15th INTERNATIONAL OPERATIONS & MAINTENANCE CONFERENCE IN THE ARAB COUNTRIES
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SECURITY CHALLENGES AND MAINTENANCE OF THE INTERNET OF THINGS

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Introduction

The Internet of Things (IoT) is an important topic in technology, industry, policy, and engineering circles and has become headline news in both the specialty press and the popular media.

This technology is embodied in a wide spectrum of networked products, systems, and sensors, which take advantage of **advancements** in computing power, electronics miniaturization, and network interconnections to offer new capabilities not previously possible.

The large-scale implementation of IoT devices promises to transform many aspects of the way we live.
For **consumers**, new IoT products like Internet-enabled appliances, home automation components, and energy management devices are moving us toward a vision of the "smart home'', offering more security and energy-efficiency.

Other personal IoT devices like **health monitoring devices** are transforming the way healthcare services are delivered.

IoT systems like **networked vehicles**, intelligent traffic systems, and sensors embedded in roads and bridges move us closer to the idea of "**smart cities**'', which help minimize congestion and energy consumption.

However, IoT raises many issues and challenges that need to be considered and addressed in order for potential benefits to be realized.

A number of companies and research organizations like Cisco, Morgan Stanley and McKinsey Global Institute **have offered a wide range of projections about the potential impact of IoT on the Internet and the economy during the next five to ten years.**

Some observers see the IoT as a **revolutionary fully–interconnected "smart" wor**ld of progress, efficiency, and opportunity, with the potential for adding billions in value to industry and the global economy. Others **warn that the IoT represents a darker world of privacy and security violations.**

This paper presents an overview of the basics of IoT and some of the key security and maintenance issues and questions that this technology raises from the perspective of the Internet Society.

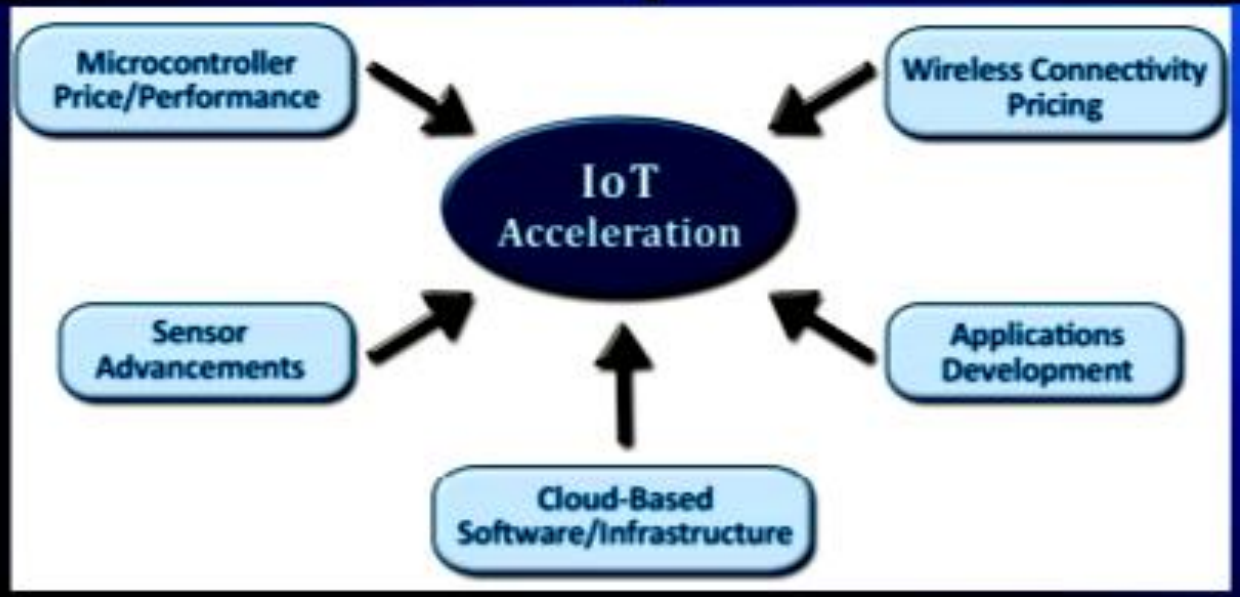
What's the Internet of Things

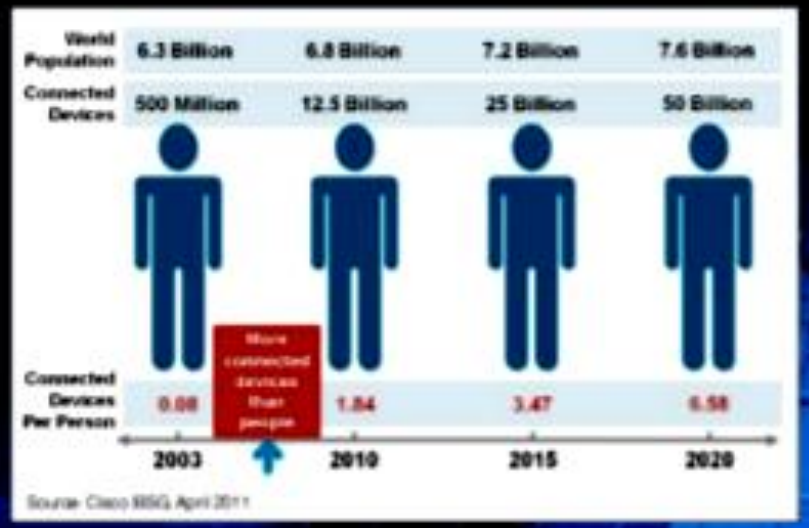
- Definition

1- The Internet of Things, also called the internet of Objects, refers to a wireless network between objects, usually the network will be wireless and self-configuring such as household appliances

2- The term "Internet of Things", has come to describe a number of technologies and research disciplines that enable the internet to reach out into the real world of physical objects.

IoT Perspective





Microcontrollers, sensor advancements, cloud-based soft & hardware, …. Lead to IoT acceleration.

	2003	2011	2020
Humans	6,3B	7B	7,6B
Devices	500M	12,5B	50B

With increasing world population, devices grow up in great rates.

Why Internet of Things

IOT technology is necessary to realize the following:

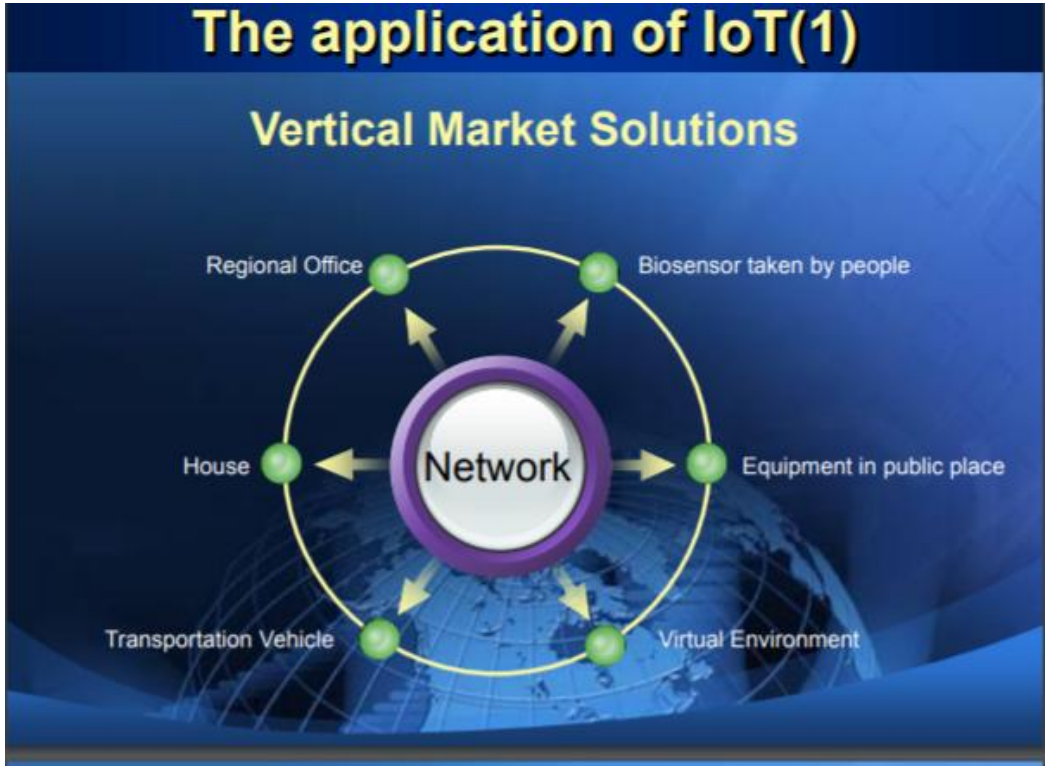
- *Dynamic control of industry and daily life*
  - Resource efficiency –energy conservation
- *Improve the resource utilization ratio*
- *Better relationship between human and nature*
  - **population and disaster avoidance**
- *Forming an intellectual entity by integrating human society and physical systems*

Why Internet of Things (ii)

- *Universal transport & internetworking*
- *Accessibility & Usability?*
- *Acts as technologies integrator*

Application areas of IoT

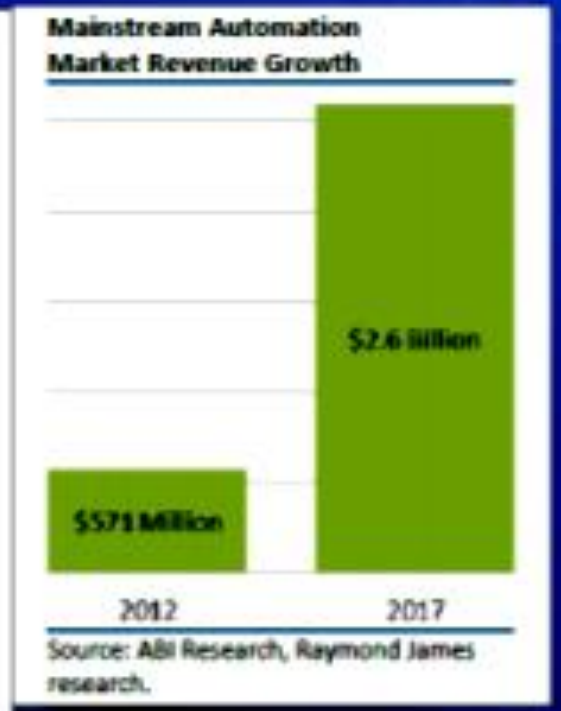
The potential applications of IoT expected to create value for industry and users are shown in Table 1.



IoT Applications		
Setting	**Description**	**Examples**
Human	Devices attached or inside the human body	Devices (wearables and ingestibles) to monitor and maintain human health and wellness; disease management, increased fitness, higher productivity
Home	Buildings where people live	Home controllers and security systems
Retail Environments	Spaces where consumers engage in commerce	Stores, banks, restaurants, arenas – anywhere consumers consider and buy; self-checkout, in-store offers, inventory optimization
Offices	Spaces where knowledge workers work	Energy management and security in office buildings; improved productivity, including for mobile employees
Factories	Standardized production environments	Places with repetitive work routines, including hospitals and farms; operating efficiencies, optimizing equipment use and inventory
Worksites	Custom production environments	Mining, oil and gas, construction; operating efficiencies, predictive maintenance, health and safety
Vehicles	Systems inside moving vehicles	Vehicles including cars, trucks, ships, aircraft, and trains; condition-based maintenance, usage-based design, pre-sales analytics
Cities	Urban environments	Public spaces and infrastructure in urban settings; adaptive traffic control, smart meters, environmental monitoring, resource management
Outside	Between urban environments (and outside other settings)	Outside uses include railroad tracks, autonomous vehicles (outside urban locations), and flight navigation; real-time routing, connected navigation, shipment tracking

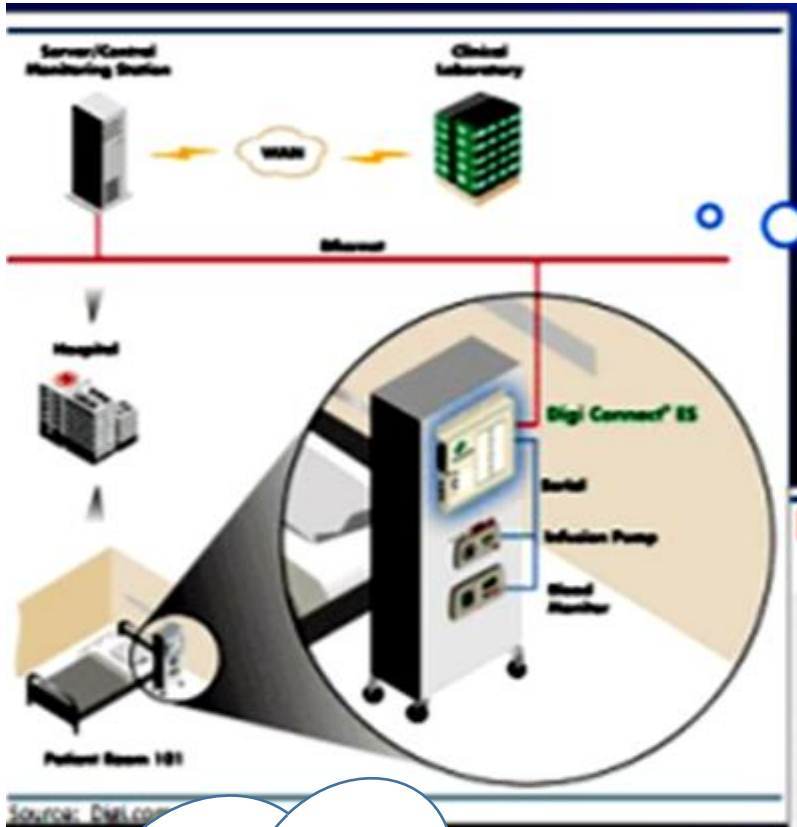
Table 1: Expected IoT Applications [4]

Scenario: Intelligent Home



Scenario: Health Care

Figure left describes how a health care provider could use real time data collected from hospitals, wearable devices, home health monitoring devices



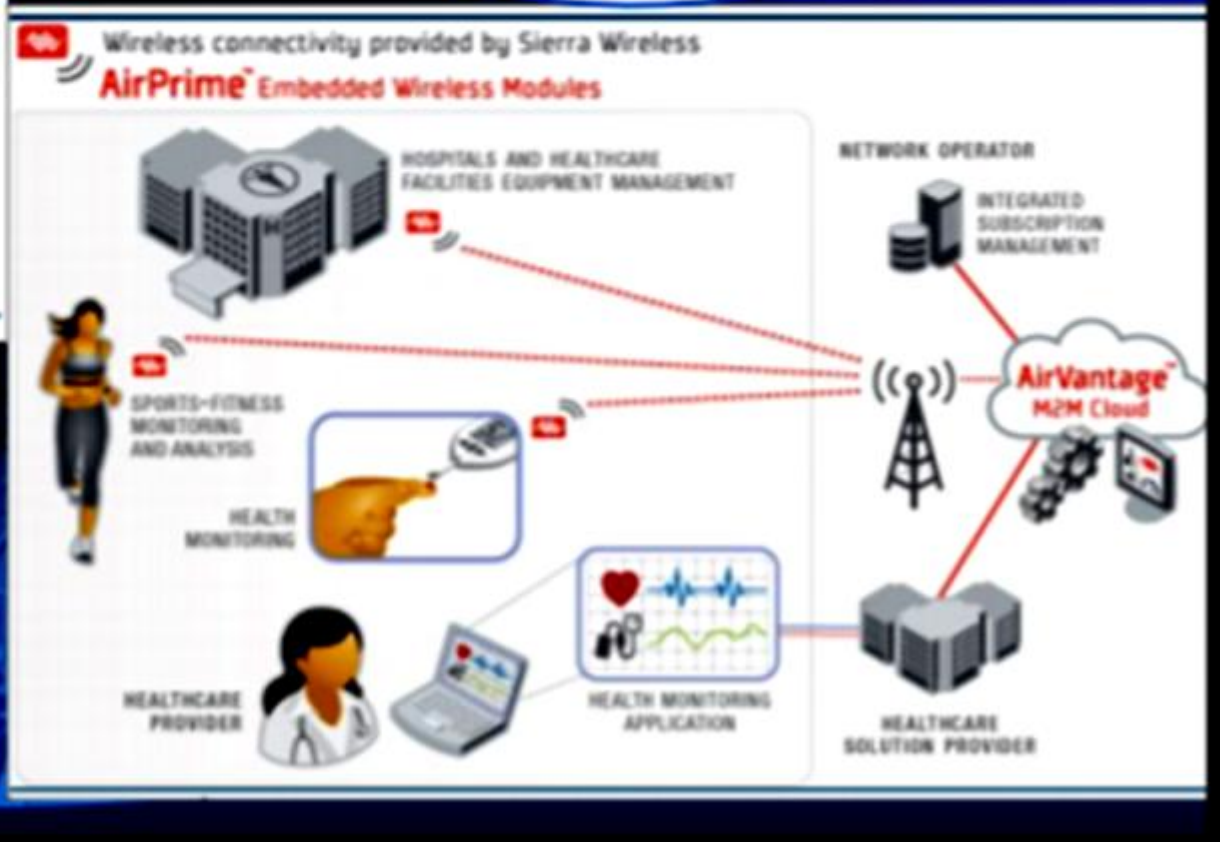
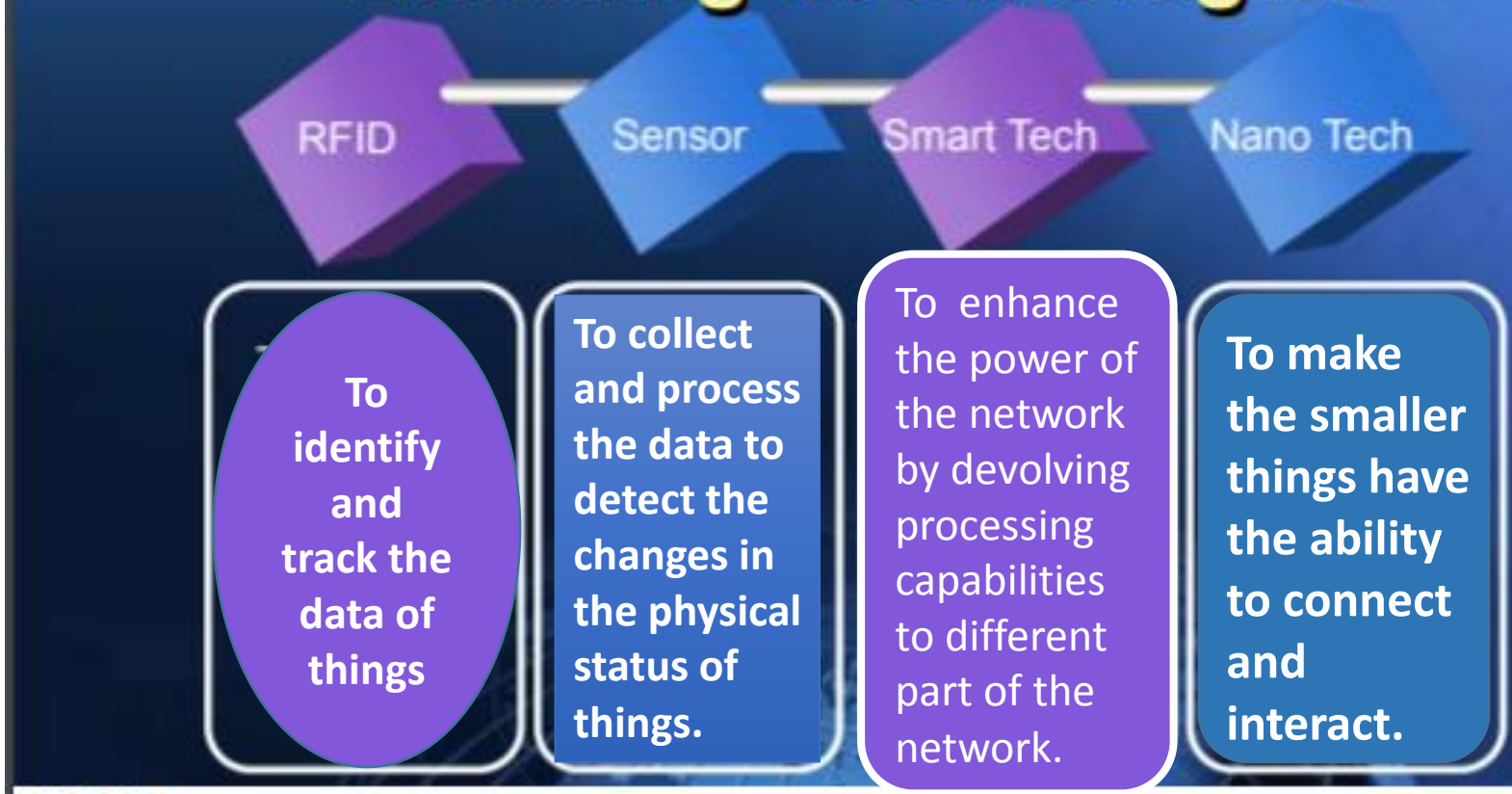


illustration of a solution allowing for remote monitoring of bedside diagnostics. Which is just one application for the internet of things within the health care environment

State of the Art of IoT

Enabling Technologies



RFID

Radio frequency identification, denoting technologies that use radio waves to identify people or objects carrying encoded microchips.

Sensor technology

Sensors are the magic of IoT

- The ability to detect changes in the physical status of things is essential for recording changes in the environment.

- Wireless sensor technology play a pivotal role in bridging the gap between the physical and virtual worlds, and enabling things to respond to changes in their physical environment. Sensors collect data from their environment, Generating information and raising awareness about context.

Sensor technology

- Sensor Market includes: Micro-electromechanical systems (MEMS)- based sensors, optical sensors, ambient light sensors, gesture sensors, proximity sensors, touch sensors, fingerprint sensors and more.

Example: ***sensors in an electronic jacket can collect information about changes in external temperature and the parameters of the jacket can be adjusted accordingly***

The challenge of IoT

Total challenge of IOT

1. Technological Standardization in most areas are still not unified
2. managing and fostering rapid innovation is a challenge for governments
3. privacy and security
4. Absence of governance
5. Sensibility to internet attack

The challenge of IoT

How to convincing users that the IoT technology will protect their data and privacy when tracking

Potential Solutions

- **Legal & Regulatory**
- **Technical Control**
- **Social Ethic**
- **Market Self-regulation**

The challenge of IoT

Solution of the main challenge:

1- Education and Information

2- legislation

The challenge of IoT

1- Education and Information

Central aspects for the success of the upcoming IOT are:

- Capacity building programs
- Strategic communication Plan
- Positives versus Negatives of the IOT

The challenge of IoT

2- legislation

Two approaches :

- The real law
- The Cyberlaw

There is lack of legal instruments concerning :

1. Privacy
2. Intellectual property rights
3. Security
4. Data Protection
5. Cybercrime

The challenge of IoT

Limitation of IoT

The application of IoT in extreme situations are still not tested (outer space, very hot or cold area)

Standardization and Interoperability

Legal instruments

Technical limitation in some cases

Maintenance with the Internet of Things

The main reason for applying IOT to manage our assets is **predictive maintenance.** Rather than performing routine calendar-based inspections and component replacement, predictive techniques monitor equipment for pending failures and notify us when a part replacement is required. **Sensors** embedded in equipment check for abnormal conditions and trigger work orders when safe operating limits are breeched.

When a predictive maintenance strategy is working effectively, maintenance is only performed on machines when it is required, thus reducing the parts and labor costs associated with replacements. With more and more systems shipping with Internet connectivity, the concept of predictive maintenance is likely to expand exponentially in the Internet of things.

Future of IOT

IOT will be applied more and more to the following fields

Future of IOT

There are three core sectors of the IoT :

- enterprise,
- home, and
- government,

with the Enterprise Internet of Things (EIoT) being the largest of the three. By 2019, the EIoT sector is estimated to account for nearly 40% or 9.1 billion devices

Conclusions

IoT is considered as a revolutionary, fully interconnected “smart” world, with relationships between objects and their environment and people becoming more tightly networked.

While the potential IoT benefits are significant, a number of potential challenges may stand in the way of this vision – particularly in the areas of security; privacy; interoperability and standards; legal, regulatory, and rights issues; and the inclusion of emerging economies. The Internet of Things is happening now, and there is a need to address its **challenges** and maximize its benefits while reducing its risks.

The Internet Society cares about IoT, because it represents a growing aspect of how people and institutions are likely to interact with and incorporate the Internet into their personal, social, and economic lives. Solutions to maximizing the benefits of IoT while minimizing the risks will not be found by engaging in a polarized debate that pits the promises of IoT against its possible dangers. Rather, in dialogue and collaboration across a range of stakeholders to plot the most effective ways forward.

The main reason for applying IOT to manage assets is predictive maintenance. Rather than performing routine calendar-based inspections and component replacement, predictive techniques monitor equipment for pending failures and notify us when a part replacement is required. Sensors embedded in equipment check for abnormal conditions and trigger work orders when safe operating limits are violated.

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