بسم الله الرحمن الرحيم

Internet of Things

Orientation Session – Spring 2019

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College of Computing and Information Sciences

Orientation Session

- Lecture Schedule:
  - Tuesday : 18:15 – 21:00 Hrs
- Contact Details:
  - Email: m.taha@pafkiet.edu.pk
  - Phone: 35091114-7 (Ext : 244)

    Main Campus, Mon – Fri, 8:30 am to 3:30 pm (except Wed)

Internet of Things?

Few years back…

Internet of Things

and now….

and it is continuously growing day-by-day!

Internet of Things

What type of devices?

"Network of physical devices that can communicate to each other within a system and with other systems thorugh internet"

Pual Asoyan, Google

Devices – *Few Examples*

- These devices may include
  - Phones
  - Watches
  - Fitness tracking band
  - Glasses
  - Cars
  - Home appliances
    - Fridge
    - Cooking range
    - TV etc.
  - IP Cameras
  - Industrial Machines
  - Sensors
    - Accelerometer
    - Gyroscope
    - Motion
    - Temperature
    - Positioning
    - Infrared
    - Ultrasound
    - RFID

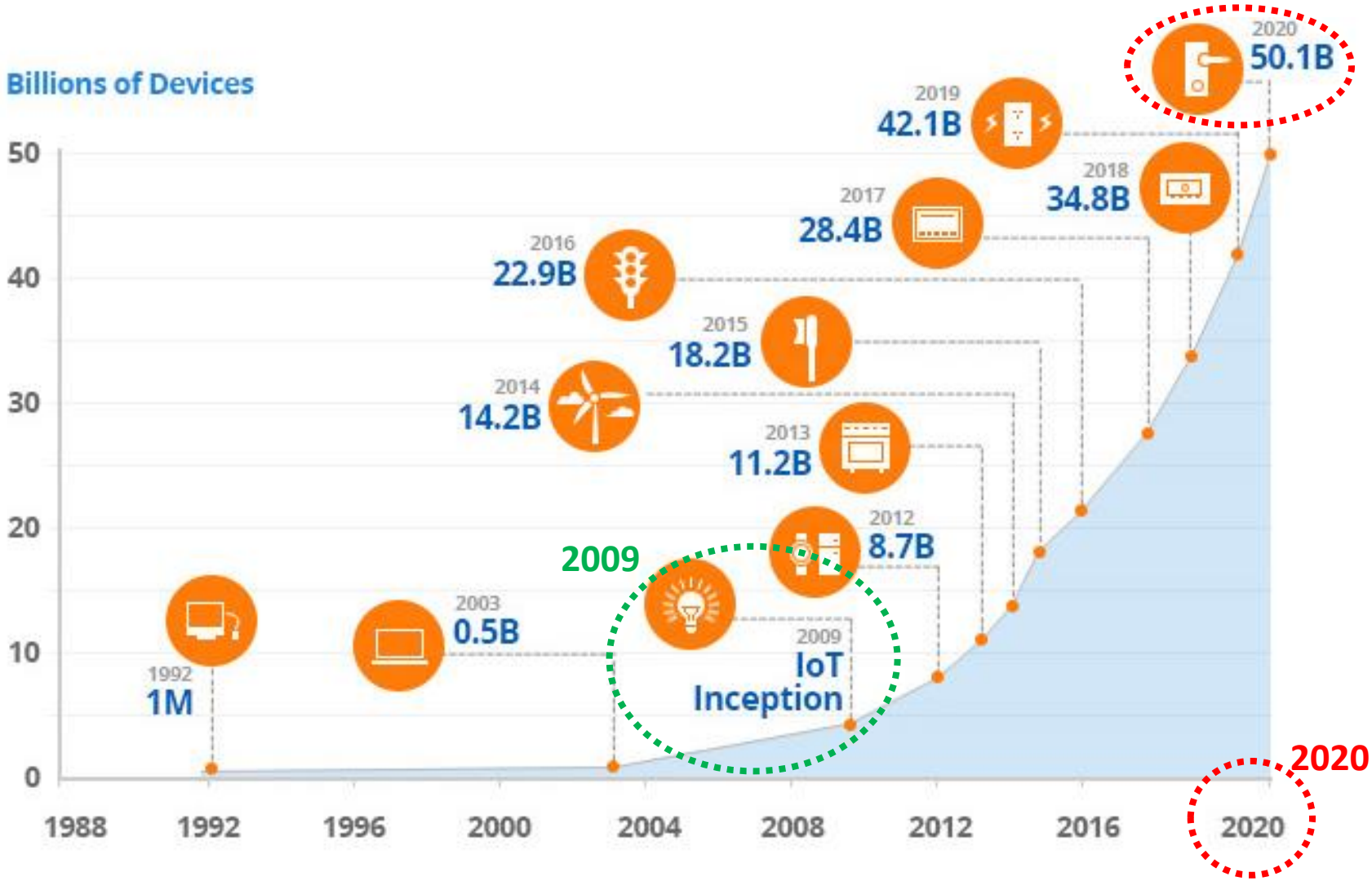
Internet of Things

Now the World is experiencing another revolution

Transforming to IoT

Billions of connected devices in upcoming years

Growth in IoT

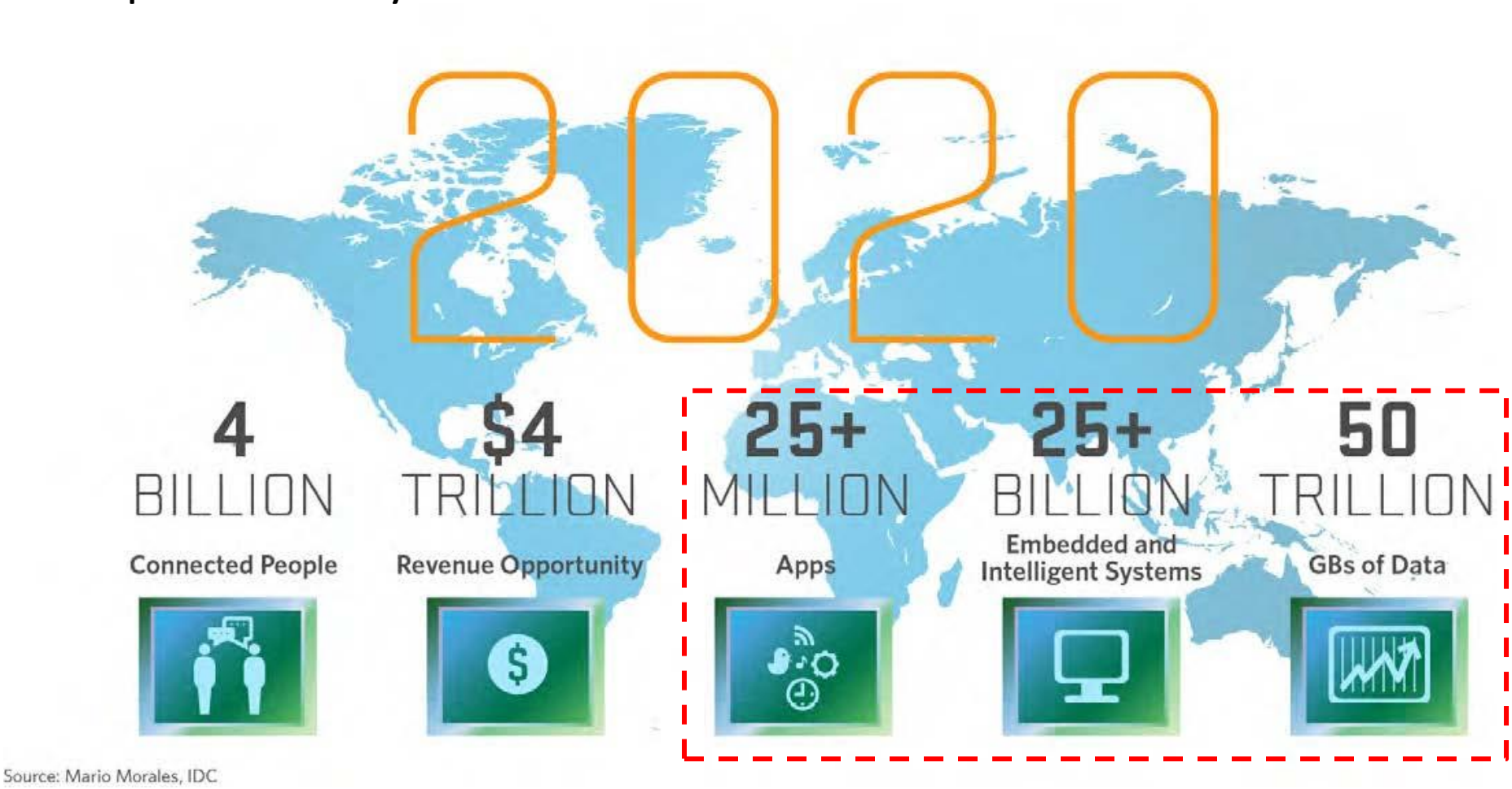


Growth in IoT

- Connected Devices per user

Growth in IoT

- Expectations by 2020



ABOUT THIS IOT COURSE

Internet of Things

Course Objective

- The objective of the course is to introduce and develop understanding of IoT.
- Students will learn various enabling technologies, architecture, protocols and services associated with IoT.
- It also provides an overview of recent advancements in this particular area.
- The main aim is to **involve students in research activities**, particularly through addressing current research challenges.
- It is highly desirable that, by the end of this course, students will able to develop an IoT application

IoT Course Outline

Tentative

Topics

- Introduction to Internet-of-Things (IoT)
- Laws that Governs Successful IoT
- Modern Computing Paradigm
- The Internet-of-Things Ecosystem
  - Sensors, Networks, Cloud, Applications
- Architectures and Protocols
- Enabling Technologies
- Overview of IoT Applications
- Key Requirements for the development of Smart systems
- Case studies - for development of IoT-based Smart Systems
- Potential Research Areas
- Hands-on experience on available tools (*if time allows*)

Internet of Things

Course Resources

- Multiple reference books will be used to cover major topics. Contents of this course will comprise of material extracted from various books, high-impact journal papers and online resources.
- Case-studies will be reviewed, to help students in their research projects.
- Special emphasis on research project will be given and students will be guided in their selected topics.

Internet of Things

Course Outcome

- Realization of IoT
  - Framework
  - Implementation/Development
  - Proposal for a particular case-study
  - Critical evaluation
- Research project report

Internet of Things

- Few Research Projects from previous semester

  Published

  - ***A Framework for Wireless Body Area Network Based Smart Healthcare System -*** International Conference for Young Researchers in Informatics, Mathematics and Engineering, (ICYRIME), Kaunas, 2017 – by Muhammad Mobeen
  - ***An iBeacon based Real-time Context-Aware e-Healthcare System*** - International Conference on Latest trends in Electrical Engineering and Computing Technologies (Intellect), Karachi Pakistan, 2017 - by Bilal Baig
  - ***Comparative Analysis of Wireless Technologies for Internet-of-Things Based Smart Farm -*** Sci. Intl. Jr. vol. 29, Issue 2, Page: 373-378, 2017 – by Asad Abbas
  - ***An Integrated System for the Issuance of e-Passports -*** 7th International Conference on Advances in Computing, Electronics and Communication, Malaysia, 2018 by H.A. Wahab

Internet of Things

- Few Research Projects from previous semester

  Under Review

  - ***A Context-aware Framework for the Mission Critical Systems – by*** Usman Skindar
  - ***A Smart Weather Forecasting System using Machine Learning – by*** Azmi Umer

Course Policies

- Assignments?
  - 2
- Quizzes?
  - 2
- Grading (re-allocation, if needed)
  - Assignments / Quizzes 10
  - Class Discussions 10
  - Mid Term Exam 25
  - Research Project 30
  - Final Term Exam 25

    Total 100

Course Plan

- Next to each session, there will be assigned reading (based on research paper)
- In addition to the exam, the grades will be based on class participation and research project. Each student will present summary of assigned papers and lead a class discussion.

Course Material

- All course related material, including lectures and announcements will be published at following link:

https://sites.google.com/view/muhammadtaha

Research

- PERVASIVE SYSTEMS RESEARCH GROUP (PSRG)
  - Group is established in 2016
  - The focused is towards the design and development of pervasive systems that are integrated with multidisciplinary fields, including sensors, wireless networks, signal processing, data sciences, software engineering and others.
  - Key research areas:
    - Internet-of-Things
    - Pervasive Computing
    - WSN, MANET & VANET
    - Context-aware and Location based services
    - Sensors and Data Fusion
    - Advanced driver-assistance systems
  - Research Projects
    - Currently working on HEC funded Research Project
    - Two more projects are under consideration by Chinese and Malaysia universities
    - 1 more project is in pipeline

Research

Research Collaborations:

- **International**
  - Dr Anh Nguyen Duc, Norway
  - Dr Ibrahima Faye, France
  - Dr Wong Peng, Malaysia
  - Dr Zhang Xiaoshuan, China
  - Dr Fadzil Hussain, Malaysia

- **National**
  - Dr Azeem Abbas, NUST, Islamabad
  - Dr Omer Chugtai, COMSATS, Islamabad
  - Dr Safdar Rizvi, Bahria University, Karachi
  - Dr Asif Aziz, SSUET, Karachi
  - Dr Abid Sohail Butta, University Of South Asia, Lahore
  - Dr Abid Khan, SSUET, Karachi

Research

Feedback

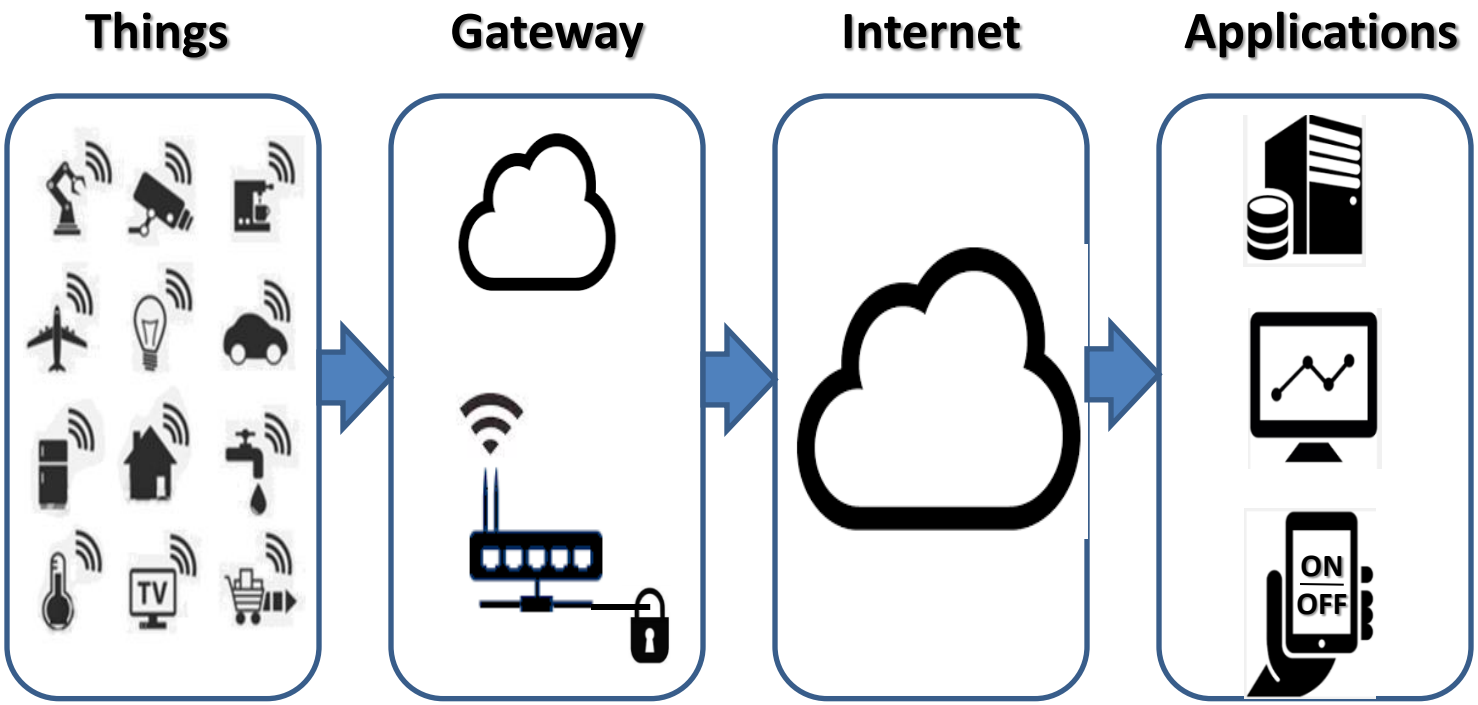
- Any queries / suggestions?

Introduction

OVERVIEW OF IOT SYSTEM

Elements of IoT

Four basic elements within IoT



Sensors

Actuators

Smart Devices

Local Network

(wired/wireless)
BAN, PAN, LAN

Cloud

(Data storage,
Basic services)

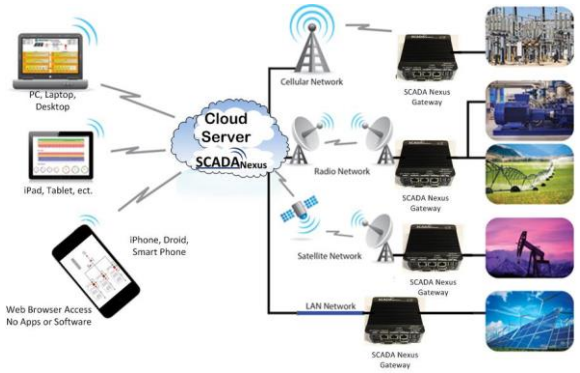
Remote Server

RT Data Analytics

RT User Access & Ctrl

Application

- Why we need to connect **Everything**?
  - Automation
  - Intelligent Systems
  - Remote access & control
  - Data Analytics
  - Mitigate Risks
    - Intelligent Business System
  - Reduce
    - downtime,
    - cost of O&M,
    - improve productivity



Smart-home

Internet of Things

- Smart City

Internet of Things

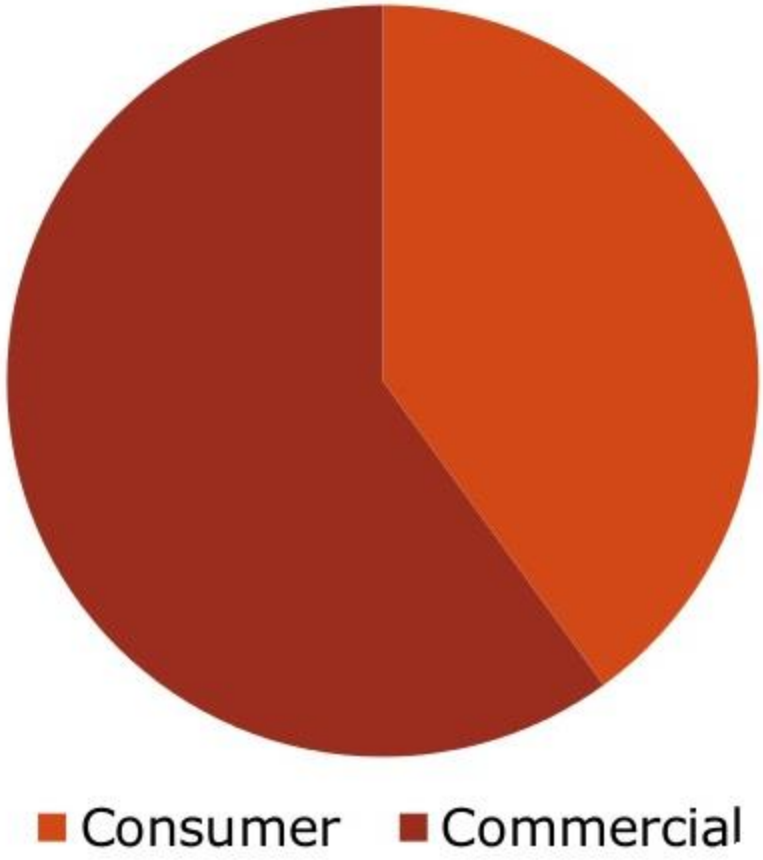
- One of the most important aspect?
  - **COST - how we can forget it!**

IOT GLOBAL MARKET SHARE

Different Perspective

IoT Market Share

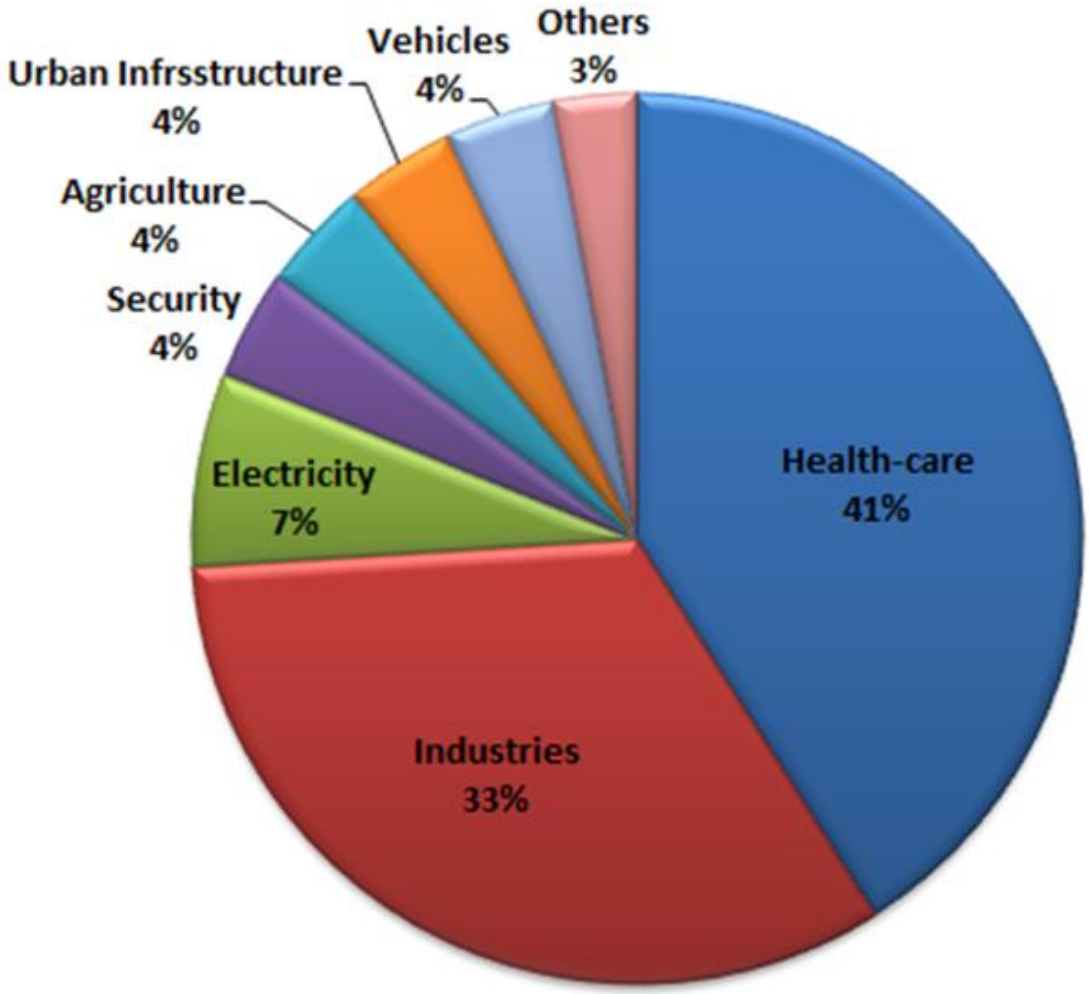
- By Products



Source : Data Markets

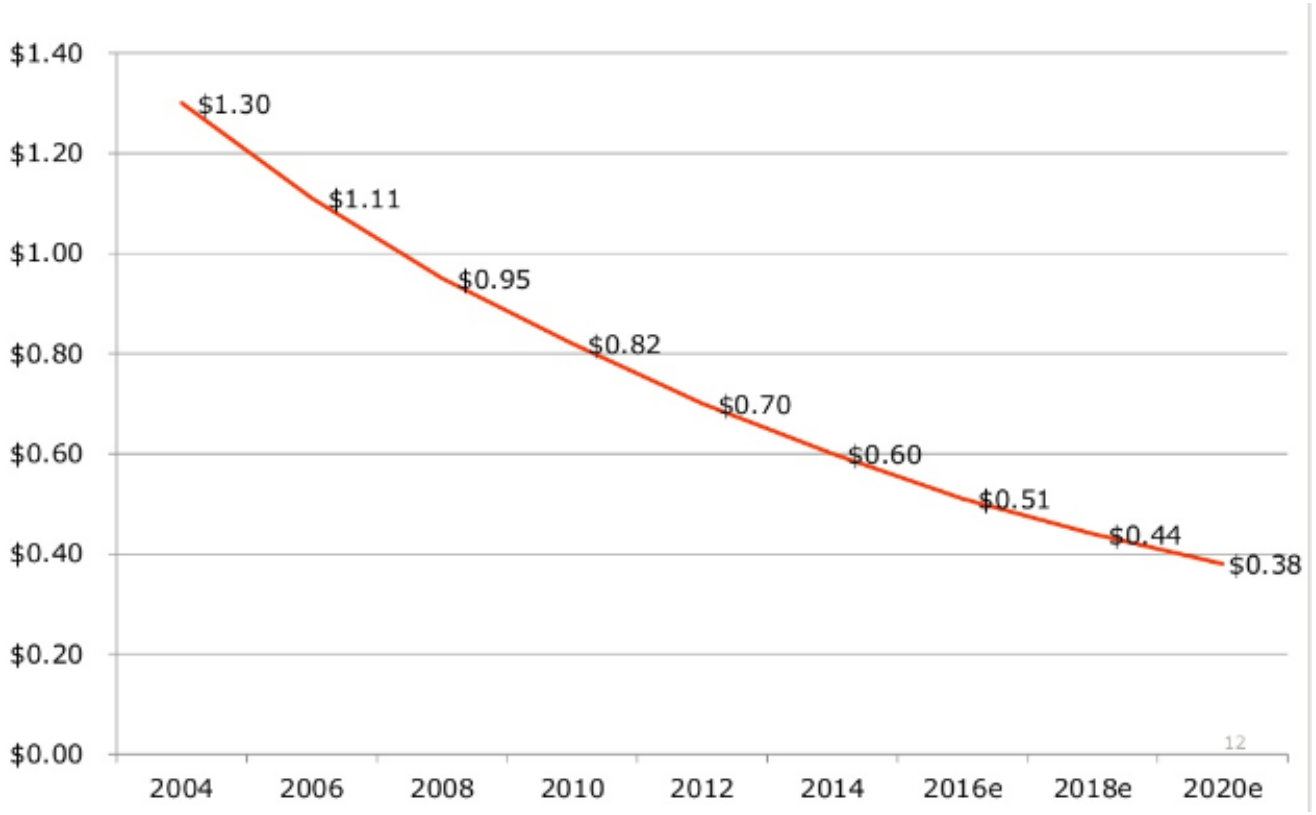
IoT Market Share

- By Applications



IoT Market Share

- Sensors Price

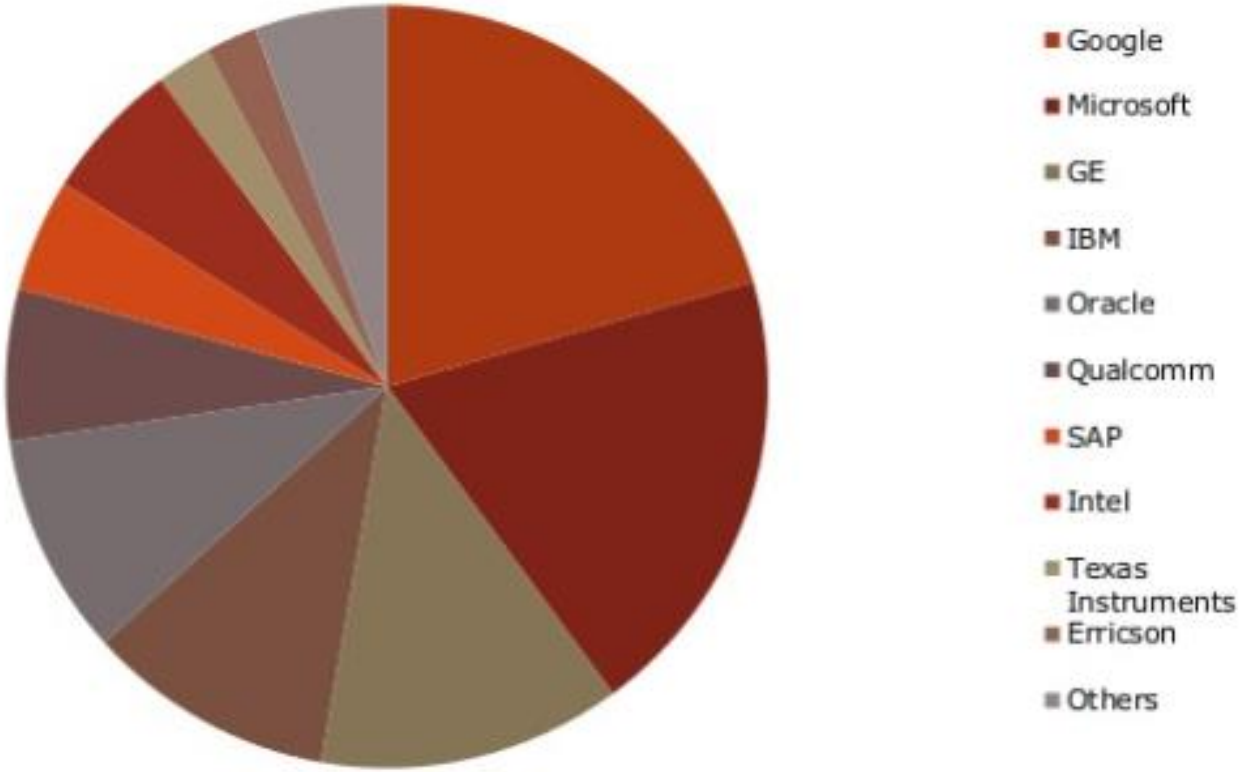


Source : Data Markets

IoT Market Share

- R&D Investment by Tech-giants in IoT

~4 Trillion Dollar Market-worth by 2020



Source : OBRC