Tieline TECHNOLOGY

Madison SBE 2009

Wired/Wireless IP Codec Technology

Kevin Webb
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Tieline Technology

Offices in Indianapolis, IN

and Ft. Worth, TX

IP Audio

IP Audio

Out of the Studio:

IP Audio

Out of the Studio:

Connecting Anywhere

Audio over IP?

Audio over IP?

Pshhh, that's easy!

Audio over IP?

CAT5,

LAN,

Firewire, right?

Audio over IP for Remotes…

Audio over IP for Remotes…

Or even “Out of the studio”

Audio over IP for Remotes…

Or even “Out of the studio”

Now that’s a different story

Tieline TECHNOLOGY

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Wired/Wireless IP Codec Technology

IP Audio - Out of the Studio: Connecting Anywhere

IP Audio - Out of the Studio: Connecting Anywhere

For Broadcast-Quality IP Audio….

More on POTS, ISDN, etc. later…

IP Audio - Out of the Studio: Connecting Anywhere

- How universal is IP, are there incompatible "flavors", and are there standards?
- What IP do you use?
  Examples include public Internet, VPN, LAN/WAN, Dedicated Service, other
- Where is IP an appropriate technology (and where is it not)?
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- Are your products designed for fixed or mobile outside locations?
- IP vs. IT – negotiating firewalls and IT departments

IP Audio - Out of the Studio: Connecting Anywhere

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IP Audio - Out of the Studio: Connecting Anywhere

How universal is IP?

IP Audio - Out of the Studio: Connecting Anywhere

How universal is IP?

- Connection elements are universal comprising TCP and/or UDP protocols
- TCP used for establishing the connection
- UPD (or TCP) used for audio transport
- UDP audio transport is used for lossy networks such as wireless or most remote applications
- TCP audio transport is used for wired controlled network connections, usually STL apps over T1s, dedicated RF links

IP Audio - Out of the Studio: Connecting Anywhere

Are there incompatible "flavors"?

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Are there incompatible "flavors"?

(simplified…) Yes as each manufacturer…

- Uses proprietary Session Data protocols
- Utilizes different proprietary algorithms
- Has different control or ancillary data (such as relay controls)
- Other proprietary elements that are unique to each manufacturer

IP Audio - Out of the Studio: Connecting Anywhere

Are there standards?

IP Audio - Out of the Studio: Connecting Anywhere

Are there standards?

Yes using SIP (Session Initiation Protocol)

- Universal signaling protocol for universal connectivity over IP
- Allows IP audio connections between differing brands
- Must use same settings on each codec (similar to ISDN between different brands)
- SIP connection possible if each codec has same algorithm (MPIII, AAC, etc)
- Does not use proprietary Session Data protocols
- Ancillary data (such as relay controls) are disabled
- Tieline one of 3 companies that is driving worldwide SIP standards for broadcast

IP Audio - Out of the Studio: Connecting Anywhere

Are there standards?

IP Audio - Out of the Studio: Connecting Anywhere

Are there standards?

Tieline is participating in the European Broadcast Union's (EBU) interoperability over IP plugfest

May 12, 2009

This week, Tieline is participating in the European Broadcast Union's (EBU) interoperability over IP plugfest held in Munich Germany.

Broadcast audio codec manufacturers from around the world are come together to demonstrate their ability to connect to each other over IP using the N/ACIP Technical standard 3326.

The standard uses SIP messaging in the RTP stream to set up a compatible session between different brands of codecs using standard algorithms such as Mpeg Layer 2, G.722 and G.711.

http://www.audio-via-ip.com/news.htm

IP Audio - Out of the Studio: Connecting Anywhere

Are there standards?

audio-via-ip experts group

IMPRESSUM

News | Technology | Partners

Overview

The Audio-via-IP Experts Group is a community of industry partners with the common intention to support interoperability between audio codecs. The first partners have joined this Experts Group and support Audio-via-IP features yet before the EBU working group N/ACIP issued the first recomendation paper on professional Audio-via-IP in October 2007.

There is a logo program which allows to be identified as a supporter of this Audio-via-IP Experts Group and to be recognized as compatible with other partners of this group.

The motivation is to offer a friendly operational environment for users and to minimize the threshold of going "Audio-via-IP" for any broadcaster of the world .

IP Audio - Out of the Studio: Connecting Anywhere

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IP Audio - Out of the Studio: Connecting Anywhere

What IP do you use?
Examples include public Internet, VPN, LAN/WAN, Dedicated Service, other?

To narrow down the answer, we'll discuss this answer assuming remote broadcast use over public Internet connections.

First, **at the studio**…

- Wired IP stand-alone DSL
- Wired IP stand-alone Business Class Cable (best for broadcast, has better upload speeds which is important for best audio & stability of connection)
- T1, T3, etc. but only if QoS (Quality of Service) is set up for both incoming/outgoing traffic, both UDP and TCP and both ports (connection and audio ports)
- Wireless ISP not recommended

IP Audio - Out of the Studio: Connecting Anywhere

What IP do you use?
Examples include public Internet, VPN, LAN/WAN, Dedicated Service, other?

To narrow down the answer, we'll discuss this answer assuming remote broadcast use over public Internet connections.

In the field…

•Wired IP DSL or (hopefully) Business Class Cable with no/low traffic (more devices sharing same connection in field compromises broadcast)

•Wireless 3G, 4G (WiMAX) via cellular carriers Verizon, Sprint, AT&T and Alltel (also some regional carriers). Verizon, Sprint, Alltel = EVDO Rev A and higher, AT&T HSDPA and higher.

• WiFi **only** if the original connection source is known and access is exclusive or very limited (example: slow DSL feeding WiFi, open to all others or good DSL and closed WiFi access? Latter is best!)

IP Audio - Out of the Studio: Connecting Anywhere

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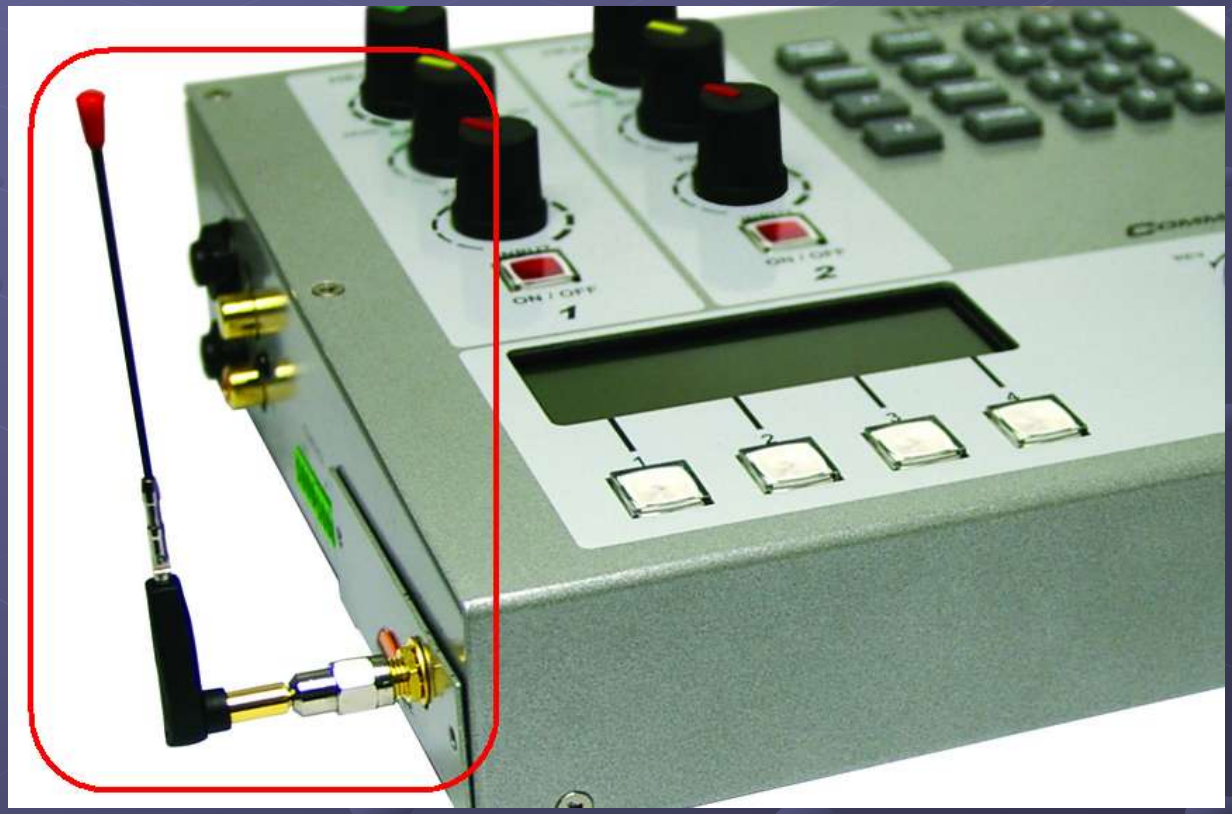
• **WiFi **only** if the original connection source is known and access is exclusive or very limited (example: slow DSL feeding WiFi, open to all others or good DSL and closed WiFi access? Latter is best!)**

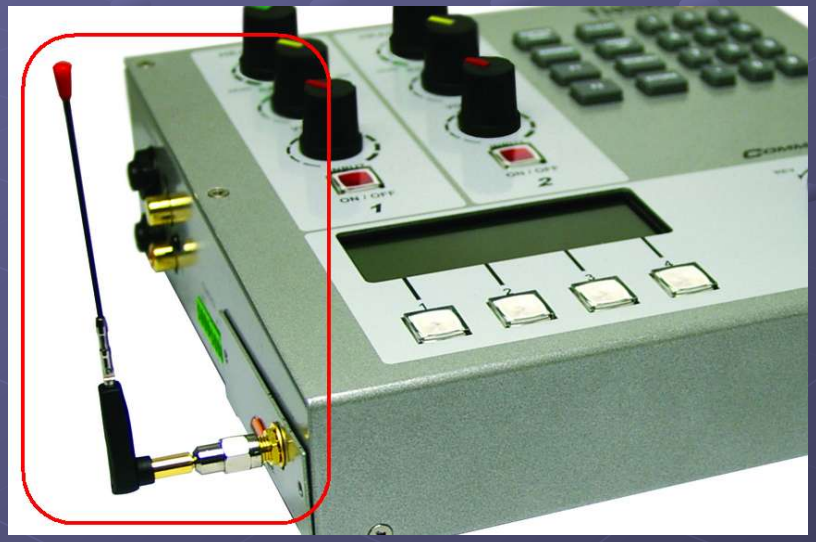
Audio over IP for Remotes…

Via WiFi

Audio over IP for Remotes…
Via 3G / 4G WiMAX Wireless



Audio over IP for Remotes…
Via 3G / 4G WiMAX Wireless



Tieline World-exclusive dedicated global 3G Wireless module

Audio over IP for Remotes…
Via 3G / 4G WiMAX Wireless

Audio over IP for Remotes…
Via 3G / 4G WiMAX Wireless

Tieline Commander G3 used during the Live WiMAX Broadcast

IP Audio - Out of the Studio: Connecting Anywhere

What IP do you use?
Examples include public Internet, VPN, LAN/WAN, Dedicated Service, other?

In the field…

- Tieline's proprietary software (QoS Performance Engine Technology) can adapt to and help make up for lossy network connections such as wireless cellular carriers
- Auto Jitter Adapt feature adapts to changing network conditions and dynamically adjusts to maintain quality audio as chosen by user (Least Delay, Best Compromise, Best Audio, etc.)
- Proprietary algorithm best suited for lossy network conditions and ideally suited for stable managed controlled network connections as well

IP Audio - Out of the Studio: Connecting Anywhere

What IP do you use?
Examples include public Internet, VPN, LAN/WAN, Dedicated Service, other?

Also in the field…

- IP over BGAN satellite at 32kbps
- 32kbps is the magic number!
- Tielines deliver 15kHz Mono or 7kHz Dual Channel over 32kbps IP data BGAN satellite stream.
- Streaming 32K = $ 2.90/minute -or- $174/one hour
- 20kHz Mono or 15kHz Stereo/Dual Channel over 64kbps IP data channel.

IP Audio - Out of the Studio: Connecting Anywhere

What IP do you use?
Examples include public Internet, VPN, LAN/WAN, Dedicated Service, other?

BGAN satellite terminal

IP Audio - Out of the Studio: Connecting Anywhere

BGAN satellite terminal

Fox News scores a first in Internet transmission during Bush visit to Africa

–Fox News Radio fed the press pool this time down in Africa for President Bush's visit this week. But in Tanzania, there are no ISDN lines. Fox News found a solution and was able to transmit the broadcasts over the Internet and provide that ability to the other networks-ABC, AP, CBS, NPR and VOA. This is the first time that a network news pool had access to an internet transmission. Says Mitch Davis, VP/Fox News Radio Network: "This is actually a set up routine for presidential trips overseas-the participating radio networks take turns feeding the transmission. Everything where we were set up was intermittent and unreliable-from electrical to phones. AT&T provides connectivity for the traveling press on these trips. They told us flat out they couldn't provide an ISDN hookup in Tanzania. So instead of settling for lesser service or have to spend an excess of money on satellite time, we've been using some hardware that gives us IT connectivity we used on a previous trip just for ourselves. We managed to move forward into the 21st Century and do this via Internet, because in many third world countries they don't have the traditional copper-based phone systems or ISDN." The gear was the Tieline Commander G3.

RBR observation: Even in third world countries, digital technology comes to the rescue. Now that the internet has proven itself worthy of use during presidential visits, these codecs may get even more use for important global press events-they're dependable and money-saving

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IP Audio - Out of the Studio: Connecting Anywhere

Where is IP an appropriate technology (and where is it not)?

Assuming remote broadcast use over public Internet connections...

First ALWAYS know the source of the IP traffic! (Where is it coming from?)

IP Audio - Out of the Studio: Connecting Anywhere

Where is IP an appropriate technology (and where is it not)?

Assuming remote broadcast use over public Internet connections...

WIRELESS

- 3G / 4G / WiMAX – Is there a good signal? (Cell phone not reliable indicator as wireless data uses different channels than voice… consult carrier's map online or contact us for US / Canada map links)
- 3G / 4G / WiMAX – How many people at event? Larger crowds = more congested traffic, less reliable connections (such as major sports events, etc.)
- WiMAX and 4G technology being rolled out promises better IP traffic overhead for broadcasters thus more stable/reliable connections

IP Audio - Out of the Studio: Connecting Anywhere

Where is IP an appropriate technology (and where is it not)?

Assuming remote broadcast use over public Internet connections...

WIRELESS

- 4G / WiMAX tests very promising here in US and Canada
- Rogers HSPA service in Canada – 5Mbps upload(!), 21Mbps download(!!!)
- Hopefully AT&T will follow suit in US.
- Sprint has rolled out WiMAX in select markets, rolling out nationwide adding more cities each month
- Verizon has near-term plans to roll out high(er) speed service beginning late this year, major US rollout 2010
- All good news for broadcasters!

IP Audio - Out of the Studio: Connecting Anywhere

Where is IP an appropriate technology (and where is it not)?

Assuming remote broadcast use over public Internet connections...

WIRED IP

ALWAYS know the source of the IP traffic!

IP Audio - Out of the Studio: Connecting Anywhere

Where is IP an appropriate technology (and where is it not)?

Assuming remote broadcast use over public Internet connections...

WIRED IP

- Stand-alone DSL or Business Class Cable can rival ISDN in audio quality
- True QoS on any Wired IP connection provided minimum bandwidth needs are met (usually 128kbps upload/download)

IP Audio - Out of the Studio: Connecting Anywhere

Where is IP an appropriate technology (and where is it not)?

Wireless remote broadcasts

Point-to-point audio distribution

Studio-to Transmitter Link

IP Audio - Out of the Studio: Connecting Anywhere

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IP Audio - Out of the Studio: Connecting Anywhere

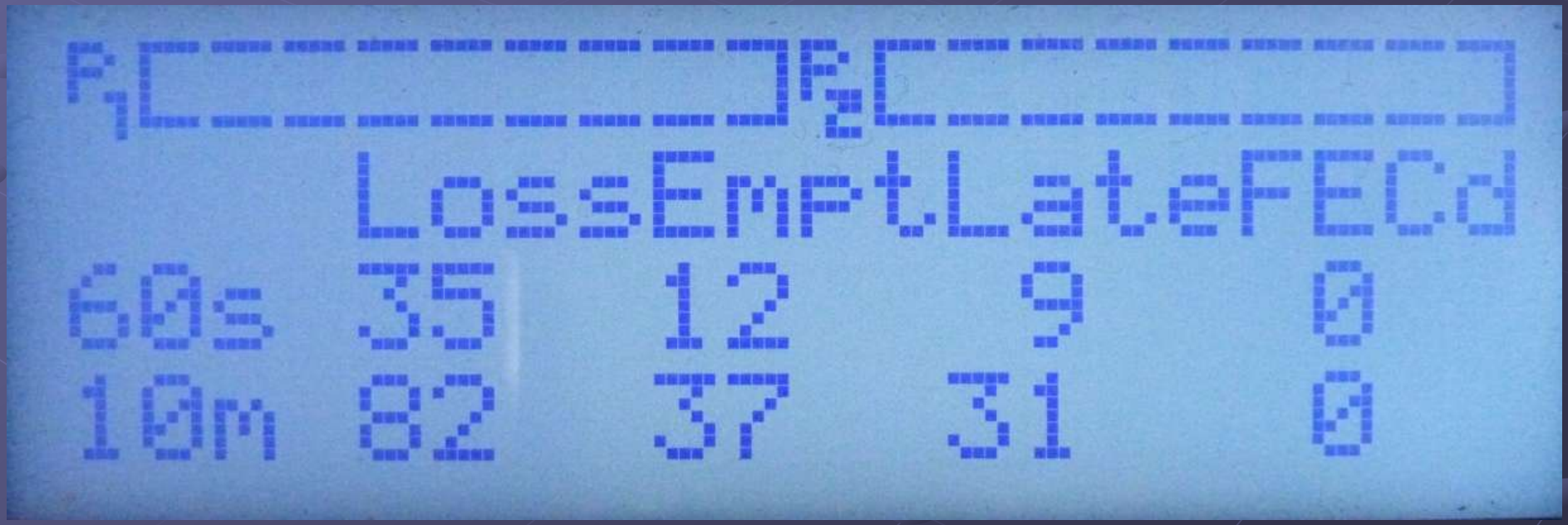
What are the problems with Quality of Service and how do you address them?

- For broadcast-quality audio, QoS assures a quality broadcast
- See previous for QoS requirements
- Tieline's QoS Performance Engine Technology adapts to changing conditions

IP Audio - Out of the Studio: Connecting Anywhere

What are the problems with Quality of Service and how do you address them?

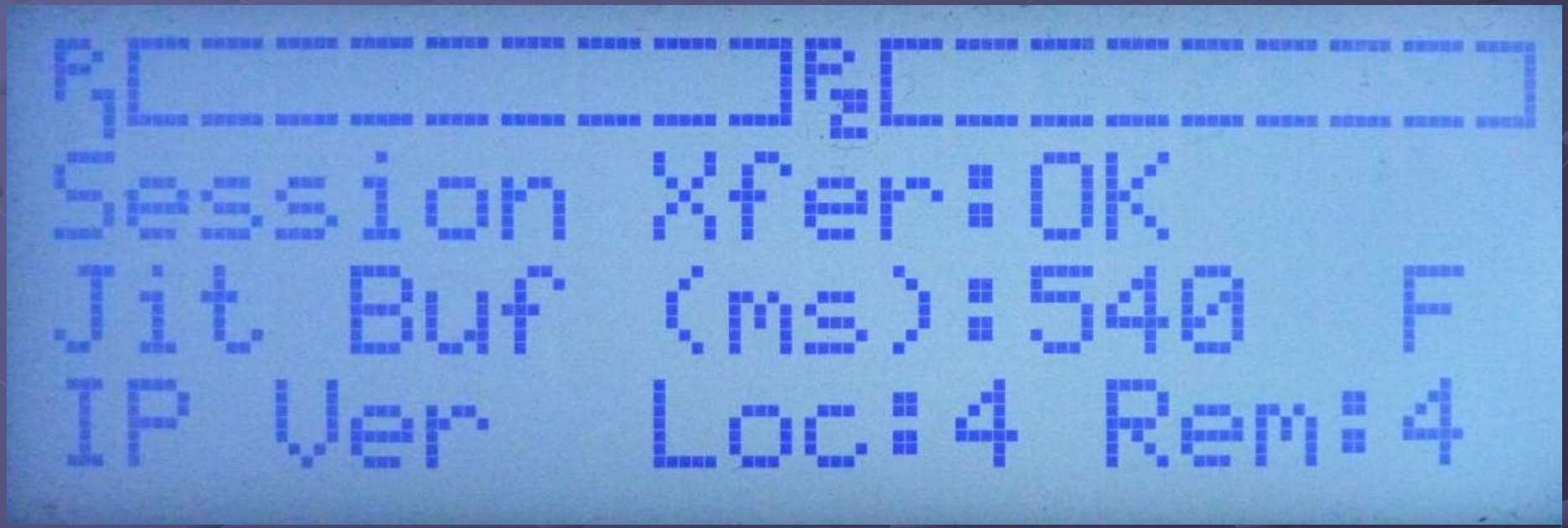
- Extremely lossy connection (below)
- Shows Packet Loss, Buffer Empty, Packets Late and FEC (Forward Error Correction)
- First line is within last 60 seconds, second line 10 minutes, 3rd line (not shown) Total for connection



IP Audio - Out of the Studio: Connecting Anywhere

What are the problems with Quality of Service and how do you address them?

- Second line below shows buffer level in milliseconds
- Codec has analyzed lossy connection and has adjusted for it based on user's preferred setting (Least Loss, Less Loss, Best Compromise, Better Audio, Best Audio)



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IP Audio - Out of the Studio: Connecting Anywhere

Compatibility between your (products) and other products?

- Completely universal compatibility with all other codecs with SIP
- Check manufacturer to ensure which of their algorithms are SIP compatible
- Tieline willing and ready to assist at our cost to share SIP technology, help other manufacturers enable SIP compatibility

IP Audio - Out of the Studio: Connecting Anywhere

Compatibility between your (products) and other products?

Look for this logo for universal IP compatibility

IP Audio - Out of the Studio: Connecting Anywhere

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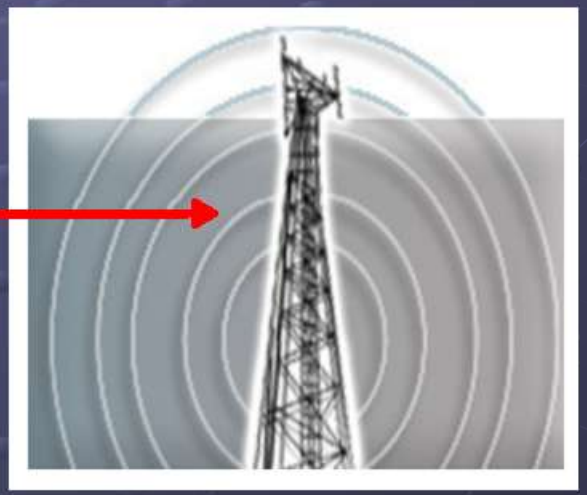
IP Audio - Out of the Studio: Connecting Anywhere

Are your products designed for fixed or mobile outside locations?

- Both…
- Can be used as true STL codec with Linear Uncompressed 23kHz Stereo algorithm (using relatively low bandwidth)
- Are being used as primary STLs over IP all over the world



IP Audio - Out of the Studio: Connecting Anywhere

Are your products designed for fixed or mobile outside locations?

- Both…
- Our original and primary focus has been remote broadcast technology

Tieline Commander G3 used during the Live WiMAX Broadcast

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IP Audio - Out of the Studio: Connecting Anywhere

IP vs. IT – negotiating firewalls and IT departments?

- Problems? With IT departments and firewalls?
- (pause for laughter to die down)
- (pause)

IP Audio - Out of the Studio: Connecting Anywhere

IP vs. IT – negotiating firewalls and IT departments?

- Tieline's TieServer (Traversal Server) will allow G5 Tielines to "see" and connect to each other through firewalls
- Eliminates the need to negotiate with IT people (leave them alone for heaven's sake!)
- Buy them a case of Monster or Mountain Dew just to be safe (for personal reasons)
- Traversal Server will also display list of other Tieline codec's status (green check mark = Available, red x = Not Available)
- Makes it easy for talent to use in studio and in the field

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POTS Audio - Connecting Anywhere

Stable POTS modem quality

15kHz FM-Quality audio over a plain phone line

Stable enough to be used as primary STLs (Studio-to-Transmitter Links) over plain phone lines

One connection, multiple years stayed connected.

WXIN TV59 Indianapolis – 9 years, CKUA-Edmonton – 3+ years, Aboriginal Radio Australia (across Outback) – 9+ years

ISDN Audio - Connecting Anywhere

- ISDN capable codec for multiple connection options
- Connect to multiple brands >>>>>>

20kHz Stereo over single B Channel

Algorithms:

Tieline Music MusicPLUS

MPEG Layer II (single, bonded, joint stereo)

G.722, G.711

New Technology - Connecting Anywhere

Bridge-IT

New Technology - Connecting Anywhere

Tieline TECHNOLOGY Madison SBE 2009 **Wired/Wireless IP Codec Technology**

New Technology - Connecting Anywhere

Bridge-IT

IP-only codec

STANDARD FEATURES

- **Encode only**
- **Decode only**
- **Tieline Music, MusicPLUS algorithms**
- **MPII, MPIII decode**
- **G.711, G.722**
- **SIP capability (universal connectivity)**
- **Multicasting (multiple connections)**
- **Digital AES and Analog Inputs/Outputs**

OPTIONAL ADD-ON FEATURES

- **Encode /Decode (Bi-Directional)**
- **SD Card Reader (backup to primary connection)**
- **AAC-LC, AAC-HE algorithms**
- **Programmable Function Manager**
- **TIESERVER Traversal Server w/Buddy List Access**
- **Web GUI interface**

Tieline TECHNOLOGY Madison SBE 2009 **Wired/Wireless IP Codec Technology**

New Technology - Connecting Anywhere

Bridge-IT

IP-only codec

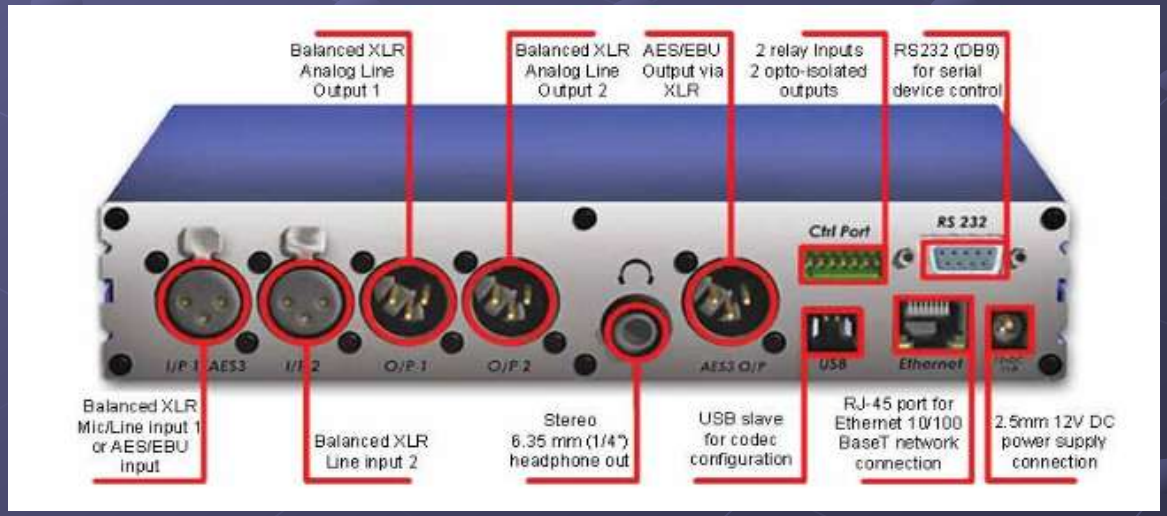
APPLICATIONS

- Low cost point-to-point audio distribution
- STL (Studio-to-Transmitter Link)
- IP Audio Distribution (network, etc.)
- IP Multicasting on Compatible IP Networks
- Simple Remote Broadcasts

New Technology - Connecting Anywhere

Bridge-IT

IP-only codec



Tieline TECHNOLOGY Madison SBE 2009 **Wired/Wireless IP Codec Technology**

New Technology - Connecting Anywhere

Bridge-IT

IP-only codec

New Technology - Connecting Anywhere

Wired/Wireless IP Codec Technology

New Technology - Connecting Anywhere

Tieline TECHNOLOGY

Madison SBE 2009

Wired/Wireless IP Codec Technology

G5 Multi-purpose 1RU codec

SOON TO BE RELEASED 1ST Q 2010

- IP (Wired and Wireless)
- POTS
- ISDN
- TIESERVER Traversal Server w/Buddy List Access
- SIP capability (universal connectivity)
- Digital AES and Analog Inputs/Outputs
- Simultaneous Digital AES/Analog Output
- Music, MusicPLUS algorithms
- MPII, MPIII decode, G.711, G.722
- Multicast Tx or Rx capability
- Up to 10 Unicast connections, each with up to 10 separate connection modes
- Double-redundant power supply
- USB read/write port for failsafe, other needs

Tieline TECHNOLOGY Madison SBE 2009 **Wired/Wireless IP Codec Technology**

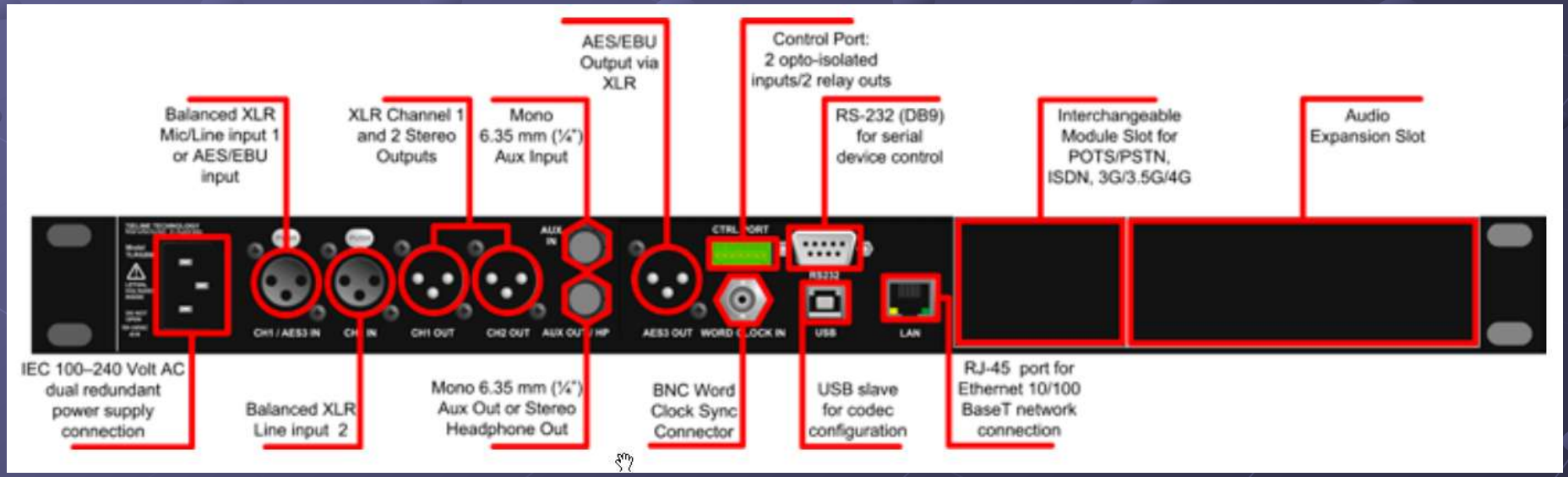
G5 Multi-purpose 1RU codec

FUTURE EXPANSION

- **5.1 Surround Sound**
- **6 Discrete Channel Input Card**
- **Stay Tuned for More!**

New Technology - Connecting Anywhere

Front Panel of the G5 1RU Rack Codec



New Technology - Connecting Anywhere

Look for instructional videos on Tieline web site…

Look for instructional videos on Tieline web site…

Setting up a wireless connection

Look for instructional videos on Tieline web site…

Programming & setting up static IP address at studio

Look for instructional videos on Tieline web site…

Complete i-Mix G3 overview

Look for instructional videos on Tieline web site…

BRIDGE-IT

A short overview of Bridge-IT. Filmed at Tieline's booth at IBC 2009

(Duration: 5:35)

Request a FREE Demo Today

Look for user stories, see what others are saying

Clear Channel Chooses Tieline for Wireless 3G Remote

- The Benjamin Franklin Parkway in Philadelphia is famous for those triumphant scenes of boxing champ Rocky Balboa raising his arms atop the steps of the Philadelphia Museum of Art.

Download Pic (1.87 MB)

It is also the location for the annual Unity Day celebrations in Philly, when hundreds of thousands of people turn out to celebrate diversity and peace.

Everything about Unity Day is huge - from the crowds, to the challenges of broadcasting live from the middle of the Benjamin Franklin Parkway.

Local radio station and major sponsor 105.3 WDAS-FM devoted a full day of airtime to this event back in August. Marcus Xenakis is Director of Engineering and IT for Clear Channel Radio in Philadelphia and was responsible for organizing the technical side of broadcasting the event.

"It presented quite a challenge," Marcus said. "Installing an ISDN line at this particular location involved a lot of red tape so we looked for a simple wireless solution for the Unity Day broadcast." Marcus heard about Tieline's 3G wireless capabilities and decided to test a pair of Commander G3 codecs for the event.

Tieline supplied a pair of demo units and Marcus conducted thorough connection tests while driving in a vehicle along the Benjamin Franklin Parkway. "The tests were very reliable and convinced us to give it a go," he said.

This was quite an endorsement because the codecs had to go the distance and broadcast live continuously for nine hours from a temporary stage set up on the street.

Look for user stories, see what others are saying

Tieline Provides Operational Power to NPR's Inaugural Coverage

Chris Nelson Mixing at the Capitol Building on Inauguration Day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More info plus user stories can be found at

www.tieline.com