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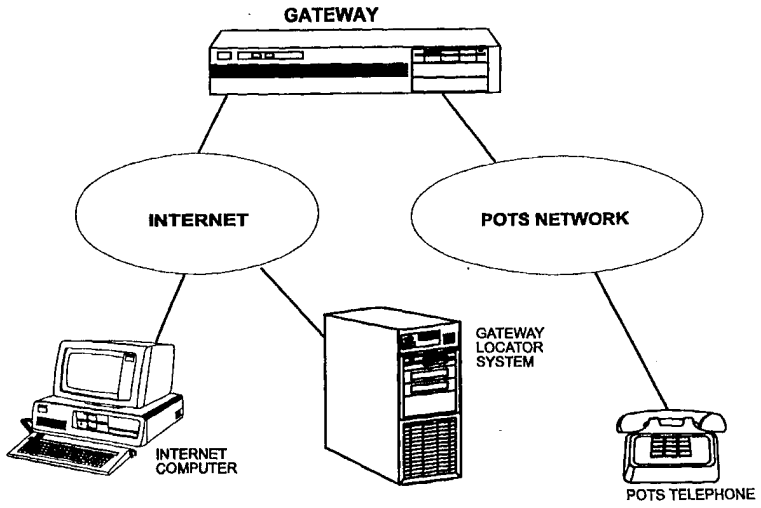

(57) Abstract

The invention provides a gateway system for an Internet telecommunication system, wherein said gateway system is adapted to connect at least one telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, and to bridge Internet voice protocols to voice protocols of said at least one telephone network, wherein said system includes a gateway locator module adapted to locate that one of a plurality of gateways which is best suited for a particular call, and wherein said gateway locator module is adapted to translate a dialed number for a telephone call into a prioritized list of preferred gateways for that call, and to locate that one of said set of preferred gateways that is available for the call and has a priority higher than other available gateways. The gateway having the highest priority is used for the call and, in the event that said gateway having the highest priority is unavailable, the other gateways, of lower priority, are tried, in turn, in accordance with their priority listing, until an available gateway is located for the call.

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GATEWAY LOCATION SYSTEM SUPPORTING POTS–INTERNET GATEWAYS

The invention relates to an Internet telecommunication system and, in particular, a gateway system for the telecommunication system, and a method for processing telephone calls over the Internet.

There is a need for a service provider, or a consortia of co-operating service providers, to be able to operate a set of Internet-POTS (Plain Ordinary Telephone Service) gateways at different locations in one, or several, countries. As can be seen from the Internet telecommunication system, which is diagrammatically illustrated in Figure 1 of the accompanying drawings, a Gateway is connected both to the Internet, which services a number of Internet computer users, and to a POTS Network, which services a number of POTS telephone users/subscribers, and the Gateway is adapted to bridge Internet voice protocols to POTS voice protocols.

It can, in general, be assumed that Internet telephony connections are charged at a flat rate and are, in practice, independent of distance, whereas the cost of POTS telephone calls are distance dependent.

In practice, the objective of a service provider is to provide a seamless service to users/subscribers, where a call is routed through a gateway, which will minimize the distance of the POTS network traversed by the call. Ideally, the user/subscriber should not have to choose the best gateway among a potentially very large set of gateways. Thus, for calls originating on the Internet side, i.e. by a user of an Internet computer, there must be a translation function for translating a "dialed number" to a "preferred gateway". Furthermore, since the "preferred gateway" may be down (inoperative), or busy, an Internet telecommunication system should be adapted to provide a second, and possibly a third, alternative gateway for a call.

According to one aspect of the present invention, there is provided, a gateway system for an Internet telecommunication system, wherein said gateway system is adapted to connect at least one telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, and to bridge Internet voice protocols to voice protocols of said at least one telephone network, and wherein said system includes a gateway locator module adapted to locate that one of a plurality of gateways which is best suited for a particular call, characterised in that said gateway locator module is adapted to translate a dialed number for a telephone call into a prioritized list of preferred gateways for that call, and to locate that one of said set of preferred gateways that is available for the call and has a priority higher than other available gateways (herein referred to as the highest priority). The gateway locator module is adapted to support telephony interworking between geographically distinct service providers.

In a preferred arrangement, the gateway having the highest priority is used for the call and, in the event that the gateway having the highest priority is unavailable, the other gateways, of lower priority, are tried, in turn, in accordance with their priority listing, until an available gateway is located for the call.

The gateway locator module may be adapted to interact with Internet users, through the World Wide Web, and the gateway locator module may include a Domain Naming System (DNS) having, for each telephone call, a Phone Gateway (PG)-record for each one of said prioritized set of preferred gateways. Each of the PG-records comprises a priority value and domain name for a respective gateway. The priority value may be a 16-digit preference value, where lower numbers indicate a higher preference, and the domain name may identify a gateway that can serve a telephone number, or a

telephone number prefix, encoded as a resolved domain name. The DNS' MX-record for mail routing is preferably used to carry the PG semantics.

A naming structure for an Internet-telephone network gateway service may include a domain name for the gateway service.

The gateway locator module preferably includes a distributed database for translating the dialed number for a telephone call into a prioritized list of preferred gateways for that call. The distributed database may be based on a Domain Naming System.

At least one of the prioritized list of preferred gateways for a call supports a VON-package used, or selected by, a calling party.

The gateway locator module preferably includes a Domain Naming System (DNS) having a VINFO record containing information on the VON-package and Nic Name to be used for voice over the Internet connections to a particular server, or host. The VINFO record is used to select a gateway for a call that supports a VON-package used, or selected by, a calling party. The VINFO record may be a string, such as, "IPHONE", or WEBPHONE", corresponding to the VON-package.

The gateway locator module preferably includes a World Wide Web (WWW) server; a Name Resolver for a Domain Name System(DNS); a Transmission Control Protocol (TCP)/Internet Protocol (IP) Interface for the WWW sever and the Name Resolver; a Gateway Locator Unit , adapted to interwork with the WWW server and the Name Resolver: and a Server System, for the DNS, adapted to interwork with the Name Resolver.

According to a second aspect of the present invention, there is provided,

an Internet telecommunication system, in which telephony and related services are provided using the Internet as a transmission medium for said services, in which a gateway system is adapted to connect at least one telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, and to bridge Internet voice protocols to voice protocols of said at least one telephone network, and in which a gateway locator system is adapted to locate that one of a plurality of gateways which is best suited for a particular call, characterised in that said telecommunication system includes a gateway system as outlined in preceding paragraphs.

According to a third aspect of the present invention, there is provided, in an Internet telecommunication system in which telephony and related services are provided using the Internet as a transmission medium for said services, in which a gateway system is adapted to connect at least one telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, and to bridge Internet voice protocols to voice protocols of said at least one telephone network, and in which a gateway locator system is adapted to locate that one of a plurality of gateways which is best suited for a particular call, a method for processing telephone calls over the Internet, characterised by the steps of translating a dialed number for a telephone call into a prioritized list of preferred gateways for that call; and locating that one of said set of preferred gateways that is available for the call and has a priority higher than other available gateways (herein referred to as the highest priority).

A preferred method may be characterised by the steps of using the gateway having the highest priority for the call; and, in the event that said gateway having the highest priority is unavailable, trying the other gateways, of lower priority, in turn, in accordance with their priority listing, until an available gateway is located for the call. In the event that none of the prioritized list of prefe call is aborted.

The method may include the step of using a Domain Naming System (DNS) to provide, for each telephone call, a Phone Gateway (PG)-record for each one of said prioritized set of preferred gateways, each of said records comprising a priority value and domain name for a respective gateway. The priority value may be a 16-digit preference value, where lower numbers indicate a higher preference, and the domain name may identify a gateway that can serve a telephone number, or a telephone number prefix, encoded as a resolved domain name.

The method may include the step of using a distributed database to translate the dialed number for a telephone call into a prioritized list of preferred gateways for that call.

In accordance with a preferred method, at least one of the prioritized list of preferred gateways for a call supports a VON-package used, or selected by, a calling party.

The method may include the steps of using a Domain Naming System (DNS) to provide a VINFO record containing information on the VON-package and Nic Name to be used for voice over the Internet connections to a particular server, or host; and using said VINFO record to select a gateway for a call that supports a VON-package used, or selected by, a calling party. The VINFO record may be a string, such as, "IPHONE", or WEBPHONE", corresponding to the VON-package.

In a preferred method, the DNS' MX-record for mail routing is used to carry the PG semantics.

The method preferably uses a naming structure to provide the domain

names, said naming structure including a domain name for an Internet-telephone network gateway service to be provided by a service provider.

The method preferably includes the steps of constructing a domain name for said gateway service to provide an apex for the naming structure; constructing a domain name for a dialed telephone number, including the name of the gateway service; attempting to DNS-resolve a string of elements forming the whole name for the dialed number; in the event that the resolution process fails, stripping off the least significant element of the string and attempting a new DNS-resolution; continuing with this process until the DNS-resolution succeeds, or the string is reduced to the name of the gateway service; and, in the event that the string is reduced to the gateway service name, the entire call attempt is aborted. In accordance with this method, on successful completion of the resolution process, a list of PG-records for a set of gateways is forwarded to the gateway locator system, and those gateways that do not support a VON-package used, or selected by, a user, are separated out, the separation being effected by performing, on each of the gateways identified by the PG-records, a DNS-lookup with QueryType=VINFO, i.e. a VINFO string is matched against the users preferred VON-package. The matched PG-records are then translated into HTML syntax, and the translated PG-records are transferred to the user; the translated PG-records representing a prioritized list of preferred gateways for a call.

In accordance with the foregoing method, a user, on making a telephone call, firstly attempts a connection to a gateway with the highest priority (lowest preference). In the event that the gateway having the highest priority is unavailable, the user tries to connect to the gateway with the second lowest preference value and so on until an available gateway is located for the call, i.e. the connection process is repeated by trying the other gateways, of lower priority, in turn, in accordance with their priority listing.

The method may include the steps of making provision for a telephone number to be redirected to another telephone number; assigning, to said redirected telephone number, a CNAME record, associated with the DNS name (coded number) corresponding to the redirected telephone number; and effecting a DNS resolution process on the CNAME.

The method may further include the steps of making provision, in the naming structure, for users having a PBX serving a number of telephone numbers having a common prefix, said users operating their own gateway serving all extensions below the prefix.

The method may still further include the steps of making provision, in the naming structure, for international calls, the telephone numbers of which are prefixed with a country code; and on completion of the indigenous gateway selection process for the call, restarting the DNS resolution process, in the country to which the call is directed, with a domain name assigned to the gateway service in that country, by a service provider. In accordance with a further step of this method, a list of PG-records is provided which corresponds to the gateways operated, in the said country, by the service provider.

The present invention is adapted to support the gateway system covered by our co-pending patent application number (Telia Case Reference No Kgp 217/96). It will be seen from our co-pending patent application that an Internet telecommunication system, in which telephony and related services are provided using the Internet as a transmission medium for the services, includes a gateway system which is adapted to connect at least one telephone network to the Internet and thereby to facilitate telephony interworking, over the Internet, between Internet users and users of the said at least one telephone network, and between said telephone network users. However, the nature of the design

of the system is such that it can, in principle, work with any other gateway design which is adapted to interface to a Gateway Locator System (see Figure 1).

The foregoing and other features of the present invention will be better understood from the following description with reference to the accompanying drawings, in which:

Figure 1 diagrammatically illustrates an Internet communication system;

Figure 2 diagrammatically illustrates, in the form of a block diagram, a gateway locator architecture, according to the present invention; and

Figure 3 illustrates part of a naming structure, or tree, which depicts an imaginary naming hierarchy.

To facilitate an understanding of the present invention, a glossary of the abbreviations used in this patent specification are set out below:

CGI: Common Gateway Interface

CNAME: Canonical name of an alias

DNS: Domain Name System

HTML: Hypertext Markup Language

HTTP: Hypertext Transfer Protocol

IP: Internet Protocol

IPHONE: VON-package from Vocaltec

MX: Type of RR (MX RR) indicating the way an E-mail is send; name on an E-post-server

PG: Phone Gateway

POTS: Plain Ordinary Telephone Service

RFC: Request For Comment; The ground for the technical documetation of Internet.

RR: Resource Records

TCP: Transmission Control Protocol

VON: Voice-over-Internet

VINFO: : A short name and information regarding von-packages, a new type of RR

WEBPHONE: VON-packages from Grace Network

WWW: World Wide Web

In accordance with the present invention, the gateway locator system of Figure 1 of the accompanying drawings will interact with users of the Internet, through the World Wide Web (WWW). The reasons for this are two fold,

namely:

1. By using the WWW, the gateway locator system will not require the use of special client software. In particular, it will be seen from the subsequent description that new types of DNS (Domain Name System) Resource Records are defined which, at least initially, will not be supported by all DNS resolvers. The design of the WWW is such that all DNS intricacies are hidden from the user.

2. The web-server of the gateway locator system provides an entry point and uniform interface to a particular service provider's gateway offering.

An architecture for a gateway locator system of the present invention, which is diagrammatically illustrated, in the form of a block diagram, in Figure 2 of the accompany drawings, includes a WWW Server 1, a Transmission Control Protocol (TCP)/Internet Protocol (IP) Interface 2 that interworks with the WWW Server 1 and a Resolver 3 for the Domain Name System(DNS). The WWW Server 1 interfaces with a Locator Module 4 by means of a Common Gateway Interface (CGI), and Locator Module 4 is adapted to interwork with the DNS' Resolver 3. The DNS' Resolver 3 also interworks with a Server System 5 for the DNS.

The core of the gateway locator system of Figure 2 is a distributed database (not shown) which is adapted to provide a translation function for translating a telephone number into a "preferred gateway", or more particularly, a prioritized list of gateways for that particular number, i.e. if the "preferred gateway" is not available, then the next gateway in the prioritized list will be used.

Furthermore, the core of the distributed database is based on a Domain

Name System [see RFC 1034, 1035]. With such a system, a telephone number is encoded in the form of Domain Names. A brief description of the Domain Name System (DNS), which is, in fact, an excerpt from RFC 1034, is given below.

In accordance with RFC 1034, the interface to the users of the gateway location service is through the World Wide Web (HTML/HTTP). Thus, when connecting to a gateway locator system (see Figure 1), a user will see a web-page having a form where the user may:

- enter the telephone number he/she wants to dial;
- select the Voice-over-Network (VON)-package he/she is using; and
- possibly also select some additional information on charging methods etc..

When the user clicks the "Submit" button, this information is transferred to a server and a new page will be presented to the user. This new page contains an ordered set of links (clickable buttons) to the gateways which are able to service the telephone number and the particular VON-package selected by the user. The telephone number is presented again so that the user will be aware if a redirect was encountered.

The Domain Name System (DNS) has three major components, namely, the Domain Name Space and Resource Records, Name Servers, and Name Resolvers.

The Domain Name Space and Resource Records are specifications for a tree structured namespace and data associated with the names. Conceptually, each node and leaf of the domain name space tree names a set

of information, and "query" operations are attempts to extract specific types of information from a particular set. A "query" names the domain name of interest and describes the type of resource information that is desired. For example, the Internet uses some of its domain names to identify hosts; queries for address resources return Internet host addresses.

Name Servers are server programs which hold information concerning the domain tree's structure and information sets. A Name Server may have cache structure, or set information, about any part of the domain tree but, in general, a particular Name Server has complete information about a subset of the domain space, and pointers to other Name Servers that can be used to lead to information from any part of the domain tree. Name Servers know the parts of the domain tree for which they have complete information; a Name Server is said to be an AUTHORITY for these parts of the name space. Authoritative information is organized into units called ZONEs, and these zones can be automatically distributed to the Name Servers which provide redundant service for the data in a zone.

Name Resolvers are programs that extract information from Name Servers in response to client requests. Resolvers must be able to access at least one Name Server and use that Name Server's information to answer a query directly, or pursue the query using referrals to other Name Servers.

A Resolver will typically be a system routine that is directly accessible to user programs. No protocol is, therefore, necessary between the Resolver and the user program.

As for a DNS extension supporting Internet-POTS Gateways, two new Resource Records (RR) will be defined to support the gateway locator service of the present invention, namely, the Phone Gateway (PG)-record and the

VINFO record.

The PG-record is a pair (i.e. “priority” and “domain-name”) where the "domain-name" identifies a gateway that can serve the POTS number (or prefix), encoded in the resolved domain name, and "priority" is a 16-digit preference value where lower numbers mean higher preference.

For example, consider the following PG-records returned by a DNS-query:

[1,phone-gw.sthlm.telia.se]
[2,phone-gw.uppsala.telia.se]
[3,phone-gw.telia.se]

The interpretation to be given to these PG-records is that the gateway having a domain name "phone-gw.sthlm.telia.se" is priority “1" and is, therefore, best suited for the telephone call. If that gateway is down, or busy, then priority “2", namely, the gateway having a domain name "phone-gw.uppsala.telia.se" should be tried. If that also fails, then the gateway having priority “3" and domain name "phone-gw.telia.se" will have to be attempted, as a last resort.

It should be noted that the syntax of a PG-record is identical to that of an MX record. However, since Mail Routing will not be relevant to the domains used to support telephone gateways, the MX record may be used to carry the PG semantics. Thus, no changes will be required to DNS Servers and Resolvers.

As for the VINFO record, this record contains information on the VON-package and Nic-Name to be used when connecting ‘voice-over the Internet’ to a particular server, or host. The VINFO record is used to select a gateway that

supports the VON-package, preferred by the user. This record is also useful for a gateway servicing POTS-originated calls which are destined for Internet users (i.e. users of computers connected to the Internet), because the gateway can determine which VON-package should be used for connection to the user's computer.

The VINFO record is a string corresponding to a VON-package, for example, ""IPHONE", or "WEBPHONE".

As for the naming structure, the service provider must establish one top domain corresponding to its POTS-Internet gateway service. This does not necessarily introduce a bottle neck, or single point of failure, because this domain can be widely replicated. Given the service provider's top-domain and the full length dialed number, a domain name can be constructed by a simple algorithm. This is best illustrated by the following example for telephone number "+ 46 8 707 5560" and a top-domain of "phonedir.telia.se":

+ 46 8 707 5560 --> p0.p6.p5.p5.p7.p0.p7.p8.p6.p4.phonedir.telia.se

This is really a "purported name" because there may, or may not, be a registered domain name corresponding to this string. However, some trailing substring of the name is likely to correspond to a node in the domain hierarchy. In the imaginary naming hierarchy, depicted in Figure 3 of the accompanying drawings, in which only part of the tree is shown, the top domain name is "phonedir.telia.se", which forms an apex for the naming structure, and there is an entry corresponding to the substring "p5.p7.p0.p7.p8.p6.p4.phonedir.telia.se".

A first step of the resolution process will be for the resolving algorithm to attempt to DNS-resolve the whole name. If that fails, the least significant

element will be stripped off, i.e. p7, in this case, and a new DNS-resolution will be attempted with the string "p6.p5.p4.p3.p2.pl.p8.p6.p4.phonedir.telia.se". If this fails, "p6" will be stripped of etc.. This process continues until the DNS-resolution succeeds, or the string is reduced to the service providers top domain, i.e. "phonedir.telia.se", in this case. If this occurs, then the entire call attempt has failed. In order to avoid unnecessary misses, a service provider may register a set of PG-records with each full length telephone number. The design is, however, robust for situations where all numbers are not registered, but name resolution performance may suffer.

If the resolution process is successful, a list of PG-records will be returned to the DNS resolver software. Thus, when the Locator Module 4 (see Figure 2) has received a list of PG-records from the DNS' Resolver 3, it is adapted to sort out those that do not support the VON-package selected by the user. This can be effected by performing a DNS-lookup with QueryType=VINFO, on each of the gateways identified by the PG-records. The VINFO string can then me matched against the users preferred VON-package. The matched PG-records are then translated into HTML syntax, by the Locator Module 4, and transferred to the user, through the WWW-Server 1. The user/client will then try to connect to the server with highest priority (lowest preference). If that server is busy, or unavailable, the user/client will try to connect to the server with the second lowest preference value etc..

The present invention also supports redirection of telephone numbers. If a particular telephone number is redirected, there will be a CNAME record, associated with the DNS name (coded number), corresponding to that telephone number. The CNAME points to the DNS name which represents the telephone number that the access shall be redirected to.

Consider, for example, a search for the telephone number +46 8 777

1111. The DNS resolver will, as illustrated in Figure 3 of the drawing, return the CNAME=pl.p2.p3.p4.p5.p6.p7.p8.p6.p4.phonedir.telia.se. The Locator Module 4, then tells the DNS' Resolver 3 to resolve this name instead.

The naming structure is flexible enough to let the service provider smoothly cooperate with partners and customers. In the example naming structure of Figure 3 of the accompanying drawings, the service provider has a customer with a PBX serving a number of telephone numbers having a common prefix, such as, "+46 8 707 5***". This customer operates his own gateway serving all extensions below this prefix. Thus, a request for telephone number "+ 46 8 707 5560" will result in the gateway having the domain name "phone-gw.haninge.trab.se", i.e. PG-record 1 of Figure 3 for the telephone number, being presented as the first choice. If this gateway is busy, or down, then the gateway "phone-gw.sthlm.telia.se" will be tried. If this also fails, then the final (last) choice will be the gateway "phone-gw.telia.se". If all three gateways are busy, or down, then the attempt to establish a telephone call connection will have failed.

Thus, in accordance with the present invention, a gateway system for an Internet telecommunication system is adapted to:

- connect at least one telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet,

- bridge Internet voice protocols to voice protocols of said at least one telephone network, and

- includes a gateway locator module adapted to:

  - translate a dialed number for a telephone call into a prioritized list

of preferred gateways for that call; and

- locate that one of said set of preferred gateways that is available for the call and has a priority higher than other available gateways.

The gateway Locator Module 4 of Figure 2 is also adapted to support partnerships between geographic distinct service providers, in that, provision is made in the name structure for international calls, i.e. the telephone numbers of which are prefixed with a country code. Thus, for telephone calls directed overseas, for example, to North America, i.e. starting with a "+1" prefix, the method of the present invention will, on completion of the indigenous gateway selection process for the call, restart the DNS resolution process, in North America, (i.e. the country to which the call is directed), with the top-domain name assigned to the gateway service, in North America, by a service provider, such as AT&T. This process will most likely result in a list of PG-records corresponding to the gateways operated by the North American service provider, such as AT&T.

CLAIMS

1. A gateway system for an Internet telecommunication system, wherein said gateway system is adapted to connect at least one telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, and to bridge Internet voice protocols to voice protocols of said at least one telephone network, and wherein said system includes a gateway locator module adapted to locate that one of a plurality of gateways which is best suited for a particular call, characterised in that said gateway locator module is adapted to translate a dialed number for a telephone call into a prioritized list of preferred gateways for that call, and to locate that one of said set of preferred gateways that is available for the call and has a priority higher than other available gateways (herein referred to as the highest priority).

2. A gateway system, as claimed in claim 1, characterised in that the gateway having the highest priority is used for the call, and in that, in the event that said gateway having the highest priority is unavailable, the other gateways, of lower priority, are tried, in turn, in accordance with their priority listing, until an available gateway is located for the call.

3. A gateway system, as claimed in any preceding claim, characterised in that said gateway locator module is adapted to interact with Internet users, through the World Wide Web, in that said gateway locator module includes a

Domain Naming System (DNS) having, for each telephone call, a Phone Gateway (PG)-record for each one of said prioritized set of preferred gateways, each of said records comprising a priority value and domain name for a respective gateway.

4. A gateway system, as claimed in claim 3, characterised in that a naming structure for an Internet-telephone network gateway service includes a domain name for the gateway service.

5. A gateway system, as claimed in claim 3, or claim 4, characterised in that said priority value is a 16-digit preference value, where lower numbers indicate a higher preference.

6. A gateway system, as claimed in any of claims 3 to 5, characterised in that said domain name identifies a gateway that can serve a telephone number, or a telephone number prefix, encoded as a resolved domain name.

7. A gateway system, as claimed in any preceding claim, characterised in that said gateway locator module includes a distributed database for translating the said dialed number for a telephone call into a prioritized list of preferred gateways for that call.

8. A gateway system, as claimed in claim 7, when appended to any of claim 4 to 7, characterised in that said distributed database is based on a Domain Naming System.

9. A gateway system, as claimed in any preceding claim, characterised in that at least one of the prioritized list of preferred gateways for a call supports a VON-package used, or selected by, a calling party.

10. A gateway system, as claimed in claim 9, characterised in that said gateway locator module includes a Domain Naming System (DNS) having a VINFO record containing information on the VON-package and Nic Name to be used for voice over the Internet connections to a particular server, or host, said VINFO record being used to select a gateway for a call that supports a VON-package used, or selected by, a calling party.

11. A gateway system, as claimed in claim 10, characterised in that said VINFO record is a string, such as, "IPHONE", or WEBPHONE", corresponding to the VON-package.

12. A gateway system, as claimed in any of claims 3 to 11, characterised in that the DNS' MX-record for mail routing is used to carry the PG semantics.

13 A gateway system, as claimed in any preceding claim, characterised in that said gateway locator module is adapted to support telephony interworking between geographically distinct service providers.

14. A gateway system, as claimed in any preceding claims, characterised in that said gateway locator module includes;

- a World Wide Web (WWW) server;
- a Name Resolver for a Domain Name System(DNS);
- a Transmission Control Protocol (TCP)/Internet Protocol (IP) Interface for the WWW sever and the Name Resolver;
- a Gateway Locator Unit , adapted to interwork with the WWW server and the Name Resolver: and
- a Server System, for the DNS, adapted to interwork with the Name Resolver.

15. An Internet telecommunication system in which telephony and related

services are provided using the Internet as a transmission medium for said services, in which a gateway system is adapted to connect at least one telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, and to bridge Internet voice protocols to voice protocols of said at least one telephone network, and in which a gateway locator system is adapted to locate that one of a plurality of gateways which is best suited for a particular call, characterised in that said telecommunication system includes a gateway system as claimed in any of claims 1 to 14.

16. In an Internet telecommunication system in which telephony and related services are provided using the Internet as a transmission medium for said services, in which a gateway system is adapted to connect at least one telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, and to bridge Internet voice protocols to voice protocols of said at least one telephone network, and in which a gateway locator system is adapted to locate that one of a plurality of gateways which is best suited for a particular call, a method for processing telephone calls over the Internet, characterised by the steps of:

- translating a dialed number for a telephone call into a prioritized list of preferred gateways for that call; and
- locating that one of said set of preferred gateways that is available for the call and has a priority higher than other available gateways (herein referred to as the highest priority).

17. A method as claimed in claim 16, characterised by the steps of:

- using the gateway having the highest priority for the call; and
- in the event that said gateway having the highest priority is unavailable, trying the other gateways, of lower priority, in turn, in accordance with their priority listing, until an available gateway is located for the call.

18. A method as claimed in claim 16, or claim 17, characterised by the step of aborting the call, in the event that none of the prioritized list of preferred gateways are available.

19. A method as claimed in any of claims 16 to 18, characterised by the step of using a Domain Naming System (DNS) to provide, for each telephone call, a Phone Gateway (PG)-record for each one of said prioritized set of preferred gateways, each of said records comprising a priority value and domain name for a respective gateway.

20. A method as claimed in claim 19, characterised in that said priority value is a 16-digit preference value, where lower numbers indicate a higher preference.

21. A method as claimed in claim 19, or claim 20, characterised in that said domain name identifies a gateway that can serve a telephone number, or a telephone number prefix, encoded as a resolved domain name.

22. A method as claimed in any of claims 16 to 21, characterised by the step of using a distributed database to translate the dialed number for a telephone call into a prioritized list of preferred gateways for that call.

23. A method as claimed in any of claims 16 to 22, characterised in that at least one of the prioritized list of preferred gateways for a call supports a VON-package used, or selected by, a calling party.

24. A method as claimed in claims 23, characterised by the steps of:

- using a Domain Naming System (DNS) to provide a VINFO record containing information on the VON-package and Nic Name to be used for voice over the Internet connections to a particular server, or host; and

- using said VINFO record to select a gateway for a call that supports a VON-package used, or selected by, a calling party.

25. A method as claimed in claim 24, characterised in that said VINFO record is a string, such as, "IPHONE", or WEBPHONE", corresponding to the VON-package.

26. A method as claimed in any of claims 19 to 24, characterised by using the DNS' MX-record for mail routing to carry the PG semantics.

27. A method as claimed in any of claims 19 to 25, characterised by the step of using a naming structure to provide said domain names, said naming structure including a domain name for an Internet-telephone network gateway service to be provided by a service provider.

28. A method as claimed in claim 26, characterised by the steps of:

- constructing a domain name for said gateway service to provide an apex for the naming structure;
- constructing a domain name for a dialed telephone number, including the name of the gateway service;
- attempting to DNS-resolve a string of elements forming the whole name for the dialed number;
- in the event that the resolution process fails, stripping off the least significant element of the string and attempting a new DNS-resolution;
- continuing with this process until the DNS-resolution succeeds, or the string is reduced to the name of the gateway service; and
- in the event that the string is reduced to the gateway service name, the entire call attempt is aborted.

29. A method as claimed in claim 27, characterised by the steps of:

- on successful completion of the resolution process, forwarding a list of PG-records for a set of gateways to the gateway locator system; and
- separating out those gateways that do not support a VON-package used, or selected by, a user.

30. A method as claimed in claim 28, characterised by the steps of:
- separating out those gateways that do not support the VON-package used, or selected by, a user by performing, on each of the gateways identified by the PG-records, a DNS-lookup with QueryType=VINFO, a VINFO string being matched against the users preferred VON-package;
- translating the matched PG-records into HTML syntax; and
- transferring the translated PG-records to the user, said translated PG-records representing a prioritized list of preferred gateways for a call.

31. A method as claimed in claim 29, characterized by the steps of:
- said user, on making a telephone call, attempting a connection to a gateway with the highest priority (lowest preference);
- in the event that the gateway having the highest priority is unavailable, trying to connect to the gateway with the second lowest preference value; and
- repeating this process, trying the other gateways, of lower priority, in turn, in accordance with their priority listing, until an available gateway is located for the call.

32. A method as claimed in any of claims 16 to 30, characterised by the steps of:
- making provision for a telephone number to be redirected to another telephone number;
- assigning, to said redirected telephone number, a CNAME record, associated with the DNS name (coded number) corresponding to the

redirected telephone number; and

- effecting a DNS resolution process on the CNAME.

33. A method as claimed in any of claims 26 to 31, characterised by the steps of making provision, in the naming structure, for users having a PBX serving a number of telephone numbers having a common prefix, said users operating their own gateway serving all extensions below the prefix.

34. A method as claimed in any of claims 26 to 31, characterised by the steps of:

- making provision, in the naming structure, for international calls, the telephone numbers of which are prefixed with a country code; and
- on completion of the indigenous gateway selection process for the call, restarting the DNS resolution process, in the country to which the call is directed, with a domain name assigned to the gateway service in that country, by a service provider.

35. A method as claimed in claim 33, characterised by the step of providing a list of PG-records corresponding to gateways operated, in the said country, by the service provider.

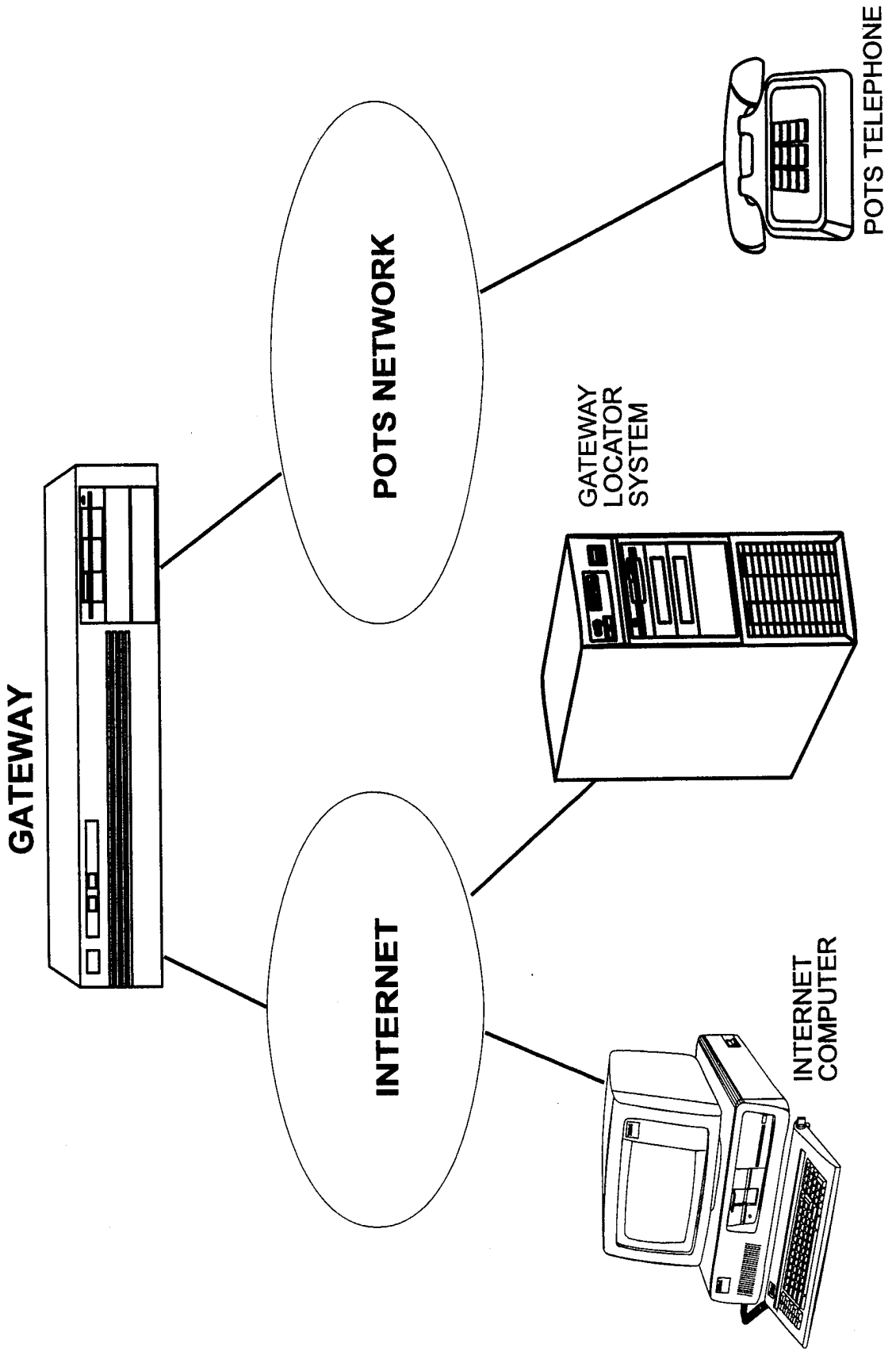

POTS TELEPHONE
POTS NETWORK
GATEWAY LOCATOR SYSTEM
GATEWAY
INTERNET
INTERNET COMPUTER

FIGURE 1

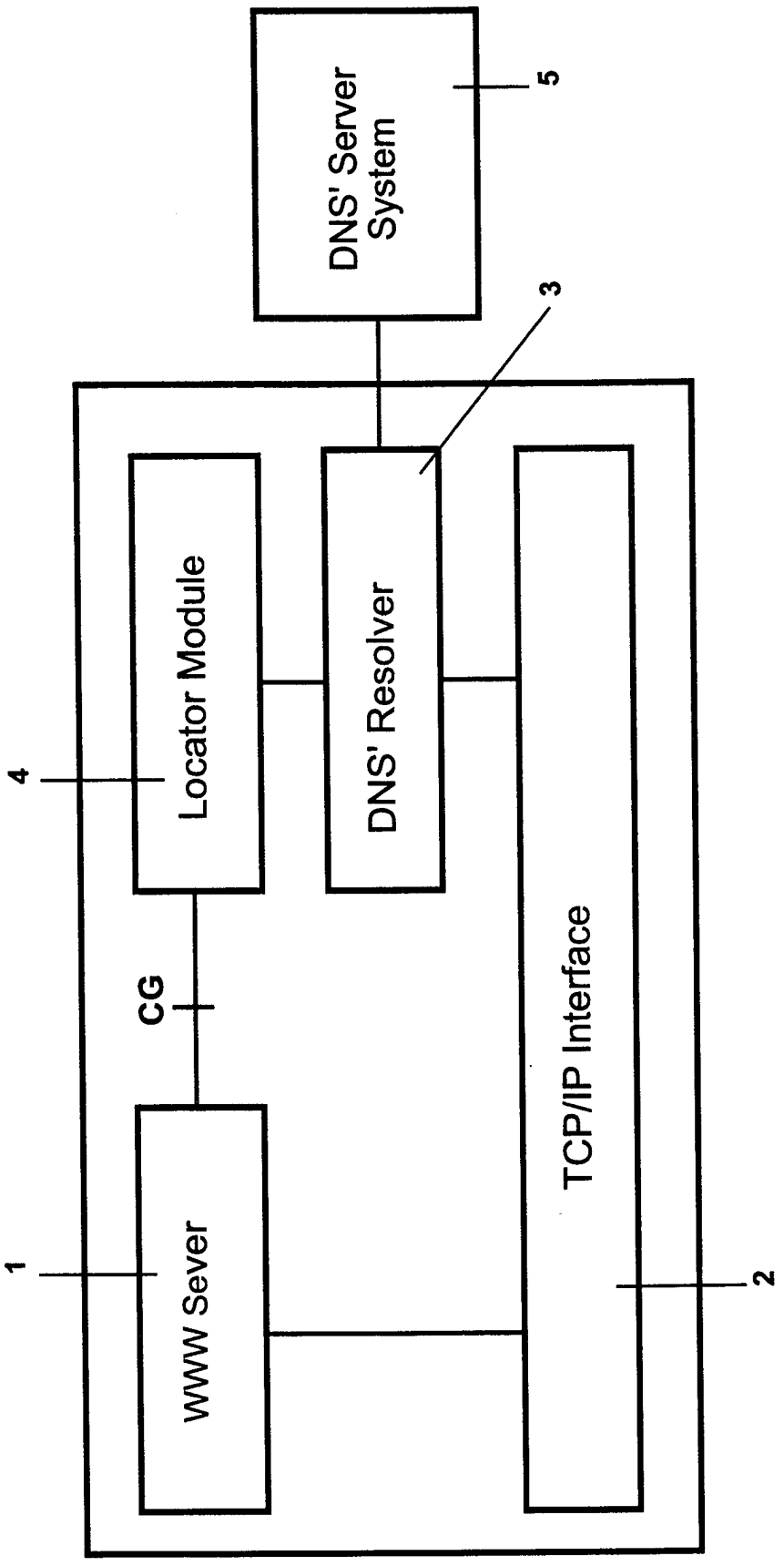
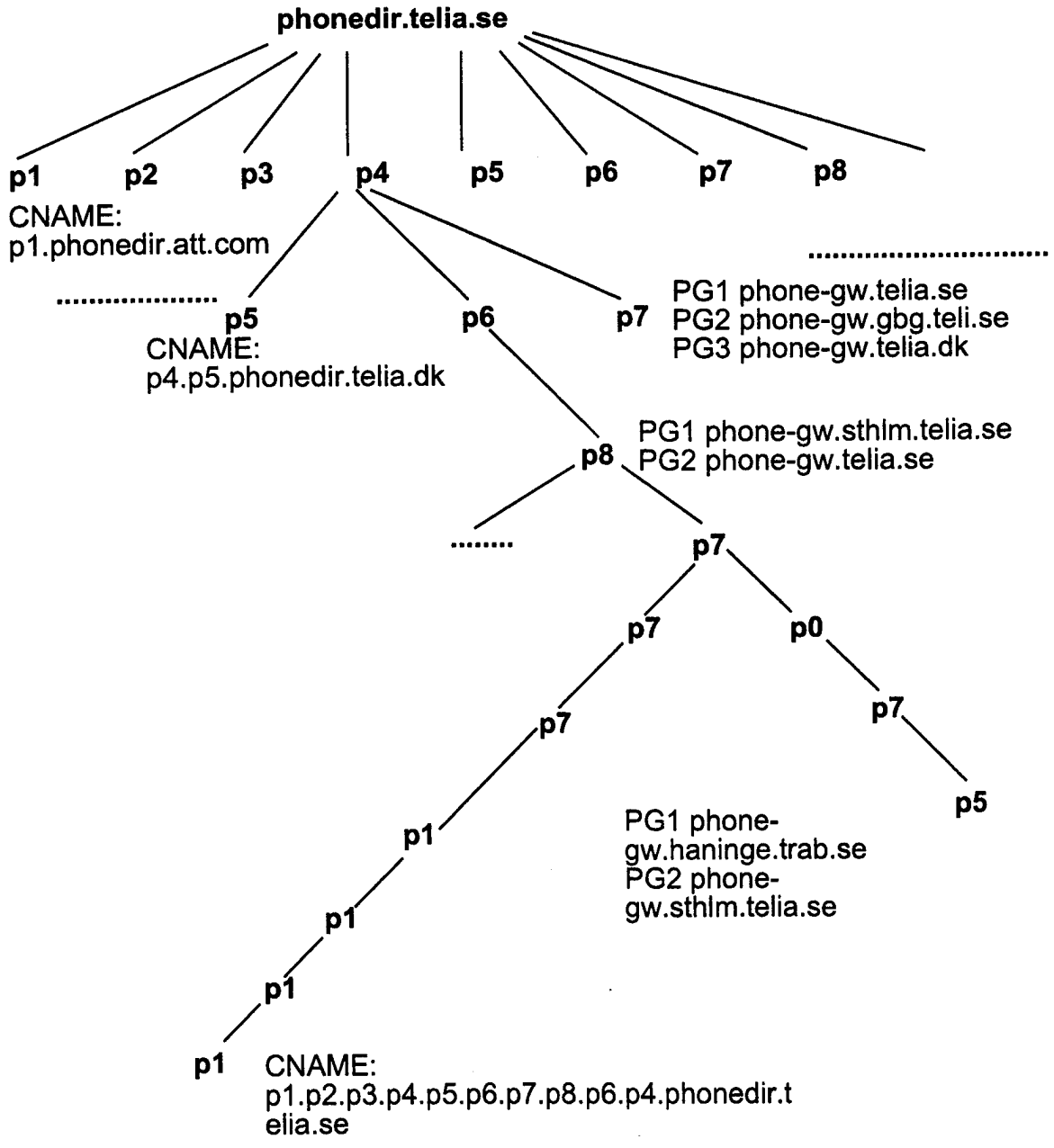

DNS' Server System
5
3
Locator Module
DNS' Resolver
TCP/IP Interface
4
CG
WWW Sever
1
2

FIGURE 2


phonedir.telia.se
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p2
p3
p4
p5
p6
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p8
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p7
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PG2 phone-gw.gbg.teli.se
PG3 phone-gw.telia.dk
p8
PG1 phone-gw.sthlm.telia.se
PG2 phone-gw.telia.se
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PG2 phone-gw.sthlm.telia.se
CNAME:
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FIGURE 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/00219

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04L 12/66
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)

IPC6: H04L

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)

WPI, JAPIO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Computer Sweden No 73 (22.12.1996) see page 12 --	1-35
Y	JP 7105111 A (NIPPON TELEGR & TELEPH CORP), 21 April 1995 (21.04.95), abstract --	1-35
A	WO 9638962 A1 (SIEMENS AKTIENGESELLSCHAFT), 5 December 1996 (05.12.96), page 11, line 25 - page 13, line 14 --	1-35
A	WO 9638018 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 28 November 1996 (28.11.96), abstract --	1-35

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

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"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
17 June 1998	18-06-1998
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 Friedrich Kühn Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

09/06/98

International application No.
PCT/SE 98/00219

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 7105111 A	21/04/95	NONE	
WO 9638962 A1	05/12/96	EP 0830776 A	25/03/98
WO 9638018 A1	28/11/96	AU 5916696 A	11/12/96
		EP 0829181 A	18/03/98
		FI 952557 D	00/00/00
		NO 975343 A	21/01/98
		FI 961690 A	25/11/96