Key Tenets for Building the Internet of Things (IoT)

Intel has defined key tenets to guide the development and deployment of IoT solutions, including security and interoperability from edge to cloud, supported by development kits.

Ensuring secure and reliable IoT deployments

Tenets for IoT Infrastructure

By 2020, it is expected that more than 50 billion devices will be connected to the cloud and each other[1] in what is commonly called the Internet of Things (IoT). Before this can become a reality, solution providers must recognize and tackle the complexity of IoT solutions to ensure secure and reliable IoT deployments. Along these lines, Intel, working with other industry leaders, has defined five key tenets to help guide those building and operating IoT infrastructure:

• **World-class security** as the foundation, using embedded hardware and software-level protection

• **Automated discovery and provisioning of edge devices** to ease deployment

• **Data normalization** through protocol abstraction to improve interoperability

• **Broad analytics infrastructure** from edge to cloud to realize customer value

• **Infrastructure** to monetize hardware, software, and data management from edge to cloud

It is critical for these tenets to be applied across the entire IoT solution, as shown in Figure 1. *Security* must be omnipresent at every point to protect devices and user IP as data travels from edge to cloud. The infrastructure must also allow for easy *discovery and provisioning* of devices and *data normalization* in order to keep operating costs low and allow for ubiquitous use of the IoT. A *broad analytics infrastructure* that spans from edge to cloud is capable of unlocking useful insights from a wealth of data which creates the true customer value. With an *infrastructure* that enables the creation and deployment of APIs from edge to cloud, developers and industry partners can extract value that can be monetized.
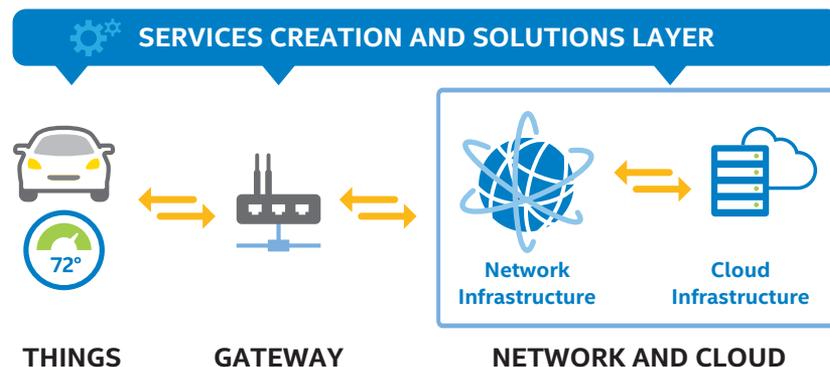

Figure 1. End-to-End Solution from Edge to Cloud

Intel® Solutions

In order to accelerate IoT development aligned with the tenets, Intel is providing the industry with technologies that can address security and interoperability challenges to enable edge to cloud solutions. These solutions include essential Intel building blocks, such as security, gateways, and data management. They are being deployed at Daikin Appied*, the world's largest air conditioning, heating, ventilating, and refrigeration company; Vnomics*, a leading provider of fleet management solutions; and by other leading providers in smart buildings and smart cities around the world.

Intel is also working with industry leaders such as AT&T*, Cisco*, GE*, and IBM* to create IoT solutions that are flexible and will help drive market adoption. Aligning on best practices to accelerate IoT deployments, this group of industry leaders has also formed the Industrial Internet Consortium.

Intel Reference Designs

In order to meet a wide assortment of requirements, Intel offers several versions of IoT Development kits with a mix of performance, I/O, and software capabilities. There are different types of IoT developers, ranging from hobbyists and enthusiasts to professional developers, and their needs will vary as they go through the innovation, prototyping, and commercialization phases.

- **Intel® IoT Developer Kit for the IoT** is designed for enthusiasts and hobbyists looking to explore and innovate in the IoT. The board, pictured in Figure 2, supports a variety of programming environments, tools, hardware, API, and cloud connectivity solutions. Based on the Intel® Quark™ SoC X1000, it delivers exceptional performance per watt for those looking for an affordable, single-board controller that will bring their project ideas to life quickly and easily. This kit is offered with open source and Intel tools that maximize flexibility and ease of use. **For more information**.

Figure 2. Intel® IoT Developer Kit for the IoT

- **Intel® Gateway Solutions for the Internet of Things (Intel® Gateway Solutions for the IoT) Development Kit** enables professional developers to quickly commercialize IoT products and services. It can be used to create a quick prototype (Figure 3) that is reliable and can scale by providing communications, security, manageability, and other key functionality. The development environment is supported by many off-the-shelf platforms from a broad set of ODMs, so developers and customers can rapidly move from development to product.

The kit can also maintain interoperability between new intelligent infrastructure and legacy systems, including sensors and datacenter servers. It comes with a fully-configured compute board, wireless communications, security software, operating system, development tools, chassis, power supply, antennas, and documentation. Developers can choose between the Intel® Atom™ processor E3826 or the Intel® Quark™ SoC (multiple SKUs).

This kit has a software stack and tool suite optimized for the IoT, including Wind River* Linux* (Host OS), Wind River Intelligent Device Platform XT, Wind River Workbench, and McAfee Embedded Control*. A number of cloud and service platforms are compatible, such as Eurotech* Everyware* Software Framework (ESF), IBM Bluemix*, and solutions from Messagesite*, Wind River, Axeda*, and Digi*. **For more information**.

Figure 3. Intelligent Gateway

Developers and customers need secure and reliable IoT infrastructure, which is why Intel has defined key tenets to help ensure deployments satisfy these critical requirements. Moreover, developers can ensure these tenets are met by using development kits from Intel that include critical hardware and software building blocks for the IoT.

To learn more about Intel® solutions for the IoT, visit **http://www.intel.com/iot**.

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