Welcome to CEVA 2019 Investor and Analyst Day
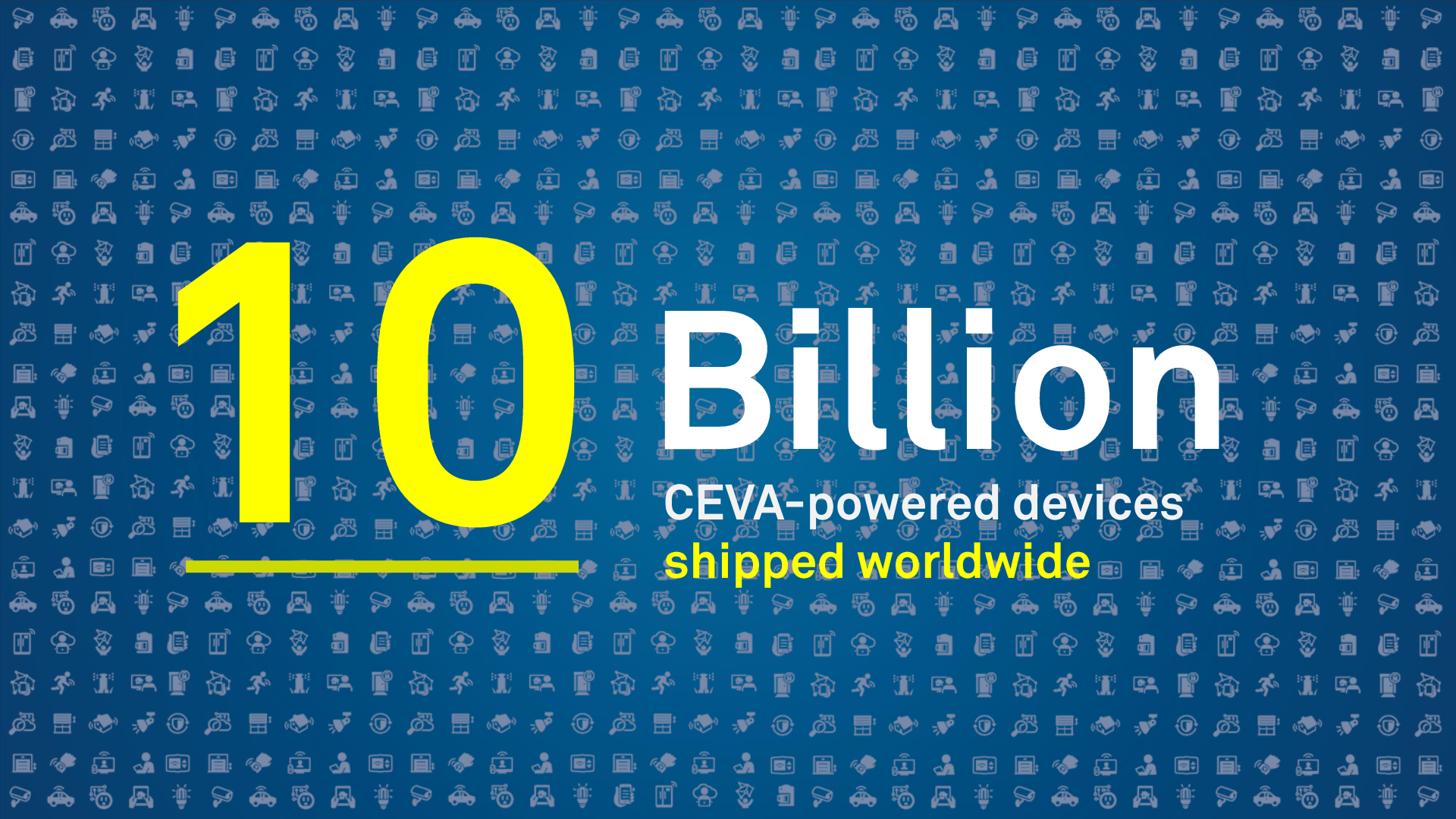
Richard Kingston

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This presentation contains forward-looking statements and projections about our strategy, market opportunity, customer base, product penetration and market share, stockholder returns, and our future performance and achievements, financial and otherwise. These statements and projections reflect management's current expectations, estimates and assumptions based on the information currently available to us and are not guarantees of future performance. Such statements involve risks and uncertainties, as well as assumptions that if they materialize or prove incorrect, could cause the results of CEVA to differ materially from those expressed or implied by such forward-looking statements. Forward-looking statements may be identified by words such as "may," "will," "expect," "intend," "anticipate," "believe," "estimate," "plan," "project," "could," "should," "would," "continue," "seek," "target," "guidance," "outlook," "optimistic," "forecast" and other similar words. Forward looking statements include statements about CEVA being strategically positioned to exploit various market segments and usage models, as well as projections relating to future royalty and licensing revenues and various 2022 financial targets. Actual results may differ materially from our statements or projections for a variety of reasons, including the ability of the CEVA DSP cores and other technologies to continue to be strong growth drivers for us; our success in penetrating new markets and maintaining our market position in existing markets; our ability to diversify our revenue streams, the ability of products incorporating our technologies to achieve market acceptance, the speed and extent of the expansion of the 4G, 5G and LTE networks, the maturation of the IoT market, the effect of intense industry competition and consolidation, global chip market trends, our ability to timely and successfully develop and introduce new technologies; and general market conditions and other risks relating to our business, including the factors described under the section titled "Risk Factors" in our most recent filings on Form 10-K and Form 10-Q available at www.sec.gov. The forward-looking statements made in this presentation are being made as of the time and date of the live presentation. If this presentation is reviewed after the time and date of the live presentation, even if subsequently made available by us, on our website or otherwise, this presentation may not contain current or accurate information. Except as required by law, we disclaim any obligation to update or revise any forward-looking statement based on new information, future events or otherwise.

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CEVA

10 Billion

CEVA-powered devices
shipped worldwide

Recent News

New Customers		New Products	New Bristol, U.K. R&D Center
NORDIC SEMICONDUCTOR	sonova HEAR THE WORLD	WhisPro™	
Atmosic Forever Connected, Anywhere.	BES 恒玄科技	CEVA BX	
OPTEK	InPLAY TECHNOLOGIES		

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Agenda - Morning

10:00am - 10:30am	CEVA Introduction	Gideon Wertheizer, CEO
10:30am - 11:10am	Cellular	Emmanuel Gresset, Director, Business Development, Wireless BU Michael Boukaya, Vice President and GM, Wireless BU
11:10am - 11:50pm	Computer Vision, AI & Automotive	Jeff VanWashenova, Director, Automotive Segment Marketing Ilan Yona, Vice President and GM, Vision BU
11:50am - 12:00pm	Morning Sessions Q&A	
12:00pm - 12:30pm	Lunch	

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Agenda - Afternoon

12:30pm - 12:55pm	Connectivity	Franz Dugand, Director, Sales and Marketing, Connectivity BU Aviv Malinovitch, Vice President and GM, Connectivity BU
12:55pm - 1:20pm	Sound	Moshe Sheier, Vice President, Marketing
1:20pm - 1:30pm	Afternoon Sessions Q&A	
1:30pm - 2:00pm	China Insight	Issachar Ohana, EVP Worldwide Sales
2:00pm - 2:20pm	Growth Strategy Implications & Financial Targets	Yaniv Arieli, CFO
2:20pm - 2:30pm	Wrap Up	

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Today's Presenters

Gideon Wertheizer

CEO

Yaniv Arieli

CFO

Issachar Ohana

EVP, Worldwide Sales

CEVA

Today's Presenters

Michael Boukaya

VP and GM, Wireless Business Unit

Aviv Malinovitch

VP and GM, Connectivity Business Unit

Ilan Yona

VP and GM, Vision Business Unit

Moshe Sheier

VP, Marketing & Sound Business Unit

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Today's Presenters

Emmanuel Gresset

Director, Business Development, Wireless Business Unit

Jeff VanWashenova

Director, Automotive Segment Marketing

Franz Dugand

Director, Sales & Marketing, Connectivity Business Unit

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Signal Processing and AI Platforms for a Smarter, Connected World

Gideon Wertheizer

CEVA at a Glance

We innovate and license technologies that process and connect data from sensors for the Internet of Things

► Our core competencies & technologies are scarce, highly-sought after and address diverse markets

  ► Cellular modems, wireless local area network protocols, AI hardware & software, computer vision, speech recognition

Everything Cellular

Smart Sensing

Short Range Connectivity

CEVA

Everything Cellular

From IoT through Infrastructure

Smartphones / Mobile broadband

- ▶ ~30 years experience in handset modem design
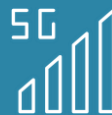- ▶ Comprehensive 5G platform, appeals to incumbents and new markets (e.g. automotive, industrial, fixed wireless)

Base Stations RAN

- ▶ Industry's most advanced SDR DSPs
- ▶ Growing adoption by tier-1 OEMs for 5G

IoT

- ▶ Highly integrated NB-IoT solutions, enabling new entrants with no cellular background

5G

3.3bn LTE subs in '18 growing to 5.4bn by '24
4.1bn cellular IoT subscribers by 2024

Source: Ericsson Mobility Report

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Smart Sensing

Making cameras and microphones intelligent

AI
▶ Optimal integration of hardware and software

▶ Lead customers in camera, drones, surveillance

Camera - Computer/Machine Vision
▶ First to introduce vision DSP and software algorithms

▶ Strong foothold in consumer and IoT

Microphone – Voice UI
▶ DSP Processor, comprehensive algorithms & software for speech recognition

1.6bn sound/AI and 1.4bn vision/AI devices shipping in 2023

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Short Range Connectivity

Bringing leading edge IP to the masses

Wi-Fi

- ▶ The only viable and credible IP provider
- ▶ Range of architectures SDM, HDM
- ▶ Solutions for client devices and AP

Bluetooth

- ▶ Large market share, premier customer base
- ▶ Standard body (SIG) contributor
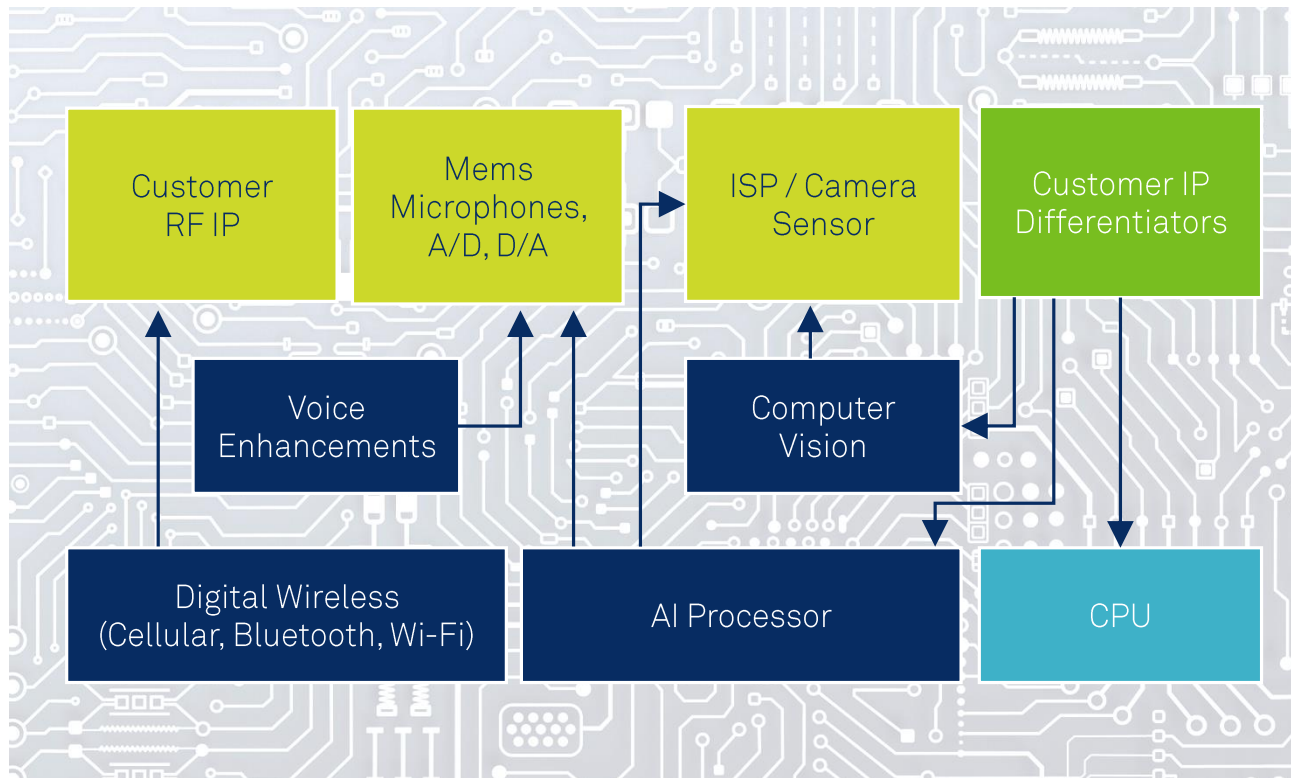- ▶ Strong competitive edge in audio over Bluetooth
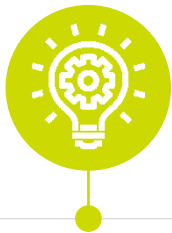
5.3bn Bluetooth and 4bn Wi-Fi devices shipping in 2023

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CEVA's IP Strategy Streamlines the Development of Emerging IoT SoCs

▶ Cuts time to market and R&D expenses

▶ CEVA's excellence is complimentary to customer excellence

▶ CEVA's "value add" is growing through broader technology offering and vertical integration
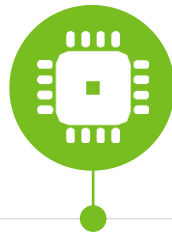

Customer RF IP

Mems Microphones, A/D, D/A

ISP / Camera Sensor

Customer IP Differentiators

Voice Enhancements

Computer Vision

Digital Wireless (Cellular, Bluetooth, Wi-Fi)

AI Processor

CPU

■ CEVA IP

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Business Model Practices

R&D
2-3 years

Product deployment ranging from 1-5 years

End products ship for up to 10+ years

Investment Phase	Licensing Phase	Royalty Phase
Define architectures, develop core technologies in tandem with lead customers. R&D intensive process.	License and support customers to integrate IP into their SoC designs.	Long-tail royalty streams generated across multiple customers, products and markets
3-4 R&D projects concurrently at any time	40-50 licensing agreements per year	40+ royalty payers today, 60+ potential royalty payers in development

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Diverse Business & Growing Markets

CEVA TAM grows ~70%, based on expansion into emerging, high-growth areas

Units, billions

~17bn unit TAM

~10bn unit TAM

- Mobile Broadband
- LTE/5G RAN
- Cellular IoT
- Computer Vision / AI
- Sound / AI
- Bluetooth
- Wi-Fi
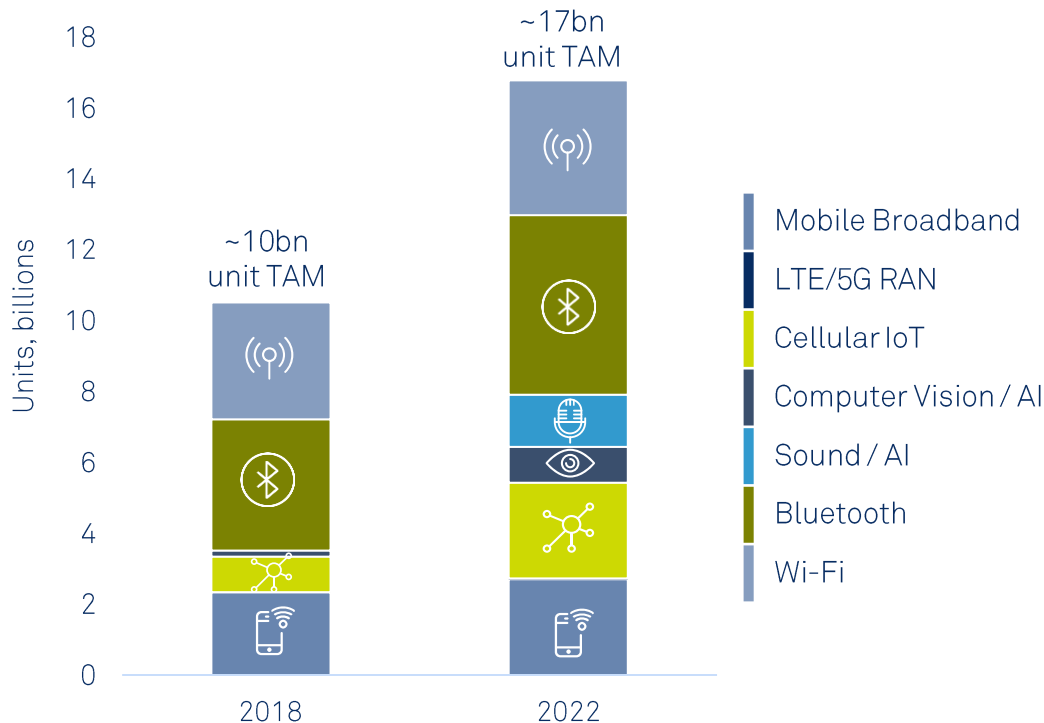
intel SAMSUNG NOKIA UNISOC ZTE ON Semiconductor NXP SigmaStar socionext NOVATEK NORDIC SEMICONDUCTOR Rockchip dialog SEMICONDUCTOR BEKEN sonova oticon PEOPLE FIRST

CEVA Proprietary Information

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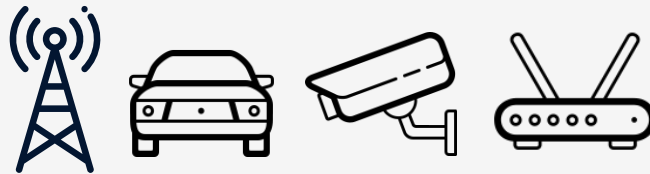# Exploiting both Short Tail and Long Tail Markets

Short Tail Markets

▶ Cellular modems, cameras, wearables, audio devices, Bluetooth devices, etc

▶ 1 to 2 year product life span

▶ Short design cycles, require vertically integrated IP

▶ Per use license model, repetitive upgrades

Long Tail Markets

▶ Base stations, automotive , surveillance cameras, Wi-Fi access points, etc

▶ Up to 10 year product life span

▶ Long design cycles require high performance IP

▶ High license fee

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Summary - Our Growth Opportunities

1

Cellular
▶ Handset / user equipment – LTE expansion in emerging market & 5G upgrade cycle
▶ Base stations – Expand customer base
▶ New use cases – Automotive, fixed wireless
▶ Cellular-IoT- Capture newcomers to the space

2

Connectivity
▶ BLE - Gain share in the quickly growing BLE market (30% CAGR)
▶ BTDM – Become the indisputable leader as one-stop-shop for BT and audio
▶ Wi-Fi - Expand into smart speakers, smart TV and access points

3

Smart Devices
▶ AI processors - Almost all connected devices will need AI
▶ Computer vision - AR and 3D scanning
▶ Sound – Voice as a primary user interface
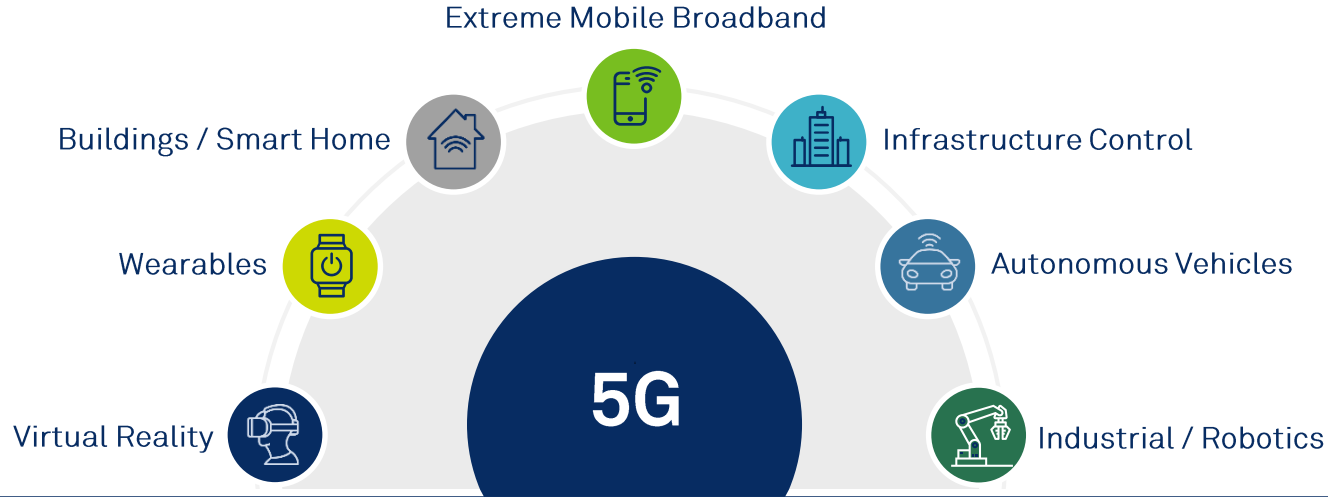
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Thank You

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Cellular

Michael Boukaya
Emmanuel Gresset

5G Vastly Expands Services and Use Cases

Extreme Mobile Broadband

Buildings / Smart Home

Infrastructure Control

Wearables

Autonomous Vehicles

5G

Virtual Reality

Industrial / Robotics

Enhanced Mobile Broadband	Massive IoT	Mission Critical Services

Wireless Local Loop

FWA

A new underlying infrastructure needs to be built to enable 5G to become reality

Wireless Infrastructure

gNB & HetNet

CloudRAN

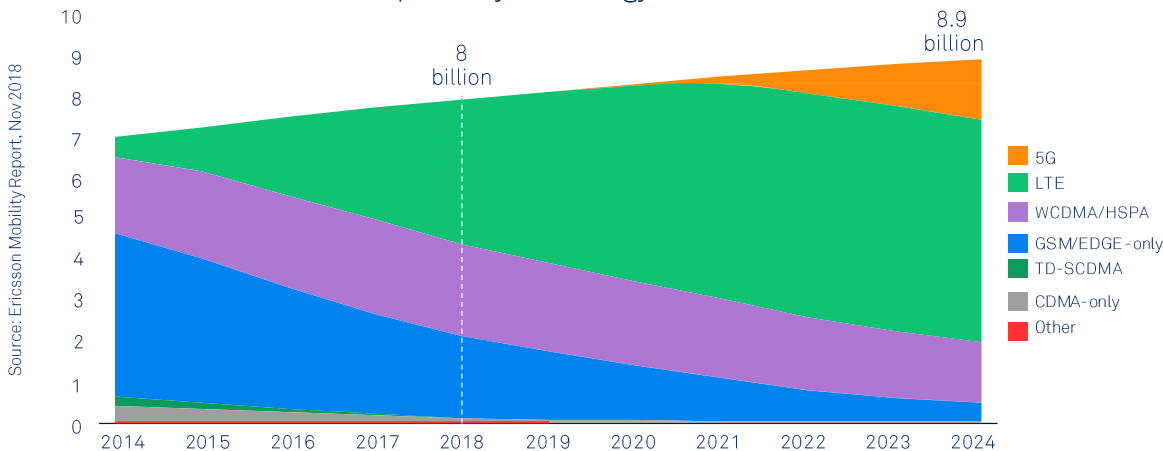Macrocell

Smallcell / Femtocell

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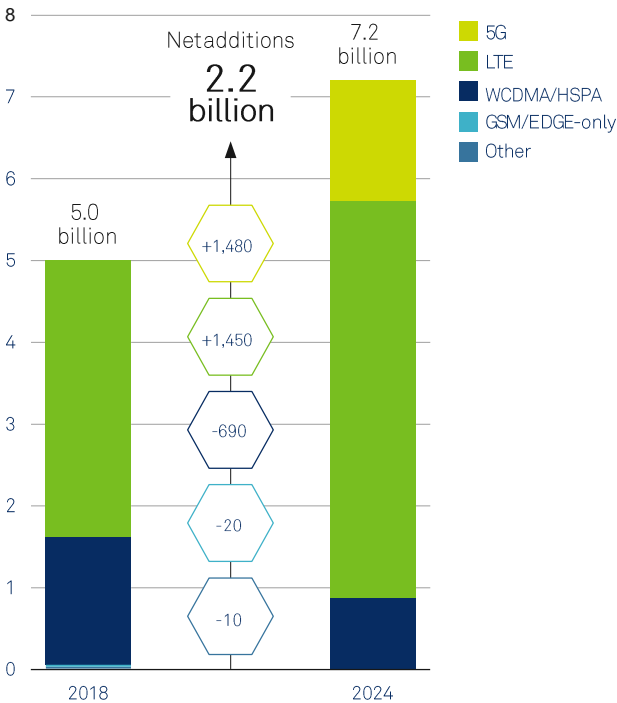# Cellular Market Dynamics & Opportunities

Strong Growth of Mobile Broadband

8.6bn **90%**

Total Subscriptions By 2022 | For Mobile Broadband

Mobile subscriptions by technology (billion)

Source: Ericsson Mobility Report, Nov 2018

- 5G
- LTE
- WCDMA/HSPA
- GSM/EDGE-only
- TD-SCDMA
- CDMA-only
- Other

8 billion

8.9 billion

Smartphone subscriptions by technology (billion)

Net additions

2.2 billion

5.0 billion

7.2 billion

+1,480
+1,450
-690
-20
-10

2018   2024

- 5G
- LTE
- WCDMA/HSPA
- GSM/EDGE-only
- Other

Source: Ericsson Mobility Report, Nov 2018

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Cellular Modem Dynamics
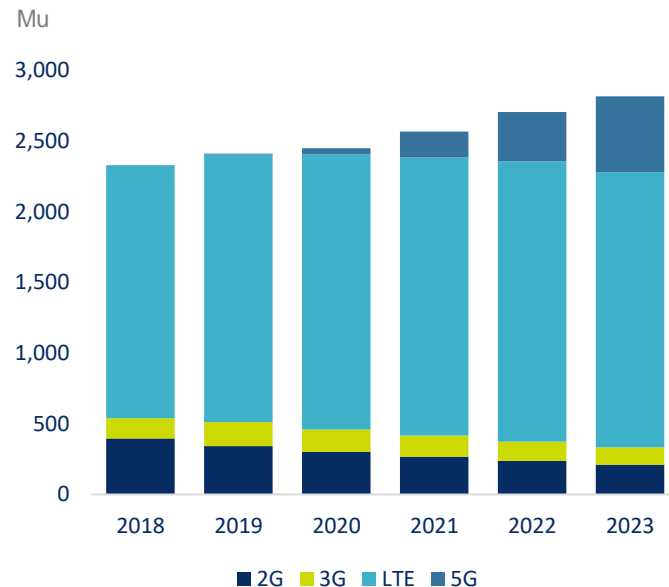
2.7Bn
Cellular modems will ship in 2022

13%
of all cellular modems will support 5G in 2022

▶ 5G will drive cellular modem growth starting in 2019

   ▶ 262% CAGR for 5G eMBB in 2019-22

▶ Strong LTE-A growth until 2021

   ▶ 18% CAGR of LTE-A handset in 2018-21 to reach 1.15Bn units in 2021
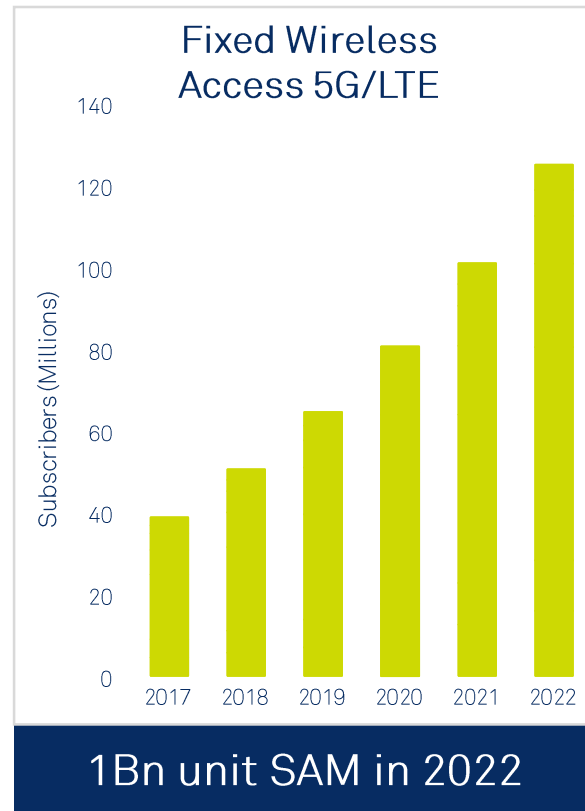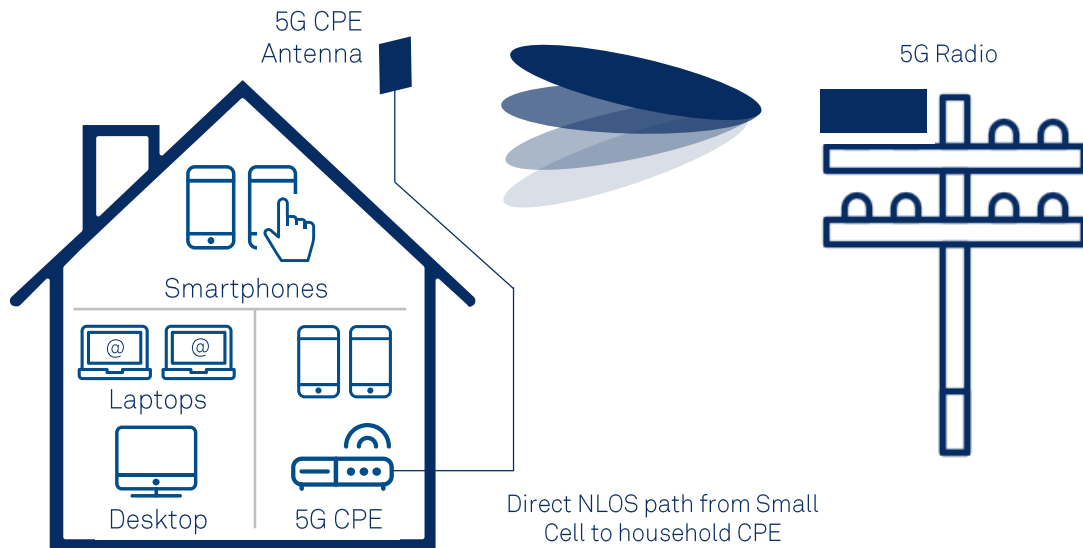
Modem Shipment by Technology

Mu

Legend: ■ 2G ■ 3G ■ LTE ■ 5G

Source: Strategy Analytics, Baseband Forecast, Q4'18
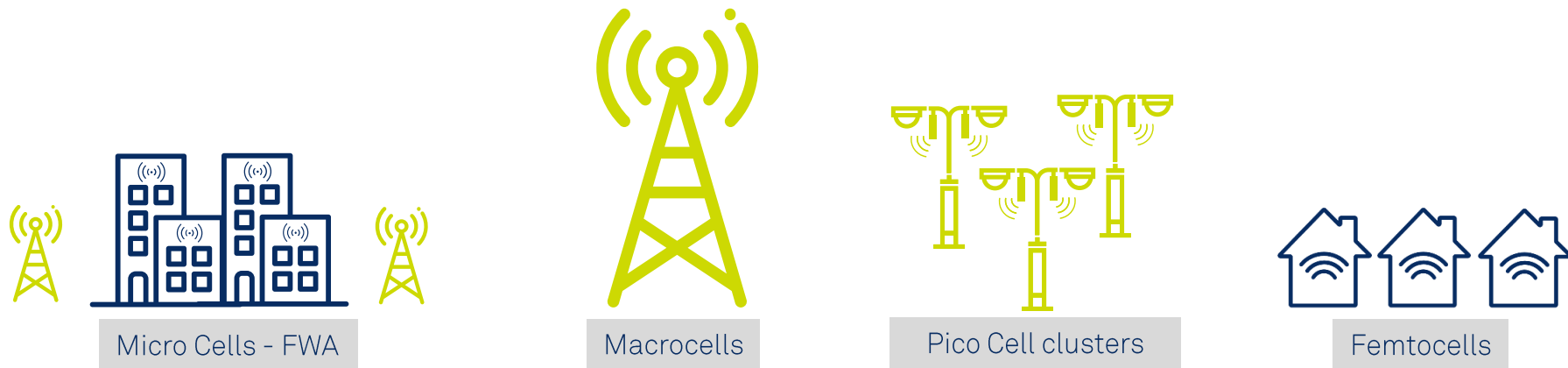
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5G CPEs – 1Bn Unit 5G Opportunity

126M 5G/LTE FWA subscriptions in 2022

900M households without fixed broadband in 2022

40% cheaper deployment than FTTH for similar performance

5G CPE Antenna

5G Radio

Smartphones

@ @

Laptops

Desktop

5G CPE

Direct NLOS path from Small Cell to household CPE

Fixed Wireless Access 5G/LTE

Subscribers (Millions)

	2017	2018	2019	2020	2021	2022

1Bn unit SAM in 2022

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HetNet Architectures for 5G and LTE-A Networks

Micro Cells - FWA

Macrocells

Pico Cell clusters

Femtocells

Heterogeneous Radio Access Network

▶ Heterogeneous Networks (HetNet) combine

- ▶ Macrocells to serve a large number of users with high mobility over 10km range

- ▶ Small Cells to provide high outdoor data-rate over 500m range

- ▶ Femtocells to provide very high indoor data-rate over 50m range

- ▶ FWA requires Small Cells to provide up to 1Gps over 28GHz mmWaves

- ▶ On Oct 1st, Verizon launched its 300Mbps 5G FWA in 4 US cities for $40/m

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The Base Station Opportunity
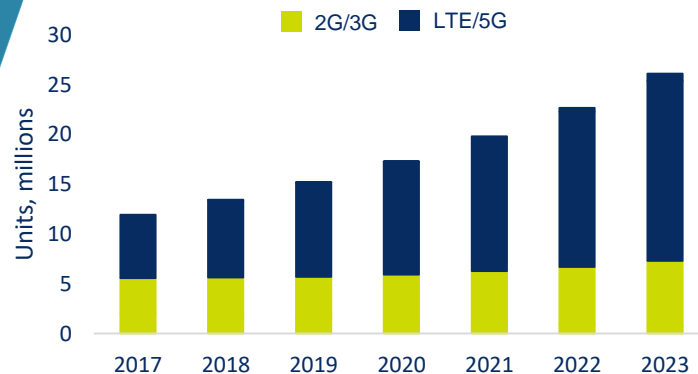
14% CAGR '18-'22

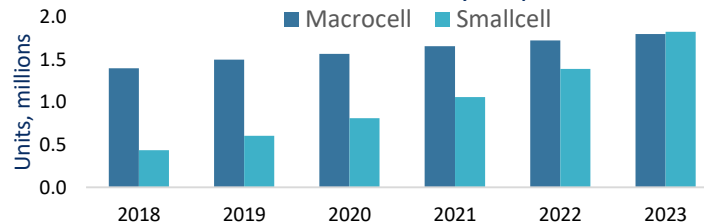**13.5m**

Legacy BTS to be upgraded to LTE-A and 5G

13m

New LTE-A and 5G BTS to be installed from '19 to '23

▶ Macro build out and upgrade

▶ Small Cell is crucial & will exceed Macro shipment by 2023 with 36% CAGR

▶ Indoor Femtocell reaches 8Mu by 2023

▶ Fixed Wireless Access to grow significantly

Installed Macro BTS & Small Cell
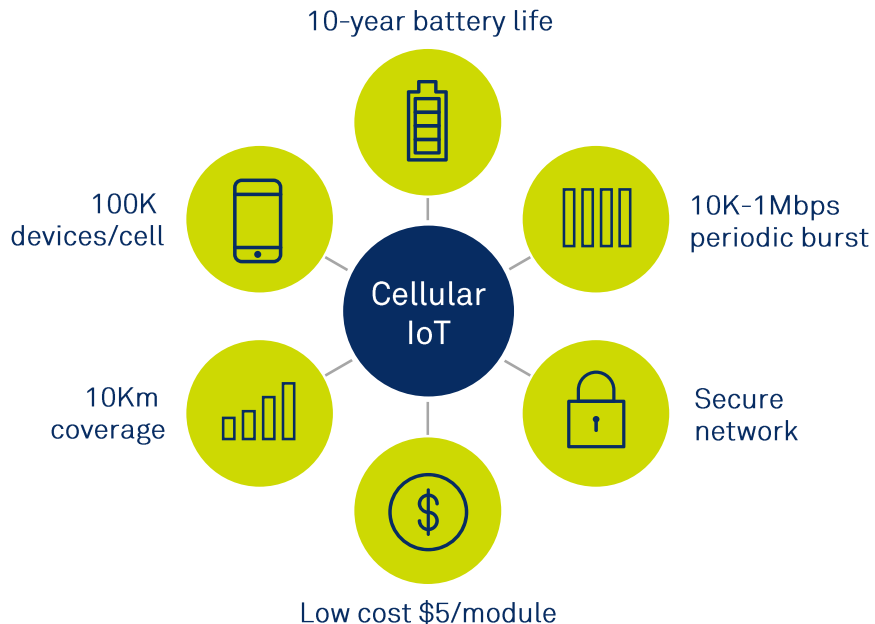
2G/3G   LTE/5G

Units, millions

30
25
20
15
10
5
0

2017 2018 2019 2020 2021 2022 2023

Macro & Small Cell Yearly Shipments

Macrocell   Smallcell

Units, millions

2.0
1.5
1.0
0.5
0.0

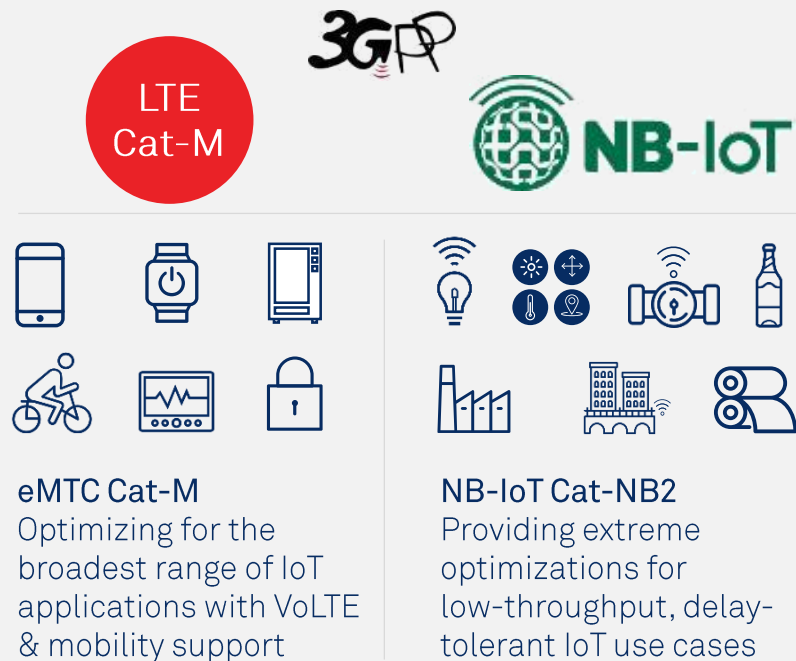2018 2019 2020 2021 2022 2023

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Cellular IoT Connects Billions of Devices

LPWA networks are designed to connect wirelessly billions of IoT devices to the Cloud with the following requirements

- 10-year battery life
- 10K–1Mbps periodic burst
- Secure network
- Low cost $5/module
- 10Km coverage
- 100K devices/cell

Cellular IoT

Cellular IoT defined by 3GPP is leading the LPWA markets with two technologies

LTE Cat-M

NB-IoT

eMTC Cat-M
Optimizing for the broadest range of IoT applications with VoLTE & mobility support

NB-IoT Cat-NB2
Providing extreme optimizations for low-throughput, delay-tolerant IoT use cases

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Cellular IoT Opportunity

2.8bn
Connections by 2022

29%
CAGR between '18 and '22

Transport and Logistics
Fleet management
Goods tracking

Utilities
Smart metering
Smart grid management

Agriculture
Climate/agriculture monitoring
Livestock tracking

Smart Cities
Parking sensors
Smart bicycles
Waste management
Smart lighting

Massive IoT

Environment
Flood monitoring/alerts
Environmental monitoring

Smart Buildings
Smoke detectors
Alarm systems
Home automation

Industrial
Process monitoring and control
Maintenance monitoring

Consumers Wearables
Kids/senior tracker
Medical monitoring

Cellular IoT Connections

Cellular IoT connections per region (billion)

Legend:
- India
- South East Asia and Oceania
- North East Asia
- Western Europe
- Central and Eastern Europe
- Middle East and Africa
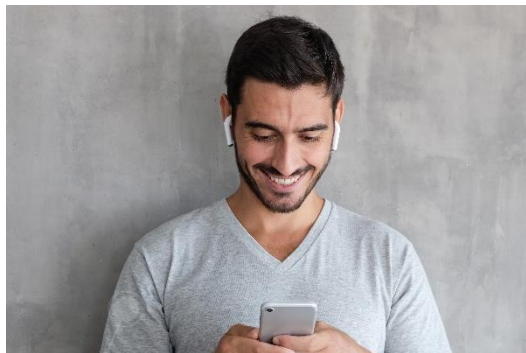- North America
- Latin America
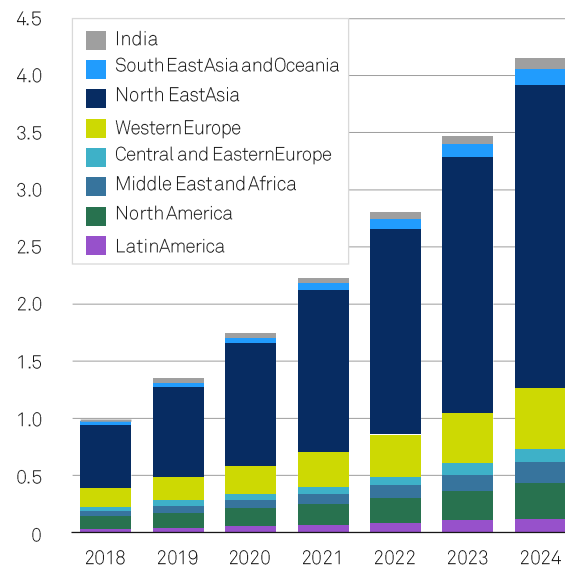
Source: Ericsson Mobility Report, Nov 2018

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The Strategy

The "Expert Source" for Wireless IP

7Bn Handsets Powered by CEVA

Successful track record from 2G to 5G

Leading 5G Infrastructure Market

3 of top 5 OEMs licensed already

Enabling Cellular IoT

Targeting massive deployment for a broad range of Industries

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CEVA Wireless Strategy

1

Move from DSP to 5G mobile platform solution, generating value-add and higher ASP

2

Expand leadership for all base station segments, resulting in long tail business, higher ASP and lucrative licensing model

3

Capitalize on unique competency to expand into mass market of cellular IoT and enabling new 5G use cases like automotive & industrial

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Mobile Broadband

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Mobile Broadband - Streamline the Path to 5G

Incumbent Players

- CEVA wireless IPs power billions of devices
- Co-ordination with existing customers on migration path to 5G
- Other incumbent players can take advantage of CEVA's broad portfolio and technology edge for 5G

OEM Internalization

- OEMs are looking to internalize modem technology
  - Better margin
  - Reduce risks of fragile ecosystem based on single source
  - Differentiate the solution
- Licensing IP is a natural choice to cut time-to-market and reducing the risks

The China Market

- China strongly pushes 5G national deployment and aiming to achieve 43% 5G subscriptions by 2024
- Government funds encourage development of 5G technology
- Trend to create local development with new players
- Licensing wireless IP is very attractive to reduce the entry barriers

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A Sizable & Lucrative Opportunity for Non-Handset Devices

Wireless IP Lowers Entry Barriers to Address New Markets

- 5G technology brings key components to open new big markets for cellular technology
  - Automotive Cellular V2X
  - Fixed Wireless Access
  - Industrial Critical Control
- Newcomers are entering these markets but lack wireless expertise to productize a full solution
  - IP licensing is the best path in order to reduce risks and time-to-market

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Challenges of 5G-NR Modem Design

Efficient modem design for 5G-NR is exponentially more complex than previous standards and calls for software-based architecture approach

1. High Performance & Power Optimized

- Multi-Gigabit capacity of up to 10 Gbps
- Wideband Carrier aggregation of up to 1GHz
- Ultra-Low latency more than 5X time shorter than LTE to support URLLC transmission

2. Multi-Mode Architecture

- 5G-NR modem requires unified platform for:
  - Sub-6GHz and mmWave
- LTE-A Evolution will still represent 70% of the overall shipment until 2023

3. Flexibility for Key 5G Functionality

- Massive MIMO algorithms
- Advanced beamforming techniques
- Complex link-adaptation schemes to sustain high-throughput

4. 5G Standard Evolution

- 3GPP Release 15 will be updated this year
- Release 16 standard for Phase 2 is not ready and will include many new features
- Hardwired-only approach is not upgradable!

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Introducing the PentaG™ Platform

World's most advanced 5G NR IP platform for smartphones and broadband connected devices

▶ Industry's first 5G-NR Rel.15 IP platform, supporting up to 10Gbps - capable of meeting the extreme performance, low latency and strict power budget requirements of mobile devices

▶ Capitalizes on vast experience (over 20 years with more than 8bn devices) of developing DSP IP for baseband processing

▶ Most power & size efficient 5G IP platform – contains specialized scalar and vector DSP processors, co-processors, AI processor, accelerators, software and other essential IP blocks

8X
Higher Performance*

50%
Lower Power Consumption*

10 Gbps

PentaG™
by CEVA

*Versus CEVA-XC4500

CEVA®
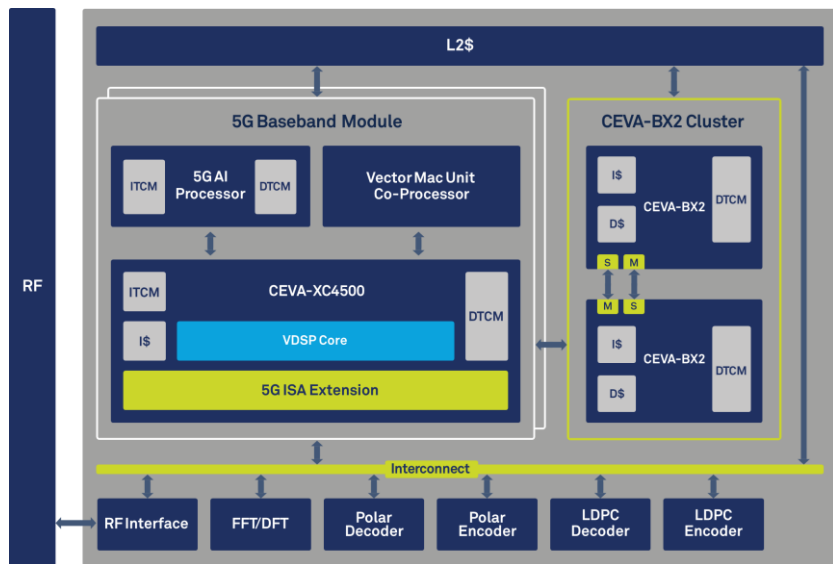
PentaG™

A modular IP platform to address 5G use cases

▶ PentaG™ reduces the enormous complexity of designing 5G-NR devices reducing entry barrier for new comers

▶ PentaG™ allows OEMs to combine specific PentaG components with their own legacy technologies

  ▶ IP components designed with standard interfaces to be smoothly integrated

  ▶ Allows flexible licensing model

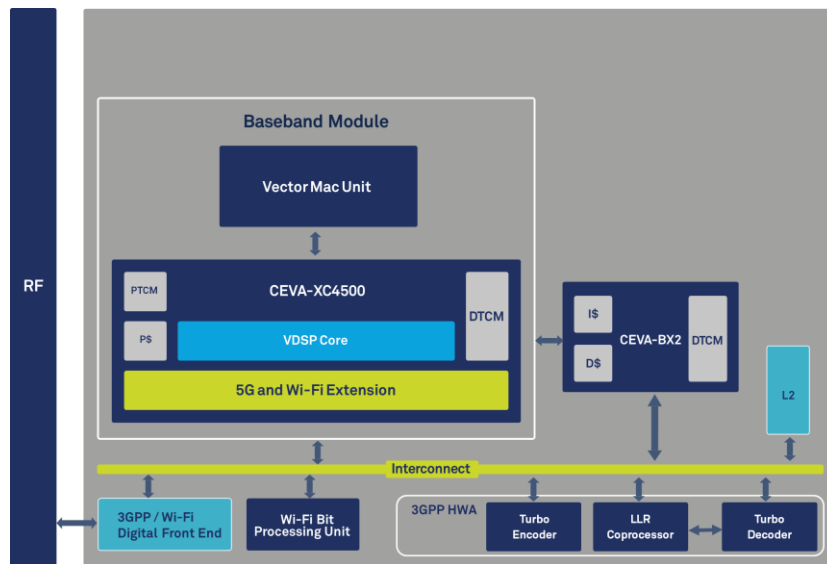▶ PentaG™ modularity enables 5G new use-cases with comprehensive IP components
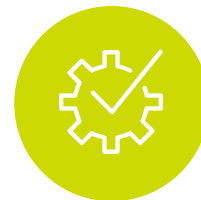
PentaG™ – From a DSP Core to a Full Modem Platform

PentaG eMBB Configuration

PentaG C-V2X Configuration

Base Station

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Base Station Challenges

- Significant computational complexity
  - Massive MIMO
  - Much wider Bandwidth available (mmWave)
  - Higher throughput and reduced latencies
- Much higher bitrates
  - Larger Bandwidth, Modulation and MIMO dimensions combined with more efficient frame
  - Supporting multiple Gigabit/sec for each Carrier/Band
- Flexible platform is essential to support standardization and multi-mode with LTE-A

- Legacy ASIC platforms based on TI/FSCL and FPGA don't meet cost, performance and efficiency
- OEMs require state-of-art DSP solution to face new baseband requirements
  - Innovative solution to manage heavy data traffics
  - Strong foundation to scale from small-cell to macro-cell architectures

Base Station – the Path to Leadership

CEVA is the undisputed #1 IP vendor for base station

▶ Strategic investment from 2012 to design state-of-the-art vector processor for the infrastructure market from LTE to 5G-NR

▶ CEVA established a tight collaboration with 3 of the 5 Tier 1 OEMs in order to specialize the IP to address most complex eNB architectures
  ▶ Results in the most sophisticated DSP architectures
  ▶ Presents the competition with very high entry barriers

▶ CEVA is the only DSP IP vendor who launched four DSP generations for this market

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CEVA – The DSP Partner for Cellular RAN

▶ CEVA's technology applies to all RAN architectures and trends

  ▶ Macro cell, small cell, RRH, backhaul, mmWave

▶ CEVA technology in mass-production with XC323 and XC4500

▶ CEVA-XC12, the most advanced DSP for next generation of 5G NR RAN base stations and edge computing

  ▶ 3 of top 5 OEMs adopted CEVA-XC12 DSP for 5G

Powering wireless infrastructure build-out for next decade
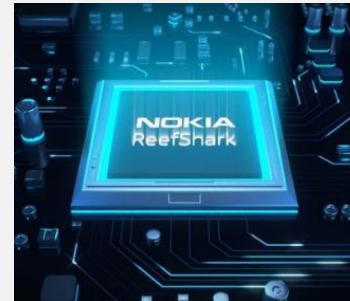
New Infrastructure Players

▶ Heterogenous nature of the 5G deployment opens the market to new small cell and femtocell companies

  ▶ These companies need DSP technology designed for infrastructure

▶ New initiatives like the OpenRAN forum will disrupt the industry landscape

  ▶ Enable an open ecosystem of complete solutions and solution components

  ▶ Introduce newcomers that can specialize on baseband only with standard interfaces
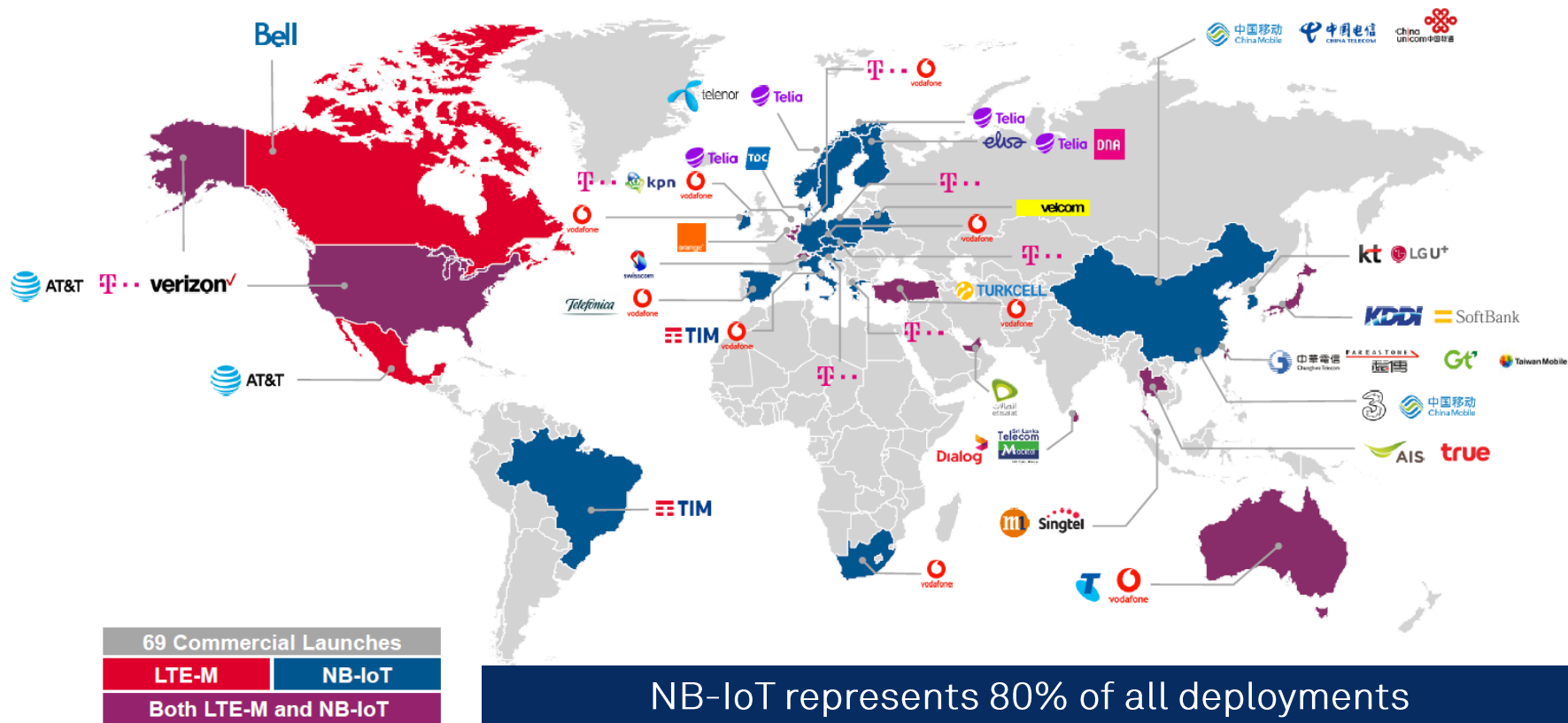
CEVA is the best positioned IP company to power newcomers

CEVA®

Cellular IoT

Cellular IoT Deployment

69 Commercial Launches

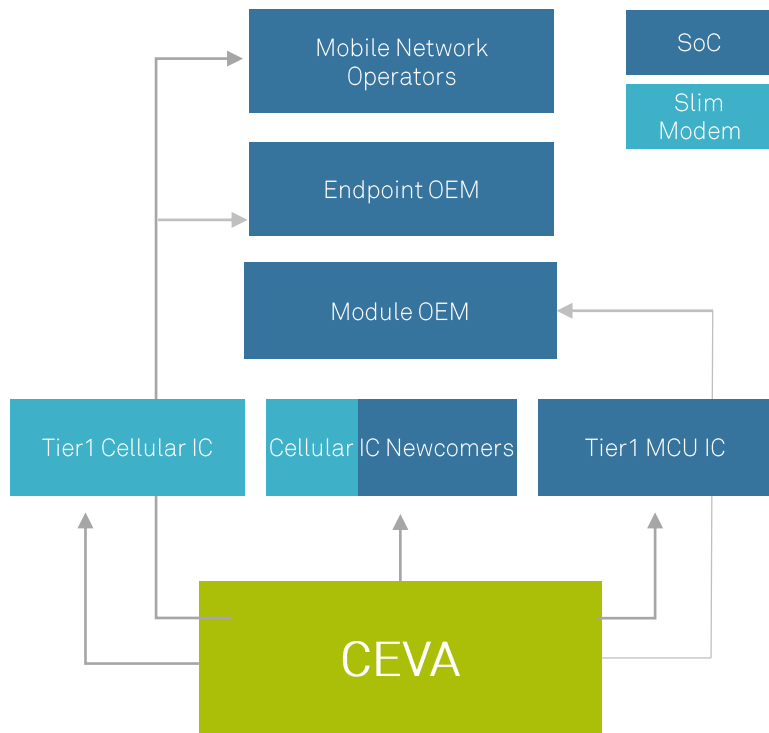| LTE-M	NB-IoT
Both LTE-M and NB-IoT	

NB-IoT represents 80% of all deployments

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The Opportunity Across the Value Chain

- Margins and fragmentation drive Semi's, module makers and mobile operators to look into owning custom chips that integrate:
  - NB-IoT modem
  - AP and sensors
  - GNSS
- TTM and lack of cellular expertise drive these new comers to look into licensing modem technology from IP companies

Licensing opportunities throughout the value chain increase licensing SAM and royalty ASP

Mobile Network Operators

SoC

Slim Modem

Endpoint OEM

Module OEM

Tier1 Cellular IC

Cellular IC Newcomers

Tier1 MCU IC

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Go-to-Market Strategy

1 — Reduce entry barriers and time to market for newcomers with a complete and self-contained modem solution
- ▶ Single core running full modem and lite-application
- ▶ Full modem RF, Digital, SoC IP
- ▶ Fully Integrated modem SW

2 — Holistic IoT endpoint offer
- ▶ GNSS
- ▶ Always-on voice commands
- ▶ Combination of BLE for short range

3 — Modular offering to accommodate the various type of customers
- ▶ From DSP only to Full-Solution
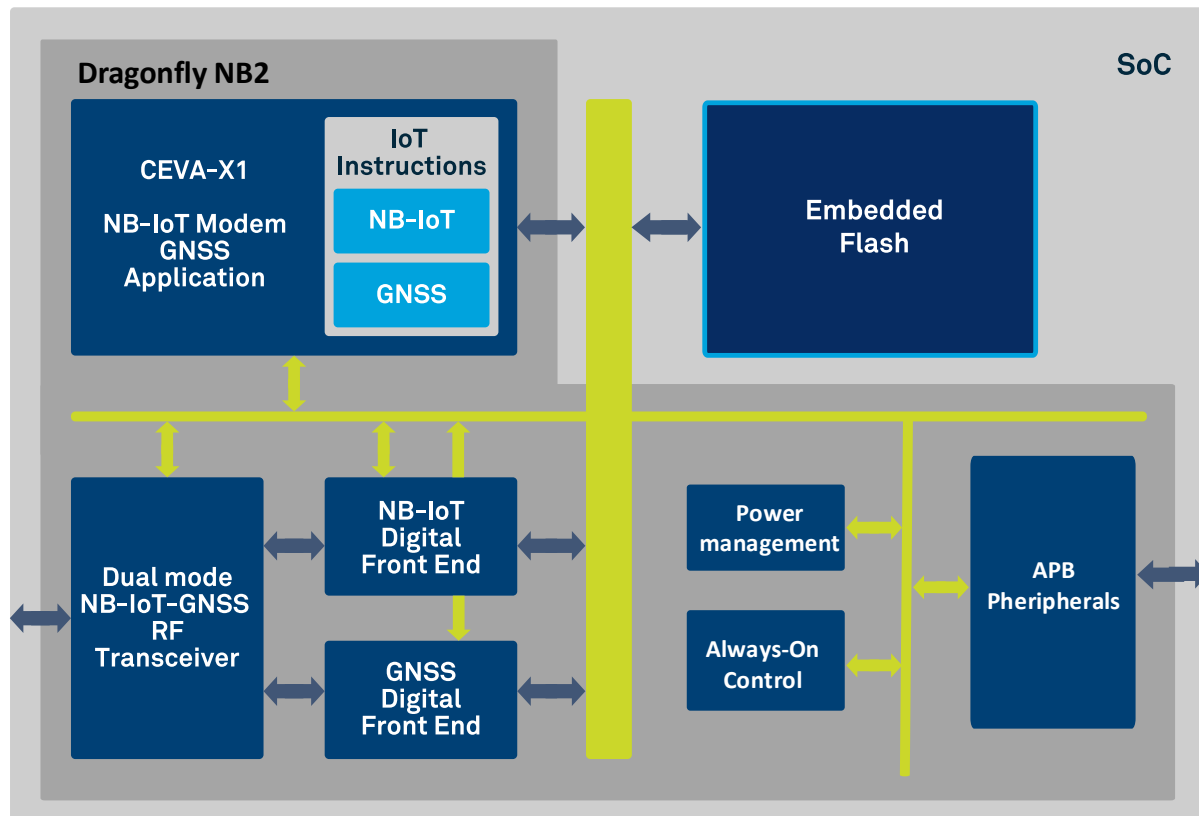
CEVA

CEVA-Dragonfly NB2

First World-Wide NB-IoT IP Solution – Silicon Proven

- ▶ Fully integrated solution compliant with 3GPP Release 14
- ▶ Integrated RF design implemented in 55nm and 40nm processes
- ▶ Intelligent ultra-low power management to achieve few microAmps
- ▶ Optimized multi-constellation GNSS package includes RF, DFE and new instructions to boost performance by a factor of 8X
- ▶ One stop shop IP solution license as a whole system or as a subset

Dragonfly NB2 lowers entry barriers and ensures lowest bill of materials of NB-IoT endpoints

CEVA-Dragonfly NB2 Block Diagram

A unique IP solution combining Cellular IoT and GNSS on single DSP

Indisputable Leadership

CEVA is the only IP vendor with the ability to deliver a complete cellular IoT offering

Nordic nRF91 uses CEVA DSP for NB-IoT/Cat-M1

ZTE Rosefinch7100 uses CEVA DSP for NB-IoT

~10 customers have licensed Dragonfly full drop-in solution

Key Takeaways

CEVA has developed unique capabilities over the last 30 years to deliver a holistic cellular IP portfolio

CEVA is primed to address the upcoming 5G cycle from both the handset and the base station fronts with highly sophisticated technologies

CEVA enables newcomers to Cellular IoT and 5G by reducing entry barriers with a full hardware and software IP solution

The de-facto wireless IP leader across all the biggest market segments

CEVA®

Thank You

CEVA®

www.ceva-dsp.com

Computer Vision, AI and Automotive

Ilan Yona
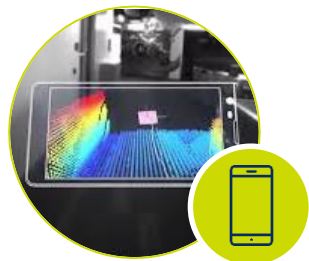Jeff VanWashenova

Market Trends

Trend #1: Cameras Become Ubiquitous

Object Detection

SLAM

AR/VR

Object Tracking
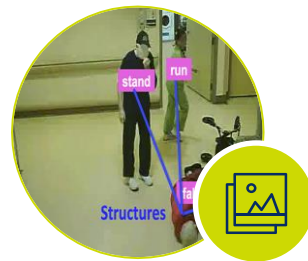
Scene Recognition

Free Space Detection

Total Cameras (Billions)

⬆ **216%**

Growth (2017-2022)

2017	2018	2019	2020	2021	2022
	17.4	20.7	27.6	36.0	44.4
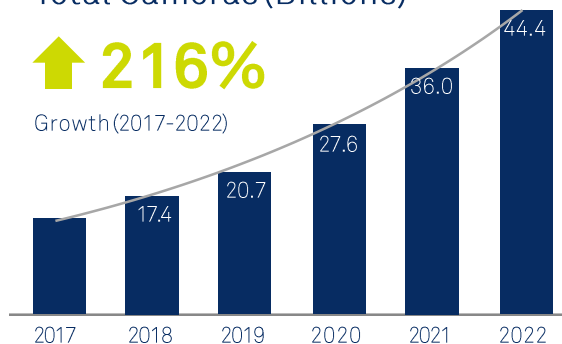
Facial Recognition

44 billion cameras in the world by 2022*

CEVA

Trend #2: Intelligence Moving to the Edge

Cloud AI

Edge Devices

Intelligence & Analytics Processing

Key benefits of intelligence at the edge:

Low Latency	Low Power	Low Cost	High Privacy	High Reliability

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Addressable Markets and Growth Trends

2022 forecast for edge devices with computer vision / AI

Consumer
375m units

Surveillance
70m units

Automotive image sensors
300m units

Smartphones
800m units

Industrial
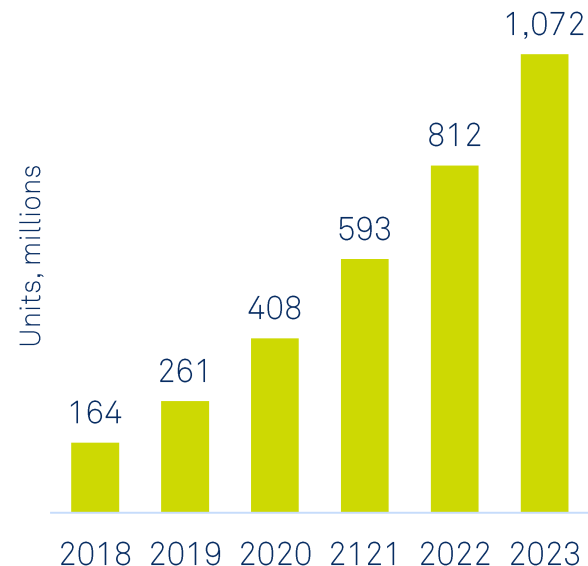**150m units**
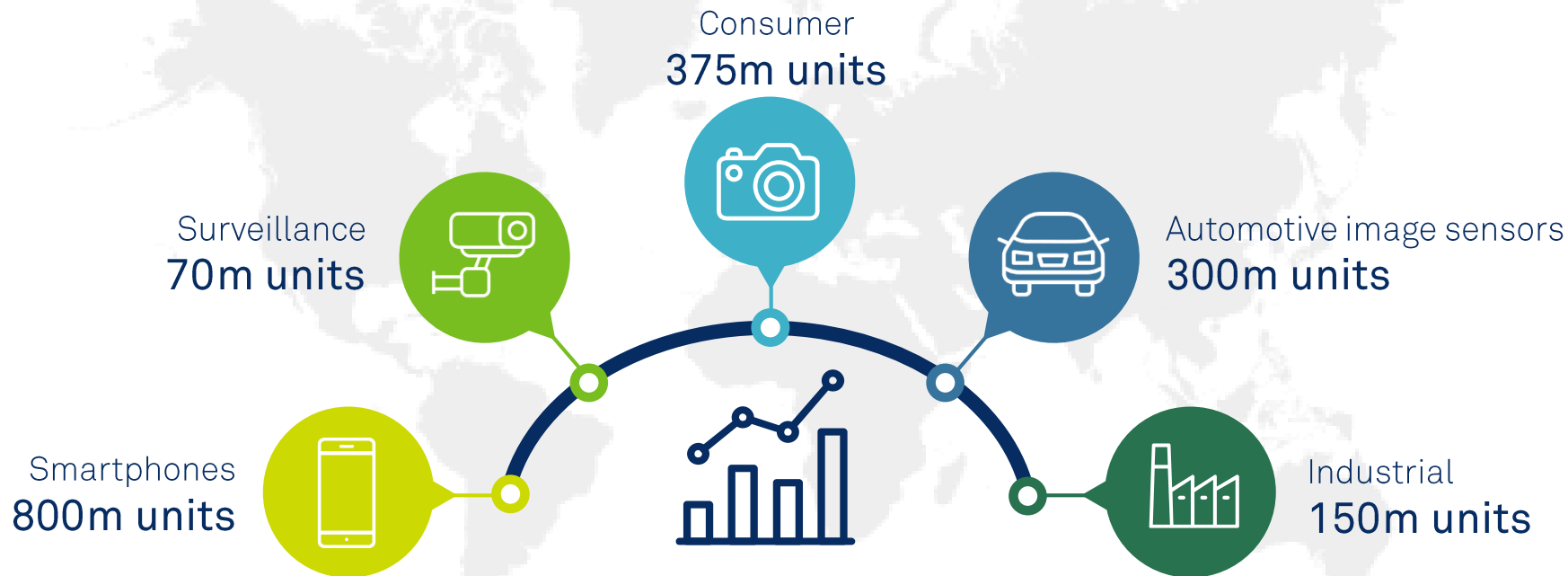
More than 1.5 billion cameras with computer vision / machine vision shipping by 2022**

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Smartphone – Enhanced Photography

- ▶ AI /Computer vision
  - ▶ Dual/Triple cameras
    - ▶ Intelligent zoom
    - ▶ Selfies
    - ▶ Low light performance
    - ▶ Face authentications and soon AR

Embedded Vision in Smartphones

Source: Yole Hardware & Software for AI, 2018

Surveillance/Security

- ▶ Government
  - ▶ Infrastructure, including airports, bridges, highways,
- ▶ Municipal government
  - ▶ Police, transportation
- ▶ Retail
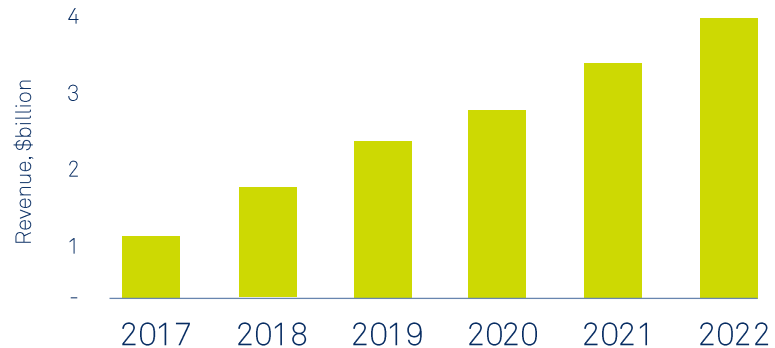 - ▶ Theft, consumer behaviour
- ▶ Defense

30B Images/second
100T/Hour

1 Camera for every 8 people on earth

Computer Vision Revenue, Surveillance & Security

Source: Tractica

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Consumer

Drones
- ▶ Action drone – follow me

Smart home
- ▶ Personalization, safety & security
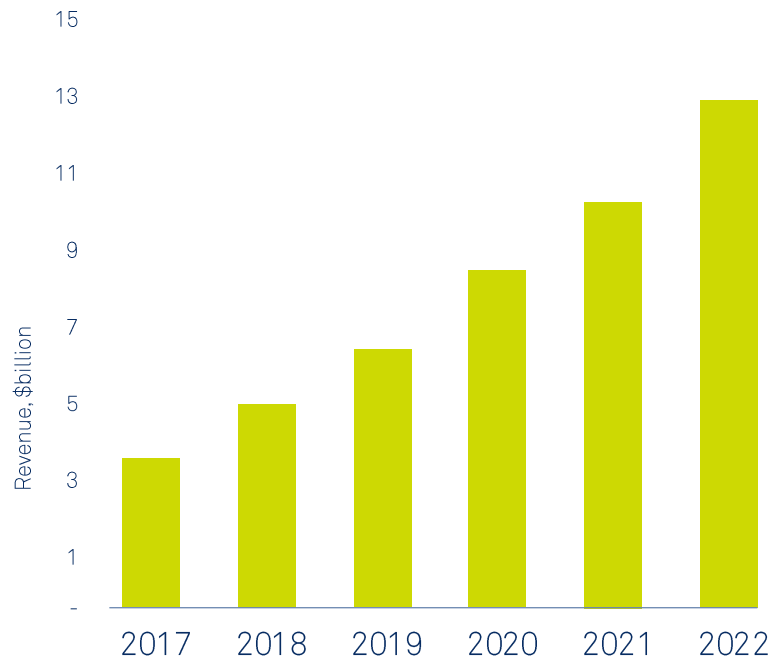
AR/VR
- ▶ Wearables

Photography
- ▶ DSLR/video/action cameras

Computer Vision Revenue, Consumer Devices

Revenue, $billion

	2017	2018	2019	2020	2021	2022

Source: Tractica

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Industrial

Next revolution

▶ Industry 4.0

▶ Smart factory infrastructure

  ▶ Robotics
  ▶ Manufacturing

▶ Computer vision

▶ Artificial Intelligence

Global robotic market

$ billion
Personal | Commercial | Industrial | Military

Year	Value
2000	7.4
2005	10.8
2010	15.1
2015	26.9
2020	42.9
2025	66.9

0   10   20   30   40   50   60
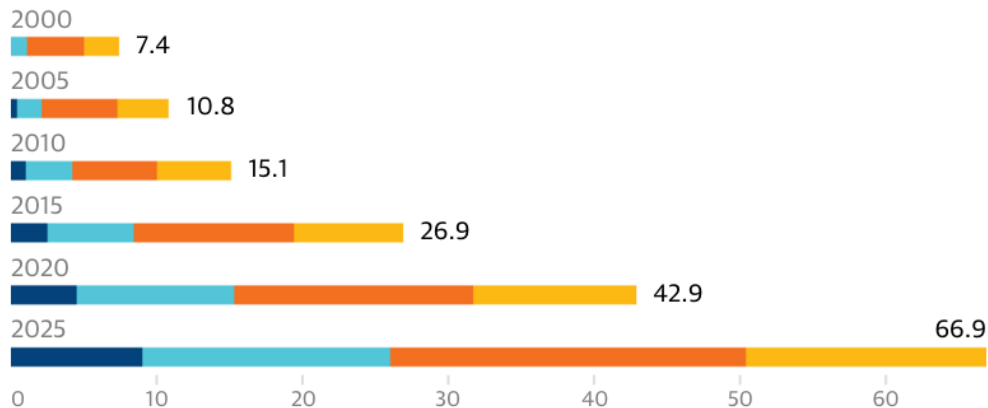
Guardian graphic   Source: BCG. Note: 2015 to 2025 estimated

📷 The robotics market is expected to be worth $66.9bn by 2025

Computer Vision and AI will help drive next revolution

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Automotive Growth Drivers

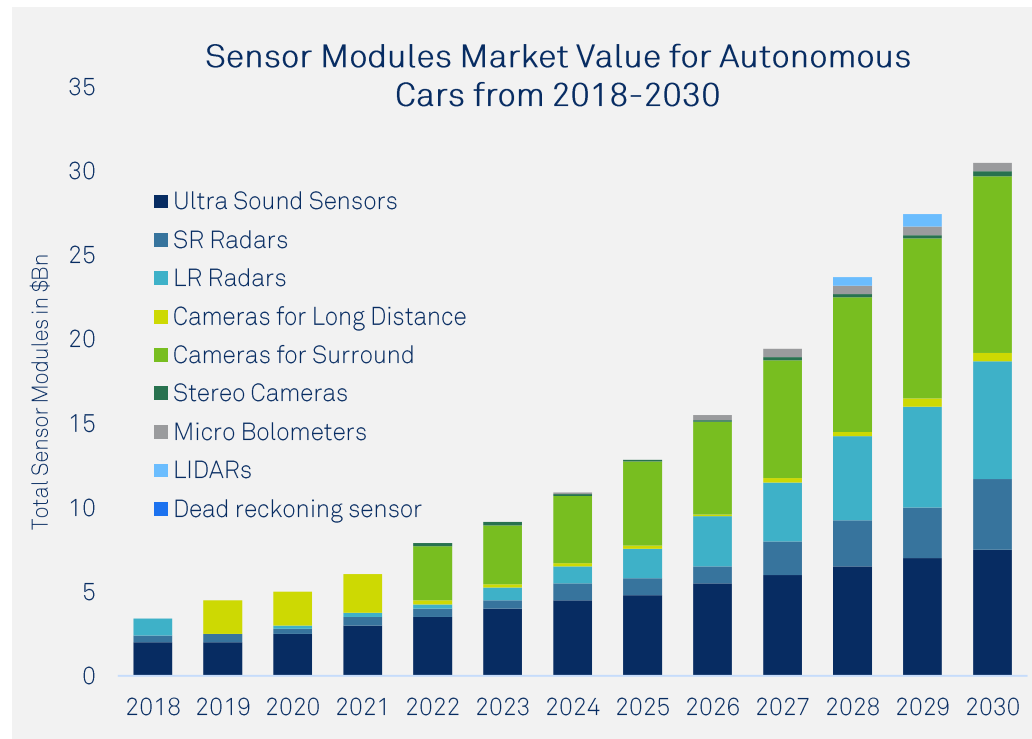## More sensors, processing and intelligence

▶ **Growth drivers**
  ▶ NCAP and active safety
  ▶ AI at the edge
  ▶ Autonomous

▶ **More sensors**
  ▶ How many sensors
  ▶ What kinds of sensor
  ▶ What kinds of application

(Source: Sensors & Data Management for Autonomous Vehicles report, Oct 2018, Yole Development)

Sensor Modules Market Value for Autonomous Cars from 2018-2030

Total Sensor Modules in $Bn

Legend:
- ■ Ultra Sound Sensors
- ■ SR Radars
- ■ LR Radars
- ■ Cameras for Long Distance
- ■ Cameras for Surround
- ■ Stereo Cameras
- ■ Micro Bolometers
- ■ LIDARs
- ■ Dead reckoning sensor

Years: 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030

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CEVA Automotive Strategy

Focus outside and position/partner for in

- Benefits of sensor first
  - Quick time to revenue
  - More license opportunities
  - Diverse opportunities
    - Rear, surround, driver monitoring
  - AI at the edge
    - Use cases

- Position for autonomous
  - Scale IP and architecture up
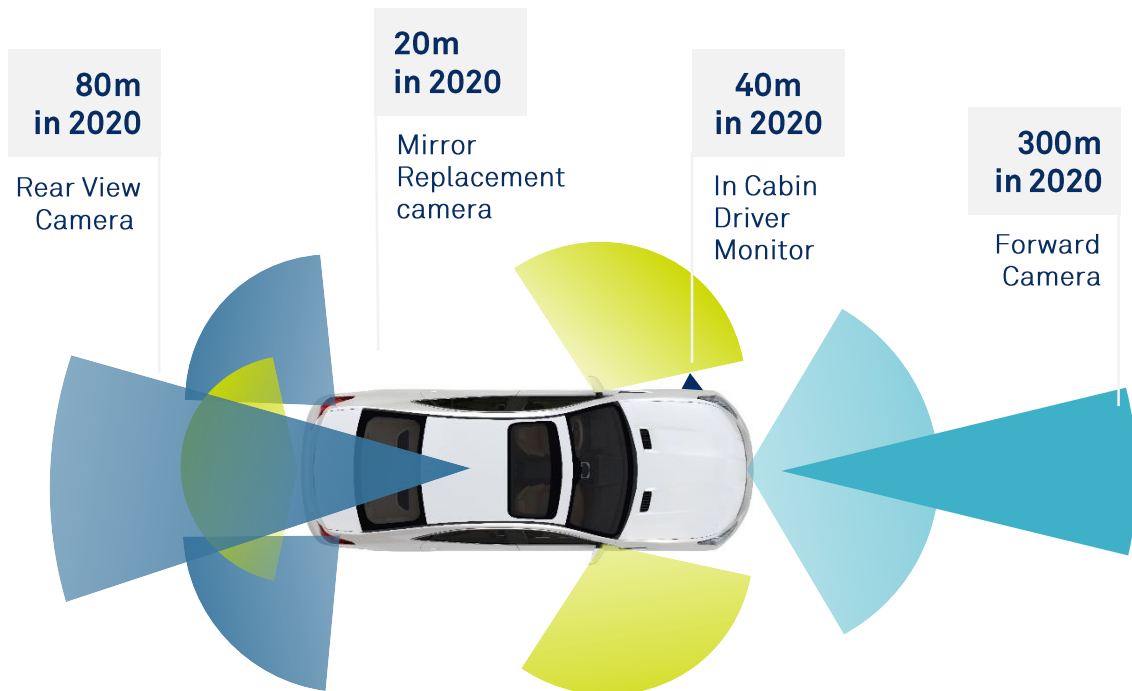 - Strategic partnerships
    - OEMs, disruptors

Registered Autonomous Passenger Vehicles by SAE Level

Units, millions

Legend:
- Level 5
- Level 4
- Level 3
- Level 2

X-axis: 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025

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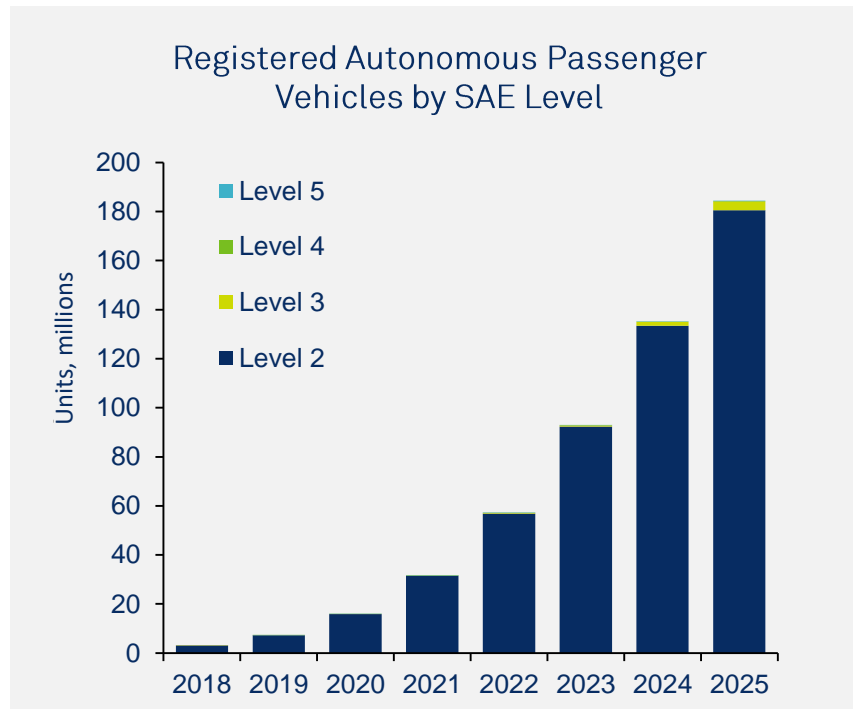
Imaging Growth

Seeing leads to action
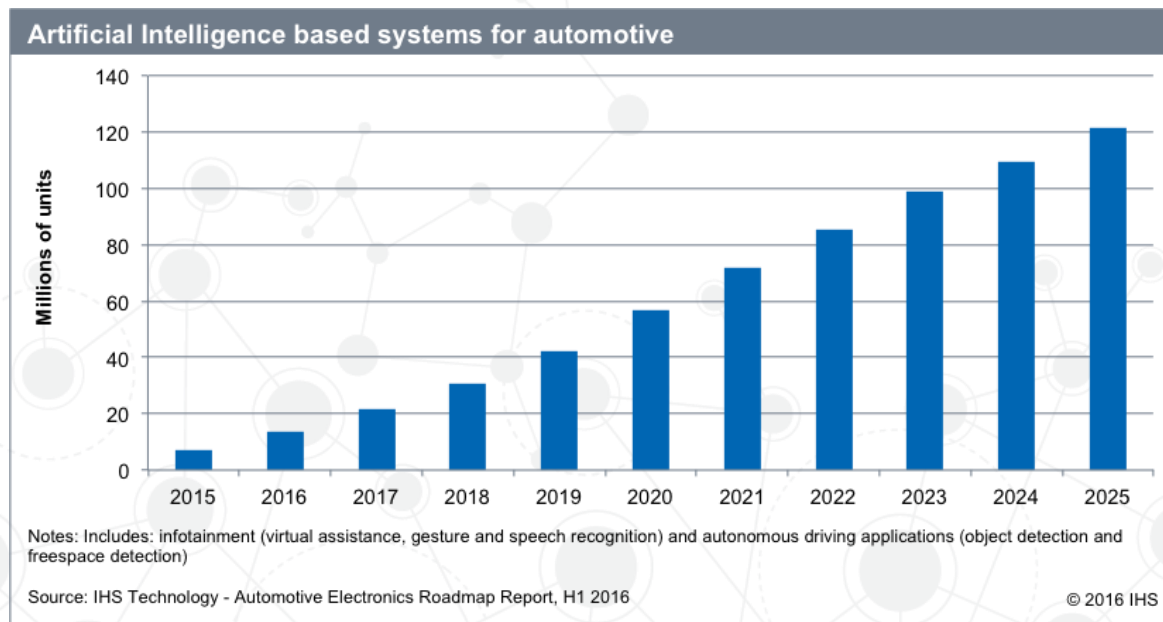
- ▶ Key growth application
  - ▶ Back-up cameras
  - ▶ Driver monitoring
    - ▶ Growth with >L2
    - ▶ Distracted driving
  - ▶ Forward cameras
    - ▶ Pedestrian
    - ▶ Automatic emergency replacement
  - ▶ Mirror replacement

80m in 2020

Rear View Camera

20m in 2020

Mirror Replacement camera

40m in 2020

In Cabin Driver Monitor

300m in 2020

Forward Camera

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Automotive Artificial Intelligence Growth

## Driven by the need for higher performance

- ▶ Challenging vision Environment
  - ▶ Weather
  - ▶ Occlusion
  - ▶ Bright/Dark
- ▶ Object Detection/identification
- ▶ Path planning
- ▶ Predictive analysis
- ▶ Driver monitoring

Artificial Intelligence based systems for automotive

Millions of units

Year	Value
2015	~7
2016	~14
2017	~21
2018	~30
2019	~42
2020	~57
2021	~72
2022	~85
2023	~99
2024	~109
2025	~121

Notes: Includes: infotainment (virtual assistance, gesture and speech recognition) and autonomous driving applications (object detection and freespace detection)

Source: IHS Technology - Automotive Electronics Roadmap Report, H1 2016

© 2016 IHS

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Artificial Intelligence

Artificial Intelligence takes ADAS to the next level

▶ Small efficient networks

▶ Improvement of specific areas
  ▶ Occlusion detection

▶ Hitting new targets
  ▶ Higher performance
  ▶ Small efficient neural networks

▶ Driver monitoring systems
  ▶ Distracted driving
  ▶ Safety/security
  ▶ Personalization
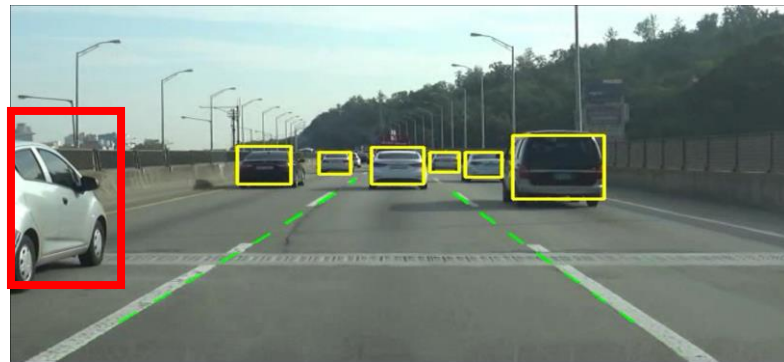
CEVA-XM4: Free space detection
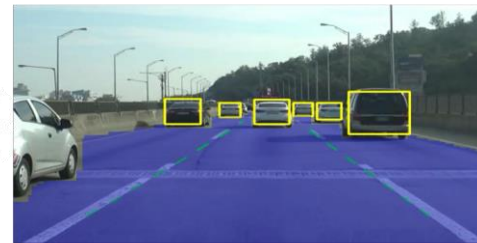
Occlusion detection (ISP + VD + LD + CEVA-XM4)

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A Strategy for Success

Focus on growth applications
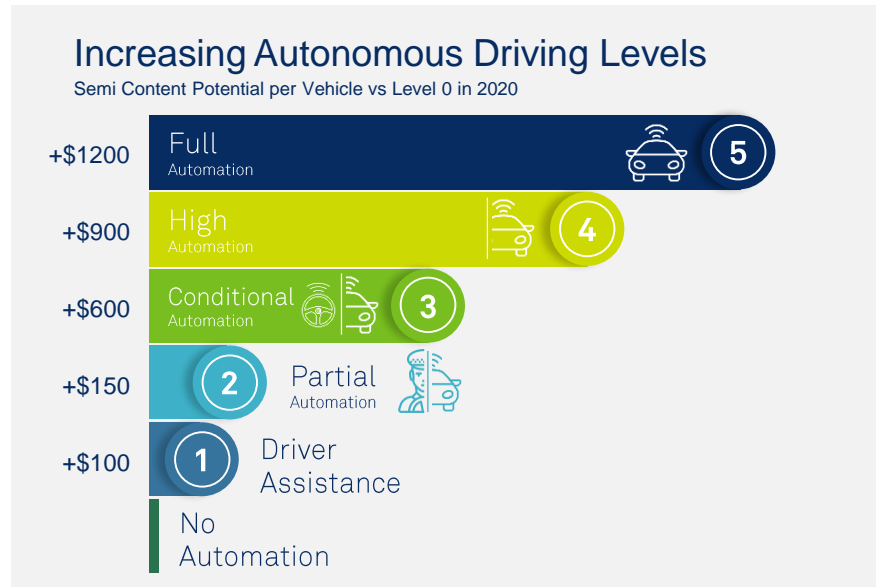
▶ Smart cameras
  ▶ Combination of CV and AI
  ▶ Not all functions are AI
    ▶ CV is stable and predictable
    ▶ AI complements CV
  ▶ CEVA-XM and NeuPro are well positioned for growth markets
  ▶ Example: NextChip – APACHE4

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Autonomous Processing Landscape

▶ New players
  ▶ Baidu, Google, Uber

▶ Traditional
  ▶ OEMs – Toyota, GM, VW, others

▶ Volume autonomy market
  ▶ L2-L3

▶ Need for efficient alternatives to large compute platforms

Increasing Autonomous Driving Levels

Semi Content Potential per Vehicle vs Level 0 in 2020

+$1200	Full Automation — 5
+$900	High Automation — 4
+$600	Conditional Automation — 3
+$150	2 — Partial Automation
+$100	1 — Driver Assistance
	No Automation

Source: NXP, Strategy Analytics

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CEVA's Opportunity in Autonomous Driving

▶ Broad engagement with OEMs, Tier-1, and disruptors of the market to understand and develop IP for L4/L5

▶ Processing requirements continue to grow quickly

▶ Solutions today not designed for mass market applications

▶ CEVA is addressing the need for new architectures to meet the cost, power and processing demands of autonomous platforms
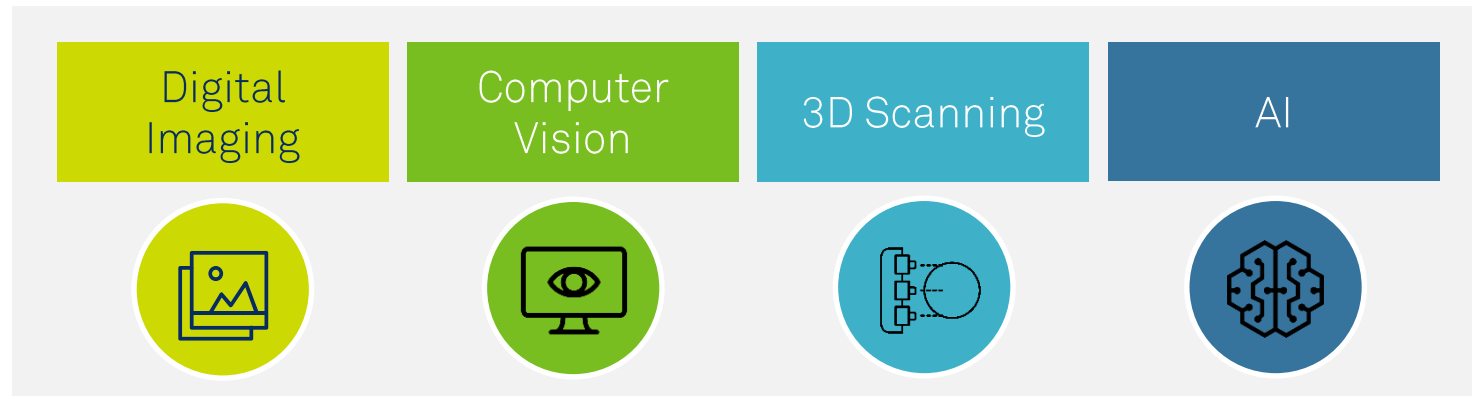
The Strategy

Technology Trends Within Cameras

▶ Traditional camera optics (DSLR) has transformed to digital & AI

▶ The role of cameras has extended beyond photography to machine vision

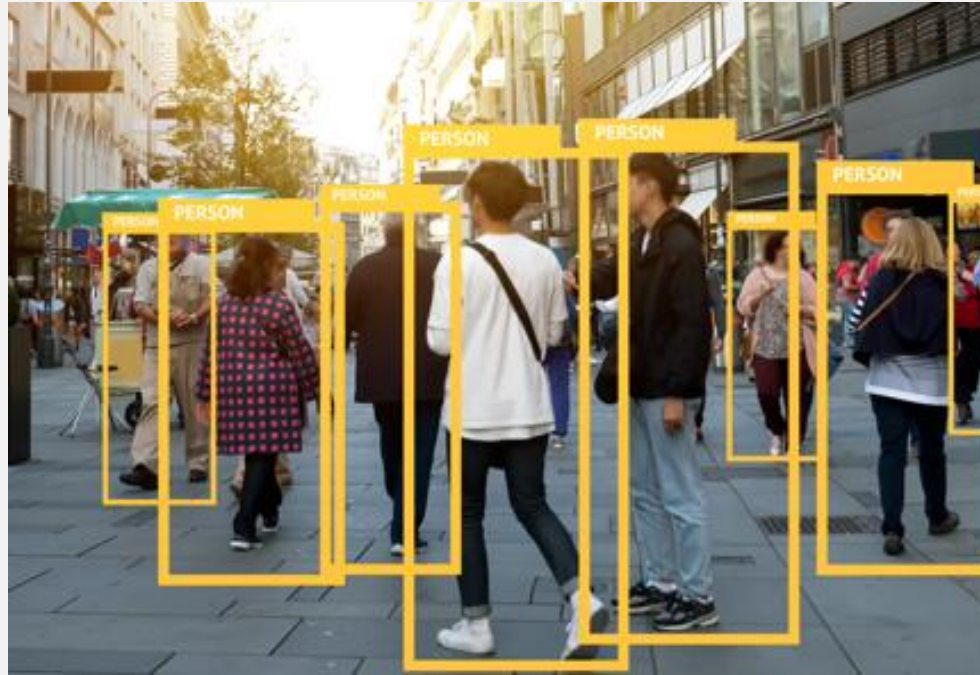▶ The four underlying technologies that drive advanced cameras are:
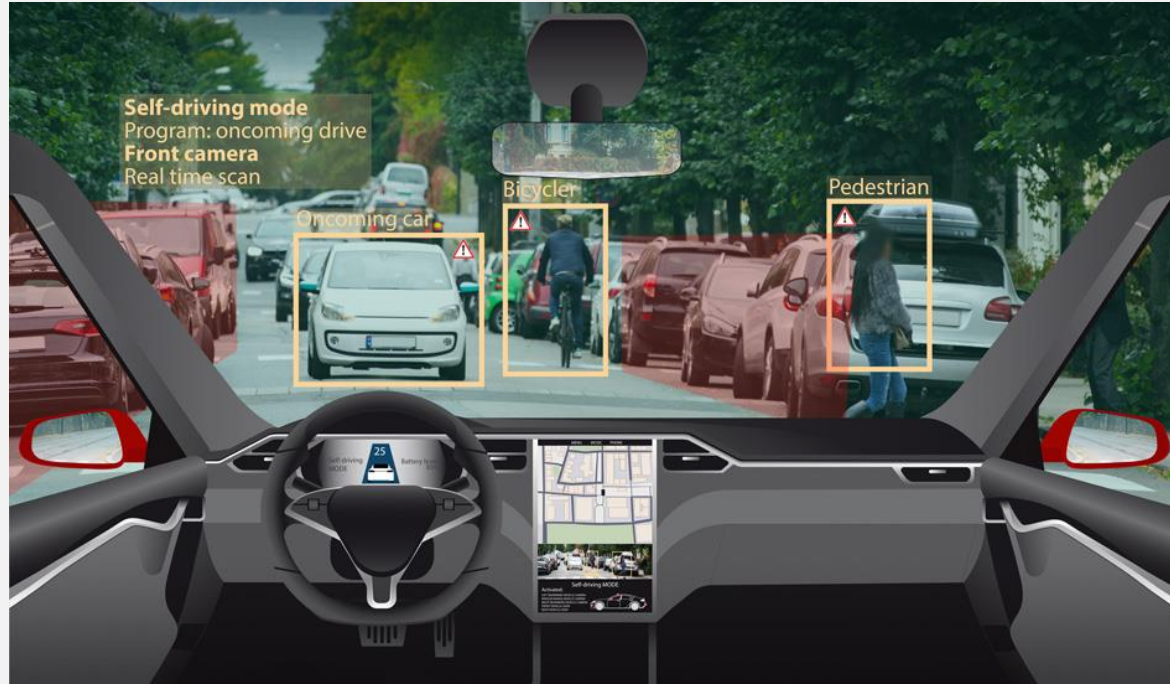
Digital Imaging	Computer Vision	3D Scanning	AI

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Digital Imaging - HDR

Before

After

CEVA

Computer Vision – Pedestrian Detection

3D Scanning

Image source: Fuel3D   CEVA Proprietary Information
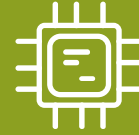
AI - Object Detection & Classification

CV/AI - High Entry Barrier Space

▶ Technology competencies are scarce

▶ AI/Machine learning space has a different domain expertise. Know how exists within the cloud, substantially less at the edge

▶ The complexity and required performance is growing at 2X-4X in every year

▶ Special purpose processors are required as classical GPU, CPU are not performance and power efficient solutions

▶ A holistic view of software and hardware is key to enabling power and performance efficiencies at the edge

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The Four Pillars of CEVA's Holistic Strategy

Specialized,
self contained
AI Processor

A highly parallel
processor for imaging
and computer vision

NN SW compiler
Comprehensive
optimizer
▶ Accuracy
▶ Performance

▶ Optimized imaging
and vision algorithms
▶ SLAM SDK
▶ Point Cloud SDK

NeuPro™

CEVA-XM

CDNN

Imaging &
Vision SW

CEVA®

Tightly Coupled HW and SW
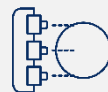
OEM Application Level

Imaging | Apple's ARKit | Google's ARCore | 3D Scanning | AI application | Neural Networks
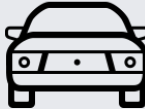
CEVA Optimized SW

CEVA-CV | SLAM SDK | Point Cloud SDK | CDNN SDK

CEVA Dedicated HW

CEVA-XM | NeuPro™ by CEVA

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NeuPro AI Processors Family

Product Name	MAC Configuration			Target Market	
	8x8	16x8	16x16		
NP4000	4096	2048	1024	High-performance edge processing in enterprise surveillance and autonomous driving	
NP2000	2048	1024	512	High-end smartphones, surveillance, robots and drones	
NP1000	1024	512	256	Mid-range smartphones, ADAS, industrial applications and AR/VR headsets	
NP500	512	256	128	IoT, wearables and cameras	

A portfolio of specialized AI processors for AI at the edge

CEVA-XM

A Multi-purpose CV Processor

▶ CEVA invented the category of multi-purpose DSP for imaging & computer vision

▶ Algorithms and applications continuously evolve and expand, requiring a flexible platform to efficiently process both computer vision algorithms and deep neural network workloads

▶ CEVA-XM displaces GPUs or proprietary vision processors with an open platform that is licensable to everyone

▶ CEVA-XM DSP has achieved strong traction and endorsement in tier 1 OEMs and semis for smartphones, ADAS, advanced cameras, drones, surveillance, action cameras, and more

OEMs whose products utilize CEVA-XM powered chips

The CDNN Compiler

Trained Neural Network

Precision Optimization (FP32 to INT8/INT16)

Layers & Tensors Fusion

Memory and Bandwidth Optimization

CDNN

Compiler (Offline)

Retraining INT8/INT16

Layer Dispatching

Multi-Stream Execution

CDNN Runtime

Optimized Inference Engine

CEVA
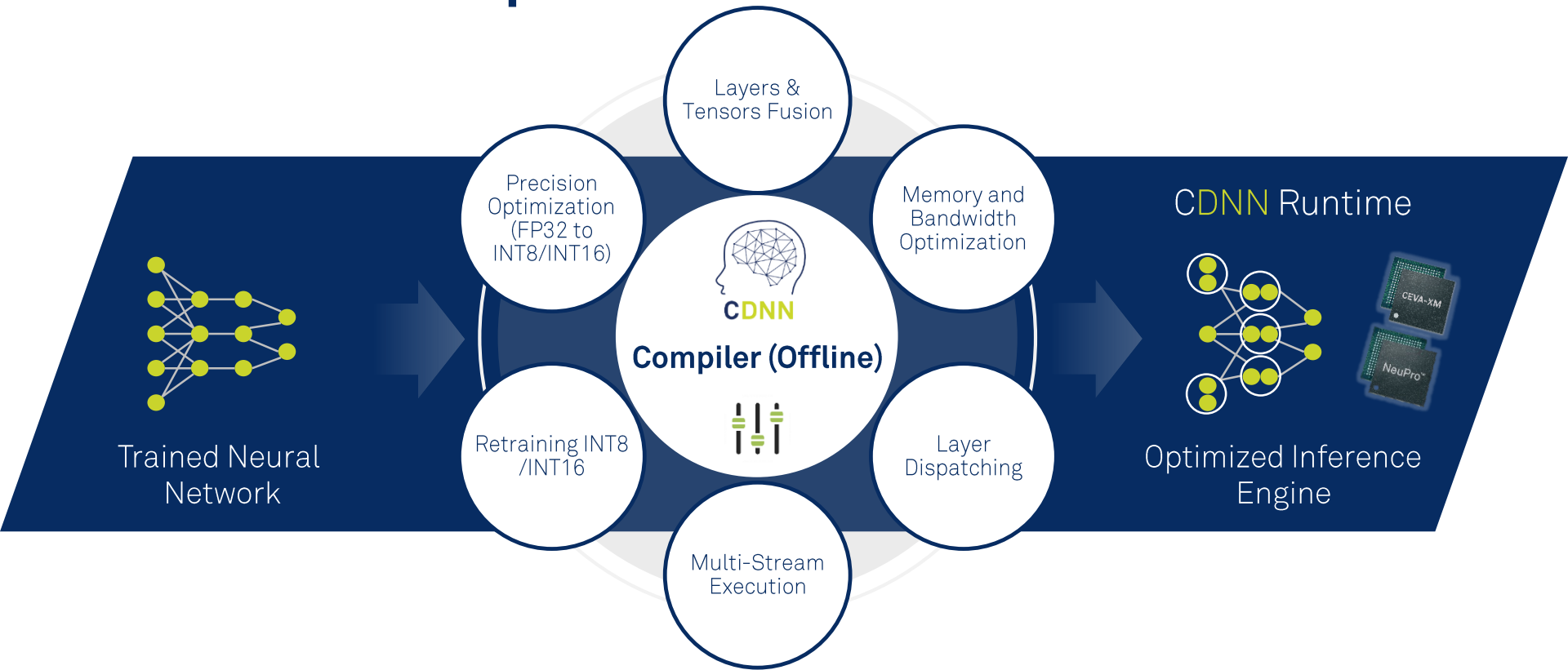
SLAM SDK

▶ Simultaneous Localization And Mapping (SLAM) is the underline technology required for AR/VR, Robots and Autonomous vehicles

▶ A heavy duty workload with both algorithms complexity involved multiple disciplines including new 3D AI

▶ CEVA offers a comprehensive SLAM SDK that streamlines the integration and entry barriers to the 3D world

▶ "Plug & Play" SDK

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3D Scanning – SLAM

Simultaneous localization and mapping
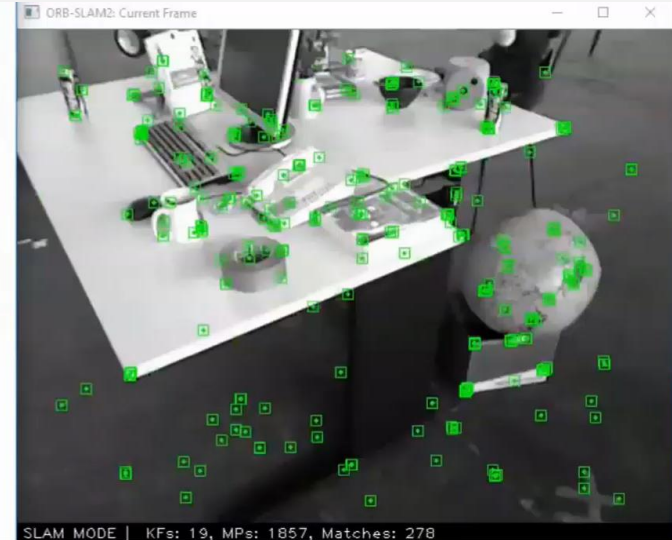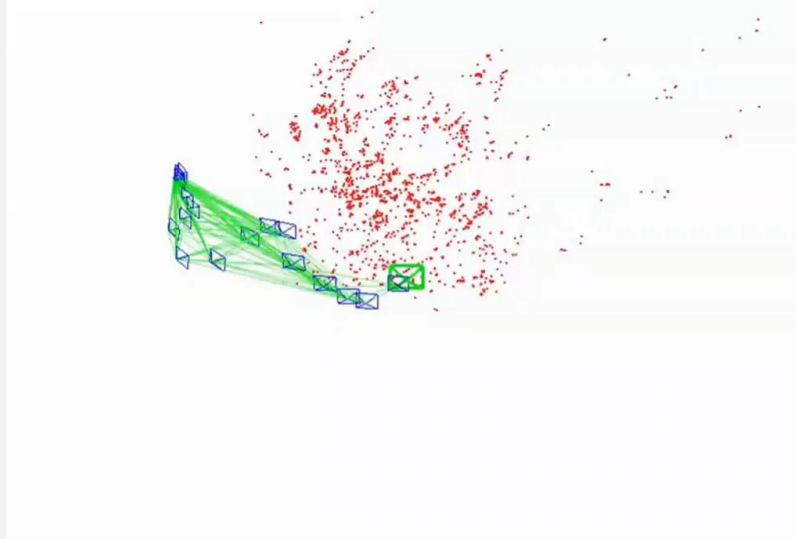
3D scanning is a pre-requisite for AR autonomous robots, self driving cars

Key Takeaways

▶ The market applications for imaging and vision technologies are constantly expanding

- ▶ AI revolutionizes the performance of photography and video
- ▶ CEVA has more than 50 design wins to date for a host of end applications and markets

▶ CEVA addresses this opportunity with a holistic platform, incorporating DSP, AI processors and a broad range of software technologies

▶ New royalty drivers to begin in '19 and '20 include leading surveillance, ADAS and drone customers

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Connectivity

Aviv Malinovitch
Franz Dugand

Market Trends & Opportunities
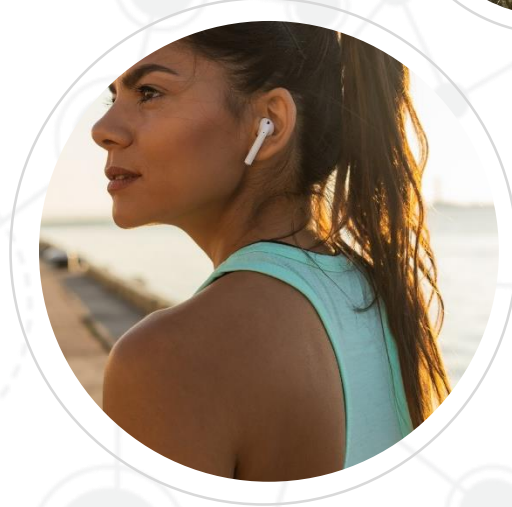
Bluetooth and Wi-Fi Dominate IoT Connectivity

Huge markets, with stable growth projections

▸ Bluetooth – shipping in 5bn devices in 2022

▸ Wi-Fi – shipping in 3.7bn devices in 2022

ABI Research – Q3'2018

Wireless Speakers

Access Points

Smart Home

Automotive

Wearables

Smartphones

Tablets

Smart Appliances

Remote Control

Consumer Electronics

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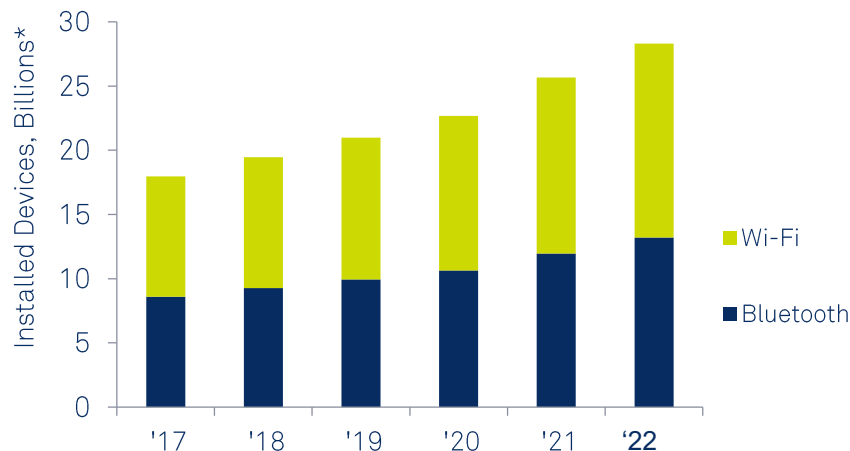
Bluetooth Growth Outlook

Bluetooth LE CAGR from '18–'22 is 24%
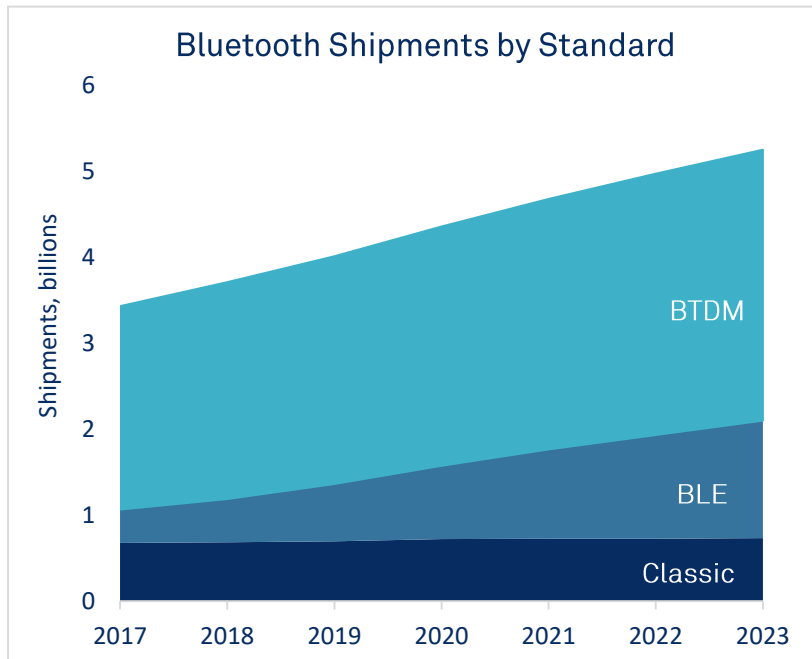
Bluetooth Shipments by Standard

BTDM

BLE

Classic

Shipments, billions

ABI Research – Q3'2018

Market segments with high CAGR

IoT **35%**

Consumer Electronics **31%**

Networking **25%**

Smart Home **21%**

Wearables **19%**

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Bluetooth Low Energy

The standard for data & information use cases

260 Million
Annual Shipments

16	17	18	19	20	21	22
30	99	170	260	360	450	520

620 Million
Annual Shipments

16	17	18	19	20	21	22
380	460	550	620	700	770	850

170 Million
Annual Shipments

16	17	18	19	20	21	22
10	40	90	170	270	350	400
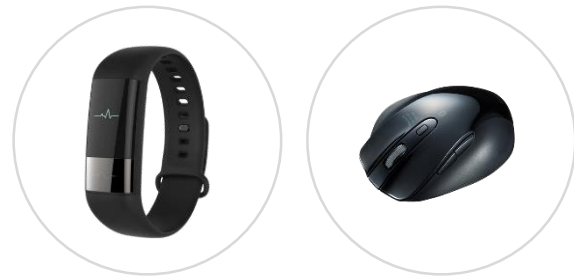
▶ **Location Services:**
- ▶ Point-of-interest info
- ▶ Indoor navigation
- ▶ Asset and item tracking
- ▶ Space utilization

▶ **Data Transfer:**
- ▶ Sport & fitness
- ▶ Health and wellness
- ▶ PC peripherals & accessories

▶ **Device Networks:**
- ▶ Control systems
- ▶ Monitoring systems
- ▶ Automation systems

BT SIG – Apr. 2018

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Bluetooth Dual Mode

The standard today for audio

- ▶ Bluetooth headset/earbuds showing strong growth
  - ▶ However, longer term, this demand switches to audio over BLE (when ratified)
- ▶ Smart speaker market grows 3 times faster than the whole smart home segment
  - ▶ Opportunities for dual mode solutions (combined with Wi-Fi)
- ▶ Bluetooth default in automotive now

970 Million Annual Shipments

Year	Shipments
2013	400
2014	480
2015	560
2016	680
2017	790
2018	880
2019	970
2020	1,070
2021	1,160
2022	1,230

BT SIG – Apr. 2018

CEVA®
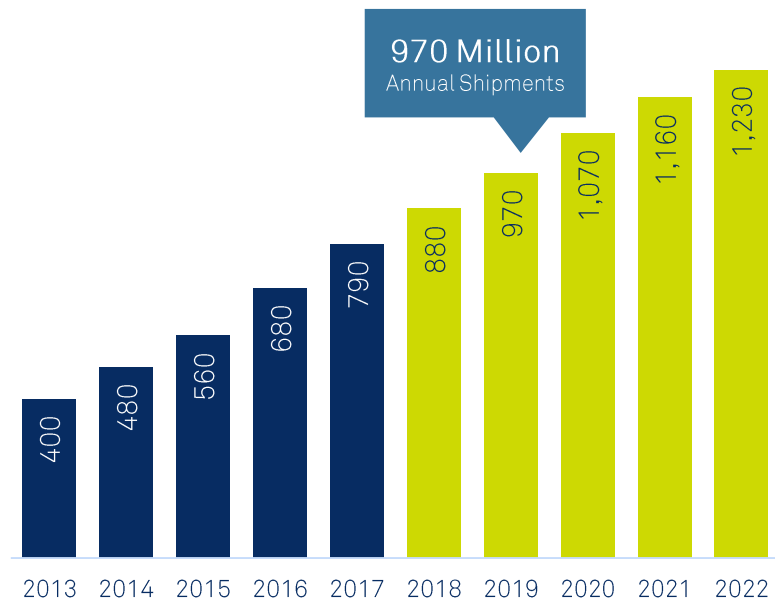
Wi-Fi Growth Outlook

Wi-Fi 6 / 802.11ax CAGR from '18-'22 is 258%
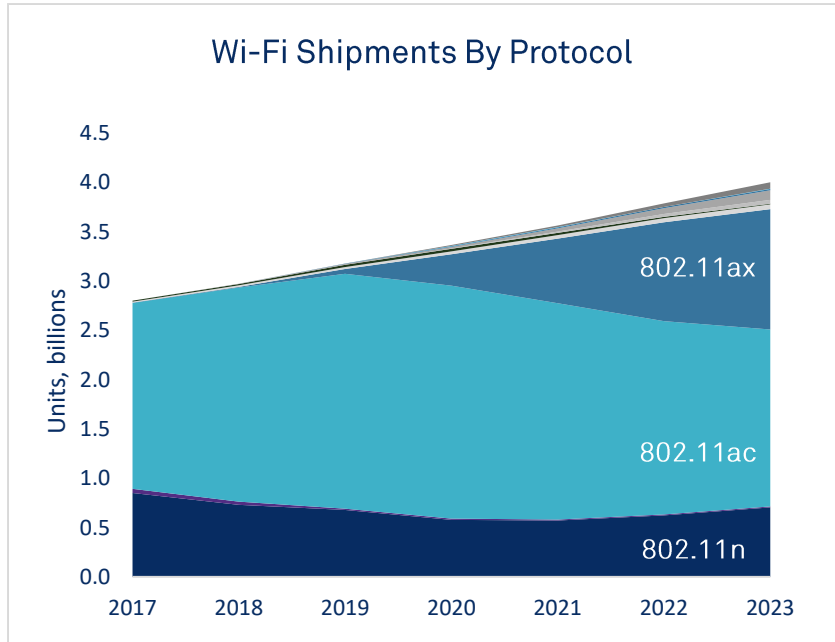
Wi-Fi Shipments By Protocol

802.11ax

802.11ac

802.11n

Units, billions

4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

2017 2018 2019 2020 2021 2022 2023

ABI Research – Q3'2018

Market segments with high CAGR

 IoT **35%**

 Consumer Electronics **31%**

 Networking **25%**

 Smart Home **21%**

 Wearables **19%**

CEVA

Wi-Fi 6 / 802.11ax is a Game Changer

▶ Wi-Fi 6 (802.11ax) will be ratified officially in Aug. 2019
  - ▶ Significantly faster
  - ▶ Improved battery life for devices

▶ Deployment of first access points has started

▶ Licensing already started for ax 1x1 for customers targeting IoT

It provides an optimal solution to all market segments:

Low power – IoT devices

Strong demand to replace 11n 1x1 devices

High performances - Smart home & handset devices

Multi-Gig – High end access point

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The Strategy

The Market Leader for Bluetooth and Wi-Fi IP

- ▶ More than 1.5bn chips shipped to date
  - ▶ 50% annual growth rate between 2014 - 2018
- ▶ More than 150 customers
  - ▶ More than 25 new deals every year
- ▶ Consistently first with latest standards
  - ▶ Already licensing Bluetooth 5.1 and Wi-Fi 802.11ax products

CEVA®

Our Vision: Low Power & Seamless Integration

▶ Low power is key in IoT
- ▶ Special attention is given to low power implementation
- ▶ We enable some of the industry's lowest power BLE chips

▶ We deliver fully integrated Bluetooth / Wi-Fi platforms including uP and sub-system
- ▶ Significant risk reduction of integration work

▶ Integration of Bluetooth and Wi-Fi as a combo

▶ Cross-selling with other CEVA products
- ▶ The only IP company capable of combining IPs of sensing, DSP processing, AI and connectivity

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RW Bluetooth Introduction

IP Market Leader World Wide

Licensing since year **2000**

More than 50 design wins alone from '16 to '18
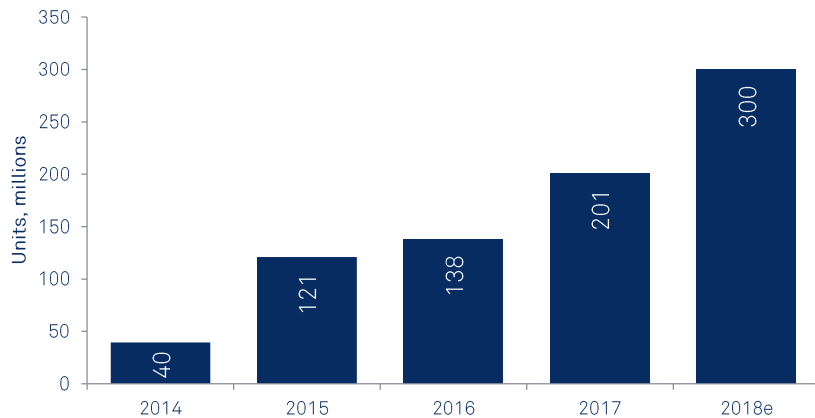
The only IP company to offer **BLE** and **BTDM**

Full solution - lowering the entry barriers/enabling the masses

A significant increase in CEVA's market share since the acquisition of RW in 2014

Shipment of devices with CEVA Bluetooth IP

Year	Units, millions
2014	40
2015	121
2016	138
2017	201
2018e	300

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Highlighted Customers

Dialog
BLE market leader

Sonova
Hearing aid market leader

Beken
Leading IC supplier for wireless applications in China

OnSemi
Offering one of industry's lowest power BLE5 chips

Bluetooth Growth and Go-to-Market Strategy

▶ Offer IPs prior to ratification and reach early engagements with market leaders

▶ Focus on audio over Bluetooth
  ▶ Take advantage of our leading position in Bluetooth and sound

▶ Cross-selling Bluetooth with other CEVA IPs:
  ▶ BTDM with Wi-Fi, Audio DSP, ClearVox, WhisPro, BLE with NB-IoT

▶ Bring more value to our customers by offering:
  ▶ MESH
  ▶ Modem
  ▶ RF
  ▶ Fully integrated platform including RISC-V uP

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RW Wi-Fi Introduction

- Long legacy in Wi-Fi:
  - Licensing since 2002
  - Widely adopted IPs: dozens of customers in Asia, Europe and U.S.

- 11ax 1x1 up to 802.11ac, 11ax 4x4:

Target Application	IP
IoT	802.11ax (20Mhz) 1x1
Smart Home; Handset	802.11ac / ax 1x1, 2x2
Access Point	802.11ac / ax 4x4

More than 10 million CEVA-powered Wi-Fi chips shipped in past 2 years and growing

802.11ax licensing will generate royalty revenue in 2-3 years' time

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Highlighted Customers

Beken
Wi-Fi 4/n chips for IoT and CE

Celeno
Wi-Fi 5/ac 4x4 SoC for access points using RW Wi-Fi IP and CEVA-XC DSP

ASR
Wi-Fi 5/ac for smartphone SoC

SiFlower
Wi-Fi 5/ac access points for China market

Wi-Fi Growth and Go-to-Market Strategy

▶ Focus on Wi-Fi 6 (802.11ax) development:

- ▶ Early engagements with market leaders for IoT and CE
- ▶ Take advantage of CEVA DSP and offer a flexible SW based solution targeting key market players for AP

▶ Cross-selling Wi-Fi with DSP and Bluetooth

▶ Bring more value to customer by offering:

- ▶ Fully integrated platform
- ▶ TCP-IP and Security/Crypto HW engines
- ▶ Highly integrated SW including support of Ali OS and Amazon AWS

Key Takeaways

Bluetooth and Wi-Fi are large and growing markets

CEVA offers a unique IP portfolio enabling customers to integrate CEVA Bluetooth and Wi-Fi IP with other CEVA IPs for comms, voice, vision, sensing and AI

We expect our customer base and our market share to continue to grow

The world's leader in Bluetooth and Wi-Fi IP with a growing customer base and market share

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www.ceva-dsp.com
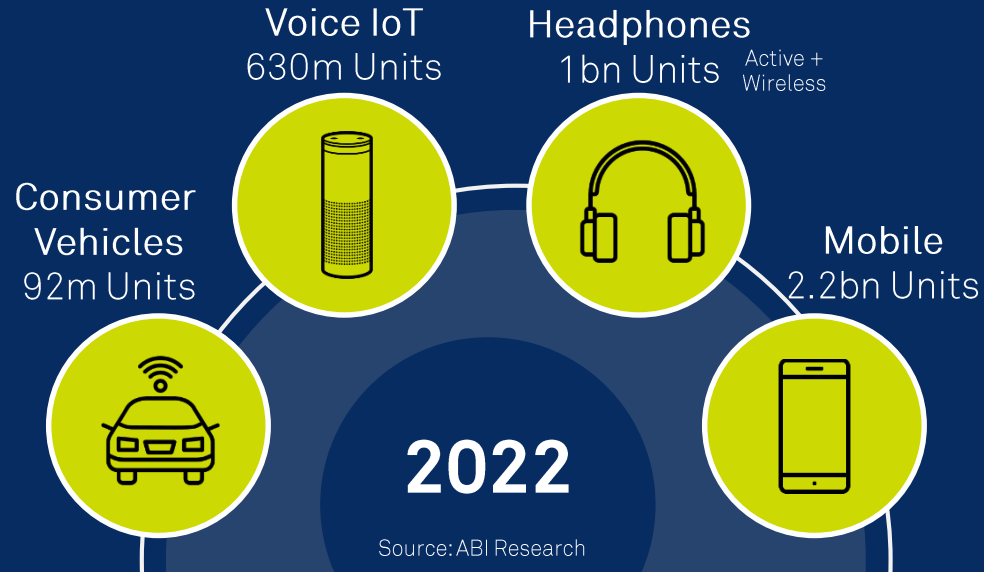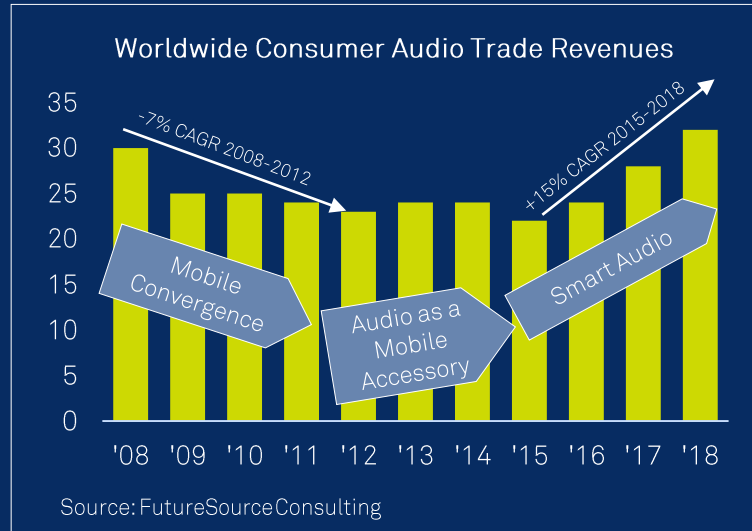
Sound

Moshe Sheier

Market Overview and Trends

"When it comes to consumer audio, we're back in boom time"

Jack Wetherill, Principal Consultant, FutureSource

▶ Huge addressable markets, diverse applications

1. Voice Enabled IoT – voice UI in smart-home/automotive/wearables
2. Headphones – audio/voice in aftermarket headphones/headsets/earbuds
3. Mobile – voice AI in smartphones

Worldwide Consumer Audio Trade Revenues

-7% CAGR 2008-2012

+15% CAGR 2015-2018

Mobile Convergence

Audio as a Mobile Accessory

Smart Audio

'08 '09 '10 '11 '12 '13 '14 '15 '16 '17 '18

Source: FutureSource Consulting

Voice IoT
630m Units

Headphones
1bn Units
Active + Wireless

Consumer Vehicles
92m Units

Mobile
2.2bn Units

2022

Source: ABI Research

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Voice Enabled IoT
The user interface of the future

Why Voice?

Natural, intuitive & personalized

Hands-free, eyes-free interaction

Device-free

Cost/small form factor

Voice – The New UI

Voice UI will dominate multiple markets:
Home, automotive, enterprise, industrial

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Smart Home is Driven by Speech Recognition

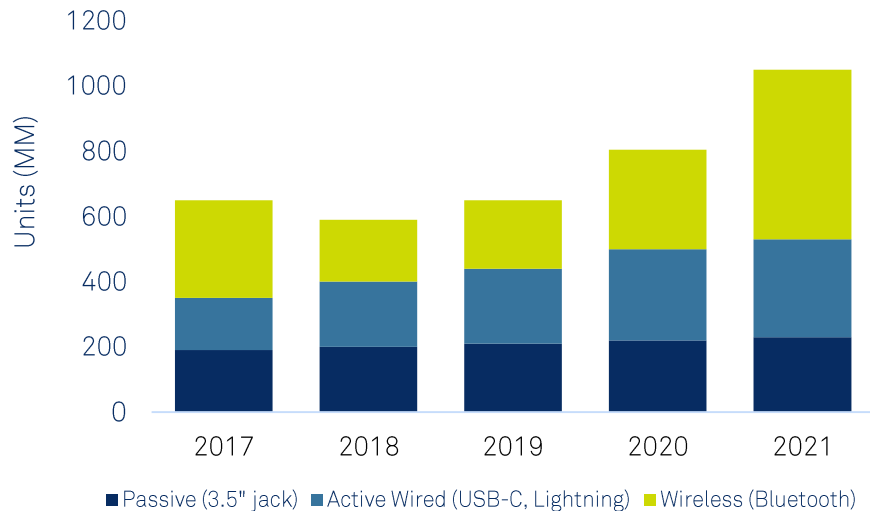| Smart Home Devices by Category, 2017 and 2022 (Value in US$M)			
Product Category	2017 Value (US$Bn)	2022 Value (US$Bn*)	CAGR, 2017-2022*
Video Entertainment	$133	$201	9%
Home Monitoring/Security	$4	$12	23%
Smart Speaker	$4.4	$17.4	32%
Lighting	$1	$3.5	26%
Thermostat	$1.7	$3.9	17%
Others	$17.5	$39	17%
TOTAL	$162	$277	11%

Source: IDC Worldwide Quarterly Smart Home Device Tracker, March 2018

Smart speaker market with the highest CAGR, growing 3 times faster than the whole Smart Home segment

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Headphones are Going Wireless and In-Ear

Headphones After Market Units

Units (MM)

1200
1000
800
600
400
200
0

2017 2018 2019 2020 2021

■ Passive (3.5" jack) ■ Active Wired (USB-C, Lightning) ■ Wireless (Bluetooth)

Worldwide Headphones Market in Value by Form Factor

Retail Value ($ Bn)

30
25
20
15
10
5
0

2016 2017 2018 2019

Total In-Ear

■ In-Ear Excluding True Wireless ■ In-Ear True Wireless ■ On-Ear ■ Over-Ear

▶ Headphones market is growing up to 1.2Bn units in 2021
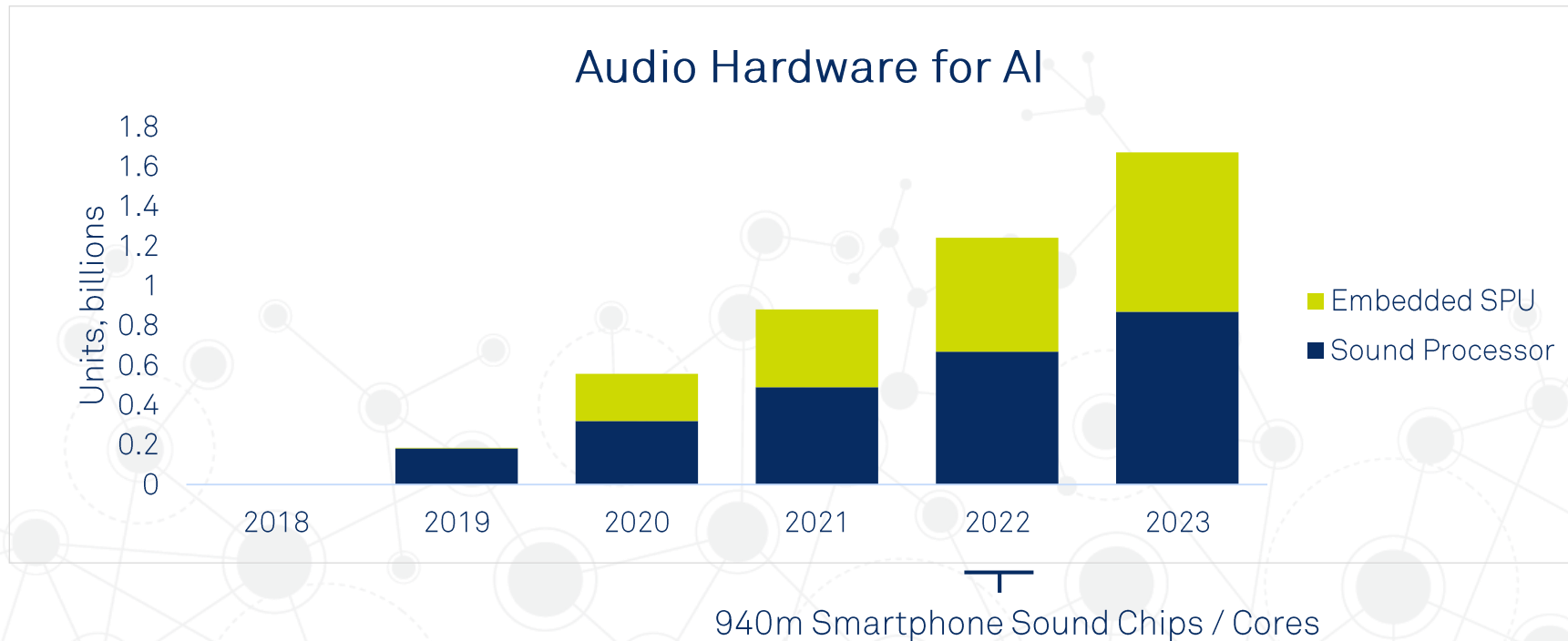
▶ Wireless headphone is the main growing segment

Source: Grand View Research, CEVA estimates
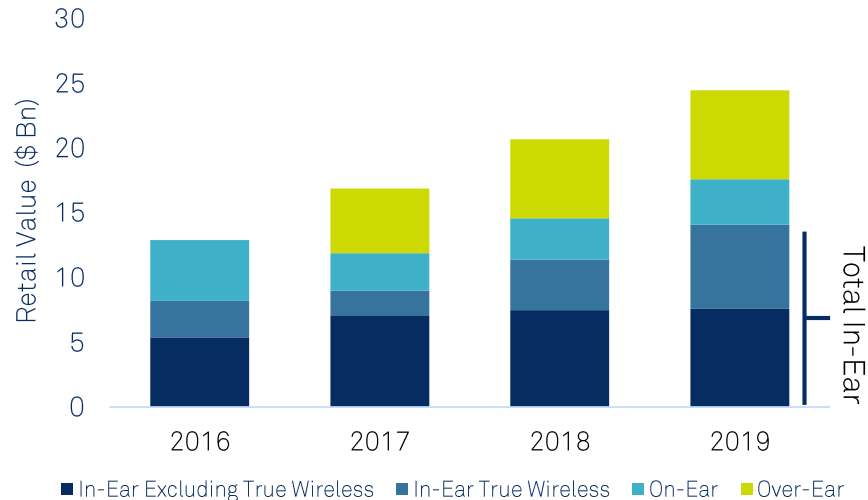
▶ In-Ear Truly Wireless headphone is fastest growing market

▶ Hearables are the next frontier for headphones, helping people who are hard of hearing, but not ready to purchase a hearing aid

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Sound AI in Mobile: ~940m Devices in 2022

Audio Hardware for AI

Units, billions

1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0

2018 2019 2020 2021 2022 2023

■ Embedded SPU
■ Sound Processor

940m Smartphone Sound Chips / Cores

Source: Yole Development, Oct. 2018

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Sound Market Trends

Bluetooth Speakers

Smart Speakers
Voice-enabled IoT
Voice Assistant

Getting Smarter

Headsets

Hearables
Truly-wireless
Voice Control
ANC

Mobile

Voice Assistant
Sound sensing

Required DSP Technologies

- Voice pickup
  - Multi-microphone
  - Beamforming
  - Noise reduction
  - Echo cancellation
- ASR and NLP
  - Voice trigger
  - Voice commands
  - Voice biometrics
  - Natural Language Understanding
- Sound sensing
  - AI at the edge
  - Positional audio
- Audio playback
  - Active Noise Control
  - Post-processing

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The Strategy

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CEVA Sound Market Adoption Today

▶ **Mobile and Headphones**
  - ▶ Smartphones
  - ▶ Smartwatches
  - ▶ Truly wireless earbuds

▶ **Voice enabled IoT**
  - ▶ Smart speakers
  - ▶ Action cameras

30+ sound customers across consumer, automotive, mobile, AI assistants

Unique Value Proposition Sound Portfolio

DSP

- ▶ **CEVA-TeakLite-4**
  Ultra Low Power

- ▶ **CEVA-X2**
  High performance

- ▶ **CEVA-BX**
  DSP + Control + AI
  Hybrid DSP architecture

Software

- ▶ **ClearVox** package for Front-end voice pickup
  - ▶ Noise reduction
  - ▶ Acoustic echo cancellation

- ▶ **WhisPro** speech recognition SDKit

- ▶ **Codecs** for audio/voice

AI

- ▶ **Neural Network** compute libraries

- ▶ **DSP NN SDK**
  - ▶ Android NN API
  - ▶ ARM NN

Differentiation using a comprehensive sound solution

CEVA®

CEVA-BX Multipurpose Architecture

just released

▶ All-purpose DSP plus Controller for broad range of **signal processing** and **real-time control** workloads

▶ Designed to deal with control workload use cases (e.g. sensor fusion, 5G PHY, motor control) plus traditional DSP tasks (beamforming, noise reduction), and neural networks (speech recognition, sound classification) in a single architecture

▶ The "ultimate all-rounder DSP" for modern workloads

4X
More DSP Horsepower

30%
Reduced Code Size

CEVA BX1   CEVA BX2

Compared to CEVA-X

Modern processor architecture, high level programmable, easy to use

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ClearVox Front-end Voice Processing Software Solution

▶ ClearVox software suite includes:

- ▶ Multi-channel Noise Reduction
- ▶ Acoustic Echo Cancellation

▶ ClearVox is available as:

- ▶ ClearVox universal – for smart speakers, DTV, automotive, wearables, and action cameras
- ▶ ClearVox headset – optimized for headsets and hearables
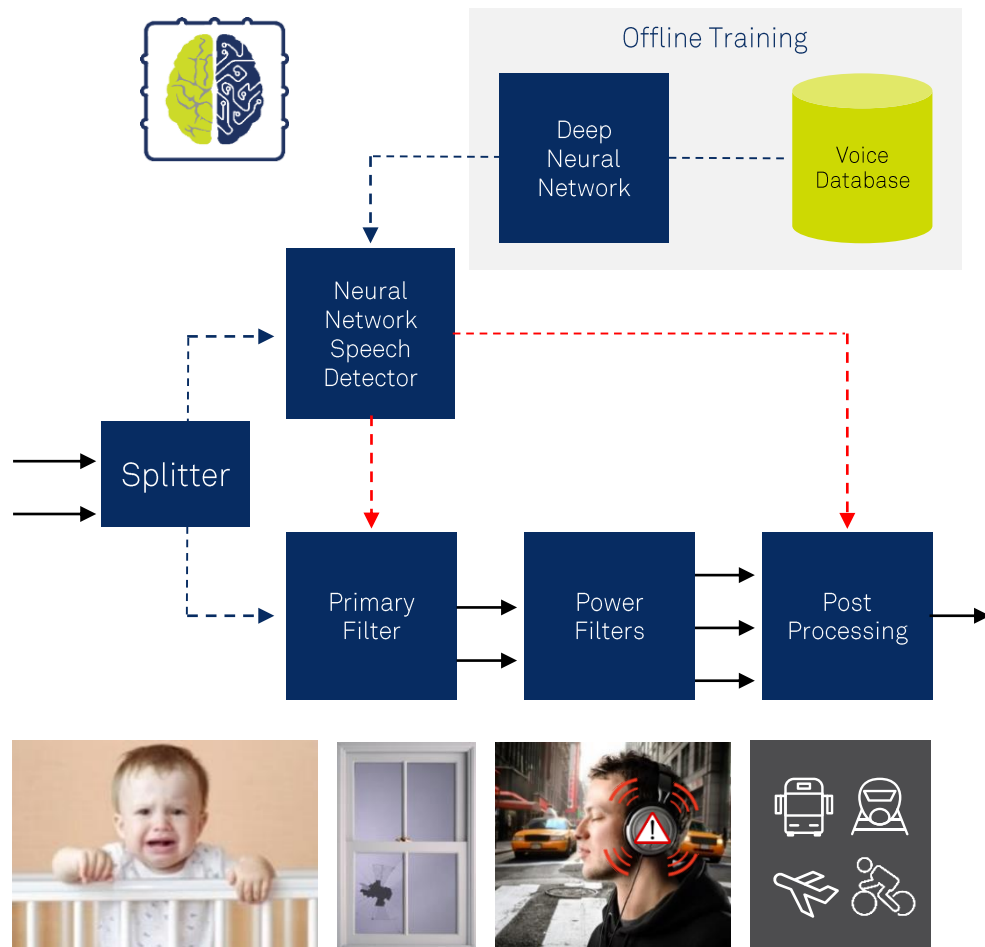
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WhisPro Speech Recognition Software Solution

▶ **WhisPro provides always listening trigger phrase capability for voice-enabled devices**

▶ **WhisPro is based on neural network speech recognition technology**

▶ **WhisPro can be customized to work with any set of customer defined keywords**

Raw Speech

CEVA Voice Trigger

Confidence Score

Detection Flag

just released

CEVA
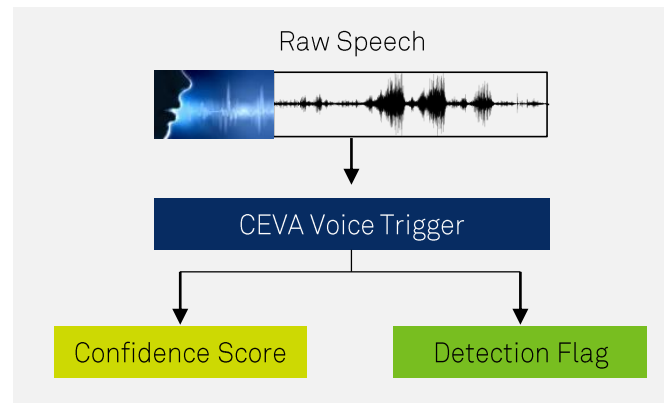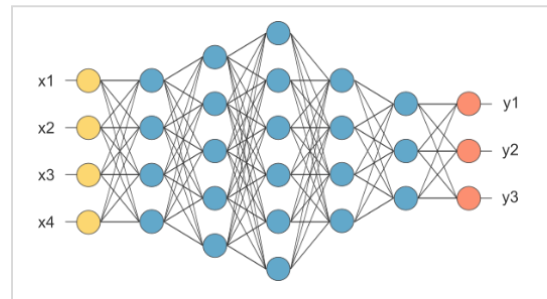
Sound AI at the Edge

- ▶ "Sound AI at the edge" is a must
  - ▶ Privacy
  - ▶ Reliability
  - ▶ Low Latency
  - ▶ Low Power and Cost
- ▶ Employed using Neural Networks
  - ▶ **Deep learning** – offline training with massive data sets
  - ▶ **NN edge inference** – classify/filter real time signals
- ▶ CEVA Sound AI distinctive offerings
  - ▶ Speech recognition
  - ▶ Sound sensing
  - ▶ Customers Proprietary NNs using CEVA sound AI infrastructure

Offline Training

Deep Neural Network — Voice Database

Neural Network Speech Detector

Splitter

Primary Filter → Power Filters → Post Processing

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Go to Market Strategy

▶ One-stop-shop for all sound processing elements

- ▶ **DSP platforms** – leveraging 25 years of CEVA's signal processing expertise to create optimized sound DSPs
- ▶ **Value-added software** – ClearVox noise reduction and WhisPro speech recognition software, not offered by any other DSP vendor
- ▶ **Sound edge AI** – unique NN compute libs and NN frameworks for AI workloads support

▶ High synergy with CEVA's connectivity portfolio

- ▶ **BT** – for headphones market
- ▶ **Wi-Fi** – for smart home market

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Thank You

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China Market Insight

Issachar Ohana

Outline

Semiconductor Market in China

Market Opportunities in China

Insight into CEVA's Customers in China

Summary

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China: in the past …   and in the Future

was disregarded as **a market follower** looking to Silicon Valley for inspiration and know-how…
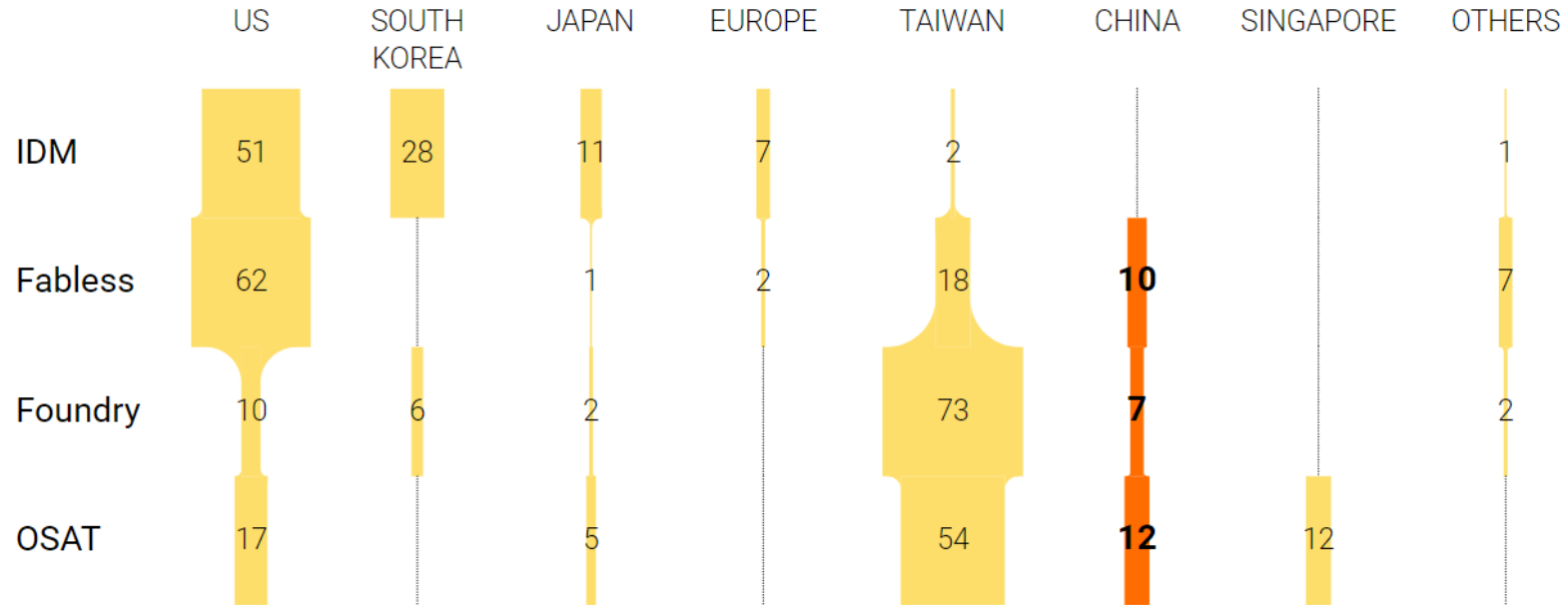
….**no more**

the Century of innovation

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Semiconductor Industry in China

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2015 Worldwide Semiconductor Industry

% of Revenues

|	US	SOUTH KOREA	JAPAN	EUROPE	TAIWAN	CHINA	SINGAPORE	OTHERS
IDM	51	28	11	7	2			1
Fabless	62		1	2	18	**10**		7
Foundry	10	6	2		73	**7**		2
OSAT	17		5		54	**12**	12	

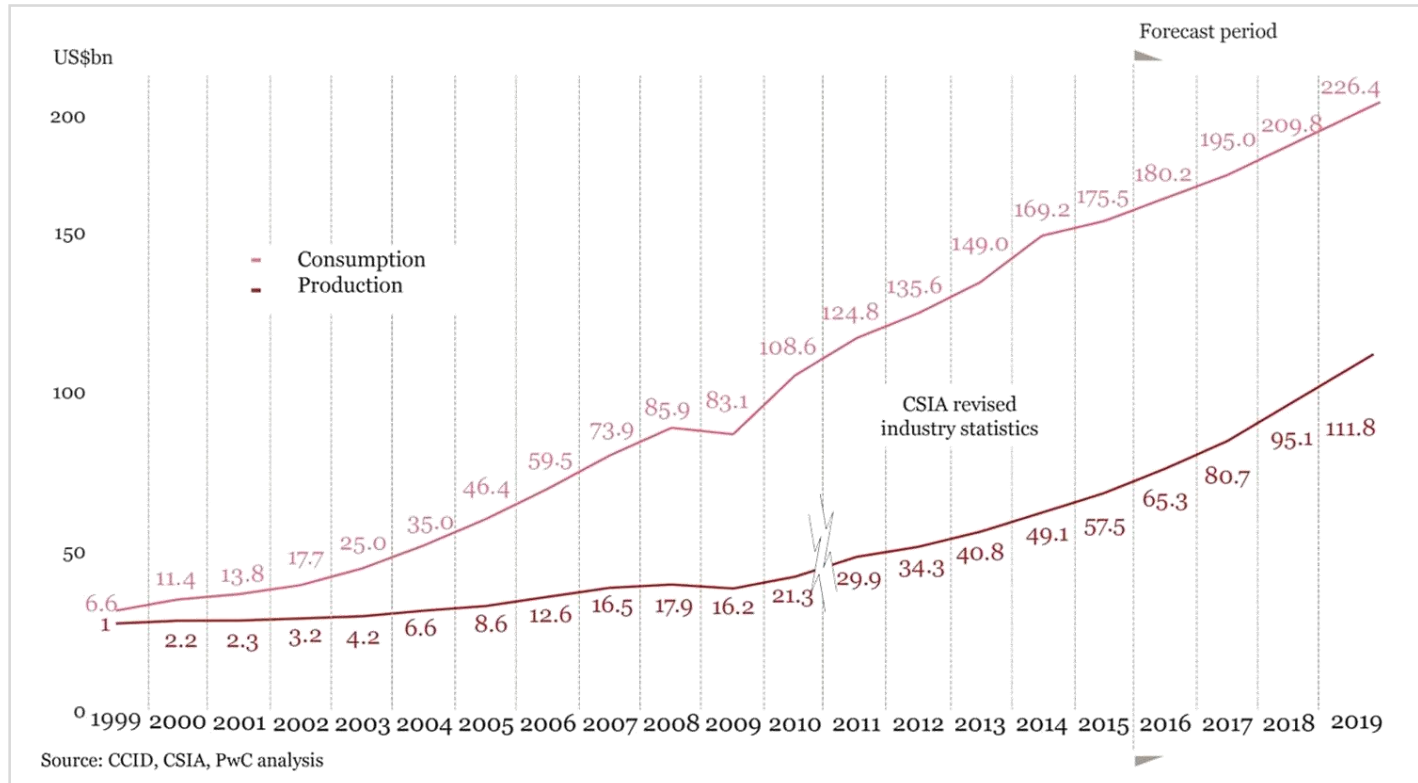OSAT = Outsourced Semiconductor Assembly and Test

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The World's Biggest Semiconductor Consumers

▶ China's demand for chips in the past two decades **has driven the growth of the global semiconductor market**

▶ The country now **consumes more than half of the world's chips**
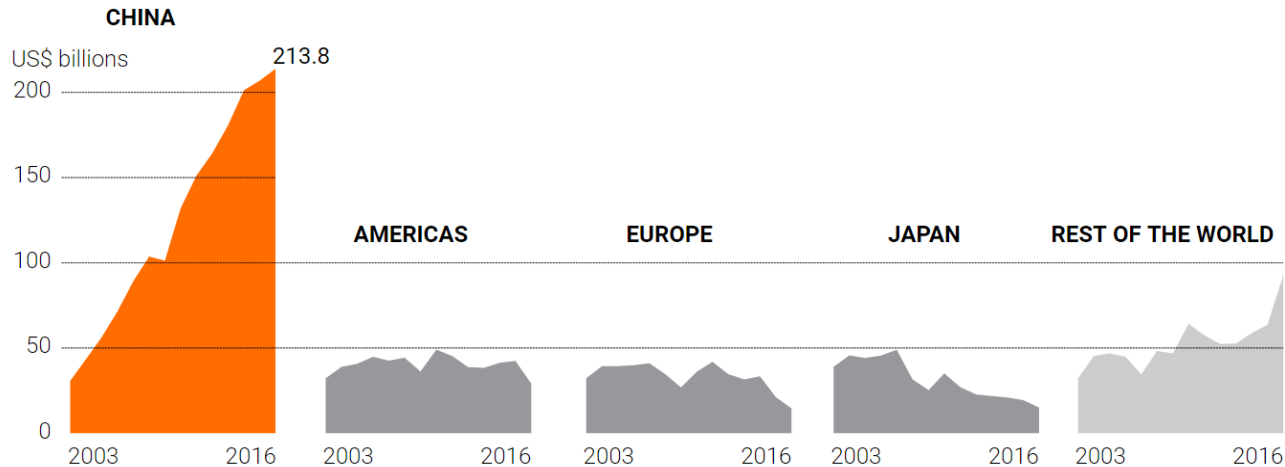
Source: Semiconductor Industry Association, McClean Report 2015, Gartner, CCID

China's IC "gap" Between Consumption and Production, 1999 – 2019

US$bn

Forecast period

Consumption
Production

Source: CCID, CSIA, PwC analysis

CSIA revised industry statistics

Consumption: 6.6, 11.4, 13.8, 17.7, 25.0, 35.0, 46.4, 59.5, 73.9, 85.9, 83.1, 108.6, 124.8, 135.6, 149.0, 169.2, 175.5, 180.2, 195.0, 209.8, 226.4

Production: 1, 2.2, 2.3, 3.2, 4.2, 6.6, 8.6, 12.6, 16.5, 17.9, 16.2, 21.3, 29.9, 34.3, 40.8, 49.1, 57.5, 65.3, 80.7, 95.1, 111.8

1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

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China Semi Industry by Segment

▶ Traditionally, focused on packing and testing

▶ Recently, design work grew 30% annually from 2005 to 2015

Yearly totals in US$ billions

Design   **Manufacturing**   **Packaging and testing**
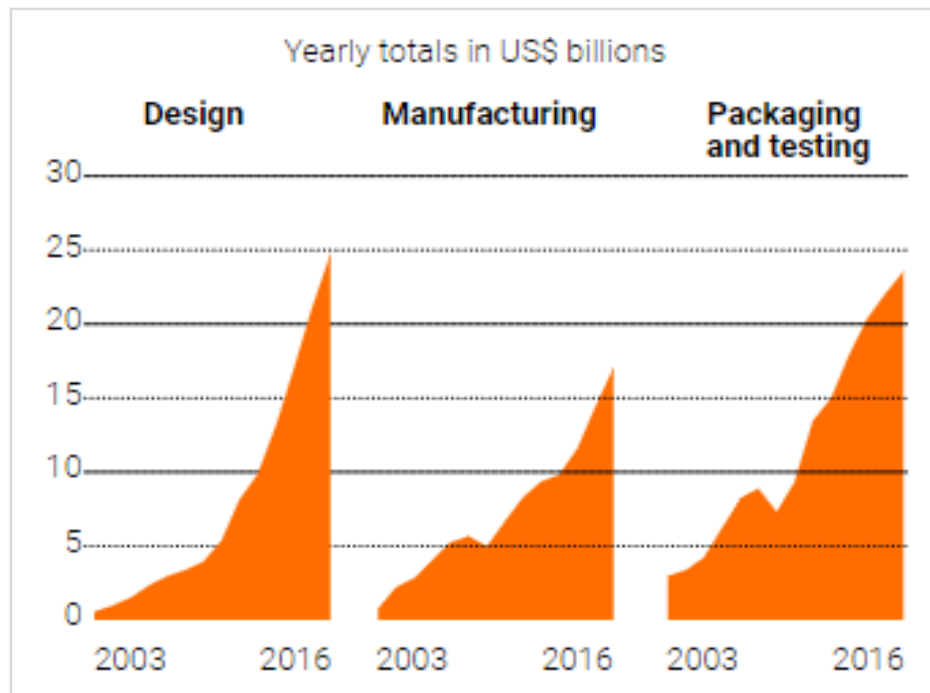
"Made in China 2025"

▶ MIC2025 blueprint sets a strategic goal to:
1. Reach US$305 billion in output by 2030
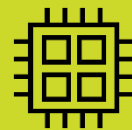   - ▶ In 2017, China produced US$67 billion of semiconductors
2. Meet 80% of domestic demand
   - ▶ In 2016, China supplied 33% of the domestic market

▶ The aim is to
- ▶ close the gap with Western hi-tech industry
- ▶ reduce China's dependency on imported technology

Imports Exports Exports targets

Year	Imports	Exports	Exports targets
2010	143	27	
2011	170	33	
2012	192	53	
2013	231	88	
2014	218	61	
2015	231	69	
2016	227	65	
2017	260	67	
2020			140
2030			305

Include MIC 2025 blueprint targets
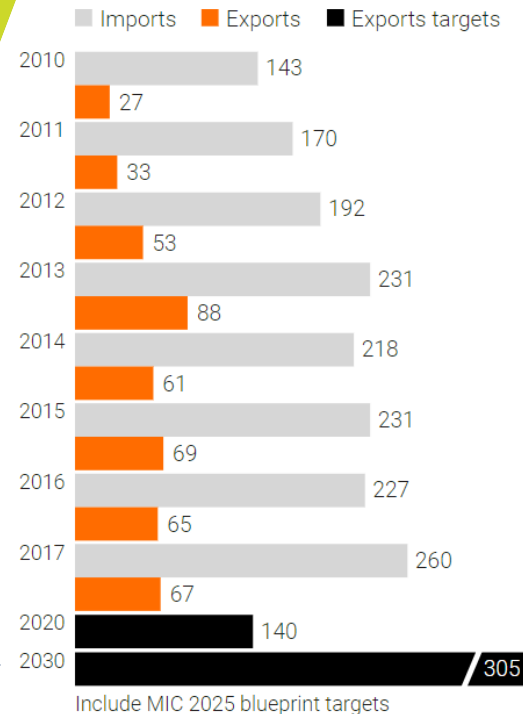
Source: China Semiconductor Industry Association

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Market Opportunities in China

1. 5G
2. AI
3. Surveillance
4. Automotive
5. IoT

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(1) 5G – Cellular

- In 4G, China had 1.1B mobile subscribers by August 2018
  - More than the population of the US, Indonesia, Russia, Japan, and Germany combined
  - However, other countries have taken the lead in wireless communication technology development
- In 5G, China has made it a priority
  - a chance to get out in-front for the first time
- China is determined to own more of 5G infrastructure
  - If "big data" is the new oil of the digital era, then 5G is the pipe that will deliver it
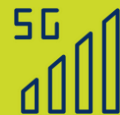
5G – The Race
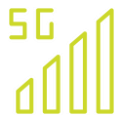
▶ **5G roll-out is in line with the MIC2025 roadmap**
  ▶ Increase broadband penetration nationwide to **82%** by 2025
  ▶ Local suppliers to make **40% of all mobile phone chips sold in China**
  ▶ To become the **world's leading maker of telecom equipment**

▶ **5G to promote IoT, self-driving cars, industrial automation, cloud computing, and AI**
 ▶ These capabilities require the support of the brand-new 5G network

▶ **China owns about 10% of 5G IPR** in radio access, modulation, and core networking (as of 2017)[1]
  ▶ Up from about 7% IPR in 4G

1. LexInnova Technologies, a US legal services and technology consulting firm

China is Leading the Race on 5G

▶ China has 14.1 sites for every 10,000 people, compared with 4.7 in the U.S.[1]

  ▶ 5G will require much more than 4G

  ▶ During 2017, China Tower added approximately 460 sites per day

    ▶ In July 2018 China Tower raised $6.9B in the world's largest IPO in 2 years

  ▶ U.S. tower companies and carriers added fewer sites in the last 3 years than China Tower added in 3 months

▶ Since 2015, China outpaced US by $24B in Wireless infrastructure[1]

  ▶ 350,000 sites in China vs. less than 30,000 in USA

Deloitte: 5G the chance to lead for a decade

Wireless antenna sites per 10,000 people, 2017

Source: Deloitte

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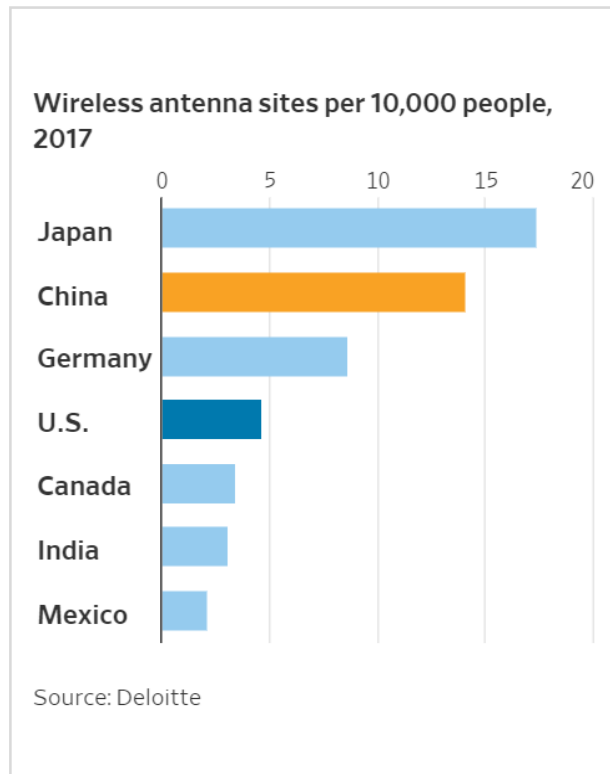
(2) Artificial Intelligence

▶ In 2017, China's government put out its **plan to lead the world in AI by 2030**

   ▶ *"Artificial intelligence has become a new engine of economic development "* (China State Council)

▶ As Google's Eric Schmidt has explained,

   ▶ *"It's pretty simple. By 2020, they will have caught up. By 2025, they will be better than us. By 2030, they will dominate the industries of AI"*

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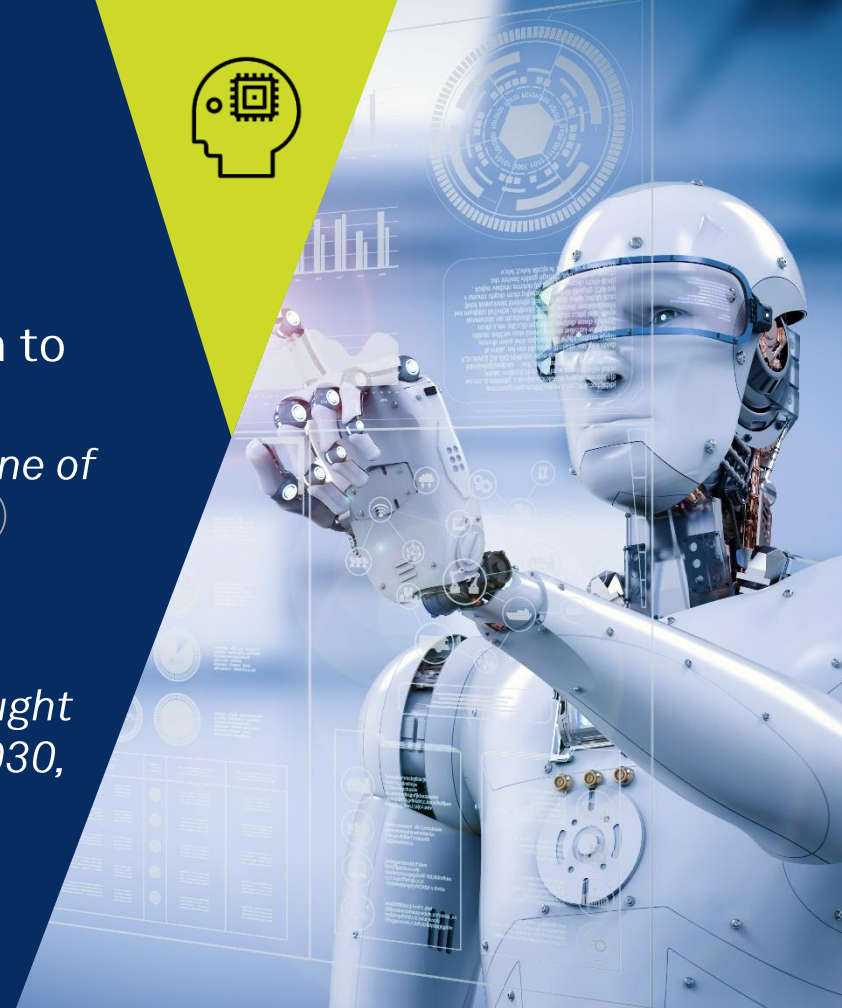
China: AI Superpower

▶ In July 2017, China's government issued its plan to become the global center of AI innovation

   ▶ Aiming for a RMB 1T (about US$150B)

▶ Within a year, Chinese VC investors were pouring record sums into AI startups, surpassing the US to make up 48% of AI Venture funding *globally*

   ▶ As of April 2018, China is home to 168 unicorns, collectively valued at over $628 billion.

▶ Smart cities like Xiong'an New Area are building out entire AI cities in the next two decades, centered around autonomous vehicles, solar panel-embedded roads, and computer vision-geared infrastructure

China Dominates Global AI Funding

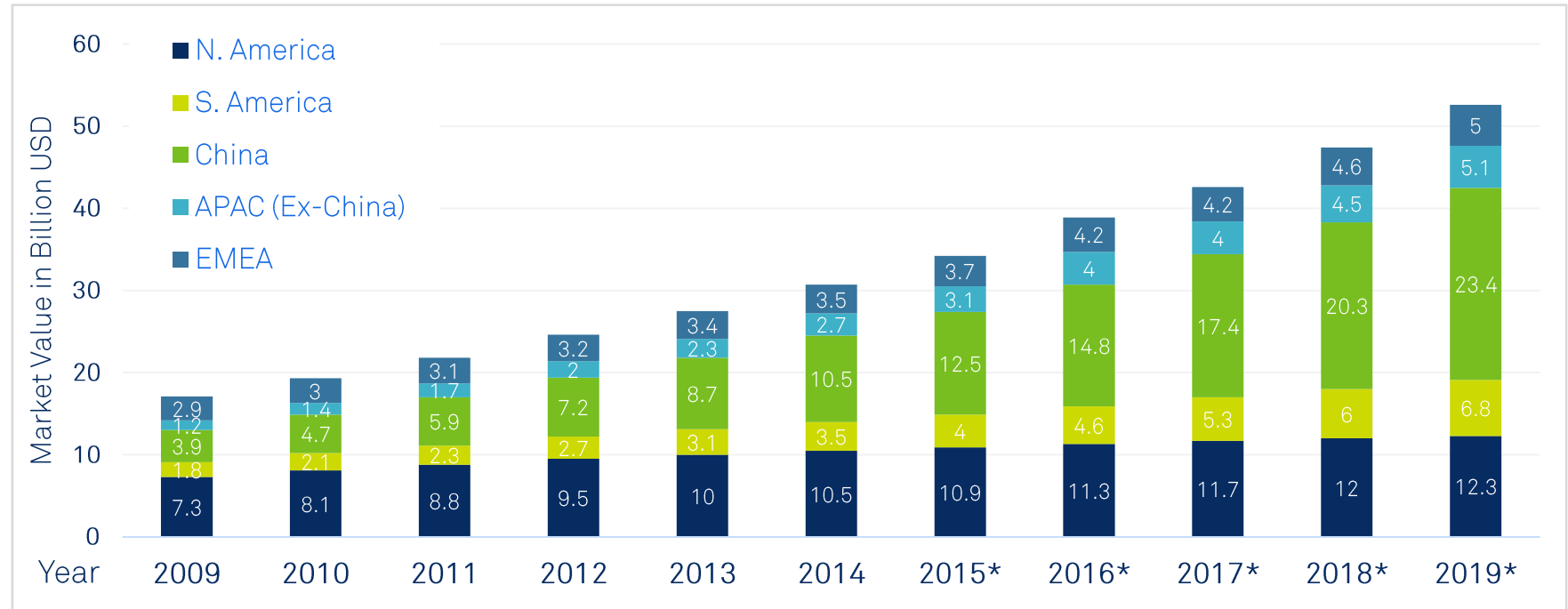US vs. China total equity funding to startups in 2017

48%
China equity funding share

38%
US equity funding share

13%
Other

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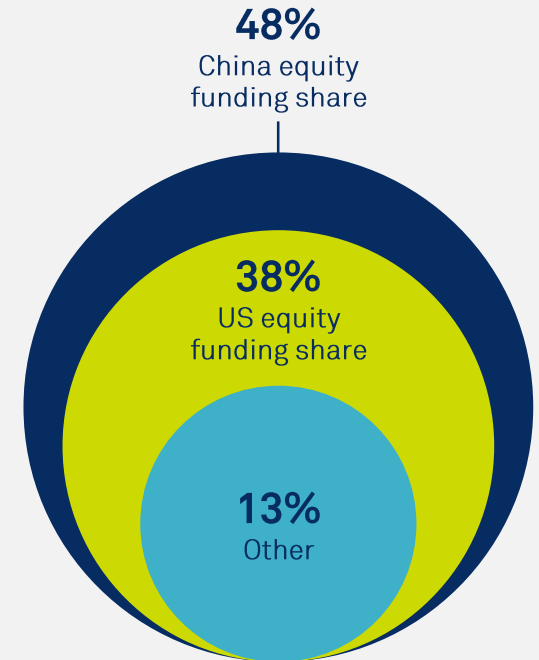
(3) Surveillance

▶ China surveillance market is expected to reach $24Bn in 2020

▶ China's video surveillance market annual growth rate is 15%

▶ The "Thirteen-Five" period (2016-2020) is a key period for China's video surveillance industry

  ▶ Road traffic infrastructure buildout

  ▶ Construction of "Safe Cities"

  ▶ Video surveillance extends to the less developed areas

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Global Video Surveillance Market

2009-2019 by region (in billion USD)

Year	2009	2010	2011	2012	2013	2014	2015*	2016*	2017*	2018*	2019*
EMEA	2.9	3	3.1	3.2	3.4	3.5	3.7	4.2	4.2	4.6	5
APAC (Ex-China)	1.2	1.4	1.7	2	2.3	2.7	3.1	4	4	4.5	5.1
China	3.9	4.7	5.9	7.2	8.7	10.5	12.5	14.8	17.4	20.3	23.4
S. America	1.8	2.1	2.3	2.7	3.1	3.5	4	4.6	5.3	6	6.8
N. America	7.3	8.1	8.8	9.5	10	10.5	10.9	11.3	11.7	12	12.3

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(4) Automotive

- In 2017, 29M new vehicles sold in China
  - More than US, Japan and India combined
  - Expected to reach 37M by 2025
    - 25% will be Level-2 or Level-3 autonomous vehicles
    - Level-4 and Level-5 autonomous vehicles will start entering the market by 2025
- China is likely to emerge as the world's largest market for autonomous vehicles and mobility services
  - worth more than US$500 billion by 2030

Source: Chinese Ministry of Industry and Information Technology's 2017 Development plan.; McKinsey, April 16, 2017

(5) IoT

▶ Backed by government support, China is betting big on the IoT

   ▶ China is major supplier of the components

   ▶ By 2020, there will be 200bn IoT connected components and devices globally

      ▶ of which 95% will be manufactured in China

▶ The Industrial IoT market in China is growing by about 25% per annum

   ▶ to reach almost 300 billion yuan (US$47 billion) in 2018 (see chart)

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Insight to
some of **CEVA** **Customers** in China

- A Leading fabless semiconductor for Mobile Communication (2G/3G/4G/5G) and IoT

- A subsidiary of Tsinghua Unigroup
  - More than 4,500 staff (as of January 2018)
  - 14 Design Centers worldwide

- Was created through the combination of **Spreadtrum and RDA, both longtime CEVA licensees**
  - Multiple DSPs and connectivity technologies
  - Intel made $1.5bn investment for 20% of Tsinghua

- Targeting revenue growth of 20% in 2019 for India

- **New CEO was appointed** in November 2018

CEVA

World leader in communication and IT

- Publically traded (HKEX:763, SZSE: 63)
- Worldwide customer base in 160 countries

Tier-1 Cellular Infrastructure

- CEVA powering Cellular Base stations
- CEVA powering NB-IOT

Recovered and resumed orderly business after US government lifted a ban that suspended operation

Key contributor to 5G standard bodies

- Declared **More than 1,000 family of 3GPP 5G SEP** (Standard Essential Patents) to ETSI (European Telecommunication Standardization Institute)

▶ **World leader in commercial and civilian drones**

  ▶ Over 70% Market share

  ▶ HQ in Shenzhen with manufacturing facilities around the world

▶ DJI's **proprietary communication powered by CEVA** (remote-control to drone)

▶ DJI's **proprietary collision avoidance powered by CEVA** (CV and AI)

▶ In 2017, DJI won a Technology & Engineering **Emmy Award** for its camera drone technology

  ▶ Providing directors and cinematographers an affordable and accessible platform to create low-altitude aerial images

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artosyn
酷芯微电子

High-performance intelligent vision and AI platform company

- Located in Shanghai, Founded in 2011

Powered by CEVA's CV DSP and CDNN

- Object detection, classification, tracking, and more
- Targeting robotics, drones, VR, surveillance, ADAS,...

Customers using Artosyn for:

- Unmanned retail
- Vacuum robots
- CAR DVR w/ ADAS
- Face and object detection camera, etc.

Customers Include

Alibaba Group
阿里巴巴集团

JD.COM

mi 小米
xiaomi.com

dji

CEVA

- ▶ **Leading wireless audio SoC supplier**
  - ▶ Founded in 2015
  - ▶ Excellent low-power RF/PMU
  - ▶ Powered by **CEVA's Bluetooth**
- ▶ **Wireless Speakers, Wireless Stereo, Wireless ear pods...**
- ▶ **Powering Huawei Freebuds**
  - ▶ Bone Voice –for e-commerce (Alipay, Wechat)
  - ▶ Voice assistant, wireless charging
  - ▶ More advanced than Apple's Airpods
- ▶ **Just won tier-1 US based earbud design**

Customers Include

CEVA

▶ IC solutions for wireless applications

▸ Powered by **CEVA's DSPs, Wi-Fi and Bluetooth**

▸ Founded in 2004, based in Shanghai
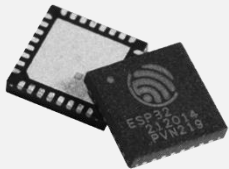
▶ Low-power Bluetooth

▸ Voice remote control, computer mouse, wireless POS

▶ Low-power Bluetooth Audio

▸ **Headsets, smart headsets,**
Smart **Headset**: voice activated, voice control, smart surround speaker

▶ Low-power IoT

▸ **Smart Plug** (Wi-Fi,), **Smart Light** (Wi-Fi, BLE, and BLE Mesh), Early Learning **Robot Story Machine** (Wi-Fi, Audio, Bluetooth)

▶ **Espressif Systems**

- ▸ Multinational, fabless semiconductor company
- ▸ Founded in 2008
- ▸ Headquarters in Shanghai
  - ▸ offices in Greater China, India and Europe

▶ **Wi-Fi+Bluetooth low-power IoT Solutions**

- ▸ Powered by CEVA's Bluetooth

▶ **Named "Cool Vendor in IoT 'Thingification' in 2016" by Gartner**

▶ **Partnering with industry leading IoT platforms**

- ▸ Baidu DuerOS & ABC-STACK, Huawei HiLink, Haier, Microsoft Azure, Amazon AWS, Xiaomi, Alibaba, JD.com Joylink, Apple's HomeKit, etc.

▶ **In 2018 received investment from Intel Capital**

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Summary

▶ CEVA's **broad IP portfolio** is an excellent fit with **China's strategy for homegrown semi industry**

 ▶ We are enabling our customers to develop leading-edge products

 ▶ We are well positioned to benefit from MIC2025

▶ **Widely deployed with 3 offices in China**

 ▶ Shanghai, Beijing, and Shenzhen

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Thank You

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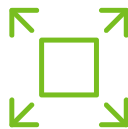# Growth Strategy Implications and Financial Targets

Yaniv Arieli

Business Model Designed for Long Term Growth

Revenue Growth

▶ Diversified product portfolio generates strong licensing demand in multiple growth markets

▶ We share in our customers' success through a royalty scheme

Margin Expansion

▶ Licensing deals are pre-cursor to royalties

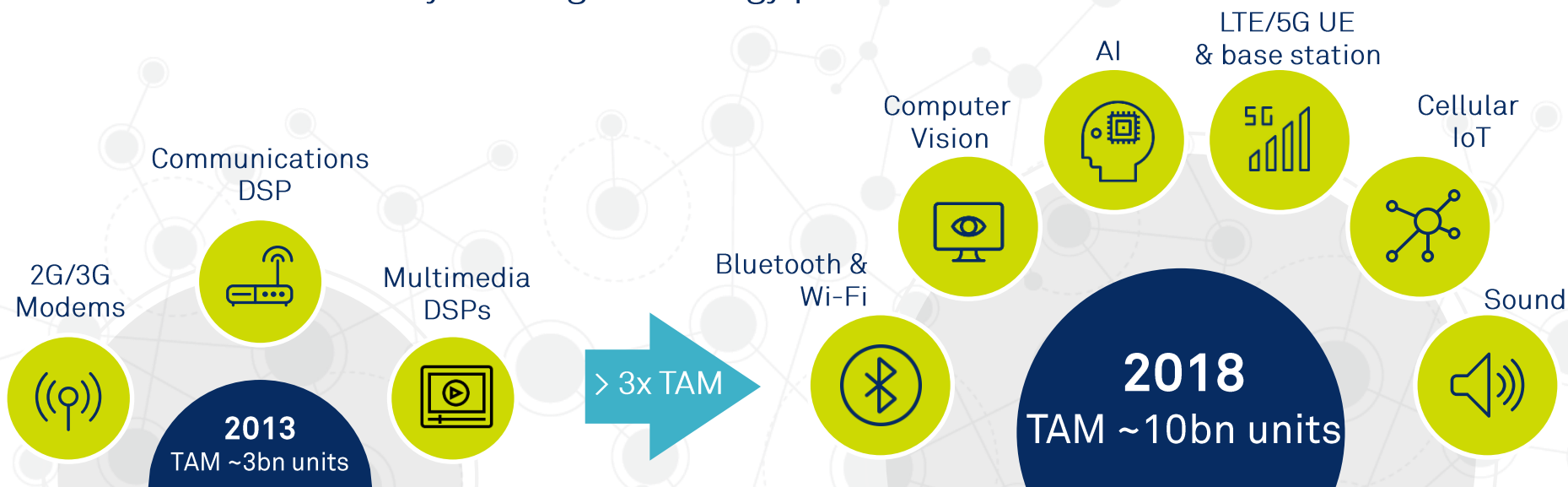▶ Royalties generate ~100% gross margin

▶ As royalties grow, so do margins

Capital Allocation

▶ Investments in R&D

▶ Strategic M&A opportunities

▶ Opportunistic stock buybacks

Focused on Delivering Long Term Stockholder Value

CEVA

Technology is Our DNA

- CEVA is a technology-centric company, with unique and scarce expertise that applies to multiple, expanding markets

- CEVA has transformed into a highly diversified organization with an with industry-leading technology portfolio

2G/3G Modems

Communications DSP

2013
TAM ~3bn units

Multimedia DSPs

> 3x TAM

Bluetooth & Wi-Fi

Computer Vision

AI

LTE/5G UE & base station

Cellular IoT

Sound

2018
TAM ~10bn units

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Investment in R&D

R&D investment strategy

- Grow R&D to address new market opportunities
  - Grew R&D from 125 to 278 headcount since end of '13
- Expand product portfolio to increase TAM and address diversified markets
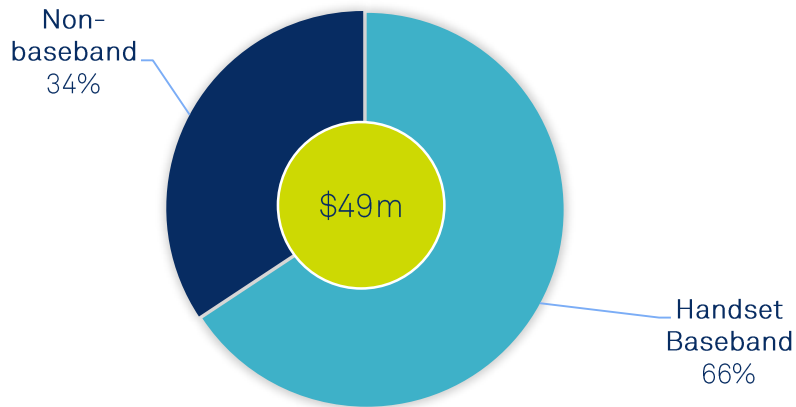- Growing licensing revenue and customer base are the metrics for success

M&A strategy

- Look for synergistic businesses in the semiconductor space
- Technology that can cross-sell to existing customer base and allow us expand into new customers
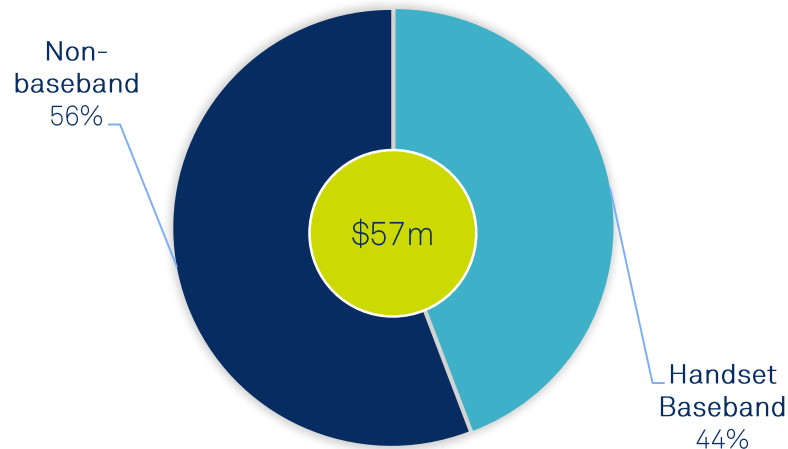- Mature/proven technology
- Should be accretive in first year

$250 million invested in R&D in last 10 years

Cumulative R&D investment, $millions

09 10 11 12 13 14 15 16 17 18e

CEVA®
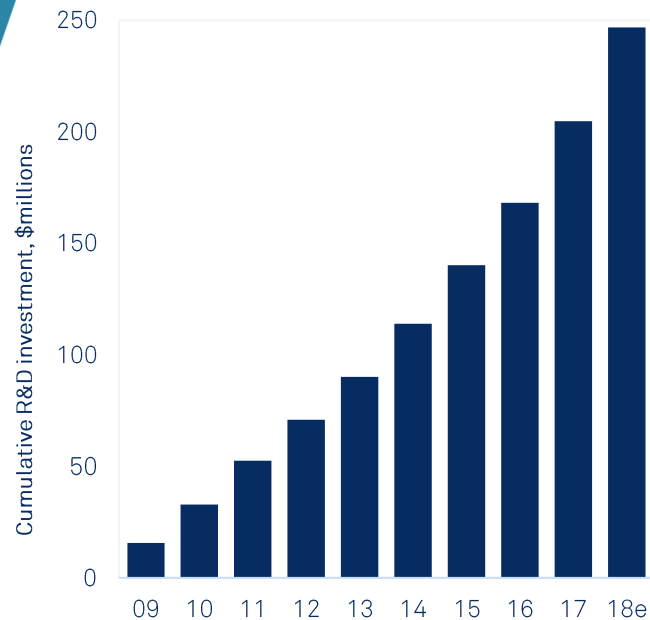
Diversification Creates Growth and Stability

2013 Revenue Breakdown

Non-baseband 34%

$49m

Handset Baseband 66%

~3bn unit TAM in 2013

Q1-Q3 2018 Revenue Breakdown

Non-baseband 56%

$57m

Handset Baseband 44%

~10bn unit TAM in 2018

Licensing Growth Through Diversification

10 Year Licensing Revenue

Licensing Revenues, $millions

diversified portfolio

2009 2010 2011 2012 2013 2014 2015 2016 2017 2018e
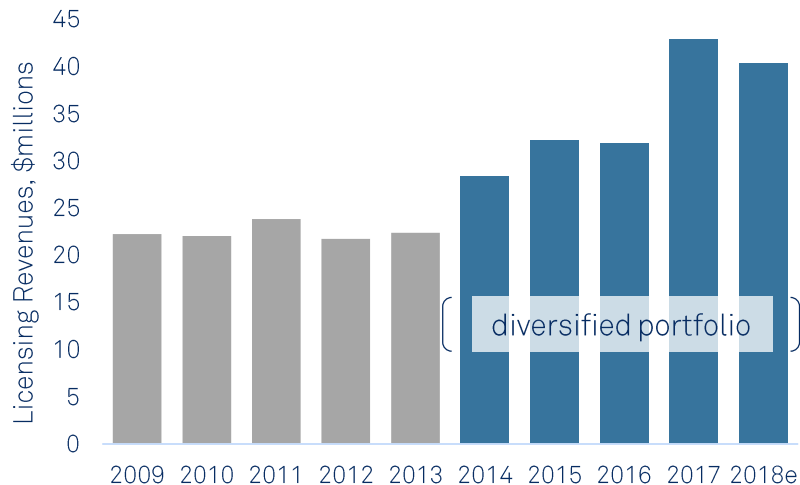
More than $280 million in licensing revenue generated

10 Year Deals Signed

Number of deals signed

diversified portfolio

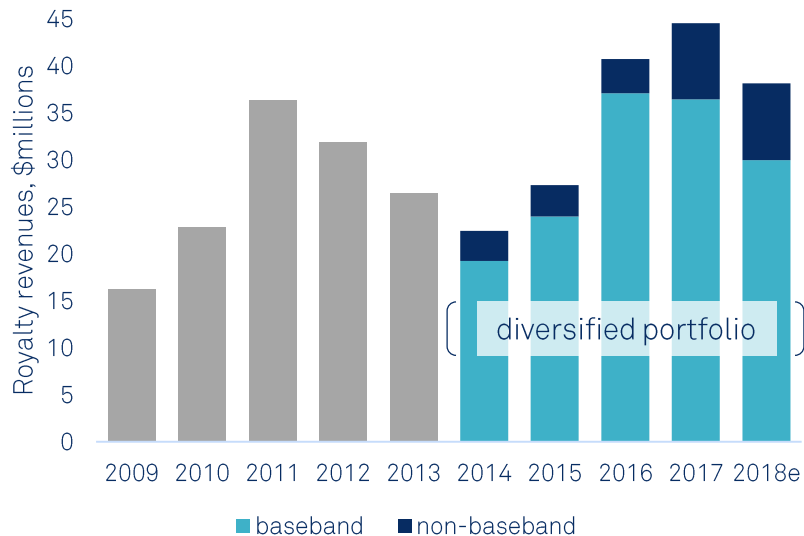2009 2010 2011 2012 2013 2014 2015 2016 2017 2018e

- baseband - non-baseband
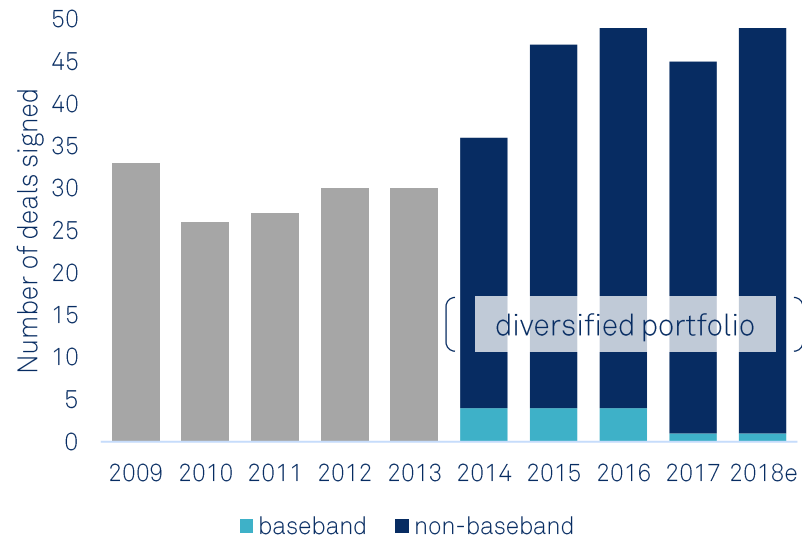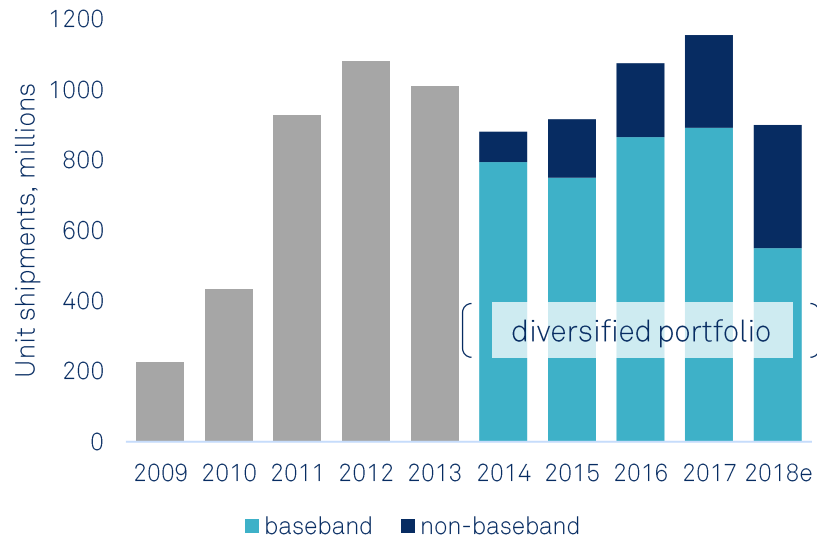
~300 non-baseband deals signed

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Royalty Mix-shift Through Diversification

10 Year Royalty Revenue

More than 9 billion units shipped in past 10 years

10 Year Royalty Shipments

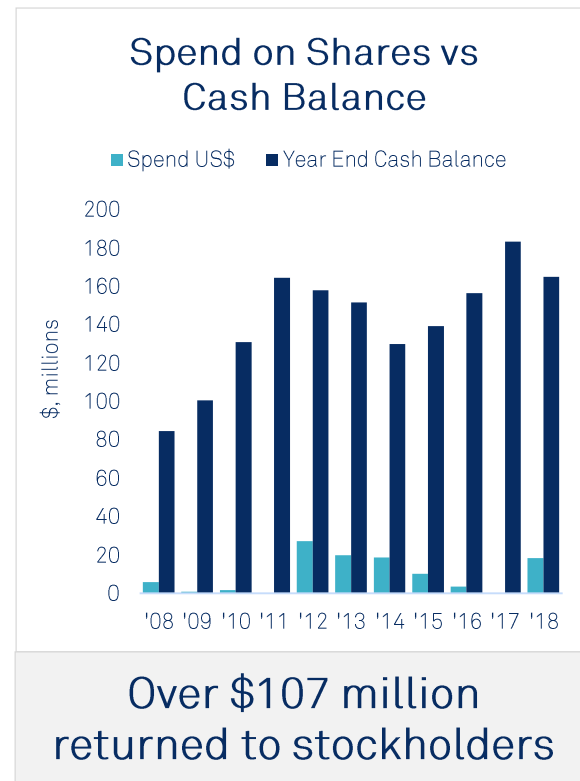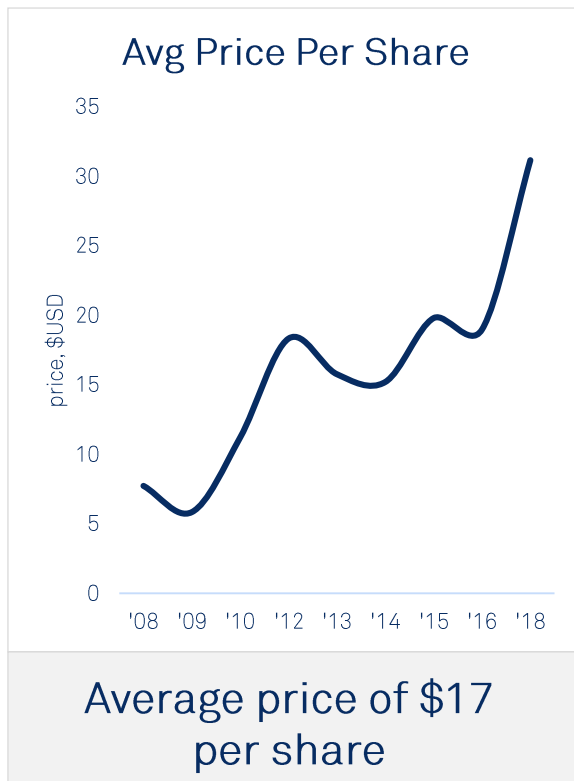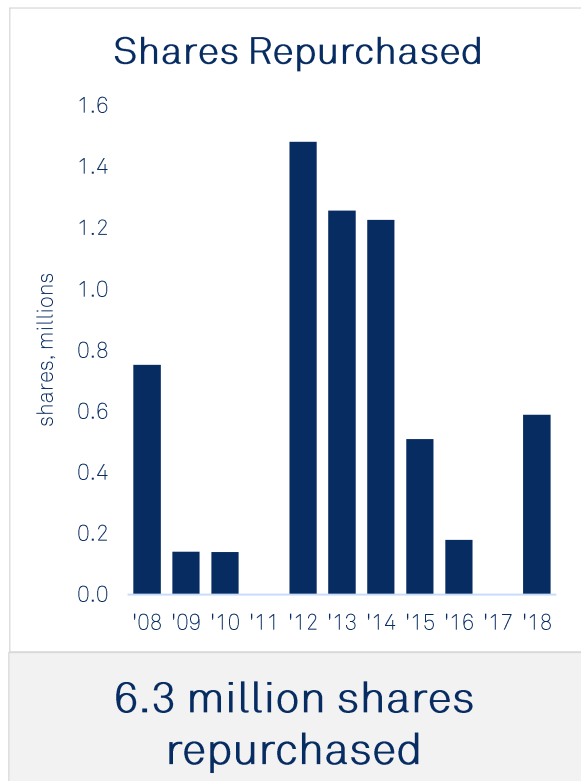**More than $300m royalty revenue generated in past 10 years**

CEVA

Creating Long Term Stockholder Value

▶ Penetrating new, growing markets where CEVA can leverage its unique expertize
  ▶ e.g. base stations

▶ Continued efforts to innovate and lead the semiconductor space, leveraging talented R&D team

▶ Cash return to stockholders
  ▶ More than $107m over 10 years

Creating Long Term Stockholder Value

Shares Repurchased

6.3 million shares repurchased

Avg Price Per Share

Average price of $17 per share

Spend on Shares vs Cash Balance

Over $107 million returned to stockholders

CEVA

Creating Long Term Stockholder Value

Burn Rate

8%
7%
6%
5%
4%
3%
2%
1%
0%

2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018

Burn rate ratio decreased dramatically over the years to maximize stockholder value

CEVA believes in and invests in:

Transparency

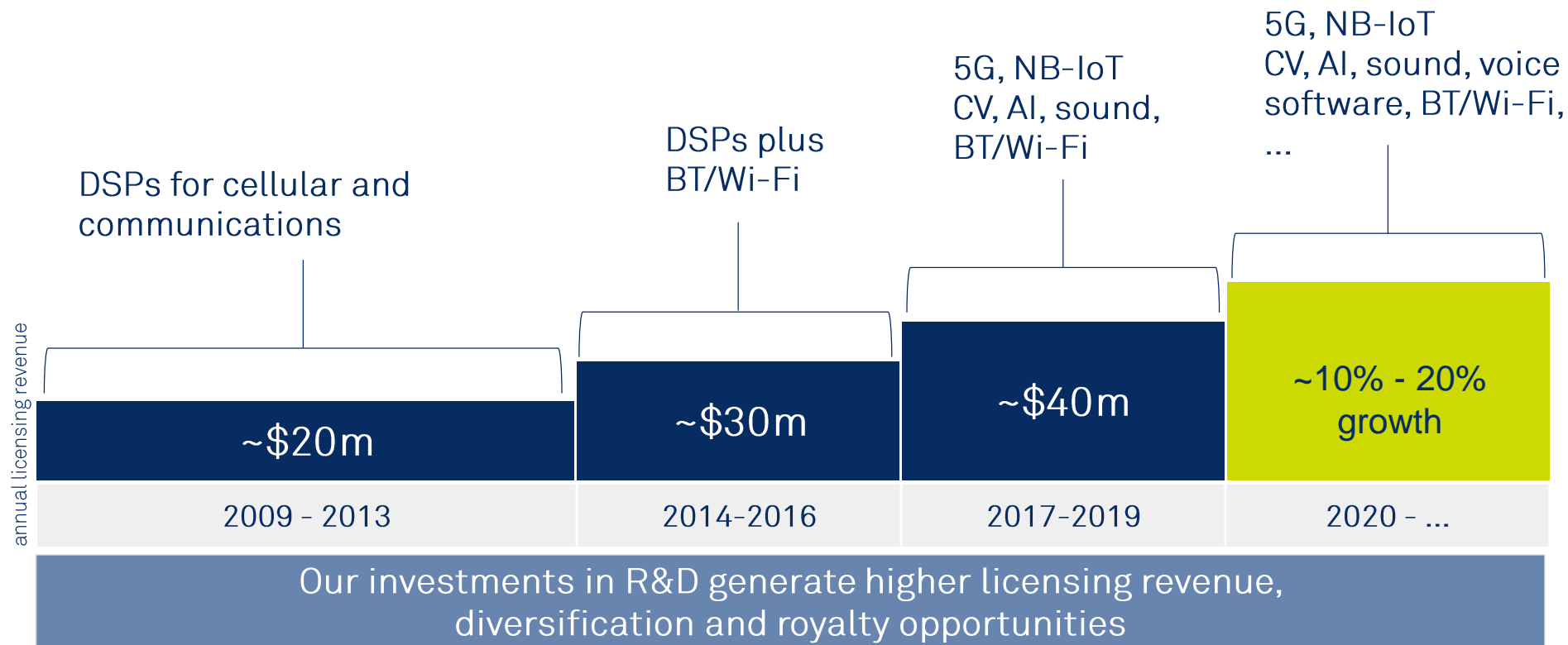Detailed technical and market data information
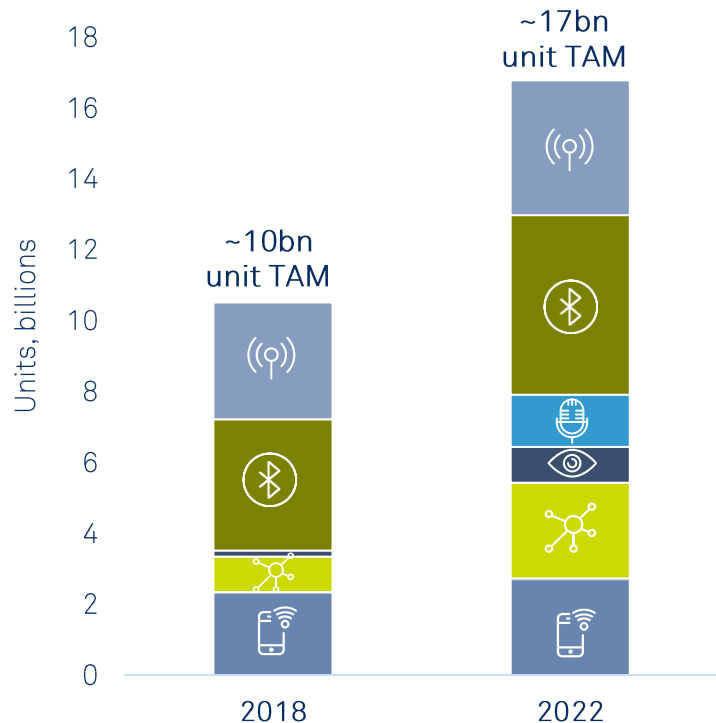
Long term business goals

Analyst and investor feedback and open communication

CEVA

Licensing Diversification and Growth

DSPs for cellular and communications

DSPs plus BT/Wi-Fi

5G, NB-IoT CV, AI, sound, BT/Wi-Fi

5G, NB-IoT CV, AI, sound, voice software, BT/Wi-Fi, ...

annual licensing revenue

~$20m

~$30m

~$40m

~10% - 20% growth

2009 - 2013

2014-2016

2017-2019

2020 - ...

Our investments in R&D generate higher licensing revenue, diversification and royalty opportunities

CEVA

Royalty Diversification and Growth

~17bn
unit TAM

~10bn
unit TAM

Units, billions

18
16
14
12
10
8
6
4
2
0

2018   2022

Technology	2022 Target Market Share
Mobile Broadband	~30%
LTE/5G RAN	~40%
Cellular IoT	~30%
Computer Vision / AI	~15%
Sound / AI	~20%
Bluetooth	~15%
Wi-Fi	~15%

2022 Royalty Target

>2x Royalty revenue growth vs 2018

>3bn CEVA-powered units shipped

CEVA

2022 Targets

▶ Revenue:
  - ▶ Licensing: 50-60 agreement per year
  - ▶ Licensing revenue: ~10%-20% growth
  - ▶ Royalty: ~2x over existing levels of ~$40m/$45m
  - ▶ Unit shipments: ~3bn CEVA-powered chips annually

▶ Operating margins: ~30%+; ~2x over existing levels

▶ EPS leverage: ~3x from existing levels

▶ Continued positive cash flows, opportunistic stock repurchase program and review of M&A opportunities

Thank You

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www.ceva-dsp.com