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IOT 'S POTENTIAL FOR TRANSFORMATION

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Abstract: With a rapid decline in the cost of sensors and new ways to connect sensors wirelessly, the Internet of Things (IoT) is poised for dramatic growth over the next few years. To enable connected 'things' to achieve their true potential, the IoT needs many additional technologies to manage communications, extract meaning from collected data, and apply that meaning in useful ways. These technologies include Big Data analytics, Artificial Intelligence (AI), Augmented Reality (AR), cloud computing, edge computing, and 5G cellular communications. The IoT story is about these technologies as much as it is about huge numbers of things.

I. Big Data in the IoT

The main reason to connect things is to harness their data. The quantities of data generated by the IoT create a wide range of opportunities for optimizing business processes and managing factories, networks, and fleets on a predictive basis. Huawei and its industry partners have developed a number of solutions that combine IoT connectivity, device management, and predictive maintenance. Big Data offers exciting prospects for many kinds of decision-making support. Combining Big Data analytics with the IoT and real-time industrial networks enables correlation-based process and productivity improvements.

II. IoT Architecture

Another important IoT development is the transition from special-purpose vertical management platforms (silo-type systems) to multi-purpose horizontal solutions. The latter promote collaborative partnerships, ecosystem development, and interaction between industry players, vertical service providers, public authorities, and communities. Horizontal solutions are useful, therefore, in dealing with the complexity of managing an IoT infrastructure that may include devices, connection methods, protocols, data throughput volumes and collection intervals, time-sensitive networks, and application requirements. An overall architecture can handle many of these variables transparently for developers and managers. An architecture ecosystem can help

cope with ever changing requirements and provide users with the required platform capabilities, flexibility, scalability, tools, SDKs, and software libraries. Connection security and data flow integrity across the whole IoT domain still pose challenges, and further advances are necessary to make horizontal platforms practical. In contrast, a lot of good work has been done to define the layers that make up the architectural framework of an End-to-End (E2E) IoT solution. Moreover, reference architectures show some commonality in the layers required to support very different vertical requirements and use cases.

The basic layers include the following:

- Smart sensor/thing layer
- Network connectivity layer
- IoT cloud platform enabling interconnection

III. Low-power Communications

NB wireless connectivity enables low-power communications using low-cost hardware. Specifically, NB-IoT can be implemented using a Huawei module that costs about USD 5, operates for up to 10 years on one battery, provides good coverage (20 dB gain), and supports connectivity of 50,000 devices per cell. This module can be used inside devices such as smart electric meters and other Smart City systems to achieve easy IoT communications. Huawei has been helping operators around the world perform tests of smart parking, street lighting, and similar projects. Huawei was the first vendor to implement the standard for NB-IoT (3GPP Release 13) on a live network. Several of Huawei's networks with Tier 1 operators will go live with NB-IoT in the first quarter of 2017.

IV. OneAir eLTE

To meet a variety of IoT connectivity needs, Huawei has integrated several communications technologies in a solution called OneAir eLTE. This solution implements enterprise private networks that provide broadband, NB, and many other industrial IoT services. The OneAir eLTE solution can be integrated in manufacturing, rail transit, petrochemical plants, ports, Wireless Internet Service Provider (WISP) networks, open-pit mines, and railway yards. The solution complies with Message Queuing Telemetry Transport (MQTT), IP Proxy, and other standard IoT protocols to allow interconnections with industrial application systems or management platforms.

V. IoT Operating System

Huawei's LiteOS supports IoT hardware that has minimal memory, consumes little power, enforces excellent security, and offers the flexibility to work in a wide variety of applications. With a kernel of just 10 kB, the OS performs auto-discovery, auto connecting, and self-organizing functions. These functions allow users to achieve rapid connection and large-scale deployments, while helping to ensure security at the kernel, transmission, and application layers. LiteOS is compatible with communications protocols that include ZigBee, Wi-Fi, Thread, LTE, Ethernet, and Bluetooth.

VI. Agile IoT Solutions

In addition to the technology needed to implement individual IoT devices, Huawei offers IoT solutions that deal with collected data and enable communication with the devices. Two of the most important parts of these Huawei solutions are gateways and controllers. By providing edge

computing capability, Huawei's agile IoT gateways meet local real-time computing and control requirements. The gateways can run OSs, such as Linux, Android, and KVM, and can be equipped with third-party application plug-ins for local processing. If sensors detect an engine abnormality in a vehicle-mounted system, for example, the local IoT gateway can take measures to deal with the problem — thus avoiding possible delays due to network faults or congestion. At a higher level of the IoT architecture, Huawei's Agile Controller provides unified management of IoT terminals, gateways, computing resources, applications, and data. The controller uses standard northbound interfaces to achieve fast interconnections with applications and other resources. The controller's open software architecture permits virtualized, distributed deployment with seamless expansion capabilities that enable management of tens of millions of IoT devices.

VII. LTE-V Solution for Vehicles

Along with general-purpose IoT solutions, Huawei offers the LTE-V solution specifically designed for Vehicle-to-Everything (V2X) applications that demand extremely low latency and reliable short distance communications. While conventional cellular networks can handle the needs of vehicle telematics, Huawei's LTE-V uses mature 4G LTE technology to meet more stringent V2X requirements.

VIII. IoT Opportunities and Challenges

The IoT represents enormous opportunities for companies across nearly all industry verticals. The way forward will not be without challenges, of course. The IoT requires a dramatic re-thinking of how to embrace new technologies. Huawei is committed to developing state-of-the-art solutions across the broad spectrum of IoT products and services in order to benefit operators, enterprises, and consumers, and make the world a smarter and better connected place for everyone.

