

INTERNET OF THINGS: TRENDS, DIRECTIONS, OPPORTUNITIES, CHALLENGES

Dr. T.DHEEPAK

Assistant Professor

Department of Computer Science

Government arts and Science College

Perambalur

What is Internet of Things?

Internet connects all people → “Internet of People”
IoT connects all things → “Internet of Things”



- Interconnection of Things or Objects or Machines, e.g., sensors, actuators, mobile phones, electronic devices, home appliances, any existing items
- Interact with each other via Internet.

INTERNET OF THINGS GROWTH

During 2008, the number of **things** connected to the Internet exceeded the number of **people** on earth.



2003



2010



2015



By 2020 there will be **50 billion**.

MAJOR SUBJECT OF 5G WIRELESS SYSTEMS (2020-2030)

**Connection of
7 Billion of People and 7
Trillion Things**

4 LAYERS MODEL OF IoT

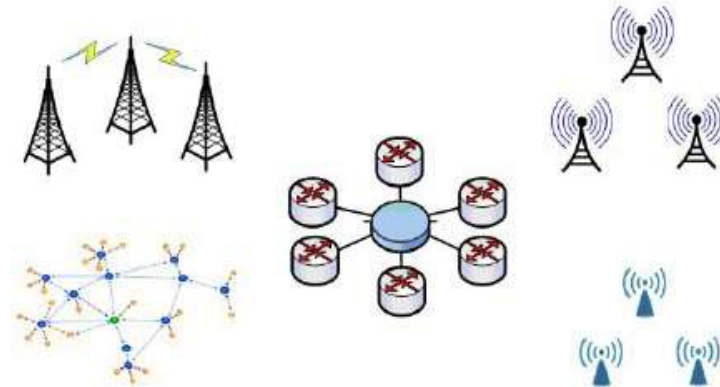
Integrated Application



Information Processing



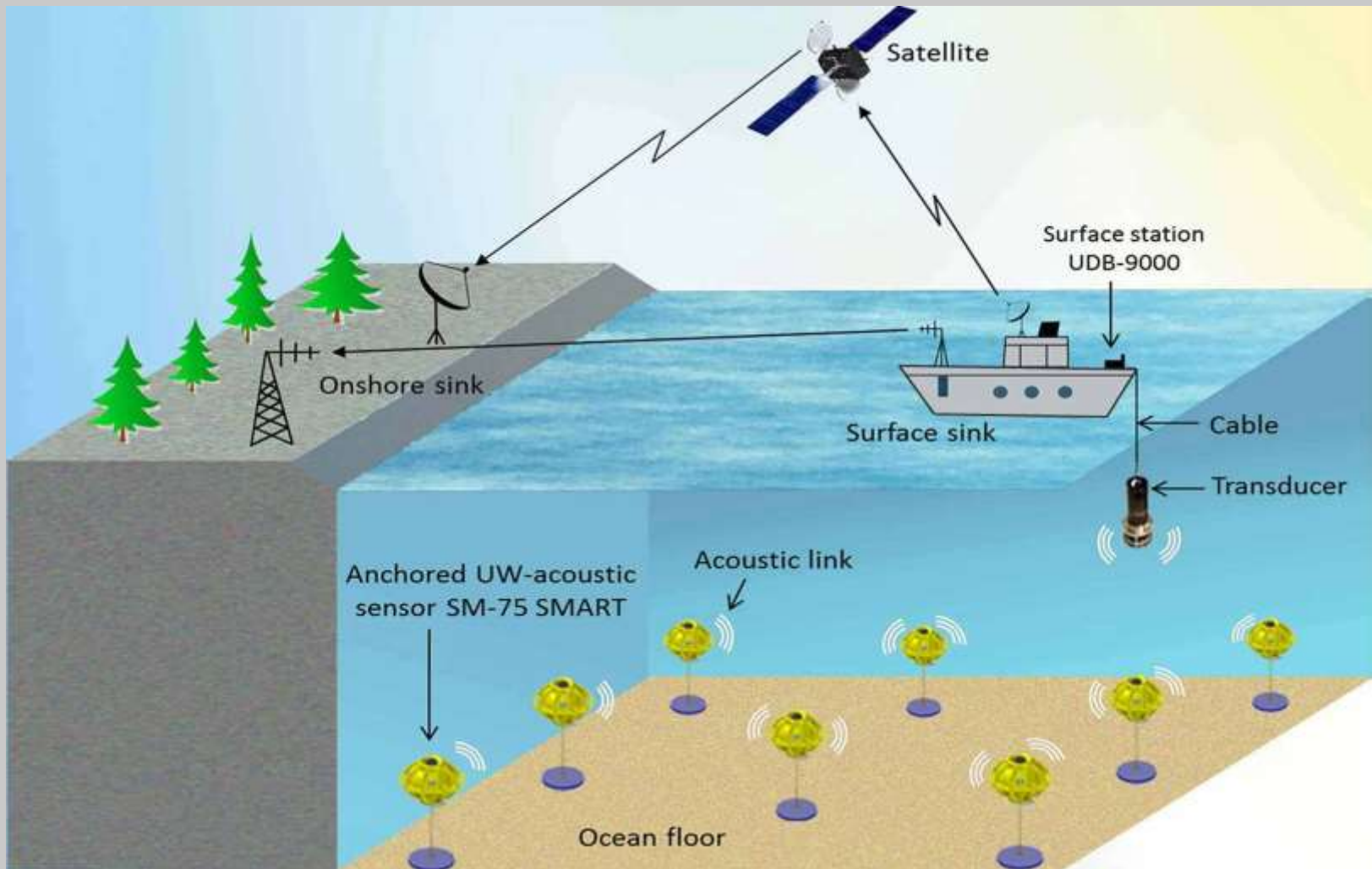
Network Construction



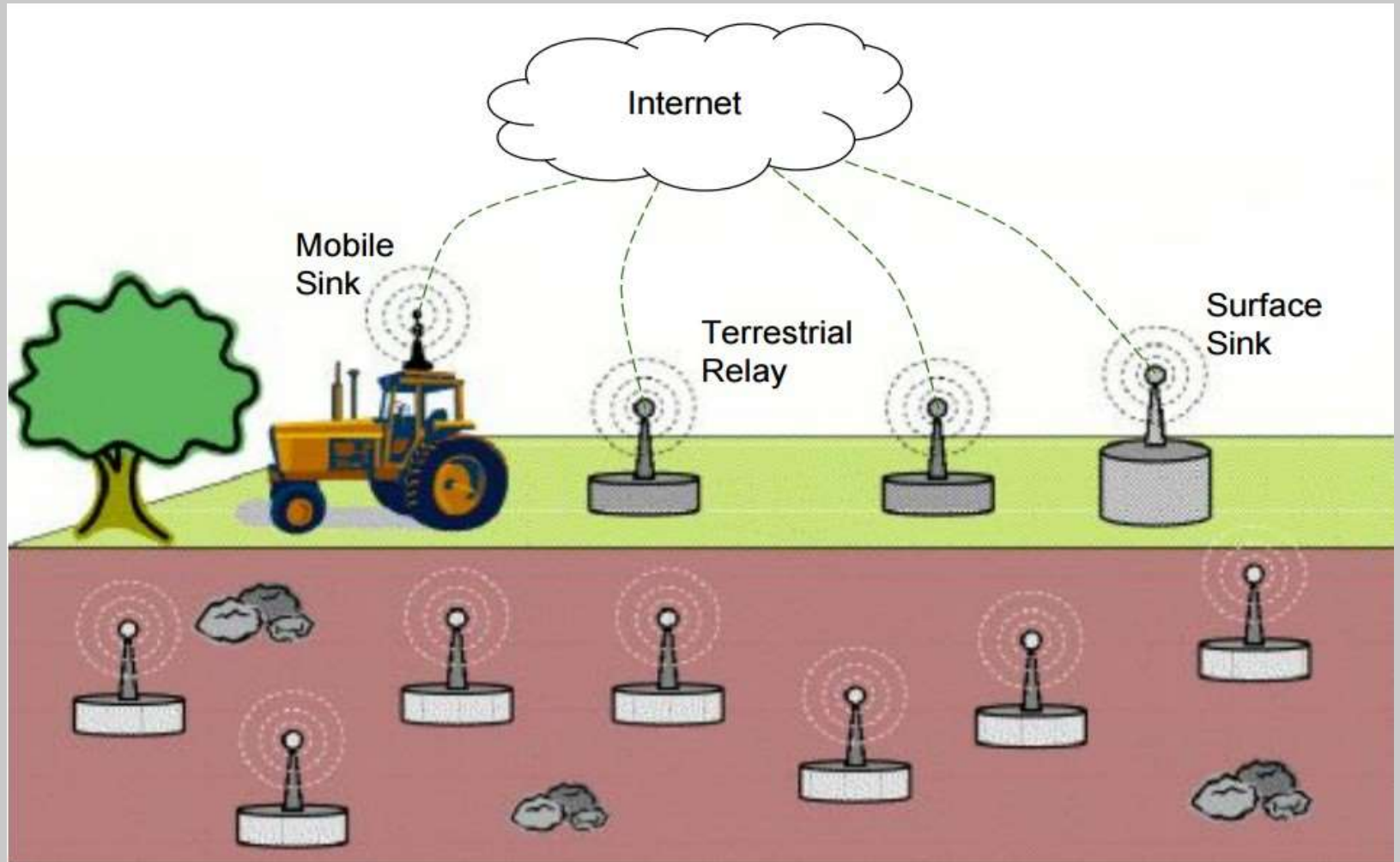
Sensing and Identification



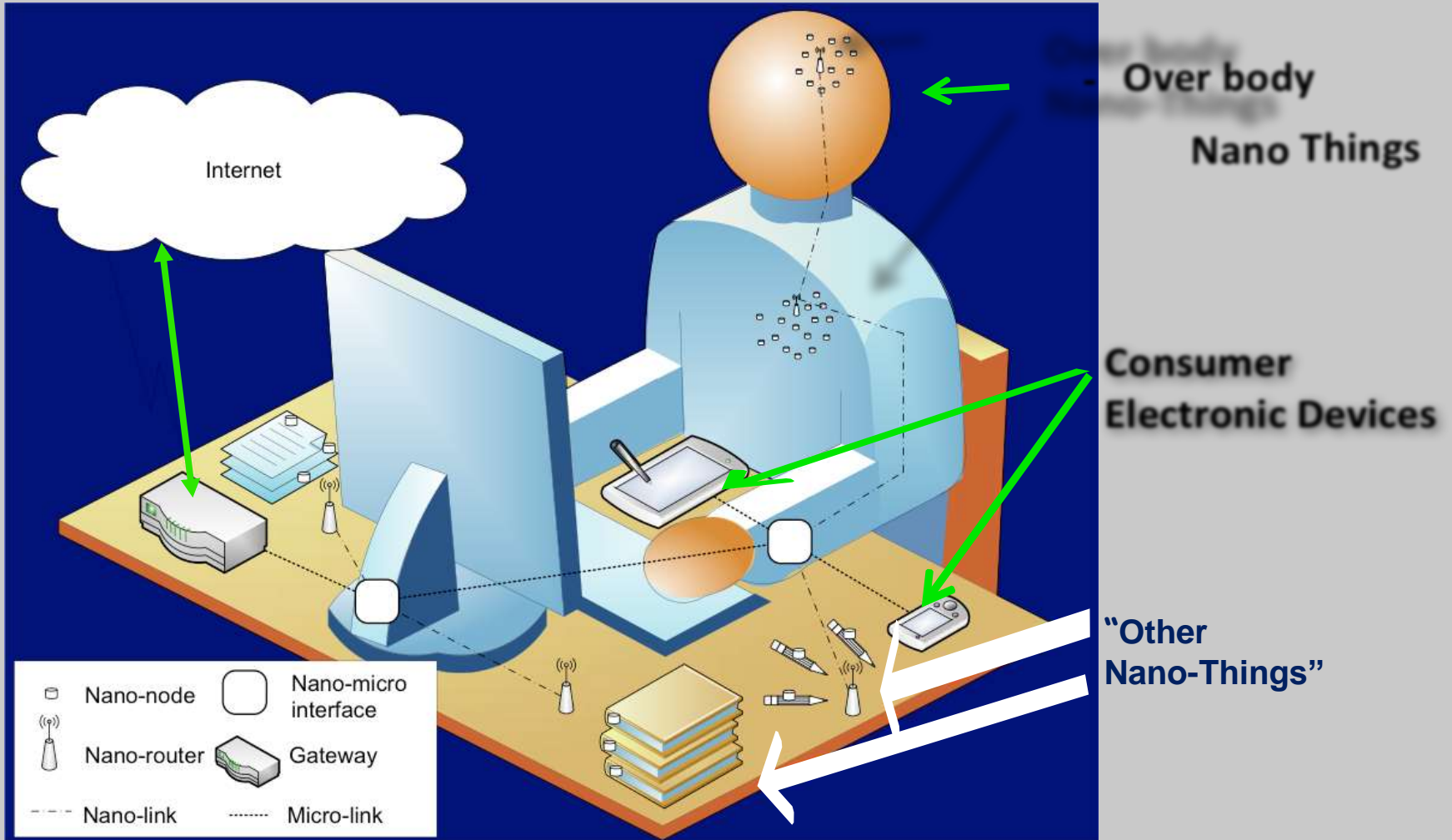
INTERNET OF UNDERWATER THINGS



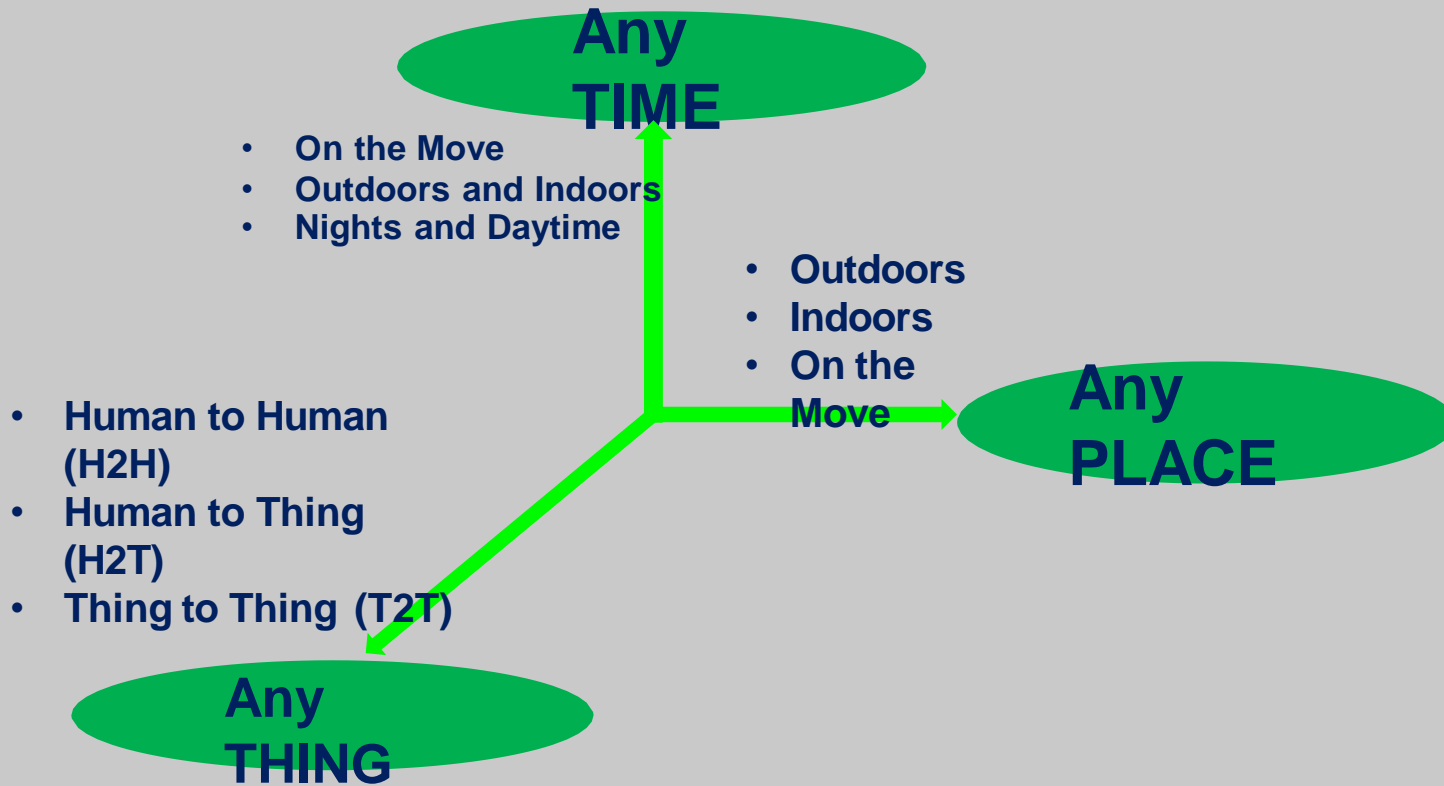
INTERNET OF UNDERGROUND THINGS



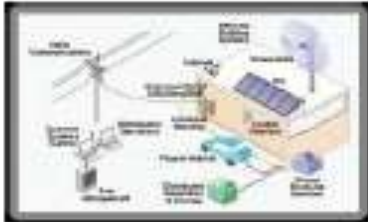
INTERNET OF NANOTHINGS



INTERNET OF THINGS: PERSPECTIVE



TOP INDUSTRIES KEY FOR IoT APPLICATIONS DEVELOPMENT AND REVENUE GENERATION



Smart Grid



Smart Health



Smart Home



Smart Cities



Smart Industries



Smart TV



Smart Watch



Smart Car



Smart Kegs

Automotive & Transportation

RECENT IoT PRODUCTS

 <p>NEST Thermostat</p>	 <p>Corventis: Wireless Cardiac Monitor</p>	 <p>WEMO Remote</p>	 <p>Tractive Pet Tracker</p>
 <p>Ninja Blocks</p>	 <p>Revolve Home Automation</p>	 <p>ThingWorx Application Platform</p>	 <p>Lings Cloud Platform</p>
 <p>Mbed Development Platform</p>	 <p>Xively Remote Access API</p>	 <p>Intel Quark Processor</p>	 <p>AllJoyn S/W Framework</p>

IoT PLATFORMS ON THE MARKET

- **GE Predix**
- **Cisco IoT Cloud**
- **IBM Watson IoT**
- **PTC ThingWorx**

GE PREDIX

- **Uses a platform as a service (PaaS) model and is a cloud-based OS**
- **Built on Cloud Foundry, an open-source platform, and is optimized for secure connectivity and analytics at scale, both in the cloud and on the edge**

CISCO IoT CLOUD

- **Designed around six pillars of technology:**

- **Network connectivity**
- **Fog computing**
- **Data analytics**
- **Security (cyber and physical),**
- **Management/automation, and**
- **Application enablement.**

Cloud addresses challenges across a wide variety of industries, including manufacturing, utilities, oil and gas, transportation, mining, and the public sector.

IBM WATSON IoT

Cloud Foundry, Docker®, OpenStack®, Watson IoT Platform development

**Platform connects sensors to cloud applications using
IBM Bluemix®**

PTC THINGWORX

- **Three pillars of technology:**
 - **Core application enablement**
 - **Connection services with device and cloud adopters**
 - **Edge connectivity using the Edge MicroServer and Edge “Always On” devices**

(27% market share)

APPLICATION OF IoT: SMART HOME

- Remote Monitoring/Control (Appliances)



- Safety:
When do the doors open/close?

- Energy Management: Turn off the lights/AC?

- Maintenance:
Are the sinks/pipes leaking?

- Entertainment Control



ADOPTION OF IoT NETWORKS: HEALTHCARE INDUSTRY

The global IoT healthcare market is expected to grow from \$32.47 billion in 2015 to \$163.24 billion by 2020:

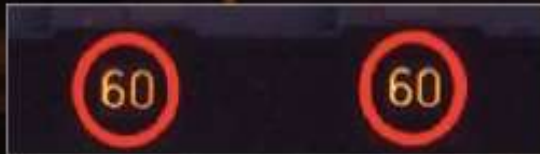
- Remote patient monitoring services**
- Mobile health technology**
- Telemedicine**
- Medication Management**
- Improved Clinical Care**
- Employee workflow management and**
- Inpatient monitoring**

ADOPTION OF IOT NETWORKS: TRANSPORTATION

- Save lives and property
- Reduce emissions
- Cut commuting time and effort

SAFETY

1.3 million dead 2013
2.4 million to die 2030



ROADSIDE INSTALLATIONS

EFFICIENCY

EU annual congestion
cost 130 billion euro.



COMMUNICATION

SUSTAINABILITY

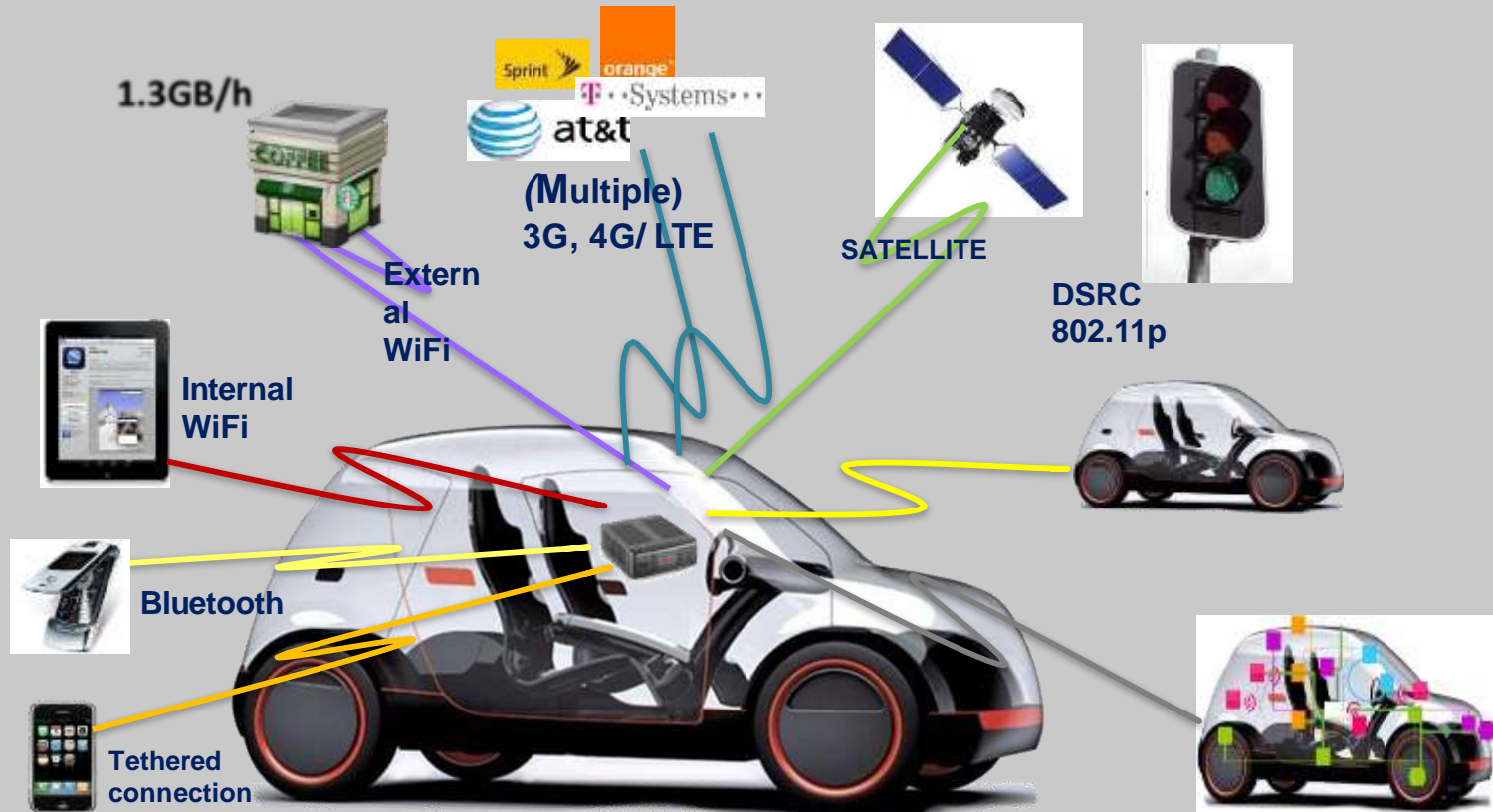
Road transport 20% of
EU total CO₂ emission



TRAFFIC MANAGEMENT

SENSORS FOR DATA COLLECTION

ADOPTION OF IOT NETWORKS: TRANSPORTATION



WHAT MEASURE THE COMPANIES TAKEN TO USE THE IoT MORE EXTENSIVELY IN THE BUSINESS

- Seeking advice from third party experts/consultants
- Learning from the successes or failures of early movers
- Training existing staff to work with the IoT
- Conducting or sponsoring research to establish market size/demand
- Establishing a cross-functional task force to explore and/or pursue IoT opportunities
- Introducing new business models
- Raising fresh capital to explore IoT options
- Hiring talent with IoT capabilities
- Establishing joint ventures or alliances to exploit IoT opportunities
- Establishing an IoT center of excellence
- Acquiring a business or assets with IoT capabilities

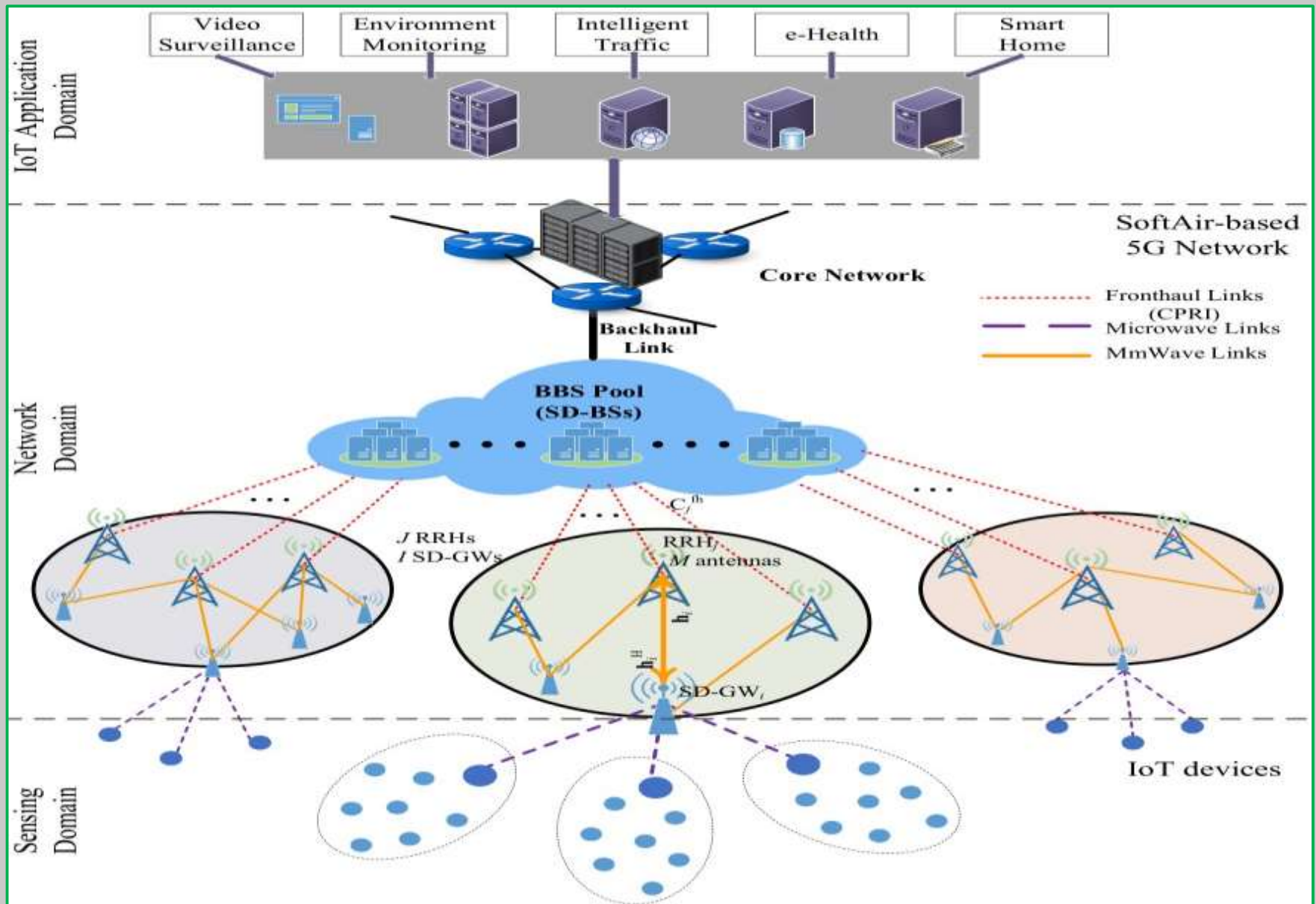
IOT TRENDS TO WATCH IN THE FUTURE

- **IT services (business consulting) □ Major Driver**
- **IoT drives demand for DATA ANALYTICS:**
- **Data must be managed, integrated and analyzed**
- **IoT drives demand for CLOUD COMPUTING**
- **IoT data □ DATA BROKER**
- **IoT generated data is bought, analyzed and sold e.g., IBM buys The Weather Company data**
- **Interoperability Problems**

RESEARCH CHALLENGES

- **Scalability (Massive Number of Devices)**
 - **Handle data generated by 50 billion devices**
 - **Reliable Coverage**
 - **Move cloud services to edge of the network
(Fog Computing)**
 - **Reduce data to be stored (Processing and Storage)**
 - **Power Consumption Problem
(Energy Harvesting; SW Optimization)**
- SDN/NFV Based IoT**

SDN/NFV Based IoT (5 G)



THANK YOU !!!!!!!