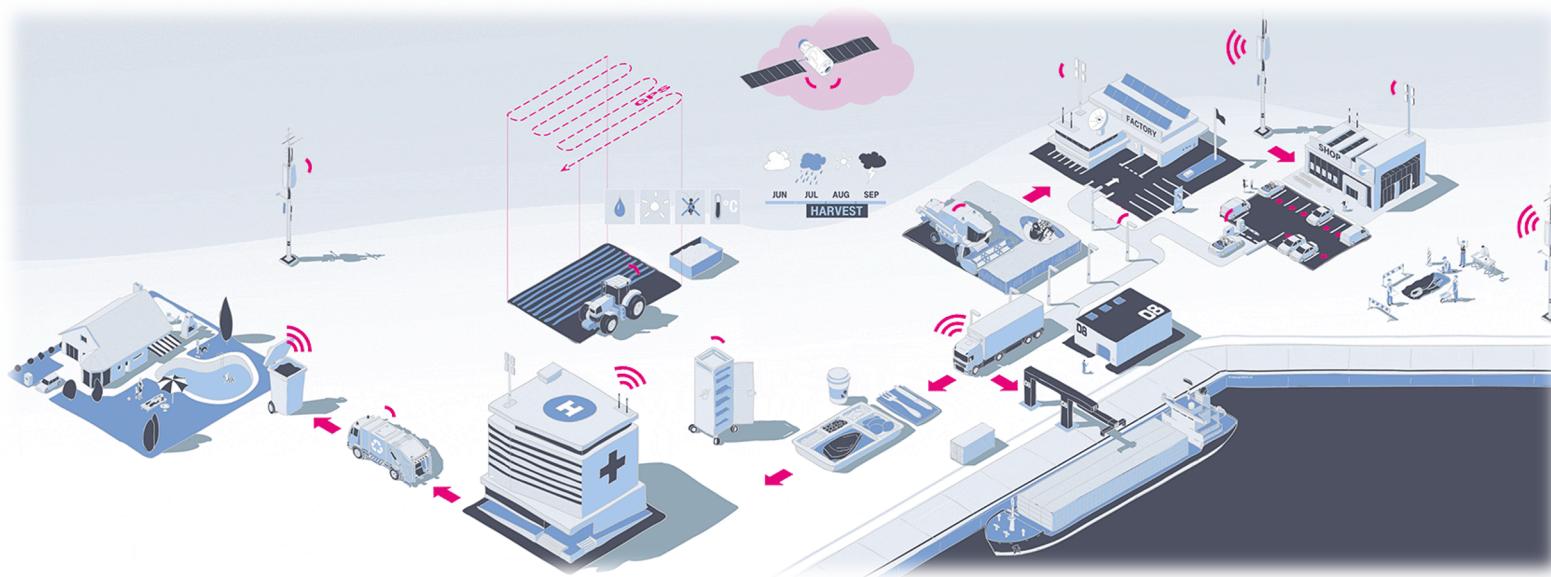




INTERNET OF THINGS (IOT)

FROM SENSORS TO REAL-TIME DECISIONS

IOT



The Internet of Things (IoT) refers to embedding sensors, computing, and connectivity in many of our everyday devices, such as thermostats, lighting, cameras, and appliances.

This opens the door to an unprecedented level of automation and personalization. However, without a scalable way to track and analyze all of the data being produced, these benefits cannot be fully realized.

The topic of IoT is not limited to devices in the home. It expands to machines on a manufacturing floor, a fleet of cars or trucks, manned/unmanned flying objects, and even a windmill farm benefit.

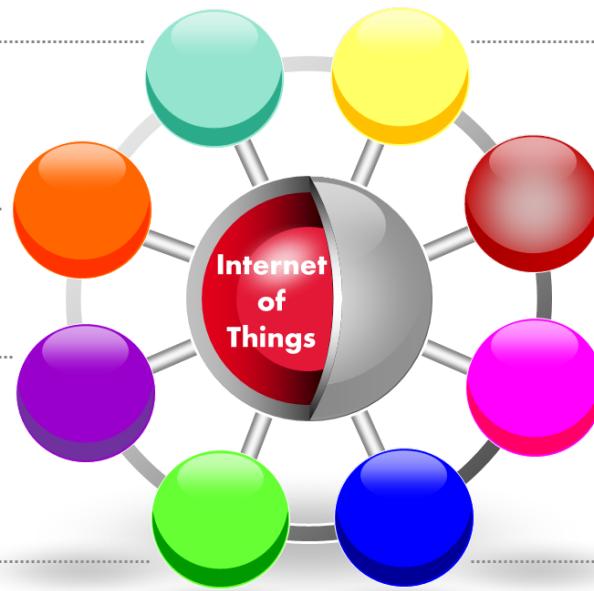
IOT

A dynamic global network infrastructure

with self configuring capabilities

based on standard and interoperable communication protocols

where physical and virtual "things"



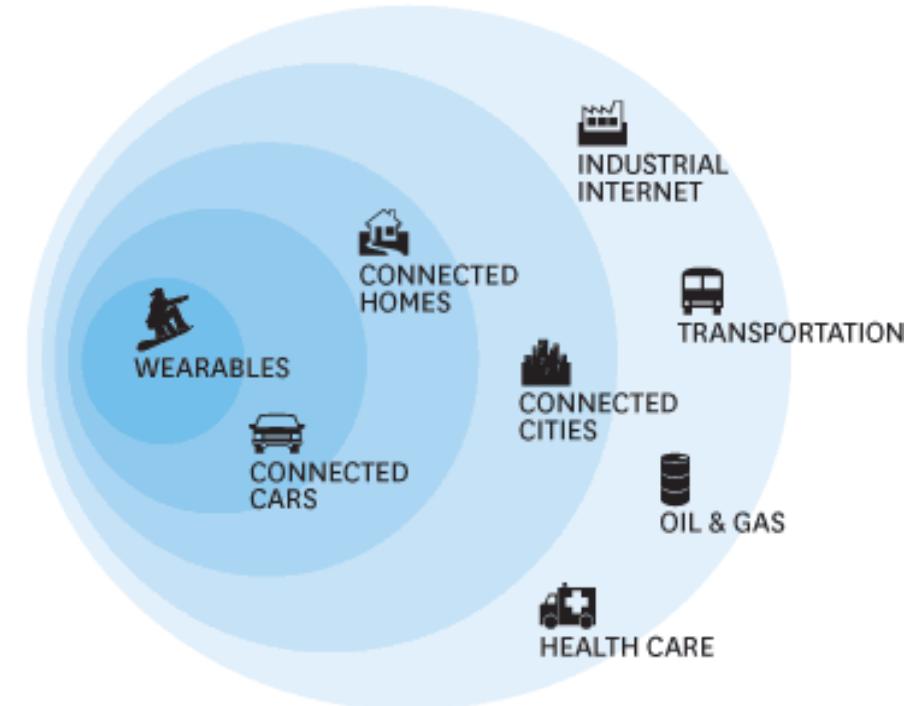
have identities, physical attributes, and virtual personalities

use intelligent interfaces,

and are seamlessly integrated

into the information network.

THE INTERNET OF THINGS LANDSCAPE



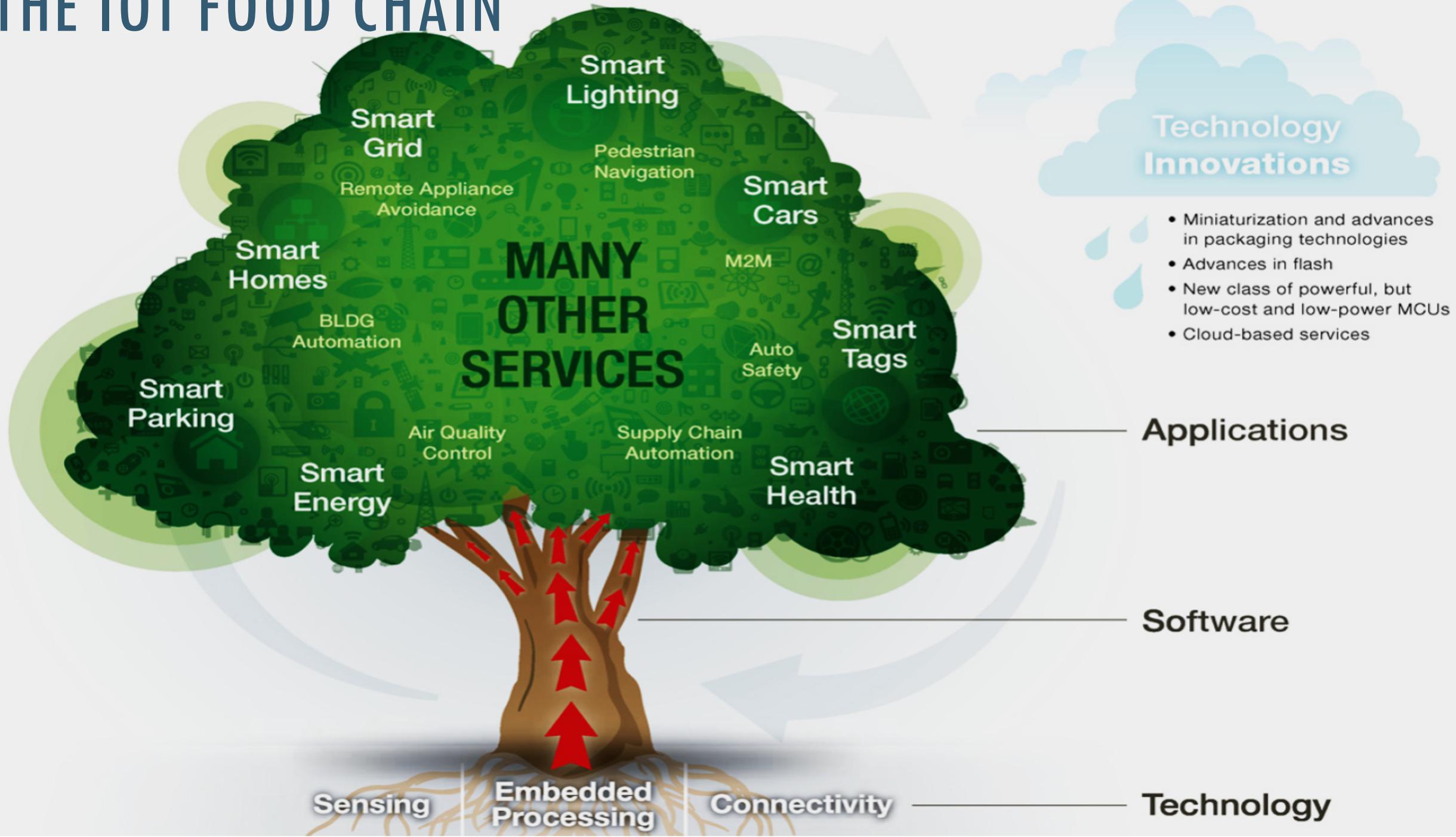
SOURCE GOLDMAN SACHS GLOBAL INVESTMENT RESEARCH

HBR.ORG

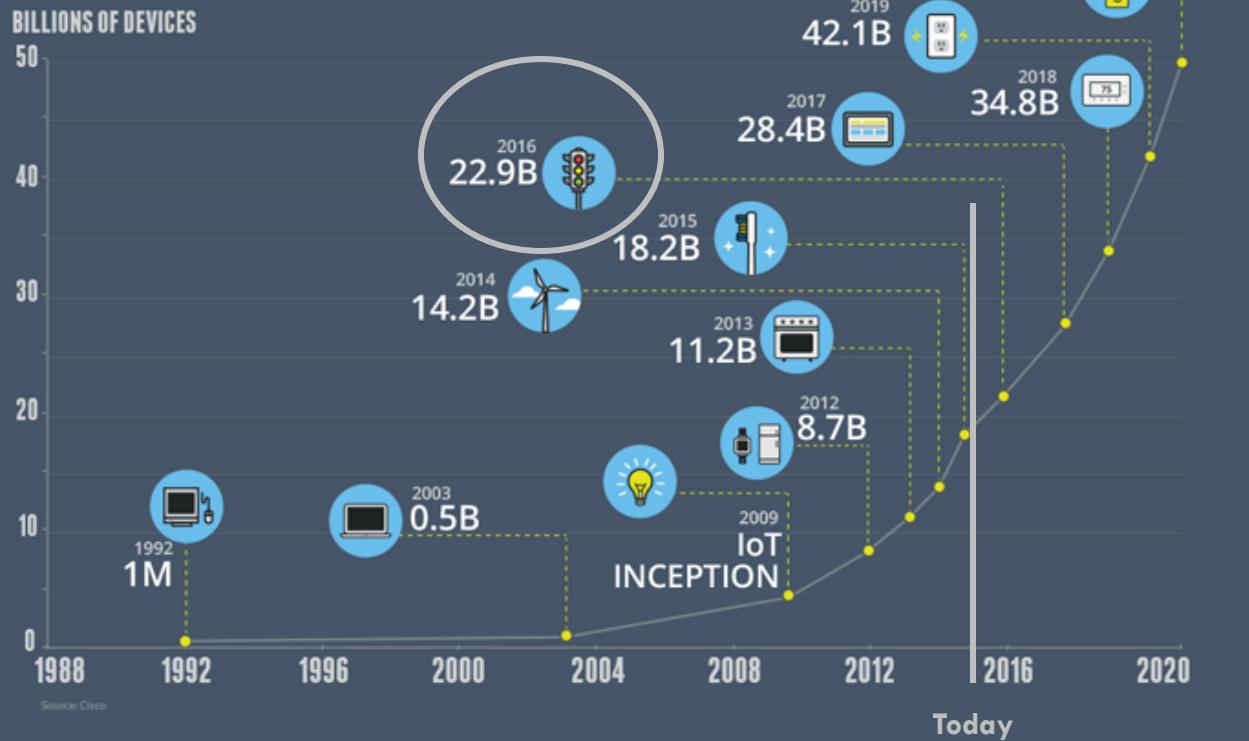
IOT- WHY?

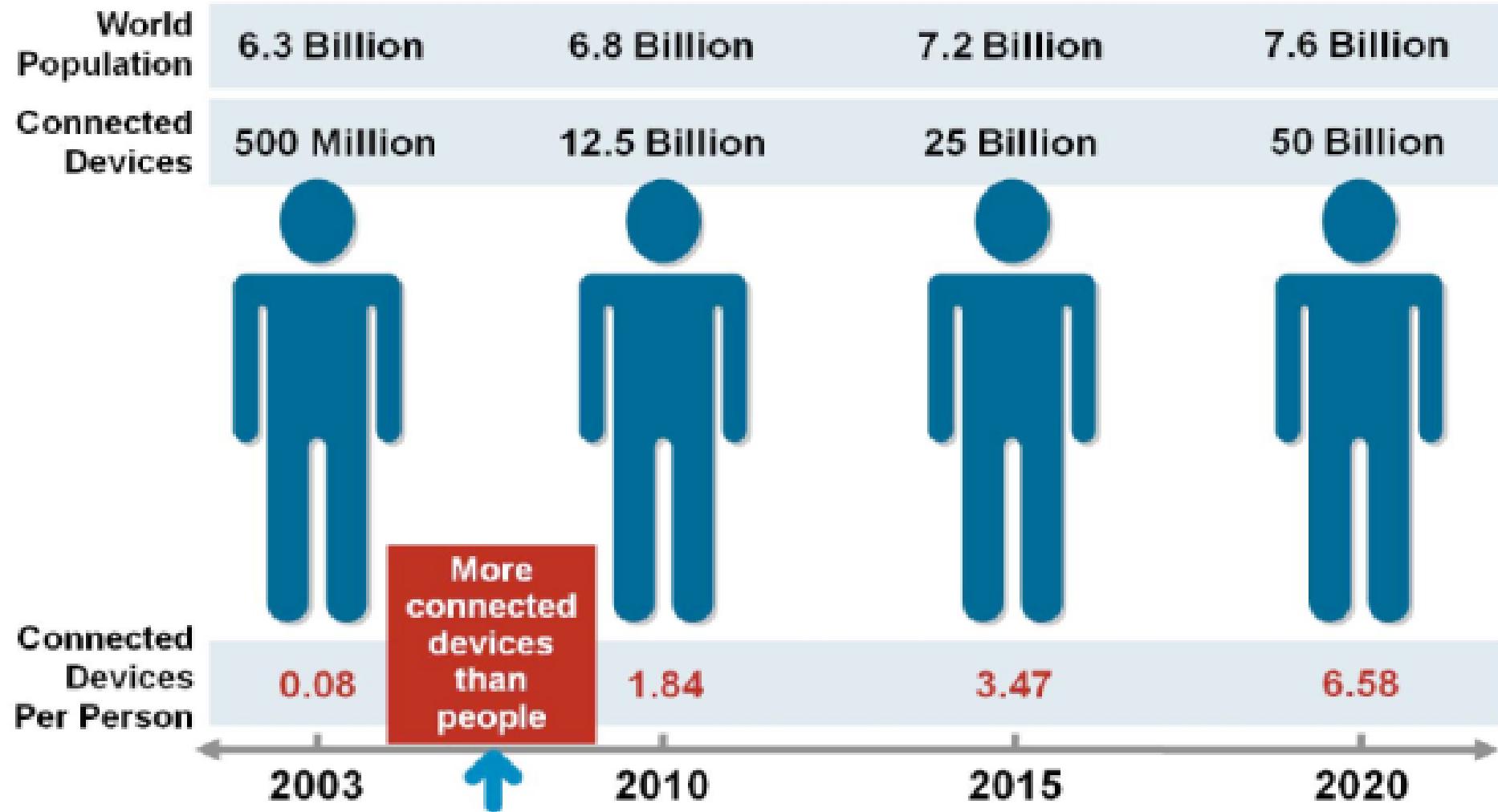
- The driver of all this connectivity of things is essentially the desire to “**add value**” to **products and/or services**.
- From a corporate perspective, this added value can come from **increased revenues** (e.g., a \$100 handset turns into a \$600 smartphone with the right connectivity and application software) or **decreased costs** (e.g., connecting one’s trucking fleet can save on productivity, gas, maintenance, etc.).
- Cisco published a fascinating white paper outlining what it calls the Internet of Everything (IoE) index. It calculates that **businesses are already generating \$613 billion** of additional profits annually due to the connection of devices to the Internet (mostly the impact of connecting computers/mobile devices).
- Cisco calculates that this **represents only 50% of the potential** of the Internet to drive profits, with **\$14.4 trillion** of net profit likely to be generated by corporations over the **next decade** if the Internet of Things is embraced.
- In essence, it has taken 15 years or so for companies to harness about 50% of the productivity potential of the Internet, and the next 50% of productivity gains likely requires connecting things.

THE IOT FOOD CHAIN

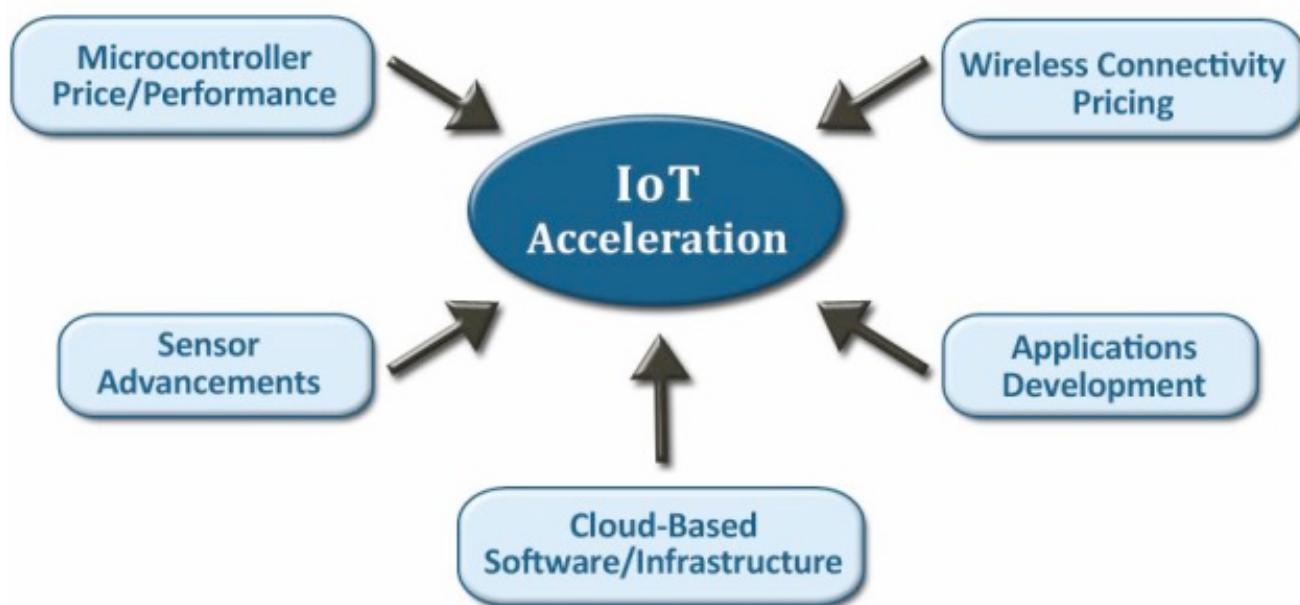


IoT Growth Drives Smart Mobility and Connected Car Extensibility





DRIVERS OF IOT GROWTH, WHY NOW?



Impact on Business, Economy and Future of Work

- What new business models, industry ecosystems and overall economic growth will the Industrial Internet create?
- How will the increasing automation transform the future job market and skillsets required to succeed in the new economy?
- How can businesses and governments best deal with the near- and intermediate-term transitions?

1. Create New Products & Services

2. Create & Destroy Industries

3. Shift Value Within, Across Industries

4. Change the Nature of Control Points

5. Redefine Role/Value of Processes, Data, Infrastructure

6. Transform How Work Is Done

Key Opportunities & Disruptions

Key Enablers

- Cloud
- Ubiquitous Connectivity
- Embedded Sensors
- Real-time Analytics
- Maturing Software Industry
- Investments by big IT firms

Industrial Internet

Key Inhibitors

- Security
- Legacy OT & Infrastructure
- Interoperability
- Privacy
- New Investment
- Perceived Risks

Recommended Areas for Action

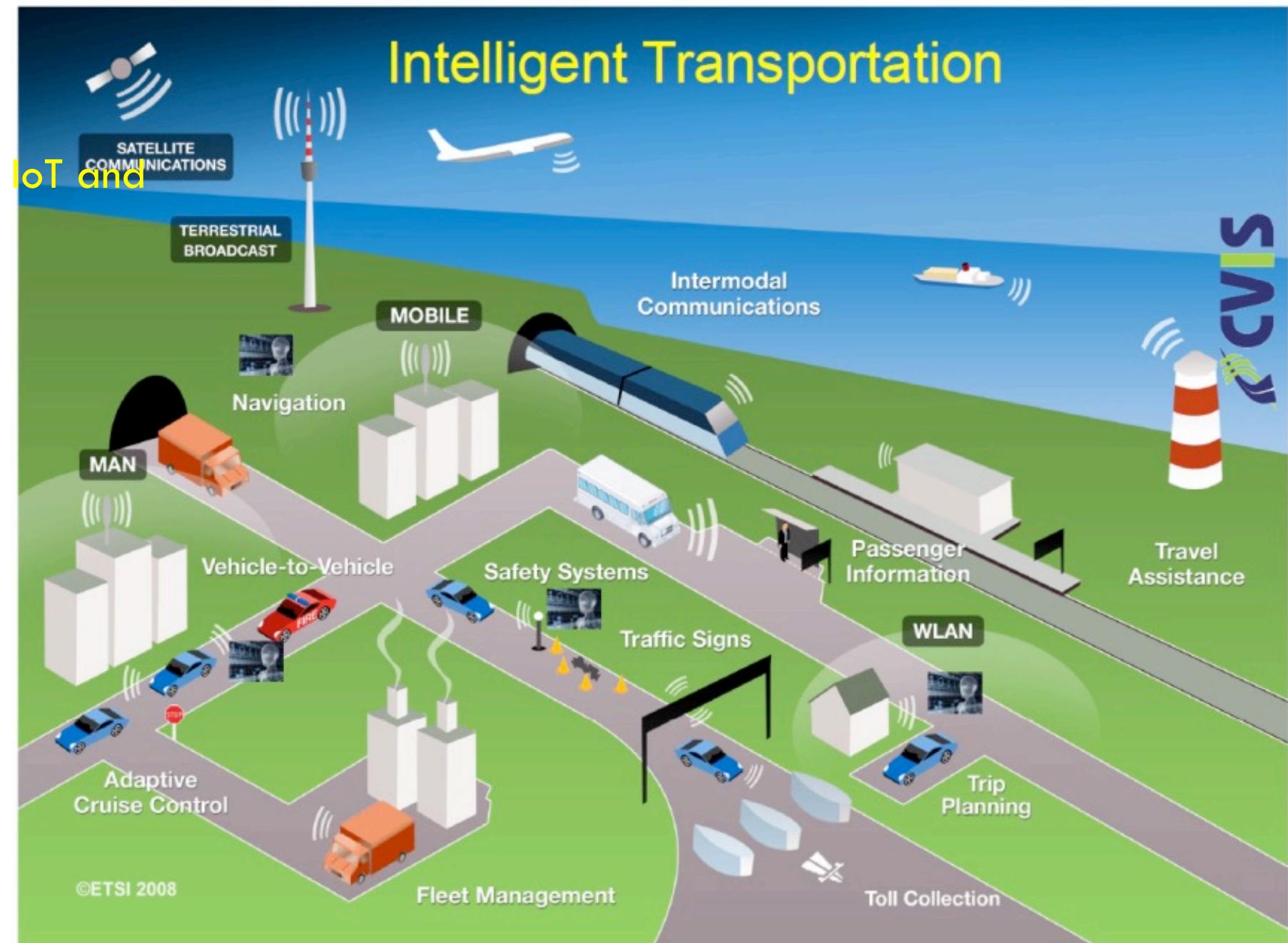
What are appropriate public policies to accelerate the development and adoption of the Industrial Internet across multiple industries, e.g., energy, manufacturing, healthcare, transportation and public sectors?

Increasing Efficiency / Reduced Cost

- Sharing of information throughout the transportation ecosystem
- Enable harmonious coordination of mobility
- Increase the efficiency of mobility
- Reduce the cost to operate within the ecosystem



At the individual level, traffic congestion cost drivers \$1,740 on average across the four countries (Inrix)



Connected Car Behaviormatics

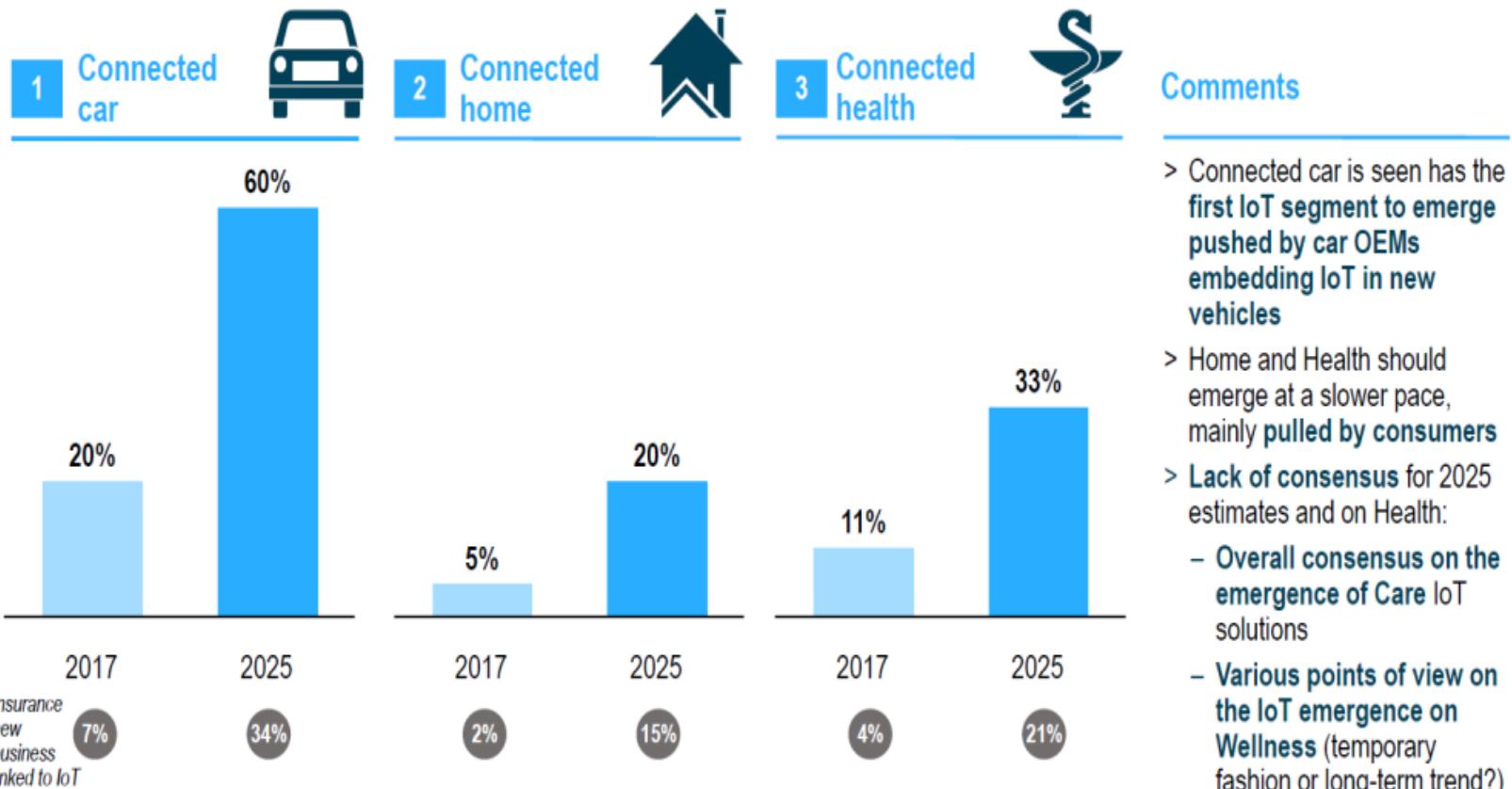
Analysis and Feedback for Behavior Modification

- Real-time via in-car HMI
- Review via mobile devices and cloud services
- Enable personalized context aware coaching (i.e. new drivers)
- Minimize risk to the driver, their passengers, assets, and other drivers on the road



Connected car is perceived as the first IoT segment to grow, pushed by car manufacturers

Expected share of cars/homes/people equipped with IoT solutions¹⁾ and share of insurance new business linked to IoT solutions



1) Connected solutions with sensors tracking multi-dimensions data on a frequent & regular basis and enabling real time consultation on smartphones/tablets/laptops

Question: Which share of cars/homes/people will be equipped with IoT solutions in 2017/2025 in your country?

Question: Which share of insurance new business will be "IoT linked" in your country (overall market)?

Source: Interviews, Roland Berger analysis

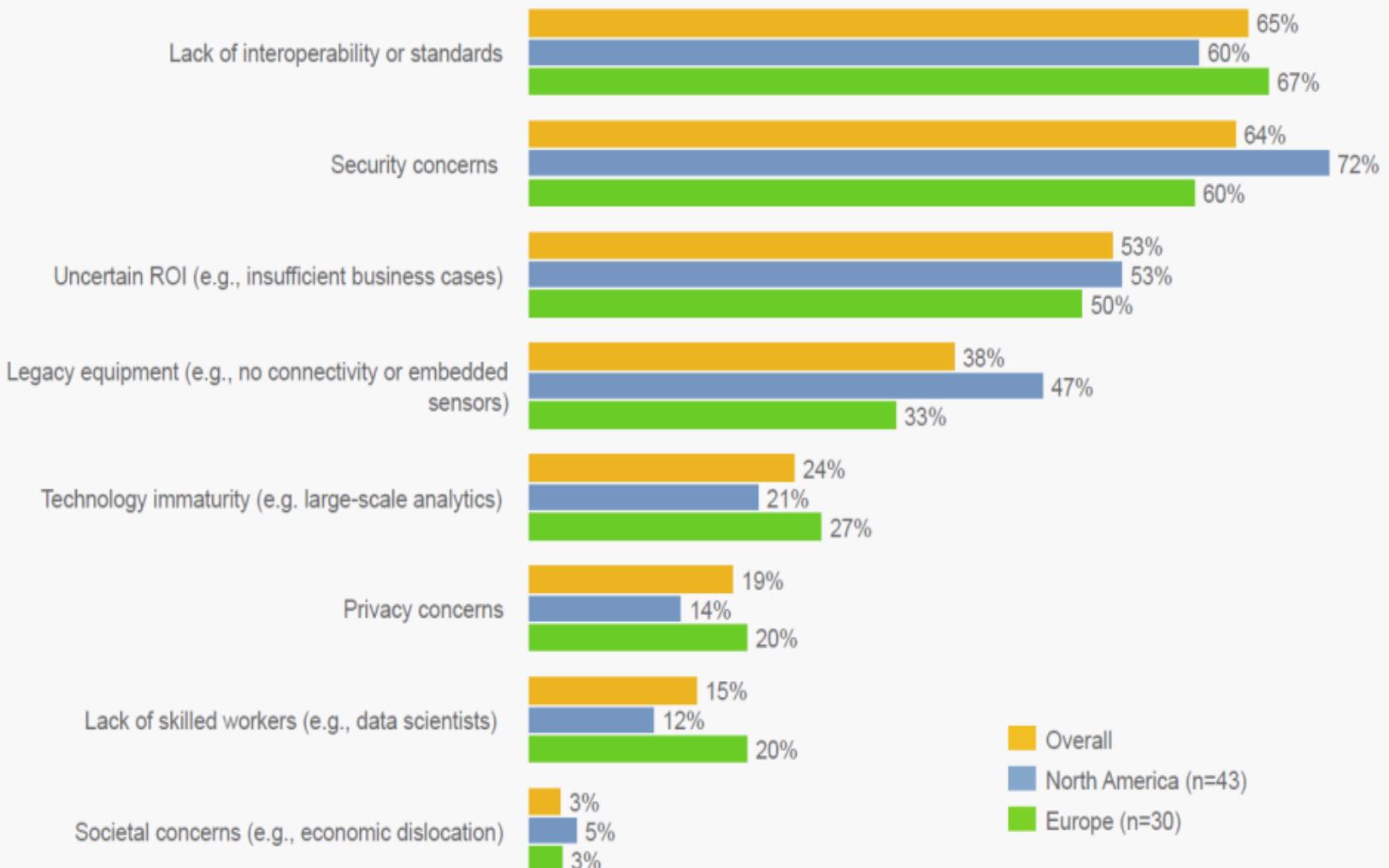
MORE CC PRODUCT CATEGORIES

| | | |
|---|---|--|
| Mobility Management Functions that allow the driver to reach a destination quickly, safely, and in a cost-efficient manner Examples: <ul style="list-style-type: none">• Current traffic information• Parking lot or garage assistance• Optimized fuel consumption | Vehicle Management Functions that aid the driver in reducing operating costs and improving ease of use Examples: <ul style="list-style-type: none">• Vehicle condition and service reminders• Remote operation• Transfer of usage data | Entertainment Functions involving the entertainment of the driver and passengers Examples: <ul style="list-style-type: none">• Smartphone interface• WLAN hotspot• Music, video, Internet, social media• Mobile office |
| Safety Functions that warn the driver of external hazards and internal responses of the vehicle to hazards Examples: <ul style="list-style-type: none">• Collision protection• Hazard warnings• Emergency functions | Driver Assistance Functions involving partially or fully automatic driving Examples: <ul style="list-style-type: none">• Operational assistance autopilot in heavy traffic, in parking, or on highways | Well-being Functions involving the driver's comfort and ability and fitness to drive Examples: <ul style="list-style-type: none">• Fatigue detection• Automatic environment adjustments to keep drivers alert• Medical assistance |

Source: Strategy&

ADOPTION BARRIERS

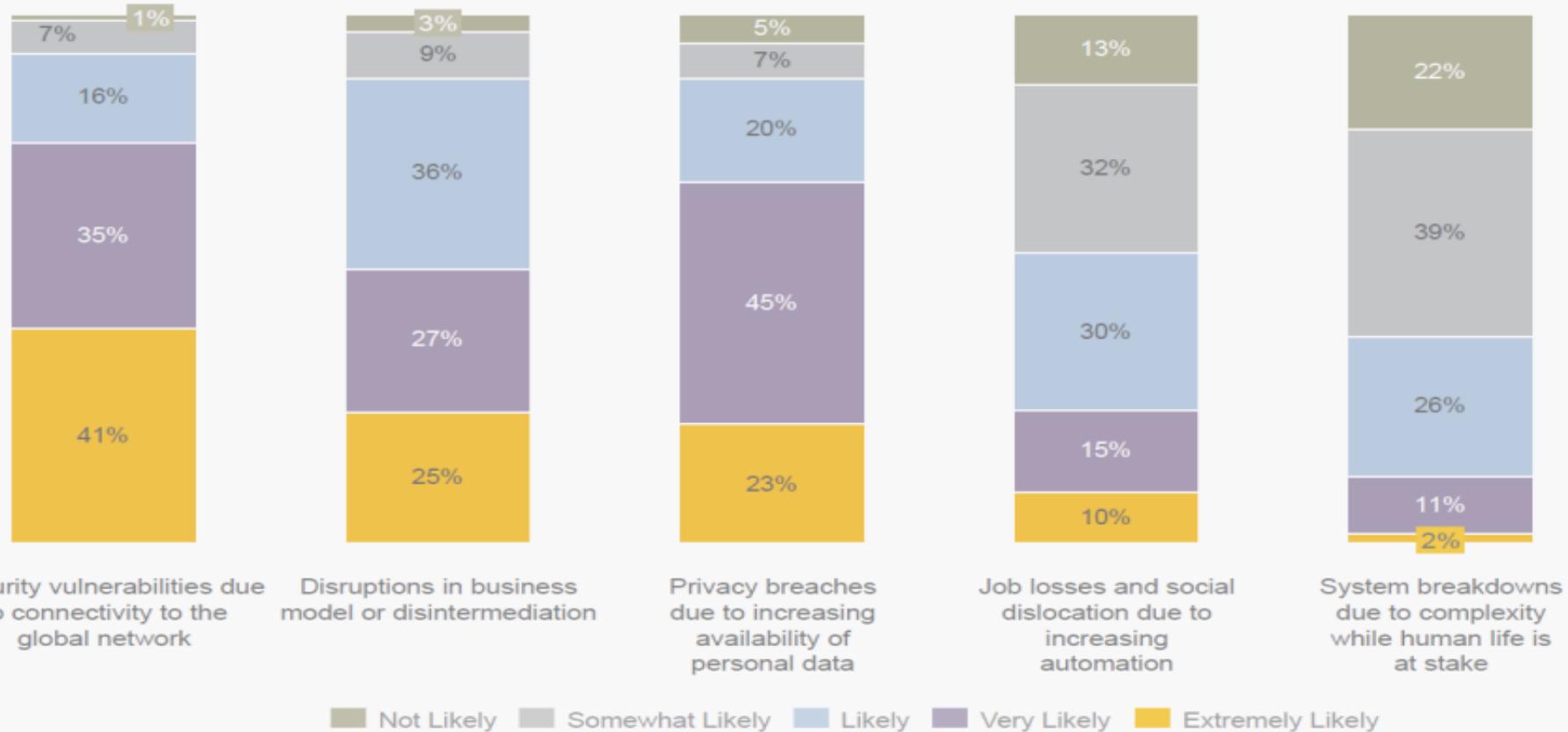
Q: What are the greatest barriers inhibiting business from adopting the industrial Internet?



approaches to better prepare younger generations for the upcoming digital workplace.

Figure 4: Likely risks for adopting the Industrial Internet

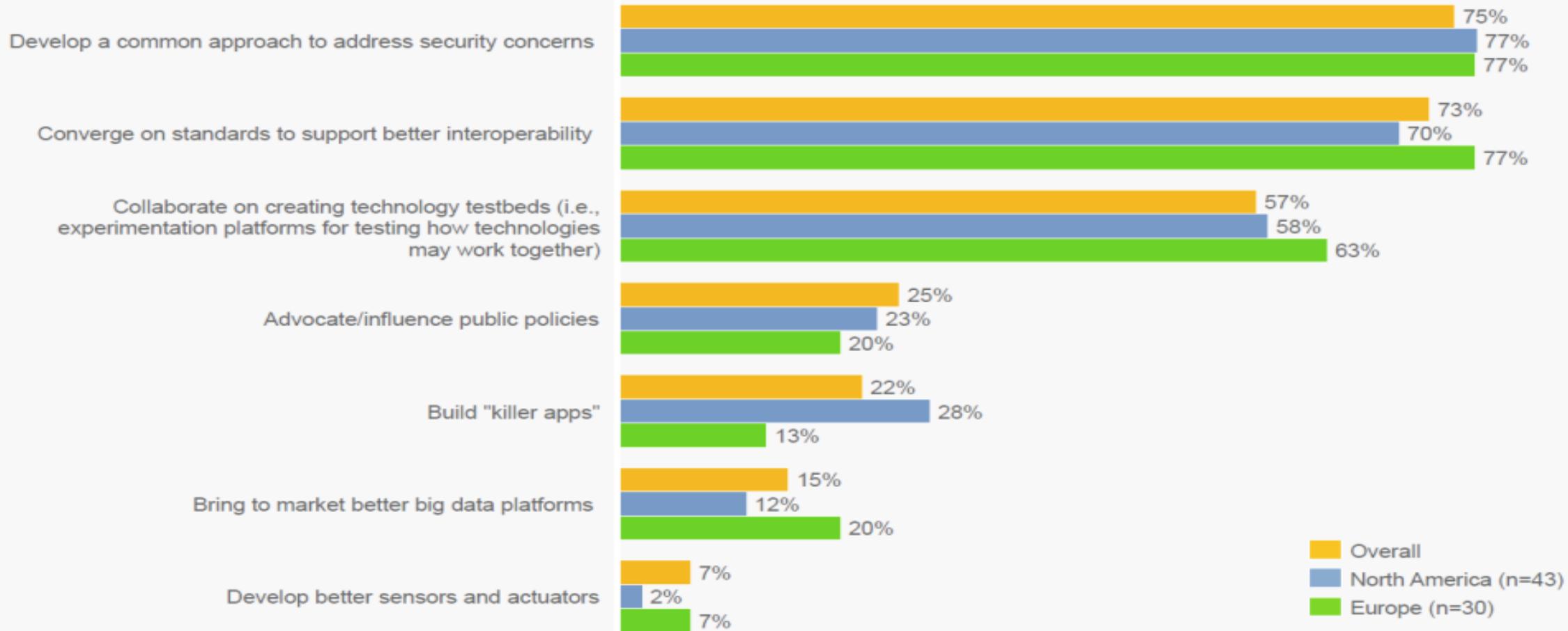
Q: How likely are the following risks or negative consequences associated with the Industrial Internet?



Source: World Economic Forum Industrial Internet Survey, 2014

Industrial Internet of Things 11

Q: What are the three most important actions the IT industry (e.g., hardware, software and service providers) can take to help accelerate the adoption of the Industrial Internet?



Source: World Economic Forum Industrial Internet Survey, 2014

Industrial Internet of Things

27

Q: What are the three most important actions governments can take to accelerate the adoption of the Industrial Internet?

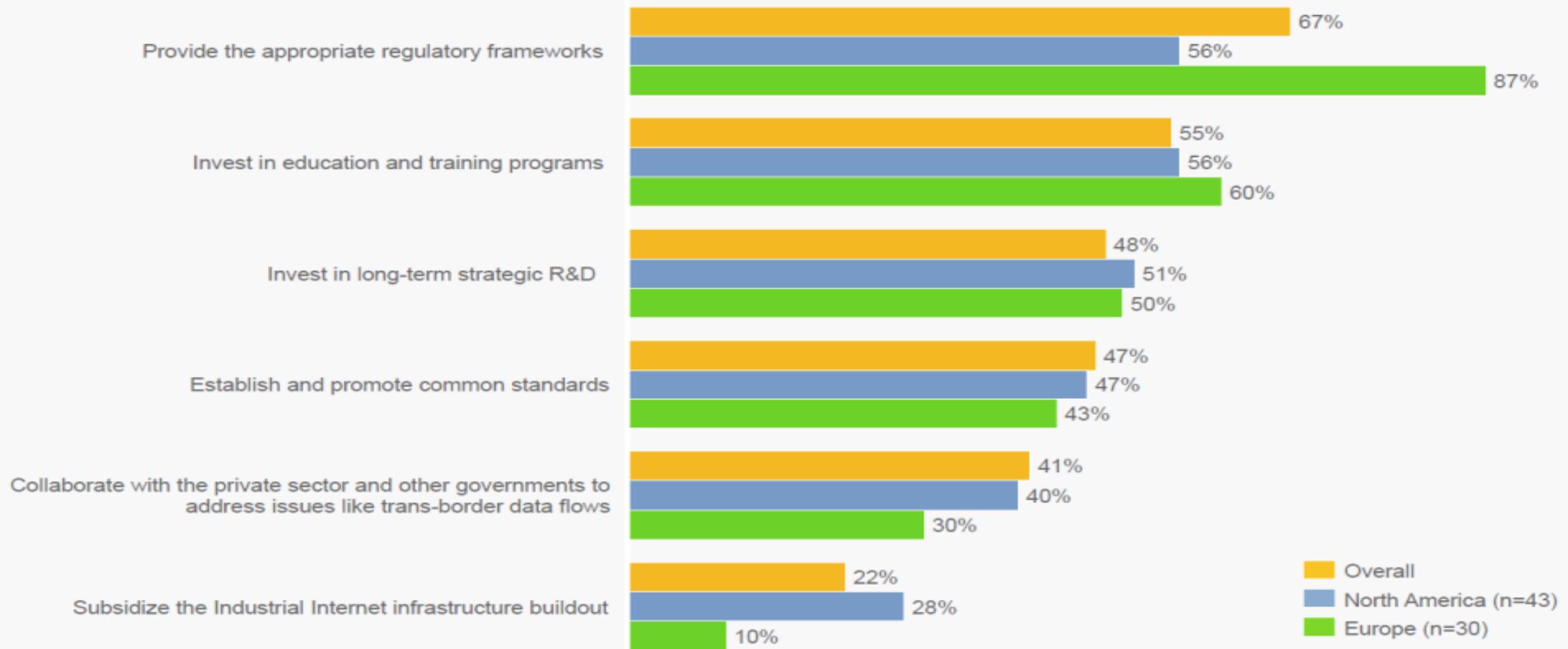
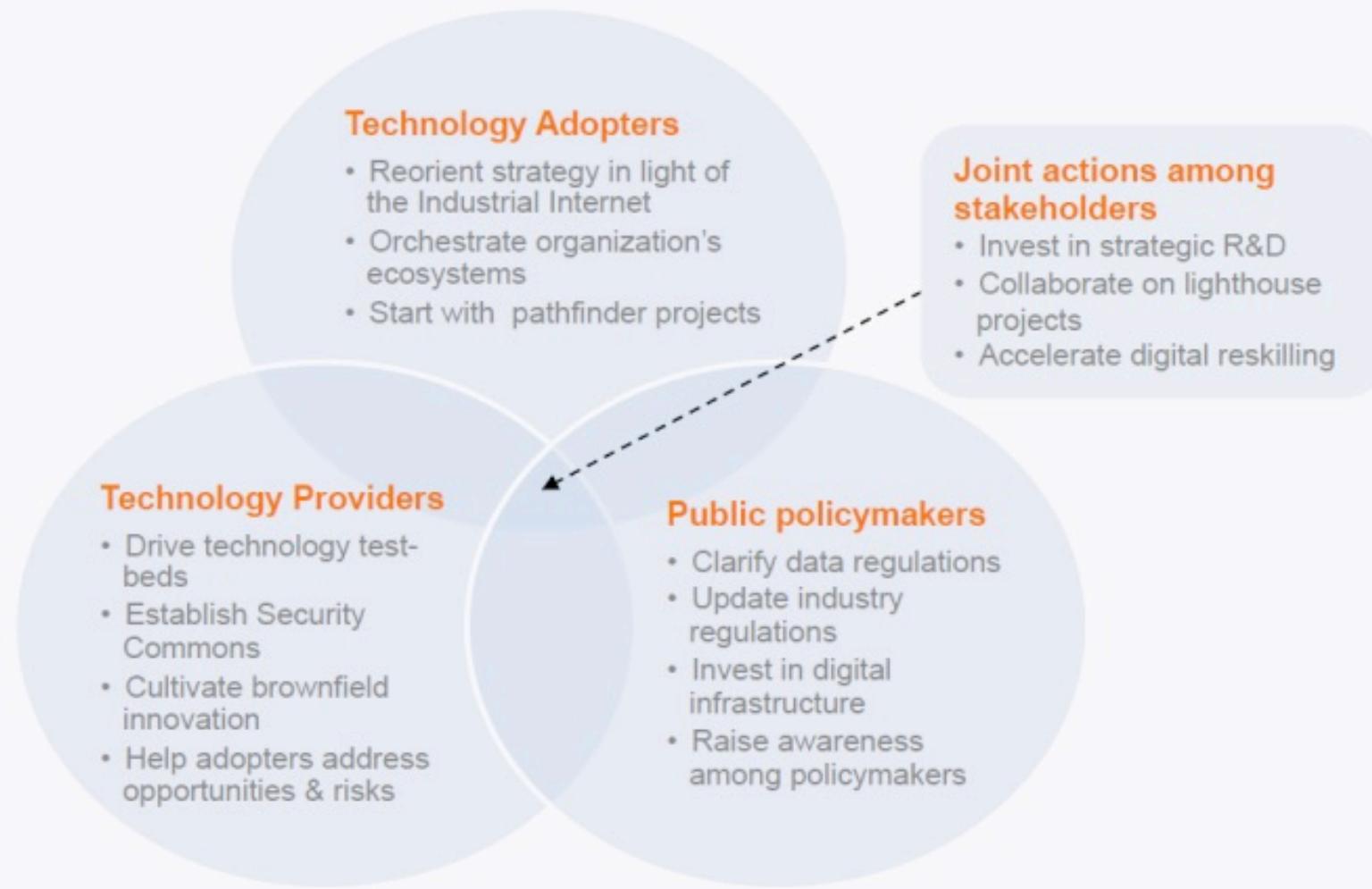


Figure 6: Key recommendations for three stakeholders groups



Source: World Economic Forum Industrial Internet Survey, 2014

Industrial Internet of Things

25

Longer term, estimates show the market continuing its rapid growth, reaching more than 400 million registered IoT vehicles in 2030.

Figure 9. Registered Vehicles with IoT Applications by Region, Forecast (Million Vehicles)

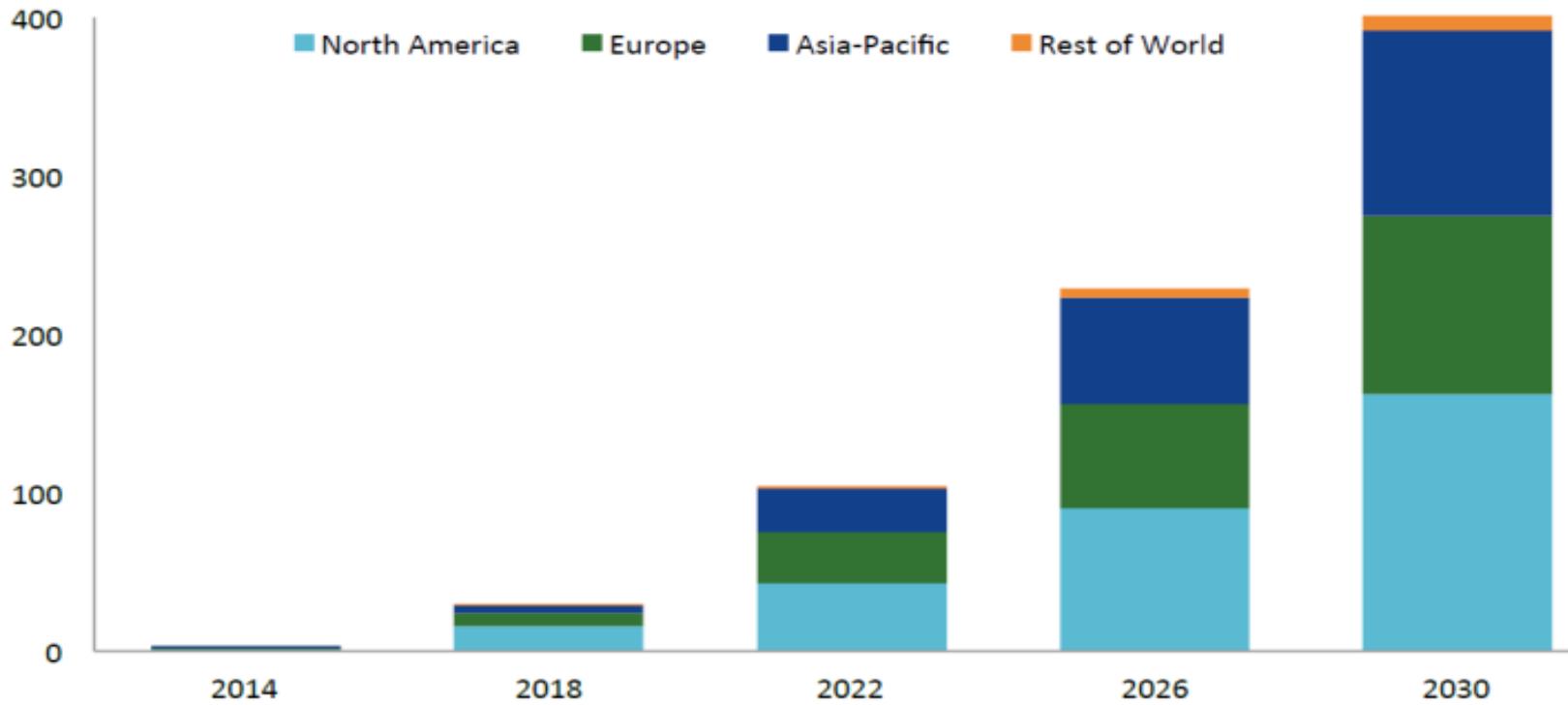
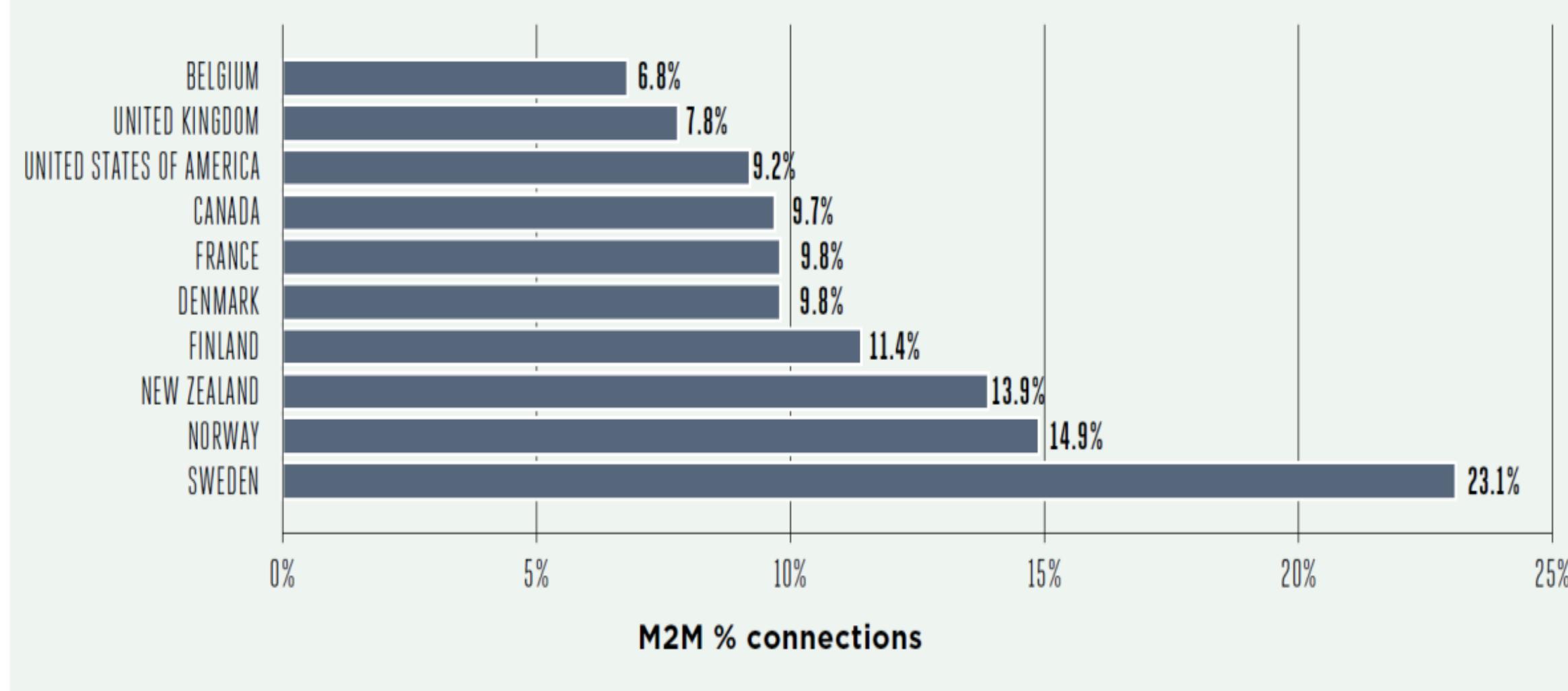


FIGURE 2: M2M AS A PERCENTAGE OF TOTAL CONNECTIONS IN LEADING MARKETS



Source: GSMAi

IOT LANDSCAPE OF OPPORTUNITIES

- Consumer**
 - Smart home control (lighting, security, comfort)
 - Optimized energy use
 - Maintenance
- Retail**
 - Product tracking
 - Inventory control
 - Focused marketing
- Medical**
 - Wearable devices
 - Implanted devices
 - Telehealth services
- Military**
 - Resource allocation
 - Threat analysis
 - Troop monitoring



- Industrial**
 - Smart Meters
 - Wear-out sensing
 - Manufacturing control
 - Climate control
- Automotive**
 - Parking
 - Traffic flow
 - Anti-theft location
- Environmental**
 - Species tracking
 - Weather prediction
 - Resource management
- Agriculture**
 - Crop management
 - Soil analysis

IOT SERVICES

IoT Services



Home
Automation



Health
Services



Energy
Management



Emergency
Services

Gateway Nodes



Smart
Phones



Raspberry
Pi



Arduino



NEST



Routers

Sink Nodes



Home
Appliances



Home
Security



Environment
Sensors



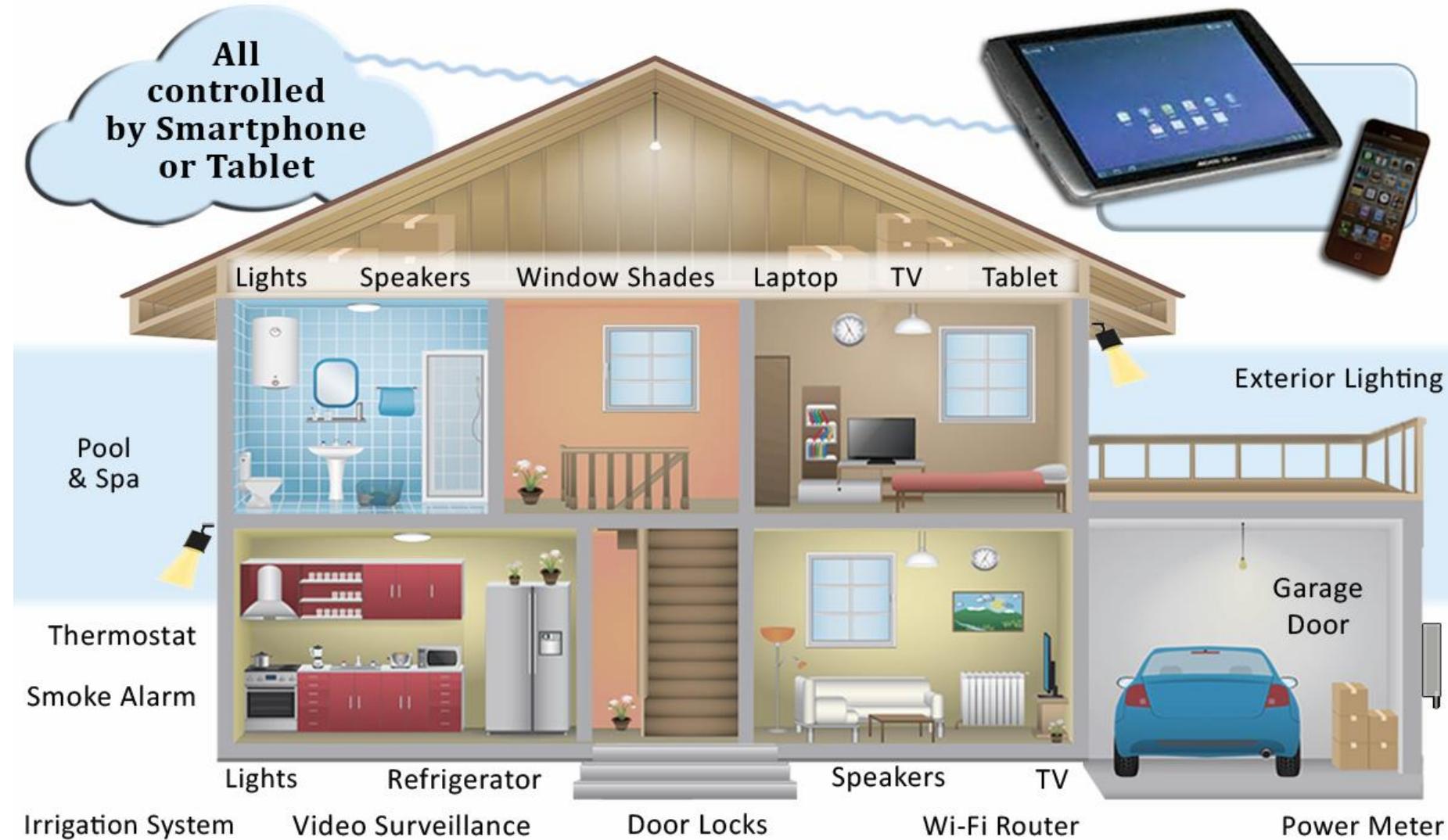
WSN
nodes



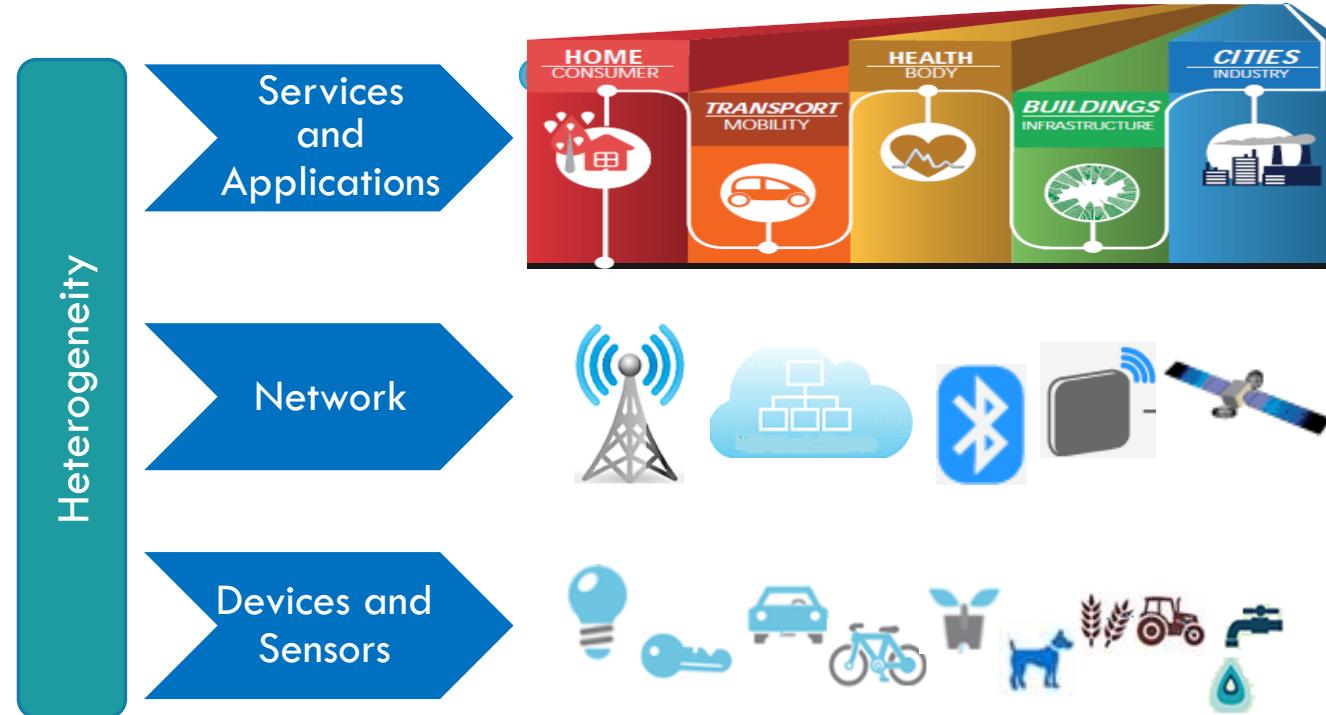
Health monitoring Sensors



IOT & HOME CONTROL



THE COST OF COVERING A WIDE SPECTRUM



IoT is redefining the power grid

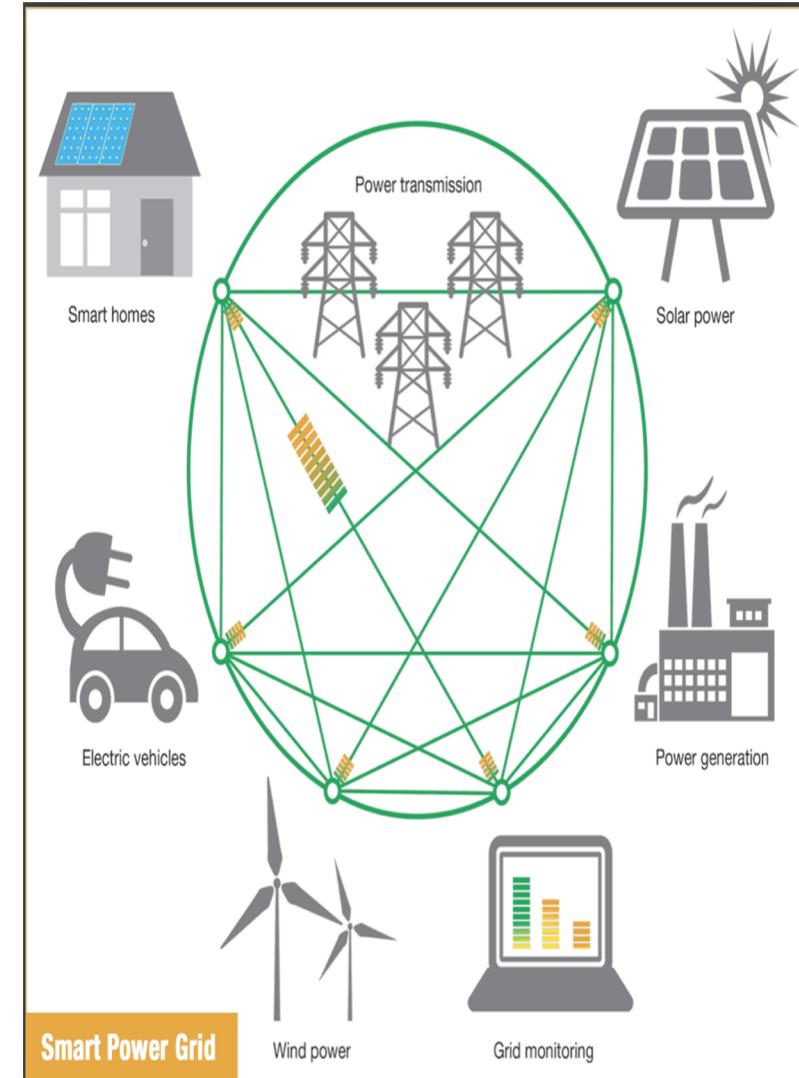
With increasingly rapid mobile connectivity speeds, smart meters provide near real-time information on energy consumption and transmission. This data allows for more efficient, demand-based electricity generation and distribution. IoT makes it possible to integrate a larger ecosystem of power sources, with electricity, hydroelectric, oil and natural gas integrated into unified distribution networks.

Smart meters are also facilitating the growth of the local, micro-production of energy such as solar panels and wind turbines. This creates potentially new revenue streams, as well as further efficiency of production and distribution. It also creates interaction with other market players in – or outside the “traditional” ecosystem.

Stronger customer relationships and new revenue streams

Just as IoT can enable demand-based energy production, utilities can further influence demand by offering consumers incentives to use energy at particular times. For the end-customer, transparent pricing lead to lower bills, while the grid operator can reduce the cost of building greater capacity.

Smart meters provide utilities a direct channel to offer the consumer value-adding services, such as smart home applications that automate energy usage. Realizing the full potential of IoT will allow utility operators deeper consumer relationships and new revenue streams over time.



IoT trends in the utilities industry

Short term trends

IoT leads to cost saving and regulatory compliance.

- An emerging need to increase meter reading frequency to shorter intervals, which will require a more advanced IoT solution, utilizing high-speed LTE and 5G mobile connectivity.
- Low margins in the utilities industry creates a barrier for investment in IoT projects.
- IoT development is likely to happen more quickly in markets where automated meter reading legislation is already in place.
- Cost savings remain the main driver for adoption, but the full potential of IoT remains untapped.
- Next-level investments in Utilities IoT will lead to more efficient grid operations with solutions for alarm functions, maintenance, and upgrades.

Long term trends

Balancing demand and improving services.

- The commercial breakthrough of electric vehicles will have a major impact on demand
- The whole industry will become more connected, driven by legislation, customer demand, and lower TCO (Total Cost of Ownership).
- Near real-time data will lead to intelligent energy distribution planning.
- IoT facilitates the growth of the localized green energy production.
- Two-way communication with end-users make differentiated pricing possible.
- The direct communication link from utility to household enables new revenue streams such as smart home automation.

FLUO \ UNDULU \



Walmart wants to put sensors on everything so it can automatically order you stuff

By [Ashley Carman](#) | [@ashleyrcarman](#) | May 5, 2017, 11:56am EDT



Walmart is thinking about the ways in which the Internet of Things could get more products into shoppers' homes. In [a patent](#) publicly revealed this week and spotted by [CB Insights](#), the company describes a system of connected sensors that could monitor customers' product consumption. The sensors would be attached to products and rely on a variety of technology, like radio frequencies, Bluetooth, conventional barcodes, and RFID tags.

Walmart doesn't suggest that any one sensor type would work best; rather, it lays out its options. Apparently it has a lot of ideas: these tags would all track how often a product is used and where it's located in a home. They could also help Walmart figure out what other products it could market to users based off their purchases.

A tag reader installed on a fridge, for example, could scan every item that goes inside. This reader could then track when food is going bad or needs to be reordered. On the other hand, an RFID system could figure out when a person is picking up their toothbrush and use that information to estimate how much toothpaste is left. It could then be automatically reordered. More than anything, Walmart stresses that these tags will help collect valuable data on consumers, which is off-putting, especially if you don't want your retailer to know everything about your consumption habits. Still, it's entirely possible Walmart will never actually implement any of these ideas.