

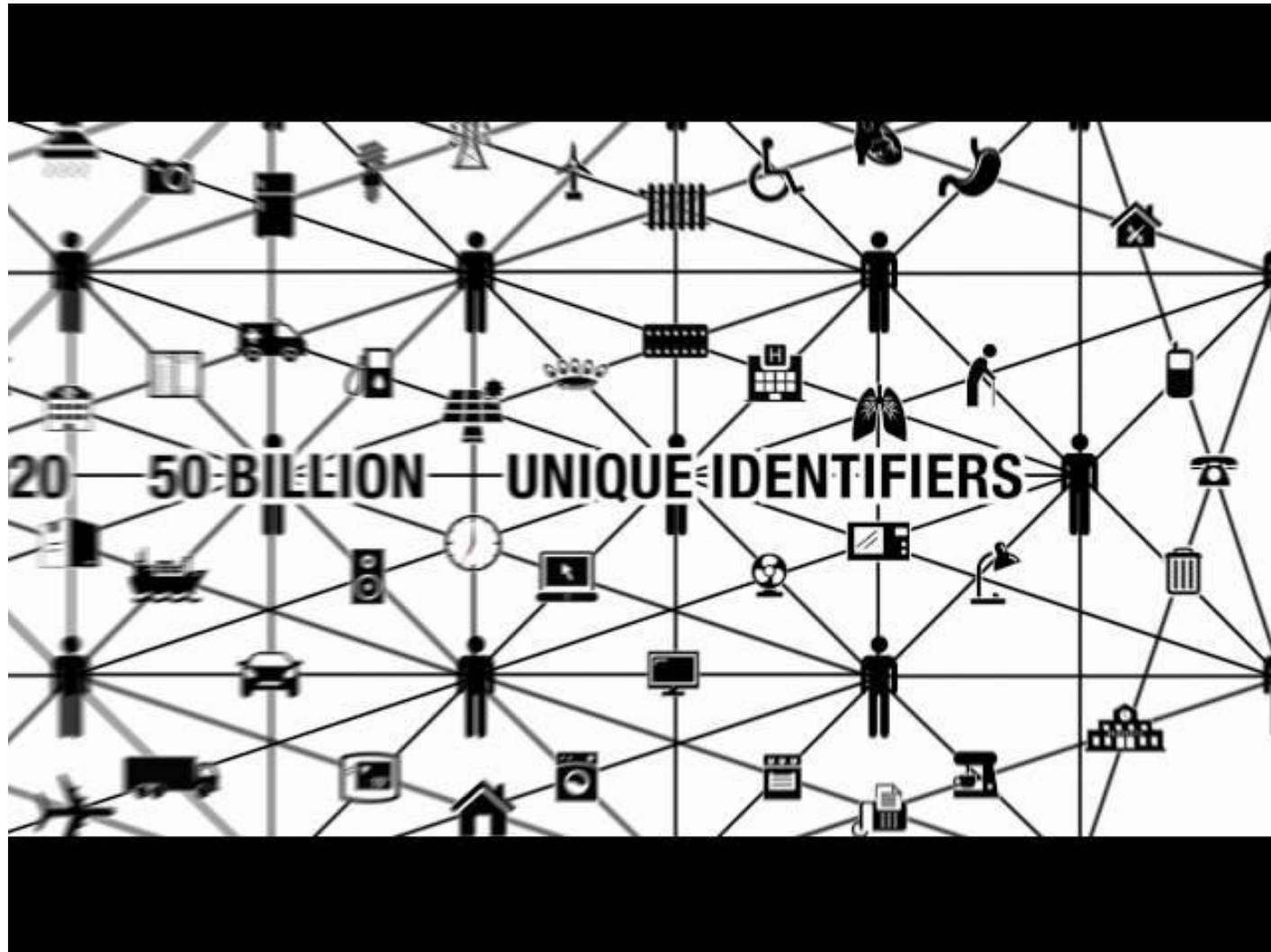
IoT

Szolgáltatások és alkalmazások szeminárium

2015-03-20

Perlaky Zoltán

Imagine...



<https://www.youtube.com/watch?v=gfhcPwzJF0&list=PLD4B1B7AB8011CFB7>

Overview

- IoT?
- Examples from the history of IoT
- IoT Hype Cycle
- IoT Application Possibilities and Examples
- Smartphone: a gateway to IoT
- Hungarian examples

IoT /Internet of Things/?

New paradigm:

- pervasive presence
 - devices: RFID tags, sensors, actuators, smartphones, smart home appliances
 - able to interact and cooperate with each other
 - to reach a common goal
- (higher degree of intelligence/smartness in end-devices)

High impact on several aspects of everyday life.

[1]

Quotes

“When wireless is perfectly applied the whole earth will be converted into a huge brain [...]. We shall be able to communicate with one another instantly, irrespective of distance. Not only this, but through television and telephony we shall see and hear one another as perfectly as though we were face to face, despite intervening distances of thousands of miles; and the instruments through which we shall be able to do this will be amazingly simple [...]. A man will be able to carry one in his vest pocket.”

An interview with Nikola Tesla by John B. Kennedy, Colliers Magazine, January 30. 1926
<http://www.tfcbooks.com/tesla/1926-01-30.htm>

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COMPUTING MACHINERY AND INTELLIGENCE by A. M. Turing, 1950
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“In a few decades time, computers will be interwoven into almost every industrial product.”

Karl Steinbuch, 1966

Interesting examples from IoT history

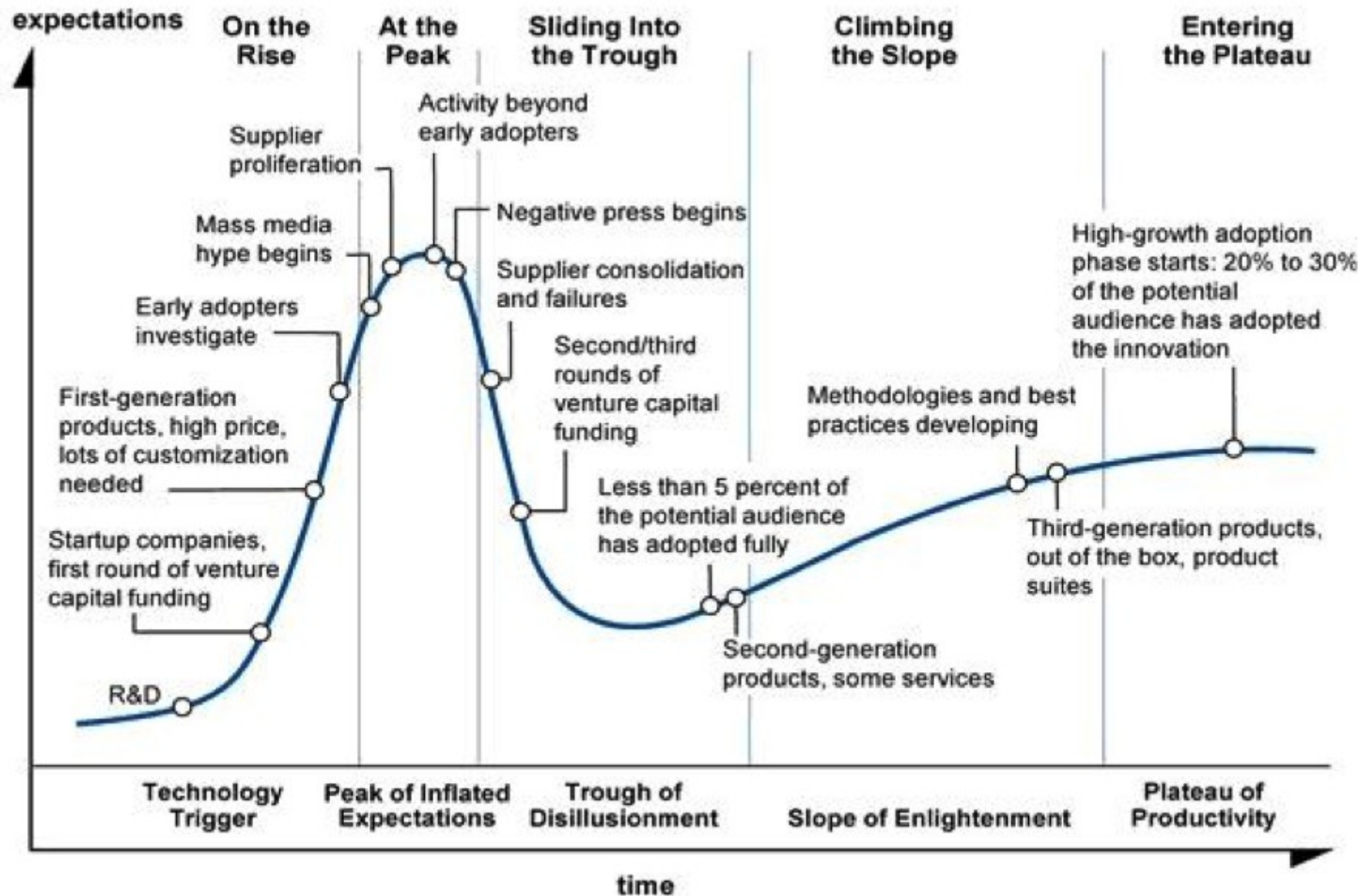
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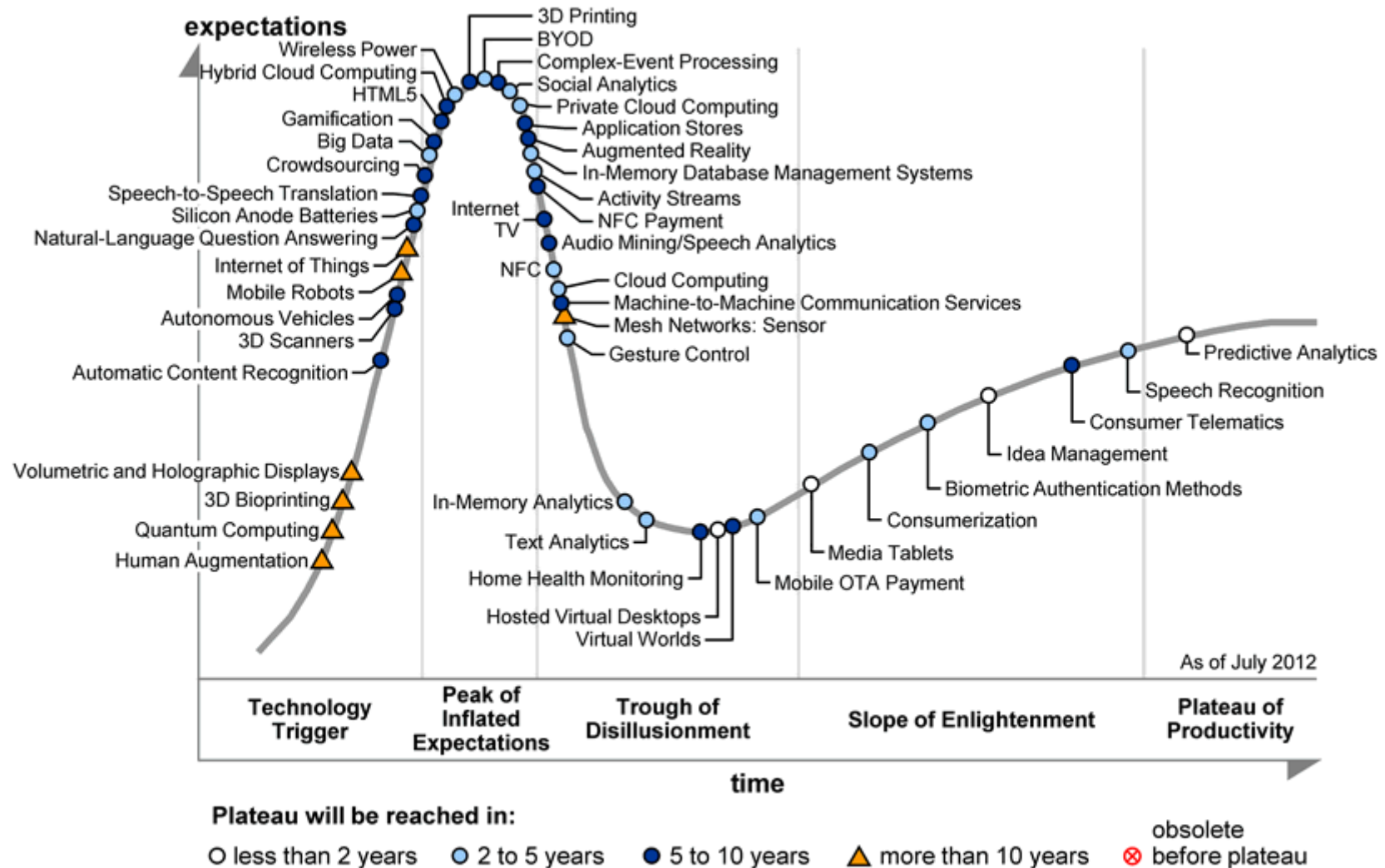
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Gartner Hype Cycle



[2] [3] <http://semiengineering.com/wp-content/uploads/2014/09/brian2.png>

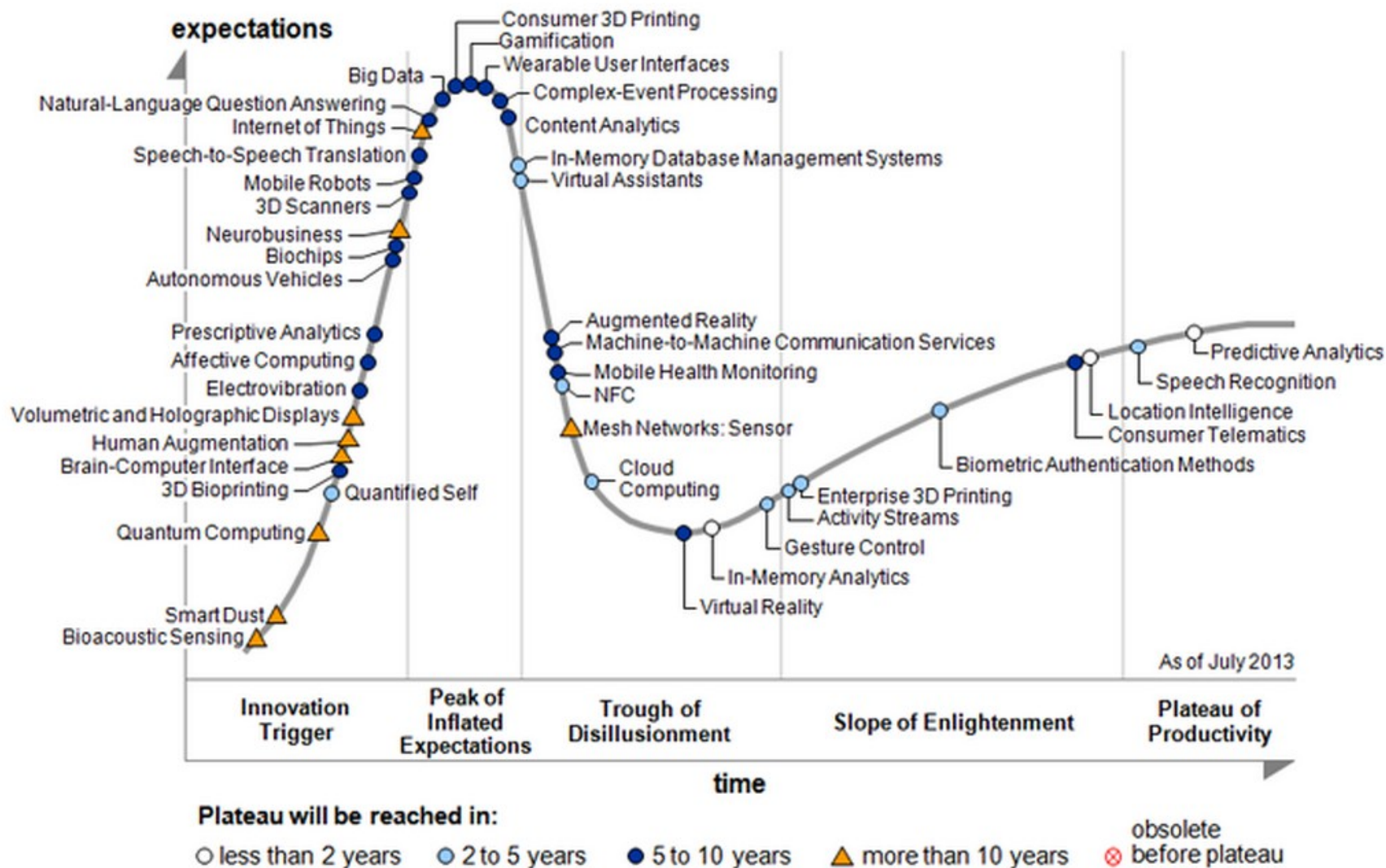
Emerging technologies 2012



[2] <http://blogs-images.forbes.com/gartnergroup/files/2012/09/2012Emerging-Technologies-Graphic4.gif>

Emerging technologies 2013

Figure 1. Hype Cycle for Emerging Technologies, 2013

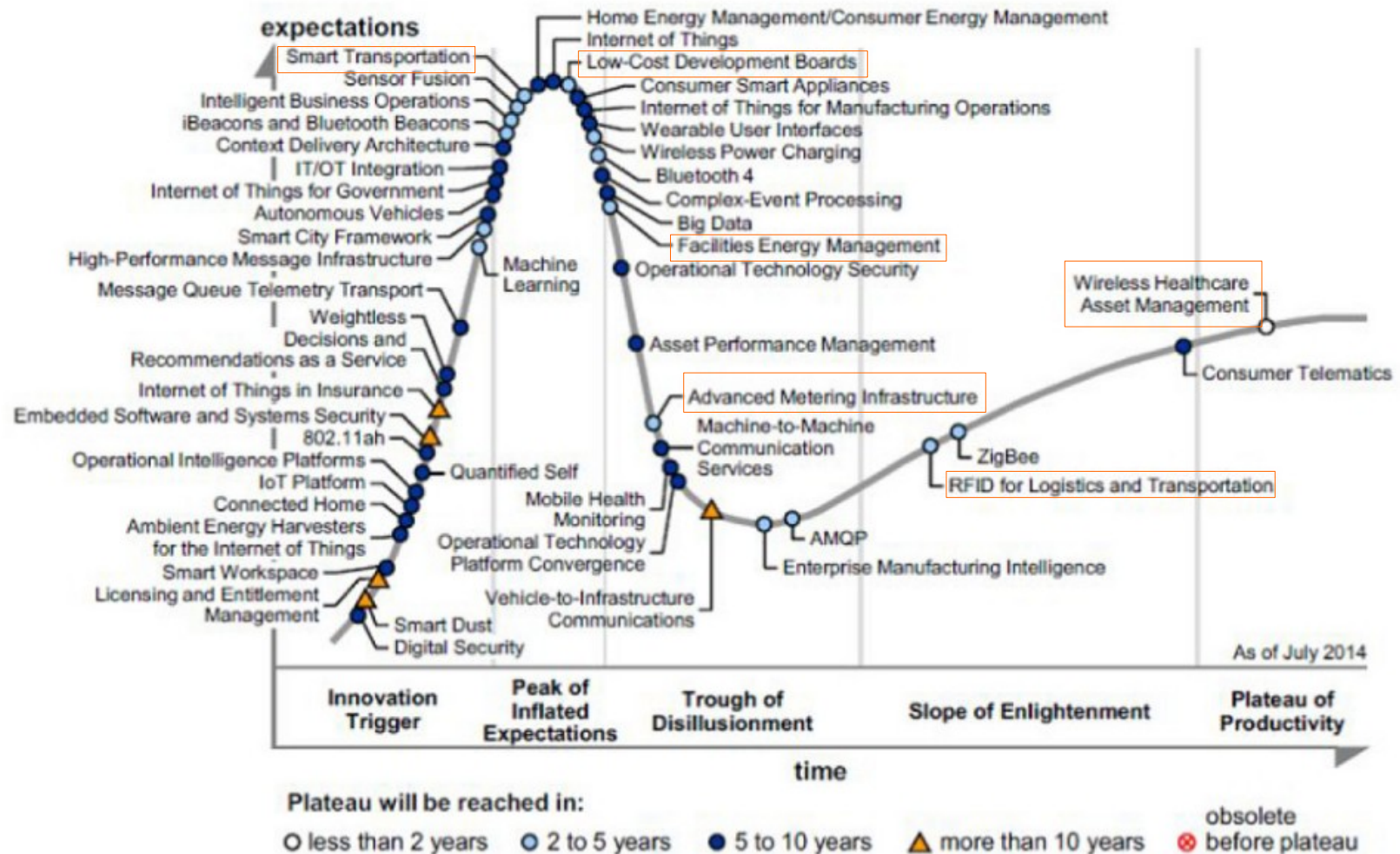


Source: Gartner August 2013

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IoT Hype Cycle 2014

Hype Cycle for the Internet of Things



Source: Gartner, July 2014

[3] https://farm4.staticflickr.com/3897/15141493602_955d5ff834.jpg

IoT Applications: Possibilities

- Transportation and logistics domain

Vehicles, roads, transported goods are equipped with sensors, actuators, processing cap. Collection and forwarding of information to
-control/reroute traffic -monitor transported goods -provide appropriate info

Areas:

Logistics – real time monitoring of the supply chain, accurate inf., less stock req.

Assisted Driving – better navigation, route optimization (for time, cost, etc.), collision avoidance

Mobile ticketing – provides transportation services info, allows to buy ticket

Environment monitoring – for perishable goods, improving food supply chain eff.

Augmented maps – tagging tourist maps, interactions (info browsing/searching about hotels/restaurants/sights/events in the area of interest)

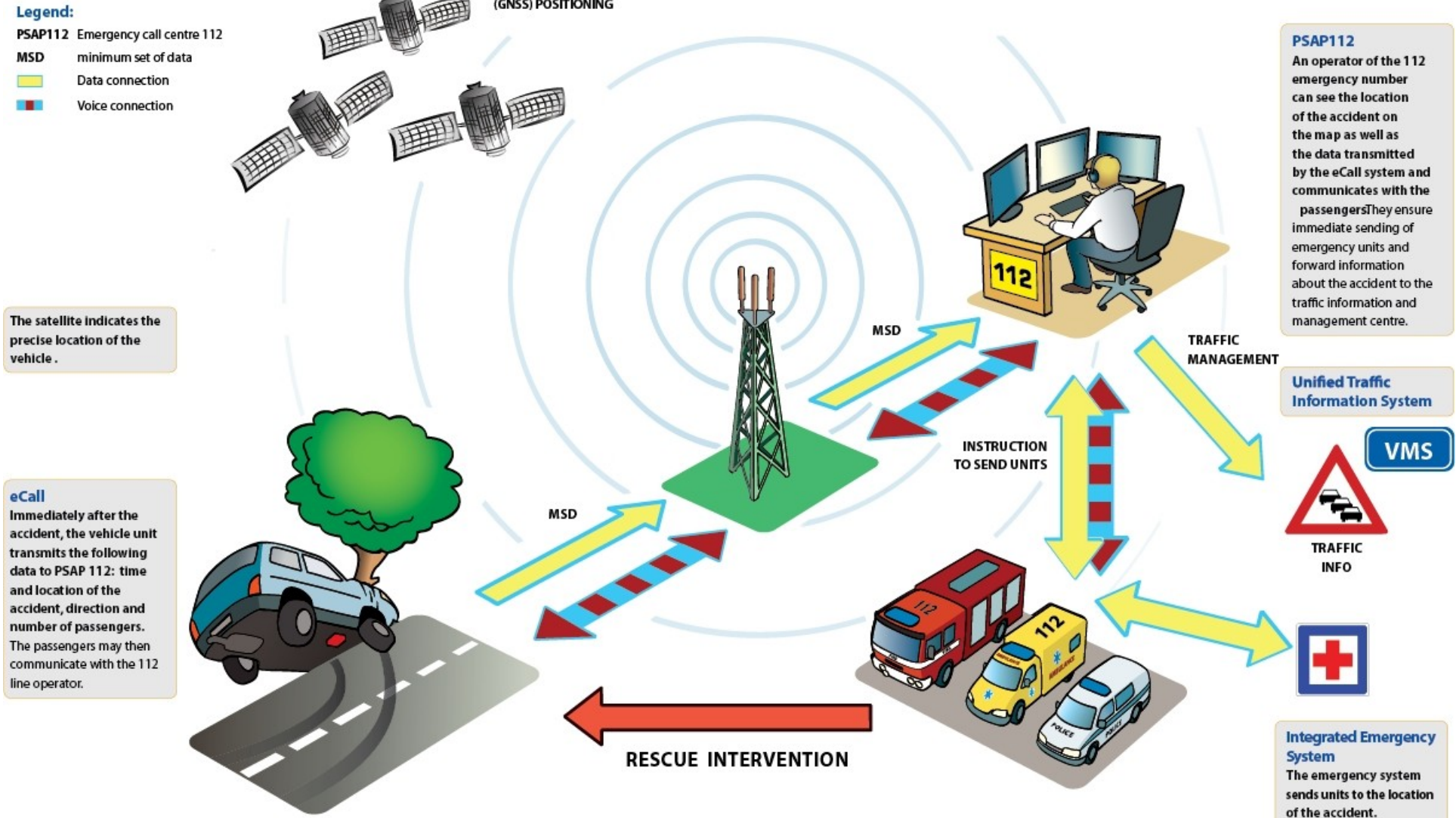
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IoT Application: Traffic Accident



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Example: eCall



http://itcafe.hu/dl/cnt/2014-06/109581/ecallinfo_png.jpg
<http://www.heero-pilot.eu/view/en/ecall.html>

IoT Applications: Possibilities

- Healthcare domain

Areas:

Tracking – Position of something/someone in motion. Finding choke points. Location of inventory, tools (surgery left-ins), samples and lab results.

Identification, authentication – Patient/infant id (vs. mishaps).

Comprehensive and current electrical medical records.

Staff id&auth to grant access. Asset id&auth to prevent thefts or losses.

Automatic data collection and transfer – Inventory management.

To reduce processing time. For automated care.

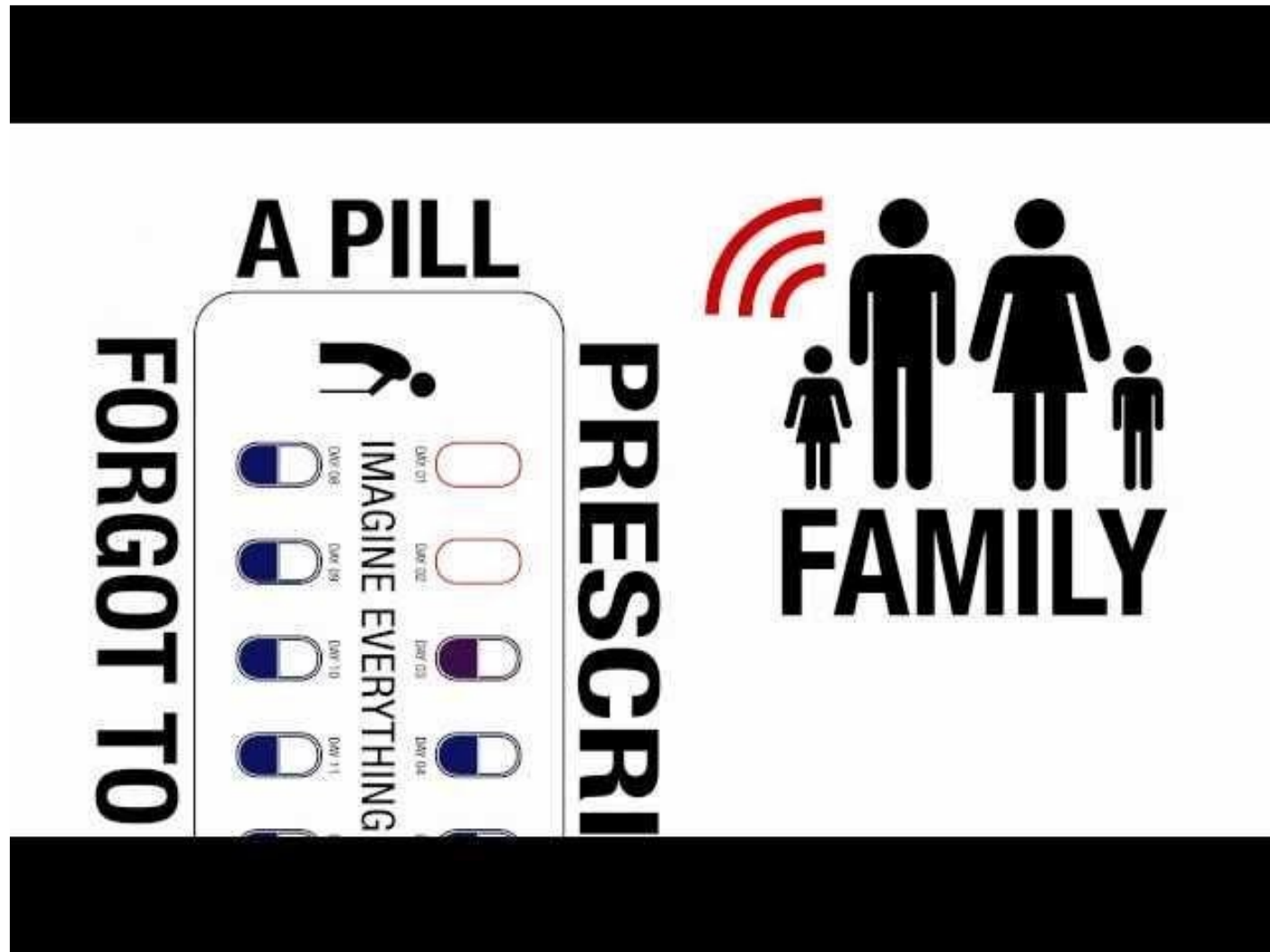
Integration of different health information and clinical applications.

Sensing – Diagnosing patients and providing real time health indicators.

Telemedicine solutions: Monitoring patient compliance with medication regiments, alerts&emergencies (both in-patient and out-patient care), remote patient monitoring to reach the patient, continuous bio-signal monitoring.

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IoT Application: Elderly Care



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IoT Applications: Possibilities

- Smart environment domain

Comfortable and user-friendly environments thanks to the intelligence of the contained objects.

Areas:

Comfortable homes, offices – Adaptive HVAC and lighting (for comfort, for energy savings). Optimize power (and other utilities) consumption and production (smooth peak loads by controlling appliances ie.: refrigerator)

Industrial plants – Improve automation with mass RFIDs. Monitoring production line (quality control, emergencies). Preventing malfunction, just-in-time maintenance.

Smart leisure (gyms) – Identifying user, automatic loading of personal preferences, exercise profile. Monitoring and reporting health parameters.

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IoT Applications: Possibilities

- Personal and social domain

Enable the user to maintain and build social relationships, interact with others. Automatic message triggers for moving from/to house, office, restaurant, venue.

Areas:

Social networking – ie. Facebook, twitter, foursquare, etc.

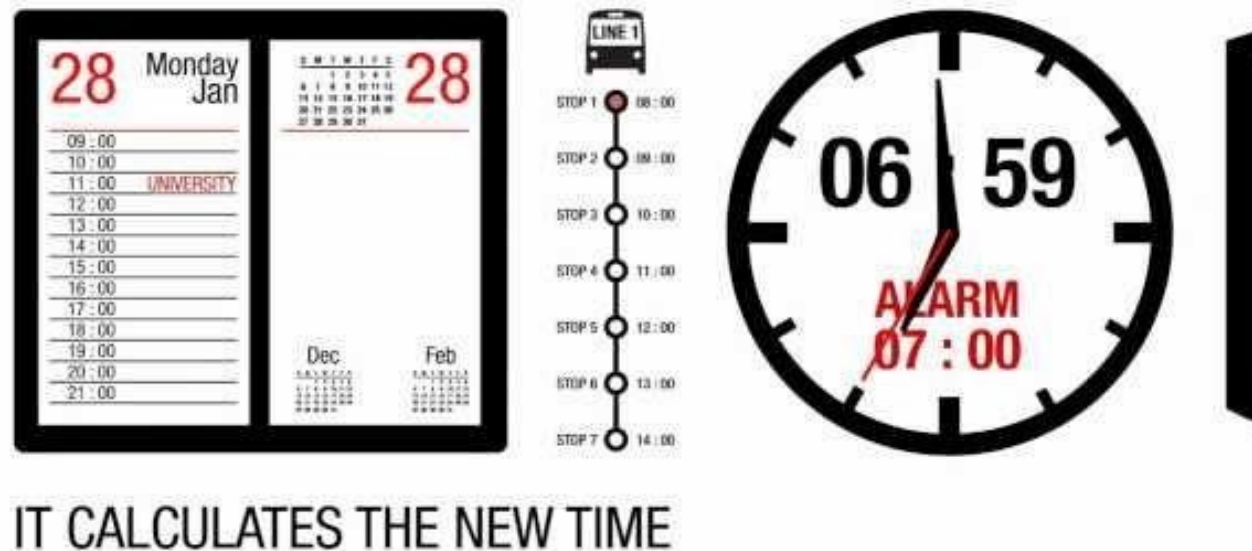
Historical queries – about people, objects and events, (automatic) digital diary

Losses – “Where is my phone?”, “Where are my keys?”

Thefts – alerts when object is moved from a restricted area (ie: wallet, laptop, car)

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IoT App: a complex automated scenario



<https://www.youtube.com/watch?v=kq8wcjQYW90&list=PLD4B1B7AB8011CFB7>

Smartphone: a gateway to IoT

- Connectivity

- 2G/3G/4G
- WiFi 802.11a/b/g/n/ac
- Bluetooth 2.0-4.1
- NFC
- USB
- Infrared
- FM radio
- (MHL / MyDP
Mobile High-Definition Link
Mobility DisplayPort)

- Sensors

- Sound (Microphones)
- Image (Cameras)
- Position (A-GPS/GLONASS)
- Orientation (Gyroscope)
- Compass (Magnetometer)
- Movement (Accelerometer)
- Proximity
- Barometer
- Thermometer
- Pressure (Heart Rate)
- Blood Oxygen
- Fingerprint

http://en.wikipedia.org/wiki/Comparison_of_smartphones

Wearables: the next gen. of gadgets?

Examples:

- Smart glasses/Head Mounted Display (Google Glass)
- Smart watches
- Activity monitor/Fitness equipment
- ...

Hungarian examples

- MOL BuBi
- BKK FUTÁR
- Online pénztárgépek
- E-útdíj
- Buxa

[5]

Questions?

How to “connect” to IoT?

- EU Digital Agenda 2020 Initiative

<http://ec.europa.eu/digital-agenda/en/internet-things>

- IVSZ IoT Munkacsoport

<http://ivsz.hu/hu/hirek-es-esemenyek/hirek/ivsz-hirek/2014/03/iot-mcs-elso-ulese-140313>

- DIY IoT Development Boards (Arduino, Raspberry PI, etc.)

<http://www.open-electronics.org/the-ultimate-comparison-of-iot-development-boards/>

Infographics

The Internet of Things Heading Towards A Smart Planet

<http://www.psfk.com/2014/03/internet-of-things-infographic.html>

What Exactly is the Internet of Things

<http://postscapes.com/what-exactly-is-the-internet-of-things-infographic>

Goldman Sachs What is the Internet of Things Macroeconomic Insights

<http://www.goldmansachs.com/our-thinking/outlook/iot-infographic.html>

IoT infographics collection:

<http://djokic.org/13-best-internet-of-things-infographics/>

Other IoT infographics collection:

<https://www.aylanetworks.com/resources/infographics>

Sources

[1] Luigi Atzori, Antonio Iera, Giacomo Morabito: The Internet of Things: A survey
Computer Networks 54, p. 2787-2805, 2010

http://www.elsevier.com/___data/assets/pdf_file/0010/187831/The-Internet-of-Things.pdf

[2] Gartner, Inc.

<http://www.gartner.com/newsroom/id/2124315>

<http://www.gartner.com/newsroom/id/2575515>

[3] Sherly Mendoza: Internet of Things Entering Peak of Inflated Expectations

<http://www.edn.com/electronics-blogs/eye-on-iot-/4437387/IoT-entering-peak-of-inflated-expectations>

[4] Brian Bailey: Limiters To The Internet Of Things

<http://semiengineering.com/limiters-to-the-internet-of-things/>

[5] Bátorfi Péter: A dolgok internetje, avagy az összekapcsolt minden Future IT(T) 2014 [2014. október 8.]

<https://www.aut.bme.hu/Future/Eloadas/2014-10-08>

[6] Dave Evans: The Internet of Things How the Next Evolution of the Internet Is Changing Everything

https://www.cisco.com/web/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf

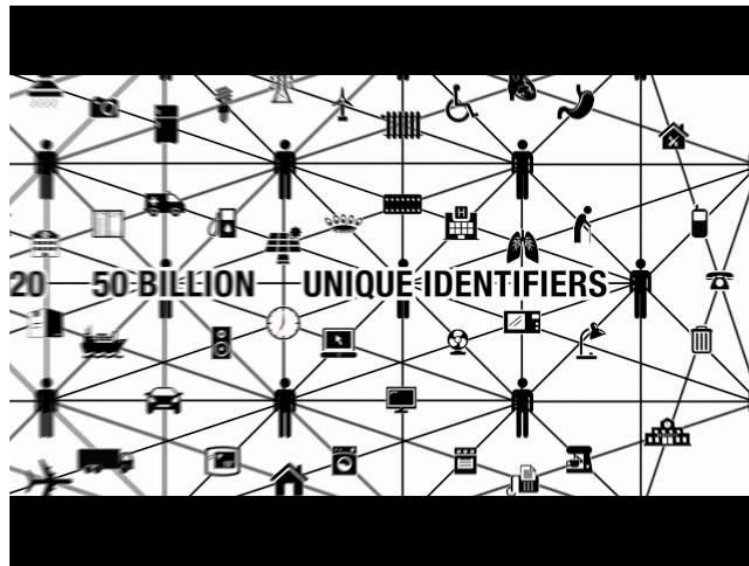
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IoT

2

Imagine everything was linked...

In a near future the Internet have people will evolve and become an internet where everyday objects can be recognized and controlled via RFID tags, sensors and smartphones.

This will allow the creation of smart environments in which objects will interact and cooperate with

each other: an Internet of Things. Our quality of life will undergo a vast transformation and will be improved.

By 2020 50 billion (10^9 , short scale) devices will be equipped with unique identifies so that they can be of great benefit in the fields of energy, safety and security, industry, manufacturing and retail, healthcare, independence on elderly people and people with reduced mobility, environment and transport, smart cities, entertainment and many more.

(Since the system will be controlled by free market like today's Internet the risk for data misuse and data security cannot be excluded. On the other hand privacy settings will be integrated and give the users the possibility to exclude certain objects from the networked environment.)

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High impact on several aspects of everyday life.

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Internet of Things semantically means:

A world-wide network of interconnected objects uniquely addressable, based on standard communication protocols.

There are different visions for IoT:

- 1) Internet oriented: the main attribute is connectivity from anytime, anywhere, *anything*
- 2) Object oriented: simple but identifiable/visible items (ie. RFID, NFC)
- 3) (Semantic oriented): extremely high number of devices, therefore representation/storage/interconnection issues, which will be handled by semantic technologies

Quotes

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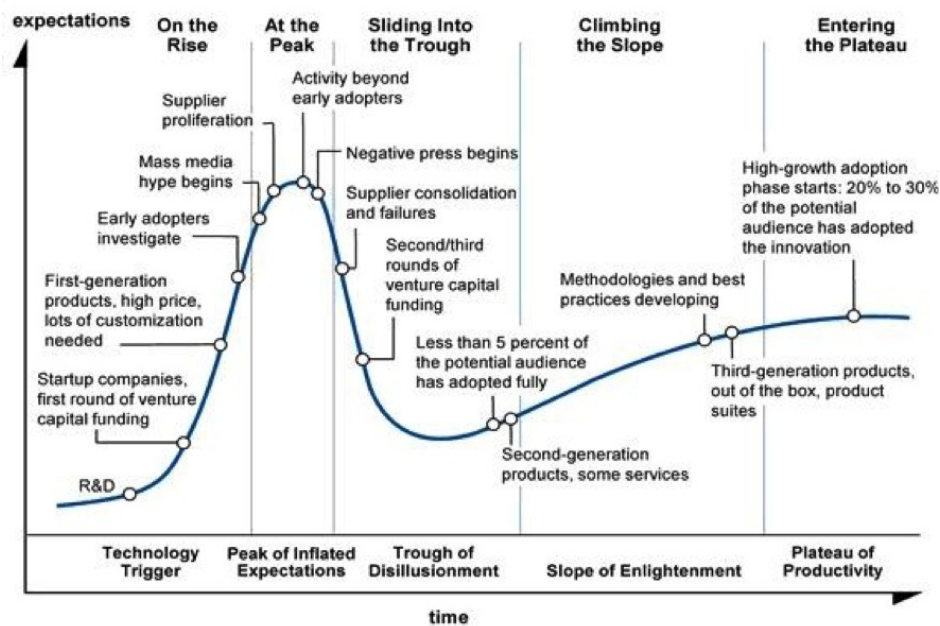
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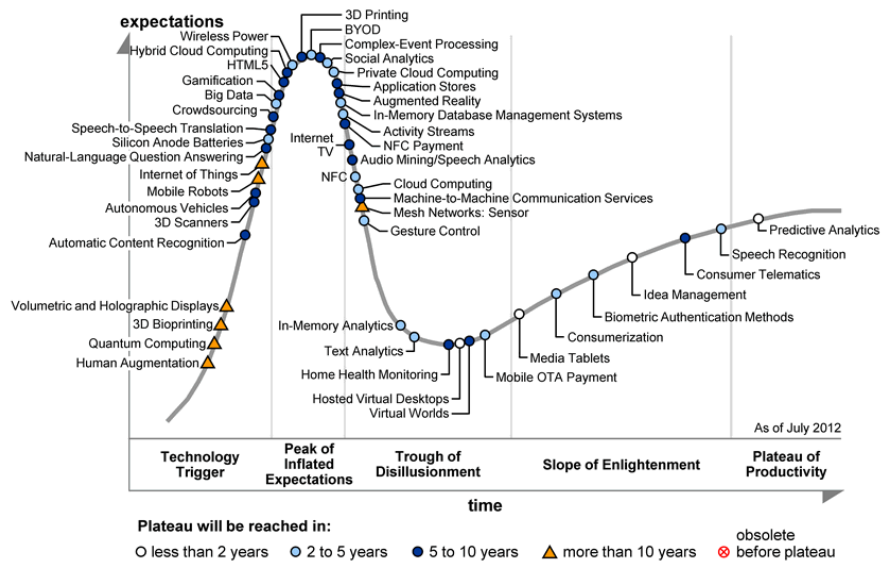
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IoT

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- **Technology or Innovation Trigger** -- A technology in this stage is starting to emerge and is having the buzz around it start. Usually, there is only a very early model or proof of concept available and no usable products are out in the market. These types of technology have shaky and unproven commercial viability. At this stage, new methodologies, research, materials, and discoveries make a new technology viable and workable.
- **Peak of Inflated Expectations** -- The media often generates a lot of publicity at this stage, usually involving a few success stories but mostly reporting on failures.
- **Trough of Disillusionment** -- At this stage interest in these technologies are on the decline because implementations, applications, and experiments tend to fail when it comes to delivering the technologies' promised benefits and features. Investors might want to get out of these technologies unless producers can prove that their products can be improved or early adopters signify satisfaction.
- **Slope of Enlightenment** -- This is when a technology becomes better understood by consumers, investors and companies capitalizing on them. This is also a stage where the technologies are already benefiting the companies invested in them. Usually, technologies at this part of the cycle have more products coming out. Investors are often very interested and more pilots are funded.
- **Plateau of Productivity** -- This is where the technology gains adoption from the mainstream. The business viability of these technologies are now very evident and these technologies often have a wide range of applications and are clearly relevant to consumers.

Emerging technologies 2012



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IoT

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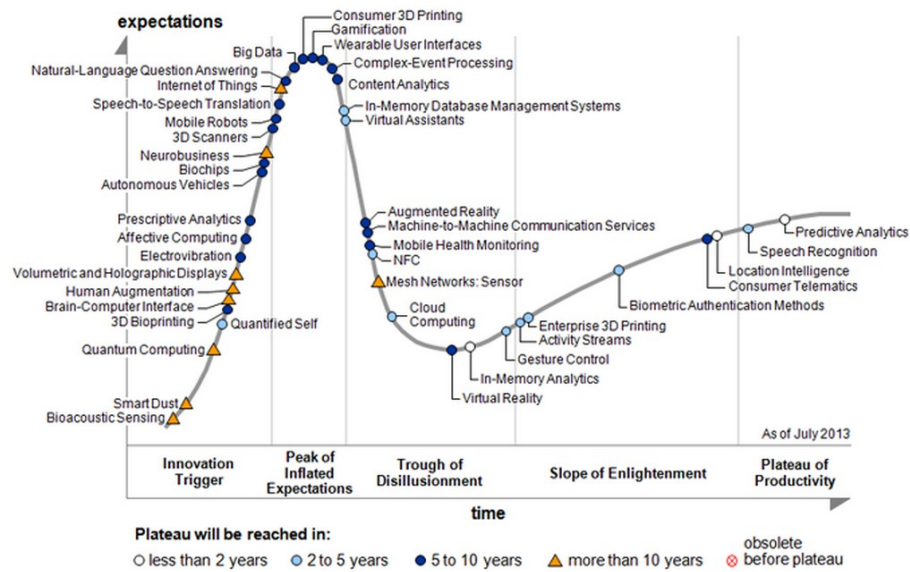
(IoT first added in 2011 - On June 8, 2011, the Internet Society together with several other big companies and organizations held World IPv6 Day, a global 24 hour test of IPv6.)

In 2012:

IoT is already in the early adapters investigate phase
Plateau more than 10 years away

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Figure 1. Hype Cycle for Emerging Technologies, 2013



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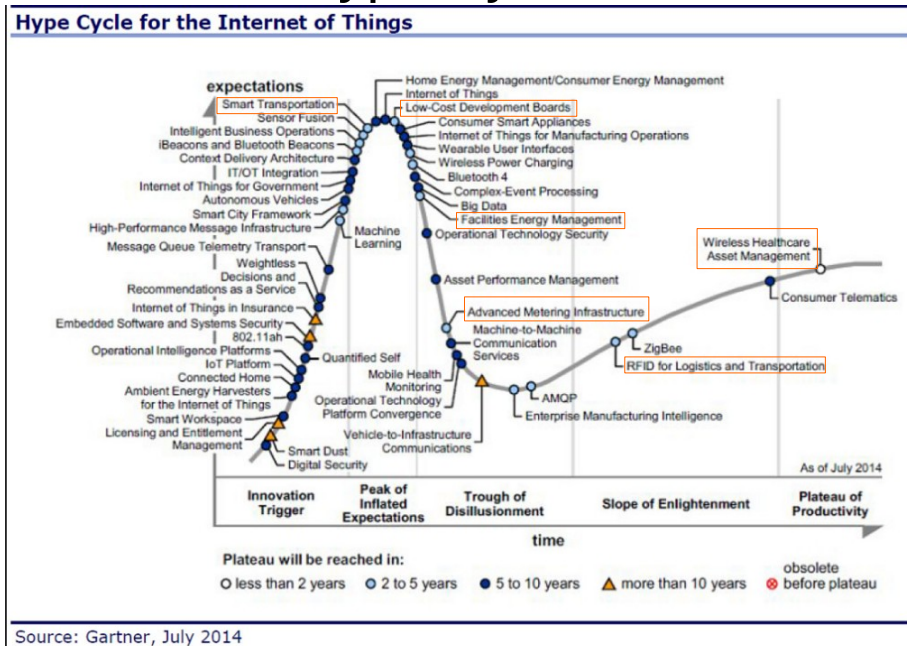
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IoT Hype Cycle 2014



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IoT

10

In 2014:

IoT was/is at the peak of inflated expectations

Plateau is 5-10 years away

However...

There are a lot of matured IoT related technologies, some of them:

Plateau in 2 years:

wireless healthcare asset management

Plateau in 2-5 years:

Advanced metering infrastructure

Facilities energy management

Smart transportation

RFID for logistics and transportation

Low cost development boards

IoT Applications: Possibilities

- Transportation and logistics domain

Vehicles, roads, transported goods are equipped with sensors, actuators, processing cap. Collection and forwarding of information to
-control/reroute traffic -monitor transported goods -provide appropriate info

Areas:

Logistics – real time monitoring of the supply chain, accurate inf., less stock req.

Assisted Driving – better navigation, route optimization (for time, cost, etc.), collision avoidance

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IoT Application: Traffic Accident



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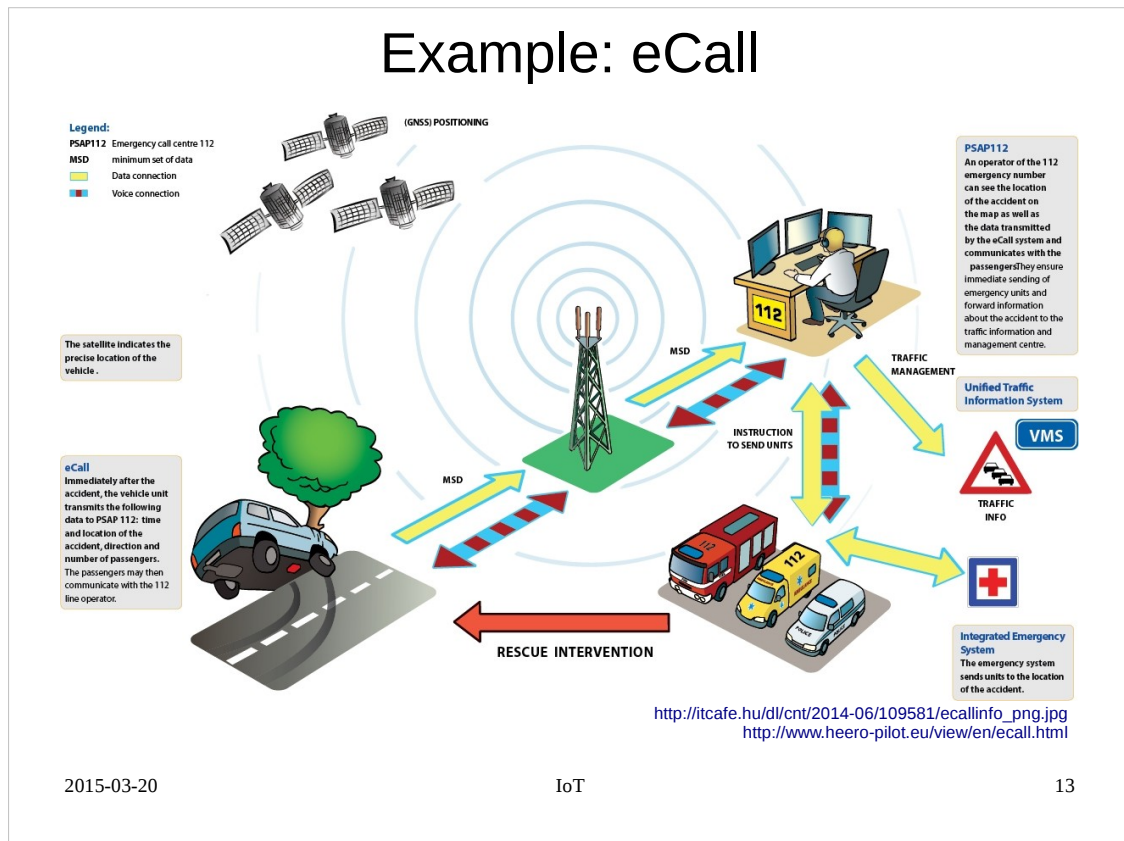
12

Imagine everything was linked...

Let's say there was a traffic accident somewhere on the road. A built-in system in the cars could automatically alert the emergency services with precise geolocation data. They can send an ambulance to the crash site.

Furthermore this new information would be passed on to a system that alerts me as I am driving and suggests an alternative route to get to my destination.

Example: eCall



As soon as the eCall device in your car senses a severe impact in an accident, it automatically initiates a 112 emergency call to the nearest emergency centre and transmits it the exact geographic location of the accident scene and other data. With the same effect, eCalls can also be made manually, at the push of a button. This is convenient if, for instance, you become witness of an accident. Whether the call is made manually or automatically, there will always be a voice connection between the vehicle and the emergency call centre in addition to the automatic data link. This way, any car occupant capable of answering questions can provide the call centre with additional details of the accident.

Getting an immediate alert in the event of an accident and knowing the exact location of the crash site cuts emergency services' response time by 50% in rural and 40% in urban areas. Thanks to this gain in time, eCall is expected to save several hundred lives in the European Union each year, and to mitigate the severity of tens of thousands of injuries. eCall will also result in faster treatment of injured people, thereby giving accident victims better recovery prospects. Arriving at the accident scene sooner will also allow faster clearance of crash sites, thus reducing the risk of secondary accidents, decreasing congestion times, cutting fuel waste and lowering CO2 emissions.

Pilot program is in phase 2 with 15 countries.

The regulation would require all new car models to be equipped with eCall technology from 31 March 2018.

IoT Applications: Possibilities

- Healthcare domain

Areas:

Tracking – Position of something/someone in motion. Finding choke points.
Location of inventory, tools (surgery left-ins), samples and lab results.

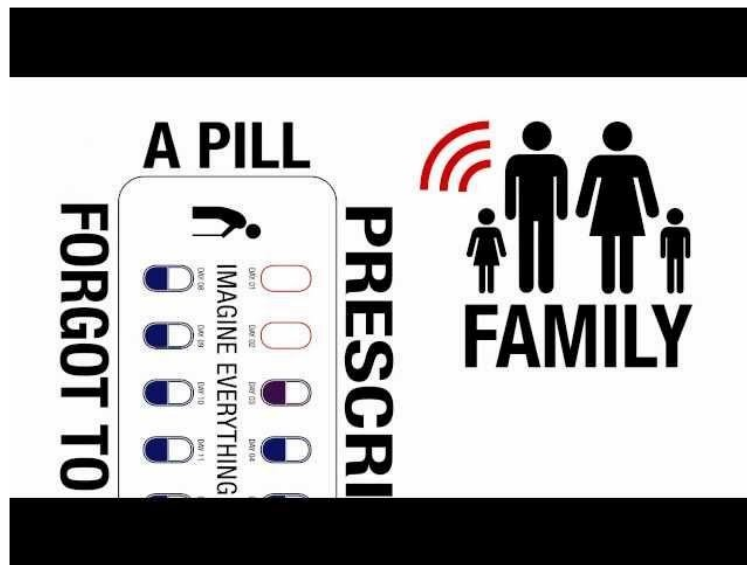
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IoT

15

Imagine everything was linked...

Let's say an elderly person forgot to take a pill prescribed by the doctor. This could trigger an alert warning a family member on their mobile phone. If that person is not available it would make a call to a second family member. Now if this person is also unavailable, it could then alert a local emergency center which would send someone to check things out.

IoT Applications: Possibilities

- Smart environment domain

Comfortable and user-friendly environments thanks to the intelligence of the contained objects.

Areas:

Comfortable homes, offices – Adaptive HVAC and lighting (for comfort, for energy savings). Optimize power (and other utilities) consumption and production (smooth peak loads by controlling appliances ie.: refrigerator)

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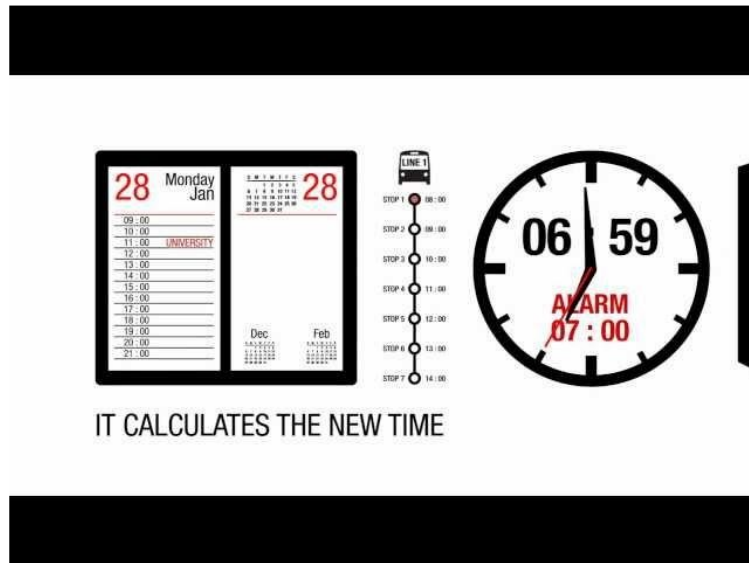
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Let's say a professor at the university is not feeling well and calls in sick. An automatic system at the school could send an alert to all the students that the class was cancelled.

Furthermore this information is passed on to a system that adapts my agenda and it calculates the new time to my next class two hours later taking into account public transport timetables. They could also reset my alarm clock to wake me up a bit later, and it could adjust the central heating system and the coffee machine.

Smartphone: a gateway to IoT

- Connectivity

- 2G/3G/4G
- WiFi 802.11a/b/g/n/ac
- Bluetooth 2.0-4.1
- NFC
- USB
- Infrared
- FM radio
- (MHL / MyDP
Mobile High-Definition Link
Mobility DisplayPort)

- Sensors

- Sound (Microphones)
- Image (Cameras)
- Position (A-GPS/GLONASS)
- Orientation (Gyroscope)
- Compass (Magnetometer)
- Movement (Accelerometer)
- Proximity
- Barometer
- Thermometer
- Pressure (Heart Rate)
- Blood Oxygen
- Fingerprint

http://en.wikipedia.org/wiki/Comparison_of_smartphones

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IoT

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Most of the users are introduced to an Internet enabled device with sensors when they started using a smartphone.

Wearables: the next gen. of gadgets?

Examples:

- Smart glasses/Head Mounted Display (Google Glass)
- Smart watches
- Activity monitor/Fitness equipment
- ...

Hungarian examples

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<https://www.aylanetworks.com/resources/infographics>

Sources

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