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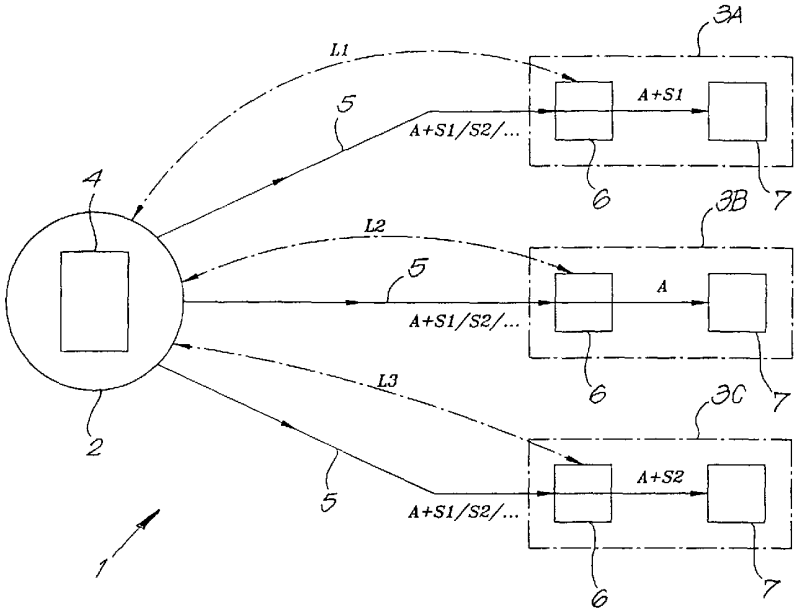
(54) Title: METHOD AND DEVICE FOR WIRELESS DATE DISTRIBUTION



(57) Abstract: Method for wireless data distribution, characterized in that the data are divided in, on one hand, general data (A) destined for a major group of users (3A-3B-3C-...) and, on the other hand, specific data (S1-S2-...) intended for one or more specific users (3A-3B-3C...) from the aforementioned group; that the general data (A) and specific data (S1-S2-...) are transmitted wireless in the form of one data stream (5), from a basic system (2) to the users (3A-3B-3C-...); and that at the users' (3A-3B-3C-...) of the specific data (S1-S2-...), by means of filtering, the specific data (S1-S2-...) concerned are made available, whereas the general data (A) are made available for all users (3A-3B-3C-...).

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Method and device for wireless date distribution.

This invention relates to a method and device for wireless data distribution.

More particularly, the invention relates to transferring, on one hand, general data or information to a major group of users and, on the other hand, specific data or information which only is intended for one or more specific users from the aforementioned group.

More particularly, the invention relates to a method and device for wireless distribution of executable data, so-called "executable code" or "programma code", as well as of direct user information.

It is known that data distribution, up to the present, substantially takes place either directly to a major group of users (multicast system), or to a specific user (unicast system), or to all users (broadcast system).

With wireless distribution of digital information to a major group of users, there is a major problem in that, if the information to be distributed frequently changes, the costs thereof become very high if the distribution takes place by means of a point-to-point communication to each new user gaining access to the group, or when the digital information changes. Wireless communication, in fact, still is an expensive form of communication.

As a consequence, the number of wireless point-to-point connections for sending data has to be minimized.

This can be realized by implementing a reliable "multicast" of common digital information, which, however, is

an expensive and difficult manner of working.

Indeed, the classic forms of "multicast" protocols necessitate a bidirectional channel for confirming the receipt, whereby such channel requires expensive wireless communication and the number of channels is directly proportional to the number of group members, in other words, one channel per user.

Such "multicast" of common digital information requires large databases and a complex management system in order to register which user already has received which information correctly. It is difficult to apply this latter on a larger scale, as the complexity of the management system grows when one starts working with subgroups and/or if the number of users grows.

Moreover, it is difficult to find a common denomination for subgroups when elements belonging to one subgroup individually perhaps also belong to other subgroups.

Also, in general, it is very difficult to optimize this classic way of working in function of all members of a group.

In the first place, the present invention aims at a novel kind of method and device for wireless data distribution which allows to transmit information in a fast and economic manner, on one hand, general information for all users of a major group and, on the other hand, specific information for certain users of the aforementioned group, whereby by said users, also subgroups may be understood. In the second place, according to a preferred form of embodiment, it also aims at a solution for the disadvantages of the aforementioned known systems.

To this aim, the invention in the first place relates to a method for wireless data distribution, with as a characteristic that the data are divided in, on one hand, general data intended for a major group of users and, on the other hand, specific data intended for one or more specific users from the aforementioned group; that the general data and specific data are sent wireless in the shape of one data stream, from a basic system to the users; and that at the users' of the specific data, by means of filtering, the specific data concerned are made available, whereas the general data are made available to all users.

In this manner, all information can be transmitted by means of one data stream, specific data as well as general data. In this manner, no separate channels are required for transmitting the specific data.

Preferably, at least a number of the specific data, and even better all specific data, are sent repetitively, and that a well-defined number of times. Hereby, it is obtained that, when the first receipt at the users' fails, then likely the following, or almost certainly the subsequent will be received. This leads to the result that the specific data will arrive at the users' with a large certainty, as a consequence of which there is no longer a necessity of a bidirectional connection for a confirmation of the receipt by the user, and at the same time a management system is made more simple or even redundant.

By changing the number of times of repetitively sending the data, the so-called "quality of service", with which the probability is meant with which all users receive the specific data, can be adapted. An increase of the number results in a larger "quality of service".

The general data can be transmitted once as well as repetitively. When they are transmitted once, an optimum capacity remains present for repetitively transmitting the specific data sent in between. In case that both are transmitted repetitively, for the different kinds of data, general and specific, respectively, a separately adapted repetition frequency can be applied or even a repetitive pattern within one cycle, in other words, some blocks can be transmitted several times within one cycle.

In practice, the data will be transmitted according to a broadcast or multicast principle.

According to an important form of embodiment of the method, the specific data are transmitted in encrypted form, and at the users' of the specific data, by means of a decoding of the specific data, exclusively the specific data to which the users have access are let through to them, whereas the general data remain accessible for all users. Thereby, the specific data obtain an individual character.

The encoding of the specific information may take place in any manner. It can take place, for example, by means of a codification, as a result of which it suffices for the users to have a code in order to gain access to the specific data, or certain specific data. This can also take place by means of encrypting, whereby at the user's side, a deciphering of the encrypted specific data must take place in order to get access thereto. Further, the encoding may also be based on a combination of both techniques, thus, on one hand, codification and, on the other hand, encryption.

In practice, hereby a plurality of keys will be used, and a difference will be made between the different specific

users, whereby each user, by means of his key, exclusively attainss access to that part of the specific data which is made accessible by means of such key.

The invention does not exclude the use of a bidirectional connection, however, preferably will apply the latter for other purposes than those known from the systems known up to the present. According to the invention, preferably use shall be made of bidirectional connections or "links" between at least a number of the specific users and the aforementioned basic system, such for transferring data related to the management of basic data, more particularly, the management of codes and keys. The bidirectional connection, however, preferably is not used for confirming the receipt of the specific data. As such bidirectional connection is applied exclusively for basic data, it does not have to be permanently active, as a result of which, seen in total, the bidirectional connections do not have a disadvantageous influence on the capacity of the entire system.

According to a variant, such system can also be applied by broadcasting the new keys to certain groups by means of old keys. In this manner, new data streams, related to the previous, such as upgrades, new services and such, can also be received.

In the first place, the invention is related to transmitting information to vehicles. Hereby, a variety of applications can be aimed at. So, for example, may the general data consist of radio signals of a radio station, whereas the specific data are formed by reports which are intended exclusively for one or more users.

In another practical application, the specific data shall comprise at least executable data by means of which a new

functionality is downloaded at the users'.

There are also "meta-data" comprising information related to the other data or, thus, the general or specific data, such as, amongst others, the size, the used compression, etc.

The invention also relates to a device for wireless data distribution, whereby the aforementioned method is realized. To this aim, this device at least consists of means which divide the data in, on one hand, general data destined for a major group of users and, on the other hand, specific data intended for one or more specific users of the aforementioned group; means for wireless transmitting the general data and specific data in the form of one data stream, from a basic system to the users; and means situated at the users' of the specific data, as a result of which the specific data are made available to the users thereof.

Preferably, the basic system comprises means for encoding the specific data before the transmission thereof, whereas the general data remain un-encoded, whereby at least a number of users have means available for decoding the specific data destined for them.

It is also preferred that, in accordance with the preferred forms of embodiment of the method described in the aforegoing, the basic system comprises means providing for that at least a number of the specific or general data is transmitted repetitively, possibly with varying parameters, such as, amongst others, the repetition frequency and the like.

In a practical application, the users will be formed by modules which are built-in in vehicles and which are

intended for providing information for the users of the vehicles.

With the intention of better showing the characteristics of the invention, hereafter, as an example without limitative character, a preferred form of embodiment is described, with reference to the accompanying drawings, wherein:

figure 1 schematically represents a device according to the invention;
figure 2 schematically represents a so-called frame of the data stream transmitted according to the invention.

The device 1 comprises a basic system 2, such as a central station which is provided with the necessary transmission and possibly receiving means, as well as users 3A-3B-3C-..., which mostly will be subgroups of users, which, in the represented example, each are represented schematically as one module, which, for example, each are built-in in a vehicle.

According to the invention, the device 1, and more particularly the basic system 2, comprises means 4, such as an appropriate computer unit, which divide the data to be transmitted into, on one hand, general data A destined for a major group of users, more particularly all of the aforementioned users 3A-3B-3C-... and, on the other hand, specific data S1-S2-... intended for one or more specific users from the aforementioned group. In the represented example, the specific information S1 is intended for user 3A, whereas the specific information S2 is intended for user 3C. For user 3B, exclusively the receipt of general information A is permitted.

Further, the device 1 comprises means for wireless transmission of the general data A and specific data S1-S2-... in the shape of one data stream 5, from the basic system 2 to the users 3A-3B-3C-... These means can form part of the computer unit 4 and further also comprise the not-represented transmission and receiving apparatus for realizing a wireless connection.

At the users' 3A-3B-3C-..., there are means 6, formed by a suitable electronic circuit or similar, by which the general data are made available for each user, whereas the specific data exclusively are made available in a useful manner for the users which are entitled thereto.

The data which by the means 6 are allowed to pass then are transmitted further to means 7 utilizing and/or transferring this information into data which, for example, can be percepted by the driver of the vehicle, which means 7 either may form part of the aforementioned module or not.

Before being transmitted, the specific data S1-S2-... are encoded in the basic system, whereas the general data A remain un-encoded. In the means 6 at the users' 3A-3B-3C-..., the specific data destined for the latter are decoded.

By using suitable keys, more particularly code keys and/or encrypting keys, the means 6 exclusively accept those specific data which may be transmitted further to the respective user. This means that the means 6 at the user's 3A exclusively accept the general data A and the specific data S1. At the user's 3B, these are exclusively the general data A, and at the user's 3C, these, then, are the general data A, together with the specific data S2.

Between the basic system 2 and the users 3A-3B-3C-..., at least in the represented example, there exist also bidirectional connections L1, L2, L3, etc. which substantially are intended for exchanging information related to the management of, for example, the code keys.

Figure 5 schematically represents a possible design, or so-called "framing", of the data stream 5. According to the invention, each frame 8 thereby comprises at least two groups of signals, on one hand, a group comprising the general data A and, on the other hand, a group comprising the specific data S1-S2-... Of course, in such frame also other data parts 9-10 can be incorporated, amongst which a "frame code check" and such.

As noted in the introduction, it is preferred that the specific data S1-S2-... are transmitted repetitively, whereas this preferably is not the case for information A.

This means that in each frame 8, the data A mostly are different. The specific information S1-S2-..., however, repeats itself over different successive frames 8. This repetition can be complete or partial, in other words, not all specific data necessarily have to be repeated for the same number of times.

The number of repetitions can be chosen in function of the desired certainty with which the data have to arrive. This number then also determines the reliability of the connection.

An advantage therewith is that the reliability is independent from the number of users.

In function of requirement, at the side of the supplier,

thus, the basic system 2, a number of additional operations can be performed, such as:

- multiplexing different data streams;
- adding redundancy for error correction and control,
- possibly adding encryption and hashing data, etc.

It is clear that, depending on the applied starting parameters, different effects are obtained in respect to the safety of the data transmission, duration, etc. This is shown in the following by means of two examples which are solely informative and non-limitative.

The first example relates to an application whereby a moderate data volume is transmitted.

Exclusively by way of example, the following data are used as a basis:

- the total data volume is 1 Mbyte, whereby 1 Mbyte in this case is equal to 8 Mbit;
- the wireless transmission medium has a bandwidth of 100 kbit per second;
- the probability "F" of a false block at a size of 1 kbit is $1e^{-3}$;
- 50% of the total bandwidth are preserved for other services than transmitting the aforementioned specific data;
- the average size of the service data or specific data S1-S2-... is 100 kbit;
- as a consequence, the number of "services" is 80, to wit 8Mbit/100 kbit;
- it is assumed that all service data S1, S2, etc. are transmitted with the same parameters in

respect to reliability, thus, with the same repetition.

As a result thereof, by means of approximate calculation, the following results are obtained:

- 50% of the bandwidth is 50 kbit per second;
- the cycle time thus is:
  8 Mbit / 50 kbit per sec = 160 seconds;
- the probability "P" that a service code or, thus, a data S1, etc., is correctly received after "n" cycles, is:
  $P = \text{number of blocks} \times F^{n+1}$
  after 2 cycles, this is 0,0001
  after 3 cycles, this is 0,0000001
  or, in other words, the probability that a "service" or, in other words, a code or data part S1, S2, etc., respectively, is not received after 8 minutes, is smaller than $1e^{-7}$, and this independently from the number of vehicles.

The second example relates to an application with larger volumes.

Exclusively by way of example, hereby one starts from the following data:

- the total data volume is 100 Mbyte or thus, in the case that 1 byte is equal to 8 bits, 800 Mbit;
- the wireless transmission medium has a bandwidth of 1 Mbit per second;
- the probability "F" of a false block at a size of 1 kbit is $1e^{-3}$;
- 50% of the total bandwidth are preserved for other services than transmitting the aforemen-

tioned specific data;

- the average size of the service data or specific data S1-S2-... is 100 kbit;
- the number of "services" is 8000;
- it is assumed that all service data S1, S2, etc. are transmitted with the same parameters in respect to reliability, thus, with the same repetition.

As a consequence thereof, the following results are obtained:

- the cycle time becomes :
  800 Mbit / 500 kbit per sec ≈ 1600 seconds;
- continuing from this example, the probability that a user or receiver has not received all data after 2 cycles is:
  $100 \times (1e^{-3})^2 = 0{,}0001$ or, thus, 0,01%
- this means that the probability that a certain data unit has not been received after 1 hour is smaller than $1e^{-4}$, and this independently from the number of users or vehicles, whereby, however, it must be noted that 90% of the users obtain all necessary information within 27 minutes.

The present invention is in no way limited to the forms of embodiment described as an example and represented in the figures, on the contrary may the method and device of the invention be realized according to different variants while still remaining within the scope of the invention.

So, for example, at least a number of the data may be compressed. The data may also comprise authentication information, whether or not combined with an encoding of data.

It is also possible to apply for each data block, more particularly the specific data and the general data, a different repetition frequency, which possibly may vary in time.

Claims.

1.- Method for wireless data distribution, characterized in that the data are divided in, on one hand, general data (A) destined for a major group of users (3A-3B-3C-...) and, on the other hand, specific data (S1-S2-...) intended for one or more specific users (3A-3B-3C...) from the aforementioned group; that the general data (A) and specific data (S1-S2-...) are transmitted wireless in the form of one data stream (5), from a basic system (2) to the users (3A-3B-3C-...); and that at the users' (3A-3B-3C-...) of the specific data (S1-S2-...), by means of filtering, the specific data (S1-S2-...) concerned are made available, whereas the general data (A) are made available for all users (3A-3B-3C-...).

2.- Method according to claim 1, characterized in that at least a number of the specific data (S1-S2-...) and/or general data (A) is sent repetitively.

3.- Method according to any of the preceding claims, characterized in that all specific data (S1-S2-...) are sent repetitively.

4.- Method according to claim 2 or 3, characterized in that for each data block, more particularly the specific data and the general data, a different frequency of repetition is applied, which possibly may be altered in time.

5.- Method according to any of the preceding claims, characterized in that at least a number of the data is compressed.

6.- Method according to any of the preceding claims,

characterized in that the data are transmitted according to a broadcast or multicast principle.

7.- Method according to any of the preceding claims, characterized in that the specific data (S1-S2-...) are sent encoded and that at the users' (3A-3B-3C-...) of the specific data (S1-S2-...), by means of a decoding of the specific data (S1-S2-...), exclusively those specific data (S1-S2-...) are passed on to these users (3A-3B-3C-...) having access thereto, whereas the general data (A) remain accessible to all users (3A-3B-3C-...).

8.- Method according to any of the preceding claims, characterized in that an encoding of the specific information takes place which is performed by means of codification and/or encrypting, and/or that thereby an authentication is performed.

9.- Method according to claim 7 or 8, characterized in that several keys are applied, as a result of which a difference is made between the different specific users (3A-3B-3C-...) or groups of users (3A-3B-3C-...).

10.- Method according to any of the preceding claims, characterized in that use is made of bidirectional connections or links (L1,L2,L3,...) between at least a number of the specific users (3A-3B-3C-...) and said basic system (2).

11.- Method according to claim 10, characterized in that the bidirectional connections exclusively are applied for transmitting data relating to the management of basic data, more particularly the management of codes and keys and/or the confirmation of the receipt of data, if this is considered necessary or desired.

12.- Method according to any of the preceding claims, characterized in that it is applied for sending informations to vehicles.

13.- Method according to any of the preceding claims, characterized in that for the data stream (5), a framing is applied with frames (8) which each comprise at least two parts, with the general data (A) and with the specific data (S1-S2-...), respectively.

14.- Method according to any of the preceding claims, characterized in that the data comprise executable data by means of which a new functionality is downloaded at the users'.

15.- Method according to any of the preceding claims, characterized in that at least a number of said users (3A-3B-3C-...) is formed by subgroups.

16.- Device for wireless data distribution according to the method of any of the preceding claims, characterized in that it at least consists of means (4) dividing the data in, on one hand, general data (A) destined for a major group of users (3A-3B-3C-...) and, on the other hand, specific data (S1-S2-...) intended for one or more specific users (3A-3B-3C...) from the aforementioned group; means which transmit the general data (A) and specific data (S1-S2-...) wireless in the form of one data stream (5), from a basic system (2) to the users (3A-3B-3C-...); and means (6) situated at the users' (3A-3B-3C-...) of the specific data (S1-S2-...), as a result of which the specific data (S1-S2-...) selectively are made available for the users (3A-3B-3C-...) thereof.

17.- Device according to claim 16, characterized in that the basic system (2) comprises means which encode the

specific data (S1-S2-...) before the transmission thereof, whereas the general data (A) remain un-encoded, however, possibly comprise authentication information, whereas at least a number of the users (3A-3B-3C-...) have means available for decoding the specific data (S1-S2-...) intended for them.

18.- Device according to claim 15, 16 or 17, characterized in that the basic system (2) comprises means providing for that at least a number of the data are sent repetitively.

19.- Device according to any of the claims 15 to 18, characterized in that the users (3A-3B-3C-...) consist of modules built-in in vehicles.

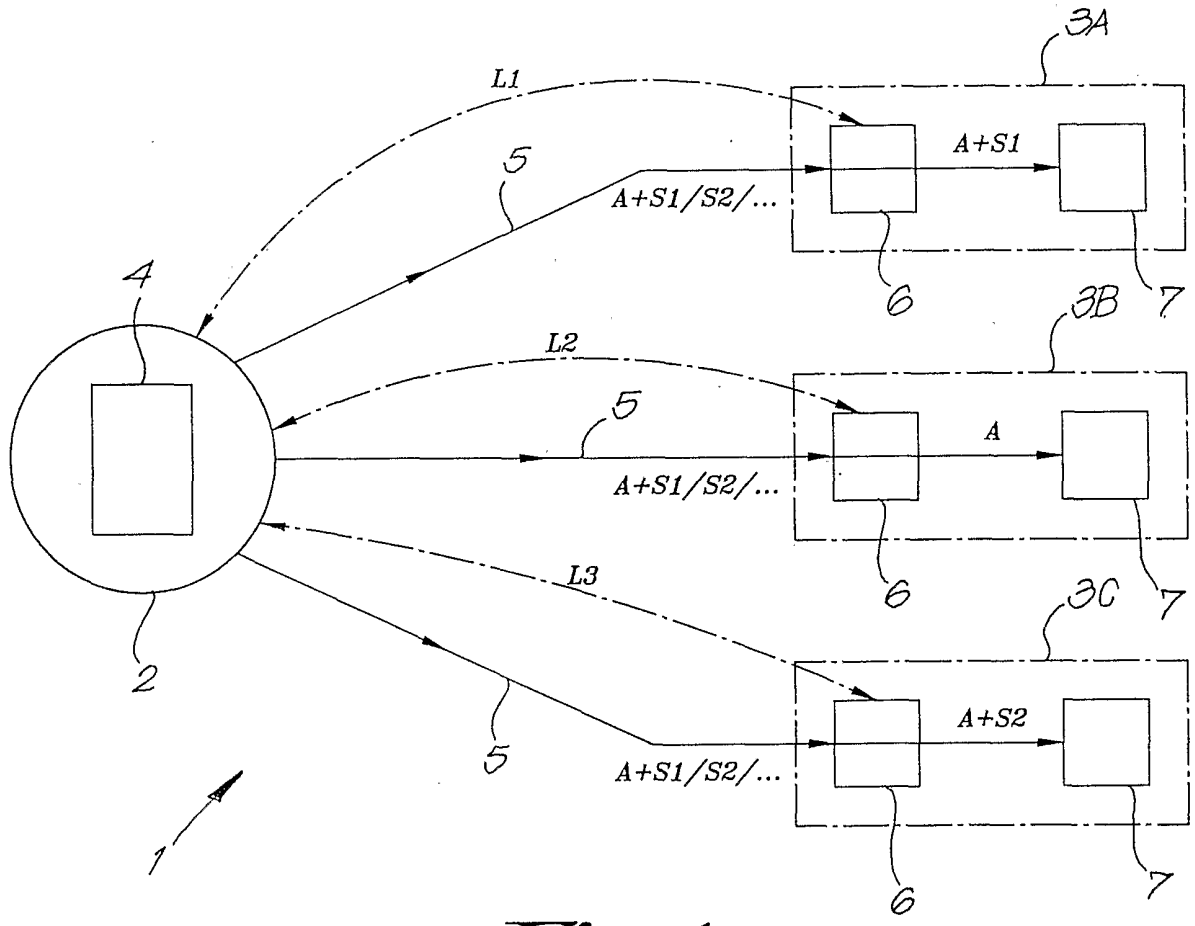
3A
L1
5
A+S1
A+S1/S2/...
4
6
7
3B
L2
5
A
A+S1/S2/...
6
7
L3
3C
2
5
A+S2
A+S1/S2/...
1
6
7

Fig. 1

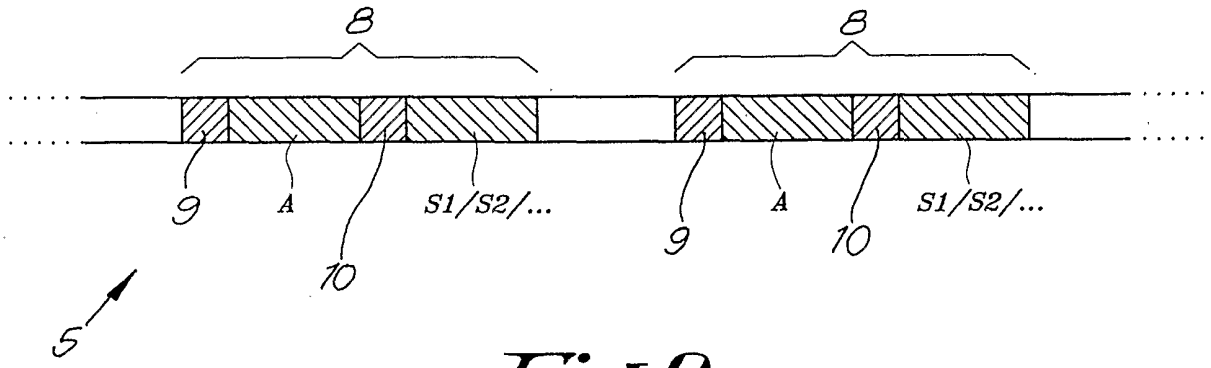
8
8
9
A
S1/S2/...
10
9
A
10
S1/S2/...
5

Fig. 2