

Multimedia Content Adaptation Using Nokia Multimedia Converter 2.0

Version 1.3; November 25, 2003

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Change History

V1.0	First Version
V1.1	Added Wide Band AMR
V1.2	Updated for new UI
V1.3	Added 128kbps bit rate.

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Multimedia Content Adaptation Using Nokia Multimedia Converter 2.0

Version 1.3; September 25, 2003

1 Product Overview

Multimedia files in mobile applications, such as multimedia messaging (MMS), are encoded according to either the 3GPP file format or the AMR/AWB storage format. Therefore, you must convert your existing multimedia files to the appropriate format before transferring them. Figure 1: illustrates a general overview of how multimedia files are generated for, transferred to, and played in a mobile multimedia application.

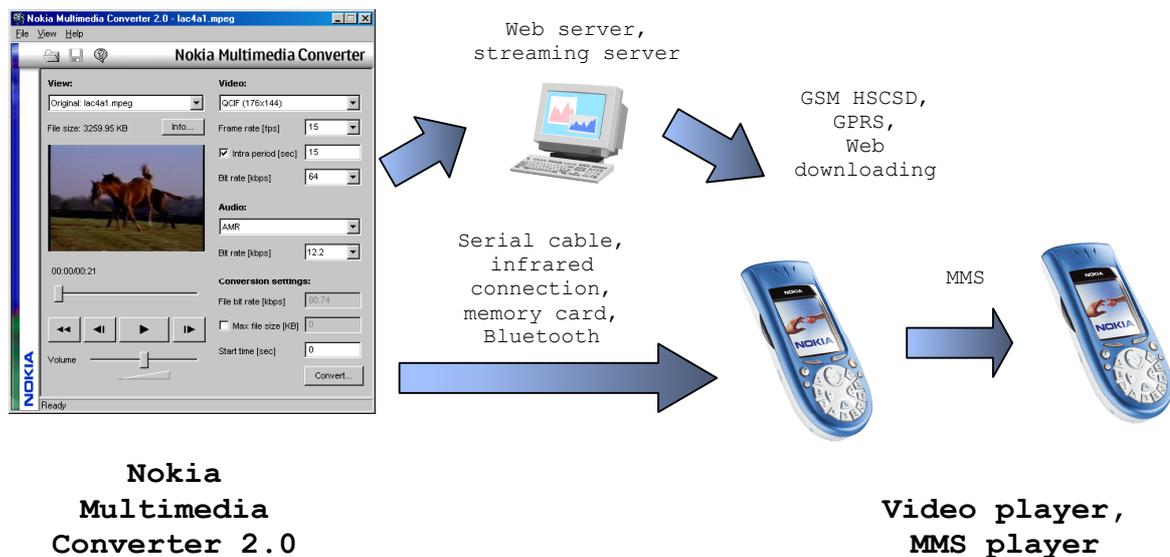


Figure 1: Multimedia file generation for mobile applications.

Multimedia Converter 2.0 runs on Microsoft Windows™ 2000 (SP2) and XP (SP1). With Multimedia Converter 2.0 you can convert common multimedia file formats to 3GPP or AMR/AWB formats.

This guide is organised as follows: Section 2 describes the installation procedure and section 3 describes how to create suitable video files. Section 4 provides instructions on using Nokia Multimedia Converter 2.0 and section 5 introduces the console version of Nokia Multimedia Converter 2.0. Section 6 provides a brief overview of audio-visual compression technology and explains how the technology is applied in Multimedia Converter. The abbreviations used and their expanded forms are listed in section 7.

2 Getting Started

2.1 Installing Nokia Multimedia Converter 2.0

This section describes how to install Nokia Mobile Multimedia Converter 2.0.

Nokia Multimedia Converter 2.0 is provided as a zip file, which is available for download from the Forum Nokia web site (www.forum.nokia.com).

Before installing the program:

- Check that your system meets the requirements described in the section titled System Requirements.
- Obtain a product serial number when you download the software (see Installation Requirements).

2.2 System Requirements

2.2.1 Hardware Requirements

Minimum Configuration	Recommended Configuration
500 MHz Pentium processor	1 GHz Pentium processor
256 MB RAM	512 MB RAM
64 K colours	64 K colours or more
60 MB disk space	60 MB disk space
Keyboard, mouse and sound card	Keyboard, mouse and sound card

2.2.2 Software Requirements

- Windows 2000 Service Pack 3 or higher, or Windows XP Service Pack 1 or higher.

2.2.3 Installation Requirements

2.2.3.1 Product serial number

A product serial number is required to install Nokia Multimedia Converter 2.0. This can be obtained free of charge through the Forum Nokia site. (**Note that if you are not a registered member of Forum Nokia, you will need to register.**) There are two ways to obtain the product serial number:

Obtain before installation (preferred). When you visit Forum Nokia, choose the **Request Serial Number** link on the same web page as the download link. An e-mail containing the product serial number is sent to you immediately; you need this number during the installation process.

Obtain during installation. During installation, submit your Forum Nokia username and password. The product serial number is immediately sent to the e-mail address associated with your Forum Nokia account. If you use this method to get the serial number, you must have an active Internet connection (see "Internet Connection" directly below).

2.2.3.2 Internet Connection

If you do not yet have a product serial number, your computer must use an active Internet connection when you install Nokia Multimedia Converter 2.0. This is because the installation program requests a product serial number from the Forum Nokia web site. The product serial number is sent to you via e-mail during the installation process itself. If you ever need to reinstall Nokia Multimedia Converter 2.0, an Internet connection is not required. You only need to enter the product serial number that you have previously obtained.

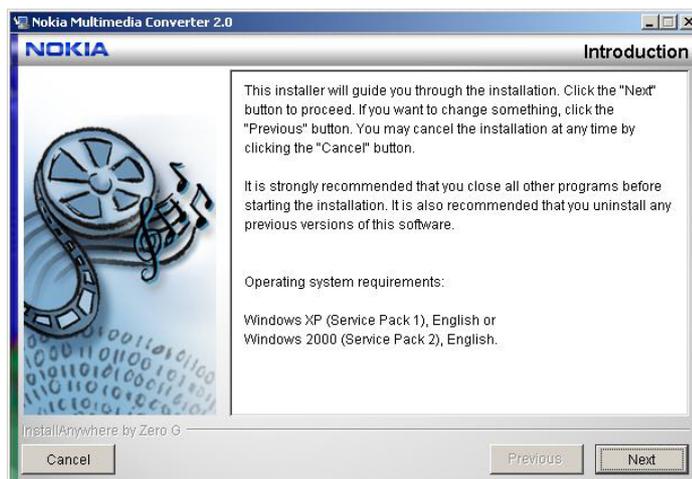
2.3 Installation Process

The following is a step-by-step description of the Nokia Multimedia Converter 2.0 installation process.

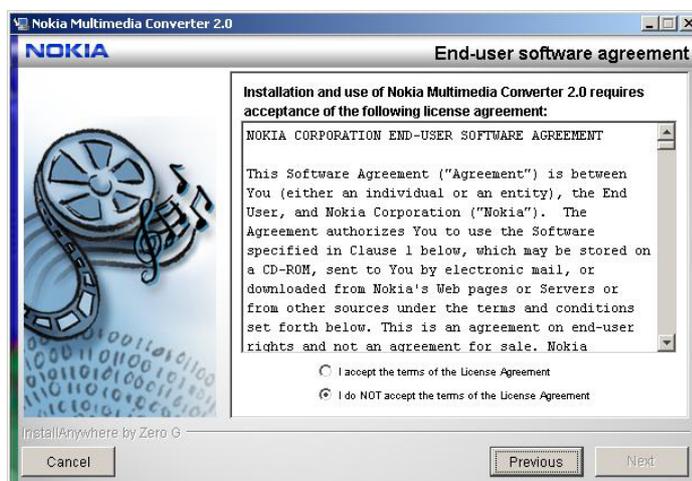
1. Download Nokia Multimedia Converter 2.0 from [Forum Nokia](#) and then unzip the downloaded file nMMCConverter_v2_0.zip. Double-click the file setup.exe.

Tip: When you visit Forum Nokia, choose the **Request Serial Number** link on the same web page as the download link. An e-mail containing the product serial number is sent to you; you need this number during the installation process.

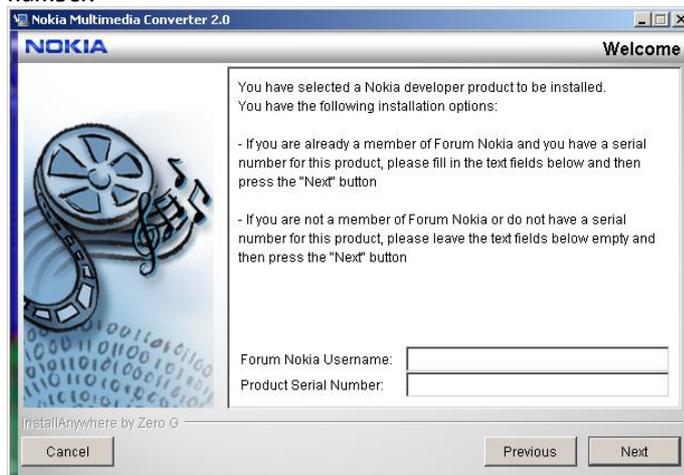
2. The first dialog (**Introduction**) of the installation program is displayed. Click **Next**.



3. The second dialog (**End-user software agreement**) describes the End-user software agreement. Select the radio button adjacent to the "I accept" text. Select **Next**.

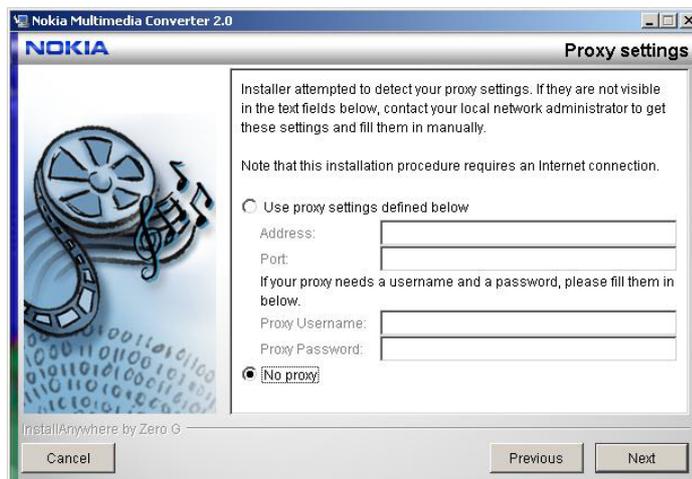


4. In the third dialog (**Welcome**), you are asked to enter your Forum Nokia username and the product serial number.

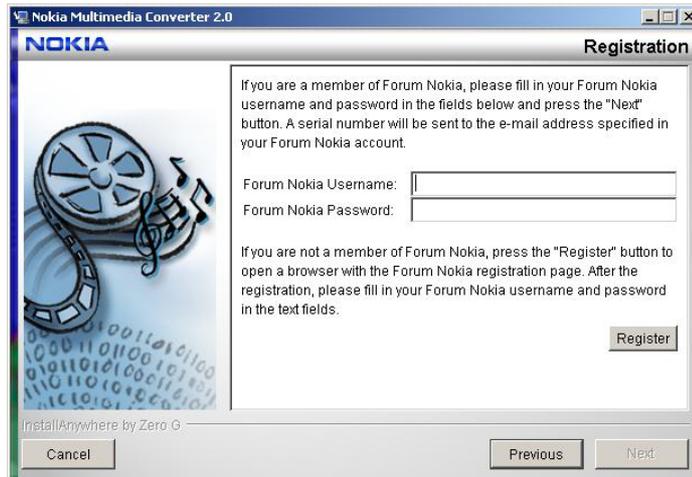


If you do not know both of these items, do not enter anything and press **Next**.

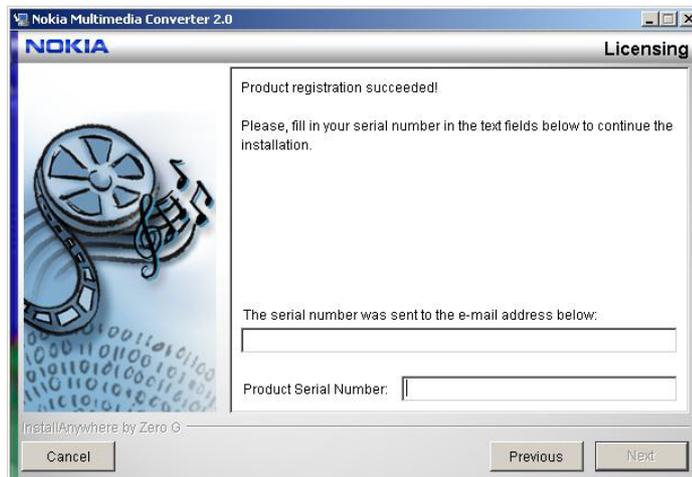
5. **Proxy Settings.** If the installation program succeeds in automatically detecting your current proxy settings, these settings are suggested. Alternatively, you can select either No proxy or Use proxy settings defined below and specify the desired settings. If your proxy needs a username and password, type them into the appropriate fields. **Note that the registration procedure requires an Internet connection.** Press the **Next** button to continue.



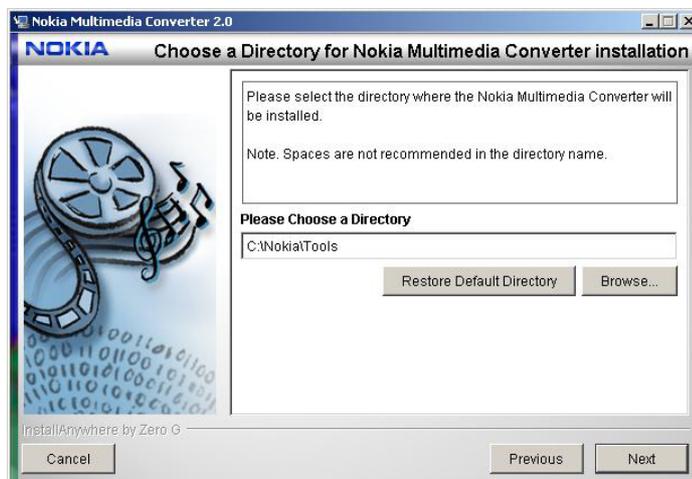
6. **Registration.** If you have a Forum Nokia account, fill in your Forum Nokia username and password and press **Next**. You will be connected to the Forum Nokia server and the serial number will be sent to the e-mail address specified in your Forum Nokia account. If you do not have a Forum Nokia account, press the **Register** button, and then register as a Forum Nokia member using your web browser. (If a web browser is not opened from the **Register** button, open your browser and go to www.forum.nokia.com/reg_form.) Having entered your new Forum Nokia username and password, press the **Next** button to continue with the installation.



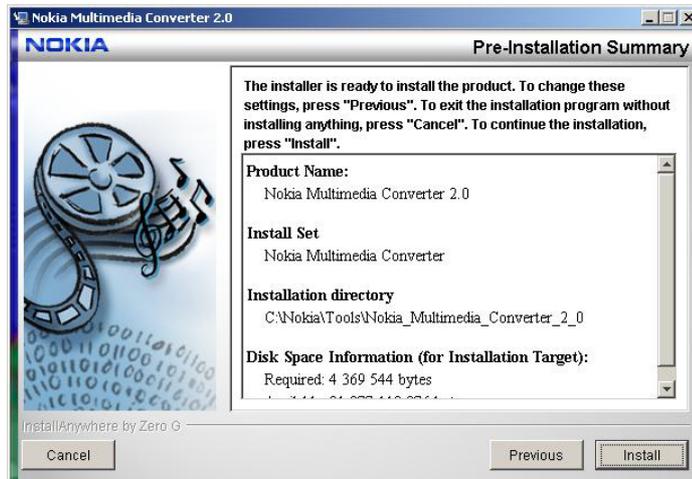
7. Check your e-mail for the serial number. You must access your email with a separate program. You cannot check your e-mail within the installation program.
8. **Licensing.** Type in the serial number and press the **Next** button.



9. **Choose a directory for Nokia Multimedia Converter 2.0 installation.** By default, Nokia Multimedia Converter 2.0 is installed in the C:\Nokia\Tools directory. You can change this directory if you wish and then press **Next** to continue.



10. **Pre-installation panel.** This panel shows you the installation information. Check that the installation directory is correct and press **Install** to continue.



11. The final dialog announces that you have successfully installed Nokia Multimedia Converter 2.0. Press **Finish** to complete the installation.



3 How to Digitise Video

This section describes how to produce suitable files for Multimedia Converter 2.0 from audio-visual source material. First, you need a signal source, such as a video camera or a video tape recorder. If your signal source is a video camera, consider using a fully digital system that complies with the DV or other appropriate specification. Digital video cameras typically provide better video quality than analogue cameras. Next, you should connect your signal source to the computer you use for digital video editing. If your signal source is analogue, you need a video capture card that digitises the analogue video signal. Refer to the manual of your capture card for details on how to connect your signal source to the capture card. The capture process is controlled by a capture application that is typically provided with the capture card. Refer to the manual of your video capture program for details on how to control the capture process. If your signal source is digital, you can use a digital interface to transfer digitally encoded video to your computer. For example, an IEEE 1394 interface is typically used to transfer DV-formatted video to a computer. Note that you may have to purchase a digital interface card for your computer, as your computer may not have such an interface by default. When you complete these steps, you should have a video file that you can play in your computer.

You may want to edit the digitised video file using a commercially available video editing application. For example, you can combine several video files into one longer file or cut some parts of a file.

When capturing a file or storing an edited file for conversion to 3GPP format, remember the following recommendations:

- The preferred video file format is Microsoft Audio-Video Interleaved (AVI).
- The video image size should be at least 128x96, preferably larger. Sizes larger than 320x240 are treated as if they were 320x240 when converting files to 3GPP format.
- The video frame rate should be as high as possible. Keep the original rate of the material (typically 25 or 30 frames per second) if possible.
- The video encoding format should be either uncompressed 24 or 32-bit RGB or lightly compressed using a common codec. For example, Intel Indeo 5 with a quality setting of around 90 (out of 100) is a good choice for a 320x240 image size. Avoid using 8-bit or 16-bit RGB formats.
- The pixel aspect ratio should be square (1:1).
- The preferred audio format is uncompressed 16-bit mono at an 8 kHz sampling rate. If you cannot set up the preferred audio format, use a sampling rate of at least 22 kHz. Preferably, audio should be stored in an uncompressed format or compressed with a high sound quality. Mono sound is sufficient. Stereo sound does not result in any improvements to quality.
- The audio recording volume should be relatively high.

When editing or shooting a video clip, remember the following hints to achieve a more pleasing end result. These hints help you to produce smaller files for local playback:

- Avoid using a handheld camera.
- Avoid shots that last less than two seconds.
- Avoid zooming and camera rotation.
- Minimise the spatial complexity of video images. Examples of spatially complex objects include trees and crowd scenes.
- You may try low-pass filtering of images to get rid of small details as well as capturing and compression artifacts.
- Avoid rapidly moving objects.
- Avoid complex scene transitions, such as fades and wipes. Use abrupt scene changes instead.

- Crop black edges if possible. For example, if the image aspect ratio was originally 16:9 but at some point it was converted to 4:3 with black edges, it is better to remove the black edges and provide a 16:9 image sequence for Multimedia Converter.
- Avoid using titles and captions. Use a large font size if you have to overlay video with text.
- Use smooth and even lighting to avoid complex shadows and hotspots.

Note : The colour display of mobile devices can be sensitive to lighting conditions and viewing angles, and therefore it is recommended that relatively bright video clips be created. Moreover, it is worth ensuring that the dynamic colour range of the image sequence is at its maximum. This means that the darkest areas in the sequence should correspond to (0,0,0) in the RGB space and the lightest areas should correspond to (255,255,255) in the 24-bit RGB space.

4 Multimedia Converter 2.0

With Multimedia Converter 2.0 you can convert common multimedia file formats (such as MPG or MP3) to 3GPP or AMR/AWB format. This section briefly describes the conversion process. (See the online help for more detailed information on different settings.)

4.1 Converting multimedia files

1. In the menu, select *File > Open*. A dialog opens. The shortcut for this is to click the Open button in the toolbar. Browse for the video file you want to convert and click **Open**. Alternatively, you can drag-and-drop a file to Multimedia Converter.
2. Select one of the image size options (see Figure 2:).
 - sub-QCIF (128x96).
 - QCIF (176x144).
3. Select the desired target video frame rate from the *Frame rate* drop down menu (see Figure 2:).
4. If you want to add periodic key frames to obtain faster random access, enter the desired key frame period in the *Intra period* edit box (see Figure 2:).
5. If necessary, change the quality of the video by setting the video bit rate in the bit rate drop down menu (see Figure 2:). The higher the bit rate is, the higher the quality of the converted video.

Note : The video bit rate of 128kbps is not a standard bit rate, and will only work with certain phones.

6. If the file contains sound, select the audio format (AMR or WB-AMR) and audio bit rate (see Figure 2:). WB-AMR produces higher quality sound than AMR. Selecting a higher bit rate increases the quality of the sound, but it produces larger files.
7. It is also possible to set the maximum size of the converted file in the *Max file size* edit box (see Figure 2:).

In MMS, the size of a video file cannot exceed certain values; for example, 100 kB, because some WAP gateways might block the transfer of larger files, operators might prefer to limit the file size to reduce air-traffic, or because not all MMS client and server implementations support large file sizes.

When you set a maximum file size limit, you cannot define the video or audio bit rate. They are adjusted automatically so that the converted file contains the whole original file from the given start point and so that its size is equal to or smaller than the given size limit. If the given size limit is too small to meet by reducing the video and audio bit rates, the converted file is truncated (shortened from the end).

Note : When the max file size option is used, Multimedia Converter selects the encoding parameters so that in normal cases the file size limit is not exceeded. In some cases due to a complex video clip, this limit can be slightly exceeded. It is strongly recommended that you check the size of the produced file after the conversion, and if necessary, set the Max file size limit somewhat smaller.

8. You can start the conversion from an offset point. Set the time stamp of the offset in the *Start time* edit box (see Figure 2:). The shortcut for this is to keep the CTRL key pressed and slide the original file location indicator to the desired position. This updates the time stamp information in the *Start time* edit box.
9. Click **Convert**. Another dialog pops up and shows the progress of the conversion. After the conversion is finished, you can view the converted file in the playback window (see Figure 2:). You can select the original or converted video for playback by selecting "Original" or "Converted" from the drop down menu (below View:). Note that the video is scaled to fit into the display.

If you need to reconvert the original file with new settings, enter the new conversion settings and press **Convert** again. When the converted file is as desired, select *File -> Save* from the menu to save the converted file into your desired location. The shortcut for this is to click the save button on the toolbar.

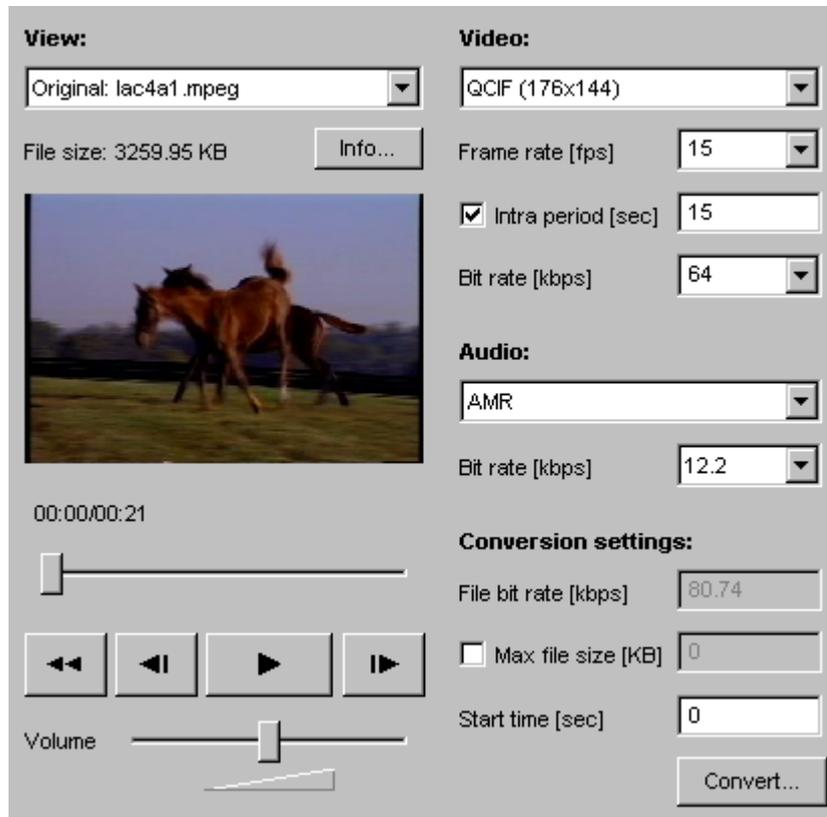


Figure 2: Playback functions and conversion parameters

The **Total bit rate** displayed in the conversion settings (see Figure 2:) is the sum of the video bit rate, audio bit rate and meta-data describing the stream. The total bit rate can be used in streaming applications to estimate the total required bandwidth to broadcast a converted file.

The conversion procedure for multimedia files containing only audio is the same as described above with the exception that the video settings do not affect conversion and are therefore disabled. The converted audio file format is AMR (.amr suffix files) or WB-AMR (.awb suffix files), depending on the audio setting.

Similarly for multimedia files containing only video, the audio settings do not affect conversion and are therefore disabled. The converted file format is 3GPP (.3gp), the same as for multimedia files containing both video and audio.

4.2 Playing multimedia files

You can play the original and converted file in Multimedia Converter by using the controls on the left side of the display (see Figure 2:). These controls do not affect the conversion process.

- Select the original or converted file from the **View** drop down menu. (The converted selection is available only when the file has been converted.)
- Use the slider below the image to set the playback position.
- Use the leftmost button to stop and rewind the clip to the beginning.

- You can move one frame forward or backwards by using the buttons on both sides of the play button. (Frame-by-frame viewing is possible only when the playback is stopped and the file contains a video stream.)
- Set the audio volume with the **Volume** slider.

4.3 Supported multimedia formats

Multimedia Converter supports most files that you can play with Windows Media Player. The exact set of supported files depends on the version of Media Player installed in your system and on the installed audio and video codecs. Typically, Multimedia Converter is able to support most AVI, WAV, MPG, and MP3 files. If you cannot open a video file in Multimedia Converter, try the following procedure:

- Open the file in Windows Media Player. If the file cannot be played, follow the next steps in the list. Otherwise, try to convert the file to an AVI file with common video and audio encoding formats using a video editing application.
- Check the version of Windows Media Player. Minimum requirement is Windows Media Player 6.0.
- Try to reopen the file in a newer version of Windows Media Player. If you do not have all the necessary codecs installed, Windows Media Player attempts to download and install codecs automatically.
- If you still cannot open the file in Windows Media Player, contact the originator of the file.

Note : Multimedia Converter supports QuickTime files. In order to convert or play a QuickTime file, QuickTime player must be installed on your system. If the version number of your QuickTime Player is less than 5.0.1, download a newer version from Apple's web site at <http://www.apple.com/quicktime/download/>.

5 Multimedia Converter 2.0 Console Version

The Multimedia Converter 2.0 package also contains a console application (MMConverterCon.exe). This allows you to convert large numbers of files using batch files. The following paragraph summarises the instructions for using the console version of Multimedia Converter 2.0.

```
Multimedia Converter 2.0 console version
Copyright (c) 2000-2003 Nokia Corporation
```

```
USAGE: MMConverterCon [options]
```

```
-i      infile          Input file name (required)
-o      outfile         Output file name without file extension
                        An appropriate file extension will be added
                        by the application.
-st     startTime       Conversion start time in seconds [0 sec]
-sl     sizeLimit       Size limit for the converted file in KB [0 KB]
                        Set to 0 to disable size limit.
-p      Turn off user  interaction [on]
-h      This message
```

```
Video options:
```

```
-v      imageSize       Video image size [qcif]
                        qcif    =>    176x144
                        subqcif =>    128x96
-fr     frameRate       Target frame rate in frames per second [15 fps]
-intra  period          Key frame period in seconds [15 sec]
                        Set to 0 to disable INTRA frame update
-br     videoBitRate    Video bit rate in kbps [64 kbps].
                        Must be between 20kbps and 64kbps.
                        128kbps is an exception:
                        You can use a 128kbps bit rate, but it will only
                        work with certain phones.
```

```
Audio options:
```

```
-a      audioType       Audio type[amr]
                        amr      =>    AMR
                        wbamr   =>    Wide Band AMR

-amr    AMRMode         Audio bit rate  [7]
                        AMR          WBAMR
0 =>    4.75 kbps        6.60 kbps
1 =>    5.15 kbps        8.85 kbps
2 =>    5.90 kbps        12.65 kbps
3 =>    6.70 kbps        14.25 kbps
4 =>    7.40 kbps        15.85 kbps
5 =>    7.95 kbps        18.25 kbps
6 =>    10.2 kbps        19.85 kbps
7 =>    12.2 kbps        23.05 kbps
8 =>
```

Note :

Default values used for conversion are shown in parenthesis; [default value].

When input files contain only video streams without audio, the audio options are ignored and vice versa.

You cannot use the size limit and bit rate options simultaneously. Bit rates are calculated for the specified size limit.

Use the “-p” option with caution since it suppresses all Yes/No queries. (For example, if the output file already exists, MMConverterCon always overwrites the existing file without asking the user when using the “-p” option.)

The video bit rate of 128kbps is not a standard bit rate and will work only with certain phones.

6 Audio-Visual Compression for Mobile Applications

6.1 Basics of Video Encoding

A video sequence consists of a series of still images. Video compression methods are based on reducing the redundant and perceptually irrelevant parts of video sequences. The redundancy in video sequences can be categorised into spatial, temporal and spectral redundancy. Spatial redundancy means the correlation between neighbouring pixels. Temporal redundancy means that the same objects appearing in the previous image are likely to appear in the current image as well. Compression can be achieved by generating motion compensation data, which describes the motion between the current and the previous image. It can be said that the current image is predicted from the previous one. Spectral redundancy means the correlation between the different colour components of the same image. However efficient it may be, compression cannot usually be reached by just reducing the redundancy of the sequence. Thus, video encoders must also discard some non-redundant information. When doing this, the encoders take into account the properties of the human visual system and mainly discard information that is least important for the subjective quality of the image. In addition, the redundancy of the encoded bit-stream is reduced by means of efficient lossless encoding of compression parameters and coefficients. The main technique is to use variable length codes.

Video compression methods typically differentiate images that can or cannot utilise temporal redundancy reduction. Compressed images, which do not utilise temporal redundancy reduction methods, are usually called INTRA or I-frames whereas temporally predicted images are called INTER or P-frames. In the INTER frame case, the predicted (motion-compensated) image is rarely precise enough, and therefore a spatially compressed prediction error image is also associated with each INTER frame.

In video encoding, there is always a trade-off between bit rate and quality. Some image sequences may be harder to compress than others due to rapid motion or complex textures. In order to meet a constant bit rate target, the video encoder controls the frame rate as well as the quality of the images: the more difficult the image is to compress, the worse the image quality is. If a variable bit rate is allowed, the encoder can maintain a constant video quality.

The ITU-T H.263 video codec utilises discrete cosine transform (DCT) to reduce spatial redundancy. The transformation converts a block of pixels to coefficients that represent the spatial frequency components of the block. Only the frequencies appearing in the block have high-amplitude coefficient values and other coefficients are close to zero. For example, a constantly coloured block has only one spatial frequency and it is transformed to one non-zero DCT coefficient, whereas the other DCT coefficients remain zero. Consequently, the DCT coefficient block is easier to encode with run-length codes than the original block of pixels. In order to gain compression, the transformed block is quantised, which means that the coefficients are rounded to certain quantisation levels. The fewer possible quantisation levels there are, the fewer bits it takes to represent a quantisation level. An approximation of the original block of pixels can be restored from the encoded DCT quantisation levels by applying an inverse DCT transformation. The fewer quantisation levels were used, the worse the quality of the reconstructed image is. ITU-T H.263 allows 31 quantisation step sizes that are controlled by the so-called quantisation parameter.

6.2 Video Encoding for Mobile Applications

Multimedia Converter processes the video track of an input file as follows:

- The video track is extracted from the input file and decompressed if necessary.
- If the image size in the input video sequence is larger than the desired image size, the images are scaled to a suitable size.

- If the image size in the input video sequence is smaller than the desired image size, black stripes are added to obtain the suitable size.
- The images are converted from the RGB colour space to the YUV colour space defined in ITU-R Recommendation BT.601-4. The H.263 coder requires YUV input images.

Selected images are compressed according to ITU-T Recommendation H.263. The generated H.263 bit stream conforms to the restrictions of H.263 profile 0, level 10. This means:

- Image size can be either QCIF or sub-QCIF
- Frame rate cannot exceed 15 fps
- Bit rate cannot exceed 64 kbps (NB: Nokia Multimedia Converter supports also 128 kbps bit rate)

6.3 Basics of Audio Encoding

Arbitrary sounds can be represented as a sum of waves having different frequencies and amplitudes. In other words, any sound is an amplitude waveform as a function of time. Sounds can be digitised when samples of the corresponding waveform are taken frequently enough. For arbitrary sounds and music, a 44.1 kHz sampling frequency is considered to provide high quality. For speech, an 8 kHz sampling frequency is adequate for most applications. Typically, 16 bits is enough to represent one sample.

Digitised audio can be compressed in various ways. A simple encoding method is to use an adaptive step size to quantise audio samples. Such a technique is used in the IMA ADPCM audio encoding standard, which reserves 4 bits per sample. Consequently, if the sampling frequency is 8 kHz, IMA ADPCM encoded audio takes 32 kbps. Another simple audio encoding method is A-law PCM, which uses a logarithmic quantisation step size and reserves 8 bits per sample.

More advanced audio encoding methods take advantage of the human psychoacoustic model. Parts of the audio signal are barely audible and can be discarded or compressed. Typically, the advanced encoding audio methods are categorised into generic audio encoding and speech encoding techniques. Generic audio encoding algorithms are optimised for music and sound as well as human voices, whereas speech encoding algorithms are aimed at speech only and perform relatively poorly when music is encoded.

One of the most advanced speech encoding standards today is the adaptive multi-rate (AMR) speech codec, which was developed by the European Telecommunications Standards Institute (ETSI). It includes eight speech encoding modes, whose bit rates range from 4.75 to 12.2 kbps. Some of the modes are speech codecs specified for other standards. For example, AMR at 12.2 kbps is the same speech codec as the GSM enhanced full-rate codec.

Similar to AMR, the WB-AMR codec is also a multi-rate speech codec. WB-AMR supports nine wide band speech encoding modes with respective bit rates ranging from 6.6 to 23.85 kbps. The sampling frequency used in WB-AMR is 16000 Hz (8000Hz with AMR).

6.4 Audio/Speech Encoding for Mobile Applications

The following procedure is used to compress high-quality audio tracks in Multimedia Converter:

- The audio track is extracted from the input file and decompressed if necessary.
- Stereo sound is converted to mono sound.
- The audio sampling rate is converted to 8 kHz (with AMR) or 16kHz (with WB-AMR).
- Audio is compressed using AMR or WB-AMR.

7 Terms and Abbreviations

Term or Abbreviation	Description
3GPP	Third Generation Partnership Project
ADPCM	Adaptive Pulse Code Modulation
AMR	Adaptive Multi-Rate speech codec
API	Application Programming Interface
AVI	Microsoft Audio-Video Interleaved file format
CD-ROM	Read-Only Compact Disc
DCT	Discrete Cosine Transform
DV	Digital Video
fps	Frames Per Second
GSM	Global System for Mobile Communication
HSCSD	GSM High Speed Circuit Switched Data
HTML	Hypertext Markup Language
Hz	Hertz, 1/sec
IMA	Interactive Multimedia Association
ITU-T	International Telecommunication Union, Telecommunication Standardization Sector
kbps	kilobits per second
MPEG	ISO/IEC Moving Pictures Experts Group
MPG	File name extension for MPEG-1 file format
MP3	MPEG-1 Audio Layer 3 audio encoding
PC	Personal Computer
PCM	Pulse Code Modulation
RGB	Red-Green-Blue colour space
WAV	Microsoft waveform audio file format
WB-AMR	Wide Band Adaptive Multi-Rate speech codec
YUV	Colour space, Y is the luminance or gray-scale component, U and V are chrominance or colour difference components

8 References

Video and Streaming in Nokia Phones v1.0 <http://forum.nokia.com/documents>

IEEE 1394 <http://standards.ieee.org>

Build Test Sell

Developing and marketing mobile applications with Nokia

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