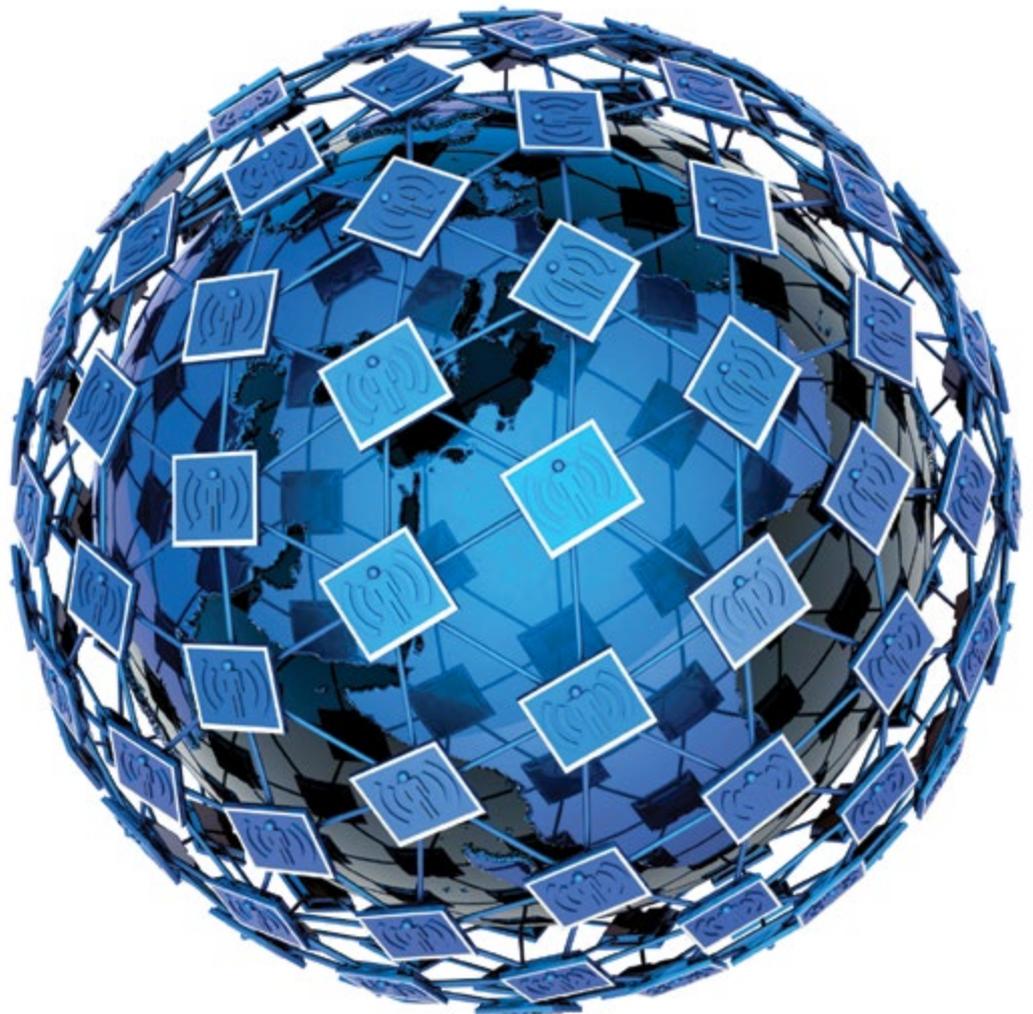


## Machine-to-Machine: Vision 2020

Is India ready to seize a USD 4.5 trillion M2M opportunity?





# Foreword



Machine-to-machine (M2M) would make those things possible and affordable, which are currently not feasible to be delivered, in a vast country like India. Technologies that enable M2M communication such as GPS unit, RFID, GPRS modules, etc. have much to offer to the developing world towards improving quality of life. In fact, these next-generation communication technologies may well originate in the larger growth markets of the developing world, particularly – China and India.

M2M can help in achieving many Millennium Development Goals of the United Nations through useful applications for medical diagnosis and treatment, cleaner water, improved sanitation, energy conservation, the export of commodities and food security. These M2M applications and services aim at improving the operational efficiency, productivity and collaboration.

M2M could help in solving some of the basic challenges being faced by India in terms of lack of infrastructure for healthcare, education, banking, etc. It could bring about radical change in the traffic congestion, accidents, emergency services, payments systems and ticketing, etc. – some of the critical areas faced in day to day life.

Smartphones and tablets are helping to control and to monitor hundreds of connected devices at home, office, car, and other possible places. This leads to enormous opportunities for smart homes, smart cars, and even smart cities, where everything is connected and could be controlled remotely.

M2M applications have a great potential to transform businesses. It will challenge companies to be innovative in the same way as mobile internet did. Given the diverse nature of M2M applications, some sectors will be more successful and emerge as a winner amongst others. The opportunity for mobile network operators (MNOs) lies in moving up the value chain vis-à-vis just providing data carriage services. The need of the hour for MNOs lies in providing end-to-end services.

However, for M2M to gain acceptance among the general populace, service providers and others players in the value chain are required to deliver applications that bring tangible value to peoples' lives.

Several barriers, however, have the potential to slowdown the development and adoption of M2M applications. Deployment of IPv6, sensor energy, standards in terms of security, privacy and architecture, current low-cost business models, network upgrades and regulatory compliances will pose challenges for all players in the M2M ecosystem. Since M2M technologies would cater to several industries such as healthcare, education, automotive, agriculture, telecom networks will need to support these vertical-tailored applications as per business and regulatory requirements.

However, despite these challenges, the enormous benefits and opportunities make M2M an untamed driver of innovation and economic growth throughout developed and developing countries. It's time to overcome these challenges and unleash its full potential. As per the World Bank study, a 10% increase in mobile and broadband penetration increases the per capita GDP by 0.81% and 1.38% respectively in the developing countries. This increase in GDP on account of telecom penetration can get further multiplier effect through M2M communication penetration. Hence, it is imperative to focus on M2M communication from a strategic growth perspective for the country.

**Hemant Joshi**

# Message from Industry Mentor



Machine to Machine or more commonly called M2M is the technology which enables various machines at remote and far flung places to make two way communications for remote monitoring and control. M2M had been historically managed by wired systems, but with increased coverage and bandwidth availability, M2M manufacturers are shifting towards wireless based Mobile communication systems.

In India, we have seen the arrival of wireless M2M almost 10 years back in the form of Vehicle tracking and since then we have seen roll out of many applications including Vehicle tracking, Automatic Meter Reading (AMR) and Wireless Point of Sales (POS) by Banks and Courier companies. Many Mobile Companies have been involved in these projects but mostly limited to providing SMS and GSM GPRS based connectivity as till now most of these projects are front ended by 'System Integrators' and 'Software Companies'.

Idea Cellular has been at the forefront of introducing M2M Services recently and completed Pan India roll out of a unique innovative 'exclusively for India' M2M service which has transformed the lives of nearly 50 million Indian households and prevented black-marketing of LPG cylinders. Idea has helped automate gas booking process for IOCL and HPCL. The solution is working in over 16 states for last 2 years.

Some of the other large projects where Idea Cellular has provided high quality M2M solution to our Enterprise clients and assisted them in delivering/ improved efficiency of their product offerings include Automatic Meter Reading (AMR) solution for UP & AP 'Power Distribution Companies (DISCOM)/ AMR for NDPL (North Delhi Power Limited), Vehicle tracking systems and wireless Point Of Sales (POS) terminals for number of nationalised and MNC banks & courier companies. While the quantum of these connected devices is only in few million with low revenue contribution, we are confident that this is just the tip of an iceberg. Industries like healthcare, logistics, manufacturing, security & surveillance, retail/home automation sectors are yet to experience the benefit of M2M, and Idea has begun earnest trials with multiple applications. In the last 2-3 years, we have seen a lot of initiatives and reform programs by Indian Government like UIDAI (Unique Identification Authority of India), Micro-Banking, R-APDRP (Restructured Accelerated Power Development & Reforms Programme), JNRUM (Jawaharlal Nehru

National Urban Renewal Mission), and in the space of City Surveillances & Smart Grid which require Mobile companies like ours to support millions of connected devices in the coming years and become the catalyst for growth of M2M market in India.

Separately, Idea Cellular is actively exploring and evaluating new 'Retail and Enterprise' applications which need high bandwidth and connectivity, including products like 'Security & Surveillance', 'Smart Home', 'Location based services', M-health and Mobile Device Management(MDM). We expect the existing and new applications to be drivers of M2M Services in the country.

Our study shows Indian M2M opportunity is likely to reach 100 million USD by 2016 as ecosystem is fast evolving. The challenges for growth of M2M business are technological including protocol standardisation, IPV6 migration, network optimisation, Cyber Security threat and Regulatory in terms of policy direction, clearances, support and high cost of module pricing etc., making the final offering not meet the aspiration of large scale adoption both at Retail & Consumer Enterprise User end. We believe, over a period, as technology matures, module and application pricing would meet mass market expectation.

From their side, the Indian Mobile Industry has taken a lead to play much bigger role beyond providing SMS & Data connectivity on pan India basis to participate in execution of large projects, transition its IT capabilities and understanding of devices, its interplay with network to support /manage millions of device customisations with the present mobile infrastructure. Idea's example of successful execution of large IOCL and HPCL projects is the harbinger of trends to emerge in future of M2M in India.

While current technological, regulatory and business challenges are making the analysts and research firms project low numbers for connected machine numbers by 2020 in India, we in the Telecom Industry believe M2M is going to surprise the investor community by growing in leaps and bounds and becoming in the medium term, a game changer in the lives of Indian population and their interplay with devices.

**Himashu Kapania**  
Managing Director, Idea Cellular Limited

# Overview

The promise of a world of connected devices, in which machines of all types and sizes can autonomously communicate with each other, has long been imagined. The past year has seen a surge of interest around the core enabling technology of the connected world: machine-to-machine (M2M) communication. As per GSMA, the proliferation of connected devices will create a USD 4.5 trillion market for global business by 2020.

## Defining Machine-to-Machine (M2M)

M2M, the acronym for Machine-to-Machine Applications (or more aptly, Mobile to Machine and Machine to Mobile communications) is an emerging area in the field of telecom technologies. For instance, Forrester report<sup>1</sup> of December 2011 notes that “M2M is a broadly applied, and therefore malleable, term; it is also referred to as the “Internet of Things,” the “Extended Internet,” or “Connected Devices.” Forrester defines M2M as “technologies that collect and transfer information on the condition of physical assets or people.” Ovum, in a mid-2010 report<sup>2</sup>, defines it as “communication where a remote machine is monitored or controlled by a central server.” The Yankee Group defines<sup>3</sup> M2M in terms of three categories “enterprise M2M devices, consumer M2M devices and connected computing devices”.

Figure 1: M2M technology



Source: Deloitte

A range of definitions give a broader or a narrow perspective of the M2M concept. While narrow definitions of M2M cover interaction between devices without a user interface e.g. automated vehicle tracking; the broader ones cover interaction between devices with a user interface. However, in this case the user does not maintain a relationship with the provider. Amazon, for instance, sells 3G-enabled Kindle Fire tablet as an M2M device. It buys wholesale bandwidth from AT&T and manages the end-user relationship.

1 Forrester, 2011. M2M Connectivity Helps Telcos Offset Declining Traditional Service. p. 4

2 Ovum, 2010. Operator Strategies in Machine-to-machine Communications. p. 2

3 Yankee Group, 2011. Mobile Broadband Connected Future: From Billions of People to Billions of Things. p.2

### M2M Ecosystem

M2M Ecosystem comprises of carrier MVNOs, hardware OEMs, supply chain, middleware, software application, deployment and asset management. A typical M2M solution consists of five to six stakeholders and each of these stakeholders perform one or more of dedicated tasks, as part of the end-to-end solution. These tasks include connectivity, platform, software development, integration services, consultation, deployment and activation.

“Healthcare, education, and skills enhancement are areas where M2M deployments hold huge potential in rural India.” - Ashok Chandak, Senior Director, Global Sales and Marketing at NXP Semiconductors India

### M2M Opportunities

M2M market has received lot of attention over the last few years as a business opportunity for substantial growth by the mobile operators, niche M2M software developers, various device manufacturers, systems integrators, network equipment vendors and consulting organizations.

Gartner predicts there will be nearly 26 billion connected devices, with a global economic value-add of \$1.9 trillion by 2020<sup>4</sup>. The International Data Corporation (IDC) estimates that devices connected to the Internet will generate nearly \$9 trillion in annual sales by 2020<sup>5</sup>.

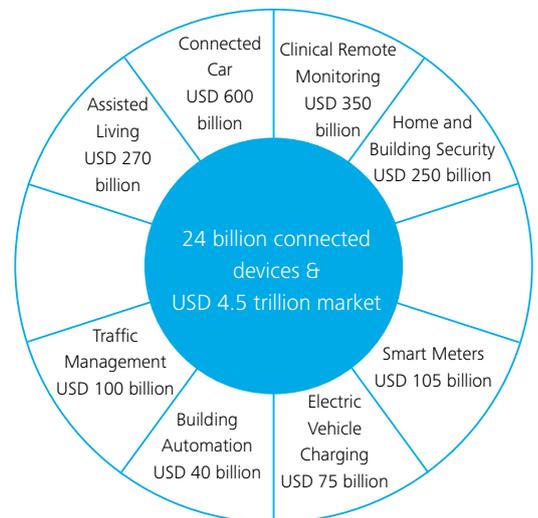
4 Peter Middleton, Peter Kjeldsen, and Jim Tully, “Forecast: The Internet of Things, Worldwide, 2013,” Gartner, November 18, 2013

5 IDC, “The Internet of Things Is Poised to Change Everything, Says IDC,” October 3, 2013

6 6Wresearch, India <http://www.6wresearch.com/market-reports/india-machine-to-machine-modules-market.html>

The opportunity for MNOs lies in moving up the value chain vis-à-vis just providing data carriage services. The need of the hour for MNOs is in the provisioning of end-to-end services. For example, in a M2M enabled home security application, there will be revenue from device sales, installation and monthly service fees. There might be small revenue from data traffic for MNOs.

Figure 2: Key figures in 2020



Source: GSMA on Business Impact of Connected Life

According to the Cyber Media Research (CMR), there is huge growth potential for Indian telecom industry in M2M applications. The Indian M2M application market is witnessing significant traction particularly in Automotive, Transport & Logistics, and Utilities sectors. The M2M application market in India is now witnessing a shift towards wireless based communication systems vis-à-vis wired systems of the past. The catalyst of growth in these sectors is the requirement for remote monitoring and control of devices that are already deployed or to be deployed in future. M2M could help in solving some of the basic challenges faced by India in terms of lack of infrastructure for healthcare, education, banking, etc. M2M could bring about radical change in the traffic congestion, accidents, emergency services, payments systems, ticketing, etc. - some of the pain areas faced in day to day life.

6Wresearch, India<sup>6</sup> has done a forecast of Indian market for 2011 – 2016. Their forecast is based on the analysis of applications across Utilities, Security,

Automotive, Transport & Logistics, Healthcare, Retail & Financial Services sectors/verticals spanning across three different types of access technologies – Short range (Wi-Fi, Bluetooth, Zigbee), Cellular (2G & 3G) and Satellite. According to 6Wresearch, India M2M market is expected to reach USD 98.38 million by 2016, with a CAGR of 33.81 per cent from 2011-2016. For the same period, cellular M2M modules are expected to grow with relatively higher CAGR of 35.32 per cent.

The CMR report<sup>7</sup> has identified following factors responsible for the growth of M2M market in India:

- Efforts of mobile service operators to generate new income streams
- Well established telecom infrastructure
- Introduction of 3G and recent launch of 4G
- Minimizing human efforts
- Demand for telematics
- Growing smart metering market, etc.

Government of India is increasingly taking serious initiatives to deploy smart energy meters to address the concern of increasing power theft and round-the-clock monitoring of power supply therefore it is expected that Utilities sector will drive the future growth of Indian M2M market. Indian market is presently dominated by short range modules such as Wi-Fi, Bluetooth and Zigbee. In the coming years, a shift is expected towards cellular and satellite M2M modules. Cellular M2M module will emerge as the market leader. 3G based modules are expected to be deployed in the coming years vis-à-vis the present deployment of 2G / 2.5G based cellular modules.

### The new business model

MNOs are used in a business model where they have a two year contract for the consumer device, device replacement every 12-18 months and some degree of customer churn. In contrast, connected machines such as remote environmental sensors, industrial machines, automobiles, devices to track cargo/point of sale devices may be operational for a period ranging from five to ten years. The service contracts may be for a period of two to five years and there is negligible customer churn.

The average revenue per device for MNOs from connected devices in M2M ecosystem, is likely to be in the range of USD 2-5 per month, since these are low speed and low usage applications. This is very low vis-à-vis average revenue per user of USD 40-50 a

month from data services for smartphones and laptops/tablets with mobile broadband connections. This market scenario demands a totally different approach from MNOs and other stakeholders in M2M ecosystem, towards deployment and ongoing maintenance and support.

### The future of M2M

M2M applications have a great potential to transform businesses. Machine-to-machine communication will challenge companies to be innovative in the same way as mobile internet did. Given the diverse nature of M2M applications, some sectors will be more successful / innovative and emerge as winner than other sectors. However, for M2M to gain acceptance among the general populace, service providers and others must deliver applications that bring tangible value to peoples' lives.

Greater clarity on standards for the interface, wireless communication protocols, clearly defined partnerships and standards will fuel rapid acceptance of M2M applications. Similarly support from governments in setting international standards, clarity on regulatory regime and expansion of cloud based services will be the growth drivers for M2M applications.

### M2M application in the Indian market

As the momentum around M2M applications deployment started picking up in the US and Europe during 2010-11, many Indian companies started working on M2M. In India, it is expected that M2M revenue will be driven by opportunities in making buildings and cities intelligent and utilities smarter. IT services companies like Infosys, Wipro, Tata Consultancy Services, and Tech Mahindra are working on designing and developing M2M solutions. Besides these IT services giants, a number of start-ups are also working on design and development of M2M solutions.

Wipro is working on the design and deployment of products like smart meters and healthcare devices. One of the healthcare device developed by Wipro, can be worn as a necklace or a belt. A doctor at remote location (without visiting patient home or hospital) can monitor a patient's respiration and heart rate, in real time on his smart phone/tablet. The device will be marketed by medical equipment manufacturers. Wipro is also working on making pumps smarter for agricultural irrigation.

<sup>7</sup> CyberMedia Research "India Wireless M2M Modules Market Review, 2011-2015" (June 2012)



Chennai Tax Corporation has replaced a manual process of property tax collection with SIM card-based machines, which run on the networks of Bharti Airtel.



Orissa State Transport Corporation buses have their seats embedded with SIM card-based devices that send alerts to digital billboards on bus stops to indicate the number of seats vacant.



Punjab State Education Department is using biometrics on top of a SIM card-based device that relays attendance record of teachers in government schools to a central database.

One of the bottlenecks, in the M2M world is the lack of interoperable standards, which makes it difficult for one machine to communicate with another. To overcome this problem, Infosys is building a library of solutions. Uptake of M2M solutions is expected to pick up rapidly, once these interoperable standards are available. Infosys is also working on M2M applications for safety of oil and gas pipelines. Data from sensors in the oil and gas pipelines is analyzed to predict chances of failure and to understand causes of damage.

Nokia has worked with Bangalore based developers Divum to develop an application running on the Nokia N8, that lets consumers control mini model cars through Wi-Fi and motion sensing. Divum labs has successfully developed and deployed M2M interface, to control complex machines like automobiles with built-in features of a smartphone. Divum has developed a prototype of an unmanned vehicle that can be used for security applications in difficult terrains.

Chennai-based online software product company, Zoho, has developed a M2M product known as 'ATM Site Manager'. An ATM installation has air conditioners, security cameras, door locks, lights, generators and backup batteries. Zoho's M2M solution remotely manages all these. Sensors are put on the equipment, which is wired to the hardware. The hardware sends the information about door and equipment usage to the central monitoring software and the ATM administrator

is notified of problem with the ATM installation. Zoho is also working on solutions to monitor mobile towers, toll road infrastructure and power grids. Sensors attached to power lines can capture data relating to voltage as well as attempts to pilfer. System integration and ongoing maintenance and support of M2M applications are big opportunities for Indian IT companies, in addition to design and development of M2M solution.

MNOs such as Vodafone and Bharti Airtel are also working on design and development of M2M solutions for the Indian market. Vodafone has developed SIM card-enabled smart meters that can relay meter readings to energy providers. Bharti is running a pilot in Orissa wherein sensors installed in buses can help track fuel consumption. Reliance Communications is working on high impact M2M applications that aid automation, surveillance, remote monitoring, and data gathering.

UK-based M2M communications company, Telit Communications, has entered the Indian market. According to Telit, introduction of large-scale national agendas such as Aadhaar (UID) and Restructured Accelerated Power Development and Reform Programme (R-APDRP) will fuel the growth of M2M market in the country. Prominent global M2M module vendor such as Sierra Wireless, Gemalto (with the acquisition of Cinterion) and SimCom have also evinced keen interest in Indian M2M market.

# M2M from the Telecom Operators Perspective



## Introduction

Mobile M2M connections are the new services and business models that have recently received significant market traction. Falling device costs have made M2M technologies feasible for mass market adoption.

More and more enterprises are considering the M2M opportunities to bring real benefits to their operations and their customers. At the same time, Mobile Network Operators (MNOs) are looking for new growth areas to supplement contracting traditional markets. M2M

market is providing the MNOs an opportunity to significantly boost their top line and bottom line, by enabling M2M solution for various applications and industries, by adapting to this technology.

The extent to which MNOs can capitalize on this opportunity is dependent on their ability to “move up the stack” to provide “value added services”, in order to generate more revenue per connection. The sectors from which the operator can gain revenues are as follows:

- Telemedicine / Healthcare
- Transportation / Fleet management
- Industrial application
- Home applications
- Financial services
- Agriculture
- Security
- Energy & Utilities

The MNOs not only provide the carrier facility and VAS but also have the key responsibility to manage the data intelligently so that the transformed data can be utilized in an effective way.

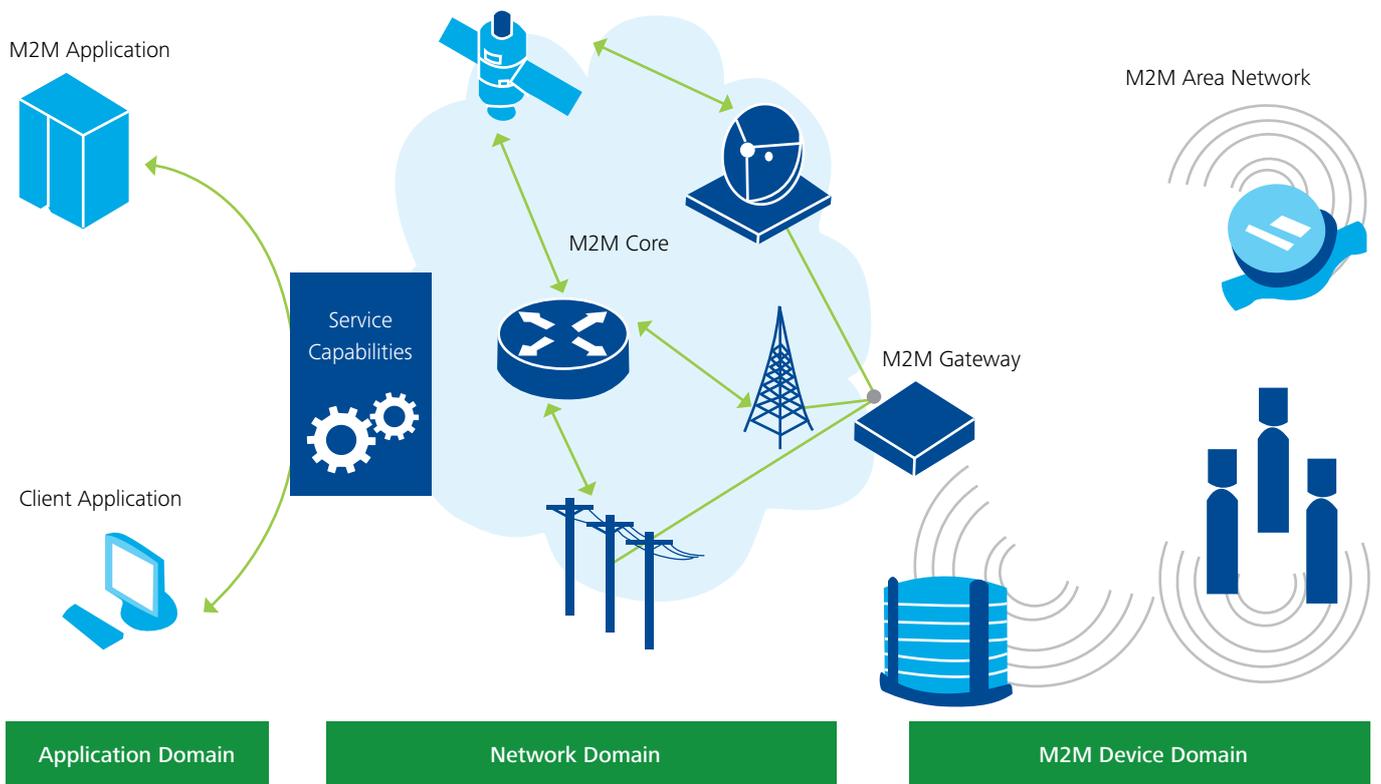
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“Connected devices using telecom networks will explode. They will overtake the human subscriber base by 2020 or even earlier.” - Najib Khan, CMO (Enterprise Services) at Bharti Airtel

### Architecture

The high-level architecture concept for M2M application support is as follows:

Figure 3: M2M Architecture



Source: Deloitte

- **M2M Device:** It is equipped with sensors and transceivers, capable of replying to requests for data contained within those devices or capable of transmitting data contained within those devices autonomously.
- **M2M Gateway:** The Gateway provides control and localization services for data collection and ensures that M2M devices are interworking and interconnected to the communication network. Gateway supports Bluetooth, Zig Bee, GPRS capabilities.
- **M2M Communication Networks (network domain):** Involves communications between the M2M gateways and M2M application servers (3G, LTE, WiMAX, WLAN, and wire-line).
- **M2M Applications:** Contains the middleware layer. Business intelligence is hosted on application server for execution of M2M business logic.

- **M2M Area Network (device domain):** Provides connectivity between M2M devices and M2M gateways - wireless personal area networks (WPANs), Wi-Fi, Zigbee/802.15.4, Bluetooth and RFID.

### Potential market size of M2M opportunity in this sector

Faced with otherwise stagnating or shrinking traditional markets and revenue streams, MNOs are clearly recognizing M2M, as a significant growth opportunity of the future. The number of M2M connections worldwide is expected to grow quickly over coming years, representing a significant opportunity for a wide range of potential market participants. The majority of wide area M2M connections will be wireless. This growth is driven by

- (a) The homogenous nature of the solution,
- (b) Ease of deployment of these technologies and

(c) The potential of these technologies to support a wide array of mobile applications.

### Global Market

Gartner projects that companies will spend nearly USD 5 billion by 2016 on consulting and implementation services related to cellular machine-to-machine (M2M) communications; with mobile network operators dominating the market.<sup>8</sup>

### Indian Market

The growth of Indian M2M market is driven by certain critical aspects like launch of 3G networks, the MNOs looking at alternative revenue streams, the increasing demand for remote monitoring & control and government initiatives. The Indian M2M market encompasses following three technologies:

- Short Range - Wi-Fi, Bluetooth, Zigbee, Ethernet
- Cellular – 2G and 3G
- Satellite

Short range M2M connections, accounting for close to 50% of the total market revenues, lead the Indian M2M market. According to 6Wresearch, India Machine to Machine (M2M) market is expected to reach USD 98.38 million by 2016, with a CAGR of 33.81% from 2011-2016, for all three technology streams (Cellular, Satellite, WiFi, Bluetooth etc.) put together. However, a clear shift towards cellular and satellite connections in M2M applications is expected in the coming years.

### Key M2M players

Gartner estimates that in 2013 operators not offering M2M will lose ground and that in 2016, the window of opportunity might be closed. Operators considering getting into the M2M business need to have a strategy in place. Almost all global MNOs have a strategy and a business unit in place to address this growing market segment. Some of the key players are as follows:

**1. SK Telecom, South Korea:** It is operating in utilities, vehicle/fleet management, asset management, health, environment and finance sectors. It has dedicated teams focused on M2M R&D, partnership, sales, marketing & standardization and specialist teams like Business to Government (B2G) team working on major strategic initiatives such as public security and other remote-monitoring applications. A major M2M initiative in South Korea is the USD 56 million Jeju Island Smart Grid project where SKT is part of a government-backed consortium.<sup>9</sup>

The project is in the first stage of a national program, which aims to cut-off USD 10 billion annual energy import payments and reduce Korea's CO2 emissions by a third.

**2. Verizon Wireless:** It provides M2M solutions for smart grid, point-of-sale, fleet management, health, and digital signage applications. To enterprise customers, it provides integrated solutions and for small to medium clients, it focuses more on broadband connectivity. Although its M2M services mostly use 2G and 3G networks, Verizon Wireless also offers 4G medical devices for ambulances and high-quality image transfer.

**3. T-Mobile:** The operator has a partner-focused business model. The company focuses on large capital intensive deployments of M2M solutions. The partners handle the smaller deployment providing the end-to-end solution like logistics, customer support and the physical product.

**4. Telenor:** It has a dedicated organization by the name "Telenor Connexion" providing M2M solution to automotive, security, utility, asset management and consumer electronics sector for the past 12 years.

**5. Orange:** The operator is a part of a global joint venture between France Telecom and Deutsche Telecom providing international access to M2M roaming connections, with full remote management to its customers. The company provides M2M solutions for automated utility meter reading, inventory management, transport and logistics, advertising and promotions etc.

**6. Telefonica:** Provides managed connected solutions to enable M2M solutions. The operator provides M2M solutions to utilities (electricity, water and natural gas), fleet and logistics management and automobile manufacturers.

**7. Nokia Siemens Networks:** The M2M software suite provided by Nokia Siemens Networks for GSM prevents the overloading of network with traffic. The solution reduces the amount of signaling information between M2M mobile stations and base transceiver stations. As a result, GSM operators with M2M service businesses don't require additional base station sites to accommodate more M2M users.

<sup>8</sup> Gartner, Market Trends: IT Services for Machine-to-Machine Communications, US, September 28, 2012.

<sup>9</sup> GSMA, Smart Cities, September 2012

## Challenges

While on one hand M2M represents a very significant potential revenue stream, on the other hand, it requires mobile operators to step significantly outside their core business areas to secure such revenue. Some of the key challenges are as follows:

- **New & different business model:** M2M being a new and different business model, cannot be effectively addressed by MNOs, with existing infrastructure and operational practices.
- **High deployment costs:** The cost of acquiring the infrastructure to launch new M2M applications is high and average revenue per user (ARPU) may remain low. Notwithstanding the expectation of huge customer base, it may take quite some time to recover the investment and start gaining profits.
- **Meeting benchmarks:** Telecom operators worldwide are investing heavily in building M2M capabilities, effectively setting a stiff benchmark of capabilities required to compete for M2M revenue.
- **Geographical coverage:** The demands of many potential M2M customers are regional or even global in nature, often extending significantly beyond the footprints of any single mobile operator. The fragmentation of mobile operator systems environments can hinder the deployment of regional solutions.
- **Complexity of applications:** Many applications are complex to develop and deploy. There is a chance of incompatibility from the network's view. Operators should factor such issues so that there is no hindrance following the deployment. The general mobile data is different from the M2M data. In that context the SIMs used in the M2M devices are also different from the traditional SIMs used in the mobile communication. Therefore, distributions, logistics & inventory of SIMs can also be a critical challenge.
- **Standardization:** There are a number of players in M2M ecosystem. Therefore, standardization is of utmost importance across all the devices for seamless operations. A common set of standards must evolve across the globe.

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“The telecom operators need to take a more daring approach toward M2M, as it holds the potential to increase ARPUs and reduce the subscriber churn. The government, telcos, as well as solution providers and consultants in the M2M space need to come together to give this market the critical push.” - Narendra Saini, CEO at Sukrut Systems

## Recommendations

1. Gross profitability for M2M services varies from 20 to 70 per cent. Such a wide variation is a reflection of how M2M service providers allocate network costs. M2M services delivered over 2G can be highly profitable, because the network may be depreciated and 2G M2M modules are cheaper.
2. CSP must strive to avoid being a bit pipe operator. They must find a way to widen their role. This will require striking a partnership with M2M developers based on revenue sharing.
3. MNOs should look beyond being M2M data wholesalers. They must focus on end-to-end service management and flexible billing for M2M applications, in addition to having revenue-sharing models with partners.
4. MNOs have expertise in securing data delivery, according to end customers' requirements. Hence, they must prioritize security because they have the required skills.
5. CSPs must consider end-to-end service management of M2M applications crossing into enterprises' privately-built networks where technologies such as Wi-Fi, wireless mesh and radio are used.
6. Instead of focusing on vertical market peculiarities,

MNOs must seek commonalities and applications matching several categories to build operational scale. Very few MNOs, are reselling functionally similar M2M applications on a horizontal basis.

7. There are several roles in M2M ecosystem - consultants, integrators, platform developers, device

testers, channel partners as well as M2M service providers, being fulfilled by MNOs. Not all the roles are desired or monetized. MNOs need to decide on their core activities and identify activities that can be undertaken by trusted partners.

### Case Studies

#### 1. AT&T

AT&T provides M2M solutions to several verticals including shipping and logistics, industrial automation, consumer electronics, telematics, fleet management and health.

AT&T's M2M activities are split between its Emerging Devices Organization (EDO) and Advanced Enterprise Mobility Solutions group (AEMS). EDO identifies new devices for consumers and enterprises, while AEMS works on enterprise platform and service components. AT&T's M2M activities have a prominent consumer-facing flavour, due to the successful launch of connected devices such as the Amazon Kindle and the iPad. AT&T expects strong growth in B2C mobile health, home security and energy sectors. A new Digital Life Services team identifies and champions new embedded devices within targeted industries.

Operationally, AT&T has outsourced most of its device provisioning and platform activity to M2M specialist Jasper Wireless. A partnership with KORE Telematics is used to speed device certification. The Jasper Wireless partnership has powered a core function: the AT&T Control Centre. This centre provides tools for M2M partners to monitor and control device activity, connection status, service costs, provisioning status, rate plan adjustments and billing. AT&T has also invested in its M2M certification lab, Data Developer Program, and API development for M2M applications. AT&T is more comfortable than many peers to have partners help drive new business. As M2M expands into B2C, AT&T is shifting its approach to be both evangelist and solutions provider.

#### 2. Vodafone

Key M2M markets serviced by Vodafone are automotive, utilities, consumer electronics and industrial automation.

Vodafone's dedicated M2M unit is known as Vodafone Global Enterprise (VGE) division and its target markets are large national and multinational enterprises. Vodafone's stated differentiators are its international network coverage, dedicated M2M organization, close links with the global enterprise and innovation groups and in-house technology, particularly its Global Data Service Platform (GDSP). The GDSP enables end-to-end visibility and service management, as well as, device and SIM provisioning. Vodafone works to integrate its platform with those of hardware manufacturers to enhance device configuration and management. Its integration with partner Verizon's platform will add to these strengths. Vodafone can offer service level agreements for end-to-end service monitoring and device control across 70 countries. It offers cross-border SIMs and SLAs, a global Home Location Register and a single tariff. Vodafone offers highly flexible pricing options to match varied consumption requirements of M2M devices and applications.

However, volumes of connections, reliability, latency, data volumes, geographic distribution and frequency of data collection vary. Pricing extends from per-connection, per-month tariffs to those based on reliability, resilience and availability. Content downloads from consumer devices may incur a partner revenue share. Vodafone also sells professional services to boost margin. The operator seeks to avoid a bit pipe role wherever possible.

# M2M in Automobile



## Current State of M2M in Automobile

In this age of M2M evolution and its deployment across all industry verticals, the automotive sector represents one of the greatest opportunities. Countries like China, USA, Japan and Germany, who are technologically and economically far more advanced as compared to the developing countries, have already adopted this advanced technology and India following their footprints is on its way to be number 5th in the Automobile sector. Intensive research is going in automobile sector with regards to M2M communication in the developed countries. Leading automotive companies such as BMW, Ford, Nissan, Toyota, Honda, Cadillac, Jaguar and many more around the globe are extensively working on developing M2M in automobiles.

Today with almost 3.60 billion<sup>10</sup> internet users across the globe ever imagined the shift in the lifestyle with internet-led talking machines and vehicles. The last

two decades witnessed a radical transformation of the automotive industry as it is increasingly becoming digitized with computer-based control systems heading this change. 'Telematics' (integrated use of telecommunications and informatics), cars, motorcycles and other road vehicles connected wirelessly are bound to bring tremendous change in everyone's lifestyle. Live traffic updates, smart routing and tracking or rapid roadside assistance in case of accidents or breakdown, automatic toll transactions, parking management, onboard entertainment, usage-based insurance and lots of other services fall under the umbrella of telematics. The business model followed by telematics companies currently is very simple: they transform existing automobile products into 'services' simply by connecting them to Internet. Hence, huge profits are generated from 'value-added' services and devices become secondary to the value it brings to the customers.

<sup>10</sup> Internetworldstats.com  
2012 estimated internet  
users

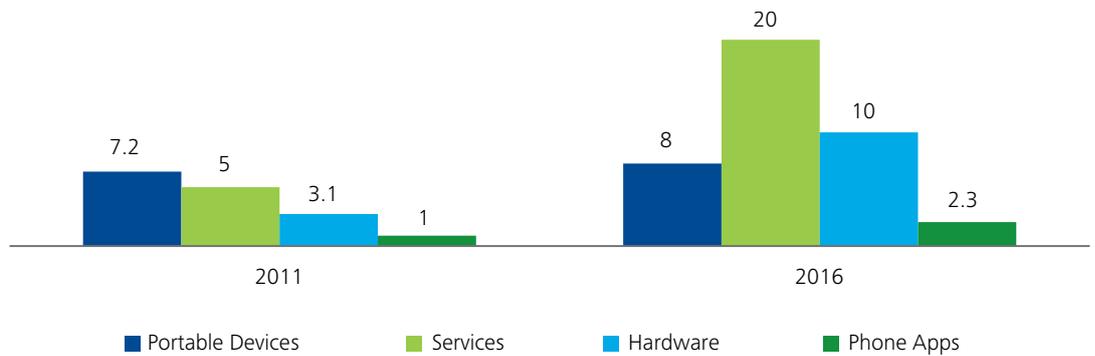
## Potential Market Size

### Global

The global market has tremendous growth opportunities. The global net market value of telematics components will grow to nearly USD 40 billion by the year 2016. Hardware will grow to nearly USD 10 billion globally.<sup>11</sup> In Asia, traditionally most of the telematics market is driven by navigation and its associated services, as well as, infotainment. The global net market in M2M is shown below:

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Figure 4: Global net market value for telematics (USD Billions)

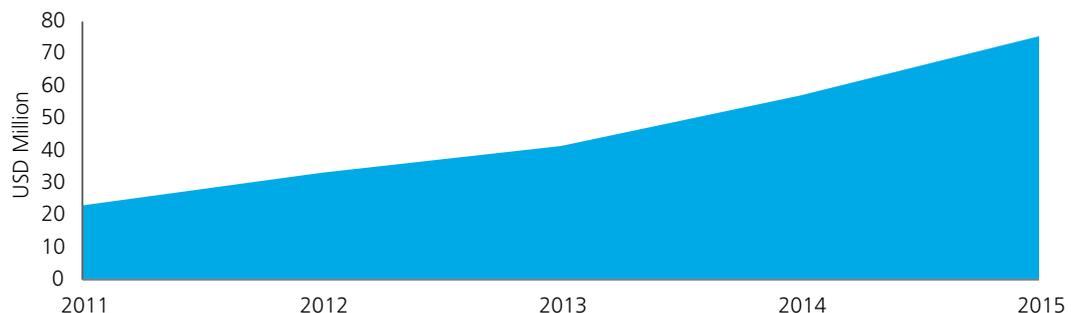


Source: BCC Research

### India

The M2M market in India has now started evolving. Car buyers are getting younger, i.e. the median age is almost 26 years. While a person aged 39 used to buy a car in the year 2000, the age bar fell to 33 in 2010. As the youth of India is also becoming more and more tech-savvy, they want their life to be as simple as possible. On the other hand, India is 3G and 4G-ready with a mobile subscriber's base of over 935 million - one of the fastest growing and second largest telecom markets in the world. With ever-rising mobile subscribers voice is increasingly becoming a commodity. Telecom companies in India have realized importance of M2M market in the automotive sector. As depicted in the graph below, it is expected that the Indian M2M modules market will grow from USD 23 million to USD 98 million with a CAGR of 33.81% from 2011-2016.

Figure 5: India M2M Modules Market (2011-2015)



Source: 6Wresearch

11 BCC Research, April 2010, Telematic Components

## Opportunities

### Global

From less than 90 million connections globally in 2010 the automotive M2M market will grow to almost 1.4 billion connections by the end of 2020<sup>12</sup>. With this, there is likely to be immense opportunities across varied verticals of M2M automobile sector.

With all these opportunities, it is also expected that many professional avenues will emerge across the globe.

### India

One of the largest automobile markets in the world, India has some remarkable facts to its credit, which make it world-renowned. The Indian auto industry has a bright future because of several factors working towards increasing demand for automobiles:

- **Rapid urbanization:** Currently more than 30 per cent of the population lives in the urban areas. Given the way India is progressing, the figures are hoped to touch 35 per cent by 2020 and 40 per cent by 2030.
- **Rising per capita GDP:** The per capita GDP of India increased from USD 1200 in 2011 to almost USD 1330 in 2012. This is further expected to cross the USD 2000 mark by 2015. Increasing GDP would mean increased purchasing power and hence increased demand for automobiles.
- **Overall growth of other industries:** Industries are usually interdependent on each other. The effect of expansion of other industries is bound to percolate to the automobile industry, as well. Since transport is a basic need of every industry, demand for automobiles will rise with every positive change in an industry.
- **Car buyers getting younger:** It is no more a hidden fact that India is one of the youngest countries in the world with a median age of almost 26 years where the working class constitutes majorly of young individuals. The car buying age has been on a decline. While a person aged 39 used to buy a car in the year 2000, the age bar fell to 33 in 2010 and the age bracket is only expected to become lesser in the coming years.

- **Growing middle class:** With the middle class of India growing annually, benefits of this sector are still untapped. It is the transition from lower class to the middle class that converts the status of car from a luxury into a need.

## Key Players

### Global

- **BMW:** Bayerische Motoren Werke AG, world's leading German automobile manufacturing company is extensively working on telematics and has come-up with its own technology known as BMW Connected Drive. The concept aims to be the ideal connection of driver and vehicle to the outside world. Some of the services under BMW Connected Drive are: BMW Assist, BMW Online and BMW TeleServices.
- **Toyota:** Toyota Motor Corporation, a multinational automaker headquartered in Toyota, Aichi, Japan was the world's largest automobile manufacturer in 2012 by production and also the 9th largest company in the world by revenue<sup>13</sup>. It has also stepped into the world of telematics in the year 2011 with services such as navigation, remote diagnostics, safety, information access and context awareness, among others.
- **Ford:** As the second largest automaker in Europe, it was quite obvious that it'll also enter into M2M world of telematics. Ford launched 'Ford Telematics' - a 'personal in-car assistant' to manage time in a better way. Developed with Vodafone, Ford Telematics will be available on Ford Focus and Ford Mondeo models.

### India

- Indian IT labs of Microsoft, Bosch, Delphi and Mercedes and software giants Infosys, Wipro, HCL Technologies and TCS are playing a critical role in the evolution of the Cloud Car. Domestic carmakers Tata Motors and Mahindra Reva have their versions of Cloud Cars almost ready.
- Ashok Leyland has already come up with Fleet Management System for its trucks and logistics. As India has a vast transport system, tracking system is much needed.

12 Automotive M2M, 2011, M2M World News

13 www.newtimes.co.nw/

Company	Service	Head Quarter	Estimated M2M End points
AT&T	Wirelessly network connectivity, mobile applications and enterprise technical support	USA	7 million
Vodafone	Provides Vehicle Relationship Management Service, Fleet Management Service, Usage based insurance, safety, security and insurance services, Remote diagnostic and maintenance services and infotainment services	UK	7 million
Verizon Wireless	Real time location of vehicles, software applications with fleet management services	USA	8.1 million
ENTEL	Point of sale, fleet management, security alarm systems, telemetry	Chile	115,000
Orange	Utilities, health, fleet management, automotive	France	2.8 million
Sprint	Telematics, smart grid, fleet management, health	USA	2.5 million
Deutsche Telekom	Automotive, industrial automation, health, energy	Germany	Not available

Source: Informa T&M

- Bosch is building a prototype application on its platform to predict accidents in cities. It is also developing a car without the console, where a piece of fiber glass in front of the driver's steering wheel will be his communication device. One just needs to swipe on the screen to get information about the car and its surroundings.
- Wipro, a major IT giant is working with tier-1 suppliers to help build Cloud Cars for several Original Equipment Manufacturers (OEMs). Wipro is specifically working on infotainment to provide the driver with an interface as good as his phone for entertainment. Wipro's connectivity framework will use analytics to generate alerts on dangerous situations like over-speeding. The third piece is Wipro's Internet offloading solution, using wired broadband linked to Wi-Fi and Femto cell to seamlessly exit and switch to high speed 3G or 4G infrastructures.
- KPIT Cummins' App-to-Go app deployment framework for in-vehicle infotainment (IVI) systems and smart phones allow car makers to bring apps to cars and keep the IVI system up to date over the life of the vehicle. It also enables integration of safety and driver assistance systems, vehicle tracking and remote diagnostics services.
- HCL labs in Noida is making an application that will analyze daily driving habits to be shared with the

insurance firm or doctor.

### M2M Challenges

#### Investment challenge

M2M applications are dependent on the deployment of 3G and 4G mobile infrastructure by mobile operators as number of M2M applications such as network video surveillance and in-vehicle camera systems will need high speed data streams. 3G services started to be rolled out in India in 2011. Recently, 4G services were also launched in 3 cities. However, it will still take some years for pan-India coverage of both, 3G and 4G services in India as this needs significant investment in infrastructure. This shall impede the ability of mobile operators and application developers to deploy 3G and 4G M2M applications.

#### Technology hurdles

- The industry is upbeat about the opportunities offered by M2M technologies, however, the success to a great extent, depends on the adoption of IPv6 by mobile operators and equipment manufacturers. There is always a drag of incumbent IPv4, which can potentially slow down the migration and thereby the M2M business, as well.
- Technology standardization is a key challenge as there are so many players involved in setting the standards, agreeing to solutions, systems integration and billing

interfaces. A common set of technology framework has to be globally standardized for a faster rollout.

- Optimize the current mobile packet gateways for M2M communications, as they need to handle large number of packet data sessions rather than large data throughputs.
- The M2M technology, being at a nascent stage, the technology expertise and customer awareness are at rudimentary levels. This is likely to slow down the mass penetration of this technology among the user population.

**Creating ‘Awareness’**

- Asia has tremendous opportunities in Telematics. But there are some challenges like its adoption and awareness. For example: China, world’s largest Automobile manufacturing country hasn’t adopted telematics as it could have. One of the reasons could be the concerns around making detailed mapping data available as there will be risk exposure and national

security issues.

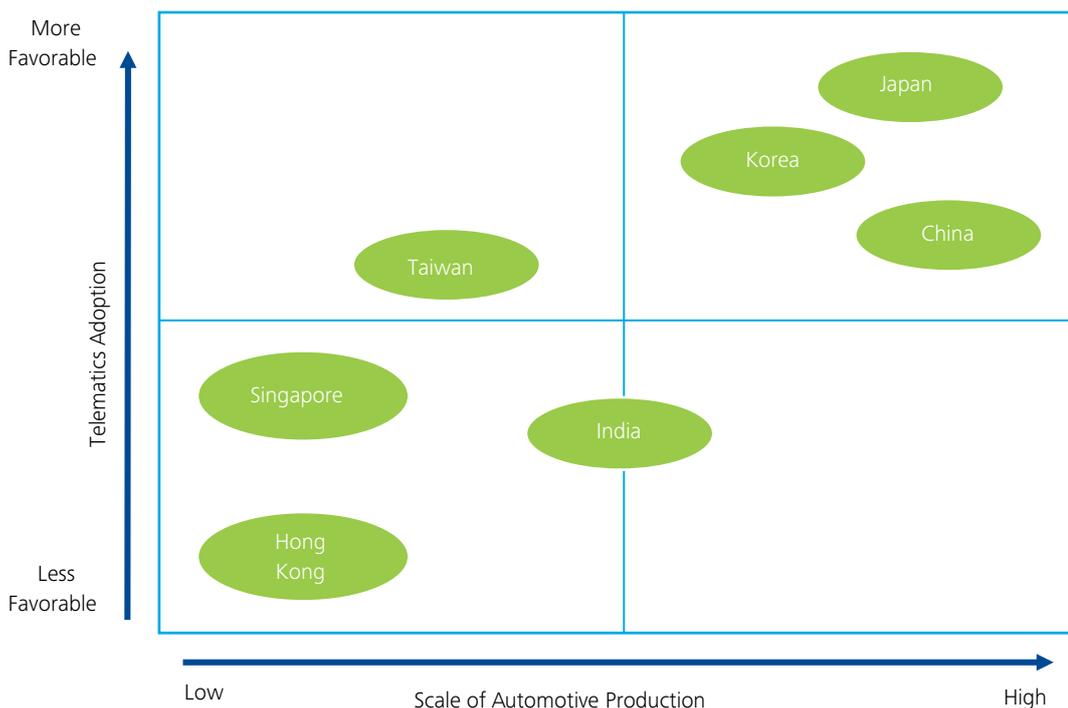
- If India is considered on similar grounds, it is the sixth largest in the world but the country faces issues regarding consumer awareness. Most of the high-end consumers are not aware of the available technology or don’t know full utilization of it. Thus, this is one of the greatest challenges, which need to be overcome to have full-fledged utilization of immense market opportunities.

**Trends**

The trends in automotive industry have tremendously changed. Right from the very beginning in 1769, when the first steam engine automobile was invented, till date many developments have occurred.

- With use of advanced technologies, now ‘cars’ are not just ‘cars’, they are Smart Cars.
- Huge research and development is happening in developing futuristic car technologies to make automobiles more energy efficient and comfortable with reduced emissions and ease.

**Figure 6: Telematics adoption v/s automotive production of Asian countries**



Source: Infocomm

“With huge amount of data coming from smart devices and sensors in real time, the need to collate and manage this huge volume of data and have a system which can perform fast analytics, recognise patterns and help in decision making, is going to be the key differentiator for any technology and IT organisation.” – Alope Palsikar, SVP & Head of Manufacturing at Mahindra Satyam

- In the year 2000, around 41 million car units were manufactured, whereas, in 2012, for the first time in the history, over 60 million passenger cars will be produced in a single year (i.e. 165,000 new cars are produced every day)<sup>14</sup>. Hence, it can be seen what M2M and automation has done at backend too.

Carmaker	Brand	Operating System	Cloud OS Partner	Functions
Toyota	Lexus, Prius	Entune,6-Book	Microsoft Azure, Salesforce	Car to Car Communication(C2CC), apps sharing, GPRS, data analytics
Chrysler	Chrysler 300	Uconnect	Microsoft	C2CC, GPRS
Ford	Focus, Lincoln, Evos	Sync	Microsoft, Bug Labs	C2CC, apps sharing, GPRS, data analytics, voice based commands
GM	Cadillac	OnStar Advanced Telematics	Proprietary, Delphi	Maps, C2CC, voice commands, vehicle diagnostics
Volkswagen	Audi A8	Urban Intelligent Assist	Proprietary, Bosch	Maps, C2CC, data analytics, voice commands, apps sharing, vehicle diagnostics
Nissan	Leaf	Carwings	Proprietary	Data analytics, voice commands, maps, vehicle diagnostics
BMW	R8 Spyder	Connected drive	Proprietary	C2CC, data analytics, voice commands, app sharing, vehicle diagnostics
Diamler	Mercedes Benz	MBrace2	Proprietary	C2CC,data analytics, voice commands, apps sharing, vehicle diagnostics
Porsche	Carrera	QNX CAR 2 Application	QNX of RIM	C2CC, data analytics, voice commands, apps sharing

14 <http://www.worldometers.info/cars/>

Source: Business World

- Big automotive companies such as BMW, Ford, Nissan, Toyota, Honda, Cadillac, Jaguar and many more around the globe are extensively working on the future cars and are now leading towards fuel efficiency, energy-savers, hybrid vehicles, battery electric vehicles, and fuel-cell vehicles.

### Innovations

#### Driverless cars

Google, the operator of world's largest internet search engine became the first company in the world to obtain a US license for driverless cars. "Nevada Department of Motor Vehicles" issued the license to Toyota Prius modified with Google's experimental driverless technology in May 2012. The project is currently being led by Google engineer Sebastian Thrun, Director of the Stanford Artificial Intelligence Laboratory and co-inventor of Google Street View. Web giant, has modified Toyota Prius, which drives itself using video cameras, radar sensors, a laser rangefinder, detailed maps and car-to-car communication. The vehicle includes a failsafe mechanism that lets the driver take control of the car simply by grabbing the steering wheel or hitting the brakes, much like the override on cruise control.

Engineers have also developed a new robotic 'traffic cop' and 'intersection controller' to help automated driverless cars via M2M communication in future to cruise through intersections faster and safely. The proposed controller will allow vehicles to keep moving and reduce the delay between each vehicle compared to traditional intersection control. Keeping vehicles moving makes them more fuel efficient and helps in reducing emissions. Many automotive manufacturers such as General Motors, Ford, Mercedes-Benz, Volkswagen, Audi, BMW, Volvo, and Cadillac have begun testing driverless car systems. With all the research and development going on, a driverless car is expected to hit the road by year 2020. Some of the companies with their driverless car models are:

- Google's Hybrid Lexus RX450h
- Volkswagen Golf GTI 53+1 a modified Volkswagen Golf GTI capable of autonomous driving. It has also developed Volkswagen Passat's driverless car model with Google.
- NSC-2015 (modified version of Nissan's Leaf model)
- Audi TTS Pikes Peak (modified Audi TTS)
- Mercedes-Benz announced that its 2013 S-Class will feature an autonomous driving system.
- Cadillac developed their semi-autonomous system called "Super Cruise"

#### Financial GPS

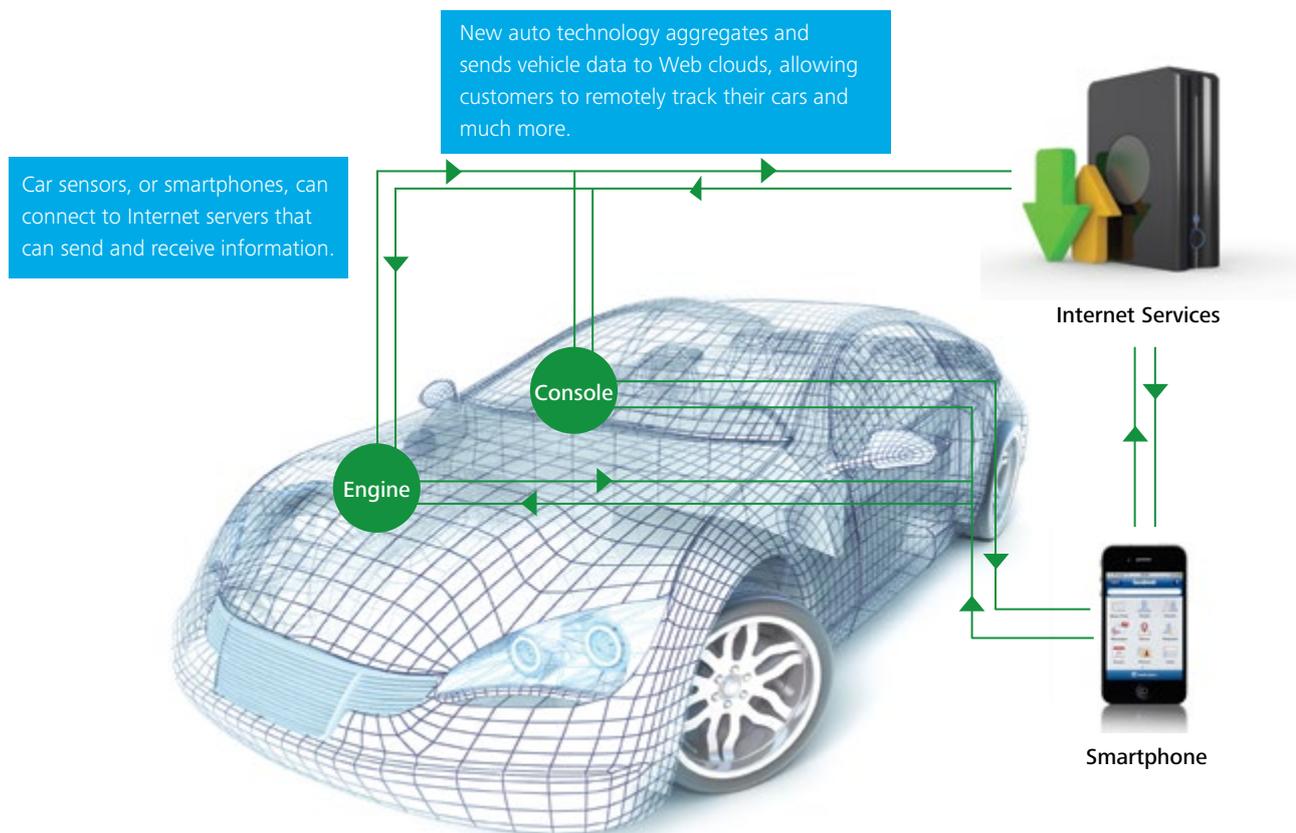
BMW has developed a key that functions as a credit card with the help of which, consumers can get one bill at the end of the month for every car-related cost: their parking, their insurance, their lease, their roads, even full repairs coverage.



## Web Traffic

Another most recent innovation in M2M is the technology known as Web Traffic.

Figure 7: How web traffic works



### Tracking uses:

- Apps can beam trip plans to the car's navigation system
- Track individual employee's use of company cars
- In the future: crash avoidance, traffic planning

### Remote control uses:

- Apps send warnings to customers when the car's oil or tire pressure need checking
- Energy companies can shut off electric-car charging at peak periods
- In the future: Dynamic road signs

Source: WSJ research

“M2M applications form the backbone of production units. These form the critical interface for the production floor.” - Rajesh Uppal, CIO of Maruti Suzuki India Ltd.

**Some other innovations are:**

			
<p><b>Navigation</b></p>	<p><b>Soft Power</b></p>	<p><b>App Access</b></p>	<p><b>Auto Alert</b></p>
<p>Sense a lane change automatically; use gesture to control car</p>	<p>Fix software glitched; get auto updates on the move</p>	<p>Book hotels, tickets using apps on connected devices</p>	<p>Automatically connect to ambulance services or police in case of crash</p>
			
<p><b>Car to Car Communication</b></p>	<p><b>Networked</b></p>	<p><b>All Play</b></p>	<p><b>Parking</b></p>
<p>Talk to other vehicles and traffic systems; avoid collisions</p>	<p>Connect to internet wi-fi; get personalized offers from shops in the vicinity</p>	<p>Play music or videos from a hard drive at home</p>	<p>Get information on parking slots and park automatically</p>

**Recommendations**

Considering automobile market, demographics and economy of India, following recommendations are made:

- Keeping in view the Indian companies and consumers, it is recommended that M2M modules should be available at low-cost. For instance, collecting and managing raw data like real-time traffic information does not come cheap. Also, a few countries like China have concerns about making detailed mapping data available as there will be risk exposure and national security issues.
- For developing countries, where recourses are less but opportunities are extremely high, automotive and 3G/4G devices should be easily available and an increasing focus should be on software solutions.
- There should be clear service agreements and uniform standards as different telecom standards in telematics involve integration with various telecom systems and standards. In Asia, various mobile communication standards are used, making it difficult to achieve the economies of scale. Thus there is a need to have uniform standards across the globe.

- Mobile network operators must intensify their cooperation with automotive sector as it is generating a growing public interest in M2M solutions. Deutsche Telekom, Orange, and TeliaSonera, for instance, have already set-up a cooperation body, the GMA or Global M2M Association. Its aim is to improve quality of service and M2M communication standards. To do so, MNOs establish network interoperability, harmonize software interfaces and jointly certify M2M modules. A similar body is M2M Alliance with members such as Vodafone, Telefónica and nearly all of the major European MNOs.
- The M2M market is very fragmented. Hence, smaller firms and start-ups must be boosted as they offer many of today's M2M solutions.
- Increasing consumer awareness is very essential. Educate consumers because an enlightened consumer is always an empowered consumer. News and information, as well as, reviews of products, services and companies must be frequently made available on social networking sites, blogs and websites that are committed to consumer awareness.

## Case Study- KORE Telematics: Fleet Management System

### **Background**

RFTrax<sup>15</sup> is a leader in total asset tracking solutions for locomotives and railcars. The company's Asset Management Platform combines state-of-the-art technologies that incorporate GPS; a full range of wireless, real-time communications; specialized business intelligence and supply chain management software that enable customers to make better business decisions, manage risk, increase profitability, and predict and prevent problems before they occur. RFTrax is headquartered in Sugar Land, Texas, and is a wholly owned subsidiary of Fairfield Industries, Inc., a privately held multinational instrumentation and data collection, processing, and licensing company.

KORE Telematics<sup>16</sup>, the largest independent wholesale GSM network service provider, is 100 per cent M2M focused. It is working with 350+ application service providers today to deliver fast, reliable, business class service for applications from vehicle location to utility metering, payment processing, landfill monitoring, asset management, offender tracking and more. With tens of thousands of subscriber connections, RFTrax have built the network and the systems to deliver SMS, GPRS and EDGE services.

### **Service description**

"Out of sight, out of mind" is not an option for today's railroads. Increasingly precious cargo, combined with a strong need to increase efficiency and mitigate risk, requires that rail companies know what is happening, when, and to which of their trains, along every mile of track — all in real time. RFTrax is a breakthrough provider of remote asset management telemetry to freight transportation companies. Its first product, the Asset Management Platform (AMP) for locomotives, gives railroads the opportunity to see exactly what is happening to any locomotive equipped with a special RFTrax transceiver known as an Asset Command Unit (ACU). All information is delivered via the Internet. By logging into a password-protected site, dispatchers and other management personnel can tell, depending on the particular sensors installed, where a locomotive

is; whether it is shut down, moving or idling; how much fuel it has on board, coolant and ambient temperature.

### **Impact**

While RFTrax is still in the early stages of its roll-out, its products and the market opportunity reveal a solution that promises to have a major impact on how success is measured in the railroad freight industry.

- Manufacturers had been able to predict the condition of a load of freight based on analysis of the g-forces the load was subject to in transit: a damaged load could be identified well before it reached the plant, and an alternative shipment could be arranged in order to meet just-in-time requirements.
- Using this data, owners of large railcar fleets have significantly shrunk dwell times by being able to monitor the exact location of an entire railcar fleet, thus preventing "warehousing" of railcars and speeding up their reuse.

### **Future plans**

The combined problems of dwindling capacity, quality challenges, increasing dwell times, and security issues, create serious limits on future growth and profitability not just for railroads, but also for the shippers and manufacturers that depend on rail freight to fuel the just-in-time economy. What is happening in real-time during loading, transit, and unloading could provide a wealth of information similar to what is traditionally provided by MES systems to manufacturers. Integrating that data with ERP and equivalent systems could provide a windfall of information for improving the efficiency and profitability of all concerned.

Following are the sectors in which the future plans to incorporate M2M are on-going:

- Automobile rental and leasing
- Federal and state agencies
- Construction equipment
- Public transportation
- Law enforcement agencies

15 <http://www.eaconsult.com/articles/RFTraxEACReport.pdf>

16 [http://www.koretelematics.com/pdf/casestudies/kore-case-study\\_rftrax.pdf](http://www.koretelematics.com/pdf/casestudies/kore-case-study_rftrax.pdf)

# M2M in Agriculture



## Current State of M2M in Agriculture Sector

Farming has long been a field at the fore front of technology. Genetically modified seeds and fertilizers are coupled with the latest machinery to produce consistent yields, year after year. Machine-to-Machine (M2M) technology is also sprouting up on farms around the world, helping farmers to increase their efficiency and productivity. The use of M2M technology, in the agriculture segment dates back to 1984, when milk producers in some parts of world experimented with RFID passive tagging to regulate the food type and volume for dairy cows.

The major problems faced in the farming sector are as follows:

- The pressure to produce more food with shrinking land & resources
- Inefficiencies caused by sub optimal use of automation in the agriculture segment
- Finding the skilled manpower for agriculture is a challenge in some countries
- Lack of appropriate environment and local weather information
- Blanket inputs (fertilizers, chemicals etc.) treatment while growing crops
- Lack of market knowledge and business information

The agricultural industry is increasingly deploying M2M technology to meet the above challenges and for improving profitability and creating a greener environment. Remote M2M provides an operator the ability to remotely monitor the status of various facets of the operation by providing real-time situational analysis and immediate delivery for alarm events and long-term trending and graphing capabilities through the use of state-of-the-art data logging. The benefits of M2M in agriculture are as follows:

- Immediate notification of alarm events
- Real-time status report of equipment details
- Remote control of equipment
- Reduced costs
- Remote back-up (Satellite Data Transmission)

The key enabling technologies and standards for M2M communication are as follows:

- Networking technologies: TCP/ IP, Wi-Fi
- Sensor technologies: Zigbee, ISM, Proprietary RF
- Cellular technologies: GSM, CDMA, 3G, LTE

## M2M Applications in Agriculture<sup>17</sup>

- **Equipment monitoring and diagnostics:** Agricultural equipment such as tractors, harvesters and tanks can be monitored remotely for their status of operation, diagnostics and proactive maintenance.

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## “In rural India, M2M will ensure optimal utilization of limited resources like water and energy, and provide better healthcare and education services to rural masses through remotely managed applications.” - David Ranjit William, Assistant Vice President, Engineering, Carrier Services and Solutions at Aricent group

Wireless modems fitted onto equipment are used for communication with central servers. Alerts are sent to farmers' mobile phone in case of any specific event. GPS is used for identifying the location of any equipment. Retrofit kits are developed to support such monitoring and diagnostics for existing equipment.

- **Equipment / process control:** Agricultural equipment and their operation can be controlled remotely. This can save significant effort and time. For example, water pump can be remotely turned on and off as required. For any regular set of control operations, rules can be set on mobile phone or PC-based user interface. For example, from October 30th to November 15th, 'turn on' water pump at 5.00 am and 'turn it off' at 7.00 am.
- **Weather conditions information:** It is of utmost important for farmers to be aware of complete weather information so that they can take informed decisions like when to sow the seeds, when to harvest the crop, irrigation planning etc. Farmers can be provided all this information over mobile phone or PC-based applications. Farmers can also configure and get alerts for any specific weather forecast conditions, if desired. Farmers can be provided weather parameters such as wind speed, sunshine, temperature, rain, pressure and humidity.
- **Remote crop monitoring:** IP-based cameras can be installed at specific locations in the farms. Farmers can get the pictures to see the growth and health of the crop and check the weed growth. This may not completely alleviate the need for closer inspection but it can reduce the frequency of farm visits, thus saving time and money e.g. Nano Ganesh<sup>18</sup>, a GSM based remote control for water pump set, is a low cost

solution and help farmers switch ON/OFF motor and even check the availability of electricity from home.

- **Logistics management:** Wireless connectivity and GPS on agricultural equipment can be leveraged to optimize the deployment of such equipment. Farmers can get a live view of their farm equipment on the PC. Farmers can send commands for movement and deployment of this equipment to any specific location with dynamic schedule management.
- **Market analysis & information sharing:** Farming market data and analysis can be made accessible to farmers by simple applications running on mobile phones and PC. Farmers' news groups and chat groups are to be evolved so that they can exchange information for business benefit.

### Key players providing M2M products<sup>19</sup>

- **Kontron's:** The Company has its headquarters in Germany with sales and support operations in US, Canada, China, and Taiwan etc. The M2M devices of Kontron have been designed to ensure accessibility of the farming market data and analysis to farmers by running applications on mobile phones and PC.
  - Agricultural equipment and their operation can be controlled remotely
  - Weather information can be provided to farmers in order to analyze for example the perfect time slot for harvesting and
  - Wireless connectivity and GPS on agricultural equipment can be used for logistics and fleet management
- **McCrometer:** The Company provides irrigation management solutions to the Agricultural and Turf markets. The McCrometer product is a turnkey

<sup>18</sup> <http://www.nanoganesh.com>

<sup>19</sup> Reference M2M Journal 14 12/12 [www.m2m-alliance.de](http://www.m2m-alliance.de)

wireless remote monitoring system with 24/7 capability for irrigation and crop management. McCrometer system is designed to operate in even the most remote areas. System options include satellite link and cell and radio communications to get the data back to the customers' home or office via the Internet, reducing costly manual data collection.

- **Tyro Remotes:** The Company offers wireless solutions. Tyro M2M systems are used in applications where the reception of the GSM network is inadequate or GSM is simply unable to provide required response rate. In addition, the mobile machines in agriculture are generally exposed to wind, weather and dirt, as well as, ammonia vapors, so that a minimum level of durability will be required. Tyro Remotes provides systems in which both the transmitter and the receiver are completely sealed and waterproof.
- **Davis Instruments:** Based in California, U.S., they manufacture wireless weather stations and accessories. Davis Instruments has simplified the challenges faced by the farmers by creating a sophisticated weather system that gives the grower the real-time and historical meteorological data he needs to grow the crop efficiently. The device provides leaf and soil moisture temperatures, frost warnings and rain values so that the grower is no longer making his best guess on irrigation, growing degree days, or spraying schedules. All this information can be remotely managed and controlled.
- **Telit Communications PLC:** This Company is an enabler of M2M communications solutions. They have worldwide operations and Telit Wireless Solutions and M2MÁR are their brands. Telit has provided its M2M expertise and wireless data communication products to a number of projects in agriculture sector.
- **Sierra Wireless Inc.:** The Company is headquartered in British Columbia, Canada. The company supplies mobile broadband devices embedded wireless modules, intelligent gateways and secure cloud platforms for M2M applications, in a number of verticals including agriculture.

#### Challenges faced by M2M in agriculture

M2M in agriculture imposes new demands on available technology. The mobile machines in agriculture are generally exposed to wind, weather and dirt, as well as, ammonia vapors, so a minimum level of durability of devices and sensors will be required. A standard SIM card is not suitable for this job. The agricultural

environment requires a Machine Identity Module (MIM) that:

- Resists extremes of vibration, temperature and humidity
- Has a long life span (approx.10 years)
- Has a small footprint (miniaturization)
- Is adapted to agricultural applications

#### Trends and Innovations

##### Global

As computers grew in both capabilities and reliability and became affordable, more farms investigated the use of automated feeding of animals and monitoring of conditions. However, until recently, these simple tasks required human interface in the way of determining the changes in feed or the logging of output. With more M2M technologies available, the systems have become more autonomous and less dependent on human interaction.

The academic world is also exploring the agriculture applications. At Iowa State University, Ratnesh Kumar<sup>20</sup>, a professor of Electrical and Computer Engineering, hopes one day farmers will be burying soil sensors under their crops. Kumar is leading the research team developing transceivers and sensors that collect data about soil moisture within a field and send that data to remote locations for analysis. The researchers hope future sensors will also collect data about soil temperature and nutrient content. Their goal is to build small sensors (the prototypes are about two inches wide, four inches long, and less than one inch thick) that can collect and send data entirely underground. The sensors won't need wires or above-ground antennas, so farmers can work right over the top of them.

The sensors would be able to report their location, making it easy to find them if a plow were to move them or when batteries need to be replaced. Kumar says the sensors are designed to be buried about a foot deep in a grid pattern 80-160 feet apart. They relay data along the grid to a central computer that would record information for researchers or farmers.

The sensors could help researchers understand precisely how water moves through a field. In turn, this would help develop better models for predicting crop growth and yield, and help gain a better understanding of the carbon and nitrogen cycles within soils. If the sensors

<sup>20</sup> <http://www.m2mpremier.com/LatestFeaturedArticles.aspx?id=FA00090410062121020>

help farmers manage their nutrient and water resources that could maximize yields and profits while minimizing environmental impacts.

### India

A project called "Kheti"<sup>21</sup> developed by academicians from UK-based Sheffield Hallam University, won the Manthan South Asia Digital Empowerment Award. The academicians from Sheffield Hallam University worked with a farmers' co-operative to design a software package for use on a mobile phone, allowing farmers to take pictures of particular problems and also describe what they saw on an audio track.

Information thus gleaned, was sent to experts with local knowledge who helped to resolve the problems. In an Indian context, the software can enable farmers in rural India to get tailored and expert advice on resolving their crop-related problems.

The Kheti system, which was first launched in rural India in the beginning of 2009, provided the means and 'know-how' to farmers by receiving immediate updates using modern communication. It has made a real difference to the lives of farmers in rural India by strengthening connections between people and their co-operative institutions, and by adding to their knowledge through mobile phone communications. The reaction from farmers was great and the service proved to be a real benefit for them.

### Recommendations

M2M devices are currently expensive for farmers. Farmers also need to be made aware of the availability of these devices and trained to use them. Once these issues are taken care of, the sight of a farmer sending and receiving immediate updates using mobile devices, including phone cameras may no longer remain a dream. The idea is to facilitate walk of a simple farmer into the era of digital revolution.

Farming market data and analysis can be made accessible to farmers by simple applications running on mobile phones and PCs. Farmers' news groups and chat groups can be evolved so that they can exchange information for business benefit. Farmers can register to get personalized (specific to their crops, geographical area etc.) reminders and tips on their mobile phones/ PCs.

Rural VAS is gradually surpassing the realms of SMS and voice. Mobile Network Operators need to launch more VAS for the rural customers. The focus of Mobile Network Operators is on urban customers only. With cell phone usage in the rural sector on the rise, and the main occupation in that area being farming, it has been unequivocally reiterated time and again that providing better VAS to farmers is the best way forward.

21 [http://voicendata.ciol.com/content/service\\_provider/110020308.asp](http://voicendata.ciol.com/content/service_provider/110020308.asp)

### 1. Optimization of harvesting operations with MachineSync - John Deere<sup>22</sup>

John Deere (silver medalist at Agritechnica 2011) has developed intelligent systems for satellite-based precision farming. John Deere has also implemented the strategy for optimization of harvesting operations. John Deere's "Farm Sight" encompasses the entire spectrum of possibilities to optimize the performance of equipment, ensure more efficient logistic processes and to provide assistance in agronomic decisions. With "MachineSync", machines (e.g. combine harvester and tractor) can exchange data in real-time during use to provide the operators all the information for the optimization of the logistics chain in harvesting grain. This avoids unnecessary empty runs and delays during the high pressure grain harvest.

The driver can use the monitor in the tractor cab to identify the field-location on a map of the harvester and other tractor/trailer combinations. This means that he can drive a combine harvester whose nearly full grain tank has to be emptied. The combine harvester operator can contact a tractor operator to empty the grain tank.

By confirming the discharge request from the combine driver, other tractors will automatically be prevented from collecting the grain from the combine tank. At the approach of the tractor/trailer combination to the combine harvester, operators can take the command of the discharge team as soon as a specified distance from the vehicle is reached. Now the combine operator controls, together with the tractor/trailer operator and depending on his own speed and direction of travel up to the harvester; the emptying of the grain tank can automatically continue parallel with the current harvest.

### 2. Farmers monitor temperature in silos with the help of M2M devices - Sierra Wireless Inc.<sup>23</sup>

Today's tough economic climate is seeing smaller farms bought out by larger neighbors, resulting in consolidated farming businesses dealing with more

storage facilities spread over a larger geographical area. In order to efficiently control grain facilities in multiple locations, farmers require remote monitoring of silos and control of fans from a central location. Vendors of M2M solutions are providing farmers with the means to remotely control the activation of fans to either dry or cool grain within their silos.

With the help of the products and solutions from M2M vendors, farmers monitor and control their grain storage facilities. The solution envisages a three-in-one controller, allowing for drying, cooling and maintenance of grain, with fully automatic transition between the three stages. The M2M solution is equipped with control inputs and outputs for eight silos. Each silo can store a different type of grain and, as such, the controls are fully configurable to monitor a specific type of grain.

The M2M device becomes a fully connected 3G remote data collection point, once it is integrated with another device for cellular communication, since wired connectivity is difficult to install in remote locations.

It is possible to enable provisioning, managing, and troubleshooting of remote equipment from one central location with the help of software.

Farmers are required to enter the condition (temperature, moisture and oil content) of the grain when filling each silo and determining a target set point for the end product. With pervasive, two-way data communication provided by the Sierra's solution, farmers can access measurable silo conditions at any time and from anywhere through a secure web interface. This centralized data access is particularly important for farmers with silos in multiple locations, allowing them to monitor and control silo conditions without having to travel to each location. In addition, farmers can set text and email alerts for notification of breaks in predetermined environmental thresholds, which further help them to catch potential issues before they can damage product and cause financial losses.

<sup>22</sup> Reference M2M Journal 14 12/12

<sup>23</sup> Reference M2M Journal 14 12/12

# M2M in Home Appliances

## Current State of M2M in Home Appliances Manufacturing

The smart home is now a reality. Machine-to-Machine (M2M) technology is making home appliances more intelligent by connecting them wirelessly to the internet. This enables them to feed useful data back to the service provider or manufacturer to achieve a better customer experience through new functionality and enhanced services.

Today, connectivity is regarded as a high-end novelty in home devices, such as utility meters, thermostats, security cameras, TVs and blu-ray players, rather than a feature for the mass-market. This view will become out-dated as we move to a future where connectivity is pervasive and embedded in virtually all household devices. Many analysts believe that the smart home of the future is likely to contain 15 to 30 connected devices and sensors, all linked via a home area network and connected to service providers' back-end systems and the Internet. Connected devices will range from ordinary household appliances to solar panels and electric vehicle charging infrastructure that both consume and generate electricity.

The mobile handset is emerging as a key interface and consumers' constant companion for remote monitoring and control of smart home services. Mobile connectivity will be a crucial ingredient in bringing together the different parts of the smart home puzzle. Without mobile networks' extended coverage, smart home services will only be available in limited locations and will miss the mass-market opportunity.

With deep expertise in technology change management and a long-term technology roadmap, mobile operators could be attractive partners for smart device and other service providers.

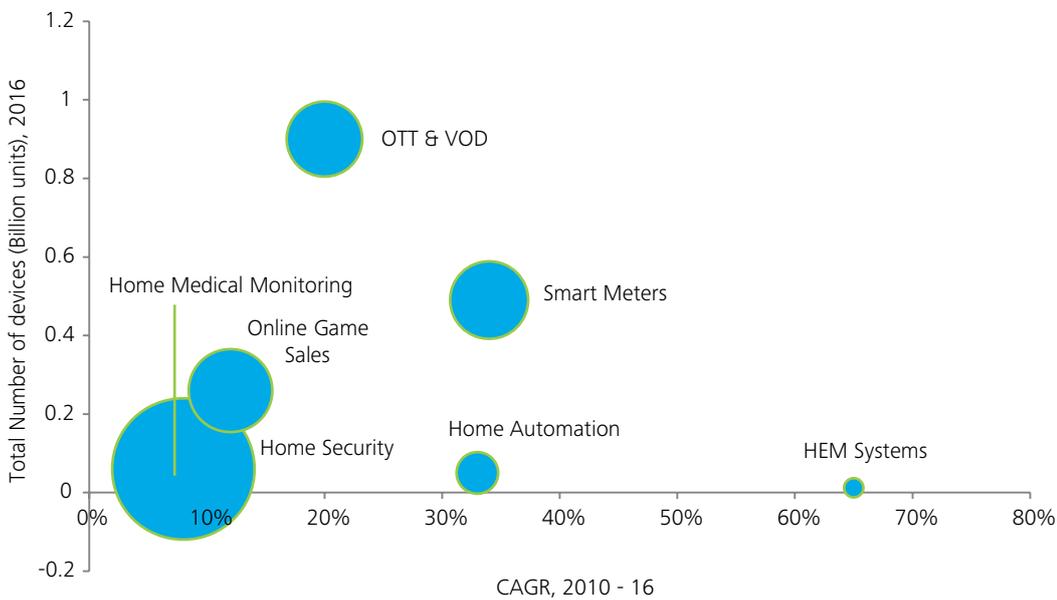
In some areas, companies from different sectors see themselves competing for "ownership" of the consumer: utilities companies have a route to the customer via smart meters; telecom companies can base their proposition on broadband hubs and set-top boxes; security companies can leverage connected security systems; and gaming providers can develop new applications for connected set-top boxes. But many of these companies will also need to co-operate to realize the full potential of smart home services. In fact, collaboration will be inevitable for the success of the smart home services market.



**Market Size of M2M Opportunity**

Global

**Figure 8: Connected Home Devices and Revenue, 2016**



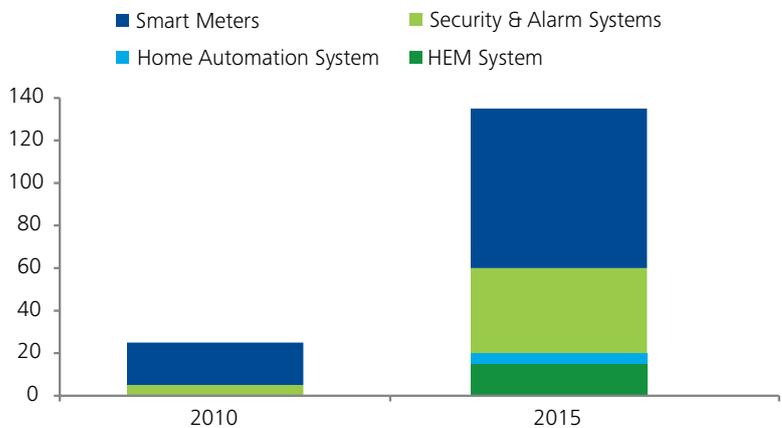
Source: GSMA

The combined revenue from the smart metering, Home Automation and Home Energy Management (HEM) segments will be worth more than USD 44 billion in 2016<sup>24</sup>.

The overall revenue potential of the smart home, however, will be considerably higher as devices from the entertainment, health and home security sectors also become connected.

Home appliances are no longer some kind of geeky gadget for rich people. During the last five years, home automation has evolved to legitimate its use in everyone's home. For example, in North America, there are 165 million homes, that include 80 per cent wireless penetration today with 200 million cell customers. Almost 45 per cent of M2M connections in Europe are home-centric, compared to fewer than 5 per cent in North America.

**Figure 9: Cellular Connected Home Devices (Millions)**



Source: GSMA

## India

A significant chunk (around 60 per cent) of Indian population is in rural area. Devices/ appliances, which suit the needs of a rural household, are different from that of an urban household. Therefore, it is time that device/appliance manufacturers start targeting the needs of rural segment. While looking at the current middle class segment, which represents 13.1 per cent of the total households (31.4 million), it is forecasted that by 2016 the households will climb to 53.3 million and is likely to double up by 2025.<sup>25</sup> To give a gist about the home appliance usage by middle class, almost 21 per cent of the Televisions, 53.2 per cent of computers, 37.8 per cent of the Microwaves and 54.7 per cent of the credit cards are possessed by the middle class. This segment can be targeted by the M2M device

manufacturers and also the operators. If the ecosystem of M2M is made affordable, we can see more number of households adapting to a basic level of M2M. As it has taken a decade's time to develop an affordable mobile communication to reach everyone, optimistically the M2M communication is likely to have its presence by 2025.

In India, though the growth is slow, there is a huge possibility that India will be a potential market for home appliances for the next half decade and further. This is owing to the pace at which Indian consumers are getting adapted to technology-based products. Furthermore, as per a recent research, increase in the number of wireless customers will also enhance the home appliances M2M market.

## Key Players Providing M2M Products and Solutions

Network Operator	Connectivity	Type of service
AT&T	Fixed and mobile	Xanboo (home automation)
Bouygues Telecom	Fixed and mobile	Communications services to support home energy management for ERDF
France Telecom/ Orange	Mobile	M2O city project with Veolia Water
KT	Fixed and mobile	Smart Green Service
Rogers Communications	Mobile and Cable	Smart Home Monitoring Service
Telecom Italia	Fixed and mobile	Energy @ Home
Telefonica O2	Fixed and mobile	Baywatch
Telenor	Mobile	Home alarm and monitoring systems, smart meters, health monitoring/remote disease management solutions, EV services.
Verizon	Fixed, with plans for mobile-based service	Home control & monitoring service (utility management and home security, with plans to cover independent living and mobile health)
Vodafone	Mobile	British Gas smart meter initiative

Source: GSMA report on "Vision of smart home: The role of mobile in the home of the future"

<sup>25</sup> National Council for Applied Economic Research's (NCAER) Centre for Macro Consumer Research

## Challenges

- Lack of common platform, i.e. disparate equipment in the home, lack of standardization and no common back-end platform to support broad variety of devices and applications.
- Long time to market, i.e. the anticipation of pre-paid energy, self-service security monitoring, etc. These applications can take more than two years to deploy and the issues are not just technological but are also related to market and government etc. Also consumer awareness is very little, therefore, time and money has to be spent on educating the consumer.
- High equipment costs may lead to slow rollout of new exciting services.
- Substantial investments in developing high-tech solutions may require an expensive technology infrastructure as it is difficult to leverage existing infrastructure to offer additional services at the domestic level.

## Trends & Innovations

### Smart Homes

A smart home or building is a home or building, usually a new set-up that is equipped with special structured wiring to enable occupants to remotely control or program an array of automated home electronic devices by entering a single command. For example, a homeowner on vacation can use a smartphone to arm a home security system, control temperature gauges, switch appliances on or off, control lighting, program a home theater or entertainment system, and perform many other tasks.

Home automation can include the scheduling and automatic operation of water sprinkling, heating and air-conditioning, window coverings, security systems, lighting, and food preparation appliances. Home automation may also allow vital home functions to be controlled remotely from anywhere in the world using a computer connected to the internet. Besides the functions already mentioned, remote control can be extended to telephones and answering machines, fax machines, amateur radios home robots such as automatic vacuum cleaners and other communication equipment.

The fundamental components of a well-designed home automation system includes a computer (or computers) with the appropriate program, various devices and

systems to be controlled, interconnecting cables or wireless links, a high-speed Internet connection, an emergency back-up power source for the computer, its peripherals, and the essential home systems.

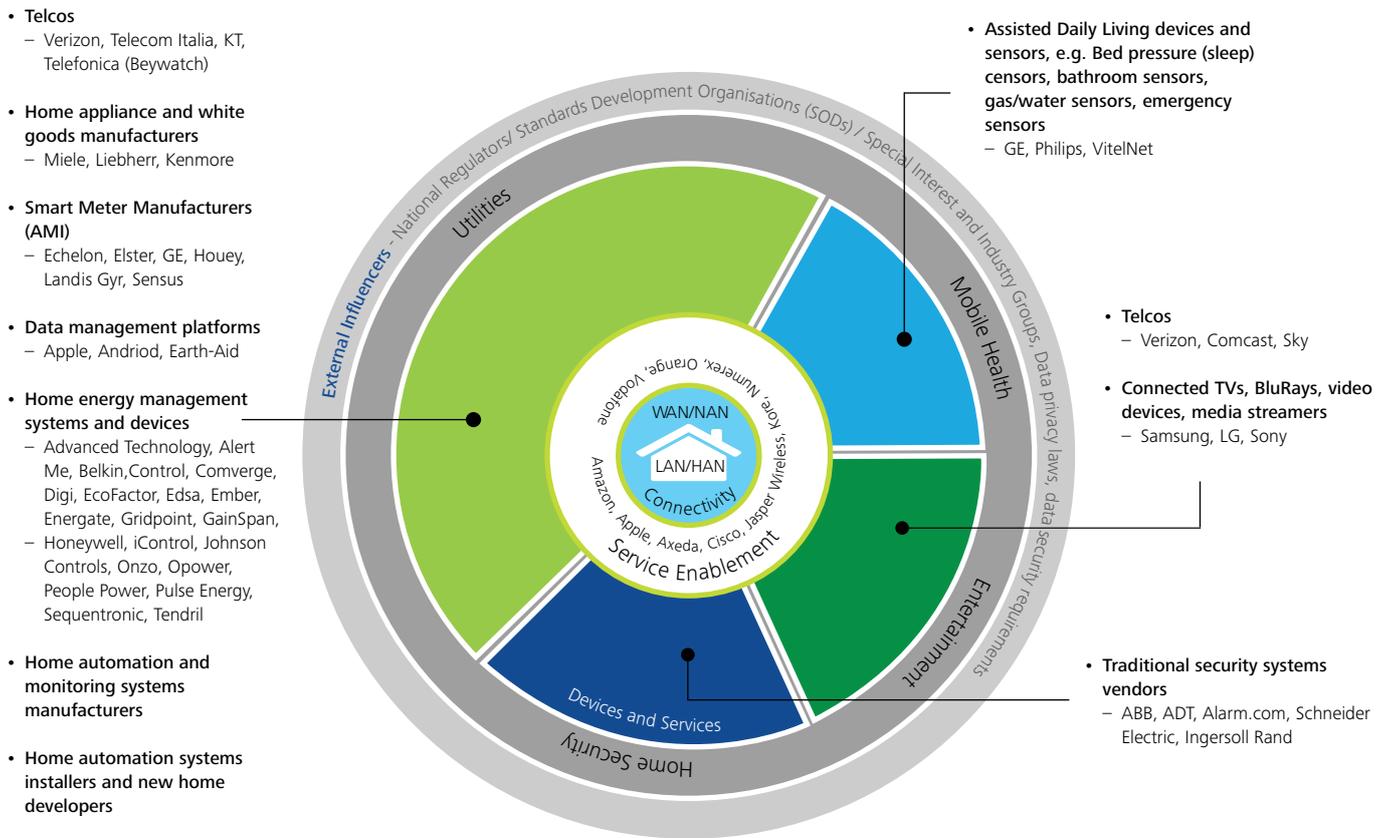
Utility providers will track usage of electricity, water and gas and provide this information to households to help customers track their current and historical consumption patterns, as well as, the amount of energy being generated by solar panels and wind turbines and the charging status of electric vehicles. It will enable householders to ensure that they are appropriately reimbursed for any power their home is feeding into the grid. They will also be able to access information about the cost of electricity and other utility services, taking advantage of any incentives for energy efficiency. Householders will be able to monitor all of this information remotely using their mobiles.

An Internet refrigerator (sometimes called a net fridge) is a version of the familiar kitchen appliance with a built-in computer that can be connected to the Internet. The Internet refrigerator is one item in a growing product category of Internet appliances that includes not only devices such as personal digital assistants (PDAs) and smart phones, but also web-enabled versions of typical household appliances such as refrigerators and microwave ovens.



SIM City

Figure 10: Smart Home Ecosystem



Source: GSMA

Real differences are being made today in the lives of the few pioneers who have access to advanced services delivered by their Smart City / Smart Homes. In the future, it is imperative industries don't create a disconnected bubble of service innovation, and instead tap into this incredible Smart Home Citizen resource or SIM City to understand the type of services that need to be developed in the future, and work with these communities to develop them.

There are already hundreds of thousands of Smart City Citizens in our global societies, the pioneers of this new way of living. One estimate is that there are already more than 180 Smart Cities in existence today. Few international examples include Tennessee, Ontario, and London etc. and some Indian examples being Ahmedabad and Chandigarh etc.

**Recommendations**

- Cross industry collaboration must be promoted for speedier development of smart home market. This will address the issue of interoperability and scalability.
- Cloud enables control of "Internet of Things" in the home to manage heating, lighting, laundry, mobile wireless network by combining mobile communications and cloud computing for the remote management of 'smart home' appliances.
- New subscription-based home automation offerings are rapidly transforming the way consumers will monitor, secure, and control their homes. Home automation, which has long been treated as more expensive & custom-installed technology, is now moving into the mainstream with companies.

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“Convincing consumers of the benefits they will enjoy as a result of M2M deployments remains a huge challenge. Ultimately, consumers are the ones who will pay for the additional cost of inserting chips and sensors in their automobiles or consumer devices.” - Vijay Sethi, Vice President and CIO at Hero MotoCorp

#### Case Study- Qualcomm Technologies

Qualcomm Technologies, Inc. (QTI), a wholly owned subsidiary of Qualcomm Incorporated, is redefining the way people incorporate wireless devices and services into everyday life. QTI and its subsidiaries operate substantially all of Qualcomm’s research and development activities, and product and service businesses, including Qualcomm’s semiconductor business, QCT. Qualcomm Incorporated is a FORTUNE 500 company and is the world leader in next-generation mobile technologies. QTI’s developments enable opportunities across the wireless and wired value chains by making devices and networks faster, content richer and communications more personal and affordable to people everywhere.

Qualcomm Technologies, Inc. (QTI) launched its networking and connectivity subsidiary, Qualcomm Atheros, Inc., unveiled the industry’s first industrial-grade HomePlug Green PHY (HPGP) device, the QCA7000-AL3B. This latest product is one of the key milestones in Qualcomm Atheros’ expanding HomePlug Green PHY ecosystem of products and partner module companies supporting utilities, OEMs and other smart home and smart grid product designs.

The QCA7000-AL3B is both hardware and software compatible with the previously-launched QCA7000 and brings full industrial temperature support to the

product line, serving outdoor applications, such as electric vehicle service equipment (EVSE), electric meters and solar panels. The QCA7000-AL3B is available in the market’s smallest form factor (8x8 quad-flat no-leads package) and includes all the previously announced QCA7000 features. It is an extremely low power, fully-integrated single chip solution delivered with advanced software and hardware support packages. The QCA7000-AL3B is available now in production volumes.

The QCA7000-AL3B adds to Qualcomm’s expanding portfolio of low-energy, standards-based communication solutions designed to connect the Internet of Everything. Qualcomm Atheros continues to build its broad portfolio of HomePlug Green PHY solutions that enables an ecosystem of ultra-low power, PLC-connected devices, which addresses unique environmental requirements, like the QCA7000 does for outdoor applications.

The Qualcomm Atheros ecosystem includes Devolo AG, a leading European company marketing PLC solutions; Devolo is now taking orders for an advanced QCA7000-AL3B-based module. The utility industry widely accepts HomePlug Green PHY power line as a standard for connectivity as the broad customer base seeks to enhance both residential and commercial environments for energy distribution and automation.

# M2M in Industrial Products Manufacturing



## Current State of M2M in Industrial Manufacturing Sector

Today's manufacturers face extraordinary challenges in the form of rigid specifications, tight timelines and even tighter budgets. In addition, they function in varied production environments with several "best-in-class" machines bought from numerous vendors. Furthermore, flexible work-flows demand the ability to make rapid, precise line changes. In such a challenging environment, factory visibility and control becomes the key to delivering world-class manufacturing. Manufacturing-control architectures are moving towards a more allied manufacturing environment with decentralized mechanization. Machine to Machine (M2M) allows the machinery to make decisions locally while intelligently communicating crucial data to the desired destination. A new generation of Industrial M2M, intelligent, component-based automation machines and devices are beginning to surface, enabling distributed intelligence and local control. While M2M concepts and technologies have been in use in industrial manufacturing, for quite some time, the changing business scenarios and newer use cases are acting as growth stimulants. The greater demand for M2M solutions is primarily being triggered by the widespread adoption and proliferation of affordable wireless communication.

Industrial M2M is a fundamental component of a much larger and more complex manufacturing infrastructure.

Industrial M2M encompasses intelligent bi-directional plant floor communications, Programmable Logic Controllers (PLCs), Supervisory Control and Data Acquisition (SCADA) systems and Manufacturing Resource Planning Systems or Enterprise Resource Planning Systems. M2M is typically the initial component at the core of any manufacturing facility, from where the infrastructure builds out.

M2M is used in manufacturing to exchange data between devices, control applications and data gathering systems. This sector also includes asset tracking of large industrial equipment and the monitoring and control of factory assets. Analog sensors, for instance, are used to measure real-world conditions and process control systems that perform analysis and control of manufacturing processes. M2M also plays a major role in remote diagnostics and maintenance or process control.

## Potential market size of M2M application in the manufacturing of industrial products

The market of M2M modules in India has picked momentum in the recent times due to the increasing demand for remote monitoring and control across different industrial applications such as automotive, transport & logistics, utilities and others. The M2M market<sup>26</sup> size in manufacturing industry segment for 2010 was USD 0.17 billion and in 2011 was USD 0.23 billion, thus achieving an overall growth rate of 35 per

cent. Indian M2M modules market<sup>27</sup> is expected to reach USD 98.38 million by 2016, with a CAGR of 33.81 per cent from 2011-2016.

#### Key M2M Players

##### General Electric (headquartered at Fairfield, USA)

"Real-Time Operational Intelligence" software intends to give manufacturers a plant-wide perspective on operations. The idea to find adverse plant conditions, equipment risk and process breaches could throw a wrench in the final product. JHP Pharmaceuticals will be the first to use the technology.

##### FreeWave Technologies (based in Boulder, Colorado)

FreeWave Technologies is the manufacturer of the most reliable, high-performance spread spectrum and licensed radios for critical data transmission. It recently (Nov, 2012) announced details of its involvement at the annual Rockwell Automation Fair, which is the leader in spread spectrum data technology. The Fair is showcasing its leading wireless M2M industrial networking solutions that extend the capabilities of Rockwell Automation Programmable Logic Controllers (PLCs). FreeWave is also employing a variety of compatible Rockwell Automation solutions, for its industry-grade manufacturing, using M2M.

##### Lantronix (headquartered at California, USA)

Lantronix had implemented an Industrial device server, which can quickly and reliably connect virtually any piece of factory equipment to a network or the Internet to interactively access, manage, control, evaluate and utilize data from the equipment. They even provide the ability to perform real-time remote diagnostics and repair, automate data capture and generate immediate notification of problems.

##### ILS TECHNOLOGY (based in Boca Raton, Florida)

ILS Technology's industrial automation solution allows customers to effectively operate a diverse production environment with minimal custom development by deploying new machines into the legacy environments and transition critical legacy machines to new manufacturing IT platforms with ease of minimizing machine MTTR (mean time to resolution), maximizing machine uptime and implementing process changes/improvements in real-time. ILS technology industrial automation solution is a combination of its universal connectivity, real-time collaboration and web visualization products that deliver the same in an easy

to deploy and use package along with streamlining manufacturing operations and rapidly aligning production activities to changing business objectives.

##### SensorLogic (headquartered at Shanghai, China)

SensorLogic<sup>28</sup> provides an industry-leading platform for the rapid development and deployment of next-generation M2M applications. They also provide original equipment manufacturers to build deploy and manage private-labeled M2M solutions in areas like asset tracking, usage-based insurance and machine monitoring & service.

##### Kepware Technologies (based in Portland)

The OPC Foundation is playing a crucial role in expanding the usage of M2M in industrial manufacturing as the foundation adapts and applies fundamental standards and technology specifications of the general computing market mainly for manufacturing industry-specific needs. Kepware is working closely with the OPC Foundation as it continues to create new standards when needs arise such as OPC-UA, which is designed to be platform-independent and operating system independent, supporting Windows, Linux and a variety of Embedded Operating Systems that M2M technology vendors will be able to influence.

##### Gardner Denver (headquartered at Philadelphia)

It is a USD 1.7 billion industrial equipment manufacturer. A smart services solution in its air compressor product line has provided a new opportunity to improve product design and quality by way of capturing compressor performance data in real-time via a wireless internet connection and feeding it back to engineering and quality teams, which provide invaluable insights for new product development.

#### Challenges

- Being at a nascent stage, the technology expertise of M2M manufacturers and customer awareness are at basic levels. This is likely to slow down the mass diffusion of this technology among the user population.
- There are complex and diversified standards laying the foundation for industries to grow into big ones but these industry standards differ from country to country for every manufacturing sector.
- The overall transformation towards smart applications to be used in manufacturing comes at a high cost and requires a new business model.

<sup>27</sup> Research and Markets, January 2012, India M2M Modules Market (2011-2016)

<sup>28</sup> <http://www.sensorlogic.com/about-us/company.html>

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“M2M brings many industry players under one umbrella. However, the biggest challenge is that all of these players are working in silos. They are building their own devices [and] in such a scenario, working on interoperability becomes difficult.” - Jaswant Boyat, Technical Director, SP India and SAARC at Cisco Systems

#### Trends and Innovations

- Machine to Machine (M2M) communication is on the rise. There will be more machines connected to the Internet than human beings in the next decade.
- M2M technologies transfer data on the condition of physical assets and devices to a remote central location for effective monitoring and control.
- The M2M trend in manufacturing automation is to use data more effectively to improve operations and efficiency. OPC and embedded device communications have evolved tremendously, specifically in the areas of communication drivers for automation controllers, I/O connections and field devices. OPC drivers and interoperability technologies continue to become more intelligent in acquiring data from equipment and using the data to auto-generate content within the driver. They are also having a positive effect on the M2M market in manufacturing.
- There has been an increase in the collaboration among M2M technology vendors; OPC is helping the industrial M2M market leverage an open communications platform, which has given end users more choices and freedom to develop more sophisticated and robust automation applications, thus enabling data flow among various networks and devices.

#### Recommendations

The arrival of M2M communications is bringing renewed interest in radio frequency identification (RFID) technology in the manufacturing sector. M2M and RFID solution providers have a tremendous opportunity if they invest in the timely development and trials of newer, cheaper RFID tags.

They must collaborate to improve upon the types of RFID systems manufacturers use today, as well as, new applications that enable manufacturers to increase productivity and make business processes more efficient and also focus on ways to help manufacturers introduce new products and services, thereby, justifying the cost of RFID implementation.

Challenges and opportunities in RFID-M2M implementation are as follows<sup>29</sup>:

- The goal of M2M-RFID systems has evolved from tracking assets to collecting detailed information about products and transmitting them to an IT network.
- The strongest driver for RFID and M2M in the manufacturing sector is in productivity and efficiency of both employees and systems.
- Inventory management in manufacturing plants will be one of the strongest opportunities for RFID and M2M vendors and service providers.
- The greatest challenge faced by RFID and M2M vendors is the high price of tags, especially as technology budgets continue to decrease.
- To cope up with different manufacturing standards for the industries implementing M2M, there has to be industry alliances established, thereby, contributing to maturity and development of the M2M sector in manufacturing all over the globe.

#### Applications of M2M in Industrial Manufacturing

**1. M2M is used in manufacturing to exchange data between device, control applications and data gathering systems**

- Many machines are built as modular components

<sup>29</sup> [http://www.lightreading.com/document.asp?doc\\_id=213307](http://www.lightreading.com/document.asp?doc_id=213307)

with standard logic and control hardware. The manufacturer has a lot more choice in machine components, such as cappers, conveyors, loaders, or labelers, that can be manufactured and tested separately, then plugged into the completed machine at the customer site. M2M comes into play once the components are installed and recognize each other after the bus connection is made. Then, communication between controllers typically starts immediately and automatically without additional programming or configuration.

- With advances in information technology, manufacturers are deploying low-power, low-cost wireless communications. Most production facilities use some form of M2M for industrial automation in the manufacturing facilities.

## 2. Remote maintenance & monitoring of industrial machinery

- M2M monitoring solutions<sup>30</sup> allow manufacturers to supervise equipment remotely in real time, enabling them to provide timely service and repairs to avoid major breakdowns.
- In an automotive factory, sensor data from a hydraulic press is automatically transmitted to the manufacturer who can see that hydraulic fluid is

below recommended operating levels. A team is sent to perform preventative maintenance and forward the data to the press engineers to assist in design refinements.

## 3. Industrial Automation

- The migration of networking into automation (and automation into Ethernet) will have profound benefits for industrial automation applications<sup>31</sup>. Unfortunately, the serial devices used in today's plants and buildings communicate using a myriad of protocols, such as Modbus, Profibus, BACnet, EtherNet/IP, DF1, and many others. Device networking enables manufacturers to achieve greater efficiency and productivity on the factory floor by providing centralized access and control of all types of industrial automation equipment.

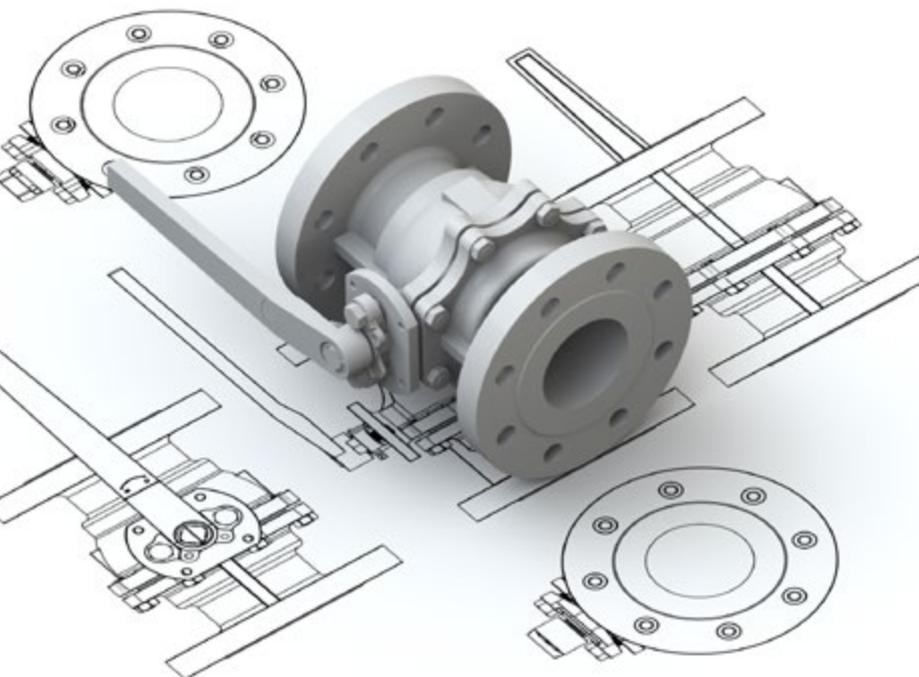
## 4. RFID-M2M

- The arrival of M2M communications is bringing renewed interest in radio frequency identification (RFID) technology in the manufacturing sector, a development that bears close monitoring by network operators and technology suppliers targeting that vertical market.
- In industrial automation, where cabled communication is difficult, impossible or simply too expensive, RF technology serves remote monitoring and control operations<sup>32</sup>. The advantages of wireless connectivity becomes apparent from an example of process engineering: spread over a large site, levels and control commands are to be measured and transmitted to a control system on the other side of the street. Digging trenches, laying cable runs and installing cables involves high costs. A radio link, on the other hand, is fast to install and creates a hassle-free communication solution at a fraction of the cost of the wired alternative.

30 Telstra M2M

31 Lantronix.com

32 [www.heavyreading.com/mobile-networks](http://www.heavyreading.com/mobile-networks)



## Case Studies

### 1. Vodafone: Providing remote tracking and monitoring services for plant vehicles

#### **Business need**

Movimatica is a division of the Merlo Group, the Italian plant vehicle manufacturer. It supplies geo-location products to Merlo and other customers, across Europe. Movimatica wanted to offer a new product with the ability to remotely monitor vehicle performance. It would use this information to carry out remote maintenance checks and boosting the vehicles' reputation in the market. In brief, the idea was to develop a solution, which could cater to the following aspects:

- Remote tracking and monitoring of plant vehicles
- Scalability to support future international expansion
- Improve security tracking of high-value plant vehicles
- Reliable coverage to ensure uninterrupted transmission of vehicle usage data

#### **The solution**

Vodafone created a solution tailored to Movimatica, with different roaming options. The customer has the option to use one SIM with either one network across Europe or individual networks in each country. A third option, one SIM and one network for each country, is also possible. The installation cost is relatively low in comparison to the vehicle's high value and more than 5,000 units are expected to be rolled out in year one. Technicians will have remote access to monitor the vehicles' mechanical performance, enabling them to gather data for future product development. The SIMs provide security tracking and Merlo can offer a higher value to its customers.

#### **Key customer benefits**

- Product differentiation: Movimatica can offer customers the ability to track vehicles, monitor technical performance and remotely resolve mechanical problems.
- Budget control: Fixed costs on installation and clear billing on usage helps with forecasting Movimatica's future growth.
- International reach: Vodafone's coverage and international reach supports Movimatica plans to roll out across Europe.
- Status: As Movimatica is one part of the Merlo business, delivering this added value service has boosted its credibility within the group.

### 2. ABB Robotics selects Wyless to deliver remote service on a global scale

ABB Robotics is a leader in power and automation technologies that enable utility and industrial organizations to improve their performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs more than 110,000 people.

#### **The challenge**

Robots play a crucial role in the high productivity and availability of a production line. In order to deliver round-the-clock services, on a global scale, ABB Robotics required a worldwide wireless data network and an internet-based Management Platform to provide real-time control and visibility of its network and connections all day, every day.

#### **The solution**

Monitoring and maintaining a fleet of robots can be difficult as they are complex pieces of equipment and therefore require specialist technicians. The remote service logs the ABB robot's key diagnostic data and sends it remotely to an ABB service centre via GPRS technology. The robot can automatically alert the central database, alert the on-call service engineer, who can then immediately access a detailed data error log and quickly identify the exact fault. At any time, from any location, an engineer can verify robot status and access important maintenance information about a robot system by logging into the ABB MyRobot website.

#### **The results**

Wyless-managed wireless data network is currently operational in 30 countries for ABB Robotics. Its customers can now communicate data securely and reliably from the robots direct to the service centre. ABB Robotics has been able to extend the uptime of its robots and lower the overall cost of ownership through proactive maintenance and reduced production disturbances.

ABB Robotics provides an integrated service, encompassing people, processes and technology to provide new value to its customers and cost savings to ABB.

The solution integrates the Wyless Management Platform, an Internet-based tool that provides unrivalled real-time network visibility, control and flexibility, to deliver a unique robot control centre. Wyless manages the network and the multiple relationships with Mobile Network Operators to reduce the complexities, risk and costs related of deploying and managing a global wireless network. Wyless' technology and patented Private Fixed IP addressing, allows ABB's robots to communicate securely, utilizing its two-way communication capabilities between its robots and the service centre, to provide improved and pro-active maintenance on a global scale.

In the near future ABB Robotics is aiming to extend its Wyless deployment almost 50 countries with 50 per cent of its new robots to be monitored remotely through the offering.

# M2M in Energy & Utilities



## Current Scenario of M2M in Energy and Utility Sector

The Energy & Utilities sector is vital for economic growth and prosperity of every nation and is the backbone of modern society. Regardless of the technology and engineering that has gone into building the energy infrastructure, economic growth is placing greater demands on already strained systems, leading to power failures, resulting in losses worth millions of dollars in manufacturing & service industries and inconvenience to ordinary citizens.

Key subsectors within Energy and Utilities sector are:

- Smart metering
- Demand management
- Smart grids
- Support for electric vehicles
- Decentralized energy management

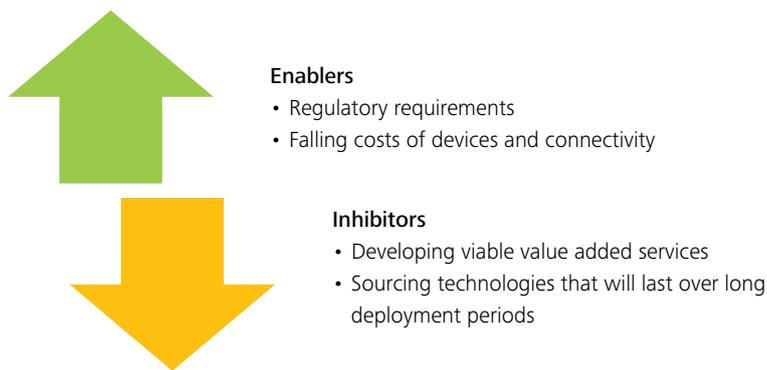
The power and energy sector has diverse requirements, ranging from monitoring and controlling of remote equipment to backing up substations and restoring power from a central location to optimizing customer service and efficiency. M2M is emerging as a cutting-edge technology for next generation “Energy

Management Systems”. The whole idea behind M2M is the deployment of “smart” and “connected” devices in the power and energy market. The M2M technology provides specialized solutions to cater to these diverse set of needs. It is a key enabling technology to meet the regulatory and business objectives with the introduction of new technologies like device controlling using powerline communication, smart grid and demand response.

Examples of M2M application in Energy and Utilities include:

- Enabling smart grids
- Implementing M2M across electricity distribution networks including intelligent switching
- Implementing M2M for intelligent Fault Management System to detect faults in the line, allowing for live switching and re-routing of energy in the event of fault detection
- Enabling stable supply from renewable energy installation by automatic switching from solar generation, when the sun is shining, to battery supply, when it is cloudy or the sun goes down

Figure 11: Major enablers and inhibitors in rollout of M2M in Energy and Utilities sector



33 [www.idate.org/](http://www.idate.org/)

34 Research and Markets, January 2012, India M2M Modules Market (2011-2016)

Source: Deloitte

### Potential Market Size of M2M in Energy and Utility

#### Global scenario<sup>33</sup>

- By 2020 there will be around 1.5 billion M2M communications in the utility business, majority being in “Smart Meters”.
- The Energy and Utility sector dependent on renewable energies, demands a share of 20 per cent of electricity from renewable sources by 2020.

#### Indian Scenario

Energy and utility are expected to drive future market growth as the Government of India is taking serious initiatives to deploy smart energy meters. Energy and utilities application markets are expected to grow with relatively higher CAGR of 38.12 percent from the period of 2011-2016.<sup>34</sup>

### Key Players Providing M2M Solutions for Energy and Utility Sectors

#### 1. Verizon Wireless

Verizon Wireless provides business solutions and services in Energy & Utility sector. These solution and services aim at improving the operational efficiency; increasing the collaboration and enhancing the productivity, in following areas:

- Smart energy and metering
- Smart grid and utilities

#### 2. Cisco

Cisco provides following M2M solutions in Energy & Utility sector:

- Energy Management Systems
- Smart grid and meters



### 3. Qualcomm

Qualcomm provides smart meters, grid devices and home energy management solutions. Its cellular chipsets enable utilities to deploy smarter grids functionality such as advanced smart metering, demand response, distribution automation, quick over-the-air firmware updates and outage management.

#### Drivers and Challenges

##### Key Drivers

##### *New generation of energy sources (mainly renewable resources)*

It is evident that within a span of few years the non-renewable sources are ought to get depleted due to their continuous use. Thus, there is a need to focus on the new generation of renewable sources, in the form of wind mills, small hydro, micro turbines, "micro grids," etc. E.g. Suzlon Group is focusing on wind farms in South Africa, Australia, Indian states like Maharashtra etc. Also the new generation of sources is located in places where direct command and control cannot be hardwired, so M2M solutions could be an alternative in this regard to enable the utility control centers without running expensive copper wires or fiber.

##### *The environment*

M2M technologies are not only helping utilities become economically more viable but are also making consumers aware of the conservation techniques that could help bring down their energy costs, thus, helping them in controlling and managing their energy use, saving money and reducing emissions. Therefore, M2M can help in reducing the carbon footprint. Smart meters will also provide consumers with more accurate information and bring an end to estimated billing.

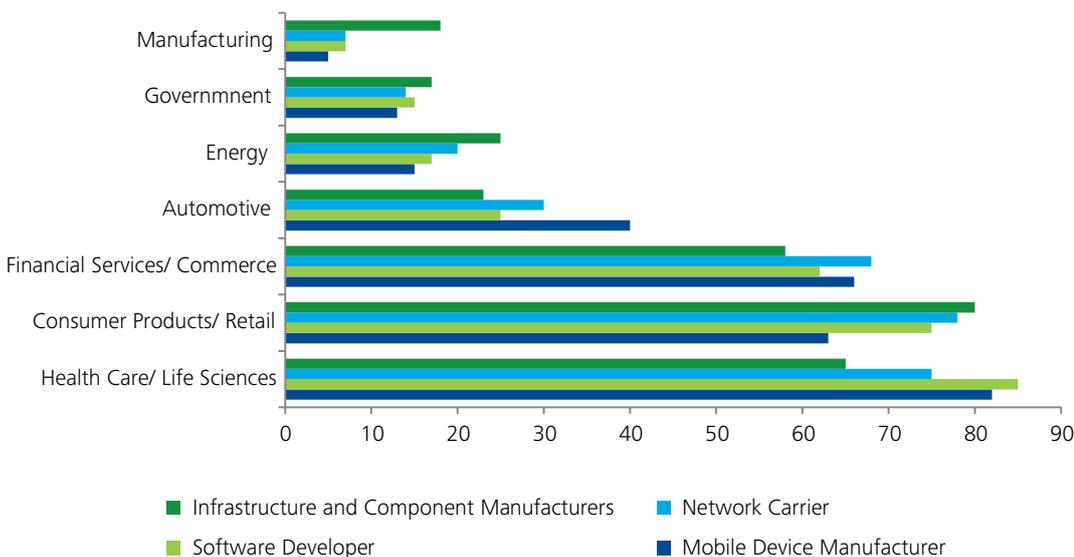
##### *Impact on core business*

Energy and utility companies are investing in M2M solutions because they not only reduce the energy wastage but also improve the efficiency of their core business operations and hence companies can directly realize the business benefits.

##### *Customer expectations*

Today's younger generation is more technology savvy, which has posed a huge opportunity for the enhancement of the energy/utility companies to provide advanced and technical solutions to this generation.

Figure 12: Growth of M2M in different sectors



Source: Deloitte Analysis



### Primary Challenges

#### ***Aging assets***

The current assets and infrastructure of energy and utilities have outlived their useful life and maintaining them is proving to be expensive. This calls for continuous up gradation.

#### ***Technology hurdles***

Technology standardization is one of the key challenges as there are so many players involved in setting the standards, agreeing to solutions and integration of systems.

#### ***Data collection and security***

Real time monitoring and controlling of parameters such as state, temperature, current, condition, location and alarms are required to be done today. Data collected from the sources such as home appliances, electricity meters, water meters or gas meters, need to be centralized at one place.

The applications of M2M solutions to smart meters or devices must be done with due care and caution so as to maintain the confidentiality and integrity of the data and protecting the systems from being intercepted.

### **Customer awareness**

People in India especially villagers, residents of remote areas and aging workforce, are not very comfortable with the upcoming technologies. Thus, developing customer awareness and interest for this technology is also a big challenge.

### **Trends and Innovations**

One trend worth noting is the use of two-way M2M technology to meet the demand and lower the demand curve of energy consumption. Efforts are being made to lower carbon emissions. Instead of throwing more energy at demand, there should be proper usage. That is where M2M and the smart grid combination come into play. Smart meters are part of this, and a number of key programs are now in the pipeline involving the deployment of smart meters. Wireless communications technology is being used to implement two-way M2M communication because it could prevent utilities from building multiple power plants by designing and creating efficiencies in the network.

Deployment of price response that allows consumers to alter their energy usage in response to a utility's pricing structure will help the consumers to decide that when would they like to curtail their use or simply shutdown their home devices and even communicate to the utility to turn everything off for a week while on vacation.

Trends may be heavily influenced by the government policy. As encouraged by the government, cellular smart meters have been deployed in several hundred thousand homes in the Nordic countries, at least in part. The government support is essential in creating best practices that will allow the utilities industry to operate in a controlled fashion, rather than having to start from the scratch. Smart meters are an example of the best practices.

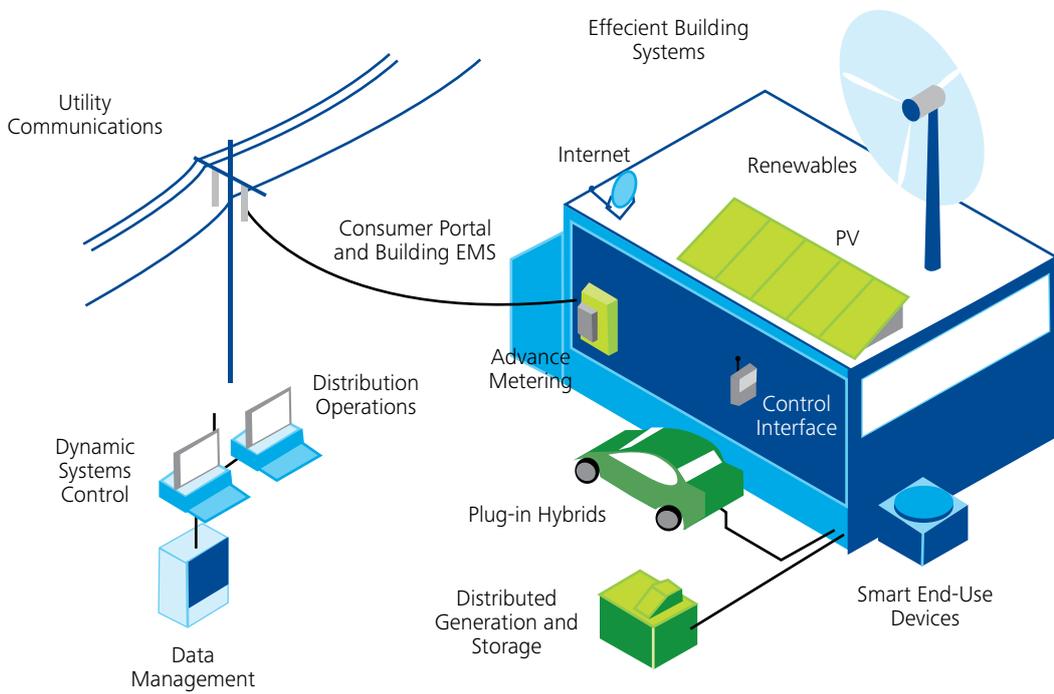
With tremendous growth in this sector, many innovations have been made using M2M technologies. Some of the significant innovations are described below:

#### **Energy Management System**

For effective energy management, there is a need for centralized system and data centers. Solutions must support agreement with energy audits and corporate reporting needs.

## Smart Grid

Figure 13: Smart Grid



Source: Electric Power Research Institute

- Simplify monitoring, reporting and control of energy consumption down to individual devices. For example, during lunch time when some ACs, fans or lights are not required, the EMS monitors and turns off the unused assets, thereby, saving the electricity consumption.
- Provide centralized energy management across distributed operations.
- Automate load shedding through policy-based decisions. The smart grid includes use of thousands of

“smart” meters and sensors that not only pass along their status and consumption data but also receive commands to turn off/turn on/throttle, etc. Similarly, there are plans to have a two-way conversation with electric vehicles when they are connected to the grid for recharge. Again, the extensive coverage of cellular signals can be a clear benefit to the energy/utility company in its plans for smart grid rollouts.

### **Smart Metering**

A Smart Meter is an electrical meter that records consumption of electric energy in regular intervals ranging over an hour or less and communicates that information back to the utility for monitoring and billing purposes.

Smart meters enable two-way communication between the meter and the central system. Unlike home energy monitors, smart meters can gather data for remote reporting, which differs from traditional automatic meter reading (AMR). Such an advanced metering infrastructure (AMI) enables two-way communications with the meter. The trend below shows that there is a huge scope for smart meters and grids in the near future.

### **Recommendations**

After seeing the potential scope and recent trends, it can be recommended that M2M solutions can help India grow economically by making more investment in M2M to create a difference in energy and utility sector.

The planning for 12th-Five Year Plan, by the Indian Ministry of Power and Bureau of Energy Efficiency, is in accordance with the “Low Carbon Growth Strategy” and energy-efficient demand management to ensure sustainable development of the power sector. Thus, emphasis is being laid on the use of nuclear, hydro, solar, wind power or power from other renewable sources. Development of advanced meters or other M2M solutions for utility-based demand side management and load management are other areas of importance.

Furthermore, M2M can be deployed in existing cabling of the premises or existing grid, thus saving lots of infrastructural investment only by upgrading its existing aging assets and by continuous maintenance. Thus, with M2M, not only the company but customers can save money. Who would not want to have cut off in power bills thereby saving electrical energy?

## Case Study - Energy Management System for the new Jamnagar Refinery in India

Bechtel has executed one of the world's largest projects "The new Jamnagar Refinery Project" in India for Reliance Industries Limited. The new refinery generates 800 MW power and electrical distribution system operates parallel to the old refinery's captive 450 MW system. Grid connections are at 132 kV. The new refinery's electrical network comprises of a 220 kV switchyard, two 33 kV main receiving substations, and nearly 40 process substations. Power is distributed at 33 kV from the main substations to the process substations, which step it down to 11 kV, 6.6 kV, and 415 V for distribution to refinery loads. To monitor and control this new large, complex electrical network, an ABB energy management system (EMS) was designed and installed.

### **Benefits of the solution**

#### 1. The EMS as Central Monitoring and Control System:

- Prompt fault reporting, easy troubleshooting, and faster decision making
- Flexible configuration
- Analysis on a common time domain
- Interoperability among different devices
- Distributed intelligence

The new refinery's EMS is designed to accomplish the following specialized functions:

- To interface with the EMS of the old refinery to acquire selected network information.
- Carry out selected control and contingency actions in the old refinery's electrical network when both networks are operating parallel to each other.
- Interface with third-party control and monitoring systems.

#### 2. Main Load-Shedding System:

When the new refinery's Main Load-Shedding system (MLS) is triggered by the operation of a critical input that results in power source loss or network disintegration, the system calculates network power balances by subtracting electrical loads from the available power.

#### 3. Under-Frequency Load-Shedding System:

The under-frequency relays installed on the two 220 kV bus sections monitor under-frequency condition and rate of frequency drop ( $df/dt$ ). Whenever these two parameters fall below their set limits, the corresponding under-frequency relay stage operates.

#### 4. Tie-Line Control:

The tie-line control scheme regulates the amount of active-reactive power flow between the two electrical networks. Tie line power

flow is usually from the new network to the old one. The tie-line scheme controls the active-reactive power generation of the new refinery to maintain the power flow between the two electrical networks.

#### 5. Unified Load-Shedding Scheme:

A unified load-shedding scheme was developed and is enabled whenever the inter-refinery tie lines are closed. This unified scheme enables power deficits to be calculated for any source loss throughout both the networks. When a power deficit condition is identified, noncritical loads are shed in either network, based on predefined priorities across both. During this scenario, the load shedding system specific to each network is barred from shedding loads.

The unified load-shedding scheme includes the following main functions:

- Determining tie-line connectivity
- Calculating unified load-shedding priorities
- Generating unified dynamic load-shedding tables
- Generating unified load-shedding commands

#### 6. Information Storage and Retrieval System:

The IS&R system provides centralized data collection, management, analysis and presentation services for the EDMS and LMS. Because information is the key asset for these two systems, the IS&R system is designed to transform raw data into meaningful outputs, generate reports, and keep the data secure for future access.

#### 7. Interfaces with Other Third-Party Systems:

The "Web interface license" residing within the IS&R server provides interface with third party systems; examples of these systems are the corporate LAN network and the CCR large screen video wall:

- Web interface with corporate LAN: The EMS Web interface with the corporate LAN provides authorized users access to key information such as important displays, reports, and alarm/event data.
- OPC interface with CCR large-screen video wall: The EDMS and Load Management System (LMS) OPC (industry standard that defines methods for exchanging real-time automation data between PC-based clients using Microsoft operating systems) interface with the large-screen video wall in the CCR enables critical data like total consumed power, system frequency, various unit loads, tie-line power flow, 220 kV system overview, and generator status to be displayed.

### Case Study - Energy giants give users more control over their consumption

British Gas collaborated in 2010 with Vodafone to rollout smart meters to nearly one million households. These smart meters produce accurate bills based on how precisely energy is being consumed by the households.

Vodafone UK won its first Smart Metering Award at the European Smart Metering Awards, part of the industry's annual UK & Europe Summit, i.e., the Network and Communications Award for 2011 in the Solutions Provider category. The award was given for its large-scale deployment of mobile data services as part of British Gas's industry leading smart metering rollout.

The technological partners that British Gas has contracted for the project are<sup>35</sup>:

- Vodafone - communications network
- Landis+Gyr - in-home smart meters and colour

touch screen energy display

- Trilliant - smart meter communications
- OSIsoft - smart meter data storage
- SAP - middleware for billing systems
- ZigBee - wireless home area network standard

The UK government has decided to go ahead with a plan to replace around 47 million gas and electricity meters in the country's homes, offices and factories by 2020 with the estimated capital cost of USD 12.87 billion. The most crucial part of the plan is the establishment of a central communications provider. British Gas has expected 3 per cent reduction in energy use that would save consumers USD 40.21 to USD 48.25 a year.

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“M2M communication is a key functionality in the smart grid applications domain. When hundreds of millions of smart meters start communicating every 15 minutes, the switches in the backbone network may not be able to handle that load. If we have to make smart infrastructures to communicate with each other perhaps we need to completely overhaul the entire telecom network in the country.” - Reji Kumar Pillai, President of India Smart Grid Forum

<sup>35</sup> <http://www.computing.co.uk/ctg/feature/2124798/energy-giants-users-control-consumption/page/1>

# M2M in Healthcare Sector



## Current state of M2M in Healthcare Sector

Healthcare industries around the world are facing a similar challenge – decrease in expenditures while increasing patient load. Globally, most hospitals are built to take care of emergencies and patients suffering from acute illnesses. Patients with chronic diseases require a different business model that provides continuous interaction between patients and doctors. Machine-to-Machine (M2M) technology is revolutionizing the healthcare sector by providing a method of interaction with the doctor, remotely on a continuous basis. M2M technology is making healthcare more mobile, improving care outcomes for patients and lowering the cost of care. M2M is acting as a tremendous catalyst for the entire healthcare industry - one that has ignited a remarkable proliferation of advanced devices and applications for improving patient care.

M2M is helping in a number of ways: Telemedicine is able to decrease the costs of expensive doctor visits by enabling remote communication between physicians and patients. Remote monitoring can reduce or eliminate hospital stays, freeing up scarce hospital beds for more serious cases. There are GPS solutions for tracking dementia and Alzheimer's sufferers. In addition,

there are a host of new technologies that put life-saving data, such as CT scans, test results and patient records, into the hands of medical staff, almost anytime, virtually anywhere. Whereabouts of health workers can be tracked ensuring that they safely arrive at and depart from appointments. Unnecessary paper work is being eliminated resulting in improvement in accuracy and compliance.

## M2M Opportunity in Healthcare Sector

There are eight major healthcare application groups:

- **Home monitoring:** This involves patient self-testing using medical devices and remote transmission of the medical data to healthcare providers for disease management. Some of the most common conditions being monitored today are chronic diseases including cardiac arrhythmia, hypertension, ischemic diseases, sleep apnea, diabetes, hyperlipidemia, asthma and Chronic Obstructive Pulmonary Disease (COPD). These conditions cause substantial costs and reduce both life expectancy and quality of life. Home monitoring can become a treatment option. Applying information and communication technologies in the healthcare industry can lead to decreased costs, more efficient care delivery and improved sustainability of the

healthcare system.

- **Clinical monitoring:** Delivers more cost-effective healthcare management and reduces costs by safely reducing patients' hospital stays and visits. Patient sensors also act as extra eyes and ears for doctors, helping them to spot early warnings of medical deterioration and apply treatment earlier than physical diagnosis allows. These solutions dramatically improve the quality of life for patients, helping them to regain their mobility and independence from the hospital environment.
- **Telemedicine:** Doctors are scarce – especially in rural areas – and their time is valuable. Telemedicine can allow these doctors to see more patients each day by eliminating unnecessary trips. M2M solutions enable patient tracking systems to keep an eye on a patient's location and monitoring can automatically alert a doctor or healthcare facility when necessary. Portable, wearable and even implantable sensors and tools can also watch vital signs and provide the data to healthcare providers – a real-time information that sometimes means the difference between life and death in case of heart failure, diabetic comas and other serious illnesses. Telemedicine helps battle the high costs of serious ailments.
- **First responder connectivity:** In healthcare industry every second counts, everything has to work. No excuses are accepted. Rock-solid reliability and innovation is expected to deliver this service to its fullest potential.
- **Connected medical environments:** Being healthy and in shape isn't just a trend anymore, it's a lifestyle. Machine-to-machine solutions can not only monitor vital signs during exercise, it can also make real-time transmissions of the data to servers or the Internet. Users can then quickly view and gain valuable insight on both their health and their fitness programs, and even share their workouts on social networks. This is possible with the help of connected weight scales, heart-rate monitors and other devices.
- **Clinical remote monitoring:** Monitor and track the status of patients with chronic conditions remotely. It improves patient care and outcomes through proactive monitoring and enables continuity of care and patient self-management. Clinical remote monitoring reduces home visits and the costs associated with them and keep patients healthy with continuous monitoring e.g. Silent Observer, developed by Sukrut Systems, uses sonography machines to track pregnancy tests, thereby reducing illegal female

feticide and also provides daily updates.

- **Assisted living and clinical trials:** Ambient assisted living allows the elderly to remain independent in their own homes. Patients receive support with their daily tasks and with arranging services from third-party healthcare providers. They are also monitored to ensure their health, safety and well-being. Patient tracking systems offer doctors, relatives and caregivers a constant update on a patient's whereabouts.
- **Asset management:** This enables tracking and managing mobile healthcare equipment. It improves productivity with visibility of asset availability. Asset management improves patient health and safety with scheduled maintenance and cleaning of equipment and reduces costs with equipment safety monitoring and incident tracking.

### Drivers

The drivers of M2M Healthcare are as follows:

- Healthcare reforms, rising costs of healthcare, ageing societies and greater emphasis on home-based care
- Growing proportion of health-conscious consumers keen to monitor their health
- Cheaper, home-based care for remote monitoring of patients and personal health monitoring
- Spread of smart phones, falling costs of devices and the cost of introducing communications technology to other electronic devices, falling below the threshold required to make it viable for many applications

### Top Players in M2M healthcare

Vitality Inc. is a US-based company. The product from the company addresses the adherence problem for pharmaceutical brands, retail pharmacies and healthcare providers. The device built by the company is known as Vitality GlowCaps. It is a simple, cellular-connected pill cap. Vitality GlowCaps illuminate, play a melody, and even ring a home phone so patients don't forget their medication at the stipulated time. The device can send weekly emails to remote caregivers, create accountability with doctors through an adherence report and automatically refill prescriptions. Vitality improves medication adherence, health, and peace of mind.

Cinterion is a German company, headquartered in Munich. It is a part of Gemalto Group. The company has sales and support operations in all the continents. Cinterion is a M2M industry pioneer for more than 15 years. With Cinterion telemonitoring device, a consulting physician can remotely monitor the patient

in emergency cases as the patient might be far from the city or in rural area. A GSM based sensor system checks the patient's vital parameters and provide an updated real-time status of the patient.

Royal Philips Electronics, the Netherlands-based electronics company also operates in health and well-being sector. Respiroics System from Philips is a sleep therapy solution. When a patient repeatedly stops breathing during sleep, the system provides treatment by delivering a specific flow of pressurized air through a mask to keep the airway open. It's a two-way wireless communication.

Qualcomm, the US-based company is a world-leader in providing wireless technology and services. A hand-held diagnostic device known as Medical Tricorder developed by Qualcomm can diagnose a set of 15 conditions, including pneumonia, diabetes and sleep apnea without relying on a doctor or nurse.

GE Healthcare: The Company is a provider of transformational medical technologies and services. The company has expertise in medical imaging, medical diagnostics, patient monitoring systems and drug discovery etc. In addition, it partners with healthcare leaders, striving to leverage the global policy change necessary to implement a successful shift to sustainable healthcare systems.

TZ Medicals: It is a US-based company in M2M healthcare. One of their products is Aera CT heart monitoring device. It is a M2M-based heart arrhythmia monitoring device. It detects heart arrhythmia daily and records it over-time. It then transmits recorded information via mobile network or internet so that care-takers could securely check the status of the person's cardiac condition, providing 24/7 patient support.

### Challenges

The challenges in M2M healthcare sector are as follows:

- The rate of adoption is slow and wireless technologies have only just begun to penetrate the market.
- Regulations act as drivers in sectors such as energy and automotive but they are a hindrance to further adoption and innovation, in healthcare sector. For instance, many doctors are reimbursed by the patients they see, not the ones they don't. This doesn't help

prioritizing M2M deployments that solve patient problems without a hospital visit.

- Identifying workable business models that fit with healthcare incentive schemes.
- Long lead times to get regulatory approval on new devices and highly complex ecosystem to connect between doctors, hospitals, ambulances, care homes and more.
- Customer concerns about privacy and security, impacting the viability of many M2M applications.

### Trends and Innovations

- CRM, field service and dispatch operations: These applications replace paper-based processes, reduce scheduling calls and get instant access to electronic medical records for healthcare professionals, while being mobile. The applications are available on smart phones.
- Electronic health record: These BlackBerry compatible applications access and update patient health information anywhere at any time via mobile handheld devices.
- Safety: The application allows the patient to quickly alert people by email, SMS and PIN with one click of smartphone. The application is BlackBerry compatible.
- Drug reference: The application instantly access drug monographs and health plan formularies, check for drug interactions, use pill ID to identify a drug based on its physical characteristics and receive current updates to content and medical news on your mobile device.
- Paging: The application replaces aging pager units with a reliable and easy-to-use application that utilizes both the cellular and Wi-Fi networks on smartphones.
- Reference: The application receives continually updated drug clinical reference at point of care, covering over 3200 diseases, conditions and procedures with images, videos and more. There are applications that provide quick and easy access to a wide variety of medical formulas, scores and classifications.
- Workforce and fleet management: The application helps a patient in locating their mobile healthcare professionals, track GPS timesheets, customize wireless forms and get voice and on-screen turn-by-turn GPS directions with full color maps. The application is available on smartphones.
- Mobile dictation: The application helps in reducing

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“The ubiquitous penetration of the Mobile and the Apps ecosystem presents unparalleled opportunity to augment not only user experience and speed but also governance like civic administration and crime monitoring. There are tremendous opportunities in emergency life threatening situations like stroke, accident alerts to empowerment platforms like learning.” - Ninad Karpe, MD of Aptech India

time and effort spent on recording and processing dictation in a healthcare facility with a simple menu system that allows for convenient recording and sending of dictation.

#### **Recommendations**

Every company seems to be promoting its own type of protocol or standard in the hopes that it becomes the industry standard. This is one of the key problems now. Industry needs to agree on technology standards and must develop open protocols. Agreement over technology standards, a simplified provider ecosystem to connect between doctors, hospitals, ambulances, care homes etc. and the expansion of cloud-based services will help to establish a platform for creativity. The process must be established to expedite regulatory approval in healthcare space.



## Case Studies

### 1. CHSSA, Canada

Community Home Support Services Association (CHSSA) in Canada supports the senior citizens and people with disabilities. Community health workers from CHSSA provide a variety of health care services during in-home client visits.

CHSSA's head office had been using voicemails to communicate client schedules to community health workers, which was a laborious and time-consuming process. Leaving a voicemail messages and subsequently retrieving the same, was an inefficient way to exchange appointment information. The system often resulted in communication breakdowns and missed appointments. In addition to this, healthcare workers were required to manually update patient reports following visits. The healthcare workers had been spending valuable time writing up time sheets. CHSSA was provided by Rogers mobile network operators in Canada, an efficient, secure and easy-to-use mobile data solution. The solution provided by Rogers was built around the smartphone with third-party software. The solution totally replaced the time-consuming voicemail-based system CHSSA was using to communicate home workers' schedules. Rogers provided over 400 CHSSA representatives, a solution capable of sending and receiving, scheduling information at the click of a button. The health workers receive the updated real-time schedules on their smartphones. The solution has eliminated the need to make a phone call to retrieve schedules.

The mobile data solution provided by Rogers also allows community health workers to accurately record patient information on their smartphones at the end of each visit, resulting in less data re-entry, faster processing times and increased reporting compliance.

### Benefits

- Reduction in paperwork, improvement in accuracy and compliance because of technology deployment by CHSSA.
- Tracking the whereabouts of community health workers, helping ensure that they safely arrive at, and depart from, appointments.
- CHSSA workers and field supervisors are more efficient, leaving them more time to focus on improving their services throughout the community.

### 2. Ideal Life

Ideal Life is a manufacturer of wireless health tracking devices. One of the company's devices is a wireless scale for Congestive Heart Failure (CHF) patients. There are 5.3 million CHF patients in US. CHF treatment is very costly and annual spend for this ailment on hospitalization in 2008 was USD 34.8 billion. The scale uses M2M to transmit patients' weight data back to their doctors' servers, which in-turn automatically flag any changes in weight that could be symptomatic of a looming problem. No training is required to be given to the patients, there is no need to plug in or set-up any devices either. The patient is required to be on the scale once a day. The product from Ideal Life has shown reductions in hospital admissions, re-admissions and related costs vis-à-vis telephone-based self-reporting of data. It reports a return on investment of USD 7.57 for every dollar invested. The high adoption rate of individuals using this platform is another significant feature of this wireless health tracking device, in addition to the healthcare savings and reduced costs.

# M2M in Retail Sector

## Current state of M2M in Retail Sector

The sale of goods and services from individuals or businesses to the end-user is called Retail. Retail industry has become one of the important verticals for cellular Machine to Machine (M2M) connectivity with 10.3 million cellular connections in 2011.

M2M technology enables devices such as POS terminals and ATMs to be used at new locations where fixed line connectivity is unavailable or is impractical. It has transformed the markets such as vending and parking, where machine operations need to be reorganized in order to benefit from the real-time information. Each and every industry in the retail sector has displayed tremendous growth as reflected in the pointers below:<sup>36</sup>

- Almost 24 per cent of ATMs in North America and 5-10 per cent of ATMs in Europe are connected with cellular network in 2011.
- Installation of vending telemetry devices in North America reached an estimation of 0.25 million units at the end of 2011.
- Parking Industry, one of the earliest adopter of M2M technology, has approximately 3 per cent of the world's 3.2 million single-space meters connected.

These are some of the industries which have already gained a good footprint in the M2M retail sector, delivering a superior shopping experience with wireless technologies, cutting operating costs and helping connect with customers securely and quickly.

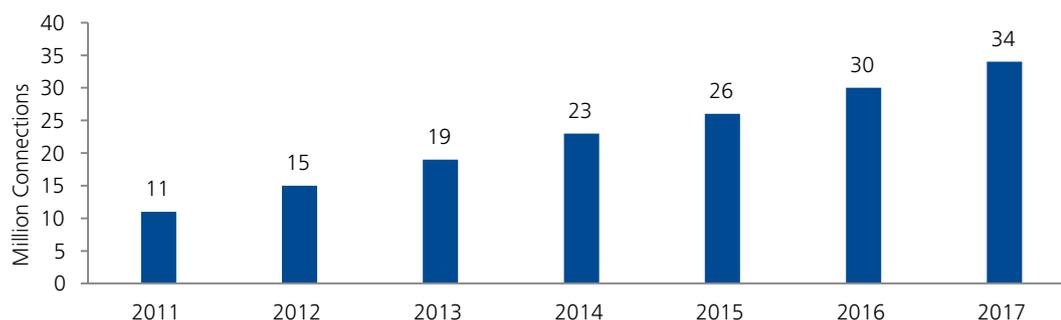
## M2M Opportunity

### Global:

The Retail industry is an important vertical for cellular M2M connectivity with 10.3 million<sup>37</sup> cellular connections in 2011 with ATMs, vending machines, parking meters and fare collection devices worldwide. It is forecasted that the number of cellular M2M connections in the Retail industry will grow at a Compound Annual Growth Rate (CAGR) of 21.6 per cent to reach 33.2 million connections worldwide in 2017<sup>38</sup>.

- Shipments of cellular M2M devices will at the same time increase at a CAGR of 10.7 per cent i.e. from 5.2 million units in 2011 to 9.6 million units in 2017.
- The technology has a more transformational effect on markets such as vending and parking, where machine operators need to reorganize their operations in order to benefit from the availability of real-time information.
- It is expected that the vending machine segment will present a major opportunity for wireless connectivity in the long term and will be the fastest growing segment during the next few years.
- In Europe, the installed base of vending telemetry devices is projected to grow from 75,000 units in 2011 to 324,000 units in 2017. Similarly, the installed base in North America is projected to increase from 0.25 million units in 2011 to one million units by 2017<sup>39</sup>.
- Cellular connectivity is incorporated in an estimated 0.1 million fare collection devices worldwide today, such as on-board ticket vending machines, stationary vending machines and hand-held ticket sales terminals.

Figure 15: Cellular M2M network connection in the retail Industry (Global 2011-2017)



Source: Berg Insight forecasts

36 Berg Insight, Retail applications and wireless M2M 2012

37 <http://www.berginsight.com>

38 [www.reportlinker.com/](http://www.reportlinker.com/)

39 [www.cellular-news.com](http://www.cellular-news.com)



**India:**

Though, M2M modules market in India is still in a nascent stage, automation and “smarter” retail devices are all destined to be an essential part of the life of every consumer. With 100 per cent FDI in single brand retail sector, opportunities for Indian consumers are aplenty.

- The fast food retail chains penetrating into the Indian market are transforming the way people eat out. M2M technology could create many opportunities in this sub-sector. For instance, in case of chilled and frozen food transportation, M2M solutions enable to identify perishable food during transportation to minimize losses. This is achieved through temperature monitoring.
- In India the markets based on the M2M modules are

expected to generate USD 98.38 million by 2016, with an estimated Compound Annual Growth Rate (CAGR) of 33.81 per cent from 2011-2016. The cellular M2M modules generated USD 9.15 million in 2011 and are expected to reach USD 41.54 million by 2016<sup>40</sup>.

- Large shopping malls, retail chain store, etc. may use vending machines and upload stock data with capability to interact with the warehouse. Store managers can even see automatically which items are stocked, which require to be sourced and how effectively certain items are selling.

**Key Players providing M2M products for Retail Sector**

Some of the major players operating in M2M retail sector are:

Company	Origin	Services
Deutsche Telekom	Bonn, Germany	Vending machines, digital signage, wireless payment solutions
Rogers Telecom Inc.	Toronto, Ontario	Wireless solutions for retail, critical network access, Point of Sale ROI calculator
Verizon Communication Inc.	New York City, United States	Digital signage, inventory monitoring, Point of Sale, smart vending, mobile commerce, interactive kiosks
Wipro	Karnataka, India	Provides different M2M industry specific solutions such as device engineering services, middleware, IT support platform and device support services

Source: Company websites

40 <http://www.m2m.com/docs>

### Challenges faced by the Industry

There are several challenges faced by providers in launching M2M modules in the retail sector - initial capital being one of the key challenges, followed by infrastructure. Some of the major challenges are:

- On a global perspective cooperation of operator, vendors and manufacturers with retailers is required for smooth functioning
- Some retailers are uncomfortable with customers comparing pricing and product availability with their smartphones. Such retailers view embedded M2M solutions as a way to send business to competitors or online outlets.
- Food retail: Optimized shelf-life of food products needs to be monitored properly and temperature needs to be constantly maintained as they tend to have short shelf life.
- In supply-chain management, major challenge is to reduce losses across supply chain and efficiently manage the supply and demand. This is a big hurdle which still needs to be addressed.
- Need to optimize the routing and delivery of stocks is a big challenge to reduce overheads incurred, as huge amount has to be spent on loss recovery.
- Maintenance: M2M devices tend to be expensive and the cost associated with their maintenance could also be large.

### Trends and Innovations in Retail Sector

M2M can be of huge assistance to the retail industry through remote monitoring and control, process automation, provision of innovative communication channels, optimizing inventory, provision of automatic updates on maintenance needs, as well as handling of payment services. M2M is becoming an asset to the industry by boosting sales through cash-free payments and monitoring processes.

Some of the trends and innovations around M2M in retail by companies such as Verizon<sup>41</sup>, Deutsche Telekom<sup>42</sup>, Rogers<sup>43</sup> are:

1. Digital Signage (Marketing): These innovations are mainly useful to improve communication between service providers and customers. In other words, it increases advertisement impact by enhancing the ad appeal and reduced operating cost from marketer's perspective. It also extends a real-time communication channel from customer's perspective. It can be an outlet for targeted information with increased visibility. Instead of using banners and posters, retailers are now

provided with an opportunity to use digital signage to engage and inform their customers. Verizon, in partnership with Reflect Systems is, for instance, deploying cloud-based network for connectivity and data service to receive digital promotions and report consumer interactions<sup>44</sup>.

2. Inventory monitoring and fleet management: This solution is meant for retailers to view their inventory remotely and optimize delivery schedules and keeping stockrooms and shelves full. Verizon, by implementing XATA Turnpike Route Tracker, is providing service to retailers to have real-time visibility into truck locations and vehicle diagnostics. The data connected through the Verizon's Wireless network is transmitted back to varied service lines like dispatch, maintenance and monitoring crews.

3. Mobile Point-of-Sale (Mobile commerce): This solution mainly helps in enhancing the ease of sale, transaction and payment solutions. By setting up wireless point-of-sale terminals and Payment Card Industry Data Security Standards (PCI DSS) – compliant router from Digi International, and over Verizon's Wireless network of a secured WLAN environment, Verizon is trying to help retailers equip locations with all-in-one magnetic-stripe readers, receipt printers, signature capture and PCI DSS-validated software from 'Charge Anywhere' to process transactions and track sales data.

4. Interactive kiosks: Interactive kiosks also provide a ground for engaging with customers to enhance efficient retail experience as they are embedded with features like live video chat for better customer service and informed purchasing decisions.

5. Wireless payment solutions: These devices are helpful to customers and retailers by ruling out the need for any cash transaction, enhances security, benefits the retailers to reach new customers with highly secure, hassle-free payment services and with increased customer satisfaction. From customers' perspective, it simplifies payment structure with expanded access to trusted retailers.

6. Vending machines (smart vending): Managing vending machines in various locations is a challenging task, but with telemetry solutions real-time information about inventory, sales, errors or even amount of coins and currency in individual machines can be remotely monitored and controlled. Telemetry also helps operators to communicate with vending machines to adjust settings or change prices according to the time of the day, weather or any other external factors that can affect. M2M solutions in vending machines have several

41 <http://www.verizonwireless.com/b2c/splash/enterprise/m2m/retailsolutions/>

42 <http://m2m.telekom.com/industry/retail-and-commerce>

43 <http://www.rogersbizresources.com/industry-insight/retail/325>

44 [http://vzwvideos.mccannslc.com/downloads/pdf/Business\\_Solutions\\_for\\_Retail.pdf](http://vzwvideos.mccannslc.com/downloads/pdf/Business_Solutions_for_Retail.pdf)



benefits. Smart vending is a solution with Business Intelligence Information System in which machines inform the retailers when supplies are low and provide insights into consumer behavior, product demand and pricing.

#### **Recommendation**

- Clearer technology standards for the interface with core sensors and various wireless communication protocols will change the face of M2M in retail.
- Better defined partnerships and the expansion of cloud-based services will further give a fillip to this sector.
- Cheaper technology and smaller devices will drive the uptake of M2M in retail.
- Retail industry also desires a seamless interface to both network standards (GSM and CDMA) that support a truly global reach and/or duplicity in domestic coverage.
- Support from governments in setting cross-border standards and streamlining regulations.

#### **Cast Study - Last-mile telecom redundancy solution for point-of-sale - Blinds to Go<sup>45</sup>**

##### **Background**

Blinds to Go<sup>46</sup> is a retailer and manufacturer of window blinds and shades in North America. The company has over 100 superstores throughout USA and Canada, which offer a large selection of custom-made blinds and shades at low, factory direct prices.

Blinds to Go was in need of a last-mile telecom redundancy solution for point-of-sale (POS) systems in their retail outlets. The objective was a failover solution that would provide continuous uptime for store transactions in the event of outage of the primary wired source of Internet connectivity. They were looking for wireless solution as 90% of the issues were arising with landline disruptions.

##### **Solution**

Rogers Communications supplied with a failover solution for the stores' POS systems that included CradlePoint mobile broadband wireless routers connected to Rogers' wireless network. This benefited Blinds to Go by providing ease of deployment, reliability, ease of management, speed as well as value.

45 <http://www.rogersbizresources.com/files/225/Rogers%20Case%20Study-Blinds%20to%20GO-EN-HR.pdf>

46 [www.blindstogo.com](http://www.blindstogo.com)

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# About CII

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the growth of industry in India, partnering industry and government alike through advisory and consultative processes.

CII is a non-government, not-for-profit, industry led and industry managed organisation, playing a proactive role in India's development process. Founded over 116 years ago, it is India's premier business association, with a direct membership of over 8100 organisations from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 90,000 companies from around 400 national and regional sectoral associations.

CII catalyses change by working closely with government on policy issues, enhancing efficiency, competitiveness and expanding business opportunities for industry through a range of specialised services and global linkages. It also provides a platform for sectoral consensus building and networking. Major emphasis is laid on projecting a positive image of business, assisting industry to identify and execute corporate citizenship programmes. Partnerships with over 120 NGOs across the country carry forward our initiatives in integrated and inclusive development, which include health, education, livelihood, diversity management, skill development and water, to name a few.

CII has taken up the agenda of "Business for Livelihood" for the year 2011-12. This converges the fundamental themes of spreading growth to disadvantaged sections of society, building skills for meeting emerging economic compulsions, and fostering a climate of good governance. In line with this, CII is placing increased focus on Affirmative Action, Skills Development and Governance during the year.

With 64 offices and 7 Centres of Excellence in India, and 7 overseas offices in Australia, China, France, Singapore, South Africa, UK, and USA, as well as institutional partnerships with 223 counterpart organisations in 90 countries, CII serves as a reference point for Indian industry and the international business community.

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# About MIT School of Telecom Management

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MITSOT strives to build premium quality manpower with Techno-managerial skills, to act as 'Business Leaders' & 'Change Managers', in the various fields. MITSOT being guided & supported by the industry- academia, blends the best of the Technical & Managerial skills in its curriculum design & course delivery mechanism, to mould students into the most sought after & highly valued breed of future managers, professionals and entrepreneurs.



## Message from MITSOT

A world of connected devices, in which machines of all types and sizes can autonomously communicate with each other, has long been imagined. Robot is one of the familiar example of machine-to-machine (M2M) communication. M2M, the acronym for Machineto-Machine Applications (or more aptly, Mobile to Machine and Machine to Mobile communications) is an emerging area in the field of telecom technologies. These technologies enable one device to communicate with another device/machine over a wireless network / internet. According to a Forrester report, M2M is also referred to as the "Internet of Things," the "Extended Internet," or "connected devices."

Machina Research has done a ten year forecast of M2M based on analysis of hundreds of individual applications, spanning across thirteen different sectors such as Utilities, Healthcare, Automotive, Consumer Electronics, Manufacturing etc. Machina has forecasted that there will be 3.5 billion active wide

area M2M connections all over the world, by the end of 2020. This is a very impressive growth rate of approx. 30% year on year basis.

According to the Cyber Media Research, there is huge growth potential for Indian telecom industry in M2M applications. The Indian M2M application market is witnessing significant traction particularly in Automotive, Transport & Logistics, and Utilities sectors. The M2M application market in India is now witnessing a shift towards wireless based communication systems vis-à-vis wired systems of the past. The catalyst of growth in these sectors is the requirement for remote monitoring and control of devices that are already deployed or to be deployed in future.

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