overcoming interoperability challenges in the internet of things

opportunities and barriers to adoption

The Internet of Things (IoT) has the potential to change the world. McKinsey & Company estimates that the overall economic impact of the IoT could reach up to $6.2 trillion by 2025[1], as the world becomes increasingly digitized and connected. The inability of today's IoT systems to communicate with each other means that most of the IoT data collected today is not used efficiently and this prevents the IoT from reaching its full potential. The lack of IoT interoperability results in a number of obstacles including:

- Complex integration with silos of isolated data
- Costly deployments and proprietary APIs
- Extended time-to-market

the need for standards-based iot interoperability

To address the IoT interoperability problem, oneM2M, a global standard for IoT and Machine-to-Machine (M2M) communications, provides a common services layer (middleware) to enable IoT device and application interoperability. This includes providing an application ID registry with globally unique identifiers to support data sharing, interworking, and security across IoT platforms and systems to communicate with each other in a standardized manner will result in:

- Increased value of IoT solutions
- Reduced costs, faster time-to-market, and improved security
- New business models from interconnected devices, platforms and applications

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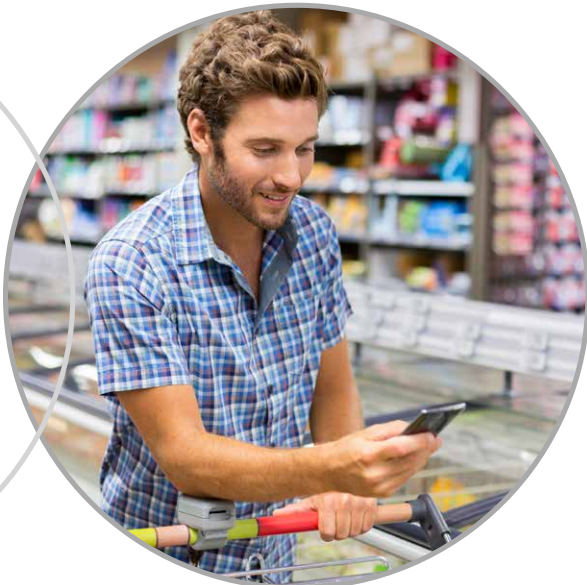
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an evolving IoT ecosystem

the promise of IoT

The exponential growth of connectivity associated with the Internet of Things has the potential to significantly improve our lives, as the physical and digital worlds seamlessly merge. In particular, the IoT will improve how we run our cities, transportation systems, buildings, healthcare and production facilities, including manufacturing and farming.

moving from M2M to IoT

Berg Insight report[2] notes the gradual move from vertical, single-purpose M2M solutions, such as traditional car telematics, fleet management and utilities metering, to multi-purpose and collaborative applications that interact across numerous industry verticals and organizations are key to the IoT. The IoT represents a transition toward increased integration of sensors, devices and information systems across industry verticals and organizations.

The IoT allows us to gain more insights from the collected data and thereby improve business operations, products and services. Berg Insight emphasizes that the transition to the IoT requires interoperability, standardized components and middleware to facilitate a seamless integration of devices, networks and applications.

emergence of IoT platforms

The IoT market is still quite fragmented and vertically integrated but a number of platforms are emerging to simplify the integration of sensors, devices and networks with applications and general enterprise IT systems and services.

These include:

- Device Management Platforms—Enable remote management of connected devices including device activation, configuration, troubleshooting and Over-The-Air

- (OTA) firmware upgrades

- Connectivity Management Platforms— Deliver SIM, billing, roaming, subscription management and service delivery capabilities

- Application Enablement Platforms— Provide tools and APIs for creating business applications, including data management, event processing, automated tasks, business logic and data analytics at the highest platform level are enterprise

- IT systems and services with cloud-based Infrastructures- a-Service (IaaS) and Platform-as-a-Service (PaaS) solutions. These are often offered by the large traditional enterprise software vendors that provide database management, ERP, CRM, business intelligence, analytics and office suites.

the value of IoT interoperability

While the IoT ecosystem is evolving rapidly and a number of IoT platforms are emerging to simplify device management, connectivity management and application enablement, the different proprietary IoT platforms and systems are still not able to talk with each other, which is a crucial and very costly limitation. In fact, introducing interoperability between IoT systems is necessary to achieve 40% of potential value across IoT applications, with that number as high as nearly 60% in some settings, according to McKinsey & Company[3].

It is clear that the IoT industry can generate tremendous additional value by allowing IoT data to be repurposed, shared and analyzed, by multiple entities, across different systems and platforms. To address the need for interoperability, oneM2M has provided a global standard, to provide an IoT services layer with common IoT functions that enables sharing and repurposing data across applications and systems. The following section describes the oneM2M standards initiative in more detail.

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standards-based interoperability and oneM2M

The oneM2M global standards initiative involves more than 200 member companies and leading standards development organizations such as ARIB (Japan), ATIS (US), CCSA (China), ETSI (Europe), TIA (US), TSDSI (India), TTA (Korea), and TTC (Japan). OneM2M has now published release version 2 of the standard for an IoT platform.

introducing a common M2M and IoT services layer

The oneM2M initiative covers technical requirements, architecture, API specifications, security solutions, data semantics and interoperability for M2M and IoT technologies. It provides a framework to support applications and services such as smart cities, connected car, home automation, public safety and healthcare. The framework consists of technical specifications for a common M2M and IoT middleware layer called the Common Services Layer, which is not only globally applicable and access network-independent but also provides seamless interworking for devices.

Difficult to share data across silos
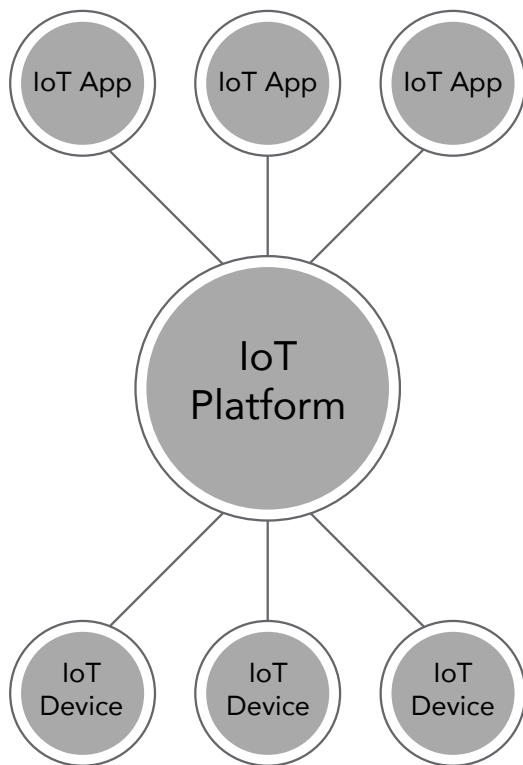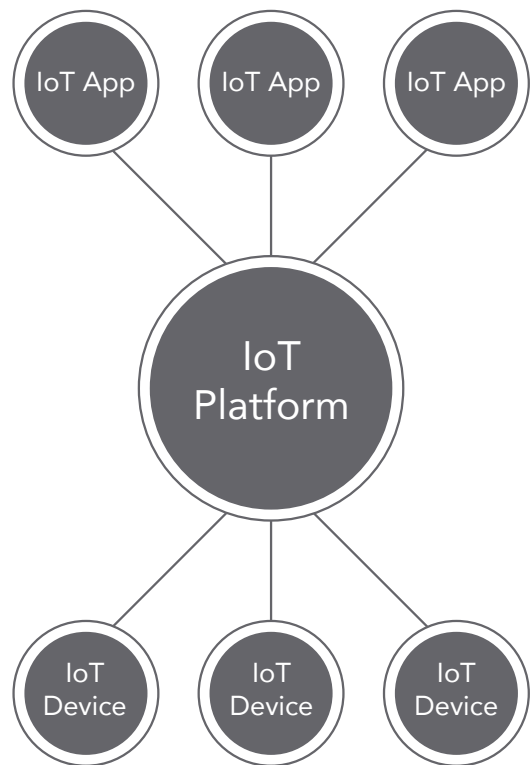
Figure 1: Conventional silo architecture where each application requires its own dedicated middleware. One application cannot access data from devices and sensors associated with another application (Source: oneM2M[4])

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In the traditional, vertical architecture as shown in the "Conventional, Silo Architecture," Figure 1, different devices, sensors and applications require different, customized middleware. This vertical architecture does not allow data sharing between applications and results in inefficient hardware use. The oneM2M Common Services Layer, on the other hand, efficiently supports multiple IoT applications, devices, and sensors as shown in the "Horizontal Platform Architecture," Figure 2. This approach represents a move toward a horizontal platform architecture that uses a common middleware layer and allows data sharing across application silos, uses hardware efficiently and reduces the need for customized software.

The oneM2M framework also includes Application-ID Registry that uniquely identifies each oneM2M application and device to effectively manage connectivity, enrolment, security, and data management services across oneM2M platforms.

Easy to connect applications and device data across IoT platforms; Open API's to enable ease of integration
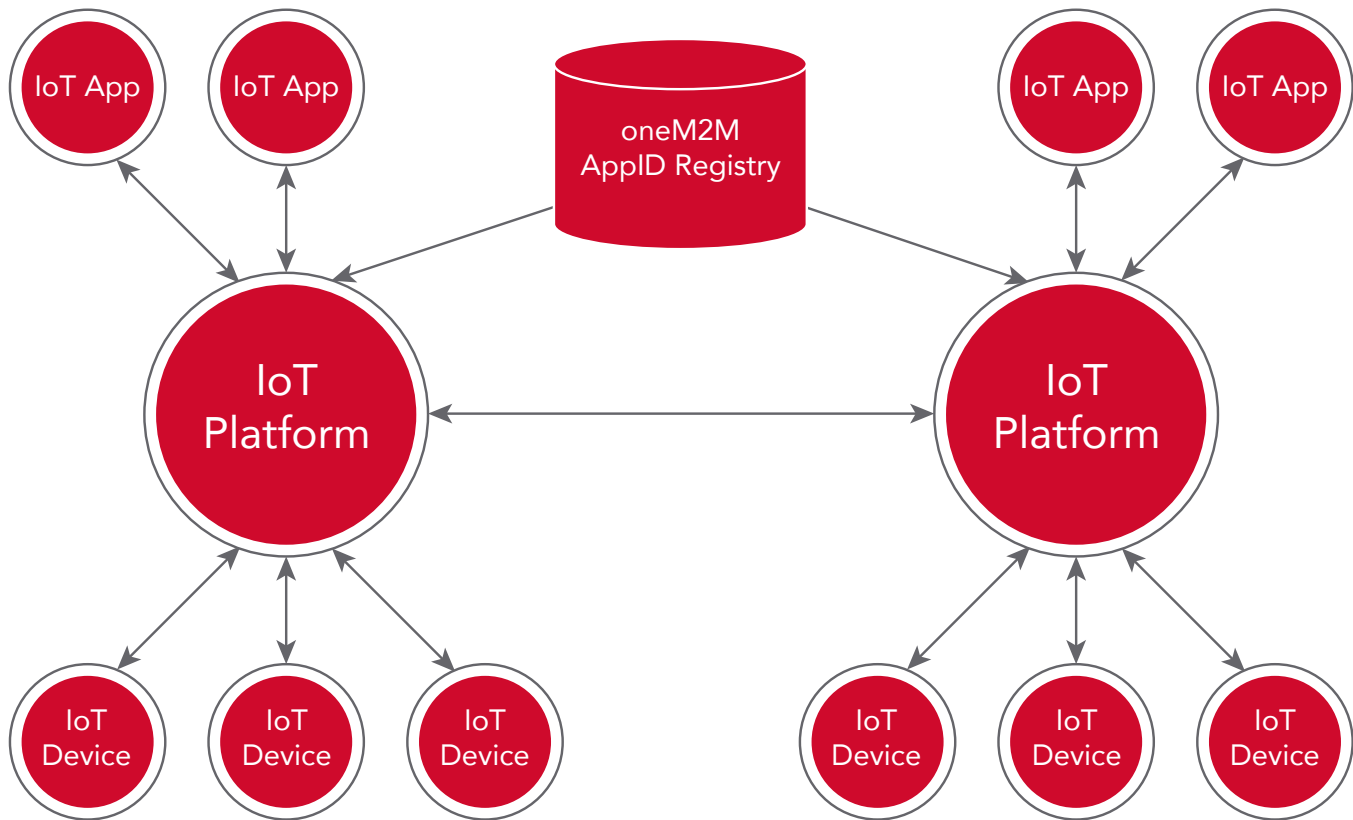
Figure 2: oneM2M enables a common middleware layer, the Common Services Layer (red circles), which efficiently supports multiple IoT applications, devices, and sensors, so that data can be shared across different applications. Also shown is the oneM2M Application-ID Registry that uniquely identifies the oneM2M applications for effective tracking, service enablement, and billing (Source: oneM2M)

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use case: smarter parking and public transportation

Consider the following use case that demonstrates how standards-based IoT interoperability can improve the quality of life for a person who lives in a metropolitan area:

Amy lives in a suburb of a large city and is currently having breakfast at home. She needs to attend an event in downtown later this morning and picks up her smartphone to plan her trip. Amy has an app that automatically reviews traffic conditions, weather, road tolls, public transportation schedules and available parking. Amy knows that driving to downtown and finding a parking space are very real challenges in metropolitan areas and she would have to spend time driving around her destination before a parking space is discovered without the benefit of information repurposed from city infrastructure sources.

using real-time data for intelligent transportation

The app recommends that she drive from her home for the first part of her trip and then take public transportation into the city. The app has determined that the best method of public transportation for her at this particular time is to go by train rather than by metro or by bus. It also identifies the most suitable train station for her.

While Amy is driving to the train station, the app concludes that all parking spaces have already been taken at the train station. The system starts looking for available parking close to the train station by searching all public, private and on-street parking options in the neighborhood.

In this particular case, Amy has several parking options but she could also have opted to reserve parking space in advance by paying an additional convenience fee. The app guides Amy to an available parking space at walking distance from the train station. She parks, pays for the train ticket using her smartphone and then enjoys a convenient and hassle-free train ride to the event in the center of the city.

Amy gets off at a train station right next to the event. The solution has not only saved her time and money but also helped the city use its valuable resources in a smarter way while reducing congestion and improving the environment.

getting the job done with standards-based IoT interoperability

The solution that Amy used considers sensor data on traffic conditions weather, estimated driving times, road tolls, available parking at public transit stations, public transportation schedules, real-time public transit conditions, and available seats on trains and buses.

Thanks to the standards-based oneM2M interoperability, all IoT applications required for the solution can communicate and interwork with each other and meter and sensor data can be discovered and shared across multiple players in the ecosystem.

Another important aspect of IoT interoperability and open IoT systems is the opportunity for a large number of competing application developers to take advantage of easily available sensor data, e.g. on traffic flows and parking availability, so that they can repurpose the data and develop innovative and useful applications for both consumers and enterprises.

the benefits of the oneM2M application-ID registry

The iconectiv AppID registry solution addresses the current lack of IoT interoperability and the inability of unrelated applications to talk to one another. An AppID creates a global identifier based on common standards for each IoT application or device and is a first-of-its kind open registry system addressing IoT interoperability. With these standardized identifiers, all applications from any developer can communicate and share data with each other, facilitating communication between applications in compliance with the global oneM2M standard that is currently being developed as the industry guideline.

The AppID Registry:

- Is the official source of global identifiers that are compliant with the growing oneM2M standard.

- Enables organizations to communicate across IoT platforms with other IoT devices and applications.

- Is able to certify compliance through an evaluation process that ensures each code is globally distinctive to its specific application.

- Is the only entity that provides global identifiers based on a global standard that are linked to a corresponding open registry.

- Can be used to verify identity of connecting application and devices.

growing the value of IoT with interoperability

The use case with Amy is just one example of how IoT interoperability can enable large numbers of devices and sensors to share information with many different systems and applications. This increases the value of all IoT solutions in the ecosystem, reduces costs and leads to a faster time-to-market. IoT interoperability can also create new innovative business models from interconnected.

let's talk about your IoT interoperability needs

As a frequent contributor to the oneM2M standardization work and the official administrator of the oneM2M Application-ID Registry, iconectiv is a leading provider of trusted registries for interconnection and network equipment management in the telecom and information management industries. Please contact us to learn more about how we can help you with your IoT interoperability needs.

FOOTNOTES

[1] Internet of Things - The IoT Opportunity, McKinsey & Company, Hong Kong IoT Conference, 2016

[2] IoT Platforms and Software, Berg Insight, M2M Research Series 2016

[3] The Internet of Things: Mapping the Value beyond the Hype, McKinsey Global Institute, 2015

[4] Solving the IoT Platform Challenge, oneM2M Executive Briefing, 2015

about iconectiv

As the authoritative partner of the communications industry for more than 30 years, iconectiv's market-leading solutions enable the interconnection of networks, devices, and applications for more than two billion people every day. Working closely with private, government and non-governmental organizations, iconectiv continues to protect and secure telecommunication infrastructures for service providers, governments and enterprises, while providing network and operations management, numbering, registry, messaging and fraud and identity solutions to more than 1,200 organizations globally. A US-based company, Telcordia Technologies, doing business as iconectiv, is a wholly owned subsidiary of Ericsson.

make the connection.

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