IoT innovation is happening

The world is on track to design, develop, and connect one trillion intelligent devices over the next two decades. In Los Angeles, acoustic sensors attached to streetlights monitor noise levels to help ensure more peaceful streets and healthier citizens. Researchers in Scotland use smart telemetry tags to track and monitor endangered harbor seals. And auto maker Daimler outfits its trucks with devices offering 3D maps, proximity control, and emergency braking assistance to improve driver safety. Welcome to the world of IoT, where networks of tiny sensors are revolutionizing entire industries. The opportunities are almost without limit—provided organizations manage the security, data management, design, and connectivity issues that arise from millions of interconnected devices.

Standards for one trillion IoT devices

A world with one trillion IoT devices will only happen if certain standards are met. For starters, IoT devices must be able to work independently. If a humidity sensor can’t function properly on its own, it’s not worth connecting to a network of devices. At the same time, devices must be able to connect seamlessly across multiple network standards, particularly mobile assets, with centralized connectivity and device management for cost efficiency and operational flexibility.

IoT solutions need to be flexible so they can work with legacy systems behind corporate firewalls, in addition to cloud-based approaches. Many companies have long-established IoT systems that handle data that managers don’t want in the cloud. Furthermore, one trillion IoT devices will generate enormous data streams—data that must work well with other sources of enterprise information to help improve operations, predict maintenance issues, and even save lives.

One trillion devices must be resilient. In today’s hyper-connected world, a nefarious hacker or software design flaw can wreak havoc on an entire network. Intelligent devices must have built-in resilience to respond quickly to security issues, unanticipated failures, and general wear and tear.

“We see opportunities for cities and organizations to make plans using real-world, real-time information. They can now operate in a data-first, experiment-first way. That’s rarely been possible before.”

–Damon Civin, principal data scientist at Arm
Lastly, no single company will provide every IoT solution up and down the technology stack. The IoT’s growth and success will depend on shared standards and a strong community of vendors. The companies that commit to innovation and build the most vibrant partner ecosystems will rise to the top.

**Principles for IoT excellence**

There are four ways to get a head start on tomorrow’s one-trillion device world:

1. **Put security first**

   Around 92 percent of global technology enterprises have security policies in place, according to Forrester’s State of IoT Security 2018 report. But only 42 percent have the necessary tools to properly enforce these policies.

   When developing an IoT security strategy, begin by taking an inventory of system and network vulnerabilities. Think about the threats that concern you and the steps you’ve taken to defend against them. Examine not only the intelligent devices on your network, but also the legacy systems you plan to integrate with your IoT system.

   Next, prioritize your risks and take action. Assess threats along a spectrum: from those that are most to least likely to happen to those that could cause the greatest and least amount of damage.

2. **Get a grip on data demands**

   With the volume of data doubling every two years, the digital universe is expected to reach 44 zettabytes by 2020.¹ Generated by billions of interconnected IoT devices, this data will consist of a range of information, from consumer behavior to 3D seismic data. And the data will be used for an array of applications, from helping farmers cultivate crops more efficiently, to allowing retail stores to provide more personalized experiences, to enabling cities to build smart bridges. The value of IoT-generated data must be fully realized for organizations to move beyond simply creating customer profiles and detecting anomalies, to using data to predict security breaches and anticipate machine failures. Yet most IoT data isn’t used.

   What’s required is a holistic approach that makes the trusted data from IoT devices and relevant enterprise data accessible for predictive insights. These insights help drive real-time dynamic optimization and new revenue opportunities.

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¹ The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things, IDC, April 2014
3. Design for energy efficiency

In a one-trillion IoT-device world, there will be many more sensors throughout an IoT network. Embedded processors will relay increasing amounts of IoT data. And IoT platforms will need to orchestrate software applications to maintain device performance. This requires a new approach to hardware and software design.

Energy efficiency is a critical factor in IoT-device hardware design. You must consider how much energy a device uses when it’s awake and idle. And since most IoT devices don’t plug into an outlet, it’s important to have a highly efficient IoT chip architecture.

When designing software for IoT devices, it’s important to balance functionality with power consumption. The most effective way is with an operating system (OS) designed for the IoT. And since today’s IoT devices are designed to last longer, the ability to monitor and maintain IoT software is imperative. Remote over-the-air software updates are an efficient and effective way to distribute and install software updates.

4. Harness machine learning at the edge

Machine learning (ML) will play an increasingly important role in tomorrow’s one-trillion device world. As innovative products like voice assistants and consumer robots enter the marketplace, AI’s reliance on machine learning is growing dramatically. For ML to reach its potential, it will increasingly be deployed at the network edge.

Scaling the IoT globally

Continued advances in chip design, sensor technology, and machine learning make the bold predictions about the IoT look increasingly likely. But for the IoT to fulfill its potential and evolve at a global scale, organizations must address difficult challenges in several areas, including security, data management, and power.

Businesses can accelerate IoT adoption and deployment by building a strong foundation that’s composed of both hardware and software and designed for IoT devices. This approach provides organizations the flexibility and scalability to exploit new opportunities and unlock even more value from IoT data.

Learn how the Arm Pelion IoT Platform can help you build a foundation for a one-trillion IoT device world.