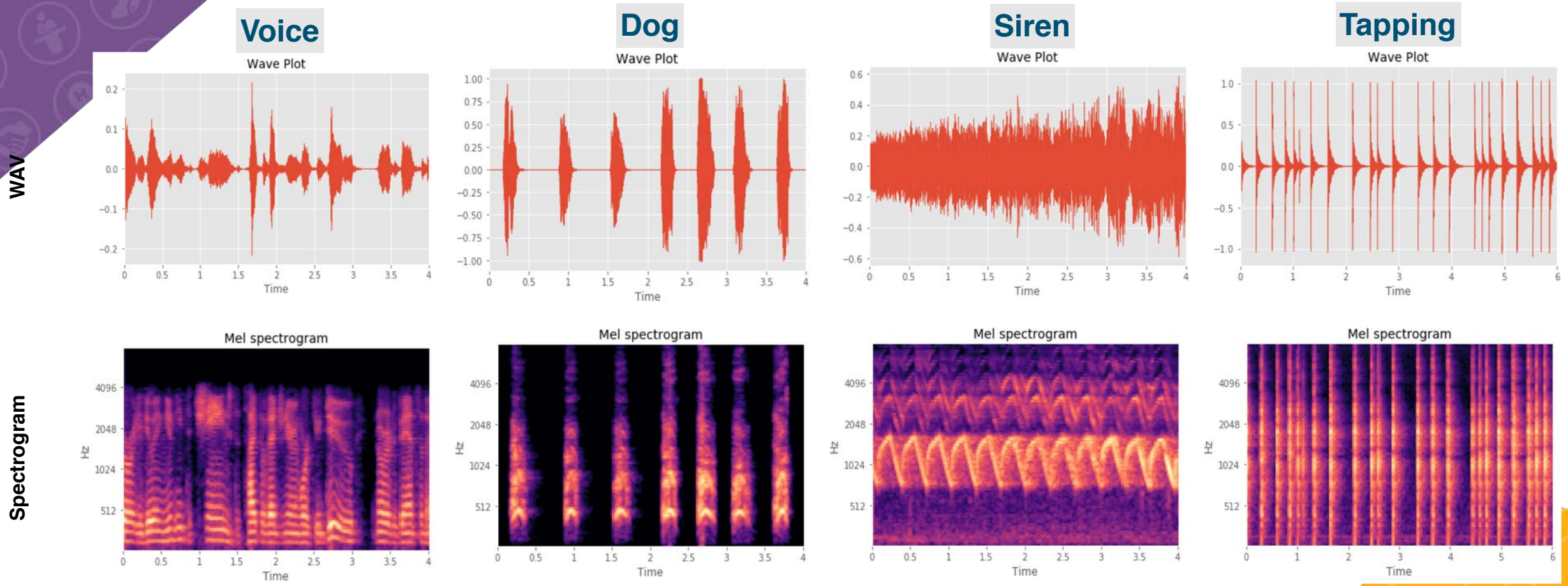
.wav file



Time

We can convert this into an image analysis problem

Classification: From Signals to Images



Voices and "noise" have a distinct "image" that can be detected and filtered.

Deep Learning at Work in Cisco Collaboration Systems

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Encrypted Traffic Analytics

Malware Detection and Visibility without Decryption

Malware in Encrypted Traffic

Is the payload within
the TLS session malicious?

- End to end confidentiality
- Channel integrity during inspection
- Adapts with encryption standards

Cryptographic Compliance

How much of my digital business
uses strong encryption?

- Audit for TLS policy violations
- Passive detection of Ciphersuite vulnerabilities

Deeper Data + More Context = Better Security

We analyze massive amounts of data — 20 billion threats blocked daily

600 Billion
Email samples

16 Billion
Web requests

3.4 Billion
AMP queries

Our real-time datasets are diverse, global, and live

100 Billion
Internet requests

80 Million
Daily active users

12,000
Enterprise customers

160
Countries worldwide

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Detecting Malware by Behavioral Analytics (ML/AI)

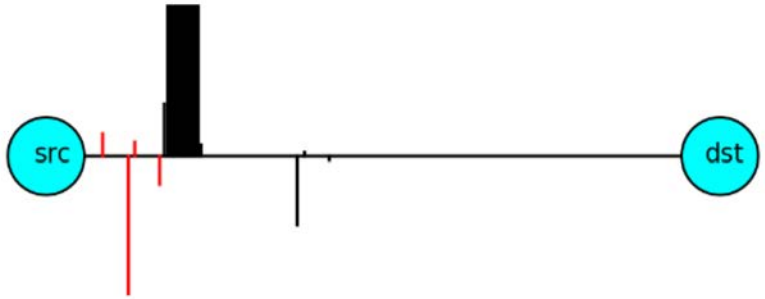
Google Search (good)

Initial Page Load

Autocomplete

Page Refresh

Bestafera (bad)



Self-Signed Certificate

Data Exfiltration

C2 Message

The Power of AI/ML in the Network

- **Anomaly detection**
  - Dynamic network performance at different times for different network conditions
  - Static thresholds (even if configurable) would likely raise many false positives or miss relevant events
- **Root cause analysis**
  - Automatic selection of relevant KPIs explaining an issue
  - Cross-correlation across multiple devices
- **Long-term trending**
  - Automatically identifying trends and behavior changes

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Thank You!

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