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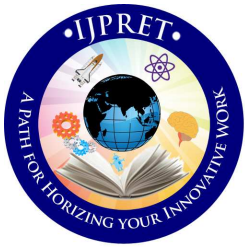

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A PATH FOR HORIZING YOUR INNOVATIVE WORK

A RESEARCH FOR MOBILE TO MOBILE CALLING THROUGH WI-FI

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Abstract

Live telephony over mobile is currently supported at a cost using service provider such as GSM and using IP service provider at cheaper cost. The purpose of this research is to implement a live telephony communication program that uses WIFI in p2p (Peer to-Peer) or WLAN (Wireless Local Area Network) as a means of communication between wireless phones at no cost. The system will allow users to search for others wireless devices within WIFI range and to establish free p2p voice connections, or to establish virtual connection through Access Points (AP). The system will use a novel algorithm to convert mobile number into IP address and use it as a mean for contacting other mobile over p2p or AP using WIFI technology. The software will use a correlation between current address books available in mobile phones to convert phone numbers into IP addresses. This system will only allow for one call per connection, and no call waiting, or conference calls. The first step of this research and development is to resolve the technical issue regarding mapping of the mobile user's phone number to a unique IP address in order to avoid IP collision, centralized control, and user configuration. In addition, voice call will be supported using WIFI to allow mobile phones to communicate free of cost to each other through p2p or through AP.

INTRODUCTION

The support of telephony services over mobile phone has been used everywhere using technology. Global System for Mobile phones and 3rd Generation mobile telecommunication but the cost is high. On the other way, using IP telephony try to reduce the cost for supporting this service over mobile phone. *The aim is to provide the service over mobile phone* live communication over IP *at no cost.* Two approaches are suggested in this paper to meet the objective of having free telephony services over mobile phones. These are the use of WIFI technology over AP and WIFI over Peer-to-Peer. In addition, a novel algorithm has been invented to tackle the first fundamental problem of designing Ad hoc and p2p telephony using WIFI, which will not depends on central database, and will not require users registration for any service. This can be achieved through executing an algorithm to map a mobile number to a unique IP address that can be used to establish p2p connection to any other mobile phone running the same algorithm. Ad hoc network is an IEEE 802.11 communication network which establishes contact with multiple stations in a specified area network without the use of access points. Peer to peer networks help extending the range of fixed wireless networks and give rise to flexible architectures to adapt to geography of users, information, and signal transmission in a locally optimal manner. This mobile telephony lends itself to be a completely distributed system in terms of architecture. Currently, servicing IP addressing in traditional networks are managed by two technologies, the DNS (Domain Name System), and DHCP (Domain Host Configuration Protocol).DNS Servers resolve human- friendly domain names to IP addresses for computers and resources on the Internet globally. DNS keeps website addresses consistent regardless of the physical location or routing protocol. DHCP helps to make automatic network configuration, IP address allocation, for network devices. Whenever a new device is connected to the network the device will request for an IP address from the server, which will allocate the address to the networked device for a specific time period, where dynamic network addressing is used.

The DNS mechanism cannot be applied to p2p Ad hoc network, and therefore a better solution should be used such as the one suggested in this paper, which is based on WIFI technology.

The first stage of developing the voice over WIFI IEEE 802.11 (Wireless Fidelity) application dealt with the problem of developing a method that could assign unique IP addresses to mobile devices on the fly without user interaction and central management. However, this was a major challenge since devices in Ad hoc mode do not register with any central service such as DHCP and DNS. Since the mobile software IP addressing facility lacks coordination with central database, then IP address allocation and IP conflicts present a major issue. The solution to the IP problem was tackled in a very innovative way that did not compromise the software's p2p and Ad hoc values. GSM mobile phones come with SIM(Subscriber Identification Modules) cards that help identify users uniquely in GSM networks, by mapping SIM numbers to subscribers and unique telephone address of the subscribe. There is no two phones can have the same number in the same network. However the GSM approach relies on centralized system of communication routing and management. However, the solution proposed in this paper will only rely on the fact that each user has a unique phone number. An algorithm was devised to map telephone numbers to IP addresses, consequently creating a unique IP addresses for p2p devices that wishes to communicate. IPv6 was chosen because of its vast address space availability which is 2138 IP addresses. IPv6 utilizes 128-bit addresses versus IPv4 which uses 32-bit addresses. The telephone number & area code are in the format of 0-9 digits for the area code and 0-9 digits, except for the first number that cannot be given the value 0 comprise off 9,000,000,000 numbers unique numbers. IPv6 which has accommodates for more spaces was a better candidate than IPv4 which has fewer space and is already being exhausted and already in use by many traditional and wireless networks.

VOIP WI-FI PHONE

Wi-Fi phone works by accessing wireless Internet connections such as a wireless router in your home or office, or Wi-Fi

hotspots around the globe. You can access open WiFi hotspots quickly and easily, as well as various secure hotspots. Voice over Internet Protocol (Voice over IP, VoIP) is a family of technologies, methodologies, communication protocols, and transmission techniques for the delivery of voice communications and multimedia sessions over Internet Protocol (IP) networks, such as the Internet. Other terms frequently encountered and often used synonymously with VoIP are *IP telephony*, *Internet telephony*, *voice over broadband* (VoBB), *broadband telephony*, and *broadband phone*. It works at many hotels, airports, coffee shops, and more! This innovative wireless Internet phone provides portable, high-quality and low-cost plans. VoIP is available on many smart phones and Internet devices so that users of portable devices that are not phones may place calls or send SMS text messages over 3G or Wi-Fi. On the receiving side, similar steps (usually in the reverse order) such as reception of the IP packets, decoding of the packets and digital-to-analog conversion reproduce the original voice stream.

MOBILE CALL USING WIFI

Wi-Fi telephony, also known as Voice over wireless LAN (VoWLAN), delivers the all the capabilities and functionality of the enterprise telephone system in a mobile handset. The Wi-Fi phone is a WLAN client device, sharing the same wireless network as laptops, PDAs and TABs. The handset is functionally equivalent to a wired desk phone, giving end-users all the features they are used to having in a wired office phone. The benefits of VoWLAN can result in substantial cost savings over other wireless technologies by leveraging the Wi-Fi infrastructure and by eliminating recurring charges associated with the use of public cellular networks. For end users, VoWLAN enables employee mobility, resulting in increased responsiveness and productivity. Wi-Fi telephony is the upcoming technology that can be set up on existing enterprise Wi-Fi network and empowers enterprises with voice mobility benefits in an easy, scalable and cost effective way. Increased deployment of superior Wi-Fi networks to achieve wireless data access and increased adoption of VoIP technologies to make cost-effective calls has led the concept of Wi-Fi telephony to

emerge in the recent years. With Wi-Fi telephony in place, voice mobility can be achieved in an easy to use and inexpensive way. Voice mobility in general refers to flexibility for users to make telephone calls from any place within a premise. Enterprise premises empowered with voice mobility have more productive employees, increased employee convenience and improved business process resulting in faster decision making, increased responsiveness and greater overall productivity and efficiency.

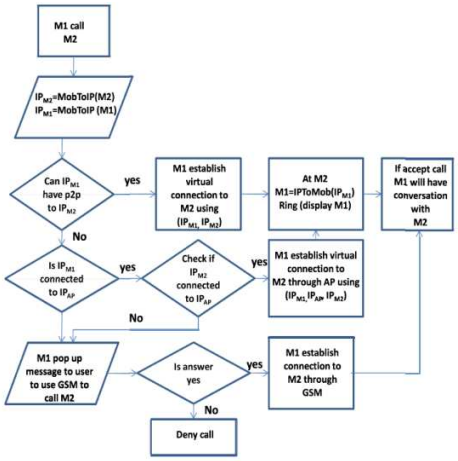

Figure 1. Using WIFI p2p and AP to establish call between mobile phones in addition to GSM

First, as described in the previous section, using WIFI technology will allow mobile phones to communicate to each other at no cost compare to GSM technology where high charge is applied. In order to support voice call over mobile phones using WIFI seamlessly without affecting the user normal behavior in making a call to any mobile phone, a new technique has been invented in this paper as described in Figure 1.

In this figure, if mobile user (U1) is willing to make a call to other mobile user (U2), the invented algorithm will convert both mobile numbers to 2 unique IP numbers using IP6. Then U1 will try to establish a p2p call to U2 using the mapped IP to Mobile (IPU1, IPU2). If U2 is Within the range of WIFI of U1, then a virtual connection will be established between U1 and U2, and then U2 will convert IPU1 to M (U1) and make the ring by showing the calling number coming from U1. If user of U2 accepts the call, U1 and U2 will be able to communicate to each other using voice over IP. However, if U2 is far from U1, then U1 will try to see if U2 is connected to close AP within the same range of U1. If both U1 and U2 are connected through AP, then U1 and U2 will establish a virtual connection using (IPU1, IPAP, IPU2). Then if user of U2 accepts the call, U1 and U2 will be able to communicate to each other using voice over IP. However, if U1 and U2 are not covered by any WIFI

network, a message will be popped up to user of U1 asking if he/she is willing to continue the call through GSM or other wireless network. Then the user would have the choice to carry on or cancel the call. As it was described in the previous section, WIFI would require the mapping of mobile number to a unique IP address, and vice versa.

Fig 2. Mobile Telephony Using Wi-Fi

The algorithm described in this paper would allow the mapping without the need for storing this mapping since it will convert mobile number to unique IP and unique IP to mobile number. This algorithm needs to be applied to all mobiles wishing to use this technique. It is clear that the new technique using WIFI would allow users to make a voice call through mobile phone at no cost.

MOBILE TO IP CONVERSION ALGORITHM

A software solution was developed in order to convert mobile numbers to IP addresses and vice versa. In this program development, it is possible to map the mobile numbers to a valid IPv6 address, and therefore there is no need for DNS lookup. In addition, there is no need for complicated hashing and addressing protocols because the IP-to-Mobile algorithm would produce a unique number used as input, leading to a unique output hexadecimal IPv6 address. The outputted address is then allocated to private IP within a specified range in order not to conflict with other devices in the same wireless range.

A. Traditional Hashing Algorithm for IP

N is the size of IP range, which should be a prime number larger than our range in order to assure good performance for the

algorithm. Consider every IP address as a quadruple of integers modulo N which in IP addresses are 32-bit which quadruple 8- bit. We can define function H for hashing of number mod N, and fix any four coefficients such that-

Ha (x1,x2,x3,x4) = (a1 × x1, a2× x2, a3 × x3, a4× x4) mod N[11].

B. Mobile to IP Conversion Algorithm

This algorithm will map any mobile number to a unique IPv6 address,

where X10 is {x |1,000,000,000≤ x ≤ 9,999,999,999) base 10 decimal integer and the function f(x) converts X base10 to X base 16 Hexadecimal integer with range

{ x|3B9ACA00 ≤ x≤2540BE3FF} as defined in the pseudo code of *MobToIP*.

C. function MobToIp(String number)

```
//Input: String representation of phone number
//Output: IPv6
String ip←"" String hex←""
//character array of 16 hexadecimal group of 4 hexadecimal octets, and all initialized to zero
and separated by":"
ipArray ← ['0','0','0','0',':',.....,':','0','0','0','0']
/* read mobile number and store it in charArray, where each digit of the mobile number is represented by one equivalent hex digit. Eg charArray [ ] = readMobNum("9897345112"), then char Array['9','8','9','7','3','4','5','1','1',2'] */
char Array [ ] =readMobNum("calledNumber")
/*Initialize Integers counter variables for loop
Integer i←0; Integer k←0;
Loop {
 if ipArray[k]=0
  {
   ipArray[k]=charArray[i]
   i←i+1
  }
  if ipArray[k]=":"
 {
  ipArray[k+1]=charArray[i]
 }
   k←k+1
}
```

While(i<=len of charArray & k<= len of ipArray)

/*create String buffer object hexBuffer
Integer c←0
Loop for c<= length of ipArray
{
hexBuffer←ipArray[c]
c←c+1
}
ip←hexBuffer return ip
End function

IP- to-Mobile Conversion Algorithm

This algorithm would do the reverse of Mobile-to-IP algorithm to convert unique IPv6 into mobile number, where X16 is {x|3B9ACA00 ≤ x ≤2540BE3FF} base 16 hexadecimal integer and the function g(x) converts X base16 from to X base10 decimal integer with range X10 is {x|1,000,000,000≤ x ≤ 9,999,999,999} as defined in the pseudo code of IpToMob.

E. Function IP To Mob

/*Input: IPv6
/*Output: String representation of phone number
/*Initialize local String variables to empty Strings

String string1, string2, string3←"" String output←""
charArray will be set to input ip value
charArray ← ip
/*String buffer object firstBuffer new buffer object
Integer loop counter i←0
Loop For i< length of charArray
{
firstBuffer←charArray[i] increment i←i+1
}
/*reverse order of string buffer elements of firstBuffer string1← firstBuffer reverse
/*Character Array charArray2 will contain values of string 1 charArray2 ← string1
/*loop replace trailing zeros with "*"

Integer loop counter c←0
Loop For c<charArray2.length
{
if charArray2[c]=':' or charArray2[c]=='0'
{
/*replace zeros & colon with “*” to mark that they are no longer needed
charArray2[c] ← '*'

```
}
else
{
break out of for loop
}
}
End for loop
String buffer secondBuffer new buffer object
Integer loop counter c←0
Loop For c<charArray2.length
{
secondBuffer<charArray2[c]
}
End for loop
/* reverse order of string buffer elements of secondBuffer
string1 ←secondBuffer reverse
 String x
character array charArray3 ← string2
Integer loop counter k←0
Loop For k←length of charArray3
 {
   if charArray3[k]!='*'
   {
    string3←string3+charArray3[k]
   }
}
End for loop
character array charArray4 ← string3
Integer loop counter a←0
Loop For a<length of charArray
{
   if charArray[a]!=':'
  {
   output ← output + charArray[a]
  }
}
End for loop
Long integer num ← output to integer
return num
End function
```

5 ALGORITHM TEST RESULT

The voice over WIFI telephony application will use Java technology as means to develop the software for mobile devices. Java for Micro-Devices or J2ME also software developers to implement software that is able to be distributed to all Java enabled phones with minimal alteration in compilation and versioning. J2ME is robust, scalable, and secure platform for mobile phones, personal digital assistants, and embedded devices. J2ME contains TCP/IP networking and GUI APIs along with other packages that will allow reliable

development mobile applications. The utilization of native platform dependent code maybe needed in order to automatically change IP addresses within the phones operating system without user interaction. At this stage implementation covers the conversion of mobile number to IPv6 address and the reverse conversion of IPv6 address into mobile number. A Java program for the conversion from mobile to IPv6 and from IPv6 to mobile has been done and proven the correctness of the algorithms. Where, a user would enter the mobile number which will be converted to a unique IPv6. The other IPv6 to mobile algorithm allows user to enter IPv6 in hex and then it will convert it to mobile number. In the future a complete program will be developed to establish a p2p connection or a virtual connection over AP in order to allow the 2 mobile phones to communicate to each other over WIFI technology at no cost.

Conclusion

It can be possible to design a application for Smartphone OS such as Android mobile by which we can communicate with other using SIP-based VoIP. The purpose of this paper is to implement a telephony program that uses WIFI in Peer to-Peer or WLAN (Wireless Local Area Network) as a means of communication between mobile phones at no cost. The system will allow users to search for other individuals within WIFI range and to establish free peer to peer connection for voice communication.

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