The Journey to 5G

Building the digital foundation and revenue streams in the 5G Partner Ecosystem

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About Us

VMware at a glance

- More than 20 years of continuous Innovation
- US$8.97B In FY19
- 20,000+ employees in >100 offices worldwide
- > 500,000 customers
- 100% Fortune 500 customers
- > 75,000 solution partners

Our Vision

A digital foundation built on VMware

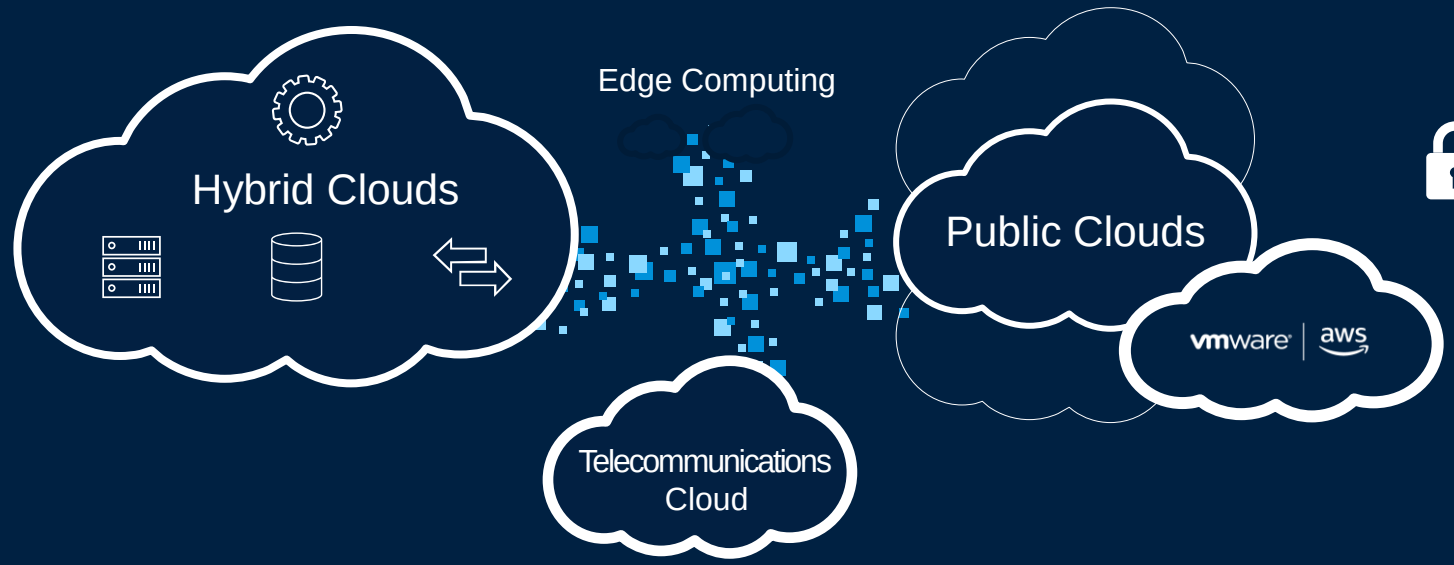
- Empower Digital Workspaces
- Transform Networking and Security
- Integrate Public Clouds
- Modernize Data Centers

Any Device

Any Application

Traditional Apps | Cloud-Native Apps | SaaS Apps

Any Cloud



5G Possibilities!

Healthcare

China Performs Country's First-Ever 5G Remote Brain Surgery

A Chinese surgeon collaborated with China Mobile to operate on the brain of a Parkinson's disease patient 3,000 km away using a 5G connection, the first time such an operation has taken place in China

Smart Cities

SKT backs Seoul smart traffic system with 5G gear

SKT will deploy sensors and vehicle-to-everything (V2X) facilities on major roads in Seoul. The operator will also supply 2,000 5G terminals to buses and taxis, and set up a 5G control centre for data collection and transmission of safety information.

Manufacturing

UK's first 5G industrial trial launched in bid to create 'smart factories'

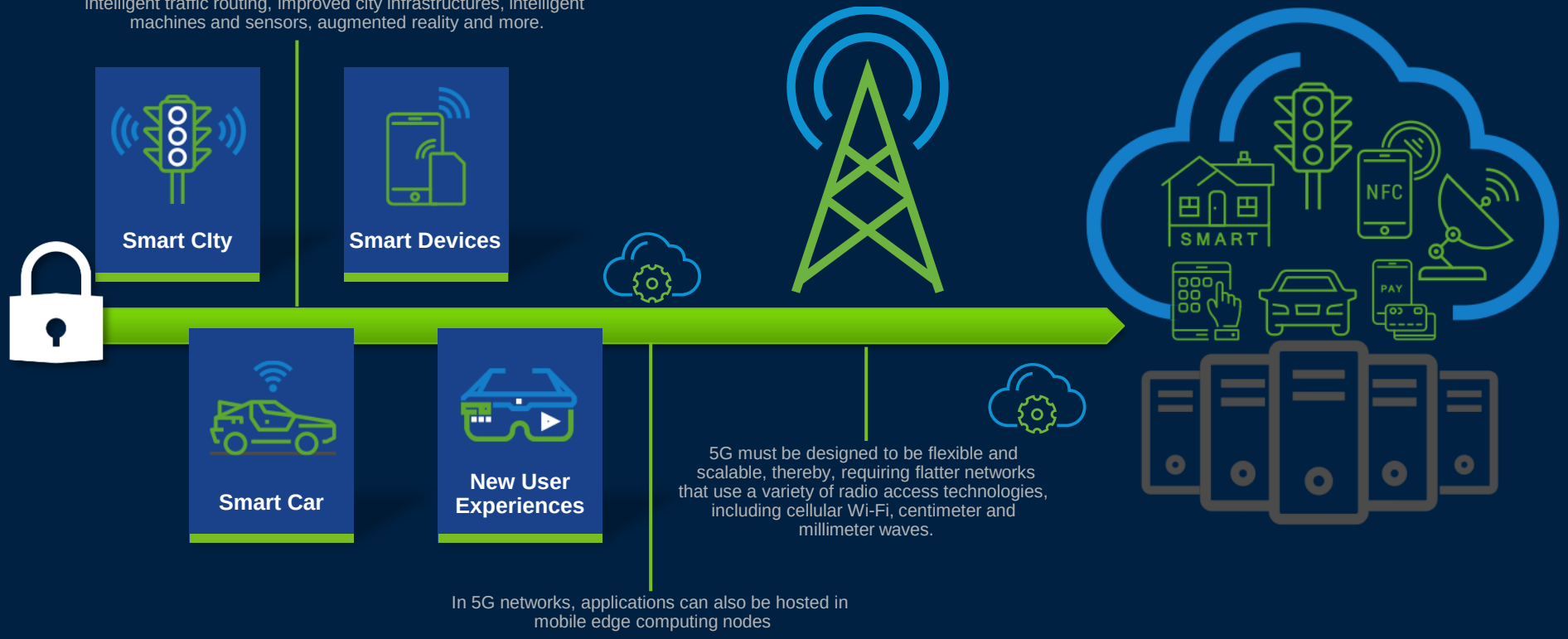
The test will use the improved network technology of 5G to run sensors in Worcester Bosch’s factory, which produces heating and hot water products.

Evolution to 5G

5G: From Device to Data Center

By 2020, 20 billion devices are expected to be in use.* 5G will help support the massive growth in the Internet of Things and enable devices to communicate with each other seamlessly through the convergences of mobile communications and computing. 5G networks will also diffuse intelligence across the entire network, from the device to the data center.

Using fast wireless connection to cloud computing and data services, and to other connected devices, 5G will enable a variety of new capabilities, user experiences and devices such as built-in intelligent traffic routing, improved city infrastructures, intelligent machines and sensors, augmented reality and more.

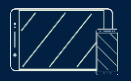


5G's combination of high-speed wireless communications and efficient cloud computing means that even the tiniest devices can access virtually unlimited computing power,

5G must be designed to be flexible and scalable, thereby, requiring flatter networks that use a variety of radio access technologies, including cellular Wi-Fi, centimeter and millimeter waves.

In 5G networks, applications can also be hosted in mobile edge computing nodes

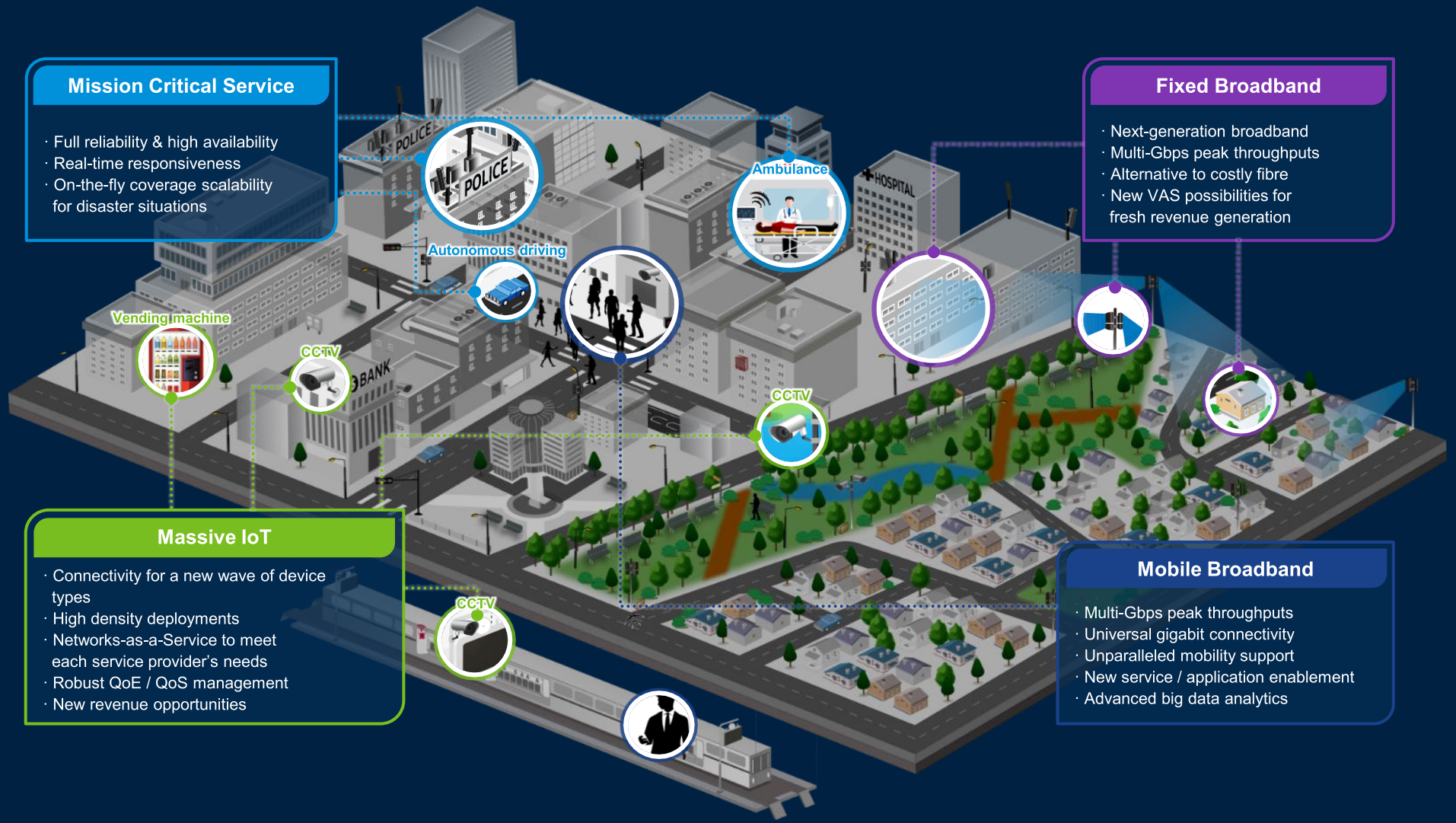
Mobile Communications: From 1G to 5G

1G		1979 AMPS, TACS Analog
2G		1991 GSM, GPRS, EDGE Digital Narrow Band < 80-100 Kbits/s
3G		2001 UMTS / HSPA Digital Broad Band Up to 2 Mbit/s
4G		2010 LTE, LTE Advances Digital Mobile Broad Band xDSL-like experience
5G		2020 - 2030 - Digital Ubiquitous Connectivity Fiber-like Experience

Source: Gartner. https://www.gartner.com/imagesrv/books/iot/iotEbook_digital.pdf

Brand new Business Models with 5G

A new wave of applications & use-cases



Mission Critical Service

- Full reliability & high availability
- Real-time responsiveness
- On-the-fly coverage scalability for disaster situations

Fixed Broadband

- Next-generation broadband
- Multi-Gbps peak throughputs
- Alternative to costly fibre
- New VAS possibilities for fresh revenue generation

Massive IoT

- Connectivity for a new wave of device types
- High density deployments
- Networks-as-a-Service to meet each service provider's needs
- Robust QoE / QoS management
- New revenue opportunities

Mobile Broadband

- Multi-Gbps peak throughputs
- Universal gigabit connectivity
- Unparalleled mobility support
- New service / application enablement
- Advanced big data analytics

5G value chain

Market size will reach $300B by 2025 with more than 675 million 5G connections in Asia

Spectrum

1 New Spectrum

New <800 MHz bands

(such as new coverage bands for IoT)

New >3GHz bands

(such as those for small-cell deployment in urban areas)

+ Unlicensed

Or secondary-license access

RAN[2] Infrastructure

2a Macro-network densification and layer upgrades (legacy network evolution)

MIMO[3]

New sites (macro densification)

- Single data rate, SON[4] features
- Network slicing to support 5G applications

2b Small-cell (outdoor) and indoor densification

Hyper-dense deployments

Centralized RAN, fiber to the antenna (FTT-A), and mmWave backhaul

Advanced indoor distributed antenna system

Transmission

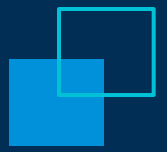
3 Increased fiberization

80 to 100 percent backhaul fiberization

New technologies Fiber to the site FTT-A (Cloud-RAN) mmWave backhaul

4 Core and features

SaaX, network-function virtualization ultra SON analytics



Separation of C-plane vs U-plane

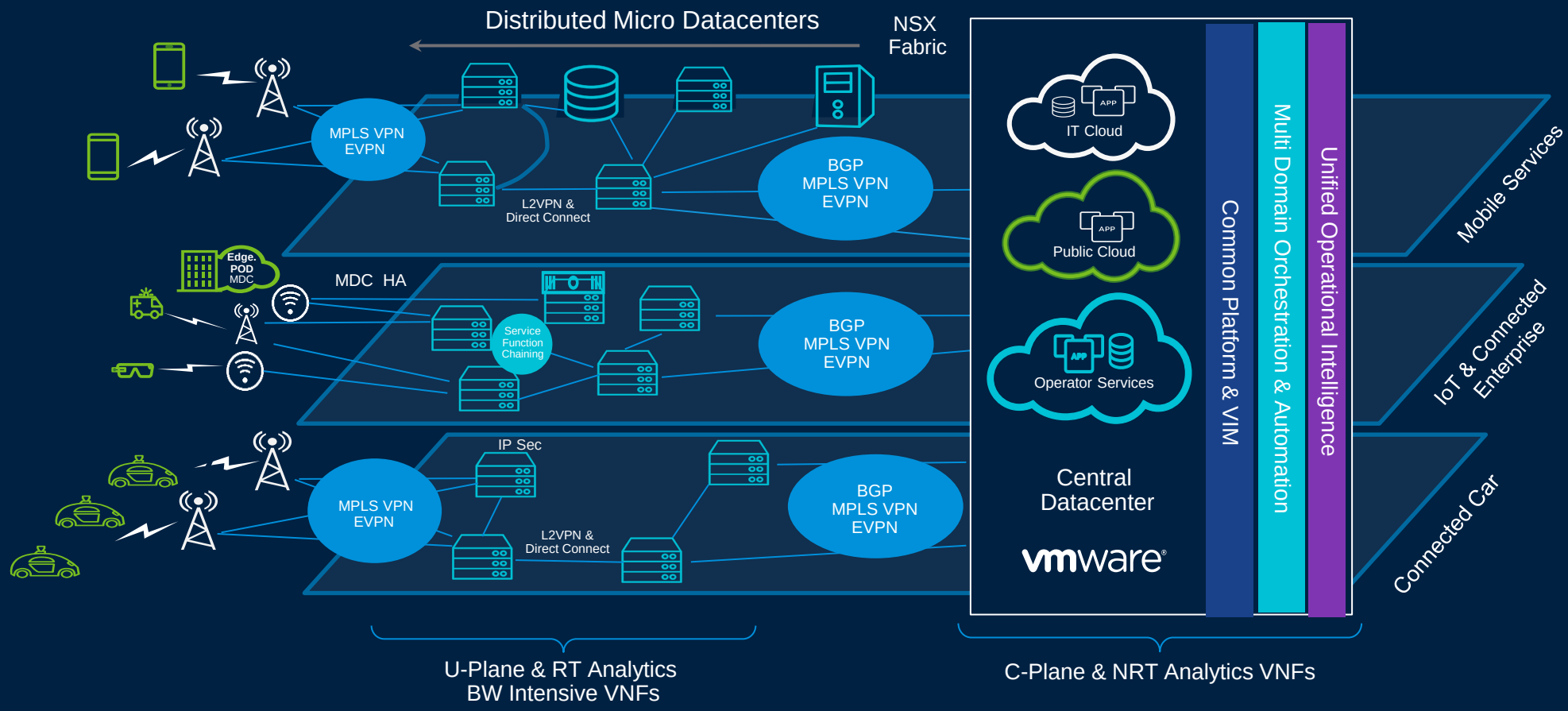
Network slicing

Source: McKinsey

VMware 5G Transformation Vison

Bringing It All Together

Management | Automation | Networking | SDN Control | Security | Policy



Unified Hybrid Container – VM Service Delivery Platform

Thank You

Please email any questions to EmilyN@vmware.com