Hewlett Packard Enterprise

Delivering on the IoT customer experience

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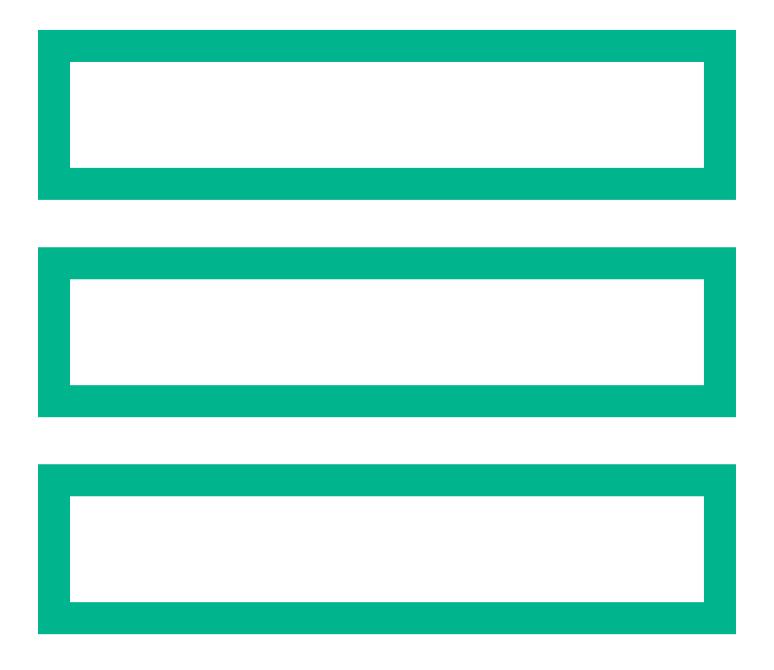

IoT evolution

Today, it's almost impossible to read news about the technology industry without some reference to the Internet of Things (IoT). IoT is a natural evolution of machine-to-machine (M2M) technology and represents the interconnection of 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 cars, the world of IoT is fast becoming a hyper-automated one.

The market for IoT devices and applications, and the new business processes they enable, is enormous. Gartner estimates endpoints of the IoT will grow at a 31.7% compound annual growth rate (CAGR) from 2013 through 2020, reaching an installed base of 20.8 billion units.[1] In 2020, 6.6 billion "things" will ship, with about two-thirds of them consumer applications; hardware spending on networked endpoints will reach $3 trillion USD in 2020.[2]

In some instances, IoT may simply involve devices connected via an enterprise's own network, such as a Wi-Fi mesh across one or more factories. In the vast majority of cases, however, an enterprise's IoT network extends to devices connected in many disparate areas, requiring connectivity over a number of connectivity options. For example, an aircraft in flight may provide feedback sensor information via satellite communication, whereas the same aircraft may use an airport's Wi-Fi access while at the departure gate. Equally, where devices cannot be connected to any power source, a low-powered, low-throughput connectivity option, such as Sigfox or LoRa, is needed.

The evolutionary trajectory—from limited-capability M2M services to the super-capable IoT ecosystem—has opened up new dimensions and opportunities for traditional communications infrastructure providers and industry-specific innovators. Those who exploit the potential of this technology—to introduce new services and business models—may be able to deliver unprecedented levels of experience for existing services, and in many cases, transform their internal operations to match the needs of a hyper-connected world.

Next-generation IoT solutions

Given the requirement for connectivity, many see IoT as a natural fit in the communications service providers' (CSPs) domain, such as mobile network operators, although connectivity is a readily available commodity. In addition, some IoT use cases are introducing different requirements on connectivity—economic (lower average revenue per user) and technical (low-power consumption; limited traffic, mobility, or bandwidth)—which means a new type of connectivity option is required to improve efficiency and return on investment (ROI) of such use cases, for example, low throughput network connectivity.

Value creation is no longer based on connecting devices and having them available. The focus now is on collecting data, validating it, enriching it with analytics, mixing it with other sources, and then exposing it 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, able to manage a limited level of interaction between the connected devices and central systems. An example would be simply collecting usage data from a utility meter or fleet of cars. These solutions are typically limited in terms of specific device type, vertical protocol, and business processes.

In a fragmented ecosystem, close collaboration among participants is required to conceive and deliver a service that connects the data monetization components, including:

• Smart device and sensor manufacturers

• Systems integrators for M2M/IoT services and industry-specific applications

• Managed ICT infrastructure providers

• Management platform providers for device management, service management, and charging

• Data processing layer operators to acquire data, then verify, consolidate, and support with analytics

• Application program interface (API) management platform providers to expose status and data to applications with partner relationship management (PRM), Marketplace, and Application Studio

With the silo approach, integration must be redone for each and every use case. IoT operators are saddled with multiple IoT 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 inhibitors for growth, as the majority of the value lies in streamlining a complete value chain to monetize data from sensor to application. This creates added value and related margins to achieve the desired business cases and therefore fuels investment in IoT-related projects. It also requires the high level of 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 monetize the value of IoT, a need exists for a horizontal platform. 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 the devices become distributed by millions over periods that could exceed 10 years. HPE Communication and Media Solutions (CMS) developed the HPE Universal IoT Platform specifically to address long-term IoT requirements. At the heart, this platform adapts its own carrier-grade telco software—widely used in the communications industry—by adding specific intellectual property to deal with unique IoT requirements. The platform also leverages HPE offerings such as cloud, Big Data, and analytics applications, which include 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 silo solutions and dramatically simplifies integrating diverse devices with different device communication protocols. HPE Universal IoT Platform can be deployed, for example, 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 Throughput Networks," such as LoRa.

On top of ubiquitous connectivity, the HPE Universal IoT Platform 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 for, 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, plus the flexibility of HPE options (including cloud-based offerings) and the ability to mitigate risk

By embracing new HPE IoT capabilities, services, and solutions, IoT operators—CSPs and enterprises alike—can deliver a standardized end-to-end platform, and create new services in the industries of their Business-to-Business (B2B), Business-to-Consumers (B2C), and Business-to-Business-to-consumers (B2B2C) customers to derive new value from data.

HPE Universal IoT Platform architecture

The HPE Universal IoT Platform architecture is aligned with the oneM2M industry standard and designed to be 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. The HPE Universal IoT Platform enables industry-specific use cases to be supported on the same horizontal platform.

HPE 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 benefit of network interworking proxy (NIP) technology, which facilitates rapid development and deployment of new protocol connectors, dramatically improving the agility of the HPE Universal IoT Platform against traditional platforms.

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 facilitates control points on data, so you can remotely manage millions of IoT devices for smart applications on the same multitenant platform.

Additionally, it's device vendor-independent and connectivity agnostic. The solution operates at a low total cost of ownership (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 heterogonous 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. The HPE Universal IoT Platform is composed of the following key modules.

Device and service management

The device and service management (DSM) module is the nerve center of the HPE Universal IoT Platform, which manages the end-to-end lifecycle of the IoT service and associated gateways, devices, and sensors. It provides a Web-based GUI for stakeholders to interact with the platform.

Hierarchical customer account modeling, coupled with the Role-Based Access Control (RBAC) mechanism, enables various mutually beneficial service models such as B2B, B2C, and B2B2C models.

With the DSM module, you can manage IoT applications—configuration, tariff plan subscription, device association, and others—and IoT gateways and devices, including provisioning, configuration, and monitoring; and troubleshoot IoT devices.

Network interworking proxy

The NIP component provides a connected devices framework for managing and communicating with disparate IoT gateways and devices, and communicating over different types of underlying networks.

With NIP, you get interoperability and information exchange between the heterogeneous systems deployed in the field and the uniform oneM2M-compliant resource mode supported by the HPE Universal IoT Platform. It's based on a "distributed message queue" architecture and designed to deal with the three Vs—volume, variety, and velocity—typically associated with handling IoT data.

NIP is supported by the "Protocol Factory" for rapid development of the device controllers and proxies for onboarding new IoT protocols onto the platform. It has built-in device controllers and proxies for IoT vendor devices and other key IoT connectivity protocols such as Message Queuing Telemetry Transport (MQTT), Lightweight M2M protocol (LWM2M), Device Language Message Specification (DLMS)/Companion Specification for Energy Metering (COSEM), HTTP Representational State Transfer (HTTP REST), and others.

Data acquisition and verification

Data acquisition and verification (DAV) supports reliable bidirectional data communication between IoT applications and IoT gateways and devices deployed in the field. The DAV component uses the underlying NIP to interact and acquire IoT data and maintain it in a resource-oriented uniform data model aligned with oneM2M. This data model is completely agnostic to the device or application, so it's completely flexible and extensible. IoT applications in turn can discover, access, and consume these resources on the northbound side using oneM2M-compliant HTTP REST interface. The DAV component is also responsible for transformation, validation, and processing of the IoT data:

- Transforming data through multiple steps that extend from aggregation, data unit transformation, and application-specific protocol transformation as defined by the rules

- Validating and verifying data elements, handling of missing ones through reacquisition or extrapolation as defined in the rules for the given data element

- Data processing and triggering of actions based on the type of message such as alarm processing and complex-event processing

The DAV component is responsible for ensuring security of the platform covering:

• Registration of IoT devices, unique identification of devices, and supporting data communication only with trusted devices

• Management of device security keys for reliable and encrypted communication

• Access control policies manage and enforce the many-to-many communications between applications and devices

The DAV component uses a combination of datastores based on relational and columnar databases for storing IoT data, ensuring enhanced performance even for distinct different types of operations such as transactional operations and analytics or batch processing—related operations. The columnar database, used in conjunction with distributed file system—based storage, provides for extended longevity of the data stored at an efficient cost. This combination of hot and cold data storage enables analytics to be supported over a longer period of IoT data collected from the devices.

Data analytics

The data analytics module leverages HPE Vertica technology for discovery of meaningful patterns in data collected from devices in conjunction with other application-specific externally imported data. This component provides a creation, execution, and visualization environment for most types of analytics, including batch and real-time—based on "complex event processing"—for creating data insights that can be used for business analysis and/or monetized by sharing insights with partners. IoT data analytics covers various types of analytical modeling such as descriptive key-performance indicator, social media, and geofencing, predictive determination, and prescriptive recommendation.

Operations and business support systems

The operations and business support systems (OSS/BSS) module provides a consolidated end-to-end view of devices, gateways, and network information. This module helps IoT operators automate and prioritize key operational tasks, reduce downtime through faster resolution of infrastructure issues, improve service quality, and enhance human and financial resources needed for daily operations. The module uses field-proven applications from HPE's own OSS portfolio such as "Telecommunication Management Information Platform," "Unified Correlation Analyzer," and "Order Management."

The BSS/OSS module drives operational efficiency and service reliability in multiple ways:

- **Correlation**: Identifies problems quickly through automated problem correlation and root-cause analysis across multiple infrastructure domains, and determines impact on services

- **Automation**: Reduces service outage time by automating major steps in the problem-resolution process

The OSS console supports business critical service operations and processes. It provides real-time data and metrics that supports reacting to business change as it happens, detecting service failures, and protecting vital revenue streams.

Data service cloud

The data service cloud (DSC) module enables advanced monetization models, especially fine-tuned for IoT and cloud-based offerings. DSC supports mashup for new content creation providing additional insight by combining embedded IoT data with internal and external data from other systems. This additional insight can provide value to other stakeholders outside the immediate IoT ecosystem, enabling monetization of such information.

Application Studio in DSC enables rapid development of IoT applications through reusable components and modules, reducing the cost and time to market for IoT applications. The DSC, a partner-oriented layer, safely manages the stakeholder lifecycle in B2B and B2B2C models.

Data monetization equals success

The end game with IoT is to reliably monetize the vast treasure troves of IoT-generated data to deliver value to enterprise applications, whether by enabling new revenue streams, reducing costs, or improving customer experience.

The complex and fragmented ecosystem that exists within IoT requires an infrastructure that interconnects the various components of the end-to-end solution, from device through to application—to sit on top of ubiquitously managed connectivity and enable identification, development, and roll out of industry-specific use cases that deliver this value.

With the HPE Universal IoT Platform architecture, you get an industry-, vertical-, and client-agnostic solution with high scalability, modularity, and versatility. This enables you to manage your IoT solutions and deliver value through monetizing the vast amount of data generated by connected devices and making it available to enterprise-specific applications and use cases.

Learn more at
hpe.com/CSP/IoT

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