

主題

# Machine to Machine Commerce(M2M Commerce) in the New Era of Network Convergence

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## Abstract

The convergence of fixed and wireless networks in data communication is providing the necessary driver for M2M commerce to take-off. The opportunities provided by M2M Commerce are only limited by imagination. Automotive Fleet and Freight, Tolling, Water and Power Metering, Supply Chain Management including Asset Management, Remote Monitoring and Diagnostics, Energy Management and Access Control and Security are among the many M2M applications that are currently getting rolled out. ARC Group expects the worldwide solutions market to be worth in excess of US\$ 100 billion by 2007. In addition, operator revenues worldwide from the transport of Telematics data alone will rise from US\$ 3.5 billion in 2002 to US\$ 78 billion

by 2007.

This paper discusses some of the lifestyle and business opportunities provided by M2M Commerce in the new era of network convergence. It also provides some case studies to demonstrate the benefits of M2M Commerce across the supply chain. The key focus of the paper is on achieving enhanced lifestyle, cost reduction, improved profitability and enhanced customer relationship management through M2M Commerce.

## Keywords

Machine to Machine Commerce; M2M Commerce; Network Ready; M2M Supply Chain

## Introduction

M2M Commerce is just not a vision but a reality now. This has become possible through the availability of increased computational speeds in microprocessors, resulting in real time application of signal processing algorithms and other advancements in networking and data communications. We would see more and more M2M based lifestyle and business applications becoming available over the next few years and the market exploding by 2008 This explosion is likely to sustain over an extended period of time for there are currently over 50 billion machines in the world.

M2M Commerce is about machines exchanging information, supporting lifestyle activities or conducting business transactions. These machines may be mobile phones or PDAs, portable computers or devices like stereo systems and fixed devices like washing machines or ovens.

The machines, typically are supervised, monitored or controlled by human beings. This is in fact a sub optimal use of human potential and intelligence, especially when the processes are simple and straightforward. M2M Commerce in the given technological environment is best suited for applications that have repeated and well standardized business processes. This includes but not limited to

Tolling, Water and Power Metering, Supply Chain Management including Asset Management, Remote Monitoring and Diagnostics, Energy Management and Access Control and Security.

The major barriers to M2M Commerce take off have been the lack of cost effective packet switched wireless data communication services, standardization of information exchange formats or frameworks and the lack of communication interfaces on the machines.

## Business Drivers

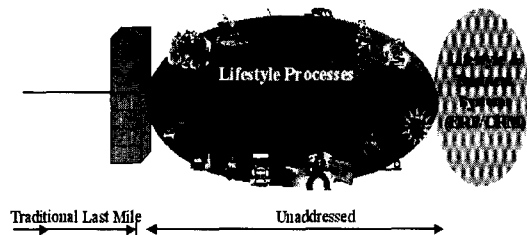
### Reduced Human Intervention

Every media break is a human intervention cost. With the manpower cost spiraling up in the developed world, the preferred choice is to seek "zero media break" for well-established and repeated processes

### Facilitation of Information Exchange between Spatially Located Processes

There is a large unaddressed gap between the "traditional last mile" and lifestyle and business systems like ERP/CRM. The telcos typically consider that their business finishes at the junction box and the IT companies have not addressed the gap for it being a networking issue. The truth is that the millions of business and lifestyle processes that sit between the two boundaries is a market opportunity for an innovative solution

that can integrate these processes and facilitate information exchange. We see more and more M2M applications addressing this opportunity, though in a very piecemeal manner.



**Figure 1 – Unaddressed Application Processes**

## Estimated Market Size

M2M Commerce is an evolving market, whose boundaries are not yet well defined and may also be not defined for some more years to come because of the sheer magnanimity of its dimensions. Different market research and consulting companies have used different basis to estimate its size, however, the common message is that the market is magnanimous. We have included some estimates to give an understanding of the size of the market

There are estimated to be 50 billion machines in the world today. Though a very small percentage of these machines are digitalized and a fraction of these digitalized machines are in fact not networked. However, over the next 10 years, a significant number of these machines will be replaced by those which are digital and are Network Ready.

Gartner Group [1] estimate that by 2005, between 100 and 160 million M2M connections will exist between field devices and mobile devices

Wireless Data Research Group [2] found that the wireless LAN based systems were the most significant contributor to the 2002 market, due mostly to telemetry systems for Healthcare, which accounted for more than US\$ 1.0 billion of the US\$ 3.4 billion market.

ARC Group [3] expects the worldwide solutions market to be worth in excess of US\$ 100 billion by 2007. In addition, operator revenues worldwide from the transport of telematics data alone will rise from US\$ 3.5 billion in 2002 to \$78 billion by 2007.

## M2M Commerce Addressing Lifestyle and Business Needs

M2M Commerce addresses both lifestyle and business needs. It enhances the lifestyle by making more quality time available by significantly reducing the human intervention in the day to day chores. These chores will be typically done by pre-programmed and remotely controlled machines.

The business needs are served by increased revenues, decreased business cost and enhanced customer relationship management. The decreased business cost is achieved through early fault detection, reduction of

downtimes, remote management and monitoring and process automation. The enhanced customer relationship management is achieved through the ready availability of accurate information through wireless or wired media and proactive customer and problem management

## M2M Commerce Technology and Application

M2M applications seek to acquire and transfer data from a collection of business equipment, devices and systems. In an extended supply chain, these diverse assets have no common interface and many are remotely located. In this situation, deciding how to establish the connections needed to enable M2M communication can be a daunting task.

Solutions can be designed to incorporate wired networks, dial-up modems, licensed radio networks, or even satellite communication. Each has unique pros and cons, and decisions on which to implement need to be made on an application-specific basis. Careful consideration must be given to installation costs, security issues, and reliability.

M2M solutions employing wireless technologies (e.g., wireless LAN and cellular) offer some distinct advantages for supply chain applications. For instance, wireless M2M

applications enable the gathering of information from equipment that is remotely located, that is, where a wired network does not exist, at an unmanned facility, or where the installation of network cabling would not be possible due to excessive cost or harsh environments. Wireless M2M also represents the most cost-effective choice when seeking to incorporate mobile physical assets (or assets that may be in transit) into the M2M applications.

### Data Communication

M2M Commerce, till the recent past, has been driven by local wireless solutions using industry standard and proprietary protocols and leased lines. It is only recently that the cellular standards like GSM and CDMA have been used to provide connectivity. However, these are circuit switched network solutions, more optimal for voice rather than data communication.

The two cellular standards that are likely to compete in the near future are 3G (W-CDMA & CDMA2000) and IEEE 802.16. The latter has an edge over the former as it is purely packet switched and generic IP.

The situation will be much clearer in a couple of years till then multiple industry and proprietary standards will co-exist.

### Electronic Business Framework (EBF)

For two parties to communicate successfully, they need to have an agreement about the way in which the information between them is transmitted (the communication protocol), they

should have a common understanding of the contents of the messages, and there has to be an awareness of the context in which the messages can be exchanged and understood. At this level, the emphasis is shifted from the transmission of data and information to the exchange of more complex and meaningful abstract structures, such as documents. Structured document types representing invoices or purchase orders, for example, will provide the context needed to process the information and thereby lay the basis for meaningful M2M communication [4]. The establishment of communication and interaction protocols is a necessary condition for progress toward semantic communication between machines.

Browser is a person to a machine interface and is not capable managing collaboration among machines. Electronic Data Interchange (EDI) served the industry, till it was replaced by Internet and WWW which in fact initiated more flexible methods of exchanging documents. Many of these methods utilize XML and various EBFs such as RosettaNet and ebXML.

EBF covers design guidelines, best practice recommendations, vocabularies and markup conventions for the annotations of documents. The evolving standard among EBFs is ebXML supported by United Nations.

### Digitalization and Network Ready Machines

There is a growing trend to replace specialized mechanical, hydraulic and electronic machines with those that are digitally controlled and Network Ready. The trend is also expanding to the consumer sector, which uses the large bulk of machines. The current Network Ready consumer machines support 802.11b standard, which is an interim protocol till broadband based cellular standards evolve.

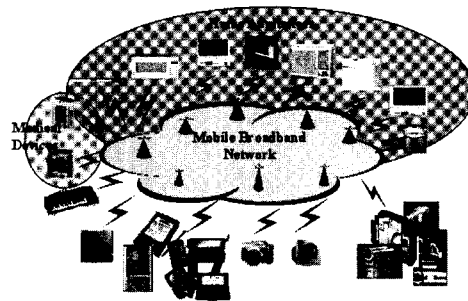


Figure 2 – M2M Commerce: Network Ready Machines

A number of M2M applications are discussed from the point of view of achieving enhanced lifestyle, cost savings and optimized utilization of manpower.

### Vehicle Management

A modern vehicle is in fact, the state of the art technology with complex electronic and mechano-electrical systems. All these systems present a challenge to be monitored, while on the road and hundreds of kilometers away from their base. The vision of every vehicle manufacturer is to provide a fault free life cycle experience to every owner. However, the

truth is that the breakdowns are a reality.

M2M based solutions can provide the status and vital information of the vehicle health, wear and tear and usage statistics that can help in proactive service planning and just in time maintenance.

### Building Management

Today's buildings employ a number of complex stand-alone and integrated systems including lighting, HVAC, elevators, fire detection and security, which need to be monitored and managed on a continuous basis to ensure that they are all well maintained and also to ensure the integrity of the building is well maintained.

M2M based solutions can provide the required level of automated monitoring and management by tracking and recording performance data from power, lighting, HVAC, and other systems for the purposes of reporting and trending; remotely detect, diagnose, and correct problems with equipment in hard-to-access areas or remote locations before incurring the cost of dispatching maintenance personnel; monitor building access and remotely lock down various areas of the facility and alert personnel via alarm, pager, e-mail, or text message an equipment failure or facility intrusion occur.

### Remote Energy Metering

The ever increasing manpower cost is challenging the managements of utilities how

best to stay profitable. Remote household and industrial premise metering is one of the more attractive solutions under consideration with the most utilities.

M2M based solutions can provide round the clock or periodic remote metering of the household and industrial premises gas, power and water usage. These solutions will be able to monitor, meter and control the usage remotely. This will enable utilities to proactively manage customer expectations, implement time of the day usage tariffs as well as provide usage profiles to their customers.

### Remote Industrial Monitoring

Effective operation of modern water, gas and other types of utilities requires comprehensive monitoring and control of key enterprise systems and equipments. Data relating to the operational status of remote pumping stations, sub stations, pipelines and other essential assets and equipments must be gathered and collated and any necessary adjustments to processes must be made in order to ensure that the utility operates safely, optimally and with no disruptions in service to end customers.

SCADA (Supervisory Control and Data Acquisition) does a good job of providing basic operational data and the ability to make on-the fly adjustments to basic processes. However, in today's challenging environment the organizations require to exercise greater

control over security, access control and the facility's other operational systems.

M2M systems will provide remote monitoring, control and management of systems and equipment not included in SCADA, such as security and access control for substations, chlorination stations, life stations and other remote facilities and log historical data for the purposes of statistical trending and regulatory compliance.

### Security

Security, today is critical not only for homes but also for industrial premises to safeguard equipment, products and processes and ensure employee and public safety. Security becomes much more complex when the facilities are located far apart or in isolated areas or when the users require access to security information.

M2M solutions can remotely lock doors, gates and other secure areas, trigger alarms, authenticate access and can also send notifications.

### Supply Chain Management

In order to maximize supply chain management (SCM) activities, both customers and suppliers must make key decisions relating to inventory and distribution. Developing strategies for managing the resources needed to meet demand ensures that the supply chain

operates efficiently and cost effectively and improves overall service levels by guaranteeing that the right products are available at the right time. Effective supply chain management strategies, however, cannot be created unless fresh, accurate data on customer orders, manufacturing processes, inventories, and deliveries is made available to decision makers all along the chain

M2M solutions can facilitate information exchange across the SCM, which will in turn reduce on-hand inventory and warehouse capacity, lower administrative costs by reducing time spent ordering, scheduling shipments, and reconciling errors and discrepancies and allow accounts receivable access to up-to-the-minute information on deliveries and replenishment so billing can begin immediately.

### M2M Supply Chains

The key objective of M2M supply chain is enabling collaboration among vendors, service providers and manufacturers through seamless information exchange and execution of business transactions. According to the Forrester report 72 percent firms agree that collaboration is "critical to the product development success."

The key challenges to M2M supply chain implementation are using technologies that use well-established industry open standards. As

matter of fact, Forrester identified rigid and proprietary standards as factors that "limit interoperability and cramp collaboration."

## M2M Supply Chain Case Studies

### *BioLab*

BioLab is a provider of pool chemicals and equipment and sells its products to market through a network of distributors and authorized service providers. The intensifying competition forced it to reconsider its options and strategized to establish a closer link with its dealer channel and, ultimately, the end consumers of its chemical products. To do so, BioLab deployed a wireless M2M system at its customers' commercial pools, water parks, fountains, and other recreational water facilities.

The solution at each site includes a M2M system that gathers real-time data such as pH balance, oxidation reduction potential (ORP) values, chemical levels, and water temperatures. The system interfaces back to a network operations center (NOC) using embedded wireless technology. At the NOC, the data is aggregated, stored, and presented to customers, dealers, and authorized BioLab personnel through a secure Web portal.

This strategy of collaborative relationship with its supply chain has been revolutionary and has delivered tangible benefits for all and

especially for the customers. Service Providers can now monitor on-line and review critical performance data, which helps to reduce disputes for the level of the service provided. BioLab can now proactively schedule deliveries and replenishments and customers can now view critical equipment performance data at any time of the day or night. Service Providers can also review formation relative to water quality and chemical usage, which helps reduce or eliminate litigation stemming from liability claims. For its part, BioLab now has the data it needs to proactively schedule chemical deliveries and ensure timely replenishment. The company has in fact leveraged M2M solution to develop new lines of business for itself and its dealers by *providing notification and repair dispatch* to the service providers should the equipment fail or the agreed specifications for water change.

### *Bayer AG*

The division of a German pharmaceutical giant, Bayer AG, supplies chemicals and gases to a number of smaller drug manufacturers. This division has deployed M2M systems for remote monitoring and administration of chemical and gas storage tanks of its customers. The systems utilize sensor technology to connect Bayer's customers' storage tanks to the Bayer corporate network via standard and wireless modems and the Internet. The M2M systems remotely monitor the tanks and send communication reports when low tank levels, power failures,



out-of-range temperatures, or other critical conditions occur. Also, as tanks are being replenished, the delivery person scans a bar-code indicating its employee identification number along with the type and quantity of each chemical or gas they are delivering. All this information goes in real time into Bayer's Oracle database and SAP supply chain management system. Access to real-time data on tank conditions and replenishment activities helps Bayer reduce costs and optimize its supply inventories by giving the company the ability to identify and deliver needed chemicals to its customers and to better coordinate their supply strategies, schedules, and processes

## Conclusion

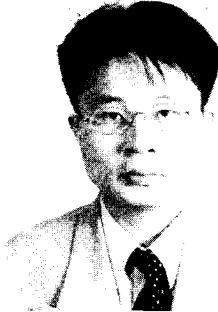
The wireless-based M2M applications are now starting to deliver value across the supply chain, which indeed is encouraging for there is a definite reason for each party to actively participate. As exciting and new technologies enter the market, we expect to see increasingly sophisticated, best-practice examples from the leading-edge companies.

The M2M solutions currently being deployed have some proprietary elements because of the lack of end to end standards and thus do not offer third party vendors to easily plug in their solutions into the given architectures. However, this is likely to change as more and more standardization evolves and both the vendors and customers will be under pressure to

deploy open solutions that can provide interoperability.

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