

Internet of Things

a brief concept and perspectives

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Outline

- 1 Introduction
- 2 Advantages
- 3 Disadvantages
- 4 Some Applications
- 5 IoT - problems and risks
- 6 Perspectives
- 7 Thank you!

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what is IoT?

- The IoT is the network of physical objects or “**things**” embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data.
- The IoT refers to the ever-growing network of physical objects that feature an IP address for internet connectivity, and the communication that occurs between these objects and other Internet-enabled devices and systems.

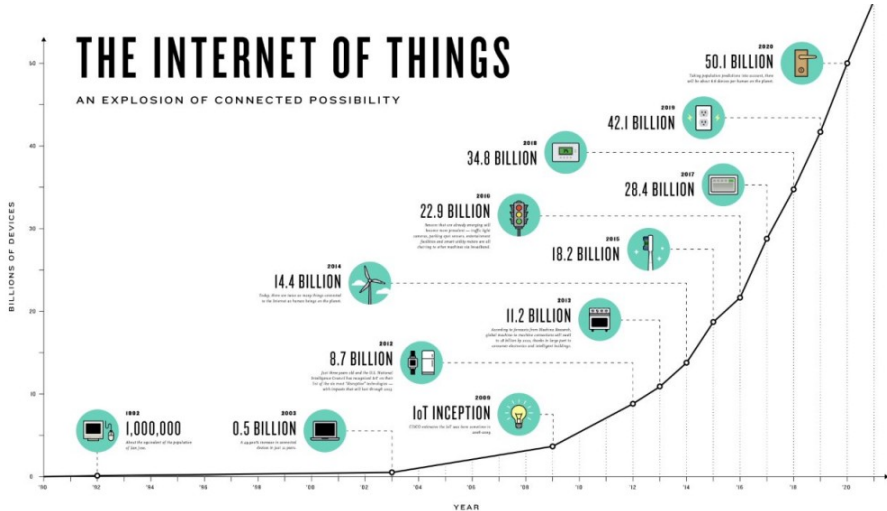
My favorite IoT concept

In simple words, IoT is an ecosystem of connected physical objects that are accessible through the internet, and it is also referred to as Machine-to-Machine (M2M), Skynet or Internet of Everything.

history of IoT

- 1999 - The IoT gets a name - Kevin Ashton coins the term “Internet of Things” and establishes MIT’s Auto-ID Center, a global research network of academic laboratories focused on RFID and the IoT.

IoT timeline supply chain



how IoT works?

How IoT works ?

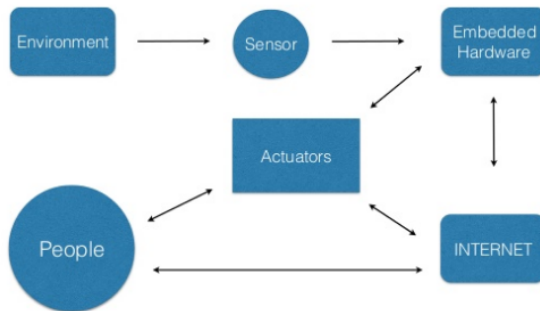


Figure: how IoT works?

IoT networks topology

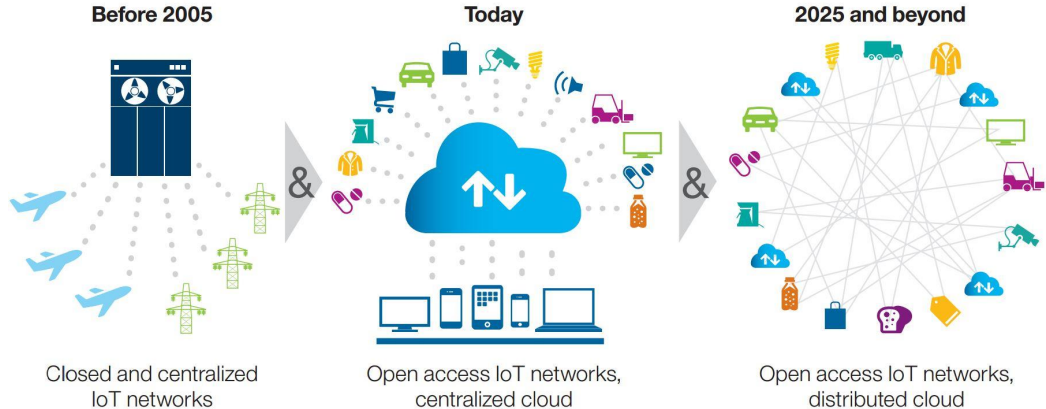


Figure: IoT networks topology

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some advantages of IoT

- 1 Data and Information
- 2 Tracking
- 3 Timeline
- 4 Money
- 5 Communication
- 6 Automation and Control
- 7 Monitor

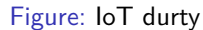
- Automation of daily tasks leads to better monitoring of devices.
- Better Quality of Life.

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some disadvantages

- ① Compatibility
- ② Complexity
- ③ Privacy and Security
- ④ Safety



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some applications of IoT

- 1 Smart Cities
- 2 Home Automation
- 3 Industrial Automation
- 4 Health Monitoring
- 5 Smart Environment

connected dumpster



Figure: Connecting bins and dumpsters with an ultrasonic sensor.

gas tank remote monitoring



Figure: Like connected dumpsters, LPG, fuel and oil tanks can benefit from connected ultrasonic sensors.

street lighting



Figure: More and more cities are considering smart lighting as it can decrease their energy bills.

smart parking



Figure: In dense areas, it can sometimes be challenging to find a parking place.

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risk management

- A lot of physical tests and measurements can be replaced by connected sensors:
 - regular actions that can be assessed remotely are causing pollution which could be avoided.
 - For safety reasons, railway companies physically monitor the temperature of their tracks at many different points to understand train speeds because as the temperature goes up, the rails bend...

IoT and the need for trust

- the use of encryption in information security is nothing new;
- currently, financial transactions are executed between two parties, but they are intermediated by a third party;
- Nakamoto (2008) says what is needed is an electronic payment system based on cryptographic proof instead trust.

recomentations and principles for IoT

- Goodman (2015) presents some security recommendations and basic principles for the IoT adopting security-by-design principles;
- development of protection, disaster response and redundancy plans for critical infrastructure;
- private sector and government should adopt expiration dates for autonomous IoT devices;
- standards development should be adopt for safety and security practices.

IoT key requirements

- Uckelmann et al. (2011) present in their book a list of 10 Key Requirements we need considered for Architecting the Internet of Things.
- They still say that these key requirements are not intended to provide a complete set of requirements and, they are meant to focus on certain aspects of the Internet of Things to start a rethinking process for future developments.

great problems

- great problems arise:

- security
- privacy
- resilience
- storage
- centralization

budget balance

attacks budget balance:

- $\approx 25\%$ of attacks will involve the IoT
- $< 10\%$ of the budget of information security will be addressed to IoT

Let's play!

Starting the race leading IT companies presents some security recommendations:

- ① developing even safer IoT applications
- ② ensure security and privacy for the IoT development

various areas to tackle

- Industrial Internet Consortium - Interoperability
- GSMA, 3G, 4G, IEEE - ubiquitous connectivity
- peer connectivity, communications frameworks
- M2M - service layer aspects
- portability, virtualization, heterogenous computing, bigg data analytics

why open-source?

- enabling the Big Data needs collaborative minds
- fragmentation will slow down innovation
- more eyeballs == more secure

Big Data

$KB > MB > GB > PT > EB > ZB > YB > non - linear$

cow data



Figure: 1.5B cows; 200MB/cow/yr; 300,000GB (0.3 petabytes)/yr

synergies

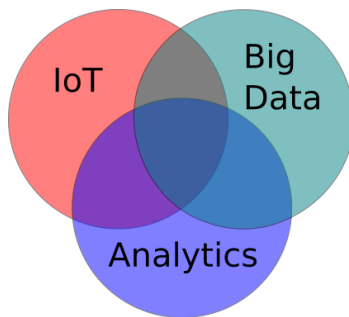


Figure: 1. IoT will enable Big Data; 2. Big Data needs analytics; 3. Analytics will improve processes for more IoT devices.

key domains

- Datacenter (Fedora, Ubuntu, CentOS)
- Networking (openWrt, yocto, Montavista)
- Digital Home and Mobile (openWrt, Linux, Android)
- Embedded and IoT (Buildroot, RTOS)

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current strategies

- Multiple context and Heterogenous Programming Models
- IBM ADEPT Architecture Protocol
- Test bed
- Digital twin

Multiple context and Heterogenous Programming Models

E.g. Develop Software Enabling Security and Multiple Contexts

- Multiple contexts are required
 - Shared resource
 - Protected resource
 - Energy conservation
- Heterogenous programming models are required
 - Close working relationship with leading industry consortia, leading semiconductor companies, OEMs and ISVs

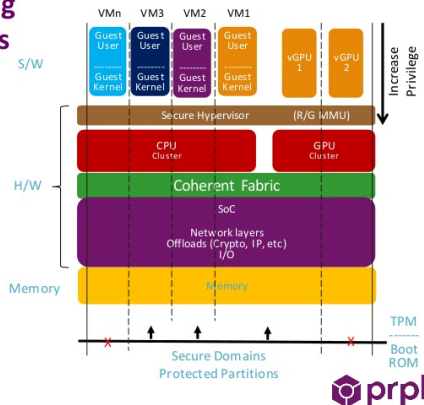


Figure: Multiple context and Heterogenous Programming Models

IBM ADEPT

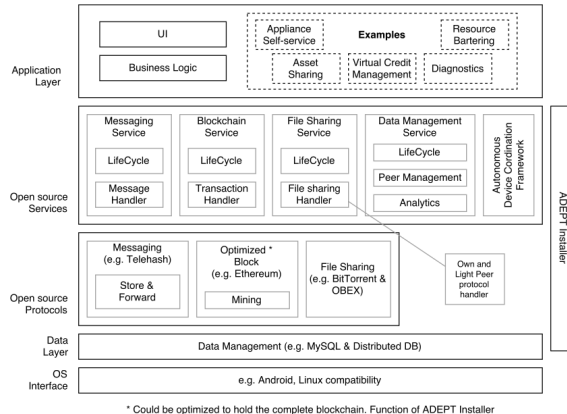


Figure: IBM ADEPT Architecture Protocol - overview

Test-bed

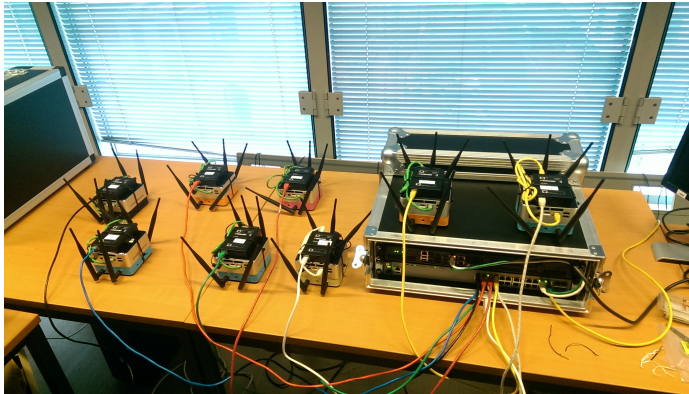


Figure: Test-bed

Digital Twin

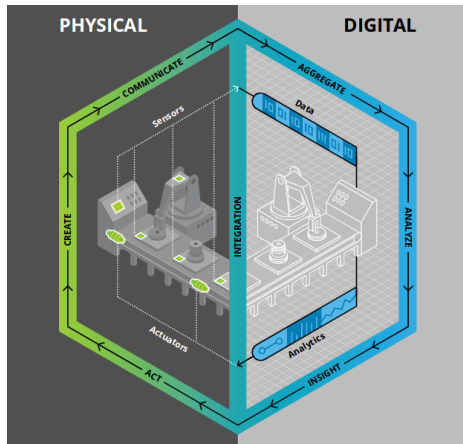


Figure: Digital Twin

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Thank you!

Questions or a little talk about...

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