Internet of Things

Medium for enabling education for the masses

Diksha Deo- Speaker Profile

www.dikshadeo.com

- **Developer** -- CRMNext Inc.
- **Member**
  - Google Women Techmaker
  - IACSIT
  - IEEE
  - Association of Engineers
  - **Tap Chief**
  - WIZIQ
- **Speaker**
  - Meetup
  - IEEE Research Forum
- **Editor and Reviewer**
  - IEEE
  - IJERP
- **Invited**
  - Guest Session Chairperson – IEEE International Conference
  - Research Member - IEEE
  - Delivered **23+ session** for international conferences and **32 +** national sessions .
- **Attended / Participated**
  - **90+** national / international conferences

Contributed Organizations

SEPT 2016

Women Techmakers

5+ years

IACSIT
International Association of Computer Science and Information Technology
WWW.IACSIT.ORG

3+ years

IEEE Xplore® Digital Library

4 months

IJSRP.ORG

1+ years

IAENG

3+ years

AMITY INNOVATION INCUBATOR

1+ years

sitepoint

2+ years

Meetup

Agenda

- IoT Buzzword
- In depth architecture
- Technologies and Languages
- Applications – LIVE scenario
- Existing company in IoT
- Future scope and challenges
- Career prospect

Ask LIVE questions

sli.do

Join at

slido.com

#1692

1. IoT Buzzword

Any Guesses ???

Internet Evolution

Internet of boffins	Internet of geeks	Internet of masses	Mobile Internet	Internet of things
				
1969 - 1995	1995 - 2000	2000 - 2007	2007 - 2011	2012 & beyond

IoT

Internet of Things

- Internet connected objects (things) working together to solve a business problem

What are the **“Things”** in the IoT ?

What are the “Things” in the IoT?

- Could be anything
  - Physical
  - Virtual

Why IoT ?

- Generate, collect, process and use acquired information to make **better decisions**
- Smart objects: Make things that weren't meant to talk to each other **interact smartly**

Show Time

- Video – IoT Intro

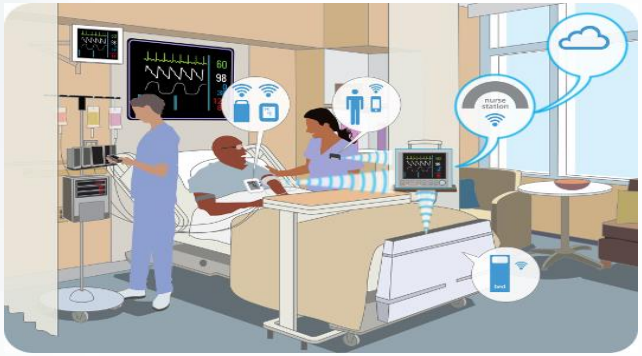
Internet of Things explained simply.mp4

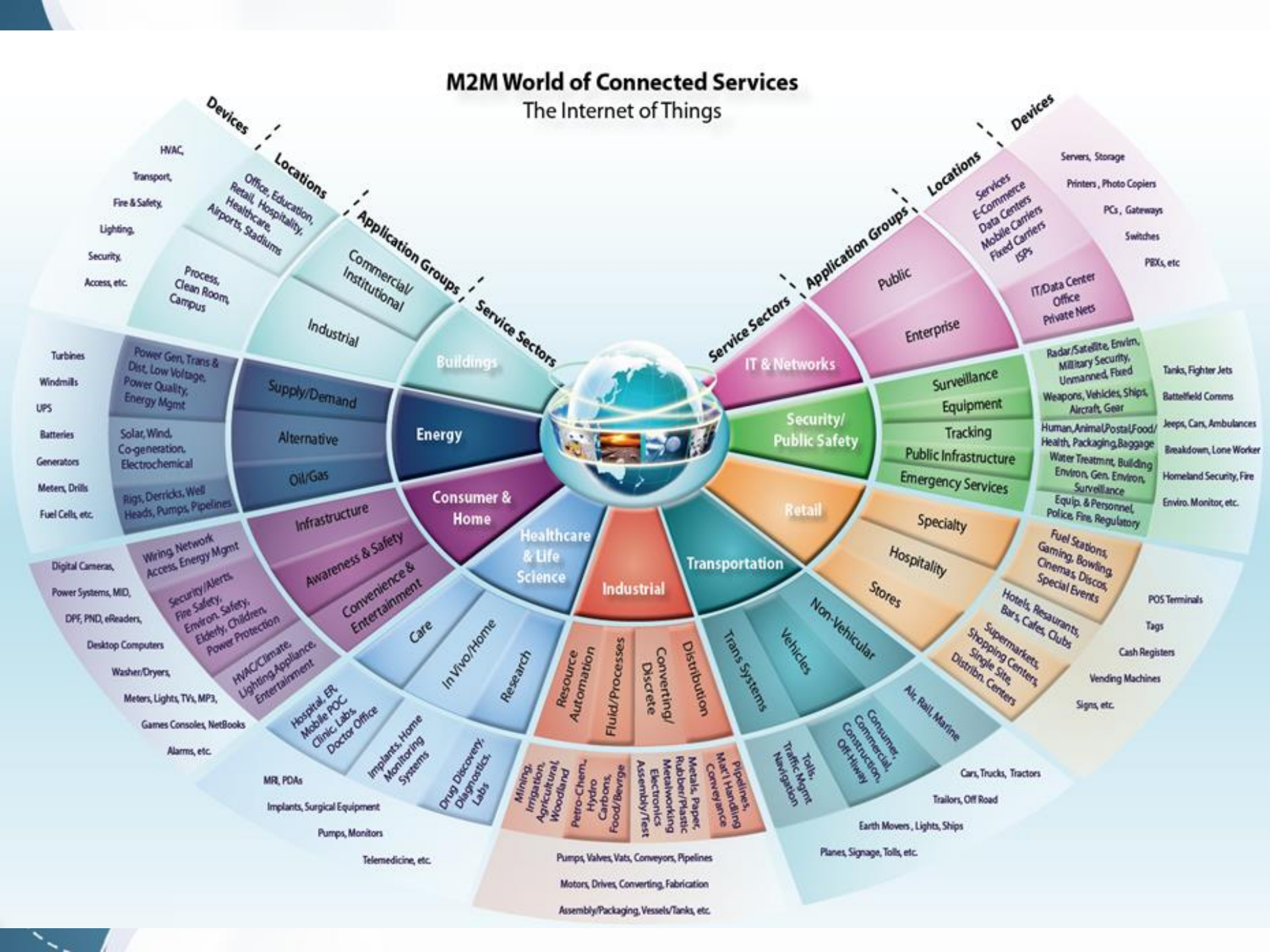
IoT is everywhere

Wearable Tech

Smart Appliances

Healthcare




M2M World of Connected Services
The Internet of Things
Devices
Locations
Application Groups
Service Sectors
HVAC,
Transport,
Fire & Safety,
Lighting,
Security,
Access, etc.
Office, Education, Retail, Hospitality, Healthcare, Airports, Stadiums
Process, Clean Room, Campus
Commercial/ Institutional
Industrial
Buildings
Energy
Consumer & Home
Healthcare & Life Science
Industrial
Transportation
Retail
Security/ Public Safety
IT & Networks
Public
Enterprise
Services
E-Commerce
Data Centers
Mobile Carriers
Fixed Carriers
ISPs
IT/Data Center
Office
Private Nets
Servers, Storage
Printers, Photo Copiers
PCs, Gateways
Switches
PBXs, etc
Turbines
Windmills
UPS
Batteries
Generators
Meters, Drills
Fuel Cells, etc.
Power Gen, Trans & Dist, Low Voltage, Power Quality, Energy Mgmt
Solar, Wind, Co-generation, Electrochemical
Rigs, Derricks, Well Heads, Pumps, Pipelines
Supply/Demand
Alternative
Oil/Gas
Digital Cameras,
Power Systems, MID,
DPF, PND, eReaders,
Desktop Computers
Washer/Dryers,
Meters, Lights, TVs, MP3,
Games Consoles, NetBooks
Alarms, etc.
Wiring, Network Access, Energy Mgmt
Security/Alerts, Fire Safety, Environ. Safety, Elderly, Children, Power Protection
HVAC/Climate, Lighting,Appliance, Entertainment
Infrastructure
Awareness & Safety
Convenience & Entertainment
MR, PDAs
Implants, Surgical Equipment
Pumps, Monitors
Telemedicine, etc.
Hospital, ER, Mobile POC, Clinic, Labs, Doctor Office
Implants, Home Monitoring Systems
Drug Discovery, Diagnostics, Labs
Care
In Vivo/Home
Research
Pumps, Valves, Vats, Conveyors, Pipelines
Motors, Drives, Converting, Fabrication
Assembly/Packaging, Vessels/Tanks, etc.
Mining, Irrigation, Agricultural, Woodland
Petro-Chem., Hydro Carbons, Food/Bevrge
Electronics Assembly/Test
Metalworking Metals, Paper, Rubber/Plastic
Pipelines, Mat'l Handling Conveyance
Resource Automation
Fluid/Processes
Converting/ Discrete
Distribution
Planes, Signage, Tolls, etc.
Tolls, Traffic Mgmt, Navigation
Consumer, Commercial, Construction, Off-Highway
Air, Rail, Marine
Cars, Trucks, Tractors
Trailors, Off Road
Earth Movers, Lights, Ships
Trans Systems
Vehicles
Non-Vehicular
Signs, etc.
Vending Machines
Cash Registers
Tags
POS Terminals
Hotels, Resaurants, Bars, Cafes, Clubs
Supermarkets, Shopping Centers, Single Site, Distribn. Centers
Fuel Stations, Gaming, Bowling, Cinemas, Discos, Special Events
Specialty
Hospitality
Stores
Surveillance
Equipment
Tracking
Public Infrastructure
Emergency Services
Radar/Satellite, Envirn, Military Security, Unmanned, Fixed
Weapons, Vehicles, Ships, Aircraft, Gear
Human,Animal,Postal,Food/ Health, Packaging,Baggage
Water Treatmnt, Building Environ, Gen. Environ, Surveillance
Equip. & Personnel, Police, Fire, Regulatory
Tanks, Fighter Jets
Battelfield Comms
Jeeps, Cars, Ambulances
Breakdown, Lone Worker
Homeland Security, Fire
Enviro. Monitor, etc.

Where is IoT ?

- On your campus…….

The Smart *Internet of Things* School

Personalized learning with adaptive eTextbooks

Digital classroom white boards and display

iBeacons

Complete coverage with high performance Wi-Fi

Wearables for athletics and attendance tracking

Video recorders for lecture capture

International Collaboration and social exchange

Online testing

Sensors on trash receptacles

Supplies and inventory tracking by sensor with auto-reorder

Student devices & eTextbooks

- Notebooks
- Tablets
- Smartphones

Robot cleaning

Augmented and virtual reality

Makerspaces with 3D printers and laser trimmers

Robotics for STEM and remote presence

Internet of Things-based HVAC

Monitor and display of air quality throughout school

File and program storage, local or cloud-based

- Demographics, academics, behavior, interests
- LMS, CMS, SIS
- Educational programs and applications
- Video files: lectures and recorded lab experiments

Surveillance security cameras

Wi-Fi sensors and locks

- Entrances and exits
- Classroom doors

Sensors track buses and verify student passengers

Sensors in parking lot and driveways

Network application analytics to monitor devices and network behavior

IoT in Education

- Video

A School Day With IoT.mp4

IoT Market

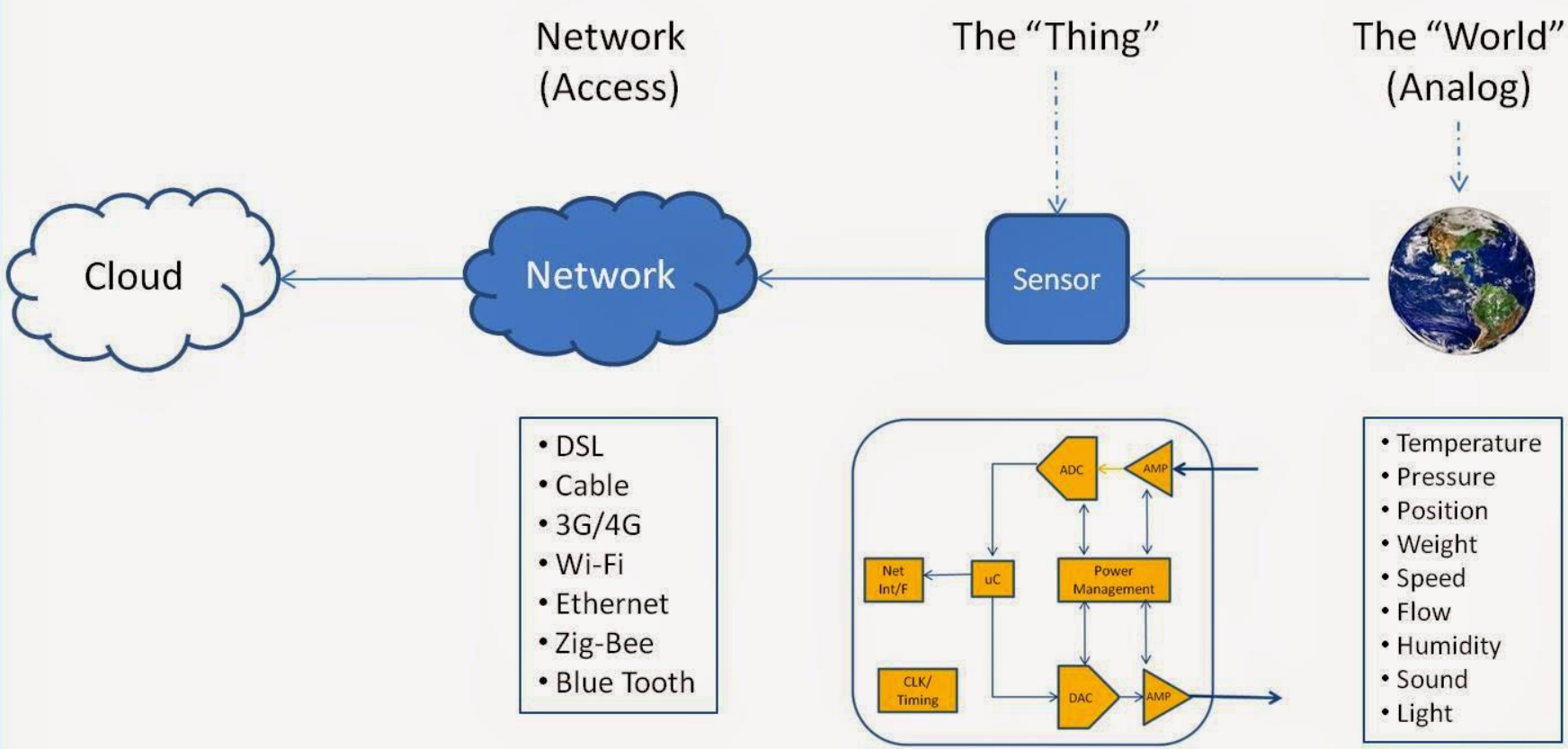
- As of 2013, **9.1 billion** IoT units
- Expected to grow to **28.1 billion** IoT devices by 2020
- Revenue growth from $1.9 trillion in 2013 to $7.1 trillion in 2020

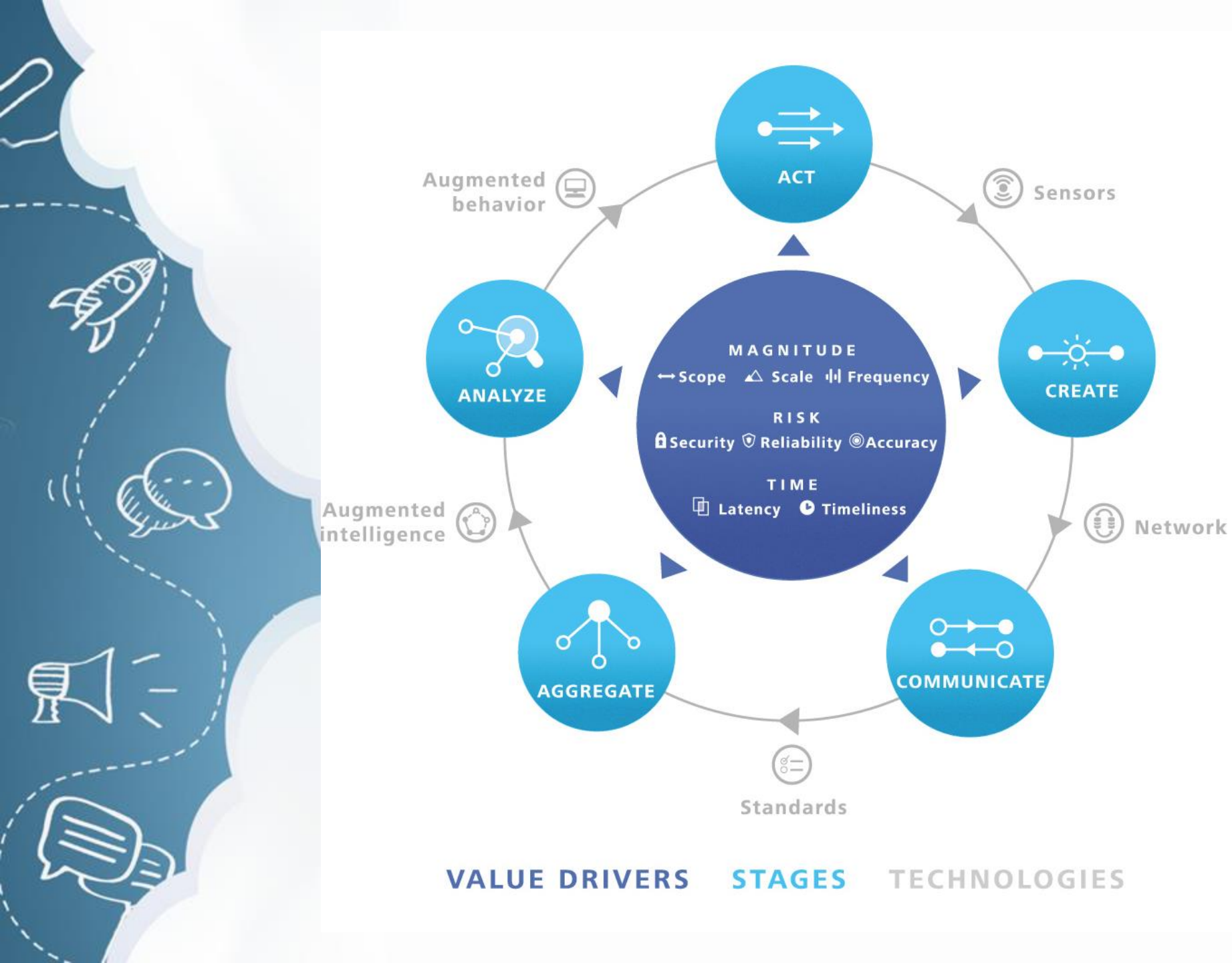
2. IoT Architecture

Why we need an architecture?

- Generate, collect, process and use acquired information to make decisions

IoT: The Basics




ACT
Sensors
CREATE
Network
COMMUNICATE
Standards
AGGREGATE
Augmented intelligence
ANALYZE
Augmented behavior
MAGNITUDE
Scope
Scale
Frequency
RISK
Security
Reliability
Accuracy
TIME
Latency
Timeliness
VALUE DRIVERS
STAGES
TECHNOLOGIES

IoT World Forum Reference Model

Levels

7 **Collaboration & Processes**
(Involving People & Business Processes)

6 **Application**
(Reporting, Analytics, Control)

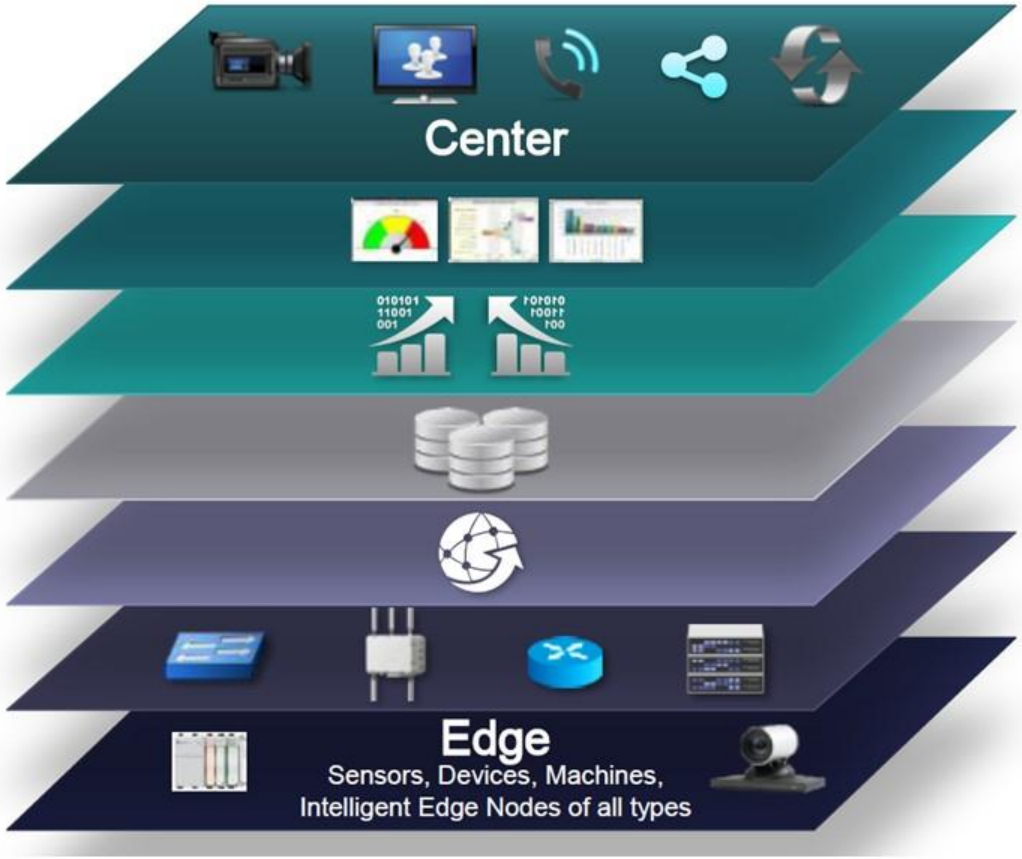
5 **Data Abstraction**
(Aggregation & Access)

4 **Data Accumulation**
(Storage)

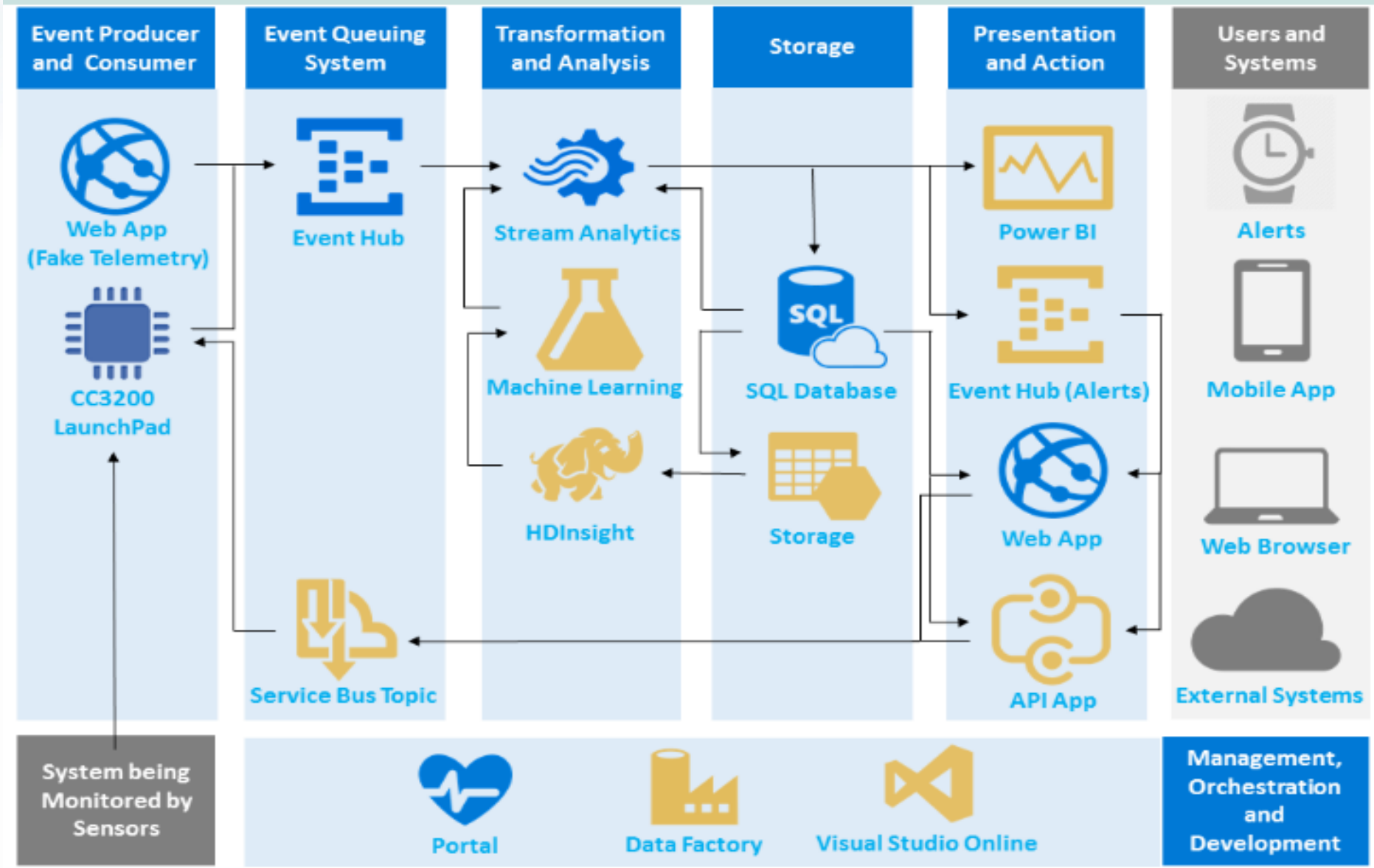
3 **Edge Computing**
(Data Element Analysis & Transformation)

2 **Connectivity**
(Communication & Processing Units)

1 **Physical Devices & Controllers**
(The "Things" in IoT)



3. Technologies used

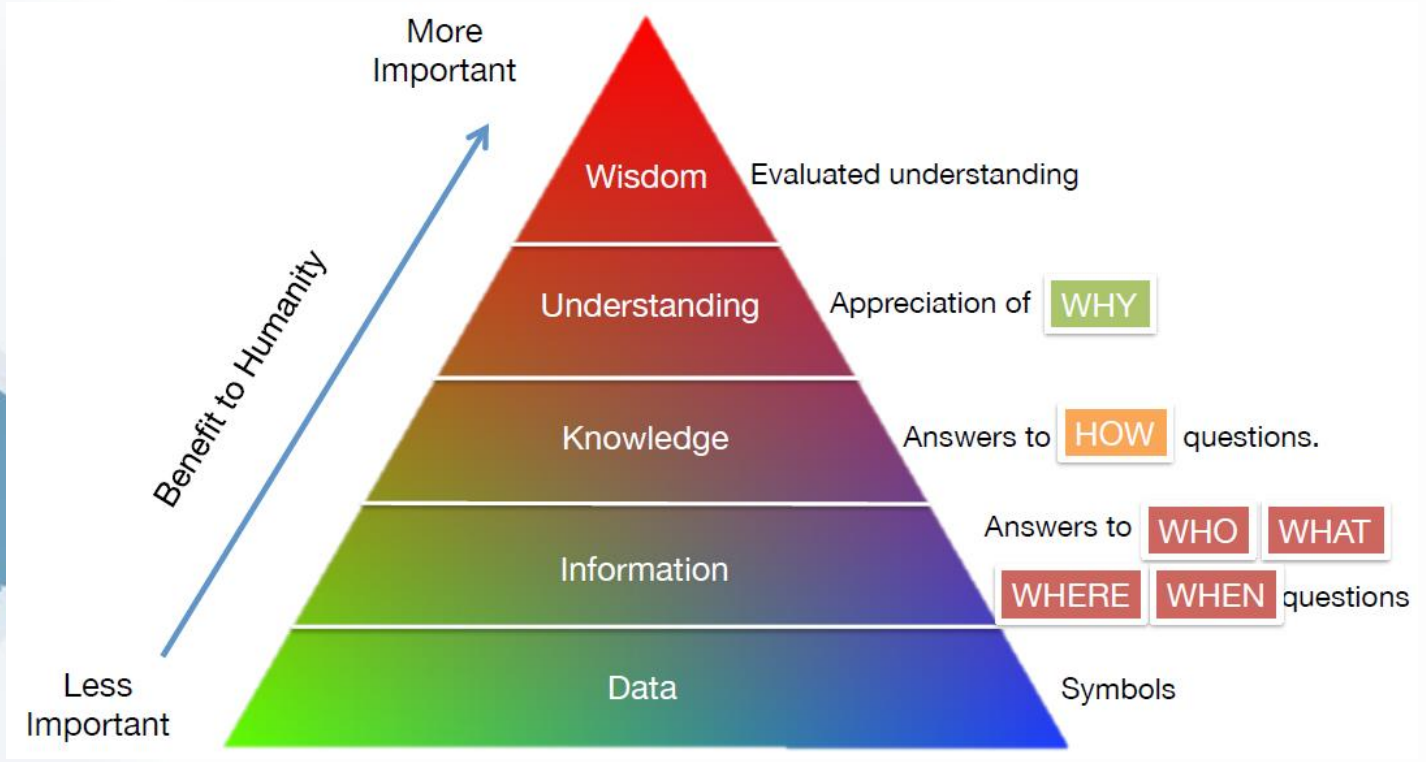


The Structure of IoT

The IoT can be viewed as a gigantic network consisting of networks of devices and computers connected through a series of intermediate technologies where numerous technologies like RFIDs, wireless connections may act as enablers of this connectivity.

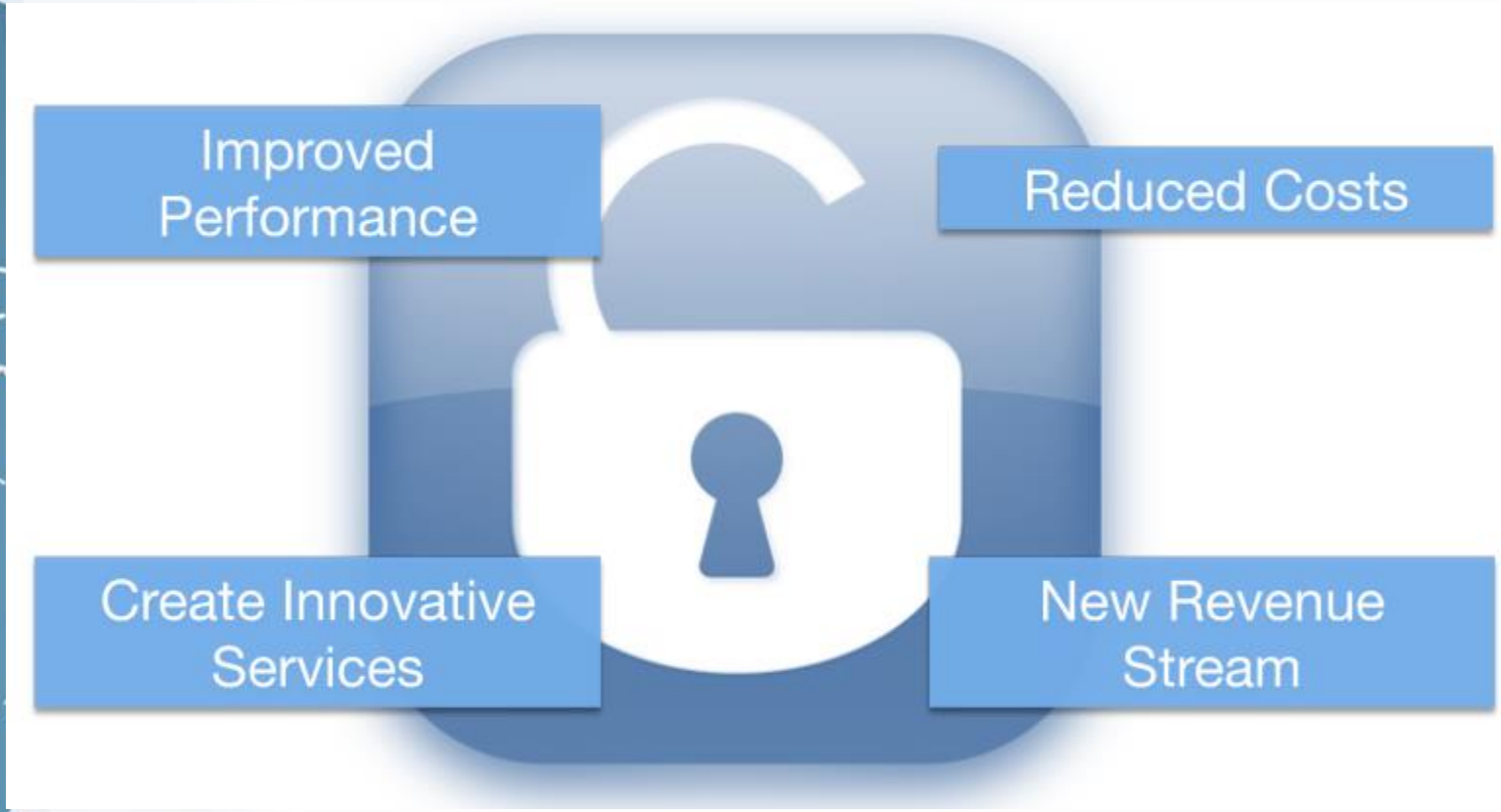
- **Tagging Things :** Real-time item traceability and addressability by RFIDs.
- **Feeling Things :** Sensors act as primary devices to collect data from the environment.
- **Shrinking Things :** Miniaturization and Nanotechnology has provoked the ability of smaller things to interact and connect within the “things” or “smart devices.”
- **Thinking Things** : Embedded intelligence in devices through sensors has formed the network connection to the Internet. It can make the “things” realizing the intelligent control.

Turning data into WISDOM

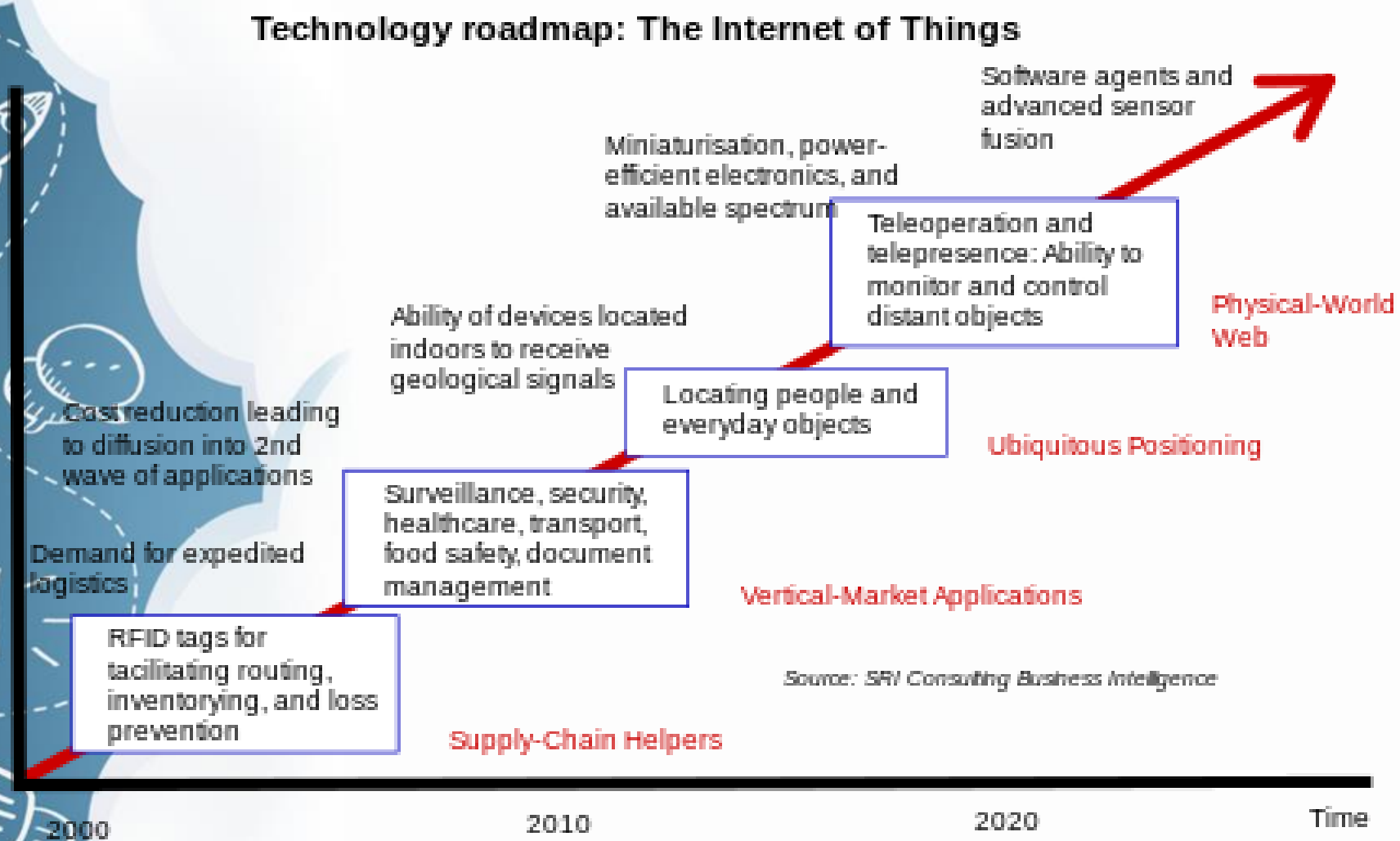


The more data that is created, the better understanding and wisdom people can obtain.

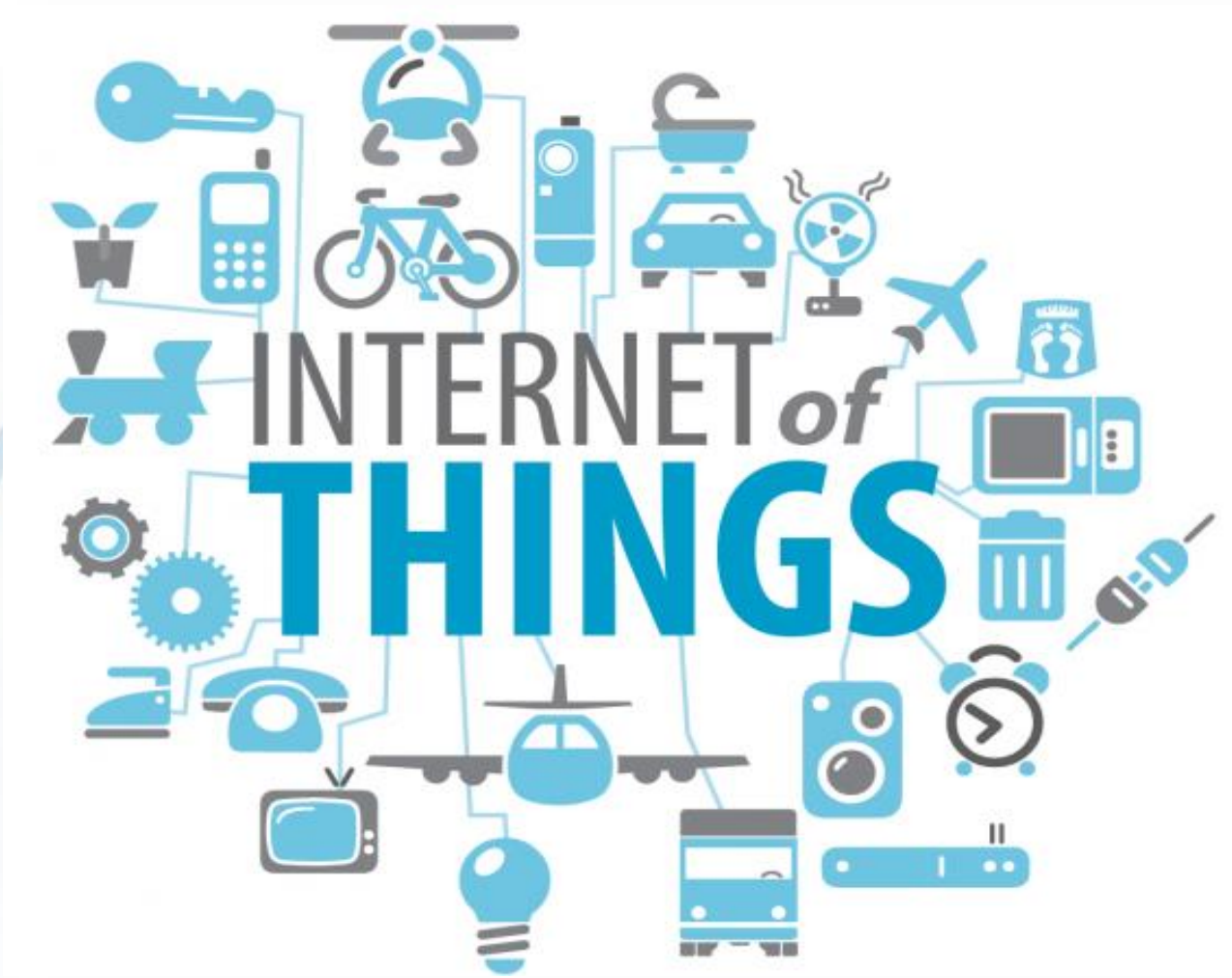
Unlock the Massive potential of IoT



IoT Roadmap


Technology roadmap: The Internet of Things
Technology Reach
Software agents and advanced sensor fusion
Miniaturisation, power-efficient electronics, and available spectrum
Teleoperation and telepresence: Ability to monitor and control distant objects
Physical-World Web
Ability of devices located indoors to receive geological signals
Locating people and everyday objects
Ubiquitous Positioning
Cost reduction leading to diffusion into 2nd wave of applications
Surveillance, security, healthcare, transport, food safety, document management
Demand for expedited logistics
Vertical-Market Applications
RFID tags for facilitating routing, inventorying, and loss prevention
Source: SRI Consulting Business Intelligence
Supply-Chain Helpers
2000
2010
2020
Time

Applications of IoT

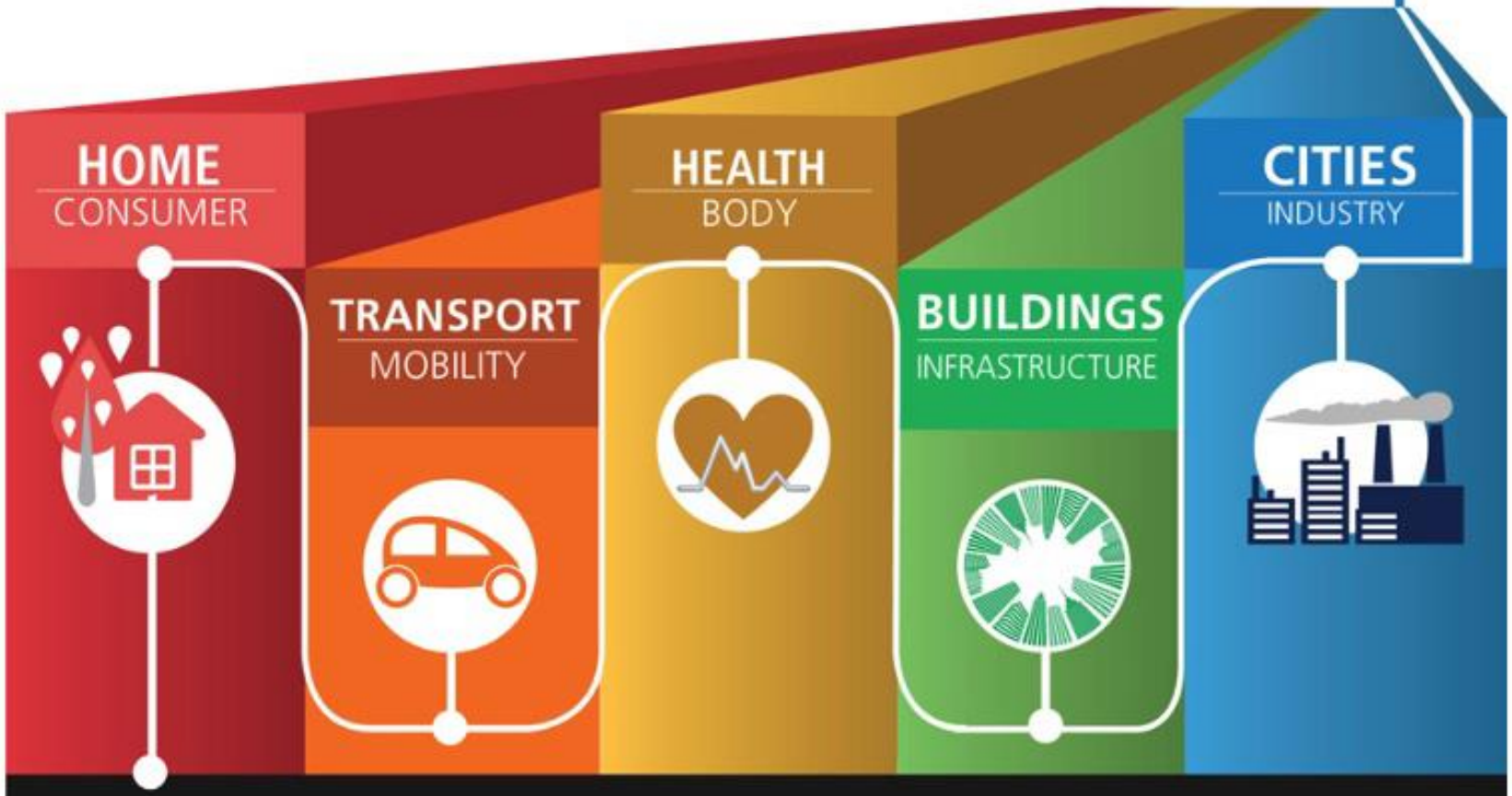


Few applications of IoT

- ✓ Building and Home automation
- ✓ Manufacturing
- ✓ Medical and Healthcare systems
- ✓ Media
- ✓ Education
- ✓ Infrastructure management
- ✓ Energy management
- ✓ Transportation
- ✓ Better quality of life for elderly
- ✓ … … …

You name it, and you will have it in IoT!

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

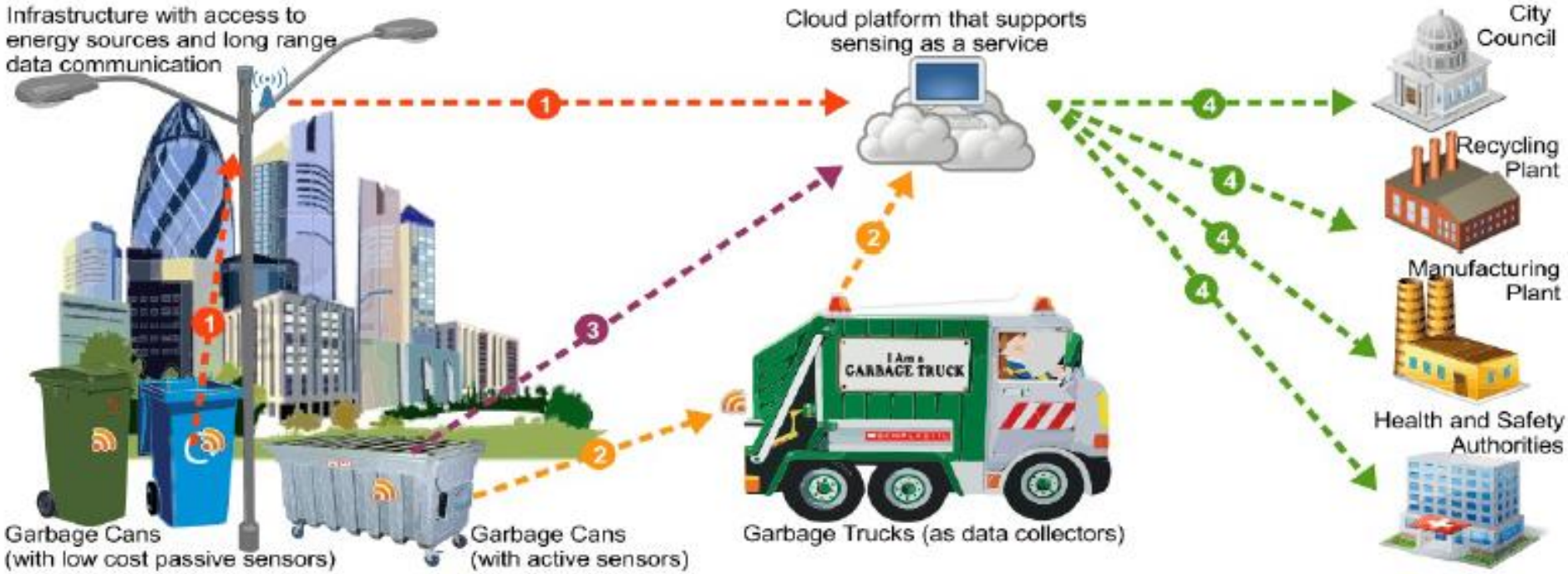
Smart Parking

Create **USD 41Billion** by providing visibility into the availability of parking spaces across the city.

Residents can identify and reserve the closest available space, traffic wardens can identify non-compliant usage, and municipalities can introduce demand-based pricing.

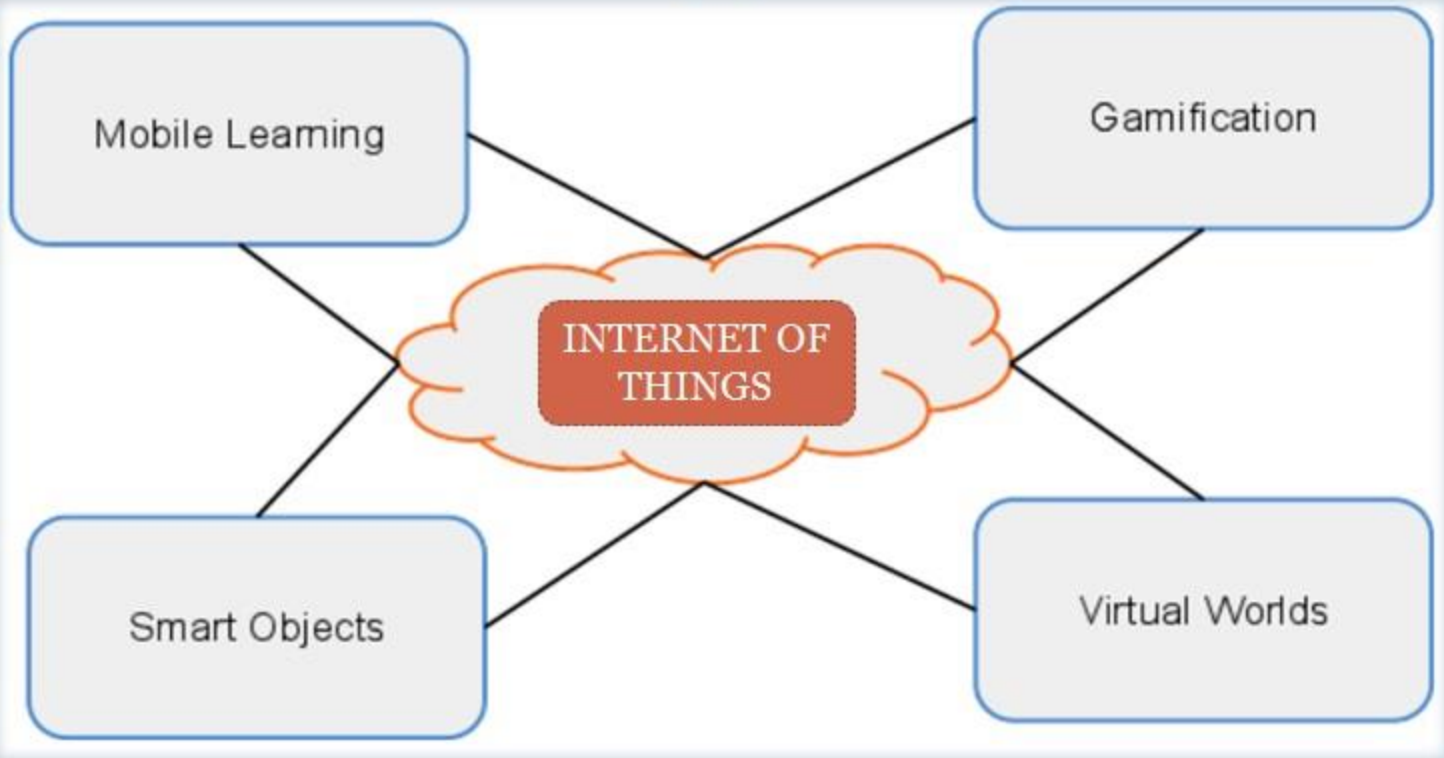
[Source: http://www.telecomreseller.com/2014/01/11/cisco-study-says-ioe-can-create-savings/]

Efficient Waste Management in Smart Cities Supported by the Sensing-as-a-Service



[Source: "Sensing as a Service Model for Smart Cities Supported by Internet of Things", Charith Perera et. al., Transactions on Emerging Telecommunications Technology, 2014]

IoTs in Education

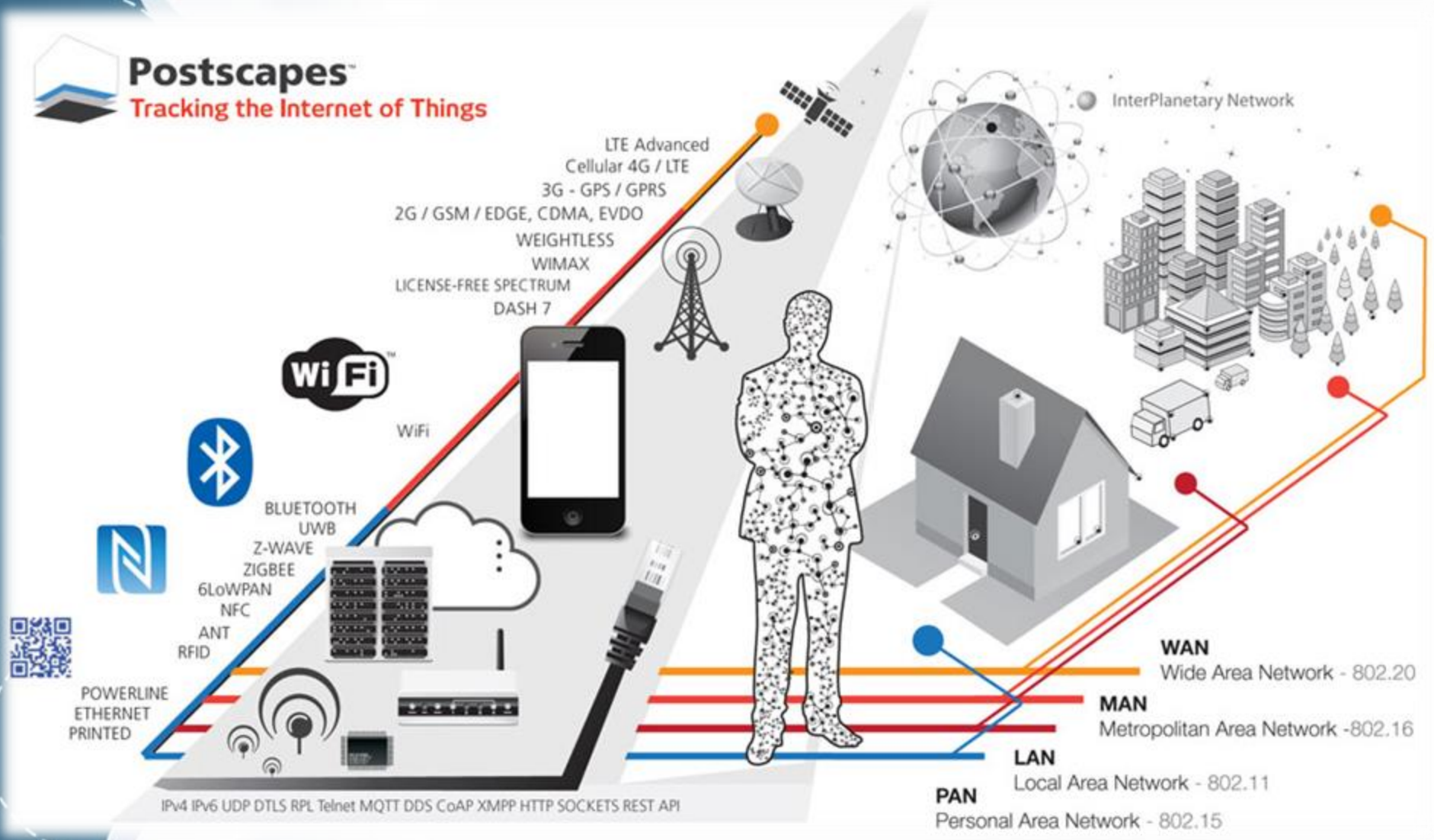


Technology Stack for IoT

- Communication
- Backbone
- Hardware
- Protocols
- Software
- Data Brokers / Cloud Platforms
- Machine Learning

Courtesy: http://www.postscapes.com/internet-of-things-technologies/#communication

1. Communication



2. Hardware

- **Wireless SoC (system on chip)**

- **Prototyping boards and platforms**

3. Software

- Riot OS
  - an operating system for Internet of Things (IoT) devices. It is based on a microkernel and designed for energy efficiency, hardware independent development, a high degree of modularity.“
- Thingsquare Mist
  - open source firmware is exceptionally lightweight, battle-proven, and works with multiple microcontrollers with a range of radios.

4. Protocols – Famous and widely used

- **RESTful HTTP**
  - "Representational State Transfer (REST) is a style of software architecture for distributed systems such as the World Wide Web. REST has emerged as a predominant web API design model. "
- **XMPP**
  - "The Extensible Messaging and Presence Protocol (XMPP) is an open technology for real-time communication, which powers a wide range of applications including instant messaging, presence, multi-party chat, voice and video calls, collaboration, lightweight middleware, content syndication, and generalized routing of XML data.“

IoT for developers

- AWS (Amazon web service) IoT
- Intel SDK for IoT

And now what?

FUTURE OF IoT

"The Sky's not the limit. It's only the beginning with IoT."