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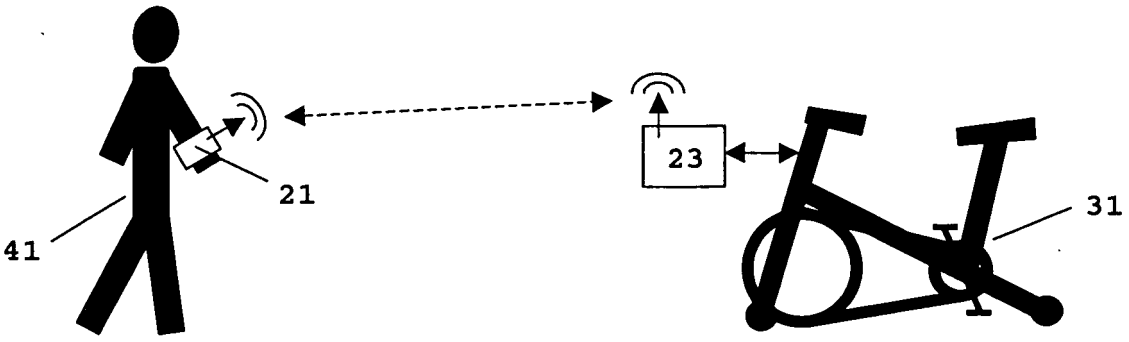
(54) Method for wireless communication between a personal mobile unit and an individually adaptable exercise equipment device

(57) The invention is directed to a method for wireless, bidirectional, user-individualised communication between at least one personal mobile device (21) and at least one individually adjustable exercise equipment device (31) provided with a transceiver interface device (23) or in communication with the same, characterised in that the mobile device (21) sends identification and setting data stored in a data storage unit of the mobile device (21) to the transceiver interface device (23) of the exercise equipment device (31) for identifying the user (41) and for causing the setting of individually adjustable features of the exercise equipment device (31) in accordance with the setting data,
the transceiver interface device (23) sends exercise data acquired and collected in the exercise equipment device (31) to the mobile device (21) and
the mobile device (21) processes the exercise data in a data processing unit (2) of the mobile device (21) for storage in the memory (3) of the mobile device (21) and for combination with other exercise data from the same and/or another exercise equipment device (31).

Fig. 2



EP 1 968 028 A1

Description

[0001] The invention relates to a method and a system for wireless, bi-directional, user-individualised communication between at least one personal mobile device and at least one broadcast interface device of at least one individually exercise equipment device.

[0002] In training centres or gyms the problem arises that many user share a pool of individually adaptable exercise equipment devices such as weight benches, spinning bikes, resistance machines, etc. that need to be adapted to the personal needs of individual users. It is desirable to make for example personal data, a workout plan or a coordinated personal training cycle "known" to the exercise equipment such that adaptable parameters of the exercise equipment devices are set automatically according to that information. This would make the usage of such exercise equipment devices much more convenient for the user and ensure a better control of individual training cycles. Instruction lessons as well as supervisory personnel could be reduced as health risks from too heavy weights or excessive exercise were minimised. Furthermore, it is desirable to keep track of all personally accomplished exercises and/or body values during exercises with all used exercise equipment devices for statistical, coordination and/or safety purposes.

[0003] In DE 103 52 591 A1 an apparatus for monitoring of physical parameters of babies is known. With this method, data are collected by means of sensors, wherein the data are processed and transmitted to a remote station.

[0004] A disadvantage of this and other apparatuses and methods, as for example described in DE 103 50 715 A1, DE 101 44 701 A1 and DE 100 66 078 B4, is that, in general, communication is possible in one direction only, that the data to be transmitted are not or only insufficiently processed and the data are not analysed, modified and do not cause any changes in this apparatuses.

[0005] Especially for the use of different exercise equipment devices it is desirable that user-individualised information, for example about personalised training cycles and the current status thereof, suitable weights or degrees of difficulty, already accomplished exercises or current body values, is transmitted to an exercise equipment device to be used. Ideally, the exercise equipment is automatically adjusted according to the transmitted user-individualised information and further accumulated user-individualised information, for example about the accomplished exercises with the used training device, is stored in the mobile device for statistical analysis and/or for adaption of further exercise equipment to be used.

[0006] It is an object of the present invention to provide a method and a system which, in a flexible manner, provide for a two-way communication between a personal mobile device associated with a user and an exercise equipment device, wherein the communication data are individualised (or user specific) with respect to the particular user.

[0007] This object is solved by the method according to claim 1 and the system according to claim 12. The dependent claims set out preferred embodiments of the invention.

[0008] Further details, features and advantages of the invention will be apparent from the following description of preferred embodiments in connection with the drawings, in which:

Figure 1 is an overview over the components of a mobile device and the transceiver interface device of an exercise equipment device.

Figure 2 shows schematically the communication between a personal mobile device and an exercise equipment device provided with a transceiver interface device.

Figure 3 shows schematically the communication between a personal mobile device and a personal computer provided with a transceiver interface device where another mobile device acts as an amplifier for the communication.

Figure 4 shows schematically a conventional communication between a mobile device connected to a personal computer.

[0009] According to Figure 1, a preferred embodiment of the personal mobile device 21 comprises a broadcast transceiver unit 1 for transmitting data in a wireless communication, a data processing unit 2 for processing commands, a data storage unit 3 for storing identification and user data, an internal energy supply 4 for autonomous use of the mobile device, an information unit 5 for user information, an input unit 6 and a connector 7. The transceiver interface device 23 comprises a broadcast tranceiver unit 8 for transmitting data in a wireless communication, an information unit 9 for user information, an input unit 10, a data processing unit 11 and a connector 12. The data processing unit 11 runs an application adapted for the specific use of the transceiver interface unit 23 in connection with an exercise equipment device.

[0010] Figure 2 shows a typical use of the personal mobile unit 21 in form of a wrist band carried by a user 41, e.g. in a gym or a sports centre. The exercise equipment device 31, e.g. a spinning bike, is provided with different automatically adjustable workout programs. It is further provided with or in direct communication with a transceiver interface device 23. The user 41 can be identified by the exercise equipment device 31 via the communication between the personal

mobile device 21 and the transceiver interface device 23. The automatically adjustable workout program can be set individually according to the personal data that is transmitted to the transceiver interface device 23. During the workout program the communication between the transceiver interface device 23 and the mobile device 21 allows the storage of statistical data such as body values, calorie consumption, etc.

[0011] Figure 3 shows the personal mobile device 21 acting as an repeater for another mobile device 22 that is too far away from the transceiver interface device 23 to communicate directly with it. The transceiver interface device 23 is in this case connected to a computer 51 in a gym or a sports centre. The transceiver interface device 23 sends data frames carrying a command request addressed to the mobile device 22. The mobile device 21 receiving this data frame resubmits the data frame. The mobile device 22 receives the resubmitted command and answers accordingly. The answer is also amplified by the mobile device 21 to reach the transceiver interface device 23. The communication protocol makes sure that there is no confusion between several data frames and copied data frames.

[0012] Furthermore, the data content of the mobile device 21 may be downloaded at another place, for example together with the coach at a central personal computer 51 or at a personal computer at home by means of a suitable interface and may be used and analysed, for example for statistical purposes, as shown in figure 4. The parameters for the exercise equipment can also be modified by the personal computer at home. The suitable interface in form of a connector 7 of the mobile device 21 may be a universal serial bus (USB), a small computer system interface (SCSI), peripheral component interconnect (PCI), FireWire, or wireless communication links such as infrared or bluetooth connections.

[0013] In the following, a detailed description of the communication protocol that may be used with a preferred embodiment of the present invention is given without limiting the scope of the invention.

[0014] Received data may be stored in the data storage unit of the mobile device in form of so-called containers. A container is a memory portion with a maximal size of 65536 bytes, where arbitrary data may be stored without any format constraints. Each container can be identified by a unique container number in form of a 16-bit long key.

[0015] Every data frame during communication with the mobile device uses a unique container number for the identification of the data. This prevents interference in case of two or more mobile devices communicating with each other and/or with one or more exercise equipment devices at the same time.

[0016] The container with number 0x0000 is a special container with identification data of the mobile device that can be read out during communication, but no write or delete process is allowed on container 0x0000 in the course of normal communication.

[0017] The identification data of the mobile device may be set in a special initialisation process in form of factory settings or during an internal actualisation process. Table 1 shows the set-up of container 0x0000 where in the first 48 bits the unique identification code of the mobile device is stored. The memory size of the data storage unit is also stored. Optionally, the percentage of used memory and the battery load of the internal energy unit is also available.

Table 1: Set-up of container 0x0000

Address	Data length [bit]	Description	Optional yes/no
0x000	48	Identification code of mobile device	no
0×006	16	Memory size	no
0x008	8	Percentage of used memory	yes
0x009	8	Battery load	yes

[0018] Data is transmitted in so-called frames, wherein each frame is composed of fields "preambel", "header", "address" or "return value", "command", "data length", "user data" and "check sum". The preambel is a 64-bit long row of alternating bits (01010101...) and the header is the 16-bit pattern 0x0C5 or 0x05C. The address is a 48-bit long identification number of a mobile unit to select a certain mobile device for communication. The command is 8 bits long and determines the process type for the user data (see table 2). The field "data length" holds in 8 bits the number of bytes of the user data in the field "user data". The length of the user data in the field "user data" must not exceed 128 bytes. The check sum is calculated in the data processing unit from the fields "command", "data length" and "user data" by usage of a CRC-16 polynomial function, e.g. $x^{16} + x^{12} + x^5 + 1$.

Table 2: Commands

Command byte	Process type
0x001	Read data

(continued)

Command byte	Process type
0x002	Write data (append)
0x003	Write data (overwrite)
0x004	Delete container
0x081	Answer: ACKNOWLEDGED
0x082	Answer: NOT ACKNOWLEDGED

[0019] Every communication is conducted as a command request "Read data" (0x001), "Write data (append)" (0x002), "Write data (overwrite)" (0x003) or "Delete container" (0x004) sent to a mobile device. The mobile device may answer on the permissible request by sending a command byte 0x081 that is interpreted as an acknowledged command that is conducted by the mobile device. If the command is not permissible a command byte 0x082 is send as an answer by the mobile device that is interpreted as a not acknowledged command that is not conducted by the mobile device.

[0020] The mobile device neither conducts the command request nor answers with a command byte 0x0081 or 0x082 if the address of the addressed mobile device in the field "address" does not correspond to its own identification code in its container 0x0000. In this case the complete command request is transmitted in an unchanged manner by the mobile unit. By this, the mobile device may act as an amplifier for a mobile device with the corresponding address. As an answer with a command byte 0x0081 or 0x082 always holds the identification number of the addressed mobile device, also this answer is amplified as it is transmitted in an unchanged manner by one or more other mobile units in the broadcast range. Complete communication between an transceiver interface device and an addressed mobile device without overlapping broadcast range can therefore be possible through amplification by one or more other mobile units between the transceiver interface device and the addressed mobile device.

[0021] In case of an incorrect check sum the command request is neither conducted nor amplified. There is also no answer send whether the command is acknowledged or not. The check sum may be incorrect in case of data loss or noise. The transceiver interface device should be able to resubmit the command request until it receives an answer from the addressed mobile device.

[0022] The command request "Read data" (see table 3) is only acknowledged if the container number exists, the start address is located in the range of existing data and the size of the user data to be read is not larger than 128 bytes. If the size of the user data to be read is larger than the amount of existing data from the start address to the end of the existing data only the existing part is send within the field "user data" of the answer with command byte 0x081.

Table 3: User data for the command "Read data"

Length	Description
16 bit	Container number
16 bit	Start address for read process
16 bit	Size of data block to be read

[0023] Data are appended to the end of existing data in an addressed container on the acknowledged command request "Write data (append)" (see table 4.1). In case the container number does not exist it is created and the user data is written to the data address 0x0000 of the new container.

Table 4.1: User data for the command "Write data (append)"

Length	Description
16 bit	Container number
n bit	data (1-126 bytes)

[0024] Table 4.2 shows the possibilities to answer for the mobile device on a command "Write data (append)" in form of a status value that is written to the field "user data" in the answer. The command is acknowledged only in case of a successful write process in an existing or a created container. In case of a not permissible request for a write process to container 0x000, a full container or too long user data, the command is not conducted and not acknowledged. The

corresponding reason is send in the field "user data" in the answer.

Table 4.2: Answer on the command "Write data (append)"

Status value	Description
0x000	Write process successful, container exists
0x001	Write process successful, container created
0x080	Write process on container 0x0000 not allowed
0x081	Container full
0x082	Data too long

[0025] Data are written to a given start address in an addressed container on the acknowledged command request "Write data (overwrite)" (see table 5.1). In case the container number does not exist it is created and the user data is written to the data address 0×0000 of the new container. If the start address is located after the end of existing data, the so far uninitialised container portion is initialised by setting the bytes with 0×0FF.

Table 5.1: User data for the command "Write data (overwrite)"

Length	Description
16 bit	Container number
16 bit	Start address for write process
n bit	data (1-126 bytes)

[0026] Table 5.2 shows the possibilities to answer for the mobile device on a command "Write data (overwrite)" in form of a status value that is written to the field "user data" in the answer. The command is acknowledged only in case of a successful write process in an existing or a created container. In case of a not permissible request for a write process to container 0x000, a full container or too long user data, the command is not conducted and not acknowledged. The corresponding reason is send in the field "user data" in the answer.

Table 5.2: Answer on the command "Write data (overwrite)"

Status value	Description
0x000	Write process successful, container exists
0x001	Write process successful, container created
0x080	Writing on container 0x0000 not allowed
0x081	Container full
0x082	Data too long

[0027] If the container number to be deleted is found and not the container 0x0000 the container with the given number is deleted on the command request "Delete container". Along with the acknowledge command byte the user data is filled with a status value 0x000 for a successful delete process in the answer.

Table 6.1: User data for the command "Delete container"

Length	Description
16 bit	Container number

[0028] The command request "Delete container" is not conducted, because the container 0x0000 is requested to be deleted or the container number is not found the reason is send with a status value and a not acknowledged command byte in the answer (see table 6.2)

Table 6.2: Answer on the command "Delete container"

Status value	Description
0x000	Delete process successful
0x080	Delete process on container 0x0000 not allowed
0x081	Container not found

Claims

1. Method for wireless, bi-directional, user-individualised communication between at least one personal mobile device (21) and at least one individually adjustable exercise equipment device (31) provided with a transceiver interface device (23) or in communication with the same,
characterised in that
the mobile device (21) sends identification and setting data stored in a data storage unit of the mobile device (21) to the transceiver interface device (23) of the exercise equipment device (31) for identifying the user (41) and for causing the setting of individually adjustable features of the exercise equipment device (31) in accordance with the setting data,
the transceiver interface device (23) sends exercise data acquired and collected in the exercise equipment device (31) to the mobile device (21) and
the mobile device (21) processes the exercise data in a data processing unit (2) of the mobile device (21) for storage in the memory (3) of the mobile device (21) and for combination with other exercise data from the same and/or another exercise equipment device (31).

2. Method according to claim 1, wherein at least one exercise device (31) adjusts automatically individually adjustable features according to the personal setting data received from a personal mobile device (21).

3. Method according to claim 1 or 2, wherein the transmitted data is encoded.

4. Method according to any of the preceding claims, wherein the identification data comprises a mobile device identification code.

5. Method according to claim 4, wherein the transceiver interface device (23) periodically addresses one or more mobile devices (21) in the broadcast range by sending data frames carrying the corresponding one or more mobile device identification codes.

6. Method according to claim 5, wherein a mobile device (21) acknowledges a data frame carrying the mobile device identification code of the mobile device (21) sent by a transceiver interface device (23) by resubmitting an answer carrying an acknowledge command.

7. Method according to claim 6, wherein one of more acknowledging mobile devices (21) in the broadcast range is selected by the user (41) for communication with the transceiver interface device (23).

8. Method according to any of the preceding claims, wherein submitted data frames are checked in the data processing unit (2) of the mobile device (21) for consistency by a cyclic redundancy check or other data verification methods.

9. Method according to claim 5, wherein a mobile device (21) does not acknowledge a data frame with a mobile device identification code other than its own and resubmits the data frame to act as an amplifier for communication between the requesting transceiver interface device (23) and other mobile units (22).

10. Method according to claim 5, wherein the user of a mobile device (21) is informed about a data frame with the mobile device identification code of the used mobile device (21) by means of an information unit of the mobile device (21) and acknowledges the data frame by means of a manual input unit of the mobile device (21).

11. Method according to one of the preceding claims, wherein the user (41) of a mobile device is informed about a data frame with the mobile device identification code of the used mobile device (21) by means of an information unit of the transceiver interface device (23) and acknowledges the data frame by means of a manual input unit of the

transceiver interface device (23).

12. System for wireless, bi-directional, user-individualised communication between at least one personal mobile device (21) and at least one individually adjustable exercise equipment device (31) provided with a transceiver interface device (23) or in communication with the same,
wherein

- at least one mobile device (21) includes a broadcast transceiver unit (1), a data processing unit (2), a data storage unit (3) and an internal energy supply (4),
- at least one transceiver interface device (23) includes a broadcast transceiver unit (8) and a data processing unit (11),

characterised in that
the mobile device (21) is arranged for holding identification and setting data in the data storage (3) of the mobile device (21) and sending that identification and setting data via the broadcast transceiver unit (1) of the mobile device (21) to the transceiver interface device (23) of the exercise equipment (31) for identifying the user (41) and for causing the setting of individually adjustable features of the exercise equipment (31) accordingly,
the transceiver interface device (23) is arranged for sending exercise data with the broadcast transceiver unit (8) of the transceiver interface device (23) to the mobile device (21) and
the mobile device (21) is arranged for processing the exercise data in the data processing unit (2) of the mobile device (21) for storage in the data storage unit (3) of the mobile device (21) and for combination with other exercise data from the same and/or other exercise equipment (31).

13. System according to claim 12, wherein a transceiver interface device (23) is a built-in component of the exercise equipment (31).

14. System according to claim 12, wherein a transceiver interface device (23) is an external accessory device in communication with the exercise equipment (31).

15. System according to any of the claims 12 to 14, wherein at least one exercise device (31) comprises at least one motor or mechanical system in communication with the transceiver interface device (23) for automatically adjusting individually adjustable features according to the personal setting data received from a personal mobile device (21).

16. System according to any of the claims 12 or 15, wherein a mobile device (21) and a transceiver interface device (23) is prepared for encoding and decoding data frames.

17. System according to any of the claims 12 to 16, wherein a mobile device (21) is prepared for resubmitting received data frames to act as an amplifier for communication between a transceiver interface device (23) and other mobile units (22).

18. System according to any of the claims 12 to 17, wherein a mobile device (21) further comprises an information unit (5) in form of a display, a lamp, an LED, a vibration alarm, a sound device or other means for informing the user (41) of the personal mobile device (21) about a data frame and a manual input unit (6) in form of a button, a selection wheel, a microphone or other means for acknowledging the data frame by the user (41) of the personal mobile device (21).

19. System according to any of the claims 12 to 18, wherein a transceiver interface device (23) further comprises an information unit (9) in form of a display, a lamp, an LED, a vibration alarm, a sound device or other means for informing the user (41) of a personal mobile device (21) about a data frame and a manual input unit (10) in form of a button, a selection wheel, a microphone or other means for acknowledging the data frame by the user (41) of the personal mobile device (21).

20. System according to any of the claims 12 to 19, wherein the broadcast range of a transceiver interface device (23) is adjustable.

21. System according to any of the claims 12 to 20, wherein further a central station such as a personal computer (21) is provided with a transceiver interface device (23) or in communication with the same to communicate with one or more personal mobile devices (11, 12).

22. System according to any of the claims 12 to 21, wherein a personal mobile device (21) comprises a connector (7) such as a universal serial bus (USB), a small computer system interface (SCSI), peripheral component interconnect (PCI), FireWire, or wireless communication links (7) such as infrared or bluetooth connections or other means for communication with a central station such as a personal computer (21).

Fig. 1

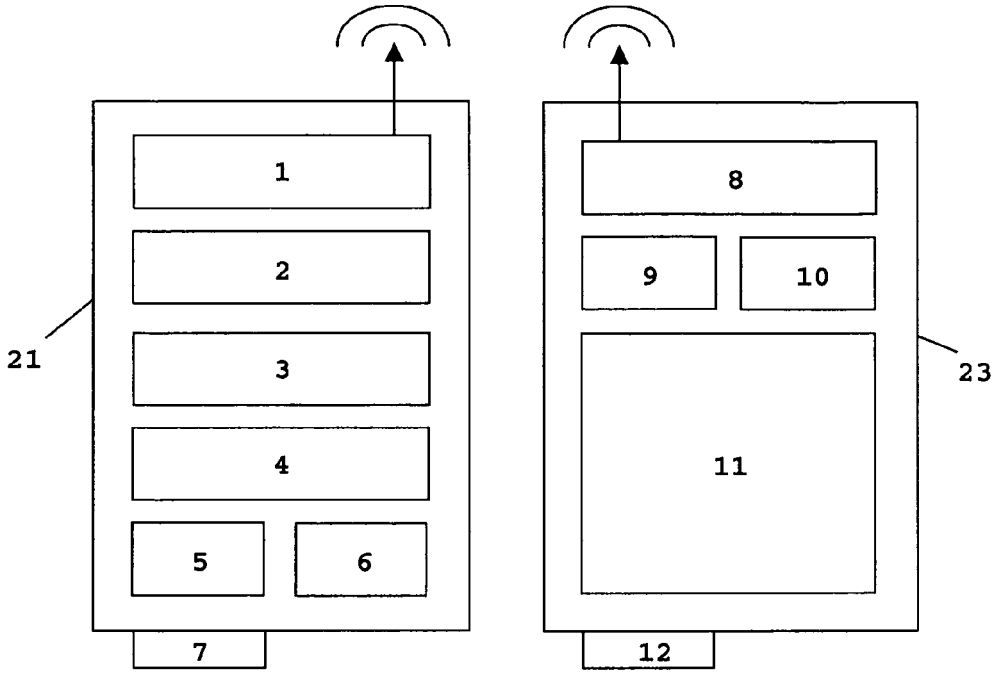


Fig. 2

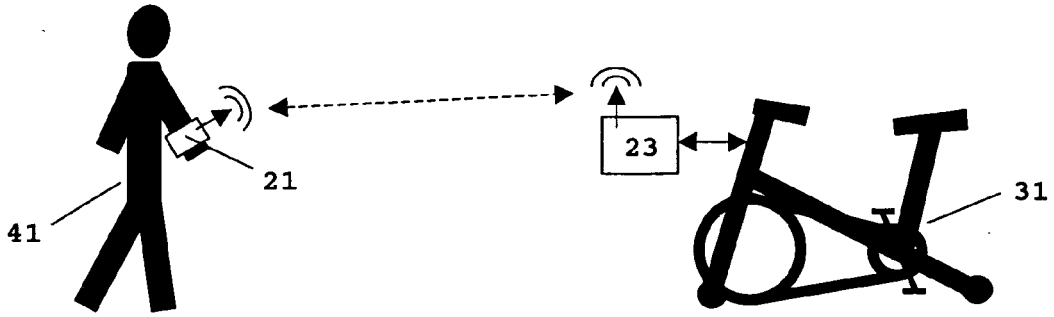


Fig. 3

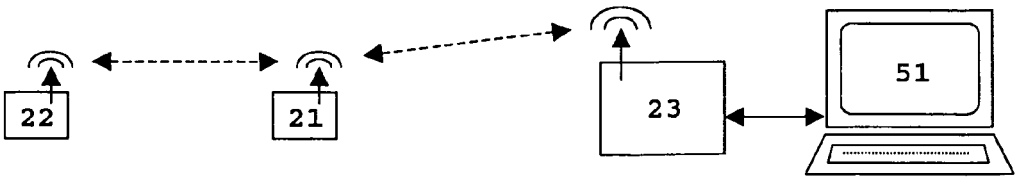
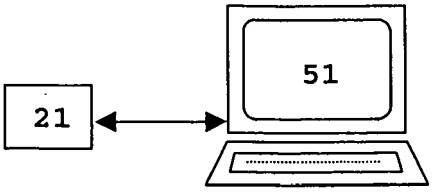


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 07 00 4469

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TECHNICAL FIELDS SEARCHED (IPC)

G08C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	26 July 2007	Pham, Phong

CATEGORY OF CITED DOCUMENTS

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26-07-2007

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