

Delivery of Requested Video Sequences by Satellite

The invention designates the delivery of requested video sequences by satellite, and in particular of music video clips, with professional picture quality to receivers for
5 primary usage in authorized discotheques. In doing this, the protection against unauthorized reproduction and usage is to be maintained in particular.

In the international patent classification (IPC), the electrical transmission of communications is assigned to class
10 H04B. Radio distribution systems, as such, are included in class H04H 1/00 and those over satellite are specially included in H04B 7/185. Picture transmission is assigned to class H04N and for color television systems specially to H04N 11/00, and for high-definition television (HDTV) to
15 H04N 11/24. Two-way operation, during which the receiver sends a program selection signal, is in H04 7/173. The transmission of digital information is assigned to class H04L and the special instructions for secure-access transmission of communications are included in class H04L 9/00,
20 special means for determination of authorization to receive in H04L 9/32 and for block coding and decoding of information to H04L 9/06.

Video sequences, and in particular music video clips, are subject, as a rule, to copyright protection, which especially
25 forbids unauthorized reproduction. When such video sequences are distributed, it must therefore be assured that unauthorized further reproduction is not supported, which, for example, is achieved through measures to protect against copying.

30 For example, it is known from publication DE4418191 that corresponding digitalized video pictures can be transmitted

over telephone lines. The disadvantage of this type of procedure is the quality loss due to the limited bandwidth of the transmission path and the limited picture resolution. In addition, due to the required point-to-point connection,
5 no concurrent delivery to multiple receivers is possible.

At the present time, moving pictures experts group (MPEG), which defines a set with standards for the compression of audio and video data, is normally used for the digital transmission of video and/or storage. MPEG is also the ab-
10 breviation for a video or audio file in the MPEG format. For differing applications and quality requirements for video information, various types of compression have been set. MPEG-1 defines, as the original MPEG standard for the storage and the requesting of video and audio information,
15 which was developed for the CD-ROM technology, a medium bandwidth of up to 1.5 Mbps, two audio channels and video without interlaced scanning. MPEG-2 defines, as an expansion of the MPEG-1 standard, which was developed for the compression of high-quality video signals and for television transmission for HDTV, a broader bandwidth of up to 40
20 Mbps, five audio channels, a broader spectrum of picture sizes and video with interlaced scanning. A fast cryptographic algorithm, which was specially optimized for MPEG-2, is described, which allows encoding and decoding and the
25 examination of the complete data stream.

The publication DE19643672 reveals a procedure for the decoding of a video bit stream according to the MPEG standard, which successively buffers an I-picture and a P-picture. To do this, the video bit stream must be continuously available during the entire time period with the re-
30 quired bandwidth, meaning available as live data.

ADR radio programs (ASTRA digital radio) allow the transmission of digital data by satellite. The European Satellite Multimedia Services S.A. allows its service - based on a continuous data stream of broad bandwidth -, ASTRA-NET, to provide digital video broadcasting (DVB) according to the MPEG-2 standard. In addition, package-switched transmission of digital data is supported, corresponding to the Internet protocol, for discontinuous data transmission with a narrow bandwidth. The standards for the package transmission in networks are documented in the CCITT-Recommendation, X.25.

The publication DE29800778 reveals an arrangement for the transmission of digital data in MPEG format over a satellite within the framework of an ADR radio program, during which a satellite receiver is directly assigned, after phase shift keying (PSK) demodulation, a MPEG decoder, which provides the continually transmitted video sequence. The disadvantage of this solution is the necessity for live data and a continuous broadband transmission.

The publication DE29603829 reveals an interactive transmission and playback of video files in MPEG format, where upon request a remote data transmission path between a file server and a playback computer is established, which is equipped with a playback device for a MPEG file. The disadvantage of this is, that multiple receivers can not receive the transmitted video file at the same time. The lack of security concerning unauthorized reproduction is also a disadvantage.

The purpose of the invention is the simple implementation of a secure delivery of the requested video sequences with a professional quality to individual authorized receivers with low loading of the transmission path and thus low
5 transmission costs.

The problem is solved with the characteristics listed in patent claim 1. Priority for further developments results from the subordinate claims.

The essence of the invention consists of the delivery of
10 requested video sequences - by means of the MPEG-2 standard, which was specially developed for the compression of high-quality video signals to insure professional picture quality - to a receiver, authorized through his receiver-specific identification, as an MPEG-2 file based on the
15 insertion of satellite-supported package-switched data transmission. An additional essential aspect is the implementation of real-time decoding of this MPEG-2 file, which can only be done by the authorized receiver. This is done with the encoding and decoding of the MPEG-2 file by means
20 of a key, which is specific to the video service provider, in real-time without having to store unencoded video sequences. For the advantageous execution of this, the special cryptographic algorithm, which is used for the encoding and decoding and examination of the complete data
25 stream described in the MPEG-2 standard, is used for real-time decoding. It could be possible to transmit the requested video sequences coupled with commercials.

In addition, it is possible to automatically assign dynamic commercials, according to instructions from the video service
30 provider and dependent on the length of the program, to

a program of video sequences, which is individually composed by the receiver, for playback.

The advantages of the invention consist, in particular, of the possibility of:

- 5 • after viewing the contents of the video sequences, which were transmitted advantageously over the network in MPEG-1 format to the computer for previewing, making an individual selection of the video sequences and ordering these individually.
- 10 • providing the requested video sequences over an economical transmission path to the receiver with the highest quality.
- being able to allow multiple receivers to receive the video sequences at the same time over the direct broadcast
15 connection.
- maintaining these video sequences freely available at the receiver's location, which would allow the receiver to prepare his own program.
- an individual playback of the video sequences.
- 20 • excluding unauthorized reproduction and use of the video sequences.
- dynamic and automatic assignment and playback of commercials per program composition.

The invention will be explained in more detail as an example of application based on figure 1 as instructions for
25 the delivery of video sequences.

According to figure 1, a data connection exists between a computer (1) of a receiver and a video service provider (2)
over a network (3), such as the Internet, and through this
30 connection the receiver, who is authorized through a re-

ceiver-specific identification (4), selects and orders from the products of the video service provider (2) individual video sequences (5), such as music video clips, advantageously after viewing the contents of the video sequences, which were transmitted for preview over the network (3) in MPEG-1 standard to the computer (1). At the conclusion of the ordering process, the free storage of computer (1) of the receiver is examined advantageously and the required storage space for the receipt of the video sequence (5) is reserved. If the storage capacity is too low, then normal procedures for the release of the lacking storage capacity are to be carried out. The video service provider (2), who collects the individual requests of various receivers and primarily groups them suitably, provides the video sequences (5) - optionally over a broadband connection (6) with required bandwidth for transmission as MPEG-2 - in the form of a MPEG-2 file (7) to a satellite transmitter (8), which divides the video sequence (5) into individual packets (9) with the data (10), which are parts of the MPEG-2 file (7), and header information (11) and - primarily secured through transmission encoding with data encryption standard (DES) 56BIT - transmits by means of an intermediate satellite (12), among other things, to a satellite receiver (13), which is connected to computer (1), which stores the data (10) in a storage unit (14). In doing this, the satellite receiver (13) insures, using the header information (11) and the receiver-specific identification (4) of the computer (1), that only computer (1), for which the data (10) are meant, stores the data (10) in the storage unit (14). Following successful transmission, storage and the connection of the data (10) of all packets (9), then the MPEG-2 file (7) is available in the storage unit (14). In order to guarantee protection against unauthorized reproduction, the MPEG-2 file (7) contains the video sequence (5) in an encoded form. The playback of the video sequence

(5) from the MPEG-2 file (7) by means of a MPEG-2 decoder (15), assigned to computer (1), is thus only possible using playback software (16), which is specific for the video service provider, and which, using the temporary storage in
5 computer (1) and the MPEG-2 decoder (15), deciphers and decodes the video sequence (5) in real-time and then outputs this as a video signal (18) without storing the unencoded video sequences (5). Since the video sequence (5) is only available in real-time as a video signal (18) at the output
10 of the MPEG-2 decoder (15), an unauthorized reproduction and use of this is not supported. The key (17), which is required for the decoding of video sequence (5), is primarily integrated as an updateable part in the video-service-provider-specific playback software (16) and this key is
15 primarily the same for all authorized receivers. It is advantageous to use the fast cryptographic algorithm for decoding, which is optimized in the MPEG-2 standard for the encoding and examination of the complete data stream, for example, the algorithm used for the digital video disk
20 (DVD).

It is, however, imaginable and also in the sense of the invention, to use a public key procedure for the encoding and decoding, whereby the key (17) required for the real-time decoding of the video sequence (5) can only be calculated
25 from the receiver-specific identification (4) and is available exclusively only temporarily. It is also advantageously imaginable to specify the MPEG-2 decoder (15) so that, with respect to the monitor signal of computer (1), a decoupling of the output of the video sequence (5) as the
30 video signal (18) is possible, which would allow the playback of video sequence (5) as video signal (18) as a type of background application. It is also imaginable that a graphic could be placed at the video output of the MPEG-2

decoder (15) and at the same time to continue working on the monitor of computer (1) in a program.

A particularly advantageous application consists of the integration of the satellite receiver (13) with the computer (1), the storage unit (14), the MPEG-2 decoder (15) and the video-service-provider specific playback software (16) in a set-top box (19) with a modem/ISDN power supply. This will allow, in addition to interactive television and TV shopping, the individual receipt of video sequences (5) and the playback of these.

The possibility of the coupling of video sequences (5) with commercials is particularly interesting for the commercial area. A video service provider (2) functions, in this respect, at the same time as a commercial provider and assigns a number of commercials to the requested video sequences (5), which were composed for various receivers, but a separate transmission of commercials is also possible. The transmission, storage and playback are done principally under the same conditions as for the video sequences (5). The receiver can select freely from the video sequences (5) stored in the storage unit (14) and individually compose a program from these. This program is dynamically assigned a certain number of commercials for a time unit, which is set by the video service provider, and which can not be influenced by the receiver. The playback occurs at irregular intervals, for example, between music video clips.

Reference Symbols Used

	1	Computer
	2	Video service provider
	3	Network
5	4	Receiver-specific identification
	5	Video sequence
	6	Broadband connection
	7	MPEG-2 file
	8	Satellite transmitter
10	9	Packet
	10	Data
	11	Header information
	12	Satellite
	13	Satellite receiver
15	14	Storage unit
	15	MPEG-2 decoder
	16	Video-service-provider-specific playback software
	17	Key
	18	Video signal
20	19	Set-top box



Patent Claims

1. The delivery of requested video sequences over satellite, which a receiver ordered in advance from a video service provider (2), to a computer (1) of the receiver, which is connected with a satellite receiver (13), whereby the video sequences (5) are coded according to the MPEG-2 standard, so characterized
- that the computer (1) is provided with a receiver-specific identification (4) for computer-supported identification of the receiver.
 - that the video sequence (5) is divided as data (10) into individual packets (9) within a packet-switching data service of the satellite transmitter (8) and delivered over satellite (12) to the satellite receiver (13) and upon the examination of the authorization through the receiver-specific identification (4) based on the header information (11) of the packets (9), the video sequence (5) is stored in the storage unit (14) of the computer (1) and whereby, as an option, the storage capacity required for the storage was checked for availability in advance upon ordering and/or reserved.
 - that the computer (1) contains an MPEG-2 decoder (15) for the real-time decoding of the MPEG-2 file (7), which represents the video sequence (5), into a video signal (18).
2. The delivery of requested video sequences over satellite, according to claim 1, is so characterized that the real-time decoding of the MPEG-2 file, which is stored in the storage unit (14), into a video signal (18) by the MPEG-2 decoder (15) can only be done with video-service-provider-specific playback software (16), whereby in real time a decoding of the MPEG-2 file is done by means of a



video-provider-specific key (17) without the storing of the unencoded video sequences (5).

3. The delivery of requested video sequences over satellite according to claim 1 or claim 2 is so characterized that
5 the special cryptographic algorithm, which is described in the MPEG-2 standard, is used for real-time decoding.

4. The delivery of requested video sequences over satellite according to claim 2 or claim 3 is so characterized that the video-service-provider-specific key (17) is temporarily
10 calculated from the receiver-specific identification (4) and a public key.

5. The delivery of the requested video sequences over satellite according to one of the claims 1 to 4 is so characterized that the MPEG-2 decoder (15) allows the decoupling
15 of the output of the video sequence (5) as a video signal (18) with respect to the monitor signal of the computer (1).

6. The delivery of the requested video sequences over satellite according to one of the claims 1 to 5 is so characterized that the satellite receiver (13) is integrated with
20 the computer (1), the storage unit (14), the MPEG-2 decoder (15) and the video-service-provider-specific playback software (16) in a set-top box (19) with power supply.

7. The delivery of the requested video sequences over satellite according to the claims 1 to 6 is so characterized
25 that the video sequences (5) are assigned commercials, which can not be influenced by the receiver.

8. The delivery of the requested video sequences over satellite according to claims 1 to 7 is so characterized that



the receiver can freely select from the stored video sequences (5) and individually compose a program from these, whereby a certain number of commercials are assigned to this program for a set time unit for dynamic playback.

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