Developers guidelines

DEVELOPER WORLD THE FAST TRACK FROM MIND TO MARKET

October 2008

Java™ Platform, Micro Edition, CLDC – MIDP 2

for Sony Ericsson feature and entry level phones

Sony Ericsson

Preface

Purpose of this document

This document describes the Java™ ME platform support for Sony Ericsson Java platforms JP-2, JP-3, JP-4, JP-5, JP-6, JP-7 and JP-8. Corresponding Developers guidelines for the Sony Ericsson Symbian Java platforms SJP-1 – SJP-3 (P900/ P910 series and P1/P990/M600/W950/W960 series of phones) can be found on Sony Ericsson Developer World.

Readers who will benefit from this document include:

- Software developers
- Corporate buyers
- IT professionals.
- Support engineers
- Business decision makers

It is assumed that the reader is familiar with Java.

These Developers guidelines are published by:

Sony Ericsson Mobile Communications AB,
SE-221 88 Lund, Sweden

Phone: +46 46 19 40 00
Fax: +46 46 19 41 00
www.sonyericsson.com/

26th revised edition (October 2008)
Publication number: EN/LZT 108 7584, R26B

Sony Ericsson Developer World

At www.sonyericsson.com/developer, developers find the latest technical documentation and development tools such as phone White papers, Developers guidelines for different technologies, Getting started tutorials, SDKs (Software Development Kits) and tool plugins. The Web site also features news articles, go-to-market advice, moderated discussion forums offering free technical support and a Wiki community sharing expertise and code examples.

For more information about these professional services, go to the Sony Ericsson Developer World Web site.

Document conventions

Products

Sony Ericsson phones are referred to in this document by generic names (for information about Sony Ericsson Java platforms, JP-2, JP-3, and so on, see “Sony Ericsson Java platforms” on page 15):

Generic names Series	**Sony Ericsson phones**
No Sony Ericsson Java platform:	
F305	F305
J132	J132
K330	K330
R300	R300, R300c, R300a
R306	R306, R306c, R306a
S302	S302
T280	T280i
T303	T303, T303a
W302	W302
Z250	Z250i, Z250c, Z250a
Z320	Z320i, Z320c, Z320a
JP-2 phone:	
Z1010	Z1010

Generic names Series	**Sony Ericsson phones**
JP-3 phones:	
F500	F500i
J300	J300i, J300c, J300a
K300	K300i, K300c, K300a
K500	K500i, K506c, K508i, K508c
K700	K700i, K700c
S700	S700i, S700c, S710a
Z500	Z500a
JP-4 phones:	
V800	V800, Vodafone 802SE
Z800	Z800i
JP-5 phones:	
K600	K600i, K608i
K750	K750i, K750c, D750i
V600	V600i
W700	W700i, W700c
W800	W800i, W800c
Z520	Z520i, Z520c, Z520a
Z525	Z525a
JP-6 phones:	
K310	K310i, K310c, K310a
K320	K320i, K320c
K510	K510i, K510c
W200	W200i, W200c
W300	W300i, W300c
W550	W550i, W550c
W600	W600i
W810	W810i, W810c, W810a
W900	W900i
Z530	Z530i, Z530c
Z550	Z550i, Z550c, Z550a

Generic names Series	**Sony Ericsson phones**
Z558	Z558i, Z558c
JP-7 phones:	
K530	K530i
K550	K550i, K550c
K610	K610i, K610c, K618i
K770	K770i
K790	K790i, K790c, K790a
K800	K800i, K800c
K810	K810i, K818c
S500	S500i, S500c
T650	T650i, T658c
W350	W350i, W350c
W380	W380i, W380c
W580	W580i, W580c
W610	W610i, W610c
W660	W660i
W710	W710i, W710c
W830	W830i, W830c
W850	W850i, W850c
W880	W880i, W888c
Z310	Z310i, Z310a
Z555	Z555i, Z555a
Z610	Z610i
Z710	Z710i, Z710c

Generic names Series	**Sony Ericsson phones**
JP-8 (8.0-8.2) phones:	
G502	G502, G502c
K630	K630i
K660	K660i
K850	K850i, K858c
V640	V640i
W890	W890i
W910	W910i, W908c
Z750	Z750i
Z770	Z770i
JP-8.3 phones:	
C702	C702, C702c, C702a
C902	C902, C902c
T700	T700
W595	W595, W595s
W760	W760i, W760c
W902	W902
W980	W980i
Z780	Z780i, Z780a
JP-8.4 phones:	
C905	C905, C905c, C905a
G705	G705

Terminology and abbreviations

API
Application Programming Interface

CLDC
Connected Limited Device Configuration. A Java ME platform configuration for mobile phones

DRM
Digital Rights Management

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

HTTP
HyperText Transfer Protocol

IDE
Integrated Development Environment

Java SE
Java platform, Standard Edition

JSR
Java Specification Request

Mascot Capsule®
Mascot Capsule Micro 3D Engine is software that renders 3D objects in real-time on a display screen of an embedded device, portable game unit or mobile phone

MIDP
Mobile Information Device Profile. A Java ME platform profile connected to the CLDC for mobile phones

MMAPI
Mobile Media Application Programming Interface

OMA
Open Mobile Alliance

SDK
Software Development Kit. A collection of tools used to develop application

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

URI
Uniform Resource Identifier.
URIs are short strings that identify online resources: documents, images, downloadable files, services, and electronic mailboxes, for example. URIs use a variety of naming schemes and access methods, such as http, ftp, mailto and telnet, to make resources available

URL
Uniform Resource Locator. See URI

WAP
Wireless Application Protocol

WMA
Wireless Messaging API

WTK
Wireless Toolkit

Trademarks and acknowledgements

Java and all Java-based marks and logos are trademarks or registered trademarks of Sun Microsystems, Inc. in the U.S. and other countries.

End-user license agreement for Sun Java platform, Micro Edition.

1 Restrictions: Software is confidential copyrighted information of Sun and title to all copies is retained by Sun and/or its licensors. Customer shall not modify, decompile, disassemble, decrypt, extract, or otherwise reverse engineer Software. Software may not be leased, assigned, or sublicensed, in whole or in part.
2 Export Regulations: Software including technical data, is subject to U.S. export control laws, including the U.S. Export Administration Act and its associated regulations, and may be subject to export or import regulations in other countries. Customer agrees to comply strictly with all such regulations and acknowledges that it has the responsibility to obtain licenses to export, re-export, or import Software. Software may not be downloaded, or otherwise exported or re-exported (i) into, or to a national or resident of, Cuba, Iraq, Iran, North Korea, Libya, Sudan, Syria (as such listing may be revised from time to time) or any country to which the U.S. has embargoed goods; or (ii) to anyone on the U.S. Treasury Department's list of Specially Designated Nations or the U.S. Commerce Department's Table of Denial Orders.
3 Restricted Rights: Use, duplication or disclosure by the United States government is subject to the restrictions as set forth in the Rights in Technical Data and Computer Software Clauses in DFARS 252.227-7013(c) (1) and FAR 52.227-19(c) (2) as applicable.

Borland, the Borland Logo and JBuilder are trademarks or registered trademarks of Borland Software Corporation in the United States and other countries.

NetBeans is a trademark or registered trademark of Sun Microsystems, Inc. in the U.S. and other countries.

Bluetooth is a trademark or registered trademark of Bluetooth SIG Inc.

Nokia is a registered trademark of Nokia Corporation.

Mascot Capsule is a registered trademark of HI Corporation.

ARM and Jazelle are registered trademarks of ARM Limited.

RealAudio and RealVideo are trademarks or registered trademarks of RealNetworks, Inc.

OpenGL is a registered trademark of Silicon Graphics, Inc..

WALKMAN is a trademark or a registered trademark of Sony Corporation.

Other product and company names mentioned herein may be the trademarks of their respective owners.

Java Verified™ program for Java ME platform

The Java Verified™ Program uses the results of the Unified Testing Initiative launched by the leading mobile phone manufacturers and Sun Microsystems.

The Java Verified program gives developers a direct way to application testing and to the market. Testing Providers all over the world, covering different regions, languages and price structures, are authorised by the Java Verified program to undertake testing on behalf of the program. A developer selects one of these providers to complete the testing of their application.

An application that successfully meets both the program guidelines and passes the testing process is permitted to use the Java Powered logo. The logo is provided by Sun Microsystems, at its own discretion, on a non-exclusive license basis. An application that passes the Java Verified program testing is digitally signed so that potential distributors can be assured of its integrity and authenticity.

Once the developer has successfully passed the testing process, their application has the opportunity to be promoted and showcased in the on-line catalogues of all Java Verified Member Companies, as well as the commercial catalogues of participating operators.

More information on the Java Verified Program is available at the Java Verified Web site (www.javaverified.com).

Document history

Change history		
2003-12-05	Version R1A	First edition
2003-12-11	Version R1B	Minor updates in technical specifications
2004-03-30	Version R2A	Document updated to comply with the latest software version of the Z1010 phone. Information about the K700 series and Z500 series added. 3D API information added
2004-07-05	Version R3A	Document updated and supplied with complementary information. Information about the S700 series and F500 added
2004-07-19	Version R4A	Information about the K500 series added
2004-11-23	Version R5A	Information about the V800 series added
2005-03-09	Version R6A	Revised edition. Information about the K300, J300, K750, W800, Z800 and K600 series added
2005-04-15	Version R6B	Revised edition. Updated specifications. Added programming tips. Sony Ericsson Java platform concept implemented in documentation
2005-04-25	Version R6C	Revised edition. Minor editorial changes
2005-08-01	Version R7A	Revised edition. Information about the V600, S600, W600 and Z520 series added
2005-08-08	Version R7B	Revised edition. S600 changed to W550
2005-09-30	Version R8A	Revised edition, adapted to the Sony Ericsson SDK for the Java™ ME Platform, ver 2.2.3
2005-10-21	Version R9A	Revised edition. Information about the W900 series added
2005-11-07	Version R9B	Revised edition. Minor editorial changes
2005-12-12	Version R9C	Revised edition. Minor changes
2006-01-04	Version R10A	Revised edition. Information about the W810 series added
2006-02-13	Version R11A	Revised edition. Information about the K610 series added
2006-02-28	Version R12A	Revised edition. Information about the K800, K790, Z530, W300, K510 and K310 series added

2006-04-12	Version R13A	13th edition. Information about the W700 and Z525 series added
2006-05-19	Version R14A	14th edition. Information about the Z550, W850, Z710 and W710 series added
2006-06-26	Version R14B	Revised edition
2006-07-07	Version R14D	Revised edition. Information about Mobile JUnit added
2006-08-22	Version R15A	15th edition. Information about the K618i and Z610 series added
2006-09-28	Version R16A	16th edition. Information about W830, K320 and Z558 series and the Z550a model added
2006-11-15	Version R16B	16th revised edition. Minor changes
2007-01-08	Version R17A	17th edition. Information about Z310 and W200 series added
2007-02-06	Version R18A	18th edition. Information about W880, K550, W610 and K810 series added
2007-03-13	Version R19A	19th edition. Information about W660 series added
2007-03-27	Version R20A	20th edition. Information about Z750 and W580 series added
2007-04-13	Version R20B	20th, revised edition. Minor changes
2007-07-02	Version R21A	21st edition. Information about K530, K850, S500, T650, W910, Z250 and Z320 series added
2007-11-06	Version R22A	22nd edition. Information about K630, K660, K770, V640, W380 and W890 series added
2008-04-08	Version R23A	23rd edition. Information about C702, C902, R300, R306, T280, T303, W350, W760, W980, Z555 and Z770 series added
2008-05-20	Version R24A	24th edition. Information about G502 and Z780 series added
2008-07-22	Version R25A	25th edition. Information about F305, J132, K330, C905, S302, T700, W302, W595 and W902 series added
2008-09-09	Version R26A	26th edition. Information about G705 series added
2008-10-17	Version R26B	26th revised edition. Minor changes. New document layout

Contents

The Java ME platform

The phones covered in this document support the MIDP 2.0 and CLDC 1.1 specifications. From Sony Ericsson Java Platform JP-8 the MIDP 2.1 maintenance release is supported.

The basic MIDP 2.x features, such as life cycle, memory handling etc, are the same as for the MIDP 1.0 environment. More information about MIDP 1.0 in Sony Ericsson phones is available at Sony Ericsson Developer World. MIDP 1.0 applications developed for the T61x, T628/T630, and Z60x phones should also execute on Sony Ericsson MIDP 2.x supported phones.

Sony Ericsson Java platforms

Sony Ericsson uses a platform approach to Java implementation allowing developers to focus on a platform rather than on a variety of different product names. Two platform branches exist, supporting Symbian (SJP) and non-Symbian (JP) based phones respectively. The platforms are implemented through an evolutionary approach in order to ensure forwards compatibility between platform versions. Normally each platform version is used in several phone models.

A list of Sony Ericsson Java platform versions for the phones in this document can be found below. Some platform features are optional, that is, configurable. For example, the Bluetooth™ APIs (JSR-82) are only enabled for phones who actually support Bluetooth wireless technology.

JP = Sony Ericsson Java platform.

Note: All platforms are backwards compatible, which means that all JSRs (except the optional) implemented on one platform are also implemented on all higher platforms.

Java Platform	Features	Optional features (JSR-82, JSR-256, VSCL 2.0) and comments
JP-8.4 C905, G705	• **Project Capuchin API** • **JSR-256 extensions**	**JSR-82**: All JP-8.4 phones **JSR-256**: All JP-8.4 phones with sensor(s)
JP-8.3 C702, C902, T700, W595, W760, W902, W980, Z780	• **Additional JSR-211 content handlers** • **PIMChangeListener API** • **JSR-256 extensions** • **Improved security handling**	**JSR-82**: All JP-8.3 phones **JSR-256**: All JP-8.3 phones with sensor(s)

Java Platform	Features	Optional features (JSR-82, JSR-256, VSCL 2.0) and comments
JP-8 (includes JP-8.0 - JP-8.2) G502, K630, K660, K850, V640, W890, W910, Z750, Z770	**JSR-211**	**JSR-82**: All JP-8 phones **JSR-256**: All JP-8 phones with sensor(s)
	JSR-179	
	JSR-177	
	JSR-239	
	JSR-238	
	JSR-229	
	JSR-226	
	JSR-180	
	JSR-248 (MSA)	
	MIDP 2.1	
JP-7 K550, K610, K770, K790, K800, K810, S500, T650, W350, W380, W580, W610, W660, W710, W830, W850, W880, Z310, Z555, Z610, Z710	**JSR-234 (Camera capabilities)**	**JSR-82: Not** W380, Z310
JP-6 K310, K320, K510, W200, W300, W550, W600, W810, W900, Z530, Z550, Z558	**JSR-205**	**JSR-82: Not** K310, W200
	JSR-172	
JP-5 K600, K750, V600, W700, W800, Z520, Z525	**JSR-75**	**JSR-82:** All JP-5 phones **VSCL 2.0**: V600 only
JP-4 V800, Z800		**VSCL 2.0**: V800 only
JP-3 F500, J300, K300, K500, K700, S700, Z500	**JSR-184**	
	Mascot Capsule Ver. 3	
JP-2 Z1010	**Nokia UI API 1.1**	
	JSR-135	
	JSR-120	
	JTWI (JSR-185)	
	MIDP 2.0	
	CLDC 1.1	

Note: JSR-184 and Mascot Capsule Ver.3 are **not** enabled in Z310 series.

Note: JSR-234 is **not** enabled in W350, W380, Z310 and Z555 series.

Phones not conforming to Sony Ericsson Java Platforms

The F305, J132, K330, R300, R306, S302, T280, T303, W302, Z250 and Z320 series do not fully conform to any Sony Ericsson Java platform. The following JSRs are supported in these phones:

- MIDP 2.0 (JSR-118)
- CLDC 1.1 (JSR-139)
- JTWI (JSR-185)
- WMA (JSR-120)
- File API part of JSR-75
- PIM API part of JSR-75 is supported in the F305 series
- Parts of MMAPI (JSR-135), only audio and camera snapshots are supported.
- Mascot Capsule ver.3 is supported in the F305 series
- In F305 and R306 series also the Nokia UI API is supported.

MIDP 2 support

All phones covered in this document are MIDP 2.0 and JTWI 1.0 compliant. From JP-8, phones are compliant with the MIDP 2.1 maintenance release.
For a list of protocols, formats, memory size, display size etc. supported by the MIDP 2 implementation in the phones, see “Appendix A Phone specifications” on page 40, which contains technical specifications for each phone.

The MIDP 2 specification contains a number of optional features of which the following are supported:

- PushRegistry Alarm and PushRegistry SMS. From *JP-4* PushRegistry CBS is also supported.
- Signed MIDlets as specified in JTWI 1.0.
- TCP and UDP server sockets as specified in MIDP 2.
- `PlatformRequest` supports the tel, http and https schemes among others.
  When the method is invoked with the tel scheme, the native phone application is accessed and the user can initiate a voice or video call, or send a message to the given phone number.
  A `PlatformRequest` invocation for http/https initiates downloading of the given URI, for example, a Java application, image etc. For http/https URIs referencing WAP or Web pages, the Web browser is invoked. The Java application is then left in the background until the phone call/download/Web session is completed, after which it is resumed.
  For information about other URI schemes supported, see Developers guidelines - Web browsing, found at http://developer.sonyericsson.com/getDocument.do?docId=88004.
- `GameCanvas.getKeyStatus()` supports the detection of several simultaneous keys. See also “Simultaneous key presses” on page 30.
- `TextBox` and `TextField` with input constraints ANY, EMAILADDR and URL support the character set specified in JTWI 1.0.
- PNG images with colour depth of 1, 2, 4, 8, 16, 24 and 32 bits per pixel are supported.
- The maximum number of application-created threads is limited only by the amount of available memory.

- A `TextBox` or `TextField` object with input constraint `TextField.PHONENUMBER` allows the user to select a phone number from the phonebook, as specified in JTWI.
- From *JP-7* `CommConnection` is implemented, but it requires an AT command, AT*SEJCOMM, to open a port before `CommConnection` can be used by a MIDlet.
- The Z558 series features a touchscreen, with support for writing recognition (in Chinese and English). The standard pointer control methods of the MIDP `Canvas` class are supported for this series of phones.

MSA (JSR-248)

Sony Ericsson **JP-8** phones are compliant with the MSA (Mobile Service Architecture) specification, available at http://www.jcp.org/en/jsr/detail?id=248.

The Java ME community has developed a unified Java application environment standard for mobile phones as part of the Java Technology for the Wireless Industry (JTWI) initiative. JTWI (JSR-185) focused on mobile devices with limited resources and capabilities, while the MSA Specification (JSR-248) addresses an even broader set of devices with more enhanced and diverse capabilities but continues its focus on high-volume mobile devices. MSA adds support for new technologies and features that are already available or will become available in the foreseeable future. It also oversees compatibility with the old JTWI environment and with the future MSA Advanced environment defined by the Mobile Service Architecture Advanced activity (JSR-249). The MSA Specification defines a set of Java ME technologies and shows how these technologies have to be correctly integrated in a mobile device to create an optimal mobile Java platform.

The MSA Specification consists of the following main logical elements:

• **Mandatory and Conditionally Mandatory Component JSRs**.

• **Additional Clarifications**. Each component JSR is accompanied by additional clarifications to remove possible problems with the interpretation of component JSRs and minimise optionality.

• **Additional Requirements** related to JTWI, security, supported content formats, and so on. Additional requirements are also specified to improve backwards compatibility, interoperability, and predictability of MSA compliant implementations.

• **Recommendations and Guidelines**.

• **Roadmap** aiming to describe the future view of the mobile Java platform.

WMA (JSR-120)

The Wireless Messaging API v 1.1 (JSR-120) is supported. GSM SMS is supported in all phones covered in this document, while GSM Cell Broadcast (CBS) is only supported on *JP-4* and higher. MIDP 2.0 security has been added to the Open connection, Send and Receive functions, as specified in WMA 1.1, http://www.jcp.org/en/jsr/detail?id=120.

The Sony Ericsson SDK for the Java™ ME platform provides support for developing WMA MIDlets. This includes API documentation, support for compiling WMA MIDlets and debugging these MIDlets using any of the phones covered in this document.

Per Appendix A, “GSM SMS Adapter”, of the WMA specification, implementations of the GSM SMS adapter must support at least three concatenated short message segments. The phones covered in this document exceed this minimum requirement, allowing MIDlets to send and receive SMS messages of up to ten segments in length.

The 3GPP specification for SMS specifies the port numbers 16000-16999 as available for applications. It is recommended that Java developers use non-reserved port numbers within this range. WMA has a system list of restricted port numbers which may not be used by Java applications. In addition to the port numbers restricted in the WMA specification, the phones covered in this document also reserve the ports listed in the table below. If a Java application attempts to use any of the restricted and/or reserved ports, an exception will be thrown.

Port number	Description
0	Internal system use
650	General obex
2948-2949	WAP
5505	PM ringtone (Nokia Smart Messaging)
5506	PM Logo (Nokia Smart Messaging)
5507	PM Icon (Nokia Smart Messaging)
5514	Picture message (Nokia Smart Messaging)
9200-9207	WAP
16733	Calendar
16987	Email notification
16988	Email account setting
49996-49997	WAP provisioning
49999	WAP provisioning

WMA 2.0 (JSR-205)

Note: The JSR-205 API is supported on *JP-6* and higher platforms.

The Wireless Messaging API 2.0 is an extension and enhancement of WMA (JSR-120). GSM SMS, GSM Cell Broadcast (CBS), and MMS are supported.

WMA 2.0 is based on the Generic Connection Framework (GCF), which is defined in the Connected Limited Device Configuration (CLDC) 1.0 specification. The package `javax.microedition.io` defines the framework and supports input/output and networking functionality in Java ME profiles.

The JSR-205 specification can be downloaded from http://www.jcp.org/en/jsr/detail?id=205.

Note: Sending DRM protected files as message parts is **not** supported in the Sony Ericsson implementation of the JSR-205 API.

MMAPI (JSR-135)

The MMAPI support in the phones in this document provides access to audio and video playback, as well as image capture with the phone camera. For a list of supported data formats for each phone, see “Java specifications” on page 44. The JSR-135 specification can be downloaded from http://www.jcp.org/en/jsr/detail?id=135.

Players can be created from:

- Java streams
- DataSources
- URIs with “http://”, “https://”, “rtsp://” or “capture://video”. From **JP-8** also URIs with “device://tone”, “capture://audio”, “capture://audio_video”, “capture://radio” and “device://midi”. `System.getproperty(....)` calls can be used to retrieve supported parameters/values in specific phones. See “MMAPI system properties” on page 81 for more information.

Note: With JP-8.x phones, it is strongly recommended **not** to use `GameCanvas` with MMAPI, `Canvas` should be used instead.

Audio support

See also “Java specifications” on page 44.

In *JP-2* and *JP-3*, a maximum of 16 audio players can exist at the same time in Started state at the Java level. The number of players that can produce audio in parallel is limited by the phone hardware. Simple tones can be generated in parallel to any of the supported audio formats, but no other parallel audio playback is supported.

From *JP-4* the number of simultaneously started players is limited only by available memory. These phones also support more advanced mixing. In *JP-4* and *JP-5*, one player can play a waveform audio file (.WAV or ADPCM) with a sample rate of 8 or 16 kHz in parallel to another player playing a MIDI file. In *JP-7* and *JP-8* up to 4 parallel players are supported, either 4 waveform players (AMR, WAV or ADPCM) or 3 waveform players and 1 player playing a MIDI file.

The MidiControl, supported from *JP-5*, allows control of a maximum of 16 MIDI channels when playing MIDI.

The following controls are implemented:

- VolumeControl
- ToneControl
- StopControl

- MetaDataControl (from *JP-6*)
- MIDIControl (from *JP-5*)
- PitchControl (from *JP-6*)
- TempoControl (from *JP-7*)
- RateControl (from *JP-7*).

Phones on *JP-6* and higher (except W350, W380, Z310 and Z555) support audio recordings in the MMAPI.

Supported Audio codecs for recordings:

- PCM : 16KHz - 256kb/s
- AMR (NB) : 8KHz - 128b/s

Video support

See also “Java specifications” on page 44.

Note: Video playback is **not** supported in *JP-2* phones and in W350, W380, Z310 and Z555 series.

Only one video player can exist at a particular time. The video player can display its contents in a `Canvas` or in an `Item` on a `Form`.

The snapshot functionality is only supported for taking a picture with the built-in camera of the phone. Access to the camera snapshot functionality follows the security policy specified in JTWI.

Video recordings from the **main** camera (that is, not the video call camera) is supported on *JP-7* and higher, except for the W350, W380, Z310 and Z555 series.

Supported video recording containers and codecs:

- JP-7 to JP-8.2:
  3GP Container
  Video: H.263 (176x144) ~9FPS 60Kbps
  Audio: AMR (NB) 8KHz

- JP-8.3 and higher:
  3GP container
  Video: Mpeg4 (320x240)
  Audio: AAC

When a phone call is received while running a Java application that uses the native camera, the Java reference to the native camera is released. Once the phone call is terminated, the application will regain focus and an END_OF_MEDIA_EVENT is sent to the application. It is then up to the application whether to restart the camera or not.

The following controls are implemented:

- VideoControl
- FramePositionControl (from *JP-7*) allows precise positioning of a video frame for the player.

Advanced Multimedia Supplements (JSR-234)

Note: Phones on *JP-7* and higher, except W350, W380 and Z310, support the JSR-234 API. For information about the implementation of JSR-234 in JP-7 and JP-8 phones, see below.

Advanced Multimedia Supplements (AMMS) builds on the framework already established in the Mobile Media API (MMAPI) (JSR-135). AMMS adds many new controls and extensions to the MMAPI framework.

The full JSR-234 specification can be downloaded from http://www.jcp.org/en/jsr/detail?id=234

JSR-234 support in JP-7 phones

In Sony Ericsson *JP-7* phones, the following classes/interfaces for extended camera and image handling functionality are implemented:

- `javax.microedition.amms.control.FormatControl`
- `javax.microedition.amms.control.ImageFormatControl`
- `javax.microedition.amms.control.camera.CameraControl`
  All methods supported, **except** `getCameraRotation()`
- `javax.microedition.amms.control.camera.ExposureControl`
  Not supported: `setExposureTime()`, `getExposureTime()`, `getExposureValue()`, `getFStop` and `setFStop()`
- `javax.microedition.amms.control.camera.FocusControl.`
  Only supported in K790, K800 and K810.
  No support for “servo focus”, that is, focus does not change automatically when the motive changes.
  Macro focusing is supported.
  Manual focusing is not supported.
  To utilise auto focusing:
  To focus, call `FocusControl.setFocus(FocusControl.AUTO)`, and the camera focuses on the object currently in the viewfinder. An ongoing focusing procedure can be interrupted by calling `FocusControl.setFocus(FocusControl.AUTO_LOCK)`. If the camera has already locked focus on an object, `FocusControl.setFocus(FocusControl.AUTO_LOCK)` releases the focus, so that a new focusing procedure can be started.
- `javax.microedition.amms.control.camera.SnapshotControl`
- `javax.microedition.amms.control.camera.ZoomControl`
  Only supported in K790, K800 and K810.
- No support for *optical* zoom features. All *digital* zoom features are supported.
  `getMinFocalLength()` is not supported
- `javax.microedition.amms.control.camera.FlashControl`

- `javax.microedition.amms.GlobalManager`

JSR 234 support in JP-8 phones

Camera

- `javax.microedition.amms.control.ImageFormatControl`
- `javax.microedition.amms.control.camera.CameraControl`
- `javax.microedition.amms.control.camera.ExposureControl`
- `javax.microedition.amms.control.camera.FocusControl`
- `javax.microedition.amms.control.camera.SnapshotControl`
- `javax.microedition.amms.control.camera.ZoomControl`
- `javax.microedition.amms.control.camera.FlashControl`

Radio

- `javax.microedition.amms.control.TunerControl`
- `javax.microedition.amms.control.RDSControl`

Audio effects

- `javax.microedition.amms.control.audioeffect.EqualizerControl`
- `javax.microedition.amms.control.audioeffect.ReverbControl`

Audio3d

- `javax.microedition.amms.control.audio3d.LocationControl`
- `javax.microedition.amms.control.audio3d.OrientationControl`
- `javax.microedition.amms.control.audio3d.DistanceAttenuationControl`
- `javax.microedition.amms.Spectator`
- `javax.microedition.amms.GlobalManager`
- `javax.microedition.amms.SoundSource3D`

Image encoding

- `javax.microedition.amms.MediaProcessor`
  A MediaProcessor can be created for JPEG and raw images.
- `javax.microedition.amms.control.ImageFormatControl`
  The JPEG format is supported.

Image post processing

- `javax.microedition.amms.control.imageeffect.ImageEffectControl`
  ImageEffectControl is supported for the MediaProcessor

- `javax.microedition.amms.control.imageeffect.ImageTransformControl`
  ImageTransformControl is supported for the MediaProcessor

- `javax.microedition.amms.control.imageeffect.OverlayControl`
  OverlayControl is supported for the MediaProcessor

3D APIs

Note: *JP-2* phones and Z310 series do **not** support the 3D APIs.

Phones on *JP-3* and higher (except the Z310) support real-time 3D graphics rendering. These platforms support two different 3D graphics APIs, Mascot Capsule Micro3D version 3 and Mobile 3D Graphics API for J2ME (JSR-184). For more information on the implementation of the 3D APIs, see the Developers guidelines “3D graphics with Java ME”, available at www.sonyericsson.com/developer/java.

PDA optional packages (JSR-75)

Note: Only phones on *JP-5* and higher support the JSR-75 API. F305, J132, K330, R300, R306, S302, T280, T303, W302, Z250 and Z320 support the File API part of JSR-75.

The PDA optional packages for Java ME (JSR-75) consist of two separate APIs, one for accessing PIM data and one for file system access.

PIM optional package

The PIM (Personal Information Management) API is standardised in the JSR-75 specification, which can be downloaded from http://www.jcp.org/en/jsr/detail?id=75. The following describes shortly the implementation in the Sony Ericsson phones where the API is supported.

In Sony Ericsson phones the PIM API handles:

- Contacts (ContactList)
- Calendar (EventList)
- Tasks (ToDoList).

For more details on the Sony Ericsson implementation of the PIM package, see “Appendix B Java programming issues” on page 55.

File Connection optional package

The File Connection API is standardised in the JSR-75 specification, which can be downloaded from http://www.jcp.org/en/jsr/detail?id=75. The following describes shortly the implementation in the Sony Ericsson phones where the API is supported.

In general, Java applications can access the same folders, subfolders and files as the built-in File manager application, both in phone internal memory and on an inserted memory card. The following folders and all contained subfolders and files are accessible via the API:

- <file:///c:/> (internal memory file root)
- <file:///c:/other/>
- <file:///c:/pictures/>
- <file:///c:/sounds/>
- <file:///c:/videos/>
- <file:///e:/> (memory card file root)
- <file:///e:/dcim/> (camera pictures folder on memory card).

Note: The folders *Games*, *Themes*, *Applications* and *Webpage* are **not** available via the File Connection API.

Note: Which folders are accessible via the File Connection API differ between phone models. For example, in JP-7 and JP-8 phones, there is a *Camera* folder in phone internal memory, <file:///c:/camera>, and the *Themes* and *Webpage* folders on memory card are accessible.
The PDAPDemo application supplied with the Sony Ericsson SDK for the Java ME platform is recommended to find out exactly which folders are accessible in internal memory and installed memory card of a specific phone model.

For more details on the Sony Ericsson implementation of the package, see Appendix B, “JSR-75 implementation” on page 66.

Bluetooth API (JSR-82)

See also “Java specifications” on page 44.

JP-5 and higher phones support JSR-82, the standard Java API for Bluetooth, as an optional feature. It provides the means for developers to create Bluetooth games and other applications as well as implement new Bluetooth profiles.

For example, the Bluetooth API offers developers the ability to:

- Create multiplayer games
- Connect to PCs from Java applications.

The complete JSR-82 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=82

Note: JSR-82 v1.1, **except** the Push Registry features, is supported from JP-7.4, JSR-82 v1.0a is supported in JP-5, JP-6 and JP-7.0 – JP-7.3 phones.

Java ME Web Services 1.0 (JSR-172)

Note: The JSR-172 API is only supported on the *JP-6* platform and higher.

The JSR-172 contains two independent, optional packages, both supported:

- Java ME XML Parser
- Java ME RPC, which facilitates access to XML based Web services from CDC and CLDC based profiles.

The complete JSR-172 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=172

SIP (Session Initiated Protocol) API (JSR-180)

Note: The JSR-180 API is only supported on the *JP-8* platform.

JSR-180 is a Java ME Optional Package that enables resource limited devices to send and receive SIP messages. The API is designed to be a compact and generic SIP API, which provides SIP functionality on transaction level. The API is integrated into the Generic Connection Framework defined in Connected Limited Device Configuration (CLDC).

JSR-180 can be used in two different modes, dedicated mode and shared mode. For a MIDlet using dedicated mode, settings are handled by the MIDlet itself. MIDlets that use shared mode share the same settings. JP-8.0 and JP-8.1 phones only support dedicated mode. From JP-8.3 both modes are supported. On these phones, shared SIP settings are found by selecting *Settings - Connectivity - SIP settings* from the phone menu.

The complete JSR-180 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=180

Scalable 2D Vector Graphics API for J2ME (JSR-226)

Note: The JSR-226 API is only supported on *JP-8.x* platforms.

JSR-226 is a small package that is closely aligned towards capabilities of the SVG Tiny format and designed to meet the need for a Mobile 2D Graphics (M2G) API. M2G provides support for loading and displaying SVG Tiny files, manipulating SVG Tiny content and creating SVG Tiny content, such as dynamic data-driven graphics.

M2G is built upon a subset of SVG Micro DOM (uDOM) corresponding to SVG Tiny 1.1, itself a subset of SVG and XML DOM for SVG Mobile (Tiny and Basic profiles). It is extended with javax.microedition.m2g for usage with the Java ME platform.

M2G consists of four basic packages, all supported on the Sony Ericsson JP-8 platform:

- `javax.microedition.m2g`
- `org.w3c.dom`
- `org.w3c.dom.svg.events`
- `org.w3c.dom.svg`

The complete JSR-226 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=226

Payment API (JSR-229)

Note: The JSR-229 API is only supported on the *JP-8* platform.

The Payment API specification defines an optional package for the Java ME Platform. It specifies the architecture and associated APIs that enables an open, third party, application development environment for payment transactions.

The complete JSR-229 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=229

Mobile Internationalisation API (JSR-238)

Note: The JSR-238 API is only supported on the *JP-8* platform.

The Mobile Internationalisation API is a Java ME Optional Package containing an application program interface that allows MIDP application developers to internationalise their applications.

Internationalisation is a prerequisite to localisation, both very important in multilingual software development. The API provides the locale-specific formatting of dates, times, numbers (including percentages) and currency amounts. It is also possible to construct messages that have a variable number of ordered parameters.

The API also defines a mechanism to retrieve application-specific and device-specific resources, and provides services for the locale-specific collation (sorting) of strings.

All classes in this API are in a single package:

- `javax.microedition.global`

The complete JSR-238 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=238

Java Bindings for OpenGL® ES API (JSR-239)

Note: The JSR-239 API is only supported on the *JP-8* platform.

JSR-239 defines an optional package, implemented on the CLDC 1.1/MIDP 2 platform.

The OpenGL® ES and EGL APIs are defined by the Khronos Group (www.khronos.org). OpenGL ES defines two profiles: the Common profile and the Common-Lite profile. The Common-Lite profile is a 32-bit fixed-point profile, while the Common profile supports floating point. The Common profile is a superset of the Common-Lite profile. The JSR-239 specification provides bindings to the Common profile (including all fixed-point functions).

Sony Ericsson JP-8 phones fully support OpenGL and EGL version 1.0.

The complete JSR-239 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=239

Security and Trust API (JSR-177)

Note: The JSR-177 API is only supported on the *JP-8* platform.

The JSR-177 specification defines optional packages for the Java ME Platform. The purpose of this JSR is to specify a collection of APIs that provides security and trust services by integrating a Security Element (SE). A SE, a component in a Java ME device, provides the following benefits:

• Secure storage to protect sensitive data, such as user private keys, public key (root) certificates, service credentials, personal information, and so on.

• Cryptographic operations to support payment protocols, data integrity, and data confidentiality.

• A secure execution environment to deploy custom security features. Java ME applications would rely on these features to handle many value-added services, such as user identification and authentication, banking, payment, loyalty applications, and so on.

A Security Element can be in a variety of forms. Smart cards, for example SIM cards in GSM phones and UICC cards in 3G phones, are commonly used to implement a SE. In GSM networks, the network operator enters the network authentication data on the SIM card, as well as the personal information of the subscriber. When the subscriber inserts the SIM into a mobile handset, the handset is enabled to work on the operator network.

The complete JSR-177 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=177

Location API (JSR-179)

Note: The JSR-179 API is only supported on the *JP-8* platform, and only in phones with a built-in GPS unit.

The JSR-179 specification defines a Java ME Optional Package that enables mobile location-based applications for resource limited devices. The API is designed to be a compact and generic API that produces information about the present geographic location and orientation of the phone and accesses a database of known landmarks stored in the phone.

The `javax.microedition.location` package contains the basic classes needed to request and get a location result.

The complete JSR-179 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=179

Content Handler API (JSR-211)

Note: The JSR-211 API is only supported on the *JP-8* platform.

The Content Handler API and execution model let an application invoke registered Java ME and non-Java applications by URL, by content type, or by content handler application id. The application can use actions provided by the handler to get a specific display or use of the content handler. For example, a MIDP MIDlet can be registered to handle the MIME type image/png and then request the handler to display the image. The handler can provide multiple actions that affect how the content is displayed, modified, or returned. The execution model leverages the application management software (AMS) of the phone to provide a smooth user experience, to control the execution of the applications, to conserve resources, and to enforce the security policy of the phone and the Java runtime.

For information about Content handlers implemented in Sony Ericsson phones, see “JSR-211 content handlers” on page 75

The complete JSR-211 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=211

Mobile sensor API (JSR-256)

Note: The JSR-256 API is only supported on the JP-8 platform.

JSR-256, Mobile Sensor API allows Java ME application developers to fetch data easily and uniformly from sensors. A sensor is any measurement data source. In Sony Ericsson JP-8 phones JSR-256 support for reading data from different types of sensors may vary between phone models, for example, in the K850 only accelerometer sensor values can be read. The API provides means to monitor measured data. The current API implementation in Sony Ericsson phones does not provide any methods to control a sensor; it only provides methods for receiving information from a sensor.

This API has only limited compile/runtime support in the SDK, for example, the `SensorManager class, findSensors(...)` method returns an empty array of `SensorInfo[]`.

The classes and interfaces of this API are defined in the package `javax.microedition.sen`sor.

The complete JSR-256 specification can be downloaded from the Java Community Pages, http://www.jcp.org/en/jsr/detail?id=256

Memory

The phones covered in this document utilise a number of different memory areas for user interface features, and for images in particular. The total amount of memory available varies depending on how much of this memory other native phone applications have currently allocated. If needed, and if memory is available, the Java heap grows dynamically up to about 30 MB in the latest phone models. In general, a Java application with around 500 kB of image data is executable.

For more information about memory in different phones, see “Java specifications” on page 44. More information about memory allocation can be found in Appendix B, “Memory usage” on page 57.

The navigation key

The phones covered in this document detect navigation key actions in the following manner:

- Two adjacent directions are simultaneously detected. If the navigation key is pressed in one of the four main directions, up, down, left or right, one event is delivered to the application. If the navigation key is pressed in a diagonal direction, two events are delivered to the application, for example, one for “up” and one for “right”
- Navigational changes are detected directly without having to go back to neutral position.

Simultaneous key presses

Support for simultaneous key presses enhances gaming experience. For example, a user playing a game can move around on the screen and shoot at the same time.

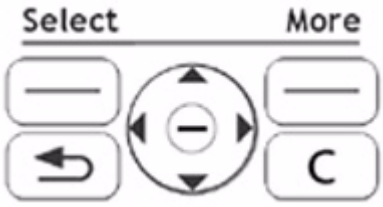
Most Sony Ericsson phones support simultaneous key presses. However, a MIDP developer can not take for granted that a certain phone model supports simultaneous key presses in all possible combinations. Games and other applications should always be tested with the actual targeted hardware. Hardware emulators does not necessarily emulate simultaneous key presses properly.

In general, when two keys are pressed at the same time, the proper events are delivered to the application. When three or more keys are pressed in some combinations, extra key presses may be detected. In other combinations, a third key is not detected at all. The general approach when more than two keys need to be detected at the same time, is to map the game keys (Fire, game A, game B, and so on) to actions that might occur at the same time as two or more other key presses.

More specific information for the simultaneous key press functions can be found in Appendix A, “Key mapping” on page 51.

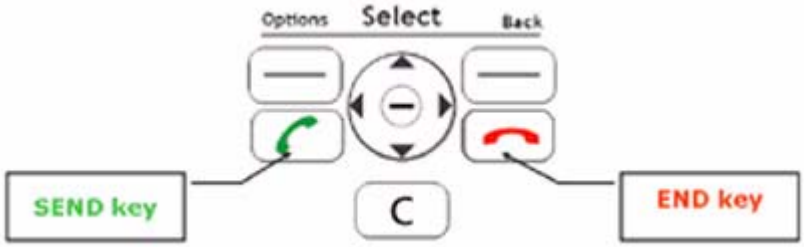
Command types

All Sony Ericsson phones on the JP-2 to JP-7 platforms have two selection keys called Left Selection Key (LSK) and Right Selection Key (RSK). The left selection key should be used for the “most likely action”, that is, what the user usually wants to do. Additional actions or commands should be handled by the right selection key. In addition to these keys, these phones have a designated key for back action. This key is referred as the physical back key.



JP-8 phones use a three selection key layout; Left Selection Key (LSK), Middle Selection Key (MSK) and Right Selection Key (RSK). The physical Back key has been removed on these phones. The middle selection key should be used for the “most likely positive action”, for example, Select, Mark (an item) or OK. The right selection key should be used for “negative actions”, for example, Back, Cancel or Exit. “Positive actions” are handled with the left and middle selection key.

JP-8 phones also include “Send” and “End” keys where pressing the “End” key prompts the user to end or minimise the active application.



Phones with two selection keys

The MIDP commands defined by an application are displayed on either the left selection key, the right selection key or they are placed in the “More” menu which is associated with the right selection key. Command type BACK is always mapped to the back button of the phone. Command type OK is generally mapped to the left selection key. It is recommended to always include BACK and OK commands. The command types are prioritised in the following order (from higher to lower):

- OK
- ITEM
- SCREEN
- BACK
- CANCEL
- EXIT
- STOP
- HELP

If a command of type BACK exists it will be mapped to the back key of the phone. It is also recommended to use the BACK command instead of the EXIT command for exiting the application, allowing the user to press the back key of the phone to exit. This conforms to the normal behaviour of Sony Ericsson phone applications.

Of all the remaining commands (excluding the one mapped to BACK) the one with the highest priority is mapped to the left selection key. All other commands are mapped to the right selection key. If more than one command is to be mapped to the right selection key, a “More” option is displayed and a list of the commands appears when the user presses the right selection key.

Phones with three selection keys

Phones with three selection keys have no back key. However, when an application is running in the foreground and the user presses the End key, the user is prompted to end or minimise the application. This key action in JP-8 corresponds to the “long back” key action in JP-2 – JP-7 phones.

If an application uses the high-level UI and adds `Command` objects to the current `Screen`, the platform places the commands on the correct selection key (as long as a logical type for the command is used). The platform also emphasises the label of the middle selection key.

The command types are prioritised in the following order (from higher to lower).

Positive actions:

- OK
- ITEM
- SCREEN
- HELP

Negative actions:

- STOP
- CANCEL
- BACK

- EXIT

Recommendations

Preloaded applications comply with the following recommendations at all times. For all other applications, it is strongly recommend to use the following guidelines to maximise end user experience.

Recommendations:

- The positive action with highest priority should always be mapped to MSK. If more than one positive action is required, the one with the highest priority is mapped to MSK and additional positive actions are mapped to LSK. Positive actions are in priority order OK, ITEM, SCREEN and HELP. Positive actions should **never** be mapped to RSK
- The negative action with highest priority should always be mapped to RSK. If more than one negative action is required, the one with the highest priority is mapped to RSK and additional negative actions are mapped to LSK. Negative actions are in priority order STOP, CANCEL, BACK and EXIT. Negative actions should **never** be mapped to MSK.
- If more than one action are to be mapped to LSK, they are placed in an “Options” list.
- Commands should be consistently placed and used throughout the application.

Additional guidelines:

- The label for MSK should be emphasised, for example, by using a bold font and/or a larger font size.
- A Back icon should look similar to  , and the size of the icon should be adapted to the screen size the application is optimised for.

On Sony Ericsson Developer World an article can be found, giving examples on selection key layouts and ten of the most common use cases for phones with three selection keys.
See http://developer.sonyericsson.com/site/global/newsandevents/latestnews/newsjune07/p_2softkeylayout_k850w910z750.jsp.

Error messages

Java exceptions that are not handled by the active MIDlet are dealt with by the Java environment. The following error messages are displayed to the user:

Java exception	Error message displayed to user
java.io.IOException	Network failure
javax.microedition.io.ConnectionNotFoundException	Network failure
java.lang.ClassNotFoundException	Invalid application
java.lang.OutOfMemoryError	The application consumes too much memory
java.io.EOFException, java.io.UnsupportedEncodingException, java.io.UTFDataFormatException	Network data error

Java exception	Error message displayed to user
javax.microedition.rms.RecordStoreFullException	Application memory full
All other Exceptions or Errors	Application error

Sony Ericsson SDK for the Java™ ME Platform

Development of Java applications for the phones covered in this document is supported by the Sony Ericsson SDK for the Java™ ME Platform. This includes PC emulation based on a customised version of the Wireless Toolkit from Sun. For example, screen size, colour depth and key inputs of the phone are emulated.

The latest version of the Sony Ericsson SDK is available for download at www.sonyericsson.com/developer/java.

For more information about the SDK, see “Appendix C Sony Ericsson SDK for the Java™ ME Platform” on page 86.

Security policy for Sony Ericsson phones

All of the phones described in this document comply with the JSR185 Java Technology for the Wireless Industry (JTWI) specification and MIDP 2 recommended security policy. For a detailed description of the installation and security rules, see Chapter 7, *Security Policy for GSM/UMTS Compliant Devices* of the JSR-185 specification (http://www.jcp.org/en/jsr/detail?id=185). A number of APIs are categorised as "restricted". Usage can result in costs for the user (traffic charges), inappropriate use may potentially affect the user data integrity or cause disturbance to other parties.

Security Configuration

The table below lists permissions per functionality and security domain in JP-8 phones. Permissions may differ slightly from this on lower Java platforms. Default permissions are in bold characters.

Functionality/Domain	**Third party protection domain (Untrusted domain)**	**Identified third party protection domain (Trusted 3rd party domain)**
Network access	No Always Ask **Ask Once**	No Always Ask **Ask Once** Never Ask
javax.microedition.io.Connector.http javax.microedition.io.Connector.https javax.microedition.io.Connector.datagram javax.microedition.io.Connector.datagramreceiver datagram server (w/o host) javax.microedition.io.Connector.socket javax.microedition.io.Connector.serversocket server socket (w/o host) javax.microedition.io.Connector.ssl ssl		
Application auto start	No Always Ask **Ask Once**	No Always Ask **Ask Once** Never Ask
javax.microedition.io.PushRegistry		
Messaging	No **Always Ask**	No **Always Ask** Ask Once Never Ask
javax.wireless.messaging.sms.send javax.wireless.messaging.sms.receive javax.microedition.io.Connector.sms javax.wireless.messaging.cbs.receive (from *JP-4*) javax.microedition.io.Connector.cbs (from *JP-4*)		

Functionality/Domain	Third party protection domain (Untrusted domain)	Identified third party protection domain (Trusted 3rd party domain)
PIM and File Connection APIs (Read/Write user data) javax.microedition.pim.ContactList.read javax.microedition.pim.ContactList.write javax.microedition.pim.EventList.read javax.microedition.pim.EventList.write javax.microedition.pim.ToDoList.read javax.microedition.pim.ToDoList.write javax.microedition.io.Connector.file.read javax.microedition.io.Connector.file.write	No **Always Ask** Ask Once Never Ask	No **Always Ask** Ask Once Never Ask
Local connectivity	No Always Ask **Ask Once** Never Ask	No Always Ask **Ask Once** Never Ask
Multimedia	No **Always Ask** Ask Once	No **Always Ask** Ask Once Never Ask
Platform request	No **Always Ask**	No **Always Ask**
Payment	**No**	No Always Ask Ask Once **Never Ask**
Location	No **Always Ask** Ask Once	No Always Ask **Ask Once** Never Ask
Landmark	No **Always Ask** Ask Once	No Always Ask **Ask Once** Never Ask
Smartcard	**No**	No Always Ask **Ask Once** Never Ask

Functionality/Domain	Third party protection domain (Untrusted domain)	Identified third party protection domain (Trusted 3rd party domain)
Authentication	**No**	No Always Ask **Ask Once** Never Ask
Call Control	No **Always Ask**	No **Always Ask** Ask Once Never Ask

Note: AT&T have their own Java signing and permission process, which should be considered before purchasing a signing certificate for applications to be installed on Sony Ericsson phones customised for AT&T. For more information, see the AT&T developer site, http://developer.att.com/developer/index.jsp?page=toolsTechDetail&id=11300213.

Note: *Unsigned* MIDlets are not allowed to:

- open datagram connections on ports 9200, 9201 or 9203
- open socket connections on ports 80, 443 or 8080
- open SSL connections on port 443.

The security domain is determined at installation as follows:

- If the MIDlet suite is unsigned, then it will be installed in the “Third party protection domain”.
- If the MIDlet suite was signed using a certificate granted by a trusted third party such as Verisign or Thawte, then it will be installed in the “Identified third party protection domain”. Operators maintain control of their certification process.
- A signed MIDlet suite is not installed if certificate verification fails, for example, when a MIDlet suite, signed by one operator, is attempted to install on a phone issued by another operator. In other words, operator signatures are not generic, but are specific to phones provided by each individual operator

The digital certificate embedded in the JAD and the signed JAR file are verified for authenticity and date validity at install time according to chapter 4 of the JSR-118 specification (http://www.jcp.org/en/jsr/detail?id=118). This assures data integrity and vendor identity.

Improved security handling implemented in JP-8.3 and higher

In a run-time permission dialog, the user is presented with the following options:

- When the user is not allowed to increase the permission level, only "Yes” and “No” options are presented.
- When the user is allowed (according to spec) to increase the permission level, “Yes”, “No” and the highest permission according to specification are presented as options, for example, “Yes”, “No” and “Never ask”.

Certificates in Sony Ericsson phones

The table below lists “factory installed” root certificates in Sony Ericsson phone models/series. The table is valid for the first released version of the different phones, later releases may in some cases contain more certificates.

Phone model/series	Certificates		
	UTI from GeoTrust (Java Verified)	Verisign	Thawte
Z1010			
F500			
J300, K300	•		•
K500			
K700			
S700i, S700c			
S710a	•	•	
Z500	•	•	
V800	•		•
C702, C902, C905, F305, G502, G705, J132, K310, K320, K330, K510, K530, K550, K600, K610, K630, K660, K750, K770, K790, K800, K810, K850, R300, R306, S302, T280, T700, V600, V640, W200, W300, W302, W350, W380, W550, W580, W595, W600, W610, W660, W700, W710, W760, W800, W810, W830, W850, W880, W890, W900, W902, W910, W980, Z250, Z310, Z320, Z520, Z525, Z530, Z550, Z555, Z558, Z610, Z710, Z750, Z770, Z780, Z800	•	•	•

Download and installation

The typical distribution mechanism for MIDP applications is over the air (OTA) via WAP or HTTP. The JAD and or JAR file(s) are accessible via the Internet and users may access either file. After downloading via the phones Browser application, installation is automatic.

Note: MIDlet installation on Z250 and Z320 can be done only by transferring JAR/JAD files using the USB mass storage functionality in the phone.

Note: When JAR files are downloaded OTA via a WAP gateway, the file size may be limited by the network operator.

In the case of a signed MIDlet, the user must access the JAD file, because the signature is in it. The JAD file is read and the URL property in the file is used to access the JAR file. Transferring the JAR file via Bluetooth, IR or serial/USB cable do not work, since these methods only work with unsigned MIDlets.

Signed MIDlets may also be installed using the correct JAD file with the Sony Ericsson SDK for the Java™ ME platform via the Device Explorer, ejava.exe command line tool or by right-clicking the file and selecting the “Install on Device” option.

A signed MIDlet can be installed on a phone with no UTI root certificate, by removing the following JAD/ Manifest attributes and the corresponding values before installation:

- MIDlet-Certificate-1-1:
- MIDlet-Jar-RSA-SHA1:

A list of JAD attributes supported in MIDP 2 compliant Sony Ericsson phones can be found in Appendix B, see “JAD/manifest attributes” on page 63.

Java applications can be installed on the memory card as well as in internal memory in phones with memory cards from *JP-4* and forward. **Note:** This is not possible in the S700 series.

To install a MIDlet on the memory card:

- Transfer the application files (JAR/JAD) to the directory *\mssemc\media files\other* in the phone file system.
- From the phone main menu, select File manager (Data folder) and browse to the application in the *other* directory. Select **Install**.

Appendix A
Phone specifications

In this appendix the technical specifications are listed for the phones covered in this Developers guideline.

Note: market/customer variations in the specifications may exist.

Screen and memory specifications

Screen sizes are specified as Width x Height (pixels).

Specification/Phone	Z1010	K700	S700	F500, K500, Z250, Z320, Z500, Z520, Z525	V800, Z800
Screen					
Screen size	176x220	176x220	240x320	128x160	176x220
Fullscreen canvas size	176x220	176x220	240x320	128x160	176x220
Non fullscreen canvas size	176x182	176x176	240x266	128x128	176x182
Pixel ratio (H:W)	1:1	1:1	1:1	1:1	1:1
Colour depth	65,536 (16-bit)	65,536 (16-bit)	262,144 (18-bit) [a]	65,536 (16-bit)	262,144 (18-bit) [a]
Transparency	Full (8-bit) alpha blending				
Memory					
Max. RMS size	Limited only by the amount of available free storage.				
Memory, storage	8 MB	40 MB	32 MB	F500 10 MB K500 10 MB Z500 6 MB Z250 10 MB Z320 10 MB Z520 16 MB Z525 16 MB	V800 8 MB [b] Z800 5 MB [b]
	Note: The amount of memory available for Java applications depends on the free amount of internal memory in the phone. Other contents, such as pictures, video clips and themes, use the same memory pool				
Java heap size	512 kB - 1.5 MB (dynamic, depending on available memory)				
Max. JAR size	Unlimited, but depending on available storage.				
Native video RAM available to Java	Approx. max 500 kB				

a) In Java only 65,536 colours (16-bit colour depth) can be used.

b) Java applications can be installed on the memory card as well as in internal memory.
To install a MIDlet on the memory card:

- Copy the application files (JAD/JAR) to the directory *mssemc**media files**other* in the phone file system.
- From the phone main menu, select Data folder and browse to the application in the *other* directory. Select **Install**.

Screen and memory specifications - continued

Specification/Phone	J300, K300	K310, K320, W200, Z310, Z530	K510, W300	K530, K550, K600, K610, K630, K750, V600, V640, W350, W380, W550, W600, W610, W660, W700, W710, W800, W810, Z550, Z555, Z558, Z610, Z710	C702, C902, C905, G502, G705, K660, K770, K790, K800, K810, K850, S500, T650, T700, W580, W595, W760, W830, W850, W880, W890, W900, W902, W910, W980, Z750, Z770, Z780
Screen					
Screen size	128x128	128x160	128x160	176x220	240x320
Fullscreen canvas size	128x128	128x160	128x160	176x220	240x320
Non fullscreen canvas size	128x110	128x128	128x128	176x176	240x266
Pixel ratio (H:W)	1:1	1:1	1:1	1:1	1:1
Colour depth	65,536 (16-bit)	65,536 (16-bit)	262,144 (18-bit) [a]	262,144 (18-bit) [a]	262,144 (18-bit) [a]
Transparency	Full (8-bit) alpha blending				
Memory					
Max. RMS size	Limited only by the amount of available free storage.				

Specification/Phone	J300, K300	K310, K320, W200, Z310, Z530	K510, W300	K530, K550, K600, K610, K630, K750, V600, V640, W350, W380, W550, W600, W610, W660, W700, W710, W800, W810, Z550, Z555, Z558, Z610, Z710	C702, C902, C905, G502, G705, K660, K770, K790, K800, K810, K850, S500, T650, T700, W580, W595, W760, W830, W850, W880, W890, W900, W902, W910, W980, Z750, Z770, Z780
Memory, storage (max. available)	8 MB	K310 15 MB K320 15 MB W200 20 MB Z310 14 MB Z530 28 MB[b]	K510 28 MB[b] W300 20 MB[b]	K530 16 MB[b] K550 64 MB[b] K600 37 MB K610 64 MB[b] K630 32 MB[b] K750 34 MB[b] V600 32 MB V640 32 MB[b] W380 14 MB[b] W550 256 MB W600 256 MB W610 64 MB[b] W660 16 MB[b] W700 34 MB[b] W710 10 MB[b] W800 32 MB[b] W810 21 MB[b] Z550 20 MB[b] Z558 18 MB[b] Z610 64 MB[b] Z710 10 MB[b]	W900: 470 MB[b] C702, C902, C905: 160 MB[b] G705: 120 MB[b] K790, K800, K810, W830, W850: 64 MB[b] T650: 50 MB[b] K850, W595, W760, W910: 40 MB[b] Z780: 35 MB[b] G502, K660, W890, Z750, Z770: 32 MB[b] K770, W580, T700, W902: 24 MB[b] W880: 16 MB[b] S500: 12 MB[b] W980: 8 GB
	Note: The amount of memory available for Java applications depends on the free amount of internal memory in the phone. Other contents, such as pictures, video clips and themes, use the same memory pool				
Java heap size	**JP-3, JP-5:** 512 kB - 1.5 MB (dynamic, depending on available memory) **JP-6**: 1.0 - 1.5 MB (dynamic, depending on available memory) **JP-7, JP-8.0 – 8.3**: dynamic, limited by available phone memory, maximum 6MB **JP-8.4**: dynamic, limited by available phone memory, maximum 30MB.				

Specification/Phone	J300, K300	K310, K320, W200, Z310, Z530	K510, W300	K530, K550, K600, K610, K630, K750, V600, V640, W350, W380, W550, W600, W610, W660, W700, W710, W800, W810, Z550, Z555, Z558, Z610, Z710	C702, C902, C905, G502, G705, K660, K770, K790, K800, K810, K850, S500, T650, T700, W580, W595, W760, W830, W850, W880, W890, W900, W902, W910, W980, Z750, Z770, Z780
Max. JAR size	Unlimited, but depending on available storage.				
Native video RAM available to Java	Approx. max 500 kB				

a) In Java only 65,536 colours (16-bit) can be used.

b) Java applications can be installed on the memory card as well as in internal memory.
To install a MIDlet on the memory card:

- Copy the application files (JAD/JAR) to the directory *mssemc**media files**other* in the phone file system.
- From the phone main menu, select the Data folder and browse to the application in the *other* directory. Select **Install**.

Java specifications

The table lists the Java characteristics of the phones covered in this document.

Characteristic	Support	Comments
CLDC version	1.1	
MIDP version	2.0, 2.1 from JP-8 *Supported image formats*: GIF87a, GIF89a, JPEG, PNG v 1.0 (colour depth 1, 2, 4, 8, 16 bits per pixel), BMP v 3.x, WBMP level 0 *Networking:* secure sockets, http 1.1, https. TLS 1.0 is also supported	See also “MIDP 2 support” on page 17 Z250 and Z320 support only GIF and JPEG formats.

Characteristic	Support	Comments
	Serial communication: JP-7 and JP-8 phones implement the `CommConnection` interface via the AT command port. The AT command port must be set to transparent mode with the AT*SEJCOMM AT command before serial communication can proceed.	See also "Serial Port Communications (from JP-7)" on page 64
JTWI (JSR-185) compliant	Yes, Release 1	
MMAPI (JSR-135)	1.1 *Supported Audio Content types, playback*: • audio/midi - MIDI (GM, GML and SP-MIDI) • audio/x-wav - WAV (PCM) • audio/x-tone-seq - JSR-135 tone sequence • audio/mpeg - MP3 (MPEG-1 layer 3, MPEG-2 layer 3, MPEG 2.5 layer 3) • audio/imelody - iMelody • audio/emelody - eMelody • audio/amr - AMR • audio/mp4a-latm - 3GP (MPEG-4 AAC LC) • audio/x-pn-realaudio (.ra) - RealAudio®, ver. 8 • audio/x-ms-wma – Windows media audio. *Supported Audio formats, recording*: • PCM : 16KHz - 256kb/s • AMR (NB) : 8KHz - 128b/s	See also "MMAPI (JSR-135)" on page 20. **Note:** Not all content types are supported in all phones

	Supported Video Content types, playback:
	• video/mp4v-es - 3GP (MPEG-4 Visual Simple Profile Level 0)
	• video/h263-2000 - 3GP (H.263 Baseline Profile 0 Level 10)
	• video/x-pn-realvideo (.rm) - RealVideo®, ver. 8
	• GIF89a animations are supported from *JP-6*
	• video/x-ms-wmv – Windows media video.
	Supported video formats, recording:
	• JP-7 to JP-8.2:
	3GP Container
	  • Video: H.263 (176x144) ~9FPS 60Kbps
	  • Audio: AMR (NB) 8KHz
	• JP-8.3 and higher:
	3GP container
	  • Video: Mpeg4 (320x240)
	  • Audio: AAC
		Note:
		Video playback is **not** supported in *JP-2* , W380, Z250, Z310 and Z320 series
		
		Note: Not all content types are supported in all phones

	Supported Image (Camera) Content types: • image/jpeg - JPEG	See also "Camera specifications" on page 48 **Note:** The camera in W380 and Z310 series is not accessible from Java.

Characteristic	Support	Comments
AMMS (JSR-234)	Extended camera and image handling functionality. From JP-8 also extended audio features are supported.	**Note:** Only supported from *JP-7* **except** W350, W380, Z310 and Z555. See also "Advanced Multimedia Supplements (JSR-234)" on page 22
WMA (JSR-120)	1.1 - GSM SMS	See also "WMA (JSR-120)" on page 18
WMA 2.0 (JSR-205)	GSM SMS GSM CBS MMS	**Note:** Only supported from *JP-6*
PDA optional packages for Java ME (JSR-75)	Version 1.0 *PIM API, supported package*: • Javax.microedition.pim *PIM API, supported classes/interfaces*: • Contact • Event • ToDo • Serialisation methods on PIM items • Serialisation of PIM items according to vCard 2.1/vCalendar 1.0. *File connection API, supported package*: • javax.microedition.io.file.	**Note:** Only supported from *JP-5* Z250 and Z320 support only the File Connection API part of JSR-75 See also "PDA optional packages (JSR-75)" on page 24 and "JSR-75 implementation" on page 66
Java Bluetooth API (JSR-82)	Version 1.0a, from **JP-7.4** version 1.1 *Supported packages*: • javax.bluetooth • javax.obex. *Supported connections*: • L2Cap (btl2cap://) • Serial Port Profile (btspp://) • Generic Object Exchange Profile (btgoep://) • irdaobex (irdaobex://). *Not supported:* Push Registry	**Note:** Only supported from *JP-5* See also "Bluetooth API (JSR-82)" on page 25
Java ME Web Services (JSR-172)	Version 1.0 *Supported packages*: • XML parsing • XML Web services	**Note:** Only supported from *JP-6*
Mobile Service Architecture, MSA (JSR-248)	Version 1.00	**Note:** Only supported from *JP-8*

Characteristic	Support	Comments
SIP API (JSR-180)	MSA compliant implementation	**Note:** Only supported from *JP-8*
Scalable 2D Graphics API (JSR-226)	MSA compliant implementation	**Note:** Only supported from *JP-8*
Payment AP! (JSR-229)	MSA compliant implementation	**Note:** Only supported from *JP-8*
Mobile Internationalisation API (JSR-238)	MSA compliant implementation	**Note:** Only supported from *JP-8*
Java Bindings for OpenGL ES API (JSR-239)	MSA compliant implementation	**Note:** Only supported from *JP-8*
Security and Trust API (JSR-177)	MSA compliant implementation	**Note:** Only supported from *JP-8*
Location AP! (JSR-179)	MSA compliant implementation	**Note:** Supported from *JP-8*, except early K850 and W910 series phones.
Content Handler AP! (JSR-211)	MSA compliant implementation	**Note:** Only supported from *JP-8*
Mobile Sensor AP! (JSR-256)	Version 1.0	**Note:** Only supported from *JP-8* Which sensor types are supported varies between phone models.
Java IR APIs	No	
Java Serial APIs	No	See also “Serial Port Communications (from JP-7)” on page 64
OTA Recommended Practice	Yes, MIDP 2 compliant	
Debug interface	KDWP	
Numeric keys	Yes (0-9, *, #)	
8-way directional key with select	Yes (navigation key)	**Note:** 4-way directional key in Z250 and Z320
Signed MIDlets	Yes	
TCP Sockets	Yes	
UDP Sockets	Yes	

Characteristic	Support	Comments
Java 3D	Mascot Capsule Micro3D version 3. Mobile 3D Graphics API for J2ME (JSR-184) version 1.0, version 1.1 is supported on JP-7.3 and higher.	See also “3D APIs” on page 24 **Note: Not** supported in *JP-2* and Z310
NokiaUI API	Version 1.1	
ARM® Jazelle® technology support	Yes	*JP-2*: No
Multitasking VM	From *JP-7:* Yes	

Camera specifications

Note: In W380 and Z310, the camera is not available to Java APIs.

In the K530, K550, K600, K610, K750, K770, K790, K800, K810, K850, S700, V640, W580, W610, W660, W700, W800, W810, W830, W850, W880, W900 and W910 the native camera application is designed for taking pictures with the phone in horisontal position. When a snapshot is taken in a Java application, the image is automatically rotated to match the image seen in the Java viewfinder.

Note: In the K600 and V600 series, only the video call camera is available for Java applications via `Manager.createPlayer("capture://video")`. In all other phones, only the main camera can be used for video capture from Java

Supported image types for a phone are obtained by calling
`System.getProperty("video.snapshot.encodings")`

The supported image types can be used in conjunction with the image sizes defined in the table below by specifying a snapshot parameter string. For example:
`videoControl.getSnapshot("encoding=jpeg&width=640&height=480");`

Java applications are restricted to use the values listed in the table below, even if the camera itself supports other image sizes.

Phone/series	Image size (pixels)											
	100 x 60	160 x 120	320 x 240	288 x 352	640 x 480	1280 x 960	1280 x 1024	1632 x 1224	1600 x 1200	2000 x 1500	2048 x 1536	2592 x 1944
Z1010, K700, K500, Z500, F500, K300		•										
S700			•									
V800, Z800	•	•			•		• [a]					
K750, W800, W700		•			•	• [a]		• [a]				

Phone/series	Image size (pixels)											
	100 x 60	160 x 120	320 x 240	288 x 352	640 x 480	1280 x 960	1280 x 1024	1632 x 1224	1600 x 1200	2000 x 1500	2048 x 1536	2592 x 1944
K600				•								
V600				•								
Z520, Z525		•	•		•							
W550, W600		•			•		• [a]					
W900		•			•			• [a]				
W810		•	•		•		• [a]					
K770, K790, K800, K810, T650					• [b]	• [a]		• [a]		• [a]	• [a]	
C702, G705, T700, W595, W760, W890, W980					•	• [a]		• [a]		• [a]	• [a]	
Z250			•		•							
K310, K320, W200, W300, Z530		•	•		•							
K510		•	•		•	• [a]						
Z320			•		•		• [a]					
Z550, Z558		•			•		• [a]					
K530, K610,S500, W830, W850, W880					• [b]	• [a]			• [a]			
G502, K550, T700, W580, W595, W610, W660, W710, Z610, Z710, Z770, Z780					• [b]	• [a]			• [a]			
K630, K660, V640, W910, Z750					•	• [a]			• [a]			
C902, C905, K850, W902					•	• [a]					• [a]	• [a]

a High resolution snapshots may not be possible to view in the Java application that took the picture, because of limited memory. However, it is possible to take a snapshot in the application and then process the created image object, for example, save it as a file in the file system of the phone.

b Resolution reported by `System.getProperty("video.snapshot.encoding")` in JP-7 phones. This is the only resolution that can be used in `VideoControl.getSnapshot()` with JP-7 phones. The other resolutions supported in these phones are available only through the JSR-234 interface `javax.microedition.amms.control.camera.CameraControl`.

From JP-8 the same resolutions are reported by `System.getProperty("video.snapshot.encoding")` and `javax.microedition.amms.control.camera.CameraControl`.

Font sizes

A font is specified by requesting a style, size and face. In Sony Ericsson phones, the style and size attributes are supported, while the face attribute is ignored.

Note: Font attributes are only available for Java in the low-level UI (`Canvas` or `GameCanvas` objects).

Due to space restrictions, all styles are not supported for Chinese characters in all phones. Also in many phones, the SIZE_LARGE attribute gives the same size as SIZE_MEDIUM.

Font heights in pixels (including line space) are listed below:

MIDP values	**Z1010**	**K700**	**S700**	**F500 K310 K320 K500 K510 W200 W300 Z250 Z310 Z320 Z500 Z520 Z525 Z530**	**J300 K300**	**K530 K550 K600 K610 K630 K750 V600 V640 V800 W350 W380 W550 W600 W610 W660 W700 W710 W800 W810 Z550 Z555 Z558 Z610 Z710 Z800**	**W900**	**K770, T650 W880**	**C702 C902 C905 G502 G705 K660 K790 K800 K810 K850 S500 T700 W580 W595 W760 W830 W850 W890 W902 W910 W980 Z750 Z770 Z780**
Western characters									
SIZE_LARGE	22 px	22 px	26 px	20 px	15 px	22 px	26 px	28 px	26 px
SIZE_MEDIUM	18 px	18 px	22 px	15 px	13 px	18 px	22 px	24 px	22 px
SIZE_SMALL	15 px	15 px	18 px	13 px	9 px	15 px	18 px	20 px	18 px

MIDP values	Z1010	K700	S700	F500 K310 K320 K500 K510 W200 W300 Z250 Z310 Z320 Z500 Z520 Z525 Z530	J300 K300	K530 K550 K600 K610 K630 K750 V600 V640 V800 W350 W380 W550 W600 W610 W660 W700 W710 W800 W810 Z550 Z555 Z558 Z610 Z710 Z800	W900	K770, T650 W880	C702 C902 C905 G502 G705 K660 K790 K800 K810 K850 S500 T700 W580 W595 W760 W830 W850 W890 W902 W910 W980 Z750 Z770 Z780
Chinese characters									
SIZE_LARGE	18 px	22px	26 px	15 px	15 px	22 px	26 px	28 px	26 px
SIZE_MEDIUM	18 px	22 px	26 px	15 px	15 px	22 px	26 px	24 px	22 px
SIZE_SMALL	15 px	18 px	22 px	13 px	13 px	18 px	22 px	20 px	18 px

Note: In the SDK emulator, versions before 2.5.0, only Western font sizes are rendered correctly. Due to variations in phone software, for example, different language packs installed, texts may be displayed differently in the emulator than in the phone.

Note: From SDK v. 2.5.0, also Chinese fonts are supported in the emulator.

Key mapping

Sony Ericsson phones support the `keyPressed( )`, `keyReleased( )`, and `keyRepeated( )` event delivery methods in class `Canvas`.

Key	Constant value	MIDP key code	Game action
4-way select up	-1		UP
4-way select down	-2		DOWN
4-way select left	-3		LEFT

Key	Constant value	MIDP key code	Game action
4-way select right	-4		RIGHT
JP-2 – JP-7: 4-way select press **JP-8**: Middle Selection Key (Soft key)	-5		FIRE
*	42	KEY_STAR	GAME_C
#	35	KEY_POUND	GAME_D
0	48	KEY_NUM0	
1	49	KEY_NUM1	
2	50	KEY_NUM2	UP
3	51	KEY_NUM3	
4	52	KEY_NUM4	LEFT
5	53	KEY_NUM5	FIRE
6	54	KEY_NUM6	RIGHT
7	55	KEY_NUM7	GAME_A
8	56	KEY_NUM8	DOWN
9	57	KEY_NUM9	GAME_B
Left Selection key (Soft key). Only available in Fullscreen Canvas mode	-6		
Right Selection key (Soft key). Only available in Fullscreen Canvas mode	-7		
C key (Clear)	-8		
Send key (**JP-8 only**)	-10		
Back key	-11		
Special keys The following keys are special keys. For some of them only `keyPressed` is called, not `keyReleased` and `keyRepeated`. **Note** that some of these special keys might not be possible to use, since they may have some native functionality, for example, starting another application.			
Power On/Off key (JP-6 and higher **only**)	-12		
Special gaming key A (W600, W550, K800, K790, W850, W830, K810 and W910 series **only**)	-13		

Key	Constant value	MIDP key code	Game action
Special gaming key B (W600, W550, K800, K790, W850, W830, K810 and W910 series **only**)	-14		
Operator key [a]	**JP-2 – JP-5:** -10 **JP-6 – JP-8:** -20		
Video call key [a] (JP-6 and higher **only**)	-21		
Media player (WALKMAN®) key [a] (JP-6 and higher **only**)	-22		
Play (media) button[a] (JP-6 and higher **only**)	-23		
Camera key [a] (JP-6 and higher **only**)	-24		
Camera focus key [a] (JP-6 and higher **only**)	-25		
Camera, capture key [a] (JP-6 and higher **only**)	-26		
Lamp key [a] (JP-6 and higher **only**)	-27		
PTT (Push-To-Talk) key [a] (JP-6 and higher **only**)	-28		
Camera lense cover open [a] (JP-6 and higher **only**)	-34		
Camera lense cover close [a] (JP-6 and higher **only**)	-35		
Volume+ (Zoom+) key [a] (JP-6 and higher **only**)	-36		
Volume– (Zoom–)key [a] (JP-6 and higher **only**)	-37		

a This key is not present in all phone models and may be referred to with different names, depending on what function it is used for in the UI of the phone. The name and function of the key may also be customised for different operators.

Swivel position detection

On jack knife phones from *JP-6* the `Canvas.keyPressed()` event delivery method can also be used to detect changes of the swivel position:

- keyCode -32 is returned when the swivel is opened
- keyCode -33 is returned when the swivel is closed

Keycodes generated when opening or closing a clam-shell phone

On clam-shell phones from *JP-6* the `Canvas.keyPressed()` event delivery method can also be used to detect when the phone flip is opened or closed:

- keyCode -30 is returned when the phone flip is opened
- keyCode -31 is returned when the phone flip is closed

Keycodes generated when opening or closing a slider phone

On slider phones from *JP-8* the `Canvas.keyPressed()` event delivery method can also be used to detect when the phone is opened or closed:

- keyCode -43 is returned when the phone is opened
- keyCode -44 is returned when the phone is closed

Simultaneous keypress support (S700, Z500, Z1010)

Two keys pressed at the same time are properly detected. More than two simultaneous key presses can in some combinations generate extra key press events. In some three key sequences, the third key is not detected.

Simultaneous keypress support (F500, J300, K300, K500, K700)

Two keys pressed at the same time are properly detected. More than two simultaneous key presses can in some combinations generate extra key press events. Pressing the navigation key in different directions and pressing other keys at the same time works with key 5 (Fire), key 7 (Game A) and key 9 (Game B). Using other keys together with the navigation key can generate false detections.

Simultaneous keypress support (*JP-4* to *JP-8* except W380 and Z310)

Two keys pressed at the same time are properly detected. More than two keys pressed simultaneously works in most cases but some combinations of keys may generate extra key press events. Pressing the navigation key and other keys at the same time works with key 0, key 1, key 3, key 7 (GAME A), key 9 (GAME B), key *(GAME C) and key # (GAME D).

Simultaneous keypress support (W380 and Z310)

Combinations of the 4-way select keys “up”, “down”, “left”, “right” and the “5” key (FIRE) are prioritised in the key detection mechanisms of the W380 and Z310. Pressing one or two of the 4-way select keys, alone or together with the “5” key, will always be properly detected, and return proper key codes with the triggered key events.

All other key combinations with two or more simultaneously pressed keys can not be properly detected by Java in the W380 and Z310.

Simultaneous keypress support (Z250 and Z320)

Two keys pressed at the same time are properly detected. More than two keys pressed simultaneously may generate unpredictable key press events. The 4-way select keys are treated as any other keys.

Appendix B
Java programming issues

This appendix contains some programming issues of interest for developers of Java MIDlets/applications for Sony Ericsson phones.

Hints for developing MIDlets

Information specific for developing Java MIDlets for wireless devices may be found in *Applications for Mobile Information Devices*, a Sun white paper with helpful hints for application developers and user interface designers using the MIDP (http://java.sun.com/j2me/docs/pdf/midpwp.pdf). The book *MIDP 2.0 Style Guide* (Wagner, Bloch - Addison Wesley, 2003) contains practical guidelines for utilising the features of MIDP 2.0. In addition, see the FAQ section of the Sony Ericsson SDK for the Java™ ME Platform release notes for more information about application development.

Writing efficient applications

Java MIDlets run on phones with limited screen sizes, memory and processing power. Reducing the number of created and destroyed objects will reduce memory usage and at the same time improve performance by reducing the time spent by the JVM for intitialisation and garbage collection of these objects.

Some recommendations for writing efficient applications:

- Make good use of static variables and avoid operations on `String` objects.
- Use the `StringBuffer` class for efficient manipulation of strings.
- Limit the use of inner classes and use an obfuscator to reduce class file size.
- Set object references to null as soon as they are no longer needed.
- Avoid unnecessary re-initialisation of variables that are automatically set to 0 or null by the VM.
- Use synchronisation sparingly. It is costly and is only needed in multi-threaded applications.
- Avoid loading the same image into memory more than once, since memory is consumed for each duplicate.
- Close network streams when finished with, in order to preserve resources.

Low-level MIDP user interface

An application using the low-level MIDP user interface will always have a `Canvas` object. The `Canvas` is implemented with double buffering to eliminate display flicker. The buffer is flushed when the `paint()` method returns.

Some recommendations for writing low-level UI applications:

- Only repaint the part of the `Canvas` to be changed, but always remember to paint what is requested of you to paint.

- In JP-2 – JP-5, the method `startApp()` is not only called when the MIDlet starts, but also when resuming after calling `pauseApp()`, for example, after the user has answered an incoming phone call. This behaviour has been changed from JP-6 and onwards, where `pauseApp()/startApp()` are no longer called in this situation. However, when the application uses a `Canvas`, `hideNotify/showNotify` are triggered on these occasions.

Memory usage

Java MIDlets/applications allocates memory in several different memory areas. Memory problems most often occur with allocation of memory for images. In this section some issues concerning memory usage are covered.

Java heap

Java applications use two kinds of heap memory, plain Java heap and LAM (Large Array Memory). The LAM is shared with other processes on the phone. Standard Java objects and vectors of Java objects are always located on the Java heap. Arrays of primitive types (`byte[], int[], float[]`) however may be put in the LAM if the plain Java heap is low on memory. Small arrays have a greater chance of ending up in the plain Java heap, while large arrays more often are stored in the LAM. Images are also sometimes placed in LAM.

The size and configuration of the Plain heap size and the LAM size varies between phone models.

Note: From JP-7 Sony Ericsson phones only have one java heap area, which grows dynamically. Maximum heap size in JP-7 and JP8.0 – 8.3 phones is 6 MB, and in JP-8.4 phones 30 MB.

The size of LAM is not included in the values reported by `Runtime.freeMemory` and `Runtime.totalMemory`.

Some simple rules to make the most of phone memory:

1. Always release memory before reallocating it:
   ```
   char [] v = new char[100];
   ... do stuff ...
   v = null; // by setting v to null the allocation below can re-use the memory.
   v = new char[200];
   ```

   The same schema goes for pictures, resources, and so on. For the phone to be able to re-use an image vector the image must first be released:
   ```
   Object o = allocateMyResource(size);
   ... do stuff ...
   o = null; // Remove the reference to the resource so that it can be resumed
   in the allocation below
   o = allocateMyResource(someOtherSize);
   ```

2. Allocate objects first, then primitive arrays and images.

Note: The Java VM in *JP-7* and *JP-8* phones supports multitasking. Even MIDlets running "in the background" may have some heap memory allocated, which in turn may influence the available amount of heap memory for MIDlets starting and running in other threads.

Video RAM areas

Note: JP-7 and JP-8 phones do not have dedicated video ram areas. In these phones the Java heap is used for graphics. Java heap grows dynamically and is limited by free phone memory.

To assure that Java MIDlets will not run out of memory due to use of graphics, the JP-2 – JP-6 phones covered in this document implement several memory areas for graphics. Graphics memory areas are used in the following order. If one area is full or an image to large to fit in the free space of one area, the next one is used instead.

1. One area of fast video RAM dedicated for graphics storage.

2. Another video RAM area, with somewhat slower access.

3. The general heap area of the phone is used for images when it is not possible to use the two video RAM areas.

4. Swapping of images to the phone flash memory is supported (not in JP-7 and later phones).

Hints for using video memory

The developer should always try to fit commonly used images into the fastest RAM area and use the slower areas for more seldomly used images. This is done by making the MIDlet fetch the commonly used images first and make sure that they fit into the 80 kb of fast video RAM.

To increase the chances that an image is actually loaded into fast memory, another image in that area, with at least the same size should be freed. Before allocating the new image into memory, garbage collection (`System.gc()`) should be called.

Another issue to take into consideration when designing applications to use the fastest possible video memory is fragmentation of memory. When an image, allocated between two other images in memory, is freed, only images smaller than the free area can be allocated in that area. Thus, even if the system reports enough free memory for allocation of an image, this may fail, because the free memory consists of several areas, each to small for the image.

When using very large images, another problem can arise. If an image is to large to fit into the memory dedicated for images, the `Image.createImage()` method may still succeed, because the image is stored in flash memory. However when the image is to be displayed, it does not fit in the available video memory, and can not be shown on the screen. The solution is to always estimate the image size in memory before trying to use it in a MIDlet. All images are stored in phone memory in a 16-bit per pixel RGB format, possibly with a 1-bit or 8-bit per pixel alpha-channel. Make sure to save all opaque images with 1-bit alpha, as they are drawn much faster on the screen.

Retrieving the IMEI number

The following command retrieves the IMEI (International Mobile Equipment Identity) number from Sony Ericsson phones:

```
System.getProperty("com.sonyericsson.imei")
```

This returns a string which uniquely identifies a phone, for example: “IMEI 004601-01-501762-8-01” (the exact format of the returned string may differ from the example). Each GSM phone is assigned a unique IMEI code when it is produced. See the following link for further information about IMEI: http://www.numberingplans.com/index.php?goto=guide&topic=imei.

Note: `"imei"` in the attribute must be written with lowercase letters when the command is used for Sony Ericsson phones, except for the P910 series where uppercase letters must be used instead (`"IMEI"`).

Note: From JP-7.2, a unique subscriber number can be retrieved via `System.getProperty("com.sonyericsson.sim.subscribernumber")`.

Minimising and maximising MIDlets

A MIDlet can request to get minimised by calling `setCurrent(null)`. A MIDlet can request to get maximised by calling `setCurrent(x)` with `x != null`.

A request to get maximised will only be granted if the previous `setCurrent()` call was a request to get minimised. Therefore a MIDlet that was minimised via the “long back” dialog can only get maximised by first calling `setCurrent(null)` and then `setCurrent(x)` with `x != null`.

When the MIDlet is minimised, a `Canvas.hideNotify()` event is raised, and when it is maximised, `Canvas.showNotify()` is raised. The `Canvas.isShown()` function can be used to query if the MIDlet is currently in maximised or minimised state.

Multitasking MIDlets

Multitasking Java™ ME was introduced with Sony Ericsson Java Platform 7 (JP-7) and allows multiple Java™ applications (MIDlets) to run concurrently within the same Virtual Machine. The implementation is backwards compatible with previous Java platforms so that all existing MIDlets work on the new platform without adjustments. The implementation is fully compliant with MIDP 2/JTWI specifications and does not require any additional JAD properties or proprietary APIs. On earlier Java Platforms, only one Java application was allowed running together with other phone applications.

The resource contention strategy for the multitasking environment is simple. Prioritisation in most cases follows the pattern of “first come - first served”. For example, Bluetooth connections, sockets, memory resources, and so on, are taken by the application/thread doing the first allocation. Exceptions to this pattern are sounds, screen and user input through keyboard. The rules applied are basically the same as when MIDlets compete with native phone applications for resources in a traditional single tasking Java platform, or when threads within the same MIDlet compete for resources.

To programmatically control MIDlets running in the multitasking environment, the `setCurrent()`, `hideNotify()`, `showNotify()` and `isShown()` methods may be used as outlined above.

The phone user can also select which application to run in the foreground and which to run in the background via the phone MMI:

- Pressing the back button for ~1 second (referred to as "long back") and then selecting "Minimise" in the popup window, puts the foreground application into background
- Pressing the "Activity Menu" button (if available) and then selecting an application running in the backround, or starting a new application through the menu system, puts the foreground application into background, and the selected application into foreground.

Adding events in the Activity menu from a MIDlet

From JP-7.5 it is possilbe for a MIDlet to publish events in the Activity Menu. This could be useful for example for messaging applications which run "in the background", to notify the user that a new event has occured without the MIDlet being "forced" into foreground.

The feature is implemented through a Sony Ericsson proprietary Java API, UIActivityMenu. The API gives access to the “New Events” list in the phone’s Activity Menu structure.

```
public class UIActivityMenu {
public static synchronized UIActivityMenu getInstance(MIDlet m)
public void setEventListener(UIEventListener el)
public int addEvent(String title, Image icon)
public int addEvent(String title, String desc, Image titleIcon, Image descIcon)
}
```

In the “New events” list, an item is shown as a Title on one row and an optional Description on the next row. Icons can be defined for the Title and the Description:

```
UIActivityMenu.getInstance(midlet).addEvent("Title", "Description", icon,
icon);
```

If no icon (null value) is defined for the Title, the default Application icon is displayed instead.

When a MIDlet is invoked as above, the Activity Menu is displayed on the phone screen, unless the camera, video-player, video-call, or some other similar application is running in the foreground. When the user selects an event from the “New events” list, the underlying application is maximised, and the application receives the appropriate events. However, if the user deletes an event from the list, no notification is sent to the application.

Standby MIDlets

JP-7 and JP-8 phones have a feature allowing developers to enable a MIDlet as a standby application. Just as the end user can assign a picture as wallpaper, it is also possible to select a Java application for this purpose. A standby MIDlet is handled by the application manager, and is started when the phone enters standby mode. It is stopped when the user selects another wallpaper, theme or picture. A MIDlet is designated as a standby application via a JAD attribute setting.

Note: Standby MIDlets are not supported in early K610, K790 and K800 phones.

For details about creating standby MIDlets and some practical advice on how to design them, see http://developer.sonyericsson.com/site/global/techsupport/tipstrickscode/java/p_standby_midlet_jp7phones.jsp.

Autostarting MIDlets

JP-7 and JP-8 phones, except early K610, K790 and K800 phones, support autostarting MIDlets.

The autostart feature uses the MIDP push registry as its driver. To register an application for autostart, simply do a push registration, either static or dynamic, using the push URI "autostart://:". The application will then start automatically the next time the phone boots.

For more information about how to create autostarting MIDlets and some code samples, see the article on the subject in the Tips, Tricks & Code section on Sony Ericsson Developer World.

Network APIs

Sony Ericsson phones support several network connections:

- HTTP 1.1 server connections (With HTTP 1.0 servers not all features below are supported)
- HTTPS connection (TLS 1.0 is also supported)
  Note: HTTPS connections via Proxy are **only** supported from *JP-5*
- Push Registry
- TLS 1.0/SSL 3.0 connections
- Socket connections
- UDP connections (datagram).

Network API features

The following table lists the Network API features and classes of the `javax.microedition.io` package, and their MIDP 2 support in Sony Ericsson phones.

Feature/Class	Supported
`Connector` class	Yes
All Fields, methods, and inherited methods for the `Connector` class	Yes
Mode parameter for the `Connector.open()` method	No
The timeouts parameter for the `Connector.open()` method	No
`Connector.http` interface	Yes
`Connector.https` interface	Yes
`SecureConnection` interface	Yes
`SecurityInfo` interface	Yes
`ServerSocketConnection` interface	Yes
`UDPDatagramConnection` interface	Yes
`PushRegistry` class	Yes
`CommConnection` interface	From **JP-7:** Yes. See also “Serial Port Communications (from JP-7)” on page 64
Dynamic DNS allocation through DHCP	Yes

HTTP 1.1 implementation

- HEAD, POST, GET methods are supported in all phones, PUT, DELETE, TRACE, and OPTIONS methods are supported on JP-8 and higher.
- Persistent HTTP/1.1 connections is supported on JP-8 and higher. Keep-alive is not supported.
- The API implementation in Sony Ericsson phones chooses whether to use chunked transfers for a particular request. Applications can **not** control whether chunking is used or not.
- User-Agent, Host, Transfer-Encoding, Content-Length and Proxy-Authorisation are set automatically by the HTTP implementation as needed.
- Request properties settings are not required.
- Connection:close is supported.

Secure sockets and HTTPS connections

HTTPS is supported only for certificates installed on the phone. The following X.509 root certificates for TSL/SSL server authentication are provided by default. However, operators can change which of them are installed and also add other certificates. Local market variations may also exist.

Certificate issuer	Label
Verisign	Verisign Class 3 CA
Baltimore	GTE Cyber Trust Root
Entrust	Entrust.net Root Certificate
GlobalSign	GlobalSign Root CA
Thawte	Thawte Server CA
RSA data Security	-

When initiating a connection and the certificate can not be validated in JP-2 to JP-5 phones, the connection fails and an exception is thrown. From JP-6, the user is prompted whether to accept the connection or not. However, the behaviour in JP-2 to JP-5 phones can be avoided by installing a certificate granting secure connections on the phone (a self-signed certificate can be used).

JAD/manifest attributes

The application descriptor **must** contain the following attributes:

- MIDlet-Name
- MIDlet-Version
- MIDlet-Vendor
- MIDlet-Jar-URL
- MIDlet-Jar-Size.

The application descriptor **may** contain:

- MIDlet-<n> for each MIDlet
- MIDlet-icon (for the ideal look and feel icon size **16x16 pixels is recommended**) This attribute is only supported from *JP-4*
- MicroEdition-Profile (**recommended**)
- MicroEdition-Configuration (**recommended**)
- MIDlet-Description
- MIDlet-Data-Size
- MIDlet-Permissions (**recommended**)
- MIDlet-Permissions-Opt
- MIDlet-Push-<n>
- MIDlet-Install-Notify
- MIDlet-Delete-Notify
- MIDlet-Delete-Confirm
- MIDlet-Certificate-<X>-<Y>

- MIDlet-Jar-RSA-SHA1
- Any application-specific attributes that do not begin with MIDlet- or MicroEdition-.

Vodafone JAD attributes

Sony Ericsson phones manufactured for Vodafone, support the following additional attributes in the JAD/ manifest:

Attribute	Comments
MIDxlet-Resident	Supported values: *Y = Resident MIDlet*, *N = Not resident MIDlet*. The attribute value *S = Stay resident* is **not** supported
MIDxlet-ScreenSize/ MIDxlet-Application-Range	Values: *W, H* or *Wmin-Wmax, Hmin-Hmax*. Screen size or minimum/maximum width and height expected by the application. Both attributes are supported, but MIDxlet-ScreenSize is recommended. If both attributes are present in a JAD file, MIDxlet-ScreenSize attribute has precedence

Serial Port Communications (from JP-7)

From Java Platform 7 (JP-7) serial port communication, defined as optional within the MIDP 2 specification, is supported.

The interface `CommConnection` extends `StreamConnection` to provide a means to access a serial port.

The port is accessed using a Generic Connection Framework string:

```
comm:<port identifier>[<optional parameters>]
```

The port identifier is one of the exposed serial ports which can be queried through the `microedition.commport` system property. A comma separated list of ports is returned.

```
String port1;
     String ports = System.getProperty("microedition.commports");
     int comma = ports.indexOf(',');
     if (comma > 0) {
          // Parse the first port from the available ports list.
          port1 = ports.substring(0, comma);
     } else {
          // Only one serial port available.
          port1 =ports;
     }
```

To use serial communications, the relevant AT command must first be issued from the host. Both Bluetooth and USB connection mechanisms are supported.

Once the phone is connected to the host, a COM port is assigned on the host side. Characters sent via this connection are, by default, interpreted as AT commands by the phone.

The AT*SEJCOMM command can be used to create a virtual port accessible from the Java platform.

Command	**Responses**
AT*SEJCOMM=<port>[,<persistent>]	CONNECT OK
	ERROR +CME ERROR <err>

The AT*SEJCOMM command puts the port into a so called “transparent mode” where the AT channel stops intercepting input, and subsequent characters appear as input on the serial port. The command expects <port> and optional <persistent> parameters.

The <port> parameter is used to specify a virtual port number which creates a binding to the physically connected port. For example, if the phone has been connected to the host and is using COM 4, the command AT*SEJCOMM=1 will instruct the phone to create a virtual port called “AT1” and connect it to COM 4. If the command is successful, "CONNECT" is returned and the AT channel enters transparent mode.

Depending on the <persistent> parameter, once the MIDlet closes or is terminated, the AT channel leaves transparent mode and the virtual port is destroyed. If the persistent flag is set with the value 1, the port remains until the bearer (for example, a USB cable) is disconnected.

The virtual ports are accessible to the Java platform in the form of “AT<port>”.

```
CommConnection cc = (CommConnection)
               Connector.open("comm:AT1");
     int baudrate = cc.getBaudRate();
     InputStream is  = cc.openInputStream();
     OutputStream os = cc.openOutputStream();
     int ch = 0;
     while(ch != 'Z') {
          os.write(ch);
          ch = is.read();
          ch++;
     }
     is.close();
     os.close();
     cc.close();
```

JSR-75 implementation

JSR-75 is implemented from *JP-5*. This section specifies which features are supported in these phones.

PIM API

The PIM API supports the following PIM lists:

- Contacts (ContactList)
- Calendar (EventList)
- Tasks (ToDoList).

Actual names of lists and other labels depend on locale.

Contacts

Supported Java PIM fields (native/GUI field names in parenthesis):

- UID (LUID)
- NAME (LastName/Name). Supported array elements:
  - NAME_FAMILY
  - NAME_GIVEN
- ADDR (HomeAddress). Only one address, always ATTR_HOME. Supported array elements:
  - ADDR_STREET (Street)
  - ADDR_LOCALITY (City)
  - ADDR_REGION (State)
  - ADDR_POSTALCODE (Zip code)
  - ADDR_COUNTRY (Country)
- TITLE
- ORG (Company)
- EMAIL
- URL
- NOTE (Freetext)
- TEL, supported attributes (max one + ATTR_PREFERRED):
  - ATTR_HOME (HomeNumber)
  - ATTR_WORK (WorkNumber)
  - ATTR_MOBILE (CellNumber/Mobile number)
  - ATTR_FAX (FaxNumber)
  - ATTR_OTHER (OtherNumber)
  - ATTR_PREFERRED (DefaultNbr), on one number only
  - Numbers are sent to different database containers based on attributes. If two numbers have the same attribute only one is stored. One number with multiple attributes creates copies in different containers (not combined on retrieval). No attribute is treated like ATTR_OTHER. As a consequence of all this, field value indexes are not preserved on retrieval
  - Supported char-set: '0'-'9','*','#','?','+' and 'p'
- PHOTO **or**
  PHOTO_URL
  - Files that have no Java mapping are not returned on read, for example, predefined images that link to system directories
  - Only local URLs ('file:///') that refer to existing files can be persisted

- RINGTONE = PIMItem.EXTENDED_FIELD_MIN_VALUE + 1 **or**
  RINGTONE_URL = PIMItem.EXTENDED_FIELD_MIN_VALUE + 2. (Ringtone). **Only** supported on JP-8

Unsupported Java standard fields

- BIRTHDAY
- CLASS
- FORMATTED_ADDR
- FORMATTED_NAME
- NICKNAME (Requires vCard 3.0)
- PHOTO
- PUBLIC_KEY
- PUBLIC_KEY_STRING
- REVISION.

Unsupported native fields

- Birthday
- ChangeCounter
- ContactPosition
- WVID (Presence ID)
- NameVoiceTag (Voice Commands)
- JapaneseReading (Furigana).

Restrictions

- All fields except TEL can have one value only
- Categories are not supported
- A maximum of 1000 contacts (2500 phone numbers) can be saved in the phone.

Calendar

Supported Java PIM fields (native/GUI field names in parenthesis):

- UID (LUID)
- SUMMARY (Summary/Description)
- LOCATION (Location)
- NOTE (Description)
- END (EndDateAndTime)
  Default: current time + 1 second
- START (StartDateAndTime)
  Default: current time
- ALARM (ReminderDateAndTime)
  Must be positive, that is, before start
- CLASS (Class)
- REVISION (LastModified).
- GEO (extended field, SEMC specific, supported **from JP-8**)

Unsupported native fields

- TimeZone
- DaylightSaving
- AllDayEvent.

Restrictions

- Database must have: ALARM <= START <= END (defaults set on commit)
- RepeatRules (Recurring events) are **only** supported **from JP-8**. In **JP-5 – JP-7** phones, only the first item in a recurrence series is retrieved

- Categories are not supported
- A maximum of 300 calendar events can be saved in the phone.

Tasks

Supported Java PIM fields (native/GUI field names in parenthesis):

- UID (LUID)
- SUMMARY (Summary/Description)
- NOTE (Description)
- DUE (RemainderDateAndTime/Reminder)
- COMPLETION_DATE (CompletedDateAndTime)
- COMPLETED (Status). Native system currently uses:
  - CAL_STATUS_NOT_STARTED_VALUE (0), mapped to false
  - CAL_STATUS_IN_PROGRESS_VALUE (1), equated to not started
  - CAL_STATUS_COMPLETED_VALUE (2), mapped to true
- PRIORITY (Priority). Native system currently uses:
  - CAL_PRIORITY_HIGH_VALUE (1)
  - CAL_PRIORITY_NORMAL_VALUE (2)
  - CAL_PRIORITY_LOW_VALUE (3)
  - Only 8 bits are persisted (not sign extended on retrieval)
- CLASS (Class)
- REVISION (LastModified).
- GEO (extended field, SEMC specific, supported **from JP-8**)

Unsupported native fields

- TimeZone
- DaylightSaving
- DueDateAndTime.

Restrictions

- Categories are not supported
- A maximum of 80 tasks can be saved in the phone.

PIMChangeListener (from JP-8.3)

On JP-8.3 and higher, the PIMChangeListener Interface can be used by applications to receive events whenever PIMItems stored in a PIMList have been changed. Events are triggered by the following operations:

- newly created and committed PIMItems (added)
- modified or removed fields in existing PIMItems (modified)
- permanently removed PIMItems from a PIMList (removed).

More information about the PIMChangeListener features can be found in PIMChangeListener doc.zip, included with the zip package containing this document.

Geographic information

The JSR-75 implementation supports geographical positions (longitute and latitude) from JP-8, but only for Event and ToDo items. The GEO field is an extended field, which makes it specific for Sony Ericsson phones. However when vCal items containing GEO field are imported, GEO information is stored together with the rest of the Event/ToDo information.

Serialisation

Serialisation includes converting vCards and vCalendar events/todos in serial (text) form into PIM items (FromSerial), and back again (ToSerial).

There are two parsers, one for vCards and one for vCalendar Events/ToDos. As required by the standard, the parsers support vCard 2.1 and vCalendar 1.0, with Quoted-Printable and BASE64 encoding formats. The character encoding must be UTF-8, which means that normal 7-bit ASCII is also allowed (since it is a subset of UTF-8).

Only values/properties supported by the databases are copied to the PIM item.

If there are too many values for a particular field, the implementation will favour those with attributes that the field supports.

File Connection API

This section specifies the File Connection API support from *JP-5* and onwards.

The folders listed below and their content (including sub-folders), which are available via the File Manager application in the phone, are available via the FileConnection API as directories (folders) and files. This includes also access to the whole file system on an external memory (removable media), if present.

- <file:///c:/>
- <file:///c:/other>
- <file:///c:/pictures/>
- <file:///c:/sounds/>
- <file:///c:/videos/>
- <file:///e:/> (memory card)
- <file:///e:/dcim/> (camera pictures folder on memory card).

Note: The folders *Games*, *Themes*, *Applications* and *Webpage* are not available via the Java File Connection API.

Note: Which folders are accessible via the File Connection API may differ between different phone models. For example, in JP-7 and JP-8 phones, there is a *Camera* folder in phone internal memory, <file:///c:/camera>, and the *Themes* and *Webpage* folders on memory card are accessible.
The PDAPDemo application supplied with the Sony Ericsson SDK for the Java ME platform is recommended to find out exactly which folders are accessible in internal memory and installed memory card of a specific phone.

To query the location of, for example, the default camera folder, the recommended approach is to use the system property "`fileconn.dir.photos`". See "JSR-75 system properties" on page 80 for details on how to query default locations of folders in the file system.

Attempts to access other file areas than the ones specified above, result in a `java.lang.SecurityException` being thrown to the Java application.

The File Connection API supports the same file/dir attributes as are supported by the built-in File manager application. File and directory names accessed via the File Connection API are case-insensitive.

The length of a file path is limited by the native file system (including the memory card file structure).

Note: The Java path is mapped to a native path. The maximum native path is 120 characters.

Restricted file/directory operations

The following operations fail if they are performed on any of the built-in roots:

- Create new file in the root directory
- Create new directory in the root directory
- Change attributes
- Delete root or built in directory
- Rename root or built in directory
- Request of last modification date returns 0.

Rules for operations on DRM protected files

The following operations are supported on DRM protected files:

- Open connection
- List (DRM protected files appear in directory lists)
- Request file size
- Request attributes and last modification date
- Delete
- Exists
- Is directory.

The following operations are not supported on DRM protected files:

- Create file
- Change attributes
- Rename file
- Truncate file
- Open input stream
- Open output stream.

Rules for operations on Sony Ericsson encrypted files

Sony Ericsson encrypted files are files that are encrypted and stored in phone memory or on the memory card. These files are not accessible for the user.

The following operations are supported on encrypted files:

- Open connection
- list (encrypted files will appear in directory lists)
- exist
- file size
- can read
- can write
- is hidden
- lastModified
- dirSize (encrypted files are counted).

The following operations are **not** supported on encrypted files:

- create
- setReadable
- setWritable
- setHidden

- delete
- rename
- truncate
- openInputStream
- openOutputstream
- read / write.

Playing media files with MMAPI using progressive download

The File Connection API implementation on Java platforms JP-6 and onwards allows progressive download of media files to be played via the MMAPI. This allows the player to start playing the media file before the whole file actually has been loaded into memory.

To make use of progressive download in a player application, the `createPlayer` method must be invoked with a file scheme locator string as parameter, for example:

```
Manager.createPlayer(file:///c:/sounds/song.mp3);
```

Note: This functionality is **not** implemented on Java platform JP-5, where the MMAPI implementation does not support the file scheme in the `createPlayer` method. In JP-5 phones, playing of media is invoked via `createPlayer(InputStream stream, String type)` which does not take advantage of progressive download. The consequence is that the whole media file must be loaded into memory before the player starts playing. This can in some cases take quite long time with large media files.

Note: from *JP-7* phones, progressive download according to 3GPP TS 26.234 45.3.0 is supported both for http download and `InputStream` via JSR-135.

Video overlay

Note: With JP-8.x phones, it is strongly recommended **not** to use `GameCanvas` with MMAPI, `Canvas` should be used instead.

On Java Platform JP-7 and JP-8 it is easy to create an overlay over a video clip shown in a MMAPI video player instance. All pixels drawn with `Canvas.paint` are overlayed over the video, canvas areas where nothing has been drawn remain transparent. Note that if a filled shape is drawn, for example, a rectangle with a background color, the video will be completely hidden behind the shape.

Before using the overlay technique, a `javax.microedition.media.control.VideoControl` has to be initiated on the current `javax.microedition.media.Player`, for example:

```
VideoControl videoControl = (VideoControl)player.getControl("VideoControl");
videoControl.initDisplayMode(VideoControl.USE_DIRECT_VIDEO | (overlay << 8),
canvas);
```

where `overlay` is set to 1 for overlay mode, 0 for no overlay.

Video rotation/mirroring

Note: The rotation/mirroring mode described here is not applicable for GIF animations.

A `VideoControl` can be used to mirror and/or rotate the video on the display. A `javax.microedition.media.control.VideoControl` is initiated on the current `javax.microedition.media.Player`, for example:

```
VideoControl videoControl = (VideoControl)player.getControl("VideoControl");
videoControl.initDisplayMode(VideoControl.USE_DIRECT_VIDEO | (orientation <<
4), canvas);
```

`Orientation` is set to one of the following integer constants in the `javax.microedition.lcdui.Sprite` class:

Orientation constant	Effect
`TRANS_MIRROR`	Causes the sprite to appear reflected about its vertical center
`TRANS_MIRROR_ROT180`	Causes the Sprite to appear reflected about its vertical center and then rotated clockwise by 180 degrees
`TRANS_MIRROR_ROT270`	Causes the Sprite to appear reflected about its vertical center and then rotated clockwise by 270 degrees
`TRANS_MIRROR_ROT90`	Causes the Sprite to appear reflected about its vertical center and then rotated clockwise by 90 degrees
`TRANS_NONE`	No transform is applied to the Sprite
`TRANS_ROT180`	Causes the Sprite to appear rotated clockwise by 180 degrees
`TRANS_ROT270`	Causes the Sprite to appear rotated clockwise by 270 degrees
`TRANS_ROT90`	Causes the Sprite to appear rotated clockwise by 90 degrees

Rotation can only be used in `VideoControl.USE_DIRECT_VIDEO` mode, using `VideoControl.USE_GUI_PRIMITIVE` throws an exception.

Note that `VideoControl.getSourceWidth()` returns the width of the non-rotated object, it is up to the MIDlet to keep track on what is height and what is width of the rotated video. Furthermore, the coordinates (0,0) always refers to the top left corner of the video, regardless of rotation.

Video rotation/mirroring during playback

A `DisplayModeControl` can be used to mirror and/or rotate the video on the display **during playback**. A `com.sonyericsson.media.control.DisplayModeControl` is initiated on the current `javax.microedition.media.Player`.

Example:

```
DisplayModeControl displayModeControl = (DisplayModeControl)player
.getControl("DisplayModeControl");
displayModeControl.setDisplayMode(orientation <<4);
```

Orientation is set to one of the integer constants in the `javax.microedition.lcdui.Sprite` class.

The interface:

```
package com.sonyericsson.media.control;
public interface DisplayModeControl extends Control {
     public void setDisplayMode(int displayMode);
     public int getDisplayMode();
}
```

Tips for using the JSR-82

Local device

To find out what is supported by the phone, use `LocalDevice.getProperty()`. See JavaDoc for valid properties.

Device discovery

Tip 1

Filter found RemoteDevices immediately by using `DeviceClass`. By doing this unnessecary actions can be avoided, for example, doing a service search on a discovered PC when running a Java ME game.

Tip 2

If retrieving cached remote devices via JSR-82 API, then the information about remote device class is not available. It might be better to implement cache with filtered devices from the initial device discovery.

Tip 3

Only ask for friendly names for the devices displayed in GUI, and save time.

`remoteDevice.getFriendlyName(true)` is supported from *JP-5*.

Tip 4

To gain better user experience, present discovered remote devices directly when found. Do not wait until the inquiry is completed.

More device discovery tips

On Sony Ericsson Developer world, an article named “Bluetooth probe for mobile phones supporting JSR-82” gives some useful tips and code examples for device discovery: http://developer.sonyericsson.com/site/global/techsupport/tipstrickscode/java/p_bluetooth_probe_jsr82.jsp

Games

Use `ByteArrayOutputStream/ByteArrayInputStream` buffer for RFCOMM.

The transfer rate may be increased by using fixed size byte array, that is, by not having to send the buffer length before sending the actual byte buffer.

Managing connections between Bluetooth SDP records and a game server

On Sony Ericsson Developer world, an article can be found, giving tips and code samples on how to handle SDP records correctly, avoiding problems with rejected Bluetooth connections, for example, when clients in one or more phones tries to connect to a game server in another phone. For details, see http://developer.sonyericsson.com/site/global/techsupport/tipstrickscode/java/p_advice_bluetooth_sdp_game+server.jsp

The accelerometer sensor in JP-8 phones

Through JSR-256, parameter values from the built-in accelerometer in, for example, the K850 and W910 series can be read and processed. The accelerometer in these phones has the following characteristics:

- Channels, X, Y and Z. Each channel represents acceleration force vectors in relation to the phone.
- Ranges: –2300 to +2300
- Datatype: `Int`
- Unit: G. Scale: -3. This implies that acceleration measurements are given in the unit milliG (10^{-3} G), where G is earth gravity (~9.81 m/s^2).

Example: A reading of Z = 1000; X = 0; Y = 0 indicates that downwards acceleration is 1000x10^{-3} = 1.0 G, which in turn means that the phone is being held horisontally with the screen facing straight upwards.

JSR-211 content handlers

JSR-211 Walkman® player content handler

This content handler, implemented on JP-8.3 and higher, can be used to launch the native music player on Walkman® phones. The code sample below illustrates:

```
Registry registry = Registry.getRegistry(this.class.getName());
Invocation invoc = new Invocation();
invocation.setID("com.sonyericsson.musicplayer");
invoc.setURL(file:///..../playlist.m3u); //optional, if not used a resume play
will be made.
invoc.setResponseRequired(true);
boolean mustExit = registry.invoke(invoc);
if (mustExit) {
     // App must exit before invoked application can run
     destroyApp(true);
     notifyDestroyed();
     }
else {
     // Application does not need to exit
     }
```

JSR-211 interaction with browser

On JP-8 and higher, the native browser is able to start MIDlets using JSR-211. If the scheme router of the browser does not recognise a URI scheme, it calls JSR-211 which invokes the MIDlet that has registered itself for that specific scheme.

To enable this feature, the MIDlet must register itself for a specific scheme.

Example on static registration for the scheme "`semc://`" in the jad file of the sample MIDlet ShowLogo:

```
MicroEdition-Handler-1: com.sonyericsson.test.ShowLogo, semc:
```

JSR-211 Shortcut launcher

JSR-211 Shortcut launcher is implemented on JP-8.4.

This content handler can be used to launch native applications using URLs. The code sample below illustrates this.

```
Registry registry = Registry.getRegistry(this.class.getName());
Invocation invoc = new Invocation();
invoc.setID("Content Handler ID");
invoc.setResponseRequired(true);
boolean mustExit = registry.invoke(invoc);
if (mustExit) {
  // App must exit before invoked application can run
  destroyApp(true);
  notifyDestroyed();
} else {
  // Application does not need to exit
}
```

The following Content Handler IDs are available:

- Alarm
  Launch the alarm settings application.
  `ID: "com.sonyericsson.alarm"`

- Browser (bookmarks)
  Launch the Web browser on a bookmark.
  `ID: "com.sonyericsson.bookmarks"`

- Browser (enter URL)
  Launch the Web browser with an entered URL.
  `ID: "com.sonyericsson.enterurl"`

- Calculator
  Launch the Calculator application.
  `ID: "com.sonyericsson.calculator"`

- Camera
  Launch the Camera application.
  `ID: "com.sonyericsson.camera"`

- Email
  Launch the email client.
  `ID: "com.sonyericsson.email"`

- Radio
  Launch the Radio application.
  `ID: "com.sonyericsson.radio"`

- Bluetooth settings
  Launch the Bluetooth connectivity dialog.
  `ID: "com.sonyericsson.settings.bluetooth"`

- Clock size settings
  Launch the clock size settings application.
  `ID: "com.sonyericsson.settings.clocksize"`

- Date settings
  Launch the date format settings application.
  `ID: "com.sonyericsson.settings.date"`

- Flight mode settings
  Launch the flight mode settings menu.
  `ID: "com.sonyericsson.settings.flightmode"`

- General settings
  Launch the control panel application.
  `ID: "com.sonyericsson.settings.general"`

- My number settings
  Launch my number display settings application.
  `ID: "com.sonyericsson.settings.mynumber"`

- Profiles settings
  Launch the profile settings menu.
  `ID: "com.sonyericsson.settings.profiles"`

- Shortcut settings
  Launch the idle shortcut settings application.
  `ID: "com.sonyericsson.settings.shortcuts"`

- Silent mode settings
  Launch the silent mode settings menu.
  `ID: "com.sonyericsson.settings.silentmode"`

- Synchronisation settings
  Launch the Synchronisation application.
  `ID: "com.sonyericsson.settings.synchronisation"`

- Time settings
  Launch the clock/clock format settings application.
  `ID: "com.sonyericsson.settings.time"`

- Wallpaper settings
  Launch the wallpaper settings application.
  `ID: "com.sonyericsson.settings.wallpaper"`

- WLAN settings
  Launch the WLAN settings application.
  `ID: "com.sonyericsson.settings.wlan"`

- Calendar
  Launch the Calendar application.
  `ID: "com.sonyericsson.calendar"`

- Media
  Launch the Media application.
  `ID: "com.sonyericsson.mediacenter.general"`

Querying system properties

Calls to the Java platform to find out which system properties are supported in a phone can be made on different levels, for example, what classes are supported in the phone or what properties are supported by a specific class.

Supported classes

To check if a phone supports a specific class, the `Class.forName()` function can be used.

```
try{
     Class.forName("...");
}
catch(Exception ex){
     System.out.println("No support for .....")
}
```

Examples:

```
Class.forName("javax.microedition.media.Manager"); //JSR135
Class.forName("com.nokia.mid.ui.DeviceControl");  // Nokia UI extension
Class.forName("javax.bluetooth.LocalDevice"); //JSR82
Class.forName("javax.wireless.messaging.MessageConnection" );//JSR120
Class.forName("javax.microedition.pim.PIM"); //JSR75
Class.forName("javax.microedition.m3g.Graphics3D"); //JSR184
Class.forName("com.mascotcapsule.micro3d.v3.Graphics3D"); //Mascotcapsule
```

System.getProperty(String Key) calls

`Java.lang.System.getProperty(String Key)` calls are used to find out what is supported in the phone.

Example:

```
import    java.lang.*;

String    value;
String    key       = "microedition.pim.version";

value     = System.getProperty( key );
...
```

Standard system properties

The following are examples of standard properties that can be retrieved with the `System.getProperty()` call:

```
microedition.configuration
microedition.profiles
microedition.encoding
microedition.locale
microedition.platform
microedition.jtwi.version //JSR-185
```

Sony Ericsson specific system properties

```
com.sonyericsson.imei
com.sonyericsson.sim.subscribernumber
com.sonyericsson.jackknifeopen
com.sonyericsson.flipopen
com.sonyericsson.java.platform
```

Note: Retrieving the unique subscriber number via `System.getProperty("com.sonyericsson.sim.subscribernumber")` is supported only from JP-7.2.

`System.getProperty("com.sonyericsson.jackknifeopen")` is only supported for phones from *JP-6* and onwards, and returns one of the following values:
0 = swivel closed
1 = swivel open
-1 = the phone does not have jack knife form factor.
Null is returned for phones on platforms *JP-2* – *JP-5*.

`System.getProperty("com.sonyericsson.flipopen")` is only supported for clam-shell phones from *JP-6* , and returns one of the following values:
0 = flip closed
1 = flip open
-1 = the phone does not have clam-shell form factor.
Null is returned for phones on platforms *JP-2* – *JP-5*.

`System.getProperty("com.sonyericsson.java.platform")` is supported from *JP-7* and returns the java platform for the phone, for example, “JP-7.1” is returned for a W850 phone.

Network properties retrieved in Sony Ericsson phones

The following network properties can be retrieved using the `System.getProperty(key)` call. Network properties are supported from JP-7.3.

`key = "com.sonyericsson.net.mcc"`
Home Mobile Country Code. Three digits, for example, 240

`key = “com.sonyericsson.net.mnc”`
Home Mobile Network Code. Two or three digits , for example, 01

`key = “com.sonyericsson.net.cmcc”`
Current (Network) Mobile Country Code. Three digits, for example 240

`Key = “com.sonyericsson.net.cmnc”`
Current (Network) Mobile Network Code. Two or three digits, for example, 01

`Key = “com.sonyericsson.net.isonhomeplmn”`

Returns "true" when the phone is camping on the home PLMN (Public Land Mobile Network), that is, the mnc of the network matches the mnc of the SIM, returns "false" otherwise , also if there is no network.

`key = "com.sonyericsson.net.rat"`
Returns the current (if any) Radio Access Technology, RAT. Possible values are "WCDMA", "GSM" or null (in flightmode).

`key = "com.sonyericsson.net.cellid"`
Returns the identity of the cell the phone is currently camping on (if any). For GSM network this is a four digit number and for WCDMA network this is a eight digit number. Returns null when the radio is not enabled.
Examples: "0123", "00192345", null

`key = "com.sonyericsson.net.lac"`
Returns the four digit location area code the phone is currently camping in (if any) or null, for example, 0064, null

`key = "com.sonyericsson.net.status"`
Network status, allowed values: "`Home PLMN`", "`Available`", "`Preferred`", "`Forbidden`", "`No Network`", "`Unknown`"

JSR-120 system properties

To find out if the API is implemented:

```
System.getProperty("wireless.messaging.sms.smsc")
```

JSR-75 system properties

To find out what versions of the JSR-75 APIs are implemented in the phone:

```
System.getProperty("microedition.io.file.FileConnection.version")
System.getProperty("microedition.pim.version")
```

The following file connection API properties are URLs of default storage directories in the phone, retrieved with the `System.getProperty()` call:

```
fileconn.dir.photos
fileconn.dir.videos
fileconn.dir.graphics
fileconn.dir.tones
fileconn.dir.music
fileconn.dir.recordings
fileconn.dir.private
```

Localised names of directories corresponding to the default URLs above are found in the following properties:

```
fileconn.dir.photos.name
fileconn.dir.videos.name
fileconn.dir.graphics.name
fileconn.dir.tones.name
fileconn.dir.music.name
fileconn.dir.recordings.name
fileconn.dir.private.name
```

The following call returns localised names to the roots returned by the `FileSystemRegistry.listRoots()` method. The returned names are listed in the same order as returned by this method and are separated by semicolon (;):

```
System.getProperty("fileconn.dir.roots.names")
```

Note: Property retrieval behaviour differs slightly between some early JP-6 phone models and other phones, due to changes in the fileconn property syntax. Null may be returned when using the above syntax with some early JP-6 phones. The following code could be used to provide a generic means to address this behaviour difference:

```
public String getProperty(String param)
{
     int index =  param.indexOf(".");
     String extension = param.substring(index,param.length());
     String value = System.getProperty("fileconn" + extension);
     return value != null ?  value : System.getProperty("filconn" + extension);
}
```

MMAPI system properties

The following properties can be retrieved from the MMAPI using the `System.getProperty()` call:

```
microedition.media.version
supports.mixing
supports.audio.capture
supports.video.capture
supports.recording
audio.encodings
video.encodings
video.snapshot.encodings
streamable.contents
```

To find out which protocols and content types are supported, the following calls can be made from a `Manager` class object:

```
static java.lang.String[] getSupportedContentTypes(java.lang.string protocol)
//lists supported content types for a given protocol
static java.lang.String[] getSupportedProtocols(java.lang.string content_type)
//lists supported protocols for a given content type
```

From a `Player` class object, a specific `Control` or the `Controls` collection supported by the player can be retrieved:

```
Control getControl(java.lang.String ControlType)
Control[] getControls()
```

AMMS system properties

The following properties can be retrieved from AMMS (JSR-234) using the `System.getProperty()` call:

```
microedition.amms.version
camera.orientations
audio.samplerates (from JP-8)
audio3d.simultaneouslocations (from JP-8)
```

`supports.mediacapabilities` (from JP-8)
`tuner.modulations` (from JP-8)

Bluetooth Local device properties (JSR-82)

To find out what Bluetooth API properties are supported in the local device, the `LocalDevice.getProperty("...")` can be called with the following parameters:

```
bluetooth.api.version
bluetooth.master.switch
bluetooth.sd.attr.retrievable.max
bluetooth.connected.devices.max
bluetooth.l2cap.receiveMTU.max
bluetooth.sd.trans.max
bluetooth.connected.inquiry.scan
bluetooth.connected.page.scan
bluetooth.connected.inquiry
bluetooth.connected.page
```

Implementation specific properties in JSR-184

The version of the JSR-184 API is retrieved with:

```
System.getProperty("microedition.m3g.version")
```

Other JSR-184 properties can be retrieved through the `Graphics3D.getProperties("...")` with the following keys:

```
supportAntialiasing
supportTrueColor
supportDithering
supportMipmapping
supportPerspectiveCorrection
supportLocalCameraLighting
maxLights
maxViewportDimension
maxTextureDimension
maxSpriteCropDimension
maxTransformsPerVertex
maxTextureUnits
```

Knowledge base

Q: How can I detect the swivel position on jack knife phones?

A: For *JP-6*, *JP-7* and *JP-8* phones the current swivel position is detected by calling
`System.getProperty("com.sonyericsson.jackknifeopen")`
Return values:
0 = swivel closed
1 = swivel open
-1 = the phone doesn't have jack knife form factor.
Null is returned for phones on platforms *JP-2* – *JP-5*.

Changes of the swivel position generates keyCodes and are detected by the `Canvas.Keypressed()` event method.

- keyCode -32 is returned when the swivel is opened
- keyCode -33 is returned when the swivel is closed

Q: How can I detect if a clam-shell phone is open or closed

A: For *JP-6*, *JP-7* and *JP-8* phones the current "flip" position is detected by calling
`System.getProperty("com.sonyericsson.flipopen")`
Return values:
0 = flip closed
1 = flip open
-1 = the phone does not have clam-shell form factor.
Null is returned for phones on platforms *JP-2* - *JP-5*.

When the phone is opened or closed, keyCodes are generated and can be detected by the `Canvas.Keypressed()` event method.

- keyCode -30 is returned when the phone is opened
- keyCode -31 is returned when the phone is closed

Q: Is it possible to tell if the user is currently using landscape or portrait playing style?

A: There is no programmatic way to detect if a phone is used in portrait or landscape playing style. Since the JVM is not aware of any screen configuration changes, the following should be considered:

- The canvas `getWidth()` and `getHeight()` methods return the **same values** regardless what screen configuration is being used.
- The canvas `sizeChanged()` is **not invoked** when the playing style changes.
- Key codes remain **constant** and are not automatically inverted.
- selection key menus **remain unchanged**, there is no way to programmatically change their orientation.

It is the responsibility of the MIDlet to supply a means to allow a user to set their screen configuration preference. The user can change between playing styles, either landscape or portrait, while the MIDlet is active. Therefore the ability to change between playing styles after initalisation should be a design consideration.

Q: Are existing portrait mode MIDlets compatible with phones offering landscape playing style?

A: In keeping the Sony Ericsson Java platform strategy, phones supporting landscape playing style remain backward compatible with phones offering the same Java platform but supporting only portrait screen configuration.

Q: How can I develop for a screen in landscape playing style?

A: There are a number of different approaches to consider when working towards landscape playing style:

- **Design for square**
  This is the simplest approach and is concerned with targeting the shortest width offered by a given screen size. By assuming a common screen size of 176 x 220 pixels but designing towards176x176, a virtual square can be created that will cater for both landscape and portrait playing style and be highly portable. A drawback to this approach is the inherent "dead space". A popular solution is to mask the dead space with suitable user interface additions.

- **Generic Layout**.
  By not deciding a layout strategy and instead using the MIDP high level APIs, the application can be allowed to decide how best to cater for the screen dimensions and layout. This is generally only practical for business applications since much of fine grained control required for game oriented content is lost and high level cannot be concurrently mixed with low level.

- **Fit to window**
  By using `Canvas` to query the screen dimensions appropriately, MIDlets can scale effectively regardless of what screen dimensions are available.

  ```
  // assumes a fixed size
  g.fillRect(4,8, 248, 220);
  g.drawString("this isn't generic",10,20,0);

  // makes a decision depending on dimensisions
  g.fillRect(0, 0, getWidth() / 2, getHeight() / 2);
  g.drawString("this is generic",getWidth() / 2, 0,g.TOP | g.HCENTER);
  ```

  This is considered "best practice" but relies heavily on other artifacts positioning to work effectively, and can lead to increased development time. It can also inherently lead to a stretched appearance though this can have relatively little impact depending on application type and genre. A popular compromise is to combine the design for square approach with "fit to window" by centering the virtual square in a generic way.

- **Fit Content**
  This approach requires reimplementation to take advantage of the extra screen width and usually also involves changing the dynamics of the application substantially, such as:

  - Increased number of artifacts.
    The new space needs to be filled in a natural way – a common answer to this is to increase the number of on screen artifacts.

  - Increased horisontal clipping distance.
    The clipping area should also be adjusted to cater for the different screen configurations.

  Fitting the content to the new dimensions provides the most optimal use of the screen space. However, it requires a significant amount of additional development.

Q: How do I use the extra A and B gaming buttons?

A: Regardless of which design strategy is used, the K790, K800, K810, W550, W600, W830, W850 and W910 series are equipped with two additional A and B buttons for improvement of the landscape gaming experience.

You can use the extra buttons via the MIDP 2 `GameCanvas GAME_A` and `GAME_B` constants or by keycodes. The key codes for the extra A and B **gaming buttons** are defined as:

- ButtonA: key code = -13
- ButtonB: key code = -14

They are used in the usual form:

```
protected void keyPressed(int keyCode) {
switch (keyCode) {
case ButtonA:
…
case ButtonB:
…
}
}
```

Q: How can I rotate my graphics to match changing playing styles?

A: The MIDP 2.0 `Sprite` class provides a convenient `setTransform` method to allow images to be easily rotated using predefined constants.

```
sprite.setTransform(Sprite.TRANS_MIRROR_ROT90);
```

Alternatively you can simply use the `Graphics drawRegion` method with the same constants, often in place of `drawImage`:

```
// the original image
g.drawImage(image, x, y, Graphics.TOP | Graphics.LEFT);
// identical to drawImage but with the image rotated.
g.drawRegion(this.image, 0, 0, image.getWidth(), image.getHeight(),
Sprite.TRANS_ROT90, x, y, g.LEFT|g.TOP);
```

When moving back and forth between landscape and portrait playing styles you will commonly use the `Sprite.TRANS_ROT90` and `Sprite.TRANS_NONE` constants.

Appendix C
Sony Ericsson SDK for the Java™ ME Platform

This appendix contains information about the Sony Ericsson SDK for the Java™ ME platform and its integration in different developer tools.

Features

The Sony Ericsson SDK for the Java™ ME Platform is a modified version of the Sun Java Wireless Toolkit (WTK). The Sony Ericsson SDK supports all Java APIs implemented in Sony Ericsson JP-2 – JP-8 phones, see “Sony Ericsson Java platforms” on page 15, and includes detailed documentation (JavaDoc) of these APIs. Full 3D emulation, Mascot Capsule Ver. 3 and Ver. 4 (JSR-184), is also supported.

The SDK also supports On-Device source-level Debugging (ODD). The Sony Ericsson SDK for Java™ ME can be integrated with any UEI compliant Java IDE.

Additionally, the SDK includes useful utilities such as the Device Explorer and the ejava.exe command line tool. These provide an interface for manipulating the phone application manager. The developer can install, remove, start, stop, pause, and resume Java applications. The Device Explorer also provides an interface for displaying heap and file system statistics, requesting garbage collection to run, enabling VM trace messages, and enabling serial network emulation.

Another utility, working with phones on JP-8.3.1 and higher, is the Resource Monitor. It is available from the ODD interface, and displays memory usage and CPU load in the phone. This utility is included with the Sony Ericsson SDK, version 2.5.0.2 and higher.

Installing and updating the SDK

Installing

Before installing the Sony Ericsson SDK for the Java™ ME Platform, the SDK Java SE Development Kit need to be installed. Installation of an IDE can be done either before or after installing the Sony Ericsson SDK for the Java™ ME Platform. Note that an IDE is not required but is highly recommended.

Updating

The latest version of the Sony Ericsson SDK for the Java™ ME Platform is available for download at www.sonyericsson.com/developer/java. The Sony Ericsson SDK for the Java™ ME platform is required for ODD.

After updating the SDK to a newer version, it is recommended to clear all platforms in the IDE and then reselect all profiles from the latest SDK version. It has been noted that, if emulator profiles are selected from an earlier version than the selected device debug profiles, the following error may occur when starting device debugging:

```
org.xml.sax.g: Unexpected end of Tag
```

Selecting devices for ODD

Regardless of which IDE is used, the On Device Debugging functionality requires settings adapted to the actual phone or platform to test on. When connecting to a phone via the Connection Proxy interface, the identification for the phone is displayed in the Connection Proxy window.

Phones on Java platforms up to and including JP-6 are identified by phone model, for example, “Sony Ericsson K750”.

From Java platform JP-7, phones are identified by platform, for example, “Sony Ericsson_JP-7”.

Note: From JP-8 a new communication solution has been implemented, using TCP/IP over local bearers instead of the earlier serial connection via COM port. Instructions on how to set up the communication is found in the SDK documentation. Before using JP-8 phones with the Connection Proxy, “Java developer mode” has to be enabled in the phone via the Service settings menu, accessed by pressing the key sequence > * < < * < * on the keypad (“<“ and “>” indicates pressing the navigation key left and right).

Note: More information about connection issues when using ODD:

- On device debugging on JP-8 phones using USB
  http://developer.sonyericsson.com/docs/DOC-1734
- Firewall issues on JP-8 and Symbian SJP-3 phones
  http://developer.sonyericsson.com/docs/DOC-1694
- On device debugging over Bluetooth for JP-7 phones
  http://developer.sonyericsson.com/docs/DOC-1684

Note: The Z250 and Z320 series do not allow connection via the Connection Proxy. ODD is therefore not available for these phones.

Integrating the Sony Ericsson SDK for the Java™ ME Platform in NetBeans 5

The Sony Ericsson SDK version 2.2.4 (and later versions) has been tested and found working also with **NetBeans 5.5.1**.

In the instructions below, <SDK_Path> stands for the path where the Sony Ericsson SDK for the Java™ ME Platform is installed.

Note: Integration of the Sony Ericsson SDK for the Java™ ME Platform in Netbeans requires NetBeans Mobility Pack add-on.

To add Sony Ericsson emulators:

1. In the Netbeans window, select the menu *Tools/Java Platform Manager*.
2. Select *Add Platform...*
3. Select *Java Micro Edition Platform Emulator*
4. Three platforms are detected, OnDeviceDebug, PC_Emulation\WTK1 and PC_Emulation\WTK1. Select these platforms
5. Click *Next* and follow the installation process to the end.

To set the platform and phone that will be used for emulation:

1. In the Netbeans window, select the menu *File/<project name> properties...* and select *Platform* in the table to the left.

2. Use the drop-down list *Project Configuration* to choose one of the platforms added above.

3. Use the drop-down list *Device* to choose one of the emulators available on the chosen platform.

4. Click *OK.*

Note: From Java Platform JP-7, the phone names for ODD refer to Java Platforms rather than to phone models, for example, “SonyEricsson_JP-7”.

Note: If NetBeans complains about the missing file "zayit.dll" when trying to run your project with a Sony Ericsson emulator, you should reboot the computer and try again.

To use Sony Ericsson On Device Debug in a project:

In the Netbeans window, select the menu *Run/Debug Main Project*, or press *F5*. Note that you must choose *Debug Main Project*, **not** *Run Main Project*.

Integrating the Sony Ericsson SDK for the Java™ ME Platform in Eclipse and JBuilder 2007

The Device Explorer plugin elaborates upon the existing Device Explorer tool by allowing it to be integrated with any Eclipse derived IDE. All features found in the standalone Device Explorer tool are encapsulated in a new view plane.

The Device Explorer concept provides the means to interact with the application manager found on all Java enabled phones.

The current list of features offered by Device Explorer plugin include:

- Listing of all installed MIDlets
- Starting, stopping, pausing and resuming execution of a MIDlet
- Deleting installed MIDlets
- Manually invoking garbage collection
- Previewing MIDlet information
- Manually deleting RMS entries
- File system browsing and MIDlet installation.

The Device Explorer is entirely connection independent, allowing you to use Bluetooth wireless technology, USB, or any other means of phone to PC connection.

By using the Device Explorer plugin in conjunction with Eclipse and the EclipseME plugin suite, a powerful and convenient platform for Java ME based development can be built. **Eclipse 3.3** with the **EclipseME 1.7.3** plugin has been tested and works properly with the Sony Ericsson SDK version 2.5.0 toolkit.

You can obtain Eclipse from http://www.eclipse.org/downloads/index.php.

More information about EclipseME can be found at http://eclipseme.org/

An extensive guide for installation and tuning of EclipseME can be found at http://eclipseme.org/docs/configuring.html.

Acquiring the software

The Device Explorer plugin is offered in two packaged formats - it is currently not offered via the Eclipse automated package manager service.

The latest version of the plugin can be downloaded from Sony Ericsson Developer World. The plugin also comes prebundled in the Sony Ericsson SDK for the Java™ ME Platform and can be found within your installation directory, for example, *<install_dir>/JavaME_SDK_CLDC/OnDeviceDebug/lib/devexp/plugins/com.sonyericsson.sdkme.deviceexplorer_<your SDK version>.* However, the prebundled version may be outdated, why it is highly recommended to look for updates on Developer World.

Installation

Before installing the Device Explorer you must stop any running instances of your Eclipse derived IDE. If you have acquired the plugin from the Sony Ericsson Developer World site you should proceed to extract the Zip file into your Eclipse plugin directory (*<install_dir>/eclipse/plugins*). If you wish to use the version supplied with the Sony Ericsson SDK you can proceed to simply copy the *com.SonyEricsson.sdkme.deviceexplorer_<your SDK version>* directory into your Eclipse plugin folder.

Using the Device Explorer plugin

Having installed the plugin, the new Device Explorer view should be available for immediate usage. Launch the Device Explorer via menu selection *Window – Show View – Other… – Sony Ericsson Device Explorer*.

When the Device Explorer launches you will see a new "Connection Proxy" window. This is a key component of the Device Explorer plugin that facilitates the connection to the Sony Ericsson phone. As with the Device Explorer tool, it is offered in a standalone form as part of the SDK. You only require one instance of the Connection Proxy to be active and it is included with the Device Explorer plugin as a convenience.

You should leave the Connection Proxy open at all times when using the Device Explorer.

Upon a successful connection, the Connection Proxy will display an image of the relevant phone and a new Device Explorer panel will be presented in Eclipse. Java applications present in the phone are listed in the panel. The relevant Device Explorer functions (Play, Stop, Pause, and so on) are available both via the toolbar buttons and by right-clicking a MIDlet in the list.

The Favorites Folder Explorer

In addition to the Device Explorer, the Favorites Folder Explorer allows you to browse the local file system and install MIDlets to the phone.

Launch the Favorites Folder Explorer via menu selection *Window – Show View – Other… – Sony Ericsson Favorites Explorer*.

When the Favorites Folder Explorer launches you will see a new "Sony Ericsson MIDlet favorites" tab, listing all local root drives.

You can browse the file system for MIDlets to install to the phone. When a JAD or JAR file is selected, the phone transfer icon is enabled allowing you to transfer the content.

Adding the PC emulator and On Device Debugger to the Eclipse workspace

Select the menu *Window->Preferences.* The “Preferences” dialog opens.Select in the left tree: *J2ME/ Device Management*

In the right panel, click the *Import* button and add the following two Wireless Toolkits:

- C:\SonyEricsson\JavaME_SDK_CLDC\OnDeviceDebug
- C:\SonyEricsson\JavaME_SDK_CLDC\PC_Emulation\WTK2.

Note: After **updating** the Sony Ericsson SDK for the Java™ ME Platform, the two directories *eclipseme.core* and *eclipseme.ui* residing in *<drive>/Program Files/eclipse/workspace/.metadata/.plugins* have to be deleted before adding the Wireless Toolkits that came with the new SDK version.

Note: From Java Platform JP-7, the platform names for ODD refer to Java Platforms rather than to phone models, for example, “SonyEricsson_JP-7”.

Appendix D
Sony Ericsson Mobile JUnit

This appendix contains information about the Sony Ericsson Mobile JUnit test tool, and how it can be used for MIDlet testing in the emulator or on physical phones.

Mobile JUnit features

Mobile JUnit is a unit testing framework from Sony Ericsson, intended for Java ME CLDC phones, where the results of the test run is communicated to a PC. This enables simple, automated regression testing of JavaME applications. No manual uploading of MIDlets or manually inspecting test results is needed.

Mobile JUnit primarily supports Sony Ericsson phones, but most Wireless Toolkit emulated devices will also be able to run Mobile JUnit.

Prerequisites:

- A wireless toolkit, supporting UEI 1.0.1, that outputs the MIDlet `System.out` to the console. All Sony Ericsson wireless toolkits and SDK versions have this capability.
- JUnit 3.8.1 installed on the computer. The binary is included with the Mobile JUnit installation, and is automatically installed, by default in the top directory of the tool (for example: `C:\SonyEricsson\JavaME_SDK_CLDC\Mobile-JUnit\junit.jar`).
- Sony Ericsson SDK for the Java ME platform is recommended for running tests on physical devices.

Installing Mobile JUnit

Mobile JUnit can be downloaded from Sony Ericsson Developer World.

To install Mobile JUnit, the downloaded `mobile-ju-setup-1.0.exe` is run. A dialog asking for where to install Mobile JUnit appears. The default location is the same as the default location for installation of the Sony Ericsson SDK. If the SDK is installed elsewhere, that location should be entered instead.

It is recommended to install the sample project by marking the “Sample Project” and “Generate Scripts” checkboxes during the installation.

If “Generate Scripts” was selected, a dialog will pop up, asking for the path to a java compiler (`javac.exe`). Browse and select a `javac.exe`. Mobile JUnit requires a java compiler to run, and “Generate Scripts” will generate a script with this particular compiler selected.

Note: The sample project is installed into the selected application directory of the specified WTK derived SDK. For example, `C:\SonyEricsson\JavaME_SDK_CLDC\PC_Emulation\WTK2\apps\mobile-ju-sampleproject`

The default directory was selected during installation, and the following directories have been added:

Mobile JUnit Runtime	`<SDK Installation Path>\JavaME_SDK_CLDC\Mobile_JUnit`
Sample Project	`<SDK Installation Path>\JavaME_SDK_CLDC\PC_Emulation\WTK2\apps\mobile-ju-sampleproject`

The sample project test

Testing with Mobile JUnit works very much the same way as with JUnit. The source code to be tested is in the project `src` directory, and the project binary in the `bin` directory. The file defining the tests to perform is found in a separate `test` directory.

For example, when “Sample Project” was selected during the Mobile JUnit installation, the sample project `mobile-ju-sampleproject` was installed in a folder with subfolders `src`, `bin`, `build` and `test`. In the `test/src` folder, a file named `SampleTest.java` contains the test code. The code is very similar to a “regular” JUnit test:

```
import com.sonyericsson.junit.framework.TestCase;

public class SampleTest extends TestCase {

    public void testCountCharacter() {
         CharacterCounter counter = new CharacterCounter();
         assertEquals(0, counter.count('a', "Hello");
         assertEquals(1, counter.count('a', "a");
         assertEquals(0, counter.count('a', "A");
         assertEquals(2, counter.count('a', "Attackaz!");
     }
}
```

Note: All `void` methods with zero arguments starting with “`test`” are considered tests by the Mobile JUnit framework.

Running the test

To run the tests of the sample project, use one of the command lines below. Normally, Mobile JUnit expects the MIDlet to test to be compiled and present in the `bin` directory. Note the `--compile-midlet` switch, which instructs Mobile JUnit to compile and create a new MIDlet. Without this switch Mobile JUnit will assume that a MIDlet is precompiled and accessible in the bin directory.

Alternative 1 (assuming you selected “Generate Scripts” during the installation):

```
run-mobile-junit --project-dir:<SDK Installation
Path>\JavaME_SDK_CLDC\PC_Emulation\WTK2\apps\mobile-ju-sampleproject --
device:SonyEricsson_W800_Emu --compile-midlet:yes
```

Alternative 2 (replace the `--javac` parameter with the compiler that Mobile JUnit should use):

```
java -classpath mobile-ju-1.0.jar;junit.jar
com.sonyericsson.sdkme.junit.OnDeviceTest --project-dir:<SDK Installation
Path>\JavaME_SDK_CLDC\PC_Emulation\WTK2\apps\mobile-ju-sampleproject --
device:SonyEricsson_W800_Emu --compile-midlet:yes --javac:<my-installation-of-
jdk>\bin\javac.exe
```

Note: This example assumes a WTK project structure. The tool does however support various configurations. See “Configuring and running mobile tests” on page 98 for more information.

Note: The command lines above should be run from the Mobile JUnit installation directory. For more information regarding the `--javac` parameter see “Configuring and running mobile tests” on page 98.

The tool finds, compiles, and runs tests according to the `SampleTest.java` file. The emulator starts and the tests are run:

The emulator terminates automatically, and the test results are output to the console:

```
Building midlet... 312ms
Building test midlet... 765ms
Uploading and running test midlet... 2s 937ms
..Running with storage root SonyEricsson_W800_Emu
Execution completed.
0 bytecodes executed
0 thread switches
822 classes in the system (including system classes)
0 dynamic objects allocated (0 bytes)
0 garbage collections (0 bytes collected)Done. 6s 109ms

Time: 4,101

OK (2 tests)
```

Test suites

Another concept found in JUnit, and inherited by Mobile JUnit, is test suites. In the sample project directory `Mobile-ju-sampleproject/test/src`, the `MyTestSuite.java` source file can be found:

```
import com.sonyericsson.junit.framework.TestSuite;

public class MyTestSuite extends TestSuite {
    public MyTestSuite() {
        addTestSuite(SampleTest.class);
    }
}
```

Note the following:

- The test suite should inherit from the `TestSuite` class, available in the framework.
- The test suite must have a constructor without any arguments, otherwise the test framework will not be able to create it.
- In this constructor, tests are added using the `addTestSuite` method. In this instance, the `SampleTest` from the previous chapter is added, and provides its class as the argument to `addTestSuite`. Other TestSuites may be added using this method.

To select a specific test suite or individual test, the `--suite:` parameter is used. If no such parameter is provided, the tool will try to find all test cases in the `test` directory and run them.

Alternative 1 (assuming you selected “Generate Scripts” during installation):

```
run-mobile-junit --project-dir:<SDK Installation
Path>\JavaME_SDK_CLDC\PC_Emulation\WTK2\apps\mobile-ju-sampleproject --
device:SonyEricsson_W800_Emu --suite:MyTestSuite --compile-midlet:yes
```

Alternative 2 (replace the `--javac` parameter with the compiler that Mobile JUnit should use):

```
java -classpath mobile-ju-1.0.jar;junit.jar
com.sonyericsson.sdkme.junit.OnDeviceTest --project-dir:<SDK Installation
Path>\JavaME_SDK_CLDC\PC_Emulation\WTK2\apps\mobile-ju-sampleproject --
device:SonyEricsson_W800_Emu --suite:MyTestSuite --compile-midlet:yes --
javac:<my-installation-of-jdk>\bin\javac.exe
```

The output should be the same as in the previous example.

On-device testing on a Sony Ericsson phone

To run tests on a physical phone, the Wireless Toolkit for testing needs to be changed. If the Sony Ericsson SDK is installed at the default location `C:\SonyEricsson\JavaME_SDK_CLDC\`, the on-device Wireless Toolkit is located at `C:\SonyEricsson\JavaME_SDK_CLDC\OnDeviceDebug`. The `--wtk:` switch is set to this location. The command line is as follows (the `--device` parameter must match the connected phone):

Alternative 1 (assuming you selected “Generate Scripts” during installation):

```
-mobile-junit --project-dir:<SDK Installation
Path>\JavaME_SDK_CLDC\PC_Emulation\WTK2\apps\mobile-ju-sampleproject --
device:SonyEricsson_W800 --suite:MyTestSuite --compile-midlet:yes --wtk:<SDK
Installation Path>\JavaME_SDK_CLDC\OnDeviceDebug
```

Alternative 2 (replace the `--javac` parameter with the compiler that Mobile JUnit should use):

```
java -classpath mobile-ju-1.0.jar;junit.jar
com.sonyericsson.sdkme.junit.OnDeviceTest --project-dir:<SDK Installation
Path>\JavaME_SDK_CLDC\PC_Emulation\WTK2\apps\mobile-ju-sampleproject --
device:SonyEricsson_W800 --suite:MyTestSuite --compile-midlet:yes --wtk:<SDK
Installation Path>\JavaME_SDK_CLDC\OnDeviceDebug --javac:<my-installation-of-
jdk>\bin\javac.exe
```

Before executing, the Connection Proxy application must be launched with the command:

```
<SDK Installation Path>\JavaME_SDK_CLDC\OnDeviceDebug\bin\serialproxy.exe
```

The Connection Proxy connects to the phone, and a dialog as below appears. If it fails to connect, click the *Settings* button (red circle) and select the serial port to which the phone is connected.

Once connected, the tests can be run by executing the above command line. The test results are output to the phone display.

Configuring and running mobile tests

There are various ways to configure Mobile JUnit. For most situations the default configuration should work. Since there are so many ways to structure a project, the tool will allow configuring most of its tasks and where to put things.

--project-dir

This is used if the project follows the Wireless Toolkit project structure. Source directories, the name of the MIDlet under test, and so on, are set automatically. However, each of these configuration settings may be changed individually.

The `--project-dir` should point at a subdirectory of the `apps` directory in the Wireless Toolkit.

Example:

```
--project-dir:C:\SonyEricsson\JavaME_SDK_CLDC\PC_Emulation\WTK2\apps\Mobile-ju-sampleproject
```

--device

Note: mandatory property.

This is the name of the phone to emulate. Most Java ME enabled IDEs can provide a list of all available phone names. Examples of device names are `SonyEricsson_JP-7` and `SonyEricsson_K750`.

--wtk

The location of the Wireless Toolkit to use for emulation or on-device execution of the tests. The Sony Ericsson SDK provides an on-device Wireless Toolkit.

If no `--wtk` is set, the tool will use the `--project-dir` setting to “guess” it.

Example:

```
--wtk:C:\SonyEricsson\JavaME_SDK_CLDC\OnDeviceDebug
```

--runmode

In some instances it may be useful to only perform the compilation of the test MIDlet, or to only run the test MIDlet without compiling it. The `--runmode` switch enables this.

- `--runmode:COMPILE-ONLY` – the test is only compiled into a test MIDlet
- `--runmode:RUN-ONLY` – the compiled test MIDlet is run (if the other configuration settings are kept from the compilation step)
- `--runmode:COMPILE-AND-RUN` – both steps are performed.

The default value is `COMPILE-AND-RUN`.

--suite

The class name of the test to run, usually a test suite, but it may also be an individual test case.

If no suite is provided, the `--test-source` directory is scanned, and any class that "`extends com.sonyericsson.junit.framework.TestCase`" is executed.

Example:

```
--suite:com.mycompany.myproduct.AllTests
```

--javac

The location of the java compiler executable, `javac.exe`. (Mobile JUnit tries to set this to a default value, but this may not be correct.)

Example:

```
--javac:C:\java\j2sdk1.4.2_08\bin\javac.exe
```

--compile-midlet

If set to `true`, `on` or `yes`, this setting instructs Mobile JUnit to build the MIDlet under test. A particularly nice feature for library development, where no MIDlet is present (this may cause problems with Wireless Toolkit). It also compiles the MIDlet with line number information, which allows for using the line coverage feature.

--name

The name of the test run. This name shows up in the xml report.

--add-line-numbers

This is a special feature for devices that do not provide a stack trace with line number information. If set to `true`, `on` or `yes`, the `--add-line-number` setting adds the line number to every assert in the set of tests.

Note: In the current implementation, the line number will not appear in the stack trace, but in the assert message.

--test-source, --test-resources, --midlet-source, --midlet-resources, --midlet-under-test, --midlet-manifest

These are directories and files the tool uses for compiling the test MIDlet. They can be configured to fit the project structure.

--test-report

This is a file where the XML used internally by the tool is stored. This may be used for reporting. However, it is recommended to wrap the test run in a regular JUnit test run and use tools that are available for JUnit to do this.

--coverage, --coverage-map, --coverage-report, --coverage-xsl

Mobile JUnit provides a simple coverage facility for line (statement) and method coverage.

If set to `L`, Mobile JUnit prepares the test MIDlet for line (statement) coverage.

If set to `M`, Mobile JUnit prepares the test MIDlet for method coverage.

Examples:

```
--coverage:L
```

```
--coverage:M
```

```
--coverage:off
```

There is also an example how to use the coverage functionality in the `build.xml` file of the sample project, target `run-with-coverage`.

`--coverage-map` points to a file that contains an internal representation of the source code.

`--coverage-report` is where the report is output.

`--coverage-xsl` is an XSL file used to produce the HTML report.

Use the `--name` parameter to set the HTML report title.

--progress

Before actually running the tests, Mobile JUnit compiles them and upload them to the (emulated) device. Progress is reported to the user. There are three levels of progress: `TEXT`, `GUI` and `NONE`. The `TEXT` progress reports progress to the console, `GUI` launches a small window to the same effect and `NONE` does not report progress at all.

Examples:

```
--progress:TEXT

--progress:GUI

--progress:NONE
```

Note: The `GUI` option launches an AWT window. Due to AWT threading issues, only a call to `System.exit` actually kills the VM. So, if the on-device tests are wrapped in a JUnit test run (see "Using JUnit to run mobile tests" on page 104), the client code must ensure that the call to `System.exit` is made.

--print-config

Setting this switch to true will output all configuration settings to the console. This may be useful when problems running Mobile JUnit arise.

Example:

```
--print-config:true
```

--config-file

Instructs Mobile JUnit to load a file containing configuration settings. If a particular setting is defined on the command line and in the file, the command line value will take precedence. The file is has the format of a Java properties file.

Example:

```
--config-file:C:/projects/my-project/test.properties
```

Example:

```
wtk = C:\\SonyEricsson\\JavaME_SDK_CLDC\\OnDeviceDebug\\bin
```

Note that parameters have no leading `--`, and that `\` must be escaped in Java properties files.

Default values

Below are default values for each of the above settings and a few more, auxiliary settings. Any one of these settings may be overidden, but it must be made sure that this does not cause some other setting to be undefined or invalid.

The `midlet-name` property is somewhat special, since its default value is set by Mobile JUnit. This is due to the fact that the Wireless Toolkit uses a special naming convention for MIDlet jars.

```
add-line-numbers=Off
clean=Off
compile=yes
compile-midlet=no
generated-tests = ${test-bin}/generated-tests
javac=${java.home}/../bin/javac
jar=${test-bin}/${midlet-name}-test.jar
jad=${test-bin}/${midlet-name}-test.jad
```

```
midlet-source=${project-dir}/src
midlet-resources=${project-dir}/res
midlet-classes=${output-classes}/../midlet-classes
midlet-manifest=${project-dir}/bin/MANIFEST.MF
midlet-under-test=${project-dir}/bin/${midlet-name}.jar
output-classes = ${test-bin}/classes
progress=TEXT
test=${project-dir}/test
test-bin=${test}/bin
test-classes = ${test-bin}/test-classes
test-report=${test}/testreport.xml
test-resources=${test}/res
test-source=${test}/src
coverage=off
coverage-map-file=${test-bin}/coverage.map
coverage-report=${test}/coverage.html
coverage-result=${test-bin}/coverage.xml
wtk=${project-dir}/../..
```

Using ANT to run mobile tests

The following is an example on how to use the ANT Java `task` to run a test:

```
<path id = "test-classpath" >
  <pathelement location="${junit}" />
  <pathelement location="${mobile-junit-jar}" />
</path>

<target name="run-javame-tests" >
  <java
    classname="com.sonyericsson.sdkme.junit.OnDeviceTest"
    fork="true" failonerror="true" >
     <classpath refid="test-classpath" />
     <arg value = "--device:SonyEricsson_K750_Emu"/>
     <arg value = "--compile:true" />
     <arg value = "--compile-midlet:true" />
  </java>
</target>
```

Note the class name `"com.sonyericsson.sdkme.junit.OnDeviceTest"`, and the `failonerror` instruction, which tells ANT to fail unless all tests pass.

In the `mobile-ju-sampleproject/build` directory, an entire ANT `build.xml` is included. It runs the above snippet. If the ANT installation is properly configured, and if “Generate Scripts” was selected at installation, the following command line should be sufficient to run it:

```
ant
```

If “Generate Scripts” was not selected at installation, the `build.properties` file located in the `build` directory may need to be modified.

Compiling a standalone test MIDlet

Normally, the MIDlet terminates after running all tests. In some instances, it might be useful to manually start, stop and restart tests. The command line parameters below will instruct Mobile JUnit to create a standalone MIDlet.

```
--test-runner-class:com.sonyericsson.junit.midletrunner.StandaloneMIDlet --
runmode:COMPILE-ONLY
```

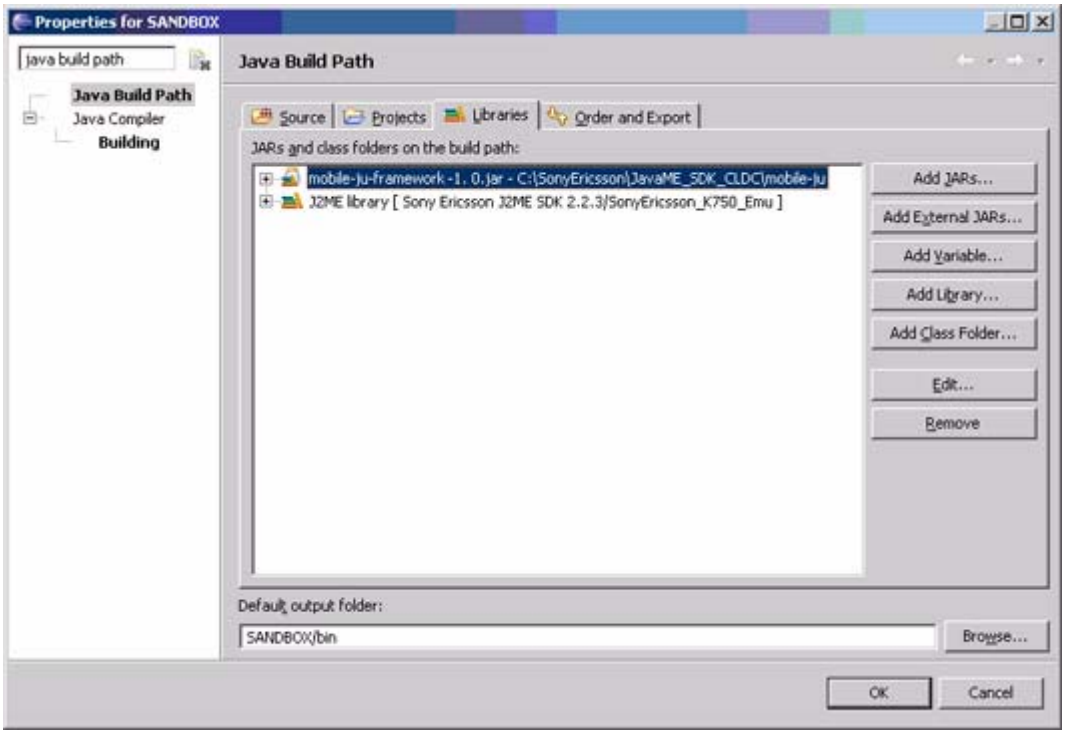
An example can be found in the `build.xml` file (target name `compile-standalone`).

Configuring Eclipse and EclipseME for mobile test development

This section describes how to configure Eclipse version 3.2 and EclipseME version 1.5.0.

The recommended procedure to use Mobile JUnit with EclipseME is as follows:

1. Add the Mobile JUnit framework to the project classpath.
    - In project settings, open the Java Build Path properties page



- Click *Add External JARs*
- Select the Mobile JUnit framework jar. If installed with default settings, this will be located at C:\SonyEricsson\JavaME_SDK_CLDC\mobile-ju\mobile-ju-framework-1.0.jar.

2. Use an ANT script to run the tests. See “Using ANT to run mobile tests” on page 102.

Using JUnit to run mobile tests

On-device tests can be run as “regular”JUnit tests. The class `com.sonyericsson.sdkme.junit.OnDeviceTest` also implements a JUnit test. The below code snippet illustrates how to run a on-device test as a JUnit test:

```
import junit.framework.Test;
import junit.framework.TestCase;
import junit.textui.TestRunner;

public class WrappedOnDeviceTest extends TestCase {

     public static Test suite() {
         OnDeviceTest test = new OnDeviceTest();
         return test;
     }
}
```

The VM argument mechanism is used to configure Mobile JUnit:

```
java -Dproject-
dir=C:\SonyEricsson\JavaME_SDK_CLDC\PC_Emulation\WTK2\apps\Mobile-ju-
sampleproject -Ddevice=SonyEricsson_W800_Emu [ ... more parameters ... ]
WrappedOnDeviceTest
```

ANT or any IDE can also be used to configure the VM arguments.

For the above command line to work properly, a `main` method is required in `WrappedOnDeviceTest`:

```
public static void main(String[] args) {
    TestResult result = TestRunner.run(suite());
    int errorsPlusFailures = result.failureCount() + result.errorCount();

    int exitCode = errorsPlusFailures > 0 ? 1 : 0;

    System.exit(exitCode);
}
```

An `OnDeviceTest` can also be created from a set of command line arguments. `main` is here used in exactly the way as we used the Mobile JUnit tool in the very first example above.

```
public static void main(String[] args) {
    OnDeviceTest test = new OnDeviceTest(args);
    [...]
}
```

Links and references

Specifications

CLDC 1.0 (JSR-30)	http://www.jcp.org/en/jsr/detail?id=30
CLDC 1.1 (JSR-139)	http://www.jcp.org/en/jsr/detail?id=139
JTWI R1 (JSR-185)	http://www.jcp.org/en/jsr/detail?id=185
MIDP 1.0 (JSR-37)	http://www.jcp.org/en/jsr/detail?id=37
MIDP 2.0 (JSR-118)	http://www.jcp.org/en/jsr/detail?id=118
MIDP 2.1 (JSR-118 maintenance release)	http://jcp.org/aboutJava/communityprocess/maintenance/jsr118/JSR_118_MR2_Changelog.pdf
MMAPI (JSR-135)	http://www.jcp.org/en/jsr/detail?id=135
AMMS (JSR-234)	http://www.jcp.org/en/jsr/detail?id=234
WMA (JSR-120)	http://www.jcp.org/en/jsr/detail?id=120
WMA 2.0 (JSR-205)	http://www.jcp.org/en/jsr/detail?id=205
3D (JSR-184)	http://www.jcp.org/en/jsr/detail?id=184
Bluetooth (JSR-82)	http://www.jcp.org/en/jsr/detail?id=82
Optional Package (JSR-75)	http://www.jcp.org/en/jsr/detail?id=75
Java ME Web services 1.0 (JSR-172)	http://www.jcp.org/en/jsr/detail?id=172
Mascot Capsule	http://www.mascotcapsule.com
Mobile Service Architecture, MSA (JSR-248)	http://www.jcp.org/en/jsr/detail?id=248
SIP API (JSR-180)	http://www.jcp.org/en/jsr/detail?id=180
Scalable 2D Graphics API (JSR-226)	http://www.jcp.org/en/jsr/detail?id=226
Payment AP! (JSR-229)	http://www.jcp.org/en/jsr/detail?id=229
Mobile Internationalisation API (JSR-238)	http://www.jcp.org/en/jsr/detail?id=238
Java Bindings for OpenGL ES API (JSR-239)	http://www.jcp.org/en/jsr/detail?id=239
Security and Trust API (JSR-177)	http://www.jcp.org/en/jsr/detail?id=177
Location AP! (JSR-179)	http://www.jcp.org/en/jsr/detail?id=179
Content Handler AP! (JSR-211)	http://www.jcp.org/en/jsr/detail?id=211

The Java ME platform

Sony Ericsson Developer World	http://www.sonyericsson.com/developer/
J2ME white paper	http://java.sun.com/products/cldc/wp/KVMwp.pdf
OTA Provisioning	http://java.sun.com/products/midp/OTAProvisioning-1.0.pdf
Helpful hints (white paper)	http://java.sun.com/j2me/docs/pdf/midpwp.pdf
Java Developer Connection Web site with Java Technical documentation	http://developer.java.sun.com/developer/infodocs/
Java Consumer Software Documentation Web site	http://java.sun.com/j2me/docs/

3D developer tools/plugins

Mascot Capsule Micro3D Version 3 plug-ins	http://www.mascotcapsule.com/toolkit/sony_ericsson/
Mascot Capsule Micro3D version 4 (JSR-184) plugins	http://www.mascotcapsule.com/M3G/download/e_index.html

Index

W