Harry Strasser, Chief Innovation Officer at Siemens Com. Strasser now finds it easier to read, write and send e-mails when he's on the move — thanks to the new Siemens SK65 cell phone. The phone's complete keyboard appears when its housing is turned.

Always Online

In the "always on" society of the future, we'll be able to continuously keep in touch with the whole world, if we choose — regardless of which terminals we use and without having to think about how the data is transmitted. Siemens is creating devices and networks to meet just these challenges.

The Internet will soon be as omnipresent as the electricity that comes out of your socket. One current trend in telecommunications is to be "always on" (online). "For me, that means being available and able to communicate when I want to and how I want to," says Harry Strasser, Chief Innovation Officer at Siemens Communications (Com). Actually most of us are already more or less always available. Just about everyone has a cell phone, a fixed-line connection, e-mail and Internet access. But no one is really always on yet. That's because availability is often difficult due to the number of devices involved in communication. Moreover, accessing the Internet and writing e-mails on a cell phone isn't much fun, and downloading music, images and documents requires much higher data transfer rates than are currently the norm. The telecommunications industry has developed many new processes for broadband communications — on both a mobile and fixed-line basis. "We're approaching a point of fragmentation in terms of data transmission technology," says Strasser. An important goal in this regard is the seamless transfer between different technologies. Users shouldn't notice which transmission standard their laptop, cell phone or PDA is using — whether it's WLAN or WiMAX, UMTS or HSDPA (see box on p. 13).

Several different standards will co-exist over the next few years, but fixed-line networks, mobile networks and the Internet will ultimately merge. Siemens has responded to this trend with one of its biggest restructuring programs in recent years. The fixed-line Group ICN and the mobile communications Group ICM have merged to become Siemens Communications in October 2004. The new Group has nearly 60,000 employees who generate annual sales of about 17 billion euros, offering infrastructure and terminals from a single source. A main activity area at the division involves the LifeWorks concept, which Siemens is using to bring together separate networks such as company LANs, mobile communications networks and fixed-line networks into a single platform (see p. 14).

Telecommunication companies are already using the Internet Protocol (IP) for long-distance phone calls, where data is transmitted as separate packets rather than via a reserved line. The advantage here is that much more data can be transmitted when pauses in conversation are used to transfer additional data. The UMTS mobile communications standard also utilizes this "packet switched" system. And it is already possible to route calls made via cordless phones through the Internet (Voice over IP, or VoIP). "In the future, a communications device will have perhaps only one external IP interface but have different modems working inside, with each utilizing a different standard," says Dr. Jürgen Schindler, who works on Access Technologies at Siemens Com.

When Worlds Converge. This convergence trend involves two currently separate worlds. Standardization committees in partnership projects for third-generation mobile communications (3GPP) are working on unifying the mobile communications networks, which include UMTS and HSDPA. These networks let users roam freely, since data is forwarded from one mobile radio cell to the next. On the other hand, the Institute of Electrical and Electronics Engineers (IEEE) is working on standards for transmission techniques that originated on the Web: WLAN and, for greater distances, WiMAX. Central radio servers used in conjunction with these technologies make users independent of wires. But users can't leave the transmission radius of a hot spot without the risk of losing the connection. Experts refer to this as a "nomadic" system, as opposed to true mobile radio. "The worlds of 3GPP and IEEE are ap-

proaching each other," says Schindler. "UMTS is increasing data transfer rates and the WiMAX standards 802.16e,g will improve mobility in the future." Mobile network operators and UMTS users place great store in the stability and quality of their telephone conversations. "With WiMAX, though, the connection can suddenly be cut off, which is a problem when dealing with encrypted, secure data — as with online banking, for example," Schindler says.

UMTS, WLAN, WiMAX** — tomorrow's cell phones will need to **handle them all.

"Standards are a key success factor for always on," says Thomas Geitner, board member and Chief Technology Officer at Vodafone (see p. 19). As an example, Geitner points to the GSM standard, which made a decisive contribution to a rapid drop in prices for everyone. "True always on won't be achieved until fees are lowered and new rate models are introduced," says Thomas Künstner, who is responsible for new media at the consulting firm Booz Allen Hamilton.

Always on will surely change our lives. Critics already warn of the stress from being constantly available, but sociologists claim this won't be a problem when individuals can decide for themselves how available they want to be (see p. 31). In our free time, we'll communicate more rapidly, in a more targeted manner and more frequently than today, whether playing online games or exchanging messages via cell phones in walkie-talkie mode. E-mail has already changed the workplace; always on will simply add a new dimension (see p. 14). "Productivity will again increase significantly," says Strasser. "It will soon be routine to use e-mails via cell phones or UMTS-enabled laptops as an integral element of communications."

Cell phones become walkie-talkies. One of the first cell phones to accommodate mobile mailing is the new Siemens SK65, which was introduced in August 2004. The device has an e-mail feature from the U.S. company RIM that was previously only available in the rather quirky BlackBerry devices. A special server automatically sends e-mails to the user's cell phone and office PC. The calendar and address book can be synchronized and company data accessed.

The SK65 also offers a new form of communication: Push to Talk over Cellular (PoC) — which Siemens calls "Push and Talk" — a type of walkie-talkie for cell phones (see p. 26). And Siemens has developed a picture-chat system that functions in a similar manner. Tests conducted in cooperation with the mobile network operator TeliaSonera during a World Rally Championship in Finland were successful. Users were able to see on their SX1 cell phones who was online at any given moment. They then simply pushed a button to send pictures taken with the phone's camera to the other users. Siemens developers combined both services at the wireless trade show in Cannes in early 2004, enabling users to operate PoC and the picture-chat system simultaneously.

High-bandwidth videoconferencing will soon be possible on the move as well.

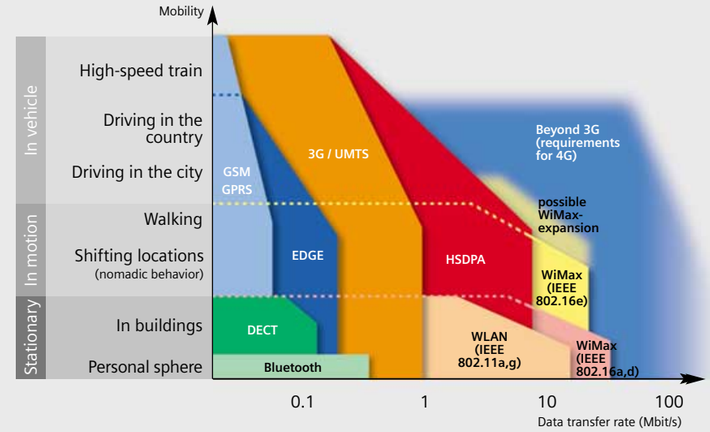
But to be always online, seamless switching must be feasible. Siemens developers have built a demonstrator that makes it possible to change networks during a call. The caller uses a data card in a laptop or PDA to call via either the company network (Ethernet), a WLAN or the UMTS network. If the user leaves the office during the call, the Ethernet connection is cut off. The VoIP data packets then automatically take the most efficient route depending on the availability of other networks. The unit also allows the UMTS network and WLANs to be simultaneously used to increase the transfer rate if large amounts of data need to be sent. The system won't be ready for market launch until at least 2005.

Next year, Siemens will introduce a UMTS cell phone with an integrated WLAN. This requires a unit equipped with two chips. And Siemens Com developers are even working on integrating different transmission standards on a single chip, with the Software Defined Radio (SDR) system. With SDR, a hard-wired chip architecture will no longer decide the frequency a terminal can transmit or receive in. Software installed in the unit will decide, so one cell phone can function in all networks. "I can imagine a market launch for such a comprehensive solution at the end of the decade," says Holger Landenberger, SDR Project Manager at Siemens Com. "We'll proceed gradually and first incorporate several standards, like UMTS, GSM and WLAN." Product development can begin in mid-2006, says Landenberger, who adds that Siemens would enjoy cost benefits from manufacturing cell phones with SDR. For example, with the new software it would be possible to decide which transmission standard and regional market to equip the unit for after assembly.

Gbit/s with your cell phone? Siemens is also lead partner in the EU-sponsored WINNER research project. The project's 40 partners plan to develop a universal radio technology to supplement current standards after 2010. One goal is to achieve data transfer rates of up to one gigabit per second (Gbit/s) at distances under 100 meters, and approximately 100 Mbit/s for a broader radius. In the laboratory, Siemens developers have already achieved data transfer rates of 360 Mbit/s with a carrier frequency of five gigahertz and a bandwidth of 100 megahertz, divided into 256 subfrequencies using Orthogonal Frequency Division Multiplexing (OFDM). This reduces the effect of echoes, which often occur at such a high carrier frequency due to reflections from buildings, for example. The researchers are also using wireless "multihop stations" — a combination of base station, repeater and router. Thanks to such stations, signals can be redirected around obstacles and amplified. During a recent field study in Munich, these multihop stations significantly increased the range of such radio systems. Researchers are also working on a combination of several antennae (MIMO) to raise the transmission rate to one Gbit/s. So at least data transfer rates would no longer pose a problem for realizing the always-on society.

But one limit will always exist: U.S. mathematician Claude Shannon, who invented the concept of the bit and founded information theory, calculated 50 years ago that, depending on transmission bandwidth and ambient noise, there is a theoretical limit to data transfer speeds. A cell phone could receive a maximum of 100 to 1,000 Gbit/s — if such a super cell phone doesn't start smoking from all that data. ■ *Norbert Aschenbrenner*

MANY ROADS LEAD TO THE MOBILE INTERNET



Key technologies: (see *Pictures of the Future*, Spring 2002, p. 11 for more information):
UMTS (Universal Mobile Telecommunications System): Standard for third-generation mobile communications (3G); operates in specially licensed frequency bands in the two-gigahertz (GHz) range. Its theoretical maximum data transfer rate is two megabits per second (Mbit/s). But there are two limits to any type of mobile radio technology: First, all users of a given cell share the available capacity. Secondly, the maximum data transfer rate decreases when the user's speed of movement increases. In practice, UMTS achieves a rate of 384 kilobits per second (kbit/s) when downloading data (downlink).
HSDPA (High Speed Downlink Packet Access): A further UMTS software development, with a maximum downlink data transfer rate of 14.4 Mbit/s. The base station's capacity can be increased by 50 percent by optimizing the modulation and coding algorithms and by making distribution of the data load at the base stations more efficient. Siemens network technology already supports the HSDPA protocol; so the only thing still needed for implementation is a software update. Siemens also plans to introduce an HSDPA card for laptops at the end of 2005. Thereafter, cell phones will also support the HSDPA standard.
WLAN (Wireless Local Area Network): A locally limited radio network operating in frequencies not subject to licenses. Inside a hot spot with a range of ten to 50 meters, a WLAN achieves maximum data transfer rates of 11 Mbit/s (Standard IEEE 802.11b at 2.4 GHz) and 54 Mbit/s (IEEE 802.11a at five GHz; or IEEE 802.11g at 2.4 GHz).
WiMAX (Worldwide Interoperability for Microwave Access): An expansion of WLAN. Like WLAN, WiMAX transmits data packets (small packets, like on the Internet) at frequencies of between two and 11 GHz; the data transfer rate can reach 75 Mbit/s. Depending on the standard (IEEE 802.16a, b, d, e, g), a range of several hundred meters to several kilometers is possible. Here too, all users share the data transfer capacity. Unlike with UMTS, WLAN and WiMAX users' speed of movement is restricted — to a maximum of walking speed. Siemens is developing a solution for WiMAX networks that's scheduled for market launch in the summer of 2005. Along with a base station, the package will consist of integration support and other services. Intel plans to begin installing WiMAX chips in notebooks in 2006.
GSM, GPRS and EDGE: Standards for second generation mobile communications.
DECT: Standard for cordless telephones.
Bluetooth: Standard for wireless communication between devices in a limited area.
4G: Requirements for fourth-generation mobile communications.