

**A system for local processing/accessing and representation
of large volumes of data**

The invention concerns a system for local processing/accessing and representation of large volumes of data, wherein the system comprises at least one input/output interface
5 for several respective bandwidth-limited telecommunication networks and at least one output interface for transferring processed or unprocessed data to at least one playback device for display and/or playback of the data.

The invention also concerns applications of the system.

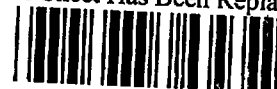
The present invention provides a system for on-demand services without the use of an
10 associated rapid and massive data transfer from an external source or external sources. A typical application is video-on-demand or VOD, i.e. services whereby the user can access a film library on request. With the present invention a VOD library can be accessed in real time without the need for on-line transfer of the selected film or films via telecommunication lines with high capacity.

15 The system according to the present invention makes use of a local mass storage unit in a decoder box with combined user control and external control. The storage medium or media in the storage unit may or may not be replaceable. The information which constitutes the requested services, e.g. films, can either be entirely stored locally in the system and accessed from it, or parts of the information can be stored locally, while
20 other parts have to be retrieved from an external source or sources. In the latter case two or more data streams are subsequently mixed to form a continuous bit stream before they are displayed on, e.g., a user monitor or another display device or used in other ways. Access is conditional and will normally require authorization, invoicing, access to the correct decoder, etc.

25 In accordance with the state of the art VOD usually requires films to be transferred to the user via high capacity telecommunication lines for immediate display.

Three general versions of direct high capacity systems of this kind have been proposed and in some cases implemented:

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Telephone transfer systems with local server and high capacity

High capacity data transmission is employed in order to transfer information to the user from local servers and via local telephone lines and in this connection exploits the fact that simple telephone lines over short distances can handle high transfer rates. The local servers used are therefore each normally connected with 50-100 consumers and thus only employ a small part of the network. In this context user interactivity can be achieved (e.g. random access, when a film is started on the request of a user), provided that the local server can handle a sufficient number of individual requests for different films and that the local telephone network has sufficient capacity. This system, however, makes great demands on the capacity of the local server, particularly if there are a great many consumers, for example more than a thousand, who can address each server. If the capacity of the server is limited, the number of servers will have to be correspondingly high and traffic costs will generally increase substantially and constitute a disproportionately large part of the total costs.

Transfer lines with a central server and high capacity

A system of this type is similar to the first, apart from the fact that the server now has to serve the entire network or the greater part of it. In theory any user can have any film whatever from the central server started on demand. In practice, in the best case the response times for such a system will be considerable. Normally the system will very quickly reach saturation point and break down. The demand on line capacity will also normally be prohibitive for an implementation of this kind.

Parallel, continuous transfer systems

These employ a number of transfer lines with high capacity for continuous, parallel transfer of a number of films. A film is normally started, e.g., every n minutes and requests from the users for a specific programme are then hooked on to the closest start-up. However, this does not give real user interactivity, and the user will either have to wait for a relatively long time, particularly if the number of available titles is large, or only have a limited number of titles from which to choose. If it is to be efficient this system also requires a considerable number of transfer channels or lines with high capacity.

Thus the known systems offer the user very limited opportunity for interactively selecting the service and for determining how and when it should be used. More



precisely, therefore, the object of the present invention is to reduce the system's response time, to increase the services on offer, e.g. the number of films which are offered, to provide a high degree of user-interactivity, to permit the use of a simple, inexpensive communication system and to offer the option of avoiding the need for transfer from an external source or external sources.

Further objects of the system according to the present invention are to enable a simple and easy commercial control to be achieved, to prevent fraud and finally to provide simple updating mechanisms.

The above-mentioned and other advantages of a system according to the present invention are achieved by means of the fact that the system comprises at least one input interface which includes at least one local mass storage unit with at least one separate, replaceable or non-replaceable storage medium, a decoder, an internal traffic controller, a control/mixing device and a user control interface, that under the control of the internal traffic controller the local mass storage unit(s) can be connected with the decoder which is adapted for the decoding of data transferred from the storage medium or media, as well as for two-way communication via the control/mixing device with an external control centre via the input/output interface and the user control interface respectively, the control/mixing device being connected via the output interface with a playback device for display and playback of data stored in the local mass storage unit.

Applications of the system according to the invention are specified by claims 8 and 9 respectively.

The invention will now be explained in more detail in connection with an embodiment and the attached drawing, in which

fig. 1a illustrates a decoder box with user control as used in the system according to the present invention,

fig. 1b illustrates the system according to the present invention and

fig. 2 illustrates an updating of the information in a local mass storage unit in the system according to the present invention.

The system will now be described with reference to a system for user-selected display of films on the user's television set, but limited to situations where either the transfer



system's bandwidth is limited or not available at all. It should be understood, however, that the system according to the invention can equally well be used in other user-selected applications of large volumes of data, for example user-selected, but authorized, invoiced or conditional use of other forms of image data or image-like data, including consumer-adapted or professional use of geographical, lexical and encyclopedic data or marketing data, consumer-orientated or professional exploitation of medical or technical image data bases and consumer-orientated utilization of video/computer games. The system according to the present invention can also be used in applications of large volumes of data which are not image data, but, e.g., sound, including speech and music. Finally the system according to the present invention can be aimed at user-orientated applications of any mixture of large volumes of data which comprise image data, image-like data or data which are not images.

Fig. 1 illustrates schematically the use of a decoder box according to the present invention. In this context the term decoder box describes the local unit which is at the user's disposal and will comprise one or more local mass storage units, an internal traffic controller, modem, decoder, interface, etc. The decoder is the unit which decodes the encoded data received. The local mass storage unit is a unit provided in the decoder box and is capable of storing large volumes of data, typically from 50 Mbit up to 100 Gbit or more. The actual storage medium is the physical medium in the mass storage unit which, for example in the case of VOD, stores film data. In this context the storage medium can be one or more of the following, viz. disks, cards, tapes or combinations of these.

The encoded data are composed of data which are represented in some kind of symbolic form, for example in order to protect the contents of a given data stream, or reduce its size or represent it in a more efficient manner, for example in order to obtain faster random access, faster read-out, etc. Examples of coding may be, e.g., encryption, compression, etc.

As illustrated in fig. 1a, the decoder box should enable the user to display, for example, various films by means of a user control, a rapid response being obtained on the user control with the system according to the present invention, despite the fact that the telecommunication connection with the outside world is bandwidth-limited.

Fig. 1b illustrates the fundamental design of the system according to the present invention and the more detailed design of the decoder box in block diagrammatic form. The decoder box has an input interface which can be connected with some form of



external signal source and which transmits signals from there to a decoder. The decoder is connected via an internal traffic controller with a local mass storage unit. This mass storage unit may have one or more replaceable or non-replaceable storage media and if the storage medium is replaceable, in reality the input interface corresponds to an input device for this storage medium. The decoder is further connected with a control/mixing device and via this with a user control interface and an output interface respectively to a playback device for reproduction of the source signals which are input via the input interface. If the data on the storage medium exist in encoded form, they are retrieved from the local mass storage unit and decoded in the decoder before being transferred to the playback device under the control of the user control interface. Furthermore the decoder box can have input/output interfaces which are illustrated here as a wide-band and a bandwidth-limited interface respectively, both of which lead to an external control centre. It should be understood that there can be several such interfaces and that they can lead to different control centres. Via the user control interface a two-way communication can take place via the traffic controller with the external control centre via the input/output interfaces, these being connected with the traffic controller via a modem. Thus the user control interface controls the user's communication with external control centres as well as the utilization of the information stored in the decoder box's mass storage unit. By means of the user control interface, at the request of the user a desired item of service information can be transferred which, for example, can be stored in a data base connected with the external control centre. In a VOD service this data base will be a film library. The service information is transferred via the interfaces in encoded or uncoded form. If large volumes of data have to be transferred via the bandwidth-limited interface, this will generally require the data to be compressed, particularly in the case of films which have to be transferred on a bandwidth-limited line. The service information can also optionally be transferred on a wide-band network, e.g. satellite lines or microwave lines. The decoder box in fig. 1b therefore gives the user a number of options for the input and updating of service information.

For local storage of data and low-capacity transfer, two-way bandwidth-limited I/O interfaces are used which in fig. 1b also represent the transfer line to an external control centre. User control data and user identification data from the user's decoder box are transferred on the two-way transfer line with low capacity to this external control centre. These data can be used for authorization, invoicing, display control, etc. Further control data and authorization are transferred on the same bandwidth-limited transfer line from the external control centre to the decoder box. These data can be used to initiate and maintain a selected film showing.

The additional control data from the external control centre can contain key information, codes and data without which the control/mixing device cannot utilize data from the local mass storage unit. This is in order to prevent fraud and various forms of illegal exploitation. The additional control data can, e.g., comprise smaller, but important parts
5 of the information or the film and different types of encrypted key information corresponding to the user identification, an identifier for the local storage unit, special identifiers for the contents of the local mass storage unit and the external control centre, etc.

The external control centre can be connected to a data base for the transfer of the
10 desired information or data, e.g. films, from a film library which in this case constitutes the data base for the users. The network can optionally be bandwidth-limited and equivalent to the telephone network or a cable network with low capacity. In this case it could correspond to the communication line between the decoder box and the external control centre. The data base, e.g. the film library, could also be connected to the
15 decoder box via a wide-band network, e.g. a satellite network, while the control information between the user and the external control centre is transferred on a bandwidth-limited line.

The data which are transferred from the user control unit in the system in fig. 1b will consist of requests to the external control centre together with user control data for
20 control of the local display unit as soon as the desired service information has been authorized and initiated.

The system according to the present invention can also be used for VOD with local storage, but without external communication. The VOD concept can in fact be implemented without the necessity of accessing an external control centre. In this case
25 the desired service information, for example all films, will be located in the decoder box, viz. stored in the local mass storage unit. User access and invoicing can be initiated, e.g. via credit card or similar means of payment, but can also be implemented by the payment of a one-time fee when a medium which contains the films is purchased, after which no further invoicing, authorization, etc. will be necessary. By
30 means of this concept it becomes possible to place restrictions on use, for example in the form of a limit on the number of times a film can be played.

The local mass storage unit can be updated in different ways and this is schematically illustrated in fig. 2.

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The local mass storage unit or units can, e.g., be updated by physically replacing the unit or units. This can involve replacing the entire storage unit or be limited to the replacement of the storage medium or media.

5 Updating can also be performed by means of an electronically implemented
modification/updating of locally stored data via the telecommunication network and
under the control of the external control centre. The electronic modification/updating
can be performed off-line, and thus will not interfere with the current user-selected
utilization of service information, and will take into consideration those possibilities
10 which exist in the commercial tele-network, while at the same time taking into account
consumer preferences. Electronic updating can be performed in each case by
transferring encoded or unprocessed data via telephone lines with low capacity,
telephone lines with higher capacity, satellite lines, cable networks, radio lines, etc.
under the control of the external control centre.

15 According to what is expedient in connection with the updating, the storage medium or
media used in the local mass storage unit can be permanent or also writable or
erasable.

In this context the local mass storage unit can employ media such as magnetic tape,
rotating optical, magneto-optical, electro-optical or magnetic discs or non-rotating
optical or magnetic cards and chips for storing the service information, for example the
20 films. These can exist in more or less compressed form in order to reduce storage
requirements or intact, i.e. uncompressed, but stored in a format which optimizes
search time, read-out speed, etc.

Such storage media are particularly suitable for VOD services with a pay-per-view
arrangement, and the storage media can then be replaceable in order to prevent wear
25 and also in order to be replaced with a new item of service information, for example
new films.

Service information such as stored films can be physically updated by replacing the
storage medium or media with new ones or by transferring the service information, i.e.
the films, via existing telecommunication networks, e.g. via satellite lines, cable
30 networks, telephone lines and microwave lines, preferably during periods of low traffic
density in order to minimize the transfer costs. The actual system according to the
invention can be controlled by using ordinary telephone connection with a low bit rate
between the user decoder box and the external control centre.





As already stated, the system according to the present invention offers a great many advantages when used for VOD services.

From the user's point of view the system according to the present invention has a very fast response time, since the lead time from the selection of a film until the display of the film starts normally only constitutes a few seconds, and this is of vital importance when comparison is made with parallel continuous transfer systems for VOD. At the same time the system according to the present invention gives the user access to an enormous number of films, since the system according to the invention offers the possibility of accessing libraries with hundreds of film titles or more in the course of seconds, while known VOD services at present normally have the capacity to offer 10-30 films.

The system according to the present invention permits a high level of interactivity, since the local storage system not only enables the user to start a desired film with a very short start-up time, but can also give the user the possibility for freeze frame, fast forward and rewinding of the film and all the other functions which can normally be provided by to-day's video recorder systems. Other forms of interactivity can also be implemented, and range over everything from simple colour adjustment to editing possibilities for an entire film or editing of local features in scenes and interactive games, etc. depending on which code technique is used.

The system according to the present invention requires a simple and inexpensive communication system, since a real time communication system with high capacity is not necessary. Nor is it necessary to have special tuning and central or local server technology, nor to be continuously linked to a high capacity transmission system. In principle an ordinary dial-up, analog telephone line on 3.4 kHz is all that is required in order to achieve the desired communication with the system according to the present invention. The computer system in the external control centre which serves a large number of customers can be simple and low cost, since only small volumes of data have to be transferred to each user or customer.

If an option is selected in which there is no need for transfer from external sources, in principle the whole film library can be stored locally, thus completely eliminating the need for expensive real time transfers from external sources such as film libraries.

For the commercial exploitation of the system according to the present invention it is an advantage that low capacity transfer via, e.g., telephone lines facilitates the user

identification and permits automatic invoicing from the external control centre. At the same time the system according to the present invention offers the possibility of implementing comprehensive security measures in order to protect the supplier's interests by preventing the exploitation of VOD services and the like with fraudulent intent, e.g. through illegal copying of programmes or pirate production of decoders, etc.

Finally the system according to the present invention can be installed and reprogrammed without the need for it to function in real time, since it is possible to use a number of updating techniques, varying from inexpensive read-only media to writable media which can be electronically updated via practically all existing communication lines and networks.

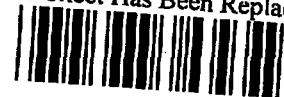
Even though the system according to the present invention is particularly well suited to VOD services with a pay-per-view arrangement, and the design is described with special reference to this, it is in no way restricted to such applications, but on the contrary can be used to handle all other forms of service information where the use of local mass storage units for permitting rapid, controlled access to and read-out of massive volumes of data is especially appropriate and desirable, with simultaneous local user control and optional external authorization and control, above all in situations where there are technical and/or commercial restrictions on the transfer bandwidth. At the same time data can be stored locally in full measure, although this is not necessary, and can in each case be supplemented with items of key and control information, which again can optionally include fraud protection, authorization data or additional data such as, e.g., key programme information.

The locally stored data can be stored in more or less encoded format, i.e. the system can handle both preprocessed and unprocessed information, and the encoded formats can, e.g., be based on standard video codecs, model-based compression systems, etc. At the same time the storage of the locally stored data can aim at achieving normal search time, read-out speed, display functionality, etc. The local mass storage unit can be employed in most examples of the prior art for storage of large volumes of data, with storage media which can be permanent or writable and erasable. Moreover as already stated, the local mass storage units can be physically removed or replaced or be installed on a non-replaceable, permanent basis. Nor is the system according to the present invention limited to the use of to-day's known media for mass storage of data, but will be capable of being adapted to future storage systems which provide greater storage density and faster access or both than state of the art mass storage techniques.



- Finally it should be mentioned that if in the system according to the present invention service information is used which is preprocessed, e.g. with coding techniques for compression, and especially model-based compression, a decoder can be employed which permits different forms of processing of the stored data, for example
- 5 interpolation, prediction and the like in connection with the decoding. This means that the service information which exists in some kind of standardized format and encoded
- by means of an appropriate technique, can be converted into other formats which enable display and playback to be performed with a higher quality than the reproduction on the basis of the source programme's original standard would permit.
- 10 This can be of special importance if, e.g. television and video standards with a higher quality than those at present should be adopted in the course of the coming years.

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**PATENT CLAIMS**

1. A system for local processing/accessing and representation of large volumes of data, wherein the system comprises at least one input/output interface to one or more bandwidth-limited telecommunication networks and at least one output interface for the transfer of processed or unprocessed data to at least one playback device for display and/or playback of data,
characterized in that the system comprises at least one input interface which includes at least one local mass storage unit with at least one separate, replaceable or non-replaceable storage medium, a decoder, an internal traffic controller, a control/mixing device and a user control interface, that under the control of the internal traffic controller the local mass storage unit(s) can be connected with the decoder which is arranged for the decoding of data transferred from the storage medium or media, as well as for two-way communication via the control/mixing device with an external control centre via the input/output interface and the user control interface respectively, the control/mixing device being connected via the output interface with a playback device for display and playback of the data stored in the local mass storage unit.
2. A system according to claim 1,
characterized in that the decoder is connected via an additional input/output interface with the external control centre via a telecommunication system with substantial data transfer capacity.
3. A system according to claim 1,
characterized in that the local mass storage unit is optionally implemented by one or more of the following types of storage media: magnetic memories, semi-conductor memories, optical memories, magneto-optical memories or electro-optical memories with a typical storage capacity in the range of 500 Mbit - 100 Gbit.
4. A system according to claim 3,
characterized in that the local mass storage medium is replaceable.
5. A system according to claim 3,
characterized in that the local mass storage medium is non-replaceable.
6. A system according to claim 4 or 5,
characterized in that the local mass storage medium is of the once-only type or permanent, i.e. of the write-once or non-erasable type.



7. A system according to claim 4 or 5,
characterized in that the local mass storage medium is writable or erasable.
8. The use of a system according to one of the claims 1-7 in a video-on-demand
(VOD) service with cash, all-included payment or pay-per-view.
- 5 9. The use of a system according to claims 1-7 in a general information supplying
system with payment on ordering or payment per item, document or file.

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