



# Migrating Your Audio Links to IP

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# Why is IP appealing?

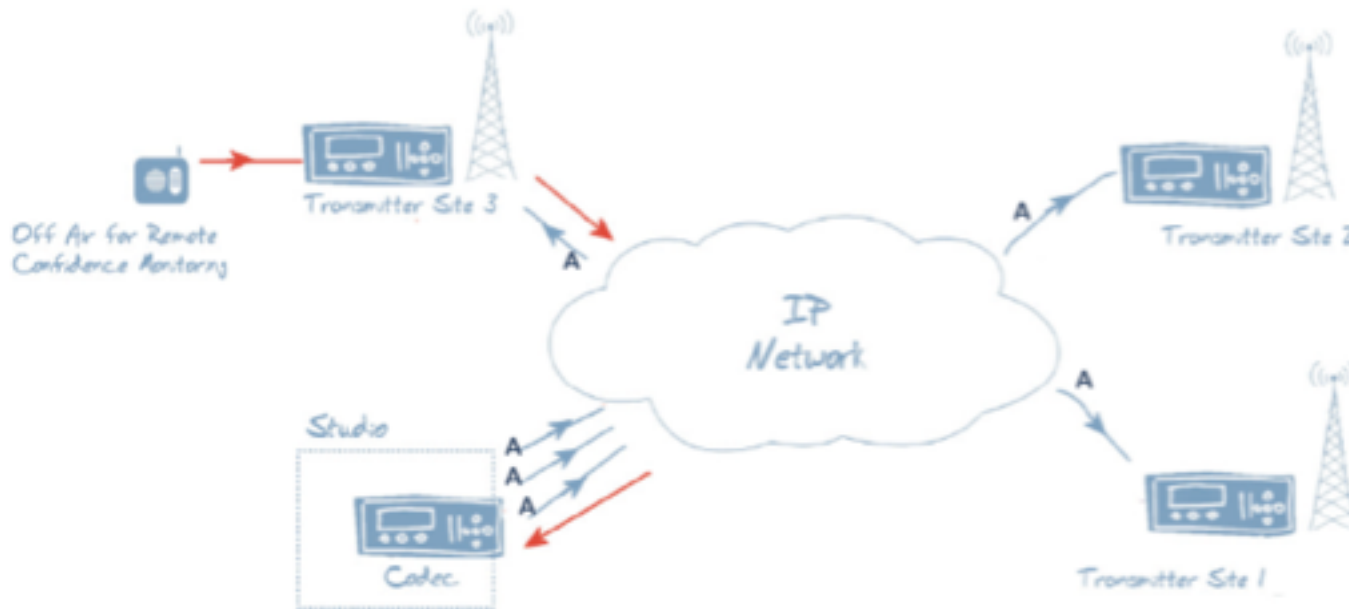
- ❑ **Cost** – IP links are generally much cheaper to install and operate.
- ❑ **Widespread availability** – IP links are generally available from all Service Providers
- ❑ **Greater flexibility** – in contrast to finite bandwidth limits of synchronous networks.
- ❑ **Greater scalability** – the incremental cost of adding bandwidth is much lower with IP.
- ❑ **Network efficiency** – IP networks can offer flexible point to multipoint configurations.
- ❑ **Simplicity** – Easy to order and license not needed.

# Are all IP links Equal ?

- ❑ Application and cost dependent.
- ❑ **Dedicated Links** – non contended or low contention, no bandwidth sharing.
- ❑ **MPLS** – Multi-protocol Label Switching. connection-oriented service with ability to support bandwidth reservation and service guarantees.
- ❑ **Metropolitan Ethernet** – allows some element of quality and service control – can be more cost effective than MPLS .....
- ❑ **Public network.**

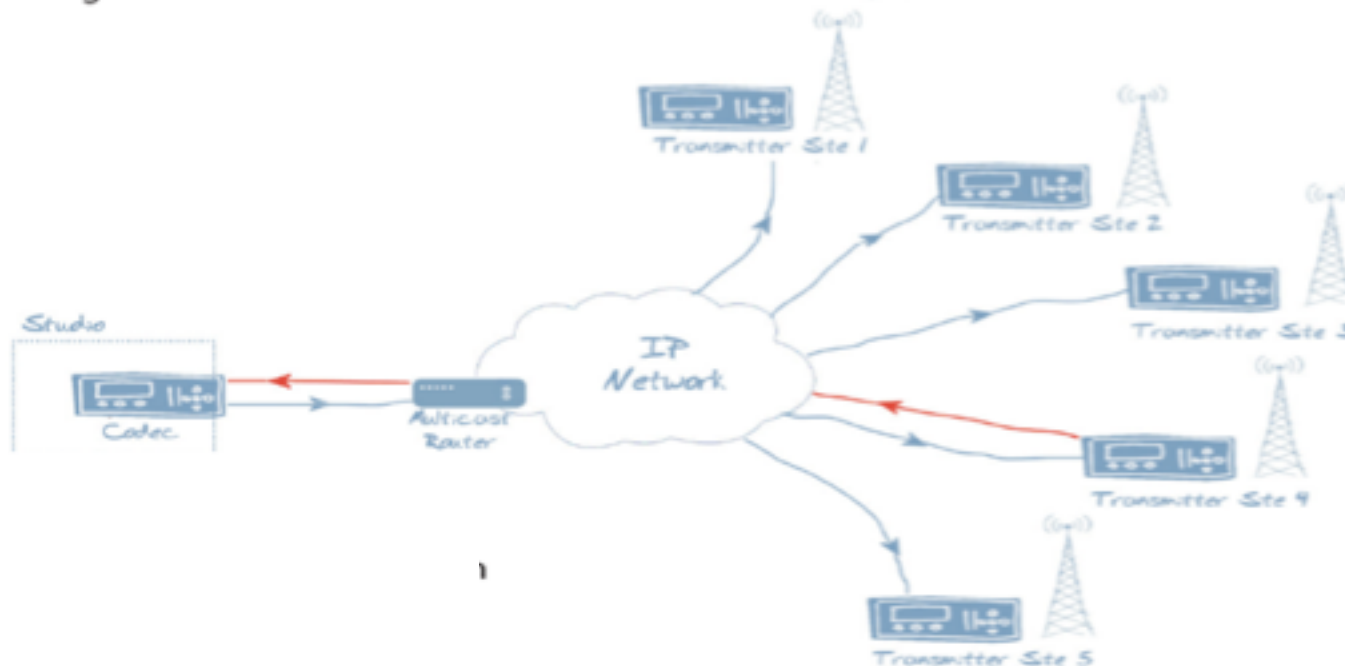
# Unicasting / Multicasting

- ❑ Unicast for simple point to point links
- ❑ Multiple Unicast used to stream from a single site to multiple sites . However circuit replicates the



# Unicasting / Multicasting

- ❑ IP Multicast highly efficient for single point to multiple end points.
- ❑ Source codec sends the IP packets to a multicast router using a Multicast Group address as it's IP destination



# Codec choice?

- ❑ DSP codec for ultimate reliability, remote control and configuration options.
- ❑ Auto Reconnection Codec, ensures the audio is automatically reframed.
- ❑ Low Delay, ADPCM Coding (Enhanced apt-X) no frame buffering required.
- ❑ IP Packet Resequencer, reassembled of out of order packets for coherent play out.
- ❑ Psycho-acoustic algorithms are lossy and the fidelity of the audio does degrade with multiple passed.

# Packet Header Construction

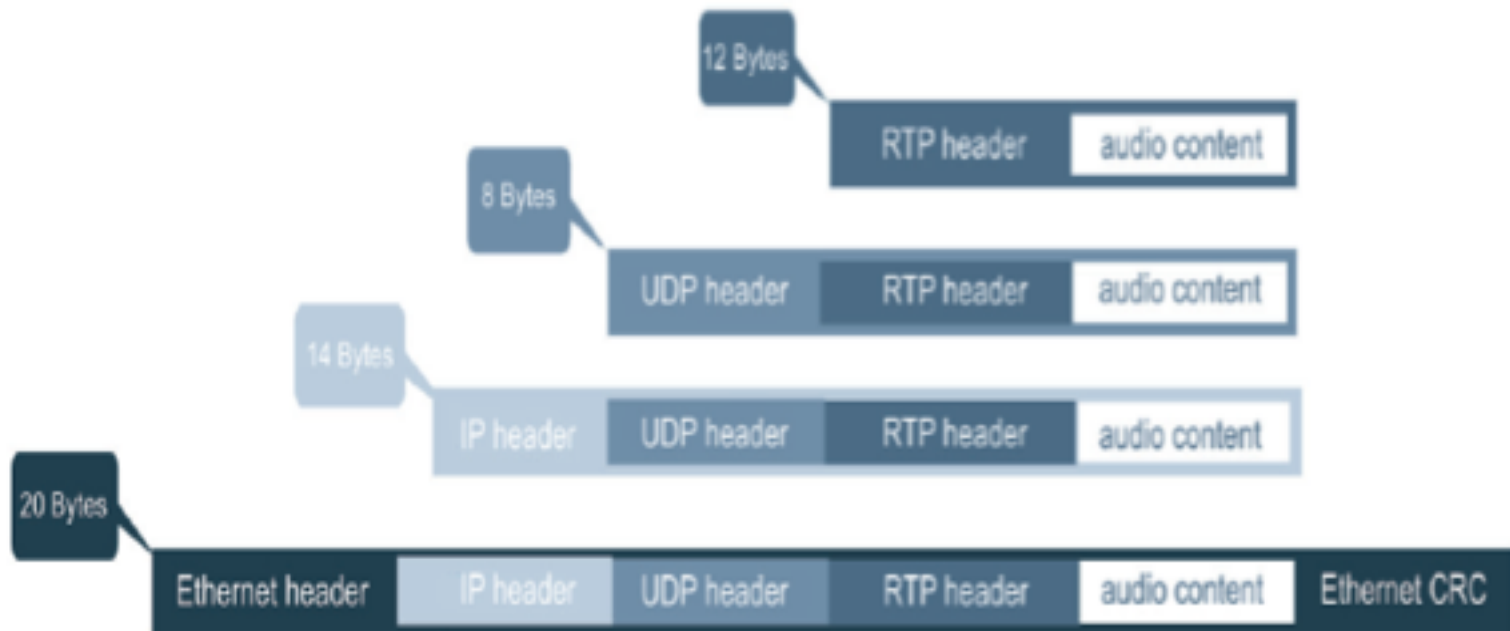


Figure 2: How an IP packet is constructed

# Packet Size - Trade Offs

Audio Data Rate	Audio Packet Size (bytes)	IP Packet Size (bytes)	IP Packets/sec	Packetization Delay (ms)	IP Data Rate
64 kbps	128	194	62.5	16	97 kbps
	256	322	31.25	32	80.5 kbps
	512	578	15.625	64	72.3 kbps
	1280	1346	6.25	160	67.3 kbps
128 kbps	128	194	125	8	194 kbps
	256	322	62.5	16	161 kbps
	512	578	31.25	32	144.5 kbps
	1280	1346	12.5	80	134.6 kbps
256 kbps	128	194	250	4	388 kbps
	256	322	125	8	322 kbps
	512	578	62.5	16	289 kbps
	1280	1346	25	40	269.2 kbps
384 kbps	128	194	375	2.7	582 kbps
	256	322	187.5	5.3	483 kbps
	512	578	93.75	10.7	433.5 kbps
	1280	1346	37.5	26.7	403.8 kbps
576 kbps	128	194	562.5	1.8	873 kbps
	256	322	281.25	3.6	724.5 kbps
	512	578	140.625	7.1	650.3 kbps
	1280	1346	56.25	17.8	605.7 kbps

Figure 3: Table Showing relationship between IP bandwidth requirements, packetization delay and data rates

# Dealing with Network Jitter.

- ❑ Characteristic of packet switched networks
- ❑ packets arrive either side of their predicted arrival time.
- ❑ Jitter Buffer stores packets so they can be reconstructed and played out coherently.
- ❑ Jitter buffer is measured in milliseconds

# Minimise Delay.

- ❑ IP network has standard transmission delay and also packetizing delay typically 10–30 ms.
- ❑ Add to this the jitter buffer delay.
- ❑ Add to this the delay associated with Audio Compression.
- ❑ Forward Error Correction adds latency.

# Dealing Packet Loss ?

- ❑ Audio loss is related to the size of the lost packets, the number of packets lost and the **compression scheme used**.
- ❑ With frame-based algorithms the loss of any packet in a frame requires the frame to be discarded.
- ❑ With ADPCM Algorithm such as Enhanced apt-X no frame buffering and offers greater flexibility in packet size selection.

Algorithm	Mode	Bit Rate	Packet Size (Bytes)	No Of Audio Samples	Audio Lost
MPEG Layer 2	16 Bit Stereo	256kbps	768	2304	24ms
Enhanced apt-X	16 Bit Stereo	256 / 384 kbps	512	64	16ms / 10.7ms
Enhanced apt-X	16 Bit Stereo	256 / 384 kbps	64	8	2ms / 1.3ms

Figure 5: Table showing how choice of compression algorithm affects packet loss

# Ensuring My Audio Traffic Is Given

- ❑ Critical packets on a network can be protected from intentional packet drop by both techniques.
- ❑ There are two main methods for the improvement of link quality: **RSVP** and **DiffServ**.
- ❑ RSVP (Resource Reservation Protocol) is more complex and involves the reservation and relinquishing of resources through the network.
- ❑ **DiffServ (Differentiated Services)** offers a traffic classification framework that evaluates the priority of packets on a per hop basis.

# Specifying an **SLA** with my

- ❑ SLA 's provide level of confidence.
- ❑ Understanding SLA Metrics

<i>Metric</i>	<i>Typical Values</i>	<i>Notes</i>
Availability %	99.9 to 99.999	Circuit uptime
Latency (round trip delay)	50 – 300 msec	Distance dependent
Packet delivery %	<b>99 – 99.999</b>	
Jitter	10-50 msec	
Mean time-to- restore service	2 – 5 hours	

# Will I need To Backup My IP Link ?

Either by a secondary IP link supplied by a different service provider, or a point-to-point synchronous link.

Selection of a number of different criteria to initiate the backup, dropped packets, silence

## Synchronous Back-Up to IP Link



Figure 10: Synchronous Back-up on APT's WorldCast Eclipse

# Manage and Monitor the Audio

## **CODEC management.**

- At a glance Status of codecs throughout the network.
- Flexible configuration of audio settings, algorithm, data rate.
- Ability to define audio profiles.
- Flexible configuration of the Transport link.

## **Network Performance management.**

- Ability to set alarm conditions and alarm grades.
- Alarm /Event Logs for diagnose persistent problems.

# Summary

- ❑ Despite the advantages IP circuits must be managed.
- ❑ Care must be taken that audio quality and circuit reliability are not sacrificed in the interest of Cost savings.
- ❑ We can balance IP network and audio codec parameters to realise reliable audio circuits.

# For Further Information:

- IP booklet: [support /downloads](#) on APT site

- Demo: Novanet Suite 320
- Celebrate: Novanet Suite 320
- Thank – You, Q & A

