Low Power Wide Area (LPWA) networks play an important role in connecting a range of devices
The evolution of IoT

Today it is almost impossible to read a publication of any kind about the tech industry without some reference to the Internet of Things (IoT). IoT is a natural evolution of machine-to-machine (M2M) technology and is the interconnection of intelligent devices and management platforms that collectively enable the “smart world” around us. From wellness and health monitoring to smart utility meters, integrated logistics, and self-driving drones, this world is fast becoming a hyper-automated one.

Connectivity options

Given the requirement for connectivity, many see IoT as a natural in the communication service providers’ (CSPs) domain, such as mobile network operators—although connectivity is a readily available commodity and therefore of low value. In addition, a growing number if IoT use cases are introducing different requirements in connectivity, both in terms of economics and technical capabilities. Matching the IoT use case to the appropriate connectivity option is key to verifying that the appropriate quality of service and the commercial viability of the service can be achieved; for example, for a connected car, where mobility and access to high-bandwidth services are critical, is ideally suited to a 3G/4G network. On the other hand, something like a support smoke detector that only transmits data when it is triggered, is better served via a low-throughput network as the costs of a 3G/4G wireless module and the relatively short battery life makes use of a traditional cellular network less practical.

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This challenge is especially pertinent in the case of a smart city where the range of potential IoT use cases and applicable services mean that a range of connectivity options is required. For example, an IP CCTV camera for security or traffic monitoring will require high bandwidth and low latency, and hence is best served by a fixed or cellular connection. Increasingly, as cellular data costs reduce and mobile cameras themselves become “smarter” with increased onboard or edge capabilities to determine what content is important/required centrally and therefore able to reduce the volume of data transmitted, cellular connectivity is becoming more cost-effective as the installation lead time and costs are much lower than installing a fixed line connection. At the other end of the spectrum, smart parking sensors need to have long battery lives to reduce maintenance and support costs, plus they transmit small payload messages over a wide range, as such they are best suited to Low Power Wide Area (LPWA) network connectivity such as LoRa or the newly 3GPP ratified cellular standards Cat-NB1 (formerly referred to as NB-IoT) and Cat-M1 (formerly referred to as LTE-M).

Increasingly, new LPWA networks such as Objenious (part of Bouygues Telecom), or dedicated cellular IoT networks are being set up to handle the demand for LPWA services especially from smart cities and intelligent buildings (See press release relating to Objenious & the HPE Universal IoT Platform). Other services such as those within a shopping mall or office complex may be best served via Wi-Fi and Bluetooth® beacons—for example in the Levi’s Stadium in Santa Clara where the 2016 Super Bowl was held, an HPE Aruba network coupled with Bluetooth beacons provides spectators with services such as accurate routing direct to their seat via their smartphone.

To be successful the IoT infrastructure deployed by a smart city needs to be able to handle devices and objects connected via any connectivity method. Using a common application-enablement platform, like the HPE Universal IoT Platform, which is agnostic of connectivity, device, protocol, and use case, enables the smart city to manage all IoT services via a single platform, therefore reducing total cost to service as well as enabling the “mash up” of use cases and data to provide new and innovative services.

In simple terms, wireless access technologies can be categorized based on two dimensions—throughput, and range.
However, choosing the right connectivity option is not as straightforward as checking these attributes. Many IoT use cases are characterized by low ARPU; for example, soil quality sensors for agriculture and farming, or smart building monitoring—where a large number of sensors are likely to be required, spread across a large area, meaning that the revenue per sensor and the associated connectivity is quite low. Other use cases present technical challenges such as the need for long battery life due to the difficulties or cost of maintenance; for example, in a traffic sensor embedded in the carriageway—such low-power consumption for the connected device is a must.

These characteristics mean that use of traditional 2G/3G/4G cellular network connectivity and SIM based devices is not feasible, however, many of these use cases themselves, like the smoke alarm highlighted above, do not require the bandwidth of a cellular network due to the limited volume of traffic generated and size of the payload. Equally important a large number of these use cases relate to stationary/fixed objects/devices; therefore, there is little need for the mobility. Together these characteristics mean that a new type of connectivity option is required to maximize efficiency and return on investment (ROI) of use cases such as provided by Low Power Wide Area networks. For example Sigfox, LoRa or increasingly the emerging cellular standards such as NB-IoT (Cat-NB1) and LTE-M (Cat-M1), recently ratified and standardized by 3GPP, are being rolled out by many Mobile Network Operators.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Application</th>
<th>2015</th>
<th>2020</th>
<th>2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connected cities</td>
<td>Environment and public safety</td>
<td>7,839</td>
<td>86,506</td>
<td>158,976</td>
</tr>
<tr>
<td>Connected cities</td>
<td>Road traffic management</td>
<td>2,290</td>
<td>37,132</td>
<td>146,085</td>
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<td>Connected industry</td>
<td>Land agriculture</td>
<td>165</td>
<td>36,573</td>
<td>117,254</td>
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<td>Connected industry</td>
<td>Construction equipment monitoring</td>
<td>61</td>
<td>41,348</td>
<td>90,316</td>
</tr>
<tr>
<td>Connected health</td>
<td>Assisted living</td>
<td>5</td>
<td>1,147</td>
<td>61,505</td>
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<td>Connected industry</td>
<td>Supply chain</td>
<td>133</td>
<td>22,204</td>
<td>51,608</td>
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<tr>
<td>Connected health</td>
<td>Clinical remote monitoring</td>
<td>46</td>
<td>15,344</td>
<td>51,159</td>
</tr>
<tr>
<td>Connected health</td>
<td>Worried well personal monitoring</td>
<td>4</td>
<td>6,043</td>
<td>47,677</td>
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<tr>
<td>Connected cities</td>
<td>Environmental monitoring</td>
<td>117</td>
<td>8,757</td>
<td>36,962</td>
</tr>
<tr>
<td>Connected health</td>
<td>Connected medical environments</td>
<td>15</td>
<td>4,725</td>
<td>27,640</td>
</tr>
</tbody>
</table>
Dedicated (non cellular) LPWA Technologies

In the long-range low-throughput area, a number of proprietary technologies, deployed in the 8-900 MHz license exempt bands, are gaining market share and penetration initially in Europe and increasingly in the U.S. market as well. Along with Sensus’s FlexNet and Ingenu’s RPMA services, there is increasingly heavily market activity with two specific non cellular LPWA technologies, namely Sigfox and LoRa, both of which are already commercially available in a number of geographies, for example in France there are already several LoRa network providers as well as Sigfox, providing a range of low-cost connectivity solutions to a broad customer base.

These networks also benefit from low cost of infrastructure (network and devices), wide coverage, and ease of connection. For example, it is possible to preinstall connectivity into a device so that there is no need for the user to connect or configure the device themselves. These capabilities make devices ideal for use in areas such as assisted living facilities for the elderly and infirm—or in other forms of monitoring where a large number of devices are required which must be easy to deploy and connect, for example traffic or environmental monitoring.

Proprietary standards tend to have a higher risk of vendor “lock-in”. Unless the technology reaches wider-stream adoption, the ecosystem of vendors and partners supporting the technology is always likely to be smaller than that of a widely accepted industry standard such as 3GPP. In turn, this may lead to the slowdown in the pace of innovation as there are fewer skilled resources available and a reluctance to invest compared to those for a major industry standard. The LoRa Alliance is aware of these concerns, and it has taken the initiative to standardize the technology’s network protocol/MAC layer as LoRaWAN and expand its ecosystem. This ecosystem is still relatively small and limited compared with that of the 3GPP, however this can be addressed if there is sufficient choice in the market and accelerated in line with adoption. The developers of LoRa technology—Semtech, recognize this and are actively looking at licensing the technology to other chip manufacturers for example, they currently consider Microchip Technology and STMicroelectronics as licensees of LoRa chipsets (or the LoRA PHY to be specific).

![Figure 3. Percentage of M2M/IoT connections using LPWA connectivity](source)

Source: Machina Research Database

Figure 3. Percentage of M2M/IoT connections using LPWA connectivity.
Proprietary LPWA access technology usually operates using an unlicensed spectrum, for example 868 MHz in International Telecommunication Union (ITU) Region 1, 915 MHz in ITU Region 2, and 2.4 GHz in other parts of the world. The use of the unlicensed spectrum helps to reduce the initial investment costs (as there are no spectrum licensing fees) but it also means that quality of service may be adversely affected, as radio interference may be a problem due to the shared nature of the frequency bands.

Technologies such as LoRa and Sigfox have one major benefit over their cellular competitors—early mover advantage. On the other hand, services like Cat-M1 (LTE-M), Cat-NB1 (narrowband/NB LTE), EC-GSM and 5G are still a number of years away from industrialization and wide-stream adoption, however this gap is closing quickly.

Leading M2M/IoT analysts Machina Research predict that the market is likely to be able to accommodate a number of these so-called dedicated LPWA alternatives, "but not all of them, so amongst the key players the race is now on to build up ecosystem-level scale and global relevance."1

Cellular LPWA connectivity for low ARPU services

The comparatively high price of wireless modules and their short battery life means that traditional cellular networks are not the optimal solution to serve the majority of the low ARPU market segment where low data throughput, infrequent data transmission, wide coverage, and massive scale are a must. In some cases however, such as smart metering, reuse of existing services can be deployed to meet this requirement, particularly where spare capacities exist within the networks. Many CSPs look to service this segment by using their aging 2G network capability; however, with the decommissioning, if such networks as the spectrum are recovered or reused for other technologies, this capability cannot be considered a long-term option. For many, 5G is seen as the solution to address the needs of IoT, regardless of ARPU levels, etc. However, a 5G solution for cellular IoT is not expected to be part of the new 5G framework until 2020. However, the recently 3GPP ratified standards for NB-IoT (now referred to as Cat-NB1) and LTE-M (now referred to as Cat-M1) provide a stepping stone between 4G LTE and the 5G standards and will enable CSPs to upgrade existing network assets rather than deploy completely new LPWA networks. In the strategic sense there seems to be a more significant overlap between NB-IoT and LTE-M than CSPs, and network equipment providers (NEPs) would ideally prefer, and as a result they are now engaged in a competition to determine a dominant access as well as trying to recover the ground already lost to the proprietary technologies such as LoRa which had first move advantage.

Cellular networks benefit greatly from standardized via 3GPP, and as a result, the large ecosystem of chipset manufacturers, devices, network equipment providers and so on reduce the risk of vendor lock-in. However, there is still a risk of selecting a solution—whether standards-based or proprietary—which meets the needs of today, but in the long term fails to gain widespread adoption. It therefore reduces the potential for further development and innovation.

The speed and relative ease with which Cat-NB1 (Standards ratified June ’16) and Cat-M1 (standardized earlier in the year) were created, demonstrates the desire of the CSPs and NEPs to address this market requirement and to compete with the other LPWA providers. These two standards, whilst addressing predominately the same target markets, have a number of distinct differences that means they are more attractive to some CSP's and use cases than others

- Cat-M1, (previously known as LTE-M or enhanced Machine Type Communications [eMTC]) is an evolution of LTE optimized for IoT services. Whilst the first instance of LTE designed for IoT, Cat 0, was included in 3GPP Release 12 back in Q4 2014, the Cat-M1 standard has been further optimization and included in Release 13, with the specifications completed in the first half of 2016. The standard defines a 1.4 MHz channel size and throughput of about 375 kbps uplink and 300 kbps downlink over licensed spectrum but at a fraction of the required device complexity required by regular LTE and subsequently with superior battery life compared to the typical 4G smartphone radio chipset. Additionally Cat-M1 will be able to support voice over LTE (VoLTE) which makes it the perfect for those IoT applications that still need moderate amounts of throughput. For example ATMs with video surveillance or retail kiosks with financial transaction components and/or voice command options. Cat-M1 also provides the ability to support handover between multiple mobile end points and is therefore truly mobile.

1 “LPWA outlook update: Dedicated players battle for scale and relevance” (Machina Research, July 2016)
• Cat-NB1 (previously referred to as NB-IoT) introduced within the underlining standards proposals a number of new optimizations including a new narrowband radio interface sometimes referred to as Clean Slate Cellular IoT or narrowband LTE. Cat-NB1 defines a very small channel size of 200 kHz and 10s of kbps of throughput which offers lower data rates than LTE-M but coupled with very lower power consumption. Handover is not supported by the standard hence the devices must effectively be stationary, nor is VoLTE supported.

• From a technical perspective Cat-NB1 benefits from lower power consumption when handling small payloads associated with sensor style applications and just payloads in the 100's of bits or so, however with larger payloads, for example 10KB and above, Cat-M1 is likely to offer better performance. Two other major advantages that Cat-NB1 has over Cat-M1 are both cost related. Firstly the cost of devices which are forecasted to be at least 10% cheaper than a Cat-M1 device which uses LTE modules similar in cost to today’s 2G modules, and secondly the ability to ‘re-farm’ existing 2G spectrum rather than purely utilizing LTE spectrum.

These two standardized, 3GPP ratified solutions for licensed cellular IoT technologies are also joined by EC-GSM, (extended Coverage GSM) is an evolutionary approach however as this is not getting a lot of market traction and is fast becoming an “also ran” technology. EC-GSM does however, still have a part to play in the LPWA IoT market and is set to see some degree of uptake amongst the MNOs that have a limited LTE coverage and do not have immediate plans to switch off their 2G networks Machina Research comment that “certain operators in Africa, Eastern Europe, and the emerging parts of Asia may base their mid-term IoT strategies on EC-GSM”.2

A summary of the attributes and comparative capabilities of the three 3GPP cellular LPWA standards are summarized in the following table.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>CAT-M1</th>
<th>CAT-NB1</th>
<th>EC-GSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectrum</td>
<td>LTE bands</td>
<td>LTE and Refarmed 2G Bands</td>
<td>2G Bands</td>
</tr>
<tr>
<td>Typical MNO</td>
<td>Good LTE Coverage</td>
<td>Ms LTE and 2G</td>
<td>Long 2G Life</td>
</tr>
<tr>
<td>Data rate</td>
<td>375 kbps</td>
<td>20–65 kbps</td>
<td>70 kbps</td>
</tr>
<tr>
<td>Channel BW</td>
<td>1.08 MHz</td>
<td>200 KHz</td>
<td>200 KHz</td>
</tr>
<tr>
<td>Mobility</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Specification available</td>
<td>Now 3GPP</td>
<td>Q2’16</td>
<td>Now 3GPP</td>
</tr>
<tr>
<td>IP vs. messaging</td>
<td>Both</td>
<td>Simple message or very low data</td>
<td>Both</td>
</tr>
<tr>
<td>Voice capable</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Network roll out</td>
<td>S/W Upgrade</td>
<td>S/W Upgrade</td>
<td>Mostly S/W Upgrade</td>
</tr>
<tr>
<td>Public network available</td>
<td>Q1-Q2 2017</td>
<td>Q1-Q2 2017</td>
<td>Q4 2016 EU</td>
</tr>
<tr>
<td></td>
<td>NA, Aus., Japan, EU</td>
<td>EU, China, NA</td>
<td></td>
</tr>
</tbody>
</table>

1 LPWA outlook update: the new 3GPP standards strengthen the MNOs’ hand (Machina Research, July 2016)
Already there is fragmentation between the major CSP’s as to which standard to focus on. For CSP’s with extensive LTE coverage the LPWA technology of choice is anticipated by many to be Cat-M1. AT&T and Verizon have already stated that they will be launching Cat-M1 services which could give the standard an advantage in generating critical mass and therefore accelerating adoption.

However in EMEA CSP’s such as Vodafone are already working with the likes of Huawei to roll out Cat-NB1 networks and services. Given Huawei footprint in the CSP network equipment market it can be expected that more operators will follow suit.

While some CSPs are already deploying these networks, the device market needs to ramp up to provide the vast number and breadth of devices forecast in order to turn these networks in a profitable businesses in their own right. As we have seen with LoRa and Sigfox connectivity the relatively slow development of devices and applications supported by such devices and networks are major drivers to the growth of such business models.

The market reaction

In order to address the specific and immediate needs of the Low ARPU market, many CSPs and some non-CSPs are taking advantage of the low cost of entry and building out their own LoRa networks. For example, Bouygues Telecom launched Objenious, a new subsidiary dedicated to its development in the IoT space using the dedicated LPWA network and supported by the HPE Universal IoT Platform.


In CSPs such as Bouygues Telecom and Orange France, these new LPWA networks which will effectively act as an overlay network to support their existing cellular networks, meaning that the CSP can select the right connectivity option, or even business unit, for the specific use case.

The comparative cheapness of the network infrastructure, together with the small physical footprint and look range makes such networks both attractive and affordable, not just to CSPs but other companies with national presence, such as postal services, to become dedicated LPWA network operators. For example in France, La Poste has invested in building out a LoRa network and were present at CES 2016 in Las Vegas with more than 20 cases of use of services developed in partnership with 16 startups and four industrial groups, demonstrating also the importance of partnerships and a wider ecosystem of partners in the IoT market.

In the cellular market several operators and network equipment providers (NEPs) have announced field trials of cellular LPWA networks, many of which made the decision to enter into these trials prior to the standards being ratified to ensure that they were able to rapidly move forward when the new standards were confirmed. For example:

- **Dec 2015—Vodafone and Huawei announced** Spain NB-LTE Vodafone Group, Huawei, and u-blox announced that they had completed the first successful commercial trial of pre-standard NB-IoT. Subsequent trials in other countries including Turkey, and the ratification of the Cat-NB1 standard means that Vodafone are on course for commercial launch of their service in 2017.

- **January 2016—Korean operator KT** has announced what it claimed to the industry’s first LTE-M field trial in partnership with Nokia. The trial was conducted on KT’s LTE network using Nokia’s Flexi Multi radio 10 Base Station. The technology uses just 1.4 MHz of the 20 MHz available in that LTE band.

- **January 2016—Ericsson** announced that they will deliver new cellular Low Power Wide Area (LPWA) software to Verizon that will enable the U.S. operator to utilize its existing LTE infrastructure for large-scale IoT deployments. In addition, they also announced that they would be working with AT&T on the rollout of Networks Software 17A, which allows cellular networks to support several “smart” initiatives including smart cities, metering and agriculture.
July 2016—AT&T announced that it will launch a pilot of Cat-M1 network technologies later this year.

August 2016—Nokia announced that as secured a double win with Singapore MNO M1 with the roll out of Singapore’s first commercial HetNet and a deal to do the same for Cat-NB1 early next year.

Now that the 3GPP standards for Cat-M1 and Cat-NB1 have now been ratified we can expect more and more of these announcements.

The net result of these developments has already been the reforecasting of volumes of devices/objects connected via LPWA network technology and an increase in the addressable market for the mobile network operators (MNOs). The big question is will the early-to-market advantage of the dedicated LPWA network operators be significant enough to enable them to gain a sufficient foothold before the MNOs are able to offer a competitive/equivalent cellular service proposition? In some geographies and use cases where LPWA has already gained significant momentum, the answer is definitely yes; others may be not.

One area where LPWA definitely has an advantage over the MNOs is the ability for enterprises and municipalities to set up their own private non cellular networks, however with the growing use of private LTE networks sharing licensed spectrum from MNO’s this advantage may be short lived. In the end, one thing for sure is that given the huge growth in connected objects together with the ever-growing list of use cases and business models, there are likely to be significant opportunities for heterogenous networks and IoT operators to bring together multiple connectivity networks to support a diverse arrays of services. Machina Research’s current anticipation, for example, is that “even though the MNOs have been catching up, the future of the LPWA market will nonetheless be defined by a fair amount of technological fragmentation.”

The capability to support fragmented connectivity environments is a core requirement for the next generation of IoT Application Enablement Platforms such as HPE’s own Universal IoT platform.

How to turn IoT into value creation

A major challenge facing all the IoT operators, whether they are CSPs or non-CSPs, is that regardless of the choice of connectivity option, is how do they ensure that they can provide efficient and effective data monetization and application enablement to help their customers create value from their IoT investments?

IoT operators who deploy LPWA networks should also understand that the value-added services that they want to offer on top of the network value creation is no longer based on connecting devices and having them available. They should instead also focus on collecting their data, validating it—possibly enriching it with analytics—and mixing with other sources, regardless of which connectivity network is used. They should then consider exposing their data to the applications that enable enterprises to derive business value from these services.

While there are already many M2M solutions in use across the market, these are often ‘silo’ solutions, capable of managing a limited level of interaction between the connected devices and central systems. An example would be simply collecting usage data from a utilities meter or for a fleet management solution. These solutions are also often limited in terms of scale being specific to a connectivity method, device type, vertical protocol, and business processes. They are often limited to a connectivity method. Moreover, they were designed and dimensioned much before the explosion in connected devices and available functionality that has given rise to the Internet of Things.

With the silo approach, integration must be redone for every single use case. IoT operators are saddled with multiple M2M silos and associated operational costs, while being unable to scale or integrate these standalone solutions or evolve them to address other use cases or industries. As a result, these silos become an inhibitor for growth, as the majority of the value lies in streamlining a complete value chain to monetize the data all the way from sensors to applications. This creates benefits and related margins to achieve the desired business cases and therefore fuel investment in IoT-related projects. This requires the maximum flexibility, scalability, cost efficiency, and versatility that a next-generation IoT platform can offer.
HPE Universal IoT Platform overview

For CSPs and enterprises to become IoT operators—and increase IoT’s value, by moving from a connectivity-centric business model to one where the value is created from the data generated by the plethora of connected devices, there needs to be a horizontal platform that is able to facilitate the use of this data across multiple use cases and industry verticals. Such a platform must be able to easily onboard new use cases being defined by an application and a device type from any industry, and manage a whole ecosystem from the time the application is on-boarded until it’s removed. In addition, the platform must also support scalability and lifecycle when devices become distributed by millions over periods that could exceed 10 years.

HPE Communication & Media Solutions (CMS) developed the HPE Universal Internet of Things Platform specifically to address long-term IoT requirements. At the heart, this platform adapts HPE CMS’s own carrier-grade Telco software—widely used in the communications industry—by adding specific intellectual property to deal with unique IoT requirements. It leverages market-leading Hewlett Packard Enterprise offerings such as cloud and Big Data and analytics applications, which include HPE Helion Managed Virtual Private Cloud and Vertica.

The HPE Universal IoT Platform enables connection and information exchange between heterogeneous IoT devices—standards and proprietary communication—and IoT applications. In doing so, it reduces dependency on legacy or connectivity-centric silo solutions. It dramatically simplifies integrating diverse devices with different device communication protocols. For example, the HPE Universal IoT Platform can be deployed to integrate with the HPE Aruba Networks WLAN solution to manage mobile devices and the data they produce within the range of that network and integrating devices connected by other Wi-Fi, fixed, or mobile networks. These include GPRS (2G and 3G), LTE 4G, and “Low Power Wide Area Networks,” such as LoRa and other 3GPP-compliant M2M devices. The HPE Universal IoT platform is already being used to support services using connectivity methods as diverse as LoRa, Sigfox and LTE 4G. Moving forward the product team are actively involved with a number of IoT operators looking to roll out both Cat-M1 and Cat-NB1 LPWA cellular networks.

On top of this ubiquitous connectivity, the HPE Universal IoT solution provides federation for device and service management, and data acquisition and exposure to applications. Using our platform, clients such as public utilities, home automation, insurance, healthcare, national regulators, municipalities, and numerous others can realize tremendous benefits from consolidating data that had been previously unobtainable.

With the HPE Universal IoT Platform, you can truly build and capture new value from the proliferation of connected devices and benefit from:

- New revenue streams when launching new service offerings for consumers, industries, and municipalities
• Faster time-to-value with accelerated deployment from HPE partners’ devices and applications for selected vertical offerings

• Lower total cost of ownership (TCO) to introduce new services with limited investment; flexibility of HPE options, including cloud-based offerings; and mitigate risk

By embracing the new capabilities, services, and solutions enabled by the HPE Universal IoT Platform, IoT operators—CSPs, cities, and enterprises alike—can deliver a standardized end-to-end platform, and create new services in the respective industry of their B2B/B2C/B2B2C customers and derive new value from data.

**HPE Universal IoT Platform architecture**

The HPE Universal IoT Platform solution architecture is aligned with oneM2M industry standard and designed to be connectivity-, industry-, vertical-, and vendor-agnostic. This supports access to different southbound networks and technologies and various applications and processes from diverse application providers across multiple verticals on the northbound side. In simple terms, the HPE Universal IoT Platform enables multiple industry verticals and industry-specific use cases to be supported on the same horizontal platform.

Hewlett Packard Enterprise enables IoT operators to build and capture new value from the proliferation of connected devices. Given its carrier-grade Telco applications heritage, the solution is highly scalable and versatile. For example, platform components are already deployed to manage data from millions of electricity meters in Tokyo, and are being used by over 170 telcos globally to manage data acquisition and verification from Telco networks and applications.

Alignment with the oneM2M standard and data model means there are already hundreds of use cases covering more than a dozen key verticals. These are natively supported by the HPE Universal IoT Platform when standards-based, largely adopted, or industry-vertical protocols are used by the connected devices to provide data. Where the protocol used by the device is not currently supported by the HPE Universal IoT Platform, it can be seamlessly added. This is a key benefit of Network Interworking Proxy (NIP) technology, which facilitates rapid development/deployment of new protocol connectors, dramatically improving the agility of the HPE Universal IoT Platform against traditional platforms.

![Figure 4. HPE Universal IoT Platform layered architecture](image-url)
The HPE Universal IoT Platform is designed to facilitate the management of devices, together with collection and use of data across multiple use cases and industry verticals. This horizontal approach means that application and data from one use case may be used in another within a different vertical, for example in addition to the collection of usage data from a utility meter (on behalf of a utility company), our platform can enable applications that would alert the homeowner if the reading is outside of normal levels. Similarly, as well as supporting a “fleet management solution”, our platform could be used to extend it with asset tracking (i.e., tracking the individual packages across the entire supply chain, not just tracking the trucks).

This capability greatly increases the flexibility of the platform and ability of customers to react to changes in their own market as well as enter new markets with compelling propositions. Through working with device manufacturers (for example low cost, small footprint asset tracking devices, temperature/motion sensors, etc.) operators of low-throughput networks can use these devices to provide additional value-added services to their customers. Such examples may include alerting a restaurant owner if the temperature in their cold room goes above or below predefined thresholds, allow consumers to tag their personal objects (e.g., bicycles, luggage, pets), and track the current location of those objects via a mobile app, tag industrial assets and get alerted if the asset goes outside a geo-fenced area, etc. By utilizing the HPE Universal IoT Platform, the IoT micro services required for such use cases can developed and deployed by an order of magnitude faster, reducing time, cost, and risk, while resulting in new revenue generating services and an enhanced customer experience.

The HPE Universal IoT Platform provides agnostic support for smart ecosystems, which can be deployed on premises and also in any cloud environment for a comprehensive as-a-Service model. Hewlett Packard Enterprise equips IoT operators with end-to-end device remote management including device discovery, configuration, and software management. The HPE Universal IoT Platform provides control points on data, so you can remotely manage millions of IoT devices for smart applications on the same multi-tenant platform.

Additionally, it is device vendor-independent and connectivity-agnostic. The solution operates at a low TCO with high scalability and flexibility when combining the built-in data model with oneM2M standards. It also has security built directly into the platform’s foundation, enabling end-to-end protection throughout the data lifecycle.

The HPE Universal IoT Platform is fundamentally built to be data-centric—as data and its monetization is the essence of the IoT business model—and is engineered to support millions of connections with heterogenous devices. It is modular and can be deployed as such, where only the required core modules can be purchased as licenses or as-a-Service, with an option to add advanced modules as required.

Learn more at hpe.com/csp/iot