White Paper

Revision C

Z500a

Preface

Purpose of this document

The aim of this White Paper is to give the reader an understanding of technology and its main applications, as well as the main functions and features of the phone.

People who can benefit from this document include:

• Operators
• Service providers
• Software developers
• Support engineers
• Application developers

More information, useful for product, service and application developers, is published at www.SonyEricsson.com/developer/, which contains up-to-date information about technologies, products and tools.

Online Developer Resources

On www.SonyEricsson.com/developer, developers will find all documentation and tools such as phone White Papers, Developers Guidelines, SDKs and APIs etc. The developer Web site also contains discussion forums monitored by our Sony Ericsson Developer Support team, a searcheable Knowledge Base of support queries and solutions, Tips & Tricks, example code etc. To stay up to date on development issues, register and subscribe to the monthly Sony Ericsson Developer Newsletter.

Sony Ericsson Developer Support

Sony Ericsson offers developers professional technical support services. The service can be purchased from the developer web portal, as part of the Sony Ericsson Core and Core+ membership package or as individual support incidents. There are two levels of support, described below.

The **Basic Email Developer Support** is an annual support service included in the Core membership that provides developers with all the basics to successfully develop world-class applications for Sony Ericsson products. With this support contract, developers get access to Sony Ericsson developer support engineers via email with same-day response, five technical support incidents as well as the ability to purchase more.

The **Priority Email Developer Support** is an annual support service included in the Core+ membership that equips professional developers with everything they need to successfully develop world-class applications for Sony Ericsson products. With this support contract, developers get priority access to Sony Ericsson developer support engineers via email with fast response times and up to 50 technical support incidents.

Document conventions

The phone has a full graphic screen which supports 65,536 colors, referred to as 65K.

The screen images in this document are in JPG format and are thus of a lower resolution than the images actually shown on the screen.

The Picture Messaging feature is referred to as *MMS* (Multimedia Messaging Service) throughout this document.

Contents

Product overview

The Z500a mobile phone features the latest in advanced messaging and access technology with a rich offering of multimedia, imaging and entertainment functions. This includes for example, playing video clips with the media player, taking pictures with the built-in camera and enjoying the latest in gaming.

Easy to use video communication provides a dedicated camera button and only five steps for taking and sending a picture or video clip.

Form follows function in this attractively designed clamshell phone with replaceable Style-Up™ Covers.

There is optimized memory for video communication with 6 MB of built-in memory for storage of content such as pictures, music, ringtones, themes, games and video clips.

Easy access to Sony music, images, video and games.

A powerful gaming solution for Java 3D with cutting edge graphics; multi-player games; a large 1.8 inch, 65,536 color; STN display and support for accessories such as a game board.

This phone supports EDGE Class 10 (Enhanced Data rates for Global Evolution) and GPRS (General Packet Radio Service) triple band 850/1800/1900 (Class 10 meaning 4+2 sum 5), and GSM (Global System for Mobile Communications). In addition to packet switched (ps) data, it also supports voice and circuit switched (cs) data.

Key functions and features

This phone is the next step in imaging for Sony Ericsson products. The evolution of mobile communications towards imaging will greatly increase the scope for new applications and services. In the area of multimedia in mobile phones, Sony Ericsson can show its vast experience in consumer electronics and entertainment – music, pictures and games – as well as its mobile technology leadership.

EDGE

EDGE (Enhanced Data rates for Global Evolution) enhances all the benefits of GPRS by providing significantly higher data rates. In addition, services are made feasible by EDGE that require more bandwidth and speed than GPRS can offer. Alternatively, the added bandwidth can be used as capacity for additional customers. Higher data rates are achieved using new modulation schemes on the air interface.

Device Management

The Z500a supports Open Mobile Alliance Device Management (OMA DM) which allows for the remote configuration and updating of settings for purposes such as web browsing and synchronization. Service providers benefit because OMA DM allows for efficient reconfiguration of phones in the field without requiring consumers to visit a retail location or call a customer service representative. Network changes such as new IP addresses can quickly be configured in numerous devices. Consumers benefit because the manual effort needed to modify settings can be avoided.

Displays

Internal

An eye-catching feature of this phone is the large color display. It measures 128 pixels wide and 160 pixels high in portait mode and has 65,536 colors, allowing high-quality color imaging and video.

External

The phone has an appealing clamshell design with an external color display. The external display measures 96 pixels wide by 64 pixels high and has 4,096 colors. It offers at-a-glance phone status and access to some phone features without opening the clamshell. The standby screen for the external display shows the service provider, time, date, signal strength, battery charge level, and other information.

Voice control capability is also supported with the clamshell closed. This capability can be accessed with a long press on the upper side volume key or the portable handsfree button. It can also be accessed using the "magic word" that activates voice control.

A long press on the camera button with the clamshell closed makes the external display function as a view finder. Zoom is controlled with the upper and lower side volume keys.

When the clamshell is open, the external display can be customized with the text or logo chosen by the customer. Details can be specified along with other customization parameters.

System

This phone supports GSM-EDGE/GPRS and is a triple band mobile phone (850, 1800, 1900 MHz).

Multimedia (streaming and download)

By streaming media such as audio and video clips, multimedia is available in virtual realtime with minimal downloading or waiting time. Media can also be downloaded and saved in the phone memory and then used with the Media player. Media such as audio files, video clips or slide shows can be played back at any time.

Media player

The Media player converts the phone into a portable MP3/MPEG4/3GP player. Play music, watch pictures and slide shows, as well as streamed or downloaded video clips.

VGA camera

With a VGA camera, the Z500a is always available to take pictures. Taking a picture or recording a video clip and sending it as part of a multimedia message or as an email attachment is just a few clicks away. The camera also features a 4X zoom.

QuickShare™

Sony Ericsson's constant goal of making products easier to use has resulted in QuickShare™.

QuickShare is the fastest and easiest way to share images. With minimal hassle and just a few clicks, moments can be captured with the integrated camera and shared with friends!

But there is more to QuickShare than sending images with a picture or email message. QuickShare is about ease of use of all the imaging features of the product.

Full graphic 65K color display

The color screen, 128 x 160 pixels, enhances viewing, facilitating high-quality multimedia and entertainment. From standby, the phone features a user interface built on the "desktop" concept, which is widely used in many computer operating systems. From here, navigation between different main functions in the phone is done by selecting the icons representing these functions.

MMS

Reacting to the enormous popularity of mobile phone messaging, Sony Ericsson has incorporated the latest messaging standard, along with a color display for an enhanced imaging experience.

Say it in words, say it with pictures, animate it, add sound. Have fun putting together Multimedia birthday and holiday greetings. On vacation, use the mobile phone to send a digital postcard with stylized text, digital pictures of the location, and authentic sound clips, to friends and family back home. When shopping, send a picture of a bargain that a friend has been looking for.

With MMS, there are many interesting applications to subscribe to, for example, stock information, movie trailers and weather reports.

PlayNow

Content such as music, video and images may be previewed before purchase.

User experience

A unique direct-link to download music, video, games, themes and images, which is easy to use and promises you the best-selling content for mobile download.

By pressing the PlayNow icon on the phone desktop, you can, for example, go straight to a live list of Top Music Hits. Choose a ringtone clip, listen to it, and if you like what you hear, you can buy it and add it to Sounds. You can then listen to it or use it as often as you want.

Content formats that are supported

All formats that are supported in the phone can be downloaded. Music, video and images may be previewed before purchase. The music format is MIDI or MP3.

How the service works

This service is owned by Sony Ericsson or hosted by Sony Ericsson for a network operator. The PlayNow or other premium content is maintained and managed, for example, by Sony Music or Sony Pictures. The content on offer can easily be suited to a specific region or operator.

Implementation costs for network operators may be minimal and server communication is based on existing, well-established standards. Sony Ericsson offers first or second line support according to the agreement on hosting a white label service or not. High level cooperation is available for the design, look and feel, of content management.

Operator benefits

This service is aimed at providing quality and quantity revenue for network operators. This is truly an ARPU driver with low costs for operators. The process involves:

- Downloading a list
- Previewing content
- Choosing content
- Buying content

Note: The availability of this unique application is limited to specific markets, where relevant infrastructure and agreements have been set up.

Other technical details

Security - Server communication is protected by Transport Layer Security (TLS).

OMA Forward lock - Content cannot be exchanged with other devices by the user, it is limited to use or delete.

Java™ 2 Micro Edition

With Java, you can download extra content, for example, new information- and entertainment-based applications. This gives users a chance to personalize the functions and features in their phones, and developers the opportunity to create new applicatons.

Gaming

Gaming is already a very popular feature in mobile phones, and with Java, users can add new games and skill levels to further enhance the entertainment value of Sony Ericsson phones.

3D Games

The Java 3D gaming software introduces and supports cutting edge 3D graphics. Audio developments such as 40 tones polyphonic sound and force feedback provide a much richer experience. With operator support, there is the possibility for multiplayer games to play against friends. The large 1.8" STN display can only add to a lasting gaming experience. Downloading graphic intensive games requiring up to 6 MB user memory is also possible with that amount of built-in memory.

Copyright protection – DRM

DRM (Digital Rights Management) assures the rights and copy protection of downloaded content (audio, pictures, ringtones, video, entertainment features such as games etc.).

Content-based services have great market potential, and to encourage this, Sony Ericsson plans to support DRM in all future multimedia products. Sony Ericsson regards DRM as a key enabler for content-based services, and is active in supporting the ongoing standardization work of the OMA (Open Mobile Alliance). Furthermore, any additional market requirements for DRM will be monitored.

More in-phone functions

Memory

The user has 6MB of user memory available for:

- video clips
- pictures
- 2D games
- 3D games
- MIDI ringtones
- MP3 songs

Navigation key

The 4-directional + select key is designed to easily navigate the menu system. In a menu, the center select button is gently pressed to select a feature.

Improved User Interface (UI)

Selection keys and the key assignment give a very efficient interactive design with full flexibility to handle all the new features and applications. Sony Ericsson has focused on user-centered design and extensive usability testing to solidify the new UI paradigm. This ensures visibility in actions and system status and consistency between applications and similar actions. The large, high-resolution color display is easily navigated with the navigation key.

Polyphonic sounds - 40 voices

Polyphonic sounds and the MIDI format have revolutionized the sound quality of ringtones in mobile phones. With this format, the user can play, compose, edit and send melodies by using the

MusicDJ™. The built-in sound synthesizer uses wavetables, real instrument sounds, with 40 voice polyphony. The new composer has an improved graphical user interface to simplify melody handling. All new and edited melodies are stored in MIDI format.

File management

There is a file manager, similar to that which can be found on many computers. In the file manager the user has an overview of the contents of the phone as well as how much memory is allocated to each function and feature.

GPRS (General Packet Radio Service)

GPRS offers the user the speed needed for satisfactory mobile Internet usability. The phone supports GPRS (Class 10 meaning 4+2 sum 5).

WAP 2.0 supporting XHTML™

The WAP browser supports the markup languages of WAP 2.0 – XHTML Mobile and XHTML Basic. These two subsets of the Web standard XHTML are supported by all major Web browsers. An XHTML page can be viewed in both the WAP browser and in any standard Web browser. All of the basic XHTML features are supported, including text, images, links, check boxes, radio buttons, text areas, headings, horizontal rules and lists.

In addition to XHTML, the WAP browser supports WML. The user can navigate between WML and XHTML pages. WAP 2.0 also supports cookies, often used by Web sites to store site-specific information in the browser between visits to the site. Cookies are often used by e-commerce sites (in shopping carts and wish lists for example), and to save the user from entering the same information more than once.

Cascading style sheets (CSS)

Before style sheets were introduced on the Web, developers had little control over the presentation of their Web pages. An XHTML document specifies the structure of the content, which part is a paragraph, which part is a heading, and so on. It does not specify how it shall be presented. Browsers use a default presentation for documents without style sheets. By adding a style sheet to the document the developer can control the presentation of the document, the colors, fonts, and layout.

On the Web, the de facto standard style sheet language is Cascading Style Sheets (CSS), specified by the W3C and implemented in IE, Netscape, and Opera. For mobile phones, the OMA has identified a subset of CSS and extended it with OMA specific style rules. The CSS subset and the OMA extensions are called Wireless CSS (WCSS). The WAP browser supports WCSS 1.1

Instant messaging (Wireless Village)

To ensure interoperability of mobile instant messaging and presence services, Sony Ericsson, Ericsson, Motorola and Nokia have created the Wireless Village Solution, an open standard. The protocol is bearer-independent and can be implemented in different networks. The Wireless Village Instant Messaging and Presence Service (IMPS) includes three primary features:

Presence

Presence information of other Wireless Village users is received and displayed to indicate their willingness to communicate. The user's own presence information is also sent for others to view. If the user is interested in another person's presence status, he or she can search for this person. If the person is found, the user may subscribe to his/her presence information. The presence information is displayed in a contact list.

Instant messaging

Instant messaging means "point-to-point messaging" between Wireless Village users. Messages can be sent to an entire contact list or to a single user. Short message histories of the communication are filed.

Groups

The user may join a chatroom and chat with the other participants/members.

Email

With inbox, outbox, save draft and reply options, you have all the functions you need for effective email communication in a powerful mobile phone. Constantly connected to a POP3, SMTP or IMAP4 email server anywhere on the Internet, your phone stores messages dynamically, depending on available memory, and updates your inbox automatically and over the air. Check your email anywhere. Reply to email on the move. Friends, family and business contacts know that when they send you email, you can receive, read and act on it immediately. You can include pictures in outgoing emails and receive attachments. Hyperlinks in emails are supported.

Personalization

With themes, the user can change many settings in the phone, for example colors, images and ringtones, making it more personal. The phone comes with a number of preloaded themes and pictures, and more can be downloaded and exchanged – sports, movie, seasonal and other themes will be available on Sony Ericsson or operator sites. Other personalizable features are the start-up picture and the screen saver. Specific pictures and ringtones can also be set for each separate name in the phonebook.

Technologies in detail

Entertainment

Media player

The Media player supports different audio and video formats, streaming as well as download and playback.

Music

The Media player is a multi-format digital audio player which enables the user to carry and play a selection of favorite songs. A range of audio formats are supported:

- MP3
  MP3 is the file extension for MPEG audio layer 3. Layer 3 is one of three coding schemes (layer 1, layer 2 and layer 3) for the compression of audio signals. Layer 3 uses a very efficient compression method, removing all irrelevant parts of a sound signal that the human ear cannot perceive. The result is, for example, CD digital audio (CDDA) converted to MP3 with almost untouched quality, compressed by a factor of around 12. The high compression of audio in MP3 files makes them relatively small, though MP3 files can be created with different size and quality compro-

mises. The small file size, together with the excellent sound quality, are the main reasons for the MP3-format's huge popularity.

- MIDI
  Musical Instrument Digital Interface.
  Unlike the other formats, MIDI is not a recording of music, but a description which enables a local synthesizer to play the music from the instructions included in the MIDI file. Since a MIDI file only represents player information, it is far more concise than formats that store the sound directly. An advantage is very small file sizes. MIDI is one format used for polyphonic ringtones.

- AMR
  Adaptive Multi Rate. A medium quality compressed sound format.

Songs may be stored in the internal Z500a user memory. The folder system enables the user to organize songs into groups and create simple playlists of MP3 songs.

Songs may be collected in numerous ways, including Internet download and file transfer from a PC.

The Media player is intelligently aware of other applications in the phone:

• Playback is paused when a telephone call is made or received.

• Playback is paused if the user starts another application which requires the audio channels to be dedicated to it.

• Playback of MP3 files continues if the user switches to another application, providing music while using other applications such as the phonebook or calendar, or playing games.

Polyphonic ringtones

Background
The word "polyphony" means producing several tones at the same time. Almost all music that we listen to consists of polyphonic melodies.

Early Ericsson mobile phones supported a proprietary non-polyphonic format called eMelody. Due to the musical limitations of eMelody, and the popularity of creating, sending and downloading ring melodies, Ericsson and Sony Ericsson, together with other manufacturers, created the more advanced non-polyphonic sound format – iMelody.

MIDI – Musical Instrument Digital Interface – is a specification for a communications protocol principally used to control electronic musical instruments. The MIDI files are small, and perfect for mobile devices, which have limited storage capacity. MIDI is today a well known standard used by many musicians, composers, arrangers and so on.

A MIDI signal or file does not contain any music. It contains binary data (information) of how a melody is played and when this data reaches a synthesizer, the synthesizer will translate the binary data to music, when connected to an amplifier with speakers so that the sound becomes audible.

Please visit www.midi.org for more information.

SP-MIDI
SP-MIDI stands for Scalable Polyphony MIDI. SP-MIDI is based on the MIDI format and adapted for mobile phones and other portable products. The objective is to secure interoperability between products with different sound capabilities.

Video clips
Moments can easily be shared with friends and family in other geographical sites by capturing the moment with the video recorder and then sending the video clip in a picture message. The video recorder supports QCIF at 10 frames per second.

The Media player supports download and playback of MPEG-4 and H.263 formats for viewing video clips in the phone.

Video clips may be downloaded from the Internet or copied from a connected PC. Video files are large compared to still images (roughly 1 MB per 1 second of video).

Files must be of types MP4 or 3GP, having video encoded in MPEG-4 Simple Visual Profile and audio in AAC or AMR format. Video may also be encoded in H.263.

Streaming Support
The Media player can be launched from hyperlinks in the Browser or in messages. Content is streamed using RTSP (Real Time Streaming Protocol) session control.

Streaming

Streaming media is a method of making audio, video clips and other multimedia available in real-time. Streaming media to computers has been used during the last couple of years, and now, the technique gives the

user a high-quality experience.

The term *streaming* refers to the technique it is based on. Previously an entire file had to be downloaded before it could be played, whereas the use of streaming means the end user can almost immediately begin to watch or listen to the content of a requested file. The data in the file is broken down into small packets that are sent in a continuous flow, a stream, to the end user. It is then possible to begin viewing the file as the rest of the packets are transferred.

Applications

The applications which can be built on top of the streaming services, can be classified into on demand, and live information delivery applications. Examples of the first category are music and video clips, news on demand as well as on demand instruction material. Live delivery of radio and television are examples of live information delivery. The following video and music codec support is provided:

- MPEG-4 Simple Visual Profile Level 0
- H.263 Profile 0 Level 10 (decode only)
- H.263 Profile 3 Level 10 (decode only)
- AMR
- MP3
- 3GP

Examples of usage

Streaming of music (on demand)
Anna browses to a Web page and decides to check out the latest top ten list of pop music. She wants to know if there are any new cool songs. She picks out a few, streams the music to her mobile phone and listens to the songs through the headset or receiver.

Streaming of news (on demand)
Bob browses to a morning paper's Web page and decides to check the news. He wants to see the five-minute version of the latest financial news. The news is streamed to his terminal, and he can watch it on the bus on his way to work.

Streaming/download of music video (on demand)
Mike browses to the a Web page and decides to check out the latest rock videos. He finds a video he wants to watch, so he clicks the link and then streams a one-minute version of the video. He then decides to download and pay for the complete video. A memory check is automatically performed to make sure that his mobile phone has enough free memory.

Streaming of live radio (broadcast)
Linda wants to check out and listen to the coolest radio station. She browses to the home page and starts to stream the content. The content is audio or audio with pictures of the artist.

Streaming of live traffic information (broadcast)
Nick wants to know if there is a traffic jam on the highway before he heads for home. He browses the page for local traffic information. There is a traffic jam, so he takes an alternative route home.

User-created content (Web album)
Sheila and Tom are on vacation. They want to show their friends how cool the beach is. They record a video clip and upload it to a Web album. Their friends can then stream or download the clip to their PC or mobile phone.

Market and revenue possibilities

As streaming means "seeing the product without having it", it can be extensively used in the music and film industry. There are also great revenue possibilities for subscription-based content: for example, the user can subscribe to several on demand services like news and traffic information.

In addition, the content is not stored on the phone so the user does not have to manage the memory usage.

Gaming

Gaming is now seen as a standard feature in mobile phones, where Sony Ericsson promises to be a step ahead in this regard. This does not only have to do with fast download through the network. Three other things make the actual gaming experience better – the way Java has been implemented, the fact that more processing power has been dedicated to the games and the large 65,536 color display. The result is games with improved graphics that react faster to user commands when using the navigation key as a game controller. The phone takes mobile gaming to new levels.

Supporting J2ME (Java 2 Micro Edition), the phone lets users download and run new games and applications. This is a great way to upgrade the game gallery, install work-supportive programs and personalize the phone.

SMIL

SMIL stands for Synchronized Multimedia Integration Language and is pronounced "smile". SMIL is an advanced XML-based protocol, and Sony Ericsson's MMS implementation supports a subset of the SMIL 2.0 protocol.

The use of SMIL in a product allows the user to create and transmit PowerPoint-style presentations on the mobile device. Using a media editor, users can incorporate text, audio, images, video clips and animations to assemble full multimedia presentations. The user can decide in which order the image and text will be displayed, as well as for how long the images and text lines are to be shown on the display.

Media types
There are certain media formats that support continuous media (speech, audio and video). The following media types are supported for SMIL:

- AMR narrow band speech codec MIME media type
- MPEG-4 AAC audio codec MIME media type
- MPEG-4 video codec MIME media type
- H.263 video codec MIME media type

The media types for JPEG and GIF can be used both in the 'content-type' field in HTTP and in the "type" attribute in SMIL 2.0. The following media types are to be used:

- JPEG MIME media type
- GIF MIME media type

All these media are pointed out by MIME (Multipurpose Internet Mail Extensions) types.

Imaging

VGA camera

VGA camera
With the integrated VGA camera, the user can take pictures and video clips and store them in the phone memory. The user can send them as an attachment in an email or a picture message (MMS).

Taking a picture
It takes only two clicks to take a picture with the dedicated camera button. The first click starts the application and the second click takes the picture. The large internal display acts as viewfinder, rotating the

picture depending on portrait or landscape orientation of the camera. Taking self portraits is easy with the clam closed, using the external display as viewfinder.

The camera application is also available in the menu system.

Image formats
The camera is able to take and send pictures in the following resolutions:

- QQVGA (160x120 pixels)
- QVGA (320x240 pixels)

- VGA (640x480 pixels)

Video format
Video clips can be recorded, played and sent using the following codec:

- H.263

Auto-exposure control
The camera has a fully automatic exposure control that selects the optimal exposure time needed to get an excellent picture. The exposure time is automatically adjusted whenever changes occur in the viewfinder.

Messaging

MMS

MMS (Multimedia Messaging Service) is expected to become the preferred messaging method of mobile phone users since there are virtually no limits to the content of an MMS transmission. An MMS message can contain text, graphics, animations, images, video, audio clips and ring melodies. For third party developers' information, please visit www.SonyEricsson.com/developer/ and look for the MMS developers guidelines.

MMS completes the potential of messaging. Sending digital postcards and PowerPoint-style presentations is expected to be among the most popular user applications of MMS. Eagerly awaited by young users in particular, MMS is projected to fuel the growth of related market segments by as much as 40%.

Multimedia Messaging uses WAP (Wireless Application Protocol) as bearer technology which can also be powered by the high-speed transmission technology EDGE/GPRS. This allows users to send and receive messages that look like PowerPoint-style presentations. The messages may include any combination of text, graphics, photographic images, speech and music clips. MMS will serve as the default mode of messaging on all terminals, making total content exchange second nature. From utility to sheer fun, it offers benefits at every level and to every kind of user.

OTA configuration
Users can easily get MMS into their phone. MMS supports OTA, meaning that the user does not have to configure the settings manually. The configuration is done by the operator.

MMS objects
Although MMS is a direct descendant of SMS, the difference in content is dramatic. The size of an average SMS message is about 140 bytes, while the maximum size of an MMS message is about 200 Kbytes (limited by both the memory capability of the mobile phone and less than ideal network conditions), enabling much richer MMS content. Complete with words, sounds and images, MMS content is endowed with the user's ideas, feelings and personality. An MMS message can contain one or more of the following:

Text
As with SMS and EMS (Enhanced Messaging Service), an MMS message can consist of normal text. The length of the text is unlimited. The main difference between an EMS and MMS message is that in an MMS message, text can be accompanied not only by simple pixel images or melodies but by photographic images, graphics, audio clips and video clips.

Templates
The phone comes with a number of MMS pre-defined templates, for example templates for birthday cards, meeting requests etc.

Audio
MMS provides the ability to send and receive audio as part of messages. The phone supports iMelody, MIDI, and AMR formats. Not only can users share a favorite song or ringtone with a friend, they can also use the mobile phone to record a sound or message and send it along with a text message. As sound includes speech as well as music, this extra dimension to an MMS message allows for a spontaneous and immediate personal

expression in communication messaging. Rather than sending a downloaded birthday jingle in EMS, a user can, for example, send a clip of his or her own personal rendition of "Happy Birthday".

Pictures and themes
By using the integrated camera, users can take a picture and immediately send it to a recipient. The ability to send pictures is one of the most exciting attributes of MMS, as it allows users to share meaningful moments with friends, family and colleagues.

Mobile picture transmission also offers inestimable utility in business applications, from sending on-site pictures of a construction project to capturing and storing an interesting design concept for later review. Editing a picture by adding text allows users to create their own electronic postcards, an application that is expected to substantially cut into the traditional postcard market.

Themes (downloaded or pre-defined) can be exchanged via MMS.

PIM communication with MMS
By using MMS, it is easy to handle PIM (Personal Information Manager) information. The user can send and receive business cards (vCard), calendar entries such as appointments (vCal) and notes (vNotes).

Streaming content in MMS

Streaming makes it possible to view files as they are being downloaded to the phone. The MPEG-4 file format can be used for continuous media along the entire delivery chain envisaged by the MMS, independent of whether the final delivery is done by streaming or download, thus enhancing interoperability.

In particular, the following stages are considered:

- Upload from the originating terminal to the MMS proxy.
- File exchange between MMS servers.
- Transfer of the media content to the receiving terminal, either by file download or by streaming. In the first case, the self-contained file is transferred, whereas in the second case the content is extracted from the file and streamed according to open payload formats. In this case, no trace of the file format remains in the content that is transmitted over the wire or over the air.

Additionally, the MPEG-4 file format can be used for storage in servers and the "hint track" mechanism can be used to prepare for streaming.

Benefits with MMS

By allowing the mobile phone to serve as an image processor and conveyor, Multimedia Messaging accommodates the exchange of important visual information as readily as it facilitates fun. Business and leisure usage of MMS will be dynamically merged, resulting in enhanced personal efficiency for users and increased network activity for operators. In short, MMS affords total usage for total communication.

As MMS uses WAP as its bearer technology and is being standardized, it has wide industry support and offers full interoperability. This is a major benefit to service providers and end users. Gradual steps in messaging evolution and the continuity of user experience has resulted in an ease-of-use where interoperability is assured.

The MMS server, through which MMS messages are sent, supports flexible addressing (to both normal phone numbers (MSISDN) and email accounts), which makes the user interface more friendly and allows greater control for operators. The MMS server, moreover, is responsible for the instant delivery feature of MMS.

MMS technical features

The MMS standard, just like that of SMS, offers store-and-forward transmission (instant delivery) of messages, rather than a mailbox-type model. MMS is a person-to-person communications solution, meaning that the user gets the message directly into the mobile phone. He or she does not have to call the server to get the message downloaded to the mobile. Unlike SMS, the MMS standard uses WAP as its bearer protocol. MMS will take advantage of the high speed data transport technology EDGE/GPRS and support a variety of image, video and audio formats to facilitate a complete communications experience.

Architecture
The MMS Center (MMS-C) is comprised of the MMS Server, the MMS Proxy-Relay and the MMS Store. The MMS Center is the central element of the MMS network architecture, providing storage and operational support, enabling instant delivery of multimedia messages from terminal-to-terminal and terminal-to-email, and supporting flexible addressing. The center's MMS Proxy-Relay interacts with the application being run on the MMS-enabled terminal to provide various messaging services. WAP is used as the bearer of an MMS message between the MMS-C and the MMS client (application). The WAP Gateway is used for delivery and retrieval of messages.
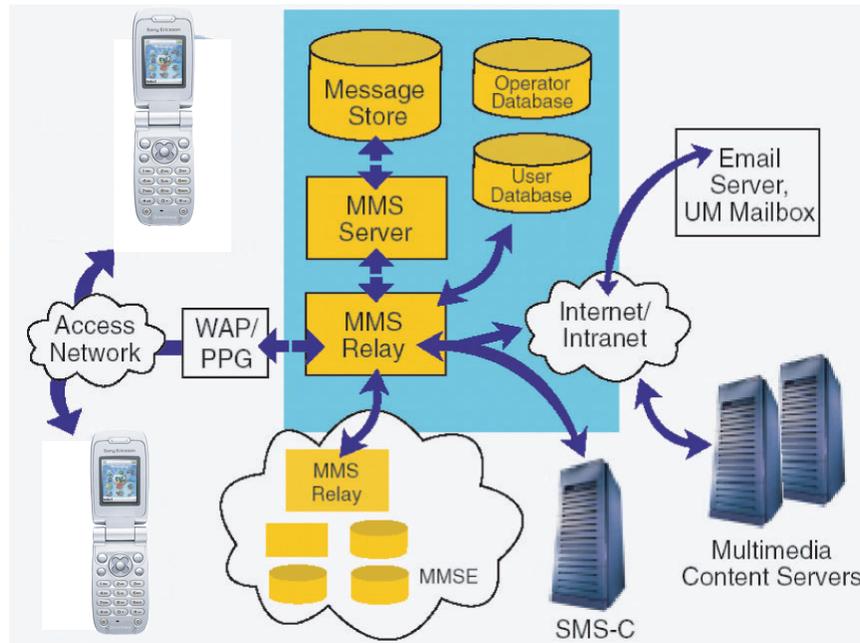
The architecture of MMS

Message conversion

The MMS-C is able to perform limited message conversion - for example, from MMS to SMS - so that processing and air time is not wasted in sending messages to mobile terminals that do not have adequate capability to receive them. It also handles service aspects such as store and forward, guaranteed delivery, subscriber preferences, operator constraints, and billing information. The MMS-C also vouches for high quality messaging, for example by format conversion. This means that the MMS-C recognizes which formats are supported in the mobile phone, and adapts the MMS messages to these formats.

Connectivity

Advantages of GPRS/EDGE

Using GPRS and EDGE has many advantages, for example:

- Constant connection
  Keep an open connection to the company network. All connection settings can be managed by using the data connections feature.
- High speed
  Gain access automatically to increased bandwidth when downloading large files, images etc.
- Cost efficient
  Use transmission capacity only when needed, thus

reducing costs.
- WAP over GPRS
  Access the Internet via WAP at high speed and with a constant connection.
- Email over GPRS
  Remain connected to an email system while reading and preparing messages, (which are then sent at high speed).
- Data communication
  Transfer data and access the Internet or an intranet

with a PC, PDA or handheld device connected via cable.
- Provide settings
  Receive GPRS configuration settings from the provider OTA (over the air), making manual configuration unnecessary.
- User-controlled settings
  Take advantage of full user control in the data connections menu, establishing multiple descriptions and accessing advanced settings for GPRS.

GPRS

The introduction of GPRS was a big step in the evolution of the GSM networks for enhancing the capabilities of data communication. Data traffic has increased (over both wired and wireless networks), with the growth in demand for Internet access and services paralleling that of mobile communications.

We can now see that the demand for high-speed Internet access is the key driver for coming generations of wireless multimedia and entertainment services.

GPRS is able to take advantage of the global coverage of existing GSM networks. Applications developed for GPRS have been deployed on a large scale and have thus reaped the associated benefits.

With GPRS, the Z500a sends data in "packets" at a high speed. The Z500a remains connected to the network at all times, using transmission capacity only when data is sent or received.

Instead of occupying an entire voice channel for the duration of a data session, the Z500a sends and receives data in small packets, as needed, much like IP on the Internet. Thanks to this, the phone is always online, using transmission capacity only when data is sent or received. The phone is compatible with GPRS R99.

The GSM system limits the ability to use all eight time slots, so the phone uses up to four time slots for receiving data, and one slot for transmitting.

Phone identity information and characteristics of the connection are described in the PDP (Packet Data Protocol) context. This information is stored both in the phone and in the mobile network, so that each phone is identified and "visible" to the system.

EDGE

EDGE (Enhanced Data rates for Global Evolution) provides all the benefits of GPRS at significantly higher data rates and enables feature-rich services that require higher data rates than GPRS can deliver. The added bandwidth can also be used to increase capacity for additional customers.

The higher data rates are achieved with the use of new modulation schemes on the air interface. Several of the new modulation schemes use 8-PSK modulation rather than the GMSK modulation used by GSM and GPRS.

The new modulation schemes may require an upgrade to the RF hardware in all base stations and new mobile stations such as the Z500a. In addition, new retransmission procedures and packet data channels are introduced with the associated signaling. The Z500a is a class B mobile station meaning it can monitor circuit switched and packet switched services simultaneously but can utilize only one of the services at a time. In addition, it is 8-PSK power class 2 meaning the nominal maximum output power is 27 dBm in the GSM 850 band and 26 dBm in the GSM 1800 or 1900 bands (see 3GPP TS45.005).
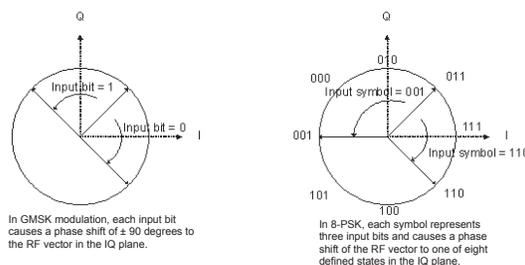
Furthermore, The Z500a is multislot class 10 meaning up to four time slots can be used for downlink data and up to two timeslots can be used for uplink data. This configuration is commonly referred to as 4+2 with a maximum sum of 5. With EDGE, it is possible to achieve a data rate of up to 59.2 kbit/second per time slot when Modulation and Coding Scheme 9 (MCS-9) is used so the Z500a can achieve rates of up to 236.8 kbit/second in the downlink direction and up to 118.4 kbit/second in the uplink direction. These rates are subject to radio conditions.

Data rates per time slot for all of the EDGE coding schemes are given in the following table.

Coding Scheme	Modulation	Transmission Rate/Time Slot (kbit/second)
MCS-1	GMSK	8.8
MCS-2	GMSK	11.2
MCS-3	GMSK	14.8
MCS-4	GMSK	17.6
MCS-5	8-PSK	22.4
MCS-6	8-PSK	29.6
MCS-7	8-PSK	44.8
MCS-8	8-PSK	54.4
MCS-9	8-PSK	59.2

In GMSK and 8-PSK the input bit sequence is represented by a phase shift of the RF signal. For GMSK, a phase shift occurs for each input bit. For 8-PSK, a sequence of three input bits represents a symbol and leads to the corresponding phase shift. In other words,

each input symbol in 8-PSK causes a phase shift to one of eight defined states. This is illustrated in the following figure.

In GMSK modulation, each input bit causes a phase shift of ± 90 degrees to the RF vector in the IQ plane.

In 8-PSK, each symbol represents three input bits and causes a phase shift of the RF vector to one of eight defined states in the IQ plane.

To minimize amplitude modulation, the 8-PSK scheme illustrated in the previous figure is offset by an angle of $3\pi/8$ in EDGE. This prevents the amplitude from crossing the origin in the IQ plane. The 8-PSK states with the $3\pi/8$ offset are shown in the following figure.
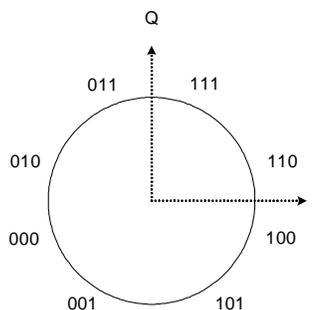
The data rates provided by EDGE open up new possibilities in multimedia, mobile internet access, and basic data services. EDGE provides the next logical step in the development of mobile networks.

Connection via cable

The Z500a supports data connectivity through its system connector. USB and RS-232 connection protocols are supported through available data cable accessories. For GPRS or EDGE data sessions, maximum throughput is made possible with the Z500a providing the air interface for your connected mobile computer.

USB

Employing the user-friendly USB standard, the DCU-11 cable accessory is an easy way to connect your Z500a and PC or PDA. The USB cable is ideal for synchronization or surfing the Internet on a mobile computer through your Z500a phone with improved transmission speeds than previous phone models. Necessary drivers are found on the CD included with the accessory cable.

RS-232

The DRS-11 cable accessory provides connectivity between your Z500a and the Serial port on a PC or PDA. When it comes to moving information between your Z500a and PC, the RS-232 Cable is a true plug-and-play solution. Requiring no drivers, it simply connects to your PC's serial port, giving you instant access to all of the data and modem operations of the Z500a.

Synchronization & Data Transfer

In everyday life, access to an updated calendar, notes and details of friends and business colleagues is greatly appreciated. To be truly mobile, users must be able to carry their important information with them. Equipping mobile phones with Personal Information Manager (PIM) programs like calendars, task lists and address books gives users access to their most important data anywhere and anytime. The information is kept updated by synchronizing with the information at the office or at home. The growing use of groupware such as Microsoft® Outlook® means that more and more meetings are booked electronically in daily business life.

The Z500a uses the SyncML 1.1.1 protocol for synchronization. This means that it has compatibility to synchronize with a wide variety of devices over a number of different communications media.

SyncML – An Open Standard for Synchronization

SyncML Background

Leading the way in providing remote synchronization capability, Sony Ericsson realizes that interoperability of remote synchronization is of utmost importance if mobile data usage is to become as widespread as generally predicted. That is why Ericsson, along with IBM, Lotus, Motorola, Matsushita, Nokia, Palm Inc., Psion and Starfish Software, founded the SyncML initiative in February 2000. Supported by more than 600 software and hardware developers, the SyncML initiative seeks to develop and promote a globally open standard for remote synchronization, called SyncML. Unlike many other synchronization platforms, SyncML is an open industry specification that offers universal interoperability. Because it uses a common language, called XML, for specifying the messages that synchronize devices and applications, SyncML has been called the only truly future-proof platform for enabling reliable and immediate update of data. The benefit for the end user is that SyncML can be used almost anywhere and in a wide variety of devices, regardless of application or operating system.

What is SyncML?

SyncML is the common language for synchronizing all devices and applications over any network. SyncML includes both data synchronization (SyncML DS) and device management (SyncML DM).

SyncML leverages Extensible Markup Language (XML), making SyncML a truly future-proof platform. With SyncML any personal information, such as Email, calendars, task lists, contact information and other relevant data, will be consistent, accessible and up to date, no matter where the information is stored. For example, a calendar entry made to a mobile device on a business trip is equally available to a secretary in a network calendar. SyncML is the ultimate choice for remote synchronization.

The phone uses SyncML for both local synchronization (for example, with a PC using a cable connection) and remote synchronization over WAP and HTTP.

Designed for the wireless world

SyncML is designed specifically with the wireless world's tight requirements in mind. SyncML minimizes the use of bandwidth and can deal with the special challenges of wireless synchronization, such as relatively

low connection reliability and high network latency. SyncML supports synchronization over WAP, HTTP or OBEX. As an open, future-proof standard, SyncML is the synchronization choice for any device or application of the mobile information society.

What information can be synchronized in the phone?

Application	Remote sync	Local sync
Contacts	Yes	Yes
Calendar	Yes	Yes
Tasks	Yes	Yes
Notes	Yes	Yes

Benefits of a common synchronization protocol

End users
Today's user of mobile devices probably uses a different synchronization product with every device. Each technology can synchronize only a few applications, or is limited to a particular type of network connection. This arrangement is expensive to install, confusing to configure and operate, and costly to administer. With SyncML, users will be able to buy devices that synchronize with a broader range of data.

Device manufacturers
Device manufacturers will benefit from a common protocol that will make the device interoperable with a broader range of applications, services, and network and transmission technologies.

Service providers
Service providers moving into the growth arena of application hosting are particularly concerned that a proliferation of synchronization technologies will make it impossible to deploy and support their customers in a cost-effective manner. To support the range of data types and devices in use today, service providers must install and configure multiple server infrastructures, maintain and support that infrastructure, and maintain compatibility and performance. The alternative now available, to use a single solution for data connectivity, involves the risk of a tight coupling to a propriety solution. With SyncML, they will be able to provide connectivity to a wider selection of applications.

Application developers
Choosing to support multiple synchronization technologies enables an application to support more types of devices and networked data, but that choice comes at a cost. With SyncML, application developers will be able to develop an application that can connect to a more diverse set of devices and network data.

Network operators
As multiple applications that need remote synchronization over WAP are developed, there will be an automatic growth of revenue for network operators.

Remote Synchronization

Remote synchronization takes place over the air using HTTP and is the ideal way to keep the phone up to date. Using EDGE/GPRS, the phone can be continuously connected to the remote synchronization server.
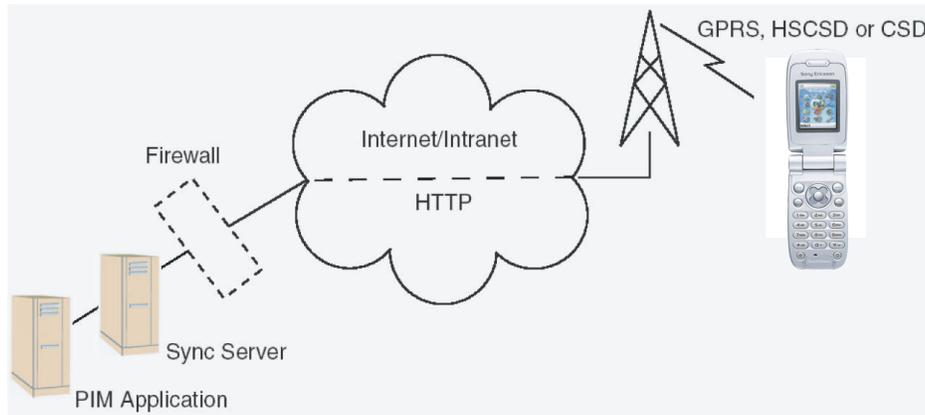
Synchronization services will be offered by third-party service providers and as added capability to corporate PIM applications. Corporate PIM applications such as Microsoft® Exchange can be supplemented with SyncML capability.

Local Synchronization

You can download PC software for local synchronization by visiting www.sonyericsson.com.
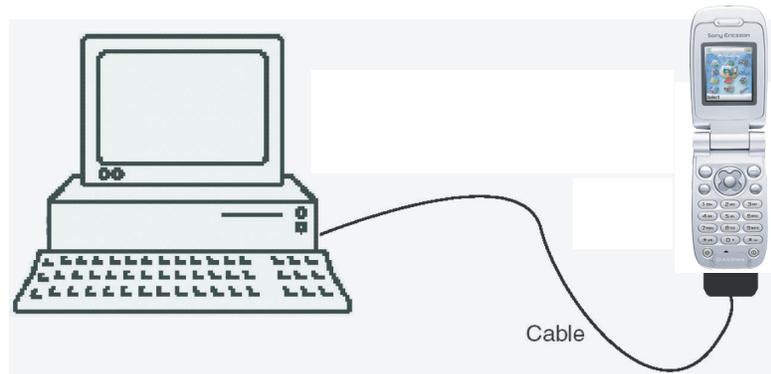
Cable

The phone always synchronizes using SyncML, regardless of connection type. It connects via cable. The cable is connected either directly to the phone or to the desktop charger.

Intelligent process

A synchronization engine performs the task of synchronizing. For local synchronization, the synchronization engine is an application that runs on the desktop computer. The synchronization engine compares, updates and resolves conflicts to ensure that the information in the phone is the same as that in the computer.

Compatibility

The supplied PC software enables synchronization with the following application:

- Microsoft® Outlook® 98, 2000, 2002

The PC requirements are as follows:

- Microsoft® Windows® 2000, Me, XP
- Minimum recommended hardware configuration for the version of Windows in use.
- 30 MB free space on hard disk

File Transfer Utility

A utility is provided which enables files to be transferred to and from the phone connected to a PC. Typical uses for this include:

- Archiving pictures taken on the phone to PC storage
- Moving images to the phone to use in personalization, MMS messages etc.
- Moving sound clips to/from the phone for personalisation.

DRM

Digital Rights Management, DRM, is a technology that enables secure distribution, promotion, and sale of digital media. Examples of such content include images, wallpapers and screen savers with themes from films, ringtones from musical artists, and branded games. In other words, content providers can control how users may use different types of content in devices, such as mobile phones, smartphones or PDAs. Content providers can also control the use of content in related services, such as MMS.

Sony Ericsson is actively focusing on technology standardization for the DRM concept, and supports the ongoing standardization work and activities of the OMA (Open Mobile Alliance). Sony Ericsson is fully committed to open standard solutions in the mobile environment and is a principal driver of many open standard initiatives. This will ensure the interoperability of mobile terminals in the DRM area and also result in a strong, competitive DRM standard.

How DRM works

The control of the content in digital media is executed by defining usage rights for the content. The usage rights give the content providers flexibility in the way they can publish and sell content. Rights can be defined so that a picture can be used by subscribers only, and rights can be defined so that a ringtone can be played only a limited number of times or for a limited period of time. Rights can also be defined so that the user is not able to forward content to other devices.

Packaging of rights and content

Rights and content can be packaged together and delivered to the device as one DRM package. As an alternative, content can be delivered to the device first, followed by the rights later being pushed to the device, for example via SMS. The kind of service and business model adopted by the content provider determines how the content and rights should be packaged and delivered to the device.

DRM packager

A DRM packager is typically included in the software used by the content provider. It is used to create the DRM package that is delivered to the device, including content and associated rights. In the device, the content of the DRM package is made available to the user according to the rights. For example, if the rights permit the user to play a ringtone ten times, the device will keep track of the number of times the ringtone is played, and notify the user when the ringtone has been used for the tenth time.

Protection properties

Content protection according to the OMA DRM standard gets special properties. Content with forward lock protection has the "Send to" option disabled, which prevents it from further distribution.

Unless the content is encrypted, the user cannot copy DRM content to other devices since the "Send To" option is disabled for pictures, ringtones, etc. that are OMA DRM protected. Content providers may choose to protect some content, but leave some content unprotected.

Package and delivery

The OMA DRM standard defines two ways to package and deliver rights and content to a device: combined or separated.

Combined delivery

Rights and content are packaged together into one DRM Package and delivered to the device. In the simplest case, no special rights are defined. The content is just put into a DRM package, thus protected from being copied out from the device by the user. This special case is called "forward-lock". It is useful for all types of content that the provider wants to charge for.

Separate delivery

Rights are defined and put into a file of their own. The content is encrypted and made available for users to download to their devices. The decryption key is put into the rights file. Since the content is encrypted, users cannot access it before the rights have also arrived to the device. In this case, the content can be freely distributed on the network, only users with the rights file can access the content. Content providers can deliver the rights to the user using push technology.

Downloading servers and publishing servers

When using a mobile phone, the users do not have to be aware of the network architecture. During a content downloading session, typically many physical servers are involved. Sometimes transactions may take place between different companies' servers.

The actual content may be put on one server, the downloading server. The content can be reached, for example, through references from one or many other servers, the publishing servers. The content creator puts his or her content on the downloading server through an interface to the content provider.

The user navigates to the publishing server and selects the content, or rather a link to or description of the content. The content is then downloaded from the actual downloading server.

When content is downloaded to the device, operators generate revenues from the user via, for example, their billing system. Operators might in their turn be billed for rights by the content aggregator, content provider or directly by the content creator.
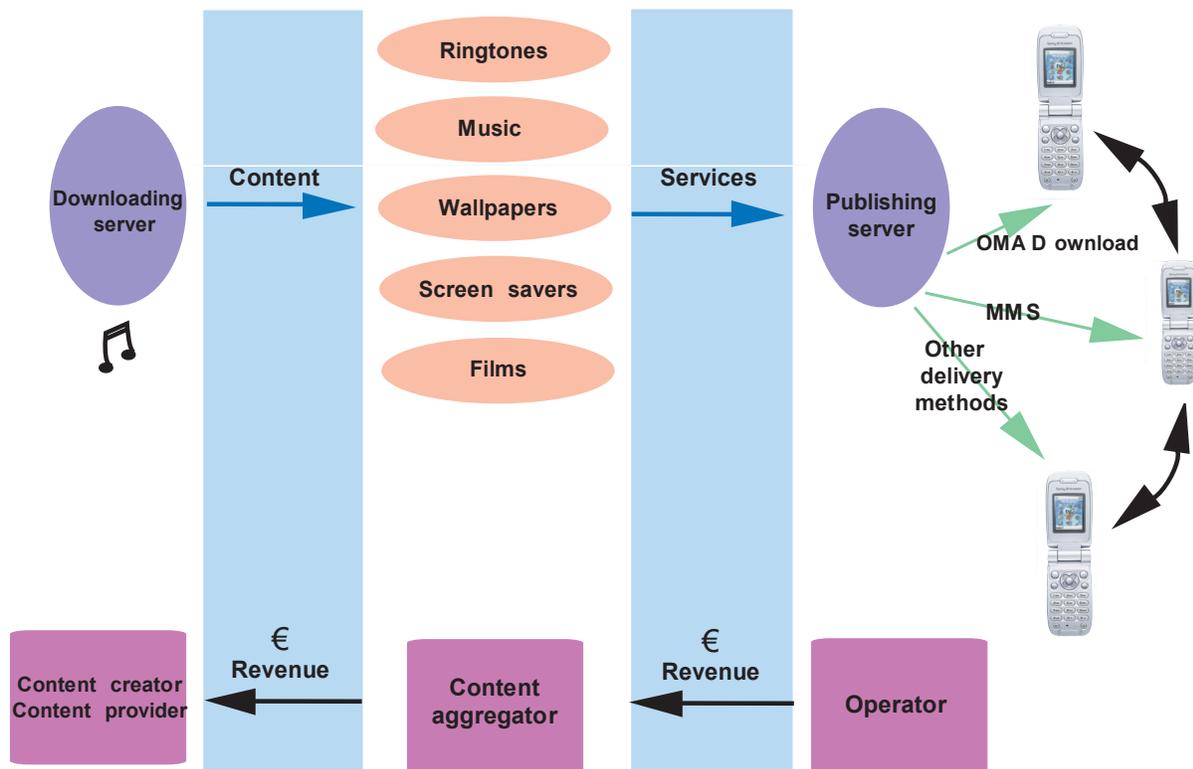
The flow of revenues and content. The content is viewed and selected from a publishing server and downloaded to the mobile phone from a downloading server. The revenue is in this case collected from the user by the operator and transferred to the content creator via the content aggregator.

Object Exchange – 'Send As'

The phone makes it possible to transfer objects via messaging. This is presented to the user via 'Send As' commands in applications. Simply select an item such as a contact, select 'Send As' and select the method to be used for sending. Typical applications are to beam an appointment to other people, or to receive a new background image.

Bearer > Application	SMS	EMS	MMS	Email
Contact	Yes	Yes	Yes	No
Appointment	No	Yes	Yes	No
Tasks	No	Yes	Yes	No
Notes	No	Yes	Yes	No
Image	No	Yes	Yes	Yes
Sound	No	Yes*	Yes	Yes
Bookmark	Yes	Yes	Yes	Yes
Voice memo	No	No	Yes	Yes
Third party applications	Yes	Yes	Yes	Yes

* Only an iMelody can be sent in an EMS.

GPRS
HSCSD
CSD
EDGE
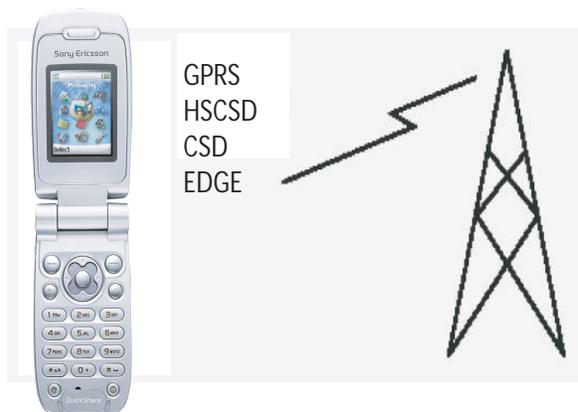
When sending via SMS, MMS or E-Mail, the required message type is created with the selected object attached. It is then sent over the air.

Device Management

Device Management is a technology that allows for the configuration and personalization of mobile phones. It has been standardized by the Open Mobile Alliance and is gaining widespread acceptance by service providers eager to simplify the process of making increasingly complex mobile phones easy for consumers to use. The

OMA DM specifications describe how a DM server must communicate with a DM client in the phone. In the Z500a implementation, OMA DM can be used to remotely configure settings such as the new address for a Domain Name System. In the long run, DM will be used

for more challenging tasks such remote problem solving and correction. In addition, DM may be one of the tools used for remote firmware updates.

DM Tree

The settings that can be configured via OMA DM must be specified in a DM tree which is a data structure with which the DM client communicates settings to the host device. The tree is made up of nodes (sometimes called management objects) that can be modified by the client. In the future, it will be possible to include nodes that support the installation and removal of software applications in devices with open operating systems. The DM tree for the Z500a includes, among other things, the settings that are necessary for WAP. These settings should be customized in the factory but can be updated by the service provider. This could prove to be extremely useful for infrastructure modifications including the modifications needed when service providers merge or increase capacity. A standardized way of dealing with these changes allows for a more efficient transition for a variety of devices from multiple vendors.

Nodes

Nodes are entities that can be manipulated by the client as commanded via the OMA DM protocol. The protocol supports nodes as simple as integers and more complex than GPRS data accounts. An interior node in the tree can have a large number of child nodes. The number is only limited by the amount of memory available. Each note has a unique URI. In addition, nodes have an associated Access Control List (ACL) that is a list of servers that are given permission to manipulate the node. The servers are identified by a unique DM-specific name rather than an IP address or certificate. Note that a node is not required to have a unique ACL. Rules exist for applying the ACL of a parent node to child nodes. With appropriate security devices can be protected.

Security

A powerful tool like OMA DM requires powerful security mechanisms. OMA DM uses Message Digest 5 (MD5) authentication. Either the client or the server may challenge for authentication. Integrity is handled with a Hashed Message Authentication Code (HMAC). User of the HMAC is optional. There are two aspects of confidentiality for OMA DM. Confidentiality of information during transport is handled by the transport protocol. TLS and HTTPS could be utilized. The other aspect of confidentiality is confidentiality between DM servers. This is handled by the ACL mentioned previously. Nodes in the DM tree cannot be modified by servers not included in the ACL.

Java 2 Micro Edition

Originally developed by Sun in 1991, Java is a programming language used to develop applications - utility programs, games, plug-ins etc. - for different hardware and software platforms. Users of Java-enabled devices can install new applications and games to make their devices more personal and adapt them to specific needs.

J2ME CLDC/MIDP (kJava)

In 1999, Sun regrouped its Java technologies into three platforms or editions. J2ME (Java 2 Micro Edition) became the platform targeting "micro" devices with small processors and memory capacities, such as mobile phones, communicators and PDAs. (The other two Java platforms are Java 2 Standard Edition, J2SE, and Java 2 Enterprise Edition, J2EE).

J2ME addresses a variety of devices. To handle the diversity, two concepts have been introduced – configurations and profiles. A configuration defines a minimum platform for a family of devices with similar processing and memory capacities. A profile targets a specific device category within that family, for instance mobile phones.

Two J2ME **configurations** are available:

- **CDC**, Connected Device Configuration. This config- uration is aimed at devices such as PDAs.
- **CLDC**, Connected Limited Device Configuration. This configuration is aimed at devices such as mobile phones and pagers.
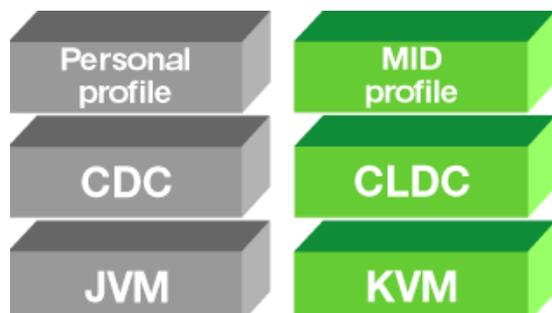
J2ME in detail

Current situation

So far, two **profiles** have been established for J2ME:

- **MIDP**, Mobile Information Device Profile, and
- **Personal Profile**.

MIDP is connected to the CLDC configuration and provides developers with essential information and guidance when writing programs for mobile phones and two-way pagers.

Personal Profile is linked to the CDC configuration. Targeted at PDAs, this combination replaces PersonalJava in J2ME.

CLDC/MIDP v. PersonalJava

Besides targeting different types of devices, the main difference between J2ME CLDC and PersonalJava from a user's point of view is that applications written in J2ME CLDC can be downloaded from the Internet. PersonalJava applications are typically transferred to devices from a PC via cable.

Hand-held computers and mobile phones that support Java also need a Java interpreter to run the applications. Since the Java Virtual Machine (JVM) was not the optimal interpreter for devices with small memory capacity and slower processors, Sun developed K Virtual Machine (KVM). A KVM requires only 40-80 KB of memory and can run on processors with low clock frequency. KVM is only used for J2ME CLDC. PersonalJava relies on the Java Virtual Machine (JVM).

PersonalJava has a richer application environment and can interact more extensively with the phone software.

J2ME CLDC uses a security model, often referred to as the sandbox. The sandbox includes a number of system components working together to ensure that untrusted applications cannot gain access to system resources. To put a sandbox into service, the Java platform uses three major components: the class loader, the byte-code verifier and the security manager. Each part plays an important role in maintaining the integrity of the system by securing that:

- Only the correct classes are loaded.
- The classes are in the correct format.
- Untrusted classes do not execute dangerous instruc- tions.

- Untrusted classes are not allowed access to protected system resources.

Java2ME in Z500a

The phone supports Java 2 Micro Edition (kJava). The functionality consists of:

- JSR 30 CLDC 1.0
- JSR 118 MIDP 2.0
- JSR 120 Wireless Msg API (the SMS part, not cell broadcast).
- The following functions of the JSR 135 Mobile Media API:
  - Audio playback
  - Video playback
  - Camera snapshot
- JSR-184 Mobile 3D Graphics API for J2ME

Facts and figures

Technical specifications

General technical data

System	Tri-band GSM phase 2 recommendations. GSM 850 (3GPP 31.010-1), GSM 1800 (CTR 31 and CTR 32), and GSM 1900. GPRS and EDGE in all bands (see "Connectivity" on page 14).
Speech coding	HR, FR, EFR, AMR supported where available, for high speech quality
GSM SIM/ UMTS USIM card	GSM SIM - GSM 11.11. Small plug-in card, 1.8 V and 3 V
Memory	6 MB

Exterior description

Length	3.72 inches (93.1 mm)
Width	1.97 inches (49.4 mm)
Size (flip closed)	3.66 x 1.93 x 0.94 inches (93 x 49 x 24 mm)

Weight	3.88 ounces (109.5 g)
Internal Display	Type: Full graphical Resolution: 128 x 160 pixels Technology: STN Colors displayed together: 65,536 (16 bit) Backlight color: White
External Display	Type: Full graphical Resolution: 96 x 64 pixels Technology: STN Colors displayed together: 4,096 (16 bit) Backlight color: White
Antenna	Built-in
Colors	Lagoon, Deep Sky Blue, Urban Grey
Battery	700 mAh, Lithium Polymer
Network LED	No
Keypad	4-directional + one select navigation key
Co-branding area	0.28" x 0.88" (7 x 22 mm)
Exchangeable covers	yes

In-Phone Functions and Features

A	AMR	Yes (AHS and AFS)
	Antenna connector, external for HF kits	No
	Automatic Bearer Selection	Yes
B	Background light	Yes
	Background pictures, pre-defined	Yes
	Background pictures, downloadable	Yes, only limited by memory
	Bluetooth wireless technology support	No
	Bookmarks (URL memory)	Yes, 25
	Built-in antenna	Yes
	Business card exchange	Yes
C	Call functions	
	Call counter	Yes
	Call barring*	Yes
	Call forward*	Yes
	Call hold*	Yes

		Call list (last dialed, answered and missed calls)	Yes
		Call screening*	Yes
		Call time/call cost (a.k.a Advice of Charge, Information/Charging)*	Yes
		Call timer (Total) is non-resettable for warranty program	Yes
		Call transfer*	Yes
		Calling card service	No
		Calling Line Identification (CLI)	Yes. Either as the number of the caller, or as a picture, icon or personal ring signal assigned to the number of the caller (on internal display only).
		Conference calls*	Yes
	Camera		Yes (VGA)
		Photo light	No
	Chat application		Yes
	Clock		Yes, with Automatic Time Zone*
	Closed User Groups (CUG)*		Yes
	Caller Name Presentation (CNAP)		Yes
	Code Memo		No
	Color display		Yes, 65,536 colors
	Connected Line Identity Presentation (COLP)		Yes
	Contacts		Yes
	Copyright protection		Yes, possible with copyright protection via OMA DRM for EMS and MMS.
	CSD, Circuit Switched Data*		Yes
	CSS		Yes
D	Date		Yes
	Display light		Yes
	DRM		Yes, OMA Level 1
E	EDGE (Enhanced Data rates for Global Evolution)*		Yes, multislot class 10
	Email address storage		Yes
	Email client		Yes, supporting IMAP4, POP3, SMTP.
	EMS (Enhanced Messaging Service)*		Yes
	EONS		Yes

	External antenna connector	No
F	File system	Yes
	Fixed Dialing Numbers (FDN)*	Yes
	FM Radio	No
G	Games	Yes. Others can be downloaded. Number only limited by available memory.
	GPRS (General Packet Radio Services)*	Yes, multislot class 10
H	High Speed Data (HSCSD)*	Yes, up to 28.8 kbps with multislot class 2.
I	Image browser	Yes. Gives access to pictures stored in the phone.
	Infrared port	No
	Input methods	T9 Text Input and Multitap
K	Keypad lock	Yes
L	Languages	American English, Latin American Spanish, Brazilian Portuguese, Canadian French
M	Melody composer	Yes
	Memory check	Yes
	MMS (Multimedia Messaging Service)	Yes
	MMS pictures, pre-defined	Yes
	MMS templates, pre-defined	Yes
	Modem	Yes
N	Nokia Group Graphics	Yes, receiving
	Nokia Operator Logos	Yes, receiving
	Nokia Picture Messaging	Yes, sending/receiving
	Nokia Ring Tones	Yes, receiving
P	Personal management	
	Calculator	Yes
	Events	Yes
	Calendar	Yes
	Alarm clock with snooze function	Yes
	Stopwatch	Yes
	Timer	Yes
	Code memo	No
	Phonebook	

	Capacity	510
	Maximum number of ADN read from the SIM	Up to 255
	Maximum number of FDN read from the SIM	SIM-dependent
	Phonebook user groups	10
	Phone lock	Yes
	Pictures	
	Total storage capacity	Limited by the memory
	Number of pre-existing pictures	TBD
	Possibility to download	Yes, storage capacity limited by memory
	Editor	Yes (QVGA or smaller)
	Picture messaging	Yes, sending/receiving
	Picture Phonebook	Yes
	Pictures, exchange	Yes, via EMS and MMS
	Polyphonic ring signals	Yes (up to 40 voices)
	Predictive text input	Yes (T9)
	Profiles	Yes
R	Re-dialing, automatic	Yes
	Ring signals	
	Total storage capacity	Limited by the memory
	Number of pre-existing ring signals	Varies according to operator
	Possibility to download	Yes, storage capacity only limited by the memory
	Possibility to compose	Yes, storage capacity only limited by the memory
	Ring signal exchange	Yes, via EMS and MMS.
	Ringtone caller ID	Yes
	Group ringtone caller ID	No
S	Scaled Vector Graphics (SVG)	Yes (SVG Tiny)
	Screen savers	Yes (internal display only)
	SIM relative features	
	SIM voltage	1.8V and 3V
	SDN support	Yes
	SIM Application Toolkit*	Yes

	SIM card copy	Yes
	SIM card lock	Yes
	Sleep mode	Yes
	SMS (Short Messaging Service)*	Yes
	SMS, long messages (also known as concatenated SMS)*	Yes, up to 10 messages of 160 characters each.
	SMS Cell Broadcast*	Yes
	SMS counter	Yes
	SMS templates	Yes
	Sound browser	Yes. Gives the user access to sounds stored in the phone.
	Sound handling	Yes (iMelody, MIDI, vMel, and AMR)
	Sound recorder	Yes, the total time is only limited by the memory. The sound recordings can be used as ring signals. Calls cannot be recorded.
	Speakerphone	Yes
	Speech coding	Enhanced Full Rate, Full Rate, Half Rate, and AMR
	Speed dialing	Yes
	Start-up/Shut-down show	Yes (internal display)
	Status menu	Yes
	Synchronization with PC	Yes
	SyncML	Yes (DS and DM)
T	Themes, pre-defined	Yes
	Themes, downloadable	Yes, only limited only by memory
	Themes, exchange	Yes, via MMS
	TTY	Yes via accessory
	Two Line Service (a.k.a Alternate Line Service, ALS)*	Yes
V	Vibrator	Yes
	Vibrator mode: vibrating only	Yes
	Vibrating mode: vibrating + ringing	Yes
	Voice coding	Yes, EFR, FR, HR, AMR (AFS and AHS)
	Voice control	Yes
	Voice dialing	Yes

Voice playback		Yes
Voice recording		Yes
Voice streaming		Yes
W	WAP browser	Yes, WAP 1.2.1 and WAP 2.0 browser and stacks with support for XHTML Basic, XHTML Mobile Profile, WML, and iHTML.
	Wireless Village	Yes
	WTLS for added WAP security*	Yes, WTLS class 1/2/3 and SignText

Performance and technical characteristics

Dimension	GSM 850	GSM 1800	GSM 1900
Frequency range	TX: 824 – 849 MHz RX: 869 – 894 MHz	TX: 1710 – 1785 MHz RX: 1805 – 1880 MHz	TX:1850 –1910 MHz RX:1930 – 1990 MHz
Channel spacing	200 kHz	200 kHz	200 kHz
Number of channels	124 Carriers *8 (TDMA)	374 Carriers *8 (TDMA)	299 Carriers *8 (TDMA)
Modulation	8PSK/GMSK	8PSK/GMSK	8PSK/GMSK
TX Phase Accuracy (GMSK)	< 5º RMS Phase error (burst)	< 5º RMS Phase error (burst)	< 5º RMS Phase error (burst)
TX Modulation Accuracy (8PSK)	< 9º EVM	< 9º EVM	< 9º EVM
Duplex spacing	45 MHz	95 MHz	80 MHz
Frequency stability	+/- 0.1	+/- 0.1	+/- 0.1
Voltage operation (nominal)	3.6 V	3.6 V	3.6 V
Transmitter RF power output (GMSK)	33 dBm Class 4 (2 W peak)	30 dBm Class 1 (1 W peak)	30 dBm Class 1 (1 W peak)
Transmitter RF Output Power (8PSK)	27 dBm Class E2 (500 mW peak)	26 dBm Class E2 (400 mW peak)	26 dBm Class E2 (400 mW peak)
Transmitter Output impedance	50 Ω	50 Ω	50 Ω
Transmitter Spurious emission	< -36 dBm up to 1 GHz < -30 dBm over 1 GHz (according to GSM spec.)	< -36 dBm up to 1 GHz < -30 dBm over 1 GHz (according to GSM spec.)	< -36 dBm up to 1 GHz < -30 dBm over 1 GHz (according to GSM spec.)
Receiver RF level	Better than – 102 dBm	– 102 dBm	– 102 dBm
Receiver RX Bit error rate	< 2.4%	< 2.4%	< 2.4%

Talk and standby times

Standard battery (Lithium Polymer)	BST-35 (700 mAh)
Standby Time	Up to 11 days
Talk time	Up to 10 hours

VGA Camera

Facts and figures	
Picture sizes (resolution) VGA camera	QQVGA (160 x 120 pixels) QVGA (320 x 240 pixels) VGA (640 x 480 pixels)
Color depth	24 bit (8 bit per RGB channel), 16.78 million colors
Viewfinder resolution internal display	128 x 96 pixels
Viewfinder resolution external display	96 x 64 pixels
Camera memory	Using phone memory, no memory dedicated to the camera only
Digital zoom	2x, 3x, 4x

Media player

File Format	Video: MP4 (MPEG4 and AAC), 3GP (H.263 and AMR) Audio: AMR, MP3, G-MIDI level 1 with 40 voices polyphony
Streaming transport	RTSP according to 3GPP
Video coding	MPEG-4 Simple Visual Profile Level 0 H.263 Profile 0 Level 10 H.263 Profile 3 Level 10
Audio coding	AAC, AMR, MPEG layer 3
Features	Automatic loop of songs in folder Automatic pause on telephone call.

Pictures

Formats	JPEG, BMP, GIF (including animated), PNG, WBMP
Sharing via	MMS, Email, PC file transfer (USB or serial)

Image Decoder

Format	Details	Size	Color depth	File format
GIF	87a/89a			
JPEG	ISO/IEC JPEG • Baseline DCT • Progressive DCT • Non-differential • Huffman coding • Symbol 'SOF2'	VGA		• JFIF v1.02 • EXIF
BMP	The bitmap image format used by Windows®.	XRAM dependent, default is VGA	24 bit	
WBMP				
PNG				

Image Encoder

Format	Details	Size	Color depth	File format
GIF	89a			
JPEG	ISO/IEC JPEG • Baseline DCT • Non-differential • Huffman coding • Symbol 'SOF0'	VGA		JFIF v1.02

Short message service

Feature	Support
SMS Center Number	It is possible to pre-record the SMS Center Number.
Pictures	It is possible to insert a picture or an icon into the text message. EMS compliant mobile handsets will be able to see the picture correctly.
Input methods	Predictive text input and multitap.
Reply to messages	It is possible to reply to received messages by SMS, phonecall or Email.
Message creation methods support	Predictive writing and multitap.
Copy, cut and paste words	No

Feature	Support
Teaching of predictive words that are not in the predictive dictionary	Yes
Possibilities when creating a message:	
save a sent message in a "sent items" folder	Yes
insert a line in the message	Yes
assign a validity period to the message	Yes
use pre-defined messages	Yes
Possibilities when receiving a message:	
reply to the sender	Yes (only to the sender, not to all or part of the message recipients)
forward the message	Yes
save the message on SIM	Yes
get delivery time and date	Yes
Possibilities of the previously sent message:	
delivery report of the message	Yes
forward the message	Yes
save the message on SIM	Yes
know the remaining capacity storage	Yes
Possibilities of the previously received message:	
reply to the sender	Yes (only to the sender, not to all or part of the message recipients)
save the message in the Inbox	Yes
forward the message	Yes
know the remaining capacity storage	Yes
Supported ways for replying to a received SMS:	
via SMS	Yes
via phone call (set up a call to the number contained in the message body)	Yes
via WAP call (go to the WAP address contained in the message body)	Yes
via USSD session	No
Possibility to offer the user the ability of sending an SMS to a list of recipients	Yes, using phonebook groups

Feature	Support
Possibility to write an email address as a recipient address	Yes, if SMS type=email
SMS storage	In the SIM and in the handset.
Nokia Picture Messaging	Yes

Enhanced message service

Feature	Support
Level of compliance supported by the handset regarding the specifications described in release 99.	Enhanced Messaging Service (EMS) according to the standard 3GPP TS 23.040 v4.3.0, with the addition of the ODI feature from 3GPP TS 23.040 v5.0.0.
Number of messages that the handset is able to handle to generate a concatenated message	10
Capacity storage	30 or more depending on space left on SIM.
Outgoing messages	It is possible to... • see how many short messages an EMS message consists of before sending it. • choose whether to send the message or not after writing it.
Incoming messages	• A signal is heard once all parts of the message have been received or when a timeout occurs. • It is possible to re-use the content of an EMS message. Sounds, pictures, and animations can be inserted in a new message, if the object is not protected using ODI.
Concatenated messages	A receipt is received in the handset when all parts of a concatenated message have been delivered.
Insert objects	It is possible to add pictures, animations and sounds to an EMS message.
Text formatting	• Centered, left and right aligned text. • Small, normal and large font size. • Bold, italic, underlined and strikethrough style.
Sounds	Chimes high, chimes low, ding, tada, notify, drum, claps, fanfare, chords high, chords low.
I-melody	Yes, version 1.2.
Melodies	It is possible to... • send and receive melodies via EMS, if the melodies are not protected by copyright. • download melodies and commercial tunes from WAP/ WAP portals. • create melodies on WAP/WAP portals.

Feature	Support
WBMP	Yes
Picture sizes	16 x 16 pixels, 32 x 32 pixels, variable size in black and white.
Pictures	It is possible to... • edit pictures by using the phone keypad. • send and receive pictures via EMS, if the pictures are not protected by copyright. • create pictures on WAP/WAP portals. • download pictures from WAP/WAP portals. • receive pictures in enhanced messages originated by service providers.
Animations	The handset supports animations. It is possible to send and receive animations.
TP-PID field value given by the handset before sending an EMS message	0x32

Multimedia message service

Feature	Support
MMS/CSD parameters and MMS/EDGE/GPRS parameters placement	MMS is bound to a WAP profile. A WAP profile is bound to a Data Account. A Data Account contains either CSD parameters or EDGE/GPRS parameters.
Possibility to pre-configure the MMS parameters in factory	• MMS/CSD: Yes • MMS/EDGE/GPRS: Yes
Possibility to configure the MMS parameters by OTA provisioning	• MMS/CSD: Yes • MMS/EDGE/GPRS: Yes
Possibility for all the parameters from the parameters set to be OTA provisioned at the same time	• MMS/CSD: Yes • MMS/EDGE/GPRS: Yes
Possibility for only one parameter from the parameters set to be OTA provisioned	• MMS/CSD: No • MMS/EDGE/GPRS: No
OTA provisioning solution	OTA specified by Ericsson and Nokia
MMS User Agent functional entity will be a separate entity from WAP browser:	Yes
MMS User Agent support	WAP WTA, WAP UAProf and WTA Public.

Feature	Support
Supplier indication of realized interoperability tests between its MMS User Agent and MMS Relay/Server from other suppliers	Yes
Support of a standard or a proprietary procedure for OTA provisioning of MMS parameters	Proprietary
Functionalities that the user is able to set during message composition:	• message *subject* • MSISDN recipient address • *email* recipient address • message *CC* recipient(s) address(es) • *delivery report* request • *read-reply* report request • *message* priority
From where can the user insert multimedia elements into multimedia messages:	• terminal memory • directly from camera
Supplier indication if MMS User Agent will be able to handle a network-based address book	No
Possibility for sent messages to be memorized into a folder in handset memory	Yes
Actions that the user can perform after message notification:	• retrieve the message immediately • defer message retrieval • reject message
Actions that the user can perform after message retrieval:	• reply to the sender of the message • reply to the sender and to CC people • forward the message • delete the message • save message into terminal
Multimedia codecs/formats supported for audio	MIDI, AMR, MP3
Multimedia codecs/formats supported for video	MPG4, 3GPP
Multimedia codecs/formats supported for image	JPEG, G1F87, GIF89A, PNG, SVG, WBMP, BMP
MMS User Agent provides:	• text formatting facilities (only text size) • colored text/background (Viewer/player supports colored text and background.) • predictive writing
Supported formats for message presentation:	• message body + attachments (email presentation) • SMIL version as described in "Nokia/Ericsson MMS Conformance document (not WML and SMIL 2.0 Boston)
Maximum message size that can be handled by the handset for message	200 KB
Possibility to configure unconditional message modification (such as media modification in messages)	Yes

Feature	Support
MMS User Agent will report problems to user in case of:	• message not sent causes no user subscription to service, if included in ResponseText (please see WAP209) • message not sent causes required functionality not supported by MMS Relay/Server, if included in ResponseText (please see WAP209) • message not sent causes insufficient credit (in case of prepaid charging), if included in ResponseText (please see WAP209)

Speech coding

Dimension	Full rate	Enhanced full rate
Type	RPE/LPC with LTP, AMR	ACELP, AMR
Bit rate	13.0 kbps	12.2 kbps
Frame duration	20 ms	20 ms
Block length	260 bits	244 bits
Class 1 bits	182 bits	
Class 2 bits	78 bits	

SIM AT services supported

Service	Mode		Support
CALL CONTROL			Yes
CELL BROADCAST DOWNLOAD			Yes
DISPLAY TEXT		Text of up to 240 characters (120 UCS2 coded).	Yes
	bit 1:	0 = normal priority	Yes
		1 = high priority	Yes
	bit 8:	0 = clear message after a delay	Yes
		1 = wait for user to clear message	Yes

Service		Mode	Support
GET INKEY		General: The GET_INKEY requires that the user confirms his/her choice	Yes
	bit 1:	0 = digits (0-9, *, # and +) only	Yes
		1 = alphabet set	Yes
	bit 2:	0 = SMS default alphabet	Yes
		1 = UCS2 alphabet	Yes
	bit 3:	0 = character sets defined by bit 1 and bit 2 are enabled	Yes
		1 = character sets defined by bit 1 and bit 2 are disabled and the Yes/No response is requested	Yes
GET INPUT		General: No. of hidden input characters	20
	bit 1:	0 = digits (0-9, *, # and +) only	Yes
		1 = alphabet set	Yes
	bit 2:	0 = SMS default alphabet	Yes
		1 = UCS2 alphabet	Yes
	bit 3:	0 = ME may echo user input on the display	Yes
		1 = user input not to be revealed in any way (see note)	Yes
	bit 4:	0 = user input to be in unpacked format	Yes
		1 = user input to be in SMS packed format	Yes
	bit 8:	0 = no help information available	Yes
		1 = help information available	No
LAUNCH BROWSER			Yes
MORE TIME			Yes
PLAY TONE			Yes
POLLING OFF			Yes
POLL INTERVAL			Yes
PROVIDE LOCAL INFORMATION		'00' = Location Information (MCC, MNC, LAC and Cell Identity)	Yes
		'01' = IMEI of the ME	Yes
		'02' = Network Measurement results	Yes
		'03' = Date, time and time zone (DTTinPLI)	Yes
		'04' - Language setting	Yes

Service	Mode	Support
	'05' - Timing setting	Yes
REFRESH	General: The reset option requests the user to wait while the phone restarts	Yes
	'00' =SIM Initialization and Full File Change Notification	Yes
	'01' = File Change Notification	Yes
	'02' = SIM Initialization and File Change Notification	Yes
	'03' = SIM Initialization	Yes
	'04' = SIM Reset	Yes
SELECT ITEM		Yes
SEND DTMF		Yes
SEND SHORT MESSAGE	bit 1: 0 = packing not required	Yes
	1 = SMS packing by the ME required	Yes
SEND SS		Yes
SEND USSD		Yes
SET UP CALL	General: Capability configuration	Yes
	Set-up speech call CallParty Subaddress DTMF support	No
		Yes
	'00' = set up call, but only if not currently busy on another call	Yes
	'01' = set up call, but only if not currently busy on another call, with re-dial	Yes
	'02' = set up call, putting all other calls (if any) on hold	Yes
	'03' = set up call, putting all other calls (if any) on hold, with re-dial	Yes
	'04' = set up call, disconnecting all other calls (if any)	Yes
	'05' = set up call, disconnecting all other calls (if any), with re-dial	Yes
SET UP EVENT LIST	'00' = MT call	Yes
	'01' = Call connected	Yes
	'02' = Call disconnected	Yes
	'03' = Location status	Yes
	'04' = User activity	Yes

Service	Mode	Support
	'05' = Idle screen available	Yes
	'06' = Card reader status	Not Applicable
	'07' = Language selection	Yes
	'08' = Browser termination	Yes
	'09' = Data available	No
	'OA' = Channel status	No
SET UP IDLE MODE TEXT		Yes, 1 row of text is supported
SET UP MENU		Yes
SMS PP DOWNLOAD		Yes
TIMER MANAGEMENT		Yes
OPEN CHANNEL		No
CLOSE CHANNEL		No
RECEIVE DATA		No
SEND DATA		No
GET CHANNEL STATUS		No

User Interaction with SIM AT

Display text
Text of up to 240 characters (120 UCS coded) is supported.

Text clearing times are 5-20 seconds and a 60-second time-out limit for the user to clear the text. 'Key' responses:

- 'Long Back' – Proactive session terminated by user.
- 'Back' – Backward move in proactive session.

Any other key clears screen if the command is performed successfully.

Get inkey
Prompt for a one-character input. Pressing 'Ok' without entering a character gives warning message "Minimum 1 character". 'Key' responses:

- 'C' clears current character.

- 'Long Back' terminates the proactive session.
- 'Back' – Backward move in proactive session.
- 'OK' – Command performed successfully.

Get input
Prompt for character input. The phone will refuse to accept further input when maximum response length is exceeded. UI Maximum Response lengths:

- Digits Only – 160 characters
- SMS default alphabet characters – 160 characters
- Hidden Characters (digits only) – 20 characters

'Key' responses:

- 'C' clears current character.
- 'Long Back' terminates the proactive session.
- 'Back' – Backward move in proactive session.
- 'OK' – Command performed successfully.

Refresh

When a refresh command is executed by the phone, it requests the user to wait while the phone restarts. A notification will be made if it is demanded that the SIM card initializes again.

Select item

Scroll to highlight item for selection. 'Key' responses:

- Joystick press down – Scroll down list.
- Joystick press up – Scroll up list.
- Long 'Back' terminates proactive session.
- 'Back' – Backward move in proactive session.
- 'OK'– Command performed successfully.

Send short message

Default message "Sending message, please wait" can be replaced for the Alpha Identifier text, or suppressed completely if a null text is provided. Default responses are "MESSAGE FAILED" or "MESSAGE SENT". 'Key' responses:

- Long 'Back' or 'Back' ends the proactive session.

Set up call

If the ME is on a call when the command 'Set up Call', 'putting all other calls on hold' is sent, the user will see the text 'Setting up a call current call will be held'. If 'OK' is pressed the current call will be put on hold and the new call set up. If the ME is on a call when the command 'Set Up Call, disconnecting all other calls' is sent, the user will see the text 'Setting up a call current call will be disconnected'. If the 'OK' key is pressed the current call will be disconnected and the new call set up.

Set up menu

Incorporates a SIM Application Toolkit Menu Item into the ME's main menu structure. In standby, the right or left arrow buttons can be pressed to select the Menu Items.

If an Alpha Identifier is supplied in the Set Up Menu command, this is used as the SIM AT entry in the ME's main menu. If no alpha identifier is supplied and several items are found in the menu, a default title is used. If the SIM AT Menu Item is selected by pressing 'Select', all the items sent in the Set Up Menu command will be available for selection, in the same way as the Select Item command.

WAP browser technical data

Feature	Support in the browser
Back to previous page	Yes
Bearer type EDGE/GPRS (IP)	Yes
Bearer type GSM Data (IP)	Yes, HSCSD, ISDN and analog
Bookmarks	Yes, up to 25 named bookmarks for easy access to frequently visited pages
Bookmark Export/Import	Yes, can be sent and received as link using SMS.
Cache	Yes (size 300 KB)
Character sets *	UTF-8 (Default), UTF-16, USASCII, Latin1, UCS2 * When creating WML applications, it is recommended that you always save the page contents as UTF-8, and that this is clearly indicated in the pages before publishing. This ensures that the contents of the application can be viewed, regardless of character sets used in gateways and the phone. All characters are not supported in all phones. The software version depends on which market the phone is associated to. Also, please note that the phone may not support input on a WAP Service which uses certain characters (languages), even if those characters are supported for browsing in the phone.
Clear cache	Yes

Feature	Support in the browser
Color	Color display
Home page	Yes, up to 5 different, one for each WAP profile
HTML version for WAP browser	xHTML, mobile profile
Hyperlinks in Text	Yes, highlighted by inverse video
Hyperlinks in Images	Yes, indicated by a frame
Image Animation	No
Image Formats	GIF (interlaced and non-interlaced) WBMP, no transparent layers, JPEG, PNG
Network Settings	Up to 5 different settings available by selecting WAP profile (Intranet, Internet, Banking, Gateway etc.)
OTA Support	Yes
PPP Authentication	PAP, CHAP supported
Reload page	Yes
Security	WTLS class 1-3 TLS 1.0, client authentication WIM on SIM ICC X.509 certificate support, WAP Profile WMLScript signText WPKI OTA download of trusted and client certificates
Tables	Yes
User Agent Profiles	Yes, list of client characteristics - for example display size
WAP/WML WAP	WAP 2.0/WML 1.3
WAP browser	WAP 2.0
WAP profiles	Dynamic - up to 5 WAP profiles, each with its own settings

WAP operator technical data

Feature	Support for WAP	
WAP Browser		
Version	2.0 baseline	
HTML	XHTML, mobile profile	
WAP Provisioning	**The Ericsson-Nokia solution**	**WAP Forum OTA provisioning**
Total Parameter sets	5	5

Feature	Support for WAP	
Parameter set list	name, homepage and homepage title (1st bookmark element), proxy/GW address, bookmarks (remaining bookmark elements), CSD phone number, CSD data rate, CSD dial type, EDGE/GPRS APN, protocol authentication, GW authentication, secure connection on/off	name, homepage, proxy/GW address, CSD phone number, CSD data rate, CSD dial type, CSD response timer, EDGE/GPRS APN, protocol authentication, GW authentication, EDGE/GPRS QoS
Parameter sets include	WAP/CSD, WAP/EDGE/GPRS (different sets)	
Factory pre-configuration	WAP/CSD (possibility to lock a setting), WAP/EDGE/GPRS	
OTA	WAP/CSD, WAP/EDGE/GPRS configuration possible	

Security mechanism

Bearer	The Ericsson-Nokia solution	WAP Forum OTA provisioning
OTA via SMS	Operator verification through a code that can be included in the OTA configuration data. This code is shown to the user who can choose installation or not.	Uses security mechanism (SEC) methods according to WAP-183-ProvCont-20010724-a (see www.openmobilealliance.org).
OTA via Cell Broadcast	-	According to ch.7.1.2, WAP-184-ProvBoot-20010314-a (see www.openmobilealliance.org).

Interface

Bearer	The Ericsson-Nokia solution	WAP Forum OTA provisioning
OTA via SMS	A question whether to install, with the code if available is asked. The user may have to choose if to create a new WAP profile or to replace an existing WAP profile.	For NETWPIN the user is asked to accept to install received settings. For USERPIN, USERNETWPIN and USERPINMAC the user is subsequently asked to enter a PIN code that is a shared secret between the service provider and the user.
OTA via Cell Broadcast	-	The user is asked whether to accept the received settings or not.

Feature	Support for WAP	
Re-provisioning Interface	**The Ericsson-Nokia solution**	**WAP Forum OTA provisioning**
OTA via SMS	Same interface as above.	If the settings previously installed were privileged or has higher priority the settings might not be possible to install again unless the terminal is reset, otherwise as above.
OTA via Cell Broadcast	-	If the settings previously installed were privileged or has higher priority the settings might not be possible to install again unless the terminal is reset, otherwise as above.
Carrier reset/provisioning	Yes, but not if the set is pre-configured in the factory and locked.	
SWIM	Not used for provisioning. The SWIM is only used for WAP security, both WTLS connections and digital signatures.	
SWIM certificate	Both client and trusted certificates can be used for WTLS connections and digital signatures.	
Applicative provisioning		
Preferred bearer customization	Yes	
Email customization	Yes, but not through WAP provisioning.	
Other applications/features	Yes. MMS, SyncML	
Technologies		
WAP Forum OTA provisioning	Yes	
Openwave OTA	No	
Other	Yes. The Ericsson-Nokia solution.	
Provisioning bearer	SMS, Cell Broadcast	
Parameter sets available	5	
Parameter sets for OTA modification	5	
PUSH		
Content types		
Service Indication (SI)	Yes	
Service Loading (SL)	Yes	
Cache Operation (CO) content type	Yes	
Session Initiation Application (SIA)	Yes	

Feature	Support for WAP
Man Machine Interface	
SI/content retrieval postponing	Yes
SI menu structure accessability	Messaging, Inbox
SL reception warning	The user can make a choice if a dialogue is wanted or not before loading the SL. Messaging/Settings/Push messages/Allow push msg/Always ask
SIA reception warning	Yes
Cache size limitations	If the inbox is full and a new push is received, the oldest push in the inbox will be discarded.
Number of push messages	Depending on the size of the push messages. Around 20 push messages with a size of 500 bytes can be stored.
Push de-activate	Yes. Messaging/Settings/Push
Dynamic push menu changes	No. There are no changes in the menus when activating/deactivating push
Security	
Mechanisms for push	None
Trust with PPG	Sending a SIA is the most trustful.
WSP push sessions	1
Denial of service/spoofing	
User agent profile	
UA profile content sent at beginning of WSP session	No
OA profile content size	
URL sent pointing to the UA profile at the beginning of WSP session	Yes
URL location	On the manufacturer WAP site.
WTAI	
WTA Make Call	Yes
WTA Send DTMF	Yes
WTA Add Phonebook	Yes
Other WTA/WTAI	No
DOWNLOAD	
WAP solutions	

Feature	Support for WAP
SAR/WSP/HTTP GET solution to download content over WAP	Yes
Download Fun from Openwave	No
Other download content over WAP	Yes. Content download limited to 200 KB when using WTP protocol. No download limit when using HTTP protocol.
Features	
Download application/product memory check	Yes
Downloaded object solution	Yes. The user is asked if the content is to be saved.
UAP indication for downloading	Yes
Other features	Yes. Store, delete, forward, use, manage.
Object formats	
Ringtones	audio/iMelody, other/vMel./MPS/MIDI
Wallpapers	Image/WBMP, GIF, JPEG.
Pictures	Image/WBMP, GIF, JPEG, PNG.
Games	Yes
JAVA applications	Yes
Screen savers	Image/GIF, JPEG, Animated GIF
Audio files	WAV uncompressed 8, 16 bit PCM sampled at 8, 11.025, 12 and 16 kHz (stereo and mono) Compressed formats not supported.
Skins (Themes)	Application/skin
Video	Yes
GRAPHICAL USER INTERFACE	
Man Machine Interface	
Selection keys	Yes
Separate/dedicated back or erase keys	Yes
Screen backlight on when browsing	Yes
Predictive writing	Yes
"http://" string displayed automatically when entering URLs	Not displayed but the "http://" is added automatically to the URL.
Elements	
Number of display lines for a WAP connection	4 to 7 plus Title, depending on the selected font size.

Feature	Support for WAP
Pop-up menus	Yes, in XHTML
Radio buttons	Yes, in XHTML.
Check boxes	Yes, in XHTML.
Buttons	Available as XHTML form controls.

WAP provisioning

	The Ericsson-Nokia solution	WAP Forum OTA provisioning
Total parameter sets	5	5
Parameter cell list	name, homepage and homepage title (1st bookmark element), proxy/GW address, bookmarks (remaining bookmark elements), CSD phone number, CSD data rate, CSD dial type, EDGE/GPRS APN, protocol authentication, GW authentication, secure connection on/off	name, homepage, proxy/GW address, CSD phone number, CSD data rate, CSD dial type, CSD response timer, EDGE/GPRS APN, protocol authentication, GW authentication, EDGE/GPRS QoS

USSD technical data

Feature	Support
USSD support	GSM Phase 1/2 (Cross-phase compatibility). EDGE/GPRS behavior according to class B.
Mode support -mode	UI-mode supported. SAT initiated USSD supported.
UI-mode details	• USSD messages disappear after time out. • It is possible to scroll the text up and down in USSD messages. • It is possible to highlight embedded numbers and take actions accordingly.

EDGE/GPRS technical data

Dimension	Support
Compatible EDGE/GPRS and SMG specifications	3GPP R99 December 2002
Data rates	**GPRS** Multislot class 10 supported (4+2) sum 5 CS-1, CS-2, CS-3, CS-4 9,050 bps, 13,400 bps, 15,600 bps, 21,400 bps supported (network-dependent) **EDGE** For EDGE data rates, see "EDGE" on page 15
Medium Access Modes	Fixed and dynamic allocation
Support of Packet Control Channels (PBCCH/PCCCH)	Yes
Network operation mode	NOM I, II, III
Support of EDGE/GPRS/CS combined procedures	Yes
Network control mode	NC0 2 (TBD)
Support of access in 2 phases	Yes
Support of PRACH on 11 bits	Yes
Support of EDGE/GPRS re-selection C31/C32	Yes
Support of static and dynamic addressing	Yes
Support of power control Uplink and Downlink	Uplink = yes, Downlink is a network feature
Support of ciphering algorithms	GEA1, GEA2
Support of compression algorithms	Yes, V42bis and IP header compression
Mode of operation	Class B and Class C modes of operation supported.
R Reference point	Physical layer: Support of RS232 PPP is supported as L2 layer in the R reference point Authentication algorithms PAP, CHAP supported
IP connectivity	PDP type IP is supported IP termination in mobile or TE (laptop, PDA) supported
PDP context	10 PDP context descriptions stored in mobile PDP context description is edited via application in mobile, AT-command or via OTA 3 Simultaneous PDP contexts are supported

Dimension	Support
SIM	EDGE/GPRS aware, as well as non-EDGE/GPRS aware; SIM cards are supported.
AT commands supported	AT+CGDCONT - define PDP context AT+CGQREQ - Quality of Service Profile (requested) AT+CGQMIN - Quality of Service Profile (Minimum Acceptable) AT+CGATT - packet domain service attach or detach AT+CGACT - PDP context activate or deactivate AT+CGDATA - enter data state AT+CGCLASS - GPRS mobile station class

SyncML technical data

Feature	Support for Sync ML
SyncML compliance	The handset is fully SyncML compliant.
Basic data formats	Contacts: vCard 2.1, Calendar: vCalendar 1.0, Tasks: vTodo 1.0, Notes: text/plain.
Possibility for operators to extend SyncML functionality	No
Possibility to synchronize other handsets using SyncML	No
Transport method for SyncML messages	WSP (i.e. using a WAP connection), HTTP, OBEX (RS232, USB).
Synchronization application placement	Inside the handset
Possibility for the user to configure login parameters (e.g. username and password) to access the remote database	Yes
Configuration parameters that can be entered/modified by the user	Server URL, Server UserID, Server PWD, Paths to databases (Calendar, Contacts, Tasks) UserID and PWD for Databases, Databases to be synched (on/off), WAP Account.
Mechanisms used by the handset to capture changes made by the end user (i.e. how does the SyncML client in your handset know which changes were made to the address book)	It uses a change log where it marks the contact as updated
Ability to deal with multiple servers	Yes
Ability to perform conflict resolution actions	No

Terminology and abbreviations

3GPP
3rd Generation Partnership Project.

ACELP
Algebraic Code Excited Linear Prediction. A process used to predict filter coefficients used in speech synthesis.

AMR
Adaptive Multi Rate. Audio format for speech sounds.

API
Application Programming Interface.

Bearer
The method for accessing WAP from the phone, for example GSM Data (CSD) and SMS.

Bookmark
A URL and header/title stored in the phone.

Browsing session
The period from the first access of content until the termination of the connection.

Calling Line Identification (CLI)
Shows the number of the caller, or a picture assigned to the number of the caller in the mobile phone display. Not all numbers can be displayed. Network-dependent service.

Card
A single WML unit of navigation and user interface. May contain information to present to the user, instructions for gathering user input, etc.

CS
Circuit Switched.

CSD
Circuit Switched Data.

Deck
A collection of WML cards.

DRM
Digital Rights Management; controlling copying and distribution of contents, with respect to intellectual property rights.

DTMF or Touch Tone
Dual Tone Multi-Frequency signal – codes sent as tone signals. Used for telephone banking, accessing an answering machine, etc.

Dual band
GSM 850/1800 or GSM 850/1900.

EDGE
EDGE stands for Enhanced Data rates for Global Evolution.

EFR
Enhanced Full Rate, speech coding.

EMS
Enhanced Messaging Service. Allows the user to add simple pixel pictures and animations, sounds and melodies to a text message. The EMS 3GPP standard also includes text formatting.

ETSI
European Telecommunications Standards Institute.

FR
Full Rate, speech coding.

Gateway
A WAP Gateway typically includes the following functions:

- A Protocol Gateway – the protocol gateway translates requests from the WAP protocol stack to the WWW protocol stack (HTTP and TCP/IP).
- Content Encoders and Decoders – the content encoders translate Web content into compact encoded formats to reduce the size and number of packets travelling over the wireless data network.

GIF
Graphics Interchange Format.

GPRS
General Packet Radio Services.

GSM
Global System for Mobile Communications. GSM is the world's most widely-used digital mobile phone system, now operating in over 100 countries around the world, particularly in Europe and Asia-Pacific.

GSM system
The GSM system family includes GSM 850, GSM 900, GSM 1800 and GSM 1900. There are different phases of roll-out for the GSM system and GSM phones are either phase 1 or phase 2 compliant.

GSM 1800
Also known as DCS 1800 or PCN, this is a digital network working on a frequency of 1800 MHz. It is used in Europe and Asia-Pacific.

HR
Half Rate, speech coding.

HSCSD
High Speed Circuit Switched Data.

HTML
HyperText Markup Language.

HTTP
HyperText Transfer Protocol.

IrMC
Infrared Mobile Communications standard.

ISP
Internet Service Provider.

ITTP
Intelligent Terminal Transfer Protocol.

LED
Light Emitting Diode.

LAN
Local Area Network.

LPC
Linear Prediction Coder

LTP
Long Term Predictor

ME
Mobile Equipment.

Micro browser
Accesses and displays Internet content in a mobile phone, using small file sizes and the bandwidth of the wireless-handheld network.

MMI
Man-Machine Interface, see UI.

MP3
Short for "MPEG layer 3", an effective audio coding scheme.

MS
Mobile Station.

MT
Mobile Termination.

ODI
Object Distribution Indicator.

OMA
Open Mobile Alliance.

OTA
Over-the Air Configuration. To provide settings for the phone by way of sending an SMS message over the network to the phone. This reduces the need for the user to configure the phone manually.

PDA
Personal Digital Assistant.

PDP
Packet Data Protocol.

Phonebook
A memory in the mobile phone or SIM card where phone numbers can be stored and accessed by name or position.

PIM
Personal Information Management.

RPE
Regular Pulse Excited

SMS-C
Service Center (for SMS).

Service provider
A company that provides services and subscriptions to mobile phone users.

SI
Service Indication.

SL
Service Loading.

SIM card
Subscriber Identity Module card – a card that must be inserted in any GSM-based mobile phone. It contains subscriber details, security information and memory for a

personal directory of numbers. The card can be a small plug-in type or credit card-sized, but both types have the same functions. The Z500a uses the small plug-in card.

SMS
Short Messaging Service. Allows messages of up to 160 characters to be sent and received via the network operator's message center to a mobile phone.

SS
Supplementary Services.

TCP/IP
Transmission Control Protocol/Internet Protocol.

UI
User Interface

UMTS
Universal Mobile Telecommunications System. The telecommunications system, incorporating mobile cellular and other functionality, that is the subject of standards produced by 3GPP.

URL
Uniform Resource Locator.
The global address of documents and other resources on the World Wide Web.

USSD
Unstructured Supplementary Services Data.

vCard
vCard automates the exchange of personal information typically found on a traditional business card, for use in applications such as Internet mail, voicemail, Web browsers, telephony applications, call centers, conferences, PIMs /PDAs, pagers, fax, office equipment, and smart cards. vCard is specified by IETF.

WAP
Wireless Application Protocol. Handheld devices, low bandwidth, binary coded, a deck/card metaphor to specify a service. A card is typically a unit of interaction with the user, that is, either presentation of information or request for information from the user. A collection of cards is called a deck, which usually constitutes a service.

WAP Application
A collection of WML cards, with the new context attribute set in the entry card.

WAP service
A WML application residing on a web site.

WBMP
Wireless BitMap.
A graphic format optimized for mobile computing devices.

WML
Wireless Markup Language. A markup language used for authoring services, fulfilling the same purpose as HyperText Markup Language (HTML) does on the World Wide Web (WWW). In contrast to HTML, WML is designed to fit small handheld devices.

WMLScript
WMLScript can be used to enhance the functionality of a service, just as, for example, Java Script may be utilized in HTML. It makes it possible to add procedural logic and computational functions to WAP-based services.

WSP
Wireless Session Protocol.

WTLS
Wireless Transport Layer Security.

WWW
World Wide Web.

XML
Extensible Markup Language.

XHTML
Extensible HyperText Markup Language.

Related information

Documents

- The Z500a User Guide
- Sony Ericsson Z500a FAQ
- AT Command Reference Manual
- WAP June2000 (WAP 1.2.1) Specification
- WAP 2.0 Specifications

Links

- www.SonyEricsson.com
- www.SonyEricsson.com/fun/
- www.SonyEricsson.com/developer/
- www.ericsson.com/mobilityworld/
- www.gprsworld.com
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