digit
January 2006

Fast Track to MOBILE TELEPHONY

- **Evolution**
- **Mobile** Technologies
- **Handsets**
- Mobile Phone **Features**
- Soft **Talk**
- New-Age **Applications**
- **Society** And The **Cell Phone**
- The Future of **Mobile Technology**

Jasubhai DIGITAL MEDIA

YOUR HANDY GUIDE TO EVERYDAY TECHNOLOGY

Fast Track to Mobile Telephony

By Team Digit

Credits

People Behind This Book

EDITORIAL
Deepak Ajwani Editor
Ram Mohan Rao, Jyotsna Rege Copy Editor
Renuka Rane, Copy Editor & Writer
Robert Sovereign-Smith Writer
Mithun Kidambi Writer
Deepak Dhingra Writer
Anup Nair Writer
Nimish Chandiramani Writer

DESIGN AND LAYOUT
Vijay Padaya Layout Designer
Sivalal S Cover Design
Harsho Mohan Chattoraj Illustrator

January 2006
Free with Digit. Not to be sold separately. If you have paid separately for this book, please e-mail the editor at **editor@thinkdigit.com** along with details of location of purchase, for appropriate action.

Stay Connected !!

"Any sufficiently advanced technology is indistinguishable from magic."

— Arthur C Clarke
Physicist and sci-fi author

If you just use your mobile phone for calls and text messages, you might wonder where the magic we're referring to lies. But if you've used it for anything beyond that, you'll have realised that the mobile phone actually makes you more of a node on the "Connected Grid," as it were, than the Internet-enabled desktop computer ever did. It's magic, all that radiation surrounding you and your phone making sense of it. And it's magic how one little gadget brings together so many diverse functions.

The power of connectivity cannot be overstated. And the possibilities arising from the 'always-there' connectivity make even the simplest of mobile phones a thing of wonder. In a sense, the mobile is the prototype of the universal personal gadget: future techno-historians will look back at our time and say, "That's when the revolution began."

It is our intention here to bring you, in one place, much of what you'll want to know about everything mobile. True, you've probably gathered bits and pieces of relevant information here and there, but what exactly is the difference between GSM and CDMA? What is the concept of a cell? Does it matter what operating system your phone runs? Are cell phones really hazardous to health? Where is mobile technology headed?

Apart from the technological aspects, we also look at how mobiles evolved, the latest uses they're being put to, and more.

It is our hope that by the time you're through with this book, you'll have developed a healthy respect for your seemingly humble handset!

Contents

Evolution

History doesn't have to be boring. In fact, in this book, since we're talking about everything mobile, it's essential to understand where it all began and what happened back then, in order to be able to get a grasp on what's happening today and why. In particular, this chapter should help demystify mobile generation terminology.

1.1 The Generations of Mobile Telephony

Humble Beginnings—The "Zeroth" Generation (0G)

In the beginning, there was radio. "Remarkable concept!" they called it. And what a concept it was! You could talk to people long distances away without the physical connection of a wire, and if you had the necessary machinery to haul around the 40-odd kilos of equipment, it was even mobile.

Then there was the telephone. Alexander Graham Bell's invention that let you talk to anyone who was connected to a network called the telephone exchange. You called the exchange, told the friendly voice at the other end who you wanted to connect to. A few plugs switched and soon you were having a happy little chat with your friend.

And then there were the wizards who realised that a combination of these two technologies could lead to the birth of an even more powerful concept. A 'breaking' concept, if you will. Two things led them to think along these lines.

Firstly, the popularity of radio—everybody wanted to be a part of it. There was HAM radio, operated by amateurs who loved to tinker with all things electronic. The growth of HAM radio led to the

Steve Roberts (aka N4RVE), a famous mobileer, with his Behemoth

A phone of the kind you would install in your car a couple of decades ago

creation of a number of wireless communities, united by their passion for the waves (not the wet kind). One of these groups, called the *Mobileers*, decided to take to the road, removing their radio kits from their 'HAM Shacks' (outdoor sheds to house HAM radio sets) and rigging them to their cars and bicycles.

Another was the fact that the police and other emergency services had already been using a two-way radio system to communicate with their headquarters. Why not take this a step further and connect the radios to the telephone exchange?

They did exactly that and in 1946, the Swedish Police carried out the first trial of a mobile telephone system. Calls could be made from a police vehicle to a telephone at the exchange and the battery would last a few calls. The system was a Push-To-Talk (PTT)—push a button to talk and release it to listen. The system, titled simply the 'Mobile Telephone System' (MTS), was implemented in the US in the late 1940s. However, MTS was little more than a two-way radio system. A call from a mobile police radio needed to be 'patched' through to the telephone network by an operator. While the equipment added around 35 kilos to the weight of the police car, it cost as much as the car itself and had only three channels (lines of communication), which meant that only three calls were possible at a time.

The world of Mobile Telephony was to be, then, revolutionised by the concept of the *Cellular Network*.

In the days before the Cellular Network, a mobile phone meant a phone installed right into your car. There was one radio antenna that serviced an entire city, and you needed a powerful transmitter to carry out a conversation. This powerful transmitter would occupy nearly all the space in the boot of your car, making family vacations quite the painful affair.

All changed with the concept of the 'cell'. An area would be divided into multiple cells, each serviced by its own fixed transmitter-receiver (transceiver), called a 'base station'. Now, because the transceiver was closer to you, your mobile phone was not necessarily the hulking monster it was before.

Refer the next chapter for more on cellular networks.

The Mobira MC 25 for ARP networks

The first commercial use of the cellular network, set up in Finland in 1971, was the *AutoRadioPuhelin* (ARP) Network, Finnish for 'Car Radio-phone'. It used cells for communication, but calls would still disconnect if one moved to a different cell.

"Its finally here!!"—The First Generation (1G)

The first generation technology in mobile telephony began to arrive in the early 1980s. The primary tools used were the concept of cellular networks and analogue transmission using Frequency Division Multiple Access (FDMA) to separate calls from different users.

The FDMA technique assigns different frequencies for different calls to avoid conversations interfering with each other. Hence the first two terms—'Frequency Division'. 'Multiple Access' meant that multiple users could use the same frequency at different times. Think FM Radio—each radio station broadcasts at its own frequency; similarly in FDMA, each call is on its own frequency.

The first use of First Generation technology was in the *Nordic Mobile Telephone* (NMT) system. While the technology was developed in Scandinavia by the Finnish Nokia (then Mobira) and Swedish Ericsson, it first rolled out in 1981 in, oddly enough, Saudi Arabia. The US and the rest of Europe would soon follow, with the *Advanced Mobile Phone Service* (AMPS) and the *Total Access Communication System* (TACS) respectively.

The systems proved to be quite robust; the NMT had excellent coverage of the unique terrain of the Scandinavian countries. In fact, the NMT and AMPS systems are still existent as backup networks, though they have been replaced by newer digital technologies. NMT even had a crude system for text messaging, called *DMS*—Data and Messaging Service.

Because the cellular operators were limited to a particular range of frequencies, there were only so many frequencies that could be allotted to calls before the entire frequency band was full. The AMPS network, for example, had a maximum capacity of 416 calls per cell—this when their system was gaining popularity. What if the 417th caller had an emergency?

Eavesdropping on a conversation within these networks was easy as pie. All you needed was a scanner; once tuned into a frequency in the cellular range, you could sit back and listen away. First, they tried to manufacture scanners that wouldn't tune into these frequencies at all. Naturally, this didn't work. It was difficult to procure such a scanner (and really, who would go hunting for one?), and even if you did end up with this piece of machinery, there was nothing a little re-programming couldn't fix. The next idea was to 'scramble' the signals, de-scrambling them at the receiving end. Scrambled signals were still quite easy to tap into, but at least now the casual listener wouldn't be able to listen to private conversations. This is about where security stopped in these systems.

Another disadvantage of the analogue systems was the difficulty in transmitting data over them. Partially digitising the system made this a little less difficult, but it was still less efficient than the newer fully digital systems which were to follow.

Standing up—The Second Generation (2G)

The Second Generation of cellular technology was marked by a shift from analogue to digital systems.

Shifting to digital networks had many advantages. Firstly, transmission in the digital format aided clarity, since the digital signal was less likely to be affected by electrical noise. Secondly, transmitting data over digital network is much easier; data could also be compressed, saving a lot of time. And finally, with the development of new multiplexing techniques, the capacity of the cellular network could be increased manifold.

The technologies in a 2G cellular network are based on one of two concepts:

- **Time Division Multiple Access (TDMA)**

Just like FDMA separated calls by assigning them different frequencies, TDMA separated calls by assigning them different time slots in the same frequency. TDMA was used in conjunction with

FDMA, so if one frequency band had, say, three time-slots, it automatically multiplied the capacity of the network thrice.

- **Code Division Multiple Access (CDMA)**

In the CDMA system, calls were separated by a unique code assigned to each of them.

FDMA, TDMA and CDMA are explained in detail in the next chapter.

Till the 1980s, there was no standardisation for cellular phone systems despite constant evolving technology in the field, causing much confusion and some dismay with respect to compatibility with other mobile phone networks. Standardisation was essential if people were to roam the world and still be able to connect to a telephone network.

In 1982, the GSM (*Groupe Spécial Mobile*) group was founded to address these issues. Three years were spent mulling over whether the global standard should be analogue or digital till finally, in 1985, after much discussion and many trial runs, they decided that the world should use digital mobile telephony. In 1987, they chose TDMA as their solution and by 1990, the first GSM Standard was published. To keep the acronym 'GSM' alive, their standard was called the Global System for Mobile Communication.

The GSM Standard introduced the SIM (*Subscriber Identity Module*) card, which held information about the user and provided memory to store phone numbers and text messages. The SIM card could be shifted from handset to handset, allowing users to choose handsets according to their fancy without having to bother about their cellular service provider. It is estimated that approximately 68 per cent of the world's cellular phone subscribers today are on a GSM network.

By 1993, Qualcomm had proposed a standard called cdmaOne, based on the CDMA technique. Unlike FDMA or TDMA, CDMA could theoretically handle an obscenely large number of callers.

The CDMA technique, however, was not new. The US Military had been experimenting with it for a long time before it came to the commercial markets. Because a CDMA signal looked like noise, it was difficult to block or listen in on a conversation. In most cases, it was difficult to distinguish between a CDMA transmission and noise—very desirable if you didn't want your enemies popping in uninvited.

Another second-generation technology was Motorola's iDEN—the Integrated Digital Enhanced Network. It was based on TDMA, and adopted in the US by Nextel. However, it is to phase out by 2010.

Nearly There (2.5G)

Moving from the second to the third generation of wireless technology was not as simple as moving from 1G to 2G. The third generation would not be a shift in technology, but would have to be an improvement on the already existing technologies. This meant a slow, steady evolution, with a number of new technologies to keep the shift entertaining.

2.5G technologies are called so because they take the capabilities of a 2G network one step ahead, but still fall short of being labelled Third Generation (3G). This feature largely governs the current use of mobile telephony.

This generation of technology has seen the development of the *General Packet Radio Service* (GPRS) and its integration into the GSM network to provide an increased data transfer rate. It would use the unused TDMA time-slots in the network to transmit and receive data. In a GPRS network, one can browse the internet, send and receive multimedia content such as sound, movies and images at faster rates, and chat with friends using Instant Messaging.

Simultaneously, the CDMA2000 standard was developed, which increased the data transfer speeds on the CDMA network to 140 kbps. CDMA2000 networks are backward-compatible with the older cdmaOne networks.

The 2.5G technologies brought multimedia to our mobile phones, but the data transfer rates have still left a lot to be desired.

The Road To 3G—The Third Generation Partnership Projects (3GPP and 3GPP2)

The Third Generation of mobile telephony is supposed to usher in a uniform standard for cellular networks worldwide, resulting in true mobility—your handset will connect you to anyone, anywhere, wherever you are. Third Generation Technology is based on CDMA, but due to the insane popularity and sheer coverage of GSM networks, things aren't really moving as planned.

The Third Generation Partnership Project (3GPP) is a collaboration of telecom associations from different parts of the world to make a globally applicable third generation system based on GSM networks. These same associations have also collaborated under the Third Generation Partnership Project—2 (3GPP2), which sets standards for a third generation system based on CDMA.

The associations are:

- Association of Radio Industries and Businesses—ARIB, China
- Telecom Technology Community—TTC, Japan
- China Communication Standards Association—CCSA, China
- Telecom Industries Association—TIA, North America
- Telecom Technologies Association—TTA, Korea

Before a cellular network can be called Third Generation, it has to meet the norms set by the International Telecom Union (ITU)'s IMT 2000 Specification, proposed by the 3GPP. Some of the requirements are:

- Data transfer rates of 144 kbps for highly mobile traffic (moving cars, etc.), 384 kbps for pedestrian traffic and 2 Mbps for indoor traffic.
- A common billing system, where usage information and user profiles are shared between operators
- The ability to deliver fixed and variable bit-rate multimedia to the mobile phone

- On-demand bandwidth
- Multimedia mail storage on the network itself
- 2 Mbps broadband Internet access

Walking Tall—The Third Generation (3G)

CDMA (the technique, not the standard) is generally considered the future of cellular technology. CDMA based networks can carry a larger number of calls, are faster, more secure, and larger areas can be covered with fewer base stations. No wonder, then, that the two technologies that might dominate the 3G world are based on the CDMA principle.

A 3G Mobile Phone with streaming Video

Existing GSM networks will proceed to use a technique called W-CDMA (Wideband CDMA), which uses CDMA, but will allow for data transfer rates of about 2 Mbps if you sit in one place. In Japan, NTT DoCoMo rolled out their W-CDMA solution in 2001. They called it FOMA—*Freedom of Mobile Multimedia Access*. By 2004 it had covered 99 per cent of Japan.

Another technology based on W-CDMA is the *Universal Mobile Telephone System* (UMTS). It integrates with existing GSM infrastructures and provides data speeds of 1.99 Mbps. UMTS networks will use USIM (Universal SIM) cards, which are advanced versions of the regular SIM cards we use today. They are more

secure and provide more memory than existing SIM cards. UMTS networks, however, will still support the older SIM, so one can breathe easy.

Though W-CDMA is based on CDMA, it is not compatible with current CDMA cellular networks, which conform to the cdmaOne or CDMA2000 standards.

Also featuring on the list of 3G technologies for GSM networks is EDGE—Extended Data Rates for GSM Evolution. EDGE is just GPRS on steroids; it can even be set up on existing GPRS networks with just a few tweaks. It manages to send three times as much data in a time slot as GPRS, greatly speeding things up.

CdmaOne networks will be upgraded to the CDMA2000 1x EV-DO standard. Let us decipher this—the EV stands for 'Evolution', and the 'DO' stands for Data Optimised. So what this means is "CDMA2000, First Evolution—Data Optimised." Instead of sending voice and data over the same channel as on the older CDMA networks, voice and data will be sent on different channels, increasing transfer rates to about 2.4 Mbps.

"I believe I can fly"—The Fourth Generation (4G)

With telecom consortia all over busy holding the world's hand in its transition to 3G, nobody has yet sat down to formulate a formal plan for the fourth generation of mobile technology. However, there are big expectations. There have been a few tests for 4G systems internationally although India is yet to take trial runs with the system.

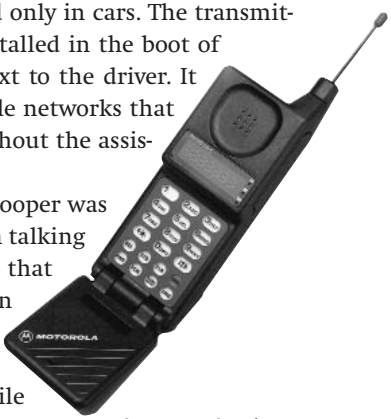
One of the key expectations from 4G networks is the availability of high quality audio and video that will render the mobile phone a portable entertainment centre. Higher data transfer rates will also mean that a James Bond style video conversation might finally be a reality.

1.2 The Evolution of the Handset

The first mobile phone

The first mobile phones were installed only in cars. The transmitting and receiving equipment was installed in the boot of the car, and a handset was placed next to the driver. It was only with the coming of 1G mobile networks that a headset could be carried around without the assistance of heavy machinery.

In 1972, Motorola's Dr Martin Cooper was spotted on the streets of Manhattan talking into a brick. It was soon discovered that the good doctor's mental condition was quite normal, and that the brick was in fact the Motorola DynaTAC—the first true mobile phone. It was about the size of a VHS videotape, with a rubber antenna at the top.



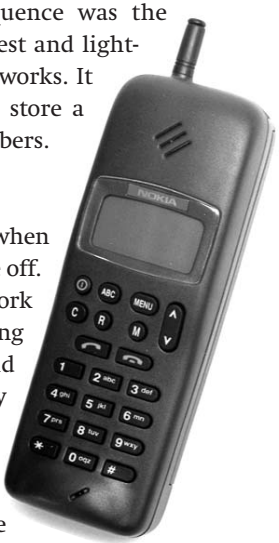
The Motorola MicroTAC


Our favourite brick, the Motorola DynaTAC

The next instrument of consequence was the Motorola MicroTAC (1989), the smallest and lightest phone available for analogue networks. It weighed in at 7.8 ounces and could store a relatively gargantuan 20 phone numbers.

2G handsets

The coming of 2G networks was when handset designs really started to take off. Because connecting to a 2G network required lesser power, the transmitting units could be made smaller and phones were thus easier to carry around.



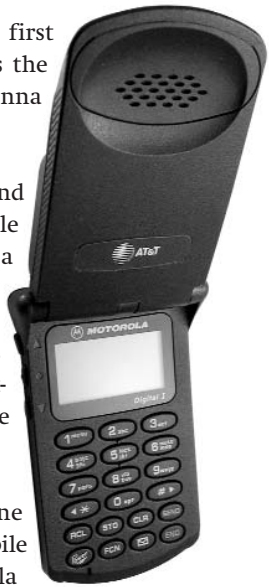
The Nokia 1011—the first true 2G handset

In 1993, Nokia released the 1011—the first digital hand phone

for the new generation GSM networks and the first phone to take the shape that we now know as the candy-bar. Of course, there was the little antenna that needed getting rid of.

1996 was a momentous year for both Nokia and Motorola. Nokia showcased its all-in-one mobile communication device (phone was too lowly a term)—the Nokia 9000 communicator at the CeBIT exhibition that year. This big block could access the Internet using WAP (Wireless Access Patrol), store your personal data and appointments, had a huge 640 x 200 display, and came with a QWERTY keyboard.

Motorola, meanwhile, released the phone which would create a whole new genre of mobile phone design—the first 'Clamshell', the Motorola StarTAC.



The Motorola StarTAC—the first clamshell

Time moved on and mobile phone designers stuck to either the candy-bar with antenna or the clamshell style phones. But while the outside remained relatively the same, the insides were undergoing a major overhaul.

The Ericsson T68

With the introduction of the WAP, users could browse the internet from their WAP-enabled mobile phones—keep up with the latest news, send and receive e-mail and so on. The Ericsson R 320 was the first WAP phone to get a nod of approval from the WAP Forum, the developers of the WAP standard.

The Ericsson T68 heralded a new era in mobile entertainment with its new 256-colour screen. Everything was suddenly so *pretty*.

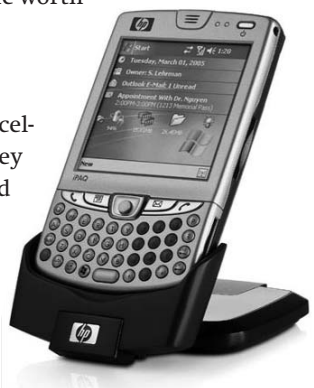
The Sharp J-SH04—the first camera phone

Demand for the ability to send multimedia messages soon soared, as did the demand for phones that could take pictures with its own little camera. The very first camera phone was Sharp's J-SH04, launched in November 2000.

Cameras, of course, are not enough to satisfy the Modern Customer. The consumer wants a total multimedia experience. And no multimedia experience is complete without music. The growing popularity of the MP3 format meant that in no time, consumers were demanding that their phones should be capable of delivering a satisfactory music experience by being able to play MP3 music on the go. What they didn't know was that there already was an MP3 phone—the Samsung SCH-M210, introduced in 1999. Unfortunately, the MP3 phone concept didn't really take off right then. Today, however, any mobile phone worth its antenna has support for MP3.

The Big Boys—Smartphones

Smartphones took the functions of a cellular phone one step further—they became hybrids of mobile phones and PDAs. In addition to the necessary feature of being able to talk to people, they offered e-mail, fax, calendars to set up appointments, calculators and occasionally even the odd game or two.



The new smartphone from HP

The first smartphone was 'Simon', developed as a concept by IBM in 1992. In addition to the expected 'smart' features, it even had a stylus you could use to write stuff on the screen with.

Advances in smartphones went hand in hand with those in PDAs and cellular phones. When a new operating system was developed for a PDA, it was not long before it was available for a smartphone. Today's smartphones run on Symbian, Palm OS or Windows Mobile.

1.3 Mobile Telephony in India

In the early '90s the government liberalised the telecom sector, a blessing for the Indian telecom companies. Operators stumbled over one another to get onto the Cellular bandwagon, and cellular telephony in India hasn't looked back since.

Timeline

What follows is a brief sketch of the growth of mobile telephony in India since its inception.

1992

Until 1992, the telecom industry in India was still under strict regulations from the government. In 1992, it was announced that the Telecom sector would be liberalised, allowing private companies to provide telecom services.

1993

The Indian telecom sector receives its first foreign investment—the sum of Rs 20.6 million.

1994/1995

The government granted licenses to set up cellular services in the four metros—Delhi, Mumbai, Kolkata and Chennai. Licenses were granted for 19 more wireless circles in 1995. These services would be provided in a *duopoly*—no more than two operators were to cover the same region.

1995

In the month of August, Kolkata became the first city to have a cellular network—Modi Telstra's MobileNet. This is what you might have paid for your cellular services then:

- Security Deposit: Rs 3,000
- Rental: Rs 156
- Standard Rate: Rs 8.40 per minute
- Peak rate (this was not supposed to exceed 4 hours per day): Rs 16.80 per minute
- Off-peak rate (on Sundays and bank holidays): Rs 4.20 per minute

Handsets manufactured by Nokia and Motorola were available for anywhere between Rs 18,000 and Rs 30,000.

BPL Mobile and Hutchison Max won Mumbai, Airtel and Essar Telephone won Delhi and RPG and SkyCell won Chennai.

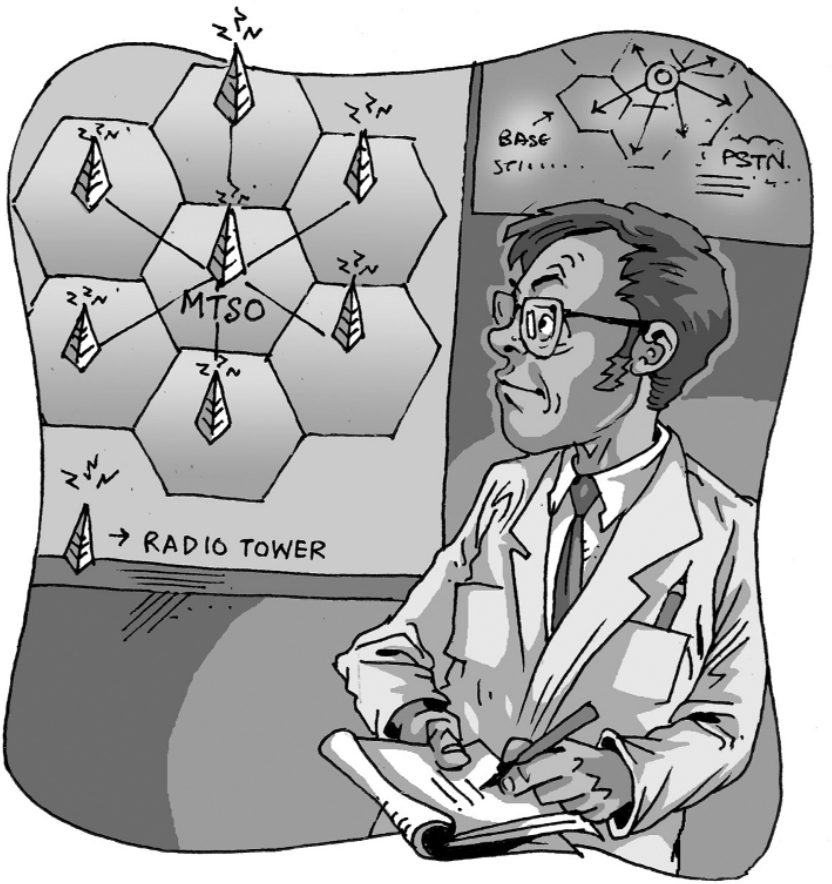
GSM swiftly gained popularity in India; though this might have been because we didn't really have a choice. Nonetheless, mobile telephony gained momentum and it is estimated that the number of GSM subscribers has increased at the rate of 70,000 per month since July 1999.

2002/2003

The beginning of 2003 saw the introduction of CDMA in India, pioneered by Reliance Infocomm. The ridiculously low call rates and a host of other features saw these little phones selling like hot cakes. In fact, with the entry of new players like Tata Indicom, CDMA has become so popular in India that today 25 per cent of all cellular subscribers are on a CDMA network.

The Indian telecom sector is still one of the more strictly regulated sectors of the world. As these regulations relax, we can only expect better and cheaper services on our mobile phones.

Mobile Technologies

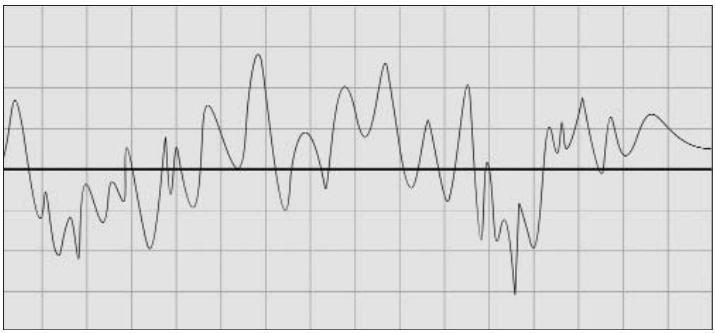


Your cellular phone is a radio. True, a highly glorified one, but a radio nonetheless. Which is why, to avoid confusion further on, it would be wise for us to spend a few moments going over the basics of radio transmission.

2.1 The Cellular Network

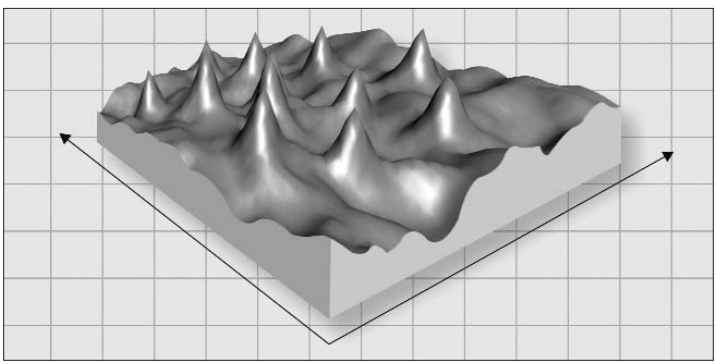
The Bare Bones

Our voices are a complex mix of different frequencies of sound. If we were to draw what your voice looks over time, it would look more or less like a continuous scribble. If we were, then, to repre-



What your voice looks like over time

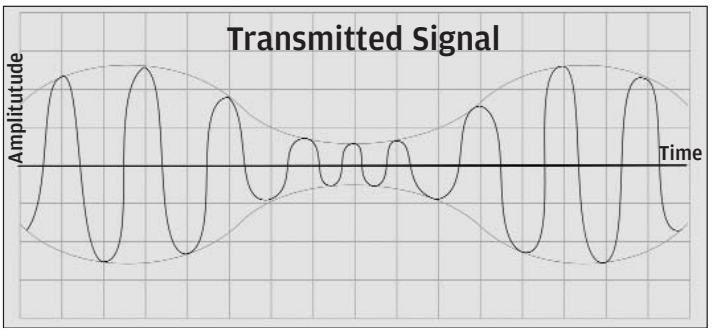
sent this same voice as a collection of different frequencies, we'd find it to be restricted to the frequencies between 20 Hz and 20 kHz. The average human cannot hear or emit a sound whose frequency falls out of this range.



What your voice would look like when we try to see its frequency distribution

When you speak into a cell phone (or any radio device for that matter), your voice is converted into an electrical signal. This signal, though, cannot be transmitted into the air as it is - it will gradually lose its strength in the face of air currents, dust and other obstacles. It would be a tall order for a piece of equipment to be able to accurately receive all the different frequencies of a human voice by themselves. To get around this, the phone makes the sound waves hitch a ride on a much more powerful, high-frequency wave called a carrier. This process is called *modulation*. The carrier wave travels at the speed of light, so your voice is almost instantaneously carried to the intended receiver.

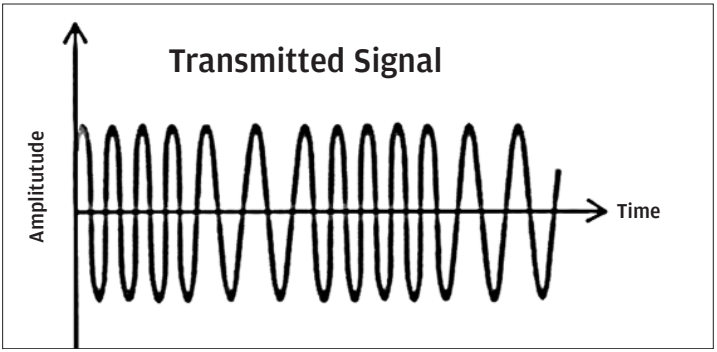
There are two ways to modulate a voice signal - Amplitude modulation (AM) and Frequency Modulation (FM). In AM, changes in the *amplitude* (intensity or loudness) of the voice signal causes changes in the amplitude of the carrier wave. In FM, the amplitude of the voice signal causes changes in the *frequency* of the carrier wave.



An amplitude modulated wave; the carrier amplitude increases and decreases with the voice amplitude.

Because our voices aren't composed of one frequency alone, modulating them causes the resulting wave to get spread over a band of frequencies - so a typical modulated wave would not just have the carrier frequency, but would be distributed over a range of frequencies. This is called a *frequency band*.

Modulating a sound wave solves several problems. For one



A frequency modulated wave; the carrier frequency increases (the waves come closer together) and decreases (The waves move away from each other) with the voice amplitude.

thing, it lets your voice carry much, much further than would be otherwise possible. Secondly, the receiver now doesn't have to catch all the frequencies in your voice signal - just tuning it to the frequency of the carrier is enough. The receiver now *demodulates* this signal to extract the sound of your voice.

Now for some essential terms: A *channel* is a carrier frequency or set of carrier frequencies that collectively make up a means of communication. (The carrier frequency is the frequency of the carrier wave, which is changed only a little bit by the frequencies of the sounds it carries.)

A *simplex channel* is one where the same carrier frequency is used for transmission and reception. Naturally, these cannot be simultaneous with a simplex channel.

A *duplex channel* is one where two different carrier frequencies are used - one for transmission and one for reception.

In a *half-duplex* channel, either transmission or reception is possible at any given time, but not both.

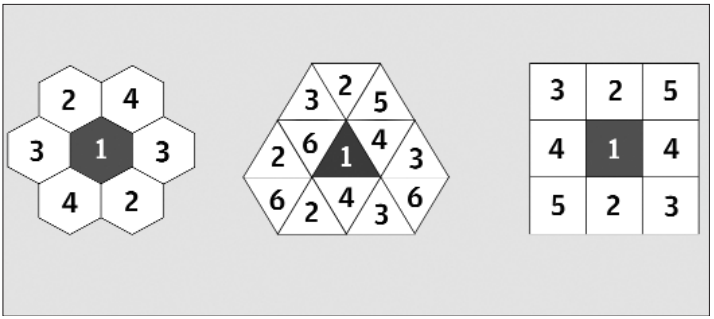
In a *full-duplex* channel, both transmission and reception hap-

pen simultaneously. (How this is done will be explained later.) This is the norm for most forms of communication today.

Each call on a mobile phone network takes place on a different channel.

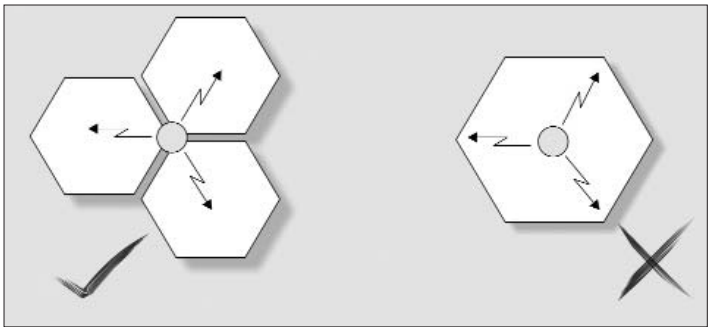
The Cell

Before the Cellular Network, scientists had two problems they needed to solve. First, how does one reach out to an entire city while still not requiring mobile transmitters to be ugly behemoths? And secondly, how can one ensure that all the people on the network can make calls from their mobile phones without exhausting the number of channels that can be supported in the system? Operators would only be authorised to use a set range of frequencies. A single antenna for an entire city would mean, say, 20 calls at a time if the authorised range could be divided into those 20 channels.



How frequency re-use would work for hexagonal, triangular and square cells. (No prizes for guessing the winner)

The answer to both these problems came in the form of the *cell*. A cell is a small area of service within a city, serviced by its own antenna. If one were to divide cities into little cells, the entire city could be easily covered. And each cell having its own antenna meant that the mobile phone transmitter need not to be that powerful - just powerful enough to reach the *base-station* that serviced the cell one was in.



Busting the misconception - cellular antennas are actually located on the corners of cells, not at their center

Another thing that resulted from the independence of these cells was the concept of *frequency reuse*. To illustrate this, suppose the government allowed operator A to use the 800 MHz - 900 MHz range of frequencies for his cellular operation. Let's say A calculated that 400 different channels would be possible in this range of frequencies. Now because each cell can be treated independently, each base station could support the 800 - 900 MHz range with 400 channels. Following this, it could mean there could be 400 calls made *from each cell* at any given time. This system, however, would not work; signals from neighbouring cells would interfere with each other, resulting in nonsensical data cluttering the airwaves. The network had to be designed so that no cell would be next to any other cell that used the same set of frequencies.

Next on the agenda was deciding the shape of the cell. It had to be made such that frequency bands would be usable as much as possible. This meant that the number of cells surrounding a central cell would have to be the minimum possible. Would it be circular, triangular, square... what? After considerable thought, the designers of the system realised that Nature had already solved that problem: the answer was the Hexagon.

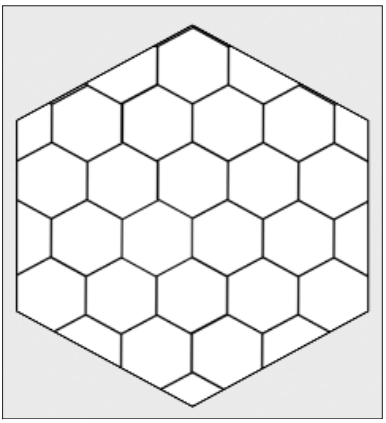
Hexagons fit neatly into each other, and each hexagon is surrounded by only six others. Comparing this with the square (eight surrounding squares) or the triangle (twelve surrounding trian-

gles!), the hexagon emerges the clear victor. This way, the problem of interference between two cells was avoided using only four different frequency bands. A CDMA network, however, doesn't need to bother with this; more on this later in this chapter.

Now that we have our cellular network working, it's time to bust a misconception: speaking about cells being serviced by a single base-station is a little inaccurate. This conjures up the image of a hexagon with an antenna at the centre, which is entirely erroneous. In reality, a base station is located at the corner of a hexagon, servicing three cells; rather, it services one-third of each of these three cells. In the cellular network then, each hexagonal cell has three base-stations at its corners.

Networks Within Networks

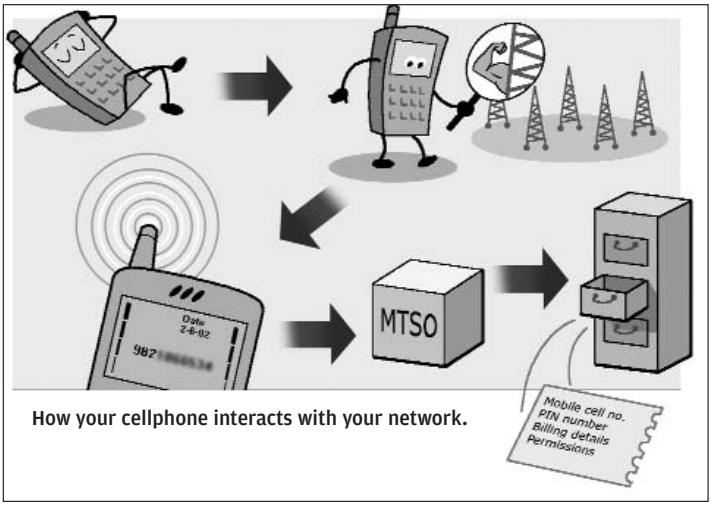
We have seen how breaking up a network into cells increases the number of callers that can be handled by the network. In urban areas, cells can be further divided into pico-cells or hot-spots, taking the capacity of the network another step ahead. This means that in city centres, where cellular traffic usually puts a strain on the network, more calls can be handled. In addition, because your mobile phone is even closer to its base station, you can get a strong signal even in unventilated corners of a building.



Lots of pico-cells inside a larger cell

You And Your Network

Each operator has its own *Mobile Telephone Switching Office (MTSO)*, which handles all the phone connections on a network and con-



How your cellphone interacts with your network.

trols all the base stations. Two channels exist in the cellular network. The first is the *Control Channel*, which is used by your MTSO to talk to your phone and vice versa. The second is the *Voice Channel*, on which your conversation is carried.

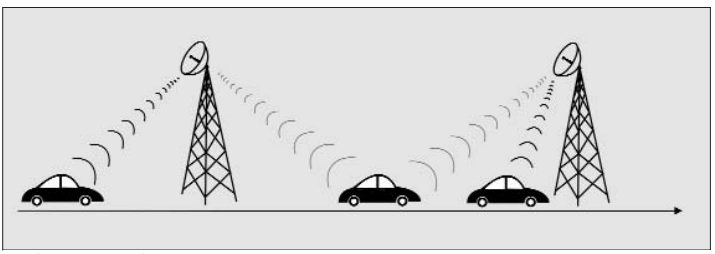
When you switch on your mobile phone, it scans for control channels within the cell. It's looking for a System Identification Code (SID), which is assigned to each operator and is broadcast by each base station. When the phone receives an SID, it compares it with the one already programmed into it. This SID may be directly programmed in the phone (for a CDMA network) or present on the SIM card (in a GSM network). If the SID it receives is different from the one it has, the phone looks for another control channel. This goes on till it finds an SID that matches. The phone now knows that it has found its 'home' network, and sends it a *Registration Request*, which includes your Mobile Identification Number (MIN) - a unique 10-digit number assigned to your phone by your operator to identify you on the network. Once the MTSO has verified this information, it acknowledges the existence of your phone, and begins to track your position in its database.

Every few seconds, your phone sends its MIN on the home control channel to tell the MTSO where it is.

When someone calls you, the request is first sent to the MTSO. The MTSO looks in its database to see which cell you're in. Once it has found you, it will decide on a frequency pair (one for talking and one for listening) for you to use for the call. It then tells your mobile phone via the control channel to tune itself to these frequencies. Once your phone has tuned itself, the MTSO connects the call.

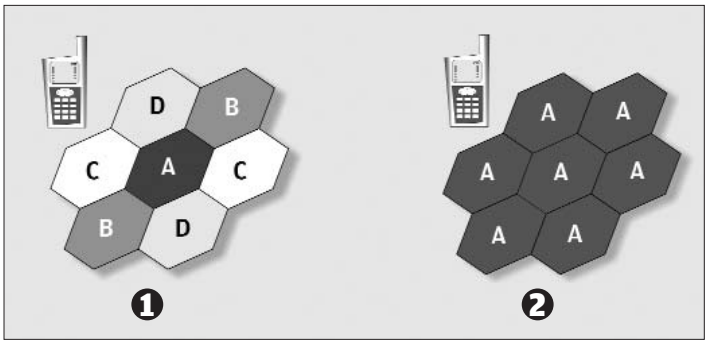
On The Move

Being mobile, of course, means moving seamlessly from area to area while talking; and moving from area to area means moving from cell to cell in the network. Even when you're on a call, your mobile phone is telling your MTSO where it is. When you move towards the edge of a cell, the base station notes that your signal strength is weakening. At the same time, the base station for the cell you're approaching feels your presence growing. The base stations co-ordinate with each other through the MTSO, each telling it how close you are to which cell. Soon enough, the MTSO decides that it is time to switch to the new cell, and will select a new frequency pair for you to use. It then tells your phone to prepare to tune itself to this new frequency pair. Once your phone has switched to the new frequencies, you are connected to the new base station. This process is called a 'hand-off'. Sometimes the hand-off goes awry, and this is when your call gets inexplicably disconnected.



Moving between different coverage areas.

In CDMA networks, there is no need for such a complex procedure. All calls are handled within the same frequency band, so when you approach a new base station, your call is already being handled by two stations. As you leave the coverage of the older base station, you are already being handled by the new base station. This is called a 'soft' hand-off. It means no dropped calls in a CDMA network.



(1) Frequency reuse in TDMA based networks.
(2) All cells in a CDMA network work on the same frequency

2.2 Cellular Access Technologies

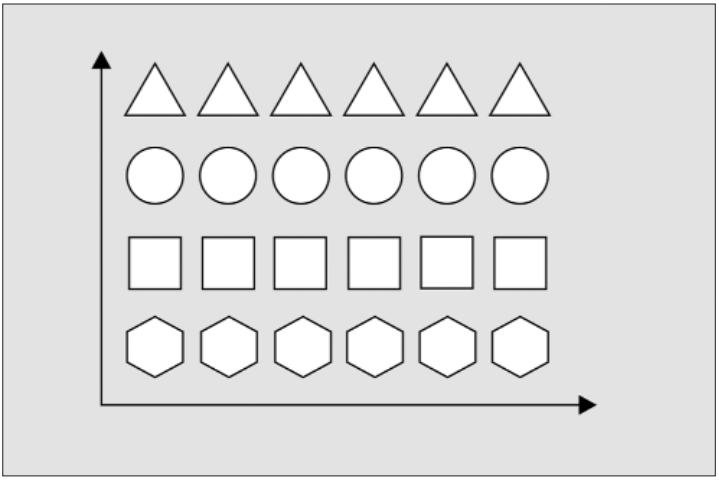
Multiplexing and Multiple Access

Going back to our analogies with radio stations, let us consider the case of a radio station in a locality A. Let's say it's popular, and therefore has loyal customers in localities B and C; and not just because of the good music. Customers in locality B can tune into the station to get news and information that is relevant only to them; ditto for locality C. To achieve this, our radio station sends one signal to users in B and an entirely different signal to users in C, at the same time. How? By using a neat concept called multiplexing. It sends the signal for B on one frequency and C on another. This is called *Frequency Division Multiplexing (FDM)*. FDM, however, is not the only way to multiplex. Another idea for multiplexing is *Time Division Multiplexing (TDM)* - in a span of one second (called the 'Time Frame'), the signal for B can be sent for the first half-second, and that for C can be sent for the second half-second. This repeats every second. TDM is quite popular because you don't need to use different frequencies for different signals.

Armed with this knowledge, we can now apply this to a mobile telephone network. A good mobile phone network allows many callers at the same time. Because callers access the network when needed rather than be connected to it all the time, the term 'Multiplexing' is now replaced by 'Multiple Access'.

A network that separates callers by different frequencies uses *Frequency Division Multiple Access (FDMA)*, one that separates callers by assigning them different time slots uses *Time Division Multiple Access (TDMA)*; and one that separates callers by assigning them unique random codes is called *Code Division Multiple Access (CDMA)*.

In the picture on the next page are four different conversations that need to take place over the cellular network. As we move along, we shall see how each method of multiple access handles these conversations.



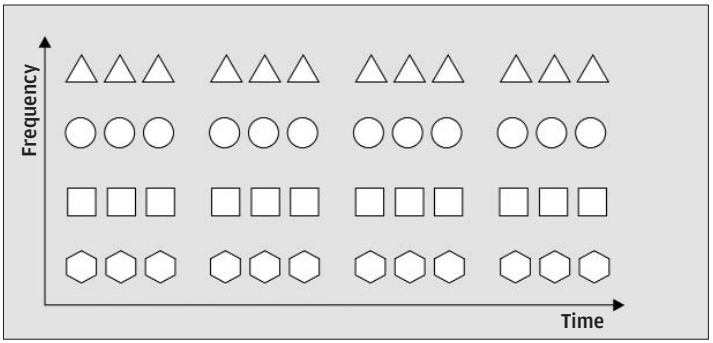
The four conversations we shall start with

Frequency Division Multiple Access - FDMA

FDMA is the oldest and most basic method for multiple access on a cellular network. It was used for analogue transmission on the first generation of cellular networks. Though it was used for analogue, it was perfectly capable of digital transmission as well; it just wasn't considered an efficient way to do so.

Each cellular operator would be authorised to use a range of frequencies. The operator would then divide this range into equal-sized frequency bands, taking into consideration two things: first, each frequency band had to be large enough to accommodate the frequencies of the human voice. Keeping the band 30 kHz wide seemed to be sufficient. Second, they needed to ensure that two calls on the network did not interfere with each other. To do this, there would be a 'guard band' between the frequencies that would actually be used for calls.

Each call is assigned a pair of frequencies - one for talking and one for listening. Once the call is done, this pair is released and available to be re-used for another call.



Our four conversations in FDMA - each conversation has its own frequency band.

The most successful networks to employ FDMA were the *Advanced Mobile Phone System (AMPS)* in the USA and the *Nordic Mobile Telephone (NMT)* in the Scandinavian countries.

The NMT system was set up in 1981. It was called NMT 450, because it operated in the 450 MHz range. In 1986, the NMT 900 system was operational. It had more channels and hence more capacity than the existing NMT 450 system.

The size of a cell in the NMT network was between 2 km and 30 km. An impressive aspect of the network is how well it covered the unique terrain of these countries. For example, in Iceland today, the GSM networks reach 98 per cent of the population, but do not cover the country that well. The NMT network, however, has nearly full coverage, extending even into the surrounding waters!

With the coming of the Digital Age, NMT networks began to implement solutions to transfer data, as opposed to just voice, over the network. The result of this effort was the *Data and Messaging Service (DMS)*, which allowed text messages to be sent and received even before SMS was available on the newer GSM networks.

Around the same time, the Americas were setting up their own FDMA network - the AMPS. It had 416 channels (395 for voice and 21 for data) and operated on the 800 MHz band. Though AMPS has been replaced by newer digital technologies such as Digital AMPS (a TDMA network that operates on the existing AMPS bands) and GSM, it still exists as a backup system for voice calls.

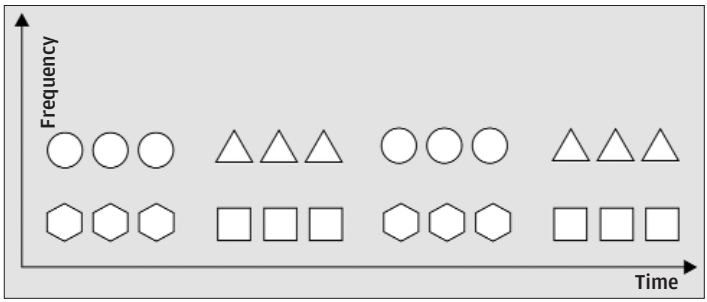
The biggest disadvantage of both these systems was the low call capacity. 395 voice channels on the AMPS network meant that if you were to be the 396th caller in a particular cell, you'd be out of luck!

Another problem with these networks was the lack of security - calls could be overheard with considerable ease, and one could steal a phone's serial code and make illegal calls on the systems.

FDMA networks would soon yield to digital networks, which have more capacity, are more efficient carriers of digital data, and can offer a host of new features such as Web browsing.

Time Division Multiple Access - TDMA

TDMA networks use Time Division Multiplexing to separate callers. Let us consider the case of three callers who have dialled numbers from their cellular phones, and are waiting for their calls to be connected and their conversations to begin. In an FDMA



Our conversations, now in TDMA - notice how we only use two frequency bands this time

network, the MTSO would assign a different frequency for each of these callers and connect their calls. In a TDMA network, however, the MTSO divides a time frame (20 milliseconds in the first TDMA networks) into three time-slots, each 6.67 milliseconds long. Caller 1 will be assigned the first time-slot, caller 2 the second, and caller 3 the third. So for the first 6.67 milliseconds, the network handles caller 1's conversation, for the next 6.67 it handles caller 2's conversation, and so on. This cycle repeats every 20 milliseconds. Since the time between two time-slots is so small, neither party in the conversation realizes that they are only really speaking for a third of the time they are connected. The advantage is that all this is taking place on the *same* frequency band.

Let us now see what happens when TDMA and FDMA are combined. Suppose that our FDMA network has 200 frequency bands. This means that only 200 callers in each cell can make calls. Now if we employed TDMA for each frequency band, three callers could be handled per band. This means that by adding TDMA to our existing FDMA network, we have now brought up the capacity of the network to 600 callers per cell!

The *Telecommu nication Industry Association (TIA)* defined the standards for TDMA networks. The Interim Standard 54 (IS-54) operates in the 800 MHz band, and the Interim Standard 136 (IS-136) operates in the 1900 MHz band. In both standards, the time frame of 20 milliseconds is divided into three time slots of 6.6 milliseconds each. In these time slots, only 3.3 milliseconds are actually used to transmit data; the other 3.3 serve as a 'guard space' between calls to prevent conversations from interfering with each other. In the USA, cellular service providers used the AMPS frequencies to implement their new TDMA technology, called Digital AMPS.

While going digital has many advantages, there are drawbacks with TDMA networks. The biggest of these is loss of voice quality. On an FDMA network, the voice signal, being analogue, sounds far better than it does on a digitised TDMA network. You've probably

often experienced the 'underwater voice effect': this happens when you're in an area with a poor signal, or if your current cell is crowded with traffic. Your phone can't pick up all the time slots, resulting in the other person's voice breaking.

A variation of the TDMA technology is Extended TDMA (ETDMA), developed by Hughes. The system here is dynamic; time slots are not assigned just because a call has been made, but only when there is data to be transferred. Consider this: you are on a call with your irate boss. Naturally, you aren't doing much talking. Even so, your network has assigned a frequency and a time slot for you to transmit on. In the ETDMA network, your empty time slots will be used to transmit data from other calls.

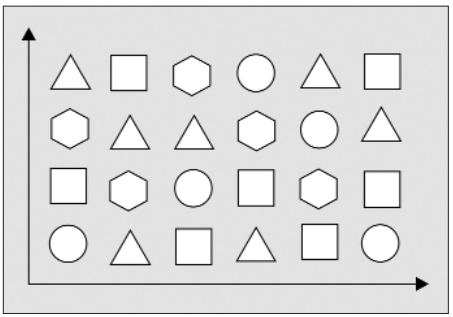
The Global System For Mobile Communications - GSM

GSM is essentially a standard or a set of recommendations to set up TDMA-based mobile telephone networks. The advantage of setting a standard was that callers who subscribed to a GSM network would be able 'roam' outside their own home networks and into other GSM networks worldwide. Most of the world's GSM networks operate on 900 MHz and 1800 MHz; major parts of the Americas, however, operate on 850 MHz and 1900 MHz. Each frequency band in a GSM network was divided into eight time-slots. GSM even introduced the concept of the *Subscriber Identity Module (SIM*) card, which stored your subscription information, the operator's information, and had some memory space for you to store your phone book. This meant that switching to a new handset would be quite simple, and you'd still have all your contacts. GSM networks also offered text messaging at low costs in addition to support for voice, data, fax calls and e-mail.

Data over the GSM network is usually transferred using the *Circuit-Switched Data (CSD)* technique. While it was quite robust, it wasn't very good for transferring large amounts of data. We'll look at the difference between circuit-switched and packet-switched data later.

Code Division Multiple Access - CDMA

While in FDMA and TDMA different calls are assigned different frequencies, in CDMA, all callers always occupy the same frequency band. Using a technique called *Direct Sequence Spread Spectrum*, the caller's voice is 'spread' over the entire frequency band by multiplying it with a unique high-frequency *pseudo-random code*, which for all practical purposes can be considered completely random. The result is a signal that is spread out both in time and frequency. The pseudo-random code is generated by the MTSO and shared only with the two mobile phones on a call. The code is used again at the receiving end to recover the original voice signal. These codes are so distinct that the possibility of one call interfering with another is reduced to a minimum. Theoretically, the number of possible codes is infinite; so on paper, a CDMA network can handle an unlimited number of subscribers.



Our conversations spread out over all frequencies in a CDMA network

cdmaOne is a standard set for CDMA based networks, proposed by Qualcomm and approved by the TIA as Interim Standard 95 (IS-95). cdmaOne networks use advanced voice compression techniques to improve the efficiency of the system, such as a variable bit-rate *Vocoder (Voice Encoder)*. A vocoder basically converts our analogue voice signal to a digital signal. Vocoders were not a new concept - they were used in all digital communication. However, these were fixed bit-rate vocoders. This meant that they would always transfer data at, say, 2400 bits per second - even when there is no talking going on. The variable bit-rate vocoder would idle at something like 800 bits per second when nobody was talking, and would

increase the bit-rate as soon as it detected that there were voices speaking. cdmaOne vocoders encode voice at 9600 bits per second. After applying the pseudo-random code, the signal is spread to 1.23 Mbps.

As mentioned before, CDMA was first tinkered with by the US Military. Because messages are spread out over a band of frequencies, an eavesdropper would dismiss this signal as electrical noise. Even if this eavesdropper did identify the signal as a CDMA transmission, it would be very difficult for him to decode it.

The capacity of a CDMA network is about four to five times as much as that of a GSM network. It offers better coverage, better call quality and practically unbreakable privacy. Because all calls on a CDMA network use the same frequency band, there is no need for 'frequency planning' in a CDMA network - all cells work on the same frequency.

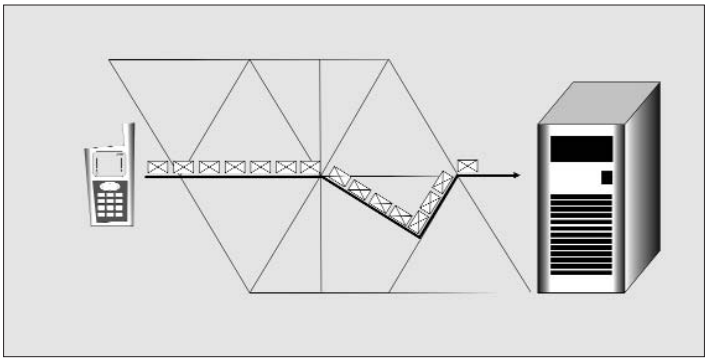
We now move on to more advanced things, having dealt with the first and second generation technologies.

The General Packet Radio Service - GPRS

GPRS is a data transfer method that integrates neatly with GSM networks. It employs unused time slots in the TDMA channels to transfer data. This is a lot faster than the method previously mentioned, of circuit-switched data transfer.

We should, perhaps, look into the differences between circuit switching and packet switching before we start making claims about which is better.

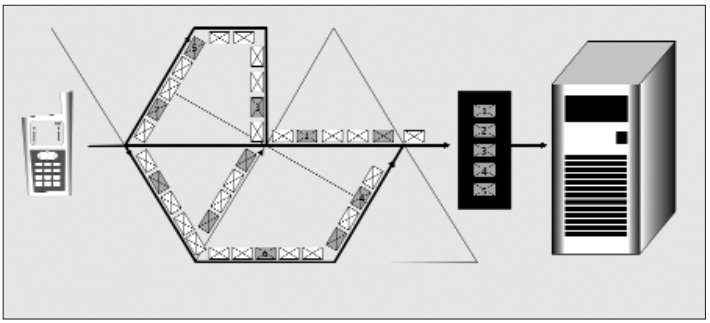
In a typical network, there are a number of different paths that could be employed to establish a link between two points. A *network controller* selects the best path, and once this path is established, communication can begin. Packets of data are sent by the transmitter; they travel the network along this path to reach the receiver. This is called *Circuit Switching*. "Quite good", you might



Data transfer using Circuit Switching - all packets follow the same path to their destination

say, "keeps my data from going AWOL." True, circuit switching is good, especially for voice transmissions.

But there's a catch; this path remains reserved even if no data is being sent - an unfortunate waste of a perfectly good connection. An alternative to this was to send packets on all the possible paths to the receiver. Just tag the packet with the name of its destination and its place in the sequence of packets and send it off on its journey. The receiver would receive these packets, put them in the right order and *voila!* - ready-to-use data. This technique is



Data transfer using packet switching - the grey packets use different possible paths to get to their destination. At the end, they are arranged in the proper sequence and then used.

called *Packet Switching*. It's more efficient because it uses network resources only when data needs to be sent, and can even avoid crowded portions of the network to get data across faster.

Returning to GPRS: older GSM networks used the circuit switching approach to transfer data. This not only put a limit on the speed possible, it also didn't exploit the bandwidth on the network. GPRS uses packet switching - it throws data into the network, filling up any unused time-slots it finds. By exploiting the network thus, GPRS achieves speeds that weren't thought of in the old days of circuit switching.

As the number of calls increases, more and more TDMA channels get allocated to voice calls, leaving less free. This, alas, is where GPRS falters. It becomes slower as traffic in the cell increases. GPRS networks also do not allow for storing messages on the network. Unlike SMS, where the message can be stored and sent later if the network is busy, messages sent via GPRS are lost forever if they don't immediately reach the intended recipient.

GPRS, from the looks of it, looked to be the fastest way to transfer data on a GSM network, but it had one last step to take.

Enhanced Data Rates For GSM Evolution - EDGE

Put GPRS into high gear and you have EDGE. The big brother of GPRS, EDGE can be deployed over existing GPRS infrastructures. However, it requires better signal quality than what already exits on the world's GSM networks.

It uses a shiny new modulation technique to be able to pack in three times as much data into a packet as GPRS, achieving transfer rates of around 384 kbps for the common user - just enough to be called a 3G technology.

So there you have it. EDGE is the fastest and the last technology that will grace the GSM network. The future, all have realised, is CDMA.

Wideband CDMA - W-CDMA

The CDMA in W-CDMA refers to the multiplexing technique, and not Qualcomm's cdmaOne standard. The W-CDMA standard uses CDMA to achieve the 144 kbps - 2 Mbps data rates that define a 3G network.

We visited the concept of a full-duplex channel at the beginning of this chapter - it allowed users to transmit and receive data simultaneously. There are two ways of 'duplexing' a channel - *Time Division Duplexing (TDD)*, which uses TDMA to separate the incoming and outgoing data, and *Frequency Division Duplexing (FDD)*, which uses FDMA to separate them. CDMA networks thus far had used TDD in 1.25 MHz of bandwidth. W-CDMA, however, uses FDD - two 5 MHz frequency bands to achieve much higher capacity and speeds for data transmission.

The first network to employ the W-CDMA technique was FOMA - Freedom of Mobile Multimedia Access, developed by Japanese company NTT DoCoMo.

It must be noted that W-CDMA is not compatible with any of Qualcomm's CDMA standards.

The Universal Mobile Telephone System - UMTS

UMTS is basically W-CDMA deployed on existing GSM infrastructure. Adding to the security of the CDMA technique itself is the USIM - Universal Subscriber Identity Module, which is a more secure version of today's SIM cards, and with more memory.

UMTS networks will have the 'soft hand-off' we saw only in the cdmaOne networks so far. Hand-offs will also be possible between UMTS and other 3G technologies, between FDD and TDD systems and between UMTS and GSM.

Such advances, however, come at the cost of a very challenging and very expensive implementation. We can only wait with bated breath. Having now looked at what will take GSM networks into the third generation, we now move on to cdmaOne networks.

CDMA2000

Converting CDMA networks into 3G is going to be easier and cheaper than for GSM; they already have the right technology, and the existing infrastructure can be used for the first few evolutions.

The CDMA2000 specification was developed by the Third Generation Partnership Project 2 (3GPP2). It was implemented on the existing cdmaOne networks, bringing data rates up to 140 kbps.

The evolution of the CDMA2000 network is called 1xEV. This transition will take place in two phases - 1xEV-DO (Evolution, Data Optimized or Data Only) and 1xEV-DV (Evolution, Data and Voice). Both will use the current CDMA band of 1.25 MHz, but with separate channels for voice and data. EV-DO has already begun commercial deployment while EV-DV still waits in line. While EV-DO will offer data rates up to 2.4 Mbps, EV-DV is expected to take it to 4.8 Mbps.

The Homo Sapiens to CDMA2000 1xEV's ape will be CDMA2000 3x. It hasn't started development yet, but when ready, will use a pair of 3.75 MHz channels (which themselves will be three 1.25 MHz channels each) to achieve even higher data rates.

2.3 Satellite Phones

A Little background

What happens when you take your antenna into outer space? You get a cell that covers an area hundreds of kilometres wide, and the whole world becomes your cellular network. This is precisely what the Iridium project did, when 66 satellites were launched into orbit with the hope of creating a mobile network that would reach every corner of the globe. It didn't catch on as well as they'd hoped, though. The jet-setting executives (for whom these phones were meant) didn't quite fancy the handsets, which were about the size of the old '80s bricks. The signal from a satellite did reach all corners of the globe, but only *outdoors*. Inside a building (where a jet-setting executive is more likely to be spotted), the signal quality took a severe hit. On top of all this, the decreasing cost and increasing popularity of GSM quickly paved the way to Iridium's bankruptcy.

Iridium's satellites, however, still orbit the earth and are used by other companies to provide satellite telephone services. Also playing the field are GlobalStar, Inmarsat, ACeS and Thuraya. Each of these providers uses a different technology for their services.

How The Satellite Phone Call Works

A satellite 'constellation' consists of many *Low Earth Orbiting (LEO)* satellites. When you switch on your satellite phone, it sends a signal straight up to the nearest satellite. The satellite then relays this signal to the nearest *Land Earth Station (LES)*, registering you with the constellation (a similar concept to registering on a cellular network). If you are calling someone at the other end of the world, your signal will be bounced off many satellites in the constellation before it is beamed down to the recipient.

Commentary On The Above

Satellite phone service providers offer common Internet services through their own gateways and outgoing servers, which is good, because one doesn't then have to deal with the eccentricities of

Internet access via cell phones - slow, sometimes unstable connections that depended too much on network traffic.

Nearly all companies that offer satellite phone services offer dual-mode phones - they can switch between satellite and GSM networks. The customer then doesn't have to bear the high cost of satellite telephony when in an area well-covered by a GSM network. The satellites will take over when he makes that urgent trip to the middle of the Sahara.

There is still a good way to go before the satellite phone becomes ubiquitous, but costs have dropped enough to make them a good deal more feasible.

2.4 The Showdown: GSM vs. CDMA

The Dream

In technology circles, it has long been known that CDMA beats the pants off GSM. It is, to state it in no uncertain terms, the technology of the future. Even third-generation GSM networks will use CDMA-based technologies.

Why?
Because CDMA is faster.
Because CDMA is more secure.
Because connections on a CDMA network will never get dropped when moving from cell to cell.
Because CDMA base-stations cover a larger area.

The Reality

GSM was the world's hero, really. It replaced the archaic analogue systems, and its popularity grew fast. While CDMA was commercially available in the US only a couple of years after GSM, this wasn't so for the rest of the world. The purpose of publishing the GSM standard was to have a world standard for mobile communications, so that all mobile users could roam free across the world without needing to bother about changing handsets. The CDMA standard, however, is patented, and anyone implementing a CDMA network or manufacturing a CDMA handset has to pay a royalty to Qualcomm. Telecom companies the world over, therefore, preferred GSM.

Today, the cellular-using world has 1 billion GSM subscribers to CDMA's 270 million. Using a GSM phone meant that you were more likely to avail of international roaming. CDMA isn't being adopted by countries as quickly as one would hope, but where it has been adopted, it's grown phenomenally. The Indian scenario is quite the same. When mobile telephony came to India, GSM was our only choice. CDMA came in only in the beginning of 2003, but has seen huge growth since then. Nonetheless, GSM still remains the preferred network for most of India's subscribers.

With both GSM and CDMA moving towards better technologies based on the CDMA technique, one hopes that in the future they would become cross-compatible. This would finally concretise the dream of a fully-connected mobile world. For now, GSM is the Goliath to CDMA's David. We're all just waiting for that stone to knock it over.

Handsets

A handset might seem to be just a device that lets you talk on a cellular network, but actually, there is a lot you need to know about handsets before you go out and buy one. What do you need? What kind of form factors are available? What about the battery? Then, there's the camera to be considered. Also, if a mobile phone is to be really *mobile*, you need to consider connectivity options. Then there are accessories to jazz up your phone -We round off this chapter with descriptions of a few especially desirable phones.

3.1 Technology in Handsets

1. **RF TX and RX amplifiers:** These handle the signals in and out of the antenna.
2. **The inner circuit:** A lot of chips are placed on the PCB. Each has an assigned function.
3. **RF and Power:** It handles the power management and recharging of the cell phone; it also deals with the reception of FM channels in phones with that feature.
4. **Microprocessor and memory:** Both these chips co-ordinate the various functions of the cell phone and are responsible for communicating with the base station.
5. **DSP:** The Digital Signal Processor is a customised processor that performs signal manipulation computations at high speeds. It also takes care of signal compression and decompression.
6. **D/A and A/C chips:** These chips work in conjunction with each other and are responsible for the conversion of analogue signals to digital and vice versa.

The above image depicts the internals of a basic mobile phone:

Display Types

Not only do mobile phone displays show caller information, menu options, contacts, etc., mobile phone displays these days need to be capable of displaying thousands of colours so that high-end features such as images and video playback offer the desired user

experience. The following is a brief on the various types of display technologies in use for mobile phones.

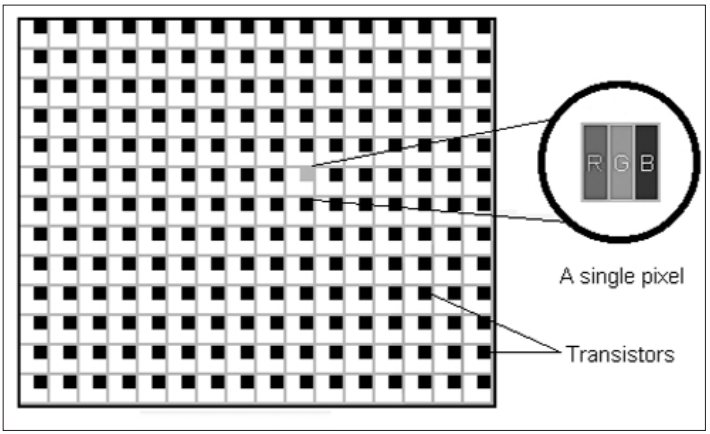
LCDs

LCD displays utilise two sheets of polarising material with a liquid crystal solution between them. Crystals in this suspension are naturally aligned parallel with one another, allowing light to pass through the panel. When electric current is applied, the crystals change orientation and block light instead of allowing it to pass through, turning the crystal region dark.

There are two main types of Liquid Crystal Displays: STN and TFT.

STN

Super Twisted Nematic LCDs use the passive matrix screen technology, which has no active or controlling element inside the display cell. Pixels are controlled by energising the appropriate row and column drive lines of the matrix from outside the display, resulting in a slow frame rate. STN screens have limited colour range and viewing angles (~15 degrees max).



Structure of a TFT LCD

TFT

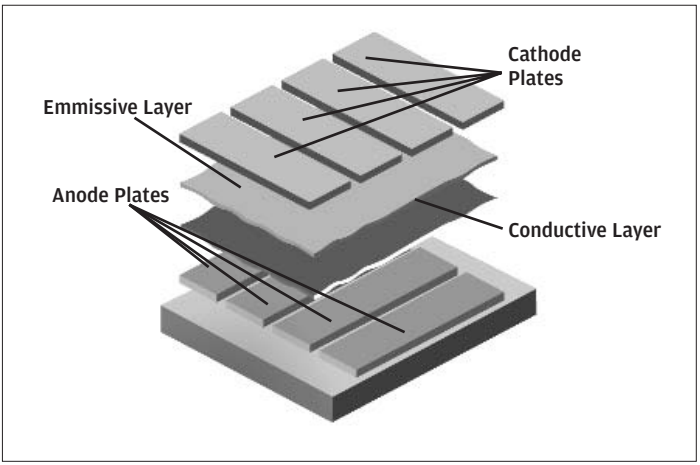
With Thin Film Transistor (TFT) LCDs, each pixel is controlled by one to four transistors. Typically one transistor is used for each of the RGB colour channels. Because of this direct control technique, TFT screens are also called Active-Matrix LCDs.

TFT technology provides more accurate colour control, allowing it to display more colours and also offer a wider viewing angle range than other types of LCDs.

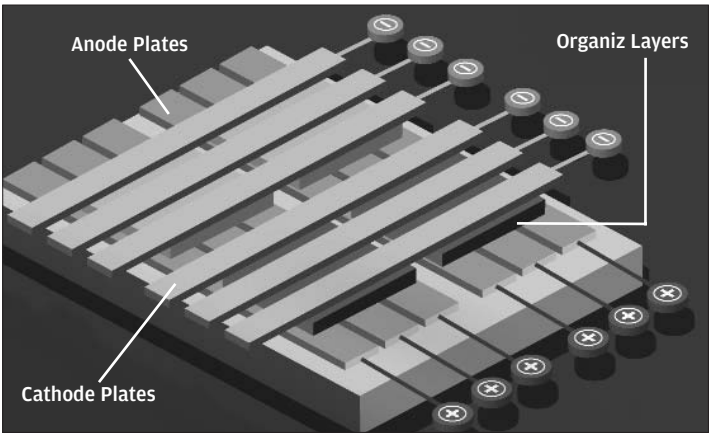
OLED

OLED stands for Organic Light Emitting Diode. OLED is a flat-panel display technology that is now being used in a variety of devices. Apart from mobile phones, you can also find OLED screens on portable audio players, car audio systems, PDAs and digital cameras. The basic property of OLEDs was discovered in 1985, over a decade before the first displays were seen. Ching Tang, a Kodak researcher, noticed that an organic material glows green if you pass an electrical current through it.

An OLED is made by placing a series of organic thin films between two conductors. They operate on the attraction between

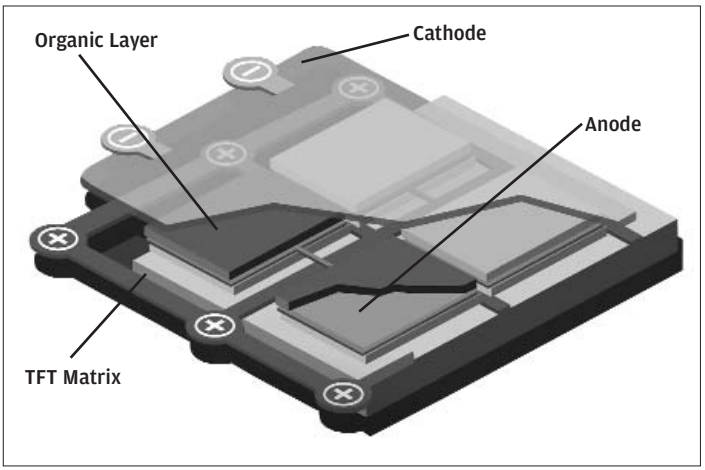


Construction of an OLED



Structure of a Passive Matrix OLED

positively and negatively charged particles. When voltage is applied, one layer becomes negatively charged relative to another transparent layer. As energy passes from the negatively charged layer to the other layer, it stimulates organic material between the two, which emits light visible through a layer of glass. There must be blue, red, and green light-producing organic material to produce the different colours. Because screens using OLED technology produce light themselves, they do not require a backlight as



Structure of an Active Matrix OLED

compared to LCD screens. This means that OLED displays require less power and also can be made very thin. Without any other source of illumination, OLED screens can display bright images that are viewable from almost any angle.

Like LCDs, OLEDs also come in passive-matrix and active-matrix flavours.

Passive-matrix OLEDs are made up of a matrix of electrically-conducting rows and columns making pixels. Between the rows and the columns are the organic layers. On the other side is the substrate, the material which gives the electricity. The more current applied, the brighter the display.

In Active-matrix OLEDs, there is a TFT back plate instead of rows and columns. This controls the brightness of each pixel. There are two TFT arrays per pixel: one to start and stop the charging of the capacitor, and one to provide a constant electrical current to the pixel. Active-matrix OLEDs consume much lower power than passive-matrix ones.

OLEDs have the following advantages over LCD or plasma displays:

New-age displays: OLEDs can bring in new types of displays, like ultra-thin, flexible or transparent displays.

Power efficiency: Since OLED screens do not require a backlight, they require much less power compared to other types of displays. This makes OLED a far better choice for portable devices. It also makes them much more environmentally friendly.

Greater brightness: Due to their high contrast and luminance, OLED screens are brighter and have a fuller viewing angle. **Greater clarity:** Since there is no intervening liquid crystal material that limits colour vibrancy, OLED screens offer better colour reproduction.

Lifelike motion: OLED pixels can turn on or off very fast, and

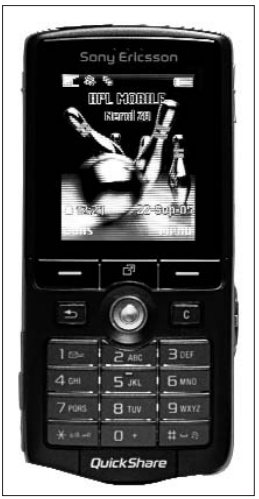
therefore reproduce lifelike video without blurring or ghosting.

Better durability: OLEDs are very durable and can operate in a broader temperature range.

Lighter weight: OLEDs can be made very thin, and can even be 'printed' onto flexible surfaces.

3.2 Handset Form Factors

Mobile phones come in a variety of different physical styles or form factors that define the design and shape of the device and the arrangement of the various elements on it. Manufacturers are continuously striving to make mobile phones thinner and lighter and to come up with innovative designs. Different form factors for cell phones affect the size (and therefore the portability), functionality, ergonomics and usability of these devices. Users may prefer one form factor over the other based on their specific preferences and requirements.



A Candy bar Phone

Though there are many form factors available in the market, most mobile handsets can be classified under the following broad categories:

Bar

Also referred to as "candy bar," this is the most basic of handset form factors. Like a bar of chocolate, the phone is rectangular in shape, and does not have any hinges or moving parts. You'll find a display screen and the standard set of number keys. Depending upon the specific phone model, you may also find soft keys, 'answer' and 'end' buttons, and navigation keys. The screen and all these keys are placed on the front of the device. Since the keys are exposed, most phones using this form factor also provide a key- guard feature that prevents the keys from being pressed accidentally when it's in your pocket.

Clamshell

Also referred to as folder, a clamshell phone consists of two halves joined by a hinge. The upper half usually sports the screen

and the speaker, while the keys are placed on the lower half. The phone is shut when not in use, hiding the screen and buttons. Most clamshell phones also boast of dual LCD screens: apart from the main screen on the inside, there is also a secondary, smaller screen on the outside that displays information such as the time, battery status, caller information etc. Depending upon the model, the two screens can have different screen resolutions and colour capabilities.

A Clamshell Phone

Most phone models using this form factor have also an 'Active flip' feature, which means that calls can be answered and ended by opening and closing the phone. In most cases, the size of a clamshell phone is quite compact when closed as compared to candy bar phones.

Flip

A flip phone is a cross between the bar and clamshell. Here, most components including the screen and the keys are placed on the bottom half of the phone. The top half is usually a plastic flap that folds on top. Again, depending upon the phone model, the top half may contain a speaker and even a transparent window that enables the user to see a portion of the screen when the phone is closed. The visible part of the screen displays the time and caller ID information. Most flip phones also have the active flip feature.

Slider

A relatively newer entrant, phones using a slider form factor are designed much like clamshell phones. The phone has two parts - one with the screen and speakers along with some keys, and the other half containing the main keypad. However, instead of folding, the bottom half with the keypad slides out from under the top half. This kind of design also allows the phone to be quite small. Also, in most cases, you can perform certain operations such as answering and ending calls and accessing the phone book and call history without opening the slider.

A Slider Phone

3.3 Battery Types

The following should give you an idea of the different types of batteries for mobile phones.

Nickel Cadmium (NiCd): These batteries are the least expensive of rechargeable batteries, but they suffer from inherent shortcomings - for instance, the memory effect. Here, if the battery is not fully drained before you recharge it, the unused portion eventually crystallises and hence, the complete capacity of the battery is not fully utilised. These types of batteries are no longer used in new mobile phone models.

A standard battery for a mobile phone

Nickel Metal Hydride (NiMH): This technology offers between 30 and 40 per cent longer operation as compared to NiCd batteries, but is susceptible to loss in performance at higher temperatures. These, too, are prone to the memory effect, but to a significantly lesser extent as compared to NiCd batteries. NiMH batteries have also been phased out on mobile phones.

Lithium Ion (Li-ion): The prime advantage that these batteries have over the older NiMH batteries is that they hold more energy for the same weight and volume. Therefore, you can get the same amount of power from much smaller and thinner batteries. Also, they do not have the inherent memory effect disadvantage of NiMH batteries. The only disadvantage with these batteries is that they cost more than other types. Most new mobile phones use Li-ion batteries.

Lithium Ion Polymer (Li-Po): Lithium ion polymer batteries, or more commonly, lithium polymer batteries, are rechargeable bat-

teries that evolved technologically from lithium ion batteries. A significant advantage of these batteries is that manufacturers can shape the battery almost however they please, which is very important to mobile phone manufacturers constantly working on smaller, thinner, and lighter phones. Many latest mobile phones and PDA phones use these types of batteries.

Steps for Longer Battery Life

In case your mobile phone uses NiCd or NiMH batteries, let them get discharged completely before you recharge them.

- Check that your phone's battery contacts are clean. You might need to sometimes clean them with alcohol.
- Keep the batteries in a cool, dry place, away from heat and magnetic objects.
- Don't leave batteries dormant over an extended period of time. Switch on your phone once in a while to ensure this doesn't happen.
- Switch off features such as Bluetooth and Wi-Fi when not in use to prolong battery life.
- Many mobile phone models allow you to customise the brightness and contrast levels of your LCD screen. Setting the brightness and contrast to low will also give you a longer battery life.
- In case your mobile lets you customise the time the backlight stays on, setting it to a lower time period will prolong battery life.
- Keeping the sound level for ringtones and other audio notifications (SMS, keypad press, etc.) at low will also help increase the time your battery lasts.
- If your mobile phone has an integrated camera with flash, minimising use of the flash will save battery power.
- Do not expose your battery to extreme temperatures.
- Do not overcharge your battery. This may result in permanent damage.
- Use battery chargers specified by the manufacturer. Using other battery chargers may damage your battery or shorten its life span.

3.4 Wireless Connectivity Options

Mobile phones are wireless gadgets, and the whole point is lost if you need to connect a cable to it for synchronising or transferring data! However, many mobile handsets boast of features that let you do this and more without the need to connect any cables. The following are the wireless connectivity options provided by mobile handsets today.

Infra-Red (IR)

The IrDA Standard, specified by the InfraRed Data Association (IrDA, formed in 1993), is intended to facilitate the point-to-point or point-to-multipoint communication between electronic devices (e.g. computers, mobile phones, peripherals) using directed infrared communications links through free space. Data transfer through infrared requires line-of-sight. Usually, each of the communicating devices has a transceiver (which is a combination of a receiver and a transmitter on one device). The data to be communicated is output from one device and converted to an analogue signal (infrared) and the other device receives it and converts it back to digital pulses.

Infrared communications are useful for indoor use. IR does not penetrate walls, and so does not interfere with devices in adjoining rooms.

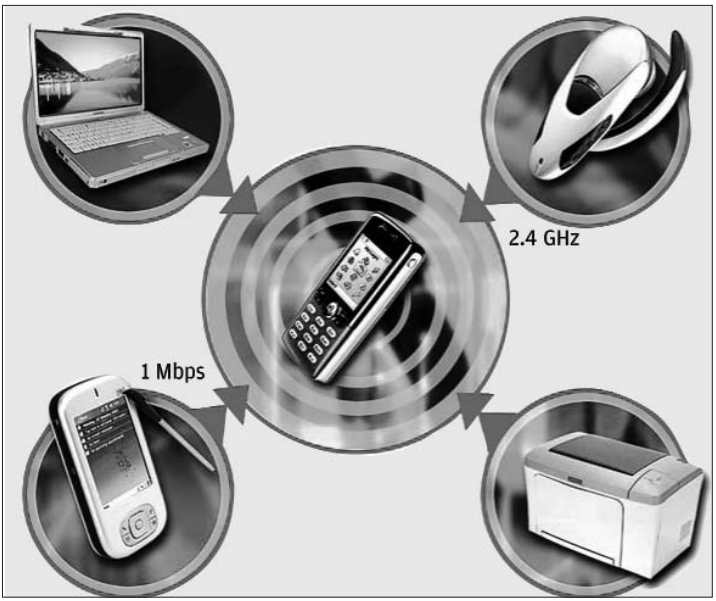
The original IrDA standard, called IrDA 1.0, allowed for the transfer of data at up to 115.2 kbps at a range of up to 1 metre. In 1996, an extension to this standard called IrDA 1.1 was adopted, which allowed for data transfers up to 35 times faster than the original specification. This extension calls for data rates up to 4 Mbps, but retains compatibility with the original (115.2kbps) specification. Since it is relatively inexpensive to implement, most notebooks and handhelds as well as a large number of mobile phones are equipped with infrared ports for wireless data transfer.

Bluetooth

Bluetooth is a short-range communications standard for wireless data communications. It works in the 2.45 GHz band and allows various devices to connect wirelessly. Bluetooth technology was conceived by Ericsson, but was founded and developed by Ericsson, Nokia, IBM, Intel and Toshiba. This consortium is called the Bluetooth Special Interest Group (SIG).

Current Bluetooth technology provides for data transfer at a rate of 1 Mbps, with a personal area range of up to 10m in client-to-client open air (5m in a building). In terms of client-to-access point, the current range is 100m in open air and 30m in buildings.

Unlike infrared, Bluetooth does not require line of sight, and you can roam around within the range and not fear about connection loss. To set up Bluetooth, you just need to switch it on and



Using Bluetooth, you can achieve data transfer speeds of 1 Mbps between your devices

Why is it called Bluetooth?

Harald Bluetooth (Harald Blåtand in Danish) was king of Denmark in the late 900s. He united Denmark and part of Norway into a single kingdom. Choosing this name for the standard indicates how important companies from the Scandinavian region (nations including Denmark, Sweden, Norway and Finland) are to the communications industry, even if it says little about the way the technology works.

let the devices search for and find each other. Then you need to enter a common pass key, decided by you, in both devices.

An increasing number of mid-range mobile phones and almost all high-end mobile phones and handhelds now boast of the Bluetooth feature. Bluetooth is also available as an integrated feature on many notebook models as well.

Wi-Fi

Wi-Fi is short for wireless fidelity and is meant to be used generically when referring to any type of 802.11 network. The Wi-Fi trademark is controlled by the Wi-Fi Alliance (formerly the Wireless Ethernet Compatibility Alliance), the trade organisation that tests and certifies equipment compliance with the IEEE 802.11 standards.

Wi-Fi allows mobile devices, such as laptop computers and PDAs, to connect to local area networks (LANs). It is also used for Internet access and wireless VoIP phones. The connection is made by radio signals and there is no need to plug the device into a network point. A wireless access point is required to create a wireless network of Wi-Fi devices. The geographical area covered by one or more access points is called a hotspot.

Desktop computers can also use Wi-Fi, allowing offices and homes to be networked without expensive wiring.

Wi-Fi Specifications

Specification	Speed	Frequency Band	Compatible with
802.11b	11 Mb/s	2.4 GHz	B
802.11a	54 Mb/s	5 GHz	A
802.11g	54 Mb/s	2.4 GHz	b, g
802.11n	100 Mb/s	2.4 GHz	b, g, n

Most notebooks today have Wi-Fi built-in. In addition, you can equip desktop computers and older notebooks with cards that will make them Wi-Fi enabled. As far as mobile phones are concerned, Wi-Fi is only available in high-end PDA phones such as the O2 XDA IIi and the Nokia Communicator 9500. PDAs and PDA phones that do not have integrated Wi-Fi but which provide an SDIO slot can be made Wi-Fi enabled by using add-on Wi-Fi SD cards.

3.5 Storage on Mobile Handsets

Various types of flash memory cards

New-age mobile phones are truly converged devices, and offer a host of features that would put a PC to shame. From basic contact management and organisers to gaming, imaging, music, video, e-mail, Internet connectivity - the latest mobile handsets have it all. Availability of all the above applications has made it necessary for cell phones to have high storage capacities. Even most high-end phones do not come with high storage capacities inbuilt, but they do provide the option to add more memory by using flash memory cards.

Flash memory is a form of rewritable memory chip that, unlike RAM, holds its content without the need of a power supply. It is a form of EEPROM (Electrically-Erasable Programmable Read-Only Memory) that allows multiple memory locations to be erased or written in one programming operation - "in a flash"; This is where the name 'Flash' comes from. EEPROM is erased and written at the byte level whereas in the case of Flash memory, this operation is done in units of memory called blocks.

Flash memory is often used to hold control code such as in the BIOS in a PC. Flash memory offers fast read access times and significantly better shock resistance than hard drives. This makes it a popular choice for storage in a variety of mobile devices including mobile phones, PDAs, digital cameras, USB drives, and MP3 players. Since there are no moving parts in

Flash memory, it is also referred to as solid-state memory.

There are several advantages of using Flash memory. Apart from offering better shock resistance as compared to hard drives, flash memory is noiseless, offers fast access, and is much smaller and lighter. However, the downsides are that the cost per MB of Flash memory is much higher than that of hard drives, and the capacities available still do not match those available on the latter.

Different types of Flash memory cards are available in different capacities for removable storage applications. The type of memory card you need to use is dictated by the device you wish to use it with. Most of these cards are physically different from one another and are not interchangeable. Some flash card formats include CompactFlash Type I & II (CF), Microdrive (MD), Memory Stick (MS), MagicGate (MG), SmartMedia (SM),

Types of Flash Cards

Name	Acronym	Form factor
CompactFlash I	CF-I	43 × 36 × 3.3 mm
CompactFlash II	CF-II	43 × 36 × 5.5 mm
SmartMedia Card	SMC	45 × 37 × 0.76 mm
Memory Stick	MS	50.0 × 21.5 × 2.8 mm
Memory Stick Duo	MS Duo	31.0 × 20.0 × 1.6 mm
Memory Stick Micro	M2	15.0 × 12.5 × 1.2 mm
MultiMediaCard	MMC	32 × 24 × 1.5 mm
Reduced Size MultiMediaCard	RS-MMC	16 × 24 × 1.5 mm
MMCmicro Card	MMCmicro	12 × 14 × 1.1 mm
Secure Digital Card	SD	32 × 24 × 2.1 mm
miniSD Card	miniSD	21.5 × 20 × 1.4 mm
microSD Card	µSD	11 × 15 × 1 mm
xD-Picture Card	xD	20 × 25 × 1.7 mm

MultiMedia Card (MMC), Secure Digital (SD), and xD Picture Card (xD).

The table on the previous page is a brief on the various types of Flash memory cards in use with mobile handsets today.

MultiMediaCard (MMC)

MultiMediaCards are about the size of a postage stamp and were introduced in 1997 with a capacity of 4 MB. Today, they are commonly used in digital cameras, mobile phones, and MP3 players. The MultiMediaCard Association sets the specifications for MMC. The data transfer speed offered by the latest MMC Cards confirming to the MMC4.1 standard (called MMCplus) is 52 MB/sec.

Reduced Size MultiMediaCard (RS-MMC)

The RS-MMC card is approximately half the size of a full MultiMediaCard. Having the same width and thickness, RS-MMC cards measure 18 mm from top to bottom instead of 32 mm. RS-MMC cards can be pushed into an adapter and plugged into full-size MMC or SD slots.

A reduced-size MultimediaCard with adapter

MMCMobile

MMCMobile is a type of reduced-size MMC card that supports dual voltages (1.8V/ 3.3V).

Secure Digital (SD)

Secure Digital is a second-generation and more popular derivative of the MultiMediaCard (MMC) standard that is backward compatible with current MMC cards. The Secure Digital format includes several important technological advancements over MMC. These include the addition of cryptographic security protection for copy-

A 1 GB Secure Digital Card

righted data and music and a 4X increase in data transfer rates.

The SD Card Association sets the specifications for Secure Digital cards. This association was formed in January 2000 by Matsushita Electric Industrial Co., Ltd. (Panasonic), SanDisk Corporation and Toshiba Corporation.

To help support higher-capacity cards, SD cards are slightly thicker than the original MMC cards. This means that devices designed to support SD cards may also accept MMC cards (if the host device is not strictly limited to SD media for data security reasons). However, devices exclusively designed for MMC cards will not support the thicker SD cards. Another difference between MMC and SD cards is that the former has seven pins as compared to nine on SD.

SD cards range in size from 16 MB up to 4 GB, and come in different transfer speed ratings. Transfer speed is an important factor if you record high frame rate motion video or high-quality audio tracks.

A miniSD card with adapter

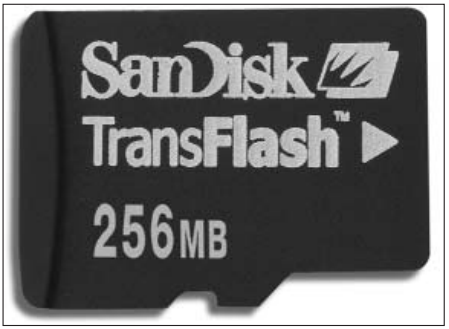
miniSD

The miniSD card was developed to meet industry demands for downsizing mobile phones, and is only 37 per cent of the volume of an SD Memory Card. The miniSD card is both electrically

and software compatible with the existing SD standard. It uses the same SD interface, including security features for content protection (CPRM-Content Protection Rights Management) as the standard SD card. You can use a minSD card in a device with a regular SD card slot by using a miniSD adapter. Currently, miniSD cards are available in capacities of up to 2 GB.

microSD or Transflash

The microSD format was originally created by SanDisk. It was originally called T-Flash and then TransFlash before being rechristened microSD when adopted by the SD Card Association (SDA). It is a semi-removable Flash memory module based on the miniSD card and TriFlash designs for future mobile phone products. Measuring just 15 x 11 x 1 mm, it is the smallest Flash memory card format available today. Due to the ultra-small size of the product, it is not intended to be handled or removed on a frequent basis. microSD cards are usable in SD-compatible devices via an adapter.



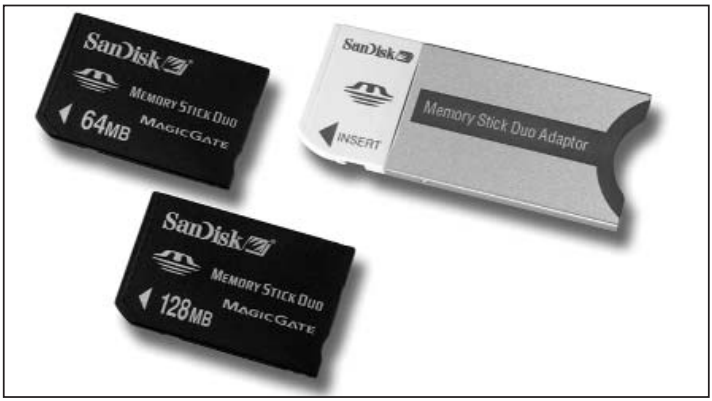
A Transflash Card

Memory Stick (MS)

In 1998, Sony introduced their own Flash memory product, called the Memory Stick. It is roughly the size of a stick of chewing gum and is used mostly in digital cameras and video camcorders.

Memory Stick Duo (MS Duo)

Memory Stick Duo is a smaller version of Sony's Memory Stick. It is about one-third the size of the original, and is meant to fit into devices such as cell phones and small digital audio players.



Memory Stick Duo cards with adapter

Memory Stick Duo cards come with an adapter so they can be used in devices that use the larger Memory Stick format.

Memory Stick PRO (MS PRO)

Memory Stick PRO is an advanced media format that incorporates various capabilities and expandability, such as high capacity, high-speed technology and data protection technology. Introduced in 2003, the MS PRO format was developed jointly by SanDisk and Sony.

Memory Stick PRO media can be used with Memory Stick PRO compatible devices only. PCs can accept this media through the use of a Memory Stick PRO compatible PC card adapter or USB reader/writer. MS PRO cards are available in capacities of up to 4 GB.

Memory Stick PRO Duo (MS PRO Duo)

At only one-third the size and half the weight of full-size Memory Stick media, Memory Stick PRO Duo media offers the same technologies and features of Memory Stick PRO media, including MagicGate copyright protection technology, high capacities and a theoretical maximum data transfer capability of up to 160 Mbps.

A Memory Stick Duo PRO card

3.6 Mobile Accessories

Most cell phones today come in a fairly bulky package that contains a charger and a plain hands-free. Expensive models may come with driver discs and data cables for synchronisation with your laptop or PC. These, however, are basic stuff, and investing just a little bit more will give you a lot more functionality and convenience.

The Cosmetics

The first thing you should look at after you've bought a phone is the face plate.

You can personalise your cell phone by changing the faceplate to any of the millions available in the market. The concept was pioneered by Nokia but these are also being offered by Sony Ericsson letting you make your cell phone mirror your personality, and if you have a lot of cash available, mirror your mood or match your outfit!

So after you've bought your phone a cool-looking panel, what next? Well, you can now choose from a range of stickers and cool flickering LEDs which you can stick on your phone's back panel or even the antenna, and watch them blink and jazz up your phone. These are ultra-light on the pocket, starting at just Rs 30!

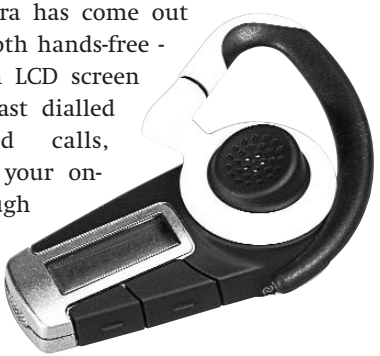
Free Your Hands!

If you've got a really neat looking cell phone but find it too cumbersome to use most of the time, what you need to invest in is a hands-free kit. These offer you freedom from holding your phone all the time, and if you set them to auto answer, no more missed calls!

If your phone has Bluetooth, you can opt for really cool, high-end Bluetooth wire-free headsets starting from Rs 2,800 (grey market), and the original top- of-the-line hands-free from Nokia will set you back by a cool Rs 6,000! But the flaunt value of these handsets is unquestionable. Looks apart, the reason you should look at

this hands-free is that it's wireless and has a range of approximately 30 feet so you can move around without being attached to your phone in any way, and for all you care it can be at the bottom of a paper-filled drawer!

A company called Jabra has come out with a new funky Bluetooth hands-free - the BT800, which has an LCD screen allowing you to access last dialled and recently received calls, send/read SMS, and use your on-phone voice tags - all through your hands-free. You cannot, however, access the phone menu or contact list.



Jabra BT800

Another kind of hands-free that is gaining popularity is the radio hands-free. If your cell phone doesn't have an inbuilt radio, you can buy this hands-free with radio integrated, and hum your way through the chores of the day!

The original Nokia radio headset is priced at around Rs 1,800, but local radio hands-frees are available for from Rs 100. The quality is decent enough.

Nokia has come out with a cool headset for MMS-enabled phones that have an integrated camera. It lets you snap pictures and save them to your phone, and then share them via MMS.

Now what happens if you are in a car and want others to hear and participate in the conversation? Manufacturers are ahead of you there as well! You can now buy hands-free speaker sets that will allow you to free your hands *and* your ears! These speakers mostly work with inbuilt batteries, though, in some cases you may need to use the cigarette lighter adapter.

There are two versions of the car hands-free. One is the Car Kit, which Nokia sells for Rs 12,000. It comes with a phone stand, charger, and speaker, and you have the option of using your car's speakers for listening to your caller! Ok, if you don't have that kind of money, you can buy a plain charger with a speaker integrated for around Rs 4,000.

Get Yourself Connected!

Imagine the day something happens to your phone book - a disaster surpassed only by your entire phone getting stolen! In either case, your phone numbers and contact lists are lost, and the process of recompiling them is long and tedious, and may not be entirely fruitful. Wouldn't it be nice if you had backed them up?

We advise you invest in a data cable and keep regular backups of your phonebook. Not all phones support this functionality. You can, however, buy data cables and back up data anyway.

Mobile Phone Data Cable

If your phone does indeed support synchronisation, then it may do so via IR, Bluetooth, and/or via a serial/USB data cable. You may need to buy the data cable if it wasn't bundled with your phone.

If your phone has Bluetooth or IR capabilities, or if you have used an adapter as mentioned above, and you would like to sync it with your PC/laptop, then your PC/laptop should support IR/Bluetooth. You can buy various devices like a USB to IR adapter or a USB to Bluetooth adapter for your laptop if it does not have these inbuilt.

An interesting feature in some high-end PDA phones is that they support Bluetooth cards via the SD I/O (Secure Digital Input/Output) interface. This means that if your device is not Bluetooth-enabled, you can buy a Bluetooth card, which looks like an SD memory card, and attach it to the phone, thereby giving you Bluetooth capabilities - after which you can use a Bluetooth hands-free and sync it to your PC. The same interface supports Wi-Fi too, so you can have your PDA phone Wi-Fi enabled! You can even buy modems that will let you connect to the Internet via your cell phone. In fact, some cell phones come with modems inbuilt!

Power-less?

Battery blues? Your phone obviously came with a charger, but can you use it everywhere? In your car, for example? To charge your phone while you drive, you should opt for a car charger which comes with a cigarette lighter adapter. You just need to take the cigarette lighter out from its socket and insert the adapter, and connect the other end of the adapter to your phone. The phone will charge itself through the car battery.

If yours is a household with multiple phones and not all are Nokia, then you need not carry all chargers on your trips. You can simply buy a multi-charger that has adapters for various cell phone brands!

If you would like to charge your phone wire-free, you can use a desk stand. Put your phone on it, and your incoming calls are routed through the desk stand speakers. A mic will let you talk to the caller!

An interesting Taiwan-made charger from a relatively unknown brand we came across was one that gives you charge when you need it the most, away from any socket whatsoever. This charger does so using 3 AAA cells, and gives nearly an hour of talk time or 4 hours of standby.

Then there is a charger which works on, well, hard work! It's

called the hand charger, and you connect it to your phone on one end and start winding it like a fishing rod.

Another option you could look at is buying a high performance battery. These, although a little costlier than regular cell phone batteries, give talk and standby time on the order of 1.5 to 2 times longer than regular batteries.

Signal Strength

If you frequently travel to areas with low signal strength or are stuck with an operator that has bad coverage, take a look at external antennas. You can attach these to your car, and they connect to your phone wirelessly. They receive the signal, amplify it and send it to your phone, giving it much higher clarity that you would get otherwise.

Other Cellular Goodies

Almost all cell phone manufacturers have now come out with external cameras that you can also use independently. Click photos and share them immediately via your MMS-enabled phone!

Nokia has a device called the Nokia Medallion, which displays the snaps you click. It's more ornamental than functional, and you can wear it as a neckline while displaying the cool photos from your camera, which you can upload to it via infrared.

Travel PAC FM Radio Handsfree

Nokia has also come out with a

Digital Pen. It works without the phone, and you can just scribble on and the data will be stored in the pen. Scribbled notes and handwritten personalised notes can be sent via MMS. This data can be retrieved to your PC once you put the phone back on its stand. The Digital Pen has an integrated camera and Bluetooth.

Another useful but quaint accessory is the Cell Socket. Connect your phone to its cradle, and you can receive cell phone calls on

Caring for your Handset

- Never keep your cell phone near heat and magnetic sources (a gas stove, direct sunlight, speakers, etc.).
- Avoid dropping it - use a wrist strap or a belt clip. Covering your phone (and possibly making it look less attractive) is a more prudent choice than damaging it because you dropped it.
- Get a screen protector to protect the LCD screen from scratches. A screen protector is a thin transparent piece of film that sticks onto the top of the screen and protects it from scratches without affecting readability. Since different phone models have different screen sizes, you'll need to make sure the screen protector you buy fits the screen on your phone. This is especially important for high-end phone models that have large screens capable of displaying thousands of colours.
- Switch the device off if it's not going to be used for a long period of time. This may affect the life span of the battery.
- Keep the device away from dust, moisture and liquids. Avoid taking the phone into areas such as kitchens or bathrooms.
- While charging the device, do not pull the adapter cord out from the device until the main electricity supply is switched off, as doing this could cause a spike that could damage the device.
- Switch off the phone before removing the battery or changing your SIM card.
- Always use the rated accessories specified by the manufacturer for your phone. If, for example, you use a higher power rating for charging your phone, it could get charged faster, but will lower the life of the battery or even damage the phone.
- Avoid exposing your handset to extreme temperatures. Switching the phone on in extremely cold weather may result in moisture formation inside, which could damage the circuits.

your landline, akin to an EPABX. You can charge your cell while you talk using your regular telephone.

A really funky accessory is the Travel Pac Wireless Handsfree Kit. It connects to your phone speaker and beams the voice at any of the two preset frequencies, which you can catch on your FM radio and use your car speakers as a hands-free!

3.7 Great Phones to own!

Samsung SCH-V770

A 7 megapixel camera phone - that's what Samsung's SCH-V770 offers! Launched at CeBIT 2005, the SCH-V770 mobile phone from Samsung is equipped with a 7 megapixel digital camera, and ushers in a new era of digital convergence.

Samsung SCH-V770

While most cell phones today offer cameras with primitive features, the 7 megapixel camera on the SCH-V770 has a level of sophistication seen on standalone digital cameras with a 7 megapixel sensor. Boasting of impressive features such as 3x optical zoom and 5x digital zoom as well as auto focusing, it should offer good results. The SCH-V770 can be fitted with wide-angle and tele-conversion lenses, a first for any mobile phone.

Another interesting first timer on a cell phone is the manual control of camera parameters. The SCH-V770 allows manual adjustment of focus, shutter speed, and auto exposure lock. It also offers shutter priority, aperture priority and fully manual options for exposure control.

The display on the V770 uses a new TFD (Thin Film Diode) LCD

that ensures QVGA resolution on the small display size. The screen can reproduce a breathtaking 16 million colours.

Video on demand (VOD) and music on demand (MOD) are other new features standard on the V770. It also supports a TV-out function for viewing photographs on a TV set. For storing pictures, the phone comes with a 32 MB MMCMicro apart from the internal memory.

Palm Treo 650

The upgraded sibling of the popular Treo 600, the 650 boasts of some significant enhancements that really make this worth a second look. The 650 is not much different in design, dimensions and weight as compared to its predecessor, measuring 11.3 x 5.9 x 2.3 cm and weighing a good 178 gm.

Major upgrades in the new model include a faster processor, an upgraded operating system, EDGE connectivity, a better screen, Bluetooth support, a removable battery and video capture functionality.

The top of the device has the external stub antenna, an IR port, ringer on/off switch, memory card slot with the SIM card tray a little towards the back. The front facia sports the screen, backlit QWERTY keyboard, five-way navigator flanked by dedicated keys for calendar, messaging, send and end keys.

Palm Treo 650

Hardware keys to access applications and menu options are located near the top of the five-way navigation key.

The Treo 650 is powered by an Intel PXA270 312 MHz CPU, running version 5.4 of Palm OS. The quad-band GSM/GPRS device offers about 23 MB of user-available memory - expandable through the SDIO slot. Installed applications include Phone, VersaMail, Web browser, camera, RealPlayer, and World Clock, apart from standard PIM applications. RealPlayer can be used to play MP3 files, though you need to have an SD/MMC card to store the tracks. Bundled applications include DataViz Documents To Go 7, Palm eReader, Zap! 2016, and Handmark Solitaire.

The Treo 650 is designed for one-handed operation using the five-way navigator and other hardware buttons. You do need to use both your hands while typing on the QWERTY keyboard, though! The touchscreen resolution on the Treo 650 is 320 x 320 pixels. Needless to say, the screen vibrance is excellent, with colours reproduced very well. The inbuilt camera with 2X digital zoom captures both stills and videos.

O2 XDA IIi

The upgraded sibling of the XDA II, the XDA IIi boasts of significant enhancements. Featuring the same design and at 200 gms, the XDA IIi is a PDA phone running Windows Mobile 2003 Second Edition for Pocket PC Phone Edition.

Enhancements include added Wi-Fi (802.11b) support, a faster processor (an Intel PXA 272 running at 520 MHz as compared to the 400 MHz CPU in the XDA II), double the ROM at 128 MB, and a 1.3 megapixel camera as compared to the VGA camera on the earlier model. Other specifications include tri-band GPRS, a 3.5-inch 240 x 320 touchscreen supporting 65K colours, 128 MB of SDRAM, an SDIO slot, infrared and Bluetooth v1.2.

The 520 MHz CPU handles most applications, multimedia and games with ease, even while multitasking. Pre-installed applications include Pocket Excel, Pocket Word, Pocket Internet Explorer,

MSN Messenger, Windows Media Player 10, Calculator, Terminal Services Clients, Games (Jawbreaker, Solitaire), Album, Camera, Java MIDlet Manager (J2ME), Photo Contacts, SIM Manager, Wireless Manager, xBackup, PowerPoint and PDF viewer, GPRS Monitor, and O2 Connect. The device connects to a PC via a USB cable and Microsoft ActiveSync 3.8, both of which come in the package.

O2 XDA IIi

Sony Ericsson W800i

In the wake of the Apple iPod's phenomenal success, it was but natural for Sony to revive its once iconic Walkman brand in some form or other. The W800i from Sony Ericsson is the first cell phone to sport the Walkman logo. Except for some cosmetic differences, this phone is an exact replica of the Sony Ericsson K750i.

The new W800i is available in an orange-white combination. Weighing just 100 gm and measuring 100 x 47 x 21 mm, the W800i is light and compact. The 1.8-inch 262K colour screen is bright and crystal clear. The 176 x 220 screen renders colours vividly, and is good for games as well as photos. The joystick and the keypad on the W800i offers good tactile feed back - SMS junkies will love it.

The W800i comes bundled with a classy 2 megapixel camera. On the phone side, the W800i sports GPRS and HSCSD, and offers tri-band support but no EDGE. For short-range communication, Bluetooth, infrared and USB 1.1 are offered. The phone comes with

38 MB of internal memory and a Memory Stick Duo slot which can be populated by the bundled 512 MB card. The of course, there are SMS, MMS and e-mail capabilities. Java 2.0 support means you can install Java-based applications easily.

Powering the device brings up a menu to use it as a phone or media player. Choosing 'media player' increases battery life for longer media playability. To do justice to the Walkman moniker, Sony Ericsson has significantly improved the audio quality on the W800i, and when coupled with the bundled Fontopia ear buds from Sony, this cell phone can match any standalone MP3 player on the market. The player supports MP3 and AAC playback, but there's no support for DRM-protected files.

Sony Ericsson W800i

One good thing Sony Ericsson has done is to include a standard 3.5 mm jack via the headset, which allows you to connect any headphone to the phone or connect the phone to a hi-fi. As on many Walkmans, the Mega Bass feature dramatically improves bass.

Nokia 9500 Communicator

The Nokia 9500 Communicator is graced with a 65K colour display - long, crisp, and perfectly legible even in outdoor lighting. The

Nokia 9500 Communicator

screen is horizontally placed, and is perfect for reading documents and browsing the Net. A sufficiently spacious QWERTY keyboard makes data entry comfortable. Other highlights of the Communicator are integrated Wi-Fi and productivity applications including a word processor, spreadsheet and presentation software.

A device that fares well on contact management, calendaring, and that offers easy e-mail management features, the 9500 offers enough for even the most choosy business executive. The 9500 Communicator lives up to its moniker, sporting a large number of connectivity options: it supports Wi-Fi, Bluetooth, IR, and a proprietary Pop-Port for a USB connection with a PC.

Mobile Phone Features

Number of mobile phone connections has exceeded that of landline connections in India. The mobile has become the preferred mode of personal communication. Apart from connectivity, let's not forget its added features—some are already integrated into the handset, while others are given by the service provider.

4.1 Messaging

Sending and receiving messages has become one of the biggest features used in mobile phones. The total number of messages sent over the airwaves in a year will amount to almost a trillion by the end of this year. This estimate clearly indicates that messaging is the most popular feature used in mobile phones today. The biggest reason for its popularity is cost.

The types of messages that can be sent from your phone also include Multimedia Messaging, and transfer of data using Enhanced Messaging systems. The technologies used to push messages across are also varied, and rely on network proximity.

The connectivity to the Internet of a handheld device may lead to droppped messages. But the lower cost and limited Internet penetration in the mobile space means that messaging will remain the preferred mode of quick communication using a mobile device.

4.1.1 SMS

Short Message Service (SMS) is a service available on most digital mobile phones, which permits the sending of short messages—also known as text messages, messages, or more colloquially SMSes, texts or even txts, between mobile phones, other handheld devices and even landline telephones.

SMS is believed to have been invented by Matti Makkonen, a civil servant from Finland, in 1982. He presented the idea in a pizzeria in Copenhagen, during a conference of mobile phone communications. Initially conceptualised as Message Handling Services, SMS was proposed to be included in the GSM digital mobile phone standard as early as 1984 by Finland, Sweden, and Norway.

Though SMS was originally designed as a part of GSM, it is now available on a wide range of networks, including 3G. However, not all text-messaging systems use SMS, and some notable alternate implementations of the concept include SkyMail and Short Mail, both in Japan. E-mail messaging from phones, as popularised by i-mode and the RIM BlackBerry, also typically use standard mail protocols such as SMTP over TCP/IP, not SMS.

The Short Message Service - Point to Point (SMS-PP) is different as compared to the Short Message Service - Cell Broadcast (SMS-CB), which latter allows messages (advertising, public information, etc.) to be broadcast to all mobile users in a specified geographical area.

Messages are sent via a store-and-forward mechanism to a Short Message Service Centre (SMSC), which attempts to send the message to the recipient, and possibly retry if the user is not reachable. Both Mobile Terminated (MT) (messages sent to a mobile handset) and Mobile Originating (MO) (those that are sent from the mobile handset) operations are supported. Message delivery is the best option, but there are no guarantees

that a message will actually be delivered to the recipient. Delay or complete loss of a message is not uncommon, particularly when sending between networks. Users may choose to request delivery reports that can provide positive confirmation that the message has reached the intended recipient, but notifications for failed deliveries are unreliable at best.

Larger content (known as long SMS or concatenated SMS) are sent over multiple messages. Many would experience this when they receive a rather long message in smaller bits. While the standard theoretically permits up to 255 segments, three- to four-segment messages are the practical maximum, and long messages are billed as equivalent to multiple SMS messages.

Short messages can also be used to send binary content such as ring tones and logos as well. These are dependent on the operator extension of the GSM specification, and there are multiple competing standards—although Nokia's Smart Messaging is by far the most common.

SMS is widely used to deliver premium content such as news alerts, financial information, logos and ring tones. Such messages are also known as premium-rated short messages (PSMS), and subscribers are charged extra for receiving this premium content. The amount is typically split with the mobile network operator and the content provider.

Premium short messages are also increasingly being used for "real-world" services. For example, some vending machines now allow payment by sending a premium-rated short message, so that the cost of the item bought is added to the user's phone bill.

Short message services are developing rapidly throughout the world. In 2004, people around the world sent more than 500 billion messages. The concept is very popular in Asian countries, as we do not have to pay to receive SMSes—unlike our American

counterparts. SMS is used for a number of interactive features in television programmes and radio shows, with the viewer messaging his response. The *Indian Idol* show reportedly received over 18 million text messages during its entire run.

A few widely-publicised speed contests have been held between expert Morse code operators and expert SMS users. Morse code has consistently won the contests, leading to speculation that cell phone manufacturers may eventually build a Morse code interface into cell phones. The interface would automatically translate the Morse code input into text so that it could be sent to any SMS-capable cell phone. This way, the receiver of the message need not know Morse code to read it. Other speculated applications include taking an existing application of Morse code and using the vibrating alert feature on the cell phone to translate short messages to Morse code for silent, hands free "reading" of the incoming messages.

Several cell phones already have informative audible Morse code ring tones and alert messages. For example, many Nokia cell phones have an option to beep SMS in Morse code when it receives a short message. There are third-party applications already available for some cell phones that allow Morse input for short messages.

Because of the limited message lengths and tiny user interface of mobile phones, SMS users commonly make extensive use of abbreviations, particularly the use of numbers for words (for instance, "4" in place of the word "for"), the omission of vowels, as in the phrase "txt msg", or the replacement of spaces with capitalisation. Historically, this language developed out of shorthand used in chat rooms on the Internet, where users would abbreviate words to allow a response to be typed more quickly. However, this became much more pronounced in SMS, where mobile phone users don't generally have access to a QWERTY keyboard as chat room users did, and more effort is required to type each character.

Predictive text software that attempts to guess words (such as AOL's T9) or Eatoni's LetterWise reduces the effort and time required to key in a message. These text software make abbreviations less necessary, and also makes it difficult to type in these abbreviations as compared to regular words, which are in the software's dictionary. However, it does make texts longer, often requiring the message to be sent in multiple parts and therefore becoming more expensive to send.

4.1.2 MMS

Multimedia Messaging System (MMS) is a system of transmitting not only text messages, but also various kinds of multimedia content (like images, audio and/or video clips) over wireless networks using the Wireless Application Protocol (WAP) protocol. MMS is an evolution of SMS. MMS has been designed to work with mobile packet data services such as GPRS and 3G.

The MMS data flow starts with a subscriber using an MMS client on the mobile phone to compose, address, and send an MMS mes-

Multimedia Messaging System (MMS) allows transfer of images, audio and video

sage to one or more recipients. MMS addresses can be either phone numbers of other users capable of receiving an MMS or e-mail.

The initial submission by an MMS client to the home MMS Center (MMSC) is accomplished using HTTP with specialised commands and encoding. Upon receiving the MMS message, the recipient MMSC (MMS Center) sends a notification to the recipient's mobile phone using either an SMS notification, HTTP Push or WAP Push.

There are two modes of delivery in MMS, immediate and deferred.

1. **Immediate delivery**: When the MMS client on the mobile phone receives the MMS notification, it immediately (without user intervention or knowledge) retrieves the MMS message from the MMSC that sent the notification. After retrieval, the subscriber is alerted to the presence of a newly-arrived MMS message.

2. **Deferred delivery**: The MMS client alerts the subscriber that an MMS message is available, and allows the subscriber to choose whether and when to retrieve the MMS message. As with the MMS submission, the MMS retrieval request, whether immediate or deferred, occurs with an HTTP request. The MMSC responds by transmitting the MMS message in an HTTP response to the MMS client, after which the subscriber is alerted that the MMS message is available.

MMS-enabled mobile phones enable subscribers to compose and send messages with one or more multimedia parts. Mobile phones with inbuilt cameras or MP3 players are very likely to also have an MMS messaging client—a software program that interacts with the mobile subscriber to compose, address, send, receive, and view MMS messages.

MMS was originally developed within the Third-Generation Partnership Program (3GPP), a standards organisation focused on standards for the UMTS/GSM networks. Since then, MMS has been deployed worldwide and across both GSM/GPRS and CDMA networks. MMS has also been standardised within the Third-Generation Partnership Program 2 (3GPP2), a standards organisation focused on specifications for the CDMA networks.

MMS faces a few challenges that aren't there for SMS:

Content adaptation: Multimedia content created by one brand of MMS phone may not be entirely compatible with the capabilities of the recipient's MMS phone. In the MMS architecture, the recipient MMSC is responsible for providing for content adaptation (e.g., image resizing, audio codec transcoding, etc.) if this feature is enabled by the mobile network operator. When a network operator supports content adaptation, its MMS subscribers enjoy compatibility with a larger network of MMS users than would otherwise be available.

Distribution lists: Current MMS specifications do not include distribution lists, and neither can the methods by which large numbers of recipients be conveniently addressed, particularly by content providers, called Value Added Service Providers (VASPs) in 3GPP. Since most SMSC vendors have adopted FTP as an *ad hoc* method by which large distribution lists are transferred to the SMSC prior to being used in a bulk-messaging SMS submission, it is expected that MMSC vendors will also likely adopt FTP.

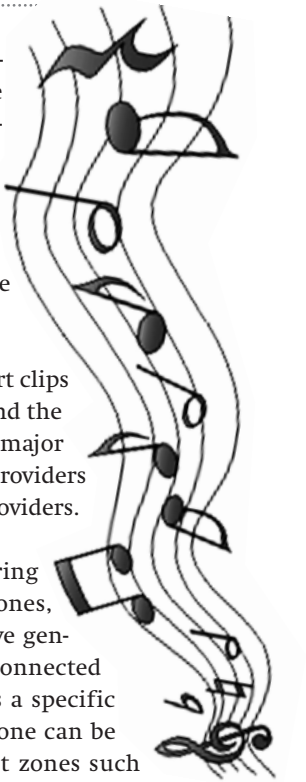
Bulk messaging: The flow of peer-to-peer MMS messaging involves several over-the-air transactions that become inefficient when MMS is used to send messages to large numbers of subscribers, as is typically the case for VASPs. For example, when one MMS message is submitted to a very large number of recipients, it is possible to receive a 'delivery report' and 'read-reply report' for each and every recipient. Future MMS specification work is likely to optimise and reduce the transactional overhead for the bulk-messaging case.

MMS should not be confused with Enhanced Messaging Service (EMS), which is simply Short Message Service (SMS) with additional payload capabilities, allowing mobile phone to send and receive messages that have special text formatting, animations, pictures, icons, sound effects and special ring tones.

4.1.3 EMS

Enhanced Messaging Service or EMS, is an application-level extension to SMS for cell phones available on GSM, TDMA and CDMA networks. An EMS-enabled mobile phone can send and receive messages that have special text formatting (such as bold or italic), animations, pictures, icons, sound effects and special ring tones. EMS messages, when sent to a device that does not support it, will be displayed as SMS transmissions. EMS is a cross-industry collaboration between Ericsson, Motorola, Siemens and Alcatel, among others.

4.2 Ring Tones



A ring tone is the sound made by a telephone to indicate an incoming call. The term is often used to refer to the customisable sounds available on mobile phones. The facility was originally provided just so people would be able to determine when their phone was ringing, when in the company of other mobile phone owners.

Most mobile phones today can use short clips of music or popular songs as ring tones, and the download and sale of these has become a major source of revenue for the mobile service providers as well as independent mobile content providers.

A phone only rings when a special "ring signal" is sent to it. For regular telephones, the ring signal is a 90-volt 20 Hz AC wave generated from the switch the telephone is connected to. For mobile phones, the ring signal is a specific radio-frequency signal. But a ringing phone can be intrusive at times—especially so in silent zones such as hospitals and classrooms. An alternative to a ring tone for mobile phones is a vibrating alert.

There are different types of ring tones depending on the sound played out. The three broad categories are Monophonic, Polyphonic and Music Ring Tones.

Monophonic: Early phones had the ability to play only monophonic ring tones, short tunes played with simple tones. These early phones also had the ability to have ring tones programmed into them using an internal ring tone composer. Various formats were developed to enable ring tones to be sent via SMS

text, for example RTTL encoding.

Polyphonic: Polyphonic means that multiple notes can be played at the same time using instrument sounds such as guitar, drums, electronic piano, etc. Many phones are now able to play more complex poly tones; up to 128 individual notes with different instruments are played simultaneously to give a more realistic musical sound. Mobile phone handsets manufacturers have taken full advantage of new technologies to improve speakers in order to produce better sound quality.

Polyphonic ring tones are based upon MIDI sequences, so they can pool in the 100+ different MIDI sounds. Many polyphonic-capable phones can play standard MIDI files; others play SP-MIDI, which is scalable polyphony, and depending on the number of channels the phone can play, the handset will render those many notes. On an old polyphonic-capable phone, one can play four notes at once, with flashier new handsets being able to render 128 notes at once. Many phones support SMAF (.mmf) files, which are based upon a sound format devised by Yamaha.

Music ring tones: They are a new version of ring tones, often called music ring tones, voice tones, real tones, sing tones or true tones. They use actual pieces of music, along with all lyrics and the entire song backing music, including backing singers. They are usually contained in the AAC, MP3, WMA, WAV, QCP, or AMR formats, which can be used as ring tones on many Series 60 or Symbian phones, and on smartphones. Many cell phone manufacturers, including Motorola, Nokia and Sony Ericsson, are including voice ring tones on most of their newly released phones.

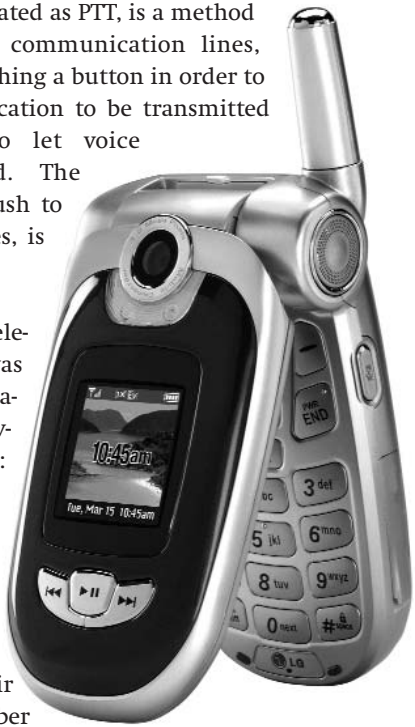
The first real music ringtone was created by Richard Fortenberry and Brad Zutaut and was sent over the Sprint network. They were two of the founders of a company called Xingtone. The ringtone was from a song by the band Devo.

Ring tones, along with operator logos, have proven a popular method of personalising phones—a major industry has popped up to tailor to the needs of people to customise their phones, and newer phones include features to allow users to create their own tones. Many people enjoy personalising their phones, but some find certain ring tones annoying in public and in certain public situations.

Many companies have set up businesses selling ring tones, advertising them on television and Web sites. One criticism of the industry is the subscription some companies lock customers into, requiring them to actively cancel their account or be charged for unwanted messages and ring tones sent to them on a weekly basis. Newer phones equipped with Bluetooth or PC-link up allow users to transfer ring tones created on a PC to their phone for free. The user can even record their own tones themselves and place them on the phone.

In Germany, ring tones are heard so frequently that some species of birds have begun imitating them!

4.3 Push To Talk



Push to talk, commonly abbreviated as PTT, is a method of conversing on half-duplex communication lines, including two-way radio, by pushing a button in order to send, allowing voice communication to be transmitted from you, and releasing to let voice communication be received. The Symbian implementation of Push to Talk, as found on Nokia devices, is commonly referred to as DVS.

One of the earliest mobile telephone protocols used PTT. It was the mobile equivalent of operator-assisted land telephone service. The protocol was as follows: The mobile telephone user pressed and held their PTT (Push-To-Talk) button for several seconds to get the mobile operator's attention. When they released PTT, an operator would reply (transmit on their channel) and ask them the number then wanted. The user would key up (PTT) and tell the operator the number they wished. The operator would dial and connect the landline, and the conversation would proceed. When there was no activity for a while or the landline hung up, the operator could reuse the channel.

The term now more commonly refers to a feature available on certain more recent phone models. It allows the mobile phone, when in a special mode, to function as a digital two-way radio in push-to-talk operation (in a fashion similar to the "trunking" feature of newer commercial and public-safety two-way radios). Only one person at a time can talk, by pressing a PTT button, and one

or several others can listen instantly. The service connects mobile phone users with each other within seconds.

Currently, PTT users have to belong to the same mobile operator's (carrier's) network in order to talk to each other. PTT commonly does not use up the regular airtime minutes that are available for general voice calls; it uses the GPRS connection, on which the amount of data transmitted is billed—not the minutes of conversation.

The Motorola and Nokia versions of PTT are based on 2.5G packet-switched networks (CDMA by Motorola, GPRS by Nokia) and use the SIP and RTP protocols. These particular versions of PTT are called "Push to Talk over Cellular", which is abbreviated "PoC". The Open Mobile Alliance is defining PoC as part of the IP Multimedia Subsystem, and a first version of OMA PoC standard was finalised in first half of 2005. A pre-standard version of PoC is also defined by the industry consortium made up of Motorola, Nokia, Ericsson, Siemens AG, AT&T Wireless, and Cingular Wireless with the aim of creating a commercial offering enabling inter-operability between vendors.

4.4 Mobile Internet And Connectivity

Every new generation of technology challenges our worldview and paradigms. For example, a paradigm shift occurred when people moved from listening to the radio to watching TV. Another example is when people went from using standalone PCs to accessing the Internet on them. It's no surprise that mobility is causing yet another paradigm shift. However, it's important to realise that there is a difference between "being mobile" and "going wireless."

Mobile computing relates to the ability to interact with the device from anywhere, whereas wireless access defines the communication between computers or devices. In mobile phones, voice and text messaging has always been the primary mode of communication. Users can now also share graphics and pictures and even videos, but a normal mobile network has lower bandwidth, thus resulting in lower speeds of data transfer. To add to this, most mobile phones come with limited storage capacity.

The latest PDA models, however, provide an impressive amount of computing power in a small form factor. Also, their high-resolution graphics, handwriting recognition, point-and-click pen interface, and access to office productivity applications are useful tools. Potential learning applications include e-books, games, reference materials, and job aids.

A number of hybrid PDAs are available that combine additional hardware devices and functions, such as camera, cell phone, bar code reader, GPS receiver, and so forth. The increase in the use of high-end mobile phones (technologically advanced not necessarily expensive models) and PDAs has resulted in the widespread use of the Internet on these devices. With protocols designed to take care of the mobile Internet and special browsers designed for handhelds, navigating the mobile Internet has become easy.

4.4.1 WAP

Wireless Application Protocol (WAP) is an open international standard for applications that use wireless communication, for example, Internet access from a mobile phone. WAP was designed to provide services equivalent to a Web browser with some mobile-specific additions, being specifically designed to address the limitations of very small portable devices. It's now the protocol used for the majority of the world's mobile Internet sites, otherwise known as WAP-sites. The Japanese i-mode system is the other major competing wireless data protocol.

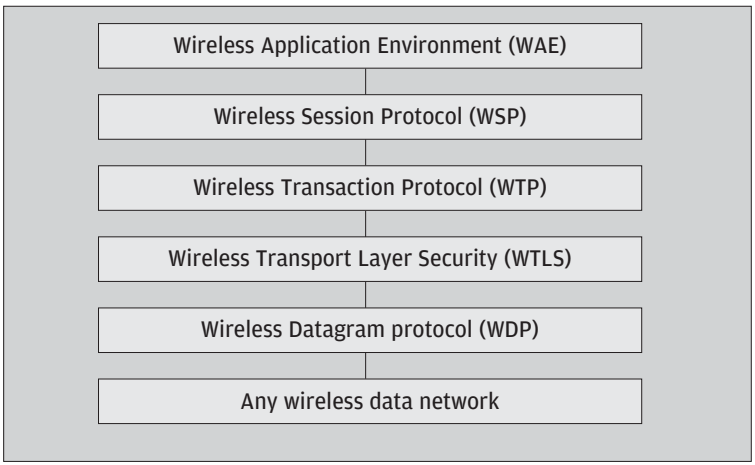
WAP is a protocol suite created for mobile devices such as PDAs and mobile phones, aiming at giving their users a richer data application experience that would enable "access to the Internet," as it was then put. Before WAP became popular, it was nearly impossible for application providers to build interactive data applications that would allow, for example, business people on the go to catch an important e-mail or learn early on that they were losing money on their stocks; neither was it possible to build rich data applications allowing consumers to get sports results and the latest news headlines from their TV. WAP aimed at enabling this type of applications to be built on wireless technology.

Before the WAP protocol was created, wireless handset data application capabilities were limited to rudimentary interfaces such as SMS or USSD, a rudimentary browsing service. Some manufacturers had also come up with their own, proprietary "enhanced" application platforms such as HDML (by Unwired Planet, now Openwave), ITTP by Ericsson and TTML by Nokia. However, to enhance the overall size of their business opportunity, manufacturers decided to join forces on technology and extended an invitation to the rest of the wireless industry in building a common standard for wireless data applications.

The WAP Forum proposed a protocol suite that would allow the interoperability of WAP equipment and software with many different network technologies; the rationale for this was to build

a single platform for competing network technologies such as GSM and IS-95 (also known as CDMA) networks.

The protocol suite can be best understood by the studying the figure below:



The bottom-most protocol in the suite is the WAP Datagram Protocol (WDP), an adaptation layer that makes every data network look a bit like UDP to the upper layers by providing unreliable transport of data with two 16-bit port numbers (origin and destination). WDP is considered by all the upper layers as one and same protocol, which has several "technical realisations" on top of other "data bearers" such as SMS, USSD, etc. On native IP bearers such as GPRS, UMTS packet-radio service, or PPP on top of a circuit-switched data connection, WDP is in fact exactly UDP.

Wireless Transport Layer Security (WTLS) provides a public-key cryptography-based security mechanism. Its use is optional. WTP provides transaction support (reliable request / response) that is adapted to the wireless world. WTP supports more effectively than TCP the problem of packet loss, which is common in

2G wireless technologies in most radio conditions, but is misinterpreted by TCP as network congestion.

Finally, Wireless Session Protocol (WSP) is best thought of on first approach as a compressed version of HTTP. This protocol suite allows a terminal to emit requests that have an HTTP or HTTPS equivalent to a WAP "gateway"; the gateway translates requests into plain HTTP.

In the Wireless Application Environment (WAE), application-specific mark-up languages are defined. The primary language of the WAE is WML, the Wireless Mark-up Language, which has been designed from scratch for handheld devices with phone-specific features. WML is an XML-compliant format. However, since XML documents can take up a lot of room, a specific compression technique for XML documents was developed (wireless binary XML, or WBXML).

There has been considerable discussion about whether the WAP protocol design was appropriate. The initial design of WAP was specifically aimed at protocol independence across a range of different protocols (SMS, IP over PPP over a circuit switched bearer, IP over GPRS etc). This has led to a protocol considerably more complex than an approach directly over IP might have caused.

Most controversial, especially for many from the IP side was the design of WAP over IP. WAP's transmission layer protocol, WTP, uses its own retransmission mechanisms over UDP to attempt to solve the problem of TCP's inadequacy for high packet loss networks.

The new version of WAP, WAP 2.0, is a re-engineering of WAP using a cut-down version of XHTML with end-to-end HTTP, i.e. dropping the gateway and custom protocol suite used to communicate with it. Some observers predict that this next-generation WAP will converge with, and be replaced by, true Web access to pocket devices. Whether this next generation

(Wireless Internet Protocol to mobile) will still be referred to as WAP is yet to be decided. XHTML MP (XHTML Mobile Profile), the mark-up language defined in WAP 2.0, is made to work in mobile devices. It is a subset of XHTML and a superset of XHTML Basic. XHTML MP supports a version of cascading style sheet called WAP CSS.

Other options in WAP such as WAP Push, available since WAP 1.2, have been incorporated into the specification to allow WAP content to be pushed to the mobile handset with minimum user intervention. A WAP Push is basically a specially encoded message, which includes a link to a WAP address. WAP Push is specified on top of WDP; as such, it can be delivered over any WDP-supported bearer, such as GPRS or SMS.

In most GSM networks, however, GPRS activation from the network is not generally supported. So, WAP Push messages have to be delivered on top of the SMS bearer. On receiving a WAP Push, a WAP 1.2 or later enabled handset will automatically give the user the option to access the WAP content. In this way, the WAP Push directs the end user to a WAP address where particular content may be stored ready for viewing or downloading to the handset. The address could be a simple page or multimedia content (e.g. polyphonic ring tone) or a Java application. Using WAP Push, one can make it easier for end users to discover and access new mobile services.

Though WAP was hyped at the time of its introduction, leading users to expect WAP to have the performance of the Web, it is widely believed in the industry that WAP has failed to deliver. One very glaring indication would be the disappearance of the courses started by computer institutes such as NIIT offering specialising in WAP. The failure to deliver has led to WAP being chided and newer acronyms such as “Worthless Application Protocol” supplanting the original acronym.

A number of reasons have been blamed for the failure of WAP to offer what it promised. A large number of critics point towards the WML language, which cut users off from the true HTML Web, leaving only native WAP content and Web-to-WAP content available to WAP users. However, others argue that technology at that stage would simply not have been able to give access to anything but custom-designed content.

Another argument is that under-specification of terminal requirements. In the early WAP standards, there were many optional features and under-specified requirements, which meant that compliant devices would not necessarily interoperate properly. This resulted in great variability in phones' actual behaviour. As an example, some phone models would not accept a page more than 1 KB in size; others would just simply crash. The user interface of devices was also under specified

Constrained user interface capabilities were also touted as a reason for the failure of the protocol. Terminals with small black and white screens and few buttons, as the early WAP terminals were, are not very apt at presenting a lot of information to their user, which compounded the other problems: one would have had to be extra careful in designing the user interface on such a resource-constrained device.

These problems might have been alleviated by a WML authoring tool that would have allowed content providers to easily publish content that would interoperate flawlessly with many models, adapting the pages presented to the User-Agent type. However, while some development kits existed, it was no such "magic software." Developing for the Web was easy: with a text editor and a Web browser, anybody could get started, in comparison, the stringent requirements of the WML specifications, the variability in terminals and the time involved in testing on wireless terminals was considerably lengthened by the lack of widely available desktop authoring and emulation tools.

Some wireless carriers had assumed a "build it and they will come" strategy, meaning that they would just provide the transport of data as well as the terminals, and then wait for content providers to publish their services on the Internet and make their investment in WAP useful. However, content providers received little help or incentive to go through the complicated route of development. Others, notably in Japan, had a more thorough dialogue with their content provider community, which was then replicated in modern, more successful WAP services such as i-mode in Europe or the Gallery service in France.

Most wireless carriers sold their WAP services that were "open," in that they allowed users to reach any service expressed in WML and published on the Internet. However, they also made sure that the first page that clients accessed was their own "wireless portal," which they controlled very closely. Given the difficulty in typing up fully qualified URLs on a phone keyboard, most users would give up going "off portal"; by not letting third parties put their own entries on the operators' wireless portal, some contend that operators cut themselves from a valuable opportunity. On the other hand, some operators argue that their customers would have wanted them to manage the experience and, on such a constrained device, avoid giving access to too many services.

So is WAP a complete failure? Countries that had been using cellular phones for a number of years such as Japan have fairly successful WAP applications. It has also led to the development of alternate systems such as i-mode. Korea is also leading the world in providing advanced WAP services. WAP on top of the CDMA2000 network has been proven to be the state of the art wireless data infrastructure.

From 2003/2004, WAP has made a stronger resurgence with the introduction of Wireless services. Transfer of GPRS and UMTS data, which is a different model to the Web, generates operator revenues and usage is up. People are starting to use

WAP and the early failures have been masked, as the real point of the system—access to wireless services and applications—has come to the forefront. Spin-off technologies such as MMS, a combination of WAP and SMS, have further driven the protocol.

4.4.2 The Microbrowser

A microbrowser (sometimes minibrowser or mobile browser) is a Web browser designed for use on a handheld device such as a PDA or mobile phone. Microbrowsers are optimised so as to display Internet content most effectively for small screens on portable devices, and have small file sizes to accommodate the low memory capacity and low bandwidth of wireless handheld devices. Essentially, they are stripped-down Web browsers.

The microbrowser usually sets up the cellular networks themselves and gets content written in XHTML Mobile Profile (WAP 2.0), or WML (WAP 1.3 which was based on HDML). WML and HDML are stripped-down formats suitable for transmission across limited bandwidth, and wireless data connection called WAP. In Japan, DoCoMo defined the i-mode service based on i-mode HTML, which is an extension of Compact HTML (C-HTML), a simple subset of HTML.

WAP 2.0 specifies XHTML Mobile Profile plus WAP CSS, subsets of the W3C's standard XHTML and

CSS with minor mobile extensions. Newer microbrowsers are full-featured Web browsers capable of HTML, WML, i-mode HTML, cHTML, plus CSS, ECMAScript, and plug-ins such as Macromedia Flash.

So-called microbrowser technologies such as WAP, NTTDocomo's i-mode platform, and Openwave's HDML platform have fuelled the first wave of interest in wireless data services.

HitchHiker is believed to have been the first microbrowser with a unified rendering model, handling HTML and WAP along with EcmaScript, WMLScript, POP3 and IMAP mail in a single client. Although it was not used, it was possible to combine HTML and WAP in the same pages although this would render the pages invalid for any other device. In 1999, Microsoft acquired it, and HitchHiker became Microsoft Mobile Explorer 2.0, not related to the primitive Microsoft Mobile Explorer 1.0.

Released in 2001, Mobile Explorer 3.0 added iMode compatibility (cHTML) plus numerous proprietary schemes. Mobile Explorer development had ceased by mid-2002 and various other microbrowsers by phone vendors made headway in the market and was replaced by the Pocket Internet Explorer.

As mentioned earlier, not only do microbrowsers need to be small in file size, the display screen is also much smaller. Extreme care and meticulous detail must be considered in displaying HTML information onto such a small screen. Bandwidth is also extremely limited and so is the stability. Connections get cut off as with ordinary cell phones and PDAs that are wirelessly connected.

The following are some of the more popular microbrowsers. Some microbrowsers are really miniaturised Web browsers. Hence, some microbrowser makers also provide browsers for the PC.

Default browsers used by major mobile phone vendors

- Nokia Series 40 Browser by Nokia
- Nokia S60 Browser by Nokia
- Web Browser for S60 by Nokia
- Opera by Opera Software ASA (Norway)
- Pocket Internet Explorer by Microsoft

User-installable microbrowsers

- WinWAP by Winwap Technologies (winwap.com)
- Minimo by the Mozilla Foundation
- Palm Web Browser Pro by PalmOne
- Pixo by Sun Microsystems
- Opera Mini by Opera

4.4.3 i-Mode

i-Mode is a wireless Internet service that's hugely popular in Japan. It was inspired by WAP developed in the US and was introduced by NTT DoCoMo, Japan's largest cellular service provider. After a two-year development, i-Mode was launched in Japan in February of 1999.

Opposed to the WAP standard which utilises WML on top of a specific protocol stack for wireless handheld devices, i-Mode borrows from fixed Internet data formats such as C-HTML, as well as DoCoMo proprietary protocols ALP (HTTP) and TLP (TCP, UDP). It became a runaway success because of the well-designed services and business model, as well as the strong need at the time for a text messaging service.

i-Mode is now a global ecosystem where operators design the compatible handsets, give strong editorial and usability rules to content providers, and propose an open business model to them. i-Mode uses open standards as technologies: a light version of HTML is used for producing content, and i-Mode mail is interoperable with e-mail, images and sound formats used on the Web. i-Mode users have access to various services such as e-mail, sports results, weather forecasts, games, financial services and ticket booking.

i-Mode phones have a special i-Mode button for the user to access the Start menu. There are numerous official sites—and even more unofficial ones—that can be made available by anyone, using HTML and with access to a standard Web server. NTT DoCoMo supervises the content on the official sites and they are often commercial. These official sites are accessed through the menus, but the unofficial site addresses may be typed manually or through the use of OCR functionality with the now ubiquitous mobile-camera. An i-Mode user pays for both sent and received data.

4.4.4 Bluetooth

Bluetooth is an industrial specification for wireless personal area networks (PANs). Bluetooth provides a way to connect and exchange information between devices such as personal digital assistants (PDAs), mobile phones, laptops, PCs, printers and digital cameras via a secure, low-cost, globally available short-range radio frequency.

Bluetooth is a radio standard primarily designed for low power consumption, with a short range and with a low-cost transceiver

microchip in each device. Bluetooth lets these devices talk to each other when they come in range, even if they are not in the same room, as long as they are within up to 100 metres (328 feet) of each other. Most smart phones and PDAs sold nowadays are compatible with the Bluetooth technology.

4.5 Camera Phones

A camera phone is a cell phone which has an inbuilt camera. The world's first camera phone was the J-SH04 by Sharp Corporation in Japan in November 2000. The cameras used in cell phones typically use CMOS image sensors. This is due largely to reduced power consumption compared to CCD-type cameras. Major manufacturers include Nokia, Samsung, Motorola, Siemens, Sony Ericsson, and LG Electronics. Typically, a camera in a mobile phone has a range of up to 2 megapixels. Samsung Electronics unveiled the world's first 8-megapixel camera phone, the WCDMA SPH-V8200, but as far sale of camera phones are concerned it is the ones with 2-megapixel cameras that sell.

The popularity of camera phones has far exceeded that of standalone digital cameras. Newer camera phones are also compatible with photo printers, and printouts of the pictures you've taken can be had really fast. As of early 2005, camera phones were already outselling digital cameras by a factor of four.

As a network-connected device, megapixel camera phones are starting to play significant roles in crime prevention, journalism and business applications. On the other hand, they are prone to abuse such as voyeurism and invasion of privacy.

Camera phones have led to the rise in mobile blogging that has

people putting up blog posts using cellular phone cameras. Some newer camera phones are also videophones, and can transmit videos and video calls. Camera phone video and photographs taken in the immediate aftermath of the 2005 London bombings was featured worldwide. CNN executive Jonathan Klein predicts camera phone footage will be increasingly used by news organisations.

Some organisations and places have started to ban camera phones because of privacy and security issues. Saudi Arabia has banned the sale of camera phones nationwide (although pilgrims on the Hajj are allowed to bring in camera phones). South Korea requires that all camera phones sold in the country make a clearly audible sound whenever a picture is taken. In Singapore, camera phones are banned in companies or facilities that have an association with national security.

One of the major drawbacks of a camera phone is image quality. To get the best from your camera phone, you might like to incorporate some of the following tips into your routine:

Use the highest resolution possible: It goes without saying, really (but we like to state the obvious!) that the higher your resolution, the clearer your shot will be. This is especially true for camera phones, which often have sensors of less than 1 megapixel. The highest resolution increases the file size, though, and therefore the time required to send photos.

Edit images later: While it can be fun to use your camera phone's inbuilt editing and effects, editing pictures later on your PC produces much better-quality images. Take your shots in colour at high resolution to keep your options open on how to treat it later. You can always make it black and white later, but you can't make it colour if you shoot it in B&W mode. Moreover, your phone's screen will never be as good as your computer's. So, if possible, hang onto your shots until you can get them onto your PC.

Choose well-lit subjects: The better lit your subject, the clearer your image is likely to be. If possible, shoot outdoors, or turn on the lights when shooting inside. Be aware that different lights impact the colour in your images differently.

Get Close: One of the most common problems with camera phone images is that the subject ends up being a tiny, unrecognisable object in the distance. Camera phone images tend to be smallish due to the low resolution—so you can afford to fill up your viewfinder with your subject to save having to zoom in on the subject in editing it later. Having said this, getting too close on some models creates distortion—either the fish-eye effect or lack of focus.

Don't use digital zoom: Digitally zooming in on your subject will decrease the quality of your shot. You can always edit your shot later using photo editing software on your computer.

Soft Talk

Different mobile phone manufactures use different software and operating systems—be it Symbian, Windows or Linux. Accordingly, the applications used on the phones vary, and so do the games, from the free ones to those that can be downloaded. This chapter tells you all there is to know about phone operating systems with some links to popular downloads.

Before operating systems were realised on mobile phones, the task of handling the features on a phone was carried out through tedious assembly language programming. Early phones had dot-matrix LCD screens; the number of lines and characters were the specifications by which one screen was graded over the other, and so was the phone in the same respect.

The development on hardware such as advanced microcontroller chips which were not only fast but also supported high-level language (C++ and JAVA) programming and easy interfacing of additional devices such as a camera led to the era of feature-rich mobile telephony. The operating system was a result of these basic developments; mobile applications and games followed with the development of the OS.

The microcontrollers or microprocessors used in a mobile phone need to be programmed to perform their various tasks. This leads us to embedded programming, a technique by which microcontrollers and microprocessors are coded using either low-level languages such as assembly language (family of the 8051 command set) or high-level languages (such as C, C++ and Java). The implementation of high-level languages made it easy to encode programs for complex functionality, which is otherwise a very tedious task using assembly language.

Using high level languages, a programmer can either develop an embedded code for the functioning of the mobile phone, or can develop an OS if the hardware resources (memory capacity and processor) employed on the phone can handle it. High-level languages can also be used to develop applications and games.

This task can also be carried out by good use of Software Development Kits (SDKs). Operating systems such as Symbian OS, Windows Mobile and Linux are battling it out to be the prominent player for mobile phones.

5.1 Operating Systems For Mobile Phones

Operating systems for mobile phones can be classified into the proprietary and open-standard categories. Symbian is an open-standard OS, not to be confused with open source. An open OS can address the diversity in phone hardware, and it can also handle changing market needs. Phone manufacturers can buy the license for such an OS to freely implement phone-specific changes. Proprietary OSes such as Windows Mobile are specifically designed for phones that use a specific set of hardware. Linux has also entered the mobile OS market, and was well received in China. Moreover, due to its open architecture, Linux can also be easily altered by phone manufactures to support their model-specific features.

5.1.1 The Symbian OS

Symbian, a software development and licensing company, was established in 1998 with its headquarters in the United Kingdom. The company's founder shareholders were Psion, Nokia, Matsushita (Panasonic), Ericsson and Motorola. Symbian develops and licenses the Symbian OS, an OS for data-enabled mobile phones. However, a third party provides the User Interface (UI) layer for this OS. The shareholders and licensees put together constitute a major proportion of the mobile phone manufacturers; this helped Symbian gain popularity. But that wasn't the only reason for its widespread acceptance: Symbian follows an open structure, by which the licensees can easily and at will make necessary changes and add their own UI to match their phone model's technical specifications.

The incessant increase in user requirement in a mobile phone has signalled the limits of proprietary OSes adopted by early mobile phone manufacturers. The mobile phone market is dominated by brands, and not the operating system that goes into it. People are not aware of, and are not bothered about, the OS or the amount of work done to develop it. Conversely, the user demand has brought about the change in the functioning of a mobile

phone and all the new feature sets. EPOC, an OS developed by Psion software in the UK, slowly evolved into the Symbian OS with the help and foresight of the leaders in the mobile phone industry way back in 1998.

The Symbian OS was designed to support the next-generation mobile phones—not the ones that were available when company was founded. The flexibility of the Symbian OS was obvious right from the first open Symbian OS phones—the Sony Ericsson P800, the Nokia 9200 series and the Nokia 7650. These phones were very different from each other despite their using the same OS; this reveals how a mobile manufacturer can implement their ideas freely on a Symbian.

Nokia 7650 and Sony Ericsson P800 running same Symbian OS but with different (customised) User Interface

With support from the open source community, the Symbian OS has been able to provide licensees with cost-effective solutions. In this way, feature-rich mobile phones have been made available to the masses at affordable rates.

The new Symbian OS v9 uses different IDEs or compilers to develop OS functionality and applications based on the type of phone and target audience. It supports ARM's RealView compiler, Code Warrior v3.0 IDE, free GCC 3.4 compiler and the new, free Eclipse-based IDE for the purposes mentioned above. In order to make things a bit clear, let's take a look at how these compilers/IDEs are used.

The Eclipse-based IDE was designed by Symbian to develop phones for the entry level market. Phones for professionals work-

ing with high-end applications are developed using 'Code Warrior for Symbian OS' (version 3 IDE) as it offers a comprehensive set of features for device integration, applications and game development projects. ARM's RealView Compiler Tools (RVCT ver2) is a high-performance compiler that enables substantial improvement in performance of key phone features such as graphics, multimedia, cryptography, artificial intelligence and other computational requirements, especially for gaming applications.

5.1.2 Windows Mobile

Unlike the Windows most people know about, Windows Mobile is a compact OS for mobile phones based on the Microsoft Win32 API. Its design is similar to the popular desktop version of Windows; the similarity is intentional, to facilitate easy adaptation for users.

Windows CE is an OS for minimalist computers and embedded systems. WinCE has a distinctive kernel that supports Intel x86, the ARM family and Hitachi SuperH processors. The reason we're talking about WinCE is due to the confusion between Windows Mobile and WinCE. Many think they are the same, or that Mobile is a development over CE. That's not entirely true.

Windows Mobile can be described as a subset of the platforms based on Windows CE. Windows CE is a modular OS that serves as a foundation of several classes of devices, which means that some of the sections of CE provide component features for other OSes. Hence, a sub-section of WinCE's modular feature set was used to devise Windows Mobile for Pocket PC, SmartPhone, and Portable Media Center.

Windows Mobile 2002 was the first one under the Windows Mobile banner and was powered by Windows CE 3.0. The next version—Windows Mobile 2003—was split into three categories: Windows Mobile 2003 for Pocket PC, Windows Mobile 2003 for

Pocket PC phones and Windows Mobile 2003 for smartphones. Despite the similarity in looks, they differed so much in platform that software applications had to be designed specifically for a device type (i.e. either Pocket PC or SmartPhone). Powered by Windows CE 4.20, the SmartPhone version of Windows Mobile 2003 did not have a touch screen, had a lower-resolution display and a regular phone keypad... all suiting single-handed usage.

Windows Mobile has sports a user interface identical to Windows XP

Code-named Magneto, Windows Mobile 5.0 is the popular OS for PDAs and smartphones in recent times. Windows Mobile 5.0 was launched in May 2005. If you're wondering about the nomenclature of this Windows Mobile version, allow us to ease your thoughts: Windows Mobile 5.0 shares its name with the WinCE 5.0 that powers its performance. Mobile 5.0 also uses .NET Compact Framework 1.0 SP2 to support those programs based on .NET.

Other features included in Windows Mobile 5.0 are:

- Office Mobile, a new version of the Office package specifically built for mobile devices. This includes Excel Mobile, Word Mobile, and finally, PowerPoint Mobile.
- Windows Media Player 10 Mobile efficiently plays back almost all media formats.
- Photo caller ID and the Picture & Video package to manage all video and picture files.
- Support for Bluetooth has been enhanced in this version.
- A management interface for GPS to all navigation programs has been incorporated.
- ActiveSync 4.0 increases synchronisation speed by 10 to 15 per cent. An error reporting facility similar to that on desktop models has been included.

- The most important feature: Persistent Storage (PS) is now supported to increase battery life, and battery power is also reserved to maintain data in the RAM to avoid any loss of data due to power failure.

5.1.3 Linux On Mobile

The open source community's most talked-about offer to the computing world is the Linux OS, be it desktops or microcontrollers. The idea behind open source is to give anyone the freedom to download the source code, learn, debug and develop new code for themselves and the community. This greatly helps the debugging process of an OS, thus providing a robust, error-free OS. Developing OSes are tagged as 'unstable versions', which means that the debugging stage is still incomplete. The final release is tagged as the 'stable version'. The same thing goes for desktops as well as microdevices such as mobile phones.

Mobile manufacturers are making efforts to develop better Linux versions for mobile, or rather telecommunication, devices. As Linux is open source, they do not have to purchase a license. This will also result in a price competition, as the cost of production of Linux-based mobile phones will be lower, so more features can be provided to the buyer.

Developments to this effect happened independently, and the movement did not gather much momentum. As a result, there were few mobile phones powered by Linux. Open Source Development Labs (OSDL), an industry consortium, has taken the initiative to spur the development of Mobile Linux and related applications, and host open source projects for the same.

The first highly optimised Linux OS for smartphones, called Mobilinux, was developed by MontaVista Software, a company in California that develops system software and embedded Linux for consumer and automotive electronics. Based on open source and open standard (like Symbian), Mobilinux was devised to provide scalability and maximise the battery life of single-chip mobile phones. The Kernel used is 2.6, and has a boot time of less than one

second. The GUI is based on TinyX and GTK+ technology. Like Symbian, MontaVista also provides an IDE based on Eclipse, called the MontaVista DevRocket. Other competitors in the Linux Mobile OS category are Wind River Systems, LynuxWorks and PalmSource.

High end Mobile Phones running Linux OS (Mobilinux)

Wipro, one of India's largest IT consulting firms, has successfully deployed its Linux-based Aqua mobile phone reference framework on Renesas' SH-Mobile line of application processors for 2.5G and 3G mobile phones.

Mobilinux or MontaVista Linux has been successfully implemented in Motorola, NEC and Panasonic phones. Linux is the newest entrant to the OS war arena. We will have to wait and see what it can deliver and how far it lives up to its expectations.

5.1.3 BlackBerry

BlackBerry is a name associated with mobile technology, which primarily deals with sending and receiving e-mails via a mobile network. BlackBerry is a line of mobile e-mail devices and services from Research In Motion (RIM). It uses 'push-based technology' that automates delivery of data between a wireless device (supporting the Blackberry service) and your mailbox, address book, calendar and so on. The handheld Blackberry device can also double up as a mobile phone.

A Canadian company, RIM manufactures the hardware (BlackBerry handheld devices) which is resold by cellular phone companies worldwide. The processor used in this device may be an Intel 80386, ARM 7 or 9 or the recently announced Intel XScale, in chronological order. The QWERTY keyboard and track-wheel with

a button form the input devices. Most of the recent devices have high-colour LCD display; the earlier ones were greyscale.

RIM provides a proprietary OS that's specifically coded for maximum functionality from the device. Any third party can write programs for the device using the BlackBerry APIs, but use of certain restricted functionality must be digitally signed so that it can be associated with a developer account with RIM; however, this does not guarantee the quality and security of the program.

Integration of BlackBerry with an organisation's e-mail system can be established by a support software called BlackBerry Enterprise Server (BES). It's a big advantage for organisations that have multiple wireless users. This software helps in synchronisation of these networks and also keeps employees updated with recent e-mails. BES also provides TCP/IP connectivity proxied through Mobile Data Services (MDS) to its handheld devices.

Many universities in the US and the UK have established BES integration with Microsoft Exchange Server to redirect e-mails to BlackBerry devices at the universities' campuses.

This technology is designed to suit professionals, executives and organisations that need constant Internet access through a device that is a combination of a PDA, mobile phone and laptop.

In India, only Airtel provides BlackBerry service. The integration of Blackberry with an e-mail account is done through secure GPRS connectivity.

5.2 Application Development Platform

Many software, application and games are developed for mobiles phones and PDAs using application development platforms such as Java and BREW. Applications on a mobile phone are generally developed by the manufacturer of the device, or a third party. You, too, can develop applications and games for your mobile. All you need is a PC-to-mobile interface and in-depth knowledge of programming and your device's architecture. But, if the software you develop doesn't match the device architecture, it will hamper the functioning of the device.

5.2.1 JAVA Platform—Micro Edition

Java ME or J2ME is a set of JAVA APIs meant for programming of an embedded system device such as mobile phones and PDAs. Java has become increasingly popular for creating games and applications for such devices because it is platform-independent, and has specific set of profiles and configuration that adhere to a family of device. For example, 'Mobile Information Device Profile' is targeted at mobile devices such as cell phones, and 'Personal Profile' is meant for consumer devices such as set-top boxes and PDAs.

Profiles form a superset of Configurations. A Configuration is a set of Java classes and libraries. There are two types of Configurations: Connected Limited Device Configuration and Connected Device Configuration. The former contains a strict set of libraries and Java classes, which is minimal requirement for a Java Virtual Machine to operate; the latter contains almost all the libraries that are not GUI-related.

J2ME also includes a modular set of Optional Packages that offer standard APIs for using both existing and emerging technologies such as database connectivity, multimedia, Bluetooth and Web services. The modular structure of these packages helps avoid unnecessary functionality by including only those packages and applications actually required by a device.

We will look at the games and applications based on Java later on in this chapter.

5.2.2 BREW

We have dealt with Java and its role in mobile telephony, but there is one more platform for application programming—BREW, which stands for Binary Runtime Environment for Wireless. It is air-interface independent, i.e. it supports GSM/GPRS, UTMS and CDMA. However, when BREW was first introduced, it was developed solely for CDMA handsets.

BREW provides solutions for wireless application development in a variety of languages such as C/C++, Java, XML etc. Device configuration and billing/payment are also facilitated by BREW. The complete solution package includes the BREW SDK for application developers, client software and porting tools for device manufacturers, and the BREW Delivery System (managed by operators).

There is a misconception that BREW is in competition with Java. The truth is that BREW supports all programming languages including Java. The BREW client acts an extended platform for other programming languages and environments (such as JVM). Any type of browser (HTML, WAP, cHTML) can run on BREW as an application. This flexibility helps incorporate a wide range of applications.

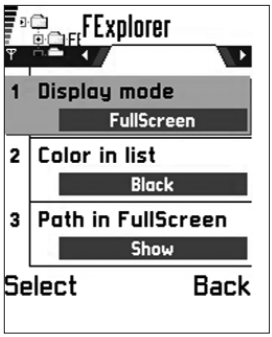
BREW runs between the application and the wireless device's chip operating system. This enables a programmer to develop applications without having to code for system interface or understand any wireless application. That's not all. The most important advantage of this platform is that it eliminates the hassles of modifying an application with every new phone model or network, thus decreasing the application development cost. All these are true only for a BREW enabled phone (according to Qualcomm, the creator of BREW).

5.3 Mobile Applications

So far, we've seen the diversity in software and OSes adopted by different mobile manufactures, and also across different models of a particular manufacturer. Applications for mobile phones thus vary depending on the OS and platform used. Most Java applications are platform-independent; they can work irrespective of the type of OS on a mobile device.

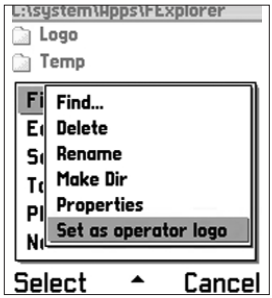
5.3.1 Symbian Applications

When downloading an application for a Symbian phone, you need to verify whether the application suits your phone model. The file extension of a Symbian OS application is '.sis'. For installing an application, you need to have your phone's data cable and the software provided by the manufacturer to communicate with the mobile device. Double-clicking on the .sis file will start a wizard that will guide you through the installation procedure. We take a peek here at some of the applications in different categories.



FExplorer is a popular Symbian application for file exploration

FExplorer is a one of the widely-used and popular downloads under the Symbian apps umbrella. This file browser not only browses through the files in your mobile device, it can also copy, edit and delete files with ease. FExplorer also displays the type of storage (whether RAM, Flash or disk; this depends on the mobile device). FExplorer is therefore something like Windows Explorer for mobile phones. One of its unique features is that you



The navigation menu of FExplorer is similar to that of Windows Explorer

can restart a mobile phone just like you can restart any OS on a PC. The file transfer feature of this browser is very user-friendly; all you need to do is choose a mode of transfer (iRDA, BlueTooth, E-mail etc.).

UltraMP3 can play multiple music formats

You can download FExplorer from www.gosymbian.com/fexplorer_ new.php

UltraMP3 is the most sought-after music player to play MP3 files on mobile phones. It sports a cool GUI. UltraMP3 loads and plays music in the MP3 and OGG formats; it also plays back module music formats—MOD, XM and S3M. The built in playlist editor allows a user to arrange music files. Users can easily change the skin of the player for a unique look!

ReadM is an excellent e-book reader, and it also supports a variety of popular text and audio formats. It can read text within GZip (not Zip) archives. You can configure the settings for viewing in landscape mode, controlling the backlight timeout, and for auto text-scrolling. Its capability to play back MP3 is an added advantage.

Keep in touch with friends and relatives while on the move—that's exactly what ProfiMail can do for you. It is a powerful E-mail client for your mobile phone; it can send text messages with attachments even with recorded sound. The package is bundled with an in-built image viewer, file explorer and file attachment interface. The client supports POP3/IMAP/SMTP mail servers.

Links:
http://www.muskurahat.com/mobile/symbian_applications/
http://www.allaboutsymbian.com/reviews/all/Applications/
http://www.pdazone.net/symbian/symbian_applications.html
http://www.symbos.com/live/
http://my-symbian.com/main/index.php

http://groups.yahoo.com/group/symbian_zones/
http://gallery.mobile9.com/f/15016

5.3.2 Windows Mobile Application

Windows Mobile is a proprietary operating system, so most of the applications are built and loaded in the devices themselves. You can still download different applications on your Windows Mobile-based PDA or smartphone to try them out, but there aren't too many free applications available.

Resco Explorer 2005, a file manager, is very similar to Windows Explorer. Notable features include an FTP browser, file encryption, file compression, an in-built picture viewer and a Registry Editor. Downloading and installing the Today plug-in will enable you to explore memory status, launch favourite applications and/or documents, get battery status and acquire details of the storage card on a single main screen.

Although Windows Mobile 5.0 comes with Windows Media Player 10, older versions can take advantage of a third-party music player by PocketPC magazine—PocketMusic. The advantage this player has over WMP is AAC (iTunes) playback capability. It also supports OGG, MP1, MP2, MP3 and WMA. PocketMusic can wake you up to your favourite music. And that's not all... Winamp skins and playlists are also supported!

Pocket MSN is as good as the regular MSN

You can stay in touch with your pals on MSN; all you need to do is download and install Pocket MSN, which, unfortunately, happens to be paid software. This application is meant for Windows Mobile-based Pocket PC phones. Through this, you can customise your device to access your Hotmail account; the mails will be downloaded to a dedicated folder. The inbox will be updated in real time. On the messenger, your contacts can see you as online and

mobile; you can chat or talk with your online friends and even e-mail those who are offline.

Opera released its latest Opera 8.5 browser for Windows Mobile smartphones. It is based on Opera's latest core technology, which offers more speed, better usability, and rich display content without sacrificing on security. This version is free to try; the trial period lasts for 14 days. You can download this fast browser for your mobile phone from http://www.opera.com/products/mobile /products/winmobile/

Note: The Opera browser is also available for other phones such as the S60 (SymbianOS) series and Linux phones.

Links:

http://www.microsoft.com/windowsmobile/downloads/default.mspx

http://www.pocketgear.com/

http://www.pocketpccity.com/

http://www.handango.com/home.jsp?siteId=1

http://www.beiks.com/pocketpc/

5.3.4 Java Applications

Phones that are low on hardware resources cannot accommodate an OS. Such phones run on Java, and the applications and games loaded (or that can be loaded) have to be programmed in Java. Applications based on Java have .jar (application) or .jad (application descriptor) extensions, and are collectively termed 'Midlets'. If you've downloaded the Midlet to your PC, use the appropriate data cable to transfer it to your mobile phone.

Midlets can be installed using an MIDP emulator, such as the J2ME Wireless ToolKit available at http://java.sun.com/products/j2mewtoolkit/download.html. You can also download applications directly to the device using a WAP browser. Let's look at some handy Midlets for your Java phone.

Remember, the phone may or may not have an OS, but Java applications can be installed on any phone that has the Java Virtual Machine running on it.

Internet connectivity through a mobile phone is gaining popularity and so are the browsers. jBrowser from Jataayu is a browser that supports WAP 2.0. It can effectively handle various displays, handle input/output capabilities and network capabilities on devices. It allows users to create bookmarks and navigate through the history of previously visited sites. Supported networks include GSM, CDMA, GPRS and 3G.

μmessenger by μppli (http://www.uppli.com/) is an easy-to-use J2ME MSN e-mail client; you can directly download it by feeding 'http://www.ublog.it/ota/umsg.jad' to your WAP browser, or you may download the files from the homepage to your PC and then transfer them to your handheld device via Bluetooth, infrared or data cable. Note that the client is a trial pack that expires in 15 days. μmessenger facilitates chatting with your online friends; it can also send e-mails to your contacts.

Visit GetJar (www.getjar.com/software) to download free/shareware Java software based on specific phone models. This site is a Mecca for mobile applications, especially Java—hence the name GetJar. The applications are categorised into Browser, E-mail, Graphic, Messengers, Travel, Utilities, and many more.

Links:
http://www.java.com/en/mobile/applications.jsp
http://www.getjar.com/software
http://www.firthsoftware.co.uk/
http://www.jfind.com/listings/2722.shtml

5.4 Mobile Games

Phone manufacturers usually provide some games with their phone; for instance, *Snake* is a popular game associated with Nokia phones. But the factory games were never sufficient for users, and with the advent of GPRS, more and more games have become available. GPRS facilitates easy transfer of data wirelessly to the user's handheld device. These games focus more on the gameplay, and the developers try to get users hooked. In India, subscribers can download games from their respective service providers. The most popular downloads from service providers (via GPRS) are based on themes such as racing and Bollywood.

5.4.1 Java Games

As mentioned earlier, Java-based games can be installed on any mobile phone that runs the Java Virtual machine. The only care that should be taken before downloading a game is to verify any limitations with respect to the phone model. Let's check out a few Java games...

Created by Sun Microsystems, the *Air Gunner 1.0* is an air battle game in which you have to spot and gun down all enemy space ships. The difficulty increases as the game proceeds. It's a simple game to kill time, and also provides wholesome entertainment.

Shooting objects falling from the top of the screen has been around ever since the monochrome PC, an era when mobile phones did not exist. Now, variants of this game are available for mobile phones created by different authors. *BattleBots 1.0* is one such game created by Sun Microsystems. The objective is to destroy the enemy tanks and disallow them from crossing the baseline (of the screen).

BrickChampion is a clone of the famous flash game *Arkanoid*. The goal is to eliminate red bricks by manoeuvring a ball through a stack of bricks. When the ball touches a non-red brick, the colour of that brick changes, sometimes to red. You need to change as many bricks as possible to red, simultaneously eliminating them.

There are thousands of such games spread across the freeware, shareware and demo categories. Some games also vary with the phone model. All these games can be downloaded from www.tagtag.com; click on tagtag.java to access everything that's Java for mobile phones. Sun Microsystems, too, has a site devoted to Java applications and games: www.java.com/en/mobile/

WWE:Aftershock, **the latest in N-Gage games**

5.4.2 N-Gage games

Nokia's N-Gage has been the phone most of us consider as the ultimate gaming phone. It gives users the 2D and 3D gaming experience on a handheld device. There are many sites dedicated to providing N-Gage games. The official site for N-Gage is www.n-gage.com, hosted by the makers—Nokia. You can get a free demo from the site, and if you like the game, you can also go ahead and buy it!

Some of the most popular games are actually remakes of PC games such as *FIFA*, *Splinter Cell, Tomb Raider* and so. The gaming category varies from strategy to role playing. The best feature about gaming in N-Gage is that you can challenge anyone who owns an N-Gage into a multiplayer game via Bluetooth. Take advantage of GPRS connectivity and go online with N-gage Arena, wherein you can compete with gamers all over the world. Besides games specifically designed for N-Gage, users can also download and play Java and Symbian games at the N-Gage site. Latest releases for N-Gage include *Prince of Persia, WWE Aftershock, X-Men Legends, Worms World Party* and *Splinter Cell—Chaos Theory*.

Links:

N-Gage has created a community of its own, and there are sites that have dedicated Web pages for N-Gage games. A few of them are:

http://ngage.gamespy.com/
www.gamespot.com/mobile/index.html
www.ngageworld.com/

5.4.3 Symbian Games

All application and games for Symbian phones come in the .sis format. There are a lot of games available for the Symbian platform, and most of them are demo versions. Free games are also available on the Internet, but they may not be that entertaining! Game packs that contain a bunch of small games are also available for download from sites that are devoted to Symbian. Games available for Symbian handsets may vary from adventure to time-killers. Some games are handset-specific; some work on several handsets. Let's check out a few popular games for Symbian.

Binary Graffitti has managed to capture gamers' attention by their latest release, *Chaos Realms*. The game is laden with adventure. You're expected to search for a golden key in the initial levels to unlock a trap door to enter higher, difficult level of dungeon demons. Armours, shields and food are available at stages.

ButterFlight is a free-to-try game from Absolutist.com. It is bright, colourful, time-killer in which your goal is to collect butterflies of a particular colour in every round. Disturb the butterflies sitting around to get those of the colour you want to collect!

Tomoe—Massacre at Shinano is a full-fledged action game based on a story of a female samurai called Tomoe. She is known for her supremacy in archery and sword fighting, which explains the weapon choice of a sword and a bow. Her skilled archery is bolstered with a range of seven different arrows. This game is an awesome entertainer for those who like action.

Tomoe **is an action game for Symbian phones**

You can also download fantastic games from Indian providers; the cost of the download may vary from Rs 15 to Rs 100. Mauj.com is a portal that provides various mobile products via SMS. Some of their action-packed games are *Melt Down, Terra Force, FasTen* (strategy) and *Midnight Robotech* (arcade).

Every game has a code number; SMS the code number to 7007 to download the game to your device.

Links:

http://www.pdazone.net/symbian/free_download_symbian_games.html
http://absolutist.com/symbian/
http://www.clickgamer.com/symbian.htm
http://www.imserba.com/free-symbian-games.html
http://www.phelios.com/symbiangames/
http://www.searchamateur.com/Symbian-OS-Software/Symbian-Games.htm
http://www.pdaapp.com/Symbian-Games.asp

5.4.4 Windows / Pocket PC Games

Almost all the Pocket PC running Windows mobiles use the FAT file system. The software installers are in the familiar .exe format; thus games are also of the same extension. Games for Windows Mobile-based handsets are available at Microsoft-recommended sites. Go to www.microsoft.com/windowsmobile/downloads/pocketpc.mspx to check the sites from where you can download games.

Installation of a game can be done either from a PC or directly from the handset. Download the installer to your PC and execute it. The installation will set up the files on your hard disk; remember that your Pocket PC should be set in sync to your machine via the data cable (cradle). The software will transfer the necessary installer to your handset; you can select the installation media (main memory or storage card). A soft reset may be needed after the completion of installation.

To install directly from Pocket PC, you will have to transfer the files from the computer to your handset using the ActiveSync software and a cradle (the cable to interface the handset to PC). Navigate to the installer using File Explorer, choose the installer file, and run it.

Next, let's look at some games available for Windows Mobile at their official sites, PocketGear.com and Handango.com.

EA sports's *Madden NFL 06* is rated as the most sought-after game. Just about 3.4 MB in size, this game sports good graphics and intelligent gameplay. It requires 6 MB of free program memory, and is compatible with both Windows Mobile and Pocket PC Phone Edition.

Madden NFL 06 **is an addictive game for Windows-based mobiles**

Razzing is an inexpensive, yet thoroughly enjoyable game. It needs a StrongARM or XScale processor with 5 MB of free program memory to run. The 24 levels showcase an intuitive and colourful interface with great music and sound support. This game will give you hours of addictive fun!

Virtual Pool is the best selling Windows Mobile game, and is also the winner of PocketPC magazine's 'Best Simulation Game Of The Year 2004'. The simulation is very real; it has brought all the aspects of the PC version of the game to a mobile phone. The game's intuitive interface and cue stick controls can give you a lesson or two to try on an actual pool table.

Finding a free Windows Mobile game is like searching for, well, a needle in a haystack, for lack of a less clichéd metaphor! Most games have a demo version which you can try for free, and if you're impressed, you can try the full version. Most Windows Mobile games cost between $5 (Rs 225) and $20 (Rs 900).

Links:
http://www.pocketgear.com/software_browse.asp?type=certified
http://www.crazysoft.gr/download_Pocket_PC_PPC_Games.asp
http://www.pocketpcmag.com/_top/downloads.asp
http://www.clickgamer.com/Windows_Mobile_Golf_Games

New-Age Applications

Like we said at the outset, the cell phone is the prototype of the all-in-one gadget of the future. In developed countries, it is already seeing advanced uses such as for GPS navigation. Then there's mobile blogging, an obvious extension of the cell phone as an Internet-enabled device. In this chapter, we look at some cutting-edge and/or non-conventional uses of the mobile phone.

The previous chapter dealt with the contemporary applications offered by mobile phones. The range of services and applications has grown over the last decade as mobile companies have integrated a large number of services to keep customers within their fold. From simple text messaging, companies today offer services such as Internet browsing and music and video playback. Many of these services are supported by newer models, but are entirely contingent on the service providers.

With the increased connectivity between the mobile world and the Internet, newer applications are sprouting. Applications that straddle these two domains are fast becoming *de rigueur*. Protocols such as WAP and tools on the Internet such as Skype have played a large role in bridging these seemingly diverse channels. Connectivity via Bluetooth and infrared has resulted in applications on mobile phones that let you control household devices such as the refrigerator, washing machines and air conditioners. This "Extended Internet" is the new driving force behind the mobile boom.

Ease of use for the consumer and a device that acts as a one point node for any human to log onto this X-Internet is what the mobile phone provides.

Among the newer applications that are being developed or in use, a few such as mobile blogging, and mobile wallets, can be operated by most mobile phones and services. Others such as RFID and GPS-enabled phones are targeted at a smaller section of the market as they are very specific utility related phones.

6.1 Mobile Blogging

Blogging has been one of the biggest revolutions on the Internet. The idea of a citizen journalist too has shaped up somewhat, and this is a quick and effective way of dispensing information to a potential mass audience. The concept of an extended Internet with humans as the node points has started becoming a reality because of the use of mobile devices to access the Internet. It is, essentially, the possibility of logging on to the network no matter where you are.

As explained earlier, accessing the Internet on the mobile phone has become a norm. Just as most tools available on the Net can today be accessed on your mobile, so can newer applications such as blogging tools and networking tools.

Mobile blogging is not just accessing a blog on your mobile device—it also means adding a post onto your blog or sending a photograph or any audio or video file to your blog, all with the help of a mobile device. This mobile device can be a mobile phone, a laptop, a PDA, or any other device that affords mobility.

Technologically, the earliest developments in 'moblogging' happened in Japan. The reason is simple—Japan was one of the first countries where camera phones were used widely. Though the first post onto the internet from a mobile device was done in 1995, the blogger used a wearable computer and not a mobile phone. The first post onto the Internet using a conventional mobile phone happened in May 2000, and is credited to Tom Vilmer Paamand of Denmark.

The term moblogging was coined a couple of years later by Adam Greenfield. Greenfield also went onto organise the first mobile blogging conference (1IMC) in Tokyo in July 2003. The burst in the popularity of moblogs came after the tsunami that hit India and parts of SE Asia in December 2004, when much of the information about relief operations and ground conditions were put up on the Internet with the help of mobile phones.

Weblogs made from portable devices are also sometimes known as CyborgLogs, abbreviated as glogs; this term is used mainly for photo blogs or image-based blog posts.

To understand how mobile blogging works, let us briefly revisit the concept of a blog.

Weblogging, or blogging, is an easy method for publishing whatever you want on the WWW without having to know HTML or any other technologies associated with publishing a page on the Internet. A blog is supported by a blog server, which generates pages from templates, and allows you to upload new blog entries. Most new entries are entered as plain text into templates provided through a browser. This means that you can post a blog as long as you have a computer or any device that allows you to access a browser and the Internet.

Now imagine a scenario where you've just walked up to the top of a hill and some good verse springs to mind. What do you do if you want to put it up as a blog post? You could take it down on a piece of paper and type it out later, or you could blog it right then and there! A less exotic scenario is that of the tsunami relief workers and people who needed to report the conditions on an urgent basis to a central relief control station. During the tsunami of December 2004, the SEAT blog acted as one of the main points of dispensing information to relief workers. This blog had posts put up by relief workers an other volunteers using both personal computers and mobile phones. It also carried pictures of the affected areas clicked by volunteers with their mobile phones, which gave an exact idea of the havoc wreaked by the tsunami—all this before TV channels and newspapers could get their reporters and crew to the location.

So how exactly does one access a blog or put up a post online using a mobile device? Putting a post online using a mobile is essentially mailing your post—it could be written text or a photograph—to the blog service provider. You could also send via MMS to

the address (or, in technical terms, shortcode) given by your provider. If you use a smartphone or PDA, then it's just like adding a post using your computer and a browser. Today, most blog sites such as Blogspot and Blogdrive, among others, offer you services that enable you to post from your mobile device. These providers also have a mobile version of the site that can accessed using a mobile phone. Post a picture and you can view it on the mobile version, provided you have a multimedia-enabled mobile device.

There are other sites used specifically for mobile viewing. Winksite is one such. You can add the RSS and other mobile feeds of your choice on the site, add a forum or poll, and even announcements and a chat service to your mobile blog as well. The simple user interface of this text-only site may seem very ordinary, but the site is heavy on functionality.

Yet another service for mobile blogging is provided by Earthcam, which lets you access Web cameras on your phone. You too can set up your own Web camera on your computer and view it on a mobile device such as a phone or PDA.

Blogger, which is by and far the most popular blogging tool, allows you to post a blog by simply sending an MMS or e-mail to go@blogger.com using your mobile device. This action creates a new blog or adds an existing blog. You can add to the post, or change a setting, either by using your mobile device or using a computer.

Blogspot also allows users of other blog services to switch to their service by sending a message to go@blogger.com from their mobile phone.

Apart from text and photos you can also use your mobile device to post audio and video content on to the Internet. Such a post is called a mobile podcast—or if tech-geek jargon is your thing, mobpodcast. A mobile podcast, or mobpodcast, consists of audio content posted to the Internet from a mobile or portable device, such as a cellular phone or PDA, which is then made accessible through the RSS 2.0 file format.

The mobile has thus moved from being a simple telecom device capable of sending text and voice messages to becoming one of the most important nodes of the extended Internet. The blogging capability of mobile devices also means that anyone who carries a WAP-enabled phone is connected to this Internet. (WAP is a set of protocols that standardise the manner in which wireless devices are able to access the Internet.)

6.2 Mobile Payments

Mobile payments are yet to gain mass acceptance

With the advent of the Internet and e-commerce, the scene of monetary transactions shifted from the real to the virtual world. The system of payment by disclosing privileged information gained in popularity as e-commerce grew, and people became comfortable conducting transactions over the Internet. Trade over the Internet meant giving out credit card details and other information such as bank account details.

PayPal brought about a change in this system by introducing the concept of e-mail payment. These changes in the way people bought and sold goods on the Internet also had an effect on offline transactions, and the onset of the earliest signs of convergence and the extended Internet meant that payments for goods moved away from the computer to any device that could facilitate data transfer. It was here that the mobile phone came into the picture.

A mobile handset that is WAP-enabled can access the Internet and send and receive data just like a computer terminal connected to the Internet. Also, with technologies such as RFID, and connectivity applications such as Bluetooth and infrared, the mobile phone can 'converse' with other devices. Thus data transfer between two devices no longer needed connection to a whole network, but just a certain level of proximity between the two devices.

The concept of a mobile wallet works pretty much along these lines. The exchange at the point of transaction (shops, banks or Web sites) would be the information from your mobile phone. Just as with a credit card, the mobile phone service provider provides the technical and logistical support for your transaction, while either the provider or a bank stands surety to the transaction.

The mobile payment system is at the nascent stage, with a number of concerns regarding security and interoperability yet to be solved. An ideal payment mechanism includes a number of security layers and a number of protocols that both the issuer and the consumer need to follow.

The first phase of the payment lifecycle is the configuration of the payment mechanism. In the mobile payment environment this could be the installation of an applet or application on a mobile device, such as a mobile wallet, or the issuance of a new mobile device pre-loaded with a certain amount of money, or a new SIM card loaded with a certain value. This setup and configuration of the payment instrument usually takes place only once, and any subsequent recharge of the mobile device or SIM is done just as a normal recharge for value. Operators such as Mobile Lime in the United States provide this service.

Mobile payments can be categorised into macro and micro payments. The distinction between the two is important since the security required for each will be different. As the names suggest, macro-payments involve transactions of large sums of money, or a credit facility, whereas micro-payments mean smaller sums, and in most cases, a direct debit of the required amount. For very obvious reasons, authentication for every macro-payment transaction through a trusted financial entity such as a bank or service provider is extremely important, whereas a simple network authentication, such as SIM verification or a PIN code may be sufficient for micro-payments as they use just the operator's infrastructure.

Most major European banks provide this service, similar to that of a credit card. In India, Standard Chartered provides this service, but this can be availed of only at select outlets in Mumbai. In most cases a bank ties up with a cellular service provider to provide support for macro-payments.

Another important factor in mobile payments is the way in which the transaction information is delivered. The information could be given using a wireless wide area network or a proximity transfer. A transfer of data using the wireless WAN would be generally used for payments made on the Internet, and this entails sending an SMS and divulging details such as the PIN code. This form of transaction can also be undertaken through a browser-based system. Although there are technical differences between IP and messaging-based communications, payment protocols can operate similarly across both.

Proximity payments involve the use of short-range messaging protocols such as Bluetooth, infrared, RFID, and contact-less chips to pay for goods and services over short distances.

As mentioned earlier the system of mobile payments is still in its infancy, even in most developed countries. The reasons for this are many. The biggest concern in using a mobile for very high-value transactions is security. The limited protection against attacks in the mobile Internet world means this threat will impede the growth of mobile payments systems. Another major problem is interoperability between operators and devices. The large number of mobile service providers and handset manufacturers has resulted in a variety of different standards in the market with limited interoperability.

A number of banks and providers are now working together towards making mobile phone payments the norm. With systems such as GPS being made mandatory in cell phones, the levels of security have been made stronger, and mobile commerce, or m-commerce if we may call it so, seems on its way to assuming the scale of e-commerce.

6.3 Niche Applications

Mobile blogging and mobile payments are targeted at every person who has a mobile device. While one aims at helping people dispense information to a large number of people around the world, the other looks at making shopping for goods and paying for services hassle-free and extremely convenient. There are other applications on your mobile phone which, though not in widespread use yet, add that extra something to your mobility.

RFID

RFID or Radio Frequency Identification is a technology that is set to soon replace bar codes. But that's not just where it ends. Beyond the tagging of goods and products, RFID will also help in tracking them as they are transported. Companies are now coming up with mobile phones that double up as RFID receivers. At first glance, an RFID receiver seems to be useful only to someone who would need to track goods, but it will soon enter the domain of the regular consumer as RFID becomes the norm and is used to help you keep a track of everything that you spend your money on.

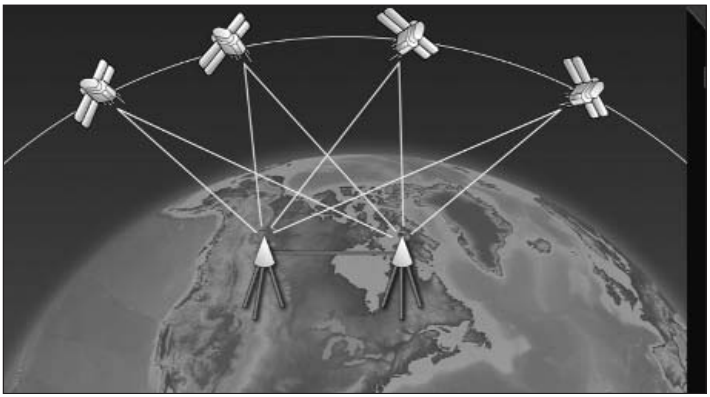
Phones with RFID chips are being developed by many companies

For example, if you were to purchase electronic equipment, to confirm that what you bought is authentic, all you need to do is use the RFID reader on the phone to take the data from the tag on the hardware. The phone can then send an SMS to the manufacturer, who can confirm whether it is genuine. Also, if the equipment turns out faulty, it becomes easier to lodge a complaint with the manufacturer. Another big plus with RFID-enabled phones is that it is easy to track them down if ever they get lost or stolen.

GPS

The Federal Communications Commission (FCC) of the United States is the body that regulates the manufacture and design of all hardware manufactured or sold in the United States. The FCC recently passed a regulation making GPS mandatory on all cellular phones made and sold in the US. So what is GPS? Global Positioning System or GPS, as the name suggests, is a system that pinpoints your exact location on the globe. It does this by interaction between a series of satellites circumnavigating the earth and base stations at various locations. Used extensively by scientists working in far off locations away from human settlements, and also by people on expeditions, GPS has trickled down from standalone readers to wrist watches.

GPS gadgets are essential for scientific expedtions



GPS on the mobile will soon become a norm after certain FCC regulations

Now with the FCC ruling, they are soon to become a standard feature on mobile phones. This must not be confused with the location that is flashed on cell phones today. This information is just that of the location of the nearest cell sites. A GPS phone will be able to provide you with more info than what suburb you are at. It can give you the latitude to the last degree, the direction you're moving in, and your orientation in relation to the nearest landmark. If the phone has a display that can show images, it will also pinpoint your location on the map that's been loaded onto the phone. Soon, your phones will also be able to give you

GPS-enabled mobiles are becoming increasingly common

directions to the nearest restaurants or medical shops, and also pinpoint your exact location on a street map. Now if that's not nifty, what is?

Google Mobile

Expect Google to get into anything that has to do with the Internet! And if the Internet gets onto the mobile, Google *would* follow suit and develop applications for your cell phone. Their latest offering is called Google Local for mobile. This application lets the user search for locations and then view them on a map. Sounds a bit like GPS, doesn't it? But Google also lets you type in text searches, and the maps developed by Google are downloaded from a server and not preloaded onto your mobile.

Google mobile helps in local searches

Users can also view the location as a satellite image and get driving directions. Also, when a user finds a listing through the service, they can click on the phone number next to the listing, and voilà, your mobile phone finally acts like a phone.

Much like Google Maps and Google Earth users, those who use Google Local on the mobile can shift their view of the map or zoom in or out. The service is now available in the US, and most mobile service providers offer support for it. Apart from this service, the company also has a slew of offerings for the mobile customer. You can send text messages to Google asking them for directions and addresses, and WAP-enabled mobiles can (obviously) access the mobile version of Google search. Although most of these services are available only in the US and other developed countries, it's only a matter of time before the company launches similar services in India.

TV On Mobile

Imagine catching the latest episode of your favourite serial on your

mobile so you won't miss it even while travelling! With the recent buzz about mobile television in India as well as in other countries, this cannot now be called a thing of the future. It's happening now. Mobile service providers in Italy such as Hutch 3G are already providing these services.

News relays often first show up on mobile phones

Mobile television will work in the same way as Internet television, unlike the relayed television series we have via cable in our homes. Users will download a mobisode—an episode that has been digitised and optimised to be played on a mobile device. Broadcast technology aimed at mobile devices such as Digital Video Broadcast—handheld (DVB-h) are being developed to handle and play content that is of a quality comparable to television or the movies. As of now, movies on the mobile phone are played in the 3GP format, which is of very poor quality.

Innovations in the way in which content can be played are also being experimented with. Methods such as 'Pause and Resume' are being employed by mobile TV providers. This allows a user to pause whatever he is playing and resume it at a later time. This is essential, as a mobile phone is used for a number of other tasks—such as communicating with people!

India, too, has mobile TV being developed by networks such as Zee in collaboration with technology companies such as IBM. The mobisodes that will be launched by Zee will be shorter versions of their episodes. With almost 50,000 hours of content being developed for mobile phones, cell phone users in India can await their daily soap on their mobiles. Though companies aren't developing original content for mobile phones, it's only a matter of time before we see serials and movies made just for the mobile market.

Society And The Cell Phone

Every technology eventually begins changing the way society behaves as a whole. In this chapter, we examine several of the negative things associated with mobile phone use: the possible health hazards, the dangers posed by poor ergonomics, the controversies associated with camera phones, and so on. We also look at such things as SMS usage, and cell phones and society in general.

7.1 Health Hazards

A major fear factor associated with mobile phones is electromagnetic radiation

A decade or so ago, when cell phones were a novelty, they had their fair share of brickbats. The largest fear factor associated with mobile telephony was the harmful effect of electromagnetic radiation. It's a known fact that due to electromagnetic induction, a strong electromagnetic field is created, which can cause electric currents that may flow across an air gap to the ground, causing sparks. These sparks can then ignite flammable materials or gases, and can lead to an explosion or fire.

Scientific evidence for the health hazards of cell phone radiation is still disputed. The WHO has recommended that a precautionary principle be voluntarily adopted. Here, the precautionary principle is "a risk management policy applied in circumstances with a high degree of scientific uncertainty, reflecting the need to take action for a potentially serious risk without awaiting the results of scientific research."

Ever since mobile phones were launched, numerous health reports have been published by various institutions worldwide. Some reports indicate that electromagnetic radiation from mobile phones cause brain tumours and can even result in Alzheimer's

disease. On the other hand, there have been a good number of reports indicating no health risk at all.

It cannot, however, be denied that mobile phone radiation affects living cells. In October 2004, scientists at the Karolinska Institute in Stockholm gave a new warning about mobile phone radiation and brain tumours. They found that long term users of mobile phones were four times as likely to develop growths on the side they held the phone, and twice as likely as non-users to develop these benign, non-cancerous growths. They saw no increased risk from mobile phone radiation in those who had used mobile phones for less than 10 years. The study was of 150 mobile phone users, compared to 60 in a control group.

However, the effects on individual users may vary depending on the type of electromagnetic radiation. For instance, GSM and GPRS (2.5G) phones use pulsed radiation, where the levels rise and fall very rapidly. 3G phones on the other hand use continuous levels. Hence, studies show varied results because they may have analysed different types of radiation. Dr Kjell Hansson Mild in Sweden studied radiation risk in 11,000 mobile telephone users. Symptoms such as fatigue, headaches, and burning sensations on the skin were more common among those who made longer mobile phone calls. Evidence from human studies of mobile phone radiation indicates short-term raised blood pressure and mild direct brain warming.

In all, different studies have reached contradictory conclusions. There still persist real uncertainties about mobile phone radiation. The health risk to an individual user from electromagnetic radiation may be minor, but it's possible that some individuals may be more prone to the side effects of radiation than others.

Nevertheless, read the user manual of any mobile phone: the safety warnings will ask you to "switch off the phone when refuelling." Avoid using your phone near fuel or chemicals. Also, don't use your phone where there is blasting in progress, and also in a hospital or when you are close to any medical equipment.

7.2 Driving, Riding And Calling

The greatest risk to a mobile phone user is an accident while distracted, particularly when driving. Don't drink and drive. Similarly, don't talk on the phone while driving. The driver talking on a cell phone need not be in an inebriated state - but he definitely is distracted. And that can mean accidents.

Obviously, the same goes for people who ride two-wheelers. In fact, two-wheeler riders face a greater risk than do drivers of four-wheelers of losing control of their bike or scooter while talking on the phone. Although a hands-free system makes things easier, it does not reduce the distraction caused by the phone call. Follow road rules while driving - your first consideration should be safety on the road.

7.3 Security Threats

Mobile spam is irritating, as you've noticed by now. Marketers are resorting to text messages to target subscribers. More and more mobile phone customers have received spam on their phones - unsolicited marketing has reached this part of the world as well. Some messages may carry viruses that could render your phone dead: mobile phones are not immune to virus threats. 'Cabir' was the first ever computer virus that infected mobile phones. For PDAs there have been Palm viruses and also infections on the Microsoft Pocket PC platform.

The earliest mobile phones did not have much security designed in. Some problems were identity theft, and "scanning" - whereby third parties in the local area could intercept and eavesdrop on calls. Although more recent digital systems (such as GSM)

have attempted to address these fundamental issues, security problems persist. Vulnerabilities (such as SMS spoofing) have been found in many current protocols that continue to allow the possibility of eavesdropping or cloning.

A virus on cell phone can render it useless

Viruses and other malicious code can spread through PDAs and smartphones. First, the handset's functioning may get impaired by the virus. Moreover, if an infected mobile device is used to upload data onto a corporate network, that may be adversely affected. The danger from mobile viruses may grow as the use of PDAs and smart phones proliferates. And virus writers will certainly not spare the mobile devices and operating systems market.

In reference to simple SMS spoofing, consider this scenario: a cyber criminal could send you a message from your friend's cell - a fake message that can fool the receiver into thinking it is from the actual sender. For instance, if someone received a message from his or her spouse that said, "Withdraw Rs 10,000 immediately and deposit into my account", he or she would first try to call the spouse. If the spouse is not reachable, the person might end up actually doing what the SMS said. Such scams have actually occurred. Of course, such scenarios are contingent on a cell phone being stolen or left unattended.

In India, SMS Spoofing of the real kind - wherein the spoofer doesn't even have access to the phone the SMS seems to be coming from - was tested by the Pune-based Asian School of Cyber Laws, which used SMS Spoofing to help investigation and law enforcement agencies trap terrorists and narcotics dealers.

The significant growth of SMS as form of communication has

also given rise to the reliance of law enforcement agencies in gathering evidence from mobile phones when a crime has been committed. Many a time, the law enforcement agencies have used the mobile phone to link a criminal to the crime committed.

To prove that a criminal could send an SMS message appearing to come from a victim's cellular phone without physically touching the victim's cell phone, the school recently conducted experiments in SMS spoofing at the national and international level. It was able to successfully spoof SMS messages and make them appear to come from other people's phones. These people were using GSM-based cellular phone services in various parts of India and other Asian as well as African countries. Needless to say, this experiment should be enough to convince cell phone users and law enforcement agencies to be careful in relying upon the authenticity of SMS messages.

7.4 Ergonomics

By and large, most users have encountered some or the other inconvenience in the usage of their cell phones. For instance, certain mobile handsets get heated even if you talk for a mere ten minutes or so. To help prevent any unpleasantness, using a hands-free is highly recommended.

Although they are hugely popular and designed for the tech-savvy consumer, cell phones such as the BlackBerry, Treo, and other devices with miniature keyboards lead to overworked thumbs. For instance, the BlackBerry mobile phone has a QWERTY keypad for thumb typing to automatically send and receive e-mail.

Sore thumb—courtesy unrestrained usage and tiny keypads

And users worldwide are increasingly depending on mobiles not only to read and for-

ward SMSes but also for everyday work such as e-mail. The injuries inflicted on the fingers due to excessive cell phone use can be considered the equivalent of the Carpal Tunnel Synd-rome (CTS) that results from incorrect position of the keyboard and mouse.

Recently, some owners of Blackberry phones were afflicted by the 'Blackberry Thumb' syndrome - courtesy prolonged and extensive use of their phone keypad. This debilitating malady is characterised by a throbbing sensation in the thumb. In some cases, people have also developed blisters due to thumb typing.

The human thumb, as you're aware, is the least dextrous of the digits. To make it undergo strenuous work by pressing buttons on a keypad a thousand times a day is unfair! Jokes apart, cell phone users must keep this in mind to prevent inconvenience and potential visits to the doctor.

For starters, avoid repetitive use of one finger. Instead of relying solely on your thumb, try using your index finger too; or, you could alternate between the thumbs of your hands. While there are some keypads that are ergonomically designed, the warning here is "Avoid Overuse."

7.5 The Camera Phone Controversy

The Delhi Public School MMS scandal shocked the nation. It also led to the arrest of auction site Bazee.com's CEO Avnish Bajaj. And thanks to the camera phone, there's been a series of intimate exposes of film celebrities. And it's not the paparazzi alone who capture video and images on their camera, but other regular users of mobile phones. For instance, last year, tabloids published intimate pictures of actress Kareena Kapoor with beau Shahid Kapoor, claimed to be shot by a fan at a Mumbai pub. More recently, actress Mallika Sherawat was caught up in a controversy involving an explicit MMS clip.

The Information Technology Act 2000 bans dissemination of

obscene images, with punishment of up to five years in jail. In fact, last year, Saudi Arabia enforced a ban on the sale of camera-equipped mobile phones as the handheld devices were believed to be synonymous with immorality, supposedly because phones were being used to photograph women on the street.

Unsuspecting people fall prey to voyeurs using camera phones

However, such a blanket ban on camera phones is not feasible and impractical. Only users can take the responsibility of not sending or downloading illegal content - and it will be yet some time before mobile phone service providers come up with the means to sanitise or block inappropriate content sent by their users.

Mobile phones that come with an integrated or attachable camera are the most popular selling category. Today, anyone toting a camera phone in places of high security could be perceived as a potential threat. In fact, some companies in India make it mandatory for their employees to not carry a camera phone at work, for security reasons.

7.6 SMS: Evolution Of The English Lexicon

OMG! wot hapnd 2 d eng lngwij?

That's SMS lingo for "Oh my God! What happened to the English language?" While cultural theorists, language historians and teachers may cry foul over the current "SMSisation" of the language, it was bound to happen sooner or later. Obviously, one cannot really expect users to be eloquent and to adhere to correct spelling and rules of grammar while SMSing! There are also smileys and emoticons that can be used to convey certain feelings

such as 'happiness', 'surprise', 'delight', 'irritation' and so on - people now tend to use fewer words to get their point across.

SMS—language as crisp as it can get!

And whether you like it or not, you have to be with it. SMS lingo is here to stay. Proving this, in October of last year, the Bible Society of Australia produced a translation of the Bible in SMS version.

The beginning verses of the SMS version are as follows: "In da Bginnin God cre8d da heavens & da earth. Da earth waz barren, wit no 4m of life; it waz unda a roaring ocean cuvred wit dRkness." There are in all 31,173 verses of the Bible in text message that can be freely accessed. The Bible Society said it took nearly one person about four weeks to convert the Old and New Testaments of the International Contemporary English Version of the Bible to SMS-speak. The Society maintains that it has remained true to the grammar, changing only the spelling. Sending the entire Bible would take more than 30,000 text messages.

Here are some common SMS abbreviations:

afaik	As far as I know
BRB	Be right back
BTDT	Been there done that
BTW	By the way
CU	See you
Da	The
Ez	Easy
ROTFLOL	Rolling on the floor laughing out loud
F2T	Free to talk
GTG	Got to go
IMHO	In my humble opinion
IM2GUD4U	I'm too good for you

K	Okay
L8	Late
MTFBWU	May the force be with you
Ne	Any
NE1	Anyone
NO1	No one
NP	No problem
OIC	Oh I see
OMG	Oh my God
RUOK	Are you okay?
SUM1	Someone
URA*	You are a star
W/O	Without
WUD?	What you doing?
XLNT	Excellent

If you want to become a pro at text messaging, help is at hand! There are Web sites that specialise in translating English into SMS-speak and vice-versa (that's for those who can't follow the latter!). Check out transl8it.com, for one.

SMS Typing Contests

A good platform for interactive marketing for companies, SMS typing contests have many takers. From product promotion to offers, quizzes etc. SMS contests require users to participate by SMSing their answers or replies to a short code.

A personal device, the mobile becomes one of the most effective means of communication for marketers. Although a new and interactive medium, SMS contests are part of various high-end promos done today. Mobile-based advertising campaigns have been adopted by the film, FMCG, finance and media industries. To give you an example, take a sales-driven wireless campaign of a financial product. The mobile user who responds is in effect is a definitive sales lead, and can lead to an actual sale.

SMS-based campaigns create excitement about the new prod-

uct or contests and help reach the target audience. SMS-based quizzes help marketers understand the style preferences of mobile owners. Such SMS promos may be devised in conjunction with print, TV, Radio and/or online campaigns. Yet, all advertisers need to understand that effective mobile marketing is pull-based and not push (spam)-based.

Wireless marketing involves delivering attractive downloadable content to the target audience. In India, marketers are tapping the increasing base of potential buyers. The more recent and successful SMS campaigns include the *Indian Idol* show. To retain the consumer's interest (here, the viewers), these campaigns are usually backed by gifts and prizes.

Film production houses are increasingly using this medium for marketing their films. There are unlimited SMS solutions through which marketers can promote their various offers. Nevertheless, mobile marketing is still at a nascent stage. Mobile solution providers are also working hard at making mobile marketing a popular phenomenon in India. All are spin-offs of mobile commerce, popularly called m-commerce.

At the same time, in the name of mobile marketing, users receive too many SMSes every day. It is therefore important to safeguard the mobile marketing channel as advertisers increasingly adopt the SMS medium. It is imperative that advertisers allow people the option of receiving/subscribing to each mobile marketing program separately. Such targeted communication is less likely to annoy consumers, and can prevent mobile spamming.

7.7 Cell Phone Usage And Society

Courtesy high mobile telephone penetration, a certain "mobile culture" has evolved, and the cell phone has become a must-have to keep up with your peers and at work. The culture spawned by mobile phones extends beyond mere talking and SMSing.

Next-generation mobile networks have revolutionised the way we view television programming and listen to music. In fact, users can now get all sorts of information - the latest sports updates, stock quotes, business listings, driving directions, movie timings, and weather conditions. People can also book travel tickets, pay bills and shop using their cell phone. For instance, through SMS, people can search the Web for stores and businesses in the neighbourhood. Popular television shows such as *Indian Idol* encourage viewers to vote for their chosen performer through SMS. And, news channels ask viewers to send in their questions or replies on various issues through SMS.


Mobile phones have become an inseparable part of present day society

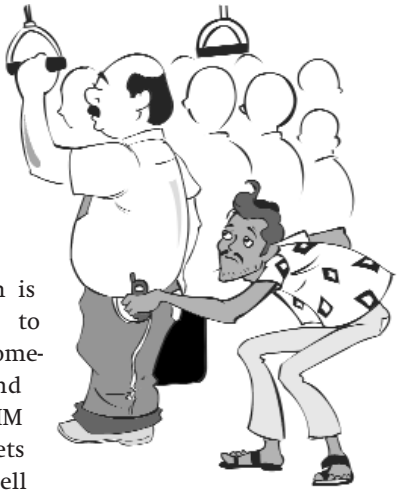
To give you a recent example, SMS text-messaging company KAPOW! announced the trial of the UK's first SMS railway-commuter club. Commuters will aim to notify *en masse* other commuters of cancellations and delays long before the railway companies are able to pass on this information.

Our dependency on cell phones has reached an extent that we can't imagine life without them. When was the last time you referred to a paper phone book to call an acquaintance?

Cell phone theft has become an everyday affair. A new age crime, cell phone theft is an ever-increasing problem. Here's a way of rendering a lost or stolen mobile useless to thieves. To check your mobile phone's serial number, key in the following on your phone:

* # 0 6 #

A fifteen digit code will appear on the screen. This is unique to your handset - note it down. If your mobile is stolen, you can phone your service provider and give them this code. They will then be able



to block your handset, so even if the thief changes the SIM card, your phone will be useless. If this practice were universally followed, no mobile phones would get stolen!

Another area of concern is 'cloning', the term used to describe calls charged to someone's account illegally and fraudulently. If you're a SIM card user, if your phone gets stolen or lost, contact your cell phone service provider immediately and have the service suspended before you get an inflated bill.

The mobile phone is now part of the average person's personality. Users customise and accessorise their cell phones. Ring tones play a crucial role in the personalisation of the cell phone. And now, there are also caller tunes - songs or any other music that you can choose to play for the listener while he or she waits. Some even change the faceplate to match the colour of the phone to that of their clothes!

And no cell phone is complete without the right accessories. Practical accessories enhance cell phone usage. Popular accessories include hands-free headsets, batteries, and car chargers. Bluetooth hands-free headsets are also getting popular. And with a USB data cable, users can easily transfer data from their phone to a computer and vice versa.

Then there's the digital camera feature. Apart from sharing photos with friends and family, mobiles also enable citizens keep guard. Anyone with a camera phone can click instant pictures of events that can be used in breaking news stories - for instance, the hurricanes in America and the London Bombings.

Mobile phone etiquette has become an important issue. People speaking loudly on their mobiles and cells ringing merrily in the middle of a movie at the theatre are just a couple of instances where mobiles become a nuisance. Certain places that prohibit the use of cell phones even install 'jamming' equipment to prevent them working.

7.8 Do Not Use Areas

Mobile phones are banned on existing aircraft for fear that they might interfere with a plane's navigation system as they attempt to log on to terrestrial networks. While experts claim that mobile phones on an aircraft can interfere with the communication systems of an aeroplane, there is no rock-solid proof. Nevertheless, cell phone use is prohibited on all commercial aircraft - etiquette, too, demands that cell phones be kept on silent, or at least on low volume, so as to not disturb co-passengers.

Cell phones in the air could also occupy multiple cell towers on the ground and cause interference with calls taking place on the ground. In July this year, three US government agencies raised safety concerns about the use of mobile phone on airplanes in-flight. Law enforcement officials said high-power mobile systems could allow terrorists to better coordinate their efforts with cohorts on the ground, and thus set off bombs on airplanes.

However, in September this year, two European airlines agreed to introduce a voice and text service for cell phones in separate three-month trial runs starting in 2006. The planes will be the first to allow passengers to make and receive calls with their own cell phones while on board.

Another area where cell phones are asked to be switched off is near petrol pumps. People are repeatedly warned against using cellular phones near gasoline fumes. However, no media or scientific reports support such claims. However, there were certain incidents in the United States where mobile phones were blamed for

fires at gas stations. But, both the Cellular Telecommuni-cations Industry Association (CTIA) and the American Petroleum Institute issued statements denying the risk.

The CTIA said, "There is no evidence whatsoever that a wireless phone has ever caused ignition or explosion at a station anywhere in the world. Wireless phones don't cause gas stations to blow up. Warnings being posted in petrol stations simply perpetuate the myth." The American Petroleum Institute said, "We can find no evidence of someone using a cellphone causing any kind of accident, no matter how small, at a gas station anywhere in the world."

Still, many reports circulated the Net which mentioned persons who were getting their cars refueled and talking on their mobile phone suffered burns and injuries as the fumes got ignited. In some cases, cars and entire petrol pumps were alleged to having been destroyed. Well, it's better to be safe than sorry, as we mentioned earlier, mobile phones should not be used around other flammable or explosive materials.

Connectivity Concerns

Most mobile users in India still do not get uninterrupted 24x7 connectivity. There are certain areas where the network coverage is excellent, some areas where it is just about OK, and other areas where it is non-existent. The reasons could be multiple - it could depend on the services of the cellular provider, or the handset, or the location. With Wi-Fi seeing increased penetration and coverage, and being a relatively inexpensive technology, connectivity issues should reduce: hybrid phones let people make connections using a local wireless Internet access point and seamlessly switch over to a cell phone network when necessary.

Moreover, cellular carriers are also upgrading their systems for high-speed data. With short-range, high-speed Internet access and cellular service coming together, users will have better connectivity.

The Future of Mobile Technology

Thus far in this book we've looked at the evolution of mobile devices and technology, their current role in our lives and the services offered. In this chapter, we look at the future of the devices and the technologies, and try and predict what kind of devices we will be using several years from now.

8.1 The Technologies

Though not all of us are too interested in the technologies that power our personal mobile devices, it is important to understand what will empower our devices in the future. It's the only way to make educated guesses at what the future devices will be.

Form Factors

Form factors of devices have reduced like crazy over the years. As you've already seen in Chapter 1, mobiles have come a long way. Today we are able to use our mobile devices for almost everything we can do on PCs—even multiplayer gaming. And all these features have to fit into a device that's truly mobile and pocketable.

In fact, we've noticed that it's design and form factors that are currently driving the industry. The stiff competition in the mobile arena has resulted in similarly-priced handsets from different manufacturers, with almost identical features. Increasingly, consumers are opting for one device over another based solely on design and form factor. This, obviously, has prompted manufacturers to spend even more time and money on design.

The future, as we see it, isn't going to be much different: manufacturers will still try and cram a host of features into tiny devices, with innovative and distinguishable designs.

Though this trend may lead you to believe that our devices might virtually disappear, or at least become small enough to be completely concealable, there are some factors that are preventing this from happening...

Displays

LCD Displays: The very first speed bump in the road to miniaturisation is a device's display. The fact is that today's mobile manufacturing technologies are easily capable of cramming currently offered features into devices that are much, much smaller than the devices of today. The problem begins with the popular LCD display technologies that are incorporated into almost all devices today.

It's not that LCD technologies are bad, or cannot be made smaller—the problem lies with human sight. You can only shrink displays to a certain size, after which they are no longer comfortably viewable by the naked eye. Since mobile phones are fast becoming all-in-one solutions, which incorporate audio-visual content such as stored movie clips, streaming video, MP3 playback, video cameras and more—it's only natural that a decent sized screen is needed.

The near future might just see the end of LCDs, in their current form, in mobile devices. However, in order do away with LCD screens we first need to develop viable alternatives.

Paper Displays: We have looked at paper displays in earlier articles in *Digit*, and only recently have these displays become viable for use in mobile devices. Paper displays can be folded, bent and rolled, and this gives them an immediate advantage over LCD displays. However, as of yet, refresh rates are a problem, and paper displays are still more suited for static content such as advertisements or e-books. Colour video is not really possible as of yet, but researchers feel that it's only a matter of time before this becomes a reality.

Many sceptics wrote off research in paper displays as a waste of time, and were also not convinced that colour paper displays would ever be made. Today, not only does the technology exist, but products and working prototypes are already available. It's true that these displays cannot replace the LCDs on high-end mobiles yet. Nevertheless, they could be used in entry-level devices.

What makes paper displays a viable option is the fact that they're a lot cheaper to mass produce than the standard LCD, use several magnitudes less of battery power, and offer better screen visibility due to their higher contrast ratio—under direct sunlight, a paper display reads just like a newspaper or magazine, while an LCD is hardly visible.

Reduced battery consumption is perhaps the trump card that paper displays hold. Unlike conventional displays that use battery power continuously to display an image, paper displays use power only when they are drawing an image. So, if no change in the image is needed, the display needs no power at all, and one could even disconnect the power source altogether without the display going blank.

This means that even current batteries could last a lot longer on a device that uses a paper display. The decrease in manufacturing costs could yield even cheaper entry level phones, which do not offer advanced features such as video playback or cameras. Since a lot of the "no-frills" phones available today still come with monochrome displays that merely show caller ID and text messages, and therefore do not need high refresh rates, it seems logical that paper displays be used in such devices.

However, we're still waiting for the day that paper displays capable of displaying video are developed. That day might spell doom for the now-ageing LCD technology.

How Paper Displays Work

The Legacy

The idea of paper displays, or ePaper as it's also known, is hardly new. Back in 1975, Nicholas Sheridan, a physicist working at the Xerox PARC (Palo Alto Research Center), started his research on ePaper. The novel idea back then was to replace paper with portable flat-panel displays, which, as we all know, were not exactly portable back then, were very expensive, and had terrible contrast—you could hardly make out the screen in a lit room, forget about outdoors!

Sheridan's dream was to make a flexible paper-like sheet that could not only display text and images, but also be re-written by using an electrostatic charge. The solution was to use tiny electrically-charged spheres, enclosed in the oil-filled cavities of a thin layer of a transparent elastomer.

Incidentally, this is the technology Xerox PARC still uses in its research of ePaper, which they call SmartPaper. Each 100-micron sphere is coloured half white and half black (or another dark colour). The spheres contain a dipole—like a magnet, with positive and negative charges on opposite ends.

Thus, when an electric charge is passed over certain pre-designated areas of the elastomer film, the spheres in those areas rotate to show their dark side, colouring the area. A chip controls charges to make an electronically-controlled etch-a-sketch!

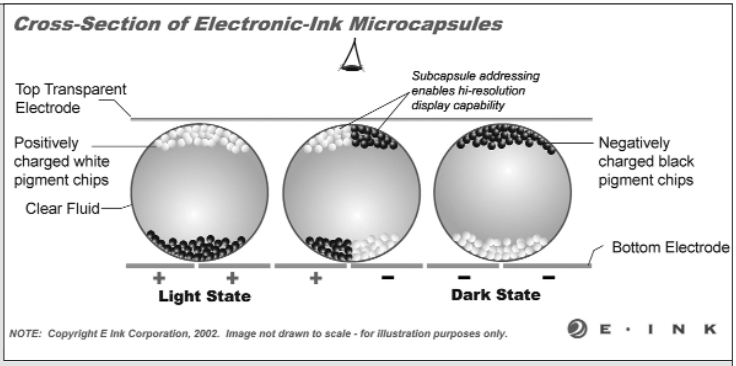
Since the spheres are reflective in nature, they are extremely high-contrast, making them readable even under direct sunlight. This technology has already been used to make some interesting products. We will talk about those a little later. Needless to say, this technology, though easily implementable, has the drawback of being monochrome. Still, it's a step in the right direction.

The Leaders

Say the words "paper display" and the name that springs to mind is E-Ink Corporation—the Xerox or Discman of paper displays!

E-Ink currently provides technology and paper displays to many corporates—not just to help them build prototypes, but also for full-fledged products. E-Ink's investors include Toppan Printing of Japan, Intel Capital Corporation, Motorola Corporation, Philips Compo-nents (a division of Royal Philips Electronics) and Vivendi Univer-sal Publishing (France).

The list of companies that are actively researching paper displays



is even longer. Needless to say, the market is waiting impatiently to see some progress in this field, and researchers are working overtime to meet this demand.

E-Ink's technology is similar to what Sheridan came up with at Xerox PARC. Instead of using microcapsules that are coloured half-black and half-white, E-Ink uses microcapsules that contain granules of a positively-charged white pigment and granules of a negatively-charged black pigment.

These capsules are suspended in a clear fluid that lies between thin layers of a plastic material, which is, in turn, laminated on a layer of micro-circuitry and electrodes.

Now, in order to draw a display, the electrodes are charged either positive or negative, according to the image requirement. The micro-circuitry is small enough for two electrodes to be placed under each microcapsule—if both electrodes are charged positively, the positively-charged white pigment granules in the capsule directly above them are pushed to the top, thus forming a white dot, or pixel. Similarly, a negative charge causes the negatively-charged black pigment granules to be pushed up, thus forming a black pixel.

Now, the two electrodes under each microcapsule can be polarised differently as well, thus forming a half-white and half-black pixel. This is how E-Ink's technology achieves higher resolutions and apparent shades of grey. All this circuitry forms a screen with a calculable resolution, which can then be controlled by a display driver or graphics chip.

Moreover, the "E-Ink" is reflective in nature, and it looks just like print on paper, has a readable angle of 170 degrees, and is clear even in direct sunlight.

OLEDs: Recently we've seen some mobile devices with OLED (Organic Light-Emitting Diodes) display screens. OLEDs use organic materials to produce light when an electric current is applied to them. They are flexible and can potentially be used in mobile devices that required rollable displays. Although much better than LCDs, they do have their shortcomings: they're expensive, have a shorter lifespan and are easily damaged by moisture. The advantages over LCDs are an OLED's reduced power consumption, the ability to make much larger screens,

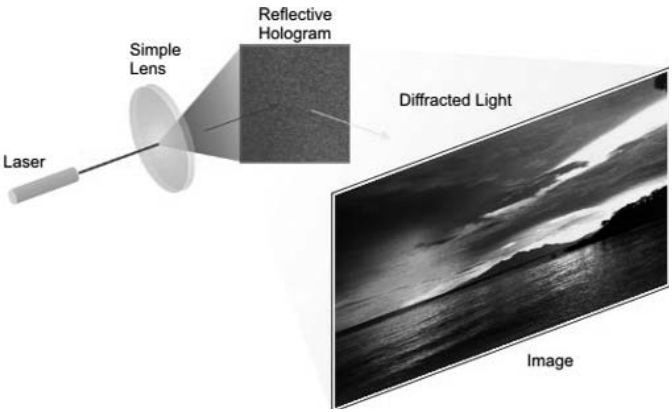
better viewing angle and increased lighting and contrast.

This means that OLEDs are better suited for mobile devices, as they have no difference in refresh rates and use much less power. The only obstacles in the mass adoption of OLEDs in mobiles have been their fragility with moisture, their relatively shorter life spans, and of course, their price!

As with any emerging technology, these limitations will soon be ironed over, and in future we can expect to see more devices with OLED displays. The future of OLEDs could also be hanging

in the balance, depending on the advancements in the research of paper displays!

Projected Displays: Projected displays are sort of like holographic displays, but in 2D. They work just as projectors do, but use lasers to project images. This helps in improving visibility in brightly lit areas. Research is underway to make projected displays that can fit into mobile devices such as laptops, PDAs and even cell phones. The aim is quite simply to do away with displays on these devices and save huge amounts of space. Since a projected display merely needs a surface, such as a wall, a door,



the ceiling or even the floor to fulfil the needs of visual interaction with a user, it is possible that, in the future, manufacturers can just do away with traditional displays, thus making mobile devices smaller and compact.

Though even prototypes of this technology are not yet available, the development of initial prototypes should begin in less than two years. This technology is perhaps the most promising for mobile devices because it can virtually eliminate the need for a display in mobile devices, thus opening up the whole mobile industry to exciting new design possibilities.

You can get more information and updates on the development of projected displays at www.lightblueoptics.com.

Video Eyewear: Though wearable displays have been around for ages, they haven't really caught on. There are hundreds of new models that come out every year, but no one seems to be buying any. Perhaps it's because of the way they limit your eyesight, and are not really good for use on the move. However, with innovations and improvements, these too could see increased acceptance.

For mobile devices, this solution is perhaps a possibility, as this too, as with projected displays, does away with the need to build a display into devices. Perhaps in the near future we will see the development of Bluetooth eyewear that can display translucent images so as not to interfere with normal vision. Though an option, the best case scenario will probably be only a few unique gadgets that offer this type of display and position themselves as lifestyle gadgets.

For more information on the latest technologies, visit Icuiti Corporation's site, www.icuiti.com. Icuiti is a leader in this field and is consistently innovating its product line-up.

Batteries

Though battery packs have become smaller, they are still one of the largest components of a mobile device. So far, this has been as unavoidable a situation as the display problems. All devices need power for at least eight hours. In fact, the norm today is several days of standby time and almost half a day of continuous usage capacity. In order to increase battery life, new technologies are being looked into to replace standard Lithium-ion, Nickel-Cadmium and Nickel metal hydride batteries.

The most notable of these technological advances is perhaps in the area of fuel cells.

Fuel Cells

Fuel cells use chemical reactions to "burn" a fuel, oxidise it and create electricity. Normally, fuel cells have cartridges that contain the fuel, and running out of power means exchanging the spent cartridge with a new one. For mobile devices, fuel cells are a great alternative, or even a great backup system. Imagine you're on the road, travelling, and your mobile battery dies. There's not a power outlet for miles, and you are expecting urgent calls. With a standard mobile battery, you're pretty much out of luck—even with the innovative "human-powered" chargers that are available, you don't really want to be huffing and puffing while on an important call. If your mobile was fuel cell-powered, all you would need to do would be to pop in a tiny fuel cartridges.

Fuel cells have reached a stage where they can power a standard mobile device for up to 10 times longer. So if your normal battery runs out in say 3 days, you can go a month with a fuel cell cartridge!

Recently, Motorola made an investment in Tekion Incorporated (www.tekion.com) that's being viewed as a strategic investment on the former's part. Tekion has developed micro fuel cells which they call Formira cells, since they use a purified formic acid as their fuel. These cells are hybrids that consist of advanced mobile cells (the

Lithium-ion kind) and micro fuel cells. The fuel cell can either power a device directly or recharge the standard battery, which in turn powers a device. This flexibility means that Tekion's Formira cells can be either incorporated into existing devices without any change in design, or even in devices in the near future. Motorola certainly is interested, and other major mobile vendors are sure to follow suit, if not with cells based on formic acid then perhaps with cells based on the more commonly available methanol fuel cells.

Visit Tekion's site to find out more about the technology that drives Formira cells.

The Result

It's pretty obvious that with micro fuel cells that can power devices for up to 10 times longer, and displays that are rollable, foldable or projectable, the future of the mobile industry will certainly surprise us with innovative designs. Expect the mobile to be heard and used, but not seen. Perhaps mobile devices will turn away from being gadgets that we like to show off and become more concealed and personal. It's not hard to imagine mobile devices that are integrated with our clothing, or perhaps only as big as the hands-free Bluetooth headsets we use today! If you start considering the other technologies that are furiously being researched, such as nanotechnology, it's easy to see that the future of mobile devices is small, very small!

8.2 The Vision

In July 2005, *Digit* carried an article on the Gadget of Our Dreams (aka GOD), in which we played soothsayer and tried to predict what the gadget of the near future would look like. We focused on shrinking the laptop or tablet PC to a more pocketable size—the size of a standard PDA today. However, though a lot of people feel that the mobile phone is set to become the master of all trades, there will perhaps always be a market for no-nonsense devices that focus on just getting a specific task done.

With the mobile phone, the trend is shifting towards convergence. Yet, it's quite possible that certain products will be made just to handle the tasks of a cell phone. Cell phones cannot shrink to minuscule sizes because of the current demands: a digital camera, MP3 player, video player, PIM applications, and more, all in one device—oh, and let's not forget the ability to send and receive calls and SMSes! Let's take a look at some pictures of devices that are already under development, are in the prototype stage, being marketed, or just simply visualised:

OK, the image on the right *is not* a real phone: it's a mock model made to make fun of the main character in the movie *Zoolander*. But even then, actually owning something like this would be really cool! Current technology is capable of developing such a device, but you would be ruining your eyesight trying to read the screen, even with a single line display!

Toshiba's 0.85 inch hard drive is made with mobile phones in mind. With capacities of up to 4 GB already shipping, it's easy to see why mobile devices will shrink in the near future. This artist's impression, courtesy Canesta (www.canesta. com), a company working on projection keyboards, gives us the impression that not just displays but even keyboards can be simulated, and thus removed from the actual device! On the right is NEC's thoughts of the future, already incorporating projected displays as well as a projected input keyboard.

8.3 Networks

The main focus of advanced network services is in Japan and Korea. While most of the world is yet to see 3G devices, the Far East is buzzing with murmurs of 4G services. What lies in the near future for countries such as the US, the UK, and India is already old news in the East. While many enjoy streaming video services with advanced features and bandwidth of the Mbps variety, we in India are still languishing with WAP-enabled browsing and pathetically slow GPRS speeds. Will this change? Yes, we will get better services, but perhaps will never catch up with the crazy East.

However, there are still some software and technologies that give us hope.

WiMAX

Though far from being implemented in India, WiMAX does offer a chance of achieving a "connected" India. Since WiMAX is much superior to existing WiFi technologies, and offers better speeds and an enhanced range, there's no doubting the fact that it might be our only hope. If India deployed a nationwide WiMAX network, which is possible given the enormous coverage offered by WiMAX, we could truly realise the dream of networking even the tiniest of villages.

WiMAX offers a range of up to 10 km per cell site, and speeds of up to 40 Mbps per channel. This is more bandwidth than cellular networks or ISPs will ever need. The equipment is expensive however, and it will be some time before we, and the service providers as well, will be able to afford such equipment.

UMA

UMA stands for Unlicensed Mobile Access. No, it's not a hacking technique or anything illegal. UMA quite simply uses GSM and GPRS services over an unlicensed frequency spectrum such as Bluetooth or WiFi.

What this means is that using this technology, you could travel into an area without a standard GSM cell, and still stay connected to your network using the local ISP. Yes, you could actually switch over to a WiFi Internet service provider as soon as you go out of range of your mobile service provider.

The best bit of UMA is its lack of governing rules, and it just uses relatively unused spectrums to keep you connected. Since it works through the IP protocol, it does have special UMA Network Controller that interfaces with the original GSM provider to keep you connected.

Applications

Another trend that we have seen is the increased power of a mobile's microprocessor. Today we're loading Java games and software applications like there's no tomorrow, and the all new genre of multiplayer mobile gaming has arrived. We're all addicted to our favourite mobile game, but what was once *Snake* could now become games such as *DOOM* or *Quake*!

With the ever-increasing capacities of hard drives and flash storage, it's no wonder that mobiles are beginning to become omnipresent, and can now store video, audio and data files as well! Another interesting field of study and improvement is voice recognition (VR). Though we already have systems deployed to help train your voice recognition software, it's all available for the PC. Simplistic versions can be found in certain devices, with features such as voice dialling. However, if possible, VR will eliminate the need for a keyboard, and will in turn reduce the amount of space required in the mobile device!

Conclusion

The fact of the matter is that there are way too many technologies and newer services and networks that are being worked upon. None of us really knows what to expect even three months from now, but by staying informed, we can make educated guesses. We hope this book has helped you better under-

stand ideas in mobile telephony, and also informed you about a few of the latest mobile devices. Write in to the editor with thoughts and comments—we'd love to hear from you!