

# A Full Decimal Method of Address Assignment for Networked Computer

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**Abstract**—The full decimal method of address assignment for networked computers and intelligent terminals which input into the computer through various input devices of the computer and intelligent terminals is realized, and then, the external address of networked computer and intelligent media stored in the database and the internal arithmetic address are created correspondingly through a variety of transmission media by combination of different computer hardware and software. The new address assignment method can provide sufficient address space for development of Internet in the future, and it also provides enough address for application of various personal information household appliances and logistics in electronic commerce and other entities and personal communication terminals while ensuring multiple levels of address structure. This paper mainly introduces the decimal address allocation algorithm and address format, which provides a solid foundation for the next generation Internet architecture design.

**Keyword**-Decimal; Future Network; IPV9; Address Assignment

## I. INTRODUCTION

With the rapid development of science and technology, the world has entered an information age of data communication. The most famous data network is the Internet, which can be seen all over the world. In 1969, in order to develop a computer network capable of resisting nuclear attacks, the US Department of Defense funded the establishment of a packet-switched network named ARPANET, which was the earliest prototype of today's Internet and was regarded as the forerunner of the information superhighway. Nowadays, almost all the countries and regions have joined the Internet. China has also established a number of international exports connected to the world's largest Internet and achieved rapid increase in user terminals.

Every single computer connected to the Internet shall be provided with one and unique address so that the information can be correctly transmitted to the destination through the Internet. At the present, there are three methods for address preparation in and out of

China: first, the “IP address”, which is composed of four segments of numbers separated by decimal points; second, the “domain name”, which is generally composed of five character strings (subdomains); and third, the “Chinese domain system”, which is composed of three levels of domain names separated by decimal points and slashes. Although the above address system guarantees each computer a unique address, it is with the unfavorable disadvantages of complex and not uniform, and is difficult to remember and input.

At present, the addressing scheme used in the Internet is still based on the original IPv4 protocol, which uses four segments of 8-bit decimal numerals to allocate the addresses of hosts and other devices connected to the Internet. In the meantime, the addresses are marked by the method of “dotted decimal notation”. Although those addresses seem to meet the needs of the entire world in the early stage of Internet development and IPv4 made incredible success, in the last two decades in the 20th century, Internet ushered rapid development all over the world and the number of hosts connected to the Internet have been doubled every year, therefore, current amount of addresses can no longer meet such development momentum. What’s more, addresses have been more and more extensively applied in logistics code in e-commerce, space code, identity code, digital currency and three-dimensional geographical code and other intelligent terminals, the existing address assignment techniques fail to meet the needs of social development. It is of vital significance to develop an address identification method that can meet activities of human for several years.

## II. DECIMAL ADDRESS ASSIGNMENT ALGORITHM

The algorithm in this study can provide a new address assignment method that offers sufficient address space for development of Internet in the future, and provides enough address for application of various personal information household appliances and logistics in electronic commerce and other personal

communication terminals in a simpler, more convenient way under a lower cost while ensuring multiple levels of the address structure.

The method by which address assignment of a networked computer by full-digital codes is with the following characteristics: the foresaid network access number refers to the stipulated numeral number of the website established in accordance with the national and regional regulations; the foresaid telephone number consists of international direct distance dialing codes of the country of the telephone user, area code for domestic direct dialing of the user and the telephone number of the organization where the user works or the user’s personal telephone number; the classification number is the numeric number preceded by the country or the area for unified classified business categories.

The technical scheme is: a full decimal method of address assignment for networked computers and intelligent terminals that is characterized with, address inputting into the computer through input devices of networked computers and intelligent terminals, such as keyboard, bar code, two-dimensional code input device, visual input device and voice input device, and corresponding preparation of external address of networked computer and intelligent media stored in the database and the internal arithmetic address by combination of various computer hardware and software via a variety of transmission media. The address assignment is conducted by the following steps:

1) External addresses of all networked computers and intelligent terminals are localized at decimal numbers with the representing range of all decimal integers from 100 to 10256, address are input into the computers via input ports of networked computers and intelligent terminals such as keyboard, voice input device etc.;

2) Internal address of all networked computers and intelligent terminals are localized at binary numbers

with the representing range of all decimal numbers from 20 to 21024;

3) The addresses can either be corresponded to the binary internal addresses either by the method through which address is with fixed length but variable location or address is with fixed location but variable length;

4) In addition to the external addresses, the above mentioned database also stores the original domain names applied in the form of numbers, English and Chinese and other different languages, as well as communication numbers such as the existing telephone numbers, area numbers, city numbers, mobile phone numbers, MAC address, and the latest digital domain names based on decimal coding;

5) The address in the database is directly corresponding to the binary internal address of the computer, and data flow is pointed to the host via computer hardware and software, for instance, the gateway through optical cable through microwave and coaxial cable and other transmission media; the decimal address for character domain name can be found after being resolved through a domain name resolver and pointed to the address of the host, the telephone number; by pointing to the gateway, the mobile phone number and other communication numbers are directly indicated in the communication system to which the communication number is belong.

### III. ADDRESS FORMAT AND ALGORITHM

In all the address assignment methods for networked computers and other intelligent terminals mentioned above, the entire external addresses is evenly divided into 4 domains, 8 domains, 16 domains or 256 domains and each domain address is with the numerical range of the decimal integers from 100 to 1064, 100 to 1032, 100 to 1016 or 100 to 101. In a corresponding way, the internal address is also evenly divided into 4 domains, 8 domains, 16 domains or 256 domains and each domain address is with the

numerical range of the binary numbers from 20 to 2256, 20 to 2128, 20 to 264 or 20 to 24.

Each domain address must be separated from each other by a separator. If there is a contiguous all-zero domain within the foresaid address or the internal address, a pair of braces or square brackets can be used to replace the all-zero domain.

If there are more than one contiguous all-zero domain in the address or internal binary address, each contiguous all-0 domain may be replaced by a pair of braces or square brackets, and a Arabic numeral are used to mark the specific amount of all-zero domains in the segment of domain within the brackets.

When there is a continuous segment of Arabic numerals found in the foresaid address or one domain of the internal binary address, the segment of Arabic numerals can be replaced by a pair of round brackets and the omitted numerals, the amount of connectors and omissions shall be clearly marked from the left to the right within the round brackets.

In addition, an external address is an address with a multilevel structure, which can be the interface of a single network, namely a unicast address. The unicast address structure is with the following three levels.

1) *Public topology layer*: a collection of network providers and network switching equipment for public Internet switching service. The public topology layer consists of a address prefix, top-level aggregation identifier, reserved domain, and second-level aggregation identifier.

2) *Station topology layer*: a specific local station or organization that not provides public Internet switching service outside the station. It is composed of a station-level aggregation identifier.

3) *Network interface identifier*: it is a network interface used for identifying the link. Besides, the foresaid second-level aggregation identifier can be further divided into internal multilevel hierarchical

structures and the foresaid station-level aggregation identifier can be used to establish its internal addressing structure and identification sub-network, the foresaid network interface identifier can be used in several interfaces at the same node.

In many cases, communication between network nodes is limited to a relatively independent region; there is no need for global aggregation of unicast address. But it is necessary to provide a address specially used for local communication, namely, local unicast address, which can be applied in communication between nodes at the same link and generating the unicast address of the local link with the structure of address format prefix and network interface identifier and a zero in the middle.

The local unicast address can also be applied in addressing of the communication Internet interface within the range of the station and generating the unicast address in station with the structure of a format prefix, sub-network identifier and network interface identifier, together with a 0 between the format prefix and sub-network identifier.

The address coding method in this study also defines some addresses for special purposes. For example, the address composed of all zeros belongs to a unspecified address and cannot be assigned to any node, which means that the network interface has not obtained a formal address for the time being.

In addition, some addresses can be assigned to more than one network interfaces at the same time, and generate a cluster address with the same structure of that of the unicast address. The address can also be assigned to a multicast address, and the address message with the destination of a multicast address would be received simultaneously by all the network interfaces provided with the multicast address.

The technical scheme adopting the above address assignment method provides sufficient address space for the development of the Internet in the future,

realizes simpler address representation, convenient use and more standardized address assignment. Meanwhile, the technical scheme has given full consideration to the size of routing table of the existing router and the current computing power of the computer.

The way to Internet access with the address prepared by the above coding method is characterized with: successful access to Email or the Internet realized after inputting the address into the computer modem via a push-button dialing telephone or the computer keyboard and linking into corresponding digital code, which is translated into a IP address or Chinese domain name system, all full-digital coded address is corresponding to an existing IP address or Chinese domain name system.

IV. ASSIGNMENT EXAMPLES

The specific address assignment algorithm is fully explained by the following examples:

A. Example I

Through this algorithm, external address of networked computers and intelligent media stored in the database and the internal arithmetic address are created correspondingly.

We can evenly divide the entire external address into 8 domains with each address of a decimal integer from 100-1032 and square brackets are used to separate all the 8 domains. Thus, the address is in the format of Y]Y]Y]Y]Y]Y]Y]Y], in which, every Y represents a domain address in the form of a 32-bit decimal number. The entire internal address is also divided into 8 domains with each address of a binary number from 20-212 in the format of X]X]X]X]X]X]X]X], in which, every X represents a domain address in the form of a 128-bit binary number.

For instance:

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0000000003338973222778830378303]00000000
00000000000000000000000000]00000000000000000000
000000000000]00000000000000000000000000000000000000
0]0000000000000000000000000000000000000000000000000000
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9875679484593909387401]0000000000897465383920958

In this address, the multiple continuous zeros at the left part of each decimal number can be omitted but the all-zero decimal numbers shall be represented at least by a zero. Thus, the above address can be written as:

33389732222778830378303]0]0]0]9875679484593909387401]989989021893]897465383920958

For further simplifying the address presentation, the continuous zeros in the address can be replaced by a pair of “[ ]”. For instance, the above address can be further simplified as:

33389732222778830378303[ ]9875679484593909387401]989989021893]897465383920958

For another instance:

0] 0] 0] 0] 0] 0] 0] 1 can be abbreviated as [ ] 1 or [ 7 ] 1

0] 0] 0] 0] 0] 0] 0] 0 can be abbreviated as [ ] or [ 8 ]

It should be noted that in abbreviation of the above addresses, you can only use “[ ]” once to represent a contiguous all-zero field, because multiple uses of [ ] can result in ambiguous addresses.

For instance, address

0] 0] 0]12345678]987654]0]0]0 can be abbreviated as:

[3]12345678] 987654][ ] or [3]12345678]987654][3], also 0] 0] 0]12345678]987654][3].

but not [ ]12345678]987654][ ], otherwise, the number of all-zero fields of the left and right part of the address may be confusing during restoration of the address and then result in ambiguous addresses.

Besides, for the purpose of further simplification of the address, if there is a continuous sequence of the same Arabic numeral in a address domain, such sequence can be replaced by a pair of round brackets,

and the omitted numerals, the number of separators and omissions shall be clearly marked from the left to the right in the brackets.

For instance:

0]0]12345678000000000]987654000000]980098000]0]0]0] can be abbreviated as [ ]12345678(0/9)]987654(0/6)]980098(0/4) [3]

In the process of address preparation of networked computers and intelligent terminals, the external address must be corresponding with the internal binary address. For such purpose, the method by which address with fixed length and variable location is adopted to make the two corresponding with each other in this example.

For instance, the external address [ 7 ]19 will be corresponding to the internal binary address [ 7 ](0/251)10011, and the address [ 7 ]21 will be corresponding to [ 7 ](0/251)10101.

The address prepared by the method mentioned above can be assigned to network interfaces, and if assigned to single network interface, the identifier is then regarded as a unicast address, and message with the destination of a unicast address will be delivered to the only network interface identified by itself. Unicast address is with the same good flexibility as that of the multilevel network structure, which is good for solving the difficult problem of router addressing. For instance, a w aggregation global unicast address is provided with three layers, namely the public topology layer, station topology layer and network interface identifier, in which, the public topology layer is consisted of a address prefix (FP), top-level aggregation level (FLA), reserved domain (RES) and second-level aggregation identifier (NLA), the station topology layer is consisted of station-level aggregation identifier, and the foresaid network interface identifier is merely consisted of network interface identifier. The specific structure is as shown in Table 1 in the following:

TABLE I. STRUCTURAL TABLE OF GLOBAL UNICAST ADDRESS

FP(4bits)	TLA Identifier (26 bits)	RES(18bits)	NLA Identifier (48 bits)	SLA Identifier (32 bits)	Network Interface Identifier (128 bits)
← Public topology layer →				← Station-level topology layer →	← Network interface identifier →

For instance, the FP of an address is 1001, TLA identifier is 8960, RES is 9806, NLA identifier is 9999999, SLA identifier is 8887, and the network interface identifier is 0, then, the entire address is identified by 1001(0/24)8960(0/4) 9806(0/14) (0/25)9999999(0/28)8887[4].

In such address, by the format prefix routing system, it is easy to tell whether the address is a unicast or other type of address. The top-level aggregation identifier is the highest level at the routing hierarchy, and in case of missing of a router, every top-level aggregation identifier shall be provided with a corresponding item in the routing table together with the routing information of provided with top-level aggregation identifiers shall employ second-level aggregation identifiers in establishment of addressing hierarchical structure and identification of internal stations in the process of internal addressing. And any organization is free to select the assignment plan according to their own needs in allocation of their second-level aggregation identifiers so as to establish their own internal addressing hierarchy. Establishment of a hierarchical structure is conducive to aggregation of routers at all levels to be greater extent, and realization of a smaller size of the routing table. A structure can be established as shown in Table 2.

TABLE II. HIERARCHICAL STRUCTURE

N L A I	Station Identifier
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Station-level aggregation identifiers are used for recognition of establishment of internal addressing hierarchical structure and identification of sub-network

number by some organizations (stations). The structure can be shown in Table 3 in the following.

TABLE III. STRUCTURE OF STATION-LEVEL AGGREGATION IDENTIFIERS

S L A I	Sub-network number
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In which, the amount of the hierarchies in the station-level aggregation identifier field and the length of SLA identifier at all levels shall be decided by the organizations themselves according to the topology layer structure of their internal sub-network.

For a global unicast address prepared and assigned by the above method; address preparation of a station itself is relatively independent of that of the Internet. If a station needs to be readdressed, among all the addresses within the station, only the two parts, namely the top-level aggregation identifiers and second-level aggregation identifiers (public topology layer) need certain modifications and the station-level aggregation identifiers and network interface identifiers can remain the same. With such assignment approach, great convenience is brought to management and allocation of Internet network addresses.

*B. Example II*

In this example, unified address assignment for various computers and intelligent terminals are basically conducted by the same steps as in Example I, but corresponding preparation of external address and internal address can be conducted by way of address with fixed location and variable length. By this method, a variety of external addresses of all computers and intelligent terminals are localized at decimal numbers with the representing range of all decimal integers

between 100 and 10256; and internal addresses of all computers and intelligent terminals are localized at binary numbers with the representing range of all binary numbers from 20 to 21024. And then a method by address with fixed location and variable length can be adopted to correspond the external addresses with binary internal addresses. To be specific, every bit of the decimal number of the external address are corresponding to 4 bits of binary numbers of the internal address of the computer.

For instance, external address of [ 7]7]7]7]7]8]8]3]3] can be corresponding to the binary internal address of [ 0]111]0111]0111]0111]0111]1000]1000]0011]0011]. In this example, every bit of the decimal number of the address is corresponding to 4 bits of binary numbers of the internal address.

In the technical scheme employed in Example I and Example II, external address and binary internal address can be evenly divided into 4 domains, 16 domains or 256 domains, and the above mentioned address can be assigned to more than one network interfaces at the same time to foster a cluster address with the same structure of that of unicast address. Besides, the foresaid address can also be assigned to multicast address. Message with the destination of multicast address can be received simultaneously by all the network interfaces provided with the multicast address. The address coding method in Example I and Example II above also defines some addresses for special purposes. For example, the address composed of all zeros belongs to a unspecified address and cannot be assigned to any node, which means that the network interface has not obtained a formal address for the time being. If the address is all one, namely the local loopback address, it is expected to loop back the message to itself at a certain node. The local loopback address is usually used when a test is conducted to see whether a protocol stack works properly.

## V. ASSIGNMENT ALGORITHM INTERPRETATION

The method by which address assignment of a networked computer by full-digital codes, including full-digital coded address consisted of network access number, telephone number and classification number. The above mentioned network access number refers to the stipulated numeral number of the website established in accordance with the national and regional regulations, for example, the network access number of "Shanghai Hotline" in Shanghai, China is "8888"; the foresaid telephone number consists of the international direct distance dialing codes of the country of the telephone user, the area code for domestic direct dialing of the user and the telephone number of the organization where the user works or the user's personal telephone number, for example, the telephone number is 008602162572047, in which, 0086 is the international distance dialing code in China, 021 is the area code of Shanghai, and 62572047 is the user's phone number, the three parts jointly serve as "telephone number" in the code. This is the key reason why this research adopts the full-digital character code address assignment -- it is simple, easy to remember and would never be duplicated. The classification number is numeric number preceded by the country or the area for unified classified business categories. Such digital numbers can be established according to the regulations of the country, area or website of the user, and can either be specified at the main category or subcategory level.

Since not all access is to be done with subcategories. Therefore, in general, those numbers are only specified at a main category level. In such case, digital number of the subcategories can be led after the category number by way of option. In actual use, if customers want to encrypt their addresses, the confidential digital numbers can be led after network access number or telephone number, which can be provided by customers themselves and registered in the address preparation organizations. In the process of use,

customers can choose telephone number dialing or input all the correct digital numbers in a continuous way via computer keyboard and surf the Internet after successful connection, which is convenient and efficient.

Given that many users surf the Internet only to send and receive E-mails, and only even apply for a work Email, Internet service providers shall establish an Email for the user which is usually named with three parts of a user name, Email server and “@” and indicated by character strings when users apply for an Internet account. For easy and unified input, Email addresses can be prepared by full-digital coding, and consist of digital number of the user name and the digital number of the domain name of the Email server which the Email is belongs to.

When the above coding method is adopted in Email access and browsing the Internet, you can use the push-button dialing telephone or the computer keyboard to input its computer modem, and link the corresponding digital code, and then, through the translation software conversion, you can get access to the Email or browse the Internet.

For the purpose of universal use, it is necessary to build a converter which correspond the digital address of the technology in this study with the domain name and IP address of the existing Internet. The converter is composed of translation software. Only by designating a full-digital coded address, it can be converted to the corresponding IP address, domain name or Chinese domain name system, and each full-digital coded address is corresponding to an existing IP address, domain name or Chinese domain name system. Since computers could only identify IP address, in this study, it is not only necessary to build a converter to converting full-digital coded address into universal domain name and IP address, but also to designate a server to translate the numeric address established through the technology in this study into IP address so

that the computer can identify the address for operation.

## VI. CONCLUSION

The methods designed in this study could not only assign a fixed static address to each networked computer but also allocate a dynamic address to a temporarily networked computer, thus, it is easy for users to apply the digital address. Besides, the auxiliary information database is established, with which, the full-digital coded address established through the technology in the study and the existing addresses with Internet access, including: domain name, IP address and Chinese domain system etc. are listed and corresponding with each other, and users can inquire the address with Internet access they need just by opening the database installed in the website. Thus, it is easy for users to choose different ways to access the Internet by inputting. The database could also be compiled into a written document for users to look up and consult.

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