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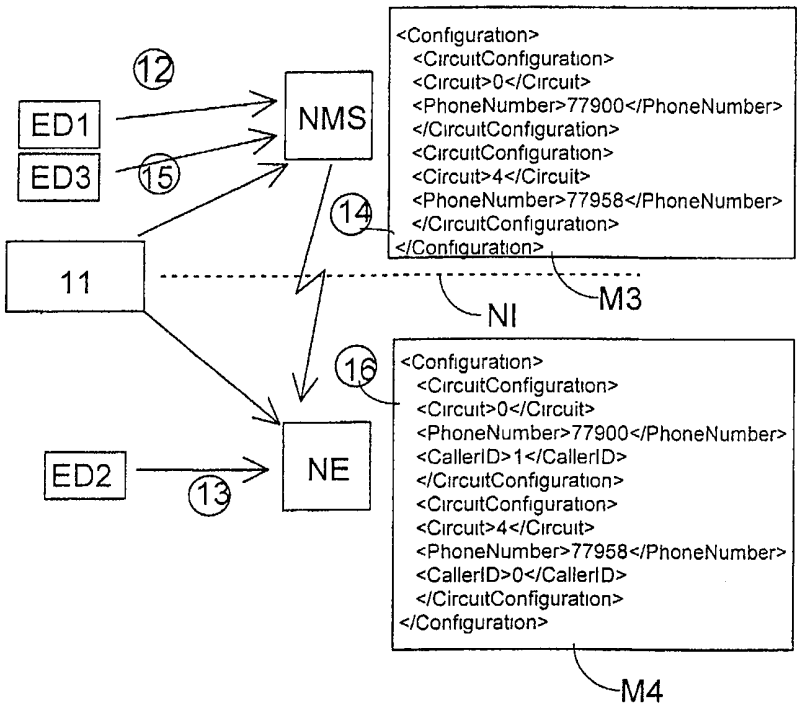
(54) Title: METHOD AND APPARATUS FOR DEFINING INTERFACE AND TELECOMMUNICATION SYSTEM

(57) Abstract

A method and apparatus for defining an interface between a network management system and a network element in a telecommunication network, wherein data elements that can be transferred over the interface are defined and stored in the network management system and network element. The data elements that can be transferred over the interface are defined by means of a self–describing mark–up language, the data elements and their values are coded by means of the self–describing mark–up language, the coded data elements and their values are conveyed over the interface and decoded at the receiving end. Different element definitions can be stored in the network management system and network element, whereby the element definition that can be transferred over the new interface can be stored either in the network management system or in the network element.



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METHOD AND APPARATUS FOR DEFINING INTERFACE AND TELECOMMUNICATION SYSTEM

The invention relates to a method for defining an interface between a network management system and a network element in a telecommunication network, in which method data elements that can be transferred over an interface are defined.

The invention also relates to a telecommunication system comprising a network management system and at least one network element and an interface between them, the interface being arranged to be defined by means of data elements.

The invention further relates to a telecommunication network element arranged to define an interface between a network management system and a network element in the telecommunication network.

The term interface refers in this connection to a point of contact between two co-operating devices, systems or programs and an agreement on the demands of the co-operation. The term telecommunication network element refers herein to a network management system or a network element, whereby the above mentioned interface can also be formed between two network elements, if at least one of the network elements is responsible for the functions of the network management system.

In large telecommunication networks, the functioning of network management systems is an essential prerequisite for ensuring the network operation. Network management systems are especially important in wireless telecommunication networks, e.g. large mobile communication networks, which may comprise thousands of logical network elements. As mobile communication networks are becoming more common, the demands for increasing the coverage area and capacity of networks become naturally stronger, which for its part increases the amount of various network elements managed by one network operator.

This demands a lot from a network management system. A network operator has to be able to monitor and control network capacity and network elements preferably from one point. Further, information on the operation of all elements should be provided at regular intervals, the information concerning element load, what kind of data transmission takes place through an element and malfunctions of elements. Adding new network elements to a telecommunication network and network management system has to be easy, which re-

quires that interfaces are accurately defined both between different network elements and between network elements and the network management system.

The term network interface is used for an interface between network elements and a network management system. The network interface allows us to determine which network element functions the network management system is capable of controlling and monitoring. If network element functions are developed or the network element is replaced by a new network element, the network interface must be redefined. In modern telecommunication networks network interfaces are defined already while the network is being planned before the implementation of network elements and the network management system. Typically a network interface is programmed into the network element and network management system already at the stage of production.

What creates problems in the above arrangement are the drawbacks caused by the redefinition of a network interface. If, due to the development of technology or hardware changes, the network interface has to be redefined or additional definitions have to be made, the network interface must be reprogrammed both in the network element using said interface and in the network management system. What this additional updating, potential hardware and software changes resulting therefrom and testings mean for production is that manufacturing times become longer and that products that have already been manufactured have to be updated again. In installed telecommunication networks, both the network element and the network management system have to be reprogrammed, which causes a lot of extra work. Typically the network element or network management system, or both, must be disconnected from the telecommunication network during updating, which naturally weakens the network capacity and requires a good planning of back-up systems.

The object of the invention is thus to provide a method and an apparatus implementing the method, by which the above problems can be eliminated. The objects of the invention are achieved by a method, which is characterized by

coding said data elements that can be transferred over the interface and their values by means of a self-describing mark-up language,

conveying the data elements and their values coded by means of said self-describing mark-up language over said interface and

decoding the received data elements and their values.

The telecommunication system of the invention is characterized in that

said data elements and their values are arranged to be coded by means of a self-describing mark-up language,

the data elements and their values coded by means of said self-describing mark-up language are arranged to be conveyed over said interface and

the received data elements and their values coded by means of said self-describing mark-up language are arranged to be decoded.

The telecommunication network element of the invention is characterized in that

the apparatus comprises means for coding data elements and their values by means of a self-describing mark-up language and/or

means for decoding the data elements and their values coded by means of the self-describing mark-up language and

communication means for receiving the coded data elements and their values and/or conveying them over the interface.

According to a preferred embodiment of the invention, different element definitions can be stored in the network management system and network element, and the element definition that can be transferred over the new interface can be stored either in the network management system or in the network element. Further, according to a preferred embodiment of the invention data elements and their values are coded by means of a self-describing mark-up language into a message such that the coded message comprises a start field, an information field and preferably an end field.

The invention is based on the idea that interface definitions are conveyed over the network interface such that data elements according to the interface definitions and the data element values are coded into the message to be transmitted. The receiver is capable of decoding the data elements and their values contained in the message.

The method of the invention provides the advantage that it is much more easier to define interfaces. The procedure of the invention for defining interfaces does not require the same interface definition on both sides of the network interface, so the interface definitions can be made in the network management system and the network element at different times. A network

management system and network element can communicate over the network interface, even though their interface definitions were different, and, unlike in the prior art, differences in the interface definitions do not cause a wrong interpretation of the messages to be conveyed over the network interface. Thus, in installed telecommunication networks, network elements or a network management system do not have to be disconnected during updating, and the updating does not have a harmful effect on the network capacity. Further, additional updatings in the production need not be made, as the procedure of the invention does not require the same interface definition in the network management system and network element at the installing stage either.

In the following the invention will be described in greater detail in connection with preferred embodiments, with reference to the attached drawings, in which

Figure 1 shows a network management system of a telecommunication network and network elements belonging to the telecommunication network;

Figure 2 shows a prior art method for defining a network interface;

Figure 3 shows a prior art method for updating a network interface definition;

Figure 4 shows a method according to a preferred embodiment of the invention for defining and updating a network interface;

Figure 5 shows a message according to a preferred embodiment of the invention for defining a network interface;

Figure 6 shows a block diagram of a telecommunication network element according to a preferred embodiment of the invention for defining a network interface and

Figure 7 shows a telecommunication system according to a preferred embodiment of the invention.

With reference to Figure 1, a typical network management system of a mobile communication network, especially GSM network, is described in greater detail in the following. However, the invention is not restricted to wireless telecommunication networks only, but the method of the invention can be used in any telecommunication network.

Figure 1 shows a typical centralized network management system (NMS), which is in connection with various network elements (NE) via a data communication network (DCN). A data communication network can be imple-

mented in a variety of known ways, e.g. as a circuit-switched PCM connection (Pulse Code Modulation), a packet-switched network or a local area network according to the OSI model. A network management system controls and monitors mobile services switching centres (MSC), visitor location registers (VLR) in connection with them, home location registers (HLR) typically also comprising an equipment identity register (EIR) and an authentication centre (AC), base station controllers (BSC), transcoders and submultiplexers (TCSM) and base transceiver stations (BTS). In addition, subordinated to a network management system, there may be network elements that do not directly belong to the functions of the mobile communication network, such as a short message service centre (SMSC) or a service control point (SCP) of an intelligent network. There may be thousands of different network elements that are subordinated to the network management system. Typically the network management system itself comprises several servers (S1, S2) and work stations (WS1 to WS3) providing a user interface. At least one server is typically reserved as a database server (DBS), to which measuring information on the network element operation can be stored.

It is to be noted that in telecommunication networks, a network management system need not necessarily be centralized, as described above, but also a decentralized network management system can be used in telecommunication networks. The network comprises then several network management systems NMS, which are independent of each other and each of which has its own sphere of responsibilities in controlling network elements. Also a network element can perform functions of a network management system in respect of other network elements. A network management system can thus be interpreted as one telecommunication network element. The method of the invention can also be applied to a decentralized network management system.

By means of Figure 2, a prior art procedure is next described for defining a network interface. Figure 2 shows a simplified telecommunication system, in which only one network management system NMS and one network element NE are described. To make the principles clearer, the amount of parameters in the interface definition (ID) is minimised. In real telecommunication systems, there are hundreds or thousands of network elements and definition parameters. There can also be several network management systems in a telecommunication system. Through a network interface (NI), information is

typically conveyed in two directions: from a network element to a network management system and vice versa. The information that is sent from the network element comprises configuration information, error messages and information on performance figures of the network element. On the basis of this information, information on network element configurations and performance figures and on error situations is updated in the network management system. The information that is sent from the network management system to the network element typically comprises configuration information by which the network management system defines network element settings. The principles that are now described for defining a network interface are applicable both from the network element to the network management system and in the opposite direction. To simplify the description, however, only methods for transmitting data from the network management system to the network element are explained.

According to the prior art, a network interface is defined before the network element and network management system are definitively installed and introduced in the telecommunication network. In the interface definition, either generally accepted standard interfaces or de facto standard interfaces can be used or the interface can be defined by the manufacturer itself. By way of example, the interface definition ID1 of Figure 2 only comprises one defined set of data elements and parameters *Configuration*. This is determined to comprise one or more data elements *CircuitConfiguration*, which according to the definition further comprises parameters *Circuit* and *PhoneNumber*. The parameter *Circuit* is given a value having the length of one byte, which value can be expressed as a hexadecimal number, for example. Further, according to the interface definition ID1 the parameter *PhoneNumber* further comprises a field *Length*, which is further determined to have the length of one byte, and a field *ASCII digit*, which may comprise one to eight ASCII-coded numerical values.

After the interface definition ID1 is performed (step 1), it is updated both in the network management system NMS and the network element NE (step 2). The updating into a part of the total definition of the network interface can be done for example manually by programming or automatically as a programming language translation. When the interface definition ID1 is updated both in the network management system NMS and the network element NE, the network management system NMS can transmit configuration information

according to the interface definition ID1 to the network element NE (step 3). The configuration information to be conveyed only comprises the values according to the interface definition ID1, and no definitions describing the values are sent at this stage. As the same interface definition ID1 is updated on both sides of the network interface, the network element can interpret the received values and perform a configuration according to these values.

In Figure 2, a configuration message M1 according to the interface definition ID1 that is sent from the network management system NMS to the network element NE (step 3) shows the byte values as hexadecimal numbers. The first byte 00 in the configuration message M1 sets a value 0 to the parameter *Circuit*. The second byte 05 sets a value 5 to the field *Length* of the parameter *PhoneNumber*, indicating that the next five bytes represent a phone number having five numbers. The bytes 3 to 7 represent ASCII-coded numbers 77900 as corresponding hexadecimal values 37 37 39 30 30. Thus, the bytes 1 to 7 form one data element *CircuitConfiguration*, by which a value 0 is defined to the parameter *Circuit* and a value 77900 to the parameter *PhoneNumber*. Starting from the byte 8 in the configuration message M1, a new *CircuitConfiguration* data element begins, for which the byte 8 (04) defines a value 4 to the parameter *Circuit*, the byte 9 (05) defines a value 5 to the field *Length* and the bytes 10 to 14 (37 37 39 35 38) define a value 77958 to the parameter *PhoneNumber*. Thus, *Configuration* described by the configuration message M1 comprises two *CircuitConfiguration* definitions.

When new functions need to be added to the network element NE, the network interface usually has to be redefined. On the basis of the previous example, Figure 3 describes the change to be made in the interface definition ID1. A parameter *CallerID* that is defined in one byte is added to the data element *CircuitConfiguration* of the interface definition ID1. The parameter *CallerID* can have either a value 0 or 1, while the hexadecimal value of the byte is correspondingly 00 or 01. A new interface definition ID2 is formed this way (step 4). The changed interface definition ID2 is updated both in the network management system NMS and the network element NE (step 5), after which the network management system NMS can transmit configuration information according to the interface definition ID2 to the network element NE (step 6). The bytes 1 to 7 of the configuration message M2 correspond to those of the configuration message M1. However, the eighth byte in the configuration message M2 belongs to the first *CircuitConfiguration* data element in

which it defines a value 1 (01) to the *CallerID* parameter. Starting from the ninth byte, a new *CircuitConfiguration* data element begins, whose bytes 9 to 15 correspond to the bytes 8 to 14 of the previous example. The byte 16, too, belongs to this second *CircuitConfiguration* data element in which it defines a value 0 (00) to the parameter *CallerID*. *Configuration* described by the configuration message M2, too, comprises two *CircuitConfiguration* definitions, which have a length of eight bytes, as distinct from the *CircuitConfiguration* definitions of the configuration message M1 that have seven bytes. As the same interface definition ID2 is updated both in the network management system NMS and the network element NE, the received message can be decoded in a right way.

This prior art procedure for defining interfaces does not, however, allow that network elements and a network management system are updated at different times, but the definitions of both of them must be updated before messages can be transferred between them. If the interface definition ID2 in the previous example were updated only in the network management system and the network element still used the message interpretation according to the interface definition ID1, the eighth byte of the configuration message M2 would be interpreted to start the second *CircuitConfiguration* definition, and the message is thus decoded in the wrong way. The demand for updating the network management system and network elements simultaneously makes it more difficult to add new functions and network elements to the telecommunication network and weakens the subscriber capacity in the network for a long time.

The procedure according to the invention for defining interfaces does not require the same interface definition on both sides of the network interface. According to the invention, the network management system and network element can communicate over the network interface, even though their interface definitions were different from each other. The full functionality of interface definitions is achieved when the interface definitions correspond to each other, but differences in interface definitions do not lead to a wrong interpretation of messages conveyed over the network interface, as in the prior art.

According to a preferred embodiment of the invention, interface definition involves a self-describing interface, for the definition of which a self-describing programming language is used. The term self-describing refers herein to any definition of an entity by means of logical rules in such a manner that the entity can be interpreted on the basis of the definition by means of

said logical rules autonomously and unambiguously. A data element that is coded by a self-describing mark-up language, such as the data element *CircuitConfiguration* described above, can be decoded at the receiving end independently and exactly correctly regardless of the type, amount, order or length of the parameters contained in the data element. Further, the type of each parameter defined in a self-describing manner can be interpreted in the right way by decoding the received message. A self-describing mark-up language is not, however, restricted to these two levels, but the data elements to be defined may comprise subelements at several levels. In this connection, the term data element refers to any logically defined information entity. Every data element comprises at least one parameter, which is the smallest defined information unit.

In the following, the implementation of the invention is explained by means of the example of Figure 4. In Figure 4, a network interface NI is based on a self-describing mark-up language 11, which is used both in the network management system NMS and in the network element NE. A self-describing mark-up language allows the coding of all data elements required in interface definition, but a mark-up language as such does not include element definitions (ED). That is why element definitions are made directly to the network management system and network element. As the procedure of the invention does not require the same definitions in the network management system and network element, both parties can have their own element definitions ED1 and ED2 that differ from each other and that are correspondingly updated to the network management system (step 12) and network element (step 13).

A configuration message M3 that is formed in a self-describing mark-up language can be transmitted from the network management system, for example, to the network element over the network interface (step 14). By way of example, the content of the message is the same as in the example of Figure 2. Data elements and parameters of the message formed in a self-describing mark-up language may preferably comprise a start field typically describing the name of the data element or parameter, an information field and preferably an end field. The end field typically comprises the name of the data element or parameter and a character, e.g. "/", indicating the end field. Both the start field and the end field are separated from the information field by specific characters, such as "<" and ">". To avoid misunderstandings, fields cannot naturally contain said separation marks. The configuration message

M3 starts with a start field *Configuration* (<*Configuration*>) of the data element. The information field of the data element *Configuration* further comprises two *CircuitConfiguration* data elements with their own definitions. The configuration message M3 ends with the end field (</*Configuration*>) of the data element *Configuration*. Correspondingly, both *CircuitConfiguration* data elements comprise a start field and an end field and an information field between them, which further comprises definitions to two parameters *Circuit* and *PhoneNumber*. These parameter definitions further comprise a start field and an end field and a value for said parameter in an information field between them. The network management system comprises preferably coding and decoding means for forming and interpreting messages according to a self-describing mark-up language. The definitions of data elements and parameters described herein are not necessarily in accordance with any known mark-up language, but they are merely shown by way of example. The self-describing definition according to the invention can be carried out in an unlimited amount of self-describing mark-up languages, which may be in accordance with a standard or de facto standard, or which may be mark-up languages that are clearly planned for a specific purpose. One self-describing mark-up language, for which a standard specification has been published, is known by the name XML (Extensible Mark-up Language), which can also be applied to the method of the invention.

The structure of the self-describing mark-up language described above is only one example of how to form a self-describing mark-up language. A language structure may also differ quite much from what is described above. For example, it is not necessary to use an end field, if the beginning of the next data element or parameter can be indicated otherwise, for example by giving the length of the information field in the start field. Thus, the implementation of the invention is not dependent on the used mark-up language nor on its structure, but the invention can be implemented using any self-describing mark-up language by which coded messages can be decoded independently and unambiguously at the reception process, regardless of the type, amount, order or length of data elements and parameters of messages.

Also the network element comprises coding and decoding means for forming and interpreting messages according to a self-describing mark-up language, so the network element can decode the definitions of the configuration message M3. This does not require that element definitions stored in the network element would correspond to those in the network management sys-

tem. The receiving network element decodes two *CircuitConfiguration* data elements of the data element *Configuration* contained in the configuration message M3 and defines values 0 and 77900 and 4 and 77958 correspondingly to the parameters *Circuit* and *PhoneNumber*. In order for the network element to be able to interpret the decoded parameters and their values in the manner required by the network management system, element definitions, i.e. definitions for control information given by each parameter, that correspond to those of the network management system have to be stored in the network element.

According to a preferred embodiment of the invention, telecommunication network parts on different sides of the network interface NI can be updated at different times without having to interrupt the communication over the network interface during the time the updating is carried out on both sides of the network interface. Network elements need not be disconnected from the telecommunication network during updating either. This is possible, as the receiving network element can decode e.g. the following message, which is defined according to the invention, independently and unambiguously:

*<Circuit>*5*</Circuit><NewElement>*12345*</NewElement><PhoneNumber>*77358*</PhoneNumber>*,

in which the network element does not know the parameter *NewElement* in advance, i.e. no element definition for the data element or parameter *NewElement* has been made to the network element. However, this is coded in accordance with the mark-up language, so the receiving network element can decode it right, giving the parameter a name *NewElement* and a value 12345.

Figure 4 further illustrates how a new data element or parameter is added to interface definition. A new element definition ED3 is added to the network management system NMS (step 15). A configuration message M4, which also comprises a parameter *CallerID* according to the element definition ED3, is sent to the network element NE (step 16). The receiving network element decodes two *CircuitConfiguration* data elements of the data element *Configuration* contained in the configuration message M4, like in the decoding of the configuration message M3 described above, adding the parameter *CallerID* to both *CircuitConfiguration* data elements and giving the corresponding values 1 and 0 to them. If a definition for control information that is given by the parameter *CallerID* and its value is stored in the network element,

the configuration measure relating to the parameter can be taken. If said element definition has not been made, the decoded parameter *CallerID* and its value can for example be left unnoticed or they can be reported back to the network management system and an announcement of an unknown parameter can be made. The existence of a new data element or parameter does not, however, hinder the communication over the network interface nor does it require the simultaneous updating of the network management system and network element. Further, all the data elements and parameters received in the message can be decoded right and also interpreted right, if control information, i.e. element definitions, are defined to data elements and parameters.

To illustrate the invention, messages to be conveyed over the network interface and the definitions included in the messages are shown as ASCII-coded data elements and parameters in the above example. According to a preferred embodiment of the invention, any coding method, e.g. binary coding, can be employed. Thus, the amount of information to be conveyed over the network interface can be decreased.

According to a preferred embodiment of the invention, the amount of information can be further decreased in messages, especially when several messages or data elements having a similar structure are transmitted one after the other. This is illustrated in the following by means of Figure 5. A message can preferably be coded such that the definitions of data elements and parameters are coded only to the first message or data element and only the corresponding values are coded in the following messages and data elements. Thus, definitions that are the same as in the first message or data element need not be added to every message and data element. In the exemplary message of Figure 5, the first *CircuitConfiguration* data element of the data element *Configuration* comprises definitions for the parameters *Circuit* and *PhoneNumber* and the corresponding values 0 and 77900. As the following data elements are also *CircuitConfiguration* data elements, their definitions need not be made separately, but the same definitions are used in decodings as in the previous data element. It is then enough that the parameter values (4 and 77958 and 6 and 77932) of these data elements are added to the message to be coded. Only when the definitions of the message or data element to be transmitted change, the message to be transmitted with new definitions is coded completely with self-describing definitions. A change in the definitions can preferably be expressed in the end field of the element definition, as in the

end field </*Configuration*> of the example in Figure 5. This procedure reduces the amount of information to be transferred over the network interface considerably. Messages that are coded according to a preferred embodiment of the invention can preferably be compressed in a more compact form with any known compressing method, in principle, which further reduces the amount of information to be transferred.

Figure 6 illustrates next a telecommunication network element used for utilising the invention. As the method of the invention can be employed for defining the interface in both directions over the interface, a telecommunication network element of the invention can be implemented in the network management system or network element. In addition to means typically belonging to each telecommunication network element, the telecommunication network element of the invention preferably comprises means (UI, User Interface) for feeding element definitions to an apparatus, means for storing the element definitions (M, Memory), means for coding the element definitions by means of a self-describing mark-up language (μP, Micro Processor) and communication means (I/O, Input/Output) for receiving the coded element definitions and/or conveying them over the interface. Said means for feeding element definitions (UI) to an apparatus may preferably comprise a display and a keyboard. Further, means for storing element definitions (M) may preferably comprise random access memory (RAM) for storing element definitions and preferably erasible programmable read-only memory (EPROM) for storing coding instructions that are in accordance with a self-describing mark-up language. Means for coding element definitions (μP) may preferably be used also in the decoding of received coded data elements.

Figure 7 shows a telecommunication system according to a preferred embodiment of the invention in a simplified way, in which system a network management system NMS is in connection with several network elements NE1 to NE6 via a data communication network DCN. The data communication network DCN forms a network interface NI between the network management system and the network elements NE1 to NE6. Interface definitions that are made according to the invention are not dependent on the data transmission protocol used in the data communication network DCN, but the information on the definitions can be transferred by means of any data transmission protocol. The telecommunication system of the invention can be implemented in any telecommunication network.

In the foregoing description and drawings the invention has been described only by way of example, and it is by no means to be so restricted. It will be apparent for those skilled in the art that the invention can be applied to any other telecommunication network, in which a network management system and network elements convey control information via a network interface. Therefore, different embodiments of the invention may vary within the scope of the appended claims.

CLAIMS

1. A method for defining an interface between a network management system and a network element in a telecommunication network, in which method data elements that can be transferred over an interface are defined, **characterized** by

coding said data elements that can be transferred over the interface and their values by means of a self-describing mark-up language,

conveying the data elements and their values coded by means of said self-describing mark-up language over said interface and

decoding the received data elements and their values.

2. A method as claimed in claim 1, **characterized** by storing said element definitions in the network management system and network element.

3. A method as claimed in claim 2, **characterized** by storing different element definitions in the network management system and network element.

4. A method as claimed in claim 2 or 3, **characterized** by

defining an element definition that differs from said stored element definitions and

storing said differing element definition in the network management system and/or network element.

5. A method as claimed in any one of the preceding claims, **characterized** by taking control measures according to the received decoded data elements and their values in response to said data elements being defined in the receiving network management system or network element.

6. A method as claimed in any one of the preceding claims, **characterized** by coding the data elements and their values by means of said self-describing mark-up language into a message such that the coded message comprises a start field, an information field and an end field.

7. A method as claimed in any one of claims 1 to 5, **characterized** by coding the data elements and their values by means of said self-describing mark-up language into a message such that the coded message comprises an information field and a start field indicating the length of the information field.

8. A method as claimed in claim 6 or 7, **characterized** by

coding the first message such that it comprises at least a start field and an information field and

coding the following messages such that they comprise an information field, in response to the structure of said following messages being defined to correspond to that of the first message.

9. A method as claimed in any one of claims 6 to 8, **characterized** by coding the messages as binary coding.

10. A method as claimed in any one of claims 6 to 9, **characterized** by compressing the coded messages such that the amount of information in the messages decreases.

11. A telecommunication system comprising a network management system and at least one network element, and an interface between them, the interface being arranged to be defined by means of data elements, **characterized** in that

said data elements and their values are arranged to be coded by means of a self-describing mark-up language,

the data elements and their values coded by means of said self-describing mark-up language are arranged to be conveyed over said interface and

the received data elements and their values coded by means of said self-describing mark-up language are arranged to be decoded.

12. A telecommunication system as claimed in claim 11, **characterized** in that element definitions are stored in the network management system and/or network element.

13. A telecommunication system as claimed in claim 12, **characterized** in that different element definitions are stored in the network management system and network element.

14. A telecommunication system as claimed in any one of claims 11 to 13, **characterized** in that control measures that are in accordance with the received decoded data elements and their values are arranged to be taken in response to said data elements being defined in the receiving network management system or network element.

15. A telecommunication system as claimed in any one of claims 11 to 14, **characterized** in that the data elements and their values are coded by means of said self-describing mark-up language into a message

such that the coded message comprises a start field, an information field and an end field.

16. A telecommunication system as claimed in any one of claims 11 to 14, **characterized** in that the data elements and their values are coded by means of said self-describing mark-up language into a message such that the coded message comprises an information field and a start field indicating the length of the information field.

17. A telecommunication system as claimed in claim 15 or 16, **characterized** in that

the first message is coded such that it comprises at least a start field and an information field and

the following messages are coded such that they comprise an information field, in response to the structure of said following messages being defined to correspond to that of the first message.

18. A telecommunication system as claimed in any one of claims 15 to 17, **characterized** in that the messages are coded as binary coding.

19. A telecommunication system as claimed in any one of claims 15 to 18, **characterized** in that the coded messages are compressed in such a manner that the amount of information has been decreased in the messages.

20. A telecommunication network element arranged to define an interface between a network management system and a network element in the telecommunication network, **characterized** in that

the apparatus comprises means for coding data elements and their values by means of a self-describing mark-up language and/or

means for decoding the data elements and their values coded by means of the self-describing mark-up language and

communication means for receiving the coded data elements and their values and/or conveying them over the interface.

21. A telecommunication network element as claimed in claim 20, **characterized** in that the apparatus further comprises means for feeding and storing element definitions in a network management system or network element.

22. A telecommunication network element as claimed in claim 20 or 21, **characterized** in that said means for coding the data elements and their values by means of the self-describing mark-up language are arranged to

code the data elements and their values into a message such that the coded message comprises a start field, an information field and an end field.

23. A telecommunication network element as claimed in claim 20 or 21, **characterized** in that said means for coding the data elements and their values by means of the self-describing mark-up language are arranged to code the data elements and their values into a message such that the coded message comprises an information field and a start field indicating the length of the information field.

24. An apparatus as claimed in claim 22 or 23, **characterized** in that

said means for coding the data elements and their values by means of the self-describing mark-up language are arranged to code the first message such that it comprises at least a start field and an information field and

the following messages such that they comprise an information field, in response to the structure of said following messages being defined to correspond to that of the first message.

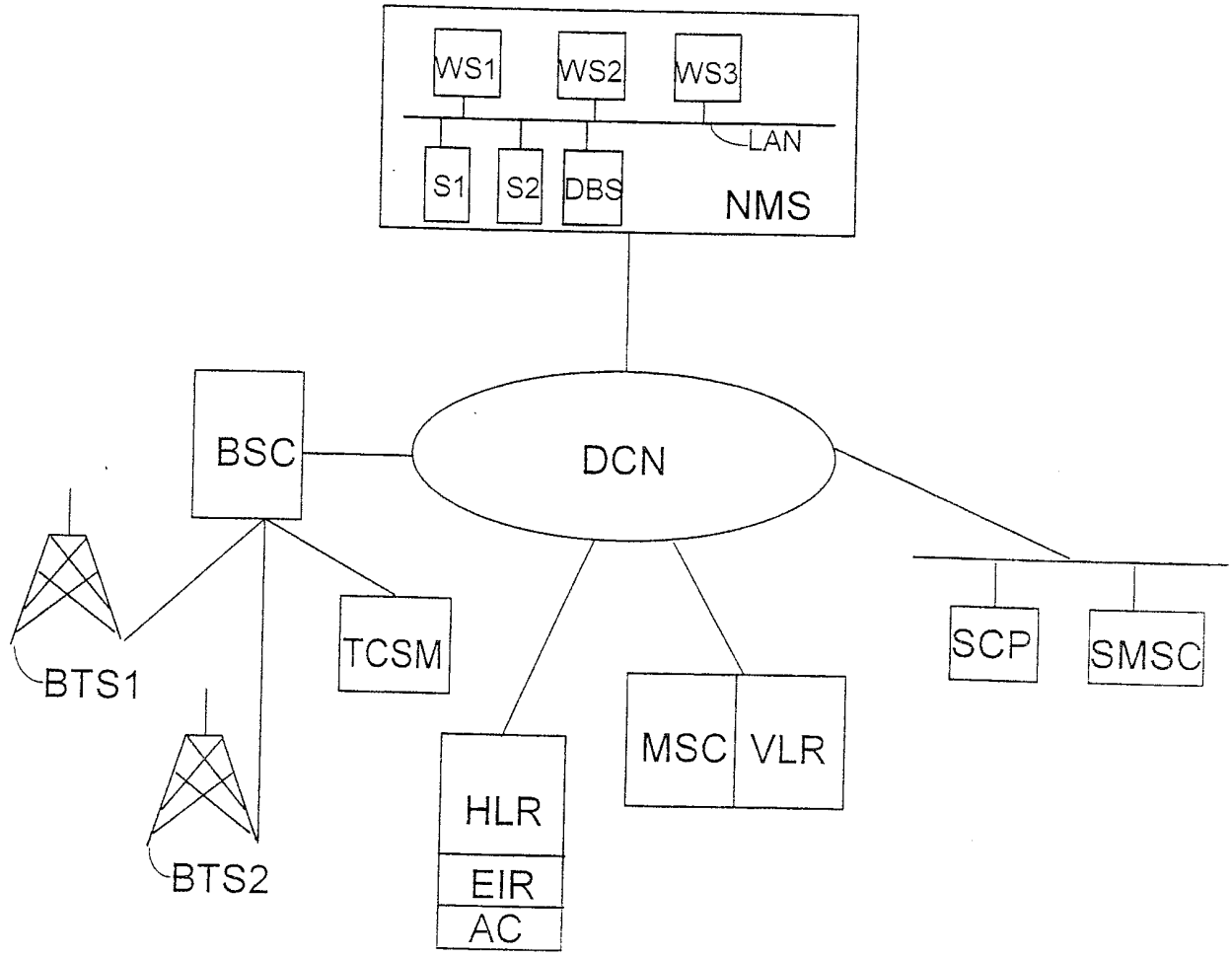
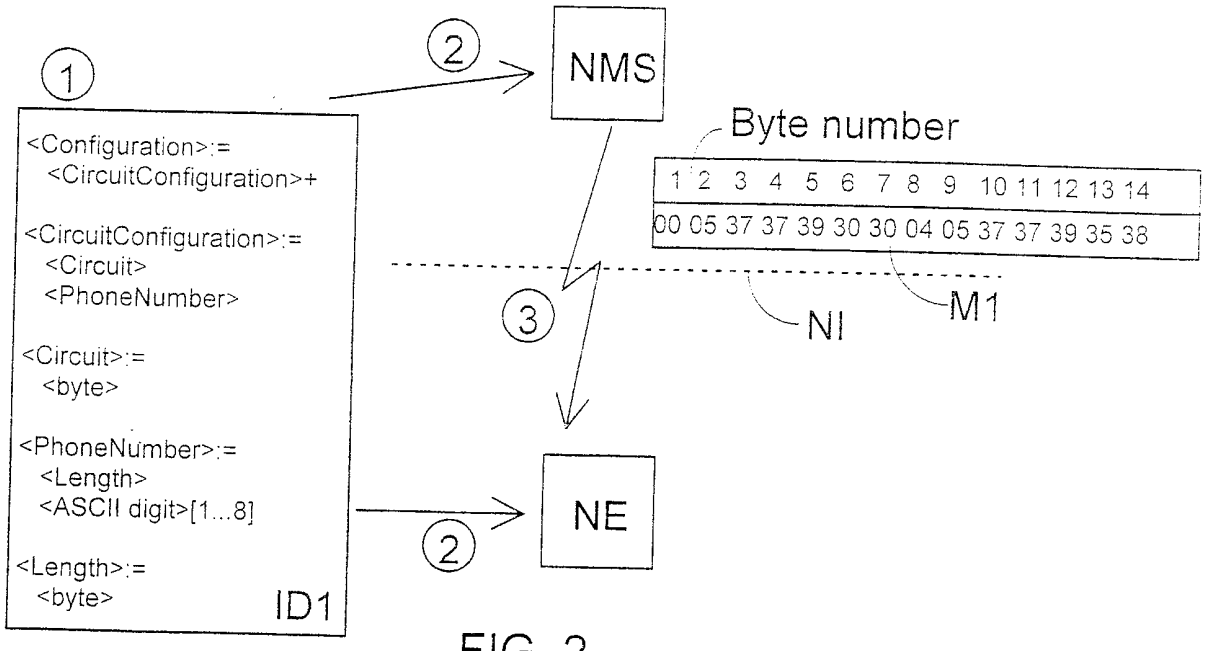

WS1
WS2
WS3
LAN
S1
S2
DBS
NMS
BSC
DCN
BTS1
TCSM
SCP
SMSC
BTS2
HLR
EIR
AC
MSC
VLR

FIG. 1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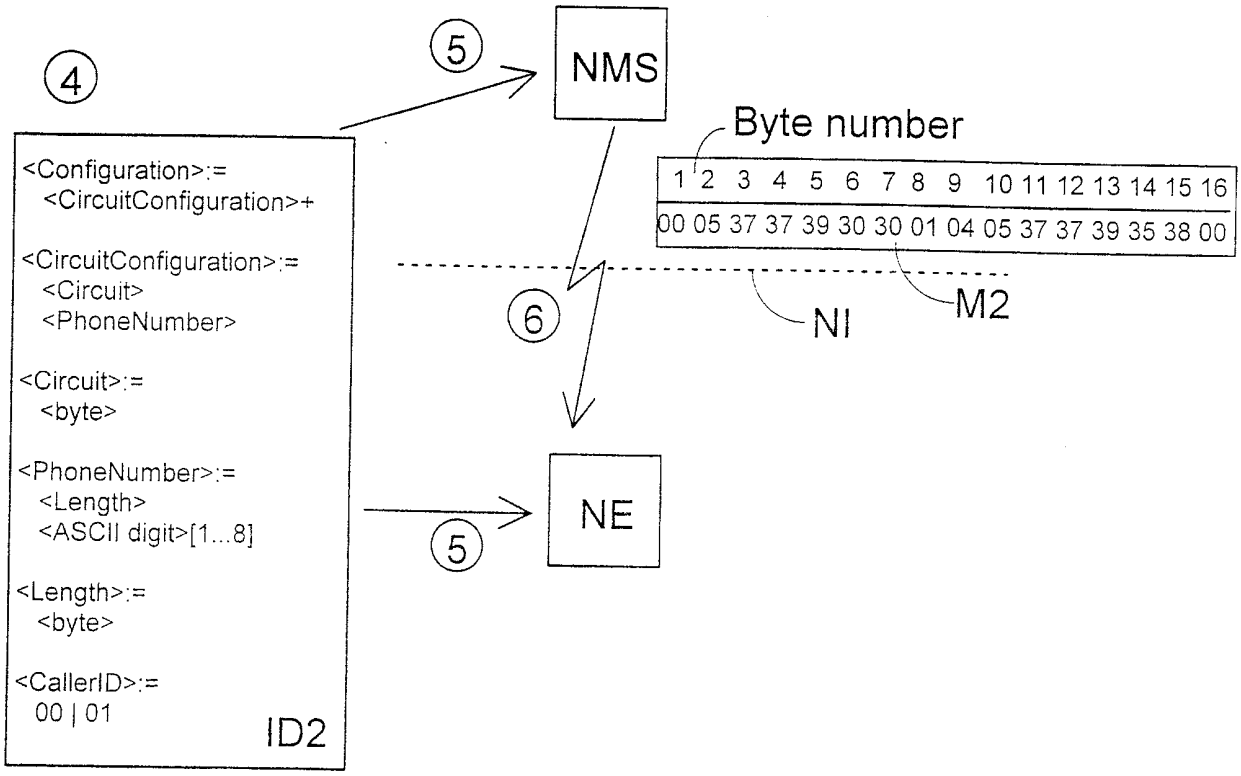
2

FIG. 2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5
NMS
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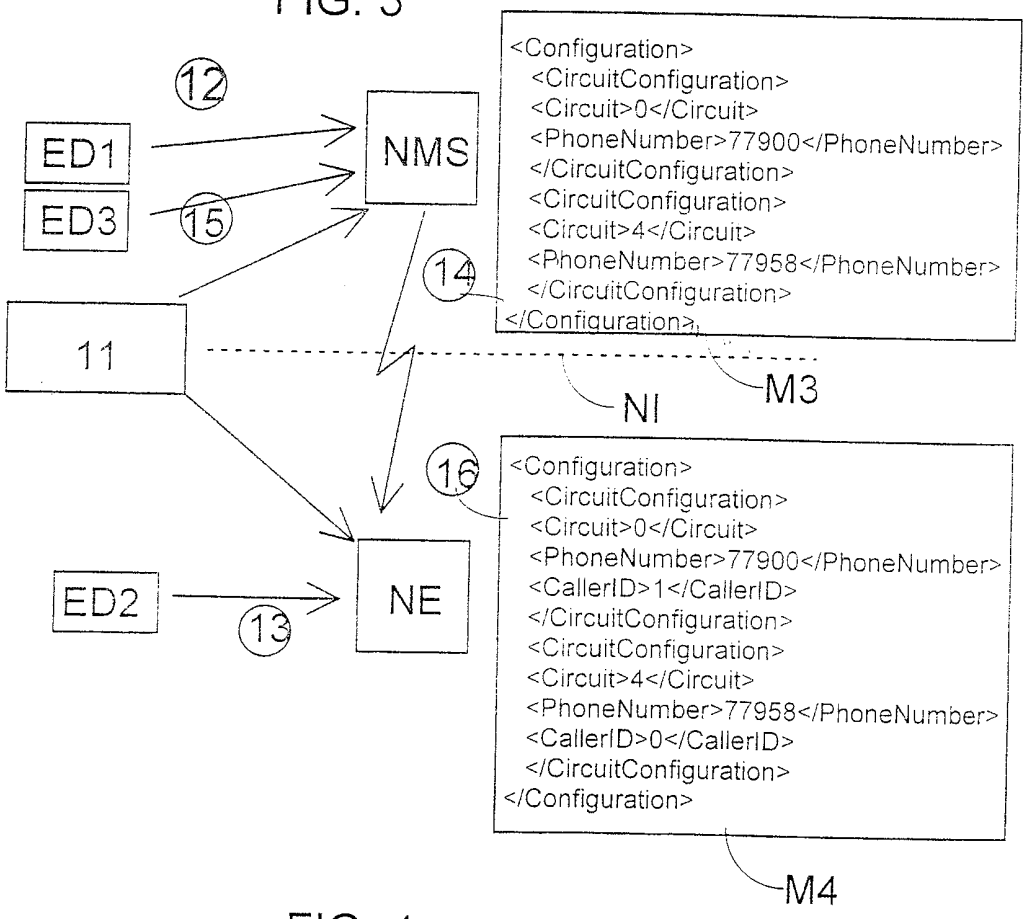
6
NI
M2
NE
5

FIG. 3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ED3
15
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11
NI
M3
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</Configuration>
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13
NE
M4

FIG. 4

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  6
  77932
</Configuration>
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FIG. 5

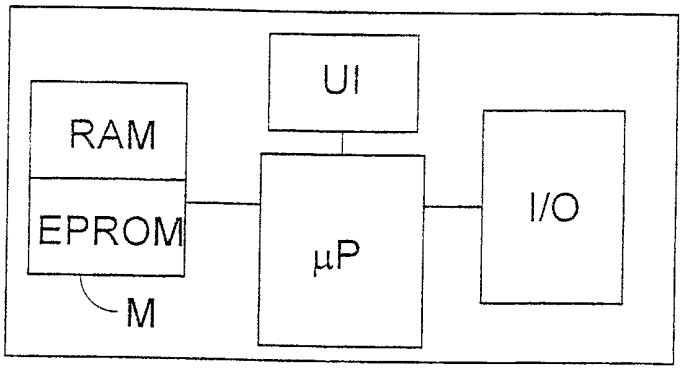

FIG. 6

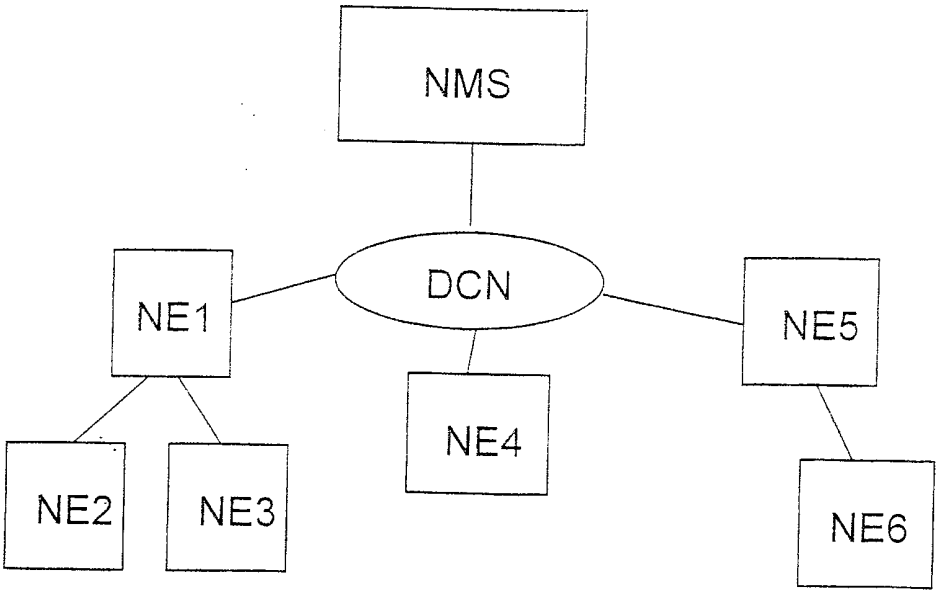

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00207

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/122, H04M 3/42
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q, H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 9940711 A1 (AMERITECH CORPORATION), 12 August 1999 (12.08.99), page 5, line 6 - line 24; page 7, line 17 - page 9, line 24	1-24
A	EP 0592154 A2 (AMERICAN TELEPHONE AND TELEGRAPH COMPANY), 13 April 1994 (13.04.94), column 2, line 1 - line 34	1,11,20
A	US 5377186 A (DAVID C. WEGNER ET AL), 27 December 1994 (27.12.94), column 6, line 1 - line 31, abstract	1,11,20

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 July 2000	02 -08- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Jaana Raivio/mj Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/FI 00/00207

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9940711 A1	12/08/99	NONE	
EP 0592154 A2	13/04/94	CA 2103868 A	10/04/94
		CA 2103869 A	10/04/94
		EP 0592153 A	13/04/94
		JP 6216996 A	05/08/94
		JP 6216997 A	05/08/94
US 5377186 A	27/12/94	CA 2128295 A	22/01/95