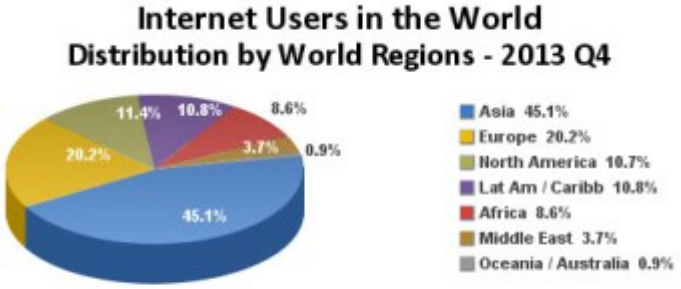
THE INTERNET OF THINGS

There should be no doubt, with the advent of the Internet our daily lives have changed in a remarkable fashion. From the Office for National Statistics (ONS), figures show that 36 million adults – or seventy-three percent (73%) – were daily internet users in 2013, up from the thirty-five percent (35 %) recorded in 2006, when comparable records began. Of course these figures are world-wide. The graphic below will indicate the breakdown by geographic region.



Source: Internet World Stats - www.internetworldstats.com/stats.htm
Basis: 2,802,478,934 Internet users on Dec 31, 2013

As you can see, our friends in Asia lead the pack by a remarkable margin with forty-five percent (45.1%) engaging the Internet on a daily basis. The chart below will indicate the increase in Internet usage by region also as well as providing additional statistics.

WORLD INTERNET USAGE AND POPULATION STATISTICS
December 31, 2013

World Regions	Population (2014 Est.)	Internet Users Dec. 31, 2000	Internet Users Latest Data	Penetration (% Population)	Growth 2000-2014	Users % of Table
Africa	1,125,721,038	4,514,400	240,146,482	21.3 %	5,219.6 %	8.6 %
Asia	3,996,408,007	114,304,000	1,265,143,702	31.7 %	1,006.8 %	45.1 %
Europe	825,802,657	105,096,093	566,261,317	68.6 %	438.8 %	20.2 %
Middle East	231,062,860	3,284,800	103,829,614	44.9 %	3,060.9 %	3.7 %
North America	353,860,227	108,096,800	300,287,577	84.9 %	177.8 %	10.7 %
Latin America / Caribbean	612,279,181	18,068,919	302,006,016	49.3 %	1,571.4 %	10.8 %
Oceania / Australia	36,724,649	7,620,480	24,804,226	67.5 %	225.5 %	0.9 %
WORLD TOTAL	7,181,858,619	360,985,492	2,802,478,934	39.0 %	676.3 %	100.0 %

NOTES: (1) Internet Usage and World Population Statistics are for December 31, 2013. (2) CLICK on each world region name for detailed regional usage information. (3) Demographic (Population) numbers are based on data from the US Census Bureau and local census agencies. (4) Internet usage information comes from data published by Nielsen Online, by the International Telecommunications Union, by GfK, local ICT Regulators and other reliable sources. (5) For definitions, disclaimers, navigation help and methodology, please refer to the Site Surfing Guide. (6) Information in this site may be cited, giving the due credit to www.internetworldstats.com.

If we look at penetration and growth, we see a huge increase just over the past five years.

The discussion today is not really about usage or the growth of the Internet. We wish to discuss several applications that are revolutionizing our daily lives. This revolution is generally called the **Internet of Things or IoT**. Other terminology for IoT is **M2M** or machine to machine. M2M is an absolutely fascinating use of technology with remarkable

applications. IoT generally refers to what some call the next-generation Internet, where physical objects are connected via **Standard Internet Protocol** or IP.

I was watching television several days ago when an advertisement began running. The driver of an automobile was required to look back at her baby snuggly strapped into a car seat. Her attention was diverted for only a second but just long enough for a truck in front of her to stop abruptly. Without applying the brakes, the car came to a gentle stop. A sensor in the grill of her vehicle detected zero movement of the truck ahead and sent that message to an onboard computer. The computer relayed a signal to the brake cylinders, thereby applying pressure—the car came to a stop. Machines "talking" to machines. Using an array of embedded sensors, actuators and a variety of other technologies, the loosely connected "things" can sense aspects of their environment and communicate that information over wired and wireless networks, without human intervention, for a variety of compelling uses. This is a great representation of IoT.

ECONOMY AND THE FUTURE

Let's take a quick look at where some feel we are going relative to IoT and M2M. The bullets below will give some indications as to what is to come.

- The total economic value-added from IoT across industries will reach $1.9 trillion worldwide in 2020, as predicted by Gartner, ***"Magic Quadrant for Business Intelligence and Analytics Platforms"***
- Fifty billion devices will be connected to the Internet by 2020, predicts Cisco Corporation.
- The remote patient monitoring market doubled from 2007 to 2011 and is projected to double again by 2016. The data generated from sensors is sent to monitoring stations where audible and/or visual indications result when a patient is in trouble.
- The utility smart grid transformation is expected to almost double the customer information system market, from $2.5 billion in 2013 to $5.5 billion in 2020, based on a study from Navigant Research. Of course, this will allow utilities to provide power at lesser rates and with more regularity.
- Wide deployment of IoT technologies in the auto industry could save $100 billion annually in accident reductions, according to McKinsey and Company.
- The industrial Internet could add $10-15 trillion to global GDP, essentially doubling the US economy, says General Electric.
- Seventy-five percent (75%) of global business leaders are exploring the economic opportunities of IoT, according to a report from The Economist.
- The UK government recently approved 45 million pounds (US$76.26 million) in research funding for Internet of Things technologies. (This is a huge sum of money. The Crown feels it will be money well spent.)
- Cities will spend $41 trillion in the next 20 years on infrastructure upgrades for IoT, according to Intel.

- The number of developers involved in IoT activities will reach 1.7 million globally by the end of 2014, according to ABI Research estimates.

As the Internet of Things ramps up and millions of devices become connected to the Internet, there is also a push to enable communication among all types of devices available on the Internet. These devices include process control systems, power line communication devices, precision machinery, and various types of infrastructure. One very critical aspect of properly working IoT devices is the need for simulation. Simulation is an essential element of building an IoT network. These networks are starting to become complex and ubiquitous, and the communication among them can be very unpredictable without considerable modeling. As we saw in the example above, successful braking is dependent upon feedback between the engine and actions of the automobile. As the braking systems are applied, fuel injection to the engine must lessen and eventually stop.

SYSTEM DESIGN

There are four (4) critical competencies needed by IT professionals for the design of systems to bring about successful and enduring operation of M2M devices. These are as follows:

- Learning how to design and implement **embedded software**. Mechanical engineers need to interface regularly with software specialists so both design aspects of the product evolve concurrently. The ME can no longer “throw it over the fence” and let the “boys” in IT solve the remainder of the problems. Also, a much higher level of software development is needed WITH simulation prior to product launch.
- **Communication capabilities** will become paramount in developing software. Engineers will need to choose from dozens of proprietary and standard communication protocols, and factor in things like network protocols, potential radio frequency (RF) noise and interference, and the physical fit and placement of new communications components as a part of their requirements. Mechanical and electromechanical design teams now have to think about communications and what domain constraints might affect layout and design.
- **Instrumentation** is absolutely critical to amass, store and manage data collected by “smart products”. Understanding the functional aspects as to how equipment is to behave will help design engineers anticipate potential failure modes much more effectively, which in turn effects how they specify instrumentation packages into designs.
- **Data and security** is an absolute MUST for any M2M application and safeguards must be factored into IT considerations. IT, typically has ownership of the data and with this being the case, IT needs to be folded in with initial planning of the product or the assembly of components. Engineers CANNOT build devices in isolation if they want to take complete advantage of all possibilities.

Source : http://cielotech.wordpress.com/2014/10/25/the-internet-of-things-or-iot/