

**SOLUTION BRIEF**  
3rd Generation Intel®  
Core™ Processors  
B&R\* Automation PC 910  
Industrial Automation

# Highest Levels of Industrial Computer Performance and Advanced Features

The B&R\* Automation PC 910, built with cutting-edge Intel® processors, delivers robustness, high reliability and long-term availability



B&R Automation PC 910

There was a time when industrial PCs, rigorously tested for high reliability, were a step behind the consumer PC market with respect to implementing the latest processors and advanced technologies. However, this definitely isn't the case for B&R\*, who works closely with Intel to carefully align its automation PC roadmap with Intel® processor launches. For instance, B&R, the world's largest private company in automation equipment manufacturing, shipped prototypes of its Automation PC 910 with 3rd generation Intel® Core™ processors just two days after Intel had announced availability.

## What's Needed for the Factory Floor

The Automation PC 910 is a flexible solution that satisfies the requirements of nearly every type of manufacturing, like metal working, food and beverage, automotive and pharmaceutical, just to name a few. The automation PC is built for continuous operation over a period of many years, providing the following essential and advanced features:

- **Long-term availability** to reduce machine maintenance effort.
- **High reliability** to minimize production line stoppages.
- **High performance** for complex applications, like visualization and motion control.
- **I/O and display flexibility** to support multiple networks, peripherals, sensors, actuators, displays, etc.
- **Graphics capabilities** for HMI displays and vision applications.
- **Remote system management** to repair systems - over the wire - quickly and at lower cost.
- **Virtualization** to reduce machine cost through application consolidation.

"B&R\* PCs are designed with the most demanding applications in mind."

*Raimund Ruf*  
HMI Business Unit Manager  
B&R

Perfection in Automation  
[www.br-automation.com](http://www.br-automation.com)



“We’ve completely redesigned the cooling system for the Automation PC 910 to optimize heat dissipation out of the housing.”

*Raimund Ruf  
Manager, HMI Business Unit  
B&R*

### About B&R\*

B&R is a privately owned company with headquarters in Austria and offices all around the world. As a global leader in industrial automation, B&R combines state-of-the-art technology with advanced engineering to provide customers in virtually every industry with complete solutions for machine and process automation, motion control, HMI and integrated safety technology. With industrial fieldbus communication standards like POWERLINK and openSAFETY as well as the powerful Automation Studio software development environment, B&R is constantly redefining the future of automation engineering. The innovative spirit that keeps B&R at the forefront of industrial automation is driven by a commitment to simplifying processes and exceeding customer expectations.

### Long-Term Availability

Product manufacturers want to equip factory floors with long-running, stable systems, and this is why standard computers’ mother boards are rarely used. First, standard computers aren’t reliable enough, and second, consumer-driven computer suppliers don’t provide revision control for board components and BIOS, which is needed to minimize machine maintenance effort.

In contrast, the typical product lifespan of a B&R Industrial PC generation is at least ten years. B&R is able to achieve this remarkable level of support by using silicon products from the Intel embedded roadmap, featuring extended life cycle support that is far longer than standard products.

In order to maximize computer availability, B&R plans its development activities around the Intel roadmap, ensuring it is one of the first vendors to market with the most recent Intel® products. Engineers at B&R have early access to Intel restricted information (e.g., design guides) and Intel application engineers, both of which help to accelerate industrial PC development.

### High Reliability

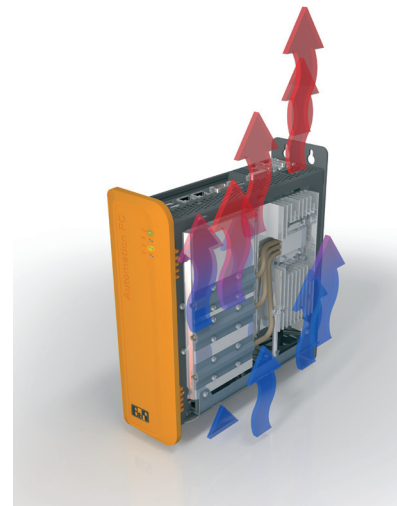
Components with moveable parts, like system fans and hard disk drives, are particularly susceptible to environmental factors that can cause early failure. This is why the Automation PC 910 supports fanless operation, with the Intel® Core™ i7-3517UE and Intel® Core™ i3-3217UE processors, and optional Intel® Solid State Drives that offer better performance and reliability than traditional hard drives.

### Convection Cooling

With Intel processors moving from 32 nm to 22 nm technology, it becomes more difficult to remove the heat they generate because it’s dissipated across a smaller surface area. Therefore, B&R performed extensive evaluations using Intel thermal models, leading to the development of a new heat sink capable of fanless, convection-only cooling for processors up to 17 watts. Simulation models were also used to redesign and enlarge the vents in the Automation PC 910 in order to provide a larger opening for air circulation while retaining the robustness and stability of the housing.

### Heat Pipes

For machines requiring very high performance, and thus necessitating fans, the Automation PC 910 uses heat pipes (i.e., hollow tubes) to efficiently transfer large amounts of heat away. This is achieved by filling the heat pipes with a liquid that improves heat transport through evaporation and condensation processes. The heat pipes are very light and take up very little space within the PC housing, as illustrated in Figure 1.



**Figure 1.** The Automation PC 910 utilizes heat pipes to achieve optimum heat dissipation in the housing. These hollow tubes efficiently transfer large amounts of heat away from a small surface area.

### High Performance

It wasn’t long ago that industrial system developers had to deal with processors that topped 100 watts, which basically cancelled out everyone’s best efforts to minimize board-level power consumption. Now, energy-efficient multi-core Intel processors are operating within a lower power range, like 17 to 45 watts. These processors are monitoring their active workloads and using power gating to significantly reduce average energy usage when possible.

“The 3rd generation Intel® Core™ i7 processor, together with B&R\* industrial PC design, provides superior performance and next-generation I/O technologies to help meet the intensive processing demands of the latest automation and control applications.”

*Matt Langman  
 Director of Marketing  
 Intelligent Systems Group  
 Intel Corporation*

**Inside the 3rd Generation Intel® Core™ Processor Family**

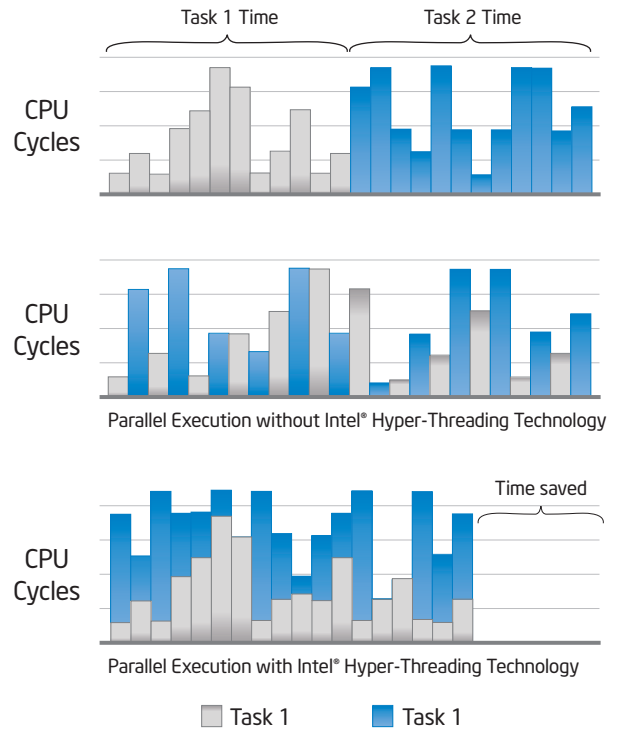
Manufactured on industry-leading 22nm process technology with 3D Tri-Gate transistors, 3rd generation Intel Core processors offer superior performance, enhanced media and graphics capabilities and flexibility, making them ideal for industrial automation. Full integration (Figure 2) of the CPU, media/graphics capabilities, cache memory and memory controller reduces the overall platform footprint and saves on-board real estate. A large shared L3 cache, between 3MB and 6MB, reduces latency to data, improving performance and power efficiency.

When paired with either the Mobile Intel® HM76 or Mobile Intel® QM77 Express chipset, this platform offers faster connectivity by integrating next-generation I/O technologies such as USB 3.0.

**More Software Threads**

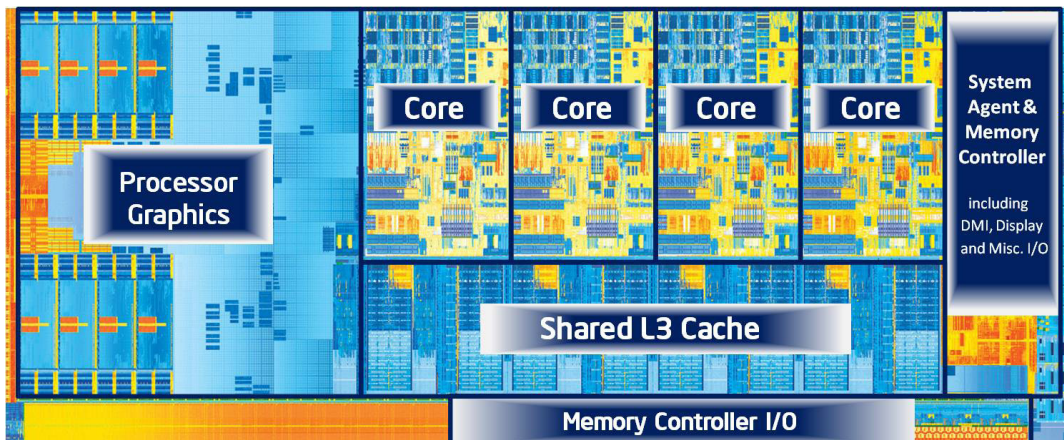
Many industrial automation systems simultaneously execute multiple workloads, each generating one or more software threads. For applications running a lot of threads, Intel® Hyper-Threading Technology (Intel® HT Technology)<sup>1</sup> doubles the number of threads each processor core can process concurrently, helping to increase performance by as much as 30 percent.<sup>2</sup>

Intel HT Technology provides separate data paths for two tasks, which means the processor maintains two execution states at the same time. As a result, the CPU will process another task if the task it’s executing stalls (e.g., waiting for an I/O device), which eliminates wasteful idle time. The performance improvement derived from Intel HT Technology is illustrated in Figure 3, showing three multi-tasking examples. First, the tasks are executed sequentially, task 1 followed by task 2. Second,



**Figure 3.** Each processor core can handle two software tasks concurrently, thereby saving processing time.

the tasks are assigned alternating time slots. These first two examples require about the same amount of time because they both incur significant delays when the CPU must wait for data. Third, Intel HT Technology executes both tasks concurrently, taking advantage of idle time to work on another task and thus reducing overall execution time.



**Figure 2.** Silicon chip image of an Intel® processor, showing processor cores, caches, processor graphics engine and memory controller.

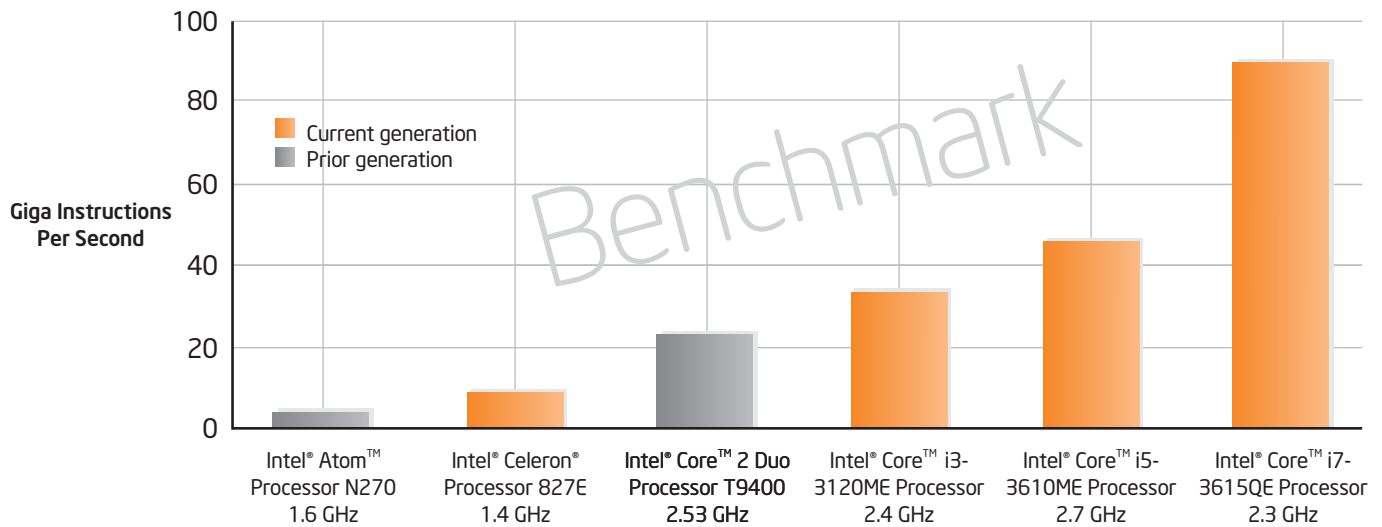


Figure 4. Performance benchmark measurements for various Intel processors

### Performance Benchmarks

The Automation PC 910 supports a rich selection of high-performance dual-core and quad-core processors with the option of using error correcting code (ECC) memory.<sup>3</sup> This includes several low-power versions that allow the Automation PC 910 to be operated fan-free, even with an Intel® Core™ i7 processor. Performance benchmarks for the processors available with the Automation PC 910 (orange bars) and the prior-generation automation PC (gray bars) are shown in Figure 4; new high-end systems demonstrate up to a four times performance increase. The processor SKUs for the Automation PC 910 are listed in Table 1.

As with previous Automation PC models, users can mix and match CPU performance with different-sized main units, as needed. For example, a quad-core CPU can be used in a single-slot housing or a single-core Intel® Celeron® processor can be

used in a five-slot housing. This gives users the freedom they need to optimize price-performance.

### I/O and Display Flexibility

I/O interface options for the Automation PC 910 I/O include two ports for Intel® Gigabit Ethernet Controllers, which are typically used to connect to machine and factory networks. There is one standard serial port and two modular ports for RS232/422/485 or CAN, together with USB 3.0 ports for connecting to peripherals, sensors, actuators, etc., as needed.

Panels, both custom and standard models, are easily connected via the Smart Display Link (SDL) interface using a single cable. SDL permits large distances between panels. In addition to the SDL interface, the Automation PC 910 has DVI and DisplayPort\* interfaces, the new standard for office environments.

Processor	Core Frequency	Cores	Threads	L3 Cache	TDP*
Intel® Core™ i7-3615QE processor	2.3 GHz	4	8	6 MB	45 W
Intel® Core™ i7-3612QE processor	2.1 GHz	4	8	6 MB	35 W
Intel® Core™ i7-3555LE processor	2.5 GHz	2	4	4 MB	25 W
Intel® Core™ i7-3517UE processor	1.7 GHz	2	4	4 MB	17 W**
Intel® Core™ i5-3610ME processor	2.7 GHz	2	4	3 MB	35 W
Intel® Core™ i3-3120ME processor	2.4 GHz	2	4	3 MB	35 W
Intel® Core™ i3-3217UE processor	1.6 GHz	2	4	3 MB	17 W**
Intel® Celeron® Processor 847E	1.1 GHz	2	2	2 MB	17 W**
Intel® Celeron® Processor 827E	1.4 GHz	1	1	1.5 MB	17 W**

\* Thermal design power (TDP)  
\*\* Fanless

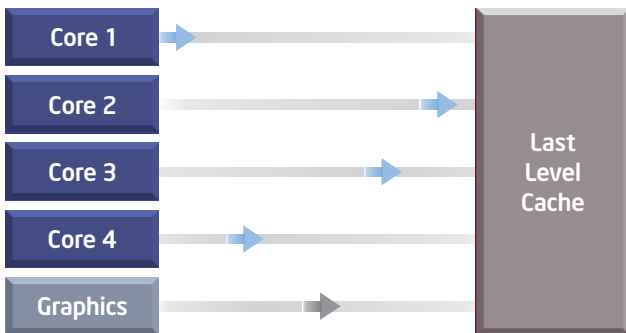
Table 1. Intel® processors available with the Automation PC 910

## Graphics Capabilities

The Automation PC 910 enables equipment manufacturers to attain new and greater levels of visual and vision performance without the need for additional discrete graphics hardware. That's because the graphics engine and media processing in the 3rd generation Intel® Core™ processor family are integrated on a single chip (Figure 5) and incorporate advanced 3D processing. Plus, the graphics engine in Intel® HD Graphics 4000 includes Microsoft\* DirectX\* 11 support and a large number of execution units (EUs), dramatically enhancing 3D functionality and other media effects. Two times faster than HD Graphics on 2nd generation Intel® Core™ processors,<sup>456</sup> Intel HD Graphics on 3rd generation Intel Core processors delivers fast, smooth multimedia rendering.

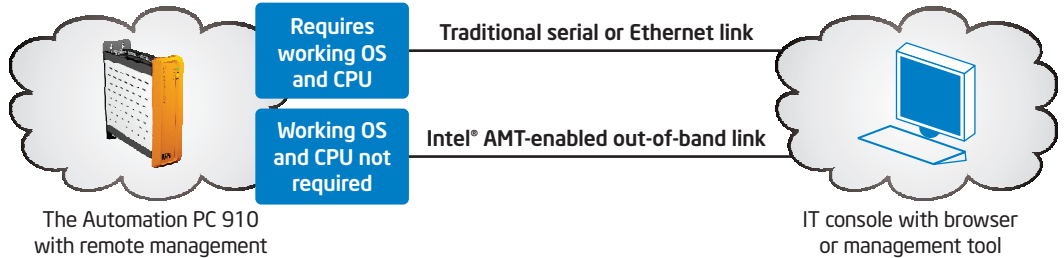
Intel HD Graphics frees application developers from design and performance challenges by providing these advanced features:

- Shared last-level cache between the processor and graphics enables accelerated graphics processing.
- Intel 22nm process technology delivers higher performance and better energy efficiency.
- Faster 3D rendering and more complex shading create more responsive and realistic 3D video and graphics.
- Other capabilities include content mixing and support for up to three independent displays.



**Figure 5.** Fast access by cores and graphics to shared data in the last-level cache accelerates graphics processing.

## Why Out-of-Band Remote Management Is Important



### Out-of-band Link Benefits

- Persistent access:** Manage industrial PC regardless of state (e.g., powered off or OS blue screen).
- Secure access:** Authenticate Intel AMT link using security certificates and keys.
- Full function:** Perform system queries, cycle power, access event logs, etc.. anytime.
- Standard interfaces:** Use standard management tools that run on a remote console.

**Figure 6.** Benefits from Out-of-Band Remote Management

## Remote System Management

When a piece of factory equipment goes down, an on-site technician may be required to fix the problem and get the production back online. It can take hours, even days, to get a technician out to the plant to fix the defective systems, resulting in lost revenue. Alternatively, manufacturers and industrial OEMs are turning to remote management solutions to diagnose, repair and get equipment online faster and at lower cost.

Taking remote management to a new level, Intel® Active Management Technology (Intel® AMT)<sup>7</sup> allows consoles to fix a wider range of systems issues, even when the operating system is down. For example, it's possible to repair corrupted drivers, application software or the operating system for a non-responsive retail system that won't run or boot. This can be done on an Intel AMT-enabled system, like the Automation PC 910, through a capability called out-of-band (OOB) management, which works over Ethernet, Wi-Fi and 3G/4G networks. This capability reduces cost and saves time by supporting devices without requiring hands on intervention, as illustrated in Figure 6. This includes the ability to automate IT support tasks, such as patch management and system configuration tracking.

This out-of-band link employs a dedicated manageability engine, which enables control over non-functioning systems. In contrast, most traditional remote management consoles use an in-band link that requires the system to perform networking functions – in other words, have a working operating system, CPU and network drivers. When a system fails, the in-band approach has the drawback of relying on the continued operation of many system components, significantly limiting the types of problems or failures that can be fixed remotely.

## Virtualization

Running millions of lines of code, industrial control systems provide the intelligence for the factory floor. Manufacturing IT must ensure there are no software conflicts, even though the code comes from various sources, like industrial OEMs, in-house programmers, legacy systems and third party vendors. Ideally, all of this software can be consolidated onto a single board, which reduces hardware cost, overall power consumption and device form factor.

Today, many industrial systems run a single operating system, typically real-time, general-purpose or homegrown. If developers want to add a legacy application running on a different operating system (e.g., DOS), they probably have to rewrite the software, which can be time-consuming and risky. Alternatively, developers can choose to run multiple operating systems and their associated applications in secure partitions using virtualization and hypervisor technology. For instance, it's possible to combine general-purpose operating systems (GPOS), such as Windows\* and Linux\*, with real-time operating systems (RTOS) on a single multi-core processor, as shown in Figure 7. The hypervisor is a layer of software separating the PC hardware from the operating systems, which run concurrently and independently of one another.

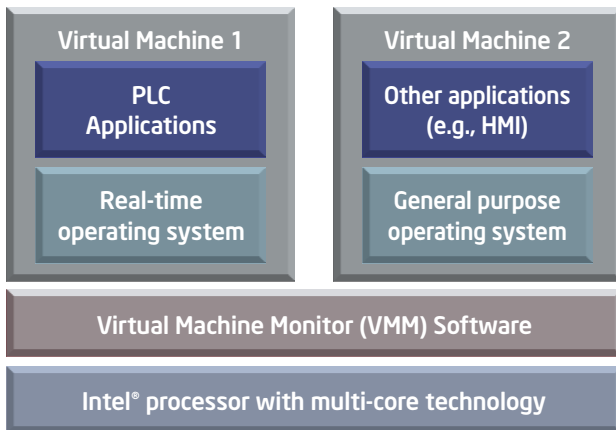


Figure 7. Code runs in secure partitions called virtual machines.

Virtualization has been around for many years, most notably used in data centers where multiple applications are consolidated onto a single server. Complementing software-based virtualization solutions, Intel® Virtualization Technology (Intel® VT)<sup>8</sup> improves their performance and robustness and gives software developers greater control over operating systems and applications. This capability increases real-time performance, safeguards safety-critical code and facilitates software consolidation. Users of the Automation PC 910 also have the option of using B&R's Automation Runtime RTOS, which provides optimal multi-core processor utilization and runs in parallel with other operating systems.

## Powerful Flexibility and New Advancements for Industrial Computers

The Automation PC 910 is based on 3rd generation Intel Core processors and offers maximum performance for demanding tasks such as those that involve vision systems. The proven standard design of the Automation PCs has been retained while adding many new capabilities to keep up with the advancements being made on the PC market. Working closely with Intel, B&R is able to provide computing systems with long-term availability, high reliability and robustness to meet the stringent requirements of industrial automation.

For more information about the Automation PC 910 from B&R, visit <http://www.br-automation.com>.

For more information about Intel solutions for industrial automation, visit [www.intel.com/go/industrial](http://www.intel.com/go/industrial).

<sup>1</sup>Intel® Hyper-Threading Technology (Intel® HT Technology) requires a computer system with an Intel® processor supporting Intel Hyper-Threading Technology and an Intel HT Technology enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. For more information, see <http://www.intel.com/content/www/us/en/architecture-and-technology/hyper-threading/hyper-threading-technology.html>; including details on which processors support Intel HT Technology.

<sup>2</sup>Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit Intel Performance Benchmark Limitations: [www.intel.com/performance/resources/benchmark\\_limitations.htm](http://www.intel.com/performance/resources/benchmark_limitations.htm).

<sup>3</sup>Error Correcting Code memory is available only on Intel® Core™ processors which come in a Ball Grid Array (BGA) package and these SKUs were specifically developed by the Intel® Intelligent Systems Group.

<sup>4</sup>With Intel® HD Graphics 4000.

<sup>5</sup>Claim based on 3DMark® Vantage scores using 3rd generation Intel® Core™ i5-3570K processor (desktop) compared with 2nd generation Intel® Core™ i5-2500K processor (desktop). Results have been based on internal Intel analysis and are provided for informational purposes only.

<sup>6</sup>Software and workloads used in performance tests may have been optimized for performance only on Intel® microprocessors. Performance tests, such as SYSmark® and MobileMark®, are measured using specific computer systems, components, software, operations, and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.

<sup>7</sup>Intel® Active Management Technology (Intel® AMT) requires a platform to have an Intel AMT-enabled chipset, network hardware and software, as well as connection with a power source and a corporate network connection. With regards to notebooks, Intel AMT may not be available or certain capabilities may be limited over a host OS-based VPN or when connecting wirelessly, on battery power, sleeping, hibernating or powered off. For more information, see <http://www.intel.com/technology/manage/amt>.

<sup>8</sup>Intel® Virtualization Technology (Intel® VT) requires a computer system with an enabled Intel® processor, BIOS, virtual machine monitor (VMM), and for some uses, certain platform software enabled for it. Functionality, performance, or other benefits will vary depending on hardware and software configurations and may require a BIOS update. Software applications may not be compatible with all operating systems. Please check with your application vendor.

