

## Chapter 10

# Terminals and Applications for the 3G Marketplace

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### 1. INTRODUCTION

Mobile communications is the trend of the future – and it will change the economy, our technology, and in the way people live, work and play.

But while traditional ideas of place and time have changed, consumers the world over continue to seek increasingly powerful and convenient ways to stay in touch. Subscribers want fast, convenient and enjoyable connectivity, and to meet that demand, the telecommunications industry must move forward to create the next generation mobile platforms and products.

The key to success in this environment – and the core driver in the development of next generation wireless phones – will be a solid understanding of the attitudes and lifestyles of those mobile consumers. Handset developers must work closely with network manufacturers, service providers and content developers to create the seamless, interoperable solutions consumers expect and demand.

In this CITI 3G White Paper, we will examine the evolution of the mobile phone, the changing nature of the mobile device, and the standards and technologies that are shaping the emerging generation of mobile devices.

## 2. THE MOBILE PHONE COMES OF AGE

A growing worldwide acceptance is rapidly making the mobile phone a normal part of the

everyday consumer lifestyle. According to our own industry analysis<sup>1</sup>, penetration rates in many markets now exceed 50%, while others are quickly approaching 70% and higher.

To gain a fuller understanding of the forces that will drive mobile phone usage in the coming years, we can examine today's "wireless literate generation", those 15-to-35-year-olds for whom the mobile phone is a natural extension of their daily lives. In some markets, for example, these intense users are now using text messaging as one of their main ways to stay in touch with family, friends and their community. These same active users will drive the movement to create and consume a wide range of content, from text and voicemail to photographs, greetings and video messages.

These younger users represents the most promising mobile data consumers, with studies indicating that roughly half of all 14 to 24-year-olds have replaced their handset within the last 12 months, compared to just 19 percent of users over 45-years-old.<sup>2</sup> Based on our own market experience, Nokia expects that by 2002 more than 40 percent of the population in key European and APAC markets will purchase a new cellular terminal each year, and that 38 percent of U.S. subscribers will buy a new cellular terminal in 2002.

At the same time, the very nature of the mobile handset has changed dramatically. In 1994, a typical single-band mobile phone measured 179 cc and weighed 235 grams, and featured 1 Mbyte of memory, 10 MIPS and a single day of standby time. By 2001, the typical dual-band phone with GPRS functionality had slimmed down to just 66 cc and 84 grams, but offered a full 8 Mbytes of memory, 200 MIPS and 16 days of standby.

As third generation or '3G' capabilities emerge, consumers are increasingly relying on the mobile phone as their touchpoint for business, personal and entertainment communications. The 3G-capable mobile phone can be expected to function as the subscriber's communications anchor – a personal organization tool, digital navigator, and gateway to a growing universe of commercial and information sources.

We believe that in the initial stages of 3G, demand will focus on the need for highly-integrated dual-mode terminals capable of supporting both current and newly developed applications, the Mobile Internet, Multimedia Messaging, Multimode radio and open standards. To ensure maximum consumer acceptance, these dual-mode mobile terminals must deliver a

<sup>1</sup> Nokia Mobile Phones

<sup>2</sup> Nokia Mobile Phones

world-class user experience while giving carriers the ability to create and sustain new revenue streams.

In the early stages of third-generation technologies, we will see the introduction of dual-mode phones designed to support both current and newly developed applications. These phones will allow the introduction of Mobile Internet services, Multimedia Messaging and other capabilities. To ensure maximum consumer acceptance, these phones must deliver a world-class user experience. They must also give carriers the ability to create and sustain new revenue streams.

Today's SMS capabilities will evolve naturally to 3<sup>rd</sup> Generation Partnership Program (3GPP)-defined Multimedia Messaging in a format that will blend text, voice annotations with digital and video images. Still-emerging technologies such as Java, WAP, Bluetooth, SyncML and IPv6 will allow third-party developers to meet consumer expectations for new applications.

### **3. 3G – SOLUTIONS FOR THE NEXT GENERATION**

Mobility and the Internet are converging to form an entirely new model for business and consumer communications. To meet the dynamic needs of this new mobile data environment, developers are now creating an entirely new generation of service applications.

#### **3.1 Multimedia Messaging**

Multimedia Message Service (MMS) is expected to play a crucial role in the emergence of the 3G terminal marketplace. MMS is an end-to-end application that is ideally suited for a wide range of mobile communications, including person-to-person, mobile-to-mobile, mobile-to-Internet and Internet-to-mobile messaging. MMS can be deployed to deliver data and text, images, audio, video and other rich multimedia content.

Multimedia Messaging can be expected to build naturally on the global acceptance of Short Message Service (SMS) applications. In August of 2000, some 9 billion SMS messages were sent worldwide<sup>3</sup>. For many operators, SMS represents the first mobile data service that has generated a positive financial result, and as consumers have altered their mobile

<sup>3</sup> GSM Association.

communications behavior to accept this new service, messaging now offer a clear pathway to future 3G profitability.

MMS builds on and enhances the established SMS model, adding new functionality and content and incorporating advanced location-based capabilities. For operators with EDGE and WCDMA investments, MMS extends the useful lifespan of those systems while creating a stable platform for the introduction of new and differentiated services. Ongoing efforts to standardize MMS under 3GPP and WAP Forum will ensure its compatibility and evolutionary flexibility.

## **3.2 Rich Call**

As the next generation of mobile devices emerges, consumers will enjoy “rich call” capabilities in which voice conversations will be enhanced by the addition of data, images. In the emerging rich call environment, a communications session might include voice, messaging, games and video elements. These capabilities will allow users to incorporate information or images into their conversations, without interrupting their voice calls to find or download that data. Operators can offer these rich call services in the initial phase of a 3G launch.

Video telephony will also become the key element of the rich call environment with the launch of 3G. Live video images of callers will pop up on display screens, much like caller ID numbers are shown on current-generation displays.

The introduction of IP technology will streamline the creation and deployment of new rich call applications. This in turn will increase consumer interest and acceptance of rich call services. Service providers can encourage consumer take-up of rich call applications by offering those services at discounted introductory rates.

## **3.3 Mobile Internet**

While simple browsing will continue to play a significant role in Internet usage, subscribers in Europe and Asia are beginning to use Mobile Internet services to do business, conduct everyday transactions, play games, watch videos, download and enjoy music, and stay in touch with family and friends.

As technologies, applications and business models are refined in those international markets, those more sophisticated Mobile Internet services can be expected to gain traction in the U.S. market as well. Developments affecting Mobile Internet usage will include:

### **3.3.1 Browsing**

Third-generation browsing will evolve from current WAP browsing to include graphics and multimedia-enriched capabilities. WAP enables Internet content to be distributed to and displayed on standard mobile phones and information devices. WAP supports mobile browsing by integrating terminal-resident and network services for telephony, communications applications, information services and operator services.

XML and the evolution from the WML mark-up language to XHTML will support the movement to true Mobile Internet browsing. To support more convenient mobile browsing, TCP-based protocols are expected to be used in next-stage versions of WAP. Regional variations in 3G development may require the use of differing wireless-optimized TCP-based versions. IPv6 is expected to play an important role in the emergence of convenient and widely used mobile Internet browsing.

### **3.3.2 Java Client Applications**

Programmable 3G terminals will allow applications to be run directly on the mobile device. This will support both client-server type applications and applications downloaded from mobile Internet portals, and will allow operators and service providers to customize the look and feel of the end-user experience.

### **3.3.3 Multimedia Streaming & Downloading**

As both terminals and bandwidth capabilities improve, 3G applications will support multimedia streaming in real-time, near-real-time and download speeds. These services may include interactive games, music, video streaming and two-way video/audio conferencing. This capability will support interactive, on-demand access to news and entertainment, educational content, corporate information, banking, shopping and other services.

### **3.3.4 Streaming Media Services**

Current-generation streaming technologies such as MP3 audio streaming will be leveraged to deliver rich content and entertainment services. In the early phases of introduction, these data-driven services will be targeted to

professional and 20-to-30-year-old subscribers who are willing to pay a premium for access to higher Quality of Service performance.

While streaming media will be available in 2.5G terminals and networks, EDGE or WCDMA radio access technologies will solve the bandwidth vs. capacity challenges needed to bring streaming services to the mass market. Streaming also alleviates crucial memory and copyright issues, since only a portion of the content resides on the terminal at any given time.

### **3.3.5 Download Media Services**

Content that requires downloads will take advantage of low usage periods in the network, and will employ generic file servers to store and process content off-line of the mobile terminal.

## **3.4 Entertainment**

Third-generation mobile handsets will allow subscribers to download, sample, purchase and play a growing selection of electronic games. The interoperability made possible by WAP, Java, GPRS and EPOC will break down traditional OEM-driven barriers, and game play will be further enhanced by improved displays, downloadable elements, Bluetooth-enabled local play and kiosk downloads.

Wireless handsets will also incorporate the ability to deliver images and music for everything from WAVE and MIDI- formatted ringtones, to full streaming music and downloads of digitized musical tracks. Consumers will use wireless access phones and high-bandwidth networks to share and distribute digital photographs in real time.

## **3.5 Location-Based Services**

Location-based services represent one of the most promising avenues for the mobile telecommunications industry. Industry observers now predict that mobile location services will grow to \$33 billion by 2005.<sup>4</sup> In a study of the most popular wireless services in Europe and the United States, four of the top six were location-based services: step-by-step directions, tracking of family members, traffic information, and facilities-based services.<sup>5</sup>

By adding location-awareness to an information, gaming or community service application, providers can build interest and value in a wide variety of offerings. Location-driven solutions use geographic information – either

<sup>4</sup> ARC estimates.

<sup>5</sup> Strategy Analytics' research.

provided by the user or detected by a positioning technology – to provide navigation, tracking, safety response, tariff input, or location-based information or e-commerce.

To enable the definition, development and marketing of interoperable, common and ubiquitous location-based service solutions, a number of industry leaders have joined to form the Location Interoperability Forum. The recommendations of LIF will be network protocol and positioning technology independent.<sup>6</sup>

Three primary technologies are emerging for wide-area location-based functionality. Those are:

- *Cell-ID information* using IN-solution, LocWAP and pure cell ID variations. This approach does not add significant terminal costs, and it allows services to be tailored to the environment of the serving cell.
- *Enhanced Observed Time Difference (E-OTD)* for GSM and its variants AF-LT and IP-DL for CDMA and WCDMA respectively. This approach employs triangulation based on the arrival of signals from three or more base stations. This approach can deliver accuracy to within 100 meters.
- *Global Positioning System (GPS)* in stand-alone, network-assisted or Bluetooth-complimentary configurations. While offering the greatest potential accuracy, the GPS approach would add significantly to the cost of the mobile terminal.

### 3.6 Mobile eBusiness

While still in its formative stages, most analysts now predict that Mobile eBusiness will be a multi-billion dollar marketplace within four to five years. The convenience, speed and portability of Mobile eBusiness offer consumers easy to understand benefits. But to realize the promise of this new medium, developers must bring focus to this emerging market and provide the consistency, ease of use and trustworthiness consumers will demand.

The Mobile Electronic Transaction (MeT) initiative was created to establish a framework for managing secure electronic transactions via a mobile device. Security for this emerging technology may be derived from the proven performance of WAP, Wireless Transport Layer Security (WTLS) and Wireless Public Key Infrastructure (W-PKI) technologies.

<sup>6</sup> Location Interoperability Forum, [www.locationforum.org](http://www.locationforum.org).

## **4. SHAPING THE PHONES OF THE FUTURE**

The simultaneous maturation of digital and 3G wireless technologies will support the development of a powerful new generation of mobile terminals. Terminals can be expected to migrate through several stages of evolution: from today's cellular phones to personal terminals optimized by function and operation; from fixed-function terminals to increasingly personalized platforms; with an eventual evolution into a "central hub of personal communications, interactive services and life management".

In our view, three new categories of terminals will be used, each delivering a particular class of service in combination with a personalized mobile application platform. Those emerging categories are:

### **4.1 Imaging Phone**

Designed for person-to-person multimedia communications, the Imaging Phone combines traditional phone functionalities with high-quality messaging and imaging capabilities. Imaging Phones will be compact and attractive and will feature an easy-to-use interface. These devices will allow consumers to create personalized content, while providing convenient access to games, media and new service applications.

### **4.2 Media Phone**

The Media Phone will be the preferred platform for personalized anywhere/anytime wireless access to the Internet. This device will combine traditional mobile phone functionality with advanced audio and data features, as well as support for third-party applications, streaming media and Personal Information Management (PIM). Media Phones will also incorporate new accessories and a superior, more adaptable display.

### **4.3 Communicator**

The Communicator is a wireless business terminal designed to provide seamless integration with corporate IT systems, ISPs and portal operators. Communicators will support email, networked office applications, real-time information sharing, and full input/output capabilities.



## 5. STANDARDS AND TECHNOLOGIES

### 5.1 Multimode and Multiband Terminals

Multimode terminals support multiple air interfaces, and can be used to enable 3G roaming and to overcome certain air interface incompatibilities. Some technologies – notably WCDMA and GSM/GPRS/EDGE, and WCDMA and TDD submode – are considered to be more smoothly compatible within the same terminal. Multimode terminals must address a number of potential concerns, including cost, service continuation, security and applications.

Multiband mobiles use a single air interface on several distinct bands to address the challenge of non-harmonized spectrum allocations. Multiband terminals do not present service or application problems, but the addition of numerous bands requiring unique RF parts can affect the size and cost of the terminal.

To achieve combined multimode and multiband capabilities, the optimal solution is to deploy single-mode wideband technologies, or to use a single technology on two or more bands. Mixing technologies on a given band would pose significant cost, service and user experience problems.

### 5.2 Symbian Platform

The adoption of standardized operating systems and the creation of mass market acceptance will be critical factors in the success of third-generation technologies.

A group of leading telecommunications firms – consisting of Nokia, Motorola, Panasonic, Ericsson and Psion – collaborated in the launch of Symbian Ltd., which was created to establish the standard for mobile wireless operating systems and to build a mass market for wireless information devices.<sup>7</sup> The Symbian platform, which uses the EPOC software architecture and highly flexible APIs, is designed to improve the quality and performance of software designed for hand-held devices.

Symbian's interactive approach allows developers to more quickly and easily integrate their solutions to multiple wireless devices, hand-portable computers, and PCs. Applications that will eventually be supported by the

<sup>7</sup> Symbian, Ltd.. Symbian supplies an operating system to the world's leading mobile phone manufacturers, enabling them to create mobile phones that combine voice communications, wireless Internet access and computing functionality.  
[www.symbian.com](http://www.symbian.com)

Symbian model include: rich calls, messaging, browsing, personalization, pay-per-download software, location-dependant software, and the extension of corporate or consumer networks into the mobile environment.

### **5.3 Internet Access – WAP and XHTML**

WAP will play an important role in the emergence of the Mobile Internet. The industry is moving towards a content-centric system architecture, application-level protocols, and applications that extend beyond the browser. While value is moving up the protocol stack, the Mobile Internet still requires basic technologies, and a standard is needed that provides a stable development platform, security, value and maximum business flexibility. The WAP framework meets these requirements in two important ways:

- WAP is a protocol-, bearer- and device-independent open technology. WAP works across various wireless networks and allows applications to scale across differing transport alternatives and device types.
- WAP is also optimized for devices that provide limited screen and input capabilities. The wireless mark-up language used in WAP (WML) is ideally suited to the bandwidth limitations of over-the-air mobile applications.

Nokia supports open, recognized industry standards and participates actively in WAP standardization through the WAP Forum.

Nokia also supports XML and the evolution towards XHTML. XML will transform the basic structure of the Web by providing a stronger, more extensible architecture. XHTML Basic establishes a global standard for all browsers and serves to bring wireless communications into alignment with the latest advances in Internet content development and presentation.

For manufacturers, XHTML supports enhanced layout control, simplified browser operation, and improved performance through strict validation and reduced memory requirements. For carriers, XHTML allows the enforcement of consistent content across all supported devices, while establishing the standards needed to attract content developers and providers. XHTML allows content developers to create for an industry standard using existing both existing tools and convenient style sheets that simplify updates and new application development.

## **5.4 Java™**

Java will be a core enabler of the mobile information society. Java is both a programming language and a runtime environment in which the Java language is executed. Java provides a range of advantages that are expected to make this language the preferred platform for Mobile Internet downloads. Java enables easier-to-use services and a more satisfying end user experience. Java is emerging as the platform for secure off-line applications and value-added services beyond WAP. When deployed with WAP, Java will support corporate and vertical server-based solutions for digital convergence products.

The Java 2 Platform, Micro Edition & MIDP, as well as Personal Java and JavaPhone technologies, will provide a rich platform for developers to create a wide range of applications and services. Because it is targeted towards all terminals, Java will help build the volume needed to drive the success of Mobile Internet services. It is now taught alongside C++ as a first language, and a community of more than 1.7 million programmers can now write Java code.

## **5.5 IPv6**

As the Internet is used increasingly as a person-to-person communications tool, the medium must adjust to accommodate a vast new variety and number of active devices. The Internet Protocol Version 6 (IPv6) will solve this challenge. This new standard will assign individual addresses to each device, enabling network-driven actions such as self-provisioned push services. Unique addressing also supports direct end-to-end connections from any device to any other – a key requirement for delivering the personal communications tomorrow's mobile subscriber will demand.

IPv6 provides a large address space, globally routable addresses and CAPEX and OPEX savings via Network Address Translation capabilities. IPv6 also features improved security and reliability, intra-network handoffs, and built-in mobility support.

## **5.6 Multimedia Streaming**

With the maturation of IETF standardized protocols and plans to create open streaming programs by 3GPP and 3GPP2 wireless standards bodies, multimedia streaming is poised to enter the world of advanced wireless devices. Perhaps the most productive initial approach to multimedia

streaming will be the use of control and transport layer protocols specified by IETF to create a rich media set with standardized audio, video and still image codecs, file formats and scene description language solutions.

Based on the success of current Internet streaming services, up to 80 percent of those technologies can be readily adapted for wireless terminals. These streaming services will be based on packet-switched bearer services and application-specific QoS differentiation, with the client-server applications themselves based on familiar IETF RTSP, RTP/RTCP protocols. We see a clear need for standardized speech and video codecs for UMTS/GSM R99 services to support streaming.

## 5.7 Digital Music Distribution

Digital Music Distribution (DMD) offers the opportunity to build new revenue streams based not only on the delivery of music, but also on the creative deployment of new promotional marketing, merchandising, interactive broadcast and event-based activities. With the proper introduction to consumers, DMD will soon be deployed to send customized music content, announcements and other information to mobile phones and other personal devices.

## 5.8 Connectivity: *Bluetooth*

Consumers want fast and easy connectivity, and Bluetooth technology is rapidly eliminating the need for hard-wire cable links between mobile devices. Bluetooth technology will allow automatic, wireless connectivity between mobile phones, PDA's, laptop and other devices within a radius of about 10 meters. Featuring a small footprint, low power requirements and mass market economies of scale, Bluetooth technology is especially well suited for deployment in mobile devices.

Bluetooth incorporates several potent security features that protect transmitted data. The technology employs an authentication mechanism based on a 128-bit link key, as well as fast frequency hopping of 1,600 hops per second on 79 channels. Security can be further enhanced at the application level to meet high-level e-commerce or corporate security requirements.

The Bluetooth Special Interest Group (SIG) enjoys the support of 2,400 companies from the telecommunications, computer, automotive and other industries that are cooperating to refine and extend the market reach of Bluetooth wireless technology. To meet the requirements of this consortium, Bluetooth products must pass a qualification process and receive an IP

license under the SIG<sup>8</sup> ([www.bluetooth.com](http://www.bluetooth.com)). It is projected that Bluetooth wireless technology will be incorporated into more than 670 million devices by 2005.<sup>9</sup>

## 5.9 Connectivity: SyncML

Local and remote synchronization is a key to the refinement of professional and other high-end wireless applications, as well as for lower terminal categories that will deliver sticky applications such as Internet calendars, contact lists and community interactive services. The SyncML Initiative was founded by Nokia, IBM, Lotus, Motorola, Palm, Ericsson, Psion and Starfish Software to create an open industry specification for common synchronization protocol for any device or application, over any network, using virtually any transport.

The SyncML Initiative will deliver an architectural specification, representation and synchronization protocols, bindings to common transport protocols, interfaces for a common programming language, and an openly available prototype implementation.<sup>10</sup> As envisioned, this synchronization protocol will work smoothly and efficiently over HTTP, the Wireless Session Protocol of the WAP suite, OBEX, SMTP, POP3, IMAP, pure TCP/IP networks, as well as proprietary wireless protocols.

The SyncML effort specifically addresses the issues of comparatively low bandwidth and connection reliability that affect the mobility and support of wireless devices.

## 6. CONCLUSIONS

The mobile phone is undergoing a fundamental transformation: from a simple voice-oriented device into a diverse family of personalized mobile terminals that consumers will use to manage their business and private lives.

To successfully create the next generation of handsets, developers must understand the attitudes and lifestyles of tomorrow's consumer. As demonstrated by early take-up in a number of global markets, consumers want mobile terminals that provide reliable, convenient access to a wide variety of personal, professional and entertainment services.

<sup>8</sup> Bluetooth Qualification Review Board

<sup>9</sup> Cahners In-Stat Group

<sup>10</sup> SyncML Initiative, [www.SyncML.org](http://www.SyncML.org).

From a technical perspective, the terminals created to meet that demand will require the support of open network architectures that enable seamless interoperability between applications, network environments and user identity/addressing. The industry must address the challenge of standardization across hardware, software and protocol environments. All participants must support the formal initiatives now underway to meet these challenges.

Consumers will also expect those next generation terminals to be compact, attractive and easy to use. By focusing on the end user experience, instead of on the intricacies of the supporting technologies, developers can ensure greater consumer satisfaction and faster acceptance of Mobile Internet devices. Carriers and their partners are working now also to formulate the business models that will define the revenue streams and profitability of the services delivered over these new mobile terminals.

For users, the device they hold in their hand will represent the reality of Next Generation mobile communications. The industry is now rushing to create the handsets that will bring the promise of 3G to fruition. The winners of that race will be those who deliver the products and services that best match the lifestyles and the attitudes of this emerging generation.