VoIP - innovative uses in small Telex

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Abstract

VoIP is a growing and exciting technology. While computer to computer and computer to telephone voice communication is easy to achieve, phone to computer calls need the target computers to have a statically assigned telephone numbers (just like IP). With the increasing number and size of LANs, and low power or no Telphone Exchange (Telex) in such LANs make it very difficult for all the computers to have individual telephone numbers. Our paper discusses few innovative ideas of bringing the benifits of VoIP to such LANs. We discuss implementing a universal voice messaging system from telephones to any memner of LAN user community, a similar idea for Video Messaging and a novel idea for enabling phone calls to a large number of computers using only a small number of telephone numbers available.

1 Introduction

Voice Over IP(VoIP) is a hot technology built around H.323 (or SIP) and sister protocols. VoIP allows transmission of audio/video data over the network from computer nodes to other nodes and telephones (and possibly other electronic devices) and vice versa. Cost reduction and support for advanced multimedia makes VoIP one of the most lucrative modern technologies.

The context we chose to work upon was implementing VoIP in our University. Our University has a big LAN supporting around 5000 computers. The University also has a Telephone Exchange (Telex) which supports around 500 telephones (POTS) in campus most of which are allowed to make local calls within the campus only. VoIP technology allows computers to be used like these POTS and **phone to PC** and **PC to phone** voice calls are possible.

Now enabling Internet Telephony per computer would mean effectively an addition of 5000 new telephone connections (telephone numbers) in our University Telephone Exchange. But the Telephone Exchange could only allow a maximum of 500 additional connections under its present capacity and trade-offs.

Our paper discusses some of following innovative ideas with which we gave VoIP facilities and benifi ts to the University community without having to invest heavily on getting a huge Telephone Exchange for supporting 10000 computers.

- Universal voice messaging using POTS or computers to any member of University.
- Universal video messaging using computers to any member of University.

- Mechanism to support VoIP on numerous computer nodes using only a few telephone numbers available from the Telex.

While a lot of work has been done on VoIP in wireline and wireless networks, we could not find any work which addresses the problem we mentioned. We reiterate at this point that our problem is not specific in nature. The use of computers and growth of number and size of LANs is becoming high everyday. It is very probable to have huge LANs but no or very small Telex. In this case our ideas extend above VoIP benfits to the user community at low costs and high speed. 'Low cost and high speed' beacuse we are not directly dependent on Internet for any of the above implementation. We make use of fast LAN speeds.

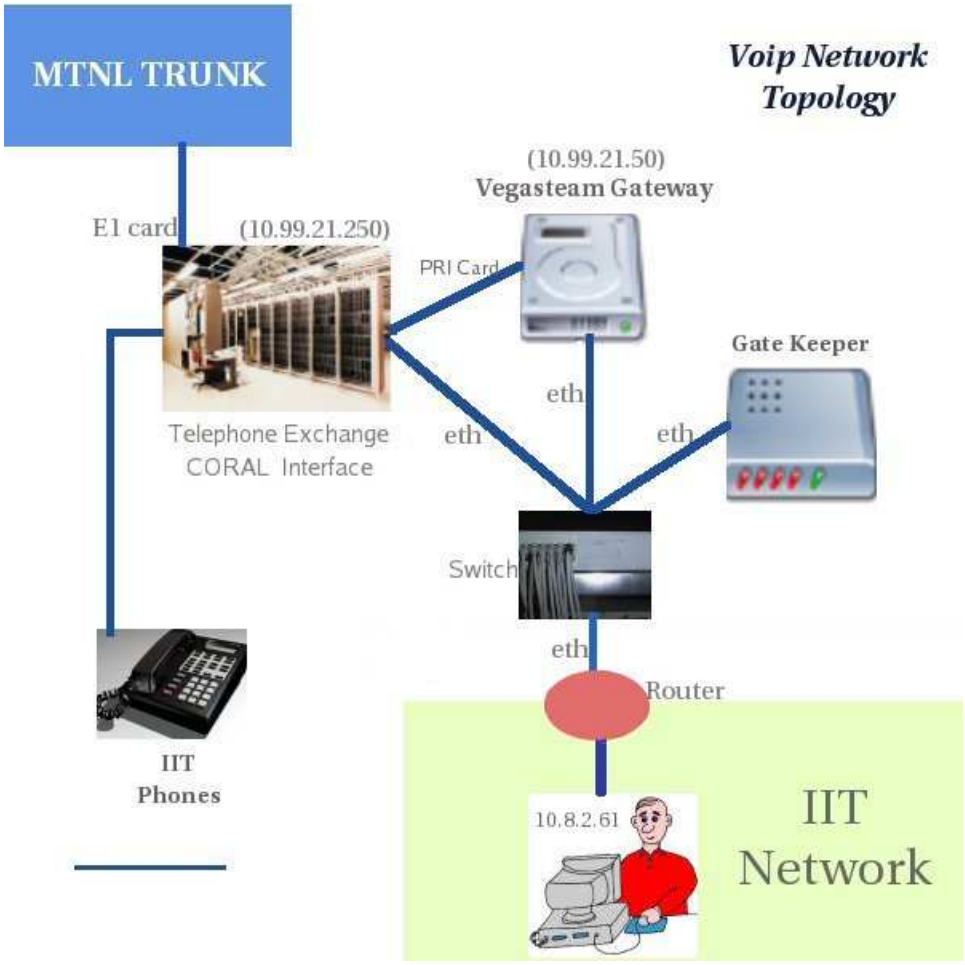
The rest of this paper first discusses related work in Section 2, and then describes our implementation in Section 3. Section 4 describes how we evaluated our system and presents the results and possible future works. Section 5 presents our conclusions.

2 Related Work and Technologies Involved

Other efforts/technologies that exist on which we build our solution are

- **Client Side**: *H.323 Terminal* implementation for most OS platforms like *Netmeeting* in Windows, *Gnomemeeting* and *Ohphone* in Linux. Answering machine (*openam*) and Interactive Voice Response System [IVRS] (*openivr*) are also available to us.
  Server Side: *H.323 gatekeeper* is GPL software project called *gnugk* and commercially available *H.323 gateway* and standard commercial Telex System like Coral.
- **LDAP technology** and a central LDAP directory for all the members of the community.
- **Mail, LAN and Internet**: Our work is certainly over a basic LAN with external connectivity to mail and Internet.

The Telex system (*Coral* in our case) is assigned an IP. The *Gateway* is connected to the LAN and assigned an IP. It is also connected to the Telex and hence serves to enable voice calls between the LAN and the POTS. Client softwares (mentioned above) and the Gateway make use of the H.323 protocol to establish a voice communication. The gatekeeper is used for additional support/ maintenance to above system.



This diagram shows the H.323 topology as in IIT Bombay.

3 Implementation

Motivation: There are 5000 odd computers and 10000 users. Sadly, Telex can give *individual* telephone numbers to atmost 500 users. So we implement the following -

Universal voice messaging using POTS or computers to any member of University.

We maintain a dedicated server machine say *voicemail.iitb.ac.in* and give this machine a fixed telephone number say 1001. Now any POTS or computer can make a voice communication to this machine. H.323 (implemented through *openh323*) supports recording of voice messages in .wav format. Now POTS make a connection to *voicemail.iitb.ac.in* and type the sender and receiver employee code by pressing buttons (IVR technology). This is followed by the voice-message to be sent. The server stores the message, uses LDAP to find the emailid of the receiver and sends the message. Authentication of sender may also be supported.

Universal video messaging using computers to any member of University

The server-client model for this implementation is basically the same as the previous model. We exploit the multimedia capacities given by H.323 protocols to send video messages to any member of the university using LDAP and sendmail in a manner similar to last example. The difference is however simple POTS can not be used to do that. So we need publicly available computers with cam and VoIP support. This reduces the effectiveness because two computers can anyway interact on LAN.

Mechanism to support VoIP on numerous computer nodes using only a few telephone numbers available from the Telex.

This is the most challenging and useful idea. We eventually allocate telephone numbers to all 5000 odd cumputers using only 500 (or a lot fewer) odd connections available from the Telex. First we set up NAT/proxy servers on say some 50 odd nodes and route the VoIP calls to all machine through them.

Say we want to call machine *adam* from a POTS *eve*. Call to *adam* is routed through the machine *devil*. *Devil* has a telephone number assigned to it by the Telex. There are a lot of machines behind *devil* who have unique ids assigned to them by *devil* but they do not have a fixed telephone number assigned by Telex. To call *adam*, *eve* first dials the number for *devil* and then presses buttons (code) for *adam* (IVR Technology). *Devil* directs the call to *Adam*. First apparent problem in this model is concurrency of phone calls.

- Concurrent calls to the same end-machine. This can simply be avoided by the using the standard protocol which does not allow call waiting facility for numbers in use.
- Concurrent calls to different machines behind the same proxy. To deal with this problem, a simplistic approach would be a simple queuing (and possibly time-out) operation at the proxy-level.

4 Evaluation and future work

voicemail.iitb.ac.in currently works for 10 POTS (experimental stage) and we can deliver voice messages to a any member of the community of strength 10000 people. Video Messaging is very easy to see in a P2P network connection. Its deployment on a major basis is yet to be done. We have been experimenting with the Telex to support more computers than its capacity using our idea and results have been encouraging. But the jitter in routed calls is too high. The highest number with allowable jitter has been achieved to 10 per proxy server (under controlled conditions) and we need some improvement here.

Suggestions for future work

- **Security features to *voicemail***: More secure authentication, encryption of passwords for POTS, time-limits of message etc could be added to the Voice messaging System.
- **Completely new approach/algorithm for Phonenumber Allocation**: An algorithm could be worked upon to dynamically allocate (limited) Phonenumbers to the large number of seeker Computers and a comparision of its performance with our solution could be done.
- **Improvement in our proxy based approach** New methods or heuristics to help increase the number of daughter nodes for a middle proxy computer and to decrease the jitter could be worked out. Better and more efficient solution to concurrency issues may also be sought after.

5 Conclusions

While computer to computer and computer to Phone voice communication are easy to achieve, phone to computer calls offer challenges in corporate/university LANs with low power or no Telex. For such situations, we have been able to suggest a few innovative and easy solutions to make use of VoIP. Universal voice messaging lets one send a voice message to any member of the LAN. Universal video messaging explores the same idea as above for video messaging. Lastly we presented a novel and simple idea to support VoIP on numerous computer nodes using only a few telephone numbers available from the Telex.

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