The Internet of Things:
Are We at the Fringes of a Paradigm Shift in Geomatics?
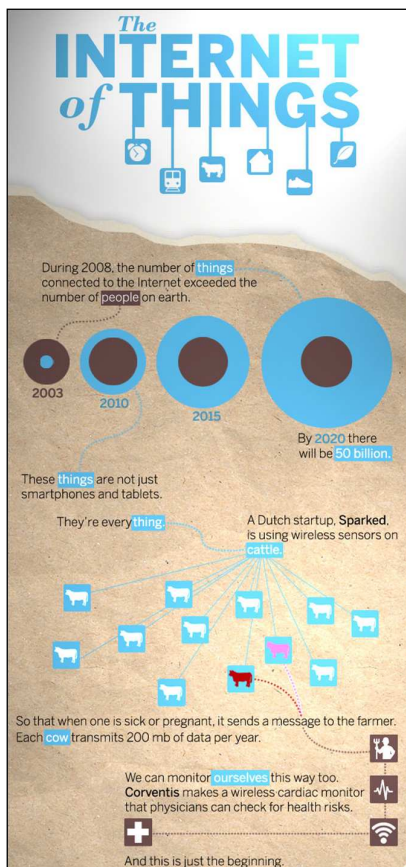
Kazimierz BECEK

Wroclaw University of Environmental & Life Sciences, Poland
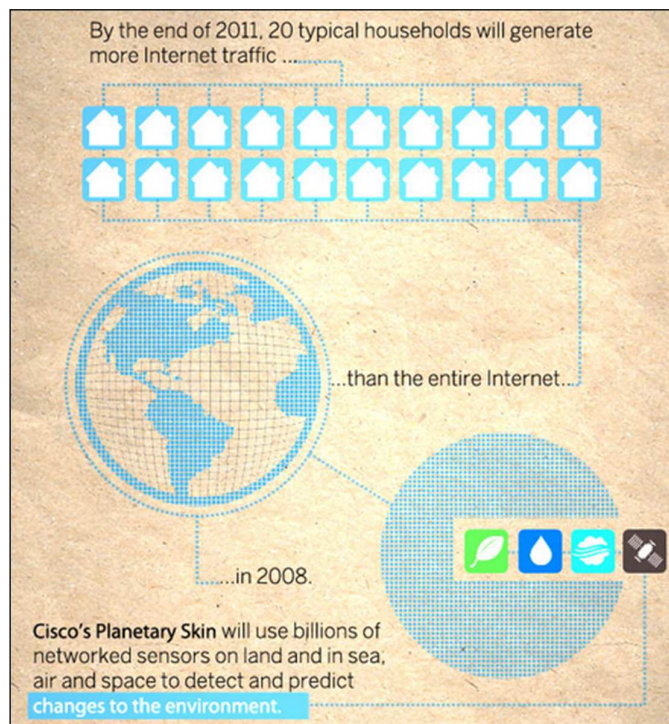
Soartech Systems Sdn Bhd, Brunei Darussalam

The Internet of Things

The addressing power of the Internet Protocol version 6 (IPv6)

XXV International Federation of Surveyors. Congress, Kuala Lumpur, Malaysia, 16 – 21 June 2014
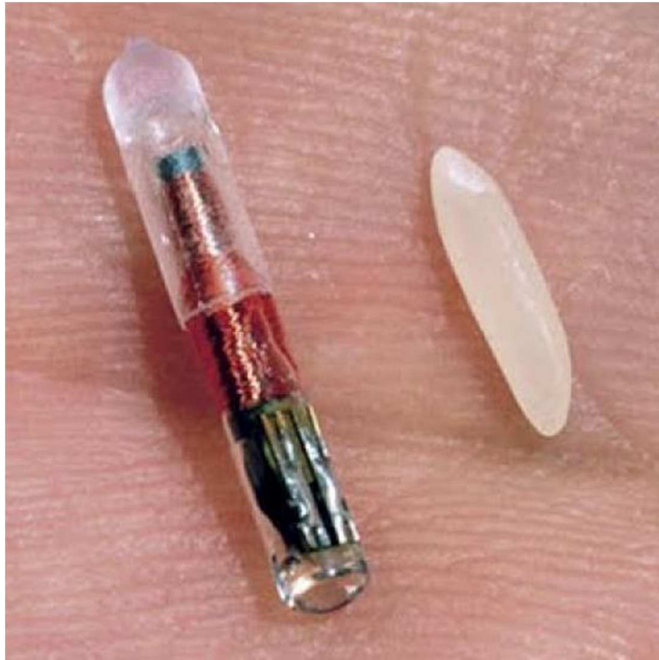
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XXV International Federation of Surveyors. Congress, Kuala Lumpur, Malaysia, 16 – 21 June 2014

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RFID - Radio-frequency identification

The Food and Drug Administration in the US has approved the use of RFID chips in humans…
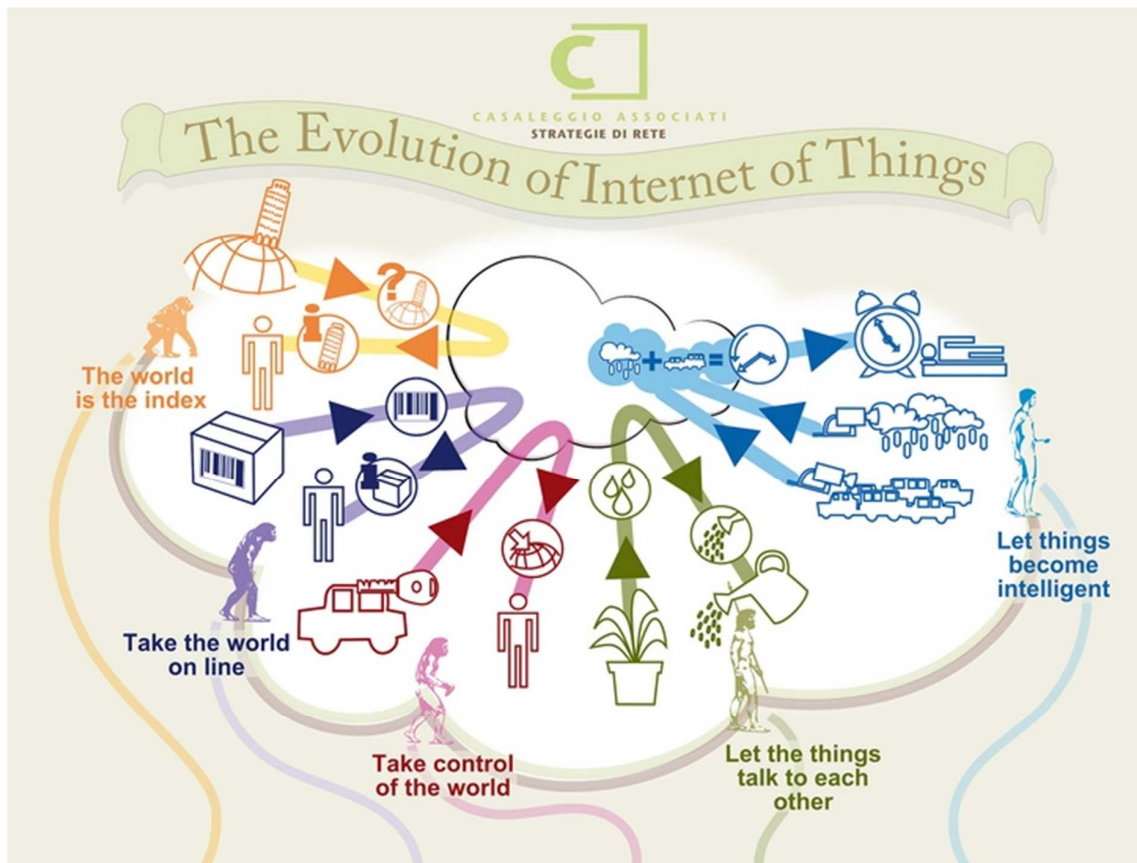
A recent story related to IoT...

IEEE SPECTRUM

Medtronic Wants to Implant Sensors in Everyone

By Eliza Strickland
Posted 10 Jun 2014 | 13:00 GMT

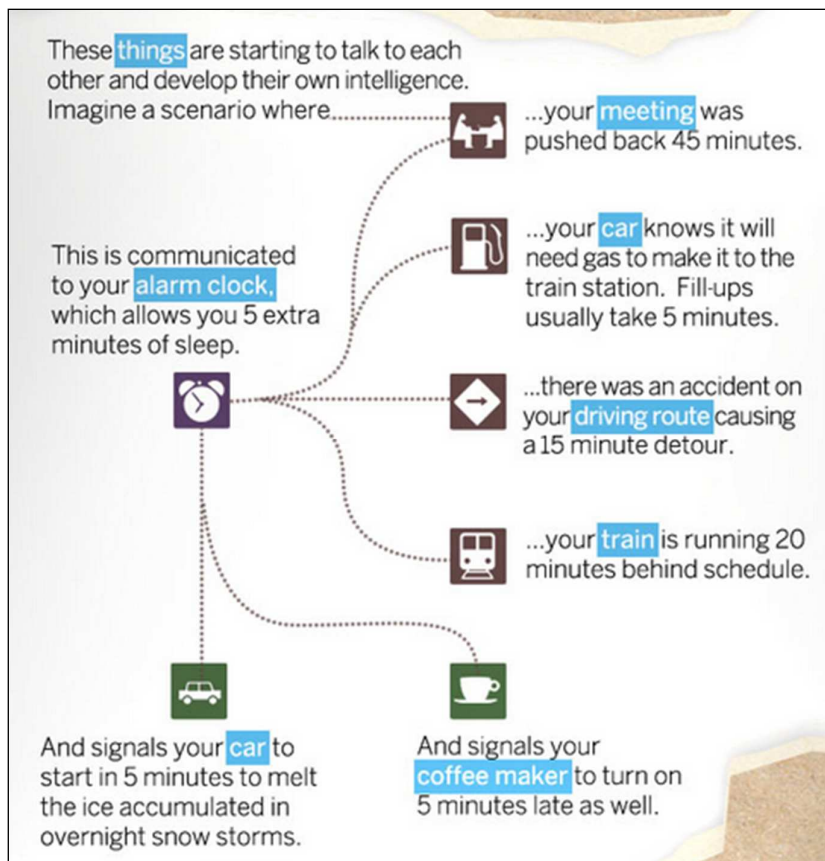

The Evolution of Internet of Things

The example

All the monuments of the world are described in detail on the Net.	The packages that we send are tracked on the Web and we know where they are.	Lost or stolen objects (eg keys or car) can tell us where they are.	Plants can water themselves when they are thirsty.	The alarm can ring earlier in case of traffic or bad weather.

How it works

Objects are identified by their position in the World. They have an information shadow on line, but there is no direct interaction with the object.	Moving objects are uniquely identified by a code. They have an information shadow on line, but there is no direct interaction with the object.	The objects are connected to the Internet and interact with people: they communicate, take orders and state information about themselves (e.g. their position if they are lost).	Objects communicate with each other and action each other to the occurrence of certain conditions.	Objects communicate with the Net to which they provide information that can be elaborated and used as new knowledge.

Technologies

Augmented Reality Geotagging GPS	RFID NearFieldCommunication Barcode Visual Recognization	Remote control	Machine2Machine	Object Generated Content (OGC) Device to grid

On the market

Audio on monuments Wikitude Google Earth	Championchip Collari RFID Stickybits, Mir:row It's alive inside Traced cows Catchthebusapp Nokia 6212, iCarte Google Shopper SoundHound Shazam Picasa	iTunes Remote Homecamera Withings Botannicalls	Goodnightlamp iPhone+Nike (Nike+) Poken Pachube	WineM Nike Human Race GlowCap Intelligent meters

Source: Casaleggio Associati, 2011 - www.casaleggio.it/internet_of_things

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These things are starting to talk to each other and develop their own intelligence. Imagine a scenario where....

...your meeting was pushed back 45 minutes.

...your car knows it will need gas to make it to the train station. Fill-ups usually take 5 minutes.

...there was an accident on your driving route causing a 15 minute detour.

This is communicated to your alarm clock, which allows you 5 extra minutes of sleep.

...your train is running 20 minutes behind schedule.

And signals your car to start in 5 minutes to melt the ice accumulated in overnight snow storms.

And signals your coffee maker to turn on 5 minutes late as well.

The Internet of Things in action

- IoT is a dynamic global network infrastructure (...) that seamlessly integrates physical and virtual "things" that have identities, physical attributes, and virtual personalities into the information network. IoT is self configuring capabilities using standard and interoperable communication protocols.

(IoT Definition / IoT SRA-CERP Cluster 2009)

- Interfaces in the form of services facilitate interactions with these "smart things" over the Internet, query and change their state and any information associated with them, taking into account security and privacy issues.
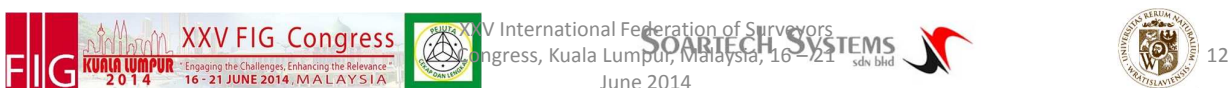
- In the IoT, "things" are expected to become active participants in business, information and social processes.
- The "things" are enabled to interact (…) among themselves and with the environment by exchanging data (…) "sensed" about the environment, while reacting autonomously to the "real/physical world" events and influencing it by running processes that trigger actions and create services (…) without (…) human intervention.

- This IoT Hub is provided by the two European Research project IoT - Architecture (IoT-A) and IoT - Initiative (IoT-i) as well as the Cluster of European Research projects on IoT (IERC).
http://www.internet-of-things.eu/

Kevin Ashton

is a British technology pioneer who cofounded the Auto-ID Centre at the Massachusetts Institute of Technology (MIT), which created a global standard system for Radio Frequency Identification (RFID) and other sensors.

The Internet of Things privacy concerns

What is the Paradigm of Geomatics?

- "A very general conception of the nature of scientific endeavour within which a given enquiry is undertaken" (1)

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(1) Collins English Dictionary – Complete and Unabridged © HarperCollins Publishers 1991, 1994, 1998, 2000, 2003.

What is the Paradigm of Geomatics?

- To provide the society with the quantitative and accurate description of position of objects in space at a given point in time (coordinates).

- To provide the society with an accurate identitfication and selected properties of geographic objects at a given point in time (attributes).

- As a product of contemporary Geomatics, a map always shows a past location of objects and their properties.

- Geographic objects are pasive subjects of Geomatics, and surveyors are active agent conducting the inquiry.
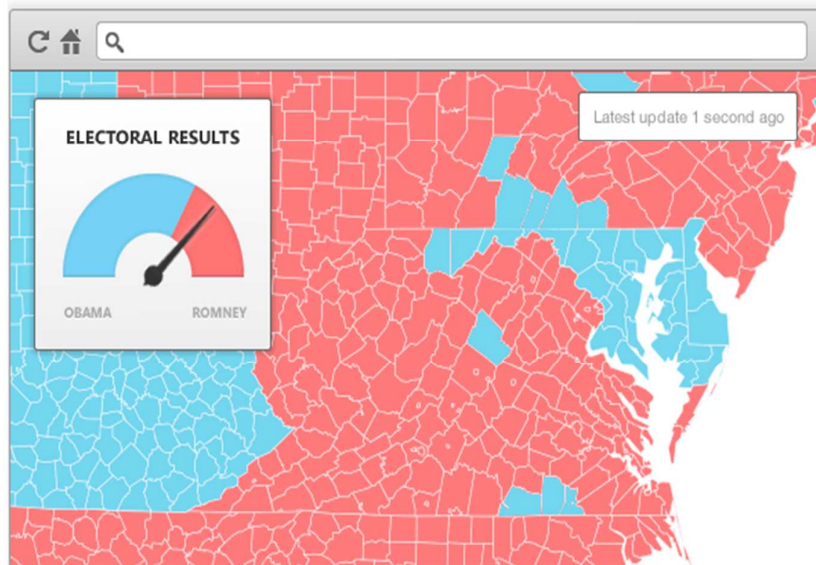
The Real-time Maps (RTM)

- A growing demand on RTMs in many sectors of human activities:

- Examples of RTM:
  - Weather maps (rainfall, lightning, clouds);
  - Logistic maps;
  - Surveillance maps;
  - Emergency response maps (flooding, fire, natural disasters),
  - Battlefield maps, and others

A Realt-time map

CartoDB – real-time mapping platform

The perfect solution for event tracking.

Whether you're mapping proprietary or user generated content, or want to integrate streams from the most popular social networks, CartoDB allows you to do so easily.

Just edit your data on your CartoDB tables through the UI or the API and all your connected maps will be automatically updated without refreshing.

Another Example of the IoT in action

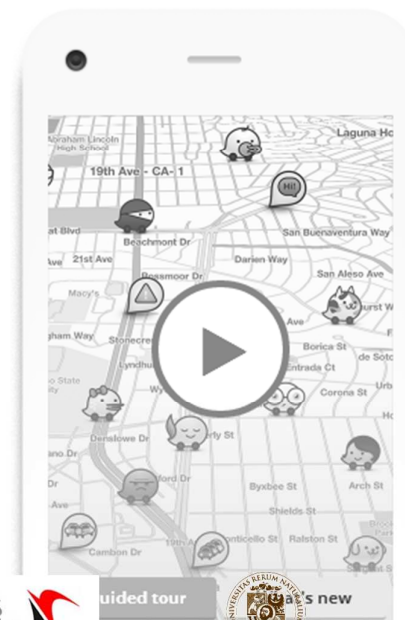**waze**   LIVE MAP   MAJOR EVENTS   SUPPORT   BLOG   ABOUT

Get the best route, every day, with real–time help from other drivers.

Waze is one of the world's largest community-based traffic and navigation apps. Join other drivers in your area who share real-time traffic and road info, saving everyone time and gas money on their daily commute.

WAZE. OUTSMARTING TRAFFIC, TOGETHER.

Confluence of IoT and GNSS

- What: Global trade item number
- Where: Global location number.

European GNSS Conference on 20 Feb 2014 in Brussels

Douglas Hill, Denmark, On GNSS added value
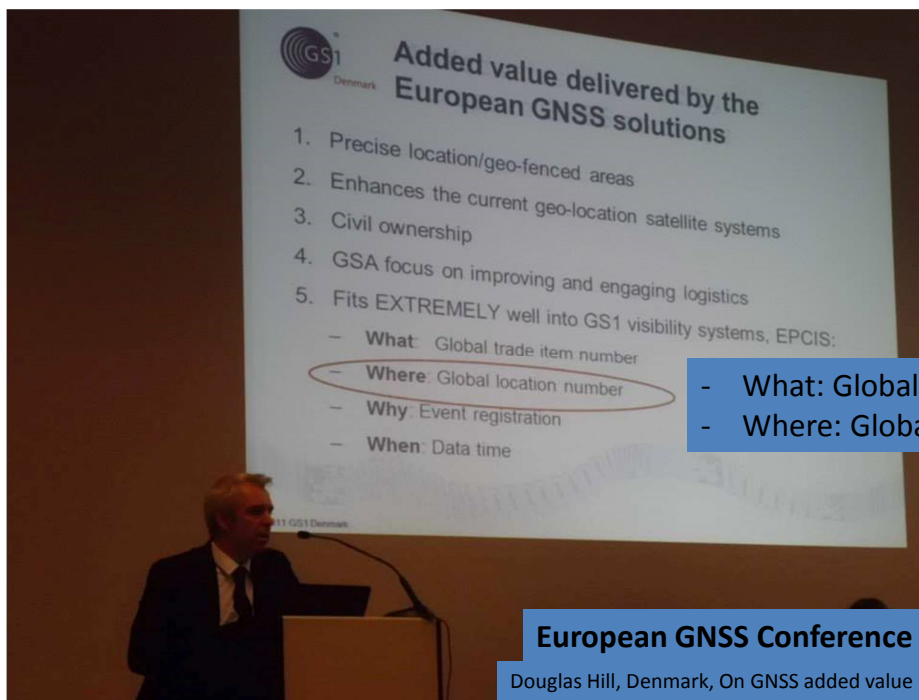
Global Earth Observation System of Systems (GEOSS)

A concept of the Internet of Things

Source: Modified Figure 1, (Kindberg et al., 2002)
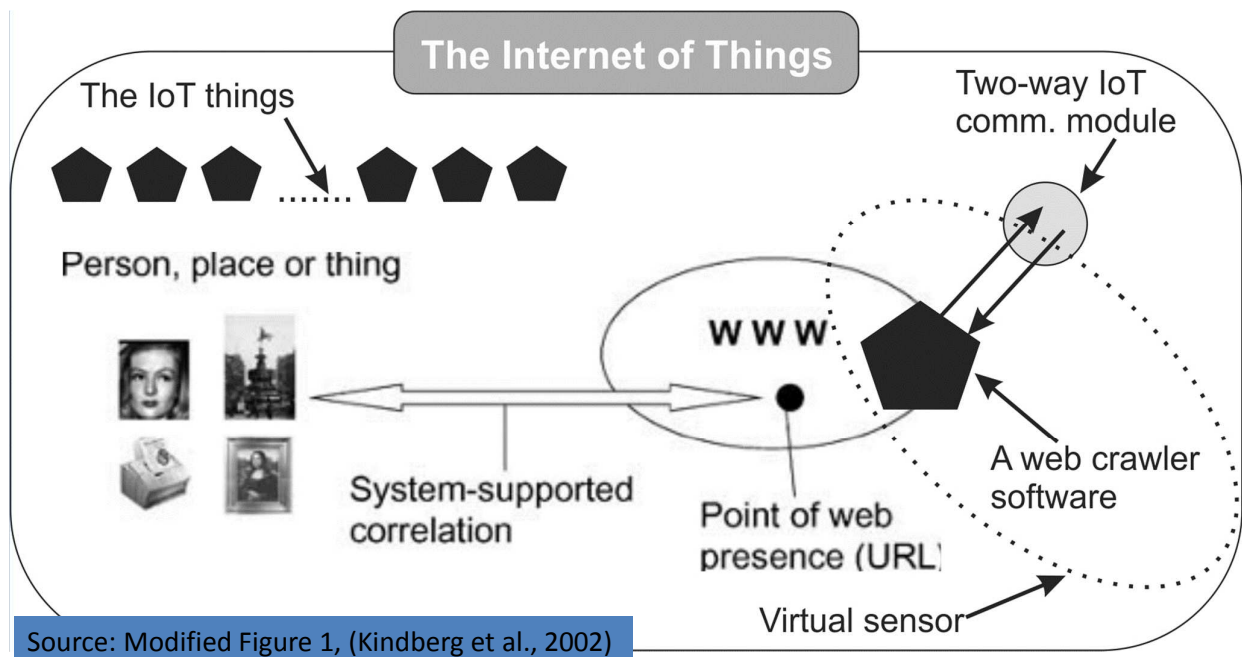
The IoT for Geomatics
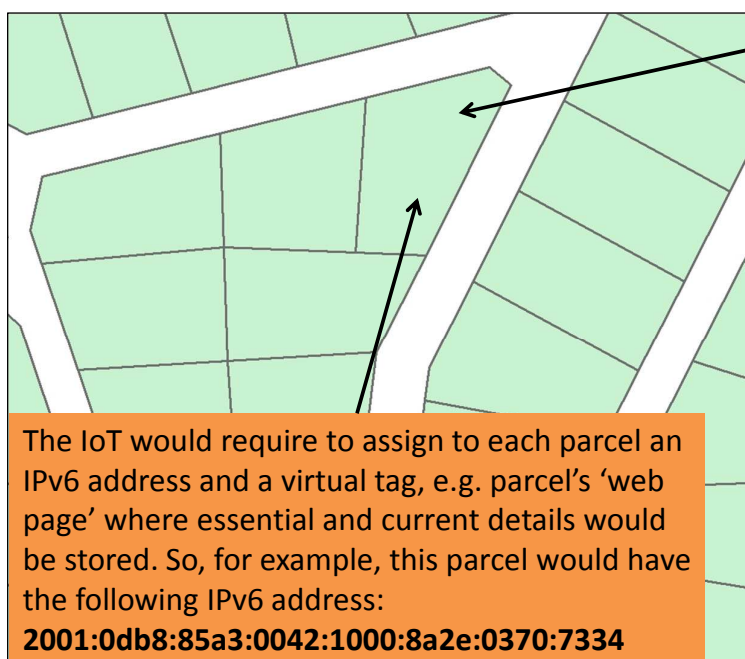
A land parcel – a geographic object usually described by its location and a set of several attributes including:
- parcel Id, e.g. SP12345
- ownership,
- land use type,
- land cover,
- valuation amount.

The IoT would require to assign to each parcel an IPv6 address and a virtual tag, e.g. parcel's 'web page' where essential and current details would be stored. So, for example, this parcel would have the following IPv6 address:
2001:0db8:85a3:0042:1000:8a2e:0370:7334

A virtual agent would discover all current facts about the parcel and update the relevant record assigned to the parcel.

Conclusions

- According to some studies, the Internet as it is known now, will case to exist.
- The IoT is been built on the assumption that the major source of data on geographic objects will be available from real or virtual "things" representing geographic objects.
- The new paradigm for Geomatics is that an enquiry about geographic objects will be made through harvesting data available from "things" representing these objects.

Conclusions (cont.)

- Geographic objects are to become the active agents of inquiries conducted in Geomatics.
- Geomaticians will be gradually playing a role of a passive agent in mapping processes.
- It is expected that a real-time map is to be gradually replacing a traditional static maps.