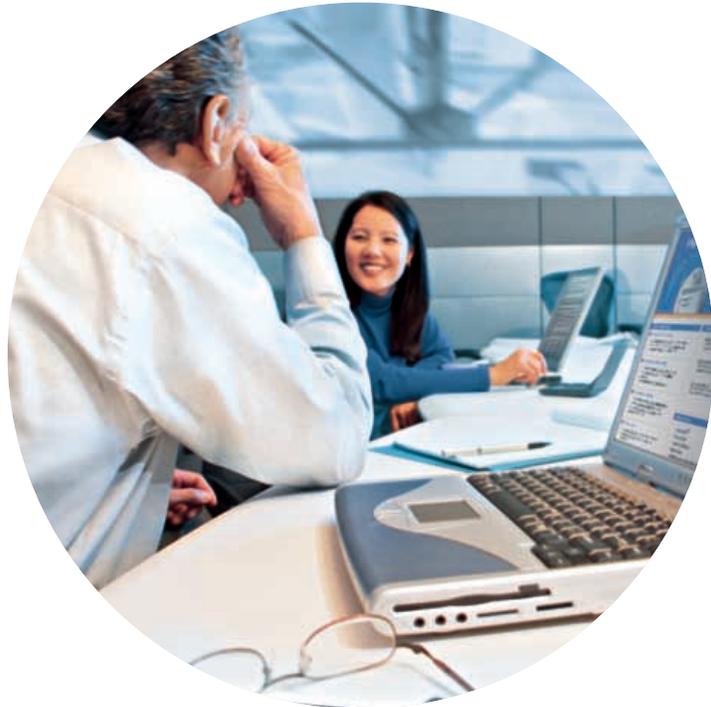




The New Wireless Landscape: Design. Build. Deploy.



“The ultimate goal—the thing that we at Intel and the industry are working for—is really bringing computing to everyone, anytime, anyplace in the world.”

*Paul Otellini
President and Chief Operating Officer, Intel
Intel Developer Forum, Fall 2002*

The Vision

Intel has a powerfully simple vision for the future of mobile products, developers and end users: enabling a naturally mobile lifestyle—one that works simply and intuitively.

This vision is more than a utopian dream. For Intel, and for many other companies, this user-centered convergence of computing and communication represents the future of our business.

Factors Driving Toward Mobility

With Intel's established leadership in not only processors, but also wired and wireless data communications, and with its ability to converge both into integrated platforms, no company is better positioned to lead the movement to mobility. Scores of companies and organizations are also working hard to build this wireless future. Why? Several powerful social, technological and commercial factors are driving the mobile movement toward critical mass:

- Today's products allow ever-increasing numbers of users to become mobile.
- Internet traffic continues to increase every year.
- Critical decision-makers are demanding mobile access to complete data.
- Businesses are recognizing the productivity gains inherent in mobile computing and communications.
- Digital devices are proliferating at a rapid rate, and becoming more powerful with each generation.
- Voice and data are becoming integrated into mobile platforms.
- Higher-capacity wireless communications standards including 802.11x and Bluetooth* have emerged to vastly improve the mobile user's experience.
- Increasing numbers of wireless LANs are appearing in businesses and homes, and thousands of public hotspots are already available.

The Mission

Building the "wireless tomorrow" requires more than a compelling vision. For a start, it requires new generations of mobile devices such as laptops, handhelds and smart phones that are powerful, highly connective, simple to use and easy to carry. But to make these devices truly useful, and ultimately ubiquitous, it also requires the creation of a complete *mobile ecosystem*—one that encompasses mobile technologies and standards, development environments, applications, services, and a pervasive wireless infrastructure.

This is no small undertaking. Yet the end-user benefits are so significant, and the business opportunities so abundant, that Intel is committing itself and leading the industry in the following areas to help make true mobility a reality:

- Applying Intel's depth of experience and innovation to develop new technologies and standards.
- Collaborating closely with OEM manufacturers, product and services developers, and network infrastructure and access providers to ensure efficient development, compatibility and reliability.
- Recognizing the needs of IT professionals who will deploy this vast array of technology, making IT secure and yet transparent to the end user.
- Investing massive financial resources to fuel strategic new initiatives and ventures.

Mobility Adoption Issues

Wireless computing and communications represents a new frontier, and with that Intel recognizes the need to address a variety of issues:

- **Unpredictable connectivity** – Early implementations of WLANs and devices had limited coverage and range. Developments in 802.11 have significantly improved signal strength, reception, integrity and data transfer capabilities. New devices are capable of advanced functions such as automatic 802.11a/b switching, offer 802.11-Bluetooth compatibility, and employ real-time calibration and pre-distortion algorithms.
- **Infrastructure build-out** – Corporate and home WLANs are relatively easy to implement, but public hotspots, while there are tens of thousands worldwide with more appearing every day, do not yet provide ubiquitous coverage. Telcos and service providers are investing heavily to provide access and expand coverage.
- **Security** – Businesses are rightfully concerned about issues of far-flung devices and the potential for rogue intruders gaining remote access to corporate networks. Many protocols and products are now available to tighten security and more are on the way, but corporate awareness, selection and deployment of these technologies remain an issue.
- **Disparate applications** – With the emergence of several classes and architectures of mobile devices, proliferation and compatibility of applications has become a significant issue. Developers are looking for ways to create cross-platform code so that they can focus on optimizing mobility with features such as seamless roaming, power management and simplified user interfaces.

Requirements for True Mobility

To bring true mobility to end users, Intel believes the following needs must be satisfied:

- **Predictable wireless connectivity** – Users must find it easy to connect, regardless of device or locale. They must be able to roam across networks, and there must be widespread coverage of networks in businesses, homes and public spaces.
- **Dependable client** – Mobile devices must be easy to use, secure, flexible, work reliably wherever the user takes them, and they must access and support robust applications.
- **Mobile performance** – Devices must provide more than enough processing power to handle every task asked of it, and offer ample wireless bandwidth, yet they must be designed to manage and conserve battery power in every way possible.
- **Design for lifestyle** – Devices must be light and easy to carry anywhere, with design features to support users' needs and styling to suit their personal tastes.

Accordingly, Intel has been investing expertise and finances to address each of these concerns, and will continue to do so.

Our Commitment Spans Across Intel: Contributing More Than Any Other Company



Pursuing the Mission

To help create a complete and healthy mobile ecosystem, Intel is applying its expertise, technology resources and financial support in three key technology areas: mobile devices, wireless connectivity, and applications and services.

1. Mobile devices: power and flexibility

Intel is developing building block technologies that will enable device manufacturers to create sleek, highly mobile new products that allow for flexible interoperability with other devices and keep people connected as they move freely about the wireless landscape.

Intel® Centrino™ Mobile Technology – Intel's new wireless-integrated technology is the wireless PC architecture of tomorrow. Designed, tested and tuned for wireless notebook PCs in designs from full-size to ultra-mobile, it offers high processing performance, 802.11 wireless capability, and an array of power-management innovations to enable extended battery life. Intel Centrino mobile technology represents a breakthrough for businesses, mobile professionals and consumers wishing to work, learn and play with more freedom than ever.

Concept Platform Development – Intel is engaged in ongoing collaborations with industrial designers and product developers to create working prototypes of groundbreaking new ideas. These concepts include a wireless PC that features a convenient secondary display on the spine, a flip-top PDA for quick reference on-the-go, and a detachable tablet display for user input flexibility.

Intel is also conducting leading-edge research in platform technology areas such as 3D graphics, mobile audio, mobile video, intuitive interfaces, and effective power management. Intel's platform technologies and proof-of-concept designs, such as the Portable Video Player, are used by device manufacturers to deliver exciting new categories of end-user devices.

The insights gained through concept investigations like this are used to build the right features into future processors and chipsets, as well as enabling the industry to create new categories of mobile devices.

Security Initiatives and Standards – To help remove security as an issue for business adoption, Intel is committed to defining, standardizing and validating a variety of security offerings. In addition to co-developing 802.11 standards and security protocols and validating third-party security products built on top of them, Intel is contributing to the SSN specification and authoring the IEEE Tgi standard.

Intel's Ease of Use Initiative – This initiative is designed to accelerate the development of robust, easy-to-use clients that improve the experience of new and existing users, thereby growing product sales. It tackles usability issues up front—at the requirements and design phases—rather than after product deployment, greatly decreasing support costs and product returns for manufacturers.

Intel® Personal Internet Client Architecture – Giving developers the tools and creative freedom to design sophisticated, next-generation wireless devices, the Intel Personal Internet Client Architecture accelerates the development and deployment of rich new applications and services that take advantage of the following building blocks:

- **Intel® XScale™ Microarchitecture** – Delivering the highest performance-to-power ratio in the industry, Intel XScale microarchitecture enables developers to deliver rich content to the broadest range of devices—from handheld Internet devices to enterprise Internet infrastructure products.
- **Intel Flash Memory** – Intel is leading the charge to produce high-density, low-power flash memory and ultra-low-profile packaging solutions to accommodate data-intensive Internet applications on smaller cell phones.
- **802.11** – Intel co-developed the 802.11 technology and standards, and it now has the largest assortment of WLAN products in the industry, offering product integration support, competitive pricing and a reliable supply of 802.11 solutions for a variety of form factors.

CMOS Radio – Intel researchers are creating on-chip, smart radio circuits with built-in, reconfigurable wireless network hookups that offer always-on connections—plus the ability to switch automatically and transparently between wired and wireless networks. Analog solutions implemented in CMOS will achieve high performance functionality and bandwidth while maintaining a low-cost, small-size, high-quality and robust architecture across the wireless market.

Sensor Networks – Intel is researching the deep networking of embedded systems, exploring how inexpensive, ubiquitously deployed wireless sensors might be networked for remote data collection. Intel is also investigating the incorporation of ultra-microscopic systems and integrated circuits on silicon to support a myriad of applications such as wireless communication and bio-medicine.

Wireless Internet on a Chip – Intel is developing a new process technology for combining a microprocessor, flash memory and analog communications circuits on a single chip of silicon. This “wireless-Internet-on-a-chip” technology could produce fast digital cellular data phones capable of operating for a month between battery charges—with all the programmability and functionality of a handheld computer.

2. Wireless connectivity: reliable, seamless, secure

Mobile workers need the flexibility to stay connected to a variety of network types without user intervention as they navigate their workdays. In their private lives, users need devices that not only connect to the Internet, but interoperate—in the home and where ever they carry them—connecting seamlessly regardless of networks available.

Intel is helping developers make these scenarios a reality by driving industry-wide adoption of open standards and supplying critical connectivity building blocks.

802.11 – Intel is actively involved in defining standards for new technologies and bringing those technologies to market in innovative, high quality products. Accordingly, Intel plans to invest \$150 million in companies developing Wi-Fi technology to accelerate wireless network deployment and proliferate the Wi-Fi standard worldwide. Cometa Networks* is one such investment—a company that will provide broadband wireless internet access throughout the United States.

Intel will also offer reliable supply, product integration support and competitive pricing for its complete family of 802.11 WLAN products for aggressive device manufacturers that plan to implement 802.11 technologies into their products.

General Packet Radio Service (GPRS) – Intel GPRS technology enables untethered connectivity without dial-up. When a paid subscriber is within the coverage area of a service provider, the subscriber can utilize always-on wireless devices that deliver Internet browsing in color, email on the move, powerful visual communications, multimedia messages and location-based services—from anywhere.

Intelligent Roaming – Intel is working to make wireless devices such as mobile PCs, cellular phones and PDAs even more convenient by enabling them to be continuously connected, authenticated, secure and easy to use across every type of connection—from LAN and WLAN to 2.5/3G and GPRS-enabled networks—via Intel® Intelligent Roaming Software technology.

Intel® Internet Exchange Architecture (IXA) – An example of Intel’s continuing data communications leadership, IXA is a comprehensive packet-processing hardware and software architecture that supports cost-effective code portability and re-use across current and future generations of Intel IXA network processors.

The combination of unlimited programmability and robust packet handling performance of Intel IXA network processors supports the rapid development and deployment of intelligent network services, while helping to extend product lifecycles for lower total cost of ownership.

Ultra Wide Band (UWB) – Seeking a way to take advantage of the vast amount of usable spectrum that exists in the wireless space, Intel is currently researching UWB technology in order to better understand its benefits, limitations and technical challenges when used for high-rate communications. Wireless UWB networks could potentially run at speeds of up to one gigabit-per-second—more than enough to handle all the phone, television and Internet traffic for any home.

Mesh Networks – In order to overcome the range limitations of a low-power UWB home network, Intel is investigating ways to deploy an array of small wireless repeaters, or mesh networks, that would let high bandwidth signals “hop over” shorter distances and maintain high bandwidth connectivity throughout the house.

Universal Plug and Play (UPnP) – Intel software for UPnP technology makes it easier for application developers, hardware designers and device manufacturers to create affordable, easy-to-use home networking products that free users from the complexities of network configurations, set-up, maintenance, software or Internet protocols.

Intel released the industry's first software development kit for UPnP technology under an open source software distribution license in 2000. Intel also co-founded the *UPnP Forum*, an association of more than 500 companies working together to develop interoperable specifications and standards for easy-to-use home networking.

Internet Protocol Version 6 (IPv6) – Intel is an active member of the *IPv6 Forum*, an international consortium working toward a smooth transition to IPv6, the next-generation Internet. Designed to solve many of the problems of the current version of IP (IPv4), IPv6 will better enable the quality of service and always-on connectivity needed for next-generation mobile devices.

Mobile Identity Framework – Intel is developing the tools and technologies that will allow service providers and developers to deliver simple, cross-platform and cross-network identity management solutions to their end-users.

3. Applications and services—access anytime, anywhere, on any device

Intel is building cross-platform application development and delivery technologies—“write-once, execute-anywhere”—that will allow developers to easily deliver services and content across a diverse array of devices and networks.

Managed Execution Environments (MEEs) – MEEs enable developers to create applications that work on many types of device platforms, while enabling carriers to more efficiently manage and provide their services in a secure fashion. Intel works with MEE developers to ensure their solutions are optimized for Intel® XScale™ technology, developing high-performance MEE components that mobile application developers can employ in their products.

Location Aware Computing – Intel is developing tools and application frameworks that allow developers and service providers to quickly deploy cross-platform solutions that integrate location-aware capabilities into mobile applications, enhancing their overall usefulness and effectiveness to end users.

Device Characterization and Provisioning – Intel is working on standards-based technologies that enable applications and services to characterize and then “adapt” to individual clients, dynamically accommodating the specific capabilities of the device—form factor, connectivity environment, and so on—and the end-user's personal preferences. This will enable communities of developers to easily contribute large amounts of new applications via carriers' service portfolios.

Mobile Video – With early implementations of the MPEG-4 Part 10 video codec, Intel is creating the building blocks that will enable developers to deliver rich, desktop-quality multimedia experiences to a wide range of mobile devices.

Intel® XScale™ Technology 3D Rendering Engine – The computational performance and display capabilities of handheld mobile devices are evolving rapidly, and Intel has introduced a software-based, high-performance 3D rendering engine to enable developers to create immersive 3D worlds on Intel XScale technology-based mobile devices.

Investing in Others

In addition to collaborating on standards development and its own research and development efforts, Intel is accelerating the pace of ecosystem development by actively investing in promising new mobility ventures through Intel Capital, its investment arm. The following are some examples of the companies* Intel has selected for investment: Cometa Networks, STSN, Nomadix, iPass, BlueSocket, Transat, Interlink, Sychip, SiliconWave, Red-M, CSR, PolyFuel, cap-XX, Iridigm, 3DSP, and DataPlay.

Building the Future—Together

Intel is applying the commitment, innovative technologies and true industry leadership to change the way we work and play—to realize the vision of a new, effortlessly mobile lifestyle—by giving users the freedom and flexibility to connect and interact, anytime, anywhere:

- Great experiences on powerful, flexible devices
- Simple, seamless connectivity
- Access to great applications and content

Become part of the industry-wide team building the future of mobility. The opportunity is here for everyone—users, developers, manufacturers, retailers, infrastructure and service providers, and IT—to build a wireless tomorrow and enjoy the vast benefits and opportunities it offers.

To learn more, contact your Intel representative, join us at the next Intel Developer Forum conference, and visit the following websites:

Intel Developer Forum: www.intel.com/idf

Intel® Centrino™ mobile technology: www.intel.com

Intel® XScale™: www.intel.com/design/intelxscale

Intel Capital: www.intel.com/capital

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Wireless connectivity requires additional software, services or external hardware that may need to be purchased separately. Availability of public wireless access points limited. Wireless home network experience may vary. System performance, battery life and functionality will vary depending on your specific hardware and software. See www.intel.com/info/centrino for information.

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