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Oracle's Internet of Things Platform: The M2M Platform for a Connected World

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Introduction 1
M2M Overview and Impact on Enterprises 2
M2M Challenges 3
Why Oracle for M2M? 5
Develop and Deploy 6
Manage and Analyze 7
Integrate and Automate 7
Protect and Comply 8
Optimize and Innovate 8
Conclusion 10

Introduction

Over the last decade, we have seen the transition from connected computers to connected smartphones. IDC[1] reports that more than 1.7 billion mobile phones will ship this year, with the predicted number reaching 2.2 billion in 2016. This smartphone revolution has presented organizations with opportunities to drive growth and improve customer experience. However, this just represents the tip of the iceberg. Cheaper, more-powerful devices, faster LTE speeds, and low-cost mobile network connectivity are driving an explosion in the number of connected devices and the data generated by them. We are now starting to see the transition from connected smartphones to connected smart devices. Smart meters, smart appliances, smart cars, and smart homes represent tremendous opportunities for organizations. This evolution, often termed *machine to machine* (M2M) or broadly the *Internet of Things*, is where more-intelligent devices can communicate with their surrounding ecosystem (humans, machines, applications, or other smart devices).

Read this white paper to learn:

- Why M2M/Internet of Things is a pressing initiative for your company
- How M2M/Internet of Things affects enterprises and what challenges and opportunities it creates
- How Oracle's Internet of Things platform can help enterprises harness the power of M2M

[1]Source: IDC Worldwide Mobile Phone 2013-2017 Forecast and Analysis, doc #239867, March 2013

M2M Overview and Impact on Enterprises

The evolution of traditional IT services outside of the firewall is starting to gain traction and drive new business opportunities in an ever-widening market. As technology has advanced and become more widespread, the adoption and application of this technical capability has also become more diverse, ranging from connected thermostats in commercial buildings to RFID labels on medicines.

However, there has been a significant piece of the jigsaw missing: the communication element. This has now been resolved with the adoption of mobile communication devices or smartphones that are more than just a phone. The investment in the mobile communication market has resulted in the significant lowering of the costs of this medium and the rapid, seemingly universal application that this enables.

The real value comes when these data-generating devices are connected to more-sophisticated analysis capabilities. These have traditionally only been available to back-office applications and normally lag behind the event that generated the data by some period of time.

Now, with faster application deployment, data processing, and data analytics, it is possible to act upon data generated in near real time, resulting in faster decision-making. With the growth in the capacity of the communication infrastructure, those decisions can be applied to the original data-generating source so that actions can be taken in the present, not in the future.

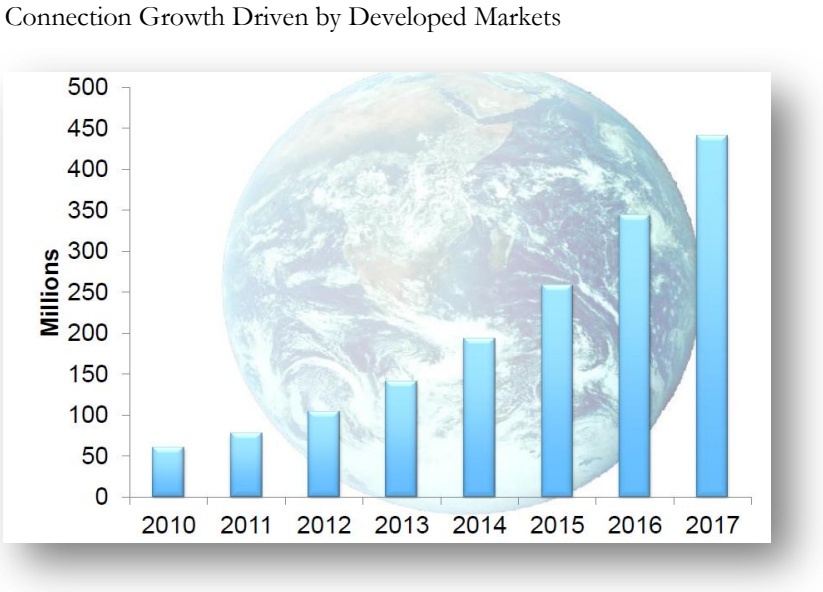

Figure 1: M2M connections driven by developed markets will double in two years.

M2M opens a whole new world of data points and enables organization to drive macro decisions with micro data coming from a wide variety of smart devices. Here are some examples:

[2]Source: IDC, M2M in the Real World: Separating Myth from Reality, Doc #DR2013_LSIS3_CM , March 2013

- Healthcare: Enable remote healthcare by transitioning care from "in hospital" to "in home." This can drive healthcare costs lower.
- Manufacturing: Optimize asset management through the ability to track the location and condition of assets from anywhere and at anytime. These optimizations can improve visibility and efficiency of business.
- Vehicle telematics: Build next-generation cars that provide remote diagnostics, personalized infotainment, and smart transportation. These innovations offer a significantly better customer experience.
- Utilities: Deploy smart meters that automate meter reading and management wirelessly. The result is better energy management.
- Home automation: Secure alarm and smart home appliances that can be controlled remotely. End users (consumers and enterprises) can benefit from greener and smarter homes.
- Telecommunications: Analyze mobile data in real time to up-sell new services to specific customers in a specific region. This positively affects revenue growth.

Data from the device is eventually consumed by enterprise applications, which in turn leverage the data to optimize business processes, drive better decision-making, or identify areas of innovation. Having the integrated flow of information from devices to the IT data center where applications reside is imperative to derive benefits from the M2M revolution. On one end of this device-to-data-center world, we have streams of raw data coming from internet-enabled devices. At the other end, we need intelligent applications that can take vast amounts of data and turn it into business knowledge and action.

M2M Challenges

The M2M value chain can be extremely complex and span multiple stakeholders, such as semiconductor manufacturers, sensing devices and gateway manufacturers, network equipment providers, telecommunications operators, independent software vendors, system integrators, and many more. Let's take a look at the simplified model (see Figure 2).

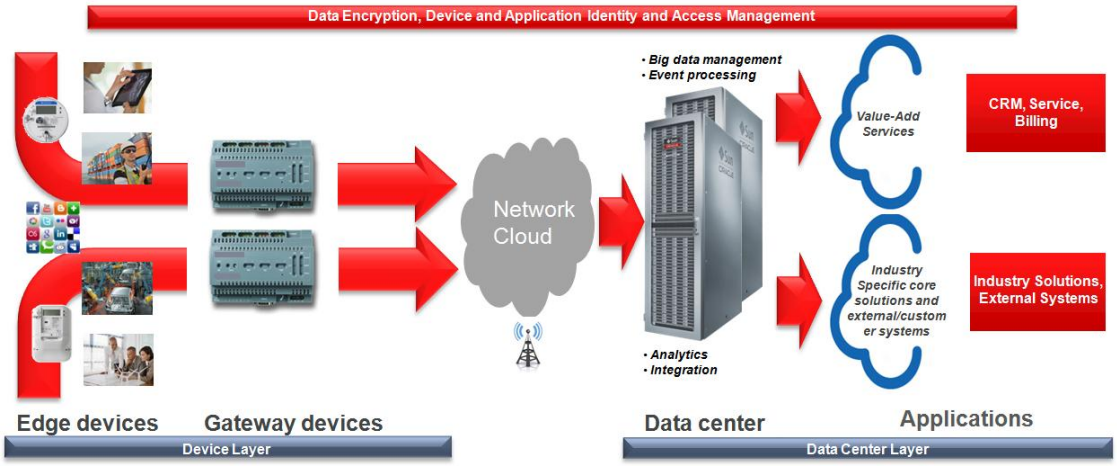

Figure 2: Simplified M2M value chain.

- Device layer: This layer is comprised of sensing devices and intelligent gateways. A sensing device, also referred to as an edge device, is loaded with sensors, processors, and communication transceivers capable of capturing events (temperature, blood pressure, inventory level, and so on) and transmitting event data to either the network directly or to an aggregating device like a gateway. A gateway device is a smart piece of hardware that aggregates M2M traffic to/from sensing devices with the network on one side and devices on the other.
- Network layer: This layer supports communications between M2M gateways and intelligent systems.
- Data center layer: This is where captured event data is translated into meaningful and actionable information, for example, inventory data is processed to indicate if items need to be restocked. This layer is comprised of intelligent applications with event processing, data management, big data, analytics, and integration capabilities. These applications could reside on premises, in the cloud, or across both infrastructures.
- Intelligent systems: Companies have new data to work with, data that is central to the way they operate and the value they provide. Intelligent systems contain the middleware (application, services, and data) where the data can be analyzed, reported, or acted upon. For example, remote monitoring data can be incorporated into customer-relationship management systems for logging service and maintenance history.
- Supporting applications: Device data is eventually consumed by enterprise applications to drive core business processes, either horizontal or industry-specific.

Having an integrated flow of information from devices to the IT data center where enterprise applications reside is imperative to derive benefits from M2M.

The M2M value chain is complex and distributed. Standards to communicate between different layers are still evolving. Not only is the data volume from devices increasing, but data velocity is accelerating. All these factors combined present several challenges to the enterprise embarking on an M2M initiative. When Beecham Research Group conducted its survey with enterprises, it uncovered the following three top priorities when delivering M2M projects:

- Ensuring end-to-end security. As the value of data increases, the need to protect and secure that data and the associated applications and devices becomes critical. Also, regulatory compliance and data privacy requirements need to be addressed.
- Integrating with IT systems. Integration and automation with IT systems is critical when delivering an M2M project. If maximum value is to be extracted, then the data needs to be made available to multiple applications and analytics environments.
- Coordinating partners in the value chain. The development and deployment of an M2M project has multiple hardware, software, and service components that can result in complexity and slow implementations and time to value. Platform standardization can enable seamless coordination across partners.

With such a wide range of challenges, organizations often use a piecemeal approach, with solutions that are seldom standards based and are not built to interoperate. Integrating them is time consuming, costly, and risky. A standardized platform from device to data center addresses challenges around security, integration, data management, and analytics.

Why Oracle for M2M?

Oracle is the only vendor with the complete portfolio to

- Develop and deploy applications from device to data center, increasing efficiency and reducing lifecycle costs
- Manage and analyze large volumes of M2M data through the entire lifecycle: collection, storage, processing, and analysis
- Integrate and automate data from connected products and assets to existing enterprise applications to quickly add real-time data capabilities
- Protect and comply with security and regulatory requirements with extensive identity and access management and data security offerings
- Optimize and innovate with Oracle business and industry applications to reduce costs and deliver new services

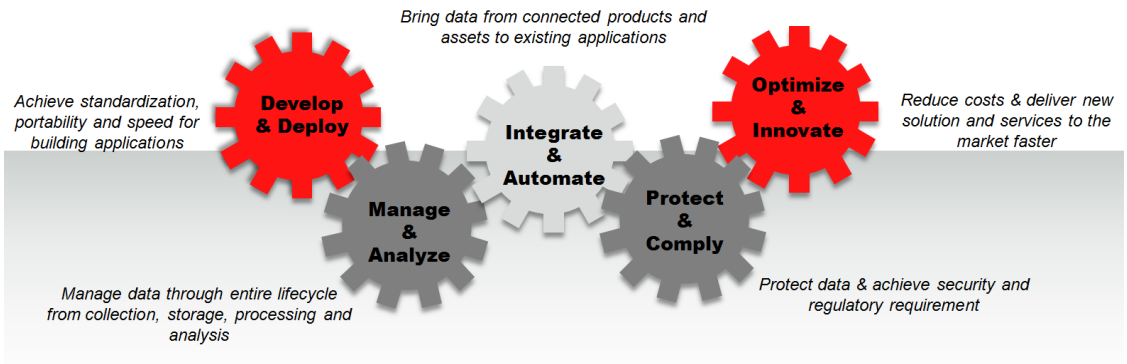

Figure 3: Oracle provides a complete Internet of Things platform

More than 125 million Java-based TV devices have been deployed.
More than 10 billion Java Cards have been shipped since its introduction.
More than 120,000 enterprise customers use Oracle Fusion Middleware.
More than 5,000 ISVs support Oracle Fusion Middleware.
Large system integrator community with more than 40,000 Oracle Fusion Middleware practitioners.
More than 70,000 customers rely on Oracle's complete application solutions.
Unrivaled Java developer and enterprise community of 1.2 million members.

Develop and Deploy

According to Beecham's report, coordination with the value chain is one of the topmost M2M priorities. Platform standardization can enable seamless coordination across partners in an increasingly complex value chain. Java is the most standardized and platform-agnostic programming language that enables rapid deployment of applications. Java offers comprehensive functionality for resource-constrained devices and data centers, with the highest level of functionality, security, connectivity, and scalability in the industry.

Oracle Java ME Embedded, ideal for sensor devices, and Oracle Java Embedded Suite, ideal for gateways, are key components of the Oracle Java Embedded platform—the platform of choice across hundreds of millions of devices, including every Blu-ray Disc player, the most popular family of e-book readers, Voice over IP (VoIP) telephones, televisions, set-top boxes, printers, and residential gateways. A broad range of development tools ensures that Java developers are productive and well supported.

Oracle Fusion Middleware, built on Java, is ideal for data center solutions. This platform is used by more than 120,000 customers worldwide and provides a standards-based environment to design, develop, and deploy business applications.

Oracle's Java Embedded technologies together with Oracle Fusion Middleware provide a complete platform to develop and deploy applications across a wide range of device/OS combinations and data centers. Organizations can help reduce development and operational costs across the entire M2M value chain by using Java capabilities.

Manage and Analyze

Adding a large amount of connected devices results in a significant amount of *big data*. How this data is collected, stored, processed, analyzed, and presented is essential to understanding operational bottlenecks and improving customer experience and decision-making. The faster you can process data, the more value you can derive from it to develop new services and new forms of value for your industry.

Oracle Fusion Middleware's event processing capability has been optimized to run on gateway devices. This optimization enables a smart gateway to process data in real time for pattern matching, aggregation, and filtering locally and to only deliver relevant data to the data center.

Oracle provides a complete data management and analysis solution across sensors, devices, and data centers. Oracle Java Embedded Suite includes a complete, multiuser relational database engine for robust data storage at the device level. Oracle Berkeley DB is a lightweight, embeddable database that can also be used to manage data on devices Oracle Fusion Middleware's event processing capability has been optimized to run on gateway devices. This optimization enables a smart gateway to process data in real time for pattern matching, aggregation, and filtering locally and to only deliver relevant data to the data center.

Once data arrives at the data center, Oracle's enterprise solutions provide a wide array of data management capabilities:

- Device data, whether structured or unstructured, can be seamlessly acquired, organized, and loaded into enterprise data warehouses with Oracle Big Data solutions.
- Database Mobile Server supports data synchronization between the device database and data center for occasionally disconnected operation.
- Massive amounts of M2M data can be stored for the highest performance at the lowest cost with Oracle Database, Oracle Exadata, or Oracle Database Appliance.
- Enterprises can gain historical and real-time visibility into this data with Oracle Business Intelligence and Oracle Exalytics.

Integrate and Automate

According to Beecham's report, integration with IT is one of the topmost M2M priorities. Effective M2M communication typically requires a number of key components: smart devices, gateways, network, and enterprise applications. Ensuring that data flows seamlessly between these components and understanding how this data affects organizational process are essential to the success of the M2M application. Using data to drive critical processes within and across organizations will give M2M adopters a significant advantage in improving customer service, faster time to market, and higher visibility into key performance indicators.

Oracle Java Embedded technologies provide a flexible platform for devices and gateways to seamless communicate with enterprise applications. With support for key messaging standards (XML and

RESTful Web Services) and robust device-level APIs, Oracle Java Embedded technologies give complete flexibility to devices to integrate with downstream applications.

Oracle Fusion Middleware is an ideal platform to turn this data into business advantage:

- Identify and act on key events as they happen with Oracle Event Processing.
- Integrate M2M data with any enterprise applications, whether on premises or in a cloud infrastructure, using Oracle SOA Suite.
- Use data to drive key business processes using Oracle Business Process Management Suite.

Protect and Comply

According to Beecham's report, ensuring end-to-end security is the topmost M2M priority. Only an integrated security approach, starting with system design, is effective in safeguarding M2M solutions and ensuring their economic success. How to secure data on devices, manage device identity from the data center, ensure data security as it travels across from devices to enterprise applications, and ensure regulatory compliance all need to be addressed to protect device-to-data-center implementations.

With Oracle, you can secure data, enable role-based access control, manage identities, and meet regulatory compliance across devices and data centers. Oracle Java ME Embedded and Oracle Java Embedded Suite provide a complete, secure platform for building embedded solutions. Sensing devices can securely store and exchange data by authorized users with Oracle Java ME Embedded support for the SATSA standard. Similarly, Oracle Java Embedded Suite can equip gateways to natively support secure storage and authentication.

Oracle Identity Management, a key component of the Oracle Fusion Middleware platform, manages device and user identity. It

- Is optimized to run locally on the gateway and manage device identity including enrollment, secure storage, and authentication. Device identity is critical to guarantee that the device is indeed what it claims to be.
- Secures enterprise applications with key capabilities such as identity provisioning and access management.
- Enables regulatory compliance with complete visibility into "who accessed what and when."

Oracle also provides a comprehensive portfolio of security solutions to ensure data privacy, protect against insider threats, and enable regulatory compliance for both Oracle and non-Oracle databases.

Optimize and Innovate

Data emanating from devices is eventually consumed by enterprise applications. These enterprise

Oracle's Java Embedded technologies together with Oracle Fusion Middleware provide a complete platform to develop and deploy applications across a wide range of device/OS combinations and data centers.

applications use a subset of the data to drive organizational processes and performance. Organizations cannot afford to build business solutions from scratch. Instead, they must focus more time on optimizing and innovating and less time on building IT applications to solve business needs.

- Oracle offers more than 200 applications that address specific category-based business requirements such as customer relationship management; financial management; governance, risk, and compliance; project management; and more. In addition, Oracle's industry solutions are best-in-class products that address complex business processes relevant to a wide range of industries. These applications are available on premises, on demand, or in the cloud.
- Large amount of data calls for high performance. Scalability and reliability become imperative as data from millions is devices is flowing in the data center and needs to be processed in real-time. Oracle Engineered systems are optimized for unmatched performance and availability.

Oracle business applications and engineered systems give organizations the right platform to optimize and innovate.

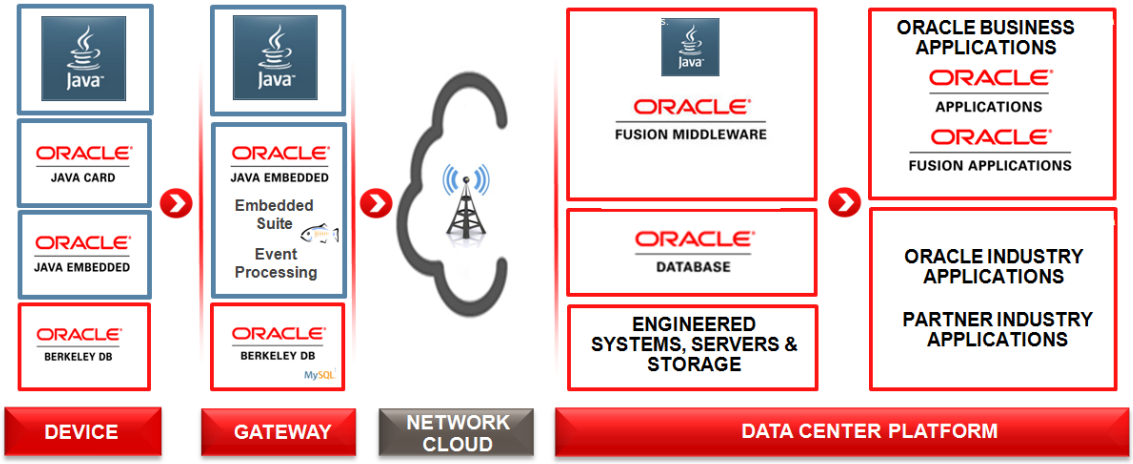

Figure 4: Oracle's Internet of Things Platform

From embedded Java on devices, up to Oracle engineered systems in the data center and big data analytical tools, Oracle provides a practical Internet of Things platform that makes it easy for organizations to collect, store, manage, and analyze data from connected devices.

Conclusion

The opportunities of M2M are driving changes in your business and customer relationships, enabled by an Internet of Things delivering new streams of business-critical content and value directly into your enterprise. This change is driving the need to address new requirements for manageability and analysis, integration and automation, security, and portability at the scale the M2M opportunity requires—now and in the future.

Only Oracle leverages an enterprise-class, fully supported application development environment, middleware, database, engineered systems, and best-in-class business applications to enable the future of a device-to-data-center approach today.

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Author: Harish Gaur
Contributing Author: Tom Angelucci

Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.

Worldwide Inquiries:
Phone: +1.650.506.7000
Fax: +1.650.506.7200

oracle.com

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Hardware and Software, Engineered to Work Together