The Application Reference Book Of IP Phone

Specification Note

In this manual, the "★" mark indicates that the specification or feature described there may be not available yet and is reserved for the future.

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Chapter 1

1. The Introduction of Applications

The purpose of this Application Reference book is to introduce some applicable architecture with the IP phones. Different cases varying from enterprise, SOHO, residential and even to ITSP application will be described here. For each case, the basic requirement of network configuration, diagram of architecture, the description of application, and how to set the parameters of IP phone are also included. After learning of these applications, you may accumulate some experience that will become very important for the deployment of your VoIP communication systems.

If you are just interested to find a solution for a particular network architecture or configuration, you may check with the table of contents and then find a proper case for reference. Due to too many varieties with different extent of complication, this reference book just offer typical cases only. For more applications and their solution, please try and learn it, or contact your supplier for assistance.

1.1. The Basic Assumptions

There are some basic assumptions for the reader listed below:

(1) The reader shall already learn how to configure the IP phone from User's Manual or Administration Guide. The configuration can be done thru Web page of IP phone, Telnet or IP phone tool.

(2) The reader shall be already know what configuration and condition of his/her network and be able to do adjustment, re-arrangement, as well as installation of software and hardware, if the study result shows something to do or try.

(3) The IP phones will be registered to a Gatekeeper, no matter what it belongs to enterprise, own office, or an ITSP company. For a connection directly to a remote IP phone or a remote Gateway, these applications will be not covered here in this book.

(4) This Application reference book has no intention to focus on Interoperability issue. Therefore, all the IP phones are assumed to have same model. And the Gatekeeper and gateways are from the same supplier or recommended vendors. After you can successfully realize the application, then you may change to different device from different vendor one by one, bit by bit.

1.2. The Configurations To Be Concerned

With the configuration Web page of IP phone, we will just focus on some particular fields that are more important to make applications work. But for another settings, please refer to User's Manual or Administrator Guide for proper settings. Although they are not the keys for the applications, they still need right or proper setting.

The following figure is the Web page of IP phone configuration. Some important fields have been highlighted. Please configure them with accordance to this reference book carefully.

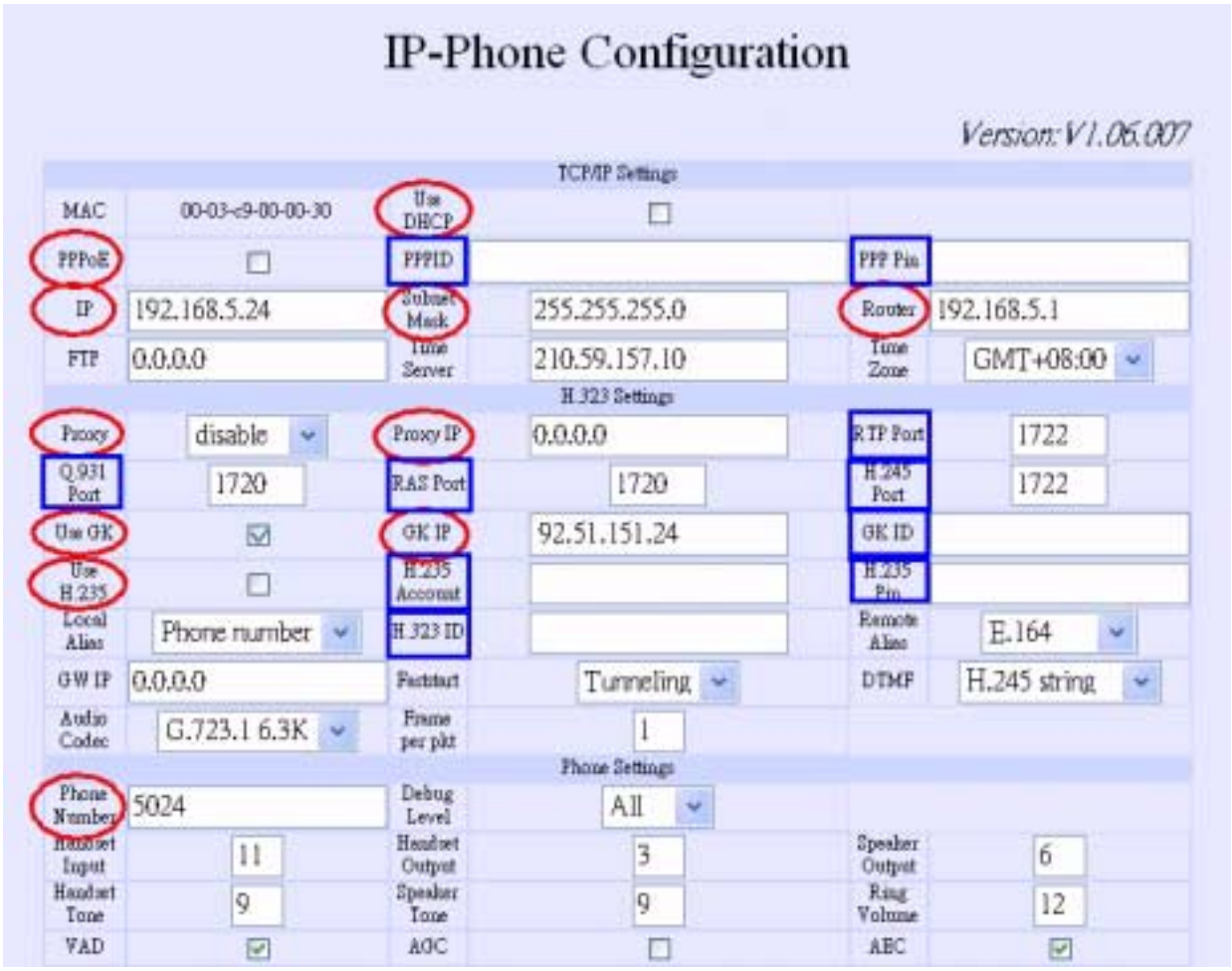

Figure 1.1. The Web Page of IP phone Configuration

The field above with a circle is very concerned items during configuring for application. And the field with a rectangular box is the secondly concerned items. They are described below with a "o" and "□" mark. For detailed function and description of each field in the Web Page, please refer the Web description in the Administration Guide of IP phone.

Some fields, like "Faststart" and "Audio Codec", have been properly set sometime. Although the IP phone can negotiate with the remote endpoints (from other vendors), if them don't support auto-fallback or auto-swapping capability, the voice channel won't work. Besides, you have to make sure if DTMF is using H.245 String us the default.

Description of each related fields:
==========

- **Use DHCP:** Enable or Disable DHCP client function.
  For IP phone located in private LAN, if this is enabled, you can get an assigned virtual IP from DHCP server.
  When PPPoE of IP phone is enabled, please disable DHCP.
  When the IP phone is assigned with a fixed (Real or virtual) IP, please disable DHCP.
- **PPPoE:** Enable or Disable PPPoE broadband Internet Dial-up access function.
  Only when you want the IP phone to dial-up to ISP and make a Internet connection,

this will be enable. Or, don't enable this field.

- **PPPID:** User ID given by ISP for Internet Dial-up access.
  When PPPoE is enabled, this field must be filled out correctly.
- **PPP Pin:** User Password for Internet Dial-up access.
  When PPPoE is enabled, this field must be filled out correctly.
- **IP:** IP address of this IP phone.
  When you want to assign a fixed (real or virtual) IP, you can set it here.
  When you want to request a IP from DHCP server or ISP (thru PPPoE), please just leave it unchanged. When the new IP is given, it will be auto-set into this field.
- **Subnet Mask:** A Mask for limiting a scope of network IP addresses for searching.
  Normally it is set as 255.255.255.0. Please consult to your network administrator.
- **Router:** The IP address of default gateway.
  The router address for inner users. Please consult to your network administrator.
- **Proxy:** Selection of Disable, Enable, Search 2, Search 3, Search 4, and Connect
  Disable: Normally, it is disabled.
  Enable: When there is a real proxy, such like H.323 Proxy box, Proxy server, PC running proxy software or Router with proxy function, if it has a fixed real IP address, please enable it.
  Search 2/3/4: If you want to search up to different layer for the router with a real IP.
  Connect: If your proxy or router use a dynamic real IP and you want to include it as a virtual H.323 Proxy, please select "Connect".
- **Proxy IP: the public IP address of Proxy**
  The real IP address of Proxy : if your network uses a standard real H.323 Proxy box, Proxy server, PC running proxy software or Router with proxy function with a real IP. If your network uses a Router with a real fixed IP, if you want to emulate a virtual H.323 Proxy.
  0.0.0.0: If you select "Search 2/3/4" in Proxy field, please specify"0.0.0.0" to this Proxy IP field.
  "**61.222.54.184**" or "**67.120.192.137**": If your network uses a H.323 Proxy box, Proxy server, PC running proxy software or Router with proxy function with a real dynamic IP and you want to emulate a virtual H.323 Proxy, please set this field with a NAT Probe Servers IP address.
- **RTP Port:** "1722" as default setting.
  When enabling Virtual H.323 Proxy function, see the description in Q.931 port for port setting.
- **Q.931 Port:** "1720" as default setting.
  When you enable Virtual H.323 Proxy function (in Proxy field) for multiple IP phones behind the same NAT environment, the port setting shall follow the following formulas: (For details, please refer to Web Page description of Administration Guide)
  Q.931 and RAS Port address = The last number of its virtual IP address + 5000.
  H.245 and RTP Port address = The last number of its virtual IP address + 5002.
  RTCP Port address = The last number of its virtual IP address + 5003.
- **RAS Port**: "1720" as factory default setting.
  When enabling Virtual H.323 Proxy function, see the description in Q.931 port for port setting.
- **H.245 Port:** "1722" as default setting.
  When enabling Virtual H.323 Proxy function, see the description in Q.931 port for port setting.
- **Use GK:** Enable or Disable
  This must be enabled in all cases with registering to a Gatekeeper

- **GK IP:** The IP address of Gatekeeper
  This must be filled with the real IP of Gatekeeper in all cases of this book.
- **GK ID:** Null, or the ID of Gatekeeper to be registered.
  Please consult to your administrator of Gatekeeper or ITSP.
- **Use H.235:** Enable or Disable
  Please consult to your administrator of Gatekeeper or ITSP. When your ITSP or administrator give you an account ID and Pin number for Gatekeeper logon, normally you have to enable this field.
- **H.235 Account:** The Account ID of H.235 for Gatekeeper
  When H.235 is enabled, this is a must.
- **H.235 Pin:** The Pin Number of H.235 for Gatekeeper
  When H.235 is enabled, this is a must.

Local Alias: Selection of Phone Number, Full Name, H.323 ID, MAC address.
This is for reference only.

- **H.323 ID:** an address used in H.323 protocol with a character string.
  When Use Gatekeeper is enabled, this is required for registration use.

GW IP: The IP address of VoIP Gateway
This is not required in all cases of this book. But you can leave it unchanged.

Faststart: Selection of Disable, Faststart, and Tunneling
This has nothing to do with network configuration. But for some conditions, it needs to be configured properly in order to set up the voice channel.

DTMF: H.245 String is default setting
This has nothing to do with network configuration. But for some conditions, it needs to be configured properly in order to make DTMF function working.

Audio Codec: G.711 a-law, G.711 μ-law, G.723.1 6.3K, G.723.1 5.3K, G.729, G.729A, G.729B, G.729AB.
This has nothing to do with network configuration. But for some conditions, it needs to be configured properly in order to set up the voice channel.

- **Phone Number:** The phone number of this IP phone.
  In any case, this is a must. But when Gatekeeper is used, this will be the extension number of Gatekeeper.

1.3. Glossary

ADSL (Asymmetric Digital Subscriber Line)
A DSL based technology that enables greater bandwidth rates over standard copper telephone lines. Subscribers install an ADSL modem in their home that allows them to access data on the Internet while at the same time use their telephone for voice conversations. This is possible because ADSL modems transmit data over telephone lines at different frequencies than voice conversations.

Cable Modem
A device used to provide fast Internet access over cable TV lines. The increased speed is made possible because coaxial cables (which transmit TV signals) have much greater bandwidth than standard telephone lines.

DOCSIS (Data Over Cable Service Interface Specification)
It defines the interface requirements for cable modems providing data distribution over a cable television network. DOCSIS ensures that a network will work properly when DOCSIS modems made by different vendors are connected to it.

Firewall
A system that secures a network and prevents access by unauthorized users. Firewalls

can be software, hardware or a combination of both. Firewalls can prevent unrestricted access into a network, as well as restrict data from flowing out of a network.

Gatekeeper

An H.323 entity that provides address translation, control access, and sometimes bandwidth management to the VoIP network for H.323 terminals, Gateways, and MCUs.

Gateway

An H.323 entity which provides real-time, two-way communications between two H.323 endpoints. An endpoint on the LAN which provides for RT 2-way communications between H.323 Terminal on the LAN and other ITU terminals (ISDN, GSTN, ATM, ...) on WAN or to another H.323 gateway.

H.323 Proxy

A device for controlling and accepting inbound and outbound H.323 traffic, removing the requirement for existing network infrastructure to be affected.

Headend

The equipment located in the central office of the service provider. The headend connects the cable network to external data networks.

ICS (Internet Connection Sharing)

A function of IP sharer or Internet gateway. This function allows all users of the home-network to share one Internet connection. It can be implemented in an embedded device or in the format of PC software.

IP type: the type of IP address. There are four different IP types.

IP Sharer or Internet Gateway

A device between a home network and the Internet. The device allows all users of the home-network to share one Internet connection. Usually provides functionality such as DHCP, NAT, VPN and more, depending on the manufacturer.

ISP (Internet Service Providers)

An Internet Service Provider (ISP) is a commercial organisation that provides access to the Internet for its subscribers

ITSP (Internet Telephony Service Providers)

A ISP engage in the telephony service and related business, like value-added telecommunication services which are based on internet system.

MCU (Multipoint Control Unit)

A central switching and control device for videoconferences involving more than two participating terminals.

NAT (Network Address Translation)

A function of Internet Gateways and routers that allows for the sharing of an IP address. For example, NAT on an Internet Gateway will allow the individual PCs in a home network to appear as the IP address of the Internet Gateway to users and PCs on the Internet, even though each PC on the home network has it's own internal private IP address.

PAT (Port Address Translation)

Port Mapping

PAT or port mapping is the process where packets arriving to a particular IP address/port can be translated and thus redirected to a different IP/port. This functionality is a way to create a persistent passage through NAT. Port Mapping is only necessary for incoming connections, not returning traffic.

PBX

Private Branch eXchange :An in-house telephone switching system that interconnects telephone extensions to each other as well as to the outside telephone network.

PPPoE (Point-to-Point Protocol Over Ethernet)

It is a protocol that is used for connecting to high speed DSL service of Internet.

Proxy Server

Used in larger companies and organizations to improve network operations and security, a proxy server is able to prevent direct communication between two or more networks. The proxy server forwards allowable data requests to remote servers and/or responds to data requests directly from stored remote server data.

Router

A device that forwards data packets from one local area network (LAN) or wide area network (WAN) to another. Based on routing tables and routing protocols, routers can read the network address in each transmitted frame and make a decision on how to send it via the most efficient route based on traffic load, line costs, speed, bad connections, etc.

SOHO

Small Office & Home Office: A term generally used to describe an office or business with ten or fewer computers and/or employees.

VoIP

Voice Over Internet Protocol: VoIP is based on the principal of transmitting digitized voice packets over networks. Basically, VoIP consists of converting voice signals into streams of digital packets and sending those packets of data through an IP-constructed network environment. VoIP can work in both LAN (local area network) and WAN (wide area network) environments for intranetwork or internetwork communication between VoIP channel users. Routers and switches and other special compression protocols direct the packetized voice data to their destination IP address. VoIP can be less expensive than voice transmission using standard analog packets over POTS (Plain Old Telephone Service). It allows telephone calls, faxes, or overhead paging to be transported over an existing IP data network topology.

1.4. Description of Different IP Type

Currently IP address wit IPv4 format has a shortage problem over the world. So, some enterprise or individual use private IP address for internal computers or network device. Therefore there are four main different IP types:

Any (Any type of IP): All of different IP.

R(Real) : is also recognized as “Public”, “Global routable” or “External” IP address

- RF(Real Fixed) or
- RD(Real Dynamic)

V(Virtual): is recognized as “Private”, “External inaccessible”, “Internal”.

- VF(Virtual Fixed), or
- VD(Virtual Dynamic).

They are described in details below:

Real Fixed IP: When an IP phone uses a Real Fixed IP, it will be immune from NAT traversal issue. Therefore, it can either easily register to a Gatekeeper for communications or directly be called by another IP phone or Gateways.

Real Dynamic IP: When an IP phone uses a Real Dynamic IP, it will be immune from NAT traversal issue, too. Even its IP will be changed daily, it still can easily register to a Gatekeeper for communications. Because our IP

Phone will periodically re-flash the link between Gatekeeper and IP phone. But in this case, there is no way for it to be called by another IP phone or Gateways.

Virtual Fixed IP: When installing an IP phone in office LAN, you may assign a particular Virtual (Private) Fixed IP address to it. With it, it is very convenient for internal management and communication. But it will face NAT traversal issue, when this phone has to communicate with outside. Because its Fixed Virtual IP address is blinded by the NAT device. So, we need a NAT solution to solve this issue.
With this case, any IP phone or Gateway located internally inside the LAN can call with this IP phone directly and easily. But for outside communication, this IP phone may be possibly called, depending the support of NAT solution. Normally, in this condition, registration to a Gatekeeper will be preferred.

Virtual Dynamic IP: When the IP phone is installed in office LAN, if you enable DHCP client flag of the IP phone, it will automatically get a Virtual (Private) Dynamic IP address from DHCP server. This IP will be changed timely by the server. With this setting, the IP phone will face more complicated NAT traversal issue, when this phone has to communicate with outside. Because not only is its Virtual IP address blinded by the NAT device, but also no any internal IP phone or Gateway can call it directly without the help of Gatekeeper. So, we need a more powerful NAT solution to solve this issue.
With this case, for both internal and external communications, a Gatekeeper will be used for registration and offer the connections among them.

Chapter 2

2. The Solution Table And Concept

2.1. The Solution Table of Different Applications

With the IP phone, you may build up different architecture for different application. There are many different cases varying from enterprise, SOHO, residential and even to ITSP application can be found in the table below. When you look up one kind of application that seems matching your environment, you may just go to its details description.

But before you go to detailed description of each application, please read the following sessions in this chapter so that you can really understand the NAT / virtual IP issue and the operational concept of solution that the IP phone provides. The knowledge may be useful for you to troubleshoot any problem encountered in your application or to overcome new issues when your application is different from the one we described in this Application Reference Book.

(1). Applications for General Offices:

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
O1		Yes (RIP)	RF IP GK **With** H.323 Proxy function	Any Any	(1) Internal Calls: All IP phones and Gateways will register to internal Gatekeeper and can call each other well internally. (2) External Calls: If external endpoint is fine in voice channel, any internal endpoint can do call setup & conversation well with the external point.	Typical VoIP System For main office
O2		Yes With a RF IP	RF IP GK **Without** H.323 Proxy function	Any R IP, V IP	(1) Internal Calls: All IP phones and Gateways will register to internal Gatekeeper and can call each other well internally. (2) External Calls: If external endpoint is fine in voice channel, any internal endpoint can do call setup & conversation well with the external point. The H.323 proxy of the IP phones need to be enabled if they want to call to outside.	Not suggested

O3	RF IP	Yes With a RD IP		R IP V IP Any	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. The H.323 proxy of the IP phones need to be enabled. So far, there is a limitation that the IP phones shall be located in the same subnet behind NAT. (2) External Calls: As H.323 Proxy enabled, our IP phones can call to any external endpoints.	Not suggested
O4	RF IP	Yes (RIP)	H.323 Proxy Box installed With a RF IP	Any Any	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Typical VoIP System For branch office

(2). Applications For SOHO Offices:

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
S1	RF IP	Yes with a RIP	H.323 Proxy Box installed With a RD IP	Any	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Typical VoIP System For SOHO
S1 -1	RF IP	Yes, with a RIP	H.323 Proxy Box installed With a RD IP.	Any	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Go thru ADSL /XDSL/ Cable/ Modem Line to access Internet.
S2	RF IP	Yes, Use one RD IP For a SOHO Router		One R IP Others VF IP	Register the IP phones to the external Gatekeeper: (1) External Calls: For the phones using V. IP, their H.323 proxy function need to be enabled. Any internal endpoint can do call setup & conversation well	Typical VoIP System for SOHO

				One R IP Others VF IP	with the external point. (2) Internal Calls: RIP phone can call to any one VIP phone. For the phones using V. IP, their H.323 proxy function need to be enabled.	

(3). Applications For Home (Residential):

No.	External GK	Number of Real IP	Router / Firewall	Internal IP Phone	Call Applications	Remarks
H1	RF IP	2 or more RDIP given	Yes, Use one RD IP For a IP sharer device	One R IP Others VF IP One R IP Others VF IP	Register the IP phones to the external Gatekeeper: (2) External Calls: For the phones using V. IP, their H.323 proxy function need to be enabled. Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: RIP phone can call to any one VIP phone. For the phones using V. IP, their H.323 proxy function need to be enabled.	for a big home network
H2	RF IP	Only 1 RDIP given	Yes, Use this RD IP in router	VF IP VF IP	Register the IP phones to the external Gatekeeper: (1) External Calls: For the phones using V. IP, their H.323 proxy function need to be enabled. Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: For the phones using V. IP, their H.323 proxy function need to be enabled.	
H3	RF IP	2 or more RDIP given	Run a PC to act as an IP sharer for NAT	 One R IP, Others VF IP One R IP, Others VF	Select a PC to run proxy software as a IP sharer. Then all H.323 proxy functions of IP phones using V IP shall be enabled and pointed to the IP sharing PC. Then, register the IP phones to the external Gatekeeper: (1) External Calls: Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: Any phone can call to any one	Typical home network. When PC is off, all other phones will be down.

				IP	phone.	
H4	RF IP	Only 1 RDIP given	Run a PC to act as an IP Sharer for NAT (PC can not be powered off.	VF IP VIP	Register the IP phones to the external Gatekeeper: (For the phones using V. IP, their H.323 proxy function need to be enabled.) (1) External Calls: Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: Any phone can call to any one phone.	
H5	RF IP	2 or more RD IP given		2 R IP 2 RIP	Register the IP phones to the external Gatekeeper: (1) External Calls: Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: RIP phone can call to other RIP phone internally.	Dual IP phone in A Home
H5 -1	RF IP	2 or more RD IP given		1 R IP	Register the IP phones to the external Gatekeeper: External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Basic home network. (IP phone + PC)
H6	RF IP	Only 1 RDIP given		R IP	Register the IP phones to the external Gatekeeper: External Calls: The phone can do call setup & conversation well with any external point.	
H7	RF IP	Only 1 RDIP given	To run a PC for Internet Sharer. With RD IP	VF IP	For the phones using VF IP, its H.323 proxy function need to be enabled. Then register the IP phone to the external Gatekeeper: External Calls: The phone can do call setup & conversation well with any external point.	Basic Home Network (IP phone + PC)

(4). Applications with A Special Gatekeeper:(★)

[Notes]: A special Gatekeeper is proposed for some applications. All endpoint including the IP phone should provide the same proprietary NAT-reserve protocol accordingly.

Even with a proprietary NAT-reverse protocol, the special Gatekeeper still maintains the Interoperability of standard H.323 protocols so that any standard H.323 endpoints, MCU and

Gatekeeper can communicate normally with this special Gatekeeper and the special endpoints. But for standard endpoints even registered to the special Gatekeeper, there is no way to offer NAT-reserve solution for them. This is a newly developing feature; please check to your supplier about the availability of this feature.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
P1 (★)	RF IP With Route mode In Main office [Remark]	Yes with a RIP	Special H.323 Proxy Box with a VF IP In office	Any	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	[Remark]: Should use a special GK which supports virtual IP solution.
P2 (★)	RF IP With Route mode at ITSP [Remark]	Yes with a RIP		Any With a special Proprietary Virtual IP support in the phone	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	[Remark]: Should use a special GK which supports virtual IP solution.
P3 (★)	RF IP With Route mode at ISTP [Remark]	Yes with a RIP		Any With a special Proprietary Virtual IP support in the phone	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (1) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	[Remark]: Should use a special GK which supports virtual IP solution.

(5). Integration Systems Reference :

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
I1		Yes, with a RF IP	GK+Proxy With a RF IP	Any (H.323 Standard)	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Main office
I1 -1		Yes with a RD IP	H.323 Proxy With a RD IP	Any (H.323 Standard)	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally thru H.323 Proxy.	Branch Office

					(2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	
I2		Yes, with a RF IP	GK+Proxy With a RF IP	Any (H.323 Standard)	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Main office
I2 -1				RD IP (H.323 Standard)	(1) External Calls: IP phone can do call setup & conversation well with any endpoint in main and branch offices.	Home Office
I3	RF IP By ITSP	Yes with a RD IP	H.323 Proxy With a RD IP	Any (H.323 Standard)	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally thru H.323 Proxy. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Office
I4	RD IP By ITSP			(H.323 Standard) RD IP Another 1 RDIP for PC	(1) External Calls: Any internal endpoint can do call setup & conversation well with any external point. Or, the outgoing call can transfer to PSTN analog phone or mobile phone thru Trunk Gateway.	Home
I5	RD IP By ITSP			(H.323 Standard) RD IP Another 1 RDIP for PC	(1) External Calls: Any internal endpoint can do call setup & conversation well with any external point. Or, the outgoing call can transfer to PSTN analog phone or mobile phone thru Trunk Gateway.	Homes
I6	RF IP By ITSP	Yes with a RIP For offices Only	For office, Proxy is equipped wit a RIP.	RD IP For home Subscriber and VF IP For office users	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point. Or, the outgoing call can transfer to PSTN analog phone or mobile phone thru Trunk Gateway.	ITSP

2.2. NAT Traversal Solution

Many private individuals or service providers are using Network Address Translation (NAT) method to get around the problem of not having enough IP addresses for IP devices. Therefore, many computers or network devices will use private (Virtual) IP address inside their LAN and transmit data to/from the Internet thru a single real public IP address. Typically, IP addresses in the private network have the form 192.168.x.x or 10.0.x.x.or 172.16x.x or 172.31.x.x. (Where x is a number between 0 and 254).

But NAT created a big problem for VoIP communication because both the VoIP signaling and the media uses UDP to transport their information. And under standard operation condition and without permission, all incoming UDP packets will be dropped by Router and/or Firewall. Firewalls often use this NAT mechanism to filter traffic entering and leaving a zone.

However, it will cause that the LAN IP phone get no voice from the far end or the call signals will be blocked inside or outside the Firewall during connection setup. When a phone located in a public network sends a signal or media packet to another phone located in private network side, the destination of packets cannot be the virtual IP address of peer private phone. Because it is not usable in public network. So the destination will be the address of NAT gateway of private IP phone. However, when NAT receives these packets, it doesn't know which port to be invoked and which private address to be translated. Finally, the packets of public IP phone will be dropped. On the contrary, the same problem occurs when a private phone wants to call a public IP phone thru external Gatekeeper.

There are different approaches to solving this problem:

- **Use a H.323-aware NAT router:**
  In fact, it is very difficult. Because most enterprise do not agree to swap current stably operating router. Besides, this kind of router is not so popular in the market and new equipment may be too expensive.
- **Set up a static route in the NAT gateway:**
  This method doesn't need any new facilities but may be denied by some enterprises. Because this action may violate to the management or configuration rules currently applied to the router. Even for a simple home or SOHO environment, end users may be confused with how to set the static route table right. However, this solution seems applicable possibly in most of routers.
- **Use STUN to measure out ports:**
  For some environments, "Simple Traversal of UDP Through NATs" (STUN) is used to get around the NAT problem. But it needs a server located in the public Internet. And the IP phones shall do some modification to support this protocol if they are going to leverage this method.
  The IP phone shall link to the STUN server and get the analysis response from SUN Server. In general, the response will tell the IP phone which type and the real IP address and ports of your NAT gateway.
  Since it needs an extra server and maintenance fee for service in the public Internet, some enterprises has comments with this solution, too.
- **Use Special Gatekeeper Solution to support NAT solution:**
  Since most IP phones will register to a public Gatekeeper, if the Gatekeeper can support NAT solution, enterprises don't need cost an extra STUN server. But,

however, the IP phone shall support a special (proprietary) protocol to work with this special Gatekeeper.
This is an easy-management and cost-effective solution for enterprises, SOHO and home users. But any standard endpoints without supporting this protocols that want to register to this Gatekeeper shall need real IP address.

2.3. What NAT Solutions Do We Support?

Basically, if the IP phones are planed only for internal (Intranet or VPN) communication, there is no need to utilize any NAT traversal solution. Otherwise, you do need to determine a proper NAT solution for your IP phone. With different needs of environment and economic consideration, the IP phone supports several solutions for the users.

(1) IP phone H.323 Proxy function and NAT Gateway port mapping:

In the IP phone, there is a built-in “H.323 Proxy” simulator that can be enabled to offer NAT solution for a fundamental private network. When this function is enabled, the IP phone will utilize a special NAT-checking protocol to communicate with a “NAT Probe Server (with fixed real IP address) to check out the real IP address of NAT gateway of private network. And then, the IP phone will virtually include the NAT gateway to be a virtual H.323-aware Proxy and do packet header transfer during sending or receiving VoIP packets as general Proxy server does (please refer to the following figure).

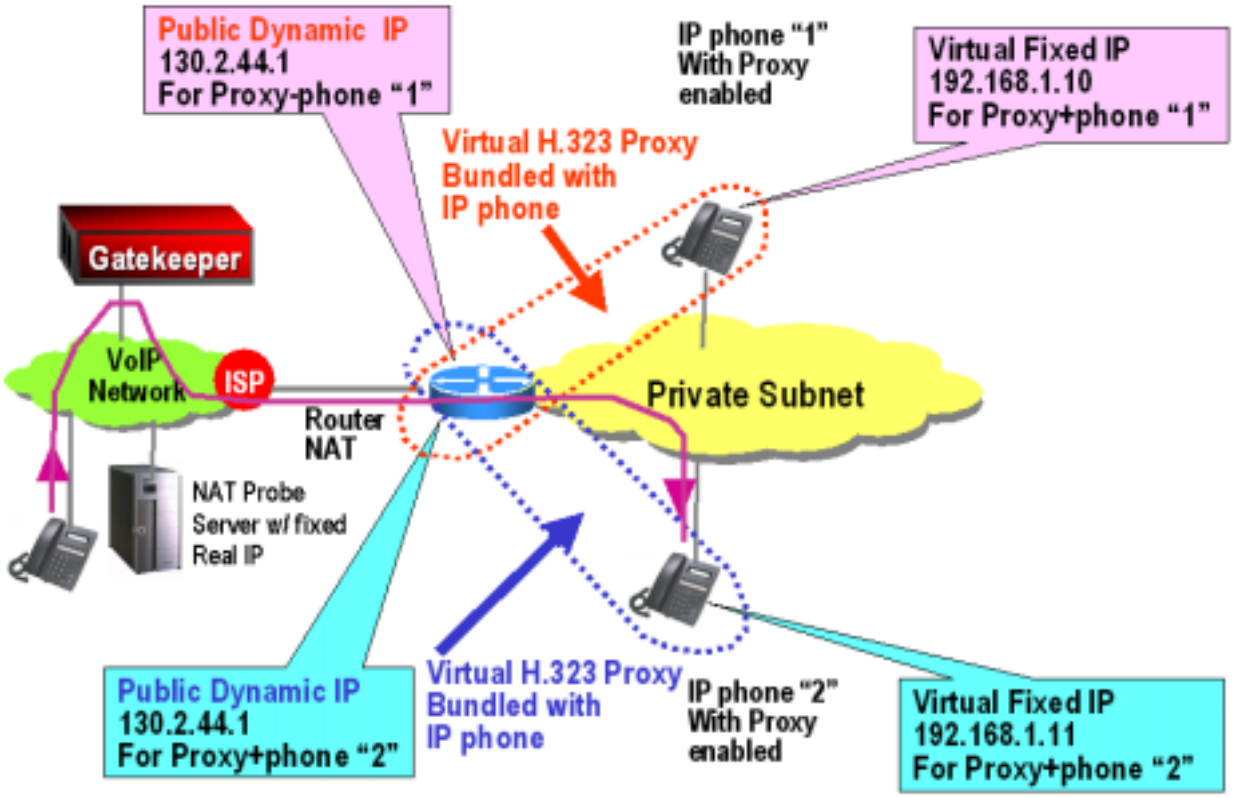

Figure 2.1. Simulating a Virtual H.323 Proxy with an IP Phone

At the same time, user has to configure the “PAT (Port Address Translation)” table on NAT Gateway so that each signal and media port of IP phone can be correspondingly mapping to related ports of NAT gateway. Please follow the manual carefully to configure the PAT table. For intercom (inside private network) calls between IP phones that all use virtual IP address and are behind the same NAT and subnet, this solution is also applicable.

For outgoing packets, the IP phone will place its private IP address into the payload and use the real “IP:port” of NAT gateway to send relative packets. For incoming packet, after NAT gateway translates the VoIP packet on a particular mapping port to a private IP address, the packet will be accurately delivered to the target IP phone for process. Please see the figure below “NAT port mapping to Private IP address” for reference.

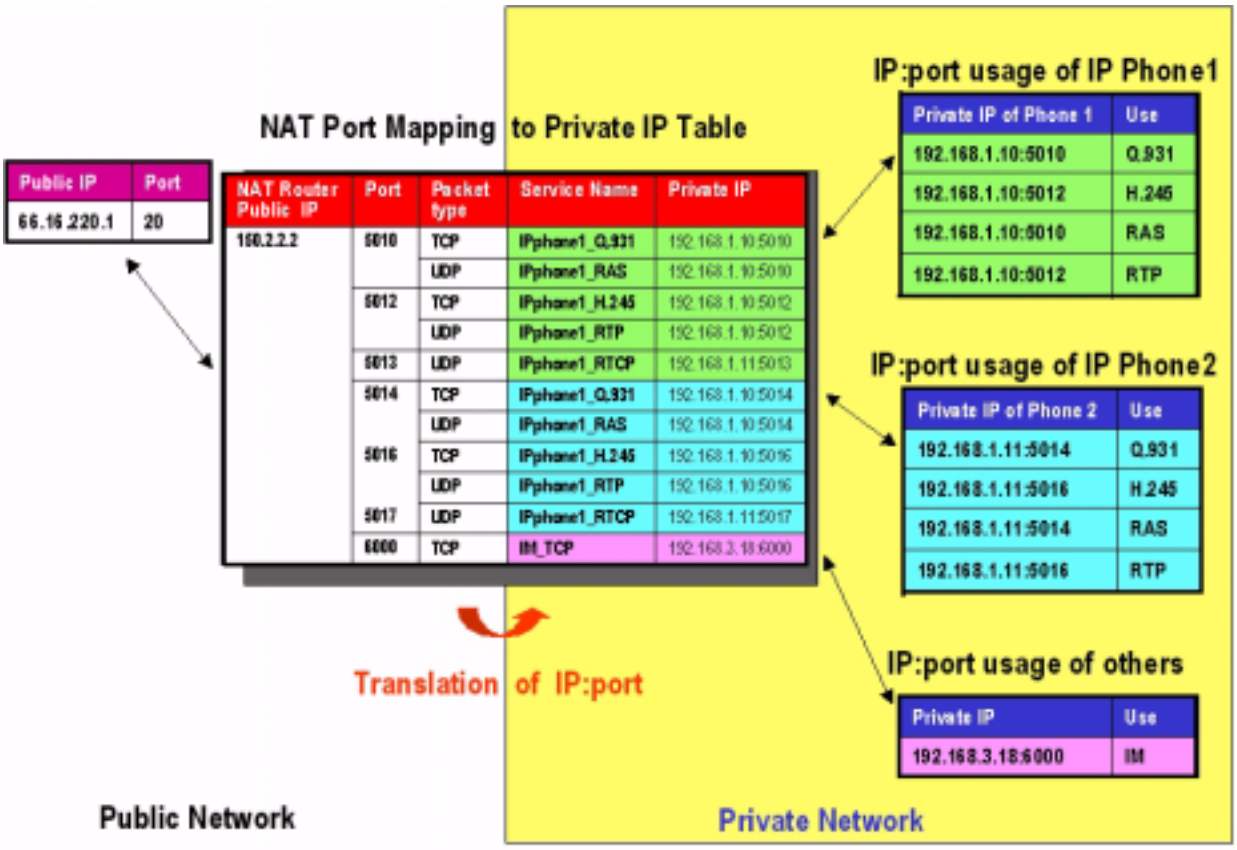

Figure 2.2. NAT port mapping to Private IP address

(2) To utilize a H.323 Proxy

H.323 Proxy Server is an application-specific device of VoIP network that allows all H.323 endpoints in the same subnet to transfer signal and media packets to/from the Internet easily. One Proxy server needs an installation of two network cards**.** Assign a fixed IP address for the INTERNAL network (such like 192.168.0.1). And the EXTERNAL network card (public network side) will need an public real IP address that may be assigned by ITSP or ISP provider.

Typically, a Proxy server is assigned with a Real Fixed IP address on the public side. So, it will be immune from any NAT traversal issue. But for using a dynamic real IP address, if this proxy cannot timely notify its new IP address to the public Gatekeeper when the old real IP is changed, the proxy will loss the link with the Gatekeeper. Unfortunately not all proxy servers support this

mechanism. Therefore, you shall choice a right one or contact us for our H.323 proxy server.

The advantage of utilizing a H.323 Proxy server is to make the solution simpler and easily for maintenance. But this approach brings some concerns to the users, such like:

- A need of extra H.323 proxy server
- A extra Real Public IP address
- All traffic routing thru the H.323 proxy so that a H.323 proxy can serve just limited H.323 endpoints, say 200 concurrent calls for a Pentium III PC system.
- If you use Real Dynamic IP for the H.323 proxy server, you will need two Ethernet ports on the H.323 Proxy. Of course, if you use Real Fixed IP address, you just need one Ethernet interface only. Besides, please make sure that your H.323 Proxy server can firmly link to the Gatekeeper from time to time.

However, it is strongly suggested enterprises to leverage this solution with a “Real Fixed IP address”. Besides, enterprises may setup another VoIP dedicated separate broadband link to connect the public network so that voice quality won’t be interfered by data streams in the same network. But this suggestion needs one more ADSL/XDSL/Cable link. The VoIP packet flow thru proxy server is illustrated in the following figure:

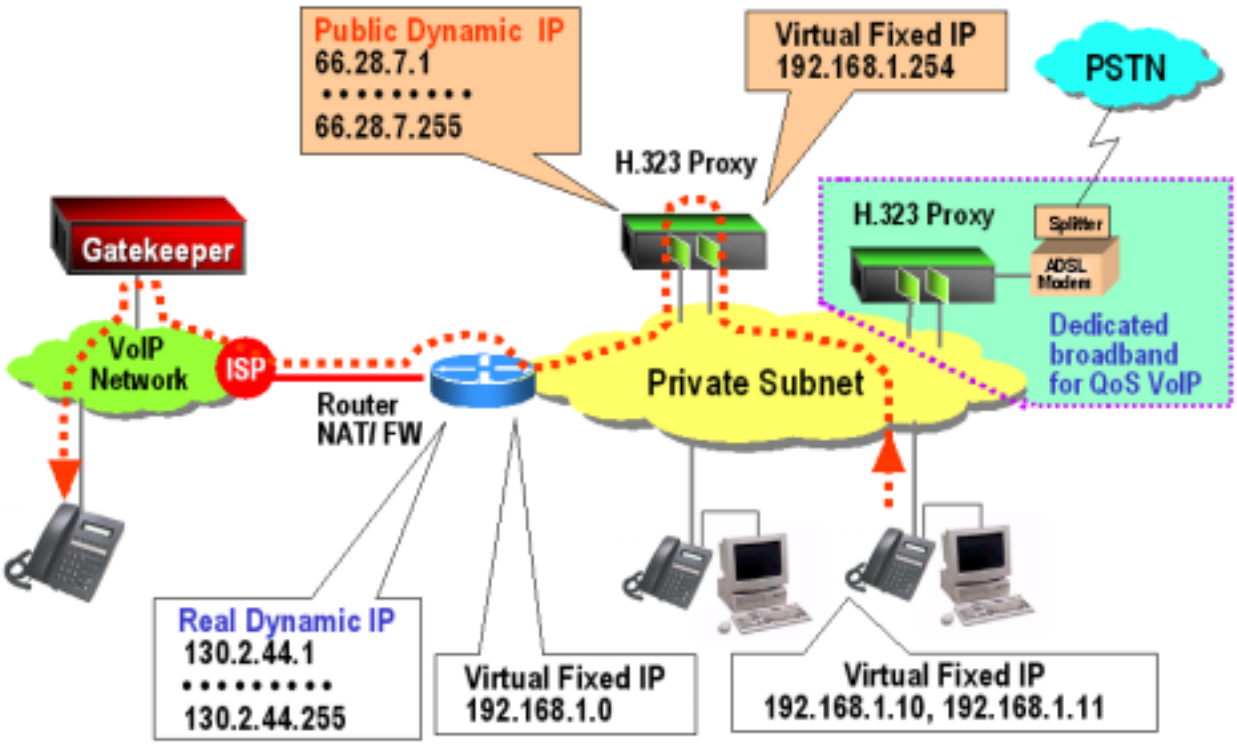

Figure 2.3. Using H.323 Proxy Box for Private IP phones

(3) To use DMZ function on the SOHO Router

This method is mainly suggested for SOHO or Home user. In fact, a DMZ (De-Military Zone) is a special feature of a Firewall or Router. You can image that it is located within two firewalls in serial and between a public network and a private network. The purpose of a DMZ is to have

a buffer zone for settling those systems that public access is allowed to as well as private user access is allowed to. In general, systems in the DMZ are not trusted and are allowed very little (if any) access back into your private network so that if a compromise were to take place in your DMZ, the attacker would have an additional (and more secure) layer to cross before getting to your most sensitive assets.

The term “DMZ” is often confused due to SOHO router companies claiming to have a 'DMZ' configuration option. This marketing ploy does not give a user a true DMZ, but rather just forwards all traffic not already accounted for by other forwarding rules to a specified host. This is not a true DMZ. But, no matter what naming it use, you may leverage this DMZ function to solve NAT issue. In general, a typical SOHO router just allows a single host to occupy the DMZ. The following methods are applicable for IP phone in your private LAN.

- To assign one IP phone to the DMZ when you need one more IP phone. The IP phone can use a virtual IP address. In general, this is used in Home network.
- To assign H.323 Proxy to the DMZ when you need more IP phones to hang onto this H.323 proxy. The IP phones can use virtual IP addresses. Basically it is applicable for SOHO network.

In convention, most administrators reserve DMZ for particular or emergency use only. So, this method will be a back-up or unofficial solution.

(4) To Run a Special Gatekeeper with associated IP phone

[Notes]: The special Gatekeeper is proposed for some applications, especially there is seriously in shortage of real IP addresses over different small sites connecting to the Gatekeeper. All endpoint including the IP phone should provide the same proprietary NAT-reserve protocol accordingly.

Even with a proprietary NAT-reverse protocol, the special Gatekeeper still maintains the Interoperability of standard H.323 protocols so that any standard H.323 endpoints, MCU and Gatekeeper can communicate normally with this special Gatekeeper and the special endpoints. But for standard endpoints even registered to the special Gatekeeper, there is no way to offer NAT-reserve solution for them. This is a newly developing feature; please check to your supplier about the availability of this feature.

Since most IP phones will register to a Gatekeeper for central administration, there is a special Gatekeeper proposed to get around NAT traversal issue. This solution is realized thru interaction between a special Gatekeeper and NAT- reversal endpoints (IP phones, Gateways, Proxies, and MCUs). A special proprietary protocol makes it come true. Please contact your supplier for the availability of this Gatekeeper and associated function in the IP phone.

In fact, with this proprietary protocol, the special Gatekeeper also acts like a “NAT Probe server”. Then an endless connection will be established and maintained between the Gatekeeper and the IP phones with periodically sending PDU information. Therefore, any another endpoints can call to this IP phone that is behind in NAT gateway. The advantage of this protocol enables any endpoints behind general NAT gateway independent and able to connect to the special Gatekeeper all the time. (Please refer to the following figure).

Of course, it brings with certain disadvantages to user, too. They are:

- You have to change to this particular Gatekeeper with a support of proprietary protocol.
- Just having limited type of endpoints (this IP phone and gateway) is available now.

- All media traffic will be routed thru the special Gatekeeper so that a heavy load and high bandwidth requirement are necessary for this special Gatekeeper.

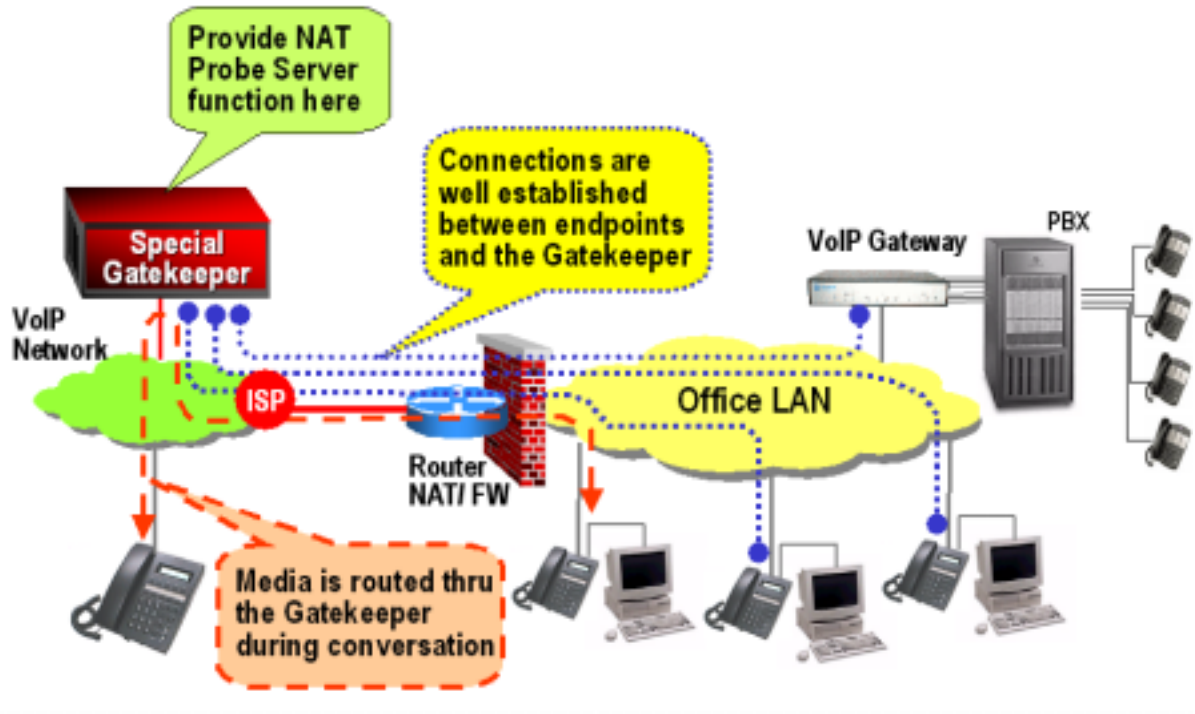

Figure 2.4. To Run A Special Gatekeeper With Associated IP phone

Chapter 3

3. The Office Applications

3.1. O1 – A Typical VoIP System For Main Office

This application with the IP phones is for a typical VoIP System in main office. It is ideal for small or medium enterprises with a size about 100 to 1000. And the main office has to own a Gatekeeper and maintain it for internal or branch offices. Besides Gatekeeper and IP phones, most application may bring in Gateway to connect to existing PBX system. They will be well planned and connected to the office network for more efficient operation and management. The main design of the IP phone is focusing on office users and very suitable for this application.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
O1		Yes (RIP)	RF IP GK **With** H.323 Proxy Function.	Any Any	(1) Internal Calls: All IP phones and Gateways will register to internal Gatekeeper and can call each other well internally. (2) External Calls: If external endpoint is fine in voice channel, any internal endpoint can do call setup & conversation well with the external point.	Typical VoIP System For main office

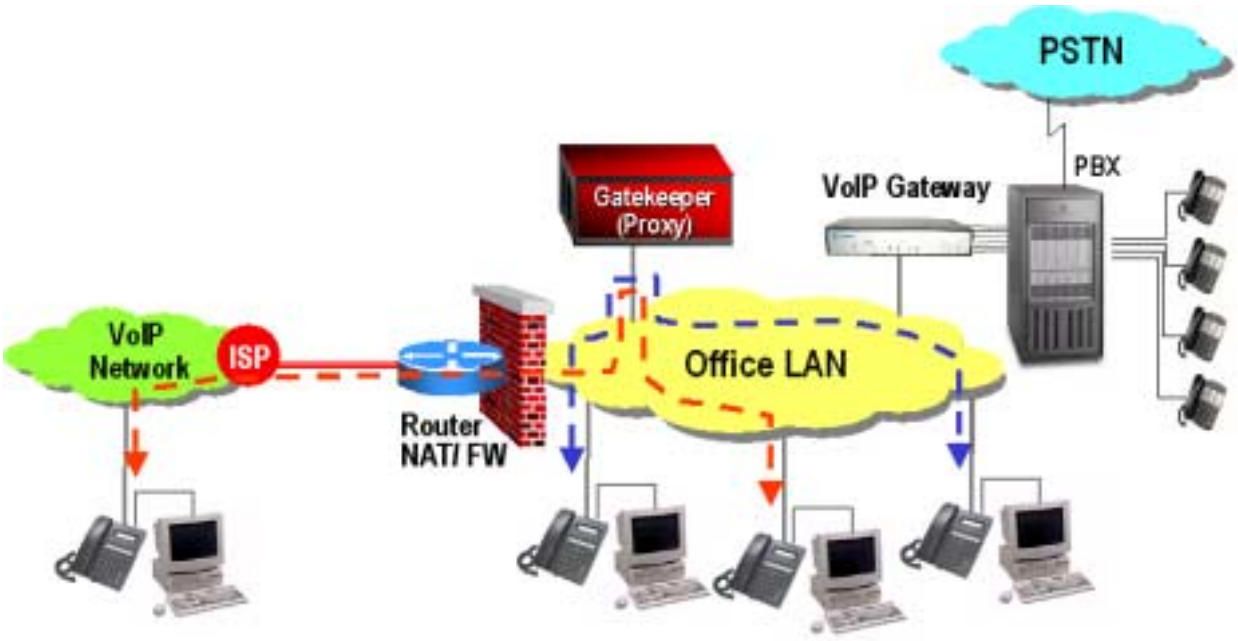

Figure 3.1. A Typical VoIP System For Main Office

[Requirement of Equipments]:

- The standard H.323 IP phones
- A standard H.323 Gatekeeper with H.323 Proxy function on (for Media Route service)
- A general office network with Router and Firewall (supporting NAT).
- A standard VoIP Gateway provides connecting the office LAN and PBX telephone system.

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper of Enterprise.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- All traffic will go thru the Gatekeeper. So, to serve a great number of endpoints depends on more powerful capacity of Gatekeeper. Be careful with the capacity planning for both internal and external traffic.
- There is no need to change any settings on Router/Firewall device.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them.
- The extension of PBX can get a line to VoIP Gateway and dial to any internal IP phones or outside endpoints.
- Any IP phones dialing to the VoIP Gateway thru Gatekeeper will get a second dial tone that you can dial to the extension number of PBX system.

[Parameter Settings]:

- **Use DHCP:** Enable
- **PPPoE:** Disable
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** Keep factory setting. A new dynamic virtual IP (say 192.168.5.24) will be auto-assigned into this field.
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.1. (a private fixed IP)
- **Proxy:** Disable
- **Proxy IP:** 0.0.0.0. (or keep "**61.222.54.184**" or "**67.120.192.137**")
- **RTP Port:** "1722" as default setting.
- **Q.931 Port:** "1720" as default setting.
- **RAS Port**: "1720" as factory default setting.
- **H.245 Port:** "1722" as default setting.
- **Use GK:** Enable
- **GK IP:** Say 92.151.51.24 (a public fixed IP address).
- **GK ID:** Null,
- **Use H.235:** Disable
- **H.235 Account:** Null.
- **H.235 Pin:** Null.
- **H.323 ID:** Null.
- **Phone Number:** Say 2100.

3.2. O2 – A Office Gatekeeper without Proxy Support

This application with the IP phones is for main office (small or medium enterprises with a size about 100 to 1000), too. A Gatekeeper is installed in office but without supporting Proxy function. Therefore, we have to find a way to solve NAT issue. Here, we suggest to enable the Virtual H.323 Proxy function of the IP phone. With this application, though it can avoid the traffic capacity issue of Gatekeeper, we do not think it is the best for enterprise. Because, you have to pay much attention to maintenance of NAT port mapping all the time. Besides Gatekeeper and IP phones, most application of this type may bring in Gateway to connect to existing PBX system. They should be well planned and connected to the office network for more efficient operation and management. Since the main design of the IP phone is focusing on office users, it will be very suitable for this application, too.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
O2		Yes With a RF IP	RF IP GK **Without** H.323 Proxy function	Any R IP, V IP	(1) Internal Calls: All IP phones and Gateways will register to internal Gatekeeper and can call each other well internally. (2) External Calls: If external endpoint is fine in voice channel, any internal endpoint can do call setup & conversation well with the external point. The H.323 proxy of the IP phones need to be enabled if they want to call to outside.	Not suggested

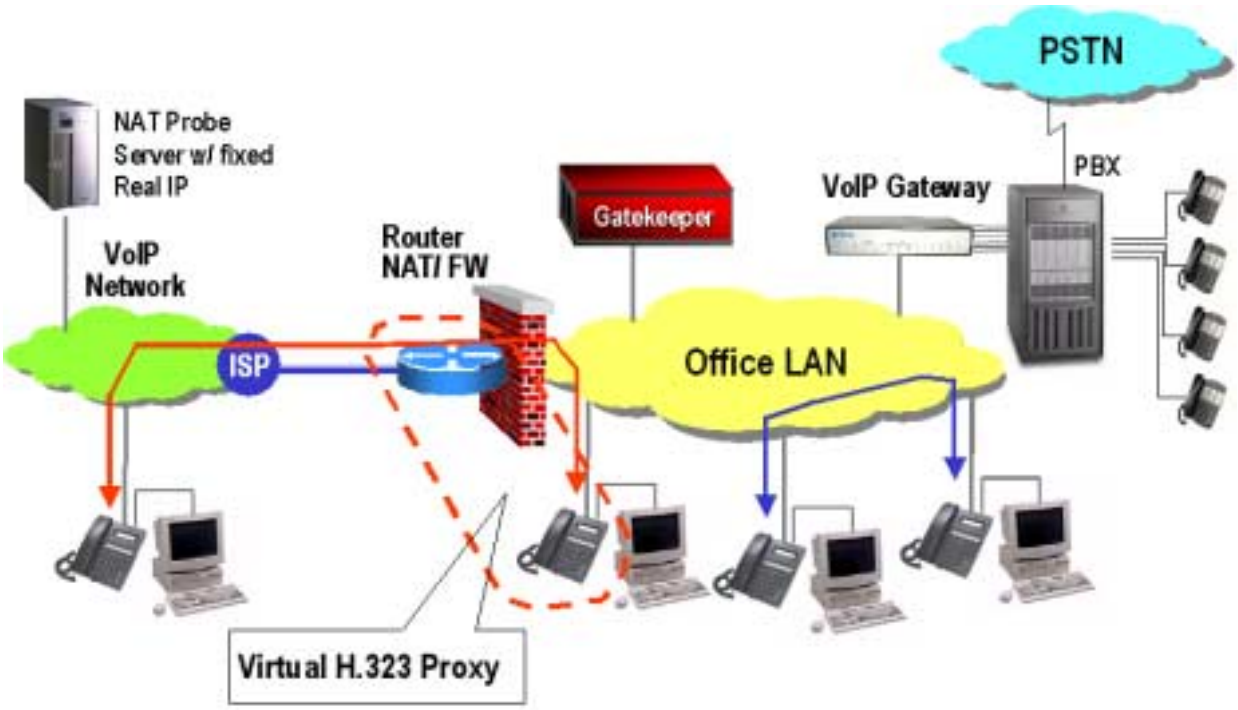

Figure 3.2. An Office Gatekeeper Without Proxy Support

[Requirement of Equipments]:

- The standard H.323 IP phones
- A standard H.323 Gatekeeper without H.323 Proxy function
- A general office network with Router and Firewall (supporting NAT).
- A standard VoIP Gateway provides connecting the office LAN and PBX telephone system. (The Gateway must provide Virtual H.323 Proxy function or runs with a Dynamic Real IP at least).
- A NAT Probe Server with Real Fixed IP address. (Or, you may utilize the supplier's server).

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper of Enterprise.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For IP phones using Virtual IP addresses, if they want to call external endpoints, the virtual H.323 proxy function of IP phones should be enabled. (Please refer to the above figure).
- All traffic will not go thru the Gatekeeper. So, the capacity of Gatekeeper is not very important in system planning.
- You MUST to configure the NAT/PAT table for those IP phones whose virtual H.323 proxy function have been enabled. Please refer to the operational manual of your office Router/Firewall device and be careful with the settings of IP port mapping.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go directly between the phones.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them.
- The extension of PBX can get a line to VoIP Gateway and dial to any internal IP phones or outside endpoints.
- Any IP phones dialing to the VoIP Gateway thru Gatekeeper will get a second dial tone that you can dial to the extension number of PBX system.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Disable
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** say 192.168.5.10 (given a virtual fixed IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.1. (a private fixed IP)
- **Proxy:** Enable
- **Proxy IP:** Say 92.151.51.20 (a real fixed IP of Router of main office)
- **RTP Port:** Say 5012 (Please refer to session 1.2. Q.931 setting).
- **Q.931 Port:** Say 5010 (Please refer to session 1.2. Q.931 setting).
- **RAS Port**: Say 5010 (Please refer to session 1.2. Q.931 setting).
- **H.245 Port:** Say 5012 (Please refer to session 1.2. Q.931 setting).
- **Use GK:** Enable

- **GK IP:** Say 92.151.51.24 (a public fixed IP address).
- **GK ID:** Null,
- **Use H.235:** Disable
- **H.235 Account:** Null.
- **H.235 Pin:** Null.
- **H.323 ID:** Null.
- **Phone Number:** Say 2100.

3.3. O3 – A Simple VoIP System For Branch Office

This application with the IP phones is for a simple VoIP System in branch office. It is for small or medium branch offices with a size about 20 to 200. Since the main office has own Gatekeeper, so its branch office can leverage it for application. Besides IP phones, most application may bring in Gateway to connect to existing PBX or KTS system. They will be well planned and connected to the branch office network for more efficient operation and management. The main design of the IP phone is focusing on office users. So, it is very suitable for this application.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
O3	RF IP	Yes With a RD IP		R IP V IP Any	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. The H.323 proxy of the IP phones need to be enabled. So far, there is a limitation that the IP phones shall be located in the same subnet behind NAT. (2) External Calls: As H.323 Proxy enabled, our IP phones can call to any external endpoints.	Not suggested

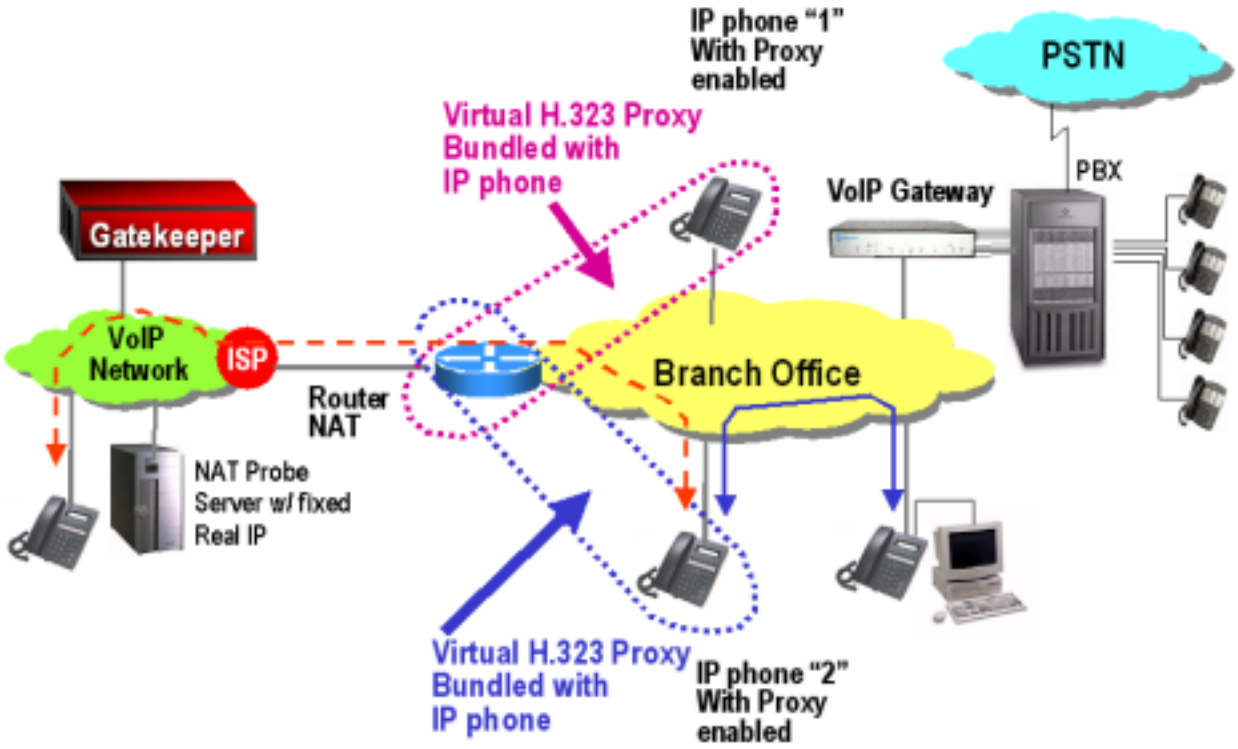

Figure 3.3. A Simple VoIP System Of Branch Office

[Requirement of Equipments]:

- The standard H.323 IP phones
- A standard H.323 Gatekeeper located in the public Internet
- A general office network with Router and Firewall (supporting NAT).
- A standard VoIP Gateway provides connecting the office LAN and PBX telephone system. (The Gateway must provide Virtual H.323 Proxy function or runs with a Dynamic Real IP at least).
- A NAT Probe Server with Real Fixed IP address. (Or, you may utilize the supplier's server).

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For IP phones using Virtual IP addresses, the virtual H.323 proxy function of IP phones should be enabled. (Please refer to the above figure).
- All traffic will not go thru the Gatekeeper. So, the capacity of Gatekeeper is not very important in system planning.
- You MUST to configure the NAT/PAT table for those IP phones whose virtual H.323 proxy function have been enabled. Please refer to the operational manual of your office Router/Firewall device and be careful with the settings of IP port mapping.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go locally between the phones.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the

reverse, so do them.

- The extension of PBX can get a line to VoIP Gateway and dial to any internal IP phones or outside endpoints.
- Any IP phones dialing to the VoIP Gateway thru Gatekeeper will get a second dial tone that you can dial to the extension number of PBX system.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Disable
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** say 192.168.5.14 (given a virtual fixed IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.1. (a private fixed IP)
- **Proxy:** Connect.
- **Proxy IP:** "**61.222.54.184**" or "**67.120.192.137**" (or your own NAT probe Server)
- **RTP Port:** Say 5016 (Please refer to session 1.2. Q.931 setting).
- **Q.931 Port:** Say 5014 (Please refer to session 1.2. Q.931 setting).
- **RAS Port**: Say 5014 (Please refer to session 1.2. Q.931 setting).
- **H.245 Port:** Say 5016 (Please refer to session 1.2. Q.931 setting).
- **Use GK:** Enable
- **GK IP:** Say 92.151.51.24 (a public fixed IP address in main office).
- **GK ID:** Null,
- **Use H.235:** Disable
- **H.235 Account:** Null.
- **H.235 Pin:** Null.
- **H.323 ID:** Null.
- **Phone Number:** Say 2100.

3.4. O4 – A Typical VoIP System For Branch Office

This application with the IP phones is for a typical VoIP System in branch office. It is for small or medium branch offices with a size about 20 to 200. Since the main office has own Gatekeeper, so its branch office can leverage it for application. Besides a Proxy box and IP phones, most application may bring in Gateway to connect to existing PBX or KTS system. They will be well planned and connected to the branch office network for more efficient operation and management. The main design of the IP phone is focusing on office users. So, it is very suitable for this application.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
O4	RF IP	Yes (RIP)	H.323 Proxy Box installed With a RF IP	Any	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call	Typical VoIP System For branch office

				Any	setup & conversation well with the external point.	

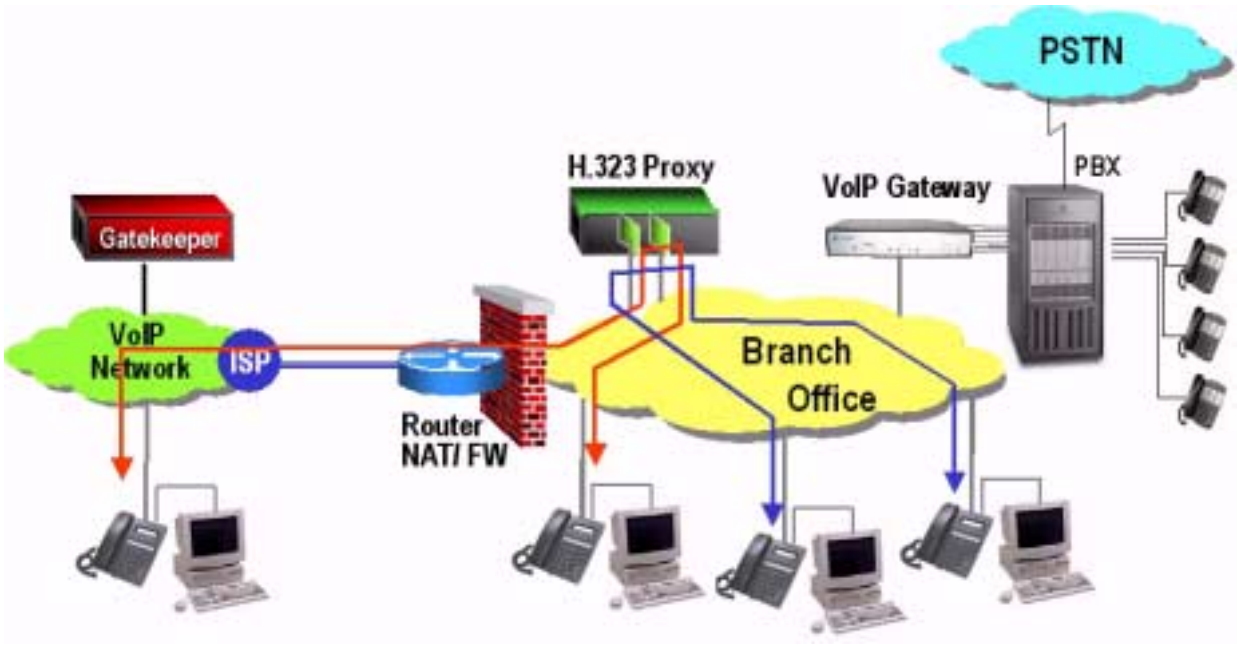

Figure 3.4. A Typical VoIP System For Branch Office

[Requirement of Equipments]:

- The standard H.323 IP phones
- A standard H.323 Gatekeeper located in the public Internet
- A general office network with Router and Firewall (supporting NAT).
- A standard VoIP Gateway provides connecting the office LAN and PBX telephone system. (The Gateway must provide Virtual H.323 Proxy function or runs with a Dynamic Real IP at least).
- A H.323 Proxy server located in the Office. You may use PC server and run a Proxy software for this application (Please see the Appendix for popular Proxy software). Or contact your supplier for the availability of H.323 Proxy Box. (The H.323 Proxy Server must run with a Dynamic Real IP or be assigned to DMZ zone of the Router, if DMZ is empty).

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- All traffic will not go thru the Gatekeeper. So, the capacity of Gatekeeper is not very important in system planning. On the reverse, all internal traffic will go thru the Proxy. Therefore, pay attention to the planning of its capacity.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go the H.323 Proxy locally.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them. But the media traffic will go the H.323 Proxy, too.
- The extension of PBX can get a line to VoIP Gateway and dial to any internal IP phones or outside endpoints.

- Any IP phones dialing to the VoIP Gateway thru Gatekeeper will get a second dial tone that you can dial to the extension number of PBX system.

[Parameter Settings]:

- **Use DHCP:** Enable
- **PPPoE:** Disable
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** say 192.168.5.24 (DHCP server assigns a virtual IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.1. (a private fixed IP)
- **Proxy:** Enable.
- **Proxy IP:** Say 22.100.5.25 (a real fixed IP for Proxy Box/Server)
- **RTP Port:** "1722" as default setting.
- **Q.931 Port:** "1720" as default setting.
- **RAS Port**: "1720" as factory default setting.
- **H.245 Port:** "1722" as default setting.
- **Use GK:** Enable
- **GK IP:** Say 92.151.51.24 (a public fixed IP address in main office).
- **GK ID:** Null,
- **Use H.235:** Disable
- **H.235 Account:** Null.
- **H.235 Pin:** Null.
- **H.323 ID:** Null.
- **Phone Number:** Say 2100.

Chapter 4

4. The SOHO Applications

4.1. S1 – A Typical VoIP System For SOHO

This application with the IP phones is for a typical VoIP System of SOHO that has a size about 10 to 100. Since it has no main offer offering an operating Gatekeeper, it shall deal with an ITSP provider to support. Therefore, PSTN traffic can go into the SOHO and outgoing long toll VoIP call can get down to PSTN network. Besides a Proxy box and IP phones, most application may bring in Gateway to connect to existing KTS system. The versatile functions of the IP phone will cover most requirements of SOHO application. However, the IP phone is a cost-efficient solution for SOHO users.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
S1	RF IP	Yes, with a RIP	H.323 Proxy Box installed With a RD IP.	Any	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Typical VoIP System For SOHO

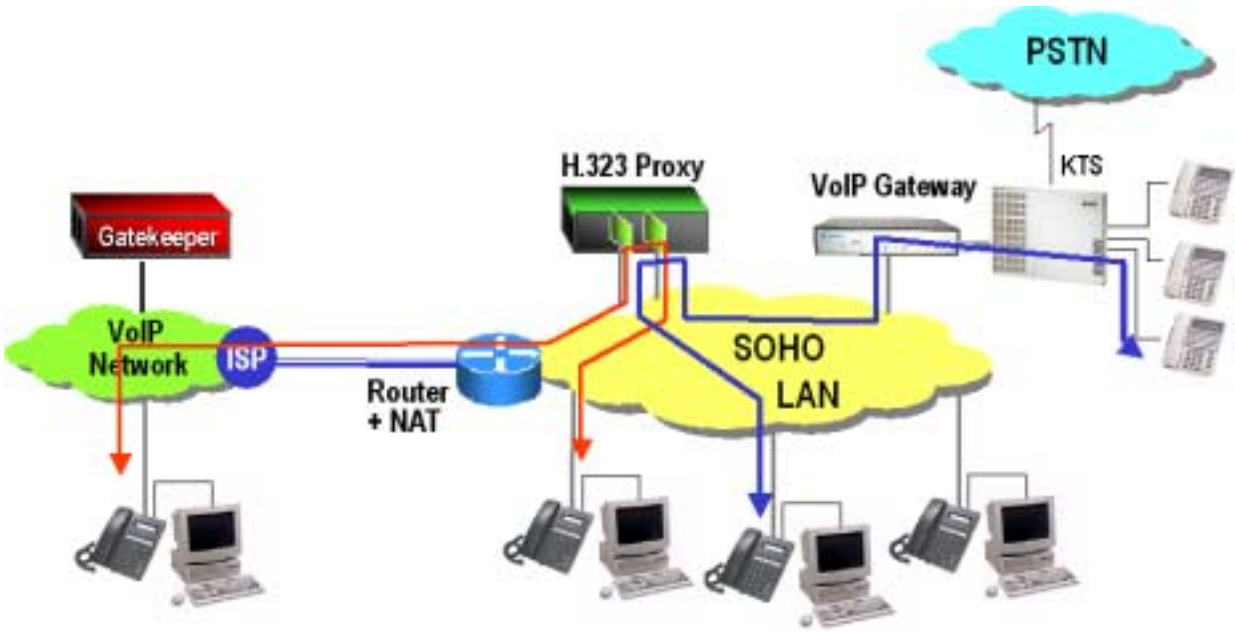

Figure 4.1. A Typical VoIP System for SOHO

[Requirement of Equipments]:

- The standard H.323 IP phones
- A standard H.323 Gatekeeper located in the public Internet
- A general SOHO Router (with Firewall / NAT).
- A standard VoIP Gateway provides connecting the office LAN and KTS telephone system.
- A H.323 Proxy server located in the Office. You may use PC server and run a Proxy software for this application (Please see the Appendix for popular Proxy software). Or contact your supplier for the availability of H.323 Proxy Box. (The H.323 Proxy Server must run with a Dynamic Real IP or be assigned to DMZ zone of the Router, if DMZ is empty).

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- All traffic will not go thru the Gatekeeper. So, the capacity of Gatekeeper is not very important in system planning. On the reverse, all internal traffic will go thru the Proxy. Since the number of endpoints is limited in SOHO, you may not be worry about the capacity of the H.323 Proxy.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go the H.323 Proxy locally.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them. But the media traffic will go the H.323 Proxy, too.
- The extension of KTS can get a line to VoIP Gateway and dial to any internal IP phones or outside endpoints.
- Any IP phones dialing to the VoIP Gateway thru Gatekeeper will get a second dial tone that you can dial to the extension number of KTS system.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Disable
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** say 192.168.5.18 (given a virtual fixed IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.1. (a private fixed IP)
- **Proxy:** Connect.
- **Proxy IP:** "**61.222.54.184**" or "**67.120.192.137**" (or your own NAT probe Server)
- **RTP Port:** Say 5020 (Please refer to session 1.2. Q.931 setting).
- **Q.931 Port:** Say 5018 (Please refer to session 1.2. Q.931 setting).
- **RAS Port**: Say 5018 (Please refer to session 1.2. Q.931 setting).
- **H.245 Port:** Say 5020 (Please refer to session 1.2. Q.931 setting).
- **Use GK:** Enable
- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper).
- **GK ID:** Null,
- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper)
- **H.235 Account:** Say "XYZ-CO-LTD".

- **H.235 Pin:** Say **"**1122334455667788**"**.
- **H.323 ID:** Null.
- **Phone Number:** Say "886226551000".

4.2. S1-1 - A Basic SOHO VoIP Application Thru ADSL

This application is for a basic SOHO to use the IP phones and it is good for an organization with a size about 3 to 10 where no PBX/KTS is installed. Since it has no main offer offering an operating Gatekeeper, it shall deal with an ITSP provider to support. Therefore, PSTN traffic can go into the SOHO and outgoing long toll VoIP call can get down to PSTN network. A Proxy box is required for IP phones to get around NAT issue. The versatile functions of the IP phone will cover most requirements of SOHO application. However, the IP phone is a cost-efficient solution for SOHO users.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
S1-1	RF IP	Yes, with a RIP	H.323 Proxy Box installed With a RD IP.	Any	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Go thru ADSL /XDSL/ Cable/ Modem Line to access Internet.

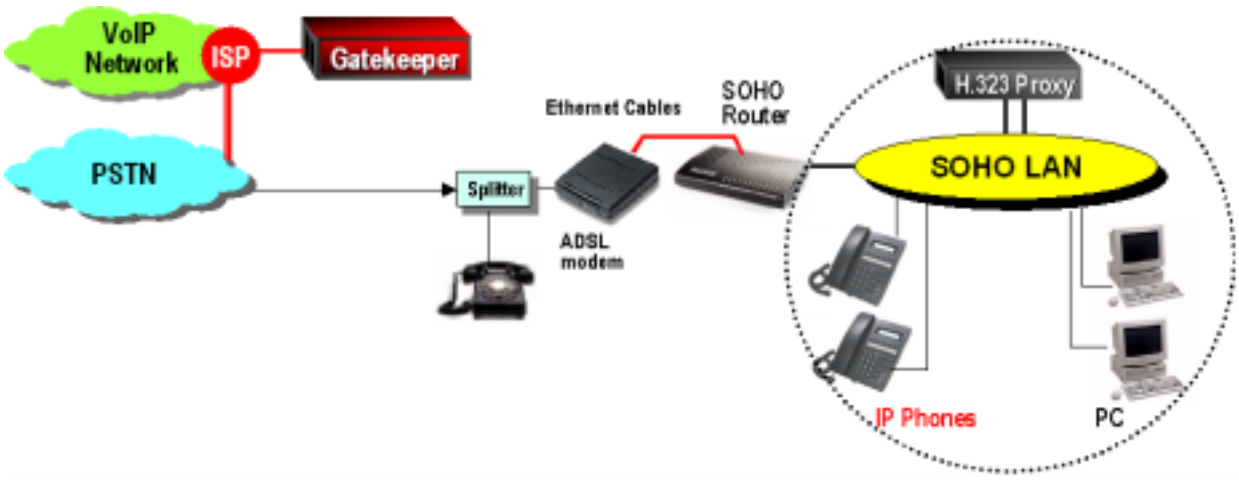

Figure 4.2. A Basic SOHO VoIP Application Thru ADSL

[Requirement of Equipments]:

- An ADSL line with ADSL modem (Can be changed to CATV and Cable Modem)
- The standard H.323 IP phones
- A standard H.323 Gatekeeper located in the public Internet
- A general SOHO Router (with Firewall / NAT).

- A standard VoIP Gateway provides connecting the office LAN and KTS telephone system, if required.
- A H.323 Proxy server located in the Office. You may use PC server and run a Proxy software for this application (Please see the Appendix for popular Proxy software). Or contact your supplier for the availability of H.323 Proxy Box. (The H.323 Proxy Server must run with a Dynamic Real IP or be assigned to DMZ zone of the Router, if DMZ is empty).

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- All traffic will not go thru the Gatekeeper. So, the capacity of Gatekeeper is not very important in system planning. On the reverse, all internal traffic will go thru the Proxy. Since the number of endpoints is limited in SOHO, you may not be worry about the capacity of the H.323 Proxy.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go the H.323 Proxy locally.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them. But the media traffic will go the H.323 Proxy, too.
- The extension of KTS can get a line to VoIP Gateway and dial to any internal IP phones or outside endpoints.
- Any IP phones dialing to the VoIP Gateway thru Gatekeeper will get a second dial tone that you can dial to the extension number of KTS system.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Disable (PPPoE is enabled at Router)
  - **PPPID:** null.
  - **PPP Pin:** null.
- **IP:** say 192.168.5.18 (given a virtual fixed IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.1. (a private fixed IP)
- **Proxy:** Connect.
- **Proxy IP:** "**61.222.54.184**" or "**67.120.192.137**" (or your own NAT probe Server)
  - **RTP Port:** Say 5020 (Please refer to session 1.2. Q.931 setting).
  - **Q.931 Port:** Say 5018 (Please refer to session 1.2. Q.931 setting).
  - **RAS Port**: Say 5018 (Please refer to session 1.2. Q.931 setting).
  - **H.245 Port:** Say 5020 (Please refer to session 1.2. Q.931 setting).
- **Use GK:** Enable
- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper).
  - **GK ID:** Null,
- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper)
  - **H.235 Account:** Say "ABC-HOUSE".
  - **H.235 Pin:** Say **"**1020304050607080**"**.
  - **H.323 ID:** Null.
- **Phone Number:** Say "26551000".

4.3. S2 – A Simple VoIP System For SOHO

This application is for a simple VoIP System for SOHO where it already has KTS installation. Since it has no main offer offering an operating Gatekeeper, it shall deal with an ITSP provider to support. Therefore, PSTN traffic can go into the SOHO and outgoing long toll VoIP call can get down to PSTN network. Since there is no Proxy box, we have to enable the virtual H.323 proxy function for the IP phones. But for Gateway, you have to assign a real IP address to it or assign DMZ of router to it. Or, you have to find a standard Gateway that can support NAT traversal function. The versatile IP phone is a cost-efficient solution for SOHO users.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
S2	RF IP	Yes, Use one RD IP For a SOHO Router		One R IP Others VF IP One R IP Others VF IP	Register the IP phones to the external Gatekeeper: (1) External Calls: For the phones using V. IP, their H.323 proxy function need to be enabled. Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: RIP phone can call to any one VIP phone. For the phones using V. IP, their H.323 proxy function need to be enabled.	Typical VoIP System for SOHO

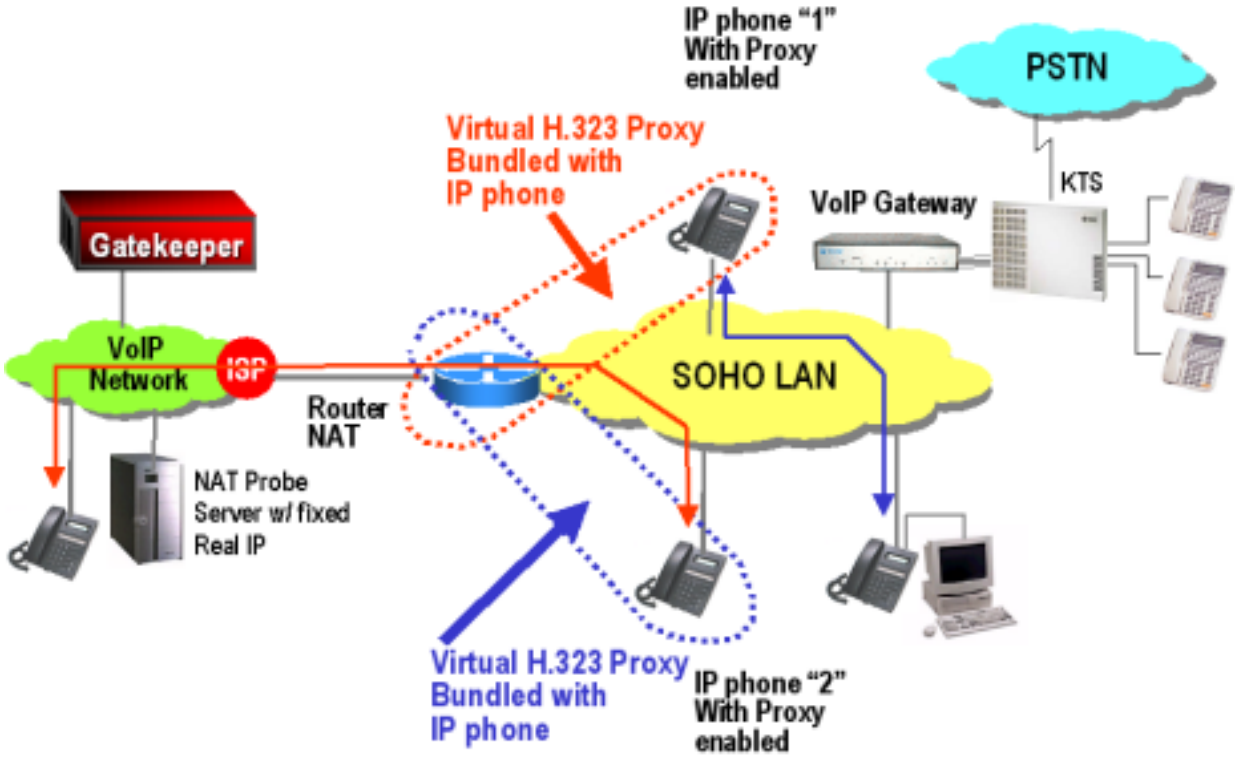

Figure 4.3. A Simple VoIP System for SOHO

[Requirement of Equipments]:

- The standard H.323 IP phones
- A standard H.323 Gatekeeper located in the public Internet
- A general SOHO Router (with Firewall / NAT support).
- A standard VoIP Gateway provides connecting the office LAN and KTS telephone system. (The Gateway must provide Virtual H.323 Proxy function or runs with a Dynamic Real IP at least).
- A NAT Probe Server with Real Fixed IP address. (Or, you may utilize the supplier's server).

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For IP phones using Virtual IP addresses, the virtual H.323 proxy function of IP phones should be enabled. (Please refer to the above figure).
- All traffic will not go thru the Gatekeeper. So, the capacity of Gatekeeper is not very important in system planning.
- You MUST to configure the NAT/PAT table for those IP phones whose virtual H.323 proxy function have been enabled. Please refer to the operational manual of your SOHO Router (with Firewall/NAT) device and be careful with the settings of IP port mapping.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go locally between the phones.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them.
- The extension of KTS can get a line to VoIP Gateway and dial to any internal IP phones or outside endpoints.
- Any IP phones dialing to the VoIP Gateway thru Gatekeeper will get a second dial tone that you can dial to the extension number of KTS system.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Disable (PPPoE is enabled at Router)
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** say 192.168.5.22 (given a virtual fixed IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.1. (a private fixed IP)
- **Proxy:** Connect.
- **Proxy IP:** "**61.222.54.184**" or "**67.120.192.137**" (or your own NAT probe Server)
- **RTP Port:** Say 5024 (Please refer to session 1.2. Q.931 setting).
- **Q.931 Port:** Say 5022 (Please refer to session 1.2. Q.931 setting).
- **RAS Port**: Say 5022 (Please refer to session 1.2. Q.931 setting).
- **H.245 Port:** Say 5024 (Please refer to session 1.2. Q.931 setting).
- **Use GK:** Enable

- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper).
- **GK ID:** Null,
- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper)
- **H.235 Account:** Say "ABC-HOUSE".
- **H.235 Pin:** Say **"**1020304050607080**".**
- **H.323 ID:** Null.
- **Phone Number:** Say "26551000".

Chapter 5

5. The Home Applications

5.1. H1 – Two Real IP For A big Home LAN

This application with the IP phones is for a big home network with 2 real IP that has a router and many computers. Since it has no Gatekeeper at home, user shall subscribe the service of ITSP's Gatekeeper. So, remote PSTN traffic can go up and get down the VoIP network for home users.

No.	External GK	Number of Real IP	Router / Firewall	Internal IP Phone	Call Applications	Remarks
H1	RF IP	2 or more RDIP given	Yes, Use one RD IP For a IP sharer device	One R IP Others VF IP One R IP Others VF IP	Register the IP phones to the external Gatekeeper: (1) External Calls: For the phones using V. IP, their H.323 proxy function need to be enabled. Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: RIP phone can call to any one VIP phone. For the phones using V. IP, their H.323 proxy function need to be enabled.	for a big Home network

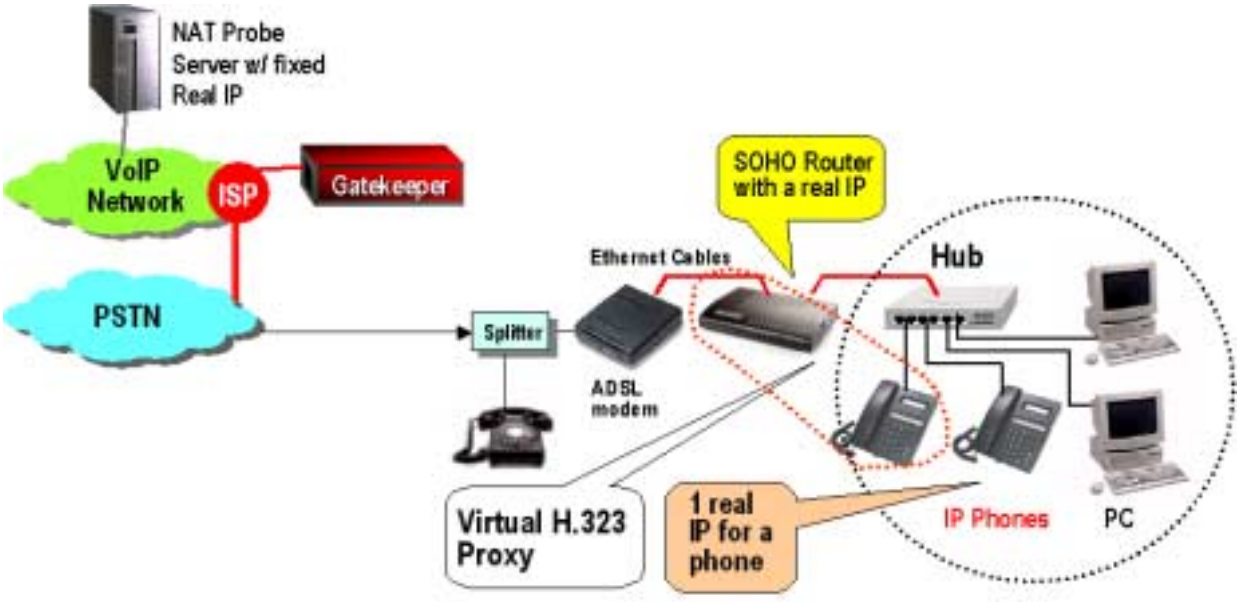

Figure 5.1. Two Real IP For A Big Home LAN

[Requirement of Equipments]:

- An ADSL line with ADSL modem (Can be changed to CATV and Cable Modem)
- A Ethernet Switch Hub for Home network
- The standard H.323 IP phones
- A standard H.323 Gatekeeper located in the public Internet
- A general SOHO Router (with Firewall / NAT).
- A NAT Probe Server with Real Fixed IP address. (Or, you may utilize the supplier's server).

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For IP phones using Virtual IP addresses, the virtual H.323 proxy function of IP phones should be enabled. (Please refer to the above figure).
- All traffic will not go thru the Gatekeeper.
- To enable the PPPoE function of the first IP phone that uses a Real Public IP. So, it can dial-up to the Internet itself.
- You MUST to configure the NAT/PAT table for those IP phones whose virtual H.323 proxy function have been enabled. Please refer to the operational manual of your SOHO Router (with Firewall/NAT) device and be careful with the settings of IP port mapping.
- (Reference: If you just have two IP phones, one may use a real IP address and the other can be assigned to DMZ zone of SOHO Router instead of enabling virtual H.323 Proxy function, if DMZ is empty)

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go locally.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them.

[Parameter Settings]:

[Note]: IP phone 1 will get a real IP address from ISP. The others will use internal virtual IP.

- **Use DHCP:** Disable for all phones
- **PPPoE:** Enabled for phone 1, and Disable for others.
- **PPPID:** Say "aolkevin01" for phone 1, and null for Disabled phones.
- **PPP Pin:** Say "mysecret" for phone 1, and null for Disabled phones.
- **IP:** say 192.168.1.10 for phone 1, 192.168.5.26, 192.168.5.30,…(virtual fixed IPs)
- **Subnet Mask:** say 255.255.255.0 for all.
- **Router:** say 192.168.5.1. (a private fixed IP) for all
- **Proxy:** "Disable" for IP phone 1 and "Connect" for others.
- **Proxy IP:** "**61.222.54.184**" or "**67.120.192.137**" (or your own NAT probe Server)
- **RTP Port:** Say 5024, … (Please refer to session 1.2. Q.931 setting).
- **Q.931 Port:** Say 5022, … (Please refer to session 1.2. Q.931 setting).
- **RAS Port**: Say 5022, … (Please refer to session 1.2. Q.931 setting).
- **H.245 Port:** Say 5024, … (Please refer to session 1.2. Q.931 setting).
- **Use GK:** Enable for all
- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper) for all.
- **GK ID:** Null for all

- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper) for all
  - **H.235 Account:** Say "Taipei Karl", "Taipei Newking", and so on.
  - **H.235 Pin:** Say **"**111111**"** for account 1, "2222" for account 2, and so on.
  - **H.323 ID:** Null.
- **Phone Number:** Say "1000" for phone1, "1001" for phone 2, and so on.

5.2. H2 – A Single Real IP For A big Home LAN

This application with the IP phones is for a big home network just with a single IP that has a router and many computers. Since it has no Gatekeeper at home, user shall subscribe the service of ITSP's Gatekeeper. So, remote PSTN traffic can go up and get down the VoIP network for home users.

No.	External GK	Number of Real IP	Router / Firewall	Internal IP Phone	Call Applications	Remarks
H2	RF IP	Only 1 RDIP given	Yes, Use this RD IP in router	VF IP VF IP	Register the IP phones to the external Gatekeeper: (1) External Calls: For the phones using V. IP, their H.323 proxy function need to be enabled. Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: For the phones using V. IP, their H.323 proxy function need to be enabled.	

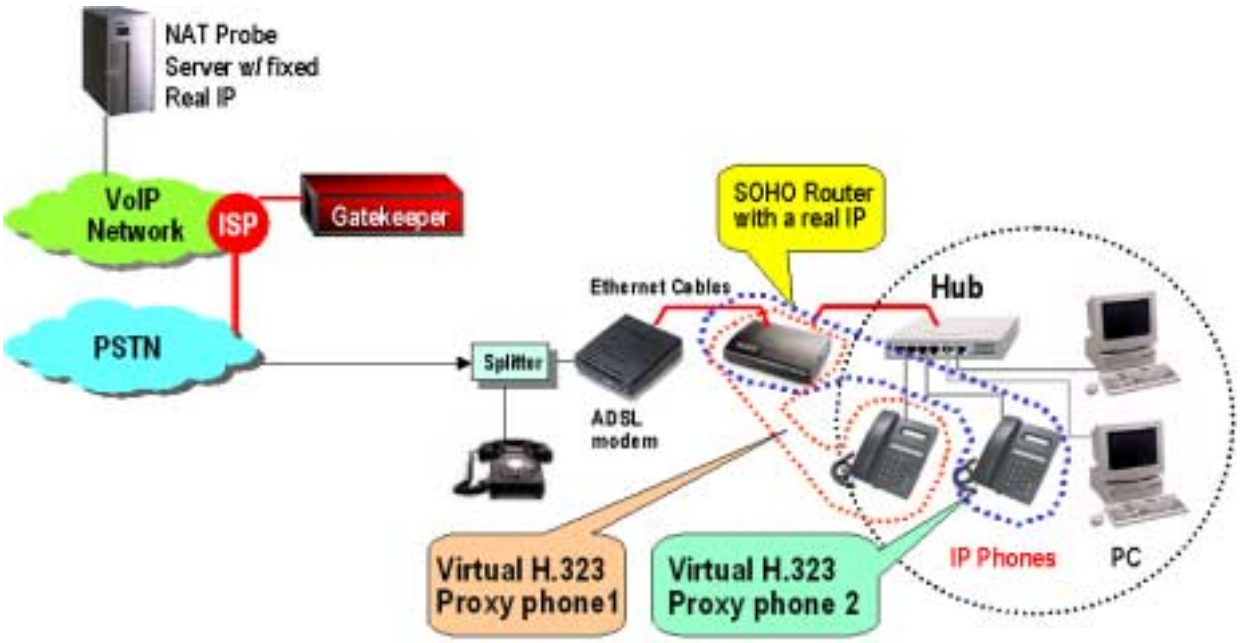

Figure 5.2. A Single Real IP For A Big Home LAN

[Requirement of Equipments]:

- An ADSL line with ADSL modem (Can be changed to CATV and Cable Modem)
- A Ethernet Switch Hub for Home network
- The standard H.323 IP phones
- A standard H.323 Gatekeeper located in the public Internet
- A general SOHO Router (with Firewall / NAT).
- A NAT Probe Server with Real Fixed IP address. (Or, you may utilize the supplier's server).

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For IP phones using Virtual IP addresses, the virtual H.323 proxy function of IP phones should be enabled. (Please refer to the above figure).
- All traffic will not go thru the Gatekeeper.
- You MUST to configure the NAT/PAT table for those IP phones whose virtual H.323 proxy function have been enabled. Please refer to the operational manual of your SOHO Router (with Firewall/NAT) device and be careful with the settings of IP port mapping.
- (Reference: You may assign an IP phone to DMZ zone of SOHO Router instead of enabling its virtual H.323 Proxy function, if DMZ is empty)

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go locally.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Disable (PPPoE is enabled at Router)
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** say 192.168.5.10, and 192.168.5.14, … (given a virtual fixed IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.1. (a private fixed IP)
- **Proxy:** Connect.
- **Proxy IP:** "**61.222.54.184**" or "**67.120.192.137**" (or your own NAT probe Server)
- **RTP Port:** Say 5012, 5016,.. (Please refer to session 1.2. Q.931 setting).
- **Q.931 Port:** Say 5010, 5014, … (Please refer to session 1.2. Q.931 setting).
- **RAS Port**: Say 5010, 5014,.. (Please refer to session 1.2. Q.931 setting).
- **H.245 Port:** Say 5012, 5016, … (Please refer to session 1.2. Q.931 setting).
- **Use GK:** Enable
- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper).
- **GK ID:** Null,
- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper)
- **H.235 Account:** Say "Taipei Karl", "Taipei Newking", ...
- **H.235 Pin:** Say "11111", "22222",….

- **H.323 ID:** Null.
- **Phone Number:** Say “26551000”, “26551001”,…

5.3. H3 –Two Real IP For A Multi-PC Home LAN

This application with the IP phones is for a home network just with two IP that has no router but multiple computers. So, we select a PC to run Proxy software for other IP phones (except phone 1). Since it has no Gatekeeper at home, user shall subscribe the service of ITSP’s Gatekeeper. So, remote PSTN traffic can go up and get down the VoIP network for home users.

No.	External GK	Number of Real IP	Router / Firewall	Internal IP Phone	Call Applications	Remarks
H3	RF IP	2 or more RDIP given	Run a PC to act as an IP sharer for NAT	One R IP, Others VF IP One R IP, Others VF IP	Select a PC to run proxy software as a IP sharer. Then all H.323 proxy functions of IP phones using V IP shall be enabled and pointed to the IP sharing PC. Then, register the IP phones to the external Gatekeeper: (1) External Calls: Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: Any phone can call to any one phone.	Typical home network. When PC is off, all other phones will be down.

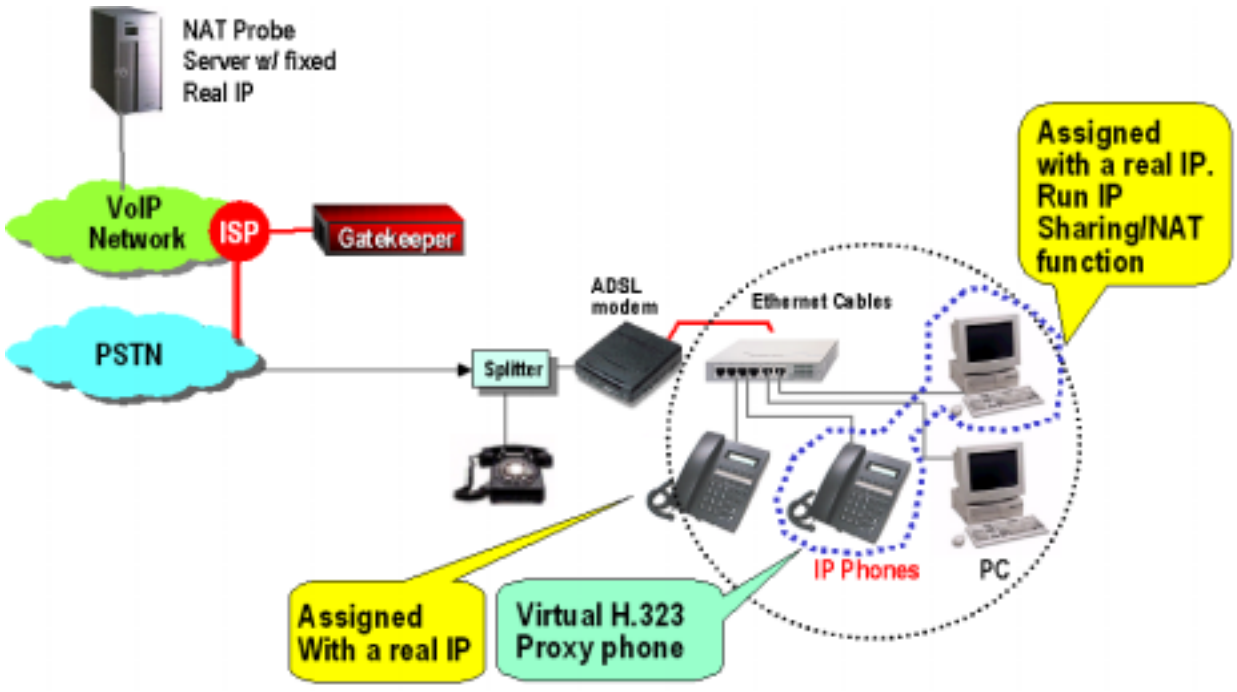

Figure 5.3. Two Real IP For A Multi-PC Home LAN

[Requirement of Equipments]:

- An ADSL line with ADSL modem (Can be changed to CATV and Cable Modem)
- A Ethernet Switch Hub for Home network
- The standard H.323 IP phones
- A standard H.323 Gatekeeper located in the public Internet
- A NAT Probe Server with Real Fixed IP address. (Or, you may utilize the supplier's server).
- A PC runs a Proxy software to act as a IP router or NAT (Please see the Appendix for popular Proxy software). This PC is expected to run all the year without shut down , or sleep or suspend, if you wish IP phones are all in connection state with Gatekeeper.

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For IP phones using Virtual IP addresses, the virtual H.323 proxy function of IP phones should be enabled. (Please refer to the above figure).
- To enable the PPPoE function of the first IP phone that uses a Real Public IP. So, it can dial-up to the Internet itself.
- All traffic will not go thru the Gatekeeper.
- You MUST to configure the NAT/PAT table for those IP phones whose virtual H.323 proxy function have been enabled. Please refer to the operational manual of Proxy software of PC and be careful with the settings of IP port mapping. (You may try the NAT setting of Windows 2000 Server in Appendix).

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go locally thru the Proxy PC.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them. The media traffic will go locally thru the Proxy PC, too.

[Parameter Settings]:

[Note]: IP phone 1 will get a real IP address from ISP. The others will use internal virtual IP.

- **Use DHCP:** Disable for all phones
- **PPPoE:** Enabled for phone 1, and Disable for others.
- **PPPID:** Say "aolkevin01" for phone 1, and null for Disabled phones.
- **PPP Pin:** Say "mysecret" for phone 1, and null for Disabled phones.
- **IP:** say 192.168.1.10 for phone 1, 192.168.5.26, 192.168.5.30,…(virtual fixed IPs)
- **Subnet Mask:** say 255.255.255.0 for all.
- **Router:** say 192.168.5.254. (a private fixed IP for this PC running proxy software)
- **Proxy:** "Disable" for IP phone 1 and "Connect" for others.
- **Proxy IP:** "**61.222.54.184**" or "**67.120.192.137**" (or your own NAT probe Server)
- **RTP Port:** Say 5024, … (Please refer to session 1.2. Q.931 setting).
- **Q.931 Port:** Say 5022, … (Please refer to session 1.2. Q.931 setting).
- **RAS Port**: Say 5022, … (Please refer to session 1.2. Q.931 setting).
- **H.245 Port:** Say 5024, … (Please refer to session 1.2. Q.931 setting).
- **Use GK:** Enable for all
- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper) for all.
- **GK ID:** Null for all

- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper) for all
  - **H.235 Account:** Say "Taipei Karl", "Taipei Newking", and so on.
  - **H.235 Pin:** Say **"**111111**"** for account 1, "2222" for account 2, and so on.
  - **H.323 ID:** Null.
- **Phone Number:** Say "1000" for phone1, "1001" for phone 2, and so on.

5.4. H4 –A Single Real IP For A Multi-PC Home LAN

This application with the IP phones is for a home network just with a single IP that has no router but multiple computers. Therefore, we select a PC to run Proxy software for all IP phones. Since it has no Gatekeeper at home, user shall subscribe the service of ITSP's Gatekeeper. So, remote PSTN traffic can go up and get down the VoIP network for home users.

No.	External GK	Number of Real IP	Router / Firewall	Internal IP Phone	Call Applications	Remarks
H4	RF IP	Only 1 RDIP given	Run a PC to act as an IP Sharer for NAT (PC can not be powered off.	VF IP VIP	Register the IP phones to the external Gatekeeper: (For the phones using V. IP, their H.323 proxy function need to be enabled.) (1) External Calls: Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: Any phone can call to any one phone.	

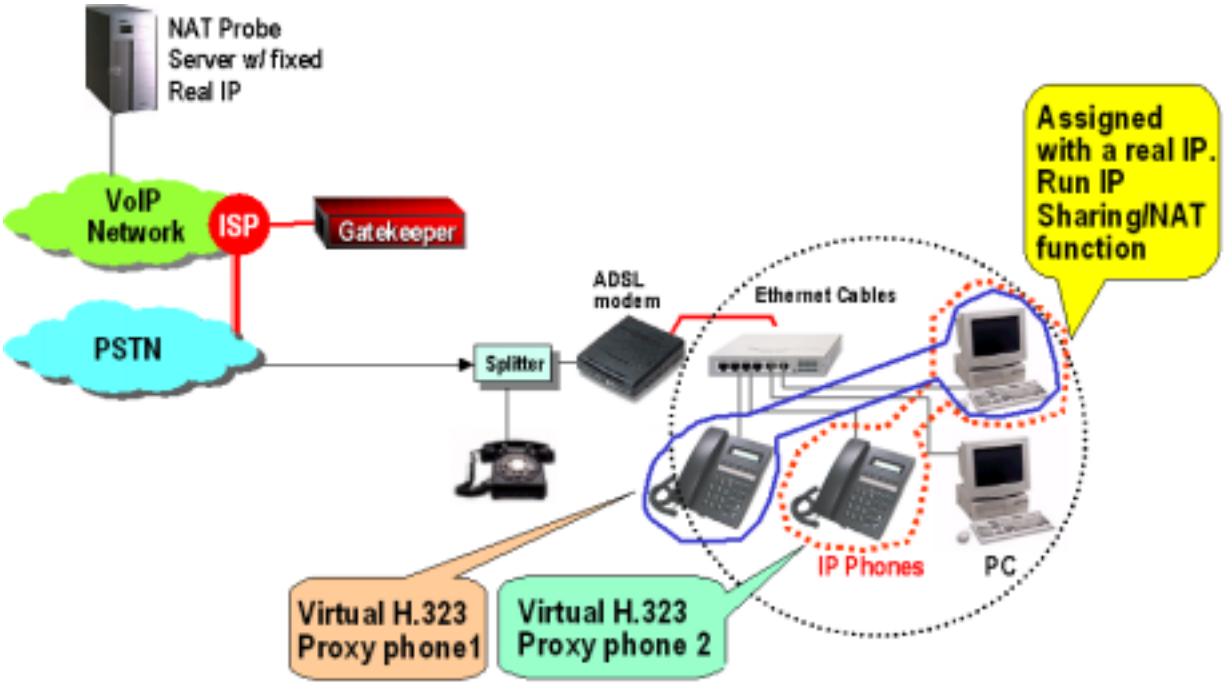

Figure 5.4. A Single Real IP For A Multi-PC Home LAN

[Requirement of Equipments]:

- An ADSL line with ADSL modem (Can be changed to CATV and Cable Modem)
- A Ethernet Switch Hub for Home network
- The standard H.323 IP phones
- A standard H.323 Gatekeeper located in the public Internet
- A NAT Probe Server with Real Fixed IP address. (Or, you may utilize the supplier's server).
- A PC runs a Proxy software to act as a IP router or NAT (Please see the Appendix for popular Proxy software). This PC is expected to run all the year without shut down , or sleep or suspend, if you wish IP phones are all in connection state with Gatekeeper.

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For IP phones using Virtual IP addresses, the virtual H.323 proxy function of IP phones should be enabled. (Please refer to the above figure).
- All traffic will not go thru the Gatekeeper.
- You MUST to configure the NAT/PAT table for those IP phones whose virtual H.323 proxy function have been enabled. Please refer to the operational manual of Proxy software of PC and be careful with the settings of IP port mapping. (Please refer to the example of the NAT setting of Windows 2000 Server in Appendix)

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go locally thru the Proxy PC.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them. The media traffic will go locally thru the Proxy PC, too.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Disable (PPPoE is enabled at Router)
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** say 192.168.5.10, and 192.168.5.14, … (given a virtual fixed IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.254. (a private fixed IP for this PC running proxy software)
- **Proxy:** Connect.
- **Proxy IP:** "**61.222.54.184**" or "**67.120.192.137**" (or your own NAT probe Server)
- **RTP Port:** Say 5012, 5016,.. (Please refer to session 1.2. Q.931 setting).
- **Q.931 Port:** Say 5010, 5014, … (Please refer to session 1.2. Q.931 setting).
- **RAS Port**: Say 5010, 5014,.. (Please refer to session 1.2. Q.931 setting).
- **H.245 Port:** Say 5012, 5016, … (Please refer to session 1.2. Q.931 setting).
- **Use GK:** Enable
- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper).
- **GK ID:** Null,
- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper)
- **H.235 Account:** Say "Taipei Karl", "Taipei Newking", ...
- **H.235 Pin:** Say "11111", "22222",….

- **H.323 ID:** Null.
- **Phone Number:** Say “26551000”, “26551001”,…

5.5. H5 – Two IP Phones With Real IP For A Home

This application is for a home that just has two IP and no computer. Therefore, we could assign two IP phones with two real IP. Since it has no Gatekeeper at home, user shall subscribe the service of ITSP’s Gatekeeper. So, remote PSTN traffic can go up and get down the VoIP network for home users.

No.	External GK	Number of Real IP	Router / Firewall	Internal IP Phone	Call Applications	Remarks
H5	RF IP	2 or more RD IP given		2 R IP 2 RIP	Register the IP phones to the external Gatekeeper: (1) External Calls: Any internal endpoint can do call setup & conversation well with the external point. (2) Internal Calls: RIP phone can call to other RIP phone internally.	Dual IP phone in a home

Figure 5.5. Two IP Phones With Real IP For A Home

[Requirement of Equipments]:

- An ADSL line with ADSL modem (Can be changed to CATV and Cable Modem)
- Two standard H.323 IP phones
- A standard H.323 Gatekeeper located in the public Internet

[Description of Application]:

- All IP endpoints have to register to the Gatekeeper located in public Internet.
- For IP phones using Real Dynamic IP addresses, it can keep alive with the Gatekeeper all the time so that no communication blocking will take place
- All traffic will not go thru the Gatekeeper.
- The voice priority of the first IP phone near to the ADSL modem is higher than that of the second IP phone.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go locally thru the Proxy PC.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Enable for all.
- **PPPID:** Say "hinetuser901".
- **PPP Pin:** Say "3838383838".
- **IP:** say 192.168.1.10, and 192.168.1.10, (just keep the default setting)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** don't care
- **Proxy:** Disable
- **Proxy IP:** 0.0.0.0 or "**61.222.54.184**" or "**67.120.192.137**".
- **RTP Port:** "1722" (default setting).
- **Q.931 Port:** "1720" (default setting).
- **RAS Port**: "1720" (default setting).
- **H.245 Port:** "1722" (default setting).
- **Use GK:** Enable
- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper).
- **GK ID:** Null,
- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper)
- **H.235 Account:** Say "Taipei Karl",and "Taipei Newking".
- **H.235 Pin:** Say "11111", and "22222".
- **H.323 ID:** Null.
- **Phone Number:** Say "26551000", and "26551001"

5.6. H5-1 – A IP Phone and A PC At Home With Two Real IP

This application is a typical and perfect solution for home user. We may assign the real IP to PC and IP phone separately. Since it has no Gatekeeper at home, user shall subscribe the service of ITSP's Gatekeeper. So, remote PSTN traffic can go up and get down the VoIP network for home users.

No.	External GK	Number of Real IP	Router / Firewall	Internal IP Phone	Call Applications	Remarks
H5-1	RF IP	2 or more RD IP given		1 R IP	Register the IP phones to the external Gatekeeper: External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Basic home network. (IP phone + PC)

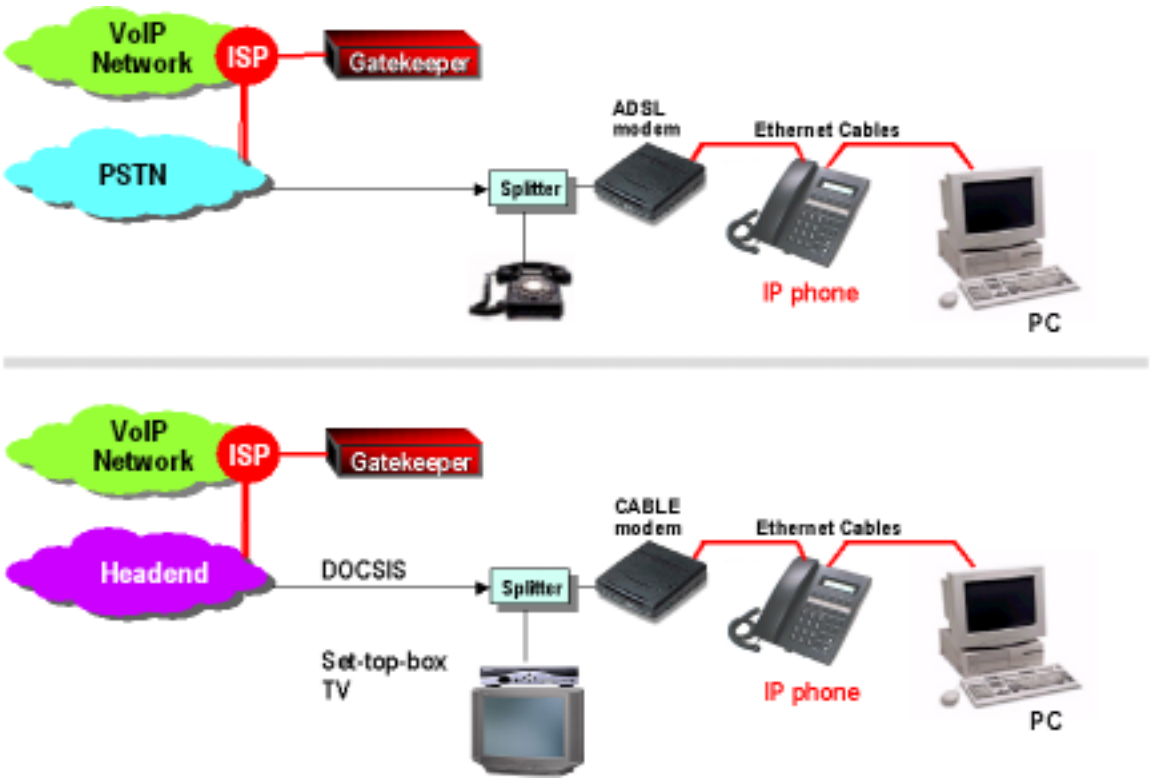

Figure 5.6. A IP Phone And A PC At Home With Two Real IP

[Requirement of Equipments]:

- An ADSL line with ADSL modem or An CATV cable with Cable Modem
- A standard H.323 IP phone
- A standard H.323 Gatekeeper located in the public Internet

[Description of Application]:

- The IP phone has to register to the Gatekeeper located in public Internet.
- For IP phone using Real Dynamic IP address, it can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- All traffic will not go thru the Gatekeeper.

[Call Paths]:

- The external endpoints can dial to the IP phone thru the Gatekeeper. On the reverse, so do them.
- The IP phone can dial to the NetMeeting™ of Windows™ on your PC thru the Gatekeeper. But the media traffic will go locally to the PC.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Enable.
- **PPPID:** Say “hinetuser901”.
- **PPP Pin:** Say “3838383838”.
- **IP:** say 192.168.1.10(just keep the default setting)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** don’t care

- **Proxy:** Disable
- **Proxy IP:** 0.0.0.0 or "**61.222.54.184**" or "**67.120.192.137**".
- **RTP Port:** "1722" (default setting).
- **Q.931 Port:** "1720" (default setting).
- **RAS Port**: "1720" (default setting).
- **H.245 Port:** "1722" (default setting).
- **Use GK:** Enable
- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper).
- **GK ID:** Null,
- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper)
- **H.235 Account:** Say "Taipei Karl".
- **H.235 Pin:** Say "11111".
- **H.323 ID:** Null.
- **Phone Number:** Say "26551000"

5.7. H6 –An IP Phone For Home With Single Real IP

This application is a typical and perfect solution for home user. For people doesn't use computer, the IP phone just uses this dynamic real IP address. Since it has no Gatekeeper at home, user shall subscribe the service of ITSP's Gatekeeper. So, remote PSTN traffic can go up and get down the VoIP network for home users.

No.	External GK	Number of Real IP	Router / Firewall	Internal IP Phone	Call Applications	Remarks
H6	RF IP	Only 1 RDIP given		R IP	Register the IP phones to the external Gatekeeper: (2) External Calls: The phone can do call setup & conversation well with any external point.	

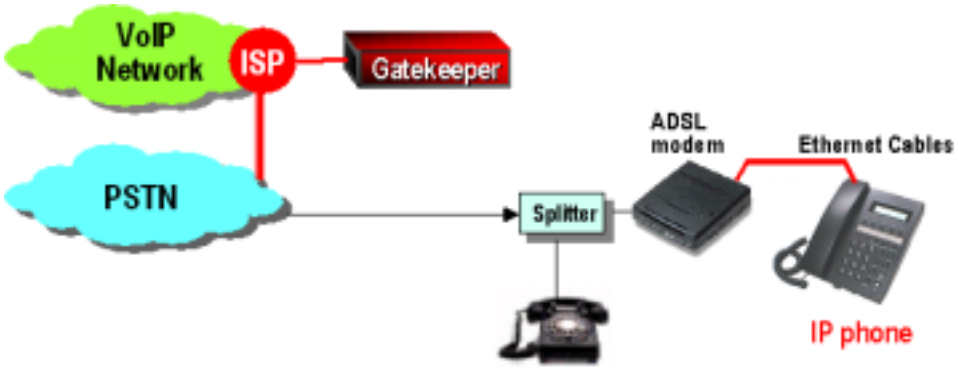

Figure 5.7. An IP Phone For Home With Single Real IP

[Requirement of Equipments]:

- An ADSL line with ADSL modem (Can be changed to CATV and Cable Modem)
- A standard H.323 IP phone

- A standard H.323 Gatekeeper located in the public Internet

[Description of Application]:

- The IP phone has to register to the Gatekeeper located in public Internet.
- For IP phone using Real Dynamic IP addresses, it can keep alive with the Gatekeeper all the time so that no communication blocking will take place
- All traffic will not go thru the Gatekeeper.

[Call Paths]:

- The external endpoints can dial to the IP phone thru the Gatekeeper. On the reverse, so do them.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Enable.
- **PPPID:** Say "hinetuser901".
- **PPP Pin:** Say "3838383838".
- **IP:** say 192.168.1.10(just keep the default setting)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** don't care
- **Proxy:** Disable
- **Proxy IP:** 0.0.0.0 or "**61.222.54.184**" or "**67.120.192.137**".
- **RTP Port:** "1722" (default setting).
- **Q.931 Port:** "1720" (default setting).
- **RAS Port**: "1720" (default setting).
- **H.245 Port:** "1722" (default setting).
- **Use GK:** Enable
- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper).
- **GK ID:** Null,
- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper)
- **H.235 Account:** Say "Taipei Karl".
- **H.235 Pin:** Say "11111".
- **H.323 ID:** Null.
- **Phone Number:** Say "26551000"

5.8. H7 –A Basic Home LAN With Single Real IP

This application is a typical and common type for home user. Since only a single real Ip is applicable, a PC will be used to run Proxy software and the virtual IP will be given to the IP phone. Since it has no Gatekeeper at home, user shall subscribe the service of ITSP's Gatekeeper. So, remote PSTN traffic can go up and get down the VoIP network for home users.

No.	External GK	Number of Real IP	PC System	Internal IP Phone	Call Applications	Remarks
H7	RF IP	Only 1 RDIP given	To run a PC for Internet Sharer.	VF IP	For the phones using VF IP, its H.323 proxy function need to be enabled. Then register the IP phone to the external Gatekeeper:	Basic Home Network

			With RD IP		External Calls: The phone can do call setup & conversation well with any external point.	

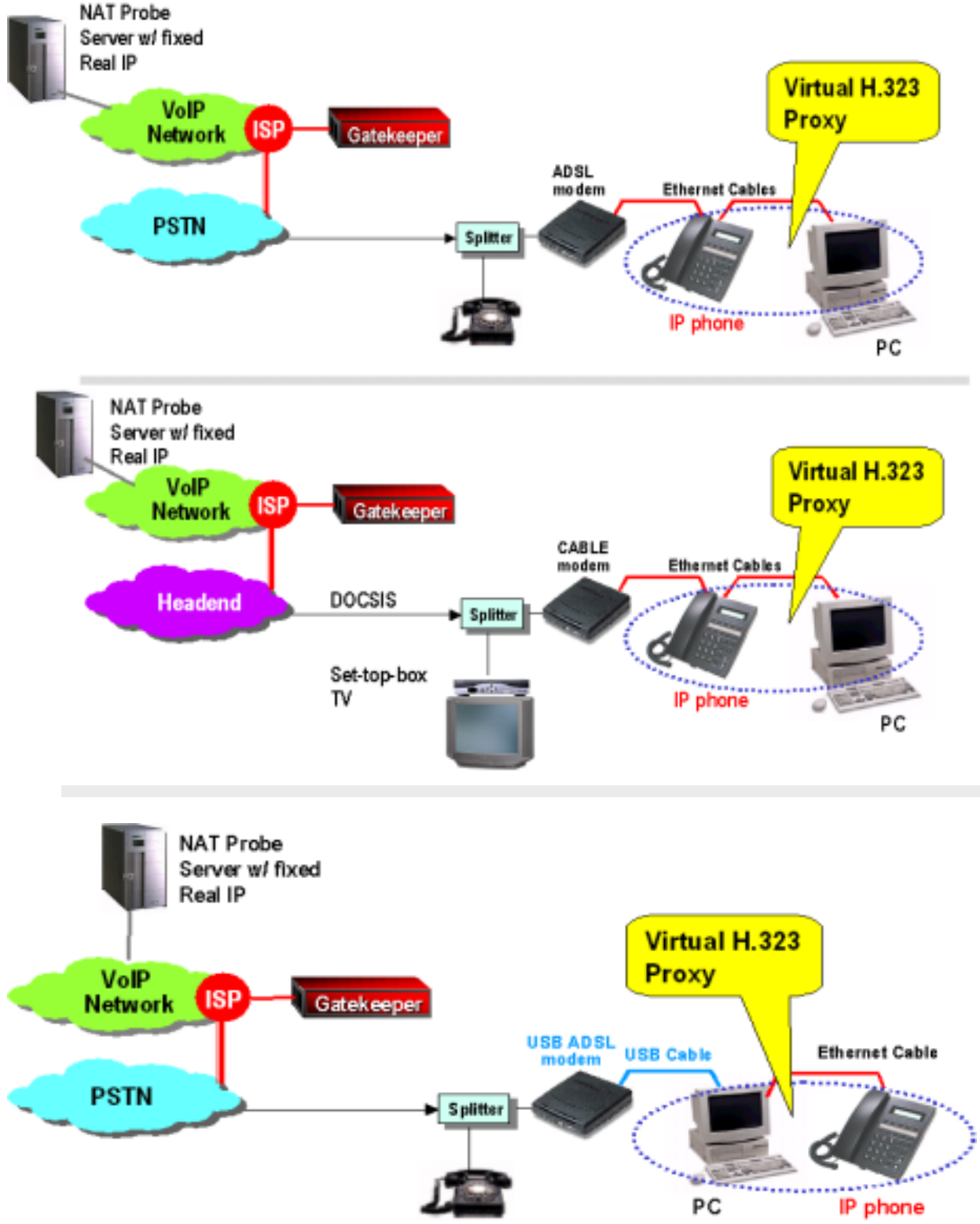

Figure 5.8. A Basic Home LAN With Single Real IP

[Requirement of Equipments]:

- An ADSL line with ADSL modem (Can be CATV and Cable Modem)
- A standard H.323 IP phone
- A standard H.323 Gatekeeper located in the public Internet
- A NAT Probe Server with Real Fixed IP address. (Or, you may utilize the supplier's server).
- A PC runs a Proxy software to act as a IP router or NAT (Please see the Appendix for popular Proxy software). This PC is expected to run all the year without shut down, or sleep or suspend, if you wish IP phones are all in connection state with Gatekeeper.

[Description of Application]:

- The IP phone has to register to the Gatekeeper located in public Internet.
- For the IP phone using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For the IP phone using Virtual IP addresses, the virtual H.323 proxy function of IP phones should be enabled. (Please refer to the above figure).
- All traffic will not go thru the Gatekeeper.
- You MUST to configure the NAT/PAT table for those IP phones whose virtual H.323 proxy function have been enabled. Please refer to the operational manual of Proxy software of PC and be careful with the settings of IP port mapping. (Please refer to the example of the NAT setting of Windows 2000 Server in Appendix)
- This type of application can have several different models. In the above figure, there are three models, one using ADSL Ethernet modem, one using CATV Ethernet modem, and the third using ADSL USB modem.

[Call Paths]:

- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them. The media traffic will go locally thru the Proxy PC.
- The IP phone can dial to the NetMeeting™ of Windows™ on your PC thru the Gatekeeper. But the media traffic will go locally to the PC.

[Parameter Settings]:

- **Use DHCP:** Disable
- **PPPoE:** Disable
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** say 192.168.5.10 (given a virtual fixed IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.254. (a private fixed IP for this PC running proxy software)
- **Proxy:** Connect
- **Proxy IP:** "**61.222.54.184**" or "**67.120.192.137**".
- **RTP Port:** "1722" (default setting).
- **Q.931 Port:** "1720" (default setting).
- **RAS Port**: "1720" (default setting).
- **H.245 Port:** "1722" (default setting).
- **Use GK:** Enable
- **GK IP:** Say 78.250.33.168 (a public fixed IP address of ITSP Gatekeeper).
- **GK ID:** Null,
- **Use H.235:** Say Enable (it depends on ISP's Gatekeeper)
- **H.235 Account:** Say "Taipei Karl".

- **H.235 Pin:** Say “11111”.
- **H.323 ID:** Null.
- **Phone Number:** Say “26551000”

Chapter 6

6. The Applications With A Special Gatekeeper

6.1. P1 –Enterprise Application With A Special GK in Main Office

This application should work with a Special Gatekeeper. If you just have one real IP for Router and don't have any other real IP for a standard H.323 Proxy box, you may adopt a Special H.323 Proxy box with a virtual fixed IP for your branch office. But, if you have a second real IP address, you can just use a standard H.323 Proxy box instead of using a special H.323 Proxy box. At the same time, all IP phones don't need any special protocol feature for this application. Therefore, this application just needs a Special GK in Main office and, in some case, a special H.323 Proxy box at each branch office. And all standard endpoints will work well under this environment. Please check your supplier about the availability of the Special Gatekeeper and Special H.323 Proxy Box.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
P1 (★)	RF IP With Route mode In Main office [Remark]	Yes with a RIP	Special H.323 Proxy Box with a VF IP In office	Any	(3) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (4) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	[Remark]: Should use a special GK which supports virtual IP solution.

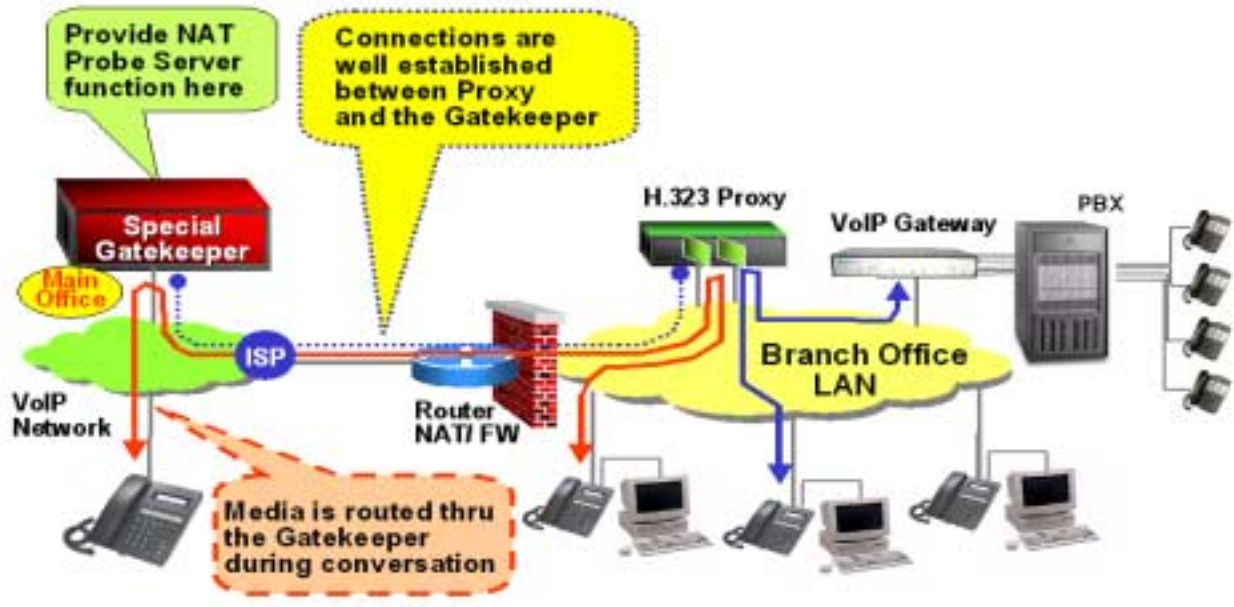

Figure 6.1. Enterprise Application With a Special GK in Main Office

[Requirement of Equipments]:

- The standard H.323 IP phones (Can use other products from other vendors)
- A Special H.323 Gatekeeper located in main office with **"NAT-reversal Proprietary Protocol"** equipped and a real fixed IP. (Notes: If any endpoints using Real Public IP, they can be registered to this special Gatekeeper as standard H.323 endpoints do.)
- A general office network with Router and Firewall (supporting NAT).
- A standard VoIP Gateway provides connecting the office LAN and PBX telephone system. (Can use other products from other vendors)
- A H.323 Proxy server located in the office with **"NAT-reversal Proprietary Protocol"** equipped. Please contact your supplier for the availability of this special H.323 Proxy Box. (The H.323 Proxy Server is supposed to run with a virtual fixed IP).

[Description of Application]:

- All IP endpoints have to register to the Special Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For the special H.323 proxy box using **"NAT-reversal Proprietary Protocol"**, the NAT traversal issue for internal endpoints is easily solved.
- For the endpoints associated to the special H.323 proxy, their outgoing traffic shall GO THRU both the H.323 Proxy Box and Gatekeeper. (But for intercom calls, the traffic will go thru the special H.323 Proxy box only). So, the capacity of Gatekeeper becomes very important in service quality planning of system.
- You MUST to enable this **"NAT-reversal Proprietary Protocol"** functions on both sides of the Special Gatekeeper and the special H.323 Proxy box.
- The advantage of this approach is to introduce any standard H.323 endpoints of other vendors into the office and save a Real Public IP address for the Special H.323 Proxy box.
- But disadvantage is that it will cost a special H.323 Proxy in the office.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will go thru the special H.323 Proxy locally.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them. But the media traffic will go the special Gatekeeper and special H.323 Proxy, too.
- The extension of PBX can get a line to VoIP Gateway and dial to any internal IP phones or outside endpoints.
- Any IP phones dialing to the VoIP Gateway thru Gatekeeper will get a second dial tone that you can dial to the extension number of PBX system.

[Parameter Settings]:

- **Use DHCP:** Enable
- **PPPoE:** Disable
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** say 192.168.5.24 (DHCP server assigns a virtual IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.254. (a private fixed IP for this PC running proxy software)
- **Proxy:** Disable.
- **Proxy IP:** 0.0.0.0

- **RTP Port:** "1722" as default setting.
- **Q.931 Port:** "1720" as default setting.
- **RAS Port**: "1720" as factory default setting.
- **H.245 Port:** "1722" as default setting.
- **Use GK:** Enable
- **GK IP:** Say 92.151.51.24 (a public fixed IP address in main office).
- **GK ID:** Null,
- **Use H.235:** Disable
- **H.235 Account:** Null.
- **H.235 Pin:** Null.
- **H.323 ID:** Null.
- **Phone Number:** Say 2100.

6.2. P2 – SOHO Application With A Special GK at ITSP

This application should work with a Special Gatekeeper. If you just have one real IP for Router and don't have any other real IP for a standard VoIP Gateway, you may adopt a Special H.323 Gateway with a virtual fixed IP for your branch office. But, if you have a second real IP address, you can just use a standard H.323 Gateway instead of using a special H.323 Gateway. At the same time, all IP phones DO NEED a special protocol feature for this application. Therefore, this application needs special IP phone and, in some case, a special H.323 Gateway to connect to your KTS telephone system. And all standard endpoints cannot work with a virtual IP addresses. Please check your supplier about the availability of the Special Gatekeeper, Special H.323 Gateway and IP phones with special feature support.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
P2 (★)	RF IP With Route mode at ITSP [Remark]	Yes with a RIP		Any With a special Proprietary Virtual IP support in the phone	(3) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (4) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	[Remark]: Should use a special GK which supports virtual IP solution.

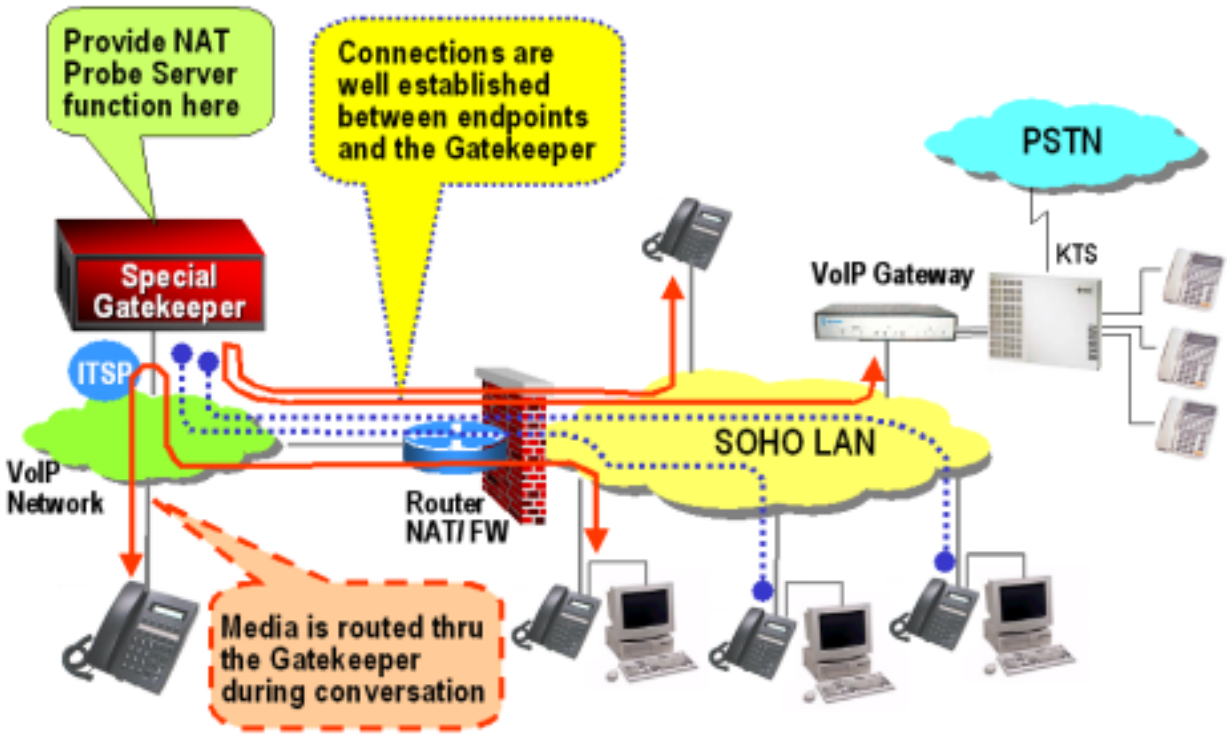

Figure 6.2. SOHO Application With A Special GK at ITSP

[Requirement of Equipments]:

- The IP phones with **"NAT-reversal Proprietary Protocol"** equipped.
- A Special H.323 Gatekeeper located in the public Internet ITSP with **"NAT-reversal Proprietary Protocol"** equipped. (Notes: If any endpoints using Real Public IP addresses, they can be registered to this special Gatekeeper as standard H.323 endpoints do.)
- A general office network with Router and Firewall (supporting NAT).
- A VoIP Gateway provides connecting the office LAN and KTS telephone system. (The Gateway must provide **"NAT-reversal Proprietary Protocol"** or runs with a Dynamic Real IP at least).

[Description of Application]:

- All IP endpoints have to register to the Special Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For IP phones using **"NAT-reversal Proprietary Protocol"**, the NAT traversal issue is easily solved.
- For the endpoints using virtual IP addresses, their traffic shall GO THRU the Gatekeeper. So, the capacity of Gatekeeper becomes very important in service quality planning of system.
- You MUST to enable this **"NAT-reversal Proprietary Protocol"** functions on both sides of the Special Gatekeeper and endpoints.
- The advantage of this approach is to provide a general NAT traversal solution for endpoints of enterprise.
- But disadvantage is that it doesn't support another endpoints of other vendors using virtual IP addresses.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But

the media traffic will forward to the Special Gatekeeper and backward to another phones inside.

- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them. And all traffic will go thru the Special Gatekeeper.
- The extension of PBX can get a line to VoIP Gateway and dial to any internal IP phones or outside endpoints.
- Any IP phones dialing to the VoIP Gateway thru Gatekeeper will get a second dial tone that you can dial to the extension number of KTS system.

[Parameter Settings]:

- **Use DHCP:** Enable
- **PPPoE:** Disable
- **PPPID:** null.
- **PPP Pin:** null.
- **IP:** say 192.168.5.24 (DHCP server assigns a virtual IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.1 (the IP of default gateway)
- **Proxy:** Disable.
- **Proxy IP:** 0.0.0.0
- **RTP Port:** "1722" as default setting.
- **Q.931 Port:** "1720" as default setting.
- **RAS Port**: "1720" as factory default setting.
- **H.245 Port:** "1722" as default setting.
- **Use GK:** Enable
- **GK IP:** Say 92.151.51.24 (a public fixed IP address in main office).
- **GK ID:** Null,
- **Use H.235:** Disable
- **H.235 Account:** Null.
- **H.235 Pin:** Null.
- **H.323 ID:** Null.
- **Phone Number:** Say 2100.

6.3. P3 – For Home Application With A Special GK

This application should work with a Special Gatekeeper. If you just have one real IP for the residential Router All IP phones DO NEED a special protocol feature for this application. Therefore, this application needs special IP phone working with virtual IP and a Special GK at ITSP site. Please check your supplier about the availability of the Special Gatekeeper and IP phones with this special feature.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
P3 (★)	RF IP With Route mode at ISTP	Yes with a RIP		Any With a special Proprietary Virtual IP	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (3) External Calls:	[Remark]: Should use a special GK which supports

	[Remark]			support in the phone	Any internal endpoint can do call setup & conversation well with the external point.	virtual IP solution.

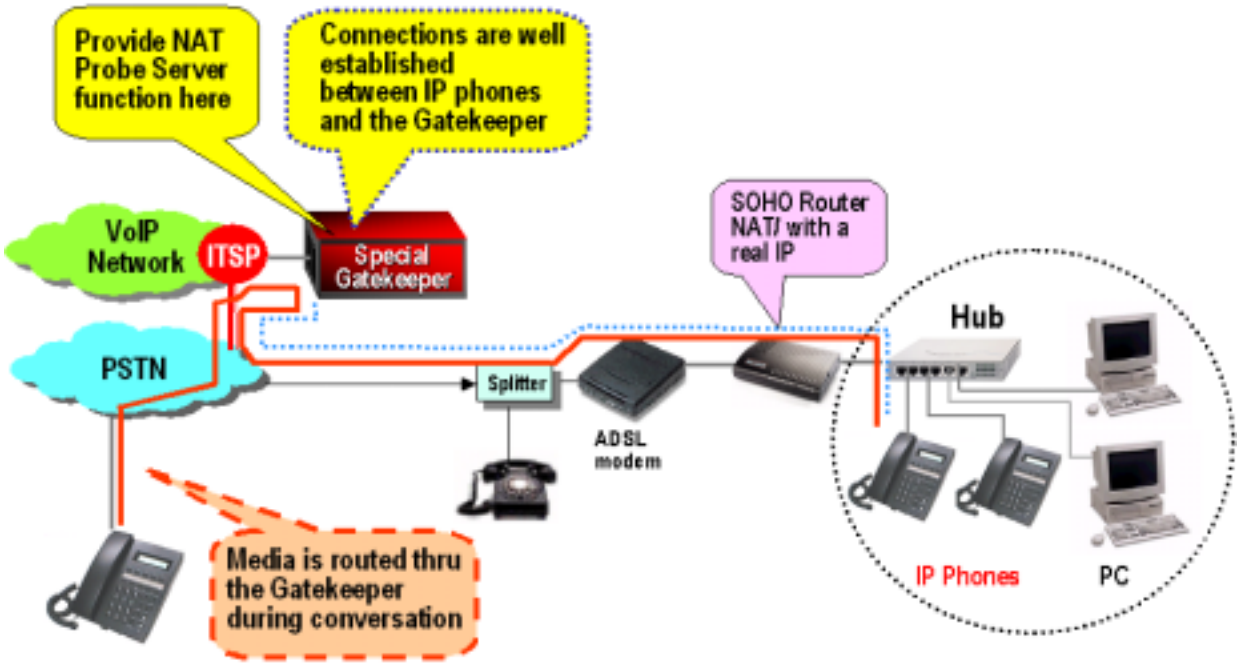

Figure 6.3. Home Application With A Special GK at ITSP

[Requirement of Equipments]:

- The IP phones with **"NAT-reversal Proprietary Protocol"** equipped.
- A Special H.323 Gatekeeper located in the public Internet with **"NAT-reversal Proprietary Protocol"** equipped. (Notes: If any endpoints using Real Public IP addresses, they can be registered to this special Gatekeeper as standard H.323 endpoints do.)
- A general office network with Router and Firewall (supporting NAT).
- A VoIP Gateway provides connecting the office LAN and PBX telephone system. (The Gateway must provide **"NAT-reversal Proprietary Protocol"** or runs with a Dynamic Real IP at least).

[Description of Application]:

- All IP endpoints have to register to the Special Gatekeeper located in public Internet.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- For IP phones using **"NAT-reversal Proprietary Protocol"**, the NAT traversal issue is easily solved.
- For the endpoints using virtual IP addresses, their traffic shall GO THRU the Gatekeeper. So, the capacity of Gatekeeper becomes very important in service quality planning of system.
- You MUST to enable this **"NAT-reversal Proprietary Protocol"** functions on both sides of the Special Gatekeeper and endpoints.
- The advantage of this approach is to provide a general NAT traversal solution for endpoints of enterprise.
- But disadvantage is that it doesn't support another endpoints of other vendors using virtual IP addresses.

[Call Paths]:

- The internal IP phone can dial to another internal endpoints thru the Gatekeeper. But the media traffic will forward to the Special Gatekeeper and backward to another phones inside.
- The external endpoints can dial to internal endpoints thru the Gatekeeper. On the reverse, so do them. And all traffic will go thru the Special Gatekeeper.
- The extension of PBX can get a line to VoIP Gateway and dial to any internal IP phones or outside endpoints.
- Any IP phones dialing to the VoIP Gateway thru Gatekeeper will get a second dial tone that you can dial to the extension number of PBX system.

[Parameter Settings]:

- **Use DHCP:** Enable
- **PPPoE:** Disable
  - **PPPID:** null.
  - **PPP Pin:** null.
- **IP:** say 192.168.5.24 (DHCP server assigns a virtual IP)
- **Subnet Mask:** say 255.255.255.0.
- **Router:** say 192.168.5.1 (the IP of default gateway)
- **Proxy:** Disable.
- **Proxy IP:** 0.0.0.0
  - **RTP Port:** "1722" as default setting.
  - **Q.931 Port:** "1720" as default setting.
  - **RAS Port**: "1720" as factory default setting.
  - **H.245 Port:** "1722" as default setting.
- **Use GK:** Enable
- **GK IP:** Say 92.151.51.24 (a public fixed IP address in main office).
  - **GK ID:** Null,
- **Use H.235:** Disable
  - **H.235 Account:** Null.
  - **H.235 Pin:** Null.
  - **H.323 ID:** Null.
- **Phone Number:** Say 2100.

Chapter 7

7. The Integration System Applications

7.1. I1 –Enterprise Integration System For Offices

This session will show a whole picture of integrated VoIP system application with the IP phones. Both the main office system and branch office system are integrated together. They can be allocated globally and provide VoIP and PSTN services together at the same time.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
I1		Yes, with a RF IP	GK+Proxy With a RF IP	Any (H.323 Standard)	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Main office
I1 -1		Yes with a RD IP	H.323 Proxy With a RD IP	Any (H.323 Standard)	(3) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally thru H.323 Proxy. (4) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Branch Office

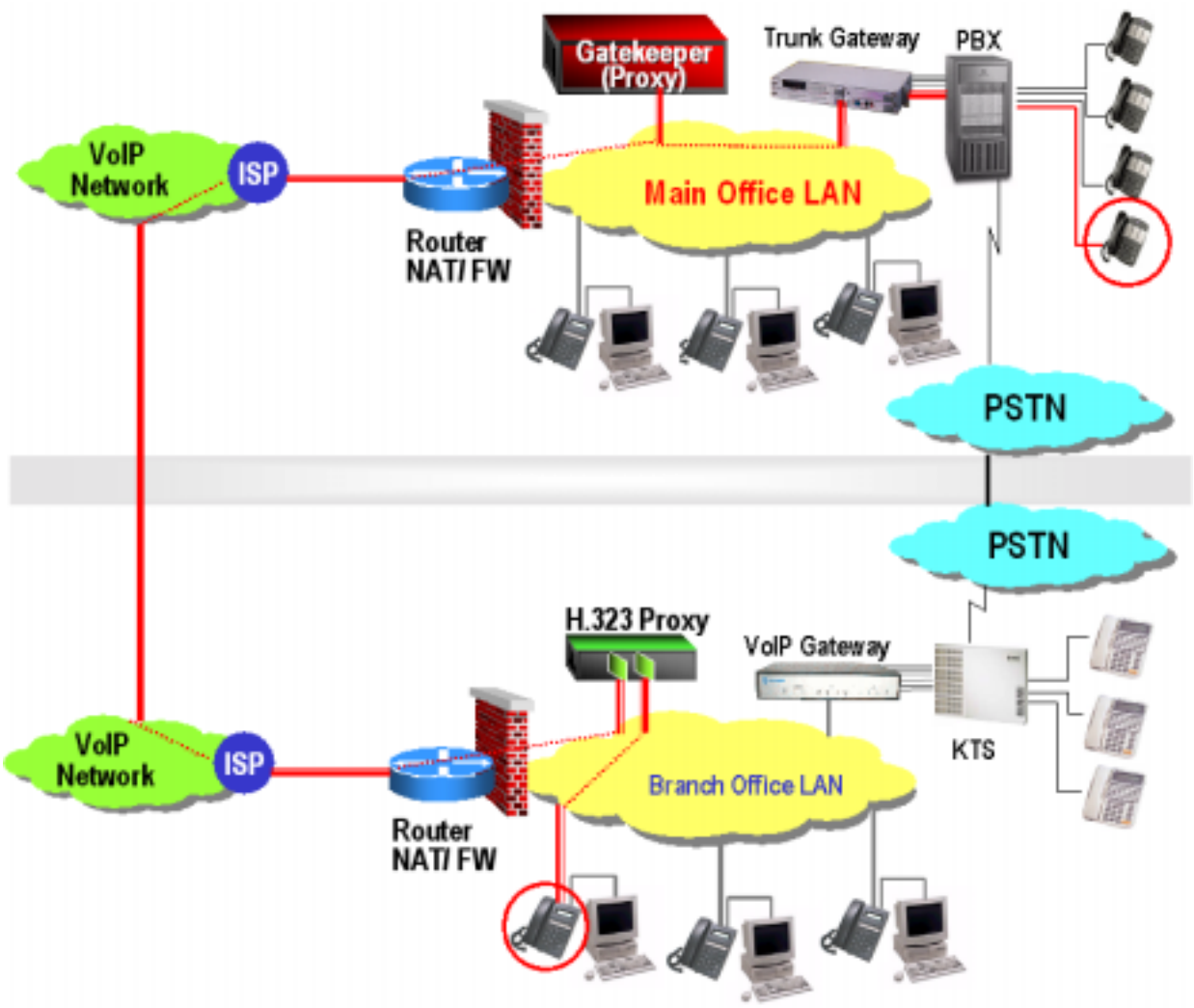

Figure 7.1. Enterprise Integration System For Offices

[Description of Application]:

- This is a typical global VoIP system for enterprise. The Gatekeeper is located at the main office and may have an Alternative Gatekeeper for back-up purpose in the key branch office.
- All IP endpoints in main office and branch offices have to register to the Gatekeeper located in the main office.
- All IP endpoints shall set its Proxy to their own H.323 Proxy boxes in branch offices or the Gatekeeper in main office.
- For IP phones using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- NAT traversal issue is easily solved with the usage of H.323 Proxy.
- All internal traffic will go thru the H.323 proxy.

7.2. I2 –Enterprise Integrated System for Remote Home Workers

This session will show a picture of integrated VoIP system application with the IP phones. The main office system provides a connection to home worker thru Internet. They can be allocated globally and provide VoIP and PSTN services together at the same time.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
I2		Yes, with a RF IP	GK+Proxy With a RF IP	Any (H.323 Standard)	(1) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (2) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Main office
I2 -1				RD IP (H.323 Standard)	(3)External Calls: IP phone can do call setup & conversation well with any endpoint in main and branch offices.	Home Office

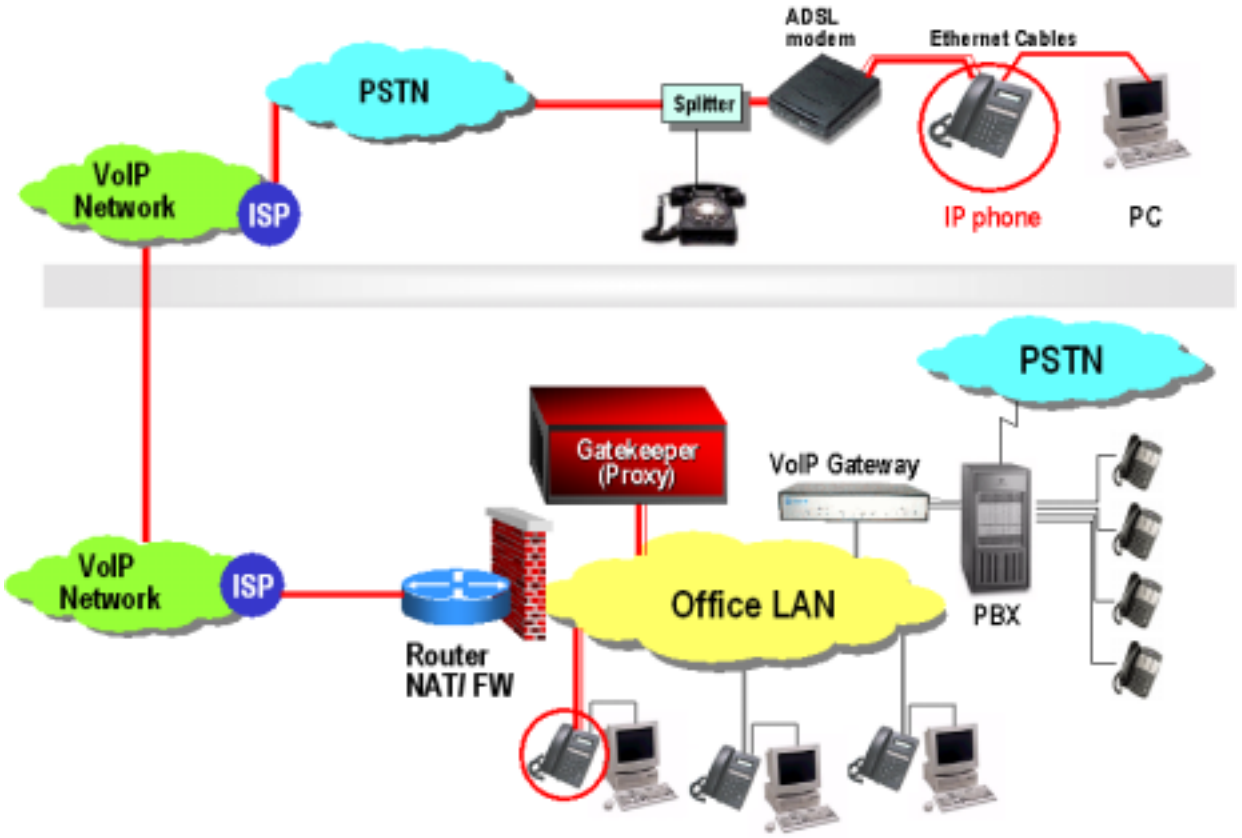

Figure 7.2. Enterprise Integrated System for Remote Home Workers

[Description of Application]:

- This is a VoIP system solution for the home workers of enterprise. The Gatekeeper is located at the main office and may have an Alternative Gatekeeper for back-up purpose in the key branch office.
- All IP endpoints in main office and home offices have to register to the Gatekeeper located in the main office.
- For IP phones in main office using Virtual Dynamic IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.

7.3. I3 –Integrated System Of Office And ITSP Service

This session will show a whole picture of integrated VoIP system application with the IP phones. Both the office VoIP system and ITSP Service system are integrated together. They can be allocated globally and provide VoIP and PSTN service together at the same time. For small or medium enterprises that do not have many overseas offices to transfer VoIP to PSTN network, this integration is a good way to solve PSTN get-on and get off issue.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
I3	RF IP By ITSP	Yes with a RD IP	H.323 Proxy With a RD IP	Any (H.323 Standard)	(3) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally thru H.323 Proxy. (4) External Calls: Any internal endpoint can do call setup & conversation well with the external point.	Office

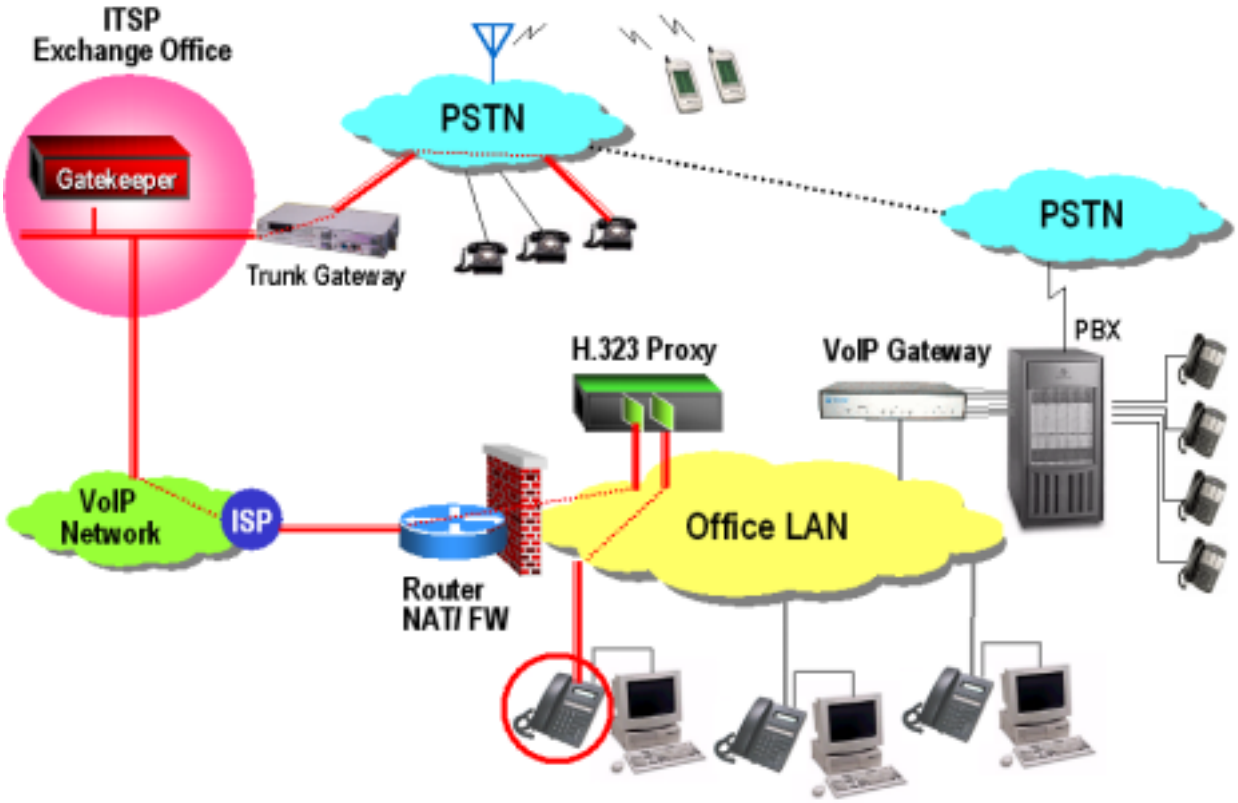

Figure 7.3. Integration System of Office and ITSP Service

[Description of Application]:

- This is an integration of Office VoIP System and ITSP VoIP service. The Gatekeeper is located at the site of ITSP.
- It offers powerful and cost-effective capability that can allow PSTN global on-net/off-

net connection for enterprise.

- All IP phones shall register to the Gatekeeper located in the ITSP site.
- For IP phones using Real Dynamic IP addresses, it can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- All IP endpoints will be associated to the H.323 Proxy box and all internal traffic will go thru this Proxy for both internal and external calls.
- The endpoints of Office can call to any registered endpoints of ITSP and to any public PSTN traditional phone or mobile phone thru trunk Gateway.

7.4. I4 –ITSP Subscriber VoIP Service Integration System

This session will show a whole picture of integrated VoIP system application with the IP phones. Both the Home system and ITSP service system are integrated together. They can be allocated globally and provide VoIP and PSTN services together at the same time.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
I4	RD IP By ITSP			(H.323 Standard) RD IP Another 1 RDIP for PC	(1) External Calls: Any internal endpoint can do call setup & conversation well with any external point. Or, the outgoing call can transfer to PSTN analog phone or mobile phone thru Trunk Gateway.	Home

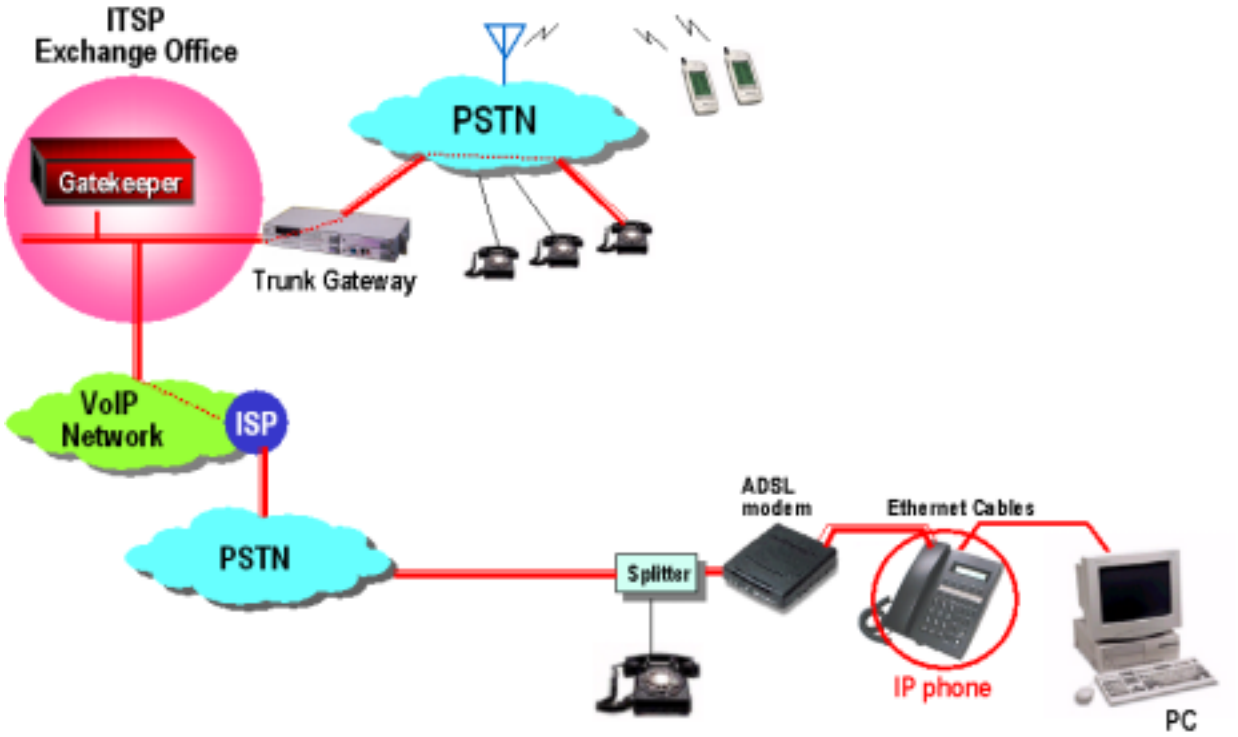

Figure 7.4. ITSP Subscriber VoIP Service Integration System

[Description of Application]:

- This is a VoIP solution for the subscribers of ITSP. The Gatekeeper is located at the site of ITSP.
- The IP phone shall register to the Gatekeeper located in the ITSP site.
- For IP phone using Real Dynamic IP addresses, it can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- The subscriber can call to any registered endpoints of ITSP and to any public PSTN traditional phone or mobile phone thru trunk Gateway.

7.5. I5 –Different VoIP Subscribers' Environment of ITSP

This session will show a whole picture of integrated VoIP system application with the IP phones. There are many kind of residential configurations with IP phone. But all of them can be integrated with the ITSP VoIP service system. And any one can be allocated globally and be provided VoIP and PSTN services together at the same time.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
I5	RD IP By ITSP			(H.323 Standard) RD IP Another 1 RDIP for PC	(1) External Calls: Any internal endpoint can do call setup & conversation well with any external point. Or, the outgoing call can transfer to PSTN analog phone or mobile phone thru Trunk Gateway.	Homes

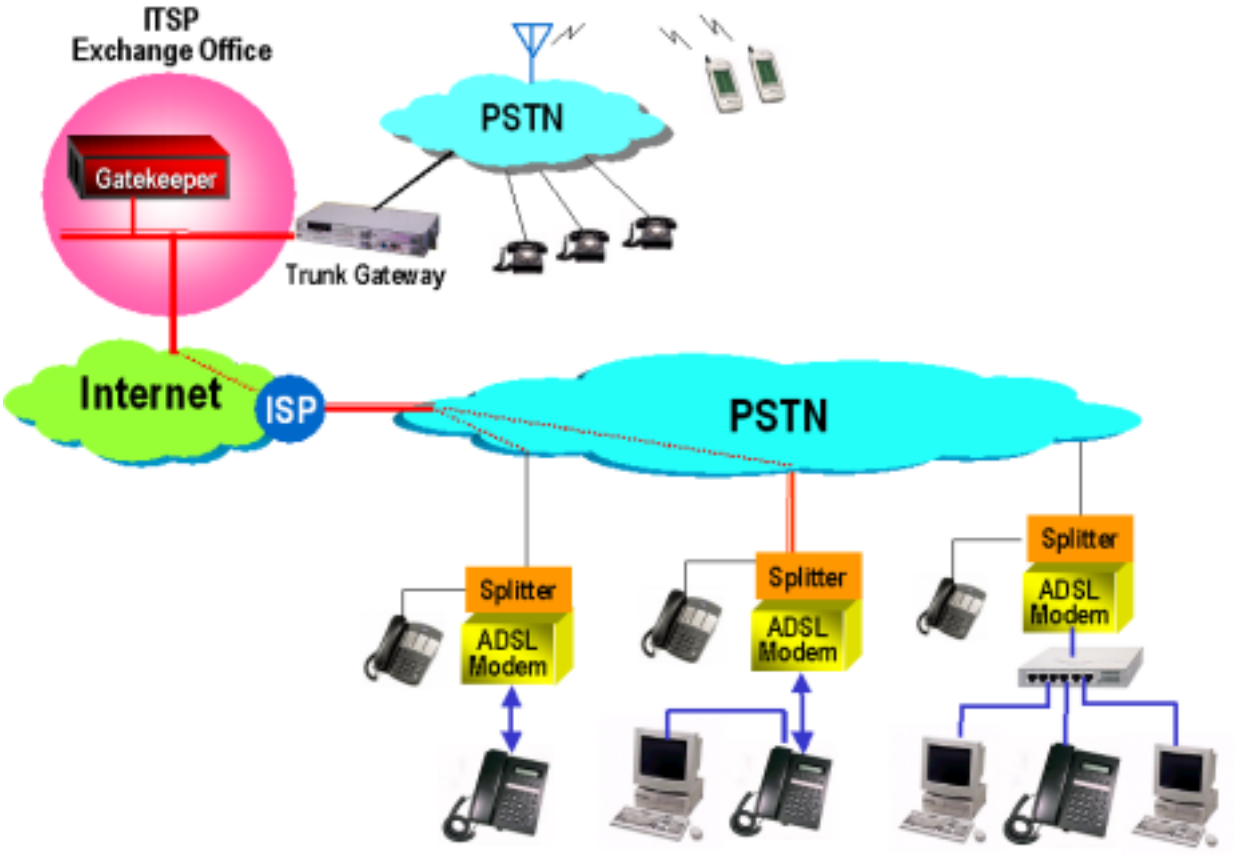

Figure 7.5. Different VoIP Subscribers' Environment of ITSP

[Description of Application]:

- This is a VoIP solution for ITSP subscribers. The Gatekeeper is located at the site of ITSP.
- There are many different environments of subscribers, like a single IP phone, IP phone along with a PC, IP phone along with 2 PCs and so on.
- The IP phone shall register to the Gatekeeper located in the ITSP site.
- For IP phone using Real Dynamic IP addresses, it can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- To get a second Real Dynamic IP for the PC or for the main PC running an Internet Connection Sharing (or Proxy) software.
- The subscriber can call to any registered endpoints of ITSP and to any public PSTN traditional phone or mobile phone thru trunk Gateway.

7.6. I6 – A VoIP Service Infrastructure of ITSP Operators

This session will show a whole picture of integrated VoIP system application with the IP phones. From enterprise, branch offices, SOHO, and residential, all of them can be integrated together and under the service of ITSP company. The subscribers of ISTP can be allocated globally and be provided VoIP and PSTN services together at the same time.

No.	External GK	Router / Firewall	Internal GK/Proxy	Internal IP Phone	Call Applications	Remarks
I6	RF IP By ITSP	Yes with a RIP For offices Only	For office, Proxy is equipped wit a RIP.	RD IP For home Subscriber and VF IP For office users	(3) Internal Calls: All IP phones and Gateways will register to the Gatekeeper and can call each other well internally. (4) External Calls: Any internal endpoint can do call setup & conversation well with the external point. Or, the outgoing call can transfer to PSTN analog phone or mobile phone thru Trunk Gateway.	ITSP

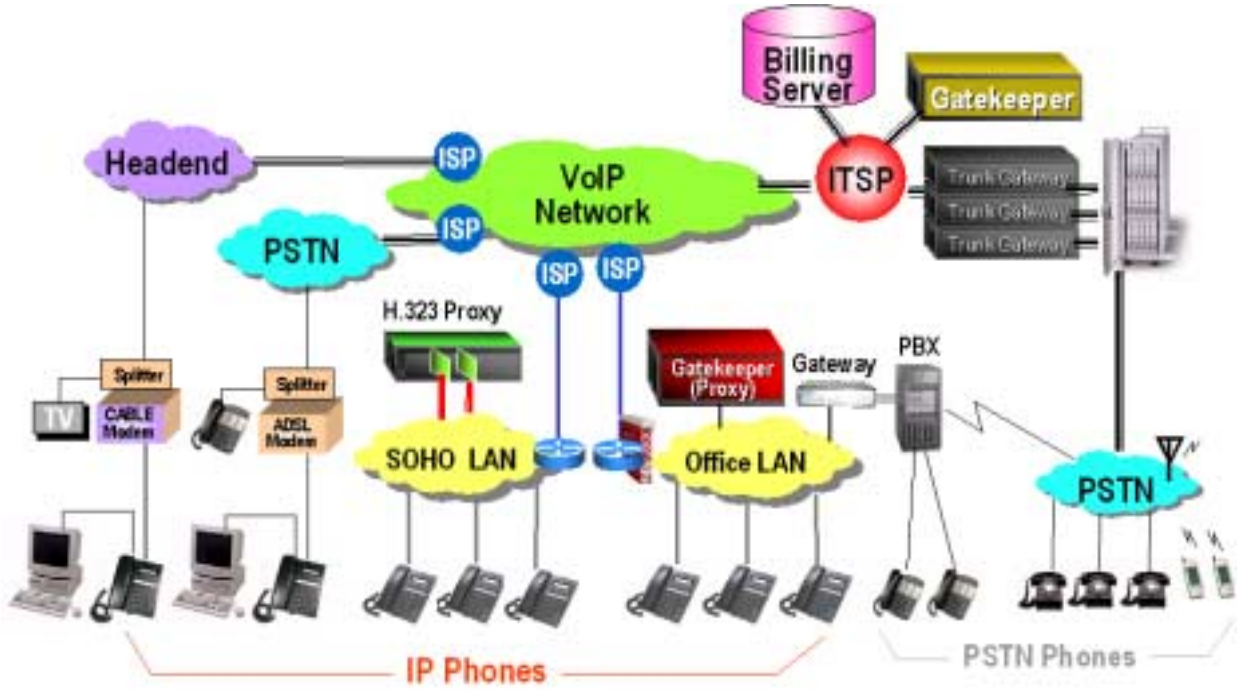

Figure A VoIP Service Infrastructure of ITSP Operators

[Description of Application]:

- This is an integration of Office VoIP system, SOHO VoIP system, Home subscribers and traditional PSTN network. The Gatekeeper is located at the site of ITSP.
- The ITSP provides the operation of VoIP service and enable all customers with a powerful and cost-effective capability that allows PSTN global on-net/off-net connection to/from the users.
- All IP phones shall register to the Gatekeeper located in the ITSP site.
- For IP phones using any IP addresses, they can keep alive with the Gatekeeper all the time so that no communication blocking will take place.
- In an office, all IP endpoints will be associated to the H.323 Proxy box and all internal traffic will go thru this Proxy for both internal and external calls.
- The endpoints of Office can call to any registered endpoints of ITSP and to any public PSTN traditional phone or mobile phone thru trunk Gateway.

Appendix

8. Appendix: Proxy Software For ICS & NAT Solution

There are many commercial PC-based Proxy software in the market that can support IP Router and NAT (Network Address Translation) functions for SOHO networks. Please refer to their sites for more detailed information. Besides, you may download their evaluation or free copy for testing.

http://www.deerfield.com/products/wingate/

http://www.kerio.com/wrp_home.html

http://www.ositis.com/english/home/hm_business_home_en.asp

http://soho.sygate.com/products/access_ov.htm

http://www.microsoft.com/windows2000/en/server/help/default.asp

http://www.nat32.com

http://www.analogx.com/contents/download/network/proxy.htm

http://www.voip-calculator.com/dualgatekeeper.html

http://www.netcplus.com/browsegate.html

The End of Document ==========

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