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High-Performance Computing Drives A Growing, Evolving Internet of Things

HP Workstation Value Proposition

HP computers are used in nearly every job today. But particularly in designing products or in mission-critical applications, HP Z Workstations, powered by Intel® Xeon® processors, play an important role.

As the market leader in this segment of computing products, HP has dedicated engineering teams that develop the products, integrate them, and manufacture them. HP ships more workstations than any competitor, and in EMEA (Europe, Middle East, and Africa), HP has shipped the most workstations since 2006.

The three main components HP focuses on when developing products are innovation, performance, and reliability. There are many innovations HP has brought to the market first. One example is the tool-less chassis design. Without any tools, the components of the system can be exchanged, upgraded, or serviced. DreamColor technology is a color-matching technology brought to market by HP. Another technology is remote graphics software that can be used to control a computer over a network connection in a very elegant way.

The second topic important to workstations is performance, and of course, HP uses the latest components from partners such as Intel to design those systems. These components are integrated into what HP calls whole system engineering design. HP controls the firmware and everything that goes into the computer to provide the maximum performance to the user, whether in high computing environments or in highly graphics-intensive applications.

The third topic is reliability — mission-critical systems controlling equipment far away. HP tests products under very rigorous conditions. HP mobile workstations are tested according to military standards.

Not too long ago, the idea of bringing intelligence to physical objects in our world and interconnecting them might have seemed like science fiction. Yet it is happening right now, as the phenomenon we call the Internet of Things (IoT) takes shape.

The IoT, a rapidly growing network of "smart" sensors, processors, actuators, and other devices that communicate over the Internet to share information with cloud-based or other hosts, has the potential to revolutionize how we live, work, and play.

The possibilities are tantalizing. Consider a day when, as your alarm clock wakes you up, it also notifies your coffee maker to start brewing. Then, when you lock the door as you leave for work, the lock tells your thermostat to turn down the heat. On the way to work, your car receives a notice of unusually heavy traffic on the road ahead from sensors along the way, and offers you an alternative route. As you get out of your car at work, your wristband vibrates, telling you that it notices you are in your office's parking lot but don't have your company ID with you.

And that's just the beginning. The data harvested from widely distributed, always-on digital devices can be used in many spheres of life for better planning; for remote monitoring and control; to optimize critical functions and improve performance; to detect, warn, and/or prevent impending problems; and to open up myriad capabilities that were impossible or uneconomic before.

On the individual level, ubiquitous connectivity will allow us to have easy access to tools and solutions that can enhance our lives in areas such as mobility, health, safety, finances, day-to-day organization and planning, and more.

Fitness bands and other wearable devices monitor and record heart rate, calories burned, vital signs, and important personal information.

For businesses, this new wave of computing promises to spawn tremendous efficiencies and new markets and business models in wearable, mobile, healthcare, transportation, smart homes, industrial production, energy delivery, and other applications.

And for society as a whole, better and safer infrastructure and security, along with more efficient and convenient delivery of services, are just some of the advantages the IoT will bring.

Of course, significant challenges as well as benefits can be expected to result from a technology as disruptive as the IoT. In a world where just about anything can be connected and can communicate intelligently — where the world becomes, in effect, one big information system — security and privacy will be major challenges.

When a business system is hacked, that's one thing, but what happens when a smart home is hacked? Could the connected lock on your front door mean that your comings and goings may be transmitted to people unknown to you, and perhaps with malicious motives?

Indeed, a recent study found that some 70 percent of people are at least somewhat concerned about data breaches as a result of an IoT device being compromised.

Nonetheless, ways will be found to deal with these challenges because the benefits of a connected world are too great to be ignored.

There is debate over how the worldwide IoT will develop, and how quickly. Some analysts predict more than a trillion sensors will be at work in IoT applications within the next decade, while others estimate there will be some 25 billion connected devices in that timeframe, more than the combined number of PCs, phones, and tablets.[1]

Generating Insight From Data

Driving the evolution of the IoT is the availability and affordability of dramatically more powerful computers, used to analyze, manage, and store the torrents of data generated by distributed devices, and to design the small, inexpensive, and increasingly sophisticated sensors, actuators, processors, and power supplies required.

Take healthcare as an example. Fitness bands and other wearable digital tools for monitoring and recording such values as steps taken, calories burned, heart rate, and other vital signs have exploded in popularity recently, as individuals try to lose weight, improve athletic performance, and improve their overall health.

Some of these devices allow the data to be transmitted to smartphones or other apps for analysis and record-keeping, and it isn't hard to see that in the not-too-distant future, extensions of this capability may lead to a virtual revolution in patient monitoring and care.

High-powered host computers will marry the data from such remote monitoring devices with new medical software to deliver healthcare based on an individual's specific needs in real time, wherever the individual happens to be.

Among the possibilities are the use of wearable or perhaps even implanted devices to track values and trends related to a patient's condition dynamically. It also may be possible to actually treat a patient's pre-surgical or post-trauma conditions remotely, with medication given as needed by IoT-connected pumps implanted in the body.

These capabilities may seem far-fetched, but as increasing numbers of people in the United States and elsewhere reach retirement age and experience new medical needs, IoT-based systems will represent one way to provide more personalized, convenient, and potentially less expensive health monitoring and treatment.[2]

Transportation is another area where the IoT is likely to lead to dramatic changes.

Automobiles are increasingly being connected via cellular networks, until now mostly for "infotainment" systems applications. In the future, though, cars may be connected to the Internet much more deeply. For example, turn-by-turn navigation directions can be enhanced with the addition of real-time traffic information supplied by IoT-connected sensors embedded in the transportation infrastructure, a necessary step to achieving practical self-driving cars.

IoT devices in and along roads and signs also could help make the roads those cars travel on smarter, too. They would enable municipalities and transportation agencies to use data captured in real time to understand and optimize traffic patterns, and to improve road safety.

Railroads are another mode of transportation where IoT technology offers ways to improve operational efficiency and reduce costs. Remotely managing track switches along a rail line and collecting fares via handheld devices are examples.

With regard to industrial production, the ability of high-performance computers to effectively capture, analyze, and manage large amounts of data in a timely fashion enables manufacturers to gain valuable insights from IoT applications.

In the semiconductor industry, for example, manufacturers are moving toward increasingly "wired" factories, where automation software manages the entire factory or large parts of it holistically for maximum efficiency and output. This technology also allows the factory to be monitored remotely, even from other spots on the globe.

Effective use of this software requires accurate and timely inputs from sensors distributed throughout the factory on production equipment. But because manufacturing advanced computer chips is a complex and expensive process, modern semiconductor production machines, or tools, may have as many as 500 sensors to monitor their condition and performance. These generate more than 100,000 different production statistics for a single processing step, and that data also may need to be sampled at rates of up to 1,000 Hz.

Gathering and making effective use of this information without the availability of high-performance computers would be impossible. But with them, some forward-thinking semiconductor manufacturers are able to use the data to optimize production, quality, output, and costs. Some are even using it to move beyond a reactive mode of operating to a predictive mode, where problems are anticipated and then either avoided or solved in a scheduled manner, rather than after they occur, when they may have caused an unexpected production shutdown.[3]

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A different way in which high-performance computers are advancing the development of the IoT comes from HP workstation Strategic Partner, PTC Inc.

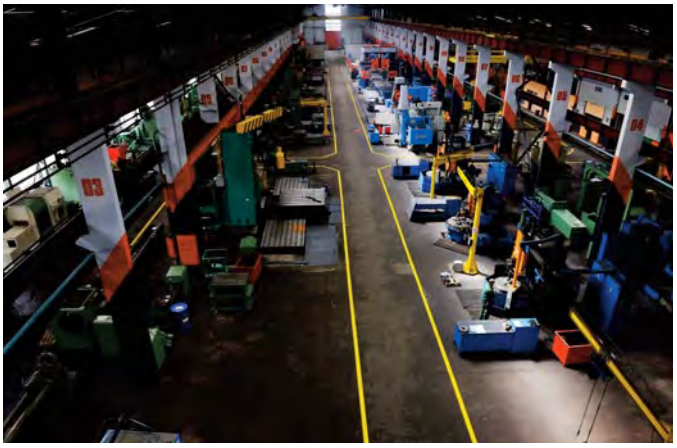
HP and PTC work together by pairing optimized high-performance HP workstations, powered by Intel processors, with PTC's suite of software solutions to help customers design, create, operate, and service products for the IoT.

For example, as part of its strategy to help customers take advantage of the IoT, PTC acquired ThingWorx, creator of an end-to-end application modeling environment designed to help customers model the "things" — business logic, visualization, data storage, collaboration, and security — required for connected applications.[4]

Wearable Devices — Not Just Fashion Statements

Perhaps the IoT's most intriguing aspect is the burgeoning number of wearable devices it is spurring, which beyond the fitness and health applications mentioned above, may provide great benefits in myriad other areas one day soon.

For example, hands-free wearables could provide access to data to workers in restricted conditions and environ-



In "wired" factories, automation software manages most or all of a factory floor, allowing it to be monitored remotely.

ments, such as individuals who must wear special protective equipment, or who need to consult technical manuals as they are engaged in equipment testing or repair.

Wearables also could provide access to important data for a wide range of mobile or isolated users in diverse occupations, from emergency personnel, firefighters, and police, to lawyers and salespeople.

Wearable devices are at an early stage, though, with plenty of room for improvement and innovation. One noteworthy effort to harness the creativity and enthusiasm of people worldwide to stimulate the growth of wearable devices for the IoT is Intel Corporation's "Make It Wearable" challenge.[5]

The contest has resulted in products as disparate as a wristband that provides cooling or warmth in response to feedback from the body; a vision system that allows the user's perspective to be shown in sporting events; a bionic mattress to keep babies in neonatal intensive care units connected with their mothers via haptic, or touch, sensations in real time; and many others.

Looking Ahead

Already, there are many devices with a "smart" label connected to the Internet. The challenge is envisioning what the Internet of Things will become and making it happen.

Whenever and however it ultimately comes to fruition, there is little doubt that the continually increasing power and affordability of the computers at the heart of the IoT mean that its long-range impact will be substantial.

Learn more at
www.hp.com/go/workstations

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