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Emerging Technical and Regulatory Structure of M2m Communications

Dr Mandeep Singh
General Manager, HRIDC
Chief Financial Officer, HORCL
Government of Haryana, Chandigarh

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ABSTRACT: Globally, the number of cellular Machine to Machine (M2M) connections in the retail industry is forecasted to reach 44.3m by 2019, up from 23.1m in 2014 at a CAGR of 13.9%. The proportion of global M2M revenue shall be 20% for connectivity and 30% for Module/Sensor by end of 2021. In this background, it is important that there is need for clear understanding on the aspect of Emerging Technical and Regulatory Structure of M2M Communications.

KEYWORDS:ETSI, M2M, CAGR, LAN, ICT, QoS, IOT

I. INTRODUCTION

Achieving better cost efficiency, M2M communications has become a market- changing force for a wide variety of real-time applications, such as environmental monitoring, remote healthcare, smart systems, industrial automation, etc. The advanced metering infrastructure of the smart grid presents the major growth potential in the M2M market today. Machine-to-Machine (M2M) communications refers to the automate exchange of information between devices for control and monitoring applications. This type of communication is not new since automated systems have been present for more than three decades. M2M usually entails a change in the core business of an industry, since the relationship with external partners and the internal tasks can be radicallymodified. The effect of M2M on current and future networks has been a topic of discussion in international organizations, such as the 3GPP, where it has been highlighted the need to efficiently provide connectivity for large number of devices, provide energy-efficient mechanism for autonomous devices and develop charging mechanisms suitable for M2M communication.

II. FUNDAMENTALS OF M2M COMMUNICATIONS

a. End-to-End Architecture for M2MCommunications

In 2009, the European Telecommunications Standards Institute (ETSI) has established the M2M Technical Committee with the purpose to develop an end-to-end architecture for M2M communications. According to ETSI, an M2M system is composed of the five key elements with functions as follows:

(i) The M2M component, embedded in a smart electrical device, transmits data or replies to requests.
(ii) The M2M gateway enables connectivity between the M2M components and the communicationnetwork.
(iii) The M2M server works as a middleware layer to pass data through various application services.
(iv) The M2M area networkprovides connectivity between M2M components and M2Mgateways.
(v) The M2M communication network provides connection between M2M gateways and M2Mservers.

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The additional spectrum and connectivity available across heterogeneous networks can be used to further improve system capacity and quality of service (QoS). The costs associated with the additional capacity are very low, because of the fact that the alternate spectrum could be free (e.g., unlicensed spectrum).

b. Applications ofM2M

The applications of M2M cover many areas and the areas in which M2M is currently used are given below:

(i) **Security:** Surveillances, Alarm systems, Access control,Car/driver security

(ii) **Tracking & Tracing:** Fleet Management, Order Management, payas you drive, Asset Tracking, Navigation, Traffic information, Road tolling, Traffic optimization/steering

(iii) **Payment:** Point of sales, Vending machines, Gamingmachines

(iv) **Health:** Monitoring vital signs, Supporting the aged or handicapped, Web Access Telemedicine points, Remotediagnostics

(v) **Remote Maintenance/Control:** Sensors, Lighting, Pumps, Valves, Elevator control, Vending machine control, Vehicle diagnostics

(vi) **Metering:** Power, Gas, Water, Heating, Grid control, Industrial metering

(vii) **Manufacturing:** Production chain monitoring and automation

(viii) **Facility Management:**Home /building / campus automation

c. Business Impact of M2M solutions

In the energy sector, smart metering increases business efficiencies and decreases operational expenses for energy companies; transportation tracking solutions improve route optimization and safety for vehicles on the road; the healthcare industry is also looking into improvement of patient care through instant device communications, remote monitoring and disease management.Among industry verticals benefitting from M2M paradigm, automotive industry is assessed as the largest as it alone accounted for approximately 40 percent of total number of wireless M2M connections in 2015. Other industry verticals employing M2M principles are given in Figure 1.

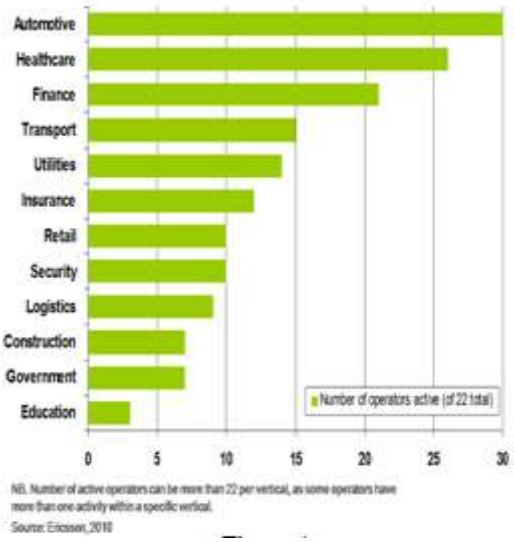

Figure-1

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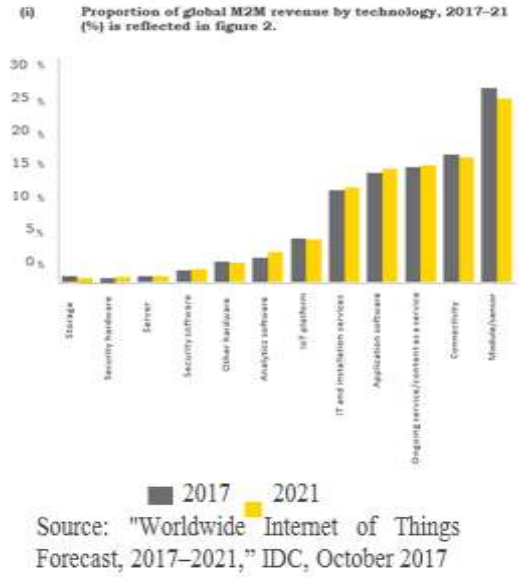
d. M2M Opportunity Matrix

It will make dramatic improvements to economic growth by creating new business opportunities for mobile operators, equipment vendors and other players in the mobile space.
The business case for M2M adoption can be analyzed from a cost and revenue perspective.
The cost-driven business case: Connected machines offer opportunities to optimize processes in order to reduce costs. According to a recent survey, 43 of the firms are planning to adopt M2M for reducing operatingcosts.

The revenue-driven business case: New and innovative solutions open up additional revenue opportunities.

(i) Proportion of global M2M revenue by technology, 2017–21 (%) is reflected in figure 2.



Source: "Worldwide Internet of Things Forecast, 2017–2021," IDC, October 2017

(ii) Response of retailcommerce to M2M Communications

Improvement and innovation in product logistics, customer experience, remote monitoring capabilities and communication channels are driving M2M in the retail industry. Globally, the number of cellular M2M connections in the retail industry is forecasted to reach 44.3m by 2019, up from 23.1m in 2014 at a CAGR of 13.9%. Wireless M2M connectivity enables retail devices such as point-of-sale (POS) terminals and vending machines to be set up in locations where fixed connectivity is unavailable.

(iii) M2M empowering the agro Sector

M2M applications are empowering farmers and agriculture businesses to monitor equipment, manage crops and livestock, assess environmental conditions and monitor fleet of tractors and other harvesting vehicles. M2M is enabling farmers to make informed decisions and improve yields, as well as increase transparency and efficiency within wider agricultural value chains

III. ECO SYSTEM OF M2M COMMUNICATION

M2M communication has a similar "game changing" impact as mobile broadband, however this time the impact would be seen across a wider range of industries. A "smart" device or machine will need to be provided, at a high level, with at least three types of services: connectivity, remote provisioning and maintenance, and the application specific functionalities.

a. Device Manufacturers

In the context of M2M, device manufactures can cover a wide range of stakeholders. every device can become part of the M2M ecosystem, granted there is a feasible business case to motivate the required investment.

b. TelecommunicationOperators

M2M represents an important growth opportunity for telecom operators for developing new competences that will enable them to deliver complete, end-to-end solutions, from M2M modules or devices to connectivity and value addedservices.

c. ServicePlatforms

A service platform is the enabler for horizontal integration of different M2M applications. From a layered architecture perspective, it is positioned between connectivity and applications**.** They provide the necessary interoperability to support applications at a global scale, which is a mandatory requirement in some cases, e.g. logistics or connectedvehicles.

d. ServiceProviders

Probably the most important benefit of M2M is the vast range of new services that it can enable, since it is the service that will create true value for end-users or companies, rather than the product itself. It include conventional service providers, for example insurance companies (with new detailed services such as pay-per-drive), healthcare companies (e-Health), cargo or transportation (real-time tracking of assets), road administration (services related to traffic report, traffic management and maintenance), parking providers (real-time payment and free spot location).

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e. InformationProcessing

The heart of M2M is to make relevant use of data but, considering the interconnection of billions of devices, raise the immediate challenge of how to handle all this information appropriately. "Big data" is a Buzz word and attracts more and more attention both for the opportunities in can provide and also for the concerns itraises.

f. Physical InfrastructureOwners

In order to enable efficient integration of services, there is a separate set of actors that become extremely relevant to M2M; the infrastructure", understood as the place where devices and networks will be installed and services will be provided.

g. End-users

In the M2M ecosystem, two types of end-users can be distinguished: direct users, who buy and use smart devices and indirect users who buy the M2M service, possibly not even interacting with anydevice. Nonetheless, there are some key sectors, such as e-healthcare or security services, where the added value is strong enough in order to attract private consumers.

IV. M2M STANDARDIZATION ACTIVITIES

One M2M aims to develop technical specifications toaddress the need for a common M2M service layer that can be readily embedded within various hardware and software. It would develop globally agreed M2M end-to-end specifications using common use cases and architecture across multiple M2M applications.

a. Global StandardizationEfforts

At the moment, standardization work in M2M is mainly focused on three areas:

(i) Standardization for Wide Area Connectivity (e.g., 3GPP, WiMAX Forum). The main goal of these activities is to standardize the required enhancements for supporting M2M communications in existing cellularnetworks;

(ii) Standardization for Service Capabilities, (e.g., one M2M, ETSI, TIA TR-50, ITU M2M Focus Group), where the scope is to provide standardized capabilities, that can be used by various M2M applications through API's, regardless of the underlying transportnetwork;

(iii) Standardization for Local Area Connectivity (e.g. ZigBee Alliance, IETF, IEEE), focusing on using LAN technologies for supporting M2Mapplications;

V. EVOLVING REGULATORY FRAMEWORK OF M2MCOMMUNICATIONS

Regulations and policies are ever-present in the world of electronic communications and are necessary to ensure fair competition, protect the end-users and sustain the development of technology. With the advent of M2M communications, which can be seen as a basis for building the Internet of Things (IoT), the question of regulating, or not regulating this area become inescapable.

On one hand it is argued that, at the moment, there is no need to create specific regulations, since the technology is not yet mature and inappropriate policies could hinder development and innovation and interfere with its natural evolution.

On the other hand, the concept of "everything connected" raises new challenges, in particular regarding data use and sharing, ethics or privacy and security that might not be addressed by existing legislation. Furthermore, the highly varied nature of M2M and IoT applications makes it difficult to develop a one-size-fits-allframework.

Based on the findings of the public consultation, another study by the EC made recommendations on potential policy options, which could advance the development of IoT, while being consistent with European regulation objectives. In particular, three possible levels for a regulatory framework are evolving: -

- **No change** with respect to the current ICTregulation;
- **Soft Law** to provide guidance by using non-legislativemeasures;
- **Hard Law** to enforce regulation policies by explicitlegislation;

The "No change" alternative implies that no specific intervention should be made by the EU regarding the M2M market. Such de-regulation will allow the market define the evolution of the sector, without setting boundaries that could restrain the potential of future application.

"Soft law" would involve, among other considerations, monitoring M2M development, supporting research and innovation in areas with high socio-economic impact, e.g., health care, smart grids, participation in standardization bodies and providing an active support to industry.

However, some areas will require stricter regulation, beyond "soft law", which lacks accountability or enforcement methods. Notably, with M2M applications, concerns regarding data privacy, security and third-party sharing will be brought outside the virtual world and into everyday

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life through interaction with "smart"devices.

A report commissioned by leading telecom operator M/s Vodafone shows that regulations are considered as the main driver behind M2M adoption for industries which are subjected to stricter legislation.

M2M	IoT
Point-to-point communication usually embedded within hardware at the customer site	Devices communicate using IP Networks, incorporating with varying communication protocols
Many devices use cellular or wired networks	Data delivery is relayed through a middle layer hosted in the cloud
Devices do not necessarily rely on an Internet connection	In the majority of cases, devices require an active Internet connection
Limited integration options, as devices must have corresponding communication standards	Unlimited integration options, but requires a solution that can manage all of the communications

VI. CHALLENGES AND WAY FORWARD FOR M2M COMMUNICATIONS.

The following challenges can be identified at this moment.

- First, there is the requirement of discovering, filtering and interpreting relevant information, while maintaining a generic character, i.e., creating a level of abstraction in which data cannot be linked to specific individuals or devices.
- the second challenge lies within the regulatory domain; in particular defining what type of data can be shared or brokered by the owners of M2M applications.
- While for commercial services, e.g., consumer electronics, logistics, the owners of the M2M platform should retain full ownership of data, there are applications where this data becomes of public or national interest, e.g. smart metering, smart cities. In this view, third challenge is enforcing separation between commercial data and publicly available data.

VII. SUMMARY AND CONCLUSION

M2M as an application holds the promise of bringing benefit to both telecom operators and vendors. For service providers it is an opportunity as low-bandwidth M2M services can be readily overlaid onto the current user services network. Vendors are expected to profit from selling both M2M-capable devices, and from the network expansion brought about by increasedthroughput.

However, it comes with change in business model and value chain. There are questions regarding the role of operators in the value chain. Also, M2M services may have their own specific characteristics which might be different from services in which humans directly influence communication flow. The standardization in the direction of special handling or optimization of the network for M2M specific service will lead for better support of M2Mcommunications.

To conclude M2M communications will play an important role in data exchange of a pervasive computing. Appropriate M2M regulatory mechanism can be adopted by the member nations in many applications (e.g., environmental monitoring, energy management, remote healthcare, etc.) with objectives to improve efficiency, reduce cost, faster response time, regulatory compliance, risk mitigation and new business opportunities.

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