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Today's webinar is entitled Digital preservation audio and video format presented by Jacob Nadal out. Jacob was appointed as a preservation officer for the UCLA Library in 2008. Previously, he served as field service library and add acting head of the New York public Library and is head of the preservation Library. I'm happy to introduce Jacob made out.

Good afternoon, everybody. Thank you for joining us. Let me reiterate my thanks to the Museum and Library services and the California preservation program and really the movers behind getting this webinar series up and online and delivered to you. This is the fourth in our four-part series about digital preservation. Today we are going to talk about audio and video format. The theme of these webinars have been to, essentially, make you all savvy shoppers as you go about planning and dealing with the general preservation issues. As on the webinars before, we will leave a little time talking about audio and video format, described how those formats are created, how they really work in the computer, then talk about what the current recommendations are and the best practices for creating and managing. So we will start in with audio.

The core of all audio preservation formats is something called uncompressed linear modulation. PCM was developed in 1937, so all of our digital formats in some ways, PCM and audio have the longest track record. This method of recording audio data, basically, takes a sample of the sound wave at regular points. This is susceptible to two problems. One is quantization errors, and that's when the sampling misses parts of the single. The other our clock errors. That's when the time dress. I have a few slides I want to show you to give a sense of how these things happen in just a moment or you broadly speaking, I just want to say that the important thing to remember in all of these audio formats is that they should contain this uncompressed PCM data. That is, essentially, the raw sound file, the way that makes up the sound that we hear. Here is a rough illustration of how the digital sound capture happens. So the red curving line is the actual waveform of the sound. You can see the blue arrows indicate points in time where you would take a sample. So it's the beginning of the wave at its peak and at the end of that peak before it goes into a process. That would get you a good sample of that wave forward. It would tell you how low it was and how high it was. You can see what would happen with the red arrows if we had our sampling. Instead of hearing the wave form in its natural, accurate version, we would hear a distortion. This is a quantization error. It's also the sort of thing that would happen if your time data becomes messed up. So if you think that a sound clip begins at one second and it really begins at 1.5 seconds. It's 13 seconds long but it's really 12, all of the data interpreted will become damaged. This is the sort of problem we try to rough away in having good digital storage. Now, the captive away if it is captured many more times than I showed you in these illustrations. Ideally, what happens is we make all of those samples and we catch many points along that curve with the intended effect of getting a constant, clear, accurate reflection of the sound. It's worth saying here that we are going to sound capture from an analog domain to a digital domain. We have a series of numbers that we are writing to record the dimensions and shape of that curve so there will never be 100% accuracy. As we talk about sound, I think you'll see that like imaging we can reach a point where there are so many instances and pixels with so much color depth to represent an image that hour I cannot tell you and likewise with capture there will be so many samples over such a wide range of amplitude. The ability to record from the top to the bottom of that wave.

A couple more charts. Just to get you worried as we start here. So the difference between original and quantize. You can see what's happening in the first chart in the second chart is you are seeing in blue the original signal, and then read the model is where the signal has been captured. Let me add a couple lines here to help sort that out. You will see where I have circled in black. Those are the areas where we've missed part of the signal so the wave is actually deeper into first circle and higher in the second. Likewise, the third and fourth Circle three of the results of that is we missed parts of the wave. It can be produced as an incorrect sound reading. This is something to be careful of when you deal with audio capture. Just as setting up image capture or video capture, it's very important to walk yourself through the chain of events that sends data from one place to another or to ask how they've set up their recording system to avoid these problems. Some things are well known and easily dealt with in 2012. The sophistication of the audio software, the natural quality control built into the system's makes it unlikely that you'll have these problems, but it's an important point if you are setting up your work with a vendor or what types of software you are using to make sure you have an answer to the question, how do I deal with quantization in time so I know it has occurred.

The format we use to capture audio, so essentially the rapper a round this PCM data is usually a wave file. The type that is most commonly used and probably most reliable for preservation services is the broadcast wave. The WS -- it's a variety of wave file and adds a header with metadata. That metadata facilitates a lot of important things. One of them is file editing. The other is identification, so it's very common to embed in the broadcast wave header what some people call catastrophe way the data. You might have a short title, author, certainly a time of the links attached to that file. Within the file header, this audio is 327 megabytes in light. What that does is supposing you ever have a situation where your data management system, your archive or sometimes a file has become separated, it's possible to determine in what you have an audio file to help you recover your data. Including file size and time information also helps editing. As we move from text files as we talked about early on to image files, we saw the size of the storage requirement grow dramatically. Audio makes the storage requirements for image files look trivial by comparison. We will be talking about storage problems that are yet another order of magnitude. The result of this has been also if we wait a few years, computers will catch up. At the present, editing a big audio file is fairly processor intensive area if you want to do any work on that file or perhaps you want to publish a very part at the end, if your computer is not smart and if it doesn't have good metadata, it will have to, essentially, playback the whole file every time you edit for a correction, this becomes especially frustrating when you realize that a broadcast wave header may actually be placed at the end of a file. Although we call it a header, it will essentially be a footer. Waiting for your computer to read through several hundred megabytes file data so that you can make a small correction to the metadata in the header is a frustrating experience. One of the important things to ask, and this is a potential pitfall, is how well all of the different pieces of software perspective the metadata headers. BWF meta- edit is probably the most commonly used tool, but there are a lot of audio software programs, and some of them are good about respecting other people's headers, others simply rewrite them. It's very easy to have your file appear damaged or corrupted simply because someone is reporting and didn't understand the headers that came along with it. Again, this is an area where you should be asking questions as you decide what software to use in-house and a place for you to ask questions. Again, this is not an area where there are not a lot of surprises but there is some complexity.

Outside of the broadcast wave file, you will need some format to deliver audience -- to deliver audio to your users. Real audio, Windows media, MP3 files, all commonly used to prevent distribution and very good for that purpose. You might want to ask questions about proprietary software that you are forging on your users, but any of these things would work. They are problematic as preservation master files. This is similar to the conversation we had. All of these file formats necessary to deliver audio over the web yet many of them are proprietary so they are strictly tied to one vendor encoding and decoding software. Several of them have some intellectual properties restrictions. Along with being proprietary, they may also be covered under someone's intellectual property. Again, fine choices for delivering files. Bad choices for preserving files long-term. This also begs the question of what to do when you receive these files into your archive. Many of you I am sure are starting to deal with more digital audio. You may be getting that from amateur reporting. A good practice is to teach from the wave format and store those files as broadcast waves going forward. Some of these files are more likely to remain usable in their native encoded form than others. That's something that your audio and software should do as a batch functions. Set it up before you go home at night and check back in the morning.

So let's talk a little more deeply about what's in these audio files. This is something that is common. Delivery versions as well as master story versions. The primary component of audio are wave forms. A stereo file has to right and left. If you are dealing with a 5.1 Channel audio that comes with movies, you would actually have six channels. A center, right, left, and the base Channel. An audiophile probably has metadata with it. This is especially important. And a wave file can hold up to 4.1 gigabytes of data, which is quite a lot of audio. There is also file format that holds lots more. It's important to note when we think about audio that each Channel increases the amount of data in a file. So we might think that a file at 96 kilohertz is going to take a certain number of gigabytes per hour, but, in fact, for a stereo file, it would take twice that amount for a 5.1 six times that amount. It is important to be aware of. It's very easy to forget and make a mistake in your math if you're thinking about storage requirements.

CD-quality audio is 44.1 kilohertz, which is 44,100 samples per second. That means for every second of time that a lapse in in an audiophile, there are 44,100 pieces of information recording the shape of that audio waveform. Most digital preservation engineers actually favor a higher level of resolution, 96 kilohertz or 96,000 samples per second. That extra sampling has two be helped to avoid errors that provides the finer reproduction of sound. It provides a level that is probably beyond our ability to hear. Like images, audio sampling involves resolution as well as pit steps. CD audio is 16 bit area that allows 65,536 levels amplitude. That's measuring from zero, the bottom of that waveform, up to 96 decibels, the peak of that waveform. 24 bit audio, which is the standard for digital preservation, actually has 16.7 million levels, potentially to capture from zero to 144 decibels of amplitude. In fact, digital audio converters can't do that. They are about 120 decibels in amplitude just because of sort of the practical limitations of electronics. It's important to note here that 96 kilohertz, 24 bit surpasses the limits of him at -- surpasses the limits of human hearing. Even if you are thinking, 120 decibels is a rock concert. It's very rarely it 0 decibels, which is purely silent. Most of the time we are recording several dozen decibels of sound. In audio capture, you don't record the below the level of the playback. So the zero to 96 is tremendously wide range compared to 144. Many of us go through that level. I think it's a significant auditory discomfort. That said, it's worth noting that 9624 surpasses the limits of human hearing about some audio signals and code data is not fit for humans, so a good example of this would be the labs. They do research, for instance, on golf in and whale calls. What really matters for their analysis are part of the sound file that are beyond their ability to hear.

Just to reiterate again, we are recording samples over time. It tells us how wide the amplitude of the sound we can reach for. To review, the standard for preservation is 96 kilohertz. That's 96,000 samples per second of resolution and 24 bits. That's 16.7 million levels of amplitude between zero and 144 decibels. And that data is stored at uncompressed PCM modulation data, and our format of choice is the wave file usually stored as part of a wave file so we can include the meta- data relative to that audio data.

So we are going to move onto video. It will just take him on it to say it that we will be doing questions. I've made sure to leave sometime at the end. At the end we will have time to come back and pick up some of those.

Moving image and video is very much an emerging area in digital preservation. Today I'm going to touch on the highlights and give you a brief survey. More than anything else we've talked about in this series, this is really basic prior to getting further help and planning to migrate a lot of video data in the very near future. I think even if you make all of the best choices today, I would still give you pretty good odds on heavens to migrate your data or making alterations in your system within the next four or five years. I think we are seeing a lot of attention paid to video. Our practices and standards are maturing quickly, but this is really the newest and the most thought area of digital preservation right now. I also want to distinguish between two types of moving image data, film and video. So film, motion picture film, is a sequence of images. Each one of those images has depth and resolution just as we talked about a few webinars ago. The text and image session. They go by a certain number of frames per second to create the impression of movement. That sequence of images accompanied by audio data of the sort we just talked about. Those are usually captured in visual waveforms that are put on the film. If you look at a frame of motion picture, there's usually an image connected to it with two or more squiggly lines that are the soundtrack, the literal soundtrack of the wave along with those images. For film, the most reliable preservation option continues to be the analog choice. Most of the film preservation studios to film transfer and they rely on the link to the of photographic film rather than a digital version of that film.

The other type of moving image is a video. Video is a way of recording image and audio David electronically. Now, video on Mike film, is almost all produced on unstable media. The magnetic tape generally used to record video even in the best of circumstances doesn't have a great life expectancy. It's something we measure in decades, not centuries. So digital transfer for video is an important preservation step and eight Mbytes naturally all sorts of digital preservation questions. I'm going to spend a little time talking about how a video file is set up. This is not common knowledge and it's important for understanding choices that we make in preservation.

So video is a way of recording image and audio data are yet it has a specific resolution drive from a number of scans of lines. These are horizontal lines that run across the video monitor, so you will see code like 720 by 480, and that is the C-cam video we are all so for now you're with. It essentially means that the video signal contains 480 visible horizontal scan lines, each 1720 pixels across. In addition, there are six lines that are for graphical metal data -- meta- data. These are digital marks put on the data that tell you certain things about the processing that video has gone through. They are not or should not be visible on your regular monitor, but if you were to look at the video on a studio monitor, you would have six extra lines so you could see the graphical data. And then there is interlacing, which is progressive scanning, which is a way of drawing the video onto the screen. It's a one line of video, one of those scanning lines looks something like this. There is a little much ammo, which measures them up of brightness in the video frame. There is a chroma Channel, which shades that video signal with color, so the composite video signal has both of these things. Analogous to the black-and-white image and then a color overlay that is laid on top of it. So the way the scanline works, if you sort of imagine going left to right, you would see brighter to progressively darker colors along that scanline. It would be high luminous at the beginning and low luminous at the end from left to right and then laid on top of that would be a variety of colors. So this is not pixel by pixel drawing as we are used to. This is acting much more on analogous to screen printing were the colors are laid on top of one another. In a little more detail, this is how a video signal is laid out. At the beginning you will see a space level described as horizontal blanking. That includes a safe tip that is a point on the video file that is used for making sure that each line of video is alive. It contains a small amount of color data for the entire line, and then an active video area which is what you'll actually see on your monitor followed by this distinct tip for the next line of video. That has a few different parts in itself. The sink tip itself, the color burst, and on the back porch. The specification of those pieces are what allows video to be played back with a high degree of fidelity so that the colors line up. After 480 of those lines of illuminated color are laid one on top of each other, they form a picture that we see.

This is what actually happens on the screen of a CRT monitor. There are a number of lines and video. An electron is used to fire against the back of that screen. I will skip down to the next line and so on. All away at the end of the video it starts to freshen over again. Each one of those lines is a limitation and color pulled together. This is very much like the color model we talked about in imaging and is roughly analogous to the way that lab color is created. And video color is YUV. The red Channel minus the luminous or the blue Channel minus the luminous. What happens when we sample video -- it's close to audio or image data. We capture illuminated video at one level and then from a information at a different level. A number of bits are assigned to each one of those channels and they are captured at some predetermined number of channels. When we talk about video sampling, we start to see things like 10 bits for 10 bits of color, uncompressed, no compression in the file, and then something like 422, which would mean, for instance, that we sampled all of the information from a video source. The different video sources have different levels of sampling that have to be applied to them. 444, 411. We will take a look at how changing the sampling effect the output.

Once you have made that conversion, you have a digital video file. JPEG is also used by the library of congress. It may be the future of the present wealth seeing a lot of problems with compatibility between different video, equipment, hardware and software. We are seeing that there are a lot of good tools available for that. The users load size and scale. So let me show you here and attempt to break down how a video signal is composed. So each one of these has four pixels assigned to luminous and then either one, two, or four read the luminous orb blue voluminous. So you will see that each image has a composite array. So, on the one hand, showing on the bottom 112022 and sampling of those channels. It's combining them to create an image. If you look especially at sort of highlights and low lights and images along the top, you will see some changes between each image. It is very clear in the bottom where you are dealing with less data. One of the things to know about video is that depending on how it's reported originally, you may have more or less data that's favorable to the one of you. It's important to work out as you are digitizing video what the characteristics of the source video are.

Having done that, the question becomes, how do we store these materials? Would talk about the tip files we use for images, the XML files used for text, the files used for audio, and then we get the digital video we don't have. Standards and practices are still developing here. A couple things we know and I can recommend unconditionally is that an uncompressed file is always more desirable. One hour of uncompressed video takes about 100 gigabytes of storage. The cost of a terabyte in terms of hard media is coming down to about $100 per terabyte. That said, when we are talking about digital preservation, we certainly want to or three copies of that so we are back up to two or $300. Additionally, we might not want to do a lot of damage with different media overtime. If you want to use an online service like Amazon.com, your costs quickly can get to about a thousand dollars per terabyte. When that happens and when we start to look for alternatives for storing the video, the natural question to ask is whether we can compress it. Compression is, in fact, quite common and video files, both analog and digital. Compression is always a little dicey in preservation terms are you one, because the way decompression happens. It's not always consistent from software program to software program. Also, in the future should we ever not remember how we compressed something in the first place, the process of decompressing it can be very problematic. I can't in good conscience recommend compression, but I also understand the reasons it would be compelling to do so. One option to consider, and I can't say that I feel completely safe with this myself is completely safe with this myself is tape storage. It's a public format that describes the way the data is entered onto magnetic tape area and the Consortium works to make sure that every generation of tape is backwards compatible for two generations. It supports a compression out of them of their own. This will not save you from doing a migration, but it may help you hinge on pennies if you have digital video. All that said, this is obviously a complex and developing area. To the extent that you can stick with uncompressed files, the easier your future is going to be. Uncompressed AVI is the safest bet for final formats. As I said earlier and I will reiterate again, there are some alternatives on the Verizon. The JPEG 2000 used at the Library of Congress has a library of congress behind it. It's very difficult to work with. I wouldn't feel comfortable recommending that to someone who's not a pretty sophisticated video operator. Like last, [indiscernible] 21 standard has potential video preservation option but the lack of tools and the complexity involved in the formats puts them on little bit the on the reach of the average user. So with digital video, I think the advice is to pick a format for the plan on the migration.

Digital video delivery. In the last year or two, H .264 video has really become standard. There is native support for this video in HTML five, and I think this is an area where web standards have done a lot to help us have a common delivery format. Hopefully, the files we created have several years of life in them. Other file formats are certainly viable but have a different level of proprietary hurdles to cross. QuickTime, real audio and video. Some people stick with it because they have invested in that hardware and software, but be aware that those may not have a lot of life left in them. I think probably the most important thing is HTML five, which has native support for video and also reaches the desktops and laptops and mobile devices, so Android. It's more likely to have support for HTML five video delivery than they will for any of the plugged in base. So again, sadly, the bottom line here is [inaudible]. On that less than happy note, we will break for questions. I keep a persistent page on my website. Knowing that this is a lot to take in quickly, if you want to go back and watch this again, click through the slides and send any questions later, you can do so through the form on that page and I will post some follow-up information on my site and make sure that info people has a note about that so its distributed to everybody. Likewise, if you just need to sleep on this and get back to me tomorrow, I more than understand it enough of me talking. I would like to turn this over to questions. A question from Melanie Maxwell. One hour of uncompressed video is 100 gigabyte. Just type your questions into the chat. A question from Pamela. Why preferred API versus MOV? This is not a strong preference on my part. The MOV format is part of the QuickTime format, very widely used and well supported. It is arguably not quite as open as the AVI format, but this is in some ways splitting pretty fine hairs. I know people who use both and have good reason for doing it. A question from Brett Lilly, would you recommend using data SQL is a video/preservation format? Yes and no. They are two of the best taped formats, so those tapes are well manufactured. They hold a lot of good uncompressed data, so they are a low risk analog tape format, but I would add a cautionary note that even low risk analog tape formats are subject to problems over time. So they are a good interim step. If you are having things that are on data SP and are well produced and you want to wait a few years before you deal with them, I think that's a smart move. A similar question. I think the same answer would apply to digital data. There is a question here about recommendations for cloud-based storage services for small libraries and archives. I think this is a place where our technology is not quite catching up with us. So commercial services like Amazon are excellent. They are very reliable but you also pay a premium for some services that we as libraries don't necessarily need, things like 24/7 customer support, round the clock 99.99% access to our files. For preservation master, that's not really necessary. There are some places in the system where we've developed some lower-cost in-house options, and your other Consortium may have like that that they are developing as well, but the prices are still high and the commercial services tend to be a -- tend to be about a thousand dollars per gigabyte, so I'm afraid this is a scenario where we don't have all those that we want.

Can you explain how HTML it delivers video and how it's good for preservation? I can't give you a very good explanation of HTML five digital delivery system except it's included in the specification as a way to play back encoded video. Video is encoded in such a way to be compliant with the standard your device should decode that natively. I'm afraid I have not spent enough time with the specifications to know the inns and outs of that. What is good for preservation of all the HTML five specification is it gives every manufacturer a comment point of reference. So everyone who creates software or digital capture software will want their data to be playable in HTML-5 so they will support a common way of rendering video. Likewise, every browser and device manufacturer will want their users to be able to use the HTML-5 video web so they can build a common decoding system into their devices. That just means eventually fewer proprietary formats for us to look after.

The question here, archives have a lot of audiovisual materials. Are there such -- other suggestions for what is preserved for the future and how the efforts can be funded? For a Cessna in preservation, it's always the same answer first. Think about time. Whenever things created quite after you've thought of a time, you generally thought the older things were more at risk than the newer things. You think about the mechanics. How is it being created? Amateur reporting are at much greater risk than professionally produced data recording. Likewise, an older amateur recording is a much greater risk than a newer amateur recording. I think those are good ways to train. You always have to marry that consideration with your collective strategy and the goals of your institution. So the old amateur video that your institution doesn't care about may be less important than the professionally institution caring about. I advise you never to preservation without having at least some input from collection development. Otherwise, you can really end up chasing infinite amount of material. Preservation is always risk management in some ways, so part of knowing the risk is knowing the value. I would also I suppose say in terms of funding, funding is available for survey and assessment. Any age preservation is a very good starting place. They will provide you enough money to bring in a consultant who will help you work through the issues, give you a report and description of some needs and potential next steps, and that will help clarify where you go next. It's also often a pretty requisite for further funding. You have a collection surveyed do can use for a larger grant proposal. So I think starting with that initial survey is a great step and very useful.

There is a question here, what are the issues with flash video and why don't Apple products support them? So the issues with flash video are in some ways a separate question. Flash can contain a number of different video code, ask him anything. Some of those are better or worse. It was actually an early adopter of this that I think everyone in the open file formats has become pretty fond of. That should be in your favor. I think the reason Apple doesn't support it has as much to do with some technical issues of battery life. The flash was never well optimized, so it was a lot of work to decode flash. As well as some sort of internal manufacturing business strategy. Some of that does have a lot of bearing on preservation. Even though it is the fallout.

So? Recommendations for short-term salute shins while we wait for better long-term storage solutions. Things like duplicates on hard drives in different locations being a enough. I think the short answer is yes. In the short-term, I am the last person that's going to decide to buy a couple extra note hard drives and make sure they don't all end up in the same building at the same time. You know, the lifespan on a drive is often three to five years. Minutes after you plug them in, they can last for a decade. But most are fairly reliable, especially if you are using them for a pretty low stress duty like to store your digital masters. I think that's viable. If hard drives as a capacity measure are just not viable, you are doing too much for hard drives to work, LPO I think is a viable option. You have to buy a tape drive. Those drives are fairly expensive. But it's all for it is very inexpensive per gigabyte of storage, and there is some baked in backwards compatibility. The drive you're using today will be good for two more generations which usually buys you a couple years for you hard drives are certainly the easiest and are viable in the near term.

Metadata schemas are another question. And I think there are two ways to answer this. One is to sort of say, although technically audio and video are different types of data, the same administrative descriptive information you would want for any format certainly applies here. So you want to know what it is and who made it and when are you that you want to know how long it is, you want to know technical characteristics for video that's going to be things like the source tape and source Video" in. For audio, did you take it off a compact disc? Those things I think are pretty common. It's simply the answers you fill in the blanks are going to be a little different. There are some formats. MX as is one that gets some play. They are used for large-scale management of digital data and are often used for video simply because of the size of the video, but I wouldn't let the questions of the metadata hang you up. by and large, you want to describe these things the way you would want to describe to any digital offer. That means knowing what it was as an analog format, what it is as a digital format, and having sort of descriptive and cataloging information.

Let's see. Just glancing through a couple questions here making sure I have -- okay. So a good question. Can you recommend a formula for predicting disc storage space for audio files? The answer is, yes, I am sure that I can but I don't want to say it out loud without glancing at my notes. I will post some common formulas to my website for video, audio, as well as image file. Those are a useful formula for you to have, and then let me also doublecheck my math before I misinform anybody. But you can imagine it's a 96,000 sample and each sample is 24 bits times the number of seconds in your audio file to tell you pretty quickly. So I will give you some data about that on the website.

A question about checksumming. Yes, you can check's on any file of any sort and any size. A checksum is, essentially, a factor unnumbered derived on the bits in the file. For a given file, if it changes in any way, the checksum will be different than its original checksum. That won't tell you what changed in the file or when or how but it will tell you if you have a problem. It's a web of verifying that nothing has changed. There are two ways to go about doing that. One is to create one checksum per file and its stored alongside the file, usually has an extension. These are just different ways of doing the math. Or you can take a group of files, package them together, that could be a whole case worth. It could be a whole directory worth. You could create a checksum for the whole directory. So the short answer is yes. The long answer is that what level of control do you want to do this. Certainly possible.

A question about the future of JPEG 2000. If it become standard, is the hope that there will be free or an expensive desktop tools for their won't need to be bought an expensive box? My answer is, that sure is my hope. Whether my hopes are realized anytime soon, I could not say. So the good thing that's happening in this metadata is that the Library of Congress has gone in this direction. Where Library of Congress goes, the library and archive profession can follow. It's reasonable to think that as part of their program they would release the open source tools to work with those formats. That hasn't quite happened yet. The other piece of this is that U.N. code the data. Right now you need some extensive professional hardware. That market will only change I think if the larger industry changes. They are certainly not the only player in the video market. There is a state called California and we make this part for everybody. I think we also will be taught depending on where the professional industry grows.

So here is a great sort of question regarding compression. If one is given a JPEG or this could be any movie, then the original has already been suppressed. I could choose to save it in a variety of uncompressed format. The quality remains the same. So given already compressed originals, is it a good idea to uncompressed these and store them in that way? So here are my thoughts on this. In the short-term, it gets pretty reasonable to continue to store digital compressed file formats. That is if you get a compressed file format and if it was done using software that you have and understand that you can reliably decompress, that's great. You need to be very intensive on select a. -- upon selecting. You can quickly surrender your whole library of -- it doesn't mean they are useless. So I think the answer to this question is in some ways it depends on how diligent you can be about monitoring the status of all of the software that those files depend on. Yes, you feel confident and comfortable making sure you and we are checking to decompress those files. You can certainly save yourself the storage space. Migrating to a master uncompressed format just saves you that handle -- that annual. I guess I would say also that the longer you maintain that suppressed archive, the greater the chance of problems occurring outside of your watchful comes. Decompressing the file depends on software, depends on your certain pieces of hardware and computer systems. It may depend on tendencies between a particular program and the operating system version. Often, little changes to your system outside the software. So you have real audio version seven and it runs great on your 10.6.1 computer. It could be that when you upgrade to 10.6.3 the dependency gets broken along the way. You might not know that from watching the real audio. So as more of these change over time, those become harder and harder to track. Short-term, viable. Be cautious if you find yourself doing that for a long time.

Well, it looks like we are about at the top of the hour. I think you've answered all the questions.

I think so. I see a few things here that I will follow up on. Please through the website simply further questions and I will post follow-up answers in formulas and the like for all of your future references. Thank you all. I've had so much fun doing these and I hope that they are valuable to you.

And thank you, Jake. This has been a great series. As a reminder, we have linked all of the previous 311 hours to today's page as well -- previous three webinars to today's page as well. Thank you all for attending and thank you, Jake. We will see you next time.

Thank you.

[event concluded]