



# Edgeless Connectivity from IoT to 5G and Data Centers

Assoc. Prof. Dr. Montri Wiboonrat

KMITL Business School (KBS),

King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand.

BICSI Thailand Country Chair



**DATACENTERUNIVERSITY.ORG**





# Agenda



[DATACENTERUNIVERSITY.ORG](http://DATACENTERUNIVERSITY.ORG)

**KMITL**

- Technology Trend 2020
- Global Market
- IoT Connectivity Technologies
- 5G Technology
- Data Center Trend 2024-2525
- Big Data to Data Analytic
- IoT Landscape
- Evolution of 5G to **C-V2X**
- **5G Case Study and Edgeless Connectivity**
- Smart City













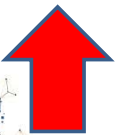
**Bicsi**<sup>®</sup>  
EMEA REGION  
[bicsi.org/emea2020](http://bicsi.org/emea2020)

# Technology Trend 2020

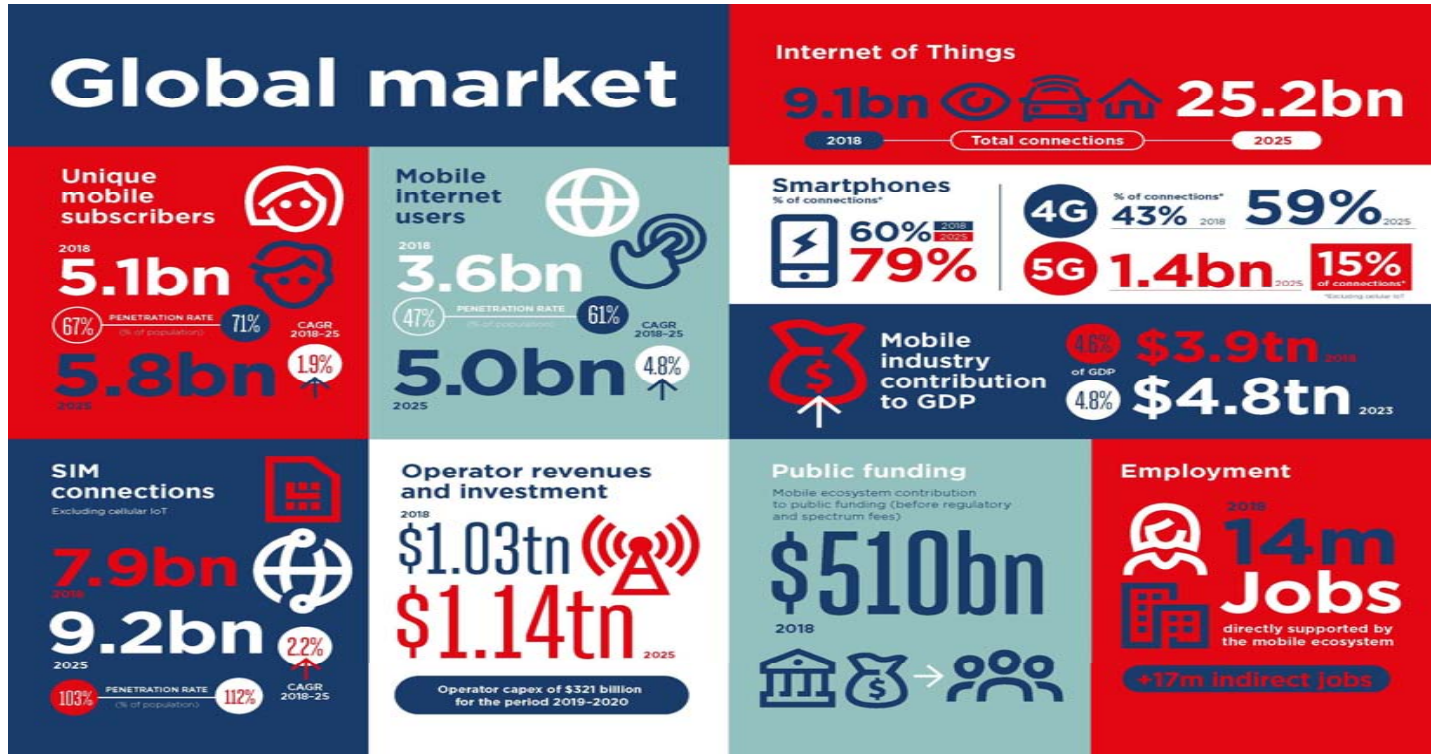
## THE TOP 10 TECHNOLOGIES TO LEARN IN 2020

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

<b>Artificial Intelligence (AI)</b> 	<b>5G data networks</b> 	<b>IoT (Internet of things)</b> 	<b>Automation</b> 	<b>NLP (Natural Language Processing)</b> 	<b>Block Chain Technology</b> 	<b>Edge Computing</b> 	<b>Facial Recognition</b> 	<b>XR (Extended Reality)</b> 	<b>Predictive &amp; Prescriptive Analytics</b> 
--	---	---	---	---	---	---	---	--	--



# Global Data Center Server Market 2023



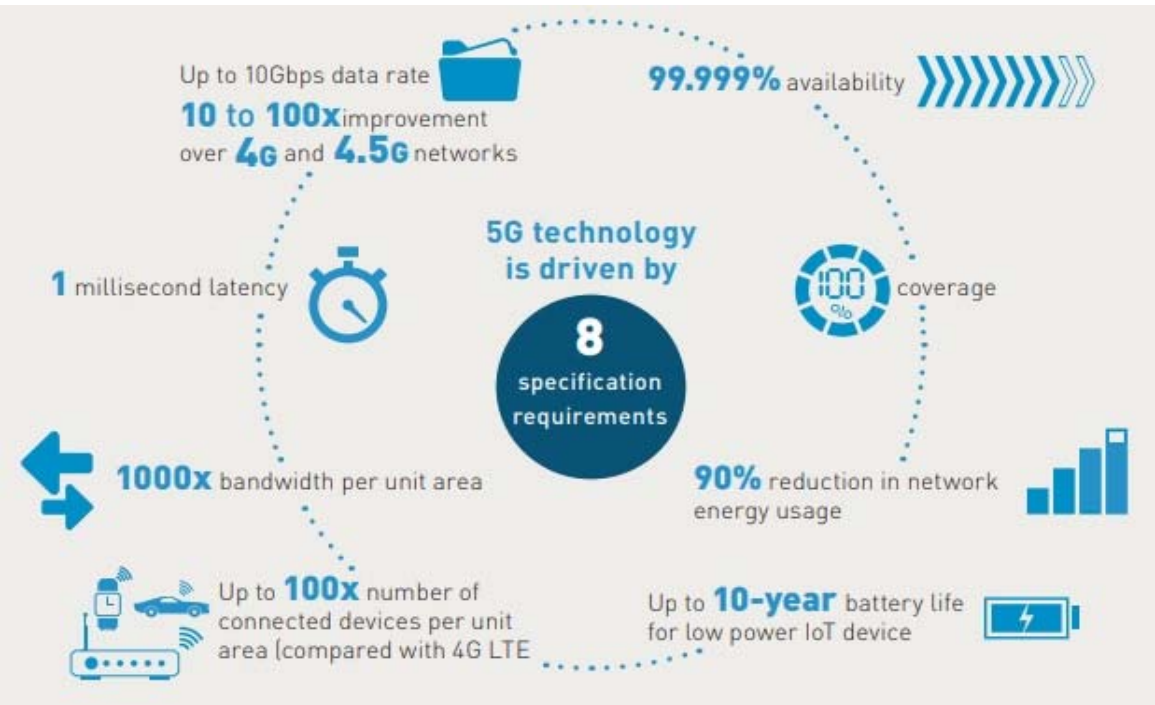
# IoT Connectivity Technologies



Copyright 2016 Everynet LTD & JBA, Inc.



# 5G Technology



## 6 advantages of #5G mobile broadband

5G will differentiate itself by delivering various improvements:



**10x**

**Decrease in latency:**  
Delivering latency as low as 1 ms.



**10x**

**Connection density:**  
Enabling more efficient signaling for IoT connectivity.



**3x**

**Spectrum efficiency:**  
Achieving even more bits per Hz with advanced antenna techniques.



**100x**

**Traffic capacity:**  
Driving network hyper-densification with more small cells everywhere.



**10x**

**Experienced throughput:**  
Bringing more uniform, multi-Gbps peak rates.



**100x**

**Network efficiency:**  
Optimizing network energy consumption with more efficient processing.

source visualcap via @mikequindazzi



# Data Center Trend 2024

## Hyperscale Data Center Market Size and Forecast 2024

Hyperscale Data Center Market was valued at \$23.4 billion in 2016 and is projected to reach \$104.8 billion by 2024

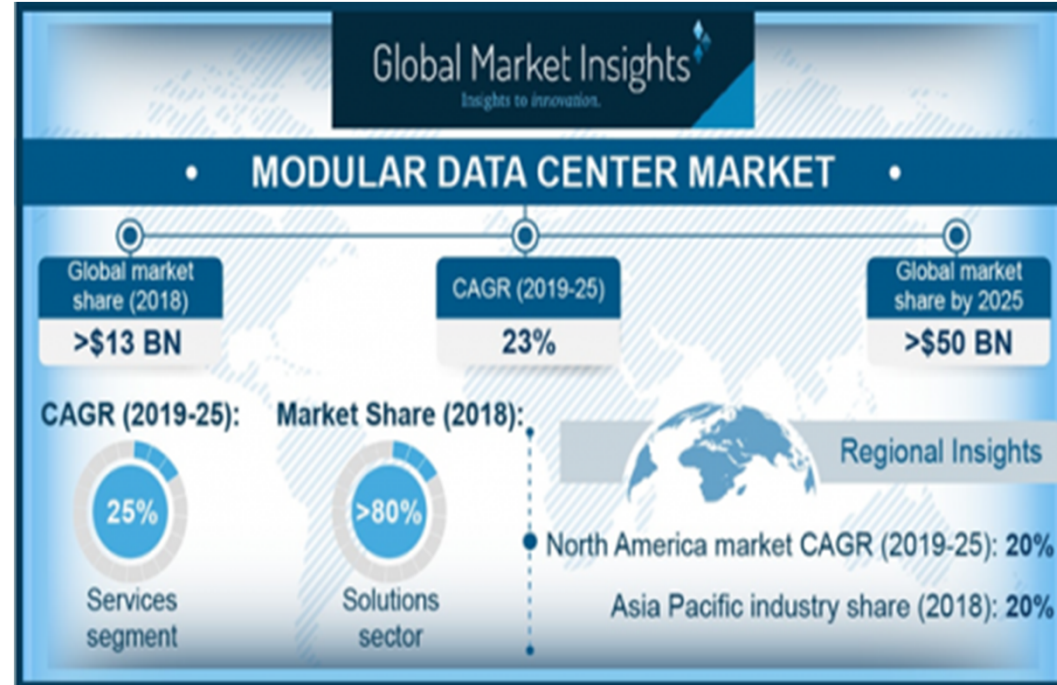
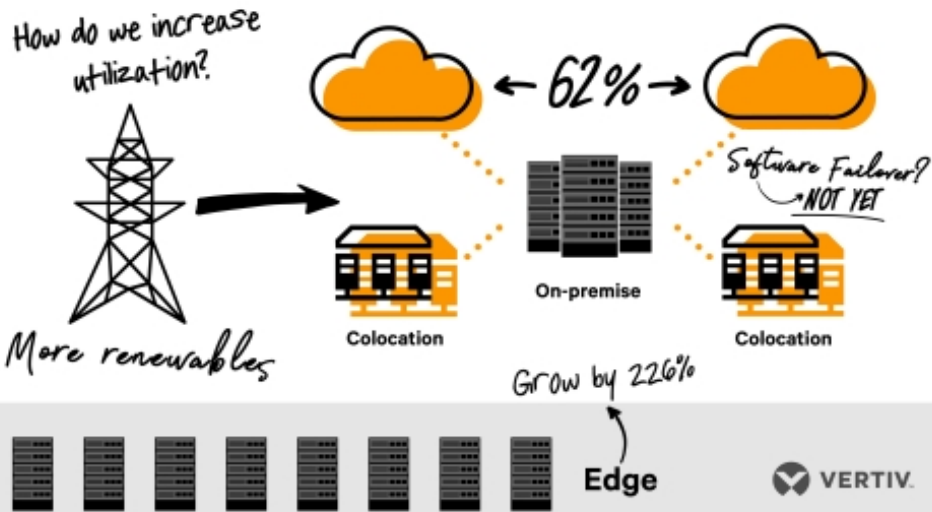


**AARKSTORE ENTERPRISE**  
 +91 9987295242 | contact@aarkstore.com



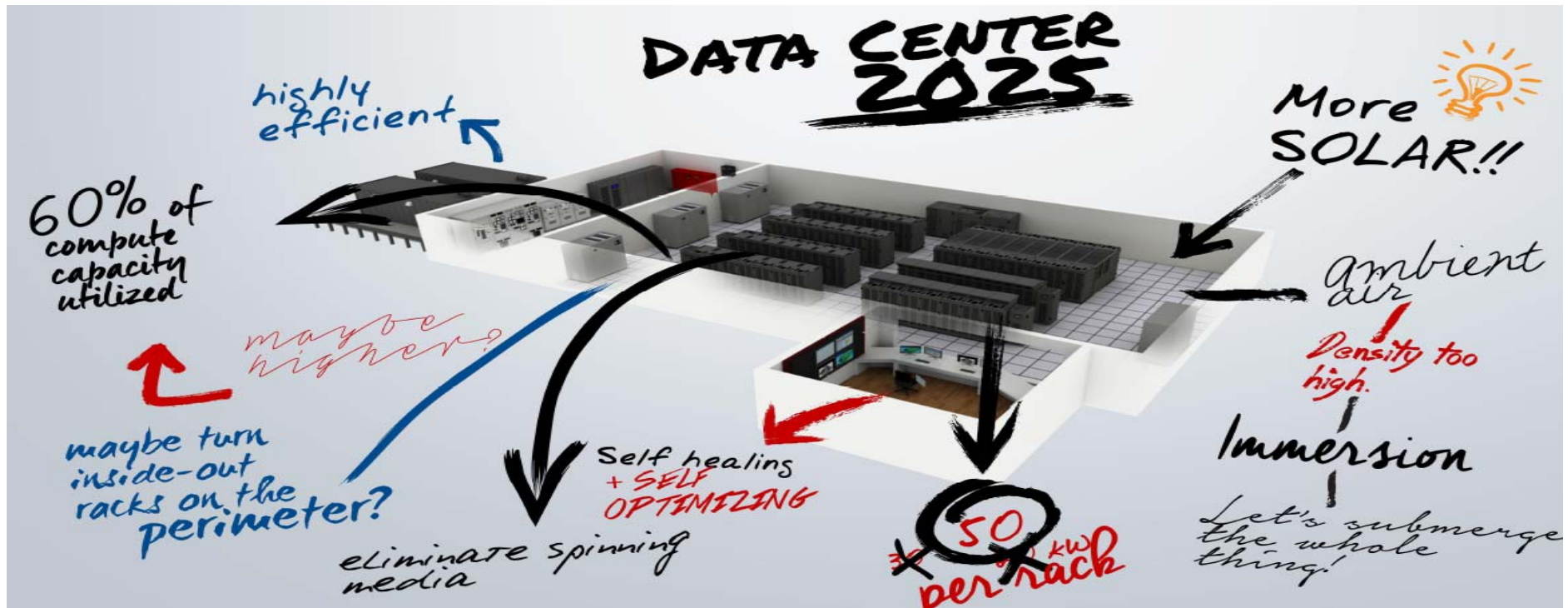
# Data Center Trend 2025

## The 2025 Data Center ECOSYSTEM

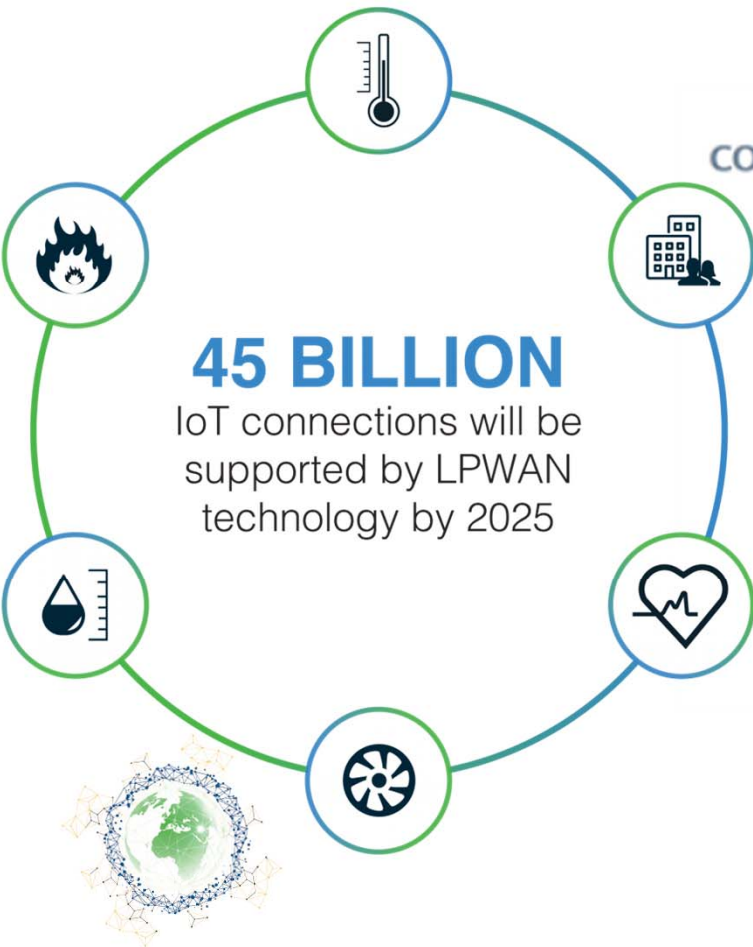




# Data Center Energy Efficiency in 2025



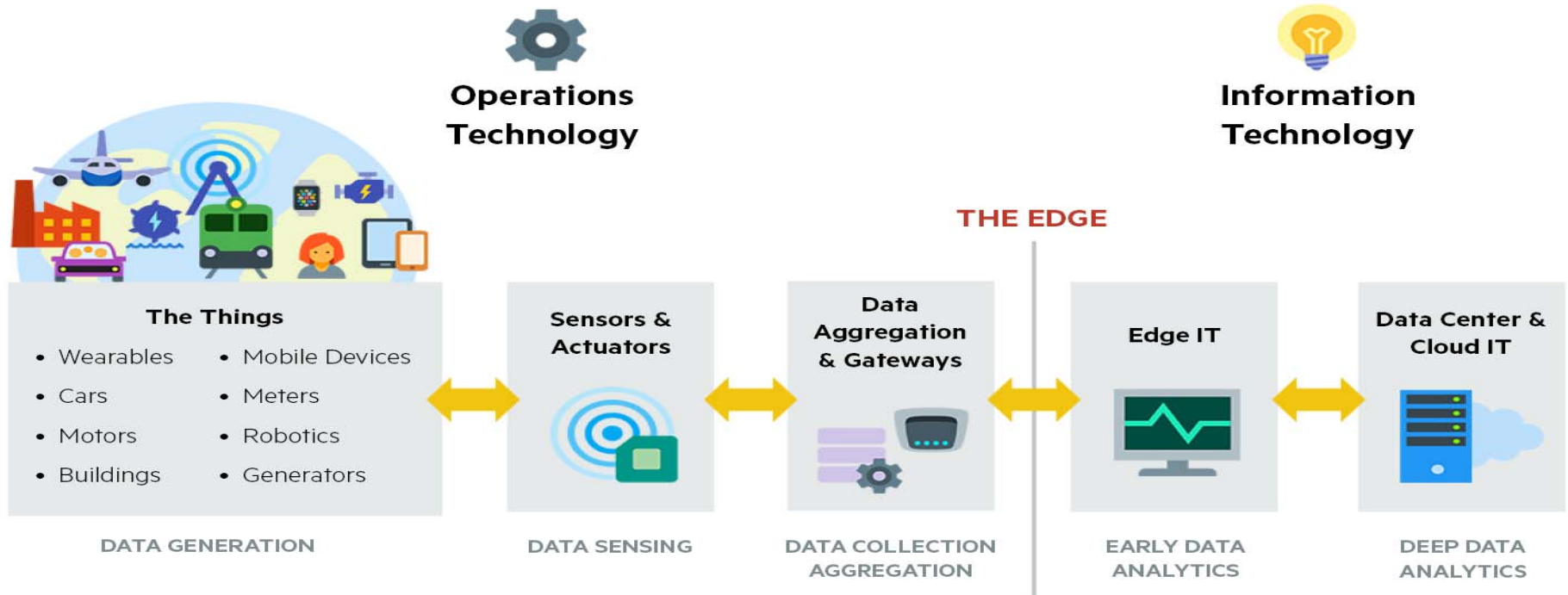
# Big Data to Data Analytic



## CONNECTED DEVICES 5G NETWORK

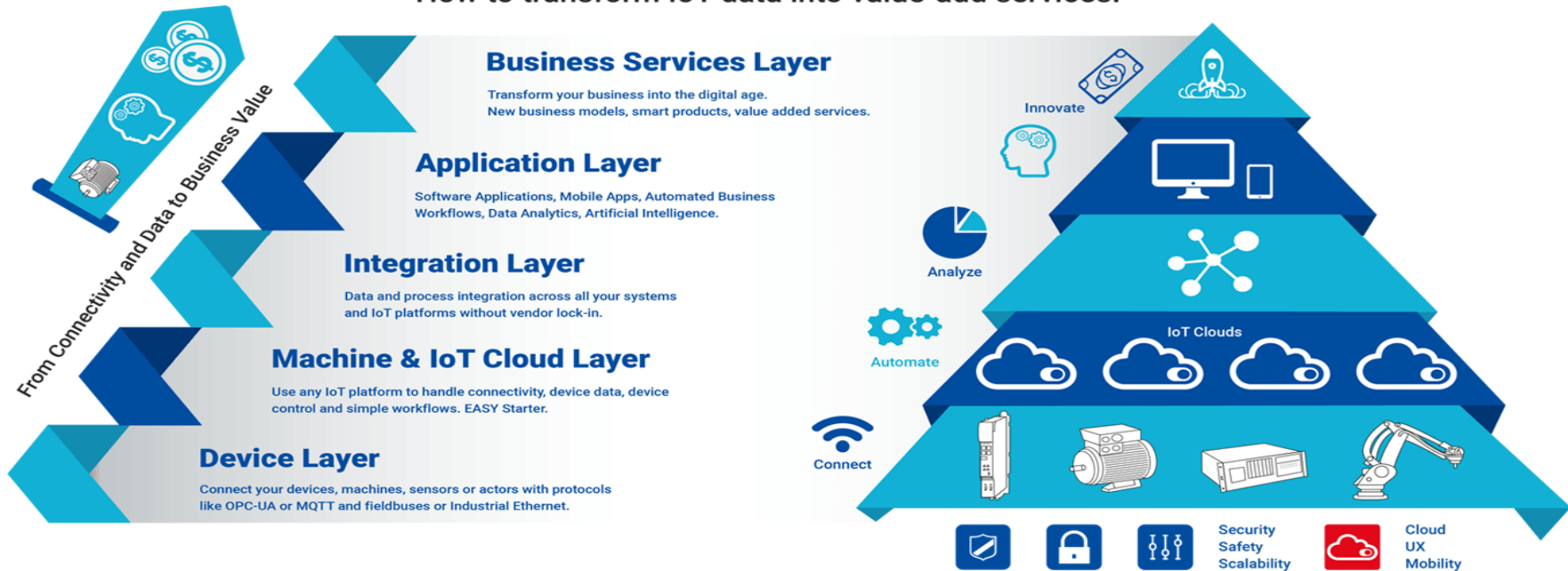


# Edgeless Computing Architecture



## The Industrial IoT Landscape

How to transform IoT data into value-add services.

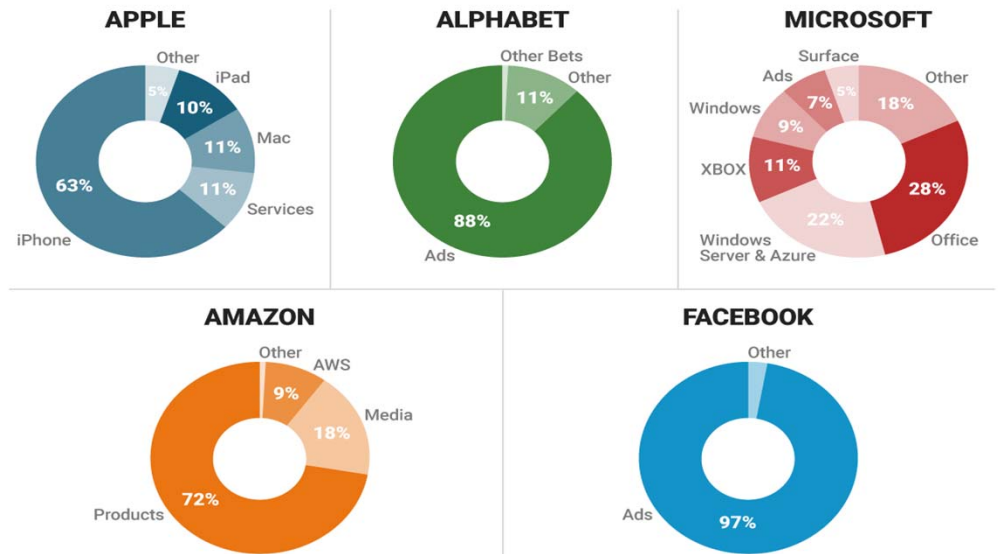


# 3G to 4G Platform Economy: The Big 5



TECH CHART OF THE DAY

## REVENUE STREAMS OF THE BIG 5 TECH COMPANIES



SOURCE: Company annual reports. Figures FY2016

VISUAL CAPITALIST | BUSINESS INSIDER



# Super Unicorn (4G)

KMITL



**Bicsi**<sup>®</sup>  
EMEA REGION  
[bicsi.org/emea2020](http://bicsi.org/emea2020)

# What is in 5G moving?

KMITL

Softbank acquires ARM Holdings

SoftBank

ARM

Yo!

Google Buys Nest for \$3.2 Billion

nest

72

AMAZON BUYS RING

ring

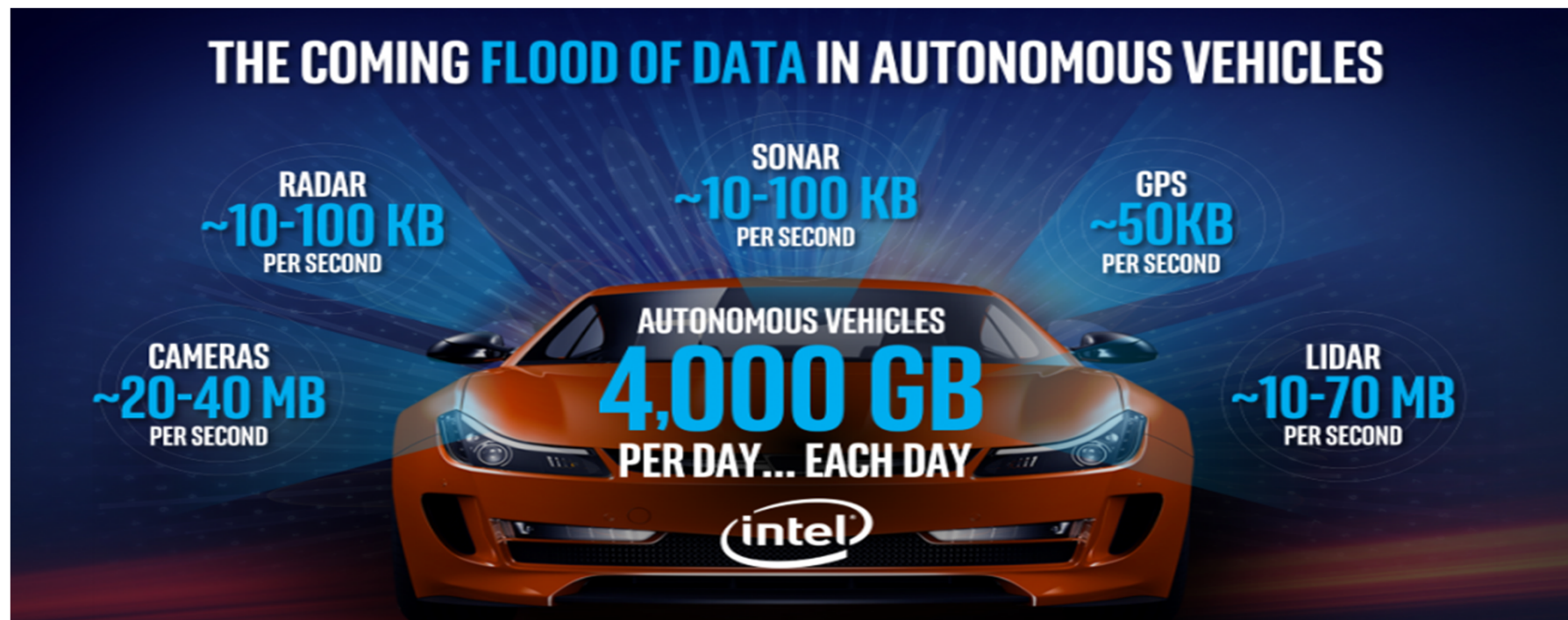
CISCO Jasper



**Bicsi**  
EMEA REGION  
[bicsi.org/emea2020](http://bicsi.org/emea2020)

# Autonomous Vehicle Data Connectivity

KMITL



**Bicsi**<sup>®</sup>  
EMEA REGION  
[bicsi.org/emea2020](http://bicsi.org/emea2020)



# Cellular Vehicle-to-Everything (C-V2X)



Attributes of 5G – including network slicing and low latency – will make safe public transport using autonomous vehicles a reality



## Continuous V2X technology evolution required Accommodating ever-evolving use cases and safety requirements

Evolution to 5G, while maintaining backward compatibility

### Basic safety 802.11p or C-V2X R14

Established foundation for basic V2X services



Forward collision warning

### Enhanced safety C-V2X R14

Better link budget leading to longer range and more reliability



Disable vehicle after blind curve

### Advanced safety C-V2X R15+ (building upon R14)

Higher throughput

Wideband ranging and positioning

Higher reliability

Lower latency



See-through / camera sensor sharing



Bird's eye view / HD map updates



Cooperative driving



# Cellular Vehicle-to-Everything (C-V2X)

**V2I - Vehicle-to-Infrastructure.**

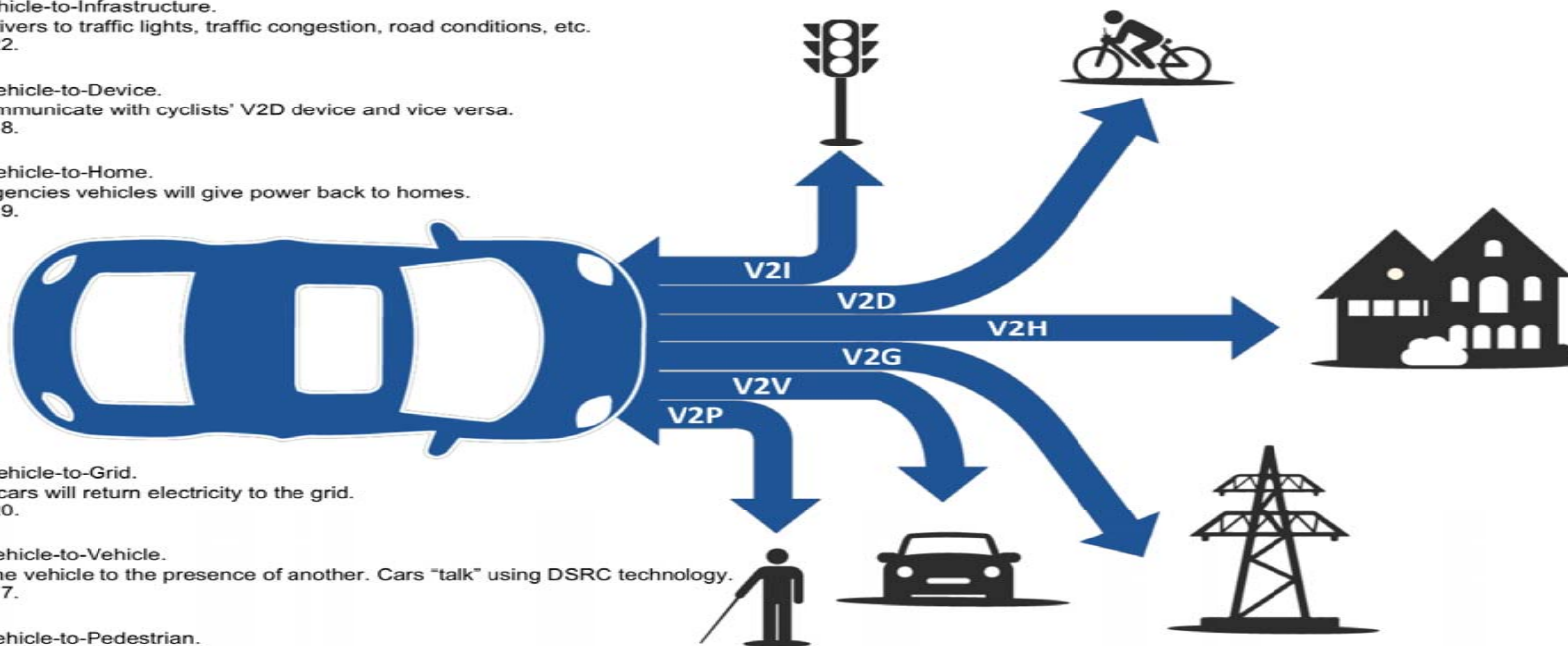
Alerts drivers to traffic lights, traffic congestion, road conditions, etc.  
Due 2022.

**V2D - Vehicle-to-Device.**

Cars communicate with cyclists' V2D device and vice versa.  
Due 2018.

**V2H - Vehicle-to-Home.**

In emergencies vehicles will give power back to homes.  
Due 2019.



**V2G - Vehicle-to-Grid.**

Electric cars will return electricity to the grid.  
Due 2020.

**V2V - Vehicle-to-Vehicle.**

Alerts one vehicle to the presence of another. Cars "talk" using DSRC technology.  
Due 2017.

**V2P - Vehicle-to-Pedestrian.**

Car communication with pedestrian with approaching alerts and vice versa.  
Due 2018.



# What is in 5G moving: Intel Case Study

KMITL

Intel Chip Chat



## INTEL-POWERED AUTOMATED DRIVING

Architecting the Future of Transportation for a Better Life and a Safer World

Backed by 30 years of security and IT expertise, Intel investment and experience are powering a "door lock to data center" platform that advances automated driving.



### DATA CENTER

Only Intel delivers data center technologies to meet tomorrow's transportation demands.

### 5G

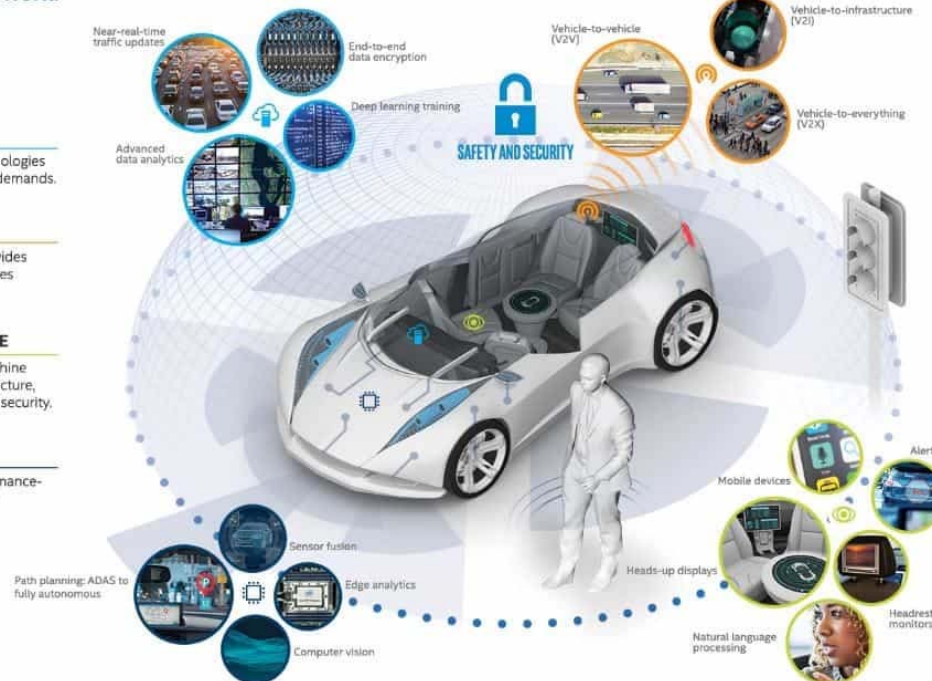
As the world moves to 5G, Intel provides an end-to-end solution that integrates intelligence across the network.

### HUMAN-MACHINE INTERFACE

Intel supports a natural human-machine interface (HMI) with a flexible architecture, advanced graphics, and end-to-end security.

### IN-VEHICLE COMPUTING

Intel delivers incredibly high-performance-per-watt silicon that is flexible, with uncompromising reliability.



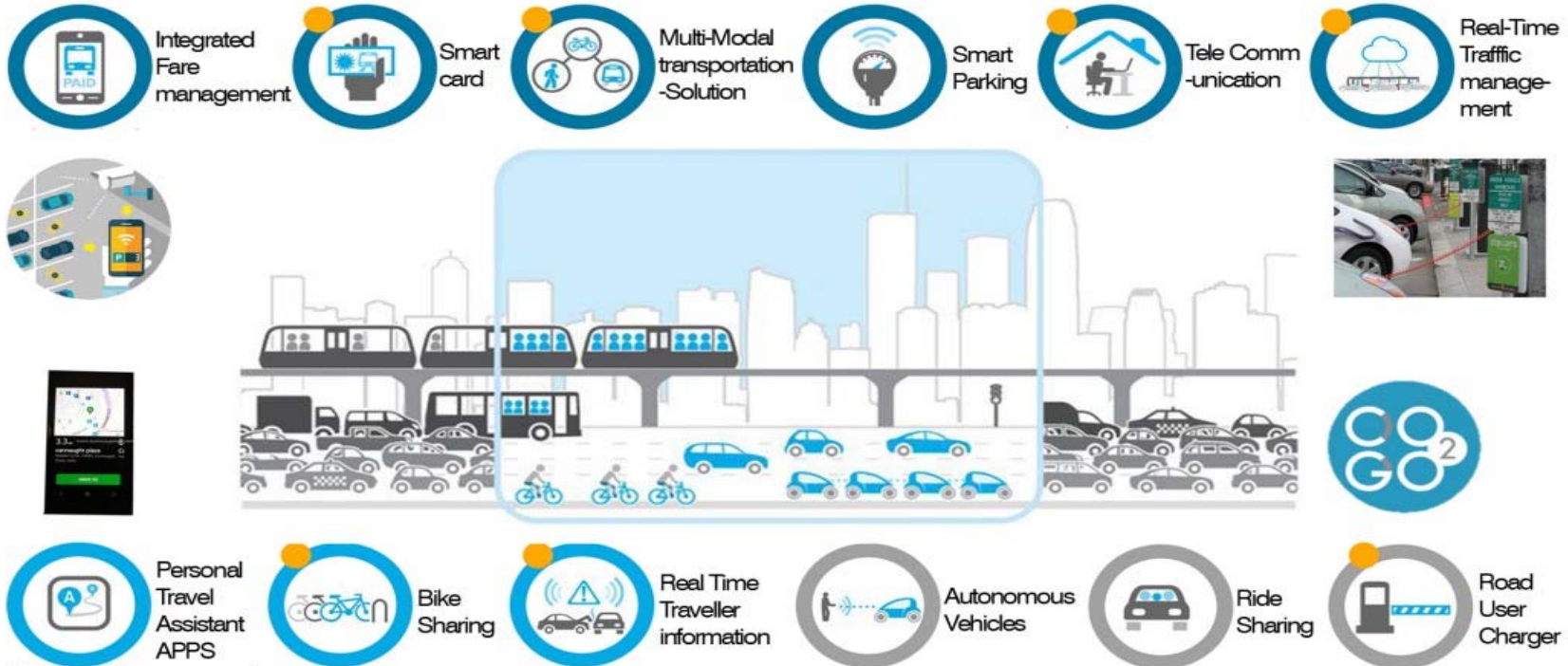
[intel.com/automotive](http://intel.com/automotive)

© 2016 Intel Corporation. All rights reserved. Intel, the Intel logo, the Intel Experience What's Inside logo, and Intel Experience What's Inside are trademarks of Intel Corporation in the U.S. and/or other countries. \*Other names and brands may be claimed as the property of others.

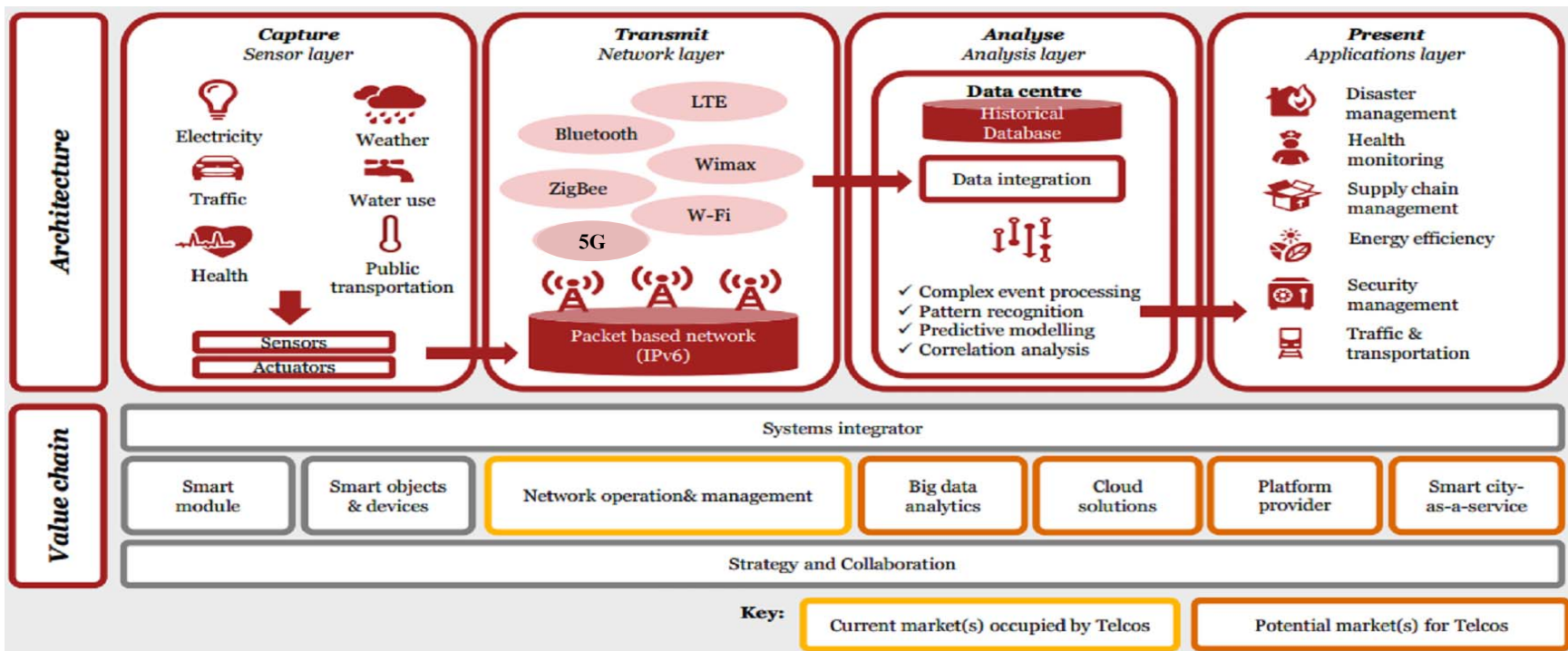
**Bicsi**  
EMEA REGION  
[bicsi.org/emea2020](http://bicsi.org/emea2020)



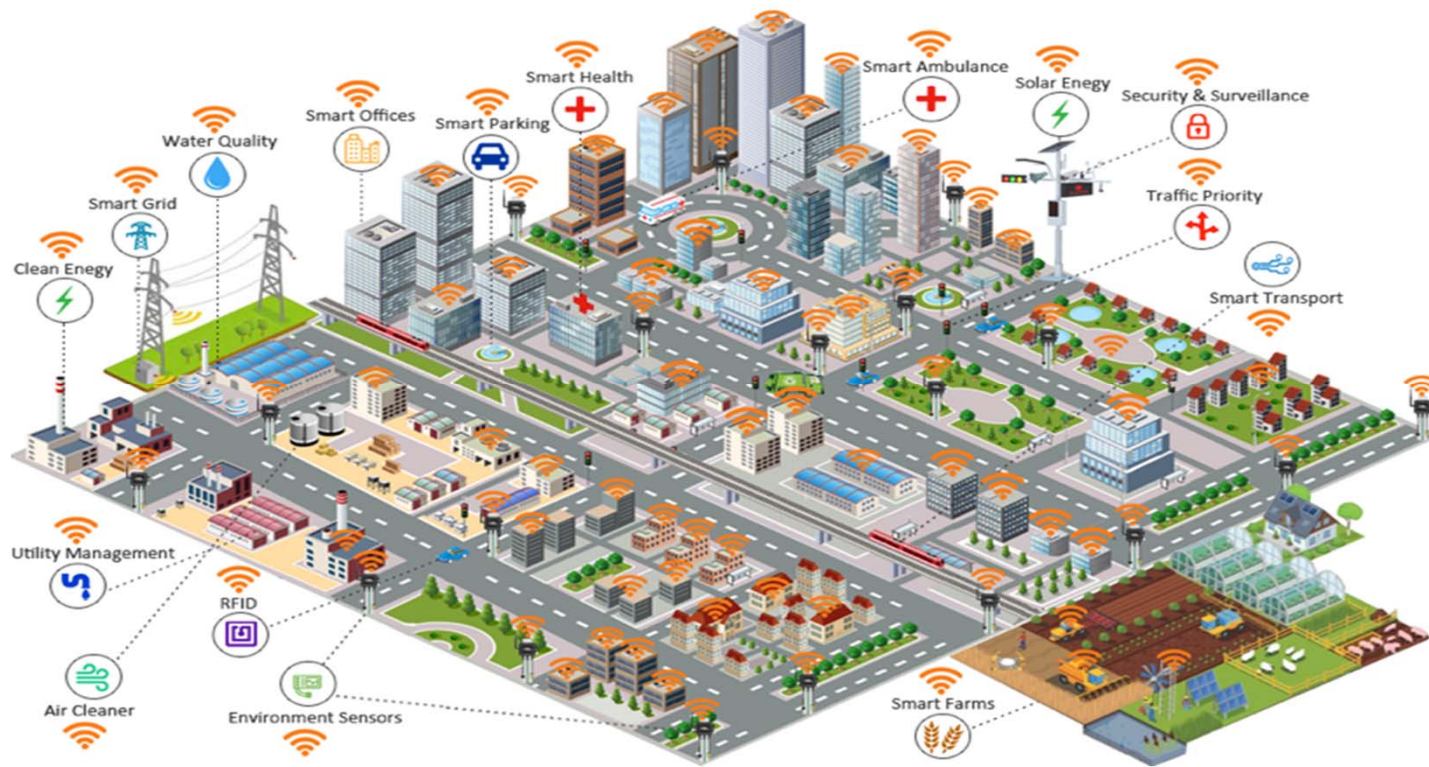
# Smart Mobility Technology



# Edgeless Connectivity

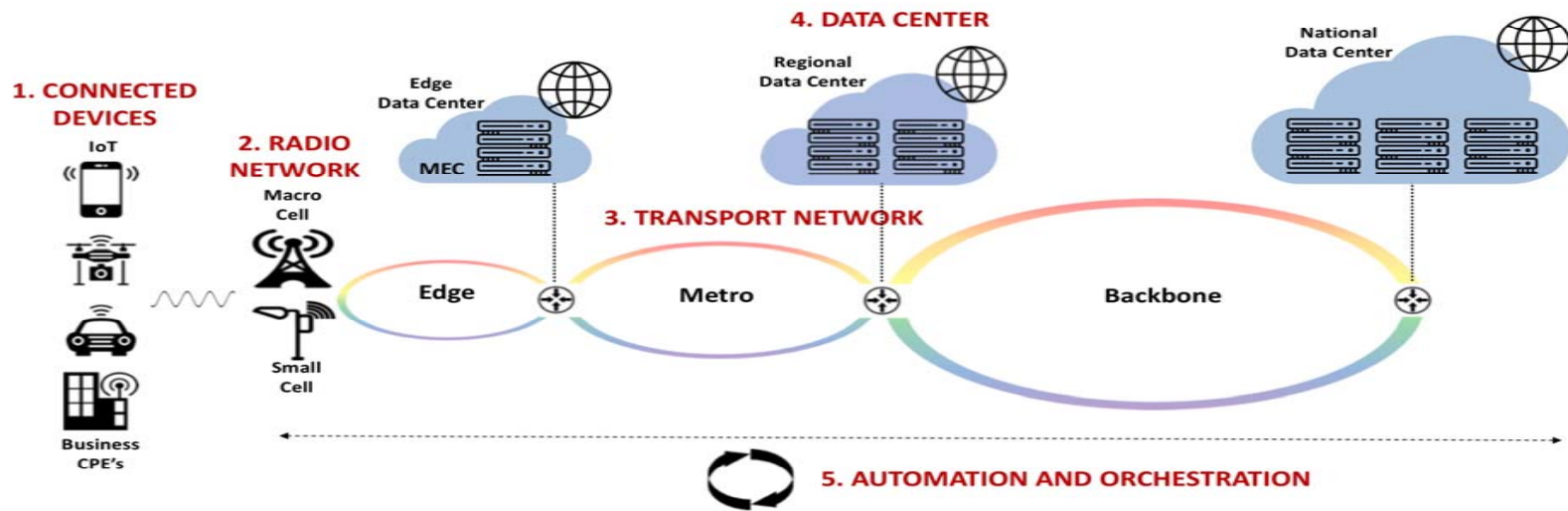


# Smart City Connectivity



# 5G and Data Center Inter City Architecture

## 5G ARCHITECTURE





**KMITL**

*Thank You!*



**DATACENTERUNIVERSITY.ORG**



**Assoc. Prof. Dr. Montri Wiboonrat**

BICSI Thailand Country Chair

[mwiboonrat@bicsi.org](mailto:mwiboonrat@bicsi.org), [montri.wi@kmitl.ac.th](mailto:montri.wi@kmitl.ac.th)

+66 8 1173 8200



**Bicsi**<sup>®</sup>  
**EMEA REGION**  
[bicsi.org/emea2020](http://bicsi.org/emea2020)