What exactly is the "INTERNET of THINGS"?

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

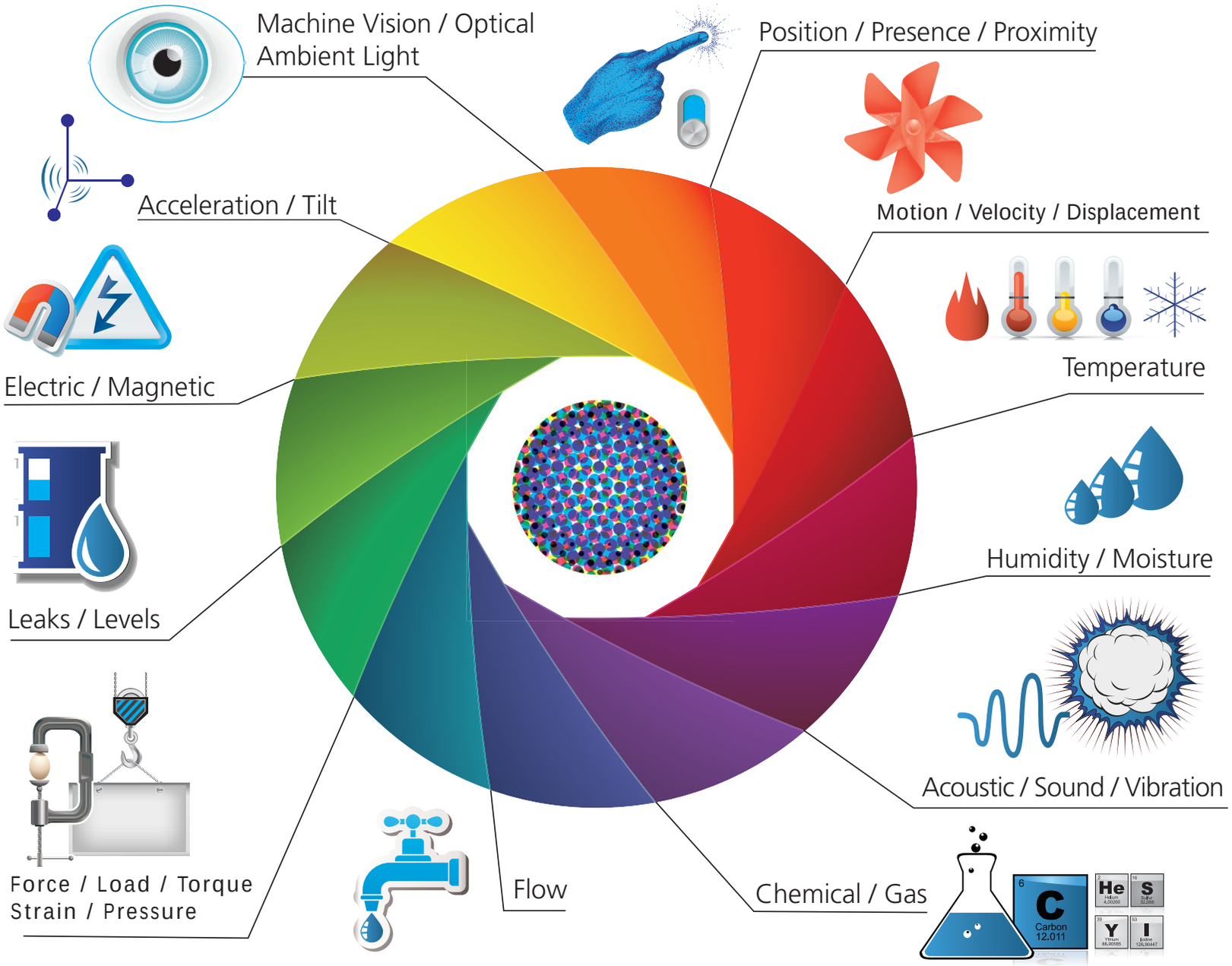
1 **SENSORS** & ACTUATORS

2 **CONNECTIVITY**

3 **PEOPLE & PROCESSES**

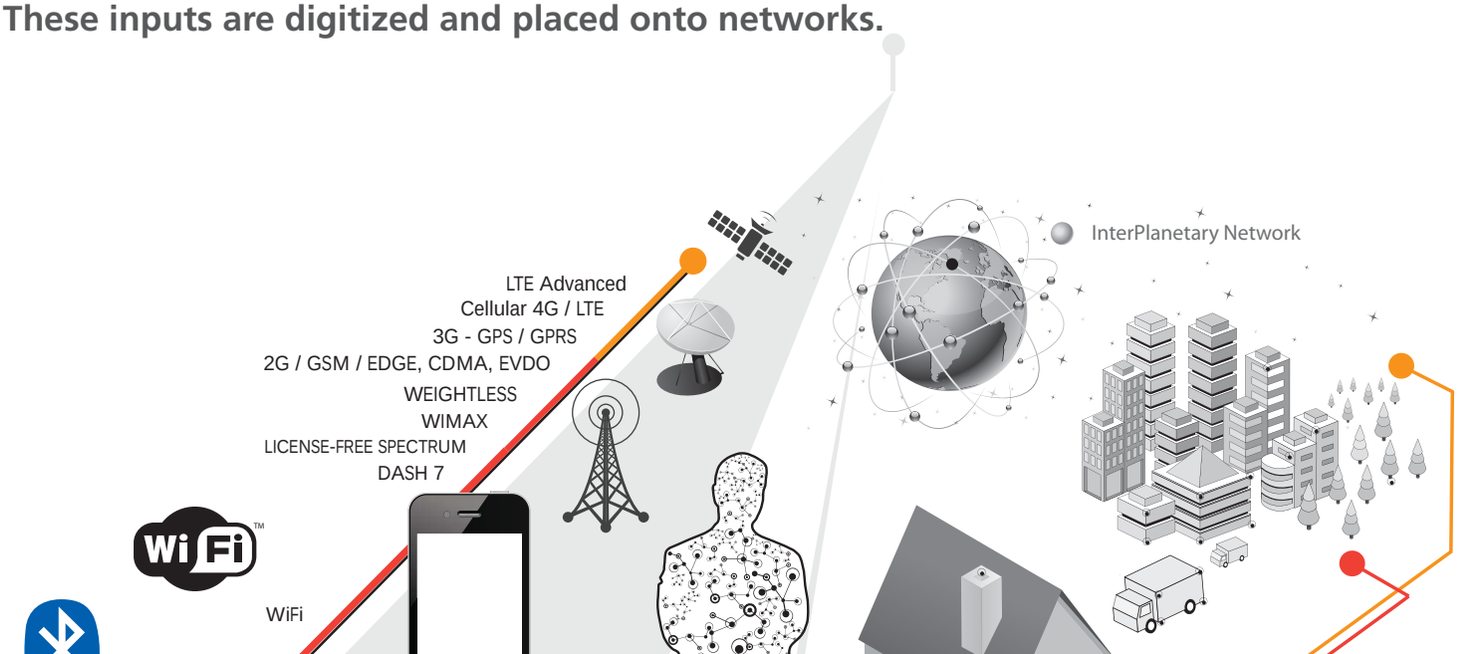
1 SENSORS & *ACTUATORS*

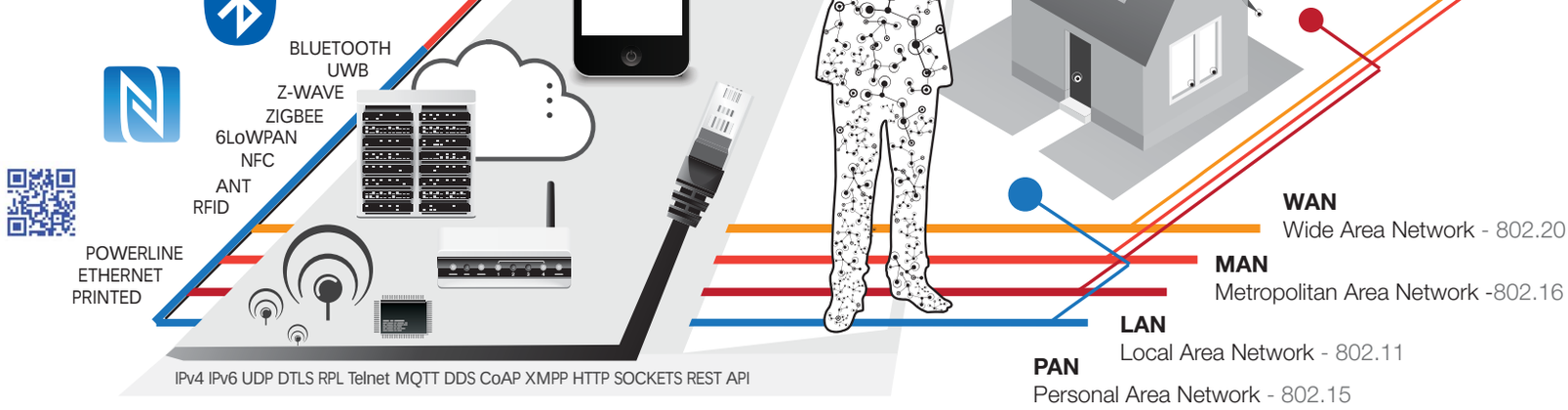
We are giving our world a digital nervous system. Location data using GPS sensors. Eyes and ears using cameras and microphones, along with sensory organs that can measure everything from temperature to pressure changes.



2 CONNECTIVITY

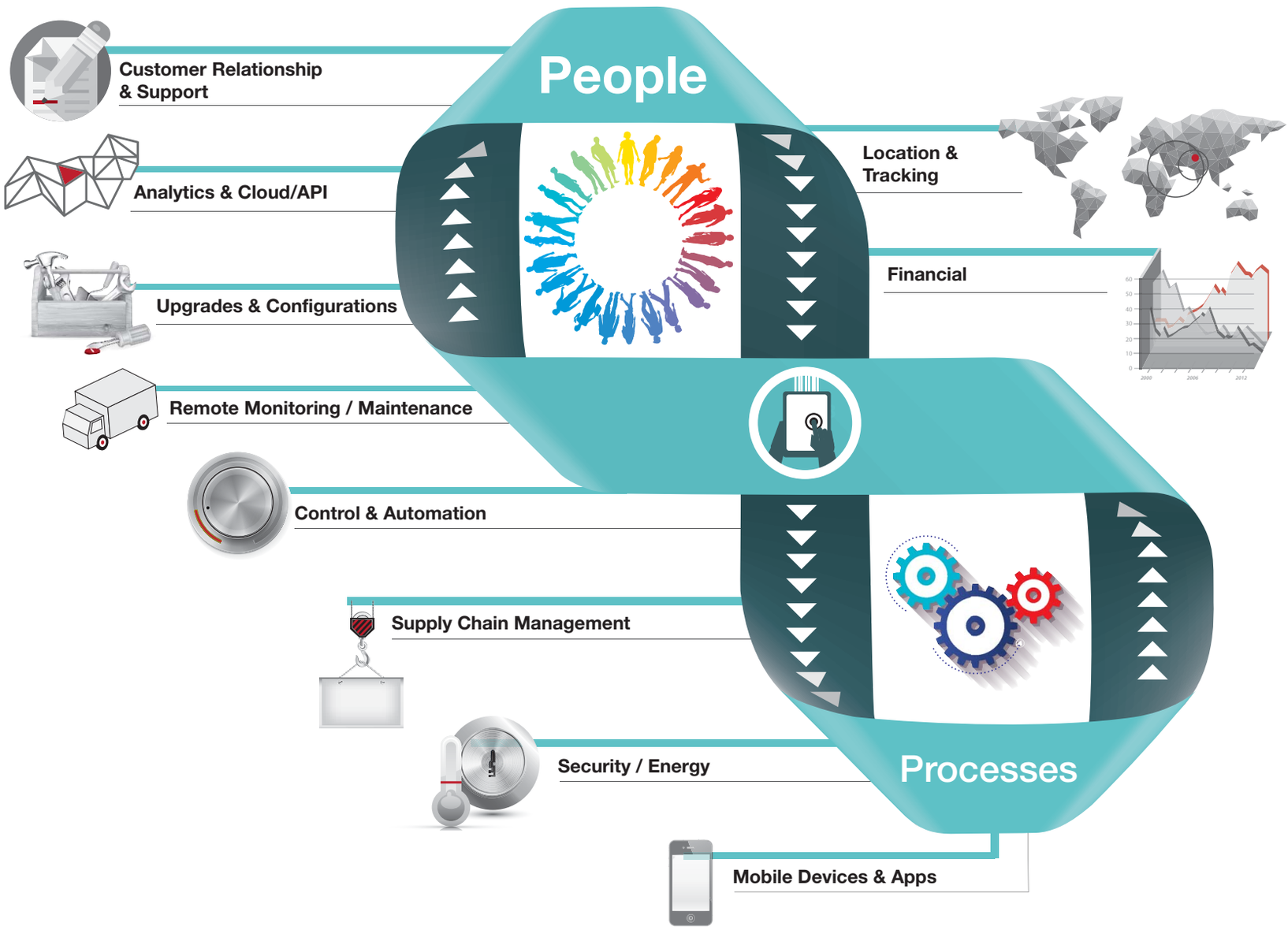
These inputs are digitized and placed onto networks.





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.



The interactions between these

SENSORS + CONNECTIVITY + PEOPLE + PROCESSES

entities are creating new types of smart applications and services.

Starting with popular connected devices already on the market

SMART THERMOSTATS

Save resources and money on your heating bills by adapting to your usage patterns and turning the temperature down when you're away from home.

CONNECTED CARS

Tracked and rented using a smartphone. Car2Go also handles billing, parking and insurance automatically.

ACTIVITY TRACKERS

Continuously capture heart rate patterns, activity levels, calorie expenditure and skin temperature on your wrist 24/7.

SMART OUTLETS

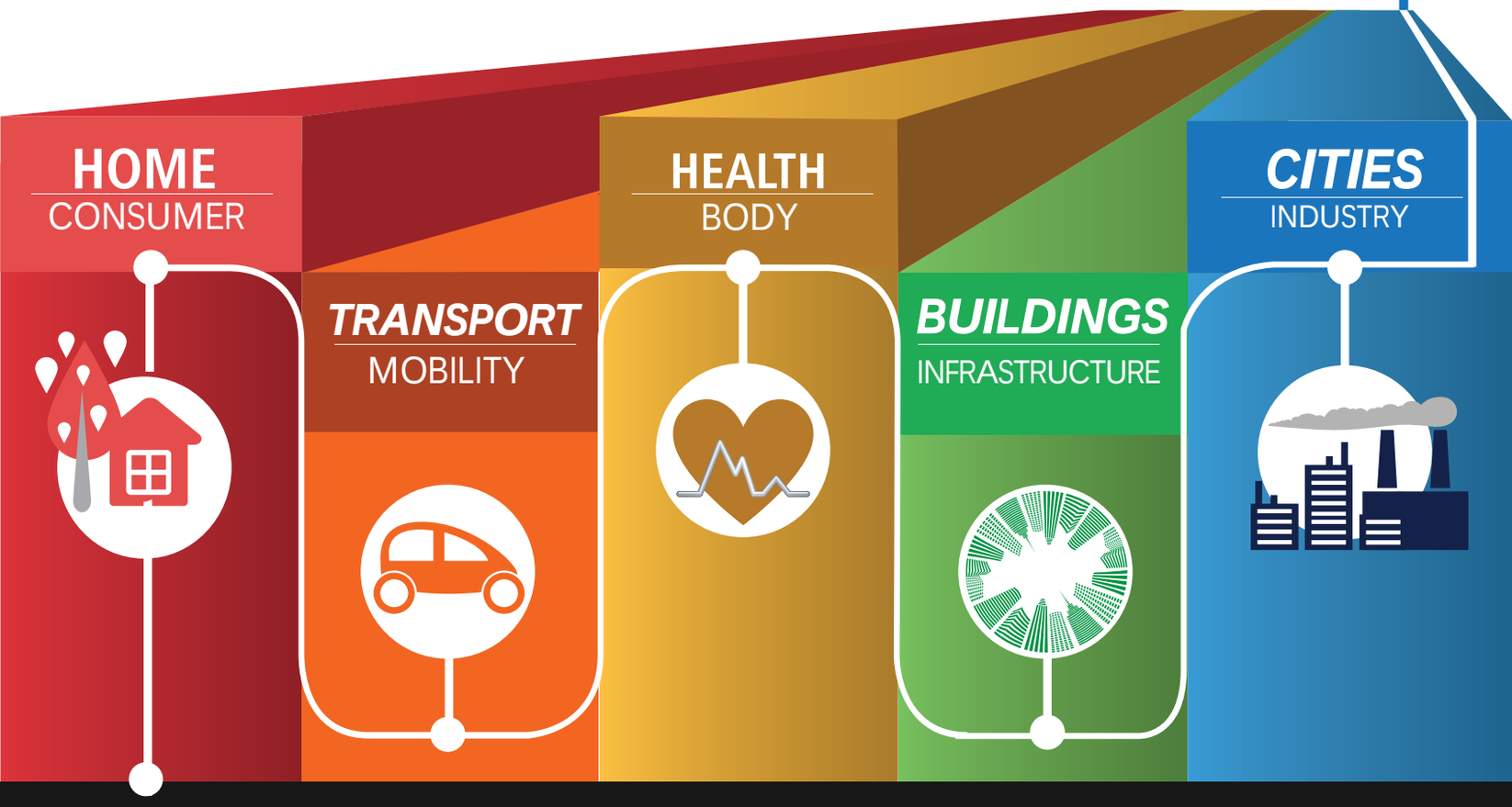
Remotely turn any device or appliance on or off. Track a device's energy usage and receive personalized notifications from your smartphone.

PARKING SENSORS

Using embedded street sensors, users can identify real-time availability of parking spaces on their phone. City officials can manage and price their resources based on actual use.

And quickly advancing

TO ➡ DIVERSE APPLICATIONS



Light bulbs
Security
Pet Feeding
Irrigation Controller
Smoke Alarm
Refrigerator
Infotainment
Washer / Dryer
Stove
Energy Monitoring

Traffic routing
Telematics
Package Monitoring
Smart Parking
Insurance Adjustments
Supply Chain
Shipping
Public Transport
Airlines
Trains

Patient Care
Elderly Monitoring
Remote Diagnostic
Equipment Monitoring
Hospital Hygiene
Bio Wearables
Food sensors

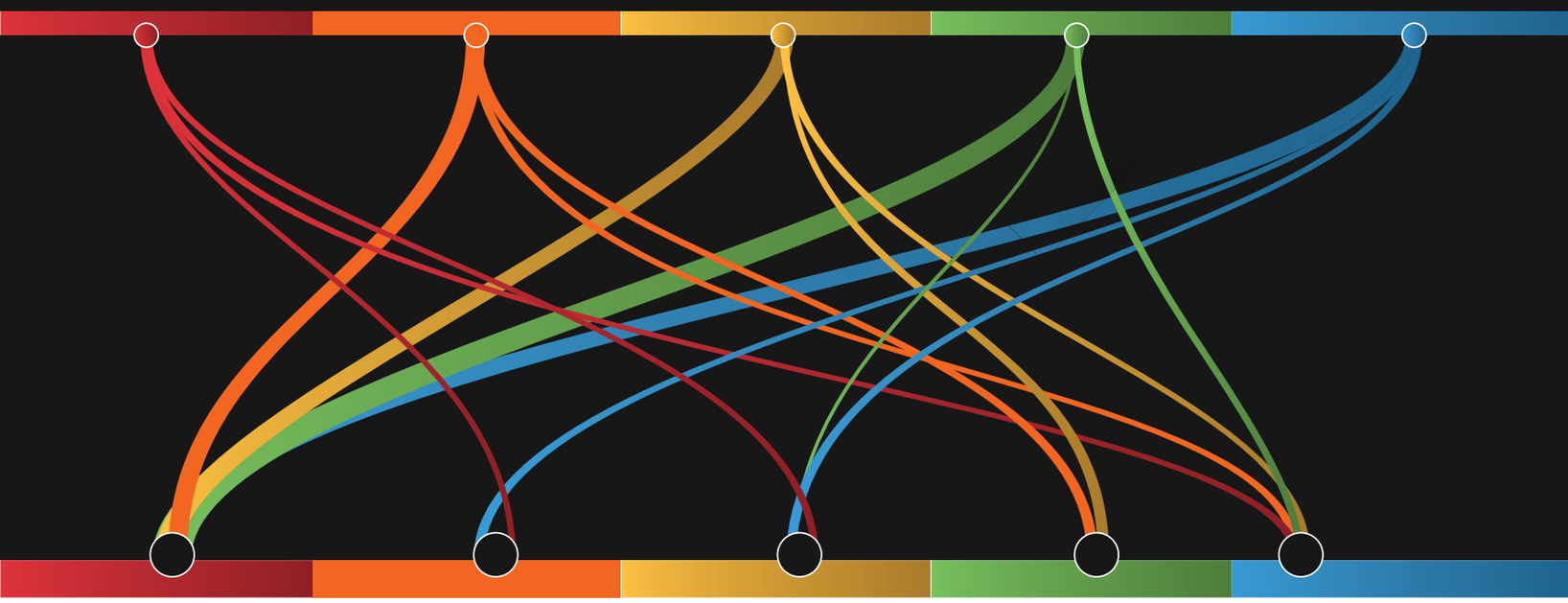
HVAC
Security
Lighting
Electrical
Transit
Emergency Alerts
Structural Integrity
Occupancy
Energy Credits

Electrical Distribution
Maintenance
Surveillance
Signage
Utilities / Smart Grid
Emergency Services
Waste Management

Things get interesting when these connected devices and services start creating

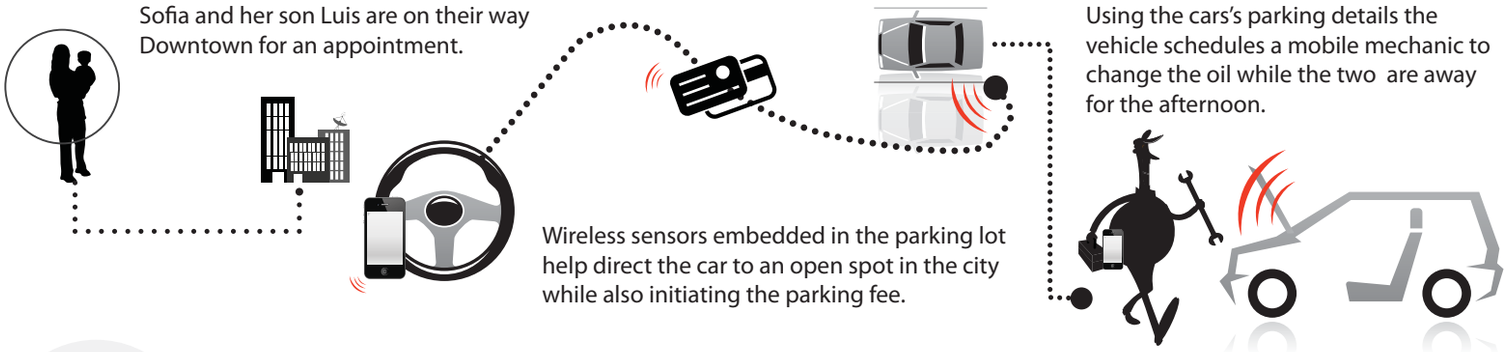
COMPOUND APPLICATIONS

within their own verticals and across industries:



FOR EXAMPLE

TRANSPORTATION + SMART CITIES

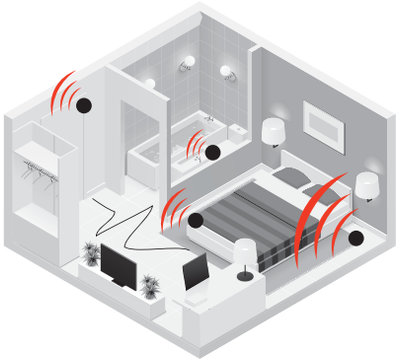


In Downtown San Francisco 20-30% of all traffic congestion is caused by people hunting for a parking spot.

- 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.

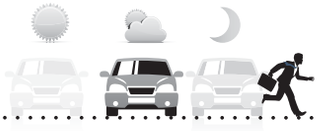
Alerts are automatically sent to health care services and authorized family members if any abnormal activity is detected.

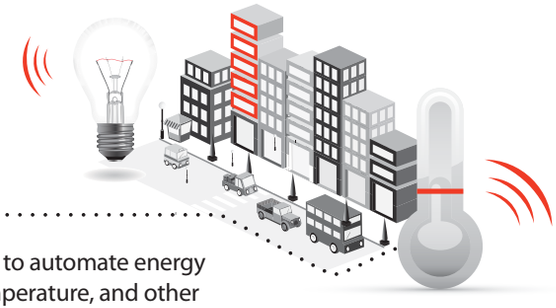
40 million adults age 65 and over will be living alone in the U.S, Canada and Europe.

- 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

Inevitably these integrations become more tightly coupled across time, location & services.

REAL-TIME SERVICE NETWORKS

R Hotel Denver,
Industrial Washer #GHS40-2608

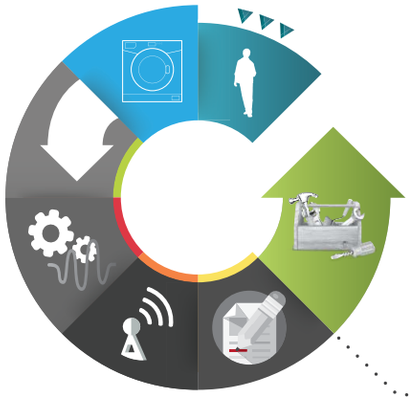
Location: ID: *FC-RM #00243* **Materials:** *FC / SUS*

- Appliance Monitoring
- Predictive Maintenance
- Service Technician / CRM
- Waste Management / Recycling

Manufacturer: *Appliance Park Louisville, KY ID: #45205343*

Sensor: *Vibration*
Connectivity: *Wireless LAN*

Connor, the Lead Maintenance Manager at the R Hotel in Denver, receives a sensor notification that the pump body O-ring #6 on washing machine #230243 is starting to fail in the housekeeping laundry room.



On his mobile, Connor prompts the machine to order a new part. This action triggers a bidding opportunity for local service technicians within the product's authorized maintenance network.

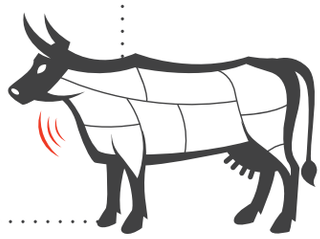
The request lays out:
- *Pricing parameters*
- *Timing requirements*
- *Machine history*
- *Part specs*
- *Predictive sensor measurements & alerts*

Tom from IA Appliances bids on the service request and receives a notification a few moments later that his bid was accepted.

Within 1.5 hours, a service technician from IA Appliances is on site (Using a temporary facility access code for the wireless door lock) to replace the water pump. Connor sends a brief note on the service quality and IA Appliances releases a bid request for the part's raw materials to local recycling centers.

DIGITAL FARM TO TABLE

- Farm & Livestock ID & Sensors
- Food packaging sensors
- Retail Supply Chain Monitoring
- Health Services



Cattle
AIN: 840 003 123 456 789

Location: ID: Braymeadow Farm *FR #00285453543*
Slaughterhouse ID: *#45205343*
Sensor: *Temperature, Accelerometer*
Connectivity: *RFID, NFC, WAN*

Maria and her daughter are picking up groceries for the week. Using packaging with printed sensors, the two can make sure the ground beef they are purchasing has never reached unsafe temperature levels while on the shelf or being transported.

The packaging also contains a QR code which they can use to query the cow's RFID tag and bring up its history:

- *Where it was raised*
- *What it was fed*
- *Where it was slaughtered*
- *How it was transported*
- *Where it was packaged*
- *The last time it was inspected.*

A week later the U.S. Department of Agriculture's Food Safety Service determines ground beef from originating from a regional packing company and sold at a neighboring store is contaminated with E. coli O157:H7. All packages from this distributer change their alert color and notification messages are sent to those shoppers that may have been impacted.

How large is the IoT Market?

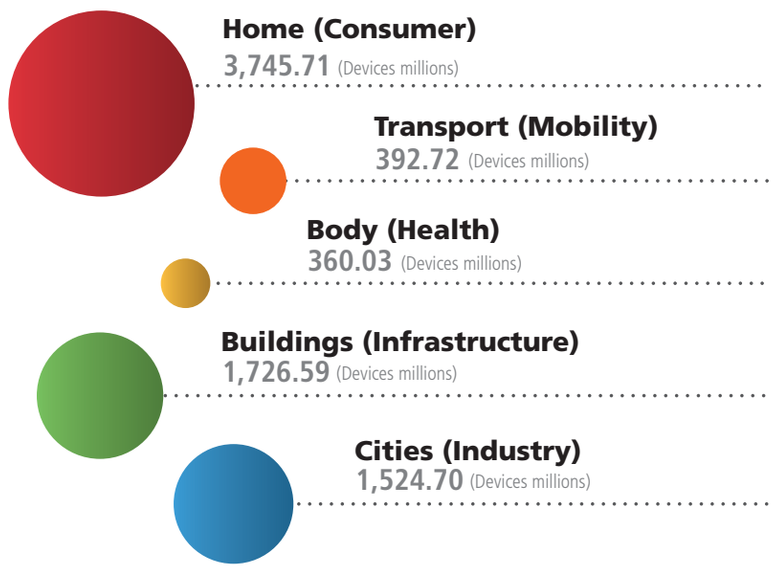
In the not-too-distant future, hundreds of millions, then billions, of individuals and businesses with billions, then trillions, of smart, communicating devices will stretch the boundaries of current systems. Creating the potential to change the way we work, learn, entertain and innovate.

Connected Devices

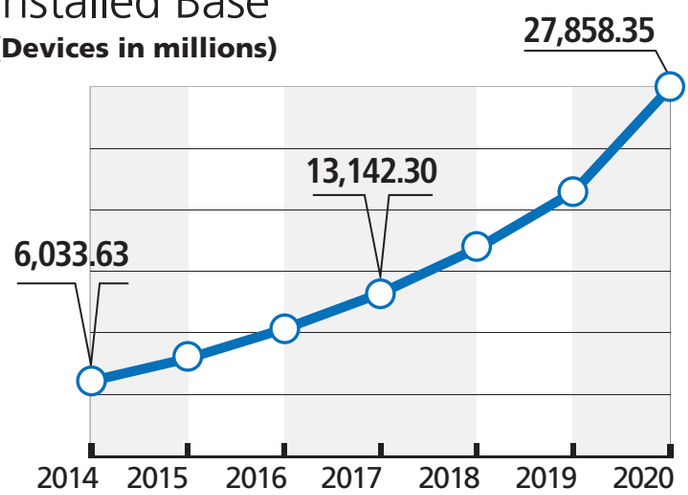
In 2014 nearly **2 billion** connected devices will be shipped

This number will grow to nearly **8 billion** devices for the year 2020

**Not including mobile phones*



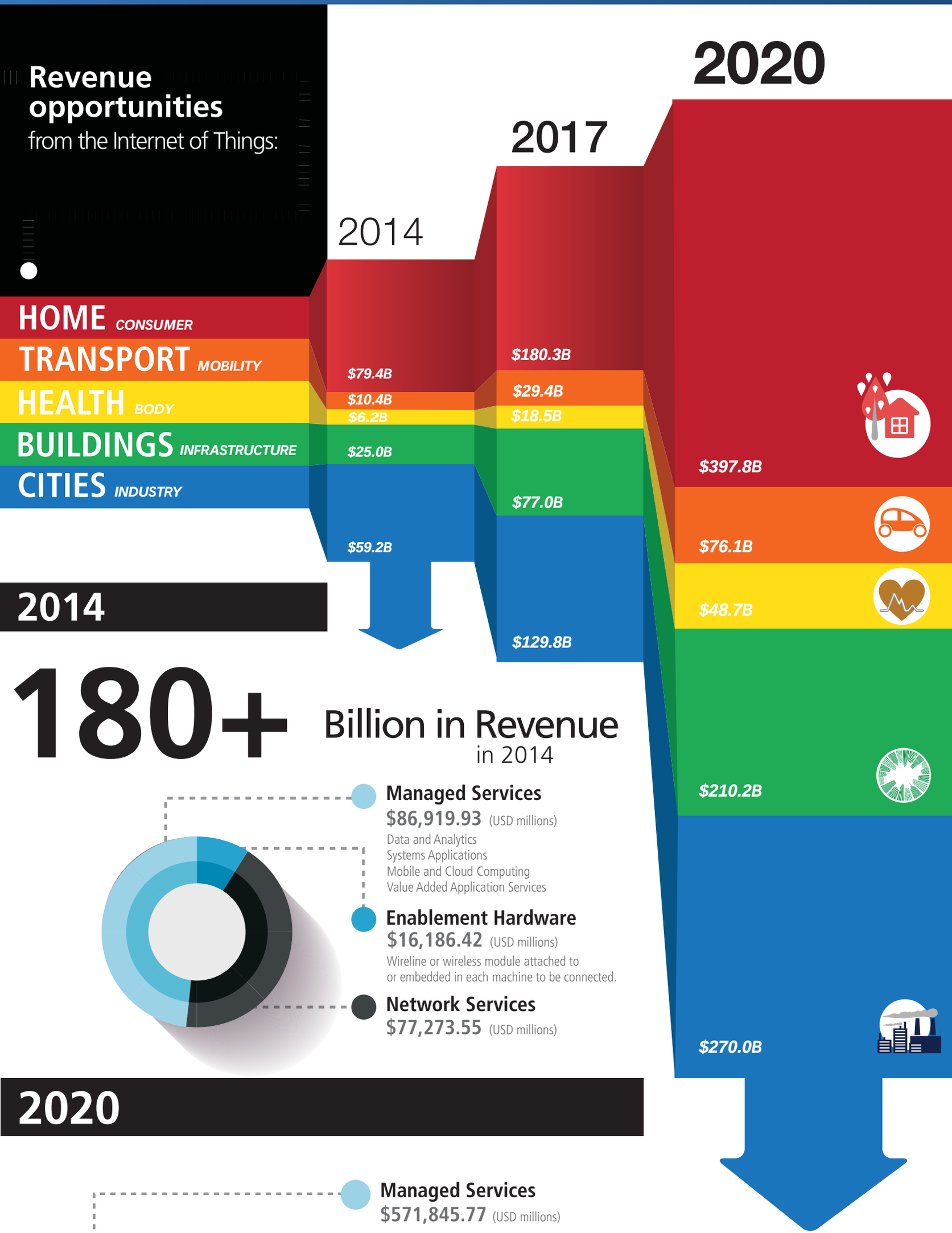
Installed Base
(Devices in millions)



Business Impact

The implications of these trends are enormous. Vertically defined, stand-alone products and application markets will increasingly become a part of larger **networked "horizontal" systems**.

Revenue opportunities
from the Internet of Things:



2014

180+ Billion in Revenue
in 2014

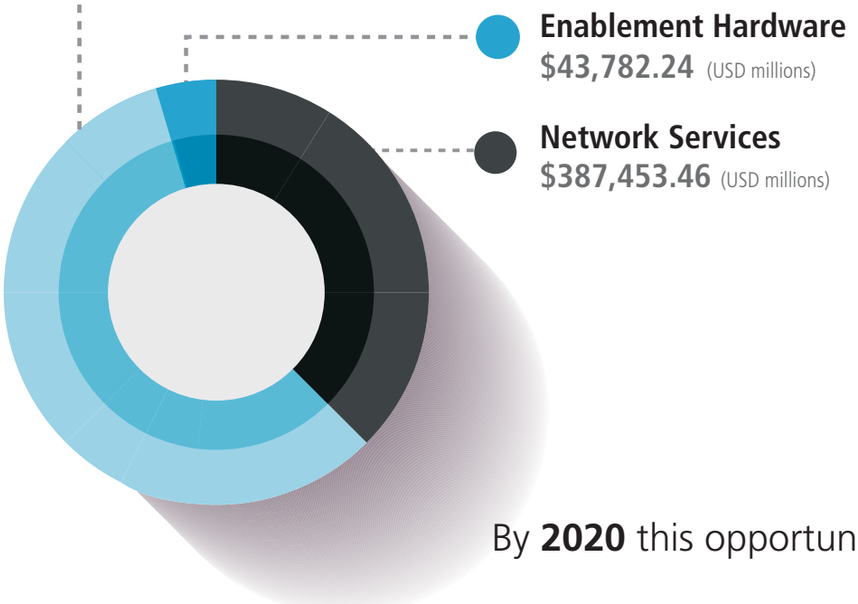
Managed Services
$86,919.93 (USD millions)
Data and Analytics
Systems Applications
Mobile and Cloud Computing
Value Added Application Services

Enablement Hardware
$16,186.42 (USD millions)
Wireline or wireless module attached to or embedded in each machine to be connected.

Network Services
$77,273.55 (USD millions)

2020

Managed Services
$571,845.77 (USD millions)



By **2020** this opportunity will grow to more than

>$1 Trillion

The **Internet** gave us the opportunity to connect in ways we could never have dreamed possible.
The **Internet of Things** will take us beyond connection to become part of a living, moving, **global nervous system**.

Whether you are an individual, technology developer, or adopter of these technologies, the Internet of Things will stretch the boundaries of today's systems. ***Are you prepared for the changes in the way we will learn, work, and innovate?***

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