Roaming Unbounded
Wi-Fi 6 in the new world of 5G

Matthew MacPherson
CTO Wireless, Cisco Systems, Inc
September 2019

Industry Megatrends & Challenges
The New Enterprise - new solutions make new problems!

Performance

Globally, mobile data traffic will increase 7x by 2021

Mobility

Users are mobile greater than 72% of the time

Cloud

94% of organizations will use multiple clouds in the next 12 months

IoT

127 new devices connect to the Internet every second; 26 billion by 2020

Solving the megatrends
Four solution pillars for innovation

NG-Access

Wi-Fi 6

5G NR

**Analytics &
Automation**

Troubleshooting

ML / AI

Onboarding

Automatic

Secure

Convergence

Heterogeneous

Multi-Path

Wi-Fi 6 provides higher Voice/Video capacity
Lower latency at increased density

Source: Cisco sponsored research

Legend:
- D99%-11ac
- D99%-11ax
- D90%-11ac
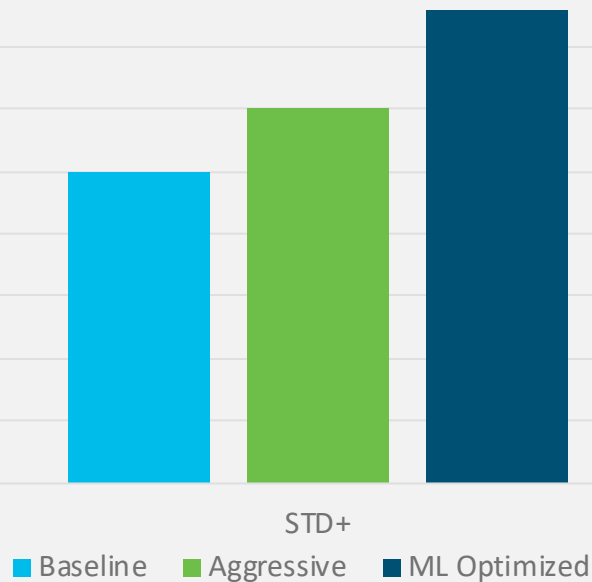- D90%-11ax

100ms
50ms

N=20   N=40   N=80 users
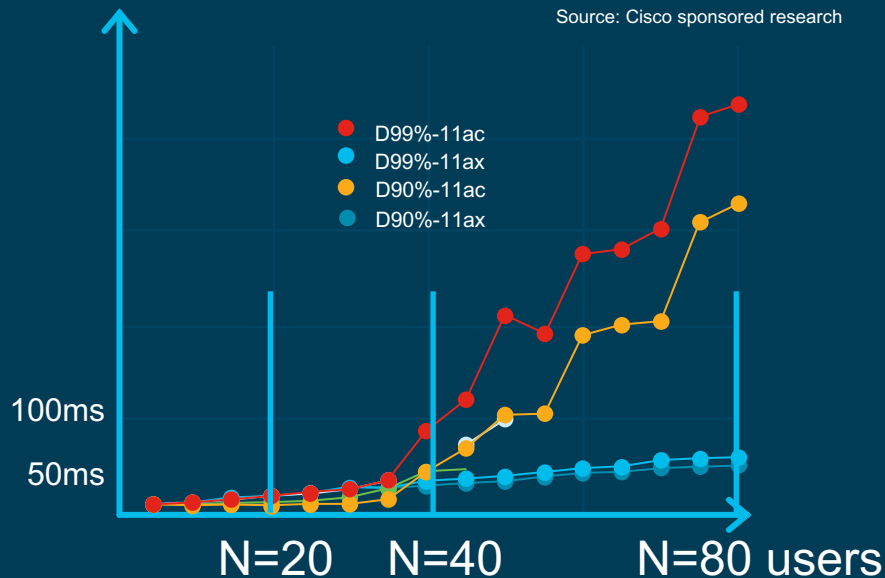
- With 11ac, as density (N=users/AP) increase from N=20 (e.g. meeting room) to N=40 (e.g. class room), latency increases 2x from an acceptable ~50ms (99%-ile) to an unacceptable 100ms – <u>unusable service</u>!

- By leveraging OFDMA, delay is bounded to ~50ms up to N=80 users/AP resulting in at least **2x the VOICE user capacity** with high quality
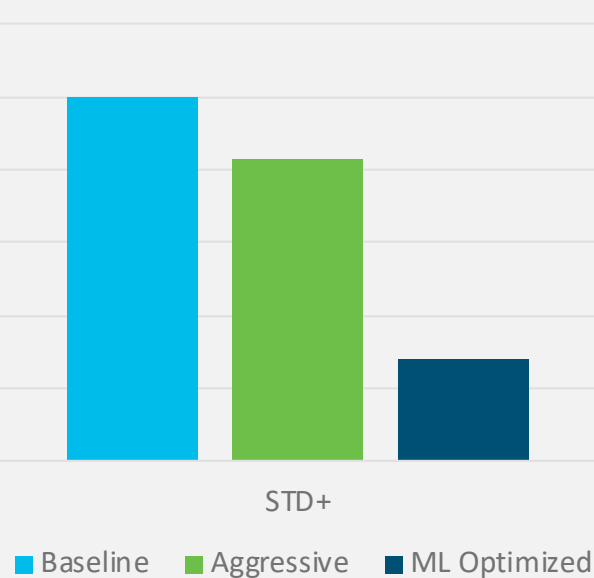
Wi-Fi 6 can achieve >2x the VOICE capacity over 11ac in High-Density (HD)

OBSS-PD (Spatial-reuse) Benefits

Throughput (relative)

STD+

■ Baseline ■ Aggressive ■ ML Optimized

Latency (relative)

STD+

■ Baseline ■ Aggressive ■ ML Optimized

Up to 50% improvement in aggregate throughput
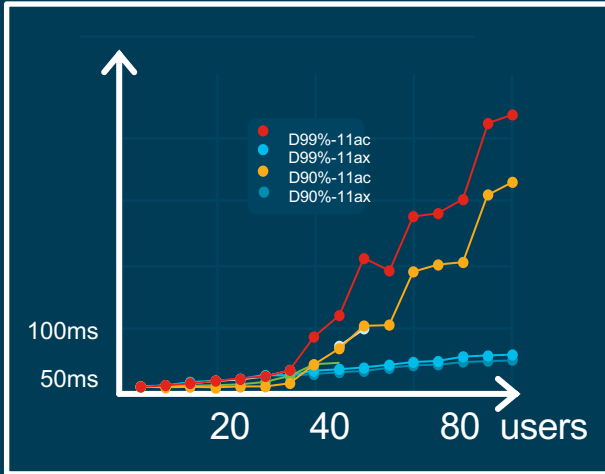
Up to 2x improvement in latency - 99% percentile!

Machine-learned (ML) thresholds (Standards+) outperform aggressive (fixed) targets

Enterprise customers expect wireless to do more

Top 5 Priority Services Enterprise Customers Plan to Adopt:

1. High density services
2. Seamless roaming from Wi-Fi to cellular
3. Guest onboarding
4. Device location services
5. Mission critical communications
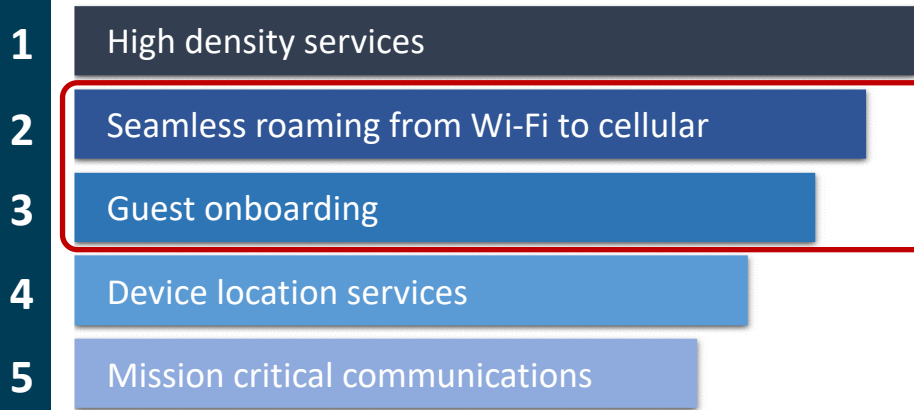
Services, Beyond Connectivity, that Enterprises Plan to Deploy:

88%
Wi-Fi Calling & Collaboration

82%
Network Performance Monitoring & Assurance

89%
Guest Wireless Access Services

85%
User Authentication Services

Increased reliable coverage is ranked as the #1 most important Next-Gen wireless component for Enterprise environments

Onboarding - The Problem

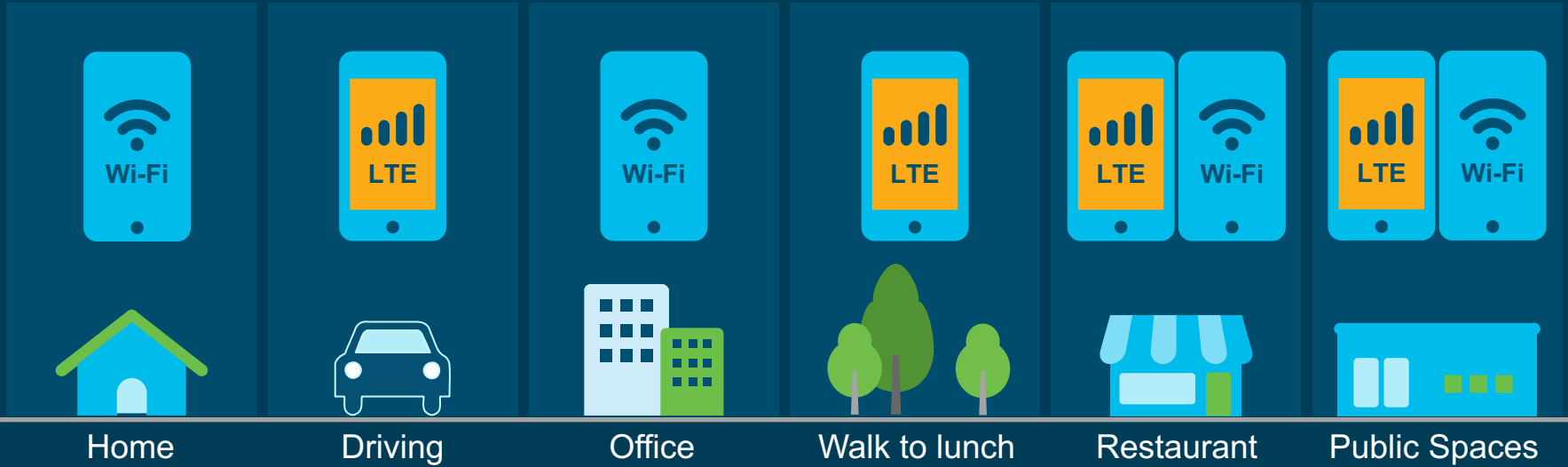| Wi-Fi	LTE	Wi-Fi	LTE	LTE Wi-Fi	LTE Wi-Fi
Home	Driving	Office	Walk to lunch	Restaurant	Public Spaces

Seamless Onboarding

- Customers say – wireless onboarding a major **pain point**!
- Improved roaming and secure auto-onboarding is the **#1 feature request** per customer mobility technical advisory board
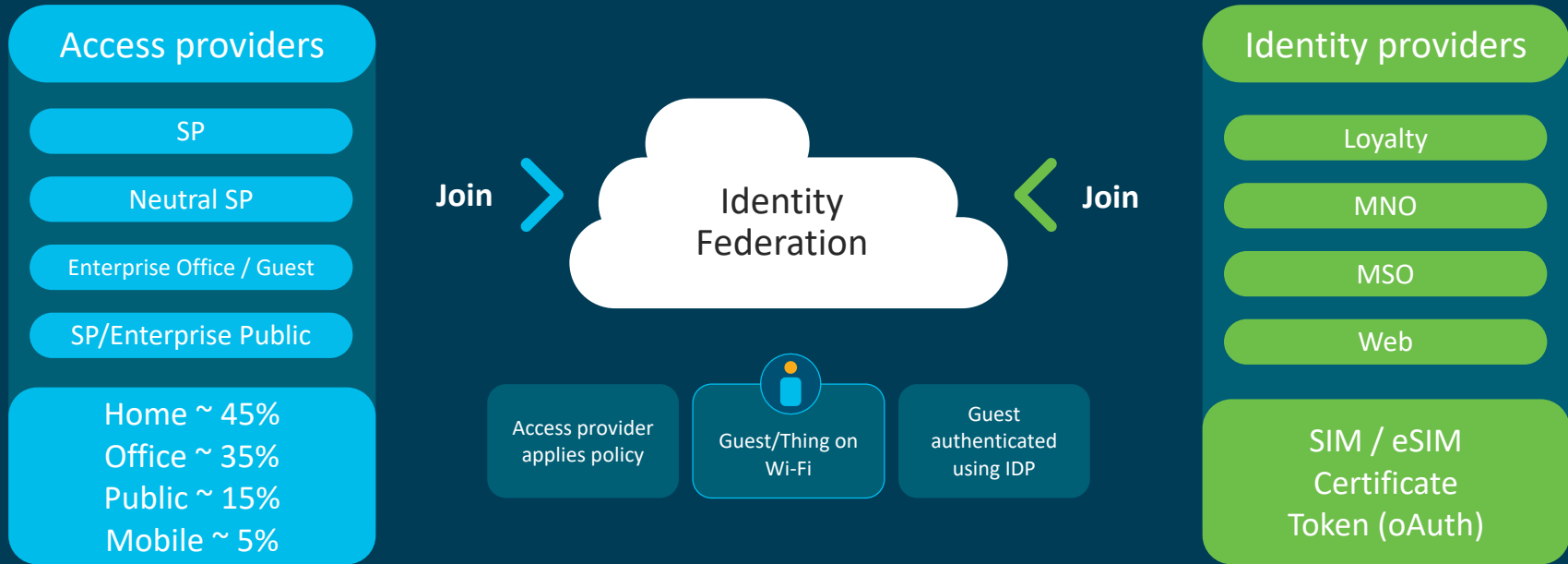
Cost Optimized Access

- Use all access - LTE/5G & Wi-Fi for best coverage and cost!
- Provide the best experience, to the most customers, anywhere, at the best cost! CAPEX & OPEX

Path Selection + Handoff

- Enables strategic, next- generation technologies such as
  - intelligent path selection
  - multi-path/Access
  - indoor to outdoor cellular to Wi-Fi handoff.

OpenRoaming: Opening the Ecosystem for new business models
Need an <u>abstraction</u> to scale and facilitate all business models efficiently – Identity Federation

Access providers

- SP
- Neutral SP
- Enterprise Office / Guest
- SP/Enterprise Public

Home ~ 45%
Office ~ 35%
Public ~ 15%
Mobile ~ 5%

Join

Identity Federation

Access provider applies policy

Guest/Thing on Wi-Fi

Guest authenticated using IDP

Join

Identity providers

- Loyalty
- MNO
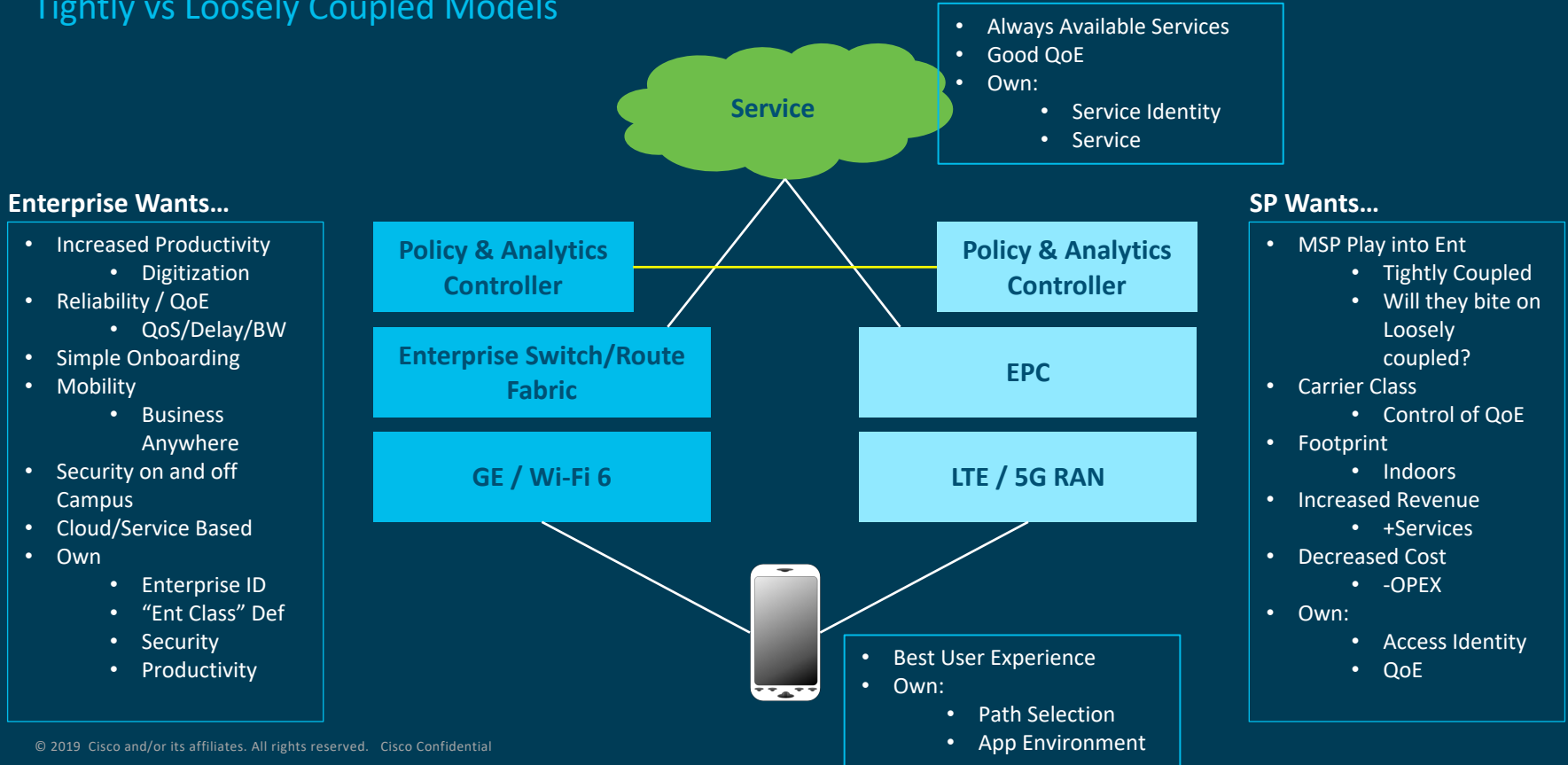- MSO
- Web

SIM / eSIM
Certificate
Token (oAuth)

Cisco is building a consortium of identity & access providers to enable seamless roaming & onboarding

What Enterprise Wants / What SP Wants

Convergence of the models: SP/Ent, Spectrum, Architecture…
Tightly vs Loosely Coupled Models

Service

- Always Available Services
- Good QoE
- Own:
  - Service Identity
  - Service

Enterprise Wants…

- Increased Productivity
  - Digitization
- Reliability / QoE
  - QoS/Delay/BW
- Simple Onboarding
- Mobility
  - Business Anywhere
- Security on and off Campus
- Cloud/Service Based
- Own
  - Enterprise ID
  - "Ent Class" Def
  - Security
  - Productivity

Policy & Analytics Controller

Enterprise Switch/Route Fabric

GE / Wi-Fi 6

Policy & Analytics Controller

EPC

LTE / 5G RAN

SP Wants…

- MSP Play into Ent
  - Tightly Coupled
  - Will they bite on Loosely coupled?
- Carrier Class
  - Control of QoE
- Footprint
  - Indoors
- Increased Revenue
  - +Services
- Decreased Cost
  - -OPEX
- Own:
  - Access Identity
  - QoE

- Best User Experience
- Own:
  - Path Selection
  - App Environment

Analytics & Automation must be End-to-End

End-to-end portfolio, built from the ground up for Intent-based Networking

Access Points

Access Switches

Agg/Core Switches

Wireless Controller

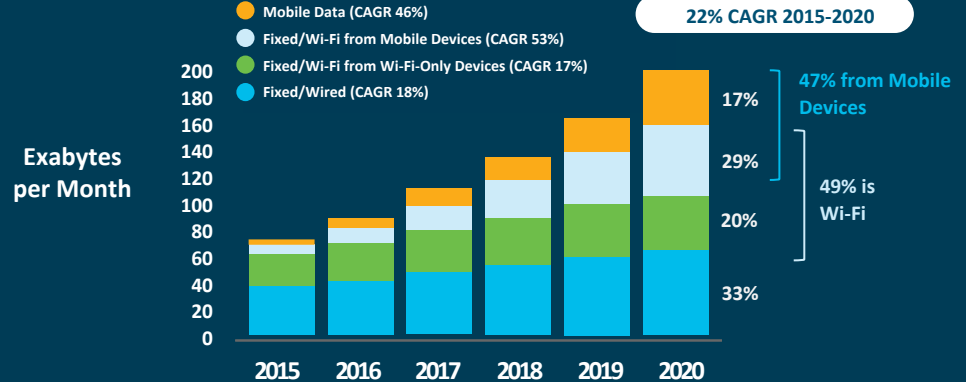Identity & Policy

Automation & Analytics
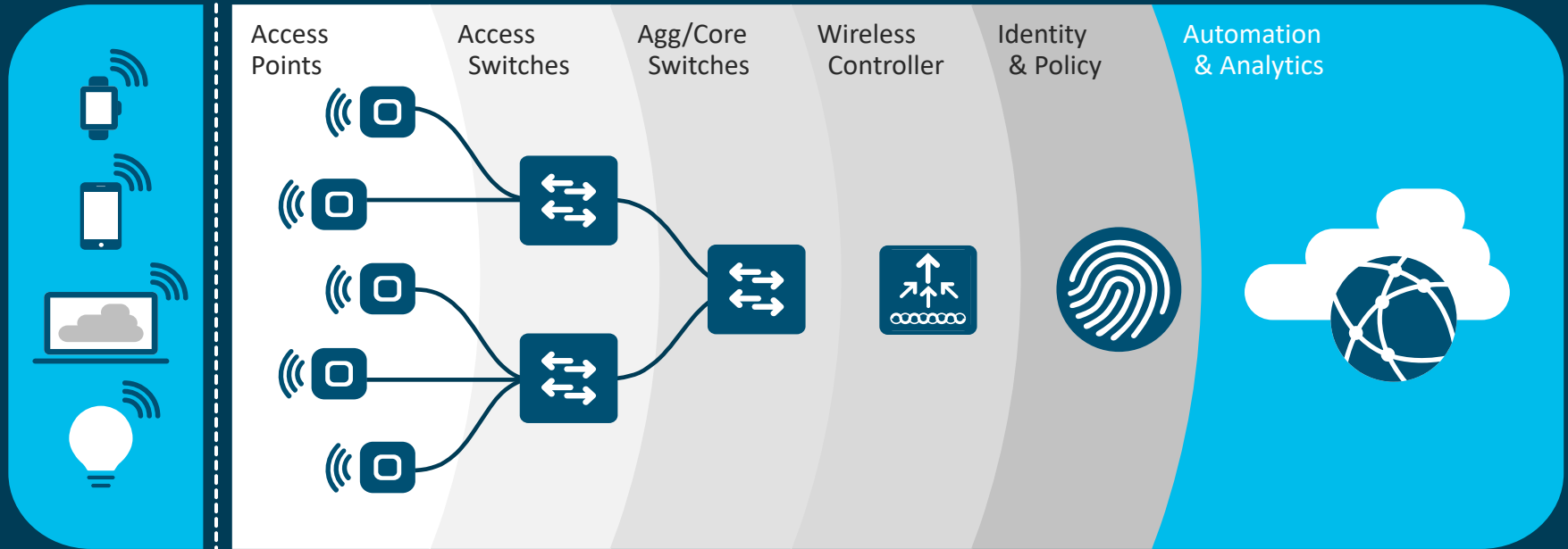
Unified operations and pervasive segmentation

The Ecosystem is VERY Big

Globally in 2017 there were 179M hotspots Projection for 2021 is 542M

Millions of hotspots

Legend:
- Middle East and Africa*
- Central and Eastern Europe
- Latin America
- North America
- Western America
- Asia Pacific

Year	Total
2016	94M
2017	179M
2018	279M
2019	362M
2020	454M
2021	542M

2021 breakdown:
- 4%
- 9%
- 17%
- 23%
- 45%
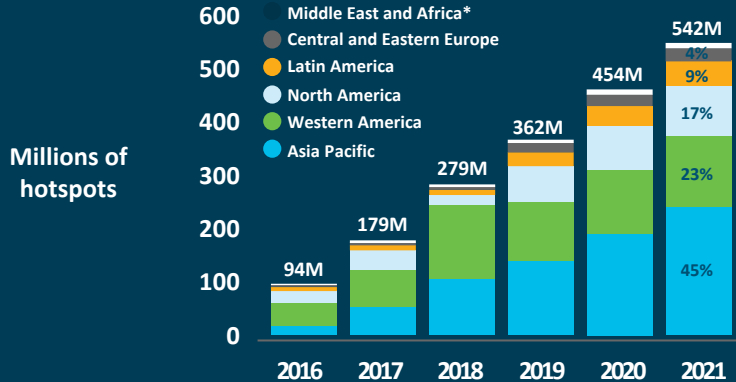
IP Traffic by Access Technology

22% CAGR 2015-2020

Exabytes per Month

Legend:
- Mobile Data (CAGR 46%)
- Fixed/Wi-Fi from Mobile Devices (CAGR 53%)
- Fixed/Wi-Fi from Wi-Fi-Only Devices (CAGR 17%)
- Fixed/Wired (CAGR 18%)

Years: 2015, 2016, 2017, 2018, 2019, 2020

2020 breakdown:
- 17% — **47% from Mobile Devices**
- 29% — **49% is Wi-Fi**
- 20%
- 33%

Note: Fixed/Wi-Fi from Mobile Devices may include a small amount of Fixed/Wired from Mobile Devices

14 billion mobile devices by 2022

Over 4 billion Wi-Fi devices hit the market ever year

Source: Cisco VNI Mobile, 2017