



White Paper

Intel® Platforms

Innovation Beyond Processors

**"You have to start by thinking
about the things people
want to do with computers
and work backward."**

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The Intel Platform Approach

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A Platform Vision

The world has changed. Digital technology is transforming every aspect of society, from enterprise to entertainment, from healthcare to education. This calls for a fundamental shift in technology development, from a focus on delivering devices, gadgets, and components to a more comprehensive focus on understanding how people actually use—or would potentially use—technology in their daily lives, and then delivering integrated solutions to address those usages. This shift has been occurring at Intel for some time through the research and design of products from the outside in; first by understanding the real problems that end users face, then by creating innovative technologies and working with the ecosystem¹ to deliver the unique solutions that address those problems, addressing both mature and emerging markets, consumers and businesses.

Traditionally, computing products have been designed based on the capabilities of the technology. Today Intel is working to first foresee what users want and need, develop technologies, and then lead the industry in delivering those capabilities and experiences. This approach, which we call the “platform approach,” has five well-known major components:

Discover: Work directly with end users and collaborate with the computing ecosystem to understand end user requirements and discover new value propositions.

Innovate: Understand and innovate in platform architectures, technologies and all other key areas to deliver those value propositions with the ecosystem.

Enable: Enable the key ingredients and make sure those ingredients are interoperable by working with our ecosystem fellow travelers throughout the platform life-cycle.

Standardize: Align the ecosystem and standardize the key ingredients and interfaces globally to maximize industry revenue and strategic value.

Integrate and Deliver: Using our core competencies, lead the industry in integrating, testing, validating, marketing, and delivering solutions to provide end user value.

This platform approach results in the development of additional opportunities for collaboration with ecosystem partners, in order to drive innovation and user value even further.

Once we determine what users need and desire, we work with the industry—through standards bodies and working groups, Independent Software Vendors (ISVs), Original Equipment Manufacturers (OEMs), and many others—to deliver these experiences. This integrated approach helps open new market segments across the industry for the delivery of real-world solutions through unique and extraordinary platforms.

1. Members of the ecosystem include Original Equipment Manufacturers (OEMs), system and network integrators, Independent Software Vendors (ISVs), Independent Hardware Vendors (IHVs), Value Added Resellers (VARs), and standards bodies.

End user Value

Value in a platform or product, or success in technology, has always been about bringing greater relevant value and benefits to the users. A critical element of success in delivering such a platform is recognizing that you can't understand end user requirements until you understand people and technology in context. This means understanding teenagers in China, farmers in Vietnam, cell-phone users in Australia, print-shop owners, bankers, high-school teachers, gamers, digital media enthusiasts, sales managers, and information technologists.

To acquire these critical types of information, make the information useful, and drive valuable innovation, Intel gathers data through our researchers in the field in all geographies.

These front-line people interact around the world with end users and ecosystem players on a daily basis. They are often the first to discover trends and emerging usage models.

Other information comes from our ethnographic research groups (which include anthropologists, sociologists, and other social scientists), user-centric design groups, product-oriented market research groups, interaction with end users during the course of our business, and also from end user projects through our Intel Solution Services (ISS) group. We work closely with Independent Software Vendors (ISVs), Original Equipment Manufacturers (OEMs), and others who have a history of understanding user needs.

Platform Definition: End-User Requirements



Understand current usage models, envision future usage models, and identify innovative value.

There are three key elements to understanding end users:

1. Understanding the user's current needs, such as accessing information and key applications anytime, anywhere or staying connected while on the go.
2. Understanding user "pain points," such as system lock-ups, viruses, scams, and software updates.
3. Identifying trends in computing that are being driven by end users; for example, entertainment on the go, increased productivity applications in handheld devices, and human-tolerant interfaces.

This approach is critical today, because the value proposition is changing. Users aren't just looking for a computer. They are looking for capabilities that solve their problems and make their lives easier, at an affordable cost, with such features as stylish form factors, ease of use, rich entertainment, access to content anywhere, anytime, securely; and much more. As a result, user friendliness is no longer limited to simply the operating system or mouse or software applications. Today, user friendliness is about usage-oriented computing, which cuts across every element of the computing system: silicon, transistors, processors, chipsets, memory, kernels, operating systems, applications, compilers, tools, power supplies, services, content providers, and more. The entire computing ecosystem needs to align to meet those values in order to provide the extraordinary experience that today's end users are demanding.

To achieve this requires a holistic approach, which includes hardware, software, and services. This holistic approach is fundamental to taking computing to the next level—to delivering a personalized experience through a pervasive and intelligent computer environment.

Intel's technology leadership and our ability to align the ecosystem puts Intel in the ideal position to deliver platform solutions that meet these user needs and take the computing industry to this next level.

What Is a Platform?

A platform is a net result of this holistic approach, which delivers this end user value. An Intel® platform has all the necessary components, in the right mix and integrated smoothly, to provide a compelling end user experience. Today, we define a platform as:

An integrated **set of ingredients** that enables targeted **usage models**, grows existing markets and creates new markets, and which delivers **greater end user benefits than the sum of its parts**.

A platform is the home—not just the framing, wiring, and plumbing, but the entire structure after it is designed, built, painted, and furnished. In today's world, the definition of a platform is hardware, software, and services—and no one can deliver it the way Intel can.

For example, Intel Centrino mobile technology is critical ingredient, providing an end user experience unique to the customers it addresses. However, Intel Centrino mobile technology-based devices are not platforms in and of themselves.

The platform is the aggregate of several important components, such as: an Intel® Pentium® M processor and compatible Intel® Chipset, a lightweight form-factor for mobility, technologies to provide great battery life, enabling the ability to work almost anywhere you want without needing a power socket, wireless capabilities that enable the ability to connect in almost any location equipped with private and public hotspots, and sophisticated applications that use the mobile form-factor efficiently. An Intel Centrino mobile technology-based product is the sum of a set of parts that provides the valuable end user experience—it is not just a device, but a platform.²

2. The iCafe, China Home Learning PC are examples of platforms Intel is developing to address user needs.

Intel® Centrino® Mobile Technology: A Platform Success Story

The Intel® Centrino® success is a story of four end user business requirements and how three critical solution components met those requirements. While designing these platforms, Intel knew that businesses wanted:

- Agents able to take the office to their customers.
- Workers and managers able to stay in touch while on the go.
- Increased productivity.
- Access to information and key applications anytime, anywhere.

First, Intel translated those needs into design requirements. For example, in order to carry an office to a customer, users needed a mobile device that was lightweight, with long battery life, and with wireless communications fully integrated. To meet these requirements, the devices needed a variety of capabilities, including intelligent software, flexible connectivity software, cooperative standards for communication in different environments, wireless infrastructure around the globe, and so forth.

Along with developing hardware to provide that solution, Intel worked with the industry in developing the software fundamental to providing these targeted user values. This included drivers, kernels, middleware, configuration software, and other application software that would complete the user experience. Intel also worked extensively with the industry to enable investments in infrastructure; hotspot locations

for homes, offices, and public places; simplified “one-bill roaming” wireless access models; industry standards; and identity and security technologies.

Basically, the Intel Centrino mobile technology success story is a result of three components: intense collaboration with the industry in developing standards for many of the mobile technologies used in Intel Centrino mobile technology-based platforms, the user-oriented design of hardware and software components, and a strong commitment to testing Intel Centrino mobile technology-based products in thousands of locations worldwide to make sure the platforms worked in all environments. Intel also marketed Intel Centrino mobile technology directly to users, creating additional market pull for mobile devices. Mobile-device original equipment manufacturers saw a direct benefit from Intel’s branding and marketing investments, which created demand for Intel Centrino mobile technology-based platforms.

The result has been a remarkably successful set of new business opportunities and end user values that have opened the door for a social revolution. From coffee shops and fast-food restaurants to bookstores, and from airports to train stations, this technology has driven truly innovative, useful solutions for business and end users alike.

Five Key Areas for the Platform Approach

Intel has identified five key areas where a platform approach would offer significant advantages for end users, OEMs, third-party vendors, and service providers:

Digital Enterprise: platforms for end-to-end solutions in businesses, offering a lower total cost of ownership (TCO), better security, reliability, scalability, automation, manageability, and responsiveness.

Digital Home: platforms for entertainment and other home uses with evolving consumer-electronics (CE) form factors; content management, protection and services; high-quality audio and video; rich graphics; multitasking; wireless access; ease of use; security; and reliability.

Mobility: platforms that will make the growing numbers of different mobile devices work together better and be easier to use, offering enhanced performance, security, mobile entertainment, and much more.

Channel Platforms: Platforms focused on the unique needs of local markets worldwide, such as the China Home-Learning PC and the Rural India PC.

Digital Health: Platforms for healthcare research, diagnostics, and productivity, as well as for personal healthcare, such as enhanced caller-ID for users with Alzheimer's Disease, and sensor networks to help caregivers better monitor patients.

Major Ingredients of Intel Platforms

There are three major ingredients in Intel platforms:

Hardware, such as processors, chipsets, communications, memory, boards, and systems.

Software, such as operating systems (OSs), applications, firmware, and compilers.

Technologies, such as Hyper-Threading Technology (HT Technology), Intel® Virtualization Technology (VT), Intel® I/O Acceleration Technology (Intel® I/OAT), and Intel® Active Management Technology (Intel® AMT).

Initiatives and standards, such as Wi-Fi, WiMAX, the Wireless Verification Program, and so on.

Services, such as digital media distribution, communications services, and system management services.

There are also external elements that make a comprehensive platform come together, such as standards, development tools, marketing initiatives, and infrastructure.

For a platform to be truly valuable, all of these elements and ingredients must work seamlessly together to create a useful and cohesive end user experience.

Benefits Across Industry

Before the Internet bubble burst, innovation slowed down. With the multifaceted, interdependence of today's technologies affecting every industry segment, the platform approach is jump-starting a new wave of innovation that is already having a dramatic impact on the economy and offering tremendous benefits across the industry.

Enabling Innovation

An Intel platform is a set of well-integrated ingredients that address a targeted usage model. Simply put, it provides a well-defined framework for the targeted end user experience. This framework provides enormous flexibility for our OEMs and ISVs to define their own solutions for that usage model on top of what Intel provides. For example, OEMs can offer their own Wi-Fi solution with a new look and feel to address a targeted usage. This type of framework increases innovation, opportunities for OEMs, and varieties and choices for end users.

Increasing Productivity and Reducing Total Cost of Ownership

Along with Intel's platform approach, Intel's platform technologies include critical capabilities that increase productivity and reduce the total cost of ownership for systems, especially for IT managers. For example, Intel® Input/Output Acceleration Technology (Intel® I/OAT) dramatically improves packet-transfer rates, reducing the need for IT managers to keep throwing money at unsealable solutions to bottlenecks while addressing the constant demand for more speed. Intel® Active Management Technology (Intel® AMT) makes it possible for IT shops to manage networked systems remotely, even when devices are powered down or their operating systems are unavailable. Intel® Virtualization Technology allows updates, security patches, and porting from one virtual system to another without downtime, while Intel's security technology (code named LaGrande Technology) will offer more tamper-resistant methods for securing and managing a network. These and other platform technologies offer a dramatic leap forward in productivity, maintenance, and management of systems.

Reducing Time to Market

By building common capabilities—such as security and device management—into base components, Intel is reducing the burden on OEMs to deal with issues typical to various platforms. OEMs can now use their innovation and development budgets to create new products faster and get those innovations to market more quickly.

Reaching the Next Billion

With capabilities like wireless and security now being incorporated into the base platform at a lower cost, the industry can more easily build platforms that address the needs of specific audiences. Economies of scale come into play for both developed and developing countries. For example, Intel's India Rural PC addresses a common problem in rural India—the lack of a local or consistent power infrastructure—by enabling the system to run on car batteries. The pervasive issue of dust in that country is addressed through a special case designed to keep out particulate matter. Intel's China Home Learning PC and iCafé platforms are other examples of addressing the needs of a particular market. Intel's platform approach allows OEMs and other channels to deliver platforms specifically targeted to market segments and dramatically reduce the digital divide. Intel has the core competencies, financial resources, and commitment to research required to successfully meet these challenges and still enable valuable, differentiated products at end user price points.

Creating New Industries

New capabilities mean opportunities for new usages and even new industries. For example, Intel's mobile technologies spurred the growth of a completely new industry: the delivery and management of wireless access points. In addition to wireless access in universities and airports, Internet cafés, coffee houses, and other organizations, businesses are now offering hotspots to customers to keep them in-store longer. Access-point companies have sprung up, new jobs have been created, and service offerings are expanding every month. Today, not only are many office buildings wireless, but more and more users are installing wireless technologies at home—all feeding new industries and economic success.

Creating New Business Models

As computing capabilities enable new usage models, new business models, such as location-aware computing, wireless access on air-planes, and entertainment on the go are also coming into existence.

Evolving a New Intel Corporation

“Intel is putting the people and resources in place to sharpen our focus on the development of platforms that meet the demands of our customers and provide innovative and exciting new technologies for the marketplace.”

Paul Otellini
Chief Executive Officer, Intel

To understand end users across the spectrum of enterprise and consumer segments, from mature to emerging markets, we are developing new skills, new tool sets, and new business processes, and deliverables for requirements capture, translation, and reuse. This will allow us to bring to the design table the right resources for the architectures and platforms that meet end user needs.

We have also taken the necessary steps organizationally to integrate the Intel platform approach into the way we do business. This includes a broad reorganization to bring our major product groups in line with the company's strategy to lead development of complete technology platforms for targeted markets. Our reorganization not only makes it easier to align enhancements and new development with today's end user needs, it reflects the increasing convergence of computing and communications technologies.

In addition, Intel has created organizations based around user-centric design groups, which use consistent, structured methods of listening,

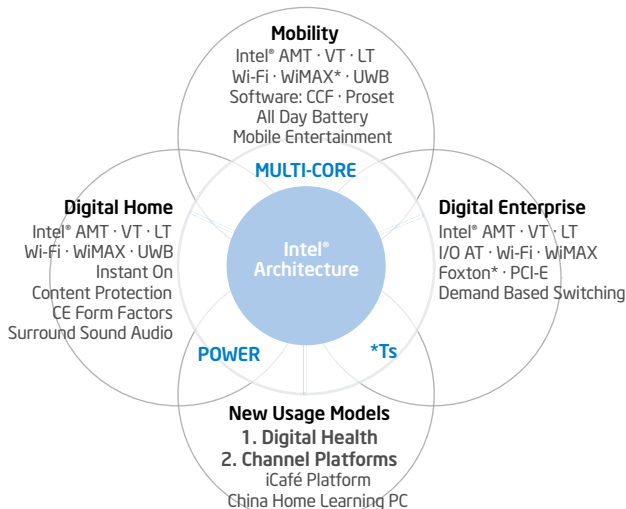
observing, and accumulating usage information. That information is passed on in consistent, structured ways to design teams, brand teams, fellow ecosystem travelers, and others who need to align their work with Intel in order to deliver the end user experience.

With this reorganization, Intel has recently announced the formation of four platform-definition centers around the world, including Bangalore, India; Cairo, Egypt; Sao Paulo, Brazil; and Shanghai, China. The centers are staffed with local ethnographers, designers, solution engineers, and systems architects and will identify environmental considerations and marketplace requirements specific to each geographic region.

Very recently, Intel also announced balanced platforms for both the digital office and the digital home. For example, the Digital Home Platform will offer dual-core processors, some supporting Hyper-Threading Technology, to provide ample performance and seamless multitasking. Furthermore, this platform will boast Intel® 945G Express/Intel® 945P Express Chipsets with Intel® High Definition Audio, as well as content protection, to provide an extraordinary entertainment experience.

Intel's next-generation mobile platforms, planned for release in 2006, will have outstanding wireless connectivity to support major wireless protocols, and will be very lightweight. They will offer rich mobile performance with dual-core, low-power IA processors, power-optimized platforms to provide great battery life, high-definition audio and video capabilities, as well as content protection like their digital home cousins, in order to provide a rich entertainment experience in mobile platforms.

Intel® Architecture and Platform Innovation



*Intel roadmap

People, Possibilities, and Platforms

The digital transformation is creating an increasingly complex world of technologies, and the challenge of creating holistic platforms in this world is significant. With more multifaceted usage models emerging every day, today's computing solutions need to be more powerful and flexible, self-maintaining, invisibly secure, and easier to upgrade and use. Tomorrow's platforms must handle increasingly massive data workloads, offer human-friendly interfaces and ubiquitous connectivity, be intuitive, and allow users to more easily and completely personalize devices.

Intel engages the entire ecosystem and drives platform design from today into tomorrow with a fundamental understanding of user needs, from bits to broadband, from the outside in. With a focus on how people really use technology, Intel is ensuring that all required and desired elements of today's platforms are optimized to answer real-world needs and maximize the value of technology for users around the world.

For more information on Intel platforms, please visit www.intel.com/platforms.

A Glimpse of the Future

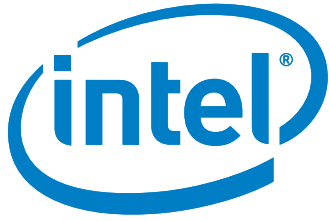
Few devices can stand on their own today. Instead, platforms rely on an increasingly wide array of technologies, from high-definition audio and video to content protection (DTCP/IP) and management. These include chipset technologies, software, and services for integrating computing with consumer electronics (CE), as well as wireless Universal Serial Bus (USB) and ultra-wideband (UWB) technologies and industry standards (such as DLNA) for connecting computers and CE devices. Multi-core processors, multithreading technologies, and concurrent programming will provide enormous processing performance with low power consumption. And high-performance algorithms, such as recognition, mining, and synthesis (RMS), will improve the usefulness of the information being acquired, downloaded, and managed. In fact, some of those algorithms are already making their way into future platforms.

Intel's research divisions are also working on high-quality microphone array technologies that will process voice and sound with excellent fidelity. At the same time, lifelike graphics will offer another generational leap forward for home theaters and gaming.

Intel has several generations of virtualization and management technologies in the research pipeline. Plans call for these technologies to start showing up in platforms in 2006; they will offer inherent reliability, transparent and/or

remote manageability, and security, while acceleration technologies will dramatically speed up server network communications. Intel researchers are also working on advanced technologies such as data mining, photorealistic rendering and signal processing, which may show up soon in our platforms. Along with Intel's long roadmap of multi-core processors, these technologies will deliver a full generational leap in platform solutions.

Already, next-generation mobile platforms are in the pipeline, ready to offer high performance using Intel's multi-core, low-power IA processors. These platforms include advanced, platform-level thermal management (which offers five to six hours of battery life), lightweight form factors, and seamless communication to all Wi-Fi protocols. Location-aware technologies are being designed to allow platforms to understand context and behave intelligently. And, Trusted Protection Module and other security technologies are already in second-generation development, to offer users better protection across the platform, from content to communication.



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+ Wireless connectivity and some features may require you to purchase additional software, services or external hardware. Availability of public wireless LAN access points is limited and some hotspots may not support Linux*-based Intel Centrino mobile technology systems. System performance measured by MobileMark* 2002. System performance, battery life, wireless performance and functionality will vary depending on your specific operating system, hardware and software configurations. See www.intel.com/products/centrino/more_info for more information.

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