ADVANCED
TELECOMMUNICATION TECHNOLOGY
RESEARCH GROUP

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Department of Communication Engineering, Faculty of Electrical Engineering

Internet-of-Things (IoT)
Your 7th Sense

CICT Cares Day

23 November 2017 | CICT UTM JB

By

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Advanced Telecommunication Technology (ATT) Research Group

Faculty of Electrical Engineering

UTM JB

www.fke.utm.my/research-groups/att/, https://www.facebook.com/ATTfkeUTM/

Outline

- Understanding IOT
- Defining IOT
- Building IOT solutions
- IOT World Roadmap
- ATT IOT Stories

Understanding IOT

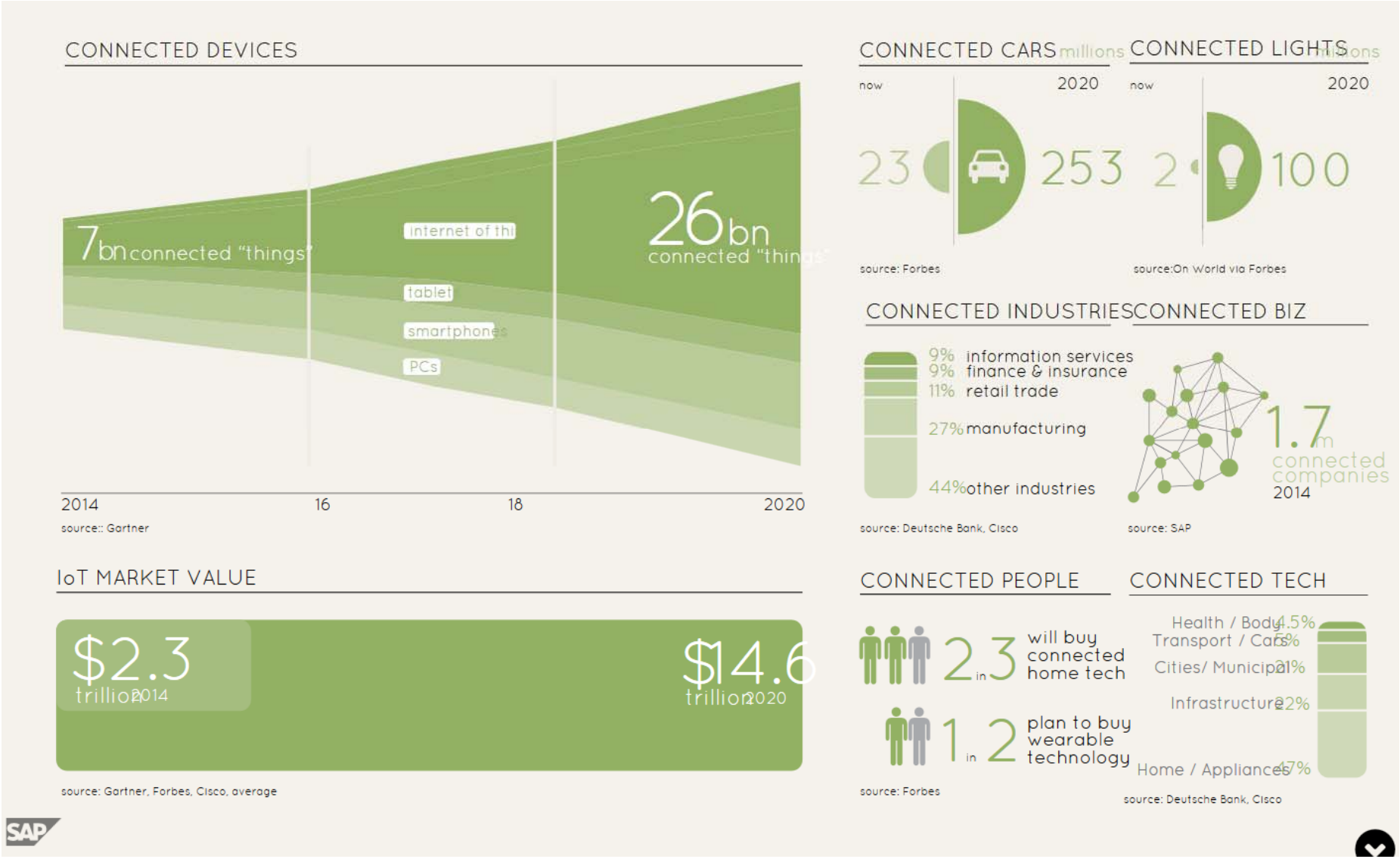
What is Exactly Internet of Things?

The First Internet Connected Appliance - 1982

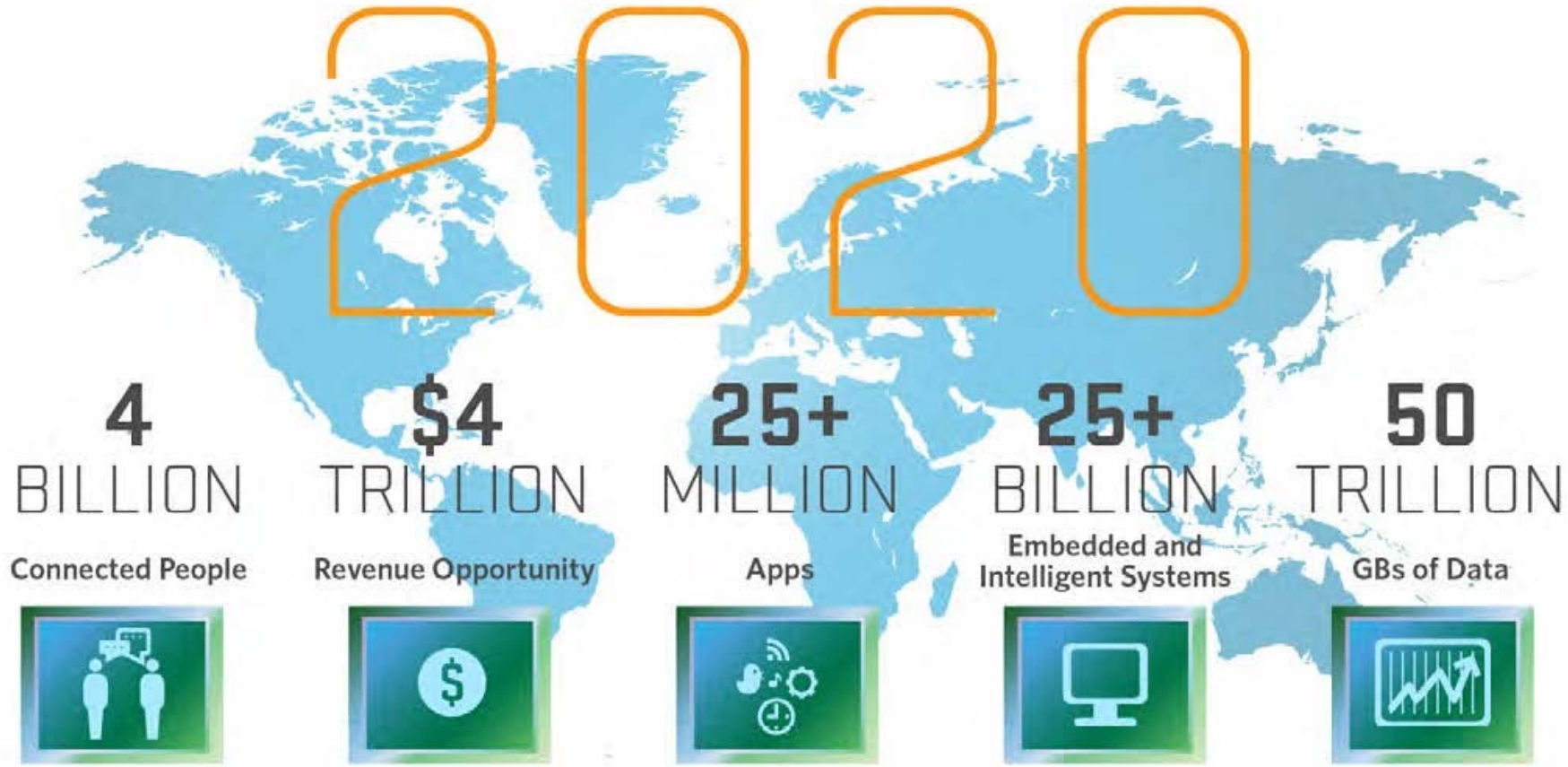
Kevin Ashton

Coined **Internet-of-Things** term in 1999

26 billions connected devices by 2020



Source: http://www.informationisbeautiful.net/visualizations/the-internet-of-things-a-primer/



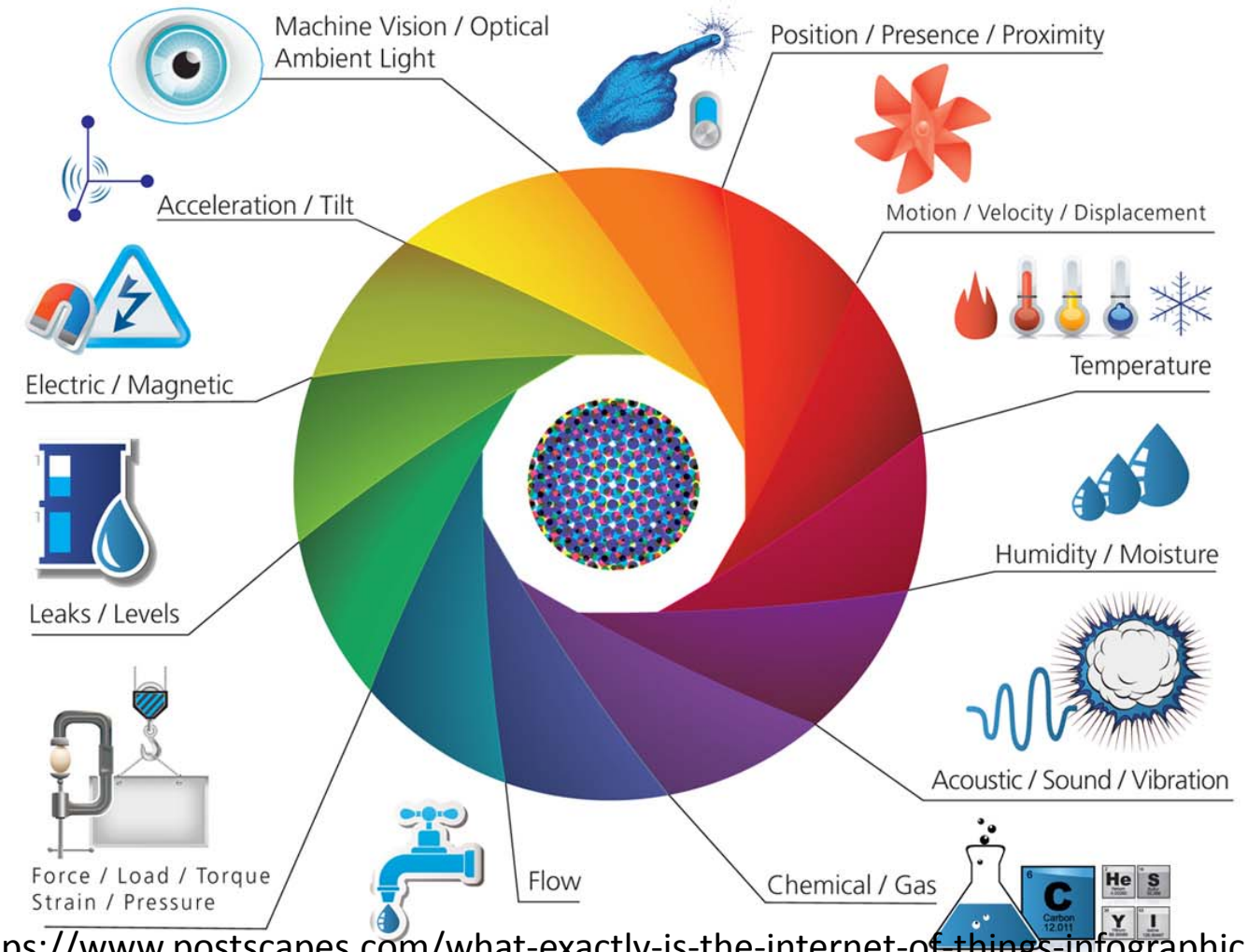
Source: Mario Morales, IDC

Smart Systems and the Internet of Things are driven by a combination of:

Source: https://www.postscapes.com/what-exactly-is-the-internet-of-things-infographic/

1 SENSORS & *ACTUATORS*

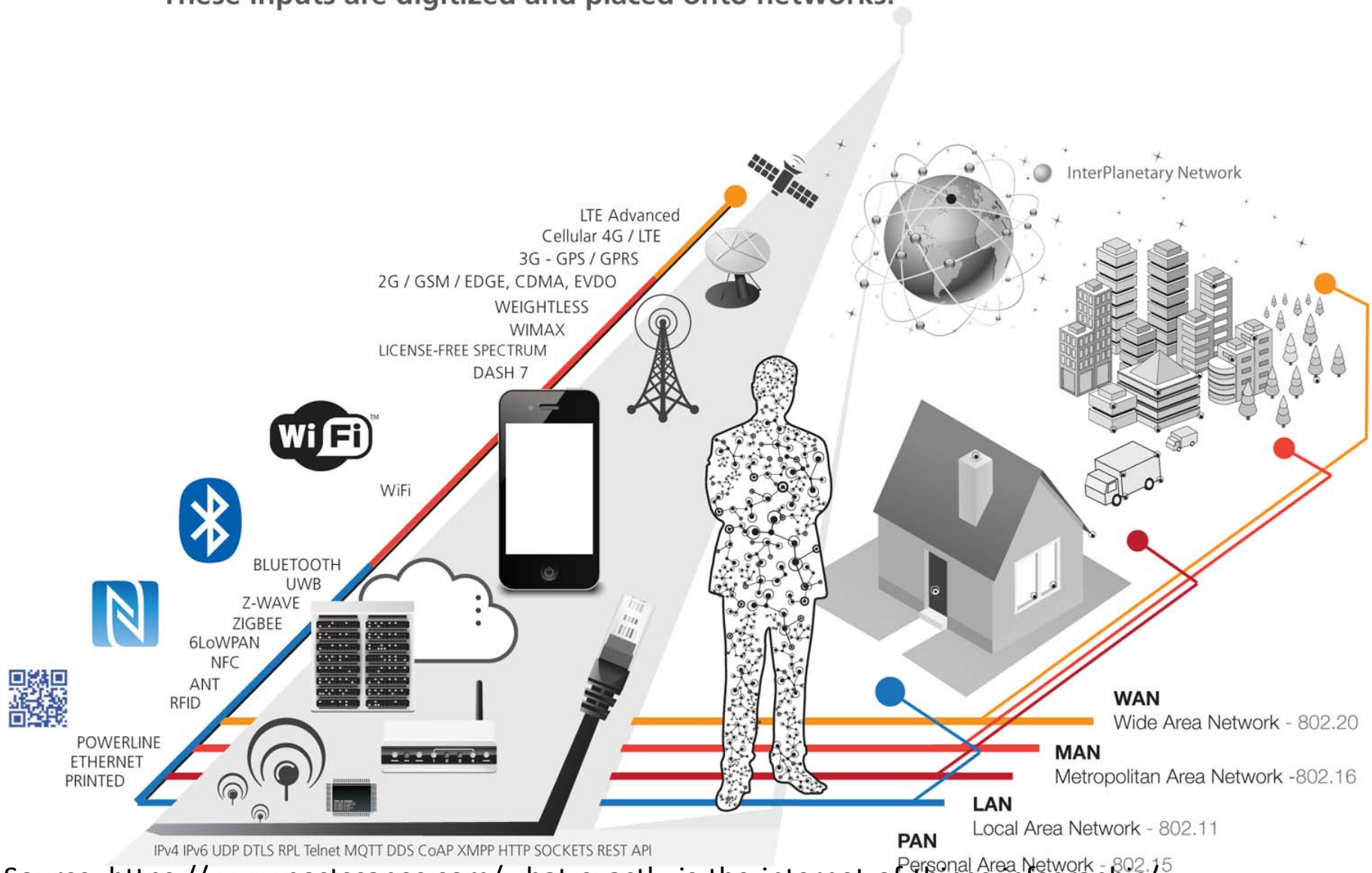
We are giving our world a digital nervous system. Location data using GPS sensors. Eyes and ears using cameras and microphones, along with sensory organs that can measure everything from temperature to pressure changes.



Source: https://www.postscapes.com/what-exactly-is-the-internet-of-things-infographic/

2 CONNECTIVITY

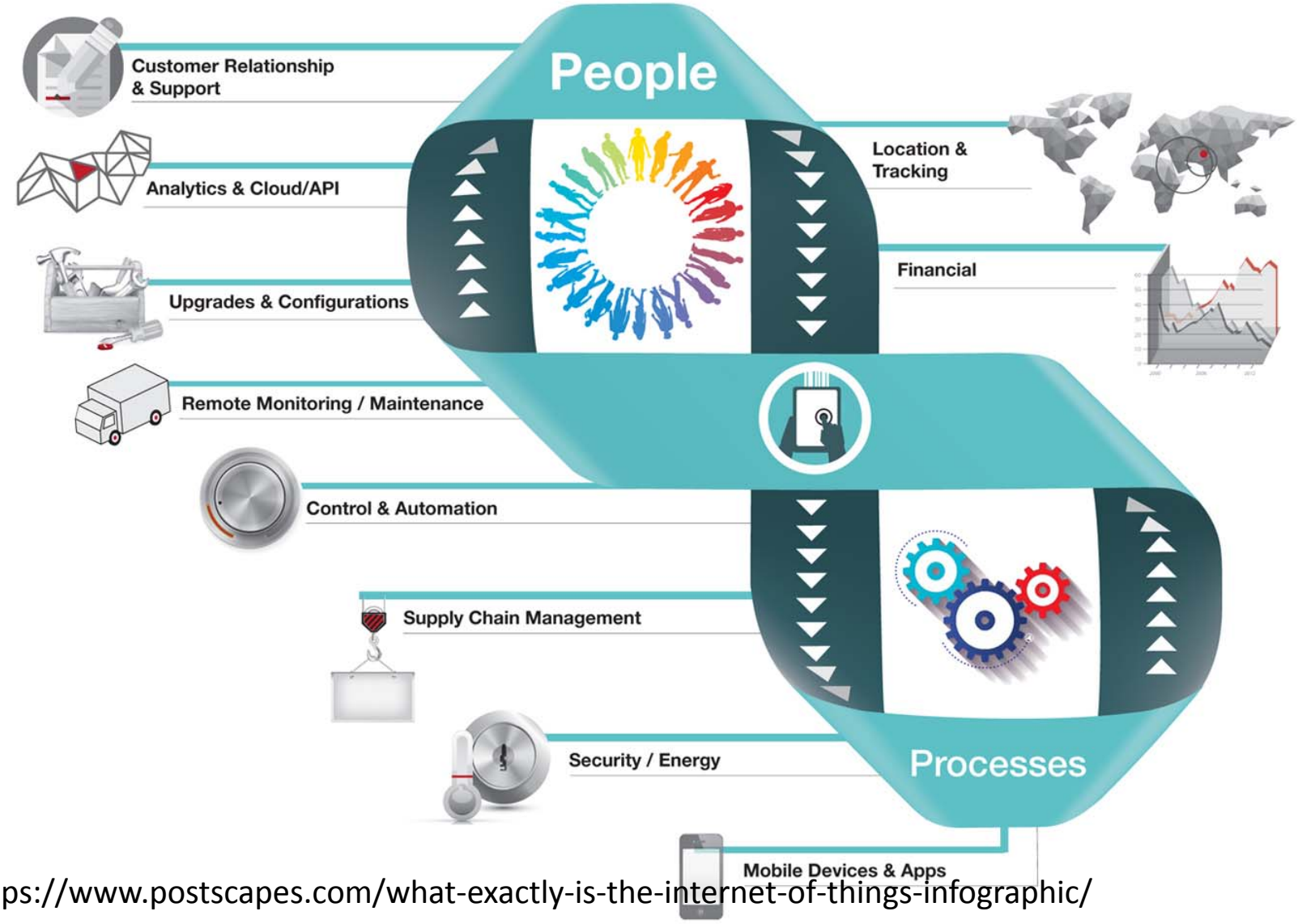
These inputs are digitized and placed onto networks.



Source: https://www.postscapes.com/what-exactly-is-the-internet-of-things-infographic/

3 PEOPLE & *PROCESSES*

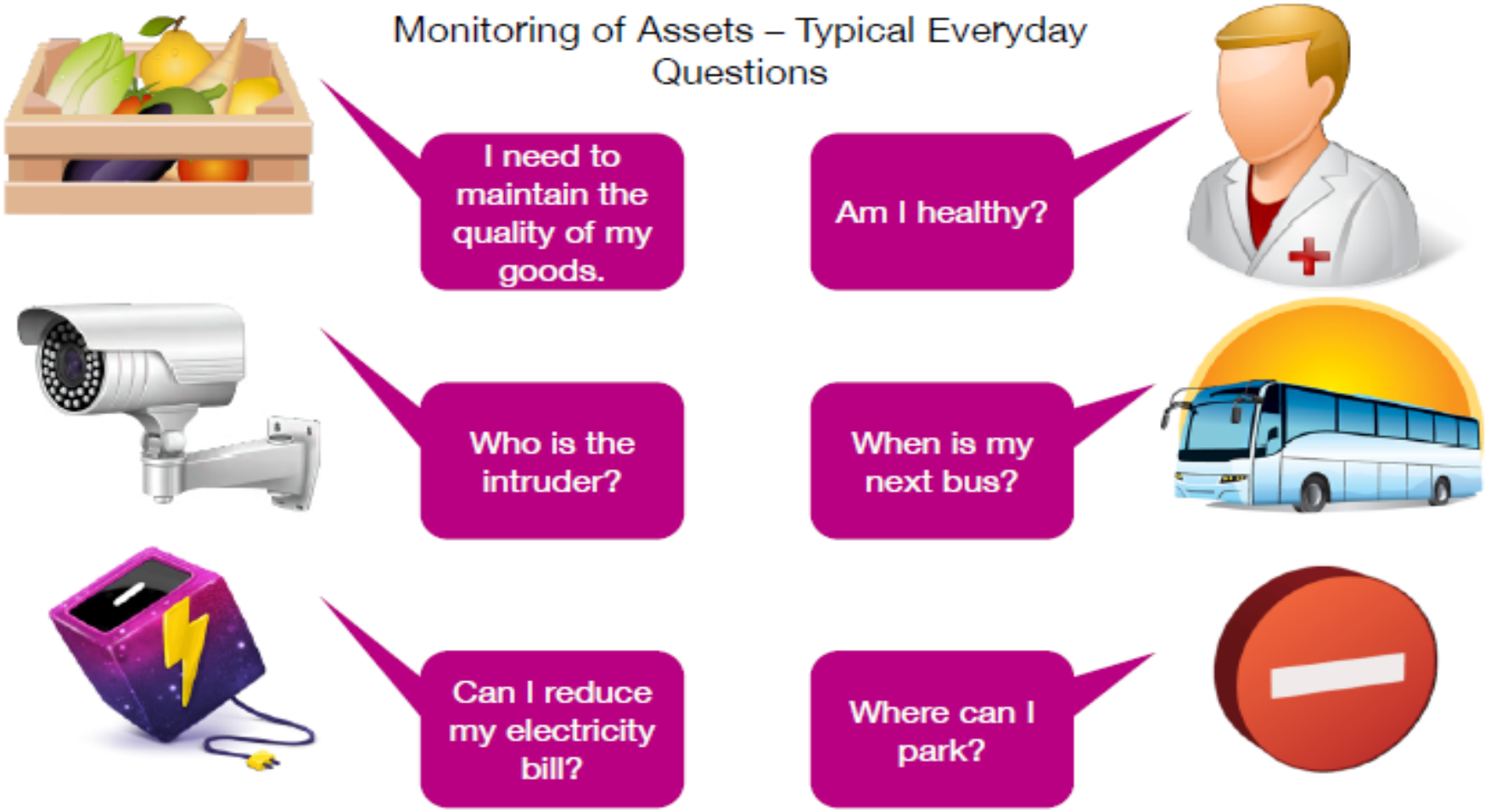
These networked inputs can then be combined into bi-directional systems that integrate data, people, processes and systems for better decision making.



Source: https://www.postscapes.com/what-exactly-is-the-internet-of-things-infographic/

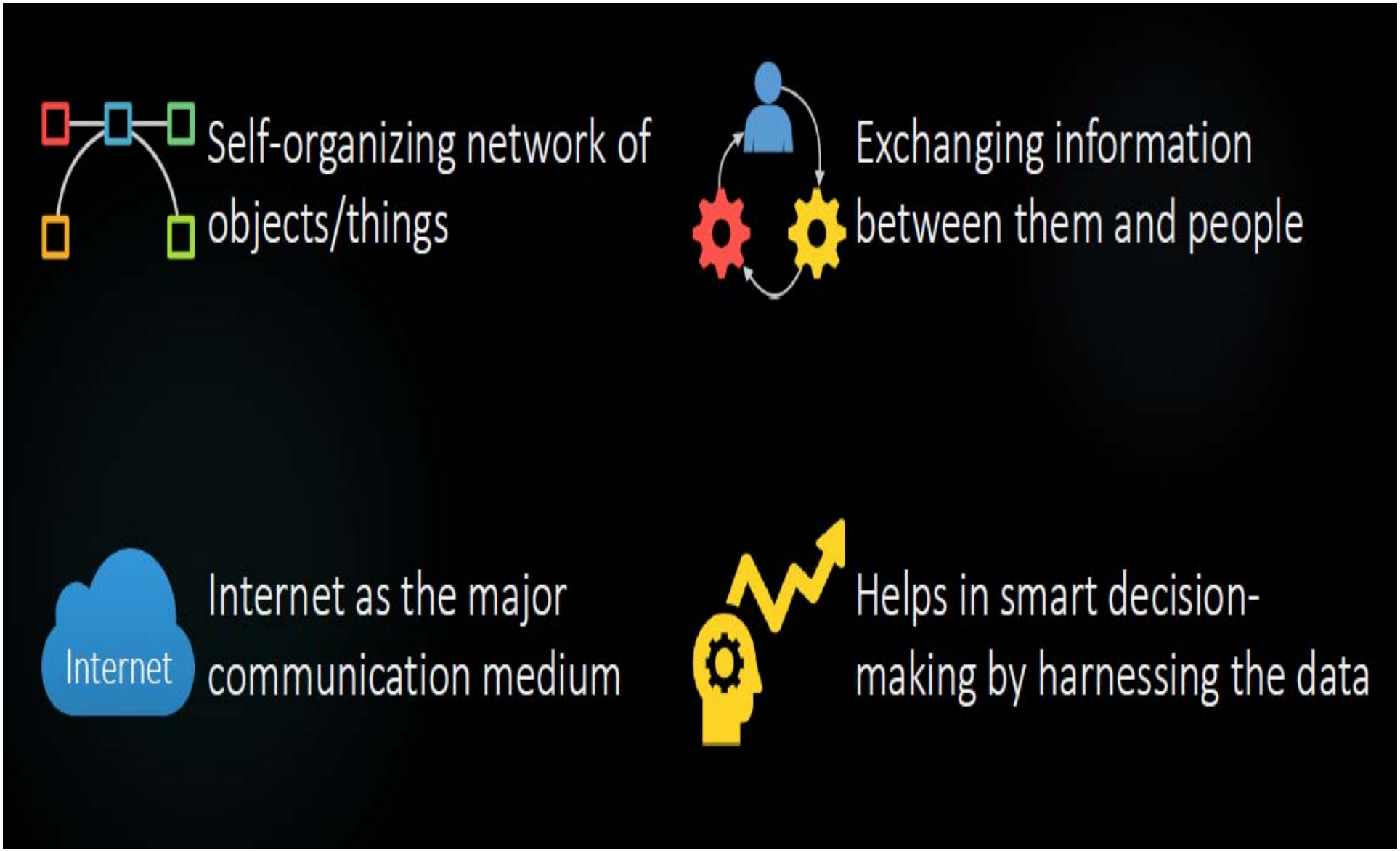
Defining IOT

The Need to Connect



What IF we can connect ALL these assets and get the answers to ALL these questions?

Internet of Things – The Definition



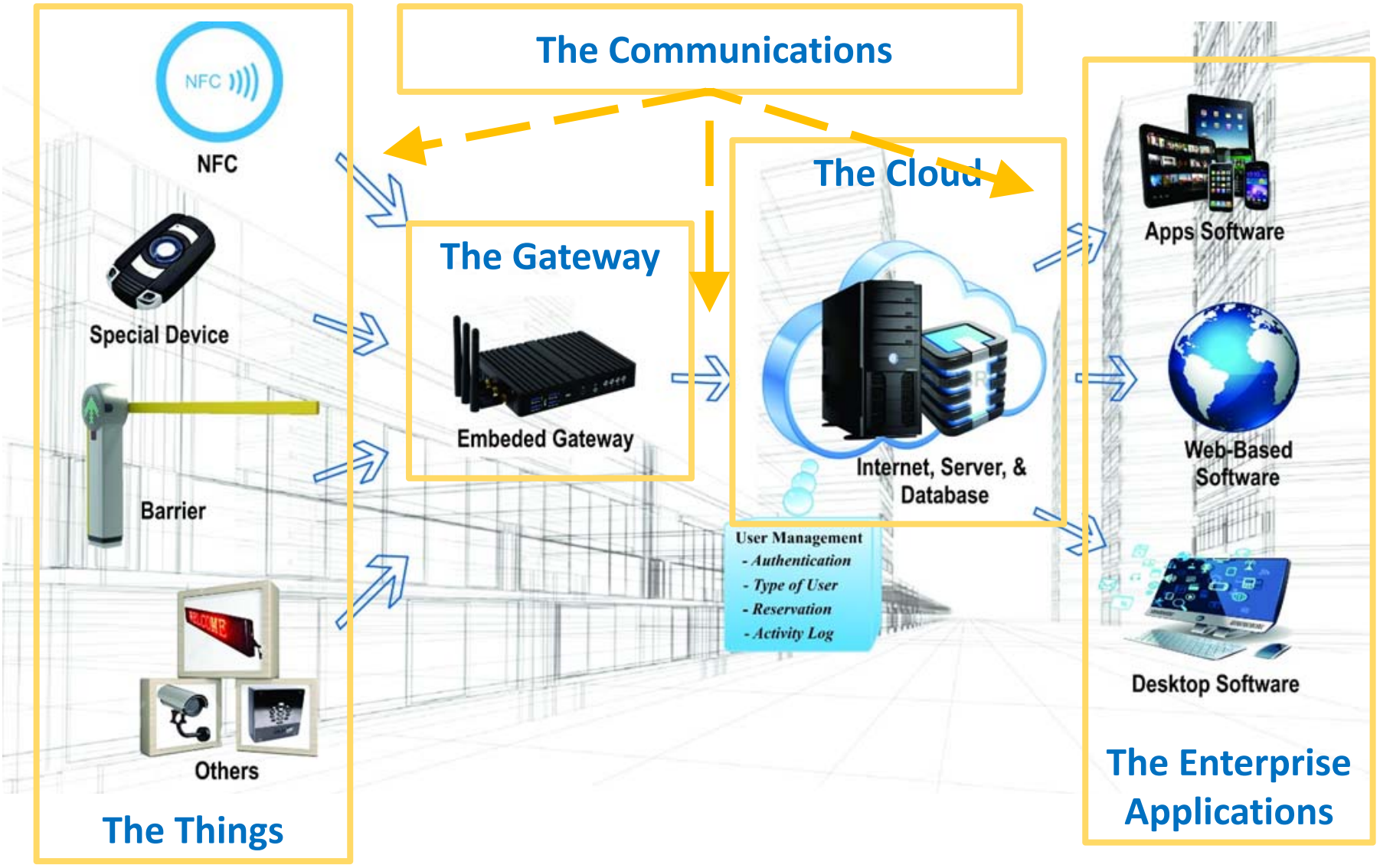

Real-time Information
Better decision making
Safety & Security
Better living standards
Aging Population
Requires better care
Lifestyle
Convenience
IoT Drivers
Limited Resources
Requires conservation
Information Generation
Measurements and tracking
Govt. Initiatives
Better citizen services
Innovation
New business models

Civilization advances by extending the number of important operations which we can perform without thinking about them.

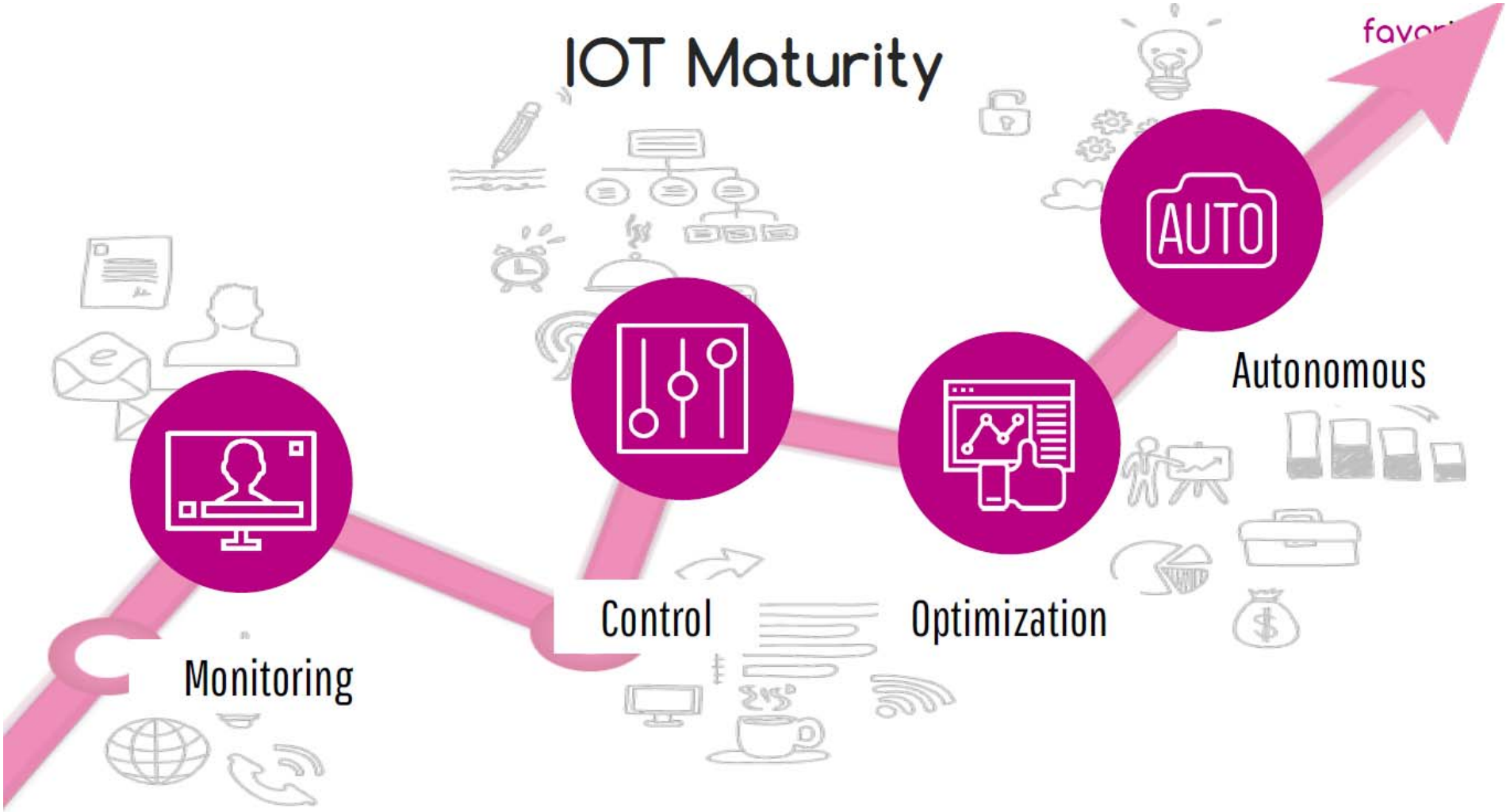
Introduction to Mathematics (1911)

Alfred North Whitehead
(1861 – 1947)

IoT Architecture



IoT Maturity Phases



Source: https://iotworld.co/2017/05/20/industry-talk-internet-of-things-journey/

Monitoring

Source: https://iotworld.co/2017/05/20/industry-talk-internet-of-things-journey/

Controlling

Source: https://iotworld.co/2017/05/20/industry-talk-internet-of-things-journey/

Optimizing

Source: https://iotworld.co/2017/05/20/industry-talk-internet-of-things-journey/

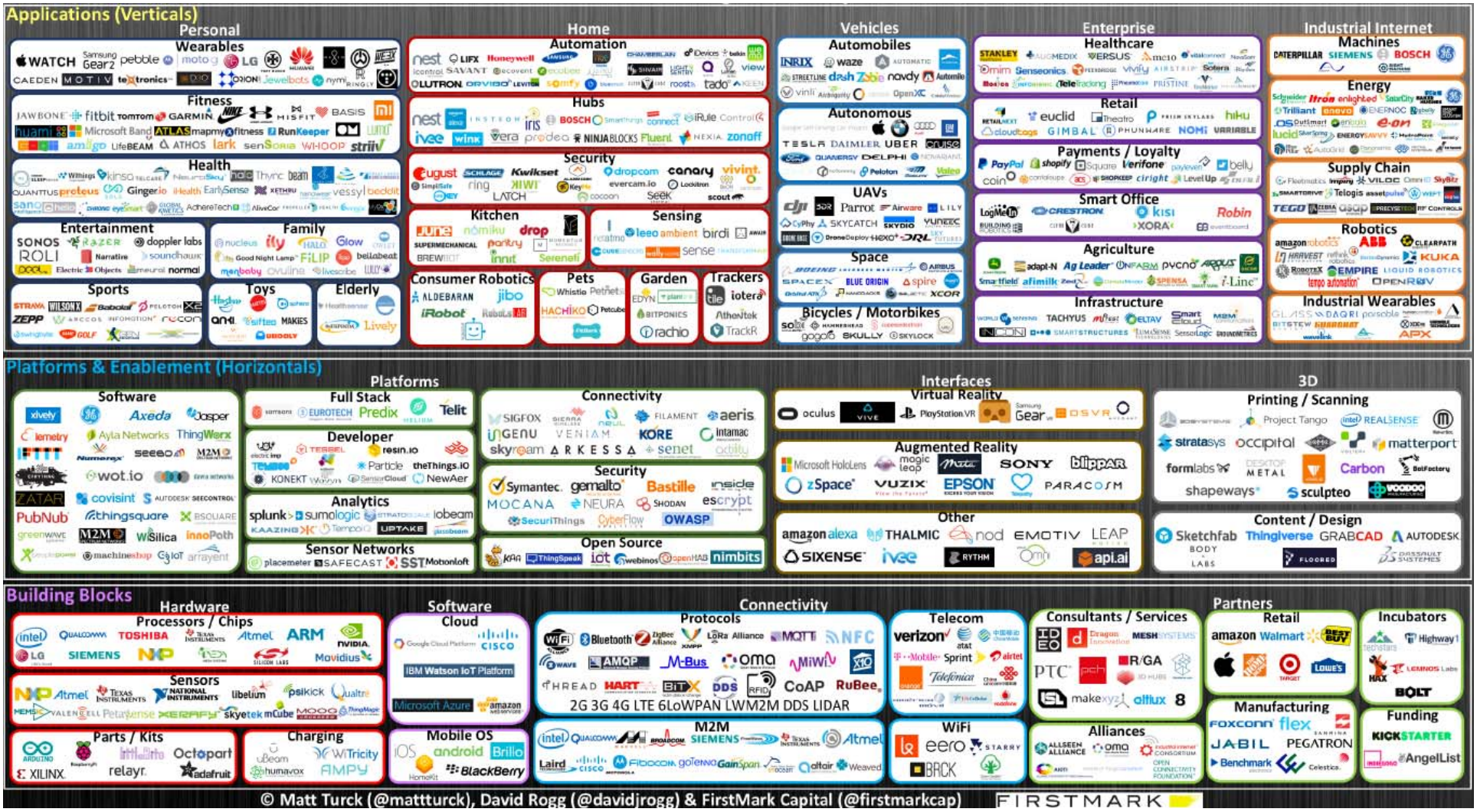
Autonomous

Source: https://iotworld.co/2017/05/20/industry-talk-internet-of-things-journey/


DRIVERLESS TAXI
UBER
ADVANCED
TECHNOLOGIES
CENTER
UBERATC.COM/CAR


FLYING TAXI
AAV - Autonomous Aerial Vehicle

IOT Ecosystem 2016

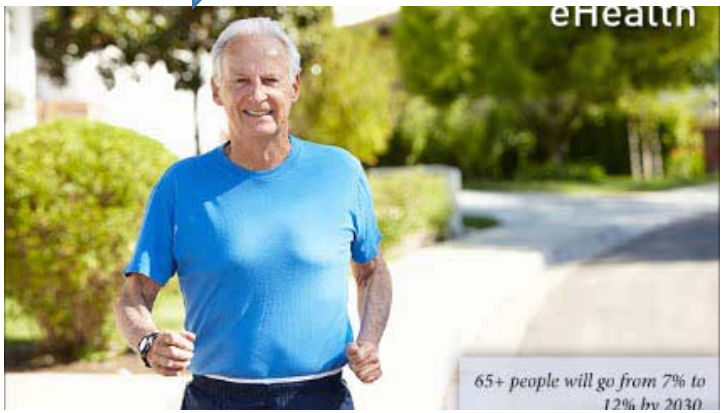


Building IOT Solutions

Leveraging the IOT Ecosystem

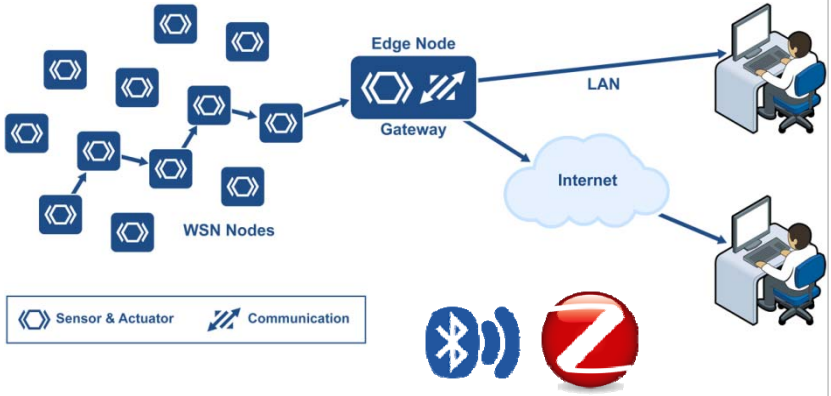
ABCD's of IoT

Applications



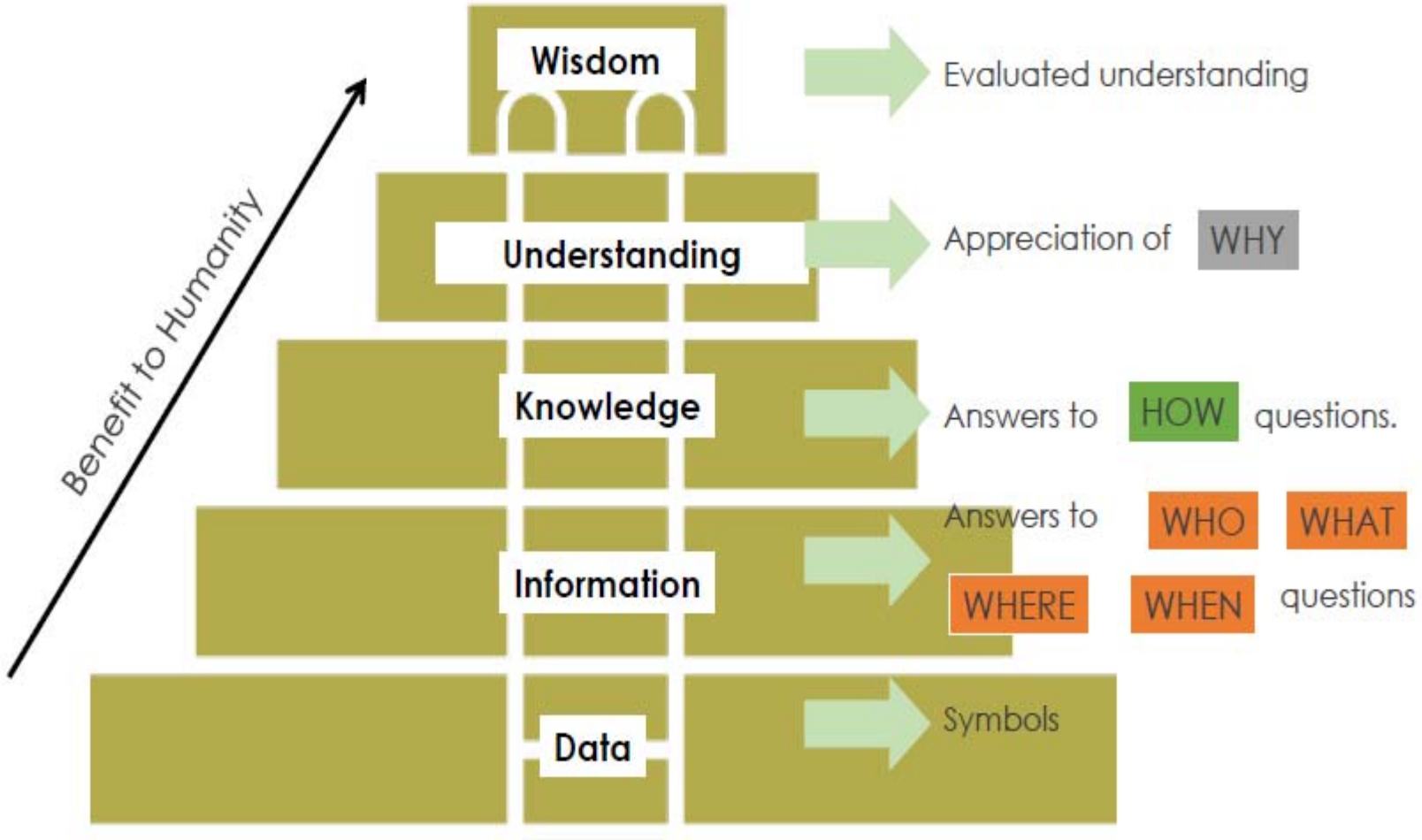
Big Data Analytics

Connectivity and Communication

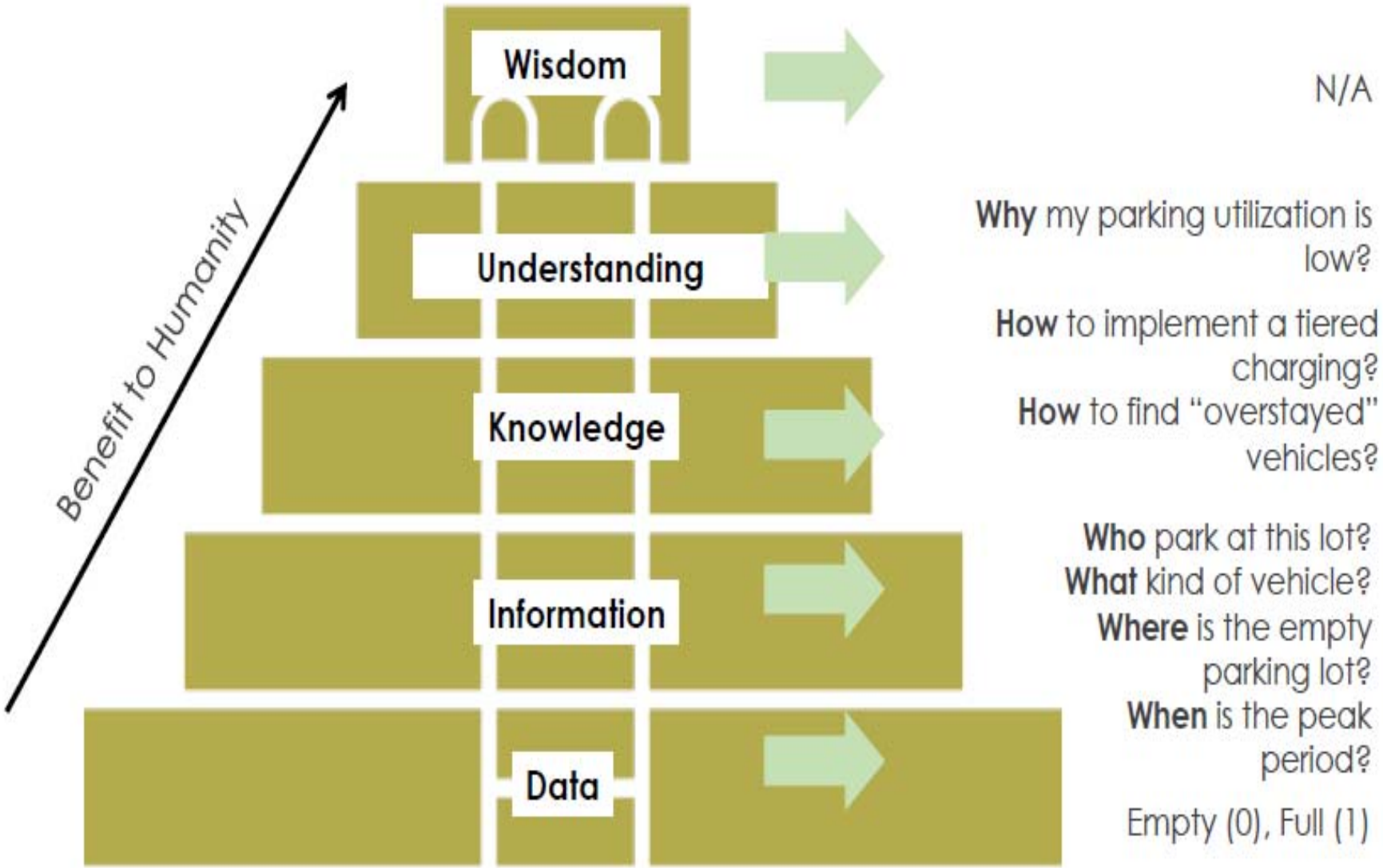


Devices – that are smart!

Value is Created by Making Sense of Data



Example: Smart Parking



Smart Parking

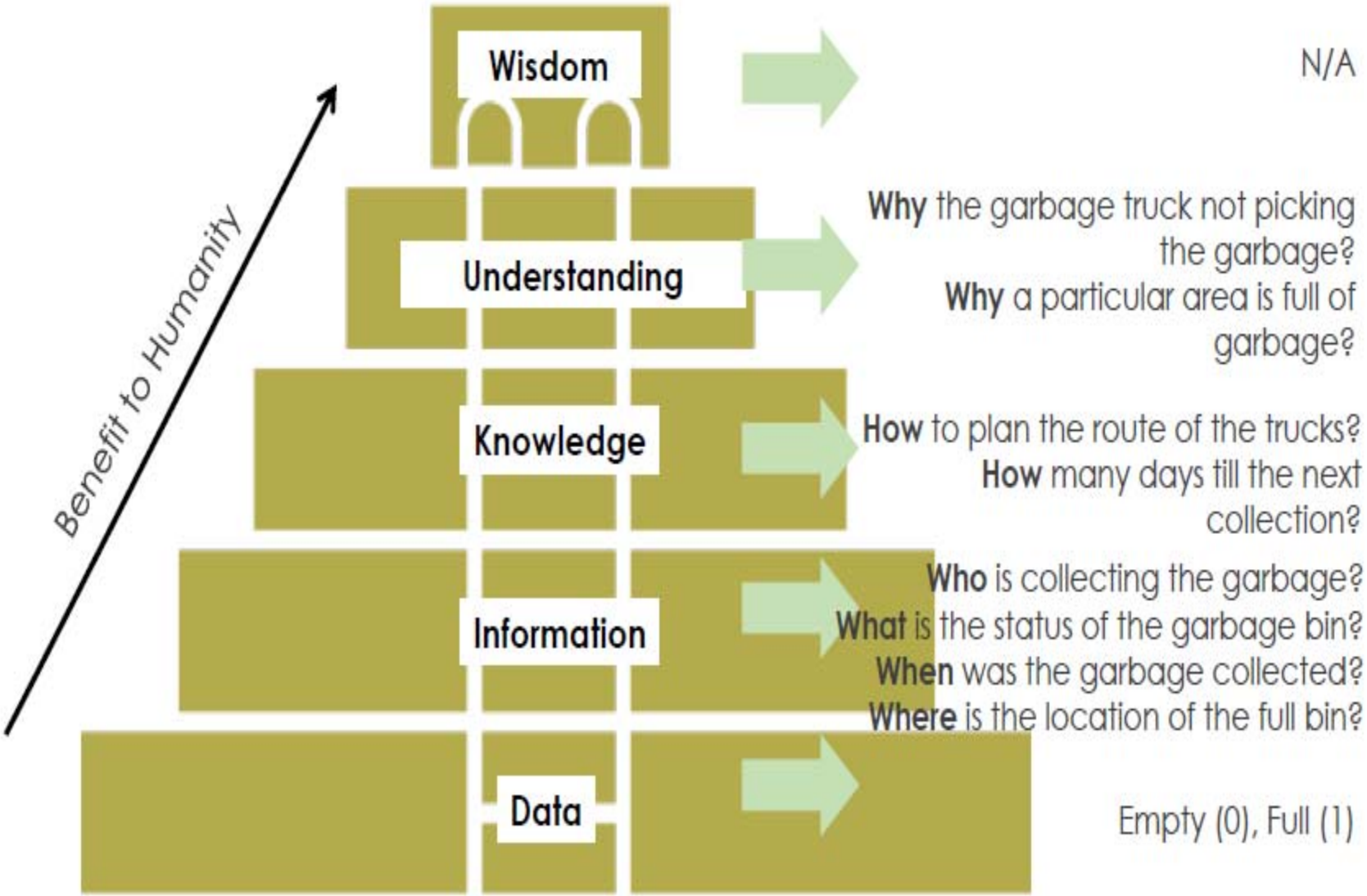
Smart Parking
With Sensors

Location of
Parking
Availability

Parking
Utilization

Tiered Pricing
Parking

Example: Smart Waste Management



Smart Waste Management

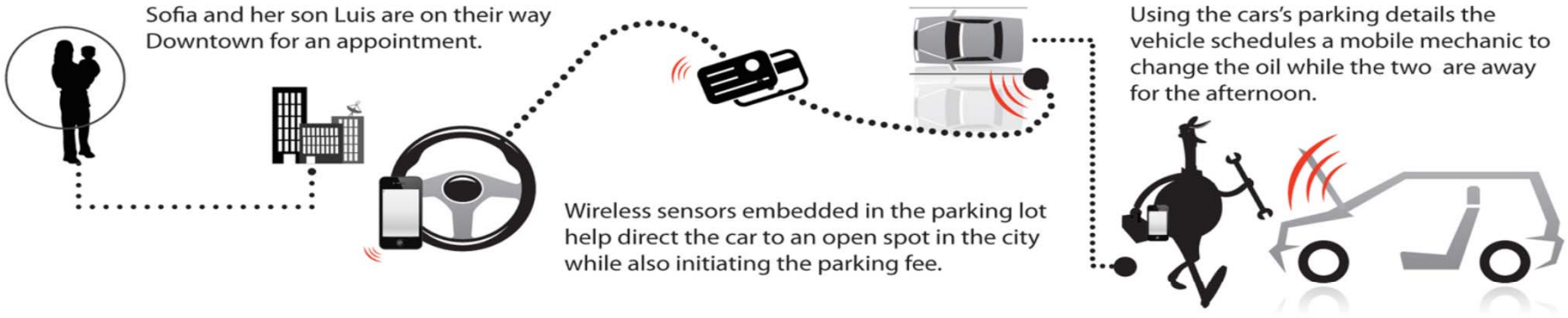
Design Challenge: Flood Monitoring

IoT based Flood Monitoring – Value Proposition

1. Early warning system for floods
2. Locating the area of violation (cause of floods)
3. Efficient rescue planning
4. Plan the widening of the river banks
5. Plan deepening of the river bed
6. Predict the conditions of flooding when coupled with a weather station, astronomical, tide and GIS.

Design Cases

TRANSPORTATION + SMART CITIES

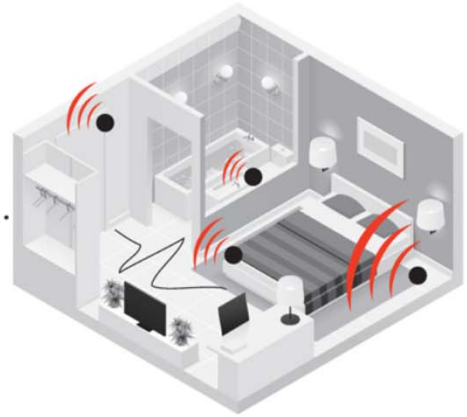


In Downtown San Francisco 20-30% of all traffic congestion is caused by people hunting for a parking spot.

- San Francisco Municipal Transportation Agency (SFMTA)

HEALTHCARE + SMART HOME

Aging uncle Earl is still living isolated at his home and you are concerned about his safety.



Wireless sensors throughout his house help measure healthy activity levels, sleeping patterns and medication schedules.

Alerts are automatically sent to health care services and authorized family members if any abnormal activity is detected.

40 million adults age 65 and over will be living alone in the U.S, Canada and Europe.

- U.S. Department of Health and Human Services: Administration for Community Living (ACL)

SMART BUILDINGS + MOBILITY

Anna is being pressured to reduce her company's expenses for their new corporate office.

After speaking with experts she decides to install sensors to automate energy usage according to building occupancy, people flow, temperature, and other ambient conditions -- improving the building's overall efficiency.

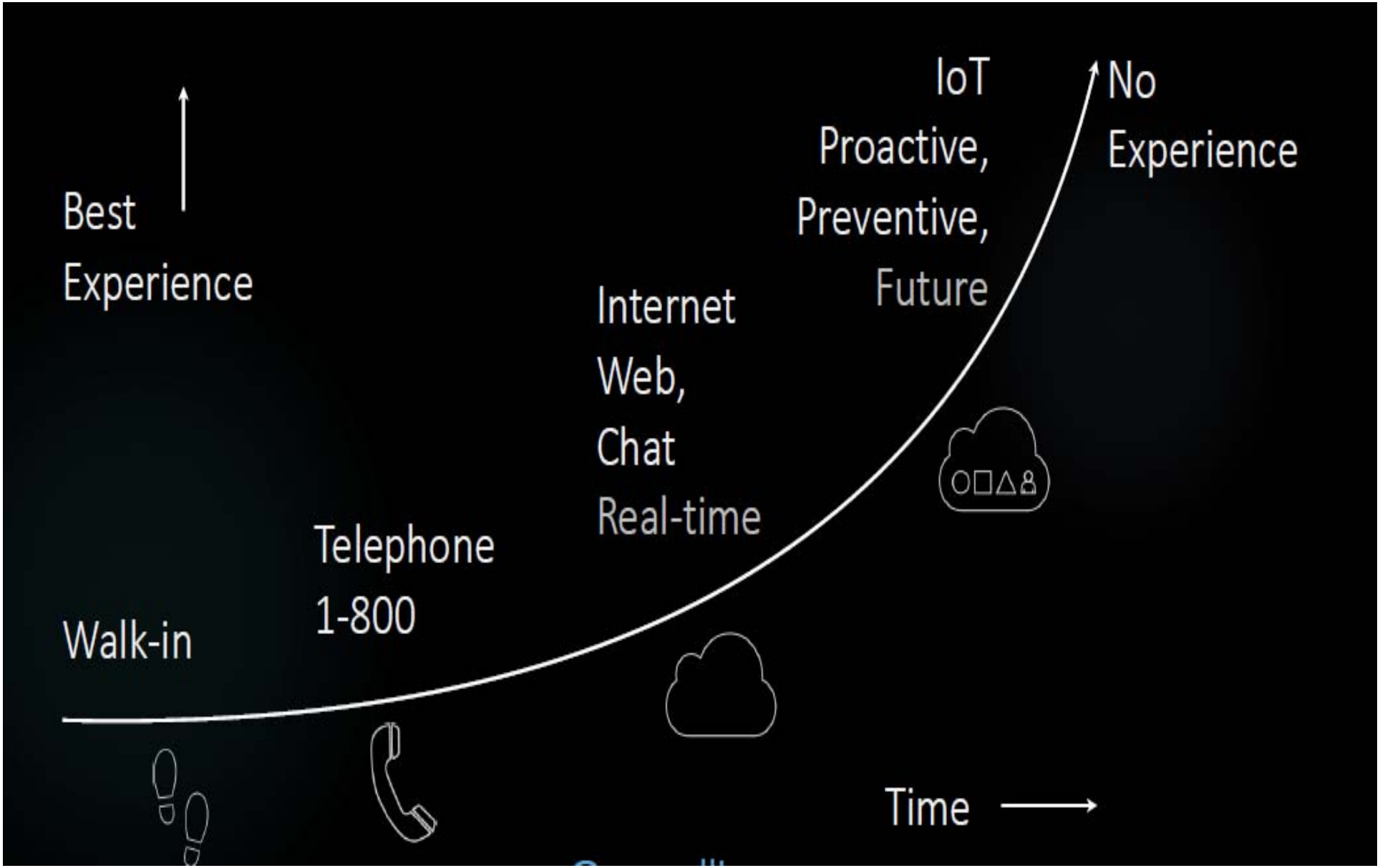
Energy used by commercial and industrial buildings in the US creates nearly 50% of our national emissions of greenhouse gases.

- United States Environmental Protection Agency

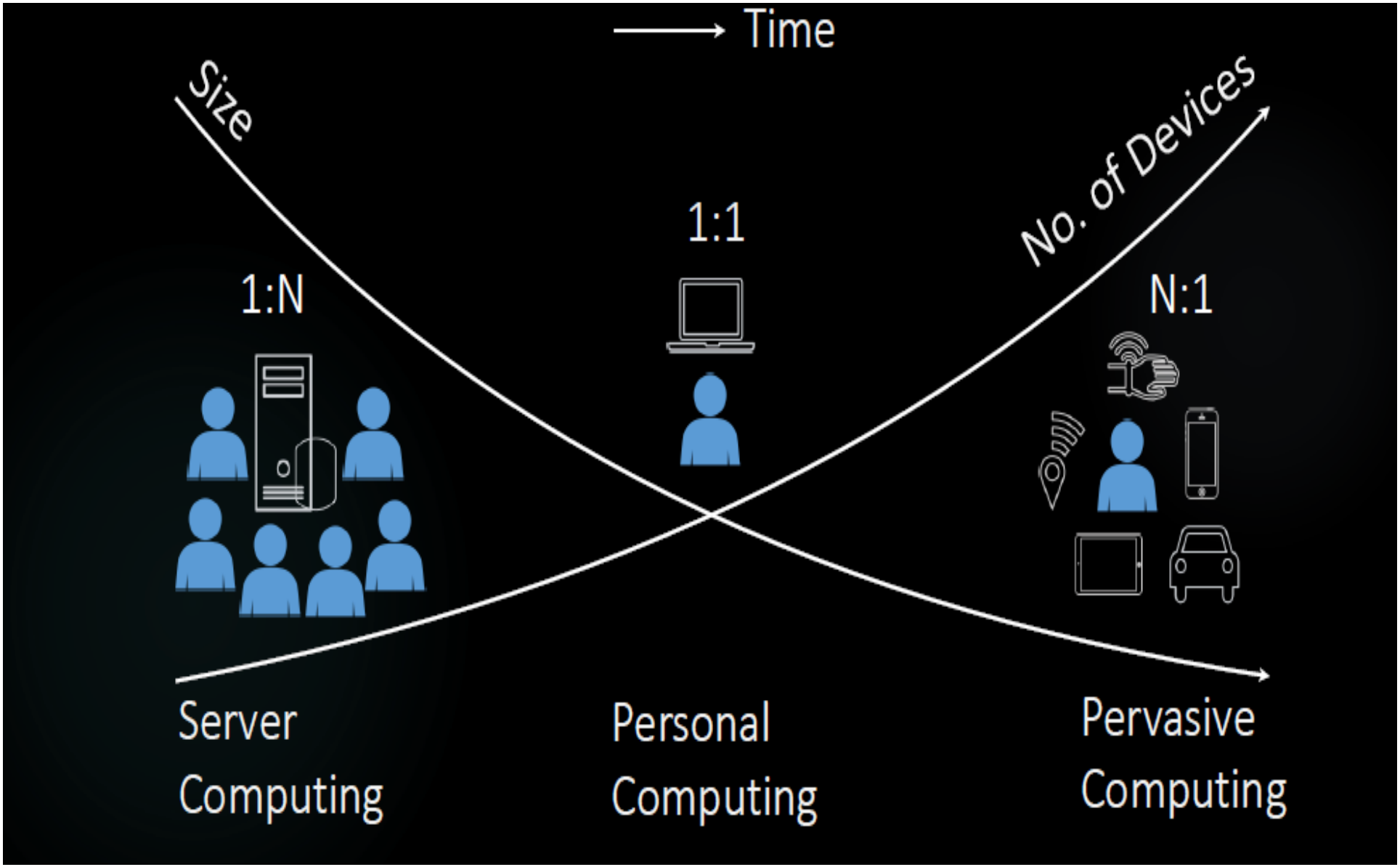
Your toothbrush could track how often you've used it today and how long you should brush. It could send you a reminder to your smart phone when you last went to the dentist, and then your smart phone could automatically set up an appointment for you.

And Many More IoT Applications!

The Future of Customer Service

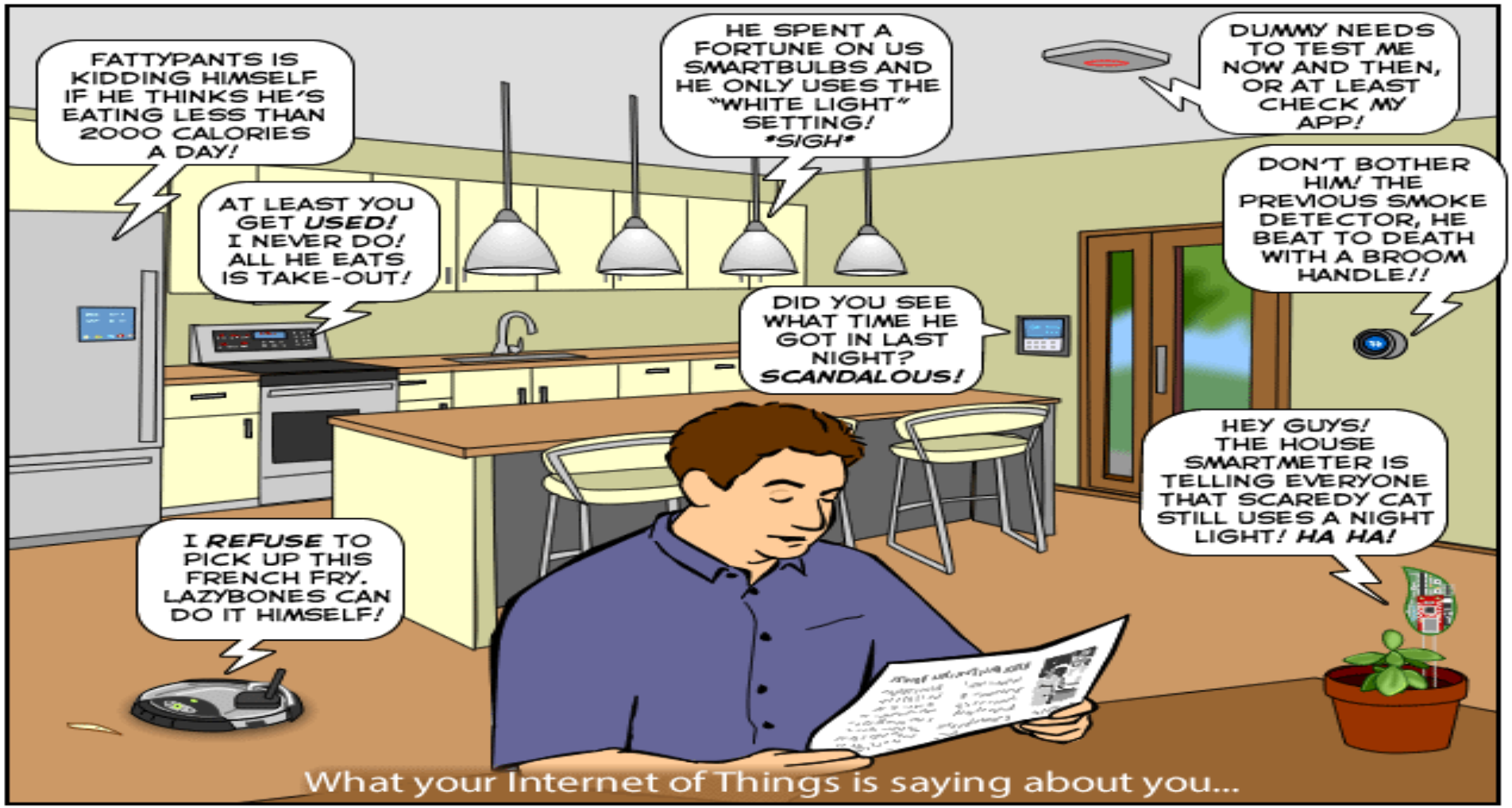


IoT is Pervasive Computing!



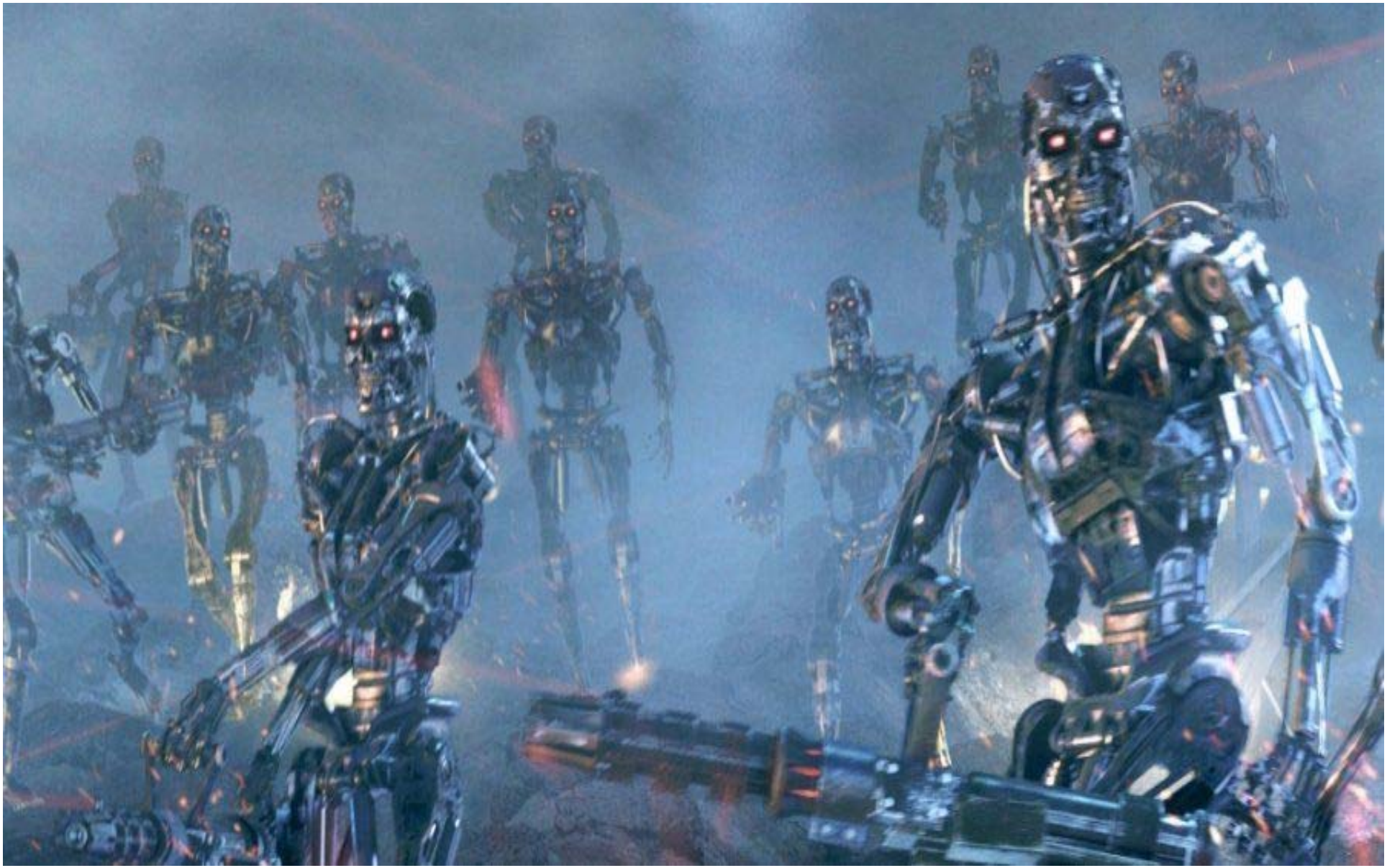
The **Joy of Tech** ™

by Nitrozac & Snaggy



What your Internet of Things is saying about you...

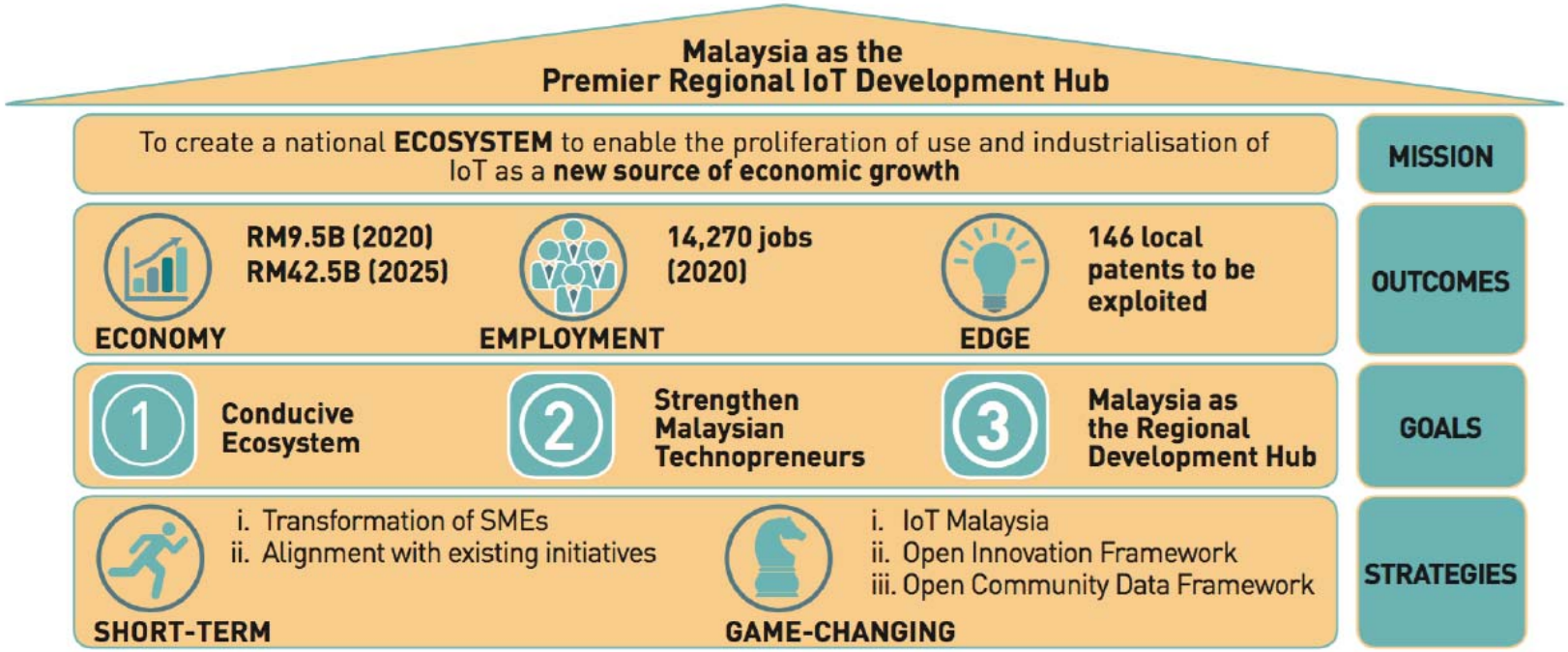
joyoftech.com



IOT World Roadmap

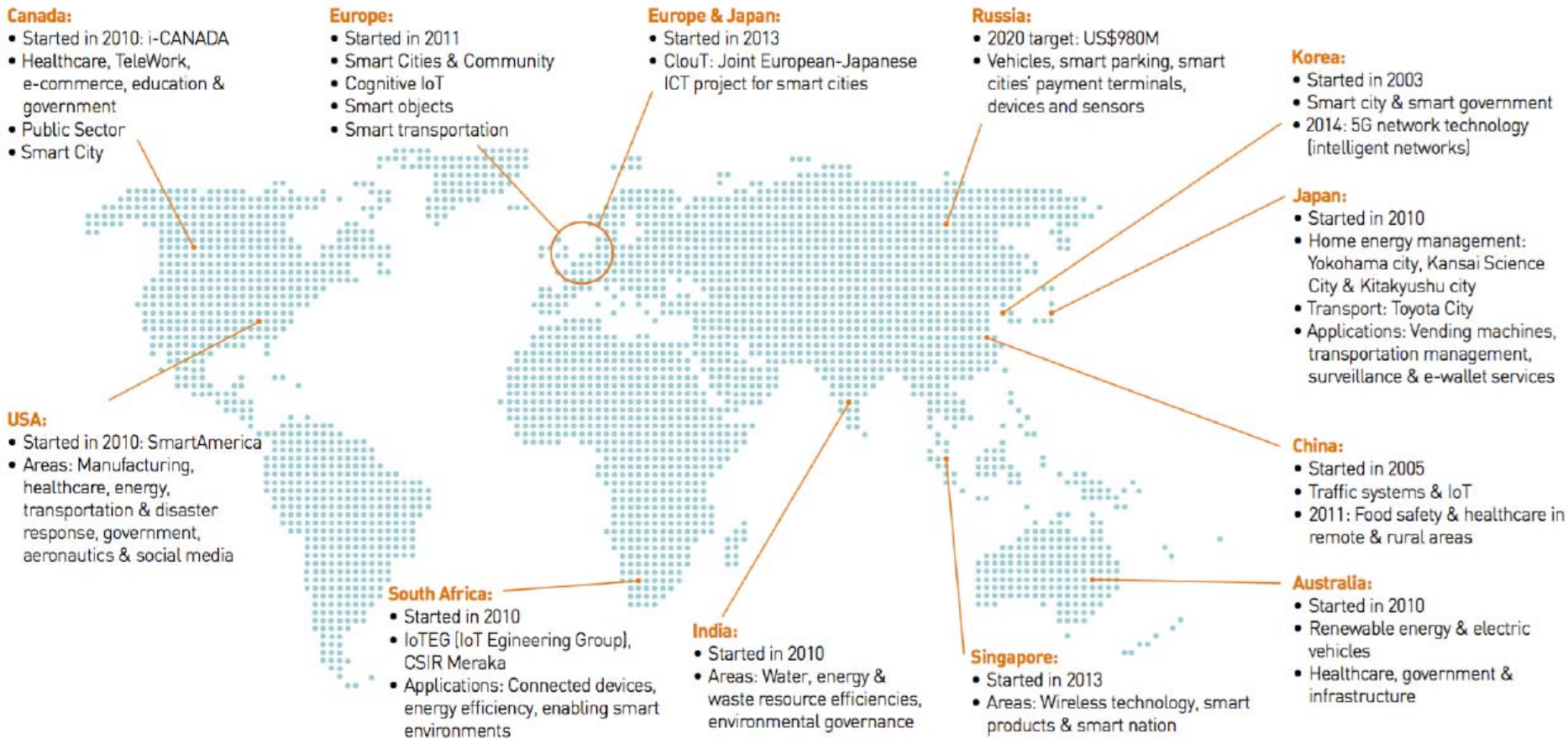
IOT in Malaysia

National IOT strategic roadmap



Source: https://iotworld.co/2017/05/20/industry-talk-internet-of-things-journey/

IOT implementation in the world



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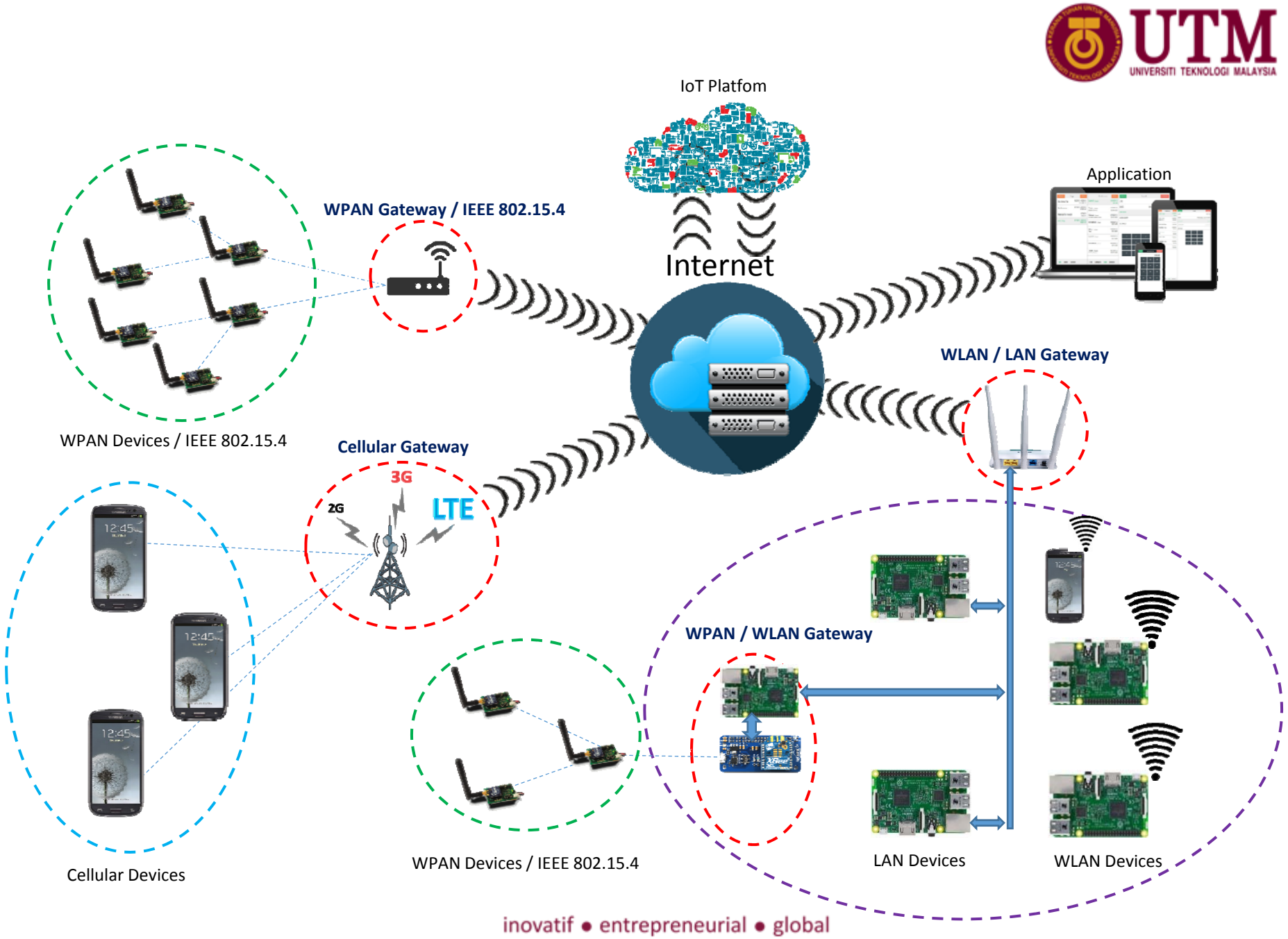
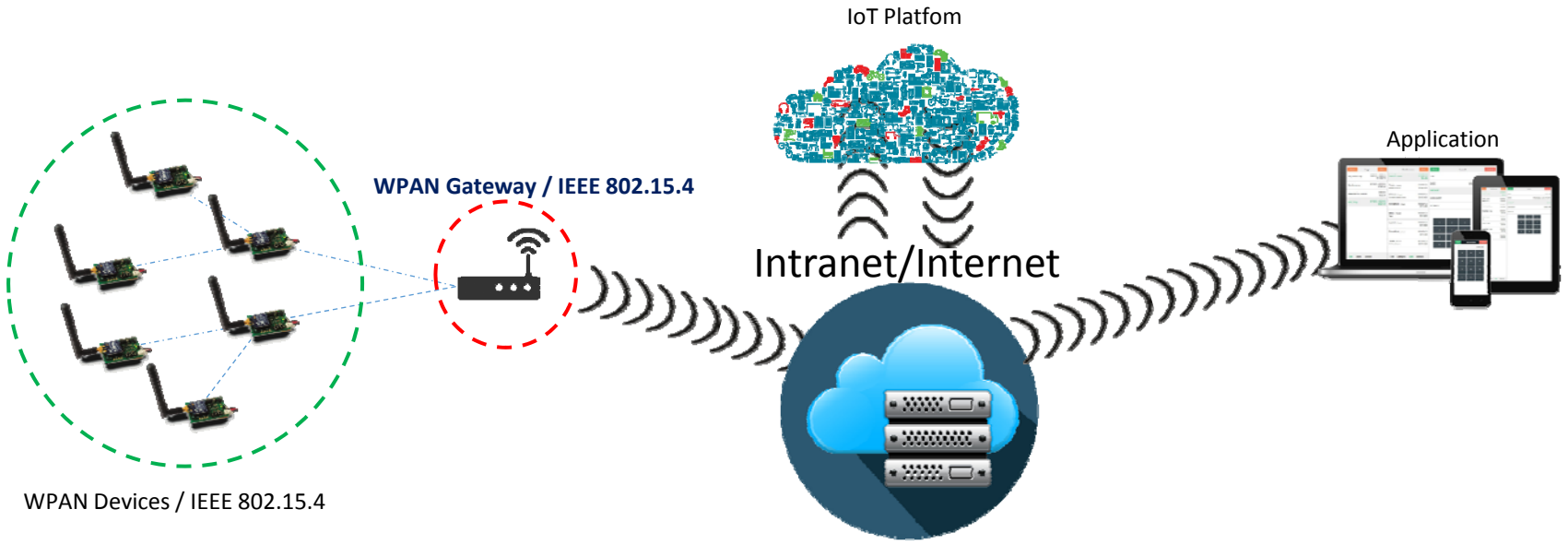
ATT IOT Stories

R&D and Products



inovatif • entrepreneurial • global

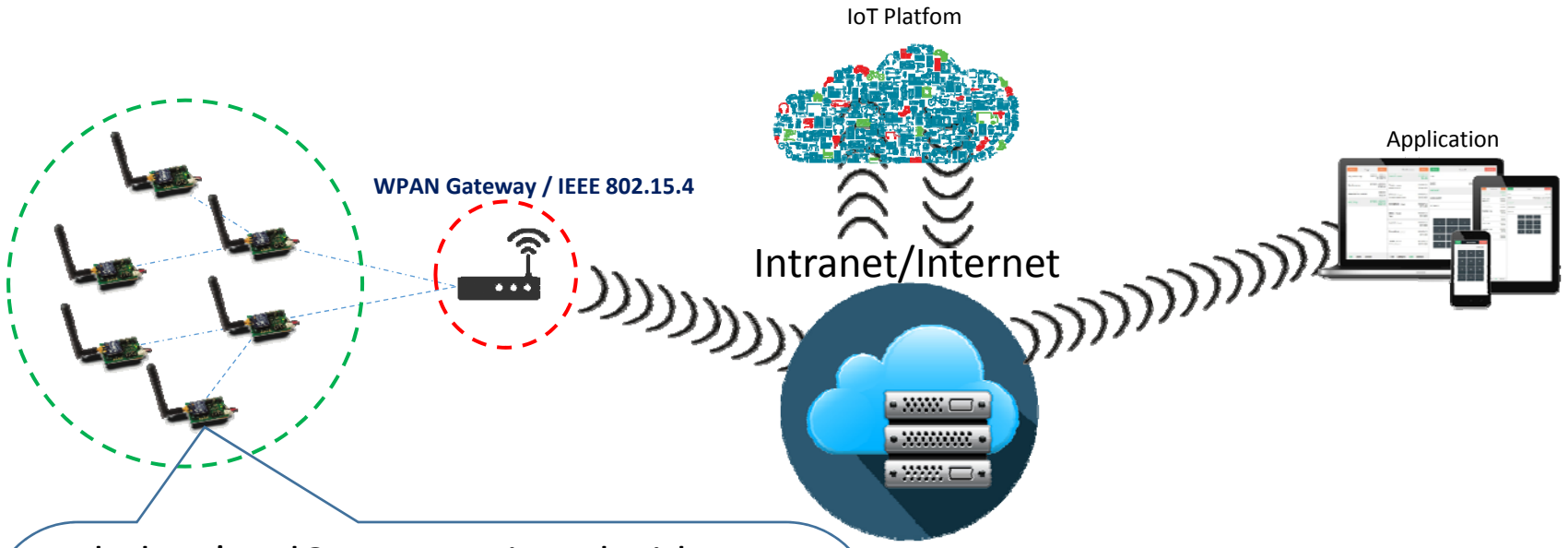
Smart Door Access v1.0



Features

- Each door were equipped with:
  - TelG mote with IEEE 802.15.4 connectivity
  - Intrusion detection and alert system
  - RFID-based access control
  - Wireless remote controller
- Monitoring/Access System web-application:
  - User management
  - Activity log
  - Access control
    - Different access credentials scheme
    - Access scheduling

Smart Door Access v1.0

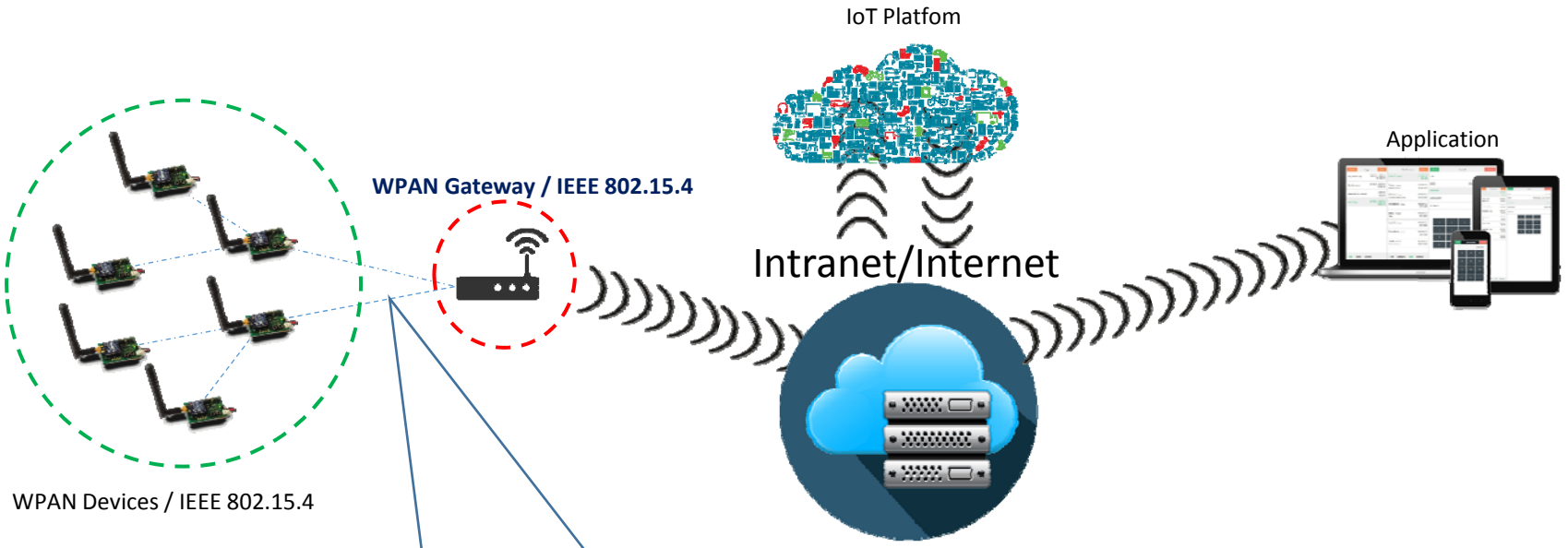


Each door's TelG were equipped with:

- RFID reader
- Door gap sensor
- Magnetic lock
- Exit button
- IEEE 802.15.4 transceiver
- LEDs
- Buzzer

The devices is not directly accessible from external network

Smart Door Access v1.0

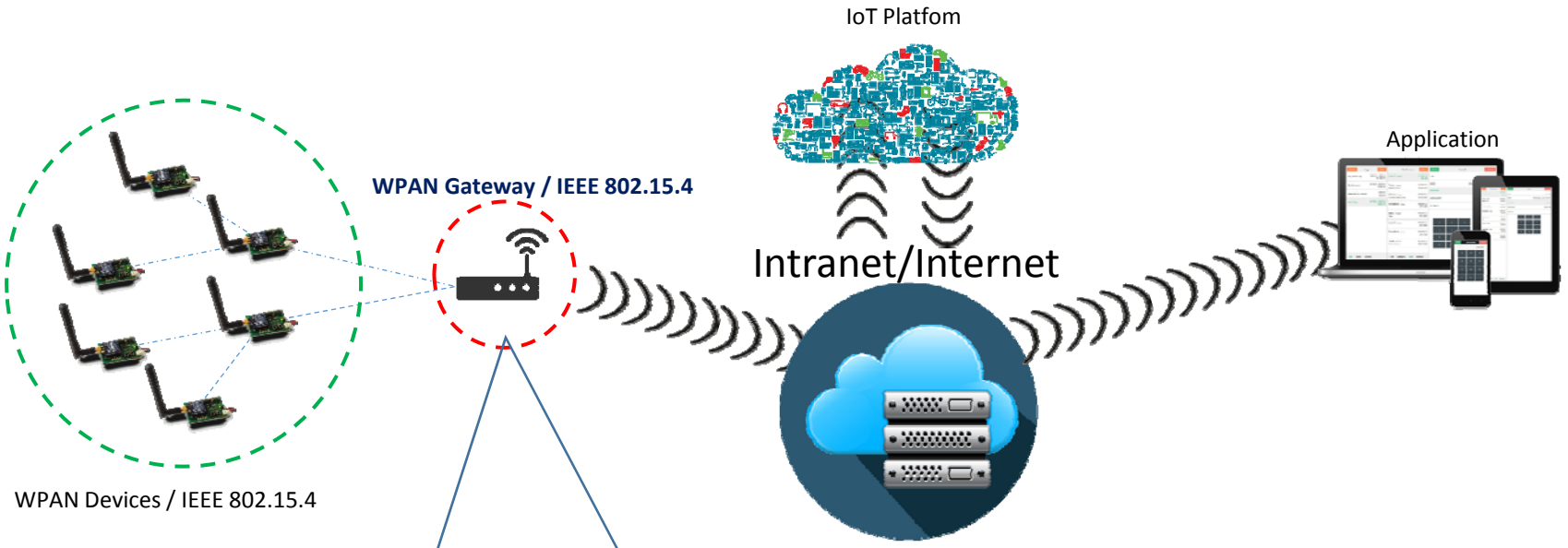


Communication:

- Multi-hop protocol
- AES encrypted

Remote controller act as a “remote sensor”

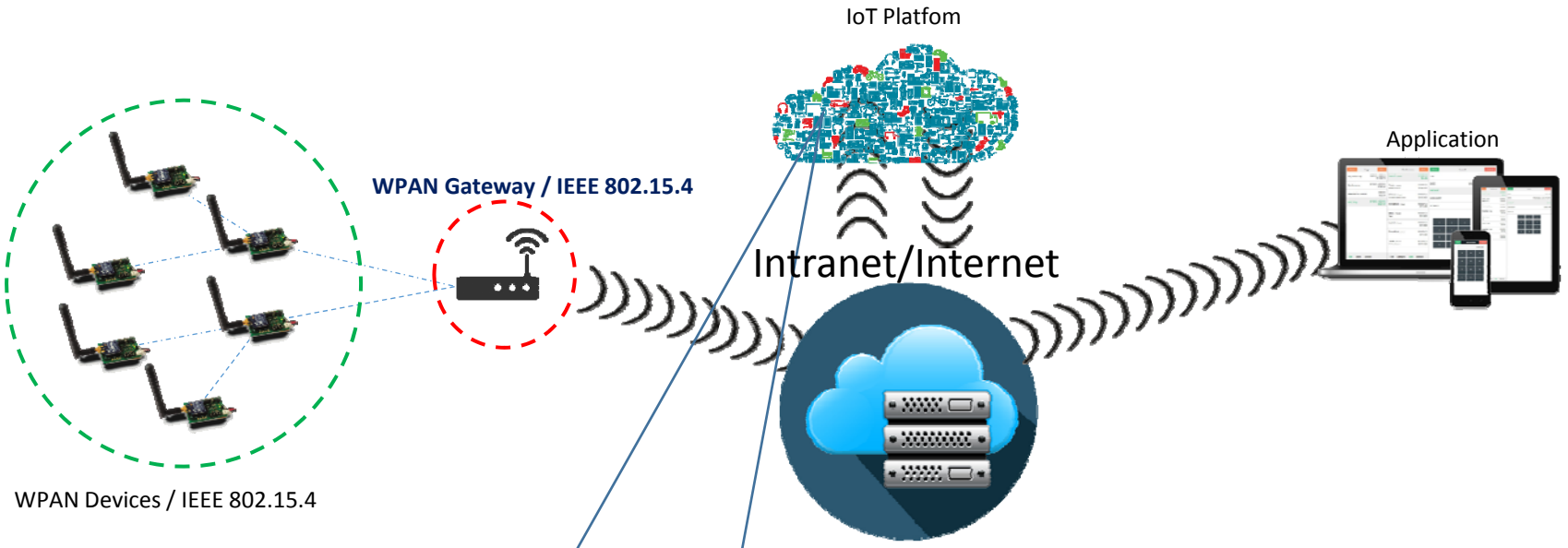
Smart Door Access v1.0



Gateway:

- IEEE 802.15.4 to WLAN and LAN interface
- Middleware exposing the services provided by WPAN devices to the external network (*custom protocol*)
- Communicate with external network using REST protocol

Smart Door Access v1.0



Storage:

- Users credentials and access level
- Users log

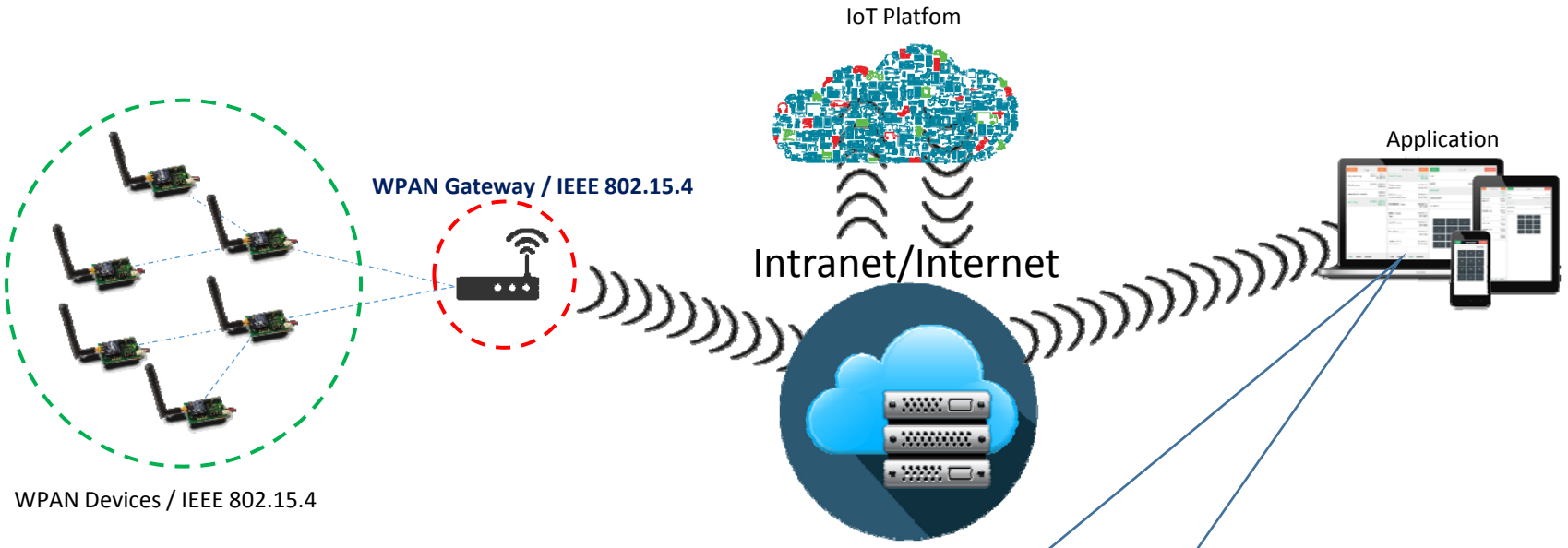
Middleware

- APIs to control the WPAN devices

Application server

- Web-based integrated solution

Smart Door Access v1.0



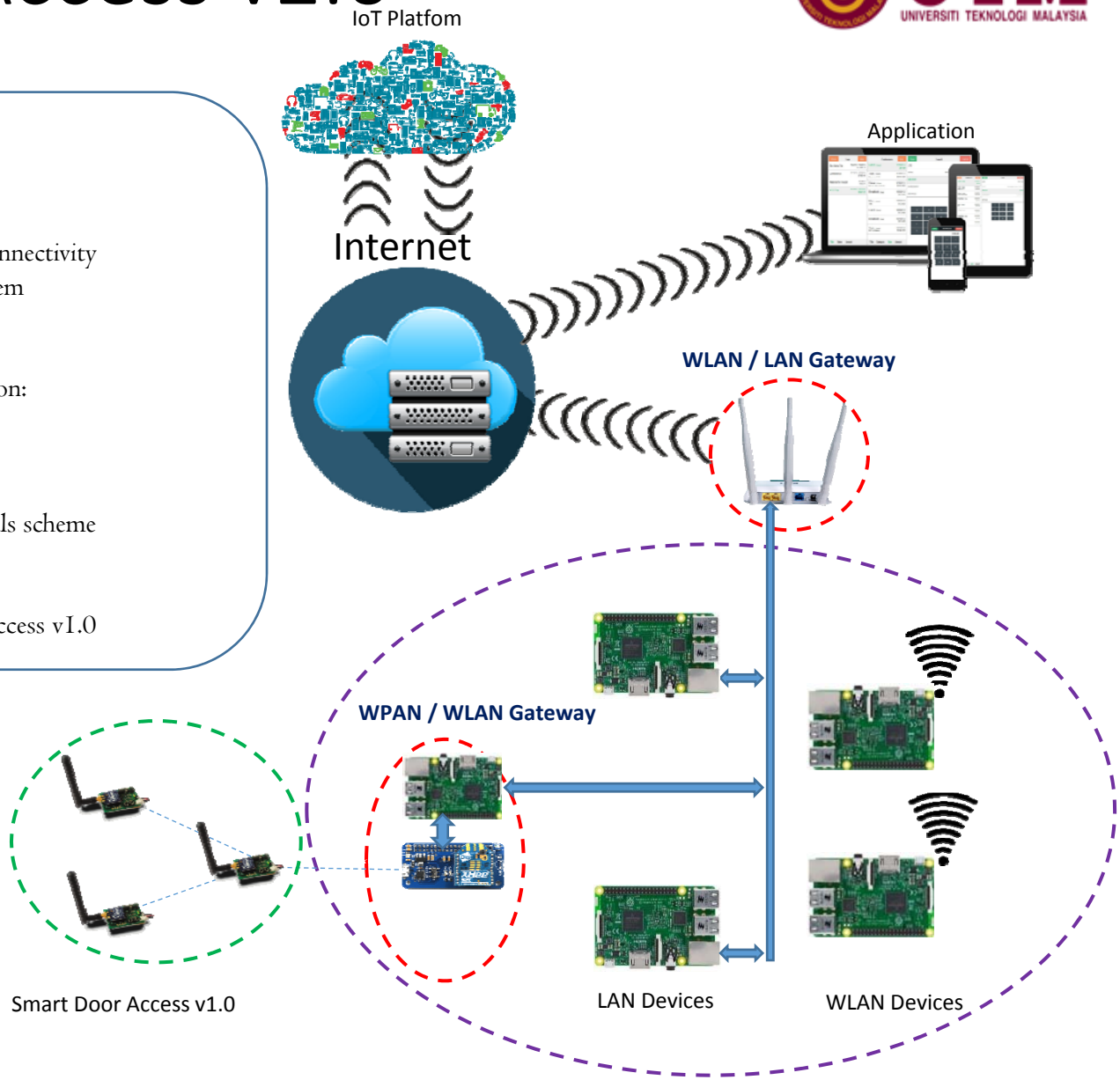
Web application:

- Record/Log management
- Access control interface
- User management interface
- Status monitoring

Smart Door Access v2.0

Features

- Each door were equipped with:
  - RPi with WLAN/LAN/BLE connectivity
  - Intrusion detection and alert system
  - NFC-based access control
  - Smart Phone remote controller
- Monitoring/Access System web-application:
  - User management
  - Activity log
  - Access control
    - Different access credentials scheme
    - Access scheduling
- Does not require a special gateway device
- Backward compatible with Smart Door Access v1.0



Smart Door Access v2.0

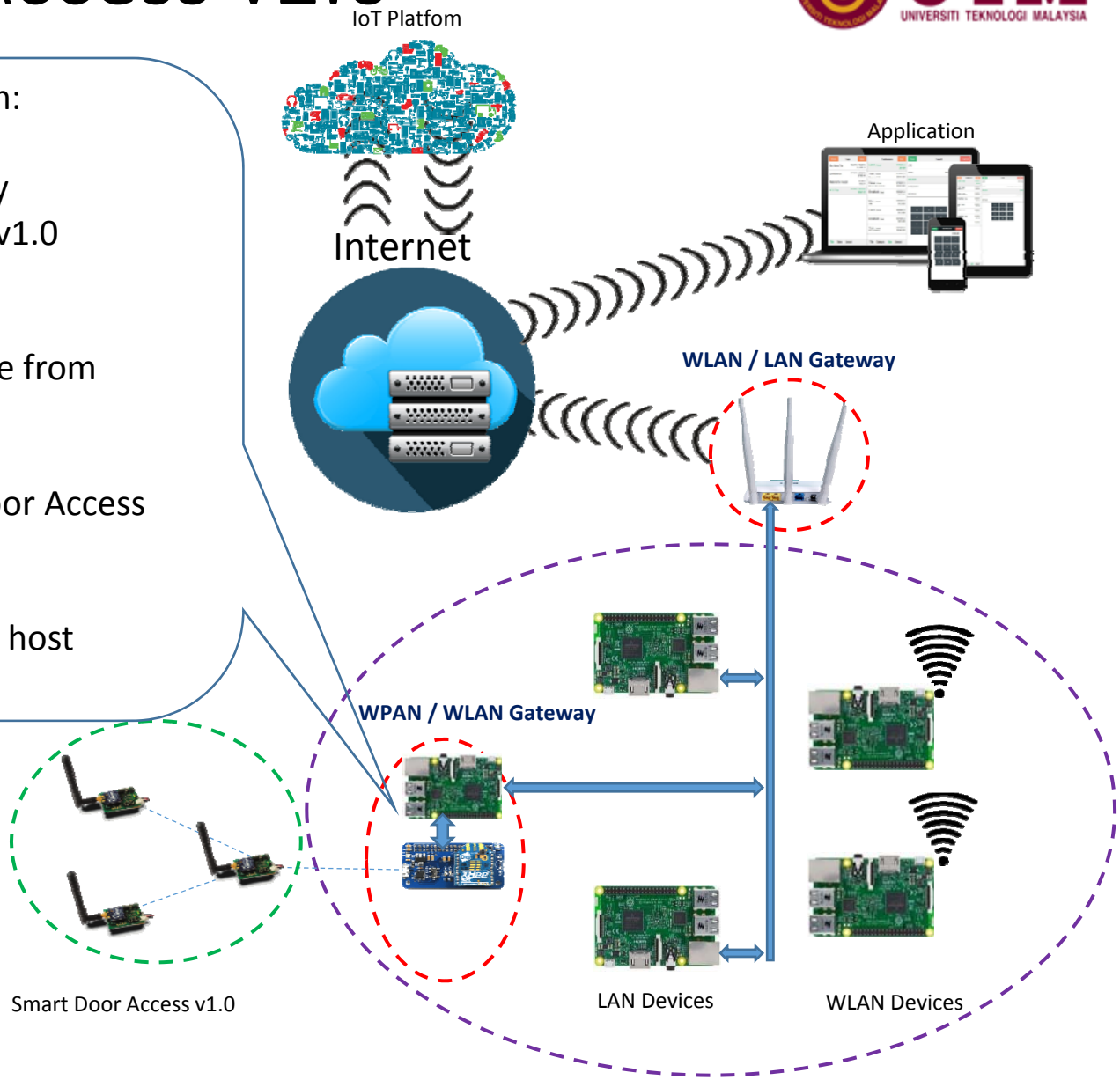
Each door's were equipped with:

- NFC reader,
- WLAN/LAN/BLE connectivity
- Same as Smart door access v1.0
- Local storage

Each device is directly accessible from external network via gateway

Capable of acting as a Smart Door Access v1.0 gateway (extra H/W)

Stand-alone deployment would host everything locally

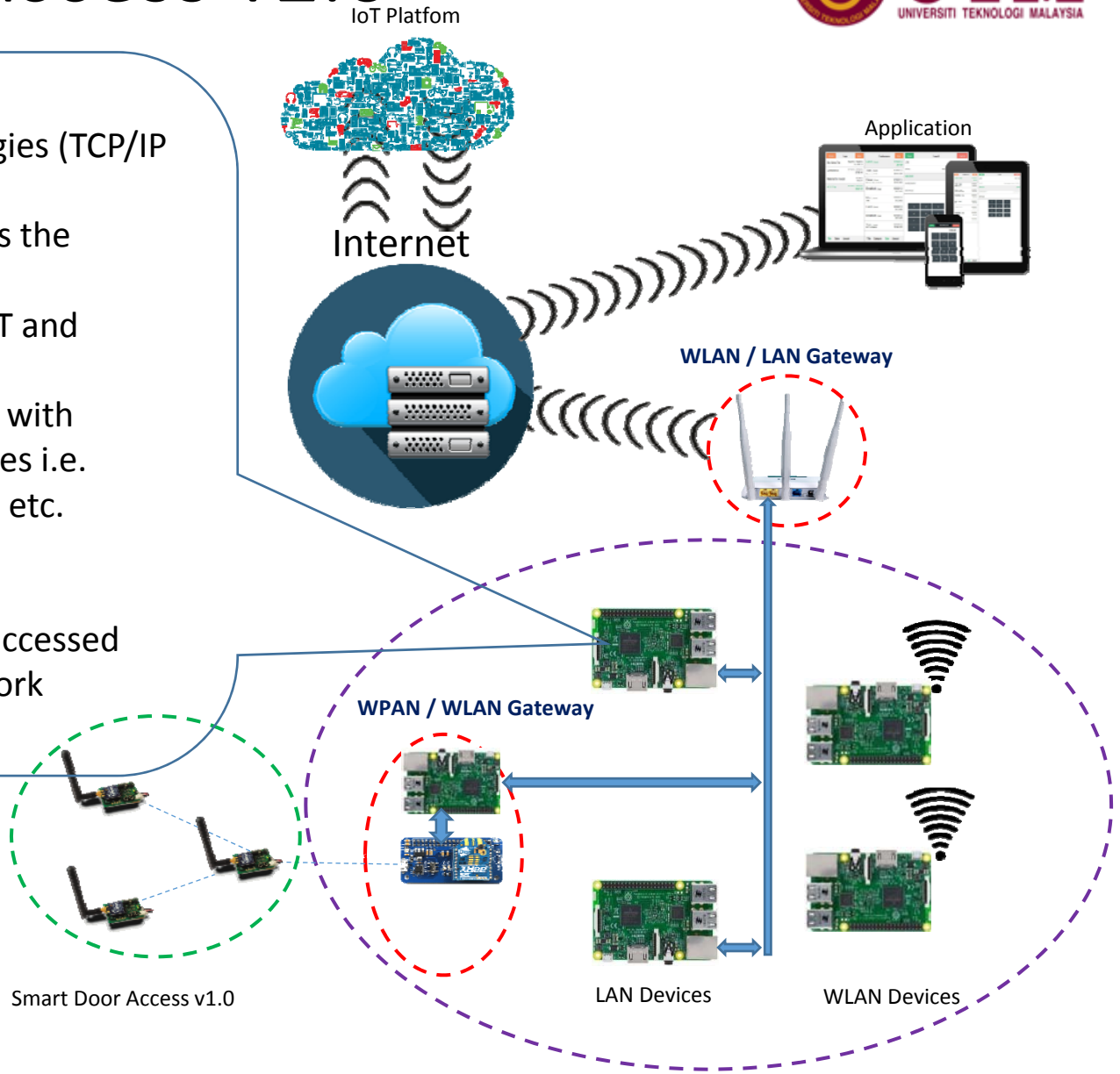


Smart Door Access v2.0

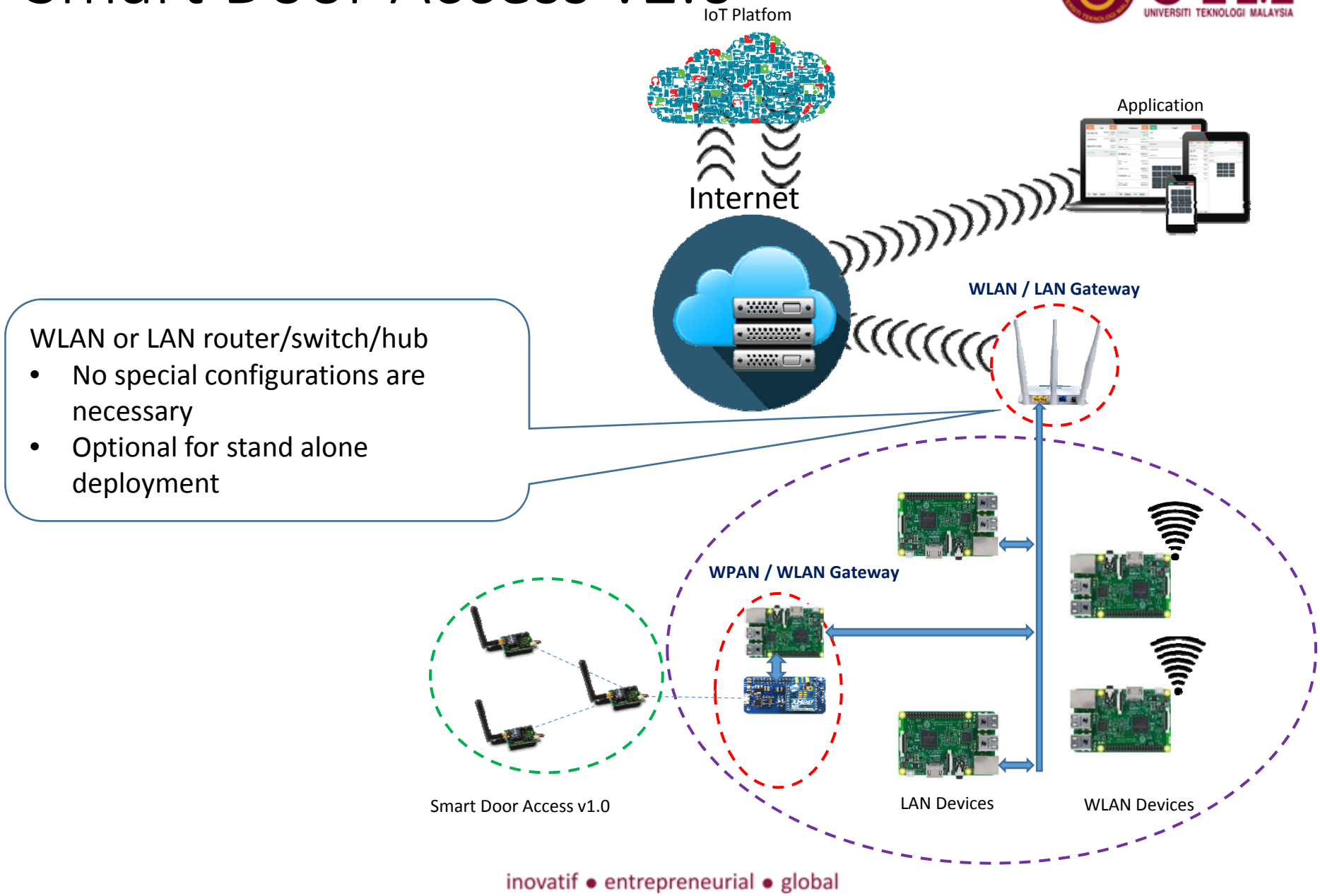
Communication:

- Utilize WLAN/LAN technologies (TCP/IP based)
- Normal WLAN/LAN router as the gateway
- Compatible with REST, MQTT and Socket.io protocols
- Extendable to communicate with almost any other technologies i.e. Zigbee, LoRa, Bluetooth and etc.
- Higher security i.e. SSL/TSL.

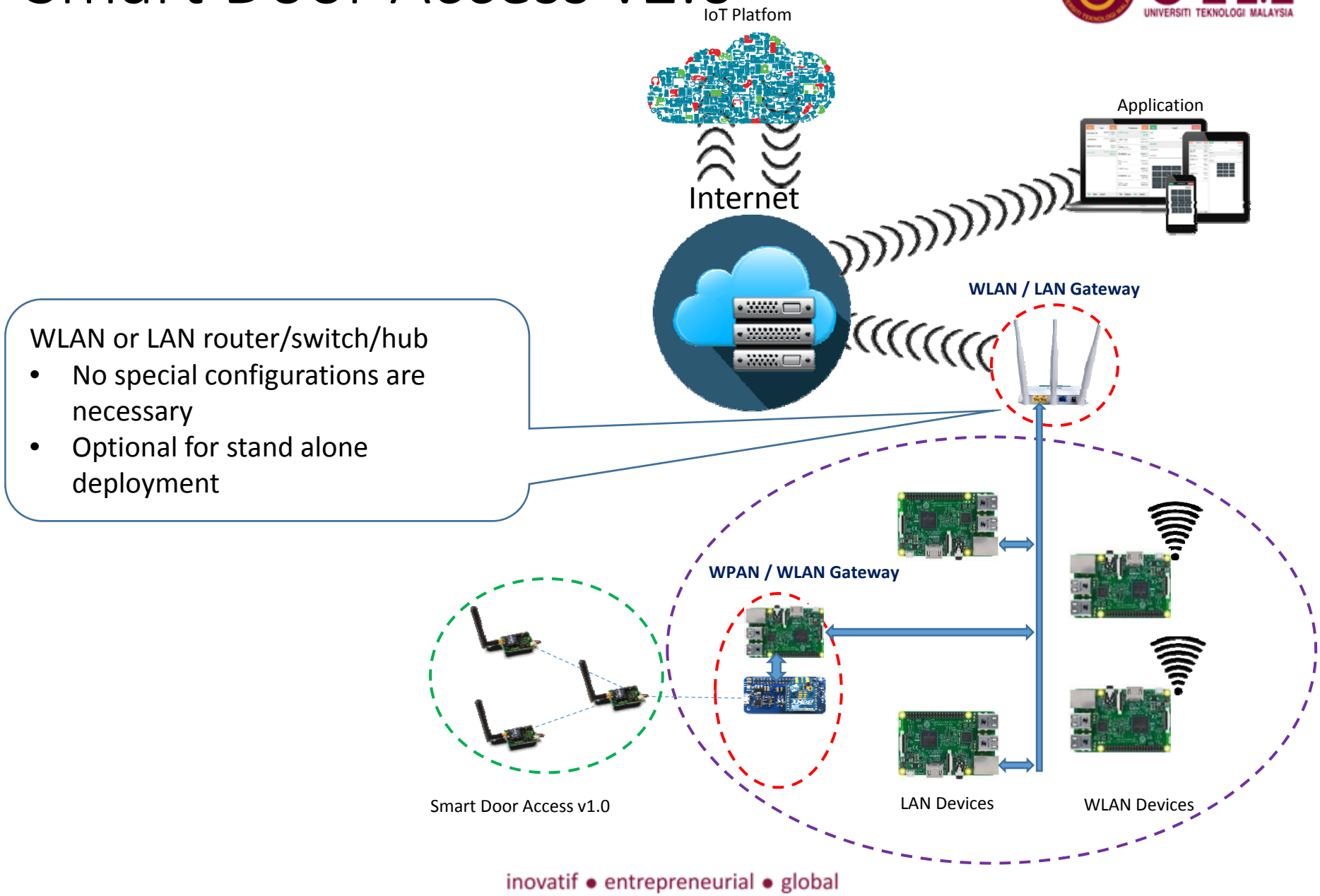
TCP/IP allows the device to be accessed directly from the external network (excluding firewall and NAT)



Smart Door Access v2.0



Smart Door Access v2.0



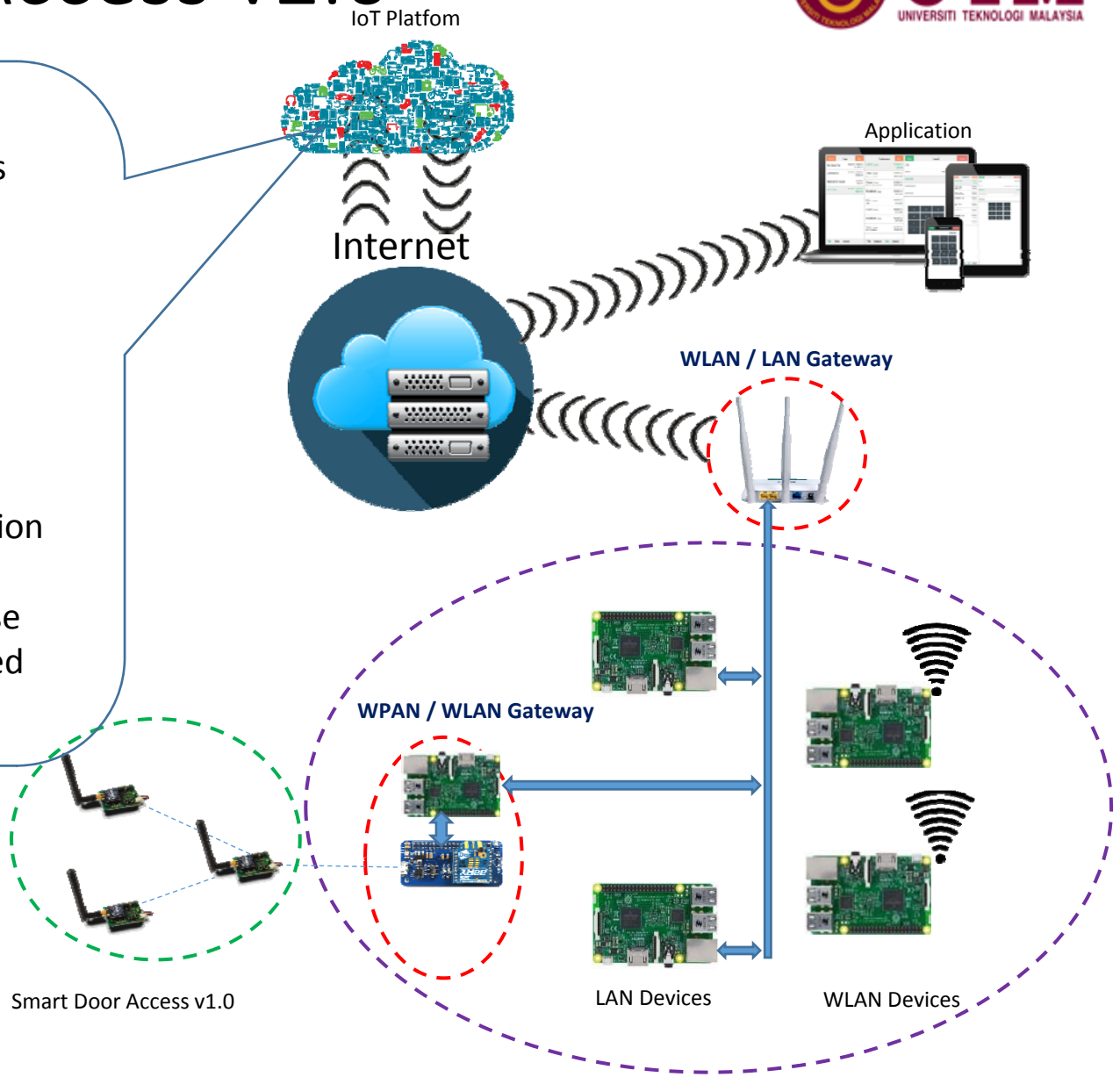
Smart Door Access v2.0

Storage:
- Users credentials and access level
- Users log

Middleware
- APIs to control the WPAN devices
- REST and MQTT support

Application server
- Web-based integrated solution

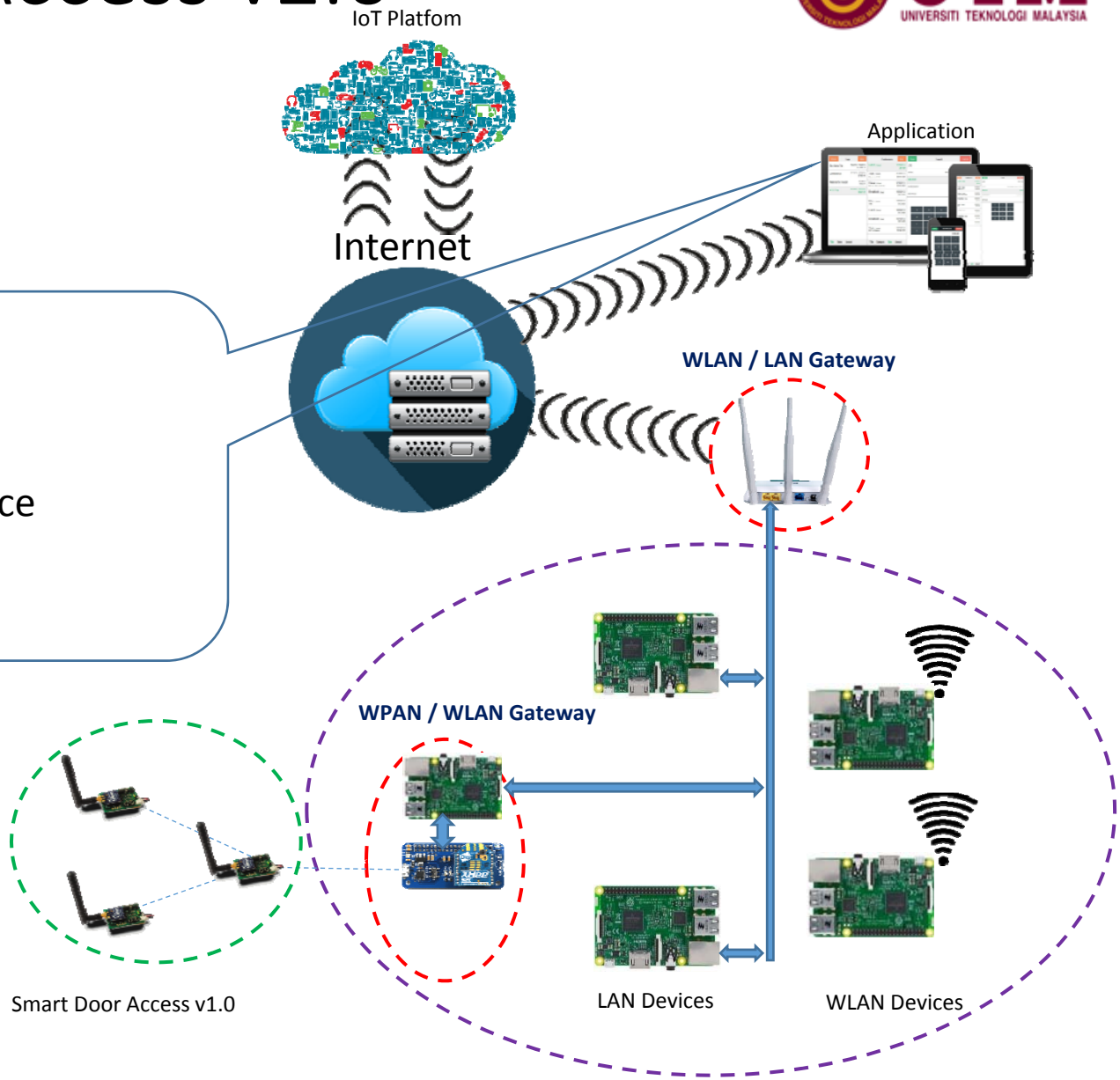
In stand alone deployment these functionalities would be retained within the LAN/WLAN devices



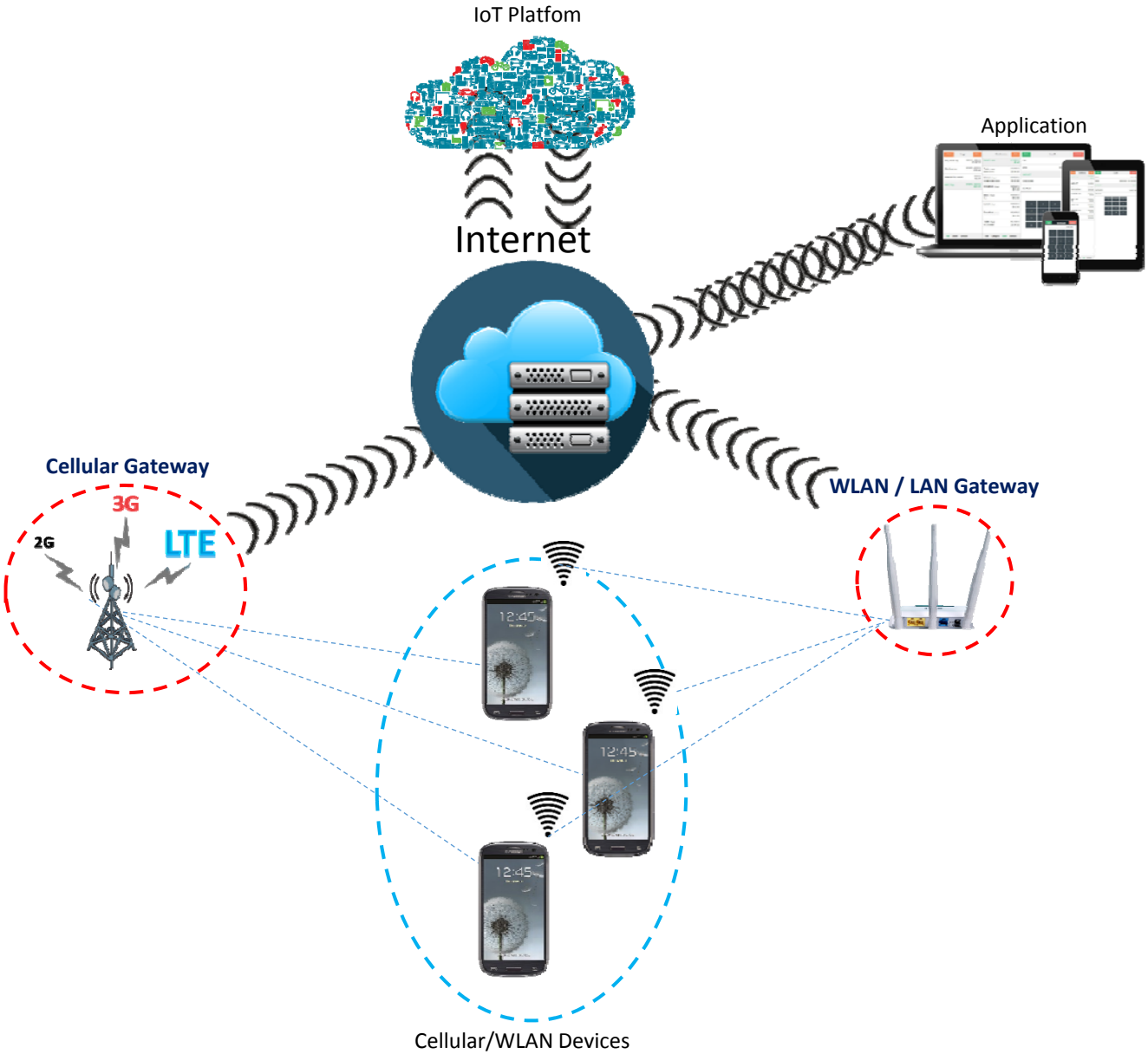
Smart Door Access v2.0

Web application:

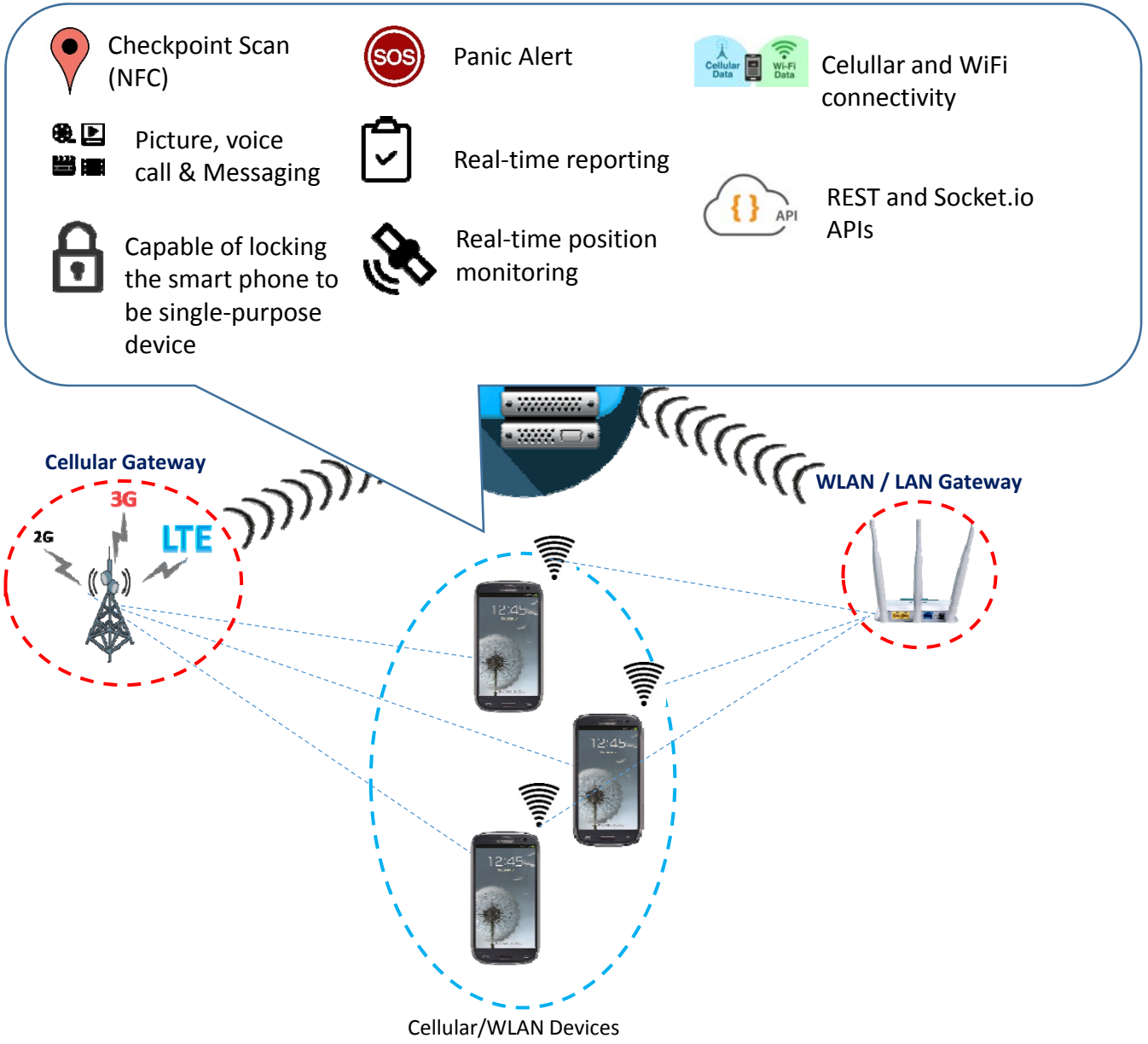
- Record/Log management
- Access control interface
- User management interface
- Status monitoring
- “Real-time” monitoring



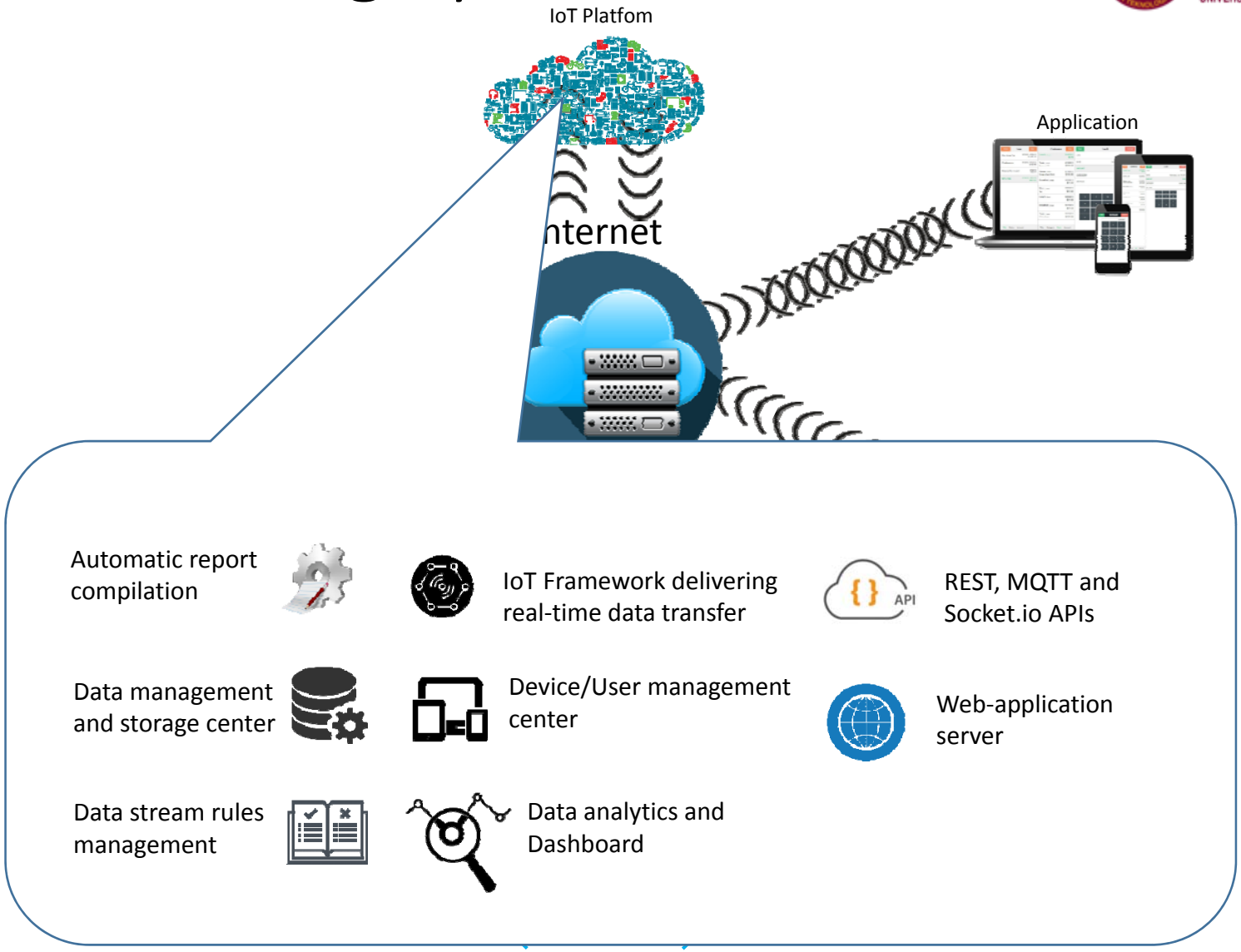
Guard Touring System



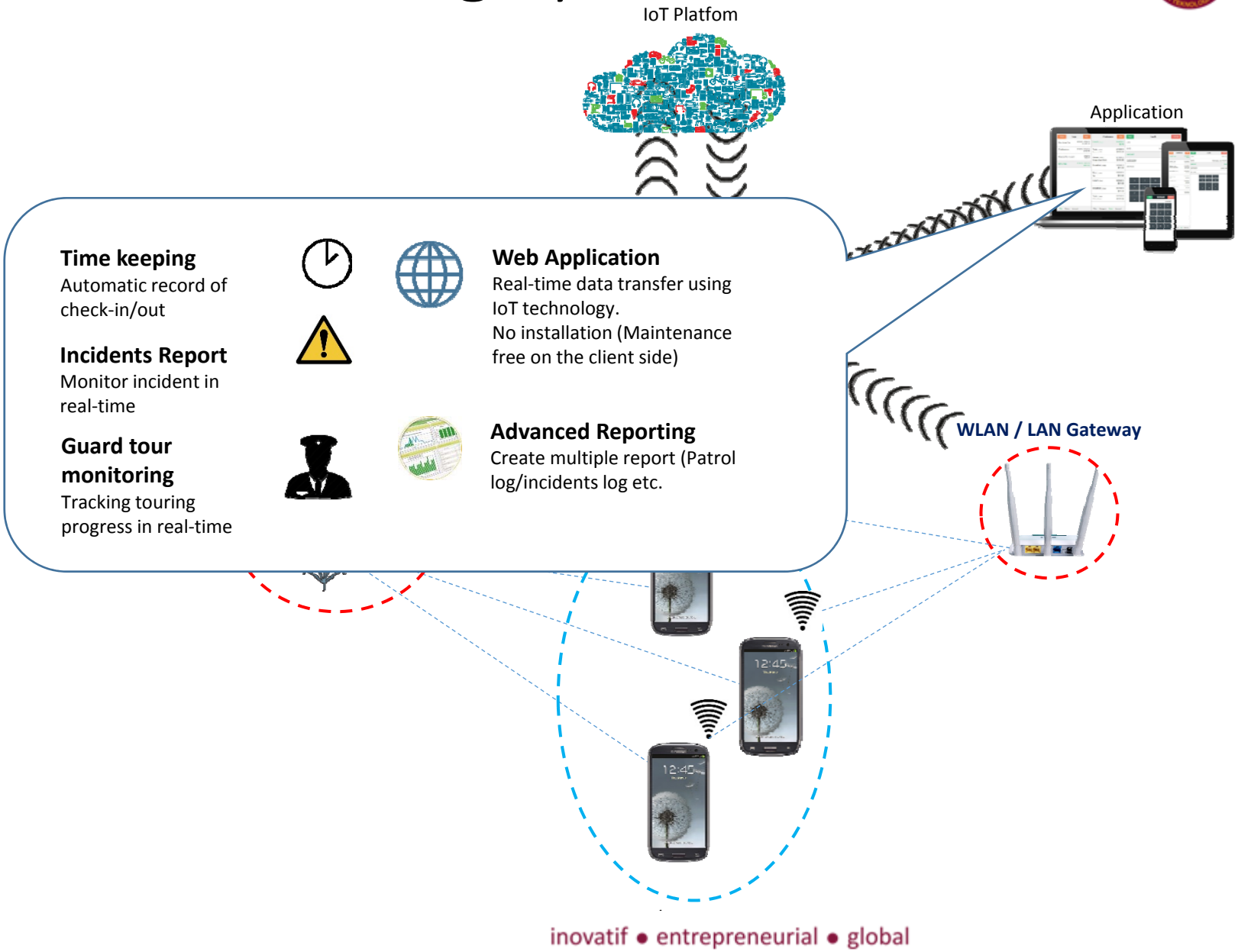
Guard Touring System



Guard Touring System



Guard Touring System

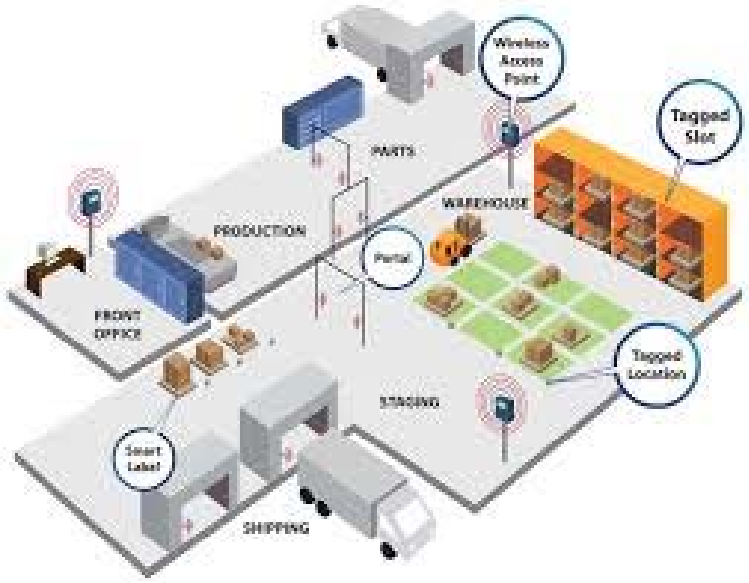


NO MORE

IoT based Warehouse Management System Using RFID

Advantages:

- the movement of goods can be tracked in real-time,
- shelf space can be managed more effectively
- inventory control is improved
- the amount of human involvement in the supply chain management is reduced considerably.



In theory, there is no difference between theory and practice.

But, in practice, there is


thank
you