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WHITE PAPER

Monitoring & Control an Audio-Over-IP Network in a Broadcast Environment: Common Challenges and Solutions

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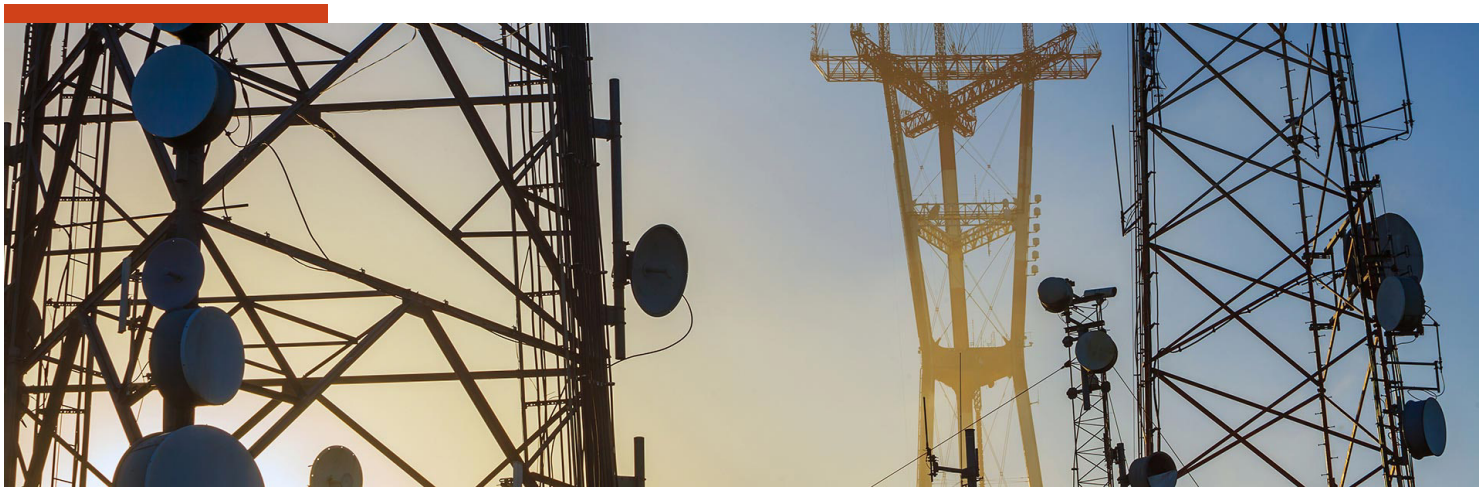

Introduction

It can be a daunting task. How to even begin to think about setting up an easy-to-use monitoring and control solution that can help operational teams make sense of or understand a complex AoIP (Audio Over IP) network, much less troubleshoot audio problems or take pro-active maintenance actions. This paper will walk the reader through the major challenges one is likely to encounter and the solutions to put in place to keep broadcast operations healthy and audiences listening.

CHALLENGE # 01

Overcoming the feeling of being overwhelmed by complexity

In some ways this is both the easiest and the hardest challenge to overcome. Because it has to deal with a particular mindset to have when making the change over to IP based workflows.

The biggest thing to remember is that at the end of the day all that is changing are the pipes to borrow a metaphor I've heard colleagues in the networking business use to simplify the work involved. Audio is still from a source (microphone, feed, playout server, etc) to a destination (someone's ears).

The only thing that changes in an AoIP world are the kinds of cables and boxes used. Simple right?

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CHALLENGE #

02

Encourage people to get started

I realized that may have been on over simplification but the point is to encourage people to get started. Audio Over IP means understanding computer networking. You can't avoid it. If you're going to do audio over IP then you're going to at least need a rudimentary understanding of modern computer networks and hardware.

Giving a basic overview of networking is not in the scope of this paper but understanding the basics is important. Remember, that as some point an audio signal is being converted to data packets or datagrams that are being sent over a computer network via TCP or UDP protocols.

You don't necessarily need to understand the difference but it is good to know whether the AoIP technology you are using is implementing one or the other. It may make a difference in which data points you choose to monitor later.

While you don't have to have a networking certification to monitor your AoIP network you will likely need to have at least some limited knowledge of configuration of the AoIP hardware involved. These could be IP encoders\decoders, network switches or probes.

Some kinds of configuration you may need to perform in order to successfully monitor your network might include…
- Turning on the SNMP (Simple Network Management Protocol) functionality on your network switches
- Setting SNMP community strings
- White listing SNMP managers that are allowed to poll or setting trap destinations
- Resetting API usernames\passwords
- Accessing any available web GUI on the devices

If you're aren't already, start to familiarize yourself with statistics such as bitrates and error rates. And switch port states like operational up\down and admin up\down. They are going to be critical when we start to monitor our AoIP network later.

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CHALLENGE #

03

Understanding how your network works

Now it's time to break out the good old network diagram and start diving into the details.

Yes, the hard to read and understand one with all the lines showing either the physical network, the audio network, the uplink network, or a drawing that may combine all of these. It may feel overwhelming but just take things one step at a time.

The goal from this point is to trace at least one audio signal from its "source" to its "destination". If the scope of your project is only to monitor from a feed to an uplink router, then that's all you need to worry about. Source and Destination in this context only mean the beginning and end of the part you want to monitor.

Start to make a list of each piece of equipment from the source to destination that the audio signal if flowing through. This includes everything in your diagrams. If you have any equipment that you know will not have any way to remotely monitor it (for example a microphone) don't skip it. Operations may want to still include it possibly in the visual layers later.

For each piece of equipment note the Make, Model and overall function of the box. For example…

Cisco	Catalyst 9000	Switch
Worldcast	APT IP Codec	Audio IP Encoder
and so on…		

If the equipment is a card\slot within a frame then make sure to note both the chasses and the card type as if they were separate pieces of equipment.
If the audio flow includes DA's (distribution amplifiers) make sure to follow all the paths to get all the equipment. But don't forget to include the DA's themselves.

It's time to dive into the details. But take things one step at a time.

CHALLENGE # 04

How do I learn what I can actually monitor on each piece of equipment?

Many customers that I've worked with in the past look at all the equipment they have in the network and assume that they will be able to monitor very specific things from each device. This may or not be the case. Each device type in your network will require a bit of investigation to learn what in fact is able to be monitored.

To note, depending on the NMS you've chosen to implement, a technical resource from the NMS vendor may help you with this part or do the work for you. Many times, this person is a technical account manager but could be any support or sales person.

If there are no professional services available for the NMS you've chosen then you'll have to do this work yourself. But in either case it's a good practice to do it anyway to help you understand your NMS at a deeper level.

For each piece of equipment find the documentation for that model and note what kinds of remote information is available and what protocol is used. Protocol possibilities and the information you should gather are as follows:

SNMP
- Which version (v1, v2c or v3)
- Get copies of the MIB files. These are text-based files that describe which information is available and which configurations can be set remotely.
- Some equipment will only have a single mib and some can have dozens of them. Just collect them all at this point. We can narrow down the data points later.

Any Web-based API
- For this just gather any documentation you can find for the API.

For other protocols, such as serial, telnet, ftp, modbus, or any other proprietary protocol try to gather any documentation at all that will give the commands or requests and responses that are available on the device.

For some equipment they will have more than one protocol available. For example, a switch may have an SNMP interface, an API and a telnet command line interface available. If this is the case you can probably concentrate on the SNMP and API interfaces only and reserve any command line commands for any critical information you may need that is not available by any other means. In the monitoring world, using the command-line to gather information should be considered a last resort. Always try to use the API or SNMP interface of the device first.

Also, for some legacy serially controlled devices such as those that only have an RS-232 or RS-485 interface you may need a hardware gateway for the NMS to be able to communicate with these devices. A typical gateway is going to have a bank of serial ports that can each be individually configured for communication with a different serial device. Then, a TCP port can be assigned to each serial port and thus any serial command can be sent to any of the connected devices by sending that command over IP to the gateway itself at a specific port.

CHALLENGE # 05

How to setup an NMS to communicate with a wide variety of equipment across a variety of communication protocols

Fortunately here, if a high quality NMS has been selected, it should have the ability to communicate with any device over any protocol.
This is typically done with a plug-in layer, often called “drivers”.

Some vendors will charge an extra fee for each driver. Others will include all the drivers for free. Also, some vendors will allow users to create their own drivers that typically required some amount of training.

After the proper drivers are all in place the equipment can now be provisioned in the NMS. The information that was gathered earlier will be needed here. SNMP community strings, API credentials, etc.

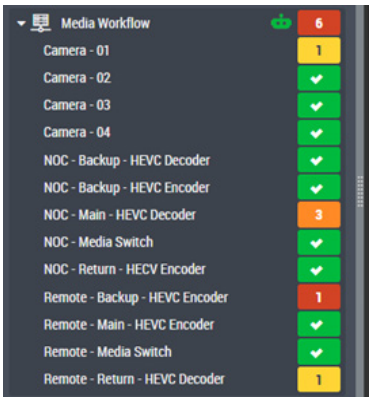

Fig 2 Equipment being monitored in an NMS

CHALLENGE # 06

How to visualize and monitor AoIP specifically

The goal of monitoring AoIP for many customers is having confidence that the underlying AoIP network is both configured correctly and functioning correctly. That means the correct audio is getting from Point A to point B. Or more likely from point A to Points B, C, D, E, F….etc.
Generally, the way organizations are going to do this is by monitoring the equipment involved in the encoding, transport and decoding of audio through the network.

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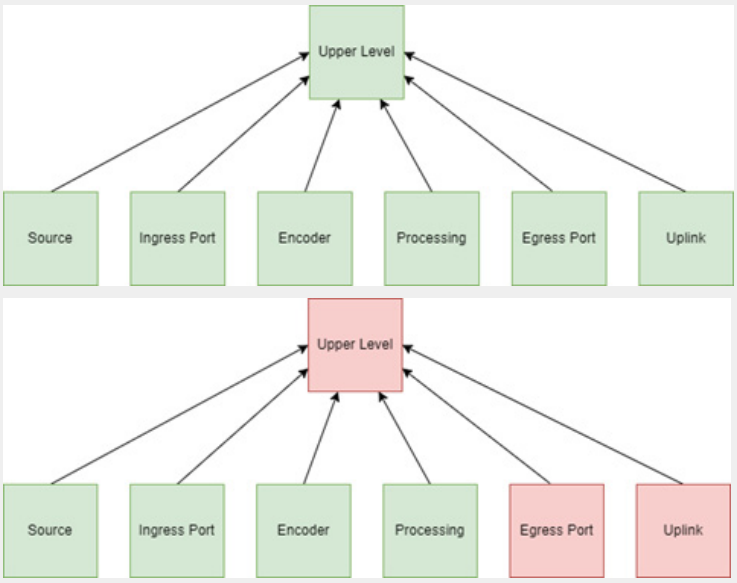
CHALLENGE #

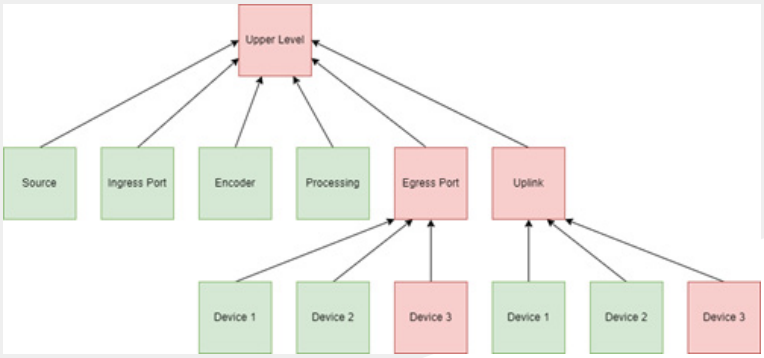
07

How to create a visual layer which masks the underlying complexity without losing visibility to all underlying problems that may be lurking in the network.

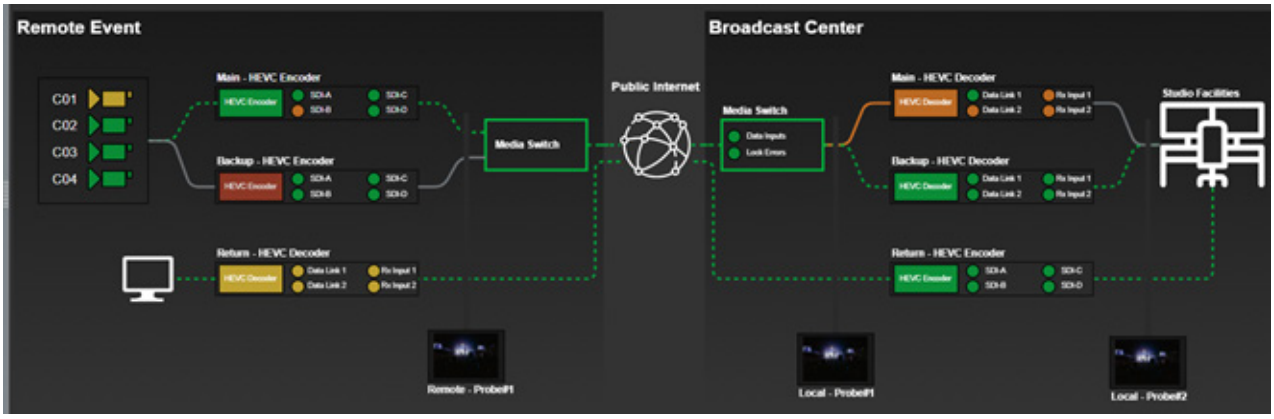
The answer here is there must be a way to show summary alarm levels in a visual graphic from underlying equipment. Ideally the higher-level object is also a clickable object that will take the user to a screen where they can see which device is causing the alarm level at the higher levels.



Building on this simple concept it is possible have a very simple screen showing status for a large amount of underlying complexity and data.



Extending this concept, a service/channel/program can now be displayed in the NOC for operations in a manner where people can immediate tell not only if there is a problem but within one or two clicks be able to see where exactly the problem lies.



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