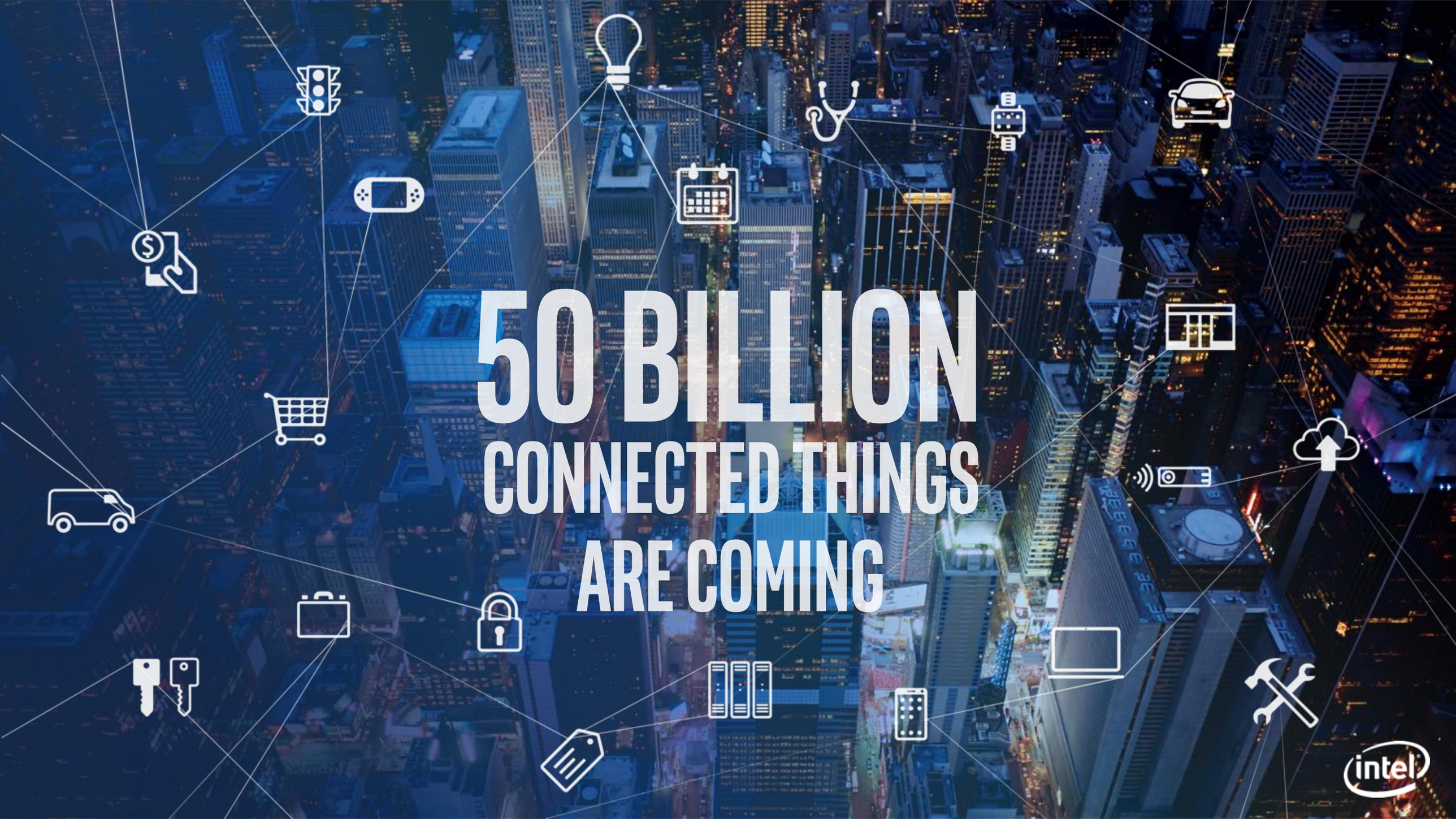
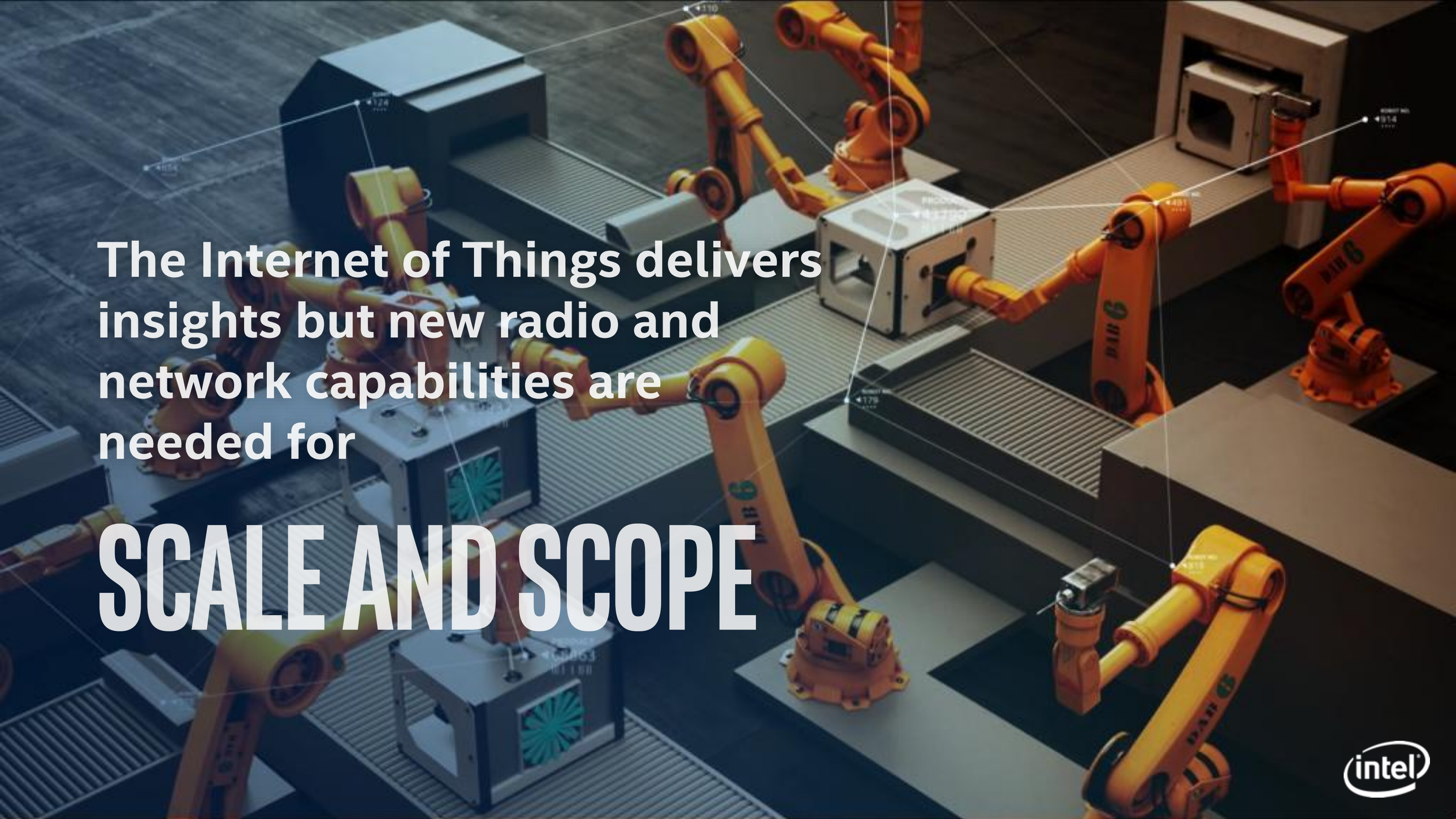
INTEL 5G

NETWORK. CLOUD. CLIENT.


50 BILLION
CONNECTED THINGS
ARE COMING
intel



The Internet of Things delivers insights but new radio and network capabilities are needed for

SCALE AND SCOPE

The visual cloud will alter how we perceive reality but immersive experiences will require
MORE BANDWIDTH
intel

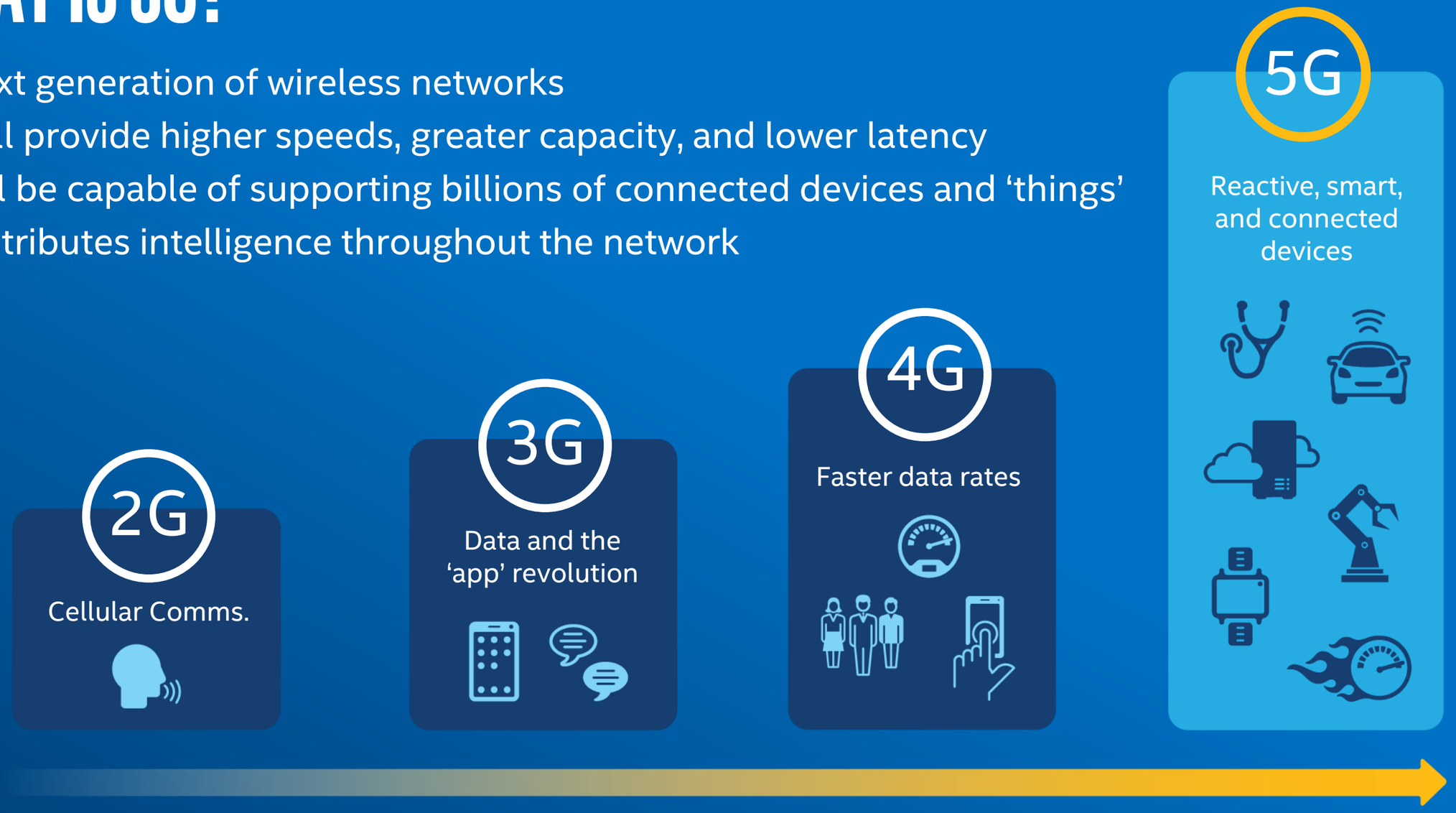
Automated vehicles are almost here but ultra reliability requires
ULTRA LOW LATENCY
intel

A NEW GENERATION OF NETWORKS IS NEEDED

5G

WHAT IS 5G?

- Next generation of wireless networks
- Will provide higher speeds, greater capacity, and lower latency
- Will be capable of supporting billions of connected devices and ‘things’
- Distributes intelligence throughout the network



5G IN ACTION

5G ENHANCEMENTS WILL TRANSFORM LIVES

Ultra Reliability and Low Latency

Massive M2M Connectivity

Enhanced Mobile Broadband

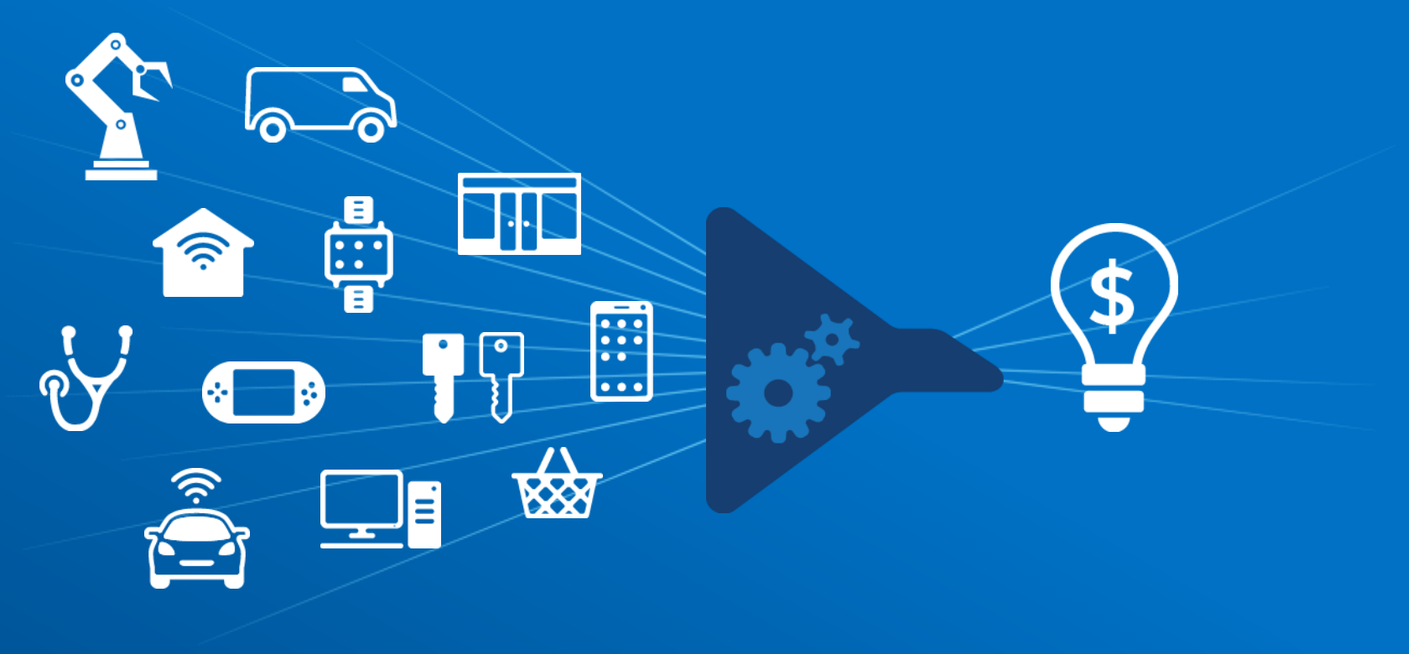
5G IS A CRITICAL ELEMENT OF THE NEW DATA ECONOMY

Connecting billions of devices will generate a massive wave of data. Only 5G has the scale and scope to enable new insights, drive business efficiencies, and create data monetization.

Autonomous Driving
1 GB/second

Smart Hospital
4000 GB/day

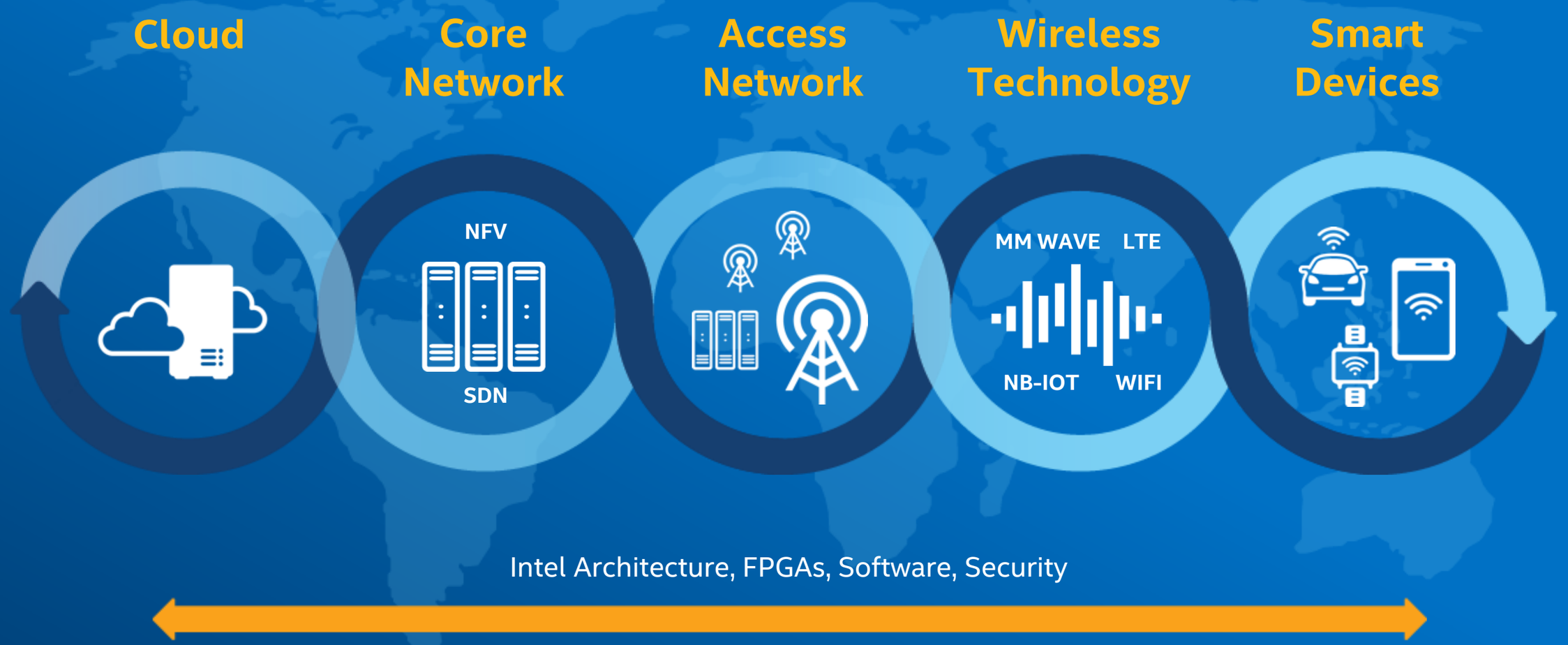
Connected Factory
1 million GB/day



Intel powers every segment of the smart, connected world, from the cloud to the network to the device. This makes us the
PARTNER OF CHOICE FOR 5G
intel

INTEL POWERS 5G END-TO-END

Intel's Scale Meets 5G Scope



INTEL IS ALREADY BUILDING 5G'S FUTURE

Collaborating to Accelerate 5G Technology, Standards, and Spectrum

ERICSSON
ALTIOSTAR
kt
Telefónica
T··
Sprint
BMW
docomo
NEC
verizon
SK
vodafone
MOBILEYE
中国移动通信 CHINA MOBILE
NOKIA
AT&T

"**BMW, Mobileye** and **Intel** are building a full self-driving car for 2021."

Tech Crunch 7/1/16

"**Intel, GE** Partner to make trains Mobile Data Centers"

eWeek 9/19/16

*Other names and brands may be claimed as the property of others.

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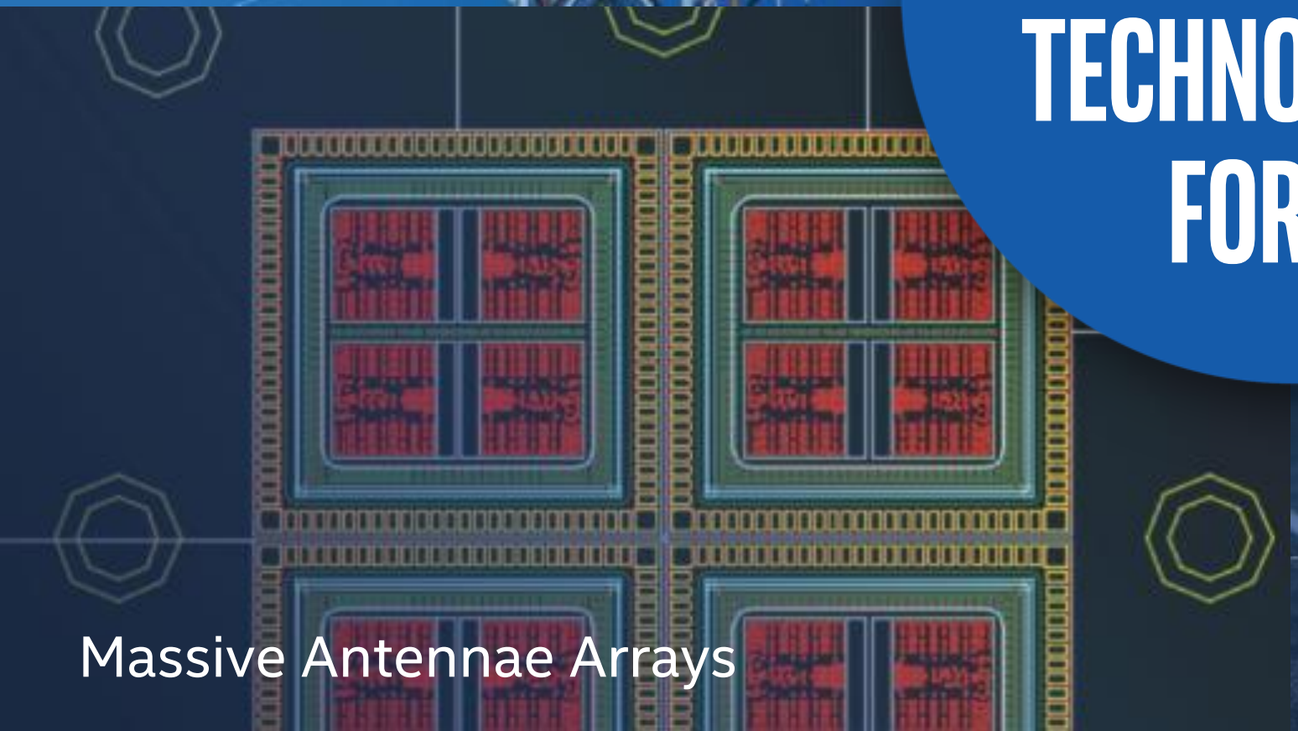
INTEL IS PREPARED FOR THE JOURNEY AHEAD

CRITICAL WIRELESS TECHNOLOGIES FOR 5G

mmWave

Narrowband IoT

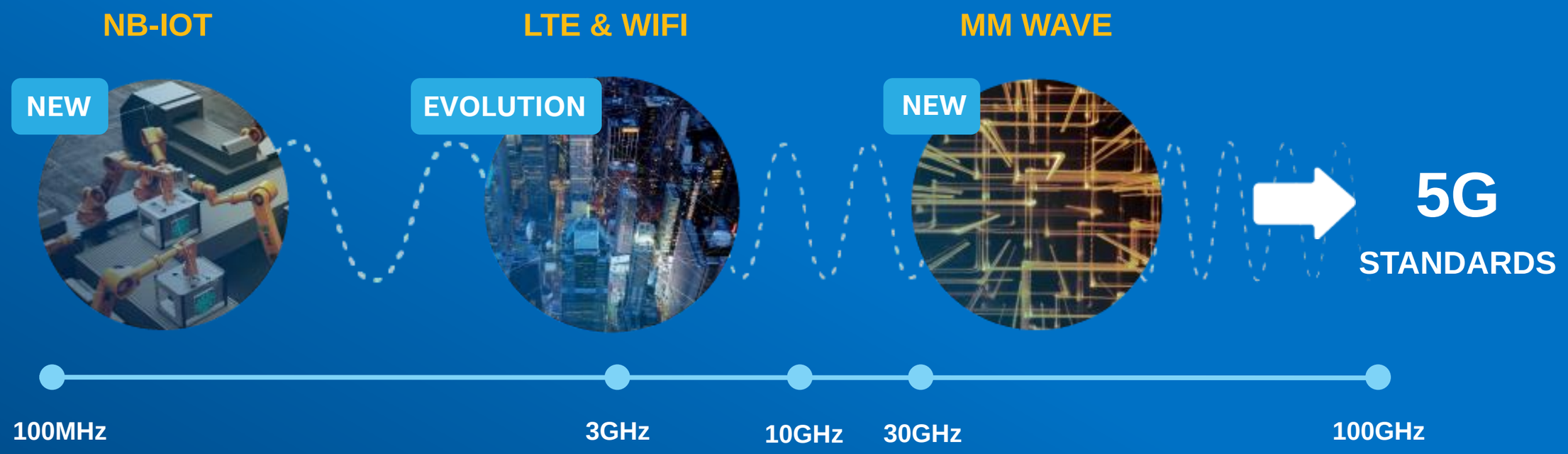


Massive Antennae Arrays

LTE-WiFi Evolution

intel

INTEL DELIVERING SOLUTIONS FOR ALL 5G RADIOS



- 5G will be a heterogeneous network of many wireless technologies
- LTE, Wi-Fi, mmWave, NB-IOT, and the new 5G interface will work together seamlessly
- Intel delivering silicon for 4G and pre-5G solutions today

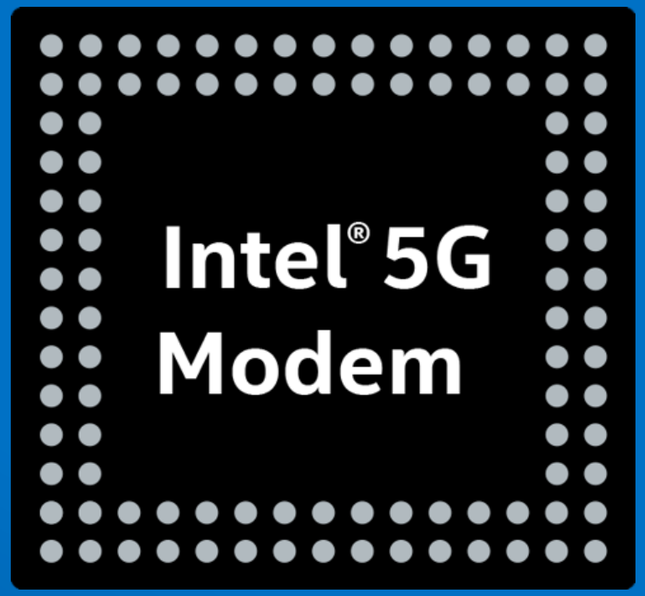
INTEL'S MOBILE TRIAL PLATFORM USED TO TEST 5G END-TO-END

- Delivered industry's first trial platform in February 2016 supporting sub 6GHz and mmWave
- A second Gen Platform with integrated 4x4 MIMO launched in August 2016
- Fully-capable, small form factor, mobile solution allows for fast field and interoperability testing
- Tier-1 service providers are already using it for 5G network testing today

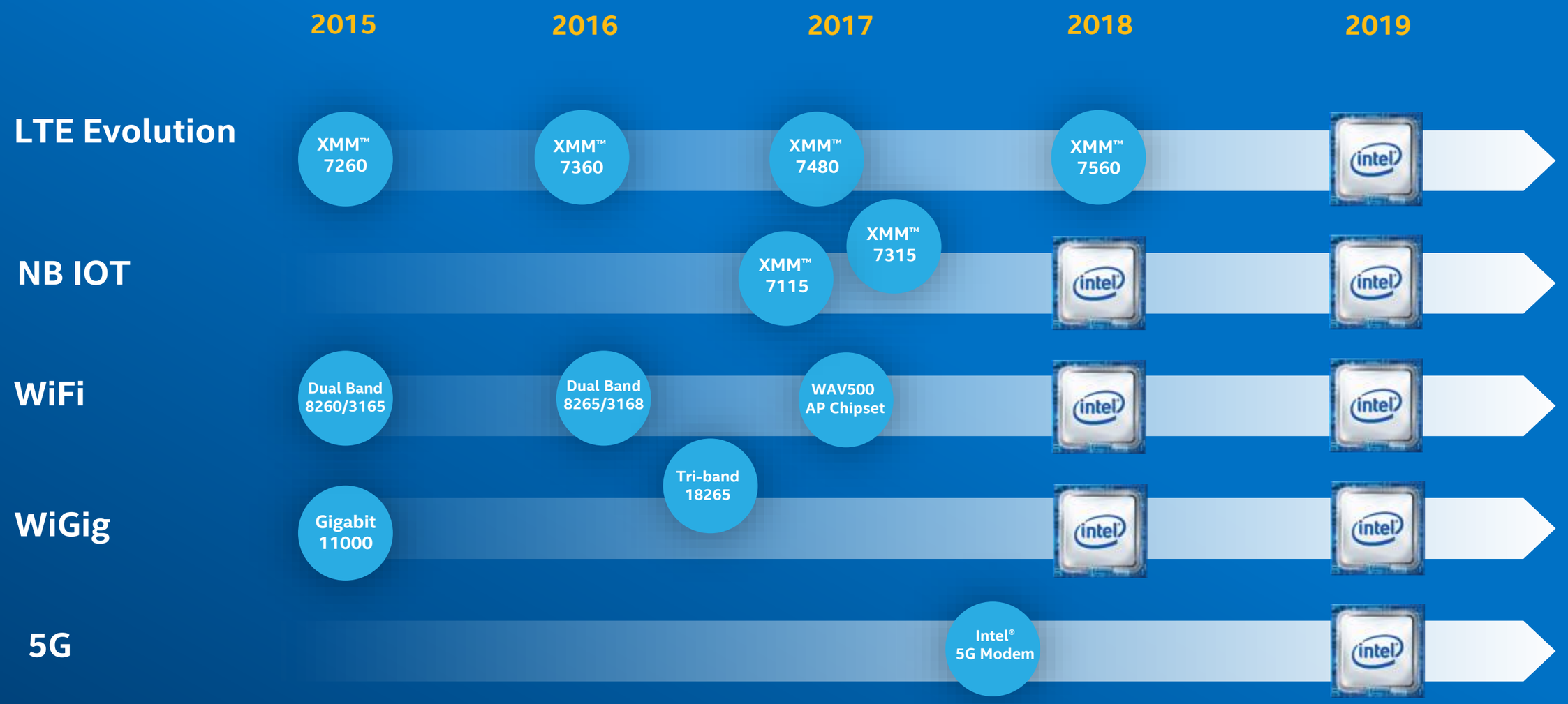
This device has not been authorized as required by the rules of the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased, until authorization is obtained.

INTEL® 5G MODEM
5G STAND-ALONE AND DUAL-CONNECTIVTY

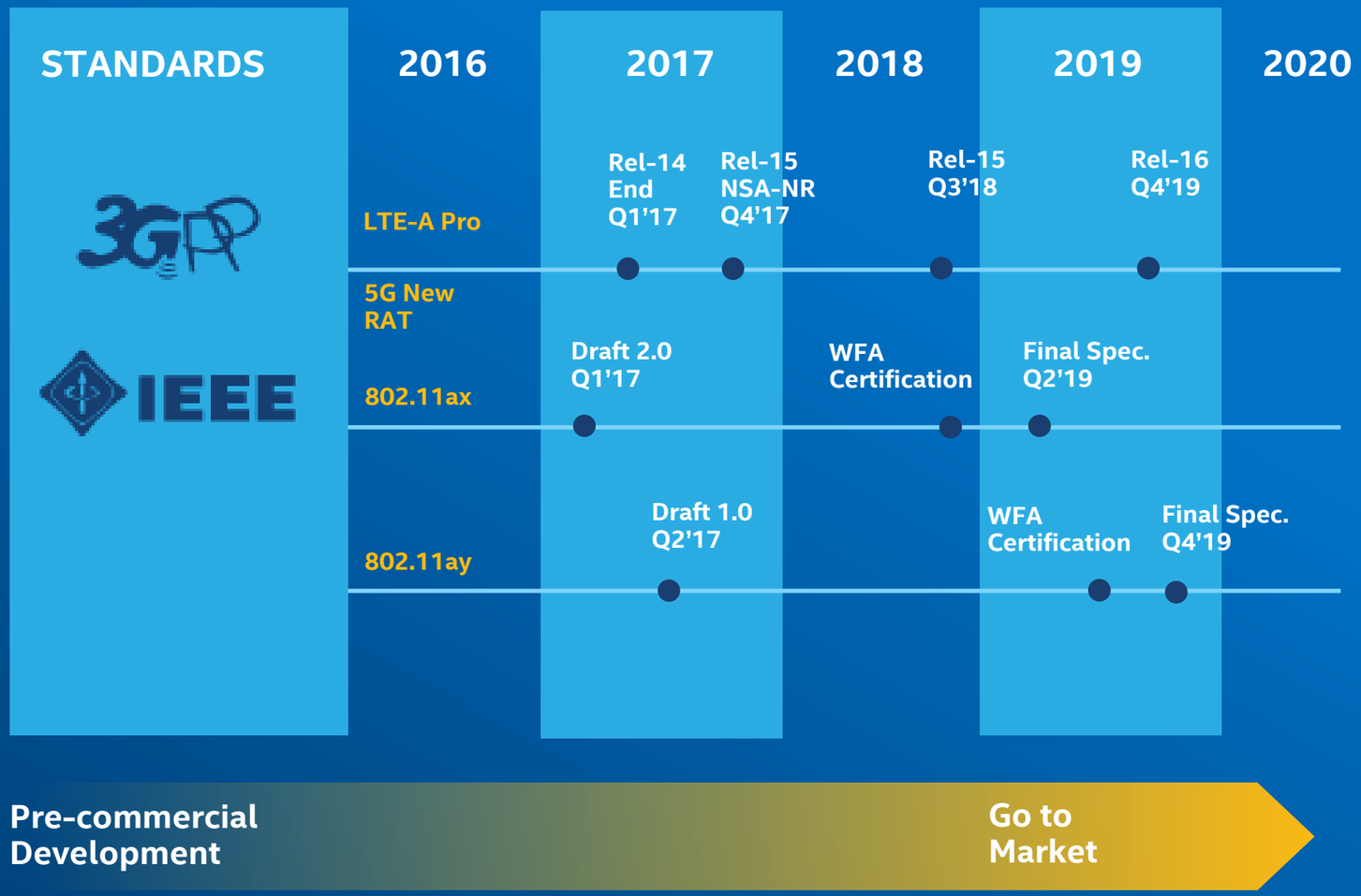
- World's first global 5G modem with ultra-high throughput wideband operation and low latency
- Pairs with Intel 28GHz and sub-6GHz RFICs
- Supports both sub-6GHz bands and mm-wave spectrum with compact chip kit
- Supports Key 3GPP 5G NR technology – low latency frame structure, advanced channel coding, massive MIMO, beamforming
- Pairs with Intel® XMM™ 7360 LTE modem for 4G/5G dual connectivity
- Chip and module samples – 2H '17



INTEL DELIVERING WIRELESS PRODUCTS PAVING THE PATH TO 5G



INTEL DRIVING HIGH IMPACT IN 5G WIRELESS STANDARDS



- Top contributor in cellular and WiFi work groups
- Multiple leadership positions in 3GPP and IEEE
- Thousands of researchers and engineers driving R&D behind the scenes

IOT AND 5G WILL GENERATE A 5G DATA EXPLOSION

Industrial IoT

Intelligent Homes & Buildings

Smart Cities

Autonomous Vehicles

INTEL'S IOT APPROACH: THINGS THROUGH CLOUD

5G delivers advanced technologies for IoT usages

The Intel® IOT Platform

Reference Architectures
Portfolio of Products

Things

Network

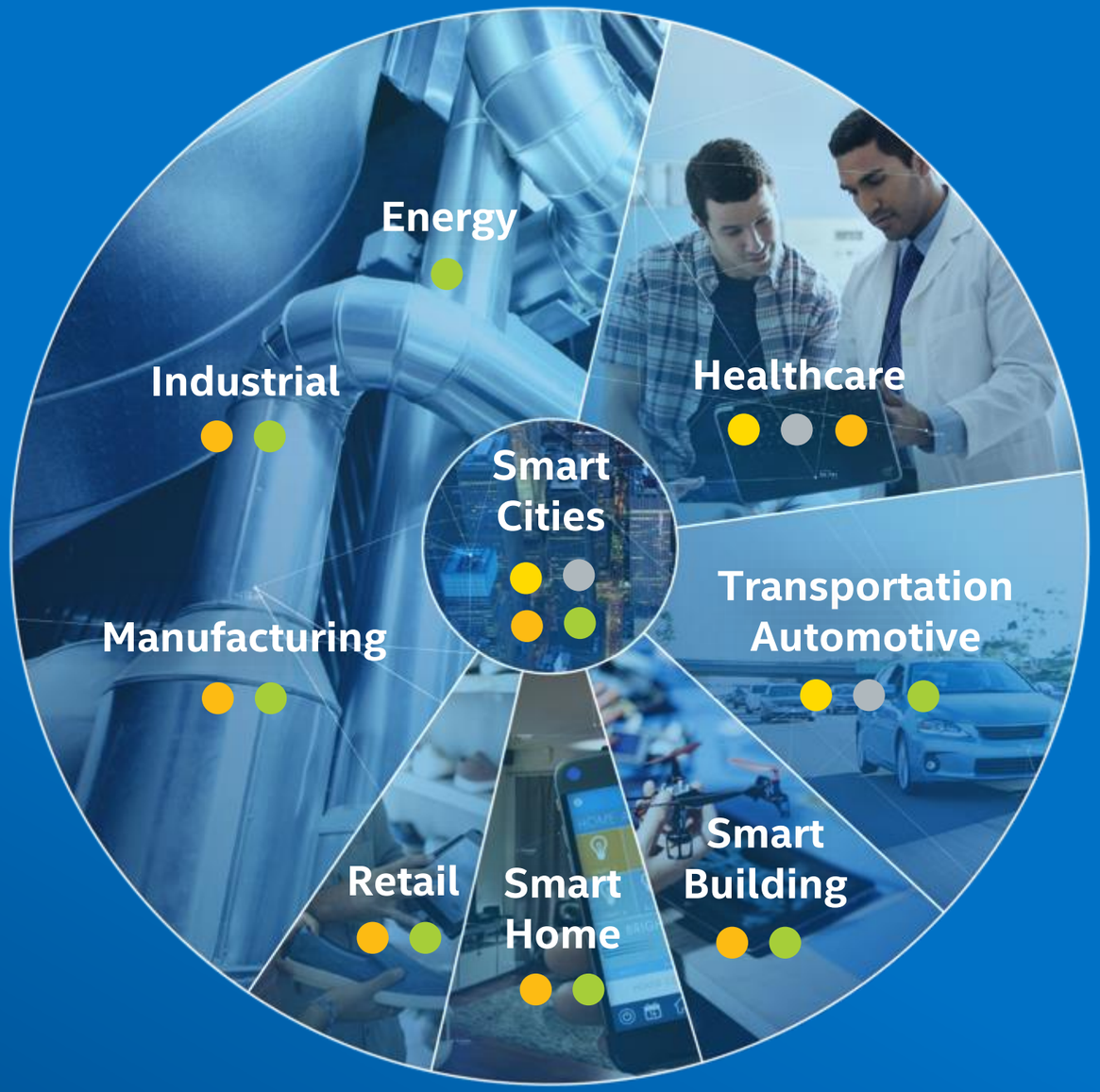
Cloud

Our Approach: Create Vertical Solutions + Build on Horizontal Platform & Products + Build Strong Ecosystem

5G Technology Innovations

DIVERSE 5G TECHNOLOGIES WILL FUEL IOT SUCCESS

Intel 5G solutions will help grow IoT deployments by matching requirements to industry use cases



LTE ADVANCED PRO

NB-IOT

802.11AX

5G NEW RADIO

PROMISE OF IOT DELIVERED THROUGH AI AND 5G

Intel investments in artificial intelligence will unleash new wave of opportunity

- 5G's billions of connected things will require AI and analytics for accurate insights and a path to monetization
- Intelligence to power AI will be embedded in devices, the edge, and the cloud
- Intel servers fuel analytics today, and we're investing in future technologies to make AI ubiquitous

TRANSFORMING THE NETWORK FOR 5G READINESS

Taking Intel's expertise in cloud and applying it to the Network

Legacy

Modern, Cloud-ready

Next Generation Networks

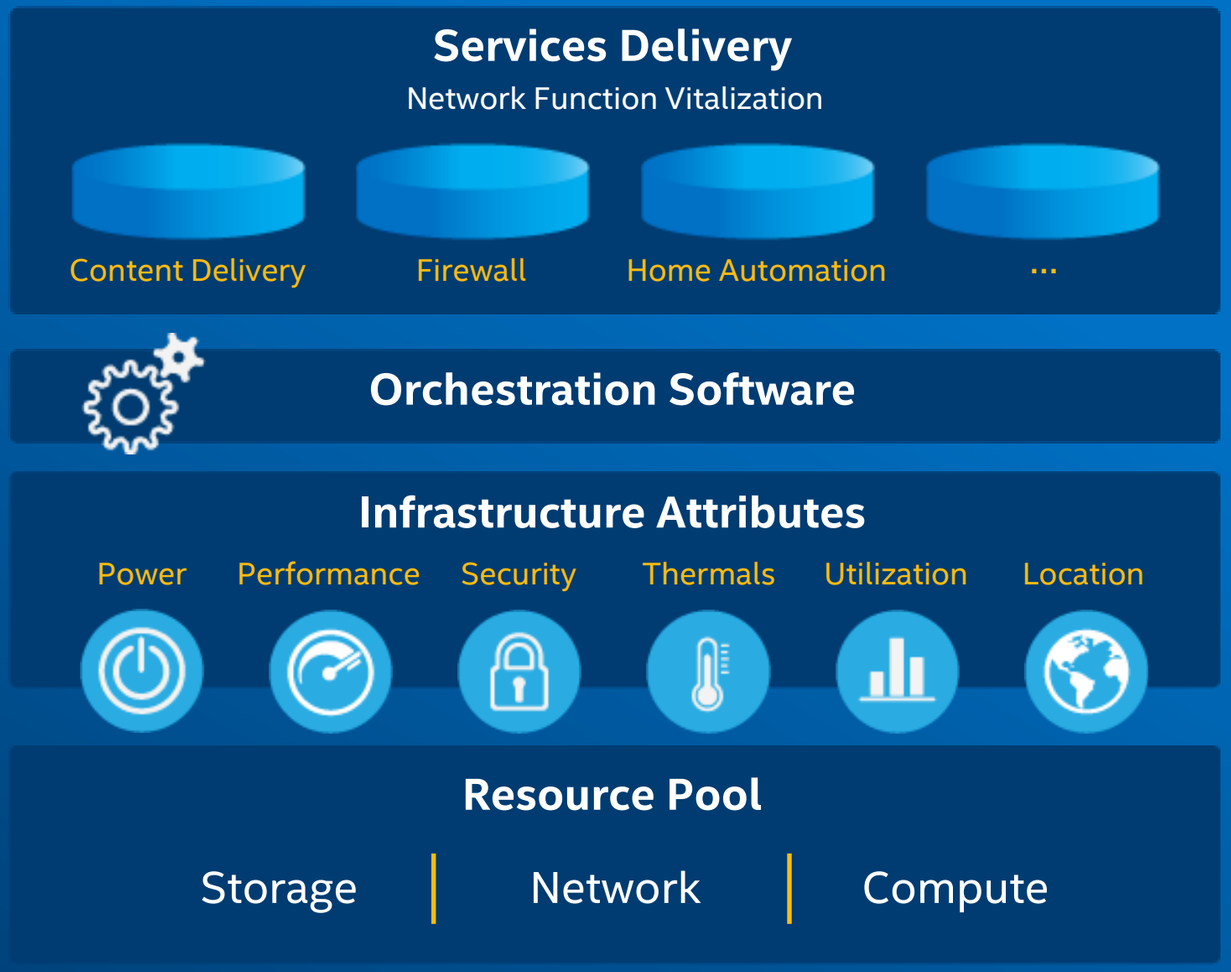
Custom
Proprietary
Hardware Defined

Software Defined
Agile
Open

Network Slicing
Analytics Core to Edge
Visual Cloud

5G READY: MODERN, SOFTWARE DEFINED INFRASTRUCTURE

Intel advancing SDI through open source, standards, and ecosystem to accelerate cloud ready networks



Agile services delivery

Next-Gen architectures
On high volume servers

Pooled resources of
Standardized solutions

5G UNLEASHES THE FULL POTENTIAL OF THE CLOUD

Opens up new business opportunities for operators

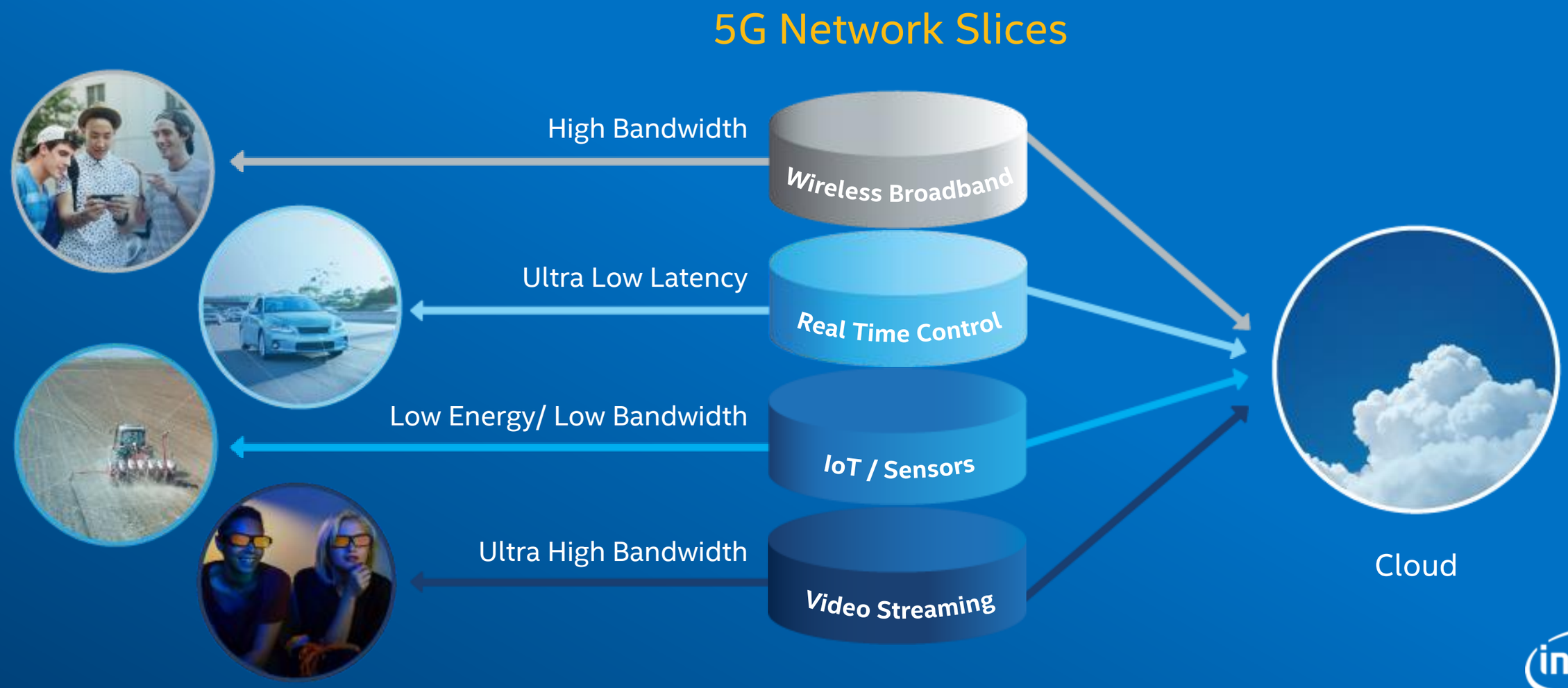
Gives more granular control for workloads and usages

Creates whole new classes of cloud services

Enables the cloud to deliver deeper insights and more accurate analysis

MATCHING CLOUD SERVICES TO DIVERSE DELIVERY NEEDS

Intel technology delivers the diverse processing requirements to power 5G network slicing



5G EXTENDS THE CLOUD TO THE MOBILE EDGE

High performance, Intel-powered analytics and services at the edge unlocks the network to new services

Radio

+

Compute
Storage

+

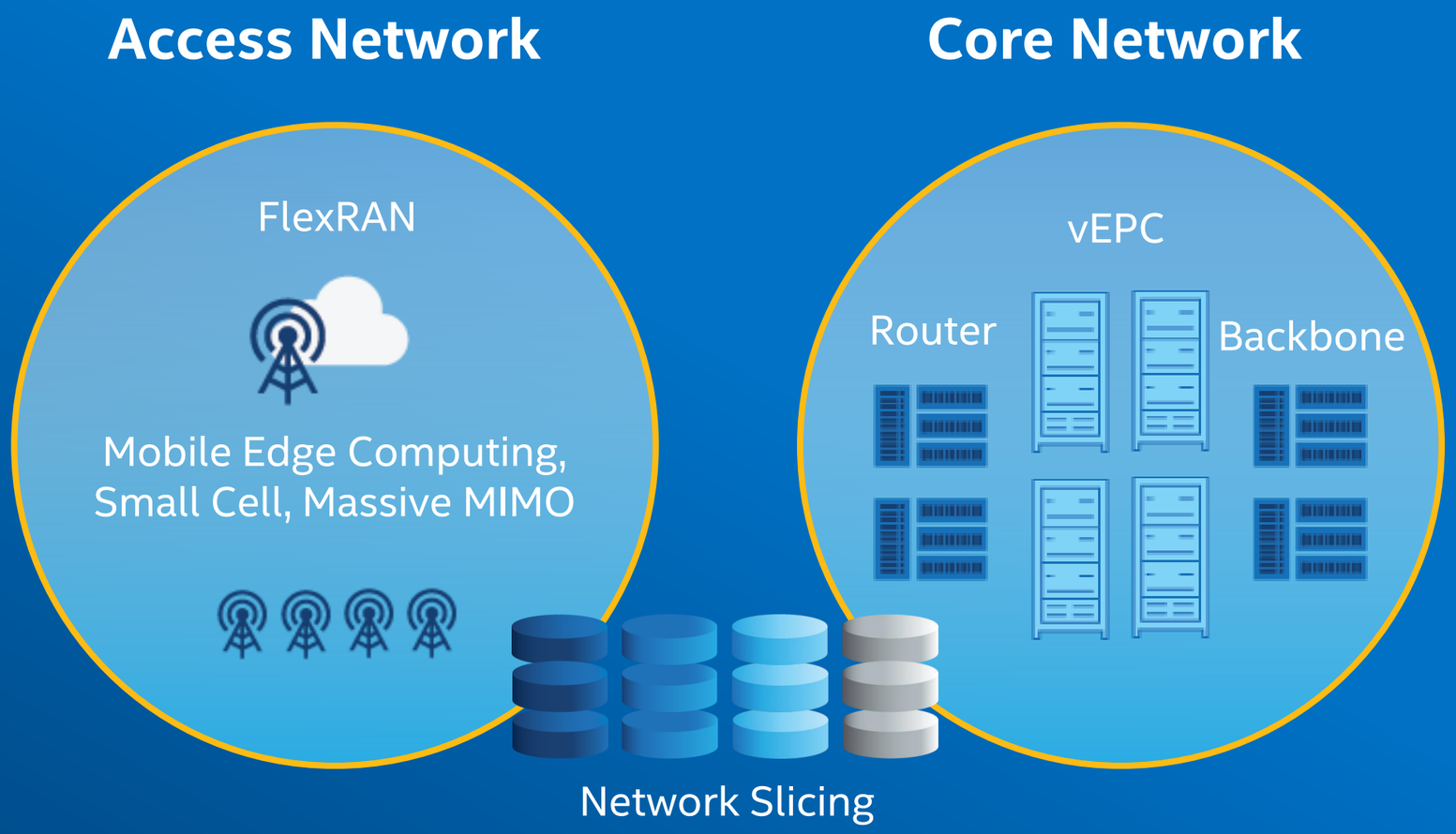
Healthcare
Connected Car
Positioning
Virtual Taps

Gaming
Virtual Apps
Smart City
Caching

=

Better User Experience
Lower Latency
Streamlined Approach

INTEL POWERS THE VIRTUAL NETWORK INFRASTRUCTURE FOR 5G



FLEXRAN: INTEL'S 5G NETWORK REFERENCE ARCHITECTURE

- An off the shelf general purpose Intel Xeon or Atom based virtualized platform containing components of Intel processors, I/O and FPGAs.
- Enables dynamic networking slicing for various use cases.
- Enables the highest level of flexibility with programmable on board features, memory and I/O
- Reference ready software and development kits: DPDK, L1 reference and L2-L3 stack
- Scales from small to large capacities with the same components

INTEL DELIVERING INFRASTRUCTURE PRODUCTS ON THE PATH TO 5G

	2016	2017	2018	2019
FlexRAN				
Xeon	Broadwell-D SDK Reference 2x2 VL1-L3 BTS	Skylake 5G SDK Reference 4x4 Multi-RAT Slicing	Next Gen	Next Gen
Atom	Denverton SDK Reference 2x2 VL1-L3 BTS	5G SDK Reference 4x4 Multi-RAT Slicing		
FPGA		CPRI <-> Ethernet Fronthaul: FFT/PRACH filtering		Next Gen
Multi-access Edge Computing SDK	SDK VT & MEC Libs	SDK Radio Agnostic		
5G Technologies	Massive MIMO REFERENCE	Network Slicing REFERENCE New Algorithm REFERENCE		

PUTTING IT ALL TOGETHER

PUTTING IT ALL TOGETHER: AUTONOMOUS DRIVING

Cloud	Core Network	Access Network	Wireless Technology	Smart Devices
Powerful analytics required to make sense of massive data from moving vehicles	Network will isolate vehicle data in a 'slice' separating it from other types of data	Cloud computing at the mobile edge lowering latency	5G radios integrate 'vehicle to vehicle' and 'vehicle to everything' connectivity	Vehicles will have intelligence to manage internal systems and connect to cloud

INTEL 5G

NETWORK. CLOUD. CLIENT.

Intel helps bring together the worlds of connectivity, computing, and cloud, for a seamlessly connected, powerfully smart 5G future.

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