



Solution to Intrinsic Issues of M2M in Cloud

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Abstract--Machine to machine (M2M) is a broad label that can be used to describe any technology that enables networked devices to exchange information and perform actions without the manual assistance of humans. Machine-to-Machine (M2M) communication is a novel communication technology which has witnessed an unprecedented growth. M2M encompasses numerous market sectors: Security, Automotive, Buildings, Smart energy, Homes, Healthcare, Industry, Infrastructure, Transportation and Retail.

The M2M industry refers to them as vertical markets because the applications were created as silo solutions that stand apart from enterprise environments. The vertical silo model is not an efficient way to communicate and it's also a barrier to further development. It's inefficient because the same wheel is reinvented for different applications, even when they are for the same sector. And it's a barrier because business processes like CRM[14] and ERP[14] employ a horizontal model, which has a common system architecture that enables component sharing.

It's clear that the vertical silo model as described above map to the flat architecture of enterprise environments, nor can it provide cloud-centric M2M services. There are a number of intrinsic issues. This paper has 3 different solution for the above problem from 3 different vendors. All three vendors have not only embraced the concept, but they have also taken it forward in interesting and innovative ways.

Keywords-- M2M, CMR, ERP, vertical silo, Cloud

I. INTRODUCTION

Machine to machine (M2M) is a broad label that can be used to describe any technology that enables networked devices to exchange information and perform actions without the manual assistance of humans. M2M is the technology that establishes intelligent communication between things.

M2M is a form of data communication that involves one or more entities that do not necessarily require human interaction or intervention in the process of communication. It can be in two ways:

- Uplink to collect product and usage information.

- Downlink to send instructions or software updates, or to remotely monitor equipment.

M2M communication is often used for remote monitoring. In product restocking, for example, a vending machine can message the distributor when a particular item is running low. M2M communication is an important aspect of warehouse management, remote control, robotics, traffic control, logistic services, supply chain management, fleet management and telemedicine. It forms the basis for a concept known as the Internet of Things (IoT)[15] that is most important to the business and future business decisions.

II. WORKING OF M2M

M2M works by embedding a communication module, sensor, or tag in a physical asset (service, finished product etc.) for sending the information about its status and performance to a computer information system. The information flow is automated and allows remotely monitoring, maintaining, and tracking these machines.

Important data about a machine can be uploaded to a computer system from the machine itself rather than being manually collected and uploaded by a human being.

It's easy to see why machine-to-machine communications have so many applications. With better sensors, wireless networks and increased computing capability, deploying an M2M makes sense for many sectors. The sensors can send information wirelessly to a computer with specific details about pressure, flow rates and temperatures or even fuel levels in on-site equipment. The computer can automatically adjust on-site equipment to maximize efficiency.

To develop and deploy M2M Technology, we must follow current standard of M2M like ETSI[16], ANSI C12[17], etc. Following figure explain the main architecture of M2M Technology

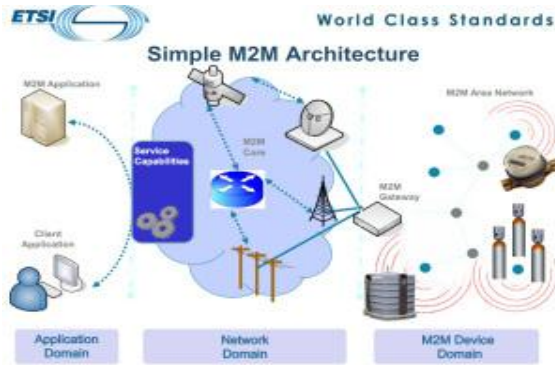


Figure 1: M2M Architecture

In the figure 1, we can see 3 main domain of M2M architecture, such as:

- M2M Application Domain
- M2M Network Domain
- M2M Device Domain

M2M Applications Domain provides application for M2M technology, such as server applications and end-user applications. M2M Applications Domain contains 2 part of basic applications:

- Client Application: provide end-user services application
- M2M Application: provides applications that located on the servers, built upon M2M service capabilities and interacting with M2M devices.

M2M Device Domain contains devices that can connect to M2M Network domain. M2M Device Domain can be called as M2M Area Network. We must refers to market requirements to choose the devices for M2M Device Domain. Diverse technologies can be used to support various applications. There are two types of devices for M2M Device Domain:

- Devices that one capable to directly connect to the network and Devices that cannot directly connect to the network domain, requires an M2M gateway in order to connect to the network.
- Proprietary devices: devices that only support proprietary interfaces. Proprietary devices need proprietary gateway to connect M2M network.

M2M Network Domain provides communication network between M2M Application Domain and M2M Device Domain. M2M Network Domain consist two basic part, such as M2M core and M2M service capabilities.

The M2M core network is the central part of the M2M communication network that provides various services to service providers connected via the access network such as GERAN, WiMAX, Satellite, DSL, UTRAN, WLAN or eUTRAN and other mobile network (e.g. 3G, 2G, LTE, 4G). M2M service capabilities are network functions defined to support M2M applications.

To develop of M2M Technology we should study about Technical Report (TR) and Technical Specification (TS). Study about technical report will give you an idea to make standard specifications to your system. After you've got standard specifications, you also need to make technical specifications. There are 3 stage to make standard technical specification of M2M Technology from high level to low level stage:

- M2M Service Requirements
- M2M Functional Architecture
- M2M Communication Interfaces (APIs)

III. INTRINSIC ISSUES OF M2M IN CLOUD

M2M communications has the proven ability to reduce costs, save time, boost operational efficiency and improve customer service or just fundamentally change business models from OPEX[18] to CAPEX[19].

M2M encompasses numerous market sectors: Security, Automotive, Buildings, Smart energy, Homes, Healthcare, Industry, Infrastructure, Transportation and Retail. The M2M industry refers to them as vertical markets because the applications were created as silo solutions that stand apart from enterprise environments.

The vertical silo model is not an efficient way to communicate and it's also a barrier to further development. It's inefficient because the same wheel is reinvented for different applications, even when they are for the same sector. And it's a barrier because business processes like CRM and ERP employ a horizontal model, which has a common system architecture that enables component sharing.

It's clear that the vertical silo model as described above map to the flat architecture of enterprise environments, nor can it provide cloud-centric M2M services. There are a number of intrinsic issues.

IV. SOLUTION TO INTRINSIC ISSUES

The challenge can only be met by starting with a clean slate, which is what the three vendors have stated in this paper. Their solutions are distinctively different but at the same time, they all deliver cloud-centric functionality.

The first solution comes from SensorLogic[20] which has been acquired by Gemalto, a world leader in digital security, they have created a model that handles the complex underlying architecture that is required in virtually all enterprise-grade M2M applications. Network operators, device manufacturers, software vendors and system integrators can use it. The company's cloud-based Service Delivery Platform(SDP) is designed to meet the M2M application development, deployment and management needs of network operators, system integrators, device manufacturers and enterprise IT organizations.

The Application Enablement Platform/SDP scales with your business, which allows you to Connect any type of device over any network combine real-time device data with contextual information from cloud applications and enterprise systems to create actionable business intelligence design, build and manage your applications with ease using pre-built service and tools regardless of the size and scope of your deployment, no matter which networks or what types of devices are involved, the platform is scalable and flexible enough to meet your needs.

That platform comprises embedded software, mobile communications, device protocols, provisioning, and real-time data processing technologies combined with advanced Web services, security, data management, and scalable cloud technologies.

Service delivery platform(SDP)



Figure 2: Gemalto's Service Delivery Platform(SDP).

The above figure shows the Gemalto service delivery platform, which comprises of sensors, machines, devices, vehicles.

The SDP consist of 3 layers, where the top layer is application services, the middle layer is complex event processing and the bottom layer is network and device management where each of them perform specific task.

The platform must also support open network connectivity with respect to network, which means support for GSM, 3G, CDMA and 4G technologies.

The second solution comes from software vendor named Viewbiquity, which provides market-leading, innovative M2M platforms that automate mission-critical business processes[21]. The company is built on a strong foundation of providing innovative services and solutions in the security, communications and surveillance markets for many years. The Concept is quite simple, and it has been divided into 3 simple steps.

In step 1 What Viewbiquity has done is it has divided server functionality between the cloud and the local level as shown in the fig 3. The hosted server enables a single Network Operations Center (NOC) to manage multiple sites and monitor the network performance while supporting multiple devices, applications and resources. In a nutshell, it does the heavy lifting.

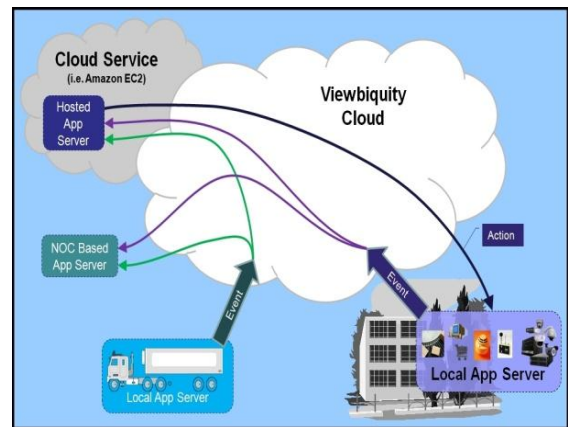


Figure 3: Viewbiquity's Cloud Interface (VCI)

In step 2 The applications run on one or several off-the-shelf computers. They function as a local application server that communicates with the cloud. In addition, the local server (or servers) connects to input and output devices, which can include sensors as well as stand-alone M2M solutions and IP PBXs. These solutions can operate independently or in concert with an application server that's in the cloud. Operation is secure and execution is behind a firewall.

The step 3 is completely based on internet, the client interface is the customer-facing portal. It gives users real-time visibility into monitored and controlled business processes and activities via the Internet. It is the way users interface with Viewbiquity applications.

Figure 3 shows viewbiquity's cloud Interface(VCI) which comprises of viewbiquity cloud, cloud services such as amazon, azure, local app server and NOC based app server. The VCI is a hybrid solution that enables remote management through universal connectivity of geographically disparate devices and processes.

Right now M2M applications run on proprietary middleware platforms. In VCI the apps run on regular servers and are created using a combination of JavaScript and HTTP APIs plus a library of device templates.

The third solution is from Palantiri Systems which has been acquired by ThingWorx. In June 2011 Thingworx acquired Palantiri Systems, a visionary provider of the AlwaysOn software platform that enables intelligent machines to participate in a connected, collaborative world. The combination of ThingWorx and Palantiri Systems creates a single company that represents the catalyst for the next stage of the "connected device" revolution. Palantiri Systems has created a model that allows machines and production equipment to communicate with each other (M2M) as well as the people responsible for their continued operation (remote maintenance and diagnostics). That's a well-known application and when there are multiple locations communicating, is conducted via the Cloud. That's the baseline function. It's important to keep that function in mind because this vendor has taken it to a new level.



Figure 4: Palantiri Systems model

The above figure 4 shows the palantiri system model which comprises of a cloud, distributed intelligent devices, users and servers which consist of existing business information.

The model indicates that the model enables people, remote devices and enterprise business systems to maintain real-time communications via an encrypted, firewall-transparent cloud.

If we move up another step, it becomes clear that we are talking about a single unified system that allows users, engineers, service technicians, managers, and machines to become members of a virtual organization: a community that enables instantaneous worldwide communication between every member.

The final step is the addition of Web-based displays, instant messaging, and real-time business system integration. This is enabled by Palantiri's AlwaysOn Core platform, which provides a comprehensive set of messaging and infrastructure services: chat-based diagnostics and communications; monitoring, alarming & alerting, real-time bi-directional data access, remote application access, data collection and visualization, bidirectional file transfer and synchronization and remote desktop and application tunneling.

V. CONCLUSION

All three vendors have not only embraced the concept, but they have also taken it forward in interesting and innovative ways.

The first vendor Gemalto recognized that when M2M becomes part of an enterprise environment, ICT will want to be in charge. At times that means being able to create their own apps, and when they are mixed and matched with those of a service provider it also means having everything in a unified, easy to manage infrastructure.

The second vendor Viewbiquity has put forth model is very similar to that proposed by ETSI, which has extended M2M capabilities in network cores as well as separate device domains. Applications can therefore run over local or wide area networks. The integration of voice and video into the same platform as the M2M apps is an interesting development, but we'll have to wait and see how this pans out in practice.

The last vendor Palantiri (Thingworx) their model focuses on machine and production equipment, which is where M2M started. Remote diagnostics is a traditional app, but this vendor has taken the concept to another level by unifying M2M data with a comprehensive set of messaging and infrastructure services.

These models are different, but they share a common vision. The integration of M2M apps with mainstream business processes will be enabled via cloud-centric technology.



International Journal of Recent Development in Engineering and Technology

Website: www.ijrdet.com (ISSN 2347 - 6435 (Online)) Volume 4, Issue 7, July 2015)

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