ZETRON®

Model 6300 IP Gateway

025-9631D.1

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Regulatory Compliance

Information on Disposal of Old Electrical and Electronic Equipment and Batteries (applicable for EU countries that have adopted separate waste collection systems)

Products and batteries with the symbol (crossed-out wheeled bin) cannot be disposed as household waste. Old electrical and electronic equipment and batteries should be recycled at a facility capable of handling these items and their waste byproducts.

Contact your local authority for details in locating a recycle facility nearest to you.

Pb

Proper recycling and waste disposal will help conserve resources whilst preventing detrimental effects on our health and the environment.

Notice: The sign "Pb" below the symbol for batteries indicates that this battery contains lead.

FCC Class A User Information

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

EMC Compliance Standards

This product meets the requirements of the standards listed below.

- FCC Part 15 – Radiated & Conducted Emissions (USA)
- ICES-003 – Radiated & Conducted Emissions (Canada)
- EN 55022 – Radiated & Conducted Emissions (Europe & Australia)
- EN 55024 – Immunity (Europe)

Regulatory Compliance Markings

Product Certification Markings:

- FCC Part 15 (USA)
- CE (Europe)
- C-tick (Australia)

Safety Summary

Warning! For your safety and the protection of the equipment, observe these precautions when installing or servicing Zetron equipment.

- Follow all warnings and instructions marked on the equipment or included in documentation.
- Only technically qualified service personnel are permitted to install or service the equipment.
- Be aware of and avoid contact with areas subject to high voltage or amperage. Because some components can store dangerous charges even after power is disconnected, always discharge components before touching.
- Never insert objects of any kind through openings in the equipment. Conductive foreign objects could produce a short circuit that could cause fire, electrical shock, or equipment damage.
- Remove rings, watches, and other metallic objects from your body before opening equipment. These could be electrical shock or burn hazards.
- Ensure that a proper electrostatic discharge device is used, to prevent damage to electronic components.
- Do not attempt internal service of equipment unless another person, capable of rendering aid and resuscitation, is present.
- Do not work near rotating fans unless absolutely necessary. Exercise caution to prevent fans from taking in foreign objects, including hair, clothing, and loose objects.
- Use care when moving equipment, especially rack-mounted modules, which could become unstable. Certain items may be heavy. Use proper care when lifting.

Change List for Rev D, 21 February 2012

- Corrected Hi-Z and Lo-Z impedance values on page 41.

Change List for Rev D.1, 5 April 2012

- Fixed IP address typo on page 37.

Contents

Introduction

This manual provides procedures and reference information used to install and configure the Zetron Model 6300 IP Gateway.

Note All instructions in this manual assume that the user is reasonably experienced with installation of radio and telecommunication equipment. Persons without proper knowledge, skills, or authorization must not be allowed to install this equipment.

System Overview

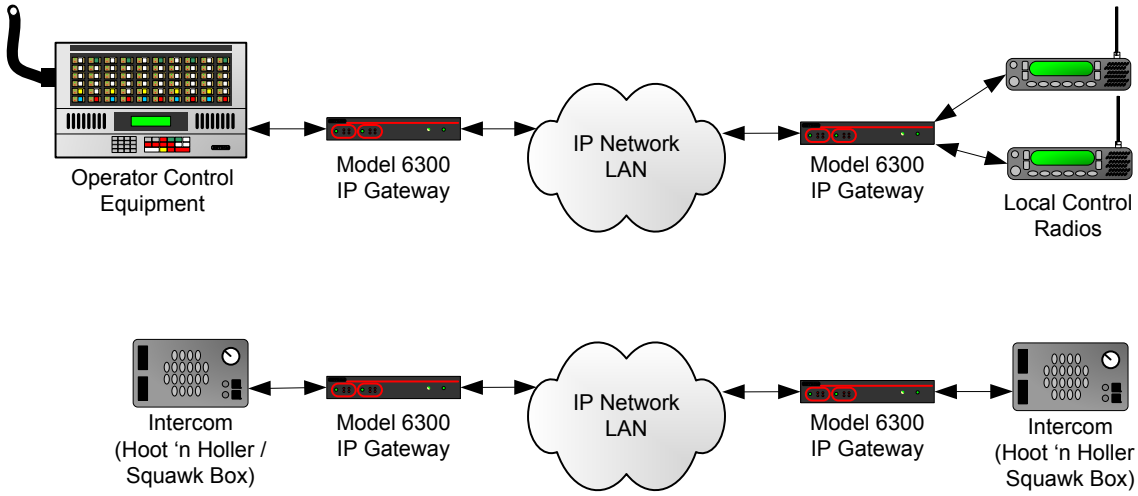
The Zetron Model 6300 IP Gateway is a "Radio over IP" (RoIP) device that provides a means of connecting radio consoles with radios, or radios with radios by way of an IP network instead of traditional dedicated wire connections or microwave radio. The IP Gateway transports analog wireline two-way radio control circuits over IP network by converting audio and control information into IP packets, routing them over an IP network, and converting them back into useful form.

Each Model 6300 IP Gateway supports one or two radio circuits (the Model 6301 supports one circuit, the Model 6302 supports two circuits), with each circuit supporting analog audio, binary control (PTT & COR), and RS-232 serial data. The analog audio is field selectable between a balanced 4-wire connection suitable for most fixed station radios, and unbalanced transmit and receive audio suitable for direct connection to most mobile radios. In many cases, a mobile radio's programming and/or control head serial data can be transported over IP as well (contact Zetron for radio serial data compatibility). A pair of RoIP Gateways is thus able to transport one or two analog radio circuits across an IP network. The maximum number of links is only limited by network bandwidth and quality.

A pair of Model 6300 IP Gateways is used to provide a radio communication link over IP. One IP Gateway resides at the console and the other resides at the radio.

The following figure provides two simple examples of the Model 6300 used to connect legacy radio equipment and intercoms across an IP network.

Figure 1 – Model 6300 example configurations



Specifications

Physical Dimensions

Rack-mounted

IP Gateways are preferably mounted to a 19-inch rack-mount plate located on a rack in a controlled server environment. Each plate mounts up to two IP Gateways.

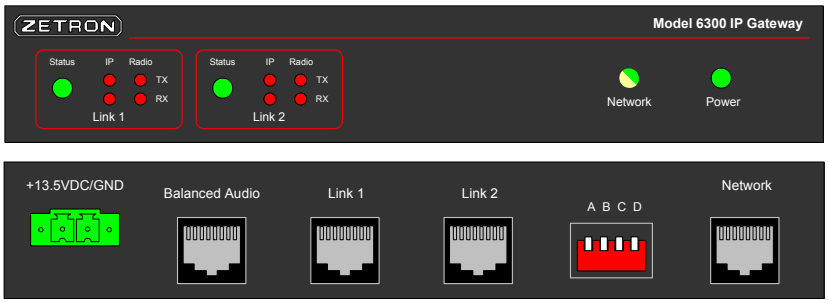
Figure 2 – Rack-mounted IP Gateways

Parameter	Description
Height:	1.75 inches / 1 rack units
Width:	19 inches
Depth:	10 inches

Stand-alone

The IP Gateway can also be placed as a stand-alone unit.

Figure 3 – Stand-alone IP Gateways



Parameter	Description
Height:	1.25 inches
Width:	7.5 inches
Depth:	10 inches

Inputs and Outputs

Parameter	Description
COR Input	Active < 0.8V Inactive > 2.0V 10K ohm pull-up to 5.0V
PTT Output	PTT <10 ohms to ground active, <100 na to ground when inactive Sinks 50 ma @ 12VDC
General Purpose I/O (configured for input)	Active < 1.0V Inactive > 3.6V 10K ohm pull-up to 5.0V
General Purpose I/O (configured for output)	Open-drain Active 10 ohm or less to ground Sinks 50 ma @ 12VDC
Serial Data I/O	Selectable RS-232 levels or TTL levels. Handshake signals are not supported.

Cable

CAT5 cable contains four pairs of copper wire. It supports Fast Ethernet speeds (up to 100 Mbps). As with all other types of twisted pair EIA/TIA cabling, CAT5 cable runs are limited to a maximum recommended run length of 100m (328 feet).

Environmental and Power Requirements

Parameter	Description
Power Input	+13.5VDC (+10.5 to +16VDC)
Max Power Draw	500mA @ 10.5VDC
Operating Temperature	5 to 55 degrees C (41 to 131 F)

The Model 6300 IP Gateway uses Zetron power supply P/N 950-0406. It is also compatible with Zetron Redundant 12VDC Power System Kits P/N 950-1142 and 950-1143.

Mean Time Between Failures

Hardware	Part Number	MTBF (years)[1]
Model 6300 IP Gateway	901-9681	283

[1] Using HRD5 model (temperature controlled locations)

Compatibility

Operator Control Equipment

Zetron

The Model 6300 IP Gateway works with the following Zetron consoles and desktop remotes:

- Model 4010
- Series 4000 (except wireless option for EDACS and iDEN)
- DCS-5020
- Acom System
- Model 280/284 Desktop Remote

Third Party

The Model 6300 IP Gateway works with most Zetron and third-party (non-Zetron) consoles providing Tone Remote Control (TRC) or E&M signals. However, there are some limitations when used with third-party consoles:

- The IP Gateway requires a 4-wire interface to the console; a Tx pair and an Rx pair. It is not compatible with consoles that only offer a 2-wire connection.
- If used in conjunction with Zetron or third party interfaces or adapters, such as a Radio Interface Module or Tone Remote Adapter, there may be additional limitations imposed by those interfaces or adapters.

The Model 6300 IP Gateway also works with non-radio, specialty voice applications (e.g. hoot-n-holler and intercom lines).

Radio Compatibility

The IP Gateway is compatible with the audio and PTT/COR signals of most radios, using either the balanced 4-wire or unbalanced direct connection ports of the IP Gateway.

If a radio's serial data is to be passed through the IP Gateway, the radio either needs to use RS-232 or TTL serial data, or external third-party devices will be needed to convert the radio's electrical interface to RS-232 or TTL. The IP Gateway's serial data signals only include transmit and receive data – additional handshake lines such as RTS/CTS and DSR/DTR are not supported. Radios that require these signals will not work with the IP Gateway.

Note Serial data protocols used by many devices such as mobile radios may have stringent timing requirements. Operation over IP networks can introduce delays which may prohibit the proper operation of certain serial data protocols.

Network Compatibility

Several network parameters such as the type of switches, overall network speed, and prioritization settings have a direct, measurable effect on a system using Model 6300 IP Gateways. The following list identifies specific requirements.

Caution! Installations for critical use should only use a reliable, quality network that meets or exceeds all of the network requirements.

- Model 6300 IP Payload: 1 Kbps idle, 130 Kbps active (G.711 per radio, per direction)

- Payload to Bandwidth Ratio: < 40% (< 30% mission critical). Bandwidth of IP bearer should be 2 to 3 times the actual payload to ensure optimum voice quality.
- Packet Loss: < 5% (< 0.1% mission critical)
- Packet Delay: < 500 ms (< 40 ms mission critical)
- Packet Jitter: < 100 ms (< 20 ms mission critical)
- Network: Fully switched Ethernet, full-duplex, capable of passing unicast UDP. Sharing the network with other IP traffic may negatively impact voice quality and therefore should not be considered for mission critical applications.

Licensed Features

The Model 6300 requires a license to enable the BSI Protocol (US Department of Homeland Security Bridging System Interface). The BSI Protocol can each be licensed separately for one or both links.

Safety

Important Safety Information

The installation, maintenance, and/or operation of this equipment may present potentially unsafe conditions, including, but not limited to, electrical shock, improper voltage to components, and improper operation that can cause personal injury, death, or damage to property.

Read Instructions

Read all the safety instructions before operating the equipment. Retain these safety instructions for future reference. Specialized procedures and instructions are required and must be followed. Also, all applicable safety procedures, such as Occupational, Safety, and Health Administration (OSHA) requirements, National Electric Code Requirements, local code requirements, safe working practices, and good judgment must be used by personnel.

Heed Warnings

Adhere to all warnings on the equipment and in the operating instructions. Follow all operating and use instructions.

Mounting

Mount the equipment only as recommended by the manufacturer (see Mounting on page 17). Situate the equipment away from heat sources such as radiators, heat registers, stoves, and other devices (including amplifiers) that produce heat.

Power Sources and Grounding

Connect the equipment to the type of power source described in the installation instructions or as marked on the equipment. Take precautions to avoid defeating the grounding or polarization provisions of the equipment. Disconnect the power to the equipment by a circuit breaker when left unused for long periods of time.

Physical Installation

Overview

This chapter covers installation of the IP Gateways, including initial configuration.

Required Tools

The following tools may be required during installation.

- Screwdriver set
- Wire crimping tool
- RJ11/RJ45 crimping tool

Mounting

The IP Gateway is designed to be either a free-standing device or, with a special top cover, a rack-mount device. A free-standing IP Gateway has no mount points. An IP Gateway with a top cover meant for rack mounting has two ears with a total of four holes. In the rack-mount configuration, there are one or two IP Gateways per mounting plate.

The following diagram shows two IP Gateways in a dual unit rack mount plate (P/N 950-0588). A single unit rack mount plate is also available (P/N 950-0589).

Zetron iRIMs, VoIP Radio Gateways, and IP Gateways all have similar external cases and all use the same rack mount plates. A dual unit rack mount plate may save rack space and/or provide a more intuitive hardware layout.

♦ To mount the IP Gateway in a rack-mount configuration

1. Read Physical Dimensions on page 9.
2. Hold the rack mount in the proper top/bottom orientation. On a dual unit plate, the long edge with two rounded corners is the top. On a single unit plate, the side with the stripe is the top.
3. Slip the IP Gateway “ears” over the threaded studs on the back of the rack mount plate.
4. Secure the unit with the four provided 4-40 nuts. Repeat for additional units.
5. Install the mount plate and attached units by driving the four provided screws through the mounting plate into the rack. This is best done with two people: one to support the weight and position of the hardware and the other to drive the screws.

DIP Switches

Each IP Gateway has four DIP switches at the rear that must be configured before power is applied. The following table describes the purpose of each of the DIP switches for troubleshooting and reference purposes. For most purposes, the switches can be left in their default positions.

Table 1 - IP Gateway DIP switch settings

Switch	Position	Description
A	Up (Default)	The IP Gateway uses the IP parameters and password that the unit is configured with.
	Down	The IP Gateway uses hard-coded IP parameters and password, and they are determined by switch B. Use this position if you have forgotten the password and need to reset it.
B	Up (Default)	IP address = 192.168.0.1 Netmask = 255.255.255.0 Gateway = 192.168.0.100 Password = 8206363
	Down	IP address = 192.168.0.133 Netmask = 255.255.255.0 Gateway = 192.168.0.100 Password = 8206363
C	Up (Default)	Disables option uploads and restore factory defaults feature.
	Down	Enables option uploads and restore factory defaults feature.
D	Up	Perform a full memory test at power-up. The front panel LEDs will remain lit for the duration of the test (approximately 15 seconds). If there is no error, the IP Gateway will boot up. If there is an error, the LEDs will flash for 10 seconds and the IP Gateway will attempt to boot up.
	Down (Default)	Skip memory test and attempt to boot up normally when power is applied.

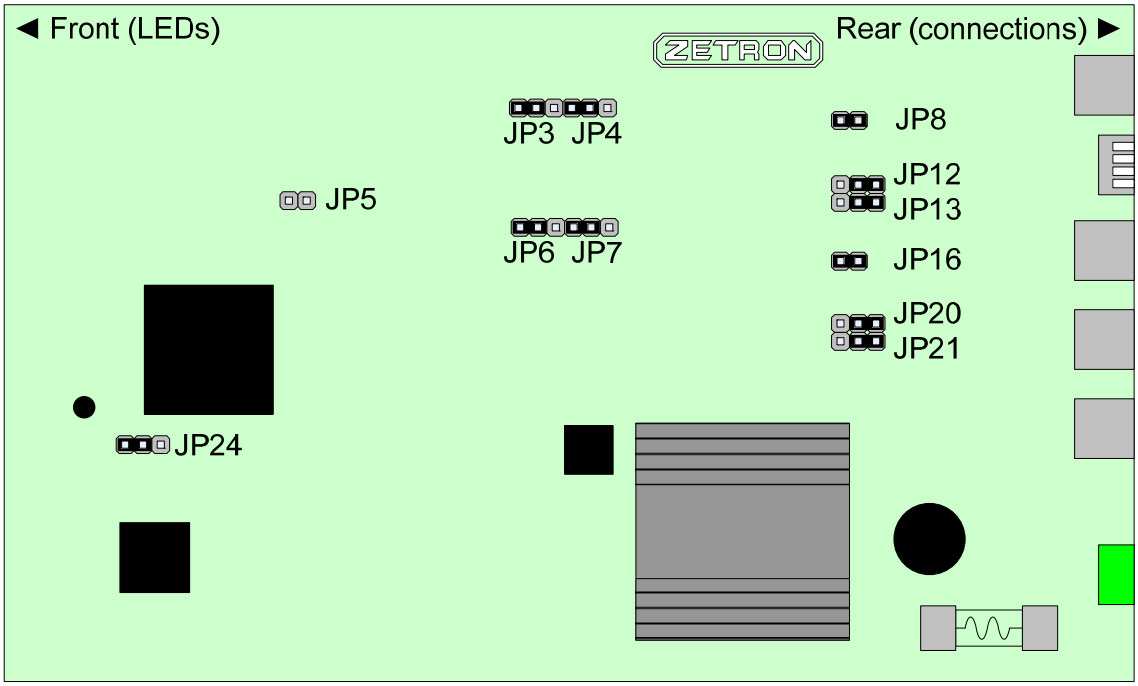
Note The normal operating position for the four switches are UP, UP, UP, DOWN.

Jumpers

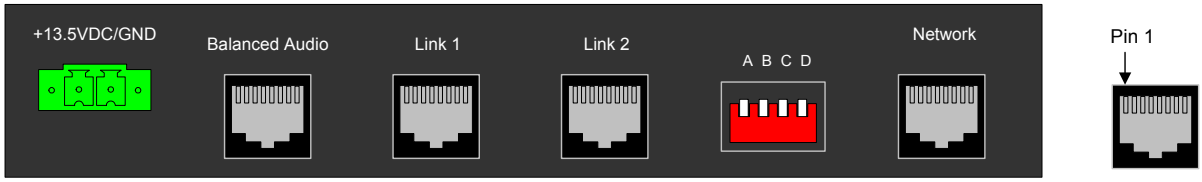
Table 2 – Model 6300 jumper settings

Jumper	Position	Purpose
JP3 JP4	A: Normal* B: Non-inverted	These jumpers must be moved together to set the signal to inverted or non-inverted for Link A.
JP5	Installed: Enable flashing Removed: Write-protect*	Install the jumper during the procedure to add licenses. Otherwise, the jumper should be removed.
JP6 JP7	A: Normal* B: Non-inverted	These jumpers must be moved together to set the signal to inverted or non-inverted for Link B.
JP8	Installed*	Factory use only. Leave in the default position.
JP12 JP13	A: TTL levels* B: RS232 levels	These jumpers must be moved together to set the levels for Link B.
JP16	Installed*	Factory use only. Leave in the default position.
JP20 JP21	A: TTL levels* B: RS232 levels	These jumpers must be moved together to set the levels for Link A.
JP24	A: Normal* B: Failsafe	Toggles normal operation and failsafe operation. Failsafe operation is only needed if the product's firmware becomes corrupted. For normal operation, leave the jumper in the default position A.
* = Default position		

Figure 4 – Model 6300 jumper locations



Connections



Power Port

Power should be applied only after jumpers and switches are set, and after the other cables have been connected. Power should be removed if changing jumper or switch settings.

The IP Gateway can be powered by your own power supply or by a Zetron-supplied power supply. The IP Gateway accepts from +10.5 to +16 VDC with a minimum 500mA rating. See Figure 3 on page 10 for the polarity.

- To use your own power supply, a green screw terminal and cable are provided to plug into the IP Gateway. Wire this connector/cable to your power supply.
- To power the IP Gateway from the Zetron supplied power supply (P/N 950-0923), simply plug it into the IP Gateway.

Balanced Audio Port

In order to provide for several connection scenarios, three cables are provided for this port. Cable 709-7845 carries both Link A and Link B audio. Cables 709-7944 and 709-7945 carry one link each, using splitter 709-0153 to connect to the port.

Table 3 – Balanced Audio Port pinout

Signal	Balanced Audio Port Pin #	Cable 709-7845 Wire Colors	Cable 709-7944 Wire Colors	Cable 709-7945 Wire Colors
Link B TX+ Output	1	Grey	N/C	White/Orange
Link B TX– Output	2	Brown	N/C	Orange
Link A TX+ Output	3	Yellow	White/Orange	N/C
Link A RX+ Input	4	Green	White/Blue	N/C
Link A RX– Input	5	Red	Blue	N/C
Link A TX– Output	6	Black	Orange	N/C
Link B RX+ Input	7	Orange	N/C	White/Blue
Link B RX– Input	8	Blue	N/C	Blue

Link 1 and Link 2 Ports

The Model 6300 IP Gateway is compatible with radios using RS-232 or TTL signaling. It can also be used with radios using other methods of signaling, such as RS-422 or RS-485, when installed with proper converters.

Tip Serial and TTL level converters can be found at B&B Electronics (http://www.bb-elec.com).

Table 4 – Link 1 and Link 2 Port pinouts

Signal	Link Port Pin #	Cable 709-7845 Wire Colors	Description
TX Audio Output	1	Grey	Output to radio. 50Ω impedance, ground referenced. 40mV p-p to 3.6V p-p.
RX Audio Input	2	Brown	Input from radio. 50KΩ impedance, ground referenced. 40mV p-p to 5V p-p.
Ground	3	Yellow	Ground.
COR Input	4	Green	Optional input from radio.
PTT Output	5	Red	Output to radio. Active low (to ground). 50mA max.
GPIO Configurable Input or Output	6	Black	The General Purpose I/O is used as either an input or an output
TX Data Output	7	Orange	RS-232 or TTL serial transmit data from the Gateway.
RX Data Input	8	Blue	RS-232 or TTL serial receive data to the Gateway.

Network Port

The Ethernet port is a standard RJ45 network port used to connect to the IP network, typically by way of an Ethernet switch. The pinout is standard for an Ethernet network port.

Tip A crossover cable is included that is not shown in any of the connection diagrams. The crossover cable is identified by the word "XO", "XOVER", or "CROSSOVER" printed on the cable or molded into the plug. This cable is used to temporarily and directly connect a computer to an IP Gateway for configuration using a web browser. See HTTP Configuration on page 24. When using a crossover cable, ensure that the computer and IP Gateway Ethernet LEDs are showing network activity.

System Configuration

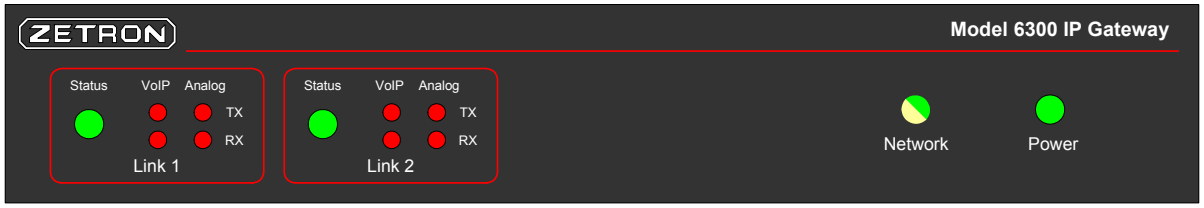
Startup

When the IP Gateway is powered up or rebooted, if it is configured for power-up memory test (DIP switch D is in the Up position), the Status LEDs will light up constant orange, and the VoIP/Analog TX/RX LEDs will light up constant red. When the memory test is completed, or immediately if DIP switch D is in the Down position, all VoIP/Analog LEDs will go out, and the Status LEDs will appear as follows:

Status 1	Status 2	Description
Green	off	IP Gateway is booting firmware image A.
off	Green	IP Gateway is booting firmware image B.
Red	Red	IP Gateway is booting failsafe firmware image.

Once the IP Gateway has fully booted, it has reached a quiescent state.

IP Gateway LEDs



Note LED behavior is different when the IP Gateway is booting up. See Startup on page 22.

Table 5 - IP Gateway LED behavior

LED	Description
Status	Green = The IP Gateway is paired with another IP Gateway Amber = The IP Gateway cannot detect a paired IP Gateway
VoIP	TX = The IP Gateway is sending IP data on this link RX = The IP Gateway is receiving IP data on this link
Analog	TX = The IP Gateway is sending a transmission on this link RX = The IP Gateway is receiving a transmission on this link
Network	Green = Network link Amber = Network activity Dead = No network link
Power	Green = Power is applied

Initial Configuration

To configure the IP Gateway's DIP switches, see DIP Switches on page 18.

First-Time IP Configuration

The IP Gateway is primarily configurable through a standard web browser such as Internet Explorer. During installation, the simplest way to physically connect to the IP Gateway from a computer is to connect the two using the supplied crossover cable. The crossover cable looks like a normal Ethernet cable, except it has the text "XO" "XOVER" or "CROSSOVER" printed along the length of the cable or molded into the plug. Connect one end of the crossover cable to the computer's Ethernet jack and the other end of the cable to the IP Gateway's Network jack.

The IP Gateway's default address is 192.168.0.1. This IP address is probably incompatible with both your LAN and the network settings of the computer you are using to configure it. Therefore, for first-time configuration, you may need to use temporary networks settings on your computer in order to communicate with the IP Gateway.

- **To configure your computer for first-time IP Gateway configuration**

1. Disable or bypass proxy server settings in Internet Explorer. The following steps describe how to make these settings in Internet Explorer 7. Other versions may vary somewhat.
   a. Click **Start, Control Panel, Internet Options, Connections, LAN settings**.

b. Clear the checkbox for **Use a proxy server for your LAN**.
c. Click **OK** to close the settings windows.

2. Configure TCP/IP settings in Windows:
   a. Click **Start, Control Panel, Network Connections, Local Area Connection, Properties**.
   b. Click **Internet Protocol (TCP/IP)**, then **Properties**.
   c. Write down your current TCP/IP properties so you can restore them later.
   d. Select **Use the following IP address**.
   e. Configure the following settings:
      - IP address = 192.168.0.10
      - Netmask = 255.255.255.0
      - Gateway = (blank)
   f. Click **OK** and **Close**.
   g. Wait about 30 seconds for the new TCP/IP settings to take effect.
3. Verify an Ethernet connection:
   a. If you are using a network switch instead of a crossover cable, check the link and activity LEDs on the switch. Switches vary, but typically the link LED should be solid and the activity LED should flash occasionally.
   b. Check the link and activity LEDs on the computer's Ethernet jack. Computers vary, but typically the link LED should be solid and the activity LED should flash occasionally.
   c. Check the Ethernet LED on the front of the IP Gateway. It should be solid green with an occasional flash.
4. Open a command line window and ping the IP Gateway:
   a. Click **Start**, **Run**.
   b. Type `cmd` and click **OK**.
   c. At the command line, type `ping 192.168.0.1` and press **Enter**.
   d. If successful, there should be several replies from the IP Gateway. If not, check your connections, cabling, and TCP/IP settings.

You should now be able to configure the IP Gateway using Internet Explorer.

HTTP Configuration

If the IP Gateway is connected to a switch, you should be able to perform HTTP configuration using a computer connected to the same switch, either directly or through the associated network.

If the IP Gateway is not connected to a switch, you can use an Ethernet crossover cable to make the connection to a computer with a web browser and then perform HTTP configuration.

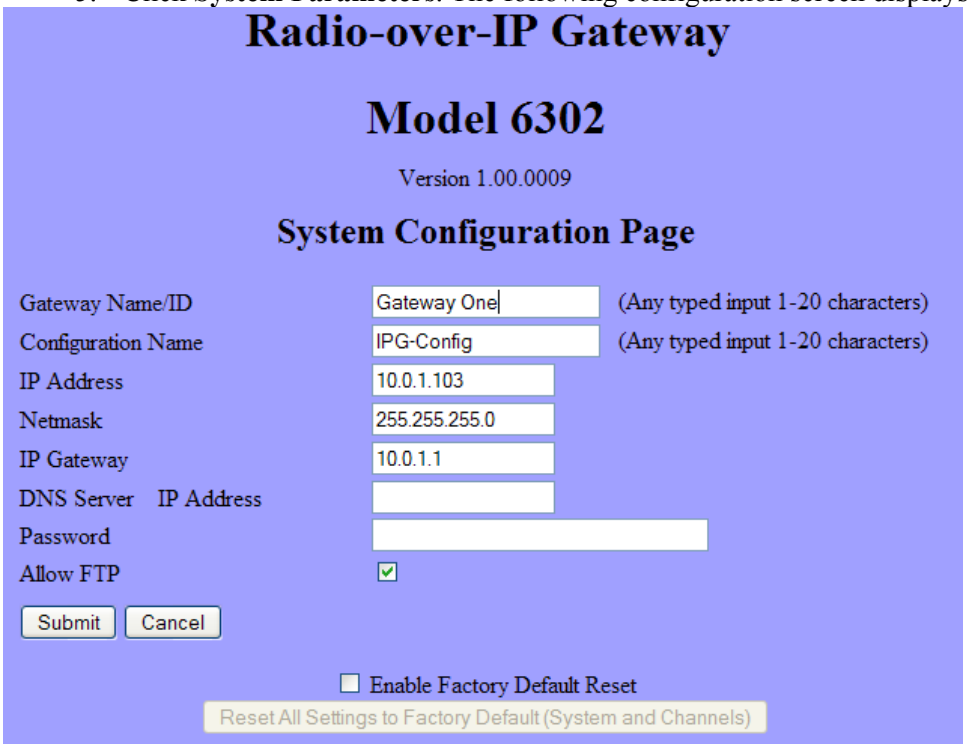
Tip Some settings reveal or hide other settings. When using Internet Explorer, it is often necessary to click elsewhere on the screen after making a selection before that selection is considered active.

♦ To configure the IP Gateway System Parameters

1. Use a computer connected to the IP Gateway through the network or by a crossover cable.
2. Connect to the IP Gateway by entering its IP address in your web browser's address bar. The default address is 192.168.0.1.
3. If prompted for a password, enter it. The factory-configured password is 8206363.

Tip If the IP address or password doesn't work, a DIP switch can be set to force the IP Gateway to run with a factory hard-coded password and IP address (see DIP Switches on page 18). Ensure that power is removed when changing DIP switch settings.

4. Click **View or Modify Configuration**. From the resulting screen you can configure the IP Gateway, the links, and the audio levels. The following procedures describe configuration in further detail.
5. Click **System Parameters**. The following configuration screen displays.



Note The settings shown here are examples only and do not reflect the default settings.

6. The following system parameters require configuration:
   - IP Address
   - Netmask
   - IP Gateway

The remainder of the system parameters can be left at their defaults or adjusted according to your preferences. The following table describes the purpose of each system parameter.

Table 6 - IP Gateway system parameters

Parameter	Purpose
Gateway Name/ID	The informal name of the IP Gateway. Default is the unit's MAC address. 1-20 characters long.
Configuration Name	The informal name of the current configuration, used to identify different configurations or as installer notes. Default "IPG-Config". 1-20 characters long.
IP Address	The unique IP address of this IP Gateway. The address is typically assigned by your network administrator and it must be unique. The default setting is determined by the position of IP Gateway DIP switch B. (See DIP Switches on page 18.) (Default) UP = 192.168.0.1 and DOWN = 192.168.0.133
Netmask	Indicates class of network. Typically 255.255.255.0. Check with your network administrator. Default 255.255.255.0.
IP Gateway	The IP address of the network's Internet gateway. Typically assigned by your network administrator. Default 192.168.0.100.
DNS Server 1 IP Address	If there is a domain name server and you would like the IP Gateway to use it, enter its IP address here.
Password	The password used to access the web configuration. Default "8206363".
Allow FTP	Turns FTP access on or off. FTP is used to update the IP Gateway's firmware. Default checked.

7. Click **Submit**. The main web page for the IP Gateway should redisplay.
8. Submitting the changes does not alter the configuration of the IP Gateway. Click **Save Changes** to update the IP Gateway settings with the new configuration.
9. Wait for the unit to automatically reboot.

Tip If you need to continue configuration after changing the IP address, you must use the IP Gateway's *new* IP address to access the web-based configuration pages. Using the old IP address or trying the browser's refresh/reload button will not work. Also, you may have to change the computer's TCP/IP settings to be compatible with the IP Gateway's new IP address.

The IP Gateway's system parameters are now configured. The next step is to install and configure your radios, including the IP Gateway's link parameters.

Recommended Analog Line Settings

Overview

This chapter describes the recommended configuration settings for the three most common radio applications of the Model 6300:

1. Extending a 4-wire balanced circuit with in-band control (e.g. tone remote control) between a fixed radio and its wireline control equipment (e.g. desktop remote or dispatch console).
2. Extending a 6-wire balanced circuit with out-of-band control using an external PTT signal between a fixed radio and its wireline control equipment. This is sometimes also known as Local control.
3. Connecting two radios together as a bridge between two radio bands or two geographic coverage areas. In this scenario the radios may be either fixed types (using balanced wireline) or mobile radios (using unbalanced wireline). This scenario uses an external PTT signal in both directions. This is sometimes also known as 4-wire E&M with the “Ear” and “Mouth” control signals being separate from the audio pairs.

The following configuration descriptions focus only on audio and PTT. These various scenarios may be used with or without simultaneous serial data or general purpose I/O.

4-Wire/Tone Remote Control Configuration

In a four-wire scenario, radio control is accomplished by in-band tones, such as tone remote control. In this scenario the Model 6300's COR and PTT signals are not used. Because of this VOX detection must be relied upon to detect the presence of incoming audio so as to initiate a VoIP connection with the remote paired link. When VOX is used, it is important to enable Full Duplex operation, because otherwise a reply to a transmission that occurs during the VOX hold time will not be heard (disabling Full Duplex disables the ability to send voice in both directions simultaneously).

Parameter	M6300 #1 Setting	M6300 #2 Setting
Full Duplex Enable	Enabled	Enabled
Remote PTT Keying & Analog-to-VoIP Audio Gating	VOX	VOX
VOX Hold Time	Set to maximum	Set to maximum

6-Wire/Local Control Configuration

In a six-wire scenario, radio control is accomplished by the use of an external PTT signal rather than by in-band control tones. In this scenario the Model 6300's COR and PTT signals are used in the path from the control equipment to the radio, and VOX is used in the path from the radio to the control equipment. Because VOX is used, it is important to enable Full Duplex operation.

Parameter	M6300 #1 Setting	M6300 #2 Setting
Full Duplex Enable	Enabled	Enabled
Remote PTT Keying & Analog-to-VoIP Audio Gating	COR	VOX
VOX Hold Time	(N/A)	Set to maximum

8-Wire/E&M Control/Radio Bridging Configuration

In this scenario, radio control is accomplished by the use of an external PTT signal rather than by in-band control tones. Because two radios are being bridged the Model 6300's COR and PTT signals are used in both directions. Because VOX is not used, it is not necessary to enable Full Duplex operation.

Parameter	M6300 #1 Setting	M6300 #2 Setting
Full Duplex Enable	(as needed)	(as needed)
Remote PTT Keying & Analog-to-VoIP Audio Gating	COR	COR
VOX Hold Time	(N/A)	(N/A)

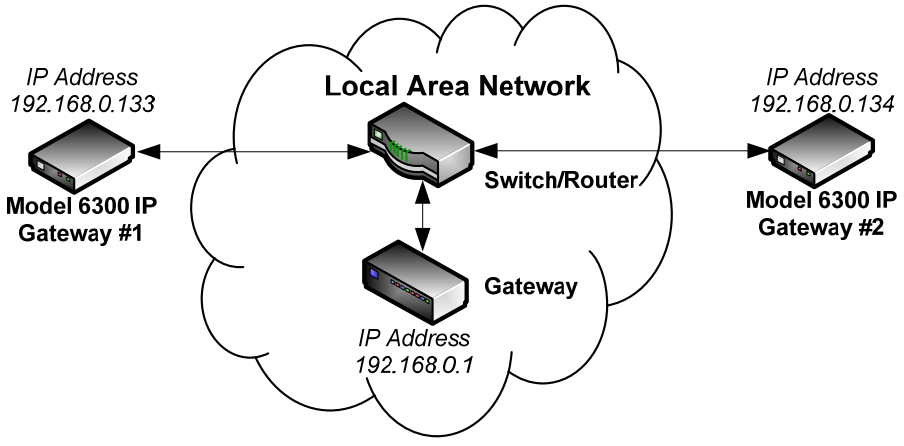
Connecting Two IP Gateways

Overview

This chapter describes how to connect and configure the links for two Model 6300 IP Gateways in order for them to operate over Local Area Network (LAN) or a Wide Area Network (WAN).

Configuring Two IP Gateways on a Local Area Network (LAN)

This section describes how to connect and configure the links for two Model 6300 IP Gateways in order for them to operate over a single subnet of a Local Area Network (LAN). In a LAN configuration, there are typically one or more IP switches and/or routers used to interconnect the devices. The following figure shows a diagram of a typical scenario.



Given the LAN above, here is how you would configure the RoIP Gateway parameters to allow Link 1 of the Model 6300 #1 to be paired with Link 1 of the Model 6300 #2.

System Parameters for Model 6300 #1:

Tip For a full description of each setting on the Link Configuration pages, see Table 6 on page 26.

- **IP Address**: *192.168.0.133*. Usually the first three fields of the IP address (192.168.0) must match the first three fields of the LAN IP Address of other devices on the LAN. The last field must be unique and not used by any other device within the LAN.
- **Netmask**: *255.255.255.0*. Most local area networks have less than 256 devices within their subnet (i.e. Class C) and therefore almost always use a net mask of 255.255.255.0.
- **IP Gateway**: *192.168.0.1*. An IP Gateway is not needed for a pure LAN configuration since there is no external traffic nor dynamically allocated IP addresses. But if one exists, its IP address should be inserted here. Otherwise you may leave this field blank or use a non-existent IP address compatible with the LAN (e.g. 192.168.0.x).
- **DNS Server IP Address**: <*blank*>. Since RoIP Gateways have a fixed IP address, there is typically no need to use DNS in a LAN configuration.

Link 1 Parameters for Model 6300 #1:

Tip For a full description of each setting on the Link Configuration pages, see Link Configuration on page 39.

- **IP Send Address**: *192.168.0.134*. This is the IP address of Model 6300 #2.
- **SIP Receive Port Number**: *5060*. This should match the SIP Receive Port Number of the paired Link (Link 1 of Model 6300 #1).
- **SIP Send Port Number**: *5060*. This should match the SIP Send Port Number of the paired Link (Link 1 of Model 6300 #1).
- **RTP Receive Port Number**: *4000*. This should match the RTP Receive Port Number of the paired Link (Link 1 of Model 6300 #1). The RTP port number must be even.
- **RTP Send Port Number**: *4004*. This should match the RTP Send Port Number of the paired Link (Link 1 of Model 6300 #1). The RTP port number must be even.
- **TCP Receive Port**: *6060*. The TCP Send Port of the paired Link (Link 1 of Model 6300 #1) should match this.
- **TCP Send Port**: *6060*. This should match the TCP Receive Port of the paired Link (Link 1 of Model 6300 #1).

System Parameters for Model 6300 #2:

Tip For a full description of each setting on the Link Configuration pages, see Table 6 on page 26.

- **IP Address**: *192.168.0.134*. Usually the first three fields of the IP address (192.168.0) must match the first three fields of the LAN IP Address of other devices on the LAN. The last field must be unique and not used by any other device within the LAN.
- **Netmask**: *255.255.255.0*. Most local area networks have less than 256 devices within their subnet (i.e. Class C) and therefore almost always use a net mask of 255.255.255.0.
- **IP Gateway**: *192.168.0.1*. An IP Gateway is not needed for a pure LAN configuration since there is no external traffic nor dynamically allocated IP addresses. But if one exists, its IP address should be inserted here. Otherwise you may leave this field blank or use a non-existent IP address compatible with the LAN (e.g. 192.168.0.x).
- **DNS Server IP Address**: <*blank*>. Since RoIP Gateways have a fixed IP address, there is typically no need to use DNS in a LAN configuration.

Link 1 Parameters for Model 6300 #2:

Tip For a full description of each setting on the Link Configuration pages, see Link Configuration on page 39.

- **IP Send Address**: *192.168.0.133*. This is the IP address of Model 6300 #1.
- **SIP Receive Port Number**: *5060*. This should match the SIP Receive Port Number of the paired Link (Link 1 of Model 6300 #1).
- **SIP Send Port Number**: *5060*. This should match the SIP Send Port Number of the paired Link (Link 1 of Model 6300 #1).
- **RTP Receive Port Number**: *4000*. This should match the RTP Receive Port Number of the paired Link (Link 1 of Model 6300 #1). The RTP port number must be even because the companion RTCP service uses the next/odd numbered port.
- **RTP Send Port Number**: *4004*. This should match the RTP Send Port Number of the paired Link (Link 1 of Model 6300 #1). The RTP port number must be even because the companion RTCP service uses the next/odd numbered port.
- **TCP Receive Port**: *6060*. The TCP Send Port of the paired Link (Link 1 of Model 6300 #1) should match this.
- **TCP Send Port**: *6060*. This should match the TCP Receive Port of the paired Link (Link 1 of Model 6300 #1).

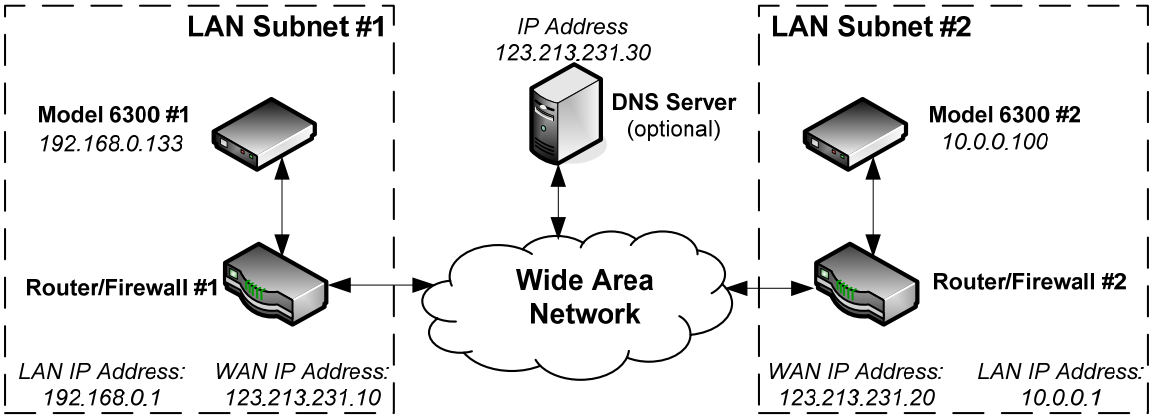
Summary of Settings

Parameter	M6300 #1 Setting	M6300 #2 Setting
System IP Address	192.168.0.133	192.168.0.134
System Netmask	255.255.255.0	255.255.255.0
System IP Gateway	192.168.0.1	192.168.0.1
System DNS Address		
Link IP Send Address	192.168.0.134	192.168.0.133
Link SIP Receive Port	5060	5060
Link SIP Send Port	5060	5060
Link RTP Receive Port	4000	4000
Link RTP Send Port	4004	4004
Link TCP Receive Port	6060	6060
Link TCP Send Port	6060	6060

Configuring Two IP Gateways on a Wide Area Network (WAN)

This section describes how to configure two Model 6300's to operate over two different subnets of a Wide Area Network (WAN). This also applies to using the Model 6300 between two sites interconnected by the Internet.

In a WAN or Internet configuration, there is typically a router, access point or firewall between the WAN and the Local Area Network (LAN). The following figure shows a diagram of a typical scenario.



Given the WAN above, here is how you would configure the RoIP Gateway parameters to allow Link 1 of the Model 6300 #1 to be paired with Link 1 of the Model 6300 #2.

System Parameters for Model 6300 #1:

- **IP Address**: *192.168.0.133*. Usually the first three fields of the IP address (192.168.0) must match the first three fields of the LAN IP Address of Router/Firewall #1. The last field must be unique and not used by any other device within LAN Subnet #1.
- **Netmask**: *255.255.255.0*. Most local area networks have less than 256 devices within their subnet (i.e. Class C) and therefore almost always use a net mask of 255.255.255.0.
- **IP Gateway**: *192.168.0.1*. This must match the LAN IP address of Router/Firewall #1.
- **DNS Server IP Address**: *123.213.231.30*. This is only needed if an IP Send Address in the Link Parameter Configuration pages use a URL rather than an IP address. If used, this must match the WAN IP address of the DNS Server otherwise this field should be left blank. See note.

Link 1 Parameters for Model 6300 #1:

- **IP Send Address**: *123.213.231.20*. This is the WAN IP address (or URL – see note) of the Router/Firewall connected to the Model 6300 #2.
- **SIP Receive Port Number**: *5060*. This must match the SIP Receive Port Number of the paired Link (Link 1 of Model 6300 #2).
- **SIP Send Port Number**: *5060*. This must match the SIP Send Port Number of the paired Link (Link 1 of Model 6300 #2).
- **RTP Receive Port Number**: *4000*. This must match the RTP Receive Port Number of the paired Link (Link 1 of Model 6300 #2). The RTP port number must be even.
- **RTP Send Port Number**: *4004*. This must match the RTP Send Port Number of the paired Link (Link 1 of Model 6300 #2). The RTP port number must be even.
- **TCP Receive Port**: *6060*. The TCP Send Port of the paired Link (Link 1 of Model 6300 #2) should match this.
- **TCP Send Port**: *6060*. This should match the TCP Receive Port of the paired Link (Link 1 of Model 6300 #2).

System Parameters for Model 6300 #2:

- **IP Address**: *10.0.0.100*. Usually the first three fields of the IP address (10.0.0) must match the first three fields of the LAN IP Address of Router/Firewall #2. The last field must be unique and not used by any other device within LAN Subnet #2.
- **Netmask**: *255.255.255.0*. Most local area networks have less than 256 devices within their subnet (i.e. Class C) and therefore almost always use a net mask of 255.255.255.0.
- **IP Gateway**: *10.0.0.1*. This must match the LAN IP address of Router/Firewall #2.
- **DNS Server IP Address**: *123.213.231.30*. This is only needed if an IP Send Address in the Link Parameter Configuration pages use a URL rather than an IP address. If used, this must match the WAN IP address of the DNS Server otherwise this field should be left blank. See note.

Link 1 Parameters for Model 6300 #2:

- **IP Send Address**: *123.213.231.20*. This is the WAN IP address (or URL – see note) of the Router/Firewall connected to the Model 6300 #1.
- **SIP Receive Port Number**: *5060*. This must match the SIP Receive Port Number of the paired Link (Link 1 of Model 6300 #1).
- **SIP Send Port Number**: *5060*. This must match the SIP Send Port Number of the paired Link (Link 1 of Model 6300 #1).
- **RTP Receive Port Number**: *4004*. This must match the RTP Receive Port Number of the paired Link (Link 1 of Model 6300 #1). The RTP port number

must be even because the companion RTCP service uses the next/odd numbered port.

- **RTP Send Port Number**: *4000*. This must match the RTP Send Port Number of the paired Link (Link 1 of Model 6300 #1). The RTP port number must be even because the companion RTCP service uses the next/odd numbered port.
- **TCP Receive Port**: *6060*. The TCP Send Port of the paired Link (Link 1 of Model 6300 #1) should match this.
- **TCP Send Port**: *6060*. This should match the TCP Receive Port of the paired Link (Link 1 of Model 6300 #1).

The following table summarizes the example configuration settings:

Parameter	M6300 #1 Setting	M6300 #2 Setting
System IP Address	192.168.0.133	10.0.0.100
System Netmask	255.255.255.0	255.255.255.0
System IP Gateway	192.168.0.1	10.0.0.1
System DNS Address	123.213.231.30	123.213.231.30
Link IP Send Address	123.213.231.10	123.213.231.20
Link SIP Receive Port	5060	5060
Link SIP Send Port	5060	5060
Link RTP Receive Port	4000	4000
Link RTP Send Port	4004	4004
Link TCP Receive Port	6060	6060
Link TCP Send Port	6060	6060

Router/Firewall Configuration

In order to allow RoIP Gateway traffic to flow between two LANs on a WAN, it is usually necessary to also configure the Router/Firewall for each LAN.

Routers and Firewalls are used to intelligently route IP packets to the devices to which they are addressed. This prevents putting unnecessary traffic on the ports connected to other devices. Firewalls have the additional function of blocking certain kinds of IP traffic from the outside world. The outside world may know the WAN address of the firewall, but it does not know the LAN addresses of the devices on the other side of the firewall. Thus, any communications to devices on the LAN must be sent to the WAN address, where the firewall controls whether or not it passes to the LAN. To pass unsolicited data from the WAN to the LAN, the firewall must use the IP port number to determine which internal device to route the data to. This process is called Port Forwarding or Network Address Translation (NAT) and goes by other names depending

on the manufacturer of the router/firewall. The following table shows how external (WAN) port accesses must be routed to internal (LAN) IP addresses.

Router/Firewall #1		Router/Firewall #2		Notes
Port Access	**To Address**	**Port Access**	**To Address**	
5060	192.168.0.133	5060	10.0.0.100	For SIP UDP traffic
4000	192.168.0.133	4004	10.0.0.100	For RTP UDP traffic
4001	192.168.0.133	4005	10.0.0.100	For RTCP UDP traffic (one port number higher than RTP)
6060	192.168.0.133	6060	10.0.0.100	For TCP traffic

About Dynamic IP Addresses

Each RoIP Gateway is configured by the installer with a static IP address. The RoIP Gateway does not support automatic assignment of its IP address via DHCP (Dynamic Host Configuration Protocol). But provisions exist to allow a RoIP Gateway to connect to a peer which resides behind a dynamically allocated router/firewall WAN IP address.

In some cases (typical of most Internet Service Providers - ISPs) WAN addresses are dynamic rather than static meaning that they router/firewall's WAN IP address may change every few days. The only way to maintain a RoIP Gateway connection in such cases is to use a URL (e.g. a www.name.com type of name) for the WAN's IP address which requires a Domain Name Service which translates the URL to the current IP address. When URLs are used to reference an IP Send Address then it is necessary for the RoIP Gateway to be configured with the IP address of a DNS (Domain Name System) Server so that it can discover the current IP address for the destination.

Link Configuration

Overview

The Model 6301 has a single link (channel) labeled Link 1. The Model 6302 has two links (channels) labeled Link 1 and Link 2. The parameters specific to each link are described below. When two Links are configured to interoperate together, they are considered "paired."

Parameter	Purpose
Link Name/ID	The field customized alternate name for this link. 1-20 characters. Spaces are not allowed.
IP Protocol	Determines the protocol used for VoIP communication. Zetron (default)
Peer IP Connection	
SIP Receive Port Number	The port number used to receive Session Initiation Protocol (SIP) messages, which control Push-to-Talk (PTT) among other things. This should match the SIP Receive Port Number of the paired link. Valid range 0-65535. Default 5060.
RTP Receive Port Number	This is the IP port number used to receive Real Time Protocol (RTP) which conveys Voice-over-IP. This should match the RTP Receive Port Number of the paired link. The RTP port number must be even because the companion RTCP service uses the next/odd numbered port. Valid range 0-65535. Default 4000.

RTP Send Port Number	This is the IP port number used to send Real Time Protocol (RTP) which conveys Voice-over-IP. This should match the RTP Send Port Number of the paired link. The RTP port number must be even because the companion RTCP service uses the next/odd numbered port. Valid range 0-65535. Default 4000.
TCP Command Link Receive Port	This parameter is only available if **IP Protocol** is set to **Zetron**. This is the port number this device will listen to for an incoming link connection. The other unit's **Send Port** must match this. This port number is used to receive Transmission Control Protocol messages, which convey I/O state and RS-232 data among other things. Valid range 0-65535. Default 6060.
IP Send Address	This is the IP address to which IP messages are sent. This must match the IP address of the remote paired Model 6300 (or BSI-compatible device if in BSI-mode). The IP address may instead contain a web address/URL if a DNS server is specified. A full URL must be used including the domain name. For example: *name.example.com* Default 192.168.0.2.
SIP Send Port Number	The port number used to send Session Initiation Protocol (SIP) messages, which control Push-to-Talk (PTT) among other things. This should match the SIP Send Port Number of the paired link. Valid range 0-65535. Default 5060.
TCP Command Link Send Port	This parameter is only available if **IP Protocol** is set to **Zetron**. This is the port number on the other device in the link this unit will send to. It must match the other unit's **Receive Port**. This port number is used to send Transmission Control Protocol messages, which convey I/O state and serial data among other things. Valid range 0-65535. Default 6060.
Heartbeat Period	This parameter is only available if **IP Protocol** is set to **Zetron**. Heartbeat is used during idle periods to verify that the IP path between paired links is present. This parameter specifies how frequently the heartbeat is sent. Valid range 1 to 60 seconds. Default 5.
Heartbeat Retries	This parameter is only available if **IP Protocol** is set to **Zetron**. If a heartbeat is not acknowledged this device will repeat the attempt by the number specified here before it declares loss of path with the paired link. Valid range 1 to 1000 retries. Default 5.
Forced Reconnect	Forced Reconnect reestablishes a lost IP connection while the remote source is active. This is especially useful when the link is monitoring traffic of long or continuous duration, such as weather radio. If not enabled, a link will not be

	reestablished until the remote source goes inactive and again active. If **Forced Reconnect** is enabled, **PTT Max Duration** must be set to "0".
Call-Session Verification Time	This monitors the IP connection of a paired link while a source is active. (Heartbeat is used to monitor the IP path between links while the source is idle). Valid range 5 to 60 seconds (1 second increments). Default 40 seconds.
Audio	
Line Type	The line type of the radio interface, either **Unbalanced**, **Balanced 2-Wire**, or **Balanced 4-wire** (default). 4-wire audio is required if the IP Gateway is used with a Zetron iRIM.
RX Pair Impedance	This parameter is only available if **Line Type** is set to **Balanced 4-wire**. Sets the RX Termination impedance of a 4-wire line to one of the following: • Lo-Z (7.5K Ohms, default) • Hi-Z (200K Ohms)
TX Pair Impedance	This parameter is only available if **Line Type** is set to **Balanced 2-Wire** or **Balanced 4-Wire**. Sets the TX Termination impedance of a 4-wire line to one of the following: • Lo-Z (7.5K Ohms, default) • Hi-Z RX/Lo-Z TX (200K Ohms RX/7.5K Ohms TX).
Full Duplex Enable	This parameter is only available if **Line Type** is set to **Balanced 4-wire**. Enable for full-duplex radios. Disable for half-duplex radios.
Tx Pair Monitoring Enable	This parameter is only available if **Line Type** is set to **Balanced 4-wire**. This enables monitoring audio over the TX pair of wires. When multiple 4-wire consoles are connected to a single radio, dispatchers should monitor the Tx pair before they transmit in order to ensure a radio is not already busy.
Receive AGC Enable	If this option is enabled, automatic gain control (AGC) will be applied to the RX amplifier, so that the output signal level is constant despite varying input levels. Default enabled.
RTP VoIP Vocoder Selection	Determines the voice quality and bandwidth used. Higher bandwidth settings result in higher quality. Lower bandwidth settings should only be used when network bandwidth limitations are encountered. To ensure that the desired voice quality is used, set this value the same for both the local and remote paired link. The default setting 64 kbps PCM/G.711 is the only codec that supports MDC-1200, DTMF, and Tone Remote Control signaling.
RTP VoIP Jitter Buffer Duration	The buffer is used to reassemble IP voice packet which may be received out-of-order due to the IP traffic taking different routes between paired links. The audio to the analog circuit is necessarily delayed by this amount. The value should only be reduced if the paired devices have very few network nodes between the paired

	devices. Valid range 20 to 2000 milliseconds in 20 ms increments. Default 200.
Remote PTT Keying & Analog-to-VoIP Audio Gating	This determines what causes the remote Push-to-talk (PTT) of the paired link to be activated. The choices are Local VOX, Local COR, or Local VOX & COR. The default value is **Local VOX**, which causes this link to use VOX to detect an incoming call. If incoming call detection is accomplished by way of a COR signal, configure this setting for **Local COR**. To combine COR with VOX for call detection, select **Local VOX & COR.** Incoming call detection based on COR Input is passed on to the connected equipment; it does not mute audio. For example, if the connected equipment were a radio dispatch console, it could be used for call indication at the console.
VOX Threshold	This parameter is only available if **COR Input** is set to **Unused**, **Active High w/VOX**, or **Active Low w/VOX**. The threshold for VOX activation. When the receive audio level (sine wave) exceeds this threshold, audio is passed to the workstation. Valid range -35 dB to 0 dB (in 1 dB increments). Default -25.0 dB.
VOX Hold Time	This parameter is only available if **COR Input** is set to **Unused**, **Active High w/VOX**, or **Active Low w/VOX**. The time, in milliseconds, between (a) the instant that the receive audio signal drops below the VOX activation threshold and (b) the instant that the device stops transmitting voice. Helps prevent small pauses in speech from deactivating VOX prematurely. Valid range 100 ms to 10000 ms (in 100 ms increments). Default 10000 ms.
VOX Attack Time	This parameter is only available if **COR Input** is set to **Unused**, **Active High w/VOX**, or **Active Low w/VOX**. The time, in milliseconds, between (a) the instant that the receive audio signal exceeds the VOX activation threshold and (b) the instant that the device starts transmitting voice. Helps prevent stray noise from activating the VOX. Valid range 5 to 50. Default 10 ms.
Radio Control	
PTT Maximum Duration	This is the maximum duration allowed for PTT Output to be active. If PTT remains active for this duration it will automatically be made inactive. Once this occurs PTT can not be made active again until the remote source goes inactive and again active. If **Forced Reconnect** is enabled, **PTT Max Duration** must be set to "0". Valid range 0 to 300 seconds. Default 1 minute. Set to 0 to disable.
VoIP Drop Out for PTT Release	When local PTT is active and VoIP traffic ceases for this duration, PTT is forced inactive. This is helpful should the PTT inactive message from the remote paired link be lost in the IP network. Once this timeout occurs PTT can not be made active again until the remote source goes inactive and again active.

	Valid range 0 to 2000 milliseconds. Default 100.
I/O Control	
I/O Direction	This parameter is only available if **IP Protocol** is set to **Zetron**. Input (default) or Output.
Input Polarity	This parameter is only available if **IP Protocol** is set to **Zetron** and if **I/O Direction** is set to **Input**. Determines if the input is considered active while low or high. **Active Low** is the default.
Output Polarity	This parameter is only available if **IP Protocol** is set to **Zetron** and if **I/O Direction** is set to **Output**. Determines if the output is considered active while low or high. **Active Low** is the default.
Output Control	This parameter is only available if **IP Protocol** is set to **Zetron** and if **I/O Direction** is set to **Output**. Determines if the Output Control is Disabled or Remote Input (default).
Serial Data	
Serial Data Enable	This parameter is only available if **IP Protocol** is set to **Zetron**. Enables or disables the serial port.
Serial Port Baud Rate Serial Port Data Bits Serial Port Parity Serial Port Stop Bits	This parameter is only available if **IP Protocol** is set to **Zetron** and if **Enable Serial Port** is checked (enabled). Valid baud rates are 300, 1200, 2400, 4800, 9600, 19200, and 38400. The parameters define the serial port communication settings. The defaults are 9600, 8, None, 1.

Maintenance

Overview

This chapter describes the use of configuration files and maintenance-related pages in the web interface.

In this chapter:

Configuration Settings File

This section describes how to download and upload a file that contains the IP Gateway's configuration settings.

♦ To download the IP Gateway configuration settings

1. Use a computer connected to the IP Gateway through the network or by a crossover cable.
2. Connect to the IP Gateway by entering its IP address in your web browser's address bar. The default address is 192.168.0.1.
3. If prompted for a password, enter it. The factory-configured password is 8206363.

Tip If the IP address or password doesn't work, a DIP switch can be set to force the IP Gateway to run with a factory hard-coded password and IP address (see DIP Switches on page 18). Ensure that power is removed when changing DIP switch settings.

4. Follow the instructions on the screen for downloading the configuration file.

   The configuration file is saved to your computer. The filename is taken from the **Configuration Name** field on the **System Configuration** page.

♦ To upload the IP Gateway configuration settings

Requirements:

- FTP must be enabled (see Table 6 on page 26)
- You must be logged out from the web configuration page

1. Use a computer connected to the IP Gateway through the network or by a crossover cable.
2. Enter the command line on your computer:
   a. Press **WIN+R** (where WIN is the windows key on your keyboard)
   b. Type **CMD** and press enter.
3. Navigate to the location of the configuration file.
4. Type the following command and press **enter**. (Where <IP Address> is the address of the IP Gateway. The default address is 192.168.0.1.)
   ```
   FTP <IP Address>
   ```
5. The username is blank. Press **enter**.
6. When prompted for a password, type it in and press **enter**. The factory-configured password is 8206363.

Tip If the IP address or password doesn't work, a DIP switch can be set to force the IP Gateway to run with a factory hard-coded password and IP address (see DIP Switches on page 18). Ensure that power is removed when changing DIP switch settings.

7. Type the following to upload the file. (Where <filename> is the filename of the configuration file. Note that "config.txt" must follow the actual filename as shown.)
   ```
   put <filename> config.txt
   ```
   You will automatically be dropped from the FTP connection. The IP Gateway will load the configuration file and reboot. Once it has rebooted, you can log in using the web browser and check the settings.

Tip If there is a problem with the new configuration settings, you can revert back to the previous configuration settings. See Versions on page 48.

Link Status

Parameter	Description
Link Name/ID	This matches the Link Name/ID parameter that is configured during Link Configuration.
RoIP Local Transmit	Active: IP Gateway is transmitting radio audio. Idle: IP Gateway is not transmitting radio audio.
RoIP Local Receive	Active: IP Gateway is receiving radio audio. Idle: IP Gateway is not receiving radio audio.
RoIP SIP Transmit to…	Active: This IP Gateway is transmitting RoIP SIP data to its paired IP Gateway. Idle: This IP Gateway is not transmitting RoIP SIP data.
RoIP SIP Receive on…	Active: This IP Gateway is receiving RoIP SIP data from its paired IP Gateway. Idle: This IP Gateway is not receiving RoIP SIP data.
TCP Control Heartbeat…	Indicates the connection status to the paired IP Gateway.
Last RTP received by…	The amount of time passed since RTP was received from the paired IP Gateway.
TCP Control Heartbeat Connection Log	Click to view the TCP Command heartbeat connection log.
I/O Input State	Indicates whether the I/O State is Active or Inactive. Whether the active state is High or Low is defined in the Link settings (see Link Configuration on page 39).
Logged Runtime	A run counter showing the amount of time logged during operation. Rebooting the unit or cycling its power will not cause the runtime to reset.
Logged Reboots	The number of power cycles and reboots since the *log.txt* file was last deleted.

Option Installation

The Model 6300 IP Gateway uses licensing in order to determine the optional features installed. Although the initial licensing occurs at the factory prior to delivery, additional licensing can be installed in the field in order to support BSI links.

The process to upgrade the Model 6300 is two-fold. First, Zetron must be contacted in order to purchase and obtain an upgraded license file. The license file is unique to a specific Model 6300, based on its MAC address. The MAC address must be provided to Zetron. Second, the unique license file is installed into the Model 6300.

♦ To obtain a license file

1. Log into the Model 6300 web configuration.
   a. Use a computer connected to the IP Gateway through the network or by a crossover cable.
   b. Connect to the IP Gateway by entering its IP address in your web browser's address bar. The default address is 192.168.0.1.
   c. If prompted for a password, enter it. The factory-configured password is 8206363.

Tip If the IP address or password doesn't work, a DIP switch can be set to force the IP Gateway to run with a factory hard-coded password and IP address (see DIP Switches on page 18). Ensure that power is removed when changing DIP switch settings.

2. Click **Option Installation**. The Option Installation page indentifies the installed licenses and displays the unit's unique MAC address.
3. Make a note of the MAC address.
4. Contact Zetron in order to purchase an upgrade license. You must provide the MAC address from the Option Installation page. Contact information can be found at http://www.zetron.com.
5. Zetron will provide you with a license file unique to the Model 6300 with the specified MAC address. The license file usually has the file extension ".zlic".

♦ To install a license file into the Model 6300

1. Remove power from the unit and open the cover.
2. Install jumper JP5 in order to enable write flashing (see Figure 4 on page 19).
3. Close the cover.
4. Set DIP switch C to the down position (see Table 1 on page 18).
5. Restore power to the unit.
6. On a PC connected to the IP Gateway, copy the content of the license file:
   a. Use Windows Notepad to open the license file provided by Zetron.
   b. In Notepad, press CTRL-A to select the entire content of the license file. The entire content should now be highlighted.
   c. Press CTRL-C to copy the selected content to the clipboard.
7. Log into the Model 6300 web configuration:
   a. Use a computer connected to the IP Gateway through the network or by a crossover cable.

b. Connect to the IP Gateway by entering its IP address in your web browser's address bar. The default address is 192.168.0.1.

c. If prompted for a password, enter it. The factory-configured password is 8206363.

Tip If the IP address or password doesn't work, a DIP switch can be set to force the IP Gateway to run with a factory hard-coded password and IP address (see DIP Switches on page 18). Ensure that power is removed when changing DIP switch settings.

8. Click **Option Installation**. The Option Installation page indentifies the installed licenses and displays the unit's unique MAC address.
9. There is a large text box preceded by the note "*Options can be updated by copying and pasting the contents of a valid license file into the below text box*". Click inside this text box.
10. Press **CTRL-V** to paste the contents of the license file from the clipboard into the text box.
11. Click **Load Options**.

    The IP Gateway will load the options and reboot. After booting is finished, you can check the installed licenses at the **Option Installation** and **Versions** pages.
12. Once you have verified that the option is working, you should remove the jumper that was installed earlier:
    a. Remove power from the unit and open the cover.
    b. Remove jumper JP5.
    c. Close the cover and restore power to the unit.

Versions

The Versions web page displays the unit's various firmware versions, the last two configurations, and the available link options. To access the Versions web page, click **Versions** from the main page.

There are two executable firmware versions, A and B, which represent the last two loaded firmware versions. If you have installed a new firmware and are experiencing problems, you can revert to the previous firmware by clicking **Revert to previous executable version**.

There are also two stored configurations, A and B, which represent the last two configurations. If you have reconfigured the unit and are experiencing problems, you can revert to the previous configuration by clicking **Revert to previous configuration**.

Audio Level Adjustment

This chapter describes how to adjust the audio levels of the Model 6300.

The procedures in this chapter refer to the Gateway and Link that is receiving external audio as the *Receiving Link*, and refers to the paired Gateway and Link that is transmitting external audio as the *Sending Link*.

Receive Level Adjustment

- **To adjust the receive level**

1. With a PC, use its web browser to navigate to the IP address of the Receiving Link and to the correct **Link Level Adjustment** web page (Link 1 for a Model 6301, or Link 1 or 2 for a Model 6302).
2. **Note:** If the Receiving and Sending Links are operationally paired, this step may result in an attempted transmission at the Sending Link.

   At the Receiving Link, connect a constant tone signal, such as a 1000 Hz sine wave, at 60% of peak voice level (or 60% deviation if an FM radio channels is being used) to the appropriate balanced or unbalanced receive audio input of the Link being adjusted (make sure this is the Gateway and Link number, matching the **Link Level Adjustment** web page shown on the PC's web browser, and make sure you are using the balanced or unbalanced receive input signal that the Gateway has been configured to use). In the absence of a 1000 Hz tone, a DTMF tone may be used instead.

   a. While the signal is present, click the **Start Automatic Adjust** button of the **Link Level Adjustment** web page. Within three seconds the unit should automatically adjust its receive gain to adapt to the provided signal. This can be confirmed by a change in the value shown in the web page's **Receive Gain** text box. Write down the level appearing in the **Receive Gain** box. This may be used in a subsequent step.

b. If the automatic receive level adjustment fails, a note will appear saying "*An input signal was not detected.*" If this occurs, double check that the tone is being sent to the right Gateway, Link, and receive input, and that the web browser is showing the matching web page for the Gateway and Link.

3. If it is not feasible to provide a constant tone to the receive audio input, but the approximate level of the input signal is known, then you may directly enter the desired gain into the **Receive Gain** box on the **Level Adjustment** page. To make the entered value take effect, click the adjacent **Apply** button. The target internal level is -13 dB0 for 60% of maximum RMS voice level. Use one of the two following formulas to determine the Receive Gain based on the known input signal.
   - To calculate receive gains for a balanced input sine wave level in dBu RMS, use the following formula where *x* is the known input signal and *y* is the value to enter into the **Receive Gain** text box:
     $$(x-4)\times(-1)=y$$
     For example, with a known input value of -10.0, subtract 4 for -14.0, and multiply by -1 for 14.0.
     $$(-10-4)\times(-1)=14.0$$
   - To calculate receive gains for balanced input speech level in dBu RMS, use the following formula where *x* is the known input signal and *y* is the value to enter into the **Receive Gain** text box:
     $$(x+2)\times(-1)=y$$
     For example, with a known input value of -10.0, add 2 for -8.0, and multiply by -1 for 8.0.
     $$(-10+2)\times(-1)=8.0$$
4. After the receive level has been set, click the **Save** button on the **Link Level Adjustment** page. This may result in the Gateway rebooting, which is normal. Also remove the tone signal from the receive audio input.
5. If the linked pair will be used in the reverse direction as well, then repeat the above steps by reversing the links so that the former Sending Link becomes the new Receiving Link, and the former Receiving Link becomes the new Sending Link.

Transmit Level Adjustment

♦ **To adjust the transmit level**

1. With a PC, use its web browser to navigate to the IP address of the Sending Link and to the correct **Link Level Adjustment** web page (Link 1 for a Model 6301, or Link 1 or 2 for a Model 6302).

2. If the paired Links are being used to tunnel an existing analog circuit through an IP network (i.e. where the end points were formally directly connected by an analog circuit), then end-to-end unity gain from Receiving Gateway to Sending Gateway will be desired. To configure the Sending Gateway for unity gain, use the **Receive Gain** written down in *Receive Level Adjustment* step 3 on page 50, and plug its additive inverse value into the **Transmit Gain** box of the Sending Link's **Link Level Adjustment** web page. For example, if the **Receive Gain** is 25 dB at the Receiving Link, then use a value of -25 dB for **Transmit Gain** at the Sending Link.
3. For scenarios other than end-to-end unity gain, connect an AC level meter to the Sending Link's appropriate transmit audio output (either balanced or unbalanced), or in the case of a radio application connect the radio transmitter to the signal and use a service monitor to measure the over-the-air modulation. (Leave **Speech Level** set to the default -2.0 dBu.)
4. Click the **Enable 60% Deviation Reference Tone** button on the **Link Level Adjustment** web page. This will send a 1000 Hz sine wave tone to the transmit audio signal (to transmit this signal over a radio transmitter may require manual operation of the transmitter's PTT signal). Repeat clicks of the web page's **Increase** and **Decrease** buttons until the signal of 60% of the maximum desired RMS voice level is achieved. Alternatively, you may manually enter a gain value into the **Transmit Gain** text box of the web page, and click **Apply**.
5. There is also a **Speech Level** text box on the **Link Level Adjustment** web page. Normally this should be left at its factory default of -2 dBu. However if the Sending Link is in BSI mode and the paired device is not another Model 6300, then it may be necessary to use this adjustment depending on results of initial operational tests. In this scenario, if the speech level is not satisfactory, use the **Speech Level** box rather than the Transmit Gain to make adjustments.
6. After making **Transmit Gain** and/or **Speech Level** changes, click the **Save** button on the web page.

Note If the linked pair will be used in the reverse direction as well, then repeat the above two procedures by reversing the links so that the former Sending Link becomes the new Receiving Link, and the former Receiving Link becomes the new Sending Link.

Appendix A: Keys to a Successful Mission-Critical VoIP Installation

Overview

There are two essential things needed for a successful Zetron Voice-over-IP (VoIP) installation (VoIP applications include Radio-over-IP or RoIP); these are the right knowledge, and the right IP network. And a third thing is helpful – a definition of success.

Let's start with the definition of "success". If the VoIP system is to carry mission-critical voice, then success means no or very, very little disruption of voice and radio transmissions. For example, **although the human mind can make up by context for the loss of an occasional syllable, it can't easily distinguish between "shoot" and "don't shoot" if the word "don't" is missing**. But if the VoIP system is to carry non-critical voice, then some slight or moderate disruption of voice and radio transmissions may be acceptable.

The Right IP Network

Next, let's consider the IP network. Unlike the old analog, copper wire days of point-to-point circuit switched networks, an IP network is designed to carry data from a number of different users, and a number of different applications. Of course it is possible to create a single-purpose IP network dedicated to a task such as VoIP, but doing so may defeat one of the prime advantages of an IP network. So let's assume that you are going to put a VoIP system on an existing IP network. That means that both voice (VoIP) packets and other packets (presumably non-voice data) will be traveling the IP network at the same

time. If there is sufficient bandwidth in the network compared to the payload of the devices connected to the network, the VoIP system will probably meet the definition of mission-critical success on that network.

LAN vs. WAN Bandwidth

It is fairly easy and inexpensive to create a high-bandwidth "internal" Local Area Network (LAN) within a single building to help ensure that the bandwidth-to-payload ratio stays high. However, it becomes more difficult once the traffic makes its way onto some Wide Area Network (WAN) "external" bearer with limited or unpredictable bandwidth. The bandwidth of various bearers is mostly a function of how much monthly fee the user is willing to pay for service. DSL speeds of 100-200 kbps are fairly inexpensive. Cable and WiMAX are often in the 0.5 to 5 Mbps range (speed may vary depending on loading by other users). DSL and Cable are generally used for public (internet) rather than private networks, where security can be an issue, and where bandwidth can not generally be guaranteed. T1 and E1 are 1.5 or 2 Mbps respectively which can have less bandwidth than Cable or WiMAX, but they do offer a guaranteed bandwidth, and they can be used for a private (non internet) network. Fiber offers the best bandwidth, but at a cost generally higher than other options.

Data vs. Voice Traffic

It is hard to quantify how much payload data-traffic uses unless intelligent network equipment is configured to intentionally control the amount of payload allowed through. Without such limits, data applications can briefly take up the entire available bandwidth of a limited pipe such as a T1 or E1 circuit (e.g. during file downloads). Unlike VoIP applications, where lost packets are audibly recognized, dropped data packets are usually not recognized by the application user. This is because data packets have built-in retry mechanisms – if one gets dropped, the same packet is sent again until it makes its way through the network. However, with VoIP packets, there are generally no such retries – lost packets are usually not recovered. Thus the most notable effect of lost data packets is increased delay in getting the data (e.g. web pages take longer to load, etc.), but the notable effect of lost voice packets is gaps in the received audio – missing syllables and words. A sparse number of dropped packets is usually unnoticeable to a data user, while still very noticeable to a voice user. For this reason **a network that may have been perfectly adequate for data-only applications, could be horrible for voice applications**.

While VoIP traffic is unforgiving of packet loss, its payload is thankfully fairly predictable – a function of the number of calls in progress (see Figure 5A). But data traffic, although forgiving of packet loss, is usually unpredictable (see Figure 5B).

Shared Private vs. Public Networks

The goal of making VoIP reliable is hampered when the bandwidth-to-payload ratio is unpredictable. The problem with shared private networks (even LANs) is that the combined payload is not only variable but often unpredictable (see Figure 5C) and the more applications that share the network, the more unpredictable it is (see the sidebar for potential solutions to this problem). The problem with public networks (like the internet) is that the bandwidth is variable – its theoretical maximum reduced by traffic from public users (see Figure 6). If either the bandwidth or the payload is variable and the degree to which they vary is unknown then the bandwidth-to-payload ratio is unpredictable.

The best network for mission-critical VoIP traffic is one in which both the bandwidth and the payload are predictable and which has ample spare bandwidth left. Which means avoiding public networks, and it means knowing or controlling how much peak payload traffic all applications on a private network are generating. **The easiest of all configurations to reliably support mission-critical VoIP is a private, dedicated (non-shared) network**.

Figure 5 - The Effects of Multiple Applications on a Fixed Bandwidth (Private) Network

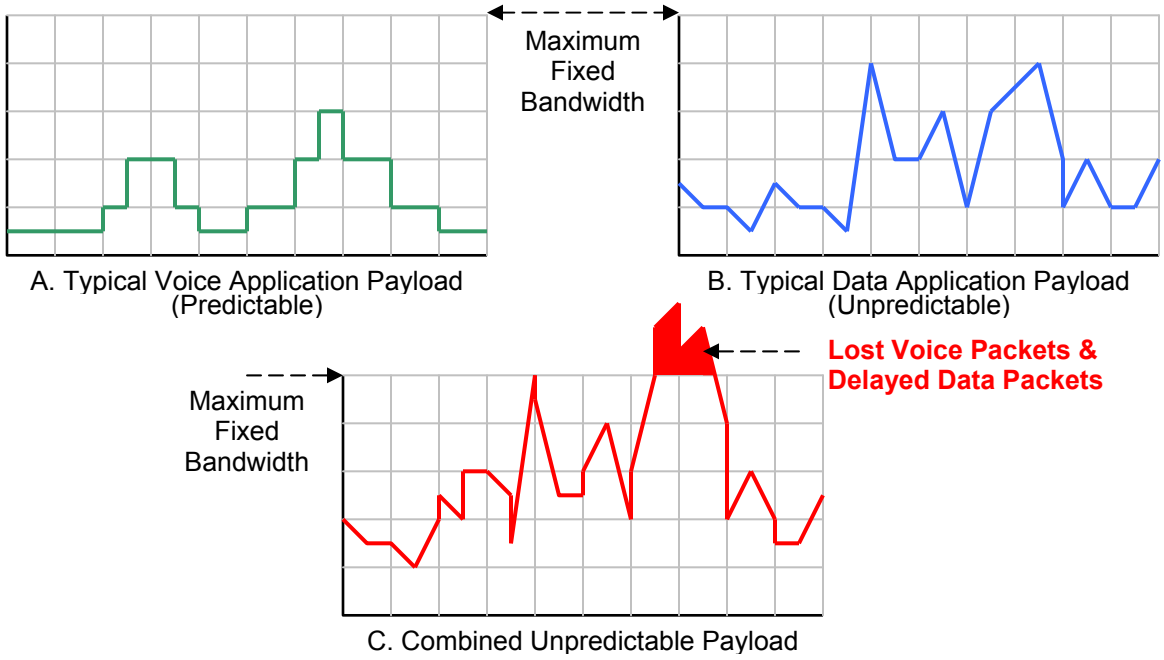
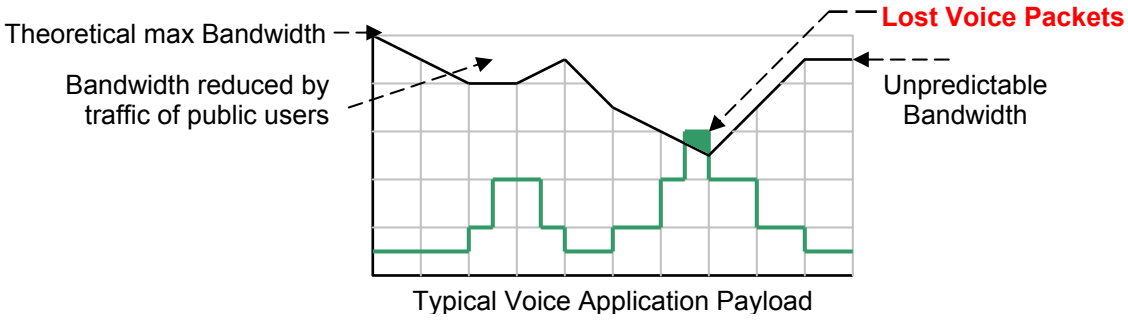


Figure 6 - The Effects of a Variable Bandwidth (Public) Network on Applications



Solutions for Shared VoIP & Non-VoIP IP Traffic

When there is no choice but to put your VoIP application on the same network as other applications, there are some things you can do to help ensure that the VoIP packets are not lost. The solution is to use a priority scheme that gives VoIP packets higher priority than other traffic. This can be done by proper setup of configurable routers and switches; by giving priority to the switch & router jacks to which VoIP equipment is connected, or by giving priority to IP addresses and ports numbers used by VoIP traffic. Some VoIP equipment also allows you to append priority bits (called QOS bits) to VoIP packets themselves so that intelligent routers in the network deliver the VoIP packet with priority end-to-end. But beware that you can only provide such priority on the private portion of the network you control – not on traffic which flows through a public network such as the internet.

The Right Knowledge

This brings us to the other key to success, and that is the right knowledge. By this we mean the knowledge of the technical staff planning and installing the system. The planning staff needs to know how to calculate, measure, and/or control traffic on the target network, so that they can determine the peak payload being used. And they need to know the end-to-end bandwidth capability of the target IP network. Then they need to compare this against the payload, delay, and jitter requirements of the VoIP system (which can generally be found on the product specification sheet). This information will then tell the technical staff whether or not the VoIP system is compatible with the target network.

The installation staff will need to know to configure equipment to work on the IP network; they must be familiar with IP addresses, IP ports, routers, switches, and the like. Basic computer networking skills may be sufficient if the installation is occurring only within a dedicated LAN, but **if an IP network includes shared traffic or multiple subnets or a WAN, then the installation staff should be qualified IT professionals**.

Non-Critical Applications

OK, but what about non-critical applications? The problem with considering the non-critical definition of success is that if you have a network that can't carry mission critical traffic, then it may be on the ragged edge of being acceptable for non-mission critical traffic – depending on how non-important the "non-critical" voice is. When operating with payload near the available bandwidth, a slight increase in shared payload, or a slight decrease in public bandwidth will easily increase the dropped packets from an occasional syllable, to whole sentences. This could significantly inhibit the ability to receive even mildly important voice traffic.

Using the Internet

Zetron never recommends putting mission critical voice over the internet (the worst of all public networks) because once on the internet there is no way to ensure necessary bandwidth, and there are no provisions in the internet infrastructure to prioritize voice packets over other traffic. There may be special tunneling devices (or services such as VPN) that improve it, but no device or service can absolutely guarantee loss-less delivery over the internet. However, the internet may work just fine for non-critical voice, especially casual monitor-only audio.

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